Drilling Work Plan for Regional Aquifer Well R-30

Primary Purpose	Regional aquifer well R-30 is being installed as part of investigations underway at Technical Area 49 (TA-49). The proposed site for R-30 is near the eastern boundary of TA-49 and downgradient of Material Disposal Area (MDA) AB (Figure 1). The target depth for the R-30 borehole is 1275 ft. R-30 is expected to penetrate the top of regional saturation in lavas at about 1125-ft depth and is tentatively designed with a single 20-ft-long screen within the regional zone of saturation (Figure 2). A final well design will be based on hydrogeological conditions encountered during drilling, and a revised well design document will be submitted to the New Mexico Environment Department (NMED) for approval. Figure 2 shows the stratigraphy and proposed well design for R-30. Figure 3 is a geologic cross-section that shows the distribution of hydrostratigraphic units in the vicinity of R-30.
Conceptual Model	MDA AB at TA-49 was used for underground hydronuclear experiments, with releases of explosive compounds (TNT, RDX, HMX, and barium nitrate); Pu, Am, U, and other radionuclides; and Pb plus minor amounts of Be. Well R-27 was installed in Water Canyon to the north, with a screen set in the Puye Formation that shows no evidence of contamination. A thin perched zone was noted at the top of Cerros del Rio lavas when R-27 was drilled; it is uncertain whether that perched zone extends south beneath TA-49. The hydrogeologic conceptual model at R-30 is complicated by conflicting interpretations of the lavas that host the top of regional saturation. Lithologic logs from older test wells (DT-5A, DT-9, and DT-10) suggest Tschicoma dacitic lavas may be present rather than the Cerros del Rio basalts. Cuttings and geophysical logs from R-30 will help resolve this uncertainty. The conceptual model for contaminant migration from MDA AB is that there is limited migration due to the relatively dry vadose system beneath this mesa-top site; however, migration in this system is expected to be principally vertical if it occurs. An exception to the concept of vertical movement could occur if there is a perched interval on top of the lavas, allowing movement downdip and possibly to the west (if Cerros del Rio basalt) or east (if Tschicoma dacite).
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, advance the borehole when open-hole drilling is not possible, and 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 (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 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 a regional aquifer monitoring well downgradient of TA-49. • Other objectives include ❖ establishing water levels in the regional aquifer in this area for use in further constraining regional groundwater flow direction and gradients, ❖ determining if perched intermediate water zone(s) occur in the area of MDA AB, and ❖ determining from cuttings and geophysical logs if the lavas at about 1087 ft are Tschicoma or Cerros del Rio lavas, a difference in volcanic stratigraphy that can impact flow models in this area.
Potential Groundwater Occurrence and Detection	• *Perched:* 881 ft, at base of Guaje Pumice Bed and 1087 ft (possibly based on observed thin perched zone in R-27) at top of lava • *Regional:* 1125 ft, regional groundwater expected to occur in lavas of the Tschicoma or Cerros del Rio. 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 of the distance from potential source area at MDA AB.
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 Earth and Environmental Sciences Division's Geochemistry and Geomaterials Research Laboratory and for high explosives, tritium, and volatile organic compounds by off-site laboratories.
Groundwater Characterization Sampling	• A groundwater sample will be collected from the completed well between 10 and 60 d after well development, in accordance with the Compliance Order on Consent. This sample will be analyzed for the full suite of constituents, including radionuclides, metals/cations, general inorganic chemicals, high explosives, volatile organic compounds, semivolatile organic compounds, and stable isotopes. • 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 may be used in the open borehole before drill casing is lowered in, if conditions allow. • A full suite of geophysical logs may 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, Elemental Capture, and Formation Micro-Imager logs. In cased portions of the borehole, Neutron Porosity, Triple Lithodensity, 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 will also be used to select the well screen depth. The suite and timing of geophysical logging will depend on borehole conditions.
Well Completion Design	One 20-ft well screen will be placed at 1135–1155 ft in the regional aquifer.

