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

FEB 19 2020

EMLA-2020-1288-02-001


Mr. Kevin Pierard
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-71

Dear Mr. Pierard:

Enclosed please find two hard copies with electronic files of the "Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-71." Submittal of this work plan fulfills fiscal year 2020 Milestone #5 of Appendix B of the 2016 Compliance Order on Consent. This work plan reflects the approach agreed upon by the U.S. Department of Energy; Newport News Nuclear BWXT-Los Alamos, LLC (N3B); and the New Mexico Environment Department during a pre-submission meeting held on April 18, 2019.

If you have any questions, please contact Steve White at (505) 309-1370 (steve.white@em-la.doe.gov) or Cheryl Rodriguez at (505) 257-7941 (cheryl.rodriguez@em.doe.gov).

Sincerely,

FOR: Stephen J. Yanicak

Arturo Q. Duran
Compliance and Permitting Manager
Environmental Management
Los Alamos Field Office

Enclosures:

1. Two hard copies with electronic files – Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-71 (EM2020-0026)

CC (letter and enclosure[s] emailed):
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## Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-71

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| **Primary Objectives and Purpose** | This work plan presents the objectives, drilling approach, and conceptual design for a new groundwater monitoring well, R-71. The proposed location for R-71 is shown in Figure 1. The primary objective for R-71 is to further characterize the lateral and vertical extent of the chromium contamination in the northwestern portion of the chromium plume. The need for this information was jointly identified in chromium project technical team meetings with the New Mexico Environment Department (NMED) in 2019.The need to further characterize the northwestern portion of the plume is driven by steadily increasing chromium concentrations in wells R-62 and R-43. Chromium in well R-62 is currently higher than 300 ppb, at a depth of 16 ft below the water table, compared with a high of approximately 200 ppb in 2016. Chromium concentrations in R-43 screen 1, at a depth of 11 ft below the water table have increased from background concentrations (approximately 7 ppb) in 2010 to approximately 220 ppb in 2019. Screen 2 at R-43, at a depth of 76 ft below the water table, is also showing increases in chromium concentrations starting at background in 2010 to approximately 32 ppb in 2019.<br><br>Characterization of the extent of chromium contamination in the proposed R-71 location is expected to provide important information on the nature and extent of the plume. R-71 is proposed to be completed with two screens in the upper portion of the regional aquifer. Conceptually, the monitoring data collected at R-71 will bound the northwestern extent of chromium contamination or may show chromium concentrations indicative of the apparent flow path between R-62 and R-43 as indicated by the similar geochemistry and pattern of increases in chromium concentrations. The relatively deep contamination at R-43 screen 2 compels the second screen proposed for R-71 to characterize the vertical extent of contamination. Depending on the final approved remediation approach and the conditions at R-71, the well could (1) provide important long-term performance monitoring data, (2) be repurposed for injection to hydraulically control the northern edge of the plume if concentrations at R-71 are relatively low, or (3) be used to extract contaminated groundwater if concentrations are elevated such that source control and mass removal are necessary.<br><br>Perched groundwater could be present in the R-71 area based on the presence of south-to-southwestward-dipping geosurfaces in the vadose zone beneath the initial infiltration window in Sandia Canyon. The possibility of perched groundwater is also based on observations from drilling of other monitoring wells in the area, including R-62, SCI-1, SCI-2, and R-43. Attempts will be made to characterize the hydrology and geochemistry of any perched groundwater encountered during drilling using methods described in a later section of this drilling work plan.<br><br>Because of terrain constraints directly over the target location in the regional aquifer, angled drilling will be used to achieve the target location in the aquifer. Figure 2 is a cross-section from R-62 to R-43 that shows the anticipated formation-scale stratigraphy, contacts, and water table that are expected at R-71.<br><br>The well will be constructed like other chromium interim measure infrastructure wells to enable potential repurposing for either extraction or injection if remediation is necessary in that portion of the plume. The larger drill-casing diameters used for angled wells in the chromium project area are necessary to maintain drilling angles and ensure the advancement of the borehole stays on target. The upper screen will target the portion of the aquifer close to the water table (expected within the Miocene pumiceous unit), and the lower screen will target a depth intended to constrain the vertical extent of chromium contamination, likely a depth similar to R-43, screen 2. Because of the potential for using R-71 as a remediation well in the future, it may be appropriate to balance the objectives of shorter screen lengths (nominally approximately 20 ft) with longer screens (e.g., 30–40 ft), which can provide good integrated characterization information and also result in better injection or extraction hydraulics. |

