

**Supplemental Investigation Report
for Consolidated Unit 21-018(a)-99,
Material Disposal Area V,
at Technical Area 21₁
Revision 1**

Prepared by the Environmental Programs Directorate

Los Alamos National Laboratory, operated by Los Alamos National Security, LLC, for the U.S. Department of Energy under Contract No. DE-AC52-06NA25396, has prepared this document pursuant to the Compliance Order on Consent, signed March 1, 2005. The Compliance Order on Consent contains requirements for the investigation and cleanup, including corrective action, of contamination at Los Alamos National Laboratory. The U.S. government has rights to use, reproduce, and distribute this document. The public may copy and use this document without charge, provided that this notice and any statement of authorship are reproduced on all copies.

Supplemental Investigation Report for Consolidated Unit 21-018(a)-99, Material Disposal Area V, at Technical Area 21.

Revision 1

~~February~~ April 2008

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EXECUTIVE SUMMARY

This supplemental investigation report presents the results of additional remediation and investigation conducted in 2006 and 2007 at an area of elevated radioactivity within Consolidated Unit 21-018(a)-99 at Los Alamos National Laboratory. This consolidated unit consists of four inactive solid waste management units (SWMUs) and one inactive area of concern (AOC). The area of elevated radioactivity is within the vicinity of SWMU 21-018(a), to the east of three former absorption beds comprising Material Disposal Area (MDA) V within Technical Area (TA) 21.

The supplemental remediation and investigation finalized surface and subsurface chemical cleanup and characterization of Consolidated Unit 21-018(a)-99 and included removal of soil and tuff from an area of elevated radioactivity identified in a 2006 surface radiological survey. The data evaluated in this report supplement the data collected previously in 2005–2007 at Consolidated Unit 21-018(a)-99.

Postexcavation confirmation data were used to define the nature and extent of contamination associated with the area of elevated radioactivity and to determine whether this area of the site poses a potential unacceptable risk to human health or the environment. The primary objective of remediation activities performed in 2006–2007 was to remove environmental media with concentrations of chemicals of potential concern (COPCs) exceeding residential soil screening levels (SSLs) for inorganic and organic chemicals or residential screening action levels (SALs) for radionuclides.

Based on the characterization data from current and previous investigations conducted at the site, the nature and extent are defined for radionuclide, inorganic, and organic COPCs in both surface and subsurface media for the four SWMUs and one AOC [SWMUs 21-018(a), 21-018(b), 21-013(b), 21-023(c), and AOC 21-013(g)]. The nature and extent of shallower pore gas were inconclusive in the initial subsurface investigation of pore gas at the site. Therefore, a monitoring well installation plan is being submitted with this supplemental investigation report to provide data needed to determine concentration trends for shallower pore gas nature and extent.

Maximum concentrations of all COPCs (carcinogenic, noncarcinogenic, and radionuclides) identified in the 2006–2007 supplemental investigation sampling of the area of elevated radioactivity at MDA V are less than the respective residential SSLs and SALs in all postexcavation samples. The total estimated excess cancer risk is approximately 3×10^{-7} , which is less than the target level of 1×10^{-5} set by the New Mexico Environment Department (NMED). The noncarcinogenic COPC hazard index (HI) is 0.1, which is less than the NMED target level of an HI of 1.0. The total dose is 0.44 millirem (mrem)/yr, which is less than the target dose of 15 mrem/yr set by the U.S. Department of Energy. Based on the human health risk assessment results presented in this supplemental investigation report, concentrations of COPCs in soil and tuff in the area of elevated radioactivity at Consolidated Unit 21-018(a)-99 do not pose a potential unacceptable risk/dose to human health under a residential scenario. The conclusions drawn in the previous investigation report that there are no potential unacceptable risks to human health under a residential scenario are still valid.

The ecological risk screening eliminated all chemicals of potential ecological concern (COPECs), indicating that no potential risk to terrestrial receptors exists from exposure to residual COPEC concentrations in the area of elevated radioactivity. Based on the ecological risk assessment results, the conclusions drawn in the previous investigation report that concentrations of COPECs in soil and tuff in the area of elevated radioactivity at Consolidated Unit 21-018(a)-99 do not pose a potential unacceptable risk to ecological receptors are still valid.

Based on the results of this and previous investigations, corrective action is complete at the area of elevated radioactivity and the five sites within Consolidated Unit 21-018(a)-99, specifically SWMUs 21-018(a), 21-018(b), 21-023(c), 21-013(b), and AOC 21-013(g). Additionally, the nature and

extent of contamination have been defined, with the exception of low levels of tritium in subsurface pore gas, as detailed in the 2007 MDA V investigation report, revision 1. Groundwater monitoring requirements for TA-21, including Consolidated Unit 21-018(a)-99, are addressed in the "Los Alamos and Pueblo Canyons Groundwater Monitoring Well Network Evaluation and Recommendations," which was submitted to NMED on December 21, 2007.

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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 covers 40 mi² 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 6200 to 7800 ft above mean sea level (amsl).

The Laboratory's Environmental Programs (EP) Directorate is participating in a national effort by DOE to clean up sites and facilities formerly involved in weapons research and development. The goal of EP is to ensure that past operations do not threaten human or environmental health and safety in and around Los Alamos County, New Mexico. To achieve this goal, EP is currently investigating sites potentially contaminated by past Laboratory operations. These sites are designated as solid waste management units (SWMUs) or areas of concern (AOCs). Individual SWMUs and AOCs may be grouped into consolidated units.

This supplemental investigation report addresses additional remediation and investigation activities conducted in 2006 and 2007 at Consolidated Unit 21-018(a)-99, also known as Material Disposal Area (MDA) V, in an area of elevated radioactivity on the eastern side of the site. All previous investigations at the site are detailed in the "Investigation Report for Consolidated Unit 21-018(a)-99, Material Disposal Area V, at Technical Area 21, Revision 1" (LANL 2007, 098942).

Corrective actions at the Laboratory are subject to the March 1, 2005, Compliance Order on Consent (Consent Order). The Consent Order was issued pursuant to the New Mexico Hazardous Waste Act, New Mexico Statutes Annotated (NMSA) 1978, §74-4-10, and the New Mexico Solid Waste Act, NMSA 1978, §74-9-36(D). Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to the New Mexico Environment Department (NMED) in accordance with DOE policy.

1.1 General Site Information

Consolidated Unit 21-018(a)-99 is located in the southeastern section of the Delta Prime (DP) Mesa (Figures 1.1-1 and 1.1-2). The elevation of DP Mesa ranges from 7160 to 7170 ft amsl, with a 5% slope southward at MDA V into BV Canyon, named for its location directly below MDAs B and V. The approximate elevation of the center of MDA V is 7165 ft amsl. The canyon slope ranges in elevation from 7050 ft amsl at the bottom of BV Canyon to 7160 ft amsl along the southern edge of Consolidated Unit 21-018(a)-99.

From 1945 to 1978, Technical Area (TA) 21 was used primarily for plutonium research, metal production, and related activities. Since 1978, various administrative and chemical research activities have been conducted at TA-21. The current land use is industrial, and it is expected to remain industrial for the reasonably foreseeable future.

Consolidated Unit 21-018(a)-99 consists of four inactive SWMUs and one inactive AOC consolidated in 1999 according to their related operational history as well as the proximity of each site to one another (Figure 1.1-3). The sites include the following:

- SWMU 21-018(a) (MDA V)—Three wastewater absorption beds that received effluent from 1945 to 1961, located on the mesa south of the laundry facility: The area of elevated radioactivity addressed in this report is located to the east of absorption bed 2.
- SWMU 21-018(b)—A former laundry facility for radioactively contaminated clothing that operated from 1945 to 1961: This site is located immediately south of DP Road and directly north of the absorption beds.
- SWMU 21-023(c)—A waste treatment laboratory septic system and outfall that received effluent from 1948 to 1965: The septic tank and inlet are located primarily on the mesa, and the outfall is on the south-facing hillslope of BV Canyon.
- SWMU 21-013(b)—A surface disposal area emplaced in 1965 during demolition of the laundry facility [SWMU 21-018(b)] and a waste research laboratory (AOC 21-009): This SWMU consists of building debris and is located south of the MDA V absorption beds on the slope leading into BV Canyon.
- AOC 21-013(g)—A surface disposal area emplaced post-1965 east of SWMU 21-013(b): This area consists of building debris of unknown origin and is located on the south-facing hillslope of BV Canyon.

1.2 Scope of Activities

The primary objective of this investigation was to complete remediation and characterization of Consolidated Unit 21-018(a)-99 at the area of elevated radioactivity to the east of absorption bed 2 within SWMU 21-018(a). Remediation activities were conducted to remove contaminated soil in an area where radionuclides exceeded residential screening action levels (SALs) (LANL 2005, 088493). Confirmation sampling was conducted after completion of excavation activities (Table 1.2-1). The investigation, remediation, and confirmation sampling activities were conducted in three phases between September 2006 and November 2007. The following describes each phase of the supplemental investigation:

- Phase 1—September 2006 investigation: Hand-auger sampling was conducted in an area of approximately 6 × 12 ft, to the east of absorption bed 2, where surface radiological walkover surveys indicated potential elevated radiological contamination.
- Phase 2—May 2007 excavation: Soil from the 6- × 12-ft area was removed to a depth of 4 ft using a backhoe and bucket. The removal exposed an approximate 2-in. layer of elevated radiological soil/waste material likely associated with historical absorption bed overflows or other laundry facility operations extending laterally beyond the 6- × 12-ft excavation area.
- Phase 3—August and November 2007 excavation and confirmation sampling: An area approximately 30 × 50 ft to a depth of 5 to 6 ft was excavated in August 2007 to remove the 2-in. layer of soil/waste material identified in May 2007. Following removal activities, confirmation samples were collected from the bottom of the excavation, the sidewalls of the excavation, and outside of the excavation perimeter. In November 2007, a small volume of tuff was removed (approximately 69 ft² × 1 ft deep) that was centered on the original May 2007 excavation because the August 2007 analytical results indicated residual contamination of plutonium-239 remained slightly above the residential SAL.

The presence of this area of elevated radioactivity was reported in the original investigation reports of MDA V (LANL 2006, 094361; LANL 2007, 098942). The supplemental remediation and investigation activities were conducted in accordance with the supplemental investigation work plan (LANL 2007, 097448) and approved by NMED (2007, 098287). This report refers to the previously reported remediation and sampling activities conducted at MDA V as “2005–2006,” even though additional remediation and sampling activities were conducted on the southwest slope [SWMU 21-013(b) and AOC 21-013(g)] in 2007. The supplemental sampling included in this report is referred to as “2006–2007.”

Appendix A provides the acronym list, glossary, metric conversion table, and data qualifier definitions for this report. Appendix B presents the analytical results for the 2006–2007 supplemental investigation. Specific details of the excavation and sampling activities are presented in Appendix C. The conversion of borehole 21-02523 for vapor monitoring at the site is addressed in Appendix D. Appendix E describes the analytical program, and Appendix F provides all of the analytical suites and results and analytical reports (on a compact disc [CD] included with this report). The waste disposal procedures and documentation are presented in Appendix G. Appendix H contains the results of the risk assessments performed for this supplemental investigation.

2.0 BACKGROUND

The following sections summarize the description and operational history of the site, the details of which are provided in the MDA V investigation report, revision 1 (LANL 2007, 098942, Section 2.0). The historical investigation report for Consolidated Unit 21-018(a)-99 (LANL 2004, 087358, Appendix B) provides details of previous investigations at Consolidated Unit 21-018(a)-99.

