EMID-702305

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

EMLA-2022-BF135-02-001

September 2, 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 Completion Report for Regional Aquifer Monitoring Well R-72

Dear Mr. Shean:

Enclosed please find two hard copies with electronic files of "Completion Report for Regional Aquifer Monitoring Well R-72." The dual-screen well casing and annular fill materials were installed between October 13 and November 21, 2021. Additional development of screens 2 and 1 was completed in December 2021 and January 2022, respectively. The screen 2 first sample was collected on December 19, 2021, and the screen 1 first sample was collected on January 9, 2022.

If you have any questions, please contact Christian Maupin (505) 695-4281 (christian.maupin@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: 2022.09.01 15:12:43 -06'00'

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

Enclosure(s): Two hard copies with electronic files
1. Completion Report for Regional Aquifer Monitoring Well R-72 (EM2022-0304)

cc (letter and enclosure[s] emailed):
Laurie King, EPA Region 6, Dallas, TX
Raymond Martinez, San Ildefonso Pueblo, NM
Dino Chavarria, Santa Clara Pueblo, NM
Chris Catechis, NMED-RPD
Steve Yanicak, NMED-DOE-OB

Jennifer Payne, LANL
Stephen Hoffman, NA-LA
Felicia Aguilar, N3B
William Alexander, N3B
Ryan Flynn, N3B
Vicky Freedman, N3B
Sherry Gaddy, N3B
Jeff Johnston, N3B
Thomas Klepfer, N3B
Kim Lebak, N3B
Joseph Legare, N3B
Dana Lindsay, N3B
Robert Macfarlane, N3B
Pamela Maestas, N3B
Christian Maupin, N3B
Bruce Robinson, N3B
Joseph Sena, N3B
Troy Thomson, N3B
John Warren, N3B
Amanda White, N3B
M. Lee Bishop, EM-LA
John Evans, EM-LA
Thomas McCrory, EM-LA
David Nickless, EM-LA
Cheryl Rodriguez, EM-LA
Hai Shen, EM-LA
emla.docs@em.doe.gov
n3brecords@em-la.doe.gov
Public Reading Room (EPRR)
PRS website

September 2022
EM2022-0304

Completion Report for Regional Aquifer Monitoring Well R-72

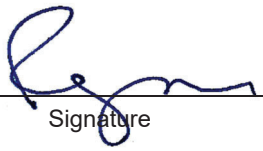
N3B Los Alamos

EM2022-0304

Completion Report for Regional Aquifer Monitoring Well R-72

September 2022

Responsible program director:

Printed Name	Signature	Title	Organization	Date
Ryan Flynn		Program Director	Water Program	August 25, 2022

Responsible N3B representative:

Printed Name	Signature	Title	Organization	Date
Troy Thomson		Program Manager	N3B Environmental Remediation Program	August 25, 2022

Responsible DOE EM-LA representative:

Printed Name	Signature	Title	Organization	Date
Arturo Q. Duran	ARTURO DURAN Digitally signed by ARTURO DURAN Date: 2022.09.01 15:13:11 -06'00'	Compliance and Permitting Manager	Office of Quality and Regulatory Compliance	

EXECUTIVE SUMMARY

This well completion report describes the drilling, well construction, and pump development for regional aquifer monitoring well R-72, located in Technical Area 05 at Los Alamos National Laboratory, Los Alamos, New Mexico. Well R-72 was installed as part of the Chromium Groundwater Project monitoring network, in accordance with "Drilling Work Plan for Regional Well R-72". Well R-72 was installed vertically to a measured depth of 1320 ft below ground surface (bgs) and has two screens in the Miocene pumiceous unit deposits to provide samples from the regional aquifer. The primary objective for well R-72 is to further characterize the lateral and vertical extent of chromium and perchlorate contamination in the southwestern portion of the chromium plume footprint as depicted by the estimated extent of chromium concentrations above the 50 ppb New Mexico Environment Department (NMED) drinking water standard. The screening level for perchlorate is 13.8 µg/L. The need for this information was jointly identified in chromium project technical team meetings with NMED in 2019. Data from the well R-72 location may also be used to optimize the details of the remediation strategy in that portion of the plume.

Well R-72 was drilled August 27–September 26, 2021, using dual-rotary fluid-assisted air-drilling casing-advance methods. Telescoping casing sizes between 20 in. and 14 in. were used to advance the borehole to the total depth of 1320 ft bgs. Fluid additives used included potable water, hammer oil, and foaming agent. Foam-assisted drilling was terminated at 1095 ft bgs, which is 93.7 ft above the measured depth to water of 1188.7 ft bgs and within the pumiceous Puye Formation. The only deviation from plan during drilling was the loss of the 16-in. hammer bit downhole (unthreaded), which was quickly fished from the borehole.

The following geologic formations were encountered in well R-72: Tshirege Member of the Bandelier Tuff, Cerro Toledo Interval of the Bandelier Tuff, Otowi Member of the Bandelier Tuff, Guaje Pumice Bed, upper Puye Formation, Cerros del Rio basalt, Puye Formation, and Miocene pumiceous unit. No perched groundwater was encountered when the well R-72 borehole was drilled.

From October 16 through October 22, 2021, 8-in. stainless-steel well casing was installed, and from October 23 through November 21, 2021, annular fill material was installed. Well R-72 is completed as a dual-screen well in accordance with the NMED-approved well design received October 15, 2021, allowing evaluation of water quality at two discrete depth intervals in the upper portion of the regional aquifer within the Miocene pumiceous unit, with a 20-ft upper screen from 1220 ft to 1240 ft and a 20-ft lower screen from 1290 ft to 1310 ft bgs.

Development began November 22, 2021. Both well screen completion zones were pump developed while water field parameters were taken of temperature, pH, oxidation-reduction potential, specific conductivity, and dissolved oxygen until they stabilized in both screens. Chromium concentration at the end of pump development was 5.79 ppb in screen 1 and 5.25 ppb in screen 2. Perchlorate concentrations were analyzed to determine the ability of the development wastewater to be treated by the chromium treatment system before land application. The perchlorate concentrations at the end of pump development were 0.433 ppb in screen 1 and 0.351 ppb in screen 2. The first samples for groundwater characterization were taken December 19, 2021, and January 9, 2022, from screen 2 and screen 1, respectively. The deviations from the plan for pump development were (1) there was not enough downhole cable initially and (2) the shroud on the first pumping system was blocking inflow to the pump, which required the receipt and installation of a second pumping system.

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Acronyms and Abbreviations

amsl	above mean sea level
APV	access port valve
bgs	below ground surface
BHA	bottom hole assembly
Consent Order	Compliance Order on Consent (NMED)
DO	dissolved oxygen
DP-1793	Discharge Permit 1793
gpm	gallons per minute
hp	horsepower
I.D.	inside diameter
IDW	investigation-derived waste
JSL	Johnson Spring Lock
LANL	Los Alamos National Laboratory
LIC	liquid inflation chamber
N3B	Newport News Nuclear BWXT-Los Alamos, LLC
NMED	New Mexico Environment Department
NTU	nephelometric turbidity unit
O.D.	outside diameter
ORP	oxidation-reduction potential
PVC	polyvinyl chloride
SOP	standard operating procedure
TA	technical area
TD	total depth
TOC	total organic carbon
WCSF	waste characterization strategy form

1.0 INTRODUCTION

This well completion report summarizes borehole drilling, well construction, and pump development for regional aquifer monitoring well R-72, in accordance with "Drilling Work Plan for Regional Well R-72" (NMED 2020, 700817; NMED 2021, 701477). The primary objective for well R-72 is to further characterize the lateral and vertical extent of chromium and perchlorate contamination in the southwestern portion of the chromium plume footprint as depicted by the estimated extent of chromium concentrations above the 50-ppb New Mexico Environment Department (NMED) drinking water standard. The screening level for perchlorate is 13.8 µg/L (NMED 2022, 702141).

Well R-72 was completed with two screens in the upper portion of the regional aquifer. The well was designed with an 8-in. inside diameter (I.D.) casing with two 20-ft 0.040-in. slot screens. Final well design was based on data from lithology logs, water-level measurements, video logs, and geophysical logs. Specific well design recommendations were submitted to NMED for review and approval before the well was constructed.

Secondary objectives include identifying and establishing water levels in perched-intermediate aquifers, collecting samples of drill cuttings for lithologic description, and acquiring borehole geophysical data. Well R-72 borehole was drilled to a vertical depth of 1320 ft below ground surface (bgs) from August 27 through September 26, 2021. During drilling, cuttings samples were collected at 5-ft intervals from ground surface to total depth (TD). NMED approved the well design on October 15, 2021 (Catechis 2021, 702276). Well R-72 well casing was installed from October 16, 2021 through October 22, 2021, with a 20-ft screened interval at 1220 to 1240 ft bgs and a 20-ft screened interval at 1290 to 1310 ft bgs, both within the Miocene pumiceous unit. The depth to water of 1188.7 ft bgs was recorded on September 28, 2021, before well casing installation. Installation of annular fill materials was completed from October 23, 2021, through November 21, 2021. Pump development began November 22, 2021.

Post-installation activities included pump development and collection of first groundwater characterization samples December 19, 2021, and January 9, 2022, from screen 2 and screen 1, respectively. Activities remaining to be completed at well R-72 include installation of the permanent electrical control box, site restoration, and waste management.

The information presented in this report was compiled from field records, logbooks, and daily activity reports. Records including field reports, field logs, and survey information are on file at Newport News Nuclear BWXT-Los Alamos, LLC (N3B) Records Management. This report contains brief descriptions of activities and supporting figures, tables, and appendices associated with the well R-72 drilling project.

2.0 ADMINISTRATIVE PLANNING

The following documents were prepared to guide the activities associated with the drilling, installation, and development of Chromium Groundwater Project monitoring network well R-72:

- "Drilling Work Plan for Regional Well R-72" (NMED 2020, 700817)
- "Response to Amended Approval Letter for Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-71 and Amended Approval Letter for Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-72" (NMED 2021, 701477)
- "Field Implementation Plan for Regional Aquifer Well R-72" (N3B 2021, 701582)

- Waste Characterization Strategy Form (WCSF) for Groundwater Monitoring Well R-72, Revision 1 (N3B 2020, 700952)
- "Storm Water Pollution Prevention Plan: Chromium Piping and Infrastructure Project Phase 6, R-71 and R-72 Well Pad Construction and Drilling Activities, R1," August 5, 2021 (N3B 2022, 702237)

3.0 DRILLING ACTIVITIES

The following are descriptions of the field activities that took place during the drilling of regional aquifer monitoring well R-72 in Technical Area 05 (TA-05) at Los Alamos National Laboratory (LANL or the Laboratory). The location of monitoring well R-72 is shown in Figure 3.0-1.

3.1 Drilling Approach

The drilling method, equipment, and drill-casing sizes for monitoring well R-72 were selected to retain the ability to investigate and case or seal off any perched groundwater encountered above the regional aquifer. The drilling approach ensured that a sufficiently sized drill casing was used to meet the required 2-in. minimum annular thickness of the filter pack around an 8.625-in.–outside diameter (O.D.) well screen. Boart Longyear was the drilling contractor chosen to install well R-72 and provided all necessary equipment, personnel, and materials.

Dual-rotary, casing advance, air-foam drilling methods using a Foremost DR-24HD drilling rig were employed to drill the well R-72 borehole. The drilling rig was equipped with conventional drilling rods/pipe, reverse-circulation rods, tricone bits, downhole hammer bits, three Ingersoll Rand 1100–cubic feet per minute auxiliary compressors, an airlift swabbing tool, and general drilling equipment. A 1500-gal. flatwater truck, winch truck, manlift, 3000-gal. water truck, inertial gyro with digital wireline counter, and two telehandler forklifts were also used for drilling activities. Light plants provided lighting for night work. After the well was drilled to TD, the Foremost DR-24HD rig was used to construct the well.

A Pulstar P100 Pump Hoist rig was mobilized to the site after the well was constructed. This rig was used for the installation of a temporary pump system for development, and pump development.

3.2 Chronological Drilling Activities

The Foremost DR-24HD drilling rig, ancillary equipment, and supplies were mobilized to the well R-72 drill site on August 4, 2021. The equipment and tooling were decontaminated and inspected before mobilization to the site. Site preparation included installing polyethylene secondary containment beneath the drilling rig and ancillary equipment, welding a drive shoe to the 20-in.-diameter casing, connecting the centralizer plate to the bottom of the drilling rig, and setting up the discharge line from the drilling rig to the cuttings pit. After site setup was complete and the drilling permit was received, the walkdown and authorization-to-proceed inspection were completed on August 27, 2021.

Drilling commenced on August 27, 2021, with advancement of the 20-in.-diameter surface casing using a 21.25-in.-diameter Mincon MP180 underreaming hammer bit. The surface casing was advanced through the Tshirege Member of the Bandelier Tuff to a depth of 320.0 ft bgs. The 20-in. casing shoe was mechanically cut, abandoning 4.2 ft of casing in place (315.8 to 320.0 ft bgs).

From September 2 to September 9, 2021, an 18-in.-diameter casing was installed through the 20-in.-diameter surface casing. Casing was advanced using a 19.25-in.-diameter underreaming hammer bit

through the Tshirege Member of the Bandelier Tuff, the Cerro Toledo Interval of the Bandelier Tuff, the Otowi Member of the Bandelier Tuff, the Guaje Pumice Bed, the Upper Puye Formation, and into the Cerros del Rio basalt to 720 ft bgs. The 18-in. casing shoe was mechanically cut, abandoning 8.0 ft of casing in place (712.0 to 720.0 ft bgs).

From September 9 to September 20, 2021, a 16-in.-diameter casing was installed within the 18-in.-diameter casing. Starting on September 9, 2021, a 16-in.-diameter casing was advanced using a 17-in.-diameter underreaming hammer bit through the Cerros del Rio basalt. On September 13, 2021, drilling from 830 to 835 ft bgs, the driller had issues lifting the top drive and believed cuttings were not allowing underreamer wings to close. The crew tripped out drill rods and the 16-in. bottom hole assembly (BHA) and noticed the lower part of the hammer bit was missing, having become unthreaded. After several attempts to retrieve the hammer bit by using drill rods and the upper part of the BHA, the crew successfully retrieved the hammer bit with a modified fishing tool on September 17, 2021. Drilling and casing advance continued through the Cerros del Rio Basalt and into the Puye Formation to 1070 ft bgs. The 16-in. casing shoe was mechanically cut, abandoning 8.6 ft of casing in place (1061.4–1070.0 ft bgs).

From September 20 to September 26, 2021, 14-in.-diameter casing was installed within the 16-in.-diameter casing. From September 20 to September 26, 2021, the 14-in.-diameter casing was advanced using a 15.25-in.-diameter underreaming hammer bit through the Puye Formation and into the Miocene pumiceous unit to TD at 1320 ft bgs. The 14-in. casing shoe was mechanically cut, abandoning 6.5 ft of casing in place (1313.5 to 1320.0 ft bgs).Table 3.2-1 presents a record of fluid quantities used during drilling and well construction.

No potential perched groundwater bearing zones, particularly in and near the Cerros del Rio Basalt where the occurrence of groundwater was anticipated, were observed during the drilling of the borehole. The final static water level in the regional aquifer was recorded at 1188.7 ft bgs on September 28, 2021.

Geophysical surveys using gamma and neutron logging tools were conducted on October 1 and October 15, 2021. Figure 3.2-1 shows the as-built diagram for R-72, and Figure 3.2-2 presents technical notes.

4.0 SAMPLING ACTIVITIES

This section describes the cuttings and groundwater sampling activities for monitoring well R-72. All sampling activities were conducted in accordance with applicable procedures.

4.1 Cuttings Sampling

Cuttings samples were collected from the monitoring well R-72 borehole at 5-ft intervals from ground surface to the TD of 1320 ft bgs. At each interval, approximately 500 mL of bulk cuttings was collected by the site geologist from the drilling discharge assembly, placed in resealable plastic bags, labeled, and archived in core boxes. Cuttings splits were delivered to NMED. Whole rock, +35 sieve-size fractions, and +10 sieve-size fractions were also processed, placed in chip trays, and archived for each 5-ft interval. Radiological control technicians screened the cuttings for radiological contamination per N3B-EP-DIR-SOP-10021, “Characterization and Management of Environmental Program Waste.” All screening measurements were below background values and/or negative. The cuttings were delivered to N3B at the conclusion of drilling activities. The stratigraphy at well R-72 is summarized in section 5.1, and a detailed lithologic log is presented in Appendix A.

4.2 Water Sampling

4.2.1 Potential Perched Water Samples

No perched groundwater screening samples were collected, as no perched groundwater zones were observed during the drilling of well R-72.

4.2.2 Pump Development Samples

Groundwater samples were collected during pump development and analyzed for total organic carbon (TOC). Five samples were collected from screen 1 between December 8 and December 10, 2021, and 5 samples were collected from screen 2 between December 10 and December 13, 2021. Field parameters collected during development included temperature, pH, dissolved oxygen (DO), oxidation-reduction potential (ORP), specific conductance, and turbidity. Sand volume was measured through a Rossum Sand Tester.

Samples from each screen were also analyzed for naphthalene, sulfonic acid and disulfonic acid, rhenium, perchlorate, and TOC.

4.2.3 Groundwater Characterization Samples

Groundwater characterization samples were collected from the completed well at the conclusion of pump development of each screen in accordance with the 2016 Compliance Order on Consent (Consent Order). Samples were collected from screen 2 on December 19, 2021, and from screen 1 on January 9, 2022, consisting of full groundwater characterization analytical suites, compliant with the Consent Order, and TOC screening samples. Analytical results of these samples are in the Intellus New Mexico database https://www.intellusnm.com/ and will also be reported in the next periodic monitoring report for the Chromium Investigation monitoring group, to be submitted in May 2023.

Additionally, analytical results are reported in Appendix B, Table B-1.1-1. Field water-quality parameters are presented in Tables B-1.1-2, B-2.1-1, and B-2.1-2. Table 4.2-1 summarizes groundwater samples collected during drilling and pump development of well R-72, and Table 4.2-2 presents groundwater samples collected during extended pumping.

5.0 GEOLOGY AND HYDROGEOLOGY

The geologic and hydrogeologic features encountered at well R-72 are summarized below. The N3B geology task leader and project site geologist examined drill cuttings and the natural gamma-ray log to determine geologic contacts and hydrogeologic conditions. Drilling observations and water-level measurement data were considered in the identification of groundwater and potential perched groundwater encountered in well R-72.

5.1 Stratigraphy

Rock units for the well R-72 borehole are presented below in order of youngest to oldest in stratigraphic occurrence. Lithologic descriptions are based on binocular stereo microscope analysis of drill cuttings collected from the discharge hose. Figure 5.1-1 illustrates the borehole stratigraphy of well R-72, and Appendix A presents lithologic descriptions of well R-72.

Unit 4, Tshirege Member of the Bandelier Tuff, Qbt 4 (0–30 ft bgs)
Unit 4 of the Tshirege Member of the Bandelier Tuff was encountered from 0 to 30 ft bgs. Unit 4 contains large glassy pumice fragments in outcrop that decrease with depth and become devitrified.

Unit 3, Tshirege Member of the Bandelier Tuff, Qbt 3 (30–65 ft bgs)
Unit 3 of the Tshirege Member of the Bandelier Tuff was encountered from 30 to 65 ft bgs. Unit 3 is a poorly to moderately welded devitrified ash-flow tuff (i.e., ignimbrite) that is crystal rich, slightly pumiceous, and lithic poor and exhibits a matrix of fine ash.

Unit 2, Tshirege Member of the Bandelier Tuff, Qbt 2 (65–135 ft bgs)
Unit 2 of the Tshirege Member of the Bandelier Tuff was encountered from 65 to 135 ft bgs. Unit 2 represents a moderately to strongly welded devitrified rhyolitic ash-flow tuff (i.e., ignimbrite) that is composed of abundant quartz and sanidine crystals. Cuttings typically contain abundant fragments of indurated tuff and numerous free quartz and sanidine crystals.

Unit 1v, Tshirege Member of the Bandelier Tuff, Qbt 1v (135–225 ft bgs)
Unit 1v of the Tshirege Member of the Bandelier Tuff was encountered from 135 to 225 ft bgs. Unit 1v is a poorly to moderately welded, devitrified rhyolitic ash-flow tuff that is pumiceous, generally lithic poor, and crystal bearing to locally crystal rich. Abundant ash matrix is rarely preserved in cuttings. Cuttings commonly contain numerous fragments of indurated crystal-rich tuff with devitrified pumice. Abundant free quartz and sanidine crystals dominate cuttings in many intervals, and minor small (generally less than 10 mm in diameter) volcanic lithic inclusions also occur in cuttings.

Unit 1g, Tshirege Member of the Bandelier Tuff, Qbt 1g (225–322 ft bgs)
Unit 1g of the Tshirege Member of the Bandelier Tuff was encountered from 225 to 322 ft bgs. Unit 1g is a poorly welded vitric rhyolitic ash-flow tuff that is poorly to moderately indurated, strongly pumiceous, and crystal bearing. White to pale orange, lustrous, glassy pumice lapilli are characteristic of unit 1g. Cuttings contain abundant free quartz and sanidine crystals and glassy pumices.

Cerro Toledo Interval, Qct (322–355 ft bgs)
The Cerro Toledo interval was encountered from 322 to 355 ft bgs. The Cerro Toledo interval is a sequence of poorly consolidated tuffaceous and volcaniclastic sediments that occur intermediately between the Tshirege and Otowi Members of the Bandelier Tuff. Sediments are largely stained with orange oxidation on grain surfaces.

Otowi Member of the Bandelier Tuff, Qbo (355–680 ft bgs)
The Otowi Member of the Bandelier Tuff was encountered from 355 to 680 ft bgs. The Otowi Member is composed of poorly welded vitric rhyolitic ash-flow tuffs that are pumiceous and crystal- and lithic-bearing. Drill cuttings contain pale orange to white pumices, volcanic lithic clasts, and quartz and sanidine crystals. Lithic fragments are commonly subangular to subrounded and generally of intermediate volcanic composition, including porphyritic dacites.

Guaje Pumice Bed, Qbog (680–695 ft bgs)
The Guaje Pumice Bed represents an air-fall tephra deposit of rhyolitic pumice that forms the base of the Otowi Member. The Guaje deposit was encountered from 680 to 695 ft bgs. Drill cuttings in this interval contain abundant lustrous vitric pumice lapilli (up to 15 mm in diameter) with trace occurrences of small volcanic lithic fragments. The deposit is poorly consolidated.

