



## REPORT

# Annual Coal Combustion Residuals Groundwater Monitoring and Corrective Action Report – 2023

*Nebraska Public Power District, Gerald Gentleman Station*

Submitted to:

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## Executive Summary

This report presents the results from groundwater monitoring that occurred at Nebraska Public Power District's Gerald Gentleman Station in 2023 to meet the requirements of the United States Environmental Protection Agency's Coal Combustion Residuals Rule (40 Code of Federal Regulations 257.90 through 257.98). The facility entered 2023 under a detection monitoring program and remains in detection monitoring based on the results of sampling and analysis events conducted in the second quarter (Q2) and fourth quarter (Q4) of 2023.

No potential exceedances were identified during either the Q2 2023 or Q4 2023 detection monitoring sampling events. A verified statistically significant increase (SSI) was identified for chloride at APMW-6 during the Q2 2023 and Q4 2023 sampling events. The verified SSI was originally identified following the Q4 2021 sampling event. A previously prepared successful alternative source demonstration (ASD) was reviewed for ongoing applicability for the verified SSI for both Q4 2022 and Q2 2023 and was found to remain applicable following sampling events. Based on the results of the Q4 2023 event, the previously completed ASD was reviewed for continued applicability. The conclusions of the previous ASD remain valid; therefore, Gerald Gentleman Station will remain in detection monitoring for the first semi-annual detection monitoring event of 2024, to be conducted in Q2 2024.

Sulfate at APMW-19 was previously identified as a verified SSI. A previously prepared successful ASD was reviewed for ongoing applicability for the verified SSI for the Q4 2022 event and was found to remain applicable following the sampling event. The Q2 2023 event marked the second consecutive event where both the analytical result and the calculated cumulative sum (CUSUM) value were below the statistical limit, following the Q4 2022 event, such that sulfate at APMW-19 is no longer considered a verified SSI.

As described in the *Groundwater Monitoring System Certification* (GAI 2017b) and the *Groundwater Monitoring Statistical Methods Certification* (GAI 2017a), the groundwater monitoring and analytical procedures meet the general requirements of the Coal Combustion Residuals Rule, and modifications to the monitoring network and sampling program are not recommended at this time.

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## 1.0 INTRODUCTION

WSP USA Inc. (WSP) has prepared this report describing the 2023 groundwater sampling and comparative statistical analysis for Nebraska Public Power District's (NPPD's) Gerald Gentleman Station (GGS) in Sutherland, Nebraska. This report was written to meet the requirements for groundwater monitoring and corrective action within the United States Environmental Protection Agency's Coal Combustion Residuals (CCR) Rule, 40 Code of Federal Regulations (CFR) 257.90 to 257.98.

### 1.1 Facility Information

GGS is located approximately 5 miles south of Sutherland, Nebraska, and 1.2 miles south of Sutherland Reservoir. The ash disposal facility at GGS is situated in the NW 1/4, NE 1/2, Section 30 of Township 13N, Range 33 W, in Lincoln County, Nebraska. NPPD began operating GGS in 1979 as a coal-fired electrical generation facility. GGS is both owned and operated by NPPD. The plant, with a generation capacity of 1,365 megawatts of power, uses a low-sulfur coal from Wyoming's Powder River Basin. The active CCR landfill at the site contains fly ash and bottom ash.

### 1.2 Purpose

The federal CCR Rule established specific requirements for reporting of groundwater monitoring and corrective actions in 40 CFR 257.90. Per part (e) of 40 CFR 257.90, 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 NETWORK PROGRAM STATUS

The groundwater monitoring network for the active CCR landfill at GGS consists of 14 monitoring wells, as shown in Figure 1 and Figure 2. The four upgradient wells are APMW-5, APMW-15, APMW-16A, and APMW-17 and are indicated by the inclusion of "(U)" throughout the text. The 10 downgradient monitoring wells are APMW-4, APMW-6, APMW-8A, APMW-10, APMW-11, APMW-12, APMW-13, APMW-14, APMW-18, and APMW-19.

### 2.1 Completed Key Actions in 2023

The following key actions were completed in 2023:

- The 2022 annual CCR groundwater monitoring and corrective action report was completed and placed within the operating record and on NPPD's publicly accessible CCR website (WSP 2023).
- Detection monitoring samples were collected in June and November 2023 and analyzed for the Appendix III constituent list associated with the federal CCR Rule.
- Additional samples were collected from APMW-4 and APMW-11 in June and July and from APMW-11 in November for separate state reporting requirements and analyzed for the Appendix IV parameters.
- Comparative statistical analysis was completed for the second quarter (Q2) 2023 and fourth quarter (Q4) 2023 detection monitoring events, collected in June and November 2023, respectively.

### 2.2 Installation and Decommissioning of Monitoring Wells

No monitoring wells associated with the ash disposal facility groundwater quality monitoring network were installed or decommissioned at GGS in 2023.

## 2.3 Problems and Resolutions

During the Q2 2023 sampling event, the groundwater level at APMW-5 (U) was below the level of the dedicated low-flow pump, resulting in a groundwater level not being recorded. However, enough water was present for a sample to be collected for laboratory analysis.

Upon review of the Q2 2023 analytical report, a difference was noted in the provided reporting limit for fluoride across the collected samples. In correspondence with Eurofins Environment Testing Cedar Falls, the laboratory noted that during a recent reevaluation and certification of the minimum detectable levels (MDLs) for the laboratory instrument using method SW 9056A for fluoride, the undiluted MDL for fluoride increased from 0.044 mg/L to 0.075 mg/L. This resulted in a concurrent increase in the undiluted reporting limit, given as the practical quantitation limit, from 0.10 mg/L to 0.20 mg/L. Samples were analyzed using a similar dilution factor to prior results, resulting in non-detects reported as ND < 1.000 mg/L for the collected samples. This result is not considered a statistical increase, based on the difference in results stemming from changes to the laboratory reporting limits.

During the Q4 2023 sampling event, the groundwater level at APMW-15 (U) was below the level of the dedicated low-flow pump, resulting in a groundwater level not being able to be recorded for the monitoring event. However, enough water was present at APMW-15 (U) for proper purging to occur and for a sample to be collected for laboratory analysis. Additionally, wells APMW-5 (U) and APMW-4 were dry during the Q4 2023 sampling event, preventing collection of groundwater levels and analytical sampling at both wells. NPPD will continue to monitor APMW-5 (U), APMW-15 (U), and APMW-4 during future sampling events.

## 2.4 Proposed Key Activities for 2024

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

- The 2023 annual monitoring report will be finalized and placed on the publicly accessible CCR website and in the site operating record.
- Detection monitoring sampling events and associated comparative statistical analysis are planned to occur in Q2 and Q4 2024.

## 3.0 GROUNDWATER MONITORING ANALYTICAL PROGRAM STATUS

Analytical activities associated with the groundwater monitoring program are described as follows.

### 3.1 Samples Collected

GGs staff collected monitoring samples for the CCR detection monitoring program in June and November 2023. Specific dates for each sample are provided on the tables included as Appendix A.

Additional samples were collected at APMW-4 and APMW-11 in support of separate, Nebraska-specific reporting requirements. The analyses are not required as part of the CCR detection monitoring program. The collected results have been included on the tables in Appendix A.

#### 3.1.1 Groundwater Elevation and Flow Rate

Groundwater elevations were measured in 13 of the 14 wells during the Q2 sampling event and 11 of the 14 wells during the Q4 event prior to purging. During the Q2 2023 sampling event, the groundwater level at APMW-5 (U) was below the level of the dedicated low-flow pump, resulting in a groundwater level not being recorded, but

enough water was present for a sample to be collected for laboratory analysis. APMW-5 (U) and APMW-4 were dry during the Q4 2023 monitoring event, with both groundwater levels and samples for laboratory analyses unable to be collected. During Q4 sampling, the groundwater level at APMW-15 (U) was below the level of the dedicated low-flow pump, resulting in a groundwater level not being recorded, but enough water was present for a sample to be collected for laboratory analysis. Groundwater elevation measurements can be found in the tables included as Appendix A for each location. Groundwater elevations and interpolated groundwater contours are shown in Figure 1 for the June 2023 (Q2 2023) detection monitoring sampling event. Groundwater elevations and interpolated groundwater contours are shown in Figure 2 for the November 2023 (Q4 2023) detection monitoring sampling event.

The groundwater flow rate across the facility 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 from slug testing results from system wells, in ft/day
- $i$  is the hydraulic gradient, calculated based on groundwater elevations for each monitoring event, in feet per foot (ft/ft)
- $n_e$  is the effective porosity, a unitless parameter, estimated to be 0.25 for site soils

Hydraulic conductivity values at the site range from 0.14 to 19 ft/day, based on slug test data reported in *Design and Construction of a Groundwater Monitoring Network, Final Report*, issued in September 1991 by Woodward-Clyde Consultants. According to the 1991 report, a hydraulic conductivity value of 0.14 ft/day represents the Ogallala Formation silts. Values of 16 and 19 ft/day were reported for Ogallala Formation sands. Both 0.14 and 19 ft/day have been used to estimate the range of hydraulic conductivities present at GGS. The effective porosity estimate listed above is based on typical values for sands and silts, as presented in *Applied Hydrogeology* (Fetter 1994).

Based on the range of site values for hydraulic conductivity, the estimated effective porosity, and the calculated hydraulic gradient based on water level readings, the average groundwater flow rate for June 2023 was estimated between  $4.0 \times 10^{-4}$  ft/day to  $5.5 \times 10^{-2}$  ft/day. The average groundwater flow rate from wells with recorded groundwater elevations in November 2023 was estimated between  $6.8 \times 10^{-4}$  ft/day to  $9.8 \times 10^{-2}$  ft/day. Gradients for the November 2023 monitoring event were calculated from APMW-16A, based on not being able to collect a water level at APMW-15 during the monitoring event.

## 3.2 Monitoring Data (Analytical Results)

Analytical results for the CCR Rule Appendix III detection monitoring events in June 2023 and November 2023 are shown in the tables included as Appendix A.

## 3.3 Comparative Statistical Analysis

A description of the steps taken for comparative statistical analysis is summarized as follows with the results presented in the tables included as Appendix B.

Comparative statistical analysis is conducted following each detection monitoring event consisting of the Appendix III parameters (USEPA 2015). For both Shewhart-CUSUM limits and non-parametric prediction limits (NP-PL), the comparative statistical analysis consists of a comparison of detection monitoring results collected during the period of interest to the statistical limit calculated from the baseline data collection period. For well-constituent pairs with increasing trends identified during the baseline period, an alternative trend test, as

described by the Electric Power Research Institute (EPRI) (2015) has been used to determine compliance. For well-constituent pairs with decreasing trends identified for the baseline period, a Sen's slope test was used to assess the compliance results. At present, no well-constituent pairs have either increasing or decreasing trends within the baseline period, and no alternative methods for trend analysis have been used within this report. Additional information on the methods used for the comparative statistical analysis can be found in the *Groundwater Monitoring Statistical Methods Certification* (GAI 2017b).

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

- **Elevated CUSUM:** defined as when the calculated CUSUM value is greater than the Shewhart-CUSUM limit established by the baseline statistical analysis, but the analytical result does not exceed the Shewhart-CUSUM limit. An elevated CUSUM is an indication that concentrations are gradually increasing and that the analytical results may exceed the Shewhart-CUSUM limit in the future. For elevated CUSUMs in the case of two-tailed analysis for field-measured pH, the CUSUM value may also be below the lower Shewhart-CUSUM limit established by the baseline statistical analysis.
- **Potential exceedance:** defined as an initial elevated CUSUM or an initial analytical result that exceeds the Shewhart-CUSUM limit or non-parametric statistical limit established by the baseline statistical analysis. Confirmatory resampling will determine if the potential exceedance is a false positive or a verified statistically significant increase (SSI). Non-detect results that exceed either the Shewhart-CUSUM limit or the non-parametric statistical limit are not considered potential exceedances.
- **False positive:** defined as an analytical result that exceeds the statistical limit that can clearly be attributed to laboratory error, changes in analytical precision, or is invalidated through confirmatory resampling. False positives are not used in calculations of any subsequent CUSUM values.
- **Confirmatory resampling:** designated as the next scheduled sampling event.
- **Verified SSI:** interpreted as two consecutive exceedances (the original sample and the confirmatory re-sample for analytical results, or two consecutive elevated CUSUMs) for the same constituent at the same well.

Results of the statistical analysis for the Q2 2023 and Q4 2023 detection monitoring events are shown in the tables included as Appendix B. For reporting purposes, compliance samples with non-detect results are shown at the practical quantitation limit (PQL) on the tables included as Appendix B.

### **3.3.1 Potential Exceedances**

No potential exceedances were identified during the Q2 2023 or Q4 2023 detection monitoring sampling events.

### **3.3.2 False Positives**

No false positives were identified during the Q2 2023 or Q4 2023 detection monitoring sampling events.

### **3.3.3 Verified Statistically Significant Increases**

No new verified SSIs were identified during either the Q2 2023 or Q4 2023 detection monitoring sampling events. During both monitoring events, chloride was identified as a verified SSI at APMW-6, which was initially verified during the Q4 2021 sampling event.

Sulfate at APMW-19 was previously identified as a verified SSI. The Q2 2023 event marked the second consecutive event where both the analytical result and the calculated CUSUM value were below the statistical limit, following the Q4 2022 event, such that sulfate at APMW-19 is no longer considered a verified SSI.

As discussed in Section 2.3, reported fluoride values beginning with the Q2 2023 sampling event reflect a change in the reporting limit based on revised method certifications for the analytical laboratory. As the reported values for both the Q2 2023 and Q4 2023 sampling events are associated with non-detect analytical results with consistent analytical methodology and dilution factors to past results, non-detect results above the statistical limits are not considered exceedances for either upgradient or downgradient locations.

### **3.4 Program Transitions**

Beginning in Q4 2017, the groundwater monitoring program at GGS transitioned from the baseline period to detection monitoring. During the baseline period, eight independent samples from each well within the program were collected and analyzed for the constituents listed in Appendix III and Appendix IV of the CCR rule prior to October 17, 2017, as specified in 40 CFR 257.94(b), with the previously reported exceptions of APMW-5 (U) and APMW-4 due to lack of precipitation (GAI 2018).

#### **3.4.1 Detection Monitoring**

Samples for the detection monitoring program are collected on a semi-annual basis, beginning with the sample collected in November 2017. NPPD plans to collect semi-annual samples for the detection monitoring program in Q2 and Q4 2024.

#### **3.4.2 Alternative Source Demonstrations**

Resulting from the verified SSI for chloride at APMW-6 during the Q4 2022 and Q2 2023 detection monitoring events and the verified SSI for sulfate at APMW-19 during the Q4 2022 detection monitoring event, the previously prepared alternative source demonstrations (ASDs) were reviewed for ongoing applicability. As specified in 40 CFR 257.94, the conclusions were found to remain applicable within 90 days of identification of each of the SSIs, and the CCR unit remained in detection monitoring for the Q4 2023 detection monitoring event.

As noted in Section 3.3.3, the Q2 2023 event marked the second consecutive event where sulfate at APMW-19 was below the associated statistical limit. Consequently, sulfate is no longer considered an SSI at APMW-19 and a review of the ASD was not conducted following the Q2 2023 monitoring event.

Based on the Q4 2023 verified SSI for chloride at APMW-6, the previously completed ASD was reviewed for continued applicability. The conclusions of the previous ASD were found to remain valid; therefore, NPPD will remain in detection monitoring (see Appendix C).

#### **3.4.3 Assessment Monitoring**

The current groundwater monitoring program at GGS is not in assessment monitoring. Assessment monitoring has not been triggered as described in 40 CFR 257.95.

#### **3.4.4 Corrective Measures and Assessment**

The current groundwater monitoring program at GGS does not indicate the need for corrective measures. An assessment of corrective measures, as described in 40 CFR 257.96, has not been required. No ASDs for Appendix IV parameters have been made. No corrective actions are required at this time.

## 4.0 RECOMMENDATIONS AND CLOSING

This report presents the results from the Q2 2023 and Q4 2023 detection monitoring events of the CCR program and the associated comparative statistical analysis. The groundwater monitoring and analytical procedures implemented at GGS meet the requirements of the CCR Rule and are consistent with the approach described in *Groundwater Monitoring System Certification* (GAI 2017a) and the *Groundwater Monitoring Statistical Methods Certification* (GAI 2017b). Modifications to the monitoring network and sampling program are not recommended at this time, and the program will remain in detection monitoring for the Q2 2024 detection monitoring event.

## Signature Page

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[https://wsonline.sharepoint.com/:w:/r/Sites/Global-NPPD2023GWQualityRep/Project%20Files/6%20Deliverables/009-RPT-NPPD\\_GGS\\_2023\\_Annual\\_GW\\_Rpt/Rev0/31405886.001-009-RPT-0-NPPD\\_GGS\\_2023\\_Annual\\_CCR\\_GW\\_Rpt\\_30JAN24.docx](https://wsonline.sharepoint.com/:w:/r/Sites/Global-NPPD2023GWQualityRep/Project%20Files/6%20Deliverables/009-RPT-NPPD_GGS_2023_Annual_GW_Rpt/Rev0/31405886.001-009-RPT-0-NPPD_GGS_2023_Annual_CCR_GW_Rpt_30JAN24.docx)

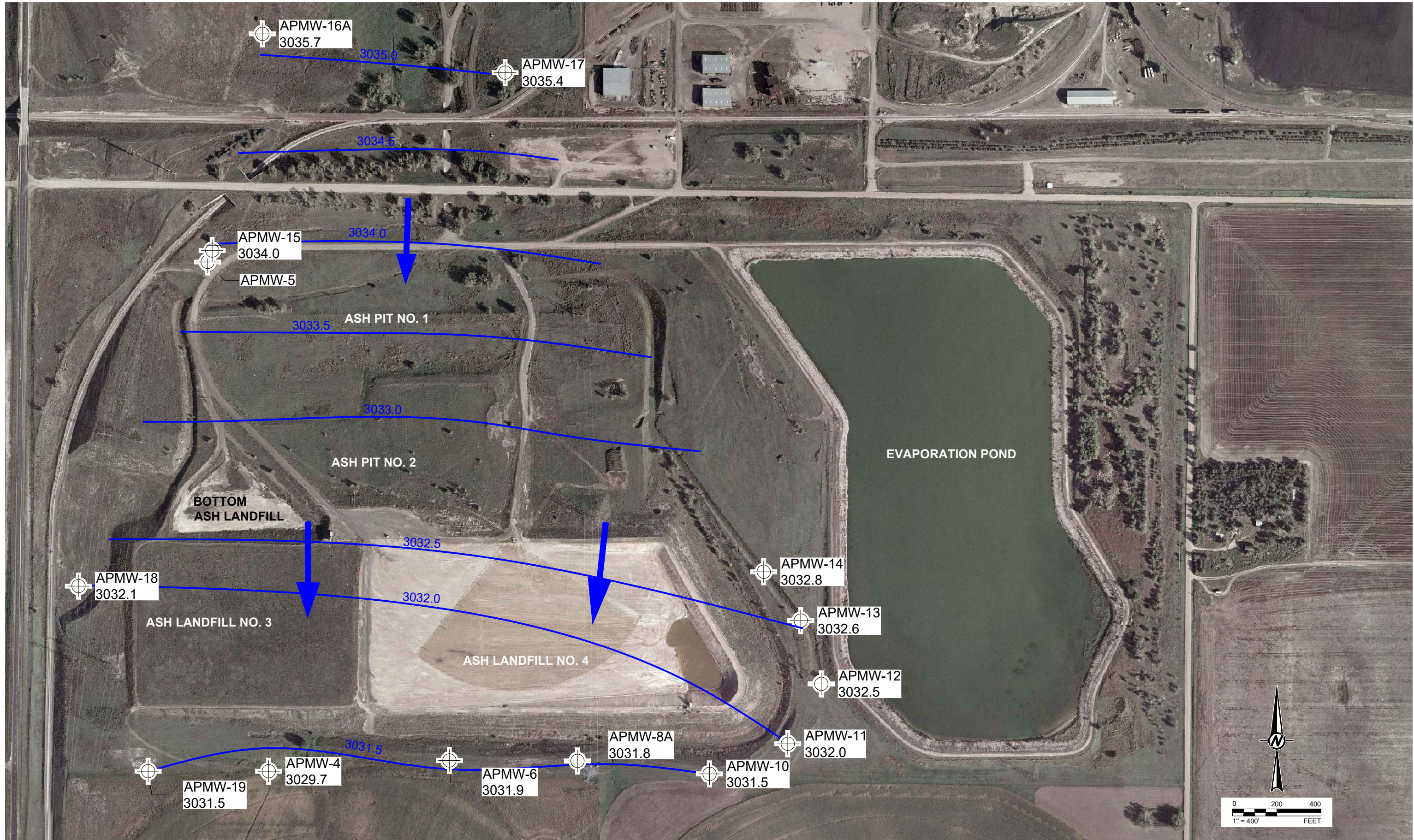
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## Figures





NOTE  
GROUNDWATER CONTOURS DEVELOPED FROM LEVELS MEASURED IN ACTIVE  
MONITORING WELLS SHOWN.

NEBRASKA PUBLIC POWER DISTRICT  
GERALD GENTLEMAN STATION  
GROUNDWATER MONITORING WELL NETWORK  
JUNE 2023 GROUNDWATER CONTOURS  
FIGURE 1









**APPENDIX A**

# Monitoring Data

**Table 1: Data Summary Table - APMW-5 (Upgradient)**

Analytes	Units	6/5/2023	11/13/2023
		Detection Monitoring <sup>(a)</sup>	
Water elevation	ft amsl	*	***
<b>Appendix III</b>			
Boron, total	mg/L	< 0.100	NS
Calcium, total	mg/L	50.3	NS
Chloride	mg/L	15.9	NS
Fluoride	mg/L	< 1.00	NS
pH, field	pH units	*	NS
Sulfate	mg/L	47.9	NS
Total dissolved solids	mg/L	264	NS
<b>Appendix IV</b>			
Antimony, total	mg/L	NA	NA
Arsenic, total	mg/L	NA	NA
Barium, total	mg/L	NA	NA
Beryllium, total	mg/L	NA	NA
Cadmium, total	mg/L	NA	NA
Chromium, total	mg/L	NA	NA
Cobalt, total	mg/L	NA	NA
Fluoride	mg/L	NA	NA
Lead, total	mg/L	NA	NA
Lithium, total	mg/L	NA	NA
Mercury, total	mg/L	NA	NA
Molybdenum, total	mg/L	NA	NA
Radium-226	pCi/L	NA	NA
Radium-228	pCi/L	NA	NA
Radium-226 + radium-228	pCi/L	NA	NA
Selenium, total	mg/L	NA	NA
Thallium, total	mg/L	NA	NA

a. As indicated by the CCR Rule (40 CFR 257.94), the Detection Monitoring Program monitors all constituents found in Appendix III.

\* = Field parameters were unable to be collected during sampling of APMW-5 during the Q2 2023 sampling event. See the text for further discussion.

\*\*\* = APMW-5 was dry during the Q4 2023 sampling event, preventing collection of a sample. See text for details.

NS = no sample; NA = not applicable; ft amsl = feet above mean sea level; mg/L = milligrams per liter; pCi/L = picocuries per liter

**Table 2: Data Summary Table - APMW-15 (Upgradient)**

Analytes	Units	6/5/2023	11/13/2023
		Detection Monitoring <sup>(a)</sup>	
Water elevation	ft amsl	3,034.01	*
<b>Appendix III</b>			
Boron, total	mg/L	0.101	0.118
Calcium, total	mg/L	87.7	104
Chloride	mg/L	21.7	24.5
Fluoride	mg/L	< 1.000	< 1.000
pH, field	pH units	7.54	7.45
Sulfate	mg/L	123	127
Total dissolved solids	mg/L	508	526
<b>Appendix IV</b>			
Antimony, total	mg/L	NA	NA
Arsenic, total	mg/L	NA	NA
Barium, total	mg/L	NA	NA
Beryllium, total	mg/L	NA	NA
Cadmium, total	mg/L	NA	NA
Chromium, total	mg/L	NA	NA
Cobalt, total	mg/L	NA	NA
Fluoride	mg/L	NA	NA
Lead, total	mg/L	NA	NA
Lithium, total	mg/L	NA	NA
Mercury, total	mg/L	NA	NA
Molybdenum, total	mg/L	NA	NA
Radium-226	pCi/L	NA	NA
Radium-228	pCi/L	NA	NA
Radium-226 + radium-228	pCi/L	NA	NA
Selenium, total	mg/L	NA	NA
Thallium, total	mg/L	NA	NA

a. As indicated by the CCR Rule (40 CFR 257.94), the Detection Monitoring Program monitors all constituents found in Appendix III.

\* = During the Q4 2023 monitoring event, the groundwater level at APMW-15 was below the top of the dedicated pump. However, enough volume was present to allow appropriate purging and collection of an analytical sample.

NA = not applicable; ft amsl = feet above mean sea level; mg/L = milligrams per liter; pCi/L = picocuries per liter

**Table 3: Data Summary Table - APMW-16A (Upgradient)**

Analytes	Units	6/5/2023	11/13/2023
		Detection Monitoring <sup>(a)</sup>	
Water elevation	ft amsl	3,035.66	3,033.91
<b>Appendix III</b>			
Boron, total	mg/L	0.129	0.128
Calcium, total	mg/L	98.3	112
Chloride	mg/L	25.7	30.7
Fluoride	mg/L	< 1.000	< 1.000
pH, field	pH units	7.37	7.25
Sulfate	mg/L	155	161
Total dissolved solids	mg/L	574	590
<b>Appendix IV</b>			
Antimony, total	mg/L	NA	NA
Arsenic, total	mg/L	NA	NA
Barium, total	mg/L	NA	NA
Beryllium, total	mg/L	NA	NA
Cadmium, total	mg/L	NA	NA
Chromium, total	mg/L	NA	NA
Cobalt, total	mg/L	NA	NA
Fluoride	mg/L	NA	NA
Lead, total	mg/L	NA	NA
Lithium, total	mg/L	NA	NA
Mercury, total	mg/L	NA	NA
Molybdenum, total	mg/L	NA	NA
Radium-226	pCi/L	NA	NA
Radium-228	pCi/L	NA	NA
Radium-226 + radium-228	pCi/L	NA	NA
Selenium, total	mg/L	NA	NA
Thallium, total	mg/L	NA	NA

a. As indicated by the CCR Rule (40 CFR 257.94), the Detection Monitoring Program monitors all constituents found in Appendix III.

NA = not applicable; ft amsl = feet above mean sea level; mg/L = milligrams per liter; pCi/L = picocuries per liter

**Table 4: Data Summary Table - APMW-17 (Upgradient)**

Analytes	Units	6/5/2023	11/13/2023
		Detection Monitoring <sup>(a)</sup>	
Water elevation	ft amsl	3,035.44	3,033.71
<b>Appendix III</b>			
Boron, total	mg/L	< 0.100	< 0.100
Calcium, total	mg/L	102	121
Chloride	mg/L	21.7	30.9
Fluoride	mg/L	< 1.000	< 1.000
pH, field	pH units	7.57	7.3
Sulfate	mg/L	118	117
Total dissolved solids	mg/L	494	484
<b>Appendix IV</b>			
Antimony, total	mg/L	NA	NA
Arsenic, total	mg/L	NA	NA
Barium, total	mg/L	NA	NA
Beryllium, total	mg/L	NA	NA
Cadmium, total	mg/L	NA	NA
Chromium, total	mg/L	NA	NA
Cobalt, total	mg/L	NA	NA
Fluoride	mg/L	NA	NA
Lead, total	mg/L	NA	NA
Lithium, total	mg/L	NA	NA
Mercury, total	mg/L	NA	NA
Molybdenum, total	mg/L	NA	NA
Radium-226	pCi/L	NA	NA
Radium-228	pCi/L	NA	NA
Radium-226 + radium-228	pCi/L	NA	NA
Selenium, total	mg/L	NA	NA
Thallium, total	mg/L	NA	NA

a. As indicated by the CCR Rule (40 CFR 257.94), the Detection Monitoring Program monitors all constituents found in Appendix III.

NA = not applicable; ft amsl = feet above mean sea level; mg/L = milligrams per liter; pCi/L = picocuries per liter



Table 5: Data Summary Table - APMW-4

Analytes	Units	6/5/2023	11/13/2023	6/5/2023	7/11/2023	11/13/2023
		Detection Monitoring <sup>(a)</sup>		Additional State Program Required Samples <sup>(b)</sup>		
Water elevation	ft amsl	3,029.67	***	3,029.67	*	***
<b>Appendix III</b>						
Boron, total	mg/L	< 0.100	NS	NA	NA	NA
Calcium, total	mg/L	48.9	NS	NA	NA	NA
Chloride	mg/L	43	NS	NA	NA	NA
Fluoride	mg/L	< 1.000	NS	NA	NA	NA
pH, field	pH units	7.91	NS	NA	NA	NA
Sulfate	mg/L	29.8	NS	NA	NA	NA
Total dissolved solids	mg/L	290	NS	NA	NA	NA
<b>Appendix IV</b>						
Antimony, total	mg/L	NA	NA	< 0.002	< 0.002	NS
Arsenic, total	mg/L	NA	NA	0.00427	0.00429	NS
Barium, total	mg/L	NA	NA	0.0893	0.0801	NS
Beryllium, total	mg/L	NA	NA	< 0.001	< 0.001	NS
Cadmium, total	mg/L	NA	NA	< 0.0002	< 0.0002	NS
Chromium, total	mg/L	NA	NA	< 0.005	< 0.005	NS
Cobalt, total	mg/L	NA	NA	< 0.0005	< 0.0005	NS
Fluoride	mg/L	NA	NA	< 1.000	< 1.000	NS
Lead, total	mg/L	NA	NA	< 0.0005	0.0005	NS
Lithium, total	mg/L	NA	NA	0.0177	0.0139	NS
Mercury, total	mg/L	NA	NA	< 0.0002	< 0.0002	NS
Molybdenum, total	mg/L	NA	NA	0.0051	0.00772	NS
Radium-226	pCi/L	NA	NA	0.166 ± 0.103	0.102 U ± 0.0788	NS
Radium-228	pCi/L	NA	NA	1.28 ± 0.440	1.34 ± 0.473	NS
Radium-226 + radium-228	pCi/L	NA	NA	1.45 ± 0.452	1.45 ± 0.480	NS
Selenium, total	mg/L	NA	NA	0.0163	0.0138	NS
Thallium, total	mg/L	NA	NA	< 0.001	< 0.001	NS

a. As indicated by the CCR Rule (40 CFR 257.94), the Detection Monitoring Program monitors all constituents found in Appendix III.

b. Beginning with the Q2 2023 sampling event, additional samples have been collected at APMW-4 for separate, Nebraska-specific permit reporting requirements.

\* = During the Q3 2023 state monitoring event, the groundwater level at APMW-4 was below the top of the dedicated pump. However, enough volume was present to allow appropriate purging and collection of an analytical sample.

\*\*\* = APMW-4 was dry during the Q4 2023 sampling event, preventing collection of a sample. See text for details.

NS = no sample; NA = not applicable; ft amsl = feet above mean sea level; mg/L = milligrams per liter; pCi/L = picocuries per liter; U = result is less than the sample detection limit (varies by sample for radiological results)

**Table 6: Data Summary Table - APMW-6**

Analytes	Units	6/5/2023	11/13/2023
		Detection Monitoring <sup>(a)</sup>	
Water elevation	ft amsl	3,031.90	3,029.18
<b>Appendix III</b>			
Boron, total	mg/L	< 0.100	< 0.100
Calcium, total	mg/L	49.4	56.7
Chloride	mg/L	23.4	23.2
Fluoride	mg/L	< 1.000	< 1.000
pH, field	pH units	7.74	7.62
Sulfate	mg/L	28.5	25.4
Total dissolved solids	mg/L	260	266
<b>Appendix IV</b>			
Antimony, total	mg/L	NA	NA
Arsenic, total	mg/L	NA	NA
Barium, total	mg/L	NA	NA
Beryllium, total	mg/L	NA	NA
Cadmium, total	mg/L	NA	NA
Chromium, total	mg/L	NA	NA
Cobalt, total	mg/L	NA	NA
Fluoride	mg/L	NA	NA
Lead, total	mg/L	NA	NA
Lithium, total	mg/L	NA	NA
Mercury, total	mg/L	NA	NA
Molybdenum, total	mg/L	NA	NA
Radium-226	pCi/L	NA	NA
Radium-228	pCi/L	NA	NA
Radium-226 + radium-228	pCi/L	NA	NA
Selenium, total	mg/L	NA	NA
Thallium, total	mg/L	NA	NA

a. As indicated by the CCR Rule (40 CFR 257.94), the Detection Monitoring Program monitors all constituents found in Appendix III.

NA = not applicable; ft amsl = feet above mean sea level; mg/L = milligrams per liter; pCi/L = picocuries per liter

**Table 7: Data Summary Table - APMW-8A**

Analytes	Units	6/5/2023	11/13/2023
		Detection Monitoring <sup>(a)</sup>	
Water elevation	ft amsl	3,031.76	3,029.26
<b>Appendix III</b>			
Boron, total	mg/L	< 0.100	< 0.100
Calcium, total	mg/L	111	81.8
Chloride	mg/L	73.5	73.7
Fluoride	mg/L	< 1.000	< 1.000
pH, field	pH units	7.46	7.44
Sulfate	mg/L	142	37.1
Total dissolved solids	mg/L	554	354
<b>Appendix IV</b>			
Antimony, total	mg/L	NA	NA
Arsenic, total	mg/L	NA	NA
Barium, total	mg/L	NA	NA
Beryllium, total	mg/L	NA	NA
Cadmium, total	mg/L	NA	NA
Chromium, total	mg/L	NA	NA
Cobalt, total	mg/L	NA	NA
Fluoride	mg/L	NA	NA
Lead, total	mg/L	NA	NA
Lithium, total	mg/L	NA	NA
Mercury, total	mg/L	NA	NA
Molybdenum, total	mg/L	NA	NA
Radium-226	pCi/L	NA	NA
Radium-228	pCi/L	NA	NA
Radium-226 + radium-228	pCi/L	NA	NA
Selenium, total	mg/L	NA	NA
Thallium, total	mg/L	NA	NA

a. As indicated by the CCR Rule (40 CFR 257.94), the Detection Monitoring Program monitors all constituents found in Appendix III.

NA = not applicable; ft amsl = feet above mean sea level; mg/L = milligrams per liter; pCi/L = picocuries per liter

**Table 8: Data Summary Table - APMW-10**

Analytes	Units	6/5/2023	11/13/2023
		Detection Monitoring <sup>(a)</sup>	
Water elevation	ft amsl	3,031.52	3,029.58
<b>Appendix III</b>			
Boron, total	mg/L	< 0.100	< 0.100
Calcium, total	mg/L	55.5	59.2
Chloride	mg/L	20.6	23.6
Fluoride	mg/L	< 1.000	< 1.000
pH, field	pH units	7.72	7.7
Sulfate	mg/L	47.4	42
Total dissolved solids	mg/L	292	294
<b>Appendix IV</b>			
Antimony, total	mg/L	NA	NA
Arsenic, total	mg/L	NA	NA
Barium, total	mg/L	NA	NA
Beryllium, total	mg/L	NA	NA
Cadmium, total	mg/L	NA	NA
Chromium, total	mg/L	NA	NA
Cobalt, total	mg/L	NA	NA
Fluoride	mg/L	NA	NA
Lead, total	mg/L	NA	NA
Lithium, total	mg/L	NA	NA
Mercury, total	mg/L	NA	NA
Molybdenum, total	mg/L	NA	NA
Radium-226	pCi/L	NA	NA
Radium-228	pCi/L	NA	NA
Radium-226 + radium-228	pCi/L	NA	NA
Selenium, total	mg/L	NA	NA
Thallium, total	mg/L	NA	NA

a. As indicated by the CCR Rule (40 CFR 257.94), the Detection Monitoring Program monitors all constituents found in Appendix III.

NA = not applicable; ft amsl = feet above mean sea level; mg/L = milligrams per liter; pCi/L = picocuries per liter

**Table 9: Data Summary Table - APMW-11**

Analytes	Units	6/6/2023	11/13/2023	6/6/2023	7/11/2023	11/13/2023
		Detection Monitoring <sup>(a)</sup>		Additional State Program Required Samples <sup>(b)</sup>		
Water elevation	ft amsl	3,032.04	3,029.82	3,032.04	3,031.21	3,029.82
<b>Appendix III</b>						
Boron, total	mg/L	< 0.100	< 0.100	NA	NA	NA
Calcium, total	mg/L	77.7	51.3	NA	NA	NA
Chloride	mg/L	44.9	53.6	NA	NA	NA
Fluoride	mg/L	< 1.000	< 1.000	NA	NA	NA
pH, field	pH units	7.39	7.56	NA	NA	NA
Sulfate	mg/L	63.6	48.3	NA	NA	NA
Total dissolved solids	mg/L	388	352	NA	NA	NA
<b>Appendix IV</b>						
Antimony, total	mg/L	NA	NA	< 0.002	< 0.002	< 0.002
Arsenic, total	mg/L	NA	NA	< 0.002	< 0.002	< 0.002
Barium, total	mg/L	NA	NA	0.222	0.222	0.189
Beryllium, total	mg/L	NA	NA	< 0.001	< 0.001	< 0.001
Cadmium, total	mg/L	NA	NA	< 0.0002	< 0.0002	< 0.0002
Chromium, total	mg/L	NA	NA	< 0.005	< 0.005	< 0.005
Cobalt, total	mg/L	NA	NA	< 0.0005	< 0.0005	< 0.0005
Fluoride	mg/L	NA	NA	< 1.000	< 1.000	< 1.000
Lead, total	mg/L	NA	NA	< 0.0005	< 0.0005	< 0.0005
Lithium, total	mg/L	NA	NA	0.017	0.0182	0.0136
Mercury, total	mg/L	NA	NA	< 0.0002	< 0.0002	< 0.0002
Molybdenum, total	mg/L	NA	NA	0.00264	0.00259	0.00217
Radium-226	pCi/L	NA	NA	0.244 ± 0.111	0.167 ± 0.0835	0.129 U ± 0.185
Radium-228	pCi/L	NA	NA	0.385 U ± 0.350	0.183 U ± 0.283	2.01 ± 0.634
Radium-226 + radium-228	pCi/L	NA	NA	0.630 ± 0.367	0.350 U ± 0.295	2.14 ± 0.660
Selenium, total	mg/L	NA	NA	0.0179	0.0248	0.0208
Thallium, total	mg/L	NA	NA	< 0.001	< 0.001	< 0.001

a. As indicated by the CCR Rule (40 CFR 257.94), the Detection Monitoring Program monitors all constituents found in Appendix III.

b. Beginning with the Q2 2023 sampling event, additional samples have been collected at APMW-11 for separate, Nebraska-specific permit reporting requirements.

NA = not applicable; ft amsl = feet above mean sea level; mg/L = milligrams per liter; pCi/L = picocuries per liter; U = result is less than the sample detection limit (varies by sample for radiological results)

**Table 10: Data Summary Table - APMW-12**

Analytes	Units	6/6/2023	11/14/2023
		Detection Monitoring <sup>(a)</sup>	
Water elevation	ft amsl	3,032.49	3,030.33
<b>Appendix III</b>			
Boron, total	mg/L	0.287	0.296
Calcium, total	mg/L	145	159
Chloride	mg/L	161	165
Fluoride	mg/L	< 1.000	< 1.000
pH, field	pH units	7.04	7
Sulfate	mg/L	292	274
Total dissolved solids	mg/L	1020	1010
<b>Appendix IV</b>			
Antimony, total	mg/L	NA	NA
Arsenic, total	mg/L	NA	NA
Barium, total	mg/L	NA	NA
Beryllium, total	mg/L	NA	NA
Cadmium, total	mg/L	NA	NA
Chromium, total	mg/L	NA	NA
Cobalt, total	mg/L	NA	NA
Fluoride	mg/L	NA	NA
Lead, total	mg/L	NA	NA
Lithium, total	mg/L	NA	NA
Mercury, total	mg/L	NA	NA
Molybdenum, total	mg/L	NA	NA
Radium-226	pCi/L	NA	NA
Radium-228	pCi/L	NA	NA
Radium-226 + radium-228	pCi/L	NA	NA
Selenium, total	mg/L	NA	NA
Thallium, total	mg/L	NA	NA

a. As indicated by the CCR Rule (40 CFR 257.94), the Detection Monitoring Program monitors all constituents found in Appendix III.

NA = not applicable; ft amsl = feet above mean sea level; mg/L = milligrams per liter; pCi/L = picocuries per liter

**Table 11: Data Summary Table - APMW-13**

Analytes	Units	6/6/2023	11/14/2023
		Detection Monitoring <sup>(a)</sup>	
Water elevation	ft amsl	3,032.60	3,030.47
<b>Appendix III</b>			
Boron, total	mg/L	0.282	0.296
Calcium, total	mg/L	149	151
Chloride	mg/L	149	142
Fluoride	mg/L	< 1.000	< 1.000
pH, field	pH units	7.08	7.02
Sulfate	mg/L	294	248
Total dissolved solids	mg/L	1010	946
<b>Appendix IV</b>			
Antimony, total	mg/L	NA	NA
Arsenic, total	mg/L	NA	NA
Barium, total	mg/L	NA	NA
Beryllium, total	mg/L	NA	NA
Cadmium, total	mg/L	NA	NA
Chromium, total	mg/L	NA	NA
Cobalt, total	mg/L	NA	NA
Fluoride	mg/L	NA	NA
Lead, total	mg/L	NA	NA
Lithium, total	mg/L	NA	NA
Mercury, total	mg/L	NA	NA
Molybdenum, total	mg/L	NA	NA
Radium-226	pCi/L	NA	NA
Radium-228	pCi/L	NA	NA
Radium-226 + radium-228	pCi/L	NA	NA
Selenium, total	mg/L	NA	NA
Thallium, total	mg/L	NA	NA

a. As indicated by the CCR Rule (40 CFR 257.94), the Detection Monitoring Program monitors all constituents found in Appendix III.

NA = not applicable; ft amsl = feet above mean sea level; mg/L = milligrams per liter; pCi/L = picocuries per liter

**Table 12: Data Summary Table - APMW-14**

Analytes	Units	6/6/2023	11/14/2023
		Detection Monitoring <sup>(a)</sup>	
Water elevation	ft amsl	3,032.75	3,030.59
<b>Appendix III</b>			
Boron, total	mg/L	0.252	0.228
Calcium, total	mg/L	151	151
Chloride	mg/L	140	127
Fluoride	mg/L	< 1.000	< 1.000
pH, field	pH units	7.11	7.09
Sulfate	mg/L	224	183
Total dissolved solids	mg/L	894	808
<b>Appendix IV</b>			
Antimony, total	mg/L	NA	NA
Arsenic, total	mg/L	NA	NA
Barium, total	mg/L	NA	NA
Beryllium, total	mg/L	NA	NA
Cadmium, total	mg/L	NA	NA
Chromium, total	mg/L	NA	NA
Cobalt, total	mg/L	NA	NA
Fluoride	mg/L	NA	NA
Lead, total	mg/L	NA	NA
Lithium, total	mg/L	NA	NA
Mercury, total	mg/L	NA	NA
Molybdenum, total	mg/L	NA	NA
Radium-226	pCi/L	NA	NA
Radium-228	pCi/L	NA	NA
Radium-226 + radium-228	pCi/L	NA	NA
Selenium, total	mg/L	NA	NA
Thallium, total	mg/L	NA	NA

a. As indicated by the CCR Rule (40 CFR 257.94), the Detection Monitoring Program monitors all constituents found in Appendix III.

NA = not applicable; ft amsl = feet above mean sea level; mg/L = milligrams per liter; pCi/L = picocuries per liter



**Table 13: Data Summary Table - APMW-18**

Analytes	Units	6/5/2023	11/13/2023
		Detection Monitoring <sup>(a)</sup>	
Water elevation	ft amsl	3,032.11	3,029.45
<b>Appendix III</b>			
Boron, total	mg/L	< 0.100	< 0.100
Calcium, total	mg/L	80.1	99.7
Chloride	mg/L	59.6	138
Fluoride	mg/L	< 1.000	< 1.000
pH, field	pH units	7.57	7.48
Sulfate	mg/L	56.2	23.7
Total dissolved solids	mg/L	392	438
<b>Appendix IV</b>			
Antimony, total	mg/L	NA	NA
Arsenic, total	mg/L	NA	NA
Barium, total	mg/L	NA	NA
Beryllium, total	mg/L	NA	NA
Cadmium, total	mg/L	NA	NA
Chromium, total	mg/L	NA	NA
Cobalt, total	mg/L	NA	NA
Fluoride	mg/L	NA	NA
Lead, total	mg/L	NA	NA
Lithium, total	mg/L	NA	NA
Mercury, total	mg/L	NA	NA
Molybdenum, total	mg/L	NA	NA
Radium-226	pCi/L	NA	NA
Radium-228	pCi/L	NA	NA
Radium-226 + radium-228	pCi/L	NA	NA
Selenium, total	mg/L	NA	NA
Thallium, total	mg/L	NA	NA

a. As indicated by the CCR Rule (40 CFR 257.94), the Detection Monitoring Program monitors all constituents found in Appendix III.

NA = not applicable; ft amsl = feet above mean sea level; mg/L = milligrams per liter; pCi/L = picocuries per liter

**Table 14: Data Summary Table - APMW-19**

Analytes	Units	6/5/2023	11/13/2023
		Detection Monitoring <sup>(a)</sup>	
Water elevation	ft amsl	3,031.54	3,028.62
<b>Appendix III</b>			
Boron, total	mg/L	< 0.100	< 0.100
Calcium, total	mg/L	83.1	80
Chloride	mg/L	37.9	31.7
Fluoride	mg/L	< 1.000	< 1.000
pH, field	pH units	7.53	7.47
Sulfate	mg/L	114	73.6
Total dissolved solids	mg/L	466	376
<b>Appendix IV</b>			
Antimony, total	mg/L	NA	NA
Arsenic, total	mg/L	NA	NA
Barium, total	mg/L	NA	NA
Beryllium, total	mg/L	NA	NA
Cadmium, total	mg/L	NA	NA
Chromium, total	mg/L	NA	NA
Cobalt, total	mg/L	NA	NA
Fluoride	mg/L	NA	NA
Lead, total	mg/L	NA	NA
Lithium, total	mg/L	NA	NA
Mercury, total	mg/L	NA	NA
Molybdenum, total	mg/L	NA	NA
Radium-226	pCi/L	NA	NA
Radium-228	pCi/L	NA	NA
Radium-226 + radium-228	pCi/L	NA	NA
Selenium, total	mg/L	NA	NA
Thallium, total	mg/L	NA	NA

a. As indicated by the CCR Rule (40 CFR 257.94), the Detection Monitoring Program monitors all constituents found in Appendix III.

NA = not applicable; ft amsl = feet above mean sea level; mg/L = milligrams per liter; pCi/L = picocuries per liter

**APPENDIX B**

# Comparative Statistical Results

**Table 1: Comparative Statistics - APMW-5 (Upgradient)**

Detection Monitoring Analytes	Units	Statistical Method	Statistical Limit	Detection Monitoring Result	CUSUM Value	Within Limit?	Detection Monitoring Result	CUSUM Value	Within Limit?
				6/5/2023			11/13/2023		
Boron, total	mg/L	NP-PL	0.200	< 0.100	NA	Yes	***	NS	NS
Calcium, total	mg/L	CUSUM	120.2	50.3	71.5	Yes	***	NS	NS
Chloride	mg/L	CUSUM	108.1	15.9	35.7	Yes	***	NS	NS
Fluoride	mg/L	CUSUM	1.785	< 1.000	0.765	Yes	***	NS	NS
pH, field	pH units	NP-PL	7.23, 9.71	*	NA	NA	***	NS	NS
Sulfate	mg/L	CUSUM	76.9	47.9	42.1	Yes	***	NS	NS
Total dissolved solids	mg/L	CUSUM	653	264	385.8	Yes	***	NS	NS

\* = Field parameters were unable to be collected during sampling of APMW-5 during the Q2 2023 sampling event. See text for further discussion.

\*\*\* = APMW-5 was dry during the Q4 2023 sampling event. See text for details.

NP-PL = non-parametric prediction limit; CUSUM = cumulative sum, parametric Shewhart-CUSUM control chart; NA = not applicable; NS = no sample

**Table 2: Comparative Statistics - APMW-15 (Upgradient)**

Detection Monitoring Analytes	Units	Statistical Method	Statistical Limit	Detection Monitoring Result	CUSUM Value	Within Limit?	Detection Monitoring Result	CUSUM Value	Within Limit?
				6/5/2023			11/13/2023		
Boron, total	mg/L	NP-PL	0.200	0.101	NA	Yes	0.118	NA	Yes
Calcium, total	mg/L	CUSUM	145.0	87.7	105.8	Yes	104.0	106	Yes
Chloride	mg/L	CUSUM	40.4	21.7	34.0	Yes	24.5	34.0	Yes
Fluoride	mg/L	NP-PL	0.716	< 1.000	NA	Yes *	< 1.000	NA	Yes *
pH, field	pH units	CUSUM	6.24, 8.15	7.54	7.20, 7.55	Yes	7.45	7.20, 7.56	Yes
Sulfate	mg/L	CUSUM	209	123	138	Yes	127	138	Yes
Total dissolved solids	mg/L	CUSUM	853	508	585	Yes	526	585	Yes

\* = See text for discussion of non-detects greater than the statistical limit and changes to the reporting limit for Fluoride.

NP-PL = non-parametric prediction limit; CUSUM = cumulative sum, parametric Shewhart-CUSUM control chart; NA = not applicable

**Table 3: Comparative Statistics - APMW-16A (Upgradient)**

Detection Monitoring Analytes	Units	Statistical Method	Statistical Limit	Detection Monitoring Result	CUSUM Value	Within Limit?	Detection Monitoring Result	CUSUM Value	Within Limit?
				6/5/2023			11/13/2023		
Boron, total	mg/L	NP-PL	0.200	0.129	NA	Yes	0.128	NA	Yes
Calcium, total <sup>(a)</sup>	mg/L	CUSUM	199.3	98.3	133.7	Yes	112.0	133.5	Yes
Chloride <sup>(a)</sup>	mg/L	CUSUM	126.2	25.7	56.4	Yes	30.7	56.2	Yes
Fluoride	mg/L	NP-PL	1.490	< 1.000	NA	Yes	< 1.000	NA	Yes
pH, field	pH units	CUSUM	6.08, 8.00	7.37	7.04, 7.26	Yes	7.25	7.04, 7.23	Yes
Sulfate <sup>(a)</sup>	mg/L	CUSUM	278	155	194	Yes	161	193	Yes
Total dissolved solids <sup>(a)</sup>	mg/L	CUSUM	1046	574	715	Yes	590	714	Yes

a. Seasonality was detected in the baseline period. Statistical limits may vary slightly between monitoring events due to deseasonalization of the data or if seasonality is not identified in the full data set (i.e., the baseline period and any comparative points).

NP-PL = non-parametric prediction limit; CUSUM = cumulative sum, parametric Shewhart-CUSUM control chart; NA = not applicable

**Table 4: Comparative Statistics - APMW-17 (Upgradient)**

Detection Monitoring Analytes	Units	Statistical Method	Statistical Limit	Detection Monitoring Result	CUSUM Value	Within Limit?	Detection Monitoring Result	CUSUM Value	Within Limit?
				6/5/2023			11/13/2023		
Boron, total	mg/L	NP-PL	0.200	< 0.100	NA	Yes	< 0.100	NA	Yes
Calcium, total	mg/L	CUSUM	184	102	140	Yes	121	140	Yes
Chloride	mg/L	CUSUM	59.0	21.7	42.5	Yes	30.9	42.5	Yes
Fluoride	mg/L	NP-PL	1.070	< 1.000	NA	Yes	< 1.000	NA	Yes
pH, field	pH units	CUSUM	5.99, 7.88	7.57	7.12, 7.59	Yes	7.30	7.12, 7.56	Yes
Sulfate	mg/L	CUSUM	225	118	142	Yes	117	142	Yes
Total dissolved solids	mg/L	CUSUM	927	494	589	Yes	484	589	Yes

NP-PL = non-parametric prediction limit; CUSUM = cumulative sum, parametric Shewhart-CUSUM control chart; NA = not applicable

**Table 5: Comparative Statistics - APMW-4**

Detection Monitoring Analytes	Units	Statistical Method	Statistical Limit	Detection Monitoring Result	CUSUM Value	Within Limit?	Detection Monitoring Result	CUSUM Value	Within Limit?
				6/5/2023			11/13/2023		
Boron, total	mg/L	NP-PL	0.200	< 0.100	NA	Yes	***	NS	NS
Calcium, total	mg/L	CUSUM	64.3	48.9	55.1	Yes	***	NS	NS
Chloride	mg/L	CUSUM	51.4	43.0	40.1	Yes	***	NS	NS
Fluoride	mg/L	NP-PL	0.569	< 1.000 *	NA	Yes **	***	NS	NS
pH, field	pH units	CUSUM	6.21, 9.02	7.91	7.62, 7.62	Yes	***	NS	NS
Sulfate	mg/L	CUSUM	40.5	29.8	28.0	Yes	***	NS	NS
Total dissolved solids	mg/L	CUSUM	428	290	306	Yes	***	NS	NS

\* = Two sets of results were collected for fluoride for the CCR and Nebraska-specific sampling programs. Statistical analysis has been conducted on the average of both results, based on recommendations from the Unified Guidance (USEPA 2009).

\*\* = See text for discussion of non-detects greater than the statistical limit and changes to the reporting limit for fluoride.

\*\*\* = APMW-4 was dry during the Q4 2023 sampling event. See text for details.

NP-PL = non-parametric prediction limit; CUSUM = cumulative sum, parametric Shewhart-CUSUM control chart; NA = not applicable; NS = no sample



**Table 6: Comparative Statistics - APMW-6**

Detection Monitoring Analytes	Units	Statistical Method	Statistical Limit	Detection Monitoring Result	CUSUM Value	Within Limit?	Detection Monitoring Result	CUSUM Value	Within Limit?
				6/5/2023			11/13/2023		
Boron, total	mg/L	NP-PL	0.200	< 0.100	NA	Yes	< 0.100	NA	Yes
Calcium, total	mg/L	CUSUM	65.7	49.4	52.4	Yes	56.7	53.4	Yes
Chloride	mg/L	CUSUM	20.4	23.4	53.7	No - Verified Exceedance	23.2	64.1	No - Verified Exceedance
Fluoride	mg/L	NP-PL	0.713	< 1.000	NA	Yes *	< 1.000	NA	Yes *
pH, field	pH units	CUSUM	6.24, 8.62	7.74	7.43, 7.44	Yes	7.62	7.43, 7.43	Yes
Sulfate	mg/L	CUSUM	38.4	28.5	28.1	Yes	25.4	28.1	Yes
Total dissolved solids	mg/L	CUSUM	414	260	291	Yes	266	291	Yes

\* = See text for discussion of non-detects greater than the statistical limit and changes to the reporting limit for fluoride.

