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105038

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Date: September 29, 2008
Refer To: EP2008-0507

James P. Bearzi, Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Subject: Submittal of the Response to the Notice of Disapproval for the Investigation Work Plan for Upper Cañada del Buey Aggregate Area and Revision 1

Dear Mr. Bearzi:

Enclosed please find two hard copies with electronic files of the response to the notice of disapproval for the Investigation Work Plan for Upper Cañada del Buey Aggregate Area and Revision 1 of the work plan. Also enclosed is an electronic copy of a redline/strikeout version of the work plan that includes all changes made in response to the New Mexico Environment's (NMED's) notice of disapproval. A table detailing where revisions have been made to the work plan with cross-references to NMED's numbered comments is also included.

If you have any questions, please contact Kent Rich at (505) 665-4272 (krich@lanl.gov) or Cheryl Rodriguez at (505) 845-5804 (crodriguez2@doeal.gov).

Sincerely,

Susan G. Stiger, Associate Director
Environmental Programs
Los Alamos National Laboratory

Sincerely,

David R. Gregory, Project Director
Environmental Operations
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SS/DG/DM/KR:sm

Enclosures: Two hard copies with electronic files:

1) Response to the Notice of Disapproval for the Investigation Work Plan for Upper Cañada del Buey Aggregate Area (EP2008-0507)
2) Investigation Work Plan for Upper Cañada del Buey Aggregate Area, Revision 1 (EP2008-0508)
3) An electronic copy of the redline-strikeout version of the plan that includes all changes and edits to the document
4) Cross-reference table of NMED NOD comments and revisions to Cañada del Buey investigation work plan

Cy: (w/enc.)
Kent Rich, EP-CAP, MS M992
RPF, MS M707 (with two CDs)
Public Reading Room, MS M992

Cy: (Letter and CD only)
Kim Birdsall, North Wind
Cheryl Rodriguez, DOE-LASO, MS A316
Laurie King, EPA Region 6, Dallas, TX
Steve Yanicak, NMED-OB, White Rock, NM
Kristine Smeltz, EP-WES, MS M992
EP-CAP File, MS M992

Cy: (w/o enc.)
Tom Skibitski, NMED-OB, Santa Fe, NM
Alison Bennett, DOE-LASO (date-stamped letter emailed)
Susan G. Stiger, ADEP, MS M991
Alison M. Dorries, EP-WES, MS M992
Dave McInroy, EP-CAP, MS M992
IRM-RMMSO, MS A150 (date-stamped letter emailed)

Response to the "Notice of Disapproval for the Investigation Work Plan for Upper Cañada del Buey Aggregate Area, Los Alamos National Laboratory EPA ID No: NM0890010515, HWB-LANL-08-013," Dated August 28, 2008

INTRODUCTION

To facilitate review of this response, the New Mexico Environment Department's (NMED's) comments are included verbatim. The comments are divided into general and specific categories, as presented in the notice of disapproval. Los Alamos National Laboratory's (LANL's or the Laboratory's) responses follow each NMED comment. This response contains data on radioactive materials, including source, special nuclear, and byproduct material. Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to NMED in accordance with U.S. Department of Energy (DOE) policy.

GENERAL COMMENTS

NMED Comment

At each site undergoing investigation, 20% of all samples must be sent for off-site laboratory analysis of polychlorinated biphenyls (PCBs). The selected samples must be biased toward areas where field screening indicates the greatest presence of contamination or areas with the highest potential for contamination (e.g., closest to the contamination source).

LANL Response

1. The proposed sampling has been revised to include polychlorinated biphenyl (PCB) analyses for at least 20% of samples collected at each site undergoing investigation where PCB sampling was not already proposed. Table 4.0-1 has been revised to reflect the addition.

NMED Comment

2. *Table 7.0-2, page 141, includes a listing of 27 metals to be analyzed and the listing summary indicates the metals are the Target Analyte List (TAL) metals under US EPA's current Contract Laboratory Program. The current TAL includes 23 metals (found at http://www.epa.gov/superfund/programs/clp/target.htm). The table listing in the Plan includes boron, lithium, silicon, titanium and uranium which are not included in the current TAL and the table does not include mercury which is on the current TAL. If the Permittees wish to retain the metals listed in Table 7.0-2, mercury must be added to the table's list.*

LANL Response

2. The LANL contract analytical laboratory target analyte list (TAL) metals suite is consistent with the U.S. Environmental Protection Agency's (EPA's) current Contract Laboratory Program list of 23 metals. Table 7.0-2 has been revised to incorporate the 23 TAL metals, including mercury, on EPA's Contract Laboratory list.

NMED Comment

3. *All Plan figures should be reviewed to ensure applicable area canyon drainage features are illustrated on the figures, similar to the figures recently provided in the July 2008 Upper Sandia Canyon Aggregate Area Investigation Work Plan, Revision 1. The review may help the Permittees in determining whether sample location coverage for the various Areas of Concern (AOCs) and Solid Waste Management Units (SWMUs) addressed in the Plan overlaps sample coverage provided in other Los Alamos National Laboratory (LANL) aggregate area AOC and SWMU investigations.*

LANL Response

3. The figures have been revised to show the locations of canyon investigation reaches in Cañada del Buey. The reach investigation activities in Cañada del Buey will be conducted in October 2008. The sampling locations and data will be presented in specific canyons investigation reports, to be submitted to NMED in accordance with the Compliance Order on Consent (the Consent Order). Data from the canyons investigation reports will be assessed in the Upper Cañada del Buey Aggregate Area investigation report to confirm the nature and extent of contamination have been determined for these sites.

NMED Comment

4. *Canyon drainage samples must be obtained in the drainages from the top of the slope to the toe of the colluvium. Sampling must target areas such as fine-grained sediments or other areas of sediment accumulation.*

LANL Response

4. Drainage and sediment sampling locations from the top of the slope to the toe of the colluvium have been proposed in the figures showing sampling locations (for sites where drainage and sediment sampling is required). Text has been added to section 7.0, Investigation Methods, to clarify that drainage sampling locations are determined on the basis of geomorphic relationships and the presence of appropriate sediment packages. Any changes to sediment sampling locations based on field observations at the time of sampling will be documented as deviations from the work plan.

SPECIFIC COMMENTS

NMED Comment

1. ***Section 5.1.2, Scope of Activities for SWMU 46-002, page 14, first paragraph:***

   Permittees' Statement: *"Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites."*

   NMED Comment: *Table 4.0-1 contains a footnote that excludes analyses of isotopic thorium for each of the sampling locations at SWMU 46-002. The RFI Work Plan for OU 1140 (RFI Work Plan), page 5-54, lists thorium as a potential chemical of concern at SWMU 46-002. The Permittees must revise the table to include analyses of isotopic thorium for each sample collected at SWMU 46-002.*

LANL Response

1. The text in section 5.1.2 and Table 4.0-1 have been revised to indicate that each of the 59 samples to be collected at Solid Waste Management Unit (SWMU) 46-002 will be analyzed for isotopic thorium.

NMED Comment

2. ***Section 5.6.2, Scope of Activities for SWMU 46-003(e), page 18, second paragraph:***

   Permittees' Statement: *"Eight samples will be collected from four locations associated with the location of the former distribution box and drain field (Figure 5.6-2)."*

   NMED Comment: *The Permittees must also collect samples adjacent to the area where the drain line exits Building 46-58. All samples must be analyzed for the same analytical suite as proposed in Table 4.0-1 and must be collected from two depths to define the nature and the extent of contamination.*

LANL Response

2. Figure 5.6-2, the text in section 5.6.2, and Table 4.0-1 of the work plan have been revised to indicate that two additional samples will be collected from one location next to the area where the drainline exits building 46-58. The samples will be collected from the 0- to 1-ft interval directly beneath the drainline and from the 5- to 6-ft interval beneath the drainline and analyzed for TAL metals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy.

NMED Comment

3. ***Section 5.7.2, Scope of Activities for SWMU 46-003(f), page 19, second paragraph:***

   Permittees' Statement: *"Eight samples will be collected from four locations associated with the distribution box and drain field to define nature and extent of contamination (Figure 5.4-2)."*

   NMED Comment: *Figure 5.4-2 shows a pipeline structure exiting the northeast corner of the site drain field. The Permittees have proposed a sample location at the north end of the structure. The Plan must be revised to clarify the nature and use of the structure. If the structure is an outfall associated with the drain field, the Permittees must propose additional down slope sampling locations north of the structure to characterize the area between the structure and the common drainage segment of SWSC Canyon.*

LANL Response

3. The drain field, distribution box, and drainpipe outfall associated with the SWMU 46-003(f) septic system have all been removed. The drainpipe outfall formerly located at the northeast corner of the former drain field was installed to improve drain field performance. The text in section 5.7 and Table 4.0-1 have been revised to include one additional sampling location north of the first sampling location below the former drainpipe outfall. Two samples will be collected from the new location at the same depth intervals and analyzed for the same constituents as the samples to be collected from the location directly north of the former drainpipe outfall. Data from samples collected in SWSC Canyon downgradient of the drain field outfall pipe will also be used to evaluate SWMU 46-003(f).

Figure 5.4-2 has been revised to show the additional sampling location and the sampling locations in SWSC Canyon downgradient of SWMU 46-003(f).

NMED Comment

4. ***Section 5.8.2 Scope of Activities for SWMU 46-003(g), pages 19 and 20, first and last paragraphs:***

   Permittees' Statements: *"Two samples will be collected from one location below the tank (Figure 5.8-2)." and, "Four samples will also be collected from two locations beneath the primary and secondary inlet lines (Figure 5.8-2)."*

   NMED Comment: *The Permittees must collect samples from beneath the inlet pipe, the tank inlet and tank outlet at two depths to define the nature and extent of contamination. Additionally, the proposed sample location just north of former structure 46-175 must be moved approximately 20 feet south to the piping bend located a few feet west of the former structure to address potential contamination. In the event underground or overhead utility lines preclude moving the sample location farther south, the Permittees must state the reason(s) for not moving the location in their response to the NOD. All samples must be analyzed for the analytical suites listed in Table 4.0-1 for the SWMU.*

LANL Response

4. The text in section 5.8.2 and Table 4.0-1 of the work plan have been revised to indicate that samples will be collected from two depth intervals at three sampling locations beneath the septic tank and the tank inlet and outlet to define the nature and extent of contamination. Figure 5.8-2 has been revised to show the new sampling locations and the proposed sampling location just north of former structure 46-175, now located approximately 20 ft to the south, next to the piping bend located a few feet west of former structure 46-175. The new samples will be collected from the same depth intervals and analyzed for the same constituents as the samples previously proposed for this SWMU.

NMED Comment

5. ***Section 5.11 SWMU 46-004(b), Former Tank, page 22, first line:***

   Permittees' Statement: *"SWMU 46-004(b) is the location of a former alkali-metal cleaning tank (structure 46-81) (Figure 5.5-1)."*

   NMED Comment: *Section 5.2.2 of the June 1996* RFI Report for Potential Release Sites in TA-46 *(1996 RFI) indicates the former tank historically occupied at least two locations at SWMU 46-004(b). Review of Figure 5.2.2-1 of the 1996 RFI indicates neither of the historical tank locations shown on that figure correspond with the location shown on Figure 5.5-1 of the Plan. The Permittees must explain why the tank location shown in the Plan figure differs from the locations shown on the 1996 RFI figure.*

LANL Response

5. Figure 5.5-1 of the work plan shows the original (operating) location of the SWMU 46-004(b) alkali-metal cleaning tank but does not show the second (staging) location. The location of the tank as shown in Figure 5.5-1 is based on the location shown in engineering drawing C-38763 (Attachment 1). The tank location depicted in the 1996 Resource Conservation and Recovery Act

(RCRA) facility investigation (RFI) report figure showing it to be directly next to building 46-31 is incorrect.

As shown in the 1996 RFI report figure, the tank occupied a second location for a short period of time (LANL 1996, 054929). In 1970–1971, during the construction of the Arc Jet Test addition at building 46-31, the tank was emptied, disconnected from piping, and moved to an existing concrete pad located approximately 15 ft northwest of the original tank location. Engineering drawing C-38763 (dated September 14, 1970) directs that the piping to the tank be capped and provides no direction for installing piping at the tank's new location, indicating that the tank would no longer be used. As is common practice in many technical areas throughout the Laboratory, equipment removed from service is often placed at a convenient outside location until the items can be removed for disposal. The tank was staged at this location until it was removed for disposal in 1973.

The second location of the tank was used only for staging the tank before it was removed off-site. The tank did not operate during the time it occupied this location. Therefore, LANL did not indicate the second location of the tank on Figure 5.5-1, and sampling at this location is not necessary.

NMED Comment

6. ***Section 5.15.1.2 Scope of Activities for SWMU 46-004(d), page 26:***

Permittees' Statements: *"Twelve samples will be collected from three locations, one down the center of and two adjacent to the dry well (Figure 5.6-2)." and, "In the event of auger refusal because of the presence of gravel/cobbles in the bottom of the well, an alternative location/borehole will be drilled downgradient of the well."*

NMED Comment: *The two proposed sample locations located adjacent to the dry well must be moved to a physically accessible transect location down slope of the dry well. See also, comment number 7 below. Samples must be analyzed for the same analytical suite as proposed in Table 4.0-1 and must be collected from two depths to define the nature and the extent of contamination. The Permittees must revise the Plan to provide for consulting NMED in the event auger refusal is encountered in the well bottom borehole.*

LANL Response

6. In response to Specific Comments 6 and 7, Figure 5.6-2 and the text in sections 5.15.1.2 and 5.15.2.3 have been revised to show that three of the proposed sampling locations next to the dry wells have been moved to transect locations downslope of both dry wells. Table 4.0-1 has been revised to indicate that the samples from these new locations will be collected from two depth intervals (0 to 1 ft and 1 to 2 ft) and analyzed for the same analytical suite proposed for the other samples to be collected for SWMUs 46-004(d) and 46-004(e). The text in sections 5.15.1.2 and 5.15.2.3 has been revised to state that NMED will be consulted in the event auger refusal is encountered during sampling activities at the bottom of each dry well. In addition, the description of the dry wells has been revised to indicate that the base of each well is approximately 10 ft below ground surface (bgs).

NMED Comment

7. ***Section 5.15.2.3 Scope of Activities for SWMU 46-004(e), page 26:***

   Permittees' Statements: *"Twelve samples will be collected from three locations, one down the center of and two adjacent to the dry well (Figure 5.6-2).", "Samples will be collected from four depths (at the base of the well, and 5 ft, 10 ft, and 15 ft below the well)..." and, "In the event of auger refusal because of the presence of gravel/cobbles in the bottom of the well, an alternative location/borehole will be drilled downgradient of the well."*

   NMED Comment: *Samples must also be collected from the area where the drain line exits the building. The proposed sample location north of and adjacent to the drywell must be moved to a physically accessible transect location down slope of the dry well. See also, comment number 6 above. Samples must be analyzed for the same analytical suite as proposed in Table 4.0-1 and must be collected from two depths to define the nature and the extent of contamination. Additionally, the Permittees must revise the Plan to provide for consulting NMED in the event auger refusal is encountered at the well bottom location.*

LANL Response

7. See response to Specific Comment 6 above. Figure 5.6-2 and the text in section 5.15.2.3 have been revised to show the proposed sampling location southeast of the dry well has been moved to a location next to the concrete platform/loading dock attached to the north side of building 46-58. This sampling location is the closest point to the area where the inlet drainline to the SWMU 46-004(e) dry well exits building 46-58. Samples from this location will be collected from depth intervals of 0 to 1 ft and 2 to 3 ft beneath the drainline and analyzed for the same analytical suite proposed in Table 4.0-1.

NMED Comment

8. ***Section 5.20.3, Scope of Activities for SWMU 46-004(m), page 35, first paragraph:***

   Permittees' Statement: *"Twenty samples will be collected from 10 locations in the drainage at and below the outfall (Figure 5.12-2)."*

   NMED Comment: *Section 5.5.1 of the 1996 RFI indicated "Except for the cooling water line from an air compressor, sinks and floor drains in TA-46-30 are clogged with debris and are unusable, but are not permanently plugged." Subsequent sampling below or adjacent to the drain line, between the outfall and building 46-30 has apparently not been conducted since the RFI field effort. Sample locations proposed for other SWMUs and AOCs addressed in the Plan do not provide coverage for the area between the outfall and Building 46-30. The Permittees must add a sample location between the SWMU 46-004(m) outfall and Building 46-30 to evaluate potential soil contamination below and adjacent to the drain line. The sample location must be positioned to evaluate soil contamination below the drain line as close as possible to where the line exits from Building 46-30. As discussed during NMED's August 7, 2008 site visit, the other sample location proposed for SWMU 46-004(m) must be moved from the mouth of the outfall to approximately six feet east of the outfall. Samples from these locations must be collected at two depths and analyzed for the same constituents proposed for other locations at SWMU 46-004(m).*

LANL Response

8. Figure 5.12-2 and the text in section 5.20.3 have been revised to show a new sampling location along the drainline between the SWMU 46-004(m) outfall and building 46-30 and next to the drainline as close as possible to the point where the line exits building 46-30. In addition, one of the proposed sampling locations at the outfall discharge point was moved approximately 6 ft to the east. Samples for these locations will be collected at two depths and analyzed for the same constituents proposed for the other locations at SWMU 46-004(m).

NMED Comment

9. ***Section 5.22, SWMU 46-004(q), Outfall, page 36, first paragraph:***

   Permittees' Statement: *"SWMU 46-004(q) is an outfall located north of building 46-58 (Figure 5.6-1)."*

   NMED Comment: *Figure 5.21.11-3 of the 1996 RFI shows three outfalls (designated A, B and C) associated with SWMU 46-004(q). As illustrated on that figure, the three outfalls are shown as being approximately 25 feet from each other. The 1996 RFI and the associated RFI Work Plan indicate only one of the three outfalls (Outfall "B") was sampled during the RFI field effort. The figure indicates Outfall "C" was located at the end of a drain line which is shown as originating near the northwest corner of building 46-16. The 1996 RFI narrative indicates Outfall C was a two foot diameter culvert that received parking lot runoff from the northeast quadrant of TA-46. The RFI Work Plan and the 1996 RFI narratives indicate the source of Outfall B was unknown. Neither document discussed the nature and origin(s) of Outfall "A".*

   The proximity of the outfall associated with SWMU 46-004(h) suggests that this outfall may have been one of the three outfalls described above. If there are currently three (or two) outfalls still associated with SWMU 46-004(q), the Permittees must revise the Plan to include discussion of the nature and location of each outfall and propose sampling locations at appropriate depth intervals to characterize potential impacts associated with each outfall. If there is only one outfall currently associated with SWMU 46-004(q), the Permittees must revise the Plan to include discussion concerning the physical and/or administrative disposition of the other two outfalls identified in the 1996 RFI.

LANL Response

9. Only one outfall (Outfall B) is associated with SWMU 46-004(q).

   During field investigations in preparation for writing the 1993 RFI work plan for Operable Unit (OU) 1140, alphanumeric field designators were given to outfalls at Technical Area 46 (TA-46) (LANL 1993, 020952). The field designators were merely used as a method for easily locating the outfalls during field investigations and were not linked to SWMU or area of concern (AOC) designations. Figure 5.21.11-3 of the 1996 RFI report shows three of these outfalls (designated A, B, and C), which are located within close proximity of each other (LANL 1996, 054929). Although the figure shows Outfalls A, B, and C within the boundary of SWMU 46-004(q), the figure is incorrect. Outfalls B and C are in close proximity to, but do not fall within, the SWMU 46-004(q) boundary. Text in the 1993 RFI work plan (p. 5-124) corroborates that Outfall A is SWMU 46-004(h) and goes on to describe the source of Outfall A as the floor drains and possibly the roof drains in building 46-16. The 1993 RFI work plan also provides the description for SWMU 46-004(q), stating that the SWMU is Outfall B

(p. 5-124). Outfall C is described in Table 5-4-4 (p. 5-134) of the 1993 RFI work plan as a corrugated metal pipe that receives storm runoff from the area west of building 46-16 (LANL 1993, 020952).

The work plan addresses the sampling for Outfall A under the proposed sampling for SWMU 46-004(h) (p. 30). The work plan addresses the sampling for Outfall B under the proposed sampling for SWMU 46-004(q) (p. 36). Outfall C is not a SWMU or AOC, nor is it associated with any SWMUs or AOCs; therefore, no sampling is proposed, and no change to the text or figures is required.

NMED Comment

10. Section 5.32.2, Scope of Activities for SWMU 46-005, page 45, second paragraph:

Permittees' Statement: *"Fourteen samples will be collected from seven locations within and next to the surface impoundments (Figure 5.8-2)."*

NMED Comment: *The northern impoundment (structure 46-171) is approximately 500 square feet larger than the southern impoundment (structure 46-170). The Permittees must revise the Plan (and associated figures) to move the proposed sample location from outside of and just east of the southern impoundment (structure 46-170) to a location south of the fence along the north side of the north impoundment (structure 46-171) to evaluate potential overflow from the impoundment. In addition, one of the proposed sample locations from the south impoundment must be moved to a location inside the northern impoundment to provide better sample coverage within the structure.*

LANL Response

10. Figure 5.8-2 of the work plan has been revised to show the proposed sampling location outside of and just east of the southern impoundment (structure 46-170) has been moved to a location south of the fence along the north side of the north impoundment (structure 46-171). In addition, one of the proposed sampling locations from the south impoundment has been moved to a location inside the northern impoundment, and the symbol for the sampling location next to the line connecting the two impoundments has been changed (from a circle to a triangle) to denote that surface and subsurface samples will be collected. In addition, section 5.32.2, Table 4.0-1, and Figure 5.8-2 have been revised to clarify sampling depths associated with the four locations beneath the drainlines.

NMED Comment

11. Section 5.36.3, Scope of Activities for SWMU 46-006(d), page 50, first paragraph:

Permittees' Statement: *"Eight samples will be collected from four locations within the SWMU boundary along the north wall of building 46-31 (Figure 5.5-2.). Samples will be collected from two depths (2 to 3 ft and 4 to 5 ft)...".*

NMED Comment: *The Permittees must propose collection of revised sample depths (0 to 1 and 4 to 5 feet) in each of the four locations along the north building wall.*

LANL Response

11. The text in section 5.36.3 and Table 4.0-1 have been revised to indicate that the samples from the four locations within the SWMU boundary along the north wall of building 46-31 will be collected from depth intervals of 0 to 1 ft and 4 to 5 ft beneath the asphalt within SWMU 46-006(d).

NMED Comment

12. Section 5.46.3, Scope of Activities for SWMU 46-009(a), page 59, first and second paragraphs:

Given the uncertainty concerning the nature of materials that may have been disposed in the landfill area, the Permittees must include analyses of total petroleum hydrocarbons (TPH) for samples collected within the landfill and from sample locations down slope of the landfill area. Alternatively, the Permittees may provide justification for why TPH analyses are not appropriate at this SWMU. Additional sample locations are needed in the SWSC Canyon drainage area shown on the lower right-hand corner of Figure 5.2-2 and east of the SWSC WWTP in the drainage area near the eastern boundary of Technical Area (TA) 46 as shown on Plate 1 of the Plan. See also, comment 13 below.

LANL Response

12. The text in section 5.46.3 and Table 4.0-1 have been revised to indicate that samples collected within the landfill and from sample locations downgradient of the landfill will be analyzed for total petroleum hydrocarbons (TPH). Figure 5.2-2, Table 4.0-1, and text in section 5.46.3 have been revised to include 14 samples collected from seven additional locations in SWSC Canyon (see response to Specific Comment 13).

NMED Comment

13. Section 5.47.2, Scope of Activities for SWMU 46-009(b), page 59, second paragraph:

Permittees' Statement: *"Six samples will be collected from three mesa slope next to and downgradient of the former surface disposal area (Figure 5.1-2)."*

NMED Comment: *In addition to the three mesa slope locations shown on Figure 5.1-2 of the Plan, sample locations must be proposed in the eastward drainage located just south of the southernmost mesa slope location. The Permittees must ensure that samples are collected in the drainage to Cañada del Buey Canyon to define the nature and extent of contamination. See also, comment 12 above.*

LANL Response

13. Figure 5.1-2 and the text in section 5.47.2 have been revised to include 14 samples from seven additional locations in the drainage south and east of SWMU 46-009(b) in SWSC Canyon to define the nature and extent of contamination. Table 4.0-1 has been revised to indicate samples will be collected from two depth intervals at each of the new sampling locations and analyzed for the same constituents proposed for other locations at SWMU 46-009(b).

NMED Comment

14. Sections 5.48.3, Scope of Activities for SWMU 46-010(d), page 60, first and second paragraphs:

Permittees' Statements: *"Four samples will be collected from two locations at the storage area (Figure 5.2-2)." and, "Six samples will be collected from three locations south and downgradient of the storage area (Figure 5.2-2)."*

NMED Comment: The Permittees must revise the Plan and propose collection of samples from all sample locations and intervals to include analyses of TPH or provide justification for why TPH analyses are not appropriate at this SWMU

LANL Response

14. The text in section 5.48.3 and Table 4.0-1 have been revised to indicate that the 10 samples to be collected within and downgradient of SWMU 46-010(d) will be analyzed for TPH.

NMED Comment

15. Section 5.49.2, Scope of Activities for AOC C-46-001, page 61, second sentence:

Permittees' Statement: "Since the location of the spill is not well documented, indirect sampling of AOC C-46-001 is proposed."

NMED Comment: Given the uncertainty of where the spill occurred and the drainage patterns of the paved areas around Building 46-75, a multi-depth sample location is needed above the storm drain approximately 25 feet southwest of the southwest corner of the building shown on Figure 5.4-2 of the Plan.

LANL Response

15. Figure 5.4-2 and the text in section 5.49.23 have been revised to indicate that two samples will be collected from one additional sampling location above the storm drain, approximately 15 ft southwest of the southwest corner of building 46-75. Table 4.0-1 has been revised to indicate that the samples will be collected from two depth intervals (0 to 1 ft and 2 to 3 ft beneath the asphalt) and analyzed only for mercury.

NMED Comment

16. Figure 5.12-2, page 96:

As discussed during the August 2008 site visit, LANL staff agreed that the sample locations within the down slope areas on the north side of Cañada del Buey for various SWMUs and AOCs illustrated on the figure are not positioned in well defined drainages. The proposed locations should be spread over appropriate bench areas below the mesa top to define contaminant extent for affected SWMUs and AOCs.

LANL Response

16. Since there are no defined drainage channels below the outfalls of SWMUs 46-004(c2), 46-004(g), 46-004(m), 46-004(z), 46-004(y), 46-004(x), 46-004(u), 46-004(v), 46-004(h), and 46-004(q) and AOC 46-004(f2), Figures 5.10-1 and 5.12-2 have been modified to show proposed sampling locations in transects across the bench areas below the mesa top where sheet flow could carry potential contaminants to the canyon bottom. The sampling locations associated with individual SWMUs and AOCs shown in these figures have been revised based on the new hillside transect sampling approach agreed upon with NMED during the August 2008 site visit. Sampling locations previously sited in the canyon bottom were relocated to the toe of the slope as part of the hillside transect sampling approach (see also the crosswalk table, the revised work plan text, and Table 4.0-1).

REFERENCES

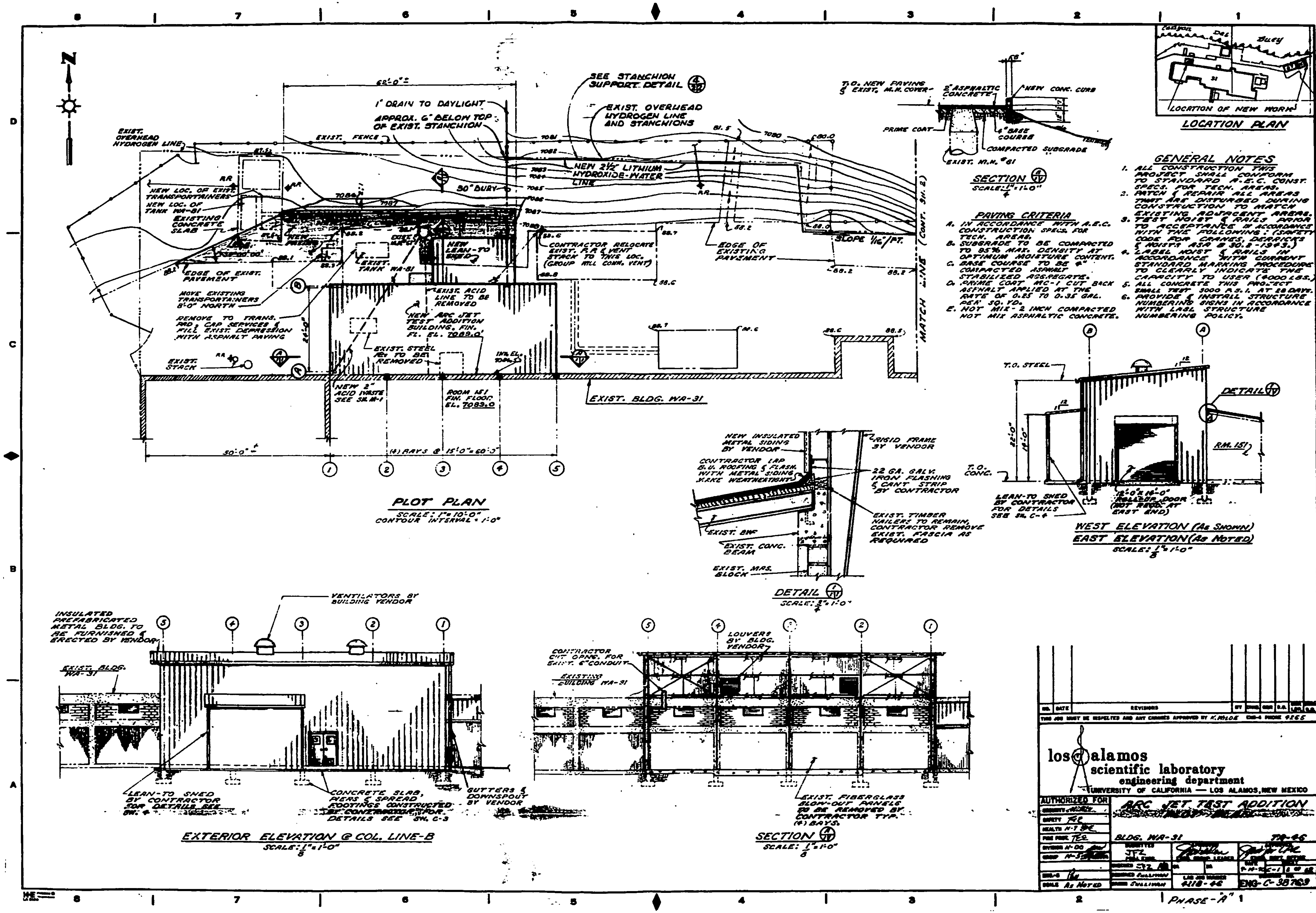
LANL (Los Alamos National Laboratory), August 1993. "RFI Work Plan for Operable Unit 1140," Los Alamos National Laboratory document LA-UR-93-1940, Los Alamos, New Mexico. (LANL 1993, 020952)

LANL (Los Alamos National Laboratory), June 1996. "RFI Report for Potential Release Sites in TA-46, 46-003(h), 46-004(b), 46-004(g), 46-004(h), 46-004(m), 46-004(q), 46-004(s), 46-004(u), 46-004(v), 46-004(x), 46-004(y), 46-004(z), 46-004(a2), 46-004(b2), 46-004(c2), 46-004(d2), 46-004(e2), 46-004(f2), 46-006(a), 46-006(b), 46-006(c), 46-006(d), 46-006(f), 46-006(g), 46-007, 46-008(b), 46-010(d), C-46-002, C-46-003," Los Alamos National Laboratory document LA-UR-96-1957, Los Alamos, New Mexico. (LANL 1996, 054929)

LANL (Los Alamos National Laboratory), June 2008. "Investigation Work Plan for Upper Cañada del Buey Aggregate Area," Los Alamos National Laboratory document LA-UR-08-3864, Los Alamos, New Mexico. (LANL 2008, 101802)

Attachment 1

Engineering Drawing C-38763



PLOT PLAN
SCALE: 1"=10'-0"
CONTOUR INTERVAL = 1'-0"
SEE STANCHION SUPPORT DETAIL
EXIST. OVERHEAD HYDROGEN LINE AND STANCHIONS
1" DRAIN TO DAYLIGHT
APPROX. 6" BELOW TOP OF EXIST. STANCHION
EXIST. OVERHEAD HYDROGEN LINE
EXIST. FENCE
NEW 2½" LITHIUM HYDROXIDE-WATER LINE
30" DURY
NEW LOC. OF EXIST. TRANSPORTAINERS
NEW LOC. OF TANK WA-81
EXISTING CONCRETE SLAB
EDGE OF EXIST. PAVEMENT
MOVE EXISTING TRANSPORTAINERS 8'-0" NORTH
REMOVE TO TRANS. PAD, CAP SERVICES & FILL EXIST. DEPRESSION WITH ASPHALT PAVING
EXIST. STACK
EXIST. TANK WA-81
NEW LEAN-TO SHED
CONTRACTOR RELOCATE EXIST. P.R. & VENT STACK TO THIS LOC. (GROUP WILL CONN. VENT)
EDGE OF EXISTING PAVEMENT
SLOPE 1/16"/FT.
MATCH LINE (CONT. SH. 2)
EXIST. ACID LINE TO BE REMOVED
NEW ARC JET TEST ADDITION BUILDING, FIN. FL. EL. 7089.0
EXIST. STEEL PO. TO BE REMOVED
NEW 2" ACID WASTE SEE SH. M-1
ROOM 151 FIN. FLOOR EL. 7089.0
EXIST. BLDG. WA-31
50'-0"
(4) BAYS @ 15'-0" = 60'-0"
62'-0"
LOCATION OF NEW WORK
LOCATION PLAN
T.O. NEW PAVING & EXIST. M.H. COVER
2" ASPHALTIC CONCRETE
NEW CONC. CURB
PRIME COAT
4" BASE COURSE
COMPACTED SUBGRADE
EXIST. M.H. #61
SECTION
SCALE: 1/4"=1'-0"
PAVING CRITERIA
A. IN ACCORDANCE WITH A.E.C. CONSTRUCTION SPECS. FOR TECH. AREAS.
B. SUBGRADE TO BE COMPACTED TO 95% MAX. DENSITY AT OPTIMUM MOISTURE CONTENT.
C. BASE COURSE TO BE 4" COMPACTED ASPHALT STABILIZED AGGREGATE.
D. PRIME COAT MC-1 CUT BACK ASPHALT APPLIED AT THE RATE OF 0.25 TO 0.35 GAL. PER SQ. YD.
E. HOT MIX - 2 INCH COMPACTED HOT MIX ASPHALTIC CONCRETE.
GENERAL NOTES
1. ALL CONSTRUCTION THIS PROJECT SHALL CONFORM TO STANDARD A.E.C. CONST. SPECS. FOR TECH. AREAS.
2. PATCH & REPAIR ALL AREAS THAT ARE DISTURBED DURING CONSTRUCTION TO MATCH EXISTING ADJACENT AREAS.
3. TEST HOIST & RAILS PRIOR TO ACCEPTANCE IN ACCORDANCE WITH THE FOLLOWING: (SAFETY CODE FOR CRANES, DERRICKS & HOISTS ASA B 30.2-1943.)
4. LABEL HOIST & RAILS IN ACCORDANCE WITH CURRENT STANDARD MARKING PROCEDURE TO CLEARLY INDICATE THE CAPACITY TO USER (4000 LBS.)
5. ALL CONCRETE THIS PROJECT SHALL TEST 3000 P.S.I. AT 28 DAYS.
6. PROVIDE & INSTALL STRUCTURE NUMBERING SIGNS IN ACCORDANCE WITH LASL STRUCTURE NUMBERING POLICY.
NEW INSULATED METAL SIDING BY VENDOR
RIGID FRAME BY VENDOR
CONTRACTOR LAP B.U. ROOFING & FLASH. WITH METAL SIDING MAKE WEATHERTIGHT
22 GA. GALV. IRON FLASHING & CANT STRIP BY CONTRACTOR
EXIST. TIMBER NAILERS TO REMAIN, CONTRACTOR REMOVE EXIST. FASCIA AS REQUIRED
EXIST. BUR
EXIST. CONC. BEAM
EXIST. MAS. BLOCK
DETAIL
SCALE: 3/4"=1'-0"
T.O. STEEL
DETAIL
RM. 151
T.O. CONC.
LEAN-TO SHED BY CONTRACTOR FOR DETAILS SEE SH. C-4
12'-0" x 16'-0" ROLLUP DOOR (NOT REQD. AT EAST END)
WEST ELEVATION (AS SHOWN)
EAST ELEVATION (AS NOTED)
SCALE: 1/8"=1'-0"
INSULATED PREFABRICATED METAL BLDG. TO BE FURNISHED & ERECTED BY VENDOR
VENTILATORS BY BUILDING VENDOR
EXIST. BLDG. WA-31
LEAN-TO SHED BY CONTRACTOR FOR DETAILS SEE SH. 4
CONCRETE SLAB, PIERS & SPREAD FOOTINGS CONSTRUCTED BY CONTRACTOR FOR DETAILS SEE SH. C-3
GUTTERS & DOWNSPOUT BY VENDOR
EXTERIOR ELEVATION @ COL. LINE-B
SCALE: 1/8"=1'-0"
CONTRACTOR CUT OPNG. FOR EXIST. 6" CONDUIT
EXISTING BUILDING WA-31
LOUVERS BY BLDG. VENDOR
EXIST. FIBERGLASS BLOW-OUT PANELS TO BE REMOVED BY CONTRACTOR TYP. (4) BAYS.
SECTION
SCALE: 1/8"=1'-0"
REVISIONS
THIS JOB MUST BE INSPECTED AND ANY CHANGES APPROVED BY K. WILDE ENG-4 PHONE 4265
los alamos scientific laboratory
engineering department
UNIVERSITY OF CALIFORNIA — LOS ALAMOS, NEW MEXICO
AUTHORIZED FOR
ARC JET TEST ADDITION
BLDG. WA-31
TA-46
SCALE AS NOTED
4118-46
ENG-C-38769
PHASE-"A"

LA-UR-08-6122
September 2008
EP2008-0508

Investigation Work Plan for Upper Cañada del Buey Aggregate Area, Revision 1

Los Alamos
NATIONAL LABORATORY
EST.1943

Prepared by the Environmental Programs Directorate

LA-UR-08-6122
EP2008-0508

Investigation Work Plan for Upper Cañada del Buey Aggregate Area, Revision 1

September 2008

Responsible project leader:

Printed Name	Signature	Title	Organization	Date
Kent Rich		Project Leader	Environmental Programs	9/23/08

Responsible LANS representative:

Printed Name	Signature	Title	Organization	Date
Susan G. Stiger		Associate Director	Environmental Programs	9/24/08

Responsible DOE representative:

Printed Name	Signature	Title	Organization	Date
David R. Gregory		Project Director	DOE-LASO	9/29/08

EXECUTIVE SUMMARY

This investigation work plan presents the investigation activities at solid waste management units (SWMUs) and areas of concern (AOCs) located within the Upper Cañada del Buey Aggregate Area. The Upper Cañada del Buey Aggregate Area consists of 83 SWMUs and AOCs located in Technical Area 46 (TA-46) and TA-52. This aggregate area also includes two sites associated with former TA-04 but which lie within the boundary of TA-52. These two sites will be investigated as part of this work plan. TA-46 contains 71 SWMUs and AOCs: 17 sites have been approved for no further action (NFA), and 54 sites will be investigated as part of this work plan. TA-52 contains 10 sites: 9 have been approved for NFA and 1 is pending New Mexico Environmental Department review.

This investigation work plan identifies and describes the activities needed to complete the investigation of the remaining 56 SWMUs and AOCs. Details of previous investigations and analytical results for the 56 sites included in this work plan are provided in the historical investigation report for Upper Cañada del Buey Aggregate Area.

The objective of this work plan is to evaluate the historical data and, based on that evaluation, to propose additional sampling as necessary to define the nature and extent of contamination associated with the SWMUs, AOCs, and consolidated units within the Upper Cañada del Buey 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 (Figure 1.0-1) is located in north-central New Mexico approximately 60 mi northeast of Albuquerque and 20 mi northwest of Santa Fe. The Laboratory site covers 40 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 to 7800 ft above mean sea level (amsl).

The solid waste management units (SWMUs), areas of concern (AOCs), and consolidated units addressed in this investigation work plan are potentially contaminated with both 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 5400.5, "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 the March 1, 2005, Compliance Order on Consent (the Consent Order). This work plan describes work activities that will be executed and completed in accordance with the Consent Order.

1.1 Work Plan Overview

The Upper Cañada del Buey Aggregate Area consists of 83 SWMUs and AOCs located in Technical Area 46 (TA-46) and TA-52 (Table 1.1-1 and Plate 1). Historical details of previous investigations and data for these sites are provided in the historical investigation report (HIR) for Upper Cañada del Buey Aggregate Area (LANL 2008, 101803, p. 3-2). This aggregate area also includes two sites that are associated with former TA-04 but that lie within the boundary of TA-52. Both sites will be investigated as part of this work plan. TA-46 contains 71 SWMUs and AOCs: 17 sites have been approved for no further action (NFA), and 54 sites will be investigated as part of this work plan. TA-52 contains 10 sites: 9 have been approved for NFA and 1 is pending NMED review. This work plan proposes investigating 56 sites using information from previous field investigations to evaluate current conditions at each site. Table 1.1-1 provides a summary of the 83 sites within the Upper Cañada del Buey Aggregate Area. For NFA and pending NFA sites, only brief descriptions and the reference for the approval document are provided in Table 1.1-1.

Section 2 of this work plan presents the general site information, operational history, and the preliminary conceptual site model of the Upper Cañada del Buey Aggregate Area. General site conditions are presented in section 3. The specific site descriptions and proposed investigation activities are presented in sections 4, 5, and 6. The investigation methods are described in section 7. Ongoing monitoring and sampling programs in the Upper Cañada del Buey Aggregate Area and surrounding TAs are presented in section 8, and an overview of the anticipated schedule is presented in section 9. Section 10 lists the references cited in this work plan and the map data sources. Appendix A contains the list of acronyms and abbreviations used in this investigation work plan, a metric conversion table, and a data qualifier definition table. Appendix B describes the management of investigation-derived waste (IDW).

1.2 Work Plan Objectives

The objective of this work plan is to determine the nature and extent of releases, if any, from the 56 sites under investigation. To accomplish this objective, this work plan presents historical and background information on the sites; describes the strategy for proposed data collection activities, and identifies and proposes appropriate methods for collecting samples and analyzing data.

2.0 BACKGROUND

2.1 General Site Information

The Upper Cañada del Buey Aggregate Area consists of 83 SWMUs and AOCs located in TA-46 and TA-52 (Plate 1). This aggregate area also includes two sites that are associated with former TA-04 but that lie within the boundary of TA-52. These two sites will be investigated as part of this work plan. TA-46 contains 71 SWMUs and AOCs: 17 sites have been approved for NFA, and 54 sites will be investigated as part of this work plan. TA-52 contains 10 sites: 9 have been approved for NFA and 1 is pending NMED review.

Former TA-04, called Alpha Site, was used as a firing site until the late 1940s. The former TA lies within the current boundaries of TA-63 and TA-52. The SWMU and AOC within former TA-04 addressed in this work plan are located within the boundaries of TA-52.

TA-46 is one of the Laboratory's basic research areas. TA-46 is bounded to the north by Cañada del Buey. A small tributary to Cañada del Buey, informally known as Sanitary Waste System Consolidation (SWSC) Canyon, originates near the southern end of TA-46 and drains northeast to Cañada del Buey. The Laboratory's main sanitary waste treatment plant, the SWSC facility, was constructed in 1992 and is located in this small tributary canyon. A detached cluster of buildings and two sewage ponds are located south of SWSC Canyon. Pajarito Road extends along the southern boundary of TA-46 (LANL 1993, 020952, p. 2-1).

TA-52 provides a wide variety of theoretical and computational research and development activities related to nuclear reactor performance and safety, and several environmental, safety, and health activities.

2.2 Operational History

The Laboratory's primary use of Cañada del Buey has been as a buffer zone for surface and subsurface material disposal areas (MDAs) at TA-54 on Mesita del Buey, located just south of the canyon. The earliest discharges to Cañada del Buey were associated with outfalls, surface runoff, and dispersion from firing sites located at former TA-04 (LANL 1999, 064617, p. 1-5).

TA-04 was used as a firing site during the late 1940s. Maximum charges fired were 200 lb. Other documented studies at TA-04 included smaller tests of the "pin shot" and "magnetic" methods of studying implosions and equation of state experiments. Use of TA-04 was discontinued in the late 1940s, and the TA was decontaminated and decommissioned in 1985.

TA-46 was established in 1954 as a weapons assembly site but was never used for weapons assembly. Instead, TA-46 was used to house the Nuclear Rocket Division's Rover Program that developed nuclear reactors for propulsion of space rockets. TA-46 was improved with additional buildings in the 1950s. These buildings housed experiments that included coolant-flow and structural testing of fuel elements made of uranium-loaded graphite. The Rover Program terminated in 1973 (LANL 1993, 020952, p. 2-1).

The Jumper Program, which developed uranium-isotope separation methods, was established at TA-46 in 1976. This Program used lasers to excite hexafluoride gas of various enrichments. The Jumper Program terminated in the early 1980s. In addition, the Energy Division conducted solar energy research at TA-46 from the 1970s to the late 1980s. Other activities at TA-46 included free-electron laser research, heat-pipe research, accelerator technology, electronics development, and production of nonradioactive isotopes of oxygen, carbon, and nitrogen. Currently, laser research is the principal activity at TA-46.

TA-52 provides a variety of theoretical and computational research and development related to nuclear reactor performance and safety, and several environment, safety, and health activities.

2.3 Conceptual Site Model

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

2.3.1 Potential Contaminant Sources

Releases at the sites within the Upper Cañada del Buey Aggregate Area may have occurred as a result of air emissions; potential leaks from septic systems, tanks, waste lines and drains; discharges from outfalls; and spills. Previous sampling results indicate contamination from inorganic chemicals, organic chemicals, and radionuclides (LANL 2008, 101803). Additional sampling is needed to determine the nature and extent of contamination.

2.3.2 Potential Contaminant Transport Mechanisms

Current potential transport mechanisms that may lead to exposure include

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

2.3.3 Potential Receptors

Potential receptors at one or more of the sites include on-site and nearby Laboratory workers, recreational users of nearby trails, and plants and animals.

2.3.4 Cleanup Standards

As specified in section VII.B.1 of the Consent Order, screening levels will be used as soil cleanup levels unless they are determined to be impracticable or unless values do not exist for the current and reasonably foreseeable future land use. Human health screening levels for chemicals and radionuclides are provided in Table 2.3-1.

2.4 Data Overview

Data evaluated in this report include historical data collected from 1994 to 1998 as part of Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) activities. In the Laboratory's Environmental Programs (EP) Directorate's database, all data records include a vintage code field denoting how and where samples were submitted for analyses. In the early years of the RFI, the samples were submitted to the Laboratory's Chemical Science and Technology (CST) Division. They either were analyzed at a CST laboratory (on-site) or submitted to one of several off-site contract laboratories. Samples analyzed at a CST laboratory are identified by the vintage code "CST Onsite." Samples submitted by CST Division to off-site laboratories are identified by the vintage code "CST Offsite." From late 1995 until the present, samples have been submitted through the Sample Management Office (SMO) to off-site contract laboratories. These samples are identified by the vintage code "SMO." Analytical data presented in this report provide supporting information for the investigation activities proposed in this work plan.

All data presented for the SWMU and AOC within TA-04 in the Upper Cañada del Buey Aggregate Area are reported with the "SMO" vintage code and are decision-level data that are used to determine the nature and extent of releases. All previous sampling data for the SWMUs and AOCs within TA-46 are screening-level only and are not used to determine the nature and extent of releases. The screening-level data are presented in the HIR (LANL 2008, 101803) and are summarized in this work plan.

3.0 SITE CONDITIONS

3.1 Surface Conditions

3.1.1 Soil

Soil on the Pajarito Plateau was initially mapped and described by Nyhan et al. (1978, 005702). The soil on the slopes between the mesa tops and canyon floors was mapped as mostly steep rock outcrops consisting of approximately 90% bedrock outcrop and patches of shallow, weakly developed colluvial soil. South-facing canyon walls generally are steep and usually have shallow soil in limited, isolated patches between rock outcrops. In contrast, the north-facing canyon walls generally have more extensive areas of shallow, dark-colored soil under thicker forest vegetation. The canyon floors generally contain poorly developed, deep, well-drained soil on floodplain terraces or small alluvial fans (Nyhan et al. 1978, 005702).

The soil on the mesa top in the Upper Cañada del Buey Aggregate Area belongs generally to the Hackroy series (Nyhan et al. 1978, 005702). Hackroy soil consists of very shallow to shallow, well-drained, and moderately developed soil with an A-B horizon sequence. Soil textures can range from sandy loams to clay loams. The parent material of the soil may range from Bandelier Tuff to sequences of alluvium/colluvium interstratified with moderately developed to well-developed buried soil.

3.1.2 Surface Water

Most surface water in the Los Alamos area occurs as ephemeral, intermittent, or interrupted streams in canyons cut into the Pajarito Plateau. Springs on the flanks of the Jemez Mountains, west of the Laboratory's western boundary, supply flow to the upper reaches of Cañon de Valle and to Guaje, Los Alamos, Pajarito, and Water Canyons (Purtymun 1975, 011787; Stoker 1993, 056021). These springs discharge water perched in the Bandelier Tuff and Tschicoma Formation at rates from 2 to

135 gal./min (Abeele et al. 1981, 006273). The volume of flow from the springs maintains natural perennial reaches of varying lengths in each of the canyons.