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), as applicable. Target water-quality parameters: turbidity <5 nephelometric turbidity units, TOC <2 ppm, other parameters stable
Hydraulic Testing	Hydraulic testing will be conducted if a significant water-producing horizon is encountered. The test will likely consist of a constant-rate 24-h pumping test.
Investigation-Derived Waste Management	Investigation-derived waste (IDW) 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.
Schedule	The NMED-completion date for R-30 is targeted for no later than April 29, 2010 (see attached Gantt chart, Figure 4). This date represents a request for extension of the current completion date for R-30 required by NMED in a letter dated March 31, 2008 (2008, 101116). The new requested date is based on the Laboratory's proposed prioritization for new wells in a letter dated October 14, 2009 (LANL 2009, 107088). Additionally, the Laboratory has set the drilling schedule for the other investigation well for MDA AB (R-29) to precede drilling at R-30 because R-29 has been identified by NMED in a letter dated August 31, 2009 (2009, 107002), as the appropriate well to characterize the presence or absence of perched intermediate groundwater in support of the MDA AB investigation report due to NMED on May 30, 2009. The schedule in Figure 4 details the activities that precede the anticipated mobilization date of February 18, 2009, shown in activity ID B160F31380. Monitoring conducted subsequent to installation of the well will be implemented in the "Interim Facility-Wide Groundwater Monitoring Plan" and will support investigations and potential corrective actions at MDA AB and other site investigations within the south canyons.

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), 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)

NMED (New Mexico Environment Department), March 31, 2008. "Approval for Extension to Complete Regional Groundwater Monitoring Well R-30," New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2008, 101116)

NMED (New Mexico Environment Department), August 31, 2009. "Approval, Request for Deviations from the Approved Investigation Work Plan for Sites at Technical Area 49 Inside the Nuclear Environmental Sites (NES) Boundary," New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2009, 107002)

