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DP-10005-CdV-16-4ip

**Installation of Well CdV-16-4ip,
TA-16, Los Alamos National Laboratory**

**Task Order 4
In accordance with
Master Task Order Agreement 72006-000-09**

Revision 1

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Approved:

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NWV Project Manager

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Date

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ACRONYMS

ACO	Access Control Office
bgs	below ground surface
DOE	Department of Energy
EES-14	Earth and Environmental Sciences Division, Hydrology, Geochemistry, and Geology Group
EP	Environmental Programs
FOM	Field Operations Manager
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSR	Health and Safety Representative
ID	inside diameter
IDW	investigation-derived waste
LANL	Los Alamos National Laboratory
LANS	Los Alamos National Security, LLC
Layne	Layne Christensen Company
LWI	LANL work instruction
NMED	New Mexico Environment Department
NOI	notice of intent
NTU	nephelometric turbidity unit
NWI	North Wind, Inc.
OD	outside diameter
PIC	person in charge
POC	point of contact
ppm	parts per million
psi	pounds per square inch
RCT	Radiation Control Technician
SMO	Sample Management Office
SOP	standard operating procedure
SSEHASP	Site-Specific Environmental Safety and Health Plan
STR	Subcontract Technical Representative
SWP	Safe Work Permit
SWPPP	Storm Water Pollution Prevention Plan
TA	technical area

TD	total depth
TOC	total organic carbon
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WCSF	waste characterization strategy form

1.0 INTRODUCTION

Los Alamos National Laboratory (LANL) Management and Operations contracted North Wind, Inc. (NWI) to manage the installation of intermediate monitoring well CdV-16-4ip. The well is being installed to provide hydrogeologic and water quality data required by the March 1, 2005, Compliance Order on Consent (Consent Order) agreed to by the New Mexico Environment Department (NMED) and the Department of Energy (DOE) for environmental remediation at LANL. NWI will complete this work for the Los Alamos National Security, LLC (LANS) Environmental Programs (EP) Directorate – American Reinvestment and Revitalization Act Project Office.

Well CdV-16-4ip is located in Technical Area 16 (TA-16) in the southwest corner of Los Alamos National Laboratory (Figure 1.0-1). The primary purpose of this well is to provide a pumping well for obtaining field-scale measurements of aquifer parameters for the deep-perched groundwater zone at Consolidated Unit 16-021(c)-99 (260 Outfall) (LANL 2010, LA-UR-10-2147). Data from pumping coupled with the response in nearby wells, will be used to assess the potential for pumping and treatment of the contaminated perched groundwater. The secondary purpose of CdV-16-4ip will be directed toward contaminant detection, characterization, and monitoring with reference to replacing the upper screens in well R-25 (NMED 2010).

The depth to the top of the perched-intermediate groundwater is expected to be approximately 715 ft with a thickness of up to 420 ft. Based on information from surrounding wells, the perched zone at CdV-16-4ip is expected to occur within the tuffs of the Otowi Member of the Bandelier Tuff and in sedimentary deposits of the underlying Puye Formation. Data from wells and drilling in the TA-16 area indicate the perched groundwater system is characterized by a series of saturated horizons separated by unsaturated strata. The specific nature of vertical connection between the perched groundwater system and the regional aquifer is not known.

The target depth for the CdV-16-4ip borehole is approximately 1150 ft. The well design includes two screens, each 40 to 60 ft in length, within the perched groundwater zone. The current design includes placement of the upper screen near the top of saturation in the Otowi Member of the Bandelier Tuff, and the lower screen in the productive zone of sedimentary deposits in the Puye Formation (See Section 2.8). Final well design will be based on hydrogeological conditions encountered during drilling, and a revised well design document will be submitted to the New Mexico Environment Department (NMED) for approval before well construction.

A more in-depth discussion of the objectives for the drilling and well design of CdV-16-4ip, as well as the hydrogeologic conceptual model in the TA-16 area, can be found in "Drilling Work Plan for CdV-16-4ip" (LANL 2010, LA-UR-10-2147). Approval of the Drilling Work Plan was provided by NMED in May, 2010 (NMED 2010).

1.1 Program Management and Operations

1.1.1 Project Staff

Tables 1.1-1 and 1.1-2 indicate the project roles, staff, and responsibilities for NWI project personnel and LANL project personnel, respectively. The overall project organization of the field personnel is shown on Figure 1.1-1. Additional qualified and experienced staff, both existing and new, may be added after submitting this drill plan. With approval of the LANL Subcontract Technical Representative (STR), staff will be identified and roles will be assigned prior to commencement of field work.

Project management, administration, and quality assurance oversight will be conducted out of NWI's Los Alamos, New Mexico office. The Field Operations Manager (FOM) or designee will provide oversight and will review ongoing operations as they relate to this drilling plan and will assist the drilling team with any technical, operational, or other project related issues.

During each drilling shift, a minimum of one NWI personnel will be present at the drill site. The Field Geologist will have the following responsibilities:

- Maintain detailed field notes describing general drill site activities;
- Compile and submit daily reports and drilling forms (examples included in Appendix A);
- Record down-hole tool types and lengths;
- Conduct lithologic logging;
- Conduct daily safety meetings; and,
- Inspect equipment.

The FOM and/or Field Geologist will also be responsible for compliance with established health and safety documentation and will serve as the alternate Health and Safety Representative (HSR) in the absence of the designated project HSR.

A person in charge (PIC) will be designated at all times during field operations. The PIC is responsible for interaction with LANL personnel and other visitors to the site. Ordinarily, the PIC will be the FOM. In the event that the FOM is not present, the following person(s) will be designated to act as the PIC in this order:

- Lead NWI Field Geologist,
- Associate NWI Geologist / Environmental Scientist.

During an emergency situation, in the absence of on-site NWI personnel, the following person(s) will be designated to act as the PIC in this order:

- Drilling Supervisor (tool pusher);
- Driller.

1.1.2 Health and Safety Training

Though not anticipated to be a hazardous waste site, NWI will have personnel on site that are trained in the requirements of Occupational Safety and Health Administration Hazardous Waste Operations and Emergency Response (HAZWOPER). In addition, at least two site personnel will be trained in first aid/cardiopulmonary resuscitation.

Additional project and site-specific training is documented in the Site Specific Environmental, Health, and Safety Plan for Task Order #4 (SSEHASP-10005-004). Before mobilization into the field all staff will be trained to these requirements.

1.1.3 Security and Traffic Control

Well CdV-16-4ip is located within the limited access area of TA-16, but may include TA-15 if the alternate CdV-16-4ip lay-down area on R-Site Road is used. Security escorts will be required for entry (one escort per a maximum of five individuals on site). At least two security escorts per shift will be necessary. The escorts will maintain a log of personnel on site at all times.

No personal cell phones or electronic communication devices are allowed in TA-16 or TA-15. Communications will be conducted using two-way radios provided by the LANL Environmental

Programs – Field Services and a two-way radio and/or pager provided by the TA-16 Access Control Office (ACO). A LANL-issued cellular phone will be provided for emergency use only. The cellular phone will be stored with the batteries removed to comply with TA-16 security regulations. Restrictions on smoking, eating, welding, and cellular phone use will be enforced. Combustion powered equipment will be equipped with spark arresters on the exhaust systems, as necessary.

A security zone will be established and constructed of high-visibility safety fencing surrounding the drill site. All site personnel will remain within the security zone, and at least one security escort will be present within this area at all times. If un-cleared site personnel leave the security zone, an escort must accompany them. Site personnel must always remain within sight of the security escort. Security requirements are further outlined in Appendix B.

There are no roads requiring access control passing through the well site. One road accessing the well site will be marked with signs establishing the PPE and visitor sign-in requirements for entry onto the site. Access to existing LANL sampling locations in Cañon de Valle can be accessed by skirting the well site on an existing roadway. If sampling personnel must pass through the drill site boundaries, they will be required to sign in and out with the NWI Person in Charge (PIC). Well site personnel and visitors will be required to park vehicles on graveled, established areas only. No parking on naturally vegetated or rehabilitated areas will be allowed. Traffic control requirements are further outlined in Appendix C.

1.1.4 Schedule

Table 1.1-3 shows the tentative well CdV-16-4ip drilling schedule. Well CdV-16-4ip is proposed for completion by September 30, 2010 (NMED 2010).

Mobilization to well CdV-16-4ip and commencement of drilling will begin on a day schedule from 11 am to 11 pm for approximately a week. The drill crew will then take a 7 day break before resuming drilling activities. All drilling and well completion operations will be conducted on a 24-hour schedule with shift changes at 7 am and 7 pm until well CdV-16-4ip is NMED complete. The remainder of operations will be conducted on a day only schedule, with an option of moving to a 24-hour schedule if necessary .

1.1.5 Permits

A National Pollutant Discharge Elimination System Storm Water Pollution Prevention Plan (SWPPP) permit has been implemented by LANL. The SWPPP notice of intent (NOI) has been submitted to the United States Environmental Protection Agency (USEPA). Other required permits have been defined as required through the LANL Permits and Requirements Identification process, including the Excavation Permit and the Spark or Flame Producing Operation Permit. Copies of permits, notifications, inspection reports, and site access authorization will be maintained at the drilling site as required. NWI will assume implementation of the LANL-provided Spill Prevention Containment, Control and Countermeasures Plan because NWI intends to maintain bulk fuel storage at the drilling site. A well permit will be obtained from the New Mexico Office of the State Engineer prior to drilling.

1.1.6 New Mexico Environment Department Field Visits

If NMED personnel visit the site, the PIC will notify the STR or other appropriate LANL personnel (Table 1.1-2). Thus, LANL personnel shall be promptly informed of NMED personnel visits to the site, and will maintain agency coordination.

2.0 FIELD ACTIVITIES

2.1 Designated Travel Route

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A designated travel route through TA-16 and TA-15, if necessary, is provided in Figure 2.1-1. This route has been provided by LANL and must be followed to avoid the potential of inadvertently entering areas at TA-16 where prior authorization is necessary.

2.2 Site Preparation and Drilling Site Maintenance

Basic site preparation will be conducted by LANL personnel prior to drill rig and personnel mobilization. This task will include construction of access roads to provide adequate passage for transporting the drilling and support equipment to the site. Construction of the drilling pads, as well as the construction and lining of cuttings pits and installation of elk fence around the cuttings pit, will also be conducted by LANL. This task will also provide work areas for the drilling crew and the scientific/engineering personnel, and will provide adequate space for the drill rig, support equipment, and temporary storage of the investigation-derived waste (IDW).

North Wind and Layne Christensen will stage drilling materials in a manner that will allow the most ergonomic, efficient, and safe work practices for the many stages of drilling operations. This will include appropriate placement of staged equipment, parking of vehicles, securing of cuttings, management of equipment, etc.

NWI will place secondary containment basins beneath the drill rig and support vehicles and equipment prior to commencement of drilling activities. Berms will be constructed to surround the work areas to prevent run-on and run-off of precipitation from the site, in accordance with the SWPPP. Rope ladders and life rings provided by NWI will be accessible and placed near the pits to be utilized in the event of an emergency.

During drilling activities, NWI will keep the drilling site and work areas safe, neat, and in orderly condition at all times. NWI will maintain temporary fencing and barricades and will be responsible for snow removal in the immediate vicinity of the drill site.

2.2.1 Radiological and High Explosives (HE) Screening

LANL will screen and clear the work zone and access roads prior to mobilization and site-preparation activities. Drilling equipment and tooling will be screened prior to mobilization to the CdV-16-4ip well site from the R-3 well site within TA-74, unless determined by LANL to be unnecessary. Radiation Control Technician (RCT) support will be provided by LANL as needed.

Any equipment (e.g., drilling tools, drill rods, casing, etc.) that has come in contact with borehole materials will be screened by a TA-16 HE Technician before removal from the drill site.

2.2.2 Field Office and Site Services

A cargo trailer will be used as a field office. Potable water for drilling will be provided to the drilling site through the use of a water truck or hose to transport water from LANL fire hydrants #619 and #620 to the drilling site. Figures 1.0-1 and 2.3-1 show the water source location for operations at well site CdV-16-4ip.

A Safe Work Permit (SWP) shall be obtained from TA-16 ACO for all motorized equipment before it enters the drill site.

2.2.3 Lay-Down Area

The Pajarito Lay-down Yard (also known as the White Rock Lay-down Yard) is the primary lay-down area for all drilling contractors. It is located on the northwest corner of the intersection of NM State Highway 4 and Pajarito Road. An additional lay-down area on 340 Loop Road near well R-48 will be used to allow for expedient access to tooling and materials. An alternate lay-down

area on R-Site Road within TA-15 will be used if necessary. The routes to the lay-down areas are shown on Figure 2.2-1.

