Drilling Work Plan for Well CdV-R-15-1

Primary Purpose	Well CdV-R-15-1 will be installed at Technical Area (TA) 15, ~1 mi. east of well R-25 (Broxton et al. 2002, 072640), between wells R-18 and CdV-R-15-3. Figure 1 shows the locations of R-25, proposed well CdV-R-15-1, and other wells and boreholes associated with Consolidated Unit 16-021(c)-99 (aka the 260 Outfall) groundwater investigations. The purpose of well CdV-R-15-1 is to enhance the TA-16 monitoring well network by providing a regional aquifer well to the northeast of the 260 Outfall. The TA-16 monitoring well network analysis is presented in “Evaluation of the Suitability of Wells Near Technical Area 16 for Monitoring Contaminant Releases from Consolidated Unit 16-021(c)-99, Revision 1” (LANL 2007, 100113). The planned screened interval for CdV-R-15-1 will be in a producing zone located within 50 ft of the regional water table. Based on the potentiometric surface in the 3-D regional geohydrologic model, the regional water table is expected to be located at a depth of ~1276 ft (Figure 2). The proposed approach is to advance the borehole to a depth of 1380 ft, which is ~100 ft into the regional aquifer. Downhole video and geophysics will be completed below the water table, and a producing zone will be targeted for the screen. Figure 2 shows the stratigraphy for the CdV-R-15-1 area and the proposed well design for the well. Figure 3 is a geologic cross-section that shows the distribution of hydrostratigraphic units in the vicinity of well CdV-R-15-1 and the predicted geology at this location.
Conceptual Model	Modeling results presented in the monitoring well network analysis demonstrated that flow paths from the Cañon de Valle area trend to the northeast, between CdV-R-15-3 and R-18. These calculations also suggest that a well in this area would bring the efficiency of the TA-16 well network to greater than 95% detection efficiency. The final location of this well will be determined following drilling of CdV-16-3(i) and completion of additional network efficiency calculations. Strata at the regional water table are anticipated to be Puye Formation fanglomerates.
Drilling Approach	Drilling will be conducted using methods selected to optimize the potential of completing the well without using any drilling additives in the zone of saturation. Specifically, efforts will be made to meet the target depth of approximately 1380 ft below ground surface (bgs) and to provide a stable borehole environment for constructing the well. The primary method for advancing the borehole will be a combination of open-hole air-rotary and casing-advance with air-rotary. The following is a summary of the proposed methods by depth interval. • A 16-in. surface casing will be set to 20 ft bgs. • A 15-in. open borehole will be advanced with fluid-assisted air-rotary to the base of the Cerro Toledo at ~700 ft bgs. • A 12-in. casing will be lowered into the open borehole and advanced with fluid-assisted air-rotary to 1200 ft. • A 10-in. casing will be advanced to the target depth of 1380 ft without using drilling-fluid additives. If the well cannot be completed without using drilling fluids within the regional aquifer, NMED will be consulted and a modified drilling strategy will be developed. Municipal water may be added to cool the drill bit.
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 Los Alamos National Laboratory (the Laboratory) and have been characterized geochemically: • potable water from the municipal water supply to aid in delivery of other drilling additives • QUIK-FOAM, a blend of alcohol ethoxy sulfates, to be used as a foaming agent • AQF-2, an anionic surfactant, to be used as a foaming agent
Geochemical Objective	The geochemical objective is to provide a groundwater sampling point free of drilling-fluid effects within the regional aquifer.

