EMID-701935

DEPARTMENT OF ENERGY

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

EMLA-2022-BF060-02-001

March 17, 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 Chromium Groundwater Project Regional Aquifer Monitoring Well R-77

Dear Mr. Shean:

Enclosed please find two hard copies with electronic files of the "Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-77." Submittal of this work plan fulfills fiscal year 2022 Milestone #9 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
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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 Chromium Groundwater Project Regional Aquifer Monitoring Well R-77 (EM2022-0116)

cc (letter and enclosure[s] emailed):
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Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-77

Primary Objectives and Purpose	This work plan presents the objectives, drilling approach, and conceptual design for groundwater monitoring well R-77. The primary objective for R-77 is to characterize vertical extent of chromium contamination in the regional aquifer near CrEX-4, which is a two-screen extraction well completed in November 2017. Initial data collected in December 2017 during discrete-screen interval pumping conducted shortly after completion of CrEX-4 showed chromium concentrations of approximately 350 ppb in the upper screen (screen 1) and approximately 540 ppb in the lower screen (screen 2). The two screens are separated by a blank section of casing only 10 ft in length. The primary objective of R-77 is to delineate vertical extent of chromium in the CrEX-4 area and provide for long-term performance monitoring for chromium as part of future remediation efforts. This objective drives the deep screen in R-77 to be deeper than screen 2 in CrEX-4. An additional aspect of this deep characterization objective is to set the deep screen within the Chamita formation (Tcar) to address uncertainties of whether the Tcar is a preferential pathway for chromium migration and whether groundwater flow within the Tcar is uniquely influenced by pumping of Los Alamos County water-supply wells, particularly well PM-4. R-77 will complement a series of wells, including R-78 (the R-28 replacement well) and R-73, which will characterize the Tcar from west to east along the groundwater flow path. Additional objectives are (1) to characterize and monitor the lateral variability in chromium concentrations observed in CrEX-4 screen 2 and (2) to characterize the vertical gradient at depth in the central portion of the plume. The deep characterization of the plume centroid provided by R-77 may assist in further understanding the nature and source of deep contamination observed downgradient in R-70 screen 2 and R-45 screen 2. Two considerations drive the proposed location for R-77 (Figure 1). First, the primary objective of R-77 supports a location near CrEX-4. Second, the location needs to be off-gradient from aquifer sediments and groundwater potentially influenced by the residual effects of sodium dithionite deployed at R-42 as part of the study to evaluate the feasibility of using amendments for in situ treatment of chromium in the regional aquifer. Potential locations are also constrained by the floodplain and nearby existing infrastructure. Figure 2 presents a cross-section that extends from R-42 to CrEX-4, showing the stratigraphic sequence and screen positions of nearby wells and those proposed for R-77. Figure 3 shows the conceptual design for R-77, with the understanding that a separate and more detailed design package that reflects actual information obtained during and following drilling will be submitted to the New Mexico Environment Department (NMED) for review and approval.
Drilling Approach	The proposed drilling approach for R-77 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 170 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-42 and CrEX-4, perched-intermediate groundwater is known to be present in the vicinity of the proposed location for R-77. Methods used to identify perched-intermediate groundwater during drilling will include driller's observations, water-level measurements, and borehole video, if appropriate. The top of the regional aquifer is projected to occur at approximately 924 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 during well development 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 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. 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 R-77 is a proposed fiscal year 2023 Appendix B target.

