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Supplemental Investigation Work Plan for Technical Area 57 Aggregate Area (Fenton Hill)

Los Alamos
NATIONAL LABORATORY
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Prepared by the Associate Directorate for Environmental Management

EP2017-0064

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June 2017

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EXECUTIVE SUMMARY

The Technical Area 57 (TA-57) Aggregate Area, located on U.S. Forest Service property west of Los Alamos National Laboratory, includes a total of 10 areas of concern (AOCs). Of these 10 sites, 3 sites have previously been approved for no further action and 2 sites were investigated in 2015. This investigation work plan identifies and describes the activities needed to complete the investigation of the remaining 5 AOCs. Details of previous investigations and analytical results for the 5 sites included in this work plan are provided in the supplemental historical investigation report for the TA-57 Aggregate Area.

The objective of this supplemental investigation work plan is to evaluate the historical data and, based on that evaluation, propose sampling to define the nature and extent of contamination associated with the five AOCs within the TA-57 Aggregate Area.

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1.0 INTRODUCTION

Los Alamos National Laboratory (LANL or the Laboratory) is a multidisciplinary research facility owned by the U.S. Department of Energy (DOE) and managed by Los Alamos National Security, LLC. The Laboratory is located in north-central New Mexico, approximately 60 mi northeast of Albuquerque and 20 mi northwest of Santa Fe. The Laboratory site covers approximately 39 mi^2 of the Pajarito Plateau, which consists of a series of fingerlike mesas separated by deep canyons containing perennial and intermittent streams running from west to east. Mesa tops range in elevation from approximately 6200 ft to 7800 ft above mean sea level (amsl).

The Laboratory is participating in a national effort by DOE to reduce risk to human health and the environment at its facilities. The goal of the Laboratory's effort is to ensure past operations do not threaten human or environmental health and safety in and around Los Alamos County, New Mexico. To achieve this goal, the Laboratory is currently investigating sites potentially contaminated by past Laboratory operations. These sites are designated as solid waste management units and areas of concern (AOCs).

The Technical Area 57 (TA-57) Aggregate Area is located on Fenton Hill, which lies on the western side of the Jemez Mountains, approximately 11 mi west of the Laboratory, at an elevation of approximately 8700 ft (Figure 1.0-1). TA-57 is located on property owned by the U.S. Forest Service and used by DOE under an Interagency Agreement with the Forest Service. Laboratory operations have been conducted in the aggregate area since 1974.

The AOCs (the sites) addressed in this supplemental investigation work plan (IWP) are potentially contaminated with hazardous and radioactive components. The New Mexico Environment Department (NMED), pursuant to the New Mexico Hazardous Waste Act, regulates cleanup of hazardous wastes and hazardous constituents. DOE regulates cleanup of radioactive contamination, pursuant to DOE Order 458.1, Administrative Change 3, "Radiation Protection of the Public and the Environment," and DOE Order 435.1, "Radioactive Waste Management." Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to NMED in accordance with DOE policy.

Corrective actions at the Laboratory are subject to a Compliance Order on Consent (the Consent Order). This supplemental investigation work plan describes work activities that will be executed and completed in accordance with the Consent Order.

1.1 Work Plan Overview

The TA-57 Aggregate Area consists of 10 AOCs located within TA-57 and on nearby U.S. Forest Service land. Of the 10 sites, 3 have previously been approved for no further action (NFA), 2 were investigated in 2015, and 5 require additional characterization. Table 1.1-1 provides a summary of the 10 sites within the TA-57 Aggregate Area. For the 5 sites approved for NFA or previously investigated, brief descriptions and the references for the approval documents are provided in Table 1.1-1. Historical details of previous investigations and data for the remaining 5 sites are provided in the supplemental historical investigation report (HIR) for TA-57 Aggregate Area (LANL 2017, 602376). This supplemental IWP addresses the 5 sites to be investigated using the information from previous field investigations to evaluate current conditions at each site.

These five sites were all associated with geothermal exploration activities conducted at TA-57. These sites were previously regulated and administratively closed under a discharge permit issued by the

New Mexico Oil Conservation Division (NMOCD) and were not included in the TA-57 IWP (LANL 2012, 214550) and HIR (LANL 2012, 214549) pending determination of whether they would also be regulated under the Consent Order. The five sites are included in Appendix A of the 2016 Consent Order and, therefore, will be investigated under the Consent Order as AOCs.

Section 2 of this supplemental IWP presents general site information, operational histories, the conceptual site model, and a data overview. General site conditions at TA-57 are described in section 3. Section 4 presents site descriptions, summaries of previous investigations and data collected, and the scope of proposed investigation activities for each site. Section 5 presents investigation methods for proposed field activities. Ongoing monitoring and sampling programs in the TA-57 Aggregate Area are discussed in section 6. Section 7 is an overview of the anticipated schedule of the investigation. Section 8 provides a list of the references cited in this supplemental work plan and the map data sources. Appendix A of this IWP includes a list of acronyms and abbreviations, a metric conversion table, and the data qualifier definitions table. Appendix B describes the investigation-derived waste (IDW) management plan.

1.2 Work Plan Objectives

The objective of the investigation activities described in this work plan is to finalize the nature and extent of contamination at the five sites requiring further characterization.

To help accomplish this objective, this work plan

- presents historical and background information on the five sites,
- describes the rationale for proposed data collection activities, and
- identifies and proposes appropriate methods and protocols for collecting and analyzing data to characterize these sites.

2.0 BACKGROUND

2.1 General Site Information

The TA-57 Aggregate Area is located on the western side of the Jemez Mountains, west of the Valles Caldera, on land owned by the U.S. Forest Service. The TA-57 location is northwest of the township of La Cueva, approximately 37 road miles west of the Laboratory (Figure 1.0-1). The site occupies approximately 20 acres and is located on Lake Fork Mesa, which is bordered to the south by Lake Fork Canyon and to the north by Barley Canyon and Rio Cebolla. The Laboratory has conducted operations at the site since 1974 under an Interagency Agreement with the U.S. Forest Service.

2.2 Operational History

TA-57 was originally established at the Fenton Hill site to support the Laboratory’s Hot Dry Rock (HDR) program, an experimental program designed to test the feasibility of extracting heat from deep geologic units near the Valles Caldera. The first site investigated was in Barley Canyon north of the current TA-57 site. This location was abandoned because of poor winter access and topographic limitations after one test well had been drilled. Operations were then moved to the current TA-57 site, which offered a large flat area with easier access. Operations at the TA-57 site began in 1974.

The HDR concept was based on drilling deep (i.e., 10,000 ft to 15,000 ft) boreholes into the low permeability, hot crystalline rock beneath the site. Hydraulic fracturing was then used to create a permeable fractured zone between the two boreholes. During operation, pressurized water was injected into one well and extracted from the other after flowing through the fractured zone and becoming heated. Heat exchangers on the surface were used to extract heat from the water, which was then circulated through settling ponds for further cooling before being reinjected.

The first geothermal well drilled at TA-57, well GT-2, was started in 1974 and completed in 1975. Upon completion of hydraulic fracturing of well GT-2, drilling began on well EE-1, which was to be the extraction well used with GT-2. After completion of fracturing and additional drilling, testing of the two-well system began in 1978. Work on a larger Phase II system began in 1979 with drilling of well EE-2, the injection well for the Phase II system. Well EE-2 was completed in 1980 and drilling began on extraction well EE-3, which was completed in 1981. Testing of the Phase II system began in 1985 and continued until 1992, when operations were substantially reduced because of funding limitations.

When the extraction wells were drilled, various materials were added to drilling muds to lubricate the drill bit and maintain the borehole. Drilling mud additives used in large quantities included bentonite clay, barium sulfate, sodium hydroxide, ammonium bisulfite, cotton seed hulls, lime, sawdust, and walnut hulls (LANL 1994, 034757, pp. 2–13). Materials used in smaller quantities included para-formaldehyde (a biocide), organic solvents and salts, inorganic and organic acids, isopropyl alcohol, and phosphate descaler. Drilling muds were discharged to mud pits and settling ponds near the drill sites. These sites were regulated by NMOCD and closed in accordance with NMOCD requirements.

As noted above, during geothermal testing, water was injected into injection wells, heated as it flowed through fractures in the hot rock, and extracted into extraction wells. As the fluid was circulated, it dissolved and mobilized residual additives from the wells as well as constituents from the rock. Constituents dissolved and mobilized from rock include arsenic, boron, cadmium, carbonates, chloride, fluoride, lithium, silica, sodium, sulfate, and uranium. Because these chemicals generally have higher solubility at high temperature, they would come out of solution and precipitate as the fluid cooled in the settling ponds.

After the end of the HDR project, a 5-million-gal. synthetically lined settling pond [AOC 57-004(b)] originally constructed for the HDR program was converted to a gamma-ray observatory for a project known as Milagro. To construct the observatory, over 700 photomultiplier tubes were installed in the pond. The liquid and sludge were removed from the pond, the interior of the pond was cleaned, the photomultiplier tubes were placed on the bottom of the pond, and it was refilled with pure water. A cover was also constructed over the pond to keep out ambient light. Operation of the Milagro observatory began in July 2000 and decommissioning began in June 2008.

The TA-57 site is now used to operate a fully automated observatory in support of the Thinking Telescopes project in the Laboratory's Intelligence and Space Research Division. This project combines automated telescope observation, feature extraction from image data, change and anomaly detection, and automated response. An automated measurement program continuously scans the sky to detect optical transients. Transients may be a gamma-ray burst that is of interest to the open science community or a man-made object of interest for space situational awareness.

2.3 Conceptual Site Model

The sampling proposed in this supplemental IWP uses a conceptual site model to predict areas of potential contamination and to allow for adequate characterization of these areas. A conceptual site model describes potential contaminant sources, transport mechanisms, and receptors.

2.3.1 Potential Contaminant Sources

Releases at sites within the TA-57 Aggregate Area may have occurred as results of normal site operations or potential spills/leaks. Additional sampling is needed to determine the nature and extent of contamination.

Potential contaminant sources associated with TA-57 include settling ponds, an outfall, and a disposal pit.

2.3.2 Potential Contaminant Transport Mechanisms

Current potential transport mechanisms that may lead to exposure include

- airborne transport of contaminated surface soil,
- dissolution and/or particulate transport of surface contaminants during precipitation and runoff events,
- disturbance of contaminants in shallow soil and subsurface tuff by Laboratory operations,
- continued dissolution and advective/dispersive transport of chemical contaminants contained in subsurface soil and tuff as a result of past operations, and
- disturbance and uptake of contaminants in shallow soil by plants and animals.

2.3.2.1 Surface Processes

Laboratory operations, disturbance and uptake by plants and animals, surface water runoff, and wind can disturb contaminants present in shallow soils. During summer thunderstorms and spring snowmelt, runoff may flow down drainages from the site towards Lake Fork Canyon. Surface water runoff and erosion of contaminated surface soil could lead to contamination of the surface water off-site. Surface water may also access subsurface contaminants exposed by soil erosion. Soil erosion can vary significantly depending on factors that include soil properties, the amount of vegetative cover, the slope of the contaminated area, and the intensity and frequency of precipitation. Surface transport of contaminants represents the dominant transport pathway in the TA-57 Aggregate Area.

2.3.2.2 Subsurface Processes

Studies have shown that infiltration of natural precipitation is quite low across the mesa tops of the Pajarito Plateau and, therefore, should also be low at the Fenton Hill site. The average annual potential evapotranspiration rates far exceed precipitation rates. Under these conditions, infiltration events that propagate beneath the root zone are sporadic and occur only when the short-term infiltration rate exceeds the evapotranspiration rate, such as during summer thunderstorms and spring snowmelt. However, summer thunderstorms and spring snowmelt more commonly produce runoff into neighboring canyons, resulting in infiltration rates below the root zone on the order of a few millimeters or less per year for mesa-top sites (Collins et al. 2005, 092028, pp. 2-84–2-88; Kwicklis et al. 2005, 090069).

This slow infiltration rate generally leads to present-day subsurface contaminant migration of only a few meters deep. Geochemical interactions between the contaminants and the rocks generally act to retard migration further. Therefore, groundwater transport of contaminants through the unsaturated zone to the regional aquifer does not represent a dominant pathway for contaminant transport in the TA-57 Aggregate Area.

2.3.3 Potential Receptors

Site workers are the primary potential human receptors for on-site contaminants. Access to the main TA-57 site is restricted, so members of the public would not be potential receptors. Recreational users of the National Forest are the primary potential human receptors for off-site contaminants (i.e., the drilling mud disposal pit located on Forest Service property). Ecological receptors, such as plants and animals, may be exposed to contaminants from the sites.

2.3.4 Cleanup Standards

As specified in Section IX.E of the Consent Order, NMED soil screening levels (SSLs) (NMED 2017, 602273) may be used as soil cleanup levels or site-specific risk-based cleanup levels may be developed based on NMED's risk assessment guidance for site investigations and remediation (NMED 2017, 602273). If NMED SSLs do not exist, U.S. Environmental Protection Agency (EPA) regional screening values will be used (http://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2016).

2.4 Data Overview

Data evaluated in this report include historical data collected in 1994 and 2002 as part of a Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) and NMOCD closure, respectively. All data records include a vintage code field denoting how and where samples were submitted for analyses. In the early years, the samples were submitted to the Laboratory's Chemical Science and Technology (CST) Division and were either analyzed at a CST laboratory (on-site) or submitted to one of several off-site contract analytical laboratories. Samples analyzed at a CST laboratory are identified by the vintage code "CST Onsite." Two vintage codes identify samples CST Division submitted to off-site contract analytical laboratories—"CST Offsite" if validation was not performed and "CSTROUT03" if validation was performed.

From late 1995 to the present, samples have been submitted through the Sample Management Office (SMO) to off-site contract analytical laboratories. Two vintage codes identify samples the SMO submitted to off-site contract analytical laboratories: "AN95" if validation was not performed and "SMO" if validation was performed.

All the data collected during the 1994 RFI are screening-level data and are summarized in section 4.0. Samples from the 2002 NMOCD closure were analyzed for inorganic chemicals at an on-site laboratory, and results are considered screening-level data and are discussed in section 4.0. Results of organic chemical analysis for samples from the 2002 NMOCD closure are from an off-site laboratory and are decision-level data. All valid 2002 organic results, however, were below detection limits. Because these results were below detection limits, they are not presented in tables or figures in this supplemental IWP.

Screening-level data are used to identify areas of potential contamination and to guide sample collection and analyses proposed in this supplemental IWP but will not be used in defining the nature and extent of contamination or in risk-screening evaluations.

3.0 SITE CONDITIONS

3.1 Surface Conditions

3.1.1 Topography

The TA-57 site is located on Lake Fork Mesa at an elevation of approximately 8700 ft amsl. The site is relatively flat and generally slopes to the south. The southern edge of the mesa is just south of the site boundary and the topography to the south steepens toward Lake Fork Canyon.

3.1.2 Vegetation

Typical vegetation in the vicinity of the TA-57 site is mixed conifer forest with spruce, fir, and ponderosa pine. The TA-57 site and surrounding area were burned by wildfire in 1971, and most of the vegetation at the site was destroyed. Following the fire, the area was aerially reseeded with pasture grasses and legumes and ponderosa pine seedlings were planted. Currently, the dominant trees at the site are aspen, ponderosa pine, Douglas fir, and white fir. Most of the area within the TA-57 fence is vegetated with grasses and brush.