Potential Groundwater Occurrence and Detection	The top of the regional groundwater system is expected to occur at a depth of approximately 1276 ft (see Figures 2 and 3) based on the local water table map. Based on drilling at nearby wells (R-18 and CdV-R-15-3), there is no expectation that a perched zone capable of producing water will be detected. Methods for groundwater detection may include driller's observations, water-level measurements, and borehole video.
Core Sampling	Core sampling is not proposed for CdV-R-15-1.
Groundwater Screening Sampling	A screening water sample will be collected from the screened interval following well development. The screening sample will be analyzed by the Earth and Environmental Sciences Group chemistry laboratory for cations/metals (dissolved and total), anions (dissolved), and select high explosives (HE) compounds (total).
Groundwater Characterization Sampling	Groundwater samples will be collected from the completed well between 10 and 60 d after well development in accordance with the Compliance Order on Consent. These samples will be analyzed for the full suite of TA-16-related constituents, including tritium; metals/cations; general inorganic chemicals; volatile organic compounds; semivolatile organic compounds; HE compounds, including RDX (research department explosives [hexahydro-1,3,5-trinitro-1,3,5-triazine]) and related degradation products; and stable isotopes. Subsequent groundwater samples will be collected under the "Interim Facility-Wide Groundwater Monitoring Plan" (LANL 2005, 088789).
Geophysical Testing	The Laboratory's borehole video camera, natural gamma, and induction tools will be used if open-hole conditions allow logging in the CdV-R-15-1 borehole before each casing string is introduced. If borehole conditions are stable and open-hole geophysics can be conducted, the 10-in. casing will be pulled back from total depth to expose the entire saturated interval for borehole logging by Schlumberger tools.
Well Completion Design	The proposed well design is shown in Figure 2, which assumes a producing zone is found at a depth of less than 1380 ft. If such a zone is not found at a depth less than 1380 ft, NMED will be consulted, and a revised drilling strategy will be developed.
Well Development	The well may be developed by both mechanical and chemical means. Mechanical means include swabbing, bailing, and pumping. Chemical means include the use of sodium acid pyrophosphate or AQUA-CLEAR PFD to remove natural and added clays and/or chlorination to kill bacteria introduced during well completion. Chemical means will be used only after additional discussions with, and approval by, NMED. After initial swabbing and bailing, the well will be pumped to complete the development. Water-quality parameters to be monitored are as follows: pH, specific conductance, temperature, turbidity, and total organic carbon (TOC), and acetone or ethylene glycol, as applicable. Target water-quality parameters are as follows: turbidity <5 nephelometric turbidity units, TOC <2 parts per million, other parameters stable.
Hydraulic Testing	A single-step pumping test, injection/straddle packer test, or slug test will be conducted in the well screen.

Investigation-Derived Waste (IDW) Management	All waste water produced during drilling will be managed and disposed of in accordance with the NMED-approved Notice of Intent (NOI) Decision Tree: Drilling, Development, Rehabilitation, and Sampling Purge Water (November 2006). Cuttings produced during drilling will be containerized or stored in lined pits and managed and disposed of in accordance with the NMED-approved NOI Decision Tree: Land Application of IDW Solids from Construction of Wells and Boreholes (November 2006). All wastes, such as contaminated personal protective equipment, disposable sampling equipment, decontamination waste, or other materials contaminated by drilling activities, will be characterized and managed in accordance with the associated waste characterization strategy forms and Standard Operating Procedure 5022, Characterization and Management of Environmental Restoration (ER) Project Waste. It is anticipated that all materials from above the water table will initially be managed as nonhazardous waste because the borehole is located in an area not thought to be contaminated.
Tentative Drilling Schedule	The following are activities and the duration at well CdV-R-15-1: • Drilling and completion of borehole (includes mobilization and site preparation): 45 d • Collection of borehole geophysical data: 2 d • Development of CdV-R-15-1: 5 d • Characterization sampling of CdV-R-15-1: 10 to 60 d (following development) • Site restoration at CdV-R-15-1: 7 d The proposed start date for drilling activities is April 30, 2009.

REFERENCES

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

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

Broxton, D., R. Warren, P. Longmire, R. Gilkeson, S. Johnson, D. Rogers, W. Stone, B. Newman, M. Everett, D. Vaniman, S. McLin, J. Skalski, and D. Larssen, March 2002. "Characterization Well R-25 Completion Report," Los Alamos National Laboratory report LA-13909-MS, Los Alamos, New Mexico. (Broxton et al. 2002, 072640)

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LANL (Los Alamos National Laboratory), May 2005. "Interim Facility-Wide Groundwater Monitoring Plan," Los Alamos National Laboratory document LA-UR-05-3443, Los Alamos, New Mexico. (LANL 2005, 088789)

