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Date: July 31, 2009
Refer To: EP2009-0348

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 R-27i

Dear Mr. Bearzi:

Enclosed please find two hard copies with electronic files of the Drilling Work Plan for Intermediate Aquifer Well R-27i 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 Schnell for MJG

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

Sincerely,

Edin P. Worth for

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

31870

MG/DG/PH/ME:sm

Enclosures: Two hard copies with electronic files – Drilling Work Plan for Perched Intermediate Aquifer Well R-27i (LA-UR-09-4724)

Cy: (w/enc.)
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Drilling Work Plan for Perched-Intermediate Aquifer Well R-27i

Primary Purpose	Los Alamos National Laboratory (LANL) will install perched-intermediate well R-27i to monitor groundwater beneath Water Canyon encountered during the drilling of regional well R-27 in October 2005. A perched-intermediate zone was measured at 628 ft below ground surface (bgs) when the borehole was 6 ft into the Cerros del Rio lavas (i.e., a borehole depth of 640 ft) for a total of 12 ft of standing water. A video log showed water entering the borehole from Puye Formation sediments at the 616-ft depth. Although existing data indicate no contamination is present in the vadose zone at this location (see conceptual model discussion below), the primary objective for installing this well is to establish a monitoring location that would benefit corrective measures decisions for both Technical Area 16 (TA-16) and Material Disposal Area (MDA) AB. This location will provide near-field monitoring for potential transport from MDA AB and midfield to distal monitoring for potential migration from known contaminated perched-intermediate groundwater beneath TA-16. The site for R-27i is on the existing drill pad for R-27 (Figure 1). R-27i is expected to penetrate perched saturation at approximately the 616-ft depth and will have a single 20-ft-long screen spanning the top of saturation and a lower bentonite annular fill that seals off the upper part of the Cerros del Rio lavas (Figure 2). Figure 2 shows the stratigraphy and proposed well design for R-27i, and Figure 3 is a geologic cross-section showing the distribution of hydrostratigraphic units in the vicinity of R-27i.
Conceptual Model	Perched water at R-27/R-27i has the potential to carry contaminants from either TA-16 or potentially TA-49. Contaminants from TA-16 are predominantly high explosives compounds, barium, chlorinated solvents, tritium, boron, and perchlorate. MDA AB at TA-49 was used for underground hydronuclear experiments involving the use of explosives compounds (TNT, RDX, HMX, barium nitrate); plutonium, americium, uranium and other radionuclides; and lead along with minor amounts of beryllium. Open borehole water-screening analyses from the R-27 perched zone show little or no contamination. One screening analysis from water collected from the open borehole using the less sensitive analytical method (U.S. Environmental Protection Agency [EPA] Method 314) shows perchlorate detected at 7.6 ppb in one of the samples but not in the other; no high explosives compounds were detected. Water samples collected from the completed R-27 well indicate no contaminants in the regional aquifer at this location. Flow along Water Canyon fed by snowmelt and seasonal rainfall often extends to and beyond the R-27/R-27i location. The hydrogeologic conceptual model at R-27i suggests that canyon-bottom recharge supplies the perched zone that will be sampled by the screen at R-27i (Figure 3).
Drilling Approach	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 zone of saturation. Specifically, efforts will be made to reach the targeted perched water on top of the Cerros del Rio basalt at a depth of approximately 634 ft with air-rotary casing advance. The following is a summary of the proposed methods by depth interval: • A 16-in. surface casing will be advanced using fluid-assisted air-rotary methods through the alluvium to near the base of Qbt 1g of the Tshirege Member to approximately 40 ft bgs. • A 15-in. open borehole will be advanced using fluid-assisted air-rotary methods into the top of the Cerros del Rio basalt and continuing down to a total depth of 654 ft. No drilling fluid additives will be used below 529 ft (top of the Puye Formation). Potable water will be added to cool the drill bit, as needed. • If no perched water is observed above the basalt, a 12-in. casing will be lowered into the borehole, and a 10.5-in. open hole will be advanced through the Cerros del Rio basalt into the Puye Formation (765 ft). If any perched water is encountered in the basalt the well will be completed with a screen spanning the saturated zone.

