**REPORT**

# Annual Groundwater Report – 2019

*Great River Energy – Stanton Station*

Submitted to:

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# 1.0 REPORT SUMMARY

This report presents the results from groundwater monitoring events that occurred at Great River Energy's Stanton Station in 2019 to meet the requirements of the Coal Combustion Residuals (CCR) rule (40 Code of Federal Regulations 257.90 through 257.98). The facilities entered 2019 under a detection monitoring program and remain in detection monitoring at the conclusion of 2019. The following items of statistical significance were identified in 2019 for the comparative statistical analysis of the fourth quarter (Q4) 2018 and second quarter (Q2) 2019 detection monitoring events:

- Verified Statistically Significant Increases (SSIs): No verified SSIs were identified during the Q4 2018 detection monitoring event for potential exceedances identified during the Q2 2018 detection monitoring event. Three verified SSIs (chloride at MW-9N and MW-103 and fluoride at MW-103) were confirmed during the Q2 2019 detection monitoring event from potential exceedances identified during the Q4 2018 detection monitoring event.
- Potential Exceedances and False-Positives:
  - Four potential exceedances were identified in Q4 2018: chloride at MW-9N and MW-103, total dissolved solids (TDS) at MW-103, and fluoride at MW-103. Confirmatory re-sampling occurred for these samples during the Q2 2019 detection monitoring sampling event. The TDS potential exceedance at MW-103 was found to be a false-positive, while the other identified potential exceedances were verified as noted above.
  - Two potential exceedances were identified in Q2 2019: chloride at MW-6B and field-measured pH at MW-101. Confirmatory re-sampling for chloride at MW-6B will be completed following comparative statistical analysis for the Q4 2019 sampling event. MW-101 was abandoned as a result of restoration construction activity following the Q2 2019 sampling event.

Due to the verified SSIs confirmed following the Q2 2019 detection monitoring sampling event, alternative source demonstrations (ASDs) were prepared for each SSI. The ASDs have been included as Appendix A of this document. The facilities currently remain in detection monitoring as a result of the successful ASDs.

As described in the Coal Combustion Residuals Groundwater Monitoring System Certification, Revision 1 (Golder 2020a) and the Coal Combustion Residuals Groundwater Monitoring Statistical Methods Certification, Revision 1 (Golder 2020b), the groundwater monitoring and analytical procedures meet the general requirements of the CCR rule, and modifications to the monitoring networks and sampling program are not recommended at this time.

# 2.0 INTRODUCTION

Golder Associates Inc. (Golder) has prepared this report for the 2019 groundwater sampling and comparative statistical analysis for Great River Energy's (GRE) Stanton Station to meet the requirements of the Coal Combustion Residuals (CCR) rule's sections on groundwater monitoring and corrective action, 40 Code of Federal Regulations (CFR) 257.90 through 257.98.

## 2.1 Purpose

The CCR rule established specific requirements for reporting of actions related to groundwater monitoring and corrective actions in 40 CFR 257.90. In accordance with part (e) of 40 CFR 257.90, owners or operators of CCR units must prepare an annual groundwater monitoring and corrective action report.

## 2.2 Site Background

Stanton Station was a coal-fired electric generation facility located along the Missouri River in Mercer County, approximately three miles southeast of Stanton, North Dakota. Stanton Station began generating power in 1966, ceased power production in February 2017, and demolition of the industrial site was finished in 2019. CCRs were managed in composite-lined surface water impoundment cells and dry waste facilities regulated and permitted by the North Dakota Department of Environmental Quality (NDDEQ) in accordance with North Dakota Administrative Code Article 33-20, Solid Waste Management and Land Protection.

Stanton Station has two CCR facilities that are within the purview of the United States Environmental Protection Agency (USEPA) CCR rule:

- Bottom Ash CCR Landfill (Bottom Ash Landfill)
- Bottom Ash CCR Surface Impoundment (Bottom Ash Impoundment)

These facilities are currently separated into two monitoring network units. Locations of the facilities, groundwater monitoring network units, and groundwater monitoring wells are shown in Figures 1 and 2.

## 2.3 Site Closure and Restoration

Between 2017 and 2019, the remaining bottom ash and economizer ash from the plant and Bottom Ash Impoundment (north and center cells) was placed in the south cell of the Bottom Ash Impoundment. Construction and Demolition (C&D) material from plant demolition activities as well as coal and coal yard soil, and clayey soils underlying the geomembrane of the Bottom Ash Impoundment north and center cells excavated during site restoration have been placed in the Bottom Ash Landfill or the south cell of the Bottom Ash Impoundment (as approved through the NDDEQ state permit program).

In general, CCR, soil, and C&D material associated with plant deconstruction and site restoration activities are being consolidated on the east side of the Bottom Ash Landfill after which the facility will be closed with the permitted wastes remaining in-place and in accordance with the final cover design outlined in the Closure and Post-Closure Plan (Golder 2019a). The north cell and center cell of the Bottom Ash Impoundment were closed by removal of CCR and liner systems in the fall of 2019. The south cell will be closed with permitted waste remaining in-place and in accordance with the final cover design outlined in the Closure and Post-Closure Plan (Golder 2019b).

Site restoration activities began in the summer of 2019 and are expected to be completed in 2020. These activities primarily include closure of the Bottom Ash Landfill and Bottom Ash Impoundment as described above as well as re-grading the site to promote drainage and vegetative growth.

# 3.0 GROUNDWATER MONITORING NETWORK PROGRAM STATUS

Through Q2 2019, the CCR groundwater monitoring system at Stanton Station consisted of a total of twelve monitoring locations (five background and seven downgradient wells). During site restoration, two monitoring wells were abandoned downgradient of the Bottom Ash Landfill, so the network currently consists of five background and five downgradient wells at the end of Q4 2019. After site restoration is complete (2020), approximately three additional downgradient monitoring wells are proposed to be installed. The current monitoring locations are shown in Figures 1 and 2 and listed in Table 1. Additional information on the groundwater monitoring system can be found in the Coal Combustion Residuals Groundwater Monitoring System Certification, Revision 1 (Golder 2020a), including information regarding the proposed additional downgradient monitoring wells. Through

Q2 2019, each CCR facility is part of a monitoring network consisting of at least one upgradient and three downgradient monitoring wells.

The groundwater monitoring system at Stanton Station is divided as follows:

- The background monitoring wells are located south and west of the CCR facilities where groundwater is not expected to have been influenced by CCR deposition based on groundwater flow trends. There are four upgradient monitoring wells and one side-gradient monitoring well shared between the CCR facilities.
- The Bottom Ash Landfill had four downgradient monitoring wells prior to October 24, 2019. Currently, the Bottom Ash Landfill has three downgradient monitoring wells.
- The Bottom Ash Impoundment had three downgradient monitoring wells prior to October 24, 2019. Currently, the Bottom Ash Impoundment has two downgradient monitoring wells until closure and site restoration activities are completed and new wells can be installed.

## 3.1 Completed Key Actions in 2019

The following key actions were completed in 2019:

- The 2018 annual CCR groundwater monitoring and corrective action report was completed and placed within the operating record and on the publicly accessible CCR website (Golder 2019c).
- Detection monitoring samples were collected in June (Q2) and November (Q4) 2019, respectively, and analyzed for the Appendix III constituent list associated with the CCR rule for the program wells. Additionally, samples were collected from program wells for the Appendix IV constituent list associated with the CCR rule for additional baseline data.
- Comparative statistical analysis was completed for the Q4 2018 and Q2 2019 detection monitoring samples, which were collected in Q4 2018 and Q2 2019, respectively.
- Demolition, closure, and site restoration activities at Stanton Station continued throughout 2019, with additional activities scheduled to occur in 2020.
- Alternative source demonstrations were conducted for chloride at MW-9N and MW-103 and fluoride at MW-103 following the Q2 2019 detection monitoring event. Further information is provided in Section 5.1.1.

## 3.2 Installation and Decommissioning of Wells

No wells were installed as part of the Stanton Station CCR monitoring well network in 2019.

As part of the closure and site restoration activities at Stanton Station, wells MW-3B and MW-101 were decommissioned on October 24, 2019.

## 3.3 Problems and Resolutions

As discussed in the 2018 report (Golder 2019c), during the Q4 2018 detection monitoring event well MW-1R was inaccessible for sampling due to the presence of materials and equipment associated with the demolition of Stanton Station. The well was accessible during both the Q2 2019 and Q4 2019 sampling events.

## 3.4 Key Activities for 2020

The following key activities have already been or are anticipated to be completed in 2020:

- Revision 1 of the Coal Combustion Residuals Groundwater Statistical Method Certification (Golder 2020b) was placed within the operating record and on the publicly accessible CCR website.
- Revision 1 of the Coal Combustion Residuals Groundwater Monitoring System Certification (Golder 2020a) was placed within the operating record and on the publicly accessible CCR website.
- The 2019 annual CCR groundwater monitoring and corrective action report will be completed and placed within the operating record and on the publicly accessible CCR website.
- Comparative statistics for the Q4 2019 detection monitoring samples within 90 days of receipt of the final analytical results.
- Detection monitoring sampling events will occur in Q2 and Q4 of 2020, and will consist of sampling, data review, and comparative statistics. Comparative statistics for both the Q2 2020 and Q4 2020 detection monitoring samples will be completed within 90 days of receipt of the final analytical results.
- Installation and development of proposed additional downgradient monitoring wells will occur following completion of site restoration activities. Initial baseline samples will be collected from the wells beginning in 2020.

# 4.0 GROUNDWATER MONITORING ANALYTICAL PROGRAM STATUS

Analytical activities associated with the groundwater monitoring program are described below.

## 4.1 Collected Samples

Detection monitoring samples were collected by field staff from Minnesota Valley Testing Laboratory (MVTL) in June (Q2) 2019 and November (Q4) 2019. Precise dates vary between locations and can be found in Tables 2 through 13. Samples were collected using low-flow methodology with dedicated bladder pumps. The sampling procedures and analytical test methods are in accordance with USEPA-accepted procedures.

### 4.1.1 Groundwater Elevation and Flow Rate

Depths to groundwater were measured in each well during each sampling event prior to purging. Groundwater elevations can be found in Tables 2 through 13. Groundwater elevations from the Q2 2019 detection monitoring event are shown on Figure 1. Groundwater elevations from the Q4 2019 detection monitoring event are shown on Figure 2. Based on both the Q2 (June) 2019 and Q4 (November) 2019 groundwater elevations, the shallow groundwater at the CCR facilities generally flows to the northeast.

The groundwater flow rate across each 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 the system wells (Braun 1993), in ft/day

- $i$ is the hydraulic gradient, calculated based on groundwater elevations for each monitoring event, in feet per feet (ft/ft)
- $n_e$ is the effective porosity, estimated to be 0.25 for a silt/sand and is reflective of site soils (Duffield 2007)

The range of groundwater flow velocities calculated for the units during the Q2 2019 and Q4 2019 detection monitoring sampling events are shown below. As the Bottom Ash Landfill and Bottom Ash Impoundment are adjacent to one another and intersect similar geologic formations within the uppermost water-bearing zone, the groundwater flow rates are the same for the facilities during each sampling event and are presented below based on a range of measured hydraulic conductivity ($k$) values from 1.05 ft/day to 40 ft/day.

- Q2 2019: 0.03 – 1.18 ft/day
- Q4 2019: 0.03 – 1.25 ft/day

## 4.2 Monitoring Data (Analytical Results)

Analytical results for samples collected in 2019 for monitoring wells within the networks are shown in Tables 2 through 13.

## 4.3 Comparative Statistical Analysis

The comparative statistical analysis for the Q4 2018 and Q2 2019 detection monitoring events is summarized below, and the results are presented in Tables 14 through 25. Comparative statistical analysis for the Q4 2019 detection monitoring event will occur within 90 days of data review following receipt of the analytical data. Based on the timing of the Q4 2019 detection monitoring sample, comparative statistical analysis for the Q4 2019 event will be completed during the first quarter (Q1) of 2020. A full description of the steps taken for comparative statistical analysis can be found in Revision 1 to the Coal Combustion Residuals Groundwater Statistical Method Certification, Great River Energy – Stanton Station (Golder 2020b).

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 (NPPL), the comparative statistical analysis consists of a comparison of detection monitoring collected during the period of interest (compliance period) to the statistical limit calculated from the baseline data collection period. For constituent-well pairs with increasing trends identified during the baseline period, an alternative trend test, such as that described by the Electric Power Research Institute (EPRI 2015) has been used to determine statistical significance. For constituent-well pairs with decreasing trends identified during the baseline period, a Sen's Slope trend test was used to assess the results. A detailed discussion of the methodology used for comparative statistical analysis is provided in the Coal Combustion Residuals Groundwater Monitoring Statistical Methods Certification, Revision 1 (Golder 2020b). At present, no parameters have increasing or decreasing trends that prevent establishment or updating of the associated baseline periods.

### 4.3.1 Definitions

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

- Elevated CUSUM – an elevated CUSUM occurs when the CUSUM 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 analytical results may exceed the Shewhart-CUSUM limit in the future. For elevated CUSUMs in the case of two-tailed analysis (field-measured pH), the CUSUM value may also be below the lower Shewhart-CUSUM limit established by the baseline statistical analysis.

- Potential Exceedance – is 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 – is 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 re-sampling. False-positives are not used in calculation of any subsequent CUSUMs.
- Confirmatory re-sampling – is designated as the next scheduled sampling event.
- Verified SSI – is 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.

### 4.3.2 Potential Exceedances

The following potential exceedances were identified during comparative statistical analysis for the Q4 2018 detection monitoring event:

- MW-9N (Downgradient, Bottom Ash Landfill) – Chloride Elevated CUSUM
- MW-103 (Downgradient, Bottom Ash Impoundment) – Chloride Elevated CUSUM
- MW-103 (Downgradient, Bottom Ash Impoundment) –TDS Elevated CUSUM
- MW-103 (Downgradient, Bottom Ash Impoundment) – Fluoride

Confirmatory re-sampling for these constituent-well pairs occurred during the Q2 2019 detection monitoring sampling event, with results discussed in the following sections.

The following potential exceedances were identified during comparative statistical analysis for the Q2 2019 detection monitoring event:

- MW-6B (Side-gradient) – Chloride Elevated CUSUM
- MW-101 (Downgradient, Bottom Ash Landfill) – Field-Measured pH Elevated CUSUM (calculated CUSUM value below the lower CUSUM limit)

Confirmatory re-sampling for chloride at MW-6B will be completed following comparative statistical analysis for the Q4 2019 sampling event. MW-101 was abandoned as a result of restoration construction activity following the Q2 2019 sampling event. Comparative statistics for the Q4 2019 detection monitoring event will be completed within 90 days of data review for the final analytical results.

### 4.3.3 False-Positives

No false-positives were identified from confirmatory re-sampling during the Q4 2018 detection monitoring event.

The following false-positive was identified for the Q4 2018 detection monitoring event following confirmatory re-sampling during Q2 2019:

- MW-103 (Downgradient, Bottom Ash Landfill) – TDS

### 4.3.4 Verified SSIs

No verified SSIs were identified during the Q4 2018 detection monitoring event, as no potential exceedances had been identified during the Q2 2018 detection monitoring event.

The following verified SSIs were confirmed during the Q2 2019 detection monitoring event from potential exceedances identified during the Q4 detection monitoring event:

- MW-9N (Downgradient, Bottom Ash Landfill) – Chloride, Elevated CUSUM values
- MW-103 (Downgradient, Bottom Ash Impoundment) – Chloride, Elevated CUSUM values
- MW-103 (Downgradient, Bottom Ash Impoundment) – Fluoride

GRE pursued alternative source demonstrations (ASDs) after identifying the verified SSIs for chloride at MW-9N and MW-103 and fluoride at MW-103 during the Q2 2019 detection monitoring event. As specified in 40 CFR 257.94, GRE had 90 days to complete the ASD following completion of comparative statistics or establish an assessment monitoring program. The successful ASDs were completed on January 2, 2020 and are included in Appendix A. As a result of the successful ASD outcomes, GRE remains in detection monitoring.

