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Date: SEP 28 2017
Refer To: ~~ADEM-17-0246~~ ADEM-17-0242
LAUR: 17-28551

John Kieling, Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Subject: Summary Report for R-68 and Drilling Work Plan for R-69, Revision 1

Dear Mr. Kieling:

Enclosed please find two hard copies with electronic files of the Summary Report for R-68 and Drilling Work Plan for R-69, Revision 1. This report is being submitted in accordance with the requirements of the New Mexico Environment Department's (NMED's) Approval [of the] Extension Request for Submittal of Final Corrective Measures Evaluation Report for RDX, Technical Area 16, dated February 20, 2017.

The enclosed report recommends the installation of monitoring well R-69 based on hydraulic and geochemical data obtained from recently completed R-68. The report is a follow-up to the Groundwater Investigation Work Plan for Consolidated Unit 16-021(c)-99, Including Drilling Work Plans for Wells R-68 and R-69, submitted to NMED on September 6, 2016.

If you have any questions, please contact Stephani Swickley at (505) 606-1628 (sfuller@lanl.gov) or Cheryl Rodriguez at (505) 665-5330 (cheryl.rodriguez@em.doe.gov).

Sincerely,

Bruce Robinson, Program Director
Environmental Remediation Program
Los Alamos National Laboratory

Sincerely,

David S. Rhodes, Director
Office of Quality and Regulatory Compliance
Environmental Management
Los Alamos Field Office

BR/DR/SS:sm

Enclosures: Two hard copies with electronic files – Summary Report for R-68 and Drilling Work Plan for R-69, Revision 1 (EP2017-0129)

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LA-UR-17-28551
September 2017
EP2017-0129

Summary Report for R-68 and Drilling Work Plan for R-69, Revision 1

Los Alamos
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EST. 1943

Prepared by the Associate Directorate for Environmental Management

Los Alamos National Laboratory, operated by Los Alamos National Security, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC52-06NA253 and under DOE Office of Environmental Management Contract No. DE-EM0003528, has prepared this document pursuant to the Compliance Order on Consent, signed June 24, 2016. The Compliance Order on Consent contains requirements for the investigation and cleanup, including corrective action, of contamination at Los Alamos National Laboratory.
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EP2017-0129

Summary Report for R-68 and Drilling Work Plan for R-69, Revision 1

September 2017

Responsible project manager:

Printed Name	Signature	Title	Organization	Date
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Responsible LANS representative:

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for Randall Erickson		Associate Director	Associate Directorate for Environmental Management	9/21/17

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Printed Name	Signature	Title	Organization	Date
David S. Rhodes		Office Director	Quality and Regulatory Compliance	9-28-2017

CONTENTS

Figures

Appendixes

1.0 INTRODUCTION

This report provides a recommendation for the installation of monitoring well R-69 based on hydraulic and geochemical data obtained from recently completed R-68. The U.S. Department of Energy (DOE) and Los Alamos National Security, LLC, (LANS) submitted the groundwater investigation work plan (GIWP) for Consolidated Unit 16-021(c)-99 on September 6, 2016 (LANL 2016, 601779). The New Mexico Environment Department (NMED) approved this plan on September 27, 2016 (NMED 2016, 601855).

The objectives of drilling conducted pursuant to the GIWP were as follows:

1. Refine understanding of nature and extent of contamination in the regional aquifer
2. Evaluate potential Technical Area 09 (TA-09) source of high explosives (HE) contamination in the regional aquifer
3. Constrain regional water table north of Cañon de Valle
4. Characterize the (northern) extent of the contaminated perched-intermediate groundwater zone observed at CdV-9-1(i)
5. Fill data gaps for regional aquifer performance monitoring

To meet these objectives, the GIWP recommended installing up to two monitoring wells completed in the regional aquifer (LANL 2016, 601779). The first well, R-68, was completed in early 2017. The need for second well, R-69, was to be assessed based on the data collected from R-68. Information gained from the drilling and sampling of R-68 is presented below and provides the basis for a recommendation to drill additional monitoring well R-69.

Although R-69 was originally proposed to be installed east of TA-09, its new proposed location has been moved slightly farther to the east to address remaining data uncertainties based on data collected from R-68. In addition, the well design for R-69 has been revised, with the proposed well now a two-screened well for reasons discussed below. The revised drilling work plan is presented in Appendix A of this report.

2.0 FINDINGS FROM R-68

Monitoring well R-68 was completed on February 27, 2017 (LANL 2017, 602539). The static depth to water after well installation was measured at 1325.7 ft below ground surface (bgs), within 1 ft of the predicted elevation of 1325 ft bgs (LANL 2016, 601779). The water-level information from R-68 helps constrain the groundwater flow direction and gradient in the area north of Cañon de Valle, thus meeting one of the primary objectives of the GIWP. The water-level data from R-68 indicate no change from the inferred flow direction presented in the GIWP (LANL 2016, 601779), which suggests flow in the R-68 area is generally to the north-northeast. Figure 2.0-1 shows a water-level contour map for both the perched-intermediate groundwater and the regional aquifer.

Regional groundwater characterization samples were collected from R-68 on March 20, June 2, and July 13, 2017, and samples were analyzed off-site at GELC Laboratories, LLC, Charleston, SC. The samples were analyzed for a full suite of constituents, including HE compounds and degradation products, volatile organic and semivolatile organic compounds, metals, low-level tritium, and general inorganics.

