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DEPARTMENT OF ENERGY
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos, New Mexico 87544

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NMED Hazardous Waste Bureau

EMLA-2022-BF061-02-001

March 21, 2022

Mr. Rick Shean
Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6313

Subject: Submittal of the Drilling Work Plan for Groundwater Regional Aquifer Monitoring Well R-76 (Replacement of Groundwater Regional Aquifer Monitoring Well R-28)

Dear Mr. Shean:

Enclosed please find two hard copies with electronic files of the "Drilling Work Plan for Groundwater Regional Aquifer Monitoring Well R-76 (Replacement of Groundwater Regional Aquifer Monitoring Well R-28)." Submittal of this work plan fulfills fiscal year 2022 Milestone #8 of Appendix B of the 2016 Compliance Order on Consent.

If you have any questions, please contact Joseph Sena at (505) 551-2964 (joseph.sena@em-la.doe.gov) or Cheryl Rodriguez at (505) 414-0450 (cheryl.rodriguez@em.doe.gov).

Sincerely,

ARTURO DURAN

Digitally signed by ARTURO DURAN
Date: 2022.03.21 08:53:09 -06'00'

Arturo Q. Duran
Compliance and Permitting Manager
U.S. Department of Energy
Environmental Management
Los Alamos Field Office

Enclosure(s):
1. Two hard copies with electronic files – Drilling Work Plan for Groundwater Regional Aquifer Monitoring Well R-76 (Replacement of Groundwater Regional Aquifer Monitoring Well R-28) (EM2022-0114)

cc (letter and enclosure[s] emailed):
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Drilling Work Plan for Groundwater Regional Aquifer Monitoring Well R-76 (Replacement of Groundwater Regional Aquifer Monitoring Well R-28)

Primary Objectives and Purpose	This work plan presents the objectives, drilling approach, and conceptual design for groundwater monitoring well R-76. The primary objective for R-76 is to replace the monitoring capability historically provided by groundwater monitoring well R-28. In accordance with a July 2017 work plan approved by the New Mexico Environment Department (NMED), Los Alamos National Laboratory (LANL or the Laboratory) conducted a study at R-28 of the potential for molasses to be applied in the aquifer as an agent for initiating geochemical reduction that would result in in situ conversion of hexavalent chromium to trivalent chromium (LANL 2017, 602505; NMED 2017, 602546). Data collected from R-28 as part of the study showed that intended chromium reduction was achieved; however, geochemically reducing conditions have persisted in the aquifer around the well, yielding it currently unusable for water-quality monitoring, especially for reduction/oxidation-sensitive constituents such as chromium and nitrate. Replacement of R-28 will provide for monitoring in an important area of the chromium plume where chromium concentrations in R-28 have historically been in the 400 ppb range. R-76 will also provide for long-term performance monitoring for chromium and related constituents as part of future remediation efforts. An additional objective for R-76 is to characterize the vertical extent of contamination in the same area of the plume by including a second screened interval at a depth within the Chamita formation (Tcar). Characterization and monitoring within Tcar will help address uncertainties of whether the Tcar is a preferential pathway for chromium contamination that might originate within the plume centroid. Monitoring within the Tcar in this area of the plume will also inform whether groundwater flow within the Tcar is uniquely influenced by pumping of Los Alamos County water-supply wells, particularly well PM-3. The deeper screen at R-76 will complement a series of wells, including R-77 and R-73 that will characterize the Tcar from west to east along the groundwater flow path. The two-screen configuration will also help characterize the vertical gradient in the regional aquifer in the central portion of the plume. Two considerations drive the proposed location for R-76 (Figure 1). First, the primary objective of R-76 as a replacement for R-28 supports a location close to R-28. Second, the location needs to be off-gradient from aquifer sediments and groundwater potentially influenced by the residual effects of molasses deployed at R-28, and potential effects of tracer deployments into CrPZ-2a. There is some indirect evidence that the naphthalene sulfonate tracer injected into PZ-2a (and possibly also the sulfonate tracer injected into PZ-2b) may have biodegraded in the aquifer based on its sudden shift to nondetect in monitoring data collected from CrEX-3, whereas the co-deployed perrhenate (rhenium) tracer persisted. If sulfonate degradation has occurred in the aquifer, it could result in the presence of an area with biological activity that could impact data representativeness in the upper screen interval proposed for R-76. Potential locations are also constrained by nearby existing infrastructure, including buried piping used for the chromium interim measure. The proposed location to the northwest of R-28 is shown in Figure 1 as being near an historical drainage based on the current GIS coverage, but current site conditions do not indicate that location would be susceptible to flooding. The proposed location would still need to be vetted through the United States Army Corp of Engineers (USACE) Albuquerque office to ensure that there are no Clean Water Act Section 404 constraints for construction of a drilling pad and drilling activities. The review process with the USACE will be initiated upon concurrence of NMED of the proposed location. Figure 2 presents a cross-section that extends from CrPZ-2 to CrEX-3 showing the stratigraphic sequence and screen positions of nearby wells and those proposed for R-76. Figure 3 shows the conceptual design for R-76, with the understanding that a separate and more detailed design package that reflects actual information obtained during and following drilling will be submitted to NMED for review and approval.

