2020 Annual Groundwater Monitoring and Corrective Action Report

JH Campbell Power Plant
Ponds 1-2 North and 1-2 South CCR Unit

West Olive, Michigan

January 2021

Prepared For:

Consumers Energy Company

Prepared By:

TRC
1540 Eisenhower Place
Ann Arbor, Michigan 48108

Sarah B. Holmstrom, P.G.
Project Manager/Sr. Hydrogeologist

Graham Crockford, C.P.G.
Program Manager

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Executive Summary

On behalf of Consumers Energy, TRC has prepared this report for the JH Campbell (JHC) Pond 1-2 Coal Combustion Residual (CCR) unit to cover the period of January 1, 2020 to December 31, 2020. Pond 1-2 was in assessment monitoring at the beginning and at the end of the period covered by this report. Data that have been collected and evaluated in 2020 are presented in this report.

Consumers Energy first reported the potential for statistically significant increases (SSIs) for Appendix III constituents in the *Annual Groundwater Monitoring Report, JH Campbell Power Plant, Unit 1-2 North and 1-2 South CCR Unit* (TRC, January 2018). The statistical evaluation of the Appendix III indicator parameters confirming SSIs over background were as follows:

- Boron at JHC-MW-15001, JHC-MW-15002, JHC-MW-15003, JHC-MW-15004, and JHC-MW-15005;
- Calcium at JHC-MW-15001 and JHC-MW-15004;
- Chloride at JHC-MW-15001;
- pH at JHC-MW-15002 and JHC-MW-15003;
- Sulfate at JHC-MW-15001, JHC-MW-15002, JHC-MW-15003, JHC-MW-15004, andJHC-MW-15005; and
- Total dissolved solids (TDS) at JHC-MW-15001, JHC-MW-15004, and JHC-MW-15005.

On April 25, 2018, Consumers Energy entered assessment monitoring upon determining that an Alternate Source Demonstration for the Appendix III constituents was not successful. After subsequent sampling for Appendix IV constituents, Consumers Energy provided notification that arsenic was present at statistically significant levels above the federal groundwater protection standard (GWPS) established at 10 ug/L (TRC, 2019) in two out of five downgradient monitoring wells at Ponds 1-2 as follows:

- Arsenic at JHC-MW-15002 and JHC-MW-15003.

The *Assessment of Corrective Measures* (ACM) was initiated on April 15, 2019 and was certified and submitted to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) on September 11, 2019 in accordance with the schedule in §257.96. The certification for a 60-day time extension to the 90-day completion period of the ACM required per §257.96(a) is included in this report.

The ACM documents that the groundwater nature and extent has been defined, as required in §257.95(g)(1). Although arsenic concentrations exceed the GWPS in on-site groundwater, the property containing the site is owned and operated by Consumers Energy and on-site groundwater is not used for drinking water. The nearest residential drinking water wells are located north and east of the Dry Ash Landfill (north of the background monitoring wells and upgradient of Ponds 1-2) and to the south-southeast of Pond 1-2, on the opposite side of the Pigeon River. Per §257.96(b), Consumers Energy is continuing to monitor groundwater in accordance with the assessment monitoring program as specified in §257.95. Overall, the assessment monitoring statistical evaluations show arsenic concentrations are declining and

confirm that arsenic is the only Appendix IV constituent present at statistically significant levels above the GWPS. Groundwater monitoring downgradient from Ponds 1-2 further demonstrate that there are currently no adverse effects on human health or the environment from either surface water or groundwater due to the CCR management at Ponds 1-2.

Consumers Energy has not selected a remedy pursuant to §257.97. The semiannual progress report describing the progress in selecting and designing the remedy required pursuant to §257.97(a) is included in this report. The *JH Campbell Generating Facility Bottom Ash Ponds 1-2 Closure Plan,* prepared by Golder in January 2018 was submitted to and approved by the EGLE. Dewatering and removal of ash from Ponds 1-2 for beneficial reuse began in June 2018 and continued through September 2018. CCR removal activities at Ponds 1-2 were completed in October 2018 and Consumers Energy submitted final documentation of CCR removal to the EGLE in August 2019. On October 22, 2019, the EGLE provided written concurrence that all bottom ash had been removed from Ponds 1-2 based on multiple lines of evidence described in the approved closure work plan.

Consumers Energy will continue to evaluate corrective measures in accordance with §257.96 and §257.97 as outlined in the ACM and will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98, which includes semiannual assessment monitoring in accordance with §257.95 to monitor site groundwater conditions and inform the remedy selection. The next semiannual assessment monitoring events are scheduled to occur in the second and fourth calendar quarters of 2021.

1.0 Introduction

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule) (USEPA, April 2015 as amended). Standards for groundwater monitoring and corrective action codified in the CCR Rule (40 CFR 257.90 – 257.98), apply to the Consumers Energy Company (Consumers Energy) Ponds 1-2 North and 1-2 South bottom ash pond CCR Unit at the JH Campbell Power Plant Site (JHC Ponds 1-2). Pursuant to the CCR Rule, no later than January 31, 2018, and annually thereafter, the owner or operator of a CCR unit must prepare an annual groundwater monitoring and corrective action report for the CCR unit documenting the status of groundwater monitoring and corrective action for the preceding year in accordance with §257.90(e).

On behalf of Consumers Energy, TRC has prepared this Annual Groundwater Monitoring Report for JHC Ponds 1-2 to cover the period of January 1, 2020 to December 31, 2020. Ponds 1-2 was in assessment monitoring at the beginning and at the end of the period covered by this report. Data that have been collected and evaluated in 2020 are presented in this report.

1.1 Program Summary

As discussed in the *2018 Annual Groundwater Monitoring Report for the JH Campbell Power Plant Units 1-2 North and 1-2 South CCR Unit* (2018 Annual Report) (TRC, January 2019), Consumers Energy initiated an Assessment Monitoring Program for the Ponds 1-2 pursuant to §257.95 of the CCR Rule that included sampling and analyzing groundwater within the groundwater monitoring system for all constituents listed in Appendix III and Appendix IV.

On April 25, 2018, Consumers Energy entered assessment monitoring upon determining that an Alternate Source Demonstration for the Appendix III constituents was not successful. After subsequent sampling for Appendix IV constituents, Consumers Energy provided notification that arsenic was present at statistically significant levels above the federal groundwater protection standard (GWPS) established at 10 ug/L (TRC, 2019) in two out of five downgradient monitoring wells at Ponds 1-2 as follows:

- Arsenic at JHC-MW-15002 and JHC-MW-15003.

The CCR Rule 40 CFR §257.96(a) requires that an owner or operator initiate an assessment of corrective measures to prevent further release, to remediate any releases, and to restore impacted areas to original conditions if any Appendix IV constituent has been detected at a statistically significant level exceeding a GWPS. The Assessment of Corrective Measures report (ACM) (TRC, September 2019) was initiated on April 15, 2019 and was certified and submitted on September 11, 2019 in accordance with the schedule in §257.96.

The ACM documents that the groundwater nature and extent has been defined, as required in §257.95(g)(1), based on the site-specific hydrogeology and data collected from existing monitoring wells. Although arsenic concentrations exceed the GWPS in on-site groundwater, an evaluation of risk demonstrates that there are currently no adverse effects on human health or the environment from either surface water or groundwater due to CCR management at Ponds 1-2.

Consumers Energy will continue to evaluate corrective measures in accordance with §257.96 and §257.97 as outlined in the ACM and will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98, which includes semiannual assessment monitoring in accordance with §257.95 as presented in this report.

1.2 Site Overview

The JH Campbell Power Plant is a coal fired power generation facility located in West Olive, Michigan, on the eastern shore of Lake Michigan. It is bordered by the Pigeon River on the south, 156th Avenue on the east, and Croswell Street to the north with Lakeshore Drive bisecting the site from north to south. The power generating plant consists of three coal fired electric generating units located on the western side of the site and the CCR disposal area is on the east side of the site, east of Lakeshore Drive. Figure 1 is a site location map showing the facility and the surrounding area.

Currently, there are no remaining active CCR surface impoundments at the JHC solid waste disposal facility. The CCR disposal area had contained two primary components: a system of wet ash ponds and a dry ash disposal facility (i.e., the JHC Dry Ash Landfill). The CCR surface impoundments located within the former wet ash pond area are Pond 1-2 Bottom Ash Ponds (Ponds 1-2), Pond 3 North and Pond 3 South Bottom Ash Pond (collectively Pond 3), and Pond A. All of these impoundments have been deactivated and decommissioned. The existing Dry Ash Landfill is a double-composite geomembrane lined landfill which is licensed and permitted for CCR disposal and includes two double-lined leachate and contact water retention ponds. Site features are shown on Figure 2.

Dry, moisture-conditioned CCR from the three coal fired electric generating units continues to be managed in the licensed solid waste landfill which is regulated under Part 115 of the Natural Resources and Environmental Protection Act (NREPA), PA 451 of 1994, as amended, and monitored in adherence to the facility's Michigan Department of Environment, Great Lakes, and Energy (EGLE)[1] -approved *Hydrogeological Monitoring Plan (HMP) for JH Campbell Ash Storage Facility, Consumers Power Company, Solid Waste Disposal Area, Coal Ash, Type III* (September 1996).

The surface impoundments in the wet ash pond areas were decommissioned starting in 2017 and replaced with concrete bottom ash treatment tanks. Bottom ash is currently sluiced to the concrete tanks where it is dewatered. The settled and dewatered bottom ash is beneficially reused or managed at the Dry Ash Landfill. Sluice water decanted from the tanks flows through a permitted ditching system to the recirculation pond. Water in the recirculation pond is then discharged through a National Pollutant Discharge Elimination System (NPDES) permitted outfall and into Pigeon River.

The purpose of the dry ash disposal facility is to contain dry bottom and fly ash produced as a result of burning coal for power production. Dry ash from all of the generating units is stored in silos until it is placed into the facility or is sold and shipped off site. This report focuses on the

[1] Effective Monday, April 22, 2019, the Michigan Department of Environmental Quality (MDEQ) became known as the Michigan Department of Environment, Great Lakes, and Energy.

JHC Ponds 1-2 CCR unit.

1.3 Geology/Hydrogeology

The upgradient/background wells are located to the north-northwest of the JHC Dry Ash Landfill. Groundwater is typically encountered around 30 to 35 feet below ground surface (ft bgs), except in the recently excavated areas of Bottom Ash Ponds 1-2 and Bottom Ash Pond 3 South where groundwater is now within 5 to 10 ft bgs due to grade changes, and generally flows to the south-southeast toward the Pigeon River. The subsurface materials encountered at the JH Campbell site generally consist of approximately 40 to 60 feet of poorly graded, fine-grained lacustrine sand. A laterally extensive clay-rich till is generally encountered within approximately 40 to 60 ft bgs across the site that according to deep drilling logs conducted at the JH Campbell Power Plant (just west of the CCR units) is on the order of 80 feet thick and extends to the top of shale bedrock approximately 140 ft bgs.

2.0 Groundwater Monitoring

2.1 Monitoring Well Network

In accordance with 40 CFR 257.91, Consumers Energy established a groundwater monitoring system for JHC Ponds 1-2, which currently consists of 12 monitoring wells (6 background monitoring wells, 3 downgradient monitoring wells, and 3 side/upgradient wells) that are screened in the uppermost aquifer. The monitoring well locations are shown on Figure 2. Six monitoring wells located north-northwest of the Dry Ash Landfill provide data on background groundwater quality that has not been affected by the CCR unit (JHC-MW-15023 through JHC-MW-15028). Background groundwater quality data from these six background wells are additionally used for the CCR groundwater monitoring program at three other JH Campbell CCR units.

Six Background Monitoring Wells:

- JHC-MW-15023 through JHC-MW-15028

Due to the cessation of hydraulic loading and decommissioning of Ponds 1-2, the groundwater flow direction changed significantly from the previous baseline and assessment monitoring events such that groundwater flow is generally toward the south at Ponds 1-2. As a result, the following wells are no longer located downgradient of Ponds 1-2: JHC-MW-15001 (upgradient), JHC-MW-15002 (side gradient), JHC-MW-15003 (side gradient). In response, as documented in the 2018 Annual Report, Consumers Energy installed two new downgradient wells on December 3 through December 5, 2018 and collected additional data from these new wells to reassess groundwater flow and ensure sufficient wells were appropriately located to assess groundwater quality downgradient from the Ponds 1-2 CCR Unit. As documented in the *2019 Annual Groundwater Monitoring Report, JH Campbell Power Plant, Unit 1-2 North and 1-2 South CCR Unit* (2019 Annual Report) (TRC, January 2020), sampling data from 2018 and 2019 confirmed that monitoring wells JHC-MW-18004 and JHC-MW-18005 are appropriately positioned to assess groundwater quality downgradient from the Ponds 1-2 CCR Unit. Therefore, JHC-MW-18004 and JHC-MW-18005 have been added to the downgradient monitoring network, in addition to existing downgradient monitoring well JHC-MW-15005, for Ponds 1-2. Monitoring wells JHC-MW-15002 and JHC-MW-15003 were historically located downgradient of Ponds 1-2, when flow was radially outward, and will continue to be sampled and evaluated as part of the assessment monitoring program to evaluate groundwater quality post-CCR removal.

Additionally, since Ponds 1-2 has been deconstructed and groundwater levels have re-equilibrated, dry conditions were observed at JHC-MW-15001 throughout both 2020 semiannual sampling events. Given that JHC-MW-15001 is upgradient of Ponds 1-2 and no Appendix IV constituents have been observed at statistically significant levels above the GWPSs at JHC-MW-15001 since monitoring began in 2015, in addition to groundwater re-equilibrating at an elevation below the well screen, the monitoring well is being removed from the monitoring network moving forward. An updated groundwater monitoring network certification is included as Appendix A.

The Ponds 1-2 monitoring wells now consist of:

Ponds 1-2 Downgradient Monitoring Wells:

- JHC-MW-15005
- JHC-MW-18004
- JHC-MW-18005

Other Ponds Assessment Monitoring Wells (currently located side gradient):

- JHC-MW-15002 (side gradient)
- JHC-MW-15003 (side gradient)

As shown on Figure 2, monitoring wells JHC-MW-15029 and JHC-MW-15030 are used for water level measurements only. Static water level data are collected at additional wells throughout the JH Campbell CCR units and used to construct a site-wide groundwater contour map.

2.2 Semiannual Groundwater Monitoring

Per §257.95, all wells in the CCR unit monitoring program must be sampled at least semiannually. One semiannual event must include analysis for all constituents from Appendix III and Appendix IV constituents and one semiannual event may include analysis for all constituents in Appendix III and those constituents in Appendix IV of the CCR Rule that were detected during prior sampling. In addition to the Appendix III and IV constituents, field parameters including dissolved oxygen, oxidation reduction potential, specific conductivity, temperature, and turbidity were collected at each well. Samples were collected and analyzed in accordance with the JH Campbell Monitoring Program Sample Analysis Plan (SAP) (ARCADIS, 2016).

2.2.1 Data Summary

The first semiannual groundwater assessment monitoring event for 2020 was performed on April 14 through 16, 2020 and the second semiannual groundwater assessment monitoring event for 2020 was performed on October 19 through 23, 2020. Both events were performed by Consumers Energy, and samples were analyzed by Consumers Energy Laboratory Services in Jackson, Michigan in accordance with the SAP. Static water elevation data were collected at all monitoring well locations. Groundwater samples were collected from the background monitoring wells and Ponds 1-2 monitoring wells for the Appendix III and Appendix IV constituents and field parameters. As discussed above, there was insufficient volume of groundwater present at JHC-MW-15001 to collect samples in both semiannual assessment monitoring events for 2020.

A summary of the groundwater data collected during the April and October 2020 events are provided on Table 1 (static groundwater elevation data), Table 2 (field data), Table 3 (background well analytical results), and Table 4 (Ponds 1-2 analytical results).

2.2.2 Data Quality Review

Data from each round were evaluated for completeness, overall quality and usability, method-specified sample holding times, precision and accuracy, and potential sample contamination. The data were found to be complete and usable for the purposes of the CCR monitoring program. The data quality reviews are summarized in Appendix B.

2.2.3 Groundwater Flow Rate and Direction

Groundwater elevations measured across the Site during the April and October 2020 events are provided on Table 1. April 2020 and October 2020 groundwater elevations were used to construct the groundwater contour maps provided on Figure 3 and Figure 4, respectively. The average hydraulic gradient was calculated using the following well pairs: JHC-MW-15029/JHC-MW-15030, JHC-MW-15029/JHC-MW-15005, JHC-MW-15019/JHC-MW-15035 and JHC-MW-15023/JHC-MW-15037 (Figure 2). Using the mean hydraulic conductivity of 62 ft/day (ARCADIS, 2016) and an assumed effective porosity of 0.4, the estimated average seepage velocity is approximately 0.68 ft/day or 250 ft/year for the April 2020 event, and approximately 0.63 ft/day or 230 ft/year for the October 2020 event.

The general groundwater flow direction is similar to that identified in previous monitoring rounds and continues to demonstrate that the downgradient wells are appropriately positioned to detect the presence of Appendix IV constituents that could potentially migrate from Ponds 1-2.

3.0 Statistical Evaluation

Assessment monitoring is continuing at Ponds 1-2 while corrective measures are further evaluated in accordance with §257.96 and §257.97 as outlined in the ACM. The following section summarizes the statistical approach applied to assess the 2020 groundwater data in accordance with the assessment monitoring program. The statistical evaluation details are provided in Appendix C (*April 2020 Statistical Evaluation of Initial Assessment Monitoring Event*) and Appendix D (*October 2020 Assessment Monitoring Data Summary and Statistical Evaluation*).

3.1 Establishing Groundwater Protection Standards

The Appendix IV GWPSs are used to assess whether Appendix IV constituent concentrations are present in groundwater at unacceptable levels as a result of CCR Unit operations by statistically comparing concentrations in the downgradient wells to the GWPSs for each Appendix IV constituent. The calculation of the GWPSs is documented in the Groundwater Protection Standards technical memorandum included in Appendix C of the 2018 Annual Report.

3.2 Data Comparison to Groundwater Protection Standards

Consistent with the *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (Unified Guidance) (USEPA, 2009), the preferred method for comparisons to a fixed standard are confidence limits. An exceedance of the standard occurs when the 99 percent lower confidence level of the downgradient data exceeds the GWPS. As documented in the January 14, 2019 *Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per* §257.95(g), arsenic was present at statistically significant levels above the GWPSs in two of the downgradient wells at Ponds 1-2 based on the statistical data comparison for the first semiannual assessment monitoring event (June 2018). Therefore, Consumers Energy initiated an Assessment of Corrective Measures (ACM). Assessment monitoring is ongoing.

Overall, the statistical evaluations have confirmed that arsenic is the only Appendix IV constituent present at statistically significant levels above the GWPSs. Ponds 1-2 have been decommissioned and CCRs have been removed. Arsenic was identified at downgradient monitoring well JHC-MW-15002 and JHC-MW-15003 at statistically significant levels exceeding the GWPS during the initial assessment monitoring event conducted in June 2018. As shown in the data tables and trend tests included in Appendix C and D, arsenic concentrations at these two wells have generally decreased since 2018. At JHC-MW-15003 arsenic has decreased to concentrations below or slightly above the GWPS resulting in the lower confidence limit dropping below the GWPS in 2020. The arsenic concentrations at JHC-MW-15002 have begun to decline in 2020 but remain above the GWPS. Arsenic concentrations in the other monitoring wells, which are located downgradient from Ponds 1-2, have generally remained stable at concentrations below the GWPS. Due to the changes in groundwater flow direction subsequent to pond decommissioning, monitoring wells JHC-MW-15001, JHC-MW-15002 and JHC-MW-15003 are no longer downgradient of groundwater flow across the Ponds 1-2 area. However,

as discussed in Section 2.1, they will continue to be sampled and evaluated as part of the assessment monitoring program and used to evaluate groundwater quality post-CCR removal, with the exception of JHC-MW-15001 which is being removed from the monitoring well network moving forward. A summary of the confidence intervals for April 2020 and October 2020 are provided in Table 5 and Table 6, respectively.

Groundwater chemistry is currently changing as a result of closure activities performed at Ponds 1-2. As discussed in the ACM, Ponds 1-2 have been decommissioned and CCRs have been removed and groundwater flow direction has changed such that groundwater generally flows to the south-southwest and mounding is no longer observed. The cessation of hydraulic loading and recharge of the aquifer are expected to have changed groundwater conditions, and many Appendix III and Appendix IV constituents may be affected by this change. Groundwater conditions will continue to be monitored while corrective measures continue to be evaluated and a remedy is selected. There is still some uncertainty surrounding how changes in groundwater oxidation-reduction conditions may affect contaminant transport as a result of changing conditions due to CCR removal activities. Groundwater monitoring in 2021 will reduce uncertainty surrounding the potential changes in groundwater oxidation-reduction conditions and the effect on contaminant transport. These observations will be critical for the comparison of corrective measures alternatives.

4.0 Corrective Action

Consumers Energy provided notification that arsenic was present at statistically significant levels above the federal GWPS established at 10 ug/L (TRC, 2019) in two out of five downgradient monitoring wells at Ponds 1-2 as follows:

- Arsenic at JHC-MW-15002 and JHC-MW-15003

The CCR Rule 40 CFR §257.96(a) requires that an owner or operator initiate an ACM to prevent further release, to remediate any releases, and to restore impacted areas to original conditions if any Appendix IV constituent has been detected at a statistically significant level exceeding a GWPS. The ACM was initiated on April 15, 2019 and was certified and submitted to the EGLE on September 11, 2019 in accordance with the schedule in §257.96.

4.1 Nature and Extent Groundwater Sampling

Per §257.95(g)(1), in the event that the facility determines, pursuant to §257.93(h), that there is a statistical exceedance of the GWPSs for one or more of the Appendix IV constituents, the facility must characterize the nature and extent of the release of CCR as well as any site conditions that may affect the remedy selected. The nature and extent data consist of Appendix III and IV constituents collected from the background and downgradient CCR monitoring well networks and from supplemental downgradient wells in the HMP monitoring well network. In addition to the existing HMP wells, TRC, on behalf of Consumers Energy, installed shallow and deep step out wells nested with existing downgradient wells MW-14, PZ-23, PZ-24, and PZ-40 (shallow well only) in April 2018 to further characterize the horizontal and vertical distribution of Appendix III and IV constituents in groundwater downgradient from the CCR units. The locations of the additional downgradient step out wells (MW-14S, MW-14D, PZ-23S, PZ-23D, PZ-24S, PZ-24D, PZ-40S) are shown on Figure 2. A summary of the nature and extent groundwater data collected in 2020 are provided on Table 7 (Nature and Extent analytical). The TDS data collected from the supplemental downgradient wells during the October 2020 event contained potential errors introduced from inaccurate pre-determined bag weights provided by the lab materials manufacturer and results varied significantly from historical data at each of the monitoring wells; therefore, the TDS data have been considered unusable for the purposes of the nature and extent monitoring program. The soil boring logs and well construction diagrams for the step out monitoring wells utilized for the nature and extent groundwater sampling are included in the 2019 Annual Report.

As discussed in the ACM, the nature and extent of contamination (e.g. arsenic in groundwater) relative to GWPSs has been defined per the RCRA CCR Rule requirements based on the site-specific hydrogeology. The presence of nearby surface water bodies (Recirculation Pond and the Pigeon River) as well as the unimpacted background monitoring wells to the north provide the boundaries for the extent of the GWPS exceedances. In addition, the underlying clay unit prevents the downward vertical migration of groundwater. Although Michigan Part 201 residential drinking water criteria are exceeded, there are no onsite drinking water wells downgradient from Ponds 1-2 and the closest downgradient drinking water wells are located south and east of the Pigeon River, separated hydraulically by the river. Shallow groundwater

has the potential to vent to nearby surface water boundaries that are not used for drinking water. Although several Appendix III and IV constituents exceed the Michigan Part 201 generic groundwater-surface water interface (GSI) criteria in on-site wells, compliance for the GSI pathway is currently met based on data collected from the step out wells and the NPDES outfall at the Recirculation Pond.

4.2 Assessment of Corrective Measures

The ACM was completed on September 11, 2019 as a step towards developing a final remedy.

Several groundwater remediation alternatives evaluated in the ACM are considered technically feasible to reduce on-site groundwater concentrations. The following corrective measures were retained for further evaluation for Ponds 1-2:

- Source Removal with Groundwater Monitoring and Institutional Controls;
- Source Removal with Post Source Control/Removal Monitoring;
- Source Removal with Groundwater Capture/Control;
- Source Removal with Impermeable Barrier;
- Source Removal with Active Geochemical Sequestration; and
- Source Removal with Passive Geochemical Sequestration.

Consumers Energy plans to utilize an adaptive management strategy for selecting the final groundwater remedy for Ponds 1-2 in coordination with the specified CCR source material management strategies discussed in the ACM. Under this remedy selection strategy, measures that remove source material, reduce infiltration, and/or minimize the potential for future migration during the closure process may be implemented to address existing conditions followed by monitoring and evaluation of the performance after closure. Adjustments will be made to the corrective measure remedy, as needed, to achieve the remedial goals (e.g. GWPS and/or risk/exposure/pathway-based criteria).

4.3 Remedy Selection

Consumers Energy has not selected a remedy pursuant to §257.97. The semiannual progress report describing the progress in selecting and designing the remedy required pursuant to §257.97(a) is included in Appendix E of this report. Consumers Energy has performed CCR removal at Ponds 1-2 as documented in the *JH Campbell Generating Facility Bottom Ash Ponds 1-2 Closure Plan,* (Golder, January 2018). Ponds 1-2 is undergoing closure by removal of CCR in accordance with §257.102(c). The December 2017 *Bottom Ash Ponds 1-2 Closure Work Plan* was submitted to and approved by EGLE. Dewatering and removal of ash from Ponds 1-2 for beneficial reuse began in June 2018 and continued through September 2018. CCR removal activities were completed in October 2018 and Consumers Energy submitted final documentation of CCR removal to EGLE in August 2019. On October 22, 2019, EGLE provided written concurrence that all bottom ash had been removed from Ponds 1-2 based on multiple lines of evidence described in the approved closure work plan. Changes in groundwater chemistry continue to be evaluated following the completion of CCR removal at Ponds 1-2.

Groundwater monitoring in 2021 will reduce uncertainty surrounding potential changes in redox conditions and the effect on contaminant transport. These observations will be critical for the comparison of corrective measures alternatives.

5.0 Conclusions and Recommendations

Assessment monitoring is ongoing at the JHC Ponds 1-2 CCR unit while corrective action continues to be assessed. Ponds 1-2 have been decommissioned and CCRs have been removed. Overall, the statistical evaluations have confirmed that arsenic is the only Appendix IV constituent present at statistically significant levels above the GWPSs.

The ACM also documents that groundwater nature and extent have been defined, as required in §257.95(g)(1). Although arsenic concentrations exceed the GWPS in on-site groundwater, concentrations are generally declining, and an evaluation of risk demonstrates that there are currently no adverse effects on human health or the environment from either surface water or groundwater due to CCR management at Ponds 1-2.

Consumers Energy has also completed the removal of CCR from Ponds 1-2. The ACM report provided a high-level assessment of groundwater remediation technologies that could potentially address site-specific constituents of concern (i.e. arsenic) under known groundwater conditions. Changes in groundwater chemistry continue to be evaluated following the completion of CCR removal at Ponds 1-2. Groundwater monitoring in 2021 will reduce uncertainty surrounding potential changes in groundwater oxidation-reduction conditions and the effect on contaminant transport. These observations will be critical for the comparison of corrective measures alternatives.

Consumers Energy will continue to evaluate corrective measures in accordance with §257.96 and §257.97. The groundwater management remedy for the JHC Ponds 1-2 will be selected as soon as feasible to, at a minimum, meet the federal standards of §257.97(b) of the CCR Rule. Consumers Energy will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98. The next semiannual monitoring events are scheduled for the second and fourth calendar quarters of 2021.

6.0 References

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Tables

Table 1
Summary of Groundwater Elevation Data – April & October 2020
JH Campbell – RCRA CCR Monitoring Program
West Olive, Michigan

Well Location	Ground Surface Elevation (ft)	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Elevation (ft)			April 13, 2020		October 19, 2020	
							Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Background										
JHC-MW-15023	617.01	619.98	Sand	603.0	to	593.0	15.00	604.98	17.70	602.28
JHC-MW-15024	613.79	616.62	Sand	606.8	to	596.8	9.92	606.70	12.49	604.13
JHC-MW-15025	614.14	617.17	Sand	607.1	to	597.1	8.93	608.24	11.40	605.77
JHC-MW-15026	615.09	618.04	Sand	607.1	to	597.1	10.61	607.43	12.90	605.14
JHC-MW-15027	614.77	617.30	Sand	604.8	to	594.8	10.87	606.43	13.13	604.17
JHC-MW-15028	611.02	613.80	Sand	603.0	to	593.0	11.51	602.29	12.75	601.05
JHC-MW-15029	608.08	610.95	Sand	600.1	to	590.1	9.60	601.35	10.57	600.38
JHC-MW-15030	604.05	607.17	Sand	600.1	to	590.1	8.22	598.95	9.17	598.00
Pond 1N, 1S, 2N, 2S										
JHC-MW-15001	607.02	609.53	Sand	603.5	to	598.5	11.41	598.12	11.78	597.75
JHC-MW-15002	618.18	621.27	Sand	590.2	to	580.2	23.88	597.39	24.61	596.66
JHC-MW-15003	623.16	627.20	Sand	595.2	to	585.2	32.35	594.85	32.94	594.26
JHC-MW-15005	606.22	609.99	Sand	579.2	to	569.2	18.01	591.98	18.27	591.72
JHC-MW-18004	602.92	605.72	Sand	596.9	to	586.9	11.33	594.39	12.17	593.55
JHC-MW-18005	600.30	603.16	Sand	595.3	to	585.3	10.18	592.98	10.69	592.47
Pond 3N, 3S										
JHC-MW-15013	632.40	635.25	Sand	604.4	to	594.4	34.28	600.97	34.98	600.27
JHC-MW-15015	632.46	635.20	Sand	604.5	to	594.5	33.44	601.76	34.13	601.07
JHC-MW-15016	631.81	632.52	Sand	603.8	to	593.8	30.70	601.82	31.46	601.06
JHC-MW-18001	609.09	611.98	Sand	603.1	to	593.1	11.04	600.94	11.71	600.27
JHC-MW-18002	605.53	608.93	Sand	602.0	to	592.0	8.37	600.56	8.88	600.05
JHC-MW-18003	605.36	608.78	Sand	601.9	to	591.9	8.30	600.48	8.86	599.92
Landfill										
JHC-MW-15017	613.69	616.61	Sand	603.7	to	593.7	13.05	603.56	14.54	602.07
JHC-MW-15018	614.26	617.02	Sand	604.3	to	594.3	13.80	603.22	15.23	601.79
JHC-MW-15019	609.81	612.86	Sand	603.8	to	593.8	10.22	602.64	11.66	601.20
JHC-MW-15022	620.92	623.79	Sand	597.9	to	587.9	27.28	596.51	28.78	595.01
JHC-MW-15031	632.94	635.87	Sand	599.9	to	589.9	41.84	594.03	42.82	593.05
JHC-MW-15032	611.32	614.29	Sand	598.3	to	588.3	15.31	598.98	17.15	597.14
JHC-MW-15033	618.08	620.99	Sand	602.1	to	592.1	19.89	601.10	22.07	598.92
JHC-MW-15034	612.90	615.97	Sand	601.9	to	591.9	13.55	602.42	15.90	600.07
JHC-MW-15035	632.53	634.28	Sand	599.5	to	589.5	39.11	595.17	40.09	594.19
JHC-MW-15036	617.94	618.34	Sand	597.9	to	587.9	25.43	592.91	26.41	591.93
JHC-MW-15037	614.28	616.06	Sand	591.3	to	586.3	23.97	592.09	24.95	591.11
Pond A										
JHC-MW-15006	624.74	627.58	Sand	599.7	to	589.7	33.65	593.93	34.98	592.60
JHC-MW-15007	624.82	627.70	Sand	602.8	to	592.8	33.95	593.75	Dry	
JHC-MW-15008	632.43	635.30	Sand	604.4	to	594.4	Decommissioned		Decommissioned	
JHC-MW-15008R[(1)]	632.32	634.67	Sand	597.3	to	587.3	41.46	593.21	42.98	591.69
JHC-MW-15009	632.33	635.32	Sand	602.3	to	592.3	41.77	593.55	Dry	
JHC-MW-15010	632.55	635.57	Sand	602.6	to	592.6	41.28	594.29	42.38	593.19
JHC-MW-15011	627.71	630.83	Sand	600.7	to	590.7	37.83	593.00	38.71	592.12
Downgradient Wells										
MW-13	593.40	595.37	Clayey Silt	587.9	to	585.4	9.59	585.78	Dry	
MW-14S	587.36	590.98	Sand	582.9	to	577.9	8.38	582.60	9.02	581.96
PZ-23S	602.84	604.97	Sand	591.8	to	586.8	14.81	590.16	15.34	589.63
PZ-24S	586.56	590.15	Sand	584.6	to	579.6	7.94	582.21	7.53	582.62
PZ-40S	589.51	593.25	Sand	585.5	to	575.5	9.86	583.39	10.91	582.34
TW-19-04A	608.15	611.44	Sand	591.2	to	586.2	20.85	590.59	22.15	589.29
TW-19-05	603.44	606.36	Sand	592.8	to	587.8	14.37	591.99	16.14	590.22
TW-19-06A	599.61	602.54	Sand	592.3	to	587.3	11.81	590.73	13.44	589.10

Notes:
Survey conducted by Nederveld, November 2015, October 2018, December 2018, and August 2019.
Elevation in feet relative to North American Vertical Datum 1988 (NAVD 88).
TOC: Top of well casing.
ft BTOC: Feet below top of well casing.
--: Not measured
(1): JHC-MW-15008R installed in June 2019.

Table 2
Summary of Field Parameters: April & October 2020
JH Campbell Ponds 1-2N/1-2S - West Olive - RCRA CCR Monitoring Program
West Olive, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Background							
JHC-MW-15023	4/16/2020	0.81	208.9	5.4	84	8.2	0.0
	10/20/2020	0.62	225.8	5.5	74	12.1	9.4
JHC-MW-15024	4/16/2020	0.87	203.3	6.5	321	7.5	0.0
	10/20/2020	0.28	116.1	6.9	308	11.9	9.1
JHC-MW-15025	4/16/2020	4.19	193.8	6.2	215	7.2	0.0
	10/20/2020	1.42	136.7	6.6	262	12.0	9.2
JHC-MW-15026	4/16/2020	2.86	189.4	6.4	185	8.1	0.0
	10/20/2020	3.77	138.1	6.4	127	11.5	8.6
JHC-MW-15027	4/16/2020	4.13	147.2	5.6	59	7.7	2.8
	10/20/2020	1.87	94.3	6.0	81	11.0	5.7
JHC-MW-15028	4/16/2020	7.13	186.4	6.0	82	8.8	0.0
	10/20/2020	4.92	101.4	7.3	82	12.5	7.6
Ponds 1-2N/1-2S							
JHC-MW-15001	4/16/2020(1)	--	--	--	--	--	--
	10/22/2020(1)	--	--	--	--	--	--
JHC-MW-15002	4/16/2020	0.43	-39.8	6.1	854	11.2	0.0
	10/22/2020	0.46	-33.8	5.7	587	11.8	9.0
JHC-MW-15003	4/16/2020	0.08	-49.6	8.3	804	14.0	2.0
	10/22/2020	0.26	-26.3	8.3	560	14.2	5.8
JHC-MW-15005	4/16/2020	3.39	141.2	7.1	843	7.8	1.3
	10/22/2020	0.33	105.4	7.2	1,125	14.3	7.3
JHC-MW-18004	4/16/2020	3.69	68.3	6.9	912	9.2	3.4
	10/22/2020	0.59	99.8	7.4	765	14.0	8.5
JHC-MW-18005	4/16/2020	1.37	4.6	8.5	452	9.6	2.1
	10/22/2020	0.35	77.5	8.4	501	14.2	7.4

Notes:
mg/L - Milligrams per Liter.
mV - Millivolts.
SU - Standard Units.
umhos/cm - Micromhos per centimeter.
°C - Degrees Celcius.
NTU - Nephelmetric Turbidity Unit.
-- - Not Measured.
(1) - Not sampled; insufficient amount of groundwater present to collect sample.