2.3 Well Drilling

Layne Christensen Company (Layne), under contract to, and direct supervision of, NWI will drill the borehole. Necessary drilling equipment will be situated near the drill site in a safe and secure manner. The orientation and placement of this equipment will depend upon the physical constraints at the drilling site. Figure 2.3-1 shows the site layout and dimensions.

2.3.1 Drilling Method

The proposed well design schematic and anticipated stratigraphy and groundwater occurrences are depicted on Figure 2.3-2. Drilling will be conducted with methods selected to optimize the potential of completing the well without the use of any drilling additives in or immediately above the target zone of saturation. Specifically, no drilling additives other than potable municipal water will be used within 100 ft of the projected top of the deep-perched groundwater zone, expected at 715 ft bgs. A combination of casing advance and open-hole drilling methods may be employed. The determination of the preferred drilling method will be based on field assessments of subsurface conditions including but not limited to: lithologic conditions, borehole stability, occurrence of perched water, and/or loss of circulation. Each interval of open hole or casing-advance will be optimized to meet well objectives depending upon site conditions.

The borehole will be advanced using a Schramm Inc. T130XD Rotadrill dual rotary drilling rig with casing rotator. The dual rotary system will allow for advancement of the casing with the casing rotator while drilling with conventional air/mist/foam methods. Steel drive casing will be used to protect the open borehole intervals and to advance the borehole when open borehole drilling is not possible.

The subcontractor intends to install two strings of steel casing to a depth between 40 - 60 ft bgs, before attempting to advance the borehole via open-hole methods. These casing strings will include a 24-in surface conductor casing, as well as an 18-in. casing string. If required, the annular space around the outermost surface conductor casing will be sealed with backfill materials from a minimum depth of 20.0 ft bgs to ground surface in accordance with NMAC19.27.4 Well Driller Licensing; Construction, Repair, and Plugging of Wells. The borehole will be advanced via dual rotary methods from ground surface to the top of competent rock, in order to install the 24-in. surface conductor casing. The 18-in. casing will then be installed inside the 24-in. to the bottom of the 24-in. casing, and the annular space between the 18-in and 24-in casing will be sealed with bentonite at the bottom, and a welded flange at ground surface. This will decrease the annular volume between the drill pipe and inside diameter (ID) of the casing and, as a result, increase the up-hole velocity and aid cuttings returns. If possible, the borehole will then be advanced via open-hole methods using a 17-in. diameter tricone bit to 700 ft bgs, and 12-in. casing landed at this point if necessary.

Below this point, an attempt will be made to drill forward open hole to TD with a 12-in nominal tricone bit, or if conditions require it, the borehole may be under-reamed in order to advance 12-in casing. If 12-in casing advance becomes too difficult, 10-in casing will be advanced to the projected TD of 1150 ft bgs in the Puye Formation.

The top of saturation is projected at approximately 715 ft bgs in the Otowi Member of the Bandelier Tuff. The borehole will be advanced to approximately 615 ft bgs using air and potable water, with foam if necessary. At this depth, the use of drilling additives other than potable water will be discontinued, and the borehole will be advanced with only air and potable water injection.

2.3.1.1 Drilling Additives

Fluids and additives that may be used to facilitate drilling are consistent with those previously used in the drilling program at LANL and have been characterized geochemically. The fluids and additives previously authorized by NMED include:

1. Potable water from the municipal water supply, which may be used to aid in the delivery of other drilling additives and to cool the drill bit;
2. QUIK-FOAM™, a blend of alcohol ethoxy sulfates, which may be used as a foaming agent;
3. AQF-2™, an anionic surfactant, which may be used as a foaming agent;
4. Suppressor 3579™, a blend of white mineral oil and paraffin, which may be used as a de-foaming agent, and;
5. Devil Dog DF430™, a silicone emulsion, which may be used as a de-foaming agent.

Complete records will be maintained detailing the type, amount, and volume of drilling fluids used; the borehole depth where the drilling fluids are added; the estimated amount of drilling fluids in storage; and the estimated volume of drilling fluids recovered. No drilling fluids except potable municipal water will be used within 100 ft of the regional aquifer. If the regional aquifer cannot be reached without adding other drilling fluids, the situation will be discussed with LANL and NMED personnel. In addition, no other chemicals except those listed above will be added to the borehole without approval from LANL and NMED.

2.3.1.2 Dust Control

The drill rig may generate dust during dry drilling operations. Dust control will be implemented by applying potable water to the drill rig discharge line. Dust control will also be managed by sprinkling water from the water truck as needed to manage dust on the access roads and drill pad.

2.3.2 Drilling Contingencies

NWI will attempt to drill the borehole with the methods described above. However, drilling conditions may require converting to alternative drilling methods. NWI will consult with LANL before modifying the above referenced drilling methods (see Section 2.3.1.1).

Historically, borehole instability and/or the loss of drilling fluid circulation have been the most common and difficult drilling conditions encountered. In preparation for this possibility, additional tooling will be stored in the Los Alamos area to expedite the change in drilling procedures.

2.4 Core Sampling

Core samples will not be collected for CdV-16-4ip.

2.5 Groundwater Detection

Methods for groundwater detection include driller's observations, water-level measurements, borehole video, and borehole geophysics. If groundwater is detected at any point, the depth to water will be checked using appropriate methods. The LANL STR will be notified immediately when groundwater is detected. The presence of water will be verified as necessary by LANL personnel.

Depth-to-water measurements will be conducted in accordance with the following NWI SOPs:

- NWI ENVP-007, Water Level Measurements, and
- NWI ENVP-014, Sampling Equipment Decontamination.

2.6 Sample Collection Procedures

Groundwater and cuttings sample collection and handling activities are described in the following subsections.

2.6.1 Groundwater Sample Collection

Sample collection and handling activities will be conducted in accordance with the following LANL and NWI requirements and SOPs.

- Filtering and Chemical Preservation of Water Samples, ENV-WQH-SOP-066;
- Field Water Quality Analyses, ENV-DO-203;
- Groundwater Sampling, SOP-5232;
- Field Decontamination of Equipment, EP-ERSS-SOP-5061;
- NWI ENVP-002, Sample Handling, Packaging and Shipping;
- NWI ENVP-004, Collection of Quality Control Samples;
- NWI ENVP-006, Groundwater Sampling;
- NWI ENVP-014, Sampling Equipment Decontamination;
- NWI ENVP-021, Chain of Custody Documentation; and
- NWI LWI-010, Filtering and Chemical Preservation of Water Samples.

The Sampling and Analysis Plan in Table 2.6-1 details the analyte suite, container types and volumes; and, preservative, if applicable, for all the groundwater samples that will be collected in the open borehole as well as in the completed well.

2.6.1.1 Perched Groundwater Sampling

No perched groundwater screening samples will be collected during drilling of the CdV-16-4ip borehole. Screening samples will be collected during well development (see Table 2.6-1).

2.6.1.2 Regional Groundwater Sampling

Regional groundwater will not be encountered in CdV-16-4ip.

2.6.1.3 Groundwater Sample Handling Procedures

Groundwater samples will be preserved in iced coolers, and delivered to the Sample Management Office (SMO) for processing. After processing, NWI personnel or available LANL

personnel will transport the groundwater samples to EES-14 for analysis. EES-14 will provide rapid turn-around analyses for the screening analytes (see Table 2.6-1).

2.6.1.4 NMED Split Sampling

NMED personnel may perform a field visit to collect a split of the groundwater samples during drilling. The procedure for an NMED visit is as follows.

- The STR will notify NMED personnel when the drilling team detects, or is expected to encounter water-bearing zones.
- Once on-site, NMED personnel will sign the visitor's log.
- Due to restrictions outlined in the SSEHASP, it is a requirement that NMED personnel collect a split of the groundwater sample outside of the exclusion zone.
- In the case of limited groundwater volume, the appropriate LANL analyte suite outlined in Table 2.6-1 will be given priority.

2.6.2 Cuttings Sampling

Samples of cuttings generated during drilling of CdV-16-4ip will be collected from the drilling rig discharge line or cyclone. When cuttings returns are available, cuttings will be collected over the entire interval of the borehole, separated and homogenized in 5-ft intervals. The cuttings will be examined to determine lithologic characteristics and to prepare the borehole lithologic log. Sample collection of the borehole cuttings is outlined in Table 2.6-1. The sampling will be conducted in accordance with the following NWI SOPs:

- NWI LWI-001, Geologic Logging of Cuttings and Core;
- NWI ENVP-014, Sampling Equipment Decontamination; and,
- NWI LWI-011, Transportation and Admittance of Borehole Materials to the Field Support Facility.

Portions of the cuttings will be sieved using >#10 and >#35 mesh sieves and placed in chip trays along with a sample of un-sieved (whole rock) cuttings. Finer sieved sizes or bulk cuttings will be collected when >#10 mesh materials are absent. The remaining cuttings will be placed in Ziploc[®] bags (approximately 200 to 300 ml), labeled, and archived in core boxes. Cuttings will be screened by an RCT before being removed from the drilling site.

Zones where no cuttings are returned (e.g., zones of lost circulation) will be indicated by labeling the appropriate depths in the sample trays with "no returns." If foam or drilling mud is used during drilling, cuttings return lag time will be recorded. Up-borehole velocities will be calculated based on borehole diameter and fluid volumes used. Physical measurements of lag time may also be made by clean circulating the borehole, drilling a 6-in. interval, and measuring the up-borehole travel time.

2.7 Down-Hole Geophysics

As conditions allow, LANL's borehole video camera, natural gamma, and induction tools will be used to view and evaluate the open borehole prior to installing well casing in the borehole after drilling is completed. The natural gamma tool has the capability to be run in a cased borehole, and may be used to determine cased borehole characteristics, if conditions require.

If open borehole conditions exist at TD, the following geophysical logs may be conducted by Schlumberger Water Services:

- Array Induction,
- Combined Magnetic Resonance,
- Natural and Spectral Gamma,
- Accelerator Porosity Sonde (Neutron Porosity),
- Caliper log, and
- Formation Micro-Imager logs.

If borehole conditions are not stable, the following geophysical logs may be conducted by Schlumberger Water Services in the cased-hole:

- Triple Lithodensity,
- Natural and Spectral Gamma,
- Elemental Capture,
- Accelerator Porosity Sonde (Neutron Porosity), and

These geophysical logs will be used to characterize the hydraulic properties of saturated rocks in the regional aquifer, to select the well screen depth, number of screens, screen lengths, and other aspects of well construction. The suite and timing of geophysical logging will depend on borehole conditions. Alternatively, they may be used to define geologic and hydrogeologic properties of the borehole, and to determine zones of perched water.

An NWI field staff member will be present during logging operations to oversee logging runs and calibration checks. NWI will notify the STR at the start and end of geophysical logging operations, and will provide to the STR three hard copies and one electronic copy of unprocessed geophysical logs. Oversight of geophysical logging will be performed in accordance with NWI-LWI-004, Contract Geophysical Logging.

2.8 Well Installation and Completion

The top of perched saturation at CdV-16-4ip is approximately 715 ft bgs. Well CdV-16-4ip is tentatively designed with two 40-ft to 60-ft screens, with the upper screen placed within the Otowi Member near the top of the perched zone, and a deeper screen will be placed in Puye Formation approximately 150 to 200 ft below the upper screen (see Figure 2.3-2). Actual screen lengths and intervals will be determined based on data acquired during drilling, video logging, and geophysical logging.

2.8.1 Well Construction

Well casing and screen will be provided by LANL. The casing and screen will be factory-cleaned before shipment and delivery to LANL. Additional decontamination of the stainless steel components will be performed on-site prior to well construction using high pressure heated water, if necessary. Water used during decontamination will be managed as discussed in Section 2.9.

The well will be constructed of 5.0-in ID/5.563-in outer diameter (OD) type A304 passivated stainless steel casing fabricated to American Society for Testing and Materials Standard A312, "Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes." If the casing provided has beveled and welded joints, a slag apron or "witch's hat" will be placed around the casing being welded to prevent slag and welding debris from entering the borehole or well casing. Stainless steel casing will be placed below the screen to provide a 20-ft sump (to be determined by LANL). Stainless steel centralizers will be placed immediately above and below the screen(s). The well casing string will be suspended in the borehole during backfill and will not be allowed to rest on the bottom of the borehole at any time.

If drive casing is used to advance the borehole to TD, the casing shoe will be cut off prior to well installation. The casing shoe will be entombed in bentonite, with at least 5 vertical ft of bentonite between the top of the cut off section of casing and shoe and the bottom of the primary filter pack.

