CLOSURE PLAN
FORMER ACID NEUTRALIZATION UNIT

SOLID WASTE MANAGEMENT UNIT (SWMU) 89
U.S. Army White Sands Missile Range, New Mexico

EPA ID # NM2750211235

New Mexico Environment Department – Hazardous Waste Bureau

FINAL

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TABLES

FIGURES

DEFINITIONS

Terms used in this Closure Plan shall have the same meanings as those in the Hazardous Waste Act (HWA), Resource Conservation and Recovery Act (RCRA), and their implementing regulations unless this Closure Plan specifically provides otherwise. Where a term is not defined in the HWA, RCRA, implementing regulations, or this Closure Plan the meaning of the term shall be determined by a standard dictionary reference, EPA guidelines or publications, or the generally accepted scientific or industrial meaning of the term.

List of Abbreviations

ACA	Accelerated Corrective Action
ASTM	American Society for Testing and Materials
bgs	below ground surface
CFR	Code of Federal Regulations
CMS	Corrective Measures Study
COC	Chain-of-Custody
COPC	Contaminant of Potential Concern
DAF	Dilution Attenuation Factor
DoD	Department of Defense
DPT	Direct Push Technology
DQO	Data Quality Objectives
EPA	United States Environmental Protection Agency
eV	electron volt
ft	foot/feet
ft amsl	Feet Above Mean Sea Level
gal	gallon
GPS	Global Positioning System
HWA	Hazardous Waste Act
HWMU	Hazardous Waste Management Unit
HWMC	Hazardous Waste Management Center
IDW	Investigation Derived Waste

L	liter
MCL	Maximum Contaminant Level
mg/L	milligrams per liter
NMED	New Mexico Environment Department
NMSSL	New Mexico Soil Screening Level
NOD	Notice of Disapproval
PID	Photoionization Detector
QA	Quality Assurance
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RSSL	Residential Soil Screening Level
SSG	Soil Screening Guidance
SSL	Soil Screening Level
SVOC	Semi-Volatile Organic Compound
SWMU	Solid Waste Management Unit
TAL	target analyte list
TCLP	Toxicity characteristic leaching procedure
USCS	Unified Soil Classification System
VOC	Volatile Organic Compound
WSMR	White Sands Missile Range
WTS	White Sands Technical Services
WQCC	Water Quality Control Commission

1. INTRODUCTION

This Closure Plan describes the activities necessary to close the hazardous waste management unit (HWMU) designated as the former Acid Neutralization Unit, Solid Waste Management Unit (SWMU) 89 at U.S. Army White Sands Missile Range (WSMR or the Permittee), hereafter referred to as the "Neutralization Pit" or "SWMU 89." SWMU 89 is listed in Table 4-4 of the 2009 Resource Conservation and Recovery Act (RCRA) Permit (Permit) in Appendix 4. The information provided in this Closure Plan addresses the closure requirements specified in the Code of Federal Regulations (CFR), Title 40, Part 264, Subpart G and the New Mexico Hazardous Waste Act (HWA) and is consistent with the requirements outlined in the Permit. The Permittee submitted *Revised Closure Plan SWMU 89, Former Acid Neutralization Unit at the Hazardous Waste Storage Facility (WSMR-27)*, dated April 2017; this Closure Plan is based on the information contained within the Permittee's submittal.

WSMR is a United States Army Installation Management Command (IMCOM) Installation established in 1945. WSMR is the largest land area military installation in the United States, encompassing approximately 3,200 square miles of land in Doña Ana, Socorro, Lincoln, Otero, and Sierra Counties in south-central New Mexico. The installation is approximately 99 miles long (north to south) and 25 to 40 miles wide (east to west). WSMR was established on July 9, 1945, as White Sands Proving Ground (the name was changed in 1958) to be the nation's testing range for the newly developed missile weapons. WSMR is located in the Tularosa Basin of south-central New Mexico, and portions of WSMR extend west into the Jornada del Muerto Basin. The headquarters (Main Post) area of WSMR is located at the southwestern corner of the installation, approximately 27 miles east-northeast of Las Cruces, New Mexico, and 45 miles north of El Paso, Texas. The main entrance to WSMR is on U.S. Highway 70 (Figure 1-1).

SWMU 89 was an aboveground, open-top, double-walled concrete evaporation tank (Evaporation Tank Number [No.] S-22896) located within the Hazardous Waste Storage Facility (HWSF), approximately 8 miles east of the WSMR Main Post (Figure 1-2). The Neutralization Pit was used to evaporate liquid chemical wastes generated at photographic laboratories. The unit was also occasionally used as a storage pad for damaged transformers containing polychlorinated biphenyls (PCBs). In 1981, the unit was converted to a loading dock. Because of the dates of use, SWMU 89 is considered a Hazardous Waste Management Unit (HWMU) and must be closed in accordance with 40 CFR § 265. Subpart G.

2. DESCRIPTION OF THE UNIT TO BE CLOSED

The Neutralization Pit consisted of an aboveground, open-top, double-walled concrete evaporation tank with the inner tank coated with a corrosion-resistant epoxy. The tank was 21 feet long by 21 feet wide by 18 inches high and was located within the Facility's HWSF. The Neutralization Pit was used to evaporate liquid chemical wastes generated at photographic laboratories and was also occasionally used as a storage pad for damaged transformers containing polychlorinated biphenyls (PCBs).

The RCRA Facility Assessment (RFA) (A.T. Kearney, 1988) noted that the exact date of construction of the Neutralization Pit was unknown, but the tank was reportedly operated for 10 to 15 years from the late 1960s until 1981, when it was converted to a loading dock. The wastes included potassium ferricyanide, potassium ferrocyanide, waste bleach solution, soil contaminated with methylene chloride (from a spill at the Temperature Test Facility), and containerized liquids contaminated with PCBs (A. T. Kearney, 1988).

The RFA reported that in 1981, when PCB transformers were stored in the tank, a batch of corrosive photographic waste was also placed in the unit. As a result, PCBs leaked from the transformers and mixed with the corrosive photographic waste. Soil sampling around the tank at the time indicated PCB contamination was present. The cleanup and remediation were performed by WSMR with EPA Region 6 and New Mexico Environmental Improvement Division oversight (A.T. Kearney, 1988). In 1981, the unit was converted to a loading dock by extending its walls to 4 feet high, filling it with clean fill dirt, and installing a reinforced concrete cap/seal over the structure.

3. SUBSURFACE CONDITIONS

3.a. Geology and Soil

3.a.i. Regional Geology

WSMR lies within the Mexican Highland Section of the Basin and Range Province. This province is characterized by a series of tilted fault blocks forming longitudinal, asymmetric ridges, or mountains, and broad intervening basins. The geology of WSMR consists predominantly of the Tularosa Basin and surrounding mountain ranges. The San Andres, San Augustin, and Oscura Mountains border the Tularosa Basin on the west, and the Sacramento Mountains form the eastern border. A narrow region of north-south–trending, large-displacement normal faulting separates the mountains from the basin resulting in the change in relief across the missile range. The majority of WSMR property, including most test facilities, is located within the Tularosa Basin (WTS, 2006). The Tularosa Basin contains thick sequences of Tertiary and Quaternary age alluvial or bolson fill deposits. These sediments, more than 5,000 feet in thickness in some areas, primarily consist of silt, sand, gypsum, and clay weathered from the surrounding mountain ranges. The average elevation of the basin floor is 4,000 feet above mean sea level, and surface features consist of flat sandy areas, sand dunes, basalt flows, and playas (dry lake beds) (WTS, 2006). SWMU 89 is located within the Tularosa Basin in the southern portion of WSMR.

3.a.ii. Site-Specific Geology

The site overlies thick sequences of unconsolidated sediments of the Quaternary and Neogene age that have eroded from the Organ, San Augustin, and San Andres Mountains along with evaporite deposits that have filled the Tularosa Basin. Sediments were deposited in alluvial fans, aeolian dunes, stream channels, and in lacustrine silts, clays, and gypsum. The site topography is flat, with ground elevations ranging from 4,032 feet above mean sea level in the west to 4,038 feet above mean sea level in the north. Drainage is to the southwest. Surface soils are dry and sandy, and vegetation is sparse mesquite and creosote brush. Based on soil borings from previous SWMU 89 investigations that ranged in depth from 5 to 30 feet bgs and soil excavation observations, the near surface geology consists of unconsolidated deposits characterized by Quaternary/Tertiary soils composed of alternating layers of silty sands, sandy silts, and fine-grained sands with some cementation occurring at approximately 10 feet bgs. Poorly graded gravels were noted in some boreholes at approximately 4 feet bgs.

3.b. Hydrogeology

3.b.i. Regional Hydrogeology

Surface hydrogeology at WSMR is generally characterized by low precipitation, high infiltration rates, and high evapotranspiration rates. Thunderstorm activity is common in the summer. Playas within the basin may temporarily contain standing water, and arroyos that drain the surrounding mountain ranges may contain water after precipitation events. The Tularosa Basin is a closed basin with no surface water drainage outside of WSMR (WTS, 2006).

During precipitation events, the precipitation infiltrates the unconsolidated alluvial fan deposits, and the resultant groundwater flows toward the center of the Tularosa Basin, generally to the east-southeast. Groundwater becomes more mineralized to the east, primarily with sulfate and chloride, potentially due to the slow lateral migration of groundwater from recharge areas to discharge areas and the presence of soluble minerals in the bolson sediments. Groundwater flow direction in the western portion of the Tularosa Basin region is to the south toward the northern Hueco Basin of western Texas. No surface expressions of groundwater discharge have been reported in the western Tularosa Basin (WTS, 2006).

The WSMR Main Post obtains its potable water supply from an aquifer in the upper bolson deposits where the majority of recharge occurs through coarse, unconsolidated Tertiary/Quaternary alluvial fan deposits and arroyos along the eastern flank of the Organ, San Andres, and San Augustin Mountains. The aquifer is a wedge-shaped belt of potable water more than 30 miles long, north to south, and 3 to 5 miles wide, east to west, and up to 1,800 feet deep (McClean, 1970). The aquifer generally contains total dissolved solids (TDS) concentrations of less than 1,000 milligrams per liter (mg/L), making it suitable for human consumption in most areas.

3.b.ii. Site-Specific Hydrogeology

Four monitoring wells (TW1, TW2, TW3, and TW4) are located in the vicinity of SWMU 89, with the closest (TW3) located approximately 150 feet to the south (Figure 1-2). Monitoring wells TW1, TW2, and TW3 were drilled in 1983 as part of a joint military training program sponsored by the U.S. Navy and U.S. Army. The wells were drilled as exploratory and monitoring wells for the hazardous-waste storage facility (Myers, 1987). Monitoring well TW4 was added in 1989 (IT Corporation, 1992). These four monitoring wells penetrated similar lithologies consisting primarily of heterogeneous bolson fill deposits of interbedded sand, gravel, silt, and clay. There are boring logs for wells TW1, TW2, and TW3; however, a boring log for well TW4 is not available.

According to 2012 monitoring results, the depth to groundwater is approximately 230 feet bgs, and groundwater generally flows to the south, although there is some uncertainty associated with the groundwater flow direction. The groundwater is highly saline, with a TDS concentration of more than 13,500 mg/L. The nearest production well yielding potable water is in the WSMR Main Post area, more than 8 miles west of SWMU 89.

4. GENERAL CLOSURE INFORMATION

Evaporation tank No. S-22896 (the Neutralization Pit) reportedly operated from the late 1960s until 1981, when it was converted to a loading dock. In September 2012, an Accelerated Corrective Action (ACA) was performed at SWMU 89, which consisted of demolishing the loading dock and evaporation tank and removing contaminated soil from beneath the tank. Soil sampling indicated that some residual arsenic and cyanide-contaminated soil may remain at the site after the ACA. Arsenic concentrations in surface and subsurface soils are consistent with naturally occurring conditions and are not attributed to known site releases. Surface and subsurface cyanide contamination is attributable to releases at the site. The extent of residual cyanide contamination present after corrective actions has not been adequately defined and may present a risk to human health. Groundwater monitoring indicates that there has been no impact to groundwater from operation of SWMU 89, although there is some uncertainty in the groundwater flow direction and groundwater monitoring has been inconsistent.