# 5.0 PROGRAM TRANSITIONS

Beginning in Q4 2017, the groundwater monitoring program at Stanton Station transitioned from the baseline period to detection monitoring. During the baseline period, at least 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 rule prior to October 17, 2017, as specified in 40 CFR 257.94(b). The first detection monitoring samples were collected in Q4 2017.

## 5.1 Detection Monitoring

The site is currently in detection monitoring. Samples for the detection monitoring program are collected on a semi-annual basis, beginning with the samples collected in Q4 2017. GRE plans to collect semi-annual samples for the detection monitoring program in Q2 and Q4 2020.

### 5.1.1 Alternative Source Demonstrations

GRE pursued alternative source demonstrations (ASDs) after identifying the verified SSIs for chloride at MW-9N and MW-103 and fluoride at MW-103 during the Q2 2019 detection monitoring event. As specified in 40 CFR 257.94, GRE had 90 days to complete the ASD following completion of comparative statistics or establish an assessment monitoring program. The successful ASDs were completed on January 2, 2020 and are included in Appendix A. As a result of the successful ASD outcomes, GRE remains in detection monitoring.

## 5.2 Assessment Monitoring

With the completion of the successful ASDs, the results of the comparative statistical analysis through Q2 2019 at Stanton Station do not trigger the need to implement assessment monitoring as described in 40 CFR 257.95.

## 5.3 Corrective Measures and Assessment

Results to date from the CCR groundwater monitoring program at Stanton Station do not trigger the need to assess or implement corrective measures. Since the CCR groundwater monitoring program does not require corrective measures, an assessment of corrective measures, as described in 40 CFR 257.96, has not been initiated and no actions are required.

# 6.0 CLOSING

This report presents the analytical results from the Q2 2019 and Q4 2019 detection monitoring events of the CCR groundwater monitoring program at Stanton Station. Comparative statistics for the Q4 2018 and Q2 2019 detection monitoring events are also included. Comparative statistics for the Q4 2019 detection monitoring event conducted in November 2019 will occur within 90 days of finalizing data review (during Q1 2020). The groundwater monitoring and analytical procedures implemented meet the requirements of the CCR rule and are consistent with the approach described in Revision 1 to the Groundwater Monitoring System Certification (Golder 2020a) and Revision 1 to the Groundwater Monitoring Statistical Methods Certification (Golder 2020b). Comparative statistics and the ASDs presented within this report support remaining in detection monitoring, and do not trigger assessment monitoring nor an assessment of corrective measures.

# Signature Page

**Golder Associates Inc.**

| | |
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## 7.0 REFERENCES

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# Tables

**Table 1: Monitoring Well Summary**

| Location | Well ID | Date Constructed | TOC Elevation | Ground Surface Elevation | Screen Interval | Top of Screen Elevation | Bottom of Screen Elevation | Sand Pack Interval | Geologic Unit(s) Completed In |
|---|---|---|---|---|---|---|---|---|---|
| | | | ft AMSL | ft AMSL | ft bgs | ft AMSL | ft AMSL | ft bgs | |
| Upgradient/Side-gradient | MW-6B | 9/8/1992 | 1711.2 | 1709.3 | 28.4-38.4 | 1681 | 1671 | 19.0-38.5 | Outwash |
| | MW-7A | 8/27/1992 | 1713.4 | 1711.0 | 7.0-17.0 | 1704 | 1694 | 5.0-18.0 | Silty Sand/Clay |
| | MW-7B | 9/9/1992 | 1712.7 | 1710.9 | 28.1-38.1 | 1682 | 1672 | 23.0-38.5 | Silty Sand/Outwash |
| | MW-8B | 9/3/1992 | 1749.7 | 1747.2 | 54.0-64.0 | 1694 | 1684 | 49.0-64.5 | Outwash |
| | MW-105 | 11/18/2015 | 1716.6 | 1713.5 | 9.0-19.0 | 1704 | 1694 | 7.0-19.0 | Clay/Outwash |
| Bottom Ash Landfill Downgradient | MW-3B * | 6/11/1982 | 1713.0 | 1709.4 | 23.7-28.7 | 1687 | 1682 | 23.2-29.5 | Outwash |
| | MW-9N | 7/19/2010 | 1708.1 | 1705.5 | 16.0-26.0 | 1689 | 1679 | 14.0 - 26.0 | Outwash |
| | MW-101 * | 11/17/2015 | 1710.8 | 1707.5 | 8.0-18.0 | 1700 | 1690 | 6.0-18.0 | Silty Sand/Clay |
| | MW-102 | 11/17/2015 | 1711.7 | 1708.5 | 14.0-24.0 | 1694 | 1684 | 12.0-24.0 | Silty Sand/Clay |
| Bottom Ash Impoundment Downgradient | MW-1R | 11/8/1995 | 1709.2 | 1706.8 | 27.0-36.0 | 1682 | 1671 | 25.0-38.0 | Outwash/Clay |
| | MW-103 | 11/17/2015 | 1709.1 | 1705.6 | 14.0-24.0 | 1692 | 1682 | 12.0-24.0 | Outwash |
| | MW-104 | 11/17/2015 | 1711.7 | 1708.5 | 14.0-24.0 | 1694 | 1684 | 12.0-24.0 | Outwash |

Notes:

TOC: top of casing

ft AMSL: feet above mean sea level

ft bgs: feet below ground surface

TOC and ground surface elevations surveyed by Interstate Engineering, Inc. in December 2015.

Well construction measurements are from the original bore log, well data sheet or well construction form.

* Wells MW-3B and MW-101 were abandoned due to construction activity on October 24, 2019.

**Table 2: Sample Results Summary Table - MW-6B**

| | | MW-6B | | | |
|---|---|---|---|---|---|
| | | Additional Baseline Data | | Detection Monitoring | |
| | Units | 10-Jun-19 | 25-Nov-19 | 10-Jun-19 | 25-Nov-19 |
| Water Elevation | ft AMSL | 1693.6 | 1693.9 | 1693.6 | 1693.9 |
| ***Appendix III Parameters*** | | | | | |
| Boron | mg/L | --- | --- | 0.36 | 0.33 |
| Calcium | mg/L | --- | --- | 23.5 | 21.3 |
| Chloride | mg/L | --- | --- | 16.1 | 15.9 |
| Fluoride | mg/L | --- | --- | 0.55 | 0.53 |
| pH, Field | s.u. | --- | --- | 7.43 | 7.72 |
| Sulfate | mg/L | --- | --- | 349 | 340 |
| Total Dissolved Solids | mg/L | --- | --- | 1060 | 1060 |
| ***Appendix IV Parameters*** | | | | | |
| Antimony | mg/L | < 0.001 | < 0.001 | --- | --- |
| Arsenic | mg/L | 0.0034 | 0.0047 | --- | --- |
| Barium | mg/L | 0.0287 | 0.023 | --- | --- |
| Beryllium | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Cadmium | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Chromium | mg/L | < 0.002 | < 0.002 | --- | --- |
| Cobalt | mg/L | < 0.002 | < 0.002 | --- | --- |
| Fluoride | mg/L | 0.55 | 0.53 | --- | --- |
| Lead | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Lithium | mg/L | 0.05 | 0.054 | --- | --- |
| Mercury | mg/L | < 0.0002 | < 0.0002 | --- | --- |
| Molybdenum | mg/L | 0.0143 | 0.0132 | --- | --- |
| Radium 226 | pCi/L | < 0.2 | 0.2 ± 0.1 | --- | --- |
| Radium 228 | pCi/L | < 2.0 | 0.9 ± 0.6 | --- | --- |
| Radium 226 and 228 combined | pCi/L | < 2.0 | 1.1 ± 0.7 | --- | --- |
| Selenium | mg/L | < 0.005 | < 0.005 | --- | --- |
| Thallium | mg/L | < 0.0005 | 0.0005 | --- | --- |

Legend:

--, not analyzed

ft AMSL, feet above mean sea level

mg/L, milligrams per liter

s.u., standard units for pH

pCi/L, picocuries per liter

Notes:

Non-detects have been listed at the reported primary quantitation limit.

Metal concentrations represent the total fraction (i.e. samples have not been filtered).

Precision is not recorded for samples with radiological concentrations below the reporting limit.

GRE's analytical laboratory switched radiochemical methodologies beginning in Q4 2019, resulting in changes to the radiochemical reporting.

Laboratory Provided Qualifiers:

No laboratory provided qualifiers were applied to results from the Q2 or Q4 samples.

**Table 3: Sample Results Summary Table - MW-7A**

| | | MW-7A | | | |
|---|---|---|---|---|---|
| | | Additional Baseline Data | | Detection Monitoring | |
| | Units | 10-Jun-19 | 25-Nov-19 | 10-Jun-19 | 25-Nov-19 |
| Water Elevation | ft AMSL | 1701.8 | 1703.2 | 1701.8 | 1703.2 |
| ***Appendix III Parameters*** | | | | | |
| Boron | mg/L | --- | --- | 0.70 | 0.63 |
| Calcium | mg/L | --- | --- | 377 | 452 |
| Chloride | mg/L | --- | --- | 39.8 | 36.8 |
| Fluoride | mg/L | --- | --- | 0.52 | 0.61 |
| pH, Field | s.u. | --- | --- | 7.30 | 7.36 |
| Sulfate | mg/L | --- | --- | 10700 | 10500 |
| Total Dissolved Solids | mg/L | --- | --- | 17000 | 16000 |
| ***Appendix IV Parameters*** | | | | | |
| Antimony | mg/L | < 0.001 | < 0.001 | --- | --- |
| Arsenic | mg/L | < 0.004 + | < 0.004 + | --- | --- |
| Barium | mg/L | 0.0087 | 0.0097 | --- | --- |
| Beryllium | mg/L | < 0.001 + | < 0.0005 | --- | --- |
| Cadmium | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Chromium | mg/L | < 0.004 + | < 0.002 | --- | --- |
| Cobalt | mg/L | < 0.004 + | < 0.002 | --- | --- |
| Fluoride | mg/L | 0.52 | 0.61 | --- | --- |
| Lead | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Lithium | mg/L | 0.295 | 0.29 | --- | --- |
| Mercury | mg/L | < 0.0002 | < 0.0002 | --- | --- |
| Molybdenum | mg/L | 0.0106 | 0.0106 | --- | --- |
| Radium 226 | pCi/L | < 0.2 | 0.2 ± 0.1 | --- | --- |
| Radium 228 | pCi/L | < 2.0 | 1.1 ± 0.6 | --- | --- |
| Radium 226 and 228 combined | pCi/L | < 2.0 | 1.3 ± 0.7 | --- | --- |
| Selenium | mg/L | < 0.01 + | < 0.01 + | --- | --- |
| Thallium | mg/L | < 0.0005 | < 0.0005 | --- | --- |

Legend:

--, not analyzed

ft AMSL, feet above mean sea level

mg/L, milligrams per liter

s.u., standard units for pH

pCi/L, picocuries per liter

Notes:

Non-detects have been listed at the reported primary quantitation limit.

Metal concentrations represent the total fraction (i.e. samples have not been filtered).

Precision is not recorded for samples with radiological concentrations below the reporting limit.

GRE's analytical laboratory switched radiochemical methodologies beginning in Q4 2019, resulting in changes to the radiochemical reporting.

Laboratory Provided Qualifiers:

+ = Analyte required a dilution due to internal standard response, resulting in an elevated RL.

**Table 4: Sample Results Summary Table - MW-7B**

| | | MW-7B | | | |
|---|---|---|---|---|---|
| | | Additonal Baseline Data | | Detection Monitoring | |
| | **Units** | **10-Jun-19** | **25-Nov-19** | **10-Jun-19** | **25-Nov-19** |
| Water Elevation | ft AMSL | 1701.6 | 1702.9 | 1701.6 | 1702.9 |
| ***Appendix III Parameters*** | | | | | |
| Boron | mg/L | --- | --- | 0.47 | 0.42 |
| Calcium | mg/L | --- | --- | 12.7 | 17.3 |
| Chloride | mg/L | --- | --- | 11.8 | 11.4 |
| Fluoride | mg/L | --- | --- | 0.62 | 0.6 |
| pH, Field | s.u. | --- | --- | 7.69 | 7.73 |
| Sulfate | mg/L | --- | --- | 286 | 261 |
| Total Dissolved Solids | mg/L | --- | --- | 1030 | 949 |
| ***Appendix IV Parameters*** | | | | | |
| Antimony | mg/L | < 0.001 | < 0.001 | --- | --- |
| Arsenic | mg/L | < 0.002 | < 0.002 | --- | --- |
| Barium | mg/L | 0.0144 | 0.0163 | --- | --- |
| Beryllium | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Cadmium | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Chromium | mg/L | < 0.002 | < 0.002 | --- | --- |
| Cobalt | mg/L | < 0.002 | < 0.002 | --- | --- |
| Fluoride | mg/L | 0.62 | 0.6 | --- | --- |
| Lead | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Lithium | mg/L | 0.057 | 0.062 | --- | --- |
| Mercury | mg/L | < 0.0002 | < 0.0002 | --- | --- |
| Molybdenum | mg/L | 0.0071 | 0.0068 | --- | --- |
| Radium 226 | pCi/L | < 0.2 | 0.3 ± 0.1 | --- | --- |
| Radium 228 | pCi/L | < 2.0 | 0.3 U ± 0.7 | --- | --- |
| Radium 226 and 228 combined | pCi/L | < 2.0 | 0.6 U ± 0.8 | --- | --- |
| Selenium | mg/L | < 0.005 | < 0.005 | --- | --- |
| Thallium | mg/L | < 0.0005 | < 0.0005 | --- | --- |

Legend:

--, not analyzed

ft AMSL, feet above mean sea level

mg/L, milligrams per liter

s.u., standard units for pH

pCi/L, picocuries per liter

Notes:

Non-detects have been listed at the reported primary quantitation limit.

Metal concentrations represent the total fraction (i.e. samples have not been filtered).

Precision is not recorded for samples with radiological concentrations below the reporting limit.

GRE's analytical laboratory switched radiochemical methodologies beginning in Q4 2019, resulting in changes to the radiochemical reporting.

Laboratory Provided Qualifiers:

U (Radiochem) = Not detected above the minimum detectable concentration (varies by sample).

**Table 5: Sample Results Summary Table - MW-8B**

| | | MW-8B | | | |
|---|---|---|---|---|---|
| | | Additonal Baseline Data | | Detection Monitoring | |
| | Units | 10-Jun-19 | 25-Nov-19 | 10-Jun-19 | 25-Nov-19 |
| Water Elevation | ft AMSL | 1705.6 | 1709.8 | 1705.6 | 1709.8 |
| ***Appendix III Parameters*** | | | | | |
| Boron | mg/L | --- | --- | 0.35 | 0.34 |
| Calcium | mg/L | --- | --- | 71.2 | 98.6 |
| Chloride | mg/L | --- | --- | 11.4 | 12.3 |
| Fluoride | mg/L | --- | --- | 0.27 | 0.28 |
| pH, Field | s.u. | --- | --- | 7.43 | 7.43 |
| Sulfate | mg/L | --- | --- | 354 | 358 |
| Total Dissolved Solids | mg/L | --- | --- | 1010 | 1050 |
| ***Appendix IV Parameters*** | | | | | |
| Antimony | mg/L | < 0.001 | < 0.001 | --- | --- |
| Arsenic | mg/L | < 0.002 | < 0.002 | --- | --- |
| Barium | mg/L | 0.0277 | 0.0281 | --- | --- |
| Beryllium | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Cadmium | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Chromium | mg/L | < 0.002 | < 0.002 | --- | --- |
| Cobalt | mg/L | < 0.002 | < 0.002 | --- | --- |
| Fluoride | mg/L | 0.27 | 0.28 | --- | --- |
| Lead | mg/L | < 0.0005 | 0.0005 | --- | --- |
| Lithium | mg/L | 0.075 | 0.089 | --- | --- |
| Mercury | mg/L | < 0.0002 | < 0.0002 | --- | --- |
| Molybdenum | mg/L | < 0.005 ^ | < 0.002 | --- | --- |
| Radium 226 | pCi/L | < 0.2 | 0.2 ± 0.1 | --- | --- |
| Radium 228 | pCi/L | < 2.0 | 0.5 U ± 0.6 | --- | --- |
| Radium 226 and 228 combined | pCi/L | < 2.0 | 0.7 U ± 0.7 | --- | --- |
| Selenium | mg/L | 0.0066 | < 0.005 | --- | --- |
| Thallium | mg/L | < 0.0005 | < 0.0005 | --- | --- |

Legend:

--, not analyzed

ft AMSL, feet above mean sea level

mg/L, milligrams per liter

s.u., standard units for pH

pCi/L, picocuries per liter

Notes:

Non-detects have been listed at the reported primary quantitation limit.

