



N3B-Los Alamos
 1200 Trinity Drive, Suite 150
 Los Alamos, New Mexico 87544
 (505) 257-7690



Environmental Management
 Los Alamos Field Office
 1200 Trinity Drive, Suite 400
 Los Alamos, New Mexico 87544
 (240) 562-1122

Date: November 30, 2023
Refer To: N3B-2023-0417

RECEIVED

Justin Ball, Chief
 Ground Water Quality Bureau
 New Mexico Environment Department
 1190 S. St. Francis Drive
 Santa Fe, NM 87502-5469

DEC 01 2023

**GROUND WATER
 QUALITY BUREAU**

Subject: Submittal of the Quarterly Report for the Discharge of Treated Groundwater to the Regional Aquifer under Discharge Permit 1835, Calendar Year 2023 Quarter 3, Class V Underground Injection Control Wells

Dear Mr. Ball:

On August 31, 2016, the New Mexico Environment Department (NMED) issued Discharge Permit 1835 (DP-1835) to the U.S. Department of Energy (DOE) and Los Alamos National Security, LLC (LANS) for the discharge of treated groundwater to the regional aquifer from up to six Class V underground injection control (UIC) wells. On July 21, 2017, NMED approved minor updates to DP-1835. During the second quarter of calendar year (CY) 2018, ownership of the discharge permit transferred from LANS to Newport News Nuclear BWXT-Los Alamos, LLC (N3B). Pursuant to Condition No. 10 of the above-referenced discharge permit, DOE/N3B are required to submit quarterly reports to document the following:

1. influent and discharge volumes from the treatment systems,
2. quarterly groundwater and treated effluent sampling results, and
3. operations and maintenance activities.

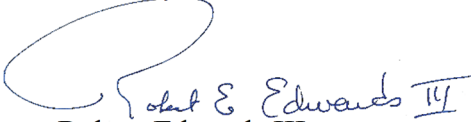
Pursuant to Condition No. 11, 12, and 13 of DP-1835, the quarterly reports shall also contain general information, performance information, and monitoring data for treated effluent from each ion-exchange treatment system. Condition No. 10 requires submission of a quarterly report to NMED by December 1, 2023, for the July 1 through September 30, 2023, discharge period.

During the CY 2023 Quarter 3 reporting period for DP-1835, no treated water was injected. Monthly sampling occurred at all injection and extraction wells, and the extracted water was treated through Chromium Treatment Unit A, and held in storage tanks. The sample water will be re-treated through Chromium Treatment Unit B and stored in the ponds for future land application.

The enclosed "Quarterly Report for the Discharge of Treated Groundwater to the Regional Aquifer under Discharge Permit 1835, Calendar Year 2023 Quarter 3," provides the information required under DP-1835 for this reporting period.

If you have questions, please contact Christian Maupin at (505) 695-4281 (christian.maupin@em-la.doe.gov) or Cheryl Rodriguez at (505) 414-0450 (cheryl.rodriguez@em.doe.gov).

Sincerely,



Robert Edwards III
Acting Program Manager
Environment, Safety, Health and Quality
N3B-Los Alamos

Sincerely,

ARTURO
DURAN

Digitally signed by
ARTURO DURAN
Date: 2023.11.29
16:27:26 -07'00'

Arturo Q. Duran
Office of Quality and Regulatory Compliance
U.S. Department of Energy
Environmental Management
Los Alamos Field Office

Enclosure(s):

1. Two hard copies with electronic files – Quarterly Report for the Discharge of Treated Groundwater to the Regional Aquifer under Discharge Permit 1835, Calendar Year 2023 Quarter 3 (EM2023-0775)

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
Steve Yanicak, NMED-DOE-OB
Jason Herman, NMED-GWQB
Neelam Dhawan, NMED-HWB
Ricardo Maestas, NMED-HWB
Kylian Robinson, NMED-HWB
Rick Shean, NMED-RPD
Shelly Lemon, NMED-SWQB
Jeannette Hyatt, LANL
Stephen Hoffman, NA-LA
John Evans, EM-LA
Brian Harcek, EM-LA
Thomas McCrory, EM-LA
Michael Mikolanis, EM-LA
Kenneth Ocker, EM-LA
Kent Rich, EM-LA
Joseph Richie, EM-LA
Cheryl Rodriguez, EM-LA
Hai Shen, EM-LA
Susan Wacaster, EM-LA
Felicia Aguilar, N3B
William Alexander, N3B

Michael Erickson, N3B
Cheryl Fountain, N3B
Debby Holgerson, N3B
Christian Maupin, N3B
Vince Rodriguez, N3B
Clark Short, N3B
Bradley Smith, N3B
Jeffrey Stevens, N3B
Troy Thomson, N3B
emla.docs@em.doe.gov
n3brecords@em-la.doe.gov
Public Reading Room (EPRR)
PRS website

**Quarterly Report for the
Discharge of Treated
Groundwater to the
Regional Aquifer under
Discharge Permit 1835,
Calendar Year 2023 Quarter 3**

Newport News Nuclear BWXT-Los Alamos, LLC (N3B), under the U.S. Department of Energy Office of Environmental Management Contract No. 89303318CEM000007 (the Los Alamos Legacy Cleanup Contract), has prepared this document. The public may copy and use this document without charge, provided that this notice and any statement of authorship are reproduced on all copies.

CONTENTS

1.0	INTRODUCTION	1
2.0	REQUIREMENTS.....	2
2.1	Influent and Discharge Volumes for the Ion-Exchange Treatment Systems (Requirement 1).....	2
2.2	Quarterly Treated Effluent Sampling Results from Each Ion-Exchange Treatment System (Requirement 2)	2
2.3	Quarterly Depth to Groundwater and Groundwater Quality Sampling Results (Requirement 3).....	3
2.4	Any Operations/Maintenance Activities Performed (Requirement 4).....	18
2.5	Any Periodic Test of Mechanical Integrity Conducted (Requirement 5).....	18
2.6	Any Replacement of Primary or Secondary IX Vessels or Associated Treatment System Infrastructure (Requirement 6)	18
2.7	Any Well Workovers Conducted (Requirement 7).....	18
2.8	Any Additional Operational Changes with the Potential to Markedly Affect the Discharge (Requirement 8)	19
2.9	Monthly Average, Maximum, and Minimum Values for Flow Rate and Volume of Treated Effluent Transferred to Each UIC Well (Requirement 9).....	19
2.10	Total Monthly Volume of Treated Effluent Transferred to Each UIC Well (Requirement 10).....	19
2.11	Monthly Average, Maximum, and Minimum Values of Injection Water Level (Pressure Head) Above Static Level for Each UIC Well (Requirement 11)	20
2.12	Daily Volume Injected at Each UIC Well (Requirement 12)	21
2.13	Daily Volume Pumped from Each Extraction Well (Requirement 13)	23
2.14	Facility Layout Map (Requirement 14).....	26
2.15	Groundwater Elevation Contour Map (Requirement 15).....	26
3.0	REFERENCES	26

Figures

Figure 2.3-1	Groundwater elevation contour map – CY 2023 Quarter 3, DP-1835	5
Figure 2.14-1	Facility layout map – CY 2023 Quarter 3, DP-1835.....	29

Tables

Table 2.1-1	Total Influent and Discharge Volumes for IX Treatment Systems – CY 2023 Quarter 3, DP-1835	2
Table 2.2-1	Analytical Results from Samples of Treated Effluent – CY 2023 Quarter 3, DP-1835.....	4
Table 2.3-1	Groundwater Elevations Summary for Groundwater Monitoring Wells – CY 2023 Quarter 3, DP-1835.....	6
Table 2.3-2	Groundwater Monitoring Wells Analytical Results Summary Table – CY 2023 Quarter 3, DP-1835	7
Table 2.4-1	Operations and Maintenance Activity Summary Table – CY 2023 Quarter 3, DP-1835.....	19
Table 2.9-1	Flows and Volumes of Treated Effluent Injected – CY 2023 Quarter 3, DP-1835	20
Table 2.11-1	Water-Level Values Above Static Level by UIC Well – CY 2023 Quarter 3, DP-1835.....	21
Table 2.12-1	Daily Injection Summary Table – CY 2023 Quarter 3, DP-1835	21
Table 2.13-1	Daily Extraction Summary Table – CY 2023 Quarter 3, DP-1835.....	24

1.0 INTRODUCTION

On August 31, 2016, the New Mexico Environment Department (NMED) issued Discharge Permit 1835 (DP-1835) to the U.S. Department of Energy (DOE) and Los Alamos National Security, LLC (LANS) for the discharge of treated groundwater to the regional aquifer through Class V underground injection control (UIC) wells (NMED 2016). On July 21, 2017, NMED approved minor updates to DP-1835 (NMED 2017a). During Quarter 2 of calendar year (CY) 2018, ownership of the discharge permit transferred from LANS to Newport News Nuclear BWXT-Los Alamos, LLC (N3B) (LANL 2018).

On June 6, 2022, NMED Groundwater Quality Bureau (GWQB) issued the “Notice of Violation, Los Alamos National Laboratory Underground Injection Control Wells, DP-1835” (NMED 2022a) to the DOE Environmental Management Los Alamos Field Office (EM-LA) based on measured concentrations of total dissolved chromium in the regional aquifer at well R-45 screen 2 that exceeded the 20.6.2.3103 New Mexico Administrative Code (NMAC) groundwater standard of 50 µg/L. EM-LA reported this exceedance to NMED-GWQB on February 26, 2021, in the “Quarterly Report for the Discharge of Treated Groundwater to the Regional Aquifer Under Discharge Permit 1835, Calendar Year 2020 Quarter 4, Class V Underground Injection Control Wells” (N3B 2021).

On September 30, 2022, EM-LA submitted the “Regional Aquifer Monitoring Well R-45 Action Plan,” (R-45 Action Plan), providing activities that EM-LA proposed for addressing chromium in the regional aquifer (N3B 2022). On December 12, 2022, NMED-GWQB provided a review of the R-45 Action Plan and direction to cease all injection of treated water authorized under DP-1835 by April 1, 2023, “until the Permittees complete the proposed corrective actions and can definitively prove through qualitative and quantitative analyses, simulations, monitoring well installation, and continued monitoring that further migration is not occurring” (NMED 2022b).