2.1 Site Description and Operational History

2.1.1 SWMU 21-018(a), MDA V

SWMU 21-018(a), more commonly referred to as MDA V, is a site approximately 1 acre, located immediately south of the former laundry facility [building 21-20; SWMU 21-018(b)] (Figure 1.1-3), consisting of three interconnected liquid waste absorption beds. MDA V received radioactive liquid waste that resulted from washing radioactively contaminated clothes in the laundry facility, and it was designed to enhance infiltration of liquids into the tuff bedrock. The absorption beds ran parallel to each other, with absorption bed 1 receiving effluent directly from the laundry. Effluent was transported from absorption bed 1 to absorption bed 2 and subsequently to absorption bed 3 by means of a series of collection and distribution pipes buried within the bed materials. This design was intended to allow absorption bed 1 to fill with effluent to a depth of approximately 2 ft from the bottom of the pit before the overflow pipes distributed water to the downgradient absorption beds.

The absorption beds were constructed in 1945 and operated until 1961. They remained on standby status until September 1963 when they were permanently removed from service (LANL 1991, 007529, p. 16-223). In January 1984, a chainlink fence was constructed around the absorption bed area. Minor surface stabilization work, including the installation of a soil cover, was completed in 1985 to repair erosion damage (Balo and Warren 1986, 007419, p. 69). It is not known whether a soil cover was ever installed over the site before the work was conducted in 1985 (LANL 1991, 007529, p. 16-223). No record exists of additional activities at the site after 1985.

2.1.2 SWMU 21-018(b), Former Laundry Facility

SWMU 21-018(b), the former laundry facility (building 21-20), was located at the eastern end and south of DP Road, immediately west of the security fence that encloses active TA-21 facilities to the east (Figure 1.1-3). Operational from 1945 to 1961, the laundry facility was used to wash personal protective clothing and other reusable cloth items used in both research and production operations involving radioactive materials at TA-21. It is estimated that the laundry facility generated approximately 2 million gal. of effluent annually (Abrahams 1962, 001306). This effluent was discharged to MDA V.

The laundry facility was a wood-frame structure with both concrete slab and wood-framing-on-pier floors. The wood portions of the building were decommissioned and demolished in 1965 and taken to MDA G where the debris was burned. The concrete foundation and associated piping were bulldozed over the edge of DP Mesa onto the south-facing slope of BV Canyon. This debris was later identified as SWMU 21-013(b). AOC 21-013(g) may have also received debris from demolition of the laundry facility.

2.1.3 SWMU 21-023(c), Waste Treatment Laboratory Septic Tank System

SWMU 21-023(c), a former septic system that consisted of a tank (structure 21-62), inlet and outlet lines, and an outfall, served as a waste treatment laboratory (building 21-33; AOC 21-009) (Figure 1.1-3). The septic tank was located immediately west of the MDA V absorption beds (drawing A5-C142, LANL 2004, 085559) and was constructed of reinforced concrete, 3.5 ft wide × 7 ft long × 5.8 ft deep. The inlet and outlet lines were 4-in. vitrified clay pipes; the outlet line surfaced 40 ft southwest from the tank, approximately 30 ft from the canyon edge above BV Canyon (drawings ENG-R-1191 and ENG-R-1193, LANL 2004, 085559). The outfall area extended south into BV Canyon.

The waste treatment laboratory septic system was put into service in 1948. Sewage was pumped from a sump in building 21-33 through the septic system. The tank was removed in 1965 and taken to MDA G. The 2005–2006 field activities confirmed that none of the septic system components remained in place.

2.1.4 SWMU 21-013(b) and AOC 21-013(g), Surface Disposal Area

SWMU 21-013(b) and AOC 21-013(g) are located immediately south of MDA V on the south-facing slope leading into BV Canyon (Figure 1.1-3). Both have historically been described as surface debris disposal sites. In 1990, sections of discarded pipe and building debris were observed during a site visit, and SWMU and AOC numbers were subsequently assigned. It is not known how long these sites received building debris; however, they did not receive wastes after 1994. SWMU 21-013(b) contained the external concrete piers, the concrete building foundations, and other building debris derived from the 1965 demolition of the laundry facility [building 21-20; SWMU 21-018(b)] and a waste treatment laboratory (building 21-33; AOC 21-009) (LANL 1991, 007680, pp. 17-29). Other debris included asphalt and concrete poured onto the slope before it solidified, broken asphalt, concrete, piping, and miscellaneous building materials. The origin of the additional debris is not documented. AOC 21-013(g) consisted of two discarded drainlines and miscellaneous building materials, also of unknown origin.

2.2 2005–2006 Investigation

The 2005–2006 investigation (LANL 2005, 088493) had two main objectives: (1) to define the lateral and vertical nature and extent of chemicals of potential concern (COPCs) at Consolidated Unit 21-018(a)-99 by collecting surface and subsurface data from around the site and (2) to reduce or prevent the migration of contamination by removing debris, infrastructure (e.g., piping), and environmental media (including absorption bed material) known to contain contaminants exceeding residential SALs for

radionuclides (LANL 2005, 088493) or residential soil screening levels (SSLs) for inorganic and organic chemicals (NMED 2006, 092513). A summary is provided of the 2005–2006 remediation and characterization activities at Consolidated Unit 21-018(a)-99 in the following sections.

2.2.1 Subsurface Characterization Sampling

Characterization drilling was performed at Consolidated Unit 21-018(a)-99 from May 12 to June 9, 2005. The objectives of characterization drilling were to define the subsurface extent of contamination and to characterize fractures known to be present in the Tshirege Member of the Bandelier Tuff, units Qbt 3 and Qbt 2. Fifteen boreholes in and around MDA V [SWMU 21-018(a)] and the former laundry facility footprint [SWMU 21-018(b)] were drilled to total depths ranging from 40 to 380 ft below ground surface (bgs) for a total of 1160 linear ft.

All 2005–2006 characterization samples collected from the boreholes were analyzed for semivolatile organic compounds (SVOCs), pH, target analyte list (TAL) metals, nitrate, perchlorate, cyanide, radionuclides by gamma spectroscopy, americium-241, isotopic plutonium, isotopic uranium, strontium-90, and tritium. In addition, three samples from location 21-24524 (BH-01) included analyses of bromide, fluoride, chloride, and sulfate.

2.2.1.1 Geotechnical Analyses

Thirteen geotechnical samples were collected from location 21-24524 (BH-01) to characterize potential fractures underlying the absorption beds in MDA V. Geotechnical samples were analyzed for moisture content, bulk density, pH, porosity, and saturated hydraulic conductivity.

2.2.1.2 Geophysical Logging

Geophysical logging was also conducted for all 15 boreholes in July 2005. Within each borehole, the following measurements were taken: soil moisture content, gamma radiation, borehole diameter, and wall imagery to capture any subsurface features, such as character and orientation of potential fracture zones.

2.2.1.3 Pore-Gas Sampling

Pore-gas sampling was conducted twice in each of the 15 boreholes at two depth intervals in July–August 2005 and May–June 2006. The shallow interval was sampled at the extrapolated base of the waste disposal units (i.e., the approximate depth of the fill/tuff contact below the absorption beds). The depth interval was sampled at the bottom of the open borehole at the time of pore-gas sampling. All pore-gas samples were analyzed for volatile organic compounds (VOCs) and tritium.

2.2.2 Surface and Near-Surface Characterization Confirmation Sampling

2.2.2.1 SWMUs 21-018(a) and 21-018(b)

After absorption bed material was excavated and removed, seven confirmation samples from the floor of each absorption bed were collected from tuff at depths of approximately 12 ft below the original ground surface.

Following removal of the distribution line that carried wastewater from the laundry facility to MDA V, confirmation samples were collected from the trench at two depth intervals each (0–0.5 ft and 1.5–2.0 ft below the trench) from three locations. After removal of the steel sump line that ran from the west end of

the laundry building, confirmation samples were collected from the trench at two depth intervals for each end of the pipeline (0–0.5 ft and 1.5–2.0 ft below the trench). Following removal of the clay pipeline, which was situated beneath and just to the west of the steel sump line, one location was sampled at approximately the middle of the run.

The confirmation samples collected at SWMUs 21-018(a) and 21-018(b) were analyzed for SVOCs, TAL metals, radionuclides by gamma spectroscopy, americium-241, isotopic plutonium, isotopic uranium, strontium-90, tritium, perchlorate, cyanide, pH, and nitrate.

2.2.2.2 SWMU 21-023(c)

Samples were collected from two depths (0–0.5 ft bgs and 1.5–2.0 ft bgs) at each of the following locations at SWMU 21-023(c):

- former septic system inlet line (4 locations)
- former septic system outlet line (3 locations)
- outfall (10 locations)
- Consolidated Unit 21-027(d)-99, drainage adjoining SWMU 21-023(c) outfall (6 locations)
- upgradient and downgradient of SWMU 21-023(c) in BV Canyon (7 locations)

All of the samples from the listed locations were analyzed for SVOCs, TAL metals, radionuclides by gamma spectroscopy, americium-241, isotopic plutonium, isotopic uranium, strontium-90, tritium, perchlorate, cyanide, pH, nitrate, and polychlorinated biphenyls (PCBs).

Excavation and removal of contaminated soil from the outfall channel were conducted in two field campaigns, starting from the southern edge of the mesa down into BV Canyon. Following removal of [outfall] soil in April 2006 from historical sampling locations where americium-241 and plutonium-239 exceeded the residential SALs and where no deeper sample was available to confirm vertical extent, eight confirmation samples were collected from a depth interval of 2 to 2.5 ft bgs.

Where activities of americium-241 and/or plutonium-239 exceeded residential SALs, additional soil and weathered tuff were removed in August 2006, and final confirmation samples were collected at depths varying between 2.5 and 4.5 ft bgs.

The April 2006 confirmation samples were analyzed for SVOCs, TAL metals, radionuclides by gamma spectroscopy, americium-241, isotopic plutonium, isotopic uranium, strontium-90, tritium, perchlorate, cyanide, pH, and nitrate. The five confirmation samples collected in August 2006 were analyzed for americium-241, plutonium-238, and plutonium-239 because extent had been established for all other COPCs.

2.2.2.3 SWMU 21-013(b) and AOC 21-013(g)

Debris removal was conducted at SWMU 21-013(b) and AOC 21-013(g) from July to October 2005. After debris was removed from the south-facing slope leading into BV Canyon, a total of 89 samples were collected from 45 locations along an approximate 25 m²-grid spacing in and around SWMU 21-013(b) and AOC 21-013(g). Two depth intervals (0.0–0.5 ft bgs and 1.5–2.0 ft bgs) were sampled from all but one location. Confirmation samples were analyzed for SVOCs, TAL metals, radionuclides by gamma spectroscopy, americium-241, isotopic plutonium, isotopic uranium, strontium-90, tritium, perchlorate, cyanide, pH, and nitrate.

Additional sampling was conducted in May 2007 to determine the extent of benzo(a)anthracene at and downgradient of location 21-24650. Four locations were sampled at two depth intervals each and the samples were analyzed for SVOCs.