Upper Puye Formation, Tpf (695–710 ft bgs)
The Upper Puye Formation was encountered from 695 to 710 ft bgs. Deposits in this interval are white to light orange/red-orange fine-grained to pebble-sized gravels and sandstones, including rounded pumice

gravels. Sand-sized pumice and volcanic clasts are typically subangular to subrounded, and fine quartz grains are subrounded.

Cerros del Rio Basalts, Tb4 (710–980 ft bgs)
Cerros del Rio volcanic rocks were encountered from 710 to 980 ft bgs and form a complex sequence that includes both massive and vesicular basaltic lavas with minor basaltic scoria deposits. The sequence also includes thin (<5 ft) basaltic sediment layers between flows. These basaltic sediments consist of reworked fine gravel, sand, and mud.

Puye Formation, Tpf (980–1198 ft bgs)
Puye Formation volcaniclastic sediments were encountered from 980 to 1198 ft bgs. The Puye Formation consists of alluvial fan deposits eroded from volcanic rocks in the nearby Jemez Mountains. Cuttings from this interval consist of grey, red, and purple dacitic and rhyolitic gravels, volcaniclastic sands, and minor devitrified pumice clasts. Cuttings are generally angular to subangular.

Miocene Pumiceous Sediments, Tjfp (1198–1320 ft bgs)
The pumice-rich volcaniclastic section was encountered from 1198 ft bgs to the bottom of the well R-72 borehole at 1320 ft bgs. These sediments are dominated by coarse to very coarse sands with subordinate silt and gravel. Additional subordinate components of the pumiceous sand and gravels include rhyolite lava, obsidian, and felsic crystals.

6.0 BOREHOLE LOGGING

On October 1 and 15, 2021, geophysical logs were run by COLOG, Inc. (COLOG) after water levels had been recorded. A pre-job geophysical logging safety and planning meeting was conducted and the downhole tools configured before borehole runs began. The geophysical surveys consisted of natural gamma and neutron porosity tool runs. Interference and data corruption occurred on the runs completed on October 1, 2021. COLOG returned on October 15, 2021, and the surveys were successfully completed.

The geophysical data in graphic form are shown in Figure 6.0-1. Figure 6.0-2 shows the gamma log overlain on the stratigraphic contacts. The geophysical logs and the gyroscopic survey are in Appendix C, on CD included with this document.

7.0 WELL CASING AND ANNULAR MATERIALS INSTALLATION

Well R-72 dual-screen well casing and annular fill materials were installed between October 13 and November 21, 2021.

7.1 Well Design

Well R-72 was designed in accordance with Consent Order guidance, and NMED approved the final well design (Appendix D). The design consisted of two screened intervals: the first between 1218.9 and 1239.4 ft bgs and the second between 1288.9 and 1309.4 ft bgs. This allows monitoring of the groundwater quality within two discrete zones of the regional aquifer.

7.2 Well Construction

From October 13 to October 17, 2021, equipment and well construction materials were mobilized to the site. Stainless-steel 8-in. well casing and screens, and tremie pipe were decontaminated with Alconox detergent and hot water pressure wash. The 8-in. well casing and screens were tested for diameter and eccentricity before acceptance.

Well R-72 is constructed of 8-in. nominal I.D., 8.625-in. O.D., schedule 40, pickled and passivated A304 stainless-steel, beveled casing fabricated to American Society for Testing and Materials A312 standards. The upper and lower screened sections used two 10-ft length, 8-in. I.D., 0.040-in. slot, rod-based, wire-wrapped screens each to make 20-ft long screened intervals. The screens were constructed with welded tabs at each end, between all rods and weld ring connections, to increase the torque strength of the screen. All individual casing and screen sections were welded together using compatible stainless-steel flux-cored arc wire welding. The screens were manufactured by Johnson Screens, an Aqseptence Group company. A nominal 2-in. (BQ) steel tremie pipe was used to deliver backfill and annular fill materials downhole during well construction.

On October 17, 2021, before beginning installation, the borehole depth was measured at 1319.5 ft bgs, indicating 0.5 ft of formation slough. Well screens and well casing were installed in the borehole from October 17 to October 22, 2021. Stainless-steel centralizers were welded to the well casing every 100 ft and 2 ft above and below each screened interval. Figure 3.2-1 presents an as-built schematic showing the construction details for the completed well.

The 14-in.-diameter casing retraction started on October 23, 2021, while the bentonite and sand pack were being installed for the lower and upper screen. The 14-in.-diameter casing removal was completed on November 9, 2021. The 16-in.-diameter casing retraction started on November 9, 2021, during installation of the bentonite seal, and was completed on November 11, 2021. The 18-in.-diameter casing retraction started on November 13, 2021, during installation of the bentonite seal, and was completed on November 16, 2021. The 20-in.-diameter casing retraction started on November 17, 2021, during installation of the bentonite seal, which was completed on November 20, 2021, at 60 ft bgs. Neat Portland Type I/II cement surface seal installation from 60 ft bgs to surface was completed on November 21, 2021, along with full removal of the 20-in.-diameter casing.

Annular materials were installed in the borehole from October 23 through November 21, 2021. The top of slough in the bottom of the borehole was tagged at 1319.5 ft bgs on October 17, 2021. Below are the dates, materials, and depths for well construction (bottom up):

Date	Material	Depth
October 23–24, 2021	Bentonite Pel-Plug	1319–1315 ft bgs
October 24–28, 2021	8/16 filter pack sand	1315–1281 ft bgs
October 28, 2021	20/40 transition sand	1281–1279 ft bgs
October 28–29, 2021	Bentonite chips	1279–1245 ft bgs
October 29–November 5, 2021	8/16 filter pack sand	1245–1213 ft bgs
November 5, 2021	20/40 transition sand	1213–1206 ft bgs
November 5–20, 2021	Bentonite chips	1206–60 ft bgs
November 20–21, 2021	Neat Portland type I/II cement	60–0 ft bgs

8.0 POST-INSTALLATION ACTIVITIES

Following well casing and annular material installation at well R-72, the pump development was completed as described below.

8.1 Screen and Pump Development

The drill rig was switched over to the airlift swabbing tool on reverse circulation drill rods for screen development on October 25, 2021. Well R-72 screen 2 was airlift swabbed and surged on October 26, 2021. The drill rig was switched back to tooling used to install annular materials to above the screen 2 interval. After installation of bentonite seal between the screened intervals and the installation of the screen 2 filter pack, the drill rig was switched back over to the airlift swabbing tool on reverse circulation drill rods on October 30, 2021. Well R-72 screen 1 was airlift swabbed and surged from October 30 to November 1, 2021. On November 2, 2021, Aqua-Clear PFD was added to both screen intervals at a mixture of 1 gal. of Aqua-Clear to 400 gal. of water. Both screen intervals were surged on November 2 and 3, 2021, and airlift swabbed on November 4, 2021, to remove all Aqua-Clear and remaining fines. On November 4, the well sump was cleaned out by airlifting with reverse circulation drill rods and bullnose tip until fine sand and silt was no longer observed in the discharge as measured in an Imhoff cone.

The airlift swabbing tool employed was made up of one 0.5-in.-thick rubber gasket disc on the bottom and top of a 9-ft perforated pipe. The tool was pulled up and down repeatedly across the screened intervals, causing a surging action across the screen and filter pack while airlifting fine sand, silt, and water to surface. A bullnose attachment was lowered to the bottom of the well to airlift any sediment that may have accumulated in the sump. Swabbing and airlifting produced an estimated 3010 gal. from October 26, 2021, through November 4, 2021.

On November 22, 2021, a hoist rig was mobilized to the site and a 40-horsepower (hp) Grundfos submersible pump was deployed into the well with packers above and below the pump on November 25, 2021. From December 8 to 10, 2021, screen 2 was developed at an average discharge rate of 15 gallons per minute (gpm) with packers deflated and inflated, using step development passing the pump across the screen, producing 29,886 gal. of groundwater including 200% of any cross-flow during deflation. From December 10 to 13, 2021, screen 1 was developed at an average discharge rate of 11 gpm with packers inflated, producing 17,262 gal. of water.

Additional development of screen 2 was completed from December 14 through 19, 2021, at an average discharge rate of 11.76 gpm and a total of 9536.7 gal. Development parameter data were collected throughout pump development until development criteria were met. Screen 2 first sample was collected on December 19, 2021.

Additional development of screen 1 was completed, following the LANL holiday shutdown, from January 5 through 9, 2022, at an average discharge rate of 11.2 gpm and a total of 16,295.4 gal. Development parameter data were collected throughout pump development until development criteria were met. Screen 1 first sample was collected on January 9, 2022.

Field parameter data are discussed in greater detail in Appendix B.

Table 8.1-1 shows the volume of water produced during well development.

8.1.1 Total Volumes of Introduced and Developed Water

During drilling, 15,200 gal. of potable water was added from 1188.7 ft bgs to the TD of the borehole at 1320 ft bgs. During installation of the well casing and annular material, 12,000 gal. was added. In total, 27,200 gal. of potable water was introduced to the borehole from 1188.7 ft bgs during project activities.

A total of 2450 gal. of groundwater was developed during filter pack installation, and a total of 83,516 gal. of groundwater was developed from well R-72 during pump development and extended pumping activities.

8.1.2 Pump Development Field Parameters

During the pump development, temperature, pH, DO, ORP, specific conductance in µS/cm, and sand volume were measured. Five samples were taken during well development once turbidity was below 30 nephelometric turbidity units (NTU). The samples measured total organic carbon and turbidity (NTU). The required TOC and turbidity values for adequate well development were less than the required maximum of 2.0 ppm and less than 5 NTU, respectively. The sand volume was less than the required maximum of 1 mg/L as measured via Rossum Sand Tester.

Final development samples and field parameters were measured by a YSI ProDSS from the sampling ports with the use of a flow-through cell and NTUs were confirmed with a Hach 2100Q Portable Turbidimeter. Screen 1 final development parameters were a pH of 7.84, temperature of 21.30°C, specific conductance of 127.80 µS/cm, DO of 8.59 mg/L, ORP of −59.00 mV, <1mg/L sand, and turbidity of 4.20 NTU (Hach). Screen 2 final development parameters were a pH of 7.79, temperature of 21.80°C, specific conductance of 129.80 µS/cm, DO of 6.79 mg/L, ORP of 215.40 mV, <1mg/L sand, and turbidity of 3.75 NTU (Hach). Tables B-2.1-1 and B-2.1-2 in Appendix B show field parameters measured during pump development and extended pumping.

8.2 Dedicated Sampling System Installation

The Semco 2500 Boart Longyear rig was mobilized to the R-72 well site and the dedicated sampling system was delivered and inspected at the site from June 20 through June 21, 2022. The temporary packer (set on January 10, 2022) was removed from the well on June 21, 2022. Deviation, gamma, and video surveys were performed on June 22, 2022, and on June 23, 2022, a sounder was used to confirm a static water depth of 1189.84 ft bgs. The Baski sampling system was successfully installed from June 23, 2022 through June 28, 2022.

The sampling system is a Baski, Inc.-manufactured system that uses a single 5-hp, 4-in.-O.D. environmentally retrofitted Grundfos submersible pump capable of purging each screened interval discretely via pneumatically actuated access port valves (APVs). One 1-in. stainless-steel check valve was installed within the pump shroud above the pump body. A weep valve was installed at the bottom of the uppermost pipe joint to protect the pump column from freezing. The system includes a Viton-wrapped isolation packer between screened intervals. Pump riser pipes consist of Johnson Spring Lock (JSL) coupled non-annealed (pickled), passivated 2-in.-diameter stainless steel. Two 1-in.-diameter polyvinyl chloride (PVC) tubes were installed along with, and banded to, the pump riser for dedicated transducers. The tubes are 1-in.-I.D. flush-threaded (F-480) schedule 80 PVC pipe. The upper PVC transducer tube is equipped with two 10-ft sections of 0.010-in. slot screen with a threaded end-cap at the bottom of the tube. The lower PVC transducer tube terminates at a threaded end-cap containing a central Swagelok compression fitting. To measure water levels in screen 2, 0.25-in. stainless-steel tubing extends from the

fitting through the isolation packer. On August 3, 2022, two In-Situ LT500 transducers were installed in the PVC tubes to monitor water levels in each screened interval.

Pressure tests were performed at the recommended operating pressures for each pneumatic component during installation in the pump assembly and following all subsequent tubing connections. Tubing connections occur in the pump assembly between the lower APV and the packer, between the packer and the liquid inflation chamber (LIC), between the LIC and the upper APV, above the pump shroud, and at the wellhead. Final pressure testing of the packer/APV closed pneumatic circuit (at 220 psi operating pressure) showed no pressure loss after 7 days of monitoring.

Installation and construction details for the monitoring well R-72 sampling system are presented in Figure 3.2-1. Technical notes for the installation and construction of the R-72 sampling system are presented in Figure 3.2-2.

8.3 Wellhead Completion

Before demobilization of the drill rig, the drilling rig crew installed a 16-in.-O.D. steel protective casing around the stainless-steel riser on November 21, 2021, to a depth of 3.5 ft bgs. Environmental Remediation crafts personnel commenced surface completion on May 30, 2022. On June 2, 2022, a reinforced concrete surface pad, 6 ft wide × 6 ft long × 6 in. thick, along with a brass monument, was installed at the R-72 wellhead. The concrete pad was slightly elevated above the ground surface and crowned to promote runoff away from the wellhead. A total of four removable bollards, painted and covered with yellow bollard covers for protection and visibility, were set at the outside edges of the pad to protect the well from traffic. Because of supply chain issues, surface electrical components will be installed at a later date. A portable electrical panel will be used to collect samples until a permanent control panel is installed.

8.4 Geodetic Survey

A New Mexico licensed professional land surveyor conducted a geodetic survey on August 17, 2022. The survey data conformed to Laboratory Information Architecture project standards IA-CB02, “GIS Horizontal Spatial Reference System,” and IA-D802 “Geospatial Positioning Accuracy Standard for A/E/C and Facility Management.” All coordinates are expressed relative to the New Mexico State Plane Coordinate System Central Zone (North American datum 83); elevation is expressed in feet above mean sea level (amsl) using the National Geodetic Vertical Datum of 1929 (NGVD29). Survey points include ground surface elevation near the concrete pad, the top of the brass pin in the concrete pad, the top of the 8-in. well casing, and the top of the 16-in. protective casing for well R-72. Survey coordinates are shown in Figure 3.2-2.

8.5 Waste Management and Site Restoration

Waste generated from well R-72 included drilling fluids, purged groundwater, drill cuttings, decontamination water, New Mexico Special Waste, and contact waste. A summary of the waste characterization samples collected during drilling, construction, development, and sample system installation at well R-72 is presented in Table 8.2-1.

All investigation-derived waste (IDW) generated during well reconfiguration activities will be managed in accordance with applicable standard operating procedures (SOPs). These SOPs incorporate the requirements of all applicable U.S. Environmental Protection Agency and NMED regulations,

U.S. Department of Energy orders, and N3B requirements. The SOP applicable to the characterization and management of IDW is N3B-AP-TRU-2150, “Waste Characterization Strategy Form.”

All waste streams produced during drilling and development activities were sampled and characterized in accordance with the ”Waste Characterization Strategy Form for Chromium Regional Aquifer Wells Installation 2018-2020 (N3B 2019, 700198), which was approved per requirements of N3B-EP-DIR-SOP-10021, “Characterization and Management of Environmental Programs Waste.” This WCSF provides detailed information on IDW characterization methods, management, containerization, and potential volumes. R-72 construction materials (primarily polyvinyl chloride and stainless steel); fluids (purge and decontamination waters); contact waste (gloves, paper towels, plastic and/or glass sample bottles); and cement chase water will be the primary waste streams generated during the well development and drilling activities. The fluids produced will be sampled and analyzed for the suite of constituents listed in the WCSF and disposed of as appropriate. Site restoration will be conducted after all waste has been disposed.

Drill cuttings were 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).

Groundwater produced during development pumping was transported to the chromium treatment plant in Mortandad Canyon for processing before being transported to the evaporation pond under Discharge Permit 1973 (DP-1793). The project WCSF is written to send development water generated from well installation to the chromium treatment facility. The latest work plan update for DP-1793 states that water generated from well installations “within the chromium project area” is permitted for treatment/land application.

9.0 DEVIATIONS FROM PLANNED ACTIVITIES

Drilling, sampling, and well construction at R-72 were performed as specified in the NMED-approved “Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-72,” (N3B 2018, 700107) with the exception of the following deviations.

- On September 13, 2021, drilling from 830 ft to 835 ft bgs, driller had issues lifting the top drive and believed cuttings were not allowing cutting wings to close. Crew tripped out drill rods and 16-in. BHA, noticed lower part of hammer was missing once BHA was on surface. After several attempts to retrieve hammer bit by using drill rods and upper part of BHA, crew successfully retrieved hammer bit with modified fishing tool on September 17, 2021. Drilling advance continued through the Cerros del Rio Basalt and into the Puye Formation, to 1070 ft bgs.
- On November 27, 2021, after installation of the 40-hp pumping system, no water was pumping to surface to start pump development. Measured depth to water in the pump JSL drop pipe measured 323 ft below top of JSL drop pipe. After much troubleshooting, the system was pulled and sent back to the drilling subcontractors shop for investigation on December 1, 2021. The investigation revealed that installation of the shroud on the pump had blocked the inlet openings to the pump such that water was able only to be pushed to within 300 ft of the ground surface. A new pump with shroud was immediately sent back to the site on December 7, 2021, and was successfully used for pump development and collection of first samples.

10.0 ACKNOWLEDGMENTS

Boart Longyear drilled, installed, developed, and installed the Baski sampling system into monitoring well R-72.

COLOG, Inc., completed the geophysical downhole surveys.

11.0 REFERENCES AND MAP DATA SOURCES

11.1 References

The following reference list includes documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ERID, 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).

Catechis, C., October 13, 2021. RE: [EXTERNAL] R-72 Well Design Package. E-mail message to C. Rodriguez (EM-LA), N. Dhawan (NMED), M. Petersen (NMED), and C. Krambis (NMED) from C. Catechis (NMED), Santa Fe, New Mexico. (Catechis 2021, 702276)

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), October 2018. "Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-70," Newport News Nuclear BWXT-Los Alamos, LLC, document EM2018-0068, Los Alamos, New Mexico. (N3B 2018, 700107)

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), January 16, 2019. "Waste Characterization Strategy Form for Chromium Regional Aquifer Wells Installation 2018-2020," Newport News Nuclear BWXT-Los Alamos, LLC, document EM2018-0123, Los Alamos, New Mexico. (N3B 2019, 700198)

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), June 25, 2020. "Waste Characterization Strategy Form (WCSF) for Groundwater Monitoring Well R-72," Newport News Nuclear BWXT-Los Alamos, LLC, document EM2020-0049, Los Alamos, New Mexico. (N3B 2020, 700952)

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), July 2021. "Field Implementation Plan for Regional Aquifer Well R-72," Newport News Nuclear BWXT-Los Alamos, LLC, document EM2020-0176, Los Alamos, New Mexico. (N3B 2021, 701582)

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), May 2, 2022. "Storm Water Pollution Prevention Plan, Chromium Piping and Infrastructure Project, R-70, R-71 & R-72 Well Pad Site Completions," Newport News Nuclear BWXT-Los Alamos, LLC, document, Los Alamos, New Mexico. (N3B 2022, 702237)

NMED (New Mexico Environment Department), March 23, 2020. "Approval, Drilling Work Plan for Reginal Well R-72," New Mexico Environment Department letter to A. Duran (EM-LA) from K. Pierard (NMED-HWB), Santa Fe, New Mexico. (NMED 2020, 700817)

NMED (New Mexico Environment Department), June 11, 2021. "Response to Amended Approval Letter for Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-71 and Amended Approval Letter for Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-72," New Mexico Environment Department letter to A. Duran (EM-LA) from K. Pierard (NMED-HWB), Santa Fe, New Mexico. (NMED 2021, 701477)

NMED (New Mexico Environment Department), June 2022. "Risk Assessment Guidance for Site Investigations and Remediation, Volume 1, Soil Screening Guidance for Human Health Risk Assessments," Hazardous Waste Bureau and Ground Water Quality Bureau, Santa Fe, New Mexico. (NMED 2022, 702141)

11.2 Map Data Sources

Point Feature Locations of the Environmental Restoration Project Database; Los Alamos National Laboratory, Waste and Environmental Services Division, EP2008-0109; 12 April 2010.

Hypsography, 100 and 20 Foot Contour Interval; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program; 1991.

Surface Drainages, 1991; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program, ER2002-0591; 1:24,000 Scale Data; Unknown publication date.

Pave Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

Dirt Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

Structures; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

Technical Area boundaries; Los Alamos National Laboratory, Site Planning & Project Initiation Group, Infrastructure Planning Division; 4 December 2009.

