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

EMLA-2022-BF059-02-001

March 14, 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 RDX Groundwater Project Regional Aquifer Monitoring Well R-74

Dear Mr. Shean:

Enclosed please find two hard copies with electronic files of the "Drilling Work Plan for RDX Groundwater Project Regional Aquifer Monitoring Well R-74." Submittal of this work plan fulfills fiscal year 2022 Milestone #11 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: 2022.03.14 09:19:29 -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 RDX Groundwater Project Regional Aquifer Monitoring Well R-74 (EM2022-0115)

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Drilling Work Plan for RDX Groundwater Project Regional Aquifer Monitoring Well R-74

Primary Objectives and Purpose	This work plan presents the objectives, drilling approach, and conceptual design for groundwater monitoring well R-74. The primary objective for R-74 is to characterize vertical extent of Royal Demolition Explosive (RDX [hexahydro-1,3,5-trinitro-1,3,5-triazine]) contamination in the regional aquifer, specifically in the R-69 area (Figure 1). Well R-69 is a two-screen well installed in 2018, and data through the period of record since its installation show RDX concentrations in the deeper of two screens (screen 2) above the New Mexico tap water screening level of 9.66 µg/L. Concentrations have ranged from a maximum of 39.4 µg/L on November 9, 2018, to the most recent concentration of 14.6 µg/L from a sample collected on December 17, 2021. A downward vertical gradient is represented by an approximate 10-ft difference in head measurements between the two screens in R-69. The primary objective of R-74 is to delineate vertical extent of RDX in the R-69 area and provide for long-term monitoring for RDX in an area known to have a downward vertical gradient that could play a role in the current and potential future distribution of RDX contamination in the regional aquifer. An additional objective of the well is to further characterize and monitor for RDX near the water table between R-69 and R-18. The proposed location of R-74 would be expected to further refine the downgradient extent of RDX observed in screen 1 at R-69 and also help resolve RDX concentrations near the water table. Another objective is to further quantify the vertical downward gradient in the RDX area. Well R-74 is, therefore, proposed as a two-screen well with a 20-ft upper screen set at a depth approximately 15 ft below the water table and a 10- to 20-ft lower screen set at a depth of approximately 50 ft below the bottom of R-69 screen 2. A 10-ft lower screen is shown in Figures 2 and 3 for illustrative purposes. The net separation between well screens at R-74 will be approximately 107 ft. Characterization methods may be implemented during drilling to increase confidence of identifying the vertical extent of RDX contamination. Resultant data may be used to determine total drilling depth and placement of the deeper screen. The proposed location for R-74 is sufficiently close to R-69 to provide confidence that the extent of RDX contamination observed in R-69 screen 2 is characterized (Figure 1). In addition to terrain and site-operational constraints in the Weapons Facility Operations area of Los Alamos National Laboratory, other potential drilling locations further away from R-69 might result in deep characterization information that would misrepresent the vertical extent of RDX contamination observed in the R-69 area. Figure 2 shows two cross-sections of the approximated RDX distribution in the regional aquifer. The upper cross-section depicts the approximated plume profile using RDX concentrations that were measured in the wells at the time just before submittal of the “Investigation Report for Royal Demolition Explosive in Deep Groundwater” (N3B 2019, 700561). The lower cross-section shows the current concentrations of RDX in the R-69 area and also includes the proposed approximate location and design concept for the R-74 well screens. Figure 3 shows the conceptual design for R-74, with the understanding that a separate and more detailed design package that reflects characterization 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-74 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 100 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 R-69, perched-intermediate groundwater is known to be present in the vicinity of the proposed R-74 drilling location. 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 1300 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 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. After initial airlift swabbing and bailing during filter pack placement, a 6-in. submersible pump will be used to complete the development process following well completion. A 6-in. pump will be capable of removing significantly higher volumes of water than the 4-in. pump that will be part of the final sampling system. Sand production will be measured with a Rossum Sand Tester. 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 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 (cont.)	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 high explosives, metals, semivolatile organic compounds, and general inorganic compounds. 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 high explosives, metals, general inorganic compounds, 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 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 Program 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-74 is currently an Appendix B target in fiscal year 2023.