The analytical results from R-68 were screened against the lowest applicable screening value, and the HE compound RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) was detected above the New Mexico tap water screening level of 7.02 µg/L. RDX was detected at 8.82 µg/L, 8.08 µg/L, and 10.2 µg/L in the March, June, and July samples, respectively. No other HE compounds (including HMX [octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine]) and no degradation products (including MNX [hexahydro-1-nitroso-3,5-dinitro-1,3,5-triazine]; DNX [hexahydro-1,3-dinitro-5-nitro-1,3,5-triazine]; and TNX [2,4,6-trinitroxylene]) were detected in samples from R-68. No other constituents exceeded screening values.

A primary objective of the GIWP was to further refine the nature and extent of RDX contamination in the regional aquifer, especially in relation to the potential pathway(s) between Cañon de Valle and R-18. The RDX concentration at R-68 is near the health-based value of 7.02 µg/L, suggesting a reasonable approximation of extent of contamination in the northeasterly portion of the plume. However, the relation between RDX at R-68 and R-18 remains unclear. The difference in contaminant concentrations between R-68 and R-18 is low (approximately 8.83 µg/L near the water table at R-68 and approximately 3 µg/L about 70 ft below the water table at R-18), particularly given the likelihood of substantial vertical mixing and high recharge rates near the mountain front.

A significant perched-intermediate groundwater zone was encountered during drilling at R-68. This zone is believed to be an extension of the perched zone identified during the drilling of CdV-9-1(i). The top of saturation in the perched-intermediate zone encountered during drilling at R-68 is lower in elevation than the top of saturation observed during drilling at CdV-9-1(i) (6830 ft versus 6910 ft). RDX screening sample concentration data from R-68 and CdV-9-1(i) are presented in the well completion reports for these wells (LANL 2015, 600503; LANL 2017, 602539). In general, screening samples of perched-intermediate groundwater at CdV-9-1(i) showed higher RDX concentrations than screening samples collected from perched groundwater at R-68.

Perched-intermediate groundwater was not encountered at R-18. The perched zone identified at wells CdV-9-1i and R-68 is a potential source of the RDX to the regional aquifer and is possibly related to RDX at well R-18.

3.0 REMAINING UNCERTAINTIES IDENTIFIED DURING THE GIWP

An important objective of the RDX project is to address key uncertainties that are important for assessing the potential long-term impacts of RDX contamination to the regional aquifer, particularly with respect to the long-term fate of the mass in perched-intermediate groundwater. This requires sufficient constraints on where perched-intermediate groundwater is a source of RDX to the regional aquifer, and the long-term fate of the mass and the implications on a projected concentration profile in the regional aquifer.

Key remaining uncertainties include the following:

- The relation between RDX in regional well R-68 and in regional well R-18. This includes an understanding of the northern extent of perched-intermediate groundwater and whether the perched zone is hydrologically connected to the regional aquifer north of R-68.
- The vertical hydraulic head gradient and contaminant concentration gradient in the distal portion of the plume. These data are important for estimating the concentration of RDX near the water table in the R-18 area and for groundwater model calibration.

An additional objective of R-69 was to establish a reliable long-term monitoring location at the distal portion of the plume at the water table in the regional aquifer.

4.0 RECOMMENDATIONS

Based on the remaining uncertainties and the original objectives of the GIWP (LANL 2016, 601779), drilling of regional monitoring well R-69 is recommended. The proposed location for the well has been revised from the original location proposed in the GIWP to address the remaining uncertainties. Figure 4.0-1 shows the proposed new location for R-69.

To address the uncertainties discussed above, including the issue of vertical hydraulic head and contaminant gradients, R-69 is proposed to be drilled as a two-screened well. The upper screen will be completed just below the regional aquifer water table to assess contaminant concentrations at the top of the regional aquifer. The lower screen of R-69 will be completed at approximately the same depth as the R-18 screened interval (the screen of R-18 is located between 69 ft and 92 ft below the water table). Both completion zones will be hydraulically isolated using a Baski inflatable packer system.

The location of R-69 (Figure 4.0-1) was selected for the following reasons:

1. This location lies between wells R-68 and R-18 and will provide additional information regarding the northern lateral extent of the perched-intermediate groundwater zone.

2. This location is sufficiently close to R-18 to allow for a better understanding of the vertical distribution of RDX in this distal portion of the plume. Data from both screens of R-69 will allow RDX concentrations to be measured at the regional aquifer water table and at the approximate depth interval at which R-18 was completed.

Following completion of R-69, an extended hydraulic testing program will be conducted to maximize the data to be collected from R-69's two screens and to take advantage of the location of R-69 with respect to other regional monitoring wells (R-18, R-68, and R-47 in Figure 4.0-1). A 72-h aquifer test will be conducted on each screen of R-69, followed by recovery monitoring of an appropriate duration. The 72-h duration for pumping and recovery of each screen will provide a better assessment of horizontal and vertical anisotropy in the aquifer, with the improved probability of drawdown responses in nearby R-18, and possibly also in R-68 and in R-47 (Figure 4.0-1). During the extended hydraulic testing program, transients in RDX concentrations will be assessed, providing valuable data to be used for the groundwater risk assessment and for evaluation of potential remedial alternatives to address RDX in the regional aquifer.

5.0 SCHEDULE

The proposed location for R-69 is within the core habitat of a threatened or endangered species, and therefore, most drilling-related work is prohibited after February and extending into May of each year. The goal is to have the well pad completed by the end of February 28, 2018, to allow drilling to begin in early June 2018. If drilling of R-69 commences in June 2018, once the threatened and endangered species restrictions are lifted, the estimated completion date for the well would be September 30, 2018.