The hydrogeology of the canyon systems is discussed in section 2.1.3 of the Hydrogeologic Workplan (LANL 1998, 059599). The surface water infiltration pathways within the aggregate area include native or disturbed soil, unconsolidated alluvium, Bandelier Tuff, Puye Formation, and basalt, faults and fracture systems, and cooling joints (LANL 1999, 064617, p. 3-25).

No springs are known to be present in Cañada del Buey. However, a possible seep may be present north of TA-46 near the location of temporary flume, structure 46-1, which is downgradient of National Pollutant Discharge Elimination System (NPDES) outfalls on the north side of TA-46. It is not known if a natural seep is present at this location or if damp soil conditions are the result of effluent discharges at TA-46. There is no flow from the possible seep (LANL 1999, 064617, p. 3-106).

The SWSC plant is located at TA-46 and was initially considered for discharge into the TA-46 fork of Cañada del Buey. But because portions of the Cañada del Buey channel near TA-54 and MDA G cross onto San Ildefonso Pueblo land, Cañada del Buey did not offer an adequate length of stream channel to ensure that surface water effluent flow would remain on Laboratory property. Therefore, effluent from the SWSC plant at TA-46 is pumped to TA-03 and discharged into upper Sandia Canyon. No treated effluent has been discharged from the SWSC plant into Cañada del Buey (LANL 1997, 056684, p. 28).

Cañada del Buey receives runoff from surrounding mesa tops and effluent from NPDES outfalls at TA-46. The runoff and effluent do not support continuous flow in any part of the canyon; the stream is entirely ephemeral on Laboratory property (LANL 1999, 064617, p. 3-103). Local runoff from seasonal rainstorms occasionally extends from the Laboratory boundary downstream as far as the Rio Grande, but flow in the upper and middle canyon is rarely continuous (LANL 1999, 064617, p. 3-5).

No perennial reaches occur in Cañada del Buey on Laboratory property. A continuous reach extends a short distance downstream from the White Rock sewage treatment plant discharge point. Surface water flow in the stream channel and across the eastern Laboratory boundary at NM 4 is ephemeral. Flow reaches the Rio Grande occasionally as the result of high snowmelt runoff or periodic storm events (LANL 1999, 064617, p. 3-113).

3.1.3 Land Use

Currently, land use of the mesa tops within the Upper Cañada del Buey Aggregate Area is industrial. It is anticipated that the mesa tops will remain industrial through continued use by the Laboratory and will not change in the foreseeable future. Public access is controlled at TA-46 through physical and administrative controls such as fencing and access control. Cañada del Buey is used as a recreational area by Laboratory workers; however, no recreational use of the land occurs within the sites under investigation.

3.2 Subsurface Conditions

3.2.1 Anticipated Stratigraphic Units

The stratigraphy of the Upper Cañada del Buey Aggregate Area is summarized in this section. Additional information on the geologic setting of the area and information on the Pajarito Plateau can be found in the Laboratory's Hydrogeologic Workplan (LANL 1998, 059599).

The bedrock at or near the surface of the mesa top is the Bandelier Tuff. There are approximately 1250 ft of volcanic and sedimentary materials between any potential contaminant-bearing units at the mesa-top surface and the regional aquifer. The stratigraphic units that may be encountered during investigation of the Upper Cañada del Buey Aggregate Area are described briefly in the following sections. The descriptions begin with the oldest (deepest) and proceed to the youngest (topmost). The stratigraphic units that may be encountered during investigation of the Upper Cañada del Buey Aggregate Area are limited to the upper units (Qbt 3, Qbt 2, Qbt 1v, and Qbt 1g) of the Tshirege Member of the Bandelier Tuff, described below (LANL 1999, 064617; LANL 2006, 093196, p. 13). Stratigraphic units comprising the Bandelier Tuff are shown in Figure 3.2-1.

The Bandelier Tuff

The Bandelier Tuff consists of the Otowi and Tshirege Members, which are stratigraphically separated in many places by the tephras and volcaniclastic sediment of the Cerro Toledo interval. The Bandelier Tuff was emplaced during cataclysmic eruptions of the Valles Caldera between 1.61 and 1.22 million yr ago. The tuff is composed of pumice, minor rock fragments, and crystals supported in an ashy matrix. It is a prominent cliff-forming unit because of its generally strong consolidation (Broxton and Reneau 1995, 049726).

Otowi Member. Griggs and Hem (1964, 092516), Smith and Bailey (1966, 021584), Bailey et al. (1969, 021498), and Smith et al. (1970, 009752) describe the Otowi Member. It consists of moderately consolidated (indurated), porous, and nonwelded vitric tuff (ignimbrite) that forms gentle colluvium-covered slopes along the base of canyon walls. The Otowi ignimbrites contain light gray to orange pumice that is supported in a white to tan ash matrix (Broxton et al. 1995, 050121; Broxton et al. 1995, 050119; Goff 1995, 049682). The ash matrix consists of glass shards, broken pumice, and crystal fragments, and fragments of perlite.

The Guaje Pumice Bed. The Guaje Pumice Bed occurs at the base of the Otowi Member, making a significant and extensive marker horizon. The Guaje Pumice Bed (Bailey et al. 1969, 021498; Self et al. 1986, 021579) contains well-sorted pumice fragments whose mean size varies between 0.8 and 1.6 in. Its thickness averages approximately 28 ft below most of the plateau, with local areas of thickening and thinning. Its distinctive white color and texture make it easily identifiable in borehole cuttings and core, and it is an important marker bed for the base of the Bandelier Tuff.

Tephras and Volcaniclastic Sediment of the Cerro Toledo Interval. The Cerro Toledo interval is an informal name given to a sequence of volcaniclastic sediment and tephra of mixed provenance that separates the Otowi and Tshirege Members of the Bandelier Tuff (Broxton et al. 1995, 050121; Broxton and Reneau 1995, 049726; Goff 1995, 049682). Although it is located between the two members of the Bandelier Tuff, it is not considered part of that formation (Bailey et al. 1969, 021498). Outcrops of the Cerro Toledo interval generally occur wherever the top of the Otowi Member appears in Sandia Canyon and in canyons to the north. The unit contains primary volcanic deposits described by Smith et al. (1970, 009752) and reworked volcaniclastic sediment. The occurrence of the Cerro Toledo interval is widespread; however, its thickness is variable, ranging between several feet and more than 100 ft.

The predominant rock types in the Cerro Toledo interval are rhyolitic tuffaceous sediment and tephra (Heiken et al. 1986, 048638; Stix et al. 1988, 049680; Broxton et al. 1995, 050121; Goff 1995, 049682). The tuffaceous sediment is the reworked equivalents of Cerro Toledo rhyolite tephra. Oxidation and clay-rich horizons indicate that at least two periods of soil development occurred within the Cerro Toledo deposits. Because the soil is rich in clay, it may act as a barrier to the movement of vadose zone moisture. Some of the deposits contain both crystal-poor and crystal-rich varieties of pumice. The pumice deposits tend to form porous and permeable horizons within the Cerro Toledo interval, and locally may provide important pathways for moisture transport in the vadose zone. A subordinate lithology within the

Cerro Toledo interval includes clast-supported gravel, cobble, and boulder deposits derived from the Tschicoma Formation (Broxton et al. 1995, 050121; Goff 1995, 049682; Broxton and Reneau 1996, 055429).

Tshirege Member. The Tshirege Member is the upper member of the Bandelier Tuff and is the most widely exposed bedrock unit of the Pajarito Plateau (Griggs and Hem 1964, 092516; Smith and Bailey 1966, 021584; Bailey et al. 1969, 021498; 1970, 009752). Emplacement of this unit occurred during eruptions of the Valles Caldera approximately 1.2 million yr ago (Izett and Obradovich 1994, 048817; Spell et al. 1996, 055542). The Tshirege Member is a multiple-flow, ash-and-pumice sheet that forms the prominent cliffs in most of the canyons on the Pajarito Plateau. It is a chemical cooling unit whose physical properties vary vertically and laterally. The consolidation in this member is largely from compaction and welding at high temperatures after the tuff was emplaced. Its light brown, orange-brown, purplish, and white cliffs have numerous, mostly vertical fractures that may extend from several feet up to several tens of feet. The Tshirege Member includes thin but distinctive layers of bedded, sand-sized particles called surge deposits that demark separate flow units within the tuff. The Tshirege Member is generally over 200 ft thick.

The Tshirege Member differs from the Otowi Member most notably in its generally greater degree of welding and compaction. Time breaks between the successive emplacement of flow units caused the tuff to cool as several distinct cooling units. For this reason, the Tshirege Member consists of at least four cooling subunits that display variable physical properties vertically and horizontally (Smith and Bailey 1966, 021584; Crowe et al. 1978, 005720; Broxton et al. 1995, 050121). The welding and crystallization variability in the Tshirege Member produce recognizable vertical variations in its properties, such as density, porosity, hardness, composition, color, and surface-weathering patterns. The subunits are mappable based on a combination of hydrologic properties and lithologic characteristics.

Broxton et al. (1995, 050121) provide extensive descriptions of the Tshirege Member cooling units. The following paragraphs describe, in ascending order, subunits of the Tshirege Member.

The Tsankawi Pumice Bed forms the base of the Tshirege Member. Where exposed, it is commonly 20 to 30 in. thick. This pumice-fall deposit contains moderately well-sorted pumice lapilli (diameters reaching about 2.5 in.) in a crystal-rich matrix. Several thin ash beds are interbedded with the pumice-fall deposits.

Subunit Qbt 1g is the lowermost tuff subunit of the Tshirege Member. It consists of porous, nonwelded, and poorly sorted ash-flow tuff. This unit is poorly indurated but nonetheless forms steep cliffs because of a resistant bench near the top of the unit; the bench forms a harder, protective cap over the softer underlying tuff. A thin (4 to 10 in.), pumice-poor surge deposit commonly occurs at the base of this unit.

Subunit Qbt 1v forms alternating cliff-like and sloping outcrops composed of porous, nonwelded, crystallized tuff. The base of this unit is a thin, horizontal zone of preferential weathering that marks the abrupt transition from glassy tuff below (in unit Qbt 1g) to the crystallized tuff above. This feature forms a widespread marker horizon (locally termed the vapor-phase notch) throughout the Pajarito Plateau. The lower part of Qbt 1v is orange-brown, resistant to weathering, and has distinctive columnar (vertical) joints; hence, the term "colonnade tuff" is an appropriate description. A distinctive white band of alternating cliff- and slope-forming tuffs overlies the colonnade tuff. The tuff of Qbt 1v is commonly nonwelded (pumices and shards retain their initial equant shapes) and have an open, porous structure.

Subunit Qbt 2 forms a distinctive, medium-brown, vertical cliff that stands out in marked contrast to the slope-forming, lighter-colored tuff above and below. It shows the greatest degree of welding in the

Tshirege Member. A series of surge beds commonly mark its base. It typically has low porosity and permeability relative to the other units of the Tshirege Member.

Subunit Qbt 3 is a nonwelded to partially welded, vapor-phase-altered tuff that forms the upper cliffs. Its base consists of a purple-gray, unconsolidated, porous, and crystal-rich nonwelded tuff that forms a broad, gently sloping bench developed on top of Qbt 2. Abundant fractures extend through the upper units of the Bandelier Tuff, including the ignimbrite of the unit 3 of the Tshirege. The origin of the fractures has not been fully determined, but the most probable cause is brittle failure of the tuff caused by cooling contraction soon after initial emplacement (Vaniman 1991, 009995.1; Wohletz 1995, 054404).

3.2.2 Hydrogeology

The hydrogeology of the Pajarito Plateau is separable in terms of mesas and canyons forming the plateau. Mesas are generally devoid of water, both on the surface and within the rock forming the mesa. Canyons range from wet to relatively dry; the wettest canyons contain continuous streams and contain perennial groundwater in the canyon-bottom alluvium. Dry canyons have only occasional stream flow and may lack alluvial groundwater. Intermediate perched groundwater has been found at certain locations on the plateau at depths ranging between 100 and 700 ft below ground surface (bgs). The regional aquifer is found at depths of about 600 to 1200 ft bgs.

The hydrogeologic conceptual site model for the Laboratory (LANL 1998, 059599) shows that, under natural conditions, relatively small volumes of water move beneath mesa tops because of low rainfall, high evaporation, and efficient water use by vegetation. Atmospheric evaporation may extend into mesas, further inhibiting downward flow.

3.2.2.1 Groundwater

In the Los Alamos area, groundwater occurs as (1) water in shallow alluvium in some of the larger canyons, (2) intermediate perched groundwater (a perched groundwater body lies above a less permeable layer and is separated from the underlying aquifer by an unsaturated zone), and (3) the regional aquifer. Numerous wells have been installed at the Laboratory and in the surrounding area to investigate the presence of groundwater in these zones and to monitor groundwater quality. The locations of the existing wells within the vicinity of the Upper Cañada del Buey Aggregate Area are shown in Plate 1.

The Laboratory formulated a comprehensive groundwater protection plan (LANL 1995, 050124) for an enhanced set of characterization and monitoring activities. The approved Hydrogeologic Workplan (LANL 1998, 059599; NMED 1998, 058027) details the implementation of extensive groundwater characterization across the Pajarito Plateau within an area potentially affected by past and present Laboratory operations. Groundwater monitoring is conducted under the Interim Facility-Wide Groundwater Monitoring Plan (IFWGMP) (LANL 2008, 101897).

Alluvial Groundwater

Intermittent and ephemeral stream flows in the canyons of the Pajarito Plateau have deposited alluvium that is as much as 100 ft thick. The alluvium in canyons that head on the Jemez Mountains is generally composed of sands, gravels, pebbles, cobbles, and boulders derived from the Tschicoma Formation and Bandelier Tuff on the flank of the mountains. The alluvium in canyons that head on the plateau is comparatively more finely grained, consisting of clays, silts, sands, and gravels derived from the Bandelier Tuff (LANL 1998, 059599, p. 2-17).

In contrast to the underlying volcanic tuff and sediment, alluvium is relatively permeable. Ephemeral runoff in some canyons infiltrates the alluvium until downward movement is impeded by the less permeable tuff and sediment, which results in the buildup of a shallow alluvial groundwater body. Depletion by evapotranspiration and movement into the underlying rock limit the horizontal and vertical extent of the alluvial water (Purtymun et al. 1977, 011846). The limited saturated thickness and extent of the alluvial groundwater preclude its use as a viable source of water for municipal and industrial needs. Lateral flow of the alluvial perched groundwater is in an easterly, downcanyon direction (Purtymun et al. 1977, 011846).

Nine shallow alluvial groundwater observation wells (CDBO-1 through CDBO-9) are sampled annually; water has been observed only in CDBO-6 and CDBO-7. The water appears to be present in the colonnade tuff at the base of Qbt 1v, which underlies the alluvium in the middle portion of the canyon (LANL 1999, 064617, p. 3-107). These wells are located along a 2.6-mi segment of Cañada del Buey extending from northeast of TA-46 to north-northwest of MDA G at TA-54 (LANL 1999, 064617, p. 2-6). CDBO-5 is the only alluvial groundwater observation well located within the Upper Cañada del Buey Aggregate Area (Plate 1).

Regional Aquifer

The regional aquifer is the only aquifer capable of large-scale municipal water supply in the Los Alamos area (Purtymun 1984, 006513). The surface of the regional aquifer rises westward from the Rio Grande within the Santa Fe Group into the lower part of the Puye Formation beneath the central and western part of the Pajarito Plateau. The depth to groundwater below the mesa tops range between about 1200 ft along the western margin of the plateau and about 600 ft at the eastern margin. The location of wells and generalized water-level contours on top of the regional aquifer are described in the 2008 General Facility Information report (LANL 2008, 101932). The regional aquifer is typically separated from the alluvial groundwater and intermediate perched zone groundwater by 350 to 620 ft of tuff, basalt, and sediment (LANL 1993, 023249).

Groundwater in the regional aquifer flows east-southeast, toward the Rio Grande. The velocity of groundwater flow ranges from about 20 to 250 ft/yr (LANL 1998, 058841, p. 2-7). Details of depths to the regional aquifer, flow directions and rates, and well locations are presented in various Laboratory documents (Purtymun 1995, 045344; LANL 1997, 055622; LANL 2000, 066802).

No regional aquifer wells are located within the Upper Cañada del Buey Aggregate Area. Two municipal supply wells (PM-4 and PM-5) are located in or near the Cañada del Buey watershed and provide water-level and water-quality information on the regional aquifer. Regional aquifer wells R-1, TW-8, R-13, R-14, R-15, R-16, R-21, R-28, R-33, and R-34 are located in the Mortandad Canyon watershed to the north of Cañada del Buey, and wells R-17, R-18, R-19, R-20, R-23, and R-32 are located in the Pajarito Canyon watershed to the south. These wells are monitored for water quality as described in the IFWGMP (LANL 2008, 101897, pp. 16, 18).

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.

Although water moves slowly through the unsaturated tuff matrix, it can move rapidly through fractures if saturated conditions exist (Hollis et al. 1997, 063131). Fractures may provide conduits for fluid flow but probably only in discrete, disconnected intervals of the subsurface. Because they are open to the passage of both air and water, fractures can have both wetting and drying effects, depending on the relative abundance of water in the fractures and the tuff matrix.

The Bandelier Tuff is very 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 native tuff is low, generally less than 5% by volume throughout the profile (Kearl et al. 1986, 015368; Purtymun and Stoker 1990, 007508).

4.0 PROPOSED INVESTIGATION ACTIVITIES AT FORMER TA-04

Former TA-04 lies within the current boundaries of TA-52 and TA-63 (Figure 1.0-1). The site is located on a small fingerlike mesa that extends eastward from the main Pajarito Mesa. The mesa is bounded on the north by Ten Site Canyon, which branches west from Mortandad Canyon, and on the south by Cañada del Buey (LANL 1992, 007666, p. 3-2).

TA-04 was established in 1944 as a test firing site for small charges and for implosion studies using the electric method of detonation wave determination. Maximum charges fired were 200 lb. Other activities at TA-04 included smaller tests of the pin shot and magnetic methods of studying implosions and equation of state experiments. TA-04 operated from 1944 until 1949 (LANL 1992, 007666, p. 3-5).

The sites within the Upper Cañada del Buey Aggregate Area associated with former TA-04 consist of Consolidated Unit 04-003(a)-00, which contains one SWMU and one AOC, each requiring additional investigation. Both of these sites are located within the current boundary of TA-52. All data previously collected for the sites within Consolidated Unit 04-003(a)-00 are decision-level data. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites at TA-04.

4.1 Consolidated Unit 04-003(a)-00

Consolidated Unit 04-003(a)-00 consists of SWMU 04-003(a), an outfall, and AOC 04-004, an area of potential soil contamination (Figure 4.1-1). RFI activities were performed at both sites in 1994, 1995, and 1998.

4.1.1 SWMU 04-003(a), Outfall

SWMU 04-003(a) is the outfall and associated drainlines from former building 04-7, which contained a darkroom and photoprocessing laboratory (Figure 4.1-1). The outfall discharged to the south side of building 04-7 to a trench that eventually discharged into Cañada del Buey. Portions of the probable path of the trench have since been covered by buildings 52-114 and 52-115 and an asphalt parking lot. Beta activity was detected in the darkroom in 1955, and portions of the floor were removed in an attempt to remediate the contamination (Lopez Escobedo 1998, 058840, p. 1-2). The outfall was not removed when the building was dismantled in 1956. It is not known whether the drainlines remain or were removed (LANL 1992, 007666, p. 3-7).

4.1.1.1 Summary of Previous Investigations for SWMU 04-003(a)

RFI activities were performed at SWMU 04-003(a) in 1994, 1995, and 1998. Radiation surveys were performed in November 1994 and May 1995. Radiation measurements were within instrument background for both surveys. In 1995, 18 soil, sediment, and tuff samples were collected from six locations. All samples were submitted for isotopic plutonium and isotopic uranium analyses. One sample was also submitted for analyses of inorganic chemicals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), gamma spectroscopy, and gross-alpha and gross-beta radiation (Lopez Escobedo 1998, 058840, pp. 2–8). Samples collected in 1995 and analyses requested are presented in Table 4.1-1.

In 1998, 10 soil and sediment samples were collected from three locations sampled during the 1995 Phase I RFI and from two new locations. Samples were submitted for analyses of inorganic chemicals, SVOCs, and high explosives (HE) (Lopez Escobedo 1998, 058840, pp. 3–4). Samples collected in 1998 and analyses requested are presented in Table 4.1-1.

4.1.1.2 Summary of Data for SWMU 04-003(a)

Analytical data from the June 1995 sampling event are presented in Tables 4.1-2, 4.1-3, and 4.1-4. Sampling locations and results for inorganic chemicals detected above background values (BVs), organic chemicals detected, and radionuclides detected or detected above BVs/fallout values (FVs) are shown in Figures 4.1-2, 4.1-3, and 4.1-4, respectively. Cadmium was detected above BV in one soil sample. Pentachlorophenol and gross-alpha and gross-beta radiation were detected in one soil sample. Plutonium-239/240 was detected in two soil samples at depths greater than the applicable FV. Isotopic uranium was not detected or was not detected above BV. Radionuclides analyzed by gamma spectroscopy were not detected or were not detected above FVs. VOCs were not detected.

Analytical data from the 1998 sampling event are presented in Tables 4.1-2 and 4.1-3. Sampling locations and results for organic chemicals detected are shown in Figure 4.1-3. Benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene were detected in one sediment sample. The detection limit for mercury was above BV in one soil and one sediment sample; the detection limit for selenium was above BVs in six sediment samples. HE was not detected.

4.1.1.3 Scope of Activities for SWMU 04-003(a)

Six samples will be collected from two locations in the drainage below the former outfall to supplement data from previous investigations to define the nature and extent of contamination (Figure 4.1-5). Samples will be collected from three depths (1 to 2 ft, 2 to 3 ft, and 3 to 4 ft) and analyzed for target analyte list (TAL) metals, SVOCs, cyanide, isotopic uranium, isotopic plutonium, and americium-241. Four samples will be collected from two locations in the drainage southeast of the parking lot. Samples will be collected from two depths (1 to 2 ft and 2 to 3 ft) and analyzed for TAL metals, SVOCs, cyanide, isotopic uranium, isotopic plutonium, and americium-241. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

4.1.2 AOC 04-004, Potential Soil Contamination

AOC 04-004 is potentially contaminated soil associated with the footprint of former building 04-7 (Figure 4.1-1). The building, which measured approximately 16 ft × 43 ft, consisted of a darkroom and photoprocessing laboratory. The building, used to develop film from approximately 1948 to 1955, was removed in 1956 (Lopez Escobedo 1998, 058840, pp. 1–3).

4.1.2.1 Summary of Previous Investigations for AOC 04-004

RFI activities were performed at AOC 04-004 in 1994, 1995, and 1998. Radiation surveys were performed in November 1994 and in May 1995. Radiation measurements were within instrument background for both surveys. Phase I RFI sampling was performed in June 1995. Twelve soil and tuff samples were collected from four locations. All samples were submitted for isotopic plutonium and isotopic uranium analyses. One soil sample was also submitted for analysis of inorganic chemicals, a second soil sample was submitted for analysis of SVOCs; and a third soil sample was submitted for gamma spectroscopy and analysis of gross-alpha and gross-beta radiation (Lopez Escobedo 1998, 058840, pp. 2–8). The samples collected in 1995 are presented in Table 4.1-5.

Seventeen soil and fill samples were collected in 1998 from four locations sampled during the 1995 Phase I RFI and from one new location. Samples were submitted for analyses of inorganic chemicals, SVOCs, and HE (Lopez Escobedo 1998, 058840, pp. 3–4). Three samples from one location were also analyzed for VOCs. The samples collected in 1998 are presented in Table 4.1-5.

4.1.2.2 Summary of Data for AOC 04-004

Analytical data from the 1995 sampling event are presented in Tables 4.1-6 and 4.1-7. Sampling locations and results for inorganic chemicals detected above BVs and radionuclides detected or detected above BVs/FVs are shown in Figures 4.1-2 and 4.1-4, respectively. Arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, nickel, selenium, silver, thallium, vanadium, and zinc were detected above BVs in one soil sample. Gross-alpha and gross-beta radiation were detected in one soil sample. Plutonium-239/240 was detected in four soil samples. Isotopic uranium was not detected above BV. Radionuclides analyzed by gamma spectroscopy were not detected or were not detected above FVs. SVOCs were not detected.

Analytical data from the 1998 sampling are presented in Table 4.1-6. Sampling locations and results for inorganic chemicals detected above BVs are shown in Figure 4.1-2. Lead was detected above BV in three soil samples; zinc was detected above BV in two soil samples and one fill sample. The detection limits for mercury were above BV in nine soil and two fill samples. VOCs, SVOCs, and HE were not detected.

4.1.2.3 Scope of Activities for AOC 04-004

Eighteen surface and subsurface samples will be collected from six locations within and bounding the footprint of the former building to supplement data from previous investigations to define nature and extent of contamination (Figure 4.1-5). Samples will be collected from three depths (1 to 2 ft, 2 to 3 ft, and 3 to 4 ft) and analyzed for TAL metals, SVOCs, cyanide, isotopic uranium, isotopic plutonium, and americium-241. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

5.0 PROPOSED INVESTIGATION ACTIVITIES AT TA-46

TA-46 was established in 1954 as a weapons assembly site; however, weapons assembly never took place at this TA. Instead, TA-46 was used for the Laboratory's Nuclear Rocket Division's Rover Program. The Rover Program, which worked on developing nuclear reactors for propulsion of space rockets, continued through approximately 1973. TA-46 was taken over by the Laboratory's Applied Photochemistry Division. By 1976, the Photochemistry Division had established the Jumper Program, which developed uranium isotope separation methods using lasers. The Jumper Program terminated in the early 1980s, but laser research remains a principal activity at TA-46. In addition, the Laboratory's Energy Division conducted solar energy research from the 1970s to the late 1980s. Other activities conducted at TA-46 included free-electron laser research, heat pipe research, accelerator technology, electronics development, and the production of nonradioactive isotopes of oxygen, carbon, and nitrogen. TA-46 remains one of the Laboratory's basic research areas (LANL 1993, 020952, pp. 2-1, 2-3). There is no documented evidence of HE being used at TA-46 from its establishment in 1954 to the present.

The Upper Cañada del Buey Aggregate Area contains 71 sites associated with TA-46. Of these, 17 sites have been approved for NFA or are pending NFA approval. These sites are presented in Table 1.1-1. The remaining 54 sites are described below. All data previously collected from the 54 sites under investigation are screening-level data. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites at TA-46.

5.1 SWMU 46-002, Surface Impoundment

SWMU 46-002 is a surface impoundment system located at the east end of TA-46, southeast of the prototype fabrication building (building 46-77) on the north facing slope of SWSC Canyon (Figure 5.1-1). The SWMU consists of a lagoon (structure 46-149) measuring approximately 62 ft × 102 ft × 11 ft deep, associated drainlines, a siphon box, and three sand filters measuring approximately 22 ft × 38 ft × 3 ft deep (LANL 1990, 007513, p. 208). The lagoon and the sand filters are lined with butyl rubber. The impoundment system was constructed in the early 1970s to receive sanitary waste from buildings within the fenced area of TA-46 (LANL 1993, 020952, p. 5-54). Sanitary waste from TA-46 buildings was formerly handled by individual sanitary systems associated with SWMUs 46-003(a) through 46-003(f) (sections 5.2 through 5.7) (LANL 1990, 007513, p. 208). Effluent received in the lagoon flowed through an outlet box to a siphon box and through pipes that discharged to daylight, just above the sand filters. Effluent from the pipes was discharged onto concrete pads located in the middle of the sand filters where it was distributed evenly throughout the filters. Effluent from the sand filters was discharged to the canyon from a former U.S. Environmental Protection Agency (EPA) NPDES-permitted outfall (SSS07S). The lagoon also had an overflow outfall that discharged into the canyon. The top 6 in. of sand and sludge from the filters was removed every 2 or 3 months and disposed of at Area G at TA-54. The sand beneath this top layer was pushed over the side of the canyon and the filters were replenished with clean sand. The material pushed over the side of the canyon comprises SWMU 46-009(b) (section 5.47). In 1990, the siphon box and the sand filters were taken off-line and the effluent in the lagoon was pumped to another wastewater treatment facility (LANL 1993, 020952, p. 5-56). The lagoon was removed from service in the early 1990s when the SWSC plant, located to the south of SWMU 46-002, was constructed. The outfall from the surface impoundment system was removed from the NPDES permit before 1993 (LANL 1993, 020952, p. 129).

5.1.1 Summary of Previous Investigations for SWMU 46-002

No sampling has been conducted at this SWMU.

5.1.2 Scope of Activities for SWMU 46-002

Nine will be collected from three locations within and beneath the impoundment (Figure 5.1-2). Samples will be collected from three depths: impoundment contents (if present), immediately below the liner, and 5 ft below the base of the liner. The samples will be analyzed for TAL metals, VOCs, SVOCs, polychlorinated biphenyls (PCBs), nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, isotopic thorium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

Twelve samples will be collected from four locations bounding the impoundment and inlet pipe (Figure 5.1-2). Samples will be collected from four depths (0 to 1 ft, at the base of the unit, and 5 ft below the base of the unit) and analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, isotopic thorium, americium-241, and gamma spectroscopy.

Twelve samples will be collected from four locations beneath the drainlines and siphon box (Figure 5.1-2). Samples will be collected from three depths (0 to 1 ft, at the soil/tuff interface, and 5 ft below the soil/tuff interface) and analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, isotopic thorium, americium-241, and gamma spectroscopy.

Nine samples will be collected from three locations within and beneath the sand filters (Figure 5.1-2). Samples will be collected from three depths (0 to 1 ft in filter bed contents [if present], below the base of the unit, and 5 ft below the base of the unit) and analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, isotopic thorium, americium-241, and gamma spectroscopy.

Nine samples will be collected from three locations bounding the sand filters (Figure 5.1-2). Samples will be collected from three depths (0 to 1 ft, at the soil/tuff interface, and 5 ft below the soil/tuff interface) and analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, isotopic thorium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

Two samples will be collected from one location below the impoundment overflow outlet (Figure 5.1-2). Samples will be collected from two depths (0 to 1 ft and 1 to 2 ft) and analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, isotopic thorium, americium-241, and gamma spectroscopy.

Four samples will be collected from two locations in the drainage below the outfall, and 16 samples will be collected from eight locations in SWSC Canyon (Figure 5.1-2). Samples will be collected from two depths (0 to 1 ft and 1 to 2 ft) and analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, isotopic thorium, americium-241, and gamma spectroscopy.

SWMU 46-002 is partially collocated with SWMU 46-009(b) (section 5.47), which is a surface disposal area for sand removed from the sand filter beds. Data obtained from samples collected within, bounding, and in the drainage below the sand filter beds will also be used to evaluate SWMU 46-009(b).

5.2 SWMU 46-003(a), Septic System

SWMU 46-003(a) is a septic system consisting of a septic tank (structure 46-8), a manhole (structure 46-6), two distribution boxes (structures 46-9 and 46-10), and a drain field (Figure 5.2-1). The septic tank is located approximately 50 ft west of the southwest corner of building 46-41 at the head of SWSC Canyon. This septic system was installed in 1954 to serve restroom facilities in buildings 46-1 and

46-2. A janitorial sink in the basement of building 46-1 also drained to the septic system. Building 46-1 housed offices, two assembly bays, a machine shop, several laboratories for the assembly and checkout of electrical components, general laboratories, and a uranium polishing area. All functions within building 46-1 supported the Rover Program (LANL 1993, 020952, p. 5-7). Building 46-2 was a guard station that was relocated approximately 150 ft south of its original location in the mid-1960s (LANL 1993, 020952, p. 5-12). In 1959, this septic system was connected to a restroom facility and a sink along the north wall of building 46-30, which was constructed as a hydraulics laboratory and contained a high-bay area with a crane, an actuator test area, and a small machine shop (LANL 1993, 020952, p. 5-7). Before 1968, the drain field associated with this septic system was removed from service, and septic tank 46-8 was rerouted to the septic system associated with SWMU 46-003(f) (section 5.7) (LANL 1993, 020952, p. 5-9). In the 1970s, sanitary waste drainlines were rerouted to the SWMU 46-002 surface impoundment system, and septic tank 46-8 was removed from service, emptied, filled, and left in place (LASL 1975, 101827). In the early 1990s, the sanitary waste drainlines that previously served SWMU 46-003(a) were rerouted to the SWSC plant and are currently active (LANL 1996, 101813).

5.2.1 Summary of Previous Investigations for SWMU 46-003(a)

No sampling has been conducted at this SWMU.

5.2.2 Scope of Activities for SWMU 46-003(a)

Verification of the location and current construction of the septic system will be performed. The septic tank and its contents will be removed, characterized, and disposed of at an appropriate waste facility. Site characterization will be performed following removal of the septic system using the methods discussed in section 7.8. After the tank has been removed, eight samples will be collected from four locations beneath the inlet pipe, tank inlet, tank, and tank outlet (Figure 5.2-2). Samples will be collected from two depths (at the base of the line or tank and 5 ft below the base of the line or tank) and analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

In addition, six samples will be collected from three locations associated with the distribution box and drain field (Figure 5.2-2). Samples will be collected from two depths (at the base of the distribution box [if present] or the soil/tuff interface and 5 ft below the box or soil/tuff interface) and analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy.

SWMU 46-003(a) lies partially within the boundary of SWMU 46-009(a) (section 5.46). SWMU 46-009(a) is located on the downgradient side of SWMU 46-003(a). Data obtained from samples collected at SWMU 46-009(a) will be used to evaluate both sites.

5.3 SWMU 46-003(b), Septic System

SWMU 46-003(b) is a septic system consisting of a septic tank (structure 46-22), a distribution box (structure 46-29), associated drainline, and drain field (Figure 5.1-1). Septic tank 46-22 and its drain field, located approximately 50 ft south of building 46-77, served the restroom facilities in building 46-17. This building housed a generator that charged batteries for the Rover Program. The septic system was removed from service in approximately 1992 to 1993, and drainlines that discharged to SWMU 46-003(b) were rerouted to the SWMU 46-002 surface impoundment system. Septic tank 46-22 was emptied, filled, and left in place (LASL 1975, 101827). The drainlines that previously served SWMU 46-003(b) were rerouted to the SWSC plant in the early 1990s and are currently active (LANL 1996, 101813).

5.3.1 Summary of Previous Investigations for SWMU 46-003(b)

No sampling has been conducted at this SWMU.

5.3.2 Scope of Activities for SWMU 46-003(b)

Verification of the location and current construction of the septic system will be performed. The septic tank and its contents will be removed, characterized, and disposed of at an appropriate waste facility. Site characterization will be performed following removal of the septic system using the methods discussed in section 7.8. After the tank has been removed, eight samples will be collected from four locations beneath the inlet pipe, tank inlet, tank, and tank outlet (Figure 5.2-2). Samples will be collected from two depths (at the base of the line or tank and 5 ft below the base of the line or tank) and analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

Six samples will be collected from three locations associated with the distribution box and drain field (Figure 5.2-2). Samples will be collected from two depths (at the base of the distribution box [if present] or soil/tuff interface and 5 ft below the box or soil/tuff interface) and analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy.

5.4 SWMU 46-003(c), Septic System

SWMU 46-003(c) is a septic system consisting of a septic tank (structure 46-49), a distribution box (structure 46-50), associated drainline, a drain field, and an outfall (Figure 5.4-1). This septic system served the restroom facilities, floor drains, roof drains, sinks, and acid sinks in building 46-24, which housed offices, a machine shop, electrical laboratories, and chemical laboratories where fuel rods were handled (LANL 1993, 020952, p. 5-10). Septic tank 46-49 is located southeast of building 46-76, beneath an asphalt road outside the TA-46 security fence. In 1958, an acid dry well located in room B22 of building 46-24 was connected into this system but drained to the septic tank for less than 1 yr. The drain field associated with this septic system was removed from service sometime before 1968, and septic tank 46-49 was rerouted to the drain field associated with SWMU 46-003(f) (LANL 1993, 020952, p. 5-10). In the 1970s, sanitary waste drainlines that previously discharged to septic tank 46-49 were rerouted to the SWMU 46-002 surface impoundment system, and septic tank 46-49 was removed from service, emptied, filled, and left in place (LASL 1975, 101827).

5.4.1 Summary of Previous Investigations for SWMU 46-003(c)

No sampling has been conducted at this SWMU.

5.4.2 Scope of Activities for SWMU 46-003(c)

Verification of the location and current construction of the septic system will be performed. The septic tank and its contents will be removed, characterized, and disposed of at an appropriate waste facility. Site characterization will be performed following removal of the septic system using the methods discussed in section 7.8. After the tank has been removed, 10 subsurface samples will be collected from five locations beneath the inlet pipe, tank inlet, tank, tank outlet, and outlet pipe (Figure 5.4-2). Samples will be collected from two depths (at the base of the line or tank and 5 ft below the base of the line or tank) and analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

Ten samples will be collected from five locations associated with the distribution box and drain field (Figure 5.4-2). Samples will be collected from two depths (at the base of the distribution box [if present] or soil/tuff interface and 5 ft below the box or soil/tuff interface) and analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy.

5.5 SWMU 46-003(d), Septic System

SWMU 46-003(d) is a septic system consisting of a septic tank (structure 46-53), a distribution box (structure 46-54), associated drainline, a drain field, and associated outfall (Figure 5.5-1). The septic tank, located approximately 30 ft northwest of building 46-31, served restroom facilities in building 46-31, which housed test cells with electrical furnaces for thermal testing of graphite and uranium-235/uranium-238 fuel rods in support of the Rover Program. Welding experiments involving thorium were also conducted in building 46-31 (LANL 1993, 020952, pp. 5-11–5-14). The septic system was removed from service in approximately 1972 to 1973, and its drainline was rerouted to the SWMU 46-002 surface impoundment system. Septic tank 46-53 was emptied, filled, and left in place (LASL 1975, 101827).

5.5.1 Summary of Previous Investigations for SWMU 46-003(d)

No sampling has been conducted at this SWMU.

5.5.2 Scope of Activities for SWMU 46-003(d)

Verification of the location and current construction of the septic system will be performed. The septic tank and its contents will be removed, characterized, and disposed of at an appropriate waste facility. Site characterization will be performed following removal of the septic system using the methods discussed in section 7.8. After the tank has been removed, six samples will be collected from three locations beneath the tank inlet, tank, and tank outlet (Figure 5.5-2). Samples will be collected from two depths (at the base of the line or tank and 5 ft below base of the line or tank) and analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

Eight samples will be collected from four locations associated with the distribution box and drain field (Figure 5.5-2). Samples will be collected from two depths (at the base of the distribution box [if present] or the soil/tuff interface and 5 ft below the box or soil/tuff interface) and analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy.

5.6 SWMU 46-003(e), Septic System

SWMU 46-003(e) is a septic system consisting of a septic tank (structure 46-66), a siphon tank (structure 46-67), a distribution box (structure 46-68), and a drain field (Figure 5.6-1). Septic tank 46-66, located approximately 20 ft east of building 46-58 outside the TA-46 perimeter fence, served the restroom facility, shower, water cooler, janitorial sink, and mechanical room floor drain in building 46-58, which contained office space, a laboratory, a machine shop, and an equipment room. The septic system was removed from service in approximately 1972 to 1973, and its drainline was rerouted to the SWMU 46-002 surface impoundment system. Septic tank 46-66 was emptied, filled, and left in place (LASL 1975, 101827).

5.6.1 Summary of Previous Investigations for SWMU 46-003(e)

During the preparation of the 1993 RFI work plan, a distribution box was found on the ground surface in Cañada del Buey near the location of SWMU 46-003(e) and is the SWMU 46-003(e) septic system distribution box, presumably moved to its current location during the early 1970s construction of the SWMU 46-002 surface impoundment system. Swipe samples collected and analyzed for radioactivity at the time of discovery detected no radioactivity above instrument background. No visual indications of staining or sediment deposits were found on the box (LANL 1993, 020952, p. 6-8).

No additional samples have been collected at SWMU 46-003(e).

5.6.2 Scope of Activities for SWMU 46-003(e)

Verification of the location and current construction of the septic system will be performed. The septic tank and its contents will be removed, characterized, and disposed of at an appropriate waste facility. If the lines to the tank are still connected, they will be disconnected. Site characterization will be performed following removal of the septic system using the methods discussed in section 7.8. After the tank has been removed, six samples will be collected from three locations beneath the tank inlet, tank, and tank outlet (Figure 5.6-2). If the tank cannot be removed because of the active sanitary system drainline configuration, samples will be collected as close to the proposed locations as conditions permit. Two samples will also be collected from one location next to the area where the drainline exits building 46-58. Samples will be collected from two depths (at the base of the line or tank and 5 ft below the line or tank) and analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

Eight samples will be collected from four locations associated with the location of the former distribution box and drain field (Figure 5.6-2). Samples will be collected from two depths (at the base of the distribution box [if present] or the soil/tuff interface and 5 ft below the box or soil/tuff interface) and analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy.

5.7 SWMU 46-003(f), Septic System

SWMU 46-003(f) is a septic system consisting of a septic tank (structure 46-94), a manhole (structure 46-95), a distribution box (structure 46-97), and a drain field (Figure 5.4-1) (LANL 1993, 020952, pp. 5-12, 5-130). Engineering drawings show that a drainpipe outfall, located approximately 30 ft northeast of the drain field, is also associated with this system (LANL 1993, 020952, p. 5-130). Septic tank 46-94 is located approximately 300 ft east of building 46-88. Visual observation indicates that the distribution box,drain field, and drainpipe outfall have been removed. This septic system served the restroom facilities, floor drains, and restroom sinks in building 46-88. This building was the core support test facility for the Rover Program and provided a clean-room, temperature- and humidity-controlled environment for the testing and certification of hydrogen vessels. A guard station (building 46-2) previously had been connected to another septic system, SWMU 46-003(a), but was disconnected from that unit and connected to this septic system when it was relocated in the mid-1960s to its present location west of building 46-24. Beginning in 1968, the drain field received effluent not only from septic tank 46-94 but also from septic tank 46-8 [SWMU 46-003(a)] and septic tank 46-49 [SWMU 46-003(c)]. This septic system was removed from service in approximately 1972 to 1973, when the buildings it served were connected to a sanitary lagoon (SWMU 46-002) (LANL 1993, 020952, p. 5-12). Septic tank 46-94 was emptied, filled, and left in place (LASL 1975, 101827).

5.7.1 Summary of Previous Investigations for SWMU 46-003(f)

No sampling has been conducted at this SWMU.

5.7.2 Scope of Activities for SWMU 46-003(f)

Verification of the location and current construction of the septic system will be performed. The septic tank and its contents will be removed, characterized, and disposed of at an appropriate waste facility. Site characterization will be performed following removal of the septic system using the methods discussed in section 7.8. After the tank has been removed, eight samples will be collected from four locations beneath the inlet pipe, tank inlet, tank, and tank outlet (Figure 5.4-2). Samples will be collected from two depths (at the base of the line or tank and 5 ft below the base of the line or tank) and analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

Ten samples will be collected from five locations associated with the distribution box, drain field, and drain field outfall pipeto define nature and extent of contamination (Figure 5.4-2). Samples will be collected from two depths (at the base of the distribution box [if present] or soil/tuff interface and 5 ft below the box or soil/tuff interface) and analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy.

Data obtained from samples collected in SWSC Canyon downgradient of the drain field outfall pipe will also be used to evaluate SWMU 46-003(f) (Figure 5.4-2).

5.8 SWMU 46-003(g), Septic System

SWMU 46-003(g) is a septic system consisting of a septic tank (structure 46-230) and a seepage pit (Figure 5.8-1). Septic tank 46-230, located approximately 50 ft northeast of the northeast corner of building 46-158, served the restroom facilities, water cooler, floor drains, service sinks, laboratory sinks, an eyewash sink, and a kitchen sink in building 46-158, which housed laser-induced chemistry experiments. The septic tank also received effluent from former office transportables (structures 46-175, 46-226, and 46-251). The septic tank stopped receiving effluent in 1988 when the drainlines from these buildings were rerouted to two surface impoundments, SWMU 46-005 (section 5.32) (LANL 1993, 020952, p. 5-13). However, the septic tank continued to receive effluent from at least one office transportable (structure 46-175) until 1996 when the transportable was removed from TA-46. Currently, the septic tank is not connected to any building or transportable (LANL 2008, 101882).

5.8.1 Summary of Previous Investigations for SWMU 46-003(g)

No sampling has been conducted at this SWMU.

5.8.2 Scope of Activities for SWMU 46-003(g)

Verification of the location and current construction of the septic system will be performed. The septic tank and its contents will be removed, characterized, and disposed of at an appropriate waste facility. Site characterization will be performed following removal of the septic system using the methods discussed in section 7.8. Six samples will be collected from three locations beneath the tank inlet, the tank, and the tank outlet (Figure 5.8-2). Samples will be collected from two depths (at the base of the tank and 5 ft below the base of the tank) and analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

Two samples will be collected from one location adjacent to the seepage pit (Figure 5.8-2). Samples will be collected from two depths (at the base of the pit and 5 ft below the base of the pit) and will be analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy.

Four samples will also be collected from two locations beneath the primary and secondary inlet lines (Figure 5.8-2). Samples will be collected from two depths (at the base of the line and 5 ft below the base of the line) and analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy.

5.9 SWMU 46-004(a), Drainlines

SWMU 46-004(a) consists of two drainlines from sinks in building 46-31 (Figure 5.5-1). The drainlines discharged to a dry well, SWMU 46-004(c) (section 5.13), located approximately 10 ft north of building 46-31, which housed test cells with electrical furnaces for thermal testing of graphite and uranium-235/uranium-238 fuel rods in support of the Rover Program. Welding experiments involving thorium were also conducted in building 46-31 (LANL 1993, 020952, pp. 5-11–5-14). Engineering drawings show that one drainline discharged acid waste from three sinks on the north side of room 151 (LASL 1960, 101819), while a second drainline was connected to a sink on the west side of room 151 (LANL 1993, 101825). Both drainlines extended north approximately 35 ft beneath building 46-31 to the dry well. During the Rover Program, the sinks on the north side of room 151 were removed and the drainline was left in place (LANL 1993, 020952, pp. 5-13–5-14). Engineering drawings show that the western sink was removed in the early 1990s (LANL 1993, 101823).

5.9.1 Summary of Previous Investigations for SWMU 46-004(a)

No sampling has been conducted at this SWMU.

5.9.2 Scope of Activities for SWMU 46-004(a)

Four samples will be collected from two locations adjacent to the drainlines to define vertical nature and extent of contamination (Figure 5.5-2). Samples will be collected from two depths (at the base of drainline and 5 ft below the base of the drainline) and analyzed for TAL metals, total cesium, VOCs, SVOCs, PCBs, nitrate, cyanide, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

5.10 SWMU 46-004(a2), Outfall

SWMU 46-004(a2) is an outfall located on the east side of building 46-31 (Figure 5.6-1) that received effluent from a 6-in.-diameter industrial drainline in the building. The sinks and drains in rooms 101, 103, and 105 of building 46-31 were historically plumbed to this outfall (LANL 1993, 020952, p. 5-128). The outfall discharged to a shallow ditch on the east side of building 46-31, which leads approximately 50 ft north to a storm drain culvert discharging into Cañada del Buey. By 1994, the outfall pipe was plugged (LANL 1996, 054929, p. 99), and all drains leading to the outfall either were removed from service or were rerouted to the SWSC plant (Santa Fe Engineering Ltd. 1994, 101839, Figure 2). Building 46-31 housed test cells with electrical furnaces for thermal testing of graphite and uranium-235/uranium-238 fuel rods in support of the Rover Program. Welding experiments involving thorium were also conducted in building 46-31 (LANL 1996, 054929, pp. 5-11-5-14).

5.10.1 Summary of Previous Investigations for SWMU 46-004(a2)

During the 1994 Phase I RFI, 12 soil samples were collected from nine locations. One sample was collected from the outfall, and two samples were collected from two locations in the shallow ditch. The remaining nine soil samples were collected from six locations in the drainage and at the toe of the slope downgradient of the storm drain culvert that discharges into Cañada del Buey. Four of these samples were collected from two locations at the toe of the slope. The remaining five samples were collected from four locations in the drainage. All 12 samples were submitted for analyses of inorganic chemicals, SVOCs, PCBs, pesticides, isotopic thorium, isotopic uranium, and gamma spectroscopy. All nine canyon samples were analyzed for isotopic plutonium; eight of the nine canyon samples were analyzed for VOCs. Samples collected and analyses requested are presented in Table 3.10-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803).

5.10.2 Summary of Data for SWMU 46-004(a2)

Analytical data are presented in Tables 3.10-2, 3.10-3, and 3.10-4 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for inorganic chemicals detected above BVs, organic chemicals detected, and radionuclides detected or detected above BVs/FVs are shown in Figures 3.10-1, 3.10-2, and 3.10-3, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Chromium, iron, nickel, silver, and thallium were detected above BVs in one sample. Cadmium was detected above BV in two samples; mercury was detected above BV in three samples; copper and lead were detected above BVs in four samples; zinc was detected above BV in six samples. Detection limits for cadmium, mercury, silver, and thallium were above BVs in one to three samples. Anthracene, BHC(delta-) (benzene hexachloride[delta-]), DDE(4,4'-) (dichlorophenyltrichloroethylene), di-n-octylphthalate, dieldrin, methoxychlor(4,4'-), and methylene chloride were detected in one sample. Aroclor-1254, benzo(a)anthracene, BHC(alpha-), bis(2-ethylhexyl)phthalate, dichlorodiphenyldichloroethane(4,4'-), and endrin aldehyde were detected in two samples. Benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and heptachlor epoxide were detected in three samples. Aroclor-1260, BHC(gamma-), and fluoranthene were detected in four samples. Chrysene, phenanthrene, and pyrene were detected in five samples. Plutonium-238 was detected above FV in two samples. Plutonium-238 was also detected in four samples at depths greater than the applicable FV. Isotopic uranium and isotopic thorium were not detected or were not detected above BVs. Radionuclides analyzed by gamma spectroscopy were not detected or were not detected above FVs.

