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Work Plan for Supplemental Sampling at Material Disposal Area G, Consolidated Unit 54-013(b)-99

Los Alamos
NATIONAL LABORATORY
EST. 1943

Prepared by the Environmental Programs Directorate

LA-UR-06-6508
EP2006-0820

Work Plan for Supplemental Sampling at Material Disposal Area G, Consolidated Unit 54-013(b)-99

September 2006

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EXECUTIVE SUMMARY

This supplemental investigation work plan presents drilling and sampling activities required to complete the Resource Conservation and Recovery Act facility investigation of Material Disposal Area (MDA) G [Consolidated Unit 54-013(b)-99], which consists of SWMUs 54-013(b), 54-014(b–d), 54-015(k), 54-017, 54-018, 54-019, and 54-020. These SWMUs are located within Area G at Technical Area (TA) 54 at Los Alamos National Laboratory (the Laboratory).

In September 2005, the Laboratory submitted the investigation report for MDA G (LANL 2005, 90513) to the New Mexico Environment Department (NMED). The Laboratory subsequently received two notices of disapproval (NODs) from NMED in response to the 2005 investigation activities and analytical results. These NODs assert the failure of the 2005 investigation to determine the vertical extent of vapor-phase volatile organic compound (VOC) contamination within four distinct zones. The NODs require installation of four additional boreholes or extension of four existing boreholes to greater depth to determine vertical extent of VOC contamination. NMED concurred with the Laboratory's proposed approach to extend existing boreholes (BH) (BH-2 [location 54-24361], BH-10 [location 54-24370], BH-26 [location 54-24386], and BH-34 [location 54-24394]) to a total depth at which the vertical extent of VOC contamination is defined.

These four boreholes will be completed as vapor-phase monitoring boreholes, allowing monitoring of the VOC plume in these areas. Before the borehole is instrumented, proposed as-built diagrams for each borehole will be submitted to NMED for approval. Subsurface pore-gas samples will be collected from the completed boreholes will determine the vertical extent of VOC contamination in the areas of concern at MDA G.

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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 the Los Alamos National Security, LLC. The Laboratory is located in north-central New Mexico, approximately 60 mi northeast of Albuquerque and 20 mi northwest of Santa Fe. The Laboratory site covers 40 sq mi of the Pajarito Plateau, which consists of a series of finger-like mesas separated by deep canyons containing perennial and intermittent streams running from west to east. Mesa tops range in elevation from approximately 6200 ft to 7800 ft.

Material Disposal Area (MDA) G [Consolidated Unit 54-013(b)-99] is located at Technical Area (TA) 54, Area G, on a mesa in the east-central portion of the Laboratory (Figure 1.0-1). TA-54 has been the main waste storage and disposal facility for the Laboratory since the 1950s. Area G is a 65-acre fenced area containing both surface and subsurface waste management units. MDA G consists of inactive disposal units within Area G and includes 32 pits, 194 shafts, and 4 trenches (Figure 1.0-2) with depths ranging from 10 to 65 ft below the original ground surface. The regional aquifer is estimated to be at an average depth of approximately 900 ft below ground surface (bgs) at Area G, based on data from boreholes at the Laboratory and the predictions of the hydrogeologic conceptual model for the Pajarito Plateau (LANL 1998, 59599). The topography of Area G is relatively flat. Portions of the MDA G disposal units are covered with concrete and house ongoing waste-management activities conducted at Area G.

Historically, MDA G was used for the disposal of low-level radioactive waste (LLW) and transuranic (TRU) radioactive waste, certain radioactively contaminated infectious waste, asbestos-contaminated material, and polychlorinated biphenyls (PCBs), and the retrievable storage of TRU waste. Disposal of LLW and radioactively contaminated PCB waste continues at Area G.

In September 2005, the Laboratory submitted the investigation report for MDA G (LANL 2005, 90513) to the New Mexico Environment Department (NMED). On July 26, 2006, the Laboratory received a notice of disapproval (NOD) (NMED 2006, 93385) that contained the requirements for additional investigation to determine the vertical extent of vapor phase volatile organic compound (VOC) contamination in the eastern and northern portions of MDA G. Following a review of the July 2006 periodic monitoring report for vapor sampling at MDA G (LANL 2006, 93269), NMED issued a supplemental NOD on August 4, 2006 (NMED 2006, 93754). This supplemental NOD revised the additional investigation requirements and stipulated extending existing boreholes (BH) (BH-2 [location 54-24361], BH-10 [location 54-24370], BH-26 [location 54-24386], and BH-34 [location 54-24394]).

This supplemental investigation work plan (hereafter, the work plan) briefly discusses the sampling results of 2005 site-investigation activities and addresses NMED's requirements for supplemental activities needed to complete the investigation of MDA G. This work plan also provides background information and describes the site conditions, the scope of activities needed to complete the investigation, the investigation methods, and the anticipated schedule for completing the field activities.

Investigation Objectives

The objectives of this supplemental investigation work plan for MDA G are to

- present the purpose for extending the depth of four existing boreholes located at MDA G;
- present the proposed methods for drilling, on-site field monitoring, borehole design, and borehole completion activities; and
- identify appropriate methods and protocols for collecting, analyzing, and evaluating data to finalize the characterization of MDA G.

2.0 BACKGROUND

The operational history of MDA G is summarized in the approved Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) work plan for Operable Unit (OU) 1148 (LANL 1992, 07669, pp. 5-179 to 5-200) and in the historical investigation report (HIR) of the approved investigation work plan for MDA G (LANL 2004, 87833, Appendix B). Furthermore, the performance assessment and composite analysis report (LANL 1997, 63131) and the safety analysis report for Area G (LANL 1995, 63300) present additional information on MDA G. Previous investigations performed at MDA G include quarterly pore-gas sampling, conducted from 1985 to 1996 and from 1997 to the present; RFI activities, conducted between 1993 and 1995; and the 2005 investigation work plan activities conducted to meet the requirements of the March 1, 2005, Compliance Order on Consent .