3.0 2006–2007 REMEDIATION AND SAMPLING ACTIVITIES

3.1 Remediation Activities

The primary objective of remediation activities performed in 2006–2007 was to complete the removal of soil and tuff at Consolidated Unit 21-018(a)-99 such that no residential SSLs or SALs were exceeded for inorganic chemicals, organic chemicals, or radionuclides. The removal activities at the area of elevated radioactivity were conducted to remove media contaminated with radionuclides, a result of overflow from the adjacent absorption beds. Material from an area of approximately 30 ft × 50 ft to a depth of 5 to 6 ft was removed from the site in August 2007, and an additional 69 ft² area was removed to a depth of approximately 1 ft in November 2007, representing a total volume of approximately 420 yd³ of excavated material.

Investigation sampling at the area of elevated radioactivity falls into one of two categories:

(1) preexcavation sampling, representing all samples taken at locations and depths where soil and tuff were excavated in August and November 2007, and (2) postexcavation sampling, representing all samples taken from soil and tuff that remain at the site after completion of the excavation. The preexcavation data are presented in this report but are not evaluated for potential risk, nature, and extent of potential contamination or used to make final decisions regarding cleanup because these data do not represent current or potential future site conditions. All qualified postexcavation data are presented in this report. Postexcavation data were evaluated for potential risk, nature, and extent of potential contamination and were used as the basis for determining whether cleanup goals have been met.

The preexcavation samples were collected to determine the volume of contamination of the area of elevated radioactivity, establish COPCs within the area, and evaluate the effectiveness of the excavation and remediation. Table 1.2-1 presents the preexcavation samples collected from the area of elevated radioactivity during the 2006–2007 supplemental investigation, as shown in Figure 3.1-1.

The postexcavation samples collected during the 2006–2007 investigation were collected to confirm the effectiveness of the excavation at the area of elevated radioactivity. Table 1.2-1 summarizes the postexcavation samples collected in the area of elevated radioactivity during the 2006–2007 supplemental investigation, as shown in Figure 3.1-2.

3.2 Sampling Activities

3.2.1 Preexcavation Sampling

Seven samples from three locations were collected from the area of elevated radioactivity between September 2006 and September 2007 that is representative of preexcavation conditions (Table 1.2-1). Additionally, three quality control (QC) samples were collected: one field duplicate, one field trip blank, and one field rinsate. The number and types of analyses performed varied as follows (number of samples in parentheses): anions (3), TAL metals (4), cyanide (4), nitrate (1), perchlorate (3), pH (3), SVOCs (3), VOCs (4), gamma spectroscopy (7), isotopic plutonium (7), isotopic uranium (7), americium-241 (7), strontium-90 (3), and asbestos (2).

One sample was collected from location 21-600105 at 2–2.0 ft bgs on August 22, 2007, and inspected for asbestos to determine if there was any potential health risk from asbestos to the field team. The results of this inspection are provided on the data CD included with this report; no asbestos was detected in the sample taken from this location. This sample is not summarized in the data tables or figures because it was not shipped through the Sample Management Office to an off-site lab.

3.2.2 Postexcavation Sampling

Fifteen samples from eight locations were collected from the area of elevated radioactivity in May and September 2007 that are representative of postexcavation (i.e., current) conditions (Table 1.2-1). The number and types of analyses performed on the samples varied as follows (number of samples in parentheses): anions (13), TAL metals (15), cyanide (15), perchlorate (15), pH (11), dioxins/furans (2), PCBs (2), SVOCs (13), VOCs (13), gamma spectroscopy (13), tritium (13), isotopic plutonium (13), isotopic uranium (13), americium-241 (11), strontium-90 (13), and asbestos (13). The dioxin/furan and PCB analyses were performed in May 2007 at location 21-600106 when the area of elevated radioactivity was first investigated. Because it was unknown at that time whether the area represented residual contamination related to the absorption beds and laundry facility operations or whether it was a newly identified SWMU related to other TA-21 operations, the samples collected from that location were analyzed for the COPCs identified for other TA-21 sites, which include dioxins/furans and PCBs.

4.0 REGULATORY CRITERIA

This section describes the criteria used for screening COPCs and evaluating potential risk to human and ecological receptors. Regulatory criteria identified in the Consent Order include cleanup standards, risk-based screening levels, and risk-based cleanup goals; these criteria are established by medium.

In accordance with the approved work plan for the supplemental remediation and sampling in the area of elevated radioactivity (LANL 2007, 097448), all relevant and qualified data collected during the 2006–2007 excavation and characterization activities were evaluated in risk-screening assessments (Appendix H). “Relevant data” refers to all samples collected after the submittal of the MDA V investigation report, revision 1 (LANL 2007, 098942), and “qualified data” refers to data validated according to current standards for data usability.

The human health screening assessment was performed according to NMED and U.S. Environmental Protection Agency (EPA) Region 6 guidance (NMED 2006, 092513; EPA 2007, 095866). The SSLs used in the human health screening assessment are presented in Appendix H (Tables H-4.1-1 and H-4.1-2) and were obtained from NMED (2006, 092513), EPA Region 6 (2007, 095866), and EPA Region 9 guidance (epa.gov/region09/waste/sfund/prg/files/04prgtable.pdf). The SALs were obtained from Laboratory guidance (2005, 088493) and were calculated using the radioactive residual materials model (Appendix H, Table H-4.1-3). Because this property may be transferred out of DOE control, residential SSLs and SALs are used for the cleanup levels for this site.

The human health screening levels listed are based on a target risk level of 10^{-5} for carcinogens or a hazard quotient of 1.0 for noncarcinogens (NMED 2006, 092513). For radionuclides, the target dose is 15 millirem (mrem)/yr based on DOE guidance (2000, 067489). The screening levels presented in Appendix H are based on these cleanup goals.

The ecological screening assessment was performed according to Laboratory guidance (2004, 087630). The ecological screening levels used in the screening assessment were obtained from the ECORISK Database, Version 2.2 (LANL 2005, 090032) (Appendix H, Table H-5.3-2).

Work Plan Variances

All 2006–2007 excavation, characterization, and sampling activities were conducted in accordance with the approved supplemental investigation work plan (LANL 2007, 097448), with the exception of the commitment in the work plan to abandon borehole 21-02523. After it was discovered that the borehole was uncased, ungrouted, and open to approximately 300 ft bgs, it was decided that the borehole would be converted to a vapor-monitoring well. The conversion of borehole 21-02523 for vapor monitoring at the site is addressed in Appendix D. The nature and extent of shallower pore gas were inconclusive in the initial subsurface investigation of pore gas at the site. Therefore, the monitoring well installation plan included in Appendix D will provide data needed to determine concentration trends for shallower pore gas nature and extent.

5.0 SITE CONTAMINATION

The following sections summarize the results of field-screening and fixed-analytical sampling performed during remediation activities at the area of elevated radioactivity. Appendix B provides details of the analytical results, Appendix E describes the analytical program, and Appendix F provides all of the analytical suites and results and analytical reports (on a CD included with this document).

5.1 Field-Screening Results

All pre- and postexcavation samples were field screened for alpha and beta radioactivity and VOCs. Details of the field-screening methods and instrumentation are provided in Appendix C. Table 5.1-1 presents the field-screening results (in units of disintegrations per minute [dpm] or parts per million [ppm]) for both pre- and postexcavation samples.

5.2 Soil and Rock Sampling Analytical Results

The analytical results for all pre- and postexcavation samples collected at the area of elevated radioactivity in 2006 and 2007 are summarized in Appendix B. The data reports for all of the samples evaluated are provided in Appendix F (on a CD included with this document). A summary of the analytical results for preexcavation and postexcavation samples is presented in Tables 5.2-1, 5.2-2, and 5.2-3 for inorganic, radionuclide, and organic COPCs, respectively. Figures 5.2-1, 5.2-2, and 5.2-3 show the analytical results for inorganic, radionuclide, and organic COPCs, respectively, for preexcavation samples. Postexcavation sample results are shown in Figures 5.2-4, 5.2-5, and 5.2-6 for inorganic, radionuclide, and organic COPCs, respectively. All August 2007 samples were also analyzed for asbestos because visual observation of the area of elevated radioactivity during the September 2006 activities revealed an approximate 2-in.-thick layer of debris material suspected of containing asbestos. Asbestos was not detected in any sample.

6.0 CONCLUSIONS

6.1 Summary of the Supplemental Investigation Activities

The primary objective of this supplemental investigation was to complete the remediation and characterization of Consolidated Unit 21-018(a)-99 at the area of elevated radioactivity to the east of absorption bed 2, in accordance with the approved supplemental work plan (LANL 2007, 097448; NMED 2007, 098287). The total volume of soil and tuff excavated from the area of elevated radioactivity was approximately 420 yd³.

Although all primary potential sources of contamination have been removed from Consolidated Unit 21-018(a)-99, some residual contamination remains at concentrations below applicable residential SSLs and SALs, as discussed in the following sections.

6.2 Nature and Extent of Contamination

Appendix B provides a detailed discussion of the nature and extent of residual contamination in the area of elevated radioactivity. At Consolidated Unit 21-018(a)-99, all absorption bed material, infrastructure, debris, and media with COPC concentrations above residential SSLs and SALs have been removed. The results of the confirmation samples collected at the base and sidewalls of the excavation area indicate that little residual contamination remains. Samples collected during the 2006–2007 investigation show decreasing concentrations of COPCs, both laterally and with depth. Based on the analytical results of the 2006–2007 sampling, the objectives of the supplemental remediation and investigation have been met. Plutonium-239, the driver for the supplemental activities, was detected at approximately 2 orders of magnitude less than the overlying material removed during the excavation of the area of elevated radioactivity.

6.3 Comparisons of 2006–2007 Data with Screening Levels and Applicable Cleanup Levels

The 2006–2007 sample results were used to determine COPCs in soil and tuff and to complete risk-screening assessments for human and ecological receptors for the area of elevated radioactivity. The COPC identification for the area of elevated radioactivity is presented in Appendix B. Screening-level comparisons for determining potential risks to human health (residential receptors) and terrestrial ecological receptors are provided in Appendix H. The cleanup goals are a residential human health target risk level of 10^{-5} for carcinogens and a hazard index (HI) of 1.0 for noncarcinogens (NMED 2006, 092513). For radionuclides, the target dose is 15 mrem/yr, based on DOE guidance (2000, 067489). Appendix H provides a comparison of the maximum COPC concentrations with applicable residential SSLs and SALs for the postexcavation samples from the area of elevated radioactivity. In summary, detected concentrations of all COPCs are less than their respective residential SSLs and SALs. Therefore, the cleanup goals for the area of elevated radioactivity have been met.

6.4 Comparison of 2006–2007 Data with Previously Collected Data

The 2006–2007 postexcavation analytical results from the area of elevated radioactivity are compared with the 2005–2006 analytical results for Consolidated Unit 21-018(a)-99 in Table 6.4-1. The comparison was made to determine whether concentrations of COPCs identified in the area of elevated radioactivity are similar to previously collected data and whether conclusions still apply that were drawn in the MDA V investigation report, revision 1 (LANL 2007, 098942).

