Drilling Work Plan for Perched-Intermediate Well R-26i

Primary Purpose	Perched-intermediate well R-26i is being installed to monitor water quality in perched-intermediate groundwater observed during the drilling of regional aquifer well R-26 and monitored by piezometer R-26 PZ2. The main purpose of well R-26i is to replace R-26 PZ2. This replacement well is required by the New Mexico Environment Department's (NMED's) approval with modifications, dated June 20, 2012 (NMED 2012, 520747), for the Technical Area 16 Well Network Evaluation and Recommendations report (LANL 2012, 213573). Well R-26i will be located within 50 ft of the existing R-26 piezometer nest (Figure 1). Perched groundwater zones were encountered when the core hole at regional aquifer well R-26 was advanced. Two piezometers were opportunistically installed within the core hole. The shallower piezometer (PZ2) is screened 150 to 180 ft below ground surface (bgs), and the deeper (PZ1) is screened 230 to 250 ft bgs. Well R-26i targets the shallower perched-intermediate groundwater between depths of approximately 150 and 180 ft within unit Qbt 3t of the Bandelier Tuff. The proposed total depth of the borehole is 200 ft. The well will be completed with a single screen (Figure 2). Figure 2 shows the predicted geology and preliminary well design for well R-26i. A final well design will be based on data collected during drilling. A proposed well-design document will be submitted to NMED for approval.
Conceptual Model	Piezometer R-26 PZ2 is located topographically upgradient of all known release sites within Technical Area 16 (TA-16). Turbidity in the piezometer is very high, and concentrations of cobalt, manganese, molybdenum, nickel, and zinc are variably high. Perchloroethene (PCE) is detected consistently at low levels (0.68–1.75 ppb). High explosives (HE) and other volatile organic compounds (VOCs) present at TA-16 are not detected. The piezometer cannot be purged because of a very low recharge rate, and its small diameter necessitates the use of a bailer to collect water samples, which affects the reliability of the VOC data. Generally, only enough water is available to bail 1 casing volume (approximately 0.5 gal.), allowing analysis of a limited suite. The water chemistry is distinct from area-specific background groundwater and also differs from the water chemistry in deep groundwater locations in the TA-16 area where contaminants are present. A potential source of the PCE detected in R-26 PZ2 is the nearby former Zia shops where solvents were stored and possibly used.
Drilling Approach	Drilling will be conducted with methods selected to optimize the potential of completing the well without the use of drilling additives in or immediately above the target zone of saturation. A combination of open-hole and casing-advance methods will be used. Each interval of open-hole or casing-advance will be optimized to meet well objectives. Casing will be used to secure the borehole through unstable zones or to isolate the upper-perched groundwater interval (see Potential Groundwater Occurrence and Detection).
Potential Drilling Fluids, Composition, and Use	Fluids and additives may be used to facilitate drilling. These fluids and additives are consistent with those used previously in the drilling program at Los Alamos National Laboratory (LANL or the Laboratory) and have been characterized geochemically. Fluids and additives previously authorized for use by NMED include • 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; and • AQF-2, an anionic surfactant, used as a foaming agent.

Potential Drilling Fluids, Composition, and Use (continued)	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 chemicals, other than those listed above, will be added without approval from NMED. No drilling fluids, except potable municipal water, will be used below 70 ft bgs, which is 100 ft above the target upper perched zone encountered in R-26 core hole.
Hydrogeologic and Geochemical Objectives	• The geochemical objective is to establish a monitoring location to collect representative groundwater samples, especially with respect to historical data for PCE. • The hydrogeologic objective is to replace piezometer R-26 PZ2 with a properly constructed monitoring well to better evaluate the geochemistry of perched-intermediate groundwater at the R-26 well location.
Potential Groundwater Occurrence and Detection	Based on observations from the core hole advanced at the R-26 well location, one zone of perched-intermediate groundwater is expected to occur at well R-26i. Groundwater was observed standing at 173 ft during advancement of the core hole. The core hole wall, however, was smeared with rock dust, and the groundwater producing interval could not be identified with downhole video. Natural gamma and induction logs collected in the core hole did not provide additional information about the producing interval. Therefore, the R-26i borehole will be advanced past the observed standing water level to 200 ft. Methods for groundwater detection may include driller's observations, water-level measurements, borehole video, and borehole geophysics.
Core Sampling	No core collection is planned because the well is targeting a known perched-zone interval.
Groundwater Screening Sampling	No groundwater screening samples will be collected from the borehole during drilling because they are not representative of ambient conditions.
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 radionuclides, metals/cations, general inorganic chemicals, HE, VOCs, and stable isotopes, assuming the well produces enough water (see Conceptual Model). Subsequent groundwater samples will be collected under the Interim Facility-Wide Groundwater Monitoring Plan.
Geophysical Testing	The Laboratory's borehole video camera and natural gamma and induction tools will be used in the open borehole if conditions allow. The suites run and the timing of geophysical logging will depend on borehole conditions.
Well Completion Design	Figure 2 shows the proposed well design for well R-26i. The R-26i screen will be placed to match the depth and the length of the 30 ft screen interval in R-26 PZ2.