6.0 REFERENCES AND MAP DATA SOURCES

6.1 References

The following reference list includes documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ERID or ESHID. This information is also included in text citations. ERIDs were assigned by the Associate Directorate for Environmental

Management's (ADEM's) Records Processing Facility (IDs through 599999), and ESHIDs are assigned by the Environment, Safety, and Health Directorate (IDs 600000 and above). IDs are used to locate documents in the Laboratory's Electronic Document Management System and in the Master Reference Set. The NMED Hazardous Waste Bureau and ADEM maintain copies of the Master Reference Set. The set ensures that NMED has the references to review documents. The set is updated when new references are cited in documents.

LANL (Los Alamos National Laboratory), June 2015. "Completion Report for Intermediate Aquifer Well CdV-9-1(i)," Los Alamos National Laboratory document LA-UR-15-23954, Los Alamos, New Mexico. (LANL 2015, 600503)

LANL (Los Alamos National Laboratory), September 2016. "Groundwater Investigation Work Plan for Consolidated Unit 16-021(c)-99, Including Drilling Work Plans for Wells R-68 and R-69," Los Alamos National Laboratory document LA-UR-16-26493, Los Alamos, New Mexico. (LANL 2016, 601779)

LANL (Los Alamos National Laboratory), July 27, 2017. "Completion Report for Regional Aquifer Well R-68," Los Alamos National Laboratory document LA-UR-17-26063, Los Alamos, New Mexico. (LANL 2017, 602539)

NMED (New Mexico Environment Department), September 27, 2016. "Approval, Groundwater Investigation Work Plan for Consolidated Unit 16-021(c)-99, Including Drilling Work Plans for Wells R-68 and R-69," New Mexico Environment Department letter to D. Hintze (DOE-EM-LA) and M. Brandt (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2016, 601855)

6.2 Map Data Sources

Well features; Los Alamos National Laboratory, ER-ES, As published, GIS projects folder 14-0080;\\slip\gis\GIS\Projects\14-Projects\14-0080\project_data.gdb;rdx_point_features_MASTER;2017

Springs; Sampling Locations; Los Alamos National Laboratory, Waste and Environmental Services Division; Locus EIM database pull. 2017

Outfall: WQH Inactive Outfalls; Los Alamos National Laboratory, ENV Water Quality and Hydrology Group; Edition 2002.01; 01 September 2003.

Electric transmission line: Los Alamos National Laboratory, Utilities and Infrastructure (UI), As published, \\slip\gis\ER_DGI\er-\FWO_electric\UI_Electric.gdb;TransmissionLine;2017

Named Drainage channel; Los Alamos National Laboratory, ER-ES, As published, GIS projects folder; \\slip\gis\GIS\Projects\15-Projects\15-0080\project_data.gdb; correct_drainage; 2017

Technical Area Boundaries; Los Alamos National Laboratory, Site Planning & Project Initiation Group, Infrastructure Planning Office; September 2007; as published 13 August 2010.

Paved Road Arcs; Los Alamos National Laboratory, FWO Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.

Unpaved road; Los Alamos National Laboratory, ER-ES, As published, GIS projects folder; \\slip\gis\GIS\Projects\14-Projects\14-0062\project_data.gdb; digitized_site_features; digitized_road; 2017

Structures; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.

SWMU or AOC boundary (TA-16 260 Outfall): Potential Release Sites; Los Alamos National Laboratory, ESH&Q Waste & Environmental Services Division, Environmental Data and Analysis Group.

Perched Aquifer Zones; Los Alamos National Laboratory, ER-ES, As published, GIS projects folder; \\slip\gis\GIS\Projects\15-Projects\15-0041\shp\; perched_aquifer.shp; 2017

Perched intermediate groundwater elevation contour; ER-ES, As published, GIS projects folder \\slip\gis\GIS\Projects\15-Projects\15-0041\shp; sketch_contour.shp; 2017

May 2017 groundwater elevation, 50-ft contours; ER-ES, As published, GIS projects folder \\slip\gis\GIS\Projects\16-Projects\16-0027\project_data.gdb; contour_wl2017may_2ft; 2017

Hillshade; Los Alamos National Laboratory, ER-ES, As published; \\slip\gis\Data\HYP\LiDAR\2014\Bare_Earth\BareEarth_DEM_Mosaic.gdb; 2014

Geologic horizon tops raster elevation dataset: ER-ES, As published, \\win.lanl.gov\wes\Projects\RDX Remediation Project\Geology Investigations\gis\lanl_geo_gis\WC15c_Surfaces_ForParaview\; (i.e. WC15b.top.07.Tb2.tiff, WC15b.top.[numbered unit].[gelogic horizon unit].tiff; All extracted units are horizon tops; 2015