This Closure Plan describes an investigation to evaluate the extent of potential cyanide contaminated soil at SWMU 89 through the collection and analysis of additional surface and subsurface soil samples, and, if needed, excavation of cyanide contaminated soil that exceeds the NMED risk-based soil screening level (RSSL). The soil samples will be analyzed for cyanide, which is the remaining contaminant of potential concern. The cyanide analytical data will be compared to the most current NMED RSSLs (NMED, 2017). If needed, the excavation of cyanide-contaminated soil will be limited to the upper 10 feet of impacted soil at the site. The potential exposure pathway for soils at depths greater than 10 feet below ground surface (bgs) is incomplete and contaminated soils deeper than 10 ft bgs will be left in place at the site. Excavations will be backfilled with clean soil. Additional depth to groundwater measurements will be made in nearby monitoring wells to resolve uncertainties regarding groundwater flow direction and additional groundwater sampling will be conducted.

4.a. Historical Investigation and Remediation Activities

4.a.i. Phase I RCRA Facility Investigation

The Phase I RFI (IT Corporation, 1992) included a 10-point soil vapor survey performed from February through April 1992. The target compounds included methane, carbon dioxide, methyl ethyl ketone, methyl isobutyl ketone, trichloroethylene, tetrachloroethylene, 1,1,1-trichloroethane, 1,1,2- trichloroethane, 1,1-dichloroethane, 1,2- dichloroethane, chloroform, benzene, toluene, ethylbenzene, m-xylene, o-xylene, and p-xylene.

Carbon dioxide was detected at concentrations above the quantitation limit. Carbon dioxide concentrations ranged from 1.8 to 4.0 grams per cubic meter. A trace concentration, below the quantitation limit, of o-xylene was also detected in one sample. The range of carbon dioxide concentration varied within the range of accuracy and no general trend in concentration distribution was identified. As part of the Phase I RFI investigation in April through May 1992, four 12-foot-deep soil borings (89B1, 89B2, 89B3, 89B4) were hand augered, inclined at 30 degrees from vertical beneath the tank, with samples collected at 4-, 8-, and 12-foot depth intervals along the borings. One 30-foot vertical soil boring (89B5) was performed by hollow stem auger with samples collected at 15-, 20-, 25-, and 30-foot depth intervals. Finally, one background 5-foot soil boring (89BG1) was hand augered with samples collected at 2- and 5-foot depth intervals. Soil samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals, PCBs, and total cyanide.

The detected constituents included arsenic, barium, lead, Aroclor 1260, bis(2-ethylhexyl) phthalate, acetone, and total cyanide. Of these detections, arsenic exceeded the New Mexico RSSL of 4.25 milligrams per kilogram (mg/kg) (NMED, 2015a), with a result of 10 mg/kg in sample 89B1S008. Given the 30-degree incline from vertical, the actual depth of this sample was 6.9 feet bgs under the tank. Total cyanide also exceeded the New Mexico RSSL of 11.2 mg/kg (NMED, 2015a) in samples 89B2S012 (15 mg/kg), 89B3S004 (13 mg/kg), 89B3S008 (12 mg/kg), 89B4S004 (13 mg/kg), 89B4S008 (38 mg/kg), and 89B4S012 (39 mg/kg). Given the 30-degree incline from vertical, the actual depths of these samples extended down to approximately 10.4, 6.9, and 10.4 feet bgs at the projected locations in soil borings 89B2, 89B3, and 89B4, respectively. A field duplicate sample, collected at 89B4S012, contained a cyanide concentration of 91 mg/kg.

4.a.ii. Phase II RCRA Facility Investigation

The Phase II RFI (Sverdrup, 1994) included six soil borings installed as part of a soil investigation conducted between December 1993 through January 1994. Two vertical soil borings (89SB01 and 89SB02) were drilled by hollow stem auger to 21 feet bgs adjacent to the tank. Four angled (45-degree incline) soil borings (89SB03, 89SB04, 89SB05, and 89SB06) were drilled by hollow stem auger to an approximate depth interval of 21 feet to sample beneath the tank.

The soil samples were analyzed for PCBs, metals, and total cyanide. The detected constituents include arsenic, barium, lead, mercury, Aroclor 1260, and total cyanide. Of these detections, arsenic exceeded the 2015 New Mexico residential SSL of 4.25 mg/kg in all locations except 89SB06. Exceedances were noted down to depths bgs of 14 feet (7.23 mg/kg), 9 feet (7.8 mg/kg), 10.6 feet (4.58 mg/kg), 6.4 feet (6.29 mg/kg), and 9.9 feet (5.06 mg/kg) at locations 89SB01, 89SB02, 89SB03 (projected), 89SB04 (projected), and 89SB05 (projected), respectively. Total cyanide also exceeded the 2017 New Mexico residential SSL of 11.2 mg/kg (NMED, 2015a) in samples 0089SB03 (000.0) (13.8 mg/kg), 0089SB04 (014.0) (20.3 mg/kg), and 0089SB04 (019.0) (45.7 mg/kg). The calculated actual depths of these samples are 0, 9.9, and 13.4 feet bgs at the projected locations in soil borings 89SB03 and 89SB04, respectively.

Four wells (TW-1 through TW-4), installed in the vicinity of SWMU 89, are shown on Figure 1-2. In 1989 groundwater samples obtained from the wells were analyzed for dissolved metals, VOCs, and general chemistry. In addition, the sample collected from TW-4 was also tested for pesticides and total cyanide. Toluene was detected in all of the wells. Chromium was detected in well TW-4. During the Phase II RFI investigation, groundwater samples were collected from wells TW2 and TW3 and analyzed for TDS and total cyanide. No cyanide was detected in the groundwater samples.

4.a.iii. Loading Dock and Evaporation Tank Demolition

The ramp, loading dock cover, and concrete tank were demolished and removed starting in June 2012 as a part an Accelerated Corrective Action (ACA). Demolition was performed in advance of soil removal activities. However, before the concrete tank was demolished and removed, the tank dimensions were measured, and photographic documentation of the tank was obtained (Shaw, 2012). The loading dock's dimensions were 21 feet long by 21 feet wide by 4 feet high. The loading ramp was 21 feet long, the dock side walls were 11 inches thick, and the concrete cover was 4.5 inches thick. The inside walls and floor of the tank were lined with a black epoxy-type coating.

Inspection of the tank walls showed that the tank structure had been added on to the original evaporation tank. The original evaporation tank's dimensions were 21 feet long by 21 feet wide by 18 inches high. The walls and floor were 6 inches thick. An east-west central concrete divider created two separate tanks. No cracks were observed on the exterior sides of the evaporation tank once the upper concrete walls had been removed. There appeared to be additional coating material beneath the current coating of the evaporation tank.

The ramp, loading dock cover, and concrete tank were demolished and removed. Demolition began with the mechanical removal of the concrete cover and ramp using a hydraulic hammer attachment on a backhoe. The demolished materials were further reduced to manageable-sized pieces and staged onsite. Soil within the vault was removed and placed initially into one lined and covered roll-off container and then into dump trucks for immediate transport to the Rhino Landfarm Facility, Otero County, New Mexico.

As demolition progressed two distinct concrete structures became apparent. Apparently, to attain the appropriate height for the loading dock, an additional 14 inches of concrete were added to the walls of the original evaporation tank. A total of 30 tons of soil was transported to the landfarm for treatment. Non-impacted concrete from the upper section of the tank (second structure) was segregated and transported to the WSMR materials recycling area. Once the concrete cover, ramp, and interior soil had been removed, a hydraulic hammer was used to begin demolition of the original tank structure. A second waste characterization sample consisting of soil below the tank and concrete rubble from the tank demolition was collected and analyzed for metals, PCBs, SVOCs, total petroleum hydrocarbons, VOCs, total cyanide, and miscellaneous constituents. The soil and concrete rubble were also analyzed for toxicity characteristic leaching procedure (TCLP) metals, TCLP SVOCs, and TCLP VOCs. The sampling results show that only arsenic exceeded the New Mexico RSSL (4.25 mg/kg) with a concentration of 22.4 mg/kg. It was determined that the soil and concrete could be managed as nonhazardous waste. The excavated soil and concrete were transported for disposal at the Otero/Greentree Regional Landfill, Alamogordo, New Mexico.

4.a.iv. Accelerated Corrective Action Excavations

Soil excavation at SWMU 89 was conducted in 2012. The soils immediately beneath the Neutralization Pit were examined for staining or other indicators of a historical release. No staining or odors were immediately observed. However, during the early morning hours, the soils in various areas of the initial and second excavations were observed to have a faint bluish discoloration that would disappear as the temperature increased. The bluish discoloration was a result of a reaction of iron and cyanide in the soil when it was exposed to moisture in the air, thus creating ferrocyanide. All discolored/impacted areas in the excavation were removed. No discoloration was observed in the final excavation. The initial excavation limits were approximately 21 feet long by 21 feet wide by 3.5 feet deep at the south wall to 1-foot deep at the north wall.

Confirmation soil samples were collected as grab soil samples using disposal plastic scoops. One grab soil sample was collected from each excavation side wall, and four grab soil samples were collected from the floor (one sample every 300 square feet) of the excavation. The soil samples were analyzed for PCB Aroclors (8082A), VOCs (8260B), SVOCs (8270C), the EPA target analyte list (TAL) metals (6010C/6020A/7471B), and total cyanide (9010C/9014) (EPA, 1986) Arsenic (4.25 mg/kg), Aroclor 1260 (2.43 mg/kg), and total cyanide (11.2 mg/kg) exceeded New Mexico RSSLs in one or more confirmation samples. Arsenic exceeded the New Mexico RSSL at 89-EW (7.78 mg/kg), 89-FL (10.3 J+ mg/kg), 89-FL2 (6.67 J+ mg/kg), 89-FL3 (20.2 mg/kg), and 89-NW (5.41 mg/kg). Aroclor 1260 exceeded screening levels at 89-NW (15.4 mg/kg). Total cyanide exceeded screening levels at 89-EW (641 mg/kg), 89-FL (380 mg/kg), 89-FL2 (703 mg/kg), 89-FL3 (1,120 mg/kg), 89-FL4 (359 mg/kg), 89-NW (253 mg/kg), and 89-SW (78.6 mg/kg).

Additional soil was removed from the north, east, and south walls and excavation floor, resulting in an excavation with the dimensions of 25 feet (north-south) by 22 feet (east-west) by 5 feet deep at the south wall to 2.5 feet deep at the north wall. Confirmation soil samples were collected and analyzed for the same analytical suite as the first excavation. Sampling results indicated that arsenic, Aroclor 1260, and total cyanide exceeded soil screening levels (SSLs) in one or more samples. Arsenic exceeded SSLs at 89-FL2-6 (4.71 mg/kg), 89-FL3-7 (4.99 mg/kg), and 89-NW2 (7.18 mg/kg). Aroclor 1260 exceeded SSLs at 89-NW2 (16.1 mg/kg). Total cyanide exceeded SSLs at 89-FL3-7 (140 mg/kg), 89-FL4-8 (194 mg/kg), 89-FL5 (196 mg/kg), and 89-NW2 (121 mg/kg).

Additional soil was removed from the north wall and excavation floor resulting in an excavation with the dimensions of 26 feet (north-south) by 24 feet (east-west) by 6.5 feet deep at the south wall to 8 feet deep central to 5.5 feet deep at the north wall. Confirmation soil samples were collected and analyzed for the same analytical suite as the first excavation. Sampling results indicated that only arsenic exceeded SSLs. Arsenic slightly exceeded the SSL at floor sample 89-FL12 with a detection of 4.66 mg/kg. No further excavation was performed to address the arsenic for the following reasons: the detected concentration of 4.66 mg/kg in sample 89-FL12-080612 only slightly exceeded the RSSL of 4.25 mg/kg, it is more than 200 feet to groundwater, arsenic is naturally occurring in New Mexico soils, and arsenic was not a documented waste at SWMU 89.

Backfill material was mechanically compacted with a backhoe and the area was graded to maintain positive drainage. Road gravel was then placed and graded over the area.

4.b. Groundwater Monitoring

Four monitoring wells (TW1, TW2, TW3, and TW4) located near SWMU 89 (Figure 1-2) were installed in the 1980s at the Hazardous Waste Storage Facility. Monitoring well construction data are presented in Table 2-4. Historical information indicated that the wells were never properly developed, so the monitoring wells were developed in July 2012, prior to groundwater sampling.

Well development was conducted in accordance with the WSMR RCRA Permit, Appendix 6 (Monitoring Well Construction Requirements), Section 6.3.5 (NMED, 2009).