Steel tremie pipe (2-in ID) will be used during well construction to place annular fill materials down-hole. The bottom of the borehole will be tagged prior to well installation. Sand will be placed in the bottom of the borehole to the base of the sump, unless bentonite entombment of cut-off casing is necessary at this depth. Bentonite chips will be placed around the sump, to within 5 ft of the bottom of the screen. Potable water will be used to transport backfill materials down-hole.

The primary filter pack will consist of 10/20 grade sand and will be placed on top of the bentonite seal to 5 ft above the top of the screen. The actual primary filter pack interval will be based on site-specific conditions. After placement, the screened interval will be swabbed to promote settling and compaction of the primary filter pack. A 2-ft-thick transition zone (collar) of 20/40 grade sand will be placed above the primary filter pack.

Bentonite chips will be placed on top of the fine sand collar to approximately 60 ft bgs. The initial 3-5 foot pour of bentonite chips will be allowed to hydrate for no less than 4 hours before the emplacement of additional bentonite. Additionally, the top of the bentonite seal will be allowed to hydrate for no less than 4 hours prior to emplacement of the cement surface seal. Type I/II Portland cement, with a mixture ratio of 5.2 gallons potable water per bag, or other LANL-approved mix, will be used to fill the borehole annulus from the top of the bentonite seal to approximately 3 ft bgs. The depth to annular backfill materials will be tagged after each pour to determine that the materials are settling properly. Down-hole video and natural gamma logs may be performed by LANL personnel to confirm well construction (see section 2.7).

2.8.2 Well Development

A suitable winch line rig, pulling unit, or work over rig will be used for well development. Development of the well will begin by bailing and swabbing the screened interval and sump to remove drilling fluids, as well as formational fine-grained sediments that have been introduced into the well during drilling and installation. Bailing will be conducted using a suitable stainless steel bailer. Bailing will continue until water clarity visibly improves. The screened interval(s) will be swabbed using a surge block to enhance filter pack development. The surge block will consist of an appropriately-sized rubber disk attached to a winch line or pipe. The swabbing tool will be lowered into the well and drawn repeatedly above and below the screened interval(s) for approximately 1 hour. Water turbidity will not be measured during the bailing and swabbing process. Water produced during swabbing and bailing operations will be discharged to the cuttings pit.

Upon completion of swabbing and bailing development methods, development of the well will continue by pumping the well at an appropriate rate, dependent on well and aquifer characteristics. A 4-in.-diameter Grundfos™ submersible pump (or equivalent) with an appropriately sized pump motor will be used for the final stage of well development. The pump intake will be set at multiple depths across the screened interval(s) and in the sump to remove as much suspended sediment as possible from the well, filter pack, and formation immediately

surrounding the borehole. Water produced during pumping will be captured and stored in suitable tanks. Development water will be containerized and managed as described in section 2.9, Investigation-Derived Waste. Well development through pumping will continue until the specified water quality parameters are met: turbidity <5 NTU for three consecutive readings, TOC levels less than 2.0 ppm, and all other parameters stable.

The water quality parameters that will be monitored during the pumping stage of well development include:

- pH,
- Specific conductance,
- Temperature,
- ORP
- Turbidity, and,
- total organic carbon (TOC).

During pumping, water samples will be collected daily in 40-ml septum vials and 250-ml high-density polyethylene bottles and transferred to EES-14 for TOC and anion analyses. Samples will be submitted unfiltered and without acid preservatives. During the pumping phase of well development all parameters will be measured in a flow through cell.

2.8.3 Aquifer Testing

No aquifer testing will be performed at CdV-16-4ip.

2.8.4 Sampling System Installation

No sampling system will be installed at CdV-16-4ip as part of the drilling and well installation scope. A dedicated packer will be installed between the two screens.

2.8.5 Surface Completion

Surface completion shall be performed consistent with NWI-developed and LANL-approved procedures technically equivalent to SOP-5032 no later than 30 days after the completion of well development.

The monitoring well surface completion for CdV-16-4ip will include a 16-in O.D. steel casing to protect the stainless steel monitoring well and associated sampling equipment/cabling. Monitoring well stickup will be 3.0 ft above ground surface (2.5 ft above the height of the finished concrete surface pad). The protective casing will be installed to a minimum depth of 3 ft bgs, and the top of the protective casing will be set at 4.0 ft above ground surface (3.5 ft above the subsequently finished concrete surface pad). A 0.5-in diameter weep hole will be drilled in the base of the protective casing to prevent accumulation of water inside. Pea gravel will be placed in the annulus between the protective casing and the well to roughly 1 ft above the weep hole. The top of the protective casing will be fitted with a tamper-proof well cover plate and will be set in a 10-ft × 10-ft × 6-in-thick reinforced concrete pad (2,500 psi, minimum). The surface pad will be outsloped so that meteorologic waters will drain away from the protective casing. Four bright yellow removable safety bollards will be set near the edges the pad around the wellhead. The bollards will serve as traffic barriers but will allow access during well sampling or maintenance. A brass survey marker will be placed in the northwest corner of the pad, approximately 1 ft from the

edges of the pad, and stamped with the well name, completion date, and ground surface elevation. Figure 2.8-1 shows the projected well head and surface completion details.

A New Mexico licensed Professional Land Surveyor will survey the horizontal location and elevation of the permanent brass marker, the top of the well casing, the top of the protective outer casing, and the ground surface of the completed well. Data provided by the surveyor will be in North American Datum of 1983 State Plane Coordinate, and elevation in relation to mean sea level (National Geodetic Vertical Datum of 1929). The accuracy of the survey data will be 0.1 ft for horizontal position and to the nearest 0.01 ft for vertical elevations. Survey data will be on file with NWI and provided in the well fact sheet and the well completion report.

2.9 Investigation-Derived Waste

Ordering of sample paperwork from the SMO will be coordinated with the LANL waste generator. Investigation-derived waste (IDW) will be managed in accordance with SOP EP-SOP-5328, "Characterization and Management of Environmental Program Waste" (<http://www.lanl.gov/environment/all/qa/adeq.shtml>). This SOP incorporates the requirements of applicable USEPA and NMED regulations, DOE orders, and Laboratory requirements. The primary waste streams include drill cuttings, drilling fluids, development water, purge water, decontamination fluids, and contact waste.

Drill cuttings will be managed in accordance with the Waste Characterization Strategy Form (WCSF) and the NMED-approved "NOI Decision Tree for Land Application of IDW Solids from Construction of Wells and Boreholes" (NMED 2007). Drilling, purge, and development waters will be managed in accordance with the NMED-approved "NOI Decision Tree for Drilling, Development, Rehabilitation, and Sampling Purge Water" (NMED 2006). Initially, drill cuttings and drilling water will be stored in lined pits. The contents of the pits will be characterized with direct sampling following completion of drilling activities, and waste determinations will be made from validated data in accordance with the WCSF included in Table 2.9-1. If validated analytical data show these wastes cannot be land-applied, they will be removed from the cuttings pit, containerized, and placed in accumulation areas appropriate to the type of waste. Cuttings, drilling water, development water, and purge water that cannot be land-applied and are designated as hazardous waste will be sent to an authorized treatment, storage, or disposal facility within 90 days of containerization.

Development water, purge water, and decontamination water will be containerized separately at their point of generation, placed in an accumulation area appropriate to the type of waste, and directly sampled. Contact waste will be containerized at the point of generation, placed in an appropriate accumulation area, and characterized using acceptable knowledge of the media with which it came in contact and then properly disposed in accordance with the WCSF (see Table 2.9-1).

2.10 Site Restoration

Upon completion of well construction activities and final demobilization, LANL will perform the site restoration activities including grading, seeding, and/or replacement of vegetation per the contractor's Engineering Design Standards on seeding and site stabilization and the site-specific approved SWPPP.

3.0 REFERENCES

29 CFR 1910.120, 2002, Title 29, "Labor," Part 1910, "Occupational Safety and Health Administration," Subpart H, "Hazardous Materials," Section 1910.120, "Hazardous Waste Operations and Emergency Response," *Code of Federal Regulations*, Office of the Federal Register.

LANL, 2010, "Drilling Work Plan for CdV-16-4ip," LA-UR-10-2147, EP2010-0177, Los Alamos National Laboratory, April 2010.

LANL, 2009, Security Plan

NMAC, 2005. "Rules and Regulations Governing Well Driller Licensing; Construction, Repair and Plugging of Wells (19.27.4 NMAC)," New Mexico Administrative Code, Adopted August 31, 2005.

NMED, 2010, "Approval with Modifications Drilling Work Plan for Perched-Intermediate Pumping Well CdV-16-4ip," New Mexico Environment Department, May 2010.

NMED, 2006, "NOI Decision Tree for Drilling, Development, Rehabilitation, and Sampling Purge Water," New Mexico Environment Department, November 2006.

NMED, 2007, "NOI Decision Tree for Land Application of IDW Solids from Construction of Wells and Boreholes," New Mexico Environment Department, November 2007.

North Wind, 2009, "Environmental Programs-Wide Environmental Health and Safety Plan for Projects at Los Alamos National Laboratory, Revision 3," North Wind, Inc., January 2009.

North Wind, Inc., 2009. "Environmental Programs-Wide Standard Operating Procedures for Los Alamos National Laboratory, Revision 0," January, 2009.

North Wind, 2009, "Environmental Programs-Wide Quality Assurance Plan for Projects at Los Alamos National Laboratory, Revision 0," North Wind, Inc., January 2009.

North Wind, 2009, "Site-Specific Environmental Health and Safety Plan Drilling and Installation of Wells R-29, R-51, and R-52," NWI-10005-003, In support of Task Order 3 In accordance with Master Task Order Agreement # 72006-000-09, North Wind, Inc., November 2009.

NWI ENVP-002, Sample Handling, Packaging and Shipping, Rev. 1, North Wind, Inc.

NWI ENVP-004, Collection of Quality Control Samples, Rev. 1, North Wind, Inc.

NWI ENVP-005, Design, Installation, and Development of Monitoring Wells, Rev. 2, North Wind, Inc.

NWI ENVP-006, Groundwater Sampling, Rev. 3, North Wind, Inc.

NWI ENVP-007, Water Level Measurements, Rev. 2, North Wind, Inc.

NWI ENVP-014, Sampling Equipment Decontamination, Rev. 1, North Wind, Inc.

NWI ENVP-021, Chain of Custody Documentation, Rev. 4, North Wind, Inc.

NWI LWI-001, Geologic Logging of Cuttings and Core, Rev. 0, North Wind, Inc.

NWI LWI-004, Contract Geophysical Logging, Rev. 0, North Wind, Inc.

NWI LWI-010, Filtering and Chemical Preservation of Water Samples, Rev. 0, North Wind, Inc.

NWI LWI-011, Transportation and Admittance of Borehole Materials to the Field Support Facility, Rev. 0, North Wind, Inc.

SOP EP-SOP-5238, "Characterization and Management of Environmental Program Waste" (<http://www.lanl.gov/environment/all/qa/adeq.shtml>).

**Table 1.1-1
NWI Project Staff and Roles**

Clear and unambiguous lines of authority and responsibility for safety matters are established and maintained at all organizational levels.

Role	Name	Description
Project Manager (PM)	Doug Jorgensen, PM	Responsible for ensuring all project activities are performed safely and within applicable requirements.
Field Operations Manager (FOM)	Thomas Klepfer Brennon Orr Erik Whitmore	Primary communicator between the NWI integrated team and LANL STR. Responsible for the protection of employees, the public, and the environment. In addition, the FOM shall be responsible for following: 1) oversee the day-to-day drilling and drilling-related operations; 2) manage the project field drilling operations, execute the work plan and schedule, enforce safety procedures and site controls, and document drilling field activities; and, 3) ensure that all personnel under their supervision clearly understand their authority, responsibility, and are accountable with Conduct of Operations requirements.
Lead Geologist (LG)	Dan Osbourne Greg Kinsman Mike Whitson Andrew Feltman Stephen Thomas Bill Larzelere	Provides oversight for drilling activities, monitoring well installation, and general site management/oversight services including monitoring field conditions. In addition, the LG will be responsible for geologic logging and sample collection, waste management, daily field progress reporting, and interacting with the LANL STR.
Environmental Health & Safety Representative (HSR)	Steven Gunther Or approved alternate	The HSR, as part of the field team, shall be dedicated on-site. Personnel and shall work closely with CONTRACTOR management personnel to implement and administer SUBCONTRACTOR'S approved SSEHASP.
Health and Safety Director (HSD)	Bruce Miller	Corporate HSD responsible for NWI HSPs and SSHASP approvals.
Environmental Professional	Melanie Lamb Jon Roberson	Implements and administers SUBCONTRACTOR'S required environmental deliverables and CONTRACTOR'S environmental requirements.
Geologist/Sample Technician	Kyle Morgan Desiree Staires Randall Boyle Liz Mockbee Donny Jaramillo Richard Martinez	Perform general field activities including sampling, logging, documentation, drilling oversight, and waste management per the LG and the WMC.
Waste Management Coordinator (WMC)	Kim Oman	Responsible for segregation, characterization, packaging and management of waste generated by the project; Provides real-time support to the field team; Prepares packages for shipment, as necessary.