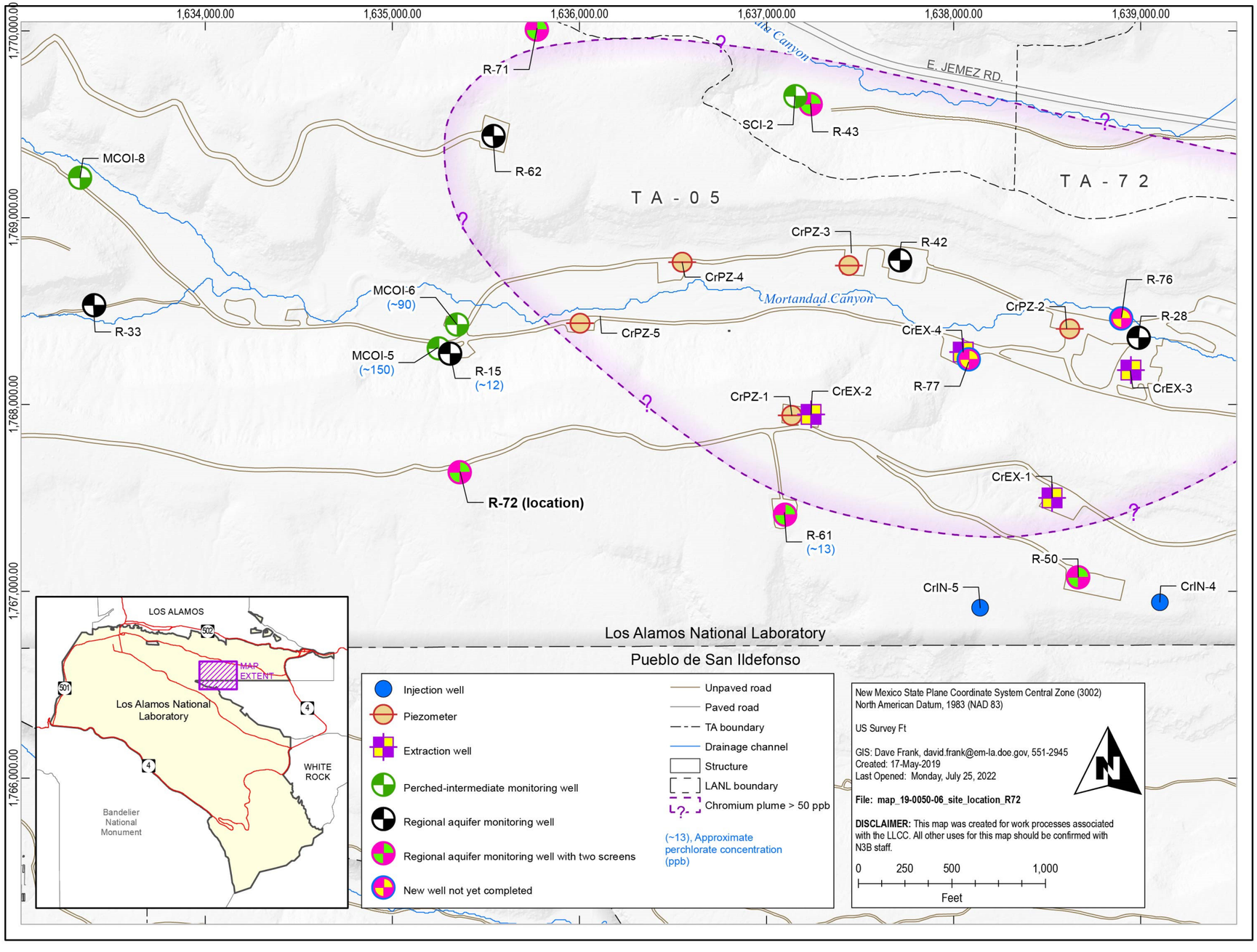

Figure 3.0-1 Location of regional aquifer well R-72

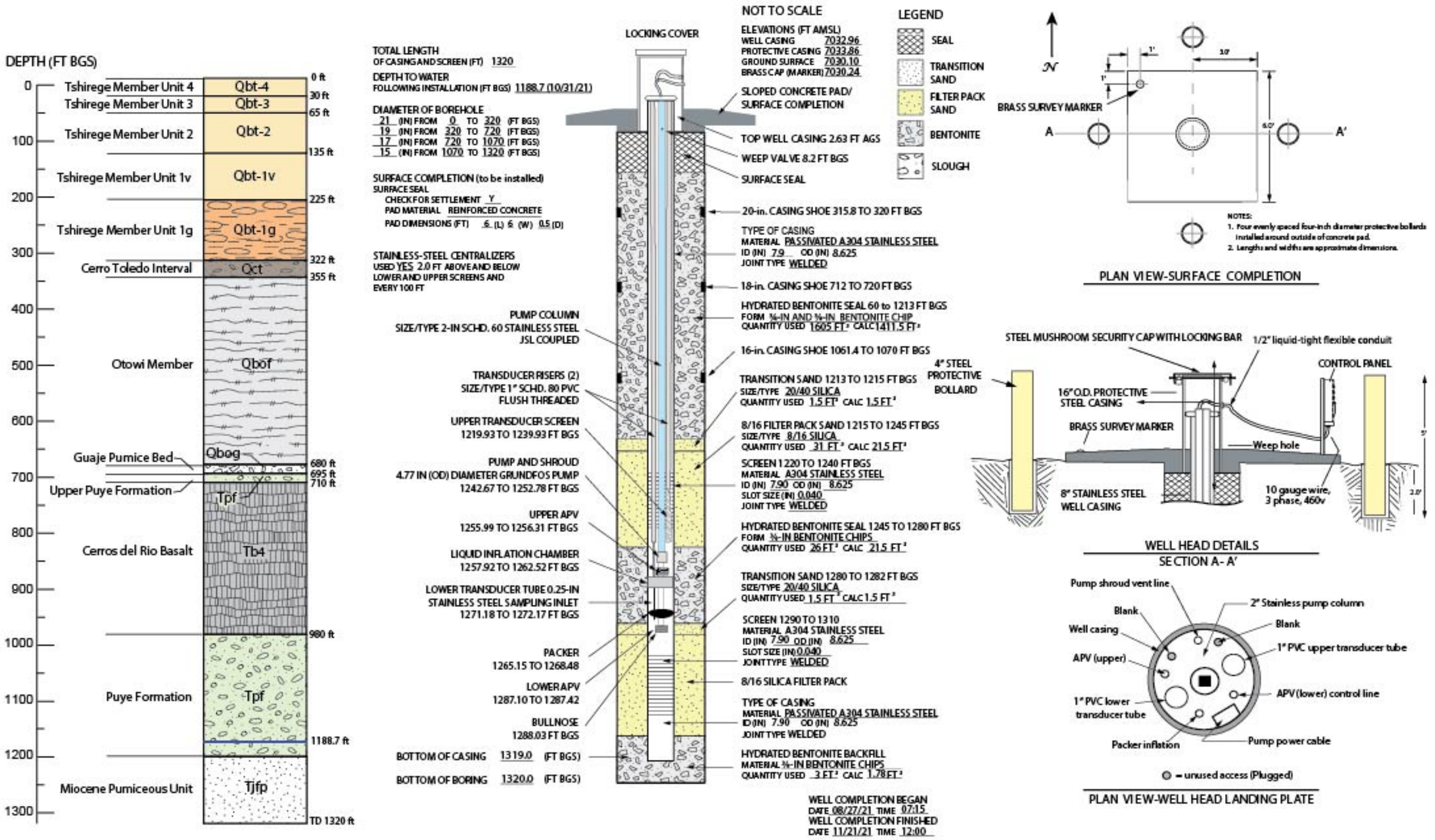

Figure 3.2-1 Monitoring well R-72 as-built construction diagram and technical well completion details

R-72 SAMPLING SYSTEM DESIGN PACKAGE TECHNICAL NOTES:

Survey Information

Brass Marker
Northing: 1767595.70/Lat. N35°51'28.983"
Easting: 1635405.46/Long. W106°16'00.883"
Elevation: 7030.24 ft amsl

8-in. Well Casing
Northing: 1767594.39/Lat. N35°51'28.970"
Easting: 1635407.07/Long. W106°16'00.863"
Elevation: 7032.96 ft amsl

Sampling System Materials and Product List

Baski Sampling System

Pump

Grundfos OK-5S501300PEC
S/N: P12134-001

Motor

Franklin 5046033
S/N: 21K14 20 03716C
Motor cable: 460v, 3ph

Shroud

Baski, 304 SS; 1242.67'-1252.78' bgs
Check Valve: 1-in. SS

Packer

Baski, S/N: 30694

Lower APV

Baski, S/N: 30721

Upper APV

Baski, S/N: 30720

Couplings

2.375 NUE / 1.315 NUE / Nitronic 60

Discharge column

2-in. 304 SS, JSL coupled drop pipe

Extended Pumping Data

Constant Draw Down Test (screen #1)
Specific Capacity: 0.45 gpm/ft
Performed on: 01/08–09/2022

Constant Draw Down Test (screen #2)
Specific Capacity: 0.2 gpm/ft
Performed on: 12/18–19/2021

Transducer Tubes

Upper = 1" PVC pipe banded to SS drop pipe (1240.06' bgs)
Lower = 1" PVC pipe banded to SS drop pipe (1240.06' bgs)

Transducers

Upper:
InSitu LT500 (30 psi)
S/N: 917921 (Manufactured 2022-04-08)
Screen: 1219.93'-1239.93' bgs

Lower:
InSitu LT500 (30 psi)
S/N: 917916 (Manufactured 2022-04-08)
Screen: 1271.18'-1272.17' bgs

Sampling tree: A304 schedule 40 stainless-steel 1-in. nipples, elbows, bushings, and hose barbs

N3B Los Alamos		R-72 SAMPLING SYSTEM DESIGN PACKAGE TECHNICAL NOTES	Fig. 3.2-2
Drafted By: N3B	Date: July 15, 2022 Filename: R-72 tech notes	Technical Area 05 (TA-05) Los Alamos National Laboratory Los Alamos, New Mexico	NOT TO SCALE

Figure 3.2-2 R-72 technical notes

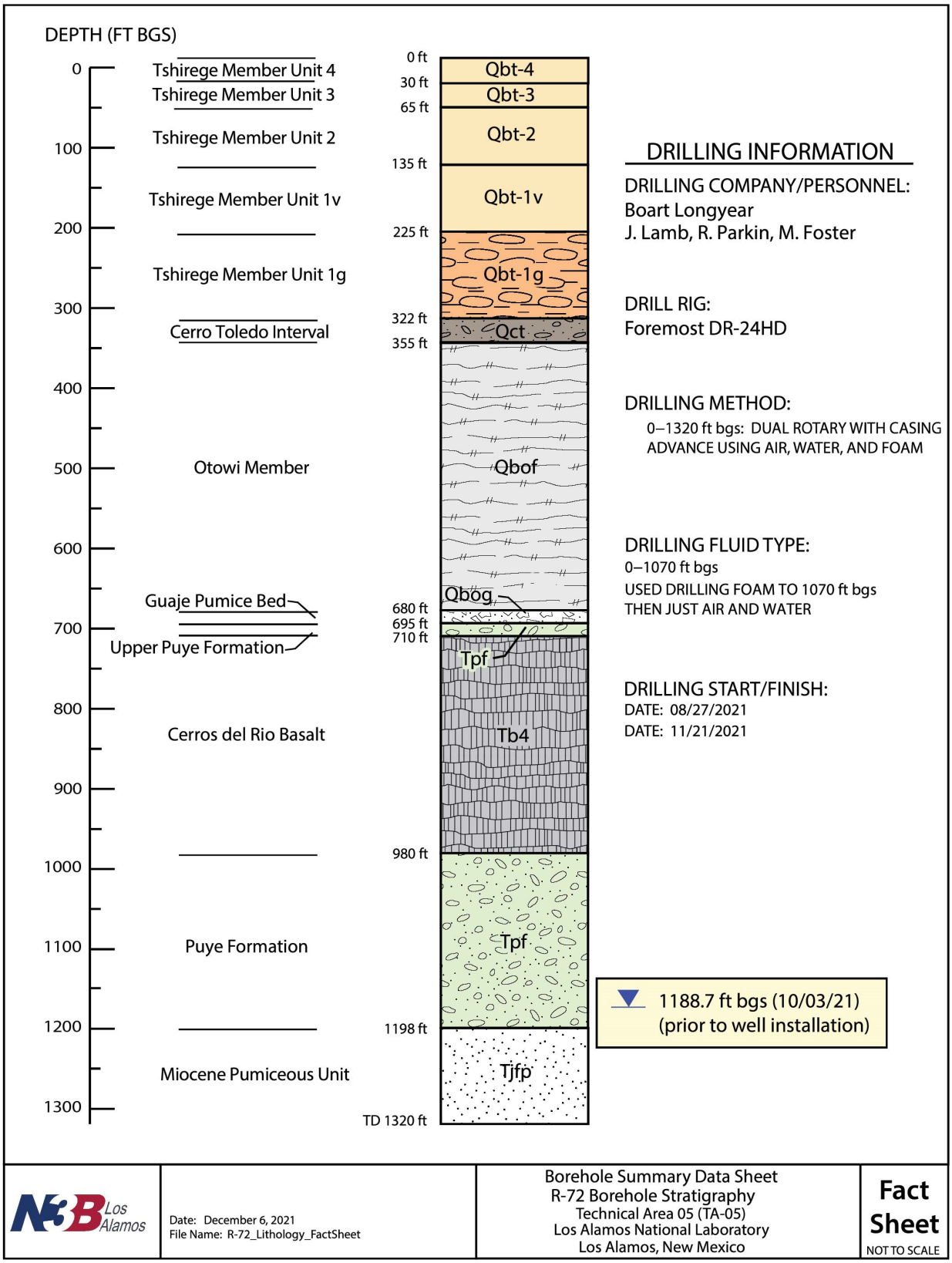

Figure 5.1-1 Monitoring well R-72 borehole stratigraphy

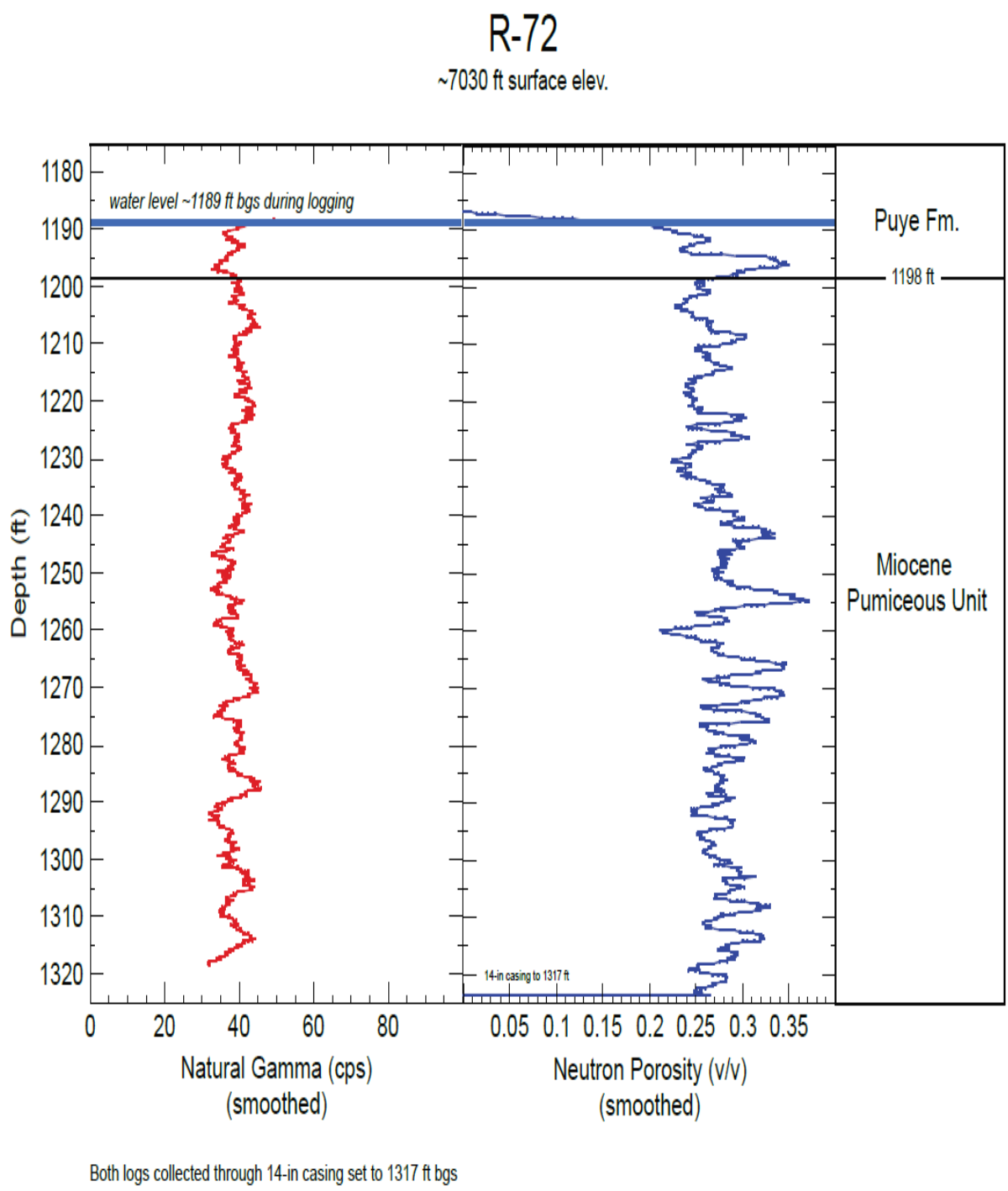

Figure 6.0-1 R-72 Geophysical logging runs

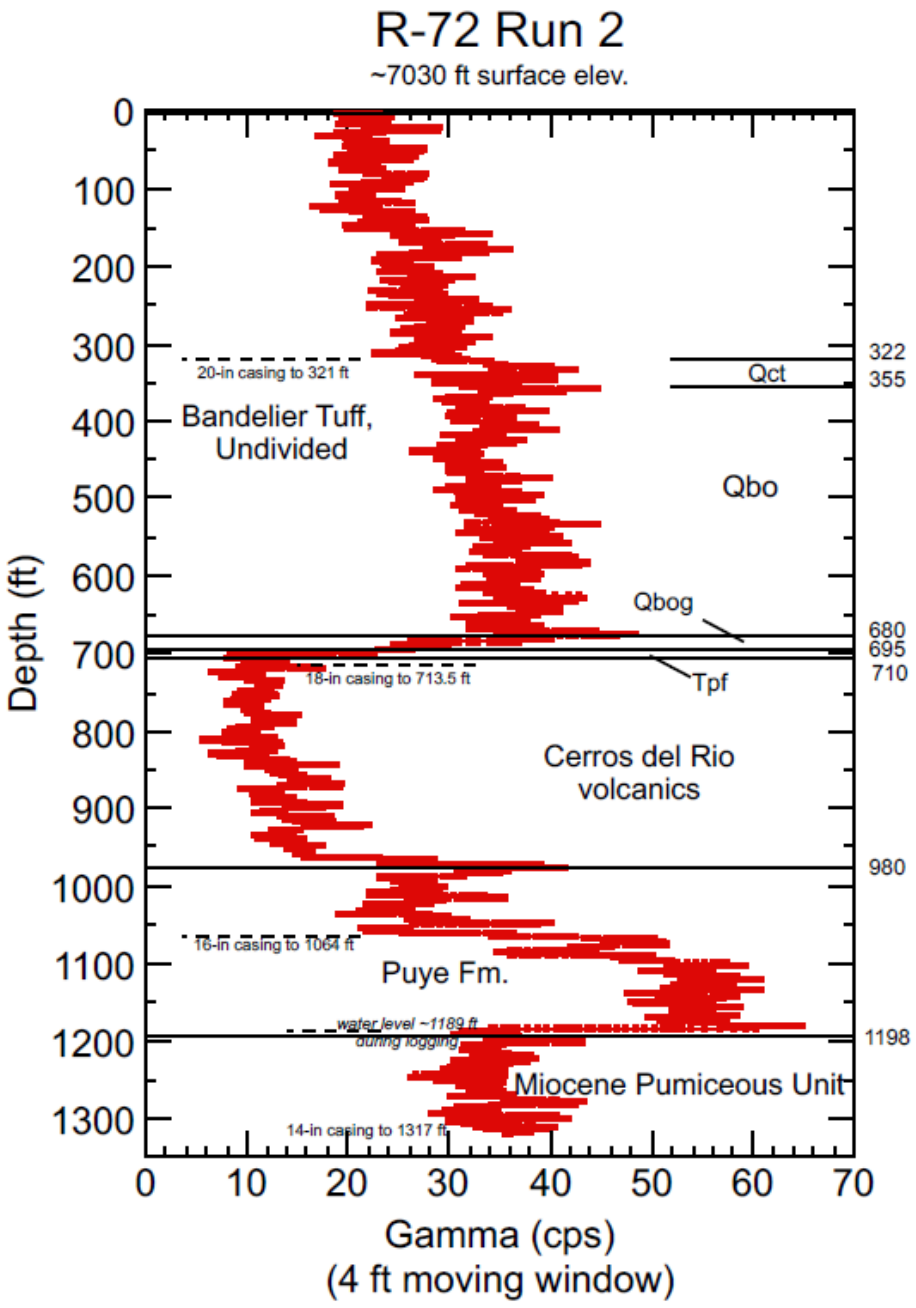

Figure 6.0-2 Gamma log correlated to borehole stratigraphy

Table 3.2-1
Fluid Quantities Used During R-72 Drilling and Well Construction

Date	Measured Depth	Water (gal.)	Water Cumulative (gal.)	AQF-2 Foam (gal.)	Foam Cumulative (gal.)
08/27/2021	0–2.5	50	50	1	1
08/27/2021	2.5–15	150	200	2	2
08/27/2021	15–35	300	500	3	5
08/27/2021	35–55	300	800	3	8
08/27/2021	55–75	300	1100	3	11
08/28/2021	75–95	300	1400	3	14
08/28/2021	95–115	300	1700	3	17
08/28/2021	115–135	300	2000	3	20
08/28/2021	135–155	300	2300	3	23
08/28/2021	155–160	100	2400	3	26
08/28/2021	160–175	200	2600	2	28
08/29/2021	175–195	400	3000	4	32
08/29/2021	195–215	300	3300	3	35
08/29/2021	215–225	200	3500	2	37
08/31/2021	203–225	300	3800	3	40
09/01/2021	225–245	300	4100	3	43
09/01/2021	245–265	500	4600	6	49
09/01/2021	265–285	400	5000	6	55
09/01/2021	285–305	300	5300	3	58
09/01/2021	305–320	500	5800	5	63
09/04/2021	320–335	600	6400	3	66
09/04/2021	335–355	750	7150	3	69
09/04/2021	355–367	200	7350	2	71
09/04/2021	367–375	200	7550	2	73
09/04/2021	375–395	300	7850	3	76
09/04/2021	395–415	400	8250	4	80
09/05/2021	415–435	900	9150	6	86
09/05/2021	435–455	700	9850	5	91
09/05/2021	455–475	1,000	10,850	5	96
09/05/2021	475–495	900	11,750	5	101
09/05/2021	495–515	800	12,550	8	109
09/05/2021	515–535	600	13,150	6	115
09/05/2021	535–555	600	13,750	6	121
09/05/2021	555–575	500	14,250	5	126
09/06/2021	575–595	800	15,050	5	131
09/06/2021	595–615	700	15,750	3	134

Table 3.2-1 (continued)

