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Date: July 31, 2009
Refer To: EP2009-0346

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

Subject: Submittal of the Drilling Work Plan for Intermediate Aquifer Well CdV-37-1i

Dear Mr. Bearzi:

Enclosed please find two hard copies with electronic files of the Drilling Work Plan for Intermediate Aquifer Well CdV-37-1i for approval by the New Mexico Environment Department.

If you have any questions, please contact Mark Everett at (505) 667-5931 (meverett@lanl.gov) or Suzy Schulman at (505) 606-1962 (sschulman@doeal.gov).

Sincerely,

B. G. Schmell for MJG

Michael J. Graham, Associate Director
Environmental Programs
Los Alamos National Laboratory

Sincerely,

Edwin P. Watkins for

David R. Gregory, Project Director
Environmental Operations
Los Alamos Site Office

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MG/DG/PH/ME:sm

Enclosures: Two hard copies with electronic files – Drilling Work Plan for Perched Intermediate Aquifer Well CdV-37-1i (LA-UR-09-4726)

Cy: (w/enc.)
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Drilling Work Plan for Perched-Intermediate Aquifer Well CdV-37-1i

Primary Purpose	Los Alamos National Laboratory (LANL) will install perched-intermediate well CdV-37-1i to fulfill one of the requirements set forth in New Mexico Environment Department's (NMED's) notice of disapproval of the south canyons work plan. This well will supplement existing characterization of perched-intermediate groundwater beneath the general area known as Technical Area 16 (TA-16). Additionally, an adjacent core hole will be advanced to 300 ft or to auger refusal to collect samples for contaminant analyses. The location of the well near the confluence of Water Canyon and Cañon de Valle will help define the eastern extent of contaminated perched-intermediate groundwater, and data from the core hole will help to determine if infiltration near the Water Canyon/Cañon de Valle confluence is partly or completely related to contamination that may be identified in CdV-37-1i (Figure 1). CdV-37-1i is expected to encounter perched saturation at some depth above the top of lavas expected to be related to the Cerros del Rio volcanic field, which were sampled farther east (e.g., in R-27). CdV-37-1i is tentatively designed with a single 20-ft-long screen within the perched groundwater saturation zone (Figure 2). A final well design will be based on hydrogeological conditions encountered during drilling and will incorporate requirements that stem from discussions with NMED. Figure 3 is a geologic cross-section showing a predicted distribution of hydrostratigraphic units in the vicinity of CdV-37-1i.
Conceptual Model	Perched-intermediate groundwater at CdV-37-1i may contain contaminants from TA-16 and other upgradient sources. Infiltration of surface water and alluvial groundwater (or even mesa-top operational water) may transport soluble contaminants, such as high explosives compounds, tritium, and perchlorate, to deeper perched-intermediate groundwater beneath the canyon floor. Data from the adjacent core hole will help assess whether infiltration and contaminant transport takes place upgradient of the CdV-37-1i location and/or near that location, presumably via a canyon floor pathway. CdV-37-1i is located in an area of considerable stratigraphic uncertainty beneath the Bandelier Tuff (Figure 3). In particular, it is not known if the Cerros del Rio lavas occur as shown in Figure 2. The borehole may encounter Tschicoma dacites instead of Cerros del Rio basalt. Moreover, it is not certain that perched water will be encountered at this site.
Drilling Approach	Drilling will be conducted with methods selected to minimize the use of additives in the zones of interest. The following is a summary of the proposed methods for the core hole and the well borehole.
	Core hole: • Continuous core will be collected with a hollow-stem auger rig without the use of fluids. • Samples will be collected at 10, 20, 30, 40, 50, 60, 80, 100, 140, 180, 220, 260, 300 ft below ground surface (bgs) or until auger refusal.
	Borehole: • A 16-in. surface casing will be advanced through the Bandelier Tuff to 60 ft bgs using the fluid-assisted air-rotary method. • A 15-in. open borehole will be advanced with fluid assisted air rotary to 500 ft bgs. Below this level no drilling additives will be used; however, municipal water will be added, as needed, to cool the drill bit. The open hole will be advanced to 650 ft bgs, at which point the drill tools will be tripped out, and borehole video and LANL geophysical tools (natural gamma and conductivity) will be run. If significant perched water is found, a well will be constructed with a screen in the saturated zone. If significant perched water is not found, open hole drilling will continue into the top of the Cerros del Rio basalts at approximately 730 ft bgs.