Metal concentrations represent the total fraction (i.e. samples have not been filtered).

Precision is not recorded for samples with radiological concentrations below the reporting limit.

GRE's analytical laboratory switched radiochemical methodologies beginning in Q4 2019, resulting in changes to the radiochemical reporting.

Laboratory Provided Qualifiers:

^ = Reporting limit elevated due to instrument performance at the lower limit of quantification (LLOQ).

U (Radiochem) = Not detected above the minimum detectable concentration (varies by sample).

**Table 6: Sample Results Summary Table - MW-105**

| | | MW-105 | | | |
|---|---|---|---|---|---|
| | | Additional Baseline Data | | Detection Monitoring | |
| | Units | 10-Jun-19 | 25-Nov-19 | 10-Jun-19 | 25-Nov-19 |
| Water Elevation | ft AMSL | 1702.2 | 1703.7 | 1702.2 | 1703.7 |
| ***Appendix III Parameters*** | | | | | |
| Boron | mg/L | --- | --- | 0.38 | 0.37 |
| Calcium | mg/L | --- | --- | 41.4 | 42.4 |
| Chloride | mg/L | --- | --- | 13.6 | 12.2 |
| Fluoride | mg/L | --- | --- | 0.89 | 1.00 |
| pH, Field | s.u. | --- | --- | 7.73 | 7.84 |
| Sulfate | mg/L | --- | --- | 622 | 571 |
| Total Dissolved Solids | mg/L | --- | --- | 1680 | 1500 |
| ***Appendix IV Parameters*** | | | | | |
| Antimony | mg/L | < 0.001 | < 0.001 | --- | --- |
| Arsenic | mg/L | < 0.002 | < 0.002 | --- | --- |
| Barium | mg/L | 0.0548 | 0.0438 | --- | --- |
| Beryllium | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Cadmium | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Chromium | mg/L | 0.005 | 0.0028 | --- | --- |
| Cobalt | mg/L | < 0.002 | < 0.002 | --- | --- |
| Fluoride | mg/L | 0.89 | 1.00 | --- | --- |
| Lead | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Lithium | mg/L | 0.057 | 0.056 | --- | --- |
| Mercury | mg/L | < 0.0002 | < 0.0002 | --- | --- |
| Molybdenum | mg/L | 0.0257 | 0.0331 | --- | --- |
| Radium 226 | pCi/L | < 0.2 | 0.2 ± 0.1 | --- | --- |
| Radium 228 | pCi/L | < 2.0 | 0.5 U ± 0.6 | --- | --- |
| Radium 226 and 228 combined | pCi/L | < 2.0 | 0.7 U ± 0.7 | --- | --- |
| Selenium | mg/L | 0.0443 | 0.0374 | --- | --- |
| Thallium | mg/L | < 0.0005 | < 0.0005 | --- | --- |

Legend:

--, not analyzed

ft AMSL, feet above mean sea level

mg/L, milligrams per liter

s.u., standard units for pH

pCi/L, picocuries per liter

Notes:

Non-detects have been listed at the reported primary quantitation limit.

Metal concentrations represent the total fraction (i.e. samples have not been filtered).

Precision is not recorded for samples with radiological concentrations below the reporting limit.

GRE's analytical laboratory switched radiochemical methodologies beginning in Q4 2019, resulting in changes to the radiochemical reporting.

Laboratory Provided Qualifiers:

U (Radiochem) = Not detected above the minimum detectable concentration (varies by sample).

**Table 7: Sample Results Summary Table - MW-3B**

| | | MW-3B | | |
|---|---|---|---|---|
| | | Additional Baseline Data | Detection Monitoring | |
| | **Units** | **10-Jun-19** | **10-Jun-19** | **25-Nov-19** |
| Water Elevation | ft AMSL | 1700.4 | 1700.4 | *** |
| ***Appendix III Parameters*** | | | | |
| Boron | mg/L | --- | 0.50 | *** |
| Calcium | mg/L | --- | 41.2 | *** |
| Chloride | mg/L | --- | 16.6 | *** |
| Fluoride | mg/L | --- | 0.57 | *** |
| pH, Field | s.u. | --- | 7.64 | *** |
| Sulfate | mg/L | --- | 497 | *** |
| Total Dissolved Solids | mg/L | --- | 1380 | *** |
| ***Appendix IV Parameters*** | | | | |
| Antimony | mg/L | < 0.001 | --- | --- |
| Arsenic | mg/L | 0.0038 | --- | --- |
| Barium | mg/L | 0.0396 | --- | --- |
| Beryllium | mg/L | < 0.0005 | --- | --- |
| Cadmium | mg/L | < 0.0005 | --- | --- |
| Chromium | mg/L | < 0.002 | --- | --- |
| Cobalt | mg/L | < 0.002 | --- | --- |
| Fluoride | mg/L | 0.57 | --- | --- |
| Lead | mg/L | < 0.0005 | --- | --- |
| Lithium | mg/L | 0.06 | --- | --- |
| Mercury | mg/L | < 0.0002 | --- | --- |
| Molybdenum | mg/L | 0.0102 | --- | --- |
| Radium 226 | pCi/L | < 0.2 | --- | --- |
| Radium 228 | pCi/L | < 2.0 | --- | --- |
| Radium 226 and 228 combined | pCi/L | < 2.0 | --- | --- |
| Selenium | mg/L | < 0.005 | --- | --- |
| Thallium | mg/L | < 0.0005 | --- | --- |

Legend:

--, not analyzed

ft AMSL, feet above mean sea level

mg/L, milligrams per liter

s.u., standard units for pH

pCi/L, picocuries per liter

Notes:

Non-detects have been listed at the reported primary quantitation limit.

Metal concentrations represent the total fraction (i.e. samples have not been filtered).

Precision is not recorded for samples with radiological concentrations below the reporting limit.

*** - MW-3B was abandoned due to construction activity following Q2 2019.

Laboratory Provided Qualifiers:

No laboratory provided qualifiers were applied to results from the Q2 sample.

**Table 8: Sample Results Summary Table - MW-9N**

| | | MW-9N | | | |
|---|---|---|---|---|---|
| | | Additonal Baseline Data | | Detection Monitoring | |
| | Units | 11-Jun-19 | 25-Nov-19 | 11-Jun-19 | 25-Nov-19 |
| Water Elevation | ft AMSL | 1689.1 | 1690.0 | 1689.1 | 1690.0 |
| ***Appendix III Parameters*** | | | | | |
| Boron | mg/L | --- | --- | 2.30 | 2.64 |
| Calcium | mg/L | --- | --- | 70.2 | 90.8 |
| Chloride | mg/L | --- | --- | 19.6 | 31.2 |
| Fluoride | mg/L | --- | --- | 0.59 | 0.54 |
| pH, Field | s.u. | --- | --- | 6.78 | 7.11 |
| Sulfate | mg/L | --- | --- | 1290 | 1360 |
| Total Dissolved Solids | mg/L | --- | --- | 2860 | 2930 |
| ***Appendix IV Parameters*** | | | | | |
| Antimony | mg/L | < 0.001 | < 0.001 | --- | --- |
| Arsenic | mg/L | < 0.002 | < 0.002 | --- | --- |
| Barium | mg/L | 0.0651 | 0.0644 | --- | --- |
| Beryllium | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Cadmium | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Chromium | mg/L | < 0.002 | < 0.002 | --- | --- |
| Cobalt | mg/L | 0.0032 | 0.0029 | --- | --- |
| Fluoride | mg/L | 0.59 | 0.54 | --- | --- |
| Lead | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Lithium | mg/L | 0.045 | 0.054 | --- | --- |
| Mercury | mg/L | < 0.0002 | < 0.0002 | --- | --- |
| Molybdenum | mg/L | 0.0488 | 0.0437 | --- | --- |
| Radium 226 | pCi/L | < 0.2 | 0.2 U ± 0.2 | --- | --- |
| Radium 228 | pCi/L | < 2.0 | 0.5 U ± 0.8 | --- | --- |
| Radium 226 and 228 combined | pCi/L | < 2.0 | 0.7 U ± 1.0 | --- | --- |
| Selenium | mg/L | 0.0234 | 0.0142 | --- | --- |
| Thallium | mg/L | < 0.0005 | < 0.0005 | --- | --- |

Legend:

--, not analyzed

ft AMSL, feet above mean sea level

mg/L, milligrams per liter

s.u., standard units for pH

pCi/L, picocuries per liter

Notes:

Non-detects have been listed at the reported primary quantitation limit.

Metal concentrations represent the total fraction (i.e. samples have not been filtered).

Precision is not recorded for samples with radiological concentrations below the reporting limit.

GRE's analytical laboratory switched radiochemical methodologies beginning in Q4 2019, resulting in changes to the radiochemical reporting.

Laboratory Provided Qualifiers:

U (Radiochem) = Not detected above the minimum detectable concentration (varies by sample).

**Table 9: Sample Results Summary Table - MW-101**

| | | MW-101 | | |
|---|---|---|---|---|
| | | Additional Baseline Data | Detection Monitoring | |
| | Units | 10-Jun-19 | 10-Jun-19 | 25-Nov-19 |
| Water Elevation | ft AMSL | 1696.4 | 1696.4 | *** |
| ***Appendix III Parameters*** | | | | |
| Boron | mg/L | --- | 1.51 | *** |
| Calcium | mg/L | --- | 9.7 | *** |
| Chloride | mg/L | --- | 8.4 | *** |
| Fluoride | mg/L | --- | 0.99 | *** |
| pH, Field | s.u. | --- | 9.75 | *** |
| Sulfate | mg/L | --- | 239 | *** |
| Total Dissolved Solids | mg/L | --- | 1940 | *** |
| ***Appendix IV Parameters*** | | | | |
| Antimony | mg/L | 0.0021 | --- | --- |
| Arsenic | mg/L | 0.081 | --- | --- |
| Barium | mg/L | 0.1647 | --- | --- |
| Beryllium | mg/L | < 0.0005 | --- | --- |
| Cadmium | mg/L | < 0.0005 | --- | --- |
| Chromium | mg/L | 0.0021 | --- | --- |
| Cobalt | mg/L | < 0.002 | --- | --- |
| Fluoride | mg/L | 0.99 | --- | --- |
| Lead | mg/L | 0.0137 | --- | --- |
| Lithium | mg/L | < 0.02 | --- | --- |
| Mercury | mg/L | < 0.0002 | --- | --- |
| Molybdenum | mg/L | 0.0395 | --- | --- |
| Radium 226 | pCi/L | 0.2 ± 0.1 | --- | --- |
| Radium 228 | pCi/L | < 2.0 | --- | --- |
| Radium 226 and 228 combined | pCi/L | < 2.0 | --- | --- |
| Selenium | mg/L | < 0.005 | --- | --- |
| Thallium | mg/L | < 0.0005 | --- | --- |

Legend:
--, not analyzed
ft AMSL, feet above mean sea level
mg/L, milligrams per liter
s.u., standard units for pH
pCi/L, picocuries per liter

Notes:
Non-detects have been listed at the reported primary quantitation limit.
Metal concentrations represent the total fraction (i.e. samples have not been filtered).
Precision is not recorded for samples with radiological concentrations below the reporting limit.
*** - MW-101 was abandoned due to construction activity following Q2 2019.

Laboratory Provided Qualifiers:
No laboratory provided qualifiers were applied to results from the Q2 sample.

**Table 10: Sample Results Summary Table - MW-102**

| | | MW-102 | | | |
|---|---|---|---|---|---|
| | | Additional Baseline Data | | Detection Monitoring | |
| | **Units** | **11-Jun-19** | **26-Nov-19** | **11-Jun-19** | **26-Nov-19** |
| Water Elevation | ft AMSL | 1693.2 | 1694.5 | 1693.2 | 1694.5 |
| ***Appendix III Parameters*** | | | | | |
| Boron | mg/L | --- | --- | 1.76 | 0.53 |
| Calcium | mg/L | --- | --- | 36.4 | 63.3 |
| Chloride | mg/L | --- | --- | 20.3 | 16.0 |
| Fluoride | mg/L | --- | --- | 0.90 | 0.53 |
| pH, Field | s.u. | --- | --- | 7.24 | 7.69 |
| Sulfate | mg/L | --- | --- | 656 | 615 |
| Total Dissolved Solids | mg/L | --- | --- | 1850 | 1450 |
| ***Appendix IV Parameters*** | | | | | |
| Antimony | mg/L | < 0.001 | < 0.001 | --- | --- |
| Arsenic | mg/L | < 0.002 | < 0.002 | --- | --- |
| Barium | mg/L | 0.0335 | 0.0254 | --- | --- |
| Beryllium | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Cadmium | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Chromium | mg/L | < 0.002 | < 0.002 | --- | --- |
| Cobalt | mg/L | < 0.002 | < 0.002 | --- | --- |
| Fluoride | mg/L | 0.9 | 0.53 | --- | --- |
| Lead | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Lithium | mg/L | 0.043 | 0.061 | --- | --- |
| Mercury | mg/L | < 0.0002 | < 0.0002 | --- | --- |
| Molybdenum | mg/L | 0.099 | 0.0293 | --- | --- |
| Radium 226 | pCi/L | < 0.2 | 0.3 ± 0.2 | --- | --- |
| Radium 228 | pCi/L | < 2.0 | 0.1 U ± 0.7 | --- | --- |
| Radium 226 and 228 combined | pCi/L | < 2.0 | 0.4 U ± 0.9 | --- | --- |
| Selenium | mg/L | < 0.005 | < 0.005 | --- | --- |
| Thallium | mg/L | < 0.0005 | < 0.0005 | --- | --- |

Legend:

--, not analyzed

ft AMSL, feet above mean sea level

mg/L, milligrams per liter

s.u., standard units for pH

pCi/L, picocuries per liter

Notes:

Non-detects have been listed at the reported primary quantitation limit.

Metal concentrations represent the total fraction (i.e. samples have not been filtered).

Precision is not recorded for samples with radiological concentrations below the reporting limit.

GRE's analytical laboratory switched radiochemical methodologies beginning in Q4 2019, resulting in changes to the radiochemical reporting.

Laboratory Provided Qualifiers:

U (Radiochem) = Not detected above the minimum detectable concentration (varies by sample).

**Table 11: Sample Results Summary Table - MW-1R**

| | | MW-1R | | | |
|---|---|---|---|---|---|
| | | Additional Baseline Data | | Detection Monitoring | |
| | Units | 11-Jun-19 | 26-Nov-19 | 11-Jun-19 | 26-Nov-19 |
| Water Elevation | ft AMSL | 1689.173 | 1689.863 | 1689.173 | 1689.863 |
| ***Appendix III Parameters*** | | | | | |
| Boron | mg/L | --- | --- | 1.34 | 1.26 |
| Calcium | mg/L | --- | --- | 100 | 120 |
| Chloride | mg/L | --- | --- | 16.8 | 16.4 |
| Fluoride | mg/L | --- | --- | 0.70 | 0.61 |
| pH, Field | s.u. | --- | --- | 7.53 | 7.81 |
| Sulfate | mg/L | --- | --- | 329 | 327 |
| Total Dissolved Solids | mg/L | --- | --- | 1020 | 1030 |
| ***Appendix IV Parameters*** | | | | | |
| Antimony | mg/L | < 0.001 | < 0.001 | --- | --- |
| Arsenic | mg/L | < 0.002 | < 0.002 | --- | --- |
| Barium | mg/L | 0.0445 | 0.0422 | --- | --- |
| Beryllium | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Cadmium | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Chromium | mg/L | < 0.002 | < 0.002 | --- | --- |
| Cobalt | mg/L | < 0.002 | < 0.002 | --- | --- |
| Fluoride | mg/L | 0.7 | 0.61 | --- | --- |
| Lead | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Lithium | mg/L | 0.052 | 0.055 | --- | --- |
| Mercury | mg/L | < 0.0002 | < 0.0002 | --- | --- |
| Molybdenum | mg/L | 0.0126 | 0.0129 | --- | --- |
| Radium 226 | pCi/L | 0.2 ± 0.1 | 0.2 U ± 0.1 | --- | --- |
| Radium 228 | pCi/L | < 2.0 | 0.8 U ± 0.7 | --- | --- |
| Radium 226 and 228 combined | pCi/L | < 2.0 | 1.0 U ± 0.8 | --- | --- |
| Selenium | mg/L | < 0.005 | < 0.005 | --- | --- |
| Thallium | mg/L | < 0.0005 | < 0.0005 | --- | --- |

Legend:

--, not analyzed

ft AMSL, feet above mean sea level

mg/L, milligrams per liter

s.u., standard units for pH

pCi/L, picocuries per liter

Notes:

Non-detects have been listed at the reported primary quantitation limit.