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 Los Alamos National Laboratory's (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).

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), August 2019. "Investigation Report for Royal Demolition Explosive in Deep Groundwater," Newport News Nuclear BWXT-Los Alamos, LLC, document EM2019-0235, Los Alamos, New Mexico. (N3B 2019, 700561)

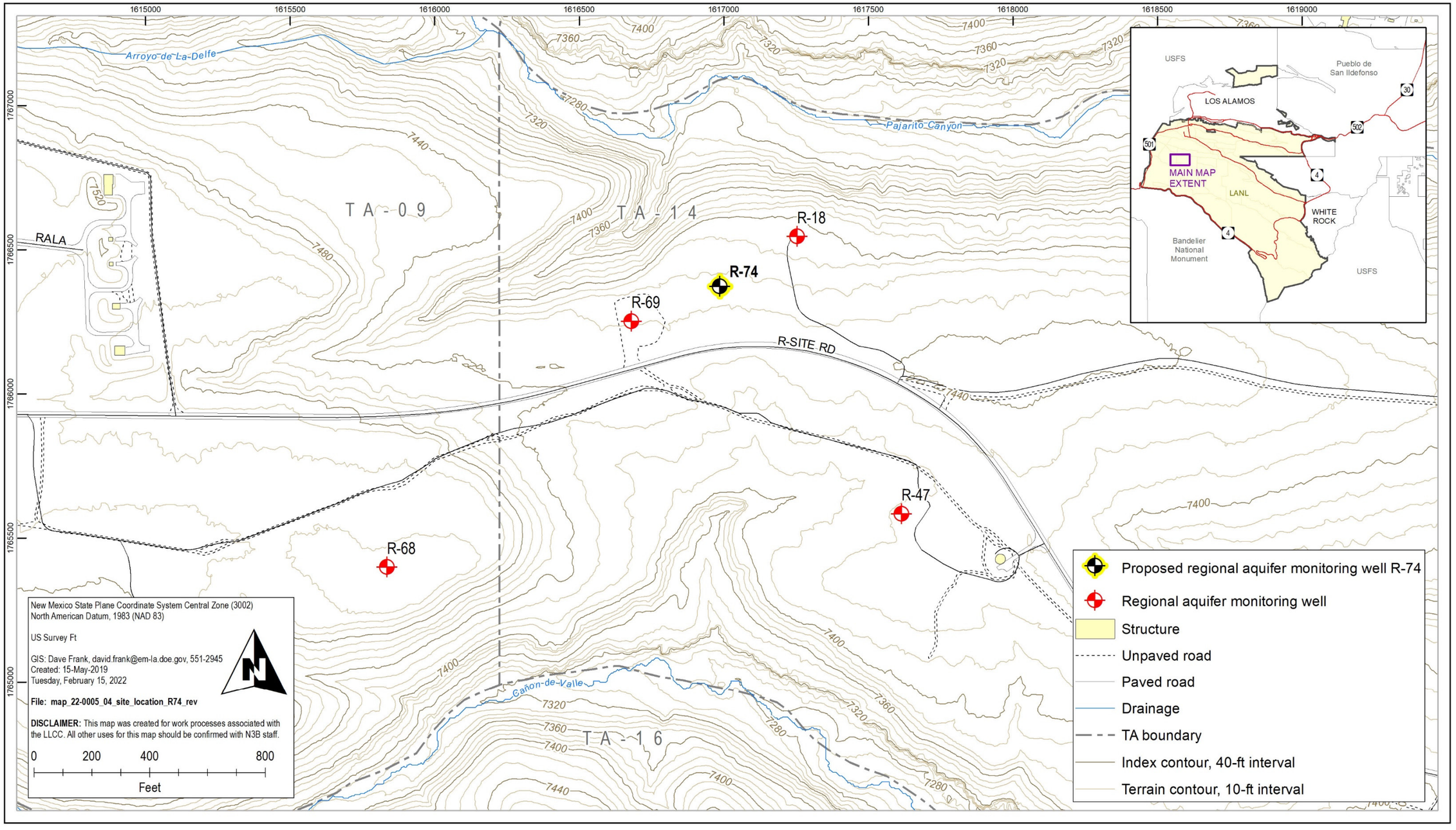

Figure 1 Proposed location for R-74

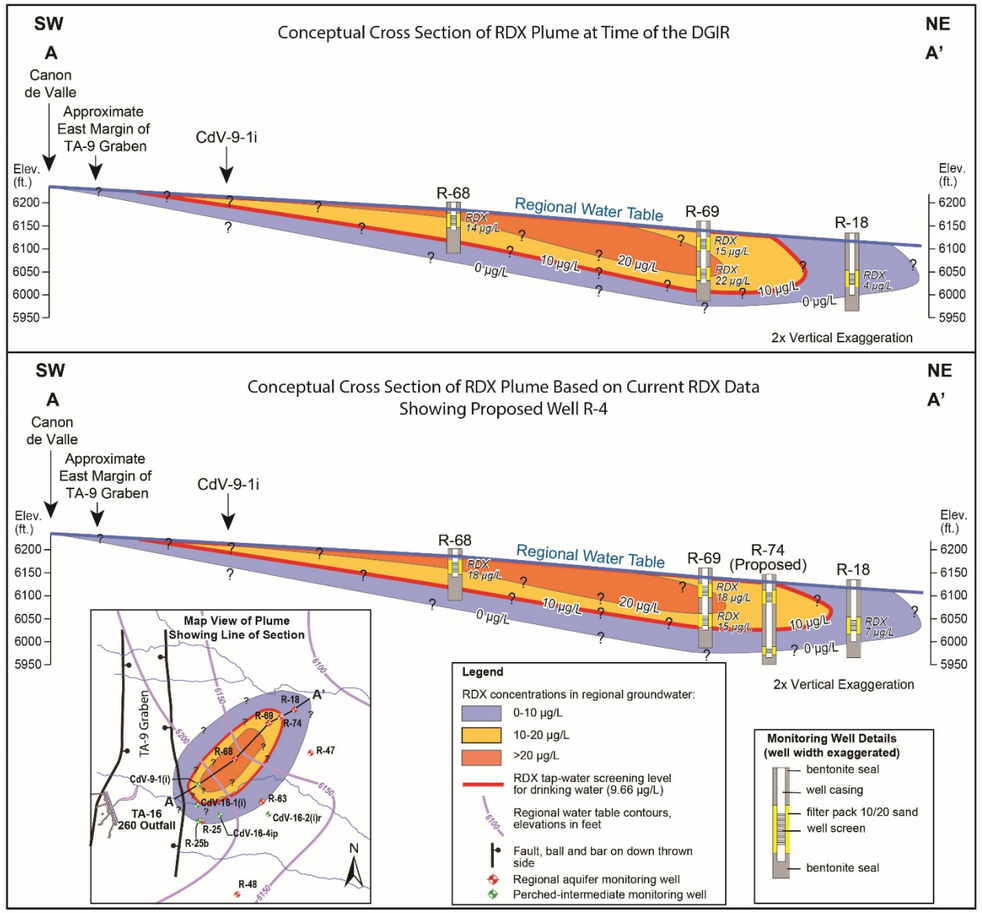

Figure 2 **The map view in the lower left portion of the figure is an estimation of the RDX plume in the regional aquifer as depicted in the "Investigation Report for Royal Demolition Explosive in Deep Groundwater." The upper cross-section derives from the map view and shows the approximated vertical distribution of RDX in the R-69 area using data from R-68, R-69, and R-18 in 2020. The lower cross-section shows the approximated present-day vertical distribution of RDX in those same wells and also the proposed location and well-screen positions for R-74.**

