National Aeronautics and Space Administration

Petition for Class 3 Permit Modification of the White Sands Test Facility Resource Conservation and Recovery Act Permit for SWMUs 21-27, 30, and 31

April 2024

Revised October 2024

NM8800019434

NASA Johnson Space Center White Sands Test Facility

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I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

____ ________________________

Timothy J. Davis Date

Chief, NASA Environmental Office

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Table of Contents

Acronyms and Abbreviations

Acronym	Definition
ACM	Accelerated Corrective Measures
ACMWP	Accelerated Corrective Measures Work Plan
bgs	Below Ground Surface
CAC	Corrective Action Complete
COPC	Contaminants of Potential Concern
EPA	U.S. Environmental Protection Agency
ft	Feet/foot
HIS	Historical Information Summary
in.	Inch
IR	Investigation Report
IWP	Investigation Work Plan
JSC	Johnson Space Center
LWP	Liquid Waste Program
mi	Miles
mg/kg	Milligram Per Kilogram
NASA	National Aeronautics and Space Administration
NMED	New Mexico Environment Department
RA Guidance	NMED Risk Assessment Guidance of Site Investigations and Remediation
RAR	Risk Assessment Report
RCR	Remedy Completion Report
RCRA	Resource Conservation and Recovery Act
SAM	San Andres Mountains
SSL	Soil Screening Level
STGT	Second TDRS Ground Terminal
SWMU	Solid Waste Management Unit
WSC	White Sands Complex
WSMR	White Sands Missile Range
WSTF	White Sands Test Facility

1.0 Introduction

The National Aeronautics and Space Administration (NASA) Johnson Space Center (JSC) [Permittee] operates the White Sands Test Facility (WSTF; facility) in accordance with the Resource Conservation and Recovery Act (RCRA) Post-Closure Permit (Permit; New Mexico Environment Department [NMED], 2023b). This Petition for a Class 3 Permit Modification (Petition) supports a change of the status to Corrective Action Complete (CAC) without controls of nine Solid Waste Management Units (SWMUs) and seven former septic tanks at WSTF. This request is being made in accordance with the New Mexico Hazardous Waste Act (Section 74-4-1 et seq., New Mexico Statutes Annotated 1978, as amended, 1992) and the New Mexico Hazardous Waste Management Regulations 20.4.1 New Mexico Administrative Code. This Petition complies with the requirements of 40 CFR 270.42(c)(1)(i) through (iv).

This Petition provides documentation of completion of corrective actions at SWMUs 21-27 (Septic Tanks), SWMU 30 (200 Area Small Arms Range), SWMU 31 (WB-2 Small Arms Firing Range), and seven former septic tanks not listed in the Permit. NASA understands these SWMUs and ancillary septic tanks are appropriate for closure status review as stated in an April 6, 2023 email from the New Mexico Environment Department (NMED, 2023c). This Petition for a Class 3 Permit Modification requests a change of the status of these sites from “Requiring Corrective Action” (Permit Table 4-1; NMED, 2023b) to “Corrective Action Complete without Controls” (Permit Table 4-3; NMED, 2023b).

The purpose of this Petition is to provide the NMED Hazardous Waste Bureau with documentation that regulatory requirements for closure without controls have been met. This submittal contains information for the following nine SWMUs and the seven ancillary septic tanks:

- SWMU 30 – 200 Area Small Arms Range
- SWMU 31 – WB-2 Small Arms Firing Range
- SWMU 21 – 100 Area Septic Tank at Guard Shack
- SWMU 22 – 100 Area Septic Tank at Building 114
- SWMU 23 – 200 Area Septic Tanks at Building 272
- SWMU 24 – 300 Area Septic Tank at Main Parking Lot
- SWMU 25 – 300 Area Septic Tank at Building 320
- SWMU 26 – 300 Area Septic Tank at Building 364
- SWMU 27 – 400 Area Septic Tank at Main Parking Lot
- 250 Area Septic Tank (Area of Interest identified in the 200 Area investigation)
- 200 Area Septic Tank at Building 272 (Tank C)
- 400 Area Septic Tank at Building T463
- 400 Area Septic Tank at Building 447
- 600 Area Septic Tank at Building 650
- 800 Area Septic Tank at Buildings 802/803
- STGT Facility Septic Tank

1.1 WSTF Location and Description

WSTF is located at 12600 NASA Road in central Doña Ana County, New Mexico. The site is approximately 12 miles (mi) northeast of Las Cruces, New Mexico and 65 mi north of El Paso, Texas. The site was strategically constructed in a remote location adjacent west of the San Andres Mountains. Access to the site is provided by a paved road that intersects U.S. Highway 70, 1 mi west of Organ, New Mexico.

WSTF has supported testing of space flight equipment and materials since 1964 and continues to operate as a field installation of JSC in Houston, Texas. The facility location is shown on Figure 1.1. The location of each SWMU and ancillary septic tank is shown on Figure 1.2.

All of the WSTF facility is strictly for industrial use. Security and fire-fighting personnel staff the facility 24 hours per day, seven days per week; however, there are no full-time residents at WSTF. WSTF is a restricted access area closed to the public, and visitor access is provided only in accordance with NASA JSC polices.

1.2 WSTF Environmental Setting

WSTF topography is characteristic of the Bolson subsection, Mexican Highland section of the Basin and Range physiographic province of the southwestern United States, formed as a result of late Tertiary extensional tectonism. The WSTF industrial area is located on the piedmont slope west of the San Andres Mountains (SAM), one of the most prominent north-south mountain ranges in southern New Mexico. The SAM extends from San Augustine Pass (6 mi south of WSTF) to Mockingbird Gap (75 mi north). The majority of the WSTF industrial area encompassing all sites addressed herein is located between Bear Canyon to the northeast and Loman Canyon to the southeast. Foothills on the western pediment of the SAM at WSTF consist of thin layers of alluvium covering fractured Paleozoic and Cretaceous carbonate and clastic (shale, siltstone, and sandstone) and Tertiary volcanic bedrock.

1.3 WSTF History and Land Use

From the early 1800s to approximately 1935, the Organ Mountains and the SAM were mined for gold, silver, zinc, copper, and lead. There were several established mines located in the SAM and numerous prospect mines. The nearest established mine to WSTF was the Smith Mine (silver) located approximately 1 mi southeast of WSTF within the Loman Canyon area. Deposits of galena (lead sulfide) and barite (BaSO4) were also mined just north of the eastern mouth of Bear Canyon.

Lands now occupied by WSTF were historically open-range grazing lands. These properties were acquired by the federal government and became part of White Sands Missile Range (WSMR). NASA Headquarters announced selection of a testing site in south-central New Mexico on July 6, 1962. The site was chosen for the isolated location and topography, which minimize the inherent hazards of aerospace propulsion testing to the general population.

WSTF is a U.S. government-controlled access site that was established to support the NASA Apollo Space Program. Although the primary purpose of the facility is to provide test services and support to NASA for the U.S. Space Program, services are also provided for the Department of Defense, Department of Energy, private industry, and foreign government agencies. WSTF administrative and testing facilities are located on White Sands Missile Range, owned by the U.S. Department of the Defense, Department of the Army. NASA is the operator of the facility under a Land Use Permit (No. DACA63-4-19-0531) with the U.S. Army. NASA also maintains land-use agreements with the New Mexico State Land Office (a water exploration/development easement), and the U.S. Department of Agriculture, Agricultural Research Service Jornada Experimental Range (an easement deed) for the use of lands located to the west of the industrial facility. The distribution of land ownership is shown on Figure 1.3.

1.4 RCRA Permit Authority

NASA's RCRA Permit (NMED, 2023b), issued by the NMED, requires NASA to complete investigation and remediation of sites in accordance with the NMED-approved investigation and/or corrective measures work plans. The goal of site investigations and corrective actions is to assess and remediate impacts of historical releases of hazardous constituents. The Permit requires NASA to demonstrate that these sites no longer pose a threat to human health or the environment.

This request is being made in accordance with the New Mexico Hazardous Waste Act (Section 74-4-1 et seq., New Mexico Statutes Annotated 1978, as amended, 1992) and the New Mexico Hazardous Waste Management Regulations 20.4.1 New Mexico Administrative Code. The SWMUs are currently listed in the Permittee's RCRA Permit Attachment 4 Table 4-1: SWMUs and AOCs Requiring Corrective Action (U.S. Environmental Protection Agency [EPA] ID No. N M8800019434).

2.0 SWMU 30 200 Area Small Arms Range

The former 200 Area Small Arms Range (SWMU 30) is located south of the main 200 Area buildings, between the 200 and 100 Areas (Figure 2.1). The range floor measures 50 feet (ft) by 50 ft, sloping up to the east, and located adjacent to Gardner Spring Arroyo. The natural, coarse-grained hillside to the east was used as the range backstop.

2.1 Historical Land Use

WSTF security personnel used the 200 Area Small Arms Range from 1964 to 1990, qualifying approximately 22 personnel (one security guard and 21 Fire Department personnel) annually. The adjoining White Sands Complex (WSC) personnel qualified approximately 22 employees from 1977 to 1990. Each employee discharged approximately 100 rounds per person for annual firearms qualifications.

2.2 Current and Future Land Use

The former 200 Area Small Arms Range is located adjacent east of Gardner Spring Arroyo on a limestone outcrop overlain by a thin soil veneer. The area is difficult to access as no improved roadway leads through the arroyo to the site. The topographic slope of the area is not conducive to construction of permanent facilities. NASA intends to allow the area to naturally revegetate and anticipates no future use of this area.

2.3 Accelerated Corrective Measures

NASA submitted the *NASA WSTF Small Arms Firing Ranges (SWMUs 29 – 31) Accelerated Corrective Measures Work Plan and Historical Information Summary* on February 26, 2015 (ACMWP and HIS; NASA, 2015a) to satisfy Permit requirements for investigation and corrective action (NMED, 2023b). The NMED approved the ACMWP and HIS with modification on May 29, 2015 (NMED, 2015). The approved ACMWP included provisions for site remediation, confirmation sampling, and reporting of results including evaluation of risk to all potential receptor populations. The objective of the accelerated corrective measures (ACM) was to remove and recycle spent ammunition scraps/fragments and then verify that the soils within and adjacent to SWMU 30 do not contain residual contamination that presents a risk to human health and the environment. The risk to residential receptors was evaluated to support unrestricted closure. Residential land use is restricted at WSTF.

2.3.1 Contaminants of Potential Concern

Lead bullets, with and without copper jackets, were discharged at this former firing range and allowed to accumulate on site. There is no evidence that other hazardous wastes or hazardous constituents were managed or disposed of at this site. Contaminants of potential concern (COPC) consisted primarily of components used in the manufacture and discharge of small arms ammunition. The ACMWP identified the potential COPCs as antimony, arsenic, copper, iron, lead, tin, and zinc (NASA, 2015a).

2.3.2 Accelerated Corrective Measure Implementation

Site remediation was completed by field screening the range floor and outfall areas using a metal detector to identify the horizontal extent of the area impacted by firing range operations. Identified ammunition waste was recovered by excavating and screening soils to separate ammunition from the soil. Recovered waste ammunition was disposed in accordance with the NMED approved ACMWP (NASA, 2015a). NASA then completed surface and shallow subsurface soil sampling activities for analyses of potential COPC concentrations. Details of the successful execution of ACM and the health risk screening evaluation are detailed in the *Approval with Modifications Revised Small Arms Firing Ranges (SWMUs 29-31) Remedy Completion Report and Risk Assessment Report* (RCR and RAR; NASA, 2023a).

2.4 Results of Accelerated Corrective Measures and Risk Assessment

NASA successfully achieved the objective of the ACM, which was to remove known and suspected COPCs related to ammunition scraps from the shallow soil at the 200 Area Small Arms Range (SWMU 30). The strategy included the manual removal of ammunition scrap and fragments from surface soil of the range floor and fallout areas. Concentrations of metals remaining in SWMU 30 soils were identified by chemical analytical results from discrete soil samples. Surface soil samples were collected from 0 to 6 inches (in.) below ground from 44 grid cells across the impacted area of SWMU 30. Each grid cell was evenly divided into quadrants and randomly selected quadrants in each cell were selected for discrete sample collection from the center of the quadrant which were numbered “1” through “4,” with quadrant 1 as the northwest corner, quadrant 2 as the northeast corner, quadrant 3 as the southwest corner, and quadrant 4 as the southeast corner. NASA used a random number generator to identify the target quadrant within each grid cell for sampling. A discrete soil sample was then collected from the approximate center of each randomly selected quadrant. Sampled locations were named in the following manner: cell “200-4.3” indicates the 200 Area range, cell number 4, southwestern quadrant approximate center. The range, grids, and quadrants sampled are shown on Figure 2.2.