Metal concentrations represent the total fraction (i.e. samples have not been filtered).

Precision is not recorded for samples with radiological concentrations below the reporting limit.

GRE's analytical laboratory switched radiochemical methodologies beginning in Q4 2019, resulting in changes to the radiochemical reporting.

Laboratory Provided Qualifiers:

U (Radiochem) = Not detected above the minimum detectable concentration (varies by sample).

**Table 12: Sample Results Summary Table - MW-103**

| | | MW-103 | | | |
|---|---|---|---|---|---|
| | | Additional Baseline Ddata | | Detection Monitoring | |
| | Units | 11-Jun-19 | 26-Nov-19 | 11-Jun-19 | 26-Nov-19 |
| Water Elevation | ft AMSL | 1689.3 | 1690.0 | 1689.3 | 1690.0 |
| ***Appendix III Parameters*** | | | | | |
| Boron | mg/L | --- | --- | 1.12 | 1.36 |
| Calcium | mg/L | --- | --- | 11.7 | 23.6 |
| Chloride | mg/L | --- | --- | 17.4 | 17.2 |
| Fluoride | mg/L | --- | --- | 0.41 | 0.41 |
| pH, Field | s.u. | --- | --- | 9.19 | 9.43 |
| Sulfate | mg/L | --- | --- | 545 | 847 |
| Total Dissolved Solids | mg/L | --- | --- | 1720 | 2110 |
| ***Appendix IV Parameters*** | | | | | |
| Antimony | mg/L | < 0.001 | < 0.001 | --- | --- |
| Arsenic | mg/L | 0.0181 | 0.0223 | --- | --- |
| Barium | mg/L | 0.0486 | 0.0548 | --- | --- |
| Beryllium | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Cadmium | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Chromium | mg/L | < 0.002 | < 0.002 | --- | --- |
| Cobalt | mg/L | < 0.002 | < 0.002 | --- | --- |
| Fluoride | mg/L | 0.41 | 0.41 | --- | --- |
| Lead | mg/L | 0.0018 | 0.003 | --- | --- |
| Lithium | mg/L | 0.022 | 0.023 | --- | --- |
| Mercury | mg/L | < 0.0002 | < 0.0002 | --- | --- |
| Molybdenum | mg/L | 0.0289 | 0.0461 | --- | --- |
| Radium 226 | pCi/L | < 0.2 | 0.7 ± 0.2 | --- | --- |
| Radium 228 | pCi/L | < 2.0 | 0.5 U ± 0.7 | --- | --- |
| Radium 226 and 228 combined | pCi/L | < 2.0 | 1.2 ± 0.9 | --- | --- |
| Selenium | mg/L | < 0.005 | 0.0105 | --- | --- |
| Thallium | mg/L | < 0.0005 | < 0.0005 | --- | --- |

Legend:

--, not analyzed

ft AMSL, feet above mean sea level

mg/L, milligrams per liter

s.u., standard units for pH

pCi/L, picocuries per liter

Notes:

Non-detects have been listed at the reported primary quantitation limit.

Metal concentrations represent the total fraction (i.e. samples have not been filtered).

Precision is not recorded for samples with radiological concentrations below the reporting limit.

GRE's analytical laboratory switched radiochemical methodologies beginning in Q4 2019, resulting in changes to the radiochemical reporting.

Laboratory Provided Qualifiers:

U (Radiochem) = Not detected above the minimum detectable concentration (varies by sample).

**Table 13: Sample Results Summary Table - MW-104**

| | | MW-104 | | | |
|---|---|---|---|---|---|
| | | Additional Baseline Data | | Detection Monitoring | |
| | **Units** | **11-Jun-19** | **26-Nov-19** | **11-Jun-19** | **26-Nov-19** |
| Water Elevation | ft AMSL | 1689.3 | 1690.0 | 1689.3 | 1690.0 |
| ***Appendix III Parameters*** | | | | | |
| Boron | mg/L | --- | --- | 0.69 | 0.73 |
| Calcium | mg/L | --- | --- | 73.3 | 101 |
| Chloride | mg/L | --- | --- | 14.9 | 14.6 |
| Fluoride | mg/L | --- | --- | 0.74 | 0.65 |
| pH, Field | s.u. | --- | --- | 7.05 | 7.32 |
| Sulfate | mg/L | --- | --- | 368 | 407 |
| Total Dissolved Solids | mg/L | --- | --- | 1150 | 1190 |
| ***Appendix IV Parameters*** | | | | | |
| Antimony | mg/L | < 0.001 | < 0.001 | --- | --- |
| Arsenic | mg/L | < 0.002 | < 0.002 | --- | --- |
| Barium | mg/L | 0.0545 | 0.058 | --- | --- |
| Beryllium | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Cadmium | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Chromium | mg/L | < 0.002 | < 0.002 | --- | --- |
| Cobalt | mg/L | < 0.002 | < 0.002 | --- | --- |
| Fluoride | mg/L | 0.74 | 0.65 | --- | --- |
| Lead | mg/L | < 0.0005 | < 0.0005 | --- | --- |
| Lithium | mg/L | 0.028 | 0.032 | --- | --- |
| Mercury | mg/L | < 0.0002 | < 0.0002 | --- | --- |
| Molybdenum | mg/L | 0.025 | 0.0231 | --- | --- |
| Radium 226 | pCi/L | < 0.2 | 0.3 ± 0.2 | --- | --- |
| Radium 228 | pCi/L | < 2.0 | 0.4 U ± 0.7 | --- | --- |
| Radium 226 and 228 combined | pCi/L | < 2.0 | 0.7 U ± 0.9 | --- | --- |
| Selenium | mg/L | < 0.005 | < 0.005 | --- | --- |
| Thallium | mg/L | < 0.0005 | < 0.0005 | --- | --- |

Legend:

--, not analyzed

ft AMSL, feet above mean sea level

mg/L, milligrams per liter

s.u., standard units for pH

pCi/L, picocuries per liter

Notes:

Non-detects have been listed at the reported primary quantitation limit.

Metal concentrations represent the total fraction (i.e. samples have not been filtered).

Precision is not recorded for samples with radiological concentrations below the reporting limit.

GRE's analytical laboratory switched radiochemical methodologies beginning in Q4 2019, resulting in changes to the radiochemical reporting.

Laboratory Provided Qualifiers:

U (Radiochem) = Not detected above the minimum detectable concentration (varies by sample).

**Table 14: MW-6B Comparative Statistics**

| | | Statistical Method | Statistical Limit | Detection Monitoring Result | CUSUM Value | Within Limit? | Detection Monitoring Result | CUSUM Value | Within Limit? |
|---|---|---|---|---|---|---|---|---|---|
| **Appendix III Analytes** | **Units** | | | **26-Nov-18** | | | **10-Jun-19** | | |
| Boron, Total | mg/L | CUSUM | 0.40 | 0.31 | 0.33 | Yes | 0.36 | 0.34 | Yes |
| Calcium, Total | mg/L | CUSUM | 41.7 | 21.1 | 29.3 | Yes | 23.5 | 29.3 | Yes |
| Chloride | mg/L | CUSUM | 16.2 | 14.8 | 15.7 | Yes | 16.1 | 18.6 | No (Potential Exceedance) |
| Fluoride | mg/L | CUSUM | 0.71 | 0.59 | 0.56 | Yes | 0.55 | 0.56 | Yes |
| pH, Field-Measured | s.u. | CUSUM | 7.23, 8.00 | 7.59 | 7.61, 7.61 | Yes | 7.43 | 7.53, 7.61 | Yes |
| Sulfate | mg/L | CUSUM | 456 | 353 | 349 | Yes | 349 | 349 | Yes |
| Total Dissolved Solids | mg/L | CUSUM | 1182 | 1040 | 1053 | Yes | 1060 | 1053 | Yes |

Notes:
mg/L, milligrams per liter
s.u., standard units for pH
CUSUM: Parametric Shewhart-CUSUM Control Chart

**Table 15: MW-7A Comparative Statistics**

| Appendix III Analytes | Units | Statistical Method | Statistical Limit | Detection Monitoring Result 26-Nov-18 | CUSUM Value | Within Limit? | Detection Monitoring Result 10-Jun-19 | CUSUM Value | Within Limit? |
|---|---|---|---|---|---|---|---|---|---|
| Boron, Total | mg/L | CUSUM | 1.28 | 0.66 | 0.77 | Yes | 0.70 | 0.77 | Yes |
| Calcium, Total | mg/L | CUSUM | 503 | 403 | 430 | Yes | 377 | 430 | Yes |
| Chloride | mg/L | CUSUM | 66.8 | 35.9 | 41.9 | Yes | 39.8 | 41.9 | Yes |
| Fluoride | mg/L | CUSUM | 0.65 | 0.53 | 0.54 | Yes | 0.52 | 0.54 | Yes |
| pH, Field-Measured | s.u. | CUSUM | 6.88, 7.48 | 7.2 | 7.18, 7.18 | Yes | 7.30 | 7.18, 7.22 | Yes |
| Sulfate | mg/L | CUSUM | 14880 | 9460 | 10542 | Yes | 10700 | 10695 | Yes |
| Total Dissolved Solids | mg/L | CUSUM | 18466 | 14500 | 15650 | Yes | 17000 | 16374 | Yes |

Notes:
mg/L, milligrams per liter
s.u., standard units for pH
CUSUM: Parametric Shewhart-CUSUM Control Chart

**Table 16: MW-7B Comparative Statistics**

| | | Statistical Method | Statistical Limit | Detection Monitoring Result | CUSUM Value | Within Limit? | Detection Monitoring Result | CUSUM Value | Within Limit? |
|---|---|---|---|---|---|---|---|---|---|
| **Appendix III Analytes** | **Units** | | | **26-Nov-18** | | | **10-Jun-19** | | |
| Boron, Total | mg/L | CUSUM | 0.52 | 0.41 | 0.43 | Yes | 0.47 | 0.45 | Yes |
| Calcium, Total | mg/L | CUSUM | 21.2 | 15.6 | 18.9 | Yes | 12.7 | 18.9 | Yes |
| Chloride | mg/L | CUSUM | 14.1 | 11.4 | 11.6 | Yes | 11.8 | 13.1 | Yes |
| Fluoride | mg/L | CUSUM | 0.73 | 0.58 | 0.58 | Yes | 0.62 | 0.59 | Yes |
| pH, Field-Measured | s.u. | CUSUM | 7.18, 8.03 | 7.64 | 7.60, 7.60 | Yes | 7.69 | 7.60, 7.60 | Yes |
| Sulfate | mg/L | CUSUM | 446 | 304 | 309 | Yes | 286 | 309 | Yes |
| Total Dissolved Solids | mg/L | NP-PL | 1510 | 937 | --- | Yes | 1030 | --- | Yes |

Notes:

mg/L, milligrams per liter

s.u., standard units for pH

NP-PL: Non-Parametric Prediction Limit

CUSUM: Parametric Shewhart-CUSUM Control Chart

**Table 17: MW-8B Comparative Statistics**

| | | Statistical Method | Statistical Limit | Detection Monitoring Result | CUSUM Value | Within Limit? | Detection Monitoring Result | CUSUM Value | Within Limit? |
|---|---|---|---|---|---|---|---|---|---|
| **Appendix III Analytes** | **Units** | | | **26-Nov-18** | | | **10-Jun-19** | | |
| Boron, Total | mg/L | CUSUM | 0.59 | 0.38 | 0.31 | Yes | 0.35 | 0.30 | Yes |
| Calcium, Total | mg/L | CUSUM | 107 | 77.0 | 84.6 | Yes | 71.2 | 84.6 | Yes |
| Chloride | mg/L | CUSUM | 23.0 | 13.0 | 11.3 | Yes | 11.4 | 11.3 | Yes |
| Fluoride | mg/L | CUSUM | 0.47 | 0.35 | 0.30 | Yes | 0.27 | 0.27 | Yes |
| pH, Field-Measured | s.u. | CUSUM | 7.14, 7.63 | 7.34 | 7.29, 7.38 | Yes | 7.43 | 7.38, 7.38 | Yes |
| Sulfate | mg/L | CUSUM | 921 | 490 | 366 | Yes | 354 | 366 | Yes |
| Total Dissolved Solids | mg/L | CUSUM | 2054 | 1270 | 1028 | Yes | 1010 | 963 | Yes |

Notes:
mg/L, milligrams per liter
s.u., standard units for pH
CUSUM: Parametric Shewhart-CUSUM Control Chart

**Table 18: MW-105 Comparative Statistics**

| | | Statistical Method | Statistical Limit | Detection Monitoring Result | CUSUM Value | Within Limit? | Detection Monitoring Result | CUSUM Value | Within Limit? |
|---|---|---|---|---|---|---|---|---|---|
| **Appendix III Analytes** | **Units** | | | **26-Nov-18** | | | **10-Jun-19** | | |
| Boron, Total | mg/L | CUSUM | 0.48 | 0.34 | 0.37 | Yes | 0.38 | 0.37 | Yes |
| Calcium, Total | mg/L | NP-PL | 63.4 | 38.9 | --- | Yes | 41.4 | --- | Yes |
| Chloride | mg/L | CUSUM | 66.8 | 13.0 | 19.7 | Yes | 13.6 | 19.7 | Yes |
| Fluoride | mg/L | CUSUM | 1.35 | 1.04 | 0.96 | Yes | 0.89 | 0.96 | Yes |
| pH, Field-Measured | s.u. | CUSUM | 7.43, 8.02 | 7.77 | 7.72, 7.72 | Yes | 7.73 | 7.72, 7.72 | Yes |
| Sulfate | mg/L | CUSUM | 2028 | 597 | 916 | Yes | 622 | 916.4 | Yes |
| Total Dissolved Solids | mg/L | NP-PL | 2470 | 1410 | --- | Yes | 1680 | --- | Yes |

Notes:

mg/L, milligrams per liter

s.u., standard units for pH

NP-PL: Non-Parametric Prediction Limit

CUSUM: Parametric Shewhart-CUSUM Control Chart

**Table 19: MW-3B Comparative Statistics**

| | | Statistical Method | Statistical Limit | Detection Monitoring Result | CUSUM Value | Within Limit? | Detection Monitoring Result | CUSUM Value | Within Limit? |
|---|---|---|---|---|---|---|---|---|---|
| **Appendix III Analytes** | **Units** | | | **27-Nov-18** | | | **10-Jun-19** | | |
| Boron, Total | mg/L | CUSUM | 0.67 | 0.42 | 0.48 | Yes | 0.50 | 0.48 | Yes |
| Calcium, Total | mg/L | CUSUM | 63.3 | 45.6 | 54.8 | Yes | 41.2 | 54.8 | Yes |
| Chloride | mg/L | CUSUM | 23.6 | 17.2 | 17.7 | Yes | 16.6 | 17.7 | Yes |
| Fluoride | mg/L | CUSUM | 0.70 | 0.53 | 0.56 | Yes | 0.57 | 0.56 | Yes |
| pH, Field-Measured | s.u. | CUSUM | 7.20, 7.97 | 7.58 | 7.58, 7.58 | Yes | 7.64 | 7.58, 7.58 | Yes |
| Sulfate | mg/L | CUSUM | 853 | 506 | 617 | Yes | 497 | 617 | Yes |
| Total Dissolved Solids | mg/L | CUSUM | 1694 | 1410 | 1508 | Yes | 1380 | 1508 | Yes |