Table 3
Summary of Groundwater Sampling Results (Analytical): April & October 2020
JH Campbell Background – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15023		JHC-MW-15024		JHC-MW-15025	
						Sample Date:	4/16/2020	10/20/2020	4/16/2020	10/20/2020	4/16/2020	10/20/2020
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^							
Appendix III												
Boron	ug/L	NC	500	500	7,200		45	71	22	35	26	33
Calcium	mg/L	NC	NC	NC	500(2)		9.59	11.1	32.8	39.0	16.1	23.2
Chloride	mg/L	250**	250(1)	250(1)	500(2)		1.84	1.60	20.1	17.1	15.8	22.6
Fluoride	ug/L	4,000	NC	NC	NC		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250**	250(1)	250(1)	500(2)		9.75	10.1	6.26	8.93	8.63	9.82
Total Dissolved Solids	mg/L	500**	500(1)	500(1)	500		56	57	158	181	98	142
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5(1)**	**6.5 - 8.5(1)**	**6.5 - 9.0**		**5.4**	**5.5**	6.5	6.9	**6.2**	6.6
Appendix IV												
Antimony	ug/L	6	6.0	6.0	130		< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	10	10	10		< 1	< 1	< 1	< 1	< 1	< 1
Barium	ug/L	2,000	2,000	2,000	820		20	21	18	20	20	11
Beryllium	ug/L	4	4.0	4.0	18		< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	5.0	5.0	3.5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	100	100	11		< 1	< 1	< 1	< 1	< 1	< 1
Cobalt	ug/L	NC	40	100	100		< 15	< 6	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	NC	NC	NC		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4.0	4.0	39		< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	170	350	440		< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	2.0	2.0	0.20#		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	73	210	3,200		< 5	< 5	< 5	< 5	< 5	< 5
Radium-226	pCi/L	NC	NC	NC	NC		< 0.165	< 0.262	< 0.222	< 0.294	< 0.280	< 0.269
Radium-228	pCi/L	NC	NC	NC	NC		< 0.634	< 0.182	< 0.717	< 0.582	< 1.90	< 0.209
Radium-226/228	pCi/L	5	NC	NC	NC		< 0.634	< 0.262	< 0.717	< 0.582	< 1.90	< 0.269
Selenium	ug/L	50	50	50	5.0		< 1	< 1	< 1	1	< 1	1
Thallium	ug/L	2	2.0	2.0	3.7		< 2	< 2	< 2	< 2	< 2	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR), April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 180 mg CaCO3/L as measured at surface water sample SW-01 collected on April 9, 2018 from the Pigeon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE policy and procedure 09-014 dated June 20, 2012.
(1) - Criterion is the aesthetic drinking water value per footnote {E}.
(2) - Criterion is based on the total dissolved solids GSI value per footnote {EE}.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

Table 3
Summary of Groundwater Sampling Results (Analytical): April & October 2020
JH Campbell Background – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15026		JHC-MW-15027		JHC-MW-15028	
						Sample Date:	4/16/2020	10/20/2020	4/16/2020	10/20/2020	4/16/2020	10/20/2020
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^							
Appendix III												
Boron	ug/L	NC	500	500	7,200		< 20	25	< 20	< 20	< 20	< 20
Calcium	mg/L	NC	NC	NC	500(2)		16.6	17.1	7.78	12.9	11.1	17.4
Chloride	mg/L	250**	250(1)	250(1)	500(2)		7.21	5.33	< 1.00	< 1.00	< 1.00	< 1.00
Fluoride	ug/L	4,000	NC	NC	NC		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250**	250(1)	250(1)	500(2)		6.94	7.87	7.86	6.54	5.22	6.15
Total Dissolved Solids	mg/L	500**	500(1)	500(1)	500		76	75	37	49	42	68
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5(1)**	**6.5 - 8.5(1)**	**6.5 - 9.0**		**6.4**	**6.4**	**5.6**	**6.0**	**6.0**	7.3
Appendix IV												
Antimony	ug/L	6	6.0	6.0	130		< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	10	10	10		< 1	< 1	< 1	< 1	< 1	< 1
Barium	ug/L	2,000	2,000	2,000	820		15	14	25	14	14	7
Beryllium	ug/L	4	4.0	4.0	18		< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	5.0	5.0	3.5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	100	100	11		< 1	< 1	< 1	< 1	< 1	< 1
Cobalt	ug/L	NC	40	100	100		< 15	< 6	< 6	< 6	< 15	< 6
Fluoride	ug/L	4,000	NC	NC	NC		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4.0	4.0	39		< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	170	350	440		< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	2.0	2.0	0.20#		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	73	210	3,200		< 5	< 5	< 5	< 5	< 5	< 5
Radium-226	pCi/L	NC	NC	NC	NC		< 0.139	< 0.264	< 0.184	< 0.368	< 0.262	< 0.258
Radium-228	pCi/L	NC	NC	NC	NC		< 0.676	< 0.364	< 1.37	< 0.411	< 0.651	0.346
Radium-226/228	pCi/L	5	NC	NC	NC		< 0.676	< 0.364	< 1.37	< 0.411	< 0.651	0.403
Selenium	ug/L	50	50	50	5.0		< 1	< 1	< 1	< 1	< 1	< 1
Thallium	ug/L	2	2.0	2.0	3.7		< 2	< 2	< 2	< 2	< 2	< 2

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR), April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 180 mg CaCO3/L as measured at surface water sample SW-01 collected on April 9, 2018 from the Pigeon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE policy and procedure 09-014 dated June 20, 2012.
(1) - Criterion is the aesthetic drinking water value per footnote {E}.
(2) - Criterion is based on the total dissolved solids GSI value per footnote {EE}.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

Table 4
Summary of Groundwater Sampling Results (Analytical): April & October 2020
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:		JHC-MW-15001[3]		JHC-MW-15002[3]	
						Sample Date:		4/16/2020[4]	10/22/2020[4]	4/16/2020	10/22/2020
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^						
Appendix III											
Boron	ug/L	NC	**500**	**500**	7,200	--	--	**2,560**	**2,390**	**3,880**	**2,370**
Calcium	mg/L	NC	NC	NC	500[2]	--	--	122	80.1	94.6	57.6
Chloride	mg/L	250**	250[1]	250[1]	500[2]	--	--	15.4	16.0	17.3	22.3
Fluoride	ug/L	4,000	NC	NC	NC	--	--	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	**250****	**250[1]**	**250[1]**	500[2]	--	--	**295**	212	194	89.0
Total Dissolved Solids	mg/L	**500****	**500[1]**	**500[1]**	**500**	**--**	**--**	**567**	396	**554**	339
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5[1]**	**6.5 - 8.5[1]**	**6.5 - 9.0**	**--**	**--**	**6.1**	**5.7**	8.3	8.3
Appendix IV											
Antimony	ug/L	6	6.0	6.0	130	--	--	< 1	< 1	1	< 1
Arsenic	ug/L	**10**	**10**	**10**	**10**	**--**	**--**	**45**	**21**	9	**12**
Barium	ug/L	2,000	2,000	2,000	820	--	--	128	85	103	68
Beryllium	ug/L	4	4.0	4.0	18	--	--	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	5.0	5.0	3.5	--	--	< 0.2	< 0.2	1.0	< 0.2
Chromium	ug/L	100	100	100	11	--	--	< 1	< 1	7	7
Cobalt	ug/L	NC	**40**	100	100	--	--	< 15	< 15	**47**	< 15
Fluoride	ug/L	4,000	NC	NC	NC	--	--	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	**4.0**	**4.0**	39	--	--	< 1	< 1	**5**	2
Lithium	ug/L	NC	170	350	440	--	--	125	76	< 10	< 10
Mercury	ug/L	2	2.0	2.0	0.20#	--	--	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	**73**	210	3,200	--	--	49	43	**125**	59
Radium-226	pCi/L	NC	NC	NC	NC	--	--	0.378	0.468	0.272	< 0.322
Radium-228	pCi/L	NC	NC	NC	NC	--	--	< 0.408	< 0.250	0.541	< 0.282
Radium-226/228	pCi/L	5	NC	NC	NC	--	--	0.784	0.533	0.813	< 0.322
Selenium	ug/L	**50**	**50**	**50**	**5.0**	**--**	**--**	1	< 1	**27**	1
Thallium	ug/L	**2**	**2.0**	**2.0**	**3.7**	**--**	**--**	< 2	< 2	< 2	< 2

						Sample Location:		JHC-MW-15003[3]	
						Sample Date:		4/16/2020	10/22/2020
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^				
Appendix III									
Boron	ug/L	NC	**500**	**500**	7,200	--	--	**3,880**	**2,370**
Calcium	mg/L	NC	NC	NC	500[2]	--	--	94.6	57.6
Chloride	mg/L	250**	250[1]	250[1]	500[2]	--	--	17.3	22.3
Fluoride	ug/L	4,000	NC	NC	NC	--	--	< 1,000	< 1,000
Sulfate	mg/L	**250****	**250[1]**	**250[1]**	500[2]	--	--	194	89.0
Total Dissolved Solids	mg/L	**500****	**500[1]**	**500[1]**	**500**	**--**	**--**	**554**	339
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5[1]**	**6.5 - 8.5[1]**	**6.5 - 9.0**	**--**	**--**	8.3	8.3
Appendix IV									
Antimony	ug/L	6	6.0	6.0	130	--	--	1	< 1
Arsenic	ug/L	**10**	**10**	**10**	**10**	**--**	**--**	9	**12**
Barium	ug/L	2,000	2,000	2,000	820	--	--	103	68
Beryllium	ug/L	4	4.0	4.0	18	--	--	< 1	< 1
Cadmium	ug/L	5	5.0	5.0	3.5	--	--	1.0	< 0.2
Chromium	ug/L	100	100	100	11	--	--	7	7
Cobalt	ug/L	NC	**40**	100	100	--	--	**47**	< 15
Fluoride	ug/L	4,000	NC	NC	NC	--	--	< 1,000	< 1,000
Lead	ug/L	NC	**4.0**	**4.0**	39	--	--	**5**	2
Lithium	ug/L	NC	170	350	440	--	--	< 10	< 10
Mercury	ug/L	2	2.0	2.0	0.20#	--	--	< 0.2	< 0.2
Molybdenum	ug/L	NC	**73**	210	3,200	--	--	**125**	59
Radium-226	pCi/L	NC	NC	NC	NC	--	--	0.272	< 0.322
Radium-228	pCi/L	NC	NC	NC	NC	--	--	0.541	< 0.282
Radium-226/228	pCi/L	5	NC	NC	NC	--	--	0.813	< 0.322
Selenium	ug/L	**50**	**50**	**50**	**5.0**	**--**	**--**	**27**	1
Thallium	ug/L	**2**	**2.0**	**2.0**	**3.7**	**--**	**--**	< 2	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
NC - no criteria.
-- - not analyzed.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR), April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 180 mg CaCO3/L as measured at surface water sample SW-01 collected on April 9, 2018 from the Pigeon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.
(1) - Criterion is the aesthetic drinking water value per footnote {E}.
(2) - Criterion is based on the total dissolved solids GSI value per footnote {EE}.
(3) - Monitoring well JHC-MW-15001 has been upgradient and JHC-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 1-2 since 2018 due to post-pond decommissioning groundwater flow direction changes. These wells are no longer considered downgradient monitoring wells.
(4) - Not sampled; insufficient amount of groundwater present to collect sample.

Table 4
Summary of Groundwater Sampling Results (Analytical): April & October 2020
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15005		JHC-MW-18004		JHC-MW-18005	
						Sample Date:	4/16/2020	10/22/2020	4/16/2020	10/22/2020	4/16/2020	10/22/2020
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^							
Appendix III												
Boron	ug/L	NC	**500**	**500**	7,200		**1,020**	**1,340**	**524**	**638**	**534**	486
Calcium	mg/L	NC	NC	NC	500(2)		97.1	131	117	98.4	42.6	58.7
Chloride	mg/L	250**	250(1)	250(1)	500(2)		15.6	57.1	14.2	12.5	19.6	16.4
Fluoride	ug/L	4,000	NC	NC	NC		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	**250****	**250(1)**	**250(1)**	500(2)		133	207	249	127	74.5	105
Total Dissolved Solids	mg/L	**500****	**500(1)**	**500(1)**	**500**		487	**735**	**604**	**515**	262	339
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5(1)**	**6.5 - 8.5(1)**	**6.5 - 9.0**		7.1	7.2	6.9	7.4	8.5	8.4
Appendix IV												
Antimony	ug/L	6	6.0	6.0	130		2	2	< 1	< 1	< 1	< 1
Arsenic	ug/L	**10**	**10**	**10**	**10**		1	2	< 1	1	8	8
Barium	ug/L	2,000	2,000	2,000	820		270	354	210	323	144	207
Beryllium	ug/L	4	4.0	4.0	18		< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	5.0	5.0	3.5		0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	100	100	11		1	< 1	< 1	< 1	< 1	1
Cobalt	ug/L	NC	**40**	100	100		< 15	< 15	< 15	< 15	< 15	< 15
Fluoride	ug/L	4,000	NC	NC	NC		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	**4.0**	**4.0**	39		< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	170	350	440		59	42	< 10	< 10	< 10	< 10
Mercury	ug/L	2	2.0	2.0	0.20#		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	**73**	210	3,200		**91**	**110**	7	10	9	7
Radium-226	pCi/L	NC	NC	NC	NC		0.448	0.691	< 0.131	0.367	0.150	< 0.205
Radium-228	pCi/L	NC	NC	NC	NC		0.566	0.791	0.889	0.454	< 0.455	< 0.141
Radium-226/228	pCi/L	5	NC	NC	NC		1.01	1.48	0.952	0.821	< 0.455	< 0.205
Selenium	ug/L	**50**	**50**	**50**	**5.0**		**282**	**260**	**34**	**18**	**46**	**99**
Thallium	ug/L	**2**	**2.0**	**2.0**	**3.7**		**3**	**7**	< 2	< 2	< 2	< 2

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
NC - no criteria.
-- - not analyzed.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR), April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 180 mg CaCO3/L as measured at surface water sample SW-01 collected on April 9, 2018 from the Pigeon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.
(1) - Criterion is the aesthetic drinking water value per footnote {E}.
(2) - Criterion is based on the total dissolved solids GSI value per footnote {EE}.
(3) - Monitoring well JHC-MW-15001 has been upgradient and JHC-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 1-2 since 2018 due to post-pond decommissioning groundwater flow direction changes. These wells are no longer considered downgradient monitoring wells.
(4) - Not sampled; insufficient amount of groundwater present to collect sample.

Table 5
Summary of Groundwater Protection Standard Exceedances – April 2020
JH Campbell Unit 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

Constituent	Units	GWPS	JHC-MW-15001[(1)] (Upgradient)		JHC-MW-15002[(1)] (Side gradient)		JHC-MW-15003[(1)] (Side gradient)		JHC-MW-15005 (Downgradient)		JHC-MW-18005 (Downgradient)	
			LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL
Arsenic	ug/L	10	0.22	8.6	36	100	7.5	19	--	--	6.7	10
Cobalt	ug/L	15	--	--	--	--	3.5	33	--	--	--	--
Lithium	ug/L	40	--	--	7.1	150	--	--	31	56	--	--
Molybdenum	ug/L	100	--	--	--	--	19	99	6	430	--	--
Selenium	ug/L	50	--	--	--	--	--	--	-9.4	270	4.9	110
Thallium	ug/L	2	--	--	--	--	--	--	2.0	5.8	--	--

Notes:

ug/L - micrograms per Liter.

-- - Not Applicable; well/parameter pair did not directly exceed the GWPS and was not included in further analysis.

GWPS - Groundwater Protection Standard as established in TRC's Technical Memorandum dated October 15, 2018.

UCL - Upper Confidence Limit (α = 0.01) of the downgradient data set.

LCL - Lower Confidence Limit (α = 0.01) of the downgradient data set.

Indicates a statistically significant exceedance of the GWPS. An exceedance occurs when the LCL is greater than the GWPS.

(1) - Monitoring well JHC-MW-15001 has been upgradient and JHC-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 1-2 since 2018 due to post-pond decommissioning groundwater flow direction changes. These wells are no longer considered downgradient monitoring wells.

Table 6
Summary of Groundwater Protection Standard Exceedances – October 2020
JH Campbell Unit 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

Constituent	Units	GWPS	JHC-MW-15001[(1)] (Upgradient)		JHC-MW-15002[(1)] (Side gradient)		JHC-MW-15003[(1)] (Side gradient)		JHC-MW-15005 (Downgradient)		JHC-MW-18005 (Downgradient)	
			LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL
Arsenic	ug/L	10	0.22	8.6	29	110	7.7	17	--	--	7.1	9.7
Cobalt	ug/L	15	--	--	--	--	3.5	33	--	--	--	--
Lithium	ug/L	40	--	--	3.6	160	--	--	31	56	--	--
Molybdenum	ug/L	100	--	--	--	--	17	110	6.2	470	--	--
Selenium	ug/L	50	--	--	--	--	--	--	25	300	-0.28	110
Thallium	ug/L	2	--	--	--	--	--	--	2.0	7.0	--	--

Notes:

ug/L - micrograms per Liter.

-- - Not Applicable; well/parameter pair did not directly exceed the GWPS and was not included in further analysis.

GWPS - Groundwater Protection Standard as established in TRC's Technical Memorandum dated October 15, 2018.

UCL - Upper Confidence Limit (α = 0.01) of the downgradient data set.

LCL - Lower Confidence Limit (α = 0.01) of the downgradient data set.

Indicates a statistically significant exceedance of the GWPS. An exceedance occurs when the LCL is greater than the GWPS.

(1) - Monitoring well JHC-MW-15001 has been upgradient and JHC-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 1-2 since 2018 due to post-pond decommissioning groundwater flow direction changes. These wells are no longer considered downgradient monitoring wells.

Table 7
Summary of Groundwater Sampling Results (Analytical): February 2020 - October 2020
JH Campbell Nature and Extent Wells – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	MW-14S				PZ-23S			
					Sample Date:	2/11/2020	4/16/2020	7/16/2020	10/20/2020	2/11/2020	4/16/2020	7/15/2020	10/21/2020
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^								
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	28	21	28	44	30	22	113	25
Calcium	mg/L	NC	NC	NC	500(2)	2.32	2.14	1.82	6.39	--	7.48	--	10.7
Chloride	mg/L	250**	250(1)	250(1)	500(2)	< 1.00	< 1.00	< 1.00	< 1.00	--	< 1.00	--	< 1.00
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	--	< 1,000	--	< 1,000
Sulfate	mg/L	250**	250(1)	250(1)	500(2)	3.15	2.29	2.80	2.78	--	3.83	--	3.05
Total Dissolved Solids	mg/L	**500****	**500(1)**	**500(1)**	**500**	22	29	33	NA(3)	--	40	--	NA(3)
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5(1)**	**6.5 - 8.5(1)**	**6.5 - 9.0**	**5.8**	**5.0**	**5.4**	**5.2**	7.2	6.6	6.8	**6.4**
Appendix IV													
Antimony	ug/L	6	6.0	6.0	130	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	10	10	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Barium	ug/L	2,000	2,000	2,000	820	8	8	9	8	--	< 5	--	< 5
Beryllium	ug/L	4	4.0	4.0	18	< 1	< 1	< 1	< 1	--	< 1	--	< 1
Cadmium	ug/L	5	5.0	5.0	3.5	< 0.2	< 0.2	< 0.2	< 0.2	--	< 0.2	--	< 0.2
Chromium	ug/L	100	100	100	11	< 1	< 1	< 1	< 1	< 1	2	< 1	< 1
Cobalt	ug/L	NC	40	100	100	< 6	< 15	< 6	< 6	--	< 15	--	< 15
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	--	< 1,000	--	< 1,000
Lead	ug/L	NC	4.0	4.0	39	< 1	< 1	< 1	< 1	--	< 1	--	< 1
Lithium	ug/L	NC	170	350	440	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	2.0	2.0	0.20#	< 0.2	< 0.2	< 0.2	< 0.2	--	< 0.2	--	< 0.2
Molybdenum	ug/L	NC	**73**	210	3,200	< 5	< 5	< 5	< 5	6	6	8	6
Radium-226	pCi/L	NC	NC	NC	NC	--	< 0.172	--	< 0.493	--	< 0.131	--	< 0.475
Radium-228	pCi/L	NC	NC	NC	NC	--	< 0.414	--	< 0.383	--	< 0.403	--	< 0.294
Radium-226/228	pCi/L	5	NC	NC	NC	--	0.450	--	< 0.493	--	< 0.403	--	< 0.475
Selenium	ug/L	**50**	**50**	**50**	**5.0**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Thallium	ug/L	2	2.0	2.0	3.7	< 2	< 2	< 2	< 2	--	< 2	--	< 2

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR), April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 180 mg CaCO3/L as measured at surface water sample SW-01 collected on April 9, 2018 from the Pigeon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.
(1) - Criterion is the aesthetic drinking water value per footnote {E}.
(2) - Criterion is based on the total dissolved solids GSI value per footnote {EE}.
(3) - Total dissolved solids data for the October 2020 event contained errors introduced by the laboratory materials manufacturer and were determined to be unusable.

Table 7
Summary of Groundwater Sampling Results (Analytical): February 2020 - October 2020
JH Campbell Nature and Extent Wells – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	PZ-24		PZ-24S				
					Sample Date:	4/16/2020	10/21/2020	2/11/2020	4/16/2020	7/16/2020	10/21/2020	
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^							
Appendix III												
Boron	ug/L	NC	**500**	**500**	7,200	176	183	26	< 20	57	42	
Calcium	mg/L	NC	NC	NC	500(2)	20.9	26.0	2.39	3.16	2.88	7.58	
Chloride	mg/L	250**	250(1)	250(1)	500(2)	2.51	5.49	< 1.00	< 1.00	< 1.00	< 1.00	
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	
Sulfate	mg/L	250**	250(1)	250(1)	500(2)	31.3	15.2	2.59	2.73	2.62	3.06	
Total Dissolved Solids	mg/L	**500****	**500(1)**	**500(1)**	**500**	157	NA(3)	42	28	61	NA(3)	
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5(1)**	**6.5 - 8.5(1)**	**6.5 - 9.0**	6.9	6.8	**5.6**	**5.0**	**5.5**	**5.2**	
Appendix IV												
Antimony	ug/L	6	6.0	6.0	130	< 1	< 1	< 1	< 1	< 1	< 1	
Arsenic	ug/L	10	10	10	10	< 1	< 1	< 1	< 1	1	1	
Barium	ug/L	2,000	2,000	2,000	820	13	15	25	24	28	32	
Beryllium	ug/L	4	4.0	4.0	18	< 1	< 1	< 1	< 1	< 1	< 1	
Cadmium	ug/L	5	5.0	5.0	3.5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Chromium	ug/L	100	100	100	11	1	< 1	2	2	2	1	
Cobalt	ug/L	NC	40	100	100	< 15	< 15	< 6	< 15	< 6	< 6	
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	
Lead	ug/L	NC	4.0	4.0	39	< 1	< 1	< 1	< 1	< 1	< 1	
Lithium	ug/L	NC	170	350	440	< 10	< 10	< 10	< 10	< 10	< 10	
Mercury	ug/L	2	2.0	2.0	0.20#	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Molybdenum	ug/L	NC	**73**	210	3,200	11	9	< 5	< 5	< 5	< 5	
Radium-226	pCi/L	NC	NC	NC	NC	0.274	< 0.734	--	< 0.156	--	< 0.538	
Radium-228	pCi/L	NC	NC	NC	NC	< 0.480	< 0.390	--	< 0.376	--	0.517	
Radium-226/228	pCi/L	5	NC	NC	NC	< 0.480	< 0.734	--	< 0.376	--	< 0.538	
Selenium	ug/L	**50**	**50**	**50**	**5.0**	< 1	< 1	< 1	< 1	< 1	< 1	
Thallium	ug/L	2	2.0	2.0	3.7	< 2	< 2	< 2	< 2	< 2	< 2	

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR), April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 180 mg CaCO3/L as measured at surface water sample SW-01 collected on April 9, 2018 from the Pigeon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.
(1) - Criterion is the aesthetic drinking water value per footnote {E}.
(2) - Criterion is based on the total dissolved solids GSI value per footnote {EE}.
(3) - Total dissolved solids data for the October 2020 event contained errors introduced by the laboratory materials manufacturer and were determined to be unusable.

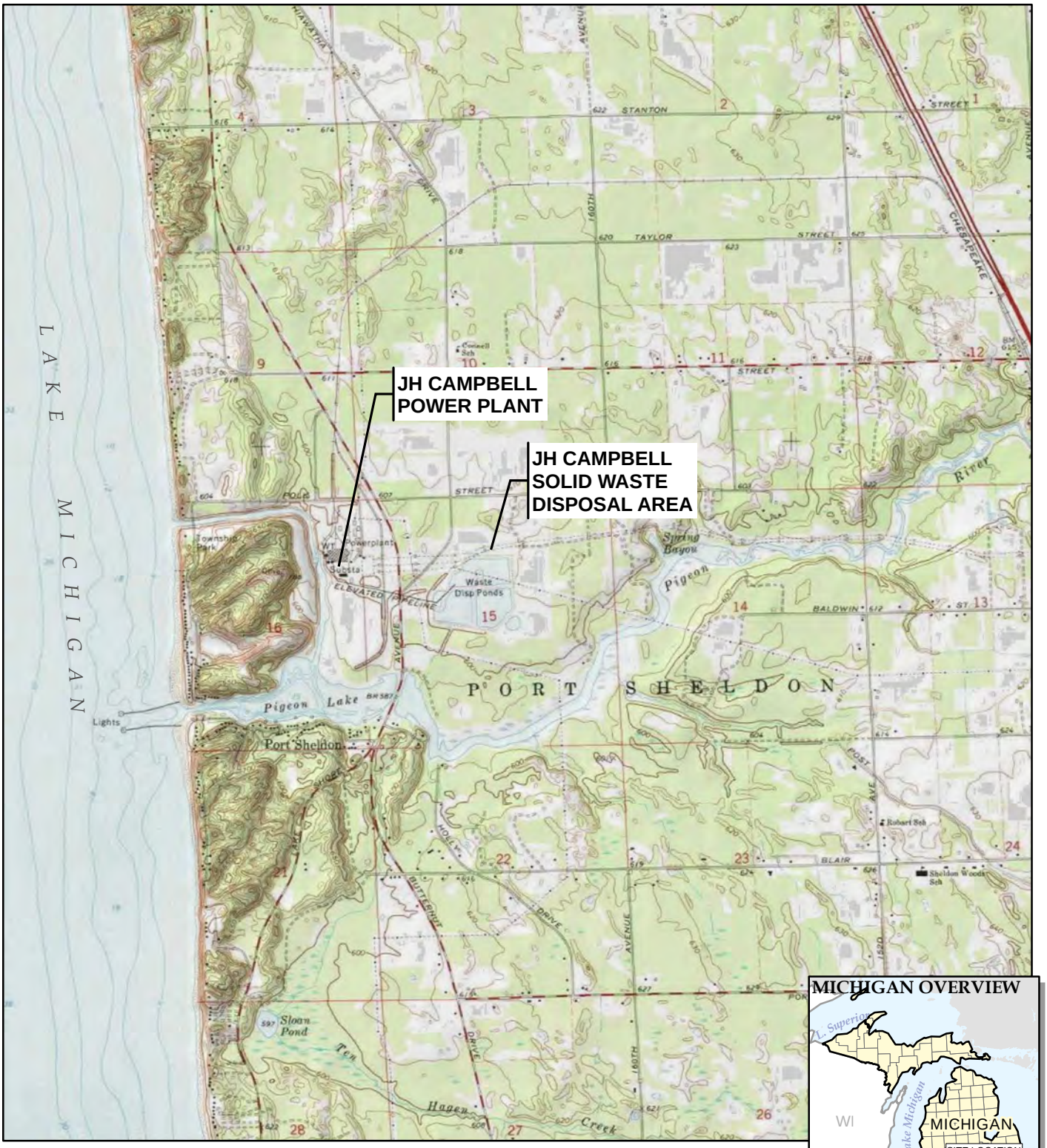
Table 7
Summary of Groundwater Sampling Results (Analytical): February 2020 - October 2020
JH Campbell Nature and Extent Wells – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	**PZ-40**		**PZ-40S**				
					Sample Date:	4/16/2020	10/21/2020	2/11/2020	4/14/2020	7/16/2020	10/21/2020	
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^							
Appendix III												
Boron	ug/L	NC	**500**	**500**	7,200	153	67	< 20	< 20	30	27	
Calcium	mg/L	NC	NC	NC	500(2)	11.2	12.6	1.36	1.65	1.35	3.51	
Chloride	mg/L	250**	250(1)	250(1)	500(2)	2.58	2.85	< 1.00	< 1.00	< 1.00	< 1.00	
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	
Sulfate	mg/L	250**	250(1)	250(1)	500(2)	13.3	8.62	2.65	2.72	2.47	1.51	
Total Dissolved Solids	mg/L	**500****	**500(1)**	**500(1)**	**500**	79	NA(3)	30	33	33	NA(3)	
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5(1)**	**6.5 - 8.5(1)**	**6.5 - 9.0**	**5.9**	**5.9**	**5.1**	**4.4**	**4.9**	**4.6**	
Appendix IV												
Antimony	ug/L	6	6.0	6.0	130	< 1	< 1	< 1	< 1	< 1	< 1	
Arsenic	ug/L	10	10	10	10	< 1	< 1	< 1	< 1	< 1	< 1	
Barium	ug/L	2,000	2,000	2,000	820	15	12	25	22	19	19	
Beryllium	ug/L	4	4.0	4.0	18	< 1	< 1	< 1	< 1	< 1	< 1	
Cadmium	ug/L	5	5.0	5.0	3.5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Chromium	ug/L	100	100	100	11	< 1	< 1	1	1	1	2	
Cobalt	ug/L	NC	40	100	100	< 15	< 15	< 6	< 15	< 6	< 6	
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	
Lead	ug/L	NC	4.0	4.0	39	< 1	< 1	< 1	< 1	< 1	< 1	
Lithium	ug/L	NC	170	350	440	< 10	< 10	< 10	< 10	< 10	< 10	
Mercury	ug/L	2	2.0	2.0	0.20#	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Molybdenum	ug/L	NC	**73**	210	3,200	7	6	< 5	< 5	< 5	< 5	
Radium-226	pCi/L	NC	NC	NC	NC	< 0.165	< 0.548	--	< 0.142	--	< 0.614	
Radium-228	pCi/L	NC	NC	NC	NC	< 0.356	< 0.302	--	< 0.370	--	< 0.442	
Radium-226/228	pCi/L	5	NC	NC	NC	0.392	< 0.548	--	< 0.370	--	< 0.614	
Selenium	ug/L	**50**	**50**	**50**	**5.0**	< 1	< 1	< 1	< 1	< 1	< 1	
Thallium	ug/L	2	2.0	2.0	3.7	< 2	< 2	< 2	< 2	< 2	< 2	

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR), April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 180 mg CaCO3/L as measured at surface water sample SW-01 collected on April 9, 2018 from the Pigeon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.
(1) - Criterion is the aesthetic drinking water value per footnote {E}.
(2) - Criterion is based on the total dissolved solids GSI value per footnote {EE}.
(3) - Total dissolved solids data for the October 2020 event contained errors introduced by the laboratory materials manufacturer and were determined to be unusable.

Figures



BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

N

1 " = 3,000 '
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PROJECT:

CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:

SITE LOCATION MAP

DRAWN BY:	S. MAJOR
CHECKED BY:	B. YELEN
APPROVED BY:	S. HOLMSTROM
DATE:	JANUARY 2021
PROJ. NO.:	367390
FILE:	367390-001-007.mxd

FIGURE 1

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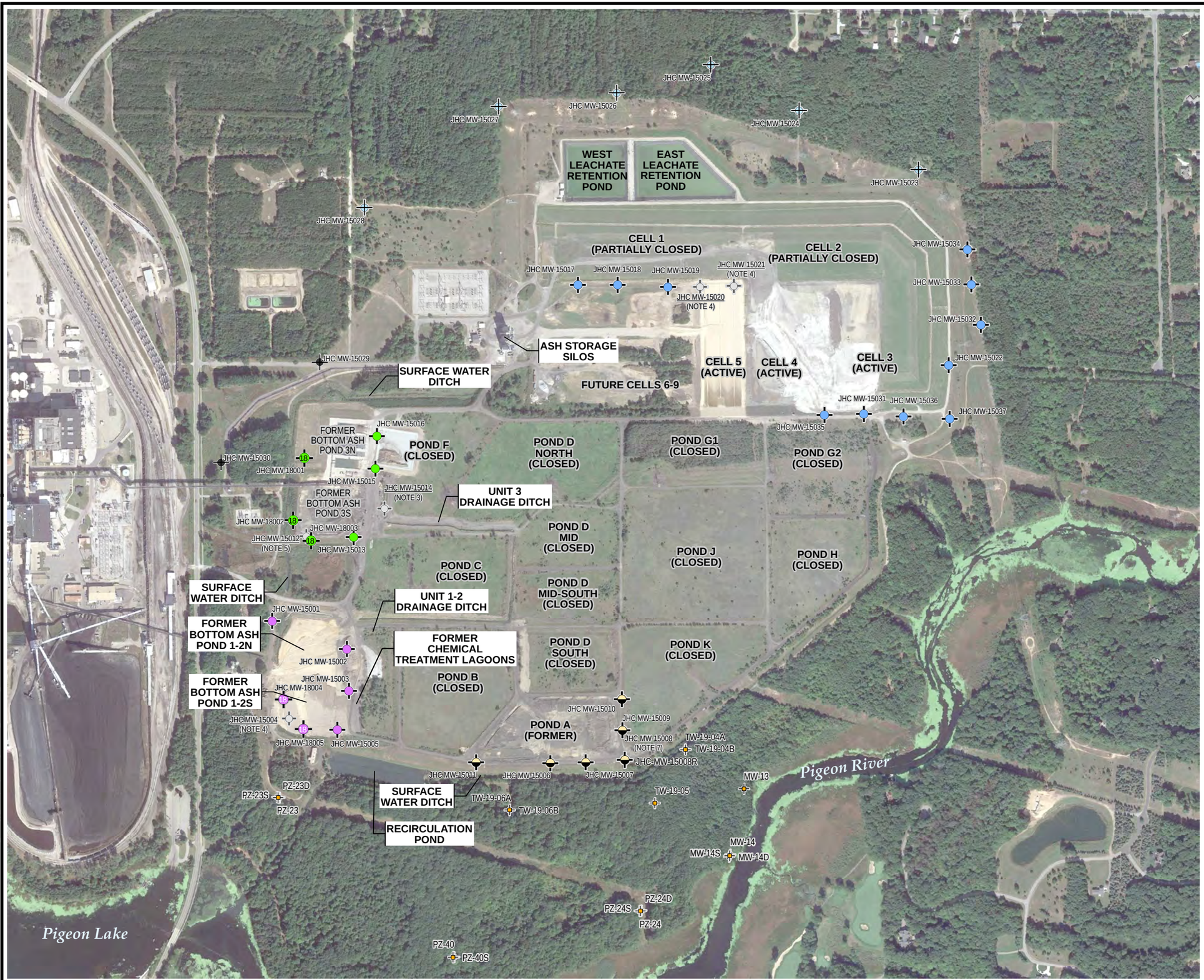

LEGEND

- BACKGROUND MONITORING WELL
- BOTTOM ASH POND 1/2 N/S MONITORING WELL
- BOTTOM ASH POND 3 N/S MONITORING WELL
- DOWNGRADIENT LANDFILL MONITORING WELL
- DOWNGRADIENT POND A MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- DECOMMISSIONED MONITORING WELL
- NEW DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL (2018)
- NEW DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL (2018)
- NATURE AND EXTENT WELL

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2018.
2. WELL LOCATIONS BASED ON SURVEY DATA THROUGH 12/07/2018.
3. MONITORING WELL DECOMMISSIONED NOVEMBER 13, 2017.
4. MONITORING WELL DECOMMISSIONED JUNE 14, 2018.
5. MONITORING WELL DECOMMISSIONED OCTOBER 10, 2018.
6. JHC-MW-1800X MONITORING WELLS INSTALLED IN DECEMBER 2018.
7. MONITORING WELL DECOMMISSIONED JUNE 24, 2019.
8. JHC-MW-15008R AND TW-19-XX MONITORING WELLS INSTALLED IN JUNE 2019.

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PROJECT:

CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:

SITE PLAN WITH CCR MONITORING WELL LOCATIONS

DRAWN BY:	S. MAJOR	PROJ NO.:	367390.0000.0000
CHECKED BY:	B. YELEN		
APPROVED BY:	S. HOLMSTROM		**FIGURE 2**
DATE:	JANUARY 2021		

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FILE NO.: 367390-001-002.mxd

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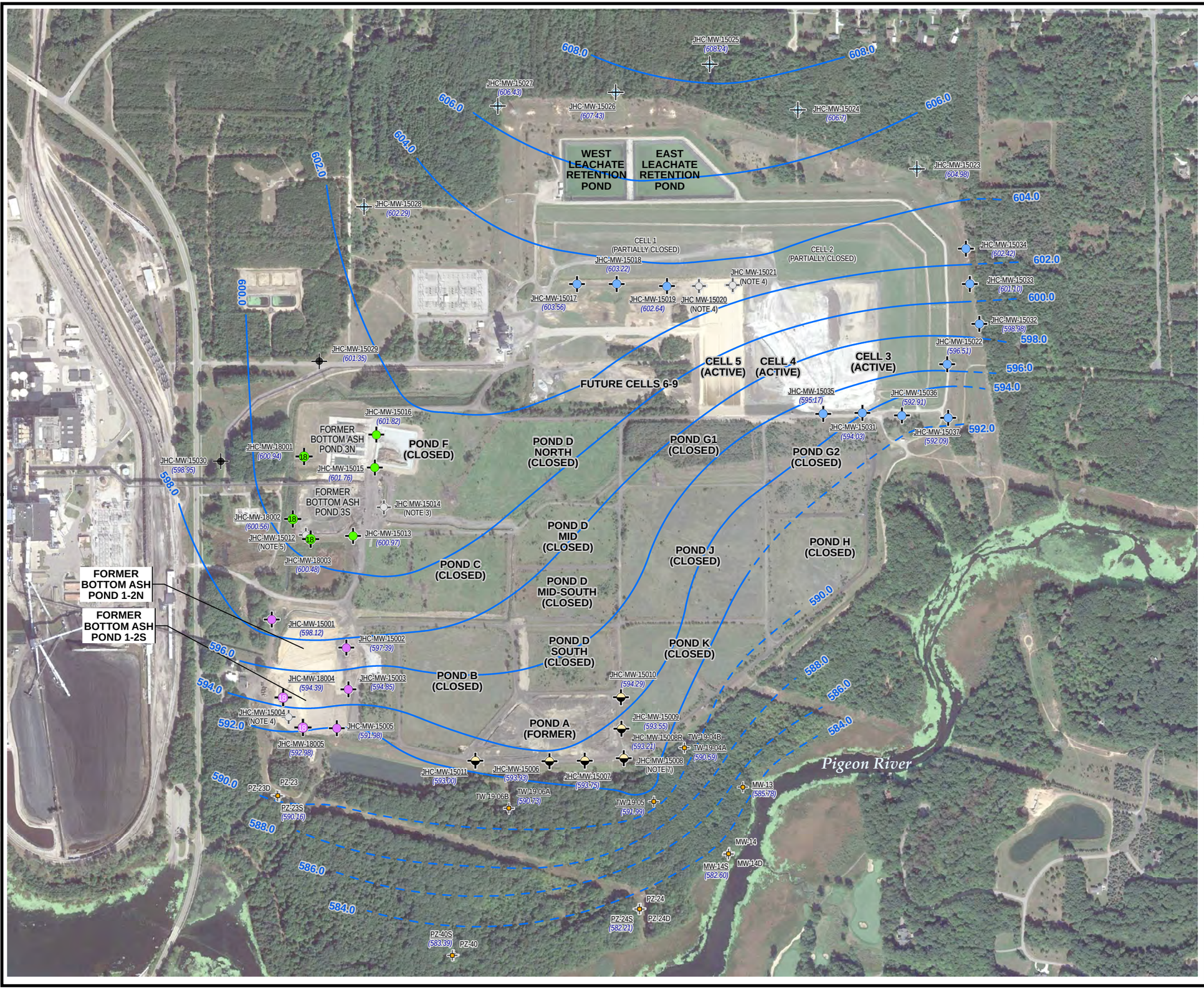
Map Rotation: 0

TRC - GIS



LEGEND

- BACKGROUND MONITORING WELL
- BOTTOM ASH POND 1/2 N/S MONITORING WELL
- BOTTOM ASH POND 3 N/S MONITORING WELL
- DOWNGRADIENT LANDFILL MONITORING WELL
- DOWNGRADIENT POND A MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- DECOMMISSIONED MONITORING WELL
- NEW DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL (2018)
- NEW DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL (2018)
- NATURE AND EXTENT WELL
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- (600.97) GROUNDWATER ELEVATION (FEET) SHALLOW WELLS
- (NM) NOT MEASURED

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2018.
2. WELL LOCATIONS BASED ON SURVEY DATA THROUGH 12/07/2018.
3. MONITORING WELL DECOMMISSIONED NOVEMBER 13, 2017.
4. MONITORING WELL DECOMMISSIONED JUNE 14, 2018.
5. MONITORING WELL DECOMMISSIONED OCTOBER 10, 2018.
6. JHC-MW-1800X MONITORING WELLS INSTALLED IN DECEMBER 2018.
7. MONITORING WELL DECOMMISSIONED JUNE 24, 2019.
8. JHC-MW-15008R AND TW-19-XX MONITORING WELLS INSTALLED IN JUNE 2019.