3.1.3 Soil

Undisturbed soil at the site is probably typical of the soil described by Nyhan and others (1978, 005702) for the plateau tops and edges in the Los Alamos area. The parent material is the Bandelier Tuff and the processes forming soil should have been very similar to the processes forming soil in the Los Alamos area. Because of site development activities, for most of TA-57 and for the sludge disposal pit no undisturbed soil remains. Much of the TA-57 site has been filled and regraded. The depth to bedrock noted during previous investigations at the site ranged from 3.5 ft to 16 ft.

A thin veneer of physically weathered bedrock colluvium is the only surficial material left in the few undisturbed areas of the site. The residual material is thicker on the top of the plateau and thins along the edges to bedrock outcrops on the steep portions of the canyon walls. There is some fine-grained to coarser material in the two small alluvial channels draining the site to the southeast and northwest; however, these channels have been considerably altered by activities related to site construction and operations. This is also true of the location of the sludge pit.

3.1.4 Surface Water

The major surface water drainage near Fenton Hill is the Jemez River and its tributaries. The East Fork of the Jemez River drains the Valle Grande. Base flow is from discharge of groundwater to the stream from the near-surface water table in the Valle Grande and from the large amount of precipitation that occurs in the high mountains around the Valles Caldera. San Antonio Creek drains the Valle Toledo to the north of the Valle Grande as well as an area along the west side of the Valles Caldera and is a tributary to the Jemez River at the confluence with the East Fork of the Jemez River. Several thermal springs discharge into the creek. Base flow in San Antonio Creek is from the discharge of groundwater from the near-surface water table in Valle Toledo and from precipitation. At the confluence of the East Fork of the Jemez River and San Antonio Creek, the combined streams become the Jemez River.

The Rio Guadalupe drains the area west of Fenton Hill and includes the tributaries Rio de las Vacas and Rio Cebolla. The Rio de las Vacas drains an area west of the Valles Caldera. Base flow to the Rio Cebolla is from groundwater discharge from the shallow alluvial aquifers along numerous tributaries and from springs on the canyon wails.

The Fenton Hill site slopes gently south so the major part of the runoff is into Lake Fork Creek, a tributary to the Rio Cebolla below Fenton Lake. The land immediately northwest of TA-57 drains into an unnamed tributary that joins the Rio Cebolla at Fenton Lake. The land immediately northeast of TA-57 drains toward San Antonio Creek but is diverted by a low divide into Lake Fork Creek.

3.1.5 Land Use

Currently, land use at the TA-57 site is industrial. The site is fenced and locked and is accessible only to authorized workers. The area immediately adjacent to the TA-57 site is used by the U.S. Forest Service as a seasonal support area for fire fighters. The remaining area around the site, including the location of the sludge disposal pit (AOC 57-002) is within the Santa Fe National Forest and is used recreationally. The current land use is not expected to change in the foreseeable future.

3.2 Subsurface Conditions

3.2.1 Stratigraphic Units

The stratigraphy of the bedrock beneath the TA-57 Aggregate Area is summarized in this section. The stratigraphy includes, in descending order, the Bandelier Tuff, the Paliza Canyon Formation, the Abiquiu Tuff, the Abo Formation, the Madera limestone, the Sandia Formation, and Precambrian granite (LANL 1994, 034757, pp. 3-12–3-14).

The Bandelier Tuff is a nonwelded to densely welded rhyolite tuff that ranges from light to dark gray. It is composed of quartz and sanadine crystals, lithic fragments of latite and rhyolite, and fragments of glass shards and rare mafic minerals in a fine-grained ash matrix. This tuff layer thins to the west and southwest away from its source at the Valles Caldera (Rea 1977, 005713; Kaufman and Siciliano 1979, 005941). The Bandelier Tuff is about 106-m (350-ft) thick under the Fenton Hill site (Purtymun et al. 1974, 005483).

The Paliza Canyon Formation underlies the Bandelier Tuff and is composed of andesite and basaltic andesite breccias that are interbedded with sand and gravels. The Paliza Canyon Formation is about 15-m (50-ft) thick under the site (Purtymun et al. 1974, 005483).

Under the Paliza Canyon is the Abiquiu Tuff, which is a light gray, friable tuffaceous sandstone. It is about 15-m (50-ft) thick under the site (Purtymun et al. 1974, 005483).

Beneath the Abiquiu Tuff are the Permian redbeds of the Abo Formation. The lithologies are typically arkosic siltstone, sandstone, and shale. There are small inclusions of calcareous gray clay. Particles include granules of quartz and feldspar and pieces of igneous rock. The thickness is highly variable because of erosion before Cenozoic volcanism (Rea 1977, 005713; Kaufman and Siciliano 1979, 005941).

Beneath the Abo Formation are Pennsylvanian limestones, shales, and arkoses of the Magdalena group. The group consists of Madera limestone over the Sandia Formation. The Madera limestone is an arkosic limestone containing both gray and red arkosic shale overlying a dark gray limestone with insets of gray shale and beds of sandstone. The Sandia Formation has an upper clastic member of sandstone, shale, and limestone. The tower part is a discontinuous dark-gray siliceous limestone (Rea 1977, 005713; Kaufman and Siciliano 1979, 005941).

The basement beneath the Sandia Formation is coarse Precambrian granite with large microcline crystals, quartz-feldspar lenticular gneiss, schists, amphibolites, and pegmatites. Veins include quartz and hornblendite. Minerals include quartz and microcline, oligoclase-andesine, hornblende, biotite, epidote, sphene, apatite, zircon, and magnetite (Rea 1977, 005713; Kaufman and Siciliano 1979, 005941).

3.2.2 Hydrogeology

3.2.2.1 Groundwater

Groundwater in the area of TA-57 occurs as (1) water in saturated alluvium, (2) perched aquifers, and (3) regional aquifer.

Saturated Alluvium

Bums Swale, a dry tributary of Lake Fork Canyon at the south side of TA-57, has a 2- to 6-ft depth of alluvium in its upper reaches and more than a 40-ft depth of alluvium at the confluence with Lake Fork Canyon. In May 1979, water was encountered in four holes bored in the alluvium. Later in the year, these holes were dry (Kaufman and Siciliano 1979, 005941). After a release of water into Bums Swale in September 1979, the two holes closest to the site again contained water. Releases to Bums Swale were observed to infiltrate the alluvium and then would have either moved downstream along the interface of the alluvium and the Cenozoic volcanics or infiltrated into the volcanics.

Perched Aquifers

The water supply for TA-57 is furnished by a well completed in a perched aquifer at a depth of about 450 ft. The aquifer is in the Abiquiu Tuff and is perched on the clays and siltstones of the Abo Formation. The aquifer is of limited extent, terminating to the east along the canyon cut by San Antonio Creek. Water movement in the aquifer is to the southwest, where a part is discharged through springs and seeps in the lower part of Lake Fork Canyon and along the Rio Cebolla.

Other perched aquifers were identified beneath the site as part of an evaluation of alternate water supplies. Four saturated zones were identified in the Abo Formation at depths of 780–800 ft, 970–995 ft, 1005–1015 ft, and 1100–1120 ft below ground surface (bgs). These zones were described as fine-grained sandstones underlain by shales. Six perched zones were also identified in the Madera Limestone.

Regional Aquifer

The regional aquifer is at the base of the Madera formation. Many of the hot springs in the region appear at outcrops of this horizon. These are generally hot mineral springs. The regional aquifer is encountered at a depth of 533 m (1750 ft) below TA-57. All of the aquifers above this depth are perched. Within the regional aquifer, a permeable horizon was found in the depth interval 540–550 m (1770–1800 ft). It consisted of 9.1 m (30 ft) of arkosic sandstone or granite wash. Geophysical log data indicate that the zone is “only fair” as an aquifer. Water in the granitic basement is primarily contained in fracture porosity.

3.2.2.2 Vadose Zone

The unsaturated zone from the mesa surface to the top of the regional aquifer is referred to as the vadose zone. The source of moisture for the vadose zone is precipitation, but much of it runs off, evaporates, or is absorbed by plants. The subsurface vertical movement of water is influenced by properties and conditions of the materials that make up the vadose zone.

The Bandelier Tuff is generally dry and does not readily transmit moisture. Most of the pore spaces in the tuff are of capillary size and have a strong tendency to hold water against gravity by surface-tension forces. Vegetation is very effective at removing moisture near the surface. During the summer rainy season when rainfall is highest, near-surface moisture content is variable because of higher rates of evaporation and of transpiration by vegetation, which flourishes during this time.

The various units of the Bandelier Tuff tend to have relatively high porosities. Porosity ranges between 30% and 60% by volume, generally decreasing for more highly welded tuff. Permeability varies for each cooling unit of the Bandelier Tuff. The moisture content of tuff beneath the mesa tops is low, generally less than 5% by volume throughout the profile (Kearl et al. 1986, 015368; Purtymun and Stoker 1990, 007508).

The vadose zone underlying TA-57 is in thin, surficial soil deposits and in the underlying volcanic tuff. Flow and transport in the vadose zone will be primarily downward to the perched water at the base of the volcanics.

4.0 SITE DESCRIPTIONS AND PROPOSED INVESTIGATION ACTIVITIES

The following section presents site descriptions, summaries of previous investigation activities, data summaries, and proposed sampling activities for each AOC. A variety of resources was used to define and revise the boundaries of each site, shown on the related figures. Existing structures, roads, and other features that could be readily observed in the field were of prime importance. If these conditions could still be observed in the field, site boundaries were then established relative to these landmarks. Other types of data references were also used, particularly for former site locations where significant changes have occurred over time. Historical aerial photographs have been an excellent resource. Drawings and sketches were used, particularly for structures and utilities, as well as engineering drawings produced for construction or record purposes. For each site, available information was reviewed, conflicts resolved as satisfactorily as possible, and site locations and boundaries revised accordingly.

4.1 AOC 57-001(b), Former Settling Pond

4.1.1 Site Description

AOC 57-001(b) consists of a former settling pond associated with the HDR geothermal energy experiments conducted at the TA-57 Fenton Hill site (Figure 4.1-1). The settling pond was designated GTP-3. Constructed in 1974, Pond GTP-3 was approximately 100 ft × 120 ft × 20 ft deep and was constructed by building a 10-ft-high berm across the head of Burns Swale and excavating into tuff behind the berm. A spillway directed overflow water around the west end of the berm and into the swale. The settling pond was used to settle out particulates from the water used in the drilling and circulating operations for well GT-2 (Plate 1). After the particulates had settled out, the water was either recirculated or discharged from the pond. Discharges to the swale were performed periodically, and the liquid from the ponds was sampled and analyzed before discharge. Solids and mud were occasionally removed from the pond during the operation period and were transported to the sludge pit (AOC 57-002). When the pond ceased to be used, all the material in the pond was removed and taken to the sludge pit, and the settling pond was backfilled.

Discharges from the pond were permitted under a National Pollutant Discharge Elimination System (NPDES) permit. The NPDES permit (NM0028576) required monitoring for arsenic, boron, cadmium, fluoride, and lithium each day a discharge occurred. In addition to the NPDES permit, the discharge was also subject to a groundwater discharge permit issued by the State of New Mexico. The groundwater discharge permit required the discharge from the outfall to be controlled so no effluent flow traveled beyond the point where Lake Fork Canyon Road crosses the watercourse receiving the discharge. This point is approximately 1 mi downstream of the outfall.

The site of the former pond is currently vegetated with grasses. The land surface where the pond was located slopes gently to the south to what appears to be the berm that formed the southern boundary of the pond. The topography then steepens to the south. A drainage ditch originates near the southwest corner of the former pond and runs along the west side of the slope below the berm. To the southeast of the pond is a discharge structure that contains a flow-measuring gauge and appears to be associated with the former NPDES outfall. A discharge hose is present below the discharge structure.

4.1.2 Previous Investigations

The Laboratory conducted a Phase I RFI at AOC 57-001(b) in 1994 (LANL 1996, 053801). The scope and results of the RFI are summarized below and described in more detail in section 2.1 of the supplemental HIR (LANL 2017, 602376).

A borehole was advanced within the footprint of former pond GTP-3. Boreholes were also advanced at two locations at and downgradient of the outfall within Burns Swale. Samples were collected at 1-ft intervals from each borehole and field screened for barium. Elevated barium was detected and used to select samples for laboratory analysis.

One sample for laboratory analysis was collected from within former pond GTP-3 at 11.0 to 12.0 ft bgs (tuff bedrock was encountered at a depth of 16 ft bgs). The material sampled at this interval was reported to be “service material” (a sludge-like mixture of drilling mud and additives) (LANL 1996, 053801, p. 27). Four samples for laboratory analysis were collected at two locations below the outfall. A surface sample (0.0 to 1.0 ft bgs) and subsurface sample (3.0 to 4.0 ft bgs or 4.0 to 5.0 ft bgs) were collected at each location. All samples were submitted to an off-site analytical laboratory for analyses of target analyte list (TAL) metals, total cyanide, uranium, and semivolatile organic compounds (SVOCs).

4.1.3 Summary of Data

The data collected during the 1994 RFI do not meet current data validation standards and are screening-level data. The results of the analyses of samples collected during the 1994 RFI are described in section 2.1.3 of the supplemental HIR (LANL 2017, 602376) and are summarized below.

- Arsenic, barium, cadmium, chromium, copper, lead, magnesium, manganese, sodium, uranium, and zinc were detected above background values (BVs) (LANL 1998, 059730).
- Arsenic was detected above residential and industrial SSLs (NMED 2017, 602273).
- SVOCs were not detected in any samples, but detection limits were elevated (69 mg/kg to 170 mg/kg) in the sample collected within the footprint of the pond because of dilutions made in the laboratory necessitated by the high organic content of the material sampled. Detection limits were not elevated for samples collected from Burns Swale.

4.1.4 Proposed Activities

The results of the 1994 RFI, although screening-level data, indicated concentrations above BVs within the footprint of the former pond and below the outfall. Sampling will be performed at and around these areas to determine the nature and extent of potential contamination. In addition, the screening-level data from the RFI indicated concentrations above SSLs within the footprint of the pond and below the outfall.

Therefore, sampling will also be performed to determine whether remediation is required and, if so, the extent of the area requiring remediation.

Samples will be collected from five locations within the footprint of the former pond to characterize the material within the former pond for potential removal and to determine the vertical extent of potential contamination. Sampling locations are identified as 57-02200 and 1b-1 through 1b-4 in Figure 4.1-1. Boreholes will be advanced at these locations to a depth of 5 ft into tuff. Samples will be collected at three 1-ft intervals above the tuff to characterize the material within the former ponds and at two 1-ft intervals in tuff (1.0 to 2.0 ft and 4.0 to 5.0 ft below the top of tuff) to determine vertical extent. Sample intervals for the material above the tuff will be from 0.0 to 1.0 ft bgs, 1 ft above the tuff interface, and 1 ft between the surface and the tuff interface. One of these intervals should include the “service material,” if encountered. If no “service material” is present, the middle interval should be centered between the ground surface and the top of the tuff.