For the 0- to 10-ft horizon (the depth interval evaluated in the human health risk assessment), the data comparison was limited to the 2005–2006 analytical results of samples from 0 to 10 ft at SWMUs 21-018(a) and 21-018(b). This comparison was chosen because the area of elevated radioactivity is within the footprint of SWMUs 21-018(a) and 21-018(b). If the 2006–2007 analytical data results had been available from the area of elevated radioactivity when the initial MDA V investigation report was submitted, they would have been included with this subset of data from Consolidated Unit 21-018(a)-99. The detected concentrations of all COPCs between 0 and 10 ft bgs in the 2006–2007 data set are within the range of the 2005–2006 data previously evaluated for SWMUs 21-018(a) and 21-018(b), with the exception of chromium, americium-241, plutonium-239, and strontium-90. These COPCs were identified elsewhere at Consolidated Unit 21-018(a)-99, indicating that these are not new COPCs at the site. In addition, four organic chemicals (1,3-dichlorobenzene; 1,4-dichlorobenzene;

methylene chloride; and toluene) were detected at trace concentrations below applicable estimated quantitation limits (EQLs) in the 2006–2007 data set and were not previously detected in soil or tuff between 0 and 10 ft at SWMUs 21-018(a) and 21-018(b).

For the 0- to 5-ft horizon (the depth interval evaluated in the ecological risk assessment), the data comparison included all 2005–2006 analytical results of samples from 0 to 5 ft at Consolidated Unit 21-018(a)-99. This comparison is valid because the previous ecological assessment included all site data from 0 to 5 ft to be consistent with the 2006 ecological risk assessment. The detected concentrations of all COPCs between 0 and 5 ft bgs in the 2006–2007 data set are within the range of data previously evaluated for Consolidated Unit 21-018(a)-99. Four organic chemicals (1,3-dichlorobenzene; 1,4-dichlorobenzene; methylene chloride; and toluene) were detected at trace concentrations below applicable EQLs in the 2006–2007 data set and were not previously detected in soil or tuff between 0 and 5 ft at Consolidated Unit 21-018(a)-99.

For both data comparisons, the 2006–2007 results for dioxins/furans cannot be compared with previously collected data at Consolidated Unit 21-018(a)-99 because dioxins/furans were not analyzed for in the 2005–2006 samples; rather, the results for dioxins/furans are compared with data collected for the TA-21 DP Site Aggregate Area investigation report (LANL 2007, 099175). The concentrations of all dioxins/furans in the 2006–2007 data set are within the range of concentrations of dioxins/furans detected elsewhere at TA-21 (Table 6.4-1).

In summary, concentrations of COPCs identified at the area of elevated radioactivity are similar to previously collected data, and both previous and current sampling have COPC concentrations below residential SSLs and SALs. Therefore, conclusions drawn in the MDA V investigation report, revision 1 (LANL 2007, 098942), are still valid.

6.5 Summary of Risk Assessments

6.5.1 Human Health Risk-Screening Assessment

Maximum concentrations of all COPCs (carcinogenic, noncarcinogenic, and radionuclides) identified in the 2006–2007 supplemental investigation sampling of the area of elevated radioactivity at MDA V are less than the respective residential SSLs and SALs in all postexcavation samples. The total estimated excess cancer risk is approximately 3×10^{-7} , which is less than NMED's target level of 1×10^{-5} (NMED 2006, 092513). The noncarcinogenic HI is 0.1, which is less than the NMED target level of an HI of 1.0 (NMED 2006, 092513). The total dose is 0.44 mrem/yr (Table H-4.1-3), which is less than DOE's target dose of 15 mrem/yr (DOE 2000, 067489). This dose corresponds to a radiological risk of approximately 1.0×10^{-5} , based on a comparison with EPA radionuclide residential preliminary remediation goals (<http://www.epa.gov/region09/waste/sfund/prg/>).

Based on the human health risk assessment results presented in this supplemental investigation report, concentrations of COPCs in soil and tuff in the area of elevated radioactivity at Consolidated Unit 21-018(a)-99 do not pose a potential unacceptable risk/dose to human health under a residential scenario. The conclusions drawn in the previous investigation report (LANL 2007, 098942) that there are no potential unacceptable risks to human health under a residential scenario are still valid.

6.5.2 Ecological Risk-Screening Assessment

The ecological risk screening eliminated all chemicals of potential ecological concern (COPECs), indicating that no potential risk to terrestrial receptors exists from exposure to residual COPEC concentrations in the area of elevated radioactivity. Based on the ecological risk-assessment results, the

conclusions drawn in the previous investigation report (LANL 2007, 098942) that concentrations of COPECs in soil and tuff at Consolidated Unit 21-018(a)-99 do not pose a potential unacceptable risk to ecological receptors are still valid.

7.0 RECOMMENDATIONS

Based on information and data presented in this supplemental investigation report, remediation and characterization activities are complete at Consolidated Unit 21-018(a)-99, in accordance with the approved supplemental work plan (LANL 2007, 097448; NMED 2007, 098287).

The area of elevated radioactivity at Consolidated Unit 21-018(a)-99 was remediated in 2006 and 2007 by removing environmental media with concentrations of COPCs exceeding residential SALs for radionuclides. No inorganic or organic chemicals were detected above residential SSLs in the 2006–2007 confirmation samples and all COPECs were eliminated. Thus, the residual contamination does not pose a potential unacceptable risk to human health (under a residential scenario) or the environment. Additionally, the nature and extent of contamination have been defined, with the exception of low levels of tritium in subsurface pore gas, as detailed in the MDA V investigation report, revision 1 (LANL 2007, 098942). Groundwater monitoring requirements for TA-21, including Consolidated Unit 21-018(a)-99, was addressed in the “Los Alamos and Pueblo Canyons Groundwater Monitoring Well Network Evaluation and Recommendations” (LANL 2007, 099936), which was submitted to NMED on December 21, 2007.

Based on the results of all remediation and sampling completed at the site from 2005 to 2007, corrective action is complete for Consolidated Unit 21-018(a)-99. Additional evaluation of tritium is pending.

8.0 REFERENCES AND MAP DATA SOURCES

8.1 References

The following list includes all documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ER ID number. This information is also included in text citations. ER ID numbers are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau; the U.S. Department of Energy–Los Alamos Site Office; the U.S. Environmental Protection Agency, Region 6; and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

Abrahams, J.H., Jr., July 1962. “Radioactive Waste Disposal at Los Alamos, New Mexico,”
U.S. Geological Survey Administrative Release, Albuquerque, New Mexico. (Abrahams 1962, 001306)

Balo, K.A., and J.L. Warren, March 1986. “1985 Waste Management Site Plan,” Los Alamos National Laboratory document LA-UR-86-990, Los Alamos, New Mexico. (Balo and Warren 1986, 007419)

- DOE (U.S. Department of Energy), June 13, 2000. "Procedure for the Release of Residual Radioactive Material from Real Property," U.S. Department of Energy memorandum to D. Glenn, I.R. Triay, M. Zamorski, E. Sellers, D. Gurule, and D. Bergman-Tabbert from C.L. Soden, Albuquerque, New Mexico. (DOE 2000, 067489)
- EPA (U.S. Environmental Protection Agency), May 4, 2007. "EPA Region 6 Human Health Medium-Specific Screening Levels," U.S. EPA Region 6, Dallas, Texas. (EPA 2007, 095866)
- LANL (Los Alamos National Laboratory), May 1991. "TA-21 Operable Unit RFI Work Plan for Environmental Restoration," Vol. II (Chapters 14 to 16), Los Alamos National Laboratory document LA-UR-91-962, Los Alamos, New Mexico. (LANL 1991, 007529)
- LANL (Los Alamos National Laboratory), May 1991. "TA-21 Operable Unit RFI Work Plan for Environmental Restoration," Vol. III (Chapters 17 to Appendix G), Los Alamos National Laboratory document LA-UR-91-962, Los Alamos, New Mexico. (LANL 1991, 007680)
- LANL (Los Alamos National Laboratory), 2004. "List of Record Drawings Used in the HIR Report, MDA V, SWMU 21-018(a)-99," Los Alamos, New Mexico. (LANL 2004, 085559)
- LANL (Los Alamos National Laboratory), June 2004. "Investigation Work Plan for Consolidated Unit 21-018(a)-99, Material Disposal Area V, at Technical Area 21," Los Alamos National Laboratory document LA-UR-04-3699, Los Alamos, New Mexico. (LANL 2004, 087358)
- LANL (Los Alamos National Laboratory), December 2004. "Screening-Level Ecological Risk Assessment Methods, Revision 2," Los Alamos National Laboratory document LA-UR-04-8246, Los Alamos, New Mexico. (LANL 2004, 087630)
- LANL (Los Alamos National Laboratory), May 2005. "Derivation and Use of Radionuclide Screening Action Levels, Revision 1," Los Alamos National Laboratory document LA-UR-05-1849, Los Alamos, New Mexico. (LANL 2005, 088493)
- LANL (Los Alamos National Laboratory), September 2005. "Ecorisk Database (Release 2.2)," on CD, LA-UR-05-7424, Los Alamos National Laboratory, Los Alamos, New Mexico. (LANL 2005, 090032)
- LANL (Los Alamos National Laboratory), October 2006. "Investigation Report for Consolidated Unit 21-018(a)-99, Material Disposal Area V, at Technical Area 21," Los Alamos National Laboratory document LA-UR-06-6609, Los Alamos, New Mexico. (LANL 2006, 094361)
- LANL (Los Alamos National Laboratory), July 2007. "Investigation Report for Consolidated Unit 21-018(a)-99, Material Disposal Area V, at Technical Area 21, Revision 1," Los Alamos National Laboratory document LA-UR-07-4390, Los Alamos, New Mexico. (LANL 2007, 098942)
- LANL (Los Alamos National Laboratory), July 3, 2007. "Sampling Data for Area of Elevated Radioactivity Near Location ID 21-02523 and North of Absorption Bed 3, Consolidated Unit 21-018(a)-99, Material Disposal Area V, at Technical Area 21," Los Alamos National Laboratory letter (EP2007-0346) to J.P. Bearzi (NMED HWB) from S. Stiger (Environmental Programs Associate Director) and D. Gregory (DOE Federal Project Director), Los Alamos, New Mexico. (LANL 2007, 097448)

LANL (Los Alamos National Laboratory), November 2007. "Delta Prime Site Aggregate Area Investigation Report," Los Alamos National Laboratory document LA-UR-07-5459, Los Alamos, New Mexico. (LANL 2007, 099175)

LANL (Los Alamos National Laboratory), December 2007. "Los Alamos and Pueblo Canyons Groundwater Monitoring Well Network Evaluation and Recommendations," Los Alamos National Laboratory document LA-UR-07-8114, Los Alamos, New Mexico. (LANL 2007, 099936)

NMED (New Mexico Environment Department), June 2006. "Technical Background Document for Development of Soil Screening Levels, Revision 4.0, Volume 1, Tier 1: Soil Screening Guidance Technical Background Document," New Mexico Environment Department, Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program, Santa Fe, New Mexico. (NMED 2006, 092513)

NMED (New Mexico Environment Department), August 9, 2007. "Approval with Modification for the Supplemental Work Plan for Consolidated Unit 21-018(a)-99, at Technical Area 21," New Mexico Environment Department letter to D. Gregory (DOE LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED HWB), Santa Fe, New Mexico. (NMED 2007, 098287)

8.2 Map Data Sources

Paved Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; 06 January 2004; Development Edition of 05 January 2005.

Dirt Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; 06 January 2004; Development Edition of 05 January 2005.

Structures; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; 06 January 2004; Development Edition of 05 January 2005.

Former TA-21 Structures; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; 06 January 2004; Development Edition of 05 January 2005.

Potential Release Sites (SWMU/AOC); Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program, ER2005-0748; 1:2500 Scale Data; 22 November 2005.

Material Disposal Areas; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program, ER2004-0221; 1:2500 Scale Data; 23 April 2004.