The primary objective of the 2005 site investigation activities was to define the nature and extent of contamination identified during previous investigations of MDA G. A total of 39 boreholes were drilled and the core samples analyzed for target analyte list metals, cyanide, nitrates, explosive compounds, dioxins, furans, perchlorate, volatile organic compounds (VOCs) and the radionuclides americium, thorium, strontium-90, uranium, and plutonium. The sampling also focused on fracture characterization. Samples of fracture fill and surrounding intact tuff were collected when substantial fractures were encountered. Additionally, geotechnical and geochemical samples were collected from the deep boreholes to measure chloride-ion concentration, matric potential, and moisture content. Pore-gas samples for tritium and VOCs were collected to evaluate the nature and extent of vapor-phase VOCs and tritium in pore water beneath MDA G. The analytical results from pore-gas samples confirmed the presence of VOCs (consisting primarily of chlorinated VOCs) in the vadose zone beneath MDA G (LANL 2005, 90513).

The vertical extent of vapor-phase VOCs was not defined in four 2005 boreholes drilled into tuff at MDA G. Specifically, concentrations of VOCs were found to increase with depth in four boreholes in the eastern and northern portion of MDA G (Table 2.0-1). Trichloroethane [1,1,1-] (TCA) was detected in subsurface pore gas at increasing concentrations in BH-18 (location 54-24378) from 30–32 to 136–138-ft depth, in BH-19 (location 54-24379) from 20–22 to 144–146-ft depth, in BH-25 (location 54-24385) from 30–32 to 134–136-ft depth, and in BH-26 from 36–37 to 156–158-ft depth. Increasing concentrations with depth were also found for other VOCs, including trichloroethene (TCE), tetrachloroethene (PCE), dichloroethane[1,1-], dichloroethene[1,1-], and trichloro-1,2,2-trifluoroethane[1,1,2-] at the above locations.

2.1 Summary of Historical Investigations

The results of previous investigations, including the RFI activities and the results of the 2005 drilling and sampling program at MDA G, are described in the approved work plan for MDA G (LANL 2004, 87833, Appendix B) and in the investigation report for MDA G (LANL 2005, 90513). The following sections summarize the results of the 2005 drilling activities and are limited to those areas within MDA G where the vertical extent of VOC contamination within the vadose zone has not been defined.

During the 2005 investigation, 39 boreholes were drilled to collect soil, rock, and pore-gas samples to determine the nature and extent of contamination at MDA G. The analytical results from 38 of the 39 boreholes from which pore-gas samples were collected confirm the presence of tritium and VOCs (consisting primarily of chlorinated VOCs) in the vadose zone beneath MDA G.

Sampling results indicate that TCA is the dominant contaminant in pore gas beneath MDA G. The highest concentration of TCA was detected in BH-18. Concentrations of TCA in nearby locations at BH-28 (location 54-24388), BH-19, BH-26 (location 54-24386), and BH-25 are also elevated compared to the rest of the site, indicating the highest concentrations of TCA are at the east end of MDA G. In addition,

results from these boreholes show TCA increased with depth. Two additional areas of elevated VOCs in pore gas were encountered in the central and western portions of MDA G. The highest levels of TCA in the central and western portions of MDA G were detected in samples collected from BH-30 (location 54-24390) and BH-34 (location 54-24394), respectively. Although TCA is still the dominant contaminant in these areas, the relatively higher concentrations of other VOCs in these samples, including TCE, Freon-113, and PCE, indicate releases from different sources. The levels of VOCs in the subsurface vapor in these portions of MDA G are an order of magnitude less than levels in the eastern portion.

While TCA is the dominant contaminant in terms of concentrations, other VOCs may be of greater concern with respect to potential groundwater contamination due to lower groundwater cleanup levels and/or lower Henry's Law constants. In particular, the NOD (NMED 2006, 93385) noted that the TCE and PCE pose the highest risk of groundwater contamination, based on the use of screening values for groundwater contamination presented in the July 2006 periodic monitoring report (LANL 2006, 93269). For the four boreholes found to have increasing vertical trends, the screening value for TCE was exceeded in the deepest samples collected in BH-18, BH-19, and BH-26; the screening value for PCE was exceeded in the deepest samples collected in BH-25 and BH-26.

The analytes TCA, TCE, and PCE were not detected in pore-gas sample collected at a depth interval of 485 ft to 700 ft from BH 15-3 (location 54-25105) in the Cerros del Rio basalt.

Perched groundwater was not encountered beneath MDA G during the 2005 drilling investigation. Subsurface samples were collected from BH 15-2 (location 54-24523) and BH-15-3 to evaluate the moisture properties and to determine the presence of perched groundwater zones beneath MDA G. Detailed lithological logging of core to a depth of 700 ft did not reveal visibly saturated zones. Sixty-two samples were submitted to an off-site analytical laboratory for moisture content and matric potential analyses. The results of gravimetric moisture analyses showed moisture levels ranging from 0.2% to 27.2% moisture by weight. Only one sample, collected from BH-15-2 at a depth of 197 ft bgs, had a moisture level of 27.2%; all the other boreholes had moisture levels of 11.2% or less. Laboratory matric potential readings confirm that the vadose zone beneath MDA G is below saturation levels. Camera logging conducted in BH-15-2 from approximately 480 ft to 700 ft bgs showed no signs of a perched zone within the Cerros del Rio basalt.

3.0 SCOPE OF ACTIVITIES

This section describes the work proposed for the supplemental field investigation of MDA G. These proposed activities are in response to an NOD, dated July 26, 2006 (NMED 2006, 93385), and a supplemental NOD, dated August 4, 2006 (NMED 2006, 93754).

Activities related to this supplemental investigation include

- advancing four boreholes, BH-2, BH-10, BH-26, and BH-34 at MDA G;
- determining the vertical extent of VOC contamination in the four advanced boreholes at MDA G; and
- constructing vapor-monitoring boreholes at BH-2, BH-10, BH-26, and BH-34.

3.1 MDA G Supplemental Investigation Activities

The pore-gas results presented in "Investigation Report for Material Disposal Area G, Consolidated Unit 54-013(b)-99, at Technical Area 54" (LANL 2005, 90513) show increases in VOC concentrations with depth in a number of boreholes. Consequently, more comprehensive sampling of four boreholes will be conducted (Figure 2.0-1). The July 26, 2006 NOD (NMED 2006, 93385) requires advancing the boreholes until field screening demonstrates that TCE and PCE concentrations in pore gas are below screening levels, based on groundwater cleanup standards. This supplemental investigation will sample the boreholes at defined intervals, in specific lithologies, and at greater depths than those sampled in the 2005 investigation. Table 4.1-1 presents the proposed depths for the sample ports and the corresponding lithology for each depth.

