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# FIELD IMPLEMENTATION PLAN FOR INTERMEDIATE WELL CdV-9-1(i)

Los Alamos
NATIONAL LABORATORY
EST. 1943

37183

Prepared by TPMC for the Environmental Programs Directorate

# Field Implementation Plan for Intermediate Well CdV-9-1(i)

October 2014

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Responsible subcontractor representatives:

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**ACRONYM LIST**

| | |
|---|---|
| APS | Accelerator Porosity Sonde |
| ASTM | American Society for Testing and Materials |
| bgs | Below ground surface |
| CD | Compact disc |
| CMR | Combinable Magnetic Resonance |
| DOE | Department of Energy |
| EES | Earth & Environment Science Division |
| EP (ADEP) | Environmental Programs Directorate |
| EP-WES | Environmental Programs Waste and Environmental Services |
| ER-SOP | Environment and Remediation Standard Operating Procedure |
| ES&H | Environment, Safety and Health |
| FMI | Formation Microimager |
| ft | Feet |
| FTL | Field Team Leader |
| FOD | Facility Operations Director |
| gal | Gallons |
| ID | Inside diameter |
| IDW | Investigation Derived Waste |
| in | inch |
| IWD | Integrated Work Document |
| LANL | Los Alamos National Laboratory |
| LANS | Los Alamos National Security |
| MDA | Material Disposal Area |
| NMED | New Mexico Environment Department |
| NTU | Nephelometric turbidity units |
| OD | Outside diameter |
| OM | Operations Manager |
| PIC | Person in charge |
| PM | Project manager |
| ppm | Parts per million |
| PVC | Polyvinyl chloride |
| RCT | Radiological control technician |
| RDX | Research Department Explosive |
| RLM | Responsible Line Manager |
| RP-1/ RP-3 | Radiological protection group(s) |
| SMO | Sample management office |

| | |
|---|---|
| SOM | Shift Operations Manager |
| SOW | Statement of Work |
| STR | Subcontract Technical Representative |
| SWPPP | Storm Water Pollution Prevention Plan |
| TA | Technical Area |
| TD | Total Depth |
| TOC | Total organic carbon |
| TPMC | TerranearPMC |
| WCSF | Waste Characterization Strategy Form |

# 1.0 INTRODUCTION

## 1.1 Background

TerranearPMC has been contracted to install an intermediate monitoring well by Los Alamos National Security (LANS) Environmental Programs (EP) Directorate. The intermediate well (designated as CdV-9-1(I)) will be located within Los Alamos National Laboratory (LANL) Technical Area (TA) 9 in Los Alamos County, New Mexico (Figure 1). All work will be performed under the statement of work (SOW) and in accordance with the Compliance Order on Consent (March 2005, revised 2008) between the New Mexico Environment Department (NMED) and the United States Department of Energy (DOE)/LANL, and the Drilling Work Plan for Well CdV-9-1(I) (LA-UR-13-20779).

Well CdV-9-1(I) will be installed as part of the Environmental Programs TA-16 monitoring network. The CdV-9-1(I) well will be installed at a depth of approximately 1220 feet (ft) below ground surface (bgs). CdV-9-1(I) will be drilled deep enough to collect representative samples from any perched intermediate aquifer that may be encountered and selected for well screen placement. Well CdV-9-1(I) is tentatively designed with one well screen within Puye Formation deposits. Final well design will be determined based on conditions found during drilling and geophysical logging and will incorporate discussions with NMED.

This Field Implementation Plan (FIP) provides guidance for drilling, sampling, borehole geophysics, well installation, well development, aquifer testing, and sampling system installation. Project staff, health and safety, waste management, security, schedules, and required permits are also discussed in this document.

## 1.2 Objectives

The CdV-9-1(I) monitoring well is intended to provide hydrogeologic and groundwater quality data to achieve specific data quality objectives consistent with the Groundwater Protection Program for the Laboratory, the Compliance Order on Consent, and the NMED approved workplan. Specifically, CdV-9-1(I) is being installed to augment the existing network to better define RDX contamination flow paths above and within the regional aquifer north of Canon de Valle. The primary purpose of CdV-9-1(I) is to provide groundwater monitoring for high explosives and other potential contaminants within intermediate perched groundwater networks above the regional aquifer downgradient of the 260 Outfall and beneath infiltration pathways associated with Canon de Valle, as required by the NMED's Approval with Modifications, Drilling Work Plan for Intermediate Well CdV-9-1(I).

Secondary objectives are to collect drill-cutting samples, acquire borehole geophysical data, and possibly sample potential perched groundwater zones, if present.

The end-users of the data collected from this project will be LANL, DOE, NMED, and the general public.

# 2.0 ORGANIZATIONAL STRUCTURE

This project is being performed for LANS. The LANL Environmental Programs Drilling Subcontract Technical Representative (STR) will assist with obtaining the necessary LANL-required permits and assist with scheduling and logistical issues.

An organizational chart is presented in Table 1.

### 2.1 TerranearPMC Project Management Team

The TerranearPMC Management Team consists of the Program Manager, Project Manager (PM), Drilling Superintendent, Environment, Safety and Health (ES&H) Representative, and Quality Assurance (QA) Manager. The Management Team will review all task order work plans, ensure compliance with QA, ES&H plans, and perform project audits of ongoing work.

The Management Team will also provide technical assistance to the Field Team. In addition, they will provide health and safety oversight and quality control guidance for well-construction and procedure compliance.

The ES&H Representative will provide health and safety related technical assistance and senior review of all project specific safety plans. He will also conduct project site safety inspections. The TPMC and LANS Management Team key personnel and their respective roles are detailed in Table 2.

### 2.2 Field Team

TerranearPMC's field team personnel and their respective roles are shown in Table 2. Additional qualified staff may be added as necessary to ensure all project requirements are met. These staff will be identified and their roles assigned before work begins.

During the drilling operations, there will be two onsite TerranearPMC personnel. One geologist will be onsite full time as the Field Team Leader (FTL)/Person in Charge (PIC) and lead site geologist. The other TerranearPMC team member will assist the FTL as needed. The field geologists will maintain field notes detailing daily site activities, compile and submit daily field reports, document down-hole tools, collect samples, conduct lithologic logging, document wastes generated, and conduct daily safety meetings and equipment inspections. The FTL/PIC will be the main point of contact at the site.