Drilling Approach	The proposed drilling approach for R-76 will use fluid-assisted air-rotary with casing-advance methods. Telescoping casing sizes between 24 in. and 10 in. and dual-rotary methods will be used to advance the borehole to a depth within the upper 185 ft of the regional aquifer. This approach will produce a borehole that can accommodate an approximate 3-in. annular filter pack around the 5-in.-diameter well screen.
Drilling Fluids, Composition, and Use	Fluids and additives will be used to facilitate drilling and may include those previously authorized for use by NMED, including the following: • Potable water, municipal water supply, to aid in delivery of other drilling additives and to cool the drill bit, • QUIK-FOAM, a blend of alcohol ethoxy sulfates, used as a foaming agent to lift cuttings, and • AQF-2, an anionic surfactant, used as a foaming agent to lift cuttings. The goal is to stop use of drilling fluids and additives 100 ft above the regional aquifer, but use of additives may be necessary to advance drilling and maintain borehole integrity. Complete records will be maintained detailing the type, amount, and volume of fluid and additives used and the depth at which fluids or additives were added to the borehole.
Potential Groundwater Occurrence and Detection	Although perched-intermediate groundwater was not observed during drilling of nearby wells R-28 and CrEX-3, perched-intermediate groundwater is known to be present in the vicinity of the proposed location for R-76. Methods used to identify perched-intermediate groundwater during drilling will include driller's observations, water-level measurements, and borehole video, if appropriate. If perched-intermediate groundwater is encountered, measures will be taken to seal the zone before advancing drilling to ensure that the perched water does not follow the drilling downhole. The top of the regional aquifer is projected to occur at approximately 895 ft below ground surface.
Geophysical Testing	Geophysical logging will be conducted through the saturated interval in the regional aquifer when the borehole has been drilled to total depth. Logging data will be used to refine estimates of the top of regional saturation and to characterize the hydraulic properties of strata beneath the water table.
Cuttings Characterization	Cuttings will be collected from the length of the borehole. Cuttings collection and characterization methods will attempt to optimize representative retention of the fine-grained fraction, particularly within the regional aquifer.