Drilling Approach (continued)	• The borehole will be plugged and abandoned in accordance with the Compliance Order on Consent (the Consent Order) if perched groundwater sufficient for building a well is not encountered.
Potential Drilling Fluids, Composition, and Use	The following fluids and additives that may be used are consistent with those used previously in the drilling program at LANL and have been characterized geochemically. No drilling fluids other than those listed below 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 the New Mexico Environment Department (NMED). No chemicals 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 Objective	The objective is to install a perched-intermediate well in Water Canyon to monitor groundwater downgradient of TA-16 and TA-49.
Potential Groundwater Occurrence and Detection	*Perched:* 616–634 ft, encountered in R-27 above the Cerros del Rio basalt. Methods for groundwater detection may include driller's observations, water-level measurements, borehole video, and borehole geophysics.
Core Sampling	Specific Comment 14 in the New Mexico Environment Department's (NMED's) February 19, 2007, notice of disapproval for the south canyons work plan required a core hole, but as described in the conceptual model section of this drilling work plan, core (pore water) samples (samples from various intervals from 0–267 ft bgs) and open borehole perched-intermediate groundwater samples were collected and analyzed during drilling of R-27. The data indicate no contamination is present; therefore, no additional core will be collected in association with drilling of R-27i.
Groundwater Screening Sampling	Screening water samples will be collected during drilling at the perched horizon and at the end of development. 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 Consent Order. These samples will be analyzed for the full suite of constituents including: radionuclides, metals/cations, general inorganic chemicals, volatile organic compounds, semi volatile organic compounds, high explosives and their degradation products, and stable isotopes. Subsequent groundwater samples will be collected under the Interim Facility-Wide Groundwater Monitoring Plan.
Geophysical Testing	LANL's borehole video camera, natural gamma, and induction tools will be used in the 15-in. open borehole if conditions allow.
Well Completion Design	One 20-ft well screen will be placed spanning the top of saturation.

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 will 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 ppm, other parameters stable.
Hydraulic Testing	Hydraulic testing will be considered if a significant perched zone is encountered.
Investigation Derived Waste Management	Investigation-derived waste (IDW) will be managed in accordance with standard operating procedure (SOP) 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 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). Initially, drill cuttings, drilling water, and purge 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. 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 in an appropriate accumulation area, and characterized using acceptable knowledge of the media with which it came in contact.
Tentative Drilling Schedule	• Drill and complete borehole (includes mobilization and site preparation): 41 days • Collect borehole geophysics data: 1 day • Develop well R-27i: 5 days • Conduct characterization sampling of R-27i: 10–60 days following development • Restore R-27i site: 7 days