Samples will be collected from four step-out locations around the footprint of the former pond to determine lateral extent of potential contamination. Sampling locations are identified as locations 1b-5 through 1b-8 in Figure 4.1-1. Boreholes will be advanced to the same depths as the adjacent boreholes within the pond footprint, and samples will be collected at the same depth intervals as the boreholes within the pond footprint.

Samples will be collected at and around the former outfall, in the drainage on the west side of the site, and in the Burns Swale drainage. Samples will be collected at the weir outfall structure (location 1b-9 in Figure 4.1-1), at three locations in the drainage on the west side of the site (1b-10 through 1b-12 in Figure 4.1-1), and below the outfall (location 1b-13 in Figure 4.1-1). Samples will be collected at the location where SSLs were exceeded during the 1994 RFI (location 57-02300 in Figure 4.1-1) and at six additional locations (57-02350 and 1b-14 through 1b-18 in Figure 4.1-1) farther downgradient in Burns Swale to determine lateral and vertical extent. At each location, samples will be collected at depth intervals of 0.0 to 1.0 ft bgs, 1 ft above top of tuff, and 2.0 to 3.0 ft into tuff.

All samples will be submitted for laboratory analysis of TAL metals, total cyanide, SVOCs, and isotopic uranium. Table 4.1-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.2 AOC 57-001(c), Former Settling Pond

4.2.1 Site Description

AOC 57-001(c) consists of a former settling pond associated with the HDR geothermal energy experiments conducted at the TA-57 Fenton Hill site (Figure 4.2-1). The settling pond was designated GTP-2. The pond was constructed in 1976 by excavation into tuff bedrock. The pond had approximate dimensions of 25 ft × 80 ft × 10 ft and was used to contain circulation fluids consisting of water injected into the deep geothermal extraction wells. This water contained tracer compounds and dissolved, naturally occurring minerals leached during contact with hot rock formations. The pond was decommissioned in 1980, cleaned, and filled with clean soil to the level of the original ground surface. A portion of building 57-56, a storage building, is currently located on the footprint of the former pond.

The site of the former pond is currently vegetated with grasses. The land surface where the pond was located slopes gently to the south. A three-sided storage building (building 57-56) is currently located along the southern boundary of the former pond. The building has metal walls and a concrete floor and currently contains two inactive 300-gal. tanks that were used to store gasoline and diesel fuel.

4.2.2 Previous Investigations

The Laboratory conducted a Phase I RFI at AOC 57-001(c) in 1994 (LANL 1996, 053801). The scope and results of the RFI are summarized below and are described in more detail in section 2.2.3 of the supplemental HIR (LANL 2017, 602376).

One borehole was advanced within the expected footprint of the former pond. A review of historical aerial photographs indicates the location of the RFI sample may not have been within the footprint of the former pond. The 1994 RFI work plan indicated the pond location was no longer evident at the time the work plan was prepared (LANL 1994, 034757, p. 5-7). The boundary of the former pond has been updated based on the aerial photographs and the updated boundary and RFI sampling location are shown in Figure 4.2-1. Samples were collected at 1-ft intervals from the borehole and field screened for barium. Elevated barium was not detected. One subsurface sample was collected at a depth interval of 4.5 to 5.0 ft bgs (tuff bedrock was encountered at a depth of 9.5 ft bgs). The material sampled at this interval was reported to be “service material” (LANL 1996, 053801, p. 41). The sample was submitted to an off-site analytical laboratory for analyses of TAL metals, total cyanide, uranium, and SVOCs.

4.2.3 Summary of Data

The data collected during the 1994 RFI do not meet current data validation standards and are screening-level data. The results of the analyses of samples collected during the 1994 RFI are described in section 2.2.3 of the supplemental HIR (LANL 2017, 602376) and are summarized below.

- Cadmium was detected above BV (LANL 1998, 059730).
- SVOCs were not detected (detection limits ranged from 0.39 mg/kg to 0.95 mg/kg).

The results of the 1994 RFI, although screening-level data, indicated concentrations of only one inorganic constituent above BV and no detected organic constituents.

4.2.4 Proposed Activities

Sampling will be performed within and around the former pond to determine the nature and extent of potential contamination.

Samples will be collected from two locations within the footprint of the former pond to characterize the material within the former pond and to determine the vertical extent of potential contamination. Sampling locations are identified as 1c-1 and 1c-2 in Figure 4.2-1. Boreholes will be advanced at these locations to a depth of 5 ft into tuff. Samples will be collected at three 1-ft intervals above the tuff to characterize the material within the former pond and at two 1-ft intervals in tuff (1.0 to 2.0 ft and 4.0 to 5.0 ft below the top of tuff) to determine vertical extent. Sample intervals for the material above the tuff will be from 0.0 to 1.0 ft bgs, 1 ft above the tuff interface, and 1 ft between the surface and the tuff interface. These intervals should include the “service material,” if encountered.” If no “service material” is present, the middle interval should be centered between the ground surface and the top of the tuff.

Samples will be collected from four step-out locations around the footprint of the former pond to determine the lateral extent of potential contamination. Sampling locations are identified as locations 1c-3 through 1c-5 and 1b-5 in Figure 4.2-1 [location 1b-5 is being used to determine lateral extent for both AOCs 57-001(b) and 57-001(c)]. Boreholes will be advanced to the same depths as the adjacent boreholes within the pond footprint, and samples will be collected at the same depth intervals as the boreholes within the pond footprint.

All samples will be submitted for laboratory analysis of TAL metals, total cyanide, SVOCs, and isotopic uranium. Table 4.2-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.3 AOC 57-002, Sludge Pit

4.3.1 Site Description

AOC 57-002 is a sludge pit located on U.S. Forest Service property approximately 2 mi west of the TA-57 site (Figure 4.3-1). This pit was used from 1974 to 1990 to dispose of solids removed from the bottom of Fenton Hill settling ponds and drilling mud removed from the Fenton Hill drilling mud pits. The sludge pit is located at the former site of a gravel pit that was used by the State of New Mexico during construction of NM 126. The approximate dimensions of the pit are 100 ft × 200 ft. The pit is divided into two sections. The western section was reported to be 15 to 20 ft deep and was used during the early stages of operation at Fenton Hill (LANL 1994, 034757). It was active until about 1985 when disposal started in the eastern section. The eastern section was reported to be 6 to 8 ft deep and was used until 1990 when pond GTP-1W [AOC 57-004(a)] was cleaned out.

During operation, sludge from cleanout of the settling ponds and mud pits at TA-57 was trucked to the site and dumped into the north end of the pit. The sludge was then distributed throughout the pit using a bulldozer. If the water in the sludge did not evaporate or infiltrate at a sufficient rate, a berm on the south side of the pit would be breached to allow the water to flow onto a graded area south of the pit where it could evaporate.

The site of the disposal pit is currently sparsely vegetated with grasses and shrubs. The pit is located in a depression that appears to be the former borrow pit. A berm divides the pit into eastern and western sections, and the ground surface of the western section is visibly higher than the eastern.

4.3.2 Previous Investigations

The Laboratory conducted a Phase I RFI at AOC 57-002 in 1994 (LANL 1996, 053801). The scope and results of the RFI are summarized below and are described in more detail in section 2.3.3 of the supplemental HIR (LANL 2017, 602376).

Two boreholes were advanced—one within the footprint of the eastern section of the pit and one in the western section. Samples were collected at 1-ft intervals and samples for laboratory analysis were selected based on visual appearance. One subsurface sample (4.5 to 5.0 ft bgs) was collected from within the eastern section (tuff bedrock was encountered at a depth of 7 ft bgs) and one subsurface sample (9.0 to 10.0 ft bgs) was collected from within the western section (tuff bedrock was encountered at a depth of 12.5 ft bgs). The material sampled at both locations was reported to be “service material” (LANL 1996, 053801, p. 44). Both samples were submitted to an off-site analytical laboratory for analyses of TAL metals, total cyanide, uranium, and SVOCs.

4.3.3 Summary of Data

The data collected during the 1994 RFI do not meet current data validation standards and are screening-level data. The results of the analyses of samples collected during the 1994 RFI are described in section 2.3.3 of the supplemental HIR (LANL 2017, 602376) and are summarized below.

- Arsenic, barium, copper, lead, magnesium, sodium, and zinc were detected above BVs (LANL 1998, 059730).

- Arsenic was detected above residential and industrial SSLs, and barium was detected above the residential SSL (NMED 2017, 602273).
- SVOCs were not detected, but detection limits were very high (64 mg/kg to 160 mg/kg) because of dilutions made in the laboratory necessitated by the high organic content of the material sampled.

4.3.4 Proposed Activities

The results of the 1994 RFI, although screening-level data, indicated concentrations above BVs within the footprint of the sludge pit. Sampling will be performed at and around this area to determine the nature and extent of potential contamination. In addition, the screening-level data from the RFI indicated concentrations above SSLs within the footprint of the pit. Therefore, sampling will also be performed to determine whether remediation is required and, if so, the extent of the area requiring remediation.

Samples will be collected from nine locations within the footprint of the pit’s two sections to characterize the material within the pit for potential removal and to determine the vertical extent of potential contamination. Sampling locations are identified as 2-1 through 2-9 in Figure 4.3-1. Boreholes will be advanced at these locations to a depth of 5 ft into tuff. Within the western portion of the pit, samples will be collected at four 1-ft intervals above the tuff to characterize the material within the pit and at two 1-ft intervals in tuff (1.0 to 2.0 ft and 4.0 to 5.0 ft below the top of tuff) to determine vertical extent. Samples will be collected at the surface (0.0 to 1.0 ft bgs) and at the top of the tuff at each location. Other sample intervals for the material above the tuff will be selected in the field based on observed conditions, with at least one interval collected from the “service material,” if encountered. If no “service material” is present, samples at four evenly spaced intervals above the tuff will be collected. Within the eastern section of the pit, samples will be collected at three 1-ft intervals above the tuff to characterize the material within the pit and at two 1-ft intervals in tuff (1.0 to 2.0 ft and 4.0 to 5.0 ft below the top of tuff) to determine vertical extent. Samples will be collected at the surface (0.0 to 1.0 ft bgs) and at the top of the tuff at each location. The other sample interval will be selected in the field based on observed conditions and will include “service material,” if encountered. If no “service material” is present, samples will be collected at three evenly spaced intervals above the tuff.

Samples will be collected from four step-out locations around the west, north, and east sides of the footprint of the pit to determine the lateral extent of potential contamination. Sampling locations are identified as 2-10 through 2-13 in Figure 4.3-1. Boreholes will be advanced at these four locations to the same depths as the adjacent boreholes within the pit, and samples will be collected at the same depth intervals as the boreholes within the pit. Samples will also be collected from five locations on two transects to the south of the pit (locations 2-14 through 2-18 in Figure 4.3-1) to characterize the extent of potential releases from overflows. Boreholes will be advanced at these five locations to the same depths as adjacent borehole 2-3 within the pit, and samples will be collected at the same depth intervals as the borehole at location 2-3.

All samples will be submitted for laboratory analysis of TAL metals, total cyanide, SVOCs, and isotopic uranium. Table 4.3-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.4 AOC 57-004(a), Former Settling Ponds

4.4.1 Site Description

AOC 57-004(a) consists of two former settling ponds (GTP-1E and GTP-1W) located at the north end of TA-57 (Figure 4.2-1). Settling pond GTP-1E was originally excavated in 1975 for use as a disposal pit during the drilling of well EE-1. Pond GTP-1E was enlarged in several stages as operations advanced and also was used for settling circulation fluids from geothermal testing. Pond GTP-1E was constructed by excavating into soil and tuff at the site and was expanded several times during operations. Final dimensions were approximately 40 ft × 310 ft. In 1983 and 1984, pond GTP-1E was decommissioned, cleaned of sludge, and backfilled with clean soil to the original ground level. Pond GTP-1W was then excavated and lined with plastic. The location of this new pond included the eastern portion of pond GTP-1E. Pond GTP-1W had a capacity of 1 million gal. and dimensions of 120 ft × 280 ft. In 1990, pond GTP-1W was relined with a double liner after the original lining deteriorated. In 1997, the pond was cleaned to remove accumulated sludge. From 1997 to 2002, the pond was used to hold geothermal circulation fluid and ion exchange backflush water from the Milagro Project.

When pond GTP-3 [AOC 57-001(b)] was in operation, no discharge occurred from pond GTP-1W to the environment. Instead, fluid would be circulated through pond GTP-1W and then sent to pond GTP-3 where supernatant liquid would be discharged through the NPDES outfall to Burns Swale. After pond GTP-3 was taken out of service in 1984, supernatant liquid from pond GTP-1W was discharged directly to the NPDES outfall.

In 2002, the Laboratory closed pond GTP-1W in accordance with a closure plan approved by the NMOCD (LANL 2002, 101220). During closure, the liquid and sludge remaining in the pond were removed and disposed of off-site (LANL 2002, 101221). The two liners and the fill between the liners were also removed and disposed of off-site. After the liners were removed, the liner bedding material, which consisted of crusher fines, was sampled and found to contain arsenic ranging from 204 mg/kg to 272 mg/kg. Similar concentrations were detected, however, in the bedding material located above the waterline of the pond. The Laboratory concluded that the arsenic was from high background levels in the crusher fines rather than from the leakage of pond fluids. The Laboratory proposed to consolidate the crusher fines in the deepest part of the pond excavation before backfilling (LANL 2003, 101221). This backfill plan was approved by NMOCD, and the pond was backfilled, graded, and reseeded (NMOCD 2003, 101222). Following completion of closure, a final closure report was submitted by the Laboratory to, and approved by, NMOCD (LANL 2003, 101264; NMOCD 2003, 101265).

The site of the former ponds is currently vegetated with grasses. The land surface where the ponds were located slopes gently to the south. No structures were located on the site of the former ponds. A monument is located north of the former ponds at the closed wellhead of geothermal well EE-3.

4.4.2 Previous Investigations

The Laboratory conducted a Phase I RFI at AOC 57-004(a) in 1994 (LANL 1996, 053801). The scope and results of the RFI are summarized below and are described in more detail in section 2.4.3 of the supplemental HIR (LANL 2017, 602376).

A borehole was advanced within the footprint of former pond GTP-1E. Samples were collected at 1-ft intervals from the borehole and field screened for barium. Elevated barium was detected and used to select a sample for laboratory analysis. A sample for laboratory analysis was collected from within former pond GTP-1E at 5.25 to 6.0 ft bgs. The material sampled at this interval was reported to be “service material” (LANL 1996, 053801, p. 50). A sample for laboratory analysis was also collected at the same location from tuff under the former pond at 6.0 to 7.0 ft bgs. Both samples were submitted to an off-site analytical laboratory for analyses of TAL metals, total cyanide, uranium, and SVOCs.

Sampling was also performed during the NMOCD-regulated closure of pond GTP-1W in 2002. After the pond contents and liners had been removed, 10 samples were collected from 5 locations in the pond footprint. At each location, a sample of the lower liner bedding material (crusher fines) was collected from an interval 0.0 to 0.5 ft below the former liner, and a sample of tuff was collected from an interval of 1.5 to 2.0 ft, except for one location where the sample was collected from 0.8 to 1.3 ft because of the hardness of the tuff. All samples were submitted to an on-site analytical laboratory for analysis of TAL metals plus boron, molybdenum, tin, thorium, and uranium. Two samples were also submitted to an off-site analytical laboratory for analysis of SVOCs.