Well Development	The well filter pack may be developed by both mechanical and chemical means. Mechanical means may include airlift swabbing, bailing, and pumping. Chemical means include the use of additives to remove clays and/or chlorination to kill bacteria that may be introduced during well completion. Filter pack development during placement will be considered complete when less than 1/10 ml/L of sand is passing through the well screen. A submersible pump will be used in the well development process following construction of the well. Sand production will be measured with a Rossum Sand Tester. The key parameters to be monitored for well development include turbidity measured in the field and total organic carbon (TOC), which will be measured at an analytical laboratory. If these water-quality parameters cannot be brought to within the target values specified below during well development, the use of chemical well development may be discussed with NMED. No chemicals will be added without NMED's approval. Chemical development methods that may be used include AQUA-CLEAR PFD or a similar product to remove clays, and/or chlorination with sodium hypochlorite. Well development will be considered complete when target water-quality parameters and sand production quantities are met and a volume of water equivalent to that which was introduced into the aquifer during drilling and construction is removed. The target water-quality parameters are turbidity <5 nephelometric turbidity units and TOC <2 ppm. The target sand production quantity is less than 1 mg/L.
Hydraulic Testing	Both screened intervals will be hydraulically tested following development.
Water-Quality Sampling	If perched-intermediate groundwater is encountered, attempts will be made to collect screening-level samples using air-lifting or bailing methods. Screening samples from perched-intermediate groundwater will be analyzed for metals, semivolatile organic compounds, and general inorganic compounds. During drilling of the well, an investigation method (not yet determined) will be used to collect discrete-interval samples to help identify vertical extent of contamination. Such data may provide useful estimates of the vertical extent of chromium and, along with other lines of evidence, will be used for the well-design package submitted to NMED for review and approval. The first groundwater samples from the completed well will be collected at the end of the hydraulic test in each of the two screens. These samples will be analyzed for metals, general inorganic chemicals (including nitrate, perchlorate, sulfate, etc.), semivolatile organic compounds, volatile organic compounds, and radionuclides (including low-level tritium). Subsequent samples will be collected from the dedicated sampling system described below.
Sampling System Installation	A two-screen Baski sampling system will be installed in the well. The system will use a typical 3- or 4-in. pump and motor to maintain sampling purge rates at or near 5 gal. per minute.

Investigation-Derived Waste Management	Investigation-derived waste will be managed in accordance with Standard Operating Procedure (SOP) N3B-EP-DIR-SOP 10021, "Characterization and Management of Environmental Programs Waste." This SOP incorporates the requirements of applicable U.S. Environmental Protection Agency and NMED regulations, U.S. Department of Energy orders, and Newport News Nuclear BWXT-Los Alamos, LLC (N3B) requirements. The primary waste streams will include drill cuttings, drilling water, drilling fluids and additives, development water, purge water generated during hydraulic testing, decontamination water, and contact waste. Drill cuttings will be managed in accordance with the NMED-approved "Decision Tree for the Land Application of Drill Cuttings" (April 2016). Drilling, purge, and development waters will be managed in accordance with the NMED-approved "Decision Tree for Land Application of Drilling, Development, Rehabilitation, and Sampling Purge Water" (November 2016). Initially, drill cuttings and drilling fluids will be stored in a lined pit. Representative samples of the drill cuttings and drilling fluids will be collected and analyzed, 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. Development and aquifer testing water that meets the requirements to be treated and land-applied will be managed under Discharge Permit 1793. Decontamination water will be containerized separately at the 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 or the media with which it came in contact.
Schedule	Documentation of completion of the replacement well for well R-28 (R-76) and collection of first samples is a proposed fiscal year 2023 Appendix B target.

REFERENCE

The following reference list includes documents cited in this plan. Parenthetical information following each reference provides the author(s), publication date, and ERID, ESHID, or EMID. ERIDs were assigned by the Laboratory's Associate Directorate for Environmental Management (IDs through 599999); ESHIDs were assigned by the Laboratory's Associate Directorate for Environment, Safety, and Health (IDs 600000 through 699999); and EMIDs are assigned by N3B (IDs 700000 and above).