3.1.2 Field Screening

Field screening using a photoionization detector (PID) and a Brüel and Kjaer (B&K) monitor will be conducted to determine total depth of the boreholes. The July 26, 2006, NOD indicates that field measurement of vapor phase TCE and PCE concentrations below half the calculated lower partitioning limits of 2200 and 3800 $\mu g/m^3$ (0.41 and 0.56 ppmv), respectively, can be used as an indicator that the total depth has been reached (NMED 2006, 93385). The four boreholes will be advanced to a depth where TCE and PCE concentrations measured in the field are below half of these lower partitioning limits or until basalt is encountered. If basalt is reached first, drilling will advance to a total depth 10 or 15 ft below the top of the basalt.

3.1.3 Subsurface Vapor-Phase Sampling

The four advanced boreholes will be completed as vapor-phase monitoring boreholes to sample TCE and PCE concentrations at various discrete depths in each borehole. These VOC concentrations will be sampled at different intervals in the borehole using sampling ports attached to the end of a length of steel tubing. Sampling will be used to determine vertical extent of VOC concentrations in each borehole. The proposed sampling depths presented in Table 4.1-1 were selected to sample pore gas in specific lithologies and at desired intervals within the borehole. Where specific lithologies are not sampled, vapor samples will be collected at 40-ft intervals.

4.0 INVESTIGATION METHODS

The following standard operating procedures (SOP), available at http://erproject.lanl.gov/documents/procedures.html, are applicable to the investigation methods proposed in this supplemental work plan.

- SOP-1.01, Rev. 2, General Instructions for Field Investigations
- SOP-1.04, Rev. 6, Sample Control and Field Documentation
- SOP-1.08, Rev. 1, Field Documentation of Drilling and Sampling Equipment
- SOP-4.01, Rev. 3, Drilling Methods and Drill Site Management
- SOP-6.31, Rev. 2, Sampling of Subatmospheric Air
- SOP-6.22, Rev. 0, Headspace Vapor Screening with a Photoionization Detector

Additional procedures may be added as necessary to describe and document quality-affecting activities.

4.1 Methods for Extending Boreholes

The four boreholes currently contain slough that must be removed before the borehole is advanced; this task will be accomplished using a $7^5/_8$ in. hollow-stem auger. The thickness of slough in each borehole is shown in the borehole construction figures (Figures 4.1-1 through 4.1-4). Boreholes BH-10 and BH-34 will be advanced using a $7^5/_8$-in. hollow-stem auger until the borehole is completed or until basalt is encountered. If necessary, a pneumatic hammer will be used to extend the boreholes 10 or 15 ft into the basalt. These methods were also used during the 2005 investigation of MDA G and are described in Appendix B of the MDA G investigation report (LANL 2005, 90513). Boreholes BH-2 and BH-26 were previously drilled to refusal depths of 170 ft and 186 ft, respectively. Therefore, after slough is removed, these two boreholes will be advanced using a pneumatic hammer to the depths described above.

4.1.1 Drilling and Screening Protocol

Drilling will proceed through the slough to the current total depth of each borehole, where drilling will cease and straddle packers will be inflated to sample for VOCs using either a PID or a B&K monitor. If the VOC concentrations at the current total depth are above one-half of field-screening levels specified in section 3.1.2, drilling will continue with interruptions at 20-ft intervals to take additional pore-gas measurements. This process will continue to a depth where concentrations of TCE and PCE are below half of the lower partitioning limits or to a depth of 10 or 15 ft into the basalt. If drilling must continue into the basalt, the auger will be removed and drilling will resume using a pneumatic hammer.

4.1.2 Construction of Vapor Monitoring Boreholes

Construction of monitoring boreholes will be based on the designs shown in Figures 4.1-1, 4.1-2, 4.1-3, and 4.1-4. Each borehole will be sampled at different depths, depending on the total depth of each borehole. Sampling will be conducted through a port at the end of a length of steel tubing. The majority of ports will be set in a 5-ft zone of slough, which will be bounded above and below by 5 ft of bentonite (Figures 4.1-1 through 4.1-4). Deviations from this ideal 15-ft construction must occur in the deeper portions of certain boreholes to accommodate correlations between sampling depths and lithologies. Specifically, in BH-2 and BH-34, the second deepest sampling ports will be overlain by only 2 ft and 3 ft of bentonite. Once the total depth for each borehole is achieved, a revised borehole construction figure will be submitted to NMED for review and approval. Upon approval, the borehole will be constructed and a final as-built diagram will be submitted with the supplemental investigation report.

4.1.3 Collection of Pore-Gas Samples

Pore-gas samples will be collected from the four boreholes at discrete sample intervals within each borehole. These samples will be collected directly at the surface from the tops of the steel tubes that extend down to each of the sampling ports. Sample ports will be located at the intervals presented in Table 4.1-1. Pore-gas samples will be collected in SUMMA canisters, according to SOP-6.31, Revision 2, and submitted for analysis using U.S. Environmental Protection Agency (EPA) Method TO-15 for VOCs. Quality assurance (QA)/quality control (QC) samples for VOCs in pore gas will consist of an equipment blank and a field duplicate. The equipment blank will detect potential cross-contamination and will be collected after sampling and subsequent purge decontamination. The field duplicate sample will indicate the precision of collection and analysis.

4.1.4 Investigation-Derived Waste Management

Waste generated during the supplemental investigation of MDA G will be managed as described in the investigation-derived waste (IDW) management plan presented in Appendix H of the approved MDA G investigation work plan (LANL 2004, 87833). Based on the results of the 2005 investigation, these wastes are expected to be characterized as LLW that may be disposed of at MDA G or a licensed off-site disposal facility.

5.0 SCHEDULE

The MDA G supplemental investigation report is due to NMED 90 days after the completion of the supplemental investigation activities. Field activities, including drilling and sampling, are expected to begin on October 10, 2006. Sampling is expected to be completed by November 17, 2006. Based on this schedule, the supplemental investigation report is scheduled to be submitted to NMED on February 16, 2007. If delays result from field or programmatic constraints, the supplemental investigation report will be submitted no more than 90 days after the completion of field activities.