5.10.3 Scope of Activities for SWMU 46-004(a2)

Eight samples will be collected from four locations: two at the outfall discharge point, one at the mouth of the culvert, and one at the culvert discharge point (Figure 5.10-1). Samples will be collected from two depths (0 to 1 ft and 2 to 3 ft) and analyzed for TAL metals, VOCs, SVOCs, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

SWMU 46-004(a2) flows to a drain network that discharges to a drainage common to two other outfalls [SWMUs 46-004(u), 46-004(v), and 46-004(x) (sections 5.26, 5.27, and 5.29, respectively)]. Data obtained from samples collected in the common segment of the drainage associated with SWMU 46-004(u) will be used to evaluate all four SWMUs.

5.11 SWMU 46-004(b), Former Tank

SWMU 46-004(b) is the location of a former alkali-metal cleaning tank (structure 46-81) (Figure 5.5-1). The tank was used in the late 1950s and early 1960s to douse laboratory equipment from cesium plasma diode experiments before the equipment's reuse or disposal. Butanol or kerosene was used on the equipment to dissolve naturally occurring alkali isotopes of cesium and lithium (LANL 1996, 054929, pp. 24, 27). The tank measured approximately 4 ft × 8 ft × 6 ft tall and was located on asphalt pavement within 20 ft of the northwest corner of building 46-31, within the boundary of SWMU 46-006(d) (section 5.36). The tank was of steel construction with an outlet plumbed to the SWMU 46-004(c) dry well (LASL 1963, 101821). The tank was removed in 1973 (LANL 1993, 020952, p. 6-7).

5.11.1 Summary of Previous Investigations for SWMU 46-004(b)

During the 1994 Phase I RFI, two soil samples were collected from two locations representing the paths for surface-water runoff from SWMU 46-004(b) (LANL 1996, 054929, pp. 27–29). The samples were collected downgradient of the tank's former location and in the drainage of a nearby outfall [SWMU 46-004(z)] (section 5.31). These two samples were part of larger sample sets collected in association with SWMUs 46-004(z) (ICF Kaiser Engineers 1995, 053452, Exhibit 3, p. 4) and 46-006(d) (LANL 1996, 054929, pp. 28, 159). Details on sampling and the results for these two samples are presented in sections 5.31 and 5.36, respectively.

5.11.2 Summary of Data for SWMU 46-004(b)

Sections 5.31 and 5.36 present a summary of the analytical data associated with this SWMU.

5.11.3 Scope of Activities for SWMU 46-004(b)

Four samples will be collected from two locations, one at the northwest corner of the tank pad and one in the drainage approximately 15 ft northwest of the pad (Figure 5.5-2). Samples will be collected from two depths (0 to 1 ft and 2 to 3 ft) and analyzed for TAL metals, total cesium, VOCs, SVOCs, total petroleum hydrocarbons (TPH), cyanide, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

5.12 SWMU 46-004(b2), Outfall

SWMU 46-004(b2) is an outfall that discharged effluent from an industrial drainline associated with the north high bay of building 46-1 (Figure 5.12-1). Engineering drawings show that the floor drains along the east wall of the north high bay in building 46-1 were plumbed to this drainline. The outfall pipe consists of a 4-in.-diameter vitrified clay pipe (VCP) that discharged to the east side of building 46-1, down a steep embankment and into a storm drainage ditch, which flowed to a storm drain culvert that discharged into Cañada del Buey (LANL 1993, 020952, p. 5-129). The storm drainage ditch also receives runoff from SWMUs 46-004(s), 46-007, and 46-008(b) (sections 5.24, 5.39, and 5.41, respectively). In 1995, the outfall was plugged and the associated floor drains either were taken out of service or were rerouted to the SWSC plant (LANL 1998, 101808, p. 75). Building 46-1 housed offices, two assembly bays, a machine shop, several laboratories for the assembly and checkout of electrical components, general laboratories, and a uranium polishing area in support of the Rover Program (LANL 1993, 020952, p. 5-7).

5.12.1 Summary of Previous Investigations for SWMU 46-004(b2)

During the 1994 Phase I RFI, three soil samples were collected from three locations near the outfall and one soil sample was collected from the mouth of the nearby storm drain culvert. All four samples were analyzed for inorganic chemicals, SVOCs, gamma spectroscopy, isotopic thorium, and isotopic uranium. Three of the four samples were analyzed for VOCs. The sample near the culvert was also analyzed for PCBs and pesticides (LANL 1996, 054929, pp. 113–115, 199, 206). Samples collected and analyses requested are presented in Table 3.12-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803).

5.12.2 Summary of Data for SWMU 46-004(b2)

Analytical data are presented in Tables 3.12-2, 3.12-3, and 3.12-4 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for inorganic chemicals detected above BVs, organic chemicals detected, and radionuclides detected or detected above BVs/FVs are shown in Figures 3.12-2, 3.12-3, and 3.12-4, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Lead was detected above BV in one sample. Copper, mercury, and zinc were detected above BVs in all four samples. Detection limits for cadmium and thallium were above BVs in one and four samples, respectively. Acenaphthene, anthracene, dibenz(a,h)anthracene, fluorene, and naphthalene were detected in two samples. Pyrene was detected in three samples. Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, and phenanthrene were detected in all four samples. Cesium-137 was detected in one sample. Uranium-234 was detected above BV in one sample. Isotopic thorium was not detected or was not detected above BVs.

5.12.3 Scope of Activities for SWMU 46-004(b2)

Four samples will be collected from two locations in the drainage ditch beneath the outfall (Figure 5.12-2). Samples will be collected from two depths (0 to 1 ft and 1 to 2 ft) and analyzed for TAL metals, VOCs, SVOCs, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

SWMUs 46-004(b2) and 46-008(b) (section 5.41) are located within a common drainage area. Data obtained from samples collected from this drainage will be used to evaluate both sites.

Runoff or discharge from SWMUs 46-004(b2) and 46-008(b) enters the drain network that receives flow from the SWMU 46-004(m) outfall (section 5.20). This drain network ultimately discharges into Cañada del Buey. Data obtained from samples collected in the common segment of the drainage below the network outfall associated with SWMU 46-004(m) will be used to evaluate these sites.

5.13 SWMU 46-004(c), Dry Well

SWMU 46-004(c) is a dry well (structure 46-61) located approximately 10 ft north of the high bay in building 46-31 (Figure 5.5-1). The dry well received effluent from industrial sink drains in room 151 of building 46-31. The dry well is constructed of two sections of 2.5-ft-diameter × 4-ft-long concrete pipe installed to approximately 8 ft bgs. Engineering drawings show that the bottom of the dry well is open (LASL 1960, 101820). Industrial sink drains in room 151 discharged to the dry well through drainlines [SWMU 46-004(a)] that run beneath building 46-31. Engineering drawings show one drainline discharged acid waste from three sinks on the north side of room 151(LASL 1960, 101819), while a second drainline was connected to a sink on the west side of room 151 (LANL 1993, 101825). During the Rover Program, the sinks on the north side of room 151 were removed, and the drainline was left in place (LANL 1993, 020952, p. 5-13–5-14). Engineering drawings show the western sink and associated drainline were removed in the early 1990s (LANL 1993, 101823). Engineering drawings also show the alkali-metal cleaning tank associated with SWMU 46-004(b) was connected to the dry well at one time (LASL 1963, 101821). Building 46-31 housed test cells with electrical furnaces for thermal testing of graphite and uranium-235/uranium-238 fuel rods in support of the Rover Program. Welding experiments involving thorium were also conducted in building 46-31 (LANL 1993, 020952, pp. 5-11–5-14).

5.13.1 Summary of Previous Investigations for SWMU 46-004(c)

No sampling has been conducted at this SWMU.

5.13.2 Scope of Activities for SWMU 46-004(c)

Eight samples will be collected from two locations, one down the center and one downgradient from the dry well (Figure 5.5-2). Samples will be collected from four depths (at the base of the well, 5 ft, 10 ft, and 15 ft below the base of the well) and analyzed for TAL metals, total cesium, VOCs, SVOCs, PCBs, nitrate, cyanide, perchlorate, asbestos, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites. In the event of auger refusal because of the presence of gravel/cobles in the bottom of the well, an alternative location/borehole will be drilled farther downgradient of the dry well.

5.14 SWMU 46-004(c2), Outfall

SWMU 46-004(c2) is the outfall from an industrial drainline in building 46-1 that received effluent from floor drains in the north equipment room of building 46-1 (Figure 5.12-1). The outfall consists of a 4-in.-diameter cast-iron pipe that discharged to a ditch approximately 50 ft northwest of building 46-1. Effluent from the floor drains discharged to the ditch. From the ditch, the effluent flowed to a storm drain culvert that discharged into Cañada del Buey. The outfall is former NPDES-permitted outfall 03AS042, which was removed from the NPDES permit in March 1998 (LANL 1999, 064617, p. 2-8). In 1997, the floor drains that discharged to the SWMU 46-004(c2) outfall either were removed from service or were rerouted to the SWSC plant (LANL 1998, 101808, pp. 77–78). Building 46-1 housed offices, two assembly bays, a machine shop, several laboratories for the assembly and checkout of electrical components, general laboratories, and a uranium polishing area in support of the Rover Program (LANL 1993, 020952, p. 5-7).

5.14.1 Summary of Previous Investigations for SWMU 46-004(c2)

During the 1994 Phase I RFI, 16 soil samples were collected from 13 locations at SWMU 46-004(c2). Three of the samples were collected from the outfall and were also used to characterize SWMU 46-006(a) (section 5.33). Nine samples were collected from six locations in the drainage downgradient of the storm drain outfall. Four samples were collected from four locations at the toe of the slope in the canyon below TA-46. All 16 samples were submitted for analyses of inorganic chemicals, SVOCs, PCBs, pesticides, gamma spectroscopy, isotopic thorium, and isotopic uranium. Ten of the samples were also analyzed for VOCs (LANL 1996, 054929, pp. 121–122, 141). Samples collected and analyses requested are presented in Table 3.14-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803).

5.14.2 Summary of Data for SWMU 46-004(c2)

Analytical data are presented in Tables 3.14-2, 3.14-3, and 3.14-4 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for inorganic chemicals detected above BVs, organic chemicals detected, and radionuclides detected or detected above BVs/FVs are shown in Figures 3.14-1, 3.14-2, and 3.14-3, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Cadmium was detected above BV in one sample; copper and mercury were detected above BVs in six samples; lead was detected above BV in 13 samples; zinc was detected above BV in 15 samples. Cesium and lithium were detected in eight samples. The detection limits for antimony, cadmium, mercury, silver, and thallium were above BVs in 2 to 11 samples. Acenaphthene, aldrin, anthracene, dibenzofuran, endosulfan sulfate, fluorene, heptachlor, heptachlor epoxide, methoxychlor(4,4'-), methylnaphthalene(2-), and naphthalene were detected in one sample. Benzo(a)pyrene, bis(2-ethylhexyl)phthalate, endosulfan II, and endrin were detected in two samples. Benzo(a)anthracene, benzo(b)fluoranthene, chrysene, and DDT (dichlorodiphenyltrichloroethane[4,4'-]) were detected in three samples. Phenanthrene and pyrene were detected in four samples; fluoranthene was detected in six samples; dieldrin was detected in seven samples. Cesium-137 was detected in two soil samples. VOCs and PCBs were not detected. Isotopic uranium and isotopic thorium were not detected or were not detected above BVs.

5.14.3 Scope of Activities for SWMU 46-004(c2)

Twenty-two samples will be collected from 11 locations in the drainage at and below the outfall (Figure 5.12-2). Samples will be collected from two depths (0 to 1 ft and 1 to 2 ft) and analyzed for TAL metals, total cesium, total lithium, VOCs, SVOCs, pesticides, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

AOC 46-004(e2) and SWMU 46-006(a) (sections 5.17 and 5.33, respectively) lie within a drainage ditch immediately upgradient of the discharge point of the SWMU 46-004(c2) outfall. Flow from this ditch enters a drainage that discharges into Cañada del Buey. Data obtained from samples collected in the segment of the drainage below the drainage ditch associated with SWMU 46-004(c2) will be used to evaluate all three sites.

5.15 Consolidated Unit 46-004(d)-99

Consolidated Unit 46-004(d)-99 consists of SWMUs 46-004(d) and 46-004(e). Both SWMUs are dry wells, which were plumbed in series and received effluent from sink drains in building 46-58 (Figure 5.6-1). The dry wells were used for acid waste disposal. Building 46-58 contains office space, a laboratory, and an equipment room, and historically it housed a machine shop (LANL 1993, 020952, p. 5-14). Both dry wells received effluent from an acid drain in building 46-58 (LANL 1993, 020952, p. 5-14) and effluent from a fume hood sink and a hand-washing sink in building 46-58 (Santa Fe Engineering Ltd. 1994, 101838, p. 16). The fume hood sink was removed and the drainline was plugged in 1994; the drainline from the hand-washing sink was repiped to the sanitary sewer system in 1995 (LANL 1998, 101808, p. 82). Both dry wells are located approximately 20 ft north of building 46-58. The dry wells are constructed of 3-ft-diameter × 4-ft-long concrete cylinders, stacked vertically, with a nesting joint and a gravel bottom. Visual inspection of both wells indicates they are approximately 10 ft deep. The dry wells are belowgrade, except for the top 4 to 6 in. concrete lip, and are covered with metal lids.

5.15.1 SWMU 46-004(d), Dry Well

SWMU 46-004(d) (structure 46-69) is a dry well located within 3 ft of the SWMU 46-004(e) dry well (structure 46-70) (Figure 5.6-1).. Engineering drawings show that SWMU 46-004(d) has an inlet pipe to receive overflow from the SWMU 46-004(e) dry well but has no outlet pipe and was not connected to building 46-58.

5.15.1.1 Summary of Previous Investigations for SWMU 46-004(d)

No sampling has been conducted at this SWMU.

5.15.1.2 Scope of Activities for SWMU 46-004(d)

Four subsurface samples will be collected from one location down the center of the dry well (Figure 5.6-2). Samples will be collected from four depths (at the base of the well, and 5 ft, 10 ft, and 15 ft below the well). Six samples will be collected from three locations along a transect on the slope below both dry wells from two depths (0 to 1 ft and 1 to 2 ft). Samples will be analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites. In the event of auger refusal because of the presence of gravel/cobles in the bottom of either well, NMED will be consulted to determine an alternative borehole location and sampling approach.

5.15.2 SWMU 46-004(e), Dry Well

SWMU 46-004(e) (structure 46-70) is a dry well located next to SWMU 46-004(d) and connected to building 46-58 by an inlet drainline (Figure 5.6-1). This dry well is of the same construction and operational history as SWMU 46-004(d) (section 5.15).

5.15.2.1 Summary of Previous Investigations for SWMU 46-004(e)

During a 1989 environmental study, two samples were collected from the sludge at the bottom of the SWMU 46-004(e) dry well and analyzed for inorganic chemicals, VOCs, SVOCs, PCBs, and radionuclides. Data for the 1989 sampling event are not presented in this report, but are summarized in the Operable Unit (OU) 1140 work plan (LANL 1993, 020952, pp. 5-17–5-18).

5.15.2.2 Summary of Data for SWMU 46-004(e)

The OU 1140 work plan (LANL 1993, 020952) presents a summary of the analytical data associated with this SWMU.

5.15.2.3 Scope of Activities for SWMU 46-004(e)

Four subsurface samples will be collected from one location down the center of the dry well (Figure 5.6-2). Samples will be collected from four depths (at the base of the well, and 5 ft, 10 ft, and 15 ft below the well). Two samples will be collected from the location that is the closest point to where the inlet drainline exits building 46-58; samples from this location will be collected from depths of 0 to 1 ft and 2 to 3 ft beneath the drainline. As stated above in section 5.15.1.2, six samples will be collected from three locations along a transect on the slope below both dry wellsfrom depths of 0 to 1 and 1 to 2 ft. The samples will be analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites. In the event of auger refusal because of the presence of gravel/cobles in the bottom of either well, NMED will be consulted to determine an alternative borehole location and sampling approach.

5.16 Consolidated Unit 46-004(d2)-99

Consolidated Unit 46-004(d2)-99 consists of SWMUs 46-004(d2), 46-004(g), and 46-004(h) and AOCs C-46-002 and C-46-003 (Figure 5.16-1). SWMU 46-004(d2) and AOCs C-46-002 and C-46-003 are associated with stack emissions from buildings 46-24, 46-31, and 46-30, respectively. SWMUs 46-004(g) and 46-004(h) include a stack emissions component and an outfall component. SWMUs 46-004(g) and 46-004(h) are associated with buildings 46-1 and 46-16, respectively.

5.16.1 Summary of Previous Investigations for Stack Emissions at Consolidated Unit 46-004(d2)-99

During the 1994 Phase I RFI, 17 soil and sediment samples were collected to assess the potential impact from stack emissions. These samples were collected from 13 locations at SWMUs 46-004(d2), 46-004(g), and 46-004(h) and AOCs C-46-002 and C-46-003. Sampling locations were selected based upon the historical prevailing wind direction and the location of building stacks. All samples were analyzed for inorganic chemicals, gamma spectroscopy, isotopic thorium, and isotopic uranium. One sediment and three soil samples were also analyzed for VOCs and SVOCs (LANL 1996, 054929, p. 216). Samples collected and analyses requested for the stack emissions are presented in Table 3.16-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803).

Soil samples were also collected to characterize the outfalls and associated drainages for SWMUs 46-004(g) and 46-004(h) (LANL 1996, 054929, pp. 32, 44). These outfall samples are discussed in sections 5.16.5 [SWMU 46-004(g)] and 5.16.6 [SWMU 46-004(h)].

5.16.2 Summary of Data for Stack Emissions at Consolidated Unit 46-004(d2)-99

Analytical data are presented in Table 3.16-2 the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for inorganic chemicals detected above BVs are shown in Figure 3.16-2 the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Copper was detected above BV in one soil sample; zinc was detected above BV in two soil samples; mercury was detected above BV in three soil samples. The detection limits for antimony, cadmium, selenium, silver, and thallium were above BVs in one to four samples. VOCs and SVOCs were not detected. Radionuclides were not detected or were not detected above BVs/FVs.

5.16.3 Scope of Activities for Stack Emissions at Consolidated Unit 46-004(d2)-99

On the mesa top proximal to stack locations, 40 samples will be collected from 20 locations to define nature and extent of contamination (Figure 5.16-2). Samples will be collected in unpaved areas and undisturbed areas. Samples will be collected from two depths (0 to 1 ft and 1 to 2 ft) and analyzed for TAL metals, SVOCs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

5.16.4 SWMU 46-004(d2), Stack Emissions

SWMU 46-004(d2) is potential surface soil contamination associated with laboratory stack emissions from building 46-24 (Figure 5.16-1). During 1960 and 1961, experiments conducted in building 46-24 used beryllium and beryllium oxide (LANL 1996, 054929, p. 215).

5.16.4.1 Summary of Previous Investigations for SWMU 46-004(d2)

Phase I RFI activities were conducted at SWMU 46-004(d2) in 1994 and are summarized in section 5.16.1.

5.16.4.2 Summary of Data for SWMU 46-004(d2)

Section 5.16.2 discusses the analytical data associated with this SWMU.

5.16.4.3 Scope of Activities for SWMU 46-004(d2)

SWMU 46-004(d2) will be characterized as part of Consolidated Unit 46-004(d2)-99 (section 5.16.3).

5.16.5 SWMU 46-004(g), Stack Emissions/Outfall

SWMU 46-004(g) consists of an area of potential surface soil contamination from laboratory stack emissions at building 46-1 and an industrial outfall pipe discharging from building 46-1 (Figures 5.12-1 and 5.16-1). Work in building 46-1 involved the baking and high-temperature testing of fuel rods (LANL 1993, 020952, p. 5-184).

The outfall component of SWMU 46-004(g) consists of a 12-in.-diameter VCP industrial drain that discharged into Cañada del Buey north of building 46-154. Engineering drawings show the floor and roof drains within the central portion of building 46-1 were plumbed to this industrial drainline (LANL 1993, 020952, pp. 5-123, 5-184). In 1996 and 1997, floor drains that discharged to this outfall either were removed from service or were rerouted to the SWSC plant. Roof drains from building 46-1 that discharged to this outfall were rerouted to the stormwater drain system in 1996 (LANL 1998, 101808, pp. 74–75). Building 46-1 housed offices, two assembly bays, a machine shop, several laboratories for the assembly and checkout of electrical components, general laboratories, and a uranium polishing area (LANL 1993, 020952, p. 5-7).

5.16.5.1. Summary of Previous Investigations for SWMU 46-004(g)

Previous investigations for the stack emissions component of SWMU 46-006(g) are summarized in section 5.16.1.

For the outfall component of SWMU 46-004(g), 11 soil samples were collected during the 1994 Phase I RFI (Figure 5.12-1). These samples were collected from nine locations at and downgradient of the outfall. Three samples were collected from the outfall, two samples were collected in the drainage downgradient of the outfall, and six samples were collected from the toe of the slope in Cañada del Buey. All samples were analyzed for inorganic chemicals, SVOCs, gamma spectroscopy, isotopic thorium, and isotopic uranium. Six samples were also analyzed for VOCs (LANL 1996, 054929, pp.32–34). Samples collected and analyses requested are presented in Table 3.16-3 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803).

5.16.5.2 Summary of Data for SWMU 46-004(g)

Analytical data for the stack emissions component of SWMU 46-006(g) are discussed in section 3.16.2.

Analytical data for the outfall component of SWMU 46-004(g) are presented in Tables 3.16-4, 3.16-5, and 3.16-6 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for inorganic chemicals detected above BVs, organic chemicals detected, and radionuclides detected or detected above BVs are shown in Figures 3.16-3, 3.16-4, and 3.16-5, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Arsenic was detected above BV in one sample; selenium was detected above BV in two samples; nickel was detected above BV in five samples; cadmium and silver were detected above BVs in six samples; chromium and lead were detected above BVs in seven samples; copper and zinc were detected above BVs in eight samples; mercury was detected above BV in nine samples. Cesium and lithium were detected in seven and six samples, respectively. Detection limits for antimony, cadmium, mercury, silver, and thallium were above BVs in one to six samples. Acenaphthene, acenaphthylene, di-n-butylphthalate, dibenzofuran, fluorene, isopropyltoluene(4-), methylnaphthalene(2-), and naphthalene were detected in one sample; anthracene and dibenz(a,h)anthracene were detected in two samples; butylbenzylphthalte was detected in three samples; benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene were detected in four samples; benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, and fluoranthene were detected in five samples. Uranium-238 was detected above BV in four samples; uranium-235 was detected above BV in seven samples; uranium-234 was detected above BV in eight samples. Radionuclides analyzed by gamma spectroscopy and isotopic thorium were not detected or were not detected above BVs/FVs.

5.16.5.3 Scope of Activities for SWMU 46-004(g)

Stack emissions associated with SWMU 46-004(g) will be characterized as part of the investigation of Consolidated Unit 46-004(d2)-99 (section 5.16.3).

Sixteen samples will be collected from 8 locations in the drainage at and below the SWMU 46-004(g) outfall (Figure 5.12-2). Samples will be collected from two depths (0 to 1 ft and 1 to 2 ft) and analyzed for TAL metals, VOCs, SVOCs, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

5.16.6 SWMU 46-004(h), Stack Emissions/Outfall

SWMU 46-004(h) consists of an area of potential surface soil contamination from laboratory stack emissions at building 46-16 and an industrial outfall pipe discharging from building 46-16 (Figures 5.6-1 and 5.16-1). Experiments with uranium-loaded graphite were conducted in building 46-16 as part of the Rover Program.

The outfall component of SWMU 46-004(h) consists of a 6-in.-diameter cast-iron pipe that discharged north of building 46-16 into Cañada del Buey. Engineering drawings show the building floor drains discharged to the outfall (LANL 1993, 020952, p. 5-124; Santa Fe Engineering Ltd. 1994, 101839, Figure 2). In 1995, floor drains that discharged to this outfall either were removed from service or were rerouted to the SWSC plant (LANL 1998, 101808, pp. 78–79).

5.16.6.1 Summary of Previous Investigations for SWMU 46-004(h)

Previous investigations for the stack emissions component of SWMU 46-004(h) are summarized in section 5.16.1.

For the outfall component of SWMU 46-004(h), one tuff and five soil samples were collected during the 1994 Phase I RFI (Figure 5.6-1) from five locations at and downgradient of the outfall and drainage. One sample was collected from the outfall, two samples were collected in the drainage downgradient of the outfall, and two samples were collected from the toe of the slope in Cañada del Buey. All samples were analyzed for inorganic chemicals, VOCs, SVOCs, gamma spectroscopy, isotopic thorium, and isotopic uranium (LANL 1996, 054929, p. 44). Four of the five samples collected were also used to characterize SWMU 46-004(q) (section 5.22) (LANL 1996, 054929, pp. 44–56). Samples collected and analyses requested are presented in Table 3.16-7 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803).

5.16.6.2 Summary of Data for SWMU 46-004(h)

Analytical data for the stack emissions component of SWMU 46-006(h) are summarized in section 5.16.2.

Analytical data for the outfall component of SWMU 46-004(h) are presented in Tables 3.16-8, 3.16-9, and 3.16-10 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for inorganic chemicals detected above BVs, organic chemical detected, and radionuclides detected or detected above BVs/FVs are shown in Figures 3.16-6, 3.16-7, and 3.16-8, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Nickel was detected above BV in the tuff sample; silver was detected above BV in one soil sample; cadmium was detected above BV in two soil samples; copper, lead, mercury, and zinc were detected above BVs in the one tuff sample and in two soil samples. Detection limits for antimony, selenium, and thallium were above BVs in the tuff sample. Bis(2-ethylhexyl)phthalate was detected in the one tuff sample and in two soil samples. Uranium-234 and uranium-235 were detected above BVs in one soil sample. Radionuclides analyzed by gamma spectroscopy and isotopic thorium were not detected or were not detected above BVs/FVs. VOCs were not detected.

5.16.6.3 Scope of Activities for SWMU 46-004(h)

Stack emissions associated with SWMU 46-004(h) will be characterized as part of Consolidated Unit 46-004(d2)-99 (section 5.16.3).

Four samples will be collected from two locations below the SWMU 46-004(h) outfall to define nature and extent of contamination (Figure 5.10-1). Samples will be collected from two depths (0 to 1 ft and 1 to 2 ft) and analyzed for TAL metals, VOCs, SVOCs, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

SWMUs 46-004(h) and 46-004(q) (section 5.22) discharge to a common drainage. Data obtained from samples collected from the common segment of the drainage associated with SWMU 46-004(q) will be used to evaluate SWMU 46-004(h).

5.16.7 AOC C-46-002, Stack Emissions

AOC C-46-002 is potential surface soil contamination associated with a one-time release of uranium-235 from a stack at building 46-31 (Figure 5.16-1). The release occurred in 1960 when a tube associated with Rover Program activities ruptured in building 46-31 (LANL 1993, 020952, p. 5-186).

5.16.7.1 Summary of Previous Investigations for AOC C-46-002

Phase I RFI activities were conducted at this AOC C-46-002 in 1994 and are summarized in section 5.16.1.

5.16.7.2 Summary of Data for AOC C-46-002

Section 5.16.2 discusses the analytical data associated with this AOC.

5.16.7.3 Scope of Activities for AOC C-46-002

Stack emissions associated with AOC C-46-002 will be characterized as part of Consolidated Unit 46-004(d2)-99 (section 5.16.3).

5.16.8 AOC C-46-003, Stack Emissions

AOC C-46-003 is potential surface soil contamination associated with a one-time release from a stack at building 46-30 of depleted uranium hexafluoride containing uranium-237 (Figure 5.16-1). The event occurred in March 1978 and was followed by a series of decontamination and monitoring efforts within and downwind for building 46-30. Ambient air monitoring conducted after the release showed no detected levels of uranium-237 (LANL 1993, 020952, pp. 5-186–5-187).

5.16.8.1 Summary of Previous Investigations for AOC C-46-003

Phase I RFI activities were conducted at this AOC C-46-003 in 1994 and are summarized in section 5.16.1.

5.16.8.2 Summary of Data for AOC C-46-003

Section 5.16.2 discusses analytical data associated with this AOC.

5.16.8.3 Scope of Activities for AOC C-46-003

Stack emissions associated with AOC C-46-003 will be characterized as part of Consolidated Unit 46-004(d2)-99 (section 5.16.3).

5.17 AOC 46-004(e2), Outfall

AOC 46-004(e2) is the outfall from roof, floor, and sink drains in building 46-42 (Figure 5.12-1). The AOC outfall consists of a 4-in.-diameter pipe located approximately 50 ft northeast of building 46-42 at the head of a ditch associated with SWMU 46-006(a) (section 5.33). The outfall is located approximately 3 ft below the level of the asphalt pavement and is covered by silt and sediment during runoff events. In the mid-1990s, the floor and sink drains that discharged to this outfall either were removed from service or were rerouted to the sanitary sewer system. The outfall currently receives stormwater from building 46-42 roof drains (LANL 1998, 101808, pp. 81–82). Building 46-42 was constructed as an equipment checkout facility and contains electronics and robotics laboratories (LANL 1996, 054929, pp. 128–129).

5.17.1 Summary of Previous Investigations for AOC 46-004(e2)

During the 1994 Phase I RFI, one fill sample was collected from the outfall. The sample was analyzed for inorganic chemicals, SVOCs, PCBs, pesticides, gamma spectroscopy, and isotopic uranium (LANL 1996, 054929, pp. 129–130). Samples collected and analyses requested are presented in Table 3.17-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Two additional soil samples were collected from the ditch below the outfall for the characterization of both AOC 46-004(e2) and SWMU 46-006(a) (LANL 1996, 054929, pp. 129, 141). Details on sampling and the results for these two samples are presented in section 5.33 for SWMU 46-006(a).

5.17.2 Summary of Data for AOC 46-004(e2)

Analytical data are presented in Tables 3.17-2 and 3.17-3 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for inorganic chemicals detected above BVs and organic chemicals detected are shown in Figures 3.14-1 and 3.14-2, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Cadmium, chromium, copper, lead, and zinc were detected above BVs. The detection limit for silver was above BV. Anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, DDE(4,4'-), DDT(4,4'-), endosulfan II, endrin, fluoranthene, methoxychlor(4,4'-), phenanthrene, and pyrene were detected. Radionuclides were not detected or were not detected above BVs/FVs. PCBs were not detected.

5.17.3 Scope of Activities for AOC 46-004(e2)

Six samples will be collected from three locations in the drainage at and below the outfall (Figure 5.12-2). Samples will be collected from two depths (0 to 1 ft and 2 to 3 ft) and analyzed for TAL metals, VOCs, SVOCs, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

AOC 46-004(e2) and SWMU 46-006(a) (section 5.33) are located within a common drainage. Data obtained from samples collected from AOC 46-004(e2) will be used to characterize SWMU 46-006(a).

AOC 46-004(e2) and SWMU 46-006(a) (section 5.33) lie within a drainage ditch immediately upgradient of the discharge point of the SWMU 46-004(c2) outfall (section 5.14). Flow from this ditch enters a drainage that discharges into Cañada del Buey. Data obtained from samples collected in the segment of the drainage below the drainage ditch associated with SWMU 46-004(c2) will be used to evaluate all three sites.

5.18 SWMU 46-004(f), Outfall

SWMU 46-004(f) is the outfall from an industrial drainline that served rooms 101 through 134 of building 46-24 (Figure 5.4-1). The outfall consists of a 6-in.-diameter VCP that receives discharges from a sump, acid sink, several floor and sink drains, and cooling water system (LANL 1993, 020952, p. 5-123). The outfall pipe discharges to a drain approximately 50 ft east of building 46-24. This drain is part of a network of drains that discharge to SWSC Canyon at former NPDES-permitted outfall 04A018 (LANL 1993, 020952, pp. 5-122–5-123). Before the outfall was removed from the NPDES permit, all discharges to the outfall from building 46-24 were ceased (LANL 1999, 064617, p. 2-8). Building 46-24 housed offices, a machine shop, electrical laboratories, and chemical laboratories where fuel rods were handled (LANL 1993, 020952, p. 5-10).

5.18.1 Summary of Previous Investigations for SWMU 46-004(f)

During the 1994 Phase I RFI, one soil sample was collected from the SWMU 46-004(f) outfall and analyzed for inorganic chemicals, SVOCs, PCBs, pesticides, gamma spectroscopy, and isotopic uranium. Samples collected and analyses requested are presented in Table 3.18-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803).

5.18.2 Summary of Data for SWMU 46-004(f)

Analytical data are presented in Table 3.18-2 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling location and results for inorganic chemicals detected above BVs are shown in Figure 3.18-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Copper, lead, mercury, and zinc were detected above BVs. The detection limit for thallium was above the BV. SVOCs, PCBs, pesticides, and radionuclides were not detected or were not detected above BVs/FVs.

5.18.3 Scope of Activities for SWMU 46-004(f)

Eight samples will be collected from four locations: two at the outfall and two below the drain network discharge point in the drainage to SWSC Canyon (Figure 5.4-2). Samples will be collected from two depths (0 to 1 ft and 2 to 3 ft) and analyzed for TAL metals, VOCs, SVOCs, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

SWMUs 46-004(r) and 46-004(w) (sections 5.23 and 5.28, respectively) are collocated outfalls that discharge to the same drain network as outfall SWMU 46-004(f). The drain network ultimately discharges to SWSC Canyon. Data obtained from samples collected in the drainage below the drain network outfall associated with SWMU 46-004(f) will be used to evaluate all three outfalls.

The drain network and another outfall, SWMU 46-004(t) (section 5.25), both discharge to SWSC Canyon. Data obtained from samples in the common segment of SWSC Canyon associated with SWMU 46-004(t) will be used to evaluate SWMU 46-004(f), SWMU 46-004(r), and SWMU 46-004(w).

5.19 AOC 46-004(f2), Outfall

AOC 46-004(f2) is an outfall located approximately 10 ft below the TA-46 perimeter fence near the northwest corner of building 46-31 (Figure 5.5-1). The outfall consists of a 4-in.-diameter cast-iron pipe located on the steep slope north of the building. This pipe received effluent from a single floor drain in room 151B of building 46-31 and discharged into Cañada del Buey. The floor drain leading to this outfall was plugged at some time before 1993. Building 46-31 housed test cells with electrical furnaces for thermal testing of graphite and uranium-235/uranium-238 fuel rods in support of the Rover Program. Welding experiments involving thorium were also conducted in building 46-31 (LANL 1993, 020952, pp. 5-11–5-14).

5.19.1 Summary of Previous Investigations for AOC 46-004(f2)

During the 1994 Phase I RFI, three soil and sediment samples were collected from three locations at AOC 46-004(f2). One sample was collected from the outfall, and two were collected from the drainage below the outfall. The samples were analyzed for inorganic chemicals, SVOCs, PCBs, pesticides, gamma spectroscopy, isotopic thorium, and isotopic uranium (LANL 1996, 054929, pp. 135–136). Samples collected and analyses requested are presented in Table 3.19-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Two additional samples were collected downgradient of the outfall and were used to characterize both AOC 46-004(f2) and SWMU 46-006(d) (LANL 1996, 054929, pp. 135, 159). Details on sampling and the results for these two samples are presented in section 5.36 for SWMU 46-006(d).

5.19.2 Summary of Data for AOC 46-004(f2)

Analytical data are presented in Tables 3.19-2 and 3.19-3 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for inorganic chemicals detected above BVs and organic chemicals detected are shown in Figures 3.19-1 and 3.19-2, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Copper was detected above BV in one sediment sample; lead was detected above BV in one soil and one sediment sample; mercury and zinc were detected above BVs in all three samples. Detection limits for selenium and silver were above BVs in two and one samples, respectively. Acenaphthene and Aroclor-1260 were detected in one sediment sample; dieldrin was detected in two sediment samples. Radionuclides were not detected or were not detected above BVs/FVs.

5.19.3 Scope of Activities for AOC 46-004(f2)

Twelve samples will be collected from six locations in the drainage at and below the outfall (Figure 5.12-2). Samples will be collected from two depths (0 to 1 ft and 1 to 2 ft) and analyzed for TAL metals, VOCs, SVOCs, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

5.20 SWMU 46-004(m), Outfall

SWMU 46-004(m) is a former NPDES-permitted outfall (04A013) located north of building 46-30 (Figure 5.12-1). The outfall protrudes from a 10-ft-deep bank located north of building 46-30. The outfall discharged effluent from an industrial drainline in building 46-30 to a ditch at the foot of the bank. The ditch flows to a storm drain culvert that discharges into Cañada del Buey (LANL 1996, 054929, pp. 48–49). Engineering drawings show this industrial drainline received effluent from the roof drains, laboratory sinks, and floor drains of building 46-30 (LANL 1993, 020952, p. 5-124). Building 46-30 was constructed as a hydraulics laboratory and contained a high-bay area with a crane, an actuator test area, and a small machine shop (LANL 1993, 020952, p. 5-7). In December 1995, the outfall was removed from the NPDES permit (LANL 1999, 064617, p. 2-8). Before the outfall was removed from the NPDES permit, all discharges to the outfall from building 46-30 were ceased.

5.20.1 Summary of Previous Investigations for SWMU 46-004(m)

During the 1994 Phase I RFI, six soil samples were collected from six locations at SWMU 46-004(m). Three samples were collected from the outfall; the other three samples were collected from the drainage downgradient of the storm drain culvert outfall that discharges into Cañada del Buey. All six samples were analyzed for inorganic chemicals, SVOCs, gamma spectroscopy, and isotopic uranium. Three samples were analyzed for PCBs, pesticides, isotopic thorium, and asbestos. Two samples were analyzed for VOCs. Two of the samples collected from the drainage were used for characterizing SWMU 46-007 (section 5.39). One of the samples collected from the drainage was used for characterizing SWMU 46-004(g) (section 5.16.5) (ICF Kaiser Engineers 1995, 053452, Exhibit E, p. 3; LANL 1996, 054929, pp. 34, 50, 199). Samples collected and analyses requested are presented in Table 3.20-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803).

5.20.2 Summary of Data for SWMU 46-004(m)

Analytical data are presented in Tables 3.20-2 and 3.20-3 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for inorganic chemicals detected above BVs and organic chemicals detected are shown in Figures 3.12-2 and 3.12-3, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Arsenic, cadmium, calcium, chromium, iron, nickel and silver were detected above BVs in one sample; lead was detected above BV in two samples; copper was detected above BV in three samples; mercury and zinc were detected above BVs in four samples. Cesium and lithium were detected in three samples. The detection limits for antimony, cadmium, cobalt, silver, and thallium were above BVs in one to five samples. Benzo(a)anthracene and dieldrin were detected in one sample. Benzo(a)pyrene, benzo(b)fluoranthene, chrysene, and endosulfan II were detected in two samples. Phenanthrene was detected in three samples; fluoranthene and pyrene were detected in four samples. VOCs, PCBs, and asbestos were not detected. Radionuclides were not detected or were not detected above BVs/FVs.

5.20.3 Scope of Activities for SWMU 46-004(m)

Eighteen samples will be collected from 9 locations in the drainage below the outfall from two depths (0 to 1 ft and 1 to 2 ft) (Figure 5.12-2). Two samples will be collected from one location adjacent to the drainline directly north of building 46-30 from two depths (0 to 1 ft and 2 to 3 ft below the drainline). Samples will be analyzed for TAL metals, VOCs, SVOCs, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

Runoff or discharge from SWMUs 46-004(b2), 46-004(s), 46-006(f), 46-007, and 46-008(b) (sections 5.12, 5.24, 5.37, 5.39, and 5.41, respectively) enters the drain network that receives flow from the SWMU 46-004(m) outfall. This drain network discharges into Cañada del Buey. Data obtained from samples collected in the common segment of the drainage below the network outfall associated with SWMU 46-004(m) will be used to evaluate SWMUs 46-004(b2), 46-004(s), 46-006(f), 46-007, and 46-008(b).

5.21 SWMU 46-004(p), Dry Well

SWMU 46-004(p) is a dry well (no structure number) located at the southwest corner of building 46-1 (Figure 5.12-1). The dry well consists of corrugated metal pipe, approximately 2 ft in diameter × 10 ft in length, placed vertically in the ground, and covered with a hinged-metal lid. The dry well was originally constructed for the disposal of alkali-metal wastes but was also used to dispose of other chemical wastes from building 46-1. Solid pieces of cesium or other alkali metals were discarded in the dry well (LANL 1993, 020952, p. 5-15). Building 46-1 housed offices, two assembly bays, a machine shop, several laboratories for the assembly and checkout of electrical components, general laboratories, and a uranium polishing area (LANL 1993, 020952, p. 5-7).

5.21.1 Summary of Previous Investigations for SWMU 46-004(p)

No sampling has been conducted at this SWMU.

5.21.2 Scope of Activities for SWMU 46-004(p)

Eight samples will be collected from two locations next to the dry well (Figure 5.12-2). Samples will be collected from four depths (at the base of the well, and 5 ft, 10 ft, and 15 ft below the base of the well) and analyzed for TAL metals, total cesium, VOCs, SVOCs, cyanide, asbestos, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

5.22 SWMU 46-004(q), Outfall

SWMU 46-004(q) is an outfall located north of building 46-58 (Figure 5.6-1). The outfall consists of a 6-in.-diameter cast-iron pipe that discharged into Cañada del Buey. The source of the discharge to the outfall is not known (LANL 1993, 020952, pp. 5-124–5-125).

5.22.1 Summary of Previous Investigations for SWMU 46-004(q)

During the 1994 Phase I RFI, one soil sample was collected from the SWMU 46-004(q) outfall and analyzed for inorganic chemicals, VOCs, SVOCs, gamma spectroscopy, isotopic thorium, and isotopic uranium (LANL 1996, 054929, pp. 55–57). Samples collected and analyses requested are presented in Table 3.22-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803).

Four samples were also collected within the vicinity of SWMU 46-004(q) for characterizing both SWMUs 46-004(q) and 46-004(h) (LANL 1996, 054929, pp. 44, 56). Details on sampling and the results for these four samples are reported for SWMU 46-004(h) in section 5.16.6.

5.22.2 Summary of Data for SWMU 46-004(q)

Analytical data are presented in Tables 3.22-2, 3.22-3, and 3.22-4 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for inorganic chemicals detected above BVs, organic chemical detected, and radionuclides detected or detected above BVs/FVs are shown in Figures 3.16-6, 3.16-7, and 3.16-8, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Barium, cadmium, copper, lead, mercury, nickel, silver, and zinc were detected above BVs. The detection limit for antimony was above BV. Bis(2-ethylhexyl)phthalate was detected. Uranium-234, uranium-235, and uranium-238 were detected above BVs. Isotopic thorium was not detected above BV. Radionuclides analyzed by gamma spectroscopy and isotopic thorium were not detected or were not detected above BVs/FVs. VOCs were not detected.

5.22.3 Scope of Activities for SWMU 46-004(q)

Twenty-six samples will be collected from 13 locations in the drainage at and below the outfall (Figure 5.10-1). Samples will be collected from two depths (0 to 1 ft and 1 to 2 ft) and analyzed for TAL metals, VOCs, SVOCs, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

SWMU 46-004(q) and SWMU 46-004(h) (section 5.16.6) discharge to a common drainage. Data obtained from samples collected from the common segment of the drainage associated with SWMU 46-004(q) will be used to evaluate SWMU 46-004(h).

5.23 SWMU 46-004(r), Outfall

SWMU 46-004(r) is an outfall located south of building 46-24. The outfall serves the west wing of building 46-24 (Figure 5.4-1). The outfall consists of a 4-in.-diameter cast-iron pipe that discharges to a drain south of building 46-24, near the northeast corner of a laser laboratory (building 46-76). Discharge from this outfall flows through a drain network that discharges to SWSC Canyon at former NPDES-permitted outfall 04A018 (LANL 1993, 020952, pp. 5-122–5-123). The drain network also received effluent from SWMUs 46-004(f) and 46-004(w) (discussed in sections 5.18 and 5.28). The outfall was removed from the NPDES permit in December 1995 (LANL 1999, 064617, p. 2-8). The SWMU 46-004(r) outfall received effluent from building 46-24 roof drains and sink drains. Building 46-24 housed offices, a machine shop, electrical laboratories, and chemical laboratories where fuel rods were handled (LANL 1993, 020952, p. 5-10). Currently, only roof drains from building 46-24 discharge to this outfall.

5.23.1 Summary of Previous Investigations for SWMU 46-004(r)

During the 1994 Phase I RFI, one surface soil sample was collected from this SWMU. The sample was also used to characterize SWMU 46-004(w). The sampling results of this sample are presented in section 5.28 for SWMU 46-004(w).

5.23.2 Summary of Data for SWMU 46-004(r)

Data are presented in Tables 3.28-2 and 3.28-3 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling location and detected results are shown in Figures 3.18-1 and 3.28-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Calcium, copper, and zinc were detected above BVs. Detection limits for cadmium and silver were greater than BVs. Benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, fluoranthene, phenanthrene, pyrene, trichloro-1,2,2-trifluoroethane(1,1,2-), trichloroethane(1,1,1-) (TCA), and trichloroethene (TCE) were detected. Radionuclides were not detected.

5.23.3 Scope of Activities for SWMU 46-004(r)

Two samples will be collected from the storm grate (Figure 5.4-2). The samples will be collected from two depths (0 to 1 ft and 1 to 2 ft) and will be analyzed for TAL metals, VOCs, SVOCs, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy.

Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

SWMUs 46-004(r) and 46-004(w) (section 5.28) are collocated. Data obtained from the samples collected from SWMU 46-004(r) will be used to evaluate both sites.

Flow from the SWMU 46-004(r) and SWMU 46-004(w) outfalls enters the drain network that receives flow from the SWMU 46-004(f) outfall (section 5.18). The drain network discharges to SWSC Canyon. Data obtained from the samples in the drainage below the drain network outfall associated with SWMU 46-004(f) will be used to evaluate SWMU 46-004(r) and SWMU 46-004(w).

The drain network and another outfall, SWMU 46-004(t) (section 5.25), both discharge to SWSC Canyon. Data obtained from samples in the common segment of SWSC Canyon associated with SWMU 46-004(t) will be used to evaluate SWMUs 46-004(f), 46-004(r), and 46-004(w).

5.24 SWMU 46-004(s), Outfall

SWMU 46-004(s) is an outfall located south of building 46-1 (Figure 5.12-1). The outfall received effluent from floor and roof drains of the south high bay in building 46-1. The outfall consists of a 4-in.-diameter cast-iron pipe located approximately 20 ft south of building 46-1. The pipe discharged to a drainage ditch (SWMU 46-007) (see section 5.39) on the south side of building 46-1 (LANL 1993, 020952, p. 5-125). The drainage ditch leads to a storm drain culvert that discharges into Cañada del Buey. In 1995, all floor drains in the south high bay of building 46-1 either were plugged or were rerouted to the SWSC plant. Currently, roof drains from the south high bay discharge to the storm drainage system and/or daylight near building 46-1 (LANL 1998, 101808, pp. 76-77). Building 46-1 housed offices, two assembly bays, a machine shop, several laboratories for the assembly and checkout of electrical components, general laboratories, and a uranium polishing area (LANL 1993, 020952, pp. 5–7).

5.24.1 Summary of Previous Investigations for SWMU 46-004(s)

During the 1994 Phase I RFI, three soil samples were collected from three locations at SWMU 46-004(s). One sample was collected from the outfall; one sample was collected below the outfall; the third sample was collected from the ditch below the outfall (SWMU 46-007). All samples were analyzed for inorganic chemicals, SVOCs, PCBs, pesticides, and isotopic uranium. Two samples were also analyzed for VOCs (LANL 1996, 054929, pp. 62–63). Samples collected and analyses requested are presented in Table 3.24-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Two additional samples were collected in the ditch below the outfall to characterize SWMUs 46-004(s) and 46-007 (LANL 1996, 054929, pp. 62, 199). Details on sampling and the results for these two additional samples are presented in section 5.39 for SWMU 46-007.

5.24.2 Summary of Data for SWMU 46-004(s)

Analytical data are presented in Tables 3.24-2 and 3.24-3 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for inorganic chemicals detected above BVs and organic chemicals detected are shown in Figures 3.12-2 and 3.12-3, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Cadmium, nickel, and silver were detected above BVs in one sample; zinc was detected above BV in two samples; copper, lead, and mercury were detected above BVs in three samples. Cesium was detected in one sample. The detection limits for thallium were above BV in three samples. Acenaphthene and dibenz(a,h)anthracene were detected in one sample. Anthracene and benzo(g,h,i)perylene were detected in two samples.

Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene were detected in all three samples. Isotopic uranium was not detected or was not detected above BVs. VOCs, PCBs, and pesticides were not detected.

5.24.3 Scope of Activities for SWMU 46-004(s)

Four samples will be collected from two locations below the outfall (Figure 5.12-2). Samples will be collected from two depths (0 to 1 ft and 1 to 2 ft) and analyzed for TAL metals, VOCs, SVOCs, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

Discharge from SWMU 46-004(s) enters a drainage ditch common to SWMU 46-007 (section 5.39). Data collected from samples at SWMU 46-007 will be used to evaluate SWMU 46-004(s).