Field operations will run 12-hours a day, seven days per week with one shift throughout the duration of the borehole drilling phase of the project. After borehole drilling is finished, it is anticipated that work shifts will be 12-hour day shifts only for the remaining tasks (i.e. well construction, well development, aquifer testing, and sampling system installation). Shift timing is yet to be determined. TerranearPMC staff will rotate shifts on a regular basis. TerranearPMC field team members will be interchangeable and their exact scheduling is expected to be flexible.

### 2.3 Drilling Subcontractor

Boart Longyear will be the drilling subcontractor supporting the drilling, well installation, and development of CdV-9-1(I). The drilling subcontractor will be responsible for site safety, consistent and adequate sample recovery, ensuring that equipment is appropriate for the goals of the drilling project and in proper working order, and that daily drilling logs are maintained.

## 3.0 FIELD ACTIVITIES

Field activities will include well drilling, sample collection, down-hole geophysical characterization, well installation, well development, aquifer testing, permanent sampling system installation, and surface completion. The Drilling Work Plan for Well CdV-9-1(I) (LA-UR-13-20779) will be used to guide field operations and ensure all objectives are met.

### 3.1 Well Drilling

Drilling equipment and supplies for the completion of the project will be staged around the work site in an organized and secure manner. Surplus and/or inactive equipment and supplies may be stored at the LANL drilling project laydown yard located at the northwest corner of Pajarito Road and New Mexico State Road 4. Access to the laydown yard is through a locked gate.

#### 3.1.1 Mobilization

Mobilization will consist of transporting and setting up equipment at the location. Mobilization will include the following:

- Mobilize drill rig, trailers, support vehicles, drilling tools and materials, and well construction materials to the drill site.
- Stage alternative drilling tools and construction materials at the laydown yard.
- Entrance radiological screening of all equipment and tooling by RP-1.
- Set up drill rig, trailers, support vehicles and tools at the location. Figure 2 presents a typical drilling site layout.
- Review scope of work and project-specific health and safety issues with crew.
- Complete all required training for all personnel.
- Obtain Facility Operations Director (FOD) Work Authorization, including rig inspection and Integrated Work Document (IWD) review.

The CdV-9-1(I) site will be accessed from the TA-15 access road. The water source for the project has been identified as a fire hydrant at TA-14 near regional monitoring well R-47.

#### 3.1.2 Drilling Methods

The STR will be notified in writing approximately 24 hours prior to commencement of drilling activities. The CdV-9-1(I) borehole will be drilled with a Foremost DR-24HD drilling rig. Specifications for this machine may be found at Foremost's website (http://www.foremostmobile.com/index.php). At least two auxiliary air compressors will be utilized along with the rig's deck compressor. A Pulstar P-100k pump hoist will be used to build and develop the monitoring well.

The CdV-9-1(I) borehole will be initiated by setting a removable 20-inch conductor casing into competent tuff at an approximate depth of 20 to 60 ft bgs. Dual rotary methods will be used to set the conductor casing. The 20-inch casing will be removed with the drill rig upon completion of drilling activities.

A 17.5-inch open hole will then be drilled to below the bottom of the first potential intermediate perched groundwater interval at approximately 110 ft bgs. If groundwater is present, the interval will be sealed by cementing. The saturated portion of the borehole will be filled with a sand/cement mix with calcium accelerators and allowed to cure. The cement will then be redrilled before continuing with borehole advancement. The 17.5-inch borehole will be advanced to approximately 695 ft bgs where the use of foaming agents will be terminated, or as far as reliable open hole drilling conditions will allow without the use of foaming agents. A string of 16-inch drill

casing will then be installed and advanced using dual rotary methods to approximately 900 to 950 ft bgs. If perched intermediate groundwater was encountered above the terminus of the 16-inch casing, the casing will be sealed with bentonite at the bottom before cutting off the drive shoe. If the bottom of the 16-inch casing should be located within a perched intermediate interval at the projected terminating depth, every effort will be made to advance the 16-inch casing below the saturated interval in order to seal the casing before continuing.

The borehole will be completed to total depth using 12-inch casing and dual rotary drilling methods. An intermediate perched aquifer will be the target for the well screen interval and is expected to be encountered above 1220 ft bgs. The total depth of the borehole is expected to be 1220 ft bgs. The 12-inch casing will be advanced to a depth greater than the bottom of the well's filter sand interval so that the drive shoe can be cut off and isolated in bentonite during well construction.

Figure 3 presents the anticipated geology and intermediate perched groundwater intervals.

### 3.1.3 Proposed Alternative Drilling Methods

Drilling conditions may require converting to alternative methods. Consultation with the LANL STR will precede any deviations from the above referenced drilling methods. Conventional dual-rotary, air rotary, and casing advance will be the primary drilling methods employed at the CdV-9-1(I) borehole.

### 3.1.4 Drilling Additives

Potable water from a municipal source will be used to cool the drilling tools, help evacuate cuttings from the borehole and suppress dust from the discharge of dry returns. Filtered compressed air will be the primary circulation 'fluid' for returning cuttings to the surface. Descriptions of potential drilling foaming agents are as follows.

- AQF-2®: Added at a rate of 0.5 to 2.0% by volume. AQF-2 is an anionic surfactant that is added to fresh water for air/foam, air/gel-foam, or mist drilling applications. AQF-2 is the newest foaming agent in the Baroid line and is the preferred foaming agent for environmental drilling applications.

- Quik Foam®: Added at a rate of 0.5 to 1.0% by volume. Quik Foam provides the surfactant necessary for foam formation.

Complete records will be maintained detailing the type, amount, and volume of drilling fluid used and the depths at which drilling fluid is added to the borehole. No drilling fluids, except potable municipal water, will be used within 100 ft of the first perched aquifer at 795 ft bgs. If the target aquifer cannot be reached without the addition of drilling fluids, the situation will be discussed with LANL and NMED.

Portland Type I/II cement with either no aggregate or a small amount of sand may be used for sealing perched groundwater intervals or managing unstable borehole conditions, if encountered. Hydrated bentonite chips may be used for sealing perched groundwater intervals. The LANL STR will be contacted for approval before any perched groundwater zone is sealed off.

### 3.1.5 Decontamination

Decontamination of the drill rig and tools will be performed by hot water/steam pressure washing before arriving onsite prior to the start of drilling activities and before leaving the site. Decontamination water will be containerized in 55-gallon drums, properly labeled and stored onsite. Decontamination of sample tools will be performed with a wire brush followed by spraying with Fantastik® and wiping clean with paper towels. Bailers will be washed with LiquiNox® detergent and potable water and rinsed prior to sample collection.