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1 " = 700 '

1:8,400

PROJECT:
CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:
GROUNDWATER CONTOUR MAP APRIL 2020

DRAWN BY:	S. MAJOR	PROJ NO.:	367390.0000
CHECKED BY:	K. LOWERY		
APPROVED BY:	S. HOLMSTROM		**FIGURE 3**
DATE:	JANUARY 2021		

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FILE NO.: 367390-001-003.mxd

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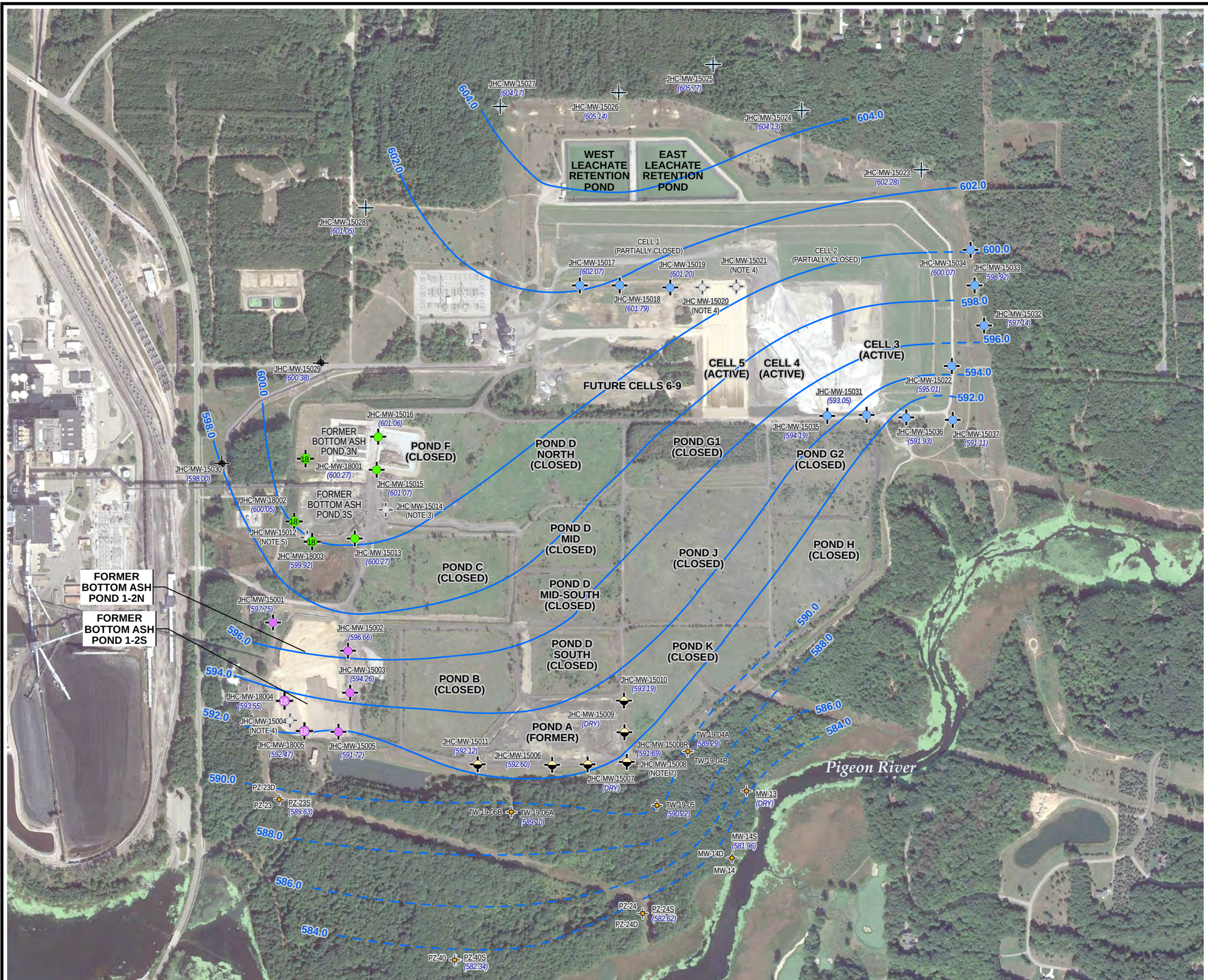

LEGEND

- BACKGROUND MONITORING WELL
- BOTTOM ASH POND 1/2 N/S MONITORING WELL
- BOTTOM ASH POND 3 N/S MONITORING WELL
- DOWNGRADIENT LANDFILL MONITORING WELL
- DOWNGRADIENT POND A MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- DECOMMISSIONED MONITORING WELL
- NEW DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL (2018)
- NEW DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL (2018)
- NATURE AND EXTENT WELL
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- (600.97) GROUNDWATER ELEVATION (FEET) SHALLOW WELLS
- (NM) NOT MEASURED

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2018.
2. WELL LOCATIONS BASED ON SURVEY DATA THROUGH 12/07/2018.
3. MONITORING WELL DECOMMISSIONED NOVEMBER 13, 2017.
4. MONITORING WELL DECOMMISSIONED JUNE 14, 2018.
5. MONITORING WELL DECOMMISSIONED OCTOBER 10, 2018.
6. JHC-MW-1800X MONITORING WELLS INSTALLED IN DECEMBER 2018.
7. MONITORING WELL DECOMMISSIONED JUNE 24, 2019.
8. JHC-MW-15008R AND TW-19-XX MONITORING WELLS INSTALLED IN JUNE 2019.
9. STATIC WATER ELEVATIONS IN NORTH AMERICAN VERTICAL DATUM 1988, NAVD 88.

N

0 700 1,400 Feet

1 " = 700 '

1:8,400

PROJECT:
CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:
GROUNDWATER CONTOUR MAP OCTOBER 2020

DRAWN BY:	S. MAJOR	PROJ NO.:	367390.0000
CHECKED BY:	B. YELEN		
APPROVED BY:	S. HOLMSTROM		**FIGURE 4**
DATE:	JANUARY 2021		

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FILE NO.: 367390-001-006.mxd

Plot Date: 1/28/2021, 10:09:35 AM by SMAJOR -- LAYOUT: ANSI B (11"x17")
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Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0
TRC - GIS

Appendix A
Groundwater Monitoring System Certification

A CMS Energy Company

Date: January 22, 2021

To: Operating Record

From: Harold D. Register, Jr., P.E.

RE: Groundwater Monitoring System Certification, §257.91(f)
JH Campbell Power Plant, Ponds 1-2 North and 1-2 South CCR Unit

Introduction

According to Title 40 Code of Federal Regulations (40 CFR) Part 257, Subpart D, §257.91(f); the owner or operator of a Coal Combustion Residual (CCR) management unit must obtain a certification from a qualified professional engineer stating that the groundwater monitoring system at the CCR management unit has been designed and constructed to meet the requirements of §257.91. Additionally, §257.91(a) details a performance standard requiring the system monitor the uppermost aquifer and include a minimum of at least one upgradient and three downgradient monitoring wells, and that if the uppermost aquifer monitoring system includes the minimum number of wells, the basis supporting use of only the minimum.

Groundwater Monitoring System

A groundwater monitoring system has been established for the JH Campbell Ponds 1-2 North and 1-2 South CCR Unit, which established the following locations for determining background groundwater quality and detection monitoring. The downgradient monitoring network accurately represents the quality of groundwater passing the waste boundary and ensures detection of groundwater contamination in the uppermost aquifer based on the groundwater flow regime and the limit of the practical length of the unit extending only 900 feet and acreage limited to approximately eleven acres.

Background:

JHC-MW-15023	JHC-MW-15026
JHC-MW-15024	JHC-MW-15027
JHC-MW-15025	JHC-MW-15028

Downgradient Monitoring Wells:
JHC-MW-15005
JHC-MW-18004
JHC-MW-18005

Other Assessment Monitoring Wells (currently located side gradient)[1]:
JHC-MW-15002 (side gradient)
JHC-MW-15003 (side gradient)

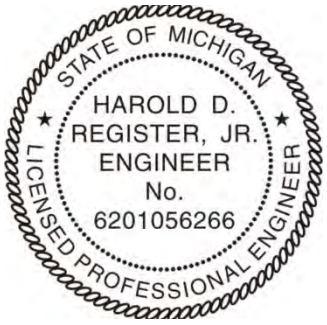
Provided herein, as required by §257.91(f), is certification from a qualified professional engineer that the groundwater monitoring system at Consumers Energy JH Campbell Ponds 1-2 North and 1-2 South CCR Unit meets the requirements of §257.91.

CERTIFICATION

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

I hereby certify that having reviewed the *2018 Annual Groundwater Monitoring Report*, *2019 Annual Groundwater Monitoring and Corrective Action Report*, and *2020 Annual Groundwater Monitoring and Corrective Action Report* for the JH Campbell Ponds 1-2 North and 1-2 South CCR Unit, and being familiar with the provisions of Title 40 of the Code of Federal Regulations §257.91 (40 CFR Part 257.91), I attest that this Groundwater Monitoring System has been designed and constructed to meet the requirements of 40 CFR 257.91. The report is accurate and has been prepared in accordance with good engineering practices, including the consideration of applicable industry standards, and with the requirements of 40 CFR Part 257.91.

Harold D. Register J.
Signature



01/22/2021

January 22, 2021
Date of Certification

Harold D. Register, Jr., P.E.
Name

6201056266
Professional Engineer Certification Number

[1] JHC-MW-15001, JHC-MW-15002, and JHC-MW-15003 were located downgradient when the pond was active. These wells are now located upgradient or side gradient of groundwater flow across the pond after groundwater flow equilibrated post-decommissioning. JHC-MW-15001 has been removed from the monitoring network as dry conditions have been observed post-decommissioning and no Appendix IV constituents have been observed at statistically significant levels above groundwater protection standards since monitoring began in 2015. Groundwater chemistry at JHC-MW-15002 and JHC-MW-15003 will continue to be used to monitor post-decommissioning changes in groundwater quality since these wells contributed to the initiation of assessment monitoring.

Appendix B
Data Quality Review

Laboratory Data Quality Review
Groundwater Monitoring Event April 2020
CEC JH Campbell Background Wells

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the April 2020 sampling event. Samples were analyzed for metals, anions, and total dissolved solids (TDS) by CE Laboratory Services in Jackson, Missouri. The laboratory analytical results were reported in laboratory project number 20-0395.

During the April 2020 sampling event, a groundwater sample was collected from each of the following wells:

- JHC-MW-15023
- JHC-MW-15024
- JHC-MW-15025
- JHC-MW-15026
- JHC-MW-15027
- JHC-MW-15028

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 300.0
Total Dissolved Solids (TDS)	SM 2540C
Total Metals	SW-846 6020, SW-846 7470A

Note that results for an extended list of metals (magnesium, potassium, and sodium), ammonia, nitrate, nitrite, alkalinity, and sulfide were provided for samples JHC-MW-15024, JHC-MW-15025, and JHC-MW-15027 as supplemental monitoring in laboratory project number 20-0395 but were not evaluated or included in this review. Further, the evaluation of radium results for samples collected during the April 2020 sampling event will be included in a supplemental review once results are available.

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA, 2017). The following items were included in the evaluation of the data:

- Sample receipt, as noted in the cover page or case narrative;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;
- Data for equipment blanks and field blanks. Field and equipment blanks are used to assess potential contamination arising from field procedures;

- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Data for laboratory duplicates, when performed on project samples. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

It should be noted that results for method blanks and laboratory control samples were not provided for review by the laboratory. Therefore, potential contamination arising from laboratory sample preparation and/or analytical procedures and the accuracy of the analytical method using a clean matrix could not be evaluated.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation are noted below.

- The reviewed Appendix III and IV constituents as well as iron, copper, nickel, silver, vanadium, and zinc will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary

- Preparation dates were not provided by the laboratory. Since the analyses were performed within the preparation holding times, where applicable, there is no impact on data usability due to this issue.
- The cooler temperatures were between 6.1 and 8.2 degrees Celsius and the laboratory noted that samples were not received on ice. Samples were not received by the laboratory on the same day as collection. Therefore, results for TDS and anions in all samples collected during this sampling event should be considered estimated and may be biased low as summarized in the attached table. However, results for TDS and anions are consistent with historical results. Therefore, data usability is not affected.
- One equipment blank (EB-03) and one field blank (FB-03) were collected. Target analytes were not detected in these blank samples.
- MS and MSD analyses were performed on sample JHC-MW-15025 for mercury, metals, and anions. The recoveries were within the acceptance limits. Relative percent differences

(RPDs) were not provided by the laboratory and therefore were not evaluated; further, MS/MSD concentrations were not provided by the laboratory. However, since all recoveries were within the acceptance limits, there is no impact on data usability due to this issue.

- The field duplicate pair samples were DUP-03/JHC-MW-15023. All criteria were met.
- It is unknown if laboratory duplicate analyses were performed on a sample from this data set since the QC reported by the laboratory was incomplete.
- Undiluted laboratory RLs were at the project-specified RLs in the monitoring plan with the following exceptions/notes:
  - RLs for total boron (20 µg/L), chloride (1,000 µg/L), and TDS (10,000 µg/L) were lower than the monitoring plan RLs (50 µg/L, 2,000 µg/L, and 50,000 µg/L, respectively). Boron in JHC-MW-15023, JHC-MW-15024, JHC-MW-15025, and DUP-03, TDS in JHC-MW-15027, JHC-MW-15028, and DUP-03, and chloride in JHC-MW-15023 were affected by the lower RL since boron, chloride, and/or TDS were detected in these samples above the laboratory's RL and below the monitoring plan RL. RLs are consistent with the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Op Memo WMRPD-115-14; therefore, data usability is not affected.
  - The RL for total barium (5 µg/L) in all samples was higher than the monitoring plan RL (1 µg/L). However, barium was detected in all samples except for the blanks (EB-03 and FB-03). The RL is consistent with the EGLE Op Memo; therefore, data usability is not affected.
  - The nondetect RL for total cobalt (15 µg/L) in all samples was higher than the monitoring plan RL (6 µg/L) and does not meet project needs.
  - The laboratory indicated in the case narrative that due to matrix interference/possible carry over effects, the RL for silver was increased to 0.3 µg/L for sample JHC-MW-15024; this RL does not meet the project-specified RL of 0.2 µg/L.

Attachment A
Summary of Data Non-Conformances for Landfill Groundwater Analytical Data
JH Campbell Background Wells – RCRA CCR Monitoring Program
West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-15023	4/16/2020	TDS, Chloride, Fluoride, Sulfate	Samples not received on ice with elevated cooler temperature; sample results should be considered estimated and may be biased low. However, results were consistent with historical results; therefore, data usability is not affected.
JHC-MW-15024	4/16/2020		
JHC-MW-15025	4/16/2020		
JHC-MW-15026	4/16/2020		
JHC-MW-15027	4/16/2020		
JHC-MW-15028	4/16/2020		
EB-03	4/16/2020		
FB-03	4/16/2020		
DUP-03	4/16/2020		

Laboratory Data Quality Review
Groundwater Monitoring Event April 2020 – Radium
Consumers Energy JH Campbell Background Wells

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the April 2020 sampling event. Samples were analyzed for radium; radium analyses were subcontracted to Eurofins TA in St. Louis, Missouri (Eurofins TA – St. Louis). The laboratory analytical results were reported in laboratory project number 160-37918-1.

During the April 2020 sampling event, a groundwater sample was collected from each of the following wells:

- JHC-MW-15023
- JHC-MW-15024
- JHC-MW-15025
- JHC-MW-15026
- JHC-MW-15027
- JHC-MW-15028

Each sample was analyzed for the following constituents:

Analyte Group	Method
Radium (Radium-226, Radium-228, Combined Radium)	EPA 903.0, EPA 904.0

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Usability Review Procedure

The analytical data were reviewed using the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

- Sample receipt, as noted in the cover page or case narrative;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;
- Data for method blanks, equipment blanks, and field blanks, where applicable. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field and equipment blanks are used to assess potential contamination arising from field procedures;
- Data for laboratory control samples (LCSs) and laboratory control sample duplicates (LCSDs), when performed. The LCSs and/or LCSDs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Data for laboratory duplicates, when performed on project samples. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;

- Percent recoveries for carriers. Carriers are used to assess the chemical yield for the preparation and/or instrument efficiency;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation are noted below.

- The reviewed Appendix IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary

- A method blank was analyzed with each analytical batch. Target analytes were not detected in the method blank samples.
- One equipment blank (EB-03) and one field blank (FB-03) were collected. Target analytes were not detected.
- The LCS and LCSD recoveries and relative percent differences (RPDs) were within QC limits with the following exceptions.
    - The recovery for radium-228 (24%) in the LCSD and the replicate error ratio (RER) in the LCS/LCSD analyses (3.46) performed with preparation batch 471099 were outside of the acceptance limits (75-125% and 1, respectively). The laboratory indicated that there was insufficient sample volume for re-preparation. There is no adverse impact on the data usability due to these issues since the recovery for radium-228 was acceptable in the LCS.
- MS and MSD analyses were not performed.
- The field duplicate pair samples were DUP-03/JHC-MW-15023; all criteria were met.
- Laboratory duplicate analyses were not performed.
- Carrier recoveries were within 40-110% with the following exceptions.
    - The barium carrier recoveries in the radium-228 analyses of samples JHC-MW-15025 (25.8%) and sample JHC-MW-15027 (34.7%) were below the acceptance criteria (40-110%). The laboratory indicated that there was physical evidence of matrix interference present during sample preparation; there was insufficient sample volume for re-

preparation. Therefore, the nondetect results for radium-228 in these samples should be considered estimated and biased low, as summarized in the attached table. However, the nondetect results were within or above the range of historical results. Therefore, data usability is not affected.

- Samples did not undergo a 21-day wait period prior to radium-226 analysis; however, combined radium results were < 5 pCi/L so there is no impact on data usability.
- The minimum detectable concentrations (MDCs) for radium-228 in samples JHC-MW-15025 (1.90 pCi/L) and sample JHC-MW-15027 (1.37 pCi/L) were above the project-specified limit of 1.00 pCi/L likely due to matrix interference; however, combined radium results were < 5 pCi/L so there is no adverse impact on data usability.

Attachment A
Summary of Data Non-Conformances
JH Campbell Background – RCRA CCR Monitoring Program
West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-15025	4/16/2020	Radium 228	Low barium carrier recovery. Potential low bias exists for these nondetect results. However, results are within or above the range of historical results; therefore, data usability is not affected.
JHC-MW-15027	4/16/2020		

Laboratory Data Quality Review
Groundwater Monitoring Event April 2020
Consumers Energy JH Campbell Ponds 1 and 2

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the April 2020 sampling event. Samples were analyzed for total metals, anions, and total dissolved solids by CE Laboratory Services in Jackson, Michigan. The laboratory analytical results were reported in laboratory project number 20-0397.

During the April 2020 sampling event, a groundwater sample was collected from each of the following wells:

- JHC-MW-15002
- JHC-MW-15003
- JHC-MW-15005
- JHC-MW-18004
- JHC-MW-18005

Well JHC-MW-15001 was dry so a sample was not collected during this event.

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 300.0
Total Dissolved Solids (TDS)	SM 2540C
Total Metals	SW-846 6020, SW-846 7470A

Note that results for an extended list of metals (iron, magnesium, potassium, and sodium), alkalinity, ammonia, nitrate, nitrite, and sulfide were provided for select samples as supplemental monitoring but were not evaluated or included in this review. Further, the evaluation of radium results for samples collected during the April 2020 sampling event will be included in a supplemental review once results are available.

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA, 2017). The following items were included in the evaluation of the data:

- Sample receipt;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;
- Data for equipment blanks and field blanks. Field and equipment blanks are used to assess potential contamination arising from field procedures;

- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Data for laboratory duplicates, when performed on project samples. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

It should be noted that results for method blanks and laboratory control samples were not provided for review. Therefore, potential contamination arising from laboratory sample preparation and/or analytical procedures and the accuracy of the analytical method using a clean matrix could not be evaluated for all parameters included in this review.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation, are noted below.

- Appendix III and IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary:

- Preparation dates were not provided by CE Laboratory Services. Since the analyses were performed within the preparation holding times, where applicable, there is no impact on data usability due to this issue.
- One of the cooler temperatures was 8.2 degrees Celsius and the laboratory noted that samples were not received on ice. Samples were not received by the laboratory on the same day as collection. Therefore, results for TDS and anions in all samples should be considered estimated and may be biased low as summarized in the attached table. However, TDS and anion results were within or above the range of historical concentrations. Data were deemed usable for the intended purpose.
- Equipment blanks and field blanks were not collected during this sampling event.
- MS and MSD analyses were performed on sample JHC-MW-18004 for mercury, metals, and anions. The recoveries were within the acceptance limits. Relative percent differences

(RPDs) were not provided by the laboratory and therefore were not evaluated; further, MS/MSD concentrations were not provided by the laboratory. However, since all recoveries were within the acceptance limits, there is no impact on data usability due to this issue.

- A field duplicate pair was not collected during this sampling event.
- It is unknown if laboratory duplicate analyses were performed on a sample from this data set since the QC reported by the laboratory was incomplete.

Attachment A
Summary of Data Non-Conformances for Landfill Groundwater Analytical Data
JH Campbell Ponds 1 and 2 – RCRA CCR Monitoring Program
West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-15002	4/16/2020	TDS, Chloride, Fluoride, Sulfate	Samples not received on ice and cooler temperature elevated; sample results may be biased low. However, results were consistent with historical results; therefore, data usability is not affected.
JHC-MW-15003	4/16/2020		
JHC-MW-15005	4/16/2020		
JHC-MW-18004	4/16/2020		
JHC-MW-18005	4/16/2020		

Laboratory Data Quality Review
Groundwater Monitoring Event April 2020 – Radium
Consumers Energy JH Campbell Ponds 1 and 2

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the April 2020 sampling event. Samples were analyzed for radium; radium analyses were subcontracted to Eurofins TA in St. Louis, Missouri (Eurofins TA – St. Louis). The laboratory analytical results were reported in laboratory project number 160-37915-1.

During the April 2020 sampling event, a groundwater sample was collected from each of the following wells:

- JHC-MW-15002
- JHC-MW-15003
- JHC-MW-15005
- JHC-MW-18004
- JHC-MW-18005

Well JHC-MW-15001 was dry so a sample was not collected during this event.

Each sample was analyzed for the following constituents:

Analyte Group	Method
Radium (Radium-226, Radium-228, Combined Radium)	EPA 903.0, EPA 904.0

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Usability Review Procedure

The analytical data were reviewed using the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

- Sample receipt, as noted in the cover page or case narrative;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;
- Data for method blanks, equipment blanks, and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field and equipment blanks are used to assess potential contamination arising from field procedures;
- Data for laboratory control samples (LCSs) and laboratory control sample duplicates (LCSDs), when performed. The LCSs and/or LCSDs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;

- Data for laboratory duplicates, when performed on project samples. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Percent recoveries for carriers. Carriers are used to assess the chemical yield for the preparation and/or instrument efficiency;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation are noted below.

- The reviewed Appendix IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary

- A method blank was analyzed with each analytical batch. Target analytes were not detected in the method blank samples with the following exception. Normalized absolute difference comparisons between the blank and sample that are between 1.96 and 2.58 may indicate biased high results and normalized absolute differences <1.96 may indicate a false positive sample result.
  - Radium-228 was detected in method blank 160-469860/21-A at 0.7796 +/- 0.428 pCi/L. The detected radium-228 results for samples associated with this method blank were potentially impacted, as summarized in the attached table, Attachment A. However, results are consistent with historical results; therefore, data usability is not affected.
- Equipment blanks and field blanks were not collected during this sampling event.
- The LCS and LCSD recoveries and relative percent differences (RPDs) for all analytes were within QC limits.
- MS and MSD analyses were not performed.
- A field duplicate pair was not collected with this data set.
- Laboratory duplicate analyses were not performed.
- Carrier recoveries were within 40-110%.

- Samples did not undergo a 21-day wait period prior to radium-226 analysis; however, combined radium results were < 5 pCi/L so there is no impact on data usability.

Attachment A
Summary of Data Non-Conformances for Landfill Groundwater Analytical Data
JH Campbell Ponds 1 and 2 – RCRA CCR Monitoring Program
West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-15005	4/16/2020	Radium-228	Detection in method blank. Normalized absolute difference between blank and samples <1.96; indicates possible false positive results. However, results are consistent with historical results; therefore, data usability is not affected.
JHC-MW-15003	4/16/2020		
JHC-MW-18004	4/16/2020		

Laboratory Data Quality Review
Groundwater Monitoring Event October 2020
CEC JH Campbell Background Wells

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the October 2020 sampling event. Samples were analyzed for total metals, anions, and total dissolved solids (TDS) by CE Laboratory Services in Jackson, Michigan. The radium analyses were subcontracted to Eurofins-TestAmerica in St. Louis, Missouri (Eurofins TA – St. Louis). The laboratory analytical results were reported in laboratory sample delivery groups 20-1192 and 160-40223-1.

During the October 2020 sampling event, a groundwater sample was collected from each of the following wells:

- JHC-MW-15023
- JHC-MW-15024
- JHC-MW-15025
- JHC-MW-15026
- JHC-MW-15027
- JHC-MW-15028

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 300.0
Total Dissolved Solids (TDS)	SM 2540C
Total Metals	SW-846 6020B/ 7470A
Radium (Ra-226, Ra-228, Combined Ra-226 & Ra-228)	EPA 903.0, EPA 904.0

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA, 2017) and the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

- Sample receipt, as noted in the cover page or case narrative;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;
- Data for method blanks, equipment blanks, and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field and equipment blanks are used to assess potential contamination arising from field procedures;

- Data for laboratory control samples (LCSs) and laboratory control sample duplicates (LCSDs), when performed. The LCSs and/or LCSDs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Percent recoveries for carriers, where applicable, for radiochemistry only. Carriers are used to assess the chemical yield for the preparation and/or instrument efficiency;
- Data for laboratory duplicates, when performed on project samples. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

It should be noted that results for method blanks and laboratory control samples were not provided for review by the laboratory. Therefore, potential contamination arising from laboratory sample preparation and/or analytical procedures and the accuracy of the analytical method using a clean matrix could not be evaluated.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation are noted below.

- The reviewed Appendix III and IV constituents as well as iron, copper, nickel, silver, vanadium, and zinc will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary

- A method blank was analyzed with each analytical batch for radium. Radium 228 was detected in MB 160-490784/23-A at 0.5069 +/- 0.266 pCi/L. There was no impact on data usability since radium 228 was not detected in the associated samples.
- One equipment blank (EB-01) and one field blank (FB-01) were collected. Target analytes were not detected in these blank samples.
- An LCS and LCSD were analyzed with each analytical batch for radium; the following issues were noted.

- Radium 226 recovered above the acceptance limits (75-125%) in LCS 160-490013/1-A (132%). No data are affected as no associated samples had positive detections for radium 226.
- Radium 228 recovered above the acceptance limits (75-125%) in LCSD 160-490784/1-A (132%). Further, the replicate error ratio was above the acceptance limit (1.0) for LCS 160-490784/1-A and LCSD 160-490784/2-A (1.02) for radium 228. No data are affected as no associated samples had positive detections for radium 228.

- MS and MSD analyses were performed on sample JHC-MW-15025 for mercury, total metals, and anions. The recoveries were within the acceptance limits. Relative percent differences (RPDs) were not provided by the laboratory and therefore were not evaluated; further, MS/MSD concentrations were not provided by the laboratory. However, since all recoveries were within the acceptance limits, there is no impact on data usability due to this issue.
- The field duplicate pair samples were DUP-01/JHC-MW-15028. All criteria were met.
- The barium carrier in samples JHC-MW-15023 (146%), JHC-MW-15025 (182%), JHC-MW-15026 (154%), and JHC-MW-15028 (140%) recovered above the acceptance limits (40-110%) for the radium 226 and 228 analyses. The carrier results were truncated by the laboratory to 100% to minimize potential high bias. The positive and nondetect results of radium 226 and 228 for these samples are potentially uncertain as summarized in the attached table, Attachment A.
- The barium carrier in sample JHC-MW-15024 (124%) recovered above the acceptance limits (40-110%) for the radium 226 analysis. The carrier result was truncated by the laboratory to 100% to minimize potential high bias. The nondetect result for radium 226 in this sample is uncertain as summarized in the attached table, Attachment A.
- CE Laboratory identified that the pre-determined weights of the bags used in the TDS analyses were inaccurate and this issue could not be resolved to determine the potential bias on the individual sample results. Therefore, the positive and nondetect results for TDS in all samples are potentially uncertain as summarized in the attached table, Attachment A. However, the results do not vary significantly from historical data for each monitoring well, therefore, the TDS data are considered usable for purposes of this monitoring program.

Attachment A
Summary of Data Non-Conformances for Landfill Groundwater Analytical Data
JH Campbell Background Wells– CCR Monitoring Program
West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-15023	10/20/2020	TDS	Pre-weighed sample bag weights were potentially inaccurate. Indicates uncertainty in results.
JHC-MW-15024	10/20/2020		
JHC-MW-15025	10/20/2020		
JHC-MW-15026	10/20/2020		
JHC-MW-15027	10/20/2020		
JHC-MW-15028	10/20/2020		
DUP-01	10/20/2020		
FB-01	10/20/2020		
EB-01	10/20/2020		
JHC-MW-15024	10/20/2020	Radium 226	Barium carrier recovery above acceptance criteria (40-110%); carrier results truncated by laboratory to 100%. Indicates potential uncertainty in results.
JHC-MW-15023	10/20/2020	Radium 226, Radium 228	Barium carrier recovery above acceptance criteria (40-110%); carrier results truncated by laboratory to 100%. Indicates potential uncertainty in results.
JHC-MW-15025	10/20/2020		
JHC-MW-15026	10/20/2020		
JHC-MW-15028	10/20/2020		

Laboratory Data Quality Review
Groundwater Monitoring Event October 2020
Consumers Energy JH Campbell Ponds 1 and 2

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the October 2020 sampling event. Samples were analyzed for total metals, anions, and total dissolved solids by CE Laboratory Services in Jackson, Michigan. The radium analyses were subcontracted to Eurofins-TestAmerica in St. Louis, Missouri (Eurofins TA – St. Louis). The laboratory analytical results were reported in sample delivery groups 20-1193R and 160-40222-1.

During the October 2020 sampling event, a groundwater sample was collected from each of the following wells:

- JHC-MW-15002
- JHC-MW-15003
- JHC-MW-15005
- JHC-MW-18004
- JHC-MW-18005

Well JHC-MW-15001 was dry so a sample was not collected during this event.

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 300.0
Total Dissolved Solids (TDS)	SM 2540C
Total Metals	SW-846 6020B, SW-846 7470A
Radium (Ra-226, Ra-228, Combined Ra-226 & Ra-228)	EPA 903.0, EPA 904.0

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA, 2017) and the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

- Sample receipt; as noted in the cover page or case narrative;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;

- Data for method blanks, equipment blanks, and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field and equipment blanks are used to assess potential contamination arising from field procedures;
- Data for laboratory control samples (LCSs) and laboratory control sample duplicates (LCSDs), when performed. The LCSs and/or LCSDs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Percent recoveries for carriers, where applicable, for radiochemistry only. Carriers are used to assess the chemical yield for the preparation and/or instrument efficiency;
- Data for laboratory duplicates, when performed on project samples. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

It should be noted that results for method blanks and LCSs were not provided for review. Therefore, potential contamination arising from laboratory sample preparation and/or analytical procedures and the accuracy of the analytical method using a clean matrix could not be evaluated for all parameters included in this review.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation, are noted below.

- Appendix III and IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary:

- A method blank was analyzed with each analytical batch for radium; radium was not detected in the method blanks.

- One equipment blank (EB-02) and one field blank (FB-02) were collected. Target analytes were not detected in these blank samples.
- An LCS and LCSD were analyzed with each analytical batch for radium. Radium 226 recovered above the acceptance limits (75-125%) in LCS 160-490013/1-A (132%). The positive detections of radium 226 in samples JHC-MW-15002, JHC-MW-15005, and JHC-MW-18004 are potentially biased high as summarized in the attached table, Attachment A.
- MS and MSD analyses were performed on sample JHC-MW-18004 for total metals and anions. The recoveries were within the acceptance limits. Relative percent differences (RPDs) were not provided by the laboratory and therefore were not evaluated; further, MS/MSD concentrations were not provided by the laboratory. However, since all recoveries were within the acceptance limits, there is no impact on data usability due to this issue.
- The field duplicate pair samples were DUP-02/JHC-MW-18005. All criteria were met.
- The barium carrier in samples JHC-MW-15002 (155%), JHC-MW-15003 (111%), JHC-MW-15005 (122%), JHC-MW-18004 (113%), JHC-MW-18005 (259%), DUP-02 (299%), FB-02 (237%), and EB-02 (149%) recovered above the acceptance limits (40-110%) for the radium 226 and 228 analyses. The carrier results were truncated by the laboratory to 100% to minimize potential high bias. The positive and nondetect results of radium 226 and 228 for these samples are potentially uncertain as summarized in the attached table, Attachment A.
- CE Laboratory identified that the pre-determined weights of the bags used in the TDS analyses were inaccurate and this issue could not be resolved to determine the potential bias on the individual sample results. Therefore, the positive and nondetect results for TDS in all samples are potentially uncertain as summarized in the attached table, Attachment A. However, the results do not vary significantly from historical data for each monitoring well, therefore, the TDS data are considered usable for purposes of this monitoring program.

Attachment A
Summary of Data Non-Conformances for Landfill Groundwater Analytical Data
JH Campbell Ponds 1 and 2– CCR Monitoring Program
West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-15002	10/22/2020	TDS	Pre-weighed sample bag weights were potentially inaccurate. Indicates uncertainty in results.
JHC-MW-15003	10/22/2020		
JHC-MW-15005	10/22/2020		
JHC-MW-18004	10/22/2020		
JHC-MW-18005	10/22/2020		
DUP-02	10/22/2020		
EB-02	10/22/2020		
FB-02	10/22/2020		
JHC-MW-15002	10/22/2020	Radium 226	Laboratory Control Sample (LCS) percent recovery (%R) above acceptance criteria (75-125%); indicates potential high bias in results.
JHC-MW-15005	10/22/2020		
JHC-MW-18004	10/22/2020		
JHC-MW-15002	10/22/2020	Radium 226, Radium 228	Barium carrier recovery above acceptance criteria (40-110%); carrier results truncated by laboratory to 100%. Indicates potential uncertainty in results.
JHC-MW-15003	10/22/2020		
JHC-MW-15005	10/22/2020		
JHC-MW-18004	10/22/2020		
JHC-MW-18005	10/22/2020		
DUP-02	10/22/2020		
EB-02	10/22/2020		
FB-02	10/22/2020		

Appendix C
April 2020 Assessment Monitoring Statistical Evaluation

1540 Eisenhower Pl.
Ann Arbor, MI 48108

T 734.971.7080
TRCcompanies.com

Technical Memorandum

Date:	August 10, 2020
To:	Bethany Swanberg, Consumers Energy
From:	Sarah Holmstrom, TRC Kristin Lowery, TRC
Project No.:	367390.0000.0000 Phase 1 Task 4
Subject:	Statistical Evaluation of April 2020 Assessment Monitoring Sampling Event, JH Campbell Bottom Ash Ponds 1-2 North and 1-2 South CCR Unit, Consumers Energy Company, West Olive, Michigan

Consumers Energy is continuing semiannual assessment monitoring in accordance with §257.95 of the CCR Rule[1] at the JH Campbell Power Plant (JHC) Bottom Ash Ponds 1-2 North and 1-2 South (Ponds 1-2). The first semiannual assessment monitoring event of 2020 was conducted on April 14 through 16, 2020. In accordance with §257.95, the assessment monitoring data must be compared to GWPSs to determine whether or not Appendix IV constituents are detected at statistically significant levels above the Groundwater Protection Standards (GWPSs). GWPSs were established in accordance with §257.95(h), as detailed in the October 15, 2018 Groundwater Protection Standards technical memorandum, which was also included in the 2018 Annual Groundwater Monitoring Report (2018 Annual Report) (TRC, January 2019). The following narrative describes the methods that were employed for comparisons to the GWPSs. The results obtained and the Sanitas™ output files are included as an attachment.

The statistical evaluation of the first semiannual assessment monitoring event for 2020 indicates that the following constituent is present at statistically significant levels exceeding the GWPS in downgradient monitoring wells at the Ponds 1-2 CCR Unit:

Constituent	GWPS	# Downgradient Wells Observed
Arsenic	10 ug/L	1 of 6

These results are consistent with the results of the initial and previous assessment monitoring data statistical evaluations and Consumers Energy will continue to evaluate corrective measures per §257.96 and §257.97. Consumers Energy will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

[1] USEPA final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) published April 17, 2015, as amended.

Assessment Monitoring Statistical Evaluation

The compliance well network at the Ponds 1-2 CCR Unit consists of six monitoring wells. JHC-MW-15001, JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 are located on the perimeter of the bottom ash ponds. Former downgradient monitoring well JHC-MW-15004 was decommissioned on June 14, 2018, during deconstruction of Ponds 1-2; therefore, statistical analysis for JHC-MW-15004 terminates at the June 2018 monitoring event. Due to the cessation of hydraulic loading to Ponds 1-2 and Bottom Ash Ponds 3 North and 3 South (Pond 3), the groundwater flow direction changed significantly from the previous baseline and assessment monitoring events. In response, as documented in the 2018 Annual Report, Consumers Energy installed two new downgradient wells (JHC-MW-18004 and JHC-MW-18005) on the south and southwest edge of former Ponds 1-2 from December 3 through December 5, 2018 to reassess groundwater flow and ensure sufficient wells are appropriately located to assess groundwater quality downgradient from the Ponds 1-2 CCR Units. These wells were sampled for Appendix III and Appendix IV constituents in February and March 2019 in addition to the April 2019 semiannual assessment monitoring event. These data confirmed that the monitoring wells are appropriately positioned to assess groundwater quality downgradient from the Ponds 1-2 CCR Unit. Therefore, JHC-MW-18004 and JHC-MW-18005 have been added to the downgradient monitoring network for Ponds 1-2 and are included in the statistical evaluation. Consumers Energy was unable to collect a groundwater sample from JHC-MW-15001 due to dry conditions in the well at the time of the April 2020 sampling event.

Following the first semiannual assessment monitoring sampling event for 2020, compliance well data for the JHC Ponds 1-2 were evaluated in accordance with the Groundwater Statistical Evaluation Plan (Stats Plan) (TRC, October 2017). An assessment monitoring program was developed to evaluate concentrations of CCR constituents present in the uppermost aquifer relative to acceptable levels (i.e. GWPSs). To evaluate whether or not a GWPS exceedance is statistically significant, the difference in concentration observed at the downgradient wells during a given assessment monitoring event compared to the GWPS must be large enough, after accounting for variability in the sample data, that the result is unlikely to have occurred merely by chance. Consistent with the Unified Guidance[2], the preferred method for comparisons to a fixed standard are confidence limits. An exceedance of the standard occurs when the 99 percent lower confidence level of the downgradient data exceeds the GWPS. Based on the number of historical observations in the representative sample population, the population mean, the population standard deviation, and a selected confidence level (i.e. 99 percent), an upper and lower confidence limit is calculated. The actual mean concentration of the population, with 99 percent confidence, will fall between the lower and upper confidence limits.

The concentrations observed in the downgradient wells are deemed to be a statistically significant exceedance when the 99 percent lower confidence limit of the downgradient data exceeds the GWPS. If the confidence interval straddles the GWPS (i.e. the lower confidence level is below the GWPS but the upper confidence level is above), the statistical test result indicates that there is insufficient confidence that the measured concentrations are different from the GWPS and thus there is no compelling evidence that the measured concentration is a result of a release from the CCR unit versus the inherent variability of the sample data. This statistical approach is consistent with the statistical

[2] USEPA. 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance*. Office of Conservation and Recovery. EPA 530/R-09-007.

methods for assessment monitoring presented in §257.93(f) and (g). Statistical evaluation methodologies built into the CCR Rule, and numerous other federal rules, are key in determining whether or not individually measured data points represent a concentration increase over the baseline or a fixed standard (such as a GWPS in an assessment monitoring program).

For each detected Appendix IV constituent, the concentrations for each well were first compared directly to the GWPS, as shown on Table B1. Constituent-well combinations that included a direct exceedance of the GWPS within the past eight monitoring events (June 2017 through April 2020 for JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 and April 2017 to April 2020 for JHC-MW-15001) and the past six events (December 2018 through April 2020) for JHC-MW-18004 and JHC-MW-18005 were retained for further analysis (Attachment 1). Direct comparison GWPS exceedances included the following constituent-well combinations:

- Arsenic in JHC-MW-15001,
- Arsenic and lithium in JHC-MW-15002,
- Arsenic, cobalt, and molybdenum in JHC-MW-15003,
- Lithium, molybdenum, selenium, and thallium in JHC-MW-15005, and
- Arsenic and selenium in JHC-MW-18005.