Security and Industrial Fences and Gates; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; Development Edition of 05 January 2005.

Hypsography, 10, 20, and 100 Foot Contour Interval; Los Alamos National Laboratory, RRES Remediation Services Project; 1991.

Water Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; Development Edition of 05 January 2005.

Steam Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; Development Edition of 05 January 2005.

Sewer Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; Development Edition of 05 January 2005.

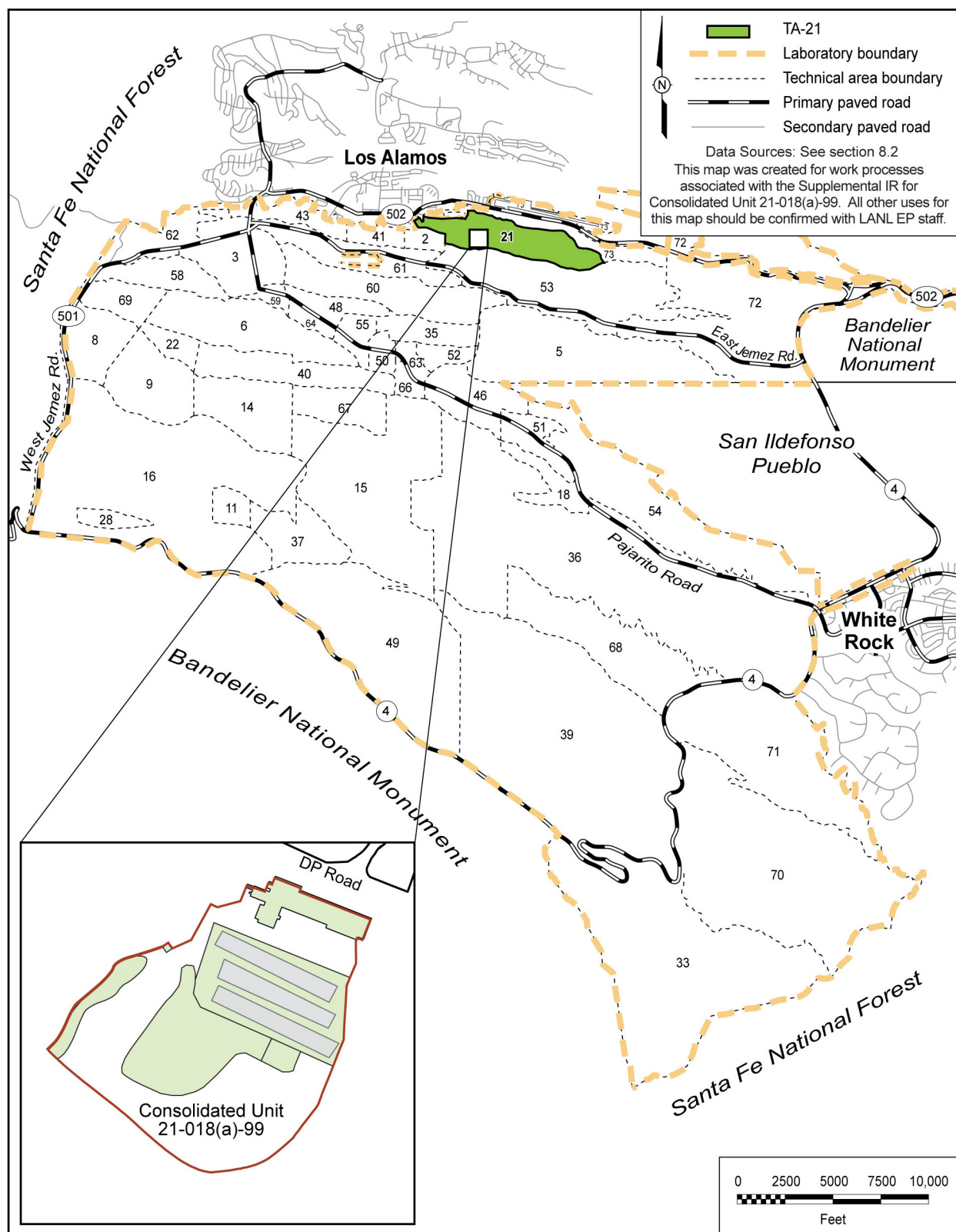
Industrial Waste Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; 06 January 2004; Development Edition of 05 January 2005.

Electric Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; 06 January 2004; Development Edition of 05 January 2005.

Communication Lines; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; 08 August 2002; Development Edition of 05 January 2005.

ER Location IDs point (borehole and sample locations); Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program; 1:2500 Scale Data; 10 November 2005.

Former Drainline; Los Alamos National Laboratory, ENV Environmental Remediation and Stewardship Program; 1:2500 Scale Data, 02 October 2006.



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Figure 1.1-1 TA-21 and Consolidated Unit 21-018(a)-99 with respect to Laboratory technical areas and surrounding land holdings