The monitoring wells were developed using gentle surging with a surge block device attached to drill pipe, bailing, and over-pumping using a submersible pump. The development of each well was continued until water removed from the well was clear, the turbidity measured less than 35 nephelometric turbidity units and the pH, temperature, and conductivity parameters were stable (less than 10 percent variation for three successive readings). During development of wells TW1 and TW3, the turbidity readings remained elevated, and development by swabbing and bailing was halted due to sand production. Wells TW1 and TW3 were thought to have some form of structural integrity issues such as damaged well screen or casing; however, during development activities, no issues were identified with the use of surge blocks and bailers in the well screens, or with casing collapse. The volume of groundwater removed during development for each well (3 to 5+ casing volumes) was likely sufficient to access formation water within each monitoring well. The development process was terminated, and the monitoring wells were left to equilibrate for approximately 2 weeks before purging and sampling. The monitoring wells were gauged before purging and sampling; the groundwater elevation data are presented in Table 2-12.

Well TW2 is located upgradient, well TW1 is generally located cross-gradient, and wells TW3 and TW4 are located downgradient from SWMU 89. As part of closure, water levels in the monitoring wells will be measured to verify the groundwater flow direction and gradient.

Groundwater samples were collected from the site on August 16 and 17, 2012. Groundwater samples from monitoring wells TW1 through TW4 were collected using low-flow sampling techniques as specified in the WSMR RCRA Permit, Appendix 5 (Investigation and Sampling Methods and Procedures), Section 5.2.2.i (NMED, 2009). Groundwater samples were analyzed for PCBs, VOCs, SVOCs, EPA TAL metals, pesticides, herbicides, and total cyanide.

The TDS concentrations in groundwater are in excess of 10,000 mg/L; therefore, the groundwater is considered non-potable as indicated in New Mexico Administrative Code Section 20.6.2. However, all groundwater in New Mexico is a resource and the condition of wells TW-1 and TW-3 may result in TDS concentrations that are not representative of formation water; therefore, analytical results were evaluated against groundwater standards. Metals and toluene in well TW2 were constituents detected. The metals detected at concentrations greater than either the WQCC or EPA cleanup levels included aluminum (TW1 and TW3 at 18.1 mg/L(J) and 6.01 mg/L respectively), arsenic (all wells ranging from 0.00176 mg/L to 0.00727 mg/L), chromium (TW1, TW2, TW3 at 0.0196 (J), 0.0193 mg/L, and 0.00855 mg/L respectively), cobalt (TW1 0.00696 (J) mg/L), iron (TW1 (16 mg/L (J), TW2 (2.93 mg/L), TW3 (4.65 mg/L)), and manganese (TW1 at 0.234 mg/L (J)). Cyanide was not detected in any of the groundwater samples.

Assuming the groundwater flow direction is to the south, monitoring well TW3 is the closest (approximately 150 feet) downgradient well to SWMU 89. Monitoring well TW2 is the closest (approximately 300 feet) upgradient well. Monitoring well TW1 is cross-gradient about 400 feet west of SWMU 89 (Figure 1-2). A comparison of the limited sampling results for downgradient well TW3 with wells TW1 and TW2 does not suggest a direct groundwater impact from releases at SWMU 89. Arsenic, chromium, and TDS concentrations are less in downgradient well TW3 than in cross-gradient well TW1 and upgradient well TW2. Aluminum and iron concentrations are less in downgradient well TW3 than in cross-gradient well TW1. Similarly, well TW4, which is approximately 525 feet downgradient from SWMU 89, exceeds residential groundwater screening standards for arsenic and TDS, but its detected arsenic concentration was less than the arsenic concentrations detected in cross-gradient well TW1 and upgradient well TW2.

4.c. Conceptual Site Model

Based on the RFI Phase I and Phase II soil boring sampling results, there may be residual cyanide contamination at soil boring locations 89B2 (at 10.4 feet bgs and below) and 89SB03 (at 0 feet bgs), which are outside of the ACA soil excavation area, and at soil boring locations 89SB3 (at 6.9 feet bgs), 89SB4 (at 6.9 feet bgs and below), and 89SB04 (at 9.9 feet bgs and below), which are inside the soil excavation footprint but deeper than the final base of the excavation. The depth of cyanide contamination was not fully defined in past investigations or the ACA. Based on the RFI Phase I and Phase II soil borings and ACA confirmation sample results, PCBs have been removed and do not require further investigation. Based on the RFI Phase I and Phase II soil boring sampling results, there may be residual arsenic contamination at soil boring locations 89B1 (at 6.9 feet bgs) and 89SB01 (down to 14 feet bgs), which are outside of the ACA limits of the soil excavation, and at soil boring locations 89SB02 (at 9 feet bgs), 89SB03 (at 6.4 and 9.9 feet bgs), and 89SB05 (at 6.4 and 9.9 feet bgs), which are inside the soil excavation area but deeper than the base of the final excavation. These residual arsenic exceedances are all bounded by deeper arsenic sample results that do not exceed the RSSL, which indicates that the vertical extent of arsenic exceedances is defined. Arsenic occurs naturally in New Mexico soils and is not a documented waste at SWMU 89. Based on the available groundwater sampling results, there does not appear to be any impact to groundwater from releases at SWMU 89.

The soil exposure pathway for cyanide from incidental ingestion, dermal contact, and inhalation of chemicals adsorbed to windblown soils released to outdoor air is identified as complete because cyanide exceeds the NMED residential SSLs in surface and subsurface soil. Cyanide is not expected to naturally degrade significantly in soil. The surface water pathway is not complete because no surface waters exist in the vicinity of the site and storm water surface drainage is minimal. Groundwater is not considered a completed pathway because depth to groundwater is greater than 200 feet, natural recharge is likely low, and the liquid source has been removed. The available groundwater sampling results do not indicate that there has been an impact to groundwater from the operation of SWMU 89, and no drinking water supply wells are located within a 1.5-mile radius of the site.

5. CLOSURE PROCEDURES

Permitting and utility clearance shall be performed before the onset of field work. A dig permit will be obtained in accordance with WSMR protocols, which include a utility clearance of the work location. In addition, a third-party utility locate will be conducted to clear a 10-foot radius surrounding each soil boring location using ground-penetrating radar.

5.a. Installation of Additional Soil Borings

Soil borings shall be advanced using the DPT drilling method. Eight soil borings are proposed at SWMU 89, as shown on Figure 3-1. Six of the soil borings will be located where previous sampling indicates the presence of residual cyanide contamination and two soil borings will be located at the center of the tank and next to the north side of the storage building, respectively.

The following drilling and soil sampling procedures shall be performed at SWMU 89:

1. Soil boring locations shall be designated, numbered, staked with a wood lath, and flagged with fluorescent survey ribbon prior to mobilization. A handheld Trimble global positioning system will be used to locate and mark the soil borings.

2. The DPT drill rig shall be equipped with a nominal 2-inch coring (Geoprobe Macro-Core or equivalent) with disposable acetate sleeves for core collection, which allows for undisturbed soil cores to be obtained for logging and sampling. Prior to drilling each boring, the drill tools and sampling equipment shall be decontaminated by steam cleaning in a portable or locally constructed decontamination pad. Upon arrival, the drill rig shall be inspected for safety checks, leaks, and contamination. The drill rig shall be decontaminated prior to arrival and removal from the site. Disposable acetate sleeves shall be used to collect intact soil core and will not be reused. Decontamination activities shall be conducted at the site using potable water obtained from an approved onsite source.

3. Soil borings shall be continuously cored to a total depth of 30 feet bgs. Soil sampling for laboratory analysis shall be performed according to the WSMR RCRA Permit, Appendix 5 (Investigation and Sampling Methods and Procedures), Section 5.2.2.b.ii (Soil and Rock Sampling) (NMED, 2009). The specific methods and procedures used in the field shall be described in the closure report. Laboratory samples shall be collected immediately from intact core upon opening of core sleeves to minimize volatilization of contaminants. Soil samples shall be collected from the undisturbed soil core using pre-cleaned disposable equipment, in appropriate containers, and placed on ice upon collection. The soil boring log shall document location, sample collection, and observations along with drilling notes and lithologic description. Photographic documentation will also be collected during field activities. If refusal is encountered, the borehole will be abandoned and the sampling location will be shifted by approximately 2 feet and re-drilled.

4. Five proposed soil samples shall be collected from boreholes 89-SB007, 89-SB008, 89-SB012, 89-SB013, and 89-SB014 at depths of 9 to 10, 14 to 15, 19 to 20, 24 to 25, and 29 to 30 feet bgs. Seven proposed soil samples will be collected from boreholes 89-SB009, 89-SB010, and 89-SB011 at depths of 0 to 1, 4 to 5, 9 to 10, 14 to 15, 19 to 20, 24 to 25, and 29 to 30 feet bgs. However, if field screening indicates the presence of contamination, the sample interval shall be modified to define the extent of potential contaminants.

5. Soil samples shall be analyzed for total cyanide.

6. Soil lithology shall be described according to the Unified Soil Classification System. In addition, the soil boring log will document location, sample collection, field observations (staining or odors), and drilling notes.

7. Upon completion of the sampling activities, boreholes shall be backfilled with bentonite chips, which will be hydrated after placement. Each boring will be restored to the original surface condition. The wood lath and survey ribbon will be placed in the top of each abandoned borehole to identify the location to be professionally surveyed. All new soil borings will be surveyed by a New Mexico-licensed Professional Surveyor. The survey shall be conducted in accordance with Section 5.5.2.f of Permit Appendix 5.

Decontamination fluids from the decontamination pad shall be collected such that no spills occur to the ground surface, contained in polyethylene tanks, and managed as IDW or allowed to evaporate from plastic sheeting, as required by the WSMR HWMC. All IDW generated onsite (for example, soil, groundwater, and disposable personal protective equipment) will be managed in accordance with the WSMR RCRA Permit Appendix 5 (Investigation and Sampling Methods and Procedures), Section 5.2.5 (NMED, 2009). Excess soil shall be containerized and characterized for disposal according to the requirements of the WSMR HWMC.

5.a.i. Soil Sampling QA/QC

Quality assurance (QA) and QC shall be achieved by using a NELAP certified laboratory, implementing the analytical program in accordance with the Permit Appendix 5, Section 5.3, analytical methodologies and QC limits, collecting sufficient QA and QC samples, and performing data review and validation in accordance with the QSM. Sample ID and QC sampling are listed in Table 3-1.

Soil sampling nomenclature shall be as follows:
XXXX-SBXXX-XX-XX-MMYY

Where:
XXXX = SWMU number
SBXXX = soil boring number
XX-XX = depth interval
MMYY = two-digit month, two-digit year

The following field QC samples are included in the planned activities:

- Soil field duplicate samples shall be collected at a 10 percent frequency.
- Equipment rinsate blanks shall be included if nondisposable or nondedicated equipment is used to collect field samples. Rinsate samples will be collected at a 5 percent rate or a minimum of one per day.

EPA Stage 3 validation will be performed for soil and water analytical data in accordance with EPA National Functional Guidelines for Inorganic Superfund Data Review (EPA, 2014b); DoD QSM Version 5.0 (DoD, 2013); and the WSMR RCRA Permit, Appendix 5 (Investigation and Sampling Methods and Procedures), Section 5.3 (NMED, 2009). IDW data will not undergo validation; however, the data will be reviewed for accuracy and completeness prior to being used for waste disposal.

5.a.ii. Analytical Methods

Soil sample analyses shall be performed by Eurofins Lancaster Laboratories Environmental, LLC, which maintains current U.S. Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP) certification. Soil analysis shall be performed by the appropriate EPA methods in accordance with reference limits and screening criteria. Sample handling and analysis will be performed according to quality control (QC) and sampling procedures listed in Appendix 5, Sections 5.1, 5.2, and 5.3 of the WSMR RCRA Permit (NMED, 2009).

5.a.iii. Soil Excavation

Soil excavation shall be performed, if necessary, using a hydraulic excavator in the areas centered over each soil boring (Figure 3-1) that have soil cyanide concentrations in excess of the NMED RSSL. Uncontaminated overburden soil will be excavated and staged on plastic sheeting for use as backfill (subsequent to a confirmation soil sample determination as being suitable for backfill). The cyanide-impacted soil will be staged on plastic sheeting, placed either in drums, in lined and covered roll-off containers, or in dump trucks for offsite disposal at an approved disposal facility. If left open overnight, the excavation will be appropriately secured with hazard marking tape, cones, or barricades. Where necessary, berms will be used to control stormwater runoff.

