Drilling Work Plan for Regional Aquifer Well R-51

Primary Purpose	Regional aquifer well R-51 is being installed to provide a regional aquifer monitoring well to the southwest of Material Disposal Areas (MDAs) H and J. The proposed site for R-51 is located in Pajarito Canyon northwest of Technical Area 18 (TA-18) (Figure 1). The well will also monitor for potential contaminants originating from sources elsewhere within the Pajarito Canyon watershed. The target depth for the R-51 borehole is 1050 ft in sediments of the Puye Formation. R-51 is expected to penetrate the top of regional saturation at about 887-ft depth and is tentatively designed with two screens within the regional zone of saturation (Figure 2). To support development of a three-dimensional perspective on potential contaminants and groundwater flow within the regional aquifer, the well is planned to have an upper screen near the top of the regional zone of saturation and a lower screen in a zone with good permeability properties, both within the Puye Formation. Screen separation will be a minimum of 50 ft to allow for the installation of a Baski sampling system. A final well design will be based on hydrogeological conditions encountered during drilling and will be submitted to the New Mexico Environment Department (NMED) for approval.
Conceptual Model	Recent groundwater maps of this area indicate a north-northeasterly gradient. Therefore, R-51 is located upgradient of potential releases of hazardous or radioactive chemicals from MDAs H and J at TA-54. Data from R-51 will provide an upgradient comparison with data from R-37 and R-52, which are downgradient of MDAs H and J.
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 target zone of saturation. A combination of open-hole and casing-advance methods will be employed. Each interval of open hole or casing advance will be optimized to meet well objectives. Casing will be used to protect open-hole intervals above, to advance the borehole when open-hole drilling is not possible, and to secure the borehole through unstable zones or through significant perched groundwater intervals.
Potential Drilling Fluids, Composition, and Use	Fluids and additives that may be used to facilitate drilling are consistent with those previously used in the drilling program at Los Alamos National Laboratory (the Laboratory) and have been characterized geochemically. Fluids and additives previously authorized for use by NMED include • potable water and 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; and • AQF-2, an anionic surfactant, used as a foaming agent. Complete records will be maintained detailing the type, amount, and volume of drilling fluid used; depth of drilling fluid added to the borehole; amount in storage in the borehole; and recovery volume of drilling fluid. No drilling fluids will be used within 100 ft of the regional aquifer, except potable municipal water. If the regional aquifer cannot be reached without adding drilling fluids, the situation will be discussed with NMED. No chemicals other than those listed above will be added without approval from NMED.
Hydrogeologic and Geochemical Objectives	• The primary objective is to provide local background for regional groundwater upgradient of potential releases of hazardous or radioactive chemicals from MDAs H and J at TA-54 and to provide downgradient data relevant to R-17/R-17i. • Another major objective is to establish water levels and flow characteristics in the regional aquifer. • A secondary objective is to determine if perched-intermediate water zone(s) occur in the area downgradient of R-17/R17i and upstream from the facilities at TA-18. This secondary purpose will be addressed to the extent possible, but drilling methods will be optimized to accomplish the primary objective.

Hydrogeologic and Geochemical Objectives (continued)	• A tertiary objective is to determine from cuttings and geophysical logs if the lavas at about 1050 ft are Tschicoma or Cerros del Rio—a difference in volcanic stratigraphy that can affect flow models in this area.
Potential Groundwater Occurrence and Detection	• *Potential Perched Water:* ~160 ft within Cerro Toledo interval, ~518 ft along the contact between the Puye Formation and the top of the Cerros del Rio basalts, and ~800 ft at the base of the Cerros del Rio basalts • *Regional:* 887 ft: Regional groundwater is expected to occur in the middle section of the Puye Formation about 70 to 80 ft below the Cerros del Rio basalts. • Methods for groundwater detection may include driller's observations, water-level measurements, borehole video, and borehole geophysics.
Core Sampling	No core collection is planned.
Groundwater Screening Sampling	• Groundwater screening samples will be collected during drilling at any groundwater zones 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 Division's Geochemistry and Geomaterials Research Laboratory and for high explosives (HE), tritium, and volatile organic compounds (VOCs) by off-site laboratories.
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 constituents, including radiochemistry, metals/cations, general inorganic chemicals, HE, VOCs, and stable isotopes. If R-51 is completed as a two-screen well, the first characterization samples will be collected at the end of each constant-rate pumping test through stainless-steel discharge pipe. • Subsequent groundwater samples will be collected under the annual "Interim Facility-Wide Groundwater Monitoring Plan."
Geophysical Testing	• The Laboratory's borehole video camera, natural gamma, and induction tools will be used in the open borehole if conditions allow. • A full suite of geophysical logs will be run in the open borehole, if required, to ensure proper placement of the screens. The logs will be collected by Schlumberger, Inc., and will include Accelerator Porosity Sonde (Neutron Porosity), Array Induction, Combined Magnetic Resonance, Natural and Spectral Gamma, and Formation Micro-Imager logs. In cased portions of the borehole, Neutron Porosity, Triple Litho-Density, Elemental Capture, Natural Gamma, and Spectral Gamma logs will be collected. These logs will be used to characterize the hydraulic properties of saturated rocks in the regional aquifer. The geophysical logs also will be used to select the well screen depth. The suite and timing of geophysical logging will depend on borehole conditions.
Well Completion Design	Two well screens are planned: one near the top of regional saturation and the other approximately 50 ft lower. Actual depths will be based on data collected from the borehole.