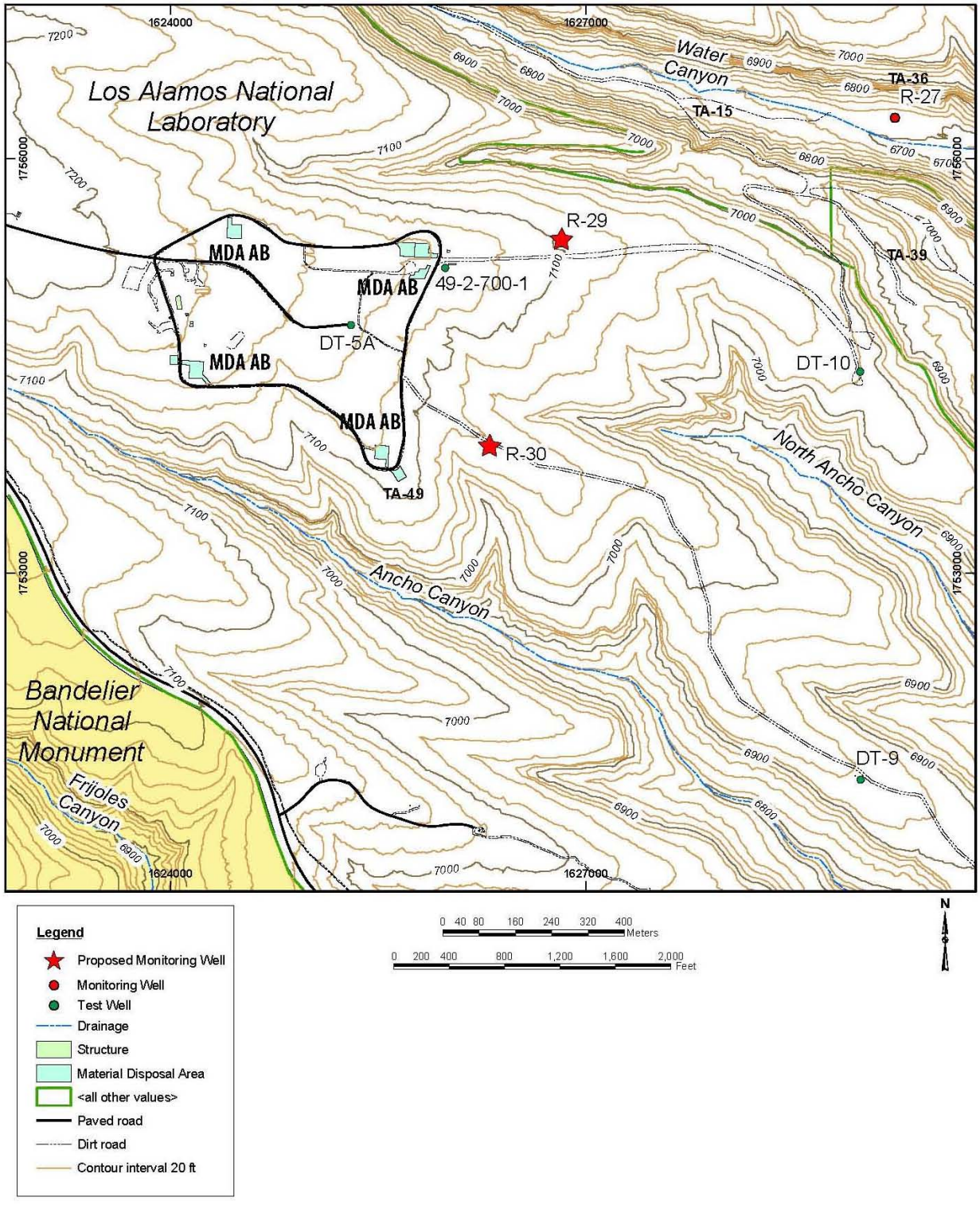
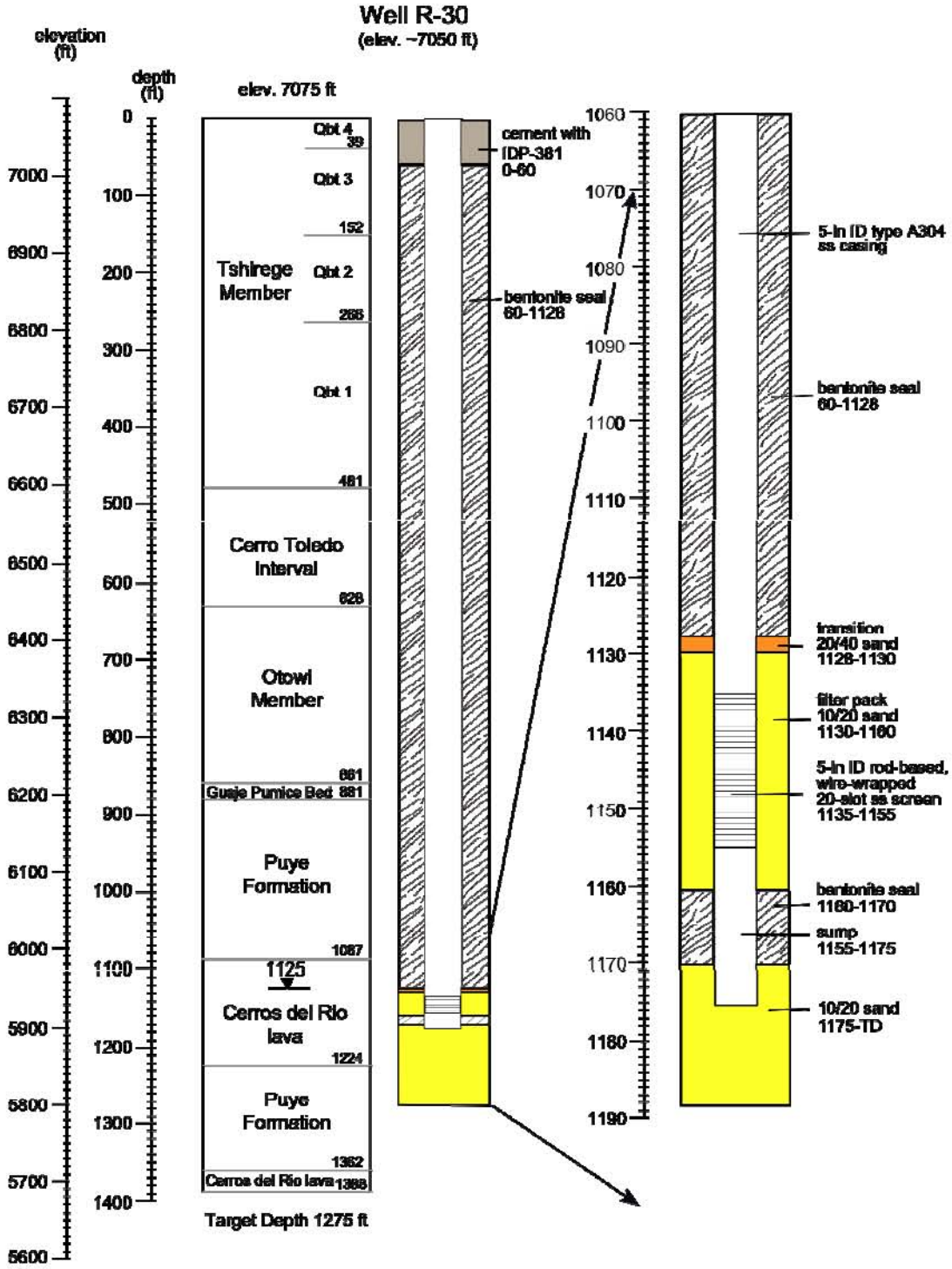