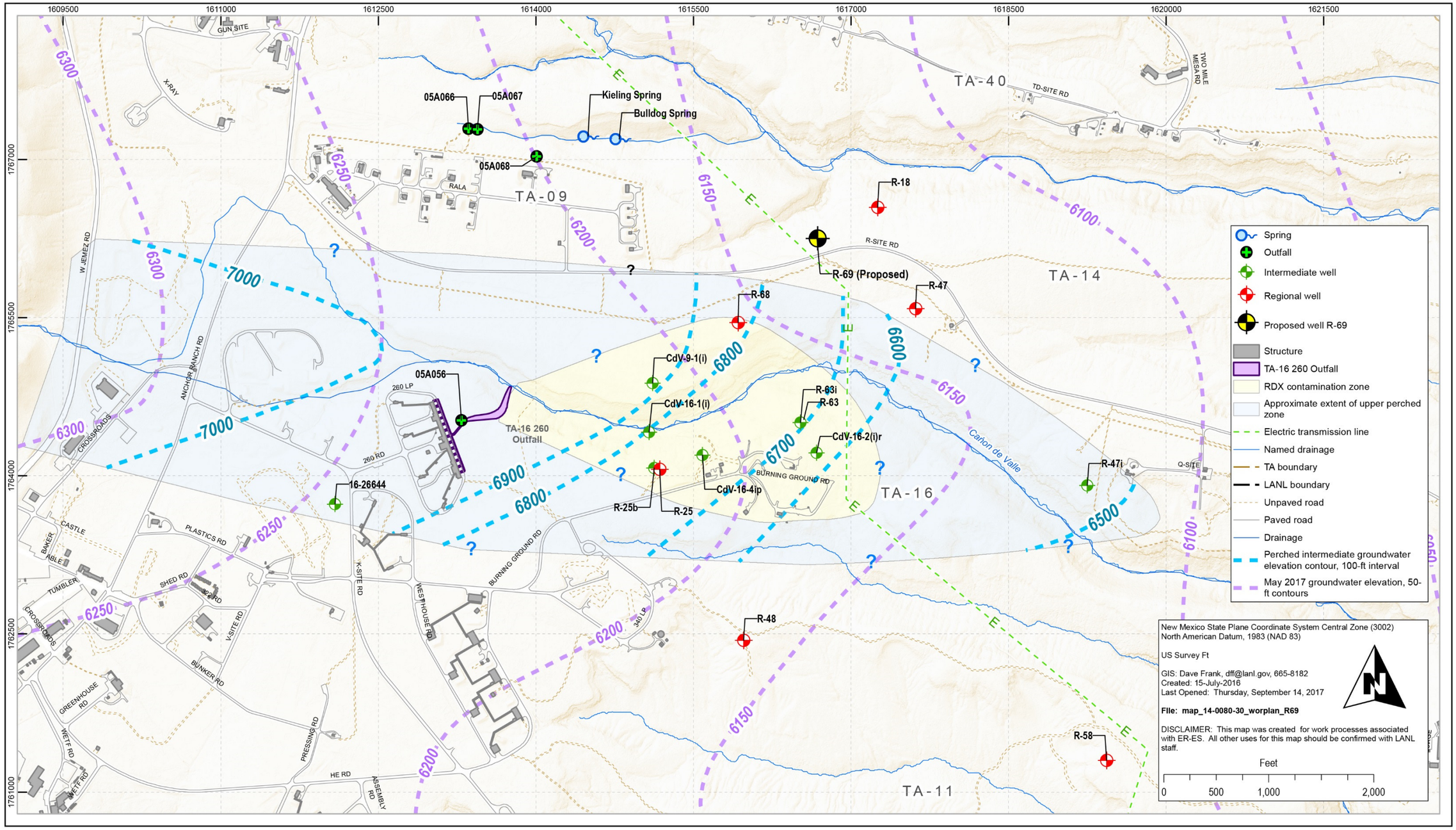

Figure 2.0-1 Water-level contour map

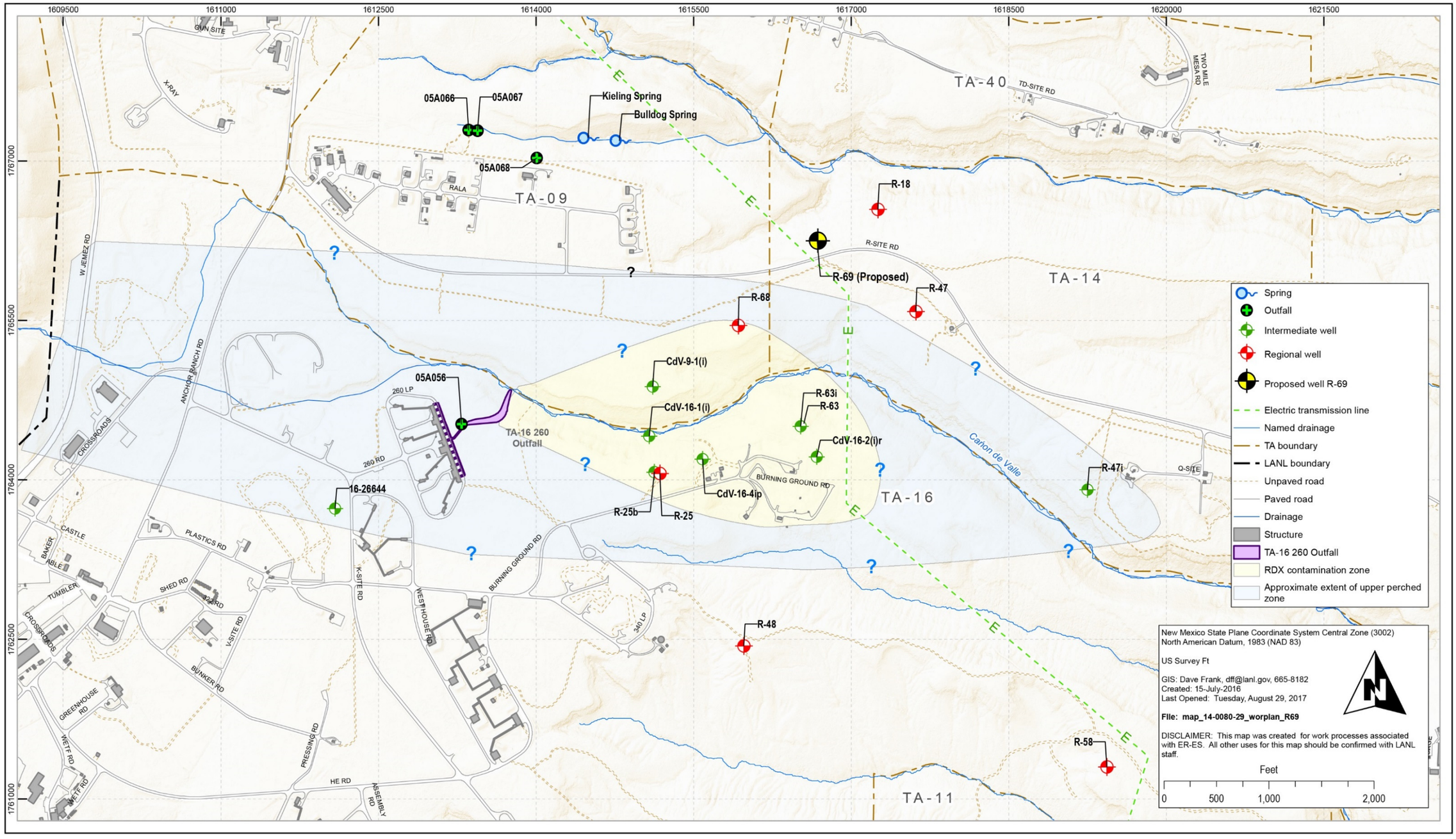

Figure 4.0-1 Proposed location of regional well R-69

Appendix A

Drilling Work Plan for Well R-69, Revision 1

Drilling Work Plan for Well R-69, Revision 1

Primary Purpose	Proposed regional monitoring well R-69 will be located approximately 1100 ft north of Cañon de Valle and 1600 ft east of Technical Area 09 (TA-09) on the mesa top just north of R-Site Road (Figure 1) at Los Alamos National Laboratory (LANL or the Laboratory). The proposed location will be approximately 644 ft southwest of R-18 and approximately 1101 ft northeast of monitoring well R-68. The well will be a two-screened well, with both screens completed in the regional aquifer. Monitoring well R-68, completed on February 27, 2017, encountered a significant perched-intermediate groundwater zone (> 300 ft thick) during drilling. This zone is believed to be the same zone encountered by perched-intermediate well CdV-9-1(i). Screening samples collected during drilling of R-68 indicated elevated RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) is present in the perched zone at concentrations up to 122 µg/L, and RDX is present in the regional aquifer at concentrations of approximately 8.8 µg/L. Installation of R-69 will help to resolve remaining uncertainties, including • The relation of RDX at R-68 and R-18. This includes an understanding of the northern extent of perched-intermediate groundwater and whether the perched zone is hydrologically connected to the regional aquifer north of R-68. • Hydraulics (vertical gradient) in the distal portion of the plume. This information is important for estimating the concentration of RDX near the water table in the R-18 area and for groundwater model calibration. In addition, R-69 will fill data gaps for regional aquifer monitoring at two discrete depth intervals in the regional aquifer. The proposed location for