Runoff or discharge from this drainage ditch enters the drain network that receives flow from the SWMU 46-004(m) outfall (section 4.20). This drain network discharges into Cañada del Buey. Data obtained from samples collected in the common segment of the drainage below the network outfall associated with SWMU 46-004(m) will be used to evaluate SWMUs 46-004(s) and 46-007.

5.25 SWMU 46-004(t), Outfall

SWMU 46-004(t) is former NPDES-permitted outfall 04A014 located southeast of building 46-76 (Figure 5.4-1). The outfall received discharge from an industrial drainline in building 46-88 (Figure 5.4-1). The outfall is a 4-in.-diameter VCP that discharged approximately 250 ft northeast of building 46-88 on the west side of SWSC Road (Figure 5.4-1). Effluent from the outfall flowed to a storm drain culvert under the road and discharged to SWSC Canyon (LANL 1993, 020952, pp. 5-125–5-126). Sink drains in rooms 101 and 102 and all floor drains in room 104 and the high bay of building 46-88 discharged to this outfall (Santa Fe Engineering Ltd. 1994, 101840, Figures 11 and 12). Outfall 04A014 was removed from the NPDES permit in July 1995. Before the outfall was removed from the NPDES permit, all discharges from building 46-88 were ceased. Building 46-88 housed a structural laboratory for testing pressure vessels associated with the Rover Program. Later, the building was used for process chemistry work to isolate nonradioactive isotopes of carbon, oxygen, and nitrogen (LANL 1993, 020952, p. 5-126).

5.25.1 Summary of Previous Investigations for SWMU 46-004(t)

No sampling has been conducted at this SWMU.

5.25.2 Scope of Activities for SWMU 46-004(t)

Twenty samples will be collected from 10 locations in the drainage at and below the outfall (Figure 5.4-2). Samples will be collected from two depths (0 to 1 ft and 2 to 3 ft) and analyzed for TAL metals, VOCs, SVOCs, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

Six samples will be collected from three locations beneath the drainline where it exits the building and at joints (Figure 5.4-2). Samples will be collected from two depths (at the base of the line and 5 ft below the base of the line) and analyzed for TAL metals, VOCs, SVOCs, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy.

Runoff or discharge from SWMUs 46-004(t), 46-004(f), 46-004(r), 46-004(w), 46-008(g), and 46-009(a) and AOC C-46-001 (sections 5.18, 5.23, 5.28, 5.45, 5.46, and 5.49, respectively) drains to SWSC Canyon. Data obtained from samples in the common segment of SWSC Canyon associated with SWMU 46-004(t) will be used to evaluate these sites.

5.26 SWMU 46-004(u), Outfall

SWMU 46-004(u) is the outfall located north of former building 46-87 (Figure 5.6-1). The outfall consisted of an 8-in.-diameter cast-iron pipe, located approximately 10 ft north of former building 46-87, that discharged into Cañada del Buey. This pipe was the overflow pipe for a concrete wet well located in former building 46-87. The wet well was designed as a deionized-water holding pit and historically received effluent from a closed-loop cooling water system serving buildings 46-16, 46-25, and 46-31. The wet well also received effluent from sink drains in building 46-25, which was a battery storage facility and for small-scale painting activities in support of the Rover Program (LANL 1993, 020952, p. 5-126). By the early 1990s, the outfall had been plugged and effluent discharged to the wet well was periodically pumped out and disposed of at the SWSC plant (Santa Fe Engineering Ltd. 1994, 101838, p. 16). By 1998, the building 46-25 drains that discharged to the wet well were removed from service (LANL 1998, 101808, p. 80). Building 46-87 was the pump house for an adjacent cooling tower (former building 46-86) that housed two wet well systems and mechanical equipment associated with the cooling tower (LANL 1993, 020952, p. 5-127). Building 46-87 also stored water treatment chemicals (Santa Fe Engineering Ltd. 1994, 101838, pp. 16-17). Building 46-87 was decontaminated and decommissioned in December 2001 (LANL 2008, 101882).

5.26.1 Summary of Previous Investigations for SWMU 46-004(u)

During the 1994 Phase I RFI, one soil sample was collected from the SWMU 46-004(u) outfall and analyzed for inorganic chemicals, SVOCs, gamma spectroscopy, isotopic thorium, and isotopic uranium. Samples collected and analyses requested are presented in Table 3.26-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). During the Phase I RFI, nine additional soil samples were collected from a drainage below the outfall and used for characterizing SWMUs 46-004(a2), 46-004(u), 46-004(v), and 46-006(d) (LANL 1996, 054929, pp. 68, 75, 100, 159). The sampling results of these nine samples are presented in section 5.10 for SWMU 46-004(a2).

5.26.2 Summary of Data for SWMU 46-004(u)

Analytical data are presented in Table 3.26-2 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling location and results for inorganic chemicals detected above BVs are shown in Figure 3.16-6 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Copper, mercury, and zinc were detected above BVs. The detection limit for thallium was above BV. SVOCs were not detected. Radionuclides were not detected or were not detected above FVs/BVs.

5.26.3 Scope of Activities for SWMU 46-004(u)

Twenty samples will be collected from 10 locations in the drainage at and below the outfall (Figure 5.10-1). Samples will be collected from two depths (0 to 1 ft and 1 to 2 ft) and analyzed for TAL metals, VOCs, SVOCs, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

SWMUs 46-004(u), 46-004(a2), 46-004(v), and 46-004(x) (sections 5.10, 5.27, and 5.29, respectively) discharge to a common drainage in Cañada del Buey. Data obtained from samples collected from within the common segment of the drainage associated with SWMU 46-004(u) will be used to evaluate all four sites.

5.27 SWMU 46-004(v), Outfall

SWMU 46-004(v) is the outfall for the industrial drainlines from former building 46-87 (Figure 5.6-1). The outfall consists of a 6-in.-diameter cast-iron pipe located approximately 20 ft north of former building 46-87. Floor and roof drains from building 46-87 discharged to this outfall. Effluent from the outfall discharged into Cañada del Buey. By the early 1990s, the floor drains that discharged to this outfall had been plugged (Santa Fe Engineering Ltd. 1994, 101838, Figure 9). Building 46-87 was the pump house for an adjacent cooling tower (former building 46-86) that housed two wet well systems and mechanical equipment associated with the cooling tower (LANL 1993, 020952, p. 5-127). This building was also used to store water treatment chemicals (Santa Fe Engineering Ltd. 1994, 101838, pp. 16-17). Building 46-87 was decontaminated and decommissioned in December 2001 (LANL 2008, 101882).

5.27.1 Summary of Previous Investigations for SWMU 46-004(v)

During the 1994 Phase I RFI, one soil sample was collected from the SWMU 46-004(v) outfall and analyzed for metals, SVOCs, gamma spectroscopy, isotopic thorium, and isotopic uranium. Samples collected and analyses requested are presented in Table 3.27-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). During the Phase I RFI, nine additional soil samples were collected from a drainage below the outfall and used to characterize SWMUs 46-004(a2), 46-004(u), 46-004(v), and 46-006(d) (LANL 1996, 054929, pp. 68, 75, 100, 159). The sampling results of these nine samples are presented in section 5.10 for SWMU 46-004(a2).

5.27.2 Summary of Data for SWMU 46-004(v)

Analytical data are presented in Tables 3.27-2 and 3.27-3 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for organic chemicals detected are shown in Figure 3.16-7 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The detection limits for mercury and thallium were above BVs. Benzo(a)anthracene, chrysene, fluoranthene, phenanthrene, and pyrene were detected. Radionuclides were not detected or were not detected above BVs/FVs.

5.27.3 Scope of Activities for SWMU 46-004(v)

Four samples will be collected from two locations in the drainage at and below the outfall (Figure 5.10-1). Samples will be collected from two depths (0 to 1 ft and 1 to 2 ft) and analyzed for TAL metals, VOCs, SVOCs, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

SWMUs 46-004(u), 46-004(a2), 46-004(v), and 46-004(x) (sections 5.10, 5.27, and 5.29) discharge to a common drainage in Cañada del Buey. Data obtained from samples collected from within the common segment of the drainage associated with SWMU 46-004(u) will be used to evaluate all four sites.

5.28 SWMU 46-004(w), Outfall

SWMU 46-004(w) is an outfall located south of building 46-24 (Figure 5.4-1). The outfall served a sink drain in building 46-59. The outfall is a 2-in.-diameter cast-iron pipe that discharged to a drain south of building 46-24, near the northeast corner of a laser laboratory (building 46-76). This drain also received effluent from the SWMU 46-004(r) outfall and was part of a network of drains that discharged to SWSC Canyon at former NPDES-permitted outfall 04A018 (LANL 1993, 020952, pp. 5-122–5-123). The outfall was removed from the NPDES permit in December 1995 (LANL 1999, 064617, p. 2-8). Before the outfall was removed from the NPDES permit, all discharges to the outfall from building 46-59 were ceased. Building 46-59 was used for hydraulic and structural testing of components in support of the Rover Program.

5.28.1 Summary of Previous Investigations for SWMU 46-004(w)

During the 1994 Phase I RFI, one soil sample was collected from the SWMU 46-004(w) outfall and analyzed for inorganic chemicals, VOCs, SVOCs, PCBs, gamma spectroscopy, and isotopic uranium. Samples collected and analyses requested are presented in Table 3.28-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). This sample was also used to characterize SWMU 46-004(r) (section 5.23).

5.28.2 Summary of Data for SWMU 46-004(w)

Analytical data are presented in Tables 3.28-2 and 3.28-3 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling location and results for inorganic chemicals detected above BVs and organic chemicals detected are shown in Figures 3.18-1 and 3.28-1, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Calcium, copper, and zinc were detected above BVs. Detection limits for cadmium and silver were above BVs. Benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, fluoranthene, phenanthrene, pyrene, trichloro-1,2,2-trifluoroethane(1,1,2-), TCA, and TCE were detected. PCBs were not detected. Radionuclides were not detected or were not detected above BVs/FVs.

5.28.3 Scope of Activities for SWMU 46-004(w)

SWMUs 46-004(w) and 46-004(r) (section 5.23) are collocated outfalls. Data obtained from the samples collected from SWMU 46-004(r) will be used to evaluate both sites. Section 5.23 describes the sampling strategy for SWMU 46-004(r).

Flow from the SWMU 46-004(w) and SWMU 46-004(r) outfalls enters the drain network that receives flow from the SWMU 46-004(f) outfall (section 5.18). The drain network ultimately discharges to SWSC Canyon. Data obtained from the samples in the drainage below the drain network outfall associated with SWMU 46-004(f) will be used to evaluate these sites.

The drain network and another outfall, SWMU 46-004(t) (section 5.25), both discharge to SWSC Canyon. Data obtained from samples in the common segment of SWSC Canyon associated with SWMU 46-004(t) will be used to evaluate SWMU 46-004(f), SWMU 46-004(r), and SWMU 46-004(w).

5.29 SWMU 46-004(x), Outfall

SWMU 46-004(x) is an outfall located approximately 30 ft northeast of building 46-31 (Figure 5.5-1). The outfall consists of a 6-in.-diameter pipe that received effluent from roof drains in building 46-31

(LANL 1993, 020952, p. 5-127). The outfall discharges into Cañada del Buey (LANL 1993, 020952, p. 5-127). The pipe extends approximately 1 ft beyond the steep canyon slope and discharges to a 1- to 2-ft-wide drainage that stretches to the toe of the slope (LANL 1996, 054929, p. 81). Building 46-31 housed test cells with electrical furnaces for thermal testing of graphite and uranium-235/uranium-238 fuel rods in support of the Rover Program. Welding experiments involving thorium were also conducted in building 46-31 (LANL 1993, 020952, pp. 5-11–5-14).

5.29.1 Summary of Previous Investigations for SWMU 46-004(x)

During the 1994 Phase I RFI, seven soil samples were collected from seven locations at SWMU 46-004(x). One sample was collected from the outfall, and two samples were collected below the outfall. Four samples were collected from four locations in the drainage below the outfall. All samples were analyzed for inorganic chemicals, VOCs, SVOCs, PCBs, pesticides, gamma spectroscopy, isotopic plutonium, isotopic thorium, and isotopic uranium. Samples collected and analyses requested are presented in Table 3.29-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803).

5.29.2 Summary of Data for SWMU 46-004(x)

Analytical data are presented in Tables 3.29-2, 3.29-3, and 3.29-4 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for inorganic chemicals detected above BVs, organic chemicals detected, and radionuclide detected or detected above BVs/FVs are shown in Figures 3.19-1, 3.19-2, and 3.29-1, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Calcium, lead, and mercury were detected above BVs in one sample; cadmium was detected above BV in two samples; copper and zinc were detected above BVs in three samples. Detection limits for antimony, cadmium, mercury, and thallium were above BVs in one to seven samples. Acenaphthylene, acetone, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, methylnaphthalene(2-), and methylphenol(4-) were detected in one sample. Acenaphthene, DDE(4,4'-), dibenzofuran, fluorene, heptachlor epoxide, and naphthalene were detected in two samples. Anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, endrin aldehyde, indeno(1,2,3-cd)pyrene, and phenanthrene were detected in three samples. Chrysene was detected in four samples. Fluoranthene and pyrene were detected in five samples. Plutonium-238 was detected above FV in one sample. Radionuclides analyzed by gamma spectroscopy, isotopic thorium, and isotopic uranium were not detected or were not detected above BVs/FVs. PCBs were not detected.

5.29.3 Scope of Activities for SWMU 46-004(x)

Ten samples will be collected from five locations in the drainage at and below the outfall (Figure 5.10-1). Samples will be collected from two depths (0 to 1 ft and 1 to 2 ft) and analyzed for TAL metals, VOCs, SVOCs, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

SWMUs 46-004(u), 46-004(a2), 46-004(v), and 46-004(x) (sections 5.10, 5.27, and 5.29) discharge to a common drainage in Cañada del Buey. Data obtained from samples collected from within the common segment of the drainage associated with SWMU 46-004(u) will be used to evaluate all four sites.

5.30 SWMU 46-004(y), Outfall

SWMU 46-004(y) is a former NPDES-permitted outfall (03A043) located approximately 20 ft north of building 46-31 (Figure 5.5-1). The outfall received blowdown from a cooling tower in building 46-31 and effluent from the building's floor, roof drains, and laboratory sinks. This outfall consisted of a 6-in.-diameter cast-iron pipe that discharged into Cañada del Buey (LANL 1993, 020952, p. 5-127). Before 1996, the outfall pipe to the canyon was removed, the roof drains were rerouted to new storm drains that discharge to the north side of building 46-31, and all floor and sink drains discharging to this outfall were rerouted to the SWSC plant (Santa Fe Engineering Ltd. 1994, 101839, Figure 2). In July 1996, the outfall was removed from the NPDES permit (LANL 1999, 064617, p. 2-8).

5.30.1 Summary of Previous Investigations for SWMU 46-004(y)

During the 1994 Phase I RFI, six soil samples were collected from five locations at SWMU 46-004(y). One sample was collected from the outfall; two samples were collected just below the outfall; two samples were collected from one location in the drainage; and one sample was collected near the bottom of the drainage at the toe of the slope. All six samples were analyzed for inorganic chemicals, SVOCs, PCBs, gamma spectroscopy, isotopic plutonium, isotopic thorium, and isotopic uranium. Five samples were also analyzed for VOCs. Samples collected and analyses requested are presented in Table 3.30-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803).

5.30.2 Summary of Data for SWMU 46-004(y)

Analytical data are presented in Tables 3.30-2, 3.30-3, and 3.30-4 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for inorganic chemicals detected above BVs, organic chemicals detected, and radionuclides detected or detected above BVs/FVs are shown in Figures 3.19-1, 3.19-2, and 3.29-1, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Nickel was detected above BV in one sample; lead was detected above BV in two samples; copper was detected above BV in four samples; mercury and zinc were detected above BVs in six samples. Detection limits for cadmium, silver, and thallium were above BVs for one to three samples. Anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene and trichlorofluoromethane were detected in one sample. Benzo(a)anthracene was detected in two samples. Fluoranthene, phenanthrene, and pyrene were detected in three samples. Methylene chloride was detected in five samples. Uranium-234 was detected above BV in one sample. Radionuclides analyzed by gamma spectroscopy, isotopic plutonium, and isotopic thorium were not detected or were not detected above BVs/FVs. PCBs were not detected.

5.30.3 Scope of Activities for SWMU 46-004(y)

Sixteen samples will be collected from eight locations in the drainage at and below the outfall (Figure 5.12-2). Samples will be collected from two depths (0 to 1 ft and 1 to 2 ft) and analyzed for TAL metals, VOCs, SVOCs, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

5.31 SWMU 46-004(z), Outfall

SWMU 46-004(z) is an outfall located approximately 20 ft northwest of building 46-31 (Figure 5.5-1). The outfall receives stormwater discharge from two roof drains at building 46-31. Previously, the outfall also served the floor drains for rooms 160 through 172 of building 46-31. This outfall consists of a 6-in.-diameter cast-iron pipe that discharges into Cañada del Buey (LANL 1993, 020952, p. 5-128). The floor drains leading to this outfall were rerouted to the SWSC plant at some time before 1993 (LANL 1996, 054929, p. 94).

5.31.1 Summary of Previous Investigations for SWMU 46-004(z)

During the 1994 Phase I RFI, 11 soil samples were collected from eight locations at SWMU 46-004(z). Because a concrete pad lies beneath the discharge pipe, samples were not collected directly beneath the outfall. Three samples were collected from two locations at the bottom of the drainage. The remaining eight samples were collected from six locations in the three drainages that diverge at the toe of the slope. Ten samples were analyzed for inorganic chemicals, SVOCs, PCBs, pesticides, gamma spectroscopy, isotopic plutonium, isotopic thorium, and isotopic uranium. Six samples were also analyzed for VOCs. One sample was analyzed for inorganic chemicals only. Samples collected and analyses requested are presented in Table 3.31-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). One sample was also used to characterize SWMU 46-004(b) (LANL 1996, 054929, p. 28).

5.31.2 Summary of Data for SWMU 46-004(z)

Analytical data are presented in Tables 3.31-2 and 3.31-3 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for inorganic chemicals detected above BVs and radionuclides detected or detected above BVs/FVs are shown in Figures 3.19-1 and 3.29-1, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Calcium, nickel, and zinc were detected above BVs in one sample. Mercury was detected above BV in 10 samples. Cesium-137 and plutonium-239/240 were detected in one and two samples, respectively. Isotopic thorium and isotopic uranium were not detected or were not detected above BVs. VOCs, SVOCs, PCBs, and pesticides were not detected.

5.31.3 Scope of Activities for SWMU 46-004(z)

Sixteen samples will be collected from eight locations in the drainage at and below the outfall (Figure 5.12-2). Samples will be collected from two depths (0 to 1 ft and 1 to 2 ft) and analyzed for TAL metals, VOCs, SVOCs, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

5.32 SWMU 46-005, Surface Impoundments

SWMU 46-005 consists of two surface impoundments (structures 46-170 and 46-171) and the associated drainlines that connected the impoundments to buildings 46-158, 46-226, and 46-251 (Figure 5.8-1). The impoundment system was constructed in the late 1970s. From 1980 to 1987, the impoundments contained salt brine and were associated with solar-energy experiments. During this time period, there is no evidence that anything other than salt brine was introduced into the impoundments. In 1982, one of the impoundments leaked for approximately 30 days, losing approximately 10,000 to 20,000 kg of sodium chloride. In 1987, the brine was drained and disposed of by a salt disposal company (LANL 1990, 007513, p. 212). After the sanitary waste line from buildings 46-158, 46-226, and 46-251 was disconnected from an on-site septic system [SWMU 46-003(g)], it was connected to the uppermost surface impoundment (structure 46-170). The upper impoundment (structure 46-170) has an overflow drain to the lower impoundment (46-171), which in turn has an overflow line to former NPDES-permitted outfall SSS12S that discharged to SWSC Canyon (LANL 1993, 020952, p. 5-56). In the early 1990s, the SWMU 46-005 impoundments were taken out of service, and the sanitary waste line to the impoundments was rerouted to the SWSC plant (LANL 1996, 101818). The outfall was removed from the NPDES permit before 1994 (LANL 1999, 064617, p. 2-8). Building 46-158 houses facilities for laser-induced chemistry experiments (LANL 1993, 020952, pp. 5-13–5-54).

5.32.1 Summary of Previous Investigations for SWMU 46-005

No sampling has been conducted at this SWMU.

5.32.2 Scope of Activities for SWMU 46-005

Eight samples will be collected from four locations beneath the drainlines, and two samples will be collected from one location at the outfall (Figure 5.8-2). Samples will be collected from two depths (0 to 1 ft and 2 to 3 ft) and analyzed for TAL metals, total cesium, VOCs, SVOCs, pesticides, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

Ten samples will be collected from five locations within the surface impoundments (Figure 5.8-2). Samples will be collected from two depths (at the base of the impoundment and 5 ft below the impoundment) and analyzed for TAL metals, total cesium, VOCs, SVOCs, pesticides, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy.

Four samples will be collected from two locations adjacent to the surface impoundments (Figure 5.8-2). Samples will be collected from two depths (0 to 1 ft and 3 to 4 ft) and analyzed for TAL metals, total cesium, VOCs, SVOCs, pesticides, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy.

Four samples will be collected from two locations in the drainage below the outfall of the surface impoundment (Figure 5.8-2). Samples will be collected from two depths (0 to 1 ft and 1 to 2 ft) and analyzed for TAL metals, total cesium, VOCs, SVOCs, pesticides, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy.

5.33 SWMU 46-006(a), Potential Soil Contamination

SWMU 46-006(a) is a 70-ft × 100-ft area located at the north end of the parking lot between buildings 46-1 and 46-42 (Figure 5.12-1). The area is paved and drains to an adjacent ditch on the north side of the area. The ditch is approximately 5 ft deep and 10 to 15-ft wide and drains through a storm drain culvert into Cañada del Buey. A 1986 site visit of the area noted fifteen 55-gal. drums containing dielectric oil were stored on the pavement. Some of the drums were leaking, and oil had migrated into a ditch next to the pad (LANL 1996, 054929, p. 140).

5.33.1 Summary of Previous Investigations for SWMU 46-006(a)

In 1989, three soil samples were collected from three locations, one on the side of the adjacent ditch and two below it. Samples were analyzed for inorganic chemicals, VOCs, PCBs, pesticides, radionuclides, and HE (LANL 1993, 020952, pp. 5-82–5-83). Data for the 1989 sampling event are not presented in this report but are summarized in the OU 1140 work plan (LANL 1993, 020952, pp. 5-84–5-85).

During the 1994 Phase I RFI, two soil samples were collected from two locations in the ditch next to SWMU 46-006(a). Both samples were analyzed for inorganic chemicals, SVOCs, PCBs, pesticides, gamma spectroscopy, isotopic thorium, and isotopic uranium. One sample was also analyzed for VOCs. Samples collected and analyses requested are presented in Table 3.33-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). These two samples were also used to characterize AOC 46-004(e2) (section 5.17) (LANL 1996, 054929, pp. 129, 140–142). Three additional samples were collected in a cluster at the eastern end of the ditch near the storm drain culvert that discharges into

Cañada del Buey. These three samples were also used to characterize both SWMUs 46-006(a) and 46-004(c2). The data for these samples are reported in section 5.14 (LANL 1996, 054929, pp. 121, 141).

5.33.2 Summary of Data for SWMU 46-006(a)

Analytical data from the 1994 Phase I RFI are presented in Tables 3.33-2 and 3.33-3 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for inorganic chemicals detected above BVs and organic chemicals detected are shown in Figures 3.14-1 and 3.14-2, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Copper, lead, and zinc were detected above BVs in both samples. Detection limits for cadmium and silver were above BVs in both samples. DDE(4,4'-), dieldrin, and endrin aldehyde were detected in one sample. Anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, DDT(4,4'-), endosulfan II, endrin, fluoranthene, methoxychlor(4,4'-), phenanthrene, and pyrene were detected in both samples. VOCs and PCBs were not detected. Radionuclides were not detected or were not detected above BVs/FVs.

5.33.3 Scope of Activities for SWMU 46-006(a)

SWMU 46-006(a) and AOC 46-004(e2) are located within a common drainage. Data obtained from samples collected from AOC 46-004(e2) (section 5.17) will be used to characterize both sites. Section 5.17 describes the sampling strategy for SWMU 46-004(e2).

AOC 46-004(e2) and SWMU 46-006(a) lie within a drainage ditch immediately upgradient of the discharge point of the SWMU 46-004(c2) outfall (section 5.14). Flow from this ditch enters a drainage that discharges into Cañada del Buey. Data obtained from samples collected in the segment of the drainage below the drainage ditch associated with SWMU 46-004(c2) will be used to evaluate all three sites.

5.34 SWMU 46-006(b), Former Storage Shed

SWMU 46-006(b) is the site of a former storage shed (structure 46-197) located approximately 40 ft north of the Laser Isotope Support Facility (building 46-41) (Figure 5.2-1). The shed was approximately 40 ft long × 8 ft wide, constructed of plywood on three sides (the north side was open) with a sheet-metal roof. The shed was used for short-term storage of oil drums, vacuum pumps, optical tables, other laboratory equipment, and electrical equipment with PCB-containing oil. The shed was installed sometime before 1977 and removed in 1990 (LANL 1993, 020952, p. 5-77). The site of the shed is paved with asphalt and slopes toward a storm drain to the southeast. During a 1986 site visit of the area, oil was observed to be leaking from under the back of the shed. In addition, an oil spill was observed east of the shed, and discolored soil was observed at the storm drain outfall (LANL 1993, 020952, p. 5-77).

5.34.1 Summary of Previous Investigations for SWMU 46-006(b)

During the 1994 Phase I RFI, five soil and fill samples were collected from five locations at SWMU 46-006(b). Two samples were collected from the footprint of the storage shed; one sample was collected in the drainage below the shed; and two samples were collected from the storm drain outfall. All samples were analyzed for inorganic chemicals, SVOCs, PCBs, gamma spectroscopy, and isotopic uranium. Two of the samples were also analyzed for isotopic thorium. Samples collected and analyses requested are presented in Table 3.34-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803).

5.34.2 Summary of Data for SWMU 46-006(b)

Analytical data are presented in Tables 3.34-2, 3.34-3, and 3.34-4 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for inorganic chemicals detected above BVs, organic chemicals detected, and radionuclides detected or detected above BVs/FVs are shown in Figures 3.34-1, 3.34-2, and 3.34-3, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Lead was detected above BV in one soil sample; zinc was detected above BV in two soil samples. Detection limits for cadmium and silver were above BVs in all five samples. Benzo(a)anthracene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, fluoranthene, and phenanthrene were detected in one soil sample. Pyrene was detected in two soil samples. Uranium-235 was detected above BV in one soil sample. Radionuclides analyzed by gamma spectroscopy and isotopic thorium were not detected or were not detected above BVs/FVs. PCBs were not detected.

5.34.3 Scope of Activities for SWMU 46-006(b)

Four samples will be collected from two locations at the former shed location (Figure 5.2-2). Samples will be biased to stains/cracks in the pavement and collected from two depths (0 to 1 ft and 3 to 4 ft beneath the asphalt). Samples will be analyzed for TAL metals, VOCs, SVOCs, TPH, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

Six samples will be collected from three locations downgradient of the former storage area, two near the storage area and one approximately 90 ft southeast at the storm drain outfall (Figure 5.2-2). Samples will be collected from two depths (0 to 1 ft and 2 to 3 ft) and analyzed for TAL metals, VOCs, SVOCs, TPH, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy.

5.35 SWMU 46-006(c), Storage Area

SWMU 46-006(c) is a paved 15-ft × 30-ft storage area located between the northeast corner of building 46-158 and the southeast side of building 46-208 (Figure 5.8-1). Some of the pavement is stained. The area is currently used to store laboratory equipment and supplies. Asphalt curbing directs runoff into a storm drain discharging to SWSC Canyon. During a 1986 site visit, drums were leaking, and oil was noted to be draining into the storm drain. The drums were removed before 1994 (LANL 1993, 020952, pp. 5-77–5-78, 5-104).

5.35.1 Summary of Previous Investigations for SWMU 46-006(c)

During the 1994 Phase I RFI, six soil, sediment, and tuff samples were collected from four locations at SWMU 46-006(c). Two soil samples were collected from a drainage ditch below the paved area; one sediment sample was collected on the slope of the canyon; one sediment and two tuff samples were collected from one location in the drainage at the toe of the slope. All samples were analyzed for inorganic chemicals. The two soil samples from the drainage below the paved area were also analyzed for SVOCs and PCBs. The four sediment and tuff samples collected from the drainage below the outfall were analyzed for gamma spectroscopy, isotopic thorium, and isotopic uranium. Samples collected and analyses requested are presented in Table 3.35-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803).

5.35.2 Summary of Data for SWMU 46-006(c)

Analytical data are presented in Tables 3.35-2 and 3.35-3 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for inorganic chemicals detected above BVs and organic chemical detected are shown in Figures 3.35-1 and 3.35-2, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Chromium, magnesium, and vanadium were detected above BVs in one tuff sample; copper was detected above BV in one soil sample; aluminum, barium, and calcium were detected above BVs in two tuff samples; lead was detected above BV in two soil samples; zinc was detected above BVs in two soil and one sediment sample; mercury was detected above BV in all six samples. Detection limits for selenium and thallium were above BVs in four samples. Bis(2-ethylhexyl)phthalate was detected in the two soil samples. PCBs were not detected. Radionuclides were not detected or were not detected above BVs/FVs. PCBs were not detected.

5.35.3 Scope of Activities for SWMU 46-006(c)

Four samples will be collected from two locations (Figure 5.8-2). Samples will be biased to stains/cracks in the pavement and will be collected from two depths (0 to 1 ft and 3 to 4 ft beneath the asphalt). Samples will be analyzed for TAL metals, VOCs, SVOCs, TPH, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

Fourteen samples will be collected from seven locations downgradient of SWMU 46-006(c) (Figure 5.8-2). Samples will be collected from two depths (0 to 1 ft and 2 to 3 ft) and analyzed for TAL metals, VOCs, SVOCs, TPH, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy.

5.36 SWMU 46-006(d), Potential Soil Contamination

SWMU 46-006(d) is an area of potential soil contamination located on the north side of building 46-31 (Figure 5.5-1). The area is approximately 50 ft × 300 ft. Oils and possibly other materials had spilled in the area. Engineering drawings show a drain from room 111A also discharged to this SWMU. The area is level near building 46-31 but drops steeply towards the TA-46 northern perimeter fence and into Cañada del Buey. During a 1986 site visit, 55-gal. drums, cans, rusty chemical storage containers, and a thick layer of oil were observed on the slope (LANL 1993, 020952, p. 5-78). With the exception of two asphalt-paved delivery and parking areas located at the eastern and western boundaries of the SWMU, most of the area is unpaved. SWMUs 46-004(a), 46-004(b), and 46-004(c) are located within SWMU 46-006(d), and drainages that flow into Cañada del Buey, north of TA-46 perimeter fence, receive runoff from SWMU 46-006(d).

5.36.1 Summary of Previous Investigations for SWMU 46-006(d)

In 1989, six soil samples were collected from six soil-stained locations at SWMU 46-006(d) and analyzed for inorganic chemicals, VOCs, SVOCs, pesticides, and radionuclides. Data for the 1989 sampling event are not presented in this report but are summarized in the OU 1140 work plan (LANL 1993, 020952, pp. 5-85–5-88).

During the 1994 Phase I RFI, 23 soil, sediment, fill, and tuff samples were collected from 17 locations at SWMU 46-006(d). Twelve samples were collected from within the SWMU boundary and from the area extending to building 46-58; seven samples were collected from five drainages behind building 46-31 that slope into Cañada del Buey; four samples were collected from the drainage behind building 46-58 that slopes into Cañada del Buey. All the samples were analyzed for inorganic chemicals, SVOCs, gamma spectroscopy, and isotopic uranium. Twenty samples were analyzed for VOCs; 19 samples were analyzed for PCBs, pesticides, and isotopic plutonium; 11 samples were analyzed for isotopic thorium. Samples collected and analyses requested are presented in Table 3.36-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Two samples collected from one of the five drainages were also used to characterize AOC 46-004(f2) (LANL 1996, 054929, pp. 135, 159) (see section 5.19). One of the samples collected within the boundary of SWMU 46-006(d) was also used to characterize SWMU 46-004(b) (LANL 1996, 054929, pp. 28, 159) (see section 5.11). Nine soil and sediment samples collected for SWMU 46-004(a2) were also used to characterize SWMUs 46-004(u), 46-004(v), and 46-006(d) (LANL 1996, 054929, pp. 68, 75, 100, 159). The sampling results of these nine samples are presented in section 5.10 for SWMU 46-004(a2).

5.36.2 Summary of Data for SWMU 46-006(d)

Analytical data are presented in Tables 3.36-2, 3.36-3, and 3.36-4 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for inorganic chemicals detected above BVs, organic chemicals detected, and radionuclides detected or detected above BVs/FVs are shown in Figures 3.36-2, 3.36-3, 3.36-4, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Aluminum, arsenic, magnesium, and vanadium were detected above BVs in one tuff sample; cobalt and iron were detected above BVs in one soil sample; cadmium and silver were detected above BVs in three soil samples; chromium was detected above BVs in two tuff samples and one soil sample; nickel was detected above BVs in one soil, one sediment, and one tuff sample. Barium was detected above BV in four tuff samples; calcium was detected above BVs in one soil, one sediment, and two tuff samples. Copper was detected above BVs in one tuff and four soil samples; lead was detected above BVs in four soil and two tuff samples. Mercury was detected above BVs in three soil, five sediment, and two tuff samples; zinc was detected above BV in seven soil samples. Detection limits for antimony, cadmium, cobalt, selenium, silver, and thallium were above BVs in 1 to 11 samples. Acenaphthene and bis(2-ethylhexyl)phthalate were detected in one soil samples; methoxychlor(4,4'-) was detected in one tuff sample. Dieldrin was detected in two soil samples; TCA and TCE were detected in two tuff samples. Aroclor-1254 was detected in three soil samples. Cesium-137 was detected in two soil samples. Plutonium-238 was detected above FV in one fill and four soil samples and above BV in three sediment samples. Plutonium-238 was also detected in one soil sample at depths greater than the applicable FV and was detected in two tuff samples. Uranium-234 was detected above BV in one soil sample. Isotopic thorium was not detected or was not detected above BVs.

5.36.3 Scope of Activities for SWMU 46-006(d)

Eight samples will be collected from four locations within the SWMU boundary along the north wall of building 46-31 (Figure 5.5-2). Samples will be collected from two depths (0 to 1 ft and 4 to 5 ft beneath the asphalt) and analyzed for TAL metals, VOCs, SVOCs, TPH, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

Thirty-two samples will be collected from 16 locations within and north of the SWMU boundary on the mesa top and slope (outside of the drainages) (Figure 5.5-2). Samples will be collected from two depths (0 to 1 ft and 1 to 2 ft) and analyzed for TAL metals, VOCs, SVOCs, TPH, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy.

Four outfalls, SWMUs 46-004(f2), 46-004(x), 46-004(y), and 46-004(z) (sections 5.19, 5.29, 5.30, and 5.31, respectively), discharge to drainages that slope from SWMU 46-006(d) and into Cañada del Buey. Data obtained from samples collected in the drainages below these outfalls will be used to evaluate these sites.

5.37 SWMU 46-006(f), Storage Area

SWMU 46-006(f) is a storage area consisting of a storage shed (building 46-36) located approximately 50 ft east of building 46-1 and the surrounding area (Figure 5.12-1). The 20-ft × 30-ft metal storage building was constructed in 1955 (Meeker et al. 1990, 054783.34, p. 39). The floor of the storage shed is paved and sits approximately 6 to 8 in. belowgrade. The area surrounding the storage area also has been a storage area, a staging area for equipment and materials awaiting disposal, and an unloading area for new equipment. The areas on the west and south sides of building 46-36 are paved; the areas on the north and east are unpaved. Stored materials may have included oils (possibly containing PCBs), alkali metals, asbestos-containing products, beryllium alloys, potassium dichromate, lead bricks, lead shot, and mercury (LANL 1993, 020952, p. 5-79). Because the floor of building 46-36 is belowgrade, frequent flooding of the building occurs during the rainy season (LANL 1996, 054929, pp. 189–190). The surrounding area slopes north to a storm drain culvert that discharges into Cañada del Buey.

5.37.1 Summary of Previous Investigations for SWMU 46-006(f)

During the 1994 Phase I RFI, three soil samples were collected from three locations at SWMU 46-006(f). One sample was collected near the southeast corner of building 46-36, next to the pavement. The remaining two samples were collected from two locations in the drainage area north of building 46-36; one sample was collected northeast of the building and the second sample was collected near the storm drain culvert. All samples were analyzed for inorganic chemicals, SVOCs, PCBs, pesticides, gamma spectroscopy, isotopic uranium, and asbestos. Samples collected and analyses requested are presented in Table 3.37-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803).

5.37.2 Summary of Data for SWMU 46-006(f)

Analytical data are presented in Tables 3.37-2 and 3.37-3 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for inorganic chemicals detected above BVs and organic chemicals detected are shown in Figures 3.12-2 and 3.12-3, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Lead was detected above BV in one sample; zinc was detected above BV in two samples; mercury was detected above BV in all three samples. The detection limit for thallium was above BV in all three samples. Aroclor-1254, dieldrin, endosulfan II, and fluoranthene were detected in one sample. Radionuclides were not detected or were not detected above BVs/FVs.

5.37.3 Scope of Activities for SWMU 46-006(f)

Four samples will be collected from two locations at the storage area to define nature and extent of contamination (Figure 5.12-2). Samples will be collected from two depths (0 to 1 ft and 3 to 4 ft beneath asphalt) and analyzed for TAL metals, VOCs, SVOCs, TPH, pesticides, PCBs, cyanide, perchlorate, asbestos, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

Four samples will be collected from two locations downgradient of the storage area to define the nature and extent of contamination (Figure 5.12-2). Samples will be collected from two depths (0 to 1 ft and 2 to

3 ft) and analyzed for TAL metals, VOCs, SVOCs, TPH, pesticides, PCBs, cyanide, perchlorate, asbestos, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy.

Runoff from SWMU 46-006(f) enters the drain network that receives flow from the SWMU 46-004(m) outfall (section 4.20). This drain network ultimately discharges into Cañada del Buey. Data obtained from samples collected in the common segment of the drainage below the network outfall associated with SWMU 46-004(m) will be used to evaluate SWMU 46-006(f).

5.38 SWMU 46-006(g), Storage Area

SWMU 46-006(g) is a storage shed and surrounding area located at the west end of building 46-31 (Figure 5.5-1). The shed is of corrugated steel construction and measures 10 ft × 20 ft. From 1982 to 1984, the shed housed vacuum pumps used in experiments involving plasma vaporization of depleted uranium powder. The area around the shed is level and paved. Because the shed was not weather-tight, rain and snowmelt routinely flooded the floor. Pump oil is known to have been spilled on the floor of the shed (LANL 1996, 054929, p. 194).

5.38.1 Summary of Previous Investigations for SWMU 46-006(g)

During the 1994 Phase I RFI, two soil samples were collected from two locations at SWMU 46-006(g). Both samples were collected from beneath the asphalt floor of the shed and analyzed for VOCs, SVOCs, gamma spectroscopy, and isotopic uranium. Samples collected and analyses requested are presented in Table 3.38-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803).

5.38.2 Summary of Data for SWMU 46-006(g)

Analytical data are presented in Table 3.38-2 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for detected organic chemicals are shown in Figure 3.19-2 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Trichloro-1,2,2-trifluoroethane(1,1,2-) and TCE were detected in one sample. Radionuclides were not detected or were not detected above BVs/FVs.

5.38.3 Scope of Activities for SWMU 46-006(g)

Six samples will be collected from three locations at the storage area (Figure 5.5-2). Samples will be biased to stains/cracks in the pavement and collected from two depths (0 to 1 ft and 3 to 4 ft beneath asphalt). Samples will be analyzed for TAL metals, VOCs, SVOCs, TPH, PCBs, cyanide, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

5.39 SWMU 46-007, Potential Soil Contamination

SWMU 46-007 is an area of potential soil contamination associated with a partially paved ditch on the south and southeast sides of building 46-1 (Figure 5.12-1). The ditch drains to the north into a storm drain culvert that discharges into Cañada del Buey. The ditch also received effluent from the SWMU 46-004(s) outfall that formerly discharged to the south side of building 46-1. The drainage path has been altered several times to accommodate construction programs at TA-46. During the late 1950s and early 1960s, the ditch was used to clean equipment from a cesium-plasma diode operation using butanol and kerosene. The ditch also received copper-containing material from heat-pipe research, and green staining was noted on outcropping tuff during early site visits. This SWMU may also have received a variety of chlorinated and hydrocarbon solvents. Mercury was known to have been spilled in the south bay of building 46-1, and some floor drains from this area discharged to the SWMU 46-004(s) outfall, which emptied into the ditch (LANL 1993, 020952, pp. 5-79–5-80).

5.39.1 Summary of Previous Investigations for SWMU 46-007

During the 1994 Phase I RFI, one fill and two soil samples were collected from three locations at SWMU 46-007. The two soil samples collected from the drainage ditch on the east side of building 46-1 and were also used to characterize SWMU 46-004(s) (section 5.24). The third sample was collected from fill material in the drainage ditch on the south side of building 46-31. All samples were analyzed for inorganic chemicals, SVOCs, PCBs, pesticides, gamma spectroscopy, and isotopic uranium. The two soil samples were also analyzed for VOCs. Samples collected and analyses requested are presented in Table 3.39-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Several samples collected to characterize other SWMUs were also used to characterize SWMU 46-007, including two soil samples collected for SWMU 46-004(m) (section 5.20), two soil samples collected for SWMU 46-004(s) (section 5.24), and one soil sample collected for SWMU 46-004(b2) (section 5.12) (LANL 1996, 054929, pp. 50, 62, 114, 199, 200, 206).

5.39.2 Summary of Data for SWMU 46-007

Analytical data are presented in Tables 3.39-2 and 3.39-3 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for inorganic chemicals detected above BVs and organic chemicals detected are shown in Figures 3.12-2 and 3.12-3, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Silver was detected above BV in the fill sample; zinc was detected above BV in one soil sample; copper, lead, and mercury were detected above BVs in all three samples. Cesium was detected in one soil sample. Detection limits for thallium were above BV in all three samples. Acenaphthene, anthracene, benzo(g,h,i)perylene, dibenzofuran, fluorene, indeno(1,2,3-cd)pyrene, and naphthalene were detected in one soil sample. Benzo(a)anthracene was detected in the fill sample and in one soil sample; benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, phenanthrene, and pyrene were detected in all three samples. VOCs, PCBs, and pesticides were not detected. Radionuclides were not detected or were not detected above BVs/FVs.

5.39.3 Scope of Activities for SWMU 46-007

Ten samples will be collected from five locations at this SWMU (Figure 5.12-2). Samples will be collected from two depths (0 to 1 ft and 2 to 3 ft) and analyzed for TAL metals, total cesium, VOCs, SVOCs, TPH, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

Discharge from the SWMU 46-004(s) outfall (section 5.24) enters a drainage ditch common to SWMU 46-007. Data collected from samples at SWMU 46-007 will be used to evaluate both sites.

Runoff or discharge from this drainage ditch enters the drain network that receives flow from the SWMU 46-004(m) outfall (section 4.20). This drain network ultimately discharges into Cañada del Buey. Data obtained from samples collected in the common segment of the drainage below the network outfall associated with SWMU 46-004(m) will be used to evaluate SWMUs 46-004(s) and 46-007.

5.40 SWMU 46-008(a), Storage Area

SWMU 46-008(a) is a storage area (Figure 5.4-1) located along the south and east sides of building 46-88 used to store laboratory equipment and supplies. In the late 1960s and early 1970s, building 46-88 housed a structural test laboratory used to test pressure vessels associated with the Rover Program. Starting in the mid-1970s, the building was used for process chemistry work to isolate nonradioactive isotopes of carbon, oxygen, and nitrogen (LANL 1993, 020952, p. 5-126). During a 1986 site visit, drums containing nitric acid, cyclohexane, pump oil, and methanol were observed in the SWMU 46-008(a) storage area. One of the drums was leaking (LANL 1993, 020952, p. 5-80).

5.40.1 Summary of Previous Investigations for SWMU 46-008(a)

During the 1994 Phase I RFI, three soil samples were collected from three locations east and southeast of SWMU 46-008(a). All samples were analyzed for inorganic chemicals and SVOCs. Samples collected and analyses requested are presented in Table 3.40-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803).

5.40.2 Summary of Data for SWMU 46-008(a)

Analytical data are presented in Table 3.40-2 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for inorganic chemicals detected above BVs are shown in Figure 3.18-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Zinc was detected above BV in one sample. Detection limits for antimony and cadmium were above BVs in all three samples. SVOCs were not detected.

5.40.3 Scope of Activities for SWMU 46-008(a)

Ten samples will be collected from five locations within and next to the storage area (Figure 5.4-2). Samples will be collected from two depths (0 to 1 ft and 2 to 3 ft) and analyzed for TAL metals, VOCs, SVOCs, TPH, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

5.41 SWMU 46-008(b), Storage Area

SWMU 46-008(b) is a former drum storage area located on the east side of building 46-1 (Figure 5.12-1). The storage area was unpaved, measured approximately 20 ft × 20 ft, and sloped east to a storm drainage ditch and culvert that discharge into Cañada del Buey (LANL 1993, 020952, pp. 5-76, 5-80). The storm drainage ditch also receives runoff from SWMU 46-007.

5.41.1 Summary of Previous Investigations for SWMU 46-008(b)

During the 1994 Phase I RFI, two soil samples were collected from two locations within the former storage area. Both samples were analyzed for SVOCs, PCBs, pesticides, and gamma spectroscopy. One sample was also analyzed for inorganic chemicals, isotopic thorium, and isotopic uranium. Samples collected and analyses requested are presented in Table 3.41-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803).

5.41.2 Summary of Data for SWMU 46-008(b)

Analytical data are presented in Tables 3.41-2 and 3.41-3 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for inorganic chemicals detected above BVs and organic chemicals detected are shown in Figures 3.12-2 and 3.12-3, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Mercury was detected above BV in one sample. The detection limit for thallium was above the BV in one sample. Bis(2-ethylhexyl)phthalate, dieldrin, fluoranthene, indeno(1,2,3-cd)pyrene, and phenanthrene were detected in one sample. Aroclor-1254, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and pyrene were detected in both samples. Radionuclides were not detected or were not detected above BVs/FVs.

5.41.3 Scope of Activities for SWMU 46-008(b)

Four samples will be collected from two locations at the storage area (Figure 5.12-2). Samples will be collected from two depths (0 to 1 ft and 2 to 3 ft) and analyzed for TAL metals, VOCs, SVOCs, TPH, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

Four samples will be collected from two locations downgradient of the storage area (Figure 5.12-2). Samples will be collected from two depths (0 to 1 ft and 2 to 3 ft) and analyzed for TAL metals, VOCs, SVOCs, TPH, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy.

SWMUs 46-008(b) and 46-004(b2) (section 5.12) are located within a common drainage area. Data obtained from samples collected from within this drainage will be used to evaluate both sites.

Runoff or discharge from SWMUs 46-004(b2) and 46-008(b) enters the drain network that receives flow from the SWMU 46-004(m) outfall (section 5.20). This drain network discharges into Cañada del Buey. Data obtained from samples collected in the common segment of the drainage below the network outfall associated with SWMU 46-004(m) will be used to evaluate these sites.

5.42 SWMU 46-008(d), Storage Area

SWMU 46-008(d) is a paved storage area located on the south side of building 46-24 (Figure 5.4-1). This area stored laboratory equipment and supplies. A 1988 site visit noted two unlabeled barrels of oil on the south side of structure 46-262, a small shed on the south side of building 46-24 (LANL 1990, 007513, p. 125).

5.42.1 Summary of Previous Investigations for SWMU 46-008(d)

During the 1994 Phase I RFI, two soil samples were collected from two unpaved locations southwest and downgradient of SWMU 46-008(d). The samples were analyzed for inorganic chemicals, VOCs, SVOCs, PCBs, gamma spectroscopy, and isotopic uranium. Samples collected and analyses requested are presented in Table 3.42-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803).

5.42.2 Summary of Data for SWMU 46-008(d)

Analytical data are presented in Tables 3.42-2, 3.42-3, and 3.42-4 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). The sampling locations and results for inorganic chemicals detected above BVs, organic chemicals detected, and radionuclides detected or detected above BVs/FVs are shown in Figures 3.18-1, 3.28-1, and 3.42-1, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Chromium, lead, nickel, and silver were detected above BVs in one sample. The detection limits for cadmium and silver were above BV in two and one samples, respectively. Bis(2-ethylhexyl)phthalate, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, fluoranthene, phenanthrene, and pyrene were detected in one sample. Cesium-137 was detected in one sample. Isotopic uranium was not detected or was not detected above BVs.

5.42.3 Scope of Activities for SWMU 46-008(d)

Twelve samples will be collected from six locations within and next to the storage area (Figure 5.4-2). Samples will be collected from two depths (0 to 1 ft and 2 to 3 ft) and analyzed for TAL metals, VOCs, SVOCs, TPH, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

5.43 SWMU 46-008(e), Storage Area

SWMU 46-008(e) is an unpaved storage area located south of an office transportable (building 46-187) (Figure 5.2-1). The 20-ft × 35-ft area has been used for storage since the 1950s. A storage shed (structure 46-79) formerly occupied the site but was removed sometime before 1988. Drums of waste vacuum oil were noted to be stored at the site during a 1986 site visit (LANL 1993, 020952, p. 5-81). Traces of asphalt in the soil indicate that the area formerly may have been paved. An office transportable (building 46-555) currently occupies the site. Drainage from the area flows east into a storm drainage that discharges to SWSC Canyon outside the TA-46 perimeter fence (LANL 1993, 020952, p. 5-81).