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Table 1.1-1 (Continued)

Role	Name	Description
Waste Management (WM) Technician	Angela Trujillo	Assists the LG and field team with supervision and implementation of waste management requirements and shall be directed in their work by the WMC.
Quality Assurance (QA) Specialist	Kitty Gandee Melanie Lamb	Assists the LG and field team with supervision and implementation of quality assurance requirements.

**Table 1.1-2
LANL Project Staff and Roles**

Role	Name	Description
Procurement Specialist	Terry Forrester	The Procurement Specialist is the authority that directs commercial or technical changes to any subcontract.
STR	Robin Reynolds (lead) Marvin Gard Dave Anderson Jim Thomson	The STR is the LANS employee with technical and performance oversight of the subcontractor's scope of work including, but not limited to, engineering, procurement, safety, quality, schedule, and coordinated execution of the work that is carried out by the subcontractor. The STR has no authority to direct commercial or technical changes to any subcontract.
Technical Lead	Mark Everett	Technical expert on-site
Environmental Health and Safety point of contact (POC)	Dave Dixon Oliver Wilton	LANS environmental safety oversight
Shift Operations Managers	Steve Pearson Greg Helland	Logistics oversight
Waste Generator	Bennie Martinez	The waste generator is the LANS employee whose act or process produces hazardous waste or whose act first causes a hazardous waste to become subject to regulation.
Waste Management (WM) Coordinator	Dave Mikkelson	The LANS WM Coordinator shall provide support as follows: 1) responsible for the segregation, characterization, packaging and management of all waste forms generated by the project; 2) provide real-time support to the field team; and, 3) prepare packages for shipment, as necessary.

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Table 1.1-3
Drilling Schedule

Activity ID		Activity Name	Original Duration	Start	Finish	2010												2011	
						July	August	S	O	N	D	J	F	ph	July	August			
LANL Drilling --T04																			
CdV-16-4ip																			
Readiness Activities																			
A1670	Contractor Preparation of Plans		7.00d	02-Jun-10	01-Jul-10														
A1680	Submit Badging Information to LANS		11.00d	25-Jun-10	25-Jun-10														
A1690	Long Lead Procurement		15.00d	02-Jul-10	16-Jul-10														
A1700	Review & Acceptance of all Plans		4.00d	02-Jul-10	05-Jul-10														
A1720	Conduct Training		2.00d	12-Jul-10*	13-Jul-10														
A1730	Equipment Inspection		1.00d	13-Jul-10*	13-Jul-10														
A1740	Notice to Deploy		0.00d		13-Jul-10														
A1750	MOV Meeting		1.00d	14-Jun-10	14-Jun-10														
A1780	CdV-16-4ip Readiness Budget		5.00d	02-Jun-10	29-Jun-10														
Mob/Re-Mob/Demob																			
A1780	Mobilize Air Rotary Rig from R-3 to Cdv-16-4ip		2.00d	14-Jul-10*	15-Jul-10														
A1810	Demob ARCA Rig Offsite from Cdv-16-4ip		2.00d	01-Oct-10	03-Oct-10														
A1840	Demob Air Rotary Rig Offsite from Cdv-16-4ip		2.00d	01-Oct-10	03-Oct-10														
A1870	Mobilize ARCA Rig from R-3 to Cdv-16-4ip		3.00d	13-Jul-10*	14-Jul-10														
A1880	Remob Workover Rig for Cdv-16-4ip Well Development		3.00d	01-Oct-10	03-Oct-10														
A1970	Remob Workover Rig for CdV-16-4ip Sample System Installation		3.00d	12-Oct-10	14-Oct-10														
A1980	Demob Workover Rig Offsite from Cdv-16-4ip		3.00d	06-Oct-10	08-Oct-10														
Site Preparation																			
A1770	Set up at CdV-16-4ip		2.00d	16-Jul-10	17-Jul-10														
Corrective Action																			
A1990	Lost Circulation or Fishing (initial NTE 10 hrs)		5.00d	21-Aug-10...	24-Aug-10														
Drilling Monitoring Wells																			
Fluid Assited Air Rotary Method																			
A1790	CdV-16-4ip Casing Advance & Drilling		41.00d	23-Jul-10*	01-Sep-10														
Mud Rotary Drilling Method																			
A2000	Alternate Mud Rotary Drilling Method (if required & Approved)		40.00d	24-Jul-10*	01-Sep-10														
Groundwater Sampling (during drilling)																			
A2010	Remove Drill Stem & Sample Groundwater if Drill Stem must be removed		58.50d	24-Jul-10*	01-Sep-10														
Logging / Wells Installation																			
Geophysical Logging																			

LANL Drilling --T04

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**Table 2.6-1
Sampling and Analysis Plan for CdV-16-4ip**

Sample Type	Analysis	Lab	Method	Container	Preservative	Interval
Drill cuttings	Lithologic	N/A*	Grab	chip tray #10 & #35 sieve and whole rock 200 ml to 300 ml plastic bags where sufficient	N/A	Every 5 ft
Perched zone water screening sampling	N/A	N/A	N/A	N/A	N/A	N/A
Regional aquifer zone water screening sampling	N/A	N/A	N/A	N/A	N/A	N/A
Well development screening water (confirmation sample everyday)*	pH	Field	Grab	N/A	N/A	At each screen interval
	ORP	Field	Grab	N/A	N/A	
	Specific conductance	Field	Grab	N/A	N/A	
	Temperature	Field	Grab	N/A	N/A	
	Turbidity	Field	Grab	N/A	N/A	
	TOC	EES-14	Grab	2 40ml VOAs	N/A	
Final well development water	Metals/cations (dissolved & total)	EES-14	Grab	1 liter poly	4°C	At each screen interval
	Anions (dissolved)	EES-14	Grab	1 liter poly	4°C	
	TOC	EES-14	Grab	2 40ml VOAs	HCl/4°C	
EES-14 = Earth and Environmental Sciences Division's Geochemistry, and Geomaterials Research Laboratory (formerly known as EES-14) TOC = total organic carbon VOA = volatile organic analysis						

Notes: RAD swipes will be collected on all equipment downhole and parked on-site. Equipment will also be screened upon entering and exiting the site.

Rinsate samples will be collected on tanks not certified as clean.

N/A = Not applicable.

* Use of flow-through cell required for measuring field parameters

**Table 2.9-1
Waste Characterization for Well CdV-16-4ip**

TABLE 1- CHARACTERIZATION TABLE

NOTE: Multiple sampling may be required to ensure WAC requirements are met.

Waste Description	Waste # 1 Contact Waste	Waste #2 Drill cuttings	Waste #3 Drilling Fluids	Waste #4 Development Water	Waste #5 Decontamination Fluids
Estimated Volume	30 cy	80 cy	50,000 gal	50,000 gal	500 gal
Packaging	Drums or roll-off bins	Lined pit or approved containers	Lined pit or approved containers	Approved Containers	Approved Containers
Regulatory Classification					
Radioactive Waste	X	—	X	X	X
Reusable Material/Recycle	—	—	—	—	—
Municipal Solid Waste (MSW)	—	—	—	—	—
Hazardous Waste	X	X	X	X	X
Mixed (hazardous and radioactive) Waste	X	—	X	X	X
Polychlorinated Biphenyls-Contaminated Waste	—	—	—	—	—
New Mexico Special Waste (NMSW)	—	—	—	—	—
Industrial	X	X	X	—	—
Waste destined for LANL's SWWS or RLWTF ¹	—	—	—	X	X
Characterization Method					
Acceptable knowledge (AK): Existing Data/Documentation	X	—	—	—	X
AK: Site Characterization	—	—	—	—	—
Direct Sampling of Waste	—	X	X	X	X
Analytical Testing					
Volatile Organic Compounds (EPA 8260-B)	—	X	X	X	X
Semi volatile Organic Compounds (EPA 8270-C)	—	X	X	X	X
Organic Pesticides (EPA 8081-A)	—	X	X	X	X
Organic Herbicides (EPA 8151-A)	—	X	X	X	X
PCBs (EPA 8082)	—	—	X	X	X
Total Metals (EPA 6010-B/7471-A or EPA 6020) ²	—	X	X	X	X
Total Cyanide (EPA 9012-A) ²	—	X	X	X	X
Nitrates/Nitrites (EPA 300.09-soil or 343.2-water)	—	X	X	X	X
Dioxins/Furans (EPA 1613 B)	—	—	—	—	—
Oil/Grease (EPA 1665)	—	—	—	X	X
Fluoride, Chlorine, Sulfate (EPA 300)	—	—	X	X	X
TTO (EPA 8260-B and EPA 8270-C) ³			Request VOCs and SVOCs above		
Total Suspended Solids (TSS) and Total Dissolved Solids (TDS) (EPA 160.1 and 160.2)	—	—	X	X	X
Chemical Oxygen Demand (COD) (EPA 410.4)	—	—	—	X	X
pH (EPA 904c)	—	—	X	X	X
Microtox or Biological Oxygen Demand (BOD) ⁴	—	—	—	X	X
Perchlorates	—	X	X	X	X
High Explosives Constituents (EPA 8330/8321-A)	—	—	X	X	X
Asbestos	—	—	—	—	—
BTEX (EPA-8021b)	—	—	—	—	—
Tot. pet. hydrocarbon (TPH)-GRO (EPA 8015-M) TPH-DRO (EPA-8015-M)	—	X (if visible stain)	—	—	—
Toxicity characteristic leaching procedure (TCLP) Metals (EPA 1311/6010-B)	—	X (As Needed)	—	—	—
TCLP Organics (EPA 1311/8260-B & 1311/8270-C)	—	X (As Needed)	—	—	—
TCLP Pest. & Herb. (EPA 1311/8081-A/1311/8151-A)	—	X (As Needed)	—	—	—
Radium 226 & 228 (EPA 9320)	—	X	X	X	X
Gross Alpha (alpha counting) (EPA 900)	—	X	X	X	X
Gross Beta (beta counting) (EPA 900)	—	X	X	X	X
Tritium (liquid scintillation) (EPA 906.0)	—	X	X	X	X
Gamma spectroscopy (EPA 901.1)	—	—	X	X	X
Isotopic plutonium (chem. separation/alpha spec.) (HASL-300)	—	X	X	X	X
Isotopic uranium (chem. separation/alpha spec.) (HASL-300)	—	X	X	X	X
Total uranium (6020 inductively coupled plasma mass spectroscopy (ICPMS))	—	—	—	—	—
Strontium-90 (EPA 905)	—	X	X	X	X
Americium-241 (Separation/alpha spec.) (HASL-300)	—	X	X	X	X

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Table 2.9-1 (Continued)