Date	Measured Depth	Water (gal.)	Water Cumulative (gal.)	AQF-2 Foam (gal.)	Foam Cumulative (gal.)
09/06/2021	615–635	500	16,250	5	139
09/06/2021	635–655	500	16,750	5	144
09/06/2021	655–675	600	17,350	5	149
09/06/2021	675–695	700	18,050	6	155
09/07/2021	695–715	1800	19,850	14	169
09/07/2021	715–720	900	20,750	6	175
09/12/2021	720–722	300	21,050	3	178
09/12/2021	722–730	900	21,950	9	187
09/12/2021	730–743	3000	24,950	15	202
09/13/2021	743–750	600	25,550	5	207
09/13/2021	750–770	450	26,000	3	210
09/13/2021	770–790	450	26,450	3	213
09/13/2021	790–810	450	26,900	4	217
09/13/2021	810–830	1800	28,700	9	226
09/13/2021	830–833	5400	34,100	27	253
09/17/2021	833–834	2500	36,600	14	266
09/18/2021	834–850	1000	37,600	10	276
09/18/2021	850–870	2000	39,600	7	283
09/18/2021	870–890	1500	41,100	10	293
09/18/2021	890–910	2500	43,600	16	309
09/18/2021	910–930	1500	45,100	10	319
09/19/2021	930–950	2000	47,100	10	329
09/19/2021	950–970	2000	49,100	8	337
09/19/2021	970–990	1000	50,100	10	347
09/19/2021	990–1010	1000	51,100	8	355
09/19/2021	1010–1030	1300	52,400	8	363
09/19/2021	1030–1050	1200	53,600	8	370
09/20/2021	1050–1070	1000	54,600	7	377
09/24/2021	1070–1075	1000	55,600	2	379
09/25/2021	1075–1095	600	56,200	1	380
09/25/2021	1095–1115	300	56,500	0	380
09/25/2021	1115–1135	750	57,250	0	380
09/25/2021	1135–1155	900	58,150	0	380
09/25/2021	1155–1175	900	59,050	0	380
09/25/2021	1175–1195	1000	60,050	0	380
09/25/2021	1195–1215	9000	69,050	0	380
09/25/2021	1215–1235	1000	70,050	0	380
09/25/2021	1235–1255	600	70,650	0	380

Table 3.2-1 (continued)

Date	Measured Depth	Water (gal.)	Water Cumulative (gal.)	AQF-2 Foam (gal.)	Foam Cumulative (gal.)
09/26/2021	1255–1275	900	71,550	0	380
09/26/2021	1275–1295	900	72,450	0	380
09/26/2021	1295–1315	900	73,350	0	380
09/26/2021	1315–1320	900	74,250	0	380

Table 4.2-1
Summary of Groundwater Samples Collected During Drilling and Well Development of Well R-72

Field Sample ID	Pump Depth	Sample Date	Parameter Name	Report Result	Report Unit
Top Screen Well Development Samples					
CAMO-22-238469	1228.42	12/08/2021	Total Organic Carbon	1.757	mg/L
CAMO-22-238506	1228.42	12/08/2021	Perchlorate	5.5	µg/L
CAMO-22-238507	1228.42	12/08/2021	Total Organic Carbon	0.2	mg/L
CAMO-22-238508	1228.42	12/08/2021	Perchlorate	5.5	µg/L
CAMO-22-238509	1228.42	12/09/2021	Total Organic Carbon	0.2	mg/L
CAMO-22-238510	1228.42	12/09/2021	Perchlorate	5.5	µg/L
CAMO-22-238511	1228.42	12/09/2021	Total Organic Carbon	0.2	mg/L
CAMO-22-238512	1228.42	12/09/2021	Perchlorate	5.5	µg/L
CAMO-22-238513	1228.42	12/10/2021	Total Organic Carbon	0.2	mg/L
CAMO-22-238514	1228.42	12/10/2021	Perchlorate	5.5	µg/L
Bottom Screen Well Development Samples					
CAMO-22-238515	1297.37	12/10/2021	Total Organic Carbon	1.077	mg/L
CAMO-22-238516	1297.37	12/10/2021	Perchlorate	5.5	µg/L
CAMO-22-238517	1297.37	12/11/2021	Total Organic Carbon	0.523	mg/L
CAMO-22-238518	1297.37	12/11/2021	Perchlorate	5.5	µg/L
CAMO-22-238519	1297.37	12/11/2021	Total Organic Carbon	0.216	mg/L
CAMO-22-238520	1297.37	12/11/2021	Perchlorate	5.5	µg/L
CAMO-22-238521	1297.37	12/12/2021	Total Organic Carbon	0.2	mg/L
CAMO-22-238522	1297.37	12/12/2021	Perchlorate	5.5	µg/L
CAMO-22-238523	1297.37	12/13/2021	Total Organic Carbon	0.2	mg/L
CAMO-22-238524	1297.37	12/13/2021	Perchlorate	5.5	µg/L

Table 4.2-2
Summary of Groundwater Samples Collected
During Extended Pumping of Well R-72

Field Sample ID	Sample Date	Depth (ft MD)*
Extended Pumping – Screen 1		
CAMO-21-234748	01/09/2022	1228.42
CAMO-21-234749	01/09/2022	1228.42
CAMO-21-234830	01/09/2022	1228.42
CAMO-21-234831	01/09/2022	1228.42
CAMO-21-237040	01/09/2022	1228.42
CAMO-22-236978	01/08/2022	1228.42
CAMO-22-236979	01/08/2022	1228.42
Extended Pumping – Screen 2		
CAMO-21-234750	12/20/2021	1297.37
CAMO-21-234751	12/20/2021	1297.37
CAMO-21-234756	12/20/2021	1297.37
CAMO-21-234757	12/20/2021	1297.37
CAMO-21-237039	11/23/2021	1297.37
CAMO-22-235260	12/18/2021	1297.37
CAMO-22-235261	12/18/2021	1297.37

* MD = Measured depth.

Table 8.1-1
Water Produced During R-72 Well Development – Airlift and Pump

Screen	Date	Time	Totalizer Readings (gal.)	Total Pumped (gal.)
2	10/26/2021	Not applicable	Not applicable	450
2	11/04/2021	Not applicable	Not applicable	
1	10/30/2021	Not applicable	Not applicable	2560
1	10/31/2021	Not applicable	Not applicable	
1	11/01/2021	Not applicable	Not applicable	
1	11/27/2021	11:10 a.m.	138,970	16,221
1	12/10/2021	11:55 a.m.	155,191	
1	12/13/2021	11:30 a.m.	185,077	1041
1	12/13/2021	12:33 p.m.	186,118	
2	12/10/2021	1:30 p.m.	155,191	29,886
2	12/12/2021	6:00 p.m.	185,077	
2	12/18/2021	8:00 a.m.	186,118	18,870
2	12/19/2021	8:00 a.m.	204,988	
1	01/08/2022	8:00 a.m.	204,988	17,498
1	01/09/2022	8:00 a.m.	222,486	
			Screen 1 Total	**37,320**
			Screen 2 Total	**49,206**
			Total	**86,526**

Table 8.2-1
Summary of Waste Characterization Samples Collected During Drilling, Construction, Development, and Sample System Installation at R-72

Sample ID	Date	Depth (ft MD[a])	Type
WST05-21-234350	08/28/2021	85–90	Cuttings
WST05-21-234388	09/12/2021	720–725	Cuttings
WST05-21-234389	09/26/2022	1300–1305	Cuttings
WST05-22-235472	11/09/2021	n/a[b]	Cuttings
WST05-22-237059	01/20/2022	n/a	Drilling fluids
WST05-22-237060	01/20/2022	n/a	Drilling fluids
WST05-22-237061	01/20/2022	n/a	Drilling fluids
WST05-22-237062	01/20/2022	n/a	Drilling fluids
WST05-22-237063	01/20/2022	n/a	Drilling fluids

[a] MD = Measured depth.

[b] n/a = Not applicable.

Appendix A

Borehole R-72 Lithologic Descriptions

BOREHOLE IDENTIFICATION (ID): R-72		**TECHNICAL AREA (TA):** 54
DRILLING COMPANY: Boart Longyear Drilling Services	**START DATE/TIME:** **08/27/2021 07:15**	**END DATE/TIME:** **11/21/2021 12:00**
DRILLING METHOD: Dual Rotary	**MACHINE**: Foremost DR-24 HD	**SAMPLING METHOD:** Grab
GROUND ELEVATION: 7030.1 FT		**TOTAL DEPTH: 1320 FT BGS**
DRILLERS: J. Lamb, R. Parkin, M. Foster	**SITE GEOLOGISTS: J. Richeson, C. Harper**	

Depth (ft bgs)	Lithology	Stratigraphic Unit
0–30	Rhyolitic tuff, gray to light buff in color. Cuttings have a sandy appearance indicative of Qbt 4. Overall, cuttings are phenocryst rich (especially from 20 to 25 ft bgs) and noticeably absent of pumice. Overall, cuttings appear to be composed mainly of ash flow tuff fragments.	Qbt 4
30–65	Rhyolitic tuff, gray to light gray in color. Cuttings contain abundant quartz crystals (>75% and up to 90% from 50 to 55 ft bgs) as well as sparse gray to brown pumice relicts (<10%). Trace dacitic clasts are also present in all sieved fractions.	Qbt 3
65–135	Rhyolitic tuff, moderately to strongly welded, gray to light gray in color. Cuttings contain abundant welded ash flow tuff fragments. High concentration of quartz and sanidine crystals in abundance of 75% to 90% observed from 105 to 130 ft bgs in +35 sieved fraction. Sparse pumice fragments and trace dacitic clasts also observed.	Qbt 2
135–225	Rhyolitic tuff, light gray to buff to brown in color. Cuttings are crystal rich with devitrified pumice throughout. Cuttings contain abundant fragments of indurated tuff and numerous free quartz and sanidine crystals. Quartz and sanidine crystals of up to 90% present in the 35+ sieved fraction. Sparse ash matrix of <20% present in WR and +10 sieved fraction. Abrupt color change from light gray to brown between 210 and 225 ft bgs also corresponds to beginning of presence of devitrified pumice. Natural gamma log corresponds to Qbt 1v/Qbt 1g contact at 225 ft bgs.	Qbt 1v
225–322	Rhyolitic tuff, light gray to brown in color, poorly welded throughout. Pulverized tuffaceous matrix present throughout. Cuttings contain abundant light gray lustrous, glassy pumice lapilli ranging in size with the largest measuring nearly 2 mm in WR fraction. Minor felsic lava fragments are also present. The +35 sieved fraction contains abundant crystals that decrease with depth. Natural gamma log as well as distinct color change corresponds to Qbt 1g/Qct contact at 322 ft bgs.	Qbt 1g
322–355	Volcaniclastic sediments, orange oxidation staining present. Cuttings contain silt to sand sized angular quartz grains and reworked white and orange stained pumice clasts as well as dacite and rhyolite clasts. Tuffaceous tephras and glass are also present. Largest pumice clasts in WR fraction are >2 mm. WR fraction contains 60%–75% reworked pumice, 20%–35% dacite and rhyolite clasts, and <5% angular quartz grains. Natural gamma log corresponds to Qct/Qbo contact at 355 ft bgs.	Qct
355–680	Rhyolitic tuff, pale orange/orange to light gray/gray in color. Tuff is poorly welded. Cuttings contain abundant rounded white to gray lustrous, glassy pumice that range in size from fine sand size to fine gravel size with the largest pumices located from 355 to 400 ft bgs and typically coarsening upward with lager pumice present locally. The cuttings also contain abundant subrounded to rounded medium gray dacite lava fragments mixed with minor perlite and obsidian fragments. The +35 sieved fraction contains 40%–60% felsic crystals, 55%–45% pumice, and <5% other volcanic lithics. Natural gamma log corresponds to Qbo/Qbog contact at 680 ft bgs.	Qbo

Depth (ft bgs)	Lithology	Stratigraphic Unit
680–695	Rhyolitic tuff, white in color. Cuttings consist of dense white pumice fragments with little to no glass present mixed with gray to dark gray dacite lava fragments. Minor banded rhyolite is also present. The +35 sieved fraction contains <5% quartz crystals. Natural gamma log corresponds to Qbog/Tpf contact at 695 ft bgs.	Qbog
695–710	Volcaniclastic sediments, varicolored grains of dacite and rhyolite present. Trace amounts of quartzite are also present. Some pumice clasts in cuttings likely falling from the above unit. All sieved fractions contain 95%–99% angular to subangular clasts of dacite and rhyolite. Trace subrounded quartz grains present in the +35 sieved fraction. Natural gamma log corresponds to Tpf/Tb4 contact at 710 ft bgs.	Tpf
710–980	Basalt lava, light gray to dark gray in color. Cuttings from 710 to 740 ft bgs are composed of basalts mixed with some dacites and rhyolites, which may have been carried down during drilling. From 740 to 780 ft bgs, cuttings are composed of all porphyritic basaltic lavas. Cuttings recovered from 780 to 795 ft bgs are reddish brown oxidized vesicular basaltic lava fragments with small amounts (<15%) of rhyolites and dacites present. Cuttings from 795 to 970 ft bgs are again composed nearly entirely of porphyritic to microcrystalline basaltic lavas with occasional localized brown oxidation present.	Tb4
970–980	Basalt lava, dark gray in color. Cuttings recovered show highly weathered basaltic lava in a matrix of red clay. Iron oxidation–altered clay is dominant from 975 to 980 ft bgs. This likely represents ancestral Rio Grande interflows. Dacite and rhyolite fragments are also present (25%) from 975 to 980 ft bgs. Natural gamma log corresponds to Tb4/Tpf contact at 980 ft bgs.	Tb4
980–1198	Volcaniclastic sediments, varicolored grains of dacite and rhyolite with minor quartzite and andesite present. Cuttings consist of poorly sorted to unsorted, moderately indurated, medium to coarse gravel with silty fine to coarse sand. Abundant pale red to gray rhyolite present at the top of the formation grading to gray Rendija Canyon dacite fragments at the base of the formation. Biotite and pyroxene phenocrysts are present throughout.	Tpf
1198–1320	Pumice-rich volcaniclastic sediments, buff in color. Cuttings are poorly to moderately sorted composed of silty fine to very course upper sand. Cuttings contain detrital pumices ranging in size up to 0.5 mm and comprising up to 45% or more of cuttings by volume. Dacite lava fragments along with flow-banded rhyolites are present. Phenocrysts are spars and consist mainly of glass lavas.	Tjfp

ABBREVIATIONS

% = estimated percent by volume of a given sample constituent

bgs = below ground surface

Qbt 4 = Unit 4 of the Tshirege Member of the Bandelier Tuff

Qbt 3 = Unit 3 of the Tshirege Member of the Bandelier Tuff

Qbt 2 = Unit 2 of the Tshirege Member of the Bandelier Tuff

Qbt 1v = Unit 1v (vapor-phase) of the Tshirege Member of the Bandelier Tuff

Qbt 1g = Unit 1g (glassy) of the Tshirege Member of the Bandelier Tuff

Qct = Cerro Toledo interval

Qbo = Otowi Member of Bandelier Tuff

Qbog = Guaje Pumice Bed

Tb4 = Cerros del Rio Basalts

Tpf = Puye Formation

Tjfp = Miocene pumiceous unit

WR = whole rock (unsieved sample)

CONVERSIONS

1 mm = 0.039 in.

1 in. = 25.4 mm

Appendix B

Groundwater Screening Analytical Results for Well R-72

B-1.0 GROUNDWATER SCREENING ANALYSIS AT R-72

Well R-72 is a regional aquifer monitoring well located in Technical Area 05 (TA-05) installed as part of the Chromium Groundwater Project monitoring network. R-72 was drilled vertically with two screens from 1220 to 1240 ft below ground surface (bgs) (screen 1) and from 1290 ft bgs to 1310 ft bgs (screen 2) in the Miocene pumiceous unit. This appendix presents the screening results for samples collected during well development and extended pumping at R-72.

B-1.1 Laboratory Analysis

Near the end of extended pumping of each screen, samples were collected and analyzed for the full groundwater characterization suite and total organic carbon (TOC). All TOC analyses were performed according to U.S. Environmental Protection Agency method SW-846:9060.

Table B-1.1-1 lists the key analytical results for these samples.

B-1.2 Field Analysis

Groundwater field parameters were recorded during the collection of the aforementioned full suite characterization samples. Field parameters included temperature, pH, oxidation-reduction potential (ORP), dissolved oxygen (DO), specific conductance, and turbidity. The time of sample collection and discharge rate were also recorded for each of these samples.

Table B-1.2-1 lists the field parameters recorded during collection of the full groundwater characterization suite from each screen.

B-2.0 SCREENING ANALYTICAL RESULTS

This section presents the TOC concentrations and field parameters measured during extended pumping.

B-2.1 Field Parameters

Field parameters were recorded from groundwater produced from both screens during well development and 24-hr extended pumping intervals. Field parameters included temperature, pH, oxidation-reduction potential (ORP), dissolved oxygen (DO), specific conductance, and turbidity Table B-2.1-1 presents the field parameters recorded during well development and Table B-2.1-2 presents the parameters recorded during the 24-hr extended pumping tests.

Table B-1.1-1
Analytical Results from Extended Pumping Samples

Field Sample ID	Sample Date	Parameter Name	Report Result	Report Unit	Lab Qualifier	Detected	Report Detection Limit
R-72 Screen 1 Extended Pumping Samples							
CAMO-22-236979	01/08/2022	Chromium	5.3756	µg/L	—[a]	Yes	—
CAMO-21-234749	01/09/2022	Chromium	5.79	µg/L	J[b]	Yes	10.0
CAMO-21-234831	01/09/2022	Chromium	5.69	µg/L	J	Yes	10.0
CAMO-22-236978	01/08/2022	Nitrate	1.8329	mg/L	—	Yes	—
CAMO-22-236978	01/08/2022	Sulfate	3.4082	mg/L	—	Yes	—
CAMO-21-234749	01/09/2022	Sulfate	2.73	mg/L	—	Yes	0.400
CAMO-21-234831	01/09/2022	Sulfate	2.74	mg/L	—	Yes	0.400
CAMO-21-237040	01/09/2022	Sulfate	0.133	mg/L	U[c]	No	0.400
CAMO-21-234748	01/09/2022	Total Organic Carbon	0.330	mg/L	U	No	1.00
CAMO-21-234830	01/09/2022	Total Organic Carbon	0.428	mg/L	J	Yes	1.00
CAMO-21-234748	01/09/2022	Tritium	−27.6	pCi/L	U	No	—
CAMO-21-234830	01/09/2022	Tritium	13.2	pCi/L	U	No	—
R-72 Screen 2 Extended Pumping Samples							
CAMO-21-237039	11/23/2021	Chromium	5.4100	µg/L	J	Yes	10
CAMO-22-235261	12/18/2021	Chromium	5.27	µg/L	—	Yes	—
CAMO-21-234751	12/20/2021	Chromium	5.13	µg/L	J	Yes	10.0
CAMO-21-234757	12/20/2021	Chromium	5.2500	µg/L	J	Yes	10
CAMO-22-235260	12/18/2021	Nitrate	9.3300	mg/L	—	Yes	—
CAMO-22-235260	12/18/2021	Sulfate	6.48	mg/L	—	Yes	—
CAMO-21-234751	12/20/2021	Sulfate	2.31	mg/L	—	Yes	0.400
CAMO-21-234757	12/20/2021	Sulfate	2.300	mg/L	—	Yes	0.400
CAMO-21-234750	12/20/2021	Total Organic Carbon	0.407	mg/L	J	Yes	1.00
CAMO-21-234756	12/20/2021	Total Organic Carbon	0.357	mg/L	J	Yes	1.00
CAMO-21-234750	12/20/2021	Tritium	−90.3	pCi/L	U	No	—
CAMO-21-234756	12/20/2021	Tritium	−5.5	pCi/L	U	No	—

[a] — = None.

[b] J = The material was positively identified, and the associated numerical value is the approximate concentration of the material in the sample.

[c] U = The material was analyzed for but was not detected above the detection limit.

Table B-1.2-1
Field Parameter Results Recorded During Collection of
Full-Suite Groundwater Characterization Samples

Screen	Date	Time	Temperature (°C)	pH	ORP (mV)	DO (mg/L)	Spec. Cond. (µS/cm)	Turbidity (NTU)[a]	Discharge Rate (gpm)[b]
1	1/9/2022	0543	22.7	7.8	243.8	8.49	128	1.47	11.2
2	12/20/2021	0708	23.5	7.8	267.7	7.94	129.2	1.05	11.8

[a] NTU = Nephelometric turbidity unit.

[b] gpm = Gallons per minute.