5.a.iv. Soil Confirmation Sampling

Confirmation soil samples shall be collected and laboratory analysis shall be performed to analyze samples for cyanide by EPA Method 9014 or 9016. Laboratory sample collection shall be performed according to the WSMR RCRA Permit, Appendix 5 (Investigation and Sampling Methods and Procedures), Section 5.2.2.b.ii (Soil and Rock Sampling) (NMED, 2009). At a minimum, one discrete sample shall be obtained from the floor, and one discrete sample shall be collected from each sidewall of the excavation area with a bias towards areas where contamination may be present based on visual or field screening evidence. One floor sample will be collected every 300 square feet from the base of the excavation. Excavation activities and subsequent sampling and analysis shall continue until confirmation soil sampling and analysis indicate that cyanide concentrations do not exceed the applicable NMED RSSL in the upper 10 feet of soil. If a confirmation soil sample exceeds the applicable cleanup levels, then an additional 2 feet of wall material or 0.5 foot of floor material will be excavated, and one additional confirmation soil samples (wall or floor) shall be collected as necessary. This process will continue until the confirmation soil samples indicate concentrations are below applicable cleanup levels. Confirmation subsurface and surface soil samples from the staged overburden soil shall be collected using disposable sampling equipment, a stainless steel trowel, or other suitable device. Soil samples shall be analyzed for total cyanide by EPA Method 9014 or 9016.

5.a.v. Site Restoration

A borrow source area shall be located and a soil sample shall be collected from the borrow source for laboratory analysis for SVOCs by EPA Method 8270C, TAL metals by EPA Methods 6000 and 7000 series and cyanide by EPA Method 9014. The excavated area shall be backfilled with clean fill from the borrow area and compacted with a vibratory compactor or equivalent.

The area will be graded to maintain positive drainage to conform to site conditions. The ground covering will then be restored to surrounding site conditions or other covering as directed by WSMR.

5.a.vi. Investigation-derived Waste Plan

The IDW generated during the investigation and corrective action is expected to result in small volumes of contaminated soils and lesser quantities of investigation and construction rubbish and decontamination fluids. All waste generated onsite including soil, water, and soiled personal protective equipment shall be managed in accordance with WSMR RCRA Permit (NMED, 2009) Appendix 5, Section 5.25. Soil and water with the potential for toxic characteristics shall be managed to prevent releases and allow for proper disposal according to RCRA waste standards and WSMR HWMC procedures. Laboratory analysis of IDW samples for cyanide by EPA Method 9014 shall provide the necessary data for proper disposal of the IDW.

Soil from characterization and corrective action activities shall be managed within the SWMU. Waste soil will be containerized and properly labeled upon generation and will be profiled for offsite disposal as appropriate based on WSMR HWMC requirements. Waste containers shall be covered, secured, labeled, and routinely inspected.

Decontamination fluids shall be managed to prevent releases to the soil shall be contained for profiling and disposal. Decontamination pads will be installed or constructed at the site. Decontamination shall be performed such that all liquids are contained. Decontamination fluids shall be containerized and profiled for disposal.

IDW with no contamination shall be containerized and managed as municipal waste. This waste is expected to consist of wood, cardboard, plastic packaging, and small quantities of plastic.

5.b. GROUNDWATER MONITORING WELL GAUGING, SAMPLING AND ANALYSIS PLAN

5.b.i. Groundwater Monitoring Well Gauging

To resolve uncertainties regarding groundwater flow direction the depth to water in monitoring wells TW1, TW2, TW3, and TW4 shall be gauged to determine the groundwater elevation for each well. If measurement of the groundwater elevations does not provide sufficient data to clarify groundwater flow direction, then additional groundwater monitoring wells shall be installed and sampled as part of this Closure Plan. Additionally, if groundwater flow direction is determined to be in a direction other than what is currently presumed, additional groundwater monitoring wells shall be installed as required by the NMED.

Depth to water in the groundwater monitoring wells shall be measured in accordance with Permit Appendix 5, Section 5.2.2.h.i using an electric measuring tape from a surveyed measurement point on each well casing. The groundwater elevation measurements shall be plotted to create a figure depicting the potentiometric surface with the groundwater flow direction and gradient.

5.b.ii. Groundwater Monitoring and Sampling

Groundwater sampling at SWMU 89 has been inconsistent and prior to the groundwater sampling conducted in 2012 it is not clear that the groundwater monitoring wells were properly developed prior to sampling. Therefore, as part of closure eight quarters of groundwater monitoring shall be conducted to provide an adequate data set. Groundwater monitoring shall include field measurement of pH, conductivity, turbidity, dissolved oxygen, temperature, and oxidation reduction potential as well as nitrate/nitrite (NO3+NO2) and cyanide analyses.

All groundwater monitoring shall be conducted in accordance with Permit Sections 5.2.2.h and 5.2.2.i. Monitoring equipment to be used includes various nitrogen gas-powered bladder pumps and controllers for low-flow sampling. Discharge tubing is dedicated to each well, separately bagged and labelled between events. High-lift bladder pumps may be used and decontaminated between wells.

Groundwater samples shall be obtained from each well after a sufficient amount of water has been removed from the well casing to ensure that the sample is representative of formation water. Groundwater samples shall be obtained using methods approved by NMED within twenty-four hours of the completion of well purging. Sample collection methods shall be documented in the field monitoring reports. The samples shall be transferred to appropriate, clean, laboratory-prepared containers provided by the analytical laboratory. Sample handling and chain-of-custody procedures are described in Permit Appendix Section 5.2.2.j. Decontamination procedures shall be established for reusable water sampling equipment as described in Permit Appendix 5, Section 5.2.3. Groundwater samples intended for metals analysis shall be submitted to the laboratory as total metals samples.

The Permittee shall submit all samples for laboratory analysis to accredited contract laboratories. The laboratories shall use the most recent EPA and industry-accepted extraction and analytical methods for chemical analyses for target analytes as the testing methods for each medium sampled. The Permittee shall use the most sensitive laboratory methods (with the lowest detection limits) available unless specific conditions preclude their use.

5.b.iii. Quality Assurance/Quality Control Sampling

Field QA/QC samples shall be collected at the frequencies described below in general accordance with Permit Appendix 5.2.2.i.

Equipment rinsate blanks shall be obtained for chemical analysis at the rate of five percent but no fewer than one rinsate blank per sampling day. Equipment rinsate blanks shall be collected at a rate of one per sampling day if disposable sampling apparatus is used. Rinsate samples shall be generated by rinsing deionized water through unused or decontaminated sampling equipment. The rinsate sample then shall be placed in the appropriate sample container and submitted with the groundwater or surface water samples to the analytical laboratory for the appropriate analyses

5.b.iv. Decontamination Procedures

All down-hole boring equipment and all reusable sampling equipment will be decontaminated in accordance with the procedures in Appendix 5, Section 5.2.3 of the Permit prior to use at each boring and sampling effort. Decontamination will be conducted at a designated on-site location. The decontamination area will be lined with polyethylene sheeting to contain incidental spills. Larger drilling equipment that may come in contact with the borehole will be decontaminated using high-pressure water wash. All decontamination fluids shall be contained on site pending testing for disposal.

To the extent possible, disposable sampling equipment shall be used to collect soil and groundwater samples. All reusable equipment (e.g., split barrel samplers, sampling spoons) will be decontaminated using the following procedures:

1. Brush equipment with a wire or other suitable brush, if necessary, to remove large particulate matter;
2. Rinse with potable tap water;
3. Wash with nonphosphate detergent (e.g.,Liqui-Nox®);
4. Rinse with tap water
5. Double rinse with deionized water.
6. All decontamination solutions shall be collected and stored temporarily in drums
7. Decontamination procedures and the cleaning agents used will be documented in the daily field log.

5.b.v. Instrument Calibration

Field instruments shall be calibrated to the manufacturer's specifications in accordance with Permit Appendix 5, Section 5.2.4d. Calibration checks shall be conducted at a minimum of every four hours during field activities. If the calibration check indicates that the measurements are off by more than five percent of the gas standard's concentration, the instrument will be re-calibrated until the measurement is within five percent of the standard. All calibration data will be recorded in the field logbook. If field equipment becomes inoperable, it will no longer be used, and a properly calibrated replacement instrument will be used.

5.b.vi. Documentation

All field activities shall be recorded in the field log book and/or on appropriate forms, as required in Appendix 5, Section 5.2.6.a of the Permit. The daily record of field activities shall include:

- Site or unit description
- Date
- Time of arrival and departure
- Field sampling team members, including subcontractors and visitors
- Weather conditions
- Daily activities and times conducted
- Observations
- Record of samples collected with sample designations and locations specified
- Photographic log
- Field monitoring data, including health and safety monitoring if conditions arise that require modifications to required work
- Equipment used and calibration records

- List of additional data sheets and maps completed
- An inventory of wastes generated and the method of storage and disposal
- Signature of personnel completing the field record.

5.b.vii. Management of Investigation Derived Wastes

All purged groundwater and decontamination water shall be temporarily stored at satellite accumulation areas or transfer stations in labeled 55-gallon drums, less-than-90-day storage areas or other containers approved by NMED until proper characterization and disposal can be arranged. The methods for disposal of purge/decontamination water shall be approved by NMED prior to removal from the temporary storage area. Disposable materials shall be handled as described in Permit Appendix Section 5.2.5.

6. CLOSURE REPORT

A Closure Report shall be submitted to NMED that describes all closure actions and initial groundwater development and sampling results in accordance with the reporting requirement outlined in Permit Appendix 7, Section 7.3.

7. CLOSURE PERMFORMANCE STANDARD

SWMU 89 must be closed to meet the performance standards in 40 CFR § 264.111 and in accordance with RCRA Permit Part IV (Closure of Hazardous Waste Management Units). As specified in 40 CFR § 264.111, the unit must be closed in a manner that: minimizes the need for further maintenance; and controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere; and comply with the closure requirements of 40 CFR § 264 Subpart G. If the Permittee is unable to achieve clean closure, the NMED will require submittal of a post-closure care plan.

8. CLOSURE SCHEDULE

Closure activities must begin no later than 90 days after approval of this plan. All closure activities, except the eight quarters of groundwater monitoring, must be completed within 180 days after beginning closure. The final submittal of the closure report must be submitted to NMED 60 days after completing closure. In the event that closure of SWMU 89 cannot proceed according to schedule, NMED must be notified in accordance with the extension request requirements in 40 CFR § 265.113(b) and comply with the applicable closure requirements in 40 CFR § 265.113(b)(1) and (2).

9. CERTIFICATION OF CLOSURE

Closure of SMWU 89 shall be deemed complete when within 60 days of completion of closure: 1) closure has been completed in accordance with this Closure Plan and been certified by an independent, professional engineer licensed in the State of New Mexico; 2) the closure report including closure certification as required by 40 CFR § 265.115, has been submitted to, and approved by, the NMED; and 3) NMED will determine final closure based on the results of the eight quarters of groundwater sampling to be reported in the Facility's yearly groundwater monitoring report.

10. SURVEY PLAT

In accordance with the requirements of 40 CFR 265.116 which is incorporated herein by reference. The Permittee shall comply with all the requirements of 40 CFR 265.116 in submitting the survey plat. A survey plat and closure certifications will be provided by WSMR to satisfy the requirements of 40 CFR 265.115 and 265.116.