Waste Description	Waste #6 Municipal Solid Waste	Waste #7 PCS	Waste #8 Concrete Chips and Concrete Slurry	Waste #9 Residual Concrete	Waste #10 Potentially Contaminated Storm water	
					Waste 10a Used Oil (recycled)	Waste #10b Other
Volume	2 cy	<1 cy	60 cy	1cy	50 gallons	
Packaging	Approved Containers	Approved Containers	Approved Containers	Approved Earthen Berm	Approved Containers	Approved Containers
Regulatory classification						
Radioactive	—	—	X	—	—	X
Reusable Material/Recycle	—	—	X	X	X	—
Municipal Solid Waste	X	—	—	—	—	—
Hazardous	—	—	X	—	—	X
Mixed (hazardous and radioactive) Waste	—	—	X	—	—	X
Polychlorinated-Biphenyls –Contaminated Waste	—	—	—	—	—	—
New Mexico Special Waste	—	X	—	—	—	—
Industrial	—	X	X	X	—	—
Waste destined for LANL's SWWS or RLWTF ¹	—	—	—	—	—	X
Characterization Method						
Acceptable knowledge (AK): Existing Data/Documentation	X	—	X	X	—	X
AK: Site Characterization	—	—	X	X	—	—
Direct Sampling of Containerized Waste	—	X	X As Needed	X As Needed	X	X
Analytical Testing						
Volatile Organic Compounds (EPA 8260-B)	—	X	—	—	X	X
Semivolatile Organic Compounds (EPA 8270-C)	—	X	—	—	X	X
Organic Pesticides (EPA 8081-A)	—	X	—	—	—	X
Organic Herbicides (EPA 8151-A)	—	X	—	—	—	X
PCBs (EPA 8082)	—	X	—	—	X	—
Total Metals (EPA 6010-B/7471-A) ²	—	X	X As Needed	X As Needed	X	X
Total Cyanide (EPA 9012-A) ²	—	X	—	—	—	X
Nitrates/Nitrites (EPA 300.09-soil or 343.2-water)	—	X	—	—	—	X
Oil/Grease (EPA 1665)	—	—	—	—	—	X
Fluorine, Chlorine, Sulfate (EPA 300)	—	—	—	—	—	X
TTO (EPA 8260-B and EPA 8270-C) ³	Request VOCs and SVOCs above					
Total Suspended Solids (TSS) and Total Dissolved Solids (TDS) (EPA 160.1 and 160.2)	—	—	—	—	—	X
Chemical Oxygen Demand (COD) (EPA 410.4)	—	—	—	—	—	X
pH (EPA 904c)	—	—	X	—	—	X
Microtox or Biological Oxygen Demand (BOD) ⁴	—	—	—	—	—	X
Perchlorates	—	X	—	—	—	X
High Explosives Constituents (EPA 8330/8321-A)	—	X	—	—	—	—
Asbestos	—	—	—	—	—	—
BTEX (EPA-8021b)	—	—	—	—	—	—
Total petroleum hydrocarbon (TPH)-GRO (EPA 8015-M) TPH-DRO (EPA 8015-M)	—	X	—	—	X	—
TCLP Metals (EPA 1311/6010-B)	—	X	—	—	—	—
TCLP Organics (EPA 1311/8260-B & 1311/8270-C)	—	X	—	—	—	—
TCLP Pest. & Herb. (EPA 1311/8081-A/1311/8151-A)	—	X	—	—	—	—
Radium 226 & 228 (EPA 9320)	—	—	—	—	—	—
Gross Alpha (alpha counting) (EPA 900)	—	X	—	—	—	—
Gross Beta (beta counting) (EPA 900)	—	X	—	—	—	—
Tritium (liquid scintillation) (EPA 906.0)	—	X	X	X	—	—
Gamma spectroscopy (EPA 901.1)	—	X	—	—	—	—
Isotopic plutonium (hem. Separation/alpha spec.) (HASL-300)	—	X	—	—	—	—
Isotopic uranium (hem. Separation/alpha spec.) (HASL-300)	—	X	—	—	—	—
Total uranium (6020 inductively coupled plasma mass spectroscopy [ICPMS])	—	—	—	—	—	—
Strontium-90 (EPA 905)	—	X	—	—	—	—
Americium-241 (hem. Separation/alpha spec.) (HASL-300)	—	X	—	—	—	—

¹ In addition to other analytes needed to characterize the waste (e.g., VOC, SVOC, total metals), analyze for TSS, TDS, Oil and Grease, gross alpha, gross beta, tritium, and pH for liquids destined for the LANL sanitary waste water system (SWWS). For wastes destined for the RLWTF additional constituents include TTO, TSS, COD, pH, total nitrates/nitrites, and gross alpha, gross beta (not including tritium), and gross gamma or the sum of individual alpha-, beta-, and gamma-emitting nuclides.

² Filtered metals and filtered Cyanide are required for land application, with the exception of Mercury (Hg).

³ TTO is the total of volatile organic and semi-volatile organic compound contaminants. Request methods EPA 8260-B (VOCs) and EPA 8270-C (SVOCs).

⁴ If Microtox analysis is not available, request BOD.

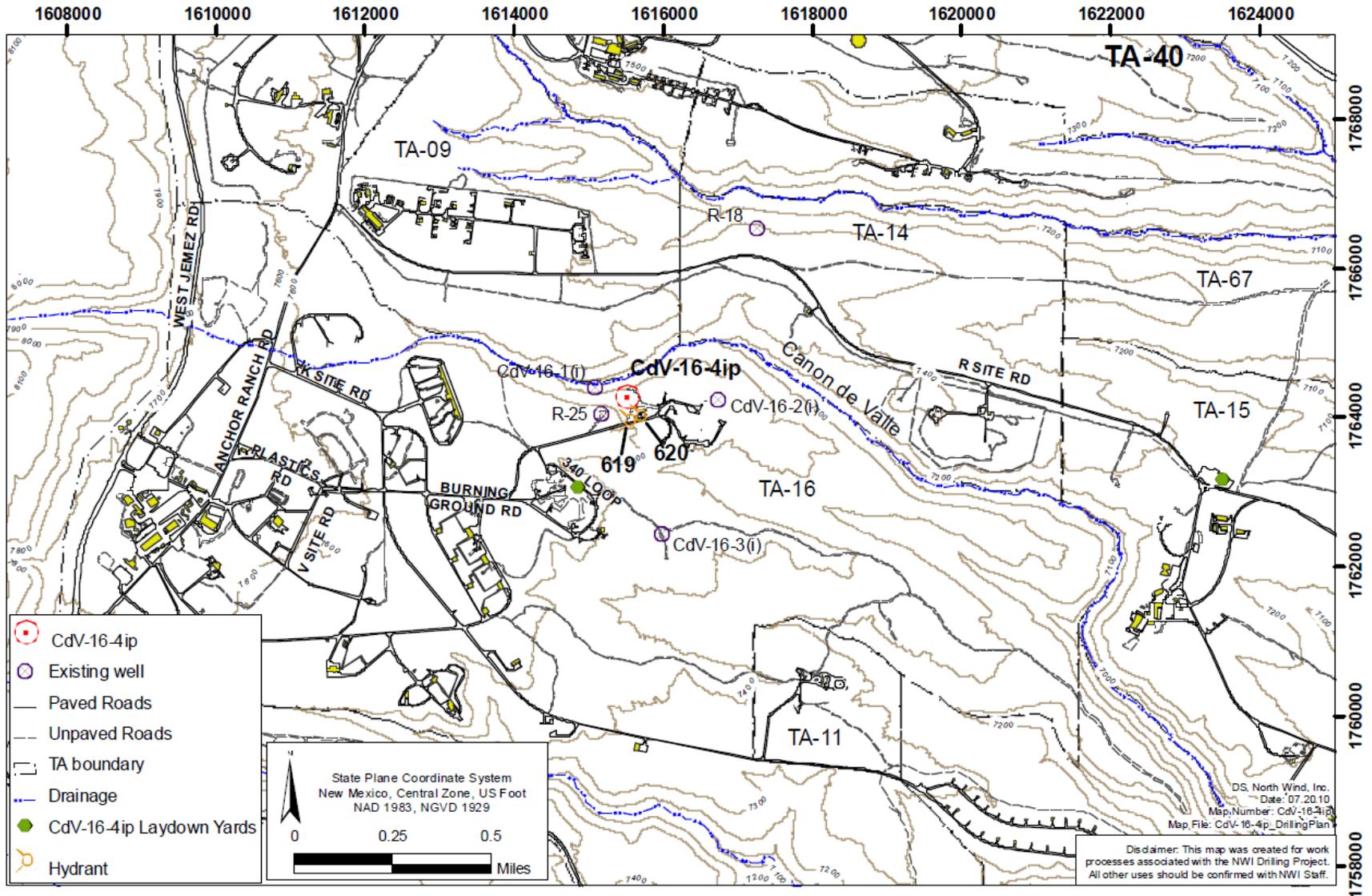


Figure 1.0-1 - Location of Well CdV-16-4ip and water sources at TA-16.

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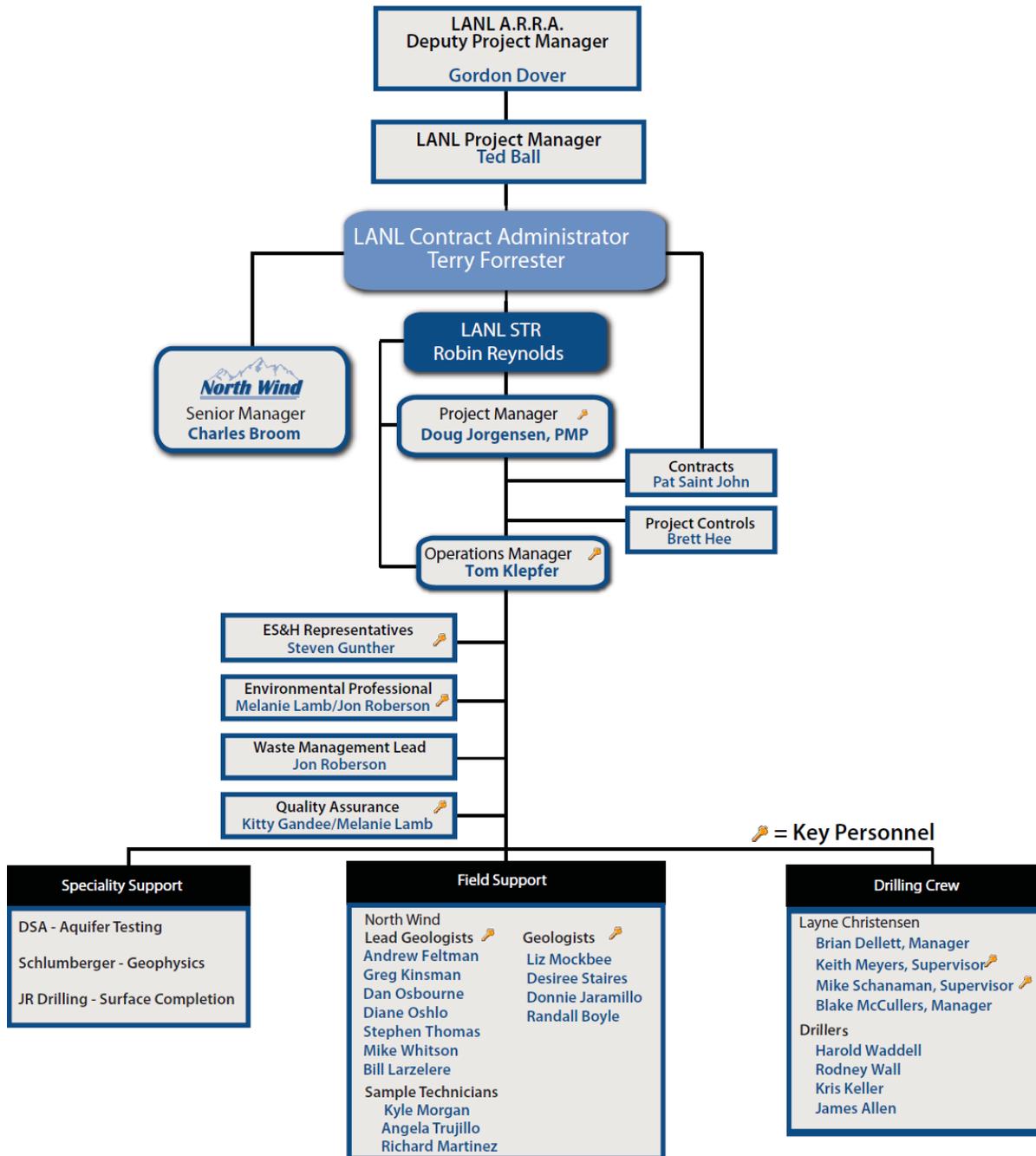


Figure 1.1-1 Project field organization chart.

