

**Drilling Work Plan for Regional Monitoring Well Near Material Disposal Area C**

<p><b>General Location and Purpose</b></p>	<p>Material Disposal Area (MDA) C is a decommissioned 11.8-acre material disposal area consisting of 7 pits and 108 shafts. MDA C operated from May 1948 to April 1974 but received waste only intermittently from 1968 until it was decommissioned in 1974. Wastes disposed of at MDA C consisted of liquids, solids, and containerized gases generated from a broad range of nuclear-energy research and development activities conducted at Los Alamos National Laboratory (the Laboratory). These wastes include uncontaminated classified materials, metals, hazardous materials, and radioactively contaminated materials. MDA C is located within Technical Area (TA) 50 at the head of Ten Site Canyon (Figure 1).</p> <p>A new regional aquifer well will be installed downgradient of MDA C to ensure that adequate monitoring is in place for the corrective measures evaluation (CME). The exact location of the well will be determined after preliminary sampling results are received in June and in cooperation with the New Mexico Environment Department (NMED). The well will be installed with one well screen and a submersible pump.</p> <p>Figure 1 shows the general area for the location of the proposed well. Figure 2 is a generic well completion diagram showing the preliminary design for the well. Figure 3 shows the stratigraphy in nearby wells and the expected stratigraphy in the new well.</p>
<p><b>Purpose of New Regional Monitoring Well</b></p>	<p>The well will be completed within the Puye Formation or in pumiceous deposits below the Puye Formation, depending on stratigraphy and top of regional saturation as encountered, in the highest productive zone near the water table (Figure 3). The well screen length will be determined based on conditions found during drilling, but it is expected to be from 20 to 40 ft in length.</p>
<p><b>Conceptual Model of Hydrogeology</b></p>	<p>MDA C is located on a mesa top above thick, unsaturated units of the Bandelier Tuff, and present-day aqueous-phase transport is generally believed to be minimal. Because of the low expected infiltration rates, travel times for nonadsorbing aqueous-phase contaminants from the disposal area to the regional aquifer are expected to be greater than several hundred years and significantly longer for sorbing constituents. However, pore-gas sampling shows that vapor-phase transport of contaminants occurs in the upper portion of the unsaturated zone. The primary vapor-phase contaminants at MDA C are tritium, trichloroethene (TCE), and tetrachloroethene (PCE).</p> <p>A thick (~330 ft) series of dacitic lavas, probably derived from western Tschicoma sources, underlie the Bandelier Tuff and are likely overlain by a thin section of Puye Formation. The top of the lava sequence and any overlying Puye deposits will exert strong controls over travel times and directions for liquid transport. The dacitic lavas have very low permeability and will inhibit downward transport. The dip of the top of the unsaturated dacite lava is also important because pore water percolating to depth may accumulate above the dacite and move laterally downdip before infiltrating the fractures.</p> <p>The thickness of the Tschicoma dacite beneath MDA C is constrained by available borehole data at surrounding boreholes R-14, MCOI-1, and R-17; nearby borehole SHB-1 provides additional constraint on the top of the dacitic lavas. Lithologic logs for these boreholes provide fairly accurate control for the stratigraphic subunits of the Bandelier Tuff, for the Cerro Toledo Interval, for thin Puye deposits beneath the Bandelier Tuff, and for the top of the dacitic lava sequence. The bottom contact of the dacitic lavas with deeper Puye Formation and the depth to upper-Santa Fe Group pumiceous deposits is poorly known in this area and somewhat speculative. Depth to water is also poorly constrained; the borehole at MDA C is in a region where the gradient at the top of regional saturation is believed to rise sharply to the west of R-17. The estimate for elevation at the top of regional saturation used here is about 5920 ft, but the actual elevation may vary by about ±20 ft.</p> <p>Groundwater flow in the regional aquifer is expected to be dominantly toward the east beneath TA-50. The water table beneath TA-50 occurs primarily within the lower Puye Formation or the upper pumiceous deposits of the Santa Fe Group.</p>