Potential Drilling Fluids, Composition, and Use	The following fluids and additives that may be used are consistent with those previously used in the drilling program at LANL and have been characterized geochemically. No drilling fluids will be used within 100 ft of the perched saturated zone, except potable municipal water. If the perched zone cannot be reached without adding drilling fluids, the situation will be discussed with NMED. No chemicals other than those listed below will be added without approval from NMED: • Potable water, municipal water supply, to aid in delivery of other drilling additives and cool the drill bit • QUIK-FOAM, a blend of alcohol ethoxy sulfates, used as a foaming agent • AQF-2, an anionic surfactant, used as a foaming agent
Hydrogeologic and Geochemical Objectives	The primary objective is to determine if perched-intermediate groundwater zone(s) occur in the area of the confluence of Cañon de Valle and Water Canyon and, if so, to monitor the perched water. Monitoring at this location will help characterize potential groundwater contamination and pathways from potential upgradient sources.
Potential Groundwater Occurrence and Detection	*Perched:* 543 ft in the Guaje Pumice Bed, 600 ft in the upper Puye Formation, and 730 ft in the upper part of Cerros del Rio lavas, based on observations in wells R-17 and R-27 Methods for groundwater detection may include driller's observations, water-level measurements, borehole video, and borehole geophysics.
Groundwater Screening Sampling	Screening water samples will be collected during drilling at any perched-intermediate horizon producing sufficient water for sampling. Screening samples of groundwater will be analyzed for cations/metals (dissolved and total) and anions (dissolved) by the Earth and Environmental Sciences (EES-14) chemistry laboratory.
Groundwater Characterization Sampling	Groundwater samples will be collected from the completed well between 10 and 60 days after well development, in accordance with the Compliance Order on Consent. These samples will be analyzed for the full suite of constituents, including radionuclides, metals/cations, general inorganic chemicals, volatile organic compounds, semivolatile organic compounds, high explosives and their breakdown products, and stable isotopes. Subsequent groundwater samples will be collected under the Interim Facility-Wide Groundwater Monitoring Plan.
Core Contaminant Sampling	The EES-14 analytical laboratory will be used for the following analysis of pore water derived from the core: • Major ions: Ca, Mg, K, Na, SO_4, Cl, NO_3, NO_2, Br, PO_4, F, oxalate, perchlorate, chlorate, total carbonate alkalinity (calculated) • Metals/trace elements: Au, Ag, As, B, Be, Cd, Co, Cr(total), Cs, Fe, Hg, Li, Mn, Mo, Ni, Pb, Rb, Sb, Se, Si, Sn, Sr, Th, Tl, Ti, U, V, and Zn General Environmental Laboratory, Inc. (an off-site contract laboratory) will be used for analysis of high explosives compounds from pore water derived from the core.

Geophysical Testing	LANL's borehole video camera, natural gamma, and induction (conductivity) tools will be used in the 15-in. open borehole at the depths specified in the "Drilling Approach" section above. Additional logs may be collected by Schlumberger, Inc., and will include accelerator porosity sonde (neutron porosity), array induction, combined magnetic resonance, natural and spectral gamma, and formation microimager logs. In cased portions of the borehole, only neutron porosity and natural and spectral gamma logs will be collected. Geophysical logs may also be used to select the well screen depth. The suite and timing of geophysical logging will depend on borehole conditions.
Well Completion Design	One well screen will be placed in the first productive zone identified within the perched-intermediate zone (if present).
Well Development	The well may be developed by mechanical and/or chemical means. • After initial swabbing and bailing, a submersible pump will be used to complete the development process. • Water-quality parameters to be monitored: pH, specific conductance, dissolved oxygen, temperature, turbidity, total organic carbon (TOC). • If LANL is unable to bring the water-quality parameters to within the limits specified below, the use of chemical well development may be discussed with NMED. No chemicals will be added without approval from NMED. • Chemical means include the use of sodium acid pyrophosphate (SAPP) or AQUA-CLEAR PFD to remove natural and added clays and/or chlorination to kill bacteria introduced during well completion. Target water quality parameters: turbidity <5 nephelometric turbidity units, TOC <2 parts per million, other parameters stable.
Hydraulic Testing	Hydraulic testing will be conducted if a significant perched zone is encountered.
Investigation Derived Waste Management	Investigation-derived waste (IDW) will be managed in accordance with standard operating procedure EP-ERSS-SOP-5022, Characterization and Management of Environmental Restoration (ER) Project Waste (http://www.lanl.gov/environment/all/qa/adep.shtml). This SOP incorporates the requirements of applicable U.S. Environmental Protection Agency (EPA) and NMED regulations, U.S. Department of Energy orders, and LANL requirements. The primary waste streams include drill cuttings, drilling water, development water, purge water, decontamination water, and contact waste. Drill cuttings will be managed in accordance with the NMED-approved Notice of Intent (NOI) Decision Tree for Land Application of IDW Solids from Construction of Wells and Boreholes (November 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 (November 2006). Drill cuttings, drilling water, and purge water will initially be stored in lined pits. The pit contents will be characterized with direct sampling following completion of drilling activities, and waste determinations will be made from validated data. If validated analytical data show these wastes cannot be land-applied, they will be removed from the 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 into an appropriate accumulation area and characterized using acceptable knowledge of the media with which it came into contact.