Table B-2.1-1
Field Parameters Monitored During Well Development

Date	Time	Temp (°C)	Spec. Cond. (µS/cm)	pH	ORP (mV)	DO (mg/L)	Turbidity (YSI)	Turbidity (Hach)
R-72 Screen 1								
12/8/2021	1445	24.2	151.1	7.58	10.4	5.73	—*	455.00
12/8/2021	1503	25.7	152.0	7.64	−2.1	5.81	—	167.83
12/8/2021	1505	24.7	151.1	7.66	−7.0	5.91	—	116.26
12/8/2021	1520	23.0	154.5	7.74	−35.2	5.84	—	21.40
12/8/2021	1530	23.4	152.1	7.74	−45.7	5.70	—	31.60
12/8/2021	1540	22.7	155.4	7.76	−48.8	5.86	45.50	—
12/8/2021	1550	23.6	156.2	7.79	−53.5	5.74	—	28.90
12/8/2021	1612	23.7	154.5	7.81	−61.0	5.98	—	34.61
12/8/2021	1630	22.5	172.0	7.37	−57.1	6.35	—	84.50
12/8/2021	1645	24.3	144.8	7.81	−38.7	7.50	—	40.65
12/8/2021	1700	23.9	134.8	7.80	−27.7	7.73	—	13.07
12/8/2021	1730	24.4	134.5	7.77	−8.6	8.89	—	7.54
12/8/2021	1745	24.0	130.5	7.77	−8.5	8.62	—	10.74
12/8/2021	1758	24.2	130.4	7.77	−8.3	8.52	—	8.78
12/9/2021	0808	17.5	130.8	7.50	−31.4	8.49	—	13.93
12/9/2021	0820	19.2	135.1	7.57	−41.1	7.64	—	50.95
12/9/2021	0835	22.3	121.1	7.55	−42.4	7.69	—	34.56
12/9/2021	0850	21.9	116.4	7.55	−44.5	7.80	—	31.82
12/9/2021	0903	21.9	130.6	7.55	−26.0	8.24	—	23.30
12/9/2021	0915	22.2	124.5	7.55	−28.6	9.18	—	20.60
12/9/2021	0925	22.1	126.1	7.55	−26.8	10.13	—	16.65
12/9/2021	0940	22.2	113.7	7.55	−40.1	9.20	—	14.94
12/9/2021	1003	21.5	112.0	7.55	−28.4	10.38	—	14.32
12/9/2021	1030	20.2	106.2	7.60	−42.1	9.78	—	11.17
12/9/2021	1045	22.5	99.7	7.56	−23.7	10.64	—	13.60
12/9/2021	1059	22.6	93.4	7.55	−15.7	9.91	—	13.61

Table B-2.1-1 (continued)

Date	Time	Temp (°C)	Spec. Cond. (µS/cm)	pH	ORP (mV)	DO (mg/L)	Turbidity (YSI)	Turbidity (Hach)
12/9/2021	1118	22.5	87.9	7.56	−20.1	9.71	—	14.46
12/9/2021	1130	22.3	87.2	7.55	−25.5	11.03	—	13.09
12/9/2021	1143	22.7	85.7	7.55	−21.6	10.27	—	14.46
12/9/2021	1200	22.4	83.7	7.56	−24.9	10.27	—	13.05
12/9/2021	1214	21.0	81.8	7.56	−49.0	9.71	—	8.08
12/9/2021	1230	21.5	81.1	7.56	−47.0	9.45	—	9.02
12/9/2021	1250	18.1	83.0	7.58	−49.8	10.27	—	9.98
12/9/2021	1320	21.3	80.3	7.59	−37.2	9.26	—	8.31
12/9/2021	1340	21.6	80.5	7.56	−50.6	9.36	—	7.68
12/9/2021	1400	21.7	130.9	7.54	−29.6	9.43	—	8.10
12/9/2021	1420	22.7	123.6	7.44	−28.4	9.71	—	9.41
12/9/2021	1435	22.4	122.5	7.54	−28.7	9.67	—	9.30
12/9/2021	1445	22.4	117.6	7.54	−41.2	9.60	—	8.95
12/9/2021	1500	21.9	119.3	7.54	−43.1	9.23	—	8.50
12/9/2021	1516	21.2	116.3	7.53	−35.9	9.67	—	8.46
12/9/2021	1545	21.4	111.7	7.53	−32.2	9.22	—	7.80
12/9/2021	1600	21.8	110.7	7.53	−33.5	9.32	—	7.66
12/9/2021	1617	21.8	108.4	7.53	−37.2	9.08	—	7.48
12/9/2021	1631	20.9	108.3	7.53	−44.6	9.78	—	7.87
12/9/2021	1646	22.3	104.0	7.52	−44.3	9.92	—	8.42
12/9/2021	1700	22.4	100.3	7.52	−20.4	10.37	—	10.66
12/9/2021	1716	22.5	93.9	7.52	−38.3	9.45	—	8.73
12/9/2021	1731	22.4	92.1	7.52	−40.8	9.83	—	8.67
12/9/2021	1750	22.2	88.7	7.52	−35.6	9.90	—	8.20
12/9/2021	1758	22.0	86.8	7.52	−30.6	10.15	—	7.88
12/10/2021	0801	17.0	129.4	7.81	−57.2	9.18	—	141.63
12/10/2021	0814	20.6	129.3	7.76	−54.6	8.53	—	26.53
12/10/2021	0828	21.4	128.0	7.77	−55.3	8.23	—	35.08
12/10/2021	0844	20.6	129.3	7.79	−56.6	8.16	—	21.49
12/10/2021	0900	21.2	128.0	7.87	−61.0	8.27	—	5.39
12/10/2021	0916	20.8	129.1	7.84	−59.6	8.10	—	6.65
12/10/2021	0930	20.8	127.9	7.82	−58.1	8.46	—	10.72
12/10/2021	0945	21.4	127.1	7.82	−58.6	8.32	—	10.62
12/10/2021	1000	21.7	128.2	7.81	−57.9	8.34	—	5.92
12/10/2021	1015	22.1	127.6	7.81	−58.2	8.34	—	7.86
12/10/2021	1030	22.3	128.9	7.80	−57.7	8.06	—	7.92
12/10/2021	1050	22.5	129.3	7.80	−57.7	7.80	—	3.97
12/10/2021	1100	21.9	128.4	7.83	−59.1	7.99	—	4.25

Table B-2.1-1 (continued)

Date	Time	Temp (°C)	Spec. Cond. (µS/cm)	pH	ORP (mV)	DO (mg/L)	Turbidity (YSI)	Turbidity (Hach)
12/10/2021	1130	21.2	128.4	7.83	−59.4	8.03	5.82	3.68
12/10/2021	1148	21.3	127.8	7.84	−59.0	8.59	5.42	4.20
R-72 Screen 2								
12/10/2021	1423	19.7	215.2	8.14	199.8	7.05	145.33	156.00
12/10/2021	1440	20.6	202.9	8.09	203.7	7.88	153.56	326.00
12/10/2021	1505	20.1	181.0	8.02	206.3	6.98	38.22	53.80
12/10/2021	1520	20.7	172.9	8.01	206.9	6.50	64.55	41.60
12/10/2021	1535	20.6	168.5	8.00	196.1	7.82	30.25	40.20
12/10/2021	1551	20.4	160.2	8.00	196.3	6.59	29.10	34.00
12/10/2021	1625	19.1	154.2	7.98	167.3	7.71	61.20	35.60
12/10/2021	1644	19.2	150.4	7.96	193.9	8.05	50.22	46.90
12/10/2021	1705	18.3	146.8	7.98	189.1	7.03	13.22	22.20
12/10/2021	1720	19.7	142.9	7.93	205.0	7.08	16.13	27.70
12/10/2021	1745	20.5	138.7	7.94	192.9	7.34	11.04	17.00
12/10/2021	1800	20.7	138.8	7.92	202.0	7.27	11.24	15.40
12/11/2021	0735	19.5	146.2	8.11	191.9	6.83	49.92	44.80
12/11/2022	0750	20.0	153.4	8.08	190.5	7.03	46.04	99.10
12/11/2023	0810	20.3	145.1	8.03	190.5	7.07	14.45	22.20
12/11/2024	0824	21.2	141.8	8.02	200.3	6.93	14.05	22.80
12/11/2025	0839	21.6	140.3	8.01	206.7	6.81	11.47	18.00
12/11/2026	0857	21.4	139.6	7.99	208.8	6.95	11.12	17.60
12/11/2027	0928	21.2	138.2	7.99	206.9	6.98	9.11	14.20
12/11/2028	0955	21.0	136.6	8.00	193.4	7.00	6.96	10.20
12/11/2029	1010	21.5	136.6	7.97	208.0	6.96	7.30	11.00
12/11/2030	1025	21.3	135.5	7.96	214.4	7.00	6.42	9.67
12/11/2031	1042	21.4	135.1	7.97	213.0	7.00	6.07	9.42
12/11/2032	1052	21.7	134.3	7.97	181.7	6.90	6.04	9.08
12/11/2033	1110	21.7	134.2	7.98	184.0	6.97	6.08	9.12
12/11/2034	1142	21.2	134.2	7.91	175.7	7.05	6.67	8.74
12/11/2035	1156	22.0	133.8	7.89	167.3	6.90	8.89	8.61
12/11/2036	1210	22.1	133.9	7.87	204.9	7.07	6.44	9.31
12/11/2037	1225	21.8	133.4	7.87	201.4	6.85	10.98	8.44
12/11/2038	1242	22.0	132.8	7.88	204.1	6.95	9.08	10.30
12/11/2039	1300	22.1	132.9	7.91	201.7	7.10	6.36	9.37
12/11/2040	1316	22.5	132.5	7.92	201.8	6.95	6.17	9.00
12/11/2041	1330	22.5	133.0	7.88	216.5	7.06	6.43	9.05
12/11/2042	1350	22.8	132.3	7.88	221.6	7.06	7.10	10.20
12/11/2043	1410	22.5	132.8	7.91	221.9	7.08	6.29	9.12

Table B-2.1-1 (continued)

Date	Time	Temp (°C)	Spec. Cond. (µS/cm)	pH	ORP (mV)	DO (mg/L)	Turbidity (YSI)	Turbidity (Hach)
12/11/2044	1425	19.8	132.1	7.95	193.3	7.15	6.70	11.10
12/11/2045	1441	22.6	131.9	7.90	215.4	7.02	6.22	9.30
12/11/2046	1455	22.5	132.1	7.89	193.7	7.21	6.10	9.00
12/11/2047	1515	22.0	131.9	7.92	209.8	7.32	6.08	8.61
12/11/2048	1530	22.3	131.8	7.88	221.5	7.15	2.47	11.20
12/11/2049	1545	22.6	130.9	7.89	214.8	7.15	6.95	9.67
12/11/2050	1605	22.2	131.4	7.88	224.7	7.19	6.94	10.70
12/11/2051	1620	22.2	131.6	7.86	212.8	7.06	9.95	11.10
12/11/2052	1636	22.4	130.6	7.90	218.3	7.12	6.33	9.44
12/11/2053	1651	22.0	129.4	7.91	214.5	7.08	7.46	9.73
12/11/2054	1706	21.7	130.0	7.88	216.9	7.19	6.71	9.28
12/11/2055	1721	22.1	130.8	7.89	213.4	7.19	6.85	10.00
12/11/2056	1744	21.1	129.7	7.90	230.8	7.29	6.51	9.73
12/11/2057	1759	21.8	130.1	7.91	213.7	7.22	7.82	10.90
12/12/2021	0805	21.9	147.1	7.93	160.6	7.18	40.47	17.00
12/12/2021	0820	23.1	138.4	7.90	189.6	7.22	50.26	11.20
12/12/2021	0834	22.4	138.2	7.93	203.0	6.78	32.76	68.30
12/12/2021	0850	22.0	132.9	7.90	198.2	7.11	18.20	32.30
12/12/2021	0905	22.0	131.9	7.90	206.0	7.10	11.76	18.50
12/12/2021	0923	21.7	131.5	7.89	211.5	7.09	12.13	19.60
12/12/2021	0939	21.9	131.4	7.91	209.0	7.09	10.11	16.00
12/12/2021	0954	22.2	131.1	7.88	217.2	7.04	8.44	12.80
12/12/2021	1011	22.0	131.0	7.89	209.1	7.02	10.18	16.00
12/12/2021	1028	22.3	130.7	7.89	216.6	6.94	9.26	14.10
12/12/2021	1044	22.3	130.0	7.91	208.7	6.98	8.58	13.20
12/12/2021	1100	22.1	130.2	7.89	216.7	6.97	7.72	11.90
12/12/2021	1117	22.0	130.3	7.90	210.4	7.09	6.96	10.70
12/12/2021	1133	22.1	130.0	7.87	217.6	7.02	6.56	9.94
12/12/2021	1147	21.8	130.0	7.90	123.5	7.17	6.48	9.95
12/12/2021	1203	22.3	137.8	7.97	218.3	6.85	34.20	92.90
12/12/2021	1218	22.8	130.2	7.88	213.4	7.81	26.78	33.80
12/12/2021	1233	22.6	129.9	7.89	221.0	6.85	9.07	14.40
12/12/2021	1247	22.4	130.1	7.88	228.2	6.93	5.10	7.56
12/12/2021	1302	22.5	129.7	7.87	233.2	6.91	5.09	7.33
12/12/2021	1316	22.8	130.4	7.87	228.5	6.94	4.99	7.90
12/12/2021	1334	23.0	130.6	7.87	231.6	6.92	4.99	7.75
12/12/2021	1400	22.9	130.6	7.89	231.4	7.57	20.25	16.30
12/12/2021	1418	22.9	129.8	7.90	228.3	6.95	6.66	9.70

Table B-2.1-1 (continued)

Date	Time	Temp (°C)	Spec. Cond. (µS/cm)	pH	ORP (mV)	DO (mg/L)	Turbidity (YSI)	Turbidity (Hach)
12/12/2021	1431	22.7	130.1	7.88	232.0	6.89	4.60	7.23
12/12/2021	1446	22.9	130.0	7.88	234.4	6.85	2.65	4.02
12/12/2021	1512	22.7	129.6	7.88	233.8	6.90	4.24	6.35
12/12/2021	1528	22.6	129.3	7.88	242.8	6.88	3.86	5.52
12/12/2021	1547	22.7	129.5	7.85	238.1	6.97	3.05	4.41
12/12/2021	1600	22.4	129.8	7.88	244.4	6.77	4.36	6.49
12/12/2021	1615	22.1	129.2	7.88	248.3	7.01	3.72	5.53
12/12/2021	1630	22.2	128.8	7.89	246.2	7.01	3.85	5.64
12/12/2021	1645	21.9	128.5	7.90	232.1	7.02	3.80	5.84
12/12/2021	1700	21.3	130.2	7.89	238.6	7.27	4.02	5.96
12/12/2021	1715	21.7	128.0	7.91	227.1	7.02	3.92	5.79
12/12/2021	1730	21.2	128.9	7.90	240.8	7.05	3.70	5.36
12/12/2021	1745	22.0	128.1	7.89	232.6	7.01	4.09	6.07
12/12/2021	1759	20.9	128.4	7.91	236.3	7.11	4.65	7.17
12/13/2021	0953	21.8	129.2	7.68	196.1	6.89	9.02	3.35
12/13/2021	1000	21.7	128.8	7.67	212.0	6.62	4.43	3.32
12/13/2021	1010	21.8	129.8	7.78	215.4	6.79	5.01	3.75

* — = No reading recorded.

Table B-2.1-2
Field Parameters Monitored During 24-hr Extended Pumping Tests

Date	Time	Temp (°C)	Spec. Cond. (µS/cm)	pH	ORP (mV)	DO (mg/L)	Turbidity (YSI)	Turbidity (Hach)
R 72-Screen 1								
1/8/2022	0905	16.8	129.5	7.79	154.1	8.52	142.83	2.14
1/8/2022	0910	18.5	130.5	7.83	122.7	7.1	254.71	—*
1/8/2022	0915	20.1	130	7.91	126.3	7.63	16696.82	3.64
1/8/2022	0920	20.8	133.9	7.91	122.2	7.1	51.58	—
1/8/2022	0925	22	133.1	7.8	131.3	7.37	132.73	—
1/8/2022	0930	22.7	132	7.77	139.9	7.77	240.21	1.51
1/8/2022	0935	22.9	131.4	7.76	143.8	7.7	519.67	—
1/8/2022	0940	23	131	7.76	147.6	7.52	13835.78	—
1/8/2022	0945	23.1	130.5	7.76	150.3	7.72	275.26	2.78
1/8/2022	0950	23	130.1	7.76	151.8	7.58	84.91	—
1/8/2022	0955	23	129.8	7.75	154.5	7.75	315.28	—
1/8/2022	1000	23.1	129.6	7.76	158	7.82	573.96	2.09
1/8/2022	1005	23.1	129.4	7.75	162.6	7.58	829.9	—

Table B-2.1-2 (continued)

Date	Time	Temp (°C)	Spec. Cond. (µS/cm)	pH	ORP (mV)	DO (mg/L)	Turbidity (YSI)	Turbidity (Hach)
1/8/2022	1010	23.2	129.4	7.75	165.4	7.77	814.92	—
1/8/2022	1015	23.1	128.9	7.75	167.5	7.76	47.5	2.43
1/8/2022	1020	23.3	129.2	7.74	169.5	7.62	327.33	—
1/8/2022	1025	23.2	129.3	7.74	171.1	7.78	465	—
1/8/2022	1030	23.3	129.3	7.74	172.6	7.77	482.63	3.07
1/8/2022	1035	23.3	128.9	7.74	174.1	7.63	607.33	—
1/8/2022	1040	23.3	129	7.74	175.6	7.83	1114.97	—
1/8/2022	1045	23.3	128.9	7.74	176.7	7.81	324.51	2.65
1/8/2022	1050	23.1	128.7	7.74	177.5	7.65	381.67	—
1/8/2022	1055	23.2	128.4	7.74	177.7	7.67	320.28	—
1/8/2022	1100	23.1	128.3	7.74	178.5	7.75	405.97	1.77
1/8/2022	1105	23.2	128.5	7.74	180	7.74	255.4	—
1/8/2022	1110	23.2	128.4	7.74	180.4	7.74	296.9	—
1/8/2022	1115	23.1	128.3	7.74	180.5	7.78	205.84	1.99
1/8/2022	1120	23.2	128.7	7.74	180.6	7.69	310.87	—
1/8/2022	1125	23.2	128.1	7.74	181.3	7.77	209.36	—
1/8/2022	1130	23.2	128.8	7.75	182.3	7.75	110.58	1.82
1/8/2022	1135	23.2	128.3	7.75	183.4	7.82	133.46	—
1/8/2022	1140	23.2	127.9	7.75	183.8	7.8	204.61	—
1/8/2022	1145	23	128.3	7.75	183.6	7.78	201.55	1.73
1/8/2022	1150	23.1	128.2	7.75	184.5	7.77	188.1	—
1/8/2022	1155	23.1	128	7.76	185.2	7.78	181.57	—
1/8/2022	1200	23	128.5	7.75	184.9	7.77	231.27	2.14
1/8/2022	1205	23.1	128	7.76	185.7	7.74	217.13	—
1/8/2022	1210	23.1	128.1	7.76	185.7	7.75	236.44	—
1/8/2022	1215	23.1	128	7.76	186.3	7.69	156.84	2.01
1/8/2022	1220	23.2	127.9	7.76	187.3	7.65	169.03	—
1/8/2022	1225	23.1	128.5	7.76	187.4	7.75	156.71	—
1/8/2022	1230	23.1	128.3	7.77	187.5	7.81	168.62	2.67
1/8/2022	1235	23.1	128.2	7.77	189.8	7.73	160.66	—
1/8/2022	1240	23	128.2	7.77	191.5	7.81	112.14	—
1/8/2022	1245	22.9	128	7.77	192	7.82	123.47	1.65
1/8/2022	1250	23	128.3	7.77	192.5	7.79	140.72	—
1/8/2022	1255	22.7	128.2	7.78	192.9	7.76	111.09	—
1/8/2022	1300	22.8	128.1	7.78	193.3	7.77	138.83	2.16
1/8/2022	1305	23	128.3	7.78	193	7.79	142.45	—
1/8/2022	1310	23	128.1	7.78	192.8	7.85	115.5	—
1/8/2022	1315	23	128.7	7.79	192.8	7.92	96.94	1.72

Table B-2.1-2 (continued)

Date	Time	Temp (°C)	Spec. Cond. (µS/cm)	pH	ORP (mV)	DO (mg/L)	Turbidity (YSI)	Turbidity (Hach)
1/8/2022	1320	23	128.2	7.78	193.8	7.83	76.09	—
1/8/2022	1325	23.1	128.2	7.79	194.2	7.91	52.95	—
1/8/2022	1330	23.1	128.2	7.79	194.7	7.78	110.3	1.90
1/8/2022	1335	23.1	128.4	7.79	194.9	7.73	73.28	—
1/8/2022	1340	22.9	128.6	7.79	195.5	7.76	141.79	—
1/8/2022	1345	22.8	128.3	7.79	196.6	7.85	101.41	2.57
1/8/2022	1350	22.9	128.7	7.8	197.5	7.77	118.74	—
1/8/2022	1355	22.6	128	7.8	197.9	7.96	168.73	—
1/8/2022	1400	22.6	128.4	7.8	197.8	7.87	119.79	2.24
1/8/2022	1405	22.5	128	7.81	198.2	7.85	86.19	—
1/8/2022	1410	22.6	128.3	7.81	198.6	7.82	113.55	—
1/8/2022	1415	22.6	128.3	7.81	198.9	7.75	88.12	1.69
1/8/2022	1420	22.8	128.2	7.81	199.4	7.87	90.33	—
1/8/2022	1425	22.7	128	7.81	199.9	7.85	88.28	—
1/8/2022	1430	22.8	128.2	7.81	200.1	7.94	153.54	1.73
1/8/2022	1435	22.8	127.9	7.81	200.7	7.78	92.85	—
1/8/2022	1440	22.9	128.1	7.81	200.9	7.91	29.32	—
1/8/2022	1445	22.9	128.1	7.81	201	7.87	50.63	1.85
1/8/2022	1450	22.9	128	7.81	201.4	7.8	110.05	—
1/8/2022	1455	22.9	128.4	7.81	202.1	7.94	37.95	—
1/8/2022	1500	22.5	128.1	7.81	203.4	7.81	25.28	2.04
1/8/2022	1505	22.7	128	7.81	203.5	7.93	105.68	—
1/8/2022	1510	22.8	128.4	7.81	203.5	7.8	109.47	—
1/8/2022	1515	22.9	128.5	7.81	203.8	7.81	82.98	1.63
1/8/2022	1520	22.8	128.5	7.81	204	8.08	62.86	—
1/8/2022	1525	22.7	127.7	7.81	204.1	7.8	114.56	—
1/8/2022	1530	23	128.2	7.81	204.4	7.85	89.99	1.68
1/8/2022	1535	22.7	128.5	7.82	205	7.85	78.72	—
1/8/2022	1540	22.6	128.1	7.81	205.5	7.98	69.25	—
1/8/2022	1545	22.8	128.1	7.82	205.3	7.88	119.69	1.97
1/8/2022	1550	22.9	128.1	7.82	206.1	7.94	116.73	—
1/8/2022	1555	22.6	128.2	7.82	207.2	7.8	79.04	—
1/8/2022	1600	22.6	128.5	7.82	208	7.82	62.62	1.98
1/8/2022	1605	22.9	128.2	7.82	207.8	7.79	91.9	—
1/8/2022	1610	23	128.2	7.82	207.7	7.92	184.88	—
1/8/2022	1615	22.8	128.2	7.82	207.9	7.8	104.8	1.97
1/8/2022	1620	22.7	128.6	7.82	207.7	7.81	75.17	—
1/8/2022	1625	22.7	128.3	7.82	208.1	8	81.47	—

Table B-2.1-2 (continued)