Decontamination will be conducted in accordance with TPMC SOP-7007.

A listing of relevant standard operating procedures (SOPs) for the CdV-9-1(I) field project is presented in Table 3.

### 3.1.6 Demobilization

Demobilization activities will include:

- Final decontamination and screening for radioactivity by RP-1 of the drill rig, tools, and support equipment.
- Loading and removal of the drilling tools, including alternative tools, from the site.
- Removal of the drill rig and support vehicles from the site.
- Staging and securing of investigation derived wastes (IDW) for future disposition.
- Removal of municipal waste (e.g. materials packaging).
- Final site cleanup.

The LANL STR will inspect the site prior to final demobilization of the drill crew. Final demobilization of the drill crew will not be permitted until the condition of the site is acceptable to the STR.

## 3.2 Groundwater Detection

Perched water is expected at this location based on previous drilling observations and geophysical studies. The potential depths of groundwater are 90-115 ft bgs and essentially at any depth below 795 ft bgs. The STR will be notified within approximately 100 ft of target aquifer depth of 795 ft bgs. Review of fluids used to date and a check of systems for remaining drilling to reach 1220 ft bgs will be conducted.

The primary indicator for perched water will be driller's observations. If the driller notes any indication of groundwater, drilling will stop, the drilling tools will be removed from the borehole and the presence of water will be verified using a water level meter. Alternatively, if the drill tools employed allow, the presence of water may be verified through the tooling without removal from the borehole. If water exists in the borehole the tools will either be pulled from the borehole or remain out of the hole to allow the field team to check for accumulation of water in the borehole.

The following guidance will be applied when the field crew has determined that the borehole is being drilled within a saturated interval:

- Upon reaching 40 ft of saturation (2 casing joints), the drilling tools will be removed and the casing will be pulled up 1 ft in order to monitor water levels for up to four hours;
- Water levels will be measured and monitored for up to four hours every 60 ft of drilling in all continuously saturated intervals. This will require the removal of the drilling tools and pulling the casing up 1 ft;
- After encountering and advancing the borehole through a saturated interval and drilling through a dry interval and saturation is re-encountered, then remove the drill tools and measure water levels at the current casing break.

The LANL STR will be notified within four hours of perched groundwater detection or by 10 AM of the following day if the detection was made during the night shift.

Groundwater measurements will be conducted in accordance with TPMC SOP-7008.

### 3.3 Sample Collection Procedures

All samples will be collect by the TPMC field team and transported to the SMO and/or LANL Earth and Environmental Sciences Division (EES) Geomaterials and Geochemistry Research Laboratory (GGRL), as appropriate. A 'samples collected' table will be maintained electronically and submitted to the STR at the conclusion of each phase of the project.

Sample collection and handling will be conducted in accordance with TPMC SOP-7001, SOP-7002, SOP-7004 and SOP-7005.

#### 3.3.1 Groundwater Screening and Groundwater Characterization Sample Collection

A groundwater screening sample will be collected for metals/cations, anions, tritium, NMED explosives suite, and RDX analyses at the first water encountered, at an anticipated depth of 795 ft bgs regardless of drilling methodology (i.e. open hole or casing advance). Subsequent groundwater screening samples will be collected for RDX analysis after each 20 ft section of borehole advancement (i.e. after each section of drill rod and casing has been advanced). A RDX screening sample will also be collected from the uppermost perched interval (95 -115 ft bgs) if present. The screening samples will be collected upon start-up of the following piece of casing advancement after establishing circulation and after unloading whatever column of water may exist in the bottom of the borehole.

Samples will be collected from the well screen interval at the end of well development and during aquifer pump testing. Development samples will be analyzed for total organic carbon (TOC) only by GGRL. Two RDX screening samples will be collected during aquifer testing.

See Table 4 for analytical suites, container size, and preservation.

Groundwater sampling will be conducted in accordance with TPMC SOP-7014. Sample collection and handling will be conducted in accordance with SOP-7001, SOP-7002, SOP-7004 and SOP-7005.

Groundwater characterization samples will be collected from the completed well between 10 and 60 days after well development in accordance with the Consent Order. The samples will be analyzed for the full suite of TA-16–related constituents, including tritium; metals/cations; general inorganic chemicals; volatile organic compounds; semivolatile organic compounds; high explosive compounds, including hexahydro-1,3,5-trinitro-1,3,5-triazine and related

degradation products; as well as stable isotopes. This sampling event will be performed by others and is not a part of this field implementation plan.

### 3.3.2 Cuttings Samples

Cuttings will be collected from the discharge line at 5-ft intervals. The cuttings will be examined to determine lithologic characteristics and will be used to prepare lithologic logs. Portions of the cuttings will be wet sieved (using #10 and #35 mesh) and placed in chip trays along with unsieved cuttings. The sieved fractions in chip trays will be submitted to the LANL archive. Lost circulation zones with no cuttings returns will be indicated by empty chip trays and cuttings-loss markers (core boxes) labeled 'no returns'. The remaining bulk cuttings will be sealed in Ziploc® bags, labeled, and archived in core boxes. The core boxes and chip trays will be delivered to the LANL archive at the conclusion of drilling activities. A summary of cuttings sampling is presented in Table 5.

Cuttings sampling will be conducted in accordance with TPMC SOP-7006, SOP-7009, and SOP-7010.

## 3.4 Down-Hole Geophysics

The CdV-9-1(I) borehole may be logged with LANL-owned geophysical tools as requested during drilling. It is anticipated that LANL geophysical runs will be coordinated with specific drilling targets (e.g. upon reaching TD or before hanging a casing string in an open portion of the borehole). Additionally, the LANL-owned down-hole video camera may be used to evaluate and remedy adverse conditions.

Subcontract geophysical logging may be performed in the CdV-9-1(I) borehole by Schlumberger Water Services. If requested, Schlumberger will log the entire borehole after TD is reached. Alternatively, Schlumberger may be called to log the upper portion of the borehole if perched intermediate saturation is encountered. If requested, drill casing may be extracted in order to evaluate borehole stability. If the borehole is stable, an open hole logging suite will be collected.