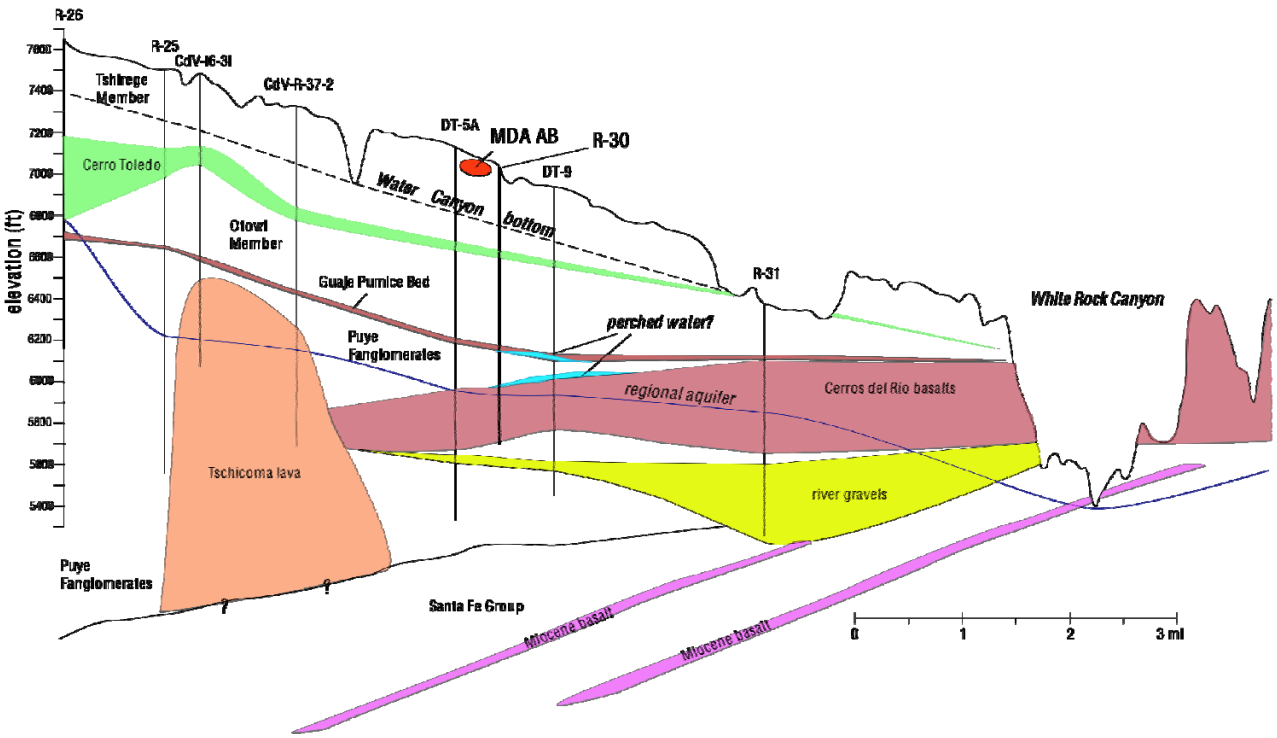