During the CY 2023 Quarter 3 reporting period for DP-1835, no treated water was injected. Monthly sampling occurred at all injection and extraction wells, with the exception of CrEX-1, which was not sampled in September due to an Uninterrupted Power Supply (UPS) battery outage caused by a lightning strike on September 9, 2023. Extracted sample water was treated through Chromium Treatment Unit A (CTUA) and held in storage tanks. The sample water will be retreated through Chromium Treatment Unit B (CTUB) and stored in the ponds for future land application.

Condition No. 10 of DP-1835 requires submission of a quarterly report to NMED by December 1 for the July 1 through September 30, discharge period. Several conditions within the permit identify information to be submitted in the quarterly report. These conditions are addressed in this report in the following requirements:

1. Influent and discharge volumes for the ion exchange (IX) treatment systems (Condition No. 10)
2. Quarterly treated-effluent sampling results from each IX treatment system (Conditions Nos. 10 and 13)
3. Quarterly depth-to-groundwater and groundwater-quality sampling results (Conditions Nos. 10 and 14)
4. Any operations/maintenance activities performed (Condition No. 10)
5. Any periodic test of mechanical integrity conducted (Condition No. 11.a)
6. Any replacement of primary or secondary IX vessels or associated treatment system infrastructure (Condition No. 11.b)

7. Any well workovers conducted (Condition No. 11.c)
8. Any additional operational changes with the potential to markedly affect the discharge (Condition No. 11.d)
9. Monthly average, maximum, and minimum values for flow rate and volume of treated effluent transferred to each UIC well (Condition No. 12.a)
10. Total monthly volume of treated effluent transferred to each UIC well (Condition No. 12.b)
11. Monthly average, maximum, and minimum values of injection water level (pressure head) above static level for each UIC well (Condition No. 12.c)
12. Daily volume injected at each UIC well (Condition No. 12.d)
13. Daily volume pumped from each extraction well (Condition No. 12.e)
14. Facility layout map (Condition No. 14)
15. Groundwater elevation contour map (Condition No. 15)

2.0 REQUIREMENTS

2.1 Influent and Discharge Volumes for the Ion-Exchange Treatment Systems (Requirement 1)

Table 2.1-1 provides the total influent volume to the IX system, and the discharge volumes from IX treatment systems CTUA, and Chromium Treatment Unit C (CTUC), during CY 2023 Quarter 3 for activities completed under DP-1835.

Table 2.1-1
Total Influent and Discharge Volumes
for IX Treatment Systems – CY 2023 Quarter 3, DP-1835

Treatment Unit	Influent Volume ^a (gal.)	Effluent Volume ^b (gal.)
CTUA	16,918	16,942
CTUC	0	0

Note: Individual flow meter accurate to $\pm 5\%$.

^a Influent volume based on extraction volumes from CrEX-1, CrEX-2, CrEX-3, and CrEX-5.

^b Effluent volume based on CTUA flow-meter readings.

2.2 Quarterly Treated Effluent Sampling Results from Each Ion-Exchange Treatment System (Requirement 2)

Analytical results from samples of treated effluent collected during CY 2023 Quarter 3 for activities completed under DP-1835 are summarized in Table 2.2-1. No sample results for total chromium or perchlorate exceeded 90% of the numeric standards of 20.6.2.3103 NMAC or, for constituents not listed in 20.6.2.3103 NMAC, 90% of the numeric screening levels established for tap water in Table A-1 of the 2022 NMED "Risk Assessment Guidance for Site Investigations and Remediation Volume 1, Soil Screening Guidance for Human Health Risk Assessments" (NMED 2022c).

The values representing 90% of the applicable standards or screening levels for these seven analytes are as follows:

- Chloride 225 mg/L
- Chromium 45 µg/L
- Fluoride 1.44 mg/L
- Nitrate 9 mg/L
- Perchlorate 12.4 µg/L
- Sulfate 540 mg/L
- Total dissolved solids 900 mg/L

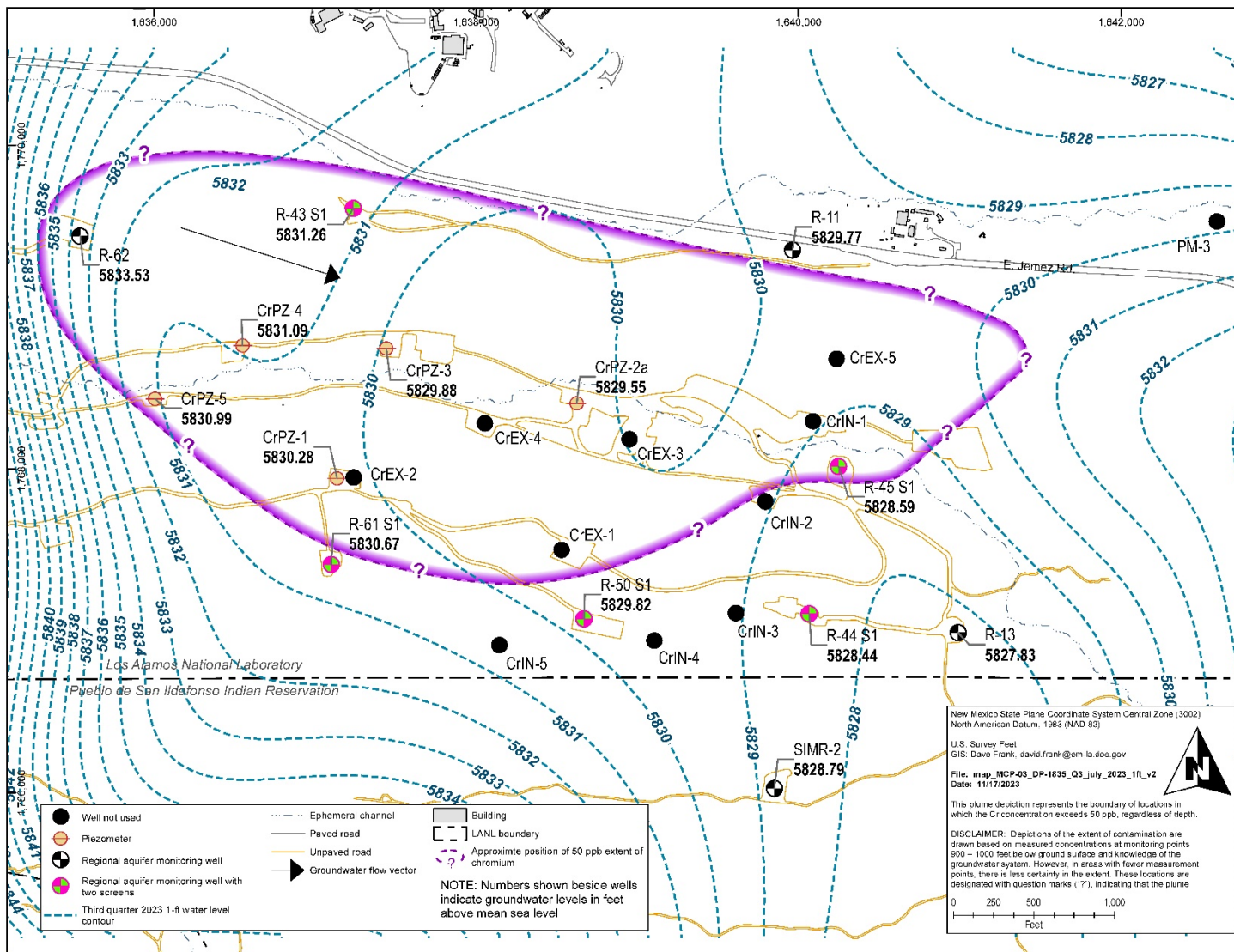
There were no effluent sample results for chloride, fluoride, nitrate, sulfate, or total dissolved solids.

2.3 Quarterly Depth to Groundwater and Groundwater Quality Sampling Results (Requirement 3)

Depth to groundwater is expressed as the elevation of the groundwater above sea level. Figure 2.3-1 is the groundwater elevation map, and Table 2.3-1 provides the quarterly groundwater elevation measurements for a nonexhaustive selection of wells. An explanation of how the groundwater elevation map was generated is provided below. Quarterly groundwater analytical results from samples collected during CY 2023 Quarter 3 for the monitoring wells listed in Condition No. 14 are summarized in Table 2.3-2. Note that some analytes reported in this table exceed their corresponding groundwater standard or screening level.

Table 2.2-1
Analytical Results from Samples of Treated Effluent – CY 2023 Quarter 3, DP-1835

Location ID	Sample ID	Sample Purpose	Sample Date	Parameter Name	Result	Report Units	90% of Standard or Screening Level	Exceeds Standard or Screening Level	Lab Qualifier	Detect Flag	Filtered	Method Detection Limit
CTUB	CrTMT-23-261608	REG	8/29/2023	Perchlorate	0.182	µg/L	12.4	N	J	Y	Y	0.05
CTUB	CrTMT-23-261608	REG	8/29/2023	Chromium	3.00	µg/L	45	N	U	N	Y	3.00
CTUB	CrTMT-23-261608	REG	8/29/2023	Nitrate-Nitrite as Nitrogen	0.0204	mg/L	9	N	J	Y	Y	0.0170



Note: Monitoring wells within and surrounding the plume are used for contour generation, including wells not presented on the map. These are CdV-R-15-3 S4, R-6, R-10a, R-15, R-21, R-34, R-35b, R-36, R-37 S2, R-51 S1, R-52 S1, R-53 S1, R-55 S1, R-56 S1, R-66, R-70 S-2, R-72 S1, and SIMR-2. With the exception of sampling events, no operations occurred at PM-3, extraction, or injection wells in July 2023.