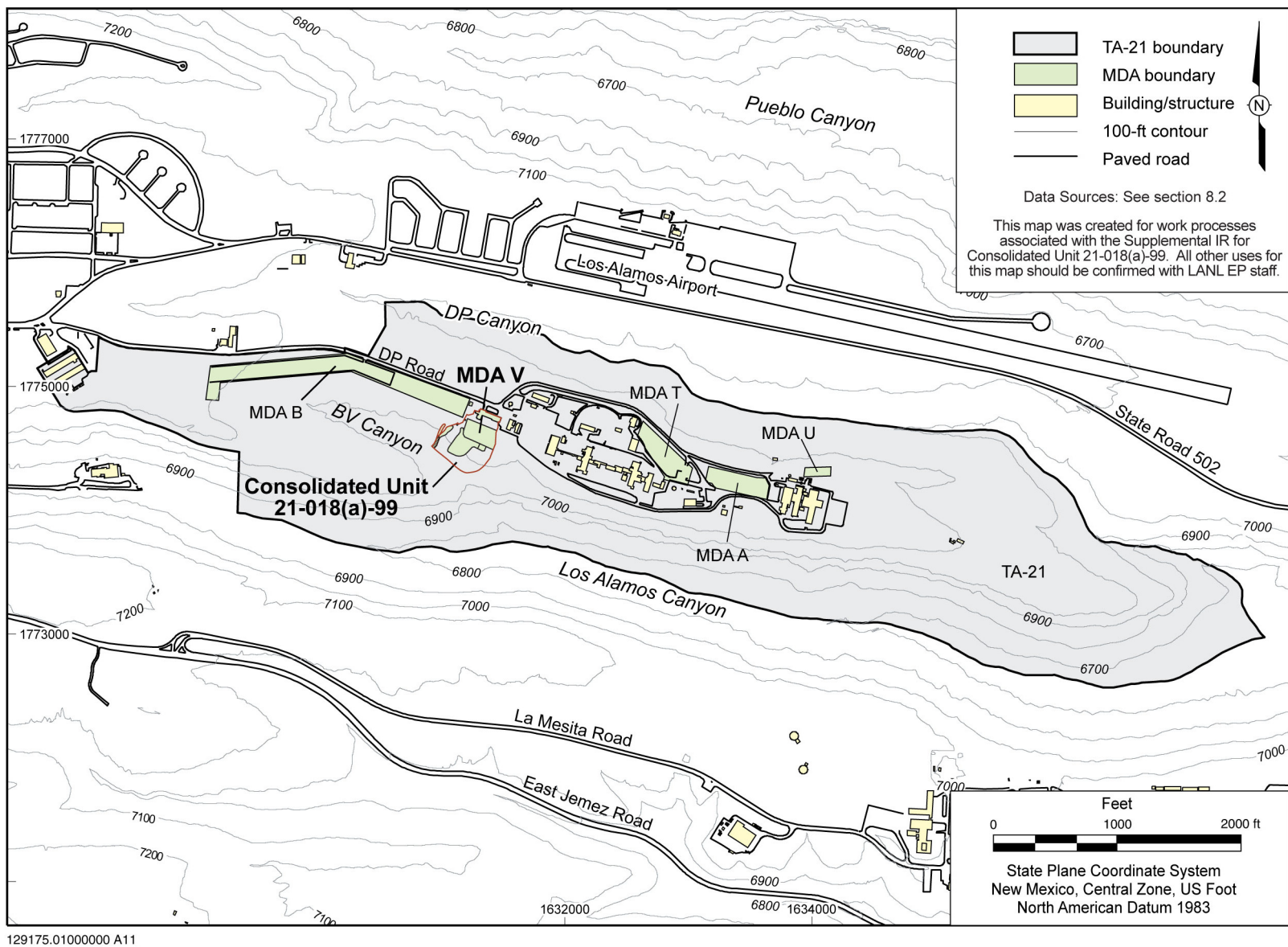


Figure 1.1-2 Consolidated Unit 21-018(a)-99 within TA-21 and surrounding MDAs

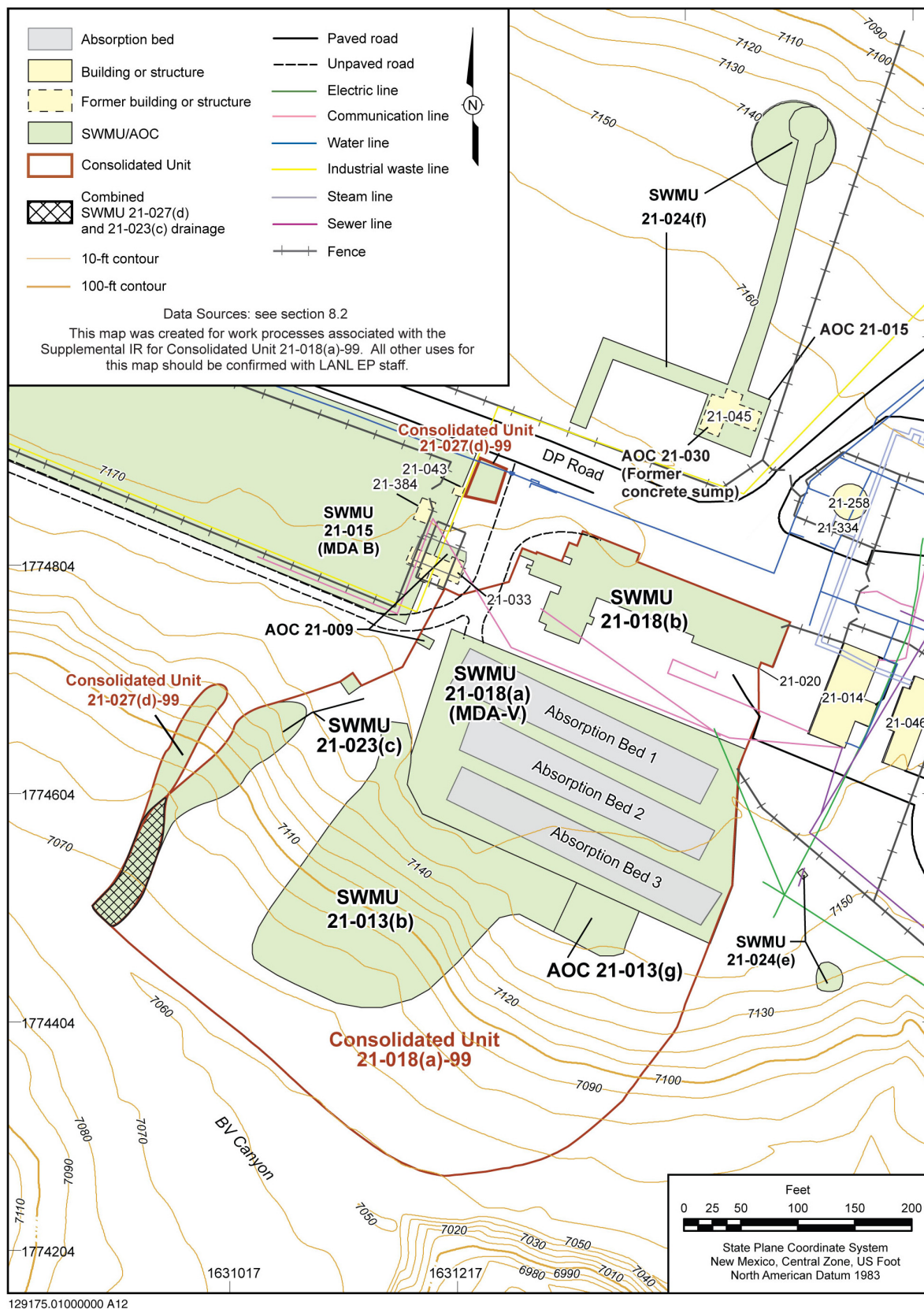


Figure 1.1-3 Consolidated Unit 21-018(a)-99 and adjacent SWMUs and AOCs

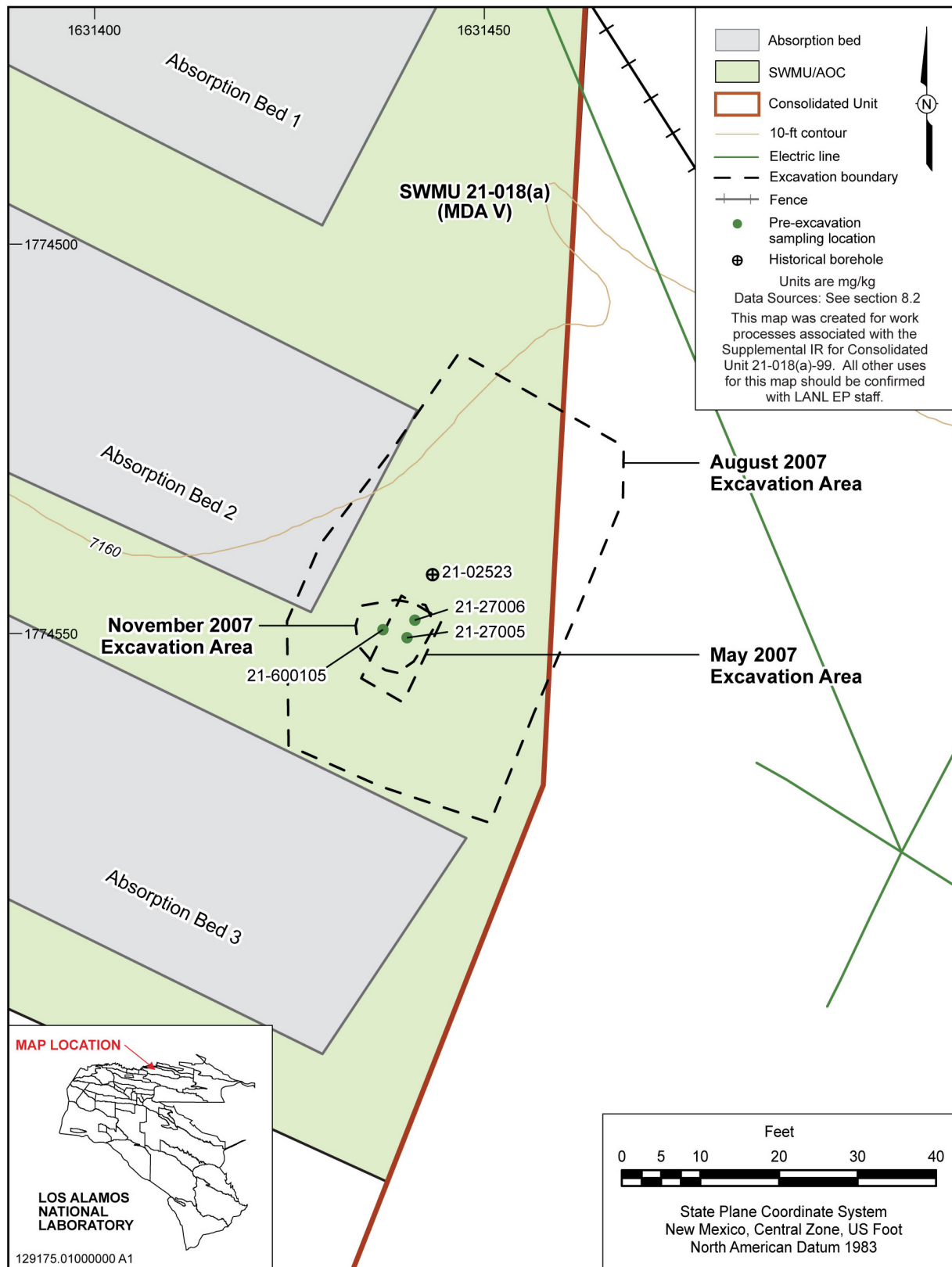


Figure 3.1-1 Preexcavation sample locations at the area of elevated radioactivity, Consolidated Unit 21-018(a)-99

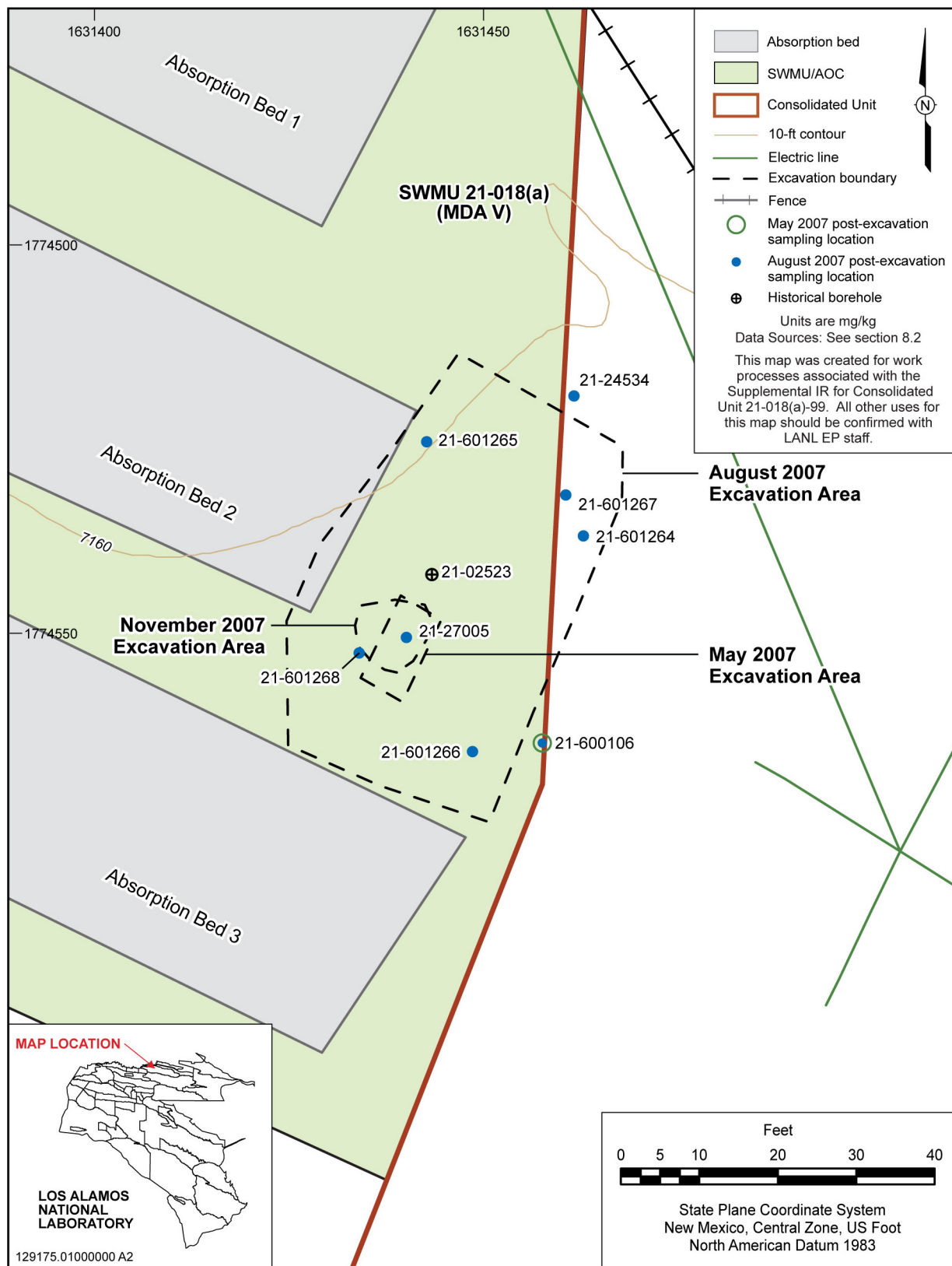


Figure 3.1-2 Postexcavation sample locations at the area of elevated radioactivity, Consolidated Unit 21-018(a)-99