Groundwater data for the constituent-well combinations with direct-comparison exceedances of a GWPS were then evaluated utilizing Sanitas™ statistical software. Sanitas™ is a software tool that is commercially available for performing statistical evaluation consistent with procedures outlined in the Unified Guidance. Within the Sanitas™ statistical program, confidence limits were selected to perform the statistical comparison of compliance data to a fixed standard. Parametric and non-parametric confidence intervals were calculated, as appropriate, for each of the CCR Appendix IV parameters using a 99 percent confidence level, i.e., a significance level (α) of 0.01. The following narrative describes the methods employed, the results obtained and the Sanitas™ output files are included as an attachment.

The statistical data evaluation included the following steps:

- Review of data quality checklists for the data sets;
- Graphical representation of the monitoring data as time versus concentration by well-constituent pair;
- Outlier testing of individual data points that appear from the graphical representations as potential outliers;
- Evaluation of visual trends apparent in the graphical representations for statistical significance;
- Evaluation of percentage of non-detects for each well-constituent pair;
- Distribution of the data; and
- Calculation of the confidence intervals for each cumulative dataset.

The results of these evaluations are presented and discussed below.

Initially, the most recent eight results (six events for JHC-MW-18004 and JHC-MW-18005)for these well-constituent pairs were observed visually for potential outliers and trends. No outliers were

apparent. Potential increasing trends were noted for lithium in JHC-MW-15002 and molybdenum in JHC-MW-15005 beginning in November 2018 (time-series plots in Attachment 1). The potential trend for molybdenum in JHC-MW-15005 was found not to be statistically significant (trend tests in Attachment 1). While the potential trend for lithium in JHC-MW-15002 was statistically significant, the most recent data point is a decrease from the previous result and may indicate a reversal of the trend. Groundwater conditions are re-equilibrating following to CCR removal activities at the JHC Ponds 1-2 that were completed in September 2018, and the groundwater monitoring system is being re-assessed to account for post-deconstruction groundwater conditions. Hydrogeologic conditions are in the process of stabilizing and recent groundwater samples from JHC-MW-15002 may no longer represent groundwater passing beneath JHC Ponds 1-2. Because hydrogeologic conditions are in the process of stabilizing, temporary trending and sporadic outlier data are not unexpected, and all data collected during the re-equilibrating period will be kept in the assessment monitoring data set. Data from each round were evaluated for completeness, overall quality, and usability and were deemed appropriate for the purposes of the CCR assessment monitoring program.

The Sanitas™ software was then used to test compliance at the downgradient monitoring wells using the confidence interval method for the most recent eight sampling events (six events for JHC-MW-18004 and JHC-MW-18005). Eight independent sampling events provide the appropriate density of data as recommended per the Unified Guidance yet are collected recently enough to provide an indication of current condition. The tests were run with a per-well significance of $\alpha = 0.01$. The software outputs are included in Attachment 1 along with data reports showing the values used for the evaluation. Non-detect data was handled in accordance with the Stats Plan for the purposes of calculating the confidence intervals.

The Sanitas™ software generates an output that includes graphs of the parametric or non-parametric confidence intervals for each well along with notes on data transformations, as appropriate. Data distributions were as follows:

Distribution	Parameter-Well Combinations
Normal	Arsenic in JHC-MW-15001 and JHC-MW-18005 Lithium in JHC-MW- 15005 Selenium in JHC-MW-15005
Normalized by square root transformation	Arsenic in JHC-MW-15003 Lithium in JHC-MW-15002 Selenium in JHC-MW-18005 Cobalt in JHC-MW-15003 (Kaplan-Meier)
Normalized by cube root transformation	Molybdenum in JHC-MW-15005
Normalized by natural log transformation	Arsenic in JHC-MW-15002 Molybdenum in JHC-MW-15003
Non-Parametric (not normalizable)	Thallium in JHC-MW-15005

The confidence interval test compares the lower confidence limit to the GWPS. The statistical evaluation of the Appendix IV constituents shows a statistically significant GWPS exceedance for arsenic in JHC-MW-15002. These results are consistent with the results of the initial assessment monitoring data statistical evaluation and Consumers Energy will continue to evaluate corrective

measures per §257.96 and §257.97. Consumers Energy will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Attachments

Table B1	Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
Attachment 1	Sanitas™ Output

Table

Table B1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15001[4]								
						Sample Date:	4/19/2017	6/20/2017	8/14/2017	9/25/2017	4/25/2018	6/18/2018	11/13/2018	4/25/2019	10/9/2019	4/16/2020[3]
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS											
Appendix III																
Boron	ug/L	NC	NA	51	NA		149	368	238	287	--	339	146	78	150	--
Calcium	mg/L	NC	NA	46	NA		70.3	50.7	70.9	68	--	68.6	72.1	69	73	--
Chloride	mg/L	250*	NA	43	NA		7.1	51.8	94.8	73.6	--	109	2.7	< 2.0	< 2.0	--
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	--
Sulfate	mg/L	250*	NA	14	NA		42.1	88	114	129	--	78.9	59.1	39	21	--
Total Dissolved Solids	mg/L	500*	NA	258	NA		440	340	562	563	--	596	310	280	350	--
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.3	6.2	6.3	6.2	7.2 (1)	6.3	6.3	6.0	6.4	--
Appendix IV																
Antimony	ug/L	6	NA	2	6		< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Arsenic	ug/L	10	NA	1	**10**		4	1.8	2.2	--	< 1.0	1.8	**12.7**	5.8	6.3	--
Barium	ug/L	2,000	NA	35	2,000		172	106	142	--	71.4	183	84.9	58	95	--
Beryllium	ug/L	4	NA	1	4		< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	--
Chromium	ug/L	100	NA	2	100		2	1.0	1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	1.2	--
Cobalt	ug/L	NC	6	15	**15**		< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	--
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	--
Lead	ug/L	NC	15	1	15		< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Lithium	ug/L	NC	40	10	**40**		< 10	< 10	< 10	--	< 10	< 10	< 10	< 10	< 10	--
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	0.25	--
Molybdenum	ug/L	NC	100	5	**100**		< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	13.3	< 5.0	< 5.0	--
Radium-226	pCi/L	NC	NA	NA	NA		< 0.352	< 1.63	< 0.708	--	< 0.545	< 0.828	< 0.755	< 0.101	< 0.162	--
Radium-228	pCi/L	NC	NA	NA	NA		2.07	< 0.628	1.20	--	< 0.799	< 1.12	< 0.879	< 0.447	< 0.516	--
Radium-226/228	pCi/L	5	NA	1.93	5		2.13	< 2.26	1.61	--	< 1.34	< 1.95	< 1.63	< 0.447	< 0.516	--
Selenium	ug/L	50	NA	5	**50**		< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Thallium	ug/L	2	NA	2	**2**		< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	--

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.
(3) Not sampled; insufficient amount of groundwater present to collect sample.
(4) Monitoring well JHC-MW-15001 has been upgradient and JHC-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 1-2 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Table B1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15002[4]											
						Sample Date:	6/20/2017	6/20/2017	8/14/2017	8/14/2017	9/25/2017	9/25/2017	4/25/2018	4/25/2018	6/19/2018	11/15/2018	11/15/2018	4/25/2019	10/9/2019	4/16/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS															
Appendix III								Field Dup		Field Dup		Field Dup		Field Dup			Field Dup			
Boron	ug/L	NC	NA	51	NA		768	678	869	946	927	894	--	--	430	1,470	1,360	3,200	1,700	2,560
Calcium	mg/L	NC	NA	46	NA		24.6	25.1	25.7	25.3	30.5	30.6	--	--	75.3	41.9	41.1	85	99	122
Chloride	mg/L	250*	NA	43	NA		20.7	20.7	20.7	20.2	25.8	26.0	--	--	22.3	19.3	19.2	17	20	15.4
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		52.8	53.3	54.5	53.7	33.9	34.3	--	--	153	95.2	94.5	190	280	295
Total Dissolved Solids	mg/L	500*	NA	258	NA		160	130	236	174	144	148	--	--	356	222	274	410	480	567
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		9.2	--	9.2	--	9.6	--	10.2 (1)	--	8.3	8.0	--	6.9	6.5	6.1
Appendix IV																				
Antimony	ug/L	6	NA	2	6		3.3	2.9	1.9	2.1	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Arsenic	ug/L	10	NA	1	**10**		**35.4**	**32.2**	**44.5**	**45.8**	--	--	**129**	**130**	**127**	**60.5**	**59.5**	**50**	**57**	**45**
Barium	ug/L	2,000	NA	35	2,000		7.2	6.3	7.8	7.7	--	--	30.4	30.4	19.8	18.4	18.1	49	150	128
Beryllium	ug/L	4	NA	1	4		< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Cadmium	ug/L	5	NA	0.2	5		< 0.20	< 0.20	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2
Chromium	ug/L	100	NA	2	100		< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Cobalt	ug/L	NC	6	15	**15**		< 15.0	< 15.0	< 15.0	< 15.0	--	--	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	< 6.0	< 15
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Lithium	ug/L	NC	40	10	**40**		< 10	< 10	11	< 10	--	--	28	28	19	**68**	**67**	**96**	**240**	**125**
Mercury	ug/L	2	NA	0.2	2		< 0.20	< 0.20	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2
Molybdenum	ug/L	NC	100	5	**100**		21.4	19.2	19.0	19.0	--	--	12.6	12.7	7.5	9.2	9.0	< 5.0	15	49
Radium-226	pCi/L	NC	NA	NA	NA		< 0.562	< 0.154	0.749	0.949	--	--	< 0.823	< 0.530	< 0.620	< 1.09	0.921	0.233	0.698	0.378
Radium-228	pCi/L	NC	NA	NA	NA		< 0.765	< 0.690	< 0.797	< 0.790	--	--	< 0.729	< 1.33	< 1.58	1.04	0.767	0.409	< 0.394	< 0.408
Radium-226/228	pCi/L	5	NA	1.93	5		< 1.33	< 0.844	< 1.43	< 1.26	--	--	< 1.55	< 1.86	< 2.20	< 1.70	1.69	0.642	1.04	0.784
Selenium	ug/L	50	NA	5	**50**		7.8	7.3	3.5	5.1	--	--	< 1.0	< 1.0	< 1.0	2.5	2.8	< 1.0	< 1.0	1
Thallium	ug/L	2	NA	2	**2**		< 2.0	< 2.0	< 2.0	< 2.0	--	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.
(3) Not sampled; insufficient amount of groundwater present to collect sample.
(4) Monitoring well JHC-MW-15001 has been upgradient and JHC-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 1-2 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Table B1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15003[4]									
						Sample Date:	6/20/2017	8/14/2017	9/25/2017	4/25/2018	6/18/2018	6/18/2018	11/15/2018	4/29/2019	10/9/2019	10/9/2019	4/16/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS							Field Dup				Field Dup	
Appendix III																	
Boron	ug/L	NC	NA	51	NA		1,240	1,150	1,120	--	1,170	1,320	1,120	1,700	3,500	3,300	3,880
Calcium	mg/L	NC	NA	46	NA		28.8	36.0	30.1	--	60.0	59.1	115	36	110	110	94.6
Chloride	mg/L	250*	NA	43	NA		24.0	22.0	19.3	--	37.5	36.6	16.3	18	47	47	17.3
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		61.8	61.9	51.9	--	81.9	82.7	294	75	210	220	194
Total Dissolved Solids	mg/L	500*	NA	258	NA		146	208	136	--	388	344	644	200	580	600	554
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		9.3	9.3	9.7	9.3	8.9	--	8.7	8.4	8.7	--	8.3
Appendix IV																	
Antimony	ug/L	6	NA	2	6		< 1.0	1.3	--	1.5	1.9	1.8	2.0	2.2	1.4	1.4	1
Arsenic	ug/L	10	NA	1	**10**		**20.4**	**23.7**	--	**12.4**	**14.1**	**14.3**	8.1	10	8.4	7.7	9
Barium	ug/L	2,000	NA	35	2,000		18.0	18.0	--	42.3	55.7	52.5	113	42	91	89	103
Beryllium	ug/L	4	NA	1	4		< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Cadmium	ug/L	5	NA	0.2	5		< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	1.7	0.41	2.5	2.5	1.0
Chromium	ug/L	100	NA	2	100		12.3	< 1.0	--	< 1.0	< 1.0	< 1.0	13.6	4.2	11	10	7
Cobalt	ug/L	NC	6	15	**15**		< 15.0	< 15.0	--	< 15.0	< 15.0	< 15.0	**23.6**	< 6.0	**43**	**41**	**47**
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	3.3	< 1.0	3.2	3.2	5
Lithium	ug/L	NC	40	10	**40**		< 10	< 10	--	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2
Molybdenum	ug/L	NC	100	5	**100**		21.1	28.2	--	19.3	53.0	51.2	65.3	20	**120**	**120**	**125**
Radium-226	pCi/L	NC	NA	NA	NA		< 1.12	1.15	--	< 0.631	< 0.623	< 0.733	< 0.579	< 0.113	0.301	0.430	0.272
Radium-228	pCi/L	NC	NA	NA	NA		< 0.722	< 0.938	--	< 0.732	< 1.01	< 1.08	< 0.657	< 0.530	0.421	< 0.361	0.541
Radium-226/228	pCi/L	5	NA	1.93	5		< 1.84	1.81	--	< 1.36	< 1.63	< 1.81	< 1.24	< 0.530	0.722	0.559	0.813
Selenium	ug/L	50	NA	5	**50**		< 1.0	1.1	--	2.2	4.4	4.5	28.6	2.9	18	19	27
Thallium	ug/L	2	NA	2	**2**		< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.
(3) Not sampled; insufficient amount of groundwater present to collect sample.
(4) Monitoring well JHC-MW-15001 has been upgradient and JHC-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 1-2 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Table B1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15005									
						Sample Date:	6/20/2017	8/14/2017	9/25/2017	4/25/2018	6/19/2018	11/15/2018	4/25/2019	4/25/2019	10/9/2019	4/16/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS									Field Dup		
Appendix III																
Boron	ug/L	NC	NA	51	NA		468	546	481	--	227	1,450	2,800	2,900	1,200	1,020
Calcium	mg/L	NC	NA	46	NA		53.6	48.0	40.3	--	61.8	61.9	170	180	110	97.1
Chloride	mg/L	250*	NA	43	NA		50.4	27.1	21.8	--	90.9	30.6	28	28	30	15.6
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	<1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		66.0	64.9	61.9	--	74.3	133	240	320	130	133
Total Dissolved Solids	mg/L	500*	NA	258	NA		306	282	300	--	462	334	800	780	360	487
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.4	7.5	7.4	7.4	7.4	7.5	7.2	--	7.3	7.1
Appendix IV																
Antimony	ug/L	6	NA	2	6		3.8	4.2	--	2.2	1.6	5.1	4.4	4.2	3.3	2
Arsenic	ug/L	10	NA	1	**10**		3.3	2.5	--	1.7	1.3	1.2	1.2	1.1	1.4	1
Barium	ug/L	2,000	NA	35	2,000		113	109	--	407	175	149	150	150	190	270
Beryllium	ug/L	4	NA	1	4		< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Cadmium	ug/L	5	NA	0.2	5		< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	0.2
Chromium	ug/L	100	NA	2	100		3.7	< 1.0	--	< 1.0	3.0	< 1.0	1.3	1.3	1.3	1
Cobalt	ug/L	NC	6	15	**15**		< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	< 6.0	< 15
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Lithium	ug/L	NC	40	10	**40**		39	36	--	**61**	35	28	38	38	**50**	**59**
Mercury	ug/L	2	NA	0.2	2		< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2
Molybdenum	ug/L	NC	100	5	**100**		14.0	10	--	31.2	15.7	**222**	**900**	**870**	**370**	91
Radium-226	pCi/L	NC	NA	NA	NA		< 0.717	< 0.877	--	0.620	< 0.758	< 0.461	0.169	0.248	0.592	0.448
Radium-228	pCi/L	NC	NA	NA	NA		< 0.728	< 0.856	--	0.700	1.22	0.967	< 0.350	0.495	0.427	0.566
Radium-226/228	pCi/L	5	NA	1.93	5		< 1.45	< 1.73	--	1.32	1.91	1.41	< 0.350	0.743	1.02	1.01
Selenium	ug/L	50	NA	5	**50**		15.5	15.7	--	**368**	14	**158**	**140**	**130**	**66**	**282**
Thallium	ug/L	2	NA	2	**2**		< 2.0	< 2.0	--	**5.8**	**2.1**	< 2.0	2.0	<2.0	**2.9**	**3**

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.
(3) Not sampled; insufficient amount of groundwater present to collect sample.
(4) Monitoring well JHC-MW-15001 has been upgradient and JHC-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 1-2 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Table B1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-18004						JHC-MW-18005						
					Sample Date:	12/7/2018	2/28/2019	4/25/2019	8/13/2019	10/9/2019	4/16/2020	12/7/2018	2/28/2019	2/28/2019	4/25/2019	8/13/2019	8/13/2019	10/9/2019	4/16/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS									Field Dup			Field Dup		
Appendix III																			
Boron	ug/L	NC	NA	51	NA	970	900	920	1,200	620	524	641	660	720	650	750	780	660	534
Calcium	mg/L	NC	NA	46	NA	48.9	55	72	97	73	117	32.5	43	42	41	43	45	55	42.6
Chloride	mg/L	250*	NA	43	NA	25.7	50	34	35	40	14.2	29.8	27	26	25	27	27	18	19.6
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	<1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	109	69	100	110	120	249	90	89	85	66	95	95	110	74.5
Total Dissolved Solids	mg/L	500*	NA	258	NA	306	330	380	490	310	604	234	280	260	250	270	290	330	262
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.0	7.6 (2)	7.2	7.5	7.2	6.9	8.8	8.6 (2)	--	9.0	8.9	--	8.8	8.5
Appendix IV																			
Antimony	ug/L	6	NA	2	6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Arsenic	ug/L	10	NA	1	**10**	1.0	< 1.0	1.1	1.2	1.1	< 1	9.5	10	**11**	8.8	7.4	7.3	7.1	8
Barium	ug/L	2,000	NA	35	2,000	92.6	170	220	680	270	210	58.1	72	73	73	120	120	150	144
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2
Chromium	ug/L	100	NA	2	100	< 1.0	1.2	2.0	1.8	1.3	< 1	1.5	4.0	4.1	2.8	2.3	2.4	1.9	< 1
Cobalt	ug/L	NC	6	15	**15**	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 15	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 15
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Lithium	ug/L	NC	40	10	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2
Molybdenum	ug/L	NC	100	5	**100**	7.4	7.4	8.2	9.0	10	7	18.6	14	15	14	15	15	66	9
Radium-226	pCi/L	NC	NA	NA	NA	< 0.695	< 0.0742	0.110	0.352	0.179	< 0.131	< 0.567	< 0.0795	<0.0779	< 0.0785	< 0.145	0.150	0.497	0.150
Radium-228	pCi/L	NC	NA	NA	NA	< 0.708	0.589	< 0.430	0.469	0.672	0.889	< 0.760	< 0.386	<0.337	< 0.357	< 0.400	< 0.374	0.456	< 0.455
Radium-226/228	pCi/L	5	NA	1.93	5	< 1.40	0.654	< 0.430	0.822	0.851	0.952	< 1.33	< 0.386	<0.337	< 0.357	< 0.400	< 0.374	0.953	< 0.455
Selenium	ug/L	50	NA	5	**50**	7.3	12	12	39	33	34	42.0	35	34	16	11	11	**140**	46
Thallium	ug/L	2	NA	2	**2**	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2

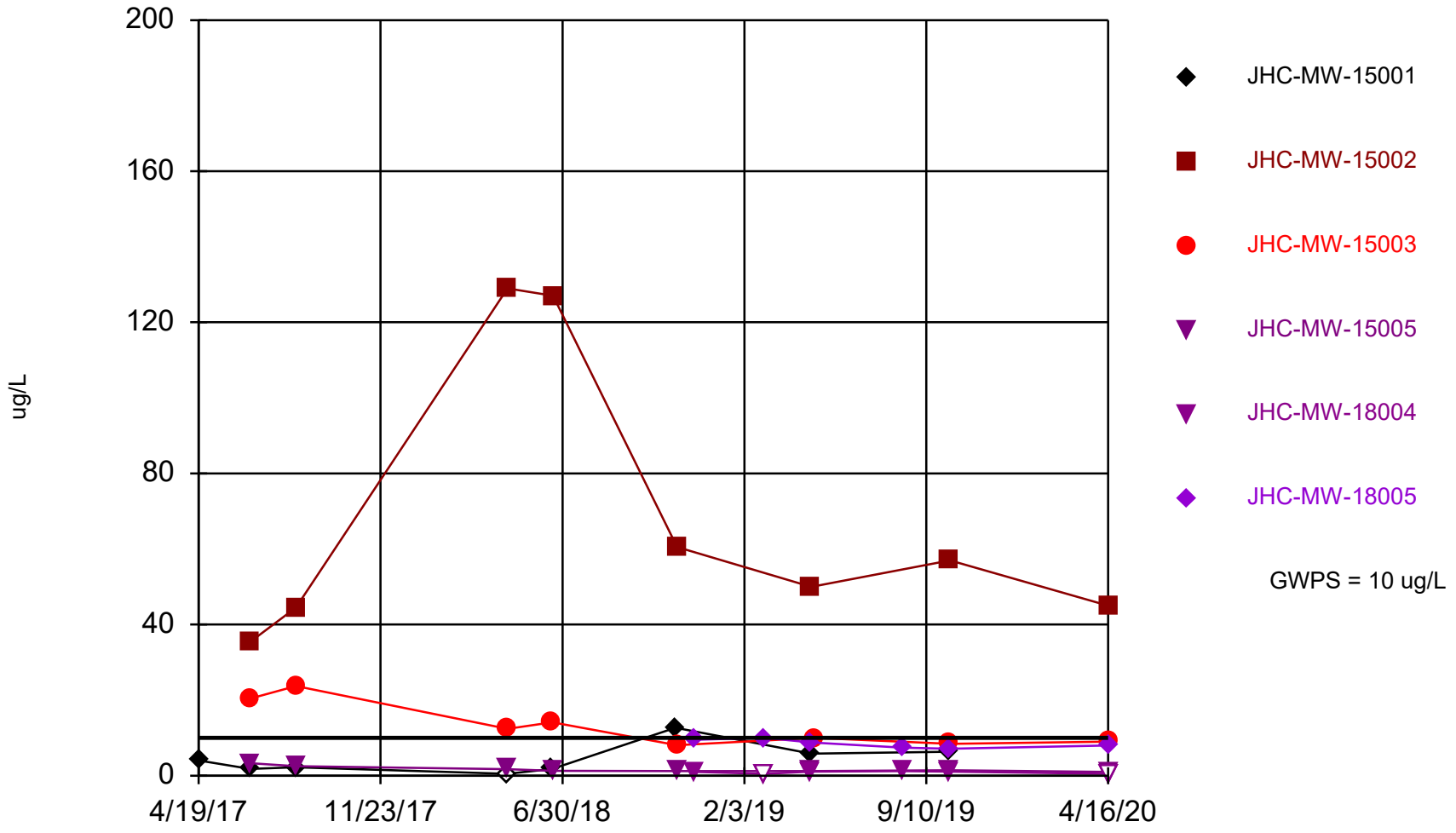
Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.
(3) Not sampled; insufficient amount of groundwater present to collect sample.
(4) Monitoring well JHC-MW-15001 has been upgradient and JHC-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 1-2 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Attachment 1
Sanitas™ Output

Hollow symbols indicate censored values.

Arsenic Comparison to GWPS

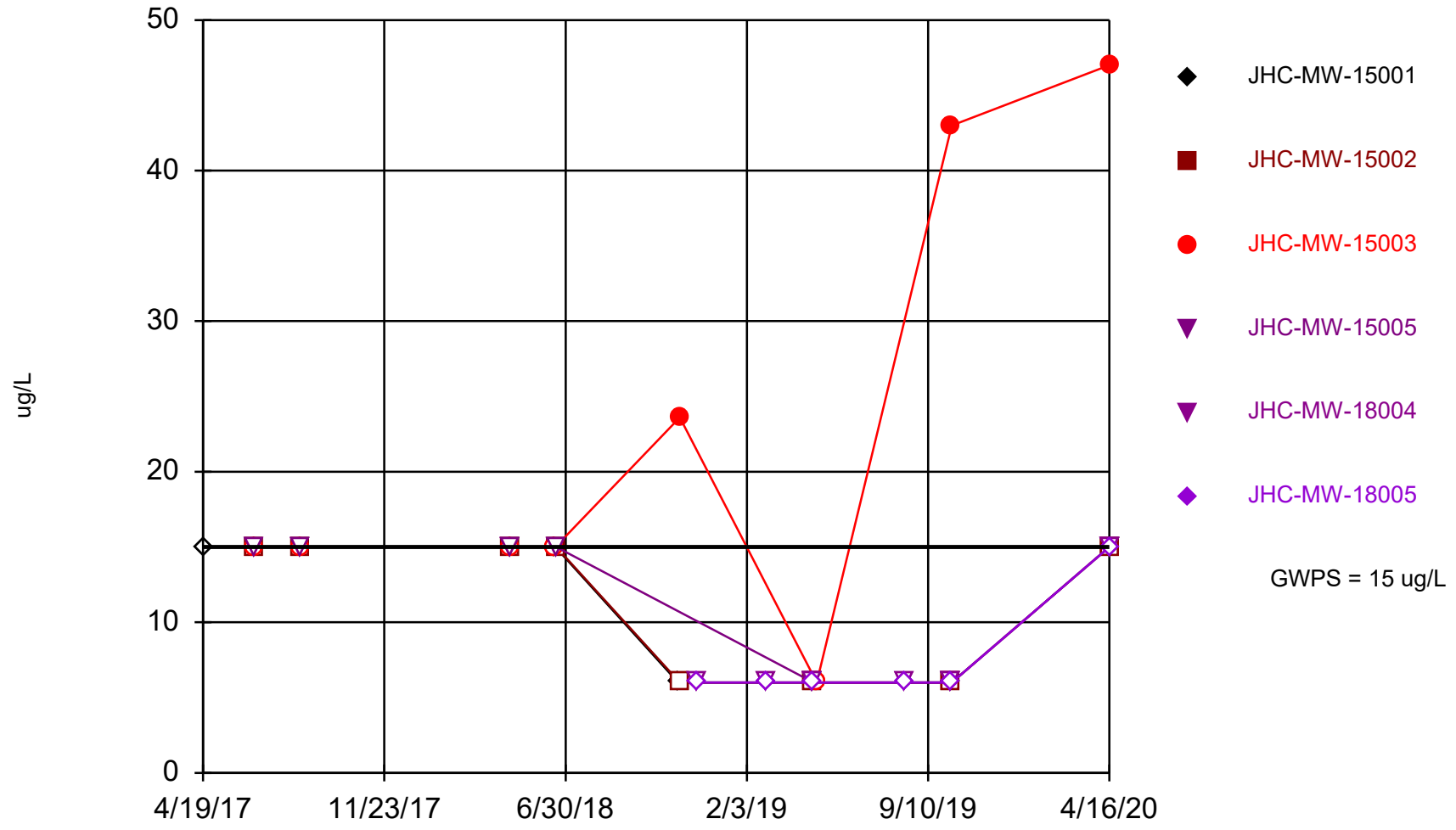


Time Series Analysis Run 1/14/2021 2:13 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

Hollow symbols indicate censored values.

Cobalt Comparison to GWPS

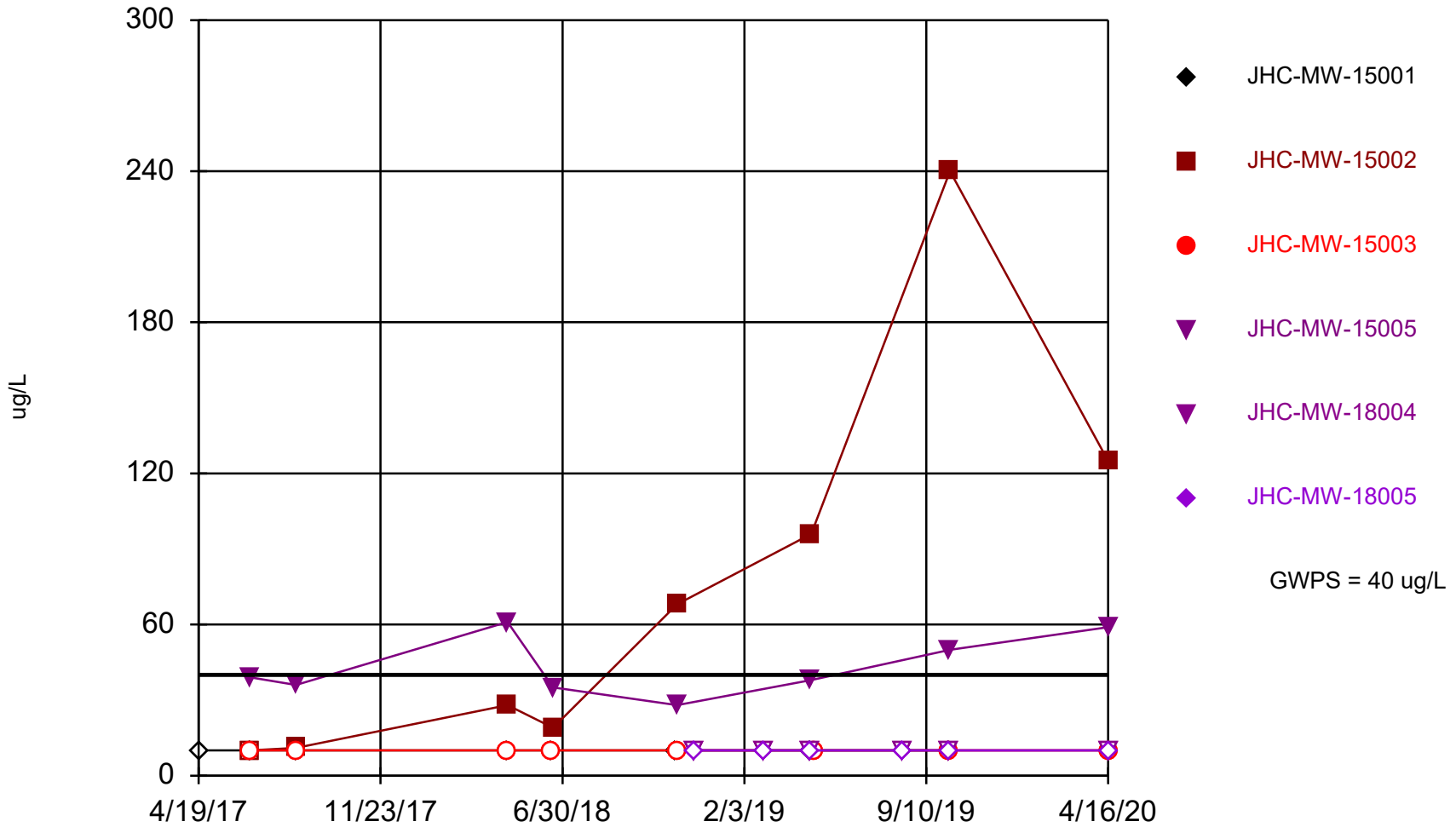


Time Series Analysis Run 1/14/2021 2:14 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

Hollow symbols indicate censored values.

Lithium Comparison to GWPS

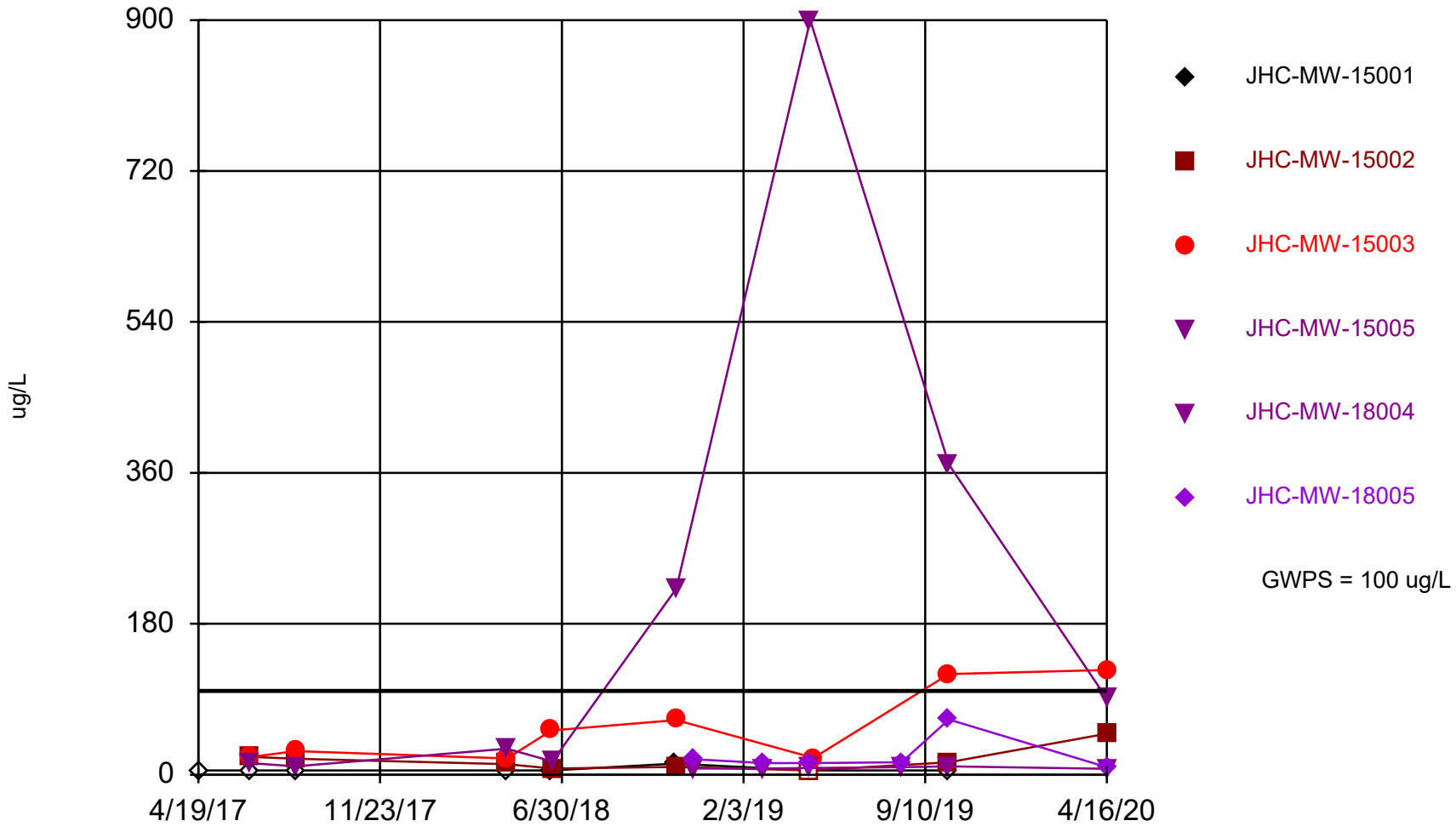


Time Series Analysis Run 1/14/2021 2:15 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

Hollow symbols indicate censored values.

Molybdenum Comparison to GWPS

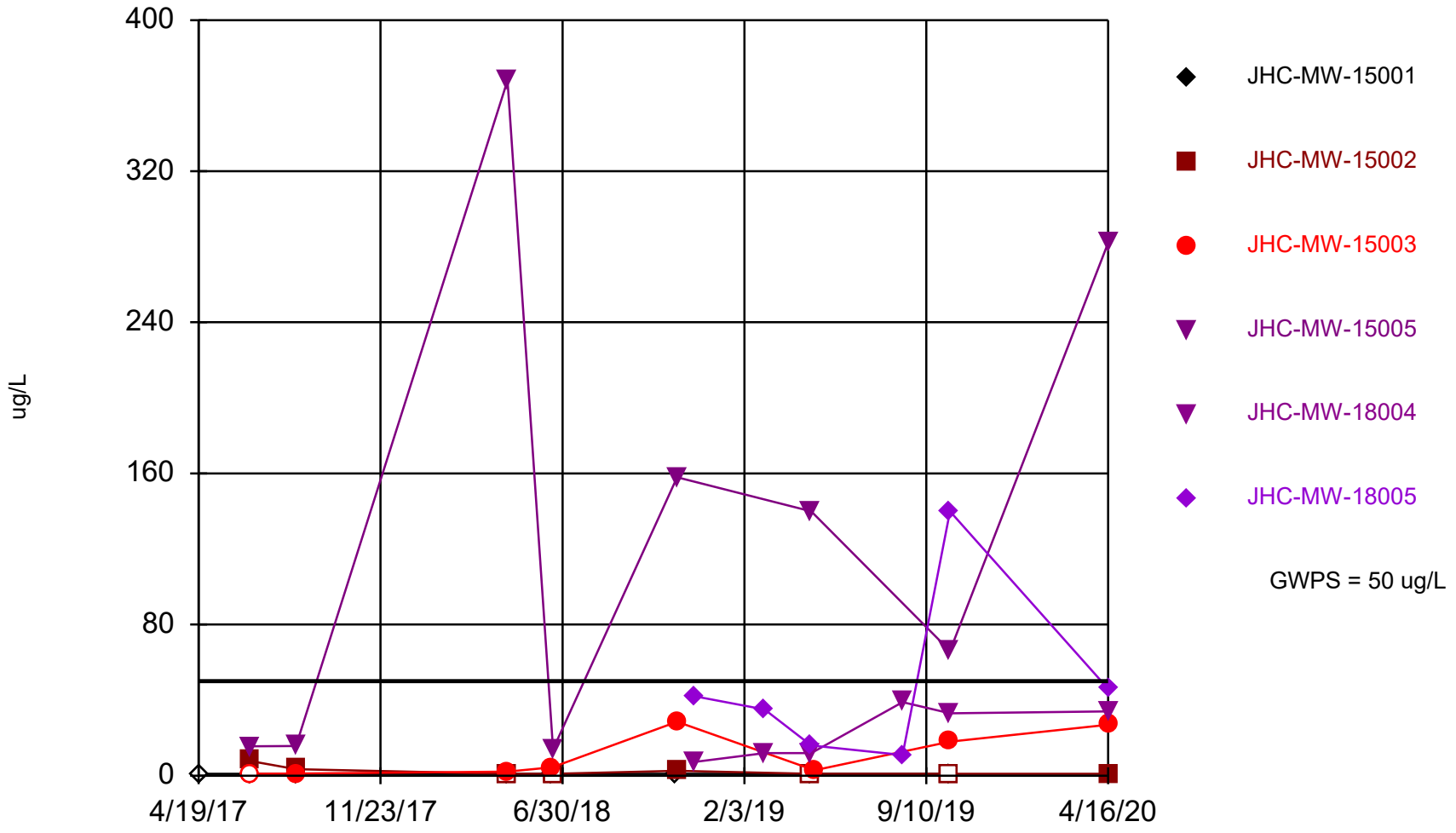


Time Series Analysis Run 1/14/2021 2:16 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

Hollow symbols indicate censored values.