<p><b>Drilling Approach for Regional Aquifer Well</b></p>	<p>To optimize the potential of completing the well without the use of any drilling additives in the zone of saturation, air-rotary casing advance will be used.</p> <ul style="list-style-type: none"> <li>• A 16-in. surface casing will be advanced with fluid assisted air-rotary methods through the Bandelier Tuff, including the Guaje Pumice Bed and any underlying Puye Formation, to the top of the dacitic lavas. At the top of the relatively impermeable dacite, the casing should be retracted several feet and potential perched water should be observed. If significant perched water is observed, a decision may be made to complete a well at this point.</li> <li>• A 15-in. open borehole will be advanced with fluid-assisted air-rotary methods through the dacitic lavas and any associated perched zones within the thick dacitic lava sequence. The open borehole will be continued through the underlying Puye Formation. Introduction of drilling additives (e.g., foam) will stop 100 ft above the regional aquifer.</li> <li>• If perched water is present, bentonite will be tremied into the borehole, and a 12-in. casing will be lowered and sealed in place.</li> <li>• If no perched water is encountered, the 12-in. casing will be lowered into the open borehole and rotated into the bottom of the borehole.</li> <li>• A 10-in. casing will be advanced to a target depth of 100 ft into the regional aquifer without the use of drilling fluid additives. Municipal water may be added to cool the drill bit as needed.</li> </ul>
<p><b>Potential Drilling Fluids, Composition, and Use</b></p>	<p>The following fluids and additives that may be used have been characterized geochemically and are consistent with those previously used in the drilling program at the Laboratory.</p> <ul style="list-style-type: none"> <li>• Potable water from the municipal water supply to cool the drill bit and to aid in delivery of other drilling additives</li> <li>• QUIK-FOAM, a blend of alcohol ethoxy sulfates, to be used as a foaming agent</li> <li>• AQF-2, an anionic surfactant, to be used as a foaming agent</li> </ul>
<p><b>Potential Groundwater Occurrence and Detection</b></p>	<p>Intermediate groundwater may occur at the top of the thick dacite lavas, as observed at R-17 in Pajarito Canyon. However, a comparable perched zone was not observed at MCOI-1 in Mortandad Canyon.</p> <p>Regional groundwater is expected to occur at about 5920 ft (±20 ft) elevation within the lower Puye Formation.</p> <p>Methods for groundwater detection may include driller's observations, water-level measurements, borehole video, and borehole geophysics.</p>
<p><b>Core Sampling</b></p>	<p>No core collection is planned.</p>
<p><b>Groundwater Screening Sampling</b></p>	<p>Screening-water samples will be collected during drilling at any perched horizon producing sufficient water for sampling and at the top of the regional aquifer.</p> <p>A screening-water sample will be collected from the screen at the end of development.</p> <p>Screening samples of groundwater will be analyzed for dissolved cations/metals and anions by the Earth and Environmental Sciences Division chemistry laboratory.</p>

<p><b>Groundwater Characterization Sampling</b></p>	<p>Groundwater samples will be collected from the completed well between 10 d 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 radioactive elements, metals/cations, general inorganic chemicals, volatile and semivolatile organic compounds, and stable isotopes of hydrogen, nitrogen, and oxygen.</p> <p>Subsequent groundwater samples will be collected as specified in the “Interim Measures Work Plan for Chromium Contamination in Groundwater” and the “Interim Facility-Wide Groundwater Monitoring Plan.”</p>
<p><b>Geophysical Testing of Regional Wells</b></p>	<p>Conditions permitting, the Laboratory’s borehole video camera, natural gamma, and induction tools will be used in the 15-in. open borehole before the 12-in. casing is lowered,.</p> <p>Borehole conditions permitting, the 10-in. casing also will be pulled up above the regional aquifer, and a full suite of geophysical logs will be run in the open borehole. 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. If the casing cannot be retracted for logging, the accelerator porosity sonde, elemental capture sonde, triple litho-density, and natural 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 will also be used to select the well screen depth. The suite and timing of geophysical logging will depend on borehole conditions.</p>
<p><b>Well Completion Design</b></p>	<p>One well screen will be placed in the most productive interval identified within the upper 100 ft of the regional aquifer.</p>
<p><b>Well Development</b></p>	<p>The well will be developed by mechanical means, including swabbing, bailing, and pumping.</p> <p>Target water-quality parameters are turbidity (&lt;5 nephelometric turbidity units), total organic carbon (&lt;2 parts per million), and other parameters stable.</p>
<p><b>Hydraulic Testing</b></p>	<p>A 24-h constant-rate pumping test is planned within the regional aquifer. No testing is planned in any intermediate-perched aquifers because these zones do not produce sufficient water to allow hydrologic testing.</p>
<p><b>Investigation-Derived Waste Management</b></p>	<p>Fluids produced during drilling will be managed and disposed of in accordance with the NMED-approved notice of intent decision tree: drilling, development, rehabilitation, and sampling purge water (November 2006). Cuttings produced during drilling will be managed and disposed of in accordance with the decision tree for managing investigation-derived waste solids from drilling operations, which is pending review and approval from NMED.</p>
<p><b>Drilling Schedule</b></p>	<p>The well will be completed by October 31, 2008, as required by NMED.</p>