Figure 2.3-1 Groundwater elevation contour map – CY 2023 Quarter 3, DP-1835

Table 2.3-1
Groundwater Elevations Summary for
Groundwater Monitoring Wells – CY 2023 Quarter 3, DP-1835

Monitoring Well	Groundwater Elevation ^a (ft)
CrPZ-1 (CrCH-1)	5830.28
CrPZ-2a (CrCH-2a)	5829.55 ^b
CrPZ-2b (CrCH-2b)	5829.2
CrPZ-3 (CrCH-3)	5829.88
CrPZ-4 (CrCH-4)	5831.09
CrPZ-5 (CrCH-5)	5830.99
R-11	5829.77
R-13	5827.83
R-43 S1 ^c	5831.26
R-43 S2 ^d	5830.62
R-44 S1	5828.44
R-44 S2	5828.13
R-45 S1	5828.59
R-45 S2	5828.41
R-50 S1	5829.82
R-50 S2	5829.29
R-61 S1	5830.67
R-61 S2	5830.71
R-62	5833.53
SIMR-2 ^e	5828.79

^a Groundwater elevations provided are based on average July 2023 values from transducers.

^b Not used in map generation

^c S1 = Screen 1.

^d S2 = Screen 2.

^e SIMR-2 data are reported here in accordance with the memorandum of agreement and protocol agreement between Pueblo de San Ildefonso and DOE.

Table 2.3-2
Groundwater Monitoring Wells Analytical Results Summary Table – CY 2023 Quarter 3, DP-1835

Location ID	Sample Date	Sample Purpose	Parameter Name	Report Result	Report Unit	Standard or Screening Level	Exceeds Standard or Screening Level	Lab Qualifier	Detect Flag	Filtered	Method Detection Limit
R-11	7/5/2023	REG	Chloride	3.44	mg/L	200	No	n/a ^a	Y ^b	Y ^c	0.0670
R-11	7/5/2023	REG	Chromium	5.01	µg/L	50	No	J ^d	Y	Y	3.00
R-11	7/5/2023	REG	Fluoride	0.562	mg/L	1.6	No	n/a	Y	Y	0.0330
R-11	7/5/2023	REG	Nitrate-Nitrite as Nitrogen	7.93	mg/L	10	No	n/a	Y	Y	0.170
R-11	7/5/2023	REG	Perchlorate	0.834	µg/L	13.8	No	n/a	Y	Y	0.0500
R-11	7/5/2023	REG	Sulfate	11.3	mg/L	600	No	n/a	Y	Y	0.133
R-11	7/5/2023	REG	Total Dissolved Solids	208	mg/L	1000	No	n/a	Y	Y	2.38
R-11	8/1/2023	REG	Chloride	3.32	mg/L	200	No	n/a	Y	Y	0.0670
R-11	8/1/2023	REG	Chromium	4.04	µg/L	50	No	J	Y	Y	3.00
R-11	8/1/2023	REG	Fluoride	0.395	mg/L	1.6	No	n/a	Y	Y	0.0330
R-11	8/1/2023	REG	Nitrate-Nitrite as Nitrogen	8.49	mg/L	10	No	n/a	Y	Y	0.170
R-11	8/1/2023	REG	Perchlorate	0.864	µg/L	13.8	No	n/a	Y	Y	0.0500
R-11	8/1/2023	REG	Sulfate	11.6	mg/L	600	No	n/a	Y	Y	0.133
R-11	8/1/2023	REG	Total Dissolved Solids	189	mg/L	1000	No	n/a	Y	Y	2.38
R-11	9/8/2023	REG	Chloride	3.24	mg/L	200	No	n/a	Y	Y	0.0670
R-11	9/8/2023	REG	Chromium	4.41	µg/L	50	No	J	Y	Y	3.00
R-11	9/8/2023	REG	Fluoride	0.717	mg/L	1.6	No	n/a	Y	Y	0.0330
R-11	9/8/2023	REG	Nitrate-Nitrite as Nitrogen	8.83	mg/L	10	No	n/a	Y	Y	0.425
R-11	9/8/2023	REG	Perchlorate	0.891	µg/L	13.8	No	n/a	Y	Y	0.0500
R-11	9/8/2023	REG	Sulfate	11.4	mg/L	600	No	n/a	Y	Y	0.133
R-11	9/8/2023	REG	Total Dissolved Solids	199	mg/L	1000	No	n/a	Y	Y	2.38
R-13	7/18/2023	REG	Chloride	3.38	mg/L	200	No	n/a	Y	Y	0.0670
R-13	7/18/2023	REG	Chromium	4.28	µg/L	50	No	J	Y	Y	3.00
R-13	7/18/2023	REG	Fluoride	0.404	mg/L	1.6	No	n/a	Y	Y	0.0330

Table 2.3-2 (continued)

Location ID	Sample Date	Sample Purpose	Parameter Name	Report Result	Report Unit	Standard or Screening Level	Exceeds Standard or Screening Level	Lab Qualifier	Detect Flag	Filtered	Method Detection Limit
R-13	7/18/2023	REG	Nitrate-Nitrite as Nitrogen	0.915	mg/L	10	No	n/a	Y	Y	0.0850
R-13	7/18/2023	REG	Perchlorate	0.419	µg/L	13.8	No	n/a	Y	Y	0.0500
R-13	7/18/2023	REG	Sulfate	3.95	mg/L	600	No	n/a	Y	Y	0.133
R-13	7/18/2023	REG	Total Dissolved Solids	126	mg/L	1000	No	n/a	Y	Y	2.38
R-43 S1 ^e	7/7/2023	REG	Chloride	6.20	mg/L	200	No	n/a	Y	Y	0.0670
R-43 S1	7/7/2023	FD	Chloride	6.13	mg/L	200	No	n/a	Y	Y	0.0670
R-43 S1	7/7/2023	REG	Chromium	144	µg/L	50	Yes	n/a	Y	Y	3.00
R-43 S1	7/7/2023	FD	Chromium	146	µg/L	50	Yes	n/a	Y	Y	3.00
R-43 S1	7/7/2023	REG	Fluoride	0.449	mg/L	1.6	No	n/a	Y	Y	0.0330
R-43 S1	7/7/2023	FD	Fluoride	0.440	mg/L	1.6	No	n/a	Y	Y	0.0330
R-43 S1	7/7/2023	REG	Nitrate-Nitrite as Nitrogen	4.76	mg/L	10	No	n/a	Y	Y	0.170
R-43 S1	7/7/2023	FD	Nitrate-Nitrite as Nitrogen	4.69	mg/L	10	No	n/a	Y	Y	0.170
R-43 S1	7/7/2023	REG	Perchlorate	0.693	µg/L	13.8	No	n/a	Y	Y	0.0500
R-43 S1	7/7/2023	FD	Perchlorate	0.687	µg/L	13.8	No	n/a	Y	Y	0.0500
R-43 S1	7/7/2023	REG	Sulfate	13.3	mg/L	600	No	n/a	Y	Y	0.133
R-43 S1	7/7/2023	FD	Sulfate	13.3	mg/L	600	No	n/a	Y	Y	0.133
R-43 S1	7/7/2023	REG	Total Dissolved Solids	167	mg/L	1000	No	n/a	Y	Y	2.38
R-43 S1	7/7/2023	FD	Total Dissolved Solids	171	mg/L	1000	No	n/a	Y	Y	2.38
R-43 S2 ^f	7/6/2023	REG	Chloride	6.25	mg/L	200	No	n/a	Y	Y	0.0670
R-43 S2	7/6/2023	REG	Chromium	26.5	µg/L	50	No	n/a	Y	Y	3.00
R-43 S2	7/6/2023	REG	Fluoride	0.391	mg/L	1.6	No	n/a	Y	Y	0.0330
R-43 S2	7/6/2023	REG	Nitrate-Nitrite as Nitrogen	3.57	mg/L	10	No	n/a	Y	Y	0.0850
R-43 S2	7/6/2023	REG	Perchlorate	0.835	µg/L	13.8	No	n/a	Y	Y	0.0500

Table 2.3-2 (continued)

Location ID	Sample Date	Sample Purpose	Parameter Name	Report Result	Report Unit	Standard or Screening Level	Exceeds Standard or Screening Level	Lab Qualifier	Detect Flag	Filtered	Method Detection Limit
R-43 S2	7/6/2023	REG	Sulfate	9.10	mg/L	600	No	n/a	Y	Y	0.133
R-43 S2	7/6/2023	REG	Total Dissolved Solids	166	mg/L	1000	No	n/a	Y	Y	2.38
R-44 S1	7/11/2023	REG	Chloride	21.0	mg/L	200	No	n/a	Y	Y	0.335
R-44 S1	7/11/2023	REG	Chromium	3.00	µg/L	50	No	U ^g	N ^h	Y	3.00
R-44 S1	7/11/2023	REG	Fluoride	0.139	mg/L	1.6	No	n/a	Y	Y	0.0330
R-44 S1	7/11/2023	REG	Nitrate-Nitrite as Nitrogen	2.87	mg/L	10	No	n/a	Y	Y	0.170
R-44 S1	7/11/2023	REG	Perchlorate	0.396	µg/L	13.8	No	n/a	Y	Y	0.0500
R-44 S1	7/11/2023	REG	Sulfate	19.9	mg/L	600	No	n/a	Y	Y	0.665
R-44 S1	7/11/2023	REG	Total Dissolved Solids	198	mg/L	1000	No	n/a	Y	Y	2.38
R-44 S1	8/3/2023	REG	Chloride	20.6	mg/L	200	No	n/a	Y	Y	0.335
R-44 S1	8/3/2023	REG	Chromium	3.00	µg/L	50	No	U	N	Y	3.00
R-44 S1	8/3/2023	REG	Fluoride	0.241	mg/L	1.6	No	n/a	Y	Y	0.0330
R-44 S1	8/3/2023	REG	Nitrate-Nitrite as Nitrogen	2.91	mg/L	10	No	n/a	Y	Y	0.170
R-44 S1	8/3/2023	REG	Perchlorate	0.386	µg/L	13.8	No	n/a	Y	Y	0.0500
R-44 S1	8/3/2023	REG	Sulfate	19.8	mg/L	600	No	n/a	Y	Y	0.665
R-44 S1	8/3/2023	REG	Total Dissolved Solids	183	mg/L	1000	No	n/a	Y	Y	2.38
R-44 S1	9/12/2023	REG	Chloride	20.7	mg/L	200	No	n/a	Y	Y	0.670
R-44 S1	9/12/2023	REG	Chromium	3.00	µg/L	50	No	U	N	Y	3.00
R-44 S1	9/12/2023	REG	Fluoride	0.289	mg/L	1.6	No	n/a	Y	Y	0.0330
R-44 S1	9/12/2023	REG	Nitrate-Nitrite as Nitrogen	2.82	mg/L	10	No	n/a	Y	Y	0.0850
R-44 S1	9/12/2023	REG	Perchlorate	0.397	µg/L	13.8	No	n/a	Y	Y	0.0500
R-44 S1	9/12/2023	REG	Sulfate	20.5	mg/L	600	No	n/a	Y	Y	1.33
R-44 S1	9/12/2023	REG	Total Dissolved Solids	185	mg/L	1000	No	n/a	Y	Y	2.38
R-44 S2	7/11/2023	REG	Chloride	2.60	mg/L	200	No	n/a	Y	Y	0.0670
R-44 S2	7/11/2023	REG	Chromium	6.86	µg/L	50	No	J	Y	Y	3.00