Tentative Drilling Schedule	• Drill core hole: 20 days • Drill and complete borehole (including mobilization and site preparation): 41 days • Collect borehole geophysics: 1 day • Develop well CdV-37-1i: 5 days • Conduct characterization sampling of CdV-37-1i: 10 to 60 days following development • Restore CdV-37-1i site: 7 days

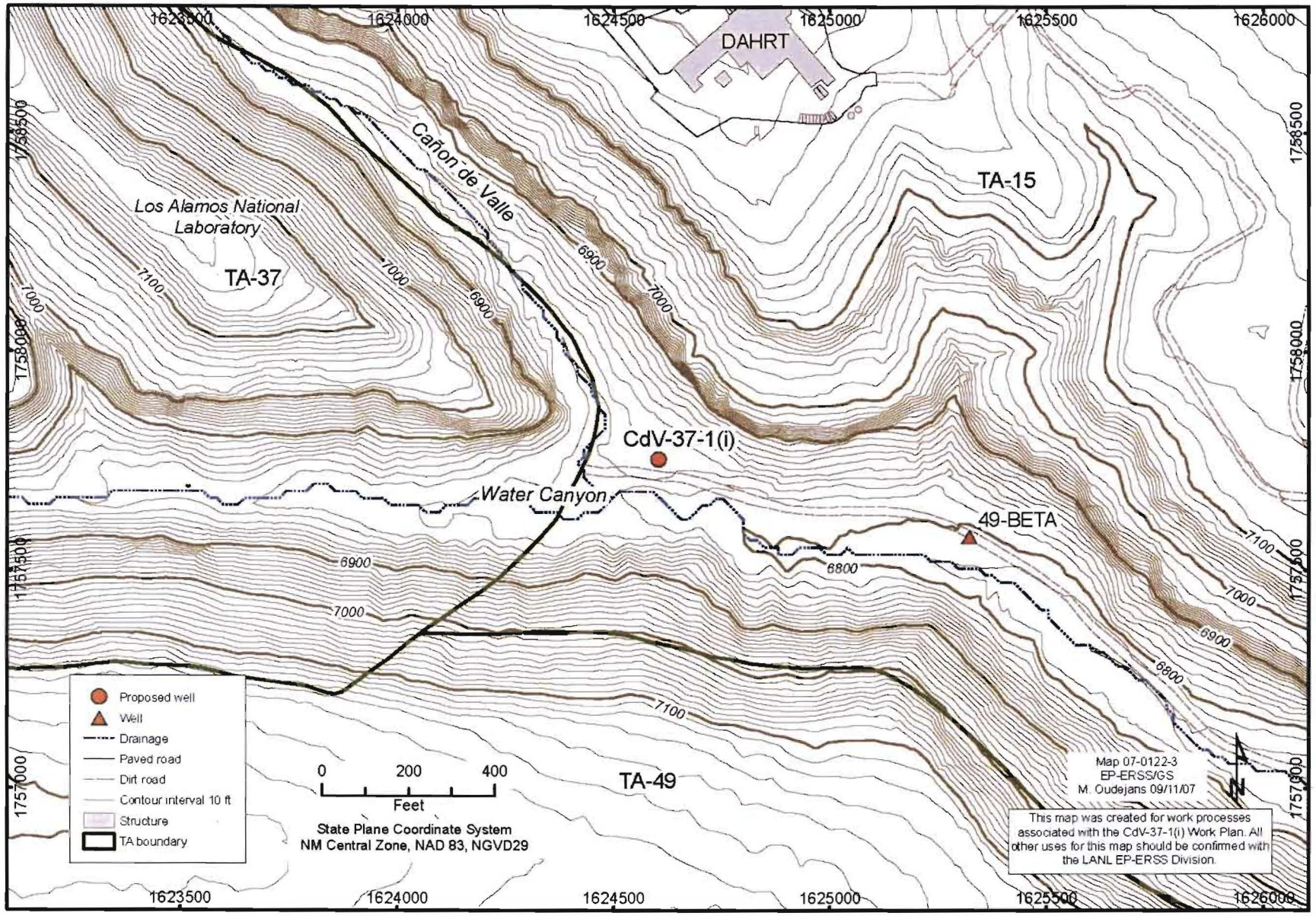
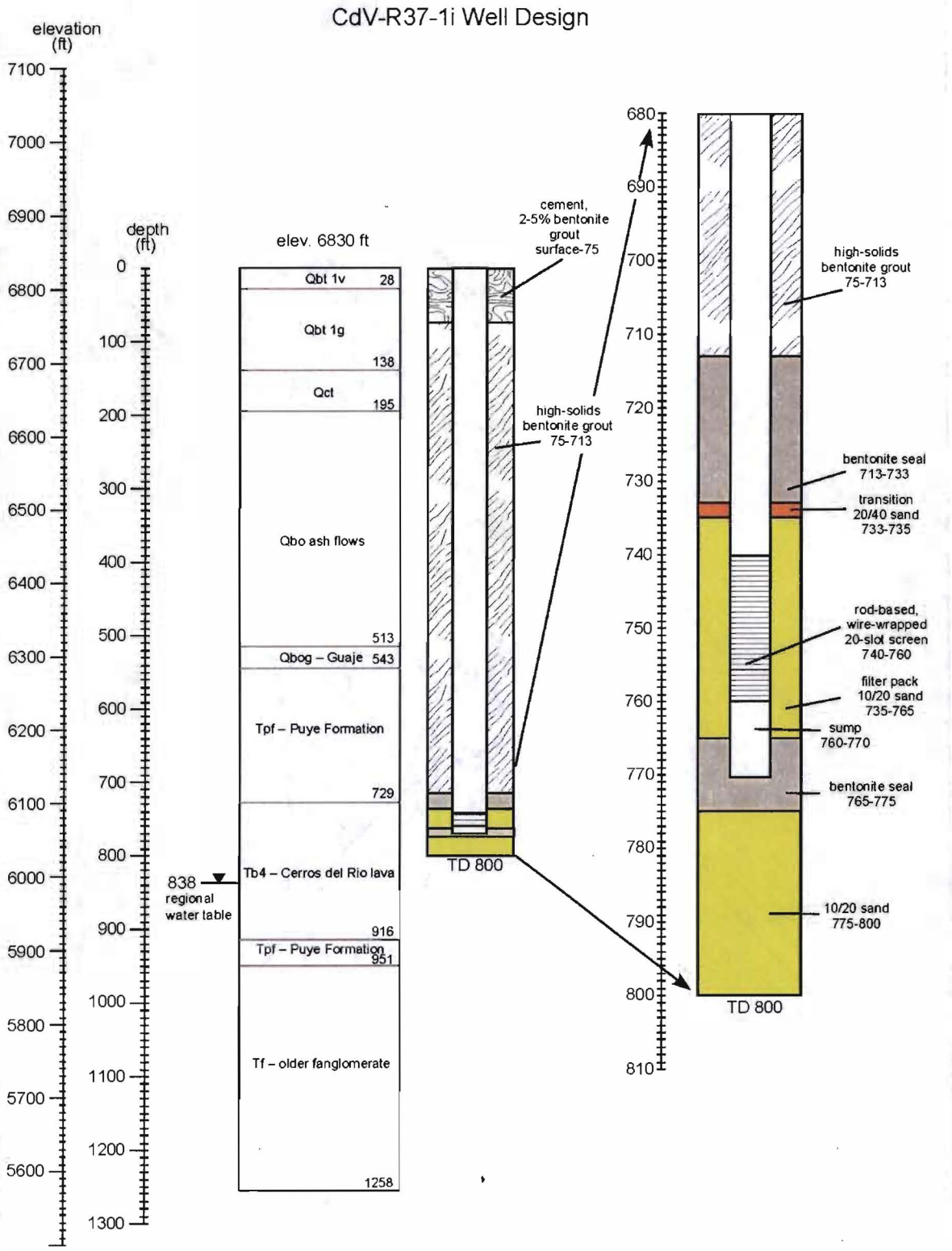