LANL (Los Alamos National Laboratory), July 2017. "Pilot-Scale Amendments Testing Work Plan for Chromium in Groundwater beneath Mortandad Canyon," Los Alamos National Laboratory document LA-UR-17-25406, Los Alamos, New Mexico. (LANL 2017, 602505)

NMED (New Mexico Environment Department), July 31, 2017. "Approval, Pilot-Scale Amendments Testing Work Plan for Chromium in Groundwater beneath Mortandad Canyon," New Mexico Environment Department letter to D. Hintze (DOE-EM) and B. Robinson (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2017, 602546)

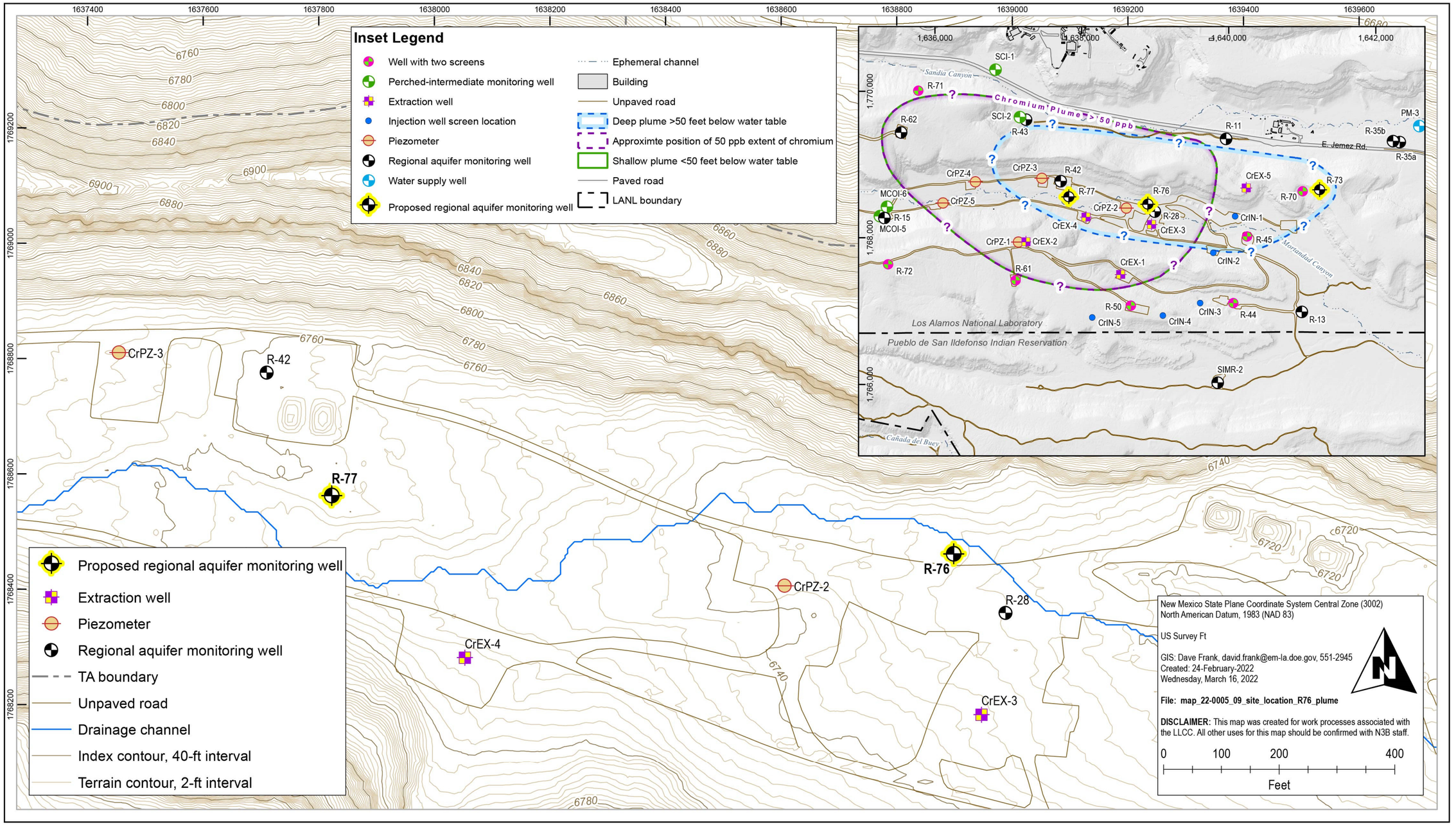

Figure 1 Proposed location for R-76

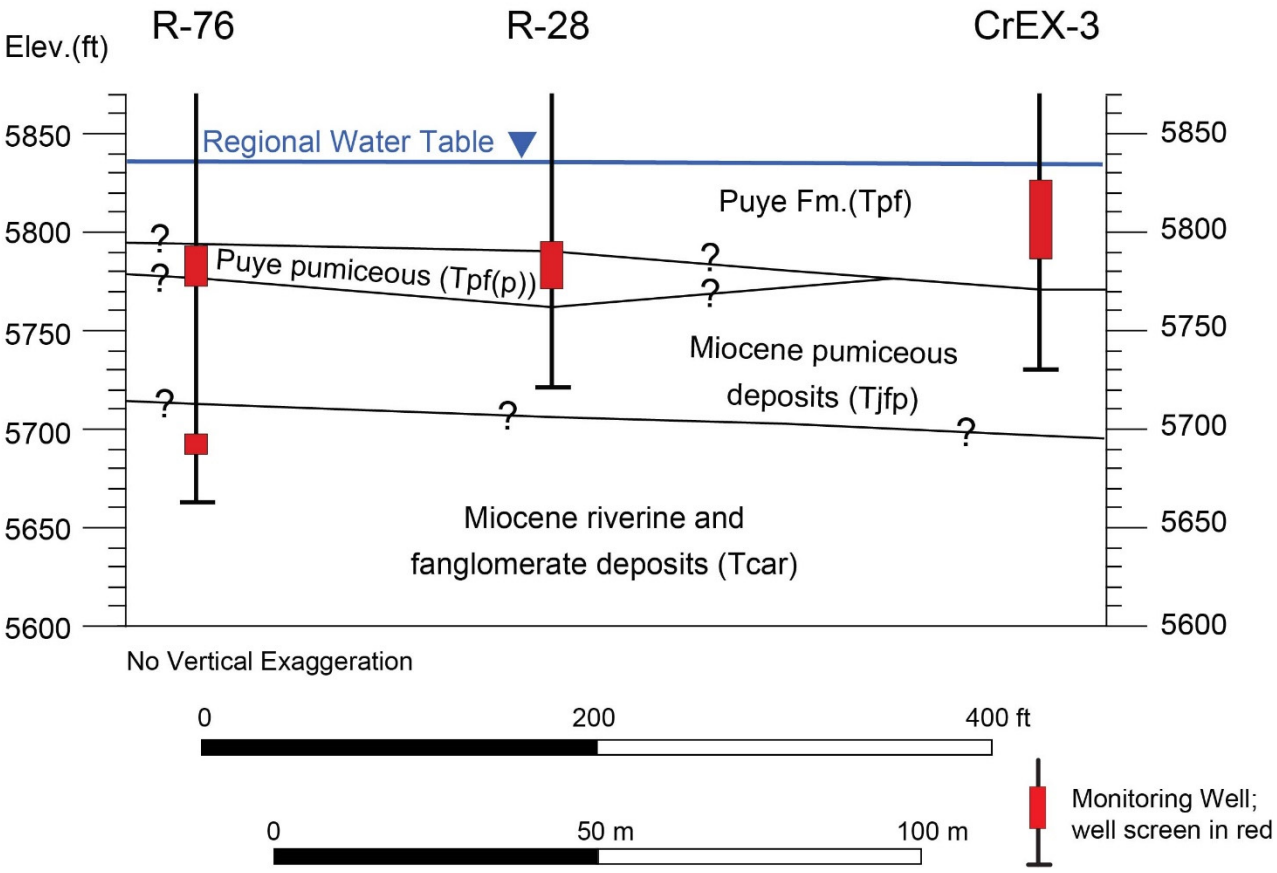

Figure 2 **Stratigraphy in the proposed R-76 area showing stratigraphic relations of the primary geologic units and well screens in nearby wells CrPZ-2, R-28, and CrEX-3. Conceptual well-screen positions for R-76 are also shown.**