In response to the detection of elevated levels of arsenic in the crusher fine samples, two additional samples of crusher fines (0.0 to 0.5 ft below the former liner) were collected from above the pond overflow pipe (i.e., above the high water line of the pond). A surface sample of tuff (0.0 to 0.5 ft bgs) was also collected outside the footprint of the pond. These samples were submitted to an on-site analytical laboratory for analysis of arsenic. In addition, three of the previous crusher fine samples were submitted to an off-site laboratory for analysis of toxicity characteristic leaching procedure metals.

4.4.3 Summary of Data

The data collected during the 1994 RFI do not meet current data validation standards and are screening-level data. The results of the analyses of samples collected during the 1994 RFI are described in section 2.4.3 of the supplemental HIR (LANL 2017, 602376) and are summarized below.

- Barium, cadmium, chromium, copper, cyanide, lead, uranium, and zinc were detected above BVs (LANL 1998, 059730) in the “service material” sample. Inorganic chemicals were not detected above BVs in tuff.
- SVOCs were not detected in the “service material,” but detection limits were very high (98 mg/kg to 240 mg/kg) because of dilutions made in the laboratory necessitated by the high organic content of the material sampled. SVOCs were not detected in tuff.

Inorganic data from the 2002 closure are screening-level data and are not presented in this work plan but are summarized below.

- Aluminum, antimony, arsenic, barium, beryllium, cobalt, magnesium, manganese, mercury, potassium, sodium, thallium, uranium, vanadium, and zinc were detected above BVs (LANL 1998, 059730) in the crusher fine samples.
- Aluminum, arsenic, barium, beryllium, chromium, copper, iron, lead, magnesium, manganese, mercury, potassium, sodium, uranium, and zinc were detected above BVs in the tuff samples.
- Arsenic was detected above residential and industrial SSLs (NMED 2017, 602273).

Organic data from the 2002 closure are decision-level data but are not presented in this work plan because all results were below detection limits.

4.4.4 Proposed Activities

The results of the 1994 RFI, although screening-level data, indicated concentrations above BVs within the footprint of former pond GTP-1E. Sampling will be performed within and around this area to determine the nature and extent of potential contamination. Screening-level data from the RFI did not indicate concentrations above SSLs so soil removal is not anticipated, although further characterization is needed to confirm that soil removal is not required. During the 2002 closure, all waste material was removed from pond GTP-1W and disposed of off-site. The inorganic chemical results of the 2002 sampling, although screening-level data, indicated concentrations above BVs in the crusher fine bedding material and in the underlying tuff. Sampling will be performed within and around the former pond to determine the nature and extent of potential contamination. In addition, the screening-level data from the closure indicated concentrations above SSLs in the crusher fines and underlying tuff. Therefore, sampling will also be performed to determine whether waste/soil removal is required and, if so, the extent of the area requiring removal.

Samples will be collected from 12 locations within the footprint of the former ponds to characterize the material within the former ponds and to determine the vertical extent of potential contamination. Sampling locations are identified as 4a-1 through 4a-12 in Figure 4.2-1.Based on the description of closure activities, locations 4a-8 and 4a-9 should be within the area where the crusher fines were disposed of. Boreholes will be advanced at all locations to a depth of 5 ft into tuff. Samples within the footprint of pond GTP-1W will be collected at four 1-ft intervals above the tuff to characterize the material within the former pond and at two 1-ft intervals in tuff (1.0 to 2.0 ft and 4.0 to 5.0 ft below the top of tuff) to determine vertical extent. Samples within the footprint of pond GTP-1E will be collected at three 1-ft intervals above the tuff to characterize the material within the former pond and at two 1-ft intervals in tuff (1.0 to 2.0 ft and 4.0 to 5.0 ft below the top of tuff) to determine vertical extent. Sample intervals for the material above the tuff will be from 0.0 to 1.0 ft bgs, 1 ft above the tuff interface (including crusher fines, if present), and one or two intervals centered between the ground surface and the top of the tuff.

Samples will be collected from seven step-out locations around the footprint of the former ponds to determine the lateral extent of potential contamination. Sampling locations are identified as locations 4a-13 through 4a-19 in Figure 4.2-1. Boreholes will be advanced at these locations to the same depths as the adjacent boreholes within the pond footprint, and samples will be collected at the same depth intervals as the boreholes within the pond footprint.

All samples will be submitted for laboratory analysis of TAL metals, total cyanide, SVOCs, and isotopic uranium. Table 4.4-1 summarizes the proposed sampling locations, depths, and analytical suites.

4.5 AOC 57-004(b), Settling Pond

4.5.1 Site Description

AOC 57-004(b) is a 5-million-gal. plastic-lined settling pond located southwest of the main TA-57 operating area (Figure 4.5-1). The pond was constructed in 1982 and previously contained circulation fluids from geothermal wells. The pond has a synthetic membrane liner with an underdrain system below the liner. In 2002, the pond was modified for use in the Milagro gamma-ray observatory project. The pond was cleaned out, instrumented with over 700 photomultiplier tubes, refilled with purified water, and covered with a lightproof cover consisting of a synthetic membrane. The Milagro project has since ended and the photomultiplier tubes have been removed. The pond liners have been partially removed.

The pond underdrain system was designed to collect any leakage through the pond liner. The underdrain system consisted of a 6-in. layer of granular material beneath the liner that was sloped toward a collection trench located along the center of the pond, between the sidewalls. The collection trench contained a 6-in. perforated pipe and granular backfill. The pipe was sloped to the west and connected to a solid 6-in. pipe at the bottom of the west sidewall. An emergency drain was located at the bottom of the west sidewall and connected to a 10-in. drainpipe. The emergency drain was controlled by a gate valve located just inside the fence west of the pond. The underdrain pipe and emergency drainpipe ran parallel to each other from the bottom of the west sidewall to a common discharge structure. The discharge structure consists of a collection sump and discharge pump as well as an emergency overflow. Water collecting in the sump would be pumped from the sump and discharged to the ground. In the event of an emergency, the sump would overflow onto the ground surface.

No records of any discharge of leakage or overflow during operation of the pond are available. During decommissioning of the Milagro Project, the pond was pumped down to allow the photomultiplier tubes to be removed. In 2015, discharge from the outfall was discovered, apparently caused by valve leakage from the drainpipe, and repairs were made to stop the leakage.

4.5.2 Previous Investigations

No previous investigations have been conducted at this site.

4.5.3 Summary of Data

No decision-level data are available for this site.

4.5.4 Proposed Activities

Sampling will be performed at AOC 57-004(b) to determine whether releases through the liner have occurred and to characterize the nature and extent of releases from the outfall. If sampling results indicate releases have occurred, the data will also be used to determine the extent of the releases and the associated risk. Samples will be collected from locations beneath the pond liner, along the drainline from the pond, and at and below the outfall.

Samples will be collected at five locations along the underdrain trench beneath the pond liner to characterize potential contamination resulting from releases to the underdrain trench. Sampling locations are identified as 4b-1 through 4b-5 in Figure 4.5-1. Samples will be collected from 0.0 to 0.5 ft below the liner (i.e., in the drainpipe bedding material) to characterize the potential for past leakage and from two 1-ft intervals in tuff (1.0 to 2.0 ft and 4.0 to 5.0 ft below the top of tuff) to determine vertical extent.

Samples will be collected at sixteen additional locations on a grid within the footprint of the bottom of the pond to characterize potential contamination resulting from leakage through the liner. Sampling locations are identified as locations 4b-6 through 4b-21 in Figure 4.5-1. Samples will be collected from 0.0 to 0.5 ft below the liner (i.e., in the liner bedding layer) to characterize the potential for past leakage and from two 1-ft intervals in tuff (1.0 to 2.0 ft and 4.0 to 5.0 ft below the top of tuff) to determine vertical extent.

Samples will be collected at four locations along the drainlines between the western edge of the pond and the outfall to characterize potential releases from the drainlines. Sampling locations are identified as 4b-22 through 4b-25 in Figure 4.5-1. Samples will be collected at three 1-ft intervals (0.0 to 1.0 ft, 2.0 to 3.0 ft, and 4.0 to 5.0 ft) below the bottom of the drainlines to define vertical extent. The upper samples will be collected in drainline bedding materal, if present.

Samples will also be collected at the outfall structure and three downgradient locations to define lateral and vertical extent. Sampling locations are identified as 4b-26 through 4b-29 in Figure 4-5.1. At each location, samples will be collected at depth intervals of 0.0 to 1.0 ft bgs, 1 ft above the top of tuff, and 2.0 to 3.0 ft into tuff to define vertical extent.

All samples will be submitted for laboratory analysis of TAL metals, total cyanide, SVOCs, and isotopic uranium. Table 4.5-1 provides a summary of the proposed sampling locations, depths, and analytical suites.

5.0 INVESTIGATION METHODS

A summary of investigation methods to be implemented is presented in Table 5.0-1. The standard operating procedures (SOPs) used to implement these methods are available at http://www.lanl.gov/environment/plans-procedures.php and can be downloaded from http://eprr.lanl.gov/oppie/service. Summaries of the field investigation methods are provided below. Additional procedures may be added as necessary to describe and document activities affecting quality.

Chemical analyses will be performed in accordance with the Laboratory's analytical statement of work. Accredited off-site contract analytical laboratories will use the most recent EPA- and industry-accepted extraction and analytical methods for chemical analyses of analytical suites.

5.1 Establishing Sampling Locations

Proposed sampling locations are identified for each site based on engineering drawings, surveyed locations of existing structures, previous sampling locations, and topography or other features identified in the field, such as drainage channels and sediment accumulation areas. The coordinates of proposed locations will be obtained by georeferencing the points from the proposed sampling maps. The coordinates will be used to locate flags or other markers in the field using a differential global positioning system (GPS) unit. If any proposed sampling locations are moved because of field conditions, utilities, or other unexpected reasons, the new locations will be surveyed immediately following sample collection as described in section 5.2.

5.2 Geodetic Surveys

Geodetic surveys will be conducted in accordance with the latest version of EP-ERSS-SOP-5028, "Coordinating and Evaluating Geodetic Surveys," to locate historical structures and to document field activities such as sampling and excavation locations. The surveyors will use a Trimble GeoXT handheld GPS or equivalent for the surveys. The coordinate values will be expressed in the New Mexico State Plane Coordinate System (transverse mercator), Central Zone, North American Datum 1983. Elevations will be reported as per the National Geodetic Vertical Datum of 1929. All GPS equipment used will meet the accuracy requirements specified in the SOP.

5.3 Field Screening

As sampling is primarily being conducted to define nature and extent based on previous investigations, field screening will be conducted mainly for health and safety purposes. However, if elevated field-screening levels are observed for the deepest sample collected from a specific sampling location, sample collection will continue until field-screening results show no elevated readings. The Laboratory's proposed field-screening approach will be to (1) visually examine all samples for evidence of contamination, (2) screen for organic vapors, and (3) screen for radioactivity.

5.3.1 Organic Vapors

Based on site histories and previous RFI results, volatile organic compound (VOC) contamination is not expected to be encountered. Organic vapor screening of surface and subsurface samples will be conducted using a photoionization detector (PID) with an 11.7-electron-volt lamp. All samples will be screened in accordance with ER-SOP-20025, "Headspace Vapor Screening with a Photoionization Detector." Before each day's fieldwork begins, the PID will be calibrated to the manufacturer's standard for instrument operation. All instrument background checks, background ranges, and calibration procedures will be documented daily in field logbooks.

5.3.2 Radioactivity

Radiological field screening will be conducted to meet of U.S. Department of Transportation requirements for shipping samples. Each sample will be field screened by a radiological control technician for gross-alpha, -beta, and -gamma radioactivity before the samples are transported to the SMO for processing as determined by the Laboratory’s Deployed Environment, Safety, and Health Services (DESHS) Division. Instruments used for field screening will be calibrated in accordance with the DESHS procedures or equivalent procedures. All instrument calibration activities will be documented daily in the field logbooks.

5.4 Sampling

Soil, fill, sediment, and tuff samples will be collected by the most efficient and least invasive method practicable. The methods will be determined by the field team based on site conditions, such as topography; the nature of the material to be sampled; the depth intervals required; accessibility; and level of disruption to laboratory activities. Typically, samples will be collected using spade and scoop, hand auger, or drill rig.

5.4.1 Surface Sampling

5.4.1.1 Spade-and-Scoop Method

Surface and shallow subsurface soil and sediment samples will be collected in accordance with ER-SOP-20069, “Soil, Tuff, and Sediment Sampling.” Stainless-steel shovels, spades, scoops, and bowls will be used for ease of decontamination. If the surface location is at bedrock, an axe or hammer and chisel may be used to collect samples. Samples collected for analyses will be placed in the appropriate sample containers depending on the analytical method requirement.

5.4.1.2 Sediment Samples

Sediment samples will be collected from areas of sediment accumulation that include sediments judged representative of the historical period of Laboratory operations. The proposed sediment sampling locations will be selected based on geomorphic relationships in areas likely to have been affected by discharges from Laboratory operations. Selected sediment sampling locations shown in proposed sampling location figures are based on map contours. However, because sediment is dynamic and subject to redistribution by runoff events, some locations may need to be adjusted when this work plan is implemented.

In the course of collecting sediment samples, it may be determined, based on field conditions, that the selected location is not appropriate—for example, the sediment is much shallower than anticipated, the sediment is predominantly coarse grained, or the sediment shows evidence of being older than the target age. Sediment sampling locations will be adjusted as appropriate, any revised locations will be surveyed, and the updated coordinates will be submitted to the Laboratory for inclusion in the Environmental Information Management database.

5.4.2 Subsurface Samples

Subsurface samples will be collected using hand- or hollow-stem auger or direct-push methods, depending on the depth of the samples and the material being sampled. A brief description of these methods is provided below.

5.4.2.1 Hand Auger

Hand augers or power-assisted augers may be used to drill shallow holes at locations that can be sampled without the use of a drill rig and at locations inaccessible by a drill rig. The hand auger is advanced by turning the auger into the soil or tuff until the barrel is filled. The auger is removed and the sample is placed in a stainless-steel bowl. Hand-auger samples will be collected in accordance with ER-SOP-20069, “Soil, Tuff, and Sediment Sampling.”

5.4.2.2 Direct Push

Direct push is a subsurface sampling method that pushes a tool string into the ground using the weight of a truck in combination with a hydraulic ram or hammer. Various tool strings can be used to collect discrete samples, continuous samples, both discrete and continuous samples, and groundwater samples. The direct-push core samples collected during this investigation will be continuous. The inside of the continuous sampler is exposed to the subsurface environment as it is advanced to the sampling interval. This is a dual-tube sampler, so named because it uses two sets of rods to collect soil cores. The outer rods receive the driving force from the hydraulic pushing method and provide a sealed hole from which soil samples may be recovered without the threat of cross-contamination or cave-in. The inner set of rods is placed within the outer rods and holds a sampler in place as the outer rods are driven to the sample interval. The inner rods are then retracted to retrieve the soil core. The direct-push methods will follow the American Society of Testing and Materials D18 Subcommittee on Direct Push Sampling (D18.21.01) (ASTM 1997, 057511).

