2021 Annual Groundwater Monitoring and Corrective Action Report

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

West Olive, Michigan

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Executive Summary

On behalf of Consumers Energy, TRC has prepared this report for the JH Campbell (JHC) Ponds 1-2 Coal Combustion Residual (CCR) unit to cover the period of January 1, 2021 to December 31, 2021. 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 2021 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 14, 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 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. 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. Concentrations of selenium present at statistically significant levels above the GWPS in one of the five Ponds 1-2 monitoring wells were successfully attributed to an alternate source in the *Alternative Source Demonstration: Selenium at JHC-MW-15005* prepared by TRC in October 2021. 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.

Remedy selection for Ponds 1-2, prescribed by the CCR Rule, is being undertaken in coordination with a Michigan Department of Environment, Great Lakes, and Energy (EGLE) Consent Agreement WMRPD No. 115-01-2018, which was executed on December 28, 2018. The January 2022 semiannual progress report describing the progress in selecting and designing the remedy required pursuant to §257.97(a) is included in this report. CCR removal activities at Ponds 1-2 were completed in October 2018 and 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.

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 and that an alternate source is impacting groundwater monitoring in the Ponds 1-2 well network, particularly at wells located along the east edge of Ponds 1-2. The groundwater management remedy for 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, 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 2022.

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 (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 Ponds 1-2 to cover the period of January 1, 2021 to December 31, 2021. 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 2021 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 14, 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.

The groundwater management remedy for 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, 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 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. Site features are shown on Figure 2.

The surface impoundments in the wet ash pond areas were decommissioned starting in 2017 and replaced with concrete bottom ash treatment tanks. 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 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 at elevations ranging from 604 feet near the background wells to 590 feet along the southeast corner of the Dry Ash Landfill and south of the former Ponds 1-2 and Pond A CCR surface impoundments 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 Ponds 1-2, which currently consists of 11 monitoring wells (6 background monitoring wells, 3 downgradient monitoring wells, and 2 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, as documented in the *2020 Annual Groundwater Monitoring Report, JH Campbell Power Plant, Unit 1-2 North and 1-2 South CCR Unit* (2020 Annual Report) (TRC, January 2021), since Ponds 1-2 has been deconstructed and groundwater levels have re-equilibrated, dry conditions were observed at JHC-MW-15001. 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, the monitoring well was removed from the monitoring network.

No changes were made to the Ponds 1-2 well network in 2021. The Ponds 1-2 monitoring wells currently 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 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 *Sample Analysis Plan* for JH Campbell Ponds 1-2 and Pond 3 (SAP) (TRC, 2021).

2.2.1 Data Summary

The first semiannual groundwater assessment monitoring event for 2021 was performed on April 12 through 14, 2021 and the second semiannual groundwater assessment monitoring event for 2021 was performed on October 19 through 22, 2021. Both events were performed by Consumers Energy, and samples were analyzed by Consumers Energy Laboratory Services in Jackson, Michigan, with radium samples analyzed by TestAmerica Laboratories in St Louis, Missouri, 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.

A summary of the groundwater data collected during the April and October 2021 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 A.

2.2.3 Groundwater Flow Rate and Direction

Groundwater elevations measured across the Site during the April and October 2021 events are provided on Table 1. April 2021 and October 2021 groundwater elevations were used to construct the groundwater contour maps provided on Figure 3 and Figure 4, respectively. The average hydraulic gradient of 0.0038 ft/ft in April 2021 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). The average hydraulic gradient of 0.0036 ft/ft in October 2021 was calculated using the following well pairs: JHC-MW-15026/PZ-23S, JHC-MW-15017/PZ-24S, and JHC-MW-15024/JHC-MW-15031 (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 0.59 ft/day or 215 ft/year for the April 2021 event, and approximately 0.56 ft/day or 200 ft/year for the October 2021 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 2021 groundwater data in accordance with the assessment monitoring program. The statistical evaluation details are provided in Appendix B (*April 2021 Statistical Evaluation of Initial Assessment Monitoring Event*) and Appendix C (*October 2021 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 initial semiannual assessment monitoring event (June 2018). Therefore, Consumers Energy initiated an Assessment of Corrective Measures (ACM). Assessment monitoring is ongoing.

The comparison of assessment monitoring data from the first semiannual monitoring event of 2021 identified a new statistically significant exceedance of the GWPS for selenium at JHC-MW-15005. In response, Consumers Energy prepared the *Alternative Source Demonstration: Selenium at JHC-MW-15005* (October 2021 ASD) included in Appendix D. The multiple lines of evidence presented in the ASD show that hydrogeological and geochemical changes post-CCR removal from Ponds 1-2 resulted in observations of new increases in groundwater constituent concentrations for several Appendix III and Appendix IV parameters in the Ponds 1-2 monitoring network, including selenium at JHC-MW-15005. The ASD concludes that the statistically significant exceedance of the GWPS for selenium at JHC-MW-15005 is unrelated to Ponds 1-2 and is occurring as groundwater responds and re-equilibrates to the new geochemical conditions coupled with the migration of constituent concentrations from an alternate source. Based on the successful ASD, selenium at JHC-MW-15005 was not included in the second semiannual event statistical evaluation. Concurrently, Consumers Energy is in the process of addressing the alternate source through a remedial action plan in coordination with the Michigan

Department of Environment, Great Lakes, and Energy (EGLE) under Consent Agreement 115-01-2018, which was executed on December 28, 2018. As such, the Appendix C statistical evaluation continues to include the detected Appendix IV constituents across the Ponds 1-2 well network, with the exception of selenium at JHC-MW-15005.

Overall, the statistical evaluations have confirmed that arsenic is the only Appendix IV constituent present at statistically significant levels above the GWPSs not attributed to an alternative source at this time. 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 B and C, 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-15002 and JHC-MW-15003 are no longer downgradient of groundwater flow across the Ponds 1-2 area. Additionally, as discussed in the October 2021 ASD, groundwater at JHC-MW-15002 and JHC-MW-15003 are influenced by an adjacent alternate source. 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 while the use of these wells in the groundwater monitoring system is re-evaluated. A summary of the confidence intervals for April 2021 and October 2021 are provided in Table 5 and Table 6, respectively.

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 14, 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 2021 are provided on Table 7 (Nature and Extent analytical). 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 is following 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.

4.3 Remedy Selection

Remedy selection for Ponds 1-2, prescribed by the CCR Rule, is being undertaken in coordination with a Michigan Department of Environment, Great Lakes, and Energy (EGLE) Consent Agreement WMRPD No. 115-01-2018, which was executed on December 28, 2018. The January 2022 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. 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 and that the immediately adjacent closed CCR units are impacting groundwater quality in the Ponds 1-2 well network, particularly at wells located along the east edge of Ponds 1-2.

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.

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 following the completion of CCR removal at Ponds 1-2 indicate that the system is establishing a new equilibrium following source removal and that the immediately adjacent closed CCR units are impacting groundwater quality in the Ponds 1-2 well network.

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 2022.

6.0 References

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USEPA. April 2018. Barnes Johnson (Office of Resource Conservation and Recovery) to James Roewer (c/o Edison Electric Institute) and Douglas Green, Margaret Fawal (Venable LLP). Re: Coal Combustion Residuals Rule Groundwater Monitoring Requirements. April 30, 2018. United States Environmental Protection Agency, Washington, D.C. 20460. Office of Solid Waste and Emergency Response, now the Office of Land and Emergency Management.

Tables

Table 1
Summary of Groundwater Elevation Data – April 2021 - October 2021
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 12, 2021		October 19, 2021	
							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	17.63	602.35	19.00	600.98
JHC-MW-15024	613.79	616.62	Sand	606.8	to	596.8	12.92	603.70	14.15	602.47
JHC-MW-15025	614.14	617.17	Sand	607.1	to	597.1	12.12	605.05	13.36	603.81
JHC-MW-15026	615.09	618.04	Sand	607.1	to	597.1	13.85	604.19	15.11	602.93
JHC-MW-15027	614.77	617.30	Sand	604.8	to	594.8	14.22	603.08	15.47	601.83
JHC-MW-15028	611.02	613.80	Sand	603.0	to	593.0	14.03	599.77	15.06	598.74
JHC-MW-15029	608.08	610.95	Sand	600.1	to	590.1	11.55	599.40	12.11	598.84
JHC-MW-15030	604.05	607.17	Sand	600.1	to	590.1	9.58	597.59	10.32	596.85
Pond 1N, 1S, 2N, 2S										
JHC-MW-15001	607.02	609.53	Sand	603.5	to	598.5	11.49	598.04	Dry	
JHC-MW-15002	618.18	621.27	Sand	590.2	to	580.2	25.16	596.11	25.35	595.92
JHC-MW-15003	623.16	627.20	Sand	595.2	to	585.2	33.31	593.89	33.47	593.73
JHC-MW-15005	606.22	609.99	Sand	579.2	to	569.2	18.50	591.49	18.50	591.49
JHC-MW-18004	602.92	605.72	Sand	596.9	to	586.9	12.37	593.35	12.69	593.03
JHC-MW-18005	600.30	603.16	Sand	595.3	to	585.3	10.50	592.66	11.90	591.26
Pond 3N, 3S										
JHC-MW-15013	632.40	635.25	Sand	604.4	to	594.4	35.75	599.50	35.91	599.34
JHC-MW-15015	632.46	635.20	Sand	604.5	to	594.5	35.07	600.13	35.30	599.90
JHC-MW-15016	631.81	632.52	Sand	603.8	to	593.8	32.44	600.08	33.71	598.81[5]
JHC-MW-18001	609.09	611.98	Sand	603.1	to	593.1	12.52	599.46	12.85	599.13
JHC-MW-18002	605.53	608.93	Sand	602.0	to	592.0	9.48	599.45	9.67	599.26
JHC-MW-18003	605.36	608.78	Sand	601.9	to	591.9	9.38	599.40	9.61	599.17
Landfill										
JHC-MW-15017	613.69	616.61	Sand	603.7	to	593.7	15.57	601.04[3]	16.40	600.21
JHC-MW-15018	614.26	617.02	Sand	604.3	to	594.3	16.30	600.72[3]	17.05	599.97
JHC-MW-15019	609.81	612.86	Sand	603.8	to	593.8	12.64	600.22[3]	Decommissioned	
JHC-MW-15022	620.92	623.79	Sand	597.9	to	587.9	28.76	595.03[4]	29.53	594.26
JHC-MW-15031	632.94	635.87	Sand	599.9	to	589.9	43.31	592.56[4]	43.65	592.22
JHC-MW-15032	611.32	614.29	Sand	598.3	to	588.3	16.98	597.31[3]	17.99	596.30
JHC-MW-15033	618.08	620.99	Sand	602.1	to	592.1	21.82	599.17[3]	23.03	597.96
JHC-MW-15034	612.90	615.97	Sand	601.9	to	591.9	15.71	600.26[3]	16.97	599.00
JHC-MW-15035	632.53	634.28	Sand	599.5	to	589.5	40.75	593.53	41.11	593.17
JHC-MW-15036	617.94	618.34	Sand	597.9	to	587.9	26.70	591.64	27.13	591.21
JHC-MW-15037	614.28	616.06	Sand	591.3	to	586.3	25.05	591.01	25.55	590.51
Pond A										
JHC-MW-15006	624.74	627.58	Sand	599.7	to	589.7	35.22	592.36	35.91	591.67
JHC-MW-15007	624.82	627.70	Sand	602.8	to	592.8	Dry		Decommissioned	
JHC-MW-15007R[2]	625.73	628.26	Sand	595.7	to	585.7	Not Installed		37.00	591.26
JHC-MW-15008R[1]	632.32	634.67	Sand	597.3	to	587.3	43.24	591.43	44.04	590.63
JHC-MW-15009	632.33	635.32	Sand	602.3	to	592.3	Dry		Decommissioned	
JHC-MW-15009R[2]	632.15	635.05	Sand	595.2	to	585.2	Not Installed		43.87	591.18
JHC-MW-15010	632.55	635.57	Sand	602.6	to	592.6	Dry		Decommissioned	
JHC-MW-15011	627.71	630.83	Sand	600.7	to	590.7	38.87	591.96	Decommissioned	
JHC-MW-15011R[2]	627.73	629.79	Sand	594.7	to	584.7	Not Installed		38.29	591.50
Downgradient Wells										
MW-13	593.40	595.37	Clayey Silt	587.9	to	585.4	Dry		Dry	
MW-14S	587.36	590.98	Sand	582.9	to	577.9	9.60	581.38	10.02	580.96
PZ-23S	602.84	604.97	Sand	591.8	to	586.8	15.96	589.01	15.61	589.36
PZ-24S	586.56	590.15	Sand	584.6	to	579.6	7.23	582.92	8.59	581.56
PZ-40S	589.51	593.25	Sand	585.5	to	575.5	10.83	582.42	11.99	581.26
TW-19-04A	608.15	611.44	Sand	591.2	to	586.2	22.34	589.10	23.00	588.44
TW-19-05	603.44	606.36	Sand	592.8	to	587.8	16.03	590.33	17.09	589.27
TW-19-06A	599.61	602.54	Sand	592.3	to	587.3	13.18	589.36	14.13	588.41

Notes:
Survey conducted by Nederveld, November 2015, October 2018, December 2018, August 2019, and July 2021.
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.
(2) JHC-MW-15007R, JHC-MW-15009R, and JHC-MW-15011R installed in July 2021.
(3) Static water level data collected on April 13, 2021.
(4) Static water level data collected on April 14, 2021.
(5) Static water level data collected on October 20, 2021.

Table 2
Summary of Field Parameters: April 2021 to October 2021
JH Campbell Ponds 1-2N/1-2S - 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	4/12/2021	0.71	242.9	5.3	108	10.8	3.4
	10/20/2021	0.93	208.3	5.8	91	13.8	2.1
JHC-MW-15024	4/13/2021	0.43	171.4	6.8	322	9.3	3.4
	10/20/2021	0.79	124.8	7.0	422	12.4	4.5
JHC-MW-15025	4/13/2021	1.53	209.8	6.7	254	7.5	2.5
	10/19/2021	0.74	144.5	7.8	340	13.1	4.5
JHC-MW-15026	4/13/2021	3.12	224.3	5.6	84	8.5	5.0
	10/19/2021	0.50	181.6	5.7	45	14.5	2.3
JHC-MW-15027	4/13/2021	1.75	130.7	5.7	76	7.9	5.7
	10/19/2021	0.63	69.4	5.9	107	16.0	8.3
JHC-MW-15028	4/12/2021	5.16	166.8	7.6	114	9.2	5.3
	10/19/2021	2.32	52.6	8.3	159	14.8	4.9
Ponds 1-2N/1-2S							
JHC-MW-15002	4/14/2021	0.58	39.1	5.3	785	13.2	9.7
	10/21/2021	0.20	-8.1	6.5	840	12.8	3.8
JHC-MW-15003	4/14/2021	0.27	-137.5	8.2	826	15.1	2.8
	10/20/2021	0.08	6.0	8.2	790	14.1	1.4
JHC-MW-15005	4/13/2021	3.04	138.2	7.4	717	9.3	3.5
	10/21/2021	0.39	32.9	7.5	735	14.6	0.0
JHC-MW-18004	4/13/2021	2.08	173.4	7.7	688	10.5	3.3
	10/22/2021	0.62	118.6	7.7	623	15.7	3.6
JHC-MW-18005	4/13/2021	1.58	133.1	8.7	463	10.7	2.0
	10/22/2021	1.04	142.7	8.4	521	15.7	2.3

Notes:
mg/L - Milligrams per Liter.
mV - Millivolts.
SU - Standard Units.
umhos/cm - Micromhos per centimeter.
°C - Degrees Celsius.
NTU - Nephelometric Turbidity Unit.

Table 3
Summary of Groundwater Sampling Results (Analytical): April 2021 - October 2021
JH Campbell Background – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15023		JHC-MW-15024		JHC-MW-15025		JHC-MW-15026		JHC-MW-15027		JHC-MW-15028	
					Sample Date:	4/12/2021	10/20/2021	4/13/2021	10/20/2021	4/13/2021	10/19/2021	4/13/2021	10/19/2021	4/13/2021	10/19/2021	4/12/2021	10/19/2021
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	Background											
Appendix III[(1)]																	
Boron	ug/L	NC	500	500	7,200	50	41	21	< 20	20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Calcium	mg/L	NC	NC	NC	500[EE]	11.1	10.7	36.8	40.2	19.8	24.2	9.23	4.01	10.9	13.4	14.0	20.0
Chloride	mg/L	250**	250[E]	250[E]	500[EE]	2.64	3.60	21.5	47.1	19.5	23.3	4.05	1.09	< 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	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250**	250[E]	250[E]	500[EE]	12.2	11.8	8.14	7.53	9.02	8.98	6.88	5.81	7.09	7.89	5.99	5.90
Total Dissolved Solids	mg/L	500**	500[E]	500[E]	500	66	77	175	242	135	259	51	34	56	71	65	203
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5[E]**	**6.5 - 8.5[E]**	**6.5 - 9.0**	**5.3**	**5.8**	6.8	7.0	6.7	7.8	**5.6**	**5.7**	**5.7**	**5.9**	7.6	8.3
Appendix IV[(1)]																	
Antimony	ug/L	6	6.0	6.0	130	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	10	10	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Barium	ug/L	2,000	2,000	2,000	820	17	21	17	25	6	6	10	8	8	15	5	8
Beryllium	ug/L	4	4.0	4.0	18	< 1	< 1	< 1	< 1	< 1	< 1	< 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	< 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	< 1	< 1	< 1	< 1	< 1	< 1
Cobalt	ug/L	NC	40	100	100	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 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	< 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	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	170	350	440	< 10	< 10	< 10	< 10	< 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	< 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	< 5	< 5	< 5	< 5	< 5	< 5
Radium-226	pCi/L	NC	NC	NC	NC	< 0.120	< 0.148	< 0.146	< 0.144	< 0.115	< 0.155	< 0.125	< 0.154	< 0.129	< 0.131	< 0.115	< 0.127
Radium-226	pci/L																
Radium-228	pci/L																
Radium-226/228	pci/L																
Radium-228	pCi/L	NC	NC	NC	NC	0.478	< 0.407	< 0.472	< 0.349	< 0.414	< 0.434	< 0.434	0.449	< 0.434	< 0.380	< 0.435	< 0.393
Radium-226/228	pCi/L	5	NC	NC	NC	0.501	< 0.407	< 0.472	0.364	< 0.414	< 0.434	0.449	0.573	< 0.434	< 0.380	< 0.435	< 0.393
Selenium	ug/L	50	50	50	5.0	< 1	< 1	< 1	2	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Thallium	ug/L	2	2.0	2.0	3.7	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2

Notes:

ug/L - micrograms per liter; mg/L - milligrams per liter.
pCi/L - picocuries per liter; SU - standard units; pH is a field parameter.
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 21, 2020.
** - 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 MDEQ policy and procedure 09-014 dated June 20, 2012.
[E] - Criterion is the aesthetic drinking water value per footnote {E}.
[EE] - Criterion is based on the total dissolved solids GSI value per footnote {EE}.
(1) 40 CFR Part 257 Appendix III Detection Monitoring Constituents and Appendix IV Assessment Monitoring Constituents.
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 2021 - October 2021
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	**JHC-MW-15002**[2]		**JHC-MW-15003**[2]		**JHC-MW-15005**		**JHC-MW-18004**		**JHC-MW-18005**	
					Sample Date:	4/14/2021	10/21/2021	4/14/2021	10/20/2021	4/13/2021	10/21/2021	4/13/2021	10/22/2021	4/13/2021	10/22/2021
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	sidegradient				downgradient					
Appendix III[1]															
Boron	ug/L	NC	**500**	**500**	7,200	**4,880**	**2,350**	**674**	**1,060**	**616**	**661**	444	456	382	408
Calcium	mg/L	NC	NC	NC	500[EE]	103	112	108	101	99.7	86.1	88.9	73.1	45.5	55.7
Chloride	mg/L	250**	250[E]	250[E]	500[EE]	14.2	18.1	24.2	16.6	6.19	14.1	5.17	10.8	16.6	8.25
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	**250****	**250**[E]	**250**[E]	500[EE]	**499**	**263**	207	172	88.8	138	64.4	69.3	75.3	79.9
Total Dissolved Solids	mg/L	**500****	**500**[E]	**500**[E]	**500**	**583**	**570**	**573**	**542**	470	489	418	407	287	337
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**[E]	**6.5 - 8.5**[E]	**6.5 - 9.0**	**5.3**	6.5	8.2	8.2	7.4	7.5	7.7	7.7	**8.7**	8.4
Appendix IV[1]															
Antimony	ug/L	6	6.0	6.0	130	< 1	< 1	1	< 1	2	3	< 1	< 1	< 1	< 1
Arsenic	ug/L	**10**	**10**	**10**	**10**	**36**	**38**	**15**	**24**	3	2	< 1	1	8	8
Barium	ug/L	2,000	2,000	2,000	820	49	47	75	75	208	229	325	361	201	310
Beryllium	ug/L	4	4.0	4.0	18	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	5.0	5.0	3.5	< 0.2	< 0.2	< 0.2	0.3	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	100	100	11	1	< 1	3	9	1	< 1	< 1	< 1	< 1	< 1
Cobalt	ug/L	NC	40	100	100	< 6	< 6	< 6	22	< 6	< 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	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4.0	4.0	39	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	170	350	440	48	24	< 10	< 10	20	46	< 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	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	**73**	210	3,200	12	**101**	38	52	**88**	50	7	7	7	< 5
Radium-226	pCi/L	NC	NC	NC	NC	0.302	0.332	0.170	0.358	0.264	0.570	0.243	0.583	0.225	0.316
Radium-228	pCi/L	NC	NC	NC	NC	0.524	0.823	< 0.423	< 0.517	< 0.360	0.553	0.642	< 0.355	< 0.395	< 0.498
Radium-226/228	pCi/L	5	NC	NC	NC	0.827	1.16	< 0.423	< 0.517	0.510	1.12	0.885	0.745	< 0.395	0.507
Selenium	ug/L	**50**	**50**	**50**	**5.0**	1	1	**25**	**38**	**165**	**98**	**39**	**34**	**58**	**31**
Thallium	ug/L	**2**	**2.0**	**2.0**	**3.7**	< 2	< 2	< 2	< 2	**3**	**4**	< 2	< 2	< 2	< 2

Notes:

ug/L - micrograms per liter; mg/L - milligrams per liter.
pCi/L - picocuries per liter; SU - standard units; pH is a field parameter.
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 21, 2020.
** - 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 MDEQ policy and procedure 09-014 dated June 20, 2012.
[E] - Criterion is the aesthetic drinking water value per footnote {E}.
[EE] - Criterion is based on the total dissolved solids GSI value per footnote {EE}.
(1) 40 CFR Part 257 Appendix III Detection Monitoring Constituents and Appendix IV Assessment Monitoring Constituents.
(2) Monitoring wells 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.
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 5
Summary of Groundwater Protection Standard Exceedances – April 2021
JH Campbell Unit 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

Constituent	Units	GWPS	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
Arsenic	ug/L	10	28	110	8.2	14	--	--	7.2	9.6
Cobalt	ug/L	15	--	--	6.0	47	--	--	--	--
Lithium	ug/L	40	12	160	--	--	27	57	--	--
Molybdenum	ug/L	100	--	--	19	110	16	470	--	--
Selenium	ug/L	50	--	--	--	--	58[2]	310[2]	9.2	102
Thallium	ug/L	2	--	--	--	--	1.2	5.5	--	--

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 wells 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.

(2) The concentrations of selenium at JHC-MW-15005 are not a result of a release from the unit, as detailed in the Alternate Source Demonstration: Selenium at JHC-MW-15005 (TRC, October 2021).

Table 6
Summary of Groundwater Protection Standard Exceedances – October 2021
JH Campbell Unit 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

Constituent	Units	GWPS	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
Arsenic	ug/L	10	26	85	7.5	18	--	--	7.2	9.3
Cobalt	ug/L	15	--	--	3.1	37	--	--	--	--
Lithium	ug/L	40	11	160	--	--	27	53	--	--
Molybdenum	ug/L	100	3.2	61	27	110	19	470	--	--
Selenium	ug/L	50	--	--	--	--	--[2]	--[2]	7.5	100
Thallium	ug/L	2	--	--	--	--	1.2	5.0	--	--

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 wells 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.

(2) The concentrations of selenium at JHC-MW-15005 are not a result of a release from the unit, as detailed in the Alternate Source Demonstration: Selenium at JHC-MW-15005 (TRC, October 2021); therefore, confidence intervals were not calculated.

Table 7
Summary of Groundwater Sampling Results (Analytical): February 2021 - October 2021
JH Campbell Nature and Extent Wells – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	MW-14S				PZ-23S				PZ-24	
					Sample Date:	2/23/2021	4/14/2021	8/17/2021	10/21/2021	2/23/2021	4/14/2021	8/17/2021	10/21/2021	4/14/2021	10/20/2021
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^										
Appendix III[1]															
Boron	ug/L	NC	500	500	7,200	< 20	< 20	24	< 20	34	23	44	25	177	181
Calcium	mg/L	NC	NC	NC	500[EE]	2.39	2.15	2.01	2.16	--	7.64	--	6.19	26.8	16.9
Chloride	mg/L	250**	250[E]	250[E]	500[EE]	< 1.00	< 1.00	1.08	1.03	--	< 1.00	--	< 1.00	1.99	1.89
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	--	< 1,000	--	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250**	250[E]	250[E]	500[EE]	1.63	1.26	1.47	2.38	--	2.72	--	2.61	28.2	11.2
Total Dissolved Solids	mg/L	500**	500[E]	500[E]	500	35	35	37	57	--	43	--	42	282	126
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5[E]**	**6.5 - 8.5[E]**	**6.5 - 9.0**	**5.4**	**5.5**	**5.6**	**5.5**	6.8	**6.4**	6.9	6.7	6.9	7.2
Appendix IV[1]															
Antimony	ug/L	6	6.0	6.0	130	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	10	10	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Barium	ug/L	2,000	2,000	2,000	820	11	10	11	11	--	< 5	--	< 5	20	12
Beryllium	ug/L	4	4.0	4.0	18	< 1	< 1	< 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	< 0.2	< 0.2
Chromium	ug/L	100	100	100	11	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1	1
Cobalt	ug/L	NC	40	100	100	< 6	< 6	< 6	< 6	--	< 15	--	< 6	< 15	< 6
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 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	< 1	< 1
Lithium	ug/L	NC	170	350	440	< 10	< 10	< 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	< 0.2	< 0.2
Molybdenum	ug/L	NC	**73**	210	3,200	< 5	< 5	< 5	< 5	6	5	7	6	7	14
Radium-226	pCi/L	NC	NC	NC	NC	--	--	--	< 0.158	--	--	--	< 0.186	--	< 0.254
Radium-228	pCi/L	NC	NC	NC	NC	--	--	--	< 0.402	--	--	--	0.521	--	0.628
Radium-226/228	pCi/L	5	NC	NC	NC	--	--	--	< 0.402	--	--	--	0.538	--	0.820
Selenium	ug/L	50	50	50	5.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Thallium	ug/L	2	2.0	2.0	3.7	< 2	< 2	< 2	< 2	--	< 2	--	< 2	< 2	< 2
Additional MI Part 115[2]															
Iron	ug/L	**300****	**300[E]**	**300[E]**	500,000[EE]	124	245	**582**	**478**	--	--	--	--	--	--
Copper	ug/L	1,000**	1,000[E]	1,000[E]	15	< 1	< 1	< 1	< 1	--	--	--	--	--	--
Nickel	ug/L	NC	100	100	86	< 2	< 2	< 2	< 2	< 2	--	< 2	--	--	--
Silver	ug/L	100**	34	98	0.2	< 0.2	< 0.2	< 0.2	< 0.2	--	--	--	--	--	--
Vanadium	ug/L	NC	**4.5**	62	27	< 2	< 2	< 2	< 2	< 2	--	< 2	--	--	--
Zinc	ug/L	5,000**	2,400	5,000[E]	190	< 10	< 10	< 10	< 10	--	--	--	--	--	--

Notes:

ug/L - micrograms per liter; mg/L - milligrams per liter.

pCi/L - picocuries per liter; SU - standard units; pH is a field parameter.

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 21, 2020.

** - 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 MDEQ policy and procedure 09-014 dated June 20, 2012.

[E] - Criterion is the aesthetic drinking water value per footnote {E}.

(1) 40 CFR Part 257 Appendix III Detection Monitoring Constituents and Appendix IV Assessment Monitoring Constituents.

(2) Per Michigan Part 115 Amendments - Public Act No. 640 of 2018 Section 11511a(3)(c) and 11519b(2) additional detection monitoring constituents (iron) and assessment monitoring constituents (copper, nickel, silver, vanadium, and zinc) are reported.

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 7
Summary of Groundwater Sampling Results (Analytical): February 2021 - October 2021
JH Campbell Nature and Extent Wells – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	PZ-24S				PZ-40		PZ-40S			
					Sample Date:	2/23/2021	4/14/2021	8/17/2021	10/20/2021	4/14/2021	10/20/2021	2/23/2021	4/14/2021	8/17/2021	10/20/2021
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^										
Appendix III[(1)]															
Boron	ug/L	NC	500	500	7,200	< 20	< 20	25	< 20	211	245	< 20	< 20	< 20	< 20
Calcium	mg/L	NC	NC	NC	500[EE]	2.65	2.11	2.70	3.61	10.6	7.58	1.67	1.35	1.73	1.75
Chloride	mg/L	250**	250[E]	250[E]	500[EE]	< 1.00	< 1.00	1.05	< 1.00	7.33	4.37	< 1.00	< 1.00	1.11	1.64
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250**	250[E]	250[E]	500[EE]	2.22	2.14	3.09	3.85	13.5	9.63	1.70	2.17	1.92	2.05
Total Dissolved Solids	mg/L	500**	500[E]	500[E]	500	51	40	37	46	90	60	45	45	46	37
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5[E]**	**6.5 - 8.5[E]**	**6.5 - 9.0**	**5.4**	**5.6**	**5.3**	**5.6**	**6.3**	**6.2**	**4.9**	**5.2**	**5.0**	**5.1**
Appendix IV[(1)]															
Antimony	ug/L	6	6.0	6.0	130	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	10	10	10	< 1	< 1	1	2	< 1	< 1	< 1	< 1	< 1	< 1
Barium	ug/L	2,000	2,000	2,000	820	27	23	32	20	16	12	16	16	26	27
Beryllium	ug/L	4	4.0	4.0	18	< 1	< 1	< 1	< 1	< 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	0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	100	100	11	2	1	2	2	< 1	< 1	2	1	1	1
Cobalt	ug/L	NC	40	100	100	< 6	< 6	< 6	< 6	< 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	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4.0	4.0	39	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	170	350	440	< 10	< 10	< 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	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	**73**	210	3,200	< 5	< 5	< 5	< 5	< 5	6	< 5	< 5	< 5	< 5
Radium-226	pCi/L	NC	NC	NC	NC	--	--	--	0.340	--	< 0.159	--	--	--	< 0.219
Radium-228	pCi/L	NC	NC	NC	NC	--	--	--	< 0.653	--	< 0.441	--	--	--	< 0.495
Radium-226/228	pCi/L	5	NC	NC	NC	--	--	--	< 0.653	--	0.541	--	--	--	< 0.495
Selenium	ug/L	50	50	50	5.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Thallium	ug/L	2	2.0	2.0	3.7	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Additional MI Part 115[(2)]															
Iron	ug/L	**300****	**300[E]**	**300[E]**	500,000[EE]	**451**	**359**	**768**	**1,170**	--	--	**710**	**959**	**1,390**	**476**
Copper	ug/L	1,000**	1,000[E]	1,000[E]	15	1	< 1	1	< 1	--	--	3	4	1	< 1
Nickel	ug/L	NC	100	100	86	< 2	< 2	< 2	< 2	--	--	< 2	< 2	< 2	< 2
Silver	ug/L	100**	34	98	0.2	< 0.2	< 0.2	< 0.2	< 0.2	--	--	< 0.2	< 0.2	< 0.2	< 0.2
Vanadium	ug/L	NC	**4.5**	62	27	2	2	3	**5**	--	--	< 2	< 2	< 2	< 2
Zinc	ug/L	5,000**	2,400	5,000[E]	190	< 10	< 10	< 10	< 10	--	--	< 10	< 10	< 10	< 10

Notes:

ug/L - micrograms per liter; mg/L - milligrams per liter.

pCi/L - picocuries per liter; SU - standard units; pH is a field parameter.

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 21, 2020.

** - 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 MDEQ policy and procedure 09-014 dated June 20, 2012.

[E] - Criterion is the aesthetic drinking water value per footnote {E}.

(1) 40 CFR Part 257 Appendix III Detection Monitoring Constituents and Appendix IV Assessment Monitoring Constituents.

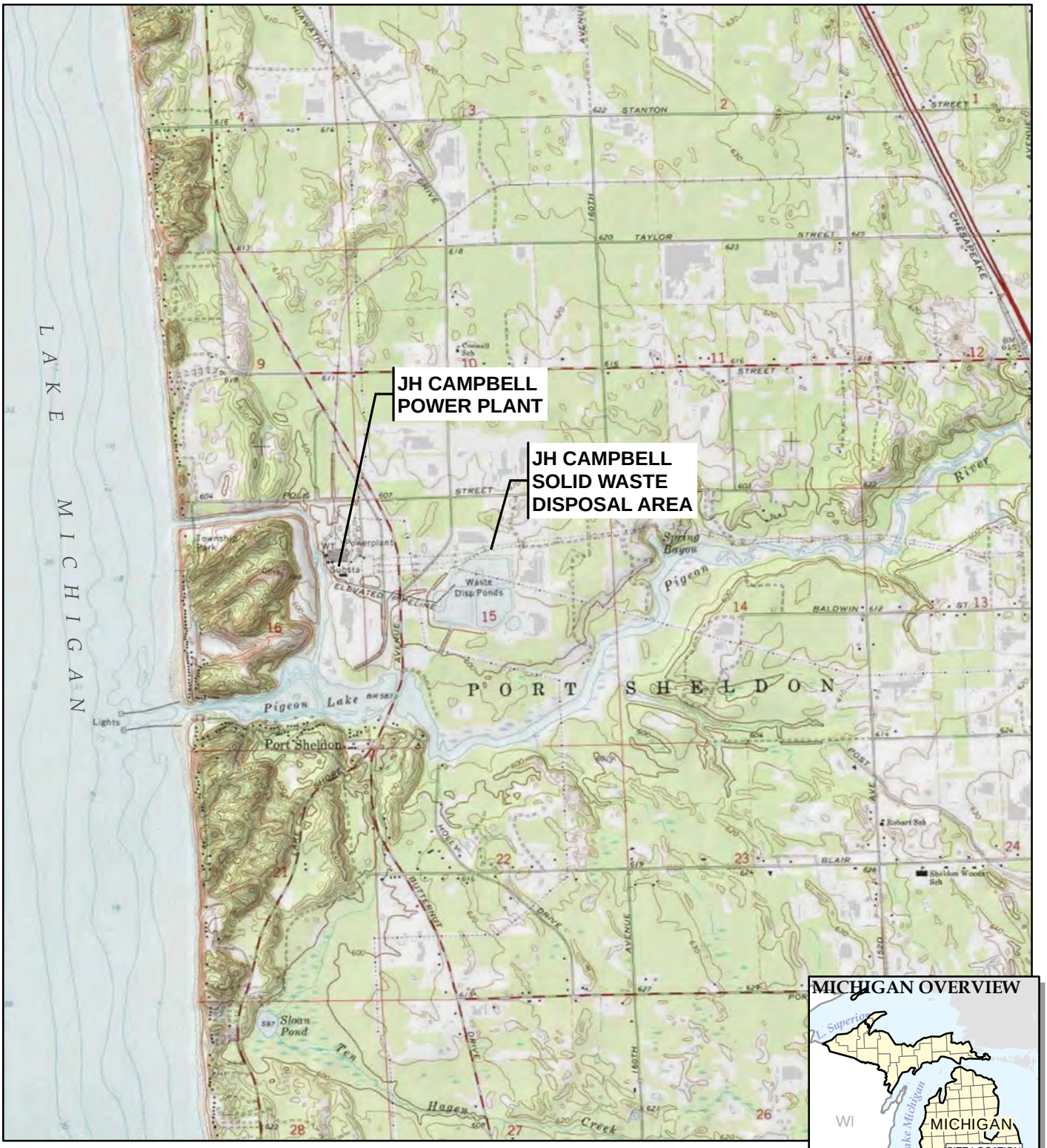
(2) Per Michigan Part 115 Amendments - Public Act No. 640 of 2018 Section 11511a(3)(c) and 11519b(2) additional detection monitoring constituents (iron) and assessment monitoring constituents (copper, nickel, silver, vanadium, and zinc) are reported.

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.

Figures



BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

N

1 " = 3,000 '
1:36,000

0 3,000 6,000 FEET

TRC

1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trccompanies.com

TRC - GIS

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 2022
PROJ. NO.:	418422
FILE:	418422-001-007.mxd

FIGURE 1

S:\1-PROJECTS\Consumers_Energy_Company\Michigan\CCR_GW\2017_269767\367390-001-007.mxd -- Saved By: SMAJOR on 1/13/2021, 09:37:27 AM

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL
- DOWNGRADIENT LANDFILL MONITORING WELL
- PIEZOMETER 2021
- 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)
- DOWNGRADIENT MONITORING WELLS
- STAFF GAUGE
- TEMPORARY WELL
- HMP WELL

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2021.
2. WELL LOCATIONS BASED ON SURVEY DATA THROUGH 8/14/2019.
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. MONITORING WELLS DECOMMISSIONED MAY 25, 2021.
10. MONITORING WELLS DECOMMISSIONED JULY 20-21, 2021.
11. STATIC WATER ELEVATIONS IN NORTH AMERICAN VERTICAL DATUM 1988, NAVD 88.

0 700 1,400 Feet

1 " = 700 '

1:8,400

N

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

TITLE:
SITE PLAN WITH CCR MONITORING WELL LOCATIONS

DRAWN BY:	A. FOJTIK	PROJ NO.:	418422-0000
CHECKED BY:	B. YELEN		
APPROVED BY:	S. HOLMSTROM		**FIGURE 2**
DATE:	JANUARY 2022		

TRC
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Ann Arbor, MI 48108-3284
Phone: 734.971.7080
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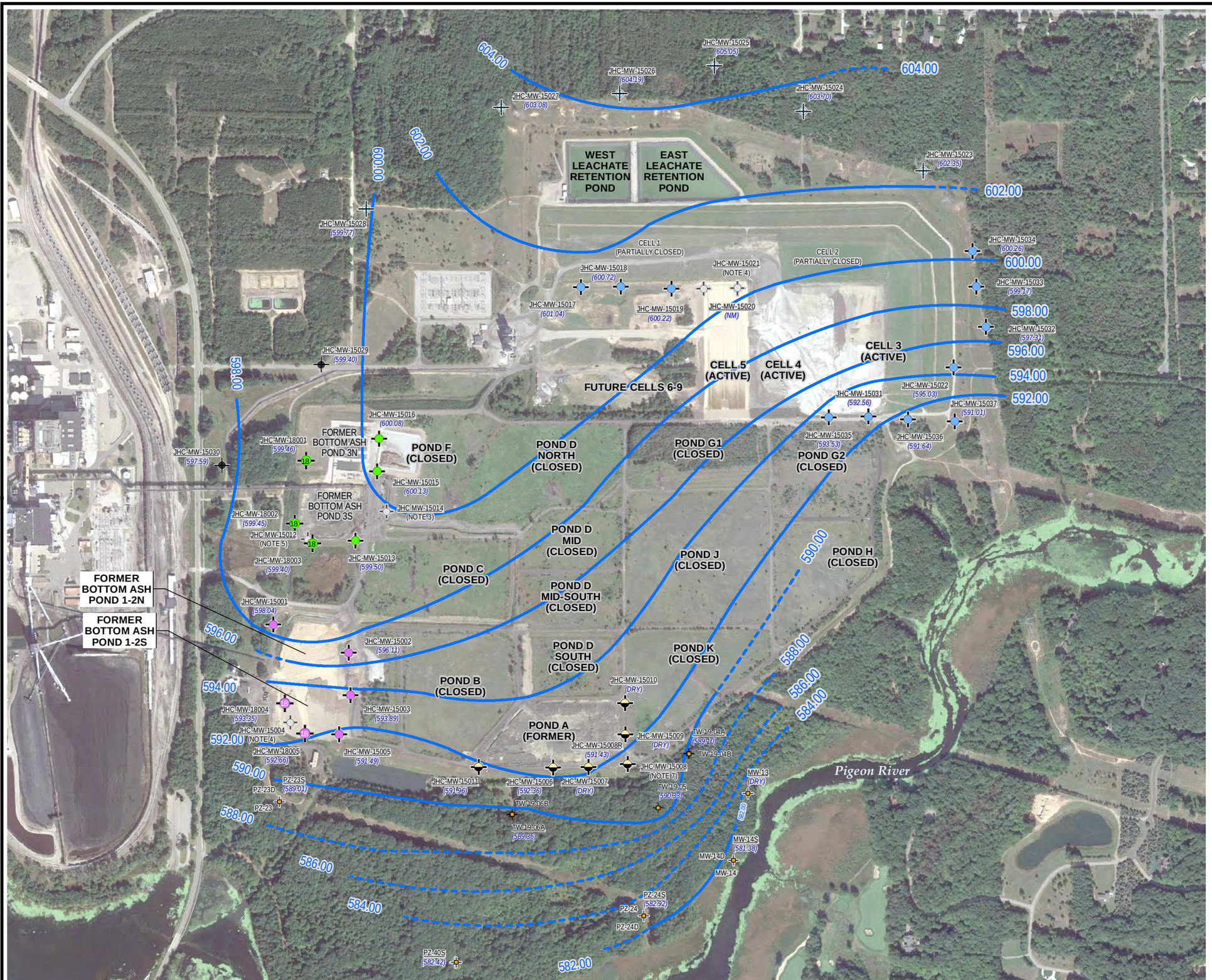
FILE NO.: 418422-003-002_fig2_af.mxd

Plot Date: 1/7/2022, 15:45:28 PM by AFOJTIK -- LAYOUT: ANSI B(11"x17")
Path: S:\1-PROJECTS\Consumers_Energy_Company\Michigan\CCR_GW\2017_269767\2_JHC\2_Maps\Rotation\418422-003-002_fig2_af.mxd
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
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

(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 APRIL 2021

DRAWN BY:	A. ADAIR	PROJ NO.:	418422.0000
CHECKED BY:	K. LOWERY		
APPROVED BY:	K. LOWERY		**FIGURE 3**
DATE:	JULY 2021		

TRC
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Phone: 734.971.7080
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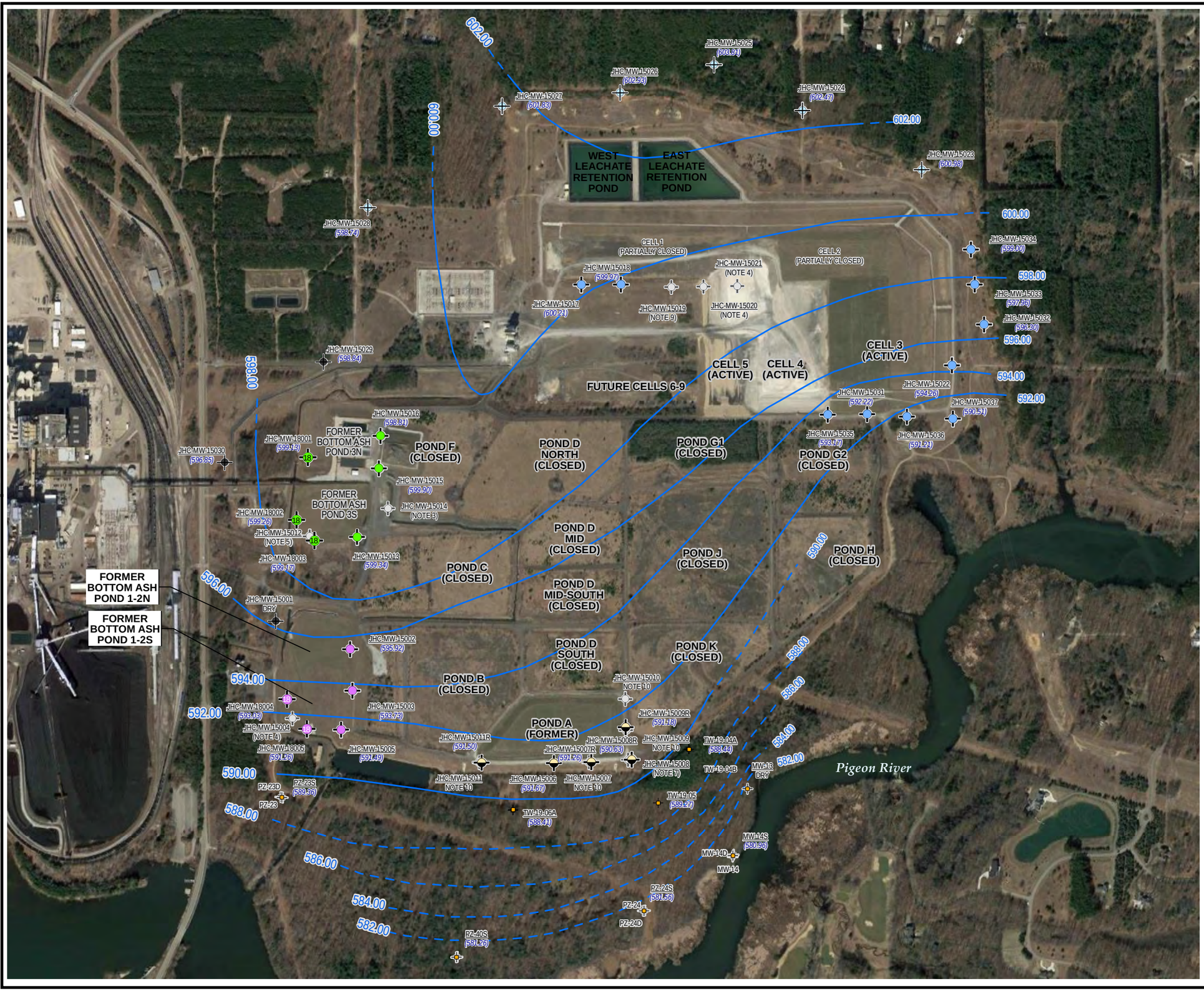
FILE NO.: 418422_200_003.mxd



LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL
- DOWNGRADIENT LANDFILL MONITORING WELL
- PIEZOMETER 2021
- 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)
- DOWNGRADIENT MONITORING WELLS
- STAFF GAUGE
- TEMPORARY WELL
- HMP WELL
- (591.25) GROUNDWATER ELEVATION (FEET ABOVE MSL)

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2021.
2. WELL LOCATIONS BASED ON SURVEY DATA THROUGH 8/14/2019.
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. MONITORING WELLS DECOMMISSIONED MAY 25, 2021.
10. MONITORING WELLS DECOMMISSIONED JULY 20-21, 2021.
11. STATIC WATER ELEVATIONS IN NORTH AMERICAN VERTICAL DATUM 1988, NAVD 88.

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 2021

DRAWN BY:	A. FOJTIK	PROJ NO.:	418422-0000
CHECKED BY:	B. YELEN		
APPROVED BY:	S. HOLMSTROM		**FIGURE 4**
DATE:	JANUARY 2022		

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trccompanies.com

FILE NO.: 418422-003-002_af.mxd

TRC - GIS
Plot Date: 1/21/2022, 13:16:33 PM by AFOJTIK -- LAYOUT:ANSI B(11"x17")
Path: S:\1-PROJECTS\Consumers_Energy_Company\Michigan\CCR_GW\2017_2697\7\2_JHC\MapFiles\2021_004_Fall\418422-003-002_af.mxd
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)

Appendix A
Data Quality Reviews

Laboratory Data Quality Review
Groundwater Monitoring Event April 2021
CEC JH Campbell Background Wells

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the April 2021 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 (SDGs) 21-0446R and 160-41801-1 Revision 1.

During the April 2021 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/ 7470A
Alkalinity	SM 2320B
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, 2020) 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 for the total metals, anions, alkalinity, and TDS analyses.

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 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.
- All samples were analyzed 12 or 13 days past holding time for alkalinity. Positive results for alkalinity in the samples are potentially biased low, as shown in the attached table, Attachment A.

- The LCS and LCSD recoveries and relative percent differences (RPDs) for radium were within QC limits.
- MS and MSD analyses were performed on sample JHC-MW-15025 for mercury, total metals, and anions. The recoveries were within the acceptance limits. 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-15028. All criteria were met.
- Carrier recoveries, where applicable, were within 40-110%.

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-15023	4/12/2021	Alkalinity	Analysis run outside of holding time; results are potentially biased low
JHC-MW-15024	4/13/2021		
JHC-MW-15025	4/13/2021		
JHC-MW-15026	4/13/2021		
JHC-MW-15027	4/13/2021		
JHC-MW-15028	4/12/2021		
DUP-02	4/12/2021		

Laboratory Data Quality Review
Groundwater Monitoring Event April 2021
Consumers Energy JH Campbell Ponds 1 and 2

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the April 2021 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 (SDGs) 21-0447R and 160-41803-1 Revision 1.

During the April 2021 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

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
Alkalinity	SM 2320B
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, 2020) 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 by CE Laboratory Services. 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 total metals, anions, alkalinity, and TDS analyses.

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-03) and one field blank (FB-03) were collected. Target analytes were not detected in these blank samples.

- All samples were analyzed 11 or 12 days past holding time for alkalinity. Positive results for alkalinity in the samples are potentially biased low, as shown in the attached table, Attachment A.
- The LCS and LCSD recoveries and relative percent differences (RPDs) for radium were within QC limits.
- MS and MSD analyses were performed on sample JHC-MW-18004 for mercury, total metals and anions. The recoveries were within the acceptance limits. 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-15005. All criteria were met.
- Carrier recoveries, where applicable, were within 40-110%.

Attachment A
Summary of Data Non-Conformances
JH Campbell Pond 1 and 2 – RCRA CCR Monitoring Program
West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-15002	4/14/2021	Alkalinity	Analysis run outside of holding time; results are potentially biased low
JHC-MW-15003	4/14/2021		
JHC-MW-15005	4/13/2021		
JHC-MW-18004	4/13/2021		
JHC-MW-18005	4/13/2021		
DUP-03	4/13/2021		

Laboratory Data Quality Review
Groundwater Monitoring Event October 2021
CEC JH Campbell Background Wells

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the October 2021 sampling event. Samples were analyzed for total metals, anions, total dissolved solids (TDS), and alkalinity by CE Laboratory Services in Jackson, Michigan. The laboratory analytical results were reported in laboratory sample delivery group (SDG) 21-1276.

During the October 2021 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
Alkalinity	SM 2320B

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, 2020). 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;
- 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 for the total metals, anions, alkalinity, and TDS analyses.

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

- One equipment blank (EB-01) and one field blank (FB-01) were collected. Target analytes were not detected in these blank samples.
- 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 with the following exception.

- The RPD for TDS (61%) was above the acceptance criteria. Therefore, potential uncertainty exists for the positive results for TDS in all groundwater samples, as summarized in the attached table, Attachment A.

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-15023	10/20/2021	Total Dissolved Solids	Field duplicate variability; potential uncertainty exists.
JHC-MW-15024	10/20/2021		
JHC-MW-15025	10/19/2021		
JHC-MW-15026	10/19/2021		
JHC-MW-15027	10/19/2021		
JHC-MW-15028	10/19/2021		
DUP-01	10/19/2021		

Laboratory Data Quality Review
Groundwater Monitoring Event October 2021
CEC JH Campbell Background Wells

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the October 2021 sampling event. Samples were analyzed for radium by Eurofins-TestAmerica laboratory in St. Louis, Missouri. The laboratory analytical results were reported in laboratory sample delivery group (SDG) 160-43807-1.

During the October 2021 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 (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 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.

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 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

- Target analytes were not detected in the method blanks.
- One equipment blank (EB-01) and one field blank (FB-01) were collected. Target analytes were not detected in the equipment and field blanks.
- LCS/LCSD recoveries and relative percent differences were within laboratory control limits.
- MS/MSD and laboratory duplicate analyses were not performed on a sample from this SDG.
- The field duplicate pair samples were DUP-01/JHC-MW-15028. All criteria were met.
- Carrier recoveries were within 40-110%.

Laboratory Data Quality Review
Groundwater Monitoring Event October 2021
Consumers Energy JH Campbell Ponds 1 and 2

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the October 2021 sampling event. Samples were analyzed for total metals, anions, total dissolved solids and alkalinity by CE Laboratory Services in Jackson, Michigan. The laboratory analytical results were reported in sample delivery group (SDG) 21-1277.

During the October 2021 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

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
Alkalinity	SM 2320B

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, 2020). 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;
- 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 by CE Laboratory Services. 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 total metals, anions, alkalinity, and TDS analyses.

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

- One equipment blank (EB-02) and one field blank (FB-02) were collected. Target analytes were not detected in these blank samples.
- MS and MSD analyses were performed on sample JHC-MW-18004 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-02/JHC-MW-15003. All criteria were met.
- The laboratory RL for cobalt (15 ug/L) was above the requested RL of 6 ug/L. Groundwater samples JHC-MW-15002, JHC-MW-15005, JHC-MW-18004, and JHC-MW-18005 were non-detect for cobalt at the elevated RL.

Laboratory Data Quality Review
Groundwater Monitoring Event October 2021
Consumers Energy JH Campbell Ponds 1 and 2

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the October 2021 sampling event. Samples were analyzed for radium by Eurofins-TestAmerica laboratory in St. Louis, Missouri. The laboratory analytical results were reported in sample delivery group (SDG) 160-43808-1.

During the October 2021 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

Each sample was analyzed for the following constituents:

Analyte Group	Method
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 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.

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 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

- Target analytes were not detected in the method blanks (MBs) with the exception of radium 226 which was detected at a concentration of 0.2467 pCi/L in MB 160-534508/23-A. Radium 226 detected in groundwater and equipment blank samples are potentially false positive results as summarized in the attached table, Attachment A.
- One equipment blank (EB-02) and one field blank (FB-02) were collected. Target analytes were not detected in the equipment and field blank samples with the exception of radium 226 which was detected at a concentration of 0.249 pCi/L in the equipment blank and combined radium which was detected at a concentration of 0.384 pCi/L in the field blank. Radium 226 in the equipment blank sample was due to MB contamination and therefore did not further impact any groundwater samples. Combined radium detected in groundwater samples are potentially false positive results as summarized in the attached table, Attachment A.
- LCS/LCD recoveries and relative percent differences for all target analytes were within laboratory control limits.
- MS/MSD and laboratory duplicate analyses were not performed on a sample from this SDG.
- The field duplicate pair samples were DUP-02/JHC-MW-15003. All criteria were met.
- Carrier recoveries were within 40-110%.

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-18004	10/22/2021	Combined Radium	Potential false positive results due to field blank contamination.
JHC-MW-18005	10/22/2021		
DUP-02	10/20/2021		
JHC-MW-15002	10/21/2021		
JHC-MW-15005	10/21/2021		
JHC-MW-15002	10/21/2021	Radium 226	Potential false positive results due to method blank contamination.
JHC-MW-15003	10/20/2021		
JHC-MW-15005	10/21/2021		
JHC-MW-18004	10/22/2021		
JHC-MW-18005	10/22/2021		
DUP-02	10/20/2021		
EB-02	10/21/2021		

Appendix B
April 2021 Assessment Monitoring Statistical Evaluation

1540 Eisenhower Pl.
Ann Arbor, MI 48108

T 734.971.7080
TRCcompanies.com

Technical Memorandum

Date:	July 30, 2021
To:	Bethany Swanberg, Consumers Energy
From:	Sarah Holmstrom, TRC Kristin Lowery, TRC
Project No.:	418422.0000.0000 Phase 1 Task 3
Subject:	Statistical Evaluation of April 2021 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 2021 was conducted on April 12 through 14, 2021. 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 2021 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
Selenium	50 ug/L	1 of 3

Constituent	GWPS	# Sidegradient Wells Observed
Arsenic	10 ug/L	1 of 2

[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.

These results are generally consistent with the results of the initial and previous assessment monitoring data statistical evaluations, with the exception of the selenium exceedance at JHC-MW-15005 which is a new statistically significant exceedance in this round of assessment monitoring. 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.

Assessment Monitoring Statistical Evaluation

The compliance well network at the Ponds 1-2 CCR Unit consists of five 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-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. Data collected from December 2018 through April 2020 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.

Following the first semiannual assessment monitoring sampling event for 2021, 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 (April 2018 through April 2021 for JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 and December 2018 through May 2021 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 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 assessment monitoring results (April 2018 through April 2021) for these well-constituent pairs were observed visually for potential outliers and trends. No outliers were apparent. A significant decreasing trend was noted for arsenic in JHC-MW-15002 (time-series plots in Attachment 1). 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. 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 at JHC-MW-15003 and JHC-MW-18005 Lithium at JHC-MW-15002 and JHC-MW-15005 Molybdenum at JHC-MW-15003 Selenium at JHC-MW-15005 and JHC-MW-18005 Thallium at JHC-MW-15005
Normalized by square root transformation	Arsenic at JHC-MW-15002 Molybdenum at JHC-MW-15005
Non-Parametric (not normalizable)	Cobalt at JHC-MW-15003 (non-detects)

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 and, for the first time, selenium at JHC-MW-15005. These results are consistent with the results of the initial assessment monitoring data statistical evaluation, with the exception of the initial statistically significant exceedance for selenium. Consumers Energy continues 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-15002[3]										
					Sample Date:	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	4/14/2021	
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS											
Appendix III							Field Dup			Field Dup						
Boron	ug/L	NC	NA	51	NA	--	--	430	1,470	1,360	3,200	1,700	2,560	2,390	4,880	
Calcium	mg/L	NC	NA	46	NA	--	--	75.3	41.9	41.1	85	99	122	80.1	103	
Chloride	mg/L	250*	NA	43	NA	--	--	22.3	19.3	19.2	17	20	15.4	16.0	14.2	
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	--	--	153	95.2	94.5	190	280	295	212	499	
Total Dissolved Solids	mg/L	500*	NA	258	NA	--	--	356	222	274	410	480	567	396	583	
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	10.2 (1)	--	8.3	8.0	--	6.9	6.5	6.1	5.7	5.3	
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**	**129**	**130**	**127**	**60.5**	**59.5**	**50**	**57**	**45**	**21**	**36**	
Barium	ug/L	2,000	NA	35	2,000	30.4	30.4	19.8	18.4	18.1	49	150	128	85	49	
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	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 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	< 6	
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	< 1000	< 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**	28	28	19	**68**	**67**	**96**	**240**	**125**	**76**	**48**	
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**	12.6	12.7	7.5	9.2	9.0	< 5.0	15	49	43	12	
Radium-226	pCi/L	NC	NA	NA	NA	< 0.823	< 0.530	< 0.620	< 1.09	0.921	0.233	0.698	0.378	0.468	0.302	
Radium-228	pCi/L	NC	NA	NA	NA	< 0.729	< 1.33	< 1.58	1.04	0.767	0.409	< 0.394	< 0.408	< 0.250	0.524	
Radium-226/228	pCi/L	5	NA	1.93	5	< 1.55	< 1.86	< 2.20	< 1.70	1.69	0.642	1.04	0.784	0.533	0.827	
Selenium	ug/L	50	NA	5	**50**	< 1.0	< 1.0	< 1.0	2.5	2.8	< 1.0	< 1.0	1	< 1	1	
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.
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) Monitoring wells 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[3]										
					Sample Date:	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	4/14/2021	
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS											
Appendix III								Field Dup				Field Dup				
Boron	ug/L	NC	NA	51	NA	--	1,170	1,320	1,120	1,700	3,500	3,300	3,880	2,370	674	
Calcium	mg/L	NC	NA	46	NA	--	60.0	59.1	115	36	110	110	94.6	57.6	108	
Chloride	mg/L	250*	NA	43	NA	--	37.5	36.6	16.3	18	47	47	17.3	22.3	24.2	
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	--	81.9	82.7	294	75	210	220	194	89	207	
Total Dissolved Solids	mg/L	500*	NA	258	NA	--	388	344	644	200	580	600	554	339	573	
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	9.3	8.9	--	8.7	8.4	8.7	--	8.3	8.3	8.2	
Appendix IV																
Antimony	ug/L	6	NA	2	6	1.5	1.9	1.8	2.0	2.2	1.4	1.4	1	< 1	1	
Arsenic	ug/L	10	NA	1	**10**	**12.4**	**14.1**	**14.3**	8.1	10	8.4	7.7	9	**12**	**15**	
Barium	ug/L	2,000	NA	35	2,000	42.3	55.7	52.5	113	42	91	89	103	68	75	
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	1.7	0.41	2.5	2.5	1.0	< 0.2	< 0.2	
Chromium	ug/L	100	NA	2	100	< 1.0	< 1.0	< 1.0	13.6	4.2	11	10	7	7	3	
Cobalt	ug/L	NC	6	15	**15**	< 15.0	< 15.0	< 15.0	**23.6**	< 6.0	**43**	**41**	**47**	< 15	< 6	
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	< 1000	< 1,000	
Lead	ug/L	NC	15	1	15	< 1.0	< 1.0	< 1.0	3.3	< 1.0	3.2	3.2	5	2	< 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**	19.3	53.0	51.2	65.3	20	**120**	**120**	**125**	59	38	
Radium-226	pCi/L	NC	NA	NA	NA	< 0.631	< 0.623	< 0.733	< 0.579	< 0.113	0.301	0.430	0.272	< 0.322	0.170	
Radium-228	pCi/L	NC	NA	NA	NA	< 0.732	< 1.01	< 1.08	< 0.657	< 0.530	0.421	< 0.361	0.541	< 0.282	< 0.423	
Radium-226/228	pCi/L	5	NA	1.93	5	< 1.36	< 1.63	< 1.81	< 1.24	< 0.530	0.722	0.559	0.813	< 0.322	< 0.423	
Selenium	ug/L	50	NA	5	**50**	2.2	4.4	4.5	28.6	2.9	18	19	27	1	25	
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.
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) Monitoring wells 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:	4/25/2018	6/19/2018	11/15/2018	4/25/2019	4/25/2019	10/9/2019	4/16/2020	10/22/2020	4/13/2021	4/13/2021
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS										
Appendix III										Field Dup					Field Dup
Boron	ug/L	NC	NA	51	NA	--	227	1,450	2,800	2,900	1,200	1,020	1,340	616	623
Calcium	mg/L	NC	NA	46	NA	--	61.8	61.9	170	180	110	97.1	131	99.7	94.7
Chloride	mg/L	250*	NA	43	NA	--	90.9	30.6	28	28	30	15.6	57.1	6.19	5.24
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	--	74.3	133	240	320	130	133	207	88.8	85.4
Total Dissolved Solids	mg/L	500*	NA	258	NA	--	462	334	800	780	360	487	735	470	455
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.4	7.4	7.5	7.2	--	7.3	7.1	7.2	7.4	--
Appendix IV															
Antimony	ug/L	6	NA	2	6	2.2	1.6	5.1	4.4	4.2	3.3	2	2	2	2
Arsenic	ug/L	10	NA	1	**10**	1.7	1.3	1.2	1.2	1.1	1.4	1	2	3	2
Barium	ug/L	2,000	NA	35	2,000	407	175	149	150	150	190	270	354	208	211
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	NA	2	100	< 1.0	3.0	< 1.0	1.3	1.3	1.3	1	< 1	1	1
Cobalt	ug/L	NC	6	15	**15**	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	< 6.0	< 15	< 15	< 6	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	40	10	**40**	**61**	35	28	38	38	**50**	**59**	**42**	20	21
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	5	**100**	31.2	15.7	**222**	**900**	**870**	**370**	91	**110**	88	90
Radium-226	pCi/L	NC	NA	NA	NA	0.620	< 0.758	< 0.461	0.169	0.248	0.592	0.448	0.691	0.264	0.284
Radium-228	pCi/L	NC	NA	NA	NA	0.700	1.22	0.967	< 0.350	0.495	0.427	0.566	0.791	< 0.360	0.471
Radium-226/228	pCi/L	5	NA	1.93	5	1.32	1.91	1.41	< 0.350	0.743	1.02	1.01	1.48	0.510	0.755
Selenium	ug/L	50	NA	5	**50**	**368**	14	**158**	**140**	**130**	**66**	**282**	**260**	**165**	**171**
Thallium	ug/L	2	NA	2	**2**	**5.8**	**2.1**	< 2.0	2.0	<2.0	**2.9**	**3**	**7**	**3**	**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) Monitoring wells 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								
					Sample Date:	12/7/2018	2/28/2019	4/25/2019	8/13/2019	10/9/2019	4/16/2020	10/22/2020	4/13/2021
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	444
Calcium	mg/L	NC	NA	46	NA	48.9	55	72	97	73	117	98.4	88.9
Chloride	mg/L	250*	NA	43	NA	25.7	50	34	35	40	14.2	12.5	5.17
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
Sulfate	mg/L	250*	NA	14	NA	109	69	100	110	120	249	127	64.4
Total Dissolved Solids	mg/L	500*	NA	258	NA	306	330	380	490	310	604	515	418
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	7.7
Appendix IV													
Antimony	ug/L	6	NA	2	6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1
Arsenic	ug/L	10	NA	1	**10**	1.0	< 1.0	1.1	1.2	1.1	< 1	1	< 1
Barium	ug/L	2,000	NA	35	2,000	92.6	170	220	680	270	210	323	325
Beryllium	ug/L	4	NA	1	4	< 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	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	NA	2	100	< 1.0	1.2	2.0	1.8	1.3	< 1	< 1	< 1
Cobalt	ug/L	NC	6	15	**15**	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 15	< 15	< 6
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
Lead	ug/L	NC	15	1	15	< 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
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	5	**100**	7.4	7.4	8.2	9.0	10	7	10	7
Radium-226	pCi/L	NC	NA	NA	NA	< 0.695	< 0.0742	0.110	0.352	0.179	< 0.131	0.367	0.243
Radium-228	pCi/L	NC	NA	NA	NA	< 0.708	0.589	< 0.430	0.469	0.672	0.889	0.454	0.642
Radium-226/228	pCi/L	5	NA	1.93	5	< 1.40	0.654	< 0.430	0.822	0.851	0.952	0.821	0.885
Selenium	ug/L	50	NA	5	**50**	7.3	12	12	39	33	34	18	39
Thallium	ug/L	2	NA	2	**2**	< 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.
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) Monitoring wells 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-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	4/13/2021
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS				Field Dup			Field Dup				Field Dup	
Appendix III																	
Boron	ug/L	NC	NA	51	NA		641	660	720	650	750	780	660	534	486	499	382
Calcium	mg/L	NC	NA	46	NA		32.5	43	42	41	43	45	55	42.6	58.7	60.1	45.5
Chloride	mg/L	250*	NA	43	NA		29.8	27	26	25	27	27	18	19.6	16.4	16.8	16.6
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
Sulfate	mg/L	250*	NA	14	NA		90	89	85	66	95	95	110	74.5	105	108	75.3
Total Dissolved Solids	mg/L	500*	NA	258	NA		234	280	260	250	270	290	330	262	339	317	287
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	--	8.7
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	< 1
Arsenic	ug/L	10	NA	1	**10**		9.5	10	**11**	8.8	7.4	7.3	7.1	8	8	8	8
Barium	ug/L	2,000	NA	35	2,000		58.1	72	73	73	120	120	150	144	207	206	201
Beryllium	ug/L	4	NA	1	4		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 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	< 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	< 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	< 6
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	< 1.0	< 1.0	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	40	10	**40**		< 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	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	5	**100**		18.6	14	15	14	15	15	66	9	7	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	0.225
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	< 0.395
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	< 0.395
Selenium	ug/L	50	NA	5	**50**		42.0	35	34	16	11	11	**140**	46	**99**	**103**	**58**
Thallium	ug/L	2	NA	2	**2**		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 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.
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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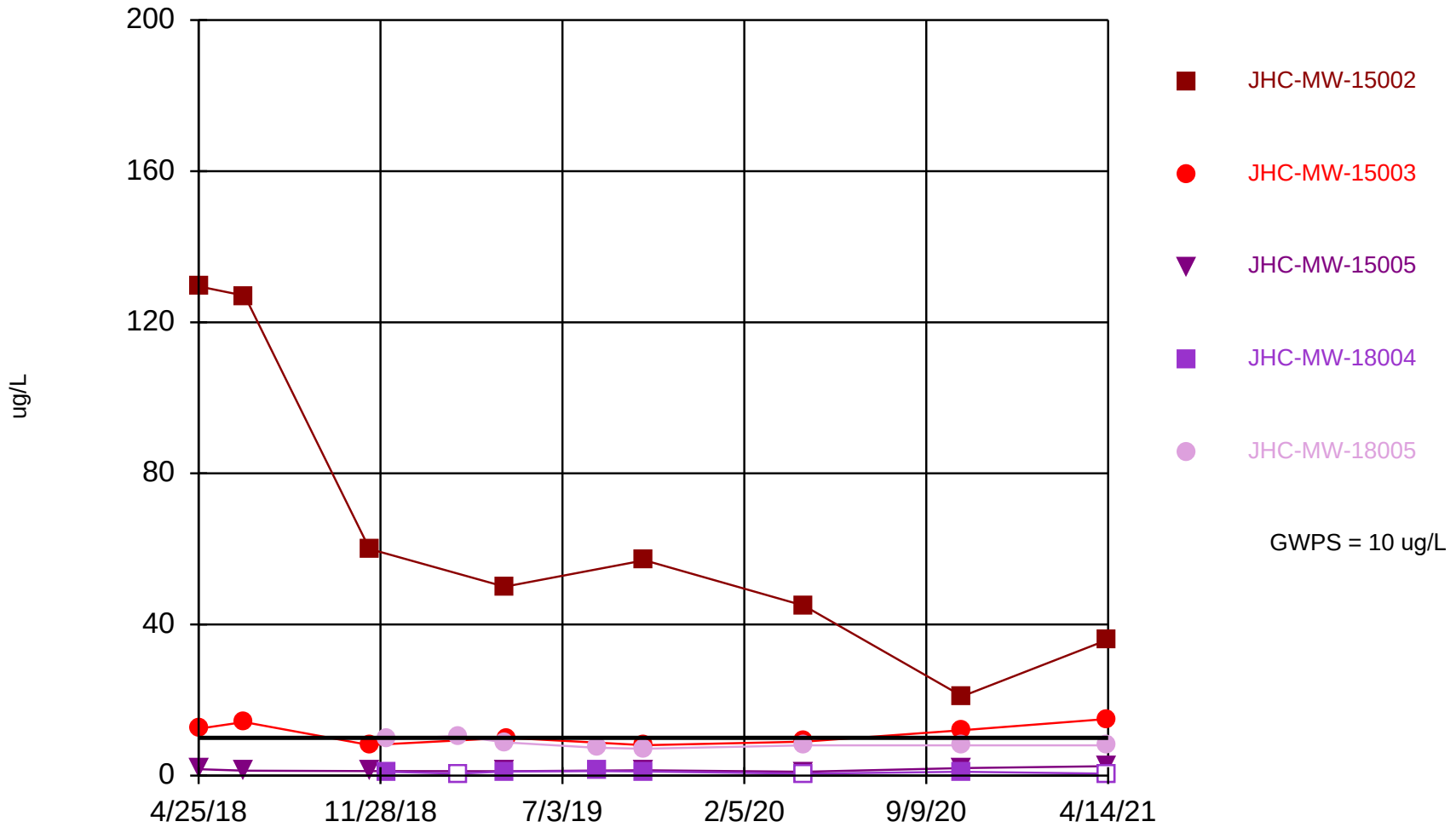
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.
(3) Monitoring wells JHC-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 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

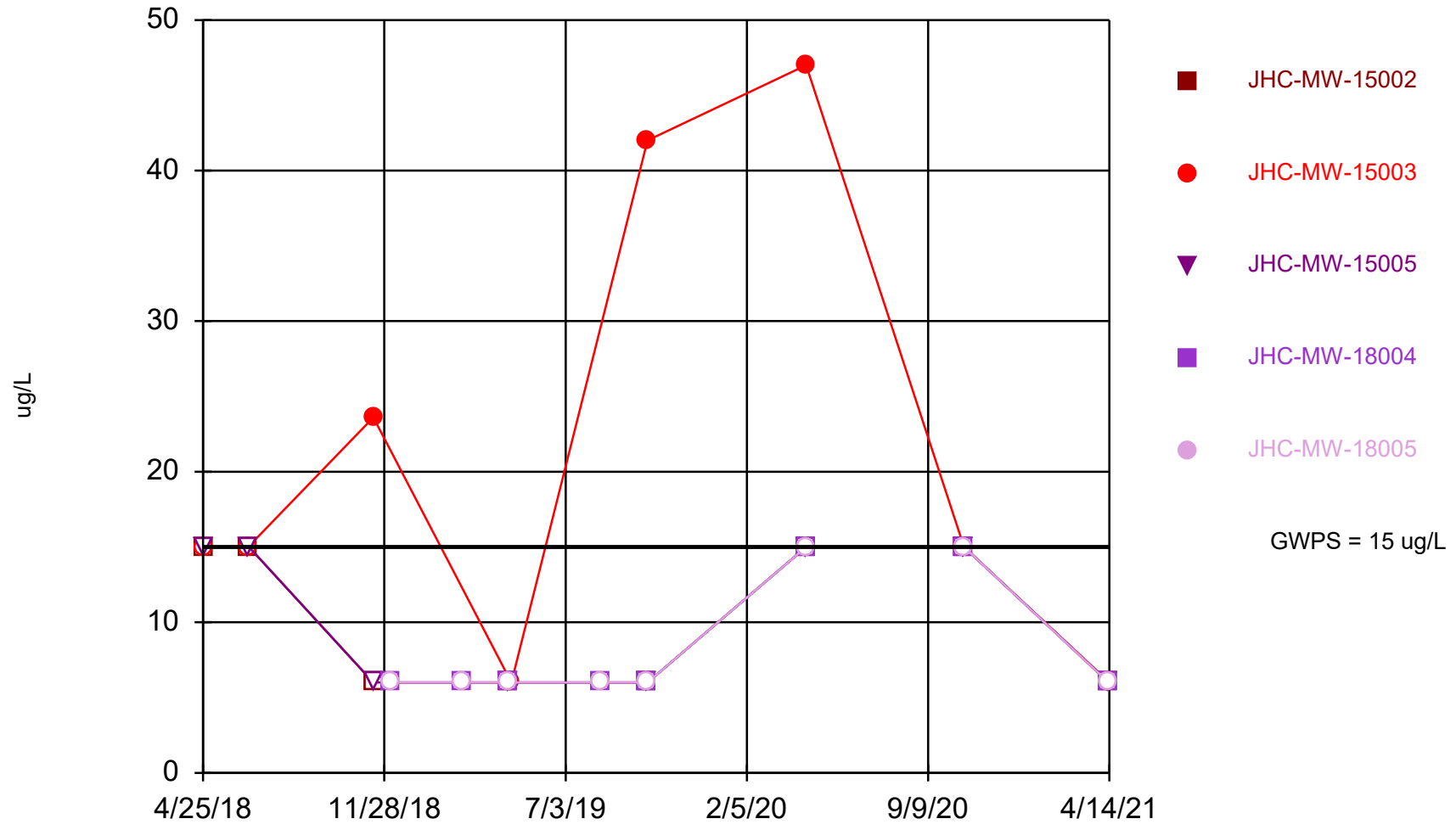


Time Series Analysis Run 6/11/2021 10:10 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

Hollow symbols indicate censored values.

Cobalt Comparison to GWPS

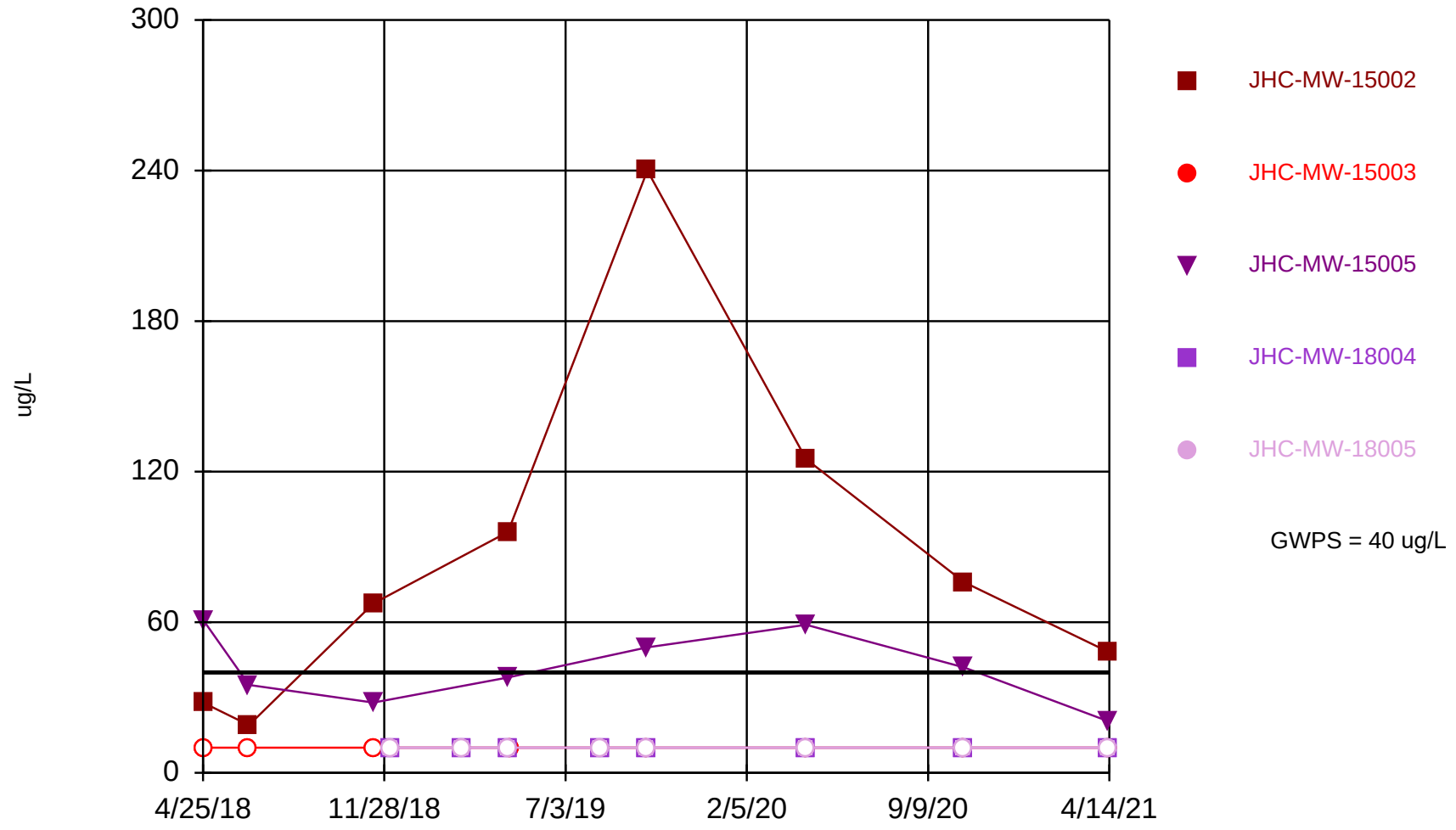


Time Series Analysis Run 6/23/2021 12:31 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

Hollow symbols indicate censored values.

Lithium Comparison to GWPS

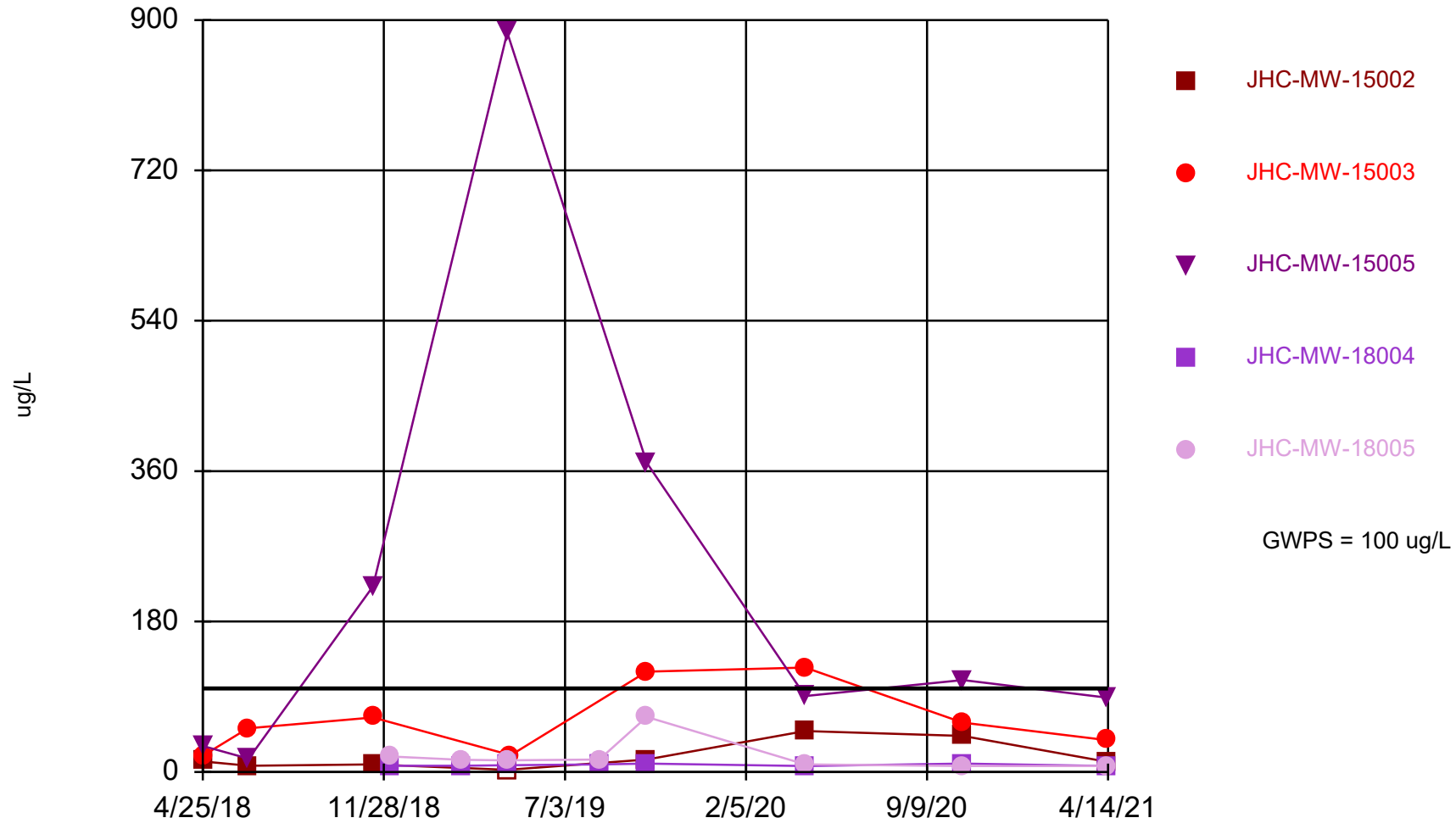


Time Series Analysis Run 6/11/2021 10:11 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

Hollow symbols indicate censored values.

Molybdenum Comparison to GWPS

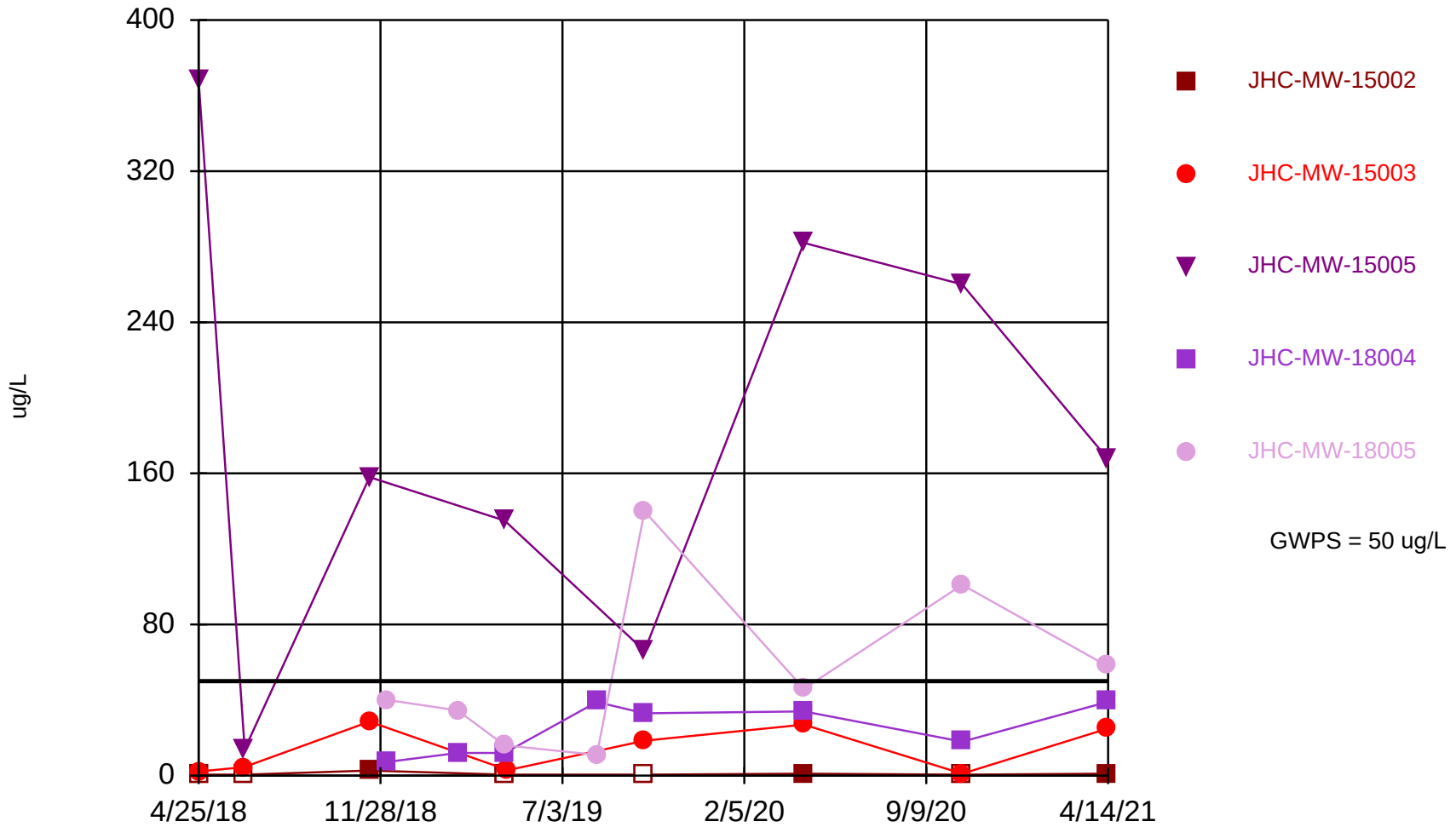


Time Series Analysis Run 6/23/2021 12:32 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

Hollow symbols indicate censored values.

Selenium Comparison to GWPS

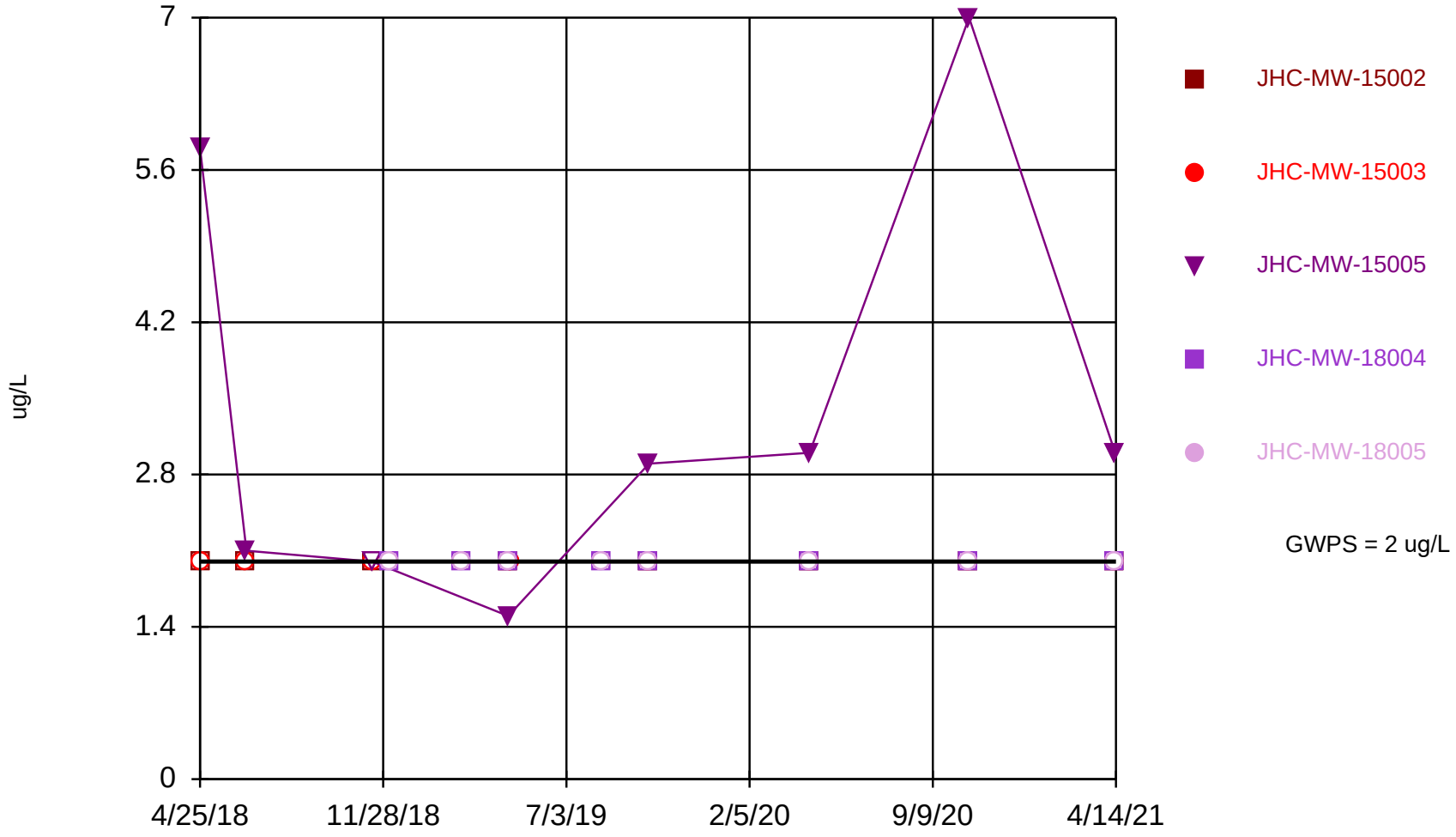


Time Series Analysis Run 6/11/2021 10:13 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

Hollow symbols indicate censored values.

Thallium Comparison to GWPS

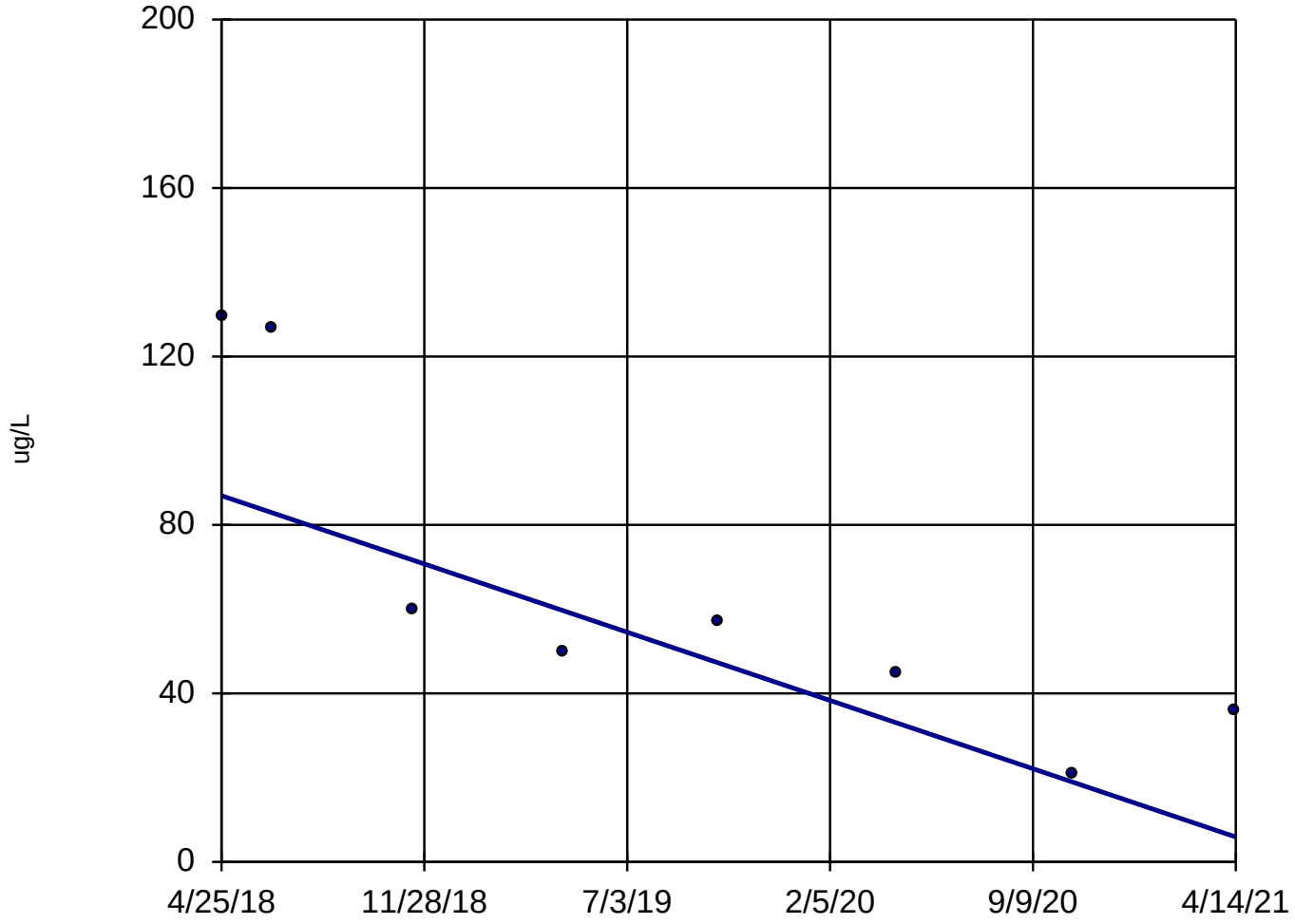


Time Series Analysis Run 6/11/2021 10:05 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

Arsenic, Total

JHC-MW-15002



n = 8

Slope = -27.25 units per year.

Mann-Kendall statistic = -24
critical = -20

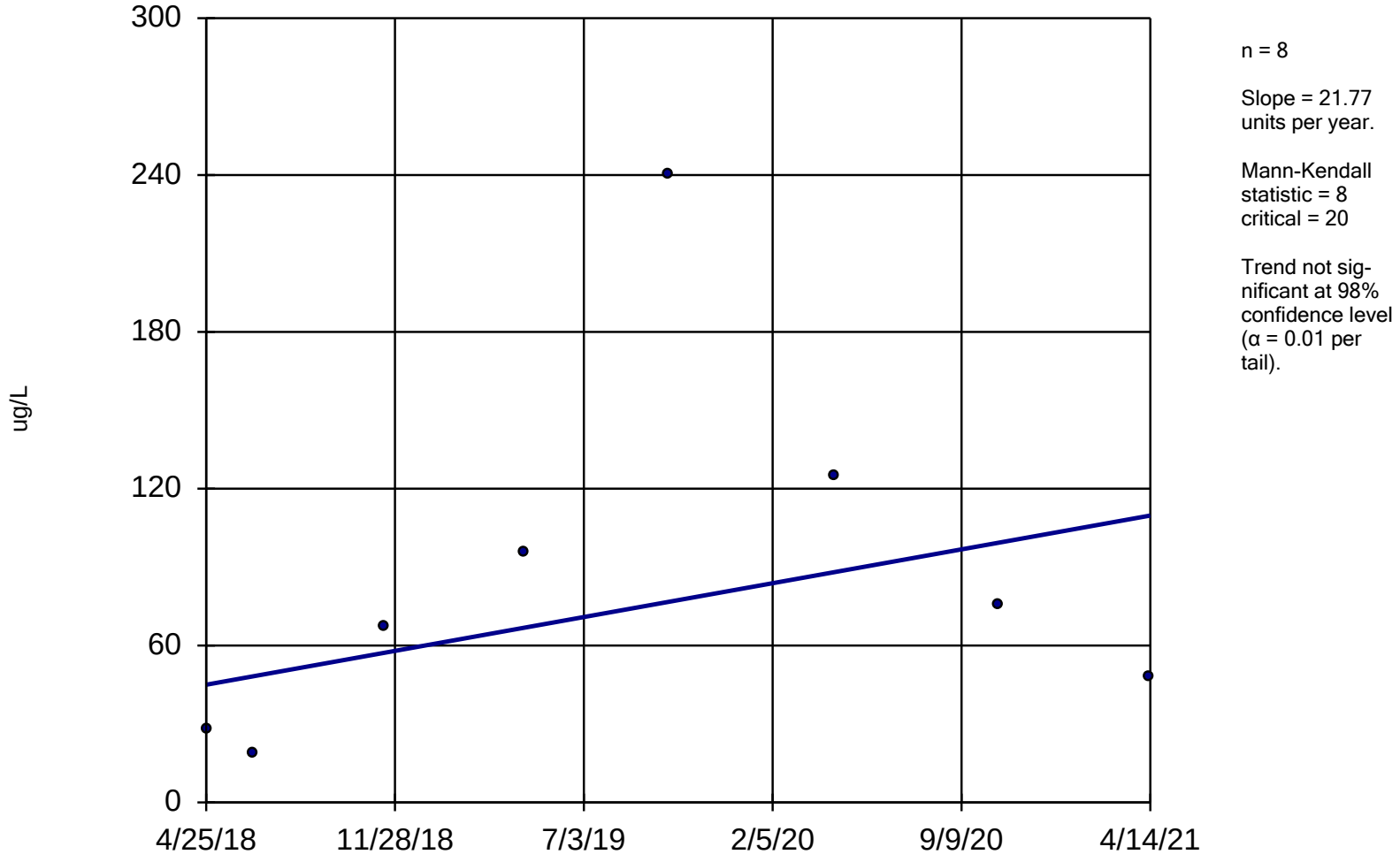
Decreasing trend significant at 98% confidence level (α = 0.01 per tail).

Sen's Slope Estimator Analysis Run 6/11/2021 11:22 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

Lithium, Total

JHC-MW-15002



n = 8

Slope = 21.77 units per year.

Mann-Kendall statistic = 8
critical = 20

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

Sen's Slope Estimator Analysis Run 6/11/2021 11:22 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

Summary Report

Constituent: Arsenic, Total Analysis Run 6/11/2021 11:34 AM
Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

For observations made between 4/25/2018 and 4/14/2021, a summary of the selected data set:

Observations = 40
ND/Trace = 3
Wells = 5
Minimum Value = 1
Maximum Value = 129.5
Mean Value = 17.56
Median Value = 8
Standard Deviation = 30.1
Coefficient of Variation = 1.714
Skewness = 2.7

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15002	8	0	21	129.5	65.69	53.5	40.52	0.6168	0.8297
JHC-MW-15003	8	0	8.05	15	11.09	11	2.706	0.2439	0.2084
JHC-MW-15005	8	0	1	2.5	1.531	1.35	0.5063	0.3307	0.8948
JHC-MW-18004	8	3	1	1.2	1.05	1	0.07559	0.07199	1.061
JHC-MW-18005	8	0	7.1	10.5	8.419	8	1.151	0.1368	0.6988

Summary Report

Constituent: Cobalt, Total Analysis Run 6/23/2021 12:35 PM
Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

For observations made between 4/25/2018 and 4/14/2021, a summary of the selected data set:

Observations = 40
ND/Trace = 37
Wells = 5
Minimum Value = 3
Maximum Value = 47
Mean Value = 7.278
Median Value = 3
Standard Deviation = 9.41
Coefficient of Variation = 1.293
Skewness = 3.34

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15002	8	8	3	7.5	5.25	5.25	2.405	0.4582	0
JHC-MW-15003	8	5	3	47	17.64	7.5	17.84	1.012	0.8227
JHC-MW-15005	8	8	3	7.5	5.25	5.25	2.405	0.4582	0
JHC-MW-18004	8	8	3	7.5	4.125	3	2.083	0.505	1.155
JHC-MW-18005	8	8	3	7.5	4.125	3	2.083	0.505	1.155

Summary Report

Constituent: Lithium, Total Analysis Run 6/11/2021 11:34 AM
Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

For observations made between 4/25/2018 and 4/14/2021, a summary of the selected data set:

Observations = 40
ND/Trace = 24
Wells = 5
Minimum Value = 10
Maximum Value = 240
Mean Value = 31.83
Median Value = 10
Standard Deviation = 43.4
Coefficient of Variation = 1.364
Skewness = 3.187

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15002	8	0	19	240	87.44	71.75	70.77	0.8094	1.294
JHC-MW-15003	8	8	10	10	10	10	0	0	NaN
JHC-MW-15005	8	0	20.5	61	41.69	40	14.33	0.3436	0.02813
JHC-MW-18004	8	8	10	10	10	10	0	0	NaN
JHC-MW-18005	8	8	10	10	10	10	0	0	NaN

Summary Report

Constituent: Molybdenum, Total Analysis Run 6/23/2021 12:35 PM
Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

For observations made between 4/25/2018 and 4/14/2021, a summary of the selected data set:

Observations = 40
ND/Trace = 1
Wells = 5
Minimum Value = 2.5
Maximum Value = 885
Mean Value = 67.01
Median Value = 15.35
Standard Deviation = 149.6
Coefficient of Variation = 2.233
Skewness = 4.458

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15002	8	1	2.5	49	18.84	12.33	17.25	0.9156	1.016
JHC-MW-15003	8	0	19.3	125	62.34	55.55	40.73	0.6534	0.6027
JHC-MW-15005	8	0	15.7	885	226.7	100.5	289.7	1.278	1.661
JHC-MW-18004	8	0	7	10	8.25	7.8	1.268	0.1537	0.4496
JHC-MW-18005	8	0	7	66	18.87	14.25	19.49	1.033	2.066

Summary Report

Constituent: Selenium, Total Analysis Run 6/11/2021 11:34 AM
Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

For observations made between 4/25/2018 and 4/14/2021, a summary of the selected data set:

Observations = 40
ND/Trace = 5
Wells = 5
Minimum Value = 1
Maximum Value = 368
Mean Value = 55.28
Median Value = 21.75
Standard Deviation = 85.22
Coefficient of Variation = 1.542
Skewness = 2.181

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15002	8	5	1	2.65	1.206	1	0.5834	0.4836	2.268
JHC-MW-15003	8	0	1	28.6	13.71	11.48	12.22	0.8916	0.1317
JHC-MW-15005	8	0	14	368	181.4	163	116.7	0.6434	0.16
JHC-MW-18004	8	0	7.3	39	24.29	25.5	13.27	0.5465	-0.05971
JHC-MW-18005	8	0	11	140	55.81	42.98	43.96	0.7878	0.9373

Summary Report

Constituent: Thallium, Total Analysis Run 6/11/2021 11:34 AM
Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

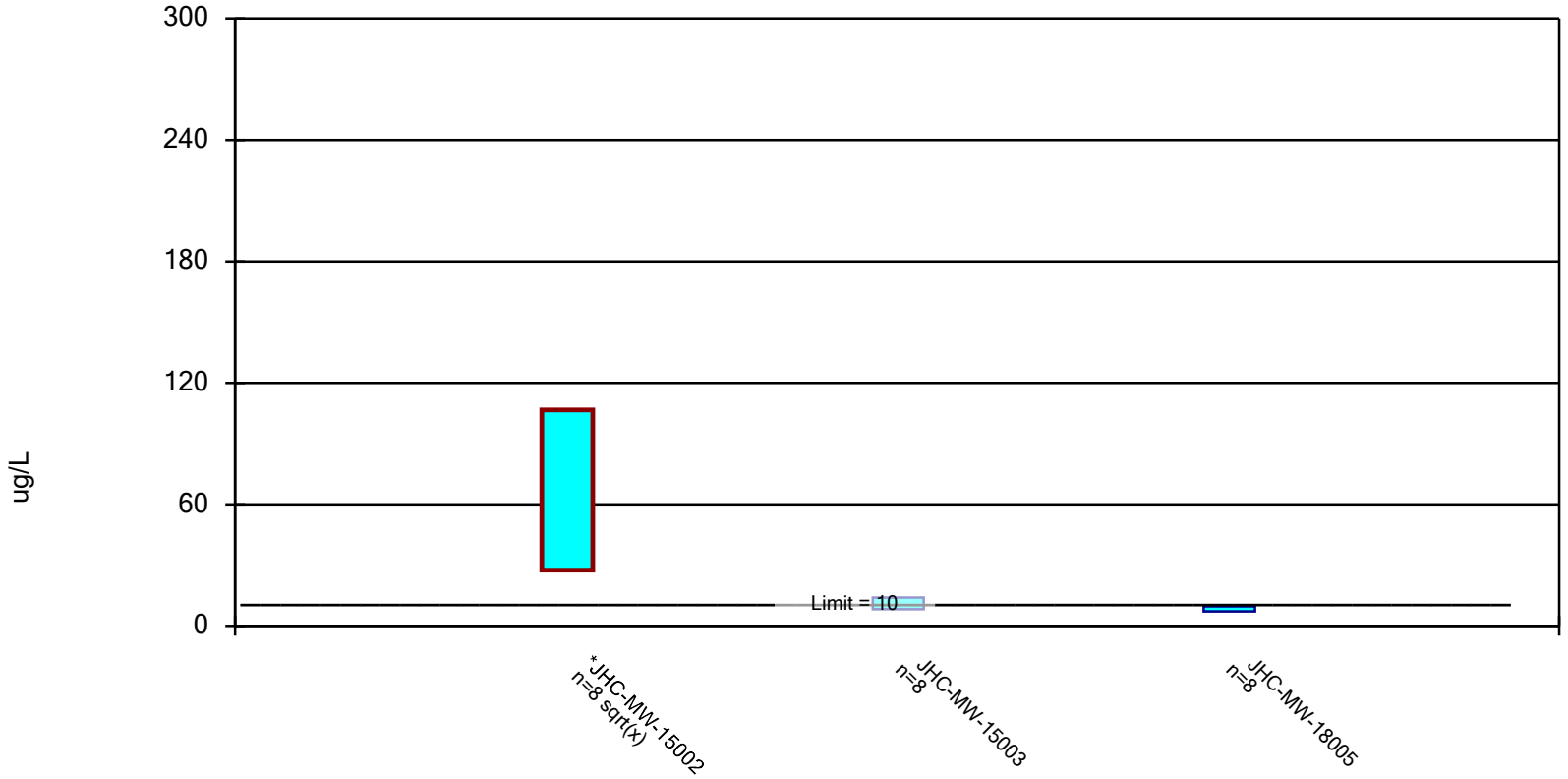
For observations made between 4/25/2018 and 4/14/2021, a summary of the selected data set:

Observations = 40
ND/Trace = 33
Wells = 5
Minimum Value = 1.5
Maximum Value = 7
Mean Value = 2.283
Median Value = 2
Standard Deviation = 1.004
Coefficient of Variation = 0.4399
Skewness = 3.803

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
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	1	1.5	7	3.413	2.95	1.947	0.5707	0.9807
JHC-MW-18004	8	8	2	2	2	2	0	0	NaN
JHC-MW-18005	8	8	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 6/23/2021 3:51 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

Confidence Interval

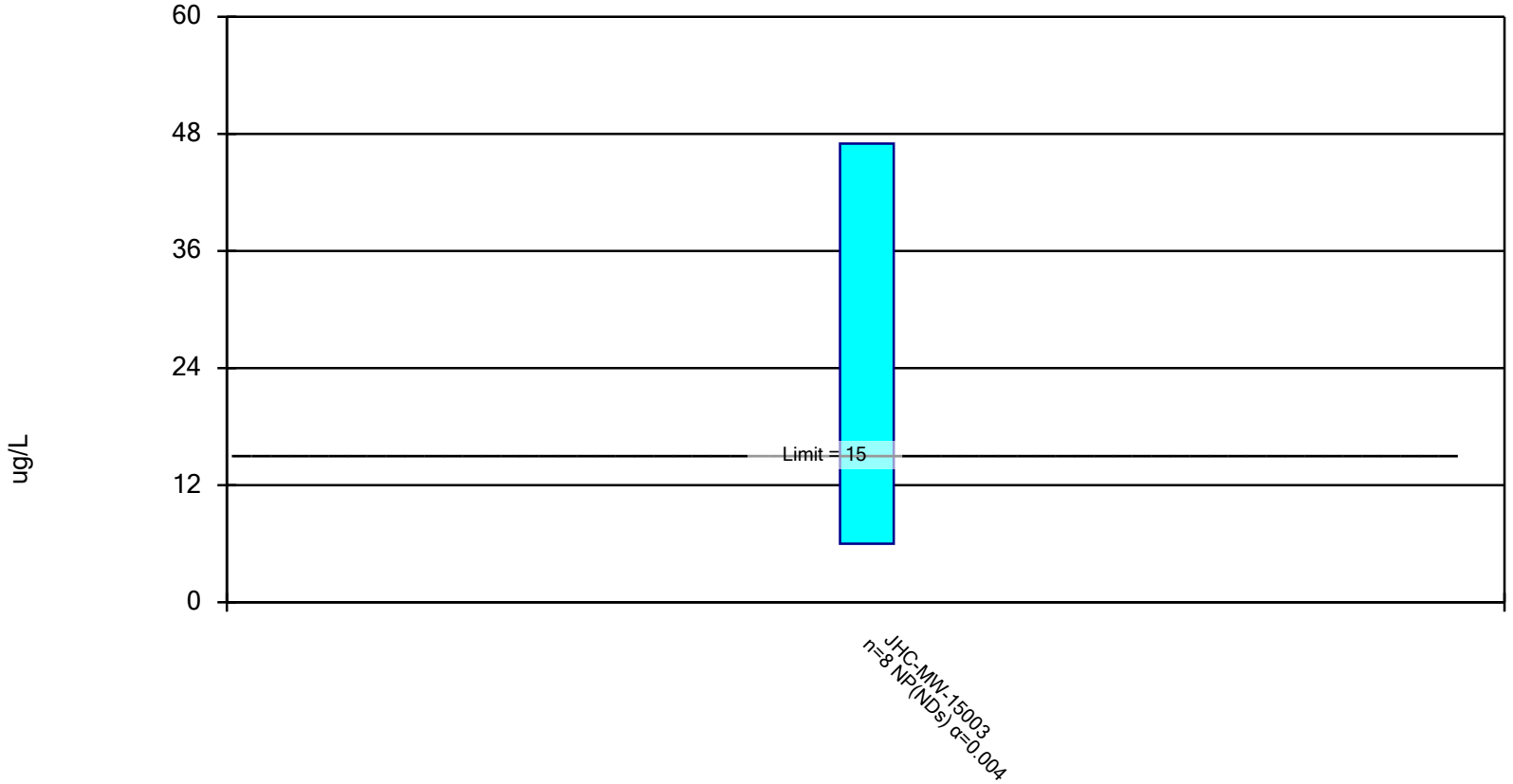
Constituent: Arsenic, Total (ug/L) Analysis Run 6/23/2021 3:51 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

	JHC-MW-15002	JHC-MW-15003	JHC-MW-18005
4/25/2018	129.5 (D)	12.4	
6/18/2018		14.2 (D)	
6/19/2018	127		
11/15/2018	60 (D)	8.1	
12/7/2018			9.6 (D)
2/28/2019			10.5 (D)
4/25/2019	50		8.8
4/29/2019		10	
8/13/2019			7.35 (D)
10/9/2019	57	8.05 (D)	7.1
4/16/2020	45	9	8
10/22/2020	21	12	8 (D)
4/13/2021			8
4/14/2021	36	15	
Mean	65.69	11.09	8.419
Std. Dev.	40.52	2.706	1.151
Upper Lim.	106.7	13.96	9.639
Lower Lim.	27.53	8.226	7.198

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Constituent: Cobalt, Total Analysis Run 6/23/2021 12:36 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

Confidence Interval

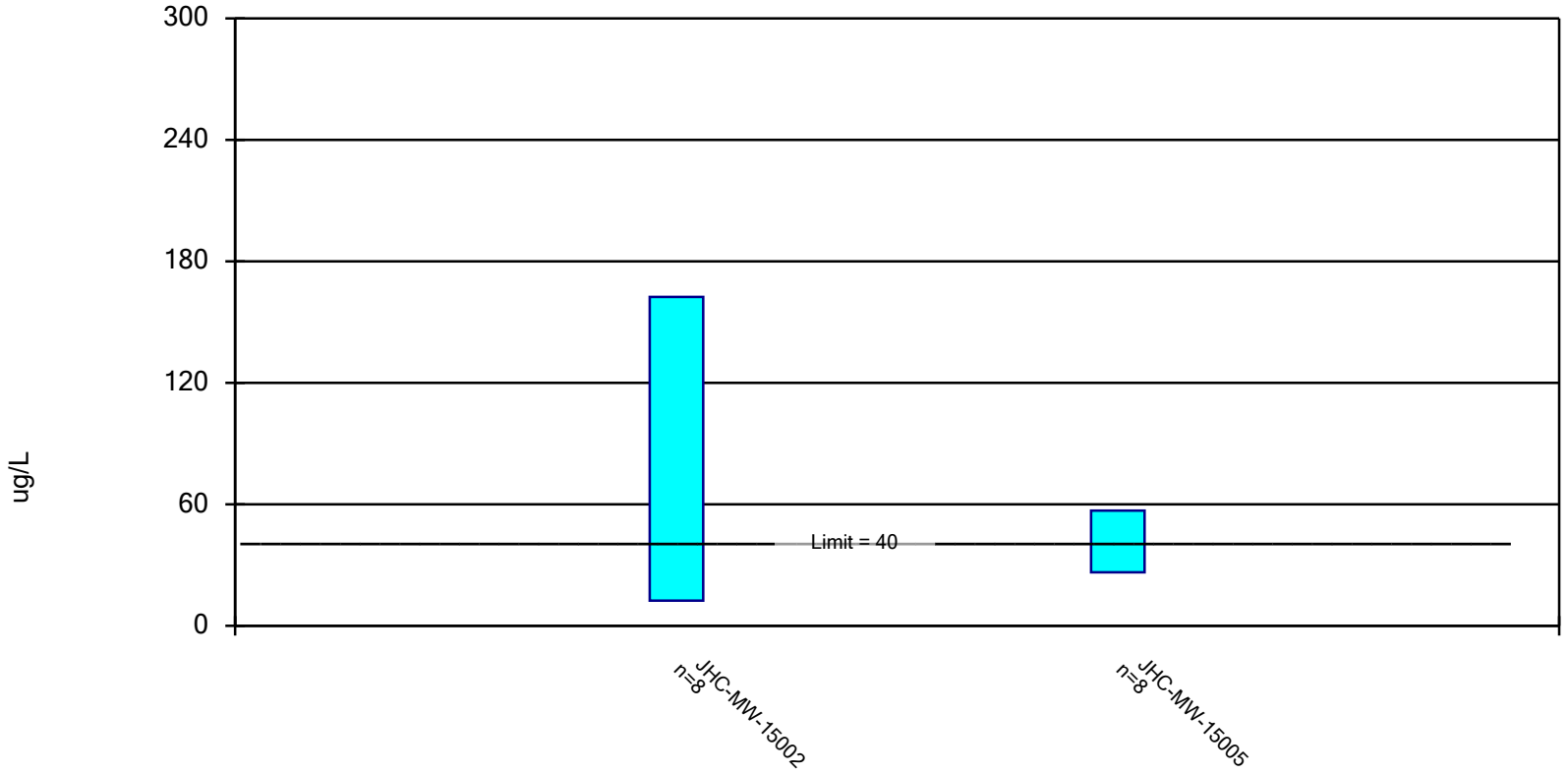
Constituent: Cobalt, Total (ug/L) Analysis Run 6/23/2021 12:38 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

	JHC-MW-15003
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
10/22/2020	<15
4/14/2021	<6
Mean	21.2
Std. Dev.	15.5
Upper Lim.	47
Lower Lim.	6

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 6/23/2021 12:44 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

Confidence Interval

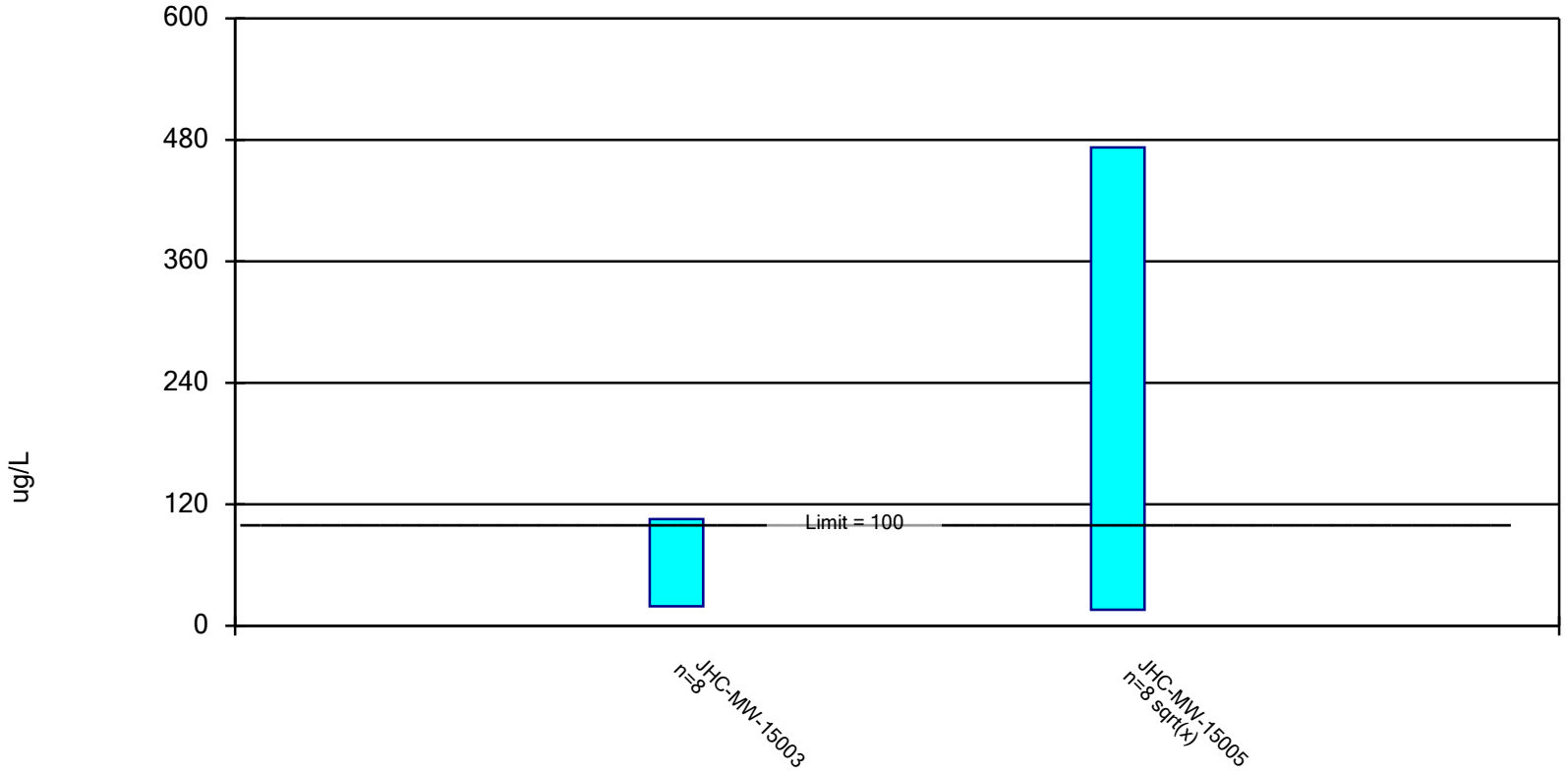
Constituent: Lithium, Total (ug/L) Analysis Run 6/23/2021 12:45 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

	JHC-MW-15002	JHC-MW-15005
4/25/2018	28 (D)	61
6/19/2018	19	35
11/15/2018	67.5 (D)	28
4/25/2019	96	38 (D)
10/9/2019	240	50
4/16/2020	125	59
10/22/2020	76	42
4/13/2021		20.5 (D)
4/14/2021	48	
Mean	87.44	41.69
Std. Dev.	70.77	14.33
Upper Lim.	162.5	56.87
Lower Lim.	12.42	26.5

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 6/23/2021 12:36 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

Confidence Interval

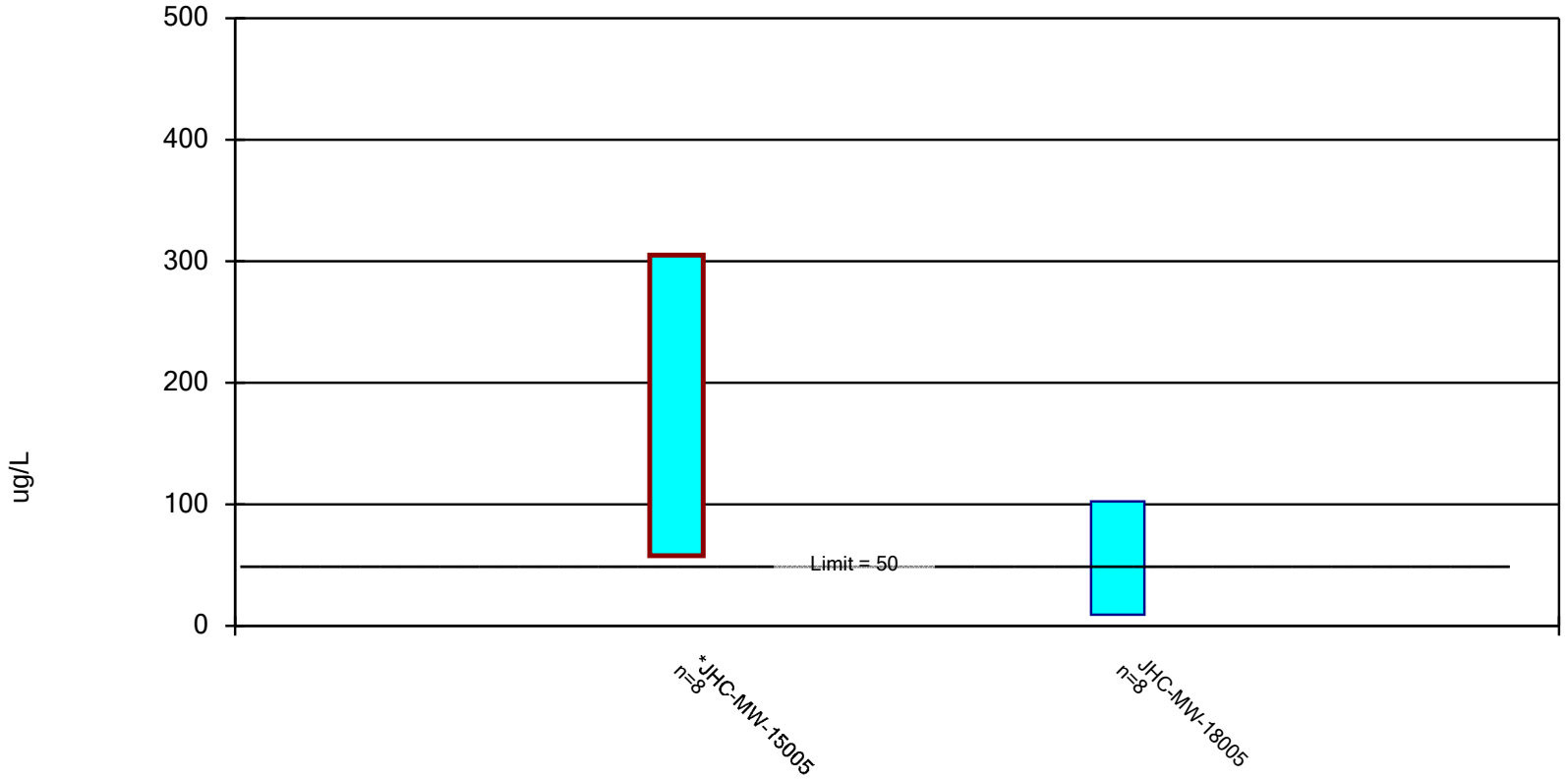
Constituent: Molybdenum, Total (ug/L) Analysis Run 6/23/2021 12:38 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

	JHC-MW-15003	JHC-MW-15005
4/25/2018	19.3	31.2
6/18/2018	52.1 (D)	
6/19/2018		15.7
11/15/2018	65.3	222
4/25/2019		885 (D)
4/29/2019	20	
10/9/2019	120 (D)	370
4/16/2020	125	91
10/22/2020	59	110
4/13/2021		89 (D)
4/14/2021	38	
Mean	62.34	226.7
Std. Dev.	40.73	289.7
Upper Lim.	105.5	472.4
Lower Lim.	19.16	15.91

Parametric Confidence Interval

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



Constituent: Selenium, Total Analysis Run 6/11/2021 11:27 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

Confidence Interval

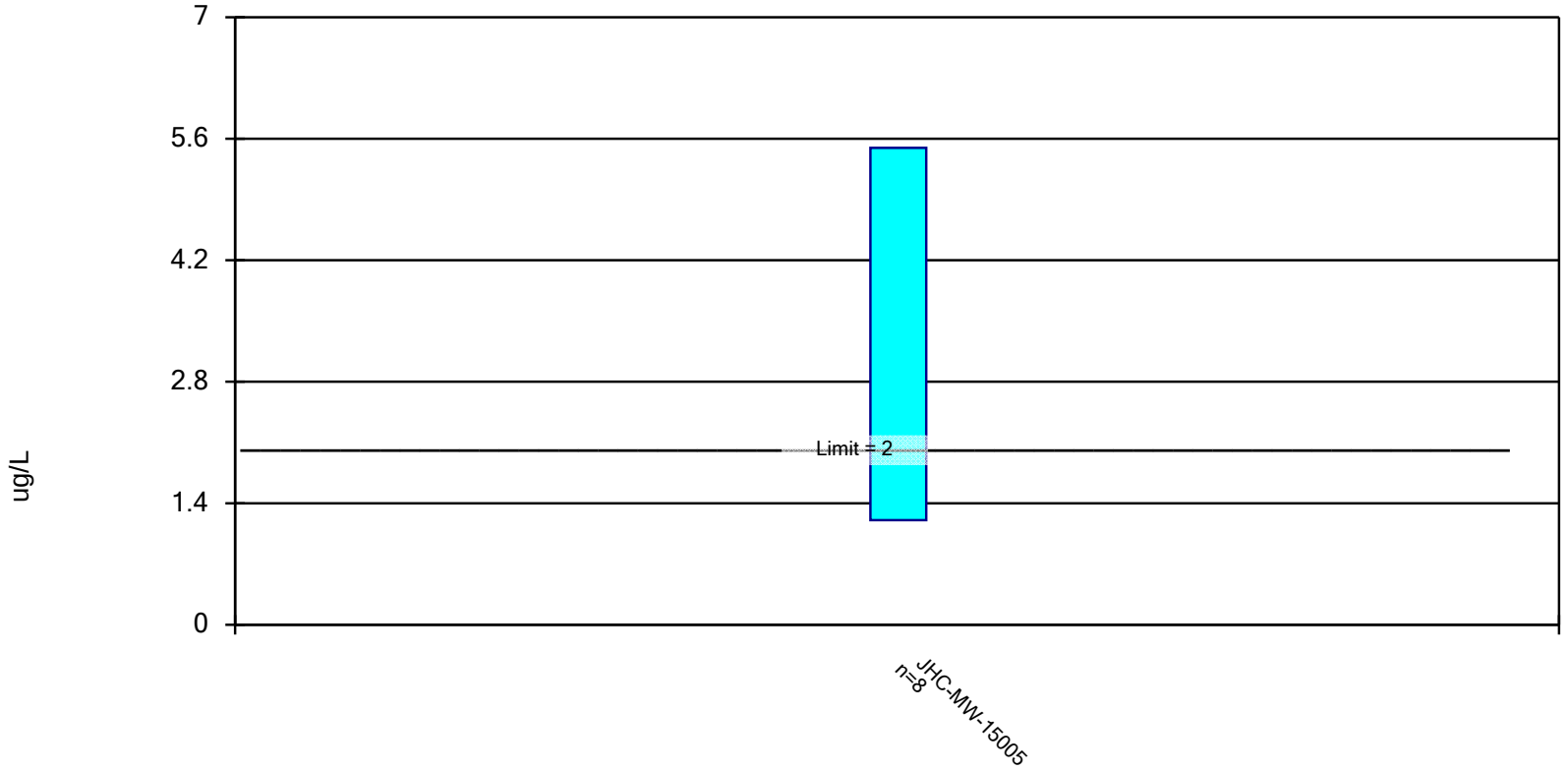
Constituent: Selenium, Total (ug/L) Analysis Run 6/11/2021 11:28 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

	JHC-MW-15005	JHC-MW-18005
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
10/22/2020	260	101 (D)
4/13/2021	168 (D)	58
Mean	181.4	55.81
Std. Dev.	116.7	43.96
Upper Lim.	305.1	102.4
Lower Lim.	57.68	9.208

Parametric Confidence Interval

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



Constituent: Thallium, Total Analysis Run 6/11/2021 11:27 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

Confidence Interval

Constituent: Thallium, Total (ug/L) Analysis Run 6/11/2021 11:28 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_1SA21

	JHC-MW-15005
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
10/22/2020	7
4/13/2021	3 (D)
Mean	3.35
Std. Dev.	2.024
Upper Lim.	5.495
Lower Lim.	1.205

Appendix C
October 2021 Assessment Monitoring Statistical Evaluation

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Technical Memorandum

Date:	January 28, 2022
To:	Bethany Swanberg, Consumers Energy
From:	Sarah Holmstrom, TRC Kristin Lowery, TRC
Project No.:	418422.0000.0000 Phase 1 Task 3
Subject:	Statistical Evaluation of October 2021 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 2021 was conducted on October 19 through 22, 2021. In accordance with §257.95, the assessment monitoring data must be compared to Groundwater Protection Standards (GWPSs) to determine whether or not Appendix IV constituents are detected at statistically significant levels above the 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 2021 indicates that the following constituent is present at statistically significant levels exceeding the GWPS in monitoring wells at the Ponds 1-2 CCR Unit:

Constituent	GWPS	# Sidegradient Wells Observed
Arsenic	10 ug/L	1 of 2

[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.

These results are generally consistent with the results of the previous assessment monitoring data statistical evaluation, with no new statistically significant levels above the GWPSs. 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.

Assessment Monitoring Statistical Evaluation

The compliance well network at the Ponds 1-2 CCR Unit consists of five 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. Monitoring wells JHC-MW-15005, JHC-MW-18004, and JHC-MW-18005 are located downgradient of Ponds 1-2 and monitoring wells JHC-MW-15002 and JHC-MW-15003 are located side gradient of Ponds 1-2, as described in the January 22, 2021 Groundwater Monitoring System Certification.

Following the second semiannual assessment monitoring sampling event for 2021, 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 is 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 sample mean, the sample 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 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).

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

For each detected Appendix IV constituent, the concentrations for each well were first compared directly to the GWPS, as shown on Table C1. Constituent-well combinations that included a direct exceedance of the GWPS within the past eight monitoring events (June 2018 through October 2021 for JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 and February 2019 through October 2021 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, lithium, and molybdenum 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.

The *Alternative Source Demonstration: Selenium at JHC-MW-15005* (TRC, October 2021) (October 2021 ASD) was prepared in response to the statistically significant level of selenium above the GWPS identified at JHC-MW-15005 in the April 2021 assessment monitoring event. The multiple lines of evidence presented in the ASD show that hydrogeological and geochemical changes post-CCR removal from Ponds 1-2 have resulted in observations of new increases in groundwater concentrations for selenium at JHC-MW-15005 that are unrelated to Ponds 1-2. Therefore, comparison of selenium concentrations at JHC-MW-15005 to the GWPS is not appropriate and a confidence interval is not calculated.

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 assessment monitoring results (June 2018 through October 2021) for these well-constituent pairs were observed visually for potential outliers and trends. No outliers were apparent. Visual trends were observed for arsenic in JHC-MW-15002 and JHC-MW-15003, molybdenum in JHC-MW-15002, and thallium in JHC-MW-15005 (time-series plots in Attachment 1); however, no statistically significant trends were observed. As discussed in the October 2021 ASD, hydrogeological and geochemical changes post-CCR removal from Ponds 1-2 have resulted in observations of new increases in groundwater constituent concentrations for several Appendix III and Appendix IV parameters in the Ponds 1-2 monitoring network unrelated to Ponds 1-2 and are occurring as groundwater responds and re-equilibrates to the new geochemical conditions coupled with the constituent concentrations from upgradient historic CCR management sources.. 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. 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	Cobalt at JHC-MW-15003 (Kaplan-Meier) Lithium at JHC-MW-15002 and JHC-MW-15005 Molybdenum at JHC-MW-15003 Selenium at JHC-MW-18005 Thallium at JHC-MW-15005
Normalized by natural log transformation	Arsenic at JHC-MW-18005
Normalized by square root transformation	Arsenic at JHC-MW-15002 and JHC-MW-15003 Molybdenum at JHC-MW-15002 and 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 previous assessment monitoring data statistical evaluations. Consumers Energy continues 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 C1
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[2]								
					Sample Date:	6/19/2018	11/15/2018	11/15/2018	4/25/2019	10/9/2019	4/16/2020	10/22/2020	4/14/2021	10/21/2021
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS									
Appendix III								Field Dup						
Boron	ug/L	NC	NA	51	NA	430	1,470	1,360	3,200	1,700	2,560	2,390	4,880	2,350
Calcium	mg/L	NC	NA	46	NA	75.3	41.9	41.1	85	99	122	80.1	103	112
Chloride	mg/L	250*	NA	43	NA	22.3	19.3	19.2	17	20	15.4	16.0	14.2	18.1
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
Sulfate	mg/L	250*	NA	14	NA	153	95.2	94.5	190	280	295	212	499	263
Total Dissolved Solids	mg/L	500*	NA	258	NA	356	222	274	410	480	567	396	583	570
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	8.3	8.0	--	6.9	6.5	6.1	5.7	5.3	6.5
Appendix IV														
Antimony	ug/L	6	NA	2	6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	NA	1	**10**	**127**	**60.5**	**59.5**	**50**	**57**	**45**	**21**	**36**	**38**
Barium	ug/L	2,000	NA	35	2,000	19.8	18.4	18.1	49	150	128	85	49	47
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	NA	2	100	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	1	< 1
Cobalt	ug/L	NC	6	15	**15**	< 15.0	< 6.0	< 6.0	< 6.0	< 6.0	< 15	< 15	< 6	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	40	10	**40**	19	**68**	**67**	**96**	**240**	**125**	**76**	**48**	24
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	5	**100**	7.5	9.2	9.0	< 5.0	15	49	43	12	**101**
Radium-226	pCi/L	NC	NA	NA	NA	< 0.620	< 1.09	0.921	0.233	0.698	0.378	0.468	0.302	0.332
Radium-228	pCi/L	NC	NA	NA	NA	< 1.58	1.04	0.767	0.409	< 0.394	< 0.408	< 0.250	0.524	0.823
Radium-226/228	pCi/L	5	NA	1.93	5	< 2.20	< 1.70	1.69	0.642	1.04	0.784	0.533	0.827	1.16
Selenium	ug/L	50	NA	5	**50**	< 1.0	2.5	2.8	< 1.0	< 1.0	1	< 1	1	1
Thallium	ug/L	2	NA	2	**2**	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 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.
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) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.
(2) Monitoring wells 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 C1
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[2]**											
					Sample Date:	6/18/2018	6/18/2018	11/15/2018	4/29/2019	10/9/2019	10/9/2019	4/16/2020	10/22/2020	4/14/2021	10/20/2021	10/20/2021
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS												
Appendix III							Field Dup				Field Dup						Field Dup
Boron	ug/L	NC	NA	51	NA	1,170	1,320	1,120	1,700	3,500	3,300	3,880	2,370	674	1,060	1,020	
Calcium	mg/L	NC	NA	46	NA	60.0	59.1	115	36	110	110	94.6	57.6	108	101	99.1	
Chloride	mg/L	250*	NA	43	NA	37.5	36.6	16.3	18	47	47	17.3	22.3	24.2	16.6	16.6	
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	
Sulfate	mg/L	250*	NA	14	NA	81.9	82.7	294	75	210	220	194	89	207	172	173	
Total Dissolved Solids	mg/L	500*	NA	258	NA	388	344	644	200	580	600	554	339	573	542	540	
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	8.9	--	8.7	8.4	8.7	--	8.3	8.3	8.2	8.2	--	
Appendix IV																	
Antimony	ug/L	6	NA	2	6	1.9	1.8	2.0	2.2	1.4	1.4	1	< 1	1	< 1	< 1	
Arsenic	ug/L	10	NA	1	**10**	**14.1**	**14.3**	8.1	10	8.4	7.7	9	**12**	**15**	**24**	**24**	
Barium	ug/L	2,000	NA	35	2,000	55.7	52.5	113	42	91	89	103	68	75	75	76	
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	1.7	0.41	2.5	2.5	1.0	< 0.2	< 0.2	0.3	0.3	
Chromium	ug/L	100	NA	2	100	< 1.0	< 1.0	13.6	4.2	11	10	7	7	3	9	9	
Cobalt	ug/L	NC	6	15	**15**	< 15.0	< 15.0	**23.6**	< 6.0	**43**	**41**	**47**	< 15	< 6	**22**	**23**	
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1000	< 1,000	< 1,000	< 1,000	
Lead	ug/L	NC	15	1	15	< 1.0	< 1.0	3.3	< 1.0	3.2	3.2	5	2	< 1	1	1	
Lithium	ug/L	NC	40	10	**40**	< 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	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Molybdenum	ug/L	NC	100	5	**100**	53.0	51.2	65.3	20	**120**	**120**	**125**	59	38	52	52	
Radium-226	pCi/L	NC	NA	NA	NA	< 0.623	< 0.733	< 0.579	< 0.113	0.301	0.430	0.272	< 0.322	0.170	0.358	0.357	
Radium-228	pCi/L	NC	NA	NA	NA	< 1.01	< 1.08	< 0.657	< 0.530	0.421	< 0.361	0.541	< 0.282	< 0.423	< 0.517	< 0.344	
Radium-226/228	pCi/L	5	NA	1.93	5	< 1.63	< 1.81	< 1.24	< 0.530	0.722	0.559	0.813	< 0.322	< 0.423	< 0.517	0.604	
Selenium	ug/L	50	NA	5	**50**	4.4	4.5	28.6	2.9	18	19	27	1	25	38	37	
Thallium	ug/L	2	NA	2	**2**	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 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.
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) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.
(2) Monitoring wells 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 C1
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:	6/19/2018	11/15/2018	4/25/2019	4/25/2019	10/9/2019	4/16/2020	10/22/2020	4/13/2021	4/13/2021	10/21/2021
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS										
Appendix III									Field Dup					Field Dup	
Boron	ug/L	NC	NA	51	NA	227	1,450	2,800	2,900	1,200	1,020	1,340	616	623	661
Calcium	mg/L	NC	NA	46	NA	61.8	61.9	170	180	110	97.1	131	99.7	94.7	86.1
Chloride	mg/L	250*	NA	43	NA	90.9	30.6	28	28	30	15.6	57.1	6.19	5.24	14.1
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	74.3	133	240	320	130	133	207	88.8	85.4	138
Total Dissolved Solids	mg/L	500*	NA	258	NA	462	334	800	780	360	487	735	470	455	489
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.4	7.5	7.2	--	7.3	7.1	7.2	7.4	--	7.5
Appendix IV															
Antimony	ug/L	6	NA	2	6	1.6	5.1	4.4	4.2	3.3	2	2	2	2	3
Arsenic	ug/L	10	NA	1	**10**	1.3	1.2	1.2	1.1	1.4	1	2	3	2	2
Barium	ug/L	2,000	NA	35	2,000	175	149	150	150	190	270	354	208	211	229
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	NA	2	100	3.0	< 1.0	1.3	1.3	1.3	1	< 1	1	1	< 1
Cobalt	ug/L	NC	6	15	**15**	< 15.0	< 6.0	< 6.0	< 6.0	< 6.0	< 15	< 15	< 6	< 6	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1000	< 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	< 1	< 1	< 1
Lithium	ug/L	NC	40	10	**40**	35	28	38	38	**50**	**59**	**42**	20	21	**46**
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	5	**100**	15.7	**222**	**900**	**870**	**370**	91	**110**	88	90	50
Radium-226	pCi/L	NC	NA	NA	NA	< 0.758	< 0.461	0.169	0.248	0.592	0.448	0.691	0.264	0.284	0.570
Radium-228	pCi/L	NC	NA	NA	NA	1.22	0.967	< 0.350	0.495	0.427	0.566	0.791	< 0.360	0.471	0.553
Radium-226/228	pCi/L	5	NA	1.93	5	1.91	1.41	< 0.350	0.743	1.02	1.01	1.48	0.510	0.755	1.12
Selenium	ug/L	50	NA	5	**50**	14	**158**	**140**	**130**	**66**	**282**	**260**	**165**	**171**	**98**
Thallium	ug/L	2	NA	2	**2**	**2.1**	< 2.0	2.0	<2.0	**2.9**	**3**	**7**	**3**	**3**	**4**

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) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.
(2) Monitoring wells 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 C1
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:	2/28/2019	4/25/2019	8/13/2019	10/9/2019	4/16/2020	10/22/2020	4/13/2021	10/22/2021
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS								
Appendix III													
Boron	ug/L	NC	NA	51	NA	900	920	1,200	620	524	638	444	456
Calcium	mg/L	NC	NA	46	NA	55	72	97	73	117	98.4	88.9	73.1
Chloride	mg/L	250*	NA	43	NA	50	34	35	40	14.2	12.5	5.17	10.8
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
Sulfate	mg/L	250*	NA	14	NA	69	100	110	120	249	127	64.4	69.3
Total Dissolved Solids	mg/L	500*	NA	258	NA	330	380	490	310	604	515	418	407
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.6 (1)	7.2	7.5	7.2	6.9	7.4	7.7	7.7
Appendix IV													
Antimony	ug/L	6	NA	2	6	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	NA	1	**10**	< 1.0	1.1	1.2	1.1	< 1	1	< 1	1
Barium	ug/L	2,000	NA	35	2,000	170	220	680	270	210	323	325	361
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	NA	2	100	1.2	2.0	1.8	1.3	< 1	< 1	< 1	< 1
Cobalt	ug/L	NC	6	15	**15**	< 6.0	< 6.0	< 6.0	< 6.0	< 15	< 15	< 6	< 6
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
Lead	ug/L	NC	15	1	15	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	40	10	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	5	**100**	7.4	8.2	9.0	10	7	10	7	7
Radium-226	pCi/L	NC	NA	NA	NA	< 0.0742	0.110	0.352	0.179	< 0.131	0.367	0.243	0.583
Radium-228	pCi/L	NC	NA	NA	NA	0.589	< 0.430	0.469	0.672	0.889	0.454	0.642	< 0.355
Radium-226/228	pCi/L	5	NA	1.93	5	0.654	< 0.430	0.822	0.851	0.952	0.821	0.885	0.745
Selenium	ug/L	50	NA	5	**50**	12	12	39	33	34	18	39	34
Thallium	ug/L	2	NA	2	**2**	< 2.0	< 2.0	< 2.0	< 2.0	< 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.
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) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.
(2) Monitoring wells 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 C1
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:						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	4/13/2021	10/22/2021
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS											
Appendix III							Field Dup			Field Dup				Field Dup		
Boron	ug/L	NC	NA	51	NA	660	720	650	750	780	660	534	486	499	382	408
Calcium	mg/L	NC	NA	46	NA	43	42	41	43	45	55	42.6	58.7	60.1	45.5	55.7
Chloride	mg/L	250*	NA	43	NA	27	26	25	27	27	18	19.6	16.4	16.8	16.6	8.25
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	89	85	66	95	95	110	74.5	105	108	75.3	79.9
Total Dissolved Solids	mg/L	500*	NA	258	NA	280	260	250	270	290	330	262	339	317	287	337
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	8.6 (1)	--	9.0	8.9	--	8.8	8.5	8.4	--	8.7	8.4
Appendix IV																
Antimony	ug/L	6	NA	2	6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	NA	1	**10**	10	**11**	8.8	7.4	7.3	7.1	8	8	8	8	8
Barium	ug/L	2,000	NA	35	2,000	72	73	73	120	120	150	144	207	206	201	310
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	NA	2	100	4.0	4.1	2.8	2.3	2.4	1.9	< 1	1	1	< 1	< 1
Cobalt	ug/L	NC	6	15	**15**	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 15	< 15	< 15	< 6	< 6
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	< 1.0	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	40	10	**40**	< 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	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	5	**100**	14	15	14	15	15	66	9	7	7	7	< 5
Radium-226	pCi/L	NC	NA	NA	NA	< 0.0795	<0.0779	< 0.0785	< 0.145	0.150	0.497	0.150	< 0.205	< 0.182	0.225	0.316
Radium-228	pCi/L	NC	NA	NA	NA	< 0.386	<0.337	< 0.357	< 0.400	< 0.374	0.456	< 0.455	< 0.141	0.131	< 0.395	< 0.498
Radium-226/228	pCi/L	5	NA	1.93	5	< 0.386	<0.337	< 0.357	< 0.400	< 0.374	0.953	< 0.455	< 0.205	0.185	< 0.395	0.507
Selenium	ug/L	50	NA	5	**50**	35	34	16	11	11	**140**	46	**99**	**103**	**58**	31
Thallium	ug/L	2	NA	2	**2**	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2	< 2	< 2	< 2	< 2

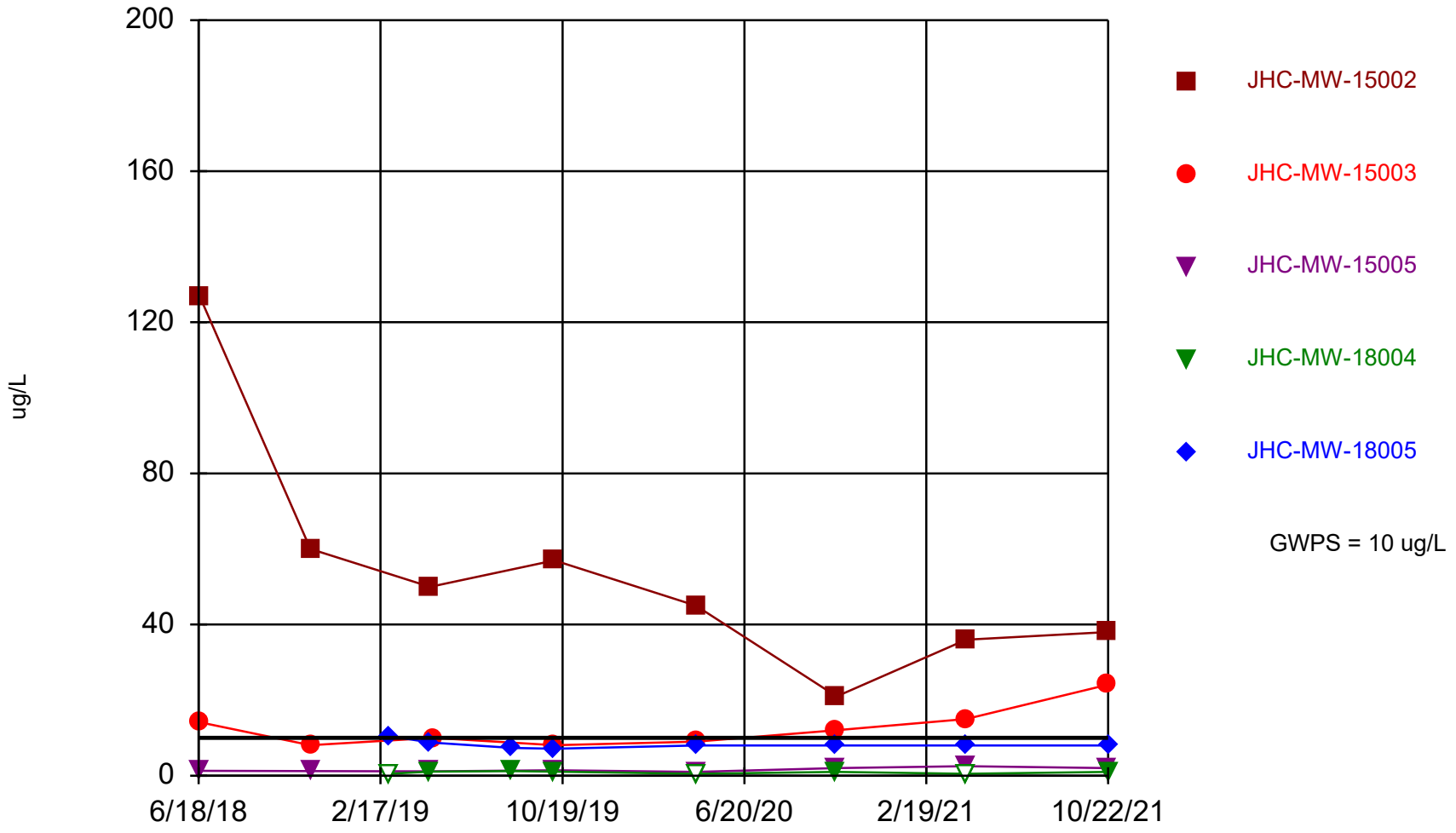
Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
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) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.
(2) Monitoring wells 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

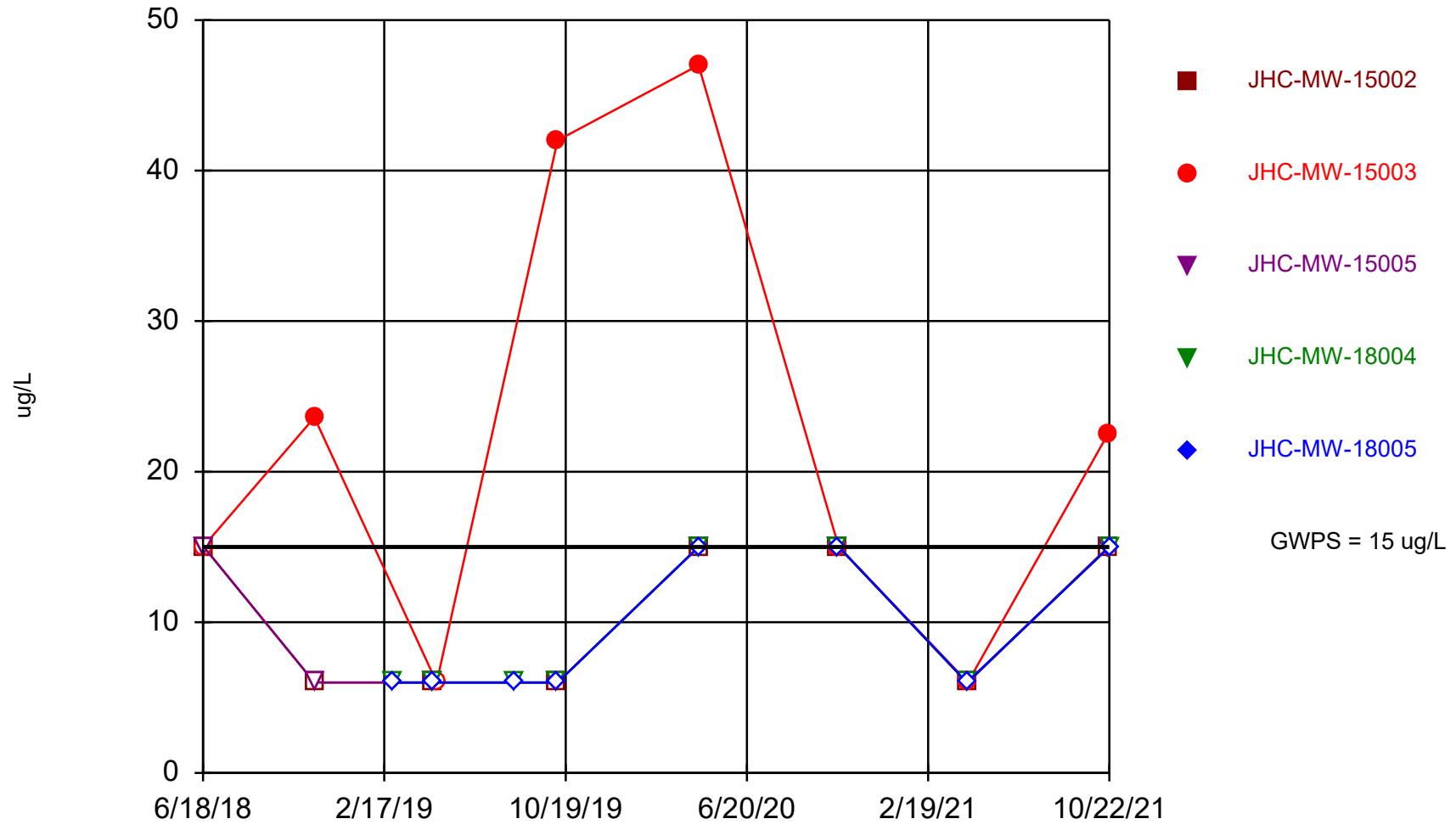


Time Series Analysis Run 12/6/2021 10:03 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

Hollow symbols indicate censored values.

Cobalt Comparison to GWPS

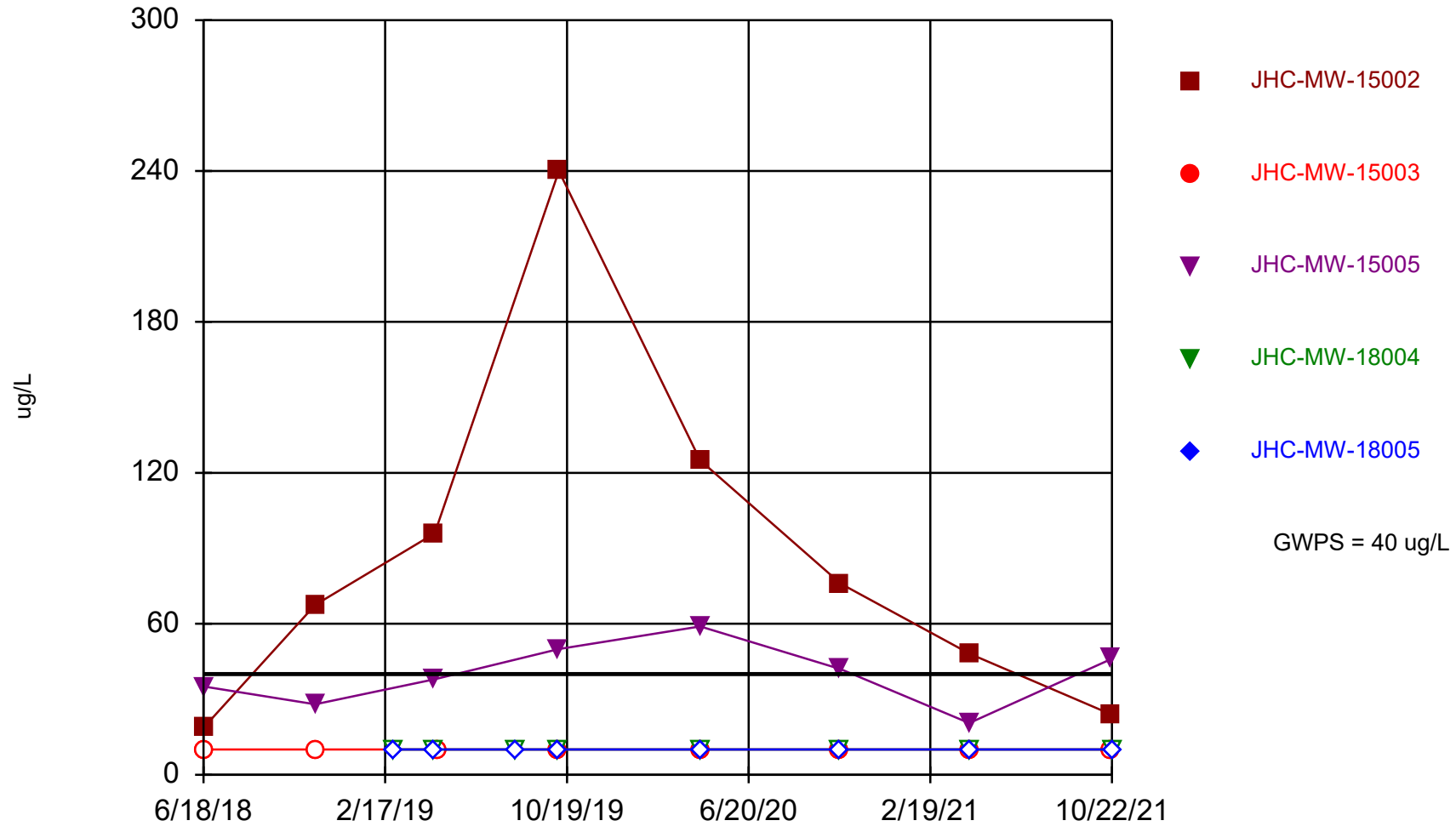


Time Series Analysis Run 12/6/2021 10:04 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

Hollow symbols indicate censored values.

Lithium Comaprison to GWPS

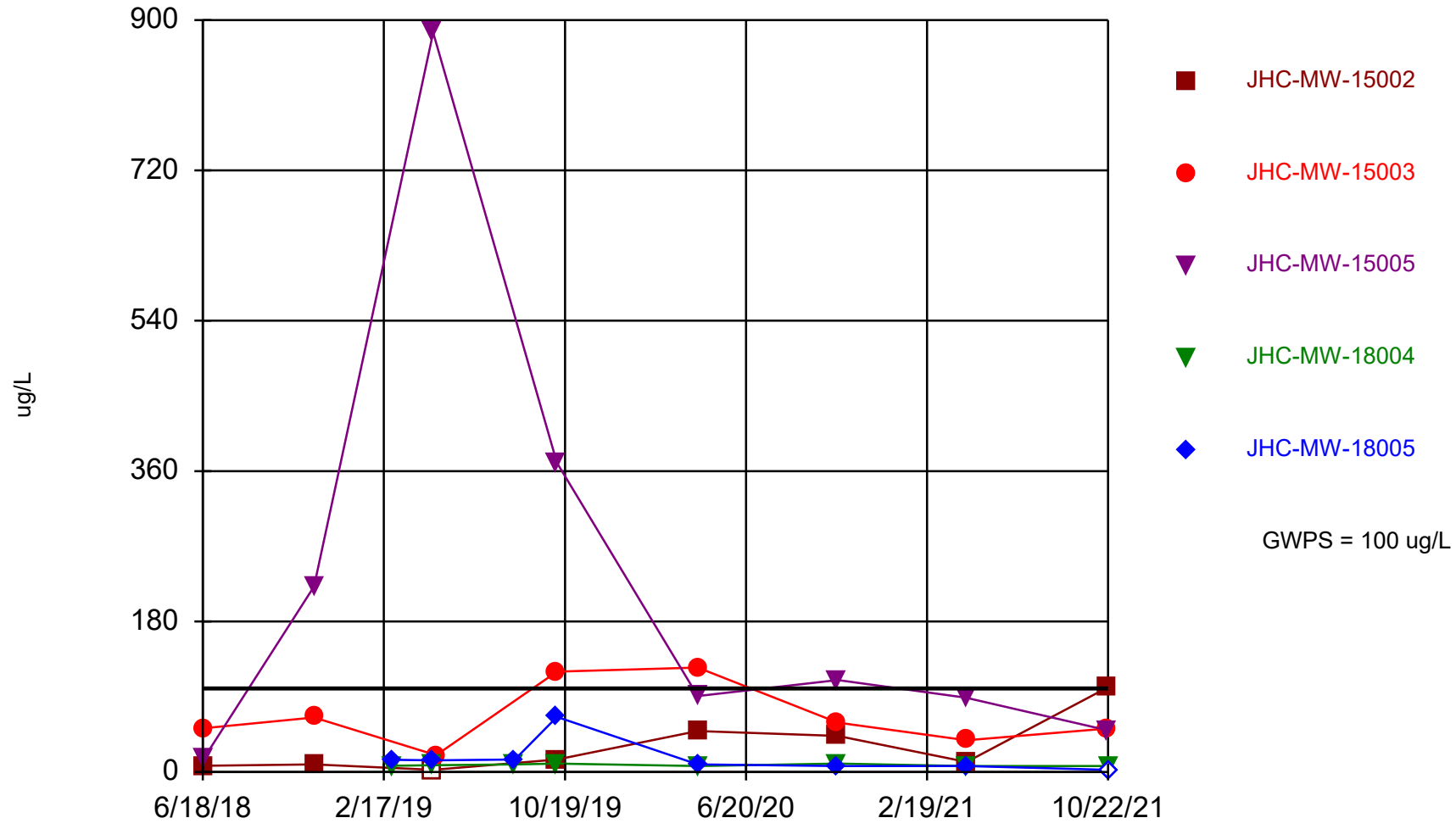


Time Series Analysis Run 12/6/2021 10:09 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

Hollow symbols indicate censored values.

Molybdenum Comparison to GWPS

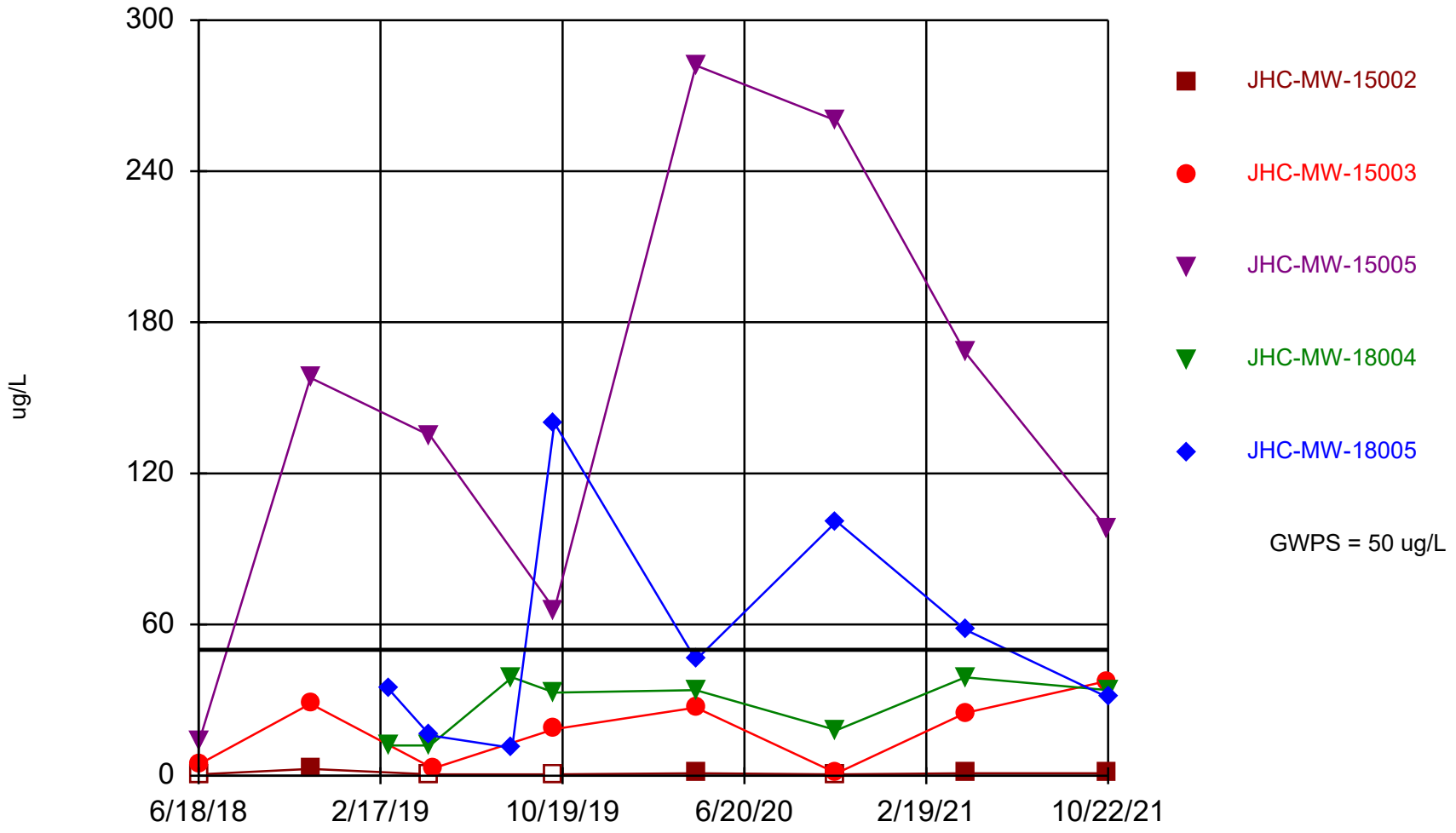


Time Series Analysis Run 12/6/2021 10:11 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

Hollow symbols indicate censored values.

Selenium Comparison to GWPS

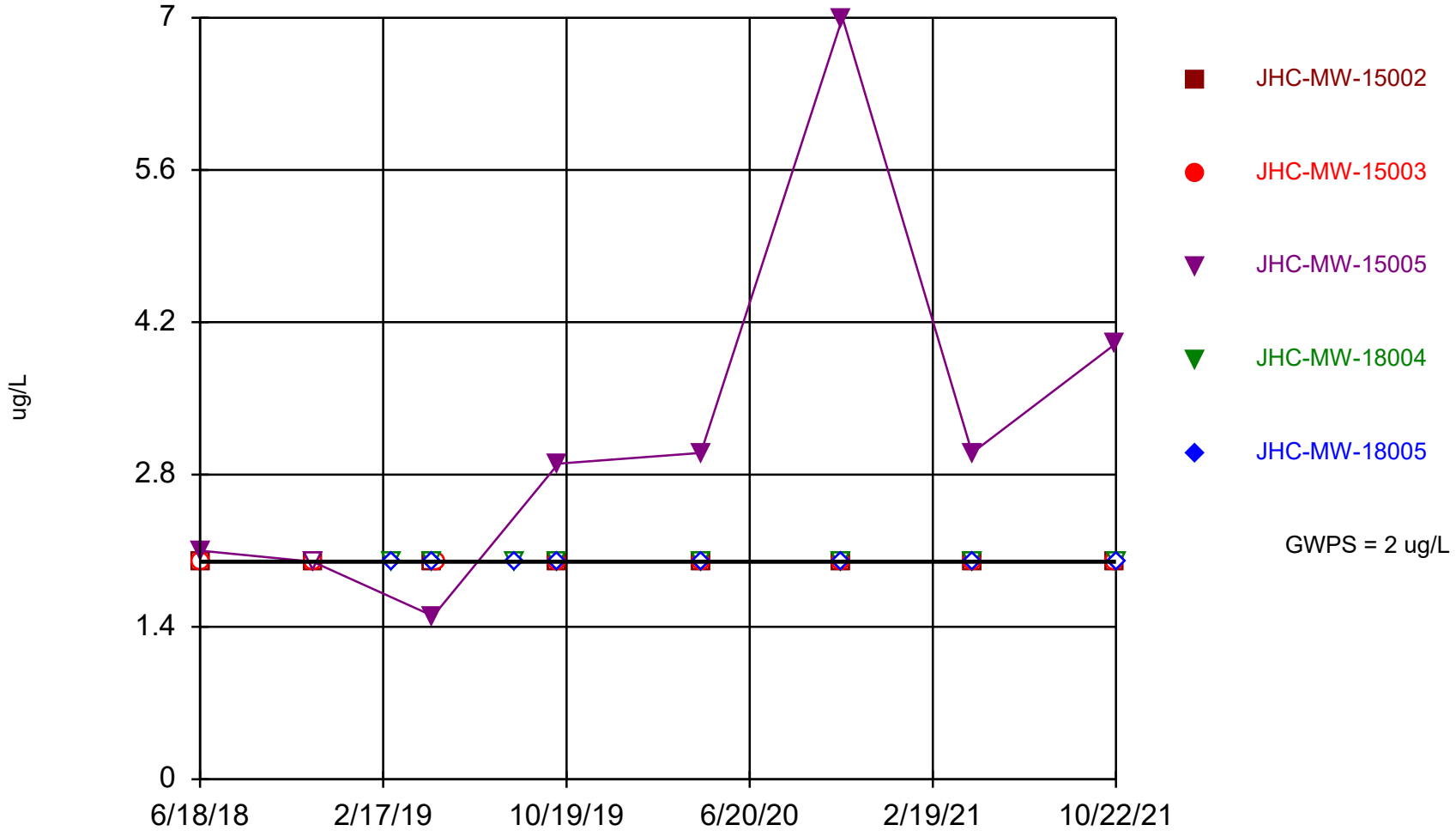


Time Series Analysis Run 12/6/2021 10:12 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

Hollow symbols indicate censored values.

Thallium Comparison to GWPS



Time Series Analysis Run 12/6/2021 10:13 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

Summary Report

Constituent: Arsenic, Total Analysis Run 12/6/2021 10:04 AM
Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

For observations made between 6/18/2018 and 10/22/2021, a summary of the selected data set:

Observations = 40
ND/Trace = 3
Wells = 5
Minimum Value = 0.5
Maximum Value = 127
Mean Value = 15.49
Median Value = 8
Standard Deviation = 24.35
Coefficient of Variation = 1.572
Skewness = 2.847

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15002	8	0	21	127	54.25	47.5	31.94	0.5887	1.581
JHC-MW-15003	8	0	8.05	24	12.54	11	5.336	0.4254	1.29
JHC-MW-15005	8	0	1	2.5	1.569	1.35	0.5311	0.3386	0.6485
JHC-MW-18004	8	3	0.5	1.2	0.8625	1	0.3068	0.3557	-0.3834
JHC-MW-18005	8	0	7.1	10.5	8.219	8	1.052	0.1279	1.31

Summary Report

Constituent: Cobalt, Total Analysis Run 12/6/2021 10:04 AM
Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

For observations made between 6/18/2018 and 10/22/2021, a summary of the selected data set:

Observations = 40
ND/Trace = 36
Wells = 5
Minimum Value = 6
Maximum Value = 47
Mean Value = 12.38
Median Value = 10.5
Standard Deviation = 9.098
Coefficient of Variation = 0.735
Skewness = 2.243

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15002	8	8	6	15	10.5	10.5	4.811	0.4582	0
JHC-MW-15003	8	4	6	47	22.14	18.75	15.3	0.6909	0.6007
JHC-MW-15005	8	8	6	15	10.5	10.5	4.811	0.4582	0
JHC-MW-18004	8	8	6	15	9.375	6	4.658	0.4968	0.5164
JHC-MW-18005	8	8	6	15	9.375	6	4.658	0.4968	0.5164

Summary Report

Constituent: Lithium, Total Analysis Run 12/6/2021 10:10 AM
Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

For observations made between 6/18/2018 and 10/22/2021, a summary of the selected data set:

Observations = 40
ND/Trace = 24
Wells = 5
Minimum Value = 10
Maximum Value = 240
Mean Value = 31.35
Median Value = 10
Standard Deviation = 43.22
Coefficient of Variation = 1.378
Skewness = 3.253

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15002	8	0	19	240	86.94	71.75	71.26	0.8197	1.271
JHC-MW-15003	8	8	10	10	10	10	0	0	NaN
JHC-MW-15005	8	0	20.5	59	39.81	40	12.27	0.3082	-0.04959
JHC-MW-18004	8	8	10	10	10	10	0	0	NaN
JHC-MW-18005	8	8	10	10	10	10	0	0	NaN

Summary Report

Constituent: Molybdenum, Total Analysis Run 12/6/2021 10:12 AM
Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

For observations made between 6/18/2018 and 10/22/2021, a summary of the selected data set:

Observations = 40
ND/Trace = 2
Wells = 5
Minimum Value = 2.5
Maximum Value = 885
Mean Value = 70.1
Median Value = 15.35
Standard Deviation = 149.3
Coefficient of Variation = 2.13
Skewness = 4.422

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15002	8	1	2.5	101	29.89	13.5	33.42	1.118	1.305
JHC-MW-15003	8	0	20	125	66.43	55.55	37.29	0.5614	0.6637
JHC-MW-15005	8	0	15.7	885	229.1	100.5	288	1.257	1.678
JHC-MW-18004	8	0	7	10	8.2	7.8	1.314	0.1602	0.4365
JHC-MW-18005	8	1	2.5	66	16.88	11.5	20.33	1.205	2.055

Summary Report

Constituent: Selenium, Total Analysis Run 12/6/2021 10:13 AM
Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

For observations made between 6/18/2018 and 10/22/2021, a summary of the selected data set:

Observations = 40
ND/Trace = 4
Wells = 5
Minimum Value = 0.5
Maximum Value = 282
Mean Value = 49.8
Median Value = 27.8
Standard Deviation = 68.37
Coefficient of Variation = 1.373
Skewness = 2.007

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15002	8	4	0.5	2.65	0.9563	0.75	0.7277	0.761	1.775
JHC-MW-15003	8	0	1	37.5	18.12	21.75	13.75	0.7589	-0.09619
JHC-MW-15005	8	0	14	282	147.6	146.5	91.3	0.6184	0.1607
JHC-MW-18004	8	0	12	39	27.63	33.5	11.65	0.4217	-0.4738
JHC-MW-18005	8	0	11	140	54.69	40.25	44.53	0.8144	0.9628

Summary Report

Constituent: Thallium, Total Analysis Run 12/6/2021 10:14 AM
Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

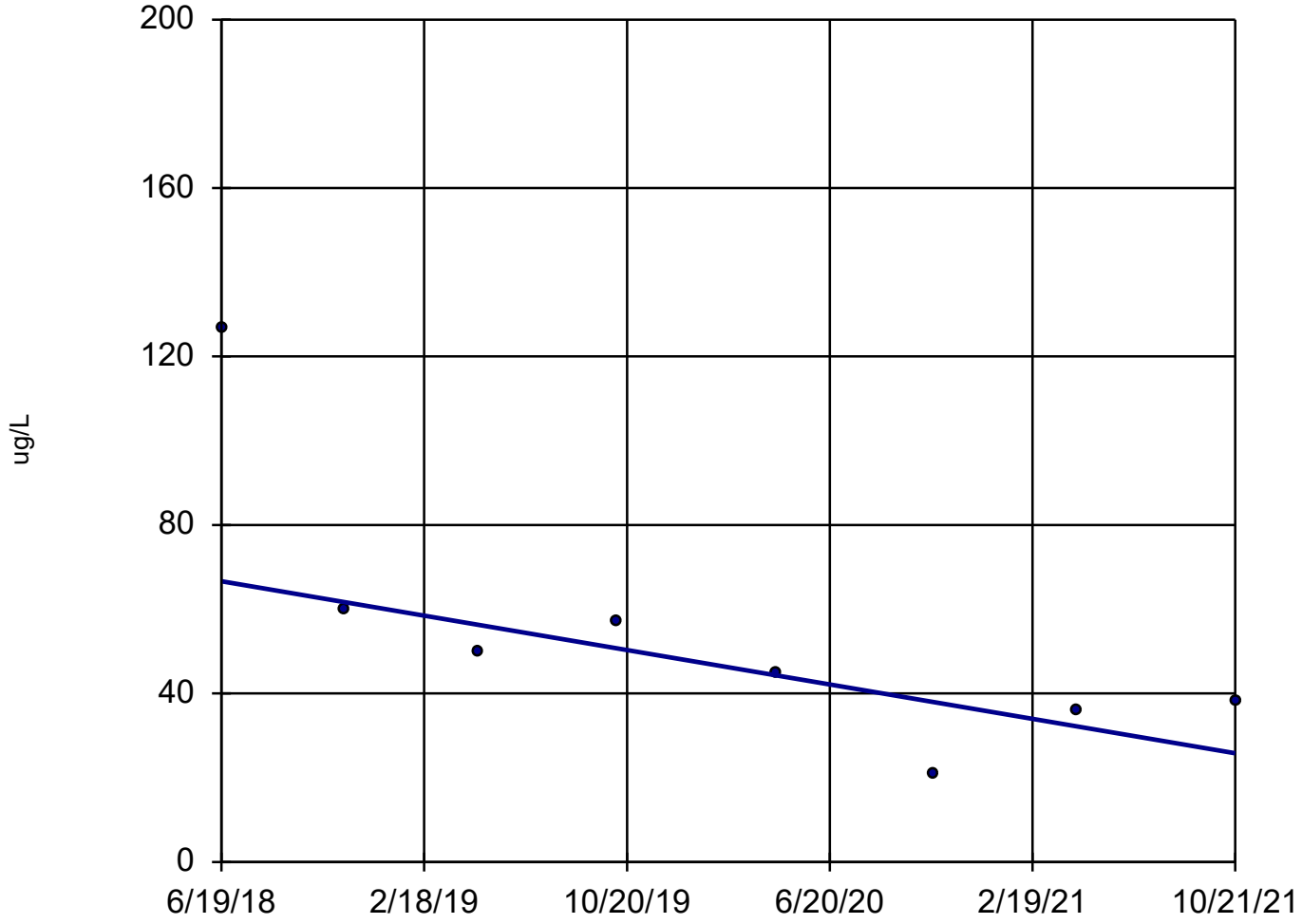
For observations made between 6/18/2018 and 10/22/2021, a summary of the selected data set:

Observations = 40
ND/Trace = 33
Wells = 5
Minimum Value = 1.5
Maximum Value = 7
Mean Value = 2.238
Median Value = 2
Standard Deviation = 0.8743
Coefficient of Variation = 0.3908
Skewness = 4.422

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
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	1	1.5	7	3.188	2.95	1.723	0.5406	1.437
JHC-MW-18004	8	8	2	2	2	2	0	0	NaN
JHC-MW-18005	8	8	2	2	2	2	0	0	NaN

Arsenic, Total

JHC-MW-15002



n = 8

Slope = -12.22 units per year.

Mann-Kendall statistic = -20 critical = -20

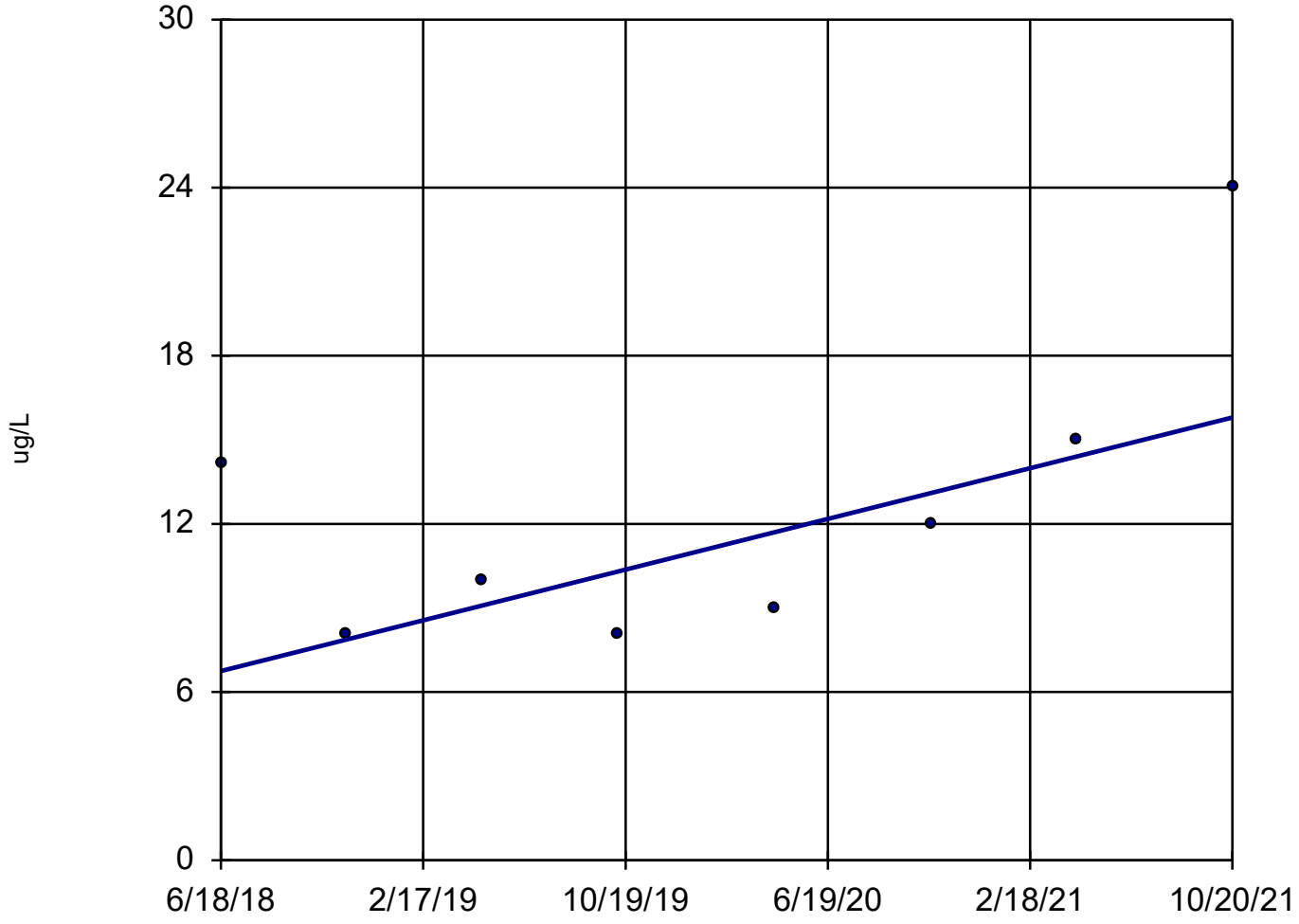
Trend not significant at 98% confidence level (α = 0.01 per tail).

Sen's Slope Estimator Analysis Run 12/6/2021 10:17 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

Arsenic, Total

JHC-MW-15003



n = 8

Slope = 2.704 units per year.

Mann-Kendall statistic = 12 critical = 20

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

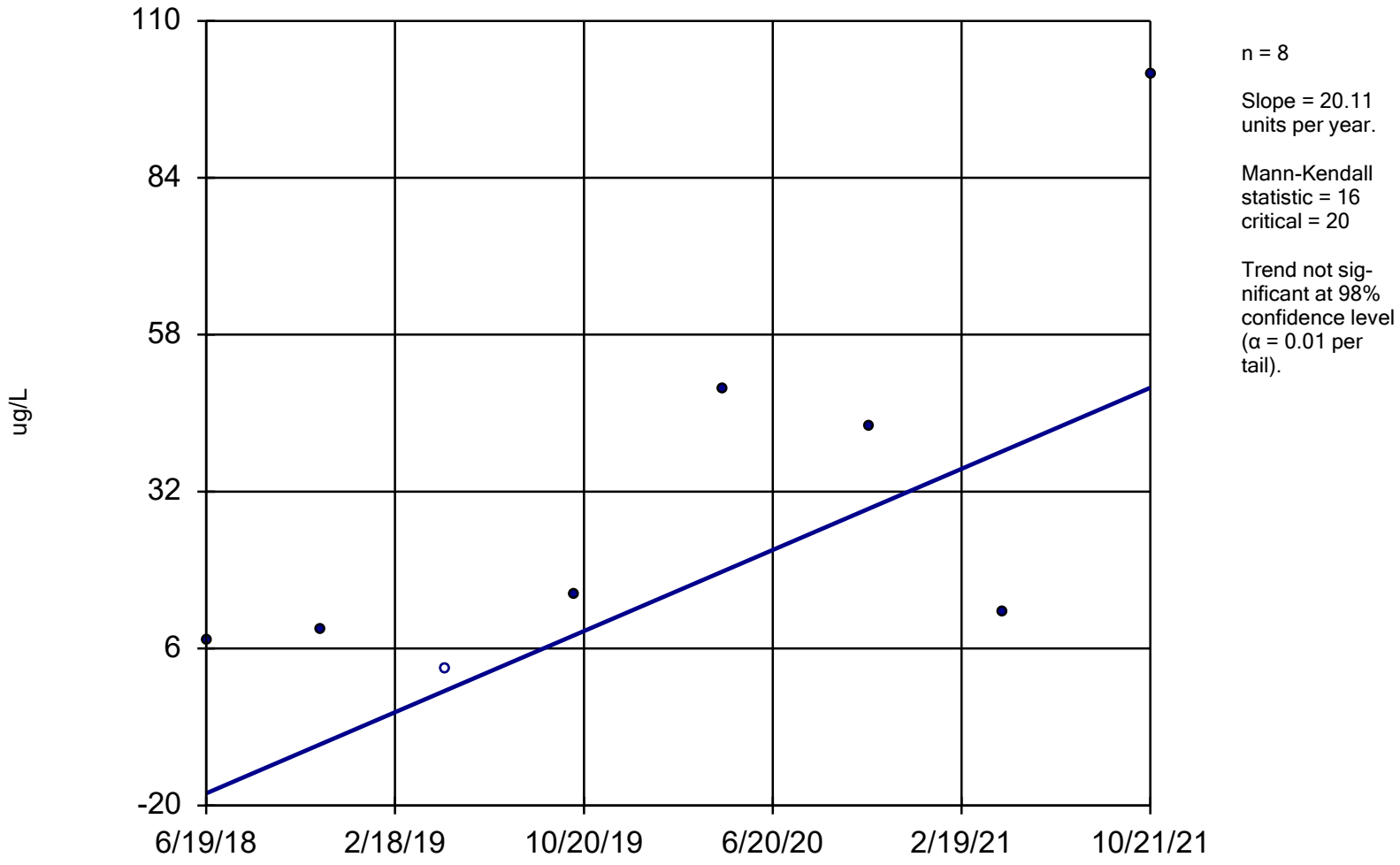
Sen's Slope Estimator Analysis Run 12/6/2021 10:17 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

Hollow symbols indicate censored values.

Molybdenum, Total

JHC-MW-15002



n = 8

Slope = 20.11 units per year.

Mann-Kendall statistic = 16
critical = 20

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

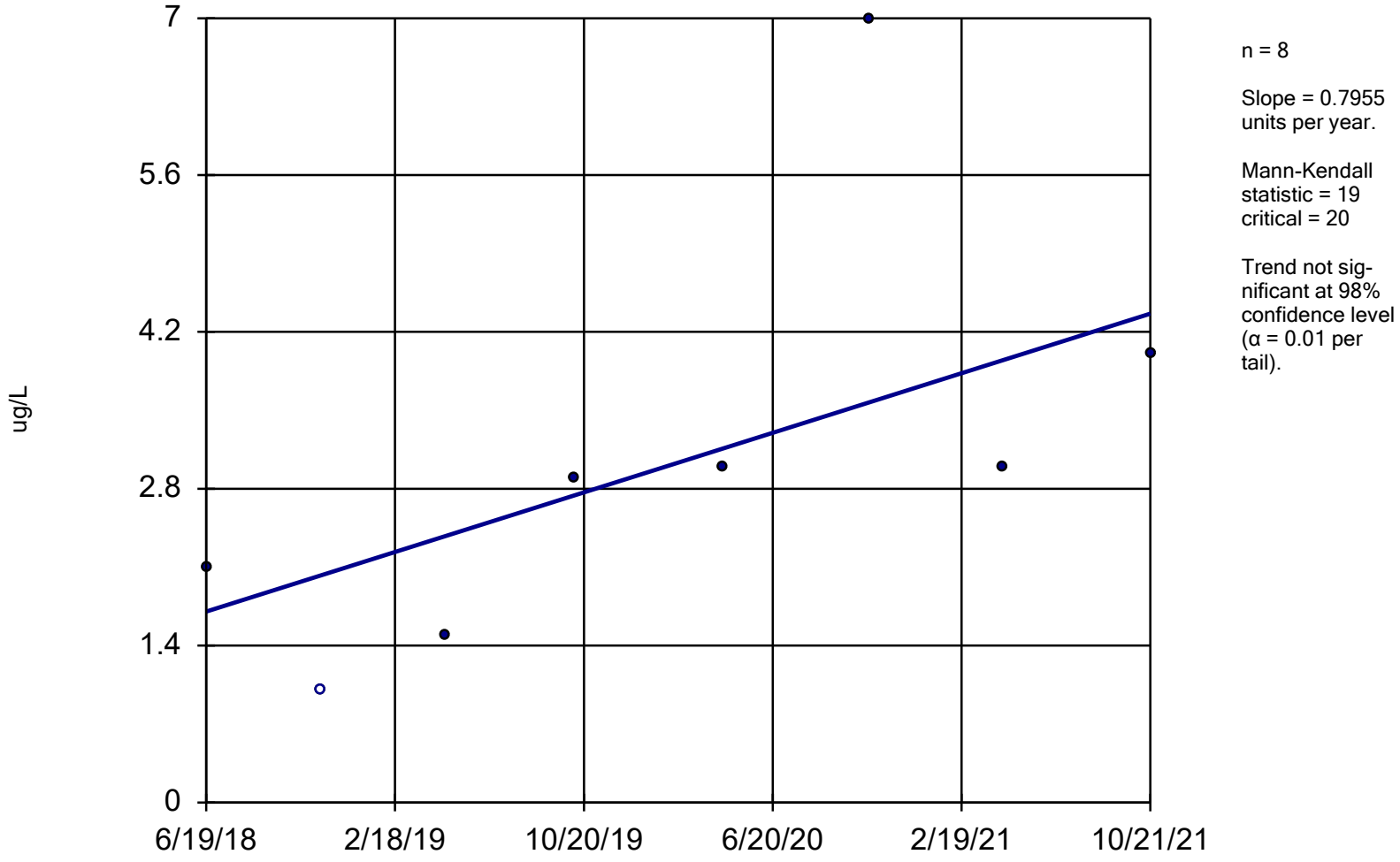
Sen's Slope Estimator Analysis Run 12/6/2021 10:17 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

Hollow symbols indicate censored values.

Thallium, Total

JHC-MW-15005



n = 8

Slope = 0.7955 units per year.

Mann-Kendall statistic = 19
critical = 20

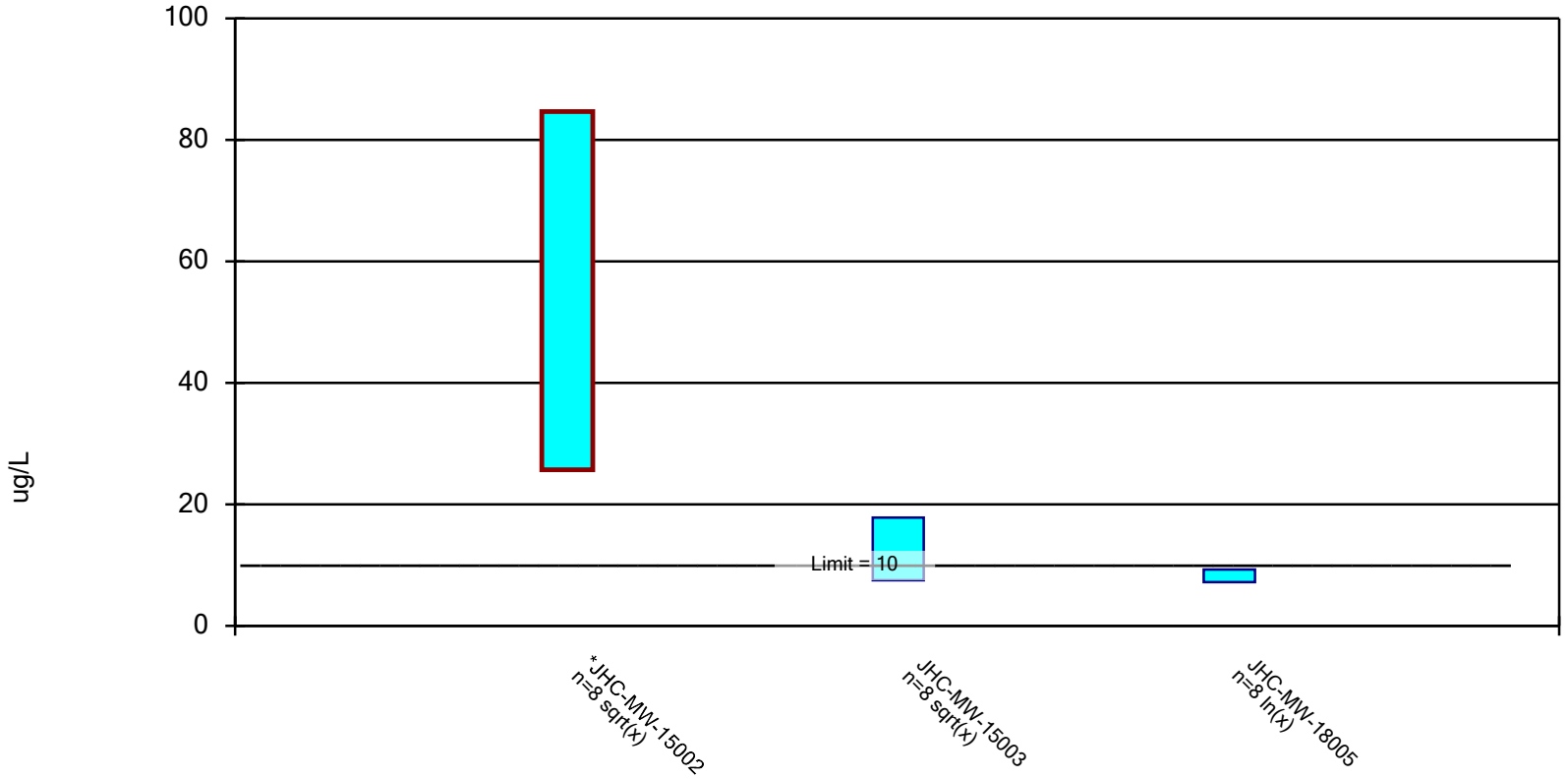
Trend not significant at 98% confidence level (α = 0.01 per tail).

Sen's Slope Estimator Analysis Run 12/6/2021 10:17 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

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 12/6/2021 10:19 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

Confidence Interval

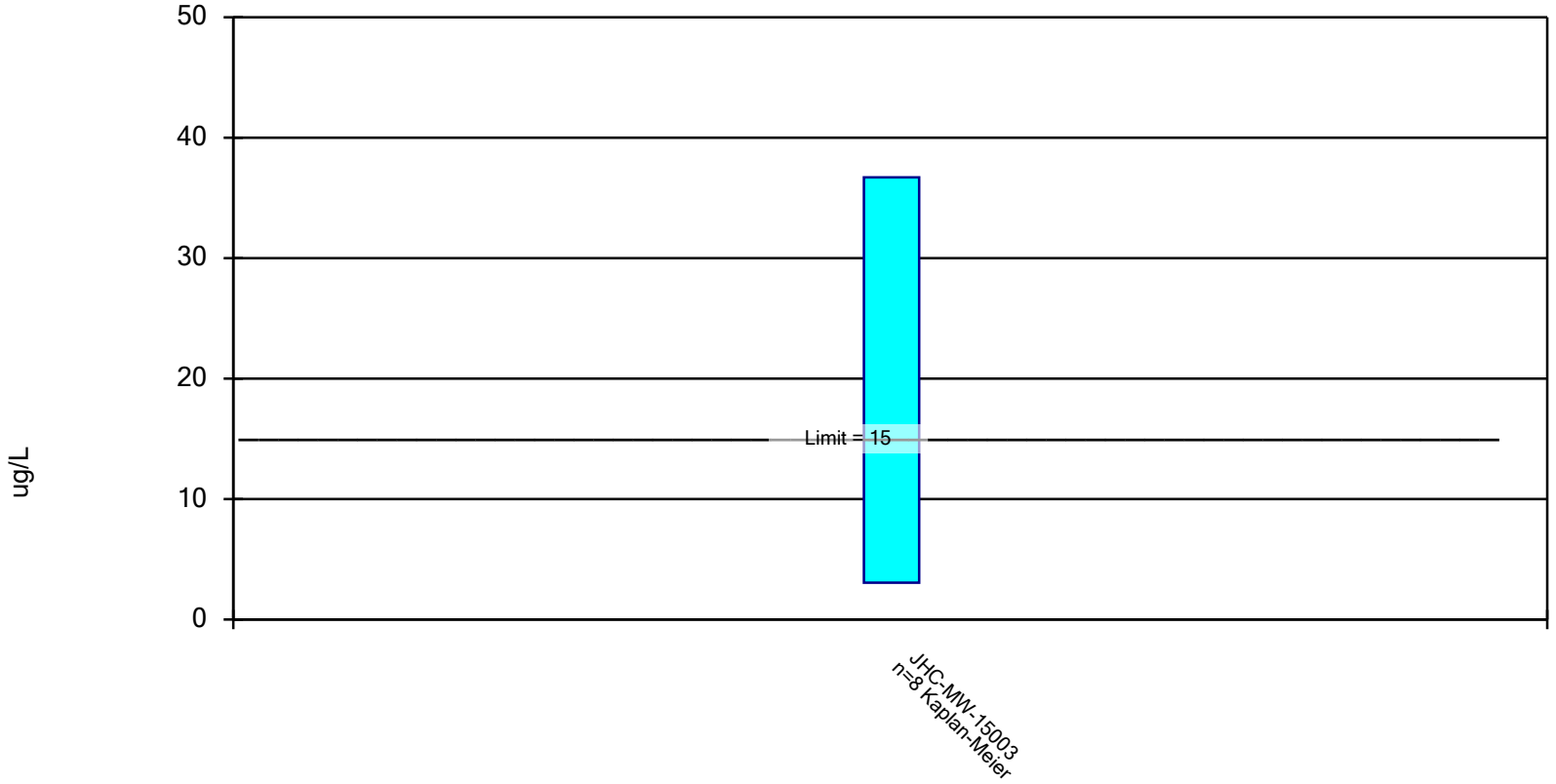
Constituent: Arsenic, Total (ug/L) Analysis Run 12/6/2021 10:19 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

	JHC-MW-15002	JHC-MW-15003	JHC-MW-18005
6/18/2018		14.2 (D)	
6/19/2018	127		
11/15/2018	60 (D)	8.1	
2/28/2019			10.5 (D)
4/25/2019	50		8.8
4/29/2019		10	
8/13/2019			7.35 (D)
10/9/2019	57	8.05 (D)	7.1
4/16/2020	45	9	8
10/22/2020	21	12	8 (D)
4/13/2021			8
4/14/2021	36	15	
10/20/2021		24 (D)	
10/21/2021	38		
10/22/2021			8
Mean	54.25	12.54	8.219
Std. Dev.	31.94	5.336	1.052
Upper Lim.	84.67	17.81	9.274
Lower Lim.	25.72	7.523	7.188

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 12/6/2021 10:19 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

Confidence Interval

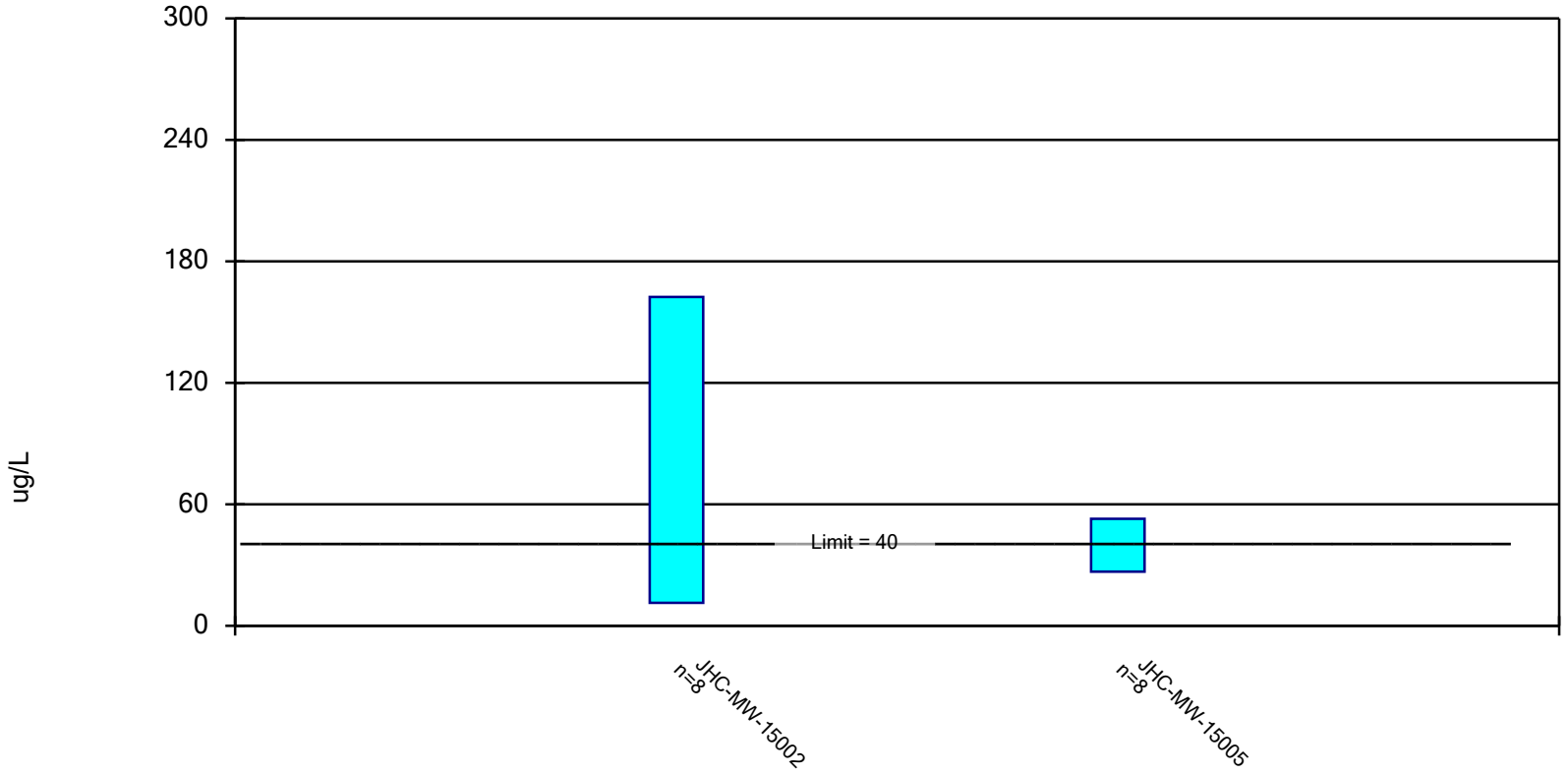
Constituent: Cobalt, Total (ug/L) Analysis Run 12/6/2021 10:19 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

	JHC-MW-15003
6/18/2018	<15 (D)
11/15/2018	23.6
4/29/2019	<6
10/9/2019	42 (D)
4/16/2020	47
10/22/2020	<15
4/14/2021	<6
10/20/2021	22.5 (D)
Mean	22.14
Std. Dev.	15.3
Upper Lim.	36.71
Lower Lim.	3.061

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 12/6/2021 10:19 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

Confidence Interval

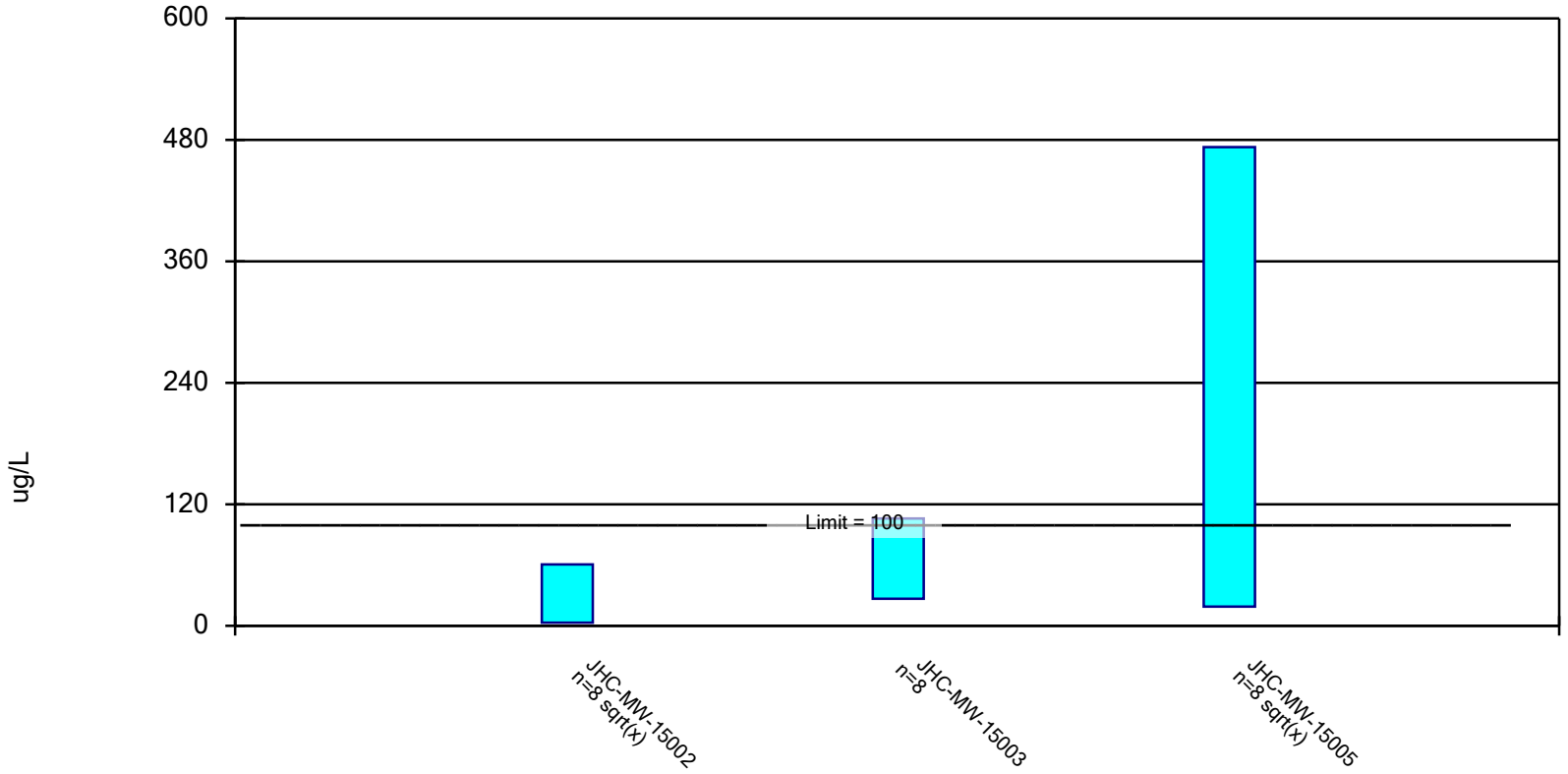
Constituent: Lithium, Total (ug/L) Analysis Run 12/6/2021 10:19 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

	JHC-MW-15002	JHC-MW-15005
6/19/2018	19	35
11/15/2018	67.5 (D)	28
4/25/2019	96	38 (D)
10/9/2019	240	50
4/16/2020	125	59
10/22/2020	76	42
4/13/2021		20.5 (D)
4/14/2021	48	
10/21/2021	24	46
Mean	86.94	39.81
Std. Dev.	71.26	12.27
Upper Lim.	162.5	52.82
Lower Lim.	11.4	26.81

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 12/6/2021 10:19 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

Confidence Interval

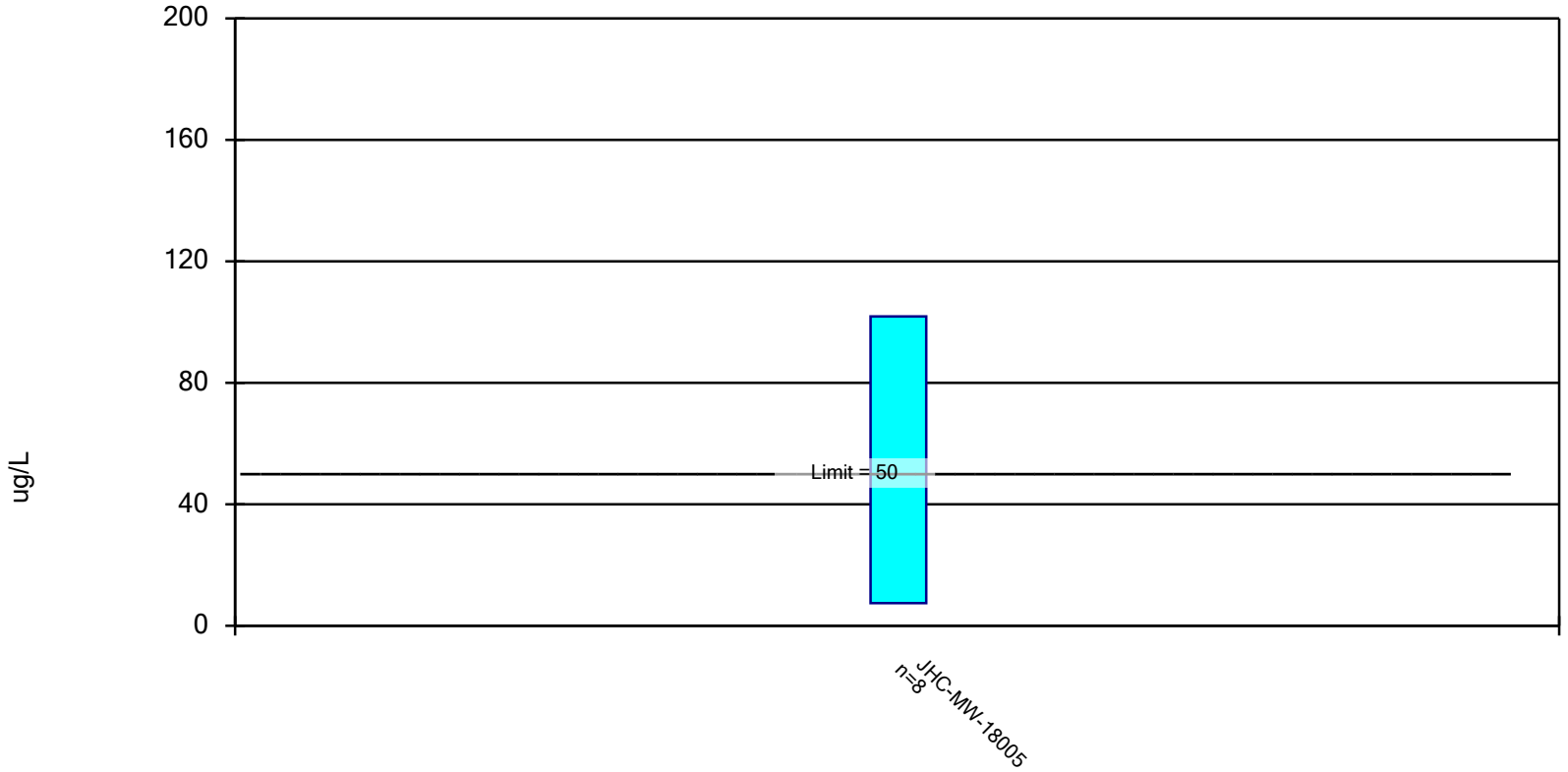
Constituent: Molybdenum, Total (ug/L) Analysis Run 12/6/2021 10:19 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

	JHC-MW-15002	JHC-MW-15003	JHC-MW-15005
6/18/2018		52.1 (D)	
6/19/2018	7.5		15.7
11/15/2018	9.1 (D)	65.3	222
4/25/2019	<5		885 (D)
4/29/2019		20	
10/9/2019	15	120 (D)	370
4/16/2020	49	125	91
10/22/2020	43	59	110
4/13/2021			89 (D)
4/14/2021	12	38	
10/20/2021		52 (D)	
10/21/2021	101		50
Mean	29.89	66.43	229.1
Std. Dev.	33.42	37.29	288
Upper Lim.	60.54	106	472.6
Lower Lim.	3.201	26.9	18.96

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 1/10/2022 4:46 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

Confidence Interval

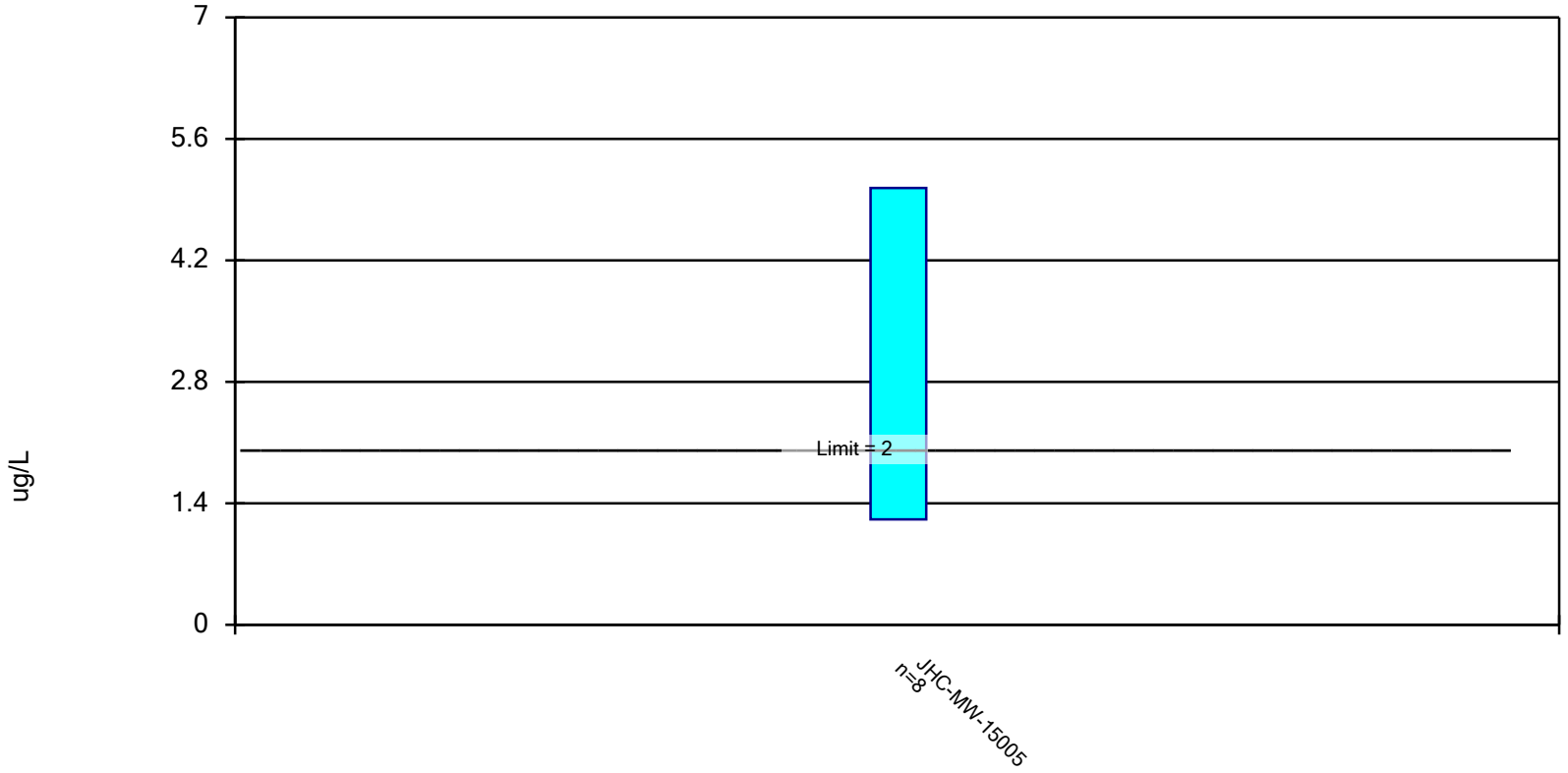
Constituent: Selenium, Total (ug/L) Analysis Run 1/10/2022 4:47 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

	JHC-MW-18005
2/28/2019	34.5 (D)
4/25/2019	16
8/13/2019	11 (D)
10/9/2019	140
4/16/2020	46
10/22/2020	101 (D)
4/13/2021	58
10/22/2021	31
Mean	54.69
Std. Dev.	44.53
Upper Lim.	101.9
Lower Lim.	7.483

Parametric Confidence Interval

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



Constituent: Thallium, Total Analysis Run 12/6/2021 10:19 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

Confidence Interval

Constituent: Thallium, Total (ug/L) Analysis Run 12/6/2021 10:19 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_4Q21

	JHC-MW-15005
6/19/2018	2.1
11/15/2018	<2
4/25/2019	2 (D)
10/9/2019	2.9
4/16/2020	3
10/22/2020	7
4/13/2021	3 (D)
10/21/2021	4
Mean	3.125
Std. Dev.	1.801
Upper Lim.	5.034
Lower Lim.	1.216

Appendix D
October 2021 Alternate Source Demonstration

Consumers Energy
Count on Us®

A CMS Energy Company

Date: October 28, 2021

To: Operating Record

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

RE: Alternate Source Demonstration Professional Engineer Certification, §257.95(g)3
Bottom Ash Pond 1-2 North and 1 2 South CCR Unit

Professional Engineer Certification Statement [40 CFR 257.95(g)3]

I hereby certify that the alternative source demonstration presented within this *Alternative Source Demonstration: Selenium at JHC-MW-15005, Consumers Energy, JH Campbell Site, Bottom Ash Pond 1-2 North and 1 2 South CCR Unit, West Olive, Michigan* been prepared to meet the requirements of Title 40 CFR §257.95(g)3 of the Federal CCR Rule. This document is accurate and has been prepared in accordance with good engineering practices, including the consideration of applicable industry standards, and with the requirements of Title 40 CFR §257.95(g)3.

Harold D. Register Jr.

Signature

October 28, 2021

Date of Certification

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

Name

6201056266

Professional Engineer Certification Number

Enclosure

TRC (October 2021). *Alternative Source Demonstration: Selenium at JHC-MW-15005, Consumers Energy, JH Campbell Site, Bottom Ash Pond 1-2 North and 1 2 South CCR Unit, West Olive, Michigan*

1540 Eisenhower Pl.
Ann Arbor, MI 48108

T 734.971.7080
TRCcompanies.com

October 28, 2021

Bethany Swanberg, P.E.
Environmental Services – Landfill Operations Compliance
Consumers Energy Company
1945 W. Parnall Road
Jackson, MI 49201

Subject: Alternative Source Demonstration: Selenium at JHC-MW-15005
Consumers Energy, JH Campbell Site, Bottom Ash Pond 1-2 North and 1 2 South CCR Unit, West Olive, Michigan

Dear Ms. Swanberg:

TRC was retained by Consumers Energy Company (Consumers Energy) to conduct semiannual assessment monitoring in accordance with §257.95 of the CCR Rule[1] for the JH Campbell Power Plant (JHC) Bottom Ash Pond Unit 1-2 North and 1-2 South (collectively Ponds 1-2) located in West Olive, Michigan. In January 2019, during the statistical evaluation of the initial assessment monitoring event, arsenic was present in two out of five downgradient monitoring wells at statistically significant levels (SSLs) exceeding the Groundwater Protection Standard (GWPS). Therefore, Consumers Energy initiated an Assessment of Corrective Measures (ACM) (TRC, September 2019) within 90 days from when the Appendix IV exceedance was determined. Consumers Energy is in the process of evaluating corrective measures per §257.96 and §257.97 and is continuing semiannual assessment monitoring in accordance with §257.95 as summarized in the *Semiannual Progress Report – Selection of Remedy*, *JH Campbell Ponds 1-2 North and 1-2 South CCR Unit, JH Campbell Pond A CCR Unit* (Consumers Energy, July 30, 2021).

Consumers Energy conducted the first semiannual assessment monitoring event of 2021 at Ponds 1-2 on April 12 through 14, 2021 in accordance with the *Sample Analysis Plan for JH Campbell Ponds 1-2 and Pond 3* (SAP) (TRC, January 2021). As discussed in the *Statistical Evaluation of April 2021 Assessment Monitoring Sampling Event* technical memorandum (TRC, July 30, 2021) and shown on Table 1, the results of the statistical evaluation of the April 2021 assessment monitoring parameters using confidence interval analysis indicated a new SSL above the GWPS for:

- Selenium at JHC-MW-15005.

The new SSL above the GWPS for selenium at JHC-MW-15005 resulted from increases in constituent concentrations observed subsequent to the cessation of hydraulic loading in 2018 and the associated change in localized groundwater flow. In accordance with §257.95(g)(3)(ii), an owner or operator is

[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 per Phase One, Part One of the CCR Rule (83 FR 36435).

allowed 90 days to:

"*Demonstrate that a source other than the CCR unit caused the contamination, or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality*."

On behalf of Consumers Energy, TRC has prepared this Alternate Source Demonstration (ASD) for selenium at JHC-MW-15005 in response to the aforementioned SSL identified in the April 2021 assessment monitoring event. The multiple lines of evidence presented in this ASD show that an increase in constituent concentrations of selenium resulting in the SSL at JHC-MW-15005 is from a source other than the former Ponds 1-2 CCR unit.

Site Overview and Background

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 Lakeshore Drive and the CCR disposal area is on the east side 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. 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.

Prior to the use of the surface impoundments and the Dry Ash Landfill, CCR was managed historically at Closed Ponds B-K shown on Figure 2. 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.

Geology/Hydrogeology

The upgradient/background wells are located to the north-northwest of the JHC Dry Ash Landfill. Groundwater is typically encountered at elevations ranging from 604 feet near the background wells to 590 feet along the southeast corner of the Dry Ash Landfill and south of the former Ponds 1-2 and

Pond A CCR surface impoundments 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. Details regarding the hydrogeology at Ponds 1-2 specific to this demonstration are provided below.

Alternate Source Demonstration

As discussed above, CCR removal was completed at Ponds 1-2 pursuant to closure by removal per §257.102(c) in conformance with the CCR Rule. The removal and decontamination of all areas affected by releases from Ponds 1-2 is documented and the groundwater assessment monitoring program continues to be performed until the groundwater monitoring concentrations do not exceed the groundwater protection standard established pursuant to §257.95(h) for Appendix IV constituents.

The confidence interval analysis for the April 2021 assessment monitoring event showed selenium present at SSLs above the GWPS (Table 1). The following discussion presents the ASD for the selenium SSLs at JHC-MW-15005. This discussion shows that the increases in selenium concentrations at this location are not due to a release of CCR constituents from the Ponds 1-2 CCR unit nor a result of failing to decontaminate the CCR unit, rather they are due to upgradient alternate sources. Lines of evidence for this demonstration were developed in consideration of the alternate source demonstration criteria set forth in the *EPA Solid Waste Disposal Facility Criteria Technical Manual* (USEPA November 1993, Revised April 1998) and document that:

1. An alternate source exists.
2. Hydraulic connection exists between the alternative source and the well with the significant increase.
3. Constituent(s) (or precursor constituents) are present at the alternative source or along the flow path from the alternative source prior to possible release from the monitored CCR unit.
4. The relative concentration and distribution of constituents in the zone of contamination are more strongly linked to the alternative source than to the monitored CCR unit when the fate and transport characteristics of the constituents are considered.
5. The concentration observed in groundwater could not have resulted from the CCR unit given the waste constituents and concentrations in the CCR unit leachate and wastes, and site hydrogeologic conditions.
6. The data supporting conclusions regarding the alternative source are historically consistent with hydrogeologic conditions and findings of the monitoring program.

The lines of evidence provided in support of this demonstration are as follows:

- **Pond removal and decontamination** – 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* pursuant to §257.102 (Golder, January 2018). The December 2017 *Bottom Ash Ponds 1-2 Closure Work Plan* was submitted to the EGLE on December 5, 2017, and approved by the EGLE on February 26, 2018. 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 the *JHC Campbell Generating Facility Bottom Ash Ponds 1-2 N/S CCR Removal Documentation Report* (CCR Removal Documentation Report) (Golder, 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. Following CCR removal, the Ponds 1-2 excavation was backfilled with clean fill to promote stormwater drainage and minimize the potential for ponding of surface water.

Ponds 1-2 were dewatered during CCR excavation in late August and early September 2018. Approximately 800,000 gallons of water were removed per day during the dewatering period, for a total removal of nearly 11.5 million gallons.

As detailed in the CCR Removal Documentation Report, CCR from Ponds 1-2 was excavated to at least the elevation of the base of CCR. Following initial excavation, CCR removal was verified visually at nodes established according to EGLE guidance *Sampling Strategies and Statistics Training Materials for Part 201 Cleanup Criteria (S3TM)*. If any CCR were visible, additional material was removed. When no CCR or only trace amounts of CCR remained, a colorimetric analysis using a digital colorimeter to precisely measure the color of a soil sample was developed to confirm CCR removal. Sampled grid nodes passed colorimetric confirmation testing if the remaining surface contained no more than 5 percent CCR material. Grid nodes which did not pass colorimetric testing were further examined by microscopy. Microscopic analysis confirmed that these grid nodes contained no more than 5 percent CCR material. If the remaining surface at a grid node was confirmed to contain more than 5 percent CCR material, additional excavation was performed. These multiple lines of evidence confirmed that all CCR material was removed from Ponds 1-2.

The fact that all the CCR has been removed from Ponds 1-2 demonstrates that the elevated selenium concentration observed in groundwater could not have resulted from a new release from the Ponds 1-2 CCR unit given that there is no longer any CCR material present in Ponds 1-2 to contribute to groundwater concentrations.

- **Timelines for CCR loading, dewatering, removal –** Sluicing of bottom ash to Ponds 1-2 was ceased in November 2017. Pond dewatering and CCR removal occurred from June 5, 2018 through September 11, 2018 as shown on the timeline below. As mentioned above, the CCR removal was documented in the CCR Removal Documentation Report. This timeline is key in evaluating groundwater concentrations observed at the Ponds 1-2 monitoring wells. As discussed in more detail below, there were several significant hydrogeological and geochemical changes in groundwater that were observed following the decommissioning of Ponds 1-2, including the selenium increase at JHC-MW-15005, indicating an alternate source.

- **Presence of an alternative source** – The alternative source of the SSL above the GWPS for selenium at JHC-MW-15005 is historic Closed Ponds B-K, which includes the historic Pond A.

  Historic Closed Ponds B-K and the historic Pond A (collectively called Ponds B-K) are shown on Figure 2 and were used for historic CCR management at the facility. Ponds B-K are not regulated under the scope of the federal CCR Rule; however, they are regulated under Michigan's Part 115 solid waste program and subject to a site-wide remedial action plan. Historic Pond A is not to be confused with the former Pond A CCR Unit that is located farther to the east and regulated under the CCR Rule. The Pond A CCR Unit is closed and capped. To avoid confusion, "Ponds B-K" is used throughout this report as a term inclusive of historic Pond A and Ponds B-K.

Ponds B-K are present immediately upgradient and are hydraulically connected to groundwater at the Ponds 1-2 well network. Since 2018 Ponds 1-2 is no longer hydraulically loading and controlling the groundwater flow in the vicinity of monitoring well JHC-MW-15005 (in addition to JHC-MW-15002 and JHC-MW-15003) (Figures 3 through 7). Rather, groundwater flows toward these three monitoring wells from within the historic Ponds B-K footprint. Shallow groundwater is situated within sandy soil and flows at a rate on the order of 400 ft/year across Ponds 1-2 using static water level data collected from February 2019 through April 2021. Ponds B-K are unlined and contain CCR fill material. Surface water run-off at Ponds B-K has the potential to percolate downward through the subsurface into groundwater.

There is also the potential that some areas of Ponds B-K contain ash in direct hydraulic communication with groundwater. As shown in Appendix A, ash within historic Pond A is present to an average elevation of approximately 603 ft. The original soil boring logs for monitoring wells JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 show ash present to elevations of 602 ft, 608 ft, and 613 ft, respectively. Ash at JHC-MW-15005 was excavated during the removal of CCR at Ponds 1-2, where the new ground surface is at an elevation of 606 ft post-CCR removal. From late 2018 to present, after Ponds 1-2 were dewatered, the water table has been below the bottom of the ash. Prior to 2018, before Ponds 1-2 were dewatered, static water elevation data indicate that there was direct communication between the ash and groundwater at some of the Ponds 1-2 wells (e.g. JHC-MW-15002). Therefore, groundwater data from monitoring wells JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 can be used to establish a geochemical fingerprint of the historic Pond A. The fingerprinting results are provided in detail below. Water table and ground surface elevation data are summarized on Table 2.

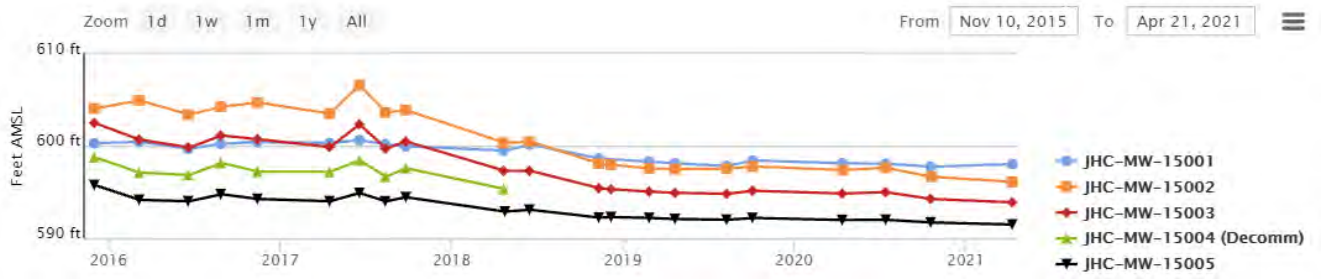
Pond C is located farther upgradient, immediately north of the historic Pond A cell, which also contains historic CCR fill material. Soil boring PZ-21-01 completed in 2021 shows that approximately 26 feet of ash fill is present at that location to an elevation of approximately 603 ft. The water table was observed at 603 ft during drilling. Static water level data collected from piezometer PZ-21-01 shows water levels are generally around an elevation of 598 ft. Water level data from other piezometers throughout the Ponds B-K area (e.g. Pond B, Pond G2, Pond H, Pond J) show that the water level is in some areas above or very close (within a foot) to the bottom of the ash (Table 2). This shows that at times, there is a direct hydraulic connection between ash and groundwater throughout the Ponds B-K area, in addition to infiltration as surface water run-off percolates downward through the fill material and interacts with groundwater. Soil boring logs for the aforementioned piezometers and monitoring wells are included in Appendix B.

- **Hydrogeologic changes** – During active hydraulic loading to the ponds, groundwater mounding was observed with localized radial flow outward around the ponds (Figure 3). The initial monitoring well network was developed under active loading conditions, in which all monitoring wells were downgradient relative to Ponds 1-2. Groundwater flow changed significantly subsequent to the cessation of hydraulic loading and decommissioning of the ponds. Sluicing to Ponds 1-2 was ceased in November 2017. In 2018, a southern groundwater flow direction was established across Ponds 1-2 and has continued to the present (Figures 4 through 7). Following the change in groundwater flow direction several of the monitoring wells were no longer positioned downgradient of Ponds 1-2, including JHC-MW-15002 and JHC-MW-15003 where arsenic SSLs above the GWPS were first observed. This change also increased the potential for alternate upgradient sources (e.g. Ponds B-K) to influence groundwater quality at the Ponds 1-2 wells. Groundwater passing beneath the Ponds B-K now flows across the eastern edge of Ponds 1-2 (Figures 4 through 7).

Monitoring wells JHC-MW-15002 and JHC-MW-15003 are installed within the footprint of the historic Pond A and JHC-MW-15005 is immediately downgradient, resulting in very short travel times for groundwater beneath the historic Pond A footprint to reach these monitoring wells. Travel time from Pond C to the three eastern Ponds 1-2 wells ranges from 0.6 years at JHC-MW-15002 to 2.1 years at JHC-MW-15005, using static water elevation data collected from February 2019 through April 2021. These travel times align with the timing of the changes observed in groundwater post-dewatering.

The water table in the vicinity of Ponds 1-2 also dropped significantly post-dewatering. As shown in the Ponds 1-2 Static Water Level Chart below, the groundwater table dropped post-cessation of sluicing in November 2017 and following dewatering and CCR removal in June 2018 such that JHC-MW-15001 went dry. Subsequently, JHC-MW-15001 was removed from the monitoring program given that it was no longer downgradient, never had a statistically significant increase for Appendix III, and Appendix IV concentrations remained below the respective GWPSs.

Ponds 1-2 Static Water Level Chart



- **Concentration trends** – Distinct changes occurred after dewatering (Figures 8 through 10), including the observed increase in selenium concentrations at JHC-MW-15005. Arsenic, which triggered the corrective action, is generally decreasing, while other constituents such as boron, barium, calcium, sulfate, selenium, thallium, cobalt, lead, and lithium, show increasing concentrations following removal of CCR from Ponds 1-2. The pH and oxidation/reduction potential (ORP) also changed significantly before and after dewatering at several of the monitoring wells. The pH was generally more basic during active loading (>9 standard units [SU]) and decreased post-loading (<9 SU) (Figures 8 through 10). Statistical analyses using two-sample t-tests was performed to assess whether there is a statistically significant difference between the means of the dataset before and dataset after dewatering. The results of the t-tests show that the concentrations of arsenic, bicarbonate, boron, calcium, magnesium, molybdenum, and sulfate at each well before dewatering are significantly different (at 95% confidence) than concentrations after loading. None of these parameters show evidence of statistically significant changes in the background monitoring wells over the same time periods. Therefore, there was a significant change in the subsurface geochemistry around wells JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 after cessation of hydraulic loading. This change correlates with the timing of the switch in groundwater flow direction along the east edge of Ponds 1-2. The t-test results are included in Appendix C.

  The significance of these changes in chemistry are further discussed below, but it should be noted that this change in chemistry immediately following CCR removal is evidence that the elevated selenium concentration is not due to a release from Ponds 1-2 CCR.

- **Geochemistry** – In order to determine the source of the concentration changes illustrated in the time-series plots (Figures 8 through 10), TRC performed a robust geochemical analysis of the data. This analysis evaluated metal behaviors including the following:
  - Metal availability and phase change,
  - Influence of pH and oxidation/reduction potential on ionic mobility,
  - Adsorption/desorption reactions due to cation exchange, and
  - Conservative versus dependent tracer concentration ratios.

  It should be noted that the presence of metals in groundwater is not, by itself, evidence of CCR impact. Achieving cleanup goals post-CCR removal can be complicated because metals are present naturally in the subsurface, in both soil and groundwater. Each of the analytes referenced above exists naturally in Michigan soils and groundwater as well as the sediments and water of Lake Michigan (Korkisch et al., 1977, Mason et al., 2000, Lee et al., 2016).

  In addition to metal behavior, the geochemical evaluation considered the location of JHC-MW-15005 in relation to groundwater mass sources as well as other monitoring wells. As noted above, JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 are within the historic Pond A footprint and directly downgradient from the Ponds B-K.

  The groundwater geochemistry for the Ponds 1-2 (pre- and post- 2018), former Pond C, former Pond D North, former Pond D South, former Pond J, former Pond K, and background were evaluated using geochemical "fingerprinting" analysis to characterize the various groundwater masses.

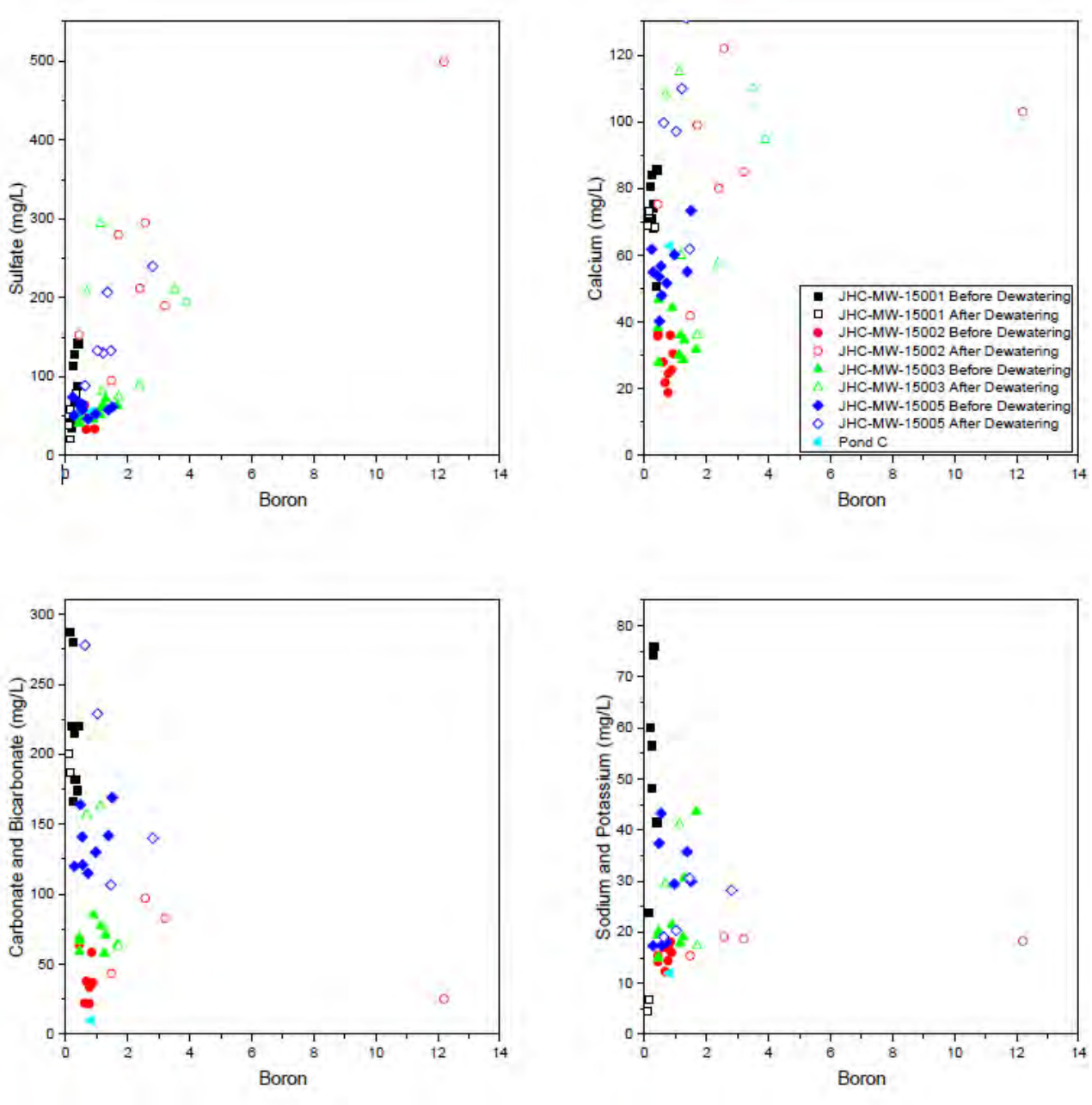
  Following fingerprinting, the oxidation/reduction potential (represented by Eh) and pH were evaluated. The Eh-pH speciation of various metals was assessed to determine phase changes before and after dewatering (pre- and post- 2018). Monitoring well JHC-MW-15001 was also included as a control because it was least affected by the operation and decommissioning of Ponds 1-2. The selected approach uses the molar ratios of relatively mobile species (dependent) in comparison to less-mobile phases (conservative). Using these ratios, fingerprints for each of the potential sources and each monitoring well were developed. Groundwater data collected from the Ponds 1-2 well network from December 5, 2015 to April 25, 2018 (pre-dewatering) and from Pond C well PZ-21-01 collected March 22, 2021, were used in this analysis. These fingerprints were then compared to groundwater data collected from the Ponds 1-2 wells post-dewatering from June 19, 2018 to April 14, 2021. Data from these same date ranges were used in the Eh-pH speciation. The analyses and the results are discussed in more detail below.

  - **Geochemical fingerprinting analysis** – Boron was used as the conservative tracer for the fingerprinting analysis. Monitoring well JHC-MW-15001 is located to the west of Ponds 1-2, farthest from the potential alternate sources (Ponds B-K) and upgradient of Ponds 1-2 after dewatering; therefore, JHC-MW-15001 is unlikely to be affected by an alternate source or Ponds 1-2 and was maintained as a control group.

    The ion fingerprinting analysis compared conservative tracers using sulfate, calcium, carbonate and bicarbonate, and sodium and potassium relative to boron (ion/boron ratios) pre- and post-dewatering for Ponds 1-2 monitoring wells JHC-MW-15001, JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005, and Pond C (PZ-21-05) as shown in the Ponds 1-2 Conservative Tracers Fingerprinting Diagram below. The closed symbols represent the pre-dewatering condition and the open symbols show the post-dewatering condition. The concentration of the conservative tracers generally increase 2- to 3-fold at JHC-MW-15002,

JHC-MW-15003, and JHC-MW-15005 post-dewatering. Monitoring well JHC-MW-15001 showed little to no change. This indicates that a significant change is similarly affecting the three wells, which is also indicative of influence from another source to monitoring wells JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 after dewatering and CCR removal at Ponds 1-2. Given the differences between the ratios at the three eastern wells and JHC-MW-15001, this potential alternate source is not influencing JHC-MW-15001.

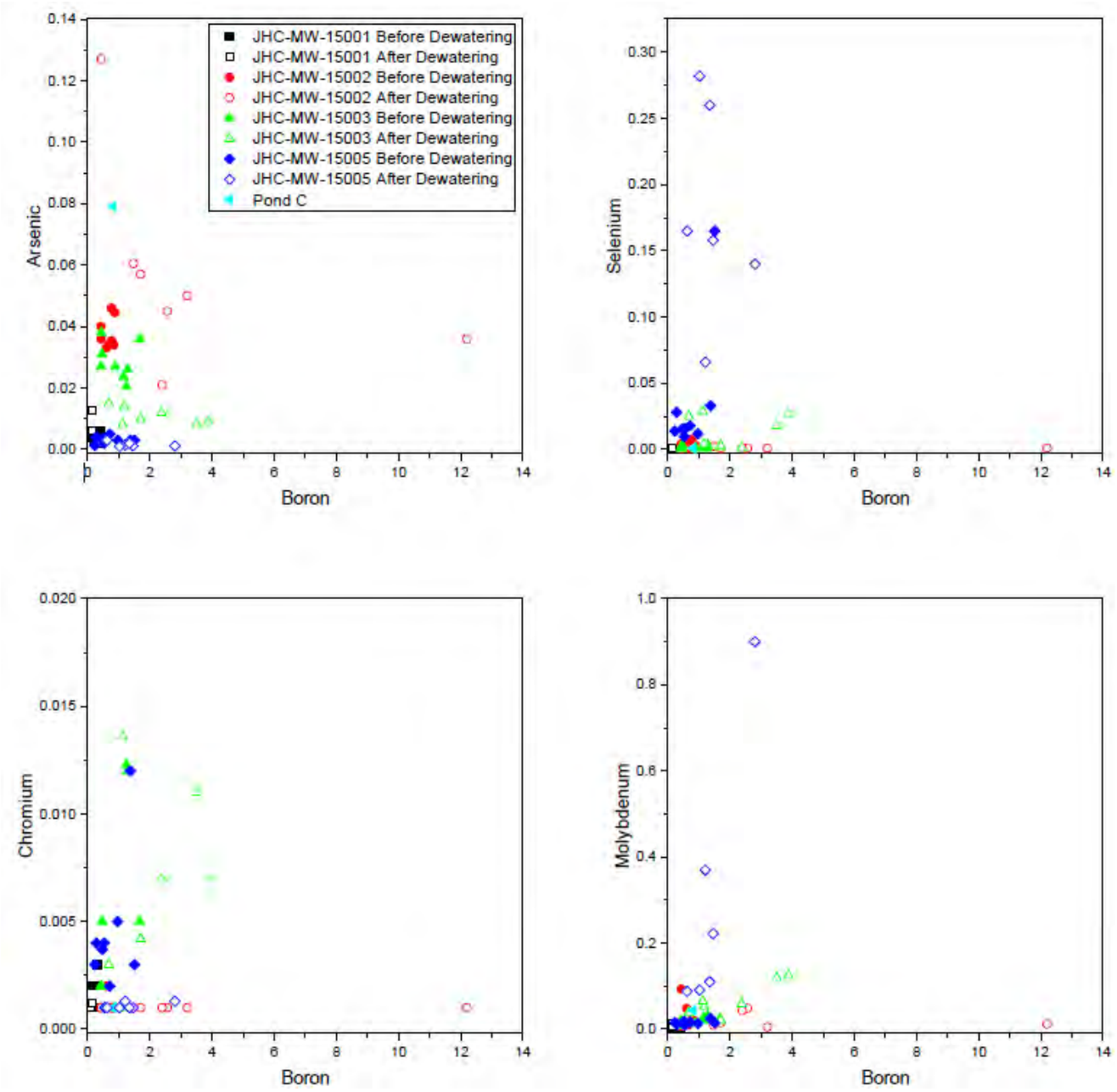
Ponds 1-2 Conservative Tracers Fingerprinting Diagram



Metals constituent concentrations were also evaluated pre- and post-dewatering by reviewing ratios of arsenic, selenium, chromium, and molybdenum to boron before and after

dewatering as shown in the Ponds 1-2 Metals Fingerprinting Diagram below. The closed symbols represent the pre-dewatering condition and the open symbols show the post-dewatering condition. The results show that the arsenic and chromium at JHC-MW-15002 (located closest to Pond C) are approaching the Pond C fingerprint, while selenium and molybdenum decrease. Arsenic and chromium decrease, and selenium and molybdenum increase at JHC-MW-15003 and JHC-MW-15005. This demonstrates that arsenic in groundwater at JHC-MW-15002 is consistent with influence from the Pond C source after dewatering and CCR removal at Ponds 1-2. It also indicates there is a significant change occurring that is influencing selenium and molybdenum concentrations at all three wells and all of the metals at JHC-MW-15003 and JHC-MW-15005. There is a weak correlation between the metals at the three Ponds 1-2 monitoring wells and the Pond C fingerprint, suggesting that there is also a flux of metals upgradient of Pond C. This source is further elucidated by comparing the concentration and molar ratios of bicarbonate, calcium, magnesium, and sulfate with boron. By comparing Ponds 1-2 fingerprints before and after dewatering, it can be seen that the data trend toward the fingerprints of the ponds upgradient of the historic Pond A. For these reasons it can be seen that the groundwater flux is primarily from the historic Pond A with remnant influence of further upstream Ponds B-K.

Ponds 1-2 Metals Fingerprinting Diagram



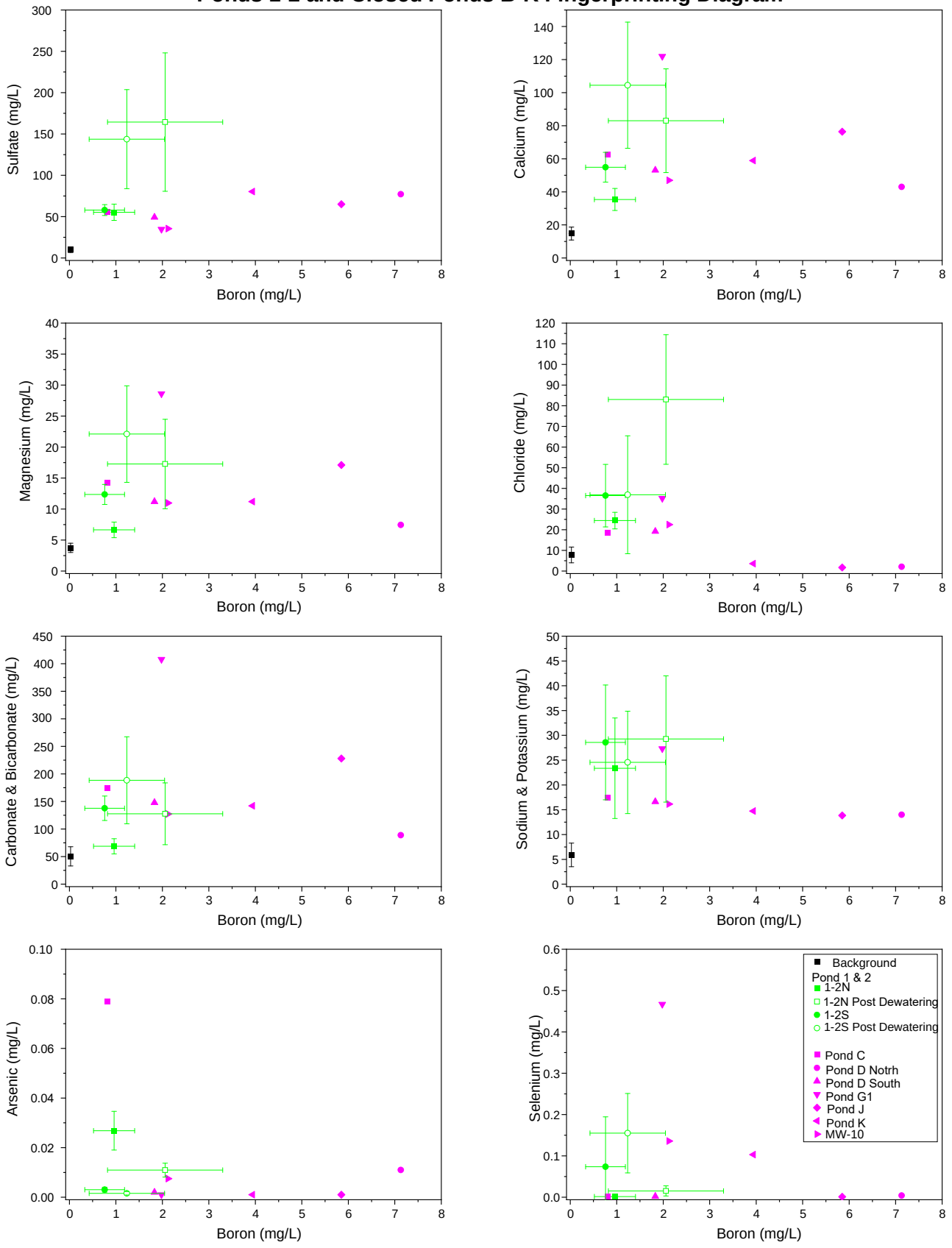
Given the location of JHC-MW-15002 and JHC-MW-15003 within the historic Pond A footprint and the aforementioned hydrogeologic changes that took place post-dewatering of Ponds 1-2, the post-dewatering major ion/boron ratios and metals ratios at JHC-MW-15002 and JHC-MW-15003 (located side gradient to the former Ponds 1-2 CCR unit) are representative of the historic Pond A fingerprint. The conservative tracer data for all three wells, most notably for sulfate and calcium, are consistent with one another, demonstrating that groundwater at JHC-MW-15005 is also influenced by the same source, historic Pond A.

Eh and pH were also evaluated to better understand the differences in the metals results, particularly for selenium at JHC-MW-15005. This is presented below in the phase change discussion.

The groundwater geochemistry for the Ponds 1-2 (pre- and post- 2018) (wells JHC-MW-15002, JHC-MW-15003 and JHC-MW-15005), former Pond C (PZ-21-01), former Pond D North (PZ-21-05), former Pond D South (PZ-21-02), former Pond J (PZ-21-06), former Pond K (PZ-21-03), and background (JHC-MW-15024, JHC-MW-15025, JHC-MW-15026, JHC-MW-15027, and JHC-MW-15028) were evaluated using fingerprinting analysis to characterize the various groundwater masses. These results are shown below in the Ponds 1-2 and Ponds B-K Fingerprinting Diagram.

As shown in the diagram below, the Ponds 1-2 post-dewatering fingerprint is distinctly different than the pre-dewatering fingerprint. The post-dewatering fingerprint plots in the same area of several of the Ponds B-K fingerprints. As discussed above, the post-dewatering Ponds 1-2 fingerprint is representative of the historic Pond A fingerprint. Conservative tracers such as calcium, magnesium, bicarbonate, potassium, and sodium match more closely than reactive ions such as selenium. This indicates that the historic Pond A fingerprint (represented by the Ponds 1-2 wells) is consistent with the other historic ponds.

Ponds 1-2 and Closed Ponds B-K Fingerprinting Diagram



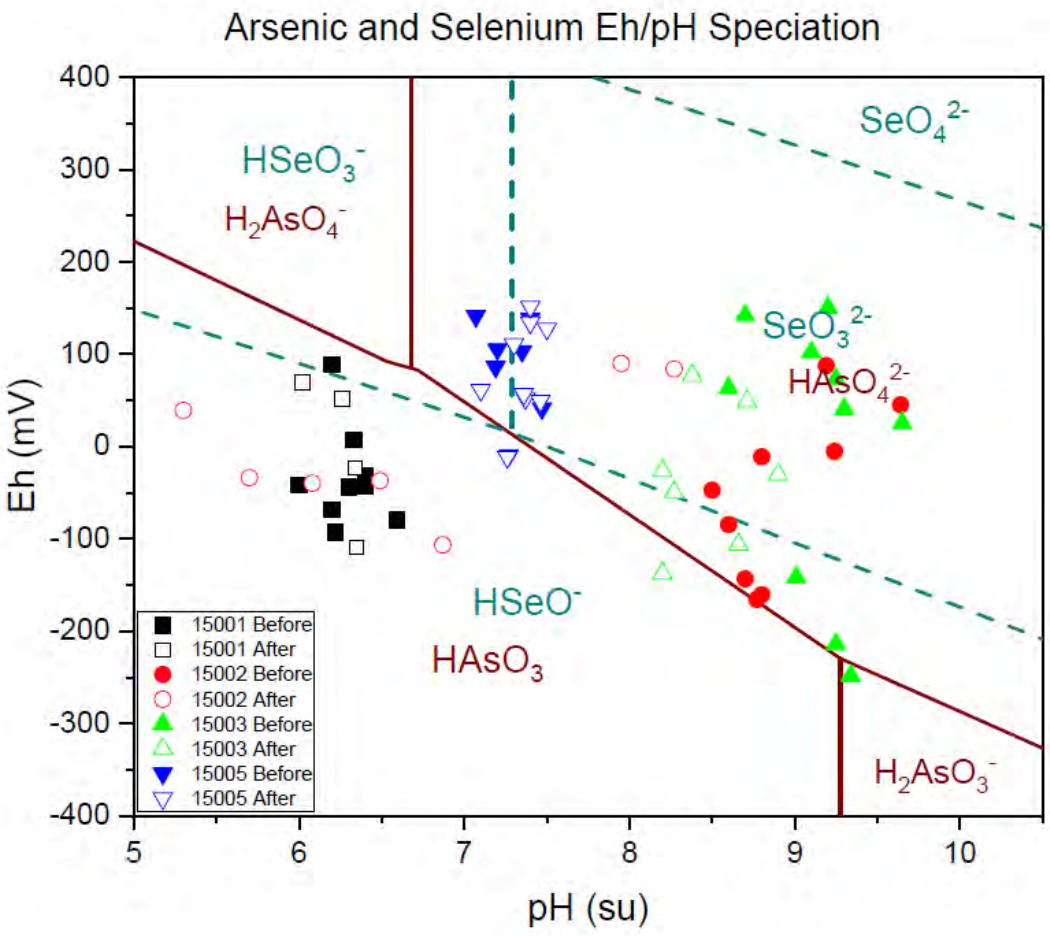
– **Phase changes** – Selenium and arsenic are susceptible to phase changes in geochemistry that mobilize or demobilize certain species and cause a change in groundwater concentration. These phase changes are principally between charged active surface sites on soil within the saturated zone and dissolved phase selenium and arsenic. Selenium is highly susceptible to pH and oxidation/reduction potential. Dissolved-phase selenium concentrations typically decrease in sub-oxic conditions via reductive precipitation, whereas arsenic is primarily controlled by pH.

  Selenium (Se) occurs in four redox states in the natural environment, which include:

  - Se(VI) – selenate: occurs under oxic conditions as an anion (SeO_4^{2-}). Selenate is generally soluble and is only weakly adsorbed by iron and aluminum oxides, hence it is relatively mobile in groundwater.
  - Se(IV) – selenite: occurs under mildly anoxic conditions also as an anion ($HSeO_3^-$ or SeO_3^{2-}). Selenite is generally soluble but is more strongly adsorbed on iron and aluminum oxides than selenate, hence it is less mobile in groundwater than selenate
  - Se(0) – elemental selenium: occurs under reducing conditions. The metal is insoluble and so immobile.
  - Se(-II) – selenide: occurs under very strongly reducing conditions and is generally insoluble.

  In order to further explore the cause of the increase in selenium at JHC-MW-15005, Eh/pH diagrams were developed to speciate the arsenic and selenium observed at Ponds 1-2 before and after dewatering, as shown below.

Ponds 1-2 Eh-Ph Diagram



JHC-MW-15001 was maintained as a control. The closed symbols are representative of the active loading condition (pre-June 2018) and the open symbols represent groundwater conditions after dewatering (post-June 2018). The results of the Eh/pH speciation show that there is a significant shift of selenium at JHC-MW-15002 and JHC-MW-15003 from selenite (SeO_3^{2-}) to elemental ($HSeO^-$) or potentially selenide (lower pH range outside the limits of the Eh/pH diagram). Selenate (SeO_4^{2-}) is not observed. JHC-MW-15002 is likely undergoing the most reductive precipitation followed by JHC-MW-15003, and JHC-MW-15005 remained in oxic/mobile conditions. This implies the source of the reducing conditions is upgradient (northeast) of JHC-MW-15002. No statistically significant Eh/pH change was observed in monitoring well JHC-MW-15001. The conditions at JHC-MW-15001 and JHC-MW-15005 are similar before and after dewatering, suggesting that the change in selenium concentration at JHC-MW-15005 is not driven by a change in geochemistry, rather the change is a result of influence from the alternate source.

- **Selenium characteristics** – As described above, selenium is highly mobile at neutral pH and oxic conditions in the environment. Many significant hydrogeological and geochemical changes took place at monitoring wells JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 as a result of deactivating and decommissioning Ponds 1-2. CCR was removed from Ponds 1-2, eliminating the potential for any new releases associated with Ponds 1-2 CCR. Groundwater flow directions

changed from radial to south-southeast, allowing historic Pond A and Pond C to influence groundwater quality along the east edge of Ponds 1-2. There were also significant pH changes at JHC-MW-15002 and pH and Eh changes at JHC-MW-15003. The influence from these upgradient sources explain the changes observed in groundwater quality post-dewatering and the increase in selenium at JHC-MW-15005.

While the same alternate sources are influencing groundwater at these three wells, selenium concentrations at JHC-MW-15005 are relatively higher than JHC-MW-15002 and JHC-MW-15003 post-2018. A significant increase in selenium at JHC-MW-15005 post-2018 is observed while the pH and redox conditions in groundwater did not change significantly pre- and post-dewatering. Given the hydrogeological changes, this indicates that as the groundwater flow shifts to the south, historic Pond A and Pond C begin to influence groundwater quality at JHC-MW-15005. The lack in significant selenium concentration change post-2018 at the other two wells (JHC-MW-15002 and JHC-MW-15003) located farther upgradient from JHC-MW-15005, side gradient from Ponds 1-2, and closer to the historic Pond A and Pond C source areas is explained by considering the fate and transport characteristics of selenium. As mentioned above, changes to pH and Eh occurred at these two wells post-2018, causing a shift to a less-mobile phase of selenium. As a result, there is a lack of significant selenium concentration increase at these locations as selenium precipitates out of groundwater due to the geochemical influences around those wells.

Based on the characteristics of selenium, coupled with the relationships of several other less reactive, more conservative constituents, groundwater at these three wells are clearly being influenced by a similar source unrelated to Ponds 1-2. The alternate source in this case is primarily attributed to historic Pond A and Pond C with added complexities of hydrogeologic and geochemical condition changes prompted by the decommissioning of Ponds 1-2.

Conclusions and Recommendations

The information provided in this report serves as the ASD for selenium at JHC-MW-15005, was prepared in accordance with §257.95(g) of the CCR Rule, and demonstrates that the selenium SSL from the first semiannual 2021 groundwater monitoring event is not due to a release of CCR into the groundwater from the former Ponds 1-2 CCR unit nor a result of failing to decontaminate the CCR unit. The documentation assembled for this ASD set forth in the *EPA Solid Waste Disposal Facility Criteria Technical Manual* (USEPA November 1993, Revised April 1998) is summarized as follows:

- *An alternate source exists.* Ponds B-K are located immediately upgradient from JHC-MW-15005, they are unlined and contain historic CCR fill material.
- Hydraulic connection exists between the alternative source and the well(s) with the significant increase. Surface water run-off at Ponds B-K has the potential to percolate downward through the subsurface into groundwater. There is also the potential that some areas of Ponds B-K contain ash in direct hydraulic communication with groundwater. Following the change in groundwater flow direction post-dewatering, several of the Ponds 1-2 monitoring wells were no longer positioned downgradient of Ponds 1-2, including JHC-MW-15002 and JHC-MW-15003. This change increased the potential for Ponds B-K to influence groundwater quality at the Ponds 1-2 wells. Groundwater passing beneath Ponds B-K now flows across the eastern edge of Ponds 1-2 and groundwater travel times indicate there has been sufficient time for Ponds B-K to influence JHC-MW-15005.
- *Constituent(s) (or precursor constituent(s)) are present at the alternative source or along the flow path from the alternative source prior to possible release from the monitored CCR unit.*

Ponds B-K were in existence prior to construction of Ponds 1-2 and both were used to manage CCR material. However, they contain different ratios of CCR constituents and major ions as shown in the geochemical fingerprinting analysis and CCR was removed from Ponds 1-2 prior to the statistically significant increase in selenium was observed at JHC-MW-15005.

Selenium and arsenic are susceptible to phase changes in geochemistry that mobilize or demobilize certain species and cause a change in groundwater concentration. These phase changes are principally between charged active surface sites on soil within the saturated zone and dissolved phase selenium and arsenic. Selenium is highly susceptible to pH and oxidation/reduction potential changes. Dissolved-phase selenium concentrations typically decrease in sub-oxic conditions via reductive precipitation, whereas arsenic is primarily controlled by pH. The results of the Eh/pH speciation show that JHC-MW-15002 is likely undergoing the most reductive precipitation followed by JHC-MW-15003, and JHC-MW-15005 remained in oxic/mobile conditions. This implies the source of the reducing conditions is upgradient (northeast) of JHC-MW-15002. No statistically significant Eh/pH change was observed in monitoring well JHC-MW-15001. The conditions at JHC-MW-15001 and JHC-MW-15005 are similar before and after dewatering, suggesting that the change in selenium concentration at JHC-MW-15005 is not driven by a change in geochemistry, rather the change is a result of influence from the alternate source.

– *The relative concentration and distribution of constituents in the zone of contamination are more strongly linked to the alternative source than to the monitored CCR unit when the fate and transport characteristics of the constituents are considered.* A significant increase in selenium at JHC-MW-15005 post-2018 is observed while the pH and redox conditions in groundwater did not change significantly pre- and post-dewatering. Given the hydrogeological changes, this indicates that as the groundwater flow shifts to the south, historic Pond A and Pond C begin to influence groundwater quality at JHC-MW-15005. The lack in significant selenium concentration change post-2018 at the other two wells (JHC-MW-15002 and JHC-MW-15003) located farther upgradient from JHC-MW-15005, side gradient from Ponds 1-2, and closer to the historic Pond A and Pond C source areas is explained by considering the fate and transport characteristics of selenium. Changes to pH and Eh occurred at these two wells post-2018, causing a shift to a less-mobile phase of selenium. As a result, there is a lack of significant selenium concentration increase at these locations as selenium precipitates out of groundwater due to the geochemical influences around those wells.

  Based on the characteristics of selenium, coupled with the relationships of several other less reactive, more conservative constituents, groundwater at all three of these wells are clearly being influenced by a similar source unrelated to Ponds 1-2. The alternate source in this case is primarily attributed to Ponds B-K with added complexities of hydrogeologic and geochemical condition changes prompted by the decommissioning of Ponds 1-2.

– *The concentration observed in groundwater could not have resulted from the CCR unit given the waste constituents and concentrations in the CCR unit leachate and wastes, and site hydrogeologic conditions.* Multiple lines of evidence confirmed that all CCR material was removed from Ponds 1-2 and actions were taken to decontaminate the CCR unit. The fact that all the CCR has been removed from Ponds 1-2 demonstrates that the elevated selenium concentration observed in groundwater could not have resulted from a new release from the Ponds 1-2 CCR unit given that there is no longer any CCR material present in Ponds 1-2 to contribute to groundwater concentrations.

Further, the conservative tracers observed in the Ponds 1-2 wells post-dewatering are consistent with the geochemical fingerprints developed for Ponds B-K. The post-dewatering fingerprint from Ponds 1-2 plots in the same area of several of the Ponds B-K fingerprints.

– *The data supporting conclusions regarding the alternative source are historically consistent with the hydrogeologic conditions and findings of the monitoring program.* Monitoring well JHC-MW-15001, located to the west of Ponds 1-2 and farthest from the potential alternate sources, showed little to no change before and after dewatering. The concentration of the conservative tracers generally increase 2- to 3-fold at JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 post-dewatering. This indicates that a significant change is similarly affecting the three wells east of Ponds 1-2, which is also indicative of influence from another source to monitoring wells JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 after dewatering and CCR removal at Ponds 1-2. Given the differences between the ratios at the three eastern wells and JHC-MW-15001, this potential alternate source is not influencing JHC-MW-15001. This aligns with the hydrogeologic conditions and groundwater monitoring data collected.

Hydrogeological and geochemical changes post-CCR removal from Ponds 1-2 have resulted in observations of new increases in groundwater constituent concentrations for several Appendix III and Appendix IV parameters in the Ponds 1-2 monitoring network, including selenium at JHC-MW-15005, that are unrelated to Ponds 1-2 and are occurring as groundwater responds and re-equilibrates to the new geochemical conditions coupled with the constituent concentrations from upgradient historic CCR management sources.

Therefore, based on the information provided in this ASD, Consumers Energy plans to continue the assessment monitoring program per §257.95 at Ponds 1-2 and is also revisiting the groundwater monitoring system established per §257.91 to continue evaluating corrective measures for arsenic per §257.96 and §257.97. Concurrently, Consumers Energy is in the process of addressing Ponds B-K through a remedial action plan under the state program.

A copy of this report will be placed in the facility operating record and included in the forthcoming annual groundwater monitoring report per §257.95(g).

Sincerely,

TRC

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

Clint Miller, Ph D.
Project Geochemist

cc: Harold Register, Jr., Consumers Energy

Attachments

Table 1 Summary of Groundwater Protection Standard Exceedances – April 2021
Table