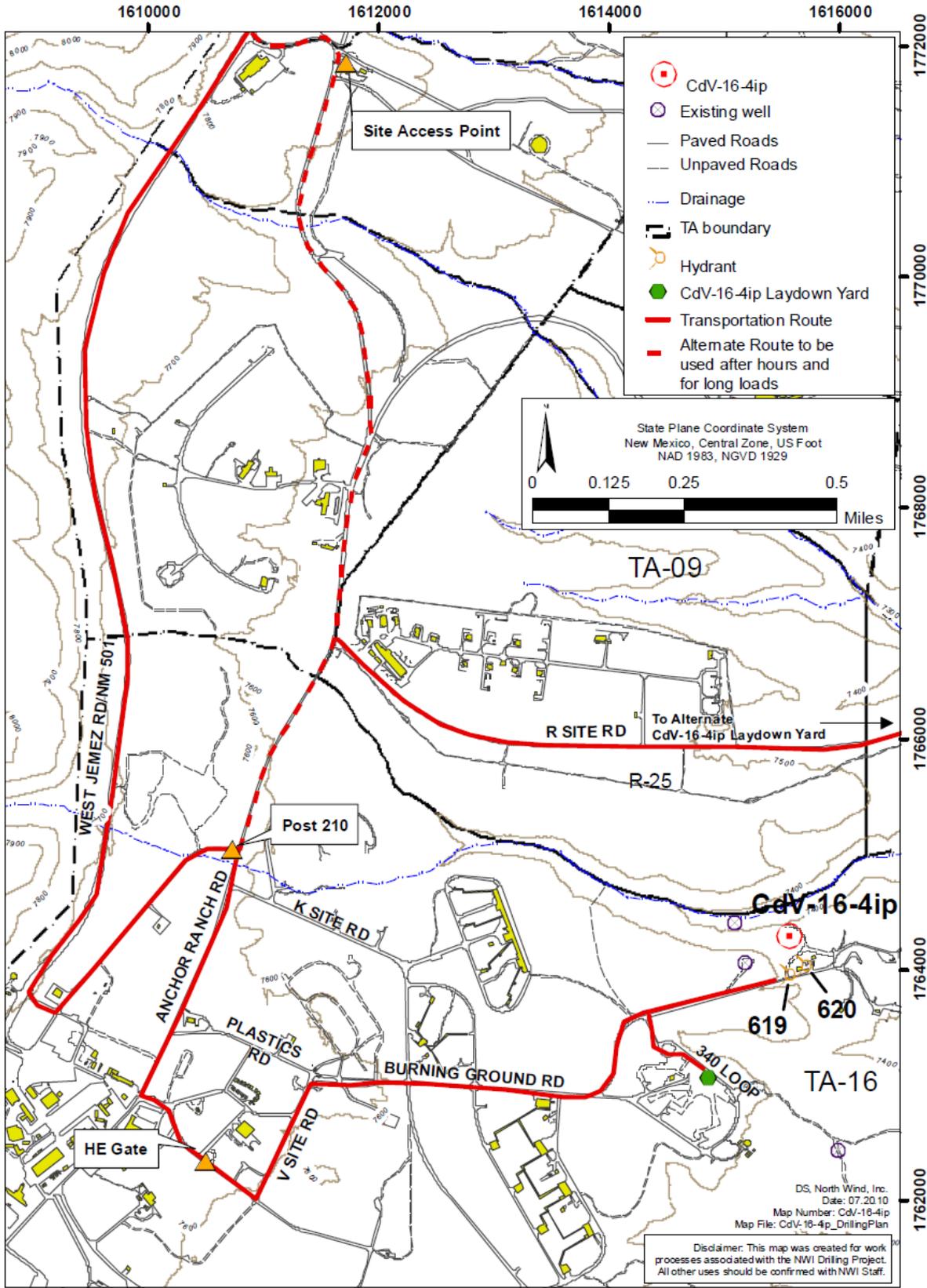


Figure 2.1-1 Designated route within TA-16.

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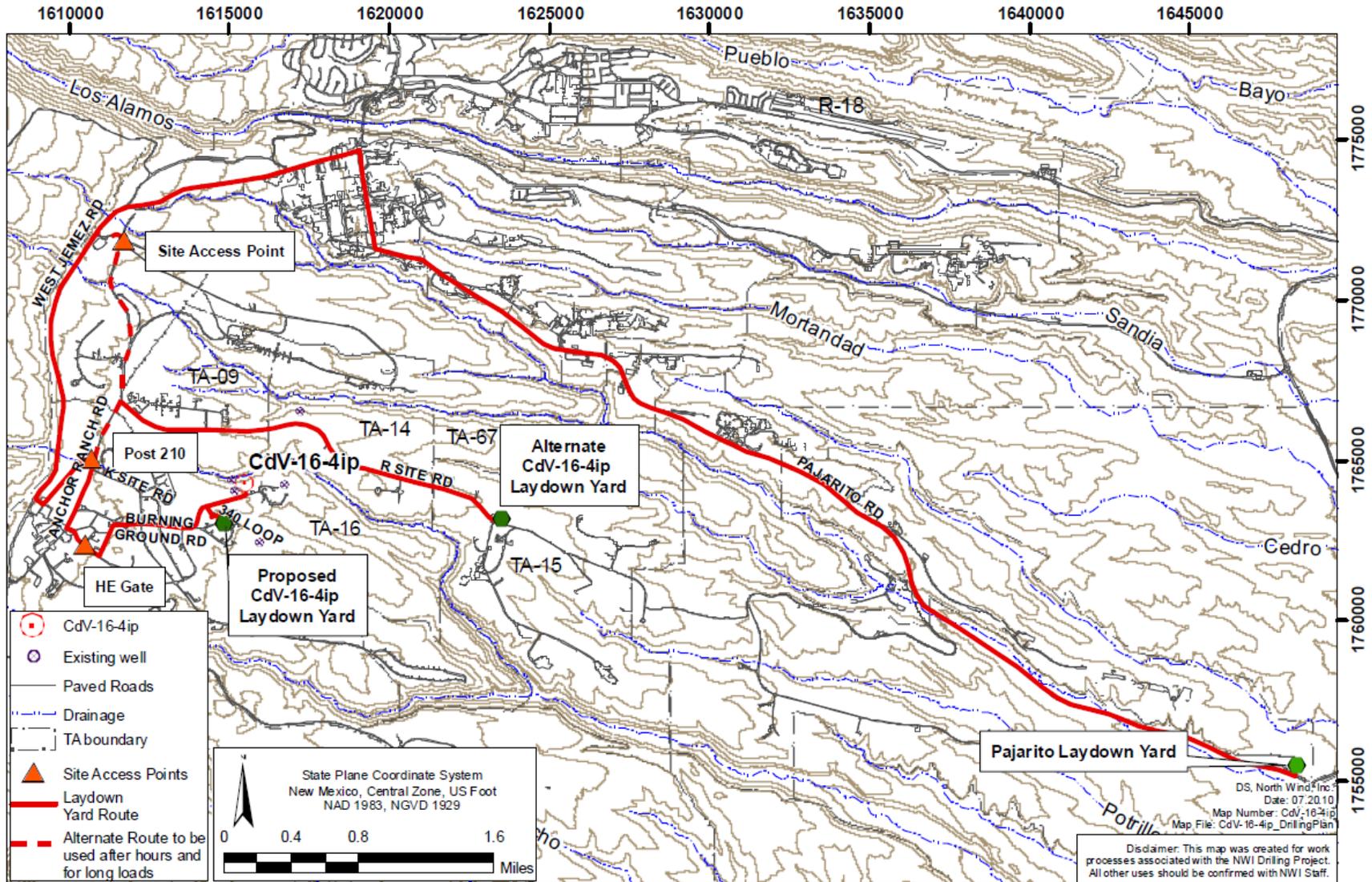


Figure 2.2-1 Route to the Pajarito, R-48, and alternate lay-down yards from Well CdV-16-4ip.

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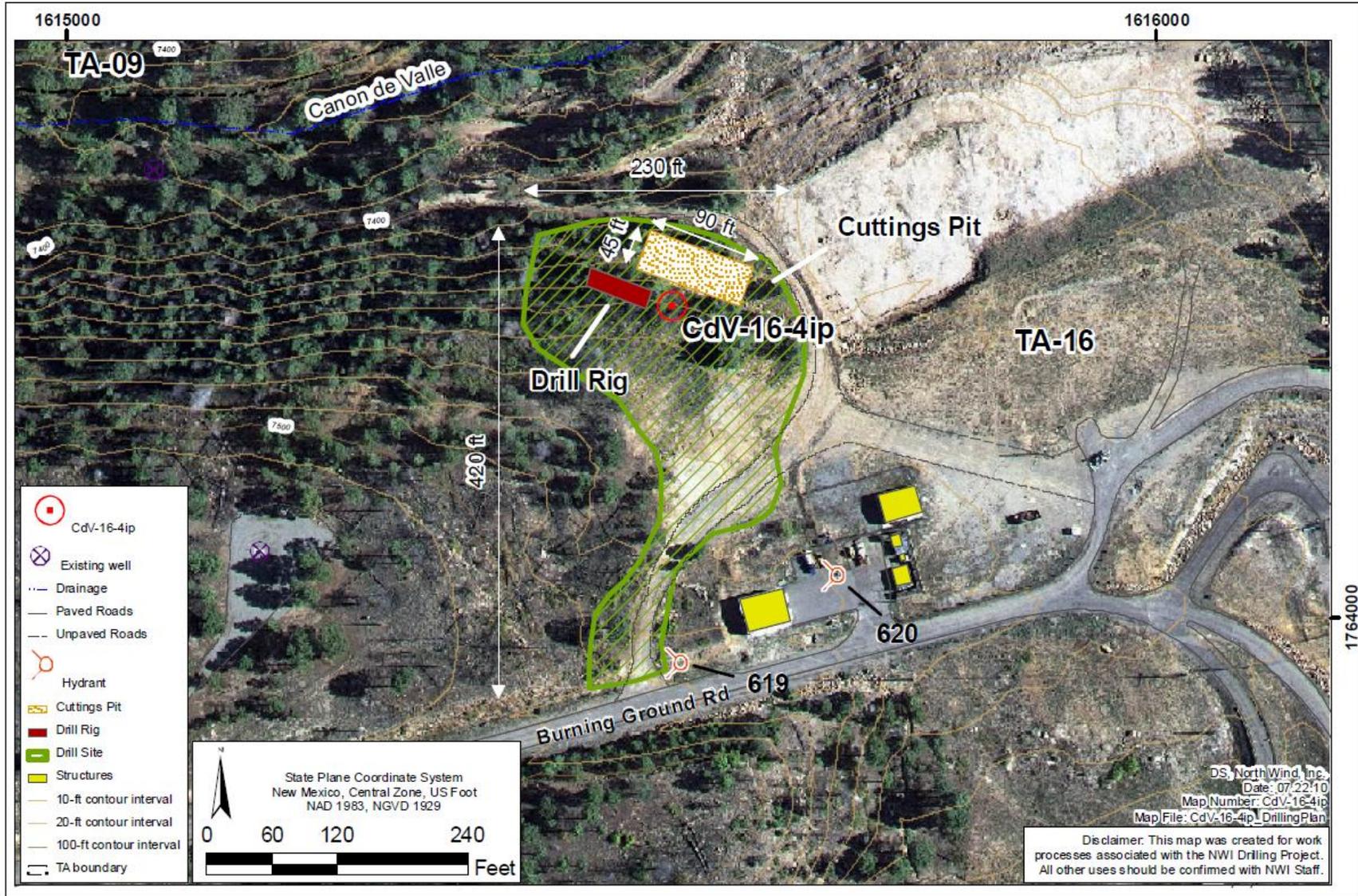


Figure 2.3-1 Well CdV-16-4ip site layout and dimensions.

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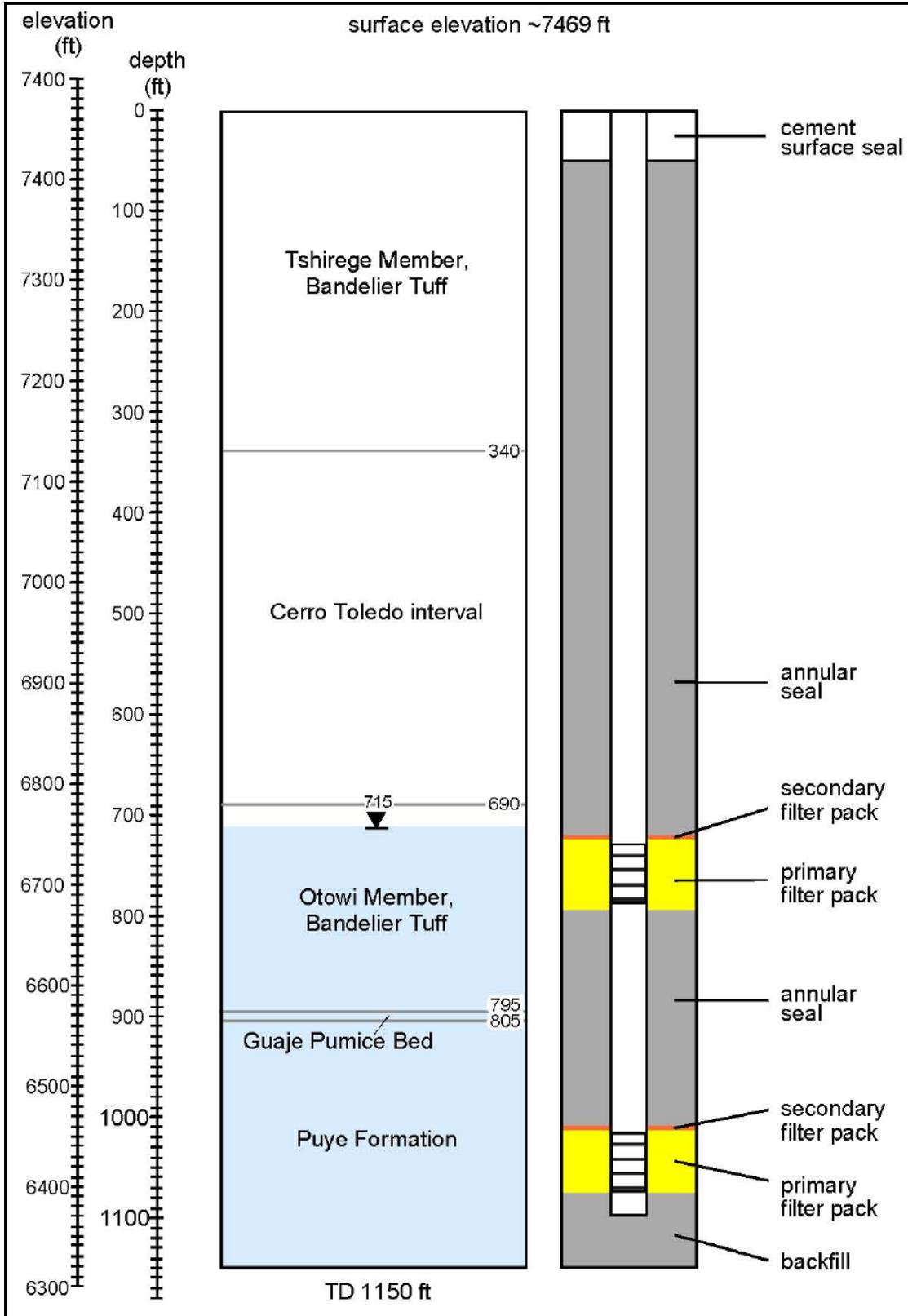