5.4.2.3 Hollow-Stem Auger

Boreholes will be drilled using a drill rig equipped with a hollow-stem auger. The hollow-stem auger consists of a hollow steel shaft with a continuous spiraled steel flight welded onto the exterior of the stem. The stem is connected to an auger bit; when the bit is rotated, it transports cuttings to the surface. The hollow stem of the auger allows insertion of drill rods, split-spoon core barrels, Shelby tubes, and other samplers through the center of the auger so samples may be retrieved during drilling operations. The hollow stem also acts to case the borehole core temporarily so a well casing (a riser) may be inserted down through the center of the auger when the desired depth is reached, thus minimizing the risk of possible borehole collapse.

A bottom plug or pilot bit can be fastened onto the bottom of the auger to keep out most of the soil and/or water that tends to clog the bottom of the augers during drilling. Drilling without a center plug is acceptable if the soil plug, formed in the bottom of the auger, is removed before sampling or installing a well casing. The soil plug can be removed by washing out the plug using a side-discharge rotary bit or auguring out the plug with a solid-stem auger bit sized to fit inside the hollow-stem auger.

During sampling, the auger will be advanced to just above the desired sampling interval. The sample will be collected by driving a split-spoon sampler into undisturbed soil/tuff to the desired depth. Samples will be collected in accordance with ER-SOP-20069, “Soil, Tuff, and Sediment Sampling.”

Field documentation will include detailed borehole logs for each borehole drilled using the hollow-stem auger method. The borehole logs will document the matrix material in detail and will include the results of all field screening; fractures and matrix samples will be assigned unique identifiers.

5.4.3 Borehole Abandonment

All hollow-stem auger boreholes will be properly abandoned in accordance with EP-ERSS-SOP-5034, “Monitoring Well and Borehole Abandonment.” Shallow boreholes, with a total depth of 20 ft or less, will be abandoned by filling the borehole with bentonite chips and then hydrating the chips in 1- to 2-ft lifts. The borehole will be visually inspected while the bentonite chips are being added to ensure bridging does not occur.

Boreholes greater than 20 ft deep will be pressure-grouted from the bottom of the borehole to the surface using the tremie pipe method. Acceptable grout materials include cement or bentonite grout, neat cement, or concrete.

The use of backfill materials such as bentonite and grout will be documented in a field logbook with respect to volumes (calculated and actual), intervals of placement, and additives used to enhance backfilling. All borehole abandonment information will be presented in the investigation report.

5.5 Chain of Custody for Samples

The collection, screening, and transport of samples will be documented on standard forms generated by the SMO. These include sample collection logs, chain-of-custody forms, and sample container labels. Sample collection logs will be completed at the time of sample collection and signed by the sampler and a reviewer who will verify the logs for completeness and accuracy. Corresponding labels will be initialed and applied to each sample container, and custody seals will be placed around container lids or openings. Chain-of-custody forms will be completed and signed to verify that the samples are not left unattended.

5.6 Quality Assurance/Quality Control Samples

Quality assurance (QA) and quality control samples will include field duplicate, equipment rinsate, and field trip blank samples. These samples will be collected following the current version of ER-SOP 20235, “Sample Containers, Preservation, and Field Quality Control.” Field duplicate, rinsate, and trip blank samples will be collected at an overall frequency of at least 1 for every 10 regular samples as specified in Appendix F, Section I.B.4.f of the Consent Order.

5.7 Laboratory Analytical Methods

Analytical suites for all sites include TAL metals, total cyanide, SVOCs, and isotopic uranium. Analytical methods are summarized in Table 5.7-1. Sample collection and analysis will be coordinated with the SMO.

5.8 Health and Safety

The field investigations described in this IWP will comply with all applicable requirements pertaining to worker health and safety. An integrated work document and a site-specific health and safety plan will be in place before fieldwork is performed.

5.9 Equipment Decontamination

Equipment for drilling and sampling will be decontaminated before and after sampling activities to minimize the potential for cross-contamination. Dry decontamination methods will be used to avoid the generation of liquid waste and to minimize the IDW. Dry decontamination uses disposable paper towels and over-the-counter cleaner, such as Fantastik or equivalent. All sampling and measuring equipment will be decontaminated in accordance with SOP-5061, "Field Decontamination of Equipment."

Dry decontamination may be followed by wet decontamination, if necessary. Wet decontamination may include washing with a nonphosphate detergent and water, followed by a water rinse and a second rinse with deionized water. Alternatively, drilling/exploration equipment that may come in contact with the borehole will be decontaminated by steam cleaning, by hot water pressure-washing, or by another method before each new borehole is drilled. The equipment will be pressure-washed with a high-density polyethylene liner on a temporary decontamination pad. Cleaning solutions and wash water will be collected and contained for proper disposal. Decontamination solutions will be sampled and analyzed to determine the final disposition of the wastewater and the effectiveness of the decontamination procedures.

5.10 Investigation-Derived Waste

IDW generated by the proposed investigation activities may include, but is not limited to, drill cuttings, contact waste such as personal protective equipment, decontamination fluids, and all other waste that has potentially come into contact with contaminants.

All IDW generated during field investigation activities will be managed in accordance with applicable EPA and NMED regulations, DOE orders, and Laboratory requirements. Appendix B presents the IDW management plan.

6.0 MONITORING PROGRAMS

No monitoring is currently being performed within the TA-57 Aggregate Area.

7.0 SCHEDULE

Preparation for fieldwork will not proceed until the work plan is approved. The period during which fieldwork can be performed at TA-57 is limited because of the high amount of snowfall that typically occurs at the site. The expected duration of field activities is 3 mo. The investigation report for TA-57 Aggregate Area will be submitted within 6 mo after completion of field activities.

8.0 REFERENCES AND MAP DATA SOURCES

8.1 References

The following reference list includes documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ERID or ESHID. This information is also included in text citations. ERIDs were assigned by the Associate Directorate for Environmental Management's (ADEM's) Records Processing Facility (IDs through 599999), and ESHIDs are assigned by the Environment, Safety, and Health Directorate (IDs 600000 and above). IDs are used to locate documents in the Laboratory's Electronic Document Management System and in the Master Reference Set. The NMED Hazardous Waste Bureau and ADEM maintain copies of the Master Reference Set. The *set ensures that NMED has the references to review documents. The set is updated when new references are cited in documents.*

ASTM (American Society for Testing and Materials), June 1997. "D6001 Standard Guide for Direct-Push Water Sampling for Geoenvironmental Investigations," in *Annual Book of ASTM Standards*, Vol. 04.09 Soil and Rock (II), ASTM, West Conshohocken, Pennsylvania. (ASTM 1997, 057511)

Collins, K.A., A.M. Simmons, B.A. Robinson, and C.I. Nylander (Eds.), December 2005. "Los Alamos National Laboratory's Hydrogeologic Studies of the Pajarito Plateau: A Synthesis of Hydrogeologic Workplan Activities (1998–2004)," Los Alamos National Laboratory report LA-14263-MS, Los Alamos, New Mexico. (Collins et al. 2005, 092028)

EPA (U.S. Environmental Protection Agency), January 21, 2005. "EPA's Prior Decisions on SWMU/AOC Sites at Los Alamos National Laboratory (LANL)," U.S. Environmental Protection Agency letter to J. Bearzi (NMED-HRMB) from L.F. King (EPA Federal Facilities Section Chief), Dallas, Texas. (EPA 2005, 088464)

Kaufman, E.L., and C.L.B. Siciliano (Comp. and Ed.), May 1979. "Environmental Analysis of the Fenton Hill Hot Dry Rock Geothermal Test Site," Los Alamos National Laboratory report LA-7830-HDR, Los Alamos, New Mexico. (Kaufman and Siciliano 1979, 005941)

Kearl, P.M., J.J. Dexter, and M. Kautsky, December 1986. "Vadose Zone Characterization of Technical Area 54, Waste Disposal Areas G and L, Los Alamos National Laboratory, New Mexico, Report 4: Preliminary Assessment of the Hydrologic System through Fiscal Year 1986," UNC Technical Services report GJ-54, Grand Junction, Colorado. (Kearl et al. 1986, 015368)

Kwicklis, E., M. Witkowski, K. Birdsell, B. Newman, and D. Walther, August 2005. "Development of an Infiltration Map for the Los Alamos Area, New Mexico," *Vadose Zone Journal,* Vol. 4, pp. 672–693. (Kwicklis et al. 2005, 090069)

LANL (Los Alamos National Laboratory), May 1994. "RFI Work Plan for Operable Unit 1154," Los Alamos National Laboratory document LA-UR-94-1096, Los Alamos, New Mexico. (LANL 1994, 034757)

LANL (Los Alamos National Laboratory), April 1996. "RFI Report for Potential Release Sites at TA-57, 57-001(b), 57-001(c), 57-002, 57-004(a), 57-006, 57-007 (located in former Operable Unit 1154)," Los Alamos National Laboratory document LA-UR-96-1062, Los Alamos, New Mexico. (LANL 1996, 053801)

LANL (Los Alamos National Laboratory), September 22, 1998. "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at Los Alamos National Laboratory," Los Alamos National Laboratory document LA-UR-98-4847, Los Alamos, New Mexico. (LANL 1998, 059730)

LANL (Los Alamos National Laboratory), February 7, 2003. "Progress Report and Proposed Backfill Plan, 1-MG Service Pond, Fenton Hill Geothermal Facility," Los Alamos National Laboratory, Los Alamos, New Mexico. (LANL 2002, 101221)

LANL (Los Alamos National Laboratory), August 2002. "Closure Plan for Fenton Hill Geothermal 1-MG Service Pond and EE-2A Production Well," Los Alamos National Laboratory document LA-UR-02-5009, Los Alamos, New Mexico. (LANL 2002, 101220)

LANL (Los Alamos National Laboratory), August 13, 2003. "Final Closure Report, 1-MG Service Pond and EE-2A Wellhead, Fenton Hill Geothermal Facility," Los Alamos National Laboratory, Los Alamos, New Mexico. (LANL 2003, 101264)

LANL (Los Alamos National Laboratory), April 2012. "Investigation Work Plan for Technical Area 57 Aggregate Area (Fenton Hill)," Los Alamos National Laboratory document LA-UR-12-20545, Los Alamos, New Mexico. (LANL 2012, 214550)

LANL (Los Alamos National Laboratory), April 2012. "Historical Investigation Report for Technical Area 57 Aggregate Area (Fenton Hill)," Los Alamos National Laboratory document LA-UR-12-20544, Los Alamos, New Mexico. (LANL 2012, 214549)

LANL (Los Alamos National Laboratory), December 2015. "Investigation Report for Technical Area 57 Aggregate Area (Fenton Hill), Revision 1," Los Alamos National Laboratory document LA-UR-15-29322, Los Alamos, New Mexico. (LANL 2015, 601045)

LANL (Los Alamos National Laboratory), May 2017. "Supplemental Historical Investigation Report for Technical Area 57 Aggregate Area (Fenton Hill)," Los Alamos National Laboratory document LA-UR-17-24145, Los Alamos, New Mexico. (LANL 2017, 602376)

NMED (New Mexico Environment Department), March 2017. "Risk Assessment Guidance for Site Investigations and Remediation, Volume 1, Soil Screening Guidance for Human Health Risk Assessments," Hazardous Waste Bureau and Ground Water Quality Bureau, Santa Fe, New Mexico. (NMED 2017, 602273)

NMOCD (New Mexico Oil Conservation Division), February 14, 2003. "Discharge Plan GW-031 1-MG Service Pond Closure Plan, Fenton Hill Geothermal Facility," New Mexico Oil Conservation Division letter to B. Beers (LANL) from W. Price (NMOCD), Santa Fe, New Mexico. (NMOCD 2003, 101222)

NMOCD (New Mexico Oil Conservation Division), August 29, 2003. "Termination of Discharge Plan GW-031, Fenton Hill Geothermal Facility," New Mexico Oil Conservation Division letter to B. Beers (LANL) from W. Price (NMOCD), Santa Fe, New Mexico. (NMOCD 2003, 101265)

Nyhan, J.W., L.W. Hacker, T.E. Calhoun, and D.L. Young, June 1978. "Soil Survey of Los Alamos County, New Mexico," Los Alamos Scientific Laboratory report LA-6779-MS, Los Alamos, New Mexico. (Nyhan et al. 1978, 005702)

Purtymun, W.D., and A.K. Stoker, September 1990. "Perched Zone Monitoring Well Installation," Los Alamos National Laboratory document LA-UR-90-3230, Los Alamos, New Mexico. (Purtymun and Stoker 1990, 007508)

Purtymun, W.D., F.G. West, and R.A. Pettitt, November 1974. "Geology of Geothermal Test Hole GT-2, Fenton Hill Site, July 1974," Los Alamos Scientific Laboratory report LA-5780-MS, Los Alamos, New Mexico. (Purtymun et al. 1974, 005483)

Rea, K.H., December 1977. "Environmental Investigations Associated with the LASL Hot Dry Rock Geothermal Energy Development Project," Los Alamos Scientific Laboratory report LA-6972, Los Alamos, New Mexico. (Rea 1977, 005713)

8.2 Map Data Sources

Data sources used in original figures created for this work plan are described below and identified by legend title.

Legend Item	Data Source
LANL Technical Areas	Technical Area Boundaries; Los Alamos National Laboratory, Site Planning & Project Initiation Group, Infrastructure Planning Office; September 2007; as published 04 December 2008.
Paved roads	Paved Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.
Dirt roads	Dirt Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.
Drainages	WQH Drainage Arcs; Los Alamos National Laboratory, ENV Water Quality and Hydrology Group; 1:24,000 Scale Data; 03 June 2003.
LANL AOC boundaries	Areas of Concern; Los Alamos National Laboratory, Waste and Environmental Services Division, Environmental Data and Analysis Group, EP2009-0137; 1:2,500 Scale Data; 25 January 2010.
LANL structures	Structures; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.
LANL fence lines	Security and Industrial Fences and Gates; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.
LANL communications lines	Communication Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 08 August 2002; as published 28 May 2009.
LANL electric lines	Primary Electric Grid; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.
LANL gas lines	Primary Gas Distribution Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.
LANL sewer lines	Sewer Line System; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.
LANL water lines	Water Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.
Contours	Hypsography, 2, 10, 20, and 100 Foot Contour Interval; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program; 1991.