6.0 REFERENCES

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

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

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LANL (Los Alamos National Laboratory), June 2006. "Periodic Monitoring Report for Vapor Sampling Activities at Technical Area 54, Material Disposal Area G," Los Alamos National Laboratory document LA-UR-06-3708, Los Alamos, New Mexico (LANL 2006, 93269)

NMED (New Mexico Environment Department), June 2006. "Technical Background Document for Development of Soil Screening Levels, Revision 4.0," New Mexico Environment Department Hazardous Waste Bureau, Ground Water Quality Bureau and Voluntary Remediation Program, Santa Fe, New Mexico. (NMED 2006, 92513)

NMED (New Mexico Environment Department), July 26, 2006. "Notice of Disapproval for the 'Investigation Report for Material Disposal Area G, Consolidated Unit 54-013(b)-99 at Technical Area 54' Los Alamos National Laboratory EPA ID #NM0890010515 HWB-LANL-05-019," New Mexico Environment Department letter to M. Johansen (DOE) and D. McInroy (LANL) from J. Bearzi (NMED), Santa Fe, New Mexico. (NMED 2006, 93385)

NMED (New Mexico Environment Department), August 4, 2006. "Supplement to Notice of Disapproval for the 'Investigation Report for Material Disposal Area G, Consolidated Unit 54-013(b)-99 at Technical Area 54' Los Alamos National Laboratory EPA ID #NM0890010515 HWB-LANL-05-019," New Mexico Environment Department letter to M. Johansen (DOE) and D. McInroy (LANL) from J. Bearzi (NMED), Santa Fe, New Mexico. (NMED 2006, 93754)

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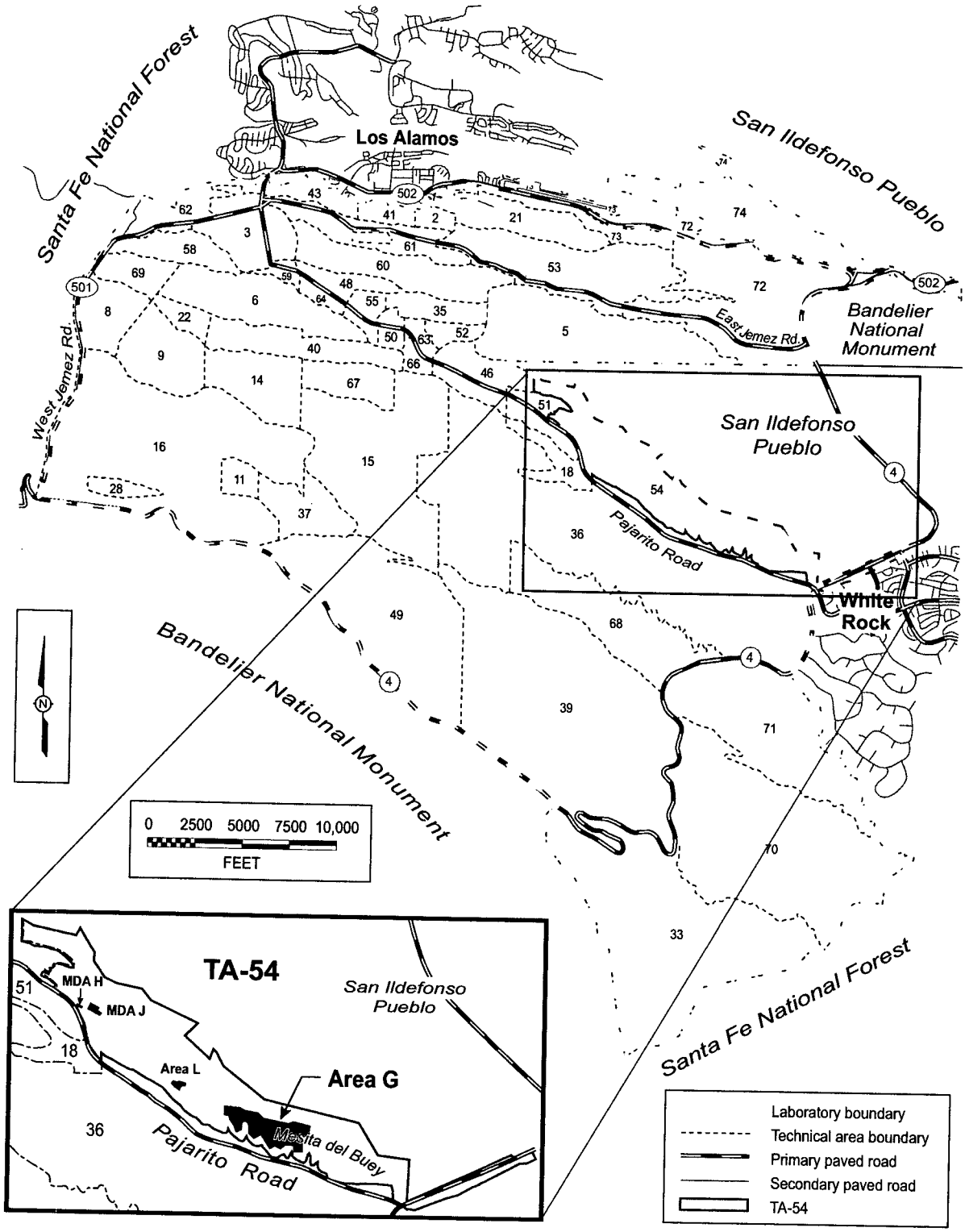

Figure 1.0-1. Location of Area G in TA-54 with respect to Laboratory technical areas and surrounding land holdings