NASA developed the RAR for SWMU 30 in accordance with the NMED’s November 2022 Risk Assessment Guidance for Site Investigations and Remediation (RA Guidance; NMED, 2022 [Vol I - human] and 2017 [Vol II - ecological]). Most of the target metals determined to be consistent with WSTF background concentrations are known to occur naturally at concentrations above regulatory levels in WSTF soils and are not considered to be the direct result of historical activities at SWMU 30. Metals exhibiting concentrations greater than established WSTF background concentrations did not exceed applicable regulatory criteria as detailed in the RAR (NASA, 2023).

The final SWMU 30 COPCs are copper and lead, identified at concentrations above the established background levels. The toxicity hazard from copper concentrations in soil was less than the NMED target hazard of 1 for both human and ecological receptor populations, which indicates copper concentrations are unlikely to result in adverse health impacts and do not warrant further site-specific evaluation or remediation.

The NMED RA Guidance Section 5, Use of the SSLs, requires that lead be evaluated separately from other COPCs included in a cumulative risk screening evaluation. The NMED soil screening levels (SSLs) include default values for lead that were calculated by using the US EPA methodologies to back-calculate a soil concentration for each receptor that would not result in an estimated blood-lead concentration of 10 micrograms per deciliter or greater. These soil concentrations include the residential adult of 400 mg/kg and industrial and construction worker of 800 milligrams per kilograms (mg/kg). In January 2024, the EPA recommended lowered residential screening levels of 200 mg/kg at sites with no other source of lead. The maximum concentration of lead in soil samples from SWMU 30 of 88.3 mg/kg does not exceed either the residential or the industrial and construction worker target soil concentrations. Note that the calculated lead hazard for each receptor is not counted toward cumulative hazard values for SWMU 30.

All COPC metals are identified by the NMED and the EPA as non-carcinogenic toxic substances. The RAR (NASA, 2023a) evaluated the toxicity hazard to all identified human (residential, industrial worker, and construction worker) as shown on Table 2.1, and ecological receptors as shown on Table 2.2. The cumulative hazard indices at SWMU 30 were less than the NMED target of 1, indicating there is no need for further evaluation and it is unlikely for even sensitive populations to experience adverse health effects. The cumulative hazard for each receptor population is 4.95E-03 for residents, 2.99E-04 for industrial workers, 1.09E-03 for construction workers, 5.9E-02 for deer mice, 7.3E-01 for horned larks, and 5.7E-02 for plants.

The RAR also evaluated the potential for metals remaining in SWMU 30 soils to impact groundwater beneath each firing range. As shown on Table 2.3, the maximum concentrations of both copper and lead do not exceed the respective NMED target soil leachate concentrations, indicating the potential for COPC concentrations remaining in SWMU 30 soils to migrate to groundwater beneath the site is minimal.

Based on the results of ACM activities, available analytical data, and the results of the risk screening evaluation, NASA concludes that the primary objectives of planned ACM were successfully achieved. Ammunition scraps and fragments were removed from the firing range floor and fallout area, and the recovered ammunition fragments were disposed of at a permitted disposal facility. As the results of the RAR identified no hazard to site receptors in excess of the NMED target of 1, no additional investigation or remediation is necessary.

2.5 Basis of Determination

NASA completed all corrective measures for SWMU 30 and is proposed for CAC Without Controls based upon the successful completion of the ACMWP objective (NASA, 2015a): “The objective of the ACM is to remove and recycle spent ammunition scraps/fragments and then verify that the soils within and adjacent to SWMU 30 do not contain residual contamination that presents a risk to human health and the environment.”

This criterion was accomplished by completing corrective measures, confirmation sampling, and the evaluation of risk to site receptors as detailed in the RCR and RAR (NASA, 2023a) that recommended no further action at SWMU 30. The NMED approved the final RCR on March 1, 2023 (NMED, 2023b).

3.0 SWMU 31 WB-2 Small Arms Firing Range

The former WB-2 Small Arms Firing Range (SWMU 31) is located east of the Tracking and Data Relay Satellite facility in the 100 Area, directly adjacent to groundwater monitoring wells 100-E-261 and WB-2, from which the range name was derived (Figure 3.1). The range floor is a flat, cleared area approximately 50 ft wide by 250 ft long with an impact berm along the eastern boundary of the range floor.

3.1 Historical Land Use

The former WB-2 Small Arms Firing Range was used periodically from September 1990 to 2000. WSTF personnel used the range from 1990 to approximately 1995 and again from 1999-2000. WSC personnel used SWMU 31 from 1990 to 1992, when use of the Small Arms Range at second TDRS Ground Terminal (STGT; SWMU 29) began, then again from 1999-2000. Approximately 23 WSTF employees (two security guards and 21 Fire Department employees) and 22 WSC employees qualified using this firing range. Each employee qualified twice annually, discharging approximately 100 rounds per person (NASA, 2015a).

3.2 Current and Future Land Use

This former range is located east of the WSTF 100 Area in a remote, unoccupied portion of the facility. The location is not easily accessible, and the location is not adjacent to occupied areas of WSTF. As such, NASA has no intension to develop this portion of the facility and plans to allow natural revegetation of the area.

3.3 Accelerated Corrective Measures

NASA submitted the *NASA WSTF Small Arms Firing Ranges (SWMUs 29 – 31) Accelerated Corrective Measures Work Plan and Historical Information Summary* on February 26, 2015 (NASA, 2015a) to satisfy Permit requirements for investigation and corrective action (NMED, 2023b). The NMED approved the ACMWP and HIS with modification on May 29, 2015 (NMED, 2015). The approved ACMWP included provisions for site remediation, confirmation sampling, and reporting of results including evaluation of risk to all potential receptor populations. The objective of the ACM was to remove and recycle spent ammunition scraps/fragments and then verify that the soils within and adjacent to SWMU 31 do not contain residual contamination that presents a risk to human health and the environment. The risk to residential receptors was evaluated to support unrestricted closure. Residential land use is restricted at WSTF.

3.3.1 Contaminants of Potential Concern

Lead bullets, with and without copper jackets, were discharged at this firing range and allowed to accumulate on site. There is no evidence that other hazardous wastes or hazardous constituents were managed or disposed of at this site. The potential COPCs consisted primarily of components used in the manufacture and discharge of small arms ammunition. The ACMWP identified the potential COPCs as antimony, arsenic, copper, iron, lead, tin, and zinc (NASA, 2015a).

3.3.2 Accelerated Corrective Measure Implementation

Site remediation was completed by field screening the range floor, impact berm, and fallout areas using a metal detector to identify the horizontal extent of the area impacted by firing range operations. Identified ammunition waste was recovered by excavating and screening soils to separate ammunition from the soil. Soils within the impact berm were remediated using heavy equipment to excavate (scrape) the face of the berm in individual 4-in. to 6-in. lifts. After the excavation of each individual lift, a metal detector survey of the berm face was completed to delineate all areas where residual bullet fragments were identified. Subsequent excavation lifts were completed and screened until the entire berm face was confirmed to be essentially clear of ammunition scrap through the results of the metal detector survey.

NASA then completed surface and shallow subsurface soil sampling activities for analyses of potential COPC concentrations. Details of the successful execution of ACM and risk activities were provided in the *Approval with Modifications Revised Small Arms Firing Ranges (SWMUs 29-31) Remedy Completion Report and Risk Assessment Report* (RCR and RAR; NASA, 2023a).

3.4 Results of Accelerated Corrective Measures and Risk Assessment

NASA successfully achieved the objective of the ACM, which was to remove known and suspected COPCs related to ammunition scraps from the shallow soil at the WB-2 Area Small Arms Firing Range

(SWMU 31). The strategy included the removal of ammunition scrap and fragments from surface soil of the range floor and fallout areas and excavation of impacted portions of the berm. Concentrations of metals remaining in SWMU 30 soils were identified by chemical analytical results from discrete soil samples. Surface soil samples were collected from 0 to 6 in. below ground from 72 grid cells across the impacted area of SWMU 31. As with SWMU 30, each grid cell was evenly divided into quadrants, and randomly selected quadrants were selected for collection of soil samples. The range, grids, and quadrants sampled are shown on Figure 3.2.

NASA developed the RAR for SWMU 30 in accordance with the NMED's RA Guidance (NMED, 2022 [Vol I - human] and 2017 [Vol II - ecological]). Most of the target metals were determined to be consistent with WSTF background concentrations, are known to occur naturally at concentrations above regulatory levels in WSTF soils and are not considered to be the direct result of historical activities at SWMU 31. Concentrations of metals reflected in chemical analytical results from discrete soil samples were either representative of WSTF background concentrations or did not exceed applicable regulatory criteria as detailed in the RAR (NASA, 2023a).

The final SWMU 31 COPCs are antimony, copper, lead, and tin, all identified at concentrations above the established background level. The toxicity hazard from antimony, copper, and tin concentrations in soil were less than the NMED target hazard of 1 for human and ecological receptor populations as shown on Table 3.1 and Table 3.2. The cumulative hazard indices at SWMU 31 are less than the NMED target of 1, indicating there is no need for further evaluation and it is unlikely for even sensitive populations to experience adverse health effects. The cumulative hazard for each receptor population is 4.31E-02 for residents, 2.6E-03 for industrial workers, 9.5E-03 for construction workers, 8.8E-02 for deer mice, 5.6E-01 for horned larks, and 6.7E-02 for plants.

The RA Guidance requires that lead be evaluated separately from other COPCs included in a cumulative risk screening evaluation, as stated previously in Section 2.4. The NMED SSLs for lead include the residential adult of 400 mg/kg and industrial and construction worker of 800 mg/kg. In January 2024, the EPA recommended lowered residential screening levels of 200 mg/kg at sites with no other source of lead. The maximum concentration of lead in soil samples from SWMU 31 of 107 mg/kg does not exceed either the residential or the industrial and construction worker target soil concentrations. Note that the calculated lead hazard for each receptor is not counted toward cumulative hazard values for SWMU 30.

The RAR also evaluated the potential for metals remaining in SWMU 30 soils to impact groundwater beneath each firing range. As shown on Table 3.3, the maximum concentrations of final SWMU 31 COPCs do not exceed the respective NMED target soil leachate concentrations, indicating the potential for COPC concentrations remaining in SWMU 30 soils to migration to groundwater beneath the site is minimal.

Final COPC concentrations remaining in SWMU 31 soils are unlikely to result in adverse health impacts and do not warrant further site-specific evaluation or remediation. The maximum COPC concentrations were likewise less than the NMED groundwater-protective SSLs, which indicates there is no potential migration of COPCs from the vadose zone to groundwater; therefore, no further leachate investigation is warranted.

3.5 Basis of Determination

NASA completed all corrective measures including confirmation sampling and determination of site risk, and SWMU 31 is proposed for CAC Without Controls based upon successful completion of the ACMWP objective (NASA, 2015a): "The objective of the ACM is to remove and recycle spent ammunition scraps/fragments and then verify that the soils within and adjacent to SWMU 30 do not contain residual contamination that presents a risk to human health and the environment."

This criterion was accomplished by completing corrective measures, confirmation sampling, and the evaluation of risk to site receptors as detailed in the RCR and RAR (NASA, 2023a) that recommended no further action at SWMU 31. The NMED approved the final RCR on March 1, 2023 (NMED, 2023b).

4.0 SWMU 22 Building 114 Septic Tank

The former 100 Area Septic Tank at Building 114 (SWMU 22) was located in the 100 Area, about 50 ft northeast of the building (Figure 4.1). The original septic tank was installed in 1963, prior to the completion of the sewage lagoons at WSTF. It was removed and a new septic tank was installed on September 10, 2013, for building occupants. The new septic tank was installed instead of connecting to the City of Las Cruces sewer system due to logistical constraints from underground utilities located close to the area.