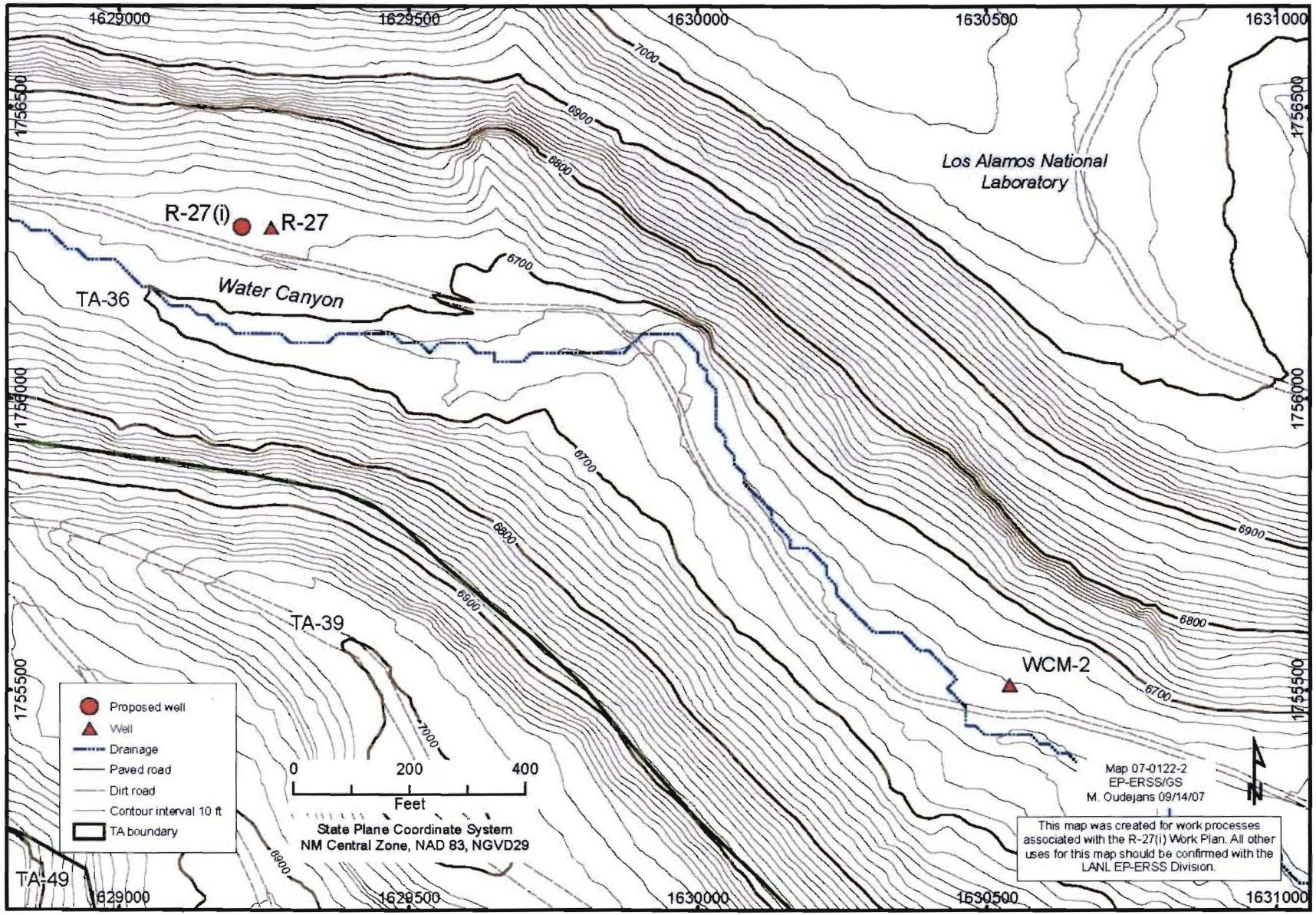
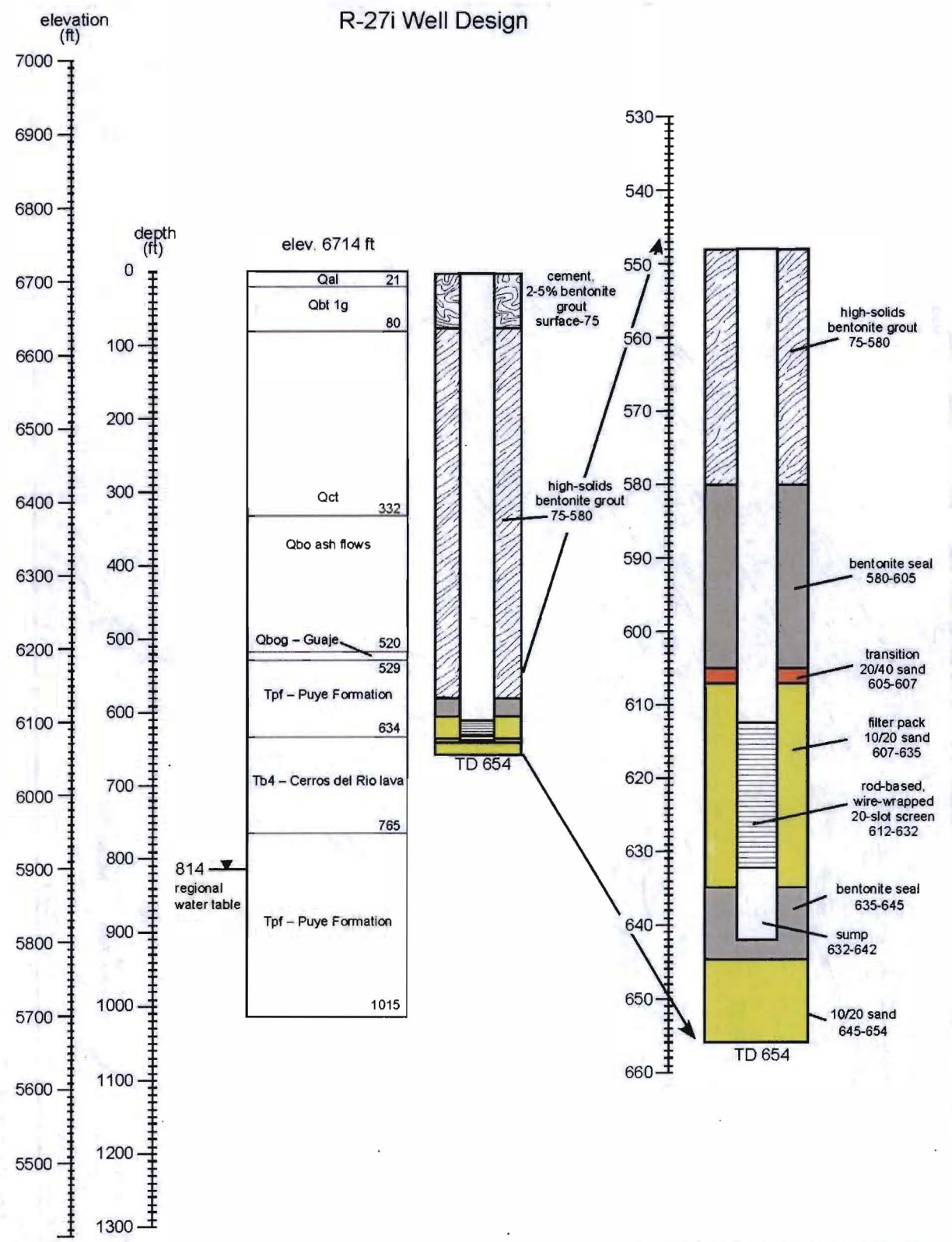
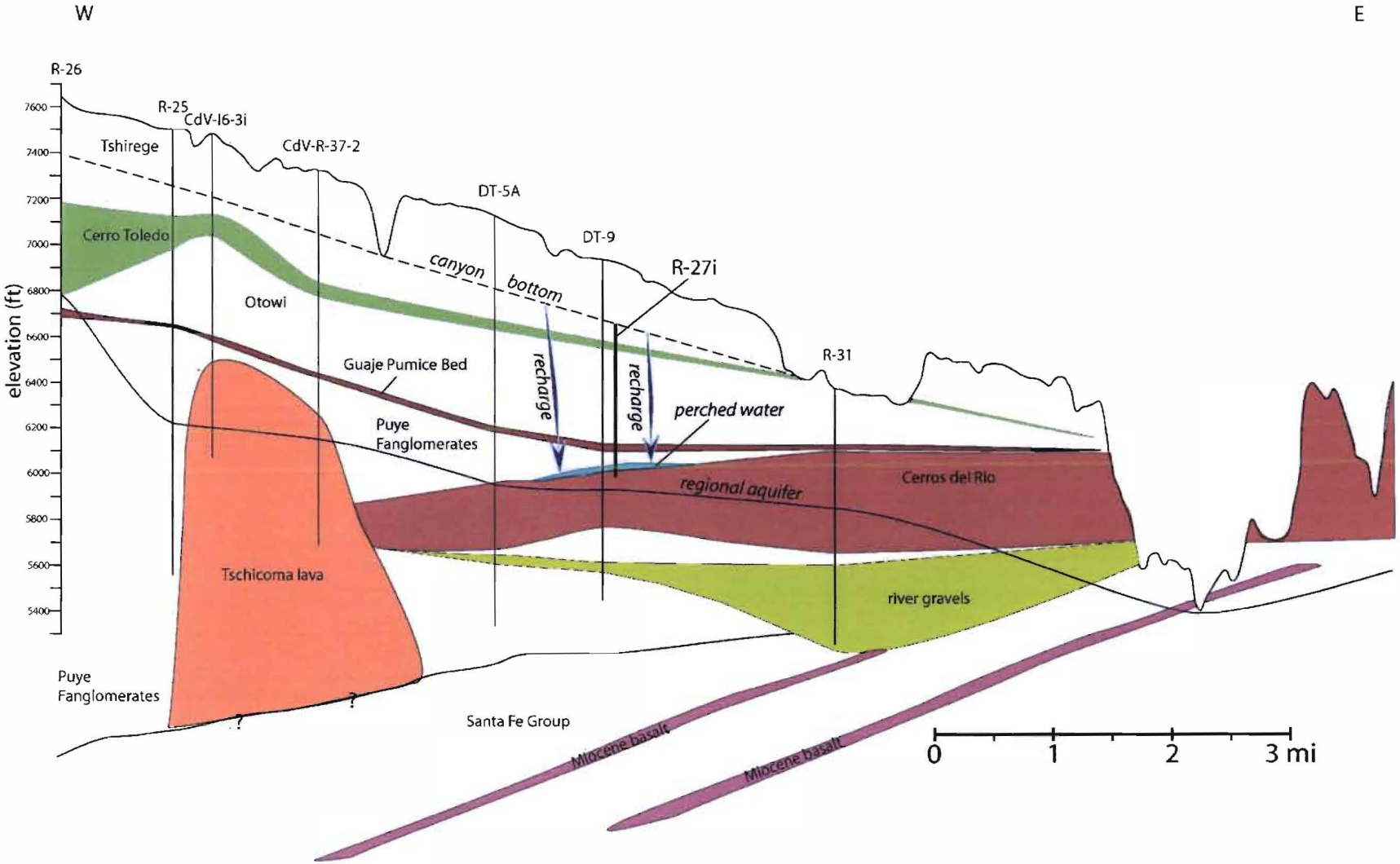


Figure 1 Location of R-27i



Notes: Qal = alluvium, 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; TD = total depth.

Figure 2 Proposed well design for R-27i



Note: Proposed location of R-27i is shown (extending from the bottom of Water Canyon), with hypothetical recharge.

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