Notes:
mg/L, milligrams per liter
s.u., standard units for pH
CUSUM: Parametric Shewhart-CUSUM Control Chart

**Table 20: MW-9N Comparative Statistics**

| | | Statistical Method | Statistical Limit | Detection Monitoring Result | CUSUM Value | Within Limit? | Detection Monitoring Result | CUSUM Value | Within Limit? |
|---|---|---|---|---|---|---|---|---|---|
| **Appendix III Analytes** | **Units** | | | **27-Nov-18** | | | **11-Jun-19** | | |
| Boron, Total | mg/L | CUSUM | 3.75 | 2.67 | 2.77 | Yes | 2.3 | 2.77 | Yes |
| Calcium, Total | mg/L | CUSUM | 94.4 | 85.5 | 86.5 | Yes | 70.2 | 78.1 | Yes |
| Chloride | mg/L | CUSUM | 22.0 | 21.2 | 25.2 | No (Potential Exceedance) | 19.6 | 27.8 | No (Verified SSI) |
| Fluoride | mg/L | CUSUM | 0.69 | 0.60 | 0.57 | Yes | 0.59 | 0.58 | Yes |
| pH, Field-Measured | s.u. | CUSUM | 6.71, 7.26 | 7.00 | 6.99, 6.99 | Yes | 6.78 | 6.85, 6.99 | Yes |
| Sulfate | mg/L | CUSUM | 1720 | 1350 | 1283 | Yes | 1290 | 1283 | Yes |
| Total Dissolved Solids | mg/L | CUSUM | 3394 | 3110 | 3066 | Yes | 2860 | 2979 | Yes |

Notes:
mg/L, milligrams per liter
s.u., standard units for pH
CUSUM: Parametric Shewhart-CUSUM Control Chart
SSI: Statistically Significant Increase

**Table 21: MW-101 Comparative Statistics**

| Appendix III Analytes | Units | Statistical Method | Statistical Limit | Detection Monitoring Result 27-Nov-18 | CUSUM Value | Within Limit? | Detection Monitoring Result 10-Jun-19 | CUSUM Value | Within Limit? |
|---|---|---|---|---|---|---|---|---|---|
| Boron, Total | mg/L | CUSUM | 2.20 | 1.56 | 1.57 | Yes | 1.51 | 1.57 | Yes |
| Calcium, Total | mg/L | NP-PL | 17.6 | 9.2 | --- | Yes | 9.7 | --- | Yes |
| Chloride | mg/L | CUSUM | 17.6 | 8.7 | 10.6 | Yes | 8.4 | 10.6 | Yes |
| Fluoride | mg/L | CUSUM | 1.49 | 0.89 | 1.15 | Yes | 0.99 | 1.15 | Yes |
| pH, Field-Measured | s.u. | CUSUM | 9.66, 10.96 | 10 | 9.96, 10.31 | Yes | 9.75 | 9.54, 10.31 | No (Potential Exceedance) |
| Sulfate | mg/L | CUSUM | 799 | 488 | 419 | Yes | 239 | 419 | Yes |
| Total Dissolved Solids | mg/L | NP-PL | 2250 | 2090 | --- | Yes | 1940 | --- | Yes |

Notes:
mg/L, milligrams per liter
s.u., standard units for pH
NP-PL: Non-Parametric Prediction Limit
CUSUM: Parametric Shewhart-CUSUM Control Chart

**Table 22: MW-102 Comparative Statistics**

| | | Statistical Method | Statistical Limit | Detection Monitoring Result | CUSUM Value | Within Limit? | Detection Monitoring Result | CUSUM Value | Within Limit? |
|---|---|---|---|---|---|---|---|---|---|
| **Appendix III Analytes** | **Units** | | | **27-Nov-18** | | | **11-Jun-19** | | |
| Boron, Total | mg/L | CUSUM | 2.84 | 1.39 | 2.09 | Yes | 1.76 | 2.09 | Yes |
| Calcium, Total | mg/L | CUSUM | 106 | 58.4 | 65.2 | Yes | 36.4 | 65.2 | Yes |
| Chloride | mg/L | CUSUM | 22.3 | 17.7 | 16.3 | Yes | 20.3 | 19.1 | Yes |
| Fluoride | mg/L | CUSUM | 1.17 | 0.64 | 0.71 | Yes | 0.90 | 0.80 | Yes |
| pH, Field-Measured | s.u. | CUSUM | 7.06, 7.71 | 7.41 | 7.38, 7.38 | Yes | 7.24 | 7.31, 7.38 | Yes |
| Sulfate | mg/L | CUSUM | 1592 | 787 | 1008 | Yes | 656 | 1008 | Yes |
| Total Dissolved Solids | mg/L | NP-PL | 2410 | 1820 | --- | Yes | 1850 | --- | Yes |

Notes:
mg/L, milligrams per liter
s.u., standard units for pH
NP-PL: Non-Parametric Prediction Limit
CUSUM: Parametric Shewhart-CUSUM Control Chart

**Table 23: MW-1R Comparative Statistics**

| | | Statistical Method | Statistical Limit | Detection Monitoring Result | CUSUM Value | Within Limit? | Detection Monitoring Result | CUSUM Value | Within Limit? |
|---|---|---|---|---|---|---|---|---|---|
| **Appendix III Analytes** | **Units** | | | **27-Nov-18** | | | **11-Jun-19** | | |
| Boron, Total | mg/L | CUSUM | 1.48 | *** | --- | --- | 1.34 | 1.29 | Yes |
| Calcium, Total | mg/L | CUSUM | 138 | *** | --- | --- | 100 | 117 | Yes |
| Chloride | mg/L | CUSUM | 24.0 | *** | --- | --- | 16.8 | 18.2 | Yes |
| Fluoride | mg/L | CUSUM | 0.89 | *** | --- | --- | 0.70 | 0.70 | Yes |
| pH, Field-Measured | s.u. | CUSUM | 7.31, 7.90 | *** | --- | --- | 7.53 | 7.60, 7.60 | Yes |
| Sulfate | mg/L | CUSUM | 470 | *** | --- | --- | 329 | 377 | Yes |
| Total Dissolved Solids | mg/L | CUSUM | 1210 | *** | --- | --- | 1020 | 1065 | Yes |

Notes:

mg/L, milligrams per liter

s.u., standard units for pH

CUSUM: Parametric Shewhart-CUSUM Control Chart

*** Sampling at MW-1R was not possible during the Q4 2018 sampling event due to site constuction activities. Sampling resumed during the Q2 2019 sampling event.

**Table 24: MW-103 Comparative Statistics**

| Appendix III Analytes | Units | Statistical Method | Statistical Limit | Detection Monitoring Result 27-Nov-18 | CUSUM Value | Within Limit? | Detection Monitoring Result 11-Jun-19 | CUSUM Value | Within Limit? |
|---|---|---|---|---|---|---|---|---|---|
| Boron, Total | mg/L | CUSUM | 1.33 | 1.25 | 1.32 | Yes | 1.12 | 1.26 | Yes |
| Calcium, Total | mg/L | CUSUM | 34.5 | 16.8 | 20.9 | Yes | 11.7 | 20.9 | Yes |
| Chloride | mg/L | CUSUM | 18.7 | 17.4 | 20.1 | No (Potential Exceedance) | 17.4 | 22.7 | No (Verified SSI) |
| Fluoride | mg/L | CUSUM | 0.33 | 0.41 | 0.53 | No (Potential Exceedance) | 0.41 | 0.68 | No (Verified SSI) |
| pH, Field-Measured | s.u. | CUSUM | 8.89, 9.47 | 9.40 | 9.18, 9.34 | Yes | 9.19 | 9.18, 9.28 | Yes |
| Sulfate | mg/L | CUSUM | 961 | 833 | 764 | Yes | 545 | 649 | Yes |
| Total Dissolved Solids | mg/L | CUSUM | 1948 | 1910 | 1975 | No (False Positive) | 1720 | 1797 | Yes |

Notes:

mg/L, milligrams per liter

s.u., standard units for pH

CUSUM: Parametric Shewhart-CUSUM Control Chart

**Table 25: MW-104 Comparative Statistics**

| | | Statistical Method | Statistical Limit | Detection Monitoring Result | CUSUM Value | Within Limit? | Detection Monitoring Result | CUSUM Value | Within Limit? |
|---|---|---|---|---|---|---|---|---|---|
| **Appendix III Analytes** | **Units** | | | **27-Nov-18** | | | **11-Jun-19** | | |
| Boron, Total | mg/L | CUSUM | 0.84 | 0.68 | 0.67 | Yes | 0.69 | 0.67 | Yes |
| Calcium, Total | mg/L | CUSUM | 108.4 | 92.8 | 92.0 | Yes | 73.3 | 92.0 | Yes |
| Chloride | mg/L | NP-PL | 16.7 | 14.8 | --- | Yes | 14.9 | --- | Yes |
| Fluoride | mg/L | CUSUM | 0.89 | 0.70 | 0.76 | Yes | 0.74 | 0.76 | Yes |
| pH, Field-Measured | s.u. | CUSUM | 6.75, 7.56 | 7.09 | 7.16, 7.16 | Yes | 7.05 | 7.14, 7.16 | Yes |
| Sulfate | mg/L | CUSUM | 586 | 392 | 389 | Yes | 368 | 389 | Yes |
| Total Dissolved Solids | mg/L | CUSUM | 1254 | 1130 | 1099 | Yes | 1150 | 1116 | Yes |

Notes:

mg/L, milligrams per liter

s.u., standard units for pH

NP-PL: Non-Parametric Prediction Limit

CUSUM: Parametric Shewhart-CUSUM Control Chart

# Figures


LEGEND

UPGRADIENT OR SIDEGRADIENT MONITORING WELL

DOWNGRADIENT MONITORING WELL - BOTTOM ASH LANDFILL

DOWNGRADIENT MONITORING WELL - BOTTOM ASH IMPOUNDMENT

MW-1R 1690 MONITORING WELL LOCATION AND GROUNDWATER ELEVATION (FEET ABOVE MEAN SEA LEVEL) NOTE 2

GENERAL DIRECTION OF GROUNDWATER FLOW

NOTE(S)

1. AERIAL IMAGERY OBTAINED FROM UNITED STATES DEPARTMENT OF AGRICULTURE, NATIONAL AGRICULTURE IMAGERY PROGRAM, 2017.
2. GROUNDWATER ELEVATIONS SHOWN WERE MEASURED IN JUNE 2019.

0 200 400
1" = 200' FEET

Path: \\Denver\acad\GREAT RIVER ENERGY\STANTON\99_PROJECTS\1894194\ | File Name: 1894194_2019 Water Quality Monitoring_22JAN20.dwg

GOLDER

**MONITORING WELL LOCATIONS**
**JUNE 2019 GROUNDWATER ELEVATIONS**
**GREAT RIVER ENERGY - STANTON STATION**

**FIGURE 1**


**LEGEND**

- UPGRADIENT OR SIDEGRADIENT MONITORING WELL
- DOWNGRADIENT MONITORING WELL - BOTTOM ASH LANDFILL
- DOWNGRADIENT MONITORING WELL - BOTTOM ASH IMPOUNDMENT
- MW-1R 1690 — MONITORING WELL LOCATION AND GROUNDWATER ELEVATION (FEET ABOVE MEAN SEA LEVEL) NOTE 2
- GENERAL DIRECTION OF GROUNDWATER FLOW

**NOTE(S)**

1. AERIAL IMAGERY OBTAINED FROM UNITED STATES DEPARTMENT OF AGRICULTURE, NATIONAL AGRICULTURE IMAGERY PROGRAM, 2017 AND DRONE AERIAL IMAGE FROM GRE, 2019.
2. GROUNDWATER ELEVATIONS SHOWN WERE MEASURED IN NOVEMBER 2019.
3. THE NORTH AND CENTER CELLS OF THE BOTTOM ASH IMPOUNDMENT HAVE BEEN CLOSED BY REMOVAL OF WASTE AND LINER.
4. THE SOUTH CELL OF THE BOTTOM ASH IMPOUNDMENT IS BEING CLOSED WITH A FINAL COVER OVER PLACED WASTE.
5. THE BOTTOM ASH LANDFILL IS BEING CLOSED BY CONSOLIDATION OF PLACED WASTE INTO A SMALLER FOOTPRINT AND CONSTRUCTION OF A FINAL COVER.
6. MONITORING WELLS MW-3B AND MW-101 WERE REMOVED DURING SITE RESTORATION ACTIVITIES IN OCTOBER 2019.

N

0 200 400
1" = 200' FEET

Path: \\Denver\acad\GREAT RIVER ENERGY\STANTON\99_PROJECTS\1894194\ | File Name: 1894194_2019 Water Quality Monitoring_22JAN20.dwg

GOLDER

**MONITORING WELL LOCATIONS**
**NOVEMBER 2019 GROUNDWATER ELEVATIONS**
**GREAT RIVER ENERGY - STANTON STATION**

**FIGURE 2**

**APPENDIX A**

# Alternative Source Demonstrations – Q2 2019

REPORT

# Alternative Source Demonstration for Chloride in Monitoring Wells MW-9N and MW-103

*Great River Energy – Stanton Station*

Submitted to:

**Great River Energy**
Stanton Station, 4001 Highway 200A, Stanton, North Dakota 58571

Submitted by:

**Golder Associates Inc.**
7245 West Alaska Drive, Suite 200, Lakewood, Colorado 80226

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1894194

January 2, 2020

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**TABLES**



**FIGURES**

# 1.0 INTRODUCTION

On behalf of Great River Energy (GRE), Golder Associates Inc. (Golder) performed a statistical evaluation of groundwater geochemistry results from the second quarter (Q2) 2019 groundwater detection monitoring event at Stanton Station's Bottom Ash coal combustion residual (CCR) landfill (Bottom Ash Landfill) and Bottom Ash CCR surface impoundment (Bottom Ash Impoundment). The statistical evaluation was performed in accordance with applicable provisions of 40 Code of Federal Regulations (CFR) Part 257, "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule" (CCR rule), as amended and as described in the Coal Combustion Residuals Groundwater Statistical Method Certification for Stanton Station (Golder 2017a).

Statistical analyses of the Appendix III detection monitoring data for chloride in groundwater at the downgradient monitoring wells MW-9N (downgradient of the Bottom Ash Landfill) and MW-103 (downgradient of the Bottom Ash Impoundment) indicated potential exceedances of the statistical limits based on the parametric Shewhart-CUSUM (Cumulative Summation) analysis of the fourth quarter (Q4) 2018 sampling results. These potential exceedances were subsequently verified as evidence of a statistically significant increase (SSI) after the Q2 2019 event. Although determination of a verified SSI generally indicates that the groundwater monitoring program should transition from detection monitoring to assessment monitoring, 40 CFR §257.94(e)(2) allows the owner or operator (i.e., GRE) 90 days from the date of determining a verified SSI (October 3, 2019) to demonstrate a source other than the regulated CCR facility caused the SSI or that the SSI was a result of an error in sampling, analysis, or statistical evaluation or natural variability in groundwater quality that was not fully captured during baseline data collection.

Golder's review of the hydrological and geological conditions at Stanton Station indicated the potential for the verified SSI to have resulted from a source other than the CCR facilities. Based on this assessment and in accordance with provisions of the CCR rule, Golder has prepared this Alternative Source Demonstration (ASD) for the CCR facilities. This ASD includes an evaluation of geological, hydrogeological, and chemical information regarding groundwater obtained from monitoring wells installed adjacent to the Bottom Ash Landfill and Bottom Ash Impoundment.

This ASD conforms to the requirements of 40 CFR §257.94(e)(2) and provides the basis for concluding that the verified SSI is not a result of a release from the Bottom Ash Landfill or Bottom Ash Impoundment. The following sections provide a summary of the site at Stanton Station, including the Bottom Ash Landfill and Bottom Ash Impoundment, analytical results, and lines of evidence demonstrating that alternative sources and/or natural variability may be responsible for the chloride verified SSI.

# 2.0 BACKGROUND

Stanton Station was a coal-fired electric generation facility located in Section 16 and 21, Township 144N and Range 84W of Mercer County, approximately three miles southeast of Stanton, North Dakota (Figure 1). Stanton Station began generating power in 1966 and ceased power production in February 2017.