4.1 Historical Land Use

The former 100 Area Septic Tank at Building 114 (SWMU 22) was installed in 1963 and used from 1963 until the mid-1980s in support of Building 114, which was used as a *"print shop"* or reproduction facility. The septic tank system initially serviced Building 114, a temporary office trailer that was removed in 1964, and then Building 119. Building 119 was connected in the mid-1990s to the influent line instead of a direct connection to the septic tank. The tank size was 1,200 gallons with a design flow rate of 600 gallons per day. There is no historical information or records that list the size of the leach field.

4.2 Current and Future Land Use

Building 114 has been unoccupied for several years. NASA plans to demolish Building 114 and does not plan any future development in the area. The location of the removed septic tank has been allowed to naturally revegetate. NASA has no intention to utilize this area for future operations.

4.3 Investigation and Corrective Measures

The septic tank contents were sampled to support definition of preliminary COPCs including metals and cyanide, that were previously identified in the *Septic Tanks (SWMU 21-27) Investigation Work Plan and WSTF Septic Tanks Historical Information Summary* (IWP; NASA, 2013). The NMED approved the IWP and HIS with modification on November 8, 2013 (NMED, 2013). Between 1963 and 1985, waste plate-maker machine chemicals were discharged from Building 114 into the septic tank. Silver and cyanide were confirmed contaminants identified within the waste plating chemicals discharged to SWMU 22.

An initial measurement of the contents of the Building 114 septic tank (SWMU 22) was performed during August 2013 prior to the tank being taken out of service. The tank contained 3 in. of sewage sludge and 28 in. of liquid wastewater. An initial visual inspection of the inside of the tank was performed in November 2013 by partially removing the tank cover. Discharges to the tank had ceased after installation of the new tank for Building 119 facilities on September 10, 2013. It was expected the Building 114 tank would contain free liquid (wastewater), as was found in the initial inspection. However, in November, there was no free liquid in the SWMU 22 tank.

A subsequent inspection following complete removal of the tank cover identified a discharge pipe extending approximately 60 ft to the northeast of the tank. Extensive investigation was conducted, but no wastewater emitters or traditional leach field were located. No evidence of wastewater was observed in the pipe and there was no evidence of wastewater discharge at the pipe termination point. Lack of staining and fluid fill lines near the effluent port in the tank also indicated that wastewater never flowed out the discharge pipe. The investigation methodology was modified because field observations indicated subsurface discharges at SWMU 22 occurred at the tank itself. The investigation was modified to determine if contaminants of concern seeped from the SWMU 22 septic tank downgradient or into the vadose zone alluvium below the tank. During excavation and tank removal, no visible seepage or moisture was detected outside of the septic tank excavation. Soil staining was only visible on the first few in. of alluvium below the contact with clean fill sediment within the footprint of the tank. For these reasons, neither surface soils nor potential leach field soils were sampled, rather subsurface soils from the base of the removed septic tank at 6 ft below ground surface (bgs) down to a depth of 27 ft bgs were sampled as part of the investigation.

4.3.1 Contaminants of Potential Concern

Based on available historical information and chemical analytical results, the preliminary COPCs for SWMU 22 were identified as silver and cyanide. NASA elected to submit all samples for analyses of arsenic, barium, cadmium, chromium, cyanide, lead, mercury, selenium, and silver.

4.3.2 Corrective Measures and Investigation

NASA pumped septage from the septic tank and removed the tank in November 2016, then backfilled the tank excavation with clean soil. Soil borings were installed, and soil samples were collected for chemical characterization of COPC concentrations during April and October 2017. The April 2017 samples were analyzed for metals and cyanide, and analytical results indicated that matrix effects from the presence of nitrate artificially inflated the cyanide results. The October 2017 samples were analyzed for cyanide using an alternate preparation method to mitigate the effect of nitrate on cyanide results and provide accurate information regarding cyanide concentrations in site soils, as reported in the *Response to Approval with Modifications Revised WSTF Septic Tanks (SWMUs 21-27) Investigation Report* (NASA, 2023b).

A total of seven soil borings were installed during the investigation, with a total of 18 discrete-depth soil samples collected. The location of these soil borings is shown on Figure 4.2. Soil sample depths are as follows:

- 114-SB-01 sampled from 5-7 and 10-12 ft bgs (2 samples);
- 114-SB-02 sampled from 6-8, 10-12, 15-17, 20-22, and 25-27 ft bgs (5 samples);
- 114-SB-03 sampled from 7-8, 10-12, 15-17, 20-22, and 25-27 ft bgs (5 samples);
- 114-SB-04 sampled from 5-7 and 10-12 ft bgs (2 samples);
- 114-SB-05 sampled from 5-7 and 10-12 ft bgs (2 samples);
- 114-SB-06 sampled from 7-9 ft bgs (1 sample), and
- 114-SB-07 sampled from 7-9 ft bgs (1 sample).

4.4 Results of Investigation and Risk Assessment

NASA evaluated soil chemical results against established WSTF background levels to identify constituent concentrations exceeding background, and identified cadmium, chromium, cyanide, and silver at concentrations exceeding background and are the designated final COPCs. Concentrations of these four COPCs were evaluated using respective NMED SSLs to complete ecological and health risk screenings. Neither residential nor construction worker exposure scenarios resulted in individual or cumulative carcinogenic risks or cumulative hazards greater than the NMED targets of 1.0E-05 for risk and 1 for hazard as shown on Table 4.1. The cumulative residential cancer risk is 1.97E-06, residential hazard is 7.9E-01, construction worker risk is 4.09E-07, and construction worker hazard is 8.74E-01. As a result, for residential and construction worker scenarios, NASA concluded that there are no adverse human health impacts at SWMU 22 (NASA, 2023b).

The risk to residential receptors was evaluated to support unrestricted closure. Residential land use is restricted at WSTF. The risk to horned lark receptors was not evaluated as releases at SWMU 22 occurred well below the 0 to 1 ft below ground exposure depth interval for non-burrowing ecological receptors.

However, for the soil-to-groundwater exposure scenario, concentrations of arsenic and cyanide exceeded soil leachate SSLs. Results of this comparison are provided on Table 4.2. WSTF background concentrations of arsenic indicate this constituent is present at similar concentrations as the SWMU 22 investigation samples. Both arsenic and cyanide concentrations were observed to decrease with increasing depth. Additionally, the source of liquid that previously mobilized COPCs downward to groundwater was removed with removal of the septic tank (NASA, 2023b).

Results of the ecological risk screening for SWMU 22 indicated total chromium concentrations constitute excess hazard for plants as shown on Table 4.3. The cumulative hazard to the deer mouse receptor of 1.06E+00 does not exceed the NMED target hazard of 1, but the cumulative hazard to plants of 5.43E+01 exceeds the target. However, SWMU 22 occupies approximately 0.1 acre, and deep-rooted plants are not present within the boundary of the SWMU. For these reasons, NASA did not identify adverse risk to the overall plant community. Evaluation of the COPC concentrations and the effect on the deer mouse receptor population did not identify adverse risk (NASA, 2023b).

4.5 Basis of Determination

The objective of the tank removal, investigation, and risk assessment was to verify that no hazardous constituents exist in the soil potentially impacted by the SWMU 22 septic tank and leach field. Septic tank removal actions, soil investigation, and the risk assessment were completed in accordance with the approved IWP (NASA, 2013). The objective was accomplished by completion of the investigation, evaluation of risk to all receptors and the environment, and demonstration that these risks were below regulatory targets and therefore acceptable. The NMED approved the final IR (including evaluation of risk) on March 16, 2023 (NMED, 2023a).

5.0 SWMUs 21 and 23 through 27 and Ancillary Septic Tanks

The SWMUs and ancillary septic tanks described in this section are former septic tank systems that were taken out of service following connection to the City of Las Cruces wastewater system in 2015. The NMED-approved *Septic Tanks (SWMU 21-27) Investigation Work Plan and WSTF Septic Tanks Historical Information Summary* (NASA, 2013) included a review of historical information for each of these sites and clearly demonstrated that hazardous waste was not disposed of using any of these septic systems. The NMED approved the IWP and HIS with modification on November 8, 2013 (NMED, 2013). Each of these septic tanks were removed in accordance with the procedures detailed in the IWP during 2015, 2016, and 2017. No investigations were completed for these systems. The SWMUs and ancillary septic tanks included in this section are:

- SWMU 21 – 100 Area Septic Tank at Guard Shack, shown on Figure 5.1
- SWMU 23 – 200 Area Septic Tanks at Building 272, Figure 5.2
- SWMU 24 – 300 Area Septic Tank at Main Parking Lot, Figure 5.3
- SWMU 25 – 300 Area Septic Tank at Building 320, Figure 5.3
- SWMU 26 – 300 Area Septic Tank at Building 364, Figure 5.3
- SWMU 27 – 400 Area Septic Tank at Main Parking Lot, Figure 5.4
- 250 Area Septic Tank (Area of Interest identified in the 200 Area investigation), Figure 5.2

- 200 Area Septic Tank at Building 272 (Tank C), Figure 5.2
- 400 Area Septic Tank at Building T463, Figure 5.4
- 400 Area Septic Tank at Building 447, Figure 5.4
- 600 Area Septic Tank at Building 650, Figure 5.5
- 800 Area Septic Tank at Buildings 802/803, Figure 5.2
- STGT Facility Septic Tank, Figure 5.6

5.1 Historical Information and Regulatory Background

NASA reviewed available historical information and completed interviews with site personnel to determine wastes potentially disposed using the septic tanks listed above and documented the findings in the *Septic Tanks (SWMU 21-27) Investigation Work Plan and WSTF Septic Tanks Historical Information Summary* (NASA, 2013). The NMED approved the IWP and HIS with modifications on November 8, 2013 (NMED, 2013). All information regarding waste streams disposed using the six septic tanks listed as SWMUs and the seven ancillary septic tanks not listed as SWMUs indicated that sewage, hand washing waste, minor amounts of janitorial waste, and minor amounts of cleaning waste were disposed, with no indications of hazardous waste disposed at these septic tanks. Corrective actions proposed by NASA and subsequently approved by the NMED included septic tank excavation and removal, followed by site restoration. Specific waste streams disposed at each septic tank are shown on Table 5.1.

Nine of these septic tanks were permitted through the NMED Liquid Waste Program (LWP) or through the NMED Ground Water Quality Bureau. The remaining four septic tanks were unpermitted. Table 5.1 lists the permit status for each of the thirteen septic tanks.

5.2 Removal Actions and Final Notifications

NASA inspected each septic tank to determine if residual septage was present, and if so, coordinated its removal. Following waste removal, NASA excavated and removed the septic tanks and coordinated their disposal at an approved off-site facility. All tanks were pumped, excavated, and removed in accordance with the septic tank removal plan (Appendix A of the IWP; NASA, 2013). Table 5.1 provides information pertaining to the required liquid waste system abandonment forms submitted to the NMED LWP for each tank.

As required by the NMED approval with modifications, NASA closely observed all septic tanks during removal. No evidence of leakage, spills, unauthorized discharges to the environment, or unexpected system configurations were observed during excavation or removal of any septic tank identified in the Permit as SWMUs 21 and 23-27 or the seven ancillary septic tanks. Tank excavations were backfilled with clean fill per the approved IWP. The clean fill was obtained from the WSTF borrow pit and, in some cases, from stockpiled soil from excavations for new sewer lines in the area. The borrow pit is located east-northeast of the 100 Area upgradient of any site where use of or releases of hazardous constituents occurred. The borrow pit and surrounding area were undisturbed by other site activities and only used for excavation of materials for use in construction projects at WSTF. Likewise, the sewer line excavations from which fill material was obtained are not located near any area where WSTF industrial activities occurred. The fill consisted of clean native soil but was not sampled or certified. After backfilling operations, the ground surface was graded and left to revegetate naturally.

Table 5.1 provides the anticipated future land use at the location of each former septic tank. Following successful completion of corrective actions at each site, NASA provided notification to the NMED for each of these thirteen septic tanks, as shown on Table 5.1.