The following cased-hole Schlumberger geophysical suite may be run in the CdV-9-1(I) borehole:

- Natural and Spectral Gamma Logs
- Elemental Capture Sonde (ECS)
- Accelerator Porosity Sonde (APS)
- Triple Litho Density
- Litho Scanner

In the event that the borehole is open, the following open-hole Schlumberger geophysical suite will be performed:

- Natural and Spectral Gamma Logs
- Accelerator Porosity Sonde (APS)
- Formation Microimager (FMI); can only be operated below the water table

- Array Induction
- Combinable Magnetic Resonance (CMR)

The logs will be used to characterize the hydraulic properties of saturated rocks within the aquifer and to help select the well screen interval. The geophysical logging operation will consist of one mobilization after reaching the total depth for CdV-9-1(I). Personnel from RP-3 will perform radiological screening and documentation of Schlumberger's down-hole radioactive source tool(s) upon arrival and prior to departure. If logging is conducted in an open hole, no radioactive sources will be used; however, RP-3 will be notified. A TPMC field crewmember will be present during logging operations to oversee logging runs and calibration checks.

Schlumberger will process the geophysical logs and provide a preliminary interpretation within 24 hours of completion. Five copies of the raw field geophysical logs and a compact disc (CD) containing the field logs (in .las format) will be provided to LANL immediately after completion of logging. Final logs, electronic files, and montages will be provided in the well completion report.

The drilling subcontractor shall assist in hanging a sheave from the rig mast or tophead for wireline access to the borehole during all geophysical logging operations.

Geophysical logging will be conducted in accordance with TPMC SOP-7011.

### 3.5 Well Installation and Completion

One well screen is tentatively designed to be placed between above 1220 ft bgs within Puye Formation. Data from screening samples and the lithologic, geophysical, and video logs will be used to determine the exact placement of the screened interval of the well. LANL will provide an approved well design to TPMC prior to the start of well installation. Final well design will be based on data review and discussions between TPMC, EP, DOE and NMED.

The total well screen length and well construction details will be based upon site-specific conditions and will be approved by the LANL STR in writing before the start of well construction. NMED will approve the design prior to well construction.

#### 3.5.1 Well Construction

The well will be constructed of 5.0-in. inside diameter (ID)/ 5.56-in outside diameter (OD), type A304, passivated stainless steel casing fabricated to ASTM A312 standards provided by LANS. The screened interval of the well will consist of nominal 11-ft length(s) of 5.3-in OD, 0.040-in slot, rod-based wire wrapped well screen. Each well screen segment has an effective screen length of 10 ft. Stainless-steel casing will be installed below the bottom-most well screen to provide up to a 20 ft sump with a threaded end cap. External couplings, also of type A304 stainless steel fabricated to ASTM A312 standards, will be used to connect individual casing and screen joints. All well screen and casing will be thoroughly washed/ decontaminated before use and wrapped in plastic if staged after washing. Centralizers will be placed 2-ft above and below the well screen. A secure cap will be welded or threaded onto the top of the well casing to prevent backfill materials from entering the well during construction.

A tremie pipe will be used during well construction to gravity feed the annular fill materials. The bottom of the borehole will be tagged at the beginning of well installation and bentonite chips will be placed from the bottom of the borehole to within 5 ft of the bottom of the screened interval. The well shall be supported from the top at all times during construction. Drill casing will be

extracted with hydraulic casing jacks and rings/slips. The drill casing will be removed in 20 ft sections and staged onsite for removal after well construction is completed.

The primary filter pack of the screened interval will consist of 10/20 sand and will be placed approximately 5 ft above and below the screened interval. The primary filter pack material and interval will be based on site-specific data. After placement, the screened interval will be swabbed to promote settling and compaction of the primary filter pack. A two to five foot thick collar of finer-grained (20/40) sand will be placed above the primary filter pack.

A bentonite seal consisting of 100 percent bentonite chips or uncoated pellets will be placed above the fine sand collar. Potable water will be used to transport the materials down-hole.

Backfill material will consist of bentonite chips to fill the borehole annulus to within 100 ft of the ground surface. Neat cement, or other approved mix, will be used to fill the remainder of the borehole annulus. The depth to annular material will be measured periodically to determine that the materials are settling properly.

The STR will be notified approximately 24 hours prior to well casing installation and backfilling of borehole/annulus.

Well construction will be conducted in accordance with TPMC SOP-7012.

### 3.5.2 Well Development

Development of CdV-9-1(I) will begin no sooner than 24-hrs after the well has been cemented to approximately 3-ft bgs. The primary objective of well development is to develop the filter pack and remove suspended sediment from the well until water quality parameters are stable, turbidity is less than 5 nephelometric turbidity units (NTUs) for three consecutive samples collected at 30-minute intervals, and twice (200%) the volume of water introduced into the aquifer during drilling, construction, and development is removed . Additional water quality parameters to be measured during development include pH, temperature, specific conductance, dissolved oxygen, and total organic carbon (TOC). If the turbidity standard is not attainable, an alternate standard of stabilization of pH, temperature, conductivity, dissolved oxygen, and a TOC level of less than 2.0 parts per million (ppm) must be achieved before termination of development procedures. Water will be collected daily in 40-ml septum vials and transferred to the LANL EES-14 laboratory for TOC analysis. Samples will be submitted unfiltered and without preservatives.

Development of the well will begin by bailing and swabbing the screened intervals and sump to remove any backfill and/or formation materials that have been introduced into the well during drilling and well construction and clean the filter pack. Bailing will continue until water clarity visibly improves.

The screened interval will be swabbed using a surge block to enhance filter pack development. The surge block will consist of a 4.75-in. OD, 1-in. thick nylon (or similar) disc attached to a weighted static rod operated on a wireline. The swabbing tool will be lowered into the well and drawn repeatedly across the screened interval for approximately 1 hour. Water turbidity will not be measured during the bailing and swabbing process.

A 4-in. diameter submersible pump with an appropriately sized pump motor will be used for the final stage of the well development. The submersible pump used during development will be a larger unit, capable of moving larger volumes (20+ gallons per minute), than the pump to be installed for the dedicated sampling system. The pump intake will be set at multiple depths within

the screened intervals and in the sump to remove as much suspended sediment as possible until the desired results (parameters) are achieved.

The use of other mechanical methods (i.e. jetting) and/or chemical well development may be discussed with LANL and NMED if water quality parameters cannot be achieved. No chemicals will be added without LANL and NMED's approval.

The STR will be notified approximately 24 hours prior to the completion of well development.

Well development will be conducted in accordance with TPMC SOP-7013 and SOP-7014.