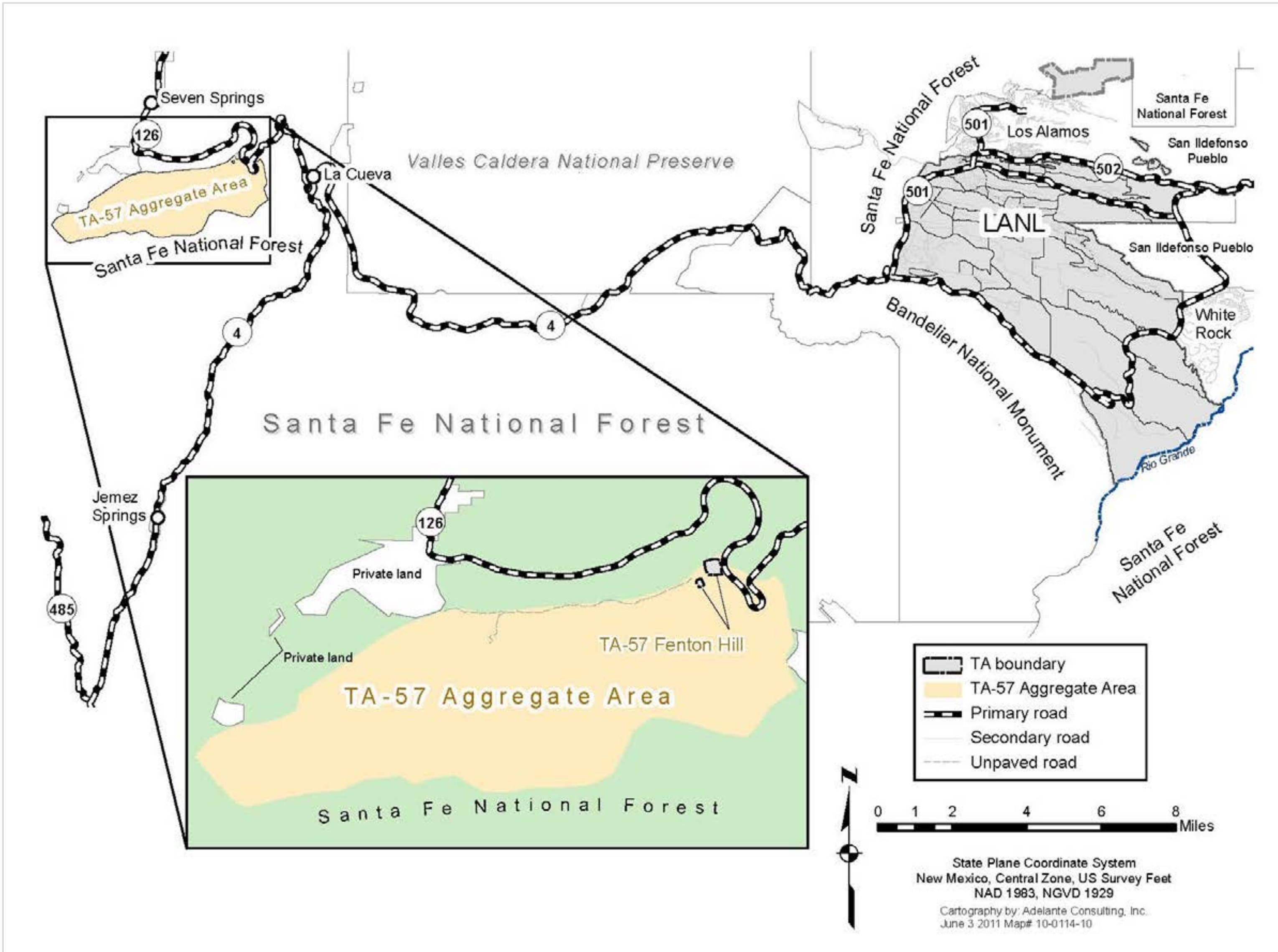

Figure 1.0-1 Location of TA-57 Aggregate Area

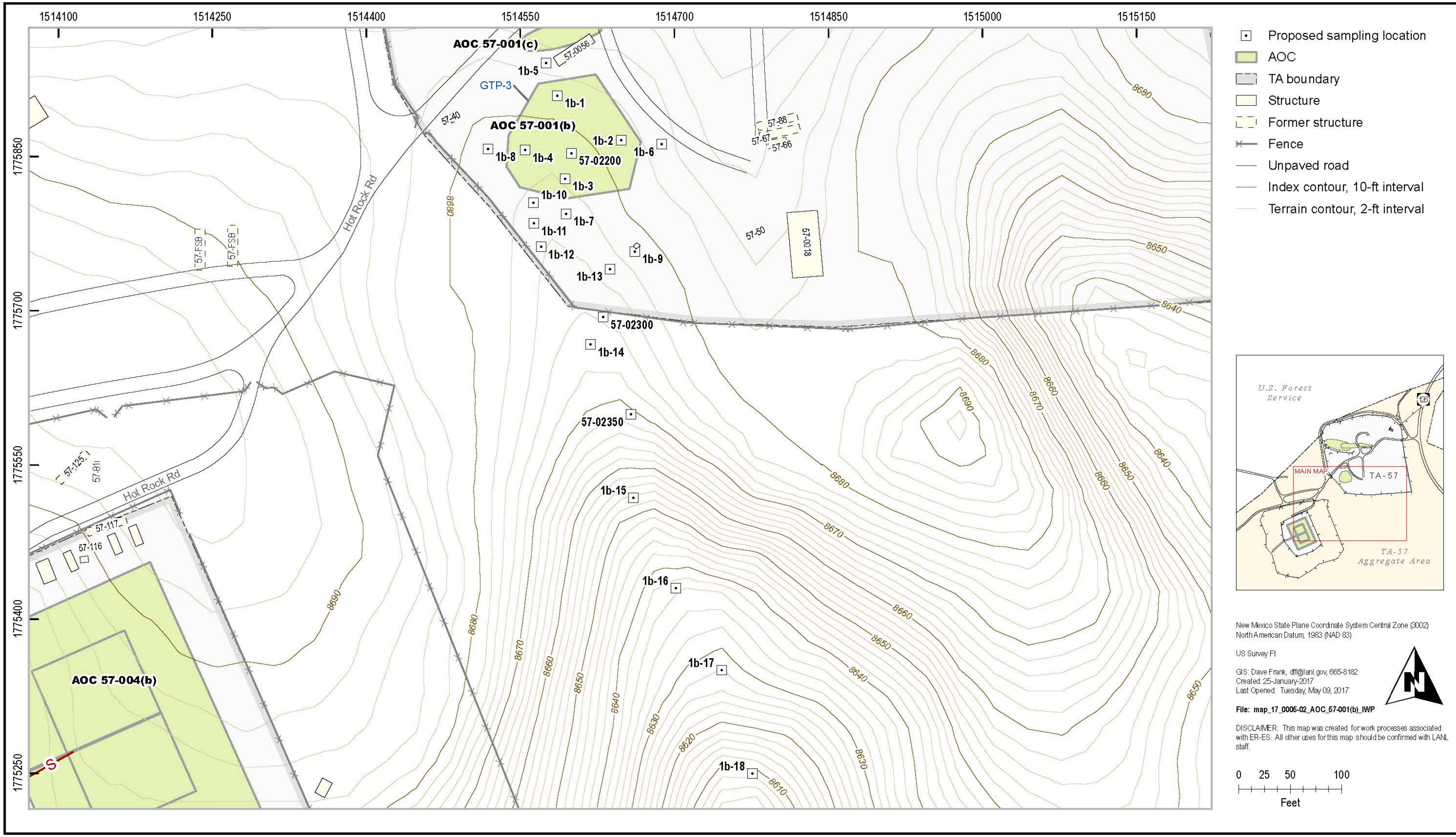

Figure 4.1-1 Proposed sampling locations for AOC 57-001(b)

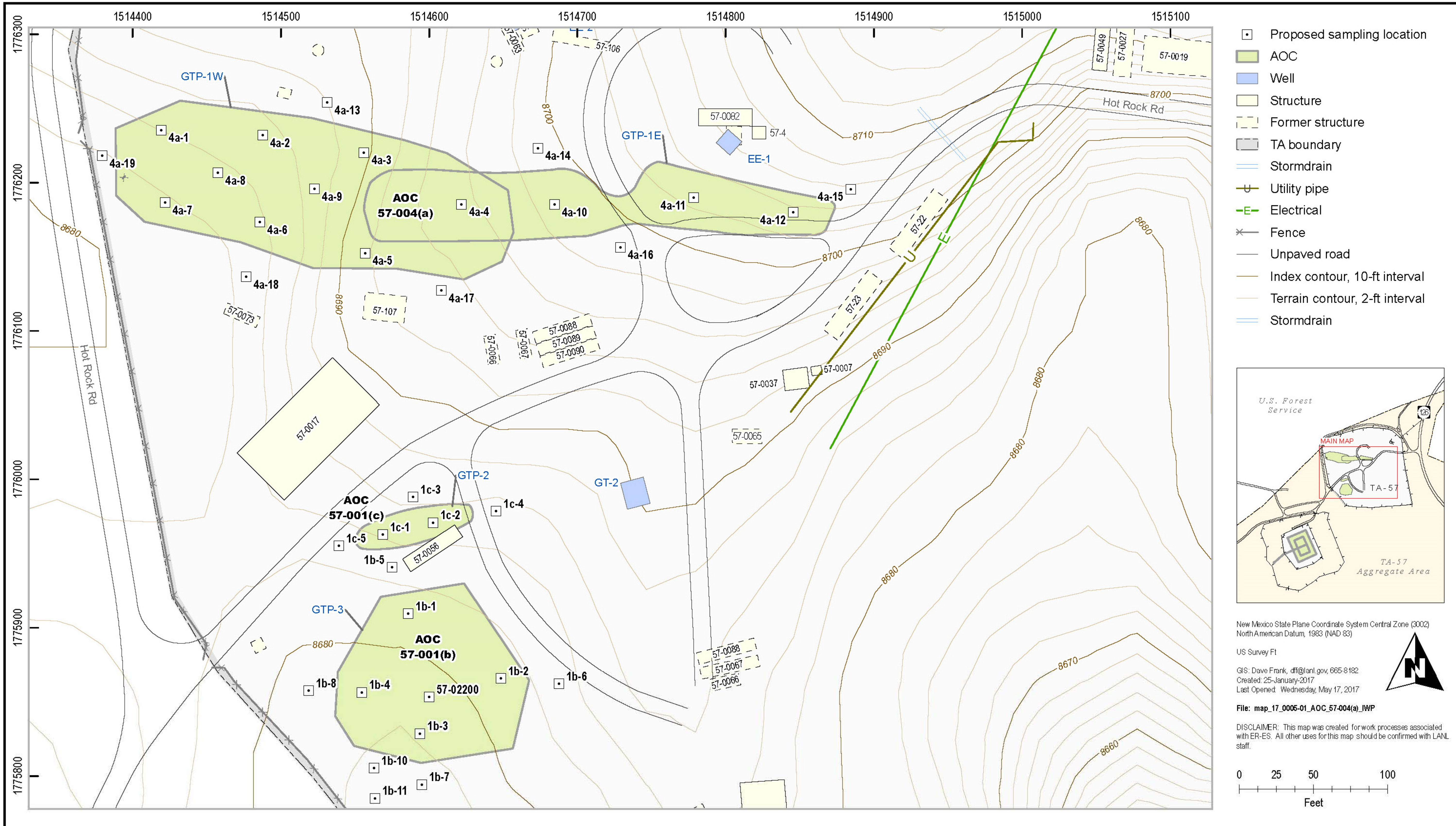

Figure 4.2-1 Proposed sampling locations for AOCs 57-001(c) and 57-004(a)