Table 2.3-2 (continued)

Location ID	Sample Date	Sample Purpose	Parameter Name	Report Result	Report Unit	Standard or Screening Level	Exceeds Standard or Screening Level	Lab Qualifier	Detect Flag	Filtered	Method Detection Limit
R-44 S2	7/11/2023	REG	Fluoride	0.329	mg/L	1.6	No	n/a	Y	Y	0.0330
R-44 S2	7/11/2023	REG	Nitrate-Nitrite as Nitrogen	0.845	mg/L	10	No	n/a	Y	Y	0.0170
R-44 S2	7/11/2023	REG	Perchlorate	0.335	µg/L	13.8	No	n/a	Y	Y	0.0500
R-44 S2	7/11/2023	REG	Sulfate	2.86	mg/L	600	No	n/a	Y	Y	0.133
R-44 S2	7/11/2023	REG	Total Dissolved Solids	133	mg/L	1000	No	n/a	Y	Y	2.38
R-44 S2	8/3/2023	REG	Chloride	2.63	mg/L	200	No	n/a	Y	Y	0.0670
R-44 S2	8/3/2023	REG	Chromium	7.28	µg/L	50	No	J	Y	Y	3.00
R-44 S2	8/3/2023	REG	Fluoride	0.369	mg/L	1.6	No	n/a	Y	Y	0.0330
R-44 S2	8/3/2023	REG	Nitrate-Nitrite as Nitrogen	0.925	mg/L	10	No	n/a	Y	Y	0.0850
R-44 S2	8/3/2023	REG	Perchlorate	0.340	µg/L	13.8	No	n/a	Y	Y	0.0500
R-44 S2	8/3/2023	REG	Sulfate	2.86	mg/L	600	No	n/a	Y	Y	0.133
R-44 S2	8/3/2023	REG	Total Dissolved Solids	117	mg/L	1000	No	n/a	Y	Y	2.38
R-44 S2	9/12/2023	REG	Chloride	2.60	mg/L	200	No	n/a	Y	Y	0.0670
R-44 S2	9/12/2023	REG	Chromium	7.54	µg/L	50	No	J	Y	Y	3.00
R-44 S2	9/12/2023	REG	Fluoride	0.372	mg/L	1.6	No	n/a	Y	Y	0.0330
R-44 S2	9/12/2023	REG	Nitrate-Nitrite as Nitrogen	0.866	mg/L	10	No	n/a	Y	Y	0.0170
R-44 S2	9/12/2023	REG	Perchlorate	0.337	µg/L	13.8	No	n/a	Y	Y	0.0500
R-44 S2	9/12/2023	REG	Sulfate	2.92	mg/L	600	No	n/a	Y	Y	0.133
R-44 S2	9/12/2023	REG	Total Dissolved Solids	110	mg/L	1000	No	n/a	Y	Y	2.38
R-45 S1	7/20/2023	REG	Chloride	6.30	mg/L	200	No	n/a	Y	Y	0.335
R-45 S1	7/20/2023	REG	Chromium	3.03	µg/L	50	No	J	Y	Y	3.00
R-45 S1	7/20/2023	REG	Fluoride	0.358	mg/L	1.6	No	n/a	Y	Y	0.0330
R-45 S1	7/20/2023	REG	Nitrate-Nitrite as Nitrogen	3.07	mg/L	10	No	n/a	Y	Y	0.170
R-45 S1	7/20/2023	REG	Perchlorate	0.410	µg/L	13.8	No	n/a	Y	Y	0.0500
R-45 S1	7/20/2023	REG	Sulfate	5.75	mg/L	600	No	n/a	Y	Y	0.665

Table 2.3-2 (continued)

Location ID	Sample Date	Sample Purpose	Parameter Name	Report Result	Report Unit	Standard or Screening Level	Exceeds Standard or Screening Level	Lab Qualifier	Detect Flag	Filtered	Method Detection Limit
R-45 S1	7/20/2023	REG	Total Dissolved Solids	196	mg/L	1000	No	n/a	Y	Y	2.38
R-45 S1	8/2/2023	REG	Chloride	20.5	mg/L	200	No	n/a	Y	Y	0.335
R-45 S1	8/2/2023	REG	Chromium	4.19	µg/L	50	No	J	Y	Y	3.00
R-45 S1	8/2/2023	REG	Fluoride	0.324	mg/L	1.6	No	n/a	Y	Y	0.0330
R-45 S1	8/2/2023	REG	Nitrate-Nitrite as Nitrogen	3.13	mg/L	10	No	n/a	Y	Y	0.170
R-45 S1	8/2/2023	REG	Perchlorate	0.380	µg/L	13.8	No	n/a	Y	Y	0.0500
R-45 S1	8/2/2023	REG	Sulfate	19.5	mg/L	600	No	n/a	Y	Y	0.665
R-45 S1	8/2/2023	REG	Total Dissolved Solids	200	mg/L	1000	No	n/a	Y	Y	2.38
R-45 S2	7/20/2023	REG	Chloride	7.04	mg/L	200	No	n/a	Y	Y	0.0670
R-45 S2	7/20/2023	REG	Chromium	54.9	µg/L	50	Yes	n/a	Y	Y	3.00
R-45 S2	7/20/2023	REG	Fluoride	0.453	mg/L	1.6	No	n/a	Y	Y	0.0330
R-45 S2	7/20/2023	REG	Nitrate-Nitrite as Nitrogen	1.31	mg/L	10	No	n/a	Y	Y	0.0850
R-45 S2	7/20/2023	REG	Perchlorate	0.463	µg/L	13.8	No	n/a	Y	Y	0.0500
R-45 S2	7/20/2023	REG	Sulfate	8.49	mg/L	600	No	n/a	Y	Y	0.133
R-45 S2	7/20/2023	REG	Total Dissolved Solids	159	mg/L	1000	No	n/a	Y	Y	2.38
R-45 S2	8/2/2023	REG	Chloride	7.24	mg/L	200	No	n/a	Y	Y	0.0670
R-45 S2	8/2/2023	REG	Chromium	57.5	µg/L	50	Yes	n/a	Y	Y	3.00
R-45 S2	8/2/2023	REG	Fluoride	0.609	mg/L	1.6	No	n/a	Y	Y	0.0330
R-45 S2	8/2/2023	REG	Nitrate-Nitrite as Nitrogen	1.40	mg/L	10	No	n/a	Y	Y	0.0850
R-45 S2	8/2/2023	REG	Perchlorate	0.414	µg/L	13.8	No	n/a	Y	Y	0.0500
R-45 S2	8/2/2023	REG	Sulfate	8.52	mg/L	600	No	n/a	Y	Y	0.133
R-45 S2	8/2/2023	REG	Total Dissolved Solids	142	mg/L	1000	No	n/a	Y	Y	2.38
R-50 S1	7/11/2023	REG	Chloride	21.9	mg/L	200	No	n/a	Y	Y	0.335
R-50 S1	7/11/2023	REG	Chromium	6.36	µg/L	50	No	J	Y	Y	3.00
R-50 S1	7/11/2023	REG	Fluoride	0.179	mg/L	1.6	No	n/a	Y	Y	0.0330

Table 2.3-2 (continued)

Location ID	Sample Date	Sample Purpose	Parameter Name	Report Result	Report Unit	Standard or Screening Level	Exceeds Standard or Screening Level	Lab Qualifier	Detect Flag	Filtered	Method Detection Limit
R-50 S1	7/11/2023	REG	Nitrate-Nitrite as Nitrogen	3.05	mg/L	10	No	n/a	Y	Y	0.170
R-50 S1	7/11/2023	REG	Perchlorate	0.442	µg/L	13.8	No	n/a	Y	Y	0.0500
R-50 S1	7/11/2023	REG	Sulfate	20.9	mg/L	600	No	n/a	Y	Y	0.665
R-50 S1	7/11/2023	REG	Total Dissolved Solids	212	mg/L	1000	No	n/a	Y	Y	2.38
R-50 S1	8/2/2023	REG	Chloride	22.2	mg/L	200	No	n/a	Y	Y	0.335
R-50 S1	8/2/2023	REG	Chromium	7.80	µg/L	50	No	J	Y	Y	3.00
R-50 S1	8/2/2023	REG	Fluoride	0.295	mg/L	1.6	No	n/a	Y	Y	0.0330
R-50 S1	8/2/2023	REG	Nitrate-Nitrite as Nitrogen	3.02	mg/L	10	No	n/a	Y	Y	0.0850
R-50 S1	8/2/2023	REG	Perchlorate	0.492	µg/L	13.8	No	n/a	Y	Y	0.0500
R-50 S1	8/2/2023	REG	Sulfate	20.8	mg/L	600	No	n/a	Y	Y	0.665
R-50 S1	8/2/2023	REG	Total Dissolved Solids	190	mg/L	1000	No	n/a	Y	Y	2.38
R-50 S2	7/11/2023	REG	Chloride	2.19	mg/L	200	No	n/a	Y	Y	0.0670
R-50 S2	7/11/2023	REG	Chromium	4.16	µg/L	50	No	J	Y	Y	3.00
R-50 S2	7/11/2023	REG	Fluoride	0.359	mg/L	1.6	No	n/a	Y	Y	0.0330
R-50 S2	7/11/2023	REG	Nitrate-Nitrite as Nitrogen	0.614	mg/L	10	No	n/a	Y	Y	0.0170
R-50 S2	7/11/2023	REG	Perchlorate	0.331	µg/L	13.8	No	n/a	Y	Y	0.0500
R-50 S2	7/11/2023	REG	Sulfate	2.56	mg/L	600	No	n/a	Y	Y	0.133
R-50 S2	7/11/2023	REG	Total Dissolved Solids	128	mg/L	1000	No	n/a	Y	Y	2.38
R-50 S2	8/2/2023	REG	Chloride	2.20	mg/L	200	No	n/a	Y	Y	0.0670
R-50 S2	8/2/2023	REG	Chromium	4.14	µg/L	50	No	J	Y	Y	3.00
R-50 S2	8/2/2023	REG	Fluoride	0.587	mg/L	1.6	No	n/a	Y	Y	0.0330
R-50 S2	8/2/2023	REG	Nitrate-Nitrite as Nitrogen	0.620	mg/L	10	No	n/a	Y	Y	0.0170
R-50 S2	8/2/2023	REG	Perchlorate	0.355	µg/L	13.8	No	n/a	Y	Y	0.0500
R-50 S2	8/2/2023	REG	Sulfate	2.53	mg/L	600	No	n/a	Y	Y	0.133
R-50 S2	8/2/2023	REG	Total Dissolved Solids	119	mg/L	1000	No	n/a	Y	Y	2.38