5.43.1 Summary of Previous Investigations for SWMU 46-008(e)

During the 1994 Phase I RFI, one fill and seven soil samples were collected from eight locations at SWMU 46-008(e). The fill and three of the soil samples were collected within the boundary of the storage area; two soil samples were collected from the storm drainage to the east; the remaining two samples were collected south and downgradient of the two storm drainage samples, on the north rim of SWSC Canyon. All samples were analyzed for inorganic chemicals, SVOCs, PCBs, gamma spectroscopy, and isotopic uranium. The four samples collected within the storage area were also analyzed for pesticides; one of these samples was analyzed for VOCs. The four samples collected within and downgradient of the storm drainage were also analyzed for isotopic thorium; one of these samples was analyzed for VOCs. Samples collected and analyses requested are presented in Table 3.43-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803).

5.43.2 Summary of Data for SWMU 46-008(e)

Analytical data are presented in Tables 3.43-2 and 3.43-3 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Sampling locations and results for inorganic chemicals detected above BVs and radionuclides detected or detected above BVs/FVs are shown in Figures 3.34-1 and 3.34-3, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Zinc was detected above BV in two soil samples; mercury was detected above BV in four soil samples. Detection limits for antimony and cadmium were above BVs in one fill and three soil samples; detection limits for thallium were above BV in four soil samples. Uranium-235 was detected above BV in one soil sample. VOCs, SVOCs, PCBs, and pesticides were not detected. Isotopic thorium was not detected above BV. Radionuclides analyzed by gamma spectroscopy and isotopic thorium were not detected or not detected above BVs/FVs.

5.43.3 Scope of Activities for SWMU 46-008(e)

Four samples will be collected from two locations at the storage area (Figure 5.2-2). Samples will be collected from two depths (0 to 1 ft and 2 to 3 ft) and analyzed for TAL metals, VOCs, SVOCs, TPH, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

Ten samples will be collected from five locations next to and downgradient of the storage area (Figure 5.2-2). Samples will be collected from two depths (0 to 1 ft and 2 to 3 ft) and analyzed for TAL metals, VOCs, SVOCs, TPH, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, isotopic thorium, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

5.44 SWMU 46-008(f), Storage Area

SWMU 46-008(f) is a paved storage area located on the southeast side of building 46-31 (Figure 5.6-1). A 1986 site visit found two drums containing methanol and unmarked cans and cylinders (LANL 1993, 020952, p. 5-81).

5.44.1 Summary of Previous Investigations for SWMU 46-008(f)

During the 1994 Phase I RFI, one soil sample was collected from the east side of the storage area, and one soil sample was collected southeast of the storage area. Both samples were analyzed for inorganic chemicals, VOCs, SVOCs, gamma spectroscopy, and isotopic uranium. Samples collected and analyses requested are presented in Table 3.44-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803).

5.44.2 Summary of Data for SWMU 46-008(f)

Analytical data are presented in Tables 3.44-2 and 3.44-3 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Sampling locations and results for inorganic chemicals detected above BVs and organic chemicals detected are shown in Figures 3.16-6 and 3.16-7, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Cadmium was detected above BV in one sample; copper, lead, and zinc were detected above BVs in both samples. The detection limits for cadmium and silver were above BVs in one and two samples, respectively. Acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene, and TCA were detected in one sample. Radionuclides were not detected or were not detected above BVs/FVs.

5.44.3 Scope of Activities for SWMU 46-008(f)

Ten samples will be collected from five locations within and next to the storage area (Figure 5.6-2). Samples will be biased to stains/cracks in the pavement and collected from two depths (0 to 1 ft and 3 to 4 ft beneath asphalt). Samples will be analyzed for TAL metals, VOCs, SVOCs, TPH, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

Four samples will be collected from two locations downgradient of the storage area (Figure 5.6-2). Samples will be collected from two depths (0 to 1 ft and 2 to 3 ft) and analyzed for TAL metals, VOCs, SVOCs, TPH, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy.

Runoff from SWMU 46-008(f) enters a drainage ditch that receives discharge from outfall SWMU 46-004(a2). This ditch drains to a culvert that discharges to a drainage in Cañada del Buey, which also receives discharge from two other outfalls, SWMUs 46-004(u) 46-004(v), and 46-004(x) (sections 5.26, 5.27, and 5.29, respectively). Data obtained from samples collected in the common segment of the drainage associated with SWMU 46-004(u) will be used to evaluate these sites.

5.45 SWMU 46-008(g), Storage Area

SWMU 46-008(g) is an unpaved storage area located south of a laser laboratory (building 46-76) (Figure 5.4-1). In 1990, drums containing dielectric oil were observed to be stored at SWMU 46-008(g) (LANL 1993, 020952, p. 5-82). The site is a level, grassy area bisected by a drainage that flows east into SWSC Canyon through a storm drain culvert. Runoff from a parking lot also drains through the drainage.

5.45.1 Summary of Previous Investigations for SWMU 46-008(g)

During the 1994 Phase I RFI, five soil samples were collected from four locations within and next to SWMU 46-008(g). All samples were analyzed for inorganic chemicals, SVOCs, and PCBs. Four samples were also analyzed for VOCs. Samples collected and analyses requested are presented in Table 3.45-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803).

5.45.2 Summary of Data for SWMU 46-008(g)

Analytical data are presented in Tables 3.45-2 and 3.45-3 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Sampling locations and results for inorganic chemicals detected above BVs and organic chemicals detected are shown in Figures 3.18-1 and 3.28-1, respectively, of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Cadmium, lead, manganese, and mercury were detected above BVs in one sample. Zinc was detected above BV in three samples. Detection limits for antimony and cadmium were above BVs in five and four samples, respectively. Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, naphthalene, and phenanthrene were detected in one sample. Fluoranthene and pyrene were detected in three samples. PCBs were not detected.

5.45.3 Scope of Activities for SWMU 46-008(g)

Fourteen samples will be collected from seven locations within and next to the storage area (Figure 5.4-2). Samples will be collected from two depths (0 to 1 ft and 2 to 3 ft) and analyzed for

TAL metals, VOCs, SVOCs, TPH, pesticides, PCBs, cyanide, asbestos, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

Runoff or discharge from SWMUs 46-008(g), 46-004(t), 46-004(f), 46-004(r), 46-004(w), and AOC C-46-001 (sections 5.25, 5.18, 5.23, 5.28, and 5.49) drains to SWSC Canyon. Data obtained from samples in the common segment of SWSC Canyon associated with SWMU 46-004(t) will be used to evaluate these sites.

5.46 SWMU 46-009(a), Landfill

SWMU 46-009(a) is a landfill located at the head of SWSC Canyon near the southeastern corner of TA-46 (Figure 5.2-1). The landfill covers approximately 5000 yd^2, extending from the canyon rim to the floor of SWSC Canyon. The landfill contains a variety of materials including asphalt, concrete, plywood, pipe, and other construction materials. The dates of operation for the landfill are not known, although 1958 aerial photographs of TA-46 show the presence of the landfill (LANL 1993, 020952, pp. 5-164–5-167).

5.46.1 Summary of Previous Investigations for SWMU 46-009(a)

A series of non-RFI-related sampling events have been performed at this site. In 1990, soil samples were collected from three boreholes drilled to depths of 24 ft along the path of the road that bisects the landfill. Soil samples were field screened for radioactivity and analyzed for metals using EPA's toxicity characteristic leaching procedure; samples were also analyzed for organic chemicals and PCBs. In 1992, 10 composite surface-soil samples collected from SWMU 46-009(a) were field screened for radioactivity and analyzed for asbestos. A second sampling event was conducted in 1992 to collect seven soil samples from various points at or near this SWMU. The samples were collected from the surface soil even though the site had been recently disturbed by road construction. The samples were field screened for radioactivity and submitted for analysis of inorganic chemicals, organic chemicals, PCBs, asbestos, and total uranium. Analytical results for these events are not presented in this report but are summarized in the OU 1140 work plan (LANL 1993, 020952, pp. 5-164–5-170).

5.46.2 Summary of Data for SWMU 46-009(a)

The OU 1140 work plan (LANL 1993, 020952) presents analytical data associated with this SWMU.

5.46.3 Scope of Activities for SWMU 46-009(a)

Eighteen samples will be collected from six locations within the landfill (Figure 5.2-2). Samples will be collected from three depths (4 to 5 ft, 9 to 10 ft, and 14 to 15 ft) and analyzed for TAL metals, TPH, VOCs, SVOCs, pesticides, PCBs, nitrate, cyanide, asbestos, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

Twenty samples will be collected from 10 locations downgradient of the landfill and in SWSC Canyon (Figure 5.2-2). Samples will be collected from two depths (0 to 1 ft and 1 to 2 ft) and analyzed for TAL metals, TPH, VOCs, SVOCs, pesticides, PCBs, nitrate, cyanide, asbestos, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy.

Runoff or discharge from SWMUs 46-009(a), 46-004(f), 46-004(r), 46-004(t), 46-004(w), 46-008(g), and AOC C-46-001 (sections 5.18, 5.23, 5.25, 5.28, 5.45, and 5.49) drains to SWSC Canyon. Data obtained from samples in the common segment of SWSC Canyon associated with SWMU 46-004(t) will be used to evaluate these sites.

5.47 SWMU 46-009(b), Former Surface Disposal Area

SWMU 46-009(b) is a former surface disposal area consisting of sand discarded from the sand filters associated with SWMU 46-002, a former sanitary impoundment system (Figure 5.1-1). The sanitary impoundment system operated from 1973 to 1990. During operation, the top 0.5 ft of sand and sludge from the filters were removed every 2 or 3 months and disposed of at TA-54 at MDA G. The sand beneath this top layer was pushed over the side of the canyon, and the filters were replenished with clean sand (LANL 1993, 020952, p. 5-166). In 1990, the sand filters were taken off-line (LANL 1993, 020952, p. 5-56).

5.47.1 Summary of Previous Investigations for SWMU 46-009(b)

No sampling has been conducted at this SWMU.

5.47.2 Scope of Activities for SWMU 46-009(b)

Six samples will be collected from three locations within the former surface disposal area (Figure 5.1-2). Samples will be collected from two depths (0 to 1 ft and 2 to 3 ft) and analyzed for TAL metals, VOCs, SVOCs, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

Twenty samples will be collected from 10 locations downgradient of the former surface disposal area and in SWSC Canyon (Figure 5.1-2). Samples will be collected from two depths (0 to 1 ft and 1 to 2 ft) and analyzed for TAL metals, VOCs, SVOCs, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy.

5.48 SWMU 46-010(d), Storage Area

SWMU 46-010(d) is a partially paved storage area located on the south side of the Laser Isotope Support Facility (building 46-41) (Figure 5.2-1). A 1986 site visit found unmarked and rusty drums at this 10-ft × 25-ft area (LANL 1993, 020952, p. 5-82).

5.48.1 Summary of Previous Investigations for SWMU 46-010(d)

In 1994, Phase I RFI activities were conducted at SWMU 46-010(d). Two soil samples were collected from two locations from the unpaved area below the storage shed. Both samples were analyzed for inorganic chemicals, VOCs, SVOCs, PCBs, and asbestos. Samples collected and analyses requested are presented in Table 3.48-1 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803).

5.48.2 Summary of Data for SWMU 46-010(d)

Analytical data are presented in Tables 3.48-2 and 3.48-3 of the Upper Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Sampling locations and results for inorganic chemicals detected above BVs and organic chemicals detected are shown in Figures 3.34-1 and 3.34-2, respectively, of the Upper

Cañada del Buey Aggregate Area HIR (LANL 2008, 101803). Copper was detected above BV in one sample; mercury and zinc were detected above BVs in both samples. The detection limits for cadmium and thallium were above BVs in one and two samples, respectively. Fluoranthene was detected in one sample. VOCs, PCBs, and asbestos were not detected.

5.48.3 Scope of Activities for SWMU 46-010(d)

Four samples will be collected from two locations at the storage area (Figure 5.2-2). Samples will be biased towards cracks/stains in the pavement and collected from two depths (0 to 1 ft and 3 to 4 ft beneath asphalt). Samples will be analyzed for TAL metals, VOCs, SVOCs, TPH, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites.

Six samples will be collected from three locations south and downgradient of the storage area (Figure 5.2-2). Samples will be collected from two depths (0 to 1 ft and 2 to 3 ft) and analyzed for TAL metals, VOCs, SVOCs, TPH, pesticides, PCBs, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy.

5.49 AOC C-46-001, Spill/Release Area

AOC C-46-001 is the location of a one-time spill in July 1975 of 0.55 to 1.1 lb of mercury in the vicinity of building 46-75. The location of building 46-75 is shown in Figure 5.4-1. Although historical documentation does not provide a precise location of the spill, aerial photos show the area was paved at the time of the spill (LANL 1993, 020952, p. 5-131). Direction was given to Laboratory personnel to clean up all visible mercury (LANL 1993, 020952, p. 5-131).

5.49.1 Summary of Previous Investigations for AOC C-46-001

No sampling has been conducted at this AOC.

5.49.2 Scope of Activities for AOC C-46-001

Runoff from AOC C-46-001 (near building 46-75) enters a drain network that discharges to SWSC Canyon. Although the location of the spill is not well documented, two samples will be collected from one location approximately 15 ft southwest of the southwest corner of Building 46-75 (Figure 5.4-2). The samples will be collected from two depths (0 to 1 ft and 2 to 3 ft) and analyzed for mercury only, Mercury data obtained from samples collected in the common segment of SWSC Canyon associated with SWMU 46-004(t) will be used to evaluate AOC C-46-001.

6.0 SITES ASSOCIATED WITH TA-52

All SWMUs and AOCs within TA-52 that are within the Upper Cañada del Buey Aggregate Area have been approved for NFA or are pending NFA approval. A brief description of each of these sites along with a reference to its associated approval document is provided in Table 1.1-1.

7.0 INVESTIGATION METHODS

A summary of investigation methods to be implemented is presented in Table 7.0-1. The standard operating procedures (SOPs) used to implement these methods are available at http://www.lanl.gov/environment/all/qa.shtml. Additional procedures may be added as necessary to describe and document quality-affecting activities.

Chemical analyses will be performed in accordance with the analytical statement of work (LANL 2000, 071233). Accredited contract analytical laboratories will use the most recent EPA- and industry-accepted extraction and analytical methods for chemical analyses of analytical suites. The analytical methods for surface and subsurface characterization are presented in Table 7.0-2.

7.1 Field Surveys

The following sections describe the field surveys that will be conducted at the Upper Cañada del Buey Aggregate Area.

7.1.1 Geodetic Surveys

Geodetic surveys will be conducted by a land surveyor in accordance to the latest version of SOP-03.11, 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 hand-held global positioning system (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.

7.1.2 Geophysical Surveys

Geophysical surveys may be performed at selected sites to verify the location, dimensions, total depth (TD), base profile, topography, low-elevation point, and downslope end using as-built construction drawings and boring logs. The surveys will verify locations determined from engineering drawings, site reconnaissance, and geodetic surveys and refine assessments of the subsurface structures. Geophysical methods employed may include electromagnetic, gravity, and ground-penetrating radar as appropriate to effectively delineate the materials or feature being surveyed.

7.2 Subsurface Characterization

7.2.1 Drilling Methods for Subsurface Sample Collection

Subsurface samples will be obtained by hollow-stem auger or hand-auger methods. A brief, general description of these methods is provided below. More information can be found in SOP-04.01, Drilling Methods and Drill Site Management. Hand-auger methods will be used until refusal, at which time hollow-stem auger methods will be used.

7.2.1.1 Hand Auger

Hand augers may be used to bore shallow holes (0 to 15 ft). The hand auger is advanced by turning or pounding the auger into the soil until the barrel is filled. The auger is removed, and the sample is dumped out. Motorized units for one or two operators may be used and can reach depths up to 30 ft under certain conditions.

7.2.1.2 Hollow-Stem Auger

A hollow-stem auger may be used to bore holes deeper than 15 ft. 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 it 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 that samples may be retrieved during drilling operations. The hollow stem also acts to case the borehole core temporarily so that a well casing (riser) may be inserted down through the center of the auger once the desired depth is reached, minimizing the risk of possible collapse of the borehole. 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.

7.2.1.4 Borehole Abandonment

All boreholes will be properly abandoned according to the most recent version of SOP-5.03, Monitoring Well and RFI Borehole Abandonment.

Shallow boreholes with a TD of 20 ft or less will be abandoned by filling the borehole with bentonite chips, which are subsequently hydrated. Chips will be hydrated in 1- to 2-ft lifts. The borehole will be visually inspected while the bentonite chips are being added to ensure that bridging does not occur.

The use of backfill materials such as bentonite and grout will be documented in a field logbook with regard to volume (calculated and actual), intervals of placement, and additives used to enhance backfilling. Information on borehole abandonment will be provided in the investigation report.

7.3 Sample Collection

7.3.1 Surface Samples

Surface and shallow subsurface soil and sediment samples will be collected in accordance with SOP-06.09, Spade and Scoop Method for the Collection of Soil Samples. 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. The analytical suites for the samples from each borehole will vary according to the data requirements as described in sections 4 and 5 and Table 4.0-1.

Quality assurance/quality control (QA/QC) samples will include field duplicate samples, equipment rinsate blanks, trip blanks, and reagent blanks. These samples will be collected following the current version of SOP-01.05, Field Quality Control Samples. Trip blanks will be supplied by the SMO and will remain with the analytical samples when samples are collected for VOC analysis.

7.3.2 Subsurface Samples

Following the current version of SOP-06.24, Sample Collection from Split-Spoon Samplers and Shelby Tube Samplers, and SOP-06.26, Core Barrel Sampling for Subsurface Earth Materials, subsurface samples will be collected from core extracted in a split-spoon core barrel. Samples collected for analyses will be placed in the appropriate sample containers depending on the analytical method requirement. The analytical suites for the samples from each borehole will vary according to the data requirements as described in sections 4 and 5 and Table 4.0-1.

QA/QC samples will include field duplicate samples, equipment rinsate blanks, trip blanks, and reagent blanks. These samples will be collected following the current version of SOP-01.05, Field Quality Control Samples. Trip blanks will be supplied by the SMO and will remain with the analytical samples when samples are collected for VOC analysis.

Field documentation will include detailed borehole logs to document the matrix material in detail; fractures and matrix samples will be assigned unique identifiers. All field documentation will be completed in accordance with the current version of SOP-12.01, Field Logging, Handling, and Documentation of Borehole Materials.

7.3.3 Sediment Samples

Sediment samples will be collected from areas of sediment accumulation that include sediments judged to be representative of the historical period of Laboratory operations. The locations were selected based on geomorphic relationships in areas likely to have been affected by discharges from Laboratory operations. Sediment sampling locations have been selected and are shown in the figures that show the proposed sampling locations. 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 that the selected location is not appropriate because of conditions observed during sampling of the sediment (e.g., 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, and any changes to sediment sampling locations will be documented as deviations from this work plan.

7.3.4 Excavation

Excavations will be completed using a track excavator or backhoe at selected site(s). Excavated soil will be staged a minimum of 3 ft from the edge of the excavation, and excavations deeper than 4 ft bgs will be properly benched to allow access and egress, if necessary. After confirmatory sampling and any necessary over-excavation work are completed, the excavations and/or trenches will be backfilled with clean fill material or overburden (if it is not contaminated). Excavators may also be used to collect grab samples.

7.4 Laboratory Analytical Methods

The analytical suites required for laboratory analyses vary by area and are summarized in Table 7.0-2. All analytical suites are presented in the statement of work for analytical laboratories (LANL 2000, 071233). Sample collection and analysis will be coordinated with the SMO.

7.5 Health and Safety

The field investigations described in this investigation work plan 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 conducting fieldwork.

7.6 Equipment Decontamination

Equipment for drilling and sampling will be decontaminated before and after sampling activities to minimize the potential for cross-contamination. 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. All sampling equipment will be decontaminated in accordance with SOP-01.08, Field Decontamination of Drilling and Sampling Equipment. 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.

7.7 Investigation-Derived Waste

The IDW generated may include, but is not limited to, drill cuttings, excavated media, excavated man-made debris, contact waste, 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 SOPs. These SOPs incorporate the requirements of all applicable EPA and NMED regulations, DOE orders, and Laboratory implementation requirements. Appendix B presents the IDW management plan.

7.8 Removal Activities

Removal of the inactive septic tanks associated with SWMUs 46-003(a), 46-003(b), 46 003(c), 46-003(d), and possibly 46-003(e) is proposed under this investigation work plan. Excavation of potentially contaminated media, waste disposition, and confirmation sampling will be completed during removal activities.

7.8.1 Septic Tanks

Septic tanks at SWMUs 46-003(a), 46-003(b), 46 003(c), 46-003(d), and 46-003(e) were previously closed in place. The contents of the septic tanks were removed and the tanks were filled with sand or gravel. The approach for removing septic tanks will generally follow the same approach for each septic tank in this work plan.

Each septic tank will be located and soil, fill, or other material covering the septic tank, will be excavated and stockpiled next to the excavation. Once exposed, the location of the septic tank and its dimensions will be surveyed. The concrete septic tank and the material within the tank (sand or gravel) will be sampled and characterized for waste management purposes. The septic tank and its contents will be removed and disposed of at an appropriate waste disposal facility. The inlet and outlet drainlines to the tank will be plugged. Potentially contaminated soil beneath the tank will be excavated, characterized, and disposed of at an appropriate waste disposal facility.

Once the tank has been removed, confirmation samples will be collected from beneath the inlet and outlet to each tank and from below the tank. Confirmation samples may be collected from additional locations beneath the drainlines. Samples will be collected from two depths (at the base of the drainline or tank and 5 ft below the base of the drainline or tank) and will be analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. Table 4.0-1 provides a summary of the proposed sampling strategy, locations, depths, and analytical suites for each septic tank.

Confirmation samples will be collected beneath the distribution box (if present) and from the drain field or seepage pit. Samples will be collected from two depths (directly beneath the distribution box [if present] and 5 ft below the box or at the soil/tuff interface) and within and next to seepage pits or drain field. The samples will be analyzed for TAL metals, VOCs, SVOCs, PCBs, nitrate, cyanide, perchlorate, isotopic uranium, isotopic plutonium, americium-241, and gamma spectroscopy. The excavated area will be backfilled with clean fill and material excavated from the surface of the septic tank.

7.8.2 Waste Management and Disposal

Management of all IDW including waste generated during tank removals is described in Appendix B.

8.0 MONITORING PROGRAMS

8.1 Groundwater

Section IV.B.2.a.ii of the Consent Order requires monitoring and sampling of all wells that contain alluvial, intermediate, and regional groundwater located in Mortandad Canyon and Cañada del Buey. Alluvial groundwater observation well CDBO-5 is located within the Upper Cañada del Buey Aggregate Area. CDBO-5 is located about 500 ft upstream from the confluence of Cañada del Buey with the TA-46 fork where potential treated effluent from the SWSC plant would discharge. Water supply wells PM-4 and PM-5 are on the mesa top just north of Cañada del Buey. These wells are monitored as part of the IFWGMP (LANL 2008, 101897).

8.2 Sediment and Surface Water

One stormwater runoff/sampling monitoring station (E218) is located in the Upper Cañada del Buey Aggregate Area (LANL 1999, 064617, p. 3-104). This station is monitored as part of the IFWGMP (LANL 2008, 101897).

Six reaches in Cañada del Buey (CDB-1 to CDB-5 and CDBS-1) were selected for the first phase of sediment sampling in the work plan for Sandia Canyon and Cañada del Buey (LANL 1999, 064617, p. 7-74); two of these reaches, CDB-1 and CDB-2, are located in the Upper Cañada del Buey Aggregate Area (Plate 1). During the initial investigation, 5 to 10 sediment samples per reach will be collected from six reaches and seven subreaches within the Upper Cañada del Buey Aggregate Area.

9.0 SCHEDULE

The scheduled notice date for NMED to approve this investigation work plan is October 28, 2008. Preparation of investigation activities is scheduled to start by January 2, 2009. Fieldwork is expected to start in July 1, 2009, and will take approximately 12 months to complete. Fieldwork is scheduled to be complete by June 30, 2010. The investigation report will be delivered to NMED on or before November 30, 2010.

10.0 REFERENCES AND MAP DATA SOURCES

10.1 References

The following list includes all documents cited in this plan. 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.

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10.2 Map Data Sources

Legend Item	Data Source
2-ft elevation contour	Hypsography, 2-ft Contour Interval; LANL, Environmental Stewardship (ENV) Environmental Remediation and Surveillance Program; 1991.
10-ft elevation contour	Hypsography, 10-ft Contour Interval; LANL, ENV Environmental Remediation and Surveillance Program; 1991.
20-ft elevation contour	Hypsography, 20-ft Contour Interval; LANL, ENV Environmental Remediation and Surveillance Program; 1991.
100-ft elevation contour	Hypsography, 100-ft Contour Interval; LANL, ENV Environmental Remediation and Surveillance Program; 1991.
Upper Cañada del Buey Aggregate Area	Aggregate Areas; LANL, ENV Environmental Remediation & Surveillance Program, ER2005-0496; 1:2,500 Scale Data; 22 September 2005.
LANL Boundary	LANL Areas Used and Occupied ; LANL, Site Planning & Project Initiation Group, Infrastructure Planning Division; 19 September 2007.
TA boundary	TA Boundaries; LANL, Site Planning & Project Initiation Group, Infrastructure Planning Division; 19 September 2007.
Fence	Security and Industrial Fences and Gates; LANL, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 04 March 2008.

Legend Item	Data Source
Former Structure	Former Structures within Upper Cañada del Buey Aggregate Area; Apogen Technologies, EP2008-0354, 13 June 2008, 101881.
Structure	Structures; LANL, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 04 March 2008.
Communication line	Communication Lines; LANL, KSL Site Support Services, Planning, Locating and Mapping Section; 08 August 2002; as published 04 March 2008.
Electric line	Primary Electric Grid; LANL, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 04 March 2008.
Gas line	Primary Gas Distribution Lines; LANL, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 04 March 2008.
Sewer line	Sewer Line System; LANL, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 04 March 2008.
Water line	Water Lines; LANL, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 04 March 2008.
Paved road	Paved Road Arcs; LANL, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 04 March 2008.
Unpaved road	Dirt Road Arcs; LANL, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 04 March 2008.
SWMU or AOC	Potential Release Sites; LANL, Risk Reduction and Environmental Stewardship Remediation Services Project, ER2005-0403; 1:2,500 Scale Data; 26 September, 2007. Change control requests pending.
Sampling location Alluvial groundwater monitoring well Groundwater supply well	Point Feature Locations of the ER Project Database; LANL, Waste and Environmental Services Division, EP2007-0683; 29 October 2007.
Approximate drain or pipeline location	Approximate drain or pipeline locations in the Upper Cañada del Buey Aggregate Area, Apogen Technologies, EP2008-0354, 13 June 2008,101881.
Associated drain or pipeline	Drain or pipelines associated with currently active sewer lines within the Upper Cañada del Buey Aggregate Area, Apogen Technologies, EP2008-0354, 13 June 2008, 101881.
Septic tanks	Approximate locations of decommissioned septic tanks within the Upper Cañada del Buey Aggregate Area, Apogen Technologies, EP2008-0354, 13 June 2008.,101881..
Surface water monitoring station	Storm Water Runoff Monitoring Stations; ENV Water Quality & Hydrology Group; 19 October 2004.

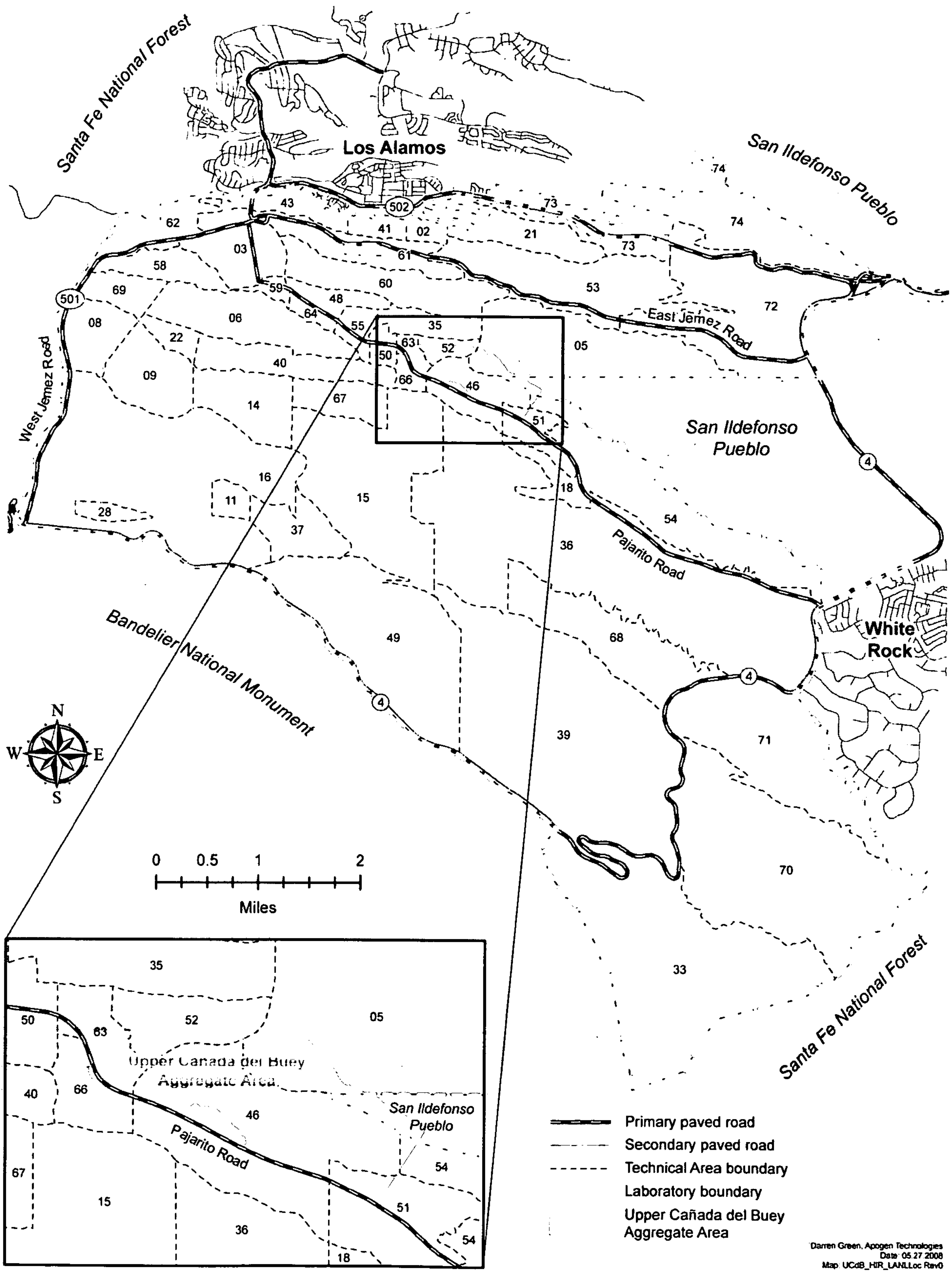

Figure 1.0-1 Upper Cañada del Buey Aggregate Area

<table>
<tr><td rowspan="6">Bandelier Tuff</td><td rowspan="6">Tshirege Member</td><td>Qbt 4</td><td rowspan="5">Ash-Flow Units</td></tr>
<tr><td>Qbt 3</td></tr>
<tr><td>Qbt 2</td></tr>
<tr><td>Qbt 1v</td></tr>
<tr><td>Qbt 1g</td></tr>
<tr><td colspan="2">Tsankawi Pumice Bed</td></tr>
<tr><td colspan="2">Cerro Toledo Interval</td><td colspan="2">Volcaniclastic Sediments and Ash-Falls</td></tr>
<tr><td rowspan="2">Bandelier Tuff</td><td rowspan="2">Otowi member</td><td colspan="2">Ash-Flow Units</td></tr>
<tr><td colspan="2">Guaje Pumice Bed</td></tr>
<tr><td rowspan="4">Puye Formation</td><td>Fanglomerate</td><td colspan="2">Fanglomerate Facies includes sand, gravel, conglomerate, and tuffaceous sediments</td></tr>
<tr><td>Basalt and Andesite</td><td colspan="2">Cerros del Rio Basalts intercalated within the Puye Formation, includes up to four interlayered basaltic flows. Andesites of the Tschicoma Formation present in western part of plateau</td></tr>
<tr><td>Fanglomerate</td><td colspan="2">Fanglomerate Facies includes sand, gravel, conglomerate, and tuffaceous sediments; includes “Old Alluvium”</td></tr>
<tr><td>Axial facies deposits of the ancestral Rio Grande</td><td colspan="2">Totavi Lentil</td></tr>
<tr><td rowspan="8">Santa Fe Group</td><td>Coarse Sediments</td><td colspan="2" rowspan="7">Coarse-Grained Upper Facies (formerly called the “Chaquehui Formation” by Purtymun 1995, 045344)</td></tr>
<tr><td>Basalt</td></tr>
<tr><td>Coarse Sediments</td></tr>
<tr><td>Basalt</td></tr>
<tr><td>Coarse Sediments</td></tr>
<tr><td>Basalt</td></tr>
<tr><td>Coarse Sediments</td></tr>
<tr><td>Arkosic clastic sedimentary deposits</td><td colspan="2">Undivided Santa Fe Group (includes Chamita[?] and Tesuque Formations)</td></tr>
</table>

Figure 3.2-1 Generalized stratigraphy of bedrock geologic units of the Pajarito Plateau

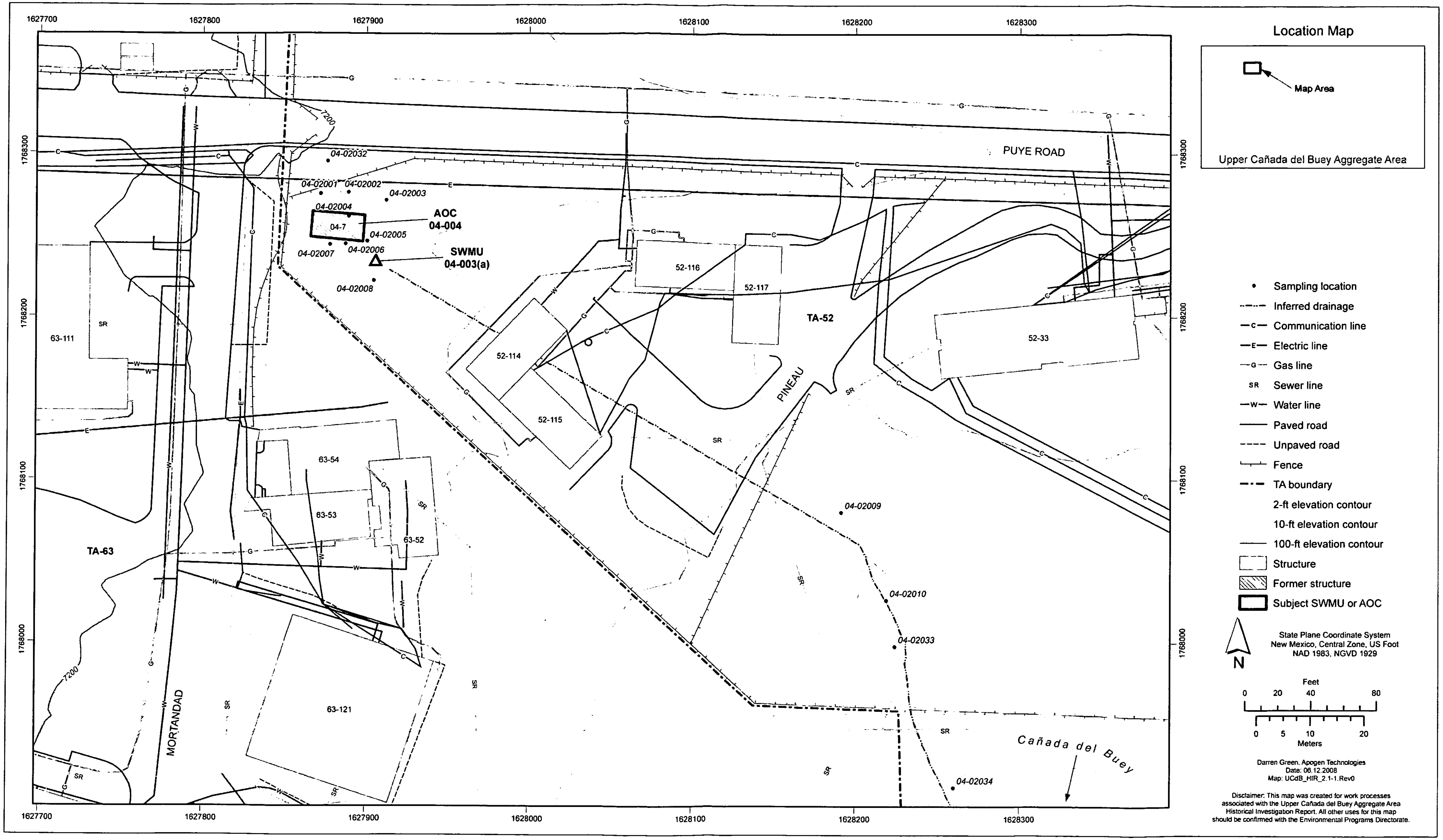

Figure 4.1-1 Site features for SWMU 04-003(a) and AOC 04-004

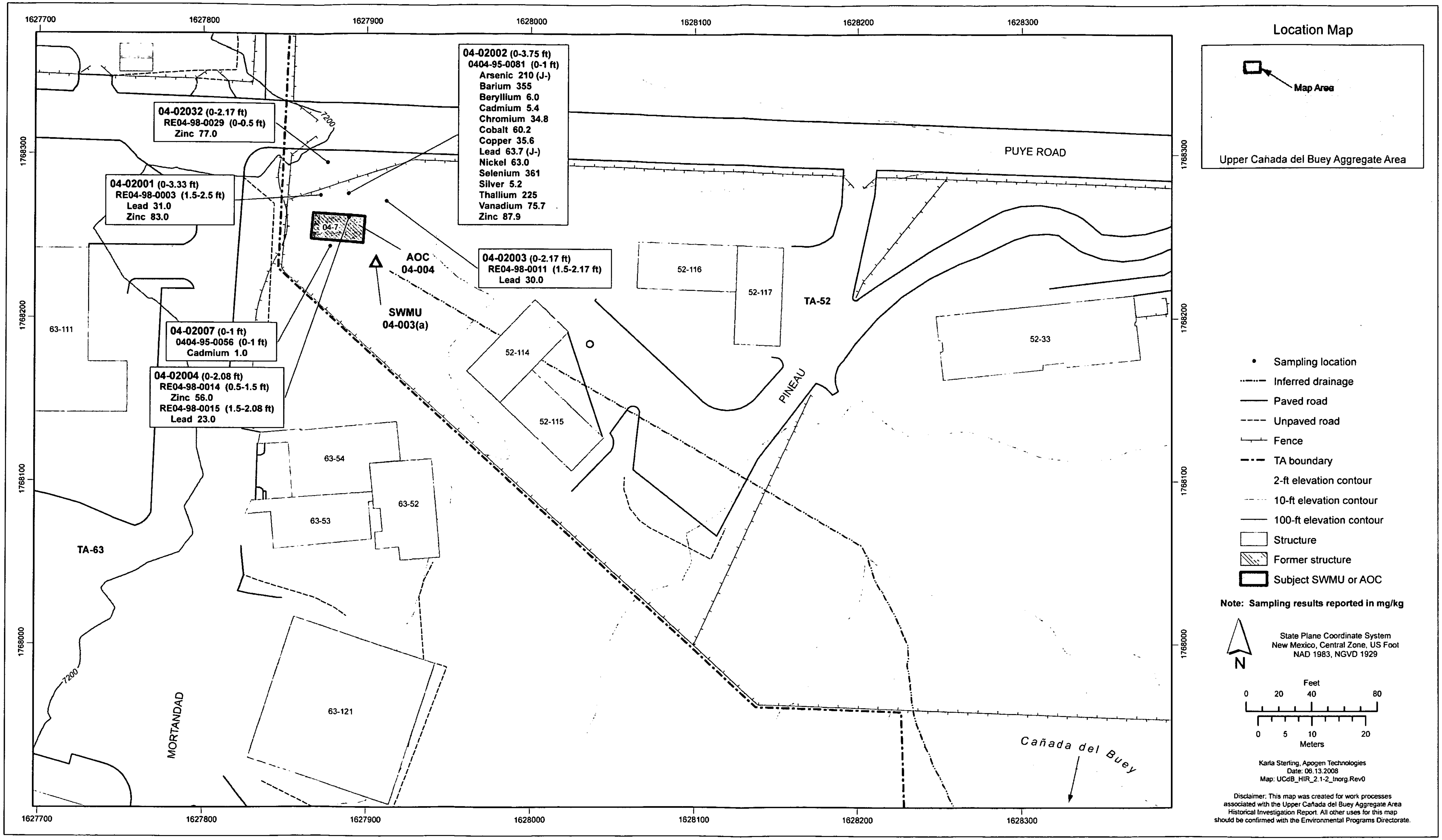

Figure 4.1-2 Inorganic chemicals detected above BVs at SWMU 04-003(a) and AOC 04-004

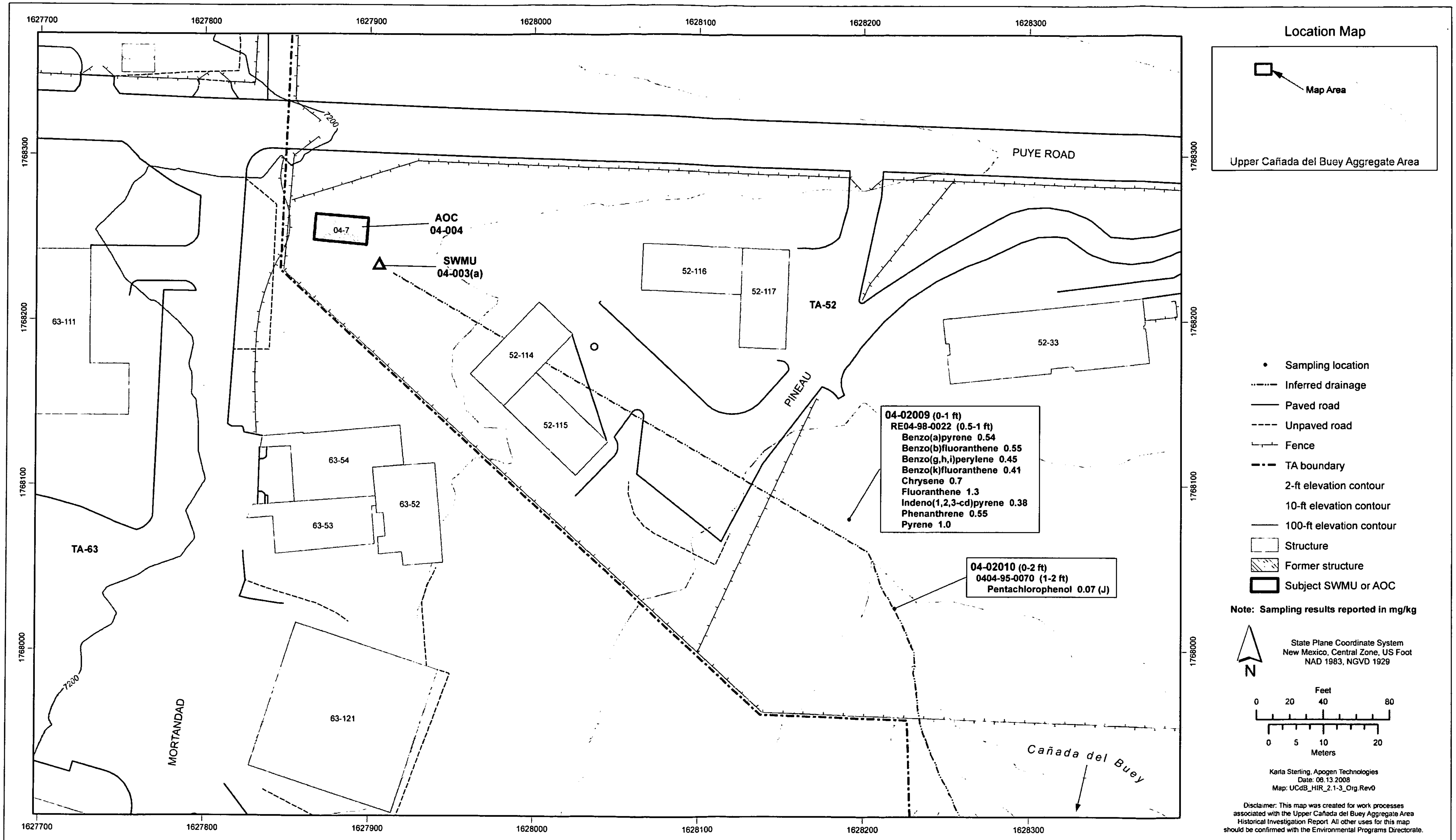

Figure 4.1-3 Organic chemicals detected at SWMU 04-003(a) and AOC 04-004

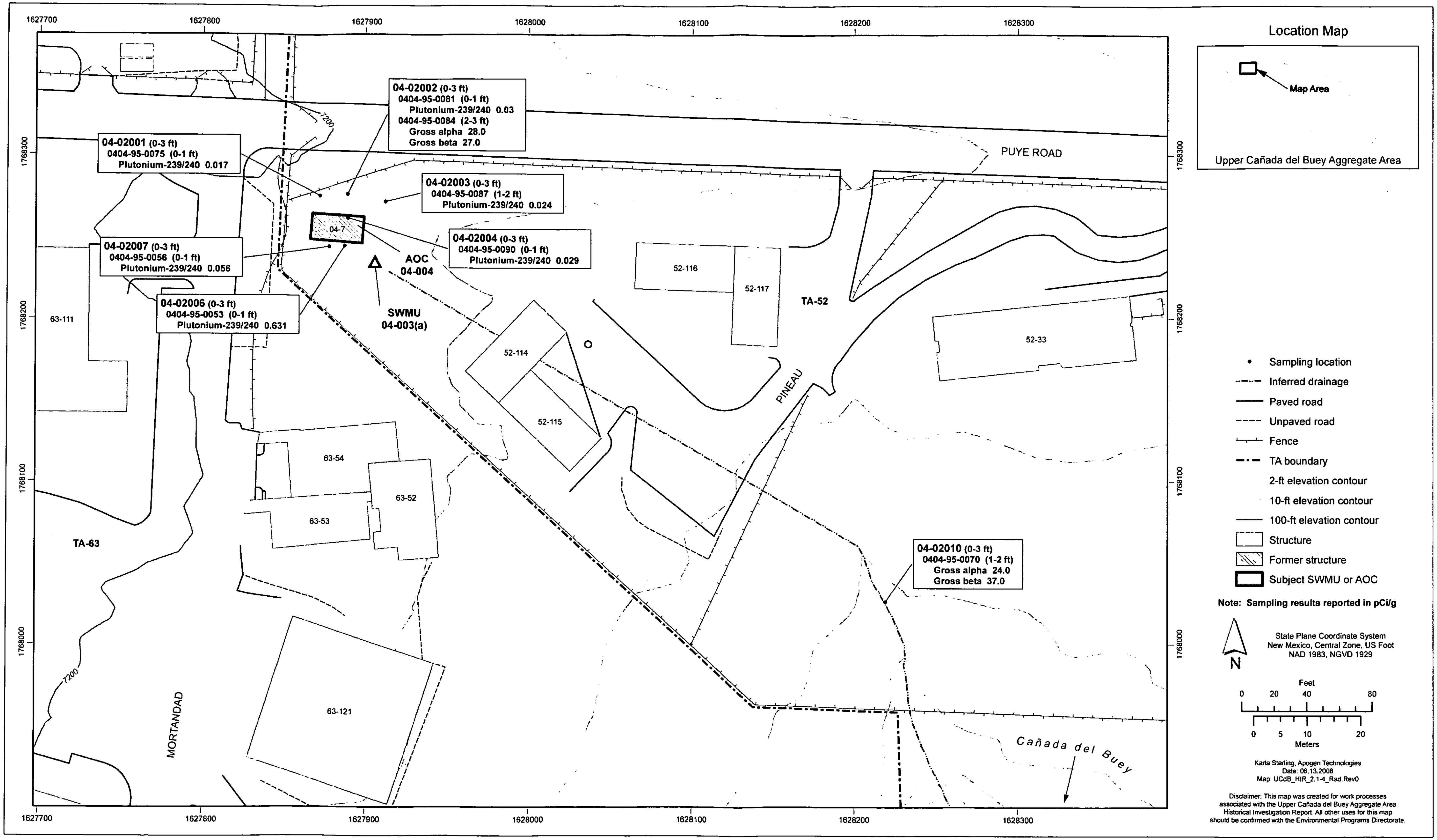

Figure 4.1-4 Radionuclides detected or detected above BVs/FVs at SWMU 04-003(a) and AOC 04-004