5.3 Basis of Determination

The Permit issued by the NMED (NMED, 2023b) requires the preparation of IWPs to assess the potential impact of any historical releases of hazardous waste or hazardous constituents that may have occurred at WSTF as part of the RCRA corrective action process. NASA completed the removal of these septic tanks in accordance with procedures detailed in the IWP (NASA, 2013) as approved by the NMED (NMED, 2013). Following removal of these septic tanks, NASA completed liquid waste program abandonment forms as stated in Section 5.2.

As detailed in the HIS (NASA, 2013), there is no evidence that hazardous materials or constituents were disposed using any of the 13 septic tanks described herein. Based on the successful completion of tank removal actions and site restoration in accordance with the NMED-approved IWP (NASA, 2013), these former septic tanks are appropriate for CAC Without Controls.

6.0 Supporting Document References

NASA Johnson Space Center White Sands Test Facility. (2013, June 27). *NASA WSTF Septic Tanks (SWMU 21-27) Investigation Work Plan and WSTF Septic Tanks Historical Information Summary.* Las Cruces, NM.

NASA Johnson Space Center White Sands Test Facility. (2015a, February 26). *NASA WSTF Small Arms Firing Ranges (SWMUs 29-31) Accelerated Corrective Measures Work Plan and Historical Information Summary*. Las Cruces, NM.

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NMED. (2017, March). *Risk Assessment Guidance for Site Investigations and Remediation. Volume II Soil Screening Guidance for Ecological Risk Assessments*. Santa Fe, NM.

NMED Hazardous Waste Bureau. (2022, November 16*). Approval with Modifications Revised Small Arms Firing Ranges (SWMU 29-31) Remedy Completion Report and Risk Assessment Report.* Santa Fe, NM.

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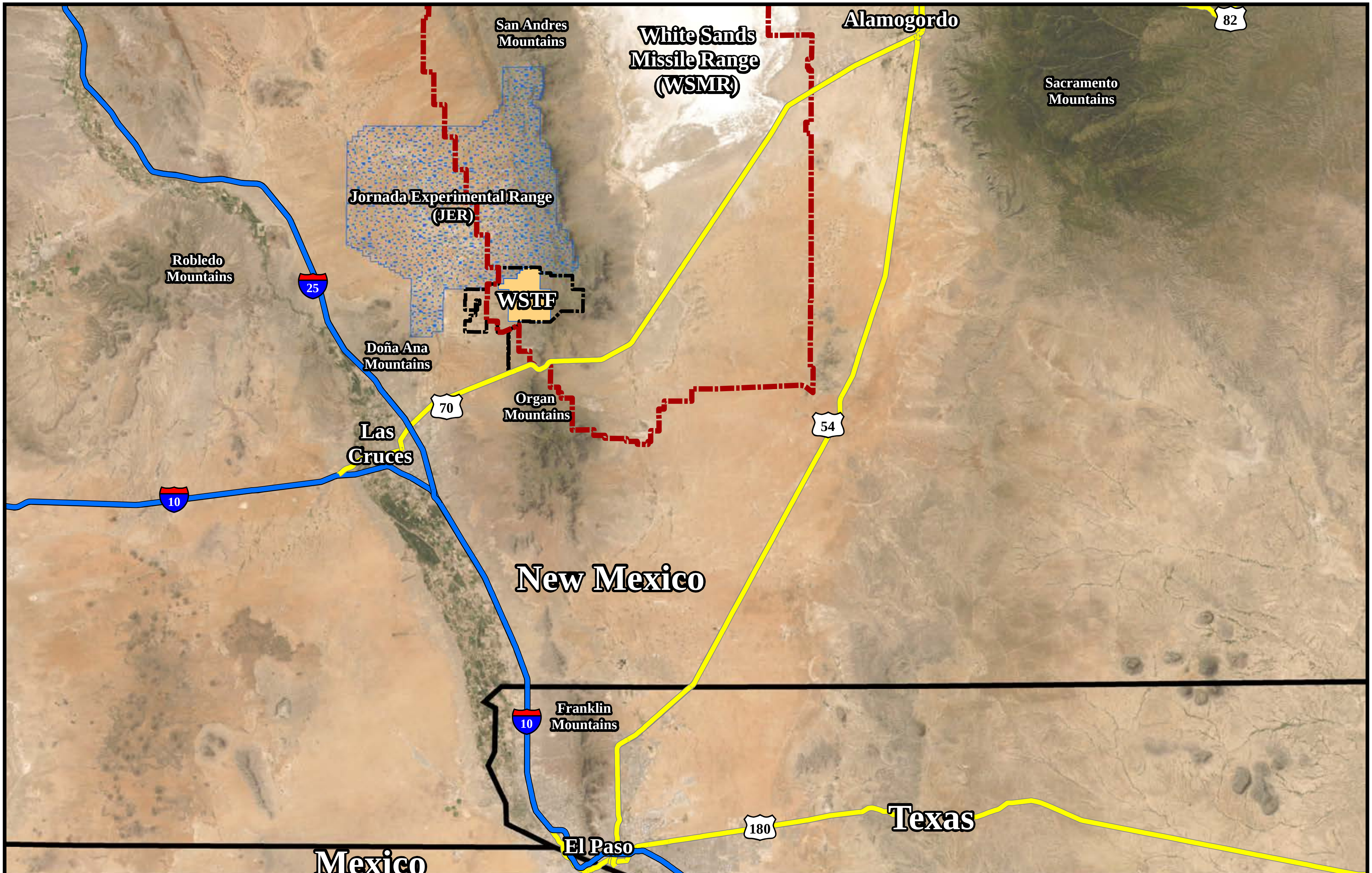
NMED Hazardous Waste Bureau. (2023b, March 28). *RCRA Permit EPA ID # NM8800019434.* Santa Fe, NM.

NMED Hazardous Waste Bureau. (2023c, April 6). *NASA WSTF Prospective Petition for Class 3 Permit Modification*. Email. Santa Fe, NM.

Figures

Figure 1.1 **WSTF Location Map**

(SEE NEXT PAGE)



N
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S

1 in = 12 miles

0 6 12 24 Miles

April 2024

WSMR Boundary

WSTF Boundary

WSTF Industrial Area

Jornada Experimental Range (JER)

WSTF Location Map

NASA Johnson Space Center
White Sands Test Facility
Las Cruces, New Mexico

Coordinate System:
NAD 1983 StatePlane New Mexico Central FIPS 3002 Feet

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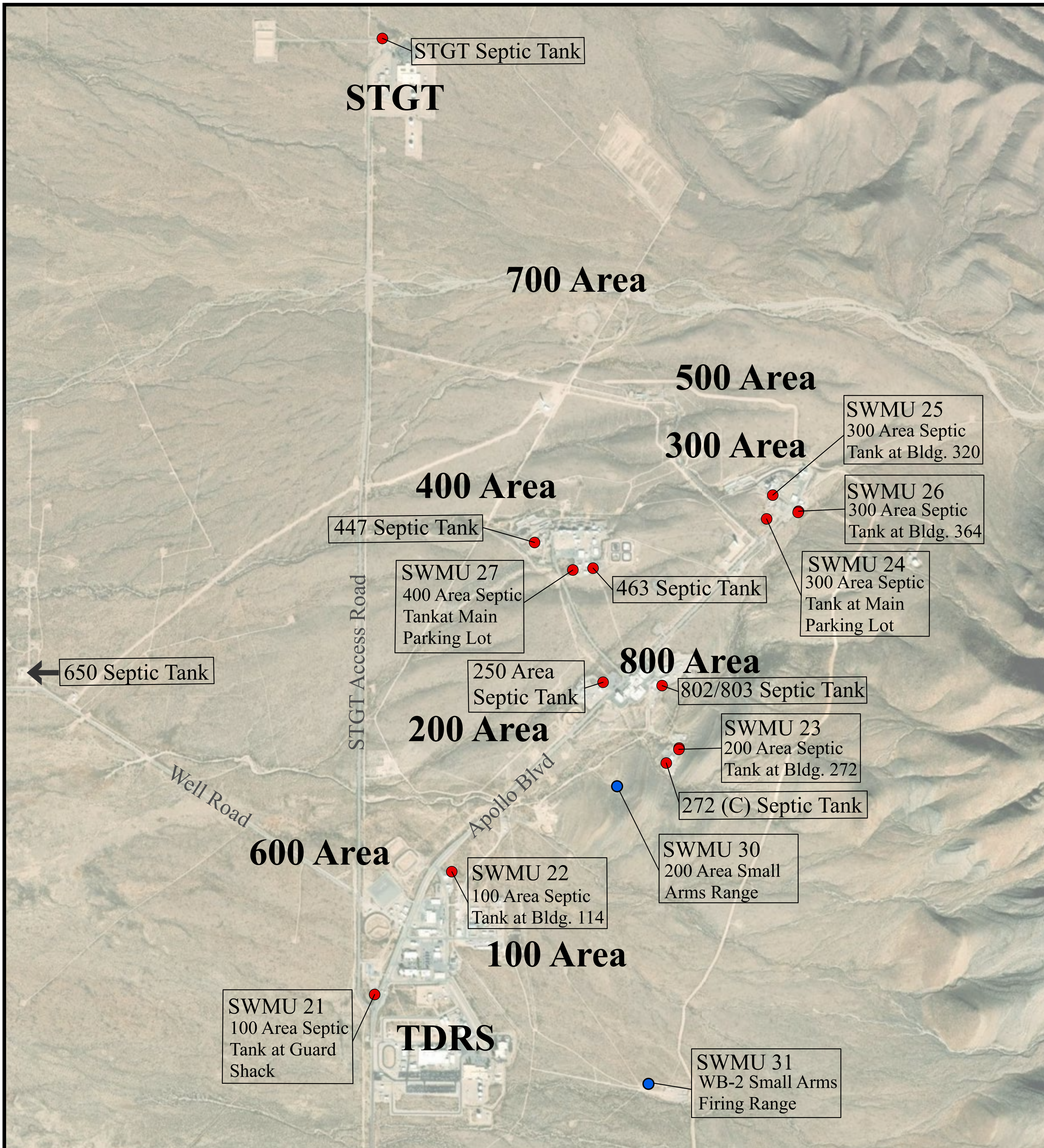
Figure 1.2 WSTF Solid Waste Management Units and Ancillary Septic Tanks

(SEE NEXT PAGE)