Figure 1 R-30 with Proposed wells R-30 and R-29



Note: Qbt = units (4, 3, 2, 1v, 1g) of the Tshirege Member of the Bandelier Tuff.

Figure 2 Predicted geology and conceptual well design for R-30

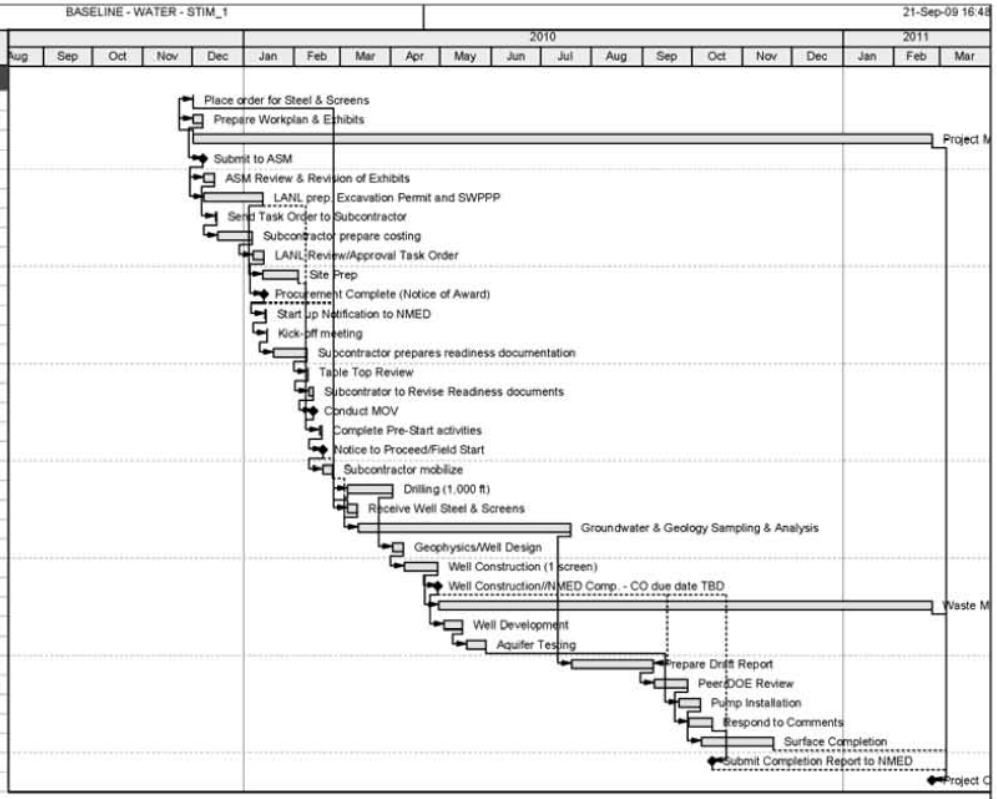


Note: MDA AB and proposed location of R-30 are shown.