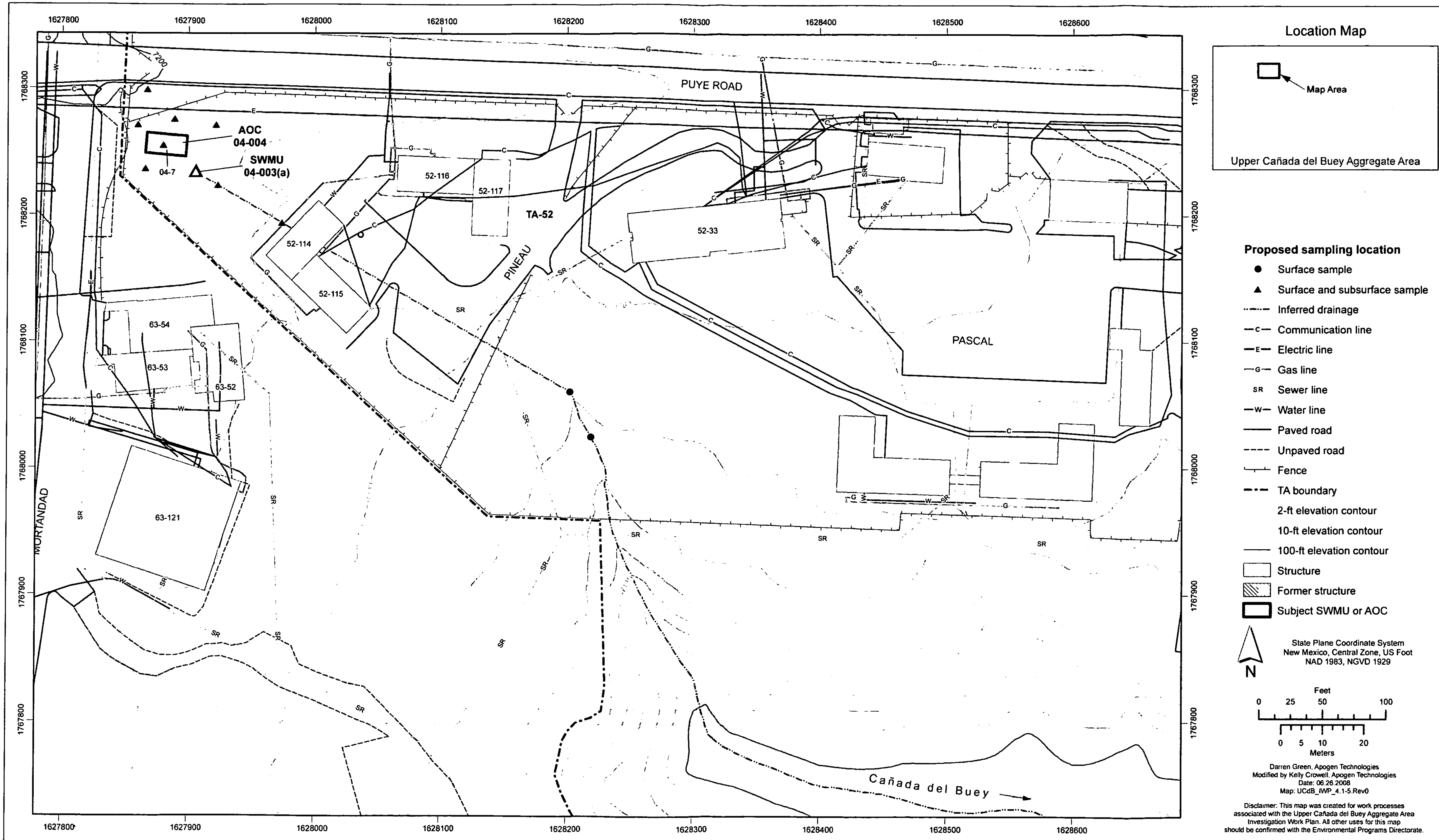

Figure 4.1-5 Proposed sampling locations for SWMU 04-003(a) and AOC 04-004

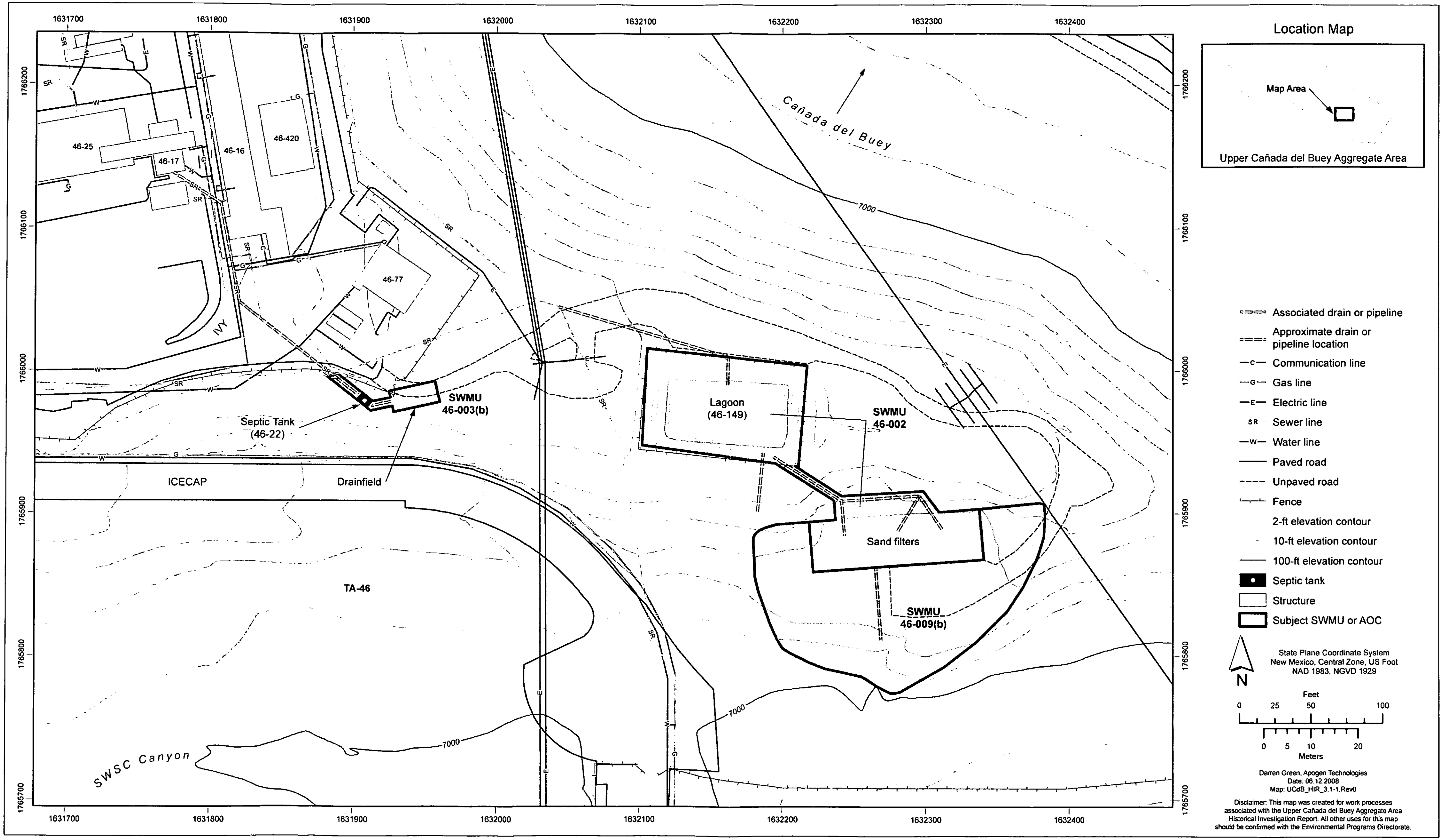

Figure 5.1-1 Site features for SWMUs 46-002, 46-003(b), and 46-009(b)

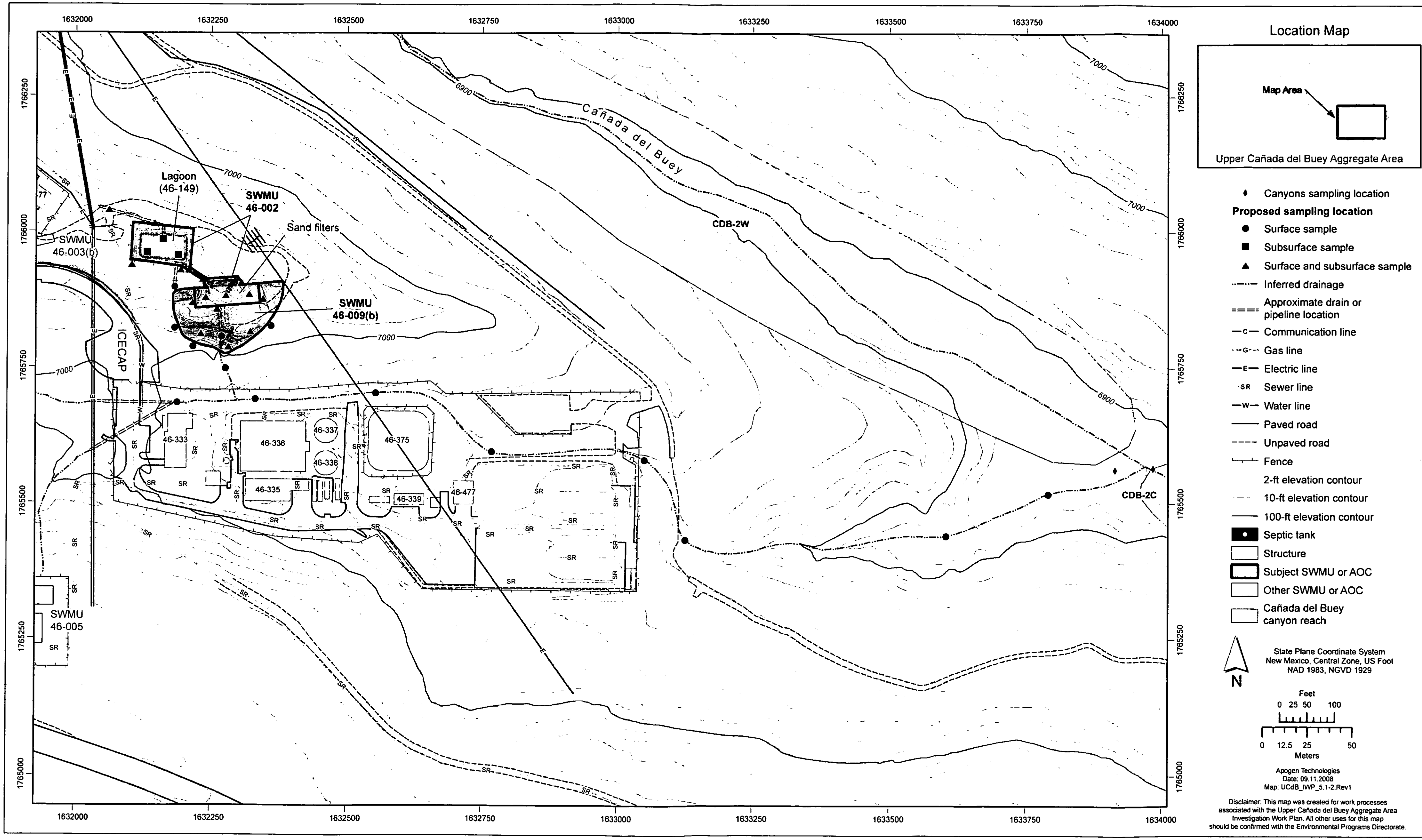

Figure 5.1-2 Proposed sampling locations for SWMUs 46-002, 46-003(b), and 46-009(b)

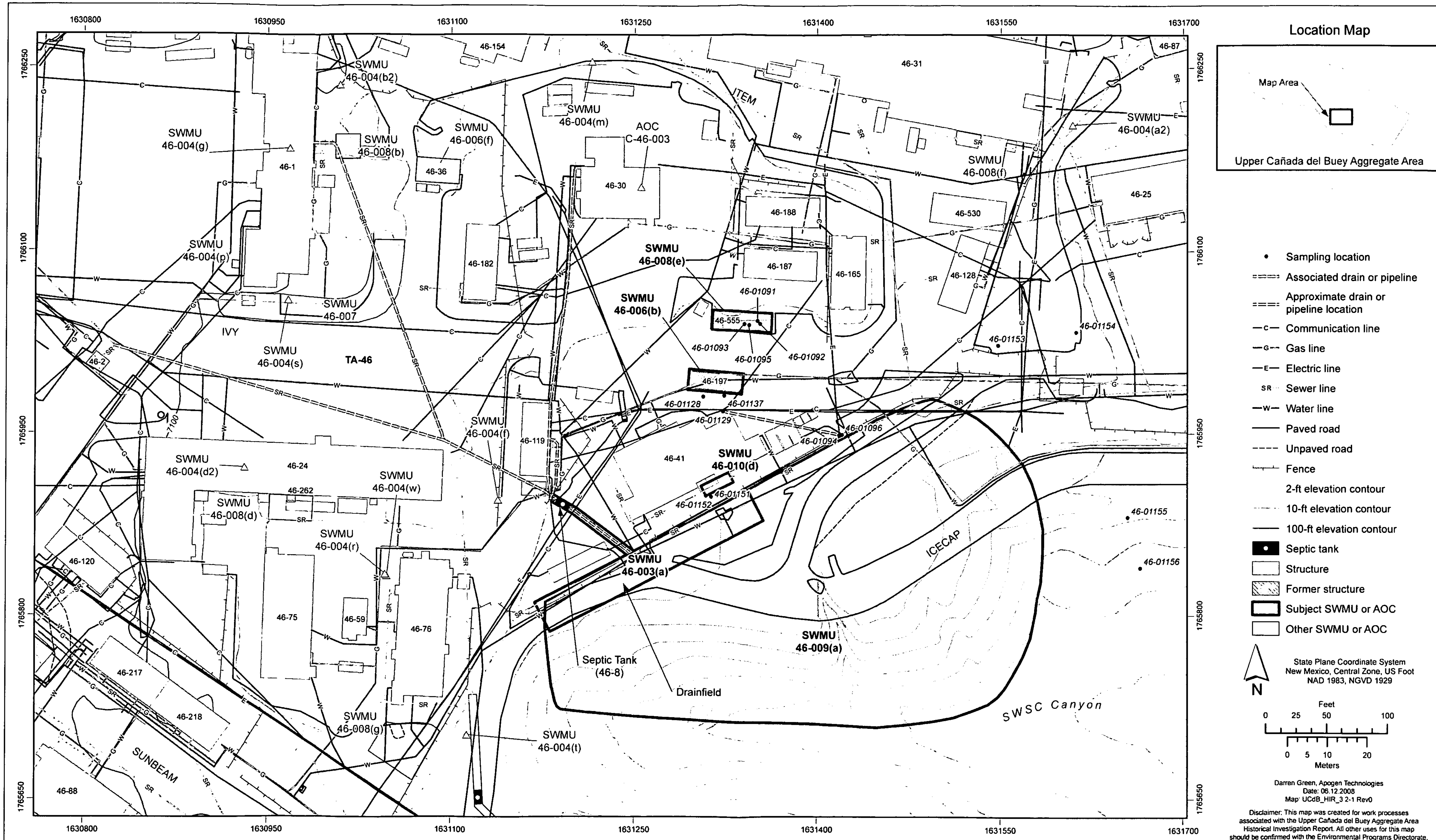

Figure 5.2-1 Site features for SWMUs 46-003(a), 46-006(b), 46-008(e), 46-009(a), and 46-010(d)

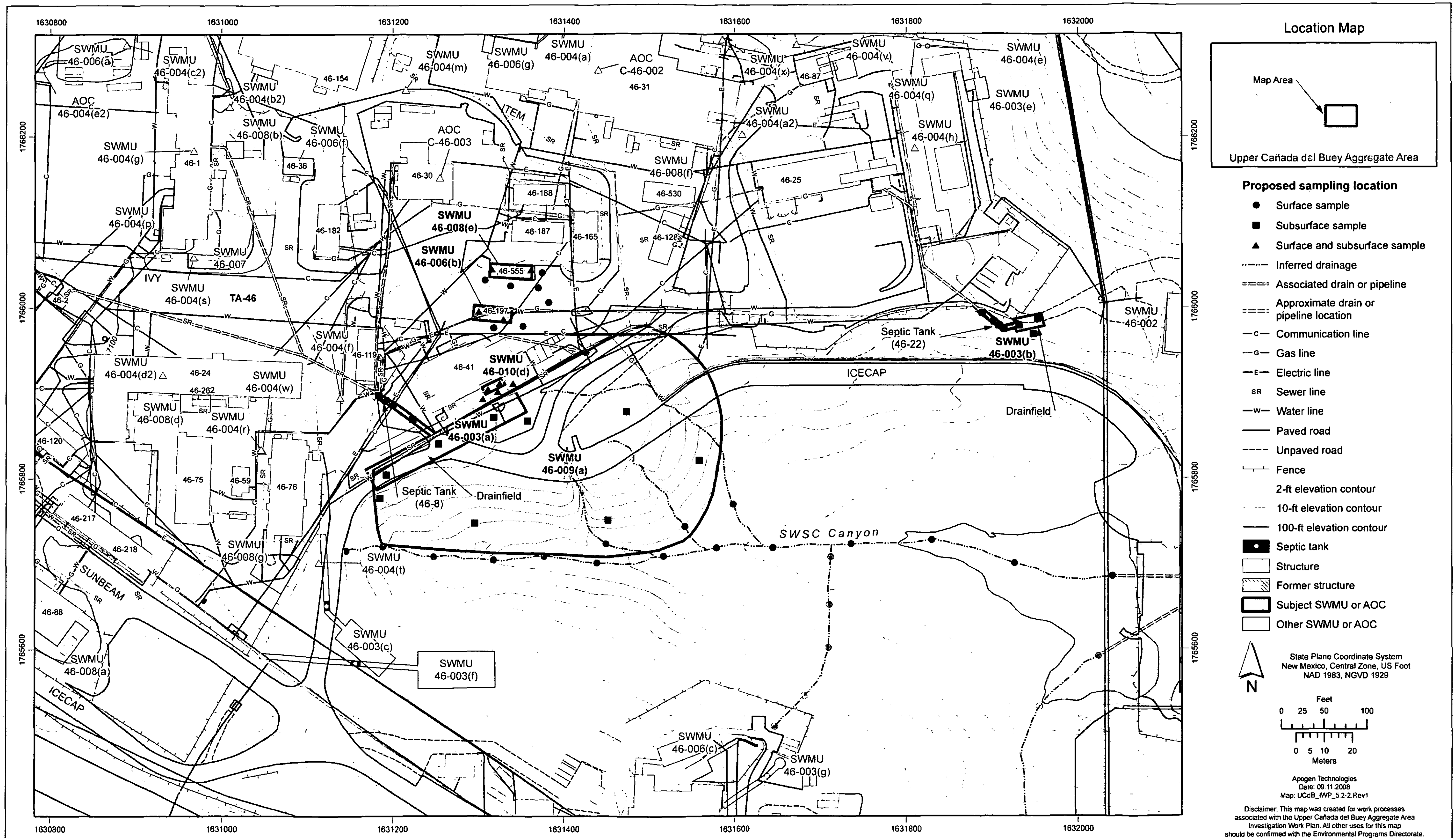

Figure 5.2-2 Proposed sampling locations for SWMUs 46-003(a), 46-006(b), 46-008(e), 46-009(a), and 46-010(d)

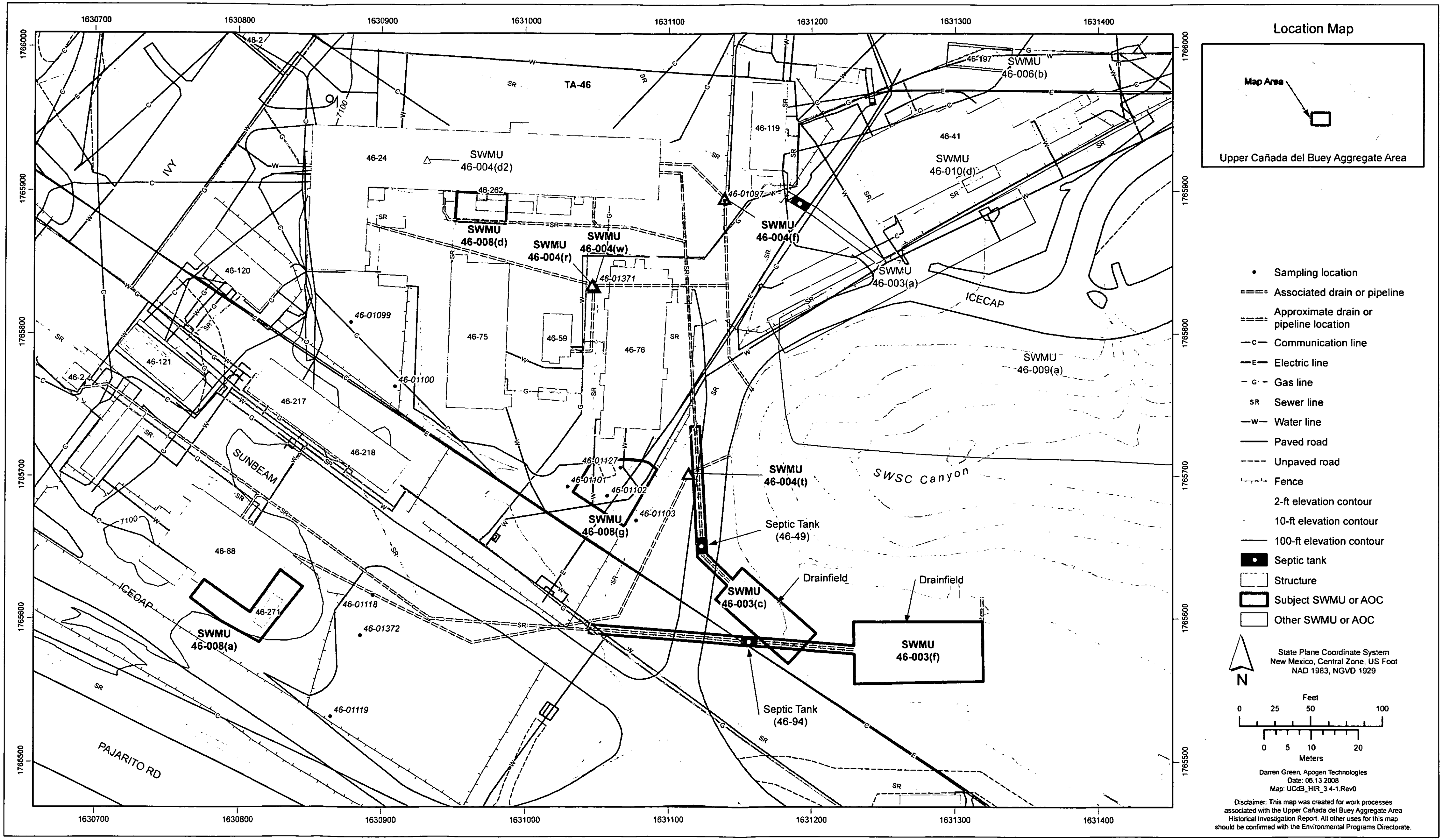

Figure 5.4-1 Site features for SWMUs 46-003(c), 46-003(f), 46-004(f), 46-004(r), 46-004(t), 46-004(w), 46-008(a), 46-008(d), and 46-008(g)

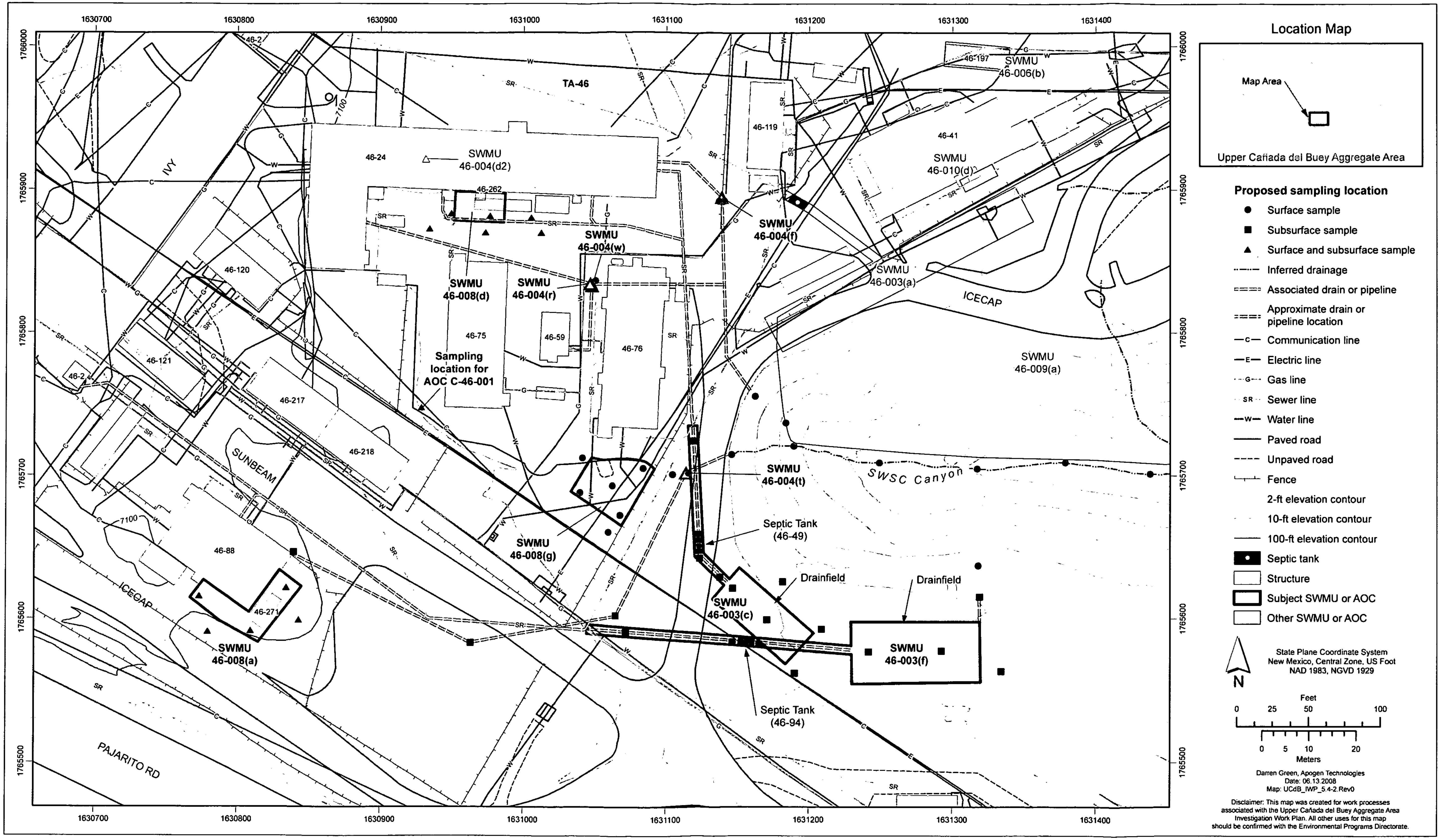

Figure 5.4-2 Proposed sampling locations for SWMUs 46-003(c), 46-003(f), 46-004(f), 46-004(r), 46-004(t), 46-004(w), 46-008(a), 46-008(d), and 46-008(g)

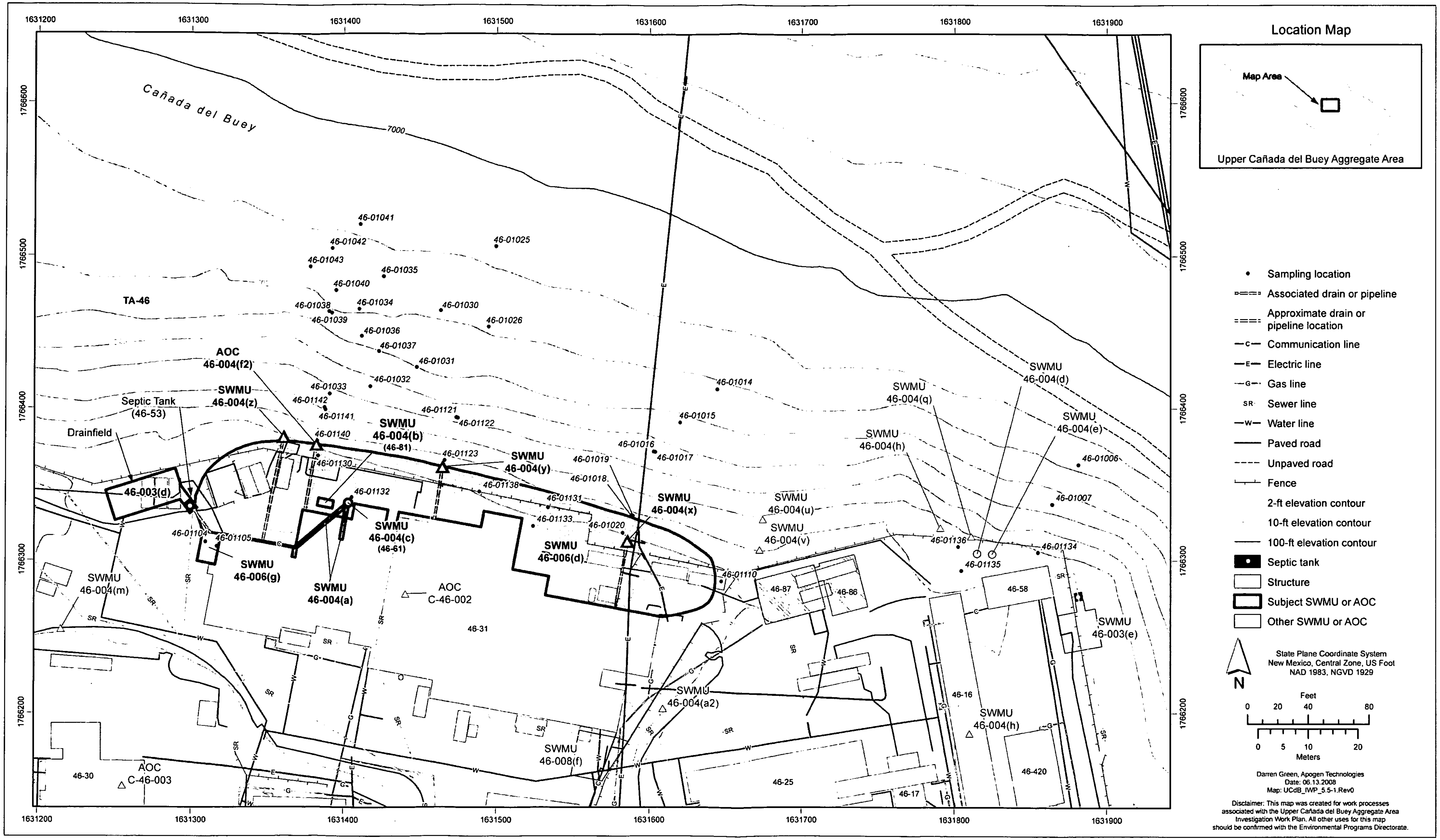

Figure 5.5-1 Site features for SWMUs 46-003(d), 46-004(a), 46-004(b), 46-004(c), 46-004(x), 46-004(y), 46-004(z), 46-006(d), 46-006(g), and AOC 46-004(f2)

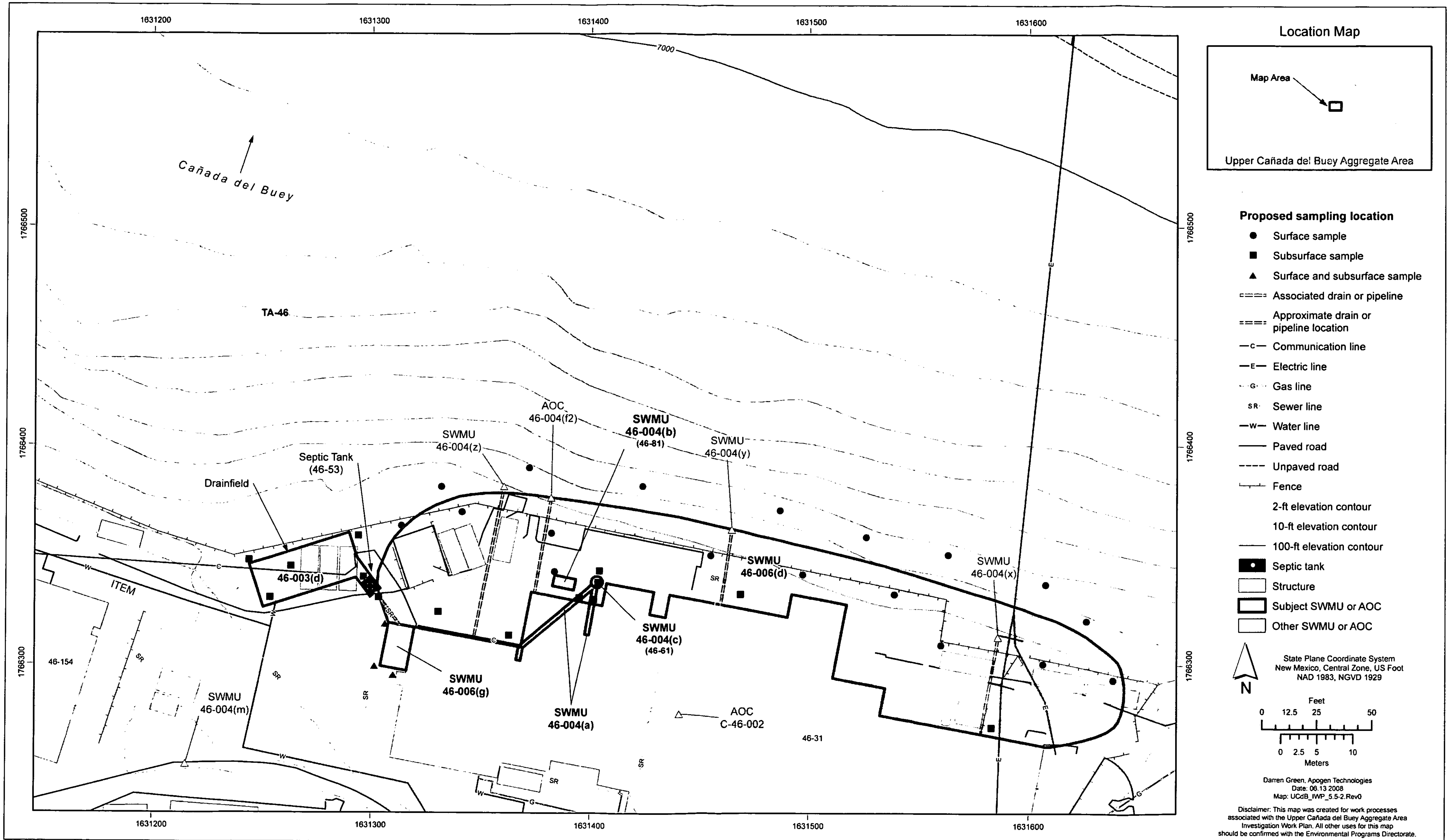

Figure 5.5-2 Proposed sampling locations for SWMUs 46-003(d), 46-004(a), 46-004(b), 46-004(c), 46-006(d), and 46-006(g)

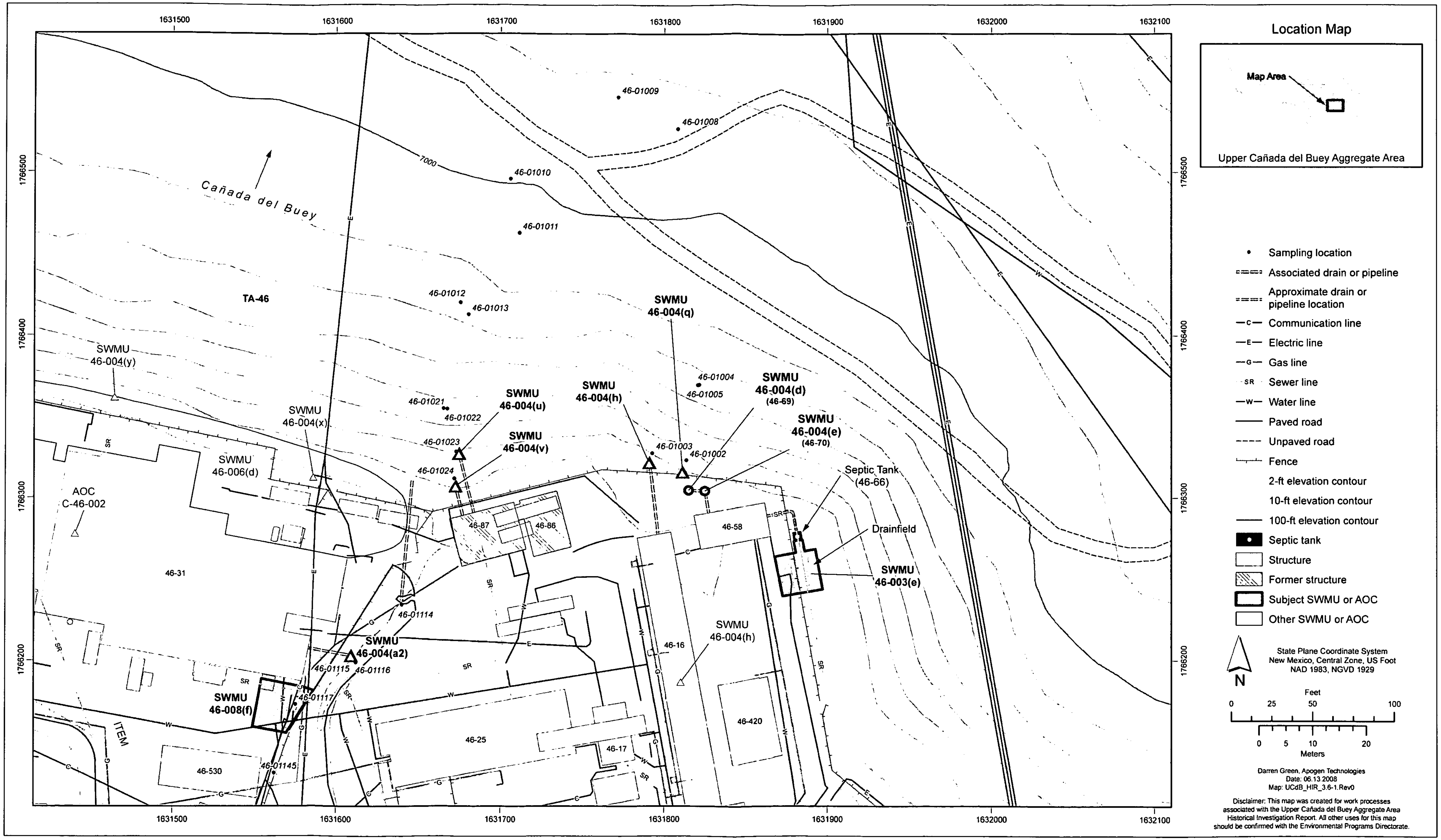

Figure 5.6-1 Site features for SWMUs 46-003(e), 46-004(a2), 46-004(d), 46-004(e), 46-004(h) (outfall), 46-004(q), 46-004(u), 46-004(v), and 46-008(f)

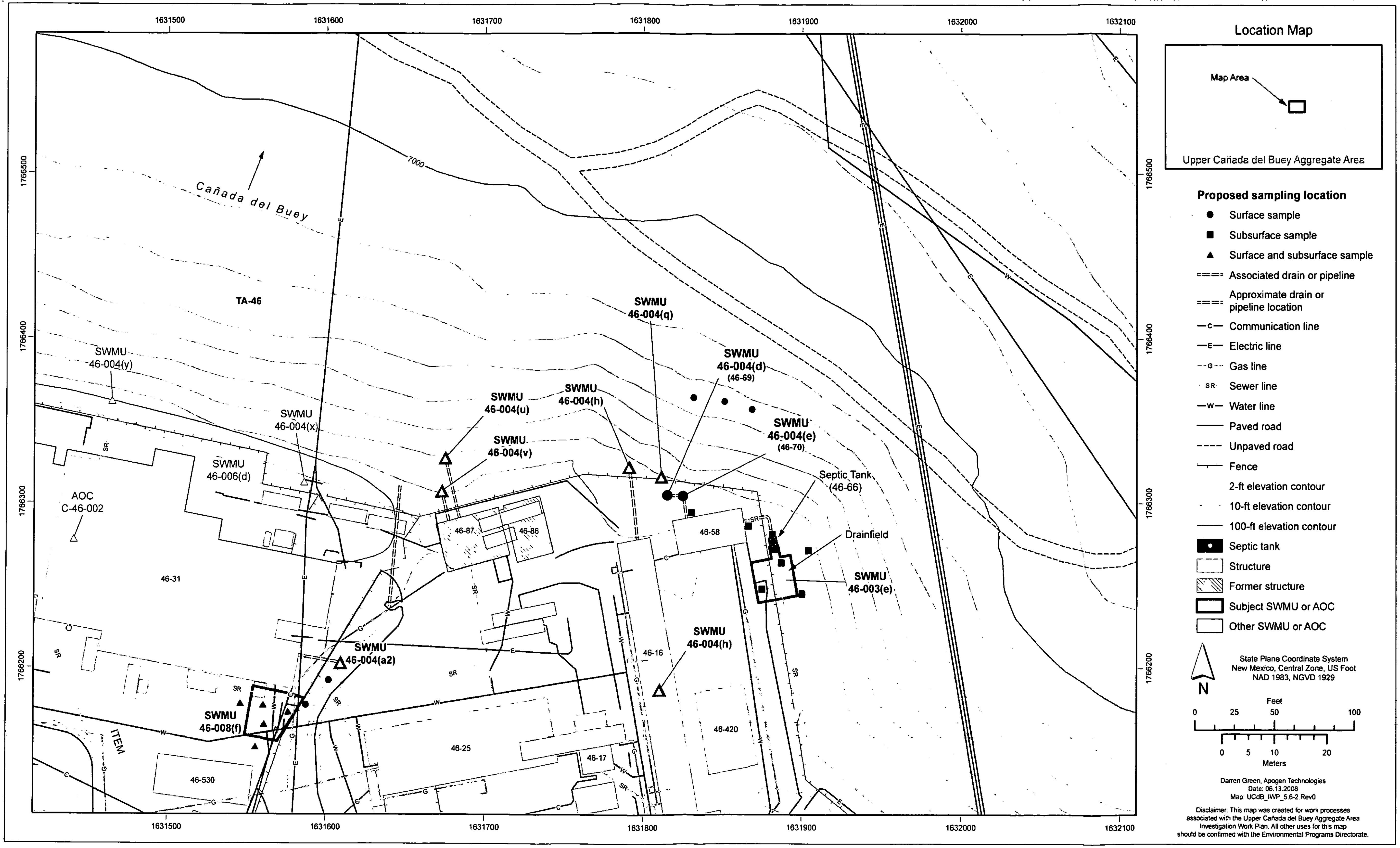

Figure 5.6-2 Proposed sampling locations for SWMUs 46-003(e), 46-004(d), 46-004(e), and 46-008(f)

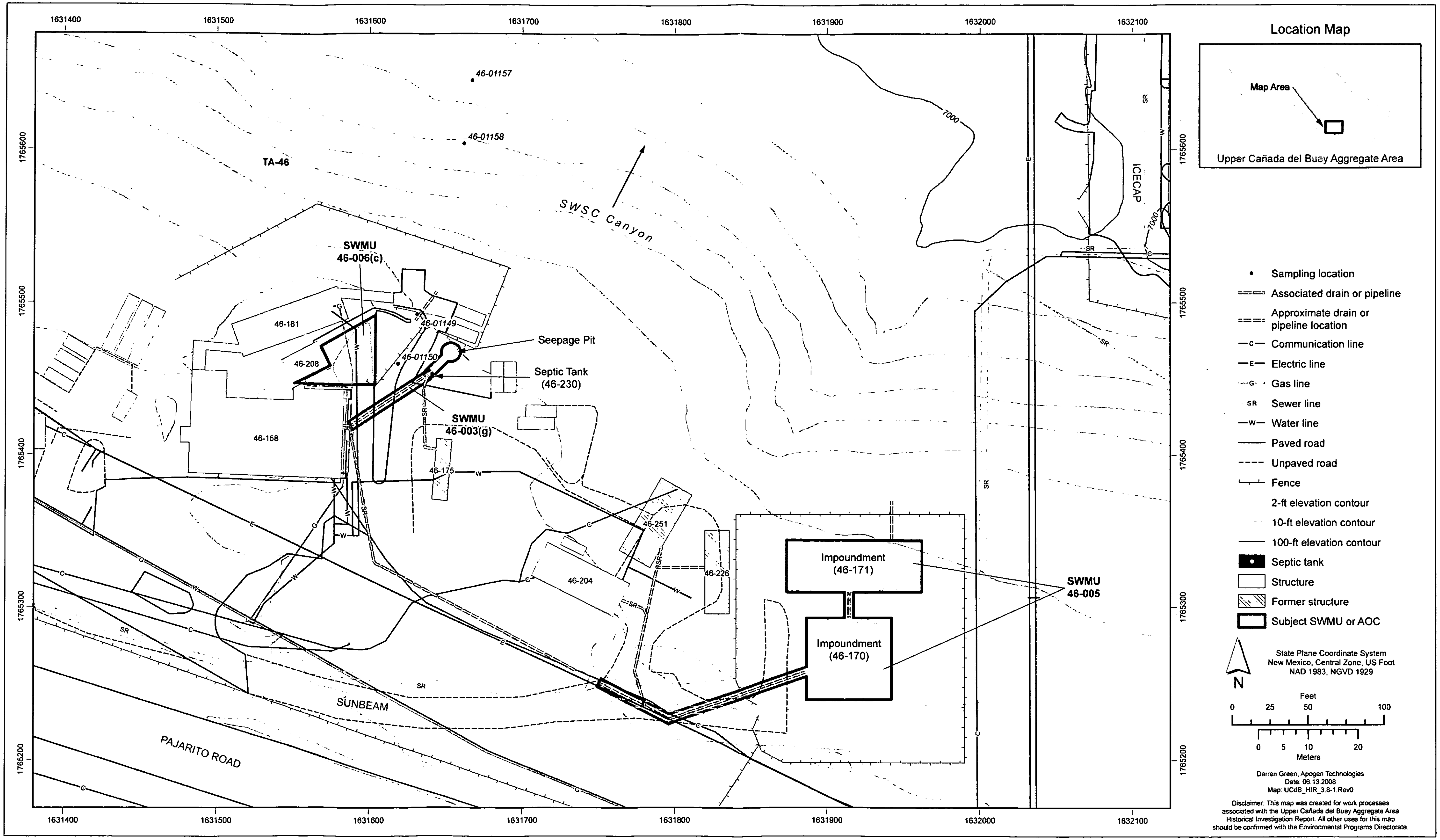

Figure 5.8-1 Site features for SWMUs 46-003(g), 46-005, and 46-006(c)

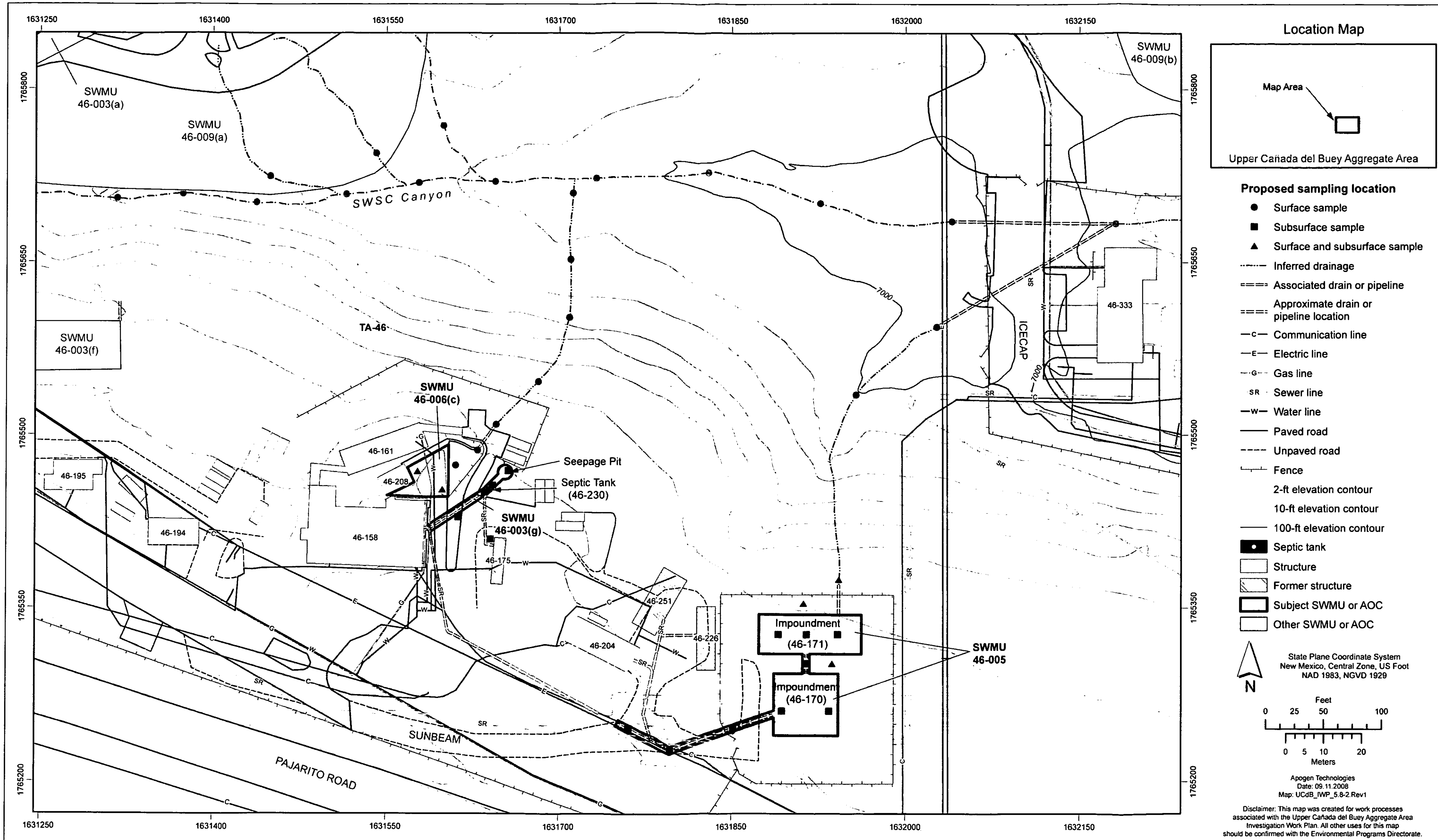

Figure 5.8-2 Proposed sampling locations for SWMUs 46-003(g), 46-005, and 46-006(c)