regional well R-69 was selected because of its relative proximity to both R-18 and R-68. This location was selected to provide a better understanding of the increasing concentrations of RDX observed in R-18, which is screened from 69 ft to 92 ft below the regional water table. Water-level data from R-69 will be used to verify the groundwater flow direction in this area and may help to determine the source of contamination at R-18 based on groundwater flow direction. If perched-intermediate groundwater is encountered, screening samples for RDX/HMX (octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)/TNT (2,4,6-trinitrotoluene), and TA-16 tracers will be collected during drilling. The screening data collected during drilling may provide useful information regarding potential sources of high explosives (HE) contamination in the area and defining the lateral extent of the RDX-contaminated perched-intermediate zone north of Cañon de Valle. It is not known whether perched-intermediate groundwater will be present at R-69. The target depth for the borehole is 1440 ft below ground surface (bgs), about 139 ft bgs within the regional aquifer. The depth of the regional groundwater is anticipated to be at a depth of 1301 ft bgs, and the target depth may be adjusted once the top of the regional aquifer is identified. Figure 2 shows the predicted geology, expected groundwater-producing interval, and proposed well design for R-69. The well is proposed as a two-screen completion. The upper screen will be placed near the top of the regional aquifer in Puye Formation deposits at a depth similar to well R-68. The lower screen will be placed at the approximate elevation as the R-18 screen was emplaced. Final selection of the lengths of both well screens and their positions will be based on data obtained during drilling, including information from lithologic logs of cuttings, water-level measurements, video logs, geophysical logs, and drilling crew observations.