## 2.1 Overview of the Disposal Area

Stanton Station has two CCR facilities that are within the purview of the CCR rule:

- Bottom Ash CCR Landfill (Bottom Ash Landfill) – The Bottom Ash Landfill is located south of the original Stanton Station plant site and adjacent to and west of the Bottom Ash Impoundment.

- Bottom Ash CCR Surface Impoundment (Bottom Ash Impoundment) – The Bottom Ash Impoundment is located south of the original Stanton Station plant site and adjacent to and east of the Bottom Ash Landfill and consists of three interconnected cells designated the north, center, and south cells.

An active rail line, Highway 200A, and agricultural land lies south and west of the Bottom Ash Landfill and Bottom Ash Impoundment and a closed CCR landfill that is currently in post-closure care is located east of the facilities. The historic coal pile and fly ash unloading facility was located north of the Bottom Ash Landfill and Bottom Ash Impoundment.

## 2.2 Site Geology and Hydrogeology

Regional geology of the area surrounding Stanton Station is documented in the Hydrogeologic Assessment Report, Stanton Station Ash Ponds (Braun 1993). Stanton Station is located in the Missouri Slope District of the Glaciated Missouri Plateau Section of the Great Plains Province. Subsurface and surficial stratigraphy of Mercer County and the adjacent Oliver County were reviewed in depth by C.G. Carlson for the North Dakota Geological Society (Carlson 1973). Primary near-surface stratigraphic units in the area of Stanton Station include the Tongue River Formation and Cannonball Formation, with named lignite beds prominent near the site.

Near-surface geology at Stanton Station consists of two primary geologic units: the upper alluvial terrace deposits of the Missouri River, and underlying sediments and bedrock belonging to the Bullion Creek Formation, each of which have varying extents and thicknesses across the site (Braun 1993).

The principal hydrostratigraphic unit and uppermost water-bearing unit near the CCR facilities consists of alluvial deposits, which includes two subunits: an upper silty sand and clay, and an underlying outwash sand and gravel. Individually, these subunits are laterally heterogeneous and geologic conditions within these subunits can be characterized by interbedded layers of gravel, sand, silt, clay, and coal.

Due to variations in subunit thickness throughout the site, groundwater in the uppermost water bearing unit is monitored in both the outwash subunit and the silty sand and clay subunit, with flow generally moving from southwest to northeast towards the Missouri River. Depths from the ground surface to the uppermost water-bearing unit range from 5 to 20 feet in the area around Stanton Station. A map showing recent available groundwater elevations is shown in Figure 1.

The groundwater gradient across the site is influenced by the subsurface units, and ranges from 0.002 to 0.01 ft/ft (Braun 1993). The geometric mean of hydraulic conductivities measured from wells screened in the upper silty sand subunit is $3.7 \times 10^{-4}$ cm/sec, or approximately 1.05 ft/day, while the hydraulic conductivity of the lower outwash unit is approximately $1.4 \times 10^{-2}$ cm/sec or 40 feet/day (Braun 1993).

## 2.3 Groundwater Monitoring Network

The CCR groundwater monitoring system at Stanton Station consists of a total of 12 monitoring wells (four upgradient, one side-gradient, and seven downgradient) to monitor the Bottom Ash Landfill and Bottom Ash Impoundment as separate CCR facilities (Golder 2017b). The monitoring well locations are shown in Figure 1 and listed in Table 1.

**Table 1: CCR Facility Monitoring Wells**

| Location | Well ID |
|---|---|
| Upgradient/Side-gradient | MW-6B (Side-gradient) |
| | MW-7A |
| | MW-7B |
| | MW-8B |
| | MW-105 |
| Bottom Ash Landfill Downgradient | MW-3B |
| | MW-9N |
| | MW-101 |
| | MW-102 |
| Bottom Ash Impoundment Downgradient | MW-1R |
| | MW-103 |
| | MW-104 |

## 2.4 Detection Monitoring Groundwater Conditions

Between June 2016 and July 2017, GRE collected between nine and eleven baseline groundwater samples from each of the upgradient/side-gradient and downgradient wells listed in Table 1, as required by 40 CFR §257.94. The results of the baseline monitoring phase were used to develop appropriate statistical limits for each constituent at each monitoring well (Golder 2017a). Following the completion of the baseline monitoring events, GRE started collecting groundwater samples on a semiannual basis in October 2017 to support the detection monitoring program. Groundwater samples for detection monitoring are collected at each of the five upgradient/side-gradient and seven downgradient monitoring wells and analyzed for 40 CFR Part 257 Appendix III constituents. During the detection monitoring program, the results of groundwater analysis are compared to the calculated statistical limits to determine whether groundwater quality remains consistent or if changes are noted.

During the baseline monitoring period, chloride concentrations were variable in the upgradient/side-gradient and downgradient groundwater, as shown in Figure 2 and Figure 3. Chloride concentrations in upgradient/side-gradient groundwater (based on 49 samples from five wells) ranged from 6.6 to 152 mg/L between June 2016 and July 2017. Downgradient groundwater was also variable (based on 66 samples from seven wells), with chloride concentrations ranging from 7.6 to 20.5 mg/L.

### 2.4.1 Chloride at MW-103

At MW-103, chloride concentrations ranged between 12.1 and 15.4 mg/L during the baseline monitoring period. Based on the baseline monitoring period at MW-103, a CUSUM limit of 18.7 mg/L was developed.

The Q4 2018 detection monitoring event reported a chloride concentration of 17.4 mg/L in groundwater samples collected from MW-103, which resulted in a CUSUM (20.1 mg/L) exceeding the statistical limit. Verification sampling was completed in June 2019 (i.e., Q2 2019) with a chloride concentration of 17.4 mg/L and a CUSUM of 22.7 mg/L, confirming that chloride at MW-103 is a verified SSI.

### 2.4.2 Chloride at MW-9N

At MW-9N, chloride concentrations ranged between 14.0 and 19.0 mg/L during the baseline monitoring period. Based on the baseline monitoring period at MW-9N, a CUSUM limit of 22.0 mg/L was developed.

The Q4 2018 detection monitoring event reported a chloride concentration of 21.2 mg/L in groundwater at MW-9N, which resulted in a CUSUM (25.2 mg/L) exceeding the statistical limit. Verification sampling was completed in June 2019 (i.e., Q2 2019) with a chloride concentration of 19.6 mg/L and a CUSUM of 27.8 mg/L, confirming that chloride at MW-9N is a verified SSI.

# 3.0 SOURCE EVALUATION

## 3.1 Recent Site Activities

As noted previously, Stanton Station ceased operation in February of 2017 and site deconstruction and restoration activities began. These activities have likely affected surface water recharge associated with precipitation and runoff and may have affected groundwater conditions (flow regime and chemistry) near Stanton Station and the associated CCR facilities.

As a part of site deconstruction, the following general activities were completed between the summer of 2017 and the fall of 2019:

- Stanton Station, associated buildings, and pavement were deconstructed and/or demolished. A majority of the above-grade structures were recycled or taken offsite for disposal; however, a small amount of construction and demolition (C&D) material was contained onsite in the Bottom Ash Landfill and Bottom Ash Impoundment (as approved and permitted via the North Dakota Department of Environmental Quality (NDDEQ)).
- The coal unloading sump (near monitoring wells MW-103 and MW-9N), which extended below the elevation of anticipated typical groundwater, was taken out of service (i.e., the sump was turned off) and subsequently filled with compacted earthen material.
- Near-surface utilities (piping, duct banks, etc.) were excavated and disposed of as C&D material.
- Other below-grade structures and utilities were either abandoned in place or filled and abandoned depending on the size of the buried structure/utility.

Site restoration work began at the end of the site deconstruction effort and generally involved the following activities:

- Between 2017 and 2019, the remaining bottom ash and economizer ash from the plant and Bottom Ash Impoundment (north and center cells) was placed in the south cell of the Bottom Ash Impoundment. The north and center cell liner systems were also removed, and these two cells were closed by removal of CCR and composite liner in the fall of 2019.
- The site began being regraded in 2019; regrading of the site will be completed in 2020 to promote drainage and vegetative growth. As a part of site regrading, a retention pond was re-located, the stormwater pond

near the historic plant site was filled in, and drainages were modified to accommodate general site drainage toward the Missouri River.

- The Bottom Ash Impoundment south cell received a composite (geomembrane and geosynthetic clay liner) final cover in 2019. Final closure of the Bottom Ash Impoundment and Bottom Ash Landfill, including placement of growth medium, infiltration, and topsoil layers will be completed in 2020 per the Closure and Post-Closure Plan (Golder 2019).

## 3.2 Summary of Chloride Concentrations

Figure 4 shows a box and whisker plot of chloride concentrations in groundwater samples collected from wells at Stanton Station. Chloride concentrations in upgradient/side-gradient wells have a larger range of observed values than the downgradient wells. In particular, chloride concentrations from upgradient well MW-7A, which represents a shallower water than its paired well MW-7B, are greater than those observed in downgradient wells MW-103 and MW-9N. Changes in the groundwater flow regime could result in an increase in chloride concentrations observed in downgradient wells because of a change to the relative proportions of deeper and shallower groundwater being monitored in downgradient wells.

Additionally, immediately following the baseline monitoring period, an increase in chloride concentrations was observed in three upgradient/side-gradient wells and four downgradient wells. Figure 3 shows the chloride concentrations of MW-7B (upgradient), MW-105 (upgradient), MW-6B (side-gradient), MW-102 (downgradient), MW-104 (downgradient), MW-103 (verified SSI; downgradient) and MW-9N (verified SSI; downgradient). Between the October 2017 and May 2018 sampling events, each of these seven wells experienced an increase in chloride concentrations of similar magnitude (2 to 5 mg/L). An increase in upgradient (MW-7B and MW-105) and side-gradient (MW-6B) wells, in the absence of evidence of mounding under the facilities, indicates there are potential off-site source(s) or natural variability that could be influencing concentrations observed in upgradient and side-gradient wells. Since the same concentration pattern is observed in the downgradient wells, this is an indication that potential off-site source(s) or natural variability are also influencing downgradient concentrations; therefore, the SSI for chloride in samples collected from MW-103 and MW-9N is not likely an indication of a release from the CCR facilities.

# 4.0 CONCLUSION

In accordance with §257.95(g)(3), this ASD has been prepared in response to the identification of verified SSIs following the June 2019 sampling event for chloride at monitoring wells MW-9N and MW-103 downgradient of the Bottom Ash Landfill and Bottom Ash Impoundment at Stanton Station, respectively.

A review of analytical results indicates that the chloride concentrations in groundwater at MW-9N and MW-103 are unlikely to be the result of seepage from the Bottom Ash Landfill or Bottom Ash Impoundment. The observed change in chloride concentrations can be attributed to variability in upgradient groundwater quality, potentially driven by changes to the surface and groundwater flow regimes at Stanton Station due to site deconstruction and restoration activities or offsite activities. Therefore, no further action (i.e., transition to Assessment Monitoring) is warranted, and the Stanton Station Bottom Ash Landfill and Bottom Ash Impoundment will remain in detection monitoring.

# 5.0 REFERENCES

Braun. 1993. Hydrogeologic Assessment Report, Stanton Station Ash Ponds. Prepared for Great River Energy Stanton Generating Station. Prepared by Braun Intertec Environmental Inc.

Carlson, C.G. 1973. Geology of Mercer and Oliver Counties, North Dakota. Bulletin 56 – Part I, for the North Dakota Geological Society. County Ground Water Studies – Part I, for the North Dakota State Water Commission.

Golder. 2017a. Coal Combustion Residuals Groundwater Monitoring Statistical Method Certification, Great River Energy – Stanton Station. October 12.

Golder. 2017b. Coal Combustion Residuals Groundwater Monitoring System Certification, Great River Energy – Stanton Station. October 12.

Golder. 2019. Coal Combustion Residuals Closure and Post-Closure Plan, Revision 1, Bottom Ash Landfill – Stanton Station. September 5.

# Certification

Based upon the review described in this report, the undersigned certifies that an alternative source has been identified for the chloride verified statistically significant increases in groundwater at MW-9N and MW-103 associated with the Bottom Ash Landfill and Bottom Ash Impoundment at Stanton Station, and that this alternative source demonstration has been completed to meet the requirements of 40 CFR 257.91.

**Golder Associates Inc.**

Sara Harkins
*Senior Project Geochemist*

Todd Stong, PE
*Associate and Senior Consultant*

SH/TS/dls

REGISTERED PROFESSIONAL ENGINEER
TODD J. STONG
PE-6144
DATE 1/2/2020
NORTH DAKOTA

# Figures


**LEGEND**

- UPGRADIENT OR SIDEGRADIENT MONITORING WELL
- DOWNGRADIENT MONITORING WELL - BOTTOM ASH LANDFILL
- DOWNGRADIENT MONITORING WELL - BOTTOM ASH IMPOUNDMENT
- GENERAL DIRECTION OF GROUNDWATER FLOW
- 1690 POTENTIOMETRIC SURFACE CONTOUR (NOTE 3)

**NOTE(S)**

1. AERIAL IMAGERY OBTAINED FROM GREAT RIVER ENERGY (2019) AND THE UNITED STATES DEPARTMENT OF AGRICULTURE, NATIONAL AGRICULTURE IMAGERY PROGRAM (2018).
2. GROUNDWATER ELEVATIONS SHOWN WERE MEASURED IN MAY 2018.
3. GROUNDWATER SITE INFORMATION WAS USED IN THE CREATION OF POTENTIOMETRIC SURFACE CONTOURS. CONTOUR INTERVAL IS 5 FEET.

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1" = 400' FEET

CLIENT
GREAT RIVER ENERGY STANTON STATION

PROJECT
ALTERNATIVE SOURCE DEMONSTRATION

CONSULTANT

GOLDER

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| PREPARED | CCS |
| REVIEWED | SAH |
| APPROVED | TJS |

TITLE
SITE MAP

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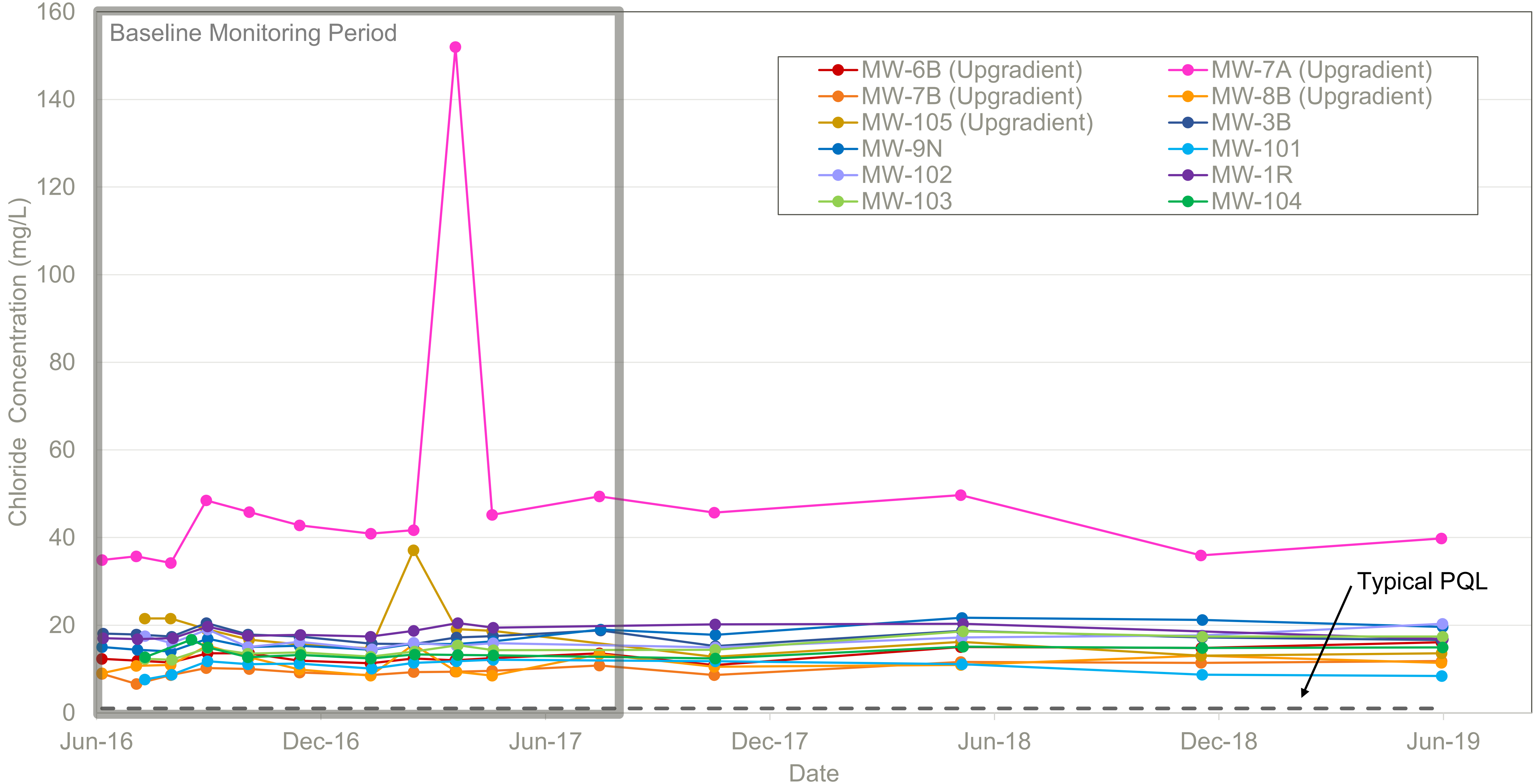