### 3.5.3 Aquifer Testing

Aquifer pump testing will be considered at CdV-9-1(I) if a sufficiently robust zone is encountered. The most likely test will be a 24hr constant-rate pumping test. The aquifer test will be designed and implemented at the direction of David Schafer and Associates.

Two RDX screening samples will be collected during the aquifer test. One sample will be collected at the approximate midpoint of the test (e.g. at hour 12) and the other sample will be collected at the end of the test.

Aquifer testing will be conducted in accordance with TPMC SOP-7015.

### 3.5.4 Sampling System Installation

A dedicated sampling system consisting of an environmentally retrofitted 4-in, Grundfos® submersible pump with a 4-in, 3-phase, 460-volt, Viton fitted Franklin® submersible motor will be installed in the well. The pump size (horsepower) will be specified after well screen interval specific capacity observations are made during well development and aquifer testing.

All materials that contact the groundwater will be constructed of stainless steel, Teflon, Viton, or polyvinyl chloride (PVC). All components of the pump column will be new. The pump column will be constructed of 1-in threaded/coupled passivated stainless steel pipe. The exact composition and pedigree of the 1-in. stainless pump column will be documented in the field logbook, in the sample system receipt inspection, and in the final well completion report. A weep hole or weep valve will be installed at the bottom of the uppermost pipe joint to protect the pump column from freezing. To measure water levels in the well, two 1-in. ID, flush-threaded, schedule 80 PVC tubes will be installed to sufficient depth to set a dedicated transducer and to collect manual water levels. The PVC transducer tubes will be equipped with 9-in sections of 0.010 in. slot screen with threaded end caps at the bottom of the tubes. A vented In-Situ® Level Troll 500 transducer will be set in one of the PVC tubes. A LANL-standardized weather-resistant pump control box will be installed next to the wellhead.

The sampling system will conform to the specifications found in the LANL ADEP E&T Wells Update and the Surface Completion Details for Intermediate and Regional Wells drawing package.

The STR will be notified approximately 24 hours prior to sampling system installation.

### 3.5.5 Surface Completion

The wellhead surface completion will include a 16-in. steel outer protective casing to protect the stainless steel monitoring well. The protective casing will extend to approximately 3-ft bgs. The

wellhead completion will be a 'stick-up' with an overall height of the protective casing, including riser cap, of 3-ft, 6-in. (42-in. above concrete pad surface). The stainless steel well casing will have an overall height of 2-ft, 6-in. (30-in. above concrete pad surface). A weep hole will be installed to prevent water build-up inside the protective casing. The top of the protective casing will be fitted with a LANL supplied tamper-proof well cover plate and will be set in a 10-ft by 10-ft by 9-in.-thick reinforced concrete pad. A 10 ft long x 0.75 in. copper clad steel grounding rod will be installed in the concrete pad. A brass survey monument, imprinted with well identification information, will be placed in the northwest corner of the pad. A total of four bollards, painted yellow for visibility, will be set at the outside edges of the pad to protect the well from traffic. All four bollards will be designed for easy removal to allow access to the well.

The surface completion will conform to the specifications found in the LANL ADEP E&T Wells Update and the Surface Completion Details for Intermediate and Regional Wells drawing package.

Southwest Mountain Surveys, a New Mexico licensed professional land surveyor, will survey the well location and elevation. Survey points will include: ground surface elevation near the concrete pad, the top of the brass pin in the concrete pad, the top of the well casing, and the top of the protective casing. The accuracy of the survey data will be in accordance with NMED Regulations and LANL procedure. Survey data will be supplied to the LANL STR and will also be provided in the completion report.

### 3.6 Investigation Derived Waste

All IDW generated during implementation of this work plan will be managed in accordance with applicable Environmental Programs–Waste and Environmental Services (EP-WES) and Environmental Protection Water Quality and Resource Conservation Recovery Group (ENV-RCRA) SOPs. These SOPs incorporate the requirements of all applicable U.S. Environmental Protection Agency (EPA) and NMED regulations, DOE orders, and Laboratory requirements. Documents applicable to the characterization and management of IDW are the following:

- SOP-10021, Characterization and Management of Environmental Program Waste (http://int.lanl.gov/environment/all/docs/qa/ep_qa/ SOP-5238.pdf);
- the NMED-approved Notice of Intent (NOI) Decision Tree for Drilling, Development, Rehabilitation, and Sampling Purge Water; and
- the NMED-approved NOI decision Tree for IDW Solids from Construction of Wells and Boreholes.

A Waste Characterization Strategy Form (WCSF) will be prepared by LANS in accordance with SOP-7016 and will provide more detailed information on waste descriptions, quantities, handling, and disposition. All wastes generated during the CdV-9-1(I) project will be managed according to the WCSF.