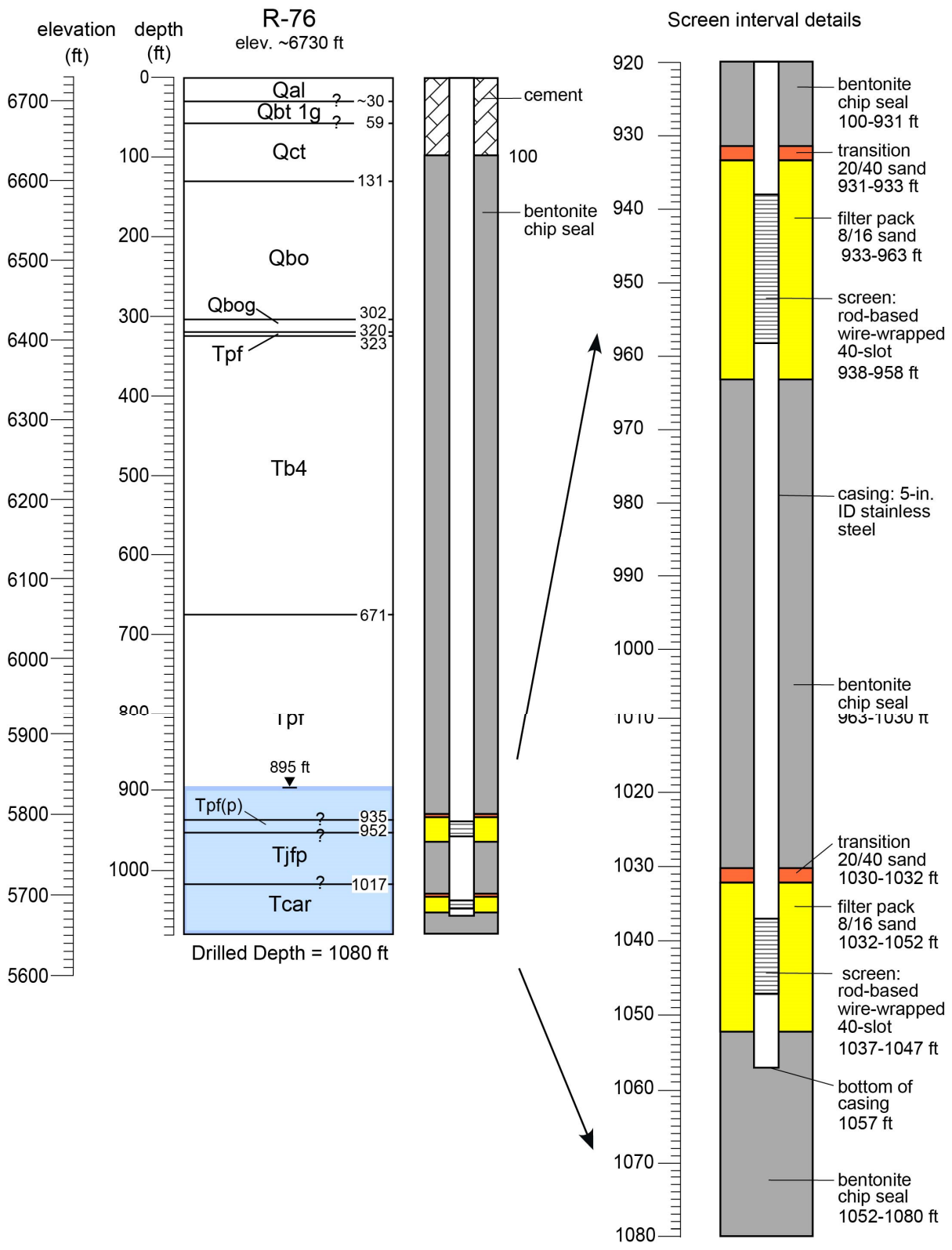

Figure 3 Conceptual well design for R-76