Primary Purpose	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 before well construction begins.
Conceptual Model	The potential exists for zones of contaminated perched-intermediate groundwater, similar to those identified at CdV-9-1(i) and at R-68, to be present, possibly contributing to the RDX detected at regional aquifer well R-18. Data from R-69 will be used to further refine the conceptual model and will aid in identifying the source(s) of the RDX observed at R-18.
Drilling Approach	Drilling will be conducted with methods selected to optimize the potential of completing the well without using drilling additives in, or immediately above, the regional aquifer. 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 the objectives. A down-the-hole (DTH) hammer, with or without casing advance, may be used to advance the borehole. If a DTH hammer is employed, hammer oil will be used as a lubricant down to a depth of 1201 ft bgs, approximately 100 ft above the expected top of the regional aquifer water table at this location. Below 1201 ft bgs, the DTH hammer without lubricating oil may be used. If this method is unsuccessful, a tricone bit air-rotary method will be used. Drilling foam may be used to condition the borehole, lift cuttings, and reduce the use of compressed air but will also be terminated at 1201 ft bgs. After the surface conductor casing is set, drilling will advance open hole, targeting the top of the Puye Formation at approximately 698 ft bgs. If perched-intermediate groundwater is present, a screening sample will be collected, and a string of drill casing may be sealed in place before the borehole is advanced to prevent perched water from advancing downhole with drilling. Casing-advance methods may then be used through the same deeper perched-intermediate zone within the Puye Formation that was observed at CdV-9-1(i) to the southwest. Groundwater production will be estimated as each 20-ft section of drill casing is advanced. A screening sample will be airlifted at startup after each new joint connection. To reduce the risk of potentially contaminated perched groundwater entering the regional aquifer, a second string of drill casing may be landed approximately 100 ft above the regional aquifer and sealed in place if perched groundwater is observed. Perched-intermediate groundwater was observed at a depth of 683 ft bgs during drilling of R-68. Assuming R-69 encounters perched-intermediate groundwater and the water table gradient shown on Figure 2.0-1 of the summary report extends to R-69, perched groundwater might be expected at an elevation of around a depth of 691 ft bgs. Drilling will be paused to interrogate this zone to try to locate the top of any perched groundwater zone. Two additional pauses may also be conducted at depths of around 820 ft and 880 ft based on subject matter expert recommendations following review of the R-18 well completion report and projecting to the R-69 location. The pause at the 880-ft equivalent depth may include an open hole video through the upper Puye Formation, which might entail pulling back on the drill casing.

Potential Drilling Fluids, Composition, and Use	Fluids and additives that may be used to facilitate drilling will be consistent with those previously used in the drilling program at the Laboratory and already characterized geochemically. Fluids and additives previously authorized for use by NMED include • potable municipal water supply to aid in the delivery of other drilling additives and cooling 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, the depth at which drilling fluid is added to the borehole, the amount in storage in the borehole, and the recovery volume of drilling fluid. No drilling fluids, except potable municipal water, will be used within 100 ft of the perched-intermediate zone of saturation. If the target zone cannot be reached without the addition of drilling fluids, the situation will be discussed with NMED. No chemicals, other than those listed above, will be added without NMED's approval.
Potential Groundwater Occurrence and Detection	*Potential Perched Water:* Based on drilling observations at wells in the area, perched water is possible at the base of the Otowi Member and within the Puye Formation. The possible depths of groundwater are approximately 680–698 ft, 755–775 ft, and 865–875 ft bgs. However, the depth and length of actual saturated sections, if present, are not known. Based on water levels measured in R-68, perched-intermediate groundwater may be encountered at 691 ft bgs. *Regional:* The top of the regional aquifer is projected to occur at approximately 1301 ft bgs. Methods to detect perched groundwater may include driller's observations, water-level measurements, borehole video, borehole geophysics, and monitoring for pressure responses in nearby wells.
Core Sampling	No core collection is planned.
Perched Groundwater Screening Sampling	Groundwater screening samples will be collected by airlifting within perched-intermediate groundwater zones as is reasonably feasible. The general approach involves airlifting to remove borehole (drilling) water and allowing formation water to enter the borehole. Airlifting is conducted again for sample collection. Resting the borehole following sampling will allow for estimations of the static water level of perched zones. The screening samples from the first perched groundwater encountered will be analyzed for cations/metals (dissolved and total), anions (dissolved), and RDX/HMX/TNT by the Earth and Environmental Sciences (EES) Division's Geochemistry and Geomaterials Research Laboratory (GGRL) and for HE and tritium by off-site laboratories. Additionally, RDX/HMX/TNT screening samples and screening samples for TA-16 tracers will be collected every 20 ft, if present, while drilling through the deep-perched interval. These samples will be submitted to the EES Division's GGRL for analysis.
Regional Aquifer Groundwater Characterization Sampling	Groundwater samples will be collected from the completed well between 10 d and 60 d after well development in accordance with the Compliance Order on Consent. If the dual-screen Baski system cannot be procured and installed within the 60-d limit, samples will be collected at the end of aquifer testing of each screened interval. These samples will be analyzed for the full suite of constituents identified in the Interim Facility-Wide Groundwater Monitoring Plan for monitoring year 2017 for the TA-16 260 monitoring group.