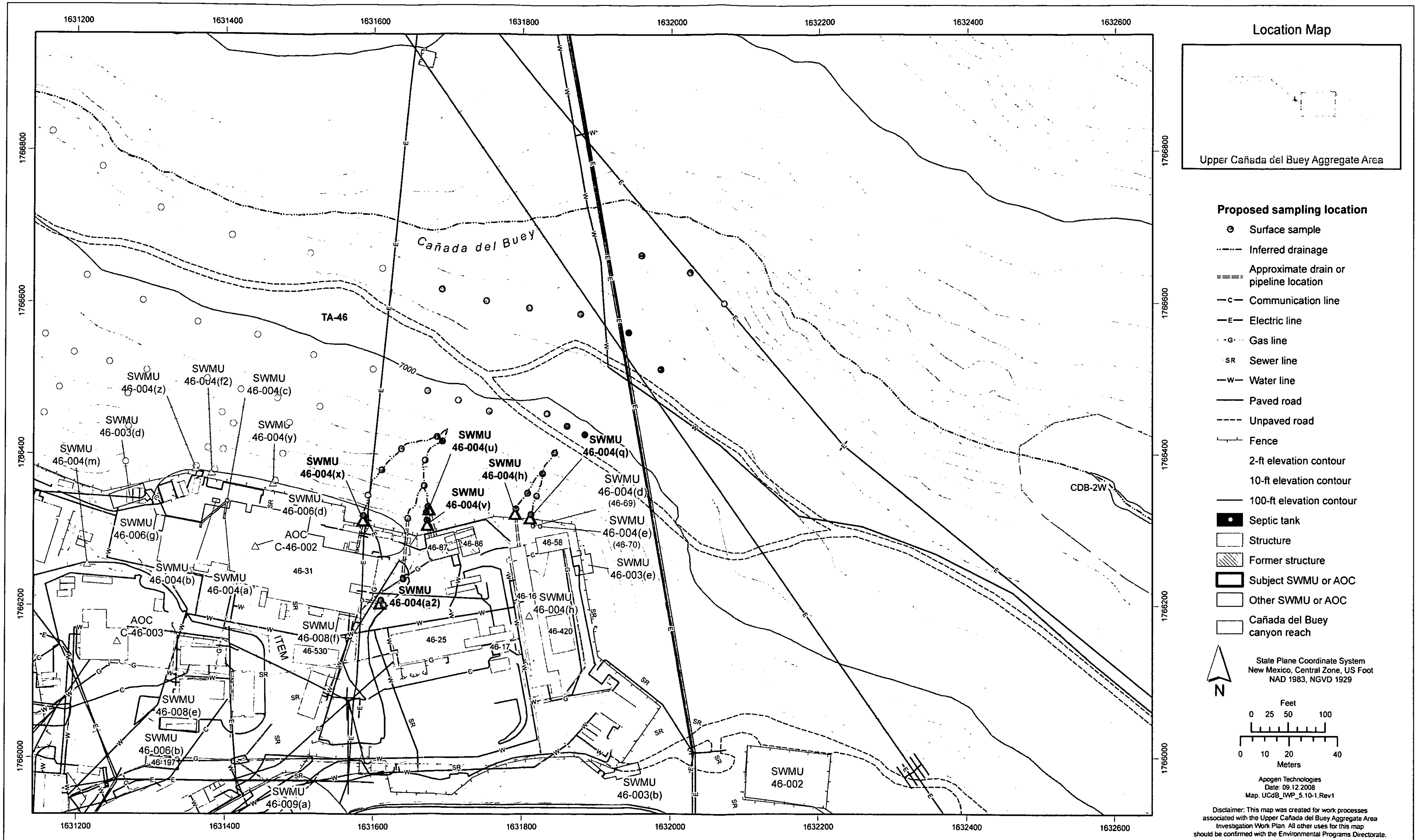

Figure 5.10-1 Proposed sampling locations for SWMUs 46-004(a2), 46-004(h) (outfall), 46-004(q), 46-004(u), 46-004(v), and 46-004(x)

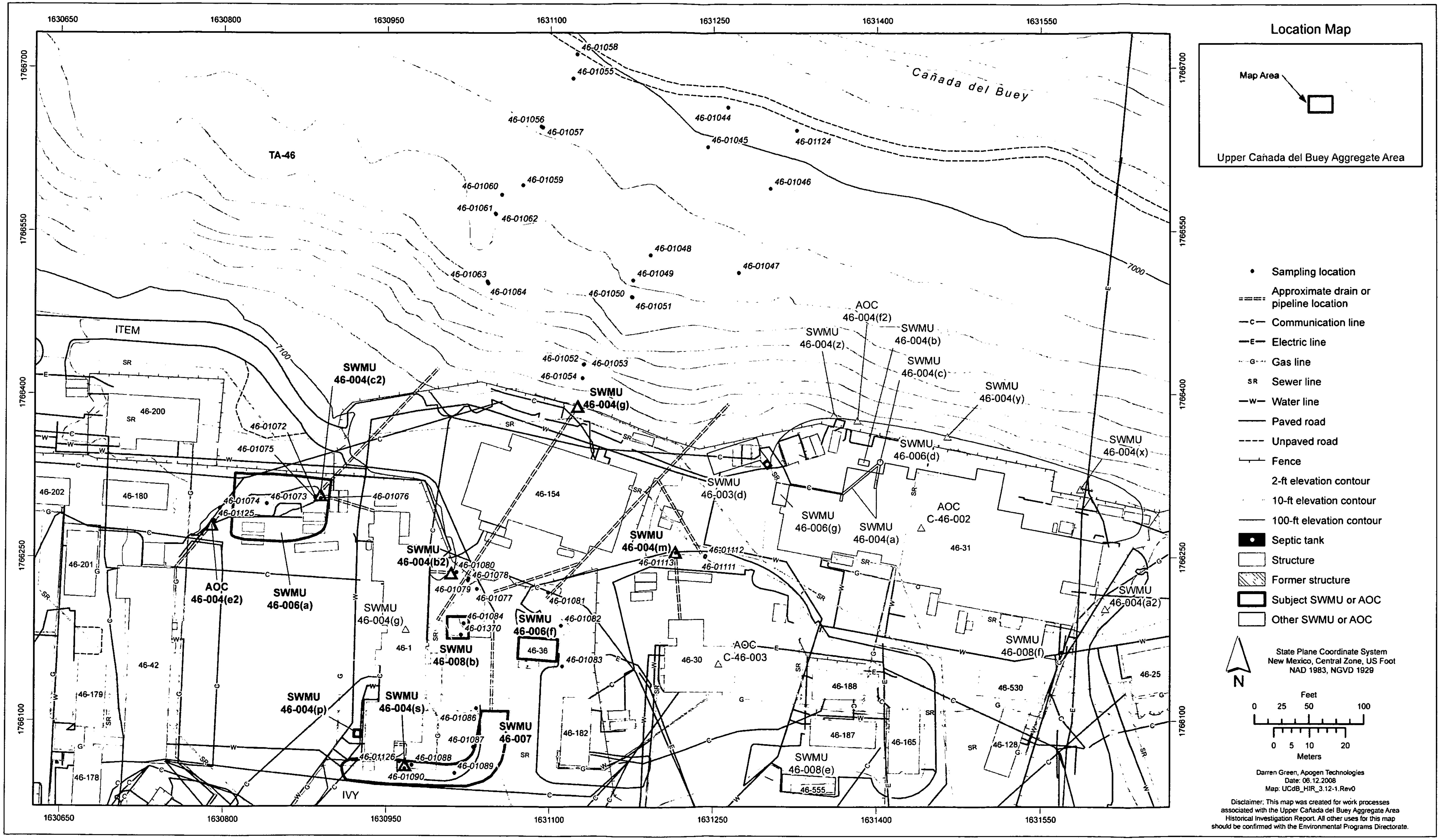

Figure 5.12-1 Site features for SWMUs 46-004(b2), 46-004(c2), 46-004(g) (outfall), 46-004(m), 46-004(p), 46-004(s), 46-006(a), 46-006(f), 46-007, 46-008(b), and AOC 46-004(e2)

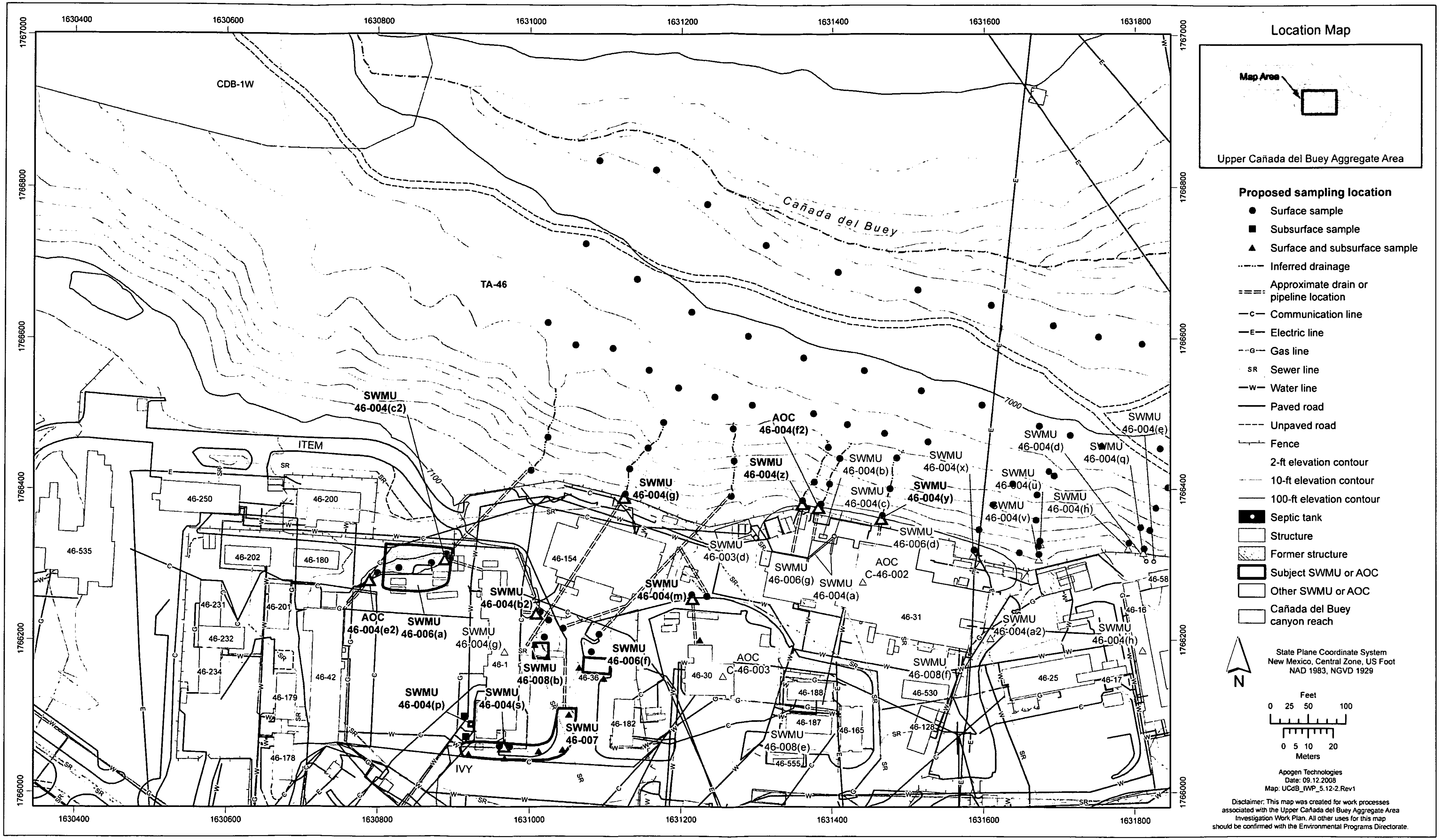

Figure 5.12-2 Proposed sampling locations for SWMUs 46-004(b2), 46-004(c2), 46-004(g) (outfall), 46-004(m), 46-004(p), 46-004(s), 46-004(y), 46-004(z), 46-006(a), 46-006(f), 46-007, 46-008(b), and AOCs 46-004(e2) and 46-004(f2)

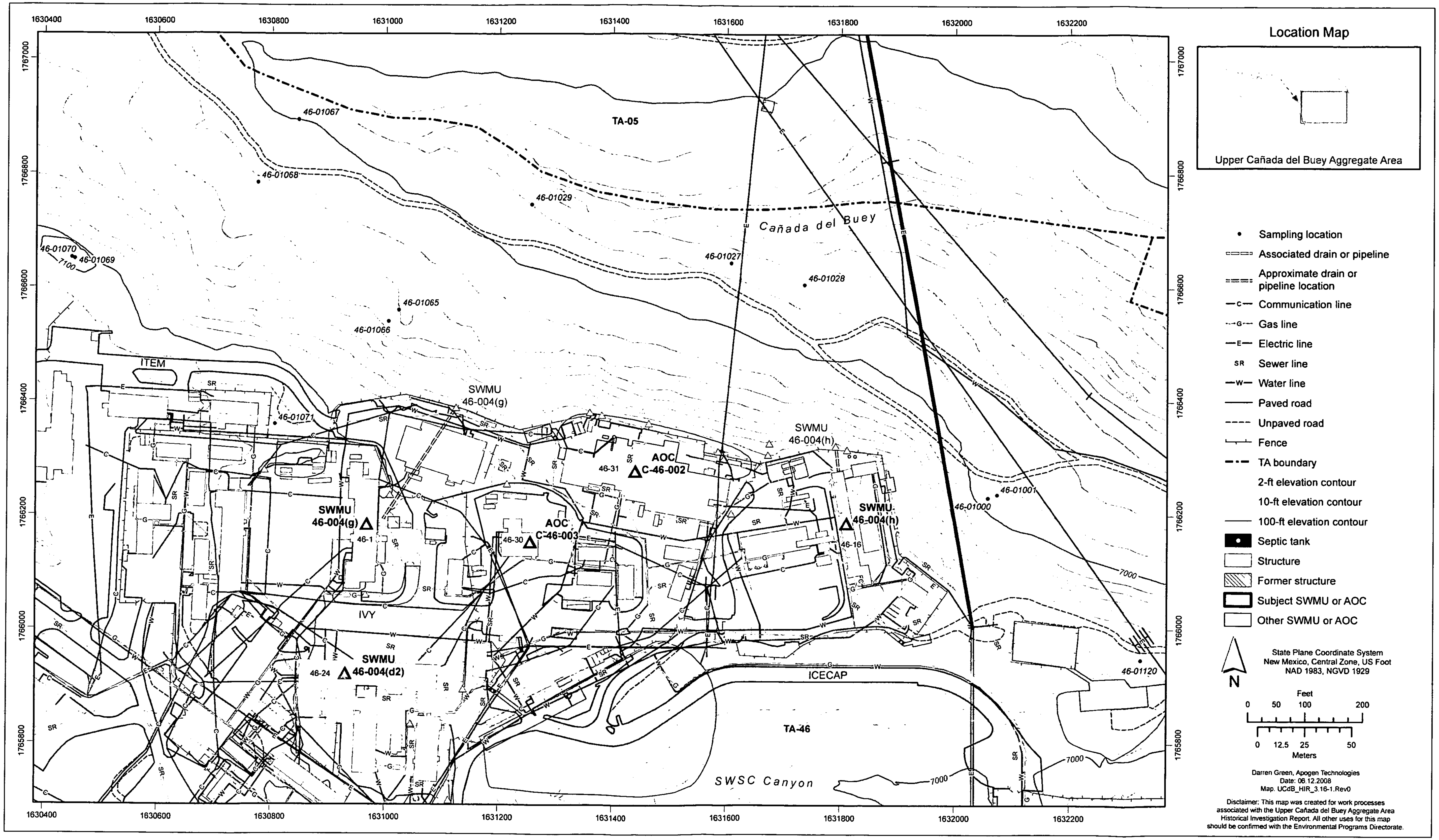

Figure 5.16-1 Site features for Consolidated Unit 46-004(d2)-99: SWMUs 46-004(d2), 46-004(g) (stack emissions), 46-004(h) (stack emissions), and AOCs C-46-002 and C-46-003

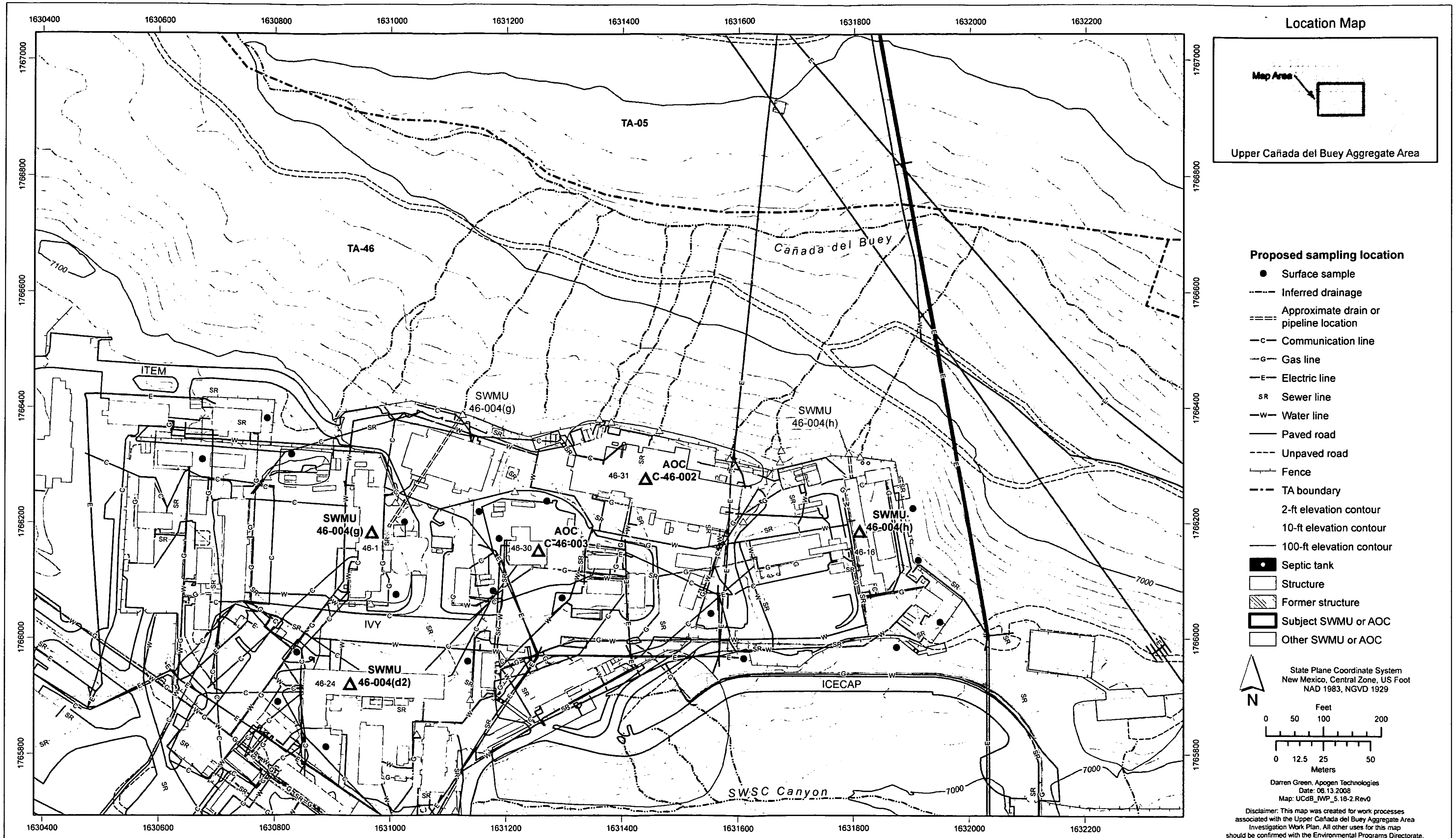

Figure 5.16-2 Proposed sampling locations for Consolidated Unit 46-004(d2)-99: SWMUs 46-004(d2), 46-004(g) (stack emissions), 46-004(h) (stack emissions), and AOCs C-46-002 and C-46-003

Table 1.1-1
SWMUs and AOCs within the Cañada del Buey Canyon Aggregate Area

Site ID	Subunit	Brief Description	Site Status	Reference
TA-04				
Consolidated Unit 04-003(a)-00	SWMU 04-003(a)	Outfall	Under Investigation	Work plan section 4.1.1
	AOC 04-004	Potential soil contamination	Under Investigation	Work plan section 4.1.2
TA-46				
AOC 46-001		Six tanks located on the southeast side of building 46-88	NFA Approved, 01/21/05	EPA 2005, 088464
SWMU 46-002		Surface impoundment	Under Investigation	Work plan section 5.1
SWMU 46-003(a)		Septic system	Under Investigation	Work plan section 5.2
SWMU 46-003(b)		Septic system	Under Investigation	Work plan section 5.3
SWMU 46-003(c)		Septic system	Under Investigation	Work plan section 5.4
SWMU 46-003(d)		Septic system	Under Investigation	Work plan section 5.5
SWMU 46-003(e)		Septic system	Under Investigation	Work plan section 5.6
SWMU 46-003(f)		Septic system	Under Investigation	Work plan section 5.7
SWMU 46-003(g)		Septic system	Under Investigation	Work plan section 5.8
SWMU 46-003(h)		Outfall from building 46-77	Corrective Action Complete Without Controls, 11/29/05	NMED 2005, 092417
SWMU 46-004(a)		Drainlines	Under Investigation	Work plan section 5.9
SWMU 46-004(a2)		Outfall	Under Investigation	Work plan section 5.10
SWMU 46-004(b)		Former tank	Under Investigation	Work plan section 5.11
SWMU 46-004(b2)		Outfall	Under Investigation	Work plan section 5.12
SWMU 46-004(c)		Dry well	Under Investigation	Work plan section 5.13
SWMU 46-004(c2)		Outfall for an industrial drainline	Under Investigation	Work plan section 5.14
Consolidated Unit 46-004(d)-99	SWMU 46-004(d)	Dry well	Under Investigation	Work plan section 5.15.1
	SWMU 46-004(e)	Dry well	Under Investigation	Work plan section 5.15.2
Consolidated Unit 46-004(d2)-99	SWMU 46-004(d2)	Area of potential soil contamination associated with laboratory stack emissions from building 46-24	Under Investigation	Work plan sections 5.16.1, 5.16.2, 5.16.3, and 5.16.4
	SWMU 46-004(g)	Stack emissions/ outfall	Under Investigation	Work plan sections 5.16.1, 5.16.2, 5.16.3, and 5.16.5

Table 1.1-1 (continued)

Site ID	Subunit	Brief Description	Site Status	Reference
Consolidated Unit 46-004(d2)-99 (continued)	SWMU 46-004(h)	Stack emissions/outfall	Under Investigation	Work plan sections 5.16.1, 5.16.2, 5.16.3, and 5.16.6
	AOC C-46-002	One-time stack emission	Under Investigation	Work plan sections 5.16.1, 5.16.2, 5.16.3, and 5.16.6
	AOC C-46-003	Stack emissions	Under Investigation	Work plan sections 5.16.1, 5.16.2, 5.16.3, and 5.16.7
AOC 46-004(e2)		Outfall	Under Investigation	Work plan section 5.17
SWMU 46-004(f)		Outfall	Under Investigation	Work plan section 5.18
AOC 46-004(f2)		Outfall	Under Investigation	Work plan section 5.19
AOC 46-004(i)		Two outfalls that received blowdown from cooling tower 46-86 and that served a holding tank located east of the cooling tower	NFA Approved, 01/21/05	EPA 2005, 088464
AOC 46-004(j)		Outfall that received blowdown from a cooling tower located at building 46-1	NFA Approved, 01/21/05	EPA 2005, 088464
AOC 46-004(k)		Outfall associated with a cooling tower that served building 46-169	NFA Approved, 01/21/05	EPA 2005, 088464
AOC 46-004(l)		Outfall for a commercial cooling unit located on the south side of building 46-24	NFA Approved, 01/21/05	EPA 2005, 088464
SWMU 46-004(m)		Outfall	Under Investigation	Work plan section 5.20
AOC 46-004(n)		Outfall for a cooling tower associated with building 46-41	NFA Approved, 01/21/05	EPA 2005, 088464
AOC 46-004(o)		Outfall for a cooling tower located at building 46-200	NFA Approved, 01/21/05	EPA 2005, 088464
SWMU 46-004(p)		Dry well	Under Investigation	Work plan section 5.21
SWMU 46-004(q)		Outfall	Under Investigation	Work plan section 5.22
SWMU 46-004(r)		Outfall	Under Investigation	Work plan section 5.23
SWMU 46-004(s)		Outfall	Under Investigation	Work plan section 5.24
SWMU 46-004(t)		Outfall	Under Investigation	Work plan section 5.25
SWMU 46-004(u)		Outfall	Under Investigation	Work plan section 5.26
SWMU 46-004(v)		Outfall	Under Investigation	Work plan section 5.27
SWMU 46-004(w)		Outfall	Under Investigation	Work plan section 5.28

Table 1.1-1 (continued)

Site ID	Subunit	Brief Description	Site Status	Reference
SWMU 46-004(x)		Outfall	Under Investigation	Work plan section 5.29
SWMU 46-004(y)		Outfall	Under Investigation	Work plan section 5.30
SWMU 46-004(z)		Outfall	Under Investigation	Work plan section 5.31
SWMU 46-005		Surface impoundments	Under Investigation	Work plan section 5.32
SWMU 46-006(a)		Potential soil contamination	Under Investigation	Work plan section 5.33
SWMU 46-006(b)		Former storage shed	Under Investigation	Work plan section 5.34
SWMU 46-006(c)		Storage area	Under Investigation	Work plan section 5.35
SWMU 46-006(d)		Potential soil contamination	Under Investigation	Work plan section 5.36
AOC 46-006(e)		Surface disposal area	NFA Approved, 01/21/05	EPA 2005, 088464
SWMU 46-006(f)		Storage area	Under Investigation	Work plan section 5.37
SWMU 46-006(g)		Storage area	Under Investigation	Work plan section 5.38
SWMU 46-007		Potential soil contamination	Under Investigation	Work plan section 5.39
SWMU 46-008(a)		Storage area	Under investigation	Work plan section 5.40
AOC 46-008 (misc)		Storage area–unable to be located	NFA Approved, 01/21/05	EPA 2005, 088464
SWMU 46-008(b)		Storage area	Under Investigation	Work plan section 5.41
SWMU 46-008(c)		Storage area–unable to be located	Removed from Module VIII of the Laboratory's Hazardous Waste Facility Permit (HWFP), 12/23/98	NMED 1998, 063042
SWMU 46-008(d)		Storage area	Under Investigation	Work plan section 5.42
SWMU 46-008(e)		Storage area	Under Investigation	Work plan section 5.43
SWMU 46-008(f)		Storage area	Under Investigation	Work plan section 5.44
SWMU 46-008(g)		Storage area	Under Investigation	Work plan section 5.45
SWMU 46-009(a)		Landfill	Under Investigation	Work plan section 5.46
SWMU 46-009(b)		Former surface disposal area	Under Investigation	Work plan section 5.47
AOC 46-010 (misc)		Storage area–unable to be located	NFA Approved, 01/21/05	EPA 2005, 088464
AOC 46-010(a)		Storage area located on south bay of building 46-1	NFA Approved, 01/21/05	EPA 2005, 088464
AOC 46-010(b)		Storage area located along south wall of building 46-24	NFA Approved, 01/21/05	EPA 2005, 088464

Table 1.1-1 (continued)

Site ID	Subunit	Brief Description	Site Status	Reference
AOC 46-010(c)		Storage area located against the south wall of building 46-31	NFA Approved, 01/21/05	EPA 2005, 088464
SWMU 46-010(d)		Storage area	Under Investigation	Work plan section 5.48
AOC 46-010(e)		Storage area located on the southwest corner of building 46-154	NFA Approved, 01/21/05	EPA 2005, 088464
AOC 46-010(f)		Storage area located on a hill above building 46-158	NFA Approved, 01/21/05	EPA 2005, 088464
AOC C-46-001		Spill release area	Under Investigation	Work plan section 5.49
TA-52				
SWMU 52-001(a)		Ultra-High-Temperature Reactor Experiment (UHTREX) equipment	Removed from Module VIII of the HWFP, 12/23/98	NMED 1998, 063042
SWMU 52-001(b)		UHTREX equipment	Removed from Module VIII of the HWFP, 12/23/98	NMED 1998, 063042
SWMU 52-001(c)		UHTREX equipment	Removed from Module VIII of the HWFP, 12/23/98	NMED 1998, 063042
SWMU 52-001(d)		UHTREX equipment	Pending NMED review of supplemental information, 04/15/08	LANL 2008, 101365
SWMU 52-002(b)		Septic system	Removed from Module VIII of the HWFP, 12/23/98	NMED 1998, 063042
SWMU 52-002(f)		Septic system	Removed from Module VIII of the HWFP, 12/23/98	NMED 1998, 063042
AOC 52-002(g)		Septic system	NFA Approved, 01/21/05	EPA 2005, 088464
AOC 52-004		Evaporator	NFA Approved, 01/21/05	EPA 2005, 088464
AOC C-52-001		Former transformer site–PCB only site	NFA Approved, 01/21/05	EPA 2005, 088464
AOC C-52-002		Former transformer site–PCB only site	NFA Approved, 01/21/05	EPA 2005, 088464

Note: Shading denotes NFA approved or pending.

Table 2.3-1
Summary of Human Health Screening Levels for Chemicals and Radionuclides

Chemical/Radionuclide	Residential	Industrial	Recreational
Organic Chemicals (mg/kg)			
Acenaphthene	3730	33,500	47,500
Acenaphthylene (use Pyrene)	2290	30,900	23,800
Acetone	28,100	100,000	100,000
Acrolein	0.206	0.752	6.33
Aldrin	0.284	1.12	1.49
Amino-4,6-dinitrotoluene[2-] (use Dinitrotoluene[2,6-])	61	680	399
Amino-2,6-dinitrotoluene[4-] (use Dinitrotoluene[2,6-])	61	680	399
Anthracene	22,000	100,000	100,000
Aroclor-1016	3.93	41.3	23.3
Aroclor-1221	1.12	8.26	10.5
Aroclor-1232	1.12	8.26	10.5
Aroclor-1242	1.12	8.26	10.5
Aroclor-1248	1.12	8.26	10.5
Aroclor-1254	1.12	8.26	6.65
Aroclor-1260	1.12	8.26	10.5
Benzene	10.3	25.8	224
Benzidine	0.0211	0.0833	0.111
Benzo(a)anthracene	6.21	23.4	30.1
Benzo(a)pyrene	0.621	2.34	3.01
Benzo(b)fluoranthene	6.21	23.4	30.1
Benzo(k)fluoranthene	62.1	234	301
Benzo(g,h,i)perylene (use Pyrene)	2290	30,900	23,800
Benzoic acid	100,000*	100,000*	100,000
BHC[alpha-]	0.902	3.99	6.05
BHC[beta-]	3.16	14	21.2
BHC[gamma-]	4.37	19.3	29.3
Bis(2-chloroethyl)ether	2.44	7.45	34.5
Bis(2-chloroisopropyl)ether or Oxybis (1-chloropropane)[2,2'-]	38.7	119	453
Bis(2-ethylhexyl)phthalate	347	1370	1830
Bromobenzene	37	137	245
Bromodichloromethane	14.4	37.2	290
Bromoform or Tribromomethane	621	2460	7160
Bromomethane	8.51	32.8	228

Table 2.3-1 (continued)

Chemical/Radionuclide	Residential	Industrial	Recreational
Butanone[2-] or Methyl ethyl ketone	31,800	48,700	48,700
Butylbenzene[n-]	62.1	62.1	62.1
Butylbenzene[sec-]	60.6	60.6	60.6
Butylbenzene[tert-]	106	106	106
Butylbenzylphthalate	240*	240*	240
Carbazole	240*	960*	1280
Carbon disulfide	460	460	460
Carbon tetrachloride	3.47	8.64	77.9
Chlordane (Technical Grade)	16.2	71.9	109
Chlordane[alpha-] (use Chlordane)	16.2	71.9	109
Chlordane[gamma-] (use Chlordane)	16.2	71.9	109
Chloro-1,3-butadiene[2-]	6.32	23	194
Chlorobenzene	194	245	245
Chlorodibromomethane or Dibromochloromethane	14.8	39.5	673
Chlorodifluoromethane	211	211	211
Chloroethane or Ethyl chloride	63.3	154	1420
Chloroform	4	9.59	102
Chloromethane	21.8	53.4	510
Chloronaphthalene[2-] or [b-]	3990	27,800	63,400
Chloronitrobenzene[o-]	1.49	5.48	44.3
Chlorophenol[2-]	166	885	2750
Chlorotoluene[2-] or [o-]	202	202	202
Chrysene	615	2310	3010
DDD[4,4'-]	24.4	111	173
DDE[4,4'-]	17.2	78.1	122
DDT[4,4'-]	17.2	78.1	122
Dibenz(a,h)anthracene	0.621	2.34	3.01
Dibenzofuran	142	1620	1580
Dibromo-3-chloropropane[1,2-]	1.84	9.68	40.4
Dibromoethane[1,2-]	0.504	1.31	9.88
Dibromomethane or Methylene bromide	179	785	3780
Dichlorobenzene[1,2-]	37.4	37.4	37.4
Dichlorobenzene[1,3-]	32.6	37.4	37.4
Dichlorobenzene[1,4-]	39.5	103	2360
Dichlorobenzidine[3,3'-]	10.8	42.6	56.9
Dichlorodifluoromethane	161	211	211
Dichloroethane[1,1-]	1400	1420	1420
Dichloroethane[1,2-]	6.04	15.2	132
Dichloroethene[1,1-]	206	777	927

Table 2.3-1 (continued)

Chemical/Radionuclide	Residential	Industrial	Recreational
Dichloroethene[cis-1,2-]	76.5	300	863
Dichloroethene[trans-1,2-]	112	429	1740
Dichlorophenol[2,4-]	183	2050	1200
Dichloropropane[1,2-]	6	14.9	136
Dichloropropene[cis/trans-1,3-] or [1,3-]	12	31.7	225
Dieldrin	0.304	1.2	1.6
Diethyl Ether or Ethyl ether	1940	1940	1940
Diethylphthalate	48,900	100,000	100,000
Dimethyl phthalate	100,000	100,000	100,000
Dimethylphenol[2,4-]	1220	13,700	7970
Di-n-butylphthalate	6110	68,400	39,900
Di-n-octylphthalate	2400*	25,000*	15,900
Dinitrobenzene[1,3-]	6.1*	68*	39.9
Dinitrotoluene[2,4-]	122	1370	797
Dinitrotoluene[2,6-]	61*	680*	399
Diphenylhydrazine[1,2-]	6.08	23.9	32
Endosulfan/Endosulfan I/Endosulfan II	367	4100	2390
Endosulfan Sulfate (use Endrin)	18.3	205	120
Endrin	18.3	205	120
Endrin aldehyde (use Endrin)	18.3	205	120
Endrin ketone (use Endrin)	18.3	205	120
Ethyl methacrylate	52.7	52.7	52.7
Ethylbenzene	128	128	128
Fluoranthene	2290	24,400	13,900
Fluorene	2660	26,500	31,700
Heptachlor	1.08	4.26	5.69
Heptachlor epoxide	0.53*	2.1*	2.81
Hexachlorobenzene	3.04	12	16
Hexachlorobutadiene or Hexachloro-1,3-butadiene	12.2	137	79.7
Hexachlorocyclopentadiene	366	4100	2390
Hexachloroethane	61.1	684	399
Hexane or Hexane[n-]	38	38	38
Hexanone[2-] (use Butanone[2-])	31,800	48,700	48,700
HMX	3060	34,200	19,900
Indeno(1,2,3-cd)pyrene	6.21	23.4	30.1
Isopropylbenzene or Cumene	271	389	389
Isopropyltoluene[4-] (use Isopropylbenzene)	271	389	389
Methoxychlor[4,4'-]	310*	3400*	1690
Methyl methacrylate	2920	2920	2920

Table 2.3-1 (continued)

Chemical/Radionuclide	Residential	Industrial	Recreational
Methyl-2-pentanone[4-] or Methyl isobutyl ketone	5510	7010	7010
Methyl tert-Butyl Ether or tert-Butyl methyl ether	388	984	8180
Methylene chloride	182	490	2630
Methylnaphthalene[2-] (use Naphthalene)	79.5	300	15,800
Naphthalene	79.5	300	15,800
Nitrobenzene	22.8	147	320
Nitrosodiethylamine[N-]	0.0324	0.128	0.171
Nitrosodimethylamine[N-]	0.0954	0.376	0.502
Nitroso-di-n-butylamine[N-]	0.269	0.728	3.19
Nitrosodiphenylamine[N-]	993	3910	5220
Nitrosopyrrolidine[N-]	2.32	9.12	12.2
Nitrophenol[2-] (use Chlorophenol[2-])	166	885	2750
Nitrotoluene[3-] or [m-]	569	569	569
Nitrotoluene[2-] or [o-}	10.8	32.3	158
Nitrotoluene[4-] or [p-]	146	437	2140
Pentachlorobenzene	48.9	547	319
Pentachlorophenol	29.8	100	117
Phenanthrene	1830	20,500	12,000
Phenol	18,300	100,000	100,000
Propylbenzene[1-] or [n-]	62.1	62.1	62.1
Pyrene	2290	30,900	23,800
RDX	44.2	174	233
Styrene	100	100	100
Tetrachlorobenzene[1,2,4,5-]	18.3	205	120
Tetrachlorodibenzodioxin[2,3,7,8-] or Dioxin	0.000039*	0.00018*	0.000277
Tetrachloroethane[1,1,1,2-]	43.2	114	827
Tetrachloroethane[1,1,2,2-]	5.55	14.6	106
Tetrachloroethene	12.5	31.6	134
Toluene	252	252	252
Toxaphene (Technical Grade)	4.42	17.4	23.3
Trichloro-1,2,2-trifluoroethane[1,1,2-]	3280	3280	3280
Trichlorobenzene[1,2,4-]	69.3	269	855
Trichloroethane[1,1,1-]	563	563	563
Trichloroethane[1,1,2-]	11.9	30.2	252
Trichloroethene	0.638	1.56	15.1
Trichlorofluoromethane	588	983	983
Trichlorophenol[2,4,5-]	6110	68,400	39,900
Trichlorophenol[2,4,6-]	6.11	68.4	39.9
Trimethylbenzene[1,2,4-]	58	213	39,600

Table 2.3-1 (continued)

Chemical/Radionuclide	Residential	Industrial	Recreational
Trimethylbenzene[1,3,5-]	24.8	69.2	69.2
Trinitrobenzene[1,3,5-]	1800*	21,000*	12,000
Trinitrotoluene[2,4,6-]	30.6	342	199
Vinyl acetate	1070	3680	3680
Vinyl chloride	2.25	14	29.7
Xylene[1,2-] or [m-]	82	82	82
Xylene[1,3-] or [o-]	99.5	99.5	99.5
Xylene[1,3] + [1,4-]	82	82	82
Xylenes (Total)	82	82	82
Inorganic Chemicals (mg/kg)			
Aluminum	77,800	100,000	100,000
Antimony	31.3	454	317
Arsenic	3.9	17.7	27.7
Barium	15,600	100,000	100,000
Beryllium	156	2250	1580
Boron	15,600	100,000	100,000
Cadmium	39	564	392
Chromium	2100*	5000*	14300
Chromium hexavalent ion	234	3400	2380
Cobalt	1520	20,500	15,700
Copper	3130	45,400	31,700
Cyanide (Total)	1220	13,700	7970
Iron	23,500	100,000	100,000
Lead	400	800	560
Manganese	3590	48,400	36,900
Mercury	23*	340*	238
Molybdenum	391	5680	3960
Nickel	1560	22,700	15,800
Nitrate	100,000	100,000	100,000
Nitrite	7820	100,000	79,200
Perchlorate	55*	790*	79.2
Selenium	391	5680	3960
Silver	391	5680	3960
Strontium	46,900	100,000	100,000
Thallium	5.16	74.9	52.3
Uranium	16*	200*	2380
Vanadium	78.2	1140	792
Zinc	23,500	100,000	100,000
Americium-241	30	180	280

Table 2.3-1 (continued)

Chemical/Radionuclide	Residential	Industrial	Recreational
Cobalt-60	1.3	5.1	46
Cesium-134	2.4	9.7	87
Cesium-137	5.6	23	210
Europium-152	2.9	11	100
Sodium-22	1.6	6.5	58
Neptunium-237	2.4	50	170
Plutonium-238	37	240	330
Plutonium-239/240	33	210	300
Strontium-90	5.7	1900	5600
Technetium-99	36	280,000	640,000
Thorium-228	2.3	9	77
Thorium-230	5	5	5
Thorium-232	5	5	5
Tritium (pCi/L)	750	440,000	5,100,000
Uranium-234	170	1500	3200
Uranium-235	17	87	520
Uranium-238	86	430	2100

Note: SSLs are from the "Technical Background Document for Development of Soil Screening Levels" (NMED 2006, 092513); shading denotes surrogate analytes.

* SSLs are from the "EPA Region 6 Human Health Medium-Specific Screening Levels" http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm (EPA 2007, 099314).

Table 4.0-1
Proposed Sampling Description and Analyses for SWMUs and AOCs at TA-04 and TA-46

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
TA-04																		
SWMU 04-003(a), Outfall	6 samples will be collected from 2 locations at the former outfall	Section 4.1.1 Figure 4.1-5	1–2 2–3 3–4	Soil, sediment, tuff	X[b]	-[c]	-	-	X	-	-	X	-	X	-	-	X[d]	-
	4 samples will be collected from 2 locations in drainage below former outfall	Section 4.1.1 Figure 4.1-5	1–2 2–3	Sediment	X	-	-	-	X	-	-	X	-	X	-	-	X[d]	-
AOC 04-004, Potential Soil Contamination	18 samples will be collected from 6 locations within and bounding the former building footprint	Section 4.1.2 Figure 4.1-5	1–2 2–3 3–4	Soil, tuff	X	-	-	-	X	-	-	X	-	X	-	-	X[d]	-
TA-46																		
SWMU 46-002, Surface Impoundment	9 samples will be collected from 3 locations within and beneath the impoundment	Section 5.1 Figure 5.1-2	Impoundment contents (if present), immediately below liner (~11–12 ft), 5 ft below base of liner (~16–17 ft)	Impound-ment contents, tuff	X	-	-	X	X	-	-	X	X	X	X	-	X	X

Table 4.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
SWMU 46-002, Surface Impoundment (continued)	12 samples will be collected from 4 locations bounding the impoundment and inlet pipe	Section 5.1 Figure 5.1-2	0–1 base of unit (~11–12 ft), 5 ft below base of unit (~16–17)	Soil, tuff	X	-	-	X	X	-	-	X	X	X	X	-	X	X
	12 samples will be collected from 4 locations beneath the drainlines and siphon box	Section 5.1 Figure 5.1-2	0–1 Soil/tuff interface, 5 ft below soil/tuff interface	Soil, tuff	X	-	-	X	X	-	-	X	X	X	X	-	X	X
	9 samples will be collected from 3 locations within and beneath the sand filters	Section 5.1 Figure 5.1-2	0–1 in filter bed contents (if present), below base of unit, 5 ft below base of unit	Filter bed contents, tuff	X	-	-	X	X	-	-	X	X	X	X	-	X	X
	9 samples will be collected from 3 locations bounding the sand filters	Section 5.1 Figure 5.1-2	0–1 Soil/tuff interface, 5 ft below soil/tuff interface	Soil, tuff	X	-	-	X	X	-	-	X	X	X	X	-	X	X
	2 samples from 1 location will be collected below the impoundment overflow outlet	Section 5.1 Figure 5.1-2	0–1 1–2	Soil, sediment, tuff	X	-	-	X	X	-	-	X	X	X	X	-	X	X

Table 4.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
SWMU 46-002, Surface Impoundment (continued)	4 samples will be collected from 2 locations in the drainage below the outfall	Section 5.1 Figure 5.1-2	0–1 1–2	Soil, sediment, tuff	X	-	-	X	X	-	-	X	X	X	X	-	X	X
	16 samples will be collected from 8 locations in SWSC Canyon Data collected at SWMU 46-009(b) (section 5.47) will be used to evaluate SWMU 46-002	Section 5.1 Figure 5.1-2	0–1 1–2	Soil, sediment, tuff	X	-	-	X	X	-	-	X	X	X	X	-	X	X
SWMU 46-003(a), Septic System	8 samples will be collected from 4 locations beneath the lines and tank	Section 5.2 Figure 5.2-2	Base of line/tank, 5 ft below base of line/tank	Tuff	X	-	-	X	X	-	-	X	X	X	X	-	X[d]	X
	6 samples will be collected from 3 locations associated with the distribution box and drain field Data collected at SWMU 46-009(a) (section 5.46) will be used to evaluate SWMU 46-003(a)	Section 5.2 Figure 5.2-2	Base of distribution box (if present) or soil/tuff interface, 5 ft below base of box or soil/tuff interface	Soil, tuff	X	-	-	X	X	-	-	X	X	X	X	-	X[d]	X

Table 4.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
SWMU 46-003(b), Septic System	8 samples will be collected from 4 locations beneath the lines and tank	Section 5.3 Figure 5.2-2	Base of line/tank, 5 ft below base of line/tank	Tuff	X	-	-	X	X	-	-	X	X	X	X	-	X[d]	X
	6 samples will be collected from 3 locations associated with the distribution box and drain field	Section 5.3 Figure 5.2-2	Base of distribution box (if present) or soil/tuff interface, 5 ft below base of box or soil/tuff interface	Soil, tuff	X	-	-	X	X	-	-	X	X	X	X	-	X[d]	X
SWMU 46-003(c), Septic System	10 samples will be collected from 5 locations beneath the lines and tank	Section 5.4 Figure 5.4-2	Base of line/tank, 5 ft below base of line/tank	Tuff	X	-	-	X	X	-	-	X	X	X	X	-	X[d]	X
	10 samples will be collected from 5 locations associated with the distribution box and drain field	Section 5.4 Figure 5.4-2	Base of distribution box (if present) or soil/tuff interface, 5 ft below base of box or soil/tuff interface	Soil, tuff	X	-	-	X	X	-	-	X	X	X	X	-	X[d]	X
SWMU 46-003(d), Septic System	6 samples will be collected from 3 location beneath the lines and tank	Section 5.5 Figure 5.5-2	Base of line/tank, 5 ft below base of line/tank	Tuff	X	-	-	X	X	-	-	X	X	X	X	-	X	X

Table 4.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
SWMU 46-003(d), Septic System (continued)	8 samples will be collected from 4 locations associated with the distribution box and drain field	Section 5.5 Figure 5.5-2	Base of distribution box (if present) or soil/tuff interface, 5 ft below base of box or soil/tuff interface	Soil, tuff	X	-	-	X	X	-	-	X	X	X	X	-	X	X
SWMU 46-003(e), Septic System	6 samples will be collected from 3 locations beneath the lines and tank, if possible	Section 5.6 Figure 5.6-2	Base of line/tank, 5 ft below base of line/tank	Tuff	X	-	-	X	X	-	-	X	X	X	X	-	X[d]	X
	2 samples will be collected from 1 location adjacent to the area where drainline exits building 46-58	Section 5.6 Figure 5.6-2	Base of line, 5 ft below base of line/tank	Soil, tuff	X	-	-	X	X	-	-	X	X	X	X	-	X[d]	X
	8 samples will be collected from 4 locations associated with the distribution box and drain field	Section 5.6 Figure 5.6-2	Base of distribution box (if present) or soil/tuff interface, 5 ft below base of box or soil/tuff interface	Soil, tuff	X	-	-	X	X	-	-	X	X	X	X	-	X[d]	X
SWMU 46-003(f), Septic System	8 samples will be collected from 4 locations beneath the lines and tank	Section 5.7 Figure 5.4-2	Base of line/tank, 5 ft below base of line/tank	Tuff	X	-	-	X	X	-	-	X	X	X	X	-	X[d]	X

Table 4.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
SWMU 46-003(f), Septic System (continued)	10 samples will be collected from 5 locations associated with the distribution box, drain field, and drain field outfall pipe	Section 5.7 Figure 5.4-2	Base of distribution box (if present) or soil/tuff interface, 5 ft below base of box or soil/tuff interface	Soil, tuff	X	-	-	X	X	-	-	X	X	X	X	-	X[d]	X
SWMU 46-003(g), Septic System	6 samples will be collected from 3 locations beneath the tank and the tank inlet and outlet	Section 5.8 Figure 5.8-2	Base of tank, 5 ft below base of tank	Tuff	X	-	-	X	X	-	-	X	X	X	X	-	X[d]	X
	2 samples will be collected from 1 location at the seepage pit	Section 5.8 Figure 5.8-2	Base of pit, 5 ft below base of pit	Soil, tuff	X	-	-	X	X	-	-	X	X	X	X	-	X[d]	X
	4 samples will be collected from 2 locations associated with the primary and secondary inlet lines	Section 5.8 Figure 5.8-2	Base of line, 5 ft below base of line	Tuff	X	-	-	X	X	-	-	X	X	X	X	-	X[d]	X
SWMU 46-004(a), Drainlines	4 samples will be collected from 2 locations adjacent to the drainlines	Section 5.9 Figure 5.5-2	Base of drainline, 5 ft below base of drainline	Soil, tuff	X	X	-	X	X	-		X	X	X	-	-	X	X