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| CLIENT<br>Great River Energy Stanton Station | PROJECT<br>Alternative Source Demonstration |
| CONSULTANT<br>GOLDER | TITLE<br>Chloride Concentrations in Network Wells |

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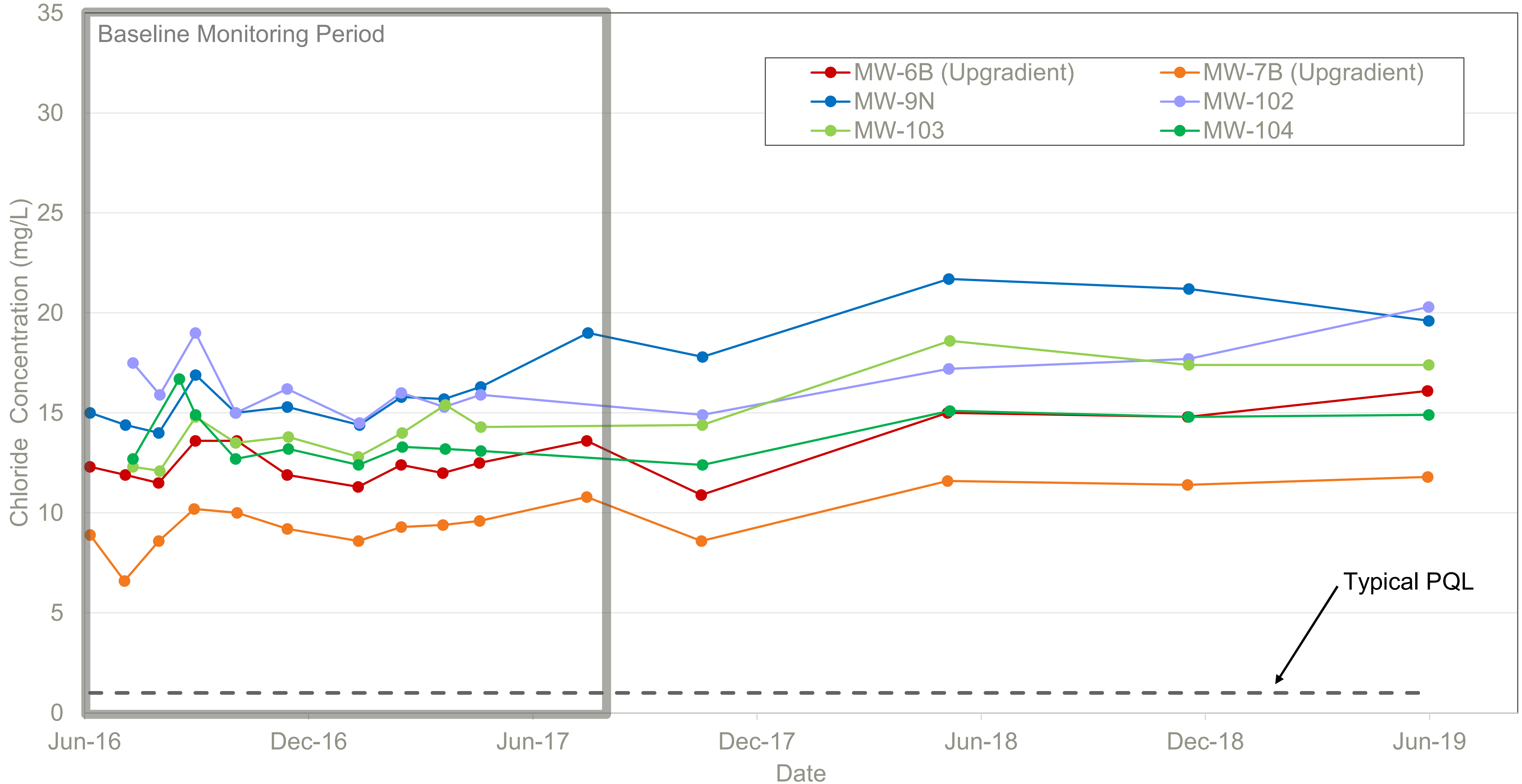


| CLIENT | PROJECT |
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| Great River Energy Stanton Station | Alternative Source Demonstration |

CONSULTANT

GOLDER

TITLE

Chloride Concentrations in Select Monitoring Wells

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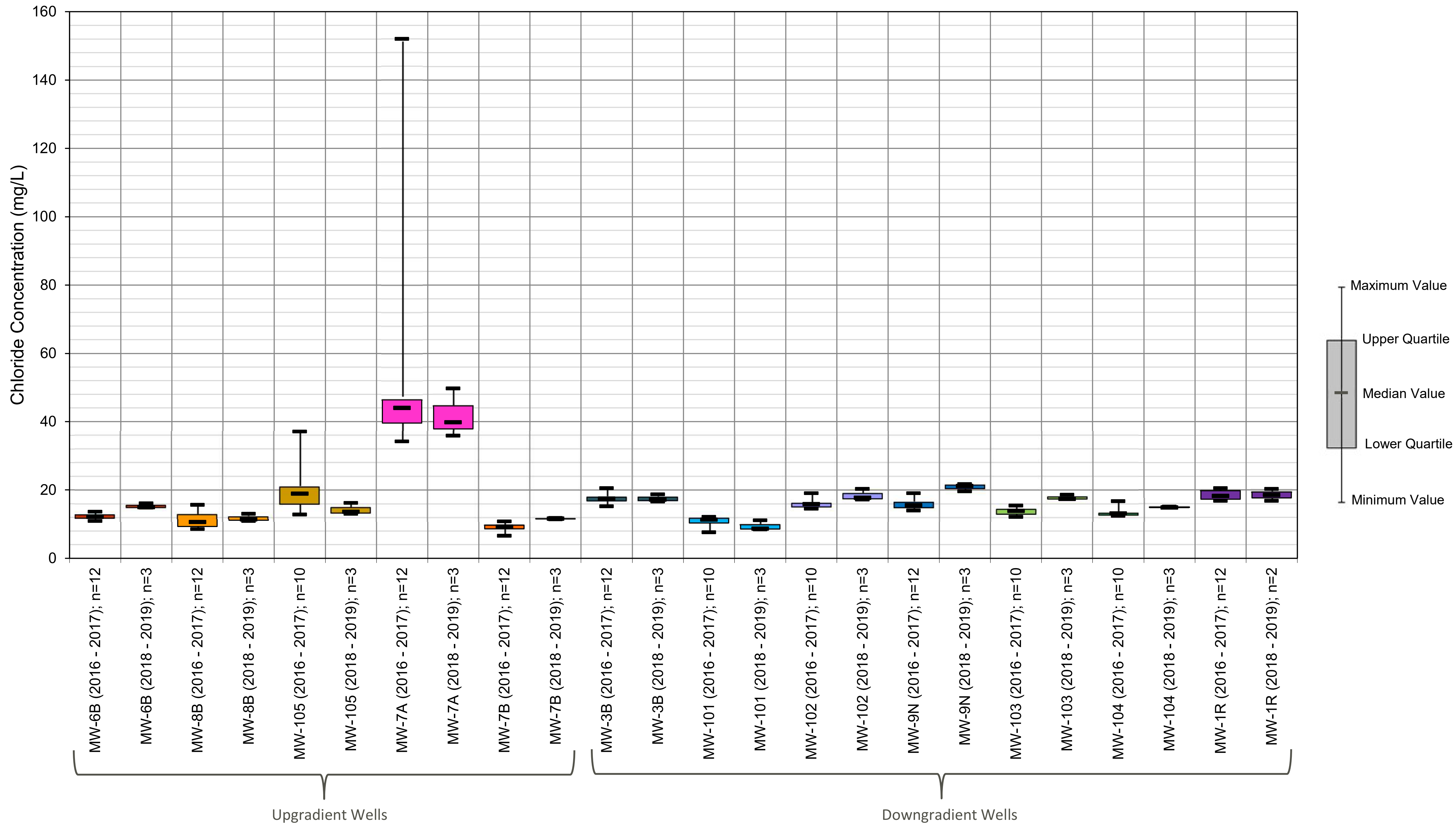


CLIENT
Great River Energy Stanton Station

PROJECT
Alternative Source Demonstration

CONSULTANT
GOLDER

TITLE
Box and Whisker Plot of Chloride Concentrations in Groundwater

| PROJECT NO. | PHASE | REV. | FIGURE |
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GOLDER

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**REPORT**

# Alternate Source Demonstration for Fluoride in Monitoring Well MW-103

*Great River Energy – Stanton Station*

Submitted to:

**Great River Energy**

Stanton Station, 4001 Highway 200A, Stanton, North Dakota 58571

Submitted by:

**Golder Associates Inc.**

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1894194

January 2, 2020

# Table of Contents



**TABLES**



**FIGURES**

# 1.0 INTRODUCTION

On behalf of Great River Energy (GRE), Golder Associates Inc. (Golder) performed a statistical evaluation of groundwater geochemistry results from the second quarter (Q2) 2019 groundwater detection monitoring event at Stanton Station's Bottom Ash coal combustion residual (CCR) surface impoundment (Bottom Ash Impoundment). The statistical evaluation was performed in accordance with applicable provisions of 40 Code of Federal Regulations (CFR) Part 257, "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule" (CCR rule), as amended and as described in the Coal Combustion Residuals Groundwater Statistical Method Certification for Stanton Station (Golder 2017a).

Statistical analyses of the Appendix III detection monitoring data for fluoride in groundwater at the downgradient monitoring well MW-103 indicated a potential exceedance of the statistical limit based on the parametric Shewhart-CUSUM (Cumulative Summation) analysis of the fourth quarter (Q4) 2018 sampling results. This potential exceedance was subsequently verified as evidence of a statistically significant increase (SSI) after the Q2 2019 event. Although determination of a verified SSI generally indicates that the groundwater monitoring program should transition from detection monitoring to assessment monitoring, 40 CFR §257.94(e)(2) allows the owner or operator (i.e., GRE) 90 days from the date of determining a verified SSI (October 3, 2019) to demonstrate a source other than the regulated CCR facility caused the SSI or that the SSI was a result of an error in sampling, analysis, or statistical evaluation or natural variability in groundwater quality that was not fully captured during baseline data collection.

Golder's review of the hydrological and geological conditions at Stanton Station indicated the potential for the verified SSI to have resulted from a source other than the CCR facility. Based on this assessment and in accordance with provisions of the CCR rule, Golder has prepared this Alternative Source Demonstration (ASD) for the CCR facility. This ASD includes an evaluation of geological, hydrogeological, and chemical information regarding groundwater obtained from monitoring wells installed adjacent to the Bottom Ash Impoundment.

This ASD conforms to the requirements of 40 CFR §257.94(e)(2) and provides the basis for concluding that the verified SSI is not a result of a release from the Bottom Ash Impoundment. The following sections provide a summary of the Stanton Station site Bottom Ash Impoundment, including analytical results and lines of evidence demonstrating that alternative sources and/or natural variability may be responsible for the fluoride verified SSI.

# 2.0 BACKGROUND

Stanton Station was a coal-fired electric generation facility located in Section 16 and 21, Township 144N and Range 84W of Mercer County, approximately three miles southeast of Stanton, North Dakota (Figure 1). Stanton Station began generating power in 1966 and ceased power production in February 2017.

## 2.1 Overview of the Disposal Area

Stanton Station has two CCR facilities that are within the purview of the CCR rule:

- Bottom Ash CCR Landfill (Bottom Ash Landfill) - The Bottom Ash Landfill is located south of the original Stanton Station plant site and adjacent to and west of the Bottom Ash Impoundment.
- Bottom Ash CCR Surface Impoundment (Bottom Ash Impoundment) - The Bottom Ash Impoundment is located south of the original Stanton Station plant site and adjacent to and east of the Bottom Ash Landfill and consists of three interconnected cells designated the north, center, and south cells.

An active rail line, Highway 200A, and agricultural land lies south and west of the Bottom Ash Landfill and Bottom Ash Impoundment and a closed CCR landfill that is currently in post-closure care is located east of the facilities. The historic coal pile and fly ash unloading facility was located north of the Bottom Ash Landfill and Bottom Ash Impoundment.

## 2.2 Site Geology and Hydrogeology

Regional geology of the area surrounding Stanton Station is documented in the Hydrogeologic Assessment Report, Stanton Station Ash Ponds (Braun 1993). Stanton Station is located in the Missouri Slope District of the Glaciated Missouri Plateau Section of the Great Plains Province. Subsurface and surficial stratigraphy of Mercer County and the adjacent Oliver County were reviewed in depth by C.G. Carlson for the North Dakota Geological Society (Carlson 1973). Primary near-surface stratigraphic units in the area of Stanton Station include the Tongue River Formation and Cannonball Formation, with named lignite beds prominent in the vicinity of the site.

Near-surface geology at Stanton Station consists of two primary geologic units: the upper alluvial terrace deposits of the Missouri River, and underlying sediments and bedrock belonging to the Bullion Creek Formation, each of which have varying extents and thicknesses across the site (Braun 1993).

The principal hydrostratigraphic unit and uppermost water-bearing unit near the CCR facilities consists of alluvial deposits, which includes two subunits: an upper silty sand and clay, and an underlying outwash sand and gravel. Individually, these subunits are laterally heterogeneous and geologic conditions within these subunits can be characterized by interbedded layers of gravel, sand, silt, clay, and coal.

Due to variations in subunit thickness throughout the site, groundwater in the uppermost water bearing unit is monitored in both the outwash subunit and the silty sand and clay subunit, with flow generally moving from southwest to northeast towards the Missouri River. Depths from the ground surface to the uppermost water-bearing unit range from 5 to 20 feet in the area around Stanton Station. A map showing recent available groundwater elevations is shown in Figure 1.

The groundwater gradient across the site is influenced by the subsurface units, and ranges from 0.002 to 0.01 ft/ft (Braun 1993). The geometric mean of hydraulic conductivities measured from wells screened in the upper silty sand subunit is $3.7 \times 10^{-4}$ cm/sec, or approximately 1.05 ft/day, while the hydraulic conductivity of the lower outwash unit is approximately $1.4 \times 10^{-2}$ cm/sec or 40 feet/day (Braun 1993).

## 2.3 Groundwater Monitoring Network

The CCR groundwater monitoring system for the Stanton Station Bottom Ash Impoundment consists of a total of eight monitoring wells (four upgradient, one side-gradient, and three downgradient) to monitor the Bottom Ash Impoundment (Golder 2017b). The monitoring well locations are shown in Figure 1 and listed in Table 1.