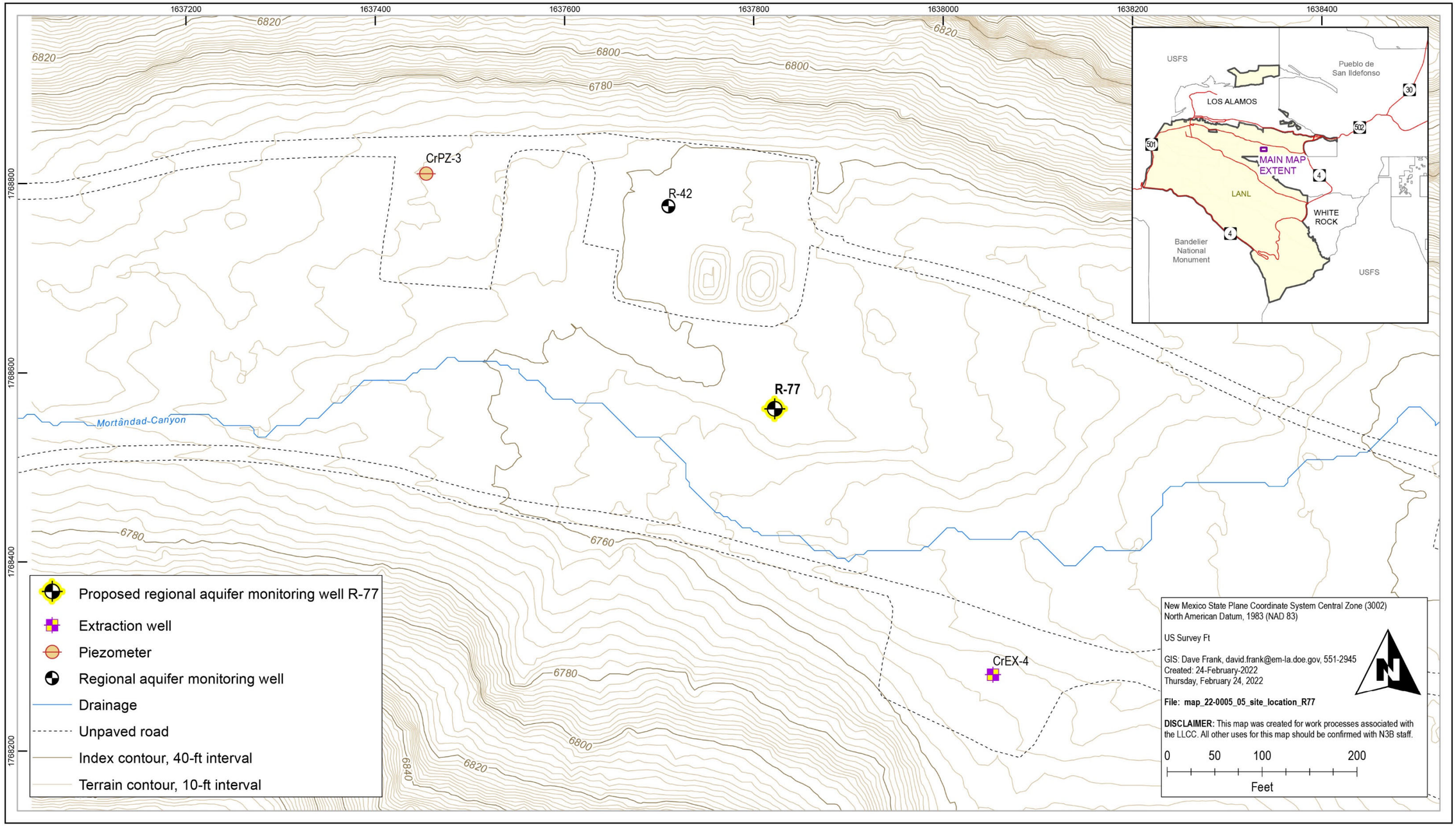

Figure 1 Proposed location for R-77

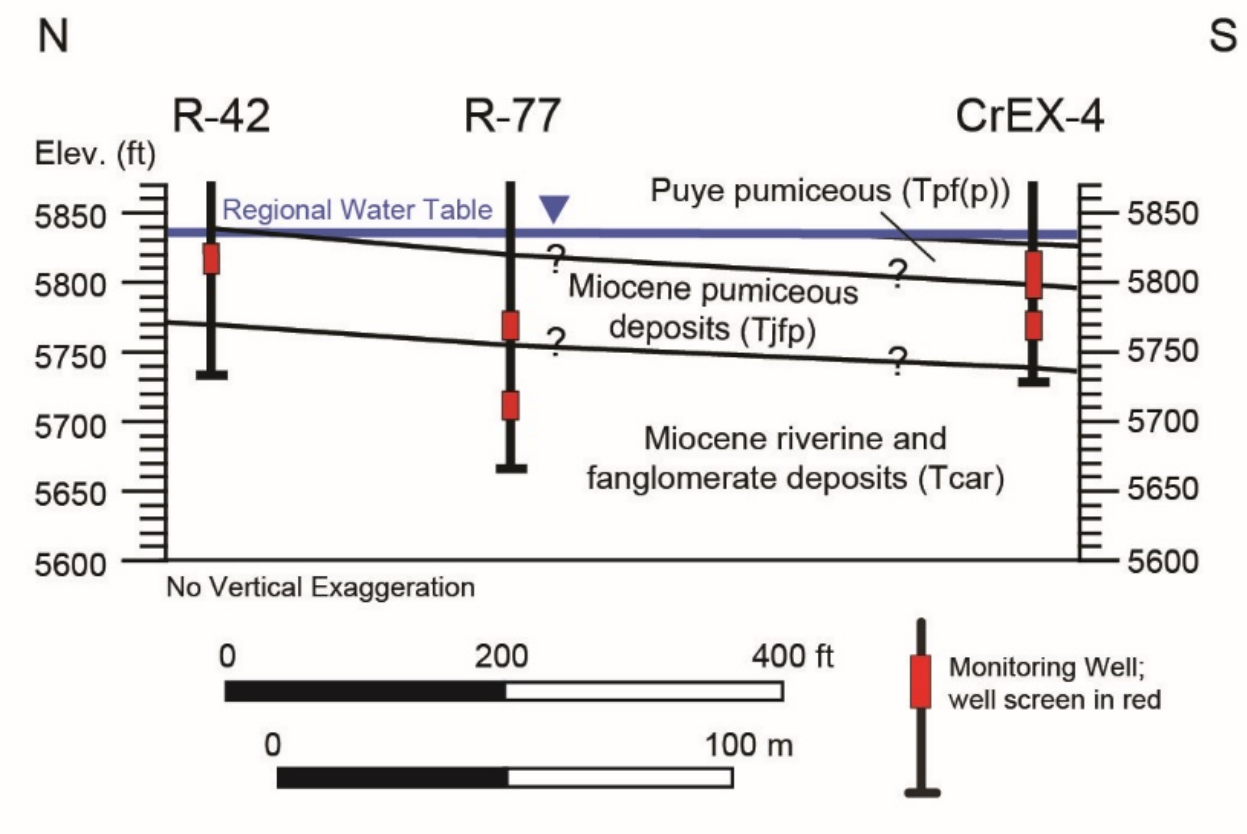

Figure 2 **Cross-section showing the stratigraphy and