Table 2.3-2 (continued)

Location ID	Sample Date	Sample Purpose	Parameter Name	Report Result	Report Unit	Standard or Screening Level	Exceeds Standard or Screening Level	Lab Qualifier	Detect Flag	Filtered	Method Detection Limit
R-61 S1	7/17/2023	REG	Chloride	4.64	mg/L	200	No	n/a	Y	Y	0.0670
R-61 S1	7/17/2023	REG	Chromium	57.4	µg/L	50	Yes	n/a	Y	Y	3.00
R-61 S1	7/17/2023	REG	Fluoride	0.387	mg/L	1.6	No	n/a	Y	Y	0.0330
R-61 S1	7/17/2023	REG	Nitrate-Nitrite as Nitrogen	2.43	mg/L	10	No	n/a	Y	Y	0.0850
R-61 S1	7/17/2023	REG	Perchlorate	12.2	µg/L	13.8	No	n/a	Y	Y	0.100
R-61 S1	7/17/2023	REG	Sulfate	8.07	mg/L	600	No	n/a	Y	Y	0.133
R-61 S1	7/17/2023	REG	Total Dissolved Solids	141	mg/L	1000	No	n/a	Y	Y	2.38
R-61 S1	8/1/2023	REG	Chloride	4.93	mg/L	200	No	n/a	Y	Y	0.0670
R-61 S1	8/1/2023	REG	Chromium	56.0	µg/L	50	Yes	n/a	Y	Y	3.00
R-61 S1	8/1/2023	REG	Fluoride	0.266	mg/L	1.6	No	n/a	Y	Y	0.0330
R-61 S1	8/1/2023	REG	Nitrate-Nitrite as Nitrogen	2.50	mg/L	10	No	n/a	Y	Y	0.170
R-61 S1	8/1/2023	REG	Perchlorate	12.1	µg/L	13.8	No	n/a	Y	Y	0.100
R-61 S1	8/1/2023	REG	Sulfate	8.60	mg/L	600	No	n/a	Y	Y	0.133
R-61 S1	8/1/2023	REG	Total Dissolved Solids	131	mg/L	1000	No	n/a	Y	Y	2.38
R-61 S1	9/8/2023	REG	Chloride	5.12	mg/L	200	No	n/a	Y	Y	0.0670
R-61 S1	9/8/2023	REG	Chromium	69.4	µg/L	50	Yes	n/a	Y	Y	3.00
R-61 S1	9/8/2023	REG	Fluoride	0.586	mg/L	1.6	No	n/a	Y	Y	0.0330
R-61 S1	9/8/2023	REG	Nitrate-Nitrite as Nitrogen	2.52	mg/L	10	No	n/a	Y	Y	0.0850
R-61 S1	9/8/2023	REG	Perchlorate	12.6	µg/L	13.8	No	n/a	Y	Y	0.100
R-61 S1	9/8/2023	REG	Sulfate	8.73	mg/L	600	No	n/a	Y	Y	0.133
R-61 S1	9/8/2023	REG	Total Dissolved Solids	131	mg/L	1000	No	n/a	Y	Y	2.38
R-62	7/6/2023	REG	Chloride	13.5	mg/L	200	No	n/a	Y	Y	0.335
R-62	7/6/2023	FD	Chloride	13.9	mg/L	200	No	n/a	Y	Y	0.335
R-62	7/6/2023	REG	Chromium	225	µg/L	50	Yes	n/a	Y	Y	3.00
R-62	7/6/2023	FD	Chromium	224	µg/L	50	Yes	n/a	Y	Y	3.00

Table 2.3-2 (continued)

Location ID	Sample Date	Sample Purpose	Parameter Name	Report Result	Report Unit	Standard or Screening Level	Exceeds Standard or Screening Level	Lab Qualifier	Detect Flag	Filtered	Method Detection Limit
R-62	7/6/2023	REG	Fluoride	0.251	mg/L	1.6	No	n/a	Y	Y	0.0330
R-62	7/6/2023	FD	Fluoride	0.250	mg/L	1.6	No	n/a	Y	Y	0.0330
R-62	7/6/2023	REG	Nitrate-Nitrite as Nitrogen	1.90	mg/L	10	No	n/a	Y	Y	0.0850
R-62	7/6/2023	FD	Nitrate-Nitrite as Nitrogen	1.86	mg/L	10	No	n/a	Y	Y	0.0850
R-62	7/6/2023	REG	Perchlorate	0.909	µg/L	13.8	No	n/a	Y	Y	0.0500
R-62	7/6/2023	FD	Perchlorate	0.902	µg/L	13.8	No	n/a	Y	Y	0.0500
R-62	7/6/2023	REG	Sulfate	23.6	mg/L	600	No	n/a	Y	Y	0.665
R-62	7/6/2023	FD	Sulfate	24.2	mg/L	600	No	n/a	Y	Y	0.665
R-62	7/6/2023	REG	Total Dissolved Solids	189	mg/L	1000	No	n/a	Y	Y	2.38
R-62	7/6/2023	FD	Total Dissolved Solids	184	mg/L	1000	No	n/a	Y	Y	2.38
SIMR-2	7/13/2023	REG	Chloride	2.11	mg/L	200	No	n/a	Y	Y	0.0670
SIMR-2	7/13/2023	REG	Chromium	5.45	µg/L	50	No	J	Y	Y	3.00
SIMR-2	7/13/2023	REG	Fluoride	0.358	mg/L	1.6	No	n/a	Y	Y	0.0330
SIMR-2	7/13/2023	REG	Nitrate-Nitrite as Nitrogen	0.841	mg/L	10	No	n/a	Y	Y	0.0170
SIMR-2	7/13/2023	REG	Perchlorate	0.619	µg/L	13.8	No	n/a	Y	Y	0.0500
SIMR-2	7/13/2023	REG	Sulfate	2.71	mg/L	600	No	n/a	Y	Y	0.133
SIMR-2	7/13/2023	REG	Total Dissolved Solids	114	mg/L	1000	No	n/a	Y	Y	2.38
SIMR-2	8/10/2023	REG	Chloride	2.11	mg/L	200	No	n/a	Y	Y	0.0670
SIMR-2	8/10/2023	REG	Chromium	5.37	µg/L	50	No	J	Y	Y	3.00
SIMR-2	8/10/2023	REG	Fluoride	0.348	mg/L	1.6	No	n/a	Y	Y	0.0330
SIMR-2	8/10/2023	REG	Nitrate-Nitrite as Nitrogen	0.825	mg/L	10	No	n/a	Y	Y	0.0170
SIMR-2	8/10/2023	REG	Perchlorate	0.628	µg/L	13.8	No	n/a	Y	Y	0.0500
SIMR-2	8/10/2023	REG	Sulfate	2.74	mg/L	600	No	n/a	Y	Y	0.133
SIMR-2	8/10/2023	REG	Total Dissolved Solids	123	mg/L	1000	No	n/a	Y	Y	2.38
SIMR-2	9/14/2023	REG	Chloride	2.27	mg/L	200	No	n/a	Y	Y	0.0670

Table 2.3-2 (continued)

Location ID	Sample Date	Sample Purpose	Parameter Name	Report Result	Report Unit	Standard or Screening Level	Exceeds Standard or Screening Level	Lab Qualifier	Detect Flag	Filtered	Method Detection Limit
SIMR-2	9/14/2023	REG	Chromium	5.46	µg/L	50	No	J	Y	Y	3.00
SIMR-2	9/14/2023	REG	Fluoride	0.367	mg/L	1.6	No	n/a	Y	Y	0.0330
SIMR-2	9/14/2023	REG	Nitrate-Nitrite as Nitrogen	0.830	mg/L	10	No	n/a	Y	Y	0.0850
SIMR-2	9/14/2023	REG	Perchlorate	0.633	µg/L	13.8	No	n/a	Y	Y	0.0500
SIMR-2	9/14/2023	REG	Sulfate	2.85	mg/L	600	No	n/a	Y	Y	0.133
SIMR-2	9/14/2023	REG	Total Dissolved Solids	98.0	mg/L	1000	No	n/a	Y	Y	2.38

^a n/a = Not applicable: no qualifiers applied.

^b In the Detect Flag column, Y = detected.

^c In the Filtered column, Y = filtered.

^d J = Analyte is classified as estimated.

^e S1 = Screen 1.

^f S2 = Screen 2.

^g U = Analyte is classified as not detected.