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April 2024

1:24,000

0 1,000 2,000 4,000 Ft

- Septic Tanks (Removed)
- Firing Ranges

White Sands Test Facility SWMUs and Ancillary Septic Tanks

NASA Johnson Space Center
White Sands Test Facility Las Cruces, New Mexico

Coordinate System:
NAD 1983 StatePlane New Mexico Central FIPS 3002 Feet

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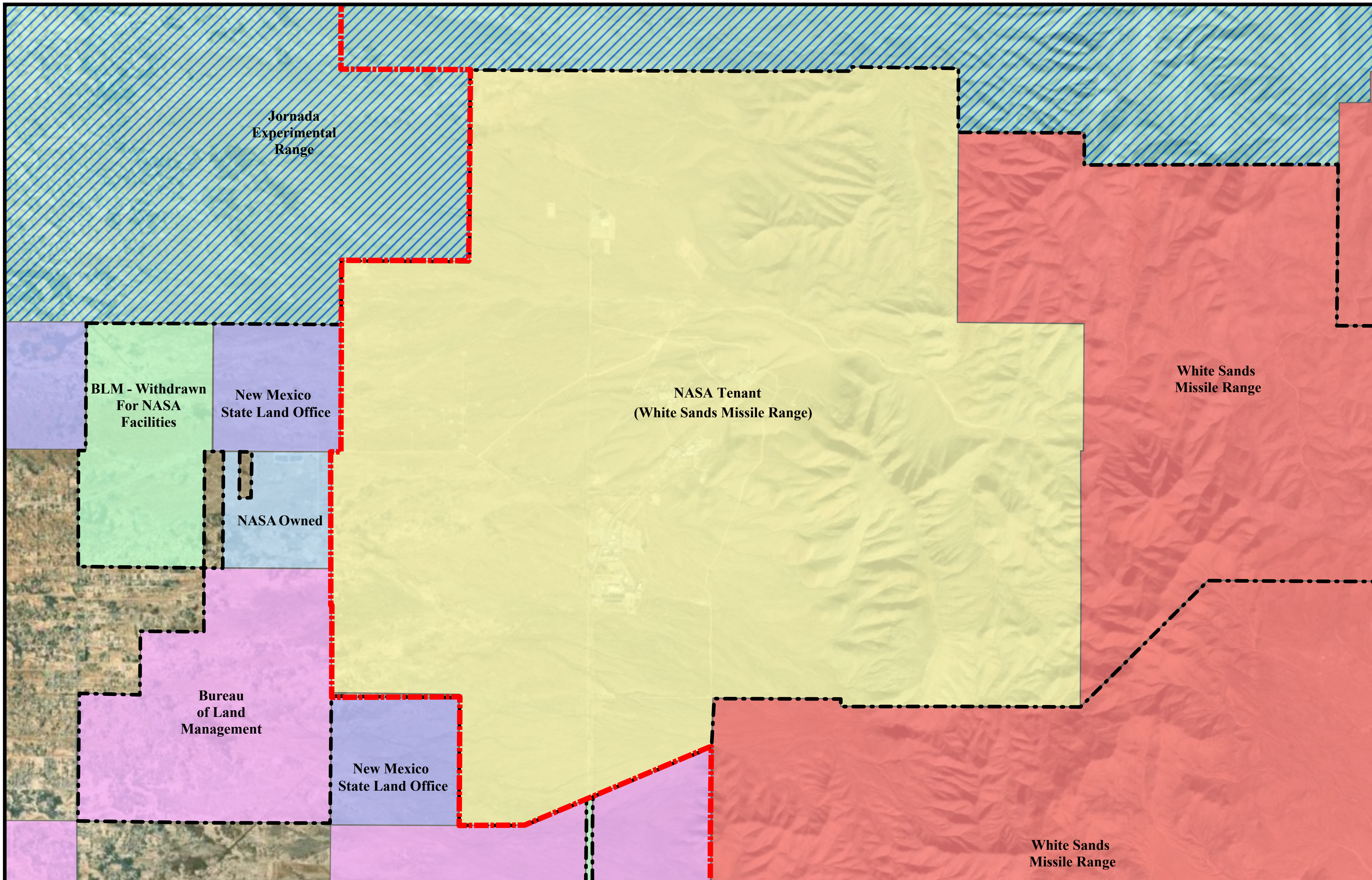
Figure 1.3 **WSTF Land Use Map**

(SEE NEXT PAGE)



April 2024

1:65,000

N W E S

0 2,000 4,000 8,000 12,000 Feet

- White Sands Missile Range Boundary
- WSTF Boundary
- Jornada Experimental Range
- BLM - Withdrawn For NASA Facilities
- Bureau of Land Management
- NASA Owned
- New Mexico State Land Office
- NASA Tenant - White Sands Missile Range
- White Sands Missile Range

WSTF Land Use

NASA Johnson Space Center
White Sands Test Facility Las Cruces, New Mexico

Coordinate System: NAD 1983 HARN StatePlane New Mexico Central FIPS 3002 Feet

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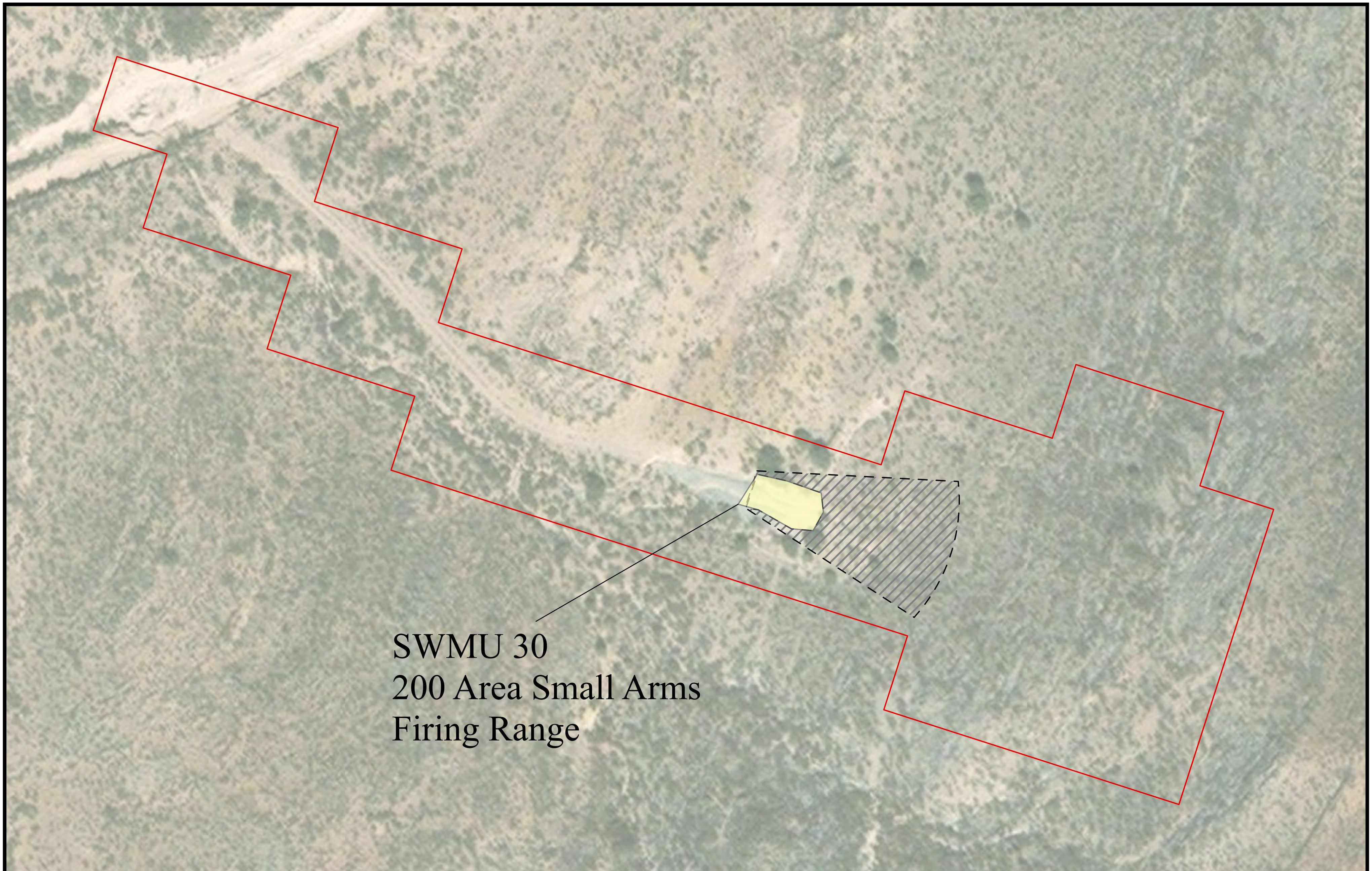
Figure 2.1 **SWMU 30 200 Area Small Arms Range**

(SEE NEXT PAGE)



April 2024

1:1,000

N
W E
S

0 37.5 75 150 225 Feet

200 Area Firing Range Extent

Potential Fallout Area

Investigation Sampling Grid

SWMU 30

200 Area Small Arms Firing Range

NASA Johnson Space Center
White Sands Test Facility Las Cruces, New Mexico

Coordinate System: NAD 1983 StatePlane New Mexico Central FIPS 3002 Feet

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Figure 2.2 200 Area (SWMU 30) Discrete Sample Locations

(SEE NEXT PAGE)

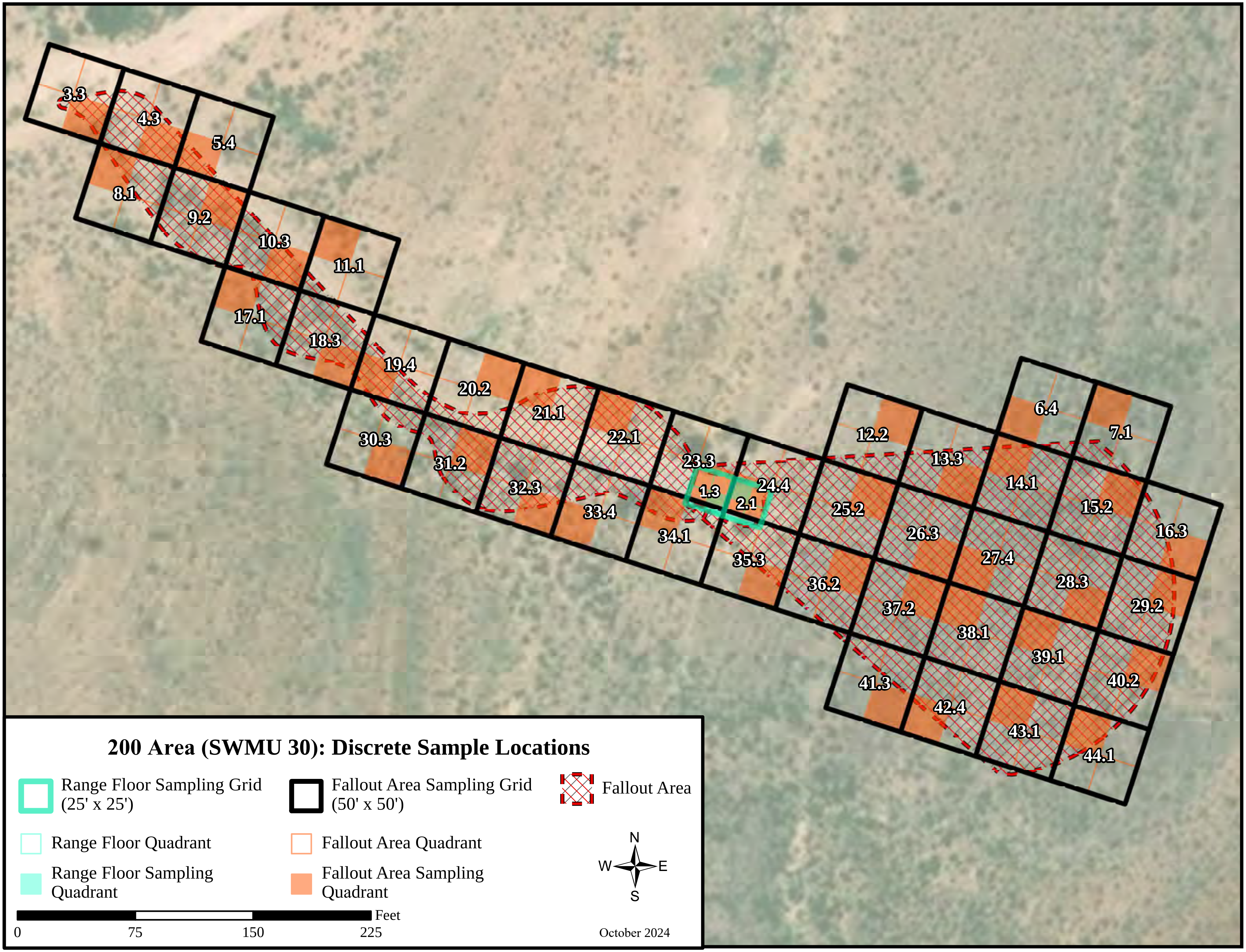
3.3
4.3
5.4
8.1
9.2
10.3
11.1
17.1
18.3
19.4
20.2
21.1
22.1
23.3
1.3
2.1
24.4
30.3
31.2
32.3
33.4
34.1
35.3
12.2
13.3
6.4
7.1
14.1
15.2
16.3
25.2
26.3
27.4
28.3
29.2
36.2
37.2
38.1
39.1
40.2
41.3
42.4
43.1
44.1
200 Area (SWMU 30): Discrete Sample Locations
Range Floor Sampling Grid (25' x 25')
Fallout Area Sampling Grid (50' x 50')
Fallout Area
Range Floor Quadrant
Fallout Area Quadrant
Range Floor Sampling Quadrant
Fallout Area Sampling Quadrant
N
W
E
S
Feet
0
75
150
225
October 2024