LANL (Los Alamos National Laboratory), November 2007. "Evaluation of the Suitability of Wells Near Technical Area 16 for Monitoring Contaminant Releases from Consolidated Unit 16-021(c)-99, Revision 1," Los Alamos National Laboratory document LA-UR-07-6433, Los Alamos, New Mexico. (LANL 2007, 100113)

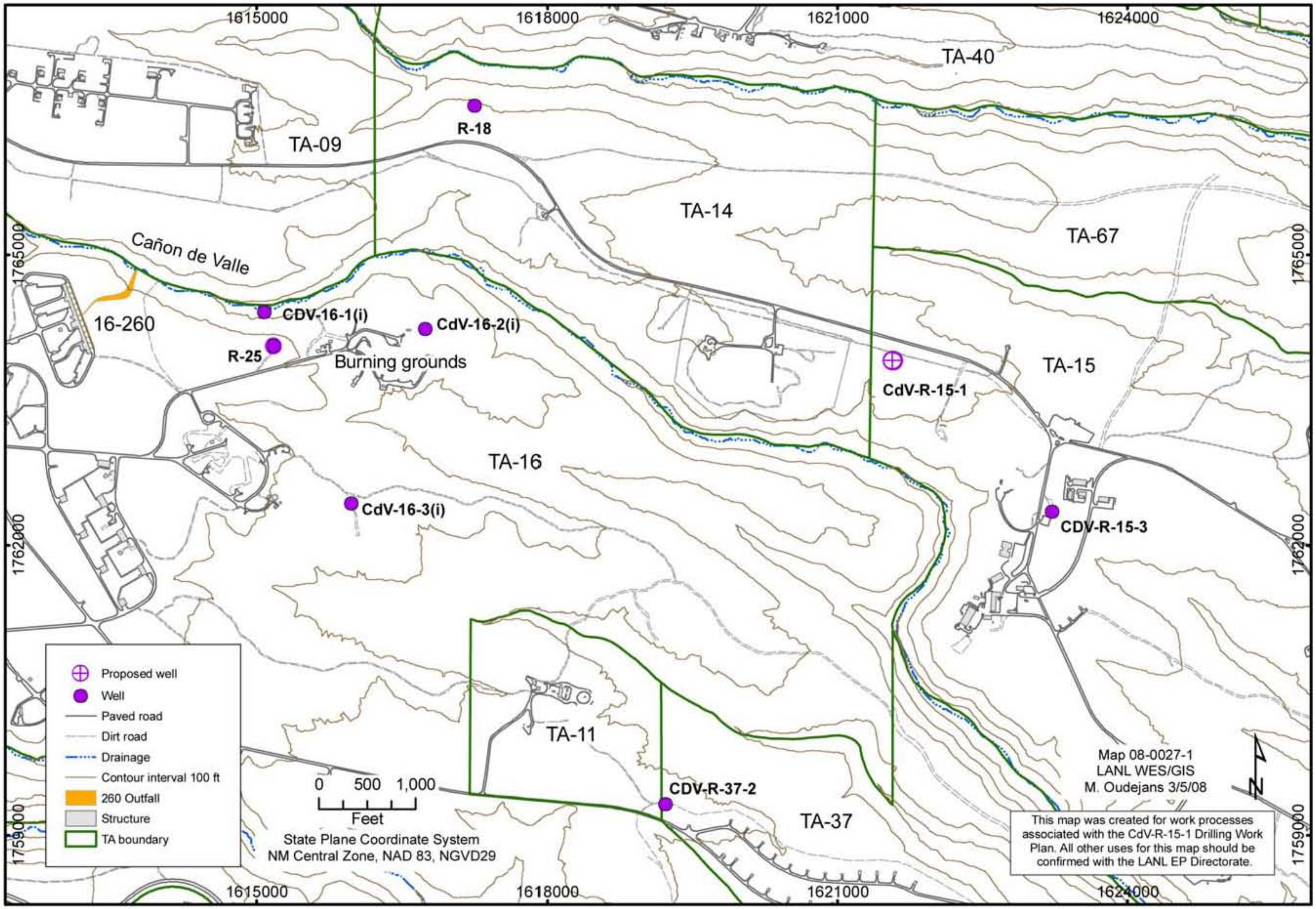
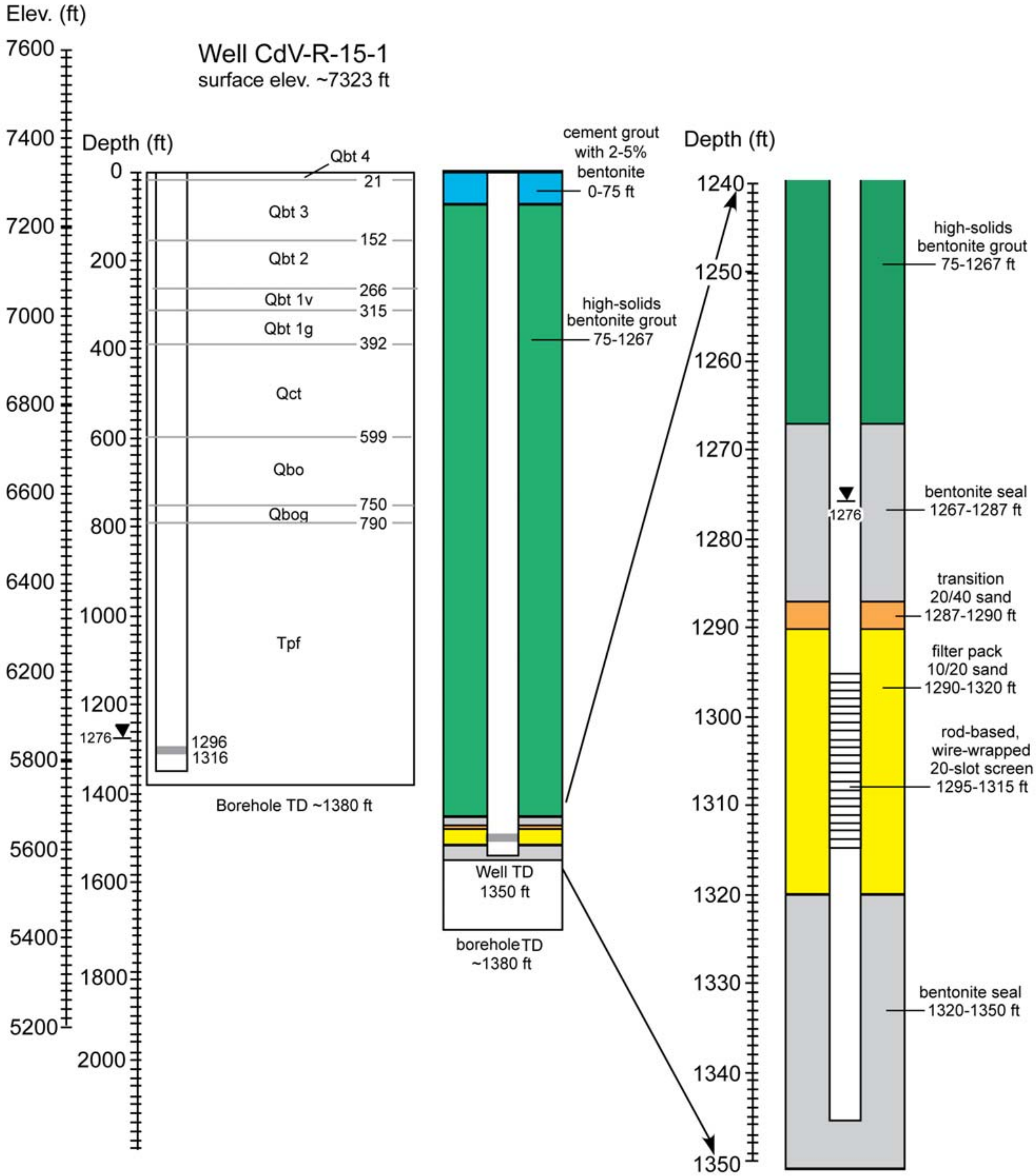
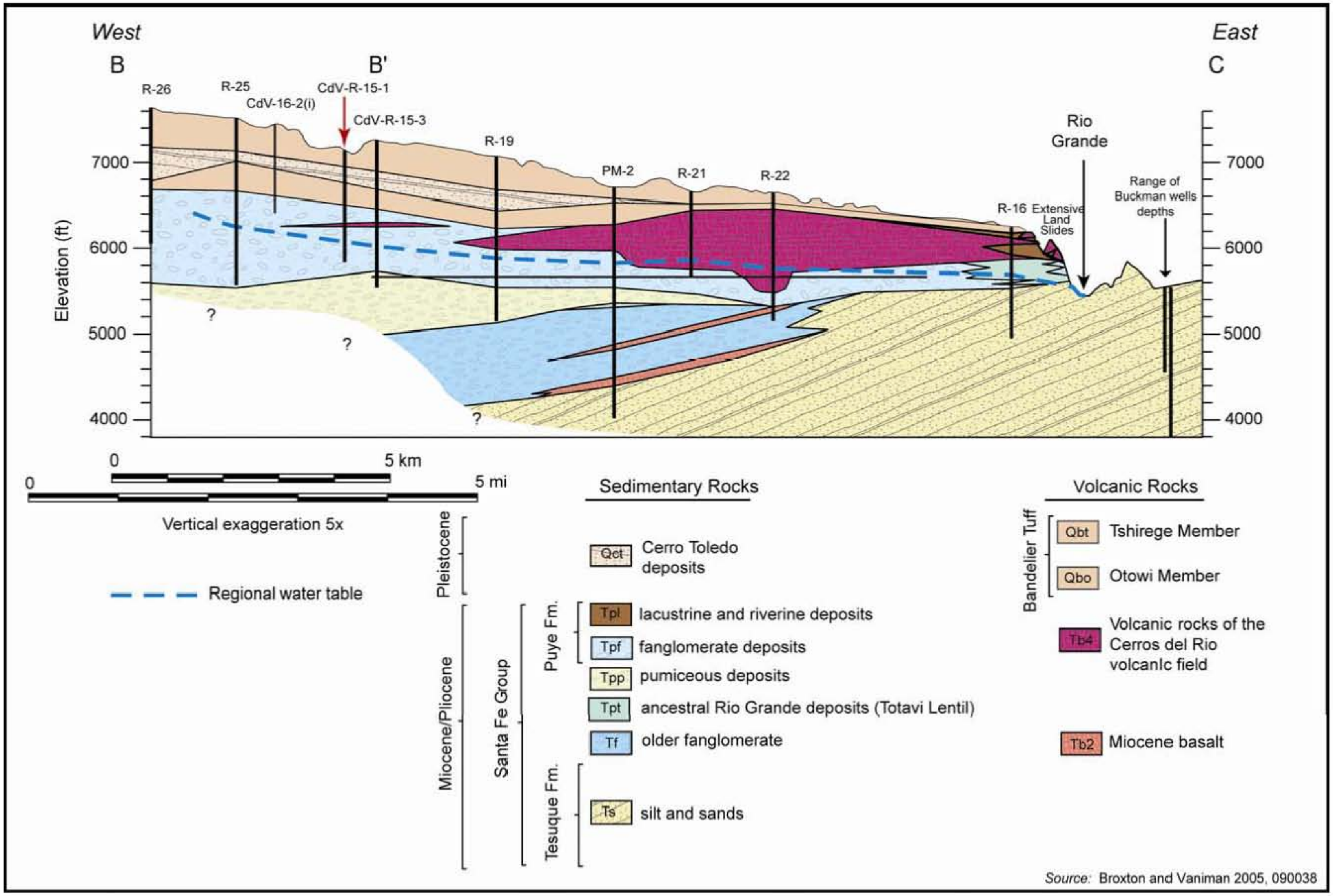


Figure 1 **Proposed location of CdV-R-15-1 relative to R-25 and other TA-16 monitoring wells**



Notes: Qbt = unit 4, 3t, 3, 2, 1v, or 1g of the Tshirege Member of the Bandelier Tuff; Qbtt = Tsankawi Pumice of the Tshirege Member; 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; TD = total depth.

Figure 2 Proposed well design for CdV-R-15-1 in relation to local stratigraphy



Note: Dashed blue line indicates possible top of regional saturation.

Figure 3 Geologic cross-section of the well CdV-R-15-1 area