**Table 1**
**CdV-9-1(I) Project Organizational Chart**

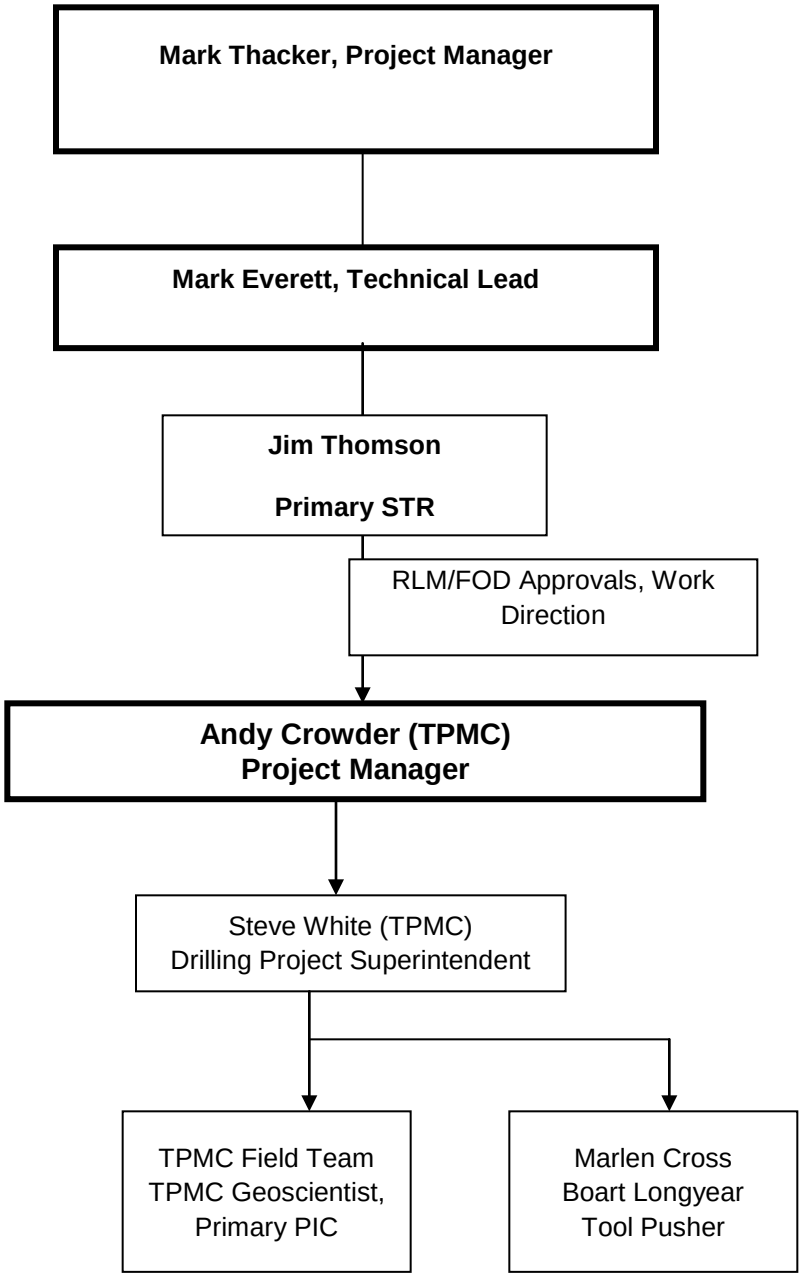

**Table 2**
**Key Team Personnel Roles and Responsibilities**

| Name | Role | Responsibilities |
|---|---|---|
| Andy Crowder | Project Manager, Alternate Person in Charge (PIC) | Project management, budget, resource commitments, and LANS interaction |
| Steve White | Drilling Superintendent, Principal Field Team Leader (FTL), Alternate PIC | Project and field management, LANS interaction, geology, and subcontractor coordination |
| Robert Brounstein | ES&H Professional | IWD and Health and Safety compliance |
| Al Whiteaker | Quality Assurance Manager | Quality assurance management oversight |
| Gary Stoopes | Environmental Professional | Regulatory compliance |
| Jim Jordan | Field Geologist, FTL/ Alternate PIC | Field management, geology, and subcontractor coordination |
| Ryan McGuill | Field Geologist, FTL/ Alternate PIC | Field management, geology, and subcontractor coordination |
| Travis Naibert | Field Geologist, FTL/ Alternate PIC | Field management, geology, and subcontractor coordination |
| Zoe Duran | Waste Team Leader | Supervise field waste personnel |
| Robert Stadeli | Boart Longyear Drilling Supervisor | Project and technical management oversight of drilling operations |
| Marlen Cross | Boart Longyear Tool Pusher | Project and technical management oversight of drilling operations |

**Table 2 (Continued)**
**Key Team Personnel Roles and Responsibilities**

| Name | Role | Responsibilities |
|---|---|---|
| Mark Thacker | Project Manager | Responsible to the Program Director for the successful execution of the project. |
| Mike Alexander | Facility Ops Director (FOD) | Facility Operations and Security Management/Coordination; When delegated authorizes and approves project work |
| Mark Everett | Drilling Project Technical Lead | Project leadership for overall drilling projects planning, coordination, oversight, execution and closeout for this project |
| Terry Forrester | Procurement Specialist, (PS) | Responsible for solicitation, negotiation, award, and administration of subcontracts and has overall commercial responsibility for respective subcontracts; designated authority to direct subcontractor |
| Jim Thomson | Primary Point-of-Contact (POC), Subcontract Technical Representative (STR) | Responsible to the Project Manager for monitoring and documenting the subcontractor's day-to-day performance, providing day-to-day oversight, assuring work is performed in a safe manner. STR is the single Point-of-Contact for interaction between LANS and Subcontractor. |

**Table 3**
**TPMC Project Specific Standard Operating Procedures (SOPs)**

| TPMC SOP | Title |
|---|---|
| SOP-7007 | Field Decontamination of Equipment |
| SOP-7008 | Manual Groundwater Level Measurements |
| SOP-7001 | Sample Control and Field Documentation |
| SOP-7002 | Sample Containers and Preservation |
| SOP-7004 | Handling, Packaging, and Transporting Field Samples |
| SOP-7005 | Field Quality Control Samples |
| SOP-7006 | Field Logging, Handling, and Documentation of Borehole Materials |
| SOP-7010 | Transportation and Admittance of Borehole Materials to the Field Support Facility |
| SOP-7009 | Field Sampling of Core and Cuttings for Geological Analysis |
| SOP-7011 | Contract Geophysical Logging |
| SOP-7012 | Well Construction |
| SOP-7013 | Well Development |
| SOP-7014 | Field Water Quality Analysis |
| SOP-7015 | Pump Testing |
| SOP-7016 | Characterization and Management of Environmental Program Waste |

**Table 4**
**Analytical Suites, Sample Containers, Sample Volume, and Preferred Laboratories for Groundwater Collection from Well CdV-9-1(I)**

| Analytical Suite | Sample Container | Sample Volume | Preferred Laboratory |
|---|---|---|---|
| **Groundwater Screening Samples** | | | |
| **First Perched Intermediate Water below 795 ft bgs** | | | |
| Metals/cations (dissolved and total) | poly | 1.0 L | EES-14* |
| Anions (dissolved, (including perchlorate) | poly | 1.0 L | EES-14 |
| Tritium (H3) | Amber glass | 1.0 L | TBD |
| NMED HEXP | (2) Amber glass | (2) 1.0 L | TBD |
| RDX** | Amber glass | 40 ml | EES-14 |
| **All Subsequent Perched Intermediate Water** (20 ft intervals) | | | |
| RDX** | Amber glass | 40 ml | EES-14 |
| **Well Development** | | | |
| Total Organic Carbon (TOC) | Amber glass | 40 ml | EES-14 |
| **Aquifer Testing** (at midpoint and end of test) | | | |
| RDX** | Amber glass | 40 ml | EES-14 |
| **Sampling System EQB*** ** | | | |
| VOCs**** | Amber glass | 40 ml | TBD |
| SVOCs***** | Amber glass | 1.0 L | TBD |

Notes:

* EES-14: LANL Earth and Environmental Sciences-Hydrology, Geochemistry and Geology Group.