Figure 3.1 **SWMU 31 WB-2 Small Arms Firing Range**

(SEE NEXT PAGE)

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April 2024

1:2,400

0 50 100 200 300 400 Feet

WB-2 Firing Range Extent

Potential Fallout Area

Investigation Sampling Grid

SWMU 31
WB-2 Small Arms Firing Range

NASA Johnson Space Center
White Sands Test Facility Las Cruces, New Mexico

Coordinate System: NAD 1983 StatePlane New Mexico Central FIPS 3002 Feet
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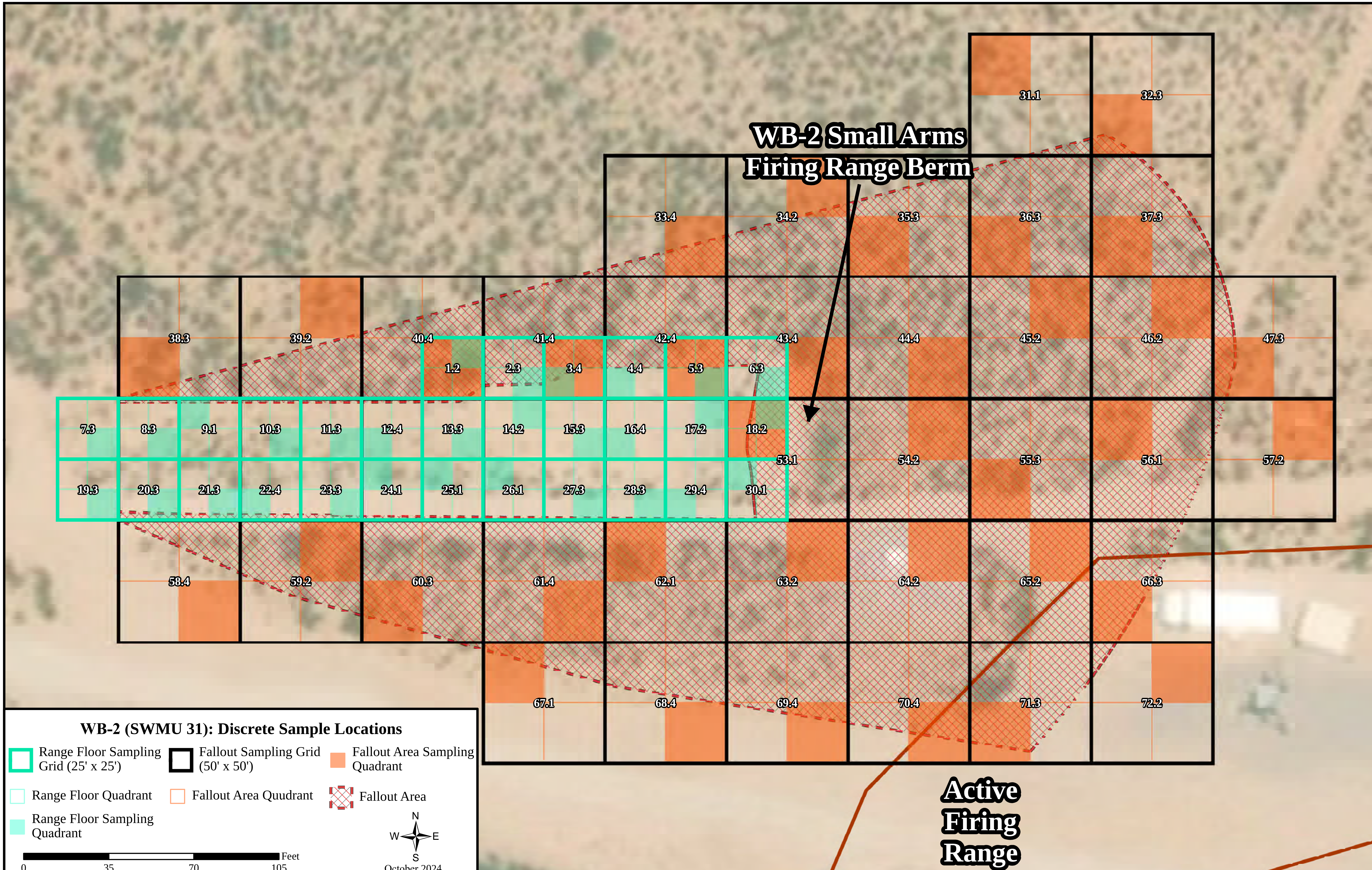
Figure 3.2 **WB-2 (SWMU 31) Discrete Sample Locations**

(SEE NEXT PAGE)



WB-2 Small Arms Firing Range Berm
Active Firing Range
31.1
32.3
33.4
34.2
35.3
36.3
37.3
38.3
39.2
40.4
41.4
42.4
43.4
44.4
45.2
46.2
47.3
1.2
2.3
3.4
4.4
5.3
6.3
7.3
8.3
9.1
10.3
11.3
12.4
13.3
14.2
15.3
16.4
17.2
18.2
53.1
54.2
55.3
56.1
57.2
19.3
20.3
21.3
22.4
23.3
24.1
25.1
26.1
27.3
28.3
29.4
30.1
58.4
59.2
60.3
61.4
62.1
63.2
64.2
65.2
66.3
67.1
68.4
69.4
70.4
71.3
72.2
WB-2 (SWMU 31): Discrete Sample Locations
Range Floor Sampling Grid (25' x 25')
Fallout Sampling Grid (50' x 50')
Fallout Area Sampling Quadrant
Range Floor Quadrant
Fallout Area Quudrant
Fallout Area
Range Floor Sampling Quadrant
0
35
70
105
Feet
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S
October 2024

Figure 4.1 SWMU 22 100 Area Septic Tank at Building 114

(SEE NEXT PAGE)

April 2024

N
W
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S

1:741

0 37.5 75 150 Ft

Septic Tank Location

SWMU 22
Building 114 Septic Tank

NASA Johnson Space Center
White Sands Test Facility Las Cruces, New Mexico

Coordinate System:
NAD 1983 StatePlane New Mexico Central FIPS 3002 Feet

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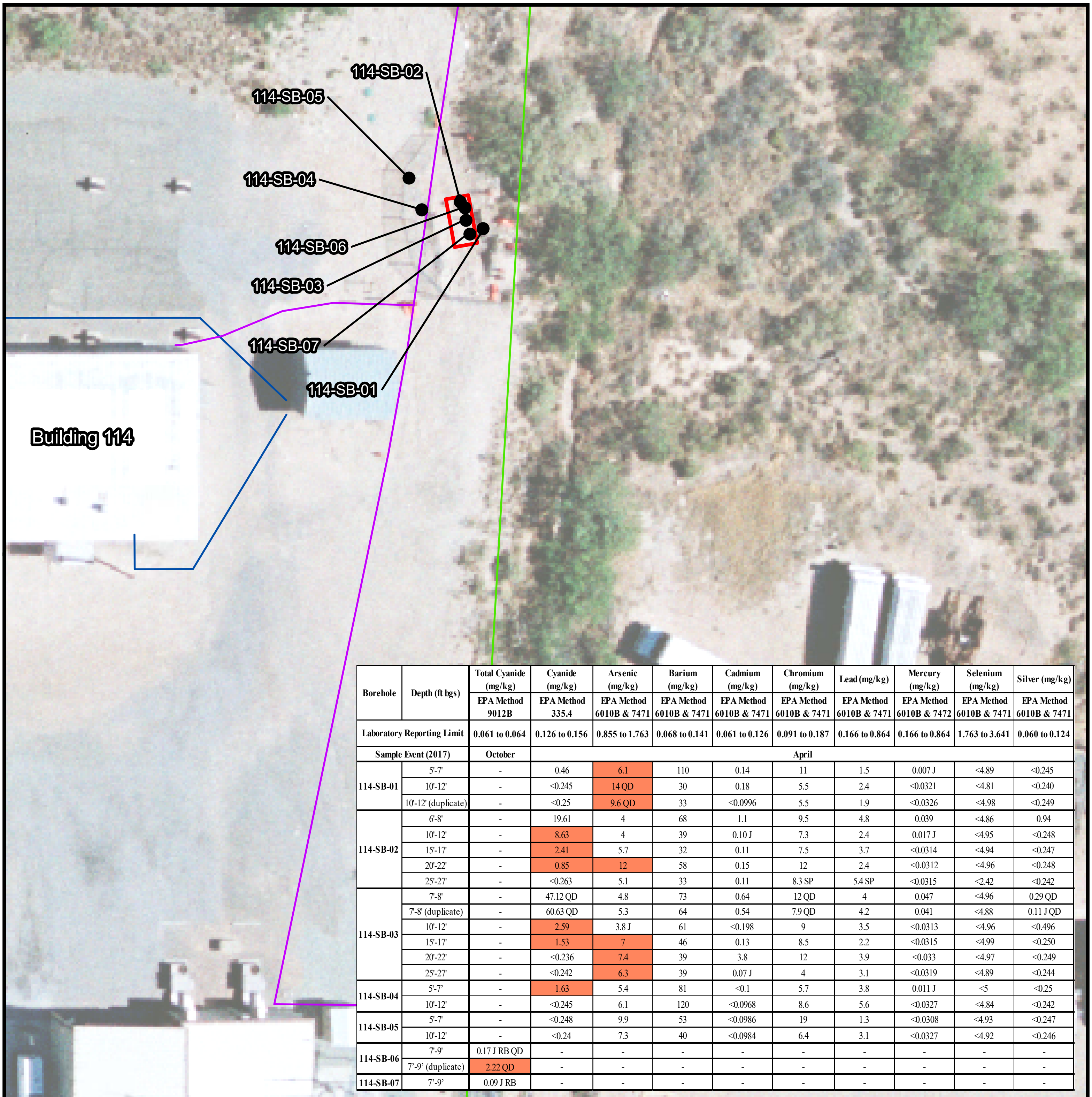
Figure 4.2 Building 114 Septic Tank Soil Boring Locations and Utilities

(SEE NEXT PAGE)



Borehole	Depth (ft bgs)	Total Cyanide (mg/kg)	Cyanide (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)
		EPA Method 9012B	EPA Method 335.4	EPA Method 6010B & 7471	EPA Method 6010B & 7471	EPA Method 6010B & 7471	EPA Method 6010B & 7471	EPA Method 6010B & 7471	EPA Method 6010B & 7472	EPA Method 6010B & 7471	EPA Method 6010B & 7471
Laboratory Reporting Limit		0.061 to 0.064	0.126 to 0.156	0.855 to 1.763	0.068 to 0.141	0.061 to 0.126	0.091 to 0.187	0.166 to 0.864	0.166 to 0.864	1.763 to 3.641	0.060 to 0.124
Sample Event (2017)		October	April								
114-SB-01	5'-7'	-	0.46	6.1	110	0.14	11	1.5	0.007 J	<4.89	<0.245
	10'-12'	-	<0.245	14 QD	30	0.18	5.5	2.4	<0.0321	<4.81	<0.240
	10'-12' (duplicate)	-	<0.25	9.6 QD	33	<0.0996	5.5	1.9	<0.0326	<4.98	<0.249
114-SB-02	6'-8'	-	19.61	4	68	1.1	9.5	4.8	0.039	<4.86	0.94
	10'-12'	-	8.63	4	39	0.10 J	7.3	2.4	0.017 J	<4.95	<0.248
	15'-17'	-	2.41	5.7	32	0.11	7.5	3.7	<0.0314	<4.94	<0.247
	20'-22'	-	0.85	12	58	0.15	12	2.4	<0.0312	<4.96	<0.248
	25'-27'	-	<0.263	5.1	33	0.11	8.3 SP	5.4 SP	<0.0315	<2.42	<0.242
114-SB-03	7'-8'	-	47.12 QD	4.8	73	0.64	12 QD	4	0.047	<4.96	0.29 QD
	7'-8' (duplicate)	-	60.63 QD	5.3	64	0.54	7.9 QD	4.2	0.041	<4.88	0.11 J QD
	10'-12'	-	2.59	3.8 J	61	<0.198	9	3.5	<0.0313	<4.96	<0.496
	15'-17'	-	1.53	7	46	0.13	8.5	2.2	<0.0315	<4.99	<0.250
	20'-22'	-	<0.236	7.4	39	3.8	12	3.9	<0.033	<4.97	<0.249
	25'-27'	-	<0.242	6.3	39	0.07 J	4	3.1	<0.0319	<4.89	<0.244
114-SB-04	5'-7’	-	1.63	5.4	81	<0.1	5.7	3.8	0.011 J	<5	<0.25
	10'-12'	-	<0.245	6.1	120	<0.0968	8.6	5.6	<0.0327	<4.84	<0.242
114-SB-05	5'-7'	-	<0.248	9.9	53	<0.0986	19	1.3	<0.0308	<4.93	<0.247
	10'-12'	-	<0.24	7.3	40	<0.0984	6.4	3.1	<0.0327	<4.92	<0.246
114-SB-06	7'-9'	0.17 J RB QD	-	-	-	-	-	-	-	-	-
	7’-9’ (duplicate)	2.22 QD	-	-	-	-	-	-	-	-	-
114-SB-07	7’-9’	0.09 J RB	-	-	-	-	-	-	-	-	-