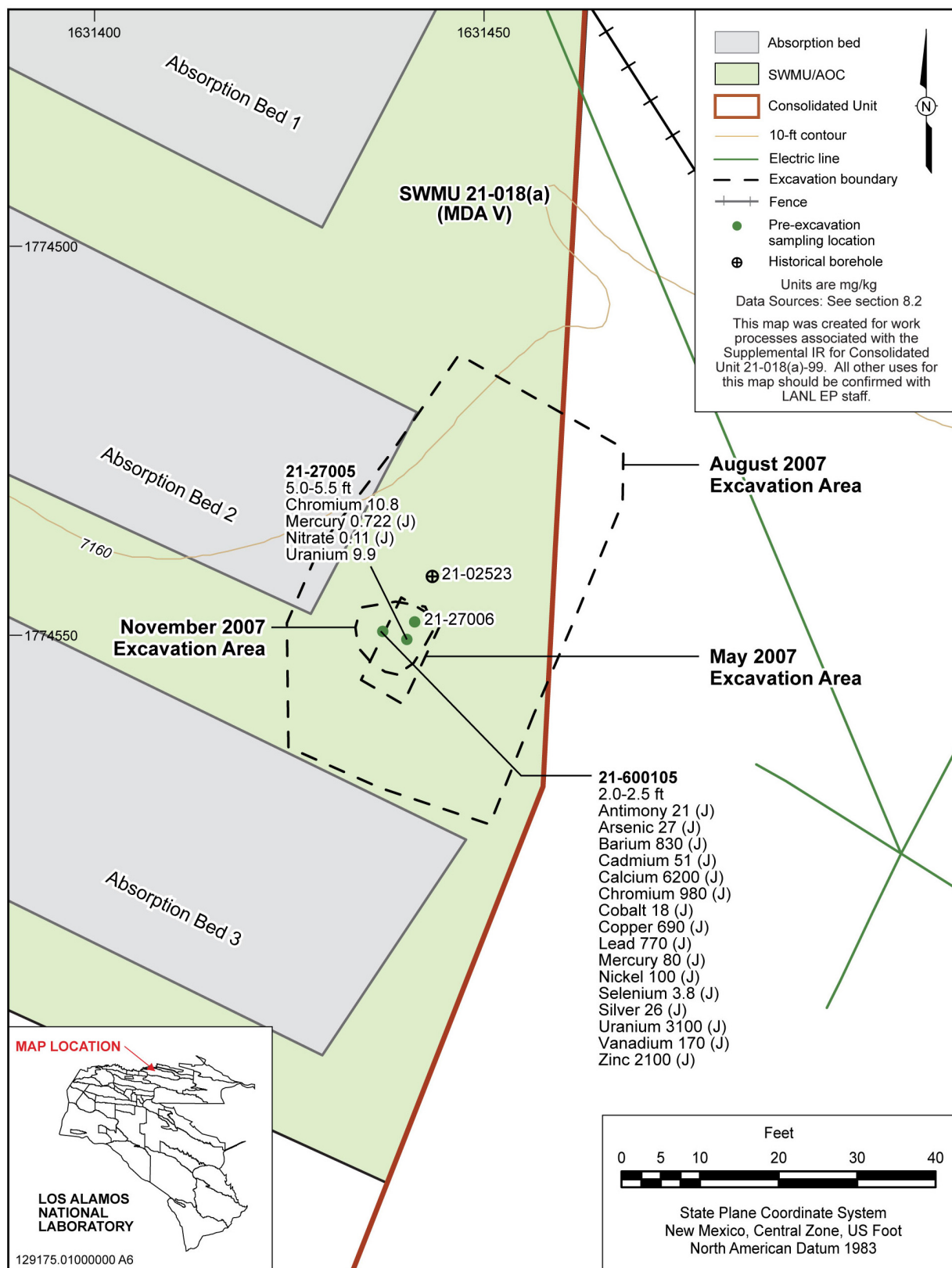


Figure 5.2-1 Preexcavation samples: inorganic chemicals detected above background values (BVs) at the area of elevated radioactivity, Consolidated Unit 21-018(a)-99

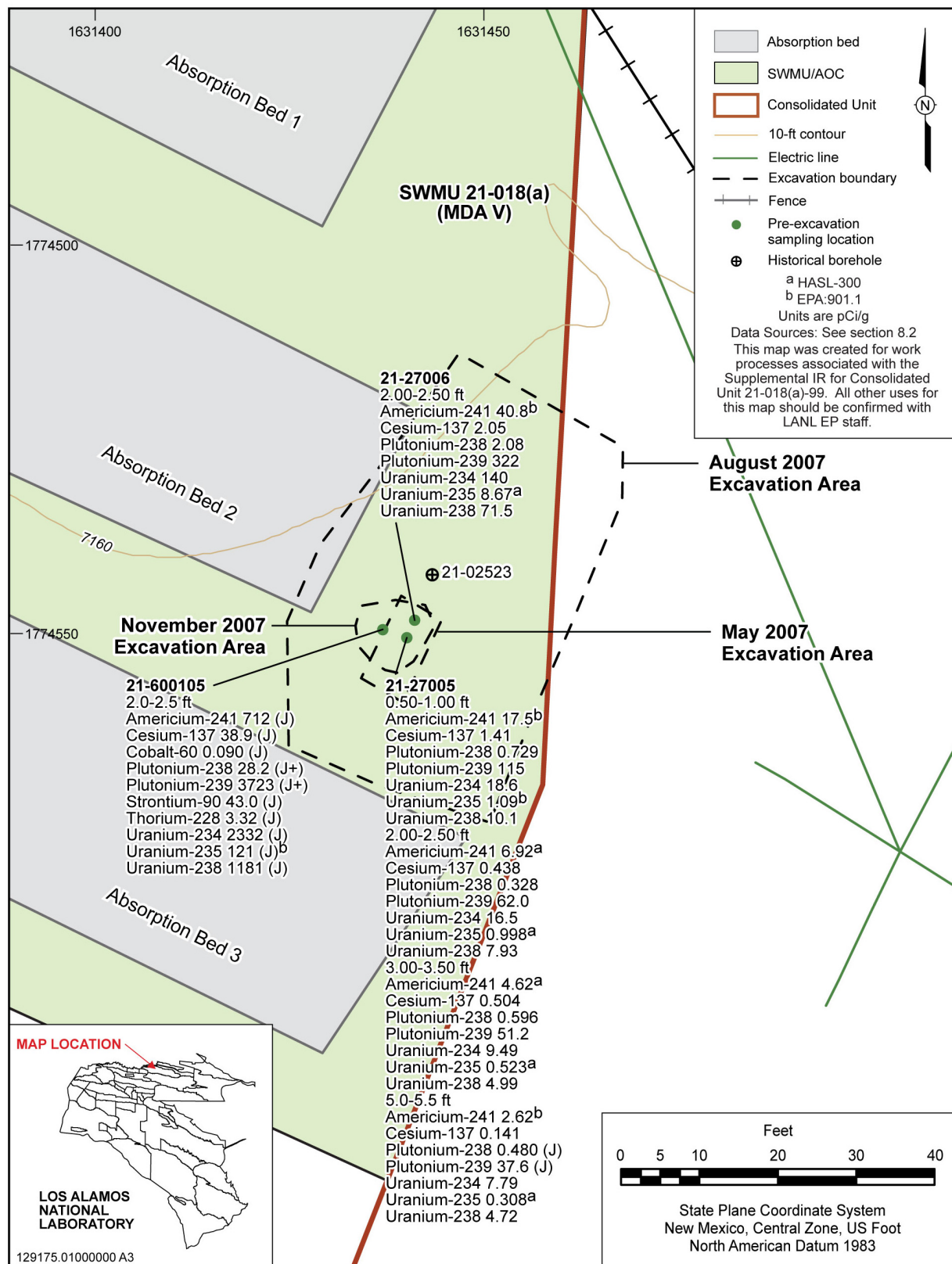


Figure 5.2-2 Preexcavation samples: radionuclides detected or detected above BVs/fallout values (FVs) at the area of elevated radioactivity, Consolidated Unit 21-018(a)-99

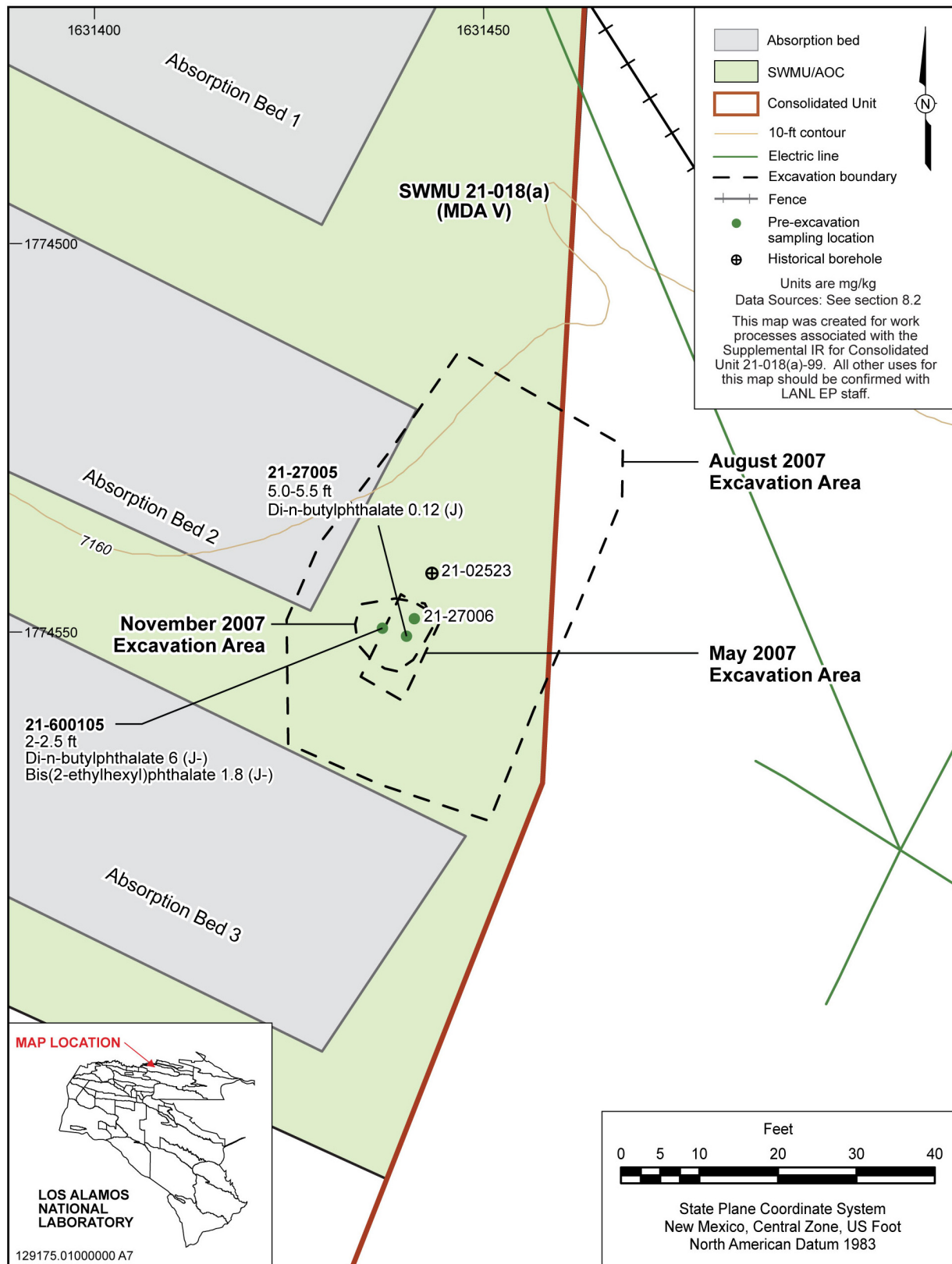


Figure 5.2-3 Preexcavation samples: organic chemicals detected at the area of elevated radioactivity, Consolidated Unit 21-018(a)-99