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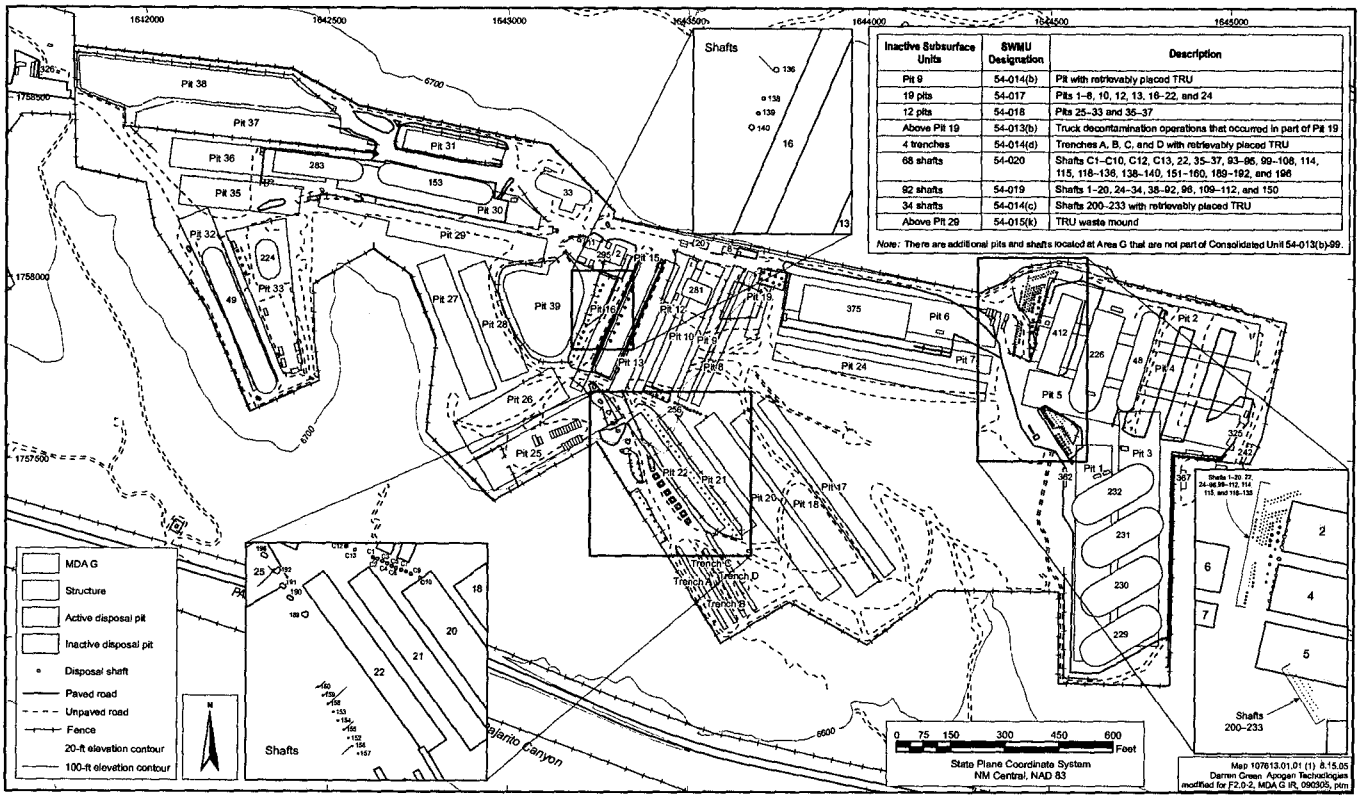

Inactive Subsurface Units	SWMU Designation	Description
Pit 9	54-014(b)	Pit with retrievably placed TRU
19 pits	54-017	Pits 1–6, 10, 12, 13, 16–22, and 24
12 pits	54-018	Pits 25–33 and 35–37
Above Pit 19	54-013(b)	Truck decontamination operations that occurred in part of Pit 19
4 trenches	54-014(d)	Trenches A, B, C, and D with retrievably placed TRU
68 shafts	54-020	Shafts C1–C10, C12, C13, 22, 35–37, 93–96, 99–108, 114, 115, 118–136, 138–140, 151–160, 189–192, and 196
92 shafts	54-019	Shafts 1–20, 24–34, 38–92, 96, 109–112, and 150
34 shafts	54-014(c)	Shafts 200–233 with retrievably placed TRU
Above Pit 29	54-015(k)	TRU waste mound

Note: There are additional pits and shafts located at Area G that are not part of Consolidated Unit 54-013(b)-99.

Figure 1.0-2. MDA G waste disposal units

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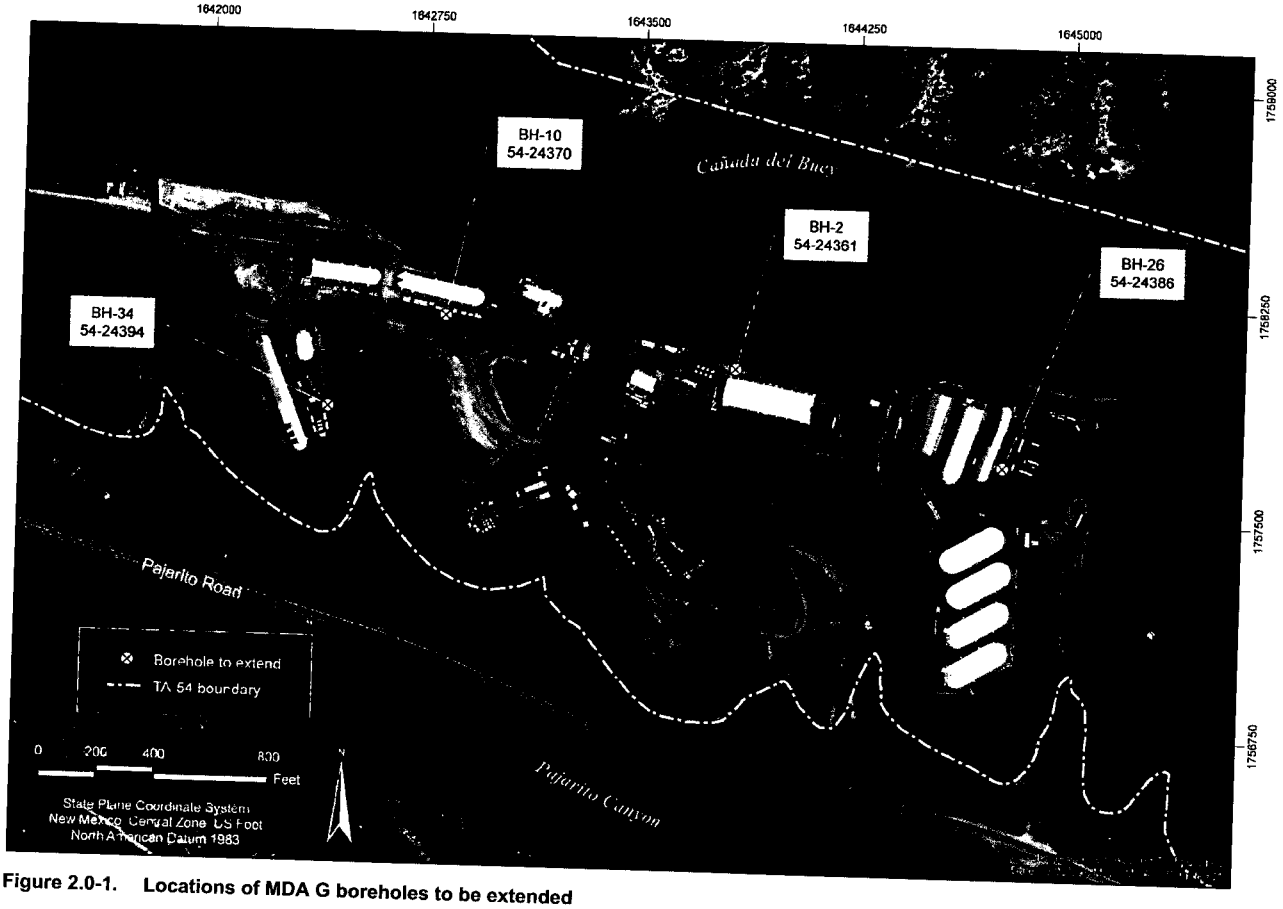