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 additives to remove clay minerals introduced as annular fill and/or chlorination to kill bacteria introduced during well completion. • After initial swabbing and bailing, a submersible pump will be used to complete the development process, if adequate water production is encountered. • Water-quality parameters will be measured in a flow-through cell. The parameters to be monitored are pH, specific conductance, dissolved oxygen, temperature, turbidity, oxidation-reduction potential, and total organic carbon (TOC). • If the Laboratory is unable to bring the water-quality parameters within the measurement limits specified below, the use of chemical well development may be discussed with NMED. No chemicals will be added without approval from NMED. • Chemicals that may be used include the addition of sodium acid pyrophosphate and AQUACLEAR PFD to remove clay minerals. Well development will be considered complete when target water-quality parameters are met. The target water-quality parameters are turbidity <5 nephelometric turbidity units, TOC <2 ppm, and other parameters stable.
Hydraulic Testing	No hydraulic testing is proposed for this well.
Investigation Derived Waste Management	Investigation-derived waste (IDW) will be managed in accordance with Standard Operating Procedure (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 will 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 "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 cuttings may or may not contain residue of drilling/well completion additives (e.g., drilling foam and bentonite clay). 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 for 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-26i is proposed for completion on October 31, 2013.

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. 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), March 2012. "Technical Area 16 Well Network Evaluation and Recommendations," Los Alamos National Laboratory document LA-UR-12-1082, Los Alamos, New Mexico. (LANL 2012, 213573)

NMED (New Mexico Environment Department), June 20, 2012. "Approval with Modifications, Technical Area 16 Well Network Evaluation and Recommendations," New Mexico Environment Department letter to P. Maggiore (DOE-LASO) and M.J. Graham (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2012, 520747)