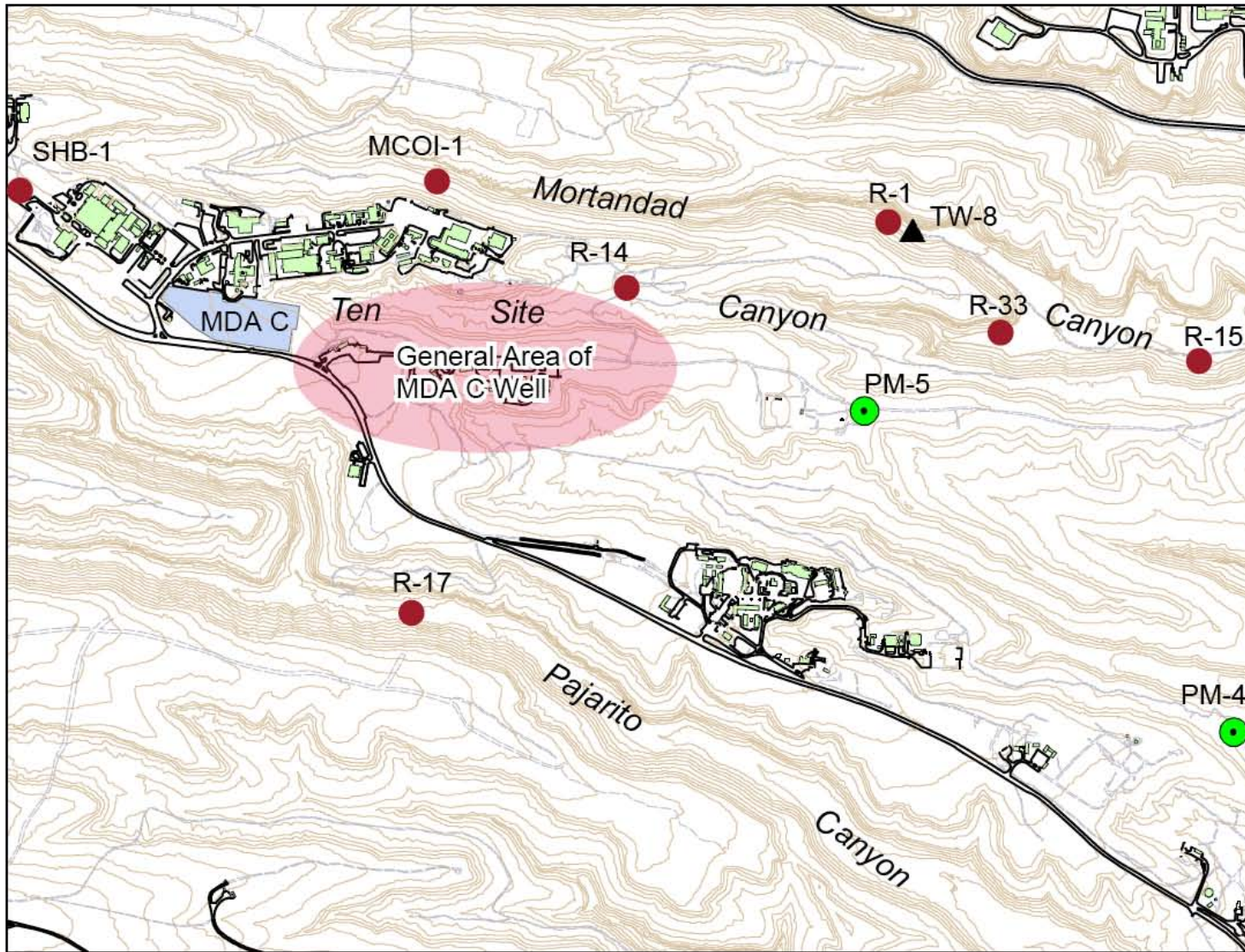