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| **Primary Objectives and Purpose (cont.)** | The initial design for the well consists of an 8-in.-diameter casing with two 40-slot screens (Figure 3). The final well design will be based on data obtained during drilling, including information from lithologic logs of cuttings, water-level measurements, video logs, geophysical logs, and field-team observations. Specific well-design recommendations will be submitted to NMED for review and approval before construction. |
| **Drilling Approach** | The proposed drilling approach for R-71 will use fluid-assisted air-rotary with casing-advance methods. Telescoping casing sizes between 24 in. and 14 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 approximately 3-in. annular filter pack around the 8-in. well screen.<br><br>R-71 will be drilled at an approximate 25-degree angle that will produce a lateral offset of about 520 ft between the wellhead and the well screens in the regional aquifer. |
| **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:<br>• Potable water, municipal water supply, to aid in delivery of other drilling additives and to cool the drill bit,<br>• QUIK-FOAM, a blend of alcohol ethoxy sulfates, used as a foaming agent to lift cuttings, and<br>• AQF-2, an anionic surfactant, used as a foaming agent to lift cuttings.<br><br>Because of the borehole diameter and length, fluids may be used for the entire length of the borehole, including within the regional aquifer. 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** | Perched-intermediate groundwater may be present within the Guaje Pumice bed, the upper Puye sediments, and the Cerros del Rio basalt at this location. Methods to identify perched groundwater include driller's observations, water-level measurements, borehole video, and borehole geophysics.<br><br>The top of the regional aquifer is projected to occur at approximately 1120 ft below ground surface (or approximately 1235 linear ft along the angled borehole). |
| **Geophysical Testing** | Geophysical logs may be collected 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 saturated strata beneath the water table.<br><br>Location surveys will be made in the angled borehole at several points during drilling (e.g., just below the top of basalt and at prescribed depths within the basalt) to ensure aquifer intersection targets are met. |
| **Cuttings Characterization** | Cuttings collection and characterization methods will attempt to optimize representative retention of the fine-grained fraction, particularly within the regional aquifer. |
| **Well Completion Design** | The R-71 monitoring well is planned with two screens in the upper portion of the regional aquifer. Figure 3 presents a conceptual well design for R-71. Final well screen placement and lengths will depend upon the geophysical logs, water-level data, and field observations. A proposed well design will be submitted to NMED for approval before well construction. |

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| **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 additives to remove clays and/or chlorination to kill bacteria that may be introduced during well completion.<br>• After initial swabbing and bailing, a 6-in. submersible pump will be used to complete the development process. 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.<br>• 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).<br>• 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.<br>Chemical development methods that may be used include sodium acid pyrophosphate and AQUA-CLEAR PFD to remove clays, and/or chlorination with sodium hypochlorite.<br>Well development will be considered complete when target water-quality parameters 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, TOC <2 ppm, and other parameters stable. |
| **Hydraulic Testing** | Both screened intervals will be hydraulically tested following development. Limited step-drawdown tests and 24-hr constant rate testing are the most likely tests. The well screens will be isolated from one another and tested separately. A 6-in. pump will be used for testing. Data from these tests will provide additional information to refine the knowledge of the hydrology in the northwestern portion of the plume. |
| **Water-Quality Sampling** | If perched-intermediate groundwater is encountered, attempts will be made to collect screening samples using air-lifting or bailing methods.<br>The first groundwater samples from the completed well will be collected at the end of the aquifer test in each of the two screens. These samples will be analyzed for metals, general inorganics (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 dual-access-port valve sampling system will be designed and installed in the well. The system will be capable of delivering water to the surface separately from each screen interval. The system will use a typical 4-in. pump and motor to maintain sampling purge rates at or near 5 gal. per minute. An inflatable packer will be part of the system to achieve zonal isolation between the screen intervals.<br>The total amount of time the two screen intervals are in cross-communication with one another will be documented for the entire project, and the sampling system will be used to purge cross-flow from the appropriate screen before sampling. |