NP-PL = non-parametric prediction limit; CUSUM = cumulative sum, parametric Shewhart-CUSUM control chart; NA = not applicable

**Table 7: Comparative Statistics - APMW-8A**

Detection Monitoring Analytes	Units	Statistical Method	Statistical Limit	Detection Monitoring Result	CUSUM Value	Within Limit?	Detection Monitoring Result	CUSUM Value	Within Limit?
				6/5/2023			11/13/2023		
Boron, total	mg/L	NP-PL	0.200	< 0.100	NA	Yes	< 0.100	NA	Yes
Calcium, total	mg/L	CUSUM	175.6	111.0	105.7	Yes	81.8	105.7	Yes
Chloride	mg/L	CUSUM	104.9	73.5	81.7	Yes	73.7	81.7	Yes
Fluoride	mg/L	NP-PL	13.700	< 1.000	NA	Yes	< 1.000	NA	Yes
pH, field	pH units	CUSUM	5.86, 8.61	7.46	7.23, 7.23	Yes	7.44	7.23, 7.23	
Sulfate	mg/L	CUSUM	244.9	142.0	103.4	Yes	37.1	90.5	Yes
Total dissolved solids	mg/L	CUSUM	850	554	536	Yes	354	536	Yes

NP-PL = non-parametric prediction limit; CUSUM = cumulative sum, parametric Shewhart-CUSUM control chart; NA = not applicable

**Table 8: Comparative Statistics - APMW-10**

Detection Monitoring Analytes	Units	Statistical Method	Statistical Limit	Detection Monitoring Result	CUSUM Value	Within Limit?	Detection Monitoring Result	CUSUM Value	Within Limit?
				6/5/2023			11/13/2023		
Boron, total	mg/L	NP-PL	0.200	< 0.100	NA	Yes	< 0.100	NA	Yes
Calcium, total	mg/L	CUSUM	78.3	55.5	62.5	Yes	59.2	62.5	Yes
Chloride	mg/L	CUSUM	63.8	20.6	38.1	Yes	23.6	38.1	Yes
Fluoride	mg/L	NP-PL	3.780	< 1.000	NA	Yes	< 1.000	NA	Yes
pH, field	pH units	CUSUM	5.95, 8.89	7.72	7.42, 7.42	Yes	7.70	7.42, 7.42	Yes
Sulfate	mg/L	CUSUM	72.4	47.4	46.1	Yes	42.0	46.1	Yes
Total dissolved solids	mg/L	CUSUM	489	292	358	Yes	294	358	Yes

NP-PL = non-parametric prediction limit; CUSUM = cumulative sum, parametric Shewhart-CUSUM control chart; NA = not applicable

**Table 9: Comparative Statistics - APMW-11**

Detection Monitoring Analytes	Units	Statistical Method	Statistical Limit	Detection Monitoring Result	CUSUM Value	Within Limit?	Detection Monitoring Result	CUSUM Value	Within Limit?
				6/6/2023			11/13/2023		
Boron, total	mg/L	NP-PL	0.200	< 0.100	NA	Yes	< 0.100	NA	Yes
Calcium, total	mg/L	CUSUM	101.7	77.7	90.1	Yes	51.3	81.6	Yes
Chloride	mg/L	CUSUM	137.0	44.9	74.2	Yes	53.6	74.16	Yes
Fluoride	mg/L	NP-PL	6.96	< 1.000 *	NA	Yes	< 1.000	NA	Yes
pH, field	pH units	CUSUM	6.89, 7.83	7.39	7.36, 7.41	Yes	7.56	7.36, 7.49	Yes
Sulfate	mg/L	CUSUM	75.0	63.6	53.4	Yes	48.3	57.2	Yes
Total dissolved solids	mg/L	CUSUM	622	388	438	Yes	352	438	Yes

\* = Two sets of results were collected for fluoride for the CCR and Nebraska-specific sampling programs. Statistical analysis has been conducted on the average of both results, based on recommendations from the Unified Guidance (USEPA 2009).

NP-PL = non-parametric prediction limit; CUSUM = cumulative sum, parametric Shewhart-CUSUM control chart; NA = not applicable

**Table 10: Comparative Statistics - APMW-12**

Detection Monitoring Analytes	Units	Statistical Method	Statistical Limit	Detection Monitoring Result	CUSUM Value	Within Limit?	Detection Monitoring Result	CUSUM Value	Within Limit?
				6/6/2023			11/14/2023		
Boron, total	mg/L	CUSUM	0.389	0.287	0.291	Yes	0.296	0.283	Yes
Calcium, total	mg/L	CUSUM	203	145	166	Yes	159	166	Yes
Chloride	mg/L	CUSUM	272	161	163	Yes	165	163	Yes
Fluoride	mg/L	NP-PL	21.300	< 1.000	NA	Yes	< 1.000	NA	Yes
pH, field	pH units	CUSUM	6.28, 7.66	7.04	6.97, 7.02	Yes	7.00	6.97, 6.97	Yes
Sulfate	mg/L	CUSUM	383	292	302	Yes	274	302	Yes
Total dissolved solids	mg/L	CUSUM	1602	1020	1108	Yes	1010	1108	Yes

NP-PL = non-parametric prediction limit; CUSUM = cumulative sum, parametric Shewhart-CUSUM control chart; NA = not applicable

**Table 11: Comparative Statistics - APMW-13**

Detection Monitoring Analytes	Units	Statistical Method	Statistical Limit	Detection Monitoring Result	CUSUM Value	Within Limit?	Detection Monitoring Result	CUSUM Value	Within Limit?
				6/6/2023			11/14/2023		
Boron, total	mg/L	CUSUM	0.449	0.282	0.314	Yes	0.296	0.314	Yes
Calcium, total	mg/L	CUSUM	196	149	148	Yes	151	148	Yes
Chloride	mg/L	CUSUM	190	149	141	Yes	142	141	Yes
Fluoride	mg/L	NP-PL	8.250	< 1.000	NA	Yes	< 1.000	NA	Yes
pH, field	pH units	CUSUM	6.05, 8.11	7.08	7.08, 7.08	Yes	7.02	7.08, 7.08	Yes
Sulfate	mg/L	CUSUM	362	294	269	Yes	248	264	Yes
Total dissolved solids	mg/L	CUSUM	1215	1010	1026	Yes	946	1026	Yes

NP-PL = non-parametric prediction limit; CUSUM = cumulative sum, parametric Shewhart-CUSUM control chart; NA = not applicable

**Table 12: Comparative Statistics - APMW-14**

Detection Monitoring Analytes	Units	Statistical Method	Statistical Limit	Detection Monitoring Result	CUSUM Value	Within Limit?	Detection Monitoring Result	CUSUM Value	Within Limit?
				6/6/2023			11/14/2023		
Boron, total	mg/L	CUSUM	0.382	0.252	0.261	Yes	0.228	0.261	Yes
Calcium, total	mg/L	CUSUM	195	151	158	Yes	151	158	Yes
Chloride	mg/L	CUSUM	207	140	135	Yes	127	135	Yes
Fluoride	mg/L	NP-PL	19.200	< 1.000	NA	Yes	< 1.000	NA	Yes
pH, field	pH units	CUSUM	6.03, 8.44	7.11	7.17, 7.17	Yes	7.09	7.17, 7.17	Yes
Sulfate	mg/L	CUSUM	272	224	217	Yes	183	217	Yes
Total dissolved solids	mg/L	CUSUM	1240	894	949	Yes	808	949	Yes

NP-PL = non-parametric prediction limit; CUSUM = cumulative sum, parametric Shewhart-CUSUM control chart; NA = not applicable

**Table 13: Comparative Statistics - APMW-18**

Detection Monitoring Analytes	Units	Statistical Method	Statistical Limit	Detection Monitoring Result	CUSUM Value	Within Limit?	Detection Monitoring Result	CUSUM Value	Within Limit?
				6/6/2023			11/14/2023		
Boron, total	mg/L	NP-PL	0.200	< 0.100	NA	Yes	< 0.100	NA	Yes
Calcium, total	mg/L	CUSUM	103.7	80.1	84.8	Yes	99.7	97.9	Yes
Chloride	mg/L	CUSUM	160.4	59.6	85.5	Yes	138.0	141.6	Yes
Fluoride	mg/L	NP-PL	1.740	< 1.000	NA	Yes	< 1.000	NA	Yes
pH, field	pH units	CUSUM	5.99, 8.01	7.57	7.33, 7.53	Yes	7.48	7.33, 7.48	Yes
Sulfate	mg/L	CUSUM	147.7	56.2	38.2	Yes	23.7	38.3	Yes
Total dissolved solids	mg/L	CUSUM	638	392	401	Yes	438	401	Yes

NP-PL = non-parametric prediction limit; CUSUM = cumulative sum, parametric Shewhart-CUSUM control chart; NA = not applicable



**Table 14: Comparative Statistics - APMW-19**

Detection Monitoring Analytes	Units	Statistical Method	Statistical Limit	Detection Monitoring Result	CUSUM Value	Within Limit?	Detection Monitoring Result	CUSUM Value	Within Limit?
				6/6/2023			11/14/2023		
Boron, total	mg/L	NP-PL	0.200	< 0.100	NA	Yes	< 0.100	NA	Yes
Calcium, total	mg/L	CUSUM	142.9	83.1	85.3	Yes	80.0	85.3	Yes
Chloride	mg/L	CUSUM	71.7	37.9	40.0	Yes	31.7	40.0	Yes
Fluoride	mg/L	NP-PL	0.665	< 1.000	NA	Yes *	< 1.000	NA	Yes *
pH, field	pH units	CUSUM	6.25, 8.29	7.53	7.27, 7.35	Yes	7.47	7.27, 7.29	Yes
Sulfate	mg/L	CUSUM	191.2	114.0	127.6	Yes	73.6	90.1	Yes
Total dissolved solids	mg/L	CUSUM	645	466	468	Yes	376	468	Yes

\* = See text for discussion of non-detects greater than the statistical limit and changes to the reporting limit for fluoride.

NP-PL = non-parametric prediction limit; CUSUM = cumulative sum, parametric Shewhart-CUSUM control chart; NA = not applicable

**APPENDIX C**

# Alternative Source Demonstrations



## REPORT

# Alternative Source Demonstration for Chloride at APMW-6

*Nebraska Public Power District*

Submitted to:

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APPENDIX A

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APPENDIX B

Eurofins TestAmerica Laboratory Report for Irrigation Water Samples

## 1.0 INTRODUCTION

On behalf of Nebraska Public Power District (NPPD), Golder Associates USA Inc. (Golder), a member of WSP, performed a statistical evaluation of groundwater quality from the second quarter groundwater detection monitoring event in 2022 (Q2 2022) at the Gerald Gentleman Station (GGS or Site) ash landfill (or CCR Unit), located at 6089 South Highway 25, Sutherland, Lincoln County, Nebraska. The statistical evaluation was performed in accordance with the Site Sampling and Analysis Plan (Golder 2019a), which was developed in compliance with applicable provisions of 40 Code of Federal Regulations (CFR) Part 257, "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals (CCR) from Electric Utilities; Final Rule" (CCR Final Rule), as amended, and corresponding regulations under Nebraska Administrative Code (NAC) Title 132, Chapter 7 (Integrated Solid Waste Management Regulations, Groundwater Monitoring and Remedial Action).

Statistical analyses of the Appendix III detection monitoring data for chloride in groundwater at the downgradient monitoring well APMW-6 indicated a potential exceedance of the statistical limit based on the parametric Cumulative Summation analysis (CUSUM) in the Q2 2021 sampling results, which was subsequently verified as evidence of a statistically significant increase (SSI) after the Q4 2021 event and again after the Q2 2022 results. Although determination of an SSI generally indicates that the groundwater monitoring program should transition from detection monitoring to assessment monitoring, both 40 CFR §257.94(e)(2) and NAC Title 132, Ch. 7, 004.03 allow the owner or operator (i.e., NPPD) 90 days from the date of determination (October 26, 2022) to demonstrate a source other than the CCR Unit, or another condition, caused the potential SSI for chloride at APMW-6.

Golder's review of the hydrological and geologic conditions at the Site indicated the potential for the SSI to have resulted from a source other than the CCR Unit. To assess potential chloride sources and the natural variability of chloride concentrations in groundwater, Golder reviewed analytical results of previously collected CCR-impacted water samples from the ash landfills, evaporation pond, surface water from the Sutherland Reservoir, surface waters from nearby agricultural areas, and groundwater samples. Based upon this assessment and in accordance with provisions of the CCR Final Rule, the NAC, and the site SAP (Golder 2019a), Golder prepared this Alternative Source Demonstration (ASD) for the CCR Unit. This ASD includes an evaluation of geological, hydrogeological, and chemical information regarding ash, surface water, and groundwater obtained from surface waters and monitoring wells installed within and adjacent to the CCR Unit.

This ASD conforms to the requirements of 40 CFR §257.94(e)(2) and NAC Title 132, Ch.7, 004.03 and provides the basis for concluding that the apparent SSI for chloride in groundwater at APMW-6 are not a result of a release from the CCR unit. The following sections provide a summary of the GGS CCR Unit, analytical and geochemical assessment results, a conceptual site model, and lines of evidence demonstrating an alternative source is responsible for the chloride SSI in groundwater at APMW-6.

## 2.0 BACKGROUND

### 2.1 Description of Waste Disposal Area

The ash landfill at GGS is located southwest of the plant's generation facility, in the northern one-half of Section 30, Township 13N, Range 33W. The ash disposal facility consists of Ash Landfill Nos. 1, 2, 3, and 4 and the bottom ash landfill. Ash Landfill Nos. 1 and 2 are closed, and Ash Landfill Nos. 3 and 4 are active (Figure 1). The bottom ash landfill was closed in October 2018.

Fly ash is currently disposed at Ash Landfill No. 4 and in the east cell of Ash Landfill No. 3. The liner design at Ash Landfill No. 4 consists of a 60-mil high density polyethylene (HDPE) geomembrane over compacted subgrade. Prior to geomembrane installation, the existing subgrade was scored to a depth of at least 6 inches and compacted to 95 percent of its maximum dry density (standard Proctor). Smooth HDPE geomembrane was placed on the bottom of the ash landfill and textured HDPE geomembrane was placed on the side slopes. Construction quality assurance for the geomembrane installation was performed by Golder Construction Services and completed on November 15, 1994. There is no leachate collection system (LCS) at Ash Landfill No. 4.

The original liner at Ash Landfill No. 3 consisted of 2 feet of soil compacted to 95 percent of the standard Proctor maximum dry density. The average permeability of the liner was  $1.2 \times 10^{-8}$  centimeters per second (cm/sec). Ash Landfill No. 3 was previously closed in 1995 with 2.0 to 7.5 feet of soil cover. This cover was removed and the historically placed CCR was covered with a new liner in 2015. The new liner system at Ash Landfill No. 3 consists of a prepared subgrade overlain by a geosynthetic clay liner and 60-mil linear low-density polyethylene (LLDPE) geomembrane. Ash Landfill No. 3 also has a 1-foot LCS sand layer that reports to two sumps. Construction of the new Ash Landfill No. 3 liner system was completed in November 2015.

To the east of the ash landfill, plant process water, such as boiler blowdown, is managed in a 50-acre evaporation pond, as shown in Figure 1. CCR materials are not stored within the evaporation pond, and the facility is not regulated under the CCR rule. The bottom of the approximately 8 to 10 feet deep evaporation pond consists of re-compacted native soils.

## 2.2 Site Geology

The geologic sequence near the ash landfill was summarized by Woodward-Clyde in 1991. In the report, soil boring data from nine boreholes (APMW-1, APMW-2, APMW-3, APMW-4, APMW-5, EPMW-1, EPMW-2, EPMW-3, and EPMW-4) were used to characterize the Site geology. The geologic sequence, from top to bottom, was described as follows:

- 4 to 5 feet of topsoil and/or fill
- 20 to 35 feet of eolian silty sands
- 8 to 10 feet of silty clay paleosol at the top of the Ogallala Formation
- 25 to 35 feet of Ogallala Formation silts
- approximately 50 feet of Ogallala Formation sands or Ogallala Formation silts and clays, to the bottoms of the boreholes

The topsoil layer consists of stiff, dark brown, low to medium plasticity silty clay directly overlying the eolian silts and sands. Thickness of topsoil ranges from 0 to 4 feet. The fill material consists of stiff, dark brown, low plasticity sandy silty clay with trace gravel and other debris. Fill thickness ranges from 0 to 5 feet.

The eolian silts and sands (Quaternary Period) consist of loose to medium dense, tan, very fine-grained, well-rounded, and well-sorted sandy silts and silty sands. The thickness of this unit ranges from 17 feet (APMW-5) to 34 feet (EPMW-2). Materials with a bimodal texture (two distinct grain sizes) are present in the lower part of this unit. The eolian silts and sands are interpreted as wind-blown dune sand deposits.

The Ogallala Formation (Tertiary Period) was encountered in each of the nine boreholes at a depth beginning at 16 to 38 feet below ground surface (ft bgs) and extending to the bottom of the boreholes (109 to 133 ft bgs). The Ogallala Formation near the ash landfill may be separated into three general stratigraphic units:

- upper silty clay paleosol unit
- middle clayey or sandy silt unit
- lower unit of either predominantly sand and gravel or an equivalent unit of predominantly silt and clay

The top of the Ogallala Formation is represented by a widespread paleosol (a previous soil horizon) that consists of a very stiff, reddish-brown to buff, low plasticity, silty clay to clayey silt with abundant calcareous nodules, calcareous matrix, and interbedded layers of caliche up to 1-foot thick. The thickness of the initial paleosol is about 8 to 10 feet, but the presence of interbedded caliche layers continues into the middle and lower Ogallala units.

The middle Ogallala Formation unit consists of a stiff to very stiff, buff-white to reddish-brown, low plasticity, clayey silt to sandy silt with abundant calcareous nodules, matrix, and caliche layers. Scattered occurrences of calcareously cemented siltstone layers from 0.5- to 1-foot thick are present in the lower part of this unit. The thickness of this middle unit ranges from about 25 to 35 feet. The clayey silts and sandy silts of this unit were possibly deposited as overbank or floodplain deposits in an alluvial depositional system.

There are two distinct lithofacies recognized in the lower Ogallala Formation unit. This unit is present for about 45 to 50 feet in the borings. One lithofacies consists of dense to very dense, reddish-brown, fine-grained silty sands grading into medium- and coarse-grained, poorly-graded sands with some fine gravels and some calcareously cemented sandstone beds (0.5- to 1-foot thick). This lithofacies was primarily encountered in borings on the northern side of the ash landfill (APMW-1, APMW-2, APMW-5, and EPMW-1; Woodward-Clyde 1991).

The second lithofacies recognized in the lower unit consists of stiff to hard, reddish-brown, low plasticity clayey or sandy silts with some calcareously-cemented siltstone beds. This lithofacies was encountered in borings on the southern side of the ash landfill (APMW-3, APMW-4, EPMW-2, EPMW-3, and EPMW-4; Woodward-Clyde 1991).

The lithologic differences and areal distribution of the two lower units suggest that the units were deposited in two separate facies of an alluvial system. The sand and gravel unit are possibly a series of longitudinal bars, channels, and channel-fill deposits, while the silt and clay unit is possibly a series of upper channel fills, overbank, or floodplain deposits (Woodward-Clyde 1991).

## 2.3 Site Hydrogeology

Based on observations made during logging of soil borings and findings of the Nebraska Water Survey Paper No. 70 (Goeke et al. 1992), the unsaturated geologic units underlying the ash landfill area consist of topsoil (0 to 4 feet thick), eolian silts and sands (15 to 25 feet thick), Ogallala Formation silts (40 to 50 feet thick), and Ogallala Formation sands and gravels (unsaturated portion of this unit is approximately 20 to 25 feet thick). Beneath these units lies 10 feet or more of saturated Ogallala Formation sands and gravels. Based on the Site observations, the thickness of the vadose zone ranges from approximately 90 to 100 feet.

The saturated geologic units underlying the ash landfill area consist of Ogallala Formation silts and sands that extend to the bottom of the aquifer. The Ogallala Formation is underlain by the White River Group, which is composed of the Brule and Chadron formations. The bedrock formations of the White River Group are not considered to be an important potential source of water, and therefore their surface is considered to form the base



of the aquifer and is regarded as the lower drilling limit for irrigation wells in the agricultural region near the Site. Underlying the White River Group is the impermeable Pierre Shale (Goeke et al. 1992).

Available groundwater elevation data indicate that groundwater beneath GGS flows from north to south (Figure 1). The groundwater gradient is controlled by the Sutherland Reservoir, an approximately 3,200-acre open water body located 1.5 miles north of the ash landfill that is used as a source of condenser cooling water for GGS (McMahon et al. 2010). Since groundwater level monitoring began in 1996, regular water level fluctuations have been observed in the monitoring wells located around the ash landfill. These fluctuations are attributed to seasonal trends in water consumption or recharge and precipitation patterns. From the time-series plot of historical water levels in each monitoring well (Figure 2), long-term changes in water levels between 1996 and 2022 are apparent. In general, water levels rose approximately 1.5 feet between 1996 and 2000 before declining between 9 to 10 feet between 2000 and 2009. The cause of the decline is not clear, but possible explanations include a regional response to the drought being experienced by parts of the western United States and/or a change in the amount of groundwater used for irrigation in the area around the Site. Between 2009 and 2022 water levels have continued to show seasonal variability, with seasonal maximums occurring in the spring and seasonal minimums occurring in the fall with no apparent long-term increasing or decreasing trend.

Groundwater flow velocity ranges from  $5.0 \times 10^{-4}$  to  $6.7 \times 10^{-2}$  per day (ft/day) and was estimated based on the following site-specific hydrogeologic data:

- estimated site hydraulic conductivities range from 0.14 ft/day to 19 ft/day (Woodward-Clyde 1991)
- an average horizontal hydraulic gradient of 0.00091 feet per foot (ft/ft) from the potentiometric surface shown in Figure 1
- an average effective porosity for Ogallala Formation sands and silts of 25 percent (Fetter 1994)

Two agricultural fields are present immediately to the south of the ash landfills. Historical aerial imagery (Figure 3) showed that there was no center-pivot irrigation system prior to 2004. By 2006, a center-pivot irrigation system was installed, and aerial images from 2006, 2012, and 2020 indicate that irrigation water from that center-pivot was crossing the property boundary of GGS, as delineated by the greener foliage compared to the unirrigated land. The greener foliage along the southern edge of the ash landfills also indicates that the irrigation runoff discharges north towards GGS, into the ditch at that location.

Photographs of the southern property boundary indicate taken August 2, 2022, indicate two drainages are present from the agricultural area onto GGS property (Figure 4A and 4B), though no runoff was observed in the drainages. On August 11, 2022, NPPD observed irrigation water from the center pivot spraying across the property boundary (Figure 4C).

## 2.4 Groundwater Monitoring Network

Design of the ash landfill groundwater monitoring program considered the size, disposal and operational history, anticipated groundwater flow direction, and saturated thickness of the uppermost aquifer. Based on these factors, a monitoring well network that consists of four upgradient (background) monitoring wells and ten downgradient monitoring wells was installed around the ash landfill. The monitoring wells are listed in Table 1 and presented in Figure 1.

**Table 1: Monitoring Well Network**

Location	Upgradient (Background) Monitoring Wells	Downgradient Monitoring Wells
Ash Landfill	APMW-5, APMW-15, APMW-16A, APMW-17	APMW-4, APMW-6, APMW-8A, APMW-10, APMW-11, APMW-12, APMW-13, APMW-14, APMW-18, APMW-19

The four upgradient monitoring wells included in the groundwater monitoring program are used to represent the background groundwater quality, including potential variability. The ten downgradient wells were installed along the western, southern, and eastern boundaries of the active ash landfill. The depths of the monitoring wells were selected such that the monitoring wells are screened in the Ogallala Formation to yield groundwater samples that are representative of water quality in the uppermost water-bearing zone.

## 2.5 Groundwater Monitoring Program

Between March 1996 and December 2015, groundwater samples were collected for arsenic, selenium, and sulfate measurement twice a year from the 10 GGS monitoring wells administered under the Nebraska Department of Environment and Energy (NDEE) monitoring program (APMW-5, APMW-15, APMW-4, APMW-6, APMW-8A, APMW-10, APMW-11, APMW-12, APMW-13, and APMW-14). In June 2005, boron measurements were added to the analyte list. In 2015, four additional monitoring wells were installed to support the federal CCR monitoring program (APMW-16A, APMW-17, APMW-18, and APMW-19) and have been incorporated into the NDEE monitoring program.

For APMW-6, the current baseline for chloride was calculated using 13 independent groundwater samples collected between December 2015 and November 2019. Statistically valid baseline values were developed for each constituent at each monitoring well (Golder 2017 and Golder 2019a).

### 2.5.1 Chloride Concentration Trends

Chloride concentrations in the upgradient and downgradient groundwater are shown in Appendix A, Figure A4. Chloride concentrations in upgradient groundwater (from the four upgradient monitoring wells) ranged from less than 5.0 to 93.8 milligrams per liter (mg/L) between December 2015 and June 2022. Chloride concentrations varied between 7.02 to 210 mg/L in downgradient groundwater wells (based on the 10 downgradient monitoring wells) over the same period.

During the current baseline dates for APMW-6 (December 2015 to November 2019), chloride concentrations in groundwater at APMW-6 remained relatively steady compared to other downgradient wells, with values ranging between 7.0 and 15.5 mg/L in the 13 samples representing the current baseline period. A concentration of 20.4 mg/L was calculated as the parametric CUSUM statistical limit for chloride at APMW-6.

The Q2 2021 detection monitoring event reported a chloride concentration of 25.8 mg/L in groundwater at APMW-6 with a parametric CUSUM value of 31.7 mg/L, both exceeding the statistical limit of 20.4 mg/L. The exceedance was verified in Q4 2021 when the reported chloride concentration was 17.6 mg/L with a parametric CUSUM value of 36.6 mg/L exceeded the statistical allowance of 20.4 mg/L. A successful alternative source demonstration report was prepared for the elevated chloride at APMW-6 and submitted to NDEE on April 28, 2022 (Golder 2022) and accepted by NDEE on July 8, 2022 (NDEE 2022).

The Q2 2022 detection monitoring event reported a chloride concentration of 17.0 mg/L, which resulted in a parametric CUSUM value of 40.8 mg/L, which continued to exceed the statistical allowance of 20.4 mg/L.

## 2.6 Review of Sampling and Laboratory Testing Procedures

As part of the ASD, a review was conducted of the sampling and laboratory testing procedures used throughout baseline monitoring and detection monitoring to date, along with the collected results. Golder found that the analytical methodologies used were consistent with the stated objectives of the sampling program. No anomalies were found within the sampling and laboratory testing procedures and the collected results are considered valid.

Additionally, a review of the statistical assessment methods and associated results found the procedures followed during baseline and detection monitoring to be consistent with the stated procedures listed in the published Groundwater Monitoring Statistical Methods Certification (Golder 2017). Calculated limits were found to be consistent with the chosen statistical procedures as described in the Sampling and Analysis Plan (Golder 2019a) and recommended methodology found within the Unified Guidance (Environmental Protection Agency [EPA] 2009).

## 3.0 DATA SOURCES USED IN ALTERNATIVE SOURCE REVIEW

To assess groundwater downgradient of the GGS CCR facilities, Golder reviewed previously collected data and performed supplemental assessment activities. The following sections summarize the supplemental assessment activities.

### 3.1 Groundwater

#### 3.1.1 On-site Groundwater Monitoring Data

NPPD GGS field personnel routinely collect groundwater samples from 14 monitoring wells around the ash landfill at GGS and submit them for chemical analysis. The following datasets were available to characterize the groundwater in the vicinity of the ash landfills:

- **NDEE and CCR monitoring programs:** As described in Section 2.5, the ongoing groundwater monitoring samples were collected between 1996 and 2022, and analyzed for field parameters, major cations, major anions, and select dissolved metals.
- **Supplemental sampling in First Quarter (Q1) 2019:** In February 2019, an additional set of groundwater samples were collected from eight of the 14 wells (APMW-5, APMW-17, APMW-4, APMW-8A, APMW-18, APMW-19, APMW-12, and APMW-14) to support the Q4 2018 ASD for fluoride at APMW-19 (Golder 2019b). These samples were analyzed for field parameters, major cations, major anions, and select dissolved metals. In addition, detection monitoring groundwater samples collected in Q4 2019 and Q2 2021 also had an expanded analyte list, including field parameters, major cations, major anions, and select dissolved metals.

#### 3.1.2 Upgradient Off-site Monitoring Data

As discussed in Section 2.3, upgradient groundwater is sourced from the Sutherland Reservoir, which is fed by the Sutherland Canal with water from North Platte and South Platte Rivers. The following data sources were used to constrain the range of potential water qualities upgradient of GGS and the ash landfill:

- **North Platte and South Platte Rivers:** The United States Geological Survey (USGS) monitored South Platte River chemistry at Roscoe, Nebraska between 1975 and 2013 (USGS 2016a). The monitoring

location at Roscoe, Nebraska is less than one mile downstream of where South Platte River water is diverted into the Sutherland Canal. The USGS also characterized North Platte River water between 1972 and 2011 at Keystone, Nebraska, immediately downstream of Lake Ogallala, where North Platte River water is diverted into the Sutherland Canal (USGS 2016b).

- **Sutherland Reservoir and Canal:** Surface water samples were collected from the Sutherland Reservoir and Sutherland Canal on October 28, 2019, to assess the source of regional groundwater at the site. These samples were analyzed for field parameters, major cations, major anions, and select dissolved metals (Golder 2019b). In addition to samples collected by NPPD personnel, seven water samples were collected from the center of the Sutherland Reservoir by the USGS between August 2005 and December 2006 (USGS 2016c and USGS 2016d).
- **Shallow Groundwater around the Sutherland Reservoir:** Between September 2005 and May 2007, the USGS collected 14 shallow groundwater samples from 12 wells less than one mile from the perimeter of Sutherland Reservoir (USGS 2016e).
- **Upgradient Wells:** In Q2 2021, NPPD personnel collected groundwater samples from wells north and east of GGS to characterize the regional groundwater. The wells included potable water wells (PW #1, PW #2, and PW #3), livestock watering wells (livestock well), and operating wells (OW-20, OW-21, OW-22, OW-23, OW-24, OW-25, and OW-36, as shown in Figure 5. The samples were analyzed for field parameters, major cations, major anions, and select dissolved metals.

## 3.2 Irrigation Water

Two types of irrigation water are identified as potentially important: center pivot spray and irrigation runoff. Center pivot spray is irrigation water that is sprayed directly onto GGS property without touching agricultural soil by the irrigation system near the southern property boundary (Figure 4c). Historical aerial imagery indicates that this irrigation system was installed in 2006 (Figure 3). NPPD was able to collect two samples of center pivot spray on August 11, 2022, with one sample collected from a tire depression in the ground and one sample caught directly in a bucket as the water sprayed onto the Site. Samples were sent to Eurofins Cedar Fall for water quality analysis, including field parameters, major cations, major anions, and select dissolved metals (Results in Appendix B). These samples were collected to characterize the water quality of the center pivot spray as it flows and infiltrates on the ground in the area of APMW-6.

Irrigation water runoff is surface water that flows through agricultural soils prior to traveling onto the Site through drainages into the ditch immediately south of the CCR unit and immediately upgradient of multiple downgradient monitoring wells, including APMW-4, APMW-6, APMW-8A, APMW-10, and APMW-11. Three indications that irrigation runoff is occurring include:

- 1) Historical aerial images from 2012 and 2020 showing green vegetation in the ditch outside of the range of the center pivot spray.
- 2) Deep drainages at low points between the agricultural fields and the ditch south of the CCR unit (Figure 4A and 4B).
- 3) Corn shucks in the ditch on NPPD property (Figure 4C).

NPPD field personnel monitored the drainages and ditch for irrigation water runoff to characterize the water quality of this flow. Unfortunately, no irrigation water runoff was observed in the drainages and ditch. Ongoing monitoring will continue until irrigation water runoff samples can be collected.

### 3.3 Evaporation Pond

In Q1 2019 and Q4 2020, surface water samples were collected from the evaporation pond. The samples were analyzed for field parameters, major cations, major anions, and select dissolved metals.

### 3.4 Coal Combustion Residuals Contact Water

To characterize the potential for the material in the ash landfill to release contaminants, NPPD GGS field personnel retrieved sump water from the Ash Landfill No. 3 LCS, and pond water in direct contact with CCR materials in Ash Landfill No.4 on October 28, 2019. These sample were analyzed for the same suite of parameters as the groundwater: field parameters, major cations, major anions, and select dissolved metals (Golder 2019b).

### 3.5 Geochemical Methods

The geochemical analysis of groundwater and surface water samples included field parameters, major cations and anions, and dissolved metals. Conductivity, pH, and temperature were measured in the field using a handheld meter. The pH of each sample was also measured in the laboratory. Major anions analyzed included chloride, sulfate, and bicarbonate and major cations included calcium, magnesium, potassium, and sodium.

The laboratory analyzed the ash landfill pond and sump water, onsite and off-site groundwater, and surface water (evaporation pond, Sutherland Reservoir, and Sutherland Canal) samples using the following methods:

- pH following SM 4500 H+ B (2017)
- alkalinity following Standard Method (SM) 2320B Alkalinity by Titration (2005)
- chloride, fluoride, and sulfate following USEPA SW846 9056A Determination of Inorganic Anions by Ion Chromatography Revision 1 (February 2007)
- ammonia following USEPA 350.1 Determination of Ammonia Nitrogen by Automated Colorimetry, Revision 2 (August 1993)
- total Kjeldahl nitrogen following USEPA 351.2 Determination of Total Kjeldahl Nitrogen by Semi-Automated Colorimetry, Revision 2 (August 1993)
- total nitrate-nitrite nitrogen following USEPA 353.2 Determination of Nitrate-Nitrite Nitrogen by Automated Colorimetry, Revision 2 (August 1993)
- antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, lead, lithium, magnesium, molybdenum, potassium, selenium, sodium, and thallium following USEPA SW-846 6020A (November 2004)

## 4.0 DATA EVALUATION

Historical concentrations of Appendix III analytes and selected Appendix IV analytes in groundwater at GGS, including analytes that are typically indicators of potential CCR seepage (e.g., arsenic, barium, molybdenum, and selenium), are presented in time series plots in Appendix A. The plots include the results of the supplemental samples that were collected in Q1 2019 to support the Q4 2018 ASD for fluoride at APMW-19 (Golder 2019b).

Sampling for the Appendix IV analytes concluded with the end of baseline monitoring in Q2 2017, which means there is a gap of six quarters in the data plots until the supplemental sampling results are shown in Q1 2019.

Figure 6 presents a Piper diagram with relative major ion chemistry for the monitoring well groundwater samples (only for samples analyzed for all major cations and anions; Q4 2017, Q1 2019, Q4 2019, and Q2 2021), offsite upgradient groundwater (NPPD and USGS sampled wells), regional groundwater sources (Sutherland Reservoir, Sutherland Canal, and North and South Platte River), irrigation waters from the center pivot spray, evaporation pond water, and coal ash impacted waters (Ash Landfill No. 3 sump water and Ash Landfill No. 4 surface pond water). The groundwater at the upgradient monitoring wells was dominated by calcium and bicarbonate. Samples from the downgradient monitoring wells were also majority calcium and bicarbonate ions, with the exception of a single sample (Q1 2019) from APMW-12 that was dominated by calcium and sulfate. The Sutherland Reservoir and Canal water, along with the average North and South Platte River waters are generally dominated by calcium, sodium, bicarbonate, and sulfate. Irrigation waters from the center pivot spray were dominated by calcium and bicarbonate. The evaporation pond water contained majority sodium and sulfate ions. The Ash Landfill No. 3 sump water sample was primarily sodium and bicarbonate, while the Ash Landfill No. 4 pond water was dominated by sodium and sulfate.

## 4.1 Potential Chloride Sources

Several potential sources, other than the active CCR Units, can contribute chloride to local groundwater at GGS, including outflows from the Sutherland Reservoir into regional groundwater, irrigation water runoff and center pivot spray from across southern property boundary, seepage from the evaporation pond, and seepage from historical deposits of fly ash that remain at GGS. These four potential sources of chloride to groundwater are described in this section.

### 4.1.1 Regional Groundwater from Sutherland Reservoir

As described in Section 2.3, the groundwater gradient in the area around the ash landfill shows groundwater flows from north to south, rather than from south to north in the direction of the South Platte River. The groundwater flow direction appears to be based on both the groundwater recharge provided by the Sutherland Reservoir to the north of GGS and groundwater extraction by irrigation wells located south of GGS that are pumped seasonally and used to support local agriculture. The Sutherland Reservoir is fed by the Sutherland Canal, which delivers water from both the North and South Platte Rivers for use as condenser cooling water at GGS.

The USGS collected 37 samples for chloride concentration analysis from the South Platte River at Roscoe, Nebraska between 1975 and 2013 (USGS 2016a). Chloride concentrations in the South Platte River ranged from 28 to 140 mg/L. The USGS collected 26 samples for chloride concentration analysis from the North Platte River at Keystone, Nebraska between 1972 and 2011 (USGS 2016b). Chloride concentrations in the North Platte River ranged from 16 to 24 mg/L.

The chloride concentrations of the Sutherland Reservoir and Sutherland Canal samples collected by NPPD field staff in October 2019 were 21.9 and 20.9 mg/L, respectively (Section 3.1.2). The six Sutherland Reservoir samples the USGS collected between August 2005 and December 2006 had chloride concentrations that ranged from 23.4 to 27.2 mg/L (USGS 2016c and USGS 2016d). The chloride concentrations in the Sutherland Reservoir and Sutherland Canal at the times of sampling (2005, 2006, and 2019) were more similar to concentrations observed in the North Platte River and lower than concentrations observed in the South Platte River.



Chloride concentrations in the North Platte River, South Platte River, and Sutherland Reservoir were sufficiently high enough to be regarded as a source of the elevated concentrations measured in groundwater at the upgradient monitoring wells at the Site and the elevated concentrations measured in downgradient groundwater at APMW-6, APMW-8A, and APMW-18. The groundwater from APMW-6 has the lowest chloride concentrations of any upgradient or downgradient CCR monitoring well (Figure 7 and Appendix A Figure A4). While the small increases in chloride concentrations at APMW-6 were only observed during detection monitoring (25.8 mg/L in Q2 2021, 17.6 mg/L in Q4 2021 which triggered the SSI, and 17.0 in Q2 2022), elevated concentrations at APMW-8A (56.3 mg/L to 124 mg/L) and APMW-18 (23.7 mg/L to 101 mg/L) were observed during the baseline and detection monitoring periods. The groundwater samples collected by the USGS and NPPD immediately around the Sutherland Reservoir (less than 1 mile) also support the hypothesis that the reservoir is the source of the elevated chloride concentrations at the Site (USGS 2016e). These shallow groundwater samples (10 collected by the USGS and 11 samples collected by NPPD) had chloride concentrations of between 21.9 and 36.1 mg/L, which is similar to the 5 to 93.8 mg/L chloride concentration range measured in groundwater at the GGS upgradient monitoring wells (APMW-5, APMW-15, APMW-16A, and APMW-17) between December 2015 and June 2022.

Figure 7 displays a box and whisker plot of the chloride concentrations from the GGS monitoring well network and samples of possible chloride sources at the Site. The plot indicates that groundwater-containing elevated chloride concentrations has been traveling across the Site, including past the upgradient monitoring wells, and has only recently started reaching downgradient monitoring wells.

McMahon et al. (2010) details the southerly flow of surface water from the Sutherland Canal and Sutherland Reservoir to the surrounding groundwater near GGS. Their analysis indicated that the front “edge” of Sutherland Reservoir water was in the approximate area of the CCR landfills, though the low density of wells sampled around the CCR landfills limited the resolution in that area.

#### **4.1.2 Irrigation Water**

As discussed in Section 2.3, historical ariel imagery (Figure 3) and site photographs (Figure 4) indicate that irrigation water runoff and center pivot spray are crossing the southern property boundary at GGS and flowing into the ditch immediately south of Ash Landfill No. 3 and No. 4. Ponded water in that ditch could infiltrate to groundwater and would have the potential to impact the wells located south of the ash landfills (APMW-4, APMW-6, APMW-8A, APMW-10, and APMW-11).

Chloride concentrations in center pivot irrigation water samples (Section 3.2) were elevated over concentrations recently observed in APMW-6 (17.0 to 25.8 mg/L between Q2 2021 and Q2 2022). On the piper diagram (Figure 6), groundwater from APMW-6 does have a similar signature (calcium bicarbonate dominant) to irrigation waters.

While two samples were collected and analyzed to represent center pivot spray water quality, NPPD field personnel did not observe irrigation water runoff to sample during the spring and summer of 2022.

#### **4.1.3 Evaporation Pond**

Although the evaporation pond is located to the east of APMW-6, and side-gradient in terms of groundwater flow (i.e., seepage from the evaporation pond would be unlikely to impact groundwater at monitoring well APMW-6), evaporation pond water quality was evaluated as a potential source in this section as it contains water related to GGS plant operations.

Groundwater quality at the three downgradient monitoring wells located around the evaporation pond (i.e., APMW-12, APMW-13, and APMW-14) indicates that process water discharged from the GGS plant and stored in the evaporation pond has migrated to groundwater. Historical monitoring results show that elevated concentrations of boron (Figure A2), chloride (Figure A4), sulfate (Figure A8), and TDS (Figure A9), which are elements that are typically associated with CCR, were detected in groundwater at these three monitoring wells closest to the evaporation pond compared to the upgradient monitoring wells.

Based on the slight differences in water quality between the groundwater at the monitoring wells APMW-12, APMW-13 and APMW-14 and the evaporation pond, mixing between the evaporation pond water and the upgradient groundwater likely occurs and groundwater at the monitoring wells is not entirely composed of seepage from the evaporation pond. This mixing reaction is supported by the Piper diagram in Figure 6, which shows samples from monitoring wells APMW-12 and APMW-14 plot on a mixing line between the evaporation pond and upgradient groundwater end-member data points.

During the Q4 2020 sampling of the evaporation pond surface water, the chloride concentration was 259 mg/L. Based on the similarities in water quality between the evaporation pond and adjacent groundwater monitoring wells (APMW-12, APMW-13, and APMW-14), the evaporation pond is considered a potential source of chloride to groundwater at GGS. However, it is unlikely the evaporation pond influenced groundwater quality at APMW-6, which is side gradient to groundwater flow underneath the evaporation pond (Figure 1).

#### 4.1.4 Historical Ash Landfills

Historical deposits of fly ash present at GGS in the closed soil-lined Ash Landfills Nos. 1 and 2 may release soluble constituents to groundwater as the seepage generated by infiltrating precipitation interacts with the ash. While it was not feasible to collect a sample of seepage from Ash Landfills Nos. 1 and 2 directly, ash-impacted waters collected from Ash Landfill No. 3 sump and Ash Landfill No. 4 pond (Section 3.4) had chloride concentrations of 69 and 463 mg/L, respectively, and are assumed to represent potential ash impacted waters from closed ash landfills. At these concentrations, ash impacted seepage has the potential to increase chloride concentrations in downgradient wells, including APMW-6.

A ternary plot comparing sodium, potassium, and sulfate (Figure 8) reveals that ash impacted waters (i.e., contact water) have higher relative sodium abundances and lower relative potassium and sulfate abundances compared to the upgradient and downgradient groundwater. If infiltrating precipitation was leaching chloride from the closed fly ash storage facilities, the relative concentrations of sodium would increase considerably in the groundwater and would be more similar to the ash impacted waters, but this elevated sodium signature was not observed in any of the samples collected from the downgradient groundwater monitoring wells.

In addition to the elevated levels of chloride in the ash-impacted waters, boron was also identified as a primary CCR indicator based on high concentrations in sump water from Ash Landfill No. 3 (18.3 mg/L) and pond water from Ash Landfill No.4 (13.8 mg/L). Boron concentrations in groundwater at the upgradient and downgradient CCR Unit monitoring wells are presented in Appendix A, Figure A2. All upgradient and downgradient CCR Unit monitoring wells, with the exception of monitoring wells near the evaporation pond that may be influenced by process waters, have boron concentrations below the practical quantitation limit (PQL) (typically less than 0.2 mg/L). If seepage from the ash landfills were impacting groundwater and causing the chloride SSI, boron concentrations would be expected to be increasing.



## 5.0 EVIDENCE OF AN ALTERNATIVE SOURCE

Based on the testing results and list of potential alternate sources of chloride presented in this report, primary lines of evidence and conclusions drawn from the evidence used to support this ASD are provided in Table 2.

**Table 2: Primary Lines of Evidence and Supporting ASD Analysis**

Key Line of Evidence	Supporting Evidence	Description
Lack of Primary CCR Indicators	Boron concentrations in groundwater	Boron (Figure A2) is a primary CCR indicator based on high concentrations in sump water from Ash Landfill No. 3 (18.3 mg/L) and pond water from Ash Landfill No. 4 (13.8 mg/L). All upgradient and downgradient CCR unit monitoring wells, with the exception of monitoring wells near the evaporation pond that may be influenced by process waters, have boron concentrations below the PQL (typically <0.2 mg/L).
	Sodium concentrations in CCR impacted waters	The relative abundance of sodium in CCR impacted waters would indicate that high sodium concentrations would also be expected in groundwater if chloride was from CCR materials (Figure 8). Relative increases in sodium were not observed in monitoring wells at the Site, suggesting an alternative source of elevated chloride in groundwater at APMW-6
Groundwater Geochemistry	Elevated and variable chloride concentrations in upgradient monitoring wells	Chloride concentrations in groundwater at upgradient monitoring wells APMW-5, APMW-16A, and APMW-17 were elevated compared to chloride concentrations at monitoring well APMW-6 throughout the baseline monitoring period. Since the CCR unit cannot influence the chloride groundwater concentration in the upgradient wells, the only explanation is that there is an alternate source of chloride present in groundwater across the Site.
	Relative ion abundances in groundwater differs from ash landfill water	As presented in the Piper plot (Figure 6), relative differences in major ion concentrations show a distinct dissimilarity between the ash-impacted sump and pond waters and the downgradient groundwater samples, including from APMW-6. The geochemical properties of the downgradient groundwater samples are not consistent with seepage from the CCR unit.
Engineering Controls	Both Active CCR Landfill are Lined	The liner system at Ash Landfill No. 3 consists of a prepared subgrade overlain by a geosynthetic clay liner and 60-mil linear low-density polyethylene (LLDPE) geomembrane. Ash Landfill No. 3 also has a 1-foot LCS sand layer that reports to two sumps.  The liner design at Ash Landfill No. 4 consists of a 60-mil high density polyethylene (HDPE) geomembrane over compacted subgrade.

Key Line of Evidence	Supporting Evidence	Description
		Liner system are less likely to release seepage and impact groundwater.
Local Sources of Chloride	Hydrogeology	The North and South Platte Rivers, which are ultimately the source of groundwater recharge that occurs from the Sutherland Reservoir located approximately 1.5 miles north of the ash landfill, have chloride concentrations between 16 and 140 mg/L. Samples from shallow wells near the Sutherland Reservoir and upgradient wells (Figures 6 and 7) indicate that groundwater with elevated chloride is migrating south through the Site (McMahon et al. 2010). Chloride concentrations in groundwater at APMW-6 were lower than other nearby wells, indicating that APMW-6 is the last of the downgradient monitoring wells to be affected by the higher chloride groundwater migrating south (Figure 7 and Appendix A Figure A4).
	Drainages from agricultural lands flow into the ditch immediately upgradient of APMW-6	Irrigation waters spraying directly onto GGS property near APMW-6 had sufficiently elevated chloride concentrations (32 to 34 mg/L) to be a potential source of chloride in groundwater downgradient of the ash landfills. Additional study is needed to understand the water quality, frequency, and magnitude of irrigation water runoff events.

## 6.0 CONCEPTUAL SITE MODEL

Golder developed a conceptual site model (CSM) that is presented graphically in Figure 9 to frame and support the ASD assessment approach. The CSM presents the GGS site layout, a summary of the geologic and hydrogeologic information, and a discussion of groundwater monitoring data, which together lays the groundwork for consideration and development of the ASD. Additionally, the CSM summarizes the findings of literature research that suggest certain naturally occurring groundwater conditions observed in Nebraska are present at the Site and may contribute to naturally elevated chloride concentrations in groundwater around the ash landfill.

## 7.0 CONCLUSIONS

In accordance with §257.95(g)(3) and NAC Title 132, Ch.7, 004.03, this ASD has been prepared in response the identification of an SSI for chloride at monitoring well APMW-6 following the Q2 2022 sampling event for the ash landfill at Gerald Gentleman Station.

A review of historical analytical results indicates that the elevated chloride concentrations in groundwater at APMW-6 were not the result of seepage from the ash landfill but can be attributed to chloride in regional groundwater from the Sutherland Reservoir or in infiltrating surficial flows of irrigation water from agricultural lands immediately to the south of the GGS property. Therefore, no further action (i.e., transition to Assessment Monitoring) is warranted, and the Gerald Gentleman Station ash landfill will remain in detection monitoring.

## Signature Page

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[https://golderassociates.sharepoint.com/sites/141322/project files/6 deliverables/reports/4-r-asd\\_chloride\\_apmw6/4-r-0/31404512.000-004-rpt-0-chloride\\_asd\\_apmw6\\_26oct22.docx](https://golderassociates.sharepoint.com/sites/141322/project%20files/6%20deliverables/reports/4-r-asd_chloride_apmw6/4-r-0/31404512.000-004-rpt-0-chloride_asd_apmw6_26oct22.docx)

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## Figures

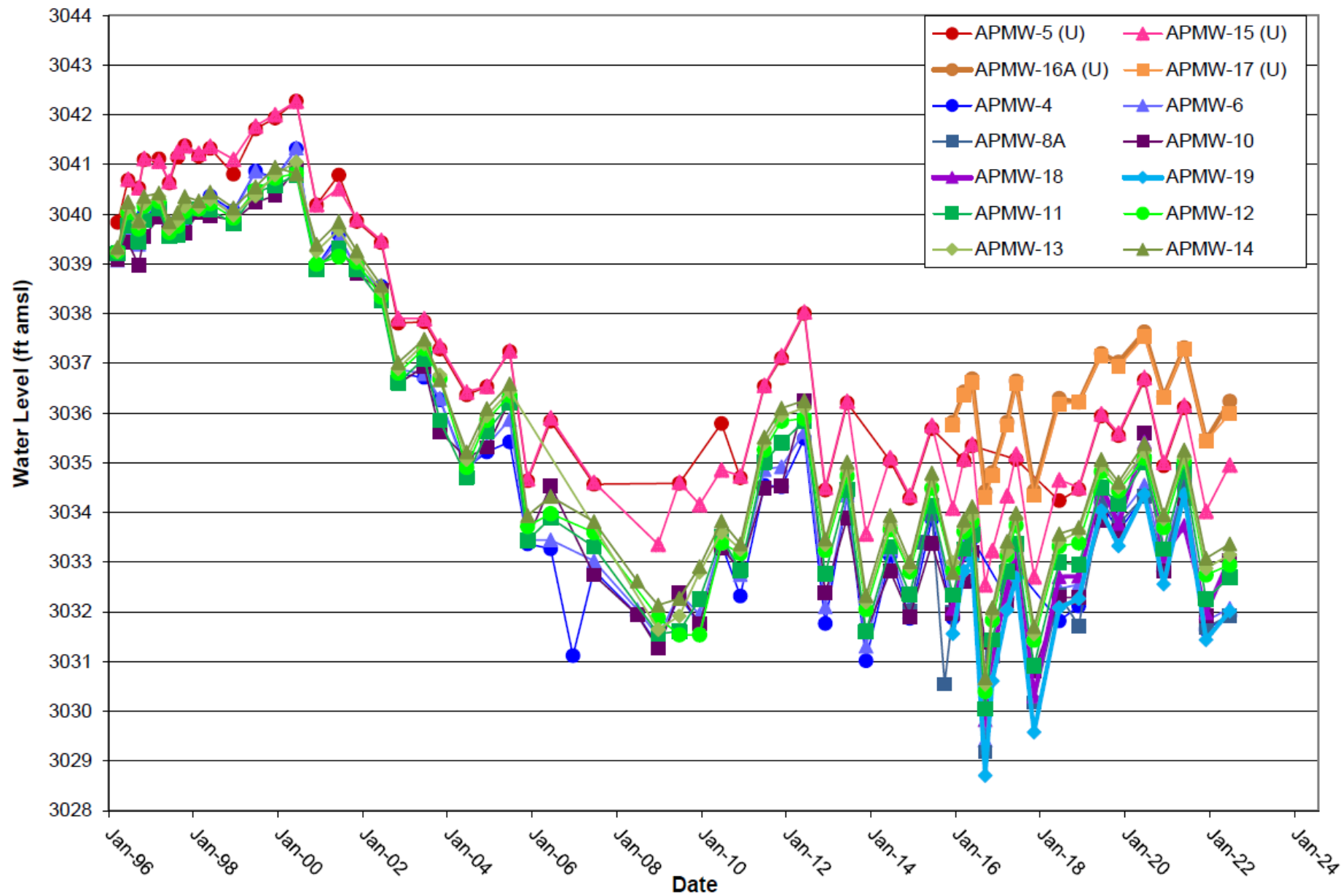




NOTE  
GROUNDWATER CONTOURS DEVELOPED FROM LEVELS MEASURED IN ACTIVE  
MONITORING WELLS SHOWN.