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. • After initial swabbing and bailing, a packer will be used to isolate the well screens during pumping development. • Water-quality parameters to be monitored: pH, specific conductance, temperature, turbidity, and total organic carbon (TOC) Target water-quality parameters: turbidity <5 nephelometric turbidity units, TOC <2 ppm, other parameters stable
Hydraulic Testing	Pumping tests at both screens will be performed if hydrologic conditions permit. Each screen will be isolated and pumped separately. Response to pumping tests will be monitored at nearby wells.
Investigation-Derived Waste Management	Investigation-derived waste will be managed in accordance with Standard Operating Procedure (SOP) EP-SOP-5238, Characterization and Management of Environmental Program Waste (http://www.lanl.gov/environment/all/qa/adep.shtml). This SOP incorporates the requirements of applicable U.S. Environmental Protection Agency and NMED regulations, U.S. Department of Energy orders, and Laboratory 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 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. 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 d 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.
Schedule	Well R-51 is proposed for NMED completion on January 29, 2010. This date is consistent with the Laboratory's October 14, 2009, letter to NMED (LANL 2009, 107088) proposing an integrated well installation schedule for wells that include R-51 and R-52, which are both specifically applicable to the collection of key groundwater data for MDA H. Monitoring conducted subsequent to installation of R-51 will be implemented under the "Interim Facility-Wide Groundwater Monitoring Plan" and will support investigations and potential corrective actions at MDA H and other sites in the vicinity as applicable.

REFERENCE

The following list includes all documents cited in this plan. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs 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 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.

LANL (Los Alamos National Laboratory), October 14, 2009. "Submittal of a Proposed Integrated Well-Installation Schedule," Los Alamos National Laboratory letter (EP2009-0496) to J.P. Bearzi (NMED-HWB) from M.J. Graham (LANL) and G.J. Rael (DOE-LASO), Los Alamos, New Mexico. (LANL 2009, 107088)