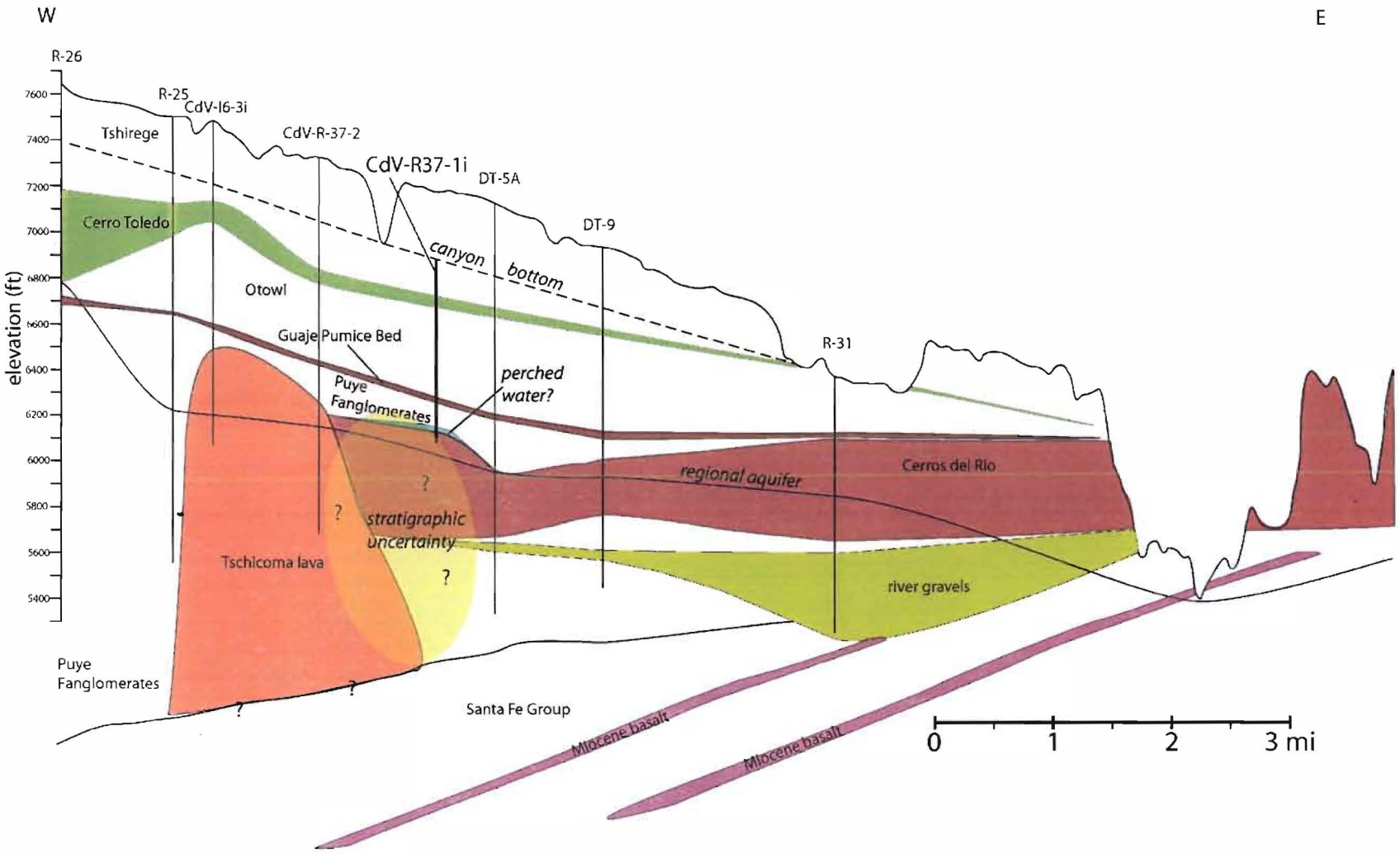


Figure 1 Location of CdV-37-1i



Note: Qbt 1v = unit 1v of the Tshirege Member of the Bandelier Tuff, Qbt 1g = unit 1g of the Tshirege Member of the Bandelier Tuff; Qct = Cerro Toledo Interval; Qbo = Otowi Member of the Bandelier Tuff; Qbog = Guaje Pumice of the Otowi Member of the Bandelier Tuff; Tpf = Puye Formation, Tb4 = Cerros del Rio lavas; Tf = older fanglomerate or possible Santa Fe Group sediments; TD = total depth.

Figure 2 Proposed well design for CdV-37-1i



Notes: Proposed location of CdV-37-1i is shown, with hypothetical recharge. A zone of stratigraphic uncertainty is indicated.

Figure 3 Direct-line borehole-to-borehole cross-section (crossing mesas and canyons) from R-26 through R-25, CdV-16-3i, CdV-R-37-2, DT-5A, DT-9, and R-31 to a point on the east side of the Rio Grande