Figure 2.3-2 Proposed well design schematic for well CdV-16-4ip.

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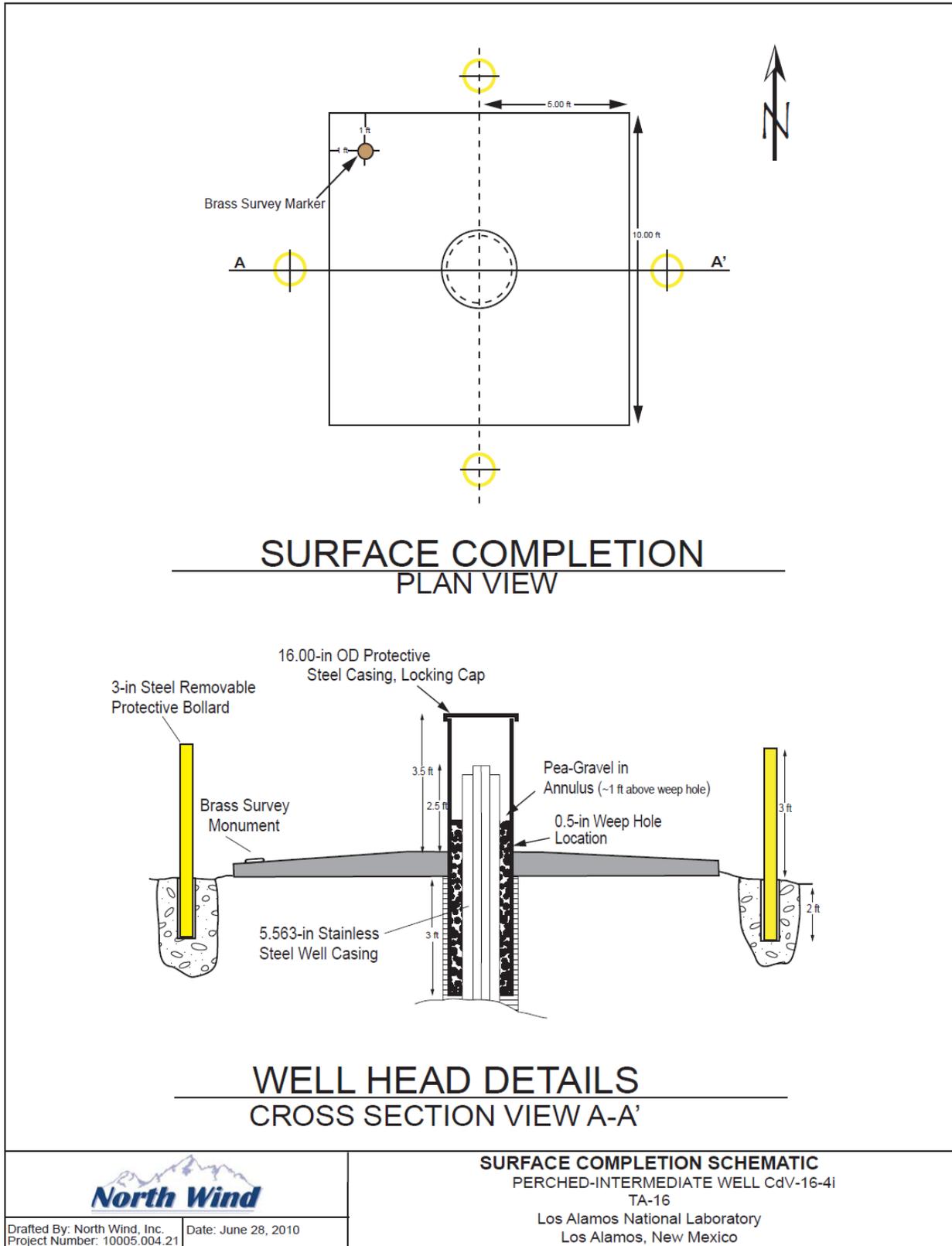


Figure 2.8-1 Surface completion schematic.

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APPENDIX A

Drilling Forms

Approved drilling and health and safety forms for the LANL Deep Drilling Project are posted on the NWI intranet website (<http://portal.northwind-inc.com/corporate/documents>). Look for drilling forms (e.g., “DPF-10005-00x) under the “Project Specific Docs” tab project name of “10005 Drilling.”

The following drilling forms are posted:

[DPF-10005-001 Rev0 Daily Drill Rig Inspection](#)
[DPF-10005-002 Rev0 Fork Lift Inspection](#)
[DPF-10005-003 Rev0 Daily Field Report](#)
[DPF-10005-004 Rev 0 Material Tally Sheet](#)
[DPF-10005-005 Rev 0 Backfill Tally Sheet](#)
[DPF-10005-006 Rev0 Construction Tally Sheet](#)
[DPF-10005-007 Rev0 Well Development and Aquifer Testing Data Sheet](#)
[DPF-10005-008 Rev0 Pump Test Tally Sheet](#)
[DPF-10005-009 Rev 0 Monitoring Well Pump Installation Data Form](#)
[DPF-10005-010 Rev 0 Surface Pad Completion Form](#)

The following form will be posted upon completion:
DPF-10005-011

Links to commonly used Health and Safety forms.

Go to <http://portal.northwind-inc.com/corporate/documents> for additional forms and procedures:

[HSF-015.1 Stop Work Action](#)
[HSF-100 Tailgate Safety Briefing](#)
[HSF-103 Safety Walkthrough Checklist](#)

APPENDIX B

Security Plan for TA-16, CdV-16-4ip Well Installation

Security Plan

TA-16 Well CdV-16-4ip is located in a Limited Area within LANL. As such, the Exhibit G, "Security Requirements For Task Order/Release" has been provided and addresses the security requirements for performing work at CdV-16-4ip.

The following are the applicable sections of Exhibit G, "Security Requirements" and their implementation.

<p>All requirements of section G2.0, Security Requirements, are applicable</p>	<p>SUBCONTRACTOR shall:</p> <ul style="list-style-type: none"> • Strive to eliminate all security events, incidents, and adverse impacts to national security. • Promote security objectives as a constant value through the Integrated Safeguards and Security Management (ISSM) process. • Spread ownership for effectiveness of the security program throughout SUBCONTRACTOR'S employees and lower-tier subcontractors. • Enhance employee awareness and involvement in their security program implementation. • Enforce employees' consistent use of secure practices in their daily work activities. • Optimize the use of continuous improvement practices as the basis for "Zero Incident Performance" initiatives. • Demonstrate to CONTRACTOR that SUBCONTRACTOR is dedicated to security compliance excellence. • Expect SUBCONTRACTOR'S senior management to demonstrate leadership and direction for "Zero Incident Performance" implementation. • Ensure that all SUBCONTRACTOR employees are empowered to implement and consistently strive for the "Zero Incident Performance" goal. • Ensure that SUBCONTRACTOR Management is accessible to employees with security concerns.
<p>Only the following specified subsections of section G3.0, General Security, are applicable.</p>	
<p>Section 3.2, <i>Integrated Safeguards and Security Management (ISSM)</i></p>	<p>ISSM five-step process to ensure that security expectations are established, implemented, and measured and reinforced in every work activity.</p> <ol style="list-style-type: none"> 1) Define Work Scope: Drilling and installing a monitoring/pumping well at TA-16 2) Analyze the Security Risk: 3) Develop and Implement Security Controls: NWI OPSEC plan, Security Training, Drilling Plan documenting designated travel route, escort requirements, prohibited items and communication devices 4) Perform Work within Security Controls: Stay on designated route, do not bring prohibited items into TA-16, do not bring personal cell phones into TA-16, do not bring personal electronic devices into TA-16, stay within sight of your escort at all times, maintain personnel on-site record. 5) Provide Feedback and Continuous Improvement

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<p>Subsection 3.3.1, <i>Operations Security (OPSEC) Plan</i></p>	<p>SUBCONTRACTOR shall develop (with assistance from CONTRACTOR'S Office of Counterintelligence, Operations Security Program Office), implement and sustain a DOE OPSEC Plan.</p> <p>NWI OPSEC PLAN for the Drilling Project Link: NWI-OPSEC-10005.002-Rev 0.pdf</p>
<p>Section 3.3.2, <i>Safeguards, Security and Counterintelligence Awareness</i></p>	<p>SUBCONTRACT workers shall report all of the following situations to the Office of Counterintelligence and inform the RLM or STR and CA. Situations may range from pointed questions to subtle elicitation.</p> <ul style="list-style-type: none"> • Professional contacts and relationships with sensitive country foreign nationals, whether they occur at one's worksite or abroad. • All unofficial travel to any sensitive country. • Any suspicious or provocative actions encountered while on travel. • Suspicious or provocative actions or behaviors on the part of foreign nationals visiting or assigned to LANL. • Substantive personal relationships with sensitive country foreign nationals (who are not lawful permanent residents), other than family members. • Business transactions including financial transactions, partnerships, or other business interests or investments with citizens of sensitive countries who are not lawful permanent residents, whether they involve one-time interactions or ongoing financial relationships. Small payments for things such as house cleaning or other such personal services or financial support provided to family members are not included. • Any attempts by unauthorized persons to gain access to classified information.
<p>Section 3.3.3, <i>Safeguards, Security and Counterintelligence Awareness</i></p>	<p>SUBCONTRACTOR shall be alert to and report the following to the RLM and STR (if an STR is assigned to this subcontract):</p> <ul style="list-style-type: none"> • attempts by unauthorized persons to obtain information; • unexplained/excessive use of copiers by workers; • workers living beyond their means; • unusual foreign travel patterns of workers; and • personal problems of workers that could affect security or fitness for duty.
<p>Section 3.5, <i>Security Stop Work</i></p>	<p>When any Subcontract Worker observes a security related hazard or unmitigated risk, the worker has the authority and responsibility to inform any worker engaged in the security related hazard or unmitigated risk of his/her concern and request that the work be stopped.</p>
<p>Section 3.6, <i>Reporting Security Incidents</i></p>	<p>Requirements for identifying and reporting known and potential incidents of security concern. Such incidents may involve issues associated with classified matter, computer systems, nuclear materials, secure communications, personnel security, and physical security occurring on LANL property, Laboratory-leased property or SUBCONTRACTOR-owned property. Subcontract Workers shall comply with the following requirements.</p> <p>3.6.1 Immediately upon discovery of a potential incident of security concern, report such concern to the Security Inquiry Team (SIT) and then inform the RLM, STR, and SPL or DSO. During normal business hours, notifications shall be made only in person or through secure communications (STU or STE) to the SIT, RLM, STR, and DSO or SPL as required below. A non-secure telephone, non-secure fax, non-secure voice mail, or non-secure electronic</p>