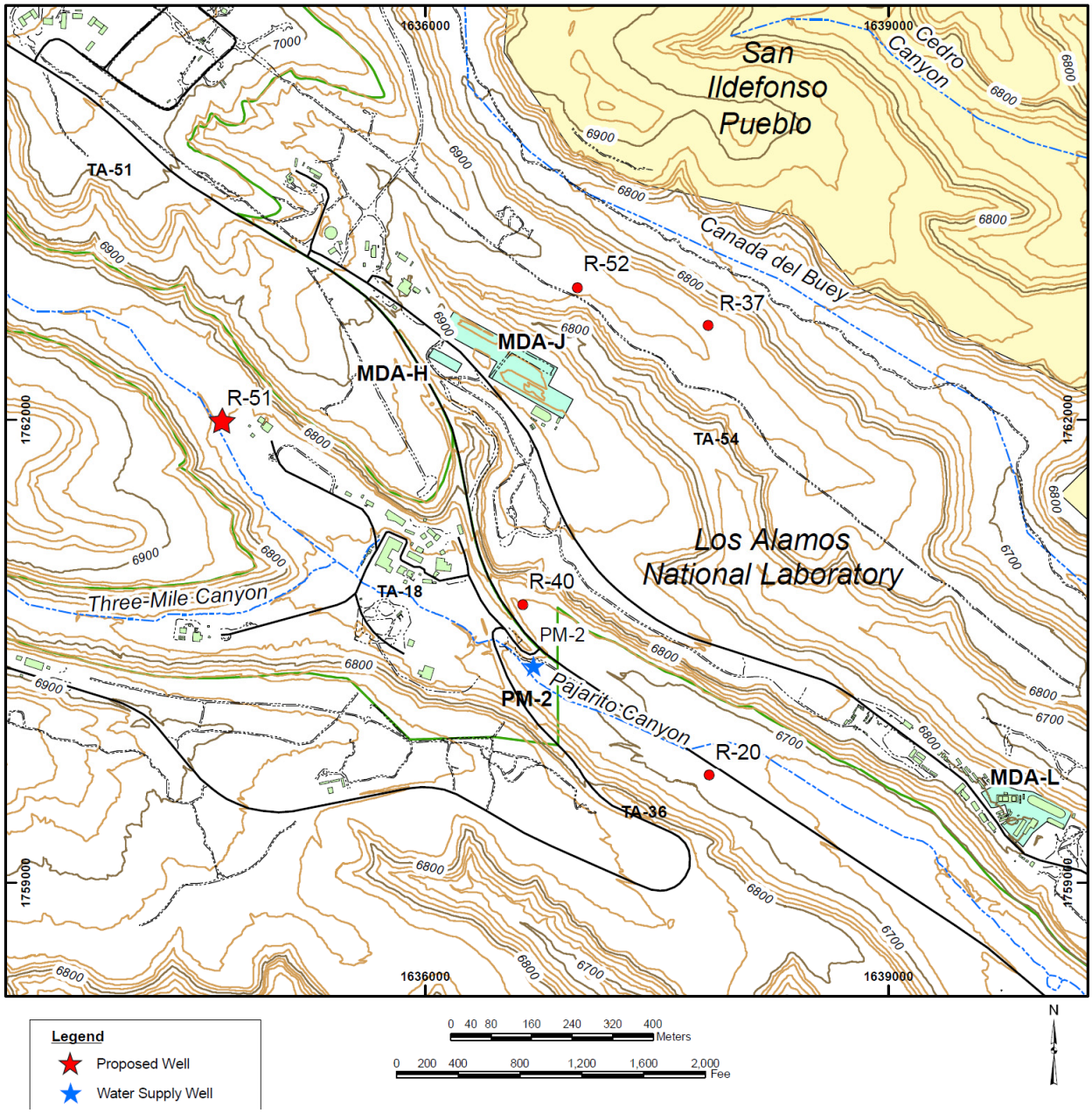

Figure 1 Proposed R-51 site

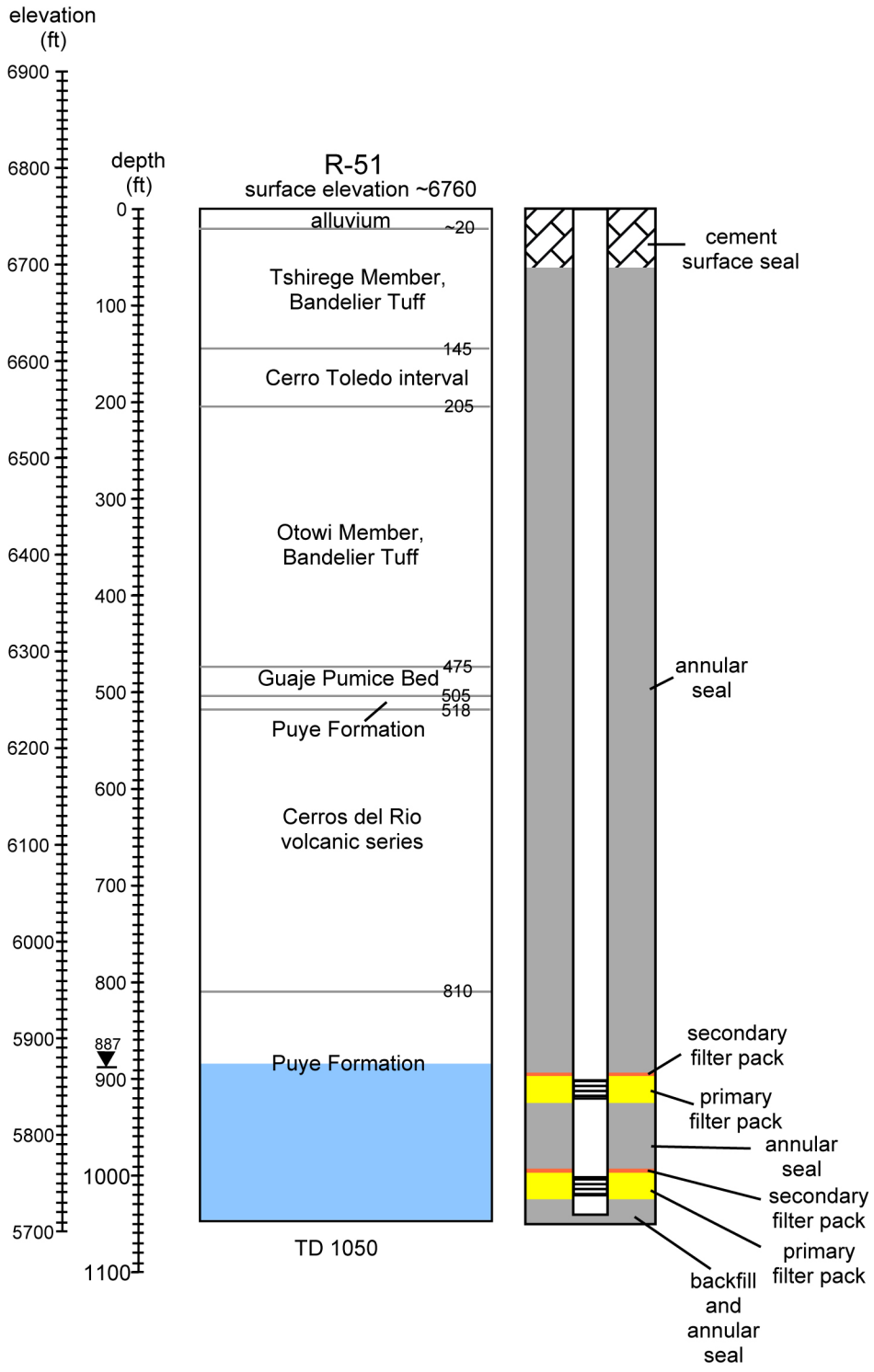

Figure 2 Predicted geology and well schematic for well R-51