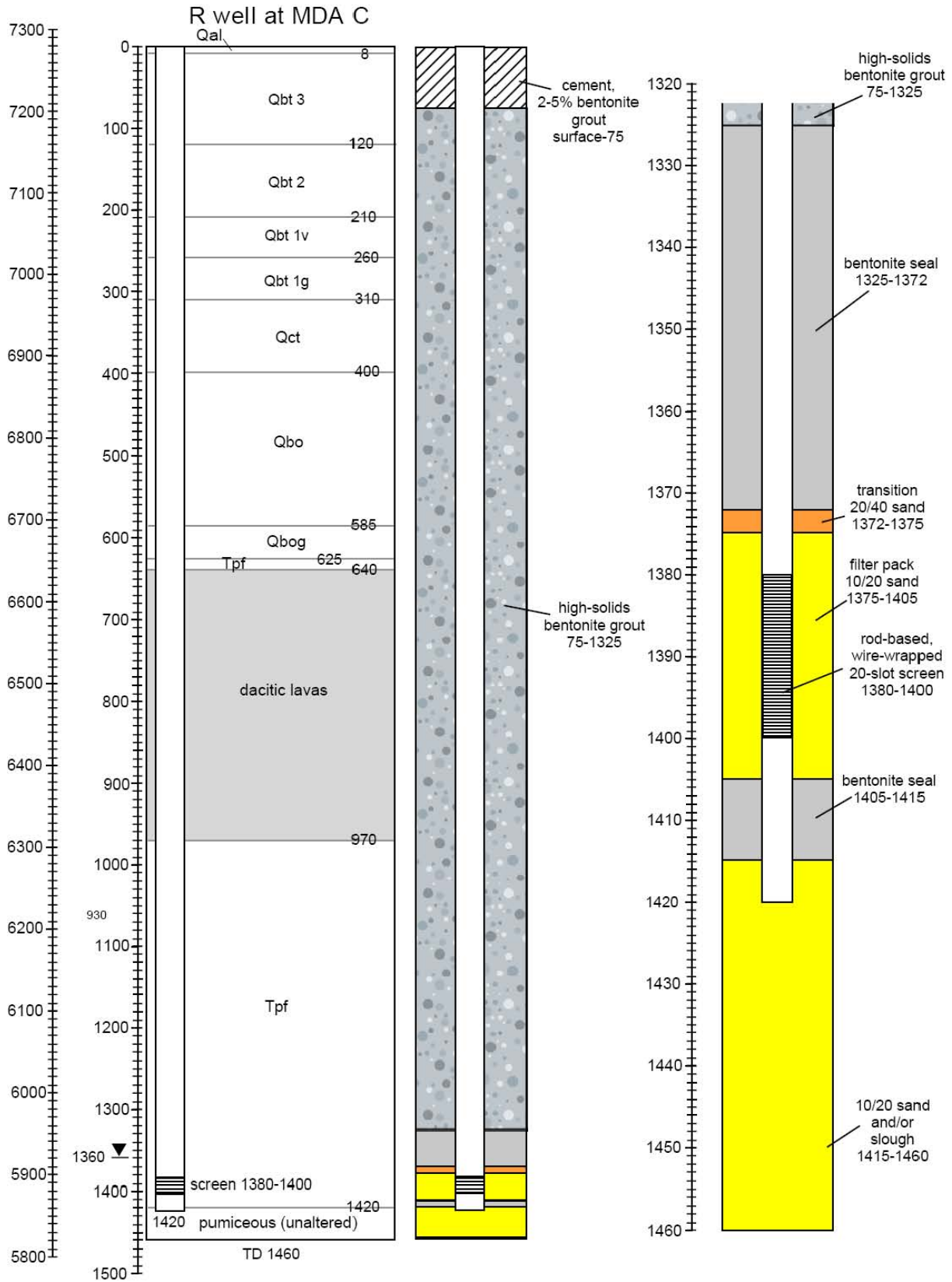