Geophysical Testing	The Laboratory's borehole video camera, natural gamma, and induction tools will be used in the open borehole if conditions allow. A full suite of geophysical logs will be run, if required, for proper placement of the screen. For open-hole conditions, the logs will include accelerator porosity sonde (neutron porosity), array induction, combined magnetic resonance, natural and spectral gamma, and formation microimager 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 also will be used to select the well screen depths. The suite and timing of geophysical logging will depend on borehole conditions.
Well Completion Design	Figure 2 shows the conceptual well design and predicted geology for well R-69.
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 introduced during well completion. • After initial swabbing and bailing, a submersible pump and isolation packer assembly will be used to complete the development process. • 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 the Laboratory is unable to bring the water-quality parameters to within the limits specified below, the use of chemical well development may be discussed with NMED. No chemicals will be added without NMED's approval. Chemical means that may be used include sodium acid pyrophosphate and AQUACLEAR PFD to remove clays and/or chlorination. 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	An enhanced hydraulic testing program is proposed to evaluate vertical anisotropy and contaminant distribution characteristics and to better interrogate the regional aquifer, with 72 h pumping tests proposed for each of the two screens. Given R-18 is completed at a depth of 69 ft to 92 ft below the regional water table and at a distance of only 644 ft northeast of R-69, it is possible that pumping of R-69 for 72 h may elicit a hydraulic response in R-18 (and possibly in R-47 and R-68). This response would provide valuable information regarding the horizontal and vertical anisotropy of the regional aquifer in this area. For this reason, a 72-h constant-rate pumping test will be conducted on each of the two R-69 screens following development. Screening samples for RDX/HMX/TNT will be collected every 8 h during the aquifer testing to provide a better understanding of contaminant distributions in the regional aquifer with depth. Water levels will be monitored in both R-69 screens, and also in nearby regional wells R-18, R-68, and R-47 (Figure 1). Additionally, pumping each of the two screens for 72 h will increase the likelihood that a potentiometric response will be observed in the other screen of R-69, providing valuable data regarding vertical anisotropy in the regional aquifer at R-69. The data collected through this enhanced hydraulic testing program will be used to evaluate potential corrective actions to address RDX contamination in the regional aquifer.

Investigation-Derived Waste Management	Investigation-derived waste (IDW) will be managed in accordance with the requirements in P-409, Waste Management, and EP-DIR-SOP-10021, Characterization and Management of Environmental Programs Waste, available at http://www.lanl.gov/environment/plans-procedures.php. This standard operating procedure 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 with residual additives will be managed in accordance with the NMED-approved Decision Tree for Land Application of Drill Cuttings (January 2016). Drilling fluids, purge water, 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) or the Groundwater Discharge Permit 1793 (DP-1793) if required conditions are met. Initially, drill cuttings and drilling fluids will be stored in lined pits. The cuttings may or may not contain residue of drilling/well completion additives (e.g., drilling foam and bentonite clay). 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. Cuttings, drilling fluids, development water, and purge water that cannot be land-applied under the cuttings and groundwater decision trees or DP-1793 will be transported to an authorized treatment, storage, or disposal facility.
Schedule	The proposed location for R-69 is within the core habitat of a threatened or endangered species, and therefore, most drilling-related work is prohibited after February and extending into May of each year. The goal is to have the well pad completed by the end of February 28, 2018, to allow drilling to begin in early June 2018. If drilling of R-69 commences in June 2018, once the threatened and endangered species restrictions are lifted, the estimated completion date for the well would be September 30, 2018. Monitoring conducted after R-69 is installed will be implemented under the Interim Facility-Wide Groundwater Monitoring Plan.