NEBRASKA PUBLIC POWER DISTRICT GERALD  
GENTLEMAN STATION GROUNDWATER  
MONITORING WELL NETWORK JUNE 2022  
GROUNDWATER CONTOURS  
FIGURE 1





CLIENT

Nebraska Public Power District: Gerald  
Gentleman Station

CONSULTANT



PROJECT

Alternate Source Demonstration

TITLE

Groundwater Monitoring Well Water Levels

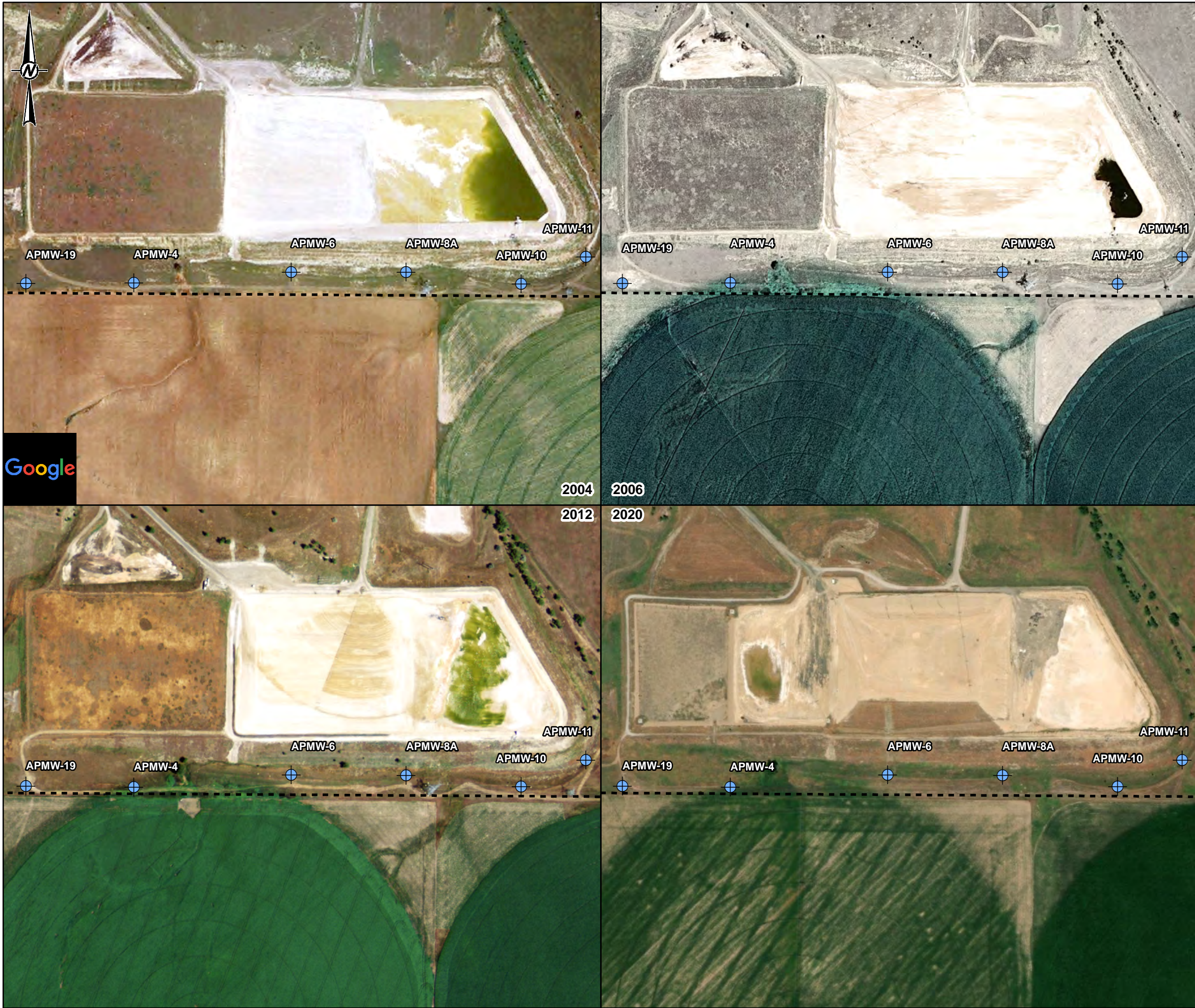
PROJECT NO.  
31404512.000

PHASE  
1

REV.

FIGURE  
2





LEGEND

MONITORING WELLS (QUALITY)

APPROXIMATE NPPD PROPERTY BOUNDARY

KEY MAP

0 250 500 1,000 Feet

**REFERENCES**

1. AERIAL IMAGERY: NATIONAL AGRICULTURE IMAGERY PROGRAM (NAIP), USDA. IMAGERY COLLECTED 06/26/2012, AND 07/14/2006.
2. AERIAL IMAGERY: ESRI PROVIDED BASEMAP, VIVID, MAXAR. IMAGERY COLLECTED 07/03/2020
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4. APPROXIMATE WATER WELL LOCATIONS: NEBRASKA DEPARTMENT OF NATURAL RESOURCES. DATASET DOWNLOADED MARCH 2019.
5. APPROXIMATE NPPD PARCEL BOUNDARIES: LINCOLN COUNTY ASSESSOR'S OFFICE, APRIL 2019.

CLIENT

NEBRASKA PUBLIC POWER DISTRICT  
GERALD GENTLEMAN STATION  
SUTHERLAND, NEBRASKA

PROJECT

Alternative Source Demonstration

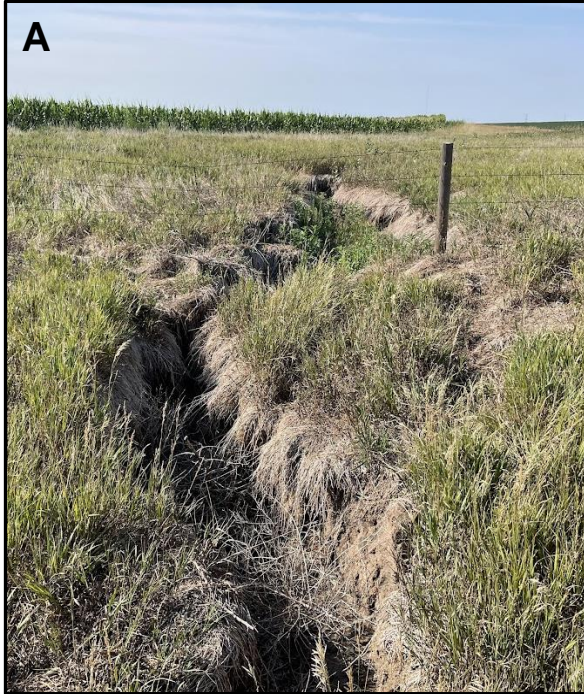
**Aerial Imagery of Irrigation Water Runoff and Center Pivot spray onto GGS Property**

CONSULTANT	YYYY-MM-DD	2021-10-26
	DESIGNED	RG/JAM
	PREPARED	JAM
	REVIEWED	GOL
	APPROVED	JS

PROJECT NO.  
31404512.000

FIGURE  
3





**Evidence of past irrigation water runoff**

East Drainage from agricultural fields onto NPPD GGS property at southern property boundary fence. No water in the drainage at the time of photograph.

Photo taken by Gregory Lehn (WSP-Golder) on August 2nd, 2022 facing south.



**Evidence of past irrigation water runoff**

West Drainage from agricultural fields onto NPPD GGS property at southern property boundary fence. Presence of dried corn shucks indicates previous flows through the drainage.

Photo taken by Gregory Lehn (WSP-Golder) on August 2nd, 2022 facing south.



**Evidence of center pivot spray**

Irrigation system spray from agricultural fields onto NPPD GGS property along southern property boundary fence. Water has been observed ponded on the surface and grass is green throughout the summer months.

Photo taken by Douglas Harris (NPPD) on August 11th, 2022 facing east along southern boundary.

CLIENT

Nebraska Public Power District: Gerald Gentleman Station

CONSULTANT

**wsp GOLDER**

PROJECT

Alternate Source Demonstration

TITLE

Photographs of Drainages and Center Pivot Spray onto GGS Property

PROJECT NO.  
31404512.000

PHASE  
1

REV.

FIGURE

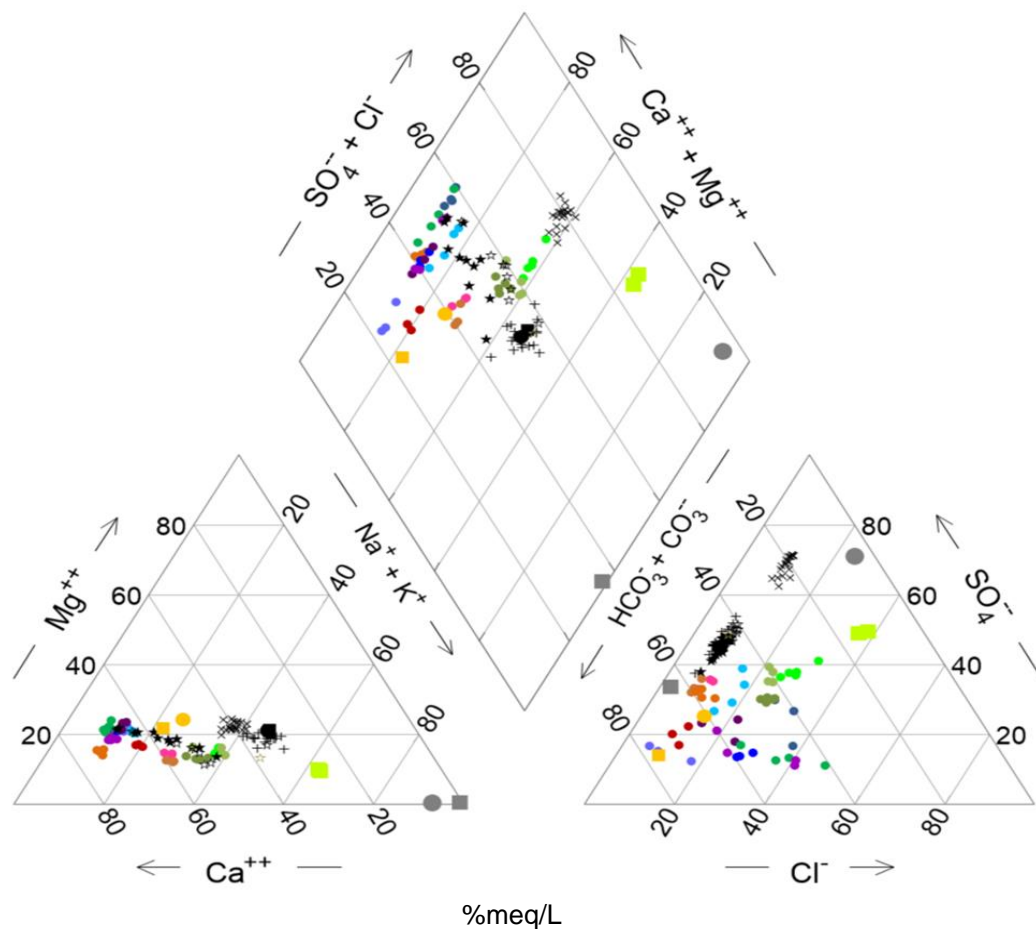
4



Path: \\golder-gis.complex\data\office\Demetri\asaf\NPPD\GCS99\_PROJ\GCS20141315 GCS GW Quality 2020 | File Name: ASD\_20141315AQ02\_GCS\_Figure 3.dwg







#### Upgradient CCR Wells

- APMW-5
- APMW-15
- APMW-16A
- APMW-17

#### Downgradient CCR Wells

- APMW-4
- APMW-6
- APMW-8A
- APMW-10
- APMW-11
- APMW-18
- APMW-19

#### Wells Impacted By Evap Pond

- APMW-12
- APMW-13
- APMW-14

#### Potential Sources Upgradient of GGS

- + North Platte River (USGS)
- × South Platte River (USGS)
- Sutherland Canal (NPPD)
- Sutherland Reservoir (USGS and NPPD)
- ★ GW near Sutherland R. (NPPD)
- ☆ GW near Sutherland R. (USGS)

#### Potential Sources at GGS

- Ash Pit 3 Sump
- Ash Pit 4 Pond
- Evaporation Pond

#### Potential Sources Downgradient of GGS

- Center Pivot Spray (from ground)
- Center Pivot Spray (bucket)

CLIENT

Nebraska Public Power District: Gerald  
Gentleman Station

CONSULTANT

**WSP** **GOLDER**

PROJECT

Alternate Source Demonstration

TITLE

Piper Diagram of Groundwater and Potential  
Chloride Sources

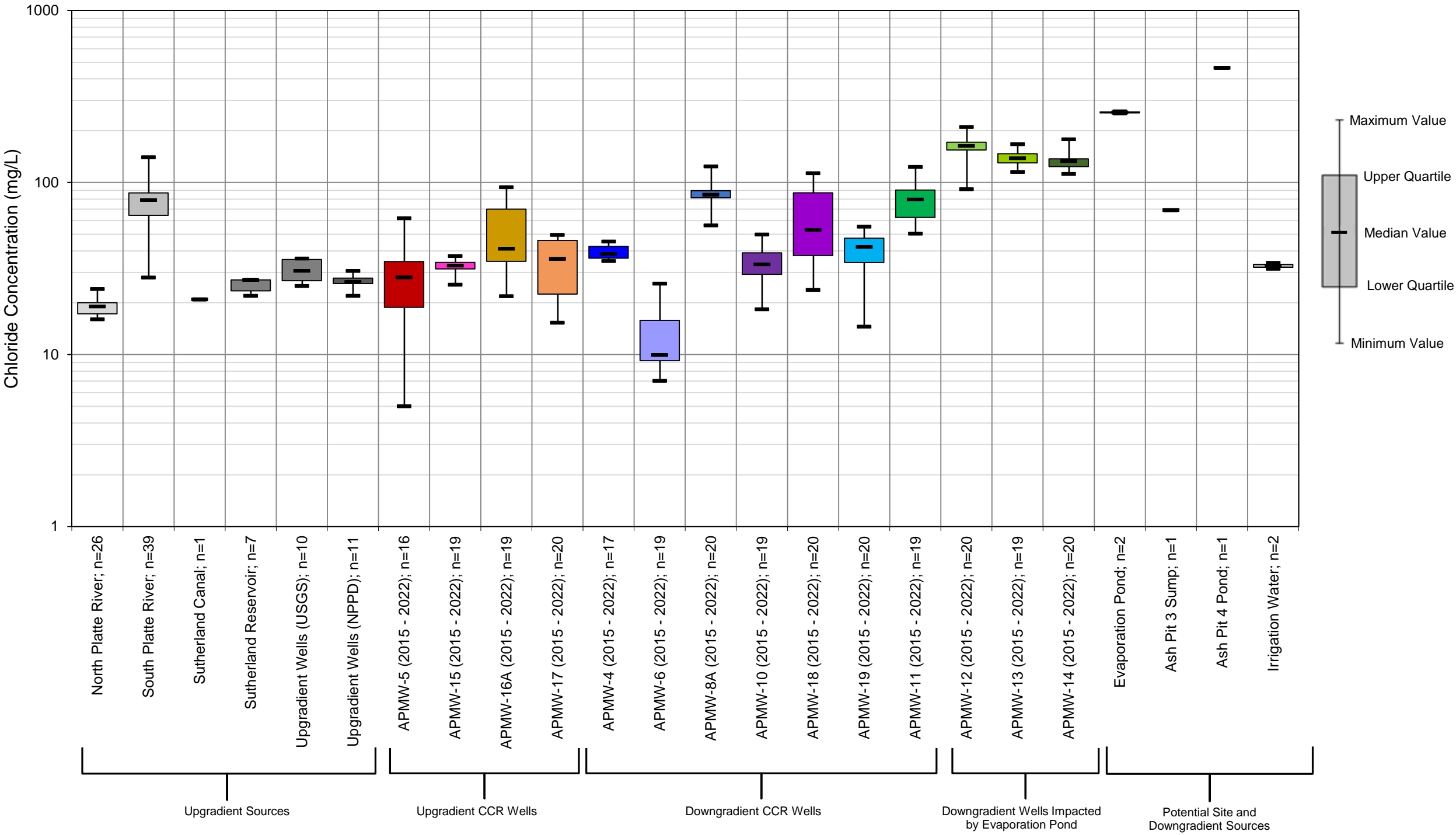
PROJECT NO.  
31404512.000

PHASE  
1

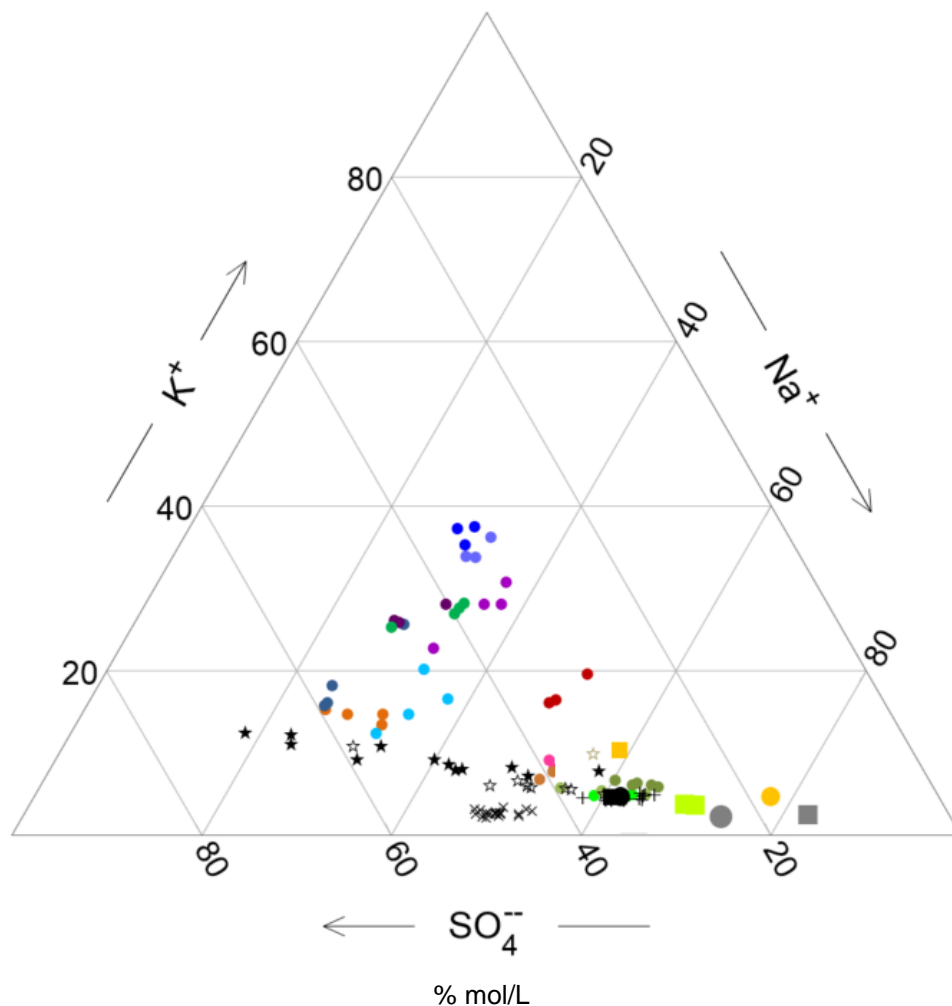
REV.

FIGURE

6







#### Upgradient CCR Wells

- APMW-5
- APMW-15
- APMW-16A
- APMW-17

#### Downgradient CCR Wells

- APMW-4
- APMW-6
- APMW-8A
- APMW-10
- APMW-11
- APMW-18
- APMW-19

#### Wells Impacted By Evap Pond

- APMW-12
- APMW-13
- APMW-14

#### Potential Sources Upgradient of GGS

- + North Platte River (USGS)
- × South Platte River (USGS)
- Sutherland Canal (NPPD)
- Sutherland Reservoir (USGS and NPPD)
- ★ GW near Sutherland R. (NPPD)
- ☆ GW near Sutherland R. (USGS)

#### Potential Sources at GGS

- Ash Pit 3 Sump
- Ash Pit 4 Pond
- Evaporation Pond

#### Potential Sources Downgradient of GGS

- Center Pivot Spray (from ground)
- Center Pivot Spray (bucket)

CLIENT

Nebraska Public Power District: Gerald Gentleman Station

CONSULTANT

**wsp** **GOLDER**

PROJECT

Alternate Source Demonstration

TITLE

Ternary Diagram of Groundwater and Potential Chloride Sources

PROJECT NO.  
31404512.000

PHASE  
1

REV.

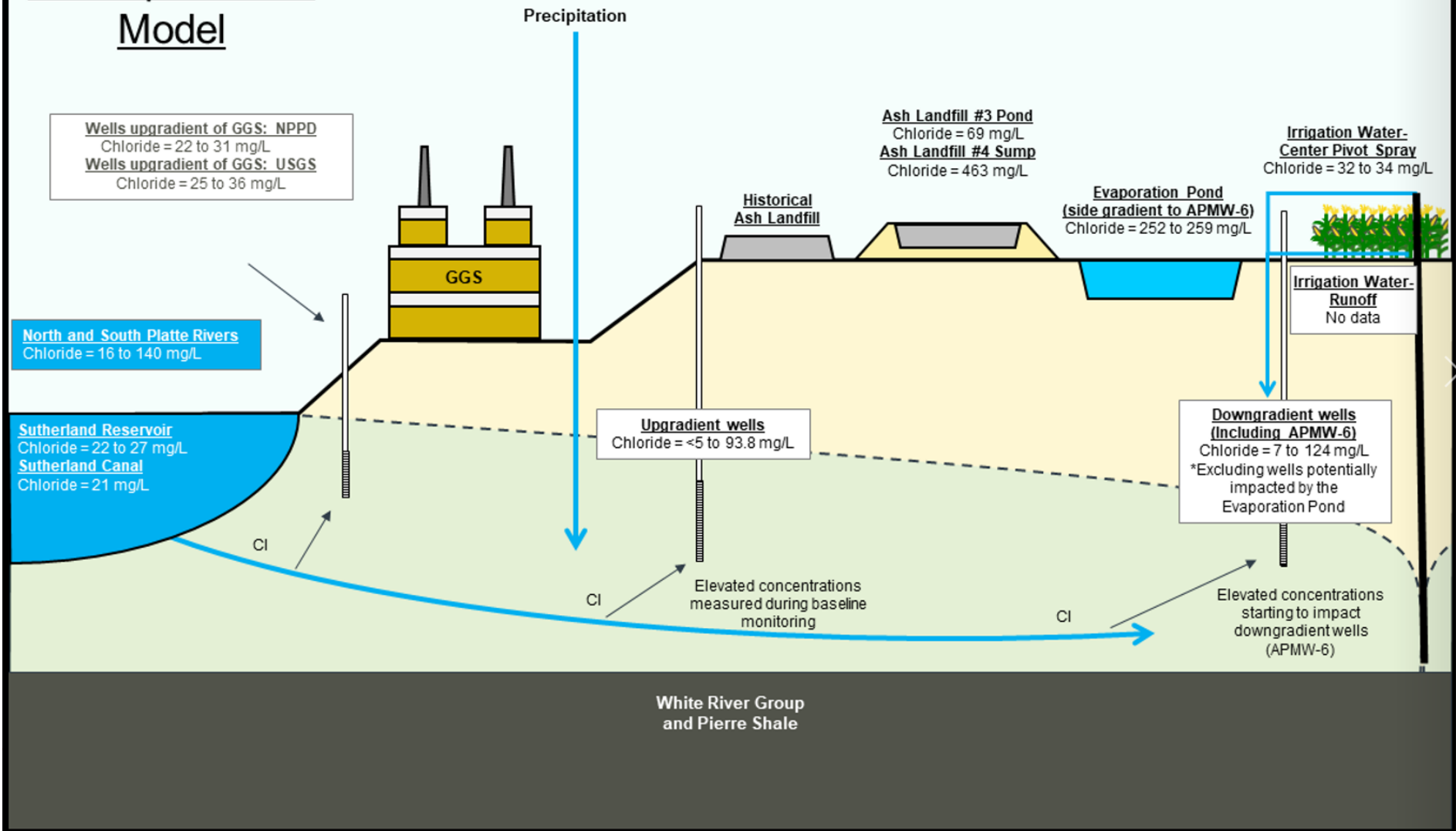
FIGURE  
8

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

1 in

0

# Conceptual Site Model



CLIENT

Nebraska Public Power District: Gerald Gentleman Station

CONSULTANT

**wsp** **GOLDER**

PROJECT

Alternate Source Demonstration

TITLE

Chloride Conceptual Site Model

PROJECT NO.  
31404512.000

PHASE  
1

REV.

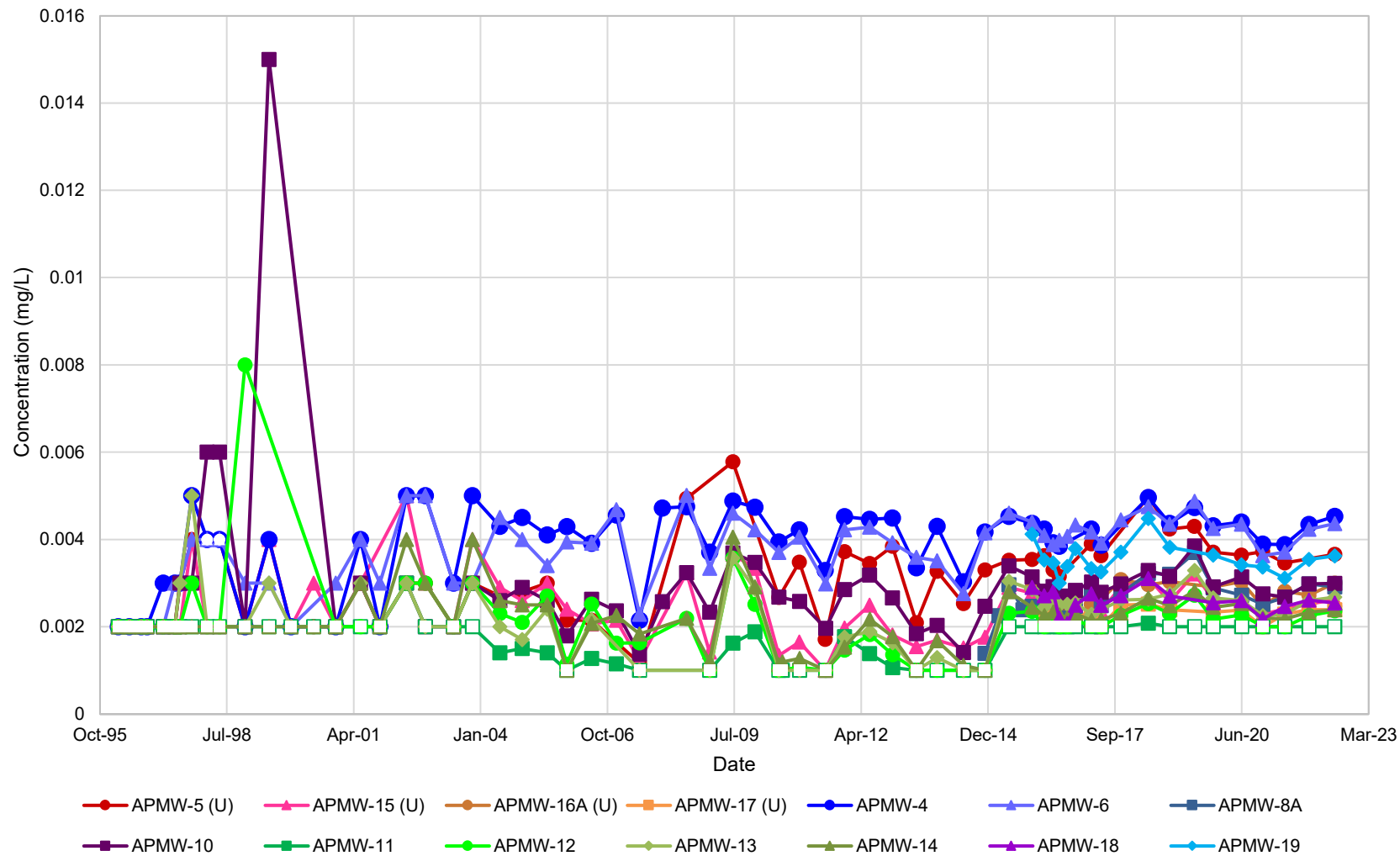
FIGURE  
9

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

1 in

**APPENDIX A**

**Historical Concentrations of  
Appendix III and Selected Appendix  
IV Analytes**



**Figure A-1**  
**Arsenic**

Nebraska Public Power District  
Gerald Gentleman Station

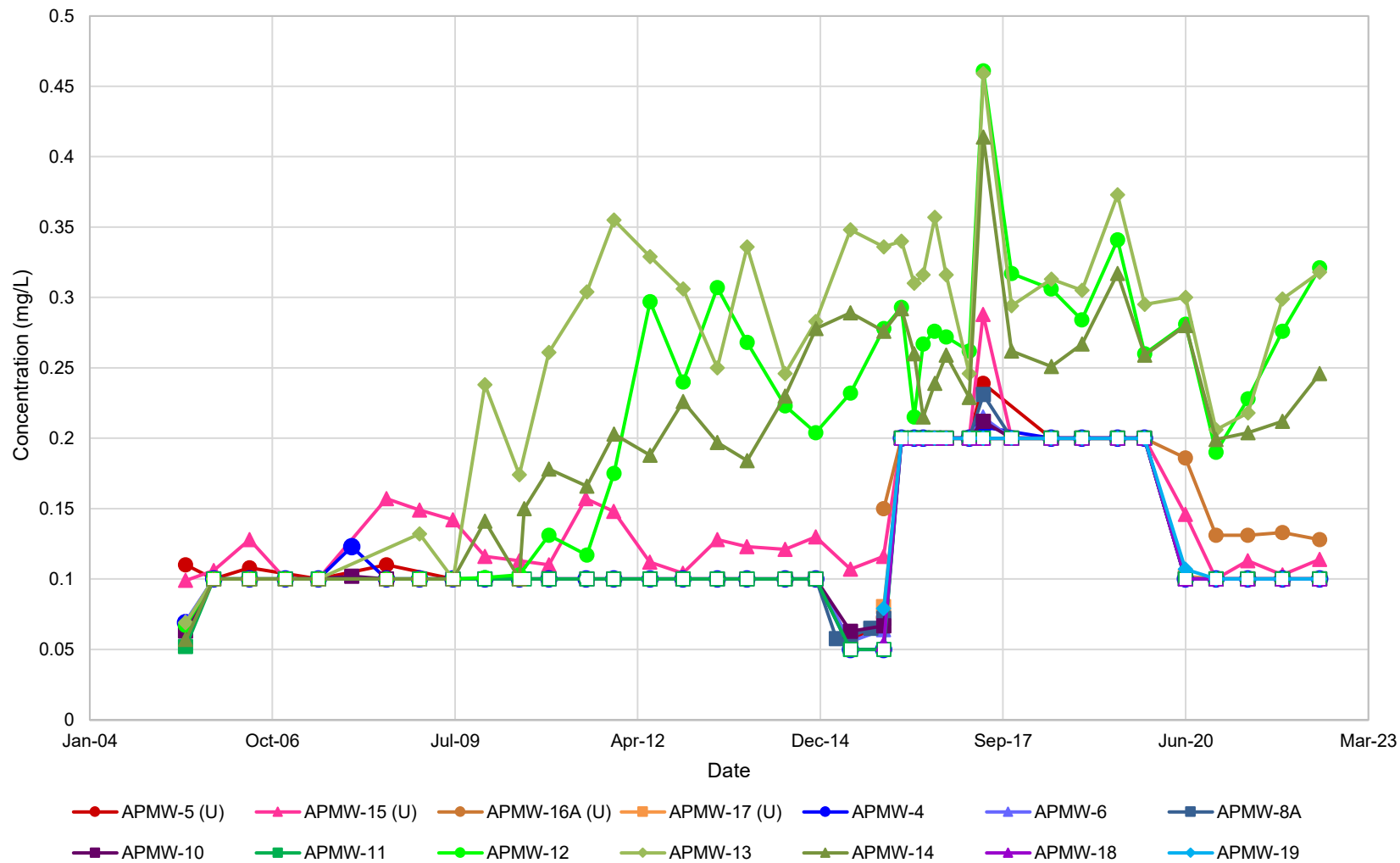
*Non-detect values are plotted with an open symbol at the practical quantitation limit.*

Denver, Colorado, USA

10/26/2022

31404512.000

**Golder Associates USA Inc., A Member of WSP**



**Figure A-2**  
**Boron**

Nebraska Public Power District  
Gerald Gentleman Station

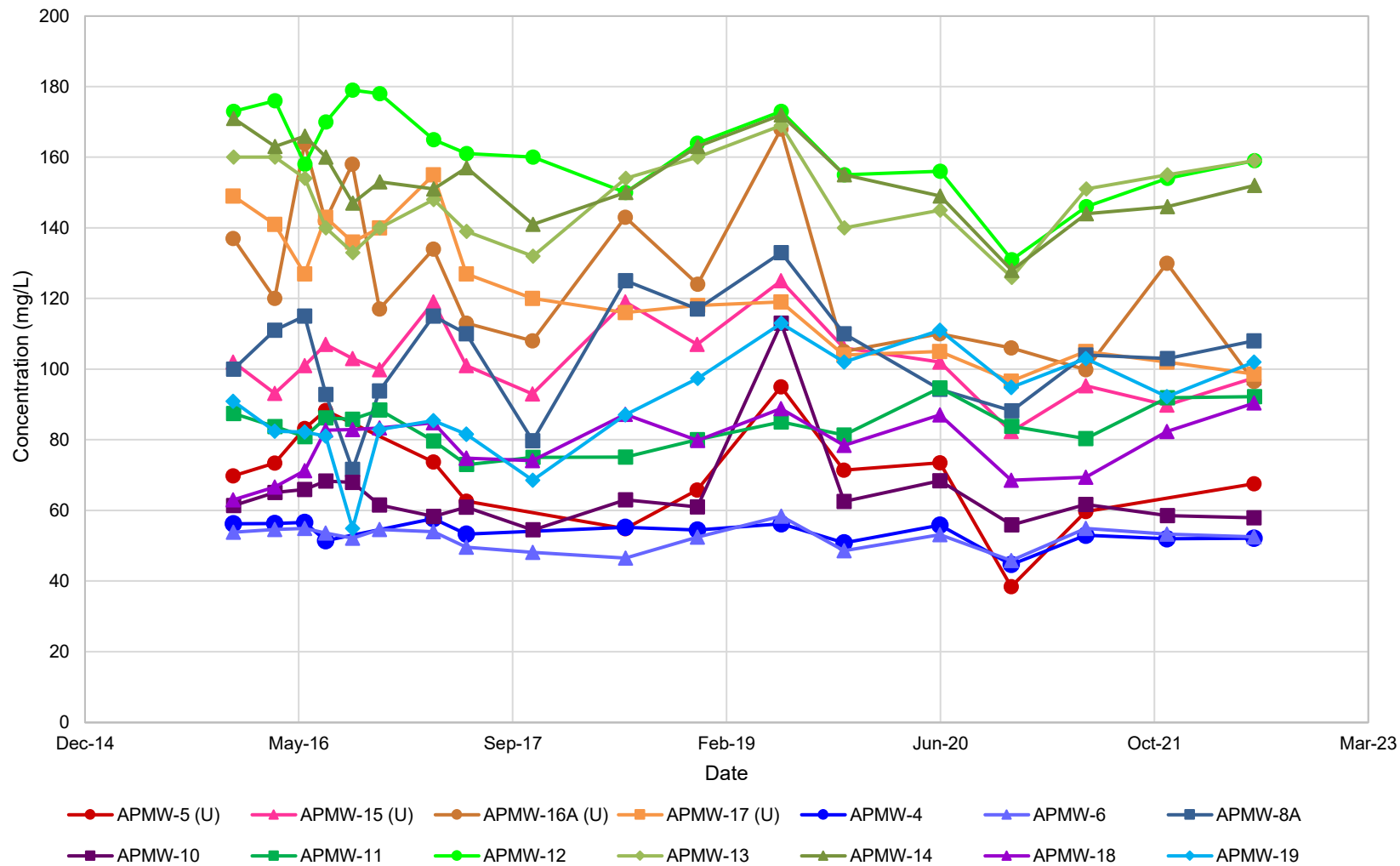
*Non-detect values are plotted with an open symbol at the practical quantitation limit.*

Denver, Colorado, USA

10/26/2022

31404512.000

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**Figure A-3**  
**Calcium**

*Non-detect values are plotted with an open symbol at the practical quantitation limit.*

Nebraska Public Power District  
Gerald Gentleman Station

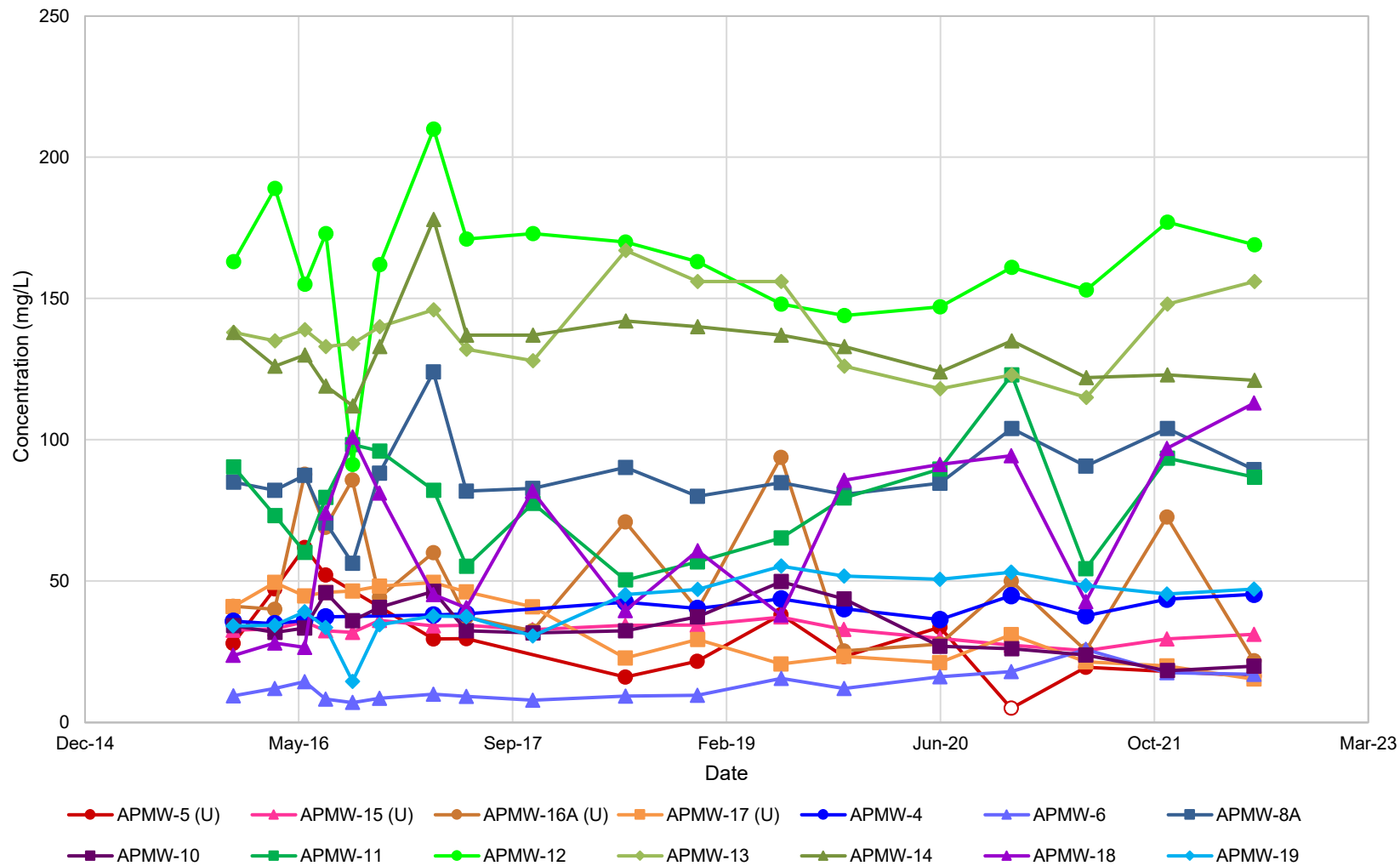
Denver, Colorado, USA

10/26/2022

31404512.000

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Non-detect values are plotted with an open symbol at the practical quantitation limit.

**Figure A-4**  
**Chloride**

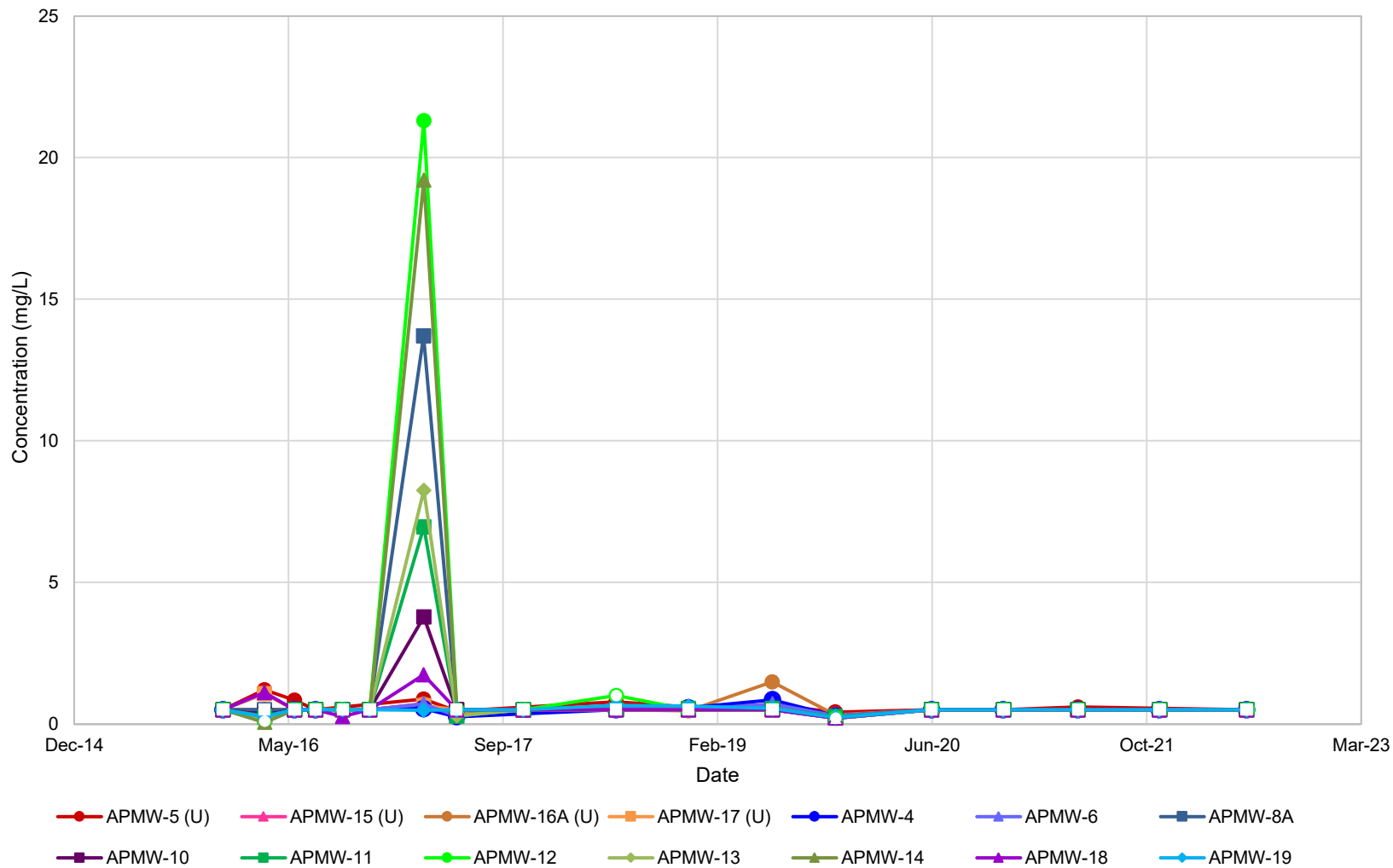
Nebraska Public Power District  
Gerald Gentleman Station

Denver, Colorado, USA

10/26/2022

31404512.000

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**Figure A-5**  
**Fluoride**

*Non-detect values are plotted with an open symbol at the practical quantitation limit.*

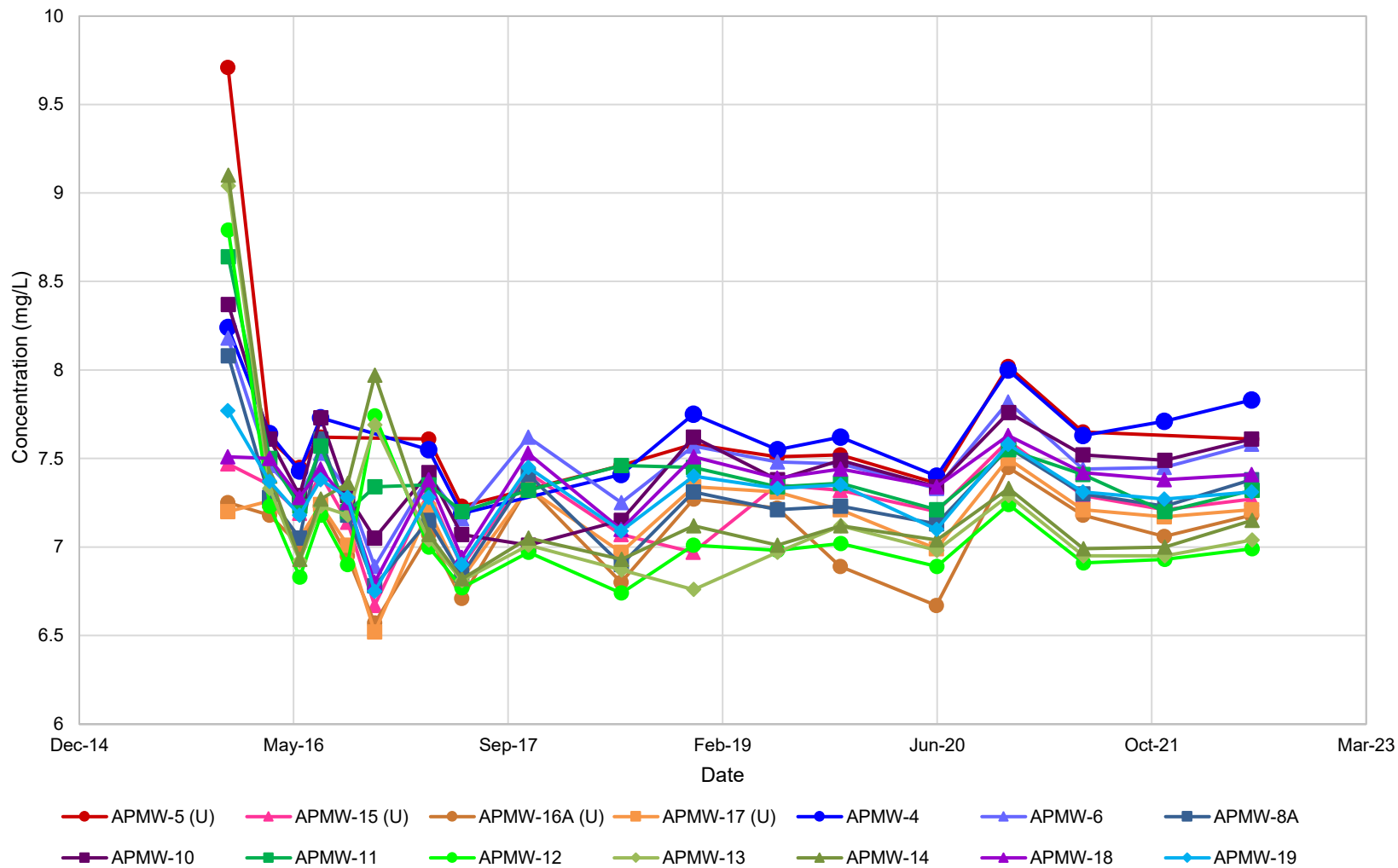
Nebraska Public Power District  
Gerald Gentleman Station

Denver, Colorado, USA

10/26/2022

31404512.000

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Non-detect values are plotted with an open symbol at the practical quantitation limit.

Figure A-6

pH, Field Measured

Nebraska Public Power District

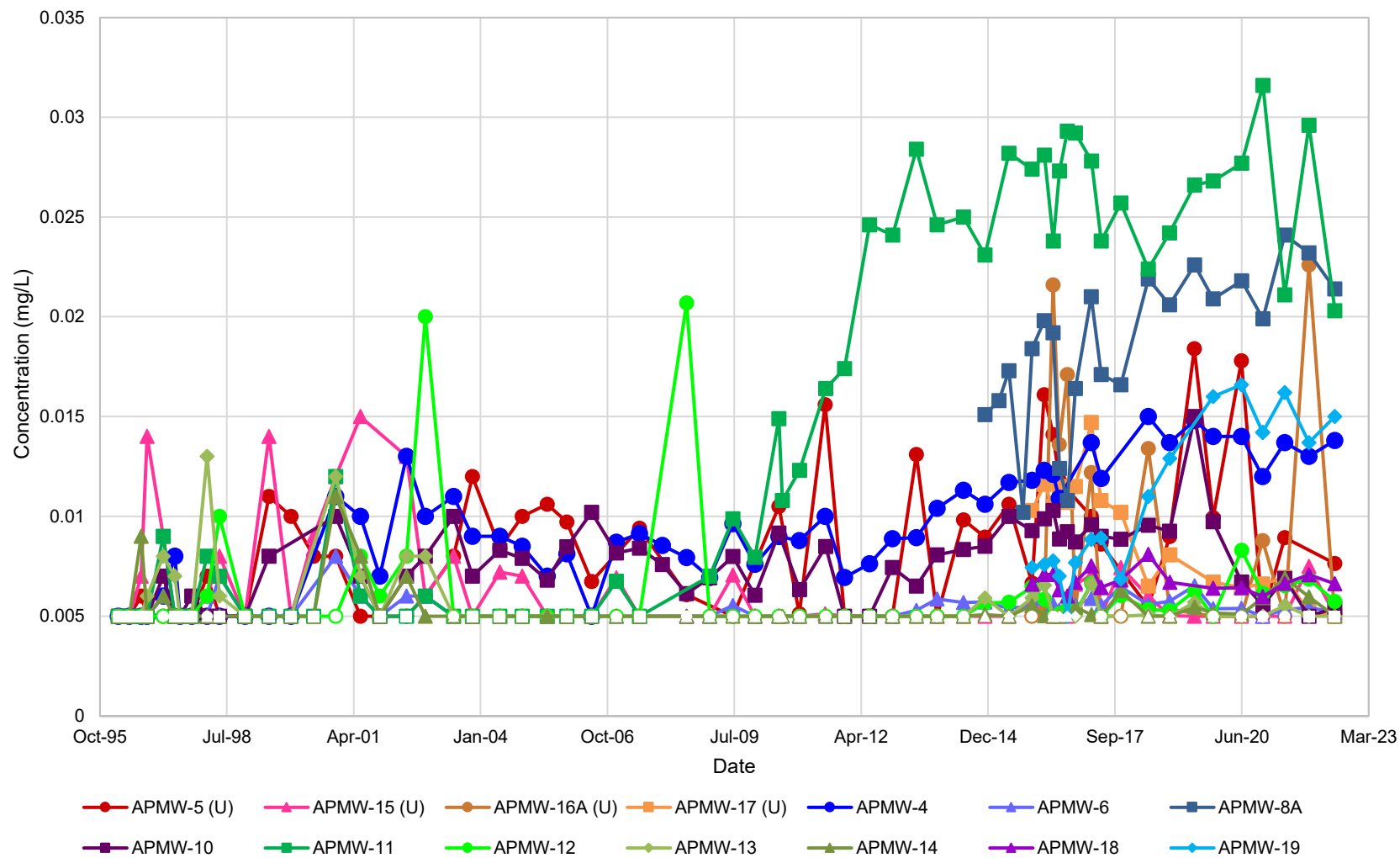
Gerald Gentleman Station

Denver, Colorado, USA

10/26/2022

31404512.000

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Non-detect values are plotted with an open symbol at the practical quantitation limit.