^h In the Detect Flag column, N = not detected

Sample results for chloride, perchlorate, total chromium, fluoride, nitrate, sulfate, and total dissolved solids are compared with numeric standards of 20.6.2.3103 NMAC or, for constituents not listed in 20.6.2.3103 NMAC, the numeric screening levels established for tap water in Table A-1 of the 2022 NMED “Risk Assessment Guidance for Site Investigations and Remediation Volume 1, Soil Screening Guidance for Human Health Risk Assessments” (NMED 2022c). The values of the applicable standards or screening levels for these seven analytes follow:

- Chloride 250 mg/L
- Perchlorate 13.8 µg/L
- Chromium 50 µg/L
- Fluoride 1.6 mg/L
- Nitrate 10 mg/L
- Sulfate 600 mg/L
- Total dissolved solids 1000 mg/L

The regional aquifer beneath the Pajarito Plateau, on which Los Alamos National Laboratory (LANL or the Laboratory) is situated, is a complex hydrogeological system. The shape of the regional water table is predominantly controlled by the areas of recharge to the west (the flanks of the Sierra de los Valles and the Pajarito fault zone) and discharge to the east (the Rio Grande and the White Rock Canyon Springs). At a more local scale, such as within the plume area, the structure of the regional water table and groundwater flow is also expected to be influenced by:

- local infiltration zones and recharge areas (e.g., beneath canyons),
- heterogeneity and anisotropy in the aquifer properties, and
- extraction and injection locations (municipal water-supply wells and chromium interim measure [IM] extraction/injection wells).

Long-term water-level data, contaminant transport observations (travel times and direction of migration), and calibrated model results suggest that the water table was relatively flat in the area of the chromium plume before the implementation of CrEX extraction and CrIN injection wells. Steeper gradients are found to the west, because of the mountain-front recharge, and to the east toward the Rio Grande. The low ambient gradient in the chromium plume area could be related to any or all of the following:

- the relatively high permeability of the Puye Formation and Miocene pumiceous sediments
- anisotropy of the regional aquifer
- localized recharge along the canyons above the regional aquifer, faults, or other lineaments that affect regional-scale hydraulic conductivity
- nearby water-supply pumping

Although it is difficult to infer absolute groundwater flow directions from the relatively flat contours in the chromium plume area, the general flow of groundwater can be determined. Groundwater elevation data and contaminant transport observations indicated that, before operation of the IM, the groundwater flowed generally toward the east-southeast. When the IM was in operation, the groundwater flowed generally towards the southeast, with the influence of IM operations being seen mainly in the vicinity of the extraction wells. Local flow direction near these wells was inward, as influenced by the extraction-induced

depression in potentiometric surface when extraction wells were in operation. With the IM inactive, flow directions appear to be reverting to prior conditions.

Water-table elevations in the chromium plume area can vary temporally as a result of transient effects that include injection into, and extraction from, the chromium IM infrastructure wells, and pumping of Los Alamos County's water-supply wells. This is discussed below for the case of CY 2023 Quarter 3.

A long-term decline of approximately 0.2 to 0.5 ft/yr in the regional water levels has been observed throughout the aquifer beneath the Pajarito Plateau. The decline could be caused by long-term changes in the aquifer recharge and discharge conditions. Because of the long-term declines and pumping transience described above, the water-level data and the respective water-table contour maps are variable over time; each map therefore represents a specific period of time. Figure 2.3-1 depicts the average water-level data and water-table contours for July 2023. General regional flow direction is indicated by the arrow.

To generate this quarterly contour map, average water levels are calculated using values from the first month of the three-month reporting period. Monitoring wells within and surrounding the plume are used, including wells not presented on the map or in Table 2.3-1. These locations are CdV-R-15-3 S4, R-6, R-10a, R-15, R-21, R-34, R-35b, R-36, R-37 S2, R-51 S1, R-52 S1, R-53 S1, R-55 S1, R-56 S1, R-66, R-70 S-2, R-72 S1, and SIMR-2. Water levels in wells surrounding the plume provide useful control points for contouring along the edges of the area of interest for this report. R-36 was used for contouring; however, water levels are anomalously high, and may represent a localized condition.

Common interpolation methods for water-table data from a complex heterogeneous site could produce maps that do not represent physically realistic hydrological systems. This water-table map is contoured by incorporating process knowledge of groundwater hydraulics (e.g., flownet conformity rules) as well as conceptual models of groundwater flow in the project area as described above. Key inputs to the conceptual model include knowledge of long-term operations of extraction and injection wells, water-level elevations in monitoring wells near extraction and injection points, and cross-hole tracer data between injection wells and monitoring wells.

In 2018 and 2019, water-table maps for DP-1835 were generated using an interpolation method called Thin-Plate Spline (TPS) (e.g., <https://www.jstor.org/stable/2241837>). TPS is a special case of universal kriging. In 2020, an interpolation method called Bayesian Canonical Correlation Regression (BCCR) (Carson et al. 2020) was implemented. BCCR increased efficiency of map-making by using prior knowledge of water levels to generate an initial water-table map of the expected surface given quarterly water levels. Kriging was then used to update the map using residuals between the water levels and the expected surface for a given quarter. In CY 2023 Quarter 2, the interpolation method reverted to TPS. This change was made because of the greater representation of TPS in the scientific literature. Maps generated with the two methods are analogous because both methods use kriging-based interpolation; the primary difference between the two methods is the incorporation of prior information as an initial estimate of water levels.

Because of the spatial coverage of wells and piezometers, and the regional structure of significantly steeper gradients to the east and west of the chromium plume area, surrounding wells (e.g., R-21, R-31, R-32, R-37, and R-40) and control points based on expert opinion are used to provide estimated water-level elevations in areas that do not have sufficient data to provide constraints. As additional analysis is performed using historical and developing data sets from existing wells and data that will be collected from proposed wells, the use of these control points is being reanalyzed, adjusted, or discontinued. The reanalysis is based on additional supporting data and contouring methods.

Over the course of operating the chromium IM system, changes to water-table elevations occur depending upon how the system has been operating. A quarter-by-quarter account of the water-table elevations is not provided as part of this quarterly report. Each quarterly report previously submitted provides information on the water-table elevation near the chromium IM wells along with possible causes for water-level variations for that specific quarter. Information on the quarterly depth to groundwater for CY 2023 Quarter 3 is provided below.

In the current reporting period of CY 2023 Quarter 3, no IM injection occurred, and extraction was limited to brief sampling events. No closed contour is present in the central area of the map. A closed contour was evident in the previous quarter (2023 Q2), but it was not present in the two quarters before that (2023 Q1 and 2022 Q4). In the central area, the presence of a closed contour is dependent on the relationship between CrPZ-2 water levels and water levels at nearby wells. For the current quarter of 2023 Q3, well R-50 was within 0.2 ft of CrPZ-2, which is sufficiently near to pull the 5829 ft contour toward the south. The absence of a closed contour at a water level lower than surroundings indicates that water may flow out of the central area of the chromium plume.

2.4 Any Operations/Maintenance Activities Performed (Requirement 4)

During the CY 2023 Quarter 3 reporting period for DP-1835, no treated water was injected. Monthly sampling occurred at injection and extraction wells, and the extracted water was treated through CTUA and held in storage tanks. The sample water will be retreated through CTUB and stored in the ponds for future land application.

Operations and maintenance activities completed during CY 2023 Quarter 3 are listed in Table 2.4-1 for the extraction, treatment, and injection system.

2.5 Any Periodic Test of Mechanical Integrity Conducted (Requirement 5)

Periodic testing of mechanical integrity was not conducted or reported to NMED during CY 2023 Quarter 3. Mechanical integrity testing was performed and reported to NMED during the CY 2019 Quarter 4 reporting period. In accordance with Condition No. 3, mechanical integrity testing will occur at least once every 5 yr unless a UIC well is reconfigured. Under this scenario, a mechanical integrity test before reinjection of treated effluent at a specific reconfigured well will be completed pursuant to Condition No. 3.

2.6 Any Replacement of Primary or Secondary IX Vessels or Associated Treatment System Infrastructure (Requirement 6)

No replacement of vessels occurred during CY 2023 Quarter 3.

2.7 Any Well Workovers Conducted (Requirement 7)

No well workovers were conducted during CY 2023 Quarter 3.

Table 2.4-1
Operations and Maintenance Activity Summary Table – CY 2023 Quarter 3, DP-1835

Maintenance Date	Elements Impacted	Operation/Maintenance Description
7/1/23 through 7/17/23	All extraction and injection wells, CTUA, CTUC	Extraction, treatment, and injection of treated groundwater suspended per NMED direction.
7/18/23 through 7/20/23	All extraction and injection wells, CTUA	Monthly sampling of all extraction and injection wells. Injection of treated groundwater suspended per NMED direction.
7/21/23 through 7/31/23	All extraction and injection wells, CTUA, CTUC	Extraction, treatment, and injection of treated groundwater suspended per NMED direction.
8/1/23 through 8/8/23	All extraction and injection wells, CTUA, CTUC	Extraction, treatment, and injection of treated groundwater suspended per NMED direction.
8/9/23	CTUA, CTUC	All influent and effluent filter bags replaced.
8/10/23 through 8/20/23	All extraction and injection wells, CTUA, CTUC	Extraction, treatment, and injection of treated groundwater suspended per NMED direction.
8/21/23 through 8/23/23	All extraction and injection wells, CTUA	Monthly sampling of all extraction and injection wells. Injection of treated groundwater suspended per NMED direction.
8/24/23 through 8/31/23	All extraction and injection wells, CTUA, CTUC	Extraction, treatment, and injection of treated groundwater suspended per NMED direction.
9/1/23 through 9/17/23	All extraction and injection wells, CTUA, CTUC	Extraction, treatment, and injection of treated groundwater suspended per NMED direction.
9/18/23 through 9/20/23	All extraction and injection wells, CTUA	Monthly sampling of extraction and injection wells. CrEX-1 and CrIN-5 were not sampled. Lightning strike on September 9, 2023 damaged CrEX-1 and CrIN-5 UPS and CrIN-5 pump starter. Injection of treated groundwater suspended per NMED direction.
9/21/23 through 9/30/23	All extraction and injection wells, CTUA, CTUC	Extraction, treatment, and injection of treated groundwater suspended per NMED direction.

2.8 Any Additional Operational Changes with the Potential to Markedly Affect the Discharge (Requirement 8)

During the reporting period, the pilot-scale molasses amendment and sodium dithionite amendment studies (NMED 2017b) did not occur because only sample water was treated during CY 2023 Quarter 3.