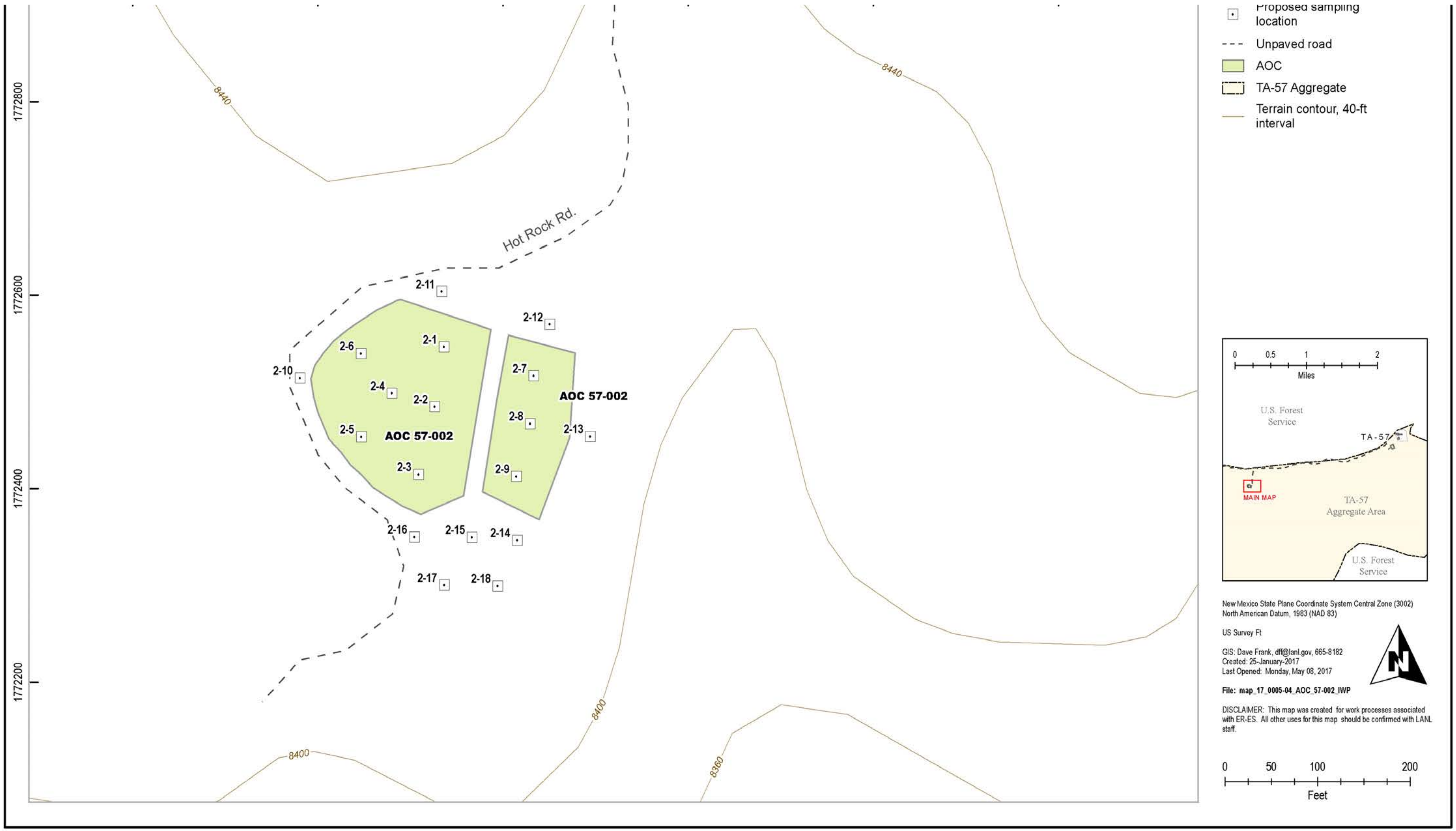

Figure 4.3-1 Proposed sampling locations for AOC 57-002

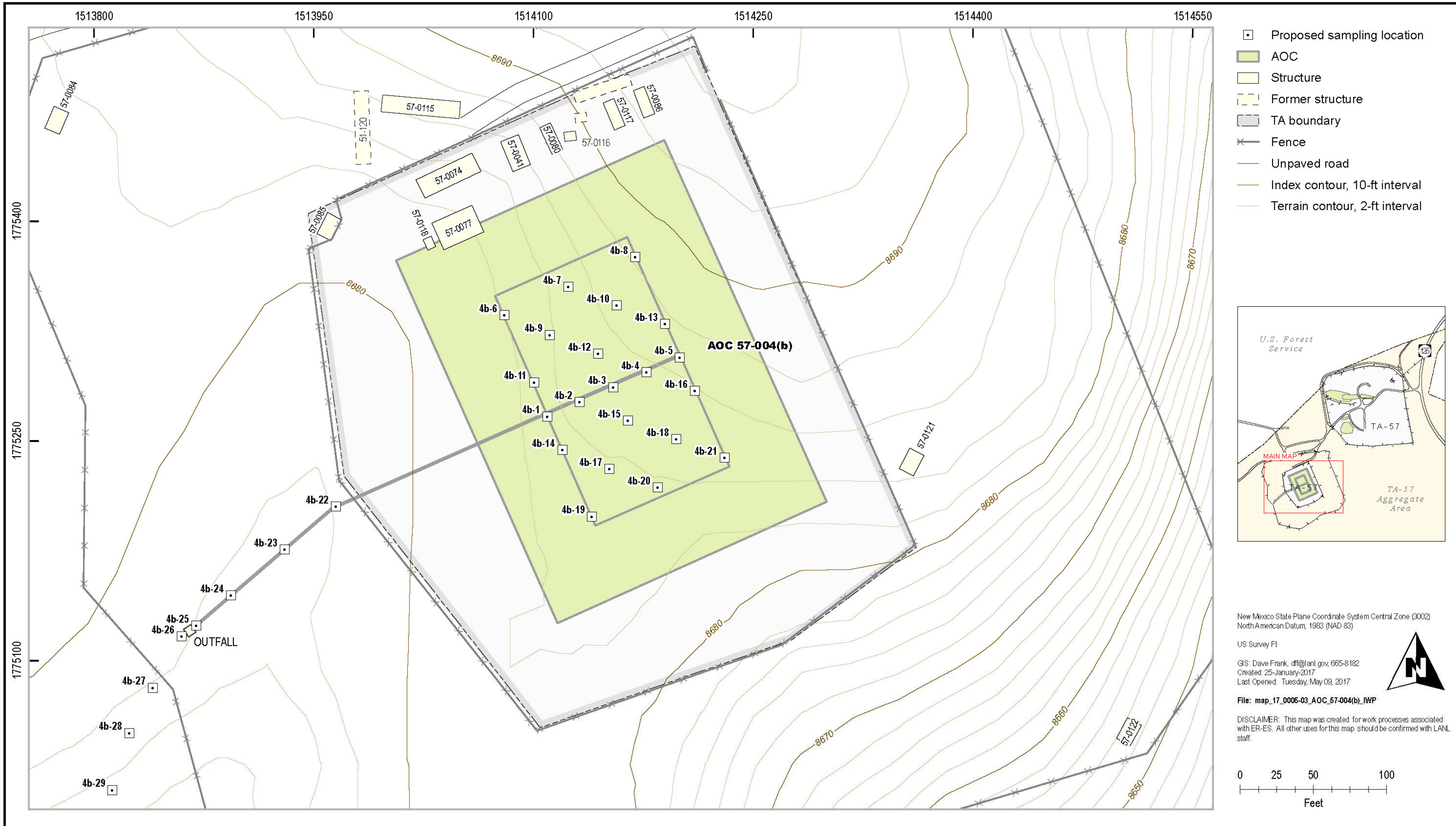

Figure 4.5-1 Proposed sampling locations for AOC 57-004(b)

Table 1.1-1
Status of AOCs in TA-57 Aggregate Area

Site ID	Brief Description	Site Status	Reference
AOC 57-001(a)	Drilling mud pits	No Further Action Approved, 01/21/05	EPA 2005, 088464
AOC 57-001(b)	Former settling ponds	Under Investigation	Section 4.1
AOC 57-001(c)	Former settling pond	Under Investigation	Section 4.2
AOC 57-002	Sludge pit	Under Investigation	Section 4.3
AOC 57-003	Container storage facility	No Further Action Approved, 01/21/05	EPA 2005, 088464
AOC 57-004(a)	Former settling ponds	Under Investigation	Section 4.4
AOC 57-004(b)	Settling pond	Under Investigation	Section 4.5
AOC 57-005	Pond filtration unit	No Further Action Approved, 01/21/05	EPA 2005, 088464
AOC 57-006	Former drum and contents	Investigation Complete	LANL 2015, 601045
AOC 57-007	Leach field	Investigation Complete	LANL 2015, 601045

Note: Shading denotes NFA approved.

Table 4.1-1
Proposed Samples and Analyses for AOC 57-001(b)

Sampling Justification	Number of Locations and Samples	Depth (ft)	Media	TAL Metals (EPA SW-846:6010B/6020)	Total Cyanide (EPA SW-846:9012A)	SVOCs (EPA SW-846:8270C)	Isotopic Uranium, (HASL-300)
Sample 5 locations in footprint of former pond to characterize contents and define vertical extent.	5 locations (57-02200 and 1b-1–1b-4), 25 samples	0.0 to 1.0 ft bgs, 1-ft interval between surface and tuff[a], 1-ft interval above tuff interface[a], 1.0 to 2.0 ft and 4.0 to 5.0 ft into tuff	Soil, tuff	X[b]	X	X	X
Sample 4 step-out locations around former pond to define lateral extent.	4 locations (1b-5–1b-8), 20 samples	Same depth intervals as in adjacent boreholes within former pond footprint	Soil, tuff	X	X	X	X
Sample at and downgradient of outfall weir structure to define lateral and vertical extent.	2 locations (1b-9 and 1b-13), 6 samples	0.0 to 1.0 ft bgs, 1 ft above tuff, 2.0 to 3.0 ft into tuff	Soil, tuff	X	X	X	X
Sample in drainage on western side of site to define lateral and vertical extent	3 locations (1b-10–1b-12), 9 samples	0.0 to 1.0 ft bgs, 1 ft above tuff, 2.0 to 3.0 ft into tuff	Soil, tuff	X	X	X	X
Resample former location above SSLs and 6 downgradient locations to define lateral and vertical extent.	7 locations (57-02300, 57-02350, and 1b-14–1b-18), 21 samples	0.0 to 1.0 ft bgs, 1 ft above tuff, 2.0 to 3.0 ft into tuff	Soil, tuff	X	X	X	X

[a] Include “service material” if present.

[b] X = Analysis proposed.

Table 4.2-1
Proposed Samples and Analyses for AOC 57-001(c)

Sampling Justification	Number of Locations and Samples	Depth (ft)	Media	TAL Metals (EPA SW-846:6010B/6020)	Total Cyanide (EPA SW-846:9012A)	SVOCs (EPA SW-846:8270C)	Isotopic Uranium, (HASL-300)
Sample 2 locations in footprint of former pond to characterize contents and define vertical extent.	2 locations (1c-1 and 1c-2), 10 samples	0.0 to 1.0 ft bgs, 1-ft interval between surface and tuff[a], 1-ft interval above tuff interface[a], 1.0 to 2.0 ft and 4.0 to 5.0 ft into tuff	Soil, tuff	X[b]	X	X	X
Sample 3 step-out locations around former pond to define lateral extent[c].	3 locations (1c-3–1c-5), 15 samples	Same depth intervals as in adjacent boreholes within former pond footprint	Soil, tuff	X	X	X	X

[a] Include "service material" if present.

[b] X = Analysis proposed.

[c] Samples from location 1b-5 at AOC 57-001(b) will also be used to define lateral extent at AOC 57-001(c).

Table 4.3-1
Proposed Samples and Analyses for AOC 57-002

Sampling Justification	Number of Locations and Samples	Depth (ft)	Media	TAL Metals (EPA SW-846:6010B/6020)	Total Cyanide (EPA SW-846:9012A)	SVOCs (EPA SW-846:8270C)	Isotopic Uranium, (HASL-300)
Sample 6 locations in footprint of western section of pit to characterize contents and define vertical extent.	6 locations (2-1–2-6), 36 samples	0.0 to 1.0 ft bgs, 2 1-ft intervals between surface and tuff[a], 1-ft interval above tuff interface[a], 1.0 to 2.0 ft and 4.0 to 5.0 ft into tuff	Soil, tuff	X[b]	X	X	X
Sample 3 locations in footprint of eastern section of pit to characterize contents and define vertical extent.	3 locations (2-7–2-9), 15 samples	0.0 to 1.0 ft bgs, 1-ft interval between surface and tuff[a], 1-ft interval above tuff interface[a], 1.0 ft to 2.0 ft and 4.0 ft to 5.0 ft into tuff	Soil, tuff	X	X	X	X
Sample 4 step-out locations west, north, and east of pit to define lateral extent.	4 locations (2-10–2c-13), 22 samples	Same depth intervals as in adjacent boreholes within pit footprint	Soil, tuff	X	X	X	X
Sample 5 locations in 2 transects south of pit to determine lateral and vertical extent in overflow area.	5 locations (2-14–2-18), 30 samples	Same depth intervals as in adjacent borehole location 2-3	Soil, tuff	X	X	X	X

[a] Include “service material” if present.

[b]-X = Analysis proposed.

Table 4.4-1
Proposed Samples and Analyses for AOC 57-004(a)

Sampling Justification	Number of Locations and Samples	Depth (ft)	Media	TAL Metals (EPA SW-846:6010B/6020)	Total Cyanide (EPA SW-846:9012A)	SVOCs (EPA SW-846:8270C)	Isotopic Uranium, (HASL-300)
Sample 9 locations in footprint of former pond GTP-1W to characterize contents and define vertical extent.	9 locations (4a-1–4a-9), 54 samples	0.0 to 1.0 ft bgs, two 1-ft intervals between surface and tuff, 1-ft interval above tuff interface[a], 1.0 to 2.0 ft and 4.0 to 5.0 ft into tuff	Soil, tuff	X[b]	X	X	X
Sample 3 locations in footprint of former pond GTP-1E to characterize contents and define vertical extent.	3 locations (4a-10–4a-12), 15 samples	0.0 to 1.0 ft bgs, 1-ft interval between surface and tuff, 1-ft interval above tuff interface, 1.0 to 2.0 ft and 4.0 to 5.0 ft into tuff	Soil, tuff	X	X	X	X
Sample 7 step-out locations around former pond to define lateral extent.	7 locations (4a-13–4a-19), 39 samples	Same depth intervals as in adjacent boreholes within former pond footprint	Soil, tuff	X	X	X	X

[a] Include crusher fines if present.

[b] X = Analysis proposed.

Table 4.5-1
Proposed Samples and Analyses for AOC 57-004(b)

Sampling Justification	Number of Locations and Samples	Depth (ft)	Media	TAL Metals (EPA SW-846:6010B/6020)	Total Cyanide (EPA SW-846:9012A)	SVOCs (EPA SW-846:8270C)	Isotopic Uranium, (HASL-300)
Sample 5 locations along underdrain trench to characterize potential releases and define vertical extent.	5 locations (4b-1–4b-5), 15 samples	0.0 to 0.5 ft below liner[a], 1.0 to 2.0 ft and 4.0 to 5.0 ft into tuff	Soil, tuff	X[b]	X	X	X
Sample 16 locations on approximate 50-ft grid in footprint of pond to characterize potential releases and define vertical extent.	16 locations (4b-6–4b-21), 46 samples	0.0 to 0.5 ft below liner[c], 1.0 to 2.0 ft and 4.0 to 5.0 ft into tuff	Soil, tuff	X	X	X	X
Sample 4 locations along drainlines between western edge of pond and outfall structure to characterize potential releases and define vertical extent.	4 locations (4b-22–4b-25), 12 samples	0.0 to 1.0 ft[d], 2.0 to 3.0 ft , and 4.0 to 5.0 ft below drainlines	Soil, tuff	X	X	X	X
Sample 4 locations at and downgradient of outfall structure to define lateral and vertical extent.	4 locations (4b-26–4b-29), 12 samples	0.0 to 1.0 ft bgs, 1 ft above tuff, 2.0 to 3.0 ft below top of tuff	Soil, tuff	X	X	X	X

[a] Sample drain pipe bedding material.

[b] X = Analysis proposed.

[c] Sample liner bedding material.

[d] Sample drainline bedding material, if present.

Table 5.0-1
Summary of Investigation Methods

Method	Summary
Geodetic Surveys	This method describes the method for coordinating and evaluating geodetic surveys and establishing QA and quality control for geodetic survey data. The procedure covers evaluating geodetic survey requirements, preparing to perform a geodetic survey, performing geodetic survey field activities, preparing geodetic survey data for QA review, performing QA review of geodetic survey data, and submitting geodetic survey data.
Spade-and-Scoop Collection of Soil Samples	This method is typically used to collect shallow (e.g., approximately 0-12 in.) soil or sediment samples. The spade-and-scoop method involves digging a hole to the desired depth, as prescribed in the sampling and analysis plan, and collecting a discrete grab sample. The sample is typically placed in a clean, stainless-steel bowl for transfer into various sample containers.
Hand-Auger Sampling	This method is typically used for sampling soil or sediment at depths of less than 10–15 ft but may in some cases be used for collecting samples of weathered or nonwelded tuff. The method involves hand-turning a stainless-steel bucket auger (typically 3–4-in. inside diameter), creating a vertical hole which can be advanced to the desired sample depth. When the desired depth is reached, the auger is decontaminated before advancing the hole through the sample depth. The sample material is transferred from the auger bucket to a stainless-steel sampling bowl before filling the various required sample containers.
Hollow-Stem Auger Drilling Methods	In this method, hollow-stem augers (sections of seamless pipe with auger flights welded to the pipe) act as a screw conveyor to bring cuttings of sediment, soil, and/or rock to the surface. Auger sections are typically 5 ft in length and have outside diameters of 4.25 to 14 in. Drill rods, split-spoon core barrels, Shelby tubes, and other samplers can pass through the center of the hollow-stem auger sections for collection of discrete samples from desired depths. Hollow-stem augers are used as temporary casings when setting wells to prevent cave-ins of the borehole walls.
Handling, Packaging, and Shipping of Samples	Field team members seal and label samples before packing and ensure that the sample containers and the containers used for transport are free of external contamination. Field team members package all samples so as to minimize the possibility of breakage during transportation. After all environmental samples are collected, packaged, and preserved, a field team member transports the samples either to the SMO or to an SMO-approved radiation screening laboratory under chain of custody. The SMO arranges to ship samples to the analytical laboratories. The field team member must inform the SMO and/or the radiation screening laboratory coordinator when levels of radioactivity are in the action-level or limited-quantity ranges.
Containers and Preservation of Samples	Specific requirements/processes for sample containers, preservation techniques, and holding times are based on EPA guidance for environmental sampling, preservation, and QA. Specific requirements for each sample are printed on the sample collection logs provided by the SMO (size and type of container (glass, amber glass, polyethylene, preservative, etc.). All samples are preserved by placing them` in insulated containers with ice to maintain a temperature of 4˚C. Other requirements such as nitric acid or other preservatives may apply to different media or analytical requests.