Selenium Comparison to GWPS

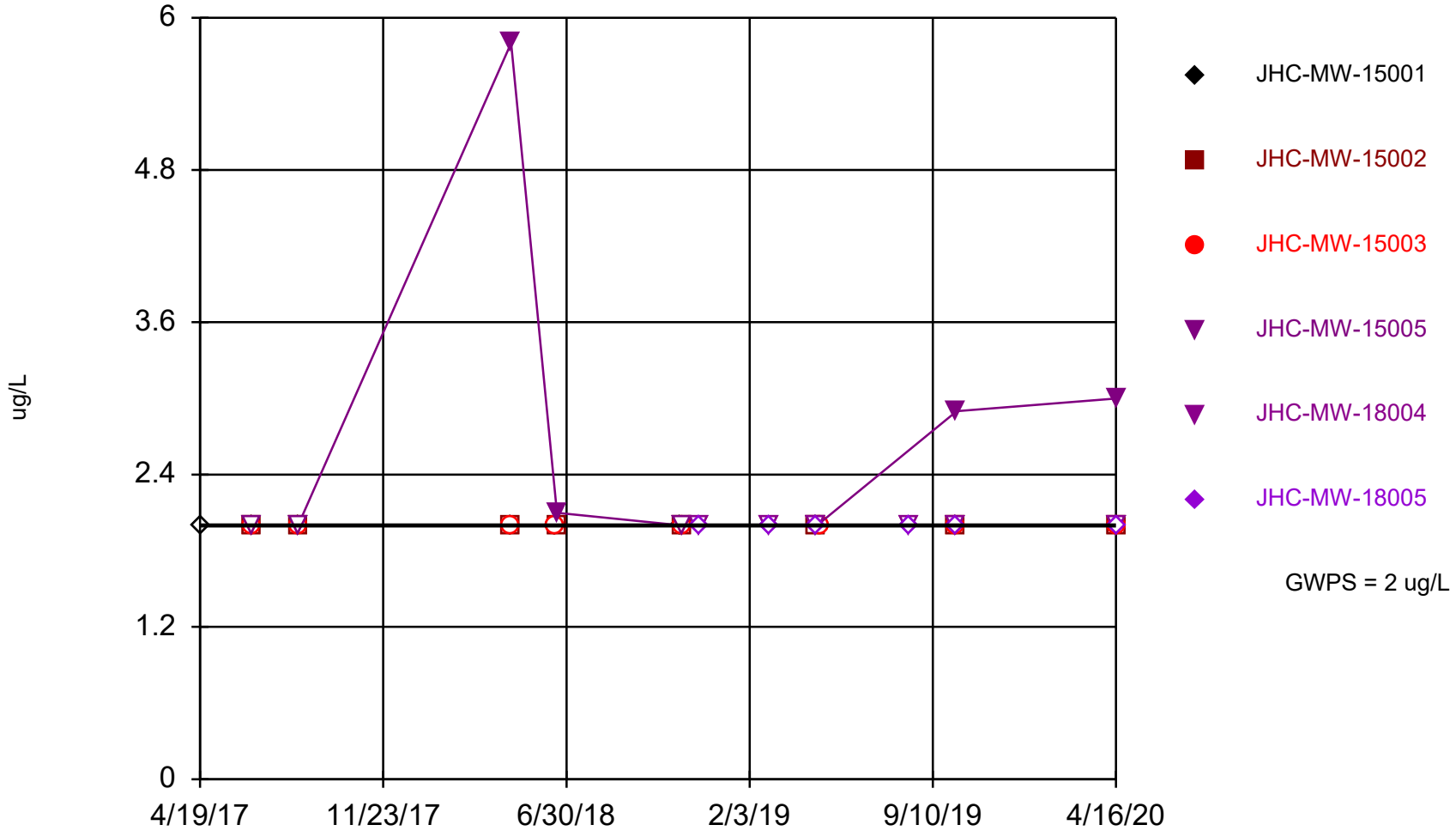


Time Series Analysis Run 1/14/2021 2:17 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

Hollow symbols indicate censored values.

Thallium Comparison to GWPS



Time Series Analysis Run 1/14/2021 2:18 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

Summary Report

Constituent: Arsenic, Total Analysis Run 1/14/2021 2:23 PM
Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

For observations made between 4/19/2017 and 4/16/2020, a summary of the selected data set:

Observations = 44
ND/Trace = 3
Wells = 6
Minimum Value = 0.5
Maximum Value = 129
Mean Value = 17.26
Median Value = 7.25
Standard Deviation = 29.22
Coefficient of Variation = 1.693
Skewness = 2.696

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	8	1	0.5	12.7	4.388	3.1	3.931	0.896	1.207
JHC-MW-15002	8	0	35.4	129	68.55	53.5	37.5	0.5471	1.01
JHC-MW-15003	8	0	8.1	23.7	13.26	11.2	5.861	0.4419	0.8617
JHC-MW-15005	8	0	1	3.3	1.7	1.35	0.7964	0.4685	1.186
JHC-MW-18004	6	2	0.5	1.2	0.9	1.05	0.3162	0.3514	-0.582
JHC-MW-18005	6	0	7.1	10	8.467	8.4	1.162	0.1373	0.1225

Summary Report

Constituent: Cobalt, Total Analysis Run 1/14/2021 2:23 PM
Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

For observations made between 4/19/2017 and 4/16/2020, a summary of the selected data set:

Observations = 44
ND/Trace = 41
Wells = 6
Minimum Value = 6
Maximum Value = 47
Mean Value = 12.47
Median Value = 15
Standard Deviation = 8.653
Coefficient of Variation = 0.694
Skewness = 2.394

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	8	8	6	15	11.63	15	4.658	0.4007	-0.5164
JHC-MW-15002	8	8	6	15	11.63	15	4.658	0.4007	-0.5164
JHC-MW-15003	8	5	6	47	22.45	15	14.73	0.6562	0.83
JHC-MW-15005	8	8	6	15	11.63	15	4.658	0.4007	-0.5164
JHC-MW-18004	6	6	6	15	7.5	6	3.674	0.4899	1.789
JHC-MW-18005	6	6	6	15	7.5	6	3.674	0.4899	1.789

Summary Report

Constituent: Lithium, Total Analysis Run 1/14/2021 2:22 PM
Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

For observations made between 4/19/2017 and 4/16/2020, a summary of the selected data set:

Observations = 44
ND/Trace = 29
Wells = 6
Minimum Value = 10
Maximum Value = 240
Mean Value = 27.8
Median Value = 10
Standard Deviation = 41.26
Coefficient of Variation = 1.484
Skewness = 3.606

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	8	8	10	10	10	10	0	0	NaN
JHC-MW-15002	8	1	10	240	74.63	48	79.17	1.061	1.188
JHC-MW-15003	8	8	10	10	10	10	0	0	NaN
JHC-MW-15005	8	0	28	61	43.25	38.5	12	0.2774	0.4507
JHC-MW-18004	6	6	10	10	10	10	0	0	NaN
JHC-MW-18005	6	6	10	10	10	10	0	0	NaN

Summary Report

Constituent: Molybdenum, Total Analysis Run 1/14/2021 2:21 PM
Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

For observations made between 4/19/2017 and 4/16/2020, a summary of the selected data set:

Observations = 44
ND/Trace = 8
Wells = 6
Minimum Value = 5
Maximum Value = 900
Mean Value = 56.33
Median Value = 14
Standard Deviation = 145.9
Coefficient of Variation = 2.59
Skewness = 4.797

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	8	7	5	13.3	6.038	5	2.934	0.486	2.268
JHC-MW-15002	8	1	5	49	17.34	13.8	13.96	0.8054	1.589
JHC-MW-15003	8	0	19.3	125	56.49	40.6	44.05	0.7799	0.7351
JHC-MW-15005	8	0	10	900	206.7	61.1	308	1.49	1.614
JHC-MW-18004	6	0	7	10	8.167	7.8	1.148	0.1406	0.6151
JHC-MW-18005	6	0	9	66	22.77	14.5	21.4	0.94	1.706

Summary Report

Constituent: Selenium, Total Analysis Run 1/14/2021 2:20 PM
Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

For observations made between 4/19/2017 and 4/16/2020, a summary of the selected data set:

Observations = 44
ND/Trace = 13
Wells = 6
Minimum Value = 1
Maximum Value = 368
Mean Value = 36.33
Median Value = 9.4
Standard Deviation = 74.34
Coefficient of Variation = 2.046
Skewness = 3.114

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	8	8	1	1	1	1	0	0	NaN
JHC-MW-15002	8	4	1	7.8	2.35	1	2.395	1.019	1.679
JHC-MW-15003	8	1	1	28.6	10.65	3.65	11.94	1.121	0.6696
JHC-MW-15005	8	0	14	368	132.4	103	133.3	1.007	0.7294
JHC-MW-18004	6	0	7.3	39	22.88	22.5	13.9	0.6072	0.01903
JHC-MW-18005	6	0	11	140	48.33	38.5	47.04	0.9733	1.435

Summary Report

Constituent: Thallium, Total Analysis Run 1/14/2021 2:20 PM
Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

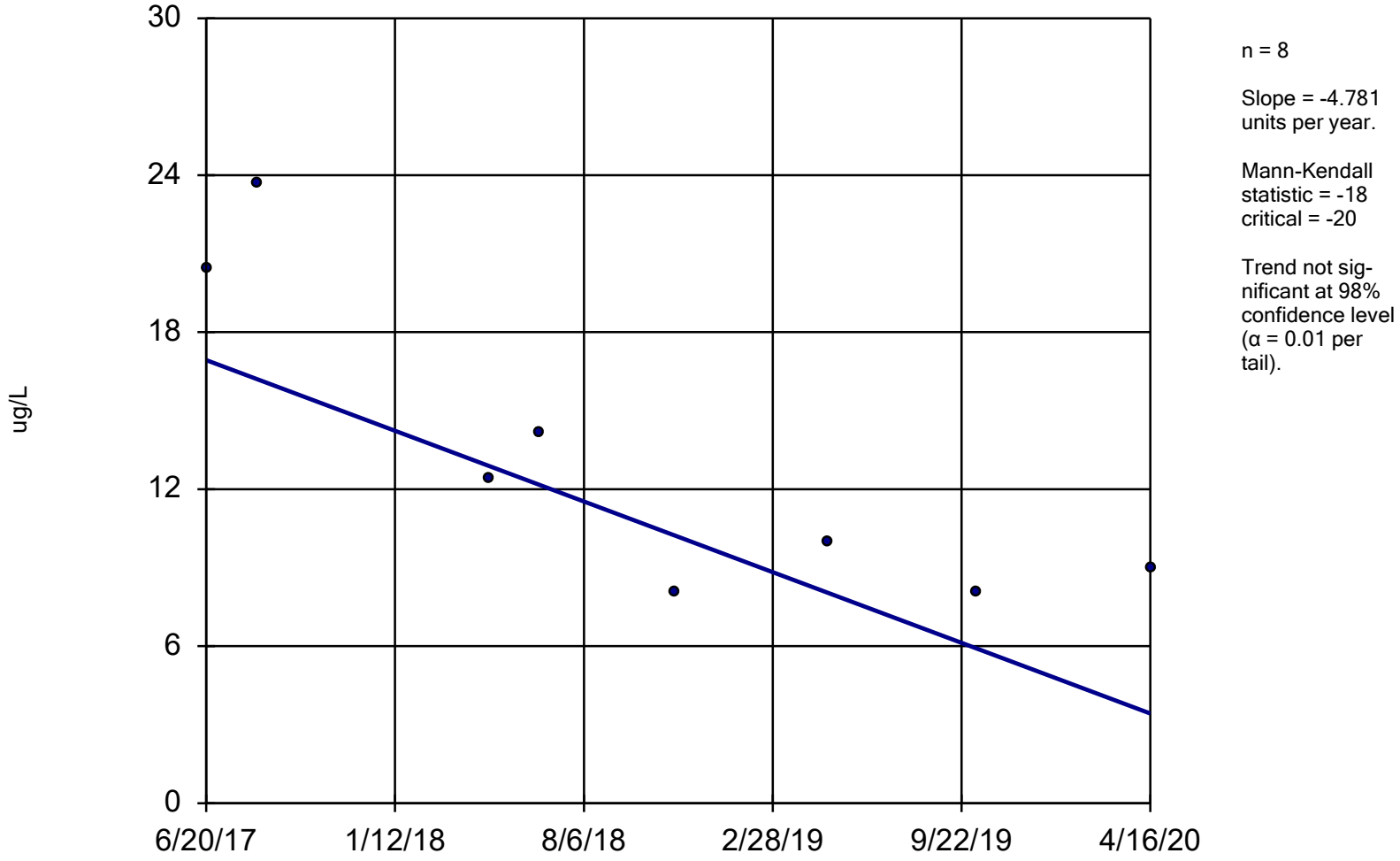
For observations made between 4/19/2017 and 4/16/2020, a summary of the selected data set:

Observations = 44
ND/Trace = 39
Wells = 6
Minimum Value = 2
Maximum Value = 5.8
Mean Value = 2.132
Median Value = 2
Standard Deviation = 0.6003
Coefficient of Variation = 0.2816
Skewness = 5.478

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	8	8	2	2	2	2	0	0	NaN
JHC-MW-15002	8	8	2	2	2	2	0	0	NaN
JHC-MW-15003	8	8	2	2	2	2	0	0	NaN
JHC-MW-15005	8	3	2	5.8	2.725	2.05	1.312	0.4816	1.847
JHC-MW-18004	6	6	2	2	2	2	0	0	NaN
JHC-MW-18005	6	6	2	2	2	2	0	0	NaN

Sen's Slope Estimator

JHC-MW-15003



n = 8

Slope = -4.781 units per year.

Mann-Kendall statistic = -18
critical = -20

Trend not significant at 98% confidence level (α = 0.01 per tail).

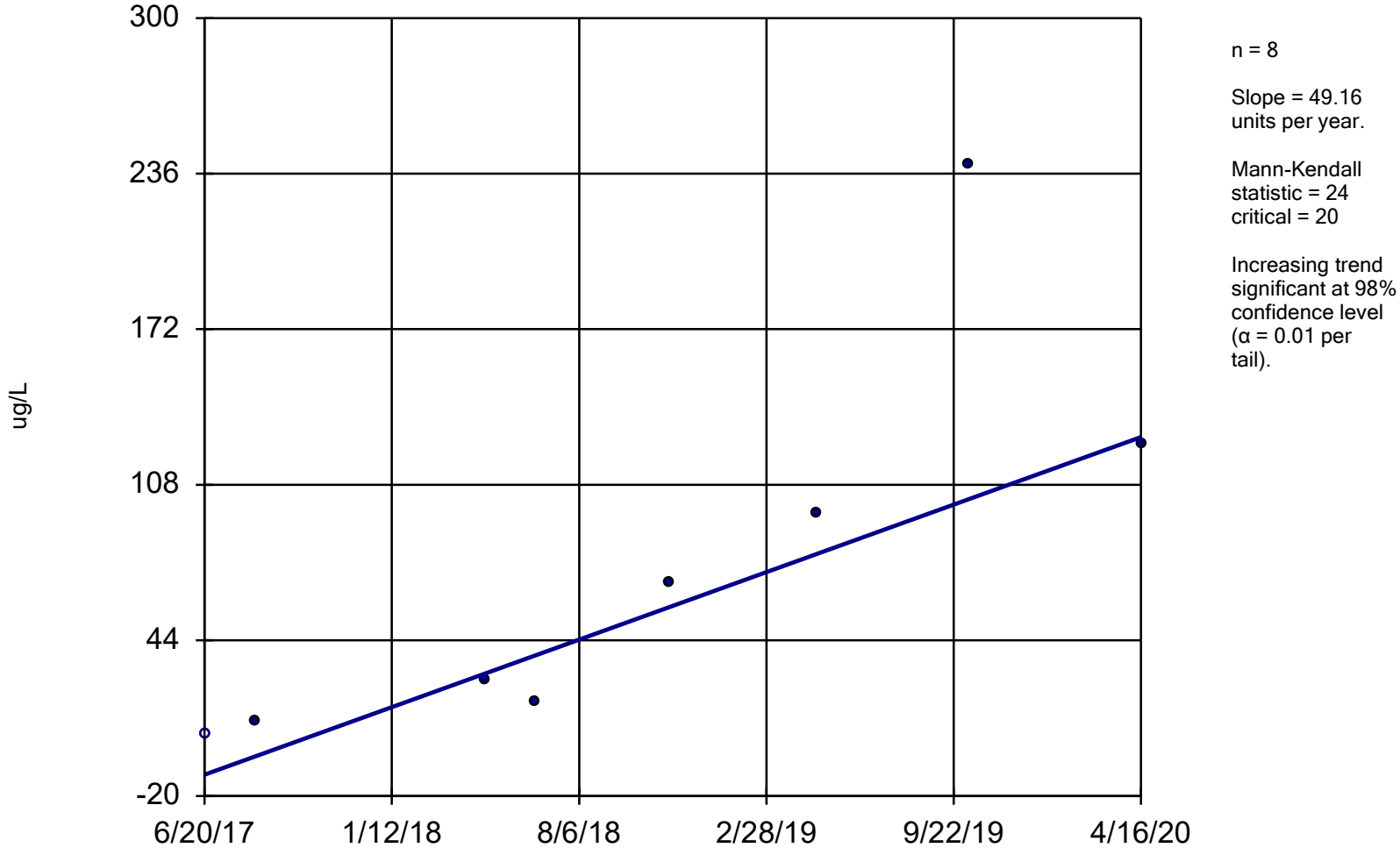
Constituent: Arsenic, Total Analysis Run 6/3/2020 2:58 PM

Client: Consumers Energy Data: JHC_Sanitas_20.05.28

Hollow symbols indicate censored values.

Sen's Slope Estimator

JHC-MW-15002



n = 8

Slope = 49.16 units per year.

Mann-Kendall statistic = 24
critical = 20

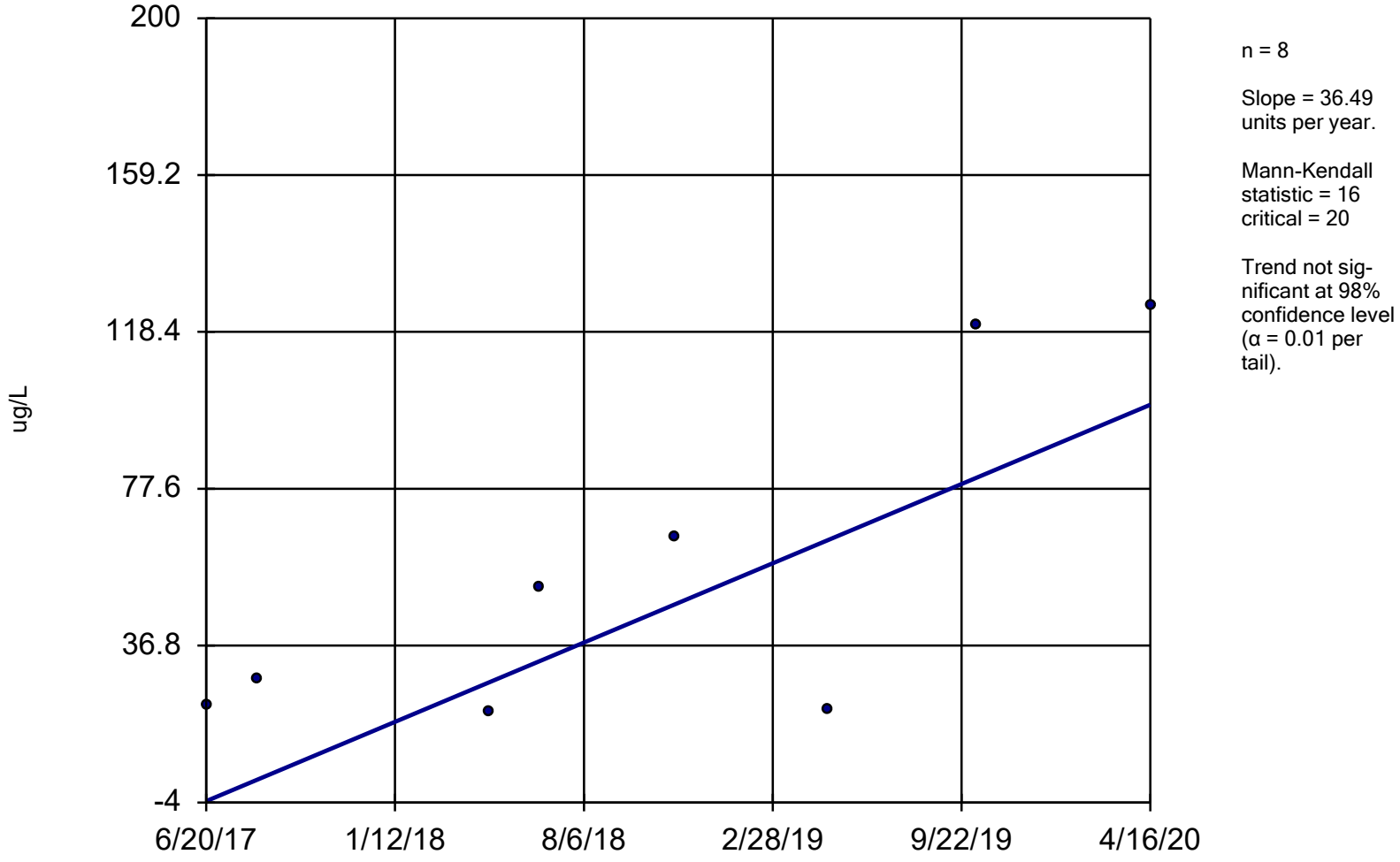
Increasing trend significant at 98% confidence level (α = 0.01 per tail).

Constituent: Lithium, Total Analysis Run 6/3/2020 2:57 PM

Client: Consumers Energy Data: JHC_Sanitas_20.05.28

Sen's Slope Estimator

JHC-MW-15003



n = 8

Slope = 36.49 units per year.

Mann-Kendall statistic = 16
critical = 20

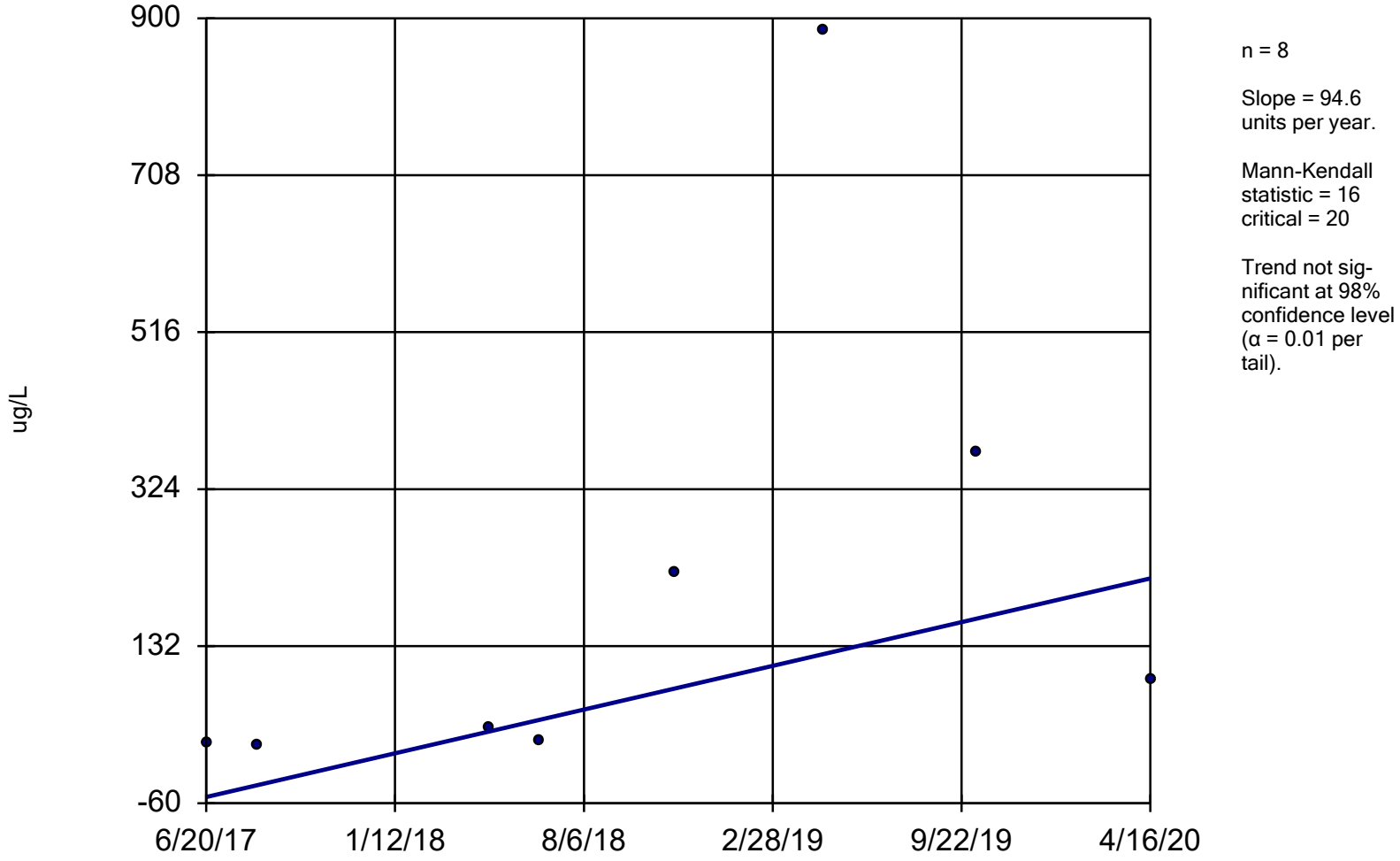
Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: Molybdenum, Total Analysis Run 6/3/2020 3:00 PM

Client: Consumers Energy Data: JHC_Sanitas_20.05.28

Sen's Slope Estimator

JHC-MW-15005



n = 8

Slope = 94.6 units per year.

Mann-Kendall statistic = 16 critical = 20

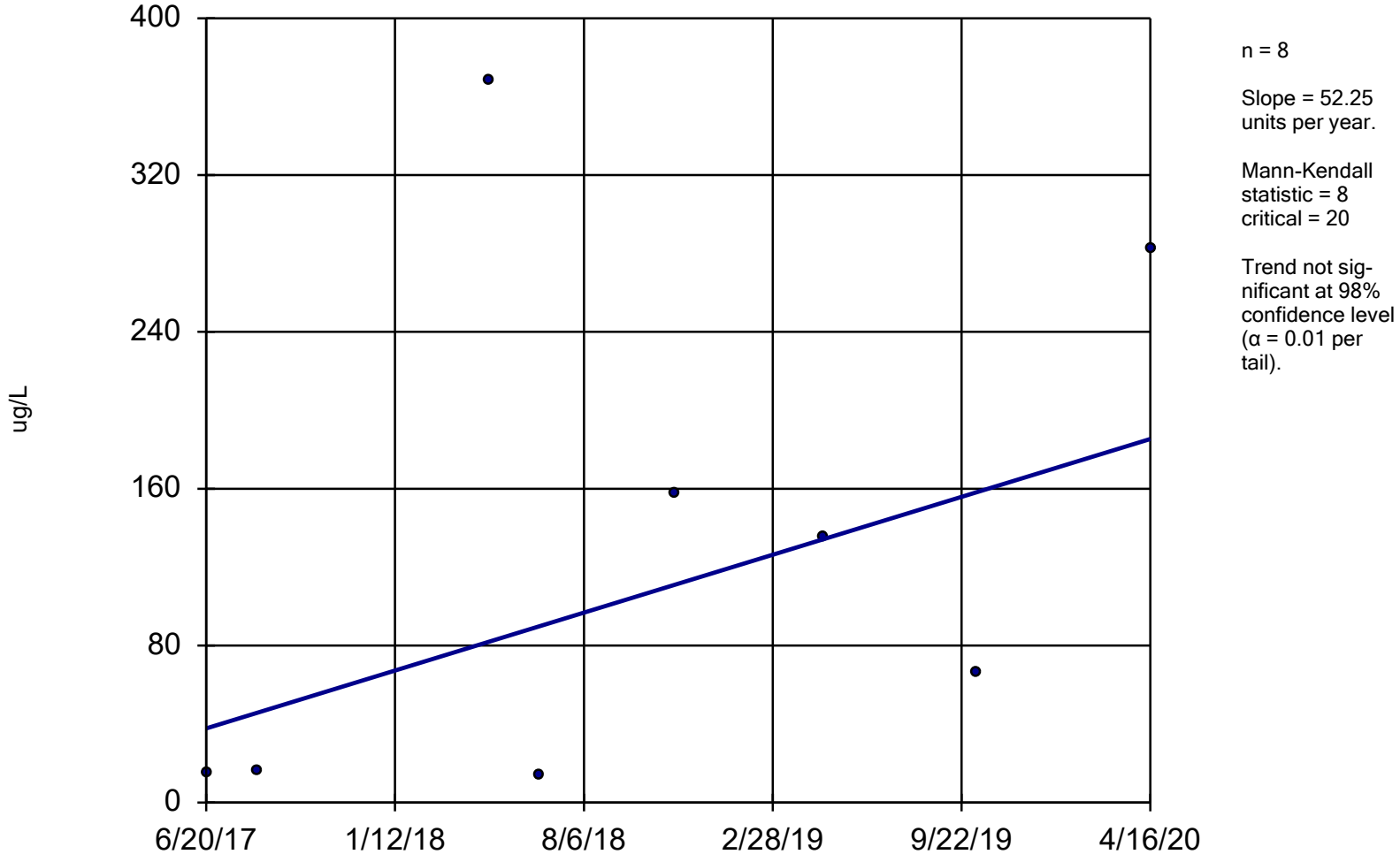
Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: Molybdenum, Total Analysis Run 6/3/2020 3:01 PM

Client: Consumers Energy Data: JHC_Sanitas_20.05.28

Sen's Slope Estimator

JHC-MW-15005



n = 8

Slope = 52.25 units per year.

Mann-Kendall statistic = 8
critical = 20

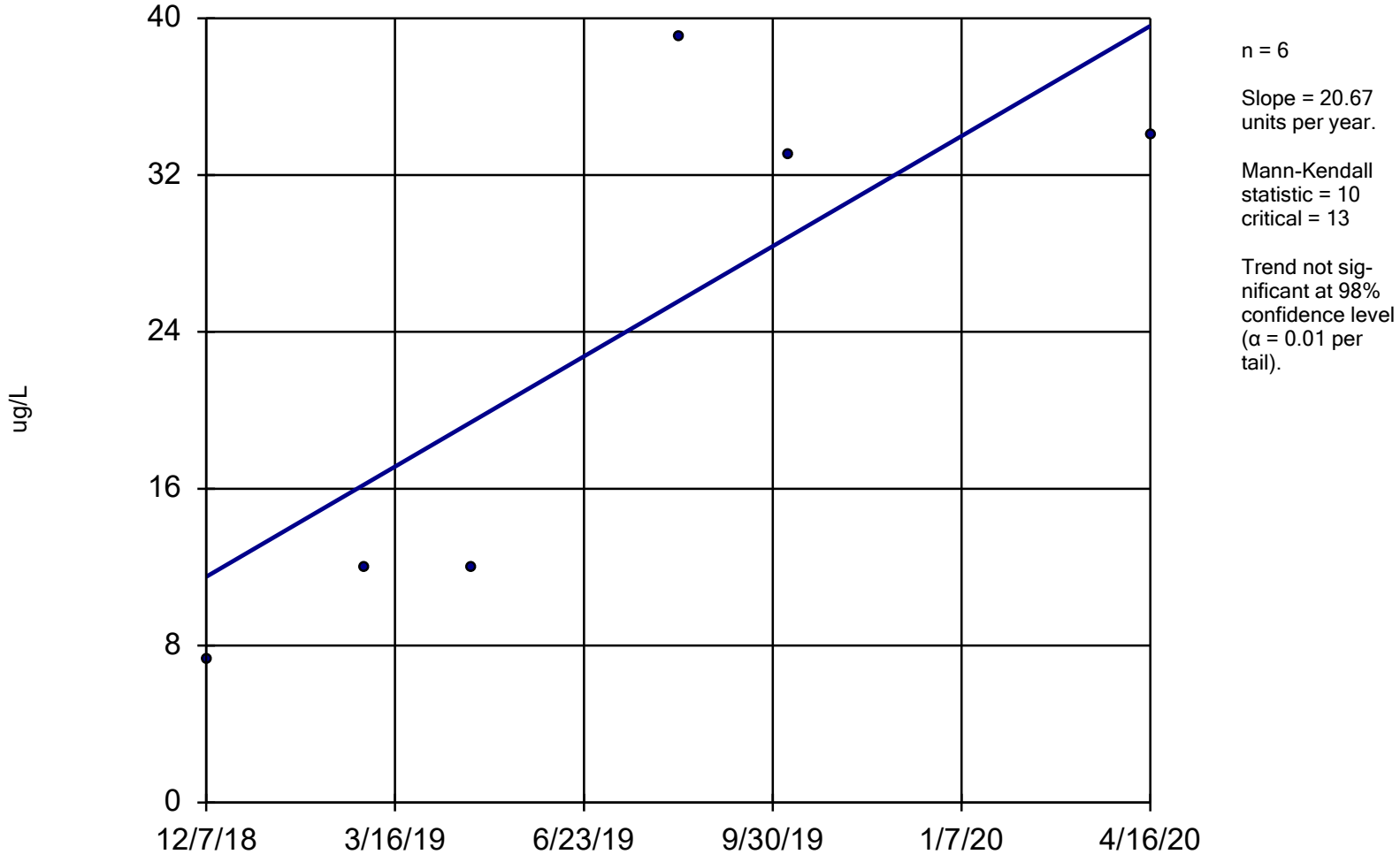
Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: Selenium, Total Analysis Run 6/3/2020 3:02 PM

Client: Consumers Energy Data: JHC_Sanitas_20.05.28

Sen's Slope Estimator

JHC-MW-18004



n = 6

Slope = 20.67 units per year.

Mann-Kendall statistic = 10
critical = 13

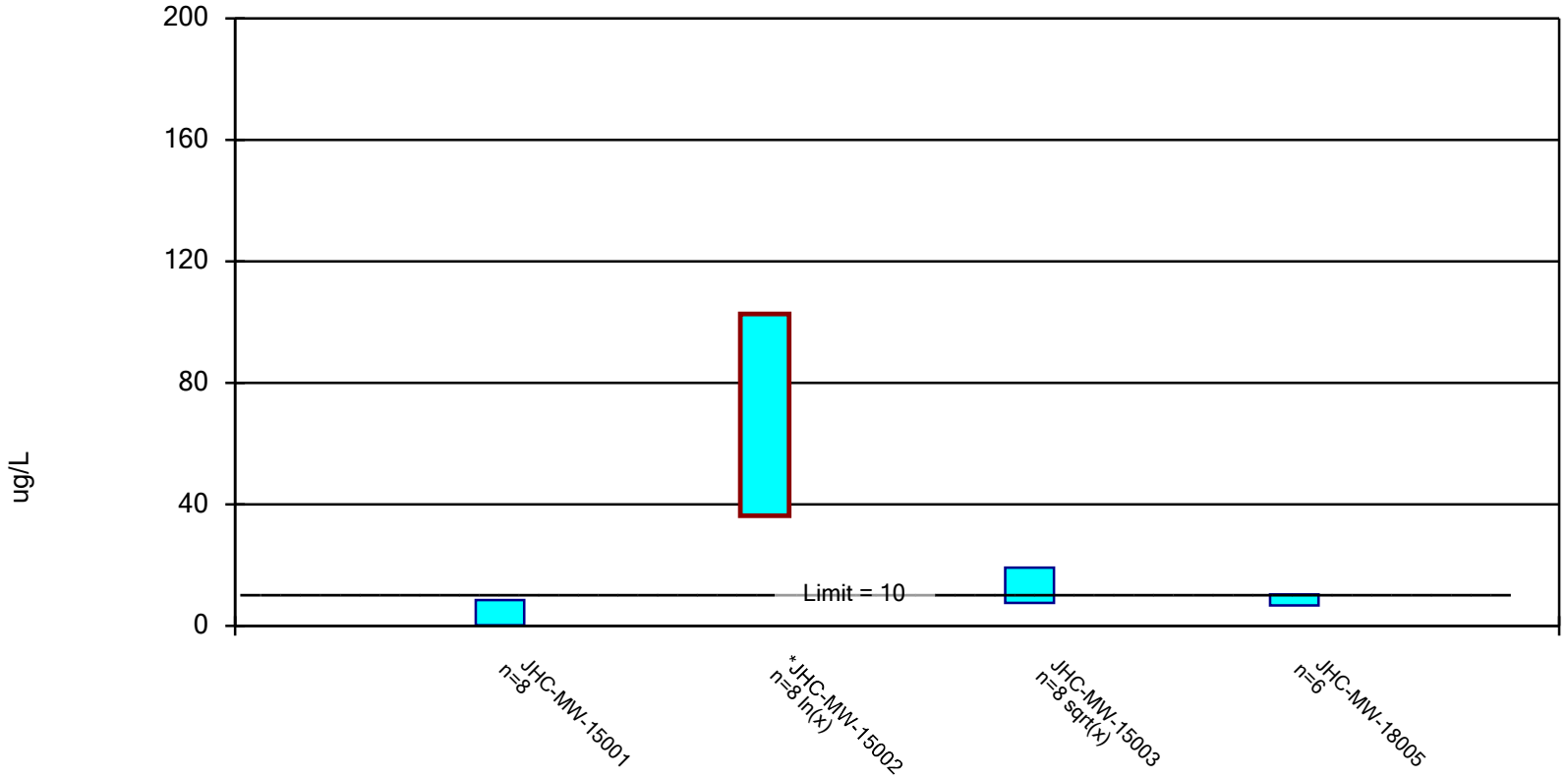
Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: Selenium, Total Analysis Run 6/5/2020 3:38 PM

Client: Consumers Energy Data: JHC_Sanitas_20.05.28

Parametric Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Arsenic, Total Analysis Run 6/5/2020 3:45 PM

Client: Consumers Energy Data: JHC_Sanitas_20.05.28

Confidence Interval

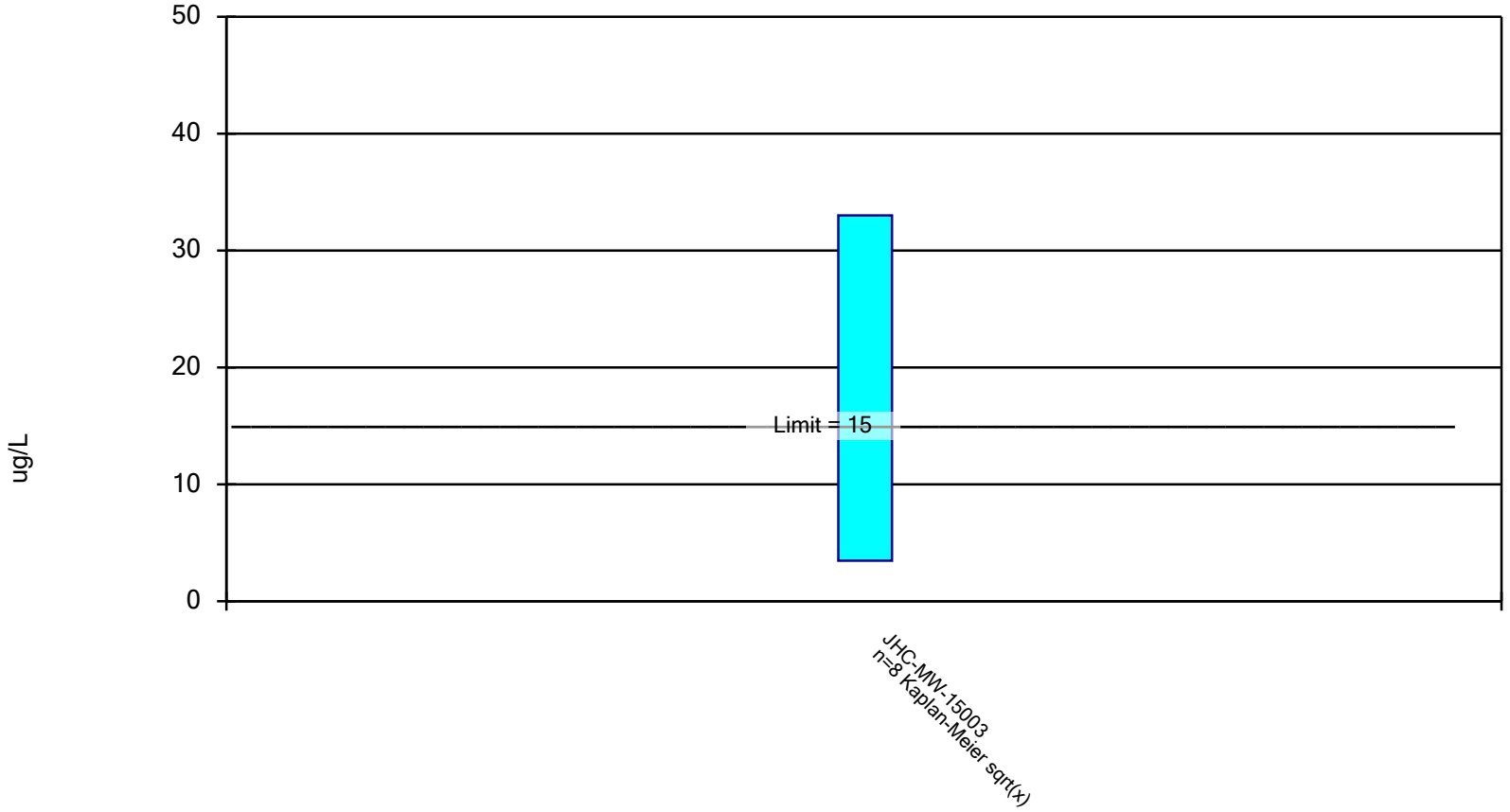
Constituent: Arsenic, Total (ug/L) Analysis Run 6/5/2020 3:45 PM