Table 4.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
SWMU 46-004(a2), Outfall	8 samples will be collected from 4 locations in the drainage below the outfall Data collected at SWMU 46-004(u) (section 5.26) will be used to evaluate SWMU 46-004(a2)	Section 5.10 Figure 5.10-1	0–1 2–3	Soil, sediment, tuff	X	-	-	X	X	-	X	X	-	X	X	-	X	X
SWMU 46-004(b), Former Tank	4 samples will be collected from 2 locations adjacent to the tank pad and in the drainage ~15 ft northwest of the pad	Section 5.11 Figure 5.5-2	0–1 2–3	Soil, sediment, tuff	X	X	-	X	X	DRO[e]	-	X	-	X	-	-	X[d]	X
SWMU 46-004(b2), Outfall	4 samples will be collected from 2 locations in the drainage ditch beneath the outfall Data collected at SWMUs 46-004(m) (section 5.20) and 46-008(b) (section 5.41) will be used to evaluate SWMU 46-004(b2)	Section 5.12 Figure 5.12-2	0–1 1–2	Soil, sediment, tuff	X	-	-	X	X	-	X	X	-	X	X	-	X	X

Table 4.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
SWMU 46-004(c), Dry Well	8 samples will be collected from 2 locations down the center of and adjacent to dry well	Section 5.13 Figure 5.5-2	Base of well (~8–9); 5, 10, and 15 ft below base of well	Well contents, tuff	X	X	-	X	X	-	-	X	X	X	X	X	X	X
SWMU 46-004(c2), Outfall	22 samples will be collected from 11 locations in the drainage below the outfall	Section 5.14 Figure 5.12-2	0–1 1–2	Soil, sediment	X	X	X	X	X	-	X	X	X	X	X	-	X	X
Consolidated Unit 46-004(d)-99																		
SWMU 46-004(d), Dry Well	4 samples will be collected from 1 location down the center of the dry well	Section 5.15.1 Figure 5.6-2	Base of well (~10 ft); 5 ft, 10 ft, and 15 ft below base of well	Well contents, tuff	X	-	-	X	X	-	-	X	X	X	-	-	X	X
SWMU 46-004(d), Dry Well (continued)	6 samples will be collected from 3 locations along a transect on the slope below **both** dry wells from two depths	Section 5.15.1 Figure 5.6-2	0–1 1–2	Soil, sediment	X	-	-	X	X	-	-	X	X	X	-	-	X	X
SWMU 46-004(e), Dry Well	4 samples will be collected from 1 location within the center of the dry well	Section 5.15.2 Figure 5.6-2	Base of well (~10 ft); 5 ft, 10 ft, and 15 ft below base of well	Well contents, tuff	X	-	-	X	X	-	-	X	X	X	-	-	X	X

Table 4.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
SWMU 46-004(e), Dry Well (continued)	2 samples will be collected from 1 location that is the closest point to where the inlet drainline exits building 46-58 Data collected at SWMU 46-004(d) (section 5.15.1) will be used to evaluate SWMU 46-004(e)	Section 5.15.2 Figure 5.6-2	0–1 2–3 beneath the drainline		X	-	-	X	X	-	-	X	X	X	-	-	X	X
Consolidated Unit 46-004(d2)-99																		
SWMUs 46-004(d2), 46-004(g) (stack emissions), and 46-004(h) (stack emissions), and AOCs C-46-002 and C-46-003	40 surface samples will be collected from 20 locations on the mesa top	Section 5.16 Figure 5.16-2	0–1 1–2	Soil	X	-	-	-	X	-	-	X	-	X	X	-	X	X
SWMU 46-004(g) (outfall)	16 samples will be collected from 8 locations below the outfall	Section 5.16.5 Figure 5.12-2	0–1 1–2	Soil, sediment, tuff	X	-	-	X	X	-	X	X	-	X	X	-	X	X

Table 4.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
SWMU 46-004(h) (outfall)	4 samples will be collected from 2 locations below the outfall Data collected at SWMU 46-004(q) (section 5.26) will be used to evaluate SWMU 46-004(h)	Section 5.16.6 Figure 5.10-1	0–1 1–2	Soil, sediment, tuff	X	-	-	X	X	-	X	X	-	X	X	-	X	X
AOC 46-004(e2), Outfall	6 samples will be collected from 3 locations in the drainage at and below the outfall Data collected at SWMU 46-004(c2) (section 5.14) will be used to evaluate SWMU 46-004(e2)	Section 5.17 Figure 5.12-2	0–1 2–3	Soil, sediment, tuff	X	-	-	X	X	-	X	X	-	X	X	-	X[d]	X

Table 4.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
SWMU 46-004(f), Outfall	8 samples will be collected from 4 locations at the outfall and in the drainage to SWSC Canyon Data collected at SWMU 46-004(t) (section 5.25) will be used to evaluate SWMUs 46-004(f), 46-004(r) (section 5.23), and 46-004(w) (section 5.28) Data collected at SWMU 46-004(f) will be used to evaluate SWMUs 46-004(r) and 46-004(w)	Section 5.18 Figure 5.4-2	0–1 2–3	Soil, sediment, tuff	X	-	-	X	X	-	X	X	-	X	X	-	X[d]	X
AOC 46-004(f2), Outfall	12 samples will be collected from 6 locations in the drainage at and below the outfall	Section 5.19 Figure 5.12-2	0–1 1–2	Soil, sediment, tuff	X	-	-	X	X	-	X	X	-	X	X	-	X	X

Table 4.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
SWMU 46-004(m), Outfall	18 samples will be collected from 9 locations at the outfall and in the drainage below the outfall Data collected at 46-004(m) in the common drainage area will be used to evaluate 46-004(b2) (section 5.12), 46-004(s) (section 5.24), 46-006(f) (section 5.37), 46-007 (section 5.39), and 46-008(b) (section 5.41).	Section 5.20 Figure 5.12-2	0–1 1–2	Soil, sediment, tuff	X	-	-	X	X	-	X	X	-	X	X	X	X	X
	2 samples will be collected from one location adjacent to the drainline directly north of building 46-30	Section 5.20 Figure 5.12-2	0–1 2–3 beneath the drainline	Soil, sediment	X	-	-	X	X	-	X	X	-	X	X	X	X	X
SWMU 46-004(p), Dry well	8 samples will be collected from 2 locations adjacent to dry well	Section 5.21 Figure 5.12-2	Base of well (~10–11 ft); and 5 ft, 10 ft, and 15 ft below base of well	Well contents, tuff	X	X	-	X	X	-	-	X	-	X	-	X	X[d]	X

Table 4.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
SWMU 46-004(q), Outfall	26 samples will be collected from 13 locations in the drainage at and below the outfall Data collected for 46-004(q) for the common drainage segment will also be used to evaluate 46-004(h) (section 5.16)	Section 5.22 Figure 5.10-1	0–1 1–2	Soil, sediment, tuff	X	-	-	X	X	-	X	X	-	X	X	-	X[d]	X
SWMU 46-004(r), Outfall	2 samples will be collected from the storm grate Data collected at SWMU 46-004(r) will be used to evaluate SWMU 46-004(w) (section 5.28) Data collected at SWMUs 46-004(f) (section 5.18) and 46-004(t) (section 5.25) will be used to evaluate SWMUs 46-004(r) and 46-004(w)	Section 5.23 Figure 5.4-2	0–1 1–2	Storm grate contents	X	-	-	X	X	-	X	X	-	X	X	-	X[d]	X

Table 4.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
SWMU 46-004(s), Outfall	4 samples will be collected from 2 locations in the drainage at and below the outfall Data collected at SWMUs 46-004(m) (section 5.20) and 46-007 (section 5.39) will be used to evaluate SWMU 46-004(s)	Section 5.24 Figure 5.12-2	0–1 1–2	Soil, sediment, tuff	X	-	-	X	X	-	X	X	-	X	X	-	X[d]	X
SWMU 46-004(t), Outfall	20 samples will be collected from 10 locations in the drainage at and below the outfall Data collected at SWMU 46-004(t) will be used to evaluate SWMUs 46-004(f) (section 5.18), 46-004(r) (section 5.23), 46-004(w) (section 5.28), 46-008(a) (section 5.40), 46-008(g) (section 5.45), 46-009(a) (section 5.46), and AOC C-46-001 (section 5.49)	Section 5.25 Figure 5.4-2	0–1 2–3	Soil, sediment, tuff	X	-	-	X	X	-	X	X	-	X	X	-	X[d]	X

Table 4.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
SWMU 46-004(t), Outfall (continued)	6 samples from 3 locations beneath the inlet line at the building exit and joints	Section 5.25 Figure 5.4-2	Base of line, 5 ft below base of line	Fill, tuff	X	-	-	X	X	-	X	X	-	X	X	-	X[d]	X
SWMU 46-004(u), Outfall	20 samples will be collected from 10 locations in the drainage at and below the outfall Data collected at SWMU 46-004(u) will be used to evaluate SWMUs 46-004(a2) (section 5.10), 46-004(v) (section 5.27), and 46-004(x) (section 5.29)	Section 5.26 Figure 5.10-1	0–1 1–2	Soil, sediment, tuff	X	-	-	X	X	-	X	X	-	X	X	-	X	X
SWMU 46-004(v), Outfall	4 samples will be collected from 2 locations in the drainage at and below the outfall Data collected at SWMU 46-004(u) (section 5.26) will be used to evaluate SWMU 46-004(v)	Section 5.27 Figure 5.10-1	0–1 1–2	Soil, sediment, tuff	X	-	-	X	X	-	X	X	-	X	X	-	X	X

Table 4.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
SWMU 46-004(w), Outfall	This SWMU is collocated with SWMU 46-004(r), Section 5.23 presents the sampling strategy for SWMU 46-004(r) Data collected from SWMU 46-004(r) will be used to evaluate SWMU 46-004(w).	Section 5.28 Figure 5.4-2			-	-	-	-	-	-	-	-	-	-	-	-	-	-
SWMU 46-004(x), Outfall	10 samples will be collected from 5 locations in the drainage at and below the outfall Data collected at SWMU 46-004(u) (section 5.26) will be used to evaluate SWMU 46-004(x)	Section 5.29 Figure 5.10-1	0–1 1–2	Soil, sediment, tuff	X	-	-	X	X	-	X	X	-	X	X	-	X	X
SWMU 46-004(y), Outfall	16 samples will be collected from 8 locations in the drainage at and below the outfall	Section 5.30 Figure 5.12-2	0–1 1–2	Soil, sediment, tuff	X	-	-	X	X	-	X	X	-	X	X	-	X	X
SWMU 46-004(z), Outfall	14 samples will be collected from 7 locations in the drainage at and below the outfall	Section 5.31 Figure 5.12-2	0–1 1–2	Soil, sediment, tuff	X	-	-	X	X	-	X	X	-	X	X	-	X	X

Table 4.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
SWMU 46-005, Surface Impoundments	8 samples will be collected from 4 locations along the drainlines (under if possible) and 2 samples will be collected from 1 location at the outfall	Section 5.32 Figure 5.8-2	0–1 2–3 beneath drainline	Soil, sediment, tuff	X	X	-	X	X	-	X	X	X	X	X	-	X[d]	X
	10 subsurface samples will be collected from 5 locations within and bounding the impoundment	Section 5.32 Figure 5.8-2	Base of impoundment 5 ft below impoundment	Soil, sediment, tuff	X	X	-	X	X	-	X	X	X	X	X	-	X[d]	X
	4 samples will be collected from 2 locations adjacent to the impoundments	Section 5.32 Figure 5.8-2	0-1 3-4	Soil, sediment	X	X	-	X	X	-	X	X	X	X	X	-	X[d]	X
	4 samples will be collected from 2 locations in the drainage below the outfall	Section 5.32 Figure 5.8-2	0–0.5 1–2	Soil, sediment	X	X	-	X	X	-	X	X	X	X	X	-	X[d]	X

Table 4.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
SWMU 46-006(a), Potential Soil Contamination	This SWMU is collocated with AOC 46-004(e2). Section 5.17 presents the sampling strategy for AOC 46-004(e2) Data collected from AOC 46-004(e2) will be used to evaluate SWMU 46-006(a)	Section 5.33 Figure 5.12-2			-	-	-	-	-	-	-	-	-	-	-	-	-	-
SWMU 46-006(b), Former Storage Shed	4 samples will be collected from 2 locations biased to stained areas/cracks in the pavement	Section 5.34 Figure 5.2-2	0–1 3–4 beneath asphalt	Fill, soil, tuff	X	-	-	X	X	DRO	X	X	-	X	X	-	X	X
	6 samples will be collected from 3 locations downgradient of the former storage shed location	Section 5.34 Figure 5.2-2	0–1 2–3	Soil, sediment	X	-	-	X	X	DRO	X	X	-	X	X	-	X	X
SWMU 46-006(c), Storage Area	4 samples will be collected from 2 locations biased toward cracks/stains in the pavement	Section 5.35 Figure 5.8-2	0–1 3–4 beneath asphalt	Fill, soil, tuff	X	-	-	X	X	DRO	X	X	-	X	X	-	X	X
	14 samples will be collected from 7 locations downgradient of release	Section 5.35 Figure 5.8-2	0–1 2–3	Fill, soil, tuff	X	-	-	X	X	DRO	X	X	-	X	X	-	X	X

Table 4.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
SWMU 46-006(d), Potential Soil Contamination	8 samples will be collected from 4 mesa top locations	Section 5.36 Figure 5.5-2	0–1 4–5 beneath asphalt	Fill, soil, tuff	X	-	-	X	X	DRO	X	X	-	X	X	-	X	X
	32 samples will be collected from 16 locations on mesa top and mesa slope Data collected at SWMUs 46-004(f2) (section 5.19), 46-004(x) (section 5.29), 46-004(y) (section 5.30), and 46-004(z) (section 5.31) will be used to evaluate SWMU 46-006(d)	Section 5.36 Figure 5.5-2	0–1 1–2	Soil, sediment	X	-	-	X	X	DRO	X	X	-	X	X	-	X	X
SWMU 46-006(f), Storage Area	4 samples will be collected from 2 locations at the storage area	Section 5.37 Figure 5.12-2	0–1 3–4 beneath asphalt	Soil, tuff	X	-	-	X	X	DRO	X	X	-	X	X	X	X[d]	X

Table 4.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
SWMU 46-006(f), Storage Area (continued)	4 samples will be collected from 2 locations downgradient of the storage area Data collected from SWMU 46-004(m) (section 5.20) will be used to evaluate SWMU 46-006(f)	Section 5.37 Figure 5.12-2	0–1 2–3	Soil, tuff	X	-	-	X	X	DRO	X	X	-	X	X	X	X[d]	X
SWMU 46-006(g), Storage Area	6 samples will be collected from 3 locations biased toward cracks/stains in the pavement	Section 5.38 Figure 5.5-2	0–1 3–4 beneath asphalt	Soil, tuff	X	-	-	X	X	DRO	-	X	-	X	-	-	X[d]	X
SWMU 46-007, Potential Soil Contamination	10 samples will be collected from 5 locations in the drainage ditch Data collected at SWMU 46-004(m) (section 5.20) will be used to evaluate SWMU 46-007	Section 5.39 Figure 5.12-2	0–1 2–3	Soil, tuff	X	X	-	X	X	DRO	X	X	-	X	X	-	X[d]	X
SWMU 46-008(a), Storage Area	10 samples will be collected from 5 locations within and adjacent to the storage area	Section 5.40 Figure 5.4-2	0–1 2–3 beneath asphalt or ground surface in unpaved areas	Soil, tuff	X	-	-	X	X	DRO	X	X	-	X	X	-	X[d]	X

Table 4.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
SWMU 46-008(b), Storage Area	4 samples will be collected from 2 locations at the storage area	Section 5.41 Figure 5.12-2	0–1 2–3	Soil, tuff	X	-	-	X	X	DRO	X	X	-	X	X	-	X	X
	4 samples will be collected from 2 downgradient locations north of the storage area Data collected at SWMUs 46-004(m) (section 5.20) and 46-004(b2) (section 5.12) will be used to evaluate SWMU 46-008(b)	Section 5.41 Figure 5.12-2	0–1 2–3	Soil, sediment	X	-	-	X	X	DRO	X	X	-	X	X	-	X	X
SWMU 46-008(d), Storage Area	12 samples will be collected from 6 locations within and adjacent to the storage area	Section 5.42 Figure 5.4-2	0–1 2–3	Soil, tuff	X	-	-	X	X	DRO	X	X	-	X	X	-	X[d]	X
SWMU 46-008(e), Storage Area	4 samples will be collected from 2 locations at the storage area	Section 5.43 Figure 5.2-2	0–1 2–3	Soil, tuff	X	-	-	X	X	DRO	X	X	-	X	X	-	X	X
	10 samples will be collected from 5 adjacent downgradient locations	Section 5.43 Figure 5.2-2	0–1 2–3	Soil, sediment	X	-	-	X	X	DRO	X	X	-	X	X	-	X	X

Table 4.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
SWMU 46-008(f), Storage Area	10 samples will be collected from 5 locations biased towards cracks/stains in the pavement	Section 5.44 Figure 5.6-2	0–1 3–4 beneath asphalt	Soil, tuff	X	-	-	X	X	DRO	X	X	-	X	X	-	X[d]	X
	4 samples will be collected from 2 downgradient locations Data collected at SWMUs 46-004(a2) (section 5.10) and 46-004(u) (section 5.26) will be used to evaluate SWMU 46-008(f)	Section 5.44 Figure 5.6-2	0–1 2–3	Soil, sediment	X	-	-	X	X	DRO	X	X	-	X	X	-	X[d]	X
SWMU 46-008(g), Storage Area	14 samples will be collected from 7 locations within and adjacent to the storage area Data collected at SWMU 46-004(t) (section 5.25) will be used to evaluate SWMU 46-008(g)	Section 5.45 Figure 5.4-2	0–1 2–3	Soil, tuff	X	-	-	X	X	DRO	X	X	-	X	-	X	X[d]	X
SWMU 46-009(a), Landfill	18 samples will be collected from 6 locations within the landfill	Section 5.46 Figure 5.2-2	4–5 9–10 14–15	Soil, debris	X	-	-	X	X	DRO	X	X	X	X	-	X	X[d]	X

Table 4.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
SWMU 46-009(a), Landfill (continued)	20 samples will be collected from 10 locations in drainages downgradient of the landfill and in SWSC Canyon	Section 5.46 Figure 5.2-2	0–1 1–2	Soil, sediment	X	-	-	X	X	DRO	X	X	X	X	-	X	X[d]	X
	Data collected at SWMU 46-009(a) will be used to evaluate SWMU 46-003(a) (section 5.2) Data collected at SWMU 46-004(t) (section 5.25) will be used to evaluate SMWU 46-009(a)				-	-	-	-	-	-	-	-	-	-	-	-	-	-
SWMU 46-009(b), Former Surface Disposal Area	6 samples will be collected from 3 locations within the disposal area	Section 5.47 Figure 5.1-2	0–1 2–3	Soil, sediment, filter material, tuff	X	-	-	X	X	-	X	X	-	X	X	-	X[d]	X

Table 4.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
SWMU 46-009(b), Former Surface Disposal Area (continued)	20 samples will be collected from 10 locations in mesa slope locations downgradient of the disposal site and in SWSC Canyon Data collected at SWMU 46-009(b) will be used to evaluate SWMU 46-002 (section 5.1)	Section 5.47 Figure 5.1-2	0–1 1–2	Soil, sediment	X	-	-	X	X	-	X	X	-	X	X	-	X[d]	X
SWMU 46-010(d), Storage Area	4 samples will be collected from 2 locations biased toward cracks/stains in the pavement	Section 5.48 Figure 5.2-2	0–1 3–4 beneath asphalt	Soil, tuff	X	-	-	X	X	DRO	X	X	-	X	X	-	X[d]	X
	6 samples will be collected from 3 locations downgradient of the storage area	Section 5.48 Figure 5.2-2	0–1 2–3	Soil, sediment	X	-	-	X	X	DRO	X	X	-	X	X	-	X[d]	X

Table 4.0-1 (continued)

Location Description	Sampling Strategy	Section/ Figure	Depth (ft)	Media	TAL Metals	Total Cesium	Total Lithium	VOCs	SVOCs	TPH	Pesticides	PCBs[a]	Nitrate	Cyanide	Perchlorate	Asbestos	Isotopic Uranium, Plutonium, Americium, Thorium	Gamma Spectroscopy
AOC C-46-001, Spill/Release Area	2 samples will be collected from 1 location 15 ft southwest of the southwest corner of Building 46-75	Section 5.49.2 Figure 5.4-2	0–1 2–3 beneath asphalt	Soil	X[f]	-	-	-	-	-	-	-	-	-	-	-	-	-
	Data collected from SWMU 46-004(t) will be used to evaluate AOC C-46-001. Section 5.25 presents the sampling strategy for SWMU 46-004(t).	Section 5.49.2			-	-	-	-	-	-	-	-	-	-	-	-	-	-

[a] At each site undergoing investigation, 20% of all samples will be sent for off-site laboratory analysis of PCBs.

[b] X = Analysis will be performed.

[c] - = Analysis is not proposed and will not be performed.

[d] Analysis does not include isotopic thorium for this site.

[e] TPH analysis will be for diesel range organics (DRO).

[f] Mercury only.

Table 4.1-1
Samples Collected and Analyses Requested at SWMU 04-003(a)

Sample ID	Location ID	Depth (ft)	Media	Gamma Spectroscopy	Gross-Alpha/ -Beta Radiation	High Explosives	Isotopic Plutonium	Isotopic Uranium	Metals	SVOCs	VOCs
1995 RFI Activities											
0404-95-0049	04-02005	0.00–1.00	Soil	-*	-	-	585	585	-	-	-
0404-95-0051	04-02005	1.00–2.00	Qbt3	-	-	-	585	585	-	-	-
0404-95-0052	04-02005	2.00–3.00	Qbt3	-	-	-	585	585	-	-	-
0404-95-0053	04-02006	0.00–1.00	Soil	-	-	-	585	585	-	-	-
0404-95-0054	04-02006	1.00–2.00	Soil	-	-	-	585	585	-	-	-
0404-95-0055	04-02006	2.00–3.00	Qbt3	-	-	-	585	585	-	-	-
0404-95-0056	04-02007	0.00–1.00	Soil	-	-	-	585	585	584	-	-
0404-95-0058	04-02007	1.00–2.00	Soil	-	-	-	585	585	-	-	-
0404-95-0059	04-02007	2.00–3.00	Soil	-	-	-	585	585	-	-	-
0404-95-0062	04-02008	0.00–1.00	Soil	-	-	-	585	585	-	-	-
0404-95-0063	04-02008	1.00–2.00	Soil	-	-	-	585	585	-	-	-
0404-95-0064	04-02008	2.00–3.00	Qbt3	-	-	-	585	585	-	-	-
0404-95-0065	04-02009	0.00–1.00	Sediment	-	-	-	585	585	-	-	-
0404-95-0066	04-02009	1.00–2.00	Qbt3	-	-	-	585	585	-	-	-
0404-95-0067	04-02009	2.00–3.00	Qbt3	-	-	-	585	585	-	-	-
0404-95-0068	04-02010	0.00–1.00	Soil	-	-	-	585	585	-	-	583
0404-95-0070	04-02010	1.00–2.00	Soil	585	585	-	585	585	-	583	-
0404-95-0073	04-02010	2.00–3.00	Soil	-	-	-	585	585	-	-	-

Table 4.1-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Gamma Spectroscopy	Gross-Alpha/ -Beta Radiation	High Explosives	Isotopic Plutonium	Isotopic Uranium	Metals	SVOCs	VOCs
1998 RFI Activities											
RE04-98-0017	04-02008	0.00–0.50	Soil	-	-	4382R	-	-	4383R	4381R	-
RE04-98-0018	04-02008	0.50–1.50	Soil	-	-	4382R	-	-	4383R	4381R	-
RE04-98-0021	04-02009	0.00–0.50	Sediment	-	-	4392R	-	-	4391R	4390R	-
RE04-98-0022	04-02009	0.50–1.00	Sediment	-	-	4392R	-	-	4391R	4390R	-
RE04-98-0025	04-02010	0.00–0.50	Soil	-	-	4392R	-	-	4391R	4390R	-
RE04-98-0026	04-02010	0.50–0.83	Soil	-	-	4392R	-	-	4391R	4390R	-
RE04-98-0033	04-02033	0.00–0.50	Sediment	-	-	4392R	-	-	4391R	4390R	-
RE04-98-0034	04-02033	0.50–0.83	Sediment	-	-	4392R	-	-	4391R	4390R	-
RE04-98-0037	04-02034	0.00–0.50	Sediment	-	-	4392R	-	-	4391R	4390R	-
RE04-98-0038	04-02034	0.50–1.00	Sediment	-	-	4392R	-	-	4391R	4390R	-

* - = Analyses not requested.

Table 4.1-2
Inorganic Chemicals above BVs at SWMU 04-003(a)

Sample ID	Location ID	Depth (ft)	Media	Cadmium	Mercury	Selenium
Soil BV				**0.4**	**0.1**	**1.52**
Sediment BV				**0.4**	**0.1**	**0.3**
0404-95-0056	04-02007	0.00–1.00	Soil	1	-*	-
RE04-98-0018	04-02008	0.50–1.50	Soil	-	0.11 (U)	-
RE04-98-0021	04-02009	0.00–0.50	Sediment	-	-	1 (U)
RE04-98-0022	04-02009	0.50–1.00	Sediment	-	-	1 (U)
RE04-98-0033	04-02033	0.00–0.50	Sediment	-	-	1 (U)
RE04-98-0034	04-02033	0.50–0.83	Sediment	-	0.11 (U)	1.1 (U)
RE04-98-0037	04-02034	0.00–0.50	Sediment	-	-	1 (U)
RE04-98-0038	04-02034	0.50–1.00	Sediment	-	-	1 (U)

Notes: All values in mg/kg. BVs are provided in LANL 1998, 059730.
* - = Not detected or not detected above BV.

Table 4.1-3
Organic Chemicals Detected at SWMU 04-003(a)

Sample ID	Location ID	Depth (ft)	Media	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Fluoranthene	Indeno(1,2,3-cd)pyrene	Pentachlorophenol	Phenanthrene	Pyrene
RE04-98-0022	04-02009	0.50–1.00	Sediment	0.54	0.55	0.45	0.41	0.7	1.3	0.38	-*	0.55	1
0404-95-0070	04-02010	1.00–2.00	Soil	-	-	-	-	-	-	-	0.07 (J)	-	-

Note: All values in mg/kg.
* - = Not detected.

Table 4.1-4
Radionuclides Detected or Detected above BVs/FVs at SWMU 04-003(a)

Sample ID	Location ID	Depth (ft)	Media	Gross-Alpha Radiation	Gross-Beta Radiation	Plutonium-239/240
Soil FV				**na**[a]	**na**	**0.054**[b]
0404-95-0053	04-02006	0.00–1.00	Soil	NA[c]	NA	0.631
0404-95-0056	04-02007	0.00–1.00	Soil	NA	NA	0.056
0404-95-0070	04-02010	1.00–2.00	Soil	24	37	-[d]

Notes: All values in pCi/g. BVs/FVs are provided in LANL 1998, 059730.
[a] na = Not available.
[b] FV applies to soil samples collected from 0–0.5 ft.
[c] NA = Not analyzed.
[d] - = Not detected or not detected above FV/BV.

Table 4.1-5
Samples Collected and Analyses Requested at AOC 04-004

Sample ID	Location ID	Depth (ft)	Media	Gamma Spectroscopy	Gross-Alpha/Beta Radiation	High Explosives	Isotopic Plutonium	Isotopic Uranium	Metals	SVOCs	VOCs
1995 RFI Sampling											
0404-95-0075	04-02001	0.00–1.00	Soil	-*	-	-	585	585	-	-	-
0404-95-0076	04-02001	1.00–2.00	Soil	-	-	-	585	585	-	583	-
0404-95-0078	04-02001	2.00–3.00	Soil	-	-	-	585	585	-	-	-
0404-95-0081	04-02002	0.00–1.00	Soil	-	-	-	585	585	584	-	-
0404-95-0083	04-02002	1.00–2.00	Soil	-	-	-	585	585	-	-	-
0404-95-0084	04-02002	2.00–3.00	Soil	585	585	-	585	585	-	-	-
0404-95-0086	04-02003	0.00–1.00	Soil	-	-	-	585	585	-	-	-
0404-95-0087	04-02003	1.00–2.00	Soil	-	-	-	585	585	-	-	-
0404-95-0088	04-02003	2.00–3.00	Soil	-	-	-	585	585	-	-	-
0404-95-0090	04-02004	0.00–1.00	Soil	-	-	-	585	585	-	-	-
0404-95-0091	04-02004	1.00–2.00	Soil	-	-	-	585	585	-	-	-
0404-95-0092	04-02004	2.00–3.00	Qbt3	-	-	-	585	585	-	-	-
1998 RFI Sampling											
RE04-98-0001	04-02001	0.00–0.50	Soil	-	-	4382R	-	-	4383R	4381R	-
RE04-98-0002	04-02001	0.50–1.50	Soil	-	-	4382R	-	-	4383R	4381R	-
RE04-98-0003	04-02001	1.50–2.50	Soil	-	-	4382R	-	-	4383R	4381R	-
RE04-98-0004	04-02001	2.50–3.33	Soil	-	-	4382R	-	-	4383R	4381R	-
RE04-98-0005	04-02002	0.00–0.50	Soil	-	-	4382R	-	-	4383R	4381R	-
RE04-98-0006	04-02002	0.50–1.50	Soil	-	-	4382R	-	-	4383R	4381R	4381R
RE04-98-0007	04-02002	1.50–2.50	Soil	-	-	4382R	-	-	4383R	4381R	4381R
RE04-98-0008	04-02002	2.50–3.75	Soil	-	-	4382R	-	-	4383R	4381R	4381R
RE04-98-0009	04-02003	0.00–0.50	Soil	-	-	4382R	-	-	4383R	4381R	-
RE04-98-0010	04-02003	0.50–1.50	Soil	-	-	4382R	-	-	4383R	4381R	-
RE04-98-0011	04-02003	1.50–2.17	Soil	-	-	4382R	-	-	4383R	4381R	-
RE04-98-0013	04-02004	0.00–0.50	Soil	-	-	4382R	-	-	4383R	4381R	-
RE04-98-0014	04-02004	0.50–1.50	Soil	-	-	4382R	-	-	4383R	4381R	-
RE04-98-0015	04-02004	1.50–2.08	Soil	-	-	4382R	-	-	4383R	4381R	-
RE04-98-0029	04-02032	0.00–0.50	Fill	-	-	4382R	-	-	4383R	4381R	-
RE04-98-0030	04-02032	0.50–1.50	Fill	-	-	4382R	-	-	4383R	4381R	-
RE04-98-0031	04-02032	1.50–2.17	Fill	-	-	4382R	-	-	4383R	4381R	-

* - = Analyses not requested.

Table 4.1-6
Inorganic Chemicals above BVs at AOC 04-004

Sample ID	Location ID	Depth (ft)	Media	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
Soil BV				**8.17**	**295**	**1.83**	**0.4**	**19.3**	**8.64**	**14.7**	**22.3**	**0.1**	**15.4**	**1.52**	**1**	**0.73**	**39.6**	**48.8**
RE04-98-0002	04-02001	0.50–1.50	Soil	-*	-	-	-	-	-	-	-	0.11 (U)	-	-	-	-	-	-
RE04-98-0003	04-02001	1.50–2.50	Soil	-	-	-	-	-	-	-	31	0.11 (U)	-	-	-	-	-	83
RE04-98-0004	04-02001	2.50–3.33	Soil	-	-	-	-	-	-	-	-	0.11 (U)	-	-	-	-	-	-
0404-95-0081	04-02002	0.00–1.00	Soil	210 (J-)	355	6	5.4	34.8	60.2	35.6	63.7 (J-)	-	63	361	5.2	225	75.7	87.9
RE04-98-0007	04-02002	1.50–2.50	Soil	-	-	-	-	-	-	-	-	0.11 (U)	-	-	-	-	-	-
RE04-98-0008	04-02002	2.50–3.75	Soil	-	-	-	-	-	-	-	-	0.11 (U)	-	-	-	-	-	-
RE04-98-0010	04-02003	0.50–1.50	Soil	-	-	-	-	-	-	-	-	0.11 (U)	-	-	-	-	-	-
RE04-98-0011	04-02003	1.50–2.17	Soil	-	-	-	-	-	-	-	30	0.11 (U)	-	-	-	-	-	-
RE04-98-0014	04-02004	0.50–1.50	Soil	-	-	-	-	-	-	-	-	0.11 (U)	-	-	-	-	-	56
RE04-98-0015	04-02004	1.50–2.08	Soil	-	-	-	-	-	-	-	23	0.11 (U)	-	-	-	-	-	-
RE04-98-0029	04-02032	0.00–0.50	Fill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	77
RE04-98-0030	04-02032	0.50–1.50	Fill	-	-	-	-	-	-	-	-	0.11 (U)	-	-	-	-	-	-
RE04-98-0031	04-02032	1.50–2.17	Fill	-	-	-	-	-	-	-	-	0.11 (U)	-	-	-	-	-	-

Notes: All values in mg/kg. BVs are provided in LANL 1998, 059730.

* - = Not detected or not detected above BV.

Table 4.1-7
Radionuclides Detected or Detected above BVs/FVs at AOC 04-004

Sample ID	Location ID	Depth (ft)	Media	Gross-Alpha Radiation	Gross-Beta Radiation	Plutonium-239/240
Soil FV/BV				**na**[a]	**na**	**0.054**[b]
0404-95-0075	04-02001	0.00–1.00	Soil	NA[c]	NA	0.017
0404-95-0081	04-02002	0.00–1.00	Soil	NA	NA	0.03
0404-95-0084	04-02002	2.00–3.00	Soil	28	27	-[d]
0404-95-0087	04-02003	1.00–2.00	Soil	NA	NA	0.024
0404-95-0090	04-02004	0.00–1.00	Soil	NA	NA	0.029

Notes: All values in pCi/g. BVs/FVs are provided in LANL 1998, 059730.

[a] na = Not available.

[b] FV applies to soil samples collected from 0–0.5 ft.

[c] NA = Not analyzed.

[d] - = Not detected or not detected above BV/FV.

Table 7.0-1
Summary of Investigation Methods

Method	Summary
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 in some cases may be used for collecting samples of weathered or nonwelded tuff. The method involves hand-turning a stainless-steel bucket auger (typically 3–4 in. inner 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 various required sample containers are filled.
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 to minimize the possibility of breakage during transportation. After all environmental samples are collected, packaged, and preserved: a field team member transports the samples to either the SMO or an SMO-approved radiation screening laboratory under chain of custody. The SMO arranges for shipping of samples to 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.
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 Environmental Restoration Database.
Field Quality Control Samples	Field quality control samples are collected as directed in the Order on Consent 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.

Table 7.0-1 (continued)

Method	Summary
Field Decontamination of Drilling and Sampling Equipment	Dry decontamination is the preferred method to minimize generating liquid waste. Dry decontamination may include the use of a wire brush or other tool to remove soil or other material adhering to the sampling equipment, followed by use of 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.
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 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.
Management, Characterization, and Storage of Investigation-Derived Waste	The IDW generated 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 shall be adequate to comply with on-site or off-site waste acceptance criteria. All stored IDW will be marked with appropriate signage and labels, as appropriate. 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 shall 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 will be segregated by classification and compatibility to prevent cross-contamination. See Appendix B for additional information on the management of IDW.
Geodetic Surveys	This method describes the methodology for coordinating and evaluating geodetic surveys and establishing QA and QC 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.
Hollow Stem Auger Drilling Methods	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.

Table 7.0-2
Analytical Methods for Surface and Subsurface Characterization

Analytical Method	Analytical Description	Analytical Suite
Inorganic Methods		
EPA Method 300	Ion chromatography	Anions (nitrates)
EPA SW-846: 9012A	Colorimetric	Cyanide
EPA SW-846: 6010B/6020	Inductively Coupled Plasma Emission Spectrometry—Atomic Emission Spectroscopy	Aluminum, antimony, arsenic, barium, beryllium, calcium, cadmium, cobalt, chromium, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, sodium, silver, thallium, vanadium, and zinc (TAL metals)
EPA SW-846: 6010B/6020	Inductively Coupled Plasma Emission Spectrometry—Atomic Emission Spectroscopy	Cesium, lithium
EPA SW-846: 6850	Liquid Chromatography/Mass Spectrometry	Perchlorate
NIOSH 9002	Microscopy	Asbestos
Organic Methods		
EPA SW-846:8270C	Gas Chromatograph/Mass Spectrometry	SVOCs
EPA SW-846:8260B	Gas Chromatograph/Mass Spectrometry	VOCs
EPA SW-846:8082	Gas Chromatograph	PCBs
EPA SW-846:8081A	Gas Chromatograph	Organochlorinated pesticides
EPA SW-846:8015B	Gas Chromatograph	TPH-DRO
Radionuclide Methods		
HASL-300	Chemical Separation/Alpha Spectrometry	Isotopic plutonium, isotopic uranium, americium-241, isotopic thorium
EPA 901.1M	Gamma Spectroscopy	Cesium-134, cesium-137, cobalt-60, europium-152, sodium-22, and ruthenium-106
EPA 906	Liquid Scintillation	Tritium

Appendix A

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

A-1.0 ACRONYMS AND ABBREVIATIONS

AK	acceptable knowledge
amsl	above mean sea level
AOC	area of concern
bgs	below ground surface
BHC	benzene hexachloride
BV	background value
CST	Chemical Sciences and Technology
DDE	dichlorophenyltrichloroethylene
DDT	dichlorodiphenyltrichloroethane
DOE	Department of Energy (U.S.)
ENV	Environmental Stewardship
EP	Environmental Programs Directorate
EPA	Environmental Protection Agency (U.S.)
FV	fallout value
GPS	global-positioning system
HE	high explosives
HIR	historical investigation report
HWFP	Hazardous Waste Facility Permit
IDW	investigation-derived waste
IFWGMP	Interim Facility-Wide Groundwater Monitoring Plan
LANL	Los Alamos National Laboratory
MDA	material disposal area
NFA	no further action
NMED	New Mexico Environment Department
NOI	notice of intent
NPDES	National Pollutant Discharge Elimination System
OU	operable unit
PCB	polychlorinated biphenyl
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
RPF	Records Processing Facility
SMO	Sample Management Office
SOP	standard operating procedure
SVOC	semivolatile organic compound
SWMU	solid waste management unit

SWSC	Sanitary Wastewater Systems Consolidation
TA	technical area
TAL	target analyte list
TCA	trichloroethane(1,1,1-)
TCE	trichloroethene
TD	total depth
TPH	total petroleum hydrocarbons
UHTREX	Ultra-High Temperature Reactor Equipment
VCP	vitrified clay pipe
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 US 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 (QA/QC) parameters.

Appendix B

Management Plan for Investigation-Derived Waste

B-1.0 INTRODUCTION

This appendix describes how investigation-derived waste (IDW) generated during the Upper Cañada del Buey Aggregate Area investigation will be managed by Los Alamos National Laboratory (the Laboratory). The IDW generated may include, but is not limited to, drill cuttings, excavated media, excavated man-made debris, contact waste, decontamination fluids, and all other waste that potentially has come into contact with contaminants.

B-2.0 IDW

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 New Mexico Environment Department (NMED) regulations, U.S. Department of Energy (DOE) Orders, and laboratory requirements. The following SOPs are applicable to the characterization and management of IDW:

- ENV-RCRA-SOP-011.0, Land Application of Drill Cuttings (http://int.lanl.gov/orgs/env/rcra/qa.shtml?6)
- EP-ERSS-SOP-5022, Characterization and Management of Environmental Restoration Project Waste, which replaces SOP-1.06 and 1.10 (http://int.lanl.gov/environment/all/docs/qa/ep_qa/EP-ERSS-SOP-5022.pdf)

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 Module VIII of the Laboratory's Hazardous Waste Facility Permit.

A waste characterization strategy form (WCSF) will be prepared and approved per requirements of EP-ERSS-SOP-5022, Characterization and Management of Environmental Restoration Project Waste. The WCSF will provide detailed information on IDW characterization methods, management, containerization, and potential volumes. IDW characterization is completed through review of sampling data and/or documentation or by direct sampling of the IDW or the media being investigated (e.g., surface soil, subsurface soil, etc.). 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 to NMED for approval.

Wastes will be containerized and placed in clearly marked and appropriately constructed waste accumulation areas. 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 will be detailed in the WCSF and approved before the waste is generated. Transportation and disposal requirements will also be detailed in the WCSF and approved before waste is generated. Table B-1.0-1 summarizes how waste will be managed.

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 chips generated by the drilling of boreholes for the intent of sampling. Drill cuttings include excess core sample not submitted for analysis and any returned samples sent for analysis. Initially, the drill cuttings will be placed in containers at a hazardous waste accumulation area until the cuttings are characterized. If the drill cuttings are found to be nonhazardous, they will be stored as nonhazardous waste. Cuttings will be land applied if they meet the criteria in the NMED-approved Notice of Intent (NOI) Decision Tree for Land Application of Investigation Derived Waste Solids from Construction of Wells and Boreholes. The use of the NOI Decision Tree is described in ENV-RCRA-SOP-011.0, Land Application of Drill Cuttings. This waste stream will be characterized based either on direct sampling of the waste or on the results from core samples collected during drilling. If the waste is directly sampled, the following analyses will be performed: volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), radionuclides, total metals, and, if necessary, toxicity characteristic metals. If process knowledge, odors, or staining indicates that the cuttings may be contaminated with petroleum products, the materials will also be analyzed for total petroleum hydrocarbons (TPH) and polychlorinated biphenyls (PCBs). Other constituents may also be analyzed to meet the waste acceptance criteria (WAC) for a receiving facility. The Laboratory expects most cuttings will be land-applied or disposed of as a low-level waste at Technical Area 54 (TA-54), Area G.

B-2.2 Excavated Environmental Media

Most of the overburden soil and rock excavated above sumps and piping is expected to be noncontaminated. In areas where no evidence (e.g., broken pipes, stains, or odors) of contamination is found, the overburden soil will be stockpiled or containerized for reuse as fill in the area from which it was excavated.

Initially, other media will be considered to be potentially contaminated and will be placed in containers at a hazardous waste accumulation area until the media are characterized. If the media are found to be nonhazardous, they will be stored as nonhazardous waste. These wastes will be directly sampled for VOCs, SVOCs, radionuclides, total metals, and if needed, toxicity characteristic metals. Other constituents may be analyzed as necessary to meet the WAC for a receiving facility. If process knowledge, odors, or staining indicates that soils may be contaminated with petroleum products, the materials will also be analyzed for TPH and PCBs. A minimum of one direct sample will be collected for every 50 yd^3 of potentially contaminated media generated. The Laboratory expects most of the potentially contaminated media to be designated as nonhazardous waste that will be disposed of at a New Mexico solid waste landfill or low-level waste that will be disposed of at TA-54, Area G.

B-2.3 Excavated Man-made Debris

Waste from the demolition and removal of septic tanks will consist of concrete reinforced with steel rebar and vitrified clay pipe or steel pipe. Where practicable, this waste stream will be characterized by direct sampling of the waste (e.g., concrete and vitrified clay pipe). If the materials are difficult to sample (e.g., metal piping), the data from associated structures, such as concrete tanks connected to the piping, may be used. The sampled materials will be analyzed for VOCs, SVOCs, radionuclides, total metals, and if necessary, toxicity characteristic metals. Other constituents may also be analyzed to meet the WAC for a receiving facility or if process knowledge or visual observations indicate that other contaminants may be present (e.g., PCBs or asbestos). A minimum of one direct sample will be collected for every 50 yd^3 of potentially contaminated debris generated.

Initially, the excavated materials will be placed in containers (e.g., rolloff bins) at a hazardous waste accumulation area until the waste is characterized. If the wastes are found to be nonhazardous, they will be stored as nonhazardous waste. The Laboratory expects most of this waste to be designated as nonhazardous, nonradioactive waste that will be disposed of at an authorized solid waste facility or as low-level waste that will be disposed of at TA-54, Area G.

Waste minimization will be implemented, where practicable. For example, cast iron pipe and vitrified clay pipe may contain lead collars. Nonradioactive lead collars will be managed as hazardous waste or recycled. Lead collars that have radioactive contamination may be decontaminated to below free-release criteria for radionuclides so they do not have to be managed as mixed waste. Materials such as metal pipes that meet release criteria will be recycled, if practicable.

B-2.3 Liquids from Septic Tanks

Liquids in septic tanks will be removed before the structures are excavated. Initially, the liquids will be placed in containers at a hazardous waste accumulation area until the waste is characterized. If the wastes are found to be nonhazardous, they will be stored as nonhazardous waste. The liquids will be sampled and analyzed for VOCs, SVOCs, radionuclides, and total metals. Other constituents may be analyzed as necessary to meet the WAC for a receiving facility or if process knowledge or visual observations indicate that other contaminants may be present. The Laboratory expects most of these wastes to be nonhazardous liquid waste or radioactive liquid waste that will be sent to one of the Laboratory's wastewater treatment facilities whose WAC allow the waste to be received.

B-2.4 Contact Waste

The contact waste stream consists of potentially contaminated materials that "contacted" waste during sampling and excavation. 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. Characterization of this waste stream will use acceptable knowledge (AK) of the waste materials, the methods of generation, and analysis of the material contacted (e.g., drill cuttings, soil, sumps, etc.). Initially, contact waste will be placed in containers at a hazardous waste accumulation area until it is characterized. If it is found to be nonhazardous, the waste will be stored as nonhazardous waste. The Laboratory expects most of the contact waste to be designated as nonhazardous, nonradioactive waste that will be disposed of at an authorized facility or as low-level waste that will be disposed of at TA-54, Area G.

B-2.5 Decontamination Fluids

The decontamination fluids waste stream will consist of liquid wastes from decontamination activities (i.e., decontamination solutions and rinse waters). Consistent with waste minimization practices, the Laboratory employs dry decontamination methods to the extent possible. If dry decontamination cannot be performed, liquid decontamination wastes will be collected in containers at the point of generation. The decontamination fluids will be characterized through AK of the waste materials, the levels 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 the fluids are directly sampled, the following analyses will be performed: VOCs, SVOCs, radionuclides, total metals, and, if necessary, toxicity characteristic metals. The Laboratory expects most of these wastes to be nonhazardous liquid waste or radioactive liquid waste that will be sent to one of the Laboratory's wastewater treatment facilities whose WAC allow the waste to be received.

Table B-1.0-1
Summary of Estimated IDW Generation and Management

Waste Stream	Expected Waste Type	Expected Disposition
Drill cuttings	Nonhazardous or low-level radioactive	Land application or disposal at TA-54, Area G
Excavated environmental media	Nonhazardous or low-level radioactive	Reused as fill at the excavation location or disposed at an approved off-site disposal facility or on-site at TA-54, Area G
Excavated man-made debris	Nonhazardous or low-level radioactive	Disposal at an approved off-site disposal facility or on-site at TA-54, Area G, or recycled
Liquids from septic tanks	Nonhazardous or low-level radioactive	Treatment at an on-site wastewater treatment facility
Contact waste	Nonhazardous or low-level radioactive	Disposal at an approved off-site solid waste disposal facility or on-site at TA-54, Area G
Decontamination fluids	Nonhazardous or low-level radioactive	Treatment at an on-site wastewater treatment facility

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Record Title	Media Type	Document Date	Author/Originator	Other Doc. # (e.g. Doc. Catalog #)	Page Count	ERID (RPF only)
Submittal of the Response to the notice of Disapproval for the investigation Work Plan for Upper Canada del Buey aggregate area and Revision 1	Paper (letter)	9/29/08	Kent Rich	2008-0508 LA-UR-08-6121 LA-UR-08-6122		105038
2 CD's						
Cross - Ref					12	105039

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Accepted | Entered AM 3-2-09 | Scanned 04/16/09 Presley M. Salg | QC: PS

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Plate 1 Upper Cañada del Buey Aggregate Area
Surface water monitoring station
Alluvial groundwater monitoring well
Groundwater supply well
Paved road
Unpaved road
Fence
TA boundary
LANL boundary
Structure
Former structure
SWMU or AOC
Cañada del Buey canyon reach
Upper Cañada del Buey Aggregate Area
10 foot elevation contour
100 foot elevation contour
Feet
0 125 250 500
0 25 50 100
Meters
N
State Plane Coordinate System
New Mexico, Central Zone, US Foot
NAD 1983
Upper Cañada del Buey Aggregate Area
TA-35
TA-52
TA-63
TA-50
TA-05
TA-46
TA-66
TA-40
TA-15
TA-36
TA-51
TA-54
PUYE RD
PAJARITO RD
MORTANDAD
ITEM
SUNBEAM
Ten Site Canyon
Cañada del Buey
SWSC Canyon
Pajarito Mesa
Mesita del Buey
Pajarito Canyon
San Ildefonso Pueblo
CDB-1
CDB-2 West
CDB-2 Central
CDBO-5
PM-5
E218
Area of Detail
Los Alamos National Laboratory
Darren Green, Apogen Technologies
Modified by Kelly Crowell, Apogen Technologies
Date: 06.25.2008
Map: UCdB_HIR_Plate1.Rev0
Disclaimer: This map was created for work processes associated with the Upper Cañada del Buey Aggregate Area Historical Investigation Report and Investigation Work Plan. All other uses for this map should be confirmed with the Environmental Programs Directorate.