**Figure A-7**  
**Selenium**

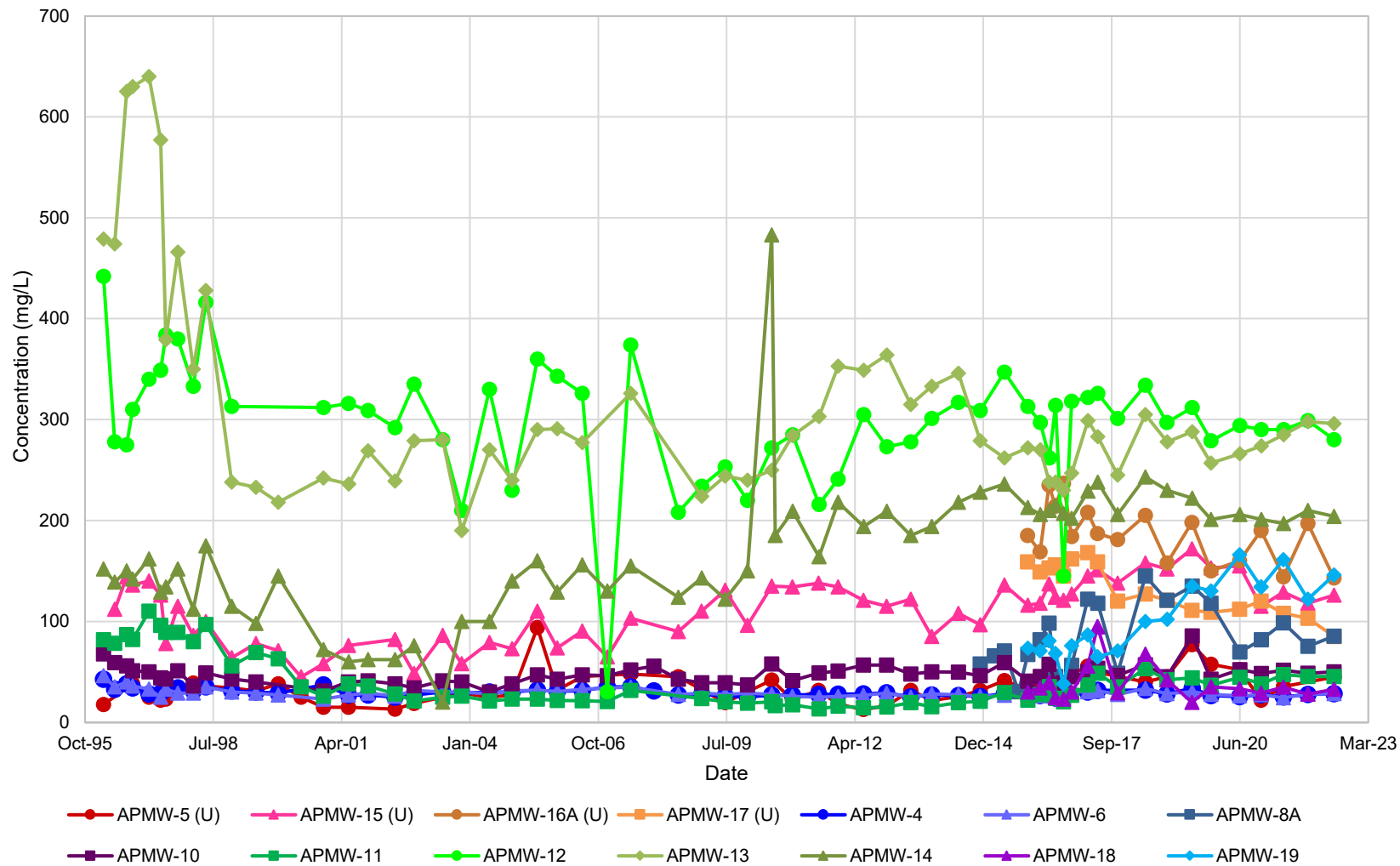
Nebraska Public Power District  
Gerald Gentleman Station

Denver, Colorado, USA

10/26/2022

31404512.000

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**Figure A-8**  
**Sulfate**

Nebraska Public Power District  
Gerald Gentleman Station

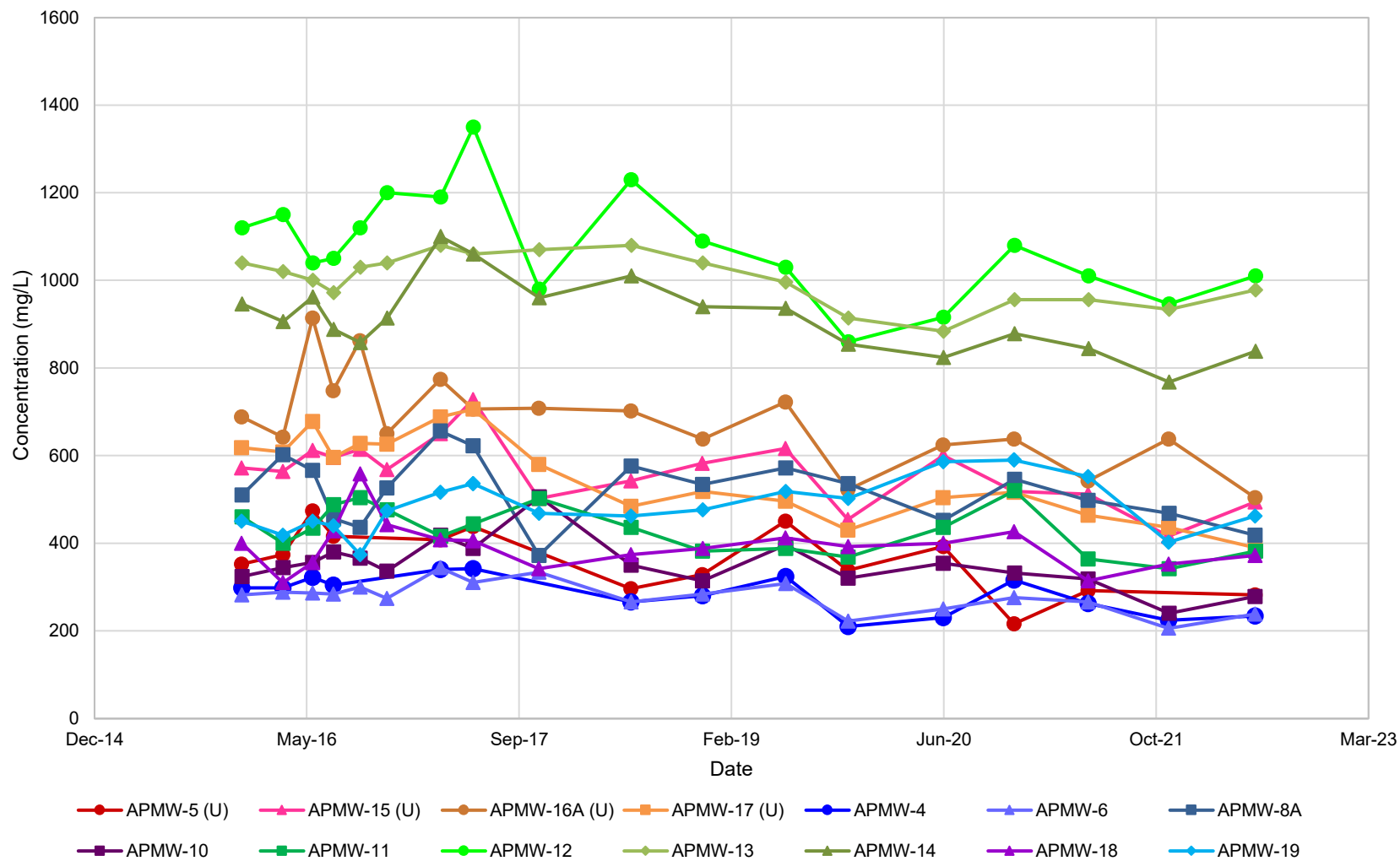
*Non-detect values are plotted with an open symbol at the practical quantitation limit.*

Denver, Colorado, USA

10/26/2022

31404512.000

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**Figure A-9**

**Total Dissolved Solids**

Nebraska Public Power District

Gerald Gentleman Station

*Non-detect values are plotted with an open symbol at the practical quantitation limit.*

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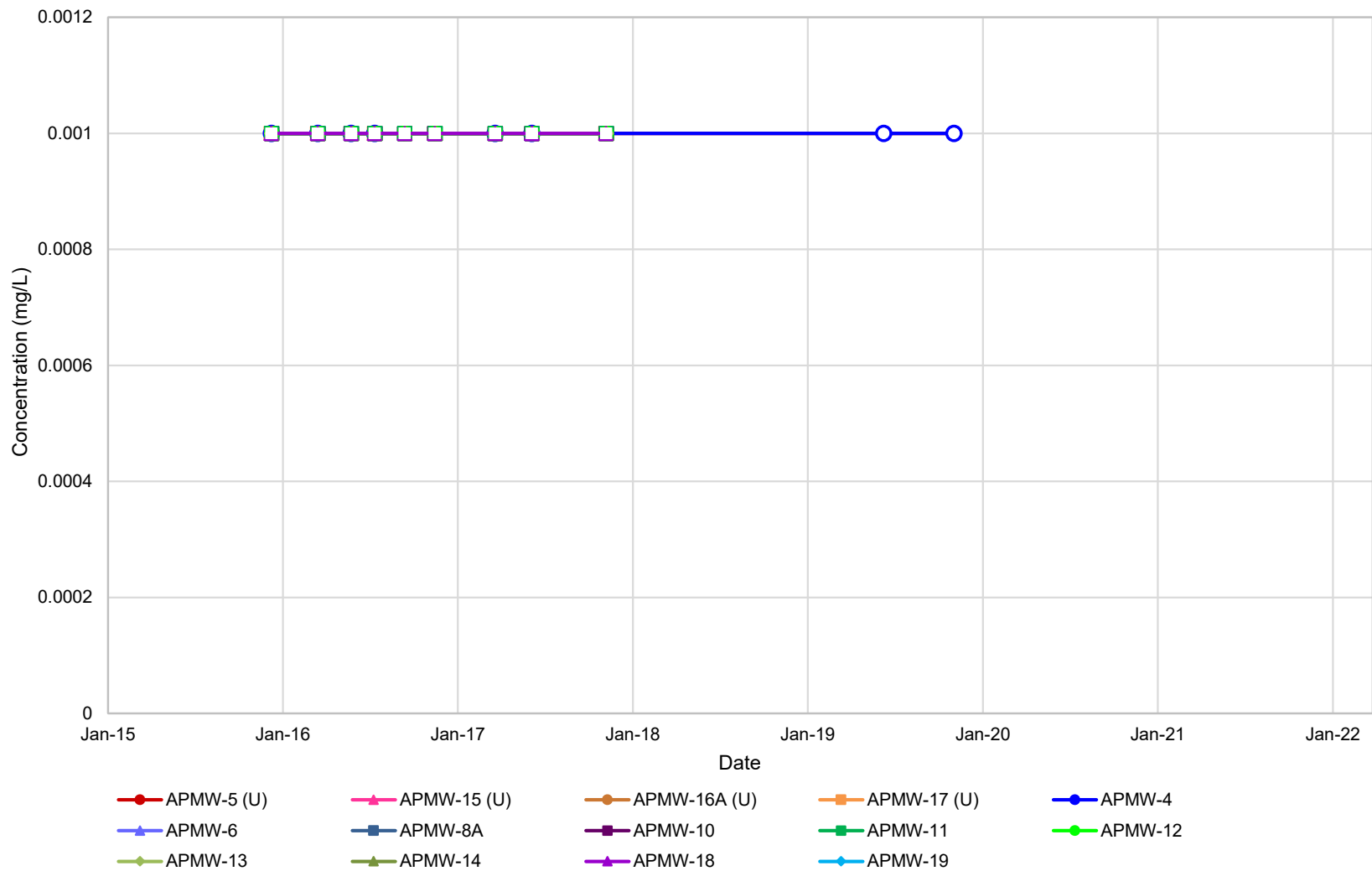


Figure A-10

Antimony

Nebraska Public Power District

Gerald Gentleman Station

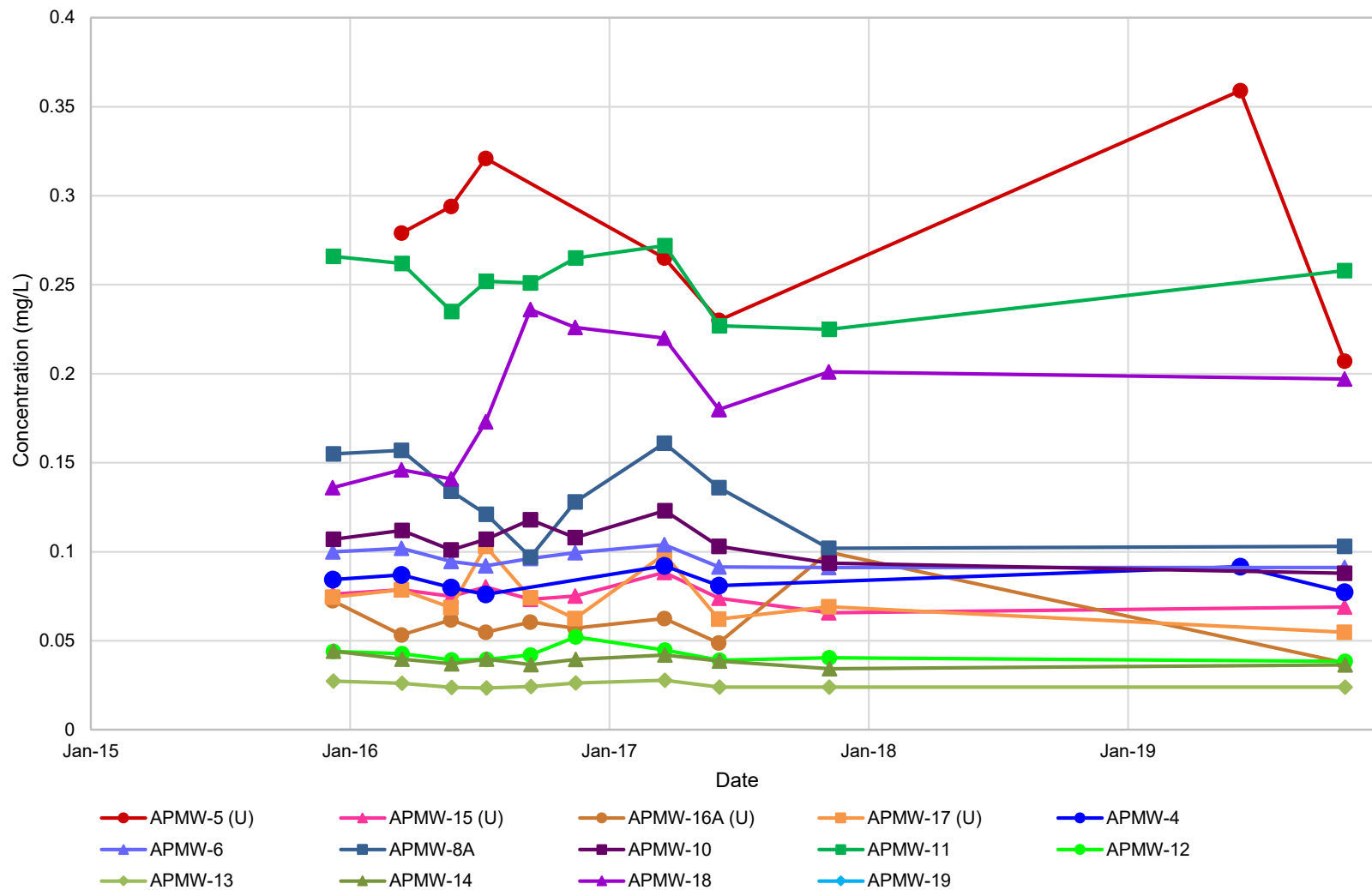
Non-detect values are plotted with an open symbol at the practical quantitation limit.

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10/26/2022

31404512.000

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**Figure A-11**  
**Barium**

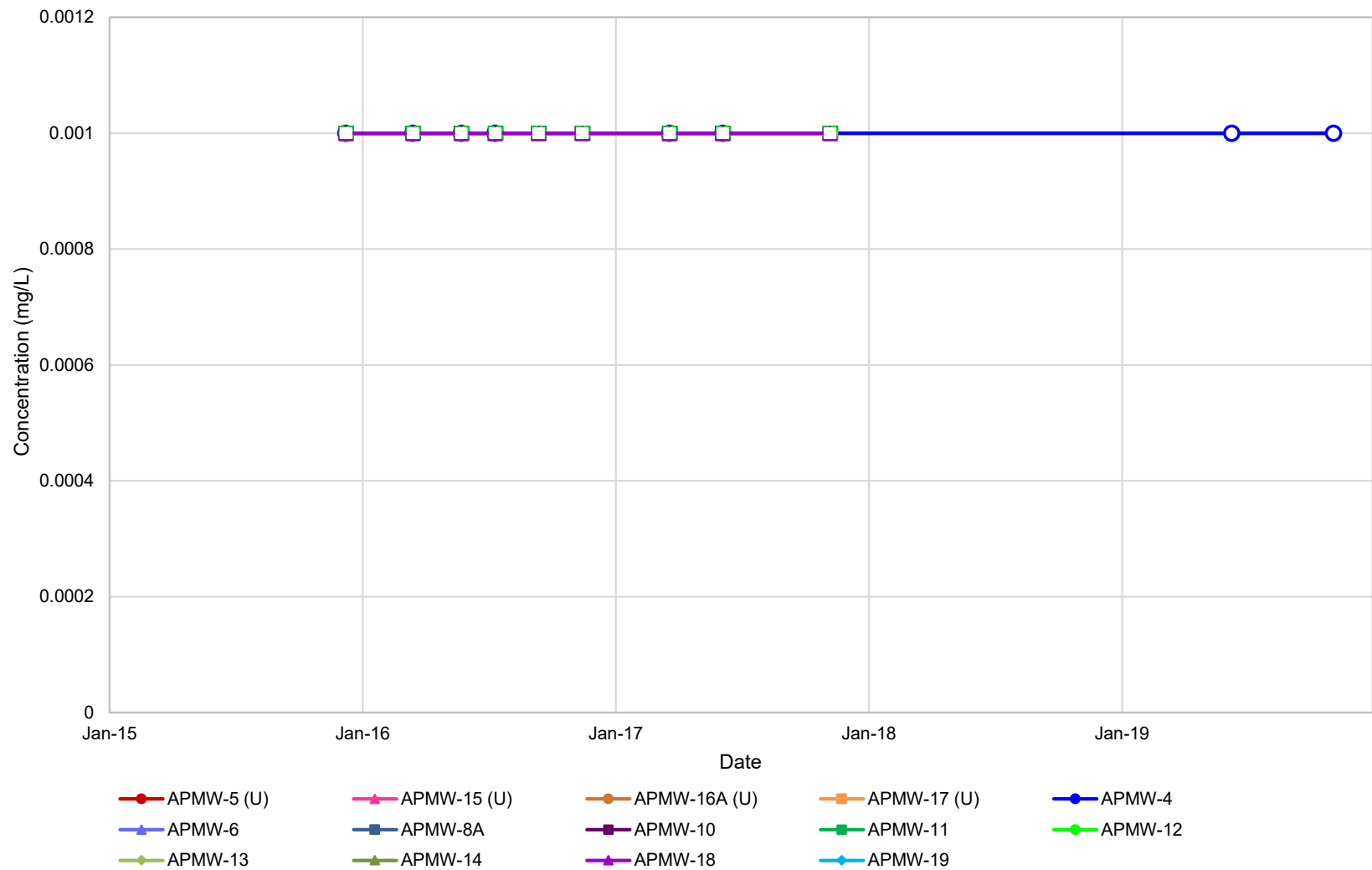
Nebraska Public Power District  
Gerald Gentleman Station

*Non-detect values are plotted with an open symbol at the practical quantitation limit.*

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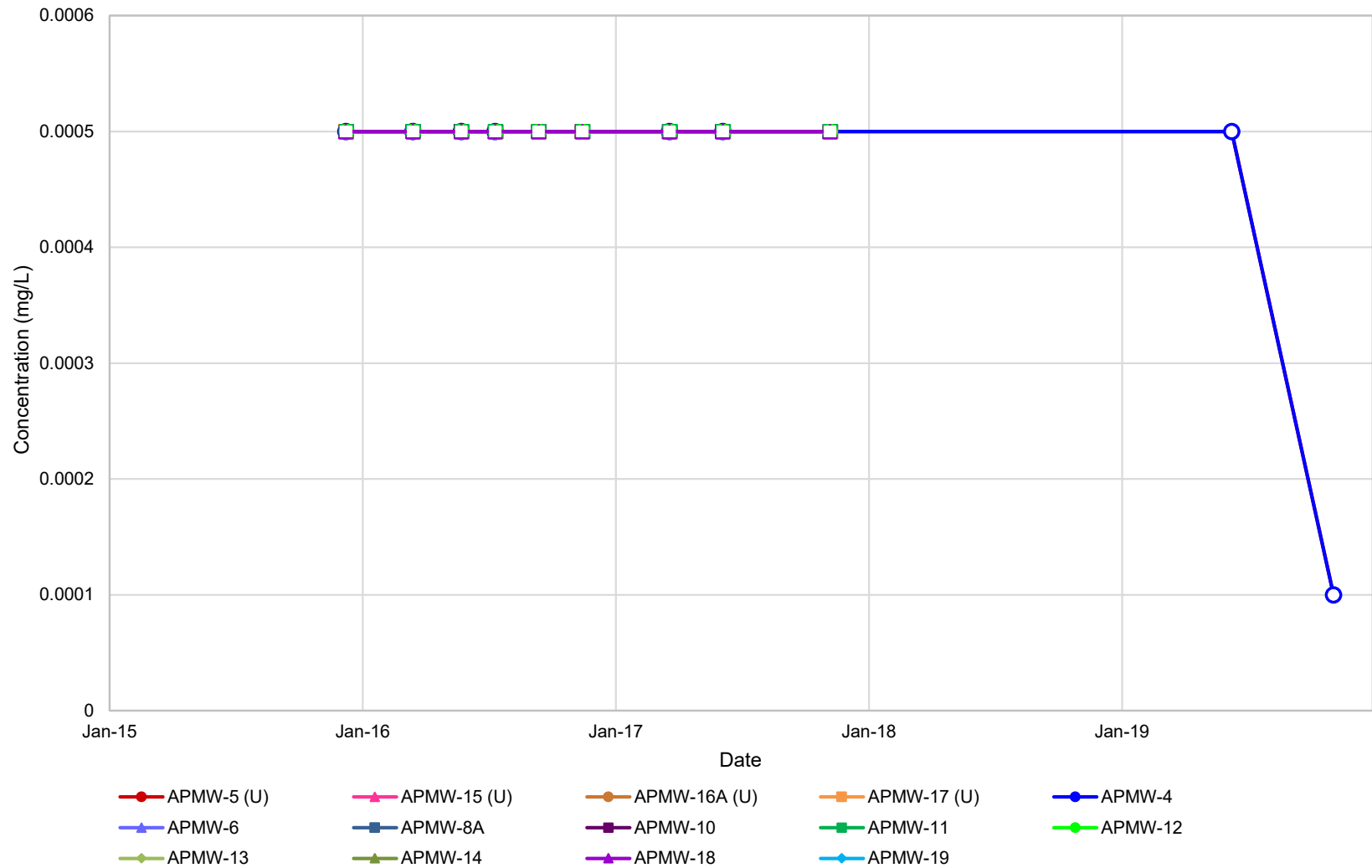


Non-detect values are plotted with an open symbol at the practical quantitation limit.

**Figure A-12**  
**Beryllium**

Nebraska Public Power District  
Gerald Gentleman Station

Denver, Colorado, USA



Non-detect values are plotted with an open symbol at the practical quantitation limit.

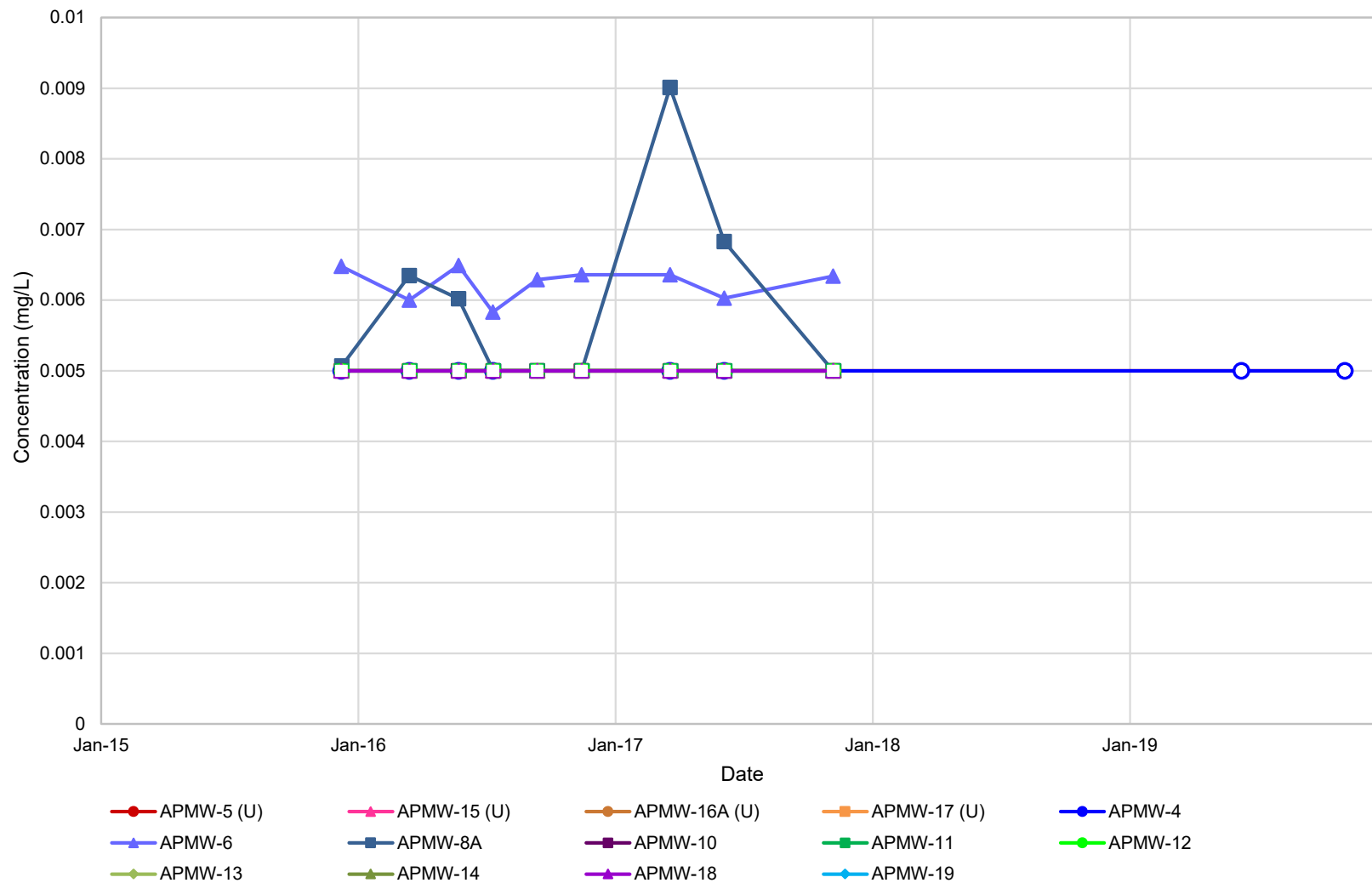
**Figure A-13**  
**Cadmium**

Nebraska Public Power District  
Gerald Gentleman Station

Denver, Colorado, USA

10/26/2022 31404512.000

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Non-detect values are plotted with an open symbol at the practical quantitation limit.

**Figure A-14**  
**Chromium**

Nebraska Public Power District  
Gerald Gentleman Station

Denver, Colorado, USA



**Figure A-15**  
**Cobalt**

Nebraska Public Power District  
Gerald Gentleman Station

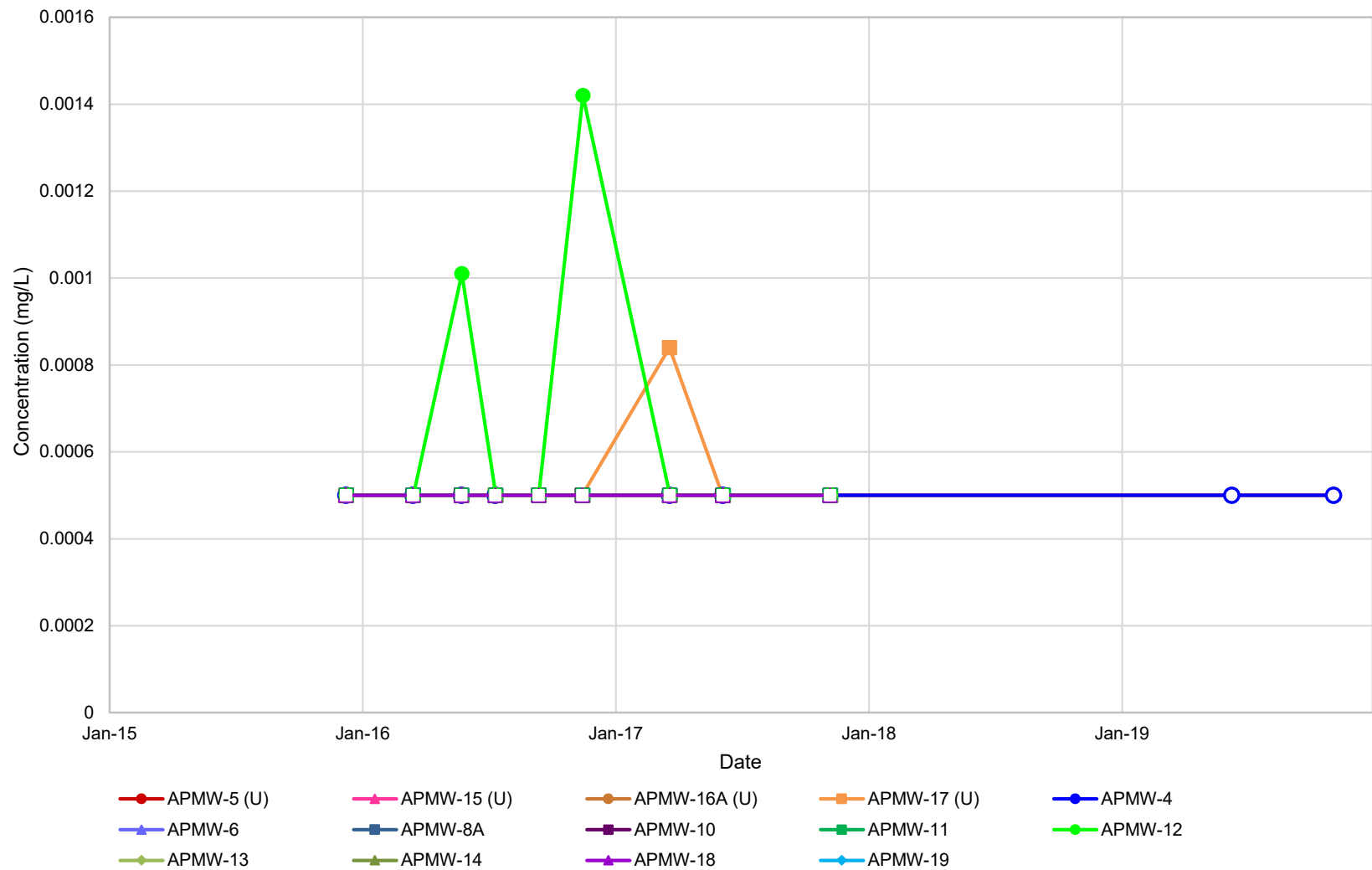
Non-detect values are plotted with an open symbol at the practical quantitation limit.

Denver, Colorado, USA

10/26/2022 31404512.000

**Golder Associates USA Inc., A Member of WSP**





**Figure A-16**

**Lead**

Nebraska Public Power District

Gerald Gentleman Station

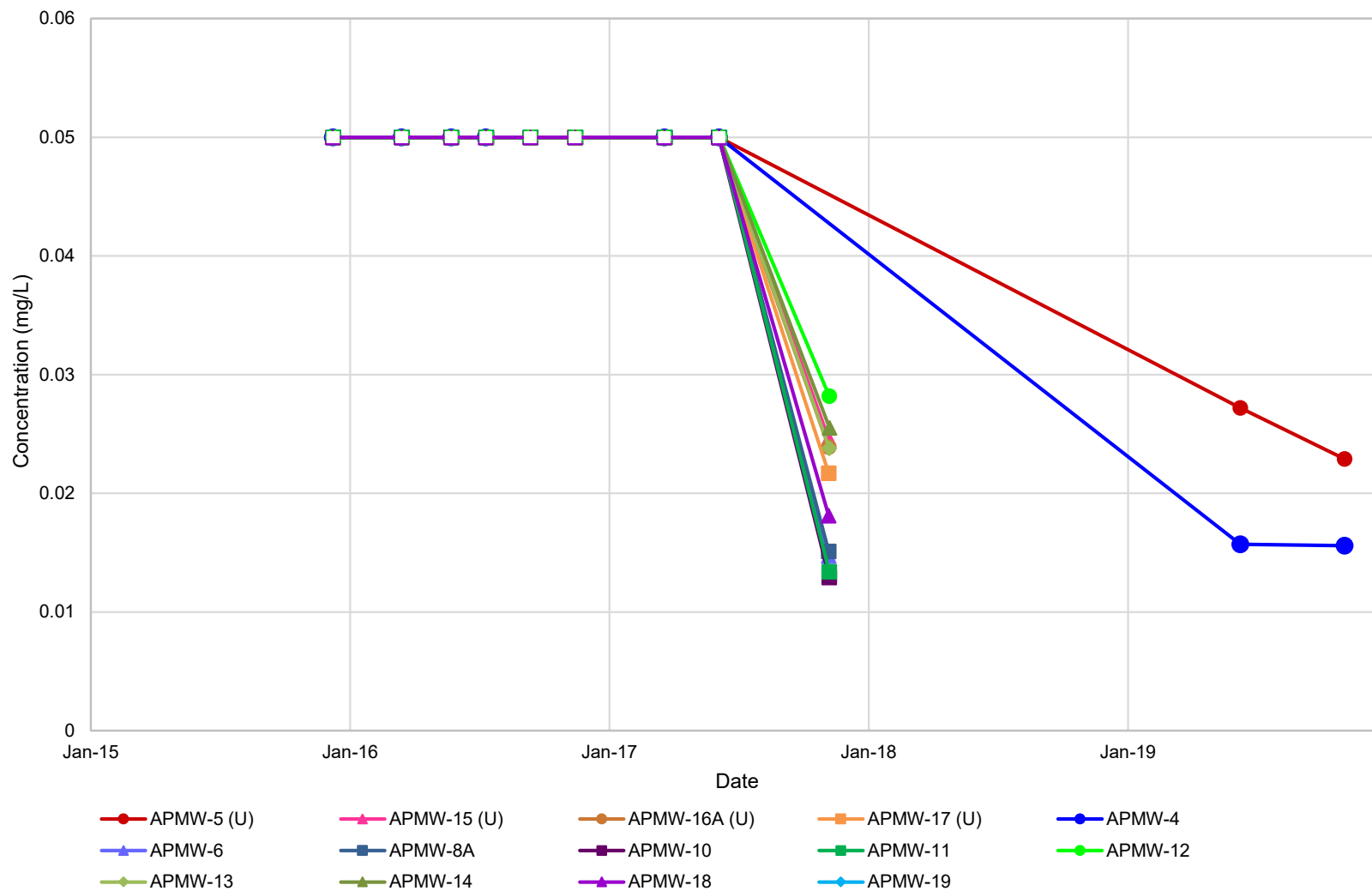
*Non-detect values are plotted with an open symbol at the practical quantitation limit.*

Denver, Colorado, USA

10/26/2022

31404512.000

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**Figure A-17**  
**Lithium**

Nebraska Public Power District  
Gerald Gentleman Station

*Non-detect values are plotted with an open symbol at the practical quantitation limit.*

Denver, Colorado, USA

10/26/2022 31404512.000

**Golder Associates USA Inc., A Member of WSP**

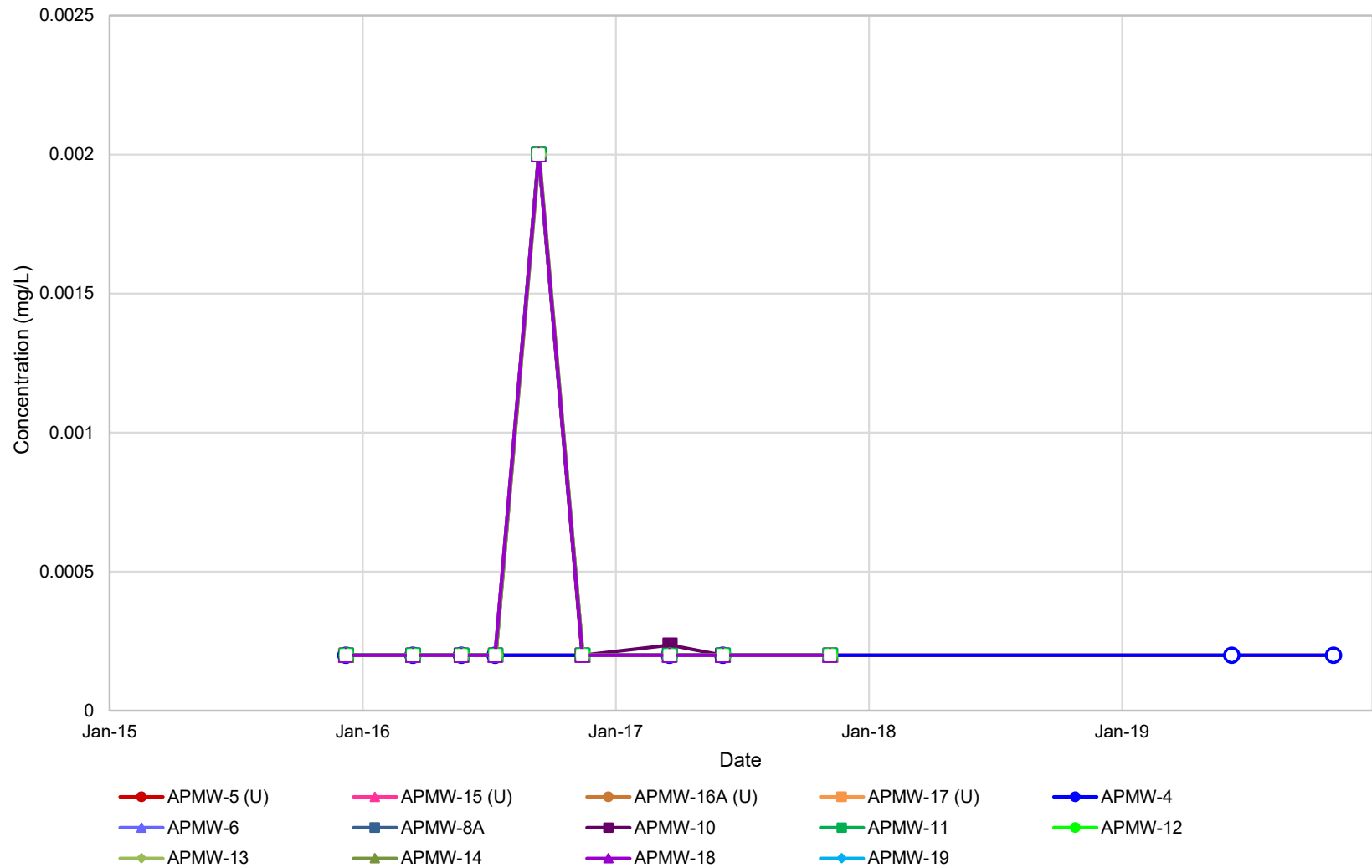


Figure A-18

Mercury

Nebraska Public Power District

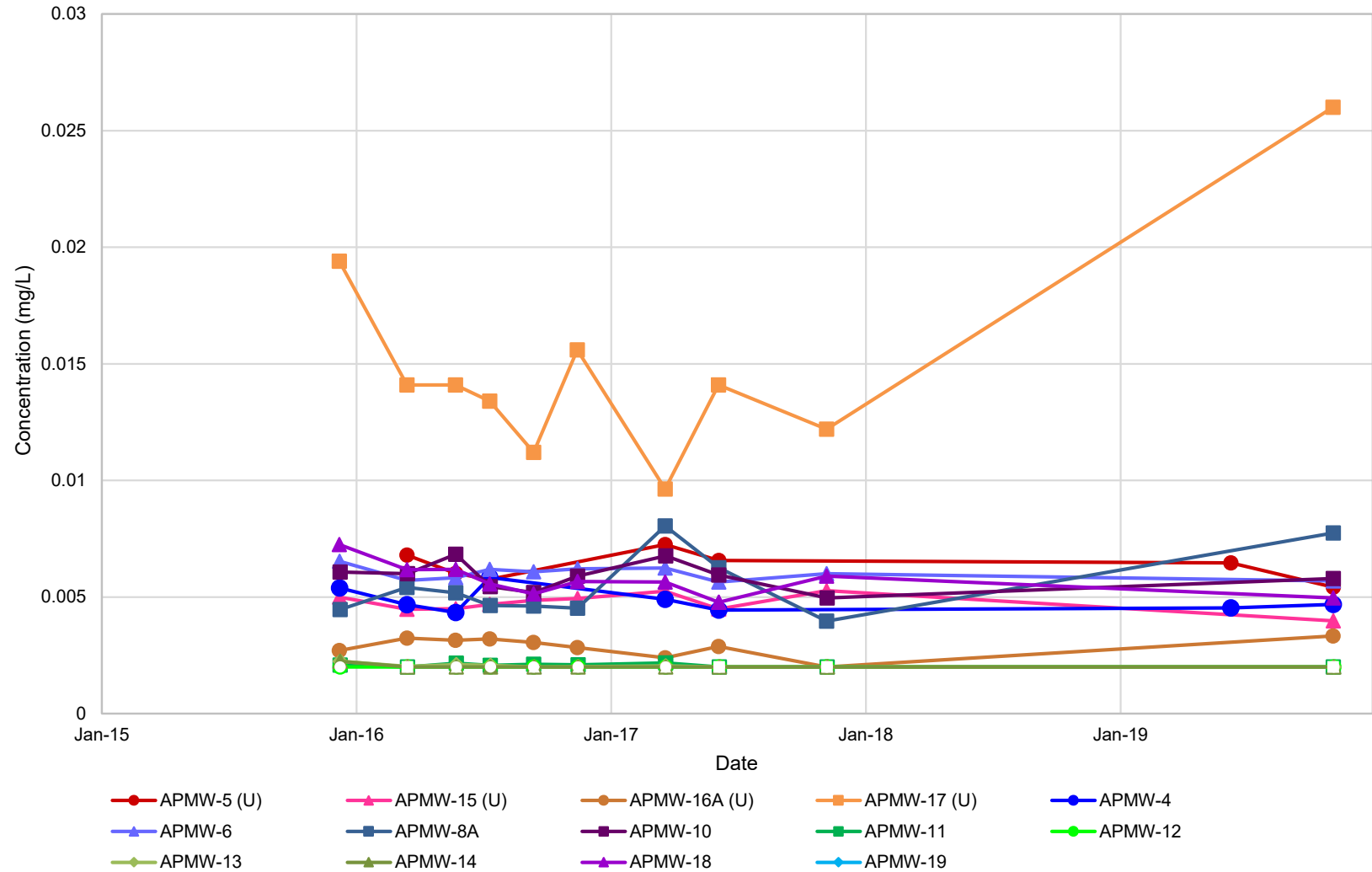
Gerald Gentleman Station

Non-detect values are plotted with an open symbol at the practical quantitation limit.

Denver, Colorado, USA

10/26/2022 31404512.000

Golder Associates USA Inc., A Member of WSP



Non-detect values are plotted with an open symbol at the practical quantitation limit.

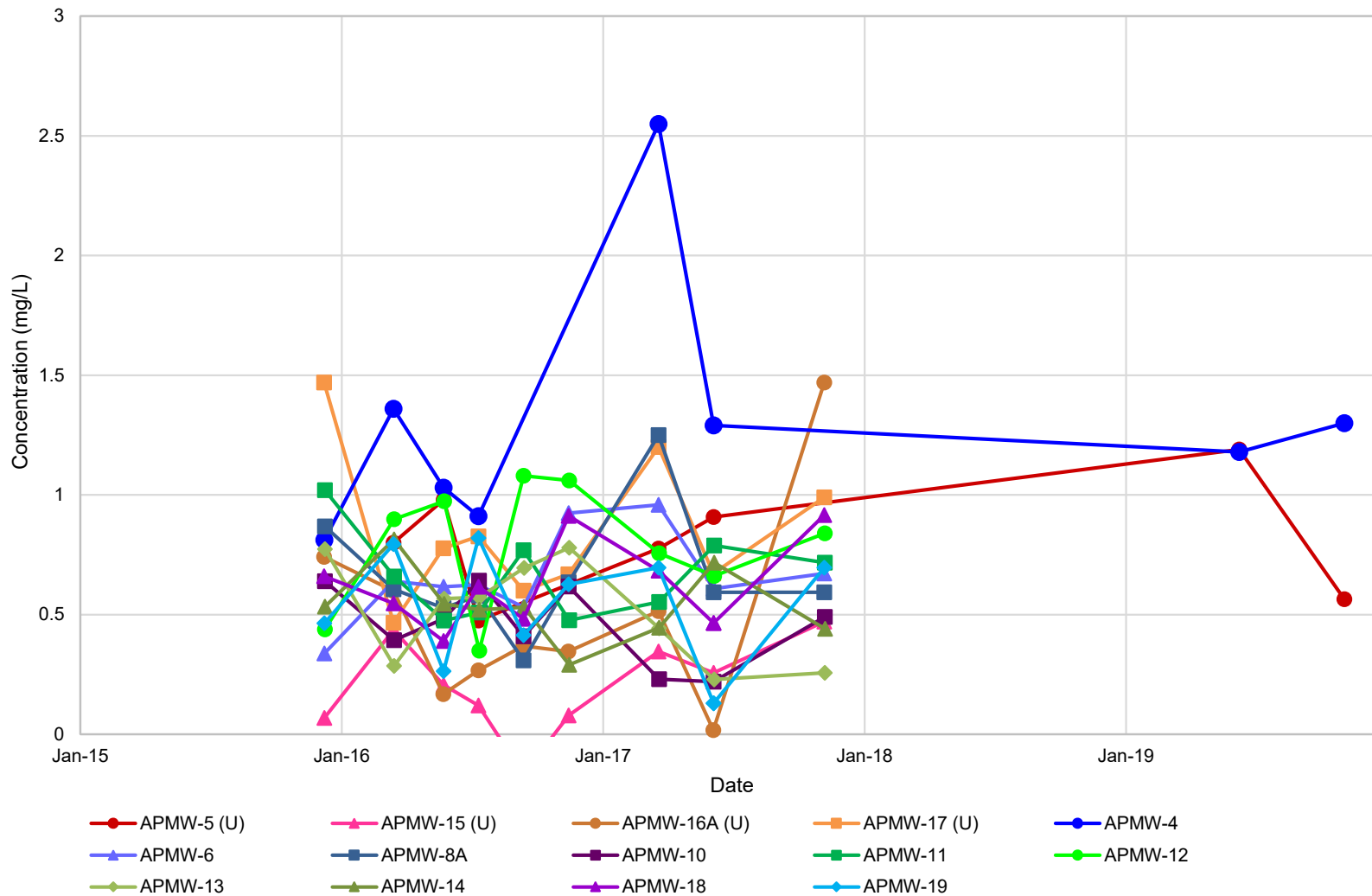
**Figure A-19**  
**Molybdenum**

Nebraska Public Power District  
Gerald Gentleman Station

Denver, Colorado, USA

10/26/2022 31404512.000

**Golder Associates USA Inc., A Member of WSP**



Non-detect values are plotted with an open symbol at the practical quantitation limit.

Figure A-20

Radium, Total

Nebraska Public Power District

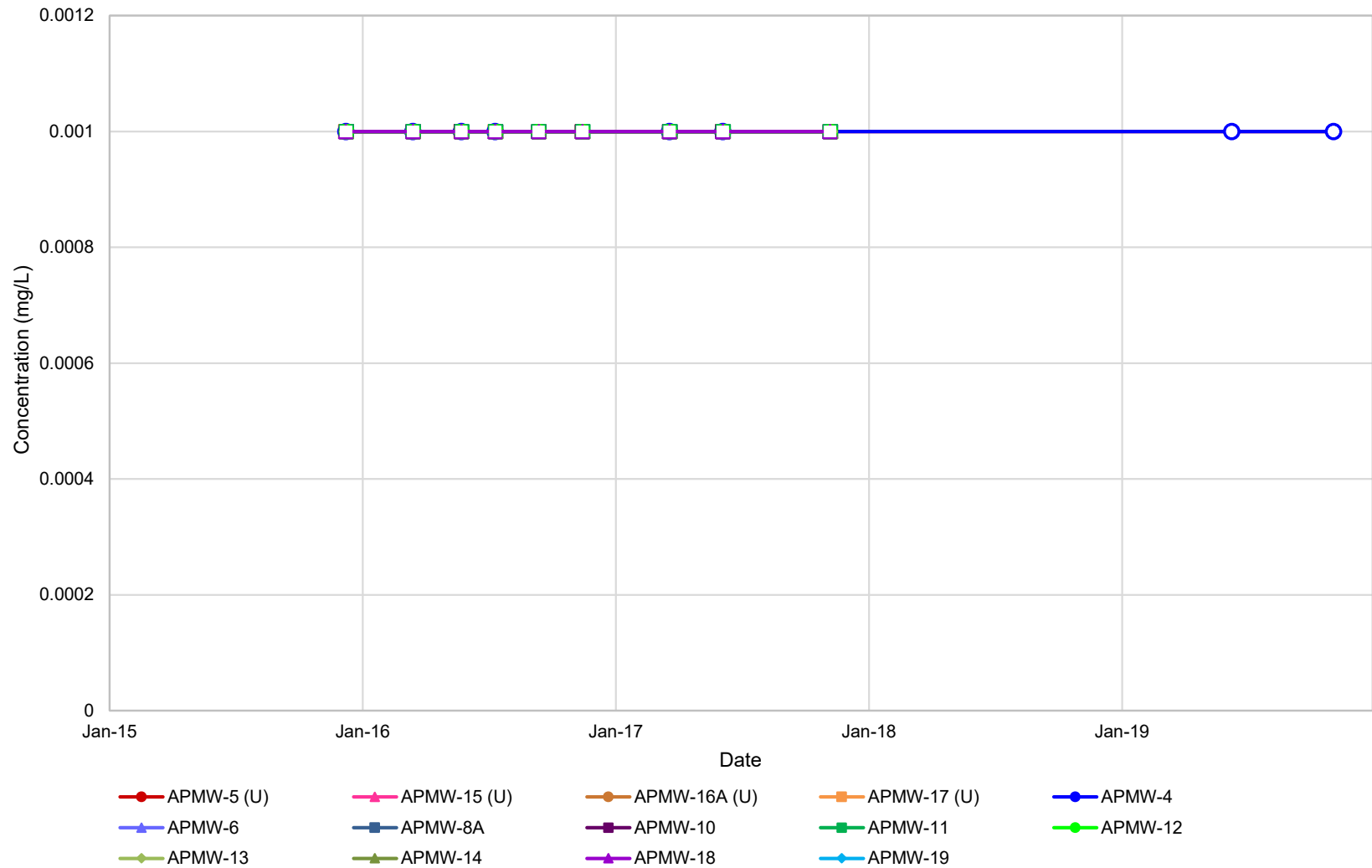
Gerald Gentleman Station

Denver, Colorado, USA

10/26/2022

31404512.000

Golder Associates USA Inc., A Member of WSP



Non-detect values are plotted with an open symbol at the practical quantitation limit.

**Figure A-21**  
**Thallium**

Nebraska Public Power District  
Gerald Gentleman Station

Denver, Colorado, USA

10/26/2022 31404512.000

**Golder Associates USA Inc., A Member of WSP**



**APPENDIX B**

**Eurofins TestAmerica Laboratory  
Report for Irrigation Water Samples**

## ANALYTICAL REPORT

Eurofins Cedar Falls  
3019 Venture Way  
Cedar Falls, IA 50613  
Tel: (319)277-2401

Laboratory Job ID: 310-237917-1  
Client Project/Site: Irrigation Runoff

For:  
Nebraska Public Power District  
6089 S Hwy 25  
Gerald Gentleman Station South  
Sutherland, Nebraska 69165

Attn: Doug Harris



Authorized for release by:  
8/24/2022 3:50:48 PM  
Brian Graettinger, Lab Director  
(319)595-2012  
[Brian.Graettinger@et.eurofinsus.com](mailto:Brian.Graettinger@et.eurofinsus.com)

Designee for  
Shirley Thompson, Client Service Manager  
(319)277-2401  
[Shirley.Thompson@et.eurofinsus.com](mailto:Shirley.Thompson@et.eurofinsus.com)

### LINKS

Review your project  
results through



Have a Question?



Visit us at:

[www.eurofinsus.com/Env](http://www.eurofinsus.com/Env)

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.



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Definitions . . . . .	8
QC Sample Results . . . . .	9
QC Association . . . . .	14
Chronicle . . . . .	17
Certification Summary . . . . .	18
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# Case Narrative

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

**Job ID: 310-237917-1**

**Laboratory: Eurofins Cedar Falls**

## Narrative

### Job Narrative 310-237917-1

## Comments

No additional comments.

## Receipt

The samples were received on 8/12/2022 8:35 AM. Unless otherwise noted below, the samples arrived in good condition, and where required, properly preserved and on ice. The temperature of the cooler at receipt was -1.6° C.

## HPLC/IC

Method 9056A: The following samples were diluted due to the nature of the sample matrix: Road Track (310-237917-1) and Pivot Bucket (310-237917-2). Elevated reporting limits (RLs) are provided.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

## Metals

Method 6020A: Due to sample matrix effect on the internal standard (ISTD), a dilution was required for the following sample: Road Track (310-237917-1).

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

## General Chemistry

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

## Sample Summary

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
310-237917-1	Road Track	Water	08/11/22 11:00	08/12/22 08:35
310-237917-2	Pivot Bucket	Water	08/11/22 11:05	08/12/22 08:35

1

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## Detection Summary

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

### Client Sample ID: Road Track

Lab Sample ID: 310-237917-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chloride	31.5		5.00		mg/L	5		9056A	Total/NA
Sulfate	61.7		5.00		mg/L	5		9056A	Total/NA
Barium	0.0228		0.00200		mg/L	1		6020A	Total/NA
Boron	0.166	+	0.100		mg/L	1		6020A	Total/NA
Calcium	71.7		2.00		mg/L	4		6020A	Total/NA
Lithium	0.0464		0.0100		mg/L	1		6020A	Total/NA
Magnesium	16.8		2.00		mg/L	4		6020A	Total/NA
Potassium	8.28		0.500		mg/L	1		6020A	Total/NA
Sodium	28.2		1.00		mg/L	1		6020A	Total/NA
Total Kjeldahl Nitrogen	4.66		1.00		mg/L	1		351.2	Total/NA
Nitrate Nitrite as N	1.69		0.100		mg/L	1		353.2	Total/NA
Alkalinity as CaCO <sub>3</sub> to pH 4.5	356		25.0		mg/L	1		SM 2320B	Total/NA
pH	8.1	HF	0.1		SU	1		SM 4500 H+ B	Total/NA

### Client Sample ID: Pivot Bucket

Lab Sample ID: 310-237917-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chloride	34.1		5.00		mg/L	5		9056A	Total/NA
Sulfate	82.8		5.00		mg/L	5		9056A	Total/NA
Barium	0.377		0.00200		mg/L	1		6020A	Total/NA
Calcium	156		0.500		mg/L	1		6020A	Total/NA
Cobalt	0.000798		0.000500		mg/L	1		6020A	Total/NA
Lithium	0.0108		0.0100		mg/L	1		6020A	Total/NA
Magnesium	45.0		0.500		mg/L	1		6020A	Total/NA
Molybdenum	0.00401		0.00200		mg/L	1		6020A	Total/NA
Potassium	8.65		0.500		mg/L	1		6020A	Total/NA
Sodium	86.7		1.00		mg/L	1		6020A	Total/NA
Ammonia as N	0.690		0.500		mg/L	1		350.1	Total/NA
Total Kjeldahl Nitrogen	3.74		1.00		mg/L	1		351.2	Total/NA
Nitrate Nitrite as N	3.89		0.100		mg/L	1		353.2	Total/NA
Alkalinity as CaCO <sub>3</sub> to pH 4.5	209		10.0		mg/L	1		SM 2320B	Total/NA
pH	8.2	HF	0.1		SU	1		SM 4500 H+ B	Total/NA

This Detection Summary does not include radiochemical test results.