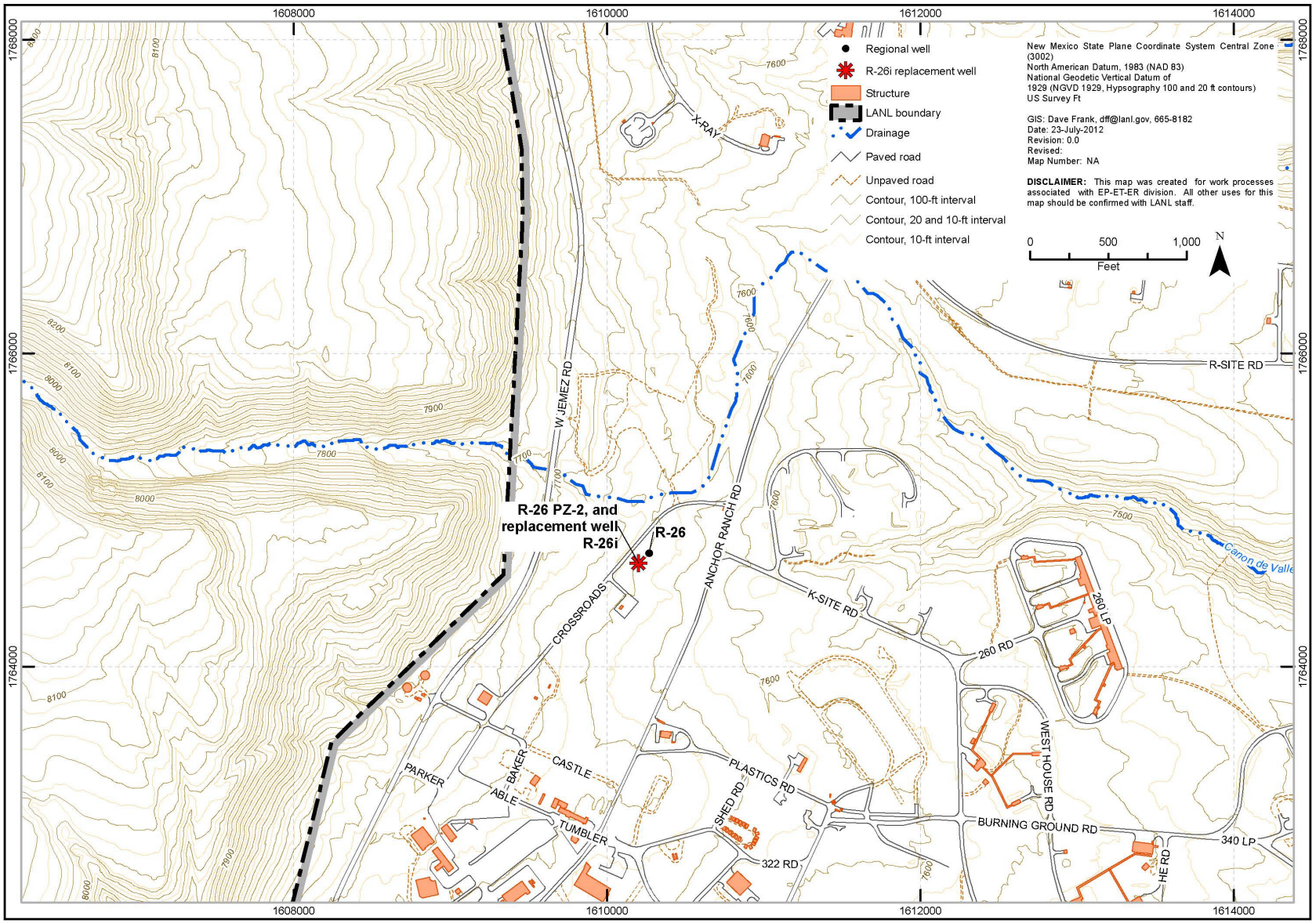

Figure 1 Proposed location for well R-26i

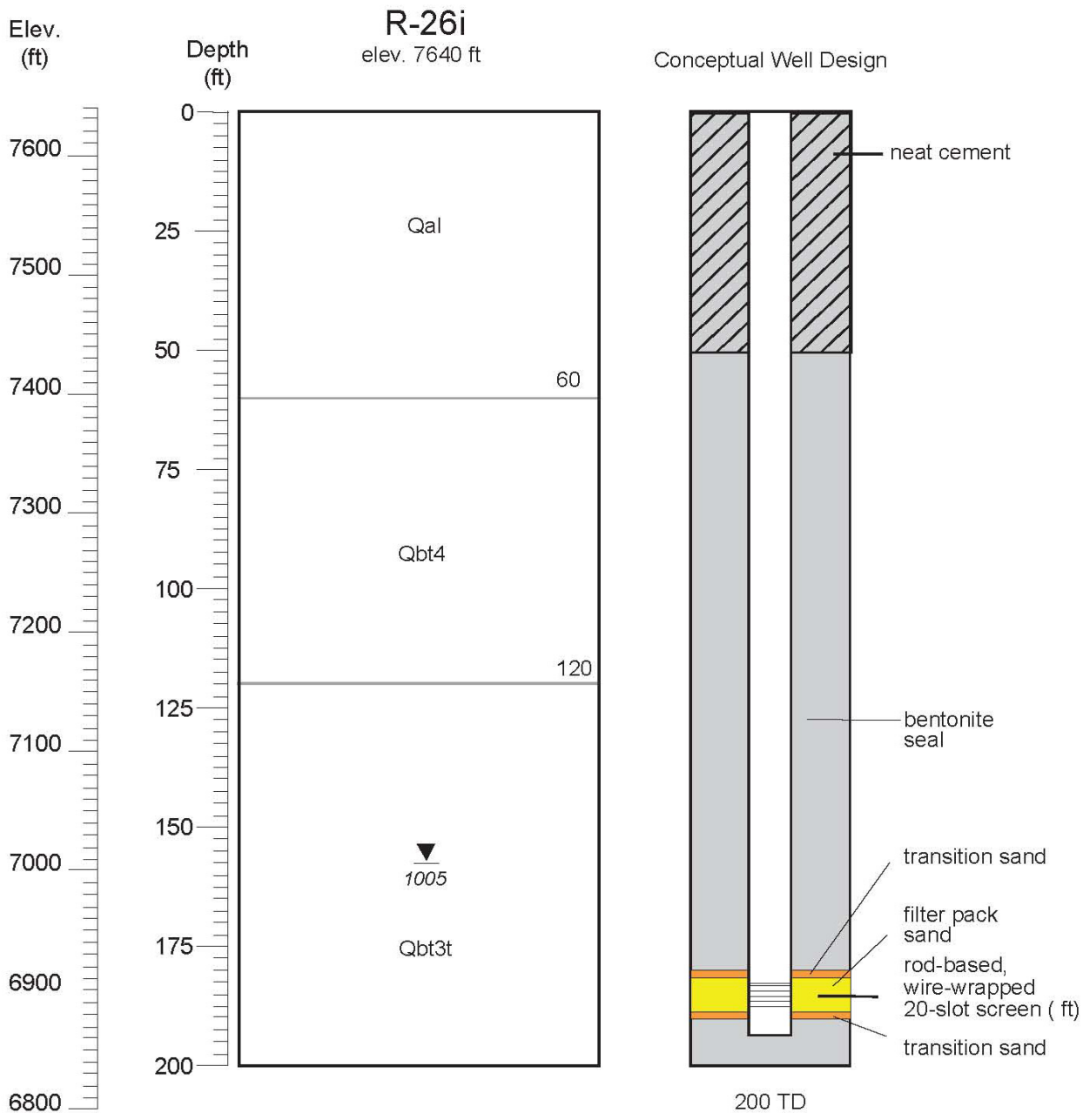

Figure 2 Predicted geology and proposed well design for well R-26i