Figure 3 **Direct-line borehole-to-borehole cross-section (crossing mesas and canyons) from R-26 to 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**

STIMULUS - WELLS | BASELINE - WATER - STIM_1 | 21-Sep-09 16:48

Activity ID	Activity Name	Original Duration	Start	Finish
Work Package Lvl-8: F3 R-30 DEEP WELL - ANCHO CYN		300	01-Dec-09	24-Feb-11
B160F31020	Place order for Steel & Screens	1	01-Dec-09	01-Dec-09
B160F31040	Prepare Workplan & Exhibits	5	01-Dec-09	07-Dec-09
B160F31000	Project Management	300	01-Dec-09*	24-Feb-11
B160F31060	Submit to ASM	0		07-Dec-09
B160F31080	ASM Review & Revision of Exhibits	5	08-Dec-09	14-Dec-09
B160F31100	LANL prep. Excavation Permit and SWPPP	20	08-Dec-09	12-Jan-10
B160F31120	Send Task Order to Subcontractor	1	15-Dec-09	15-Dec-09
B160F31140	Subcontractor prepare costing	10	16-Dec-09	06-Jan-10
B160F31160	LANL Review/Approval Task Order	5	07-Jan-10	13-Jan-10
B160F31180	Site Prep	15	13-Jan-10	03-Feb-10
B160F31200	Procurement Complete (Notice of Award)	0		13-Jan-10
B160F31220	Start up Notification to NMED	1	14-Jan-10	14-Jan-10
B160F31240	Kick-off meeting	1	15-Jan-10	15-Jan-10
B160F31260	Subcontractor prepares readiness documentation	15	19-Jan-10	08-Feb-10
B160F31280	Table Top Review	1	09-Feb-10	09-Feb-10
B160F31300	Subcontrator to Revise Readiness documents	3	10-Feb-10	12-Feb-10
B160F31320	Conduct MOV	0		12-Feb-10
B160F31340	Complete Pre-Start activities	2	16-Feb-10	17-Feb-10
B160F31360	Notice to Proceed/Field Start	0	18-Feb-10	
B160F31380	Subcontractor mobilize	5	18-Feb-10	24-Feb-10
B160F31420	Drilling (1,000 ft)	20	05-Mar-10	01-Apr-10
B160F31440	Receive Well Steel & Screens	5	05-Mar-10	11-Mar-10
B160F31460	Groundwater & Geology Sampling & Analysis	90	12-Mar-10	19-Jul-10
B160F31480	Geophysics/Well Design	5	02-Apr-10	08-Apr-10
B160F31500	Well Construction (1 screen)	15	09-Apr-10	29-Apr-10
B160F31520	Well Construction//NMED Comp. - CO due date TBD	0		29-Apr-10
B160F31400	Waste Management	200	30-Apr-10	24-Feb-11
B160F31540	Well Development	10	03-May-10	14-May-10
B160F31560	Aquifer Testing	10	17-May-10	28-May-10
B160F31580	Prepare Draft Report	35	20-Jul-10	07-Sep-10
B160F31600	Peer/DOE Review	15	08-Sep-10	28-Sep-10
B160F31640	Pump Installation	10	23-Sep-10	06-Oct-10
B160F31620	Respond to Comments	10	29-Sep-10	13-Oct-10
B160F31680	Surface Completion	30	07-Oct-10	19-Nov-10
B160F31660	Submit Completion Report to NMED	0		13-Oct-10
B160F31700	Project Completion	0		24-Feb-11



Actual Work | Remaining Work | Critical Remaining Work | Milestone | Page 1 of 1 | TASK filter: _WPs | (c) Primavera Systems, Inc

Figure 4 Detailed schedule for regional well R-30