11. REFERENCES

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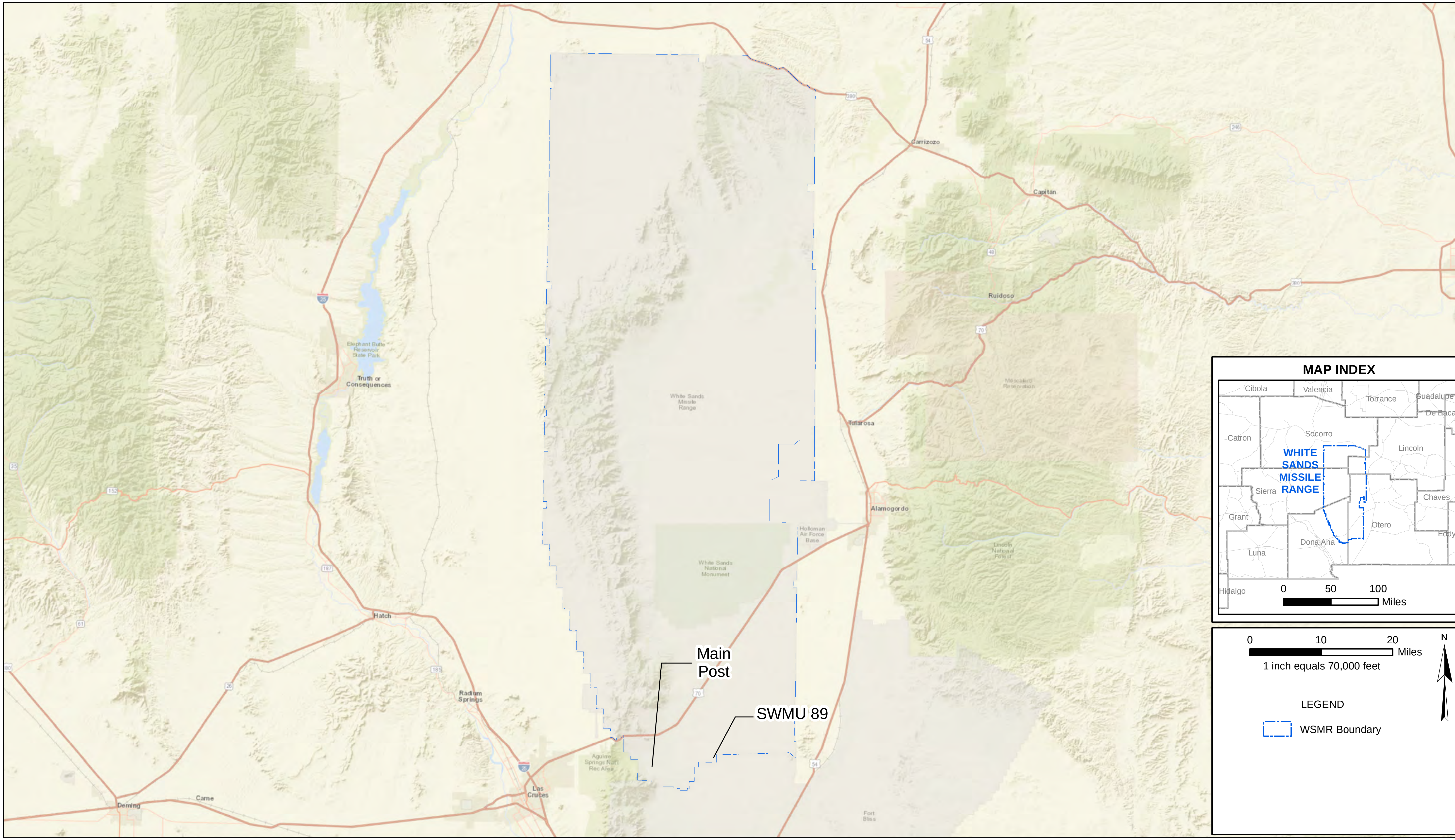
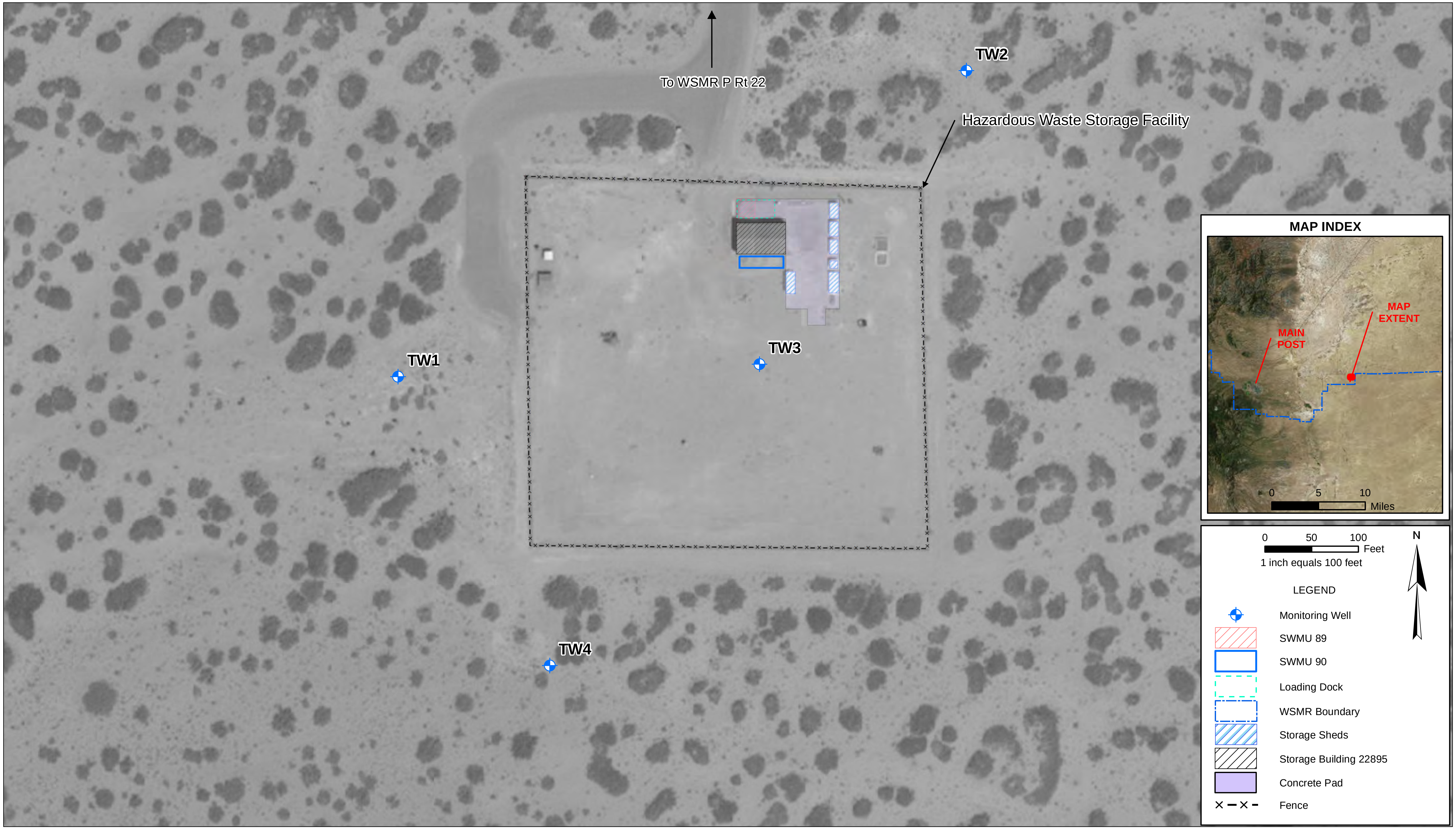
FIGURES AND TABLES



Acronym(s) and Abbreviation(s):
SWMU = Solid Waste Management Unit
WSMR = White Sands Missile Range

Note(s):
1. Imagery Source: ESRI Street Map online mapping service.
2. Site features presented are based on available information from the WSMR geodatabase.

FIGURE 1-1
GEOGRAPHIC LOCATION MAP
REVISED CLOSURE PLAN, SWMU 89, FORMER ACID NEUTRALIZATION UNIT AT THE HAZARDOUS WASTE STORAGE FACILITY
WHITE SANDS MISSILE RANGE, NEW MEXICO



Acronym(s) and Abbreviation(s):
SWMU = Solid Waste Management Unit
WSMR = White Sands Missile Range

Note(s):
1. Imagery Source: ESRI Street Map online mapping service.
2. Site features presented are based on available information from the WSMR geodatabase.

FIGURE 1-2
SITE LOCATION MAP - SWMU 89
REVISED CLOSURE PLAN, SWMU 89, FORMER ACID NEUTRALIZATION UNIT AT THE HAZARDOUS WASTE STORAGE FACILITY
WHITE SANDS MISSILE RANGE, NEW MEXICO

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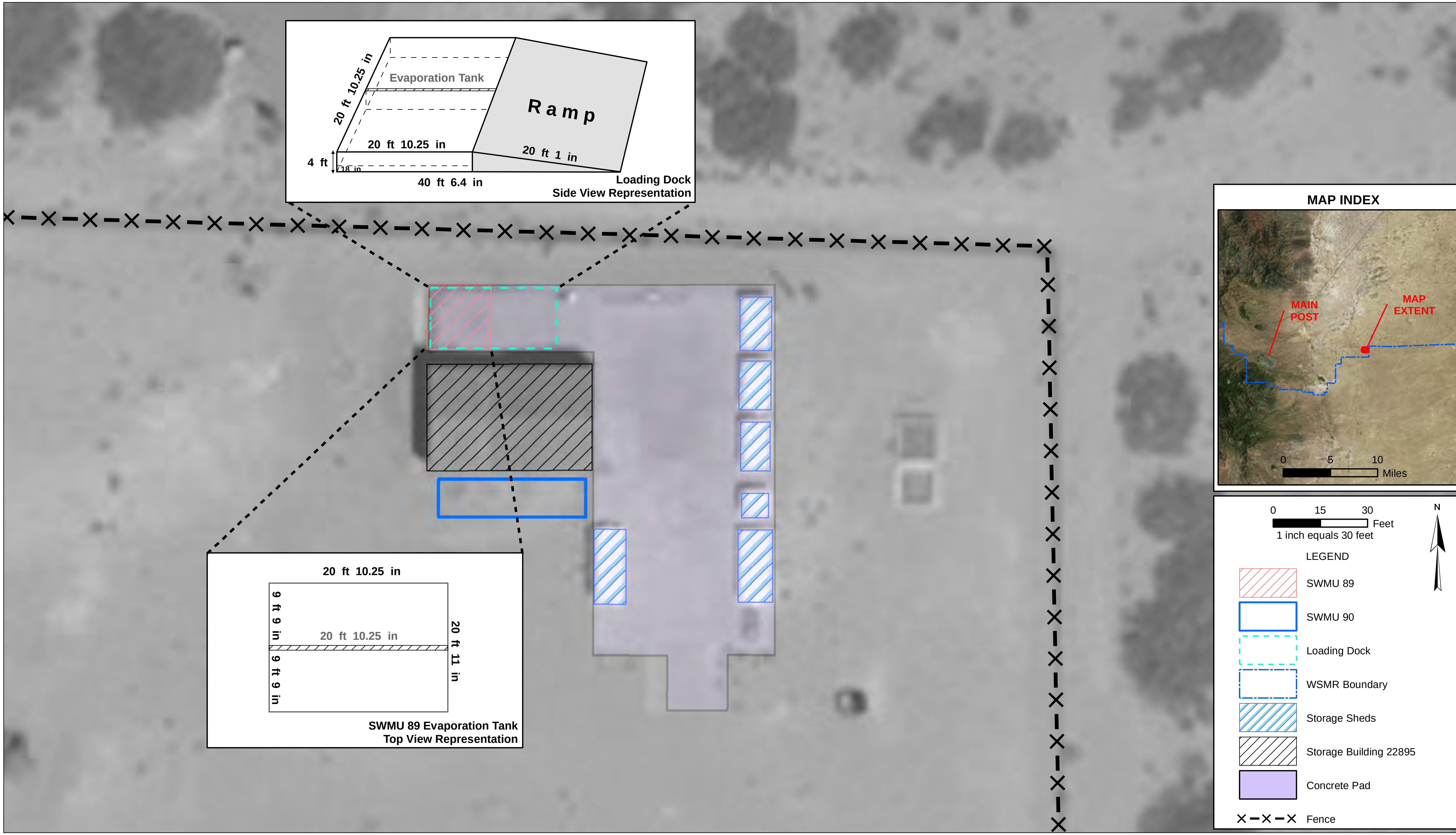
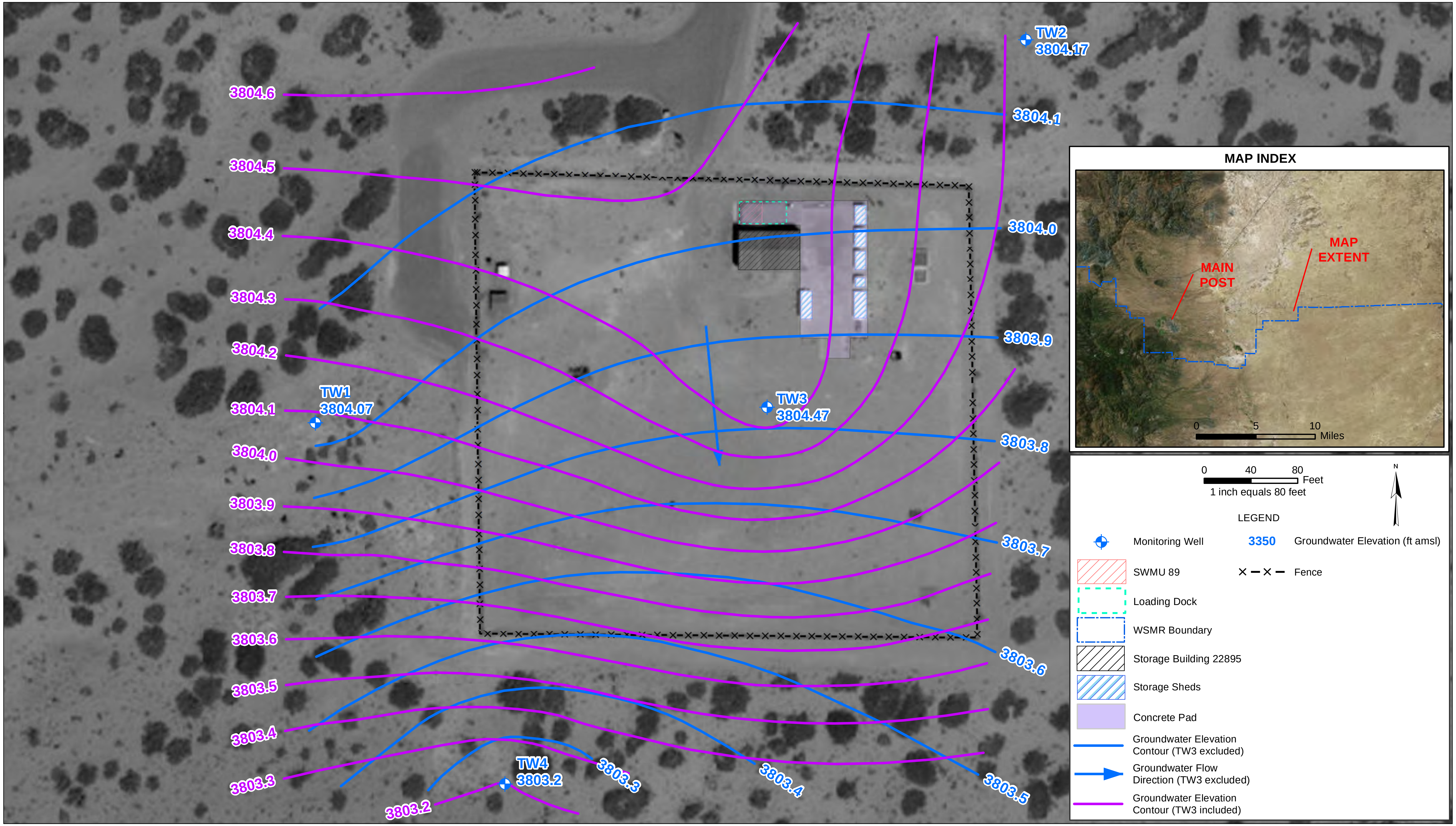