Date	Time	Temp (°C)	Spec. Cond. (µS/cm)	pH	ORP (mV)	DO (mg/L)	Turbidity (YSI)	Turbidity (Hach)
1/8/2022	1630	22.8	128.2	7.82	208.7	8.12	118.9	2.03
1/8/2022	1635	22.7	128.1	7.82	208.8	7.9	92.14	—
1/8/2022	1640	22.7	127.9	7.82	209.5	7.94	79.82	—
1/8/2022	1645	22.8	128.4	7.82	209.9	7.88	72.03	1.92
1/8/2022	1650	22.5	128.3	7.82	210.7	7.84	110.32	—
1/8/2022	1655	22.4	128.3	7.82	211.2	7.82	113.38	—
1/8/2022	1700	22.5	128.2	7.82	211.9	7.99	49.71	1.87
1/8/2022	1705	22.3	128	7.82	212.6	7.96	48.95	—
1/8/2022	1710	22.5	128.4	7.82	212.8	8.02	36.01	—
1/8/2022	1715	22.4	128.3	7.82	213.5	7.97	95.39	1.70
1/8/2022	1720	22.5	128.4	7.83	214.7	7.99	90.05	—
1/8/2022	1725	22.6	128.3	7.82	215.1	7.95	51.3	—
1/8/2022	1730	22.4	128.1	7.83	215.5	8.12	91.94	1.61
1/8/2022	1735	22.6	128.3	7.82	216.1	8.01	95.89	—
1/8/2022	1740	22.6	127.8	7.82	216.5	7.99	89.67	—
1/8/2022	1745	22.5	128.5	7.83	217	7.89	82.14	1.92
1/8/2022	1750	22.5	127.9	7.83	218.1	7.76	100.17	—
1/8/2022	1755	22.3	128.1	7.83	219	7.91	79.25	—
1/8/2022	1800	22.5	128.4	7.82	220.3	7.9	66.52	2.17
1/8/2022	1805	22.5	128	7.83	220.5	8.08	84.91	—
1/8/2022	1810	22.6	127.9	7.83	221	7.85	82.31	—
1/8/2022	1815	22.6	128.1	7.83	221.6	7.93	69.47	1.82
1/8/2022	1820	22.7	128.2	7.83	221.8	7.84	57.45	—
1/8/2022	1825	22.6	128.3	7.83	221.9	7.92	102.69	—
1/8/2022	1830	22.6	128.5	7.82	222.3	7.97	94.55	2.24
1/8/2022	1835	22.6	128.1	7.83	222.5	7.91	65.99	—
1/8/2022	1840	22.5	128.1	7.83	222.4	7.89	87.43	—
1/8/2022	1845	22.5	128	7.83	223.2	8.05	65.97	2.20
1/8/2022	1850	22.5	128	7.83	222.6	8.12	74.89	—
1/8/2022	1855	22.5	128.1	7.83	222.1	7.99	73.06	—
1/8/2022	1900	22.5	127.7	7.83	222.1	8.13	85.51	1.85
1/8/2022	1905	22.5	128	7.83	222.3	8.07	83.72	—
1/8/2022	1910	22.4	128.1	7.83	222.7	7.93	80.17	—
1/8/2022	1915	22.2	127.8	7.83	223.1	7.89	86.84	—
1/8/2022	1920	22.2	128.4	7.83	223.6	7.97	83.11	—
1/8/2022	1925	22.4	128	7.83	224.1	8.05	67.92	—
1/8/2022	1930	22.3	127.9	7.83	224.6	7.97	70.6	9.00
1/8/2022	1935	22.2	127.9	7.83	225	8.01	66.07	—

Table B-2.1-2 (continued)

Date	Time	Temp (°C)	Spec. Cond. (µS/cm)	pH	ORP (mV)	DO (mg/L)	Turbidity (YSI)	Turbidity (Hach)
1/8/2022	1940	22.1	127.8	7.83	225.3	8	99.97	—
1/8/2022	1945	22.2	128.1	7.83	225.5	7.91	26.14	—
1/8/2022	1950	22.3	128.3	7.83	225.5	8.07	85.57	—
1/8/2022	1955	22.3	128.1	7.83	224.9	7.98	78.71	—
1/8/2022	2000	22.1	127.8	7.83	225.2	7.96	90	3.30
1/8/2022	2005	22.4	127.7	7.83	225.2	8.07	89.64	—
1/8/2022	2010	22.6	127.9	7.83	225	7.91	119.46	—
1/8/2022	2015	22.5	127.9	7.83	225.1	7.93	91.52	—
1/8/2022	2020	22.5	127.8	7.83	225.5	7.87	84.22	—
1/8/2022	2025	22.4	128.7	7.81	226.5	10.91	33.14	—
1/8/2022	2030	22.6	128.6	7.86	225	9.56	98.59	2.46
1/8/2022	2035	23.1	128.8	7.83	220.3	8.91	113.82	—
1/8/2022	2040	23.1	129	7.83	219.5	8.64	97.39	—
1/8/2022	2045	22.8	129.4	7.83	218.9	8.54	76.03	—
1/8/2022	2050	23	129.1	7.83	220.1	8.32	81.8	—
1/8/2022	2055	22.7	128.9	7.83	222	8.28	104.51	—
1/8/2022	2100	22.9	128.6	7.83	223.8	8.08	101.65	1.76
1/8/2022	2105	23	128.4	7.83	225.2	8.27	64.69	—
1/8/2022	2110	23	128.4	7.83	225.5	8.12	75.42	—
1/8/2022	2115	22.8	128.4	7.83	225.8	8.01	84.2	—
1/8/2022	2120	22.6	128.2	7.83	226.6	8.16	94.09	—
1/8/2022	2125	22.6	128.6	7.83	227.4	8.04	83.54	—
1/8/2022	2130	22.6	128.2	7.83	227.6	8.15	95.78	1.57
1/8/2022	2135	22.7	128.6	7.83	228	8.03	84.66	—
1/8/2022	2140	22.8	128.3	7.83	228.5	8.02	123.25	—
1/8/2022	2145	22.8	128.4	7.83	228.6	8.11	88.9	—
1/8/2022	2150	22.6	128.4	7.83	229.2	8.12	81.87	—
1/8/2022	2155	22.8	128.4	7.83	229.5	8.05	101.05	—
1/8/2022	2200	22.8	128.5	7.83	230.1	7.98	72.89	1.24
1/8/2022	2205	22.8	128.3	7.83	230.4	8.08	83.33	—
1/8/2022	2210	22.9	128.5	7.83	230.9	8.53	81.14	—
1/8/2022	2215	23	128.3	7.83	230.7	8.01	78.73	—
1/8/2022	2220	22.8	128.5	7.83	230.5	7.97	81.23	—
1/8/2022	2225	22.7	128.3	7.83	230.9	8.15	92.43	—
1/8/2022	2230	22.7	128.4	7.83	231.2	8.02	98.16	1.42
1/8/2022	2235	22.8	128.4	7.83	230.9	8	93.01	—
1/8/2022	2240	22.5	128.2	7.83	231.5	8.01	37.43	—
1/8/2022	2245	22.8	128.7	7.83	231.5	8.17	73.19	—

Table B-2.1-2 (continued)

Date	Time	Temp (°C)	Spec. Cond. (µS/cm)	pH	ORP (mV)	DO (mg/L)	Turbidity (YSI)	Turbidity (Hach)
1/8/2022	2250	23.1	128.1	7.83	231.5	8.04	66.4	—
1/8/2022	2255	22.8	128.5	7.83	231.6	8.08	89.05	—
1/8/2022	2300	22.9	128.1	7.83	232	8.29	50.54	1.15
1/8/2022	2305	22.7	128.6	7.83	232.2	8.14	75.74	—
1/8/2022	2310	22.7	128.3	7.83	232.5	8.09	74.85	—
1/8/2022	2315	22.6	128.5	7.83	233	8.23	35.34	—
1/8/2022	2320	22.7	128.2	7.83	232.4	8.03	89.26	—
1/8/2022	2325	22.9	128.2	7.83	232.6	8.1	81.39	—
1/8/2022	2330	22.9	128.6	7.83	232.5	7.96	93.5	1.17
1/8/2022	2335	23	128.5	7.83	232.2	8.02	84.12	—
1/8/2022	2340	22.7	128.1	7.83	232.3	8.12	78.68	—
1/8/2022	2345	22.7	128.7	7.83	232	8.11	94.23	—
1/8/2022	2350	22.6	127.9	7.83	232.2	7.95	124.22	—
1/8/2022	2355	22.6	128.6	7.83	232.8	8.07	75.98	—
1/9/2022	0000	22.5	127.9	7.83	233	8.07	83.37	1.08
1/9/2022	0005	22.4	128.2	7.84	233.3	8.01	81.12	—
1/9/2022	0010	22.5	128	7.83	233.1	8.06	52.78	—
1/9/2022	0015	22.6	128.3	7.83	232.8	8.08	91.2	—
1/9/2022	0020	22.6	128.3	7.83	232.6	7.98	39.36	—
1/9/2022	0025	22.6	128	7.83	233.5	8.02	71.57	—
1/9/2022	0030	22.4	127.8	7.83	233.9	8.3	74.34	1.36
1/9/2022	0035	22.6	127.8	7.83	234.1	7.97	89.31	—
1/9/2022	0040	22.6	128	7.83	234.3	8.13	76.35	—
1/9/2022	0045	22.7	127.8	7.83	234.3	8.15	67.01	—
1/9/2022	0050	22.6	128.1	7.84	234.7	8.06	86.51	—
1/9/2022	0055	22.6	128.1	7.83	235.2	7.93	76.28	—
1/9/2022	0100	22.6	128	7.84	235.6	7.99	94.74	1.40
1/9/2022	0105	22.7	128	7.83	236	8.09	198.68	—
1/9/2022	0110	22.8	128.3	7.83	235.8	8.09	63.3	—
1/9/2022	0115	22.7	128.3	7.83	236	8.27	71.79	—
1/9/2022	0120	22.8	128.4	7.83	236	8	93.43	—
1/9/2022	0125	22.7	127.6	7.83	236	8.09	76.55	—
1/9/2022	0130	22.6	127.6	7.83	236.6	8.06	105.05	1.20
1/9/2022	0135	22.5	127.7	7.84	236.6	8.1	90.07	—
1/9/2022	0140	22.5	128.4	7.84	236.4	8.06	52.27	—
1/9/2022	0145	22.5	127.7	7.84	236.5	7.99	83.97	—
1/9/2022	0150	22.4	127.6	7.84	236.5	8.13	83.9	—
1/9/2022	0155	22.6	128.5	7.84	236.5	8.21	75.24	—

Table B-2.1-2 (continued)

Date	Time	Temp (°C)	Spec. Cond. (µS/cm)	pH	ORP (mV)	DO (mg/L)	Turbidity (YSI)	Turbidity (Hach)
1/9/2022	0200	22.8	127.6	7.83	236.8	8.15	96.61	1.27
1/9/2022	0205	22.6	127.9	7.84	237	8.13	103.25	—
1/9/2022	0210	22.7	127.9	7.84	236.7	8.12	85.75	—
1/9/2022	0215	22.8	127.9	7.83	236.8	8.26	53.47	—
1/9/2022	0220	22.8	128.1	7.83	237.2	8.25	143.25	—
1/9/2022	0225	22.9	128.3	7.83	237.9	8.28	71.51	—
1/9/2022	0230	22.8	128.1	7.84	238.4	8.09	57.38	1.41
1/9/2022	0235	22.8	127.7	7.83	238.5	8.21	81.5	—
1/9/2022	0240	22.9	128.1	7.83	238.4	8.33	53.43	—
1/9/2022	0245	22.8	128.3	7.83	238.2	8.38	78.93	—
1/9/2022	0250	22.4	127.9	7.83	238.5	8.32	65.1	—
1/9/2022	0255	22.5	127.8	7.84	239.7	8.37	66.09	—
1/9/2022	0300	22.8	128.1	7.83	240.7	8.13	52.42	0.95
1/9/2022	0305	23.2	128.2	7.83	240.8	8.14	52.74	—
1/9/2022	0310	23.1	128	7.83	241.3	8.28	43.74	—
1/9/2022	0315	23.1	128.1	7.83	241.5	8.59	57.63	—
1/9/2022	0320	23.1	127.7	7.83	241.6	8.5	36.82	—
1/9/2022	0325	23.1	128.4	7.83	241.8	8.15	76.85	—
1/9/2022	0330	23	128.3	7.83	242	8.14	53.95	0.87
1/9/2022	0335	23.2	128.3	7.83	242.4	8.21	40.66	—
1/9/2022	0340	23	128.4	7.83	242.2	8.2	96.86	—
1/9/2022	0345	22.6	127.9	7.84	242.5	8.33	132.28	—
1/9/2022	0350	22.9	128.3	7.83	242.5	8.18	70.51	—
1/9/2022	0355	23	128.3	7.83	242.5	8.61	48.69	—
1/9/2022	0400	23	128.4	7.83	242.8	8.06	54.7	0.90
1/9/2022	0405	22.9	127.9	7.83	242.9	8.27	29.22	—
1/9/2022	0410	22.8	127.9	7.83	243.4	8.23	83.89	—
1/9/2022	0415	22.8	127.9	7.83	243.2	8.22	60.17	—
1/9/2022	0420	22.9	128.1	7.84	243.2	8.38	64.16	—
1/9/2022	0425	22.8	128.1	7.83	243.8	8.46	58.24	—
1/9/2022	0430	22.8	128	7.83	244	8.29	52.27	1.23
1/9/2022	0435	22.7	127.9	7.84	244.1	8.32	58.4	—
1/9/2022	0440	22.7	127.8	7.84	243.5	8.53	64.17	—
1/9/2022	0445	22.7	128.2	7.84	243.1	8.34	65.06	—
1/9/2022	0450	22.7	127.9	7.84	242.9	8.4	39.84	—
1/9/2022	0455	22.7	127.7	7.84	243.3	8.55	29.55	—
1/9/2022	0500	22.8	128.1	7.83	243.6	8.25	32.08	1.00
1/9/2022	0505	22.7	127.9	7.84	243.6	8.25	63.25	—

Table B-2.1-2 (continued)

Date	Time	Temp (°C)	Spec. Cond. (µS/cm)	pH	ORP (mV)	DO (mg/L)	Turbidity (YSI)	Turbidity (Hach)
1/9/2022	0510	22.8	128	7.84	243.9	8.27	116.55	—
1/9/2022	0515	22.9	127.9	7.84	243.8	8.45	60.03	—
1/9/2022	0520	23.1	128.2	7.83	242.9	8.1	58.26	—
1/9/2022	0525	23	127.9	7.83	243.4	8.18	53.87	—
1/9/2022	0530	23.1	128	7.83	243.7	8.47	70.58	—
1/9/2022	0535	23	128.1	7.84	243.7	8	36.33	—
1/9/2022	0540	23	128.4	7.84	243.9	8.31	92.58	—
1/9/2022	0545	23	128.1	7.84	243.6	8.37	67.14	—
1/9/2022	0550	22.9	127.7	7.84	243.4	8.35	57.54	—
1/9/2022	0555	22.8	128.2	7.83	243.5	8.46	63.42	—
1/9/2022	0600	22.7	128	7.84	243.8	8.49	68.26	1.47
1/9/2022	0605	22.6	128.1	7.84	244.4	8.12	65.56	—
1/9/2022	0610	22.5	128	7.84	244.7	8.48	33.25	—
1/9/2022	0615	22.5	128.2	7.84	245.2	8.24	73.36	—
1/9/2022	0620	22.6	128.1	7.84	245.2	8.38	47.08	—
1/9/2022	0625	22.6	127.8	7.84	244.9	8.4	97.15	—
1/9/2022	0630	22.6	127.9	7.84	244.7	8.49	54.65	0.81
1/9/2022	0635	22.7	127.7	7.84	245.1	8.36	98.05	—
1/9/2022	0640	22.7	127.3	7.84	245.3	8.25	86.08	—
1/9/2022	0645	22.6	128.1	7.84	245.5	9.5	31.04	—
1/9/2022	0650	22.8	127.8	7.84	245.3	7.9	94.36	—
1/9/2022	0655	22.7	127.8	7.84	245.3	8.13	104.97	—
1/9/2022	0700	22.8	127.5	7.84	244.8	8.01	94.74	2.08
1/9/2022	0705	22.8	128.2	7.83	244.6	8.96	57.59	—
1/9/2022	0710	22.9	127.9	7.84	244.7	8.29	71.83	—
1/9/2022	0715	22.9	128	7.84	244.5	8.06	79.23	—
1/9/2022	0720	22.8	127.9	7.84	244.2	8.02	87.57	—
1/9/2022	0725	22.8	128.1	7.84	244.5	8	101.29	—
1/9/2022	0730	22.9	127.8	7.84	245.3	8.25	70.18	1.27
1/9/2022	0735	23	127.9	7.83	245.7	8.1	93.13	—
1/9/2022	0740	23	127.9	7.83	245.8	8.17	53.79	—
1/9/2022	0745	22.9	127.5	7.84	246.2	8.31	87.6	—
1/9/2022	0750	23	127.7	7.84	245.7	8.14	86.01	—
1/9/2022	0755	23.1	128	7.84	245.6	8.07	94.15	—
1/9/2022	0800	23	127.6	7.84	245.8	8.22	65.94	0.87
1/9/2022	0805	23	127.8	7.84	246	8.23	59.15	—
1/9/2022	0810	22.9	128	7.84	245.9	8.33	46.09	—
1/9/2022	0815	22.9	128	7.84	246.4	8.25	77.88	—

Table B-2.1-2 (continued)

Date	Time	Temp (°C)	Spec. Cond. (µS/cm)	pH	ORP (mV)	DO (mg/L)	Turbidity (YSI)	Turbidity (Hach)
1/9/2022	0820	22.9	128	7.84	245.9	7.99	82.94	—
1/9/2022	0825	23	127.7	7.84	245	8.35	71.76	—
1/9/2022	0830	22.8	127.9	7.84	244.6	8.33	51.68	—
1/9/2022	0835	22.9	128	7.84	244.2	8.32	69.22	—
1/9/2022	0840	22.8	127.6	7.84	243.6	8.23	66.15	—
1/9/2022	0845	22.8	127.8	7.84	243.3	8.35	71.59	—
1/9/2022	0850	22.8	127.9	7.84	242.6	8.24	75.89	—
1/9/2022	0855	22.9	127.7	7.84	242.1	8.3	72.11	—
1/9/2022	0900	22.4	128.2	7.85	242	9.13	15.46	—
1/9/2022	0905	20.6	1.2	6.78	322.6	6.95	3.8	—
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12/18/2021	0759	12.1	0.4	7.18	203.4	8.02	6.14	20.7
12/18/2021	0804	14.5	131.4	7.93	183.1	7.58	20.75	—
12/18/2021	0809	16.2	131.5	7.92	182.6	7.52	21.14	—
12/18/2021	0814	17.9	131.6	7.91	182.6	7.45	19.84	16.6
12/18/2021	0819	19.1	132.3	8.15	158.6	6.44	167	—
12/18/2021	0824	21	131.1	8.12	162.3	6.79	306.28	—
12/18/2021	0829	21.9	132.7	8.02	166.2	6.66	188.09	14.2
12/18/2021	0834	22.4	134.4	7.86	172.6	6.83	107.31	—
12/18/2021	0839	22.6	136.2	7.89	167.9	6.87	142.76	—
12/18/2021	0844	22.7	134.7	7.88	168.7	6.96	170.42	29.1
12/18/2021	0849	22.8	133.1	7.87	171.3	7.02	169.1	—
12/18/2021	0854	22.9	132	7.87	174.4	7.11	181.57	—
12/18/2021	0859	22.9	131.5	7.86	177.4	7.19	212.46	11
12/18/2021	0904	23.2	131.9	7.79	183.5	7.49	98.39	—
12/18/2021	0909	23.2	131.6	7.83	184	7.5	67.3	—
12/18/2021	0914	23.2	131.4	7.84	185.2	7.5	55.15	7.48
12/18/2021	0919	23.3	131.2	7.85	186.5	7.51	43.92	—
12/18/2021	0924	23.3	131.1	7.85	187.9	7.52	34.29	—
12/18/2021	0929	23.3	131	7.85	189.4	7.51	26.05	5.71
12/18/2021	0934	23.3	130.8	7.85	190.9	7.52	18.85	—
12/18/2021	0939	23.3	130.7	7.85	192.2	7.52	12.94	—
12/18/2021	0944	23.4	130.6	7.85	193.5	7.53	9.04	4.23
12/18/2021	0949	23.3	130.6	7.85	194.8	7.54	6.62	—
12/18/2021	0954	23.3	130.5	7.85	196	7.54	5.55	—
12/18/2021	0959	23.4	130.4	7.85	197.1	7.54	5.19	4.63
12/18/2021	1004	23.4	130.4	7.85	198.2	7.54	4.87	—
12/18/2021	1009	23.4	130.3	7.84	199.1	7.55	4.58	—

Table B-2.1-2 (continued)

Date	Time	Temp (°C)	Spec. Cond. (µS/cm)	pH	ORP (mV)	DO (mg/L)	Turbidity (YSI)	Turbidity (Hach)
12/18/2021	1014	23.4	130.3	7.84	200	7.55	4.51	3.44
12/18/2021	1019	23.4	130.2	7.84	200.9	7.56	4.33	—
12/18/2021	1024	23.4	130.2	7.84	201.8	7.56	4.25	—
12/18/2021	1029	23.3	130.1	7.84	202.7	7.57	4.21	3.06
12/18/2021	1034	23.4	130.1	7.84	203.3	7.57	4.28	—
12/18/2021	1039	23.4	130	7.84	204	7.57	4.13	—
12/18/2021	1044	23.4	130	7.84	204.8	7.58	4.24	2.87
12/18/2021	1049	23.4	130	7.84	205.6	7.59	3.88	—
12/18/2021	1054	23.4	129.9	7.84	206.4	7.58	3.88	—
12/18/2021	1059	23.4	129.9	7.84	207.2	7.59	3.75	2.67
12/18/2021	1104	23.4	129.9	7.84	208	7.59	3.71	—
12/18/2021	1109	23.5	129.9	7.84	208.8	7.59	3.7	—
12/18/2021	1114	23.5	129.9	7.84	209.6	7.6	3.65	2.22
12/18/2021	1119	23.5	129.8	7.84	210.4	7.6	3.69	—
12/18/2021	1124	23.5	129.8	7.84	211.1	7.6	3.67	—
12/18/2021	1129	23.5	129.8	7.84	212.1	7.6	3.52	2.32
12/18/2021	1134	23.5	129.8	7.84	212.9	7.6	3.65	—
12/18/2021	1139	23.5	129.7	7.84	213.4	7.6	3.57	—
12/18/2021	1144	23.5	129.7	7.84	214	7.61	3.34	2
12/18/2021	1149	23.6	129.7	7.83	214.7	7.61	3.35	—
12/18/2021	1154	23.5	129.7	7.83	215.3	7.61	3.27	—
12/18/2021	1159	23.5	129.7	7.84	216	7.62	3.34	1.97
12/18/2021	1204	23.5	129.6	7.83	216.7	7.62	3.29	—
12/18/2021	1209	23.5	129.6	7.83	217.2	7.62	3.29	—
12/18/2021	1214	23.5	129.6	7.83	217.8	7.62	3.24	2.53
12/18/2021	1219	23.6	129.6	7.83	218.4	7.62	3.36	—
12/18/2021	1224	23.5	129.6	7.83	218.7	7.62	3.45	—
12/18/2021	1229	23.5	129.6	7.83	219.4	7.63	3.45	2.28
12/18/2021	1234	23.5	129.6	7.83	220	7.62	3.4	—
12/18/2021	1239	23.5	129.6	7.83	220.4	7.62	3.23	—
12/18/2021	1244	23.6	129.6	7.83	220.9	7.63	3.2	2.1
12/18/2021	1249	23.6	129.5	7.83	221.4	7.63	3.11	—
12/18/2021	1254	23.6	129.5	7.83	221.9	7.63	3.05	—
12/18/2021	1259	23.6	129.5	7.83	222.2	7.64	3.05	1.65
12/18/2021	1304	23.6	129.5	7.83	222.5	7.63	3.08	—
12/18/2021	1309	23.5	129.5	7.83	222.9	7.64	3.01	—
12/18/2021	1314	23.6	129.5	7.83	223.5	7.64	3.06	1.81
12/18/2021	1319	23.6	129.5	7.83	224.3	7.65	2.95	—