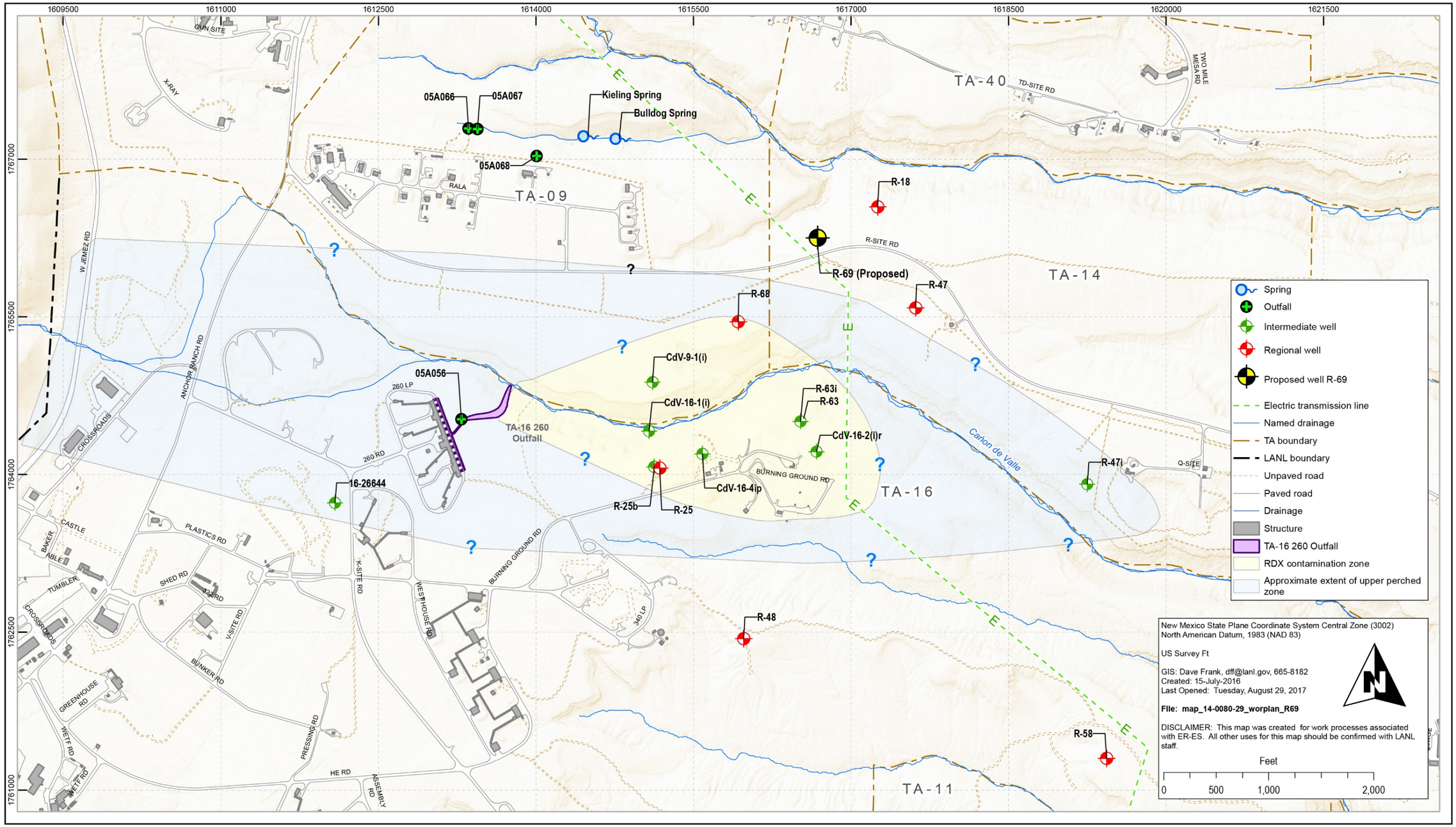

Figure 1 Proposed location of well R-69

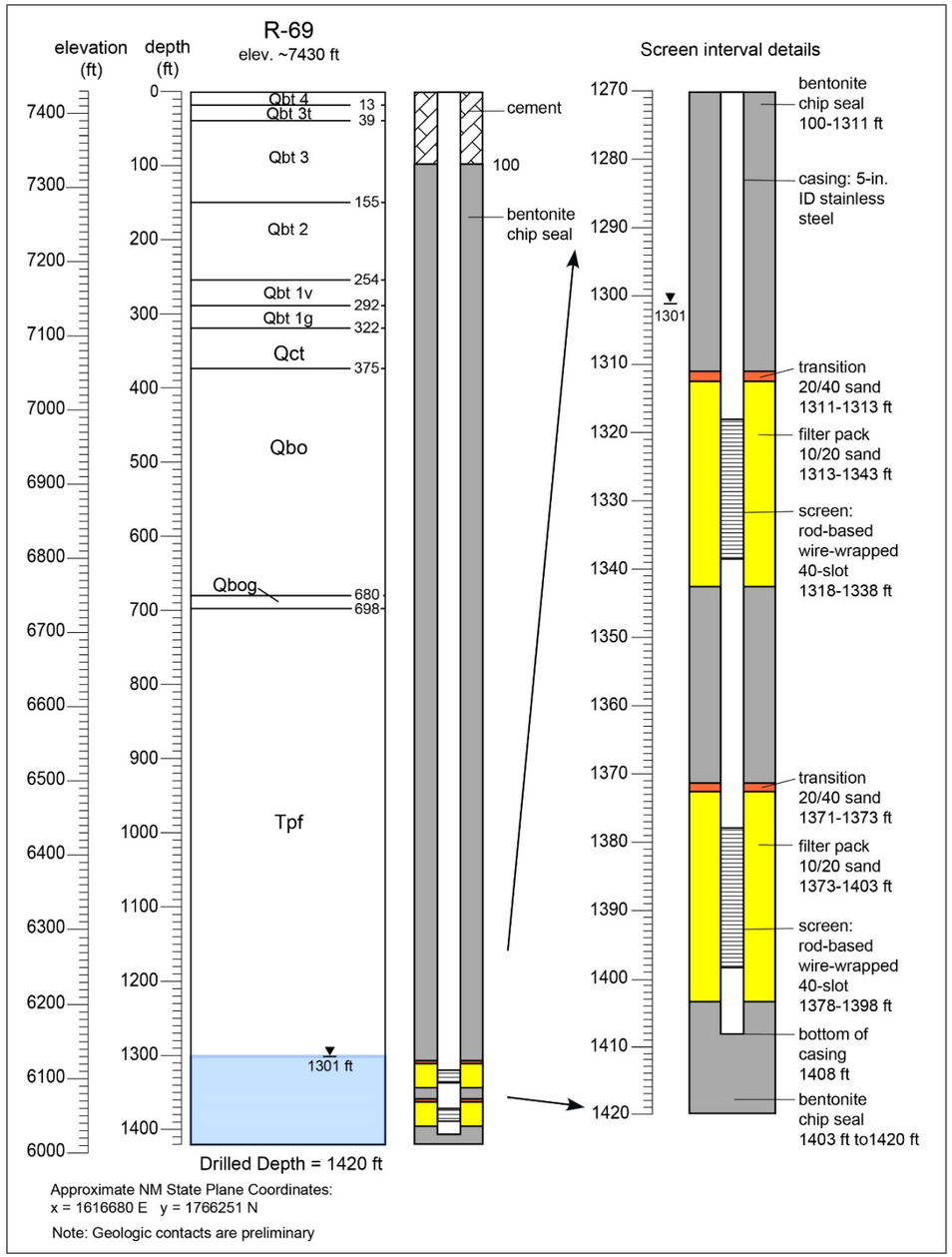

Figure 2 Predicted geology and proposed well design for well R-69