**Table 1: CCR Facility Monitoring Wells**

| Location | Well ID |
|---|---|
| Upgradient/Side-gradient | MW-6B (Side-gradient) |
| | MW-7A |
| | MW-7B |
| | MW-8B |
| | MW-105 |
| Bottom Ash Impoundment Downgradient | MW-1R |
| | MW-103 |
| | MW-104 |

## 2.4 Detection Monitoring Groundwater Conditions

Between June 2016 and July 2017, GRE collected between nine and eleven baseline groundwater samples from each of the upgradient/side-gradient and downgradient wells listed in Table 1, as required by 40 CFR §257.94. The results of the baseline monitoring phase were used to develop appropriate statistical limits for each constituent at each monitoring well (Golder 2017a). Following the completion of the baseline monitoring events, GRE started collecting groundwater samples on a semiannual basis in October 2017 to support the detection monitoring program. Groundwater samples for detection monitoring are collected at each of the five upgradient/side-gradient and three downgradient monitoring wells and analyzed for 40 CFR Part 257 Appendix III constituents. During the detection monitoring program, the results of groundwater analysis are compared to the calculated statistical limits to determine whether groundwater quality remains consistent or if changes are noted.

During the baseline monitoring period, fluoride concentrations were variable in the upgradient/side-gradient and downgradient groundwater, as shown in Figure 2. Fluoride concentrations in upgradient/side-gradient groundwater (based on 53 samples from five wells) ranged from 0.18 to 1.07 mg/L between June 2016 and July 2017. Groundwater in wells downgradient of the Bottom Ash Impoundment was also variable (based on 29 samples from three wells), with fluoride concentrations ranging from 0.22 to 0.81 mg/L.

### 2.4.1 Fluoride at MW-103

At MW-103, fluoride concentrations ranged between 0.22 and 0.28 mg/L during the baseline monitoring period. Based on the baseline monitoring period at MW-103, a CUSUM limit of 0.33 mg/L was developed.

The Q4 2018 detection monitoring event reported a fluoride concentration of 0.41 mg/L in groundwater samples collected from MW-103, which resulted in a CUSUM (0.53 mg/L) exceeding the statistical limit. Verification sampling was completed in June 2019 (i.e., Q2 2019) with a fluoride concentration of 0.41 mg/L and a CUSUM of 0.68 mg/L, confirming that fluoride at MW-103 is a verified SSI.

# 3.0 SOURCE EVALUATION

## 3.1 Recent Site Activities

As noted previously, Stanton Station ceased operation in February of 2017 and site deconstruction and restoration activities began. These activities have likely affected surface water recharge associated with precipitation and runoff and may have affected groundwater conditions (flow regime and chemistry) in the vicinity of Stanton Station and the associated CCR facility.

As a part of site deconstruction, the following general activities were completed between the summer of 2017 and the fall of 2019:

- Stanton Station, associated buildings, and pavement were deconstructed and/or demolished. A majority of the above-grade structures were recycled or taken offsite for disposal; however, a small amount of construction and demolition (C&D) material was contained onsite in the Bottom Ash Landfill and Bottom Ash Impoundment (as approved and permitted via the North Dakota Department of Environmental Quality (NDDEQ)).
- The coal unloading sump (near monitoring well MW-103), which extended below the elevation of anticipated typical groundwater, was taken out of service (i.e., the sump was turned off) and subsequently filled with compacted earthen material.
- Near-surface utilities (piping, duct banks, etc.) were excavated and disposed of as C&D material.
- Other below-grade structures and utilities were either abandoned in place or filled and abandoned depending on the size of the buried structure/utility.

Site restoration work began at the end of the site deconstruction effort and generally involved the following activities:

- Between 2017 and 2019, the remaining bottom ash and economizer ash from the plant and Bottom Ash Impoundment (north and center cells) was placed in the south cell of the Bottom Ash Impoundment. The north and center cell liner systems were also removed, and these two cells were closed by removal of CCR and composite liner in the fall of 2019.
- The site began being regraded in 2019; regrading of the site will be completed in 2020 to promote drainage and vegetative growth. As a part of site regrading, a retention pond was re-located, the stormwater pond near the historic plant site was filled in, and drainages were modified to accommodate general site drainage toward the Missouri River.
- The Bottom Ash Impoundment south cell received a composite (geomembrane and geosynthetic clay liner) final cover in 2019. Final closure of the Bottom Ash Impoundment and Bottom Ash Landfill, including placement of growth medium, infiltration, and topsoil layers will be completed in 2020 per the Closure and Post-Closure Plan (Golder 2019).

## 3.2 Summary of Fluoride Concentrations

Figure 3 shows a box and whisker plot of fluoride concentrations in groundwater samples collected from wells monitoring the Bottom Ash Impoundment. Fluoride concentrations in upgradient/side-gradient wells have a larger range of observed values than the downgradient wells. In particular, fluoride concentrations in upgradient wells

MW-6B, MW-7A, MW-7B, and MW-105 are greater than those observed in downgradient well MW-103. Only upgradient well MW-8B had fluoride concentrations below those concentrations measured in MW-103. Changes in the groundwater flow regime due to site activities deconstruction and reclamation activities could result in an increase in fluoride concentrations observed downgradient well MW-103.

# 4.0 CONCLUSION

In accordance with §257.95(g)(3), this ASD has been prepared in response to the identification of a verified SSI following the June 2019 sampling event for fluoride at monitoring well MW-103 downgradient of the Bottom Ash Impoundment at Stanton Station.

A review of analytical results indicates that the fluoride concentrations in groundwater MW-103 are unlikely to be the result of seepage from the Bottom Ash Impoundment. The observed change in fluoride concentrations can be attributed to variability in upgradient groundwater quality, potentially driven by changes to the surface and groundwater flow regimes at Stanton Station due to site deconstruction and restoration activities or offsite activities. Therefore, no further action (i.e., transition to Assessment Monitoring) is warranted, and the Stanton Station Bottom Ash Impoundment will remain in detection monitoring.

# 5.0 REFERENCES

Braun. 1993. Hydrogeologic Assessment Report, Stanton Station Ash Ponds. Prepared for Great River Energy Stanton Generating Station. Prepared by Braun Intertec Environmental Inc.

Carlson, C.G. 1973. Geology of Mercer and Oliver Counties, North Dakota. Bulletin 56 – Part I, for the North Dakota Geological Society. County Ground Water Studies – Part I, for the North Dakota State Water Commission.

Golder. 2017a. Coal Combustion Residuals Groundwater Monitoring Statistical Method Certification, Great River Energy – Stanton Station. October 12.

Golder. 2017b. Coal Combustion Residuals Groundwater Monitoring System Certification, Great River Energy – Stanton Station. October 12.

Golder. 2019. Coal Combustion Residuals Closure and Post-Closure Plan, Revision 1, Bottom Ash Landfill – Stanton Station. September 5.

# Certification

Based upon the review described in this report, the undersigned certifies that an alternative source has been identified for the fluoride verified statistically significant increases in groundwater at MW-103 associated with the Bottom Ash Impoundment at Stanton Station, and that this alternative source demonstration has been completed to meet the requirements of 40 CFR 257.91.

**Golder Associates Inc.**

REGISTERED PROFESSIONAL ENGINEER
TODD J. STONG
PE-6144
DATE 1/2/2020
NORTH DAKOTA

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| Sara Harkins | Todd Stong, PE |
| *Senior Project Geochemist* | *Associate and Senior Consultant* |

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# Figures


**LEGEND**

- UPGRADIENT OR SIDEGRADIENT MONITORING WELL
- DOWNGRADIENT MONITORING WELL - BOTTOM ASH LANDFILL (NOTE 4)
- DOWNGRADIENT MONITORING WELL - BOTTOM ASH IMPOUNDMENT
- GENERAL DIRECTION OF GROUNDWATER FLOW
- 1690 POTENTIOMETRIC SURFACE CONTOUR (NOTE 3)

**NOTE(S)**

1. AERIAL IMAGERY OBTAINED FROM GREAT RIVER ENERGY (2019) AND THE UNITED STATES DEPARTMENT OF AGRICULTURE, NATIONAL AGRICULTURE IMAGERY PROGRAM (2018).
2. GROUNDWATER ELEVATIONS SHOWN WERE MEASURED IN MAY 2018.
3. GROUNDWATER SITE INFORMATION WAS USED IN THE CREATION OF POTENTIOMETRIC SURFACE CONTOURS. CONTOUR INTERVAL IS 5 FEET.
4. DOWNGRADIENT BOTTOM ASH LANDFILL WELLS ARE SHOWN FOR INFORMATION ONLY TO SUPPORT THE POTENTIOMETRIC SURFACE CONTOURS IN THE VICINITY OF THE BOTTOM ASH IMPOUNDMENT.

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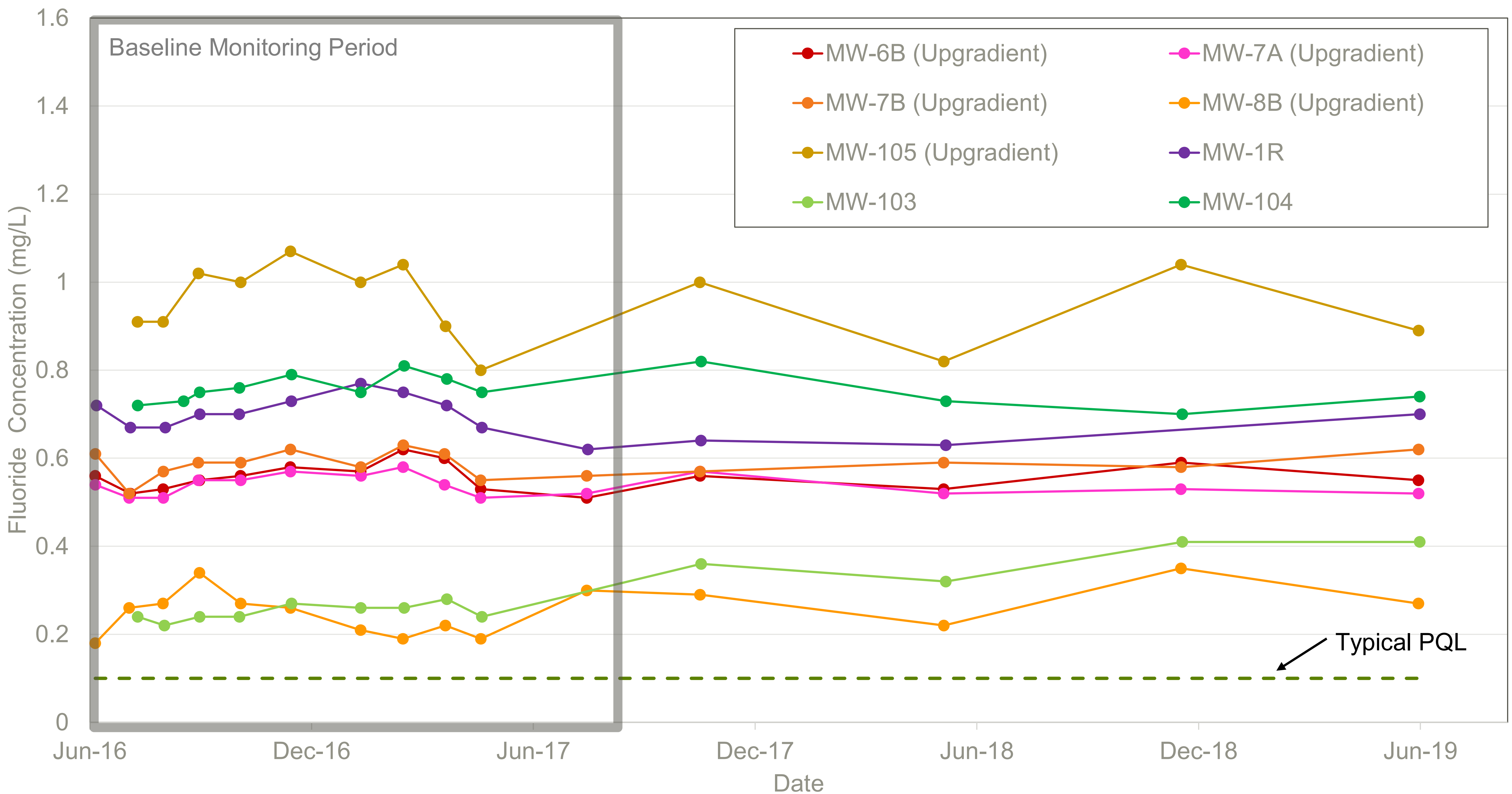


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Great River Energy Stanton Station

PROJECT
Alternative Source Demonstration

CONSULTANT
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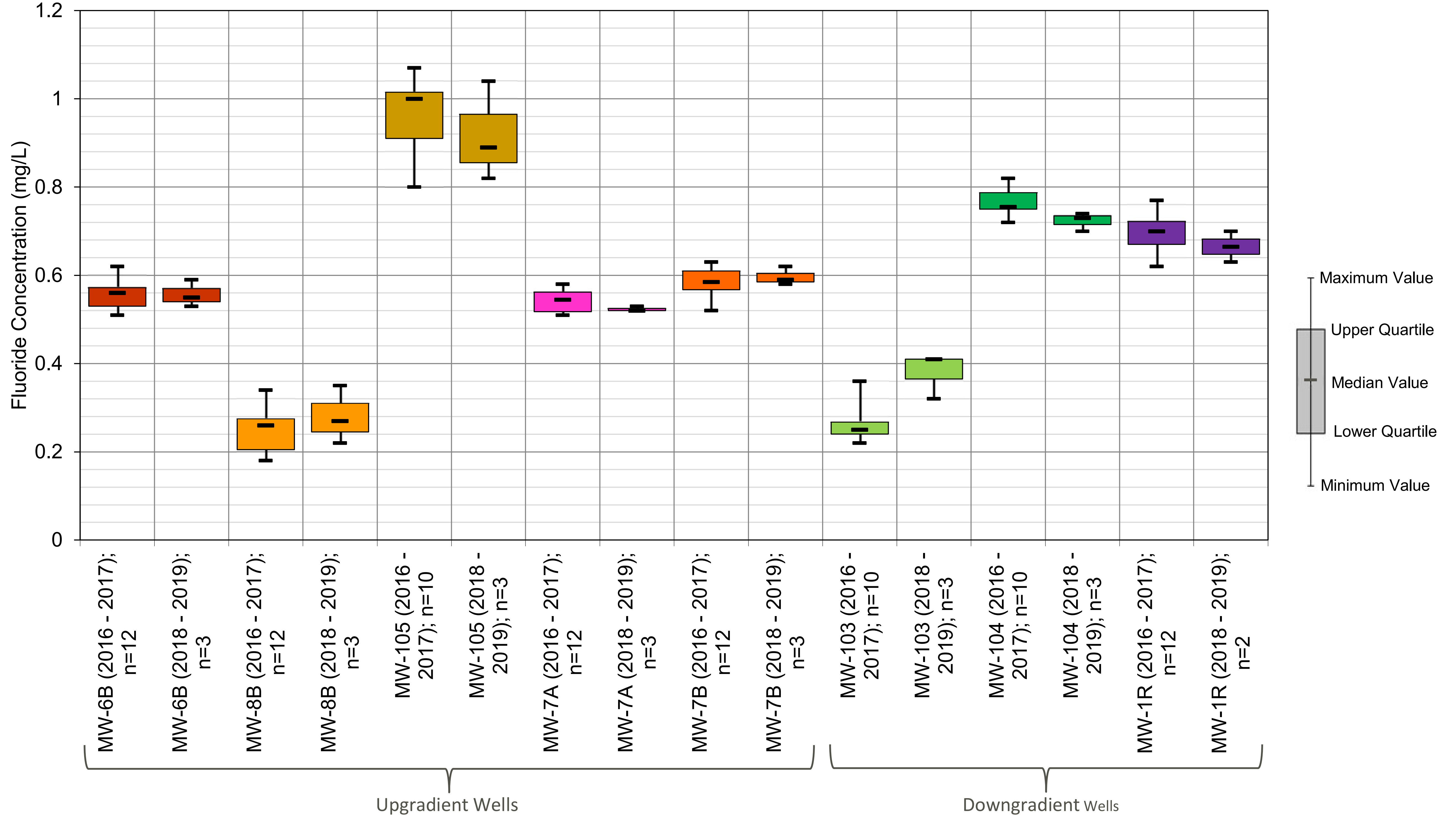


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PROJECT
Alternative Source Demonstration

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Box and Whisker Plot of Fluoride Concentrations in Groundwater

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