Table B-2.1-2 (continued)

Date	Time	Temp (°C)	Spec. Cond. (µS/cm)	pH	ORP (mV)	DO (mg/L)	Turbidity (YSI)	Turbidity (Hach)
12/18/2021	1324	23.5	129.7	7.83	224.6	7.66	3.01	—
12/18/2021	1329	23.5	129.6	7.83	224.9	7.67	2.97	1.91
12/18/2021	1334	23.5	129.6	7.83	225.3	7.66	3	—
12/18/2021	1339	23.5	129.6	7.83	225.7	7.67	2.97	—
12/18/2021	1344	23.5	129.6	7.83	226.1	7.67	2.96	1.37
12/18/2021	1349	23.6	129.6	7.83	226.4	7.67	2.85	—
12/18/2021	1354	23.5	129.6	7.83	226.9	7.67	2.86	—
12/18/2021	1359	23.5	129.6	7.83	227.4	7.68	2.84	1.71
12/18/2021	1404	23.6	129.6	7.83	227.7	7.68	2.81	—
12/18/2021	1409	23.6	129.6	7.83	228.1	7.68	2.83	—
12/18/2021	1414	23.5	129.6	7.83	228.6	7.68	2.85	1.52
12/18/2021	1419	23.5	129.6	7.83	229.2	7.69	2.79	—
12/18/2021	1424	23.5	129.6	7.83	229.7	7.69	2.86	—
12/18/2021	1429	23.5	129.6	7.83	230.1	7.69	2.86	1.95
12/18/2021	1434	23.6	129.6	7.83	231	7.69	2.81	—
12/18/2021	1439	23.6	129.6	7.83	231.6	7.69	2.81	—
12/18/2021	1444	23.6	129.6	7.83	232.2	7.69	2.78	2.34
12/18/2021	1449	23.6	129.5	7.83	232.6	7.7	2.84	—
12/18/2021	1454	23.6	129.6	7.83	232.7	7.7	2.81	—
12/18/2021	1459	23.6	129.5	7.83	233.1	7.71	2.77	1.46
12/18/2021	1504	23.5	129.5	7.83	233.6	7.7	2.75	—
12/18/2021	1509	23.6	129.5	7.86	232.8	7.71	2.66	—
12/18/2021	1514	23.6	129.5	7.86	233.4	7.71	2.71	1.5
12/18/2021	1519	23.6	129.5	7.86	233.7	7.72	2.75	—
12/18/2021	1524	23.6	129.5	7.85	234.2	7.71	2.67	—
12/18/2021	1529	23.6	129.5	7.85	234.6	7.71	2.72	1.25
12/18/2021	1534	23.5	129.5	7.85	235.2	7.72	2.73	—
12/18/2021	1539	23.6	129.5	7.85	235.8	7.72	2.71	—
12/18/2021	1544	23.6	129.5	7.85	236.3	7.72	2.75	1.99
12/18/2021	1549	23.6	129.5	7.85	236.7	7.72	2.71	—
12/18/2021	1554	23.5	129.5	7.85	237.3	7.73	2.72	—
12/18/2021	1559	23.5	129.4	7.85	237.9	7.73	2.66	1.72
12/18/2021	1604	23.6	129.5	7.85	238.6	7.74	2.69	—
12/18/2021	1609	23.6	129.5	7.85	239.1	7.74	2.69	—
12/18/2021	1614	23.6	129.4	7.85	239.7	7.74	2.72	1.78
12/18/2021	1619	23.6	129.4	7.85	240.3	7.74	2.72	—
12/18/2021	1624	23.6	129.4	7.85	240.9	7.74	2.65	—
12/18/2021	1629	23.6	129.4	7.85	241.3	7.75	2.7	1.72

Table B-2.1-2 (continued)

Date	Time	Temp (°C)	Spec. Cond. (µS/cm)	pH	ORP (mV)	DO (mg/L)	Turbidity (YSI)	Turbidity (Hach)
12/18/2021	1634	23.6	129.4	7.85	241.6	7.74	2.74	—
12/18/2021	1639	23.6	129.4	7.85	242.1	7.75	2.73	—
12/18/2021	1644	23.6	129.4	7.85	242.6	7.75	2.79	1.83
12/18/2021	1649	23.5	129.4	7.85	243.4	7.76	2.73	—
12/18/2021	1654	23.6	129.4	7.84	244.3	7.76	2.68	—
12/18/2021	1659	23.6	129.4	7.84	245.1	7.76	2.65	1.66
12/18/2021	1704	23.6	129.4	7.84	245.8	7.76	2.64	—
12/18/2021	1709	23.6	129.4	7.84	246.4	7.77	2.62	—
12/18/2021	1714	23.6	129.4	7.84	246.8	7.77	2.67	1.27
12/18/2021	1719	23.6	129.4	7.84	247.2	7.77	2.63	—
12/18/2021	1724	23.6	129.4	7.84	247.6	7.77	2.72	—
12/18/2021	1729	23.6	129.4	7.84	247.8	7.77	2.7	1.34
12/18/2021	1734	23.6	129.4	7.84	247.5	7.77	2.8	—
12/18/2021	1739	23.6	129.4	7.84	247.8	7.78	2.71	—
12/18/2021	1744	23.6	129.4	7.84	248	7.78	2.73	1.37
12/18/2021	1749	23.6	129.4	7.84	248.3	7.78	2.73	—
12/18/2021	1754	23.5	129.4	7.84	248.7	7.79	2.67	—
12/18/2021	1759	23.6	129.4	7.84	248.9	7.79	2.63	1.36
12/18/2021	1804	23.5	129.4	7.84	249.6	7.8	2.65	—
12/18/2021	1809	23.5	129.4	7.84	250	7.79	2.61	—
12/18/2021	1814	23.5	129.4	7.84	250.3	7.79	2.71	1.2
12/18/2021	1819	23.5	129.4	7.84	250.5	7.79	2.66	—
12/18/2021	1824	23.5	129.3	7.84	250.9	7.8	2.65	—
12/18/2021	1829	23.5	129.4	7.84	251.3	7.8	2.61	1.53
12/18/2021	1834	23.5	129.4	7.84	251.5	7.8	2.57	—
12/18/2021	1839	23.5	129.3	7.84	251.7	7.81	2.56	—
12/18/2021	1844	23.5	129.3	7.84	252	7.81	2.57	1.03
12/18/2021	1849	23.5	129.3	7.83	251.3	7.81	2.49	—
12/18/2021	1854	23.5	129.3	7.83	249.8	7.81	2.44	—
12/18/2021	1859	23.5	129.3	7.83	249.2	7.82	2.49	1
12/18/2021	1904	23.5	129.3	7.83	249	7.82	2.29	—
12/18/2021	1909	23.4	129.3	7.84	249.3	7.82	2.37	—
12/18/2021	1914	23.4	129.3	7.84	249.8	7.82	2.31	1.26
12/18/2021	1919	23.4	129.3	7.84	250.3	7.83	2.31	—
12/18/2021	1924	23.5	129.3	7.84	250.4	7.83	2.29	—
12/18/2021	1929	23.4	129.3	7.84	250.4	7.83	2.33	1.07
12/18/2021	1934	23.4	129.3	7.84	250.6	7.83	2.31	—
12/18/2021	1939	23.4	129.3	7.84	250	7.84	2.33	—

Table B-2.1-2 (continued)

Date	Time	Temp (°C)	Spec. Cond. (µS/cm)	pH	ORP (mV)	DO (mg/L)	Turbidity (YSI)	Turbidity (Hach)
12/18/2021	1944	23.4	129.3	7.84	250.9	7.84	2.32	1.13
12/18/2021	1949	23.4	129.3	7.84	251.2	7.84	2.41	—
12/18/2021	1954	23.4	129.3	7.84	251.4	7.84	2.37	—
12/18/2021	1959	23.5	129.3	7.84	251.3	7.84	2.37	1.13
12/18/2021	2004	23.5	129.3	7.84	251.5	7.84	2.35	—
12/18/2021	2009	23.5	129.3	7.84	251.6	7.84	2.32	—
12/18/2021	2014	23.5	129.3	7.84	251.9	7.84	2.3	1.08
12/18/2021	2019	23.4	129.3	7.84	252.2	7.85	2.25	—
12/18/2021	2024	23.5	129.3	7.84	252.5	7.85	2.29	—
12/18/2021	2029	23.5	129.3	7.84	252.8	7.85	2.32	1.02
12/18/2021	2034	23.5	129.3	7.84	252.9	7.86	2.3	—
12/18/2021	2039	23.5	129.3	7.84	252.9	7.85	2.32	—
12/18/2021	2044	23.5	129.3	7.84	252.9	7.86	2.25	1.03
12/18/2021	2049	23.5	129.3	7.84	253.2	7.86	2.3	—
12/18/2021	2054	23.5	129.3	7.84	253	7.86	2.29	—
12/18/2021	2059	23.5	129.3	7.84	253.1	7.87	2.31	0.94
12/18/2021	2104	23.4	129.3	7.84	253.3	7.86	2.43	—
12/18/2021	2109	23.5	129.3	7.84	253.3	7.87	2.37	—
12/18/2021	2114	23.5	129.3	7.84	253.4	7.86	2.33	—
12/18/2021	2119	23.4	129.3	7.84	253.7	7.87	2.3	—
12/18/2021	2124	23.5	129.3	7.84	254	7.87	2.27	—
12/18/2021	2129	23.5	129.3	7.84	254.3	7.87	2.33	1.04
12/18/2021	2134	23.4	129.3	7.84	254.6	7.87	2.31	—
12/18/2021	2139	23.5	129.3	7.84	254.7	7.87	2.32	—
12/18/2021	2144	23.5	129.3	7.84	254.6	7.87	2.28	—
12/18/2021	2149	23.5	129.3	7.84	254.8	7.87	2.3	—
12/18/2021	2154	23.5	129.3	7.84	254.8	7.88	2.32	—
12/18/2021	2159	23.5	129.3	7.84	255.2	7.87	2.3	0.9
12/18/2021	2204	23.4	129.2	7.84	255.6	7.88	2.29	—
12/18/2021	2209	23.5	129.2	7.84	256.2	7.88	2.25	—
12/18/2021	2214	23.5	129.2	7.84	256.6	7.88	2.33	—
12/18/2021	2219	23.5	129.2	7.84	256.5	7.88	2.34	—
12/18/2021	2224	23.5	129.2	7.84	256.9	7.89	2.38	—
12/18/2021	2229	23.5	129.2	7.84	257.3	7.89	2.26	1.03
12/18/2021	2234	23.5	129.2	7.84	257.6	7.88	2.33	—
12/18/2021	2239	23.5	129.2	7.84	257.8	7.89	2.29	—
12/18/2021	2244	23.5	129.3	7.84	258	7.89	2.32	—
12/18/2021	2249	23.5	129.3	7.84	257.9	7.89	2.32	—

Table B-2.1-2 (continued)

Date	Time	Temp (°C)	Spec. Cond. (µS/cm)	pH	ORP (mV)	DO (mg/L)	Turbidity (YSI)	Turbidity (Hach)
12/18/2021	2254	23.5	129.3	7.84	258.1	7.89	2.36	—
12/18/2021	2259	23.5	129.3	7.84	258.1	7.89	2.3	1.4
12/18/2021	2304	23.5	129.3	7.84	258.2	7.9	2.28	—
12/18/2021	2309	23.5	129.2	7.84	258.1	7.9	2.29	—
12/18/2021	2314	23.5	129.3	7.84	258.2	7.89	2.31	—
12/18/2021	2319	23.5	129.2	7.84	258.4	7.89	2.31	—
12/18/2021	2324	23.5	129.3	7.84	258.3	7.89	2.31	—
12/18/2021	2329	23.5	129.3	7.84	258.3	7.89	2.34	1.35
12/18/2021	2334	23.5	129.2	7.84	258.3	7.9	2.32	—
12/18/2021	2339	23.5	129.3	7.84	258.6	7.9	2.41	—
12/18/2021	2344	23.5	129.3	7.84	258.7	7.9	2.39	—
12/18/2021	2349	23.5	129.2	7.84	258.7	7.9	2.35	—
12/18/2021	2354	23.5	129.2	7.84	258.8	7.9	2.32	—
12/18/2021	2359	23.5	129.2	7.84	258.8	7.9	2.32	1.05
12/19/2021	0004	23.5	129.3	7.84	258.9	7.9	2.35	—
12/19/2021	0009	23.5	129.3	7.84	258.9	7.91	2.3	—
12/19/2021	0014	23.5	129.3	7.84	259.2	7.91	2.38	—
12/19/2021	0019	23.5	129.3	7.84	259.2	7.9	2.44	—
12/19/2021	0024	23.6	129.3	7.84	258.9	7.91	2.49	—
12/19/2021	0029	23.6	129.3	7.84	258.8	7.91	2.43	1.13
12/19/2021	0034	23.5	129.3	7.84	258.8	7.91	2.38	—
12/19/2021	0039	23.6	129.3	7.84	258.7	7.91	2.37	—
12/19/2021	0044	23.5	129.3	7.84	258.9	7.91	2.36	—
12/19/2021	0049	23.6	129.3	7.84	258.7	7.91	2.39	—
12/19/2021	0054	23.6	129.3	7.84	258.8	7.91	2.4	—
12/19/2021	0059	23.6	129.3	7.84	258.8	7.91	2.37	1.71
12/19/2021	0104	23.5	129.3	7.84	258.9	7.91	2.33	—
12/19/2021	0109	23.6	129.3	7.84	258.7	7.91	2.39	—
12/19/2021	0114	23.6	129.3	7.84	258.8	7.91	2.31	—
12/19/2021	0119	23.5	129.3	7.84	259	7.91	2.37	—
12/19/2021	0124	23.5	129.3	7.84	259.3	7.91	2.34	—
12/19/2021	0129	23.6	129.3	7.84	259.6	7.91	2.37	1.06
12/19/2021	0134	23.6	129.3	7.84	259.5	7.91	2.37	—
12/19/2021	0139	23.6	129.2	7.84	259.7	7.91	2.35	—
12/19/2021	0144	23.5	129.2	7.84	259.7	7.91	2.36	—
12/19/2021	0149	23.5	129.2	7.84	260	7.92	2.35	—
12/19/2021	0154	23.5	129.2	7.84	259.9	7.92	2.35	—
12/19/2021	0159	23.5	129.2	7.84	260.3	7.92	2.33	1.36

Table B-2.1-2 (continued)

Date	Time	Temp (°C)	Spec. Cond. (µS/cm)	pH	ORP (mV)	DO (mg/L)	Turbidity (YSI)	Turbidity (Hach)
12/19/2021	0204	23.5	129.2	7.84	260.3	7.92	2.32	—
12/19/2021	0209	23.6	129.2	7.84	260.4	7.92	2.36	—
12/19/2021	0214	23.5	129.3	7.84	260.6	7.92	2.31	—
12/19/2021	0219	23.5	129.3	7.84	260.6	7.92	2.3	—
12/19/2021	0224	23.6	129.3	7.84	260.7	7.92	2.34	—
12/19/2021	0229	23.5	129.3	7.84	260.9	7.93	2.33	0.89
12/19/2021	0234	23.6	129.3	7.84	260.9	7.92	2.38	—
12/19/2021	0239	23.5	129.2	7.84	261	7.92	2.32	—
12/19/2021	0244	23.5	129.3	7.84	261.2	7.92	2.39	—
12/19/2021	0249	23.5	129.2	7.84	261.5	7.93	2.38	—
12/19/2021	0254	23.5	129.3	7.84	261.7	7.93	2.35	—
12/19/2021	0259	23.6	129.3	7.84	261.7	7.93	2.38	0.97
12/19/2021	0304	23.6	129.3	7.84	261.8	7.92	2.4	—
12/19/2021	0309	23.5	129.3	7.84	261.9	7.93	2.39	—
12/19/2021	0314	23.5	129.3	7.84	262.1	7.93	2.39	—
12/19/2021	0319	23.6	129.3	7.84	262.2	7.93	2.41	—
12/19/2021	0324	23.6	129.3	7.84	262	7.93	2.52	—
12/19/2021	0329	23.6	129.2	7.84	262	7.93	2.48	1.15
12/19/2021	0334	23.6	129.3	7.84	262.1	7.93	2.47	—
12/19/2021	0339	23.6	129.3	7.84	262.6	7.93	2.44	—
12/19/2021	0344	23.6	129.3	7.84	262.8	7.93	2.43	—
12/19/2021	0349	23.6	129.3	7.84	263	7.93	2.4	—
12/19/2021	0354	23.5	129.3	7.84	263.2	7.93	2.4	—
12/19/2021	0359	23.5	129.3	7.84	262.8	7.93	2.45	1.48
12/19/2021	0404	23.5	129.3	7.84	262.6	7.93	2.45	—
12/19/2021	0409	23.5	129.3	7.84	262.8	7.93	2.45	—
12/19/2021	0414	23.5	129.3	7.84	262.8	7.93	2.41	—
12/19/2021	0419	23.6	129.2	7.84	262.9	7.93	2.4	—
12/19/2021	0424	23.6	129.3	7.84	262.7	7.93	2.43	—
12/19/2021	0429	23.6	129.3	7.84	263.1	7.93	2.46	1.35
12/19/2021	0434	23.5	129.2	7.84	262.7	7.93	2.5	—
12/19/2021	0439	23.5	129.2	7.84	263	7.93	2.41	—
12/19/2021	0444	23.5	129.2	7.84	263.1	7.93	2.36	—
12/19/2021	0449	23.5	129.2	7.84	263.3	7.94	2.37	—
12/19/2021	0454	23.5	129.2	7.84	263.3	7.93	2.37	—
12/19/2021	0459	23.5	129.3	7.84	263.5	7.94	2.38	1.05
12/19/2021	0504	23.5	129.3	7.84	263.5	7.94	2.37	—
12/19/2021	0509	23.5	129.3	7.84	263.7	7.94	2.4	—

Table B-2.1-2 (continued)

Date	Time	Temp (°C)	Spec. Cond. (µS/cm)	pH	ORP (mV)	DO (mg/L)	Turbidity (YSI)	Turbidity (Hach)
12/19/2021	0514	23.6	129.3	7.84	264.1	7.94	2.42	—
12/19/2021	0519	23.6	129.3	7.84	264.4	7.94	2.41	—
12/19/2021	0524	23.5	129.3	7.84	264.5	7.94	2.36	—
12/19/2021	0529	23.5	129.3	7.84	263.9	7.94	2.36	0.93
12/19/2021	0534	23.6	129.3	7.84	264.2	7.94	2.41	—
12/19/2021	0539	23.5	129.2	7.84	264.3	7.94	2.39	—
12/19/2021	0544	23.6	129.3	7.84	264.4	7.94	2.39	—
12/19/2021	0549	23.5	129.2	7.84	264.8	7.94	2.34	—
12/19/2021	0554	23.5	129.2	7.84	264.8	7.94	2.32	—
12/19/2021	0559	23.6	129.3	7.84	264.8	7.94	2.35	1.2
12/19/2021	0604	23.5	129.2	7.84	265.5	7.93	2.39	—
12/19/2021	0609	23.5	129.2	7.84	266	7.94	2.36	—
12/19/2021	0614	23.5	129.2	7.84	266.5	7.94	2.33	—
12/19/2021	0619	23.5	129.2	7.84	267	7.94	2.35	—
12/19/2021	0624	23.5	129.2	7.84	267.3	7.94	2.42	—
12/19/2021	0629	23.6	129.2	7.84	267.5	7.94	2.36	1.15
12/19/2021	0634	23.5	129.2	7.84	267.6	7.94	2.38	—
12/19/2021	0639	23.5	129.2	7.84	267.7	7.94	2.4	—
12/19/2021	0644	23.5	129.2	7.84	267.8	7.94	2.31	—
12/19/2021	0649	23.5	129.2	7.84	267.8	7.93	2.37	—
12/19/2021	0654	23.6	129.2	7.84	267.6	7.94	2.33	—
12/19/2021	0659	23.5	129.2	7.84	267.7	7.94	2.39	1.05

* — = No reading recorded.

Appendix C

Geophysical Logs
(on CD included with this document)

Appendix D

Final Well Design and
New Mexico Environment Department Approval

Date October 19, 2021

SUBCONTRACTOR TRANSMITTAL / STATUS SHEET

Subcontract Number: **Tech2Solutions PO-0000001**	**STR Name:** **Loren Bryant**

SUBCONTRACTOR

Company Name: **Tech 2 Solutions (T2S)**	**Date Submitted:** 10/19/21
Street Address: **3200 Geo. Washington Way, Suite G**	☒ **Initial Submittal of a New Document**
City, State, Zip code: **Richland, WA 99354**	☐ **Re-Submittal of Previous Document**
Subcontractor's Point of Contact: Cecilia Sadler	

Project Title:	**T2S ER Water Program**
Submittal Number:	3.017-001
Submittal Title:	T2S 3.017 R-72 NMED Approved Well Design Final Work Control Document
Revision Number:	0

Subcontractor's Representative's signature below indicates that submittal has been reviewed for accuracy and meets the requirements of the subcontract.