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| **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.<br><br>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.<br><br>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** | The drilling and installation of R-71 is anticipated to start in the fall of 2020. Currently in the Compliance Order on Consent Appendix B, there is a target completion date of January 29, 2021. |

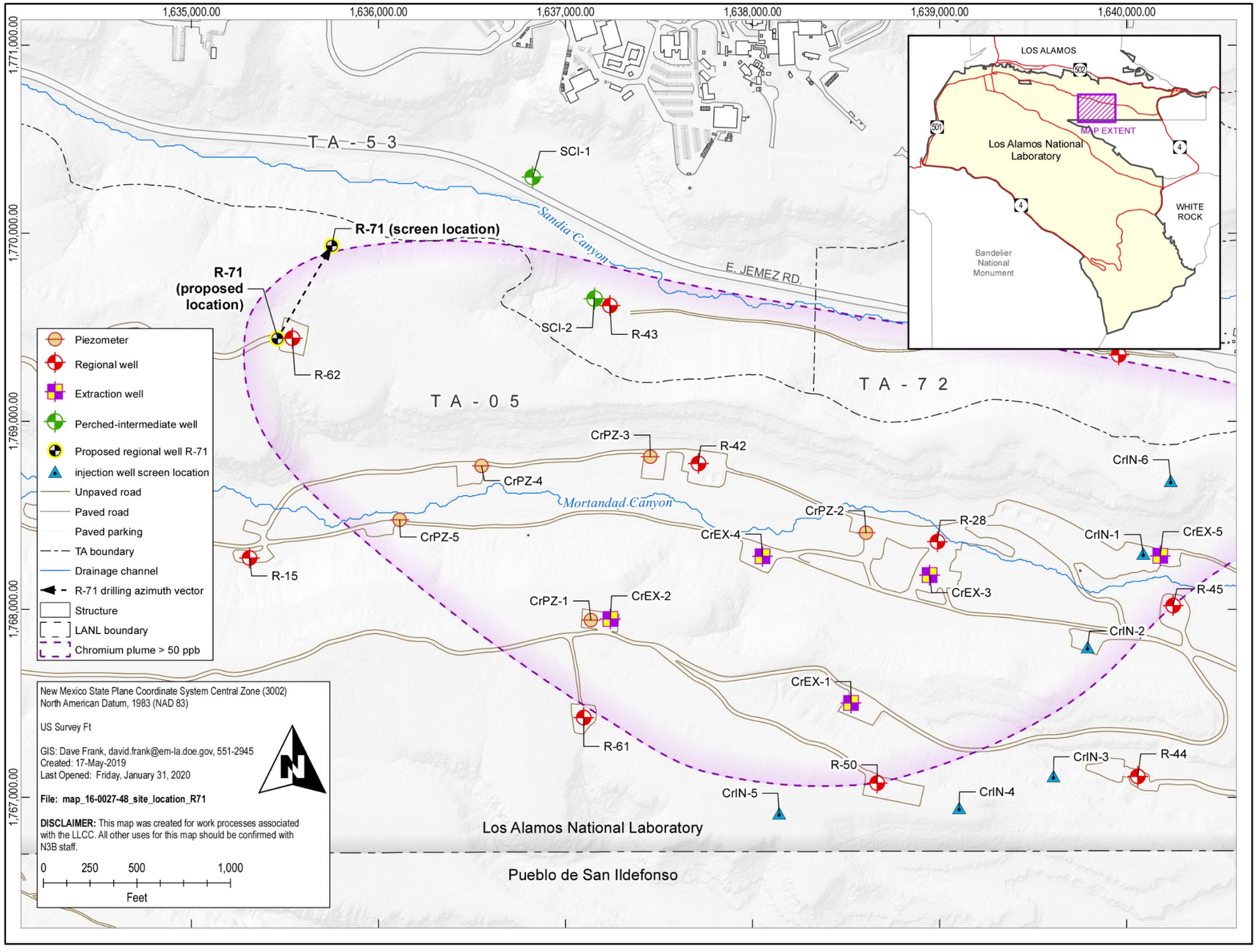


**Figure 1 Proposed location for R-71 showing the drilling location and the target terminal point and screen locations in the regional aquifer**