Figure 2.0-1. Locations of MDA G boreholes to be extended

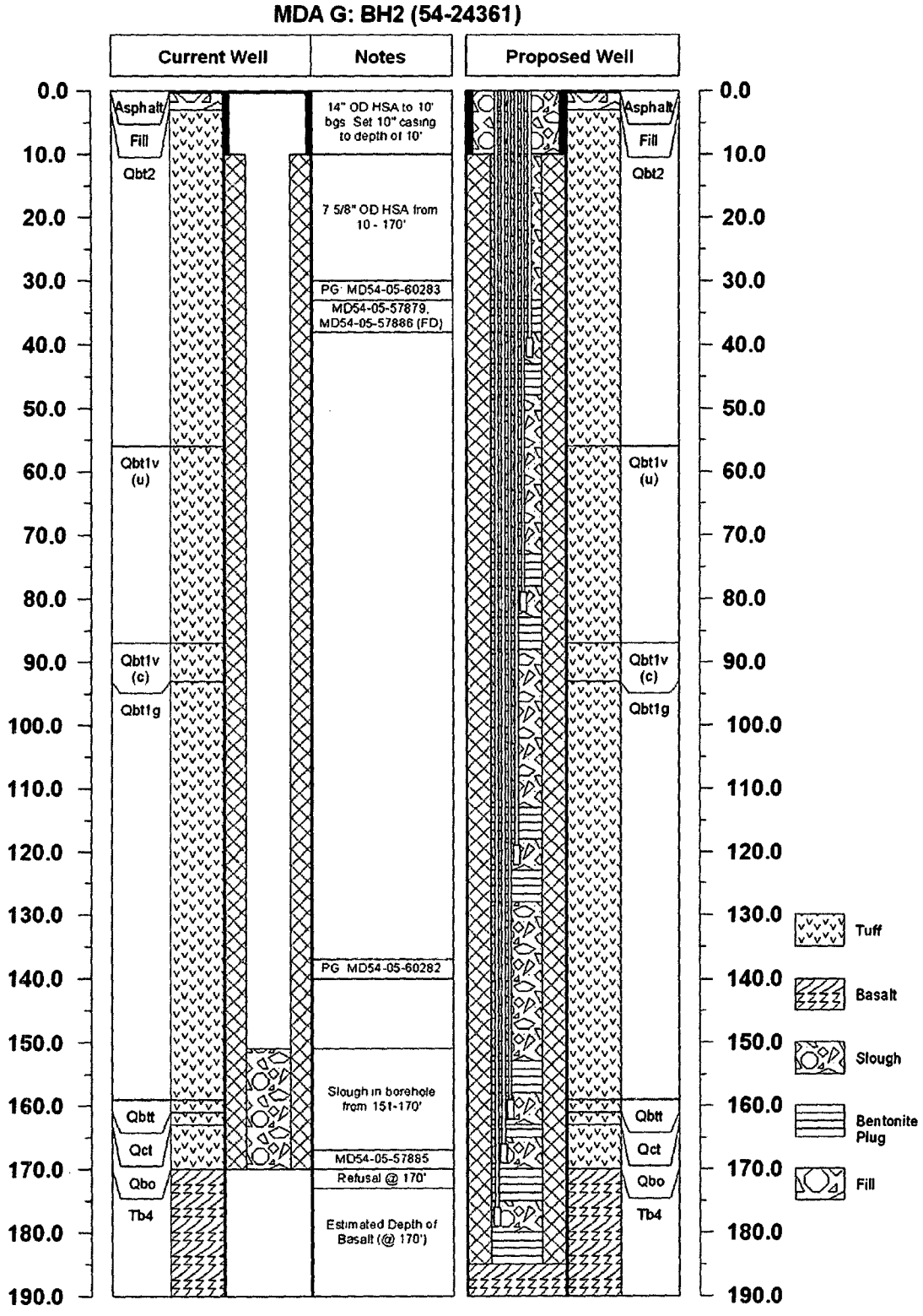

Figure 4.1-1. Detail of proposed borehole construction for BH-2, 54-24361

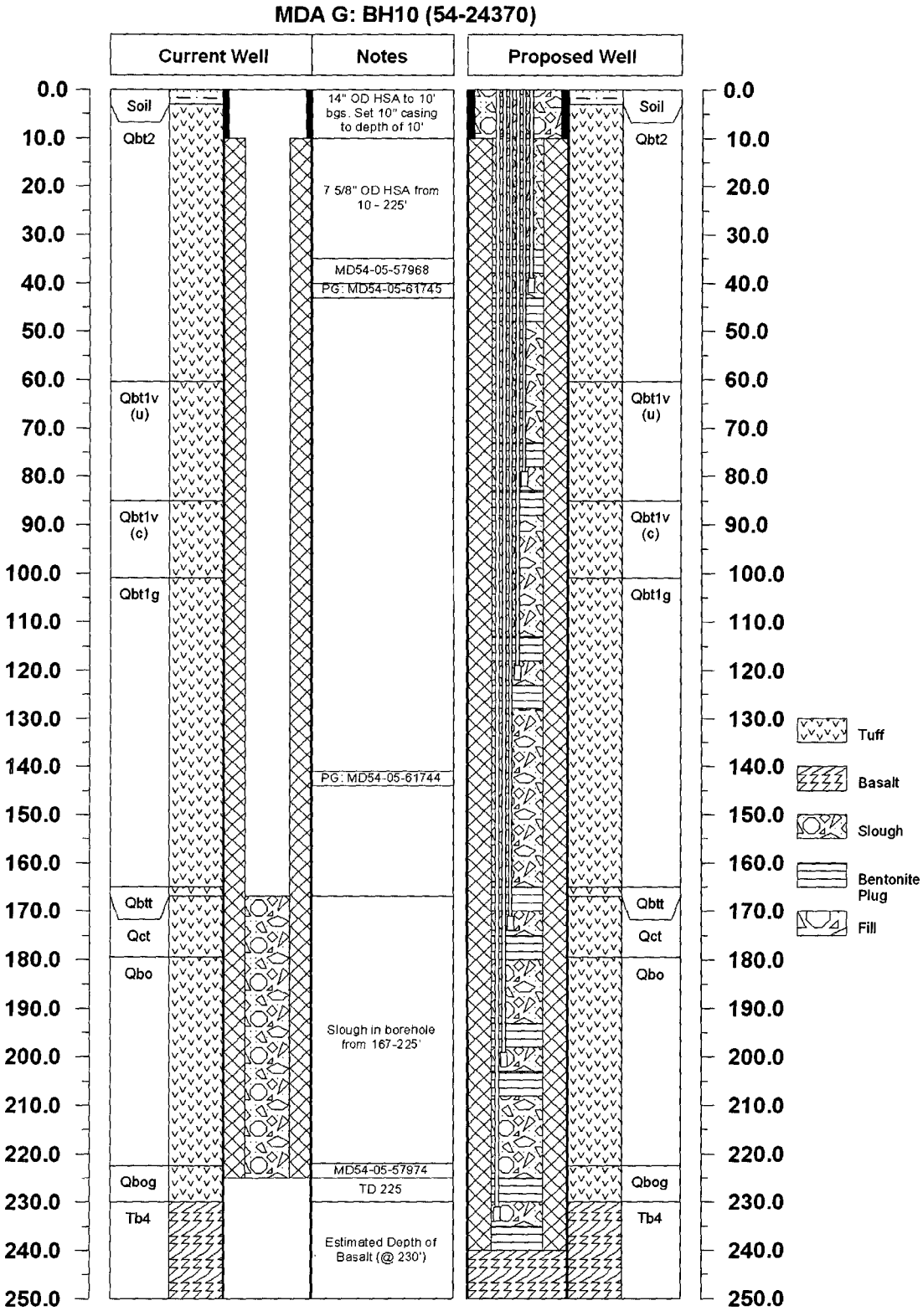

Figure 4.1-2. Detail of proposed borehole construction for BH-10, 54-24370

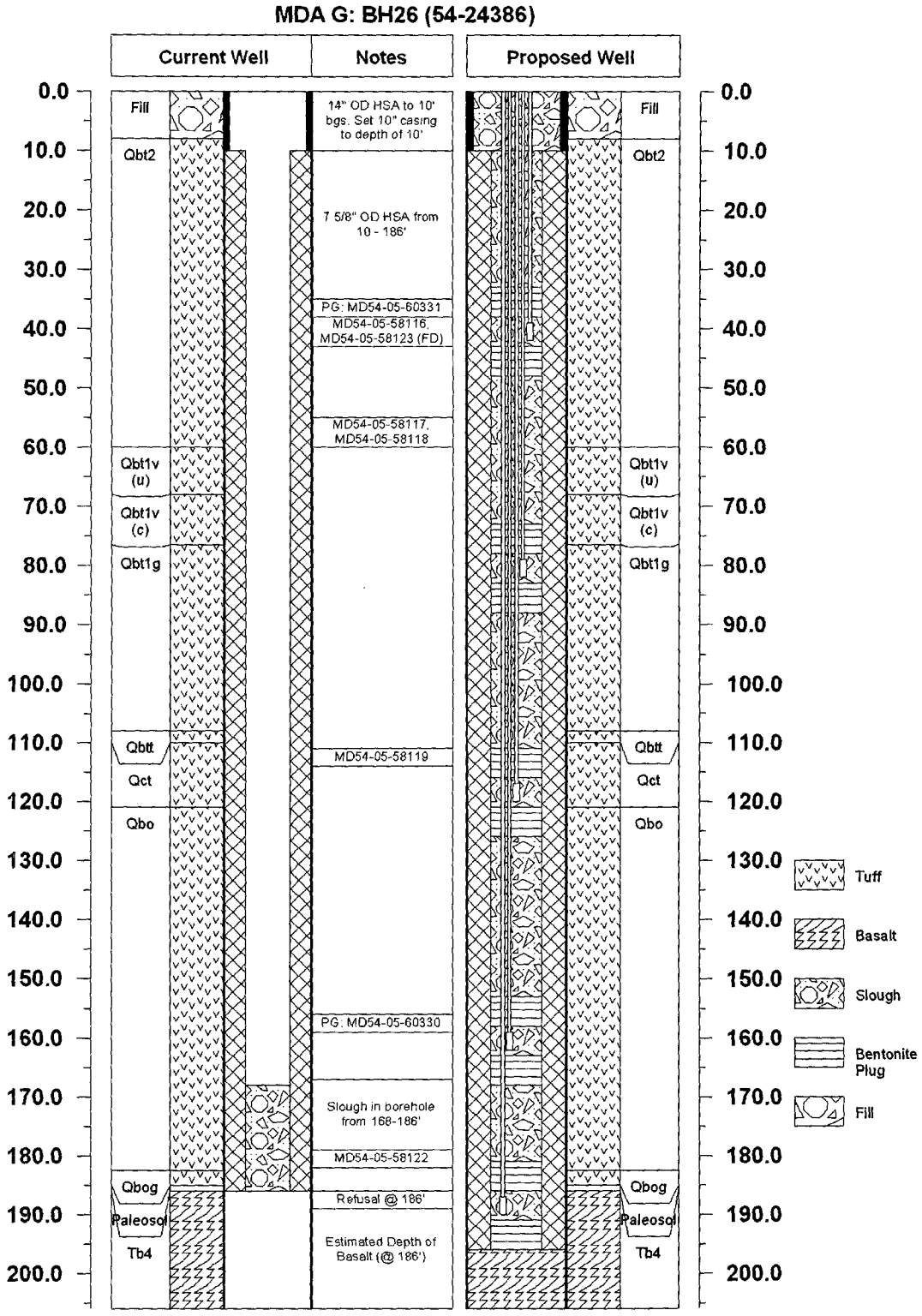

Figure 4.1-3. Detail of proposed borehole construction for BH-26, 54-24386

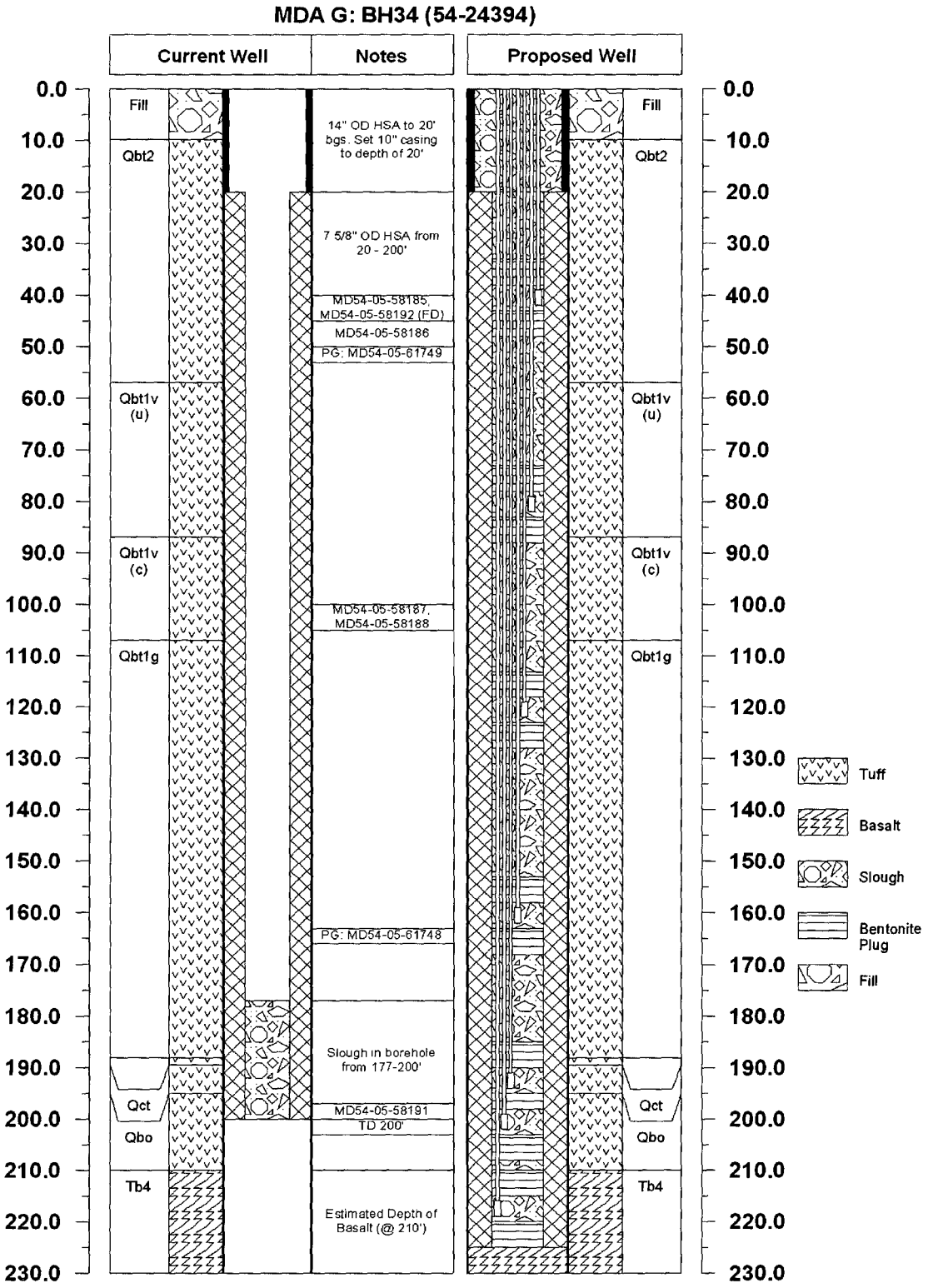

Figure 4.1-4. Detail of proposed borehole construction for BH-34, 54-24394

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Table 2.0-1
Boreholes with Increasing VOCs