Acronym(s) and Abbreviation(s):
HWSF = Hazardous Waste Storage Facility
RCRA = Resource Conservation and Recovery Act
SWMU = Solid Waste Management Unit
WSMR = White Sands Missile Range

Note(s):
1. Imagery Source: ESRI Street Map online mapping service.
2. Site features presented are based on available information from the WSMR geodatabase.

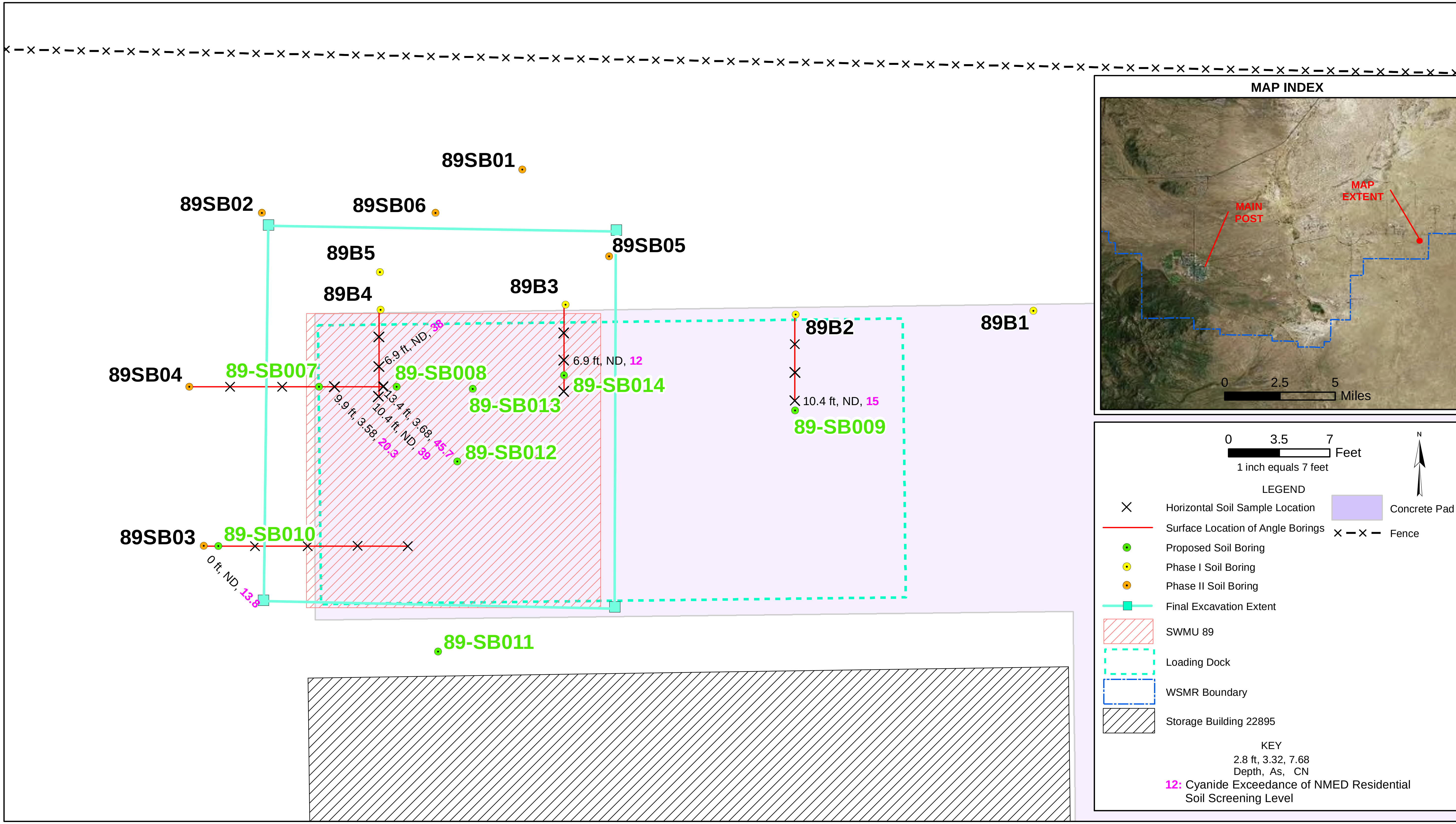
FIGURE 2-1
SITE PLAN
REVISED CLOSURE PLAN, SWMU 89, FORMER ACID NEUTRALIZATION UNIT AT THE HAZARDOUS WASTE STORAGE FACILITY
WHITE SANDS MISSILE RANGE, NEW MEXICO



Acronym(s) and Abbreviation(s):
ft amsl = feet above mean sea level
SWMU = Solid Waste Management Unit
WSMR = White Sands Missile Range

Note(s):
1. Imagery Source: ESRI Street Map online mapping service.
2. Site features presented are based on available information from the WSMR geodatabase.
3. Groundwater elevations are measured in feet above mean sea level.

FIGURE 2-6
POTENTIOMETRIC SURFACE AT SWMU 89
REVISED CLOSURE PLAN, SWMU 89, FORMER ACID NEUTRALIZATION UNIT AT THE HAZARDOUS WASTE STORAGE FACILITY
WHITE SANDS MISSILE RANGE, NEW MEXICO



Acronym(s) and Abbreviation(s):
As = Arsenic
CN = Cyanide
mg/kg = milligram(s) per kilogram
ND = not detected
NMED = New Mexico Environment Department
SWMU = Solid Waste Management Unit
WSMR = White Sands Missile Range

Note(s):
Imagery Source: ESRI Street Map online mapping service.
1. Site features presented are based on available information from the WSMR geodatabase.
2. All depths in feet below ground surface.
3. Soil concentrations units are mg/kg.
4. NMED Residential Soil Screening Level for Arsenic is 4.25 mg/kg.
5. NMED Residential Soil Screening Level for Cyanide is 11.2 mg/kg.

FIGURE 3-1
PROPOSED CLOSURE PLAN SOIL BORING LOCATIONS AT SWMU 89
REVISED CLOSURE PLAN, SWMU 89, FORMER ACID NEUTRALIZATION UNIT AT THE HAZARDOUS WASTE STORAGE FACILITY
WHITE SANDS MISSILE RANGE, NEW MEXICO

Table 2-12. Groundwater Elevation Data

Revised Closure Plan, SWMU 89, Former Acid Neutralization Unit at the Hazardous Waste Storage Facility

White Sands Missile Range, New Mexico

Well ID	Total Well Depth (ft bgs)	Top of Casing Elevation (ft amsl)	Depth to Water (ft below top of casing)	Potentiometric Surface Elevation (ft amsl)	Measurement Date
TWI	285	4035.05	230.98	3804.07	7/25/2012
TW2	285	4041.77	237.60	3804.17	7/25/2012
TW3	270	4040.62	236.15	3804.47	7/27/2012
TW4	340	4037.30	234.10	3803.20	7/23/2012

Notes:

Top of casing is the reference point on the monitoring well casing to obtain groundwater levels.

The potentiometric surface elevation is the difference between the top of casing elevation and the depth to water.

ft amsl = feet above mean sea level

ft bgs = feet below ground surface

ID = identifier

SWMU = solid waste management unit

Table 2-4. Monitoring Well Construction Details

Revised Closure Plan, SWMU 89, Former Acid Neutralization Unit at the Hazardous Waste Storage Facility
White Sands Missile Range, New Mexico

Well ID	NAD 83 State Plane		WGS NAD 83		Installation Date	Well Diameter (inches)	Top of Casing Elevation (ft amsl)	Total Measured Well Depth (ft bgs)	Total Reported Well Depth (ft bgs)	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)
	Northing (ft)	Easting (ft)	Latitude (degrees)	Longitude (degrees)							
TW1	507690.4	1615280.2	32.3957	106.3314	7/1/1983	4	4040.62	275.5	285	300	225-285
TW2	508007.0	1615497.9	32.3966	106.3307	8/1/1983	4	4041.78	297	285	300	225-285
TW3	507672.5	1614893.7	32.3956	106.3327	10/1/1983	4	4035.05	287	290	300	230-270
TW4	507365.6	1615059.6	32.3948	106.3322	9/1/1989	4	4037.3	339.5	407	NR	NR

Notes:

Survey measurements taken in North American Datum 83 (NAD 83), New Mexico State Plane Central, United States Survey Feet and converted to WGS North American Datum 83, decimal degrees using Corpson6.

Reported depth represents the recorded depth at installation. Measured depth represents the measured depth at the time of sample collection.

Reference for TW1, TW2, TW3: Myers, R.G., 1987. Test Wells TW1, TW2, and TW3, White Sands Missile Range, Otero County, New Mexico. U.S. Geological Survey Open File Report 87-47.