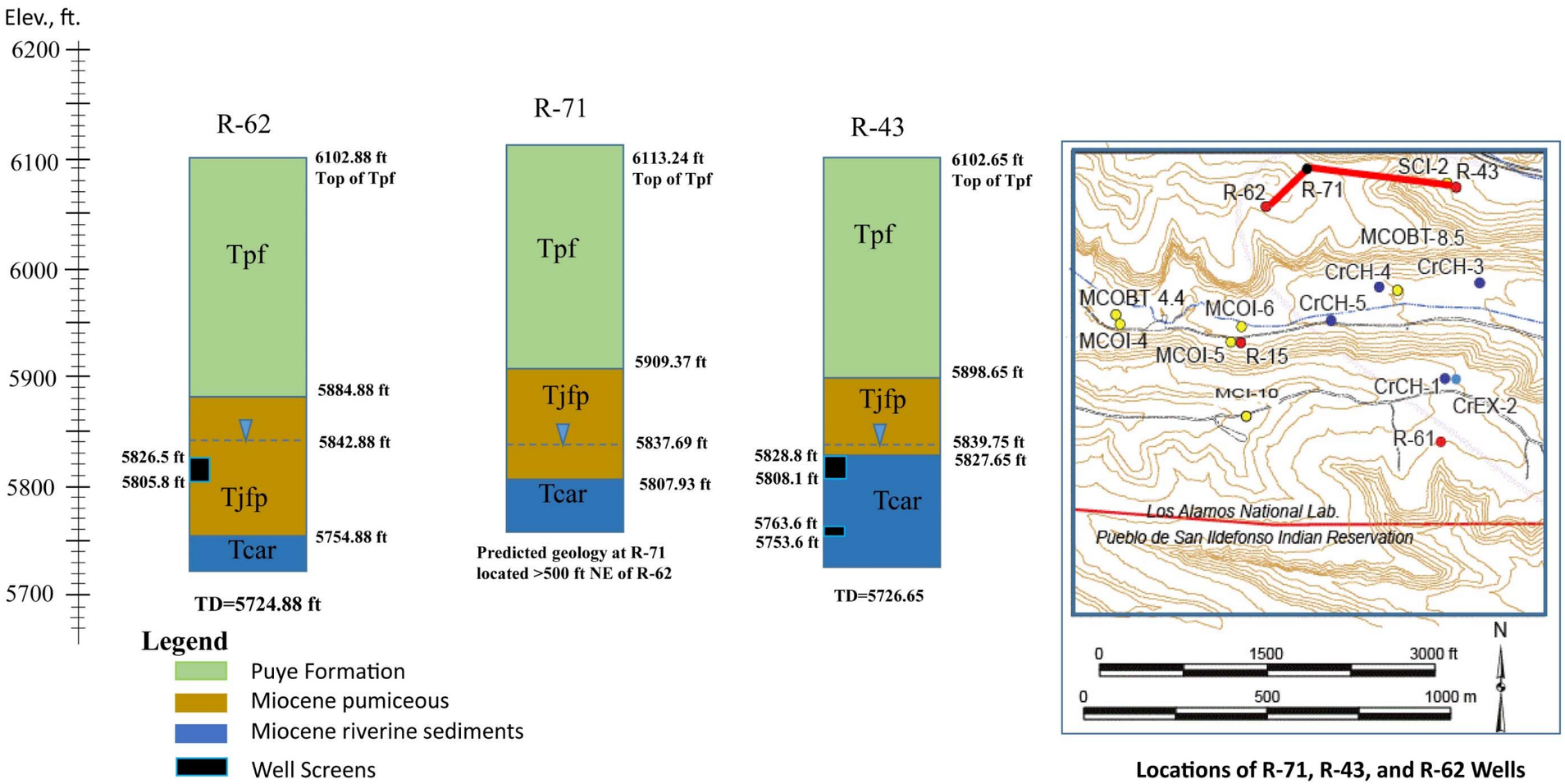


**Figure 2** **Geologic cross-section from R-62 to R-43 showing well screen