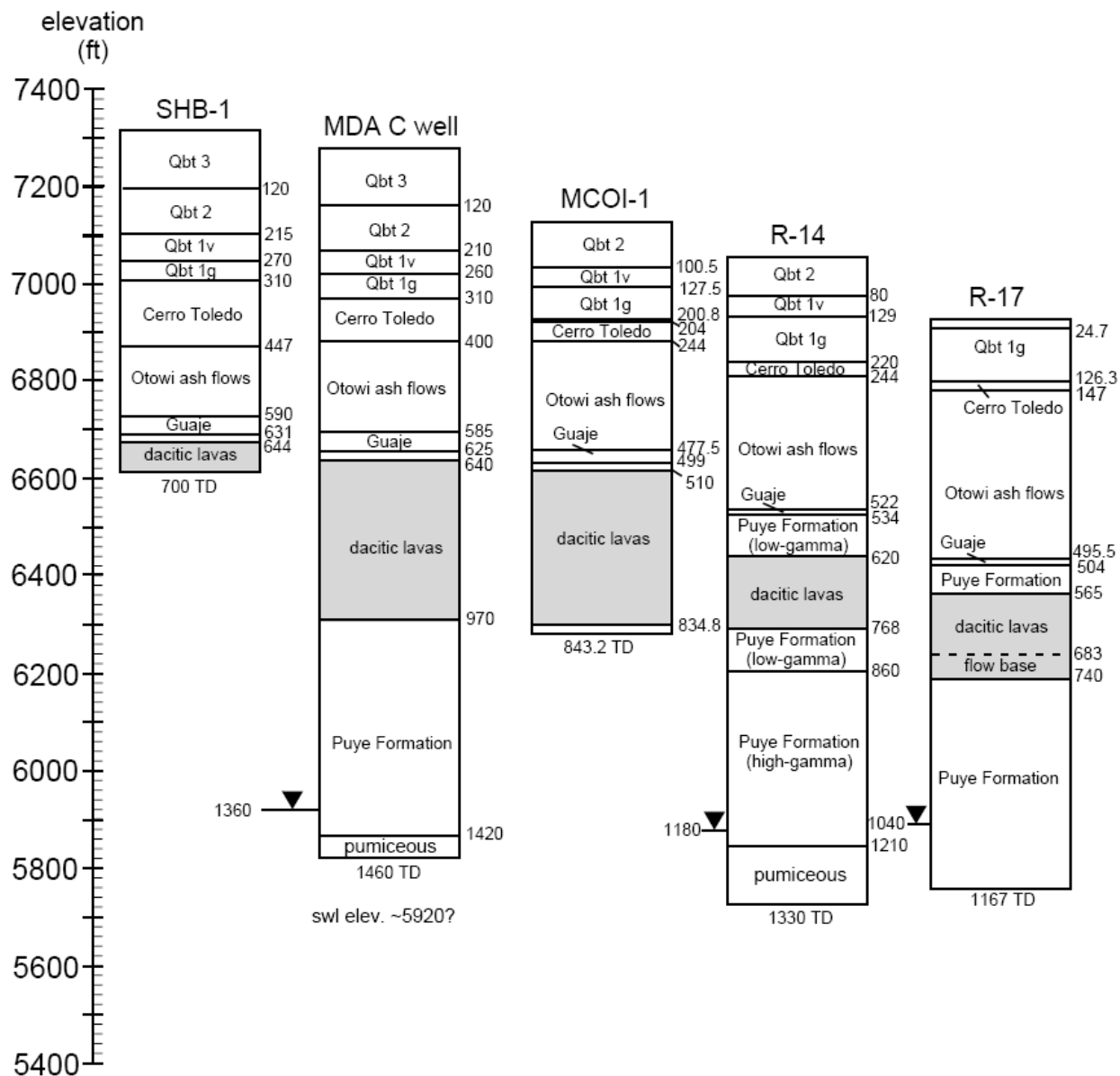
Figure 1

Map showing the locations of MDA C at TA-50 (blue area); nearby regional and intermediate characterization and monitoring wells (red circles); Test Well 8 (TW-8, black triangle); water-supply wells (green circles); and the general site for the new MDA C monitoring well (red oval).





**Figure 2** Proposed well design for new well at MDA C. All depths are listed in feet



**Figure 3** Projected stratigraphy and water level for a borehole near MDA C, based on known stratigraphy at surrounding boreholes SHB-1, MCOI-1, R-14, and R-17 and augmented by data from the Laboratory’s 3D geologic site model. Projected elevation of the top of regional saturation was estimated with an average of 10 different contourings of this surface.