Borehole Number	Location ID	Depth (ft)	Tetrachloroethene	1,1,1-Trichloroethane	Trichloroethene
BH-18	54-24378	30–32	2030 (U)[a]	464000 (NQ)[b]	4080 (NQ)
BH-18	54-24378	136–138	3120 (U)	709000 (NQ)	7520 (NQ)
BH-19	54-24379	20–22	664 (NQ)	32700 (NQ)	1240 (NQ)
BH-19	54-24379	144–146	2030 (NQ)	98200 (NQ)	4780 (NQ)
BH-25	54-24385	30–32	5630 (NQ)	65400 (NQ)	859 (NQ)
BH-25	54-24385	134–136	4880 (NQ)	70900 (NQ)	1130 (NQ)
BH-26	54-24386	35–37	1150 (NQ)	98200 (NQ)	1020 (NQ)
BH-26	54-24386	156–158	5490 (NQ)	447000 (NQ)	8590 (NQ)

[a] U = The analyte was not detected.

[b] NQ = The analyte was detected and not qualified.

Table 3.2.1
Number, Locations and Depth of Boreholes

Borehole Number	Northing	Easting	Current Depth	Proposed Depth
BH-2 (54-24361)	1758013.32	1643838.20	170 ft	190 ft
BH-10 (54-24370)	1758175.78	1642821.76	225 ft	240 ft
BH-26 (54-24386)	1757691.40	1644774.45	186 ft	196 ft
BH-34 (54-24394)	1757847.54	1642420.89	200 ft	225 ft

Table 4.1-1
Sample Port Depths

Borehole Number	Sample Port Depths in ft (Unit Sampled)						
BH-2 (54-24361)	40	80	120	160 (Qct)	168 (Qbo)	178 (Tb4)	
BH-10 (54-24370)	40	80	120	173 (Qct)	200 (Qbo)	233 (Tb4)	
BH-26 (54-24386)	40	80	120 (Qct)	160 (Qbo)	190 (Tb4)		
BH-34 (54-24394)	40	80	120	160	193 (Qct)	200 (Qbo)	218 (Tb4)

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