2.9 Monthly Average, Maximum, and Minimum Values for Flow Rate and Volume of Treated Effluent Transferred to Each UIC Well (Requirement 9)

Table 2.9-1 provides the monthly average, maximum, and minimum values for flow rate and volume of treated effluent transferred to each well in CY 2023 Quarter 3.

2.10 Total Monthly Volume of Treated Effluent Transferred to Each UIC Well (Requirement 10)

Table 2.9-1 provides total monthly volumes of treated effluent transferred to each well. No injection occurred at UIC wells during CY 2023 Quarter 3.

2.11 Monthly Average, Maximum, and Minimum Values of Injection Water Level (Pressure Head) Above Static Level for Each UIC Well (Requirement 11)

Table 2.11-1 provides the monthly average, maximum, and minimum values for injection water level above static level for each UIC well.

Table 2.9-1
Flows and Volumes of Treated Effluent Injected – CY 2023 Quarter 3, DP-1835

Injection Well	Flow rate (gpm ^a)			Daily Volume (gal.)			Total Volume (gal.)
	Average ^b	Maximum	Minimum ^c	Average	Maximum	Minimum	
July 2023							
CrIN-1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CrIN-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CrIN-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CrIN-4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CrIN-5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
August 2023							
CrIN-1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CrIN-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CrIN-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CrIN-4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CrIN-5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
September 2023							
CrIN-1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CrIN-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CrIN-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CrIN-4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CrIN-5	0.0	0.0	0.0	0.0	0.0	0.0	0.0

^a gpm = Gallons per minute.

^b Average values provide represent arithmetic mean of daily values during periods when injection of treated groundwater was occurring. All injection of treated water authorized under the DP-1835 was ceased by April 1, 2023.

^c Minimum values represent the minimum daily value recorded during days when pumping occurred.

Table 2.11-1
Water-Level Values Above Static Level by UIC Well – CY 2023 Quarter 3, DP-1835

UIC Well	July 2023			August 2023			September 2023		
	Average ^a (ft)	Maximum (ft)	Minimum (ft)	Average (ft)	Maximum (ft)	Minimum (ft)	Average (ft)	Maximum (ft)	Minimum (ft)
CrIN-1	n/a ^b	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
CrIN-2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
CrIN-3	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
CrIN-4	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
CrIN-5	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

^a Average values provide represent arithmetic mean of daily values during periods when injection of treated groundwater was occurring. All injection of treated water authorized under the DP-1835 was ceased by April 1, 2023.

^b n/a = Not applicable; treated groundwater was not injected during the month at this location.

2.12 Daily Volume Injected at Each UIC Well (Requirement 12)

Daily volumes of groundwater injected (following treatment) during CY 2023 Quarter 2 are presented in Table 2.12-1.

Table 2.12-1
Daily Injection Summary Table – CY 2023 Quarter 3, DP-1835

Date	CrIN-1 (gal.)	CrIN-2 (gal.)	CrIN-3 (gal.)	CrIN-4 (gal.)	CrIN-5 (gal.)	Total (gal.)
7/1/2023	0	0	0	0	0	0
7/2/2023	0	0	0	0	0	0
7/3/2023	0	0	0	0	0	0
7/4/2023	0	0	0	0	0	0
7/5/2023	0	0	0	0	0	0
7/6/2023	0	0	0	0	0	0
7/7/2023	0	0	0	0	0	0
7/8/2023	0	0	0	0	0	0
7/9/2023	0	0	0	0	0	0
7/10/2023	0	0	0	0	0	0
7/11/2023	0	0	0	0	0	0
7/12/2023	0	0	0	0	0	0
7/13/2023	0	0	0	0	0	0
7/14/2023	0	0	0	0	0	0
7/15/2023	0	0	0	0	0	0
7/16/2023	0	0	0	0	0	0
7/17/2023	0	0	0	0	0	0
7/18/2023	0	0	0	0	0	0
7/19/2023	0	0	0	0	0	0
7/20/2023	0	0	0	0	0	0

Table 2.12-1 (continued)

Date	CrIN-1 (gal.)	CrIN-2 (gal.)	CrIN-3 (gal.)	CrIN-4 (gal.)	CrIN-5 (gal.)	Total (gal.)
7/21/2023	0	0	0	0	0	0
7/22/2023	0	0	0	0	0	0
7/23/2023	0	0	0	0	0	0
7/24/2023	0	0	0	0	0	0
7/25/2023	0	0	0	0	0	0
7/26/2023	0	0	0	0	0	0
7/27/2023	0	0	0	0	0	0
7/28/2023	0	0	0	0	0	0
7/29/2023	0	0	0	0	0	0
7/30/2023	0	0	0	0	0	0
7/31/2023	0	0	0	0	0	0
8/1/2023	0	0	0	0	0	0
8/2/2023	0	0	0	0	0	0
8/3/2023	0	0	0	0	0	0
8/4/2023	0	0	0	0	0	0
8/5/2023	0	0	0	0	0	0
8/6/2023	0	0	0	0	0	0
8/7/2023	0	0	0	0	0	0
8/8/2023	0	0	0	0	0	0
8/9/2023	0	0	0	0	0	0
8/10/2023	0	0	0	0	0	0
8/11/2023	0	0	0	0	0	0
8/12/2023	0	0	0	0	0	0
8/13/2023	0	0	0	0	0	0
8/14/2023	0	0	0	0	0	0
8/15/2023	0	0	0	0	0	0
8/16/2023	0	0	0	0	0	0
8/17/2023	0	0	0	0	0	0
8/18/2023	0	0	0	0	0	0
8/19/2023	0	0	0	0	0	0
8/20/2023	0	0	0	0	0	0
8/21/2023	0	0	0	0	0	0
8/22/2023	0	0	0	0	0	0
8/23/2023	0	0	0	0	0	0
8/24/2023	0	0	0	0	0	0
8/25/2023	0	0	0	0	0	0
8/26/2023	0	0	0	0	0	0
8/27/2023	0	0	0	0	0	0
8/28/2023	0	0	0	0	0	0

Table 2.12-1 (continued)

Date	CrIN-1 (gal.)	CrIN-2 (gal.)	CrIN-3 (gal.)	CrIN-4 (gal.)	CrIN-5 (gal.)	Total (gal.)
8/29/2023	0	0	0	0	0	0
8/30/2023	0	0	0	0	0	0
8/31/2023	0	0	0	0	0	0
9/1/2023	0	0	0	0	0	0
9/2/2023	0	0	0	0	0	0
9/3/2023	0	0	0	0	0	0
9/4/2023	0	0	0	0	0	0
9/5/2023	0	0	0	0	0	0
9/6/2023	0	0	0	0	0	0
9/7/2023	0	0	0	0	0	0
9/8/2023	0	0	0	0	0	0
9/9/2023	0	0	0	0	0	0
9/10/2023	0	0	0	0	0	0
9/11/2023	0	0	0	0	0	0
9/12/2023	0	0	0	0	0	0
9/13/2023	0	0	0	0	0	0
9/14/2023	0	0	0	0	0	0
9/15/2023	0	0	0	0	0	0
9/16/2023	0	0	0	0	0	0
9/17/2023	0	0	0	0	0	0
9/18/2023	0	0	0	0	0	0
9/19/2023	0	0	0	0	0	0
9/20/2023	0	0	0	0	0	0
9/21/2023	0	0	0	0	0	0
9/22/2023	0	0	0	0	0	0
9/23/2023	0	0	0	0	0	0
9/24/2023	0	0	0	0	0	0
9/25/2023	0	0	0	0	0	0
9/26/2023	0	0	0	0	0	0
9/27/2023	0	0	0	0	0	0
9/28/2023	0	0	0	0	0	0
9/29/2023	0	0	0	0	0	0
9/30/2023	0	0	0	0	0	0
Total						0

2.13 Daily Volume Pumped from Each Extraction Well (Requirement 13)

Daily volumes of groundwater pumped from extraction wells during 2023 Quarter 3 are presented in Table 2.13-1.

Table 2.13-1
Daily Extraction Summary Table – CY 2023 Quarter 3, DP-1835

Date	CrEX-1 (gal.)	CrEX-2 (gal.)	CrEX-3 (gal.)	CrEX-4 (gal.)	CrEX-5 (gal.)	Total (gal.)
7/1/2023	0	0	0	0	0	0
7/2/2023	0	0	0	0	0	0
7/3/2023	0	0	0	0	0	0
7/4/2023	0	0	0	0	0	0
7/5/2023	0	0	0	0	0	0
7/6/2023	0	0	0	0	0	0
7/7/2023	0	0	0	0	0	0
7/8/2023	0	0	0	0	0	0
7/9/2023	0	0	0	0	0	0
7/10/2023	0	0	0	0	0	0
7/11/2023	0	0	0	0	0	0
7/12/2023	0	0	0	0	0	0
7/13/2023	0	0	0	0	0	0
7/14/2023	0	0	0	0	0	0
7/15/2023	0	0	0	0	0	0
7/16/2023	0	0	0	0	0	0
7/17/2023	0	0	0	0	0	0
7/18/2023	4,260	1,534	1,117	979	2,542	10,431
7/19/2023	0	0	0	0	0	0
7/20/2023	0	0	0	0	0	0
7/21/2023	0	0	0	0	0	0
7/22/2023	0	0	0	0	0	0
7/23/2023	0	0	0	0	0	0
7/24/2023	0	0	0	0	0	0
7/25/2023	0	0	0	0	0	0
7/26/2023	0	0	0	0	0	0
7/27/2023	0	0	0	0	0	0
7/28/2023	0	0	0	0	0	0
7/29/2023	0	0	0	0	0	0
7/30/2023	0	0	0	0	0	0
7/31/2023	0	0	0	0	0	0
8/1/2023	0	0	0	0	0	0
8/2/2023	0	0	0	0	0	0
8/3/2023	0	0	0	0	0	0
8/4/2023	0	0	0	0	0	0
8/5/2023	0	0	0	0	0	0
8/6/2023	0	0	0	0	0	0

Date	CrEX-1 (gal.)	CrEX-2 (gal.)	CrEX-3 (gal.)	CrEX-4 (gal.)	CrEX-5 (gal.)	Total (gal.)
8/7/2023	0	0	0	0	0	0
8/8/2023	0	0	0	0	0	0
8/9/2023	0	0	0	0	0	0
8/10/2023	0	0	0	0	0	0
8/11/2023	0	0	0	0	0	0
8/12/2023	0	0	0	0	0	0
8/13/2023	0	0	0	0	0	0
8/14/2023	0	0	0	0	0	0
8/15/2023	0	0	0	0	0	0
8/16/2023	0	0	0	0	0	0
8/17/2023	0	0	0	0	0	0
8/18/2023	0	0	0	0	0	0
8/19/2023	0	0	0	0	0	0
8/20/2023	0	0	0	0	0	0
8/21/2023	0	0	921*	1,248*	2,998*	5,167*
8/22/2023	3,463*	2,904*	0	0	0	6,367*
8/23/2023	0	0	0	0	0	0
8/24/2023	0	0	0	0	0	0
8/25/2023	0	0	0	0	0	0
8/26/2023	0	0	0	0	0	0
8/27/2023	0	0	0	0	0	0
8/28/2023	0	0	0	0	0	0
8/29/2023	0	0	0	0	0	0
8/30/2023	0	0	0	0	0	0
8/31/2023	0	0	0	0	0	0
9/1/2023	0	0	0	0	0	0
9/2/2023	0	0	0	0	0	0
9/3/2023	0	0	0	0	0	0
9/4/2023	0	0	0	0	0	0
9/5/2023	0	0	0	0	0	0
9/6/2023	0	0	0	0	0	0
9/7/2023	0	0	0	0	0	0
9/8/2023	0	0	0	0	0	0
9/9/2023	0	0	0	0	0	0
9/10/2023	0	0	0	0	0	0
9/11/2023	0	0	0	0	0	0
9/12/2023	0	0	0	0	0	0
9/13/2023	0	0	0	0	0	0
9/14/2023	0	0	0	0	0	0
9/15/2023	0	0	0	0	0	0

Date	CrEX-1 (gal.)	CrEX-2 (gal.)	CrEX-3 (gal.)	CrEX-4 (gal.)	CrEX-5 (gal.)	Total (gal.)
9/16/2023	0	0	0	0	0	0
9/17/2023	0	0	0	0	0	0
9/18/2023	0	0	1,039	1,042	2,799	4,879
9/19/2023	0	1,607	0	0	0	1,607
9/20/2023	0	0	0	0	0	0
9/21/2023	0	0	0	0	0	0
9/22/2023	0	0	0	0	0	0
9/23/2023	0	0	0	0	0	0
9/24/2023	0	0	0	0	0	0
9/25/2023	0	0	0	0	0	0
9/26/2023	0	0	0	0	0	0
9/27/2023	0	0	0	0	0	0
9/28/2023	0	0	0	0	0	0
9/29/2023	0	0	0	0	0	0
9/30/2023	0	0	0	0	0	0
Total						28,452

* Extraction volumes from August 21 and 22 were determined from field measurement readings while the chromium computer was down for software upgrades.

2.14 Facility Layout Map (Requirement 14)

Figure 2.14-1 is the facility layout map for CY 2023 Quarter 3, showing the location and number of each well.

2.15 Groundwater Elevation Contour Map (Requirement 15)

Figure 2.3-1 provides the groundwater elevation contour map. Section 2.3 provides an explanation of how this map was generated.

3.0 REFERENCES

Carson, J., A. Jordan, A. Rice, P. Black, T. Stockton, D. Katzman, and L. Foster, March 8–12, 2020, “Bayesian Approach to Estimation of Water Table Elevations Using Historical Rasters as Prior Information,” paper presented at WM2020 Conference, March 8–12, 2020, Phoenix, Arizona (Carson et al. 2020).

Carson, J., A. Jordan, A. Rice, P. Black, T. Stockton, D. Katzman, and L. Foster, March 8–12, 2020, “Bayesian Approach to Estimation of Water Table Elevations Using Historical Rasters as Prior Information,” paper presented at WM2020 Conference, March 8–12, 2020, Phoenix, Arizona (Carson et al. 2020).

LANL (Los Alamos National Laboratory) March 29, 2018. “Notification of Ground Water Discharge Plan No. 1835 (DP-1835),” Los Alamos National Laboratory letter (ADESH:18-023) to N. Lombardo (N3B) from W.R. Mairson (LANL), Los Alamos, New Mexico (LANL 2018).

NMED (New Mexico Environment Department), August 31, 2016. "Discharge Permit Issuance, Los Alamos National Laboratory Underground Injection Control Wells, Discharge Permit 1835," U1601882 to B. Beers (ENV-RCRA) from M. Hunter (NMED), Santa Fe, New Mexico. (NMED 2016)

NMED (New Mexico Environment Department) July 21, 2017. "Discharge Permit Amendment, Los Alamos National Laboratory Underground Injection Control Wells, DP-1835," New Mexico Environment Department letter to J.C. Bretzke (LANL) and C.L. Rodriguez (EM-LA) from M. Hunter (NMED-GWQB), Santa Fe, New Mexico (NMED 2017a).

NMED (New Mexico Environment Department) June 27, 2017. "Response to Notice of Intent to Discharge; Discharge Permit Not Required for Los Alamos National Laboratory Pilot Scale Molasses Amendment Study in Regional Aquifer Monitoring Well R-28, AI:856 PRD20170003," New Mexico Environment Department letter to J.C. Bretzke (LANL) and A.Q. Duran (EM-LA) from M. Hunter (NMED-GWQB), Santa Fe, New Mexico (NMED 2017b).

NMED (New Mexico Environment Department), June 6, 2022. "Notice of Violation, Los Alamos National Laboratory Underground Injection Control Wells, DP-1835," New Mexico Environment Department letter to A. Duran (DOE EM-LA) and J. Murdock (N3B) from J. Ball (NMED-GWQB), Santa Fe, New Mexico. (NMED 2022a)

NMED (New Mexico Environment Department), December 12, 2022. "Corrective Action Plan Response and Further Action Required, Los Alamos National Laboratory Underground Injection Control Wells, DP-1835," New Mexico Environment Department Ground Water Quality Bureau letter to A Duran (DOE-EM-LA) and R. Macfarlane (N3B) from J. Ball (NMED-GWQB), Santa Fe, New Mexico. (NMED 2022b)

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 2022c)

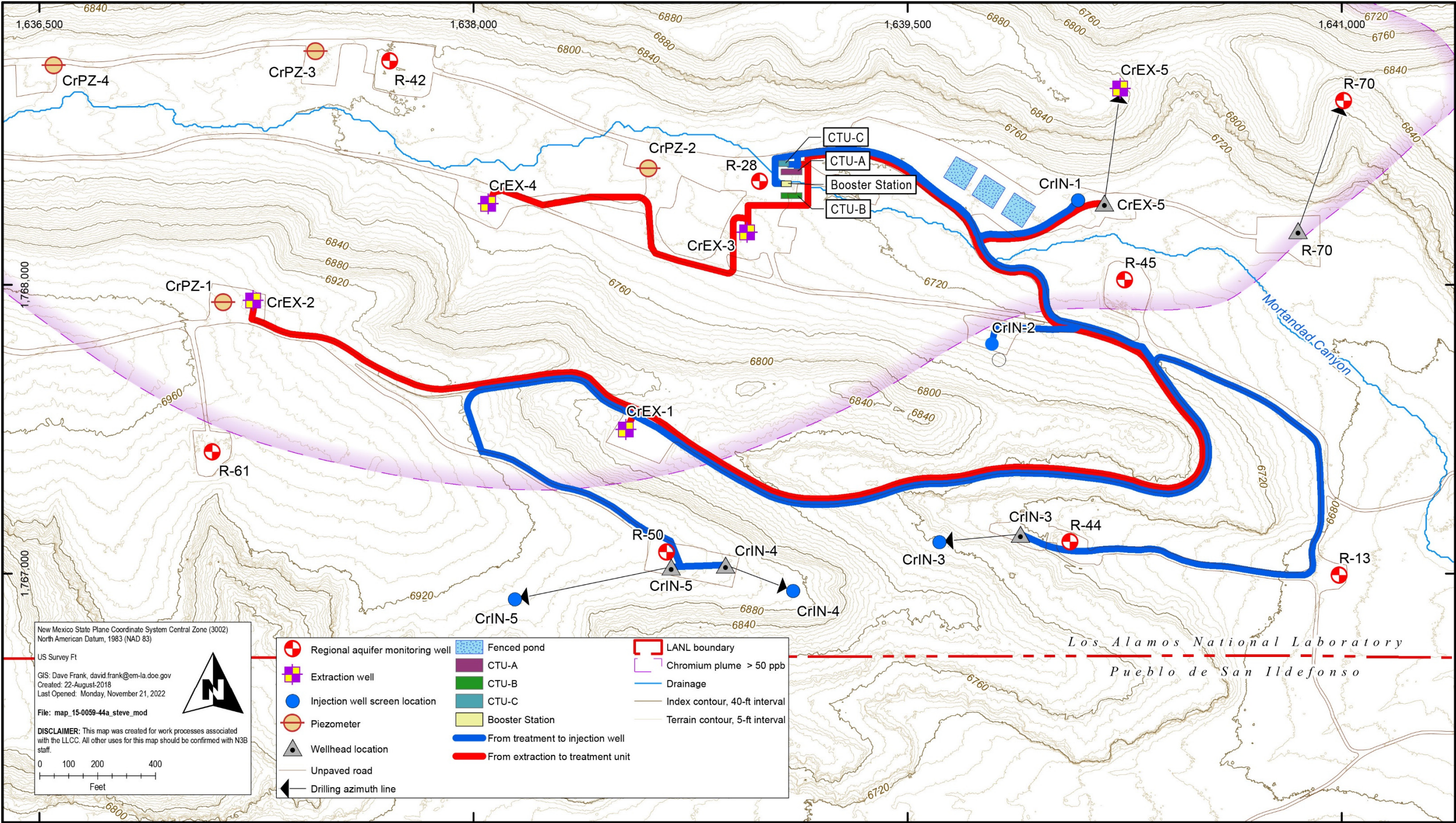


Figure 2.14-1 Facility layout map – CY 2023 Quarter 3, DP-1835