** RDX: Research Department Explosive

*** EQB: equipment blank.

**** VOC: volatile organic compound(s).

***** SVOC: semivolatile organic compound(s)

**Table 5**
**CdV-9-1(I) Sample Collection Activities for Drill Cuttings**

| Sample Description | Test | Sample Size | Container | Sample Frequency |
|---|---|---|---|---|
| Cuttings | Bulk cuttings systematically collected for archival purposes and for supplemental sample needs | 500-700 ml | Plastic Ziploc™ bags | One sample every 5-ft. |
| Cuttings | Sieved cuttings for lithologic description and binocular microscope examination | Enough to partly fill trays | Plastic chip trays | One sample every cutting run (nominally every 5-ft.) Normally, an unseived sample, >10 mesh sample, and a >35 mesh sample every cuttings run. |

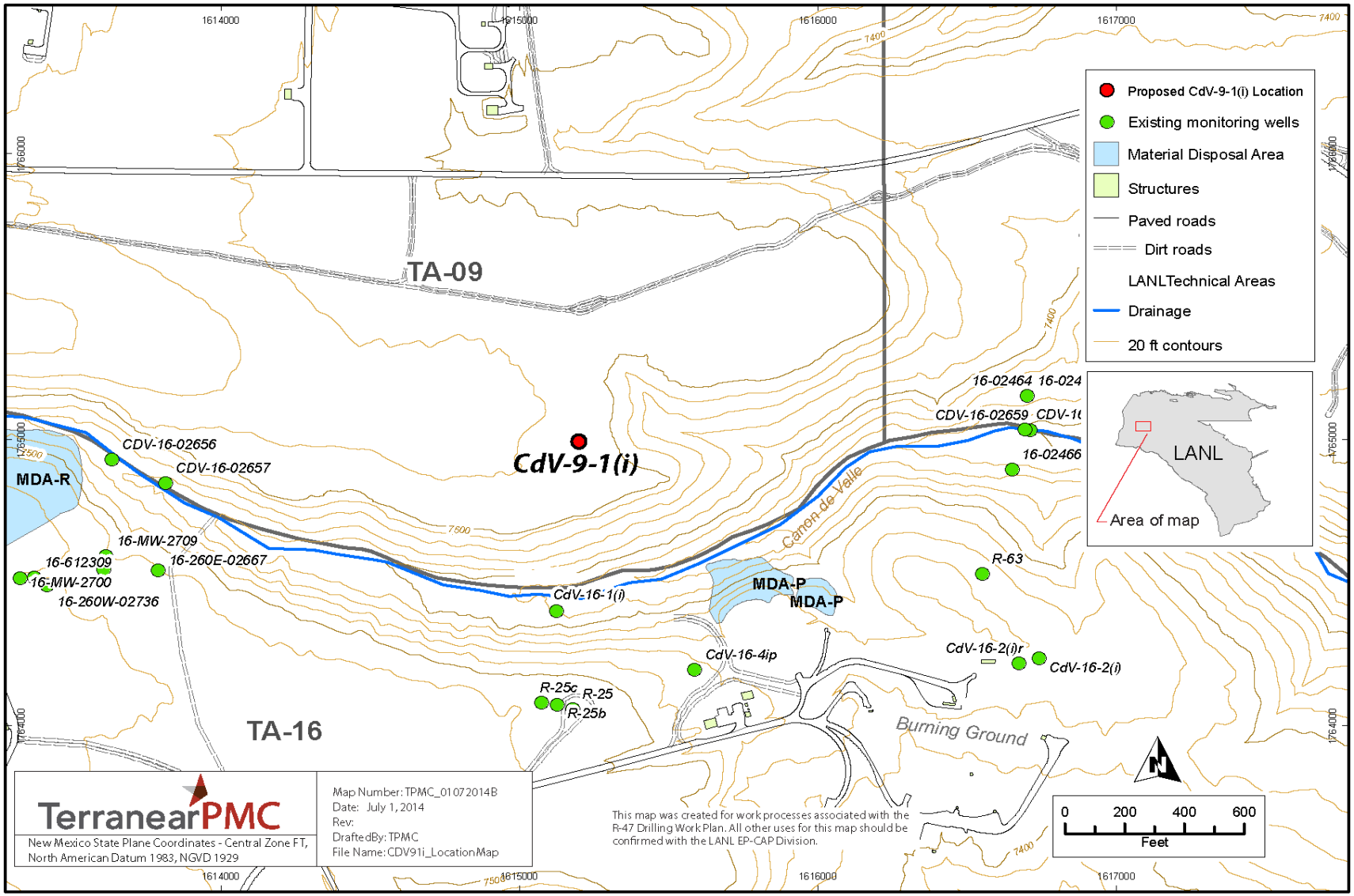


**Figure 1 Proposed location of Regional Monitoring Well CdV-9-1(I)**

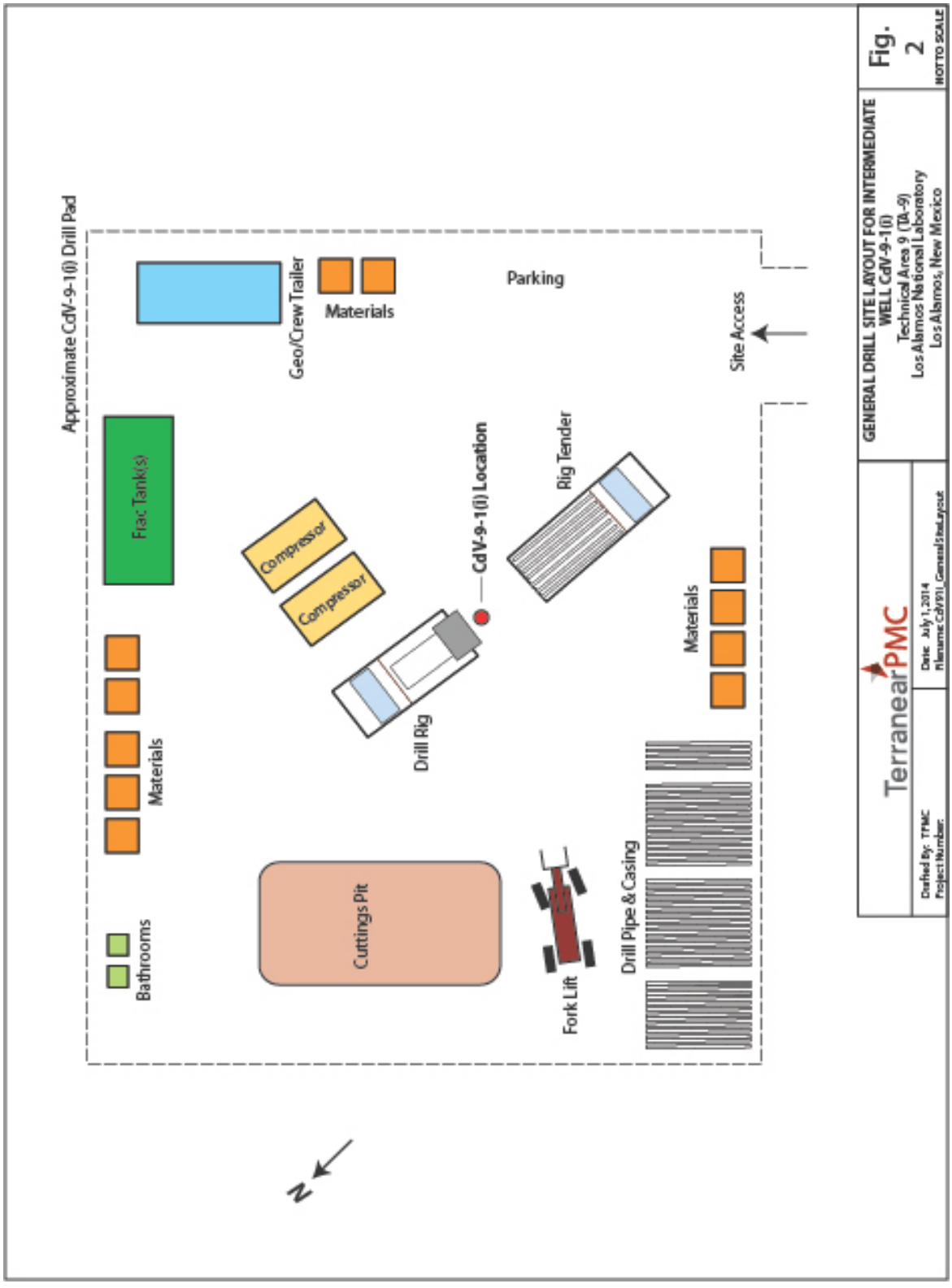


**Figure 2 General Drill Site Layout for Regional Monitoring Well CdV-9-1(I)**

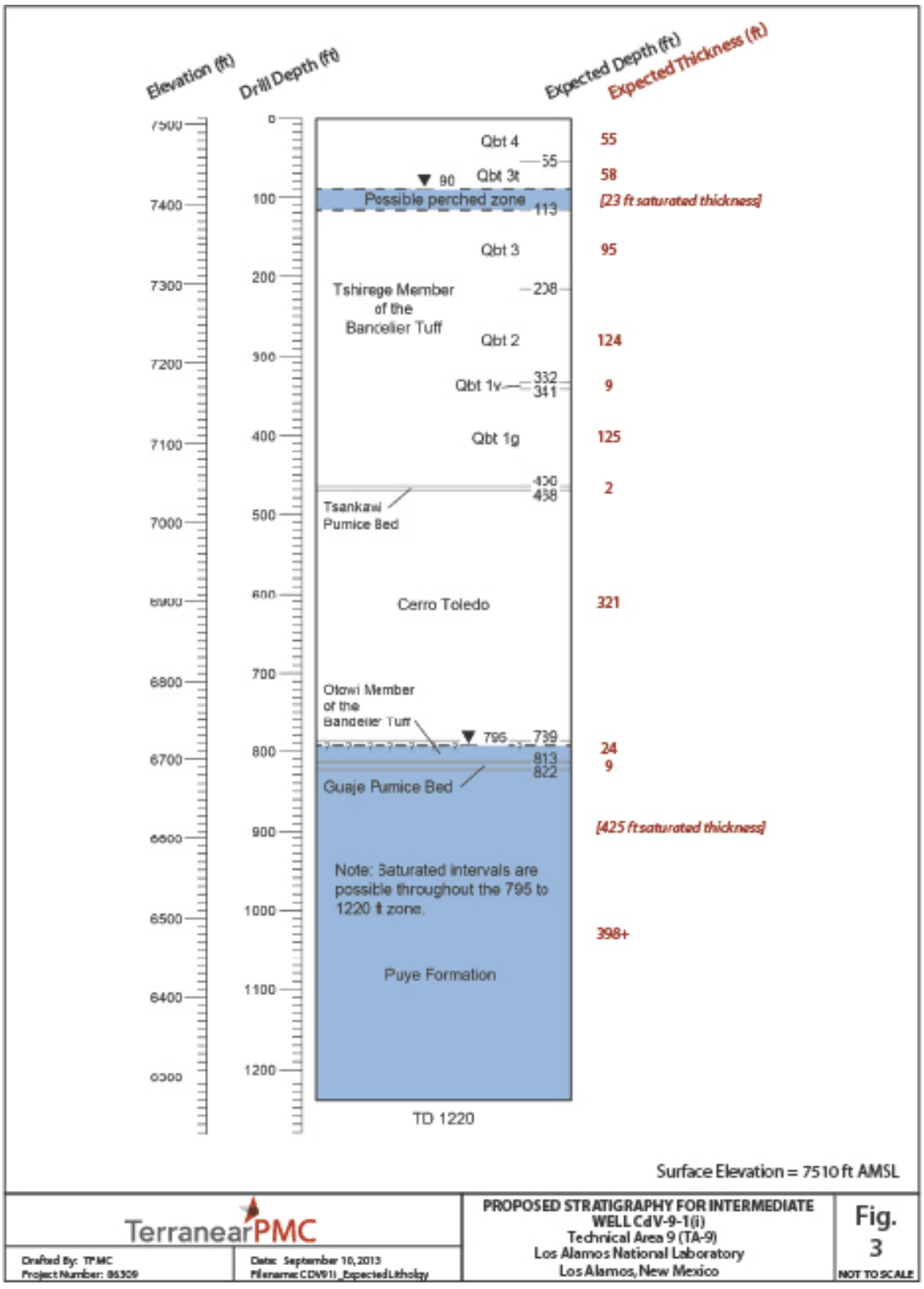


**Figure 3 Predicted stratigraphy for Regional Monitoring Well CdV-9-1(I)**