Building 114 Septic Tank Soil Boring Locations and Utilities

- ● Building 114 Septic Tank Soil Borings
- Telephone Lines
- Fiber Optic Lines
- Water Lines
- Building 114 Septic Tank Footprint

0 10 20 30 60 Feet

N
W E
S

1:355

Original Size: 8.5"x11"

North American 1983
State Plane Coordinate System
NM Centr002 (Feet)

October 2024

Fig 2_1 Bldg_114_Soil_Borings0051121.mxd

NASA Johnson Space Center
White Sands Test Facility
12600 NASA Rd
Las Cruces, NM 88012

Figure 5.1 SWMU 21 100 Area Septic Tank at Guard Shack

(SEE NEXT PAGE)

April 2024

N
W E
S

1:1,500

0 50 100 200 Ft

Septic Tank Location

SWMU 21
Guard Shack Septic Tank

NASA Johnson Space Center
White Sands Test Facility Las Cruces, New Mexico

Coordinate System:
NAD 1983 StatePlane New Mexico Central FIPS 3002 Feet

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Figure 5.2 200 Area SWMUs and Ancillary Septic Tanks

(SEE NEXT PAGE)

April 2024

N
W E
S

1:2,400

0 100 200 400 Ft

Septic Tank Location

200 Area SWMUs and Ancillary Sites

NASA Johnson Space Center
White Sands Test Facility Las Cruces, New Mexico

Coordinate System:
NAD 1983 StatePlane New Mexico Central FIPS 3002 Feet

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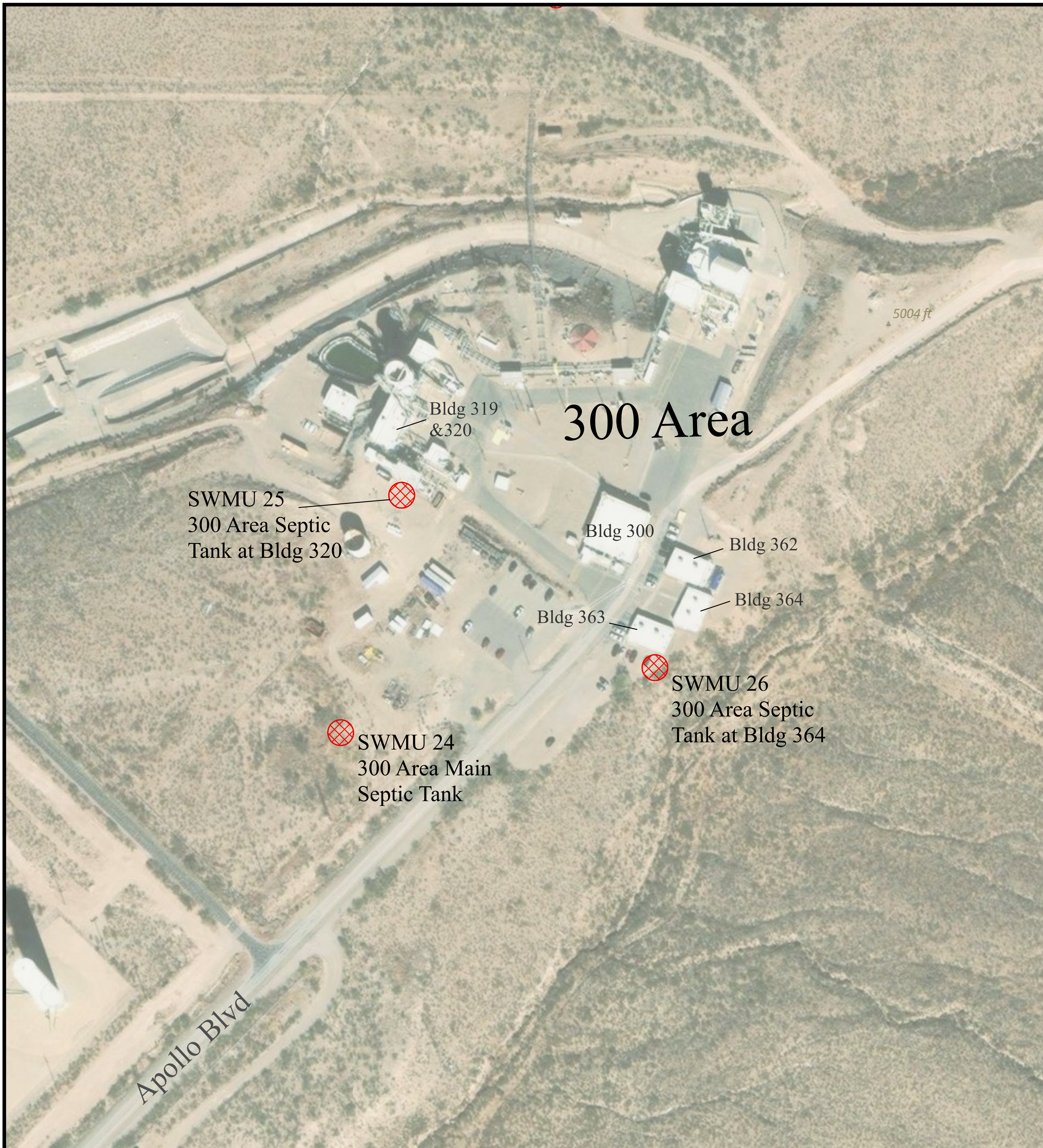
Figure 5.3 **300 Area SWMUs**

(SEE NEXT PAGE)



April 2024

N
W E
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1:2,400

0 100 200 400 Ft

Septic Tank Location

300 Area SWMUs

NASA Johnson Space Center
White Sands Test Facility Las Cruces, New Mexico

Coordinate System:
NAD 1983 StatePlane New Mexico Central FIPS 3002 Feet

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Figure 5.4 400 Area SWMUs and Ancillary Septic Tanks

(SEE NEXT PAGE)

N
W E
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April 2024

1:2,400

0 90 180 360 540 Feet

Septic Tank Location

400 Area SWMUs and Ancillary Septic Tanks

NASA Johnson Space Center
White Sands Test Facility Las Cruces, New Mexico

Coordinate System: NAD 1983 StatePlane New Mexico Central FIPS 3002 Feet

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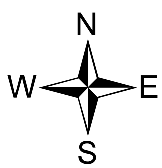
Figure 5.5 **Building 650 Septic Tank**

(SEE NEXT PAGE)



April 2024

1:3,750

Septic Tank Location

Building 650 Septic Tank

NASA Johnson Space Center
White Sands Test Facility Las Cruces, New Mexico

Coordinate System: NAD 1983 StatePlane New Mexico Central FIPS 3002 Feet

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Figure 5.6 **STGT Septic Tank**

(SEE NEXT PAGE)

N
W E
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April 2024

1:4,200

Feet
0 155 310 620 930

Septic Tank Location

STGT Septic Tank

NASA Johnson Space Center
White Sands Test Facility Las Cruces, New Mexico

Coordinate System: NAD 1983 StatePlane New Mexico Central FIPS 3002 Feet

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Tables

Table 2.1 Residential, Industrial, and Construction Worker Hazard from SWMU 30 COPCs

Noncarcinogens	Maximum Concentration 0'-10' bgs (mg/kg)	Residential SSL[1] (mg/kg)	Residential HI	Industrial/ Commercial SSL[1] (mg/kg)	Industrial/ Commercial HI	Construction Worker SSL[1] (mg/kg)	Construction Worker HI
Copper	1.55E+01	3.13E+03	4.95E-03	5.19E+04	2.99E-04	1.42E+04	1.09E-03
Lead[2]	8.83E+01	2.00E+02	2.21E-01	8.00E+02	1.10E-01	8.00E+02	1.10E-01
Site HI – 200 Area (SWMU 30)			4.95E-03		2.99E-04		1.09E-03

Notes:
HI – Hazard Index
SSL – Soil Screening Level
1 Soil Screening Level from NMED RA Guidance (NMED, 2022), Table A-1.
2 NMED RA Guidance (NMED, 2022), Table A-1 did not provide SSLs for lead, but guidance, Section 2.3.3 stated the SSLs were 400 mg/kg for residential and 800 mg/kg for industrial and construction worker pathways. In January 2024, the EPA recommended lowered residential screening levels of 200 mg/kg at sites with no other source of lead.

Table 2.2 Tier II Hazard Quotient for Ecological Receptors at SWMU 30

Receptor		EPC[1] (mg/kg)	Dose[2] (mg/kg per day)	TRV[3] (mg/kg)	SLHQ
Deer Mouse	Copper	9.52E+00	2.39E-01	9.34E+00	2.6E-02
	Lead	2.17E+01	2.90E-01	8.90E+00	3.3E-02
Deer Mouse HI					5.9E-02
Horned Lark	Copper	9.52E+00	1.45E+00	1.21E+01	1.2E-01
	Lead	2.17E+01	1.98E+00	1.79E+03	6.1E-01
Horned Lark HI					7.3E-01
Plants	Copper	9.52E+00	--	4.97E+02	1.9E-02
	Lead	2.17E+01	--	5.76E+02	3.8E-02
Plants HI					5.7E-02

Notes:
EPC – Exposure Point Concentration
HI – Hazard Index.
SLHQ – Screening Level Hazard Quotient.
TRV – Threshold Limit Values
TRV – Toxicity Reference Value

[1] Exposure Point Concentration equals the 95th Percent Upper Confidence Limit for Copper and Lead at SWMU 30.

[2] Dose is the exposure dose as calculated using Equation 13 of the RA Guidance.

[3] Toxicity Reference Values are Tier II Lowest Observed Adverse Effect Levels (LOAEL) listed in Tables C-1, C-2, and C-6 of Volume II of the RA Guidance.

Table 2.3 200 Area Firing Range (SWMU 30) COPC Concentrations and Soil-Leachate SSL Comparison

Analyte	Maximum Concentration (mg/kg)	Target Soil Leachate Concentration, DAF 20[1] (mg/kg)	Exceeds Target Soil Leachate Concentration?
Copper	1.55E+01	9.15E+02	No
Lead	8.83E+01	2.70E+02	No

Bold font indicates exceedance of target soil leachate concentration, DAF of 20.

[1] Target soil leachate concentrations from NMED RA Guidance (NMED, 2022), Table A-1 unless otherwise indicated.