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	<p>mail shall not be used to report a potential incident of security concern.</p> <p>3.6.1.1 After discovery of a potential incident of security concern involving the possible improper electronic transmission of data, report the incident immediately to the SIT and then inform the RLM, STR and the assigned OCSR.</p> <p>3.6.1.2 After discovery of any incident involving the loss, compromise, or unauthorized disclosure of classified matter, report the incident immediately to the SIT and then inform the OCSR, RLM and STR.</p> <p>3.6.1.3 After discovery of any incident involving the loss, theft, diversion, or unauthorized use of nuclear material, report the incident immediately to Material Control & Accountability Group or the SIT.</p> <p>3.6.2 Outside normal business hours, SUBCONTRACTOR shall contact the ADSS on-call duty officer through the Protective Force central alarm station at 667-4437, immediately after discovery of a potential incident of security concern. The ADSS on-call duty officer may be asked to meet with the SUBCONTRACTOR in person so that SUBCONTRACTOR may report such known or potential incidents of security concern, if secure communications are not available.</p>
<p>Only the following specified subsections of section G4.0, <i>Physical Security</i>, are applicable</p>	
<p>Subsection 4.1, <i>Prohibited and Controlled Articles</i></p>	<p>Prohibited Articles are those not permitted on DOE property (i.e., LANL) including parking lots.</p> <p>SUBCONTRACTOR shall ensure that prohibited articles are not brought on DOE property. Prohibited articles include:</p> <ul style="list-style-type: none"> • dangerous weapons (e.g., guns and knives), explosives, or other instruments or material likely to cause substantial injury or damage to persons or property; • alcoholic beverages, including unopened bottles or cans; • controlled substances such as illegal drugs and associated paraphernalia, but not prescription medicine; and • other items prohibited by law. <p>Controlled Articles are items not permitted in Security Areas without prior authorization.</p> <p>SUBCONTRACTOR shall ensure that controlled articles are not brought into a Security Area without prior written approval from the Cyber Security Office and concurrence by the RLM or STR. Controlled articles include:</p> <ul style="list-style-type: none"> • cell phones, two way pagers, personal electronic devices(e.g. iPODs), blackberries, palm pilots, and palm-top computers; • recording equipment (audio, video, optical, or data) • radio frequency transmitting equipment, two-way radios,; • electronic equipment with a data exchange port capable of being connected to automatic information system equipment (thumbdrives);

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	<ul style="list-style-type: none"> • computers and associated media, including but not limited to thumb drives; • cameras - video, still, digital, film or in cell phones. If the use of cameras, either inside or outside of a security area, is deemed mission essential, the use of cameras must be authorized via coordination among the STR, the RLM and the Physical Security Team prior to the use of such cameras.
<p>Subsection 4.2, <i>Escorting</i></p>	<p>All US citizens escorted into a Security Area shall wear one of the following:</p> <ul style="list-style-type: none"> • An uncleared DOE standard badge; • An uncleared temporary badge; • An uncleared LANL specific US visitor badge; or • A generic uncleared US visitor badge. <p>An escort shall not escort more than five (5) individuals at any one time, unless otherwise approved by LANL in writing.</p>
<p>Subsection 4.3, <i>Security Areas</i></p>	<p>SUBCONTRACTOR shall comply with all requirements for designated Security Areas. In addition, SUBCONTRACTOR shall ensure that all Subcontract Workers:</p> <ul style="list-style-type: none"> • Have the appropriate clearance (i.e., access authorization) for the Security Area or be properly escorted within the Security Area. • Adhere to the posted requirements for entering any Security Area (clearance status, badge, access status, and searches). • Report physical security and access control discrepancies to the SIT and inform the RLM and STR. Examples of a discrepancy include breaches of fences or walls, or attempts to circumvent security barriers. • Use only the badge valid for the Security Area to be entered and occupied, and display the valid badge at all times photo side out, above the waist, and in front of the body while in that area. • Cooperate with Protective Force personnel during badge checks. • Cooperate with Protective Force personnel during searches of vehicles, persons, and/or hand-carried items being brought into or out of a Security Area. All persons and their personal property are subject to search when on LANL property or leased facilities. • Protect keys to facilities within Security Areas at all times. • Return keys to the responsible organization key custodian who issued the keys when no longer required, and inform the RLM and STR. • Report lost or stolen keys to the key custodian who issued the keys. • Adhere to all requirements for escorting individuals who are not authorized to be in a Security Area unescorted. • Do not tailgate, piggyback, or vouch, nor allow another person to do so.
<p>Subsection 4.4, <i>Acknowledgement/Control of Vehicles On Site</i></p>	<p>Acknowledgement / Control of Vehicles On Site</p> <ul style="list-style-type: none"> • If requested, SUBCONTRACTOR shall submit to the STR or RLM the make, year and license number of all vehicles that will be used on site. • Vehicles driven by uncleared drivers delivering construction materials or other supplies will be permitted to enter unsecured areas provided they are under escort by personnel possessing a Q or L access authorization as appropriate for the delivery site. • Heavy duty vehicles driven by Subcontract Workers may be required to proceed to Post 10 (east end of the Truck Route Road, East Jemez Rd.) for a search conducted by the Protective Force. If the search does not disclose anything of concern, the driver will receive an appropriate pass that will allow entry into the Security Area to perform their

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	subcontract work.
Only the following specified subsections of section G5.0, <i>Personal Security</i>, are applicable	
Subsection 5.1, <i>Substance Abuse</i>	<p>All Subcontract Workers shall be required to complete and pass a pre-employment drug test and participate in random testing, regardless of the duration of their work assignment.</p> <p>Subcontract Workers shall:</p> <ul style="list-style-type: none"> • Be fit for duty and avoid behavior that compromises the health or safety of others or the security of the Lab; • Notify Personnel Security, the RLM, STR and CA immediately if arrested or convicted of a drug or alcohol violation; • Notify Personnel Security, the RLM, STR, and CA immediately after any treatment for drug or alcohol abuse, if worker possess a security clearance; • Meet with Personnel Security or Occupational Medicine promptly when asked to perform a drug and/or alcohol test; • Immediately report accidental ingestion of illegal drugs to Personnel Security, the RLM, and the STR so the appropriate action can be taken <p>Failure to Show or Refusal to Drug and/or Alcohol Test</p> <ul style="list-style-type: none"> • If a worker fails to show up for a test after being contacted, such failure shall be treated as if the worker had tested positive. • If the worker refuses to be tested, such refusal shall be reported and treated as a confirmed positive. <p>The RLM or STR will take the following actions if a Subcontract Worker has a confirmed positive drug test:</p> <ul style="list-style-type: none"> • Immediately stop the worker from performing any additional work on site; • Immediately notify SUBCONTRACTOR'S management that the worker's badge is being pulled; • Ask the worker to report back to his/her employer because his/her assignment is being terminated; • Confiscate the worker's badge and return it to Personnel Security; • Coordinate with the CA to ensure proper notifications are made.
Subsection 5.2, <i>Badges</i>	<p>All Subcontract Workers, except as otherwise provided herein, must have a badge issued by the LANL Badge Office prior to commencement of work at LANL.</p> <p>Subcontract Workers shall:</p> <ul style="list-style-type: none"> • Complete training required by Personnel Security before receiving a badge; • Wear the badge, photo-side out, above the waist, on the front side of the body, at all times while on DOE-owned property (i.e., LANL) or on CONTRACTOR leased or rented premises; • Remove the badge and protect it from public view when leaving DOE-owned property or CONTRACTOR leased or rented premises; • Present the badge whenever requested by Protective Force personnel; • Minimize the number of instances of temporary badge issuance and replacement of lost badges; • Ensure the badge is never photocopied; • Return an issued badge to the Badge Office (via the RLM or STR as appropriate) following termination of employment, badge expiration, end

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	<p>of assignment, or completion of a visit. Subcontract Workers are not permitted to retain badges for any reason.</p> <p>Lost or stolen badges shall be reported to the Badge Office within 24 hours or the next business day after discovery of the loss, whichever is soonest. The RLM or STR shall also be notified. The individual badge holder shall go to the LANL Badge Office and complete a written affidavit (Form 1672) <i>Notification of Permanent Inactivation of Badge</i> in order to obtain a replacement badge.</p> <p>In addition to the above, if a badge is stolen, the individual badge holder shall report the theft to the Security Inquiry Team (SIT) and inform the STR or CA by the next business day of discovery of the loss.</p>																																				
<p>All requirements of section G7.0, Cyber Security, are applicable</p>	<p><i>No computers or data recording devices will be allowed at CdV-16-4ip. Personnel will not have unescorted access to office buildings where computers may be located. Personnel performing geodetic surveys of completed well will be required to submit a Portable Electronic Device request for exemption and receive approval prior to performing work.</i></p> <p>Cyber Security requirements apply to any information system or network that SUBCONTRACTOR may use to collect, create, process, transmit, store or disseminate information for CONTRACTOR</p> <p>Failure of SUBCONTRACTOR to comply with the requirements of Section 7 may result in the imposition of a criminal and civil penalty. Activities on LANL systems are monitored and recorded and subject to audit. Use of LANL systems and data is expressed consent to such monitoring and recording. Any unauthorized access or use of LANL systems and data is prohibited and could subject the SUBCONTRACTOR to criminal and civil penalties.</p> <p>Required training for use of LANL information system resources</p> <table border="1" data-bbox="581 1192 1430 1812"> <thead> <tr> <th>Course Name</th> <th>Course Number</th> <th>Frequency</th> <th>All Computer Users</th> <th>Classified Computer Users</th> <th>Training Type</th> </tr> </thead> <tbody> <tr> <td>General Employee Training (GET)</td> <td>15503</td> <td>One time</td> <td>X</td> <td>X</td> <td>Live</td> </tr> <tr> <td>Initial Computer Security Briefing</td> <td>9369</td> <td>One time</td> <td>X</td> <td>X</td> <td>Online</td> </tr> <tr> <td>Annual Security Refresher</td> <td>1425</td> <td>Annually</td> <td>X</td> <td>X</td> <td>Online</td> </tr> <tr> <td>Classified Computer Security</td> <td>17846</td> <td>One time</td> <td></td> <td>X</td> <td>Online</td> </tr> <tr> <td>Annual Classified Computer Security Briefing</td> <td>Unassigned</td> <td>Annually</td> <td></td> <td>X</td> <td>Online</td> </tr> </tbody> </table>	Course Name	Course Number	Frequency	All Computer Users	Classified Computer Users	Training Type	General Employee Training (GET)	15503	One time	X	X	Live	Initial Computer Security Briefing	9369	One time	X	X	Online	Annual Security Refresher	1425	Annually	X	X	Online	Classified Computer Security	17846	One time		X	Online	Annual Classified Computer Security Briefing	Unassigned	Annually		X	Online
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Classified Computer Security	17846	One time		X	Online																																
Annual Classified Computer Security Briefing	Unassigned	Annually		X	Online																																

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<p>All requirements of section G8.0, Contacts, are applicable</p>	<p>Contacts (Dec 2007)</p> <p>Badge Office.....667-6901 badge@lanl.gov Chief Information Office667-0961 Chief Information Office on-call pager.....996-0242 Classification Group.....667-5011 Classified Matter Protection & Control.....665-1802 cmpc@lanl.gov Clearance Processing.....667-7253 clearance@lanl.gov Cyber Security Office / Helpline.....665-1795 Emergency Management & Response.....667-6211 Fire, Bomb Threat, etc.....911 Foreign Visits and Assignments.....665-1572 Fraud, Waste and Abuse.....665-6159 Material Control & Accountability Group.....667-5886 Office of Counterintelligence.....665-6090 Operations Security Program Office.....665-5561 Personnel Security POC.....665-1624 Personnel Security.....667-5897 Physical Security Team667-2510 Protective Force.....665-1279 Protective Force After Hours.....667-4409 Safety Help Desk.....665-7233 Security Help Desk.....665-2002 security@lanl.gov</p>
<p>All requirements of section G9.0, Required Notifications, are applicable</p>	<p>SUBCONTRACTOR shall notify the Requester, STR and the CA immediately, whenever a change in the scope of the work to be performed has been identified or requested. The STR shall then notify the appropriate security expert so that any security modifications can be made to the approved Exhibit G in response to the change in the scope of work.</p>

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APPENDIX C
Traffic Control Plan

Traffic Control Plan

The following general traffic safety and site specific requirements apply:

- **Visitors, including LANL sampling personnel passing through the drill site boundaries, will be required to sign in and out with the NWI PIC.**
- **Traffic safety will be observed at all times when traveling on Laboratory property.**
- **Do not drive or park on natural vegetated or reclaimed areas, i.e., stay on graveled roads and parking areas.**
- **Observe posted speed limits**
- **Wear seat belts whenever motor vehicles are in operation**