Client: Consumers Energy Data: JHC_Sanitas_20.05.28

	JHC-MW-15001	JHC-MW-15002	JHC-MW-15003	JHC-MW-18005
4/19/2017	4			
6/20/2017	1.8	33.8 (D)	20.4	
8/14/2017	2.2	45.15 (D)	23.7	
4/25/2018	<1	129.5 (D)	12.4	
6/18/2018	1.8		14.2 (D)	
6/19/2018		127		
11/13/2018	12.7			
11/15/2018		60 (D)	8.1	
12/7/2018				9.6 (D)
2/28/2019				10.5 (D)
4/25/2019	5.8	50		8.8
4/29/2019			10	
8/13/2019				7.35 (D)
10/9/2019	6.3	57	8.05 (D)	7.1
4/16/2020		45	9	8
Mean	4.388	68.43	13.23	8.558
Std. Dev.	3.931	37.78	5.906	1.328
Upper Lim.	8.554	102.6	19.22	10.38
Lower Lim.	0.2205	36.32	7.543	6.735

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Cobalt, Total Analysis Run 6/3/2020 4:17 PM

Client: Consumers Energy Data: JHC_Sanitas_20.05.28

Confidence Interval

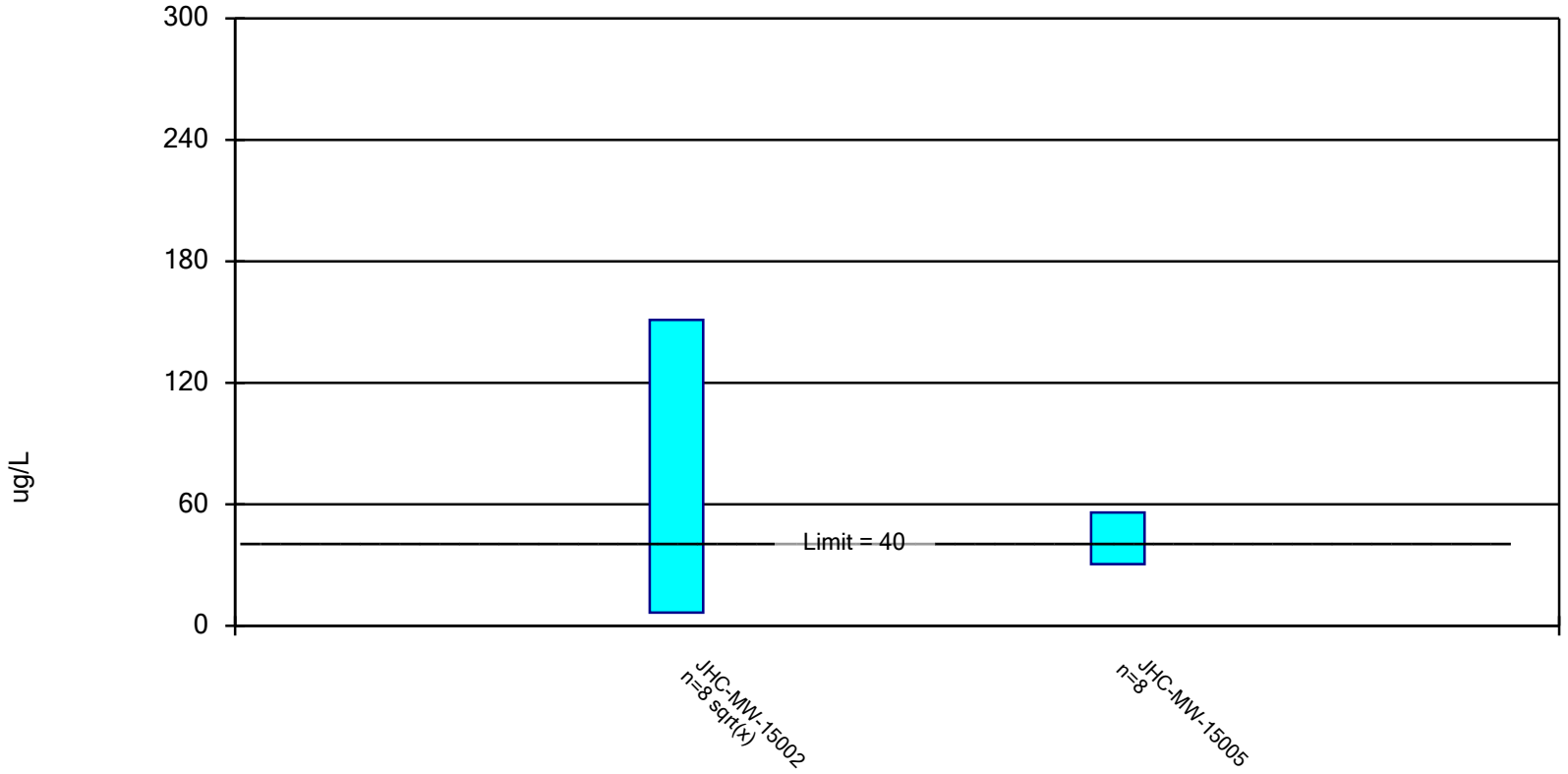
Constituent: Cobalt, Total (ug/L) Analysis Run 6/3/2020 5:34 PM

Client: Consumers Energy Data: JHC_Sanitas_20.05.28

	JHC-MW-15003
6/20/2017	<15
8/14/2017	<15
4/25/2018	<15
6/18/2018	<15 (D)
11/15/2018	23.6
4/29/2019	<6
10/9/2019	42 (D)
4/16/2020	47
Mean	22.33
Std. Dev.	14.53
Upper Lim.	32.99
Lower Lim.	3.484

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Lithium, Total Analysis Run 6/3/2020 4:17 PM

Client: Consumers Energy Data: JHC_Sanitas_20.05.28

Confidence Interval

Constituent: Lithium, Total (ug/L) Analysis Run 6/3/2020 5:32 PM

Client: Consumers Energy Data: JHC_Sanitas_20.05.28

	JHC-MW-15002
6/20/2017	<10 (D)
8/14/2017	10.5 (D)
4/25/2018	28 (D)
6/19/2018	19
11/15/2018	67.5 (D)
4/25/2019	96
10/9/2019	240
4/16/2020	125
Mean	73.88
Std. Dev.	79.84
Upper Lim.	150.8
Lower Lim.	7.142

Confidence Interval

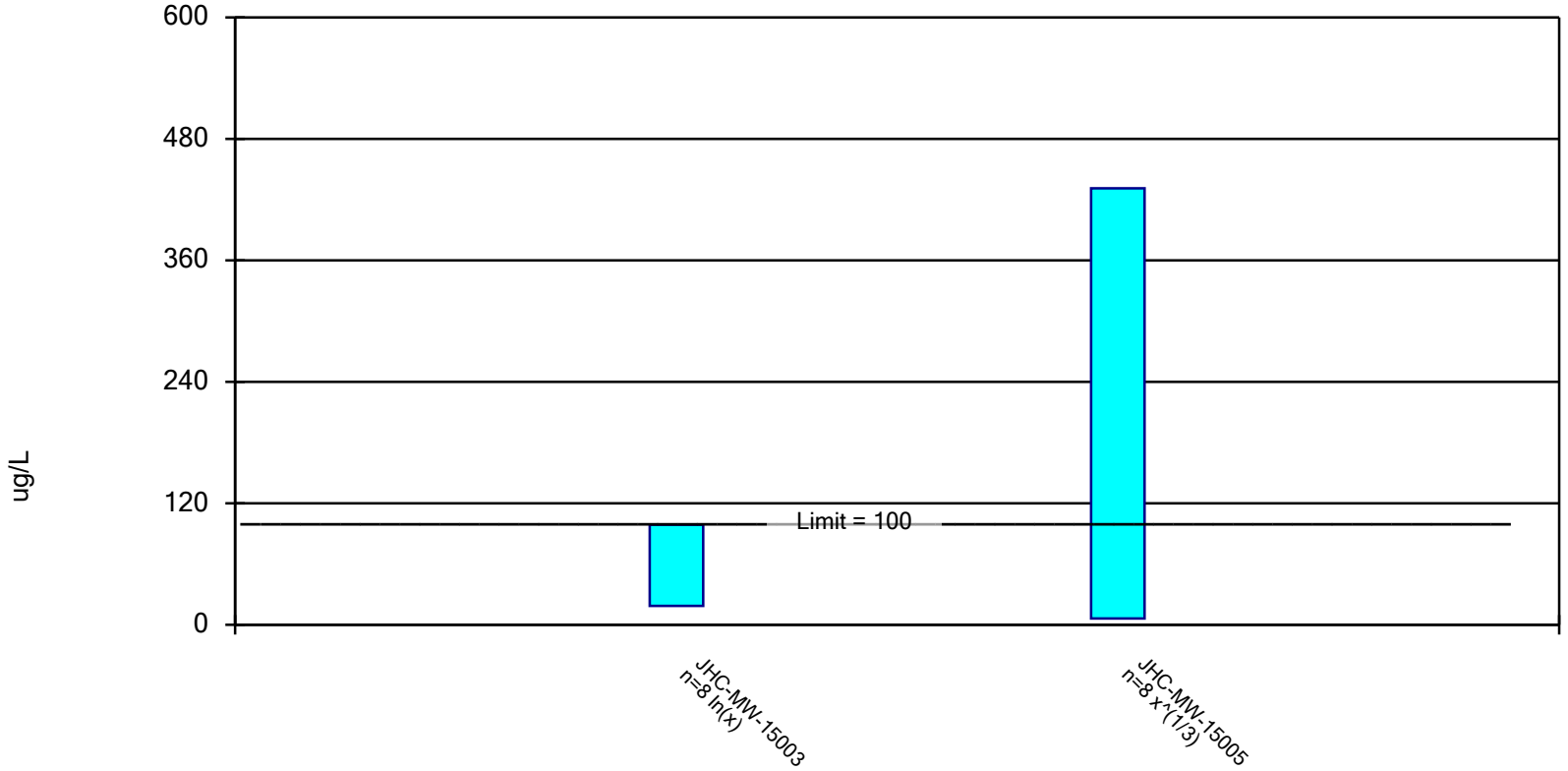
Constituent: Lithium, Total (ug/L) Analysis Run 6/3/2020 5:35 PM

Client: Consumers Energy Data: JHC_Sanitas_20.05.28

	JHC-MW-15005
6/20/2017	39
8/14/2017	36
4/25/2018	61
6/19/2018	35
11/15/2018	28
4/25/2019	38 (D)
10/9/2019	50
4/16/2020	59
Mean	43.25
Std. Dev.	12
Upper Lim.	55.97
Lower Lim.	30.53

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Molybdenum, Total Analysis Run 6/3/2020 4:18 PM

Client: Consumers Energy Data: JHC_Sanitas_20.05.28

Confidence Interval

Constituent: Molybdenum, Total (ug/L) Analysis Run 6/3/2020 5:34 PM

Client: Consumers Energy Data: JHC_Sanitas_20.05.28

	JHC-MW-15003
6/20/2017	21.1
8/14/2017	28.2
4/25/2018	19.3
6/18/2018	52.1 (D)
11/15/2018	65.3
4/29/2019	20
10/9/2019	120 (D)
4/16/2020	125
Mean	56.38
Std. Dev.	44.06
Upper Lim.	98.87
Lower Lim.	18.71

Confidence Interval

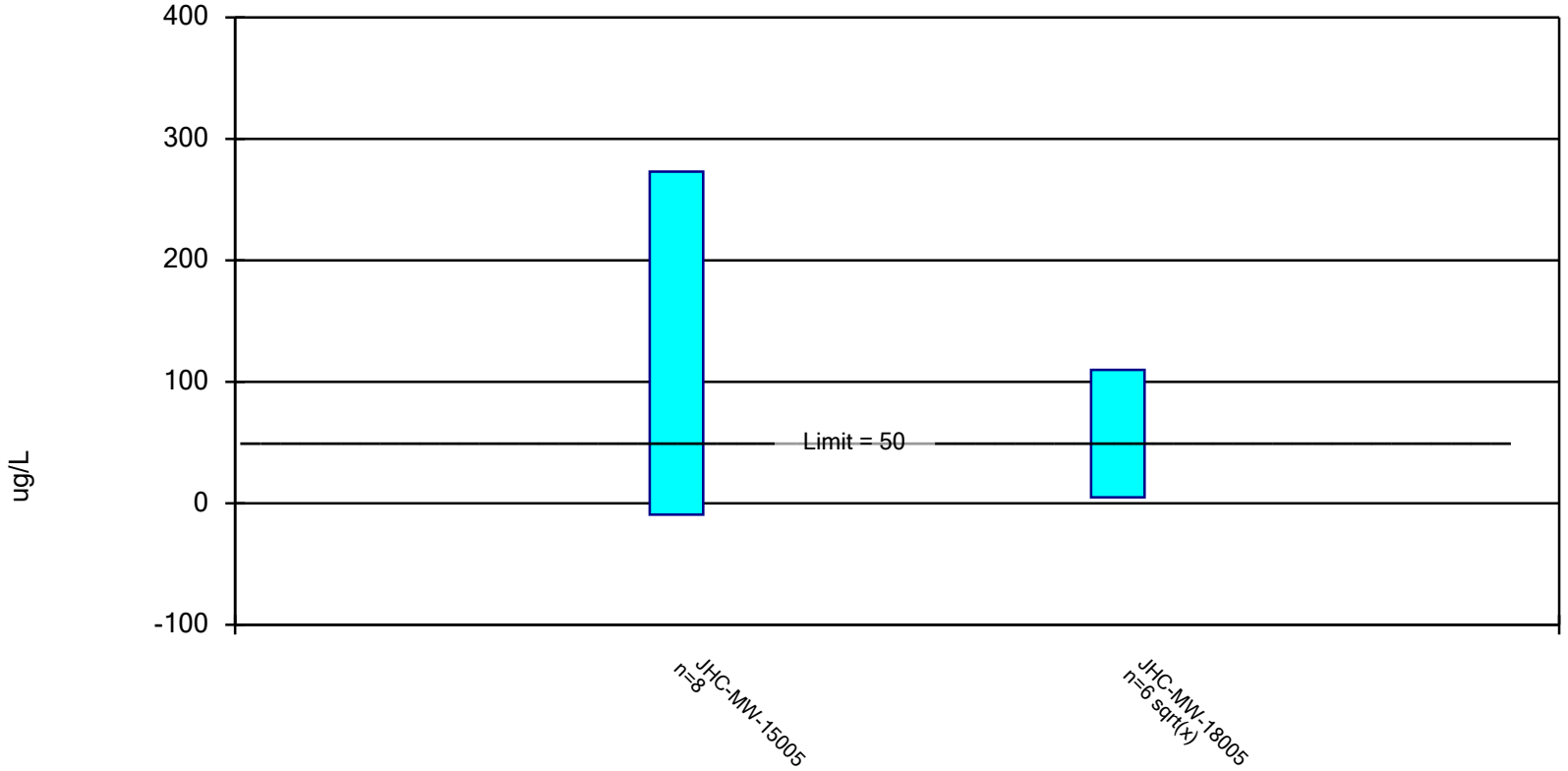
Constituent: Molybdenum, Total (ug/L) Analysis Run 6/3/2020 5:35 PM

Client: Consumers Energy Data: JHC_Sanitas_20.05.28

	JHC-MW-15005
6/20/2017	14
8/14/2017	10
4/25/2018	31.2
6/19/2018	15.7
11/15/2018	222
4/25/2019	885 (D)
10/9/2019	370
4/16/2020	91
Mean	204.9
Std. Dev.	303.2
Upper Lim.	431.2
Lower Lim.	6.157

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Selenium, Total Analysis Run 6/3/2020 4:19 PM

Client: Consumers Energy Data: JHC_Sanitas_20.05.28

Confidence Interval

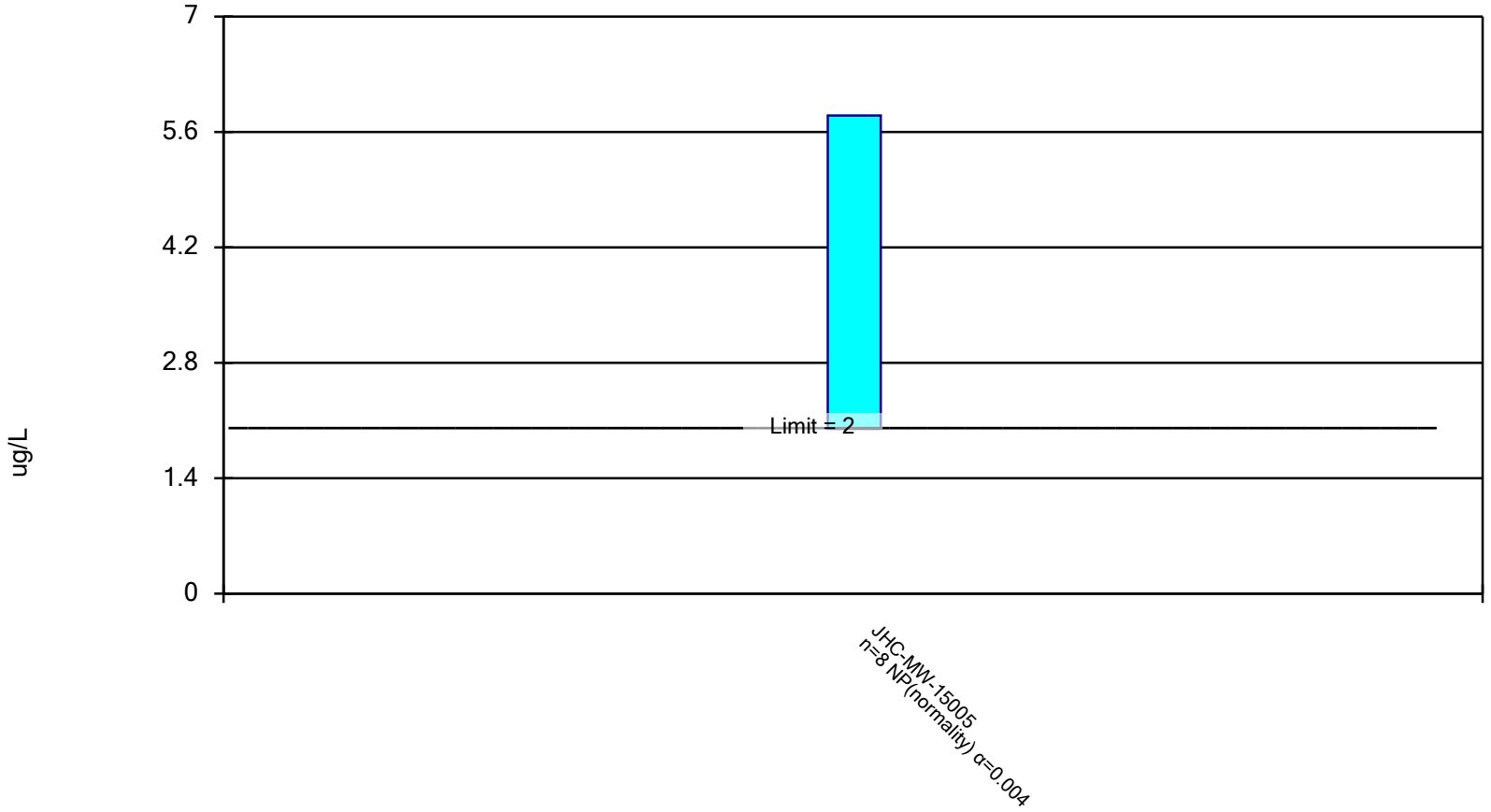
Constituent: Selenium, Total (ug/L) Analysis Run 6/5/2020 3:50 PM

Client: Consumers Energy Data: JHC_Sanitas_20.05.28

	JHC-MW-15005	JHC-MW-18005
6/20/2017	15.5	
8/14/2017	15.7	
4/25/2018	368	
6/19/2018	14	
11/15/2018	158	
12/7/2018		39.95 (D)
2/28/2019		34.5 (D)
4/25/2019	135 (D)	16
8/13/2019		11 (D)
10/9/2019	66	140
4/16/2020	282	46
Mean	131.8	47.91
Std. Dev.	133.2	47.13
Upper Lim.	273	109.9
Lower Lim.	-9.445	4.947

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Constituent: Thallium, Total Analysis Run 6/3/2020 4:20 PM

Client: Consumers Energy Data: JHC_Sanitas_20.05.28

Confidence Interval

Constituent: Thallium, Total (ug/L) Analysis Run 6/3/2020 5:37 PM

Client: Consumers Energy Data: JHC_Sanitas_20.05.28

	JHC-MW-15005
6/20/2017	<2
8/14/2017	<2
4/25/2018	5.8
6/19/2018	2.1
11/15/2018	<2
4/25/2019	2 (D)
10/9/2019	2.9
4/16/2020	3
Mean	2.725
Std. Dev.	1.312
Upper Lim.	5.8
Lower Lim.	2

Appendix D
October 2020 Assessment Monitoring Statistical Evaluation

1540 Eisenhower Pl.
Ann Arbor, MI 48108

T 734.971.7080
TRCcompanies.com

Technical Memorandum

Date:	January 22, 2021
To:	Bethany Swanberg, Consumers Energy
From:	Sarah Holmstrom, TRC Kristin Lowery, TRC
Project No.:	367390.0000.0000 Phase 1 Task 4
Subject:	Statistical Evaluation of October 2020 Assessment Monitoring Sampling Event, JH Campbell Bottom Ash Ponds 1-2 North and 1-2 South CCR Unit, Consumers Energy Company, West Olive, Michigan

Consumers Energy is continuing semiannual assessment monitoring in accordance with §257.95 of the CCR Rule[1] at the JH Campbell Power Plant (JHC) Bottom Ash Ponds 1-2 North and 1-2 South (Ponds 1-2). The second semiannual assessment monitoring event of 2020 was conducted on October 19 through 23, 2020. In accordance with §257.95, the assessment monitoring data must be compared to GWPSs to determine whether or not Appendix IV constituents are detected at statistically significant levels above the Groundwater Protection Standards (GWPSs). GWPSs were established in accordance with §257.95(h), as detailed in the October 15, 2018 Groundwater Protection Standards technical memorandum, which was also included in the 2018 Annual Groundwater Monitoring Report (2018 Annual Report) (TRC, January 2019). The following narrative describes the methods that were employed for comparisons to the GWPSs. The results obtained and the Sanitas™ output files are included as an attachment.

The statistical evaluation of the second semiannual assessment monitoring event for 2020 indicates that the following constituent is present at statistically significant levels exceeding the GWPS in downgradient monitoring wells at the Ponds 1-2 CCR Unit:

Constituent	GWPS	# Downgradient Wells Observed
Arsenic	10 ug/L	1 of 6

These results are consistent with the results of the initial and previous assessment monitoring data statistical evaluations and Consumers Energy will continue to evaluate corrective measures per §257.96 and §257.97. Consumers Energy will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

[1] USEPA final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) published April 17, 2015, as amended.

Assessment Monitoring Statistical Evaluation

The compliance well network at the Ponds 1-2 CCR Unit consists of six monitoring wells. JHC-MW-15001, JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 are located on the perimeter of the bottom ash ponds. Former downgradient monitoring well JHC-MW-15004 was decommissioned on June 14, 2018, during deconstruction of Ponds 1-2; therefore, statistical analysis for JHC-MW-15004 terminates at the June 2018 monitoring event. Due to the cessation of hydraulic loading to Ponds 1-2 and Bottom Ash Ponds 3 North and 3 South (Pond 3), the groundwater flow direction changed significantly from the previous baseline and assessment monitoring events. The following monitoring wells are no longer downgradient: JHC-MW-15001 (upgradient), JHC-MW-15002 (side gradient), JHC-MW-15003 (side gradient). In response, as documented in the 2018 Annual Report, Consumers Energy installed two new downgradient wells (JHC-MW-18004 and JHC-MW-18005) on the south and southwest edge of former Ponds 1-2 from December 3 through December 5, 2018 to reassess groundwater flow and ensure sufficient wells are appropriately located to assess groundwater quality downgradient from the Ponds 1-2 CCR Units. These wells were sampled for Appendix III and Appendix IV constituents in February and March 2019 in addition to the April 2019 semiannual assessment monitoring event. These data confirmed that the monitoring wells are appropriately positioned to assess groundwater quality downgradient from the Ponds 1-2 CCR Unit. Therefore, JHC-MW-18004 and JHC-MW-18005 have been added to the downgradient monitoring network, in addition to existing downgradient monitoring well JHC-MW-15005, for Ponds 1-2 and are included in the statistical evaluation.

Additionally, since Ponds 1-2 has been deconstructed and groundwater levels have re-equilibrated, dry conditions have been observed at JHC-MW-15001 throughout both 2020 semiannual sampling events. Given that JHC-MW-15001 is upgradient of Ponds 1-2 and no Appendix IV constituents have been observed at statistically significant levels above the GWPSs at JHC-15001, the monitoring well is being removed from the monitoring network moving forward.

Following the second semiannual assessment monitoring sampling event for 2020, compliance well data for the JHC Ponds 1-2 were evaluated in accordance with the Groundwater Statistical Evaluation Plan (Stats Plan) (TRC, October 2017). An assessment monitoring program was developed to evaluate concentrations of CCR constituents present in the uppermost aquifer relative to acceptable levels (i.e. GWPSs). To evaluate whether or not a GWPS exceedance is statistically significant, the difference in concentration observed at the downgradient wells during a given assessment monitoring event compared to the GWPS must be large enough, after accounting for variability in the sample data, that the result is unlikely to have occurred merely by chance. Consistent with the Unified Guidance[2], the preferred method for comparisons to a fixed standard are confidence limits. An exceedance of the standard occurs when the 99 percent lower confidence level of the downgradient data exceeds the GWPS. Based on the number of historical observations in the representative sample population, the population mean, the population standard deviation, and a selected confidence level (i.e. 99 percent), an upper and lower confidence limit is calculated. The actual mean concentration of the population, with 99 percent confidence, will fall between the lower and upper confidence limits.

[2] USEPA. 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance*. Office of Conservation and Recovery. EPA 530/R-09-007.

The concentrations observed in the downgradient wells are deemed to be a statistically significant exceedance when the 99 percent lower confidence limit of the downgradient data exceeds the GWPS. If the confidence interval straddles the GWPS (i.e. the lower confidence level is below the GWPS but the upper confidence level is above), the statistical test result indicates that there is insufficient confidence that the measured concentrations are different from the GWPS and thus there is no compelling evidence that the measured concentration is a result of a release from the CCR unit versus the inherent variability of the sample data. This statistical approach is consistent with the statistical methods for assessment monitoring presented in §257.93(f) and (g). Statistical evaluation methodologies built into the CCR Rule, and numerous other federal rules, are key in determining whether or not individually measured data points represent a concentration increase over the baseline or a fixed standard (such as a GWPS in an assessment monitoring program).

For each detected Appendix IV constituent, the concentrations for each well were first compared directly to the GWPS, as shown on Table B1. Constituent-well combinations that included a direct exceedance of the GWPS within the past eight monitoring events (August 2017 through October 2020 for JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 and April 2017 to October 2020 for JHC-MW-15001) and the past seven events (December 2018 through October 2020) for JHC-MW-18004 and JHC-MW-18005 were retained for further analysis (Attachment 1). Direct comparison GWPS exceedances included the following constituent-well combinations:

- Arsenic in JHC-MW-15001,
- Arsenic and lithium in JHC-MW-15002,
- Arsenic, cobalt, and molybdenum in JHC-MW-15003,
- Lithium, molybdenum, selenium, and thallium in JHC-MW-15005, and
- Arsenic and selenium in JHC-MW-18005.

Groundwater data for the constituent-well combinations with direct-comparison exceedances of a GWPS were then evaluated utilizing Sanitas™ statistical software. Sanitas™ is a software tool that is commercially available for performing statistical evaluation consistent with procedures outlined in the Unified Guidance. Within the Sanitas™ statistical program, confidence limits were selected to perform the statistical comparison of compliance data to a fixed standard. Parametric and non-parametric confidence intervals were calculated, as appropriate, for each of the CCR Appendix IV parameters using a 99 percent confidence level, i.e., a significance level (α) of 0.01. The following narrative describes the methods employed, the results obtained and the Sanitas™ output files are included as an attachment.

The statistical data evaluation included the following steps:

- Review of data quality checklists for the data sets;
- Graphical representation of the monitoring data as time versus concentration by well-constituent pair;
- Outlier testing of individual data points that appear from the graphical representations as potential outliers;
- Evaluation of visual trends apparent in the graphical representations for statistical significance;
- Evaluation of percentage of non-detects for each well-constituent pair;

- Distribution of the data; and
- Calculation of the confidence intervals for each cumulative dataset.

The results of these evaluations are presented and discussed below.

Initially, the baseline (April 2017 through August 2017) results and the assessment monitoring results (April 2018 through October 2020) for these well-constituent pairs were observed visually for potential outliers and trends. No outliers were apparent. A potential increasing trend was noted for arsenic in JHC-MW-15002 beginning in April 2018 (time-series plots in Attachment 1), but was found to not be statistically significant. Groundwater conditions are re-equilibrating following to CCR removal activities at the JHC Ponds 1-2 that were completed in September 2018, and the groundwater monitoring system is being re-assessed to account for post-deconstruction groundwater conditions. Hydrogeologic conditions are in the process of stabilizing and recent groundwater samples from JHC-MW-15002 may no longer represent groundwater passing beneath JHC Ponds 1-2. Because hydrogeologic conditions are in the process of stabilizing, temporary trending and sporadic outlier data are not unexpected, and all data collected during the re-equilibrating period will be kept in the assessment monitoring data set. Data from each round were evaluated for completeness, overall quality, and usability and were deemed appropriate for the purposes of the CCR assessment monitoring program.

The Sanitas™ software was then used to test compliance at the downgradient monitoring wells using the confidence interval method for the most recent eight sampling events (seven events for JHC-MW-18004 and JHC-MW-18005). Eight independent sampling events provide the appropriate density of data as recommended per the Unified Guidance yet are collected recently enough to provide an indication of current condition. The tests were run with a per-well significance of $\alpha = 0.01$. The software outputs are included in Attachment 1 along with data reports showing the values used for the evaluation. Non-detect data was handled in accordance with the Stats Plan for the purposes of calculating the confidence intervals.

The Sanitas™ software generates an output that includes graphs of the parametric or non-parametric confidence intervals for each well along with notes on data transformations, as appropriate. Data distributions were as follows:

Distribution	Parameter-Well Combinations
Normal	Arsenic in JHC-MW-15001 and JHC-MW-18005 Lithium in JHC-MW-15002 and JHC-MW-15005 Molybdenum in JHC-MW-15003 Selenium in JHC-MW-15005 and JHC-MW-18005
Normalized by square root transformation	Arsenic in JHC-MW-15002 Molybdenum in JHC-MW-15005 Cobalt in JHC-MW-15003 (Kaplan-Meier)
Normalized by cube root transformation	Arsenic in JHC-MW-15003
Non-Parametric (not normalizable)	Thallium in JHC-MW-15005

The confidence interval test compares the lower confidence limit to the GWPS. The statistical evaluation of the Appendix IV constituents shows a statistically significant GWPS exceedance for arsenic in JHC-MW-15002. These results are consistent with the results of the initial assessment monitoring data statistical evaluation and Consumers Energy will continue to evaluate corrective measures per §257.96 and §257.97. Consumers Energy will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Attachments

Table C1	Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
Attachment 1	Sanitas™ Output

Table

Table D1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15001[4]									
						Sample Date:	4/19/2017	6/20/2017	8/14/2017	9/25/2017	4/25/2018	6/18/2018	11/13/2018	4/25/2019	10/9/2019	4/16/2020[3]	10/22/2020[3]
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS												
Appendix III																	
Boron	ug/L	NC	NA	51	NA		149	368	238	287	--	339	146	78	150	--	--
Calcium	mg/L	NC	NA	46	NA		70.3	50.7	70.9	68	--	68.6	72.1	69	73	--	--
Chloride	mg/L	250*	NA	43	NA		7.1	51.8	94.8	73.6	--	109	2.7	< 2.0	< 2.0	--	--
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	--	--
Sulfate	mg/L	250*	NA	14	NA		42.1	88	114	129	--	78.9	59.1	39	21	--	--
Total Dissolved Solids	mg/L	500*	NA	258	NA		440	340	562	563	--	596	310	280	350	--	--
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.3	6.2	6.3	6.2	7.2 [1]	6.3	6.3	6.0	6.4	--	--
Appendix IV																	
Antimony	ug/L	6	NA	2	6		< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--
Arsenic	ug/L	10	NA	1	**10**		4	1.8	2.2	--	< 1.0	1.8	**12.7**	5.8	6.3	--	--
Barium	ug/L	2,000	NA	35	2,000		172	106	142	--	71.4	183	84.9	58	95	--	--
Beryllium	ug/L	4	NA	1	4		< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	--	--
Chromium	ug/L	100	NA	2	100		2	1.0	1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	1.2	--	--
Cobalt	ug/L	NC	6	15	**15**		< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	--	--
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	--	--
Lead	ug/L	NC	15	1	15		< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--
Lithium	ug/L	NC	40	10	**40**		< 10	< 10	< 10	--	< 10	< 10	< 10	< 10	< 10	--	--
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	0.25	--	--
Molybdenum	ug/L	NC	100	5	**100**		< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	13.3	< 5.0	< 5.0	--	--
Radium-226	pCi/L	NC	NA	NA	NA		< 0.352	< 1.63	< 0.708	--	< 0.545	< 0.828	< 0.755	< 0.101	< 0.162	--	--
Radium-228	pCi/L	NC	NA	NA	NA		2.07	< 0.628	1.20	--	< 0.799	< 1.12	< 0.879	< 0.447	< 0.516	--	--
Radium-226/228	pCi/L	5	NA	1.93	5		2.13	< 2.26	1.61	--	< 1.34	< 1.95	< 1.63	< 0.447	< 0.516	--	--
Selenium	ug/L	50	NA	5	**50**		< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--
Thallium	ug/L	2	NA	2	**2**		< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	--	--

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.
(3) Not sampled; insufficient amount of groundwater present to collect sample.
(4) Monitoring well JHC-MW-15001 has been upgradient and JHC-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 1-2 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Table D1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15002[4]												
					Sample Date:	8/14/2017	8/14/2017	9/25/2017	9/25/2017	4/25/2018	4/25/2018	6/19/2018	11/15/2018	11/15/2018	4/25/2019	10/9/2019	4/16/2020	10/22/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS													
Appendix III							Field Dup		Field Dup		Field Dup			Field Dup				
Boron	ug/L	NC	NA	51	NA	869	946	927	894	--	--	430	1,470	1,360	3,200	1,700	2,560	2,390
Calcium	mg/L	NC	NA	46	NA	25.7	25.3	30.5	30.6	--	--	75.3	41.9	41.1	85	99	122	80.1
Chloride	mg/L	250*	NA	43	NA	20.7	20.2	25.8	26.0	--	--	22.3	19.3	19.2	17	20	15.4	16.0
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	54.5	53.7	33.9	34.3	--	--	153	95.2	94.5	190	280	295	212
Total Dissolved Solids	mg/L	500*	NA	258	NA	236	174	144	148	--	--	356	222	274	410	480	567	396
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	9.2	--	9.6	--	10.2 [1]	--	8.3	8.0	--	6.9	6.5	6.1	5.7
Appendix IV																		
Antimony	ug/L	6	NA	2	6	1.9	2.1	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Arsenic	ug/L	10	NA	1	**10**	**44.5**	**45.8**	--	--	**129**	**130**	**127**	**60.5**	**59.5**	**50**	**57**	**45**	**21**
Barium	ug/L	2,000	NA	35	2,000	7.8	7.7	--	--	30.4	30.4	19.8	18.4	18.1	49	150	128	85
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2
Chromium	ug/L	100	NA	2	100	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Cobalt	ug/L	NC	6	15	**15**	< 15.0	< 15.0	--	--	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	< 6.0	< 15	< 15
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1000
Lead	ug/L	NC	15	1	15	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Lithium	ug/L	NC	40	10	**40**	11	< 10	--	--	28	28	19	**68**	**67**	**96**	**240**	**125**	**76**
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	5	**100**	19.0	19.0	--	--	12.6	12.7	7.5	9.2	9.0	< 5.0	15	49	43
Radium-226	pCi/L	NC	NA	NA	NA	0.749	0.949	--	--	< 0.823	< 0.530	< 0.620	< 1.09	0.921	0.233	0.698	0.378	0.468
Radium-228	pCi/L	NC	NA	NA	NA	< 0.797	< 0.790	--	--	< 0.729	< 1.33	< 1.58	1.04	0.767	0.409	< 0.394	< 0.408	< 0.250
Radium-226/228	pCi/L	5	NA	1.93	5	< 1.43	< 1.26	--	--	< 1.55	< 1.86	< 2.20	< 1.70	1.69	0.642	1.04	0.784	0.533
Selenium	ug/L	50	NA	5	**50**	3.5	5.1	--	--	< 1.0	< 1.0	< 1.0	2.5	2.8	< 1.0	< 1.0	1	< 1
Thallium	ug/L	2	NA	2	**2**	< 2.0	< 2.0	--	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.
(3) Not sampled; insufficient amount of groundwater present to collect sample.
(4) Monitoring well JHC-MW-15001 has been upgradient and JHC-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 1-2 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Table D1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15003[4]										
					Sample Date:	8/14/2017	9/25/2017	4/25/2018	6/18/2018	6/18/2018	11/15/2018	4/29/2019	10/9/2019	10/9/2019	4/16/2020	10/22/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS											
Appendix III										Field Dup				Field Dup		
Boron	ug/L	NC	NA	51	NA	1,150	1,120	--	1,170	1,320	1,120	1,700	3,500	3,300	3,880	2,370
Calcium	mg/L	NC	NA	46	NA	36.0	30.1	--	60.0	59.1	115	36	110	110	94.6	57.6
Chloride	mg/L	250*	NA	43	NA	22.0	19.3	--	37.5	36.6	16.3	18	47	47	17.3	22.3
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	61.9	51.9	--	81.9	82.7	294	75	210	220	194	89
Total Dissolved Solids	mg/L	500*	NA	258	NA	208	136	--	388	344	644	200	580	600	554	339
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	9.3	9.7	9.3	8.9	--	8.7	8.4	8.7	--	8.3	8.3
Appendix IV																
Antimony	ug/L	6	NA	2	6	1.3	--	1.5	1.9	1.8	2.0	2.2	1.4	1.4	1	< 1
Arsenic	ug/L	10	NA	1	**10**	**23.7**	--	**12.4**	**14.1**	**14.3**	8.1	10	8.4	7.7	9	**12**
Barium	ug/L	2,000	NA	35	2,000	18.0	--	42.3	55.7	52.5	113	42	91	89	103	68
Beryllium	ug/L	4	NA	1	4	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5	< 0.20	--	< 0.20	< 0.20	< 0.20	1.7	0.41	2.5	2.5	1.0	< 0.2
Chromium	ug/L	100	NA	2	100	< 1.0	--	< 1.0	< 1.0	< 1.0	13.6	4.2	11	10	7	7
Cobalt	ug/L	NC	6	15	**15**	< 15.0	--	< 15.0	< 15.0	< 15.0	**23.6**	< 6.0	**43**	**41**	**47**	< 15
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1000
Lead	ug/L	NC	15	1	15	< 1.0	--	< 1.0	< 1.0	< 1.0	3.3	< 1.0	3.2	3.2	5	2
Lithium	ug/L	NC	40	10	**40**	< 10	--	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	5	**100**	28.2	--	19.3	53.0	51.2	65.3	20	**120**	**120**	**125**	59
Radium-226	pCi/L	NC	NA	NA	NA	1.15	--	< 0.631	< 0.623	< 0.733	< 0.579	< 0.113	0.301	0.430	0.272	< 0.322
Radium-228	pCi/L	NC	NA	NA	NA	< 0.938	--	< 0.732	< 1.01	< 1.08	< 0.657	< 0.530	0.421	< 0.361	0.541	< 0.282
Radium-226/228	pCi/L	5	NA	1.93	5	1.81	--	< 1.36	< 1.63	< 1.81	< 1.24	< 0.530	0.722	0.559	0.813	< 0.322
Selenium	ug/L	50	NA	5	**50**	1.1	--	2.2	4.4	4.5	28.6	2.9	18	19	27	1
Thallium	ug/L	2	NA	2	**2**	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
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(2) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.
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(4) Monitoring well JHC-MW-15001 has been upgradient and JHC-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 1-2 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Table D1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

				Sample Location:	
				Sample Date:	
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS
Appendix III					
Boron	ug/L	NC	NA	51	NA
Calcium	mg/L	NC	NA	46	NA
Chloride	mg/L	250*	NA	43	NA
Fluoride	ug/L	4,000	NA	1,000	NA
Sulfate	mg/L	250*	NA	14	NA
Total Dissolved Solids	mg/L	500*	NA	258	NA
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA
Appendix IV					
Antimony	ug/L	6	NA	2	6
Arsenic	ug/L	10	NA	1	**10**
Barium	ug/L	2,000	NA	35	2,000
Beryllium	ug/L	4	NA	1	4
Cadmium	ug/L	5	NA	0.2	5
Chromium	ug/L	100	NA	2	100
Cobalt	ug/L	NC	6	15	**15**
Fluoride	ug/L	4,000	NA	1,000	4,000
Lead	ug/L	NC	15	1	15
Lithium	ug/L	NC	40	10	**40**
Mercury	ug/L	2	NA	0.2	2
Molybdenum	ug/L	NC	100	5	**100**
Radium-226	pCi/L	NC	NA	NA	NA
Radium-228	pCi/L	NC	NA	NA	NA
Radium-226/228	pCi/L	5	NA	1.93	5
Selenium	ug/L	50	NA	5	**50**
Thallium	ug/L	2	NA	2	**2**

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
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(2) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.
(3) Not sampled; insufficient amount of groundwater present to collect sample.
(4) Monitoring well JHC-MW-15001 has been upgradient and JHC-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 1-2 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Table D1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15005										
					Sample Date:	8/14/2017	9/25/2017	4/25/2018	6/19/2018	11/15/2018	4/25/2019	4/25/2019	10/9/2019	4/16/2020	10/22/2020	
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS							Field Dup				
Appendix III																
Boron	ug/L	NC	NA	51	NA	546	481	--	227	1,450	2,800	2,900	1,200	1,020	1,340	
Calcium	mg/L	NC	NA	46	NA	48.0	40.3	--	61.8	61.9	170	180	110	97.1	131	
Chloride	mg/L	250*	NA	43	NA	27.1	21.8	--	90.9	30.6	28	28	30	15.6	57.1	
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	<1,000	< 1,000	< 1,000	< 1,000	
Sulfate	mg/L	250*	NA	14	NA	64.9	61.9	--	74.3	133	240	320	130	133	207	
Total Dissolved Solids	mg/L	500*	NA	258	NA	282	300	--	462	334	800	780	360	487	735	
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.5	7.4	7.4	7.4	7.5	7.2	--	7.3	7.1	7.2	
Appendix IV																
Antimony	ug/L	6	NA	2	6	4.2	--	2.2	1.6	5.1	4.4	4.2	3.3	2	2	
Arsenic	ug/L	10	NA	1	**10**	2.5	--	1.7	1.3	1.2	1.2	1.1	1.4	1	2	
Barium	ug/L	2,000	NA	35	2,000	109	--	407	175	149	150	150	190	270	354	
Beryllium	ug/L	4	NA	1	4	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	
Cadmium	ug/L	5	NA	0.2	5	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	0.2	< 0.2	
Chromium	ug/L	100	NA	2	100	< 1.0	--	< 1.0	3.0	< 1.0	1.3	1.3	1.3	1	< 1	
Cobalt	ug/L	NC	6	15	**15**	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	< 6.0	< 15	< 15	
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1000	
Lead	ug/L	NC	15	1	15	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	
Lithium	ug/L	NC	40	10	**40**	36	--	**61**	35	28	38	38	**50**	**59**	**42**	
Mercury	ug/L	2	NA	0.2	2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	
Molybdenum	ug/L	NC	100	5	**100**	10	--	31.2	15.7	**222**	**900**	**870**	**370**	91	**110**	
Radium-226	pCi/L	NC	NA	NA	NA	< 0.877	--	0.620	< 0.758	< 0.461	0.169	0.248	0.592	0.448	0.691	
Radium-228	pCi/L	NC	NA	NA	NA	< 0.856	--	0.700	1.22	0.967	< 0.350	0.495	0.427	0.566	0.791	
Radium-226/228	pCi/L	5	NA	1.93	5	< 1.73	--	1.32	1.91	1.41	< 0.350	0.743	1.02	1.01	1.48	
Selenium	ug/L	50	NA	5	**50**	15.7	--	**368**	14	**158**	**140**	**130**	**66**	**282**	**260**	
Thallium	ug/L	2	NA	2	**2**	< 2.0	--	**5.8**	**2.1**	< 2.0	2.0	<2.0	**2.9**	**3**	**7**	

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
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Table D1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-18004						
					Sample Date:	12/7/2018	2/28/2019	4/25/2019	8/13/2019	10/9/2019	4/16/2020	10/22/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS							
Appendix III												
Boron	ug/L	NC	NA	51	NA	970	900	920	1,200	620	524	638
Calcium	mg/L	NC	NA	46	NA	48.9	55	72	97	73	117	98.4
Chloride	mg/L	250*	NA	43	NA	25.7	50	34	35	40	14.2	12.5
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	109	69	100	110	120	249	127
Total Dissolved Solids	mg/L	500*	NA	258	NA	306	330	380	490	310	604	515
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.0	7.6 (2)	7.2	7.5	7.2	6.9	7.4
Appendix IV												
Antimony	ug/L	6	NA	2	6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Arsenic	ug/L	10	NA	1	**10**	1.0	< 1.0	1.1	1.2	1.1	< 1	1
Barium	ug/L	2,000	NA	35	2,000	92.6	170	220	680	270	210	323
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2
Chromium	ug/L	100	NA	2	100	< 1.0	1.2	2.0	1.8	1.3	< 1	< 1
Cobalt	ug/L	NC	6	15	**15**	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 15	< 15
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Lithium	ug/L	NC	40	10	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	5	**100**	7.4	7.4	8.2	9.0	10	7	10
Radium-226	pCi/L	NC	NA	NA	NA	< 0.695	< 0.0742	0.110	0.352	0.179	< 0.131	0.367
Radium-228	pCi/L	NC	NA	NA	NA	< 0.708	0.589	< 0.430	0.469	0.672	0.889	0.454
Radium-226/228	pCi/L	5	NA	1.93	5	< 1.40	0.654	< 0.430	0.822	0.851	0.952	0.821
Selenium	ug/L	50	NA	5	**50**	7.3	12	12	39	33	34	18
Thallium	ug/L	2	NA	2	**2**	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.
(3) Not sampled; insufficient amount of groundwater present to collect sample.
(4) Monitoring well JHC-MW-15001 has been upgradient and JHC-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 1-2 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Table D1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-18005										
					Sample Date:	12/7/2018	2/28/2019	2/28/2019	4/25/2019	8/13/2019	8/13/2019	10/9/2019	4/16/2020	10/22/2020	10/22/2020	
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS											
Appendix III								Field Dup			Field Dup				Field Dup	
Boron	ug/L	NC	NA	51	NA	641	660	720	650	750	780	660	534	486	499	
Calcium	mg/L	NC	NA	46	NA	32.5	43	42	41	43	45	55	42.6	58.7	60.1	
Chloride	mg/L	250*	NA	43	NA	29.8	27	26	25	27	27	18	19.6	16.4	16.8	
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	<1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	
Sulfate	mg/L	250*	NA	14	NA	90	89	85	66	95	95	110	74.5	105	108	
Total Dissolved Solids	mg/L	500*	NA	258	NA	234	280	260	250	270	290	330	262	339	317	
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	8.8	8.6 (2)	--	9.0	8.9	--	8.8	8.5	8.4	--	
Appendix IV																
Antimony	ug/L	6	NA	2	6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	
Arsenic	ug/L	10	NA	1	**10**	9.5	10	**11**	8.8	7.4	7.3	7.1	8	8	8	
Barium	ug/L	2,000	NA	35	2,000	58.1	72	73	73	120	120	150	144	207	206	
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	
Chromium	ug/L	100	NA	2	100	1.5	4.0	4.1	2.8	2.3	2.4	1.9	< 1	1	1	
Cobalt	ug/L	NC	6	15	**15**	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 15	< 15	< 15	
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	
Lead	ug/L	NC	15	1	15	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	
Lithium	ug/L	NC	40	10	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	
Molybdenum	ug/L	NC	100	5	**100**	18.6	14	15	14	15	15	66	9	7	7	
Radium-226	pCi/L	NC	NA	NA	NA	< 0.567	< 0.0795	<0.0779	< 0.0785	< 0.145	0.150	0.497	0.150	< 0.205	< 0.182	
Radium-228	pCi/L	NC	NA	NA	NA	< 0.760	< 0.386	<0.337	< 0.357	< 0.400	< 0.374	0.456	< 0.455	< 0.141	0.131	
Radium-226/228	pCi/L	5	NA	1.93	5	< 1.33	< 0.386	<0.337	< 0.357	< 0.400	< 0.374	0.953	< 0.455	< 0.205	0.185	
Selenium	ug/L	50	NA	5	**50**	42.0	35	34	16	11	11	**140**	46	**99**	**103**	
Thallium	ug/L	2	NA	2	**2**	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2	< 2	< 2	

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
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(1) pH value potentially biased high due to groundwater quality meter malfunction.
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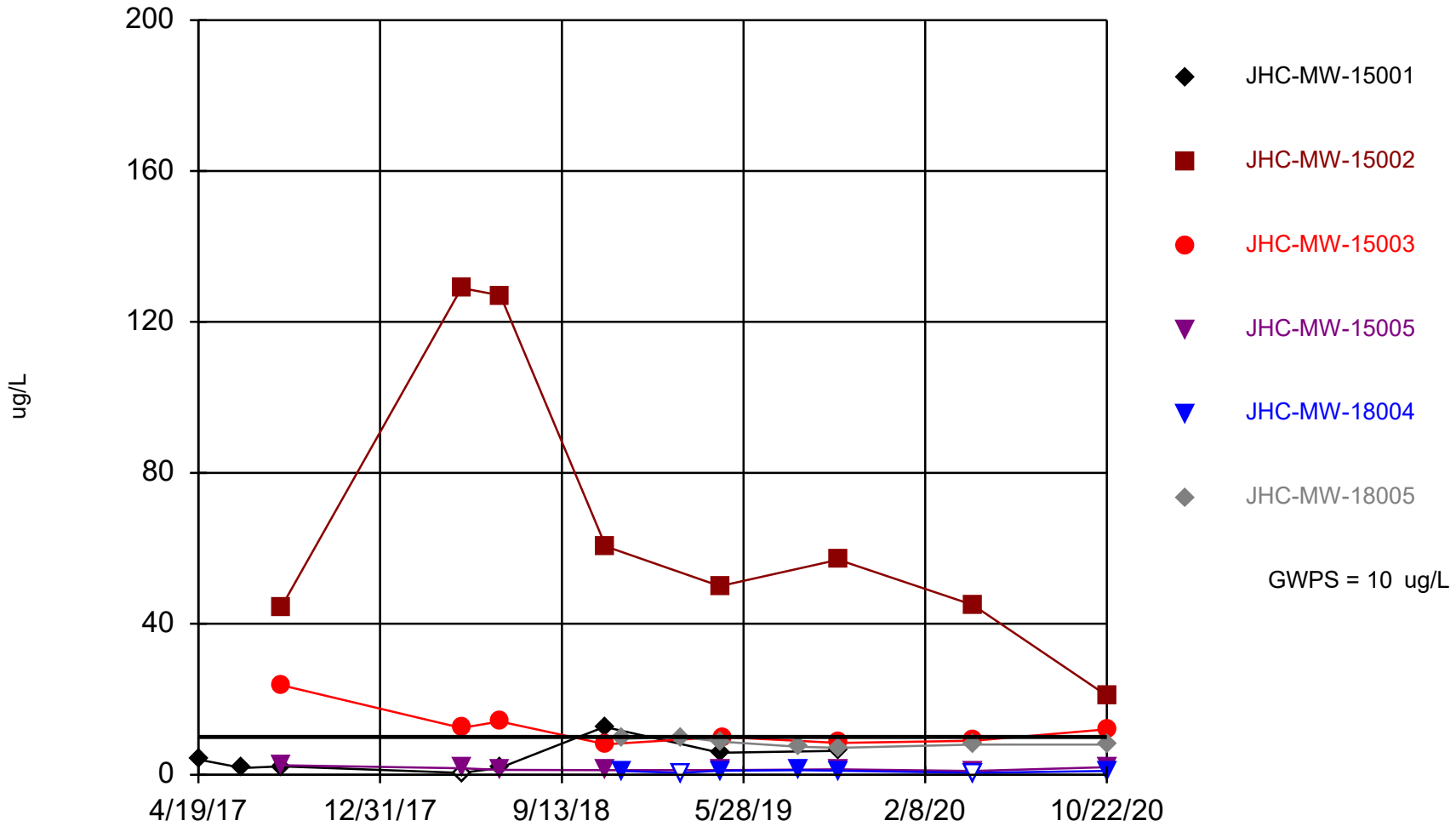
(4) Monitoring well JHC-MW-15001 has been upgradient and JHC-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 1-2 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Attachment 1
Sanitas™ Output

Hollow symbols indicate censored values.

Arsenic Comparison to GWPS

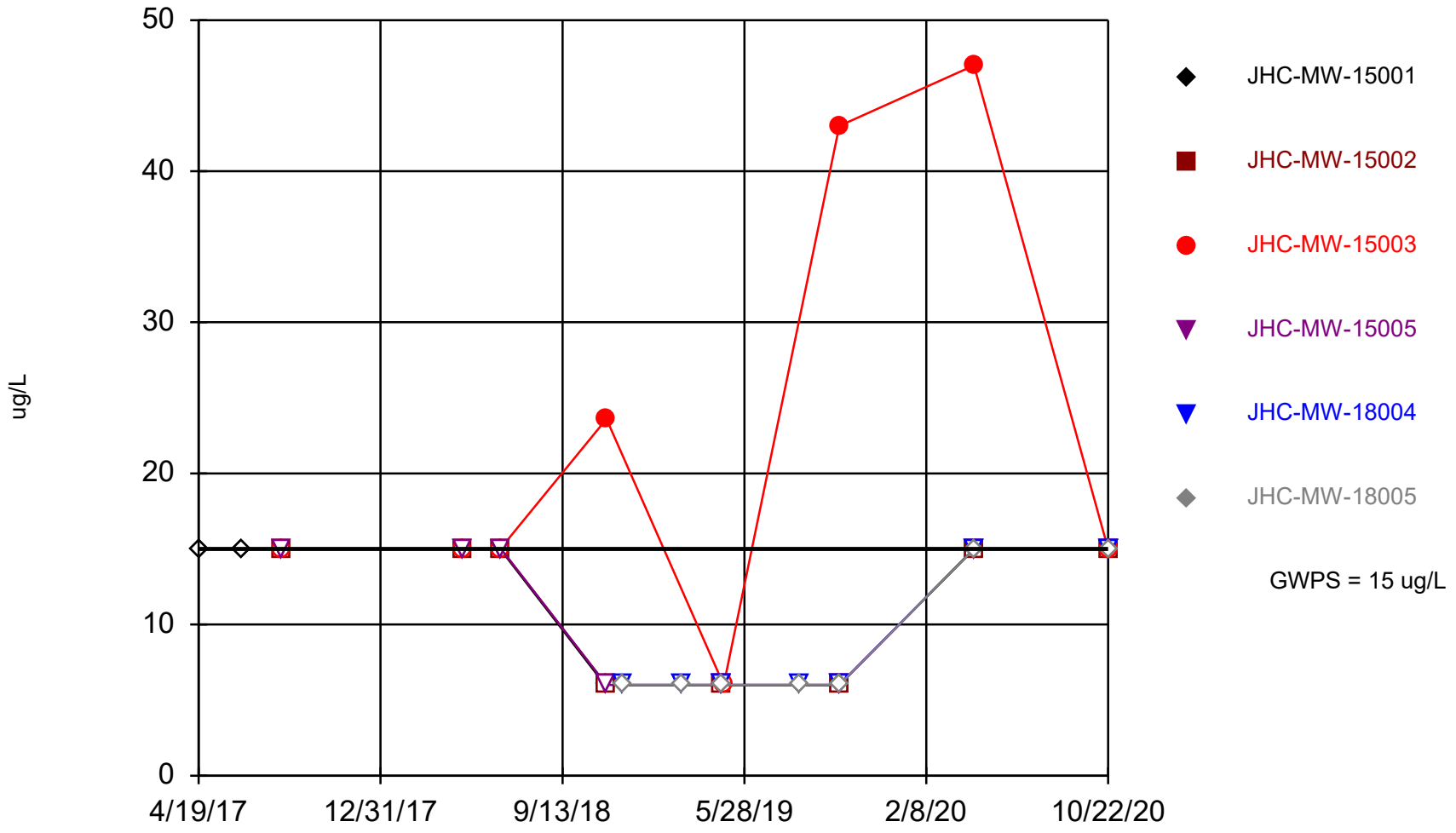


Time Series Analysis Run 12/3/2020 12:08 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

Hollow symbols indicate censored values.

Cobalt Comparison to GWPS

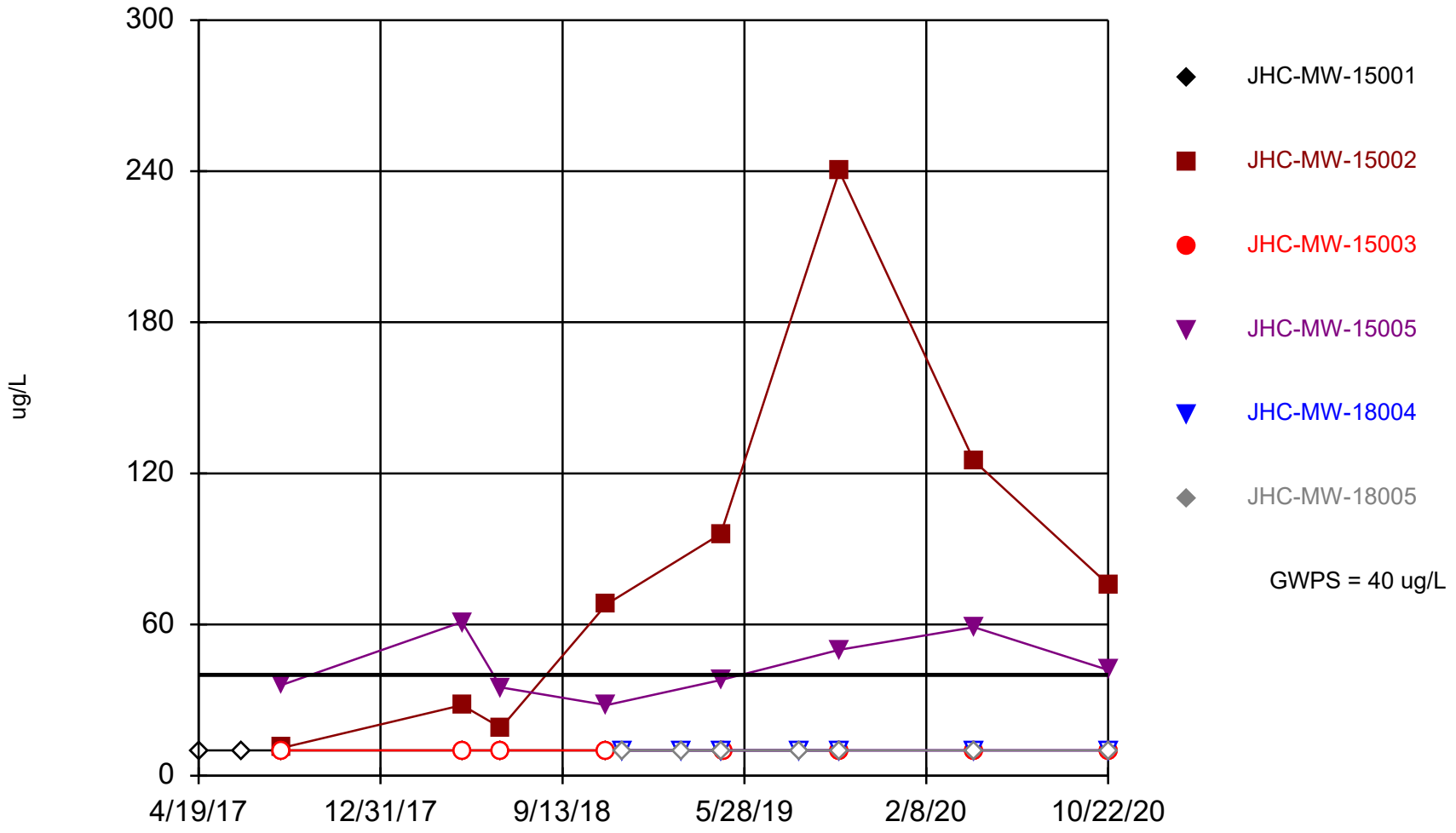


Time Series Analysis Run 12/3/2020 12:09 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

Hollow symbols indicate censored values.

Lithium Comparison to GWPS

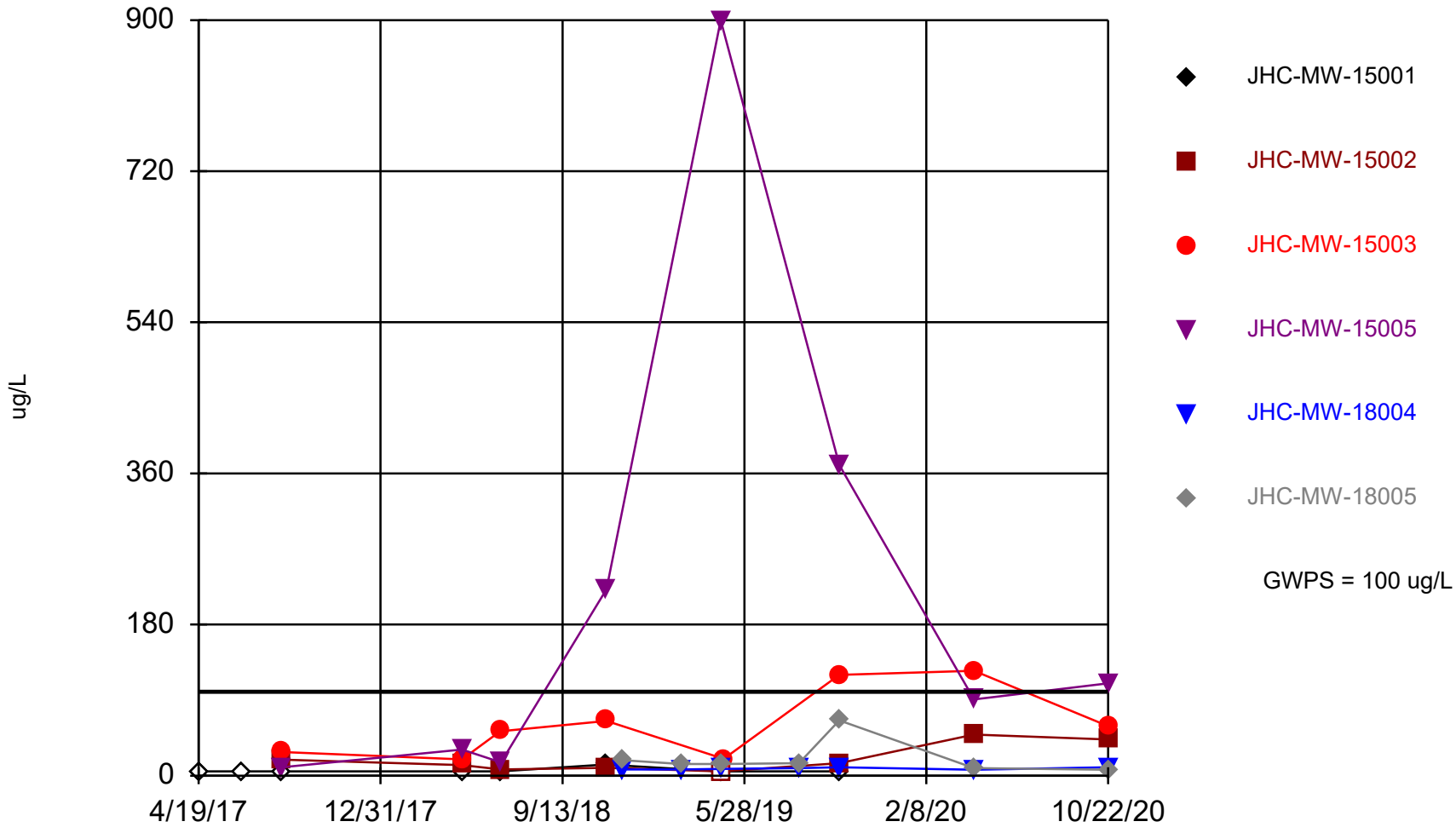


Time Series Analysis Run 12/3/2020 12:10 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

Sanitas™ v.9.6.27 Sanitas software licensed to Consumers Energy. UG
Hollow symbols indicate censored values.

Molybdenum Comparison to GWPS

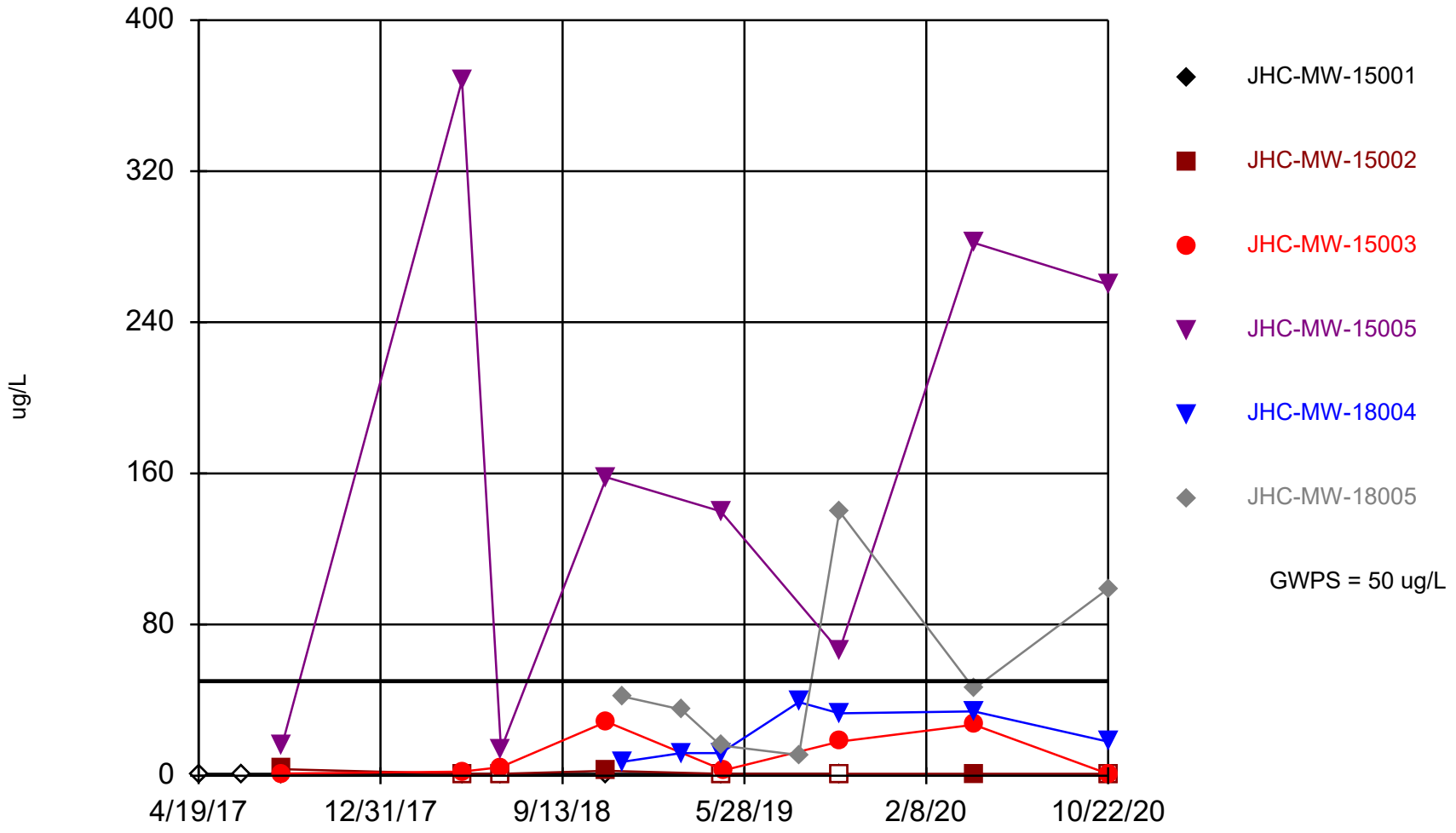


Time Series Analysis Run 12/3/2020 12:11 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

Hollow symbols indicate censored values.

Selenium Comparison to GWPS

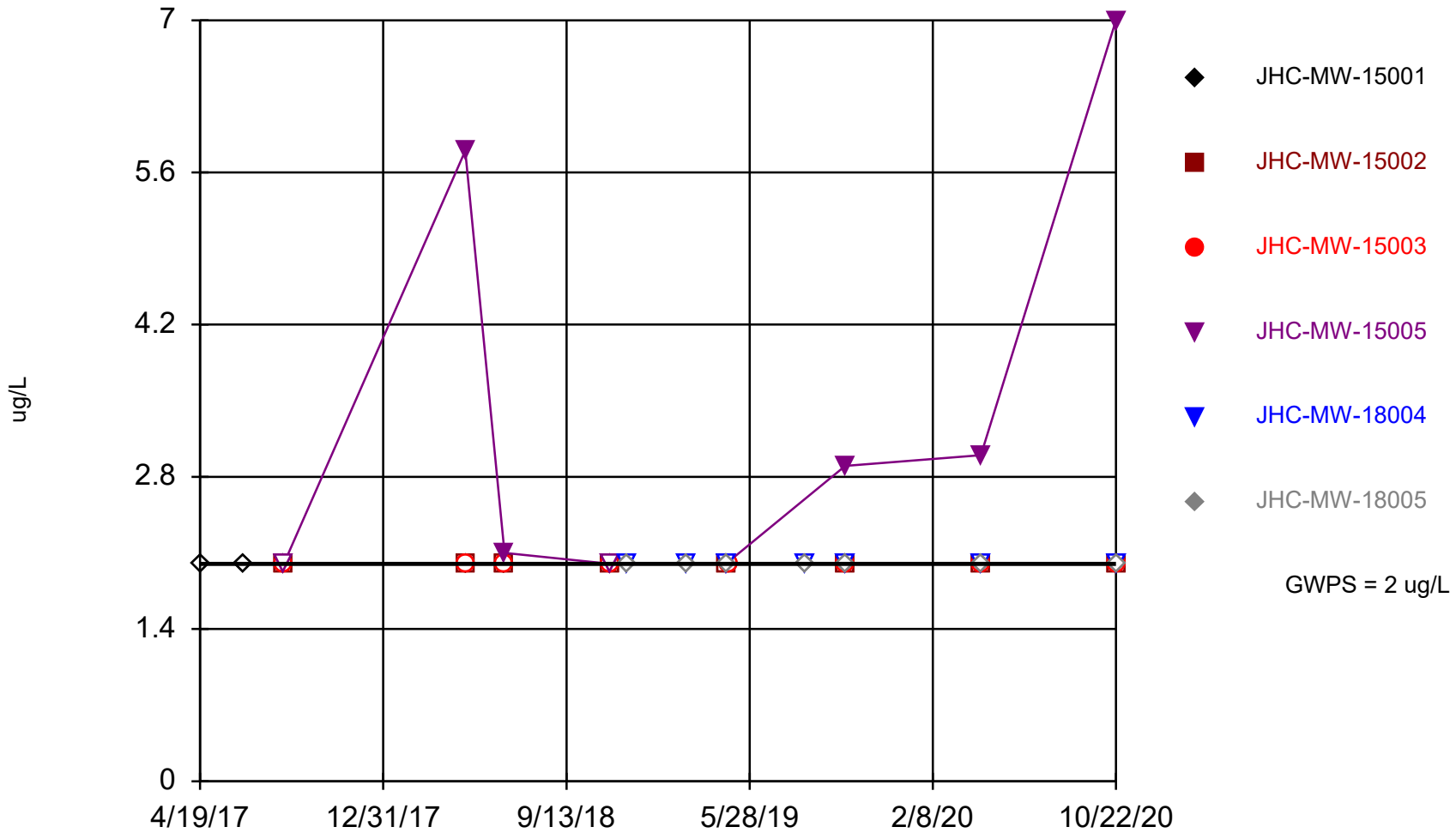


Time Series Analysis Run 12/3/2020 12:11 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

Hollow symbols indicate censored values.

Thallium Comparison to GWPS

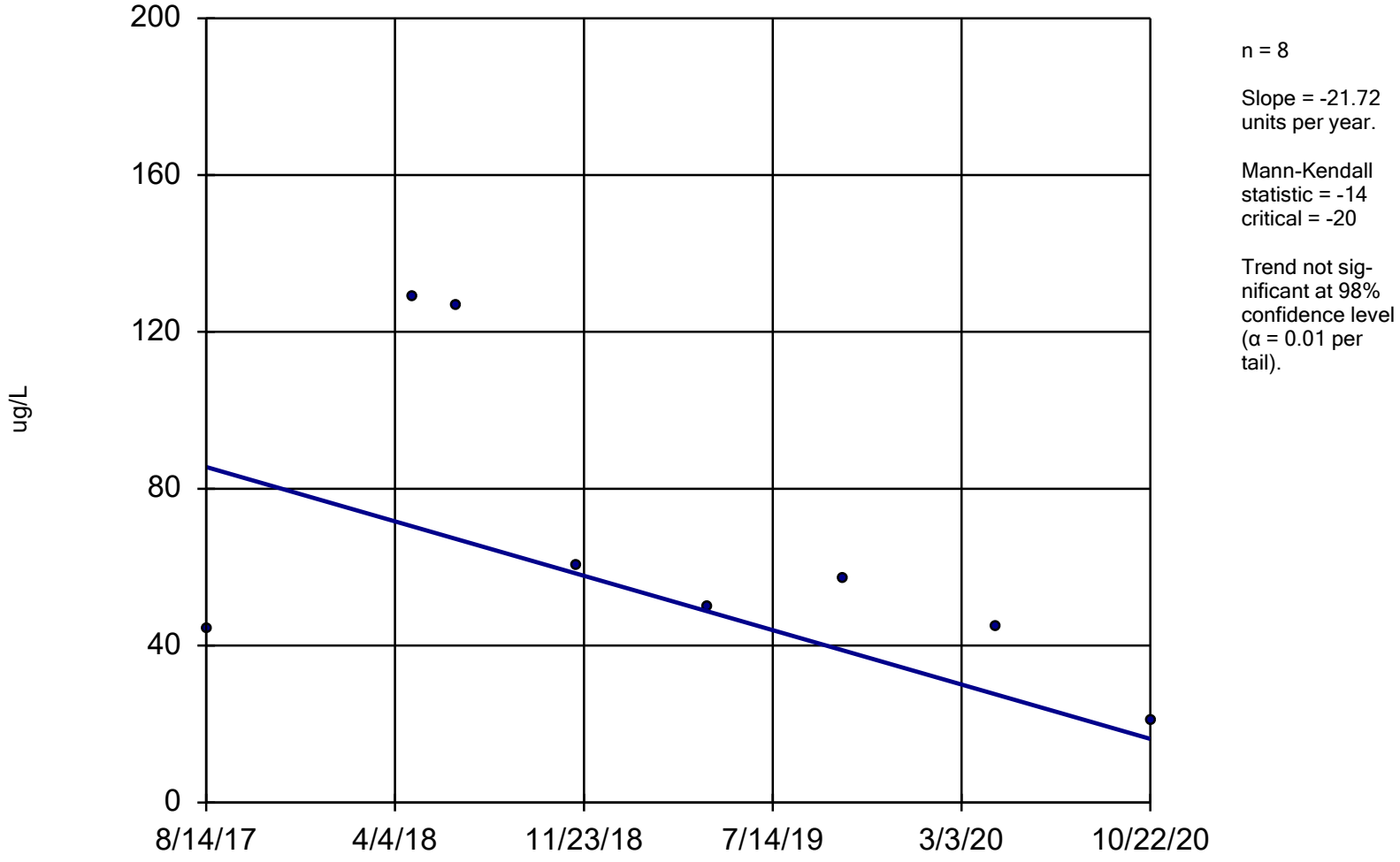


Time Series Analysis Run 12/3/2020 12:12 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

Arsenic, Total

JHC-MW-15002



n = 8

Slope = -21.72 units per year.

Mann-Kendall statistic = -14
critical = -20

Trend not significant at 98% confidence level (α = 0.01 per tail).

Sen's Slope Estimator Analysis Run 12/3/2020 1:27 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

Summary Report

Constituent: Arsenic, Total Analysis Run 12/3/2020 1:34 PM
Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

For observations made between 4/19/2017 and 10/22/2020, a summary of the selected data set:

Observations = 46
ND/Trace = 3
Wells = 6
Minimum Value = 0.5
Maximum Value = 129
Mean Value = 16.18
Median Value = 7.25
Standard Deviation = 28.58
Coefficient of Variation = 1.766
Skewness = 2.856

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	8	1	0.5	12.7	4.388	3.1	3.931	0.896	1.207
JHC-MW-15002	8	0	21	129	66.75	53.5	39.61	0.5934	0.8284
JHC-MW-15003	8	0	8.1	23.7	12.21	11	5.103	0.4178	1.556
JHC-MW-15005	8	0	1	2.5	1.538	1.35	0.5012	0.326	0.9055
JHC-MW-18004	7	2	0.5	1.2	0.9143	1	0.2911	0.3184	-0.7646
JHC-MW-18005	7	0	7.1	10	8.4	8	1.075	0.128	0.3134

Summary Report

Constituent: Cobalt, Total Analysis Run 12/3/2020 1:39 PM
Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

For observations made between 4/19/2017 and 10/22/2020, a summary of the selected data set:

Observations = 46
ND/Trace = 43
Wells = 6
Minimum Value = 6
Maximum Value = 47
Mean Value = 12.58
Median Value = 15
Standard Deviation = 8.475
Coefficient of Variation = 0.6738
Skewness = 2.396

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	8	8	6	15	11.63	15	4.658	0.4007	-0.5164
JHC-MW-15002	8	8	6	15	11.63	15	4.658	0.4007	-0.5164
JHC-MW-15003	8	5	6	47	22.45	15	14.73	0.6562	0.83
JHC-MW-15005	8	8	6	15	11.63	15	4.658	0.4007	-0.5164
JHC-MW-18004	7	7	6	15	8.571	6	4.392	0.5123	0.9487
JHC-MW-18005	7	7	6	15	8.571	6	4.392	0.5123	0.9487

Summary Report

Constituent: Lithium, Total Analysis Run 12/3/2020 1:39 PM
Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

For observations made between 4/19/2017 and 10/22/2020, a summary of the selected data set:

Observations = 46
ND/Trace = 30
Wells = 6
Minimum Value = 10
Maximum Value = 240
Mean Value = 28.52
Median Value = 10
Standard Deviation = 41.07
Coefficient of Variation = 1.44
Skewness = 3.474

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	8	8	10	10	10	10	0	0	NaN
JHC-MW-15002	8	0	11	240	82.88	72	74.8	0.9025	1.152
JHC-MW-15003	8	8	10	10	10	10	0	0	NaN
JHC-MW-15005	8	0	28	61	43.63	40	11.89	0.2726	0.3685
JHC-MW-18004	7	7	10	10	10	10	0	0	NaN
JHC-MW-18005	7	7	10	10	10	10	0	0	NaN

Summary Report

Constituent: Molybdenum, Total Analysis Run 12/3/2020 1:40 PM
Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

For observations made between 4/19/2017 and 10/22/2020, a summary of the selected data set:

Observations = 46
ND/Trace = 8
Wells = 6
Minimum Value = 5
Maximum Value = 900
Mean Value = 57.63
Median Value = 14
Standard Deviation = 142.9
Coefficient of Variation = 2.479
Skewness = 4.852

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	8	7	5	13.3	6.038	5	2.934	0.486	2.268
JHC-MW-15002	8	1	5	49	20.04	13.8	16.68	0.8327	0.9607
JHC-MW-15003	8	0	19.3	125	61.23	56	41.68	0.6807	0.5952
JHC-MW-15005	8	0	10	900	218.7	100.5	301.2	1.377	1.633
JHC-MW-18004	7	0	7	10	8.429	8.2	1.257	0.1491	0.258
JHC-MW-18005	7	0	7	66	20.51	14	20.43	0.9957	1.888

Summary Report

Constituent: Selenium, Total Analysis Run 12/3/2020 1:37 PM
Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

For observations made between 4/19/2017 and 10/22/2020, a summary of the selected data set:

Observations = 46
ND/Trace = 13
Wells = 6
Minimum Value = 1
Maximum Value = 368
Mean Value = 42.46
Median Value = 11.5
Standard Deviation = 80.31
Coefficient of Variation = 1.891
Skewness = 2.622

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	8	8	1	1	1	1	0	0	NaN
JHC-MW-15002	8	5	1	3.5	1.5	1	0.9636	0.6424	1.408
JHC-MW-15003	8	0	1	28.6	10.65	3.65	11.94	1.121	0.6696
JHC-MW-15005	8	0	14	368	163	149	130.6	0.8016	0.2602
JHC-MW-18004	7	0	7.3	39	22.19	18	12.82	0.5778	0.1865
JHC-MW-18005	7	0	11	140	55.57	42	47.02	0.8461	0.9024

Summary Report

Constituent: Thallium, Total Analysis Run 12/3/2020 1:40 PM
Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

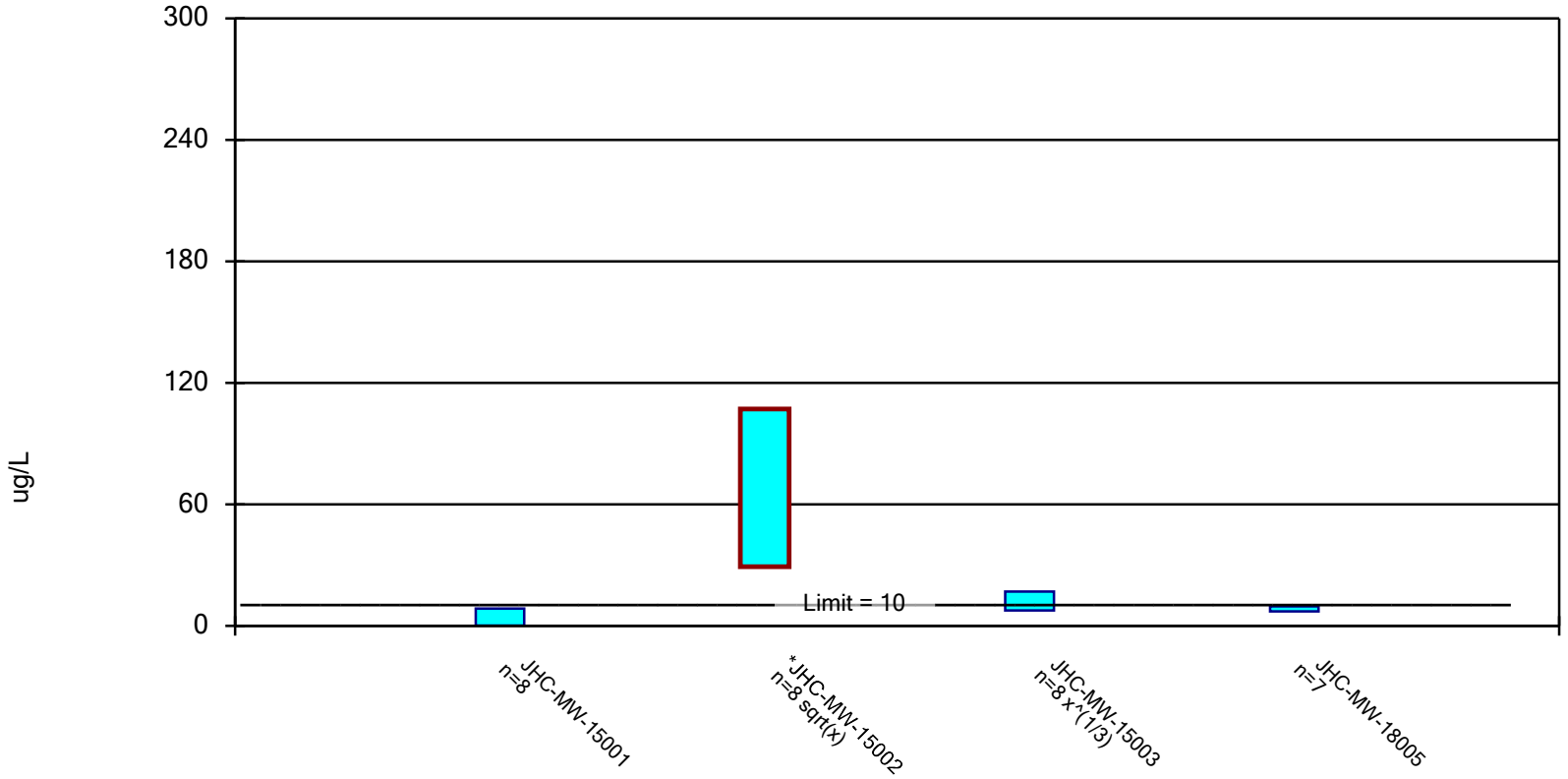
For observations made between 4/19/2017 and 10/22/2020, a summary of the selected data set:

Observations = 46
ND/Trace = 40
Wells = 6
Minimum Value = 2
Maximum Value = 7
Mean Value = 2.235
Median Value = 2
Standard Deviation = 0.9277
Coefficient of Variation = 0.4151
Skewness = 4.327

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	8	8	2	2	2	2	0	0	NaN
JHC-MW-15002	8	8	2	2	2	2	0	0	NaN
JHC-MW-15003	8	8	2	2	2	2	0	0	NaN
JHC-MW-15005	8	2	2	7	3.35	2.5	1.952	0.5828	1.106
JHC-MW-18004	7	7	2	2	2	2	0	0	NaN
JHC-MW-18005	7	7	2	2	2	2	0	0	NaN

Parametric Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Arsenic, Total Analysis Run 12/3/2020 1:34 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

Confidence Interval

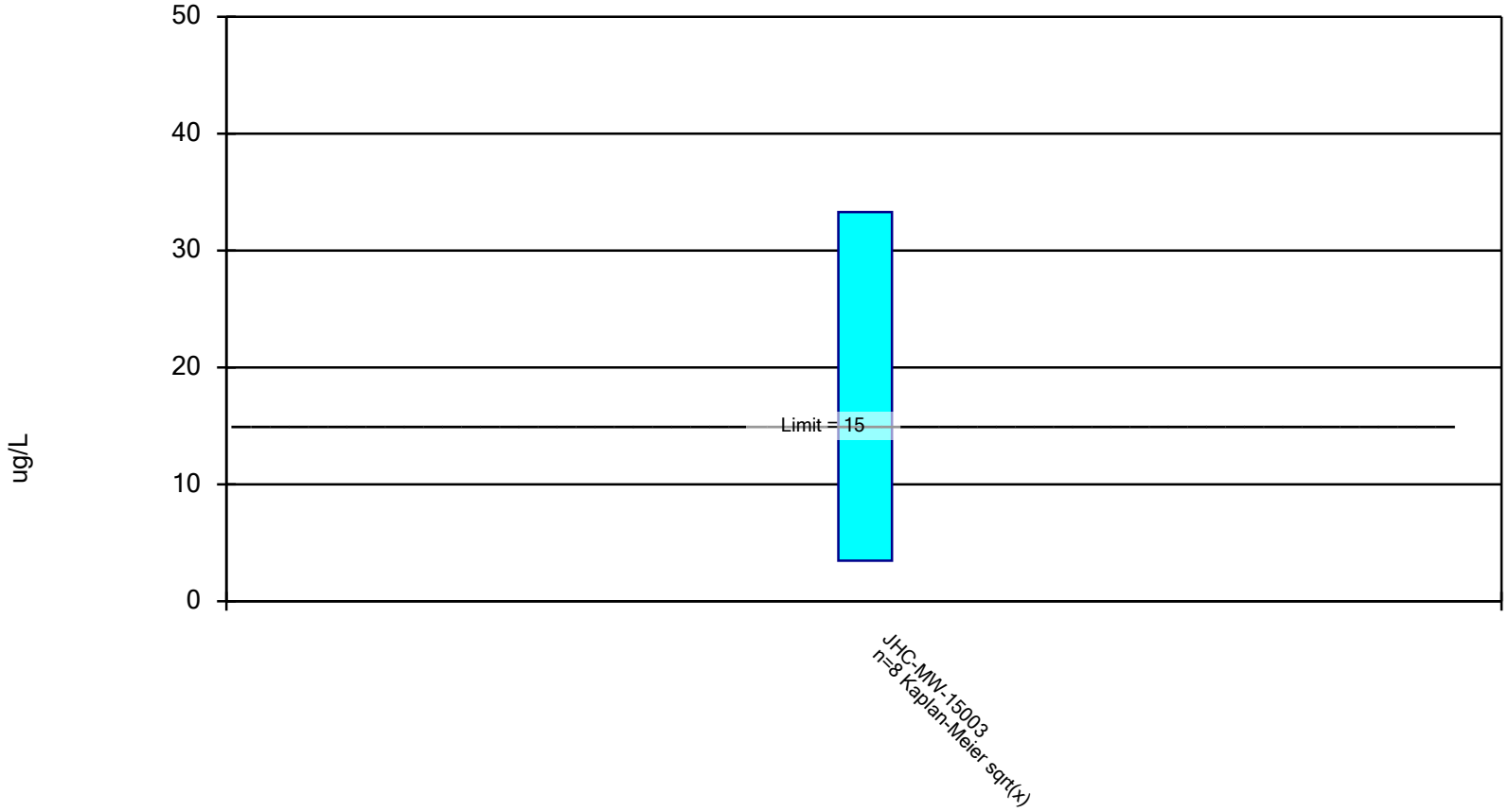
Constituent: Arsenic, Total (ug/L) Analysis Run 12/3/2020 1:36 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

	JHC-MW-15001	JHC-MW-15002	JHC-MW-15003	JHC-MW-18005
4/19/2017	4			
6/20/2017	1.8			
8/14/2017	2.2	44.5	23.7	
4/25/2018	<1	129	12.4	
6/18/2018	1.8		14.1	
6/19/2018		127		
11/13/2018	12.7			
11/15/2018		60.5	8.1	
12/7/2018				9.5
2/28/2019				10
4/25/2019	5.8	50		8.8
4/29/2019			10	
8/13/2019				7.4
10/9/2019	6.3	57	8.4	7.1
4/16/2020		45	9	8
10/22/2020		21	12	8
Mean	4.388	66.75	12.21	8.4
Std. Dev.	3.931	39.61	5.103	1.075
Upper Lim.	8.554	107	16.99	9.677
Lower Lim.	0.2205	29.18	7.657	7.123

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Cobalt, Total Analysis Run 12/3/2020 1:42 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

Confidence Interval

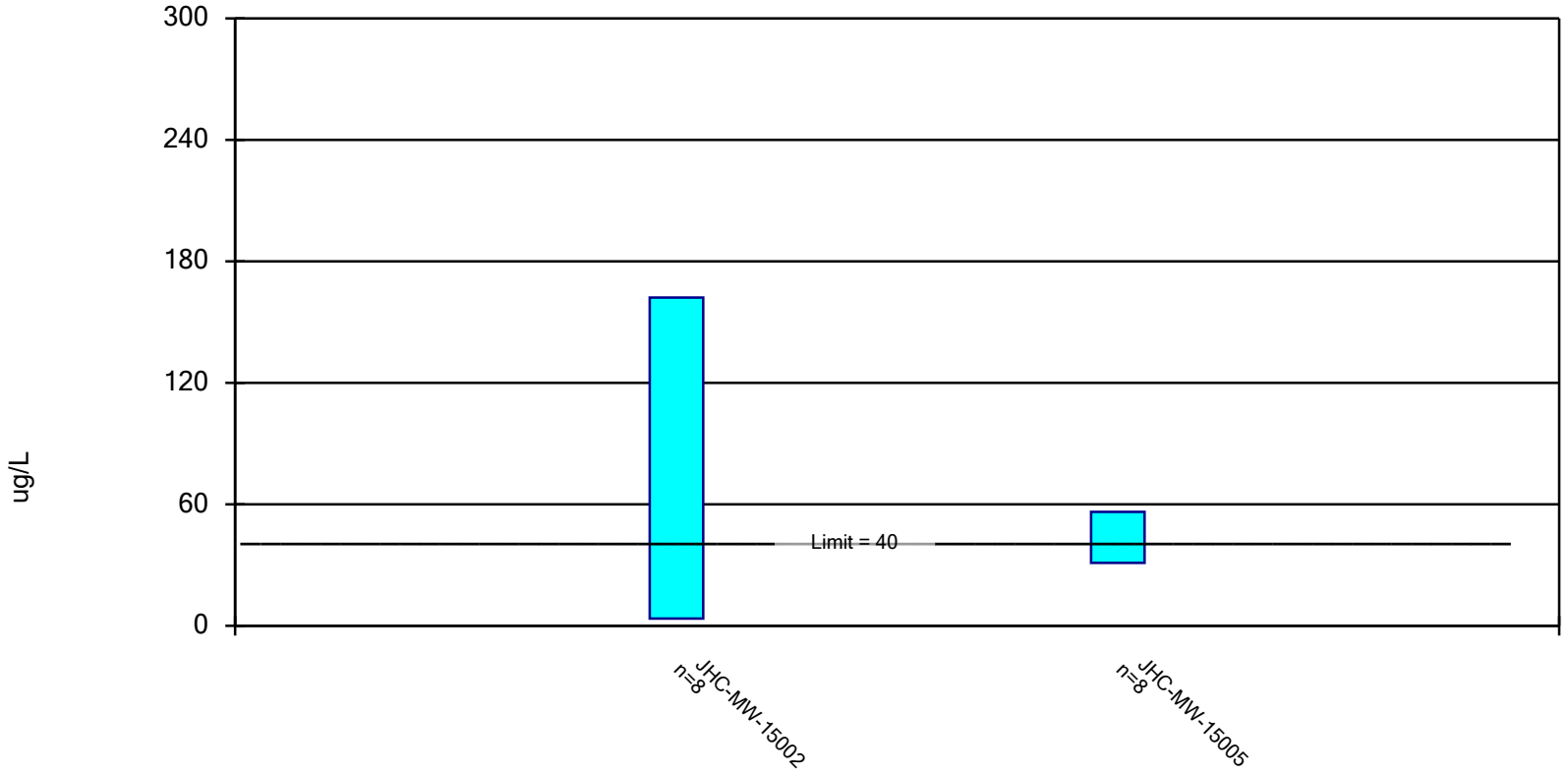
Constituent: Cobalt, Total (ug/L) Analysis Run 12/3/2020 1:43 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

	JHC-MW-15003
8/14/2017	<15
4/25/2018	<15
6/18/2018	<15
11/15/2018	23.6
4/29/2019	<6
10/9/2019	43
4/16/2020	47
10/22/2020	<15
Mean	22.45
Std. Dev.	14.73
Upper Lim.	33.27
Lower Lim.	3.464

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Lithium, Total Analysis Run 12/3/2020 1:42 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

Confidence Interval

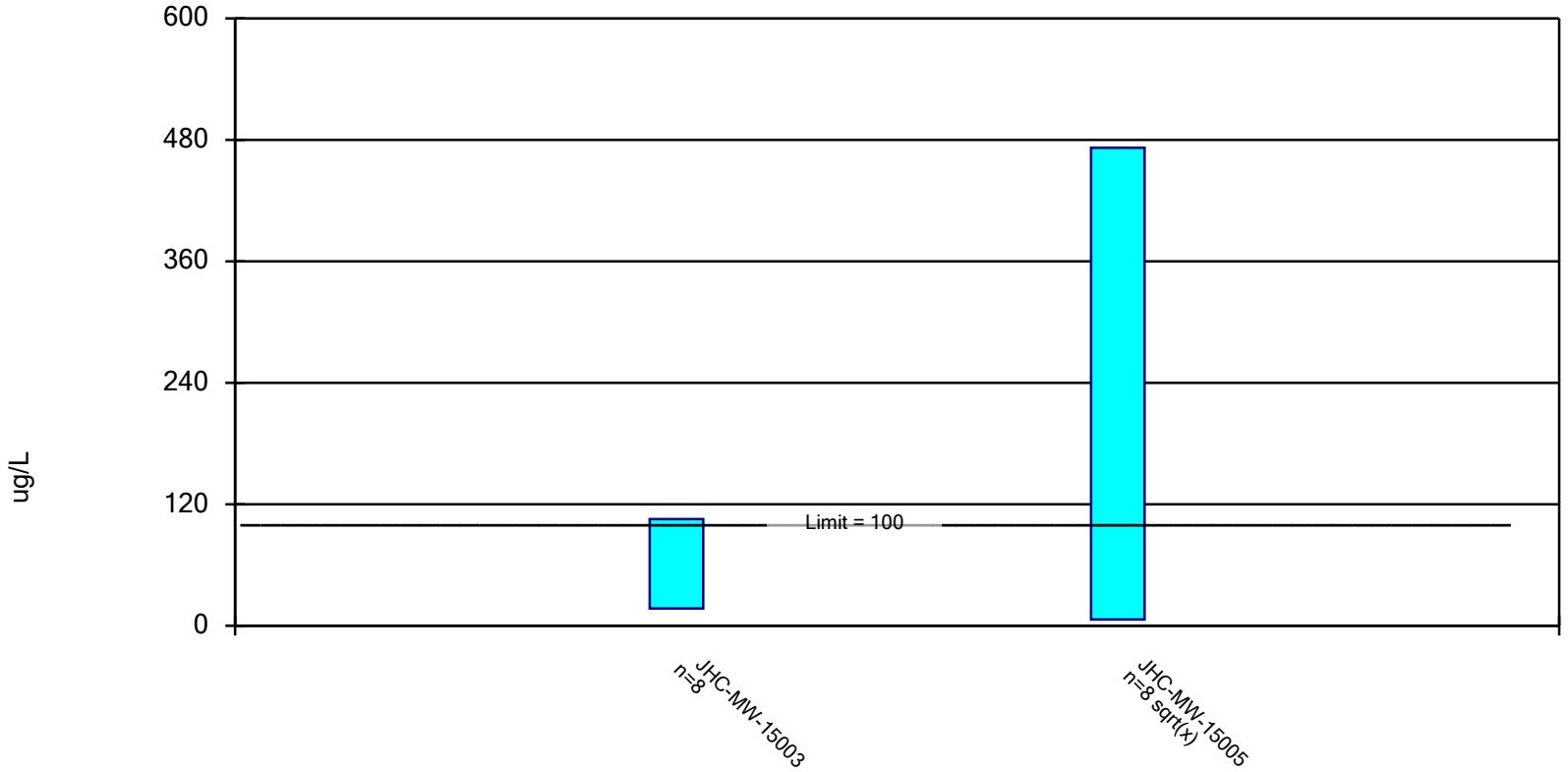
Constituent: Lithium, Total (ug/L) Analysis Run 12/3/2020 1:43 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

	JHC-MW-15002	JHC-MW-15005
8/14/2017	11	36
4/25/2018	28	61
6/19/2018	19	35
11/15/2018	68	28
4/25/2019	96	38
10/9/2019	240	50
4/16/2020	125	59
10/22/2020	76	42
Mean	82.88	43.63
Std. Dev.	74.8	11.89
Upper Lim.	162.2	56.23
Lower Lim.	3.596	31.02

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Molybdenum, Total Analysis Run 12/3/2020 1:42 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

Confidence Interval

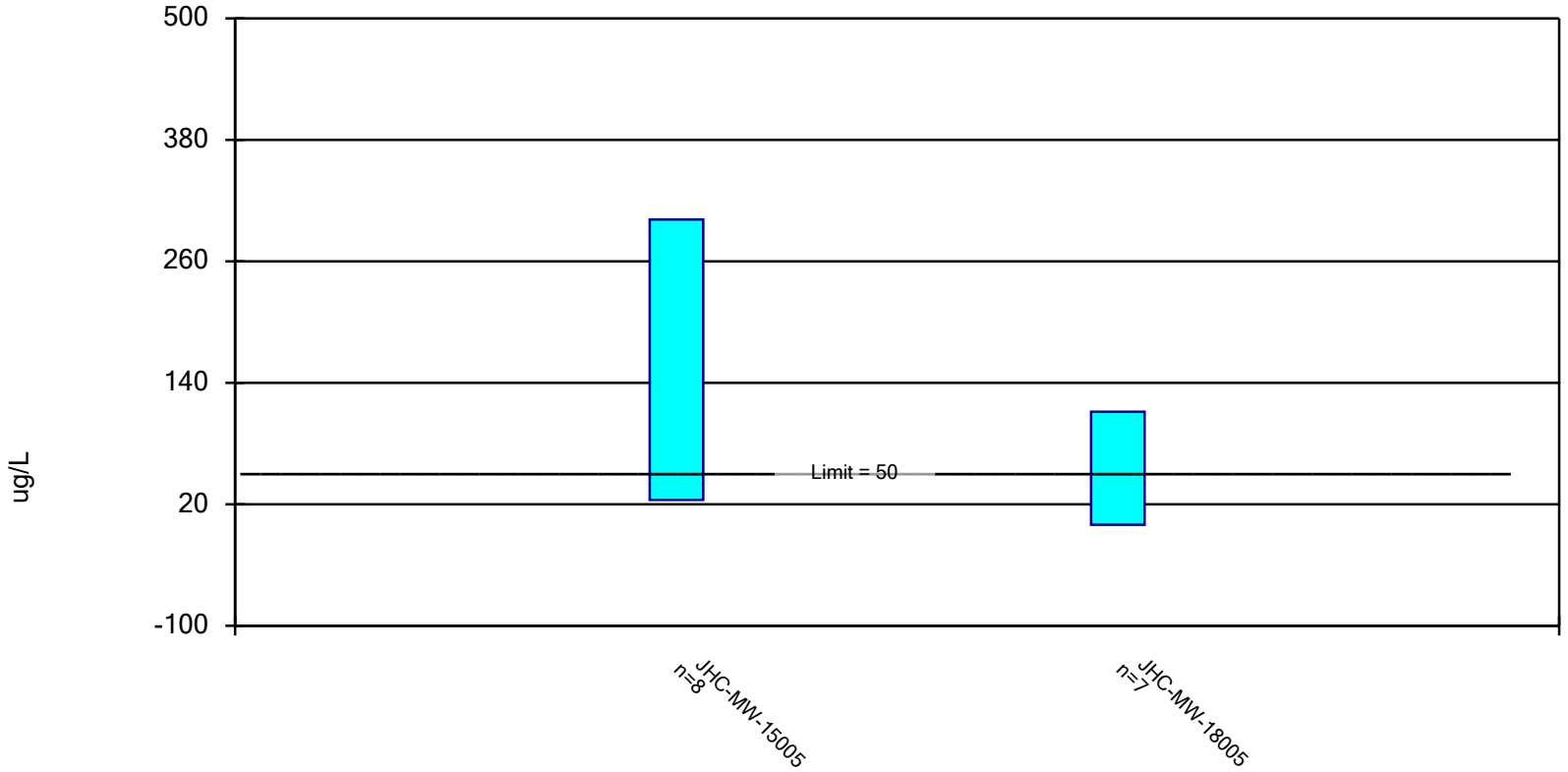
Constituent: Molybdenum, Total (ug/L) Analysis Run 12/3/2020 1:43 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

	JHC-MW-15003	JHC-MW-15005
8/14/2017	28.2	10
4/25/2018	19.3	31.2
6/18/2018	53	
6/19/2018		15.7
11/15/2018	65.3	222
4/25/2019		900
4/29/2019	20	
10/9/2019	120	370
4/16/2020	125	91
10/22/2020	59	110
Mean	61.23	218.7
Std. Dev.	41.68	301.2
Upper Lim.	105.4	472.2
Lower Lim.	17.05	6.186

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Selenium, Total Analysis Run 12/3/2020 1:42 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

Confidence Interval

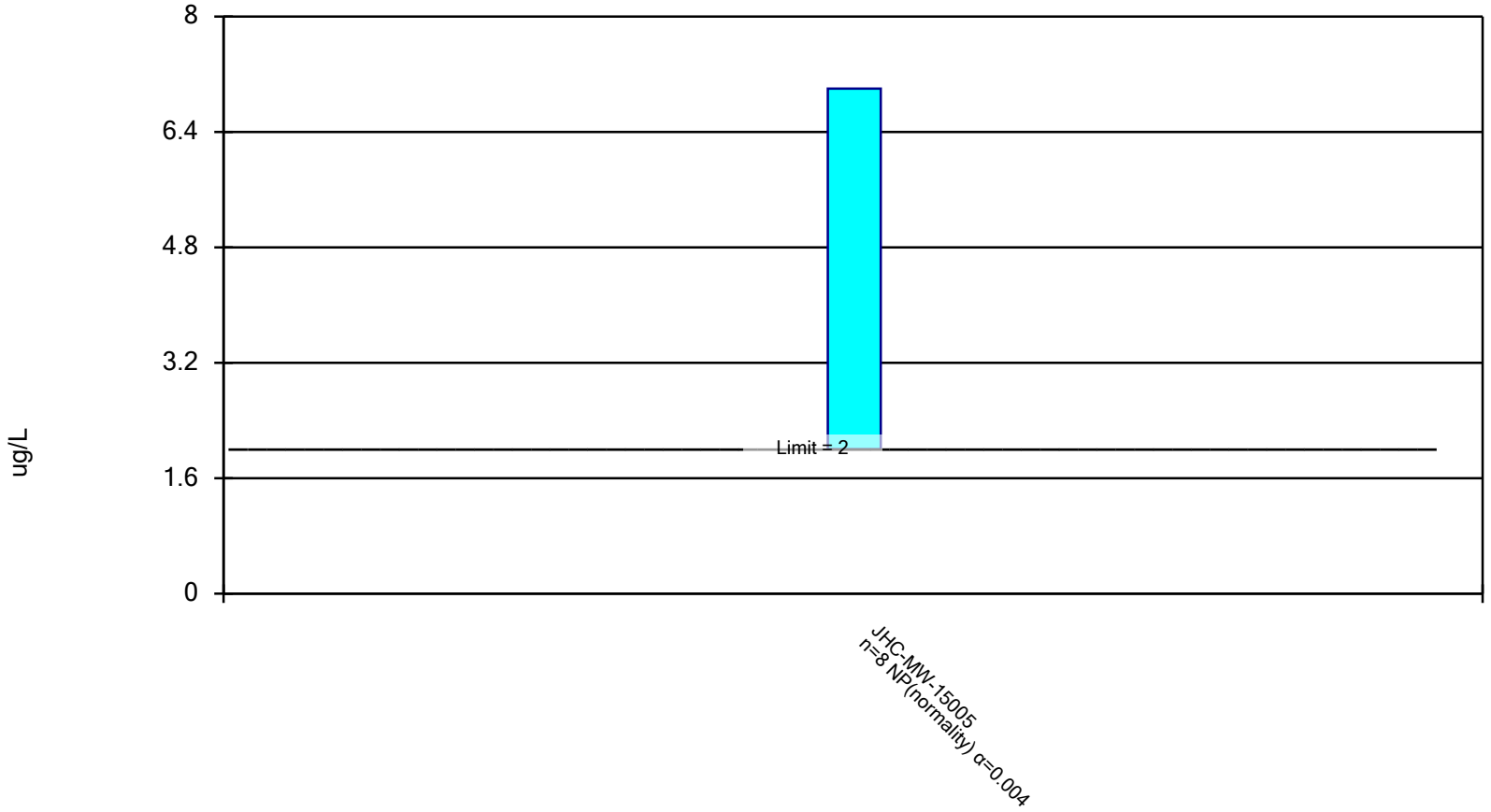
Constituent: Selenium, Total (ug/L) Analysis Run 12/3/2020 1:43 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

	JHC-MW-15005	JHC-MW-18005
8/14/2017	15.7	
4/25/2018	368	
6/19/2018	14	
11/15/2018	158	
12/7/2018		42
2/28/2019		35
4/25/2019	140	16
8/13/2019		11
10/9/2019	66	140
4/16/2020	282	46
10/22/2020	260	99
Mean	163	55.57
Std. Dev.	130.6	47.02
Upper Lim.	301.4	111.4
Lower Lim.	24.5	-0.2805

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Constituent: Thallium, Total Analysis Run 12/3/2020 1:42 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

Confidence Interval

Constituent: Thallium, Total (ug/L) Analysis Run 12/3/2020 1:43 PM

Client: Consumers Energy Data: JHC_CCR_BG_Ponds123_LF_20.11.30

	JHC-MW-15005
8/14/2017	<2
4/25/2018	5.8
6/19/2018	2.1
11/15/2018	<2
4/25/2019	2
10/9/2019	2.9
4/16/2020	3
10/22/2020	7
Mean	3.35
Std. Dev.	1.952
Upper Lim.	7
Lower Lim.	2

Appendix E
Semiannual Progress Report

January 30, 2021

Subject:
Semiannual Progress Report - Selection of Remedy
JH Campbell Bottom Ash Ponds 1-2 CCR Unit
JH Campbell Pond A CCR Unit

This Semiannual Progress Report, prepared as a requirement of §257.97(a) of 40 CFR Parts 257 and 261, Disposal of Coal Combustion Residuals from Electric Utilities, under subtitle D of the Resource Conservation and Recovery Act (RCRA), also known as the Coal Combustion Residuals (CCR) rule, describes progress toward selecting and designing remedies for two CCR units that triggered Assessment of Corrective Measures (ACM) under the CCR Rule at the JH Campbell Solid Waste Disposal Area: Bottom Ash Ponds 1-2 and Pond A. Based on the schedule of self-implementation prescribed in the CCR Rule, a progress report is required to be prepared semiannually upon completion of the Assessment of Corrective Measures Report until the remedy is selected. It is noteworthy that remedy selection for the Bottom Ash Ponds 1-2 and Pond A, prescribed by the CCR Rule, is being undertaken in coordination with a Michigan Department of Environment, Great Lakes, and Energy (EGLE) Consent Agreement 115-01-2018, which was executed on December 28, 2018.

Consumers Energy (CE) reported statistically significant exceedances above the groundwater protection standard (GWPS) for a single Appendix IV constituent, arsenic, in the "*Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g)*" (Consumers Energy Company, January 2019).

Unit with GWPS Exceedance	Constituent	# of Downgradient Wells Observed
Pond A	Arsenic	1 of 6
Bottom Ash Ponds 1-2	Arsenic	2 of 5

Subsequently, Assessment of Corrective Measures Reports (TRC, September 2019) were completed on September 11, 2019 for Bottom Ash Ponds 1-2 and Pond A.

Consumers Energy
Environmental Services
1945 W Parnall Rd. Jackson, MI 49201

An initial semi-annual progress report dated January 30th, 2020 was made available on the CE public-facing website as part of the "*2019 Annual Groundwater Monitoring and Corrective Action Report*" (TRC, January 2020) for Bottom Ash Ponds 1-2 and Pond A.

Assessment Activities

Bottom Ash Ponds 1-2

Consumers Energy has performed CCR removal at Bottom Ash Ponds 1-2 as documented in the "*JH Campbell Generating Facility Bottom Ash Ponds 1-2 Closure Plan*," (Golder, January 2018). Following the permanent cessation of hydraulic loading, CCR removal activities were completed in October 2018. On October 22, 2019 EGLE provided written concurrence that all bottom ash had been removed from Bottom Ash Ponds 1-2 based on multiple lines of evidence described in the approved closure work plan.

Consumers Energy continues to monitor Bottom Ash Ponds 1-2 semiannually for Appendix III and IV constituents.

Pond A

Consumers Energy closed Pond A according to the "*JH Campbell Generating Facility Pond A Closure Plan, West Olive, Michigan*" (Golder, October 2016) and an updated closure plan detailing the final cover system submitted to EGLE in February 2019. The state closure certification as required by Paragraph 4.2 of Consent Agreement WMRPD No. 115-01-2018 was approved by EGLE on November 25, 2019.

Since the installation of the final cover, three rounds of semiannual sampling have been conducted at Pond A. In accordance with Consent Agreement 115-01-2018, a revised Hydrogeological Monitoring Plan, *Pond A Hydrogeological Monitoring Plan, JH Campbell Power Plant, West Olive, Michigan* (HMP) (TRC, March 2019; Revised July 2019) was submitted to EGLE and approved in August 2019. The Pond A well network is being sampled quarterly under the EGLE-approved HMP.

2020 Data Analysis

Analytical results and details of the statistical evaluations from semiannual sampling are detailed in the respective "*2020 Annual Groundwater Monitoring and Corrective Action Report*" (TRC, January 2021) for each unit, to which this memo is appended. A summary of the results is included below.

Bottom Ash Ponds 1-2

Arsenic concentrations at MW-15002 reached a local maximum in 2018, during the same time period that significant earthwork was being completed to remove ash from the pond. There has been a steady decrease in observed concentrations of arsenic at MW-15002 since ash removal was completed, including the most recent results collected in 2020. Concentrations of arsenic at MW-15003 have remained steady at or near the GWPS since 2018.

Since the cessation of hydraulic loading and removal of CCR at Bottom Ash Ponds 1-2, groundwater flow direction has changed significantly and MW-15002 and MW-15003 are no longer downgradient of the former CCR unit. Concentrations at these wells are not necessarily representative of groundwater that is solely influenced by Bottom Ash Ponds 1-2. The wells continue to be monitored to evaluate groundwater quality since the removal of CCR.

As detailed in Section 4.1 of the *2020 Annual Groundwater Monitoring and Corrective Action Report*" (TRC, January 2021) for Bottom Ash Ponds 1-2, Nature and Extent sampling performed pursuant to 257.95(g)(1) demonstrates that arsenic is not observed at levels which threaten human health or the environment in downgradient wells, and exceedances of the GWPS for arsenic are limited to Consumers Energy property near the solid waste boundary of the former unit.

Pond A

Arsenic concentrations exceed the GWPS at a single well, MW-15011. These concentrations reached an apparent local maximum coincidental to the installation of the final cover system in 2019. Subsequent rounds of quarterly and semiannual sampling for arsenic at MW-15011 show a visual decline since final cover installation. Semiannual sampling results in 2020 may indicate that arsenic concentrations are equilibrating.

No additional statistically significant observations were made in the 2020 data set. Nature and Extent sampling continues to demonstrate the arsenic is not found at wells downgradient of Pond A at levels which exceed the GWPS. The dewatering of the impoundment in 2018 followed by the

completion of the final cover in 2019 has changed groundwater flow direction. Mounding is no longer observed near the unit, and static water levels have dropped by multiple feet.

Conclusions

Bottom Ash Ponds 1-2

The general decrease in arsenic concentrations suggest that source removal continues to have an observable impact on groundwater quality. Changing concentrations indicate that the system is establishing a new equilibrium following source removal. Nature and Extent sampling suggests that the GWPS exceedances do not pose an immediate threat to human health or the environment. Continued monitoring at Bottom Ash Ponds 1-2 is appropriate to understand the new geochemical equilibrium being established at the former unit and determine if the formal selection of a remedy beyond source control is required.

Pond A

Additional data gathering activities will be conducted downgradient of Pond A in 2021 to support the development of the Remedial Action Plan being submitted to the State of Michigan under Consent Agreement 115-01-2018. These data collection activities will further refine the definition of the nature and extent of arsenic concentrations associated with CCR management at the JH Campbell site and inform the selection of a final remedy, if necessary, following source control at Pond A.

Remedy Selection Process

The ACM Report identified source removal and final cover as primary corrective actions for Ponds 1-2 and Pond A, respectively, but also considered five technically feasible groundwater management alternatives to address the potential for residual arsenic. Additional data collected under the state and federal groundwater monitoring programs is being used to inform remedy selection and the creation of a Remedial Action Plan under the December 2018 agreement with EGLE.

If necessary, following the source control activities, the remedy for Ponds 1-2 and Pond A will be formally selected per §257.97 once the selected option is reviewed and commented on by EGLE and a public meeting is conducted at least 30-days prior to the final selection as required under §257.96(e).

References

Consumers Energy Company. January 2020. Initial Semiannual Progress Report, JH Campbell Bottom Ash Ponds 1-2 CCR Unit, JH Campbell Pond A CCR Unit.

Consumers Energy Company. January 14, 2019. Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g), JH Campbell Ponds 1-2 CCR Unit.

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Golder Associates. January 2018. JH Campbell Generating Facility Bottom Ash Ponds 1-2 Closure Plan, West Olive, Michigan. Prepared for Consumers Energy Company.

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TRC Environmental Corporation. January 2021. 2020 Annual Groundwater Monitoring and Corrective Action Report, JH Campbell Power Plant, Ponds 1-2 North and 1-2 South CCR Unit. Prepared for Consumers Energy Company.

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TRC Environmental Corporation. March 2019; Revised July 2019. Pond A Hydrogeological Monitoring Plan, JH Campbell Power Plant, West Olive, Michigan. Prepared for Consumers Energy Company