Table 3.1 Residential, Industrial and Construction Worker Hazard from SWMU 31 COPCs

Noncarcinogens	Maximum Concentration 0'-10' bgs (mg/kg)	Residential SSL[1] (mg/kg)	Residential HI	Industrial/ Occupational SSL[1] (mg/kg)	Industrial/ Occupational HI	Construction Worker SSL[1] (mg/kg)	Construction Worker HI
Antimony	1.20E+00	3.13E+01	3.84E-02	5.19E+02	2.31E-03	1.42E+02	8.45E-03
Copper	1.48E+01	3.13E+03	4.73E-03	5.19E+04	2.85E-04	1.42E+04	1.05E-03
Lead[2]	1.07E+02	2.00E+02	2.68E-01	8.00E+02	1.34E-01	8.00E+02	1.34E-01
Tin[3]	5.80E-01	4.70E+04	1.23E-05	7.00E+05	8.29E-07	NE	--
Site HI - WB-2 (SWMU 31)			4.31E-02		2.60E-03		9.50E-03

Notes:
HI – Hazard Index
NE – Not established as per footnote [3]
SSL – Soil Screening Level
[1] Soil Screening Level from NMED RA Guidance (NMED, 2022), Table A-1 unless otherwise indicated.
[2] NMED RA Guidance (NMED, 2022), Table A-1 did not provide SSLs for lead, but guidance, Section 2.3.3 stated the SSLs were 400 mg/kg for residential and 800 mg/kg for industrial and construction worker pathways. In January 2024, the EPA recommended lowered residential screening levels of 200 mg/kg at sites with no other source of lead.
[3] NMED RA Guidance (NMED, 2022), Table A-1 did not provide SSLs for tin. EPA RSL for tin used as the soil screening level. EPA does not establish screening levels for construction worker receptors.

Table 3.2 Tier II Hazard Quotient for Ecological Receptors at SWMU 31

Receptor		EPC[1] (mg/kg)	Dose[2] (mg/kg per day)	TRV[3] (mg/kg)	SLHQ
Deer Mouse	Antimony	1.20E+00	2.22E-02	5.90E-01	3.8E-02
	Copper	9.77E+00	2.45E-01	9.34E+00	2.6E-02
	Lead	1.56E+01	2.09E-01	8.90E+00	2.4E-02
	Tin	5.80E-01		NE	--
Deer Mouse HI					8.8E-02
Horned Lark	Antimony	1.20E+00		NE	--
	Copper	9.77E+00	1.49E+00	1.21E+01	1.2E-01
	Lead	1.56E+01	1.42E+00	3.26E+00	4.4E-01
	Tin	5.80E-01		NE	--
Horned Lark HI					5.6E-01
Plants	Antimony	1.20E+00		5.80E+01	2.1E-02
	Copper	9.77E+00		4.97E+02	1.9E-02
	Lead	1.56E+01		5.76E+02	2.7E-02
	Tin	5.80E-01		NE	--
Plants HI					6.7E-02

Notes:
EPC – Exposure Point Concentration
HI – Hazard index.
NE – Studies of the toxicity of Antimony to avian species are insufficient to establish ESLs. See *Ecological Soil Screening Levels for Antimony,* U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC, February 2005.
SLHQ – Screening Level Hazard Quotient.
TRV – Toxicity Reference Value
1 Exposure Point Concentration equals the 95th Percent Upper Confidence Limit for COPECs at SWMU 31.
2 Dose = Exposure dose as calculated using Equation 13 of the RA Guidance.
3 Toxicity Reference Values are Tier II Lowest Observed Adverse Effect Levels (LOAEL) listed in Tables C-1, C-2, and C-6 of Volume II of the RA Guidance.

Table 3.3 WB-2 Firing Range (SWMU 31) COPC Concentrations and Soil-Leachate SSL Comparison

Analyte	Maximum Concentration (mg/kg)	Target Soil Leachate Concentration, DAF 20[1] (mg/kg)	Exceeds Target Soil Leachate Concentration?
Antimony	1.20E+00	6.56E+00	No
Copper	1.48E+01	9.15E+02	No
Lead	1.07E+02	2.70E+02	No
Tin[2]	5.80E-01	3.00E+03	No

Bold font indicates exceedance of target soil leachate concentration, DAF of 20.

[1] Target soil leachate concentrations from NMED RA Guidance (NMED, 2022), Table A-1 unless otherwise indicated.

[2] NMED RA Guidance (NMED, 2022), Table A-1 did not provide SSLs for tin. EPA RSL for tin used as the soil screening level.

Table 4.1 Residential and Construction Worker Risk and Hazard from SWMU 22 COPCs

COPC	Max. Concent-ration 0'-10' bgs (mg/Kg)	Residential SSL, Cancer[1] (mg/Kg)	Residential Risk	Residential SSL Non-cancer[1] (mg/Kg)	Residential HI	Construction Worker SSL[1] Cancer (mg/kg)	Construction Worker Risk	Construction Worker SSL[1] Non-cancer (mg/kg)	Construction Worker HI
Cadmium	1.10E+00	8.59E+04	1.28E-10	7.05E+01	1.56E-02	3.61E+03	3.05E-09	7.21E+01	1.53E-02
Chromium	1.90E+01	9.66E+01	1.97E-06	4.52E+04	4.20E-04	4.68E+02	4.06E-07	1.34E+02	1.42E-01
Cyanide	8.60E+00	NE	--	1.11E+01	7.75E-01	NE	--	1.20E+01	7.17E-01
Silver	9.40E-01	NE	--	3.91E+02	2.40E-03	NE	--	1.77E+03	5.31E-04
Cumulative Risk or HI		Risk	1.97E-06	HI	7.93E-01	Risk	4.09E-07	HI	8.74E-01

Notes:
HI – Hazard Index
NE – Not Established
[1] Soil screening level from NMED RA Guidance (NMED, 2022), Table A-1.

Table 4.2 SWMU 22 COPC Concentration Comparison with Soil Leachate SSLs

COPC	Maximum Concentration All Depths bgs (mg/kg)	Cw, DAF 20 (mg/kg)	UCL95 Concentration All Depths bgs (mg/kg)	Cw, DAF 20 (mg/kg)
Arsenic	**1.40E+01**	5.83E+00	**8.33E+00**	5.83E+00
Barium	1.20E+02	2.70E+03	6.96E+01	2.70E+03
Cadmium	3.80E+00	9.39E+00	1.49E+00	9.39E+00
Chromium, total	1.90E+01	2.05E+05	1.07E+01	2.05E+05
Cyanide	**8.60E+00**	7.13E-01	**3.45E+00**	7.13E-01
Lead	5.60E+00	2.70E+02	3.89E+00	2.70E+02
Mercury[1]	4.70E-02	2.09E+00	4.70E-02	2.09E+00
Silver[1]	9.40E-01	1.38E+01	9.40E-01	1.38E+01

Notes:

Bold font indicates exceedance of soil leachate SSL from NMED Risk Assessment Guidance (NMED, 2019), Table A-1 unless otherwise indicated.

SSL – Soil Screening Level

[1] Maximum concentration retained. Insufficient detections to support statistical analyses and calculation of UCL95 concentration.

Table 4.3 Ecological Hazard from SWMU 22 COPCs

Constituents	Maximum Concentration 0'-10' bgs (mg/kg)	Tier I ESL[1] (mg/kg)	SLHQ
Plant Receptor			
Cadmium	1.10E+00	3.20E+01	3.44E-02
Chromium, total	**1.90E+01**	3.50E-01	5.43E+01
Cyanide	8.60E+00	NE	--
Silver	9.40E-01	5.60E+02	1.68E-03
Plant HI			**5.43E+01**
Deer Mouse Receptor			
Cadmium	1.10E+00	7.00E+00	1.57E-01
Chromium, total	1.90E+01	2.18E+01	8.72E-01
Cyanide	8.60E+00	6.24E+02	1.38E-02
Silver	9.40E-01	5.47E+01	1.72E-02
Deer Mouse HI			**1.06E+00**

Bold font indicates exceedance of ESL or target HI.
ESL – Ecological Screening Level
HI – Hazard Index
SLHQ – Screening Level Hazard Quotient
1 ESLs from NMED Risk Assessment Guidance Volume II (NMED, 2017) Attachment C.

Table 5.1 WSTF Septic Tank History, Notifications, and Planned Land Use

Septic Tank Designation	SWMU	NMED Liquid Waste Program (LWP) Permit Number	Location Figure	Date Installed	Date Removed	Size (gallons)	Designed Flow Rate (gpd)	Service Area	Wastes Discharged to Septic System	Hazardous Substances	LWP Notification Date (Reference)	Planned Land Use
100 Area Septic Tank at Guard Shack	21	NA	Figure 5.1	1966	7/17/2017	500	200	Building 116; Temporary Office Trailer T164 (removed 1999)	Sewage, hand-washing and common janitorial supply wastes	NA	August 8, 2017, (NASA, 2017)	Area allowed to naturally revegetate, with no future use anticipated.
200 Area Septic Tank at Building 272	23	LC 910939	Figure 5.2	12/19/1991	12/16/2015	1,200 each	600 each	Building 272	Sewage, hand-washing and common janitorial supply wastes	NA	February 4, 2016, (NASA, 2016a)	Area allowed to naturally revegetate, with no future use anticipated.
300 Area Septic Tank at Main Parking Lot	24	NA	Figure 5.3	1963	3/4/2016	5,800	680[1]	Building 300	Sewage, hand-washing, and common janitorial supply wastes	NA	April 28, 2016, (NASA, 2016c)	Area allowed to naturally revegetate, with no future use anticipated.
300 Area Septic Tank at Building 320	25	LC 930858	Figure 5.3	Aug-1993	2/10/2016	1,200	200	Building 320	Sewage, hand-washing, and common janitorial supply wastes	NA	March 30, 2016, (NASA, 2016b)	Area allowed to naturally revegetate, with no future use anticipated.
300 Area Septic Tank at Building 364	26	LC 910918	Figure 5.3	Dec-1991	5/20/2015	1,200	300	Building 364	Sewage, hand-washing, and common janitorial supply wastes	NA	July 6, 2015, (NASA, 2015c)	Area allowed to naturally revegetate, with no future use anticipated.
400 Area Septic Tank at Main Parking Lot	27	NA	Figure 5.4	1964	3/8/2016	6,200	780[1]	Buildings 400, 411, 412, 440, and 464	Sewage, hand-washing, and common janitorial supply wastes	NA	April 28, 2016, (NASA, 2016c)	Area allowed to naturally revegetate, with no future use anticipated.
250 Area tank	NA	NA	Figure 5.2	1963 or 1964	Unknown	~2,600	Unknown	Temporary Office Trailers in 250 Area (removed 1964/1965)	Sewage and hand-washing wastes	NA	Likely removed following removal of temporary buildings, (NASA, 2013)	Area allowed to naturally revegetate, with no future use anticipated.
Building 272 (Tank C)	NA	DP-392	Figure 5.2	4/15/2005	12/16/2015	900	200	Building 272	Hand-washing and common janitorial supply wastes	NA	February 4, 2016, (NASA, 2016a)	Area allowed to naturally revegetate, with no future use anticipated.
Building T463	NA	LC 920527	Figure 5.4	May-1992 – Apr-1994	1/28/2015	1,200	400	Temporary Building T463	Sewage, hand-washing, and common janitorial supply wastes	NA	March 16, 2015, (NASA, 2015b)	Area allowed to naturally revegetate, with no future use anticipated.
Building 447	NA	LC 900333	Figure 5.4	5/8/1990	2/18/2016	750	100	Buildings 447, 448	Sewage, hand-washing, and common janitorial supply wastes	NA	March 30, 2016, (NASA, 2016b)	Area allowed to naturally revegetate, with no future use anticipated.
Building 650 (Plume-Front Area)	NA	DA 010359	Figure 5.5	Apr-2001	2/17/2016	1,200	40	Building 650	Sewage and hand-washing wastes	NA	March 30, 2016, (NASA, 2016b)	Area allowed to naturally revegetate, with no future use anticipated.
Buildings 802 and 803	NA	LC 870401	Figure 5.2	Apr-1987	6/21/2017	1,500	600	Buildings 802, 803	Test article washing, washing machine, sewage, hand-washing, and common janitorial supply wastes	NA	August 8, 2017, (NASA, 2017)	Area allowed to naturally revegetate, with no future use anticipated.
STGT	NA	LC 890939	Figure 5.6	Oct-1989	7/19/2017	1,200	600	STGT operations building, vehicle maintenance building, possibly the guard gate	Sewage, hand-washing, and common janitorial supply wastes	NA	August 8, 2017, (NASA, 2017)	Area allowed to naturally revegetate, with no future use anticipated.

Notes:
gpd = gallons per day
NA = not applicable
STGT = Second Tracking Data Relay Satellite Ground Terminal
[1] Indicates that the design flow rate for the large tanks was calculated using 1996 current employees and 1994 UPC criteria and reported to NMED on October 2, 1996.