Reference for TW4: Shaw Environmental, Inc. (a CB&I Company). 2014. Final Closure Plan, SWMU 89, Former Acid Neutralization Unit at Hazardous Waste Storage Facility. Houston, Texas, May.

ft bgs = feet below ground surface

ft amsl = feet above mean sea level

ID = identifier

NR = not reported

SWMU = solid waste management unit

WGS = World Geodetic System

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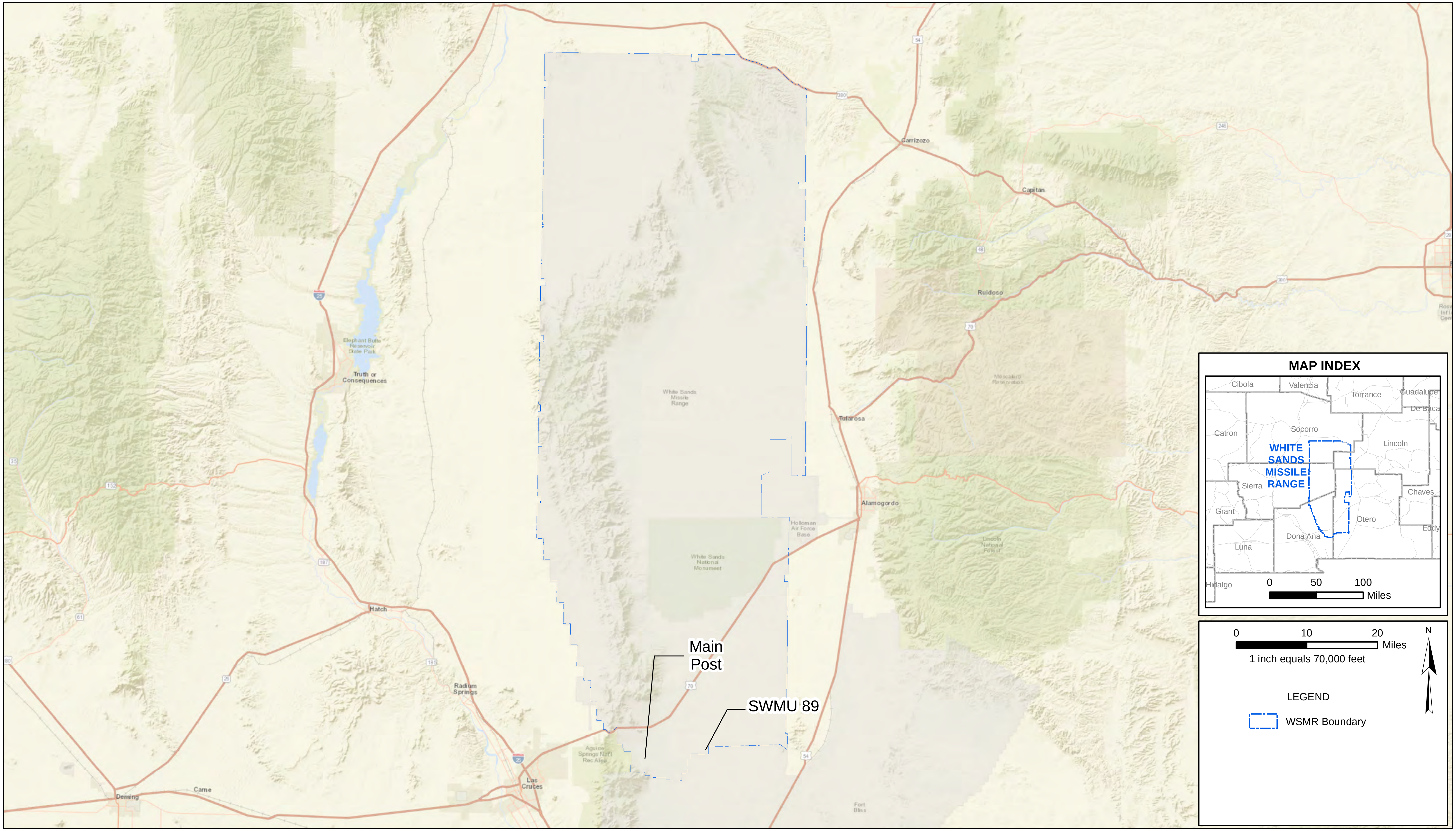
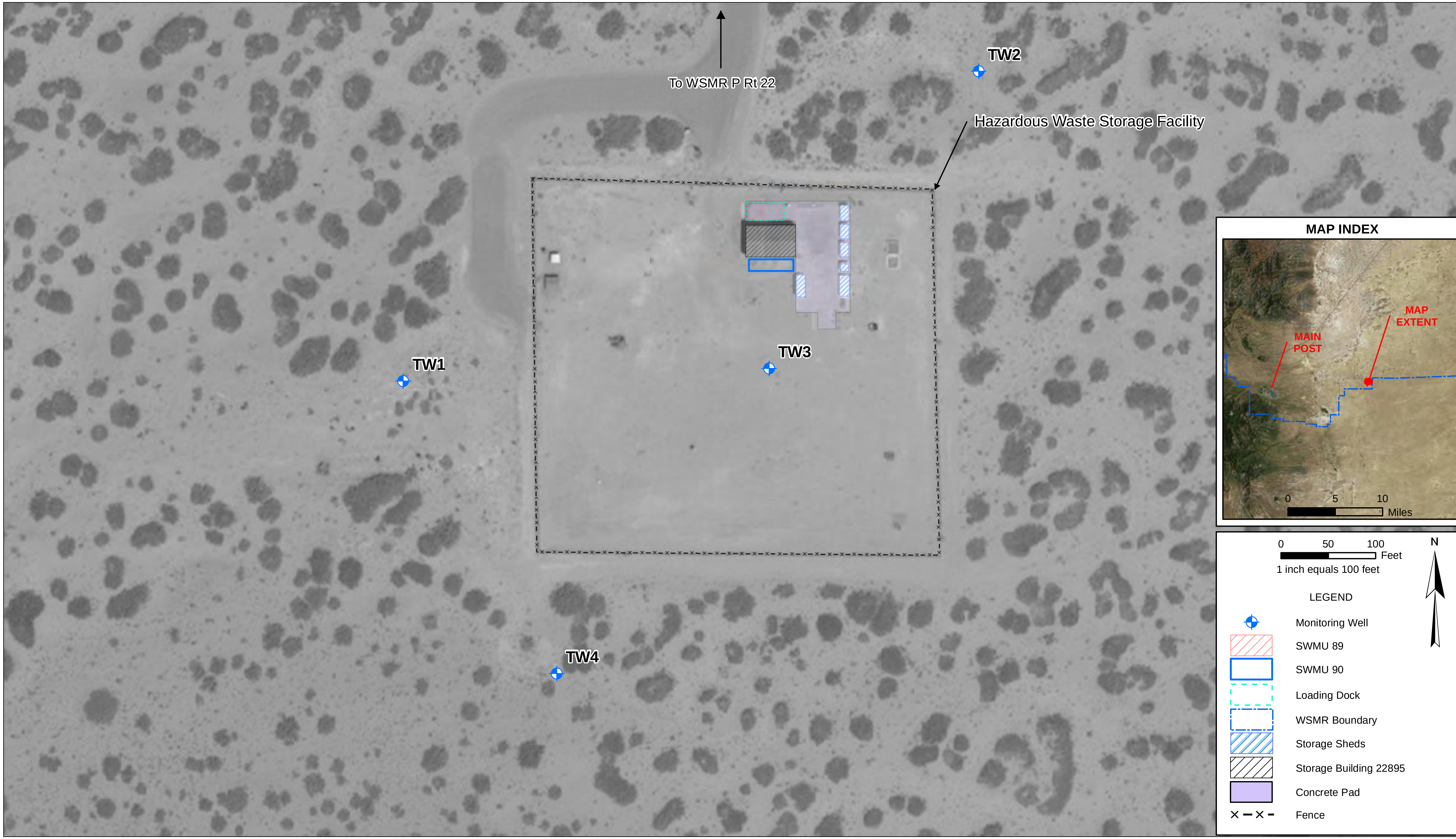


Acronym(s) and Abbreviation(s):
SWMU = Solid Waste Management Unit
WSMR = White Sands Missile Range

Note(s):
1. Imagery Source: ESRI Street Map online mapping service.
2. Site features presented are based on available information from the WSMR geodatabase.

FIGURE 1-1
GEOGRAPHIC LOCATION MAP
REVISED CLOSURE PLAN, SWMU 89, FORMER ACID
NEUTRALIZATION UNIT AT THE HAZARDOUS WASTE STORAGE FACILITY
WHITE SANDS MISSILE RANGE, NEW MEXICO



Acronym(s) and Abbreviation(s):
SWMU = Solid Waste Management Unit
WSMR = White Sands Missile Range

Note(s):
1. Imagery Source: ESRI Street Map online mapping service.
2. Site features presented are based on available information from the WSMR geodatabase.

FIGURE 1-2
SITE LOCATION MAP - SWMU 89
REVISED CLOSURE PLAN, SWMU 89, FORMER ACID NEUTRALIZATION UNIT AT THE HAZARDOUS WASTE STORAGE FACILITY
WHITE SANDS MISSILE RANGE, NEW MEXICO

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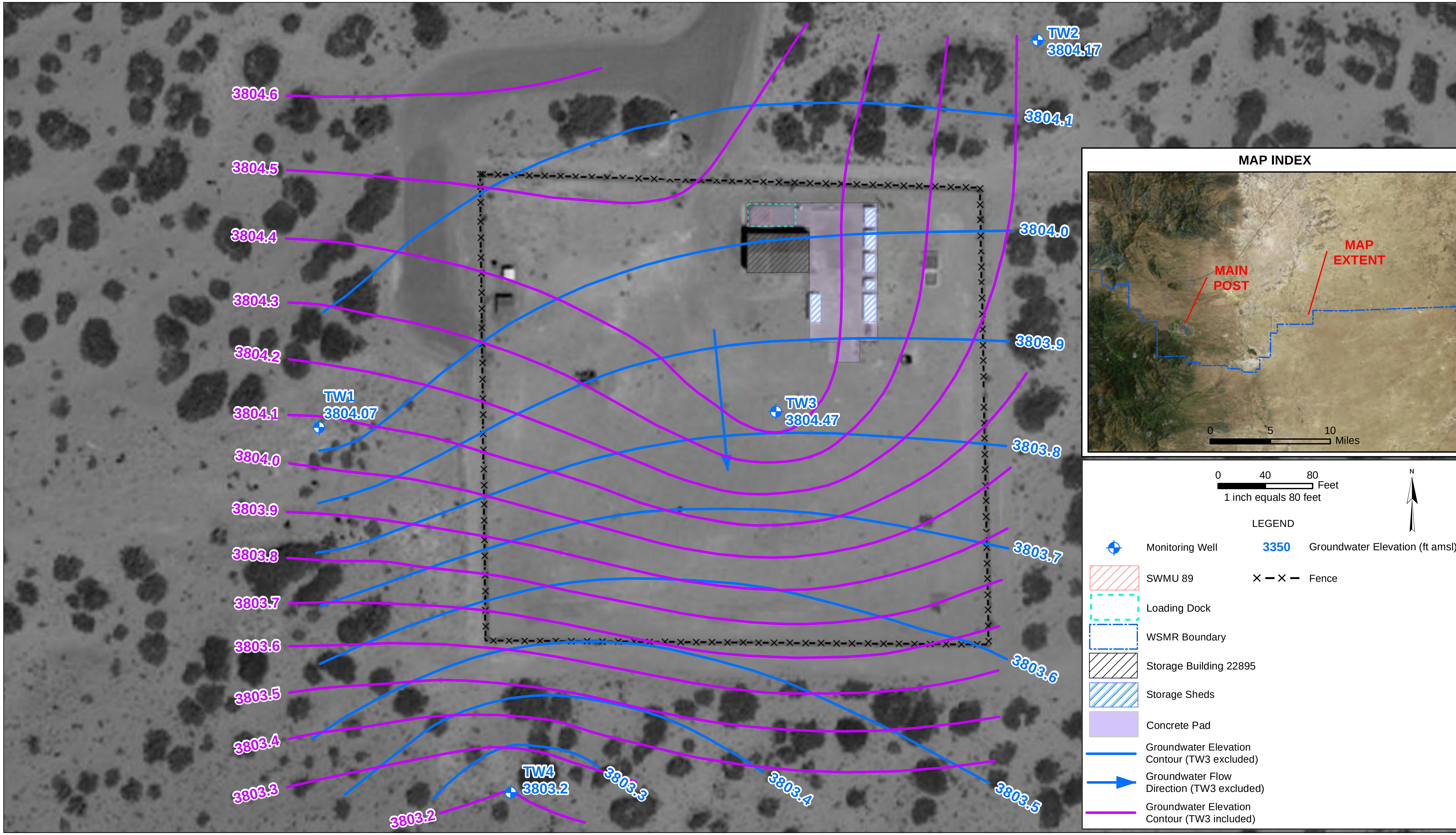

Acronym(s) and Abbreviation(s):
ft amsl = feet above mean sea level
SWMU = Solid Waste Management Unit
WSMR = White Sands Missile Range

Note(s):
1. Imagery Source: ESRI Street Map online mapping service.
2. Site features presented are based on available information from the WSMR geodatabase.
3. Groundwater elevations are measured in feet above mean sea level.