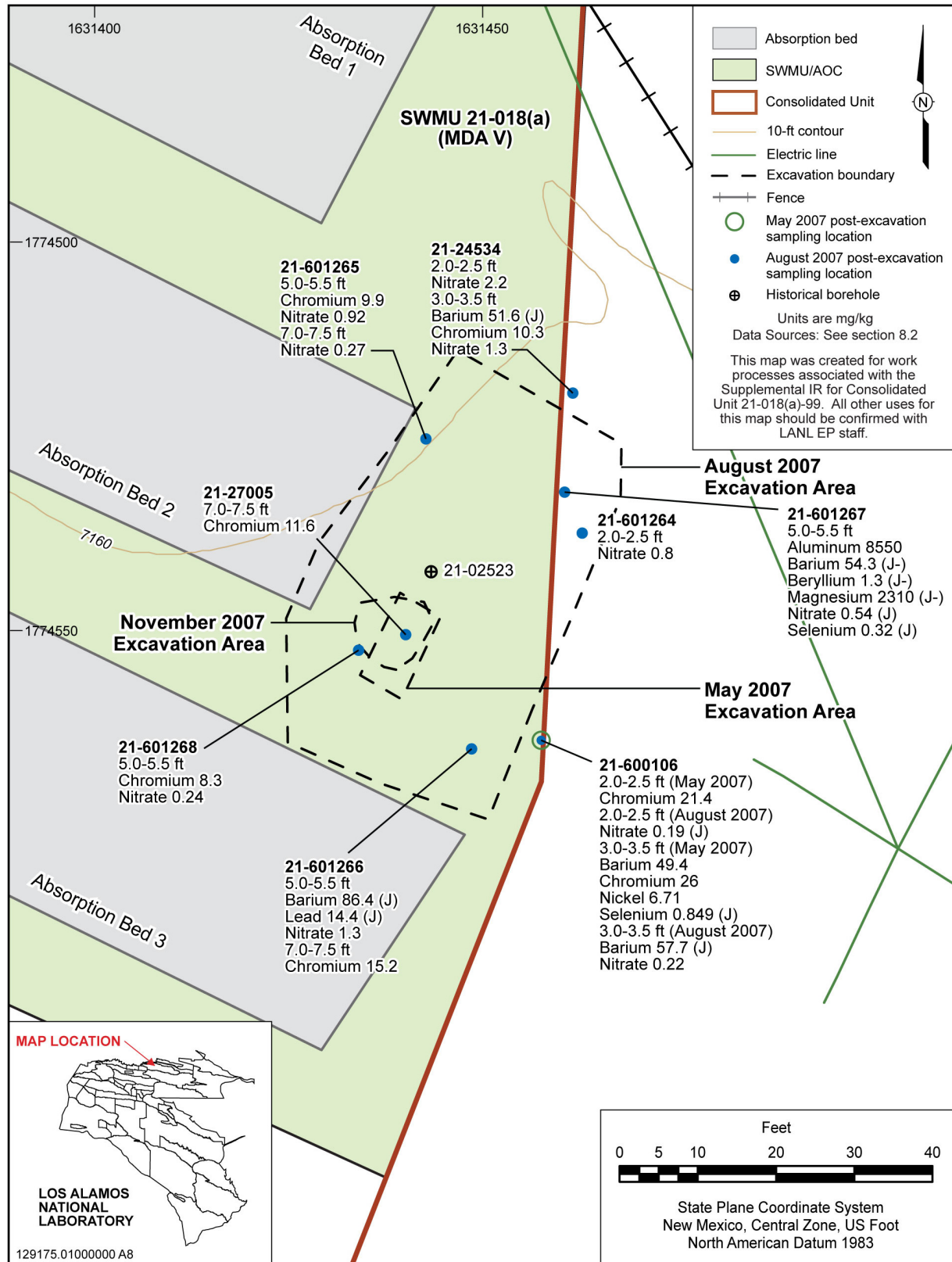


Figure 5.2-4 Postexcavation samples: inorganic chemicals detected above BVs at the area of elevated radioactivity, Consolidated Unit 21-018(a)-99

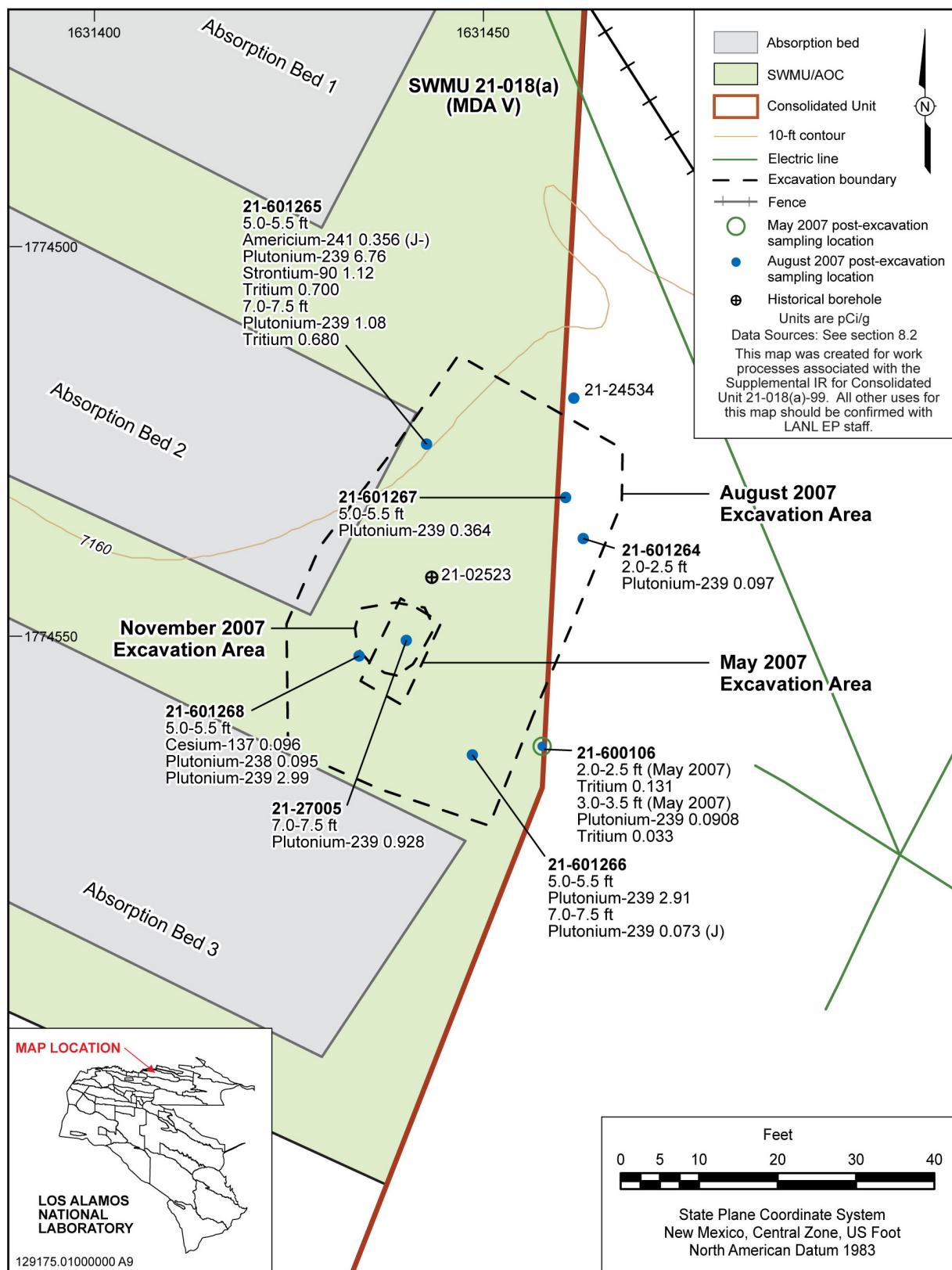


Figure 5.2-5 Postexcavation samples: radionuclides detected or detected above BVs/FVs at the area of elevated radioactivity, Consolidated Unit 21-018(a)-99

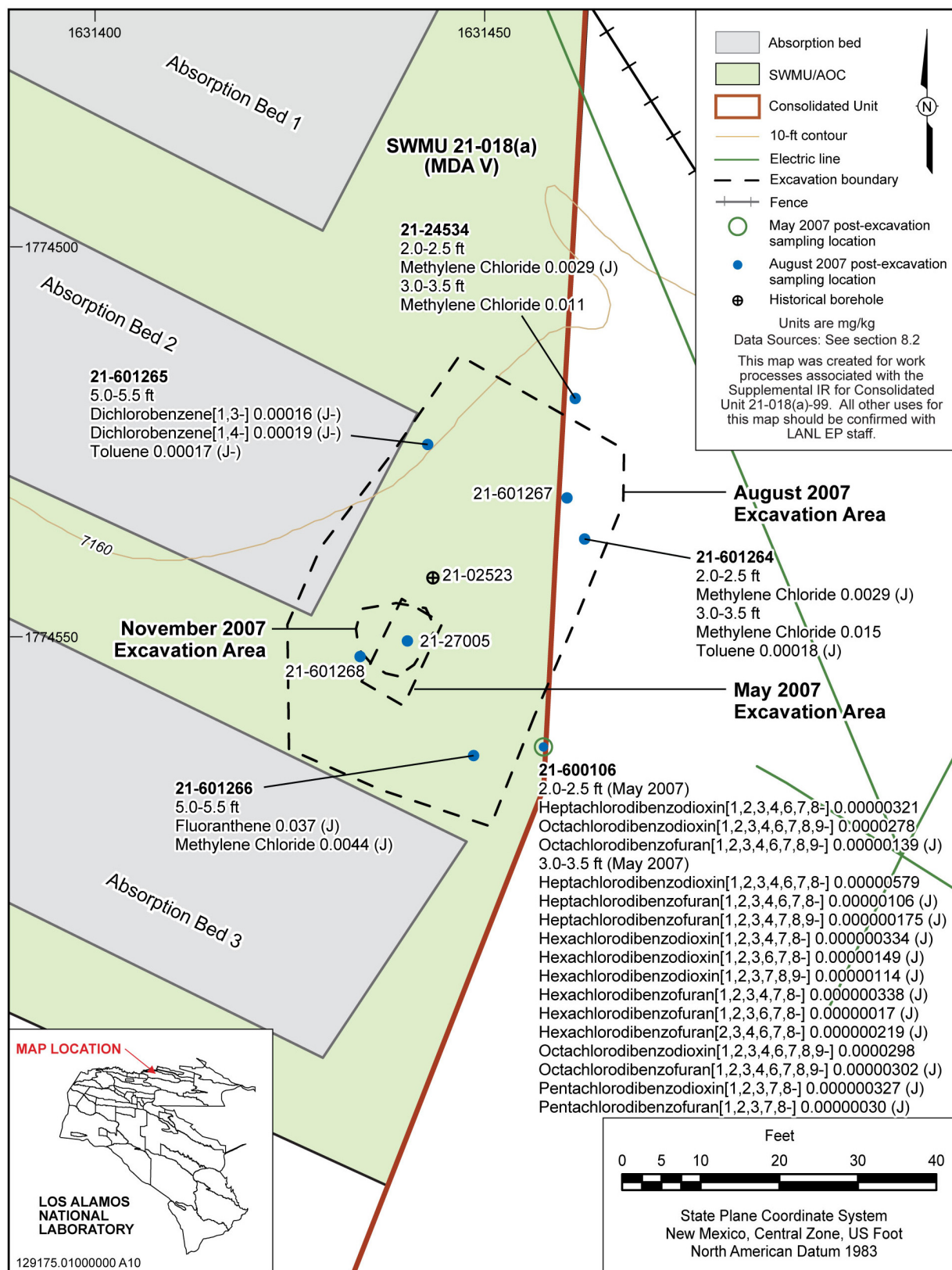


Figure 5.2-6 Postexcavation samples: organic chemicals detected at the area of elevated radioactivity, Consolidated Unit 21-018(a)-99

11x17

Table 1.2-1
Summary of Samples Collected for Analyses at the Area of Elevated Radioactivity, Consolidated
Unit 21-018(a)-99

11x17

Table 5.1-1
Field-Screening Results from the Area of Elevated Radioactivity, Consolidated Unit 21-018(a)-99

11x17

Table 5.2-1
Results of Inorganic Chemicals above BVs at the Area of Elevated Radioactivity, Consolidated
Unit 21-018(a)-99

11x17

Table 5.2-2
Results of Radionuclides Detected or Detected above BVs/FVs at the Area of Elevated
Radioactivity, Consolidated Unit 21-018(a)-99

11x17

Table 5.2-3
Results of Organic Chemicals Detected at the Area of Elevated Radioactivity, Consolidated Unit
21-018(a)-99

11x17

Table 6.4-1
Comparison of 2006–2007 COPC Analytical Results for
Area of Elevated Radioactivity, Consolidated Unit 21-018(a)-99, with 2005–2006 Data