screen positions for nearby wells and the proposed location and well-screen positions for R-77**

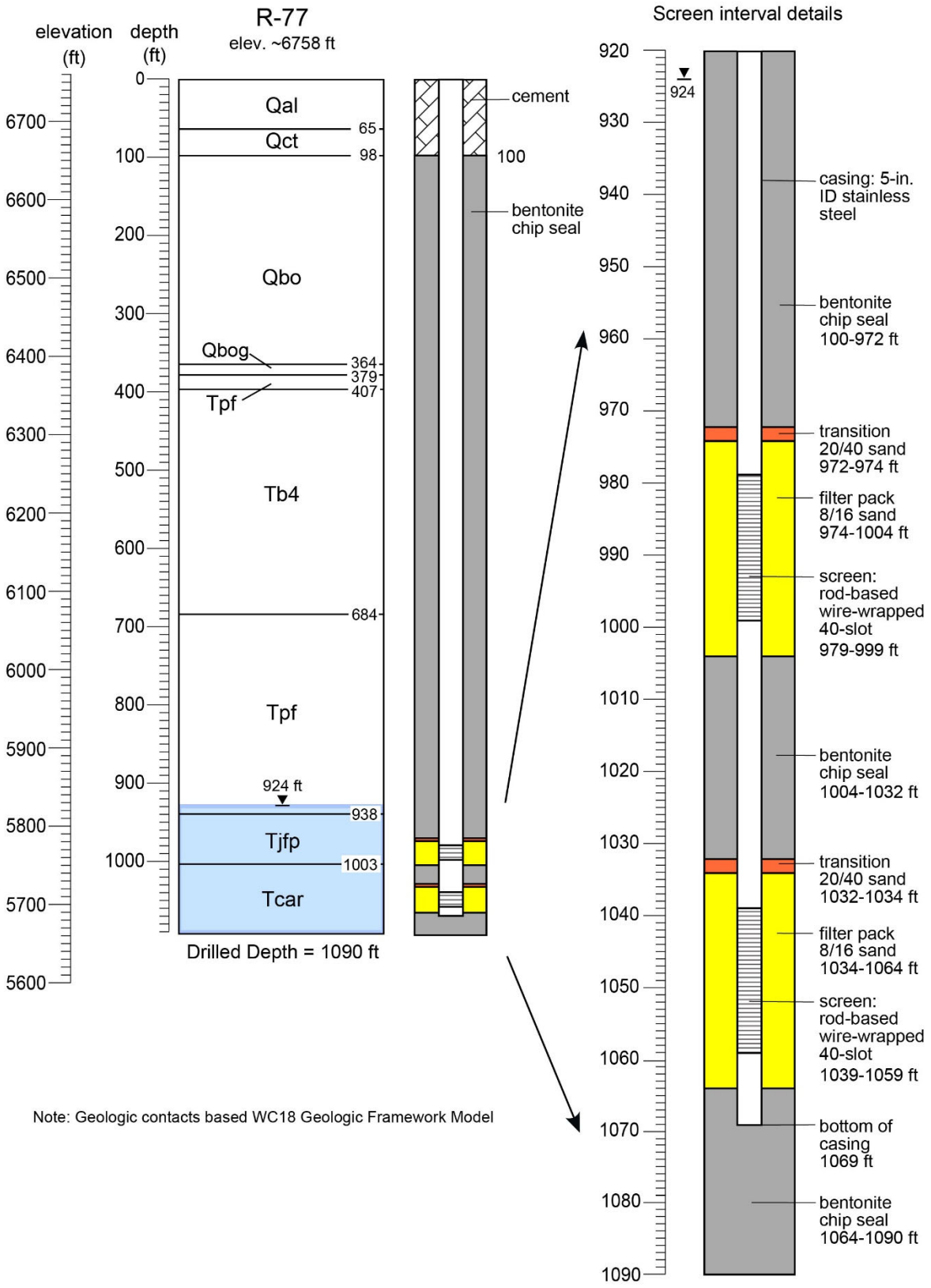

Figure 3 Conceptual well design for R-77