positions in R-62 and R-43**

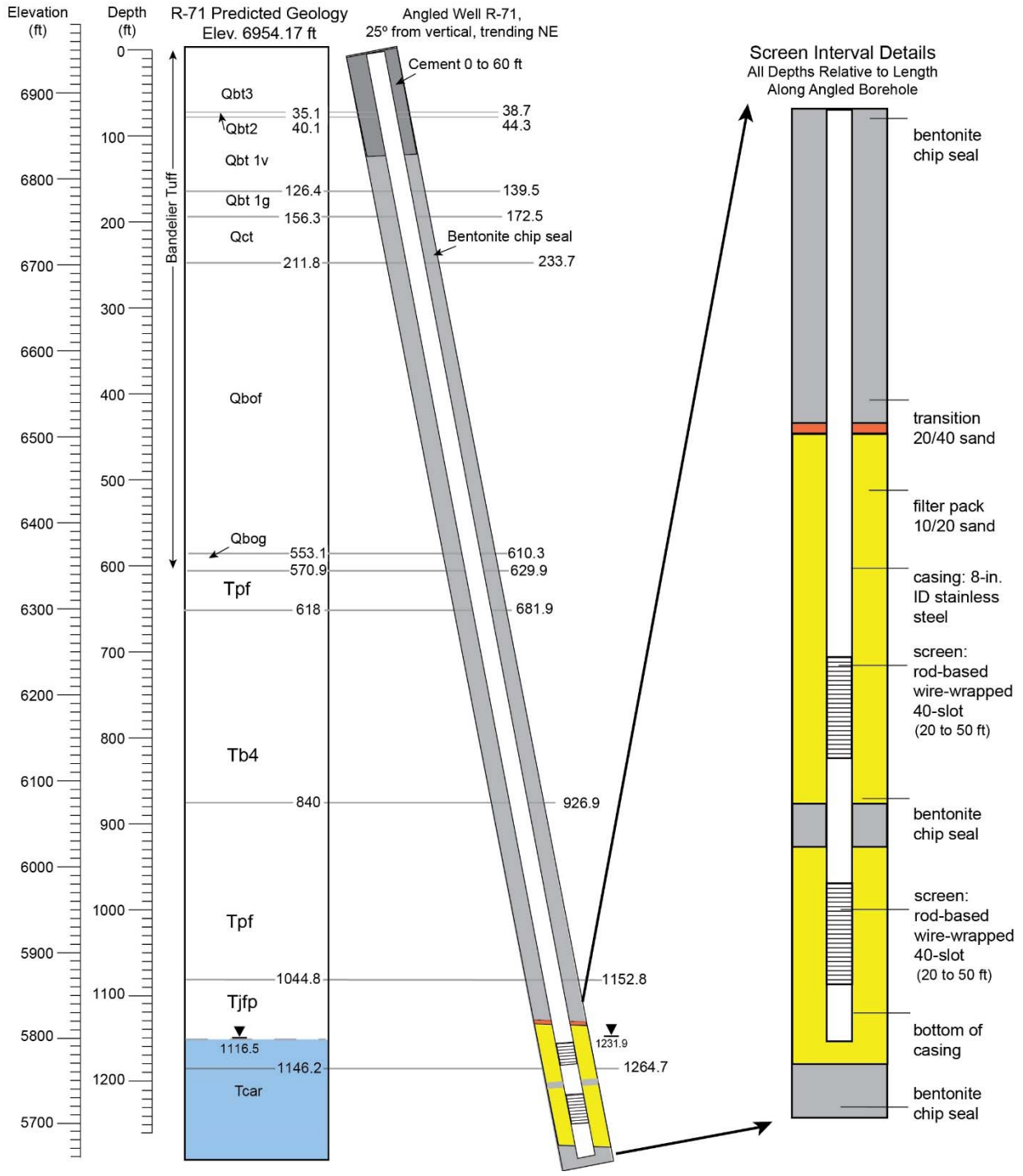


**Figure 3 R-71 conceptual well design**