FIGURE 2-6
POTENTIOMETRIC SURFACE AT SWMU 89
REVISED CLOSURE PLAN, SWMU 89, FORMER ACID NEUTRALIZATION UNIT AT THE HAZARDOUS WASTE STORAGE FACILITY
WHITE SANDS MISSILE RANGE, NEW MEXICO

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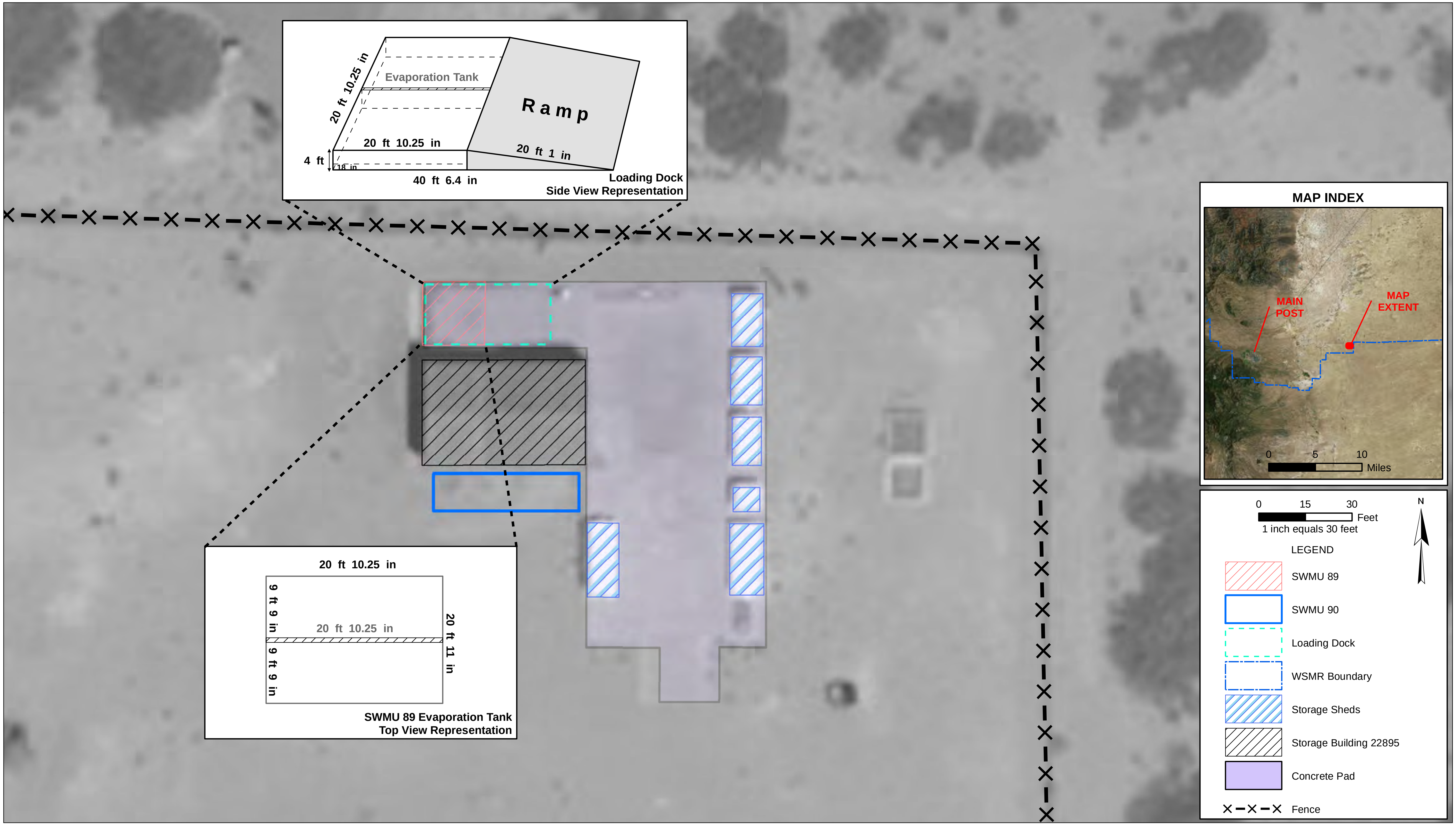
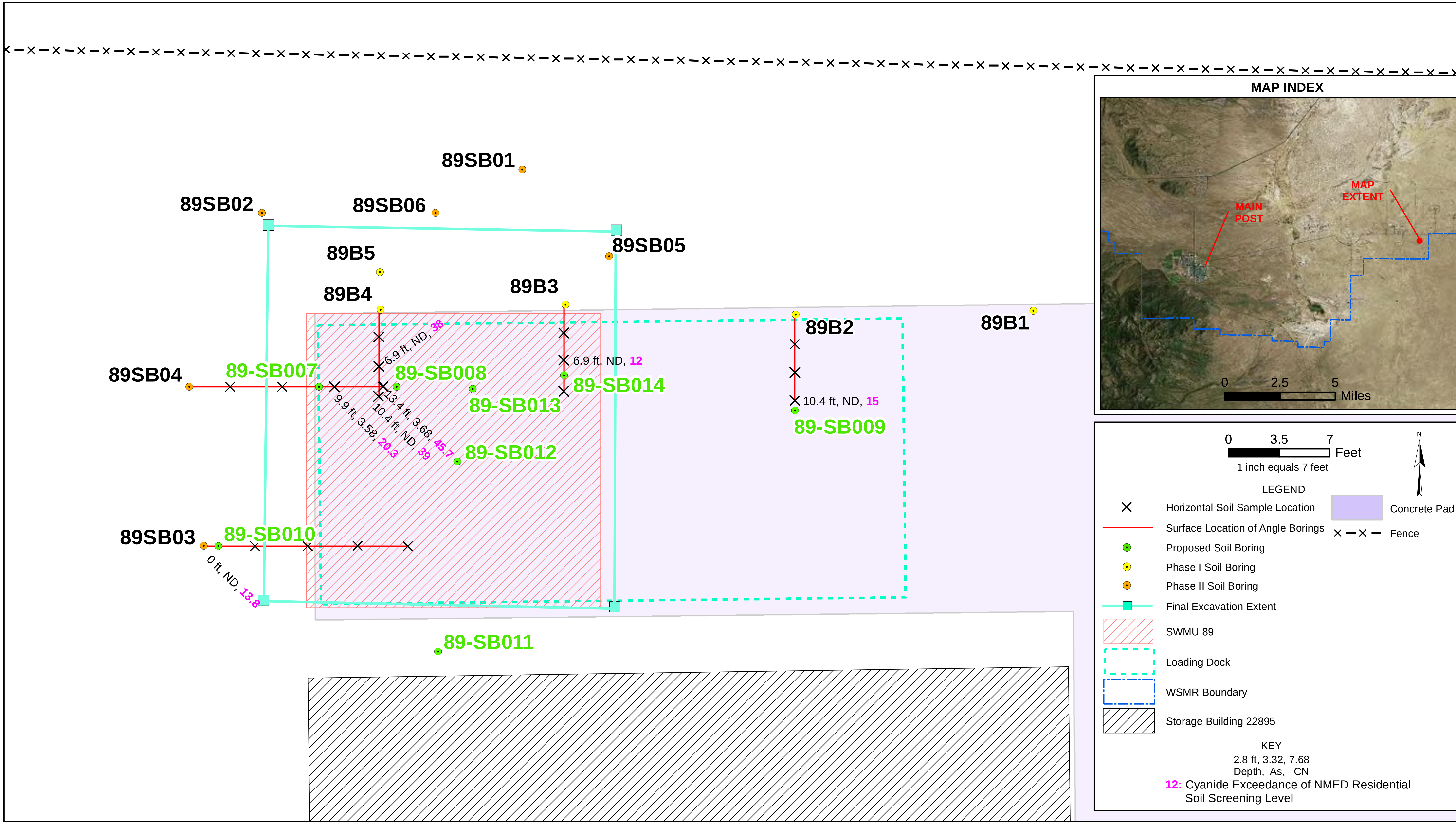


Acronym(s) and Abbreviation(s):
HWSF = Hazardous Waste Storage Facility
RCRA = Resource Conservation and Recovery Act
SWMU = Solid Waste Management Unit
WSMR = White Sands Missile Range

Note(s):
1. Imagery Source: ESRI Street Map online mapping service.
2. Site features presented are based on available information from the WSMR geodatabase.

FIGURE 2-1
SITE PLAN
REVISED CLOSURE PLAN, SWMU 89, FORMER ACID NEUTRALIZATION UNIT AT THE HAZARDOUS WASTE STORAGE FACILITY
WHITE SANDS MISSILE RANGE, NEW MEXICO



Acronym(s) and Abbreviation(s):
As = Arsenic
CN = Cyanide
mg/kg = milligram(s) per kilogram
ND = not detected
NMED = New Mexico Environment Department
SWMU = Solid Waste Management Unit
WSMR = White Sands Missile Range

Note(s):
Imagery Source: ESRI Street Map online mapping service.
1. Site features presented are based on available information from the WSMR geodatabase.
3. All depths in feet below ground surface.
4. Soil concentrations units are mg/kg.
5. NMED Residential Soil Screening Level for Arsenic is 4.25 mg/kg.
6. NMED Residential Soil Screening Level for Cyanide is 11.2 mg/kg.

FIGURE 3-1
PROPOSED CLOSURE PLAN SOIL BORING LOCATIONS AT SWMU 89
REVISED CLOSURE PLAN, SWMU 89, FORMER ACID NEUTRALIZATION UNIT AT THE HAZARDOUS WASTE STORAGE FACILITY
WHITE SANDS MISSILE RANGE, NEW MEXICO

Table 2-4. Monitoring Well Construction Details

Revised Closure Plan, SWMU 89, Former Acid Neutralization Unit at the Hazardous Waste Storage Facility
White Sands Missile Range, New Mexico

Well ID	NAD 83 State Plane		WGS NAD 83		Installation Date	Well Diameter (inches)	Top of Casing Elevation (ft amsl)	Total Measured Well Depth (ft bgs)	Total Reported Well Depth (ft bgs)	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)
	Northing (ft)	Easting (ft)	Latitude (degrees)	Longitude (degrees)							
TW1	507690.4	1615280.2	32.3957	106.3314	7/1/1983	4	4040.62	275.5	285	300	225-285
TW2	508007.0	1615497.9	32.3966	106.3307	8/1/1983	4	4041.78	297	285	300	225-285
TW3	507672.5	1614893.7	32.3956	106.3327	10/1/1983	4	4035.05	287	290	300	230-270
TW4	507365.6	1615059.6	32.3948	106.3322	9/1/1989	4	4037.3	339.5	407	NR	NR

Notes:

Survey measurements taken in North American Datum 83 (NAD 83), New Mexico State Plane Central, United States Survey Feet and converted to WGS North American Datum 83, decimal degrees using Corpson6.

Reported depth represents the recorded depth at installation. Measured depth represents the measured depth at the time of sample collection.

Reference for TW1, TW2, TW3: Myers, R.G., 1987. Test Wells TW1, TW2, and TW3, White Sands Missile Range, Otero County, New Mexico. U.S. Geological Survey Open File Report 87-47.

Reference for TW4: Shaw Environmental, Inc. (a CB&I Company). 2014. Final Closure Plan, SWMU 89, Former Acid Neutralization Unit at Hazardous Waste Storage Facility. Houston, Texas, May.

ft bgs = feet below ground surface

ft amsl = feet above mean sea level

ID = identifier

NR = not reported

SWMU = solid waste management unit

WGS = World Geodetic System

Table 2-12. Groundwater Elevation Data

Revised Closure Plan, SWMU 89, Former Acid Neutralization Unit at the Hazardous Waste Storage Facility

White Sands Missile Range, New Mexico

Well ID	Total Well Depth (ft bgs)	Top of Casing Elevation (ft amsl)	Depth to Water (ft below top of casing)	Potentiometric Surface Elevation (ft amsl)	Measurement Date
TWI	285	4035.05	230.98	3804.07	7/25/2012
TW2	285	4041.77	237.60	3804.17	7/25/2012
TW3	270	4040.62	236.15	3804.47	7/27/2012
TW4	340	4037.30	234.10	3803.20	7/23/2012

Notes:

Top of casing is the reference point on the monitoring well casing to obtain groundwater levels.

The potentiometric surface elevation is the difference between the top of casing elevation and the depth to water.

ft amsl = feet above mean sea level

ft bgs = feet below ground surface

ID = identifier

SWMU = solid waste management unit