Subcontractor's Representative's signature and date signed:

CONTRACTOR

Date Received:	

Contractor Statusing submittal - signature and date signed:

Comments:

Status Code:

- ☒ **1 Reviewed- Work may proceed**
- ☐ **2 Reviewed-Revise and resubmit. Work may proceed subject to incorporation of indicated comments.**
- ☐ **3 Reviewed. Revise and resubmit. Work may not proceed.**
- ☐ **4 Reject. Submittal does not meet requirements. Resubmit.**
- ☐ **5 Permission to proceed not required.**

Submit comments to:

Date July 21, 2021

SUBCONTRACTOR TRANSMITTAL / STATUS SHEET

Subcontract Number:	**STR Name:**
Tech2Solutions PO-0000001	Loren Bryant

SUBCONTRACTOR

Company Name: Tech 2 Solutions (T2S)	**Date Submitted:** 10-19-2021
Street Address: 3200 Geo. Washington Way, Suite G	☒ **Initial Submittal of a New Document**
City, State, Zip code: Richland, WA 99354	☐ **Re-Submittal of Previous Document**
Subcontractor's Point of Contact: Cecilia Sadler - c505-309-1359	

Project Title:	R-72 Final Work Control Document - Well Design
Submittal Number:	3.017
Submittal Title:	3.017 R-72 NMED Approved Well Design - Final Work Control Document
Revision Number:	

Subcontractor's Representative's signature below indicates that submittal has been reviewed for accuracy and meets the requirements of the subcontract.

Subcontractor's Representative's signature and date signed:
Digitally signed by Cecilia Sadler
Date: 2021.10.19 10:42:57 -06'00'

CONTRACTOR

Date Received:	

Contractor Statusing submittal - signature and date signed:

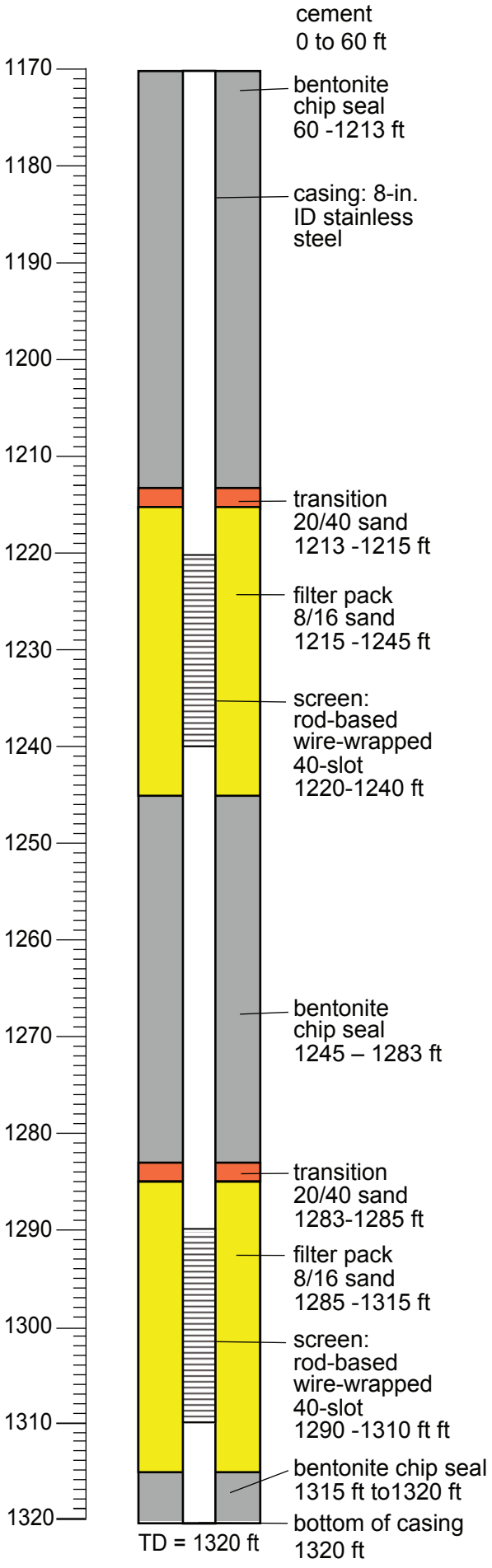
Comments:

Status Code:

- ☑ **1 Reviewed- Work may proceed**
- ☐ **2 Reviewed-Revise and resubmit. Work may proceed subject to incorporation of indicated comments.**
- ☐ **3 Reviewed. Revise and resubmit. Work may not proceed.**
- ☐ **4 Reject. Submittal does not meet requirements. Resubmit.**
- ☐ **5 Permission to proceed not required.**

Submit comments to:

R-72 Well Design
Screen interval details



From: John R. Warren <John.Warren@EM-LA.DOE.GOV>
Sent: Tuesday, October 19, 2021 9:39 AM
To: Ralph Rupp <Ralph.Rupp@em-la.doe.gov>
Cc: Sherry L. Gaddy <Sherry.Gaddy@EM-LA.DOE.GOV>; Sadler, Cecilia <Cecilia.Sadler@tetratech.com>; Cecilia M. Sadler <Cecilia.Sadler@EM-LA.DOE.GOV>
Subject: FW: [EXTERNAL] R-72 Well Design Package

Ralph,

Attached is the Final well design and communications with NMED is in the email thread.
Please let me know if you have any questions.

Thank you,

John R. Warren
Drilling Project Manager
Mobile: 352.275.7135 Mobile 2: 505.412.9992

critical subcontractor to **N3B ER Water Program**
Pueblo Complex, 1990 Diamond Drive, Los Alamos, NM 87544

From: Sherry L. Gaddy <Sherry.Gaddy@EM-LA.DOE.GOV>
Sent: Friday, October 15, 2021 4:17 PM
To: John R. Warren <John.Warren@EM-LA.DOE.GOV>
Subject: FW: [EXTERNAL] R-72 Well Design Package

FYI

Sherry L Gaddy
Drilling Program Manager
Mobile: 505.309.1377 Mobile2: 775.296.3739

critical subcontractor to **N3B ER Water Program**
Pueblo Complex, 1990 Diamond Drive, Los Alamos, NM 87544

From: Rodriguez, Cheryl <cheryl.rodriguez@em.doe.gov>
Sent: Thursday, October 14, 2021 6:12 PM
To: Joseph T. Sena <Joseph.Sena@EM-LA.DOE.GOV>; Troy D. Thomson <troy.thomson@em-la.doe.gov>; Danny Katzman <danny.katzman@em-la.doe.gov>; Bruce A. Robinson <bruce.robinson@em-la.doe.gov>; Sherry L. Gaddy <Sherry.Gaddy@EM-LA.DOE.GOV>
Cc: David Nickless <david.nickless@em.doe.gov>; Evans, John H. <John.H.Evans@em.doe.gov>; lee.bishop@em.doe.gov; Thomas McCrory <Thomas.mccrory@em.doe.gov>; Kenneth Ocker <kenneth.ocker@em.doe.gov>; Hai Shen <hai.shen@em.doe.gov>
Subject: FW: [EXTERNAL] R-72 Well Design Package

Hello Joe,
Please proceed with NMED's prescribed modified Alternative 2 well design.

Regards,

Cheryl L. Rodriguez
Program Manager, FPD II
Department of Energy, Environmental Management
Los Alamos Field Office (EM-LA)
1200 Trinity Drive, MS-M984
Los Alamos, NM 87544
Office: (240) 562-1173 (NEW)
Cell: (505) 414-0450
Email: cheryl.rodriguez@em.doe.gov

From: Rodriguez, Cheryl
Sent: Thursday, October 14, 2021 5:53 PM
To: Catechis, Chris, NMENV <Chris.Catechis@state.nm.us>; Dhawan, Neelam, NMENV <neelam.dhawan@state.nm.us>; Petersen, Michael, NMENV <Michael.Petersen@state.nm.us>; Krambis, Christopher, NMENV <Christopher.Krambis@state.nm.us>
Cc: Maestas, Ricardo P <ricardo.maestas@state.nm.us>; Bishop, M. Lee <Lee.Bishop@em.doe.gov>; Mikolanis, Michael A <michael.mikolanis@em.doe.gov>; Nickless, David <David.Nickless@em.doe.gov>; Duran, Arturo Q. <Arturo.Duran@em.doe.gov>; Shen, Hai <Hai.Shen@em.doe.gov>; Veenis, Steve J <steve.veenis@em-la.doe.gov>; Sena, Joseph T <joseph.sena@em-la.doe.gov>; Katzman, Danny <danny.katzman@em-la.doe.gov>; Sherry L. Gaddy <Sherry.Gaddy@EM-LA.DOE.GOV>; Christian T. Maupin <Christian.Maupin@em-la.doe.gov>; Ocker, Kenneth <kenneth.ocker@em.doe.gov>; Thomson, Troy D <troy.thomson@em-la.doe.gov>; Thomas McCrory <tommcc.mccrory5@gmail.com>; Evans, John H. <John.H.Evans@em.doe.gov>; Christian T. Maupin <Christian.Maupin@em-la.doe.gov>
Subject: RE: [EXTERNAL] R-72 Well Design Package

Hello Chris,
Thank you for taking our call, in the past we have worked through well design issues with NMED real time to collaborate on a final design. Based on the discussion, NMED has not altered their position but provided an alternative to wait until Monday for further discussions or construct the well as prescribed in your October 13, 2021 email. In lieu of incurring standby costs from the driller, DOE is moving forward with NMED's well design.

Regards,

Cheryl L. Rodriguez
Program Manager, FPD II
Department of Energy, Environmental Management
Los Alamos Field Office (EM-LA)
1200 Trinity Drive, MS-M984
Los Alamos, NM 87544
Office: (240) 562-1173 (NEW)
Cell: (505) 414-0450
Email: cheryl.rodriguez@em.doe.gov

From: Rodriguez, Cheryl
Sent: Thursday, October 14, 2021 3:40 PM
To: Catechis, Chris, NMENV <Chris.Catechis@state.nm.us>; Dhawan, Neelam, NMENV <neelam.dhawan@state.nm.us>; Petersen, Michael, NMENV <Michael.Petersen@state.nm.us>; Krambis, Christopher, NMENV <Christopher.Krambis@state.nm.us>
Cc: Maestas, Ricardo P <ricardo.maestas@state.nm.us>; Bishop, M. Lee <Lee.Bishop@em.doe.gov>; Mikolanis, Michael A <michael.mikolanis@em.doe.gov>; Nickless, David <David.Nickless@em.doe.gov>; Duran, Arturo Q. <Arturo.Duran@em.doe.gov>; Shen, Hai <Hai.Shen@em.doe.gov>; Veenis, Steve J <steve.veenis@em-la.doe.gov>; Sena, Joseph T <joseph.sena@em-la.doe.gov>; Katzman, Danny <danny.katzman@em-la.doe.gov>; Sherry L. Gaddy <Sherry.Gaddy@EM-LA.DOE.GOV>; Christian T. Maupin <Christian.Maupin@em-la.doe.gov>; Ocker, Kenneth <kenneth.ocker@em.doe.gov>; Thomson, Troy D <troy.thomson@em-la.doe.gov>; Thomas McCrory <tommcc.mccrory5@gmail.com>; Evans, John H. <John.H.Evans@em.doe.gov>
Subject: RE: [EXTERNAL] R-72 Well Design Package

Hi Chris,
Here is what we would like to discuss at 4:00 this afternoon. Although EM-LA still maintains that the 40-ft screen design is the better technical alternative for R-72, EM-LA offers that with NMED's Alternative 2 modification to lower the upper screen 20', there may be advantages to placing the upper 20-ft screen from 1210-1230' versus NMED's modified 1220-1240' bgs based on the following.

Perchlorate occurrences in groundwater in the area monitored by R-15 and R-61 are likely related to nearby infiltration from perched-intermediate groundwater as manifested by perchlorate concentrations in perched-intermediate wells MCOI-5 and MCOI-6. That would support raising the screen closer to the water table, i.e., approximately 20 ft below the water table instead of approximately 30 ft below the water table proposed in NMED's response. A shallower screen also better aligns with the elevation of the screens at R-15 and R-61 S1 and would be better for comparison of contaminant spatial trends.

A design with the top of the 20-ft screen at 1210' bgs still ensures that the screen and the overlying 5-ft filter pack would be entirely within the Miocene Pumiceous unit (top of primary filter pack would be at 1205 ft bgs, seven feet below the contact with the base of the Puye). A depth of 1210-1230' bgs also places the screen within a portion of the aquifer with at least 3 intervals with good porosity based on the neutron log data.

Thank you,

Cheryl L. Rodriguez
Program Manager, FPD II
Department of Energy, Environmental Management
Los Alamos Field Office (EM-LA)
1200 Trinity Drive, MS-M984
Los Alamos, NM 87544
Office: (240) 562-1173 (NEW)
Cell: (505) 414-0450
Email: cheryl.rodriguez@em.doe.gov

From: Catechis, Chris, NMENV <Chris.Catechis@state.nm.us>
Sent: Thursday, October 14, 2021 1:02 PM
To: Rodriguez, Cheryl <cheryl.rodriguez@em.doe.gov>; Dhawan, Neelam, NMENV <neelam.dhawan@state.nm.us>; Petersen, Michael, NMENV <Michael.Petersen@state.nm.us>; Krambis, Christopher, NMENV <Christopher.Krambis@state.nm.us>
Cc: Maestas, Ricardo P <ricardo.maestas@state.nm.us>; Bishop, M. Lee <lee.bishop@em.doe.gov>; Mikolanis, Michael A <michael.mikolanis@em.doe.gov>; Nickless, David <david.nickless@em.doe.gov>; Duran, Arturo Q. <arturo.duran@em.doe.gov>; Shen, Hai <hai.shen@em.doe.gov>; Veenis, Steve J <steve.veenis@em-la.doe.gov>; Sena, Joseph T <joseph.sena@em-la.doe.gov>; Katzman, Danny <danny.katzman@em-la.doe.gov>; Sherry L. Gaddy <Sherry.Gaddy@EM-LA.DOE.GOV>; Christian T. Maupin <Christian.Maupin@em-la.doe.gov>; Ocker, Kenneth <kenneth.ocker@em.doe.gov>; Thomson, Troy D <troy.thomson@em-la.doe.gov>; Thomas McCrory <tommcc.mccrory5@gmail.com>; Evans, John H. <John.H.Evans@em.doe.gov>
Subject: RE: [EXTERNAL] R-72 Well Design Package

Hi Cheryl,

That works for me, I still have availability at 4PM today.

Thanks,

Chris

From: Rodriguez, Cheryl <cheryl.rodriguez@em.doe.gov>
Sent: Thursday, October 14, 2021 12:44 PM
To: Catechis, Chris, NMENV <Chris.Catechis@state.nm.us>; Dhawan, Neelam, NMENV <neelam.dhawan@state.nm.us>; Petersen, Michael, NMENV <Michael.Petersen@state.nm.us>; Krambis, Christopher, NMENV <Christopher.Krambis@state.nm.us>
Cc: Maestas, Ricardo, NMENV <Ricardo.Maestas@state.nm.us>; Bishop, M. Lee <lee.bishop@em.doe.gov>; Mikolanis, Michael A <michael.mikolanis@em.doe.gov>; Nickless, David <david.nickless@em.doe.gov>; Duran, Arturo Q. <arturo.duran@em.doe.gov>; Shen, Hai <hai.shen@em.doe.gov>; Veenis, Steve J <steve.veenis@em-la.doe.gov>; Sena, Joseph T <joseph.sena@em-la.doe.gov>; Katzman, Danny <danny.katzman@em-la.doe.gov>; Sherry L. Gaddy <Sherry.Gaddy@EM-LA.DOE.GOV>; Christian T. Maupin <Christian.Maupin@em-la.doe.gov>; Ocker, Kenneth <kenneth.ocker@em.doe.gov>; Thomson, Troy D <troy.thomson@em-la.doe.gov>; Thomas McCrory <tommcc.mccrory5@gmail.com>; Evans, John H. <John.H.Evans@em.doe.gov>
Subject: RE: [EXTERNAL] R-72 Well Design Package
Importance: High

Hi Chris,
Again, thank you for the quick response. We are discussing the modification and would like to go over a final design at 4:00 this afternoon. The thought is to use the previously scheduled time for our drilling calls. I will follow up with the meeting call-in information and a read ahead. If this won't work, please let me know but if we can finalize design today we can get installation started tomorrow morning.

Regards,

Cheryl L. Rodriguez
Program Manager, FPD II
Department of Energy, Environmental Management
Los Alamos Field Office (EM-LA)
1200 Trinity Drive, MS-M984
Los Alamos, NM 87544
Office: (240) 562-1173 (NEW)
Cell: (505) 414-0450
Email: cheryl.rodriguez@em.doe.gov

From: Catechis, Chris, NMENV <Chris.Catechis@state.nm.us>
Sent: Wednesday, October 13, 2021 10:19 PM
To: Rodriguez, Cheryl <cheryl.rodriguez@em.doe.gov>; Dhawan, Neelam, NMENV <neelam.dhawan@state.nm.us>; Petersen, Michael, NMENV <Michael.Petersen@state.nm.us>; Krambis, Christopher, NMENV <Christopher.Krambis@state.nm.us>
Cc: Maestas, Ricardo P <ricardo.maestas@state.nm.us>; Bishop, M. Lee <lee.bishop@em.doe.gov>; Mikolanis, Michael A <michael.mikolanis@em.doe.gov>; Nickless, David <david.nickless@em.doe.gov>; Duran, Arturo Q. <arturo.duran@em.doe.gov>; Shen, Hai <hai.shen@em.doe.gov>; Veenis, Steve J <steve.veenis@em-la.doe.gov>; Sena, Joseph T <joseph.sena@em-la.doe.gov>; Katzman, Danny <danny.katzman@em-la.doe.gov>; Sherry L. Gaddy <Sherry.Gaddy@EM-LA.DOE.GOV>; Bruce A. Robinson <bruce.robinson@em-la.doe.gov>; Ocker, Kenneth <kenneth.ocker@em.doe.gov>; Thomson, Troy D <troy.thomson@em-la.doe.gov>; Thomas McCrory <tommcc.mccrory5@gmail.com>; Evans, John H. <John.H.Evans@em.doe.gov>
Subject: RE: [EXTERNAL] R-72 Well Design Package

Hi Cheryl,

Thank you for the Proposed Well Design Package for R-72. After review, NMED accepts Alternative 2 in the proposal, with modifications. NMED requests that the 20 foot upper screen be installed between 1220 - 1240 feet below ground surface to ensure that the data being captured are clearly representative of only the Miocene pumiceous (Tjfp) deposit formation and not comingled with groundwater influenced or recharged from the overlying Puye Formation. NMED desires that the screen and filter pack do not connect two hydrogeological formations so that we can fully understand nature and extent of the chromium, tritium, perchlorate and other solute contamination at the southern LANL boundary near Pueblo de San Ildefonso. In addition, this deeper placement will ensure an adequate hydraulic seal between the Puye Formation and the deeper units, which will provide a hydraulic barrier to vertical migration of any potential contaminants that may be present at the regional water table from entering the deeper portion of this aquifer. It is known that pumping from supply well PM-4 has a radius of influence reaching to R-15, which incorporates this screen. As such, it most important to provide a

screen that represents the deeper section of the R-15 screen and also overlaps with R-61 S1, which has exhibited an increasing trend in perchlorate, tritium, and total dissolved chromium.

NMED accepts the placement of screen 2 at the lower extent of the borehole.

Please feel free to reach out should you have further questions or need for clarification.

Thanks,

Christopher S. Catechis, Acting Director
Resource Protection Division
New Mexico Environment Department
1190 St. Francis Drive |Santa Fe, New Mexico 87505
(C) 505.469-6521
www.env.nm.gov | chris.catechis@state.nm.us

From: Rodriguez, Cheryl <cheryl.rodriguez@em.doe.gov>
Sent: Friday, October 8, 2021 10:40 AM
To: Dhawan, Neelam, NMENV <neelam.dhawan@state.nm.us>; Petersen, Michael, NMENV <Michael.Petersen@state.nm.us>; Krambis, Christopher, NMENV <Christopher.Krambis@state.nm.us>
Cc: Catechis, Chris, NMENV <Chris.Catechis@state.nm.us>; Maestas, Ricardo, NMENV <Ricardo.Maestas@state.nm.us>; Bishop, M. Lee <lee.bishop@em.doe.gov>; Mikolanis, Michael A <michael.mikolanis@em.doe.gov>; Nickless, David <david.nickless@em.doe.gov>; Duran, Arturo Q. <arturo.duran@em.doe.gov>; Shen, Hai <hai.shen@em.doe.gov>; Veenis, Steve J <steve.veenis@em-la.doe.gov>; Sena, Joseph T <joseph.sena@em-la.doe.gov>; Katzman, Danny <danny.katzman@em-la.doe.gov>; Sherry L. Gaddy <Sherry.Gaddy@EM-LA.DOE.GOV>; Bruce A. Robinson <bruce.robinson@em-la.doe.gov>; Ocker, Kenneth <kenneth.ocker@em.doe.gov>; Thomson, Troy D <troy.thomson@em-la.doe.gov>; Thomas McCrory <tommcc.mccrory5@gmail.com>; Evans, John H. <John.H.Evans@em.doe.gov>
Subject: [EXTERNAL] R-72 Well Design Package

Neelam-

Please find attached the Proposed Well Design Package for R-72. The design package includes narrative describing the geology, geophysics, and other pertinent information to support evaluation of 2 alternative well-designs, one which reflects DOE's preferred alternative. DOE

agrees that no remediation method has been approved or is currently being implemented in the portion of the plume where R-72 is located. However, consistent with our position presented in our June 4, 2021 response to NMED's November 3, 2020 Amended Approval for the Drilling Work Plan for Regional Well R-72, DOE remains consistent in our request that NMED consider the unique set of circumstances that should be considered for design of wells at the site, especially those drilled for the Chromium Project. In addition to DOE's proposed well design, we are also offering utilization of in-well methods to provide detailed resolution of hydraulics and geochemistry across the screened interval. We feel that addresses NMED's interest in more discrete characterization and the need for comparability of data to nearby wells with screens of different lengths and positions within the upper portion of the aquifer.

NMED's timely review would also be appreciated, so construction of the well can begin, and also to facilitate meeting the proposed Appendix B Milestone date for the well.

Please respond to the distribution on this email, and if NMED has any questions or would like to discuss the proposed well design, please contact Joe Sena at 505-551-2964 or Sherry Gaddy at 505-309-1377 to set up a time for a discussion.

Regards,

Cheryl L. Rodriguez
Program Manager, FPD II
Department of Energy, Environmental Management
Los Alamos Field Office (EM-LA)
1200 Trinity Drive, MS-M984
Los Alamos, NM 87544
Office: (240) 562-1173 (NEW)
Cell: (505) 414-0450
Email: cheryl.rodriguez@em.doe.gov