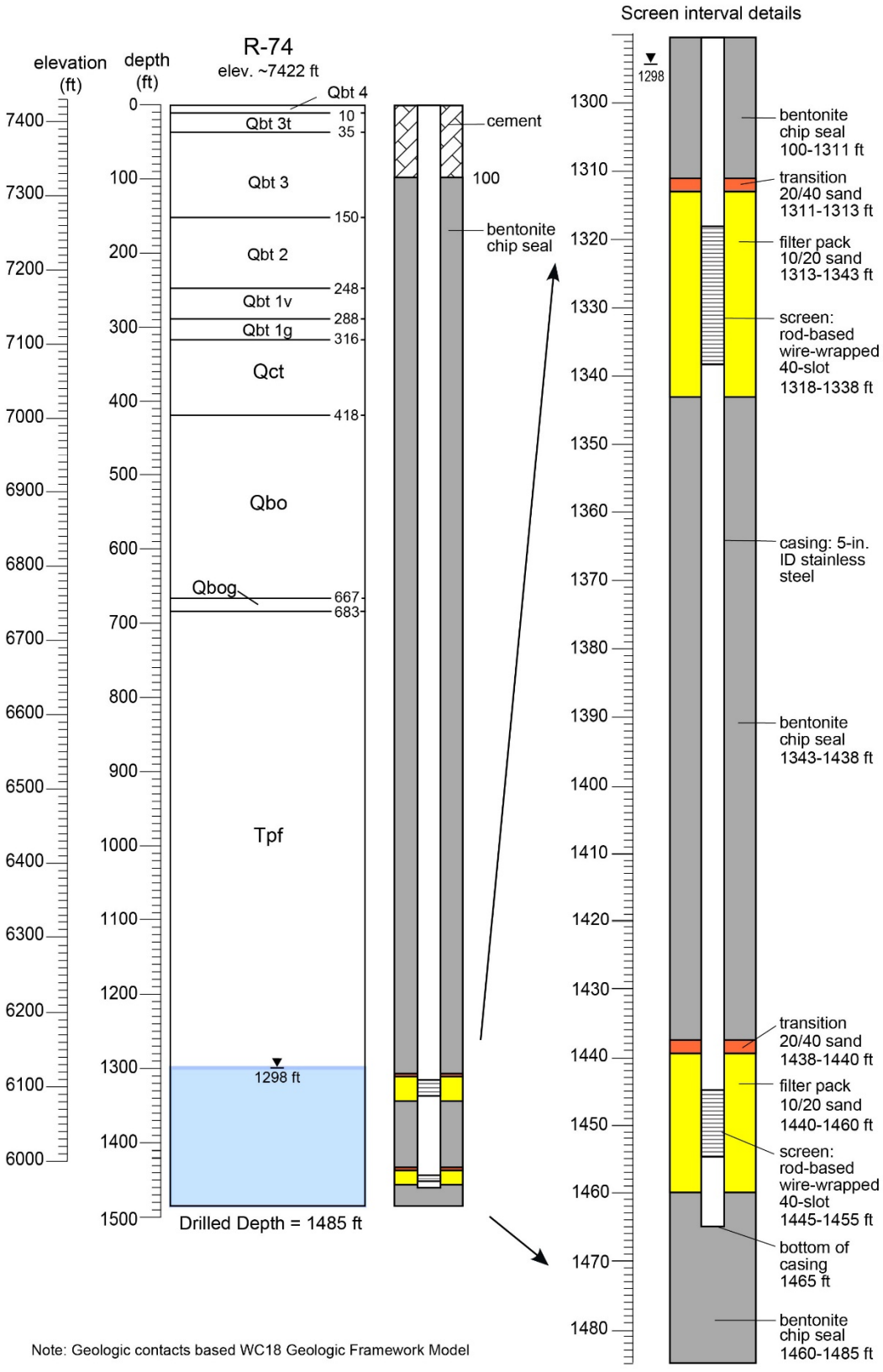

Figure 3 Conceptual well design for R-74