Table 5.0-1 (continued)

Method	Summary
Sample Control and Field Documentation	The collection, screening, and transport of samples are documented on standard forms generated by the SMO. These include sample collection logs, chain-of-custody forms, and sample container labels. Collection logs are completed at the time of sample collection and are signed by the sampler and a reviewer who verifies the logs for completeness and accuracy. Corresponding labels are initialed and applied to each sample container, and custody seals are placed around container lids or openings. Chain-of-custody forms are completed and assigned to verify that the samples are not left unattended. Site attributes (e.g., former and proposed soil sampling locations, sediment sampling locations) are located by using a global positioning system. Horizontal locations will be measured to the nearest 0.5 ft. The survey results for this field event will be presented as part of the investigation report. Sample coordinates will be uploaded into the Laboratory's database system.
Field Quality-Control Samples	Field quality control samples are collected as follows: *Field Duplicate*: At a frequency 10%; collected at the same time as a regular sample and submitted for the same analyses. *Equipment Rinsate Blank*: At a frequency of 10%; collected by rinsing sampling equipment with deionized water, which is collected in a sample container and submitted for laboratory analysis. *Trip Blanks*: Required for all field events that include the collection of samples for VOC analysis. Trip blanks containers of certified clean sand that are opened and kept with the other sample containers during the sampling process.
Field Decontamination of Drilling and Sampling Equipment	Dry decontamination is the preferred method to minimize generating liquid waste. Dry decontamination may include using a wire brush or other tool to remove soil or other material adhering to the sampling equipment, followed by using a commercial cleaning agent (nonacid, waxless cleaners) and paper wipes. Dry decontamination may be followed by wet decontamination if necessary. Wet decontamination may include washing with a nonphosphate detergent and water, followed by a water rinse and a second rinse with deionized water. Alternatively, steam-cleaning may be used.
Management, Characterization, and Storage of IDW	IDW is managed, characterized, and stored in accordance with an approved waste characterization strategy form that documents site history, field activities, and the characterization approach for each waste stream managed. Waste characterization complies with on- or off-site waste acceptance criteria. All stored IDW will be marked with appropriate signage and labels. Drummed IDW will be stored on pallets to prevent the containers from deterioration. Generators are required to reduce the volume of waste generated as much as technically and economically feasible. Means to store, control, and transport each potential waste type and classification shall be determined before field operations that generate waste begin. A waste storage area will be established before waste is generated. Waste storage areas located in controlled areas of the Laboratory will be controlled as needed to prevent inadvertent addition or management of wastes by unauthorized personnel. Each container of waste generated will be individually labeled as to waste classification, item identification number, and radioactivity (if applicable), immediately following containerization. All waste shall be segregated by classification and compatibility to prevent cross-contamination. Appendix B describes the management of IDW.

Table 5.7-1
Summary of Analytical Methods

Analyte	Analytical Method
TAL metals	SW-846:6010B; SW-846:6020; SW-846:7471A (mercury)
Total cyanide	EPA SW-846:9012A
SVOCs	SW-846:8270C
Isotopic uranium	HASL-300:ISOU

Appendix A

Acronyms and Abbreviations,
Metric Conversion Table, and Data Qualifier Definitions

A-1.0 ACRONYMS AND ABBREVIATIONS

ADEM	Associate Directorate for Environmental Management
AK	acceptable knowledge
amsl	above mean sea level
AOC	area of concern
bgs	below ground surface
BV	background value
Consent Order	Compliance Order on Consent
CST	Chemical Science and Technology Division
DESHS	Deployed Environment, Safety, and Health Services Division
DOE	Department of Energy (U.S.)
EPA	Environmental Protection Agency (U.S.)
ESH	Environment, Safety, and Health
GPS	global positioning system
HDR	Hot Dry Rock (Laboratory program)
HIR	historical investigation report
IDW	investigation-derived waste
IWP	investigation work plan
Laboratory	Los Alamos National Laboratory
LANL	Los Alamos National Laboratory
NFA	no further action
NMED	New Mexico Environment Department
NMOCD	New Mexico Oil Conservation Division
NPDES	National Pollutant Discharge Elimination System
PID	photoionization detector
QA	quality assurance
RCRA	Resource Conservation and Recovery Act
RFI	Resource Conservation and Recovery Act facility investigation
SMO	Sample Management Office
SOP	standard operating procedure
SSL	soil screening level
SVOC	semivolatile organic compound
TA	technical area
TAL	target analyte list (EPA)

VOC volatile organic compound

WAC waste acceptance criteria

WCSF waste characterization strategy form

A-2.0 METRIC CONVERSION TABLE

Multiply SI (Metric) Unit	by	To Obtain U.S. Customary Unit
kilometers (km)	0.622	miles (mi)
kilometers (km)	3281	feet (ft)
meters (m)	3.281	feet (ft)
meters (m)	39.37	inches (in.)
centimeters (cm)	0.03281	feet (ft)
centimeters (cm)	0.394	inches (in.)
millimeters (mm)	0.0394	inches (in.)
micrometers or microns (µm)	0.0000394	inches (in.)
square kilometers (km^2)	0.3861	square miles (mi^2)
hectares (ha)	2.5	acres
square meters (m^2)	10.764	square feet (ft^2)
cubic meters (m^3)	35.31	cubic feet (ft^3)
kilograms (kg)	2.2046	pounds (lb)
grams (g)	0.0353	ounces (oz)
grams per cubic centimeter (g/cm^3)	62.422	pounds per cubic foot (lb/ft^3)
milligrams per kilogram (mg/kg)	1	parts per million (ppm)
micrograms per gram (µg/g)	1	parts per million (ppm)
liters (L)	0.26	gallons (gal.)
milligrams per liter (mg/L)	1	parts per million (ppm)
degrees Celsius (°C)	9/5 + 32	degrees Fahrenheit (°F)

A-3.0 DATA QUALIFIER DEFINITIONS

Data Qualifier	Definition
U	The analyte was analyzed for but not detected.
J	The analyte was positively identified, and the associated numerical value is estimated to be more uncertain than would normally be expected for that analysis.
J+	The analyte was positively identified, and the result is likely to be biased high.
J-	The analyte was positively identified, and the result is likely to be biased low.
UJ	The analyte was not positively identified in the sample, and the associated value is an estimate of the sample-specific detection or quantitation limit.
R	The data are rejected as a result of major problems with quality assurance/quality control parameters.

Appendix B

Management Plan for Investigation-Derived Waste

B-1.0 INTRODUCTION

This appendix describes how investigation-derived waste (IDW) generated during the Technical Area 57 Aggregate Area investigation will be managed. IDW may include, but is not limited to, drill cuttings, contact waste, decontamination fluids, and all other waste that has potentially come into contact with contaminants.

B-2.0 IDW

Area of contamination request(s) may be submitted for approval to the New Mexico Environment Department (NMED) for sites at which excavation and/or drilling is planned.

All IDW generated during investigation activities will be managed in accordance with applicable standard operating procedures (SOPs). These SOPs incorporate the requirements of all applicable U.S. Environmental Protection Agency and NMED regulations, U.S. Department of Energy (DOE) orders, and Los Alamos National Laboratory (LANL or the Laboratory) requirements. The Laboratory SOP applicable to the characterization and management of IDW is EP-DIR-SOP-10021, "Characterization and Management of Environmental Programs Waste," available at http://www.lanl.gov/environment/plans-procedures.php.

The most recent version of the Laboratory's Hazardous Waste Minimization Report will be implemented during the investigation to minimize waste generation. The report is updated annually as a requirement of the Laboratory's Hazardous Waste Facility Permit.

A waste characterization strategy form (WCSF) will be prepared and approved per requirements of EP-DIR-SOP-10021. The WCSF will provide detailed information on IDW characterization methods, management, containerization, and potential volumes. IDW characterization is completed through review of investigation data and/or documentation or by direct sampling. Waste characterization may include a review of historical information and process knowledge to identify whether listed hazardous waste may be present (i.e., due diligence reviews). If low levels of listed hazardous waste are identified, a "contained in" determination may be submitted for approval to NMED.

Wastes will be containerized and placed in clearly marked and appropriately constructed waste management areas. If the analytical data change the expected waste category, the waste will be managed in accumulation areas appropriate to the final waste determination. Waste accumulation area postings, regulated storage duration, and inspection requirements will be based on the type of IDW and its classification. Container and storage requirements, as well as transportation and disposal requirements, will be detailed in the WCSF and approved before waste is generated. Table B-2.0-1 summarizes the estimated IDW waste streams, waste types and disposition.

At a minimum, the waste streams that are anticipated to be generated during work plan implementation are described below.

B-2.1 Drill Cuttings

This waste stream consists of soil and rock generated by the drilling of boreholes with the intent to sample. Drill cuttings include excess core not submitted for analysis and any returned samples sent for analysis. Drill cuttings will be containerized in 20-yd^3 rolloff containers, 55-gal. drums, B-12 containers, or other appropriate containers at the point of generation.

This waste stream will be characterized based either on direct sampling of the waste in each container or on the results from core samples collected during drilling. If directly sampled, the samples will be analyzed for the same analytical suites as identified for each site, and, if needed, toxicity characteristic metals. Other constituents may be analyzed as necessary to meet the waste acceptance criteria (WAC) for a receiving facility or if visual observations indicate that additional contaminants may be present. All wastes will be treated/disposed of at an authorized off-site facility appropriate for the waste classification.

B-2.2 Contact Waste

The contact waste stream consists of potentially contaminated materials that “contacted” waste during sampling. This waste stream consists primarily of, but is not limited to, personal protective equipment such as gloves, decontamination wastes such as paper wipes, and disposable sampling supplies. Contact waste will be stored in containers and managed in accordance with the applicable Laboratory waste management requirements based on the waste characterization results.

Characterization of this waste stream will use acceptable knowledge (AK) based on data from the media with which it came into contact (e.g., drill cuttings, soil, etc.). The Laboratory expects most of the contact waste to be designated as nonhazardous, nonradioactive waste that will be disposed of at an authorized on- or off-site facility.

B-2.3 Decontamination Fluids

Decontamination fluids consist of liquid wastes generated from decontamination of excavation, sampling, and drilling equipment. All sampling and measuring equipment, including but not limited to stainless-steel sampling tools and split-barrel or core samplers, will be decontaminated in accordance with EP-ERSS-SOP-5061, “Field Decontamination of Equipment.”

Consistent with waste minimization practices, the Laboratory uses dry decontamination methods to the greatest extent possible. If dry decontamination cannot be performed, liquid decontamination wastes will be collected in containers at the point of generation. The fluids will be characterized through AK of the waste materials, the level of contamination measured in the environmental media (e.g., the results of the associated drill cuttings), and, if necessary, direct sampling of the containerized waste. If sampled directly, the samples will be analyzed for the same analytical suites as identified for each site, and, if needed, toxicity characteristic metals and other analytes required by the receiving facility (i.e., total suspended solids, Microtox, chemical oxygen demand, oil and grease, pH, nitrates). The Laboratory expects these wastes to be nonhazardous liquid waste that will be sent to one of the Laboratory’s wastewater treatment facilities where the WAC allows the waste to be received.

Table B-2.0-1
Summary of Estimated IDW Generation and Management

Waste Stream	Expected Waste Type	Expected Disposition
Drill Cuttings	Nonhazardous waste	Treatment/disposal at an authorized off-site facility
Contact Waste	Nonhazardous waste	Disposal at an approved Laboratory or off-site facility
Decontamination Fluids	Nonhazardous waste	Treatment at an on-site wastewater treatment facility

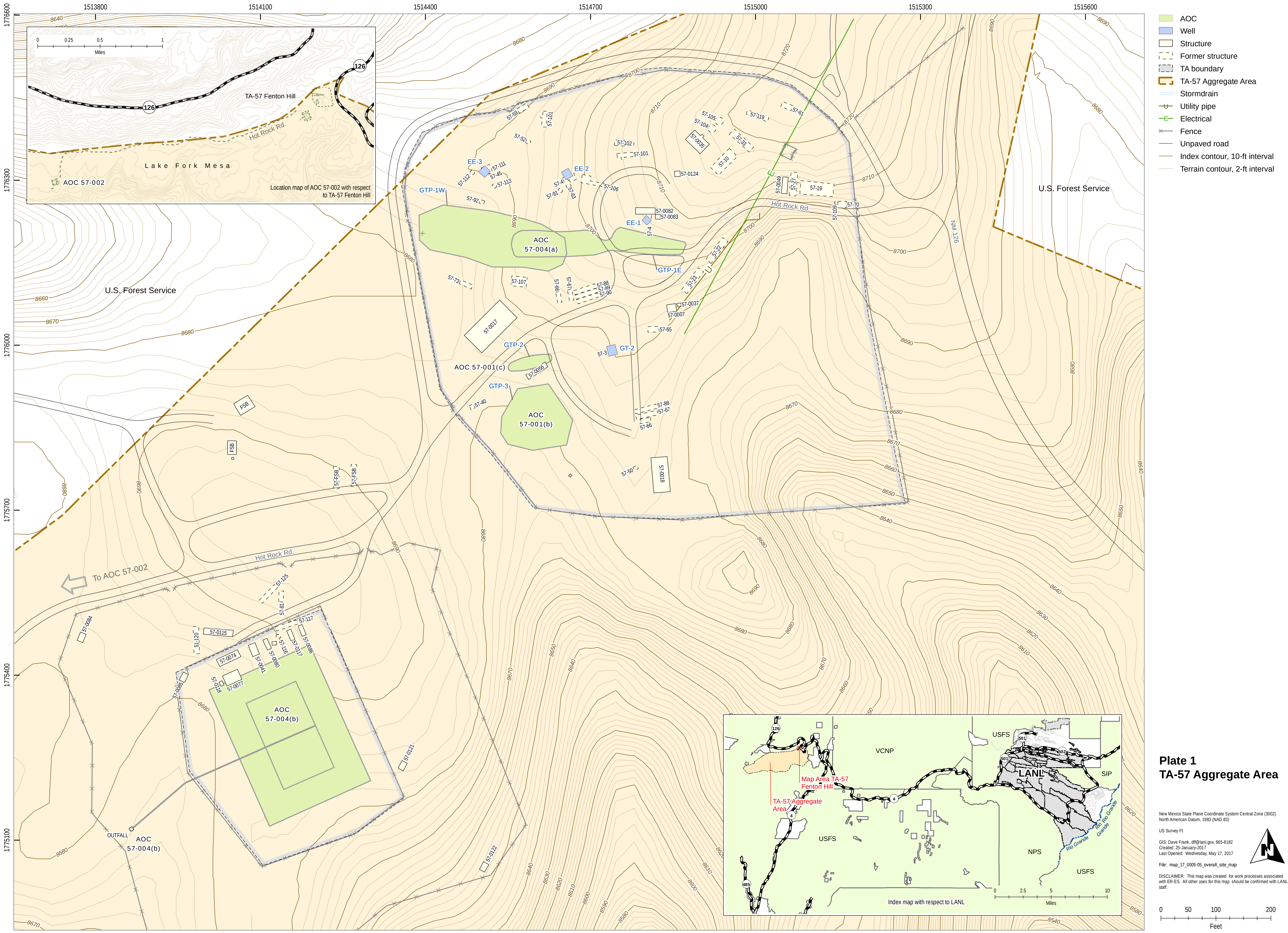

Plate 1
TA-57 Aggregate Area

New Mexico State Plane Coordinate System Central Zone (3002)
North American Datum, 1983 (NAD 83)

US Survey Ft

GIS: Dave Frank, dff@lanl.gov, 665-8182
Created: 25-January-2017
Last Opened: Wednesday, May 17, 2017

File: map_17_0005-05_overall_site_map

DISCLAIMER: This map was created for work processes associated with ER-ES. All other uses for this map should be confirmed with LANL staff.

0 50 100 200
Feet