REPORT

Annual Groundwater Monitoring Report – 2023

Active Coal Combustion Residuals Landfill
Escalante Station
Prewitt, New Mexico

Submitted to:

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Submitted by:

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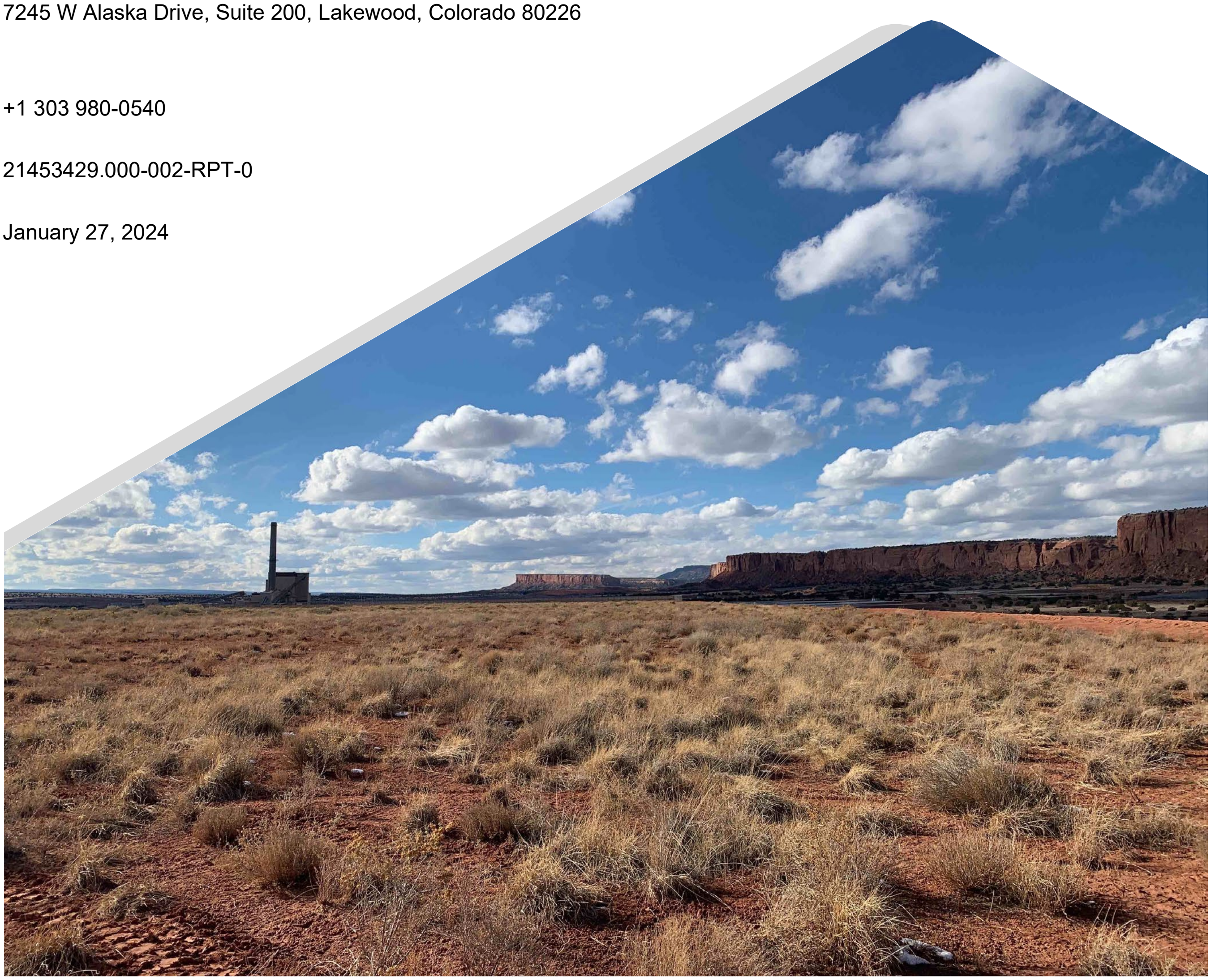
January 27, 2024



Executive Summary

This report summarizes the groundwater monitoring activities and results for the 2023 detection monitoring program for the active coal combustion residuals (CCR) landfill at Escalante Station, along with the comparative statistical analysis. The active CCR landfill, which is owned and operated by Tri-State Generation and Transmission Association, Inc., is currently in detection monitoring, and no program transitions occurred in 2023.

A potential exceedance for total recoverable calcium at TRcpc-18 that was identified following the second semi-annual 2022 sampling event was verified as a statistically significant increase (SSI) following the confirmatory resampling event in February 2023. An alternative source demonstration (ASD) was conducted in May 2023 to demonstrate that the verified SSI for total recoverable calcium at TRcpc-18 was not an indication of a release from the facility, and it was recommended that the facility remain in detection monitoring. No other verified SSIs were identified from the 2023 detection monitoring program.

As described in the Groundwater Monitoring System Certification (Golder Associates Inc. [Golder] 2017) and the Groundwater Statistical Method Certification (Golder 2020), the groundwater monitoring and analytical procedures for the program meet the requirements of 40 CFR 257 Subpart D (the CCR Rule), and modifications to the monitoring network and sampling program are not recommended at this time.

Table of Contents

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

WSP USA Inc. (WSP) prepared this report to describe the 2023 groundwater monitoring activities and comparative statistical analysis for the active coal combustion residuals (CCR) landfill at Escalante Station (the site), which is owned and operated by Tri-State Generation and Transmission Association, Inc. (Tri-State) and subject to regulation under 40 CFR 257 Subpart D (the CCR Rule). This report was written to meet the requirements of 40 CFR 257.90(e).

1.1 Facility Information

Escalante Station is a retired 270-megawatt coal-fired electric generation facility located near Prewitt, New Mexico. The generating unit was retired in August 2020. The active CCR landfill at the site contains fly ash, bottom ash, and flue gas desulfurization solids (scrubber solids).

1.2 Purpose

The CCR Rule establishes specific requirements for reporting of groundwater monitoring activities and corrective action in 40 CFR 257.90. Per 40 CFR 257.90(e), no later than January 31, 2018 and annually thereafter, owners or operators of CCR units must prepare an annual groundwater monitoring and corrective action report.

2.0 GROUNDWATER MONITORING PROGRAM STATUS

The groundwater monitoring system for the active CCR landfill at Escalante Station consists of six monitoring wells, as described in the Groundwater Monitoring System Certification (Golder Associates Inc. [Golder] 2017). The two upgradient monitoring wells are TRcpc-1 and TRcpc-2. The four downgradient monitoring wells are TRcpc-15, TRcpc-16, TRcpc-17, and TRcpc-18.

2.1 Completed Key Actions in 2023

The following key actions were completed in 2023:

- The 2022 Annual Groundwater Monitoring Report (WSP 2023) was finalized and placed within the operating record and on Tri-State's publicly accessible CCR website.
- Confirmatory resampling was performed on February 16 for a potential exceedance identified from the second semi-annual 2022 sampling event (WSP 2023).
- The first semi-annual 2023 sampling event was performed in the second quarter, on April 12, 13, and 17.
- An alternative source demonstration (ASD) was conducted in May 2023 to demonstrate that the verified statistically significant increase (SSI) for total recoverable calcium at TRcpc-18, which was identified following the February 2023 confirmatory resampling event, was not an indication of a release from the facility, and it was recommended that the facility remain in detection monitoring.
- The second semi-annual 2023 sampling event was performed in the fourth quarter, on October 9.

Additionally, a statistical baseline update was conducted concurrently with the comparative statistical analysis for the first semi-annual 2023 sampling event. This update included well-constituent pairs with previously identified SSIs where a demonstration was made that each SSI was not related to a release from the facility, but rather reflected natural variability not captured during the initial baseline period. Whenever possible, either a parametric or non-parametric method was used to generate the updated baseline statistical limit for each constituent. The method varied between well-constituent pairs and was based on the percentage of non-detect values in the baseline period and the baseline data distribution for the well-constituent pair, consistent with the Unified Guidance (USEPA 2009). For well-consistent pairs that exhibited statistically significant decreasing trends, a trend analysis will be used to assess the data for statistical significance of the parameter until a limit based on non-trending data can be established. A full description of the steps taken for the statistical baseline update can be found in the Groundwater Statistical Method Certification (Golder 2020), which is available on Tri-State's publicly accessible CCR website.

2.2 Installation and Decommissioning of Monitoring Wells

No monitoring wells were installed or decommissioned for the active CCR landfill at Escalante Station in 2023.

2.3 Problems and Resolutions

No problems were identified in 2023.

2.4 Proposed Key Activities for 2024

The following key actions are expected to be completed in 2024:

- Detection monitoring sampling events are planned to occur in the second and fourth quarters of 2024.

3.0 GROUNDWATER MONITORING RESULTS AND ANALYSIS

Results from the groundwater monitoring program in 2023 are described in this section.

3.1 Groundwater Flow

The groundwater elevation was measured in each monitoring well prior to purging during each sampling event. Groundwater elevations are presented in Table 1 through Table 6. Groundwater elevations from the first semi-annual 2023 sampling event and the second semi-annual 2023 sampling event are shown in Figure 1 and Figure 2, respectively.

Based on the groundwater elevations measured in 2023, the groundwater in the Correo Sandstone beneath the active CCR landfill generally flows east with a localized northerly flow component.

The groundwater flow rate was estimated with the equation $V_s = k \times i / n_e$, where:

- V_s is the groundwater flow rate, in feet per day (ft/day).
- k is the hydraulic conductivity, estimated to range from 0.00296 to 12.7 from site pumping test data, in ft/day.
- i is the hydraulic gradient calculated by dividing the difference between groundwater elevations in TRcpc-1 and TRcpc-16 by the horizontal distance between these monitoring wells, in feet per foot (ft/ft).
- n_e is the effective porosity, estimated to be 0.33 based on historical testing results for samples of Correo Sandstone obtained on site.

Groundwater flow velocity estimates range from 0.00004 ft/day to 0.19 ft/day for the first and second semi-annual 2023 sampling events.

3.2 Monitoring Data (Analytical Results)

Analytical results from detection monitoring in 2023 are shown in Table 1 through Table 6.

3.3 Samples Collected

The detection monitoring sampling events were conducted in April 2023 (first semi-annual 2023 sampling event) and October 2023 (second semi-annual 2023 sampling event). Additionally, a sample was collected from TRcpc-18 in February 2023 for confirmatory resampling associated with the detection monitoring program.

3.4 Comparative Statistical Analysis

The comparative statistical analysis is summarized below, and the results are presented in Table 7 through Table 12. A full description of the steps taken for the comparative statistical analysis can be found in the Groundwater Statistical Method Certification (Golder 2020).

3.4.1 Definitions

The following definitions are used in discussion of the comparative statistical analysis:

- SSI – is a statistically significant increase and is defined as an analytical result that exceeds the parametric or non-parametric statistical limit established by the baseline statistical analysis.
- Potential exceedance – is defined as an initial analytical result that exceeds the parametric or non-parametric statistical limit established by the baseline statistical analysis. Confirmatory resampling is used to determine whether the potential exceedance is a false-positive SSI or a verified SSI.
- False-positive SSI – is defined as an analytical result that exceeds the statistical limit but can clearly be attributed to laboratory error or changes in analytical precision or is invalidated through confirmatory resampling.
- Confirmatory resampling – is designated as the resampling event that occurs within 90 days of identifying an SSI over the statistical limit for determination of a verified SSI [1].
- Verified SSI – is interpreted as two consecutive SSIs (the original sample and the confirmatory resample for analytical results) for the same constituent at the same monitoring well.

If the data are assessed with a trend test, confirmatory resampling is generally not applicable, and a verified SSI is defined as a statistically significant increasing trend in the eight most recent results.

3.4.2 Potential Exceedances

No potential exceedances were identified from the 2023 detection monitoring program.

3.4.3 False-Positive Statistically Significant Increases

No false-positive SSIs were identified from the 2023 detection monitoring program.

3.4.4 Verified Statistically Significant Increases

Confirmatory resampling for a potential exceedance associated with the second semi-annual 2022 sampling event (total recoverable calcium at TRcpc-18) occurred in February 2023. The confirmatory resampling identified the total recoverable calcium result from the second semi-annual 2022 sample at TRcpc-18 as a verified SSI. In

[1] Resampling may not occur within 90 days of the sampling event that resulted in the potential exceedance because of the additional time required for activities that must occur before a potential exceedance can be identified. These include sample delivery, analytical testing, review of results, and comparative statistical analysis.

May 2023, an ASD was conducted for total recoverable calcium at TRcpc-18, and it was recommended that the program remain in detection monitoring. The ASD is provided as Appendix A.

4.0 PROGRAM TRANSITIONS

In the third quarter of 2017, the groundwater monitoring program for the active CCR landfill at Escalante Station transitioned from the baseline period to detection monitoring. The facility remains in detection monitoring, and no program transitions occurred in 2023.

4.1 Detection Monitoring

Samples for the detection monitoring program are collected on a semi-annual basis, beginning with the samples collected on August 31, 2017. Tri-State plans to collect semi-annual samples for the detection monitoring program in the second and fourth quarters of 2023.

4.2 Assessment Monitoring

The groundwater monitoring program for the active CCR landfill at Escalante Station is not in assessment monitoring. Assessment monitoring has not been triggered as described in 40 CFR 257.95. As such, no ASDs have been made under an assessment monitoring program and no actions are required.

4.3 Corrective Measures and Assessment

The groundwater monitoring program for the active CCR landfill at Escalante Station does not indicate the need for corrective measures. An assessment of corrective measures, as described in 40 CFR 257.96, is not required.

5.0 RECOMMENDATIONS AND CLOSING

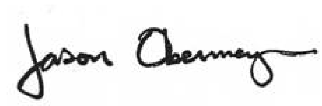
This report presents the groundwater monitoring activities and results for the 2023 detection monitoring program for the active CCR landfill at Escalante Station, along with the comparative statistical analysis. The significant findings from the 2023 monitoring activities and comparative statistical analysis are as follows:

- A potential exceedance for total recoverable calcium at TRcpc-18 that was identified following the second semi-annual 2022 sampling event (WSP 2023) was verified as an SSI following the confirmatory resampling event in February 2023. An ASD was conducted in May 2023 to demonstrate that the verified SSI for total recoverable calcium at TRcpc-18 was not an indication of a release from the facility, and it was recommended that the facility remain in detection monitoring. No further actions are required, and no other verified SSIs were identified for the 2023 detection monitoring program.
- No potential exceedances or false-positive SSIs were identified for the 2023 detection monitoring program.

As described in the Groundwater Monitoring System Certification (Golder 2017) and the Groundwater Statistical Method Certification (Golder 2020), the groundwater monitoring and analytical procedures meet the requirements of the CCR Rule, and modifications to the monitoring network and sampling program are not recommended at this time.

Signature Page

WSP USA Inc.



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21453429.000-002-RPT-0-2023_Annual_GW_Monitoring_26JAN24

REFERENCES

Golder (Golder Associates Inc.). 2017. Active Coal Combustion Residuals Landfill Groundwater Monitoring System Certification, Escalante Generating Station. Report prepared for Tri-State Generation and Transmission Association, Inc. October 13.

Golder. 2020. Active Coal Combustion Residuals Landfill Groundwater Statistical Method Certification, Escalante Generating Station. Report prepared for Tri-State Generation and Transmission Association, Inc. June 29.

USEPA (United States Environmental Protection Agency). 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance. March.

WSP (WSP USA Inc.). 2023. Annual Groundwater Monitoring Report – 2022, Active Coal Combustion Residuals Landfill, Escalante Generating Station. Report prepared for Tri-State Generation and Transmission Association, Inc. January 27.

Tables

Table 1. Sample Results Summary Table – TRcpc-1

Analytes	Units	Compliance Point (4/12/2023)	Compliance Point (10/9/2023)
Static Water Elevation	ft amsl	6860.9	6860.4
Appendix III			
Boron, Total Recoverable	mg/L	1.6	1.7
Calcium, Total Recoverable	mg/L	12	13
Chloride	mg/L	650	550
Fluoride	mg/L	1.1	1.2
pH, Field-Measured	pH units	8.4	8.3
Sulfate	mg/L	880	740
Total Dissolved Solids	mg/L	2300	2400

NOTES:
ft amsl: feet above mean sea level
mg/L: milligrams per liter

Table 2. Sample Results Summary Table – TRcpc-2

Analytes	Units	Compliance Point (4/13/2023)	Compliance Point (10/9/2023)
Static Water Elevation	ft amsl	6851.4	6851.2
Appendix III			
Boron, Total Recoverable	mg/L	1.5	1.6
Calcium, Total Recoverable	mg/L	14	15
Chloride	mg/L	1000	940
Fluoride	mg/L	1.3	1.4
pH, Field-Measured	pH units	8.3	8.2
Sulfate	mg/L	490	420
Total Dissolved Solids	mg/L	2400	2700

NOTES:

ft amsl: feet above mean sea level

mg/L: milligrams per liter

Table 3. Sample Results Summary Table – TRcpc-15

Analytes	Units	Compliance Point (4/17/2023)	Compliance Point (10/9/2023)
Static Water Elevation	ft amsl	6828.9	6828.8
Appendix III			
Boron, Total Recoverable	mg/L	1.5	1.4
Calcium, Total Recoverable	mg/L	6.0	6.1
Chloride	mg/L	590	480
Fluoride	mg/L	2.2	2.5
pH, Field-Measured	pH units	8.4	8.3
Sulfate	mg/L	240	190
Total Dissolved Solids	mg/L	1600	1600

NOTES:
ft amsl: feet above mean sea level
mg/L: milligrams per liter

Table 4. Sample Results Summary Table – TRcpc-16

Analytes	Units	Compliance Point (4/17/2023)	Compliance Point (10/9/2023)
Static Water Elevation	ft amsl	6827.9	6827.9
Appendix III			
Boron, Total Recoverable	mg/L	1.6	1.5
Calcium, Total Recoverable	mg/L	4.7	4.6
Chloride	mg/L	460	330
Fluoride	mg/L	3.0	3.4
pH, Field-Measured	pH units	8.5	8.5
Sulfate	mg/L	240	170
Total Dissolved Solids	mg/L	1300	1400

NOTES:

ft amsl: feet above mean sea level

mg/L: milligrams per liter

Table 5. Sample Results Summary Table – TRcpc-17

Analytes	Units	Compliance Point (4/17/2023)	Compliance Point (10/9/2023)
Static Water Elevation	ft amsl	6830.3	6830.2
Appendix III			
Boron, Total Recoverable	mg/L	1.5	1.5
Calcium, Total Recoverable	mg/L	16	16
Chloride	mg/L	1400	1100
Fluoride	mg/L	1.8	2.0
pH, Field-Measured	pH units	8.3	8.2
Sulfate	mg/L	310	210
Total Dissolved Solids	mg/L	2700	3000

NOTES:

ft amsl: feet above mean sea level

mg/L: milligrams per liter

Table 6. Sample Results Summary Table – TRcpc-18

Analytes	Units	Confirmatory Resample (2/16/2023)	Compliance Point (4/17/2023)	Compliance Point (10/9/2023)
Static Water Elevation	ft amsl	6841.1	6840.9	6840.6
Appendix III				
Boron, Total Recoverable	mg/L	--	0.77	0.77
Calcium, Total Recoverable	mg/L	6.2 B	5.7	4.2
Chloride	mg/L	--	360	270
Fluoride	mg/L	--	1.1	1.1
pH, Field-Measured	pH units	9.7	9.7	9.6
Sulfate	mg/L	--	180	130
Total Dissolved Solids	mg/L	--	1000	1100

NOTES:
ft amsl: feet above mean sea level
mg/L: milligrams per liter
B: Analyte was detected in the laboratory quality control blank and the sample

Table 7. Statistics Summary Table – TRcpc-1

Analytes	Units	Selected Statistical Method	Statistical Limit	April 2023		October 2023	
				Compliance Point (4/12/2023)	SSI Determination	Compliance Point (10/9/2023)	SSI Determination
Appendix III							
Boron, Total Recoverable	mg/L	NP-PL	1.7	1.6	No	1.7	No
Calcium, Total Recoverable	mg/L	NP-PL	13	12	No	13	No
Chloride	mg/L	P-PL	701	650	No	550	No
Fluoride	mg/L	NP-PL	1.8	1.1	No	1.2	No
pH, Field-Measured	pH units	P-PL	7.4, 9.4	8.4	No	8.3	No
Sulfate	mg/L	P-PL	939	880	No	740	No
Total Dissolved Solids	mg/L	NP-PL	3200	2300	No	2400	No

NOTES:

P-PL: Parametric Prediction Limit

NP-PL: Non-parametric Prediction Limit

mg/L: milligrams per liter

Table 8. Statistics Summary Table – TRcpc-2

Analytes	Units	Selected Statistical Method	Statistical Limit	April 2023		October 2023	
				Compliance Point (4/13/2023)	SSI Determination	Compliance Point (10/9/2023)	SSI Determination
Appendix III							
Boron, Total Recoverable	mg/L	NP-PL	1.6	1.5	No	1.6	No
Calcium, Total Recoverable	mg/L	NP-PL	16	14	No	15	No
Chloride	mg/L	NP-PL	1200	1000	No	940	No
Fluoride	mg/L	P-PL	2.4	1.3	No	1.4	No
pH, Field-Measured	pH units	P-PL	7.6, 8.9	8.3	No	8.2	No
Sulfate	mg/L	P-PL	623	490	No	420	No
Total Dissolved Solids	mg/L	NP-PL	2900	2400	No	2700	No

NOTES:

P-PL: Parametric Prediction Limit

NP-PL: Non-parametric Prediction Limit

mg/L: milligrams per liter

Table 9. Statistics Summary Table – TRcpc-15

Analytes	Units	Selected Statistical Method	Statistical Limit	April 2023		October 2023	
				Compliance Point (4/17/2023)	SSI Determination	Compliance Point (10/9/2023)	SSI Determination
Appendix III							
Boron, Total Recoverable	mg/L	NP-PL	1.5	1.5	No	1.4	No
Calcium, Total Recoverable	mg/L	Trend(1)	NL	6.0	No	6.1	No
Chloride	mg/L	P-PL	619	590	No	480	No
Fluoride	mg/L	NP-PL	3.0	2.2	No	2.5	No
pH, Field-Measured	pH units	Trend(1)	NL	8.4	No	8.3	No
Sulfate	mg/L	P-PL	281	240	No	190	No
Total Dissolved Solids	mg/L	NP-PL	2200	1600	No	1600	No

NOTES:

NL: Statistical limit was not calculated for analytes for which the Sen's Slope methodology was selected

P-PL: Parametric Prediction Limit

NP-PL: Non-parametric Prediction Limit

mg/L: milligrams per liter

1) Baseline data exhibited a statistically significant decreasing trend. Therefore, a trend analysis is used for the determination of SSIs.

Table 10. Statistics Summary Table – TRcpc-16

Analytes	Units	Selected Statistical Method	Statistical Limit	April 2023		October 2023	
				Compliance Point (4/17/2023)	SSI Determination	Compliance Point (10/9/2023)	SSI Determination
Appendix III							
Boron, Total Recoverable	mg/L	NP-PL	1.6	1.6	No	1.5	No
Calcium, Total Recoverable	mg/L	Trend(1)	NL	4.7	No	4.6	No
Chloride	mg/L	P-PL	545	460	No	330	No
Fluoride	mg/L	P-PL	4.2	3.0	No	3.4	No
pH, Field-Measured	pH units	Trend(1)	NL	8.5	No	8.5	No
Sulfate	mg/L	Trend(1)	NL	240	No	170	No
Total Dissolved Solids	mg/L	Trend(1)	NL	1300	No	1400	No

NOTES:

NL: Statistical limit was not calculated for analytes for which the Sen's Slope methodology was selected

P-PL: Parametric Prediction Limit

NP-PL: Non-parametric Prediction Limit

mg/L: milligrams per liter

1) Baseline data exhibited a statistically significant decreasing trend. Therefore, a trend analysis is used for the determination of SSIs.

Table 11. Statistics Summary Table – TRcpc-17

Analytes	Units	Selected Statistical Method	Statistical Limit	April 2023		October 2023	
				Compliance Point (4/17/2023)	SSI Determination	Compliance Point (10/9/2023)	SSI Determination
Appendix III							
Boron, Total Recoverable	mg/L	NP-PL	1.5	1.5	No	1.5	No
Calcium, Total Recoverable	mg/L	Trend(1)	NL	16	No	16	No
Chloride	mg/L	NP-PL	1700	1400	No	1100	No
Fluoride	mg/L	NP-PL	2.7	1.8	No	2.0	No
pH, Field-Measured	pH units	NP-PL	8.0, 8.8	8.3	No	8.2	No
Sulfate	mg/L	Trend(1)	NL	310	No	210	No
Total Dissolved Solids	mg/L	P-PL	3571	2700	No	3000	No

NOTES:

NL: Statistical limit was not calculated for analytes for which the Sen's Slope methodology was selected

P-PL: Parametric Prediction Limit

NP-PL: Non-parametric Prediction Limit

mg/L: milligrams per liter

1) Baseline data exhibited a statistically significant decreasing trend. Therefore, a trend analysis is used for the determination of SSIs.

Table 12. Statistics Summary Table – TRcpc-18

Analytes	Units	February 2023		Selected Statistical Method	Statistical Limit	April 2023		October 2023	
		Confirmatory Resample (2/16/2023)	SSI Determination			Compliance Point (4/17/2023)	SSI Determination	Compliance Point (10/9/2023)	SSI Determination
Appendix III									
Boron, Total Recoverable	mg/L	--	--	P-PL	0.93	0.77	No	0.77	No
Calcium, Total Recoverable	mg/L	6.2 B	Verified SSI(1)(2)	NP-PL	6.2	5.7	No	4.2	No
Chloride	mg/L	--	--	NP-PL	380	360	No	270	No
Fluoride	mg/L	--	--	Trend(4)	NL	1.1	No	1.1	No
pH, Field-Measured	pH units	9.7	--(3)	Trend(4)	NL	9.7	No	9.6	No
Sulfate	mg/L	--	--	NP-PL	250	180	No	130	No
Total Dissolved Solids	mg/L	--	--	Trend(4)	NL	1000	No	1100	No

NOTES:

NL: Statistical limit was not calculated for analytes for which the Sen's Slope methodology was selected

P-PL: Parametric Prediction Limit

NP-PL: Non-parametric Prediction Limit

mg/L: milligrams per liter

B: Analyte was detected in the laboratory quality control blank and the sample

1) Verified exceedance is based on a comparison to the previous baseline statistical limit of 5.3 mg/L.

2) Successful alternative source demonstration conducted in May 2023 is applicable, and the facility remains in detection monitoring.

3) Field-measured pH is reported for informational purposes. SSI determination for the confirmatory resampling event only applies to parameters identified as potential exceedances from the preceding sampling event.

4) Baseline data exhibited a statistically significant decreasing trend. Therefore, a trend analysis is used for the determination of SSIs.

Figures

LEGEND

TRcpc-1	UPGRADIENT CCR NETWORK WELL
TRcpc-15	DOWNGRADIENT CCR NETWORK WELL

NOTE(S)

1. GROUNDWATER ELEVATIONS AT TRcpc-1, TRcpc-2, TRcpc-15, TRcpc-16, TRcpc-17, AND TRcpc-18 WERE MEASURED IN APRIL 2023.
2. POTENTIOMETRIC SURFACE CONTOURS WERE CREATED USING WATER LEVEL INFORMATION FROM THE NETWORK WELLS SHOWN AND ADDITIONAL SITE WELLS. CONTOUR INTERVAL IS 5 FEET.

0 400 800
SCALE FEET

CLIENT
TRI-STATE GENERATION AND TRANSMISSION ASSOCIATION
1100 WEST 116TH AVENUE
WESTMINSTER, COLORADO 80234

CONSULTANT

wsp

YYYY-MM-DD	2024-01-27
DESIGNED	BJP
PREPARED	AGD
REVIEWED	SAH
APPROVED	JEO

PROJECT
ESCALANTE STATION
ACTIVE COAL COMBUSTION RESIDUALS LANDFILL
2023 ANNUAL GROUNDWATER MONITORING REPORT

TITLE
MONITORING WELL LOCATIONS AND GROUNDWATER ELEVATIONS (FIRST SEMI-ANNUAL 2023 SAMPLING EVENT)

PROJECT NO.	REV.	FIGURE
21453429.000	A	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

LEGEND

TRcpc-1	UPGRADIENT CCR NETWORK WELL
TRcpc-15	DOWNGRADIENT CCR NETWORK WELL

NOTE(S)

1. GROUNDWATER ELEVATIONS AT TRcpc-1, TRcpc-2, TRcpc-15, TRcpc-16, TRcpc-17, AND TRcpc-18 WERE MEASURED IN OCTOBER 2023.
2. POTENTIOMETRIC SURFACE CONTOURS WERE CREATED USING WATER LEVEL INFORMATION FROM THE NETWORK WELLS SHOWN AND ADDITIONAL SITE WELLS. CONTOUR INTERVAL IS 5 FEET.

0 400 800
SCALE FEET

N

CLIENT
TRI-STATE GENERATION AND TRANSMISSION ASSOCIATION
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CONSULTANT

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YYYY-MM-DD	2024-01-27
DESIGNED	BJP
PREPARED	AGD
REVIEWED	SAH
APPROVED	JEO

PROJECT
ESCALANTE STATION
ACTIVE COAL COMBUSTION RESIDUALS LANDFILL
2023 ANNUAL GROUNDWATER MONITORING REPORT

TITLE
MONITORING WELL LOCATIONS AND GROUNDWATER ELEVATIONS (SECOND SEMI-ANNUAL 2023 SAMPLING EVENT)

PROJECT NO.	REV.	FIGURE
21453429.000	A	2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

APPENDIX A

Alternative Source Demonstration for Calcium in Monitoring Well TRcpc-18

CERTIFICATION

Professional Engineer Certification Statement [40 CFR 257.94(e)(2)]

I hereby certify that, having reviewed the attached documentation and being familiar with the provisions of Title 40 of the Code of Federal Regulations Section 257.94 (40 CFR 257.94), this written demonstration is accurate to the best of my knowledge and has been prepared in accordance with recognized and generally accepted good engineering practices, including the consideration of applicable industry standards, and the requirements of 40 CFR 257.94(e)(2).

WSP USA Inc.

____
Signature

May 25, 2023
Date of Certification

Jason Obermeyer, PE
Name

24619
New Mexico Professional Engineer Number

REPORT

Alternative Source Demonstration for Calcium in Monitoring Well TRcpc-18

Active Coal Combustion Residuals Landfill
Escalante Generating Station
Prewitt, New Mexico

Submitted to:

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Table of Contents

1.0 INTRODUCTION

On behalf of Tri-State Generation and Transmission Association, Inc. (Tri-State), WSP USA Inc. (WSP) performed a statistical evaluation of groundwater monitoring results for the second semi-annual 2022 groundwater detection monitoring event for the active coal combustion residuals (CCR) landfill at Escalante Generating Station (the facility). The statistical evaluation was performed in accordance with applicable provisions of 40 Code of Federal Regulations (CFR) Part 257, "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule" (the CCR Rule) as amended and as described in the Groundwater Statistical Method Certification (Golder 2020).

Statistical analyses for the second semi-annual 2022 detection monitoring (Appendix III list) results for groundwater at downgradient monitoring well TRcpc-18 indicated a potential exceedance for total recoverable calcium. This potential exceedance was subsequently verified as a statistically significant increase (SSI) following the confirmatory resampling event in February 2023.

Although determination of a verified SSI generally indicates that the groundwater monitoring program should transition from detection monitoring to assessment monitoring, 40 CFR 257.94(e)(2) allows the owner or operator (i.e., Tri-State) 90 days from the date of determining a verified SSI to demonstrate that a source other than the regulated CCR unit caused the SSI or that the SSI is an indication of an error in sampling, analysis, or statistical evaluation or natural variability in groundwater quality that was not fully captured during the baseline data collection period.

WSP's review of the hydrological and geologic conditions at the site indicates that the total recoverable calcium SSI at TRcpc-18 is not an indication of impacts from the facility. This alternative source demonstration (ASD) conforms to the requirements of 40 CFR 257.94(e)(2) and provides the basis for concluding that the verified SSI for total recoverable calcium at TRcpc-18 is not an indication of an impact from the facility. The following sections provide a summary of the site geology and hydrogeology, WSP's evaluation of analytical results, and lines of evidence demonstrating that an alternative source is responsible for the total recoverable calcium SSI at TRcpc-18. More specifically, this report supports the demonstration that the SSI for calcium at TRcpc-18 (October 2022 and February 2023 samples) is a result of natural variability in groundwater quality that was not fully captured during baseline data collection.

2.0 BACKGROUND

2.1 Site Background

Escalante Generating Station is a 270-megawatt coal-fired electric generation facility located near Prewitt, New Mexico. The generating unit was retired in August 2020. The active CCR landfill at the site contains fly ash, bottom ash, and flue gas desulfurization solids (scrubber solids). These materials were deposited in the facility in a relatively dry condition.

2.2 Site Geology and Hydrogeology

The active CCR landfill is immediately underlain by Quaternary alluvium of variable thickness. The alluvial material is primarily composed of unconsolidated silty sand and clayey sand. The Triassic-aged Chinle Claystone underlies the alluvium and thickens towards the northeast within the boundary of the site, with thicknesses under the active CCR landfill ranging from approximately 75 feet at TRcpc-18 to 205 feet at TRcpc-15. The Chinle Claystone behaves as a confining unit based on the thickness of the low-permeability claystone and the artesian pressures in the underlying aquifer.

The Triassic-aged Correo Sandstone underlies the Chinle Claystone confining unit. The six CCR network groundwater monitoring wells are each screened in the Correo Sandstone. The groundwater levels in the monitoring wells, which are much higher than the screened interval (i.e., closer to the ground surface), indicate that the groundwater is under confining pressure from the overlying Chinle Claystone confining unit. The groundwater flow direction in the Correo Sandstone bed in the vicinity of the active CCR landfill is generally from west to east, with possible minor northerly or southerly components, as indicated by static groundwater levels in the monitoring wells installed at the site.

The Correo Sandstone is relatively uniform in thickness across the site and dips towards the northeast. According to Moench and Schlee (1967), the Correo Sandstone in the nearby Laguna mining district southeast of the site is composed primarily of quartz and feldspar and firmly cemented with quartz and calcite ($CaCO_3$). Calcite cement is more prominent in conglomeritic lenses of the Correo Sandstone. The regional interpretations of the Correo Sandstone by Moench and Schlee (1967) generally agree with the borehole logs from Golder (2016), which describe the Correo Sandstone as weakly cemented and having calcareous fragments.

Monitoring well TRcpc-18 is located on the south side of the active CCR landfill and was installed in January 2016. The Chinle Claystone is approximately 75 feet thick at this location, with a silty sand interval from 56 to 67.5 feet below ground surface (ft bgs) (Golder 2016). The Correo Sandstone was observed from 117 to 155 ft bgs, and the monitoring well is screened from 120 to 150 ft bgs. Due to the presence of calcareous fragments and calcite cement in the Correo Sandstone, natural variation of total recoverable calcium concentrations in groundwater samples is expected.

2.3 Groundwater Monitoring Network

The well network in the Escalante Generating Station CCR Groundwater Monitoring Program consists of TRcpc-1, TRcpc-2, TRcpc-15, TRcpc-16, TRcpc-17, and TRcpc-18 to monitor groundwater conditions around the active CCR landfill, which contains fly ash, bottom ash, and flue gas desulfurization solids (scrubber solids). The locations of the monitoring wells and the active CCR landfill are shown in Figure 1. All six monitoring wells are screened in the Correo Sandstone, which represents the uppermost continuous water-bearing unit (i.e., aquifer) below the active CCR landfill. TRcpc-1 and TRcpc-2 are upgradient of the active CCR landfill, and TRcpc-15 through TRcpc-18 are downgradient.

Additional wells not associated with the active CCR landfill are installed at the site and screened in the Correo Sandstone. These wells are also depicted in Figure 1 and discussed in the following section.

2.4 Other Site Wells

South of the active CCR landfill, Tri-State manages process and domestic wastewaters through a series of evaporation ponds, as permitted under the New Mexico groundwater pollution prevention program and shown on Figure 1. These evaporation ponds are monitored through a network of both shallow wells (set within the Quaternary alluvium) and deeper wells (set within the Correo Sandstone). The Quaternary alluvium is variably saturated and heterogenous, resulting in disconnected and isolated zones of saturation rather than a continuous aquifer that yields usable quantities of groundwater; therefore, samples from wells screened in the Quaternary alluvium do not yield groundwater samples that are representative of water quality in the uppermost aquifer. Due to the low permeability and confining nature of the Chinle Claystone, it is understood that there is no hydraulic connection between the Quaternary alluvium and the Correo Sandstone (Geosyntec 2022); therefore, the Quaternary alluvium well network is not discussed here.

In the Correo Sandstone, the evaporation ponds are monitored by a well network that includes TRcpc-3, TRcpc-5, TRcpc-6, TRcpc-7, TRcpc-8, TRcpc-9, TRcpc-10, TRcpc-11, TRcpc-12, TRcpc-13R, and TRcpc-14. WSP reviewed groundwater monitoring data from wells screened in the Correo Sandstone in order to better understand the natural variability for calcium in this unit. Groundwater quality in the vicinity of the evaporation ponds (namely Cell 4 and Cell 5) has shown evidence of impacts from a release, including increased concentrations of chloride, sulfate, and total dissolved solids (TDS) (Metric 2004). Based on the available data, the bottom of Cell 4 likely penetrated the Chinle Claystone in the vicinity of TRcpc-11 and intersected the Correo Sandstone, resulting in groundwater impacts to the Correo Sandstone (Geosyntec 2022). These impacts were initially identified due to increasing concentrations of chloride and sulfate at TRcpc-6, TRcpc-8, and TRcpc-9 and led to corrective action in 2003. Due to the corrective action, concentrations in these wells have declined (Geosyntec 2022); however, wells downgradient of the evaporation ponds (TRcpc-6, TRcpc-7, TRcpc-8, TRcpc-9, TRcpc-11, TRcpc-13R, and TRcpc-14) have not been included in the review of natural variability to be conservative.

Data from wells upgradient of the evaporation ponds (TRcpc-3, TRcpc-5, TRcpc-10, and TRcpc-12) are being presented to assist in the evaluation of natural variability for calcium. While total recoverable calcium is not routinely analyzed in samples from these wells, dissolved calcium has been monitored in these wells (and in CCR network wells TRcpc-1 and TRcpc-2) since 1983. Although data collection began in 1983, the dissolved calcium data prior to 1985 have not been included in this evaluation because the concentrations were higher than in the remaining data set for some of the wells and were considered unrepresentative.

2.5 Summary of TRcpc-18 Calcium

The initial baseline sampling for the CCR network wells consisted of eight groundwater samples collected on a monthly frequency from September 2016 through May 2017 at each monitoring well (with an additional sample for TRcpc-1 in August 2017). Following this initial baseline period, the sample frequency was changed to semi-annual. A baseline update was conducted in early 2020, resulting in an updated baseline period of September 2016 through November 2019 for most well-constituent pairs. During the baseline update, the data set was shifted for some well-constituent pairs by excluding older data so the limits could be established based on non-trending data sets.

The resulting data were used to establish intrawell baseline statistical limits for each Appendix III constituent at each groundwater monitoring well. For total recoverable calcium in TRcpc-18, a parametric prediction limit of 5.3 milligrams per liter (mg/L) was established using a baseline period of October 2016 to November 2019. During the baseline period, calcium concentrations in TRcpc-18 ranged between 4.0 and 5.0 mg/L.

Intrawell baseline statistical limits represent groundwater conditions in each individual groundwater well (USEPA 2009). Samples collected after baseline statistical limits were established are part of the detection monitoring program. Data from the detection monitoring sampling are compared against the statistical limits to assess possible changes in groundwater chemistry at each well. When the concentration of a given constituent exceeds the statistical limit in two consecutive sampling events, it is considered a verified SSI over the baseline concentration.

Calcium concentrations at TRcpc-18 exceeded the parametric statistical limit of 5.3 mg/L during the second 2022 semi-annual compliance event in October 2022 (5.6 mg/L) and during the confirmatory sampling event in February 2023 (6.2 mg/L), indicating an SSI over baseline. These concentrations, along with the most recent calcium values for other CCR network and upgradient site wells, are presented in Figure 1.

3.0 EVALUATION

3.1 Upgradient Groundwater and Natural Variability

As described in Section 2.2, groundwater in the Correo Sandstone generally flows from west to east across the site. Calcium concentrations at monitoring well TRcpc-18 will reflect the concentrations of upgradient groundwater and any additions from potential impacts from the active CCR landfill (if occurring).

A wide range of calcium concentrations are observed in the upgradient monitoring wells. The highest upgradient total recoverable calcium concentrations in a CCR network well are observed in groundwater from monitoring well TRcpc-2, ranging from 13.0 to 16.0 mg/L. By comparison, total recoverable calcium concentrations at TRcpc-18 range between 3.6 and 6.2 mg/L. Calcium concentrations range between 4.5 and 21.0 mg/L in the other downgradient wells (TRcpc-15, TRcpc-16 and TRcpc-17). Looking site wide, the highest upgradient calcium concentrations are observed in groundwater from monitoring well TRcpc-10, ranging from 22.4 to 86.0 mg/L (dissolved).

Summary statistics and box and whisker plots, presented in Table 1 and Figure 2, respectively, are useful for evaluating variability within TRcpc-18 and amongst the other monitoring wells. Summary statistics for the total recoverable calcium data for the CCR monitoring wells (baseline periods), as well as dissolved calcium data for TRcpc-1, TRcpc-2, and other upgradient site wells, are presented in Table 1. The data indicate that calcium concentration varies at each monitoring well, as indicated by the standard deviation and coefficient of variation. When compared to other monitoring wells, the TRcpc-18 baseline data show one of the narrowest ranges and a standard deviation and coefficient of variation consistent with the other CCR network wells. Figure 2 displays a box and whisker plot showing the ranges of calcium concentrations in upgradient wells (site wide and CCR network) and downgradient CCR wells. This figure demonstrates that the calcium concentrations at TRcpc-18 are lower than those in the other wells in the CCR program and highlights the natural variability of calcium at the site.

The initial baseline data for the CCR program were collected on a compressed schedule, which consisted of monthly sampling between September 2016 and May 2017. Since 2017, samples have been collected semi-annually. While three years of data collection (the baseline period) may seem like a sufficient time to capture the natural variability of a system, review of time series graphs for calcium in upgradient wells with a longer period of record, like those shown in Figure 3, demonstrates that over longer time periods, much more variability is expected. For example, upgradient well TRcpc-3, which currently has dissolved calcium concentrations very similar to the total recoverable calcium concentrations observed in TRcpc-18, has historically seen periods of higher concentrations (12 mg/L to 19.3 mg/L from 1985 to 2000) and periods of higher variability (4.7 mg/L to 16.7 mg/L from 2000 to 2014). From 1985 to 2022, dissolved calcium data (106 data points) at TRcpc-3 had a calculated coefficient of variation of 0.38, which is more than seven times the coefficient of variation calculated for the time period corresponding to the TRcpc-18 baseline period (0.05). The greater variation observed with historical data can be mainly attributed to the larger sample size and longer monitoring period, which more suitably encompass expected natural variation. Thus, the relatively small variation observed in TRcpc-18 calcium baseline data, with a coefficient of variation of 0.07, is in part a function of the limited sample size and monitoring period. The two compliance monitoring concentrations that exceeded the statistical limit are likely part of the expected natural variation, especially considering the coefficient of variation for the entire baseline and compliance total recoverable calcium data set for TRcpc-18 (20 data points) is 0.12, which is lower than the coefficient of variation for most of the upgradient wells with longer periods of record (Table 1).

3.2 Common CCR Tracers

Figure 4 shows a time series graph of total recoverable calcium at TRcpc-18, along with time series graphs for the other Appendix III parameters. If the active CCR landfill was the source of increased calcium in well TRcpc-18, then CCR-indicative constituents such as boron and fluoride would also be expected to increase. The October 2022 and February 2023 samples contained the highest calcium concentrations in TRcpc-18, but there has not been a correlating increase in boron or fluoride concentrations. In fact, the October 2022 boron and fluoride concentrations in TRcpc-18 were lower than previously observed in this well. Likewise, sulfate and TDS concentrations have been decreasing in TRcpc-18. Therefore, it is unlikely that the active CCR landfill is the source of the change in calcium concentrations leading to the identification of the SSI.

3.3 Travel Time

To evaluate the potential for a hypothetical historical release of CCR-impacted water to affect monitored groundwater quality, the travel time in the unsaturated/vadose zone was estimated using a simplified, yet conservative, analytical method for advective transport. The travel time for potential subsurface impacts to reach the top of the uppermost aquifer is based on the site hydrogeology including:

- Vadose zone thickness of the confining unit of the Chinle Claystone (i.e., the vertical separation between the top of the claystone unit and the top of the uppermost aquifer) of 75 feet, conservatively omitting the silty sandstone lens within the claystone (Golder 2016)
- Site-specific saturated hydraulic conductivity and porosity values for the Chinle Claystone of 0.0011 feet per day (4×10^{-7} centimeters per second) and 0.38, respectively, from geotechnical laboratory testing reported by Metric (2004)

For conceptual/demonstration purposes, the estimates of the above properties at the site were used to evaluate travel time of flow and conservative contaminant transport from the top of the claystone to the uppermost aquifer. The conservatively estimated vadose zone travel time through the 75-foot-thick claystone layer for a subsurface release near well TRcpc-18 is approximately 71 years. This travel time estimate is conservative since it is based on advective transport, which does not incorporate retardation in transport processes due to sorption or dispersion, assumes high-moisture conditions and simplification in using saturated hydraulic conductivity to estimate travel time instead of more applicable, lower values of unsaturated hydraulic conductivity, and omits additional travel time in the surface alluvium and sandstone lens in the claystone. The sandstone lens has not been observed in other boreholes drilled in the Chinle Claystone and is not interpreted to be a continuous water-bearing zone under the facility. In addition, site heterogeneity, e.g., bedrock and contaminant properties, are not accounted for in this estimate and will also influence travel time; such variations will generally increase travel times.

Given that the active CCR landfill has only been in operation since 2006, this analysis suggests that a hypothetical release of CCR-impacted water would not reach the uppermost aquifer until at least the year 2077 (and likely much later). Therefore, the time travel analysis eliminates the possibility that the cause of the SSI in TRcpc-18 is the active CCR landfill because it is simply not realistic for a release from the CCR unit to travel to the Correo Sandstone (in TRcpc-18) during the time span from 2006 to 2022.

4.0 EVIDENCE OF AN ALTERNATIVE SOURCE

Based on the review of natural variability presented in this report, primary lines of evidence and conclusions drawn from the evidence used to support this ASD can be summarized as follows:

- Downgradient well TRcpc-18 has lower reported total recoverable calcium concentrations than the other active CCR landfill monitoring wells, including the upgradient wells (Figure 2). Concentrations in TRcpc-18 are also lower than in other site upgradient wells. Furthermore, variability in calcium concentrations are anticipated because the host formation of the active CCR landfill monitoring wells, the Correo Sandstone, is calcite-cemented, which represents a source of calcium that is subject to natural variations.
- The relatively short baseline data period (three years instead of >30 years available for other site wells) for the CCR program did not allow for natural variations in groundwater concentrations to be fully observed during the baseline data collection period. This is supported by the natural variation observed over much longer periods of record in other upgradient site wells.
- There is an absence of increasing concentrations for other CCR indicator constituents (boron, fluoride, sulfate, etc.) in groundwater at TRcpc-18 that would likely indicate an impact from the CCR unit.
- A travel time estimate indicates that a hypothetical release of CCR-impacted water would take at least 71 years to travel through the overlying claystone to the screened unit of TRcpc-18. Therefore, it is not realistic for a release from the CCR unit to travel to TRcpc-18 during the time span from 2006 to 2022.

5.0 CONCLUSIONS

In accordance with 40 CFR 257.94(e)(2), this ASD has been prepared in response to the identification of a verified SSI for total recoverable calcium at monitoring well TRcpc-18. This demonstration details the reasons behind WSP’s conclusion that the SSI for total recoverable calcium at TRcpc-18 is not an indication of groundwater impacts from Escalante Generating Station’s active CCR landfill, but rather a reflection of natural variability in calcium concentrations that was not fully captured during the baseline data collection period.

Based on the findings of this demonstration, WSP recommends that Tri-State continue with the detection monitoring program for the active CCR landfill at Escalante Generating Station.

Signature Page

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6.0 REFERENCES

Golder (Golder Associates Inc.). 2016. Drilling and Monitoring Well Installation Summary at the Escalante Generating Station in Prewitt, New Mexico. August 19.

Golder. 2020. Active Coal Combustion Residuals Landfill Groundwater Statistical Method Certification, Escalante Generating Station. Report prepared for Tri-State Generation and Transmission Association, Inc. June 29.

Geosyntec. 2022. Discharge Permit Closure and Post-Closure Plan, Escalante Generating Station. Groundwater Discharge Permit DP-206 (Revision 2). February.

Metric (Metric Corporation). 2004. Pond 4 and Pond 5 Leakage Investigation – Correo Sandstone, Tri-State Escalante Station, Prewitt, New Mexico. April.

Moench RH and Schlee JS. 1967. Geology and Uranium Deposits of the Laguna District, New Mexico. United States Geological Survey Professional Paper 519.

USEPA (US Environmental Protection Agency), Office of Solid Waste. 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance. March.

Tables

Table 1: Calcium Summary Statistics

Subset	Monitoring Well	Constituent	Date Range[1]	Samples on Record	Calcium Concentration				
					Minimum (mg/L)	Mean (mg/L)	Maximum (mg/L)	Coefficient of Variation	Standard Deviation
Upgradient CCR Network Wells	TRcpc-1	Calcium, total recoverable	Sept 2016-Nov 2019	14	6.5	11.8	13.0	0.13	1.50
	TRcpc-1	Calcium, dissolved	Feb 1985-Oct 2022	108	10.9	13.0	17.3	0.10	1.25
	TRcpc-2	Calcium, total recoverable	Sept 2016-Nov 2019	13	13.0	14.2	15.0	0.05	0.66
	TRcpc-2	Calcium, dissolved	Feb 1985-Oct 2022	108	10.9	13.7	23.4	0.10	1.38
Downgradient CCR Network Wells	TRcpc-15	Calcium, total recoverable	Sept 2016-Nov 2019	13	6.7	7.3	7.9	0.05	0.36
	TRcpc-16	Calcium, total recoverable	Nov 2016-Nov 2019	11	4.8	5.4	6.0	0.06	0.35
	TRcpc-16	Calcium, dissolved	Oct 2016-Oct 2016	1		6.0		NA	NA
	TRcpc-17	Calcium, total recoverable	Sept 2016-Nov 2019	13	17.0	18.8	21.0	0.06	1.19
	TRcpc-17	Calcium, dissolved	Oct 2016-Oct 2016	1		19.5		NA	NA
	TRcpc-18	Calcium, total recoverable	Oct 2016-Nov 2019	13	4.0	4.4	5.0	0.07	0.30
	TRcpc-18	Calcium, dissolved	Oct 2016-Oct 2016	1		3.9		NA	NA
Other Upgradient Site Wells	TRcpc-3	Calcium, total recoverable	Sept 2016-May 2017	8	4.2	4.6	4.8	0.05	0.21
	TRcpc-3	Calcium, dissolved	Feb 1985-Oct 2022	108	4.2	11.1	19.3	0.39	4.30
	TRcpc-5	Calcium, dissolved	Feb 1985-Oct 2022	108	22.3	32.3	53.8	0.21	6.93
	TRcpc-10	Calcium, dissolved	Feb 1985-Oct 2022	109	22.4	51.7	86.0	0.32	16.68
	TRcpc-12	Calcium, dissolved	July 2001-Oct 2022	59	37.5	46.5	53.0	0.07	3.23

Notes:
(1): Indicates baseline sampling period for CCR network wells and period of record for non-CCR program sampling.
Dissolved calcium data prior to 1985 were not included in calculations due to higher reported concentrations in some wells.
CCR Rule requires analysis of total recoverable metals. Dissolved calcium analyses at TRcpc-1 and TRcpc-2 were conducted under a separate sampling program.
Summary statistics exclude the following visual outliers:
-TRcpc-3 (12/31/2008): 276 mg/L
-TRcpc-5 (12/30/2010): <0.5 mg/L

Figures

LEGEND

TRcpc-1	UPGRADIENT CCR NETWORK WELL
TRcpc-15	DOWNGRADIENT CCR NETWORK WELL
TRcpc-5	UPGRADIENT OTHER SITE WELL
TRcpc-16	DOWNGRADIENT OTHER SITE WELL
6860.9	GROUNDWATER ELEVATION (NOTE 1)
10.0	OCTOBER 2022 DISSOLVED CALCIUM CONCENTRATION (mg/L)
10.0	OCTOBER 2022 TOTAL RECOVERABLE CALCIUM CONCENTRATION (mg/L)
10.0	FEBRUARY 2023 TOTAL RECOVERABLE CALCIUM CONCENTRATION (mg/L)
	POTENTIOMETRIC SURFACE CONTOUR

NOTE(S)

1. GROUNDWATER ELEVATIONS AT TRcpc-1, TRcpc-2, TRcpc-15, TRcpc-16, TRcpc-17, AND TRcpc-18 WERE MEASURED IN OCTOBER 2022. GROUNDWATER ELEVATIONS AT TRcpc-3, TRcpc-5, TRcpc-6, TRcpc-7, TRcpc-8, TRcpc-9, TRcpc-10, TRcpc-11, TRcpc-12, TRcpc-13R, AND TRcpc-14 WERE MEASURED IN SEPTEMBER 2022.
2. CALCIUM CONCENTRATIONS FOR OTHER SITE WELLS DOWNGRADIENT OF THE EVAPORATION PONDS (TRcpc-4, TRcpc-6, TRcpc-7, TRcpc-8, TRcpc-9, TRcpc-11, TRcpc-13R, and TRcpc-14) HAVE NOT BEEN INCLUDED (SEE REPORT TEXT FOR DETAILS).

0 400 800
1" = 400' FEET

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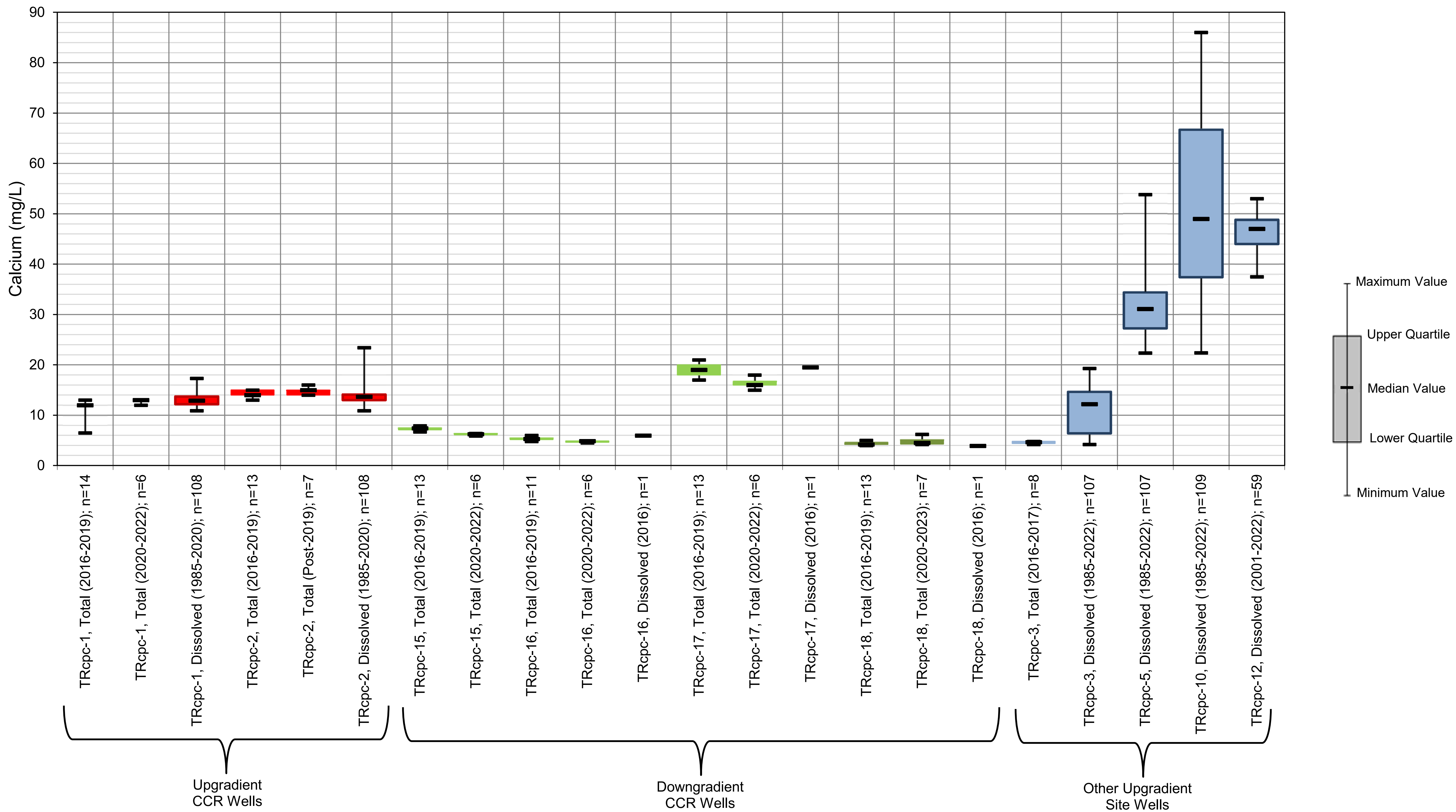
APPROVED	JEO

PROJECT
ESCALANTE GENERATING STATION
ACTIVE COAL COMBUSTION RESIDUALS LANDFILL
ALTERNATIVE SOURCE DEMONSTRATION

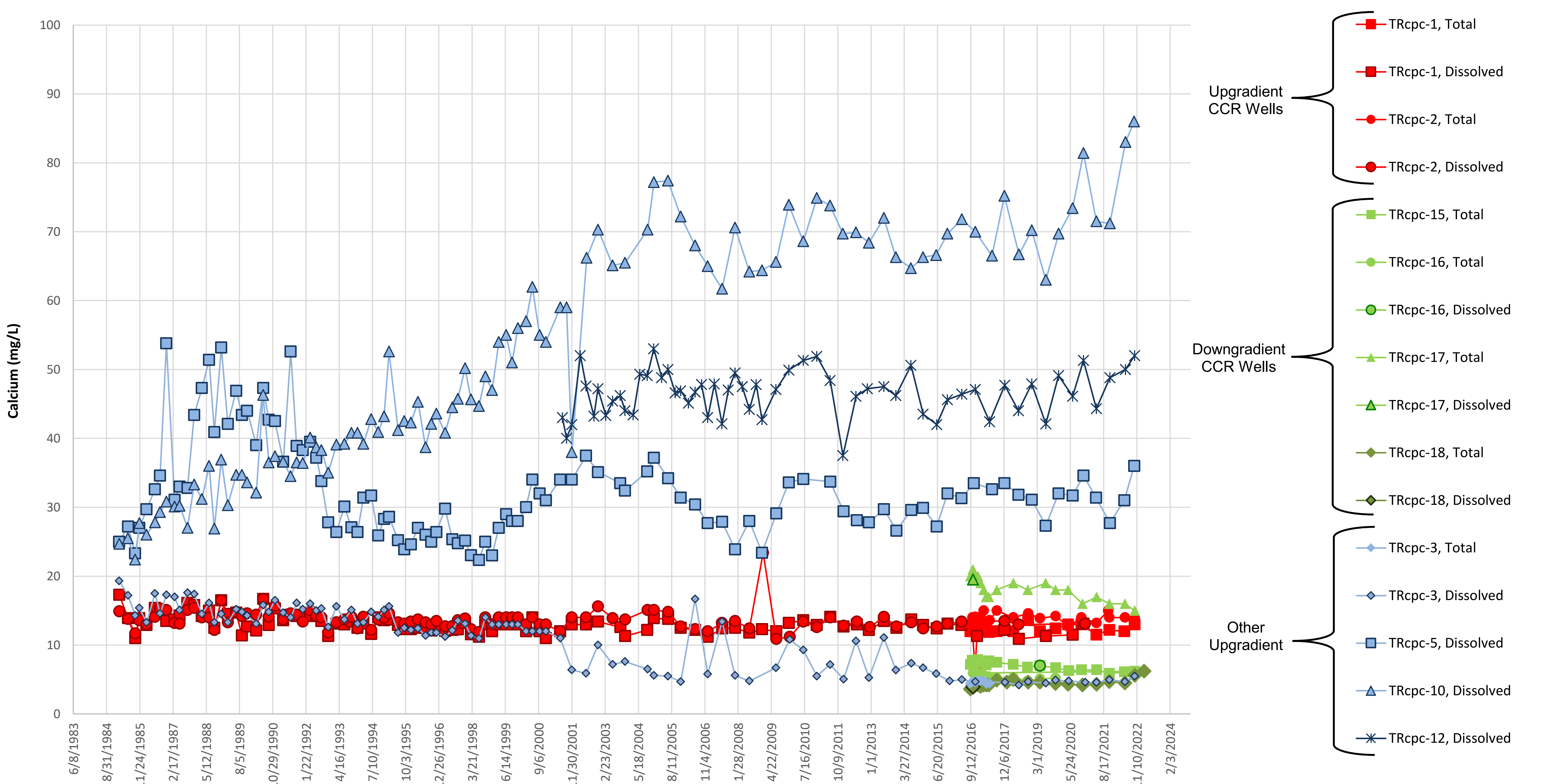
TITLE
MONITORING WELL LOCATIONS AND MOST RECENT GROUNDWATER ELEVATIONS AND CALCIUM CONCENTRATIONS

PROJECT NO.	REV.	FIGURE
21453425.000	B	1



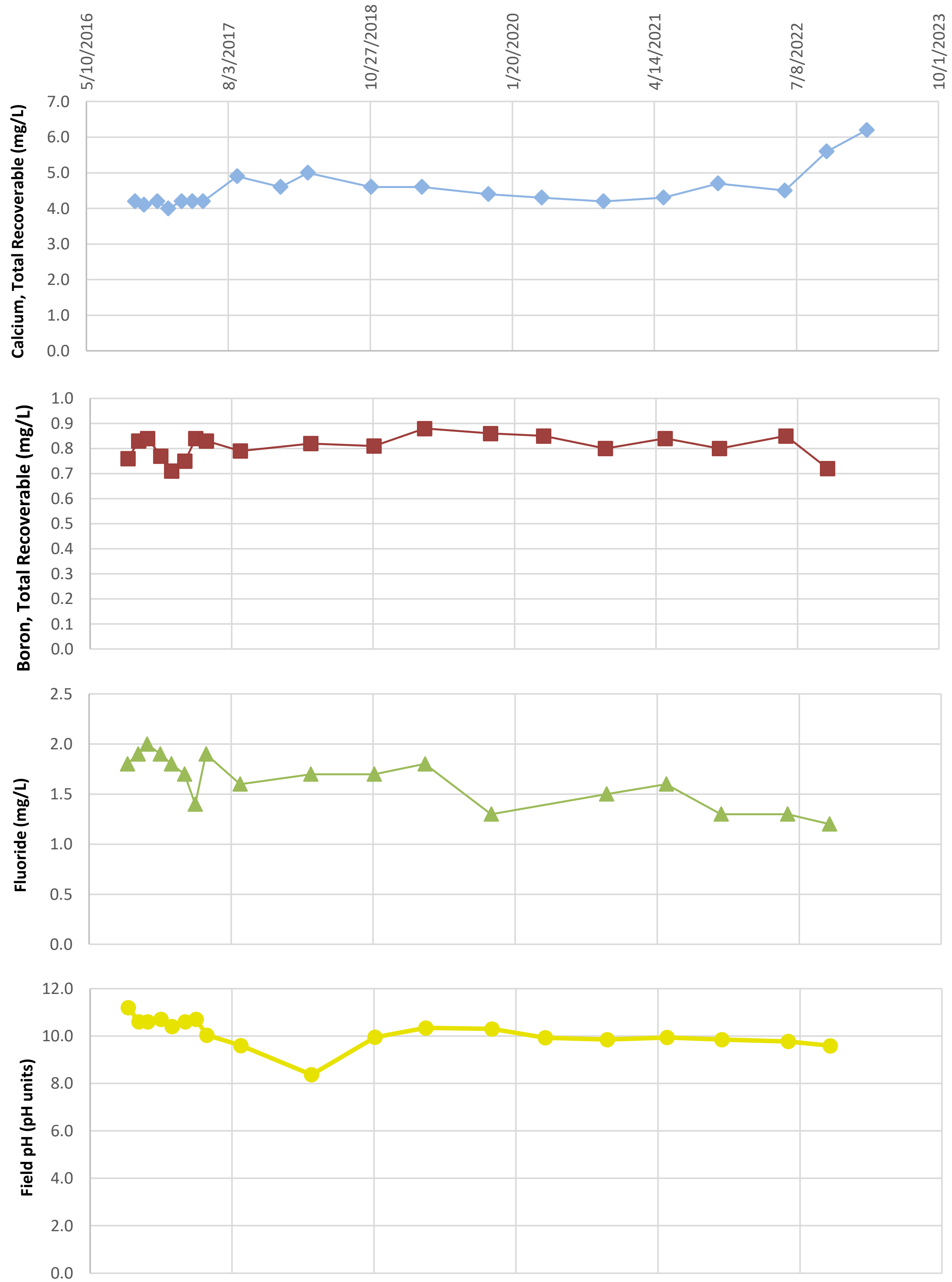
Note:
Total concentrations refer to total recoverable concentrations.
For CCR network wells, the baseline and compliance periods are shown seperately.
Plot excludes the following visual outliers: TRcpc-3 (12/31/2008): 276 mg/L and TRcpc-5 (12/30/2010): <0.5 mg/L.

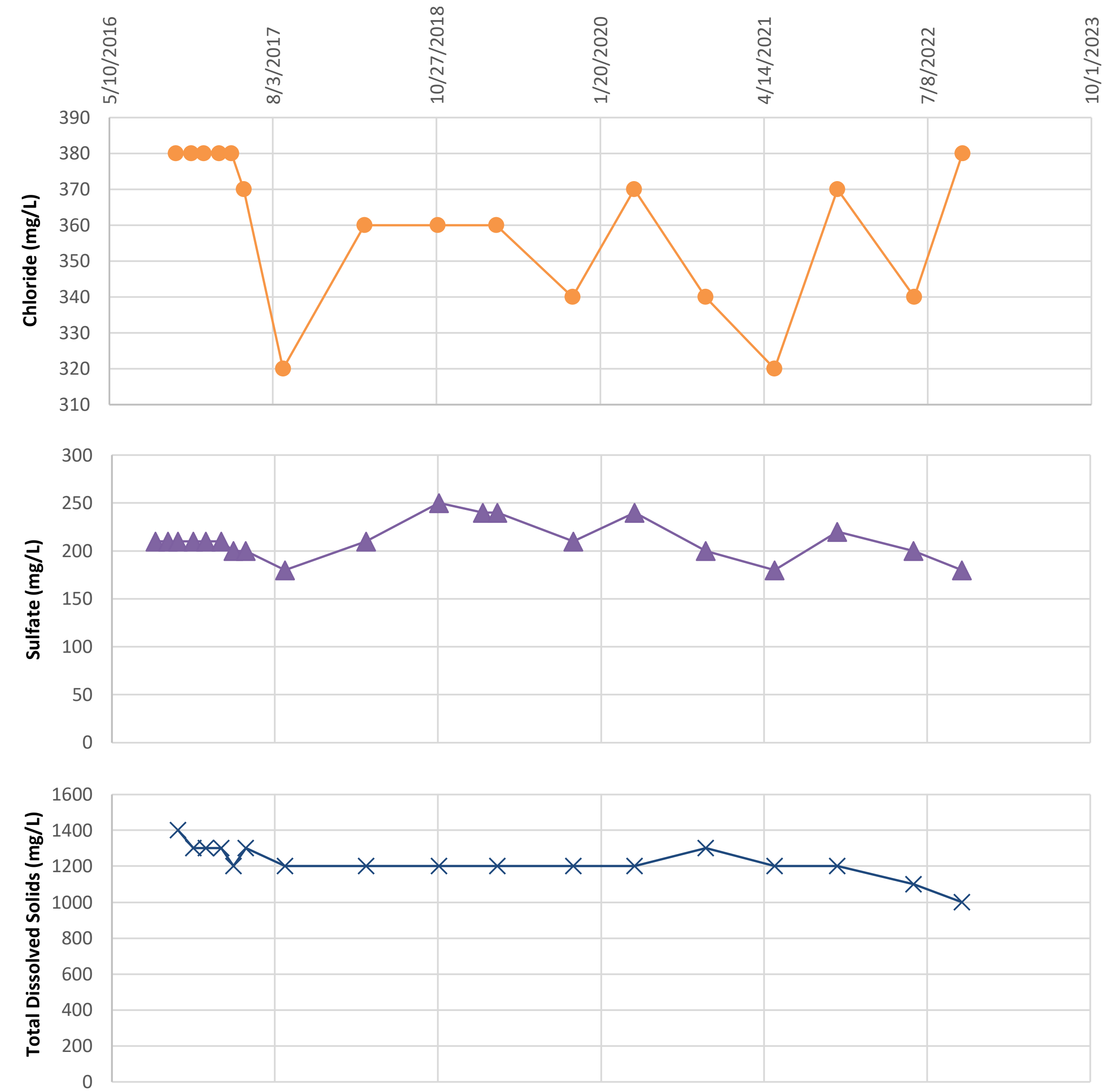
CLIENT Tri-State Generation and Transmission Association	PROJECT Alternative Source Demonstration
CONSULTANT wsp	TITLE Box and Whisker Plot for Calcium Concentrations
	PROJECT NO. 21453425.000 · PHASE 04 · REV. B · FIGURE 2



Note:
Total concentrations refer to total recoverable concentrations.
Plot excludes the following visual outliers: TRcpc-3 (12/31/2008): 276 mg/L and TRcpc-5 (12/30/2010): <0.5 mg/L.

CLIENT Tri-State Generation and Transmission Association	PROJECT Alternative Source Demonstration
CONSULTANT wsp	TITLE Calcium Concentration Time Series Graph
	PROJECT NO. 21453425.000 · PHASE 04 · REV. B · FIGURE 3





Note:
Non-detects plotted at the practical quantitation limit.

CLIENT
Tri-State Generation and Transmission Association

PROJECT
Alternative Source Demonstration

CONSULTANT
wsp

TITLE
TRcpc-18 Appendix III Time Series Graphs

PROJECT NO.	PHASE	REV.	FIGURE
21453425.000	04	B	4

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