Eurofins Cedar Falls



# Client Sample Results

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

Client Sample ID: Road Track

Lab Sample ID: 310-237917-1

Date Collected: 08/11/22 11:00

Matrix: Water

Date Received: 08/12/22 08:35

## Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	31.5		5.00		mg/L			08/22/22 15:34	5
Fluoride	<0.500		0.500		mg/L			08/22/22 15:34	5
Sulfate	61.7		5.00		mg/L			08/22/22 15:34	5

## Method: 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	<0.00200		0.00200		mg/L		08/16/22 08:30	08/18/22 17:47	1
Arsenic	<0.00200		0.00200		mg/L		08/16/22 08:30	08/18/22 17:47	1
Barium	0.0228		0.00200		mg/L		08/16/22 08:30	08/18/22 17:47	1
Beryllium	<0.00400		0.00400		mg/L		08/16/22 08:30	08/19/22 16:31	4
Boron	0.166	*+	0.100		mg/L		08/16/22 08:30	08/18/22 17:47	1
Cadmium	<0.000100		0.000100		mg/L		08/16/22 08:30	08/18/22 17:47	1
Calcium	71.7		2.00		mg/L		08/16/22 08:30	08/19/22 16:31	4
Chromium	<0.00500		0.00500		mg/L		08/16/22 08:30	08/18/22 17:47	1
Cobalt	<0.000500		0.000500		mg/L		08/16/22 08:30	08/18/22 17:47	1
Lead	<0.000500		0.000500		mg/L		08/16/22 08:30	08/18/22 17:47	1
Lithium	0.0464		0.0100		mg/L		08/16/22 08:30	08/18/22 17:47	1
Magnesium	16.8		2.00		mg/L		08/16/22 08:30	08/19/22 16:31	4
Molybdenum	<0.00200		0.00200		mg/L		08/16/22 08:30	08/18/22 17:47	1
Potassium	8.28		0.500		mg/L		08/16/22 08:30	08/18/22 17:47	1
Selenium	<0.00500		0.00500		mg/L		08/16/22 08:30	08/18/22 17:47	1
Sodium	28.2		1.00		mg/L		08/16/22 08:30	08/18/22 17:47	1
Thallium	<0.00100		0.00100		mg/L		08/16/22 08:30	08/18/22 17:47	1

## Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.000200		0.000200		mg/L		08/22/22 14:34	08/23/22 12:41	1

## General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ammonia as N	<0.500		0.500		mg/L		08/18/22 09:51	08/18/22 20:31	1
Total Kjeldahl Nitrogen	4.66		1.00		mg/L		08/17/22 07:00	08/17/22 19:01	1
Nitrate Nitrite as N	1.69		0.100		mg/L			08/16/22 20:12	1
Alkalinity as CaCO3 to pH 4.5	356		25.0		mg/L			08/15/22 08:30	1
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	8.1	HF	0.1		SU			08/12/22 15:15	1

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# Client Sample Results

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

Client Sample ID: Pivot Bucket

Lab Sample ID: 310-237917-2

Date Collected: 08/11/22 11:05

Matrix: Water

Date Received: 08/12/22 08:35

## Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	34.1		5.00		mg/L			08/22/22 15:49	5
Fluoride	<0.500		0.500		mg/L			08/22/22 15:49	5
Sulfate	82.8		5.00		mg/L			08/22/22 15:49	5

## Method: 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	<0.00200		0.00200		mg/L		08/16/22 08:30	08/18/22 18:03	1
Arsenic	<0.00200		0.00200		mg/L		08/16/22 08:30	08/18/22 18:03	1
Barium	0.377		0.00200		mg/L		08/16/22 08:30	08/18/22 18:03	1
Beryllium	<0.00100		0.00100		mg/L		08/16/22 08:30	08/19/22 16:34	1
Boron	<0.100	+	0.100		mg/L		08/16/22 08:30	08/18/22 18:03	1
Cadmium	<0.000100		0.000100		mg/L		08/16/22 08:30	08/18/22 18:03	1
Calcium	156		0.500		mg/L		08/16/22 08:30	08/18/22 18:03	1
Chromium	<0.00500		0.00500		mg/L		08/16/22 08:30	08/18/22 18:03	1
Cobalt	0.000798		0.000500		mg/L		08/16/22 08:30	08/18/22 18:03	1
Lead	<0.000500		0.000500		mg/L		08/16/22 08:30	08/18/22 18:03	1
Lithium	0.0108		0.0100		mg/L		08/16/22 08:30	08/18/22 18:03	1
Magnesium	45.0		0.500		mg/L		08/16/22 08:30	08/18/22 18:03	1
Molybdenum	0.00401		0.00200		mg/L		08/16/22 08:30	08/18/22 18:03	1
Potassium	8.65		0.500		mg/L		08/16/22 08:30	08/18/22 18:03	1
Selenium	<0.00500		0.00500		mg/L		08/16/22 08:30	08/18/22 18:03	1
Sodium	86.7		1.00		mg/L		08/16/22 08:30	08/18/22 18:03	1
Thallium	<0.00100		0.00100		mg/L		08/16/22 08:30	08/18/22 18:03	1

## Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.000200		0.000200		mg/L		08/22/22 14:38	08/23/22 12:48	1

## General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ammonia as N	0.690		0.500		mg/L		08/18/22 09:51	08/18/22 20:32	1
Total Kjeldahl Nitrogen	3.74		1.00		mg/L		08/17/22 07:00	08/17/22 19:02	1
Nitrate Nitrite as N	3.89		0.100		mg/L			08/16/22 20:13	1
Alkalinity as CaCO3 to pH 4.5	209		10.0		mg/L			08/15/22 08:30	1
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	8.2	HF	0.1		SU			08/12/22 15:21	1

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## Definitions/Glossary

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

### Qualifiers

#### Metals

Qualifier	Qualifier Description
*+	LCS and/or LCSD is outside acceptance limits, high biased.

#### General Chemistry

Qualifier	Qualifier Description
HF	Field parameter with a holding time of 15 minutes. Test performed by laboratory at client's request.

### Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
□	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

# QC Sample Results

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

## Method: 9056A - Anions, Ion Chromatography

Lab Sample ID: MB 310-363601/3

Matrix: Water

Analysis Batch: 363601

Client Sample ID: Method Blank

Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	<1.00		1.00		mg/L			08/22/22 10:23	1
Fluoride	<0.100		0.100		mg/L			08/22/22 10:23	1
Sulfate	<1.00		1.00		mg/L			08/22/22 10:23	1

Lab Sample ID: LCS 310-363601/4

Matrix: Water

Analysis Batch: 363601

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Chloride	10.0	10.06		mg/L		101	90 - 110
Fluoride	2.00	2.035		mg/L		102	90 - 110
Sulfate	10.0	10.08		mg/L		101	90 - 110

## Method: 6020A - Metals (ICP/MS)

Lab Sample ID: MB 310-362614/1-A

Matrix: Water

Analysis Batch: 362935

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 362614

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	<0.00200		0.00200		mg/L		08/16/22 08:30	08/17/22 14:51	1
Arsenic	<0.00200		0.00200		mg/L		08/16/22 08:30	08/17/22 14:51	1
Barium	<0.00200		0.00200		mg/L		08/16/22 08:30	08/17/22 14:51	1
Beryllium	<0.00100		0.00100		mg/L		08/16/22 08:30	08/17/22 14:51	1
Boron	<0.100		0.100		mg/L		08/16/22 08:30	08/17/22 14:51	1
Cadmium	<0.000100		0.000100		mg/L		08/16/22 08:30	08/17/22 14:51	1
Calcium	<0.500		0.500		mg/L		08/16/22 08:30	08/17/22 14:51	1
Chromium	<0.00500		0.00500		mg/L		08/16/22 08:30	08/17/22 14:51	1
Cobalt	<0.000500		0.000500		mg/L		08/16/22 08:30	08/17/22 14:51	1
Lead	<0.000500		0.000500		mg/L		08/16/22 08:30	08/17/22 14:51	1
Magnesium	<0.500		0.500		mg/L		08/16/22 08:30	08/17/22 14:51	1
Molybdenum	<0.00200		0.00200		mg/L		08/16/22 08:30	08/17/22 14:51	1
Potassium	<0.500		0.500		mg/L		08/16/22 08:30	08/17/22 14:51	1
Selenium	<0.00500		0.00500		mg/L		08/16/22 08:30	08/17/22 14:51	1
Sodium	<1.00		1.00		mg/L		08/16/22 08:30	08/17/22 14:51	1
Thallium	<0.00100		0.00100		mg/L		08/16/22 08:30	08/17/22 14:51	1

Lab Sample ID: MB 310-362614/1-A

Matrix: Water

Analysis Batch: 363247

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 362614

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0100		0.0100		mg/L		08/16/22 08:30	08/19/22 16:24	1

Lab Sample ID: LCS 310-362614/2-A

Matrix: Water

Analysis Batch: 362935

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 362614

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Antimony	0.200	0.2356		mg/L		118	80 - 120

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# QC Sample Results

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

## Method: 6020A - Metals (ICP/MS) (Continued)

Lab Sample ID: LCS 310-362614/2-A  
Matrix: Water  
Analysis Batch: 362935

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA  
Prep Batch: 362614

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	0.200	0.2068		mg/L		103	80 - 120
Barium	0.100	0.1131		mg/L		113	80 - 120
Beryllium	0.100	0.1097		mg/L		110	80 - 120
Cadmium	0.100	0.1050		mg/L		105	80 - 120
Calcium	2.00	1.612		mg/L		81	80 - 120
Chromium	0.100	0.1047		mg/L		105	80 - 120
Cobalt	0.100	0.1036		mg/L		104	80 - 120
Lead	0.200	0.2116		mg/L		106	80 - 120
Magnesium	2.00	2.050		mg/L		102	80 - 120
Molybdenum	0.200	0.2236		mg/L		112	80 - 120
Potassium	2.00	2.059		mg/L		103	80 - 120
Selenium	0.400	0.3907		mg/L		98	80 - 120
Sodium	2.00	2.207		mg/L		110	80 - 120
Thallium	0.200	0.2293		mg/L		115	80 - 120

Lab Sample ID: LCS 310-362614/2-A  
Matrix: Water  
Analysis Batch: 363247

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA  
Prep Batch: 362614

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Lithium	0.200	0.2192		mg/L		110	80 - 120

Lab Sample ID: LCS 310-362614/2-A  
Matrix: Water  
Analysis Batch: 363273

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA  
Prep Batch: 362614

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Boron	0.200	0.2190		mg/L		109	80 - 120

## Method: 7470A - Mercury (CVAA)

Lab Sample ID: MB 310-363323/1-A  
Matrix: Water  
Analysis Batch: 363477

Client Sample ID: Method Blank  
Prep Type: Total/NA  
Prep Batch: 363323

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.000200		0.000200		mg/L		08/22/22 14:34	08/23/22 11:44	1

Lab Sample ID: LCS 310-363323/2-A  
Matrix: Water  
Analysis Batch: 363477

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA  
Prep Batch: 363323

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Mercury	0.00167	0.001689		mg/L		101	80 - 120

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# QC Sample Results

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

## Method: 7470A - Mercury (CVAA) (Continued)

Lab Sample ID: MB 310-363324/1-A  
Matrix: Water  
Analysis Batch: 363477

Client Sample ID: Method Blank  
Prep Type: Total/NA  
Prep Batch: 363324

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.000200		0.000200		mg/L		08/22/22 14:38	08/23/22 12:44	1

Lab Sample ID: LCS 310-363324/2-A  
Matrix: Water  
Analysis Batch: 363477

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA  
Prep Batch: 363324

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Mercury	0.00167	0.001697		mg/L		102	80 - 120

Lab Sample ID: 310-237917-2 MS  
Matrix: Water  
Analysis Batch: 363477

Client Sample ID: Pivot Bucket  
Prep Type: Total/NA  
Prep Batch: 363324

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Mercury	<0.000200		0.00167	0.001664		mg/L		100	80 - 120

Lab Sample ID: 310-237917-2 MSD  
Matrix: Water  
Analysis Batch: 363477

Client Sample ID: Pivot Bucket  
Prep Type: Total/NA  
Prep Batch: 363324

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Mercury	<0.000200		0.00167	0.001669		mg/L		100	80 - 120	0	20

## Method: 350.1 - Nitrogen, Ammonia

Lab Sample ID: MB 310-363012/1-A  
Matrix: Water  
Analysis Batch: 363102

Client Sample ID: Method Blank  
Prep Type: Total/NA  
Prep Batch: 363012

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ammonia as N	<0.500		0.500		mg/L		08/18/22 09:51	08/18/22 20:09	1

Lab Sample ID: LCS 310-363012/2-A  
Matrix: Water  
Analysis Batch: 363102

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA  
Prep Batch: 363012

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Ammonia as N	4.00	4.056		mg/L		101	90 - 110

## Method: 351.2 - Nitrogen, Total Kjeldahl

Lab Sample ID: MB 310-362810/1-A  
Matrix: Water  
Analysis Batch: 362944

Client Sample ID: Method Blank  
Prep Type: Total/NA  
Prep Batch: 362810

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Kjeldahl Nitrogen	<1.00		1.00		mg/L		08/17/22 07:00	08/17/22 18:34	1

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# QC Sample Results

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

## Method: 351.2 - Nitrogen, Total Kjeldahl (Continued)

Lab Sample ID: LCS 310-362810/2-A  
Matrix: Water  
Analysis Batch: 362944

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA  
Prep Batch: 362810

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Total Kjeldahl Nitrogen	4.01	4.054		mg/L		101	90 - 110

## Method: 353.2 - Nitrogen, Nitrate-Nitrite

Lab Sample ID: MB 310-362793/43  
Matrix: Water  
Analysis Batch: 362793

Client Sample ID: Method Blank  
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Nitrate Nitrite as N	<0.100		0.100		mg/L			08/16/22 19:56	1

Lab Sample ID: LCS 310-362793/44  
Matrix: Water  
Analysis Batch: 362793

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Nitrate Nitrite as N	5.32	5.674		mg/L		107	90 - 110

## Method: SM 2320B - Alkalinity

Lab Sample ID: MB 310-362556/1  
Matrix: Water  
Analysis Batch: 362556

Client Sample ID: Method Blank  
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Alkalinity as CaCO3 to pH 4.5	<5.00		5.00		mg/L			08/15/22 08:30	1

Lab Sample ID: LCS 310-362556/2  
Matrix: Water  
Analysis Batch: 362556

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Alkalinity as CaCO3 to pH 4.5	1000	997.5		mg/L		100	90 - 110

## Method: SM 4500 H+ B - pH

Lab Sample ID: LCS 310-362509/1  
Matrix: Water  
Analysis Batch: 362509

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
pH	7.00	7.0		SU		100	98 - 102

Lab Sample ID: LCS 310-362509/25  
Matrix: Water  
Analysis Batch: 362509

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
pH	7.00	7.0		SU		100	98 - 102

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QC Sample Results

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

Method: SM 4500 H+ B - pH (Continued)

Lab Sample ID: 310-237917-1 DU				Client Sample ID: Road Track			
Matrix: Water				Prep Type: Total/NA			
Analysis Batch: 362509							
Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD Limit
pH	8.1	HF	8.0		SU		0.5 20

# QC Association Summary

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

## HPLC/IC

### Analysis Batch: 363601

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	9056A	
310-237917-2	Pivot Bucket	Total/NA	Water	9056A	
MB 310-363601/3	Method Blank	Total/NA	Water	9056A	
LCS 310-363601/4	Lab Control Sample	Total/NA	Water	9056A	

## Metals

### Prep Batch: 362614

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	3005A	
310-237917-2	Pivot Bucket	Total/NA	Water	3005A	
MB 310-362614/1-A	Method Blank	Total/NA	Water	3005A	
LCS 310-362614/2-A	Lab Control Sample	Total/NA	Water	3005A	

### Analysis Batch: 362935

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 310-362614/1-A	Method Blank	Total/NA	Water	6020A	362614
LCS 310-362614/2-A	Lab Control Sample	Total/NA	Water	6020A	362614

### Analysis Batch: 363152

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	6020A	362614
310-237917-2	Pivot Bucket	Total/NA	Water	6020A	362614

### Analysis Batch: 363247

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	6020A	362614
310-237917-2	Pivot Bucket	Total/NA	Water	6020A	362614
MB 310-362614/1-A	Method Blank	Total/NA	Water	6020A	362614
LCS 310-362614/2-A	Lab Control Sample	Total/NA	Water	6020A	362614

### Analysis Batch: 363273

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCS 310-362614/2-A	Lab Control Sample	Total/NA	Water	6020A	362614

### Prep Batch: 363323

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	7470A	
MB 310-363323/1-A	Method Blank	Total/NA	Water	7470A	
LCS 310-363323/2-A	Lab Control Sample	Total/NA	Water	7470A	

### Prep Batch: 363324

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-2	Pivot Bucket	Total/NA	Water	7470A	
MB 310-363324/1-A	Method Blank	Total/NA	Water	7470A	
LCS 310-363324/2-A	Lab Control Sample	Total/NA	Water	7470A	
310-237917-2 MS	Pivot Bucket	Total/NA	Water	7470A	
310-237917-2 MSD	Pivot Bucket	Total/NA	Water	7470A	

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# QC Association Summary

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

## Metals

### Analysis Batch: 363477

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	7470A	363323
310-237917-2	Pivot Bucket	Total/NA	Water	7470A	363324
MB 310-363323/1-A	Method Blank	Total/NA	Water	7470A	363323
MB 310-363324/1-A	Method Blank	Total/NA	Water	7470A	363324
LCS 310-363323/2-A	Lab Control Sample	Total/NA	Water	7470A	363323
LCS 310-363324/2-A	Lab Control Sample	Total/NA	Water	7470A	363324
310-237917-2 MS	Pivot Bucket	Total/NA	Water	7470A	363324
310-237917-2 MSD	Pivot Bucket	Total/NA	Water	7470A	363324

## General Chemistry

### Analysis Batch: 362509

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	SM 4500 H+ B	
310-237917-2	Pivot Bucket	Total/NA	Water	SM 4500 H+ B	
LCS 310-362509/1	Lab Control Sample	Total/NA	Water	SM 4500 H+ B	
LCS 310-362509/25	Lab Control Sample	Total/NA	Water	SM 4500 H+ B	
310-237917-1 DU	Road Track	Total/NA	Water	SM 4500 H+ B	

### Analysis Batch: 362556

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	SM 2320B	
310-237917-2	Pivot Bucket	Total/NA	Water	SM 2320B	
MB 310-362556/1	Method Blank	Total/NA	Water	SM 2320B	
LCS 310-362556/2	Lab Control Sample	Total/NA	Water	SM 2320B	

### Analysis Batch: 362793

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	353.2	
310-237917-2	Pivot Bucket	Total/NA	Water	353.2	
MB 310-362793/43	Method Blank	Total/NA	Water	353.2	
LCS 310-362793/44	Lab Control Sample	Total/NA	Water	353.2	

### Prep Batch: 362810

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	351.2	
310-237917-2	Pivot Bucket	Total/NA	Water	351.2	
MB 310-362810/1-A	Method Blank	Total/NA	Water	351.2	
LCS 310-362810/2-A	Lab Control Sample	Total/NA	Water	351.2	

### Analysis Batch: 362944

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	351.2	362810
310-237917-2	Pivot Bucket	Total/NA	Water	351.2	362810
MB 310-362810/1-A	Method Blank	Total/NA	Water	351.2	362810
LCS 310-362810/2-A	Lab Control Sample	Total/NA	Water	351.2	362810

### Prep Batch: 363012

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	Distill/Ammonia	
310-237917-2	Pivot Bucket	Total/NA	Water	Distill/Ammonia	

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## QC Association Summary

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

### General Chemistry (Continued)

#### Prep Batch: 363012 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 310-363012/1-A	Method Blank	Total/NA	Water	Distill/Ammonia	
LCS 310-363012/2-A	Lab Control Sample	Total/NA	Water	Distill/Ammonia	

#### Analysis Batch: 363102

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	350.1	363012
310-237917-2	Pivot Bucket	Total/NA	Water	350.1	363012
MB 310-363012/1-A	Method Blank	Total/NA	Water	350.1	363012
LCS 310-363012/2-A	Lab Control Sample	Total/NA	Water	350.1	363012

# Lab Chronicle

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

**Client Sample ID: Road Track**

**Lab Sample ID: 310-237917-1**

**Date Collected: 08/11/22 11:00**

**Matrix: Water**

**Date Received: 08/12/22 08:35**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	9056A		5	363601	DHM5	EET CF	08/22/22 15:34
Total/NA	Prep	3005A			362614	QTZ5	EET CF	08/16/22 08:30
Total/NA	Analysis	6020A		1	363152	A6US	EET CF	08/18/22 17:47
Total/NA	Prep	3005A			362614	QTZ5	EET CF	08/16/22 08:30
Total/NA	Analysis	6020A		4	363247	A6US	EET CF	08/19/22 16:31
Total/NA	Prep	7470A			363323	XXW3	EET CF	08/22/22 14:34
Total/NA	Analysis	7470A		1	363477	XXW3	EET CF	08/23/22 12:41
Total/NA	Prep	Distill/Ammonia			363012	ENB7	EET CF	08/18/22 09:51
Total/NA	Analysis	350.1		1	363102	ZJX4	EET CF	08/18/22 20:31
Total/NA	Prep	351.2			362810	W9YR	EET CF	08/17/22 07:00
Total/NA	Analysis	351.2		1	362944	ZJX4	EET CF	08/17/22 19:01
Total/NA	Analysis	353.2		1	362793	ZJX4	EET CF	08/16/22 20:12
Total/NA	Analysis	SM 2320B		1	362556	MAQ3	EET CF	08/15/22 08:30
Total/NA	Analysis	SM 4500 H+ B		1	362509	N7RT	EET CF	08/12/22 15:15

**Client Sample ID: Pivot Bucket**

**Lab Sample ID: 310-237917-2**

**Date Collected: 08/11/22 11:05**

**Matrix: Water**

**Date Received: 08/12/22 08:35**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	9056A		5	363601	DHM5	EET CF	08/22/22 15:49
Total/NA	Prep	3005A			362614	QTZ5	EET CF	08/16/22 08:30
Total/NA	Analysis	6020A		1	363152	A6US	EET CF	08/18/22 18:03
Total/NA	Prep	3005A			362614	QTZ5	EET CF	08/16/22 08:30
Total/NA	Analysis	6020A		1	363247	A6US	EET CF	08/19/22 16:34
Total/NA	Prep	7470A			363324	XXW3	EET CF	08/22/22 14:38
Total/NA	Analysis	7470A		1	363477	XXW3	EET CF	08/23/22 12:48
Total/NA	Prep	Distill/Ammonia			363012	ENB7	EET CF	08/18/22 09:51
Total/NA	Analysis	350.1		1	363102	ZJX4	EET CF	08/18/22 20:32
Total/NA	Prep	351.2			362810	W9YR	EET CF	08/17/22 07:00
Total/NA	Analysis	351.2		1	362944	ZJX4	EET CF	08/17/22 19:02
Total/NA	Analysis	353.2		1	362793	ZJX4	EET CF	08/16/22 20:13
Total/NA	Analysis	SM 2320B		1	362556	MAQ3	EET CF	08/15/22 08:30
Total/NA	Analysis	SM 4500 H+ B		1	362509	N7RT	EET CF	08/12/22 15:21

## Laboratory References:

EET CF = Eurofins Cedar Falls, 3019 Venture Way, Cedar Falls, IA 50613, TEL (319)277-2401

## Accreditation/Certification Summary

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

### Laboratory: Eurofins Cedar Falls

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
Colorado	Petroleum Storage Tank Program	IA100001 (OR)	09-29-22
Georgia	State	IA100001 (OR)	09-29-22
Illinois	NELAP	200024	11-29-22
Iowa	State	007	12-01-21 *
Kansas	NELAP	E-10341	01-31-23
Minnesota	NELAP	019-999-319	12-31-22
Minnesota (Petrofund)	State	3349	01-18-24
North Dakota	State	R-186	09-29-22
Oregon	NELAP	IA100001	09-29-22

\* Accreditation/Certification renewal pending - accreditation/certification considered valid.

Eurofins Cedar Falls



## Method Summary

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

Method	Method Description	Protocol	Laboratory
9056A	Anions, Ion Chromatography	SW846	EET CF
6020A	Metals (ICP/MS)	SW846	EET CF
7470A	Mercury (CVAA)	SW846	EET CF
350.1	Nitrogen, Ammonia	MCAWW	EET CF
351.2	Nitrogen, Total Kjeldahl	MCAWW	EET CF
353.2	Nitrogen, Nitrate-Nitrite	MCAWW	EET CF
SM 2320B	Alkalinity	SM	EET CF
SM 4500 H+ B	pH	SM	EET CF
3005A	Preparation, Total Metals	SW846	EET CF
351.2	Nitrogen, Total Kjeldahl	MCAWW	EET CF
7470A	Preparation, Mercury	SW846	EET CF
Distill/Ammonia	Distillation, Ammonia	None	EET CF

### Protocol References:

MCAWW = "Methods For Chemical Analysis Of Water And Wastes", EPA-600/4-79-020, March 1983 And Subsequent Revisions.

None = None

SM = "Standard Methods For The Examination Of Water And Wastewater"

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

### Laboratory References:

EET CF = Eurofins Cedar Falls, 3019 Venture Way, Cedar Falls, IA 50613, TEL (319)277-2401



Environment Testing  
America



### Cooler/Sample Receipt and Temperature Log Form

<b>Client Information</b>			
Client: <u>Nebraska Public Power</u>			
City/State:	CITY <u>Sutherland</u>	STATE <u>NE</u>	Project:
<b>Receipt Information</b>			
Date/Time Received:	DATE <u>8-12-22</u>	TIME <u>835</u>	Received By: <u>[Signature]</u>
Delivery Type: <input checked="" type="checkbox"/> UPS <input type="checkbox"/> FedEx <input type="checkbox"/> FedEx Ground <input type="checkbox"/> US Mail <input type="checkbox"/> Spee-Dee <input type="checkbox"/> Lab Courier <input type="checkbox"/> Lab Field Services <input type="checkbox"/> Client Drop-off <input type="checkbox"/> Other: _____			
<b>Condition of Cooler/Containers</b>			
Sample(s) received in Cooler?		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	If yes: Cooler ID: _____
Multiple Coolers?		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	If yes: Cooler # _____ of _____
Cooler Custody Seals Present?		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	If yes: Cooler custody seals intact? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Sample Custody Seals Present?		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	If yes: Sample custody seals intact? <input type="checkbox"/> Yes <input type="checkbox"/> No
Trip Blank Present?		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	If yes: Which VOA samples are in cooler? ↓
<b>Temperature Record</b>			
Coolant: <input checked="" type="checkbox"/> Wet ice <input type="checkbox"/> Blue ice <input type="checkbox"/> Dry ice <input type="checkbox"/> Other: _____ <input type="checkbox"/> NONE			
Thermometer ID: <u>P</u>		Correction Factor (°C): <u>0</u>	
• Temp Blank Temperature – If no temp blank, or temp blank temperature above criteria, proceed to Sample Container Temperature			
Uncorrected Temp (°C): <u>-1.6</u>		Corrected Temp (°C): <u>-1.6</u>	
• Sample Container Temperature			
Container(s) used:	CONTAINER 1	CONTAINER 2	
Uncorrected Temp (°C):			
Corrected Temp (°C):			
<b>Exceptions Noted</b>			
1) If temperature exceeds criteria, was sample(s) received same day of sampling? <input type="checkbox"/> Yes <input type="checkbox"/> No a) If yes: Is there evidence that the chilling process began? <input type="checkbox"/> Yes <input type="checkbox"/> No			
2) If temperature is <0°C, are there obvious signs that the integrity of sample containers is compromised? (e.g., bulging septa, broken/cracked bottles, frozen solid?) <input type="checkbox"/> Yes <input type="checkbox"/> No			
NOTE: If yes, contact PM before proceeding. If no, proceed with login			
<b>Additional Comments</b>			



## Login Sample Receipt Checklist

Client: Nebraska Public Power District

Job Number: 310-237917-1

Login Number: 237917

List Source: Eurofins Cedar Falls

List Number: 1

Creator: Costello, Mackenzie K

Question	Answer	Comment
Radioactivity wasn't checked or is $\leq$ background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	



[golder.com](http://golder.com)





## REPORT

# Alternative Source Demonstration for Sulfate at APMW-19

*Nebraska Public Power District*

Submitted to:

**Nebraska Public Power District**

Gerald Gentleman Station,  
6089 South Highway 25,  
Sutherland, Nebraska 69165

Submitted by:

**Golder Associates USA Inc.**

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31404512.000-003-R-0

October 26, 2022





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Figure 2: Groundwater Monitoring Well Water Levels

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Figure 4: Photographs of Drainages and Center Pivot Spray onto GGS Property

Figure 5: Q2 2021 Upgradient Groundwater Sampling Locations

Figure 6: Piper Diagram of Groundwater and Potential Sulfate Sources

Figure 7: Box and Whisker Plot of Sulfate Concentrations

Figure 8: Ternary Diagram of Groundwater and Potential Sulfate Sources

Figure 9: Sulfate Conceptual Site Model

**APPENDICES****APPENDIX A**

Historical Concentrations of Appendix III and Selected Appendix IV Analytes

**APPENDIX B**

Eurofins Laboratory Report for Irrigation Water Samples

## 1.0 INTRODUCTION

On behalf of Nebraska Public Power District (NPPD), Golder Associates USA Inc. (Golder), a member of WSP, performed a statistical evaluation of groundwater quality from the second quarter (Q2) groundwater detection monitoring event of 2022 at the Gerald Gentleman Station (GGS or Site) Ash Landfill (or Coal Combustion Residuals [CCR] Unit), located at 6089 South Highway 25, Sutherland, Lincoln County, Nebraska. The statistical evaluation was performed in accordance with the Site Sampling and Analysis plan (Golder 2019a), which was developed in compliance 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” (CCR Final Rule), as amended, and corresponding regulations under Nebraska Administrative Code (NAC) Title 132, Chapter 7 (Integrated Solid Waste Management Regulations, Groundwater Monitoring and Remedial Action).

Statistical analyses of the Appendix III detection monitoring data for sulfate in groundwater at the downgradient monitoring well APMW-19 indicated a potential exceedance of the statistical limit based on the parametric Cumulative Sum (CUSUM) analysis in the Q2 2021 sampling results, which was subsequently verified as evidence of a statistically-significant increase (SSI) after the fourth quarter (Q4) 2021 event and again after the Q2 2022 results. Although determination of an SSI generally indicates that the groundwater monitoring program should transition from detection monitoring to assessment monitoring, both 40 Code of Federal Regulations (CFR) §257.94(e)(2) and NAC Title 132, Ch. 7, 004.03 allow the owner or operator (i.e., NPPD) 90 days from the date of determination (October 26, 2022) to demonstrate a source other than the CCR Unit, or another condition, caused the potential SSI for sulfate at APMW-19.

Golder’s review of the hydrological and geologic conditions at the Site indicated the potential for the SSI to have resulted from a source other than the CCR Unit. To assess potential sulfate sources and the natural variability of sulfate concentrations in groundwater, Golder reviewed analytical results of previously collected CCR-impacted water samples from the ash landfills, evaporation pond, surface water from the Sutherland Reservoir, surface waters from nearby agricultural areas, and groundwater samples. Based upon this assessment and in accordance with provisions of the CCR Final Rule, the NAC, and the site Sampling and Analysis Plan (Golder 2019a), Golder prepared this Alternative Source Demonstration (ASD) for the CCR Unit. This ASD includes an evaluation of geological, hydrogeological, and chemical information regarding ash, surface water, and groundwater obtained from surface waters and monitoring wells installed within and adjacent to the CCR Unit.

This ASD conforms to the requirements of 40 CFR §257.94(e)(2) and NAC Title 132, Ch.7, 004.03 and provides the basis for concluding that the apparent SSI for sulfate in groundwater at APMW-19 is not a result of a release from the CCR Unit. The following sections provide a summary of the GGS CCR Unit, analytical and geochemical assessment results, a conceptual site model, and lines of evidence demonstrating an alternative source is responsible for the sulfate SSI in groundwater at APMW-19.

## 2.0 BACKGROUND

### 2.1 Description of Waste Disposal Area

The Ash Landfill at GGS is located southwest of the plant’s generation facility, in the northern one-half of Section 30, Township 13N, Range 33W. The ash disposal facility consists of Ash Landfill Nos. 1, 2, 3, and 4 and the Bottom Ash Landfill. Ash Landfill Nos.1 and 2 are closed and Ash Landfill Nos. 3 and 4 are active (Figure 1). The Bottom Ash Landfill was closed in October 2018.

Fly ash is currently disposed at Ash Landfill No. 4 and in the east cell of Ash Landfill No. 3. The liner design at Ash Landfill No. 4 consists of a 60-mil high density polyethylene (HDPE) geomembrane over compacted subgrade. Prior to geomembrane installation, the existing subgrade was scored to a depth of at least 6 inches and compacted to 95 percent of its maximum dry density (standard Proctor). Smooth HDPE geomembrane was placed on the bottom of the Ash Landfill and textured HDPE geomembrane was placed on the side slopes. Construction quality assurance for the geomembrane installation was performed by Golder Construction Services and completed on November 15, 1994. There is no leachate collection system (LCS) at Ash Landfill No. 4.

The original liner at Ash Landfill No. 3 consisted of 2 feet (ft) of soil compacted to 95 percent of the standard Proctor maximum dry density. The average permeability of the liner was  $1.2 \times 10^{-8}$  centimeters per second (cm/sec). Ash Landfill No. 3 was previously closed in 1995 with 2.0 to 7.5 ft of soil cover. This cover was removed, and the historically placed CCR was covered with a new liner in 2015. The new liner system at Ash Landfill No. 3 consists of a prepared subgrade overlain by a geosynthetic clay liner and 60-mil linear low-density polyethylene geomembrane. Ash Landfill No. 3 also has a 1-foot LCS sand layer that reports to two sumps. Construction of the new Ash Landfill No. 3 liner system was completed in November 2015.

To the east of the Ash Landfill, plant process water, such as boiler blowdown, is managed in a 50-acre evaporation pond, as shown in Figure 1. CCR materials are not stored within the evaporation pond, and the facility is not regulated under the CCR rule. The bottom of the approximately 8- to 10-foot deep evaporation pond consists of re-compacted native soils.

## 2.2 Site Geology

The geologic sequence near the Ash Landfill was summarized by Woodward-Clyde in 1991. In the report, soil boring data from nine boreholes (APMW-1, APMW-2, APMW-3, APMW-4, APMW-5, EPMW-1, EPMW-2, EPMW-3, and EPMW-4) were used to characterize the Site geology. The geologic sequence, from top to bottom, was described as follows:

- 4 to 5 ft of topsoil and/or fill
- 20 to 35 ft of eolian silty sands
- 8 to 10 ft of silty clay paleosol at the top of the Ogallala Formation
- 25 to 35 ft of Ogallala Formation silts
- approximately 50 ft of Ogallala Formation sands or Ogallala Formation silts and clays, to the bottoms of the boreholes

The topsoil layer consists of stiff, dark brown, low to medium plasticity silty clay directly overlying the eolian silts and sands. Thickness of topsoil ranges from 0 to 4 ft. The fill material consists of stiff, dark brown, low plasticity sandy silty clay with trace gravel and other debris. Fill thickness ranges from 0 to 5 ft.

The eolian silts and sands (Quaternary Period) consist of loose to medium dense, tan, very fine-grained, well-rounded, and well-sorted sandy silts and silty sands. The thickness of this unit ranges from 17 ft (APMW-5) to 34 ft (EPMW-2). Materials with a bimodal texture (two distinct grain sizes) are present in the lower part of this unit. The eolian silts and sands are interpreted as wind-blown dune sand deposits.

The Ogallala Formation (Tertiary Period) was encountered in each of the nine boreholes at a depth beginning at 16 to 38 ft below ground surface (bgs) and extending to the bottom of the boreholes (109 to 133 ft bgs). The Ogallala Formation near the Ash Landfill may be separated into three general stratigraphic units:

- upper silty clay paleosol unit
- middle clayey or sandy silt unit
- lower unit of either predominantly sand and gravel or an equivalent unit of predominantly silt and clay

The top of the Ogallala Formation is represented by a widespread paleosol (a previous soil horizon) that consists of a very stiff, reddish-brown to buff, low plasticity, silty clay to clayey silt with abundant calcareous nodules, calcareous matrix, and interbedded layers of caliche up to 1 ft thick. The thickness of the initial paleosol is about 8 to 10 ft, but the presence of interbedded caliche layers continues into the middle and lower Ogallala units.

The middle Ogallala Formation unit consists of a stiff to very stiff, buff-white to reddish-brown, low plasticity, clayey silt to sandy silt with abundant calcareous nodules, matrix, and caliche layers. Scattered occurrences of calcareously cemented siltstone layers from 1/2 to 1 ft thick are present in the lower part of this unit. The thickness of this middle unit ranges from about 25 to 35 ft. The clayey silts and sandy silts of this unit were possibly deposited as overbank or floodplain deposits in an alluvial depositional system.

There are two distinct lithofacies recognized in the lower Ogallala Formation unit. This unit is present for about 45 to 50 ft in the borings. One lithofacies consists of dense to very dense, reddish-brown, fine-grained silty sands grading into medium- and coarse-grained, poorly-graded sands with some fine gravels and some calcareously cemented sandstone beds (1/2 to 1 ft thick). This lithofacies was primarily encountered in borings on the northern side of the Ash Landfill (APMW-1, APMW-2, APMW-5, and EPMW-1; Woodward-Clyde 1991).

The second lithofacies recognized in the lower unit consists of stiff to hard, reddish-brown, low plasticity clayey or sandy silts with some calcareously-cemented siltstone beds. This lithofacies was encountered in borings on the southern side of the Ash Landfill (APMW-3, APMW-4, EPMW-2, EPMW-3, and EPMW-4; Woodward-Clyde 1991).

The lithologic differences and areal distribution of the two lower units suggest that the units were deposited in two separate facies of an alluvial system. The sand and gravel unit is possibly a series of longitudinal bars, channels, and channel-fill deposits, while the silt and clay unit is possibly a series of upper channel fills, overbank, or floodplain deposits (Woodward-Clyde 1991).

## 2.3 Site Hydrogeology

Based on observations made during logging of soil borings and findings of the Nebraska Water Survey Paper No. 70 (Goeke et al. 1992), the unsaturated geologic units underlying the Ash Landfill area consist of topsoil (0 to 4 ft thick), eolian silts and sands (1 to 25 ft thick), Ogallala Formation silts (40 to 50 ft thick), and Ogallala Formation sands and gravels (unsaturated portion of this unit is approximately 20 to 25 ft thick). Beneath these units lies 10 ft or more of the saturated Ogallala Formation sands and gravels. Based on the Site observations, the thickness of the vadose zone ranges from approximately 90 to 100 ft.

The saturated geologic units underlying the Ash Landfill area consist of Ogallala Formation silts and sands that extend to the bottom of the aquifer. The Ogallala Formation is underlain by the White River Group, which is composed of the Brule and Chadron formations. The bedrock formations of the White River Group are not considered to be an important potential source of water, and therefore their surface is considered to form the base

of the aquifer and is regarded as the lower drilling limit for irrigation wells in the agricultural region near the Site. Underlying the White River Group is the impermeable Pierre Shale (Goeke et al. 1992).

Available groundwater elevation data indicate that groundwater beneath GGS flows from north to south (Figure 1). The groundwater gradient is controlled by the Sutherland Reservoir, an approximately 3,200-acre open water body located 1.5 miles north of the Ash Landfill that is used as a source of condenser cooling water for GGS (McMahon et al. 2010). Since groundwater level monitoring began in 1996, regular water level fluctuations have been observed in the monitoring wells located around the Ash Landfill. These fluctuations are attributed to seasonal trends in water consumption or recharge and precipitation patterns. From the time-series plot of historical water levels in each monitoring well (Figure 2), long-term changes in water levels between 1996 and 2022 are apparent. In general, water levels rose approximately 1.5 ft between 1996 and 2000 before declining between 9 to 10 ft between 2000 and 2009. The cause of the decline is not clear, but possible explanations include a regional response to the drought being experienced by parts of the western United States and/or a change in the amount of groundwater used for irrigation in the area around the Site. Between 2009 and 2022 water levels have continued to show seasonal variability, with seasonal maximums occurring in the spring and seasonal minimums occurring in the fall with no apparent long-term increasing or decreasing trend.

Groundwater flow velocity ranges from  $5.0 \times 10^{-4}$  to  $6.7 \times 10^{-2}$  feet per day (ft/day) and was estimated based on the following site-specific hydrogeologic data:

- Estimated site hydraulic conductivities range from 0.14 ft/day to 19 ft/day (Woodward-Clyde 1991).
- An average horizontal hydraulic gradient of 0.00091 feet per foot (ft/ft) from the potentiometric surface shown in Figure 1.
- An average effective porosity for Ogallala Formation sands and silts of 25 percent (Fetter 1994).

Two agricultural fields are present immediately to the south of the ash landfills. Historical aerial imagery (Figure 3) showed that there was no center-pivot irrigation system prior to 2004. By 2006, a center-pivot irrigation system was installed, and aerial images from 2006, 2012, and 2020 indicate that irrigation water from that center-pivot was crossing the property boundary of GGS, as delineated by the greener foliage compared to the unirrigated land. The greener foliage along the southern edge of the ash landfills also indicates that irrigation runoff discharges north towards GGS, into the ditch between the ash landfills and the agricultural fields.

Photographs of the southern property boundary of the Site taken on August 2, 2022, indicate two drainages are present from the agricultural area onto GGS property (Figure 4A and 4B), although no runoff was observed in the drainages. On August 11, 2022, NPPD observed irrigation water from the center pivot spraying across the property boundary (Figure 4C).

## 2.4 Groundwater Monitoring Network

Design of the Ash Landfill groundwater monitoring program considered the size, disposal and operational history, anticipated groundwater flow direction, and saturated thickness of the uppermost aquifer. Based on these factors, a monitoring well network that consists of four upgradient (background) monitoring wells and ten downgradient monitoring wells was installed around the Ash Landfill. The monitoring wells are listed in Table 1 and presented in Figure 1.



**Table 1: Monitoring Well Network**

Location	Upgradient (Background) Monitoring Wells	Downgradient Monitoring Wells
Ash Landfill	APMW-5, APMW-15, APMW-16A, APMW-17	APMW-4, APMW-6, APMW-8A, APMW-10, APMW-11, APMW-12, APMW-13, APMW-14, APMW-18, APMW-19

The four upgradient monitoring wells included in the groundwater monitoring program are used to represent the background groundwater quality, including potential variability. The 10 downgradient wells were installed along the western, southern, and eastern boundaries of the active Ash Landfill. The depths of the monitoring wells were selected such that the monitoring wells are screened in the Ogallala Formation to yield groundwater samples that are representative of water quality in the uppermost water-bearing zone.

## 2.5 Groundwater Monitoring Program

Between March 1996 and December 2015, groundwater samples were collected for arsenic, selenium, and sulfate measurement twice a year from the 10 GGS monitoring wells administered under the Nebraska Department of Environment and Energy (NDEE) monitoring program (APMW-5, APMW-15, APMW-4, APMW-6, APMW-8A, APMW-10, APMW-11, APMW-12, APMW-13, and APMW-14). In June 2005, boron measurements were added to the NDEE analyte list. In 2015, four additional monitoring wells were installed to support the federal CCR monitoring program (APMW-16A, APMW-17, APMW-18, and APMW-19) and have been incorporated into the NDEE monitoring program.

For APMW-19, the current baseline was calculated using 13 independent groundwater samples collected between December 2015 and November 2019. Statistically valid baseline values were developed for each constituent at each monitoring well (Golder 2017 and Golder 2019a).

### 2.5.1 Sulfate Concentration Trends

Sulfate concentrations in the upgradient and downgradient groundwater are shown in Appendix A, Figure A8. Sulfate concentrations in upgradient groundwater (from the four upgradient monitoring wells) ranged from 12.8 to 237 milligrams per liter (mg/L) between March 1996 and June 2022. Sulfate concentrations varied between 13.4 and 640 mg/L in downgradient groundwater wells (based on the 10 downgradient monitoring wells) over the same period.

During the current APMW-19 baseline monitoring period (December 2015 – November 2019), sulfate concentrations in groundwater at this well remained relatively steady compared to other downgradient wells, with values ranging between 38.1 and 135 mg/L in the 13 samples collected. A concentration of 191 mg/L was calculated as the parametric CUSUM statistical limit for sulfate at this monitoring well.

The Q2 2021 detection monitoring event reported a sulfate concentration of 161 mg/L in groundwater at APMW-19 and the parametric CUSUM value of 212 mg/L exceeded the statistical limit of 191 mg/L. The exceedance was verified in Q4 2021 when the reported sulfate concentration was 122 mg/L, and the parametric CUSUM value of 223 mg/L exceeded the statistical limit of 191 mg/L. A successful ASD report was prepared and submitted to NDEE on April 28, 2022 (Golder 2022) and accepted by NDEE on July 8, 2022 (NDEE 2022).

The Q2 2022 detection monitoring event reported a sulfate concentration of 146 mg/L, which resulted in a parametric CUSUM value of 208 mg/L and exceeded the statistical limit of 191 mg/L.

## 2.6 Review of Sampling and Laboratory Testing Procedures

As part of the ASD, a review was conducted of the sampling and laboratory testing procedures used throughout baseline monitoring and detection monitoring to date, along with the collected results. Golder found that the analytical methodologies used were consistent with the stated objectives of the sampling program. No anomalies were found within the sampling and laboratory testing procedures and the collected results are considered valid.

Additionally, a review of the statistical assessment methods and associated results found the procedures followed during baseline and detection monitoring to be consistent with the stated procedures listed in the published Groundwater Monitoring Statistical Methods Certification (Golder 2017). Calculated limits were found to be consistent with the chosen statistical procedures as described in the Sampling and Analysis Plan (Golder 2019a) and recommended methodology found within the Unified Guidance (United States Environmental Protection Agency [EPA] 2009).

## 3.0 DATA SOURCES USED IN ALTERNATIVE SOURCE REVIEW

To assess groundwater downgradient of the GGS CCR facilities, Golder reviewed previously-collected data and performed supplemental assessment activities. The following sections summarize the supplemental assessment activities.

### 3.1 Groundwater

#### 3.1.1 On-site Groundwater Monitoring Data

NPPD GGS field personnel routinely collect groundwater samples from 14 monitoring wells around the Ash Landfill at GGS and submit them for chemical analysis. The following datasets were available to characterize the groundwater in the vicinity of the ash landfills:

- **NDEE and CCR Monitoring Programs:** As described in Section 2.5, the ongoing groundwater monitoring samples were collected between 1996 and 2022, and analyzed for field parameters, major cations, major anions, and select dissolved metals.
- **Supplemental Sampling in First Quarter (Q1) 2019:** In February 2019, an additional set of groundwater samples were collected from eight of the 14 wells (APMW-5, APMW-17, APMW-4, APMW-8A, APMW-18, APMW-19, APMW-12, and APMW-14) to support the Q4 2018 ASD for fluoride at APMW-19 (Golder 2019b). These samples were analyzed for field parameters, major cations, major anions, and select dissolved metals. In addition, detection monitoring groundwater samples collected in Q4 2019 and Q2 2021 also had an expanded analyte list, including field parameters, major cations, major anions, and select dissolved metals.

#### 3.1.2 Upgradient Offsite Monitoring Data

As discussed in Section 2.3, upgradient groundwater is sourced from the Sutherland Reservoir, which is fed by the Sutherland Canal with water from North Platte and South Platte Rivers. The following data sources were used to constrain the range of potential water qualities upgradient of GGS and the Ash Landfill:

- **North Platte and South Platte Rivers:** The United States Geological Survey (USGS) monitored South Platte River chemistry at Rosco, Nebraska, between 1975 and 2013 (USGS 2016a). The monitoring location at Rosco, Nebraska, is less than one mile downstream of where South Platte River water is diverted into the Sutherland Canal. The USGS also characterized North Platte River water between 1972 and 2011 at Keystone, Nebraska, immediately downstream of Lake Ogallala, where North Platte River water is diverted into the Sutherland Canal (USGS 2016b).

- **Sutherland Reservoir and Canal:** Surface water samples were collected from the Sutherland Reservoir and Sutherland Canal on October 28, 2019, to assess the source of regional groundwater at the site. These samples were analyzed for field parameters, major cations, major anions, and select dissolved metals (Golder 2019b). In addition to samples collected by NPPD personnel, seven water samples were collected from the center of the Sutherland Reservoir by the USGS between August 2005 and December 2006 (USGS 2016c and USGS 2016d).
- **Shallow Groundwater around the Sutherland Reservoir:** Between September 2005 and May 2007, the USGS collected 14 shallow groundwater samples from 12 wells less than one mile from the perimeter of Sutherland Reservoir (USGS 2016e).
- **Upgradient Wells:** In Q2 2021, NPPD personnel collected groundwater samples from wells north and east of GGS to characterize the regional groundwater. The wells included potable water wells (PW #1, PW #2, and PW #3), livestock watering wells (livestock well), and operating wells (OW-20, OW-21, OW-22, OW-23, OW-24, OW-25, and OW-36, as shown in Figure 5. The samples were analyzed for field parameters, major cations, major anions, and select dissolved metals.

## 3.2 Irrigation Water

Two types of irrigation water are identified as potentially important: center pivot spray and irrigation runoff. Center pivot spray is irrigation water that is sprayed directly onto GGS property without touching agricultural soil by the irrigation system near the southern property boundary (Figure 4c). Historical aerial imagery indicates that this irrigation system was installed in 2006 (Figure 3). NPPD was able to collect two samples of center pivot spray on August 11, 2022, with one sample collected from a tire depression in the ground and one sample caught directly in a bucket as the water sprayed onto the Site. Samples were sent to Eurofins Cedar Fall for water quality analysis, including field parameters, major cations, major anions, and select dissolved metals (Results in Appendix B). These samples were collected to characterize the water quality of the center pivot spray as it flows and infiltrates on the ground in the area of APMW-19.

Irrigation water runoff is surface water that flows through agricultural soils prior to traveling onto the Site through drainages into the ditch immediately south of the CCR Unit and immediately upgradient of multiple downgradient monitoring wells, including APMW-4, APMW-6, APMW-8A, APMW-10, and APMW-11. Three indications that irrigation runoff is occurring includes:

- 1) Historical aerial images from 2012 and 2020 showing green vegetation in the ditch outside of the range of the center pivot spray.
- 2) Deep drainages at low points between the agricultural fields and the ditch south of the CCR unit (Figures 4A and 4B).
- 3) Corn shucks in the ditch on NPPD property (Figure 4C).

NPPD field personnel monitored the drainages and ditch for irrigation water runoff to characterize the water quality of this flow. Unfortunately, no irrigation water runoff was observed in the drainages and ditch. Ongoing monitoring will continue until irrigation water runoff samples can be collected.

### 3.3 Evaporation Pond

In Q1 2019 and Q4 2020, surface water samples were collected from the evaporation pond. The samples were analyzed for field parameters, major cations, major anions, and select dissolved metals.

### 3.4 Coal Combustion Residuals Contact Water

To characterize the potential for the material in the Ash Landfill to release contaminants, NPPD GGS field personnel retrieved sump water from the Ash Landfill No. 3 LCS, and pond water in direct contact with CCR materials in Ash Landfill No.4 on October 28, 2019. These sample were analyzed for the same suite of parameters as the groundwater: field parameters, major cations, major anions, and select dissolved metals (Golder 2019b).

### 3.5 Geochemical Methods

The geochemical analysis of groundwater and surface water samples included field parameters, major cations and anions, and dissolved metals. Conductivity, pH, and temperature were measured in the field using a handheld meter. The pH of each sample was also measured in the laboratory. Major anions analyzed included chloride, sulfate, and bicarbonate and major cations included calcium, magnesium, potassium, and sodium.

The laboratory analyzed the Ash Landfill pond and sump water, onsite and off-site groundwater, and surface water (evaporation pond, Sutherland Reservoir, and Sutherland Canal) samples using the following methods:

- pH following SM 4500 H+ B (2017)
- alkalinity following Standard Method (SM) 2320B Alkalinity by Titration (2005)
- chloride, fluoride, and sulfate following USEPA SW846 9056A Determination of Inorganic Anions by Ion Chromatography Revision 1 (February 2007)
- ammonia following USEPA 350.1 Determination of Ammonia Nitrogen by Automated Colorimetry, Revision 2 (August 1993)
- total Kjeldahl nitrogen following USEPA 351.2 Determination of Total Kjeldahl Nitrogen by Semi-Automated Colorimetry, Revision 2 (August 1993)
- total nitrate-nitrite nitrogen following USEPA 353.2 Determination of Nitrate-Nitrite Nitrogen by Automated Colorimetry, Revision 2 (August 1993)
- antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, lead, lithium, magnesium, molybdenum, potassium, selenium, sodium, and thallium following USEPA SW-846 6020A (November 2004)

## 4.0 DATA EVALUATION

Historical concentrations of Appendix III analytes and selected Appendix IV analytes in groundwater at GGS, including analytes that are typically indicators of potential CCR seepage (e.g., arsenic, barium, molybdenum, and selenium), are presented in time series plots in Appendix A. The plots include the results of the supplemental samples that were collected in Q1 2019 to support the Q4 2018 ASD for fluoride at APMW-19 (Golder 2019b). Sampling for the Appendix IV analytes concluded with the end of baseline monitoring in Q2 2017, which means there is a gap of six quarters in the data plots until the supplemental sampling results are shown in Q1 2019.

Figure 6 presents a Piper diagram with relative major ion chemistry for the monitoring well groundwater samples (only for samples analyzed for all major cations and anions; Q4 2017, Q1 2019, Q4 2019, and Q2 2021), off-site upgradient groundwater (NPPD and USGS sampled wells), regional groundwater sources (Sutherland Reservoir, Sutherland Canal, and North and South Platte River), irrigation waters from the center pivot spray, evaporation pond water, and coal ash impacted waters (Ash Landfill No. 3 sump water and Ash Landfill No. 4 surface pond water). The groundwater at the upgradient monitoring wells was dominated by calcium and bicarbonate. Samples from the downgradient monitoring wells were also majority calcium and bicarbonate ions, with the exception of a single sample (Q1 2019) from APMW-12 that was dominated by calcium and sulfate. The Sutherland Reservoir and Sutherland Canal water, along with the average North and South Platte River waters are generally dominated by calcium, sodium, bicarbonate, and sulfate. Irrigation waters from the center pivot spray were dominated by calcium and bicarbonate. The evaporation pond water contained majority sodium and sulfate ions. The Ash Landfill No. 3 sump water sample was primarily sodium and bicarbonate, while the Ash Landfill No. 4 pond water was dominated by sodium and sulfate.

## 4.1 Potential Sulfate Sources

Several potential sources, other than the active CCR Units, can contribute sulfate to local groundwater at GGS, including outflows from the Sutherland Reservoir into regional groundwater, irrigation water runoff and center pivot spray from across southern property boundary, seepage from the evaporation pond, and seepage from historical deposits of fly ash that remain at GGS. These four potential sources of sulfate to groundwater are described in this section.

### 4.1.1 Regional Groundwater from Sutherland Reservoir

As described in Section 2.3, the groundwater gradient in the area around the Ash Landfill shows groundwater flows from north to south, rather than from south to north in the direction of the South Platte River. The groundwater flow direction appears to be based on both the groundwater recharge provided by the Sutherland Reservoir to the north of GGS and groundwater extraction by irrigation wells located south of GGS that are pumped seasonally and used to support local agriculture. The Sutherland Reservoir is fed by the Sutherland Canal, which delivers water from both the North and South Platte Rivers for use as condenser cooling water at GGS.

The USGS collected 35 samples for sulfate concentration analysis from the South Platte River at Rosco, Nebraska, between 1975 and 2013 (USGS 2016a). Sulfate concentrations in the South Platte River ranged from 208 to 890 mg/L. The USGS collected 26 samples for sulfate concentration analysis from the North Platte River at Keystone, Nebraska, between 1972 and 2011 (USGS 2016b). Sulfate concentrations in the North Platte River ranged from 150 to 230 mg/L.

The sulfate concentrations of the Sutherland Reservoir and Sutherland Canal samples collected by NPPD field staff in October 2019 were 172 and 164 mg/L, respectively (Section 3.2). The seven Sutherland Reservoir samples the USGS collected between August 2005 and December 2006 had sulfate concentrations that ranged from 194 to 220 mg/L (USGS 2016c and USGS 2016d). The sulfate concentrations in the Sutherland Reservoir and Sutherland Canal at the times of sampling (2005, 2006, and 2019) were more similar to concentrations observed in the North Platte River and lower than concentrations observed in the South Platte River.

Sulfate concentrations in the North Platte River, South Platte River, and Sutherland Reservoir were sufficiently high enough to be regarded as a source of the elevated concentrations measured in groundwater at the upgradient monitoring wells at the Site and the elevated concentrations measured in downgradient groundwater at

APMW-8a and APMW-19. While the elevated sulfate concentrations at APMW-19 were only observed during detection monitoring (161 mg/L in Q2 2021, 122 mg/L in Q4 2021 and 146 mg/L in Q2 2022, which triggered the SSI), elevated concentrations at APMW-8A (27.2 mg/L to 145 mg/L) were observed during the baseline and detection monitoring periods. The groundwater samples collected by the USGS and NPPD immediately around the Sutherland Reservoir (less than one mile) also support the hypothesis that the reservoir is the source of the elevated sulfate concentrations at the Site (USGS 2016e). These shallow groundwater samples (10 collected by the USGS and 11 samples collected by NPPD) had sulfate concentrations of between 162 and 296 mg/L, which is within the 12.8 to 237 mg/L sulfate concentration range measured in groundwater at the GGS upgradient monitoring wells (APMW-5, APMW-15, APMW-16A, and APMW-17) between March 1996 and June 2022.

Figure 7 displays a box and whisker plot of the sulfate concentrations from the GGS monitoring well network and samples of possible sulfate sources at the Site. The plot suggests that groundwater containing elevated sulfate concentrations has been traveling across the Site, including past the upgradient monitoring wells, and has only recently started reaching downgradient monitoring wells.

McMahon et al. (2010) details the southerly flow of surface water from the Sutherland Canal and Sutherland Reservoir to the surrounding groundwater near GGS. Their analysis indicated that the front “edge” of Sutherland Reservoir water was in the approximate area of the CCR landfills, though the low density of wells sampled around the CCR landfills limited the resolution in that area.

#### 4.1.2 Irrigation Water

Irrigation water (Section 2.3) was recently identified as a potential source at other downgradient monitoring wells at GGS and is evaluated as a potential source of sulfate because of its proximity to APMW-19. It is not considered a likely source of sulfate because APMW-19 is out of center pivot spray range and side-gradient to the ditch that may be impacted by irrigation water runoff.

As discussed in Section 2.3, historical ariel imagery (Figure 3) and site photographs (Figure 4) indicate that center pivot spray and irrigation water runoff are crossing the southern property boundary at GGS and flowing into the ditch immediately south of Ash Landfills No. 3 and No. 4. Ponded water in that ditch could infiltrate to groundwater and would have the potential to impact the wells located south of the Ash Landfills (APMW-4, APMW-6, APMW-8A, APMW-10, and APMW-11). As this ditch is side-gradient to the east of APMW-19, it is unlikely that irrigation water could impact sulfate concentrations at APMW-19.

Sulfate concentrations in center pivot irrigation water samples (Section 3.2) were not elevated over concentrations recently observed in APMW-19 (122.0 to 161 mg/L between Q2 2021 and Q2 2022). The piper diagram (Figure 6) also shows that groundwater from APMW-19 does not have a similar signature (calcium sulfate dominant) to irrigation waters (calcium bicarbonate dominant), which is a further indication that irrigation water is not impacting APMW-19.

#### 4.1.3 Evaporation Pond

Although the evaporation pond is located to the east of APMW-19 and side-gradient in terms of groundwater flow (i.e., seepage from the evaporation pond would be unlikely to impact groundwater at monitoring well APMW-19), evaporation pond water quality was evaluated as a potential source in this section as it contains water related to GGS plant operations.



Groundwater quality at the three downgradient monitoring wells located around the evaporation pond (i.e., APMW-12, APMW-13, and APMW-14) indicates that process water discharged from the GGS plant and stored in the evaporation pond has migrated to groundwater. Historical monitoring results show that elevated concentrations of boron (Figure A2), chloride (Figure A4), sulfate (Figure A8), and TDS (Figure A9), which are elements that are typically associated with CCR, were detected in groundwater at these three monitoring wells closest to the evaporation pond compared to the upgradient monitoring wells.

Based on the slight differences in water quality between the groundwater at the monitoring wells APMW-12, APMW-13 and APMW-14 and the evaporation pond, mixing between the evaporation pond water and the upgradient groundwater likely occurs and groundwater at the monitoring wells is not entirely composed of seepage from the evaporation pond. This mixing reaction is supported by the Piper diagram in Figure 6, which shows samples from monitoring wells APMW-12 and APMW-14 plot on a mixing line between the evaporation pond and upgradient groundwater end-member data points.

During the Q4 2020 sampling of the evaporation pond surface water, the sulfate concentration was 468 mg/L. Based on the similarities in water quality between the evaporation pond and adjacent groundwater monitoring wells (APMW-12, APMW-13 and APMW-14), the evaporation pond is considered a potential source of sulfate to groundwater at GGS. However, it is unlikely the evaporation pond influenced groundwater quality at APMW-19, which is side gradient to groundwater flow underneath the evaporation pond (Figure 1).

#### 4.1.4 Historical Ash Landfills

Historical deposits of fly ash present at GGS in the closed soil-lined Ash Landfills Nos. 1 and 2 may release soluble constituents to groundwater as the seepage generated by infiltrating precipitation interacts with the ash. While it was not feasible to collect a sample of seepage from Ash Landfills Nos. 1 and 2 directly, ash-impacted waters collected from Ash Landfill No. 3 sump and Ash Landfill No. 4 pond (Section 3.4) had sulfate concentrations of 1,270 and 1,810 mg/L, respectively, and are assumed to represent potential ash impacted waters from closed ash landfills. At these concentrations, ash-impacted seepage has the potential to increase sulfate concentrations in downgradient wells, including AMPW-19.

A ternary plot comparing sodium, potassium, and sulfate (Figure 8) reveals that ash impacted waters (i.e., contact water) have higher relative sodium abundances and lower relative potassium and sulfate abundances compared to the upgradient and downgradient groundwater. If infiltrating precipitation was leaching sulfate from the closed fly ash storage facilities, the relative concentrations of sodium would increase considerably in the groundwater and would be more similar to the ash impacted waters, but this elevated sodium signature was not observed in any of the samples collected from the downgradient groundwater monitoring wells.

In addition to the elevated levels of sulfate in the ash-impacted waters, boron was also identified as a primary CCR indicator based on high concentrations in sump water from Ash Landfill No. 3 (18.3 mg/L) and pond water from Ash Landfill No.4 (13.8 mg/L). Boron concentrations in groundwater at the upgradient and downgradient CCR Unit monitoring wells are presented in Appendix A Figure A2. All upgradient and downgradient CCR Unit monitoring wells, with the exception of monitoring wells near the evaporation pond that may be influenced by process waters, have boron concentrations below the practical quantitation limit (PQL) (typically <0.2 mg/L). If seepage from the ash landfills were impacting groundwater and causing the sulfate SSI, boron concentrations would be expected to be increasing.

### 4.1.5 Mineral Weathering

Another potential source of sulfate in the watershed is from the natural weathering of sulfur-bearing minerals. McMahon et al. (2007) used a mass balance approach to study increases in sulfate concentrations along a groundwater flow path in Central Nebraska. They determined that the oxidation of pyrite was the likely source of sulfate increases in groundwater. These natural weathering products have the potential to raise concentrations to a small degree, but the natural concentrations were relatively low compared to the concentrations in groundwater generated by the Sutherland Reservoir, particularly as demonstrated by comparing groundwater quality between the USGS shallow wells and the GGS upgradient wells (Figure 7).

## 5.0 EVIDENCE OF AN ALTERNATIVE SOURCE

Based on the testing results and list of potential alternate sources of sulfate presented in this report, primary lines of evidence and conclusions drawn from the evidence used to support this ASD are provided in Table 2.

**Table 2: Primary Lines of Evidence and Supporting ASD Analysis**

Key Line of Evidence	Supporting Evidence	Description
Lack of Primary CCR Indicators	Boron concentrations in groundwater	Boron (Figure A2) is a primary CCR indicator based on high concentrations in sump water from Ash Landfill No. 3 (18.3 mg/L) and pond water from Ash Landfill No.4 (13.8 mg/L). All upgradient and downgradient CCR unit monitoring wells, with the exception of monitoring wells near the evaporation pond that may be influenced by process waters, have boron concentrations below the PQL (typically <0.2 mg/L).
	Sodium concentrations in CCR impacted waters	The relative abundance of sodium in CCR-impacted waters would indicate that high sodium concentrations would also be expected in groundwater if sulfate was from CCR materials (Figure 8). Relative increases in sodium were not observed in monitoring wells at the Site, suggesting an alternative source of elevated sulfate in groundwater at APMW-19.
Groundwater Geochemistry	Elevated and variable sulfate concentrations in upgradient monitoring wells	Sulfate concentrations in groundwater at upgradient monitoring wells APMW-15, APMW-16A, and APMW-17 were elevated compared to sulfate concentrations at monitoring well APMW-19 throughout the baseline monitoring period. Since the CCR Unit cannot influence the sulfate groundwater concentration in the upgradient wells, the only explanation is that there is an alternate source of sulfate present in groundwater across the Site.
	Relative ion abundances in groundwater differs from Ash Landfill water	As presented in the Piper plot (Figure 6), relative differences in major ion concentrations show a distinct dissimilarity between the ash-impacted sump and pond waters and the downgradient groundwater samples, including from APMW-19. The geochemical properties of the downgradient groundwater samples are not consistent with seepage from the CCR Unit.

Key Line of Evidence	Supporting Evidence	Description
Local Sources of Sulfate	Hydrogeology	The North and South Platte Rivers, which are ultimately the source of groundwater recharge that occurs from the Sutherland Reservoir located approximately 1.5 miles north of the Ash Landfill, have sulfate concentrations between 150 and 890 mg/L. Samples from shallow wells near the Sutherland Reservoir and upgradient wells (Figures 4 and 5) indicate that groundwater with elevated sulfate is migrating south through the Site (McMahon et al. 2010).
	Mineral weathering of sulfate bearing minerals	McMahon et al. (2007) found that small increases in sulfate concentrations along a groundwater flow path in Central Nebraska were due to pyrite oxidation.
Engineering Controls	Both Active CCR Landfill are Lined	The new liner system at Ash Landfill No. 3 consists of a prepared subgrade overlain by a geosynthetic clay liner and 60-mil linear low-density polyethylene (LLDPE) geomembrane. Ash Landfill No. 3 also has a 1-foot LCS sand layer that reports to two sumps. The liner design at Ash Landfill No. 4 consists of a 60-mil HDPE geomembrane over compacted subgrade.

## 6.0 CONCEPTUAL SITE MODEL

Golder developed a conceptual site model (CSM) that is presented graphically in Figure 9 to frame and support the ASD assessment approach. The CSM presents the GGS site layout, a summary of the geologic and hydrogeologic information, and a discussion of groundwater monitoring data, which together lays the groundwork for consideration and development of the ASD. Additionally, the CSM summarizes the findings of literature research that suggest certain naturally occurring groundwater conditions observed in Nebraska are present at the Site and may contribute to naturally elevated sulfate concentrations in groundwater around the Ash Landfill.

## 7.0 CONCLUSIONS

In accordance with §257.95(g)(3) and NAC Title 132, Ch.7, 004.03, this ASD has been prepared in response to the identification of SSIs for sulfate at monitoring well APMW-19 following the Q2 2022 sampling event for the Ash Landfill at GGS.

A review of historical analytical results indicates that the elevated sulfate concentrations in groundwater at APMW-19 were not the result of seepage from the Ash Landfill but can be attributed to naturally occurring sulfate in regional groundwater from the Sutherland Reservoir. Therefore, no further action (i.e., transition to Assessment Monitoring) is warranted, and the GGS Ash Landfill will remain in detection monitoring.

## Signature Page

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## Figures

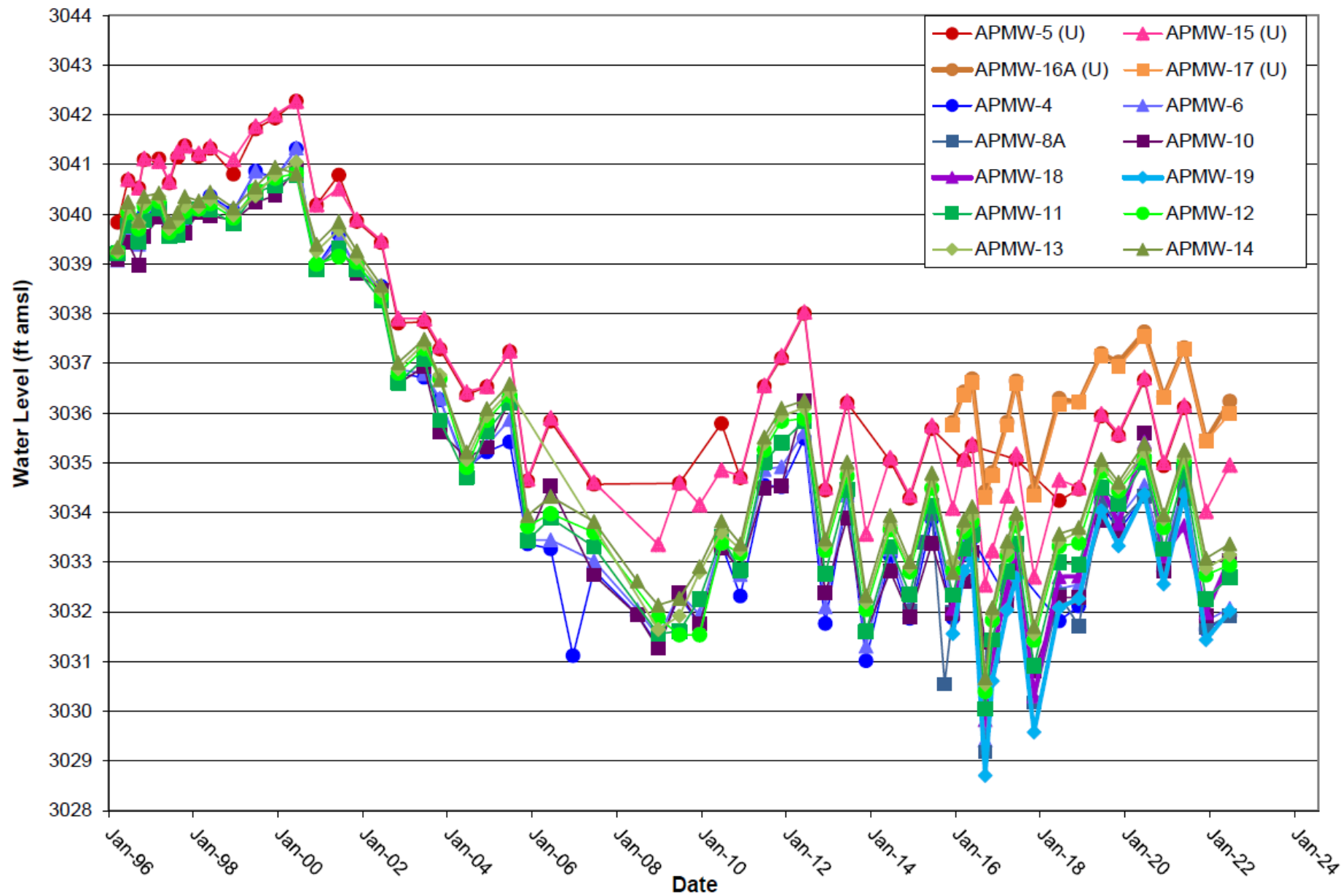




NOTE  
GROUNDWATER CONTOURS DEVELOPED FROM LEVELS MEASURED IN ACTIVE  
MONITORING WELLS SHOWN.

NEBRASKA PUBLIC POWER DISTRICT GERALD  
GENTLEMAN STATION GROUNDWATER  
MONITORING WELL NETWORK JUNE 2022  
GROUNDWATER CONTOURS  
FIGURE 1





CLIENT

Nebraska Public Power District: Gerald  
Gentleman Station

CONSULTANT

**wsp** **GOLDER**

PROJECT

Alternate Source Demonstration

TITLE

Groundwater Monitoring Well Water Levels

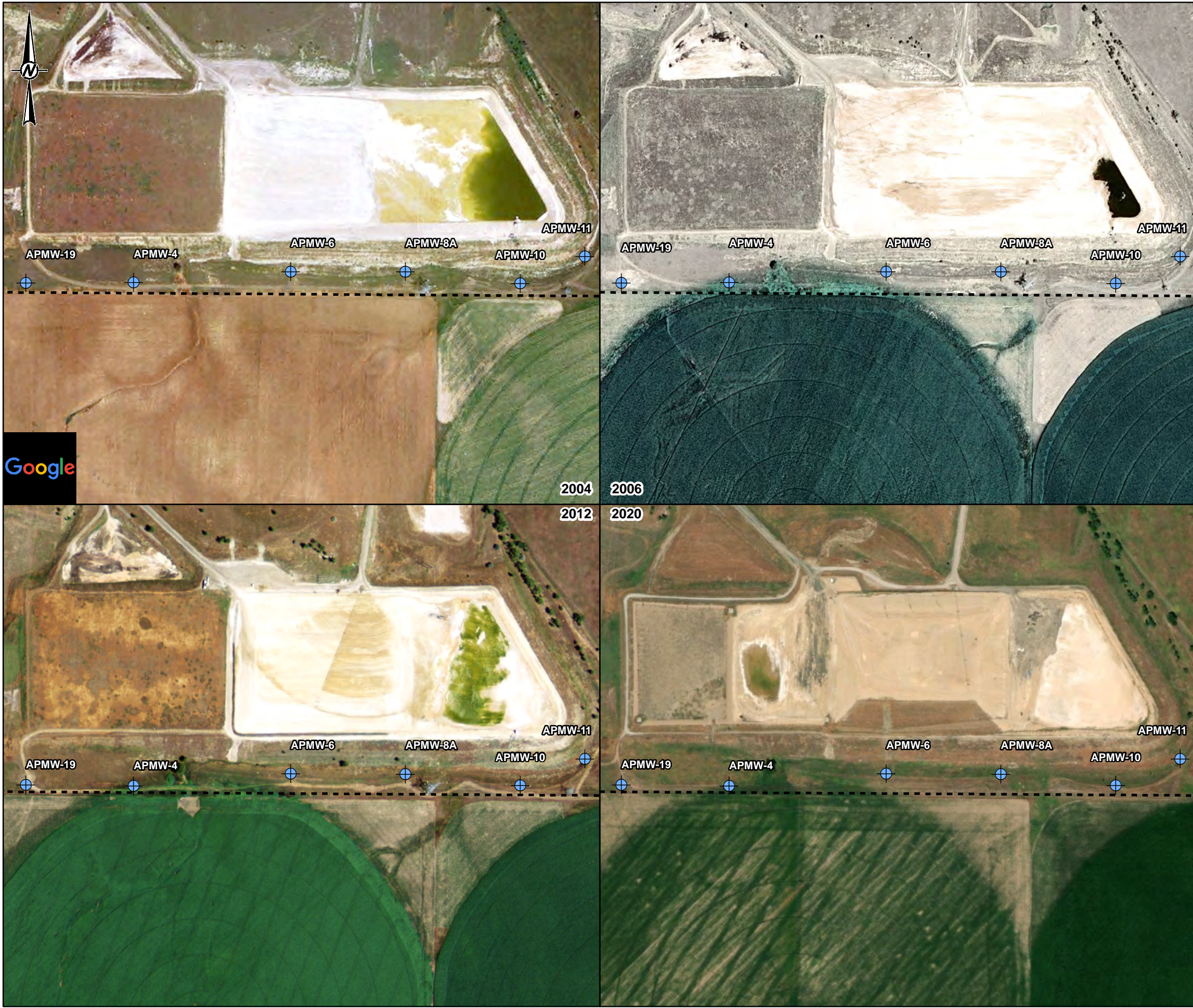
PROJECT NO.  
31404512.000

PHASE  
1

REV.

FIGURE  
2





LEGEND

MONITORING WELLS (QUALITY)

APPROXIMATE NPPD PROPERTY BOUNDARY

KEY MAP

0 250 500 1,000 Feet

**REFERENCES**

1. AERIAL IMAGERY: NATIONAL AGRICULTURE IMAGERY PROGRAM (NAIP), USDA. IMAGERY COLLECTED 06/26/2012, AND 07/14/2006.

2. AERIAL IMAGERY: ESRI PROVIDED BASEMAP, VIVID, MAXAR. IMAGERY COLLECTED 07/03/2020

3. AERIAL IMAGERY: COPYRIGHT GOOGLE 2021. IMAGERY CAPTURED MAY 2004.. IMAGE ACCURACY TO BE CONSIDERED APPROXIMATE. GOOGLE IS NOT LIABLE FOR ANY DECISIONS MADE BASED ON THE CONTENTS OF THE IMAGE SHOWN ON THIS FIGURE.

4. APPROXIMATE WATER WELL LOCATIONS: NEBRASKA DEPARTMENT OF NATURAL RESOURCES. DATASET DOWNLOADED MARCH 2019.

5. APPROXIMATE NPPD PARCEL BOUNDARIES: LINCOLN COUNTY ASSESSOR'S OFFICE, APRIL 2019.

CLIENT

NEBRASKA PUBLIC POWER DISTRICT  
GERALD GENTLEMAN STATION  
SUTHERLAND, NEBRASKA

PROJECT

Alternative Source Demonstration

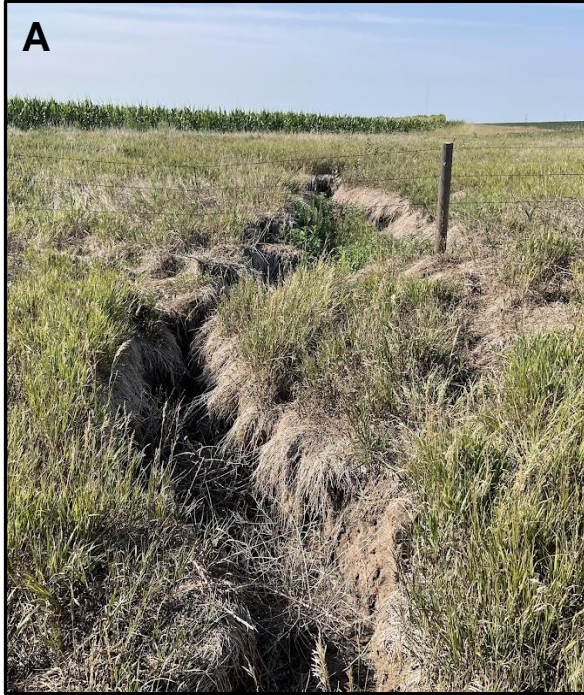
**Aerial Imagery of Irrigation Water Runoff and Center Pivot spray onto GGS Property**

CONSULTANT	YYYY-MM-DD	2021-10-26
	DESIGNED	RG/JAM
	PREPARED	JAM
	REVIEWED	GOL
	APPROVED	JS

PROJECT NO.  
31404512.000

FIGURE  
3





**Evidence of past irrigation water runoff**

East Drainage from agricultural fields onto NPPD GGS property at southern property boundary fence. No water in the drainage at the time of photograph.

Photo taken by Gregory Lehn (WSP-Golder) on August 2nd, 2022 facing south.



**Evidence of past irrigation water runoff**

West Drainage from agricultural fields onto NPPD GGS property at southern property boundary fence. Presence of dried corn shucks indicates previous flows through the drainage.

Photo taken by Gregory Lehn (WSP-Golder) on August 2nd, 2022 facing south.



**Evidence of center pivot spray**

Irrigation system spray from agricultural fields onto NPPD GGS property along southern property boundary fence. Water has been observed ponded on the surface and grass is green throughout the summer months.

Photo taken by Douglas Harris (NPPD) on August 11th, 2022 facing east along southern boundary.

CLIENT

Nebraska Public Power District: Gerald Gentleman Station

CONSULTANT

**wsp GOLDER**

PROJECT

Alternate Source Demonstration

TITLE

Photographs of Drainages and Center Pivot Spray onto GGS Property

PROJECT NO.  
31404512.000

PHASE  
1

REV.

FIGURE

4



Path: \\golder-gis-complex\data\office\Demetri\asaf\NPPD\GCS99\_PROJ\GCS20141315 GCS GW Quality 2020 | File Name: ASD\_20141315AQ02\_GCS\_Figure 3.dwg



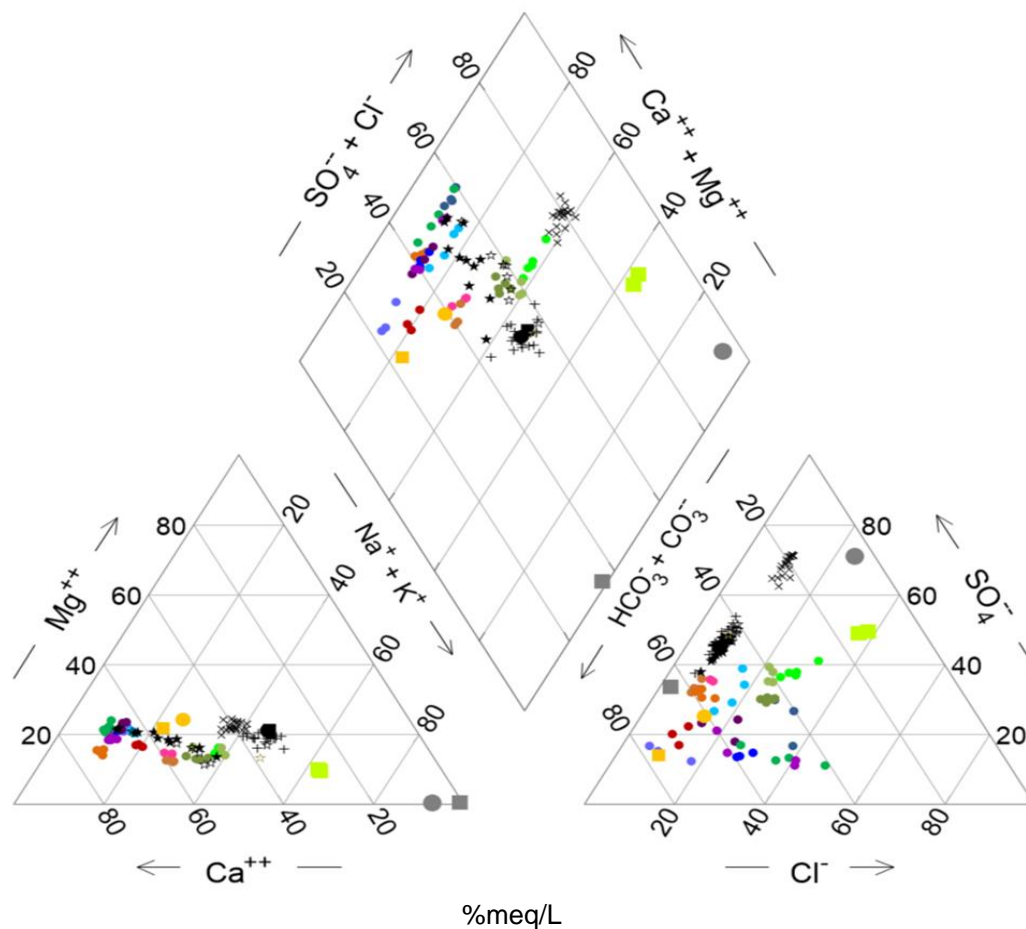
**NOTES**

1. WELL LOCATIONS ARE APPROXIMATE.

**REFERENCE(S)**

1. AERIAL IMAGERY OBTAINED FROM ESRI (MAY 2020).





#### Upgradient CCR Wells

- APMW-5
- APMW-15
- APMW-16A
- APMW-17

#### Downgradient CCR Wells

- APMW-4
- APMW-6
- APMW-8A
- APMW-10
- APMW-11
- APMW-18
- APMW-19

#### Wells Impacted By Evap Pond

- APMW-12
- APMW-13
- APMW-14

#### Potential Sources Upgradient of GGS

- + North Platte River (USGS)
- × South Platte River (USGS)
- Sutherland Canal (NPPD)
- Sutherland Reservoir (USGS and NPPD)
- ★ GW near Sutherland R. (NPPD)
- ☆ GW near Sutherland R. (USGS)

#### Potential Sources at GGS

- Ash Pit 3 Sump
- Ash Pit 4 Pond
- Evaporation Pond

#### Potential Sources Downgradient of GGS

- Center Pivot Spray (from ground)
- Center Pivot Spray (bucket)

CLIENT

Nebraska Public Power District: Gerald  
Gentleman Station

CONSULTANT

**wsp** **GOLDER**

PROJECT

Alternate Source Demonstration

TITLE

Piper Diagram of Groundwater and Potential  
Sulfate Sources

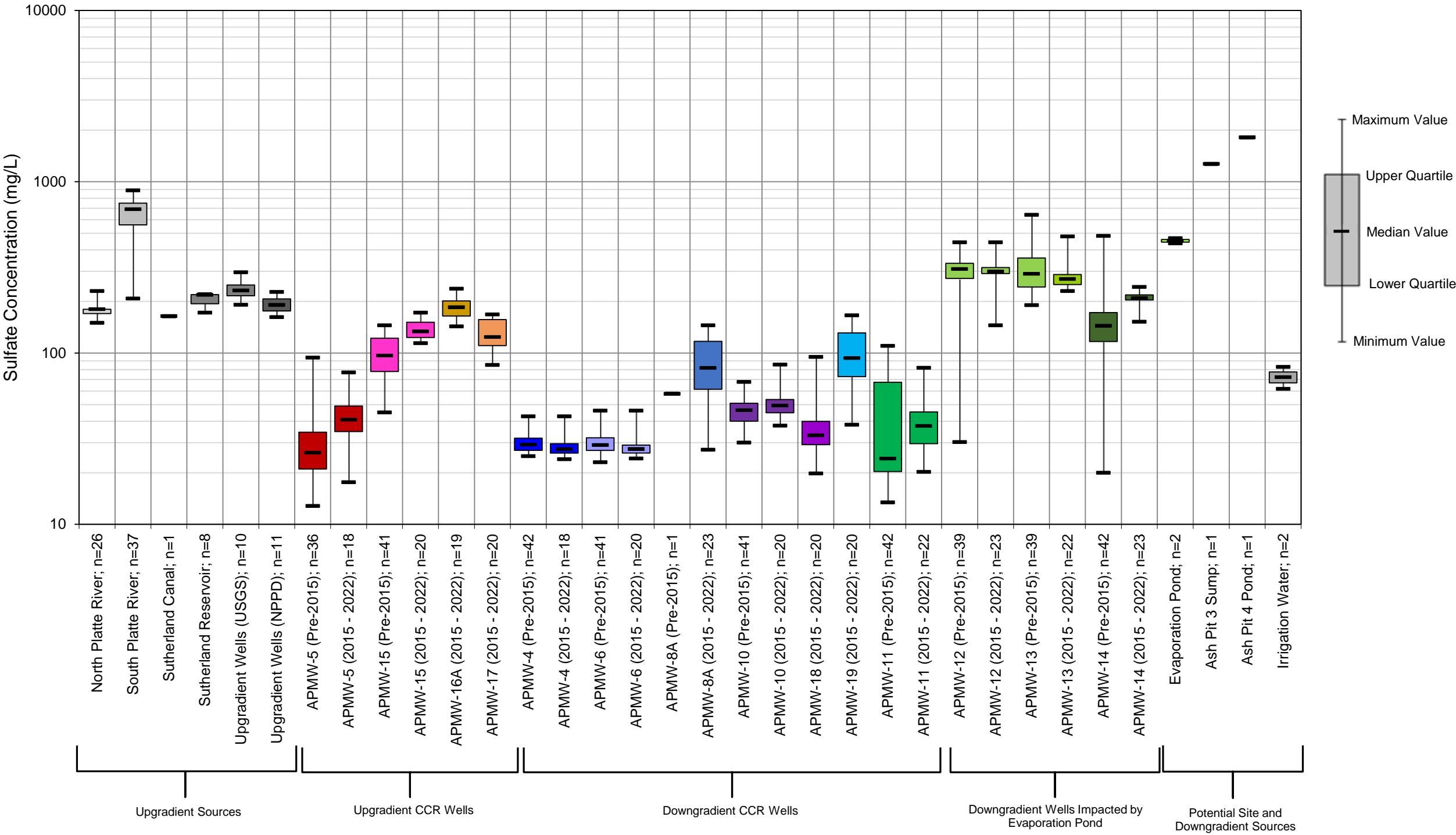
PROJECT NO.  
31404512.000

PHASE  
1

REV.

FIGURE

6



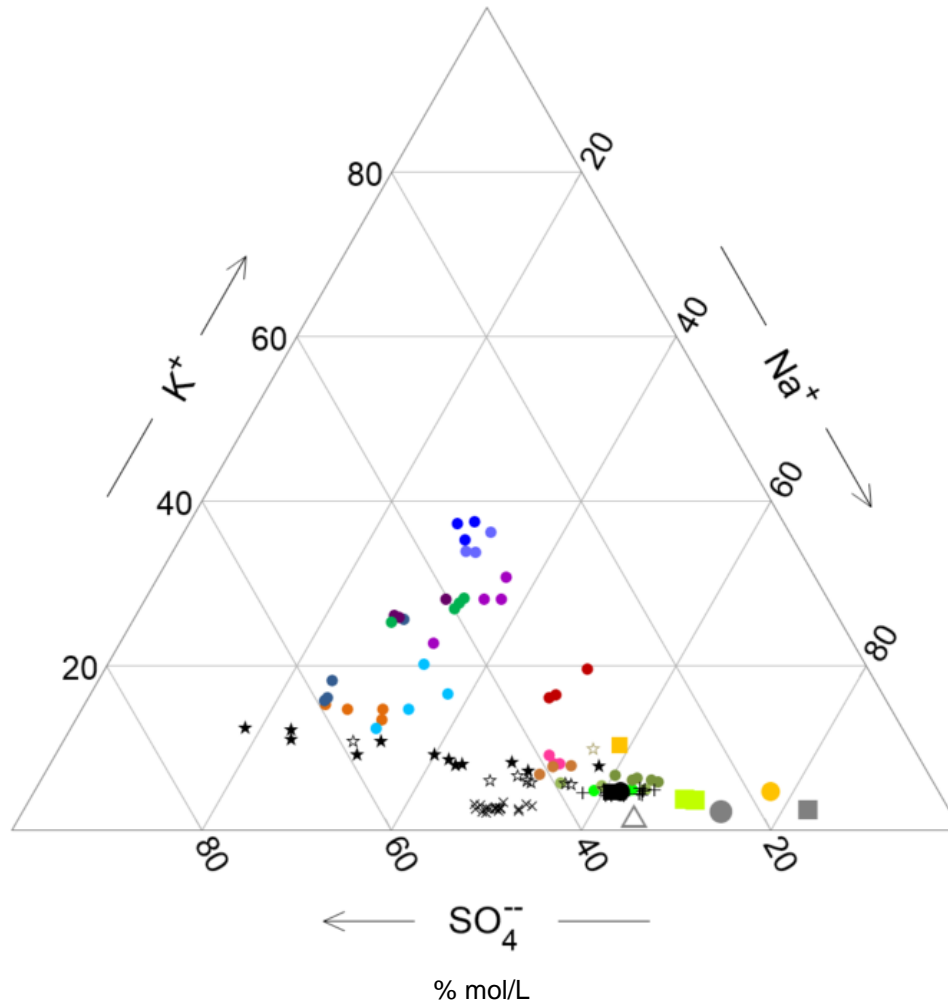
CLIENT  
Nebraska Public Power District: Gerald  
Gentleman Station

CONSULTANT  
**wsp** **GOLDER**

PROJECT  
Alternate Source Demonstration

TITLE  
Box and Whisker of Sulfate Concentrations

PROJECT NO. 31404512.000 PHASE 1 REV. FIGURE 7



#### Upgradient CCR Wells

- APMW-5
- APMW-15
- APMW-16A
- APMW-17

#### Downgradient CCR Wells

- APMW-4
- APMW-6
- APMW-8A
- APMW-10
- APMW-11
- APMW-18
- APMW-19

#### Wells Impacted By Evap Pond

- APMW-12
- APMW-13
- APMW-14

#### Potential Sources Upgradient of GGS

- + North Platte River (USGS)
- × South Platte River (USGS)
- Sutherland Canal (NPPD)
- Sutherland Reservoir (USGS and NPPD)
- ★ GW near Sutherland R. (NPPD)
- ☆ GW near Sutherland R. (USGS)

#### Potential Sources at GGS

- Ash Pit 3 Sump
- Ash Pit 4 Pond
- Evaporation Pond

#### Potential Sources Downgradient of GGS

- Center Pivot Spray (from ground)
- Center Pivot Spray (bucket)

CLIENT

Nebraska Public Power District: Gerald Gentleman Station

CONSULTANT

**wsp GOLDER**

PROJECT

Alternate Source Demonstration

TITLE

Ternary Diagram of Groundwater and Potential Sulfate Sources

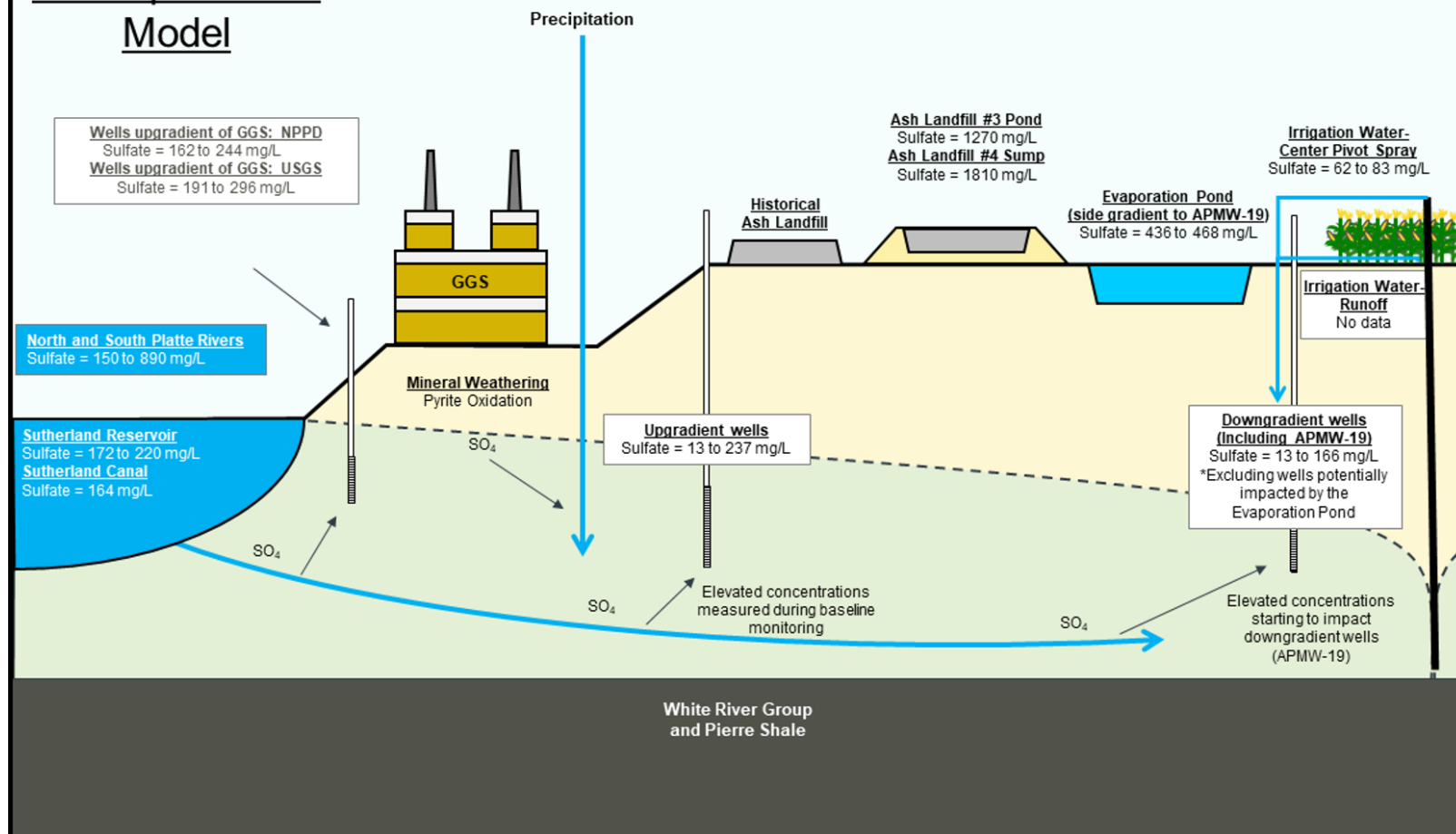
PROJECT NO.  
31404512.000

PHASE  
1

REV.

FIGURE  
8

# Conceptual Site Model



CLIENT

Nebraska Public Power District: Gerald Gentleman Station

CONSULTANT



PROJECT

Alternate Source Demonstration

TITLE

Sulfate Conceptual Site Model

PROJECT NO.  
31404512.000

PHASE  
1

REV.

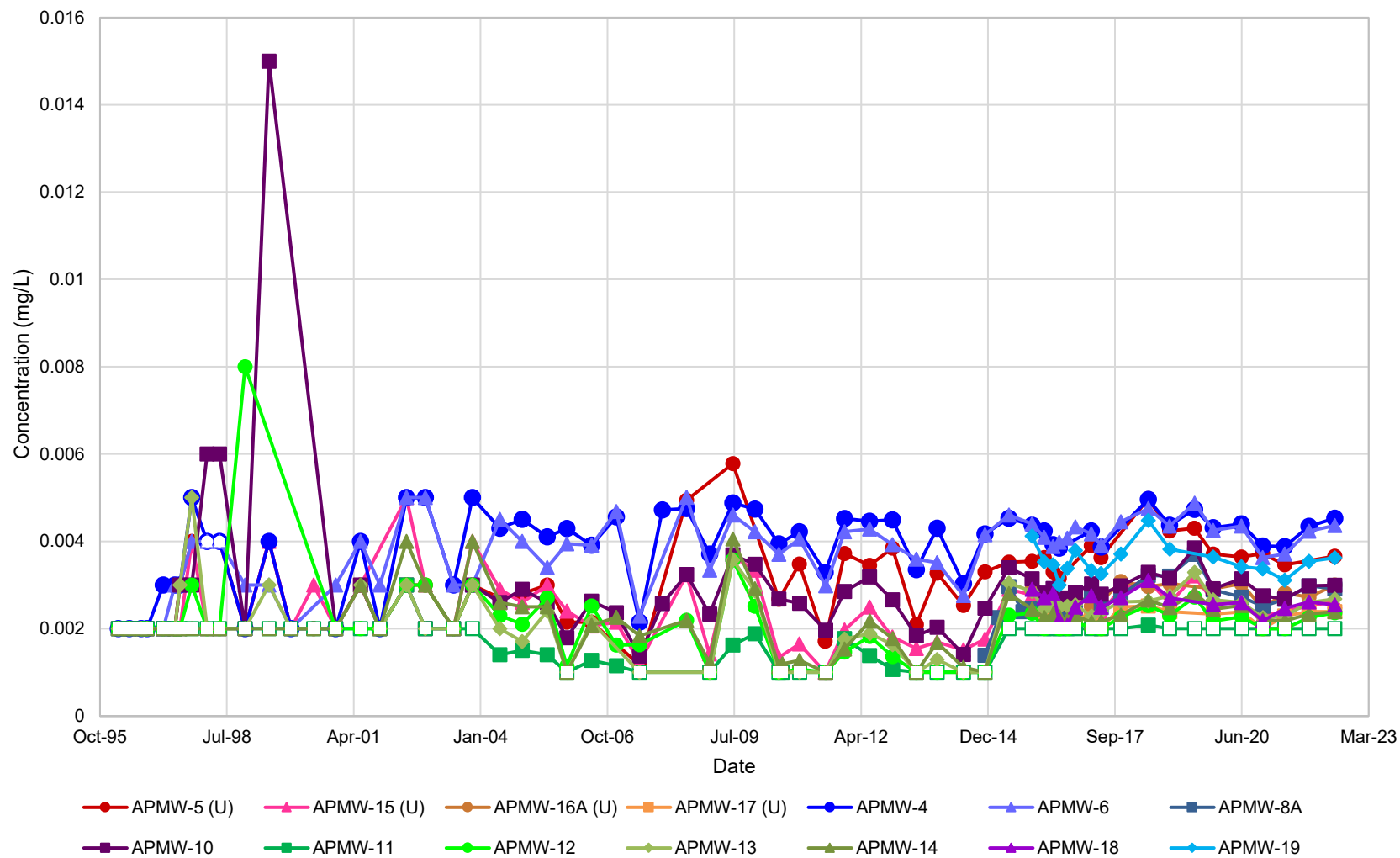
FIGURE  
9

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

**APPENDIX A**

**Historical Concentrations of  
Appendix III and Selected Appendix  
IV Analytes**





**Figure A-1**  
**Arsenic**

Nebraska Public Power District  
Gerald Gentleman Station

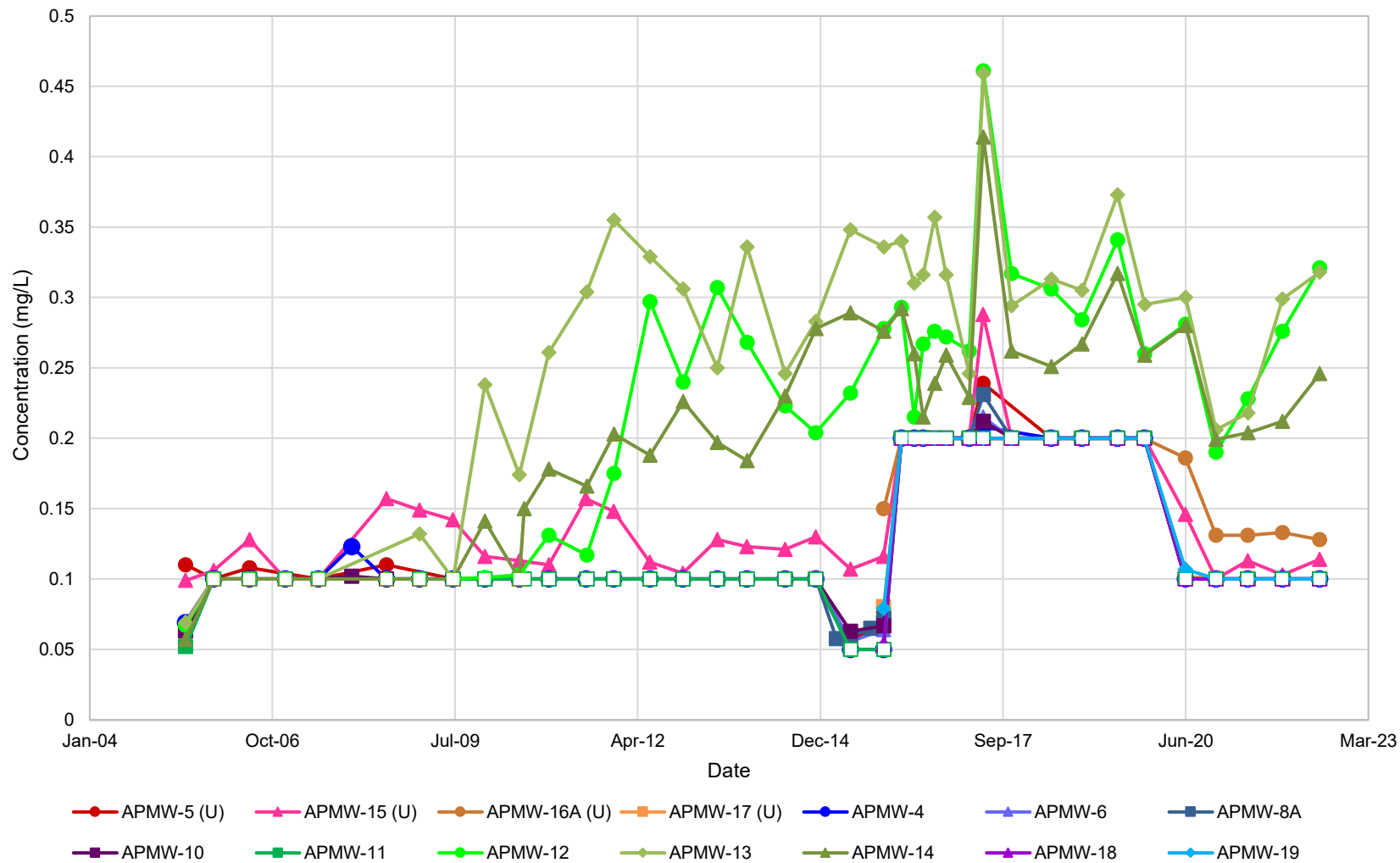
*Non-detect values are plotted with an open symbol at the practical quantitation limit.*

Denver, Colorado, USA

10/26/2022

31404512.000

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**Figure A-2**  
**Boron**

Nebraska Public Power District  
Gerald Gentleman Station

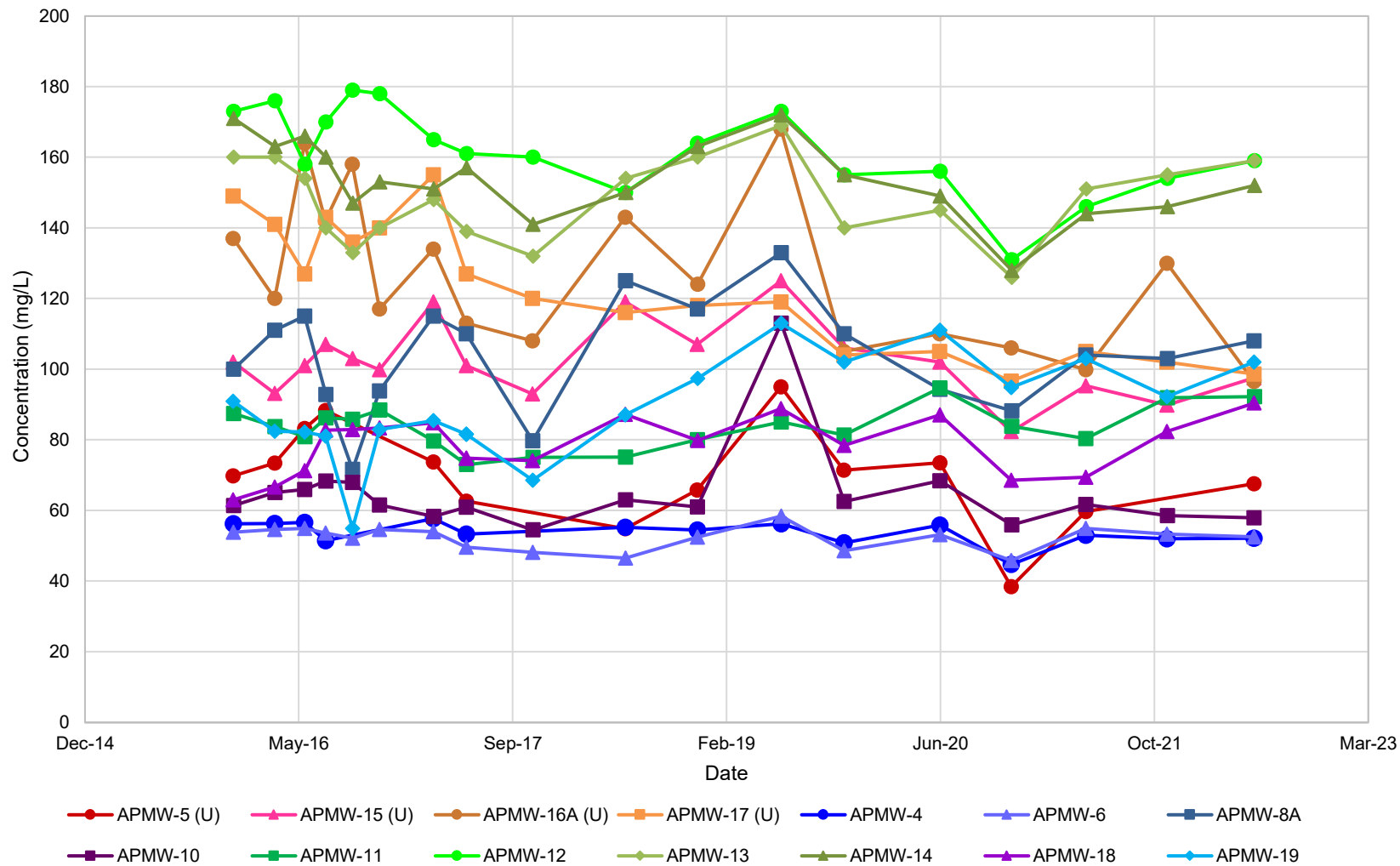
*Non-detect values are plotted with an open symbol at the practical quantitation limit.*

Denver, Colorado, USA

10/26/2022

31404512.000

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**Figure A-3**  
**Calcium**

*Non-detect values are plotted with an open symbol at the practical quantitation limit.*

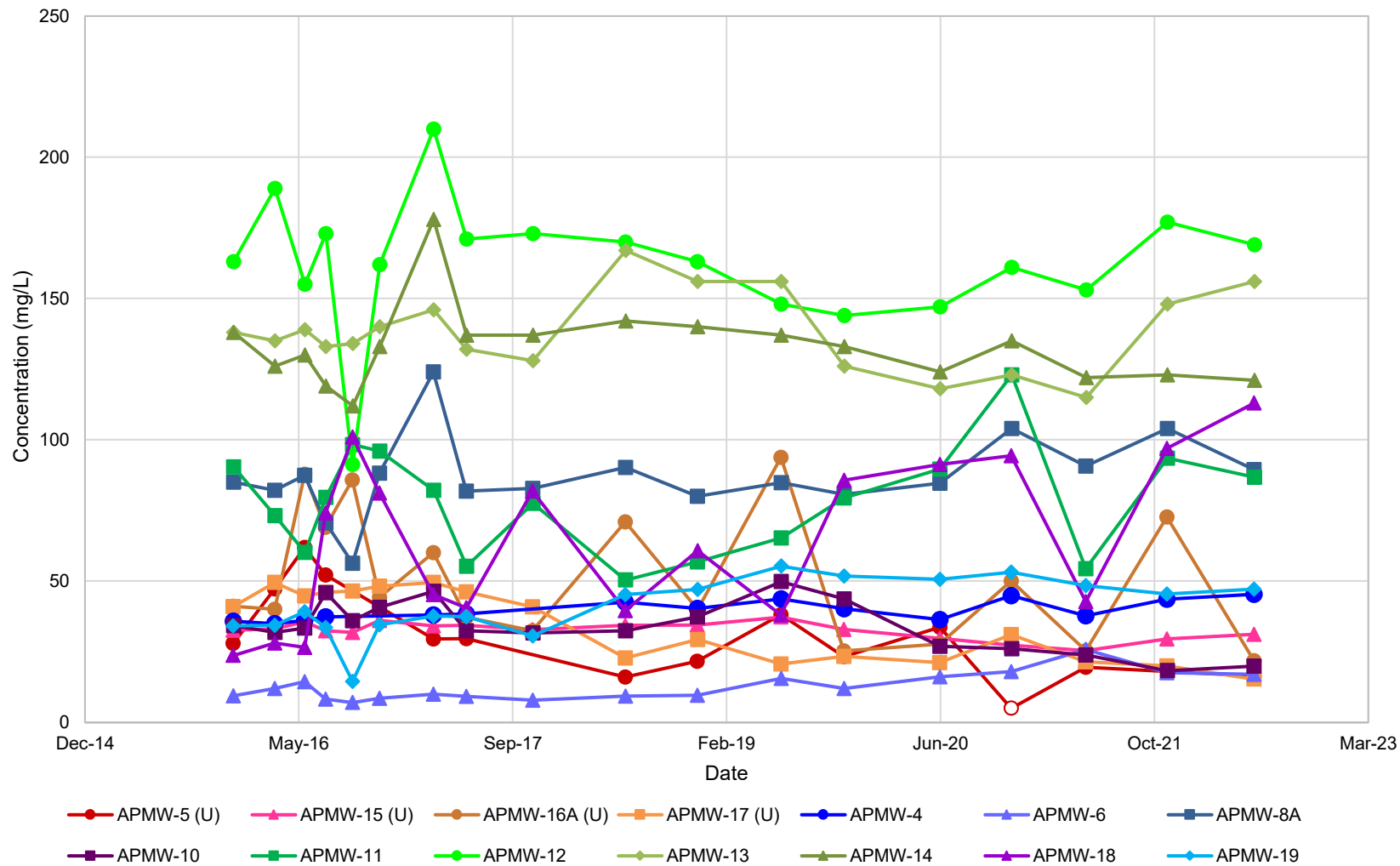
Nebraska Public Power District  
Gerald Gentleman Station

Denver, Colorado, USA

10/26/2022

31404512.000

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**Figure A-4**  
**Chloride**

*Non-detect values are plotted with an open symbol at the practical quantitation limit.*

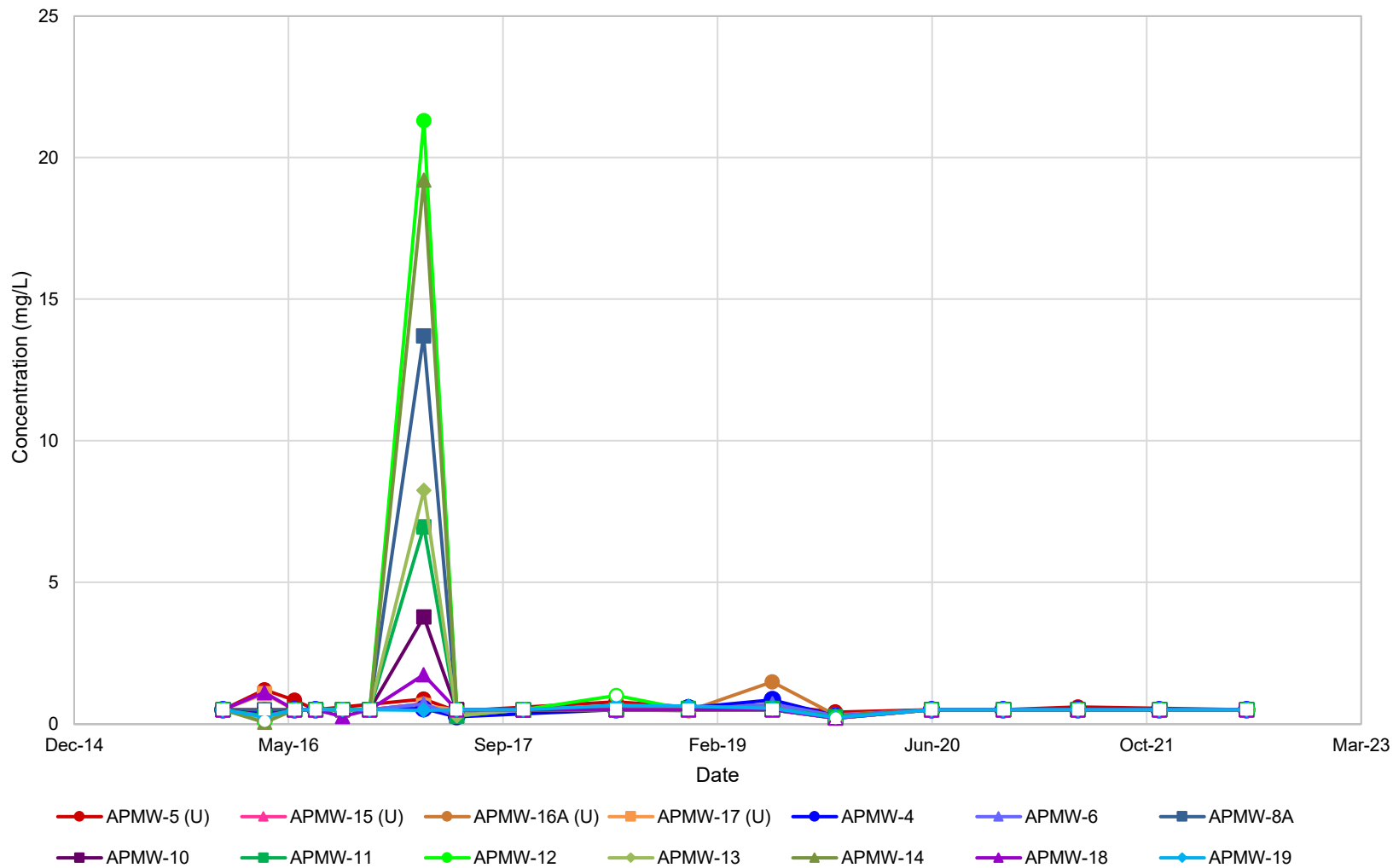
Nebraska Public Power District  
Gerald Gentleman Station

Denver, Colorado, USA

10/26/2022

31404512.000

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**Figure A-5**  
**Fluoride**

*Non-detect values are plotted with an open symbol at the practical quantitation limit.*

Nebraska Public Power District  
Gerald Gentleman Station

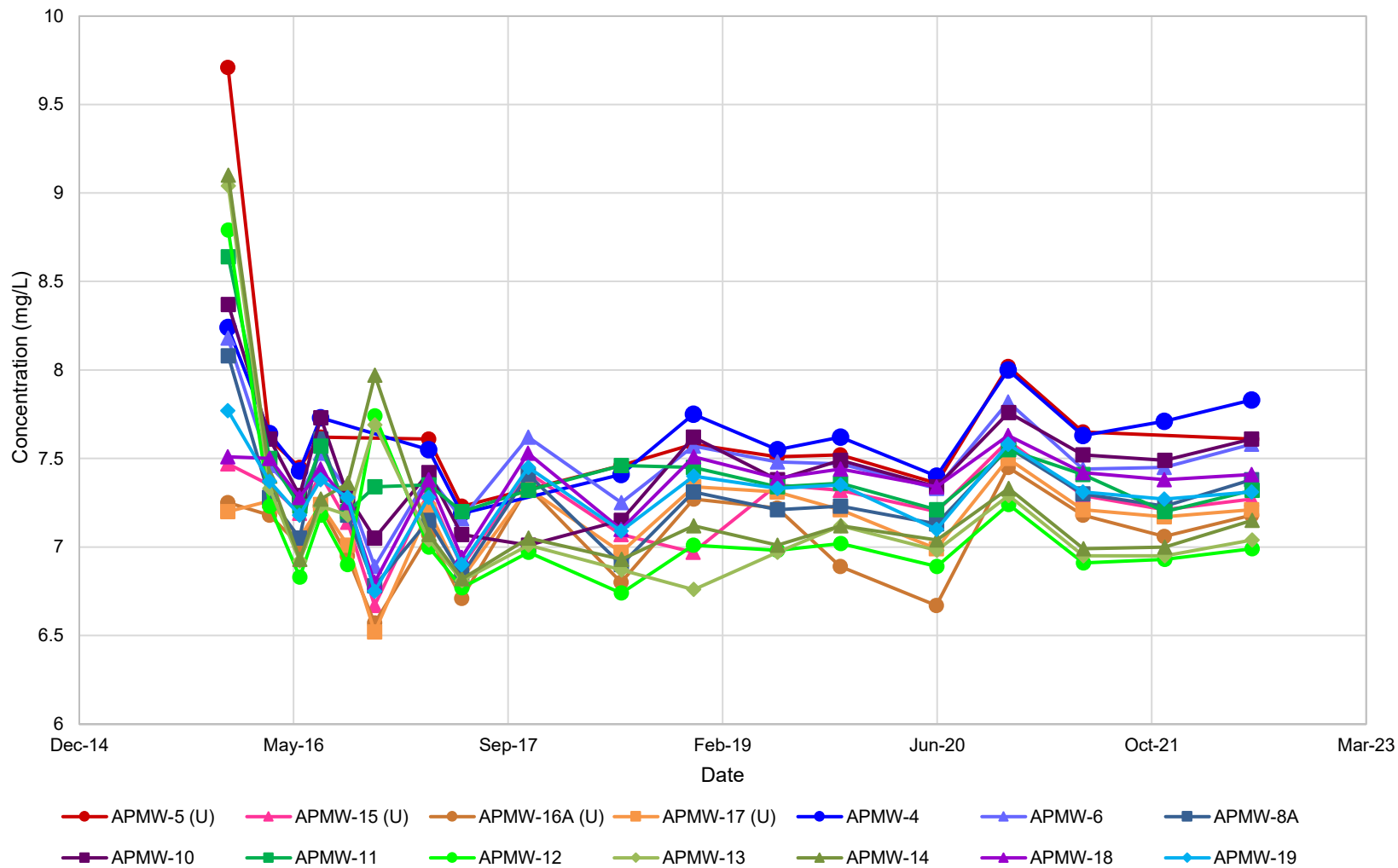
Denver, Colorado, USA

10/26/2022

31404512.000

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Non-detect values are plotted with an open symbol at the practical quantitation limit.

Figure A-6

pH, Field Measured

Nebraska Public Power District

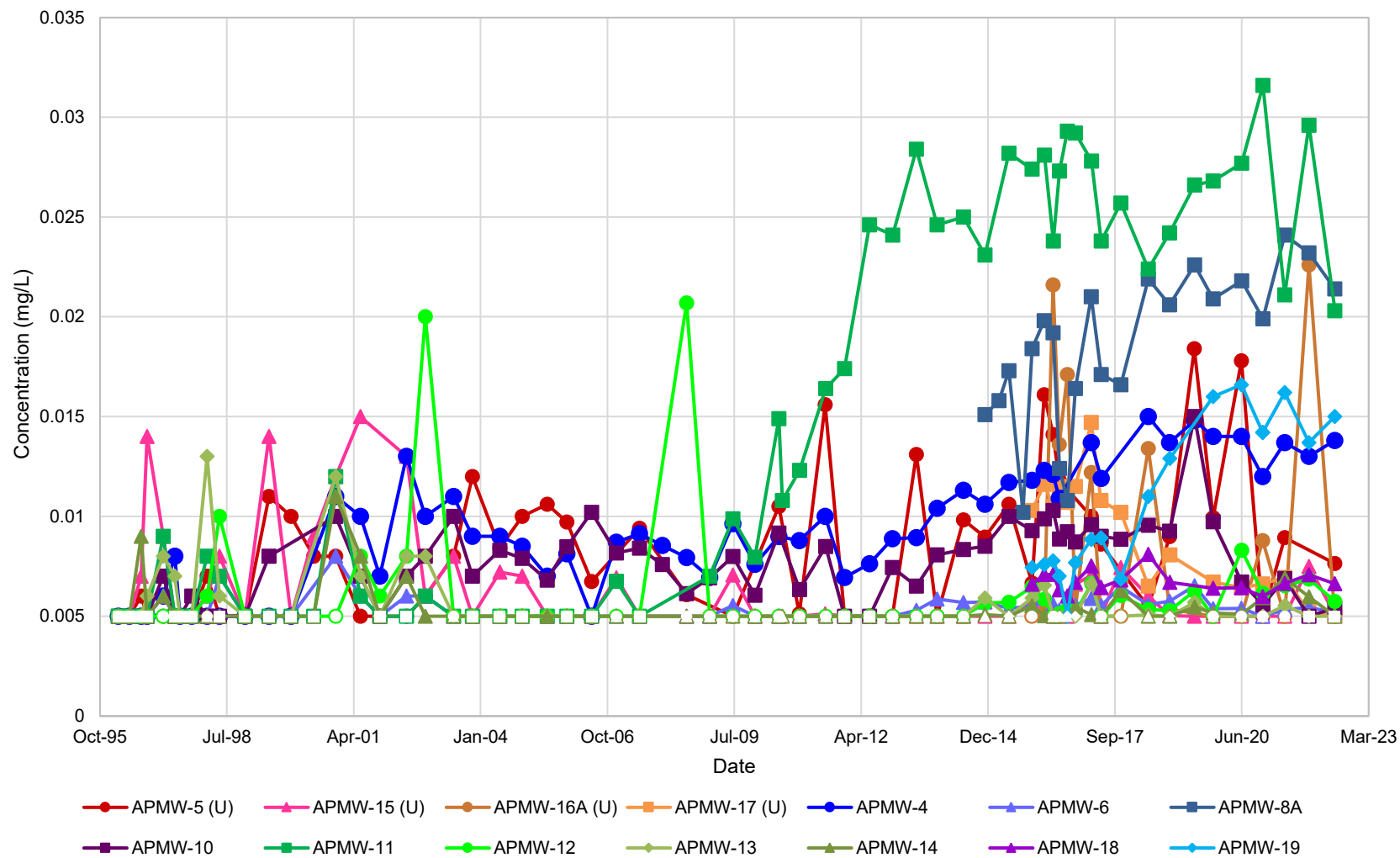
Gerald Gentleman Station

Denver, Colorado, USA

10/26/2022

31404512.000

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Non-detect values are plotted with an open symbol at the practical quantitation limit.

**Figure A-7**  
**Selenium**

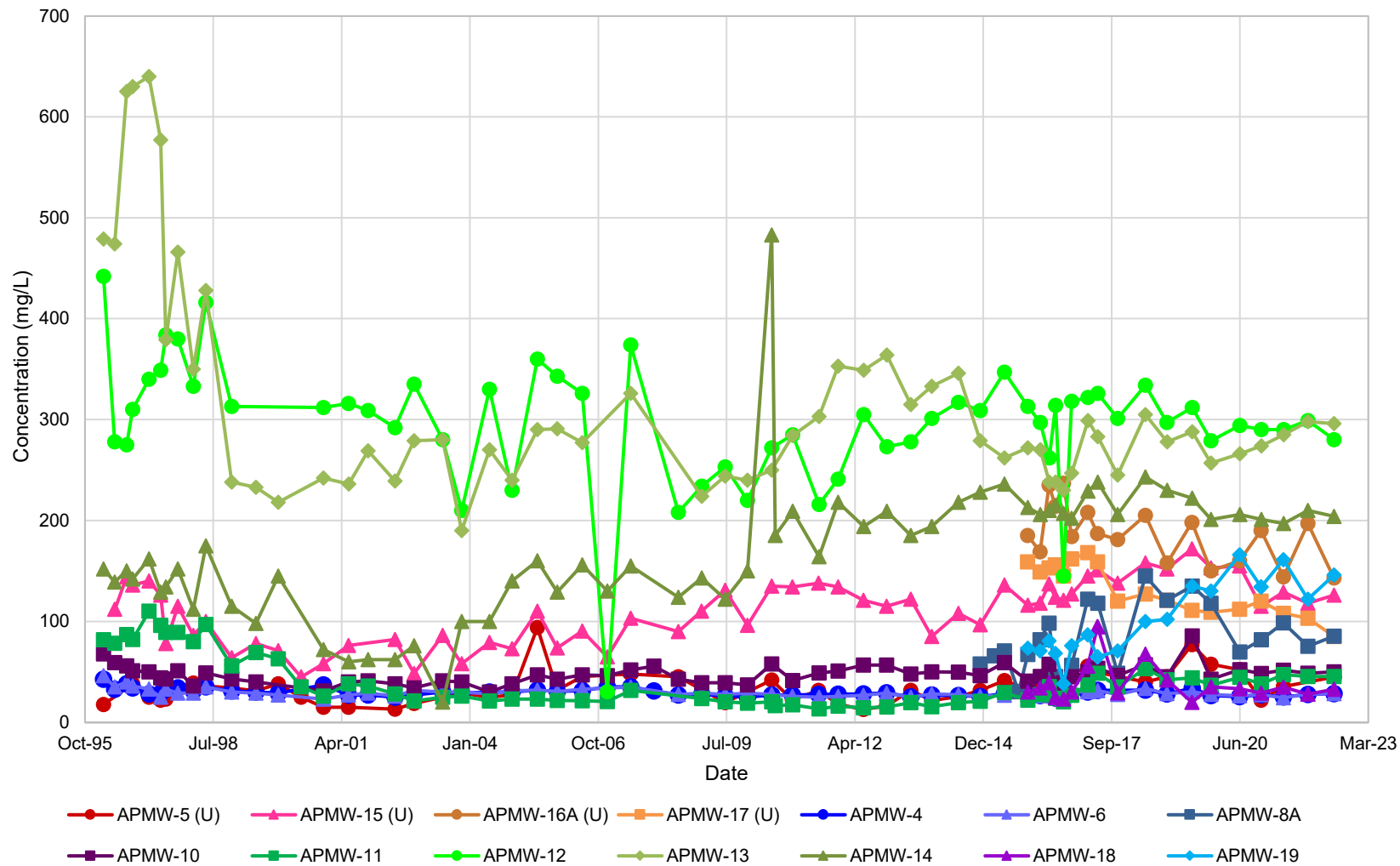
Nebraska Public Power District  
Gerald Gentleman Station

Denver, Colorado, USA

10/26/2022

31404512.000

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**Figure A-8**  
**Sulfate**

Nebraska Public Power District  
Gerald Gentleman Station

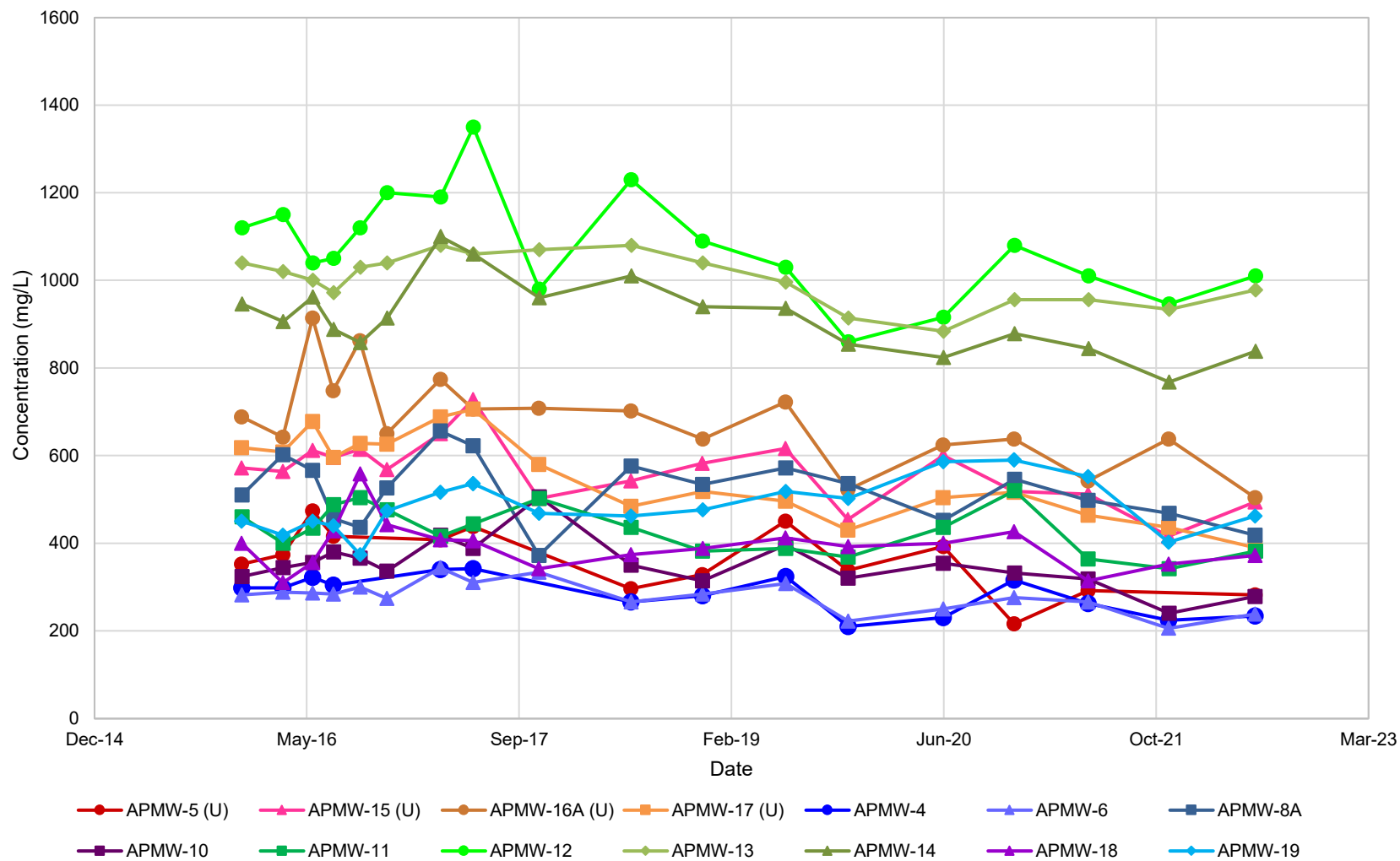
Non-detect values are plotted with an open symbol at the practical quantitation limit.

Denver, Colorado, USA

10/26/2022

31404512.000

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**Figure A-9**

**Total Dissolved Solids**

Nebraska Public Power District

Gerald Gentleman Station

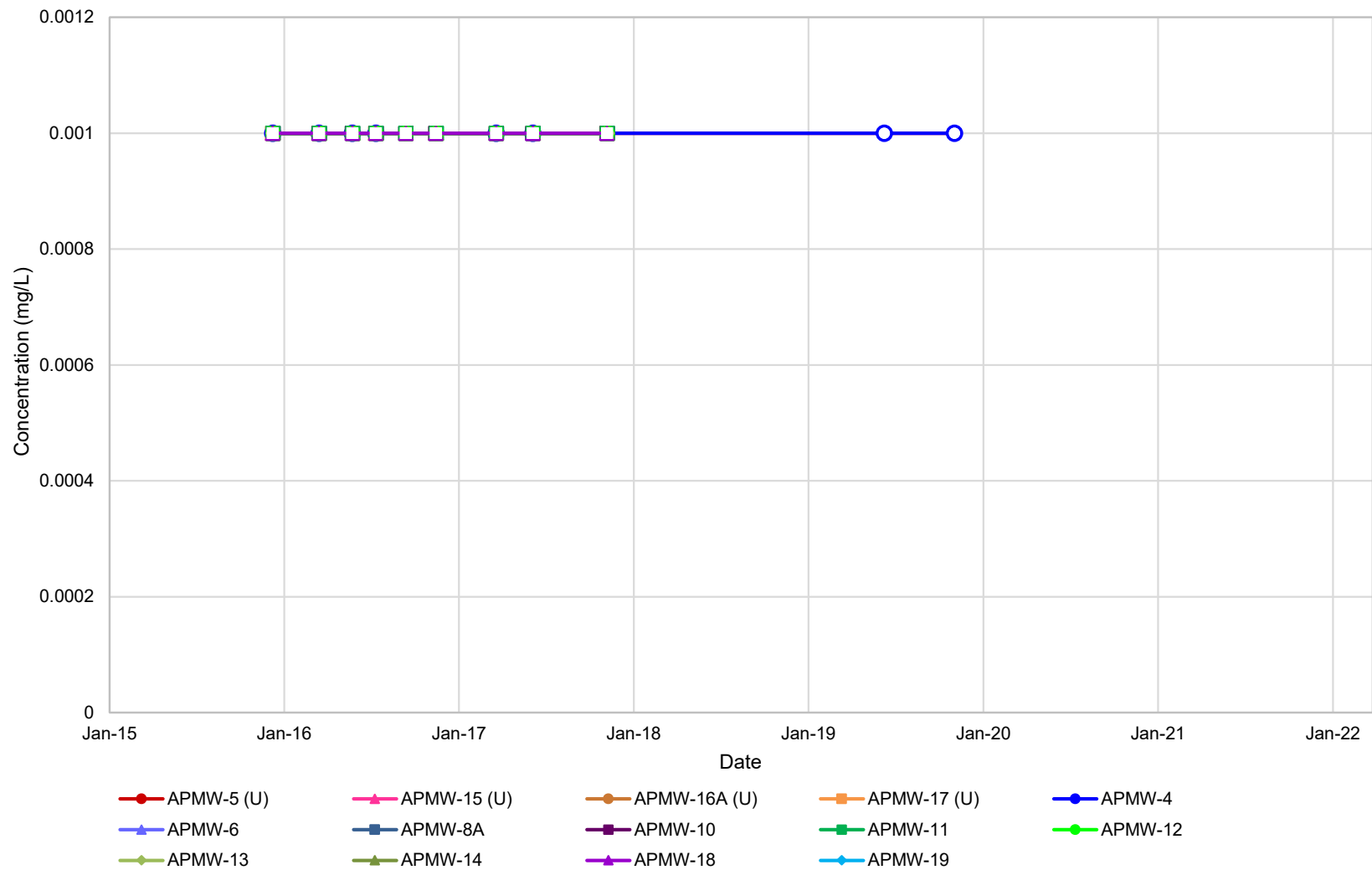
*Non-detect values are plotted with an open symbol at the practical quantitation limit.*

Denver, Colorado, USA

10/26/2022

31404512.000

**Golder Associates USA Inc., A Member of WSP**



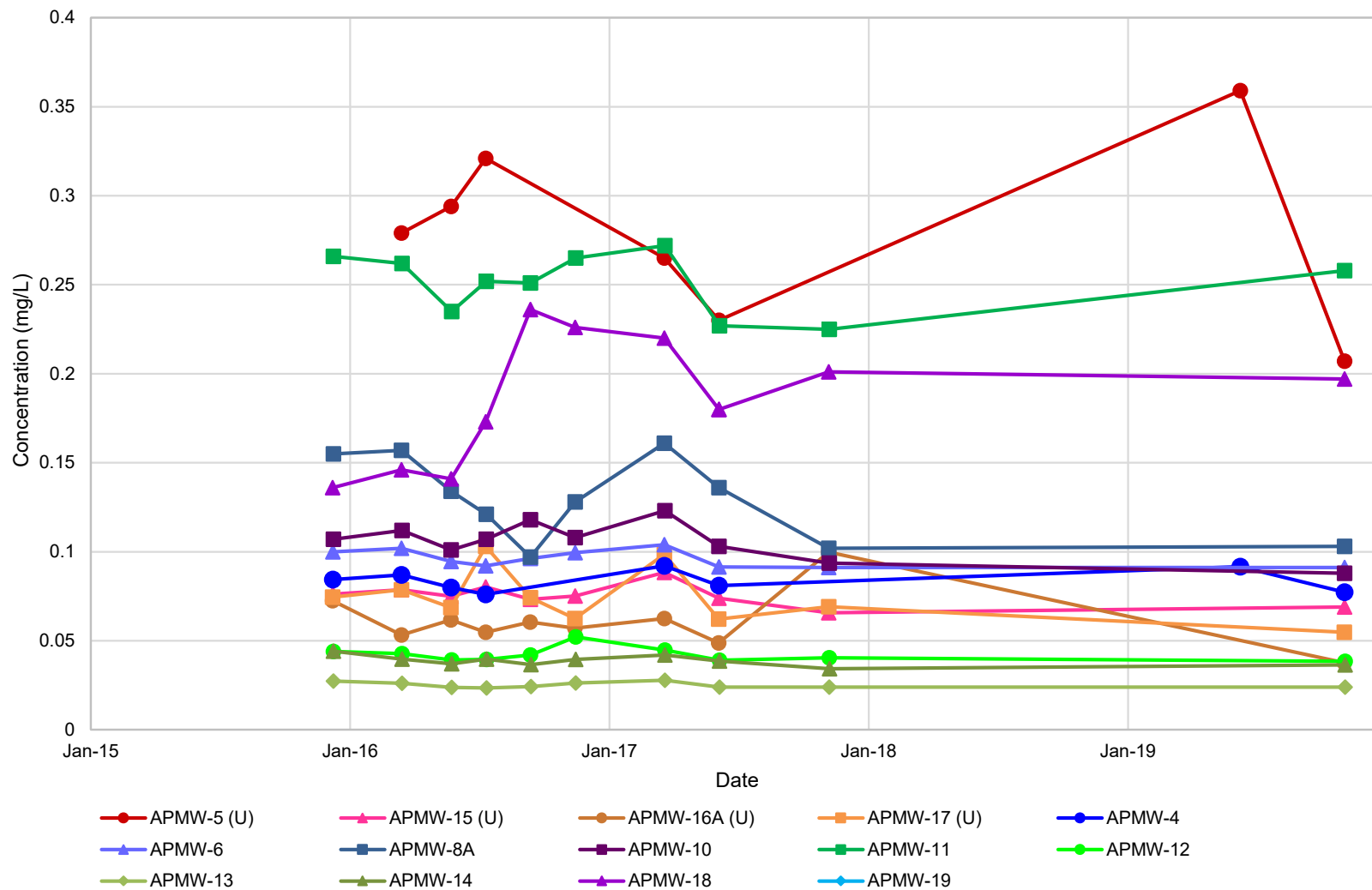
Non-detect values are plotted with an open symbol at the practical quantitation limit.

**Figure A-10**  
**Antimony**

Nebraska Public Power District  
Gerald Gentleman Station

Denver, Colorado, USA





**Figure A-11**  
**Barium**

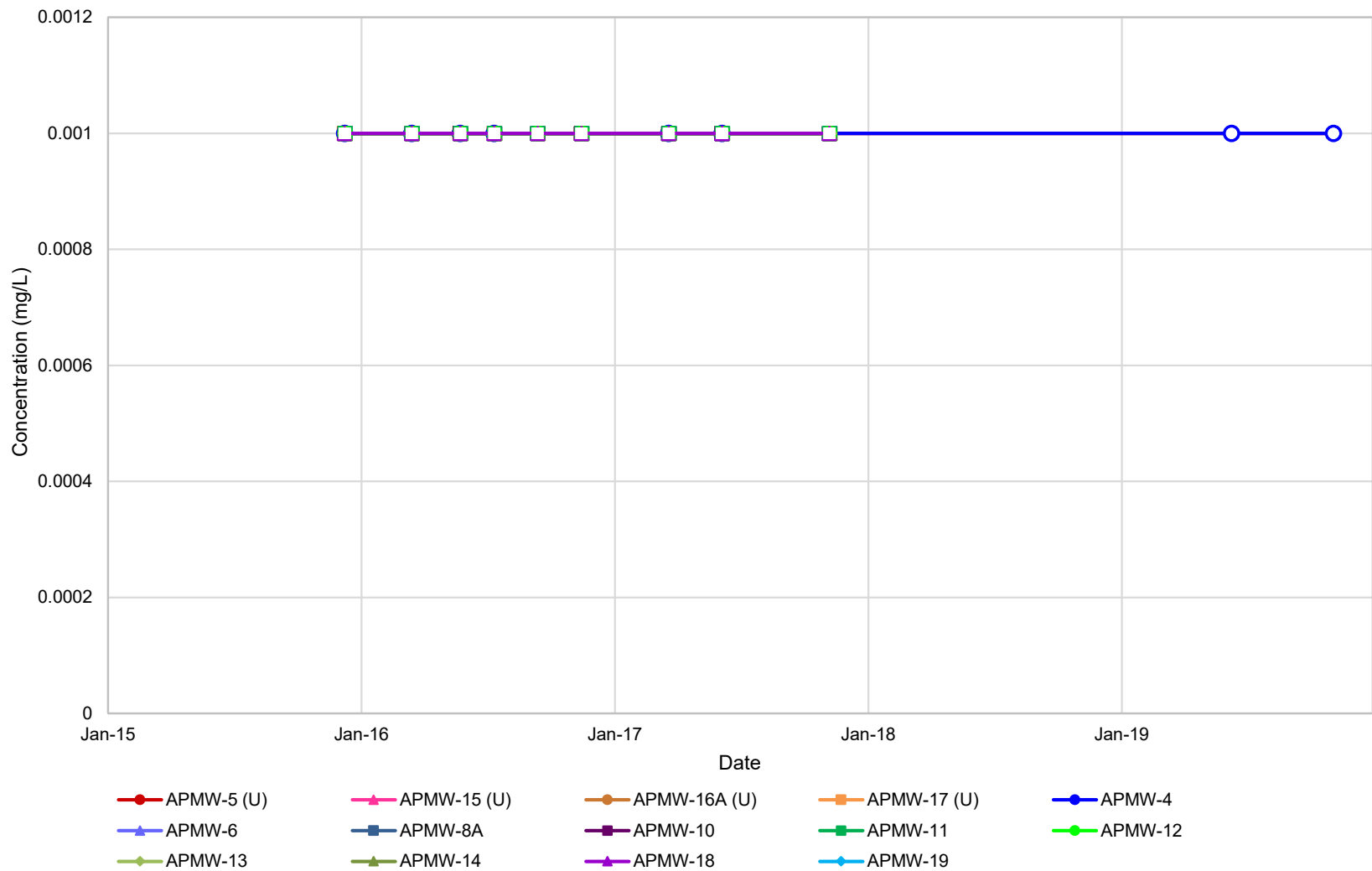
Nebraska Public Power District  
Gerald Gentleman Station

*Non-detect values are plotted with an open symbol at the practical quantitation limit.*

Denver, Colorado, USA

10/26/2022 31404512.000

**Golder Associates USA Inc., A Member of WSP**



Non-detect values are plotted with an open symbol at the practical quantitation limit.

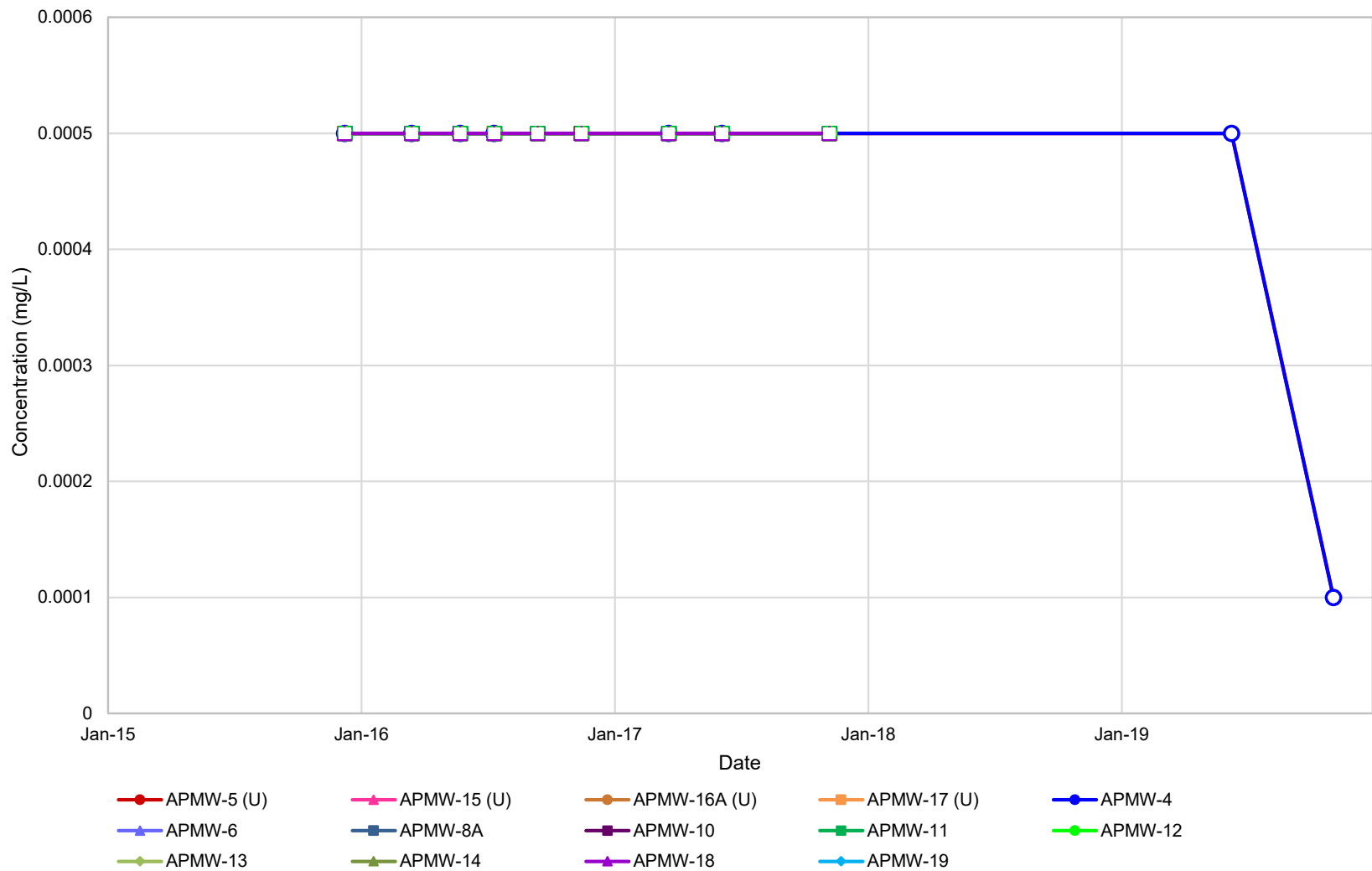
**Figure A-12**  
**Beryllium**

Nebraska Public Power District  
Gerald Gentleman Station

Denver, Colorado, USA

10/26/2022 31404512.000

**Golder Associates USA Inc., A Member of WSP**



Non-detect values are plotted with an open symbol at the practical quantitation limit.

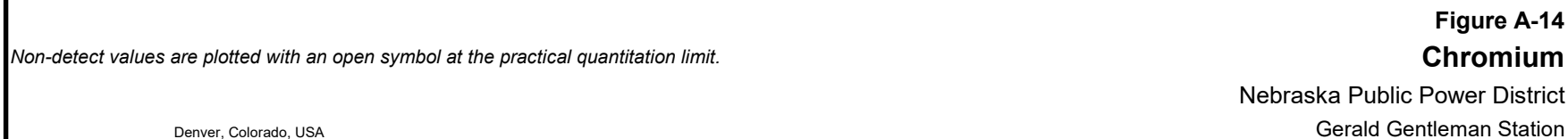
**Figure A-13**  
**Cadmium**

Nebraska Public Power District  
Gerald Gentleman Station

Denver, Colorado, USA

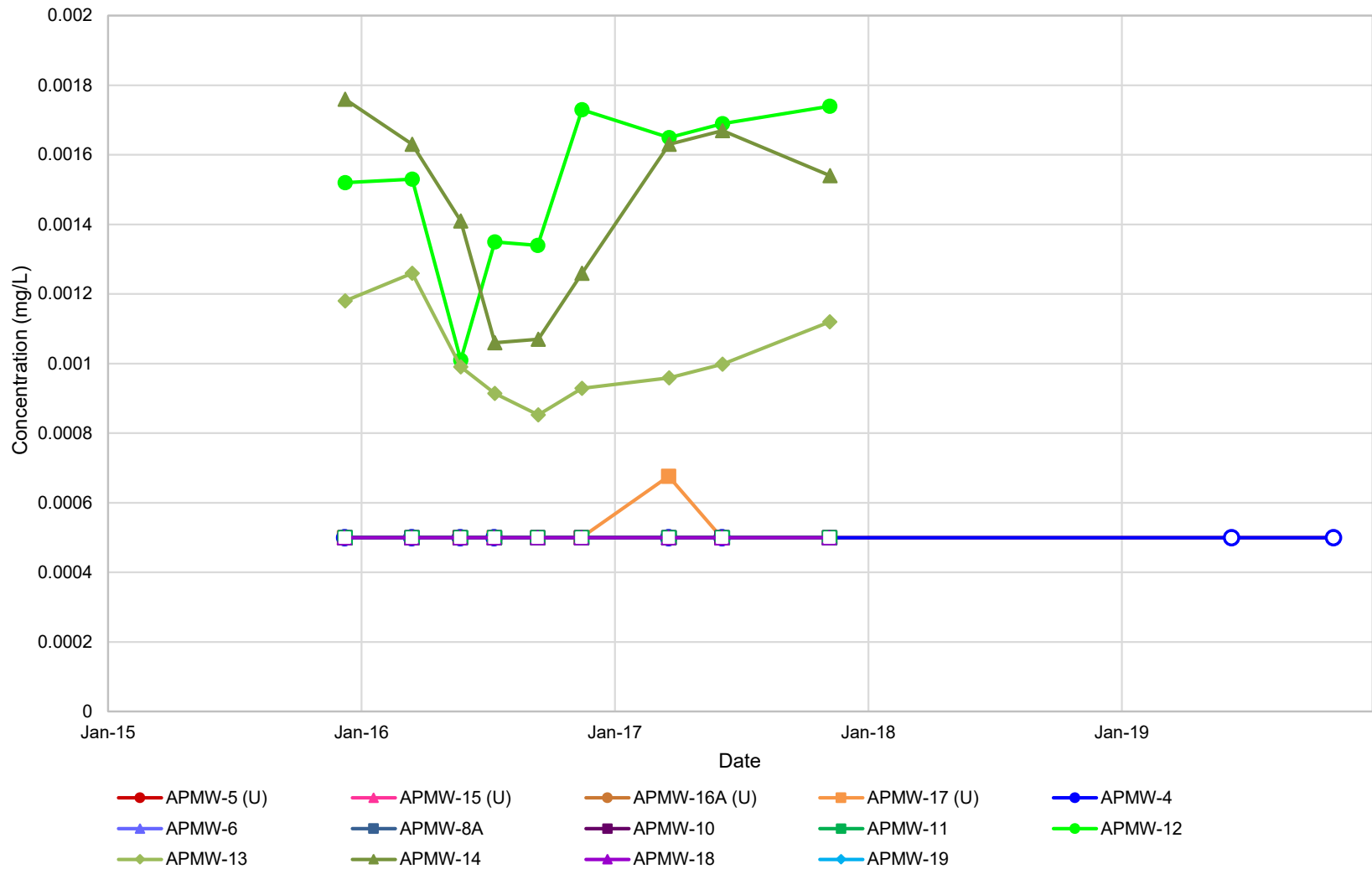
10/26/2022 31404512.000

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Nebraska Public Power District  
Gerald Gentleman Station

**Golder Associates USA Inc., A Member of WSP**



**Figure A-15**  
**Cobalt**

Nebraska Public Power District  
Gerald Gentleman Station

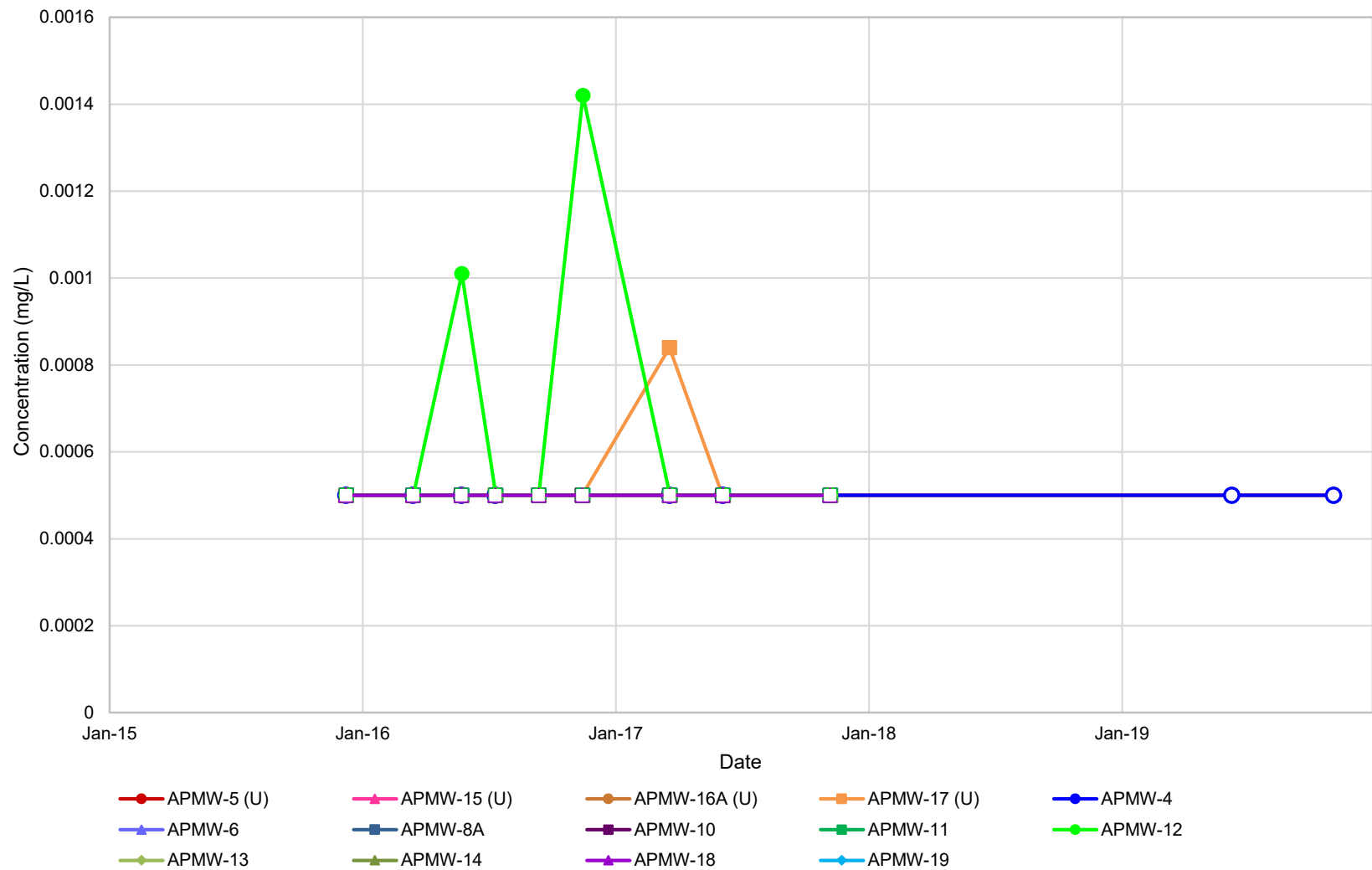
Non-detect values are plotted with an open symbol at the practical quantitation limit.

Denver, Colorado, USA

10/26/2022 31404512.000

**Golder Associates USA Inc., A Member of WSP**





**Figure A-16**

**Lead**

Nebraska Public Power District

Gerald Gentleman Station

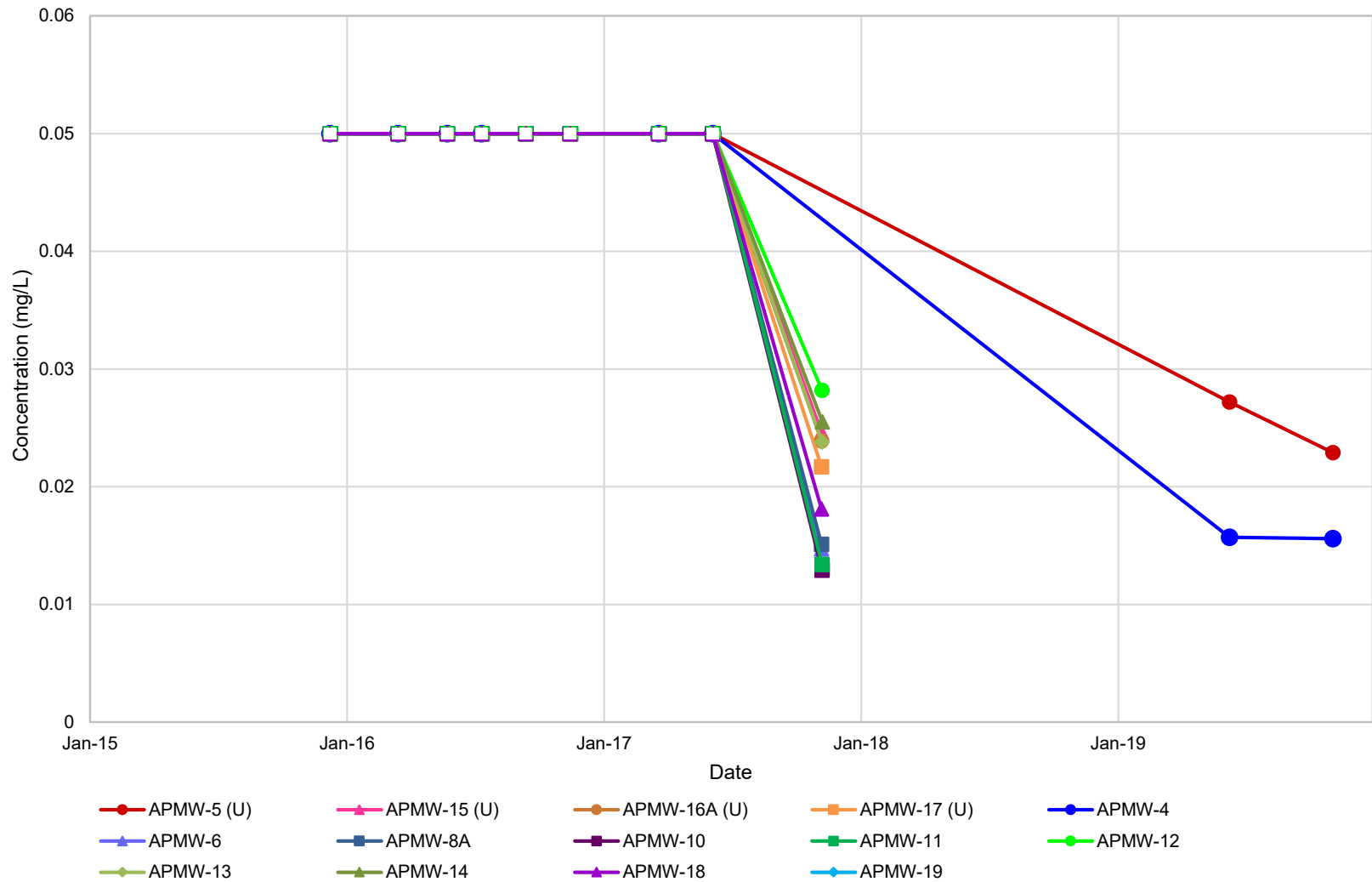
*Non-detect values are plotted with an open symbol at the practical quantitation limit.*

Denver, Colorado, USA

10/26/2022

31404512.000

**Golder Associates USA Inc., A Member of WSP**



**Figure A-17**  
**Lithium**

Nebraska Public Power District  
Gerald Gentleman Station

Non-detect values are plotted with an open symbol at the practical quantitation limit.

Denver, Colorado, USA

10/26/2022 31404512.000

**Golder Associates USA Inc., A Member of WSP**

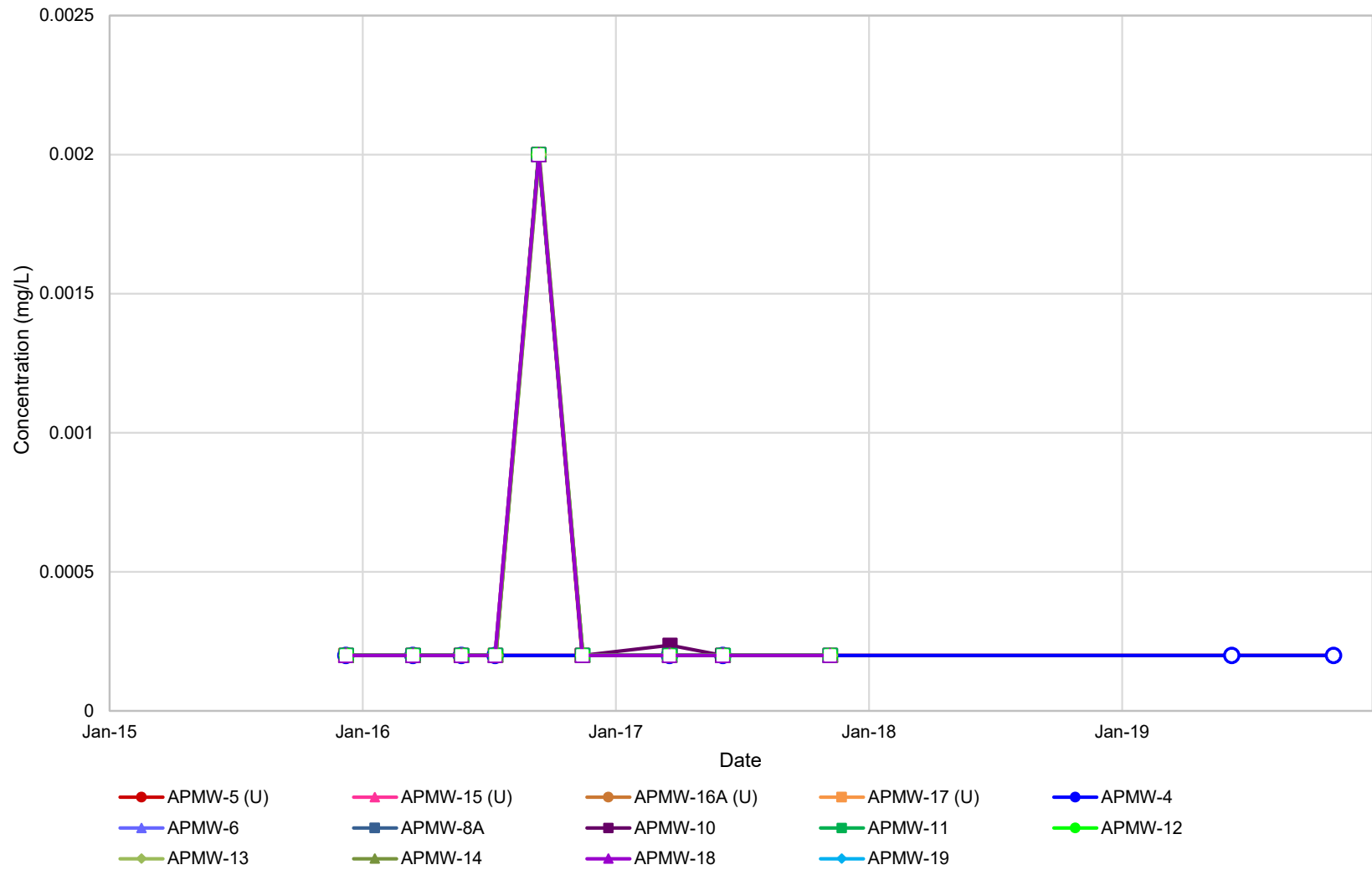


Figure A-18

Mercury

Nebraska Public Power District

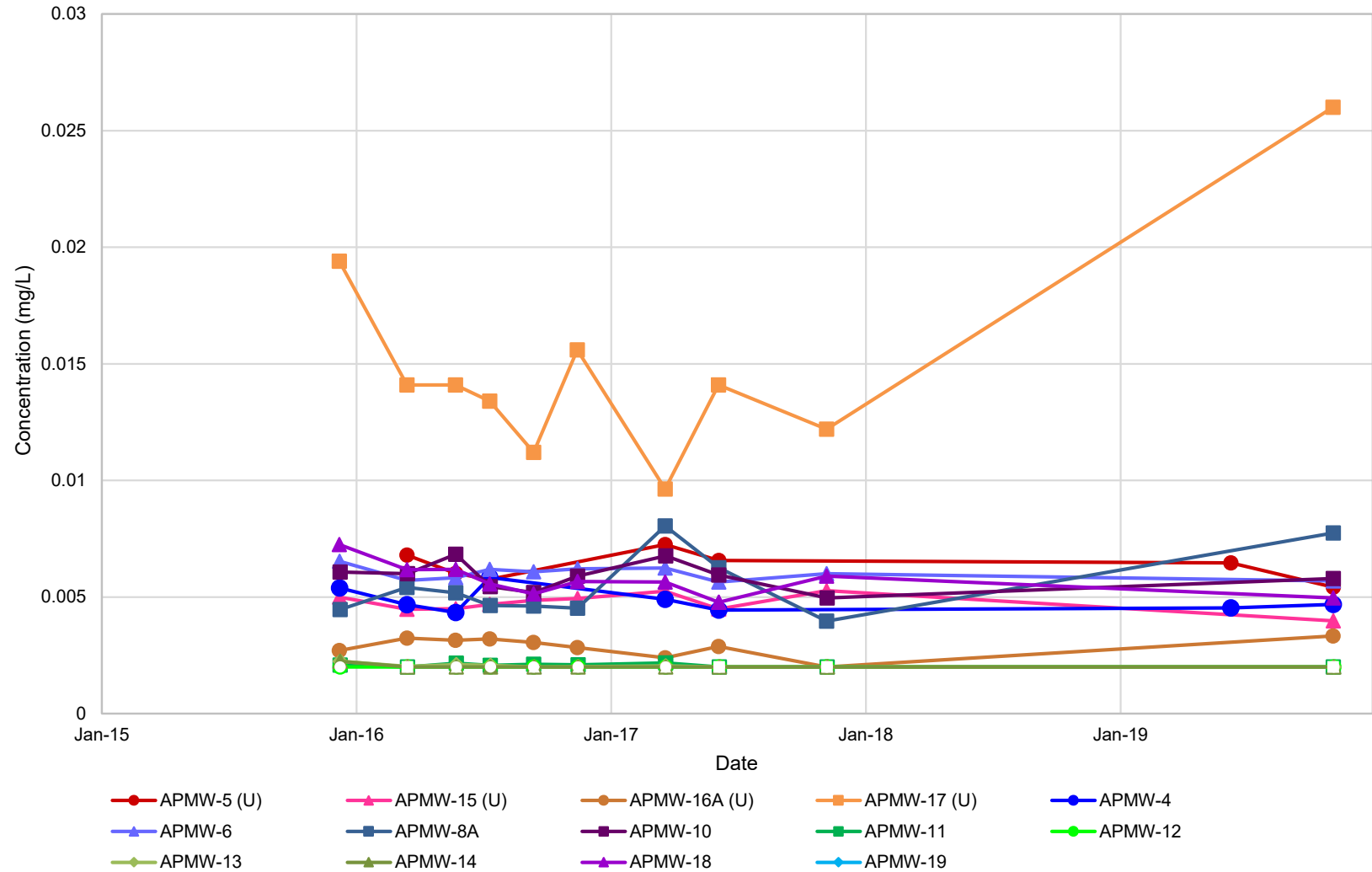
Gerald Gentleman Station

Non-detect values are plotted with an open symbol at the practical quantitation limit.

Denver, Colorado, USA

10/26/2022 31404512.000

Golder Associates USA Inc., A Member of WSP



Non-detect values are plotted with an open symbol at the practical quantitation limit.

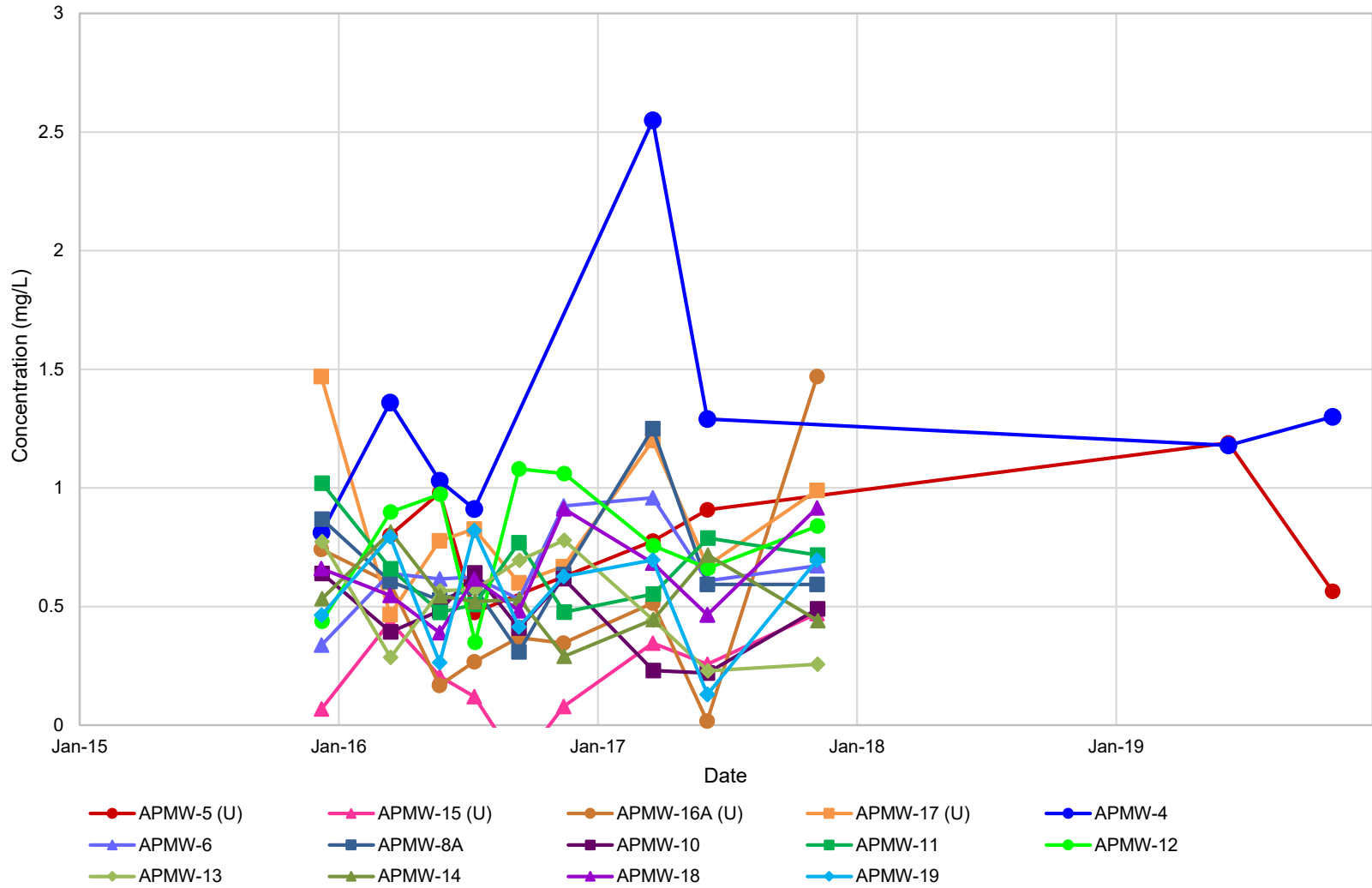
**Figure A-19**  
**Molybdenum**

Nebraska Public Power District  
Gerald Gentleman Station

Denver, Colorado, USA

10/26/2022 31404512.000

**Golder Associates USA Inc., A Member of WSP**



Non-detect values are plotted with an open symbol at the practical quantitation limit.

Figure A-20

**Radium, Total**

Nebraska Public Power District

Gerald Gentleman Station

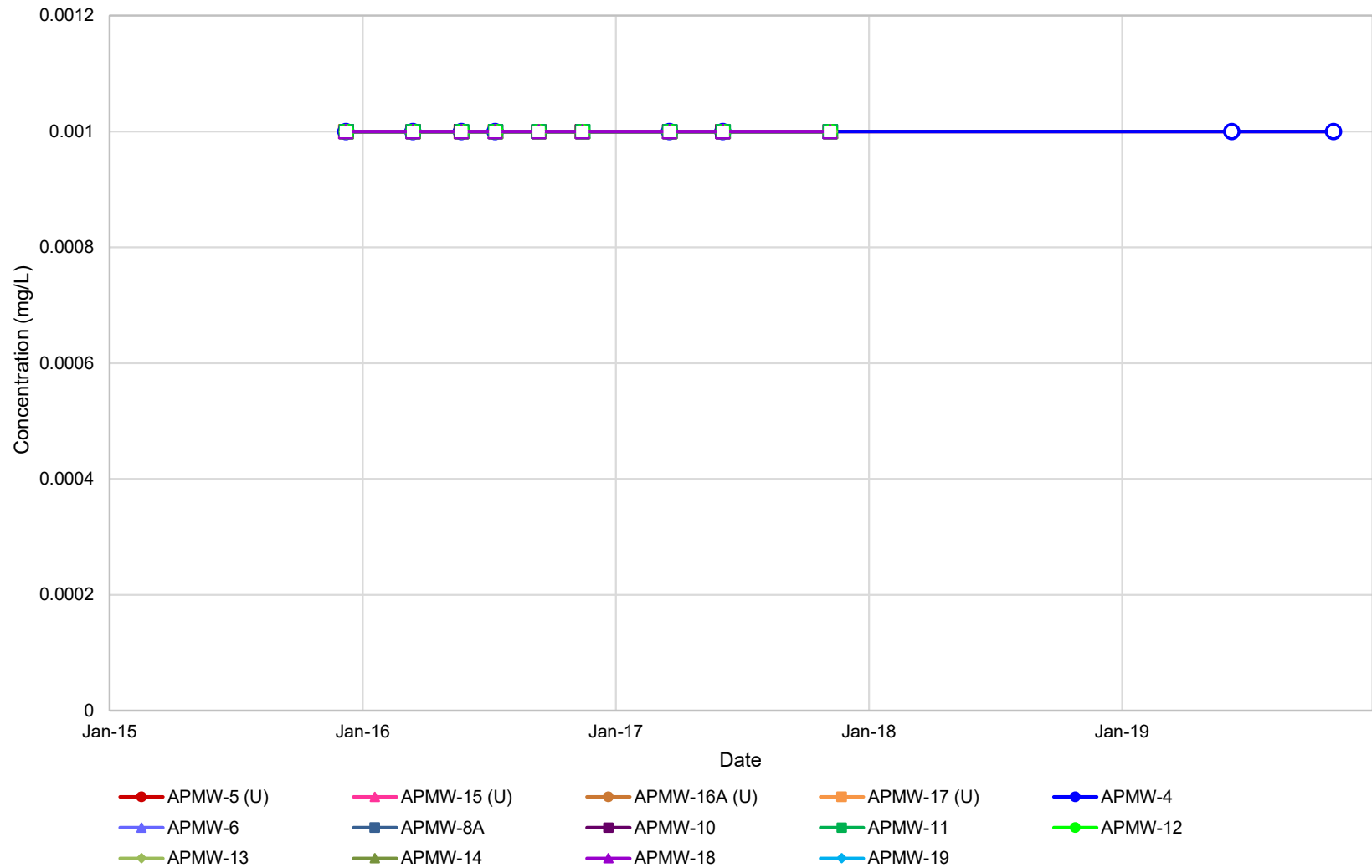
Denver, Colorado, USA

10/26/2022

31404512.000

**Golder Associates USA Inc., A Member of WSP**





**Figure A-21**  
**Thallium**

Nebraska Public Power District  
Gerald Gentleman Station

*Non-detect values are plotted with an open symbol at the practical quantitation limit.*

Denver, Colorado, USA

10/26/2022 31404512.000

**Golder Associates USA Inc., A Member of WSP**

**APPENDIX B**

**Eurofins Laboratory Report for  
Irrigation Water Samples**

## ANALYTICAL REPORT

Eurofins Cedar Falls  
3019 Venture Way  
Cedar Falls, IA 50613  
Tel: (319)277-2401

Laboratory Job ID: 310-237917-1  
Client Project/Site: Irrigation Runoff

For:  
Nebraska Public Power District  
6089 S Hwy 25  
Gerald Gentleman Station South  
Sutherland, Nebraska 69165

Attn: Doug Harris



Authorized for release by:  
8/24/2022 3:50:48 PM  
Brian Graettinger, Lab Director  
(319)595-2012  
[Brian.Graettinger@et.eurofinsus.com](mailto:Brian.Graettinger@et.eurofinsus.com)

Designee for  
Shirley Thompson, Client Service Manager  
(319)277-2401  
[Shirley.Thompson@et.eurofinsus.com](mailto:Shirley.Thompson@et.eurofinsus.com)

### LINKS

Review your project  
results through



Have a Question?



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[www.eurofinsus.com/Env](http://www.eurofinsus.com/Env)

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.



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# Case Narrative

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

**Job ID: 310-237917-1**

**Laboratory: Eurofins Cedar Falls**

## Narrative

### Job Narrative 310-237917-1

## Comments

No additional comments.

## Receipt

The samples were received on 8/12/2022 8:35 AM. Unless otherwise noted below, the samples arrived in good condition, and where required, properly preserved and on ice. The temperature of the cooler at receipt was -1.6° C.

## HPLC/IC

Method 9056A: The following samples were diluted due to the nature of the sample matrix: Road Track (310-237917-1) and Pivot Bucket (310-237917-2). Elevated reporting limits (RLs) are provided.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

## Metals

Method 6020A: Due to sample matrix effect on the internal standard (ISTD), a dilution was required for the following sample: Road Track (310-237917-1).

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

## General Chemistry

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

## Sample Summary

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
310-237917-1	Road Track	Water	08/11/22 11:00	08/12/22 08:35
310-237917-2	Pivot Bucket	Water	08/11/22 11:05	08/12/22 08:35

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## Detection Summary

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

### Client Sample ID: Road Track

Lab Sample ID: 310-237917-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chloride	31.5		5.00		mg/L	5		9056A	Total/NA
Sulfate	61.7		5.00		mg/L	5		9056A	Total/NA
Barium	0.0228		0.00200		mg/L	1		6020A	Total/NA
Boron	0.166	+	0.100		mg/L	1		6020A	Total/NA
Calcium	71.7		2.00		mg/L	4		6020A	Total/NA
Lithium	0.0464		0.0100		mg/L	1		6020A	Total/NA
Magnesium	16.8		2.00		mg/L	4		6020A	Total/NA
Potassium	8.28		0.500		mg/L	1		6020A	Total/NA
Sodium	28.2		1.00		mg/L	1		6020A	Total/NA
Total Kjeldahl Nitrogen	4.66		1.00		mg/L	1		351.2	Total/NA
Nitrate Nitrite as N	1.69		0.100		mg/L	1		353.2	Total/NA
Alkalinity as CaCO <sub>3</sub> to pH 4.5	356		25.0		mg/L	1		SM 2320B	Total/NA
pH	8.1	HF	0.1		SU	1		SM 4500 H+ B	Total/NA

### Client Sample ID: Pivot Bucket

Lab Sample ID: 310-237917-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chloride	34.1		5.00		mg/L	5		9056A	Total/NA
Sulfate	82.8		5.00		mg/L	5		9056A	Total/NA
Barium	0.377		0.00200		mg/L	1		6020A	Total/NA
Calcium	156		0.500		mg/L	1		6020A	Total/NA
Cobalt	0.000798		0.000500		mg/L	1		6020A	Total/NA
Lithium	0.0108		0.0100		mg/L	1		6020A	Total/NA
Magnesium	45.0		0.500		mg/L	1		6020A	Total/NA
Molybdenum	0.00401		0.00200		mg/L	1		6020A	Total/NA
Potassium	8.65		0.500		mg/L	1		6020A	Total/NA
Sodium	86.7		1.00		mg/L	1		6020A	Total/NA
Ammonia as N	0.690		0.500		mg/L	1		350.1	Total/NA
Total Kjeldahl Nitrogen	3.74		1.00		mg/L	1		351.2	Total/NA
Nitrate Nitrite as N	3.89		0.100		mg/L	1		353.2	Total/NA
Alkalinity as CaCO <sub>3</sub> to pH 4.5	209		10.0		mg/L	1		SM 2320B	Total/NA
pH	8.2	HF	0.1		SU	1		SM 4500 H+ B	Total/NA

This Detection Summary does not include radiochemical test results.

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# Client Sample Results

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

Client Sample ID: Road Track

Lab Sample ID: 310-237917-1

Date Collected: 08/11/22 11:00

Matrix: Water

Date Received: 08/12/22 08:35

## Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	31.5		5.00		mg/L			08/22/22 15:34	5
Fluoride	<0.500		0.500		mg/L			08/22/22 15:34	5
Sulfate	61.7		5.00		mg/L			08/22/22 15:34	5

## Method: 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	<0.00200		0.00200		mg/L		08/16/22 08:30	08/18/22 17:47	1
Arsenic	<0.00200		0.00200		mg/L		08/16/22 08:30	08/18/22 17:47	1
Barium	0.0228		0.00200		mg/L		08/16/22 08:30	08/18/22 17:47	1
Beryllium	<0.00400		0.00400		mg/L		08/16/22 08:30	08/19/22 16:31	4
Boron	0.166	*+	0.100		mg/L		08/16/22 08:30	08/18/22 17:47	1
Cadmium	<0.000100		0.000100		mg/L		08/16/22 08:30	08/18/22 17:47	1
Calcium	71.7		2.00		mg/L		08/16/22 08:30	08/19/22 16:31	4
Chromium	<0.00500		0.00500		mg/L		08/16/22 08:30	08/18/22 17:47	1
Cobalt	<0.000500		0.000500		mg/L		08/16/22 08:30	08/18/22 17:47	1
Lead	<0.000500		0.000500		mg/L		08/16/22 08:30	08/18/22 17:47	1
Lithium	0.0464		0.0100		mg/L		08/16/22 08:30	08/18/22 17:47	1
Magnesium	16.8		2.00		mg/L		08/16/22 08:30	08/19/22 16:31	4
Molybdenum	<0.00200		0.00200		mg/L		08/16/22 08:30	08/18/22 17:47	1
Potassium	8.28		0.500		mg/L		08/16/22 08:30	08/18/22 17:47	1
Selenium	<0.00500		0.00500		mg/L		08/16/22 08:30	08/18/22 17:47	1
Sodium	28.2		1.00		mg/L		08/16/22 08:30	08/18/22 17:47	1
Thallium	<0.00100		0.00100		mg/L		08/16/22 08:30	08/18/22 17:47	1

## Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.000200		0.000200		mg/L		08/22/22 14:34	08/23/22 12:41	1

## General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ammonia as N	<0.500		0.500		mg/L		08/18/22 09:51	08/18/22 20:31	1
Total Kjeldahl Nitrogen	4.66		1.00		mg/L		08/17/22 07:00	08/17/22 19:01	1
Nitrate Nitrite as N	1.69		0.100		mg/L			08/16/22 20:12	1
Alkalinity as CaCO3 to pH 4.5	356		25.0		mg/L			08/15/22 08:30	1
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	8.1	HF	0.1		SU			08/12/22 15:15	1

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# Client Sample Results

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

Client Sample ID: Pivot Bucket

Lab Sample ID: 310-237917-2

Date Collected: 08/11/22 11:05

Matrix: Water

Date Received: 08/12/22 08:35

## Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	34.1		5.00		mg/L			08/22/22 15:49	5
Fluoride	<0.500		0.500		mg/L			08/22/22 15:49	5
Sulfate	82.8		5.00		mg/L			08/22/22 15:49	5

## Method: 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	<0.00200		0.00200		mg/L		08/16/22 08:30	08/18/22 18:03	1
Arsenic	<0.00200		0.00200		mg/L		08/16/22 08:30	08/18/22 18:03	1
Barium	0.377		0.00200		mg/L		08/16/22 08:30	08/18/22 18:03	1
Beryllium	<0.00100		0.00100		mg/L		08/16/22 08:30	08/19/22 16:34	1
Boron	<0.100	+	0.100		mg/L		08/16/22 08:30	08/18/22 18:03	1
Cadmium	<0.000100		0.000100		mg/L		08/16/22 08:30	08/18/22 18:03	1
Calcium	156		0.500		mg/L		08/16/22 08:30	08/18/22 18:03	1
Chromium	<0.00500		0.00500		mg/L		08/16/22 08:30	08/18/22 18:03	1
Cobalt	0.000798		0.000500		mg/L		08/16/22 08:30	08/18/22 18:03	1
Lead	<0.000500		0.000500		mg/L		08/16/22 08:30	08/18/22 18:03	1
Lithium	0.0108		0.0100		mg/L		08/16/22 08:30	08/18/22 18:03	1
Magnesium	45.0		0.500		mg/L		08/16/22 08:30	08/18/22 18:03	1
Molybdenum	0.00401		0.00200		mg/L		08/16/22 08:30	08/18/22 18:03	1
Potassium	8.65		0.500		mg/L		08/16/22 08:30	08/18/22 18:03	1
Selenium	<0.00500		0.00500		mg/L		08/16/22 08:30	08/18/22 18:03	1
Sodium	86.7		1.00		mg/L		08/16/22 08:30	08/18/22 18:03	1
Thallium	<0.00100		0.00100		mg/L		08/16/22 08:30	08/18/22 18:03	1

## Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.000200		0.000200		mg/L		08/22/22 14:38	08/23/22 12:48	1

## General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ammonia as N	0.690		0.500		mg/L		08/18/22 09:51	08/18/22 20:32	1
Total Kjeldahl Nitrogen	3.74		1.00		mg/L		08/17/22 07:00	08/17/22 19:02	1
Nitrate Nitrite as N	3.89		0.100		mg/L			08/16/22 20:13	1
Alkalinity as CaCO3 to pH 4.5	209		10.0		mg/L			08/15/22 08:30	1
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	8.2	HF	0.1		SU			08/12/22 15:21	1

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## Definitions/Glossary

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

### Qualifiers

#### Metals

Qualifier	Qualifier Description
*+	LCS and/or LCSD is outside acceptance limits, high biased.

#### General Chemistry

Qualifier	Qualifier Description
HF	Field parameter with a holding time of 15 minutes. Test performed by laboratory at client's request.

### Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
□	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

# QC Sample Results

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

## Method: 9056A - Anions, Ion Chromatography

Lab Sample ID: MB 310-363601/3

Matrix: Water

Analysis Batch: 363601

Client Sample ID: Method Blank

Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	<1.00		1.00		mg/L			08/22/22 10:23	1
Fluoride	<0.100		0.100		mg/L			08/22/22 10:23	1
Sulfate	<1.00		1.00		mg/L			08/22/22 10:23	1

Lab Sample ID: LCS 310-363601/4

Matrix: Water

Analysis Batch: 363601

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Chloride	10.0	10.06		mg/L		101	90 - 110
Fluoride	2.00	2.035		mg/L		102	90 - 110
Sulfate	10.0	10.08		mg/L		101	90 - 110

## Method: 6020A - Metals (ICP/MS)

Lab Sample ID: MB 310-362614/1-A

Matrix: Water

Analysis Batch: 362935

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 362614

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	<0.00200		0.00200		mg/L		08/16/22 08:30	08/17/22 14:51	1
Arsenic	<0.00200		0.00200		mg/L		08/16/22 08:30	08/17/22 14:51	1
Barium	<0.00200		0.00200		mg/L		08/16/22 08:30	08/17/22 14:51	1
Beryllium	<0.00100		0.00100		mg/L		08/16/22 08:30	08/17/22 14:51	1
Boron	<0.100		0.100		mg/L		08/16/22 08:30	08/17/22 14:51	1
Cadmium	<0.000100		0.000100		mg/L		08/16/22 08:30	08/17/22 14:51	1
Calcium	<0.500		0.500		mg/L		08/16/22 08:30	08/17/22 14:51	1
Chromium	<0.00500		0.00500		mg/L		08/16/22 08:30	08/17/22 14:51	1
Cobalt	<0.000500		0.000500		mg/L		08/16/22 08:30	08/17/22 14:51	1
Lead	<0.000500		0.000500		mg/L		08/16/22 08:30	08/17/22 14:51	1
Magnesium	<0.500		0.500		mg/L		08/16/22 08:30	08/17/22 14:51	1
Molybdenum	<0.00200		0.00200		mg/L		08/16/22 08:30	08/17/22 14:51	1
Potassium	<0.500		0.500		mg/L		08/16/22 08:30	08/17/22 14:51	1
Selenium	<0.00500		0.00500		mg/L		08/16/22 08:30	08/17/22 14:51	1
Sodium	<1.00		1.00		mg/L		08/16/22 08:30	08/17/22 14:51	1
Thallium	<0.00100		0.00100		mg/L		08/16/22 08:30	08/17/22 14:51	1

Lab Sample ID: MB 310-362614/1-A

Matrix: Water

Analysis Batch: 363247

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 362614

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	<0.0100		0.0100		mg/L		08/16/22 08:30	08/19/22 16:24	1

Lab Sample ID: LCS 310-362614/2-A

Matrix: Water

Analysis Batch: 362935

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 362614

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Antimony	0.200	0.2356		mg/L		118	80 - 120

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# QC Sample Results

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

## Method: 6020A - Metals (ICP/MS) (Continued)

Lab Sample ID: LCS 310-362614/2-A

Matrix: Water

Analysis Batch: 362935

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 362614

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	0.200	0.2068		mg/L		103	80 - 120
Barium	0.100	0.1131		mg/L		113	80 - 120
Beryllium	0.100	0.1097		mg/L		110	80 - 120
Cadmium	0.100	0.1050		mg/L		105	80 - 120
Calcium	2.00	1.612		mg/L		81	80 - 120
Chromium	0.100	0.1047		mg/L		105	80 - 120
Cobalt	0.100	0.1036		mg/L		104	80 - 120
Lead	0.200	0.2116		mg/L		106	80 - 120
Magnesium	2.00	2.050		mg/L		102	80 - 120
Molybdenum	0.200	0.2236		mg/L		112	80 - 120
Potassium	2.00	2.059		mg/L		103	80 - 120
Selenium	0.400	0.3907		mg/L		98	80 - 120
Sodium	2.00	2.207		mg/L		110	80 - 120
Thallium	0.200	0.2293		mg/L		115	80 - 120

Lab Sample ID: LCS 310-362614/2-A

Matrix: Water

Analysis Batch: 363247

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 362614

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Lithium	0.200	0.2192		mg/L		110	80 - 120

Lab Sample ID: LCS 310-362614/2-A

Matrix: Water

Analysis Batch: 363273

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 362614

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Boron	0.200	0.2190		mg/L		109	80 - 120

## Method: 7470A - Mercury (CVAA)

Lab Sample ID: MB 310-363323/1-A

Matrix: Water

Analysis Batch: 363477

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 363323

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.000200		0.000200		mg/L		08/22/22 14:34	08/23/22 11:44	1

Lab Sample ID: LCS 310-363323/2-A

Matrix: Water

Analysis Batch: 363477

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 363323

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Mercury	0.00167	0.001689		mg/L		101	80 - 120

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# QC Sample Results

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

## Method: 7470A - Mercury (CVAA) (Continued)

Lab Sample ID: MB 310-363324/1-A  
Matrix: Water  
Analysis Batch: 363477

Client Sample ID: Method Blank  
Prep Type: Total/NA  
Prep Batch: 363324

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.000200		0.000200		mg/L		08/22/22 14:38	08/23/22 12:44	1

Lab Sample ID: LCS 310-363324/2-A  
Matrix: Water  
Analysis Batch: 363477

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA  
Prep Batch: 363324

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Mercury	0.00167	0.001697		mg/L		102	80 - 120

Lab Sample ID: 310-237917-2 MS  
Matrix: Water  
Analysis Batch: 363477

Client Sample ID: Pivot Bucket  
Prep Type: Total/NA  
Prep Batch: 363324

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Mercury	<0.000200		0.00167	0.001664		mg/L		100	80 - 120

Lab Sample ID: 310-237917-2 MSD  
Matrix: Water  
Analysis Batch: 363477

Client Sample ID: Pivot Bucket  
Prep Type: Total/NA  
Prep Batch: 363324

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Mercury	<0.000200		0.00167	0.001669		mg/L		100	80 - 120	0	20

## Method: 350.1 - Nitrogen, Ammonia

Lab Sample ID: MB 310-363012/1-A  
Matrix: Water  
Analysis Batch: 363102

Client Sample ID: Method Blank  
Prep Type: Total/NA  
Prep Batch: 363012

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ammonia as N	<0.500		0.500		mg/L		08/18/22 09:51	08/18/22 20:09	1

Lab Sample ID: LCS 310-363012/2-A  
Matrix: Water  
Analysis Batch: 363102

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA  
Prep Batch: 363012

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Ammonia as N	4.00	4.056		mg/L		101	90 - 110

## Method: 351.2 - Nitrogen, Total Kjeldahl

Lab Sample ID: MB 310-362810/1-A  
Matrix: Water  
Analysis Batch: 362944

Client Sample ID: Method Blank  
Prep Type: Total/NA  
Prep Batch: 362810

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Kjeldahl Nitrogen	<1.00		1.00		mg/L		08/17/22 07:00	08/17/22 18:34	1

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# QC Sample Results

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

## Method: 351.2 - Nitrogen, Total Kjeldahl (Continued)

Lab Sample ID: LCS 310-362810/2-A  
Matrix: Water  
Analysis Batch: 362944

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA  
Prep Batch: 362810

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Total Kjeldahl Nitrogen	4.01	4.054		mg/L		101	90 - 110

## Method: 353.2 - Nitrogen, Nitrate-Nitrite

Lab Sample ID: MB 310-362793/43  
Matrix: Water  
Analysis Batch: 362793

Client Sample ID: Method Blank  
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Nitrate Nitrite as N	<0.100		0.100		mg/L			08/16/22 19:56	1

Lab Sample ID: LCS 310-362793/44  
Matrix: Water  
Analysis Batch: 362793

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Nitrate Nitrite as N	5.32	5.674		mg/L		107	90 - 110

## Method: SM 2320B - Alkalinity

Lab Sample ID: MB 310-362556/1  
Matrix: Water  
Analysis Batch: 362556

Client Sample ID: Method Blank  
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Alkalinity as CaCO3 to pH 4.5	<5.00		5.00		mg/L			08/15/22 08:30	1

Lab Sample ID: LCS 310-362556/2  
Matrix: Water  
Analysis Batch: 362556

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Alkalinity as CaCO3 to pH 4.5	1000	997.5		mg/L		100	90 - 110

## Method: SM 4500 H+ B - pH

Lab Sample ID: LCS 310-362509/1  
Matrix: Water  
Analysis Batch: 362509

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
pH	7.00	7.0		SU		100	98 - 102

Lab Sample ID: LCS 310-362509/25  
Matrix: Water  
Analysis Batch: 362509

Client Sample ID: Lab Control Sample  
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
pH	7.00	7.0		SU		100	98 - 102

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QC Sample Results

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

Method: SM 4500 H+ B - pH (Continued)

Lab Sample ID: 310-237917-1 DU					Client Sample ID: Road Track				
Matrix: Water					Prep Type: Total/NA				
Analysis Batch: 362509									
Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	Limit	
pH	8.1	HF	8.0		SU		0.5	20	

# QC Association Summary

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

## HPLC/IC

### Analysis Batch: 363601

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	9056A	
310-237917-2	Pivot Bucket	Total/NA	Water	9056A	
MB 310-363601/3	Method Blank	Total/NA	Water	9056A	
LCS 310-363601/4	Lab Control Sample	Total/NA	Water	9056A	

## Metals

### Prep Batch: 362614

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	3005A	
310-237917-2	Pivot Bucket	Total/NA	Water	3005A	
MB 310-362614/1-A	Method Blank	Total/NA	Water	3005A	
LCS 310-362614/2-A	Lab Control Sample	Total/NA	Water	3005A	

### Analysis Batch: 362935

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 310-362614/1-A	Method Blank	Total/NA	Water	6020A	362614
LCS 310-362614/2-A	Lab Control Sample	Total/NA	Water	6020A	362614

### Analysis Batch: 363152

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	6020A	362614
310-237917-2	Pivot Bucket	Total/NA	Water	6020A	362614

### Analysis Batch: 363247

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	6020A	362614
310-237917-2	Pivot Bucket	Total/NA	Water	6020A	362614
MB 310-362614/1-A	Method Blank	Total/NA	Water	6020A	362614
LCS 310-362614/2-A	Lab Control Sample	Total/NA	Water	6020A	362614

### Analysis Batch: 363273

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCS 310-362614/2-A	Lab Control Sample	Total/NA	Water	6020A	362614

### Prep Batch: 363323

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	7470A	
MB 310-363323/1-A	Method Blank	Total/NA	Water	7470A	
LCS 310-363323/2-A	Lab Control Sample	Total/NA	Water	7470A	

### Prep Batch: 363324

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-2	Pivot Bucket	Total/NA	Water	7470A	
MB 310-363324/1-A	Method Blank	Total/NA	Water	7470A	
LCS 310-363324/2-A	Lab Control Sample	Total/NA	Water	7470A	
310-237917-2 MS	Pivot Bucket	Total/NA	Water	7470A	
310-237917-2 MSD	Pivot Bucket	Total/NA	Water	7470A	

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# QC Association Summary

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

## Metals

### Analysis Batch: 363477

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	7470A	363323
310-237917-2	Pivot Bucket	Total/NA	Water	7470A	363324
MB 310-363323/1-A	Method Blank	Total/NA	Water	7470A	363323
MB 310-363324/1-A	Method Blank	Total/NA	Water	7470A	363324
LCS 310-363323/2-A	Lab Control Sample	Total/NA	Water	7470A	363323
LCS 310-363324/2-A	Lab Control Sample	Total/NA	Water	7470A	363324
310-237917-2 MS	Pivot Bucket	Total/NA	Water	7470A	363324
310-237917-2 MSD	Pivot Bucket	Total/NA	Water	7470A	363324

## General Chemistry

### Analysis Batch: 362509

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	SM 4500 H+ B	
310-237917-2	Pivot Bucket	Total/NA	Water	SM 4500 H+ B	
LCS 310-362509/1	Lab Control Sample	Total/NA	Water	SM 4500 H+ B	
LCS 310-362509/25	Lab Control Sample	Total/NA	Water	SM 4500 H+ B	
310-237917-1 DU	Road Track	Total/NA	Water	SM 4500 H+ B	

### Analysis Batch: 362556

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	SM 2320B	
310-237917-2	Pivot Bucket	Total/NA	Water	SM 2320B	
MB 310-362556/1	Method Blank	Total/NA	Water	SM 2320B	
LCS 310-362556/2	Lab Control Sample	Total/NA	Water	SM 2320B	

### Analysis Batch: 362793

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	353.2	
310-237917-2	Pivot Bucket	Total/NA	Water	353.2	
MB 310-362793/43	Method Blank	Total/NA	Water	353.2	
LCS 310-362793/44	Lab Control Sample	Total/NA	Water	353.2	

### Prep Batch: 362810

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	351.2	
310-237917-2	Pivot Bucket	Total/NA	Water	351.2	
MB 310-362810/1-A	Method Blank	Total/NA	Water	351.2	
LCS 310-362810/2-A	Lab Control Sample	Total/NA	Water	351.2	

### Analysis Batch: 362944

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	351.2	362810
310-237917-2	Pivot Bucket	Total/NA	Water	351.2	362810
MB 310-362810/1-A	Method Blank	Total/NA	Water	351.2	362810
LCS 310-362810/2-A	Lab Control Sample	Total/NA	Water	351.2	362810

### Prep Batch: 363012

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	Distill/Ammonia	
310-237917-2	Pivot Bucket	Total/NA	Water	Distill/Ammonia	

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## QC Association Summary

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

### General Chemistry (Continued)

#### Prep Batch: 363012 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 310-363012/1-A	Method Blank	Total/NA	Water	Distill/Ammonia	
LCS 310-363012/2-A	Lab Control Sample	Total/NA	Water	Distill/Ammonia	

#### Analysis Batch: 363102

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-237917-1	Road Track	Total/NA	Water	350.1	363012
310-237917-2	Pivot Bucket	Total/NA	Water	350.1	363012
MB 310-363012/1-A	Method Blank	Total/NA	Water	350.1	363012
LCS 310-363012/2-A	Lab Control Sample	Total/NA	Water	350.1	363012



# Lab Chronicle

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

## Client Sample ID: Road Track

Lab Sample ID: 310-237917-1

Date Collected: 08/11/22 11:00

Matrix: Water

Date Received: 08/12/22 08:35

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	9056A		5	363601	DHM5	EET CF	08/22/22 15:34
Total/NA	Prep	3005A			362614	QTZ5	EET CF	08/16/22 08:30
Total/NA	Analysis	6020A		1	363152	A6US	EET CF	08/18/22 17:47
Total/NA	Prep	3005A			362614	QTZ5	EET CF	08/16/22 08:30
Total/NA	Analysis	6020A		4	363247	A6US	EET CF	08/19/22 16:31
Total/NA	Prep	7470A			363323	XXW3	EET CF	08/22/22 14:34
Total/NA	Analysis	7470A		1	363477	XXW3	EET CF	08/23/22 12:41
Total/NA	Prep	Distill/Ammonia			363012	ENB7	EET CF	08/18/22 09:51
Total/NA	Analysis	350.1		1	363102	ZJX4	EET CF	08/18/22 20:31
Total/NA	Prep	351.2			362810	W9YR	EET CF	08/17/22 07:00
Total/NA	Analysis	351.2		1	362944	ZJX4	EET CF	08/17/22 19:01
Total/NA	Analysis	353.2		1	362793	ZJX4	EET CF	08/16/22 20:12
Total/NA	Analysis	SM 2320B		1	362556	MAQ3	EET CF	08/15/22 08:30
Total/NA	Analysis	SM 4500 H+ B		1	362509	N7RT	EET CF	08/12/22 15:15

## Client Sample ID: Pivot Bucket

Lab Sample ID: 310-237917-2

Date Collected: 08/11/22 11:05

Matrix: Water

Date Received: 08/12/22 08:35

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	9056A		5	363601	DHM5	EET CF	08/22/22 15:49
Total/NA	Prep	3005A			362614	QTZ5	EET CF	08/16/22 08:30
Total/NA	Analysis	6020A		1	363152	A6US	EET CF	08/18/22 18:03
Total/NA	Prep	3005A			362614	QTZ5	EET CF	08/16/22 08:30
Total/NA	Analysis	6020A		1	363247	A6US	EET CF	08/19/22 16:34
Total/NA	Prep	7470A			363324	XXW3	EET CF	08/22/22 14:38
Total/NA	Analysis	7470A		1	363477	XXW3	EET CF	08/23/22 12:48
Total/NA	Prep	Distill/Ammonia			363012	ENB7	EET CF	08/18/22 09:51
Total/NA	Analysis	350.1		1	363102	ZJX4	EET CF	08/18/22 20:32
Total/NA	Prep	351.2			362810	W9YR	EET CF	08/17/22 07:00
Total/NA	Analysis	351.2		1	362944	ZJX4	EET CF	08/17/22 19:02
Total/NA	Analysis	353.2		1	362793	ZJX4	EET CF	08/16/22 20:13
Total/NA	Analysis	SM 2320B		1	362556	MAQ3	EET CF	08/15/22 08:30
Total/NA	Analysis	SM 4500 H+ B		1	362509	N7RT	EET CF	08/12/22 15:21

### Laboratory References:

EET CF = Eurofins Cedar Falls, 3019 Venture Way, Cedar Falls, IA 50613, TEL (319)277-2401

Eurofins Cedar Falls

## Accreditation/Certification Summary

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

### Laboratory: Eurofins Cedar Falls

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
Colorado	Petroleum Storage Tank Program	IA100001 (OR)	09-29-22
Georgia	State	IA100001 (OR)	09-29-22
Illinois	NELAP	200024	11-29-22
Iowa	State	007	12-01-21 *
Kansas	NELAP	E-10341	01-31-23
Minnesota	NELAP	019-999-319	12-31-22
Minnesota (Petrofund)	State	3349	01-18-24
North Dakota	State	R-186	09-29-22
Oregon	NELAP	IA100001	09-29-22

\* Accreditation/Certification renewal pending - accreditation/certification considered valid.

Eurofins Cedar Falls

## Method Summary

Client: Nebraska Public Power District  
Project/Site: Irrigation Runoff

Job ID: 310-237917-1

Method	Method Description	Protocol	Laboratory
9056A	Anions, Ion Chromatography	SW846	EET CF
6020A	Metals (ICP/MS)	SW846	EET CF
7470A	Mercury (CVAA)	SW846	EET CF
350.1	Nitrogen, Ammonia	MCAWW	EET CF
351.2	Nitrogen, Total Kjeldahl	MCAWW	EET CF
353.2	Nitrogen, Nitrate-Nitrite	MCAWW	EET CF
SM 2320B	Alkalinity	SM	EET CF
SM 4500 H+ B	pH	SM	EET CF
3005A	Preparation, Total Metals	SW846	EET CF
351.2	Nitrogen, Total Kjeldahl	MCAWW	EET CF
7470A	Preparation, Mercury	SW846	EET CF
Distill/Ammonia	Distillation, Ammonia	None	EET CF

### Protocol References:

MCAWW = "Methods For Chemical Analysis Of Water And Wastes", EPA-600/4-79-020, March 1983 And Subsequent Revisions.

None = None

SM = "Standard Methods For The Examination Of Water And Wastewater"

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

### Laboratory References:

EET CF = Eurofins Cedar Falls, 3019 Venture Way, Cedar Falls, IA 50613, TEL (319)277-2401



Environment Testing  
America



### Cooler/Sample Receipt and Temperature Log Form

<b>Client Information</b>			
Client: <u>Nebraska Public Power</u>			
City/State:	CITY <u>Sutherland</u>	STATE <u>NE</u>	Project:
<b>Receipt Information</b>			
Date/Time Received:	DATE <u>8-12-22</u>	TIME <u>835</u>	Received By: <u>[Signature]</u>
Delivery Type: <input checked="" type="checkbox"/> UPS <input type="checkbox"/> FedEx <input type="checkbox"/> FedEx Ground <input type="checkbox"/> US Mail <input type="checkbox"/> Spee-Dee <input type="checkbox"/> Lab Courier <input type="checkbox"/> Lab Field Services <input type="checkbox"/> Client Drop-off <input type="checkbox"/> Other: _____			
<b>Condition of Cooler/Containers</b>			
Sample(s) received in Cooler?		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	If yes: Cooler ID: _____
Multiple Coolers?		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	If yes: Cooler # _____ of _____
Cooler Custody Seals Present?		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	If yes: Cooler custody seals intact? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Sample Custody Seals Present?		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	If yes: Sample custody seals intact? <input type="checkbox"/> Yes <input type="checkbox"/> No
Trip Blank Present?		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	If yes: Which VOA samples are in cooler? ↓
<b>Temperature Record</b>			
Coolant: <input checked="" type="checkbox"/> Wet ice <input type="checkbox"/> Blue ice <input type="checkbox"/> Dry ice <input type="checkbox"/> Other: _____ <input type="checkbox"/> NONE			
Thermometer ID: <u>P</u>		Correction Factor (°C): <u>0</u>	
• <b>Temp Blank Temperature</b> – If no temp blank, or temp blank temperature above criteria, proceed to Sample Container Temperature			
Uncorrected Temp (°C): <u>-1.6</u>		Corrected Temp (°C): <u>-1.6</u>	
• <b>Sample Container Temperature</b>			
Container(s) used:	<u>CONTAINER 1</u>		<u>CONTAINER 2</u>
Uncorrected Temp (°C):			
Corrected Temp (°C):			
<b>Exceptions Noted</b>			
1) If temperature exceeds criteria, was sample(s) received same day of sampling? <input type="checkbox"/> Yes <input type="checkbox"/> No a) If yes: Is there evidence that the chilling process began? <input type="checkbox"/> Yes <input type="checkbox"/> No			
2) If temperature is <0°C, are there obvious signs that the integrity of sample containers is compromised? (e.g., bulging septa, broken/cracked bottles, frozen solid?) <input type="checkbox"/> Yes <input type="checkbox"/> No			
NOTE: If yes, contact PM before proceeding. If no, proceed with login			
<b>Additional Comments</b>			

## Eurofins Cedar Falls

3019 Venture Way

Cedar Falls IA 50613

Phone (319) 277-2401 Phone (319) 277-2425

## Chain of Custody Record

 eurofins

Environment Testing  
America

<b>Client Information</b>			Sampler Doug Harris			Lab PM: Hayes, Shawn M			Carrier Tracking No(s):			COC No:									
Client Contact: Doug Harris			Phone: 308-530-1124			E-Mail: Shawn.Hayes@et.eurofinsus.com			State of Origin:			Page: Page 1 of 1									
Company: Nebraska Public Power District						PWSID:			Analysis Requested						Job #:						
Address: 6089 S Hwy 25 Gerald Gentleman Station						Due Date Requested			<div>Field Filtered Sample (Yes or No) <input checked="" type="checkbox"/></div> <div>Perform MS/MSD (Yes or No) <input checked="" type="checkbox"/></div> <div>350 1 Ammonia, 351 2 TKN, 353.2 Nitrate+Nitrite</div> <div>6020A, 7470A Select Metals</div> <div>2320B Alkalinity, 9056A Chloride, Fluoride, Sulfate, SM4500_H+ pH</div> <div>Total Number of containers</div>						Preservation Codes:						
City: Sutherland						TAT Requested (days):									A - HCL M Hexane B - NaOH N - None C - Zn Acetate O - AsNaO2 D - Nitric Acid P - Na2O4S E - NaHSO4 Q - Na2SO3 F - MeOH R - Na2S2O3 G - Amchlor S - H2SO4 H - Ascorbic Acid T - TSP Dodecahydrate I - Ice U - Acetone J - DI Water V - MCAA K - EDTA W - pH 4-5 L - EDA Z - other (specify)						
State, Zip: NE 69165						Compliance Project: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No									Other						
Phone: 308-530-1124						PO #: 4500245807															
Email: ddharri@nppd.com						WO #:															
Project Name: Irrigation Runoff						Project #: 31007155			Special Instructions/Note												
Site: GGS						SSOW#:															
Sample Identification						Sample Date		Sample Time		Sample Type (C=comp, G=grab)		Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)		Preservation Code:							
Road Track						8-11-22		1100		G		Water		<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>							
Pivot Bucket						8-11-22		1105		G		Water		<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>							
↑ sample bottles only partially filled due to lack of sample - please do what we can  Doug																					
Possible Hazard Identification						Sample Disposal ( A fee may be assessed if samples are retained longer than 1 month)															
<input checked="" type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown <input type="checkbox"/> Radiological						<input type="checkbox"/> Return To Client <input type="checkbox"/> Disposal By Lab <input type="checkbox"/> Archive For _____ Months															
Deliverable Requested I, II III IV, Other (specify)						Special Instructions/QC Requirements.															
Empty Kit Relinquished by:						Date			Time			Method of Shipment:									
Relinquished by: Doug Harris						Date/Time: 8-11-22 1400			Company: NPPD			Received by: ML			Date/Time: 8-12-22 835			Company:			
Relinquished by:						Date/Time:			Company:			Received by:			Date/Time:			Company:			
Relinquished by:						Date/Time:			Company:			Received by:			Date/Time:			Company:			
Custody Seals Intact: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No						Custody Seal No			Cooler Temperature(s) °C and Other Remarks:												

## Login Sample Receipt Checklist

Client: Nebraska Public Power District

Job Number: 310-237917-1

Login Number: 237917

List Source: Eurofins Cedar Falls

List Number: 1

Creator: Costello, Mackenzie K

Question	Answer	Comment
Radioactivity wasn't checked or is $\leq$ background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	





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February 20, 2023

Project No. 31405886.001

Nebraska Public Power District  
Gerald Gentleman Station  
6089 South Highway 25  
Sutherland, Nebraska 69165

## **ALTERNATIVE SOURCE DEMONSTRATION REVIEW – Q4 2022 MONITORING EVENT**

### **1.0 INTRODUCTION**

As noted within the Annual Coal Combustion Residuals Groundwater Monitoring and Corrective Action Report – 2022 (WSP 2023), two previously identified verified statistically significant increases were identified at GGS as part of the statistical analysis following the fourth quarter (Q4) 2022 monitoring event. The identified verified SSIs were:

- APMW-6, Chloride – initially verified during the Q4 2021 event
- APMW-19, Sulfate – initially verified during the Q4 2021 event

For sulfate at APMW-19, both the current analytical and calculated CUSUM values for the Q4 2022 detection monitoring sampling event are below the associated statistical limits. The result will remain considered a verified SSI until two consecutive analytical results and calculated CUSUM values are below the statistical limit.

Alternative source demonstrations were previously prepared for both verified statistically significant increases following the Q2 2022 monitoring event, and are included as an attachment to this document. The previously prepared ASDs were reviewed for ongoing applicability in the context of the current monitoring event.

### **2.0 APMW-6 CHLORIDE**

During the Q4 2022 monitoring event, chloride at APMW-6 was reported at a concentration of 15 mg/L, with a CUSUM value of 43.1 mg/L, exceeding the Shewhart-CUSUM statistical limit of 20.4 mg/L. Chloride concentrations from the upgradient, unimpacted wells (APMW-15, APMW-16A, and APMW-17) ranged from 18.5 mg/L to 20.8 mg/L for the same monitoring event. The collected upgradient data for the current event reaffirms the presence of higher chloride concentrations upgradient of the unit.

Further, as discussed within the prior alternative source demonstration, concentrations of chloride in the Sutherland Reservoir continue to remain elevated and serve as an influence on the groundwater upgradient of the

CCR unit. As such, the CCR unit is not the source of the verified statistically significant increase in chloride at APMW-6.

### 3.0 APMW-19 SULFATE

For the Q4 2022 monitoring event, sulfate at APMW-19 was reported at a concentration of 62.5 mg/L, with a CUSUM value of 124.6 mg/L, both below the Shewhart-CUSUM statistical limit of 191.2 mg/L. As noted above, the Q4 2022 monitoring event marks the first event where the analytical value and CUSUM value are back below the statistical limit, and as such, the results remain considered as a verified statistically significant increase. Sulfate concentrations from the upgradient, unimpacted wells (APMW-15, APMW-16A, and APMW-17) ranged from 86.1 mg/L to 128 mg/L for the same monitoring event. The collected upgradient data for the current event reaffirms the presence of higher sulfate concentrations upgradient of the unit.

Additionally, as discussed in the previously completed alternative source demonstration, concentrations of sulfate in the Sutherland Reservoir continue to remain elevated and serve as an influence on the groundwater upgradient of the CCR unit. As such, the CCR unit is not the source of the verified statistically significant increase in sulfate at APMW-19.

### 4.0 CLOSING

Based on our review of the previously collected information as presented in the Q2 2022 alternative source demonstrations, and the data associated with the current event, neither verified statistically significant increase identified during the Q4 2022 event for chloride at APMW-6 or sulfate at APMW-19 is an indication of a release from the CCR unit. The identified conclusions within the previously completed alternative source demonstrations remain true, and Gerald Gentleman Station is recommended to remain in detection monitoring for the next scheduled coal combustion residuals monitoring event, scheduled for Q2 2023.

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August 18, 2023

Project No. 31405886.001

Nebraska Public Power District  
Gerald Gentleman Station  
6089 South Highway 25  
Sutherland, Nebraska 69165

## **ALTERNATIVE SOURCE DEMONSTRATION REVIEW – Q2 2023 MONITORING EVENT**

### **1.0 INTRODUCTION**

Following the second quarter (Q2 2023) coal combustion residuals detection monitoring event, a previously identified verified statistically significant increase was identified at Gerald Gentleman Station for chloride at APMW-6. Chloride was initially identified as a verified statistically significant increase following the fourth quarter (Q4) 2021 monitoring event.

An alternative source demonstration was previously prepared for the verified statistically significant increase for chloride at APMW-6 following the Q2 2022 monitoring event, which was subsequently reviewed following the Q4 2022 monitoring event. This alternative sourced demonstration is included as an attachment to this document. The previously prepared ASD was reviewed for ongoing applicability in the context of the current monitoring event.

### **2.0 APMW-6 CHLORIDE**

During the Q2 2023 monitoring event, chloride at APMW-6 was reported at a concentration of 23.4 mg/L, with a CUSUM value of 53.7 mg/L, exceeding the Shewhart-CUSUM statistical limit of 20.4 mg/L. Chloride concentrations from the upgradient, unimpacted wells (APMW-5, APMW-15, APMW-16A, and APMW-17) ranged from 15.9 mg/L to 25.7 mg/L for the same monitoring event. The collected upgradient data for the current event reaffirms the presence of higher chloride concentrations upgradient of the unit.

Further, as discussed within the prior alternative source demonstration, concentrations of chloride in the Sutherland Reservoir continue to remain elevated and serve as an influence on the groundwater upgradient of the CCR unit. As such, the CCR unit is not the source of the verified statistically significant increase in chloride at APMW-6.

### **3.0 CLOSING**

Based on our review of the previously collected information as presented in the Q2 2022 alternative source demonstrations, and the data associated with the current event, the verified statistically significant increase

identified during the Q2 2023 event for chloride at APMW-6 is not an indication of a release from the CCR unit. The identified conclusions within the previously completed alternative source demonstrations remain true, and Gerald Gentleman Station is recommended to remain in detection monitoring for the next scheduled coal combustion residuals monitoring event, scheduled for Q4 2023.

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January 25, 2024

Project No. 31405886.001

Nebraska Public Power District  
Gerald Gentleman Station  
6089 South Highway 25  
Sutherland, Nebraska 69165

## **ALTERNATIVE SOURCE DEMONSTRATION REVIEW – Q4 2023 MONITORING EVENT**

### **1.0 INTRODUCTION**

Following the fourth quarter (Q4 2023) coal combustion residuals detection monitoring event, a previously identified verified statistically significant increase was identified at Gerald Gentleman Station for chloride at APMW-6. Chloride was initially identified as a verified statistically significant increase following the fourth quarter (Q4) 2021 monitoring event.

An alternative source demonstration was previously prepared for the verified statistically significant increase for chloride at APMW-6 following the second quarter (Q2) 2022 monitoring event, which was subsequently reviewed following the Q4 2022 and Q2 2023 monitoring events. This alternative sourced demonstration is included as an attachment to this document. The previously prepared ASD was reviewed for ongoing applicability in the context of the current monitoring event.

### **2.0 APMW-6 CHLORIDE**

During the Q4 2023 monitoring event, chloride at APMW-6 was reported at a concentration of 23.2 mg/L, with a CUSUM value of 64.1 mg/L, exceeding the Shewhart-CUSUM statistical limit of 20.4 mg/L. Chloride concentrations from the upgradient, unimpacted wells (APMW-15, APMW-16A, and APMW-17) ranged from 24.5 mg/L to 30.9 mg/L for the same monitoring event. The collected upgradient data for the current event reaffirms the presence of higher chloride concentrations upgradient of the unit.

Further, as discussed within the prior alternative source demonstration, concentrations of chloride in the Sutherland Reservoir continue to remain elevated and serve as an influence on the groundwater upgradient of the CCR unit. As such, the CCR unit is not the source of the verified statistically significant increase in chloride at APMW-6.

### **3.0 CLOSING**

Based on our review of the previously collected information as presented in the Q2 2022 alternative source demonstrations, and the data associated with the current event, the verified statistically significant increase



identified during the Q4 2023 event for chloride at APMW-6 is not an indication of a release from the CCR unit. The identified conclusions within the previously completed alternative source demonstrations remain true, and Gerald Gentleman Station is recommended to remain in detection monitoring for the next scheduled coal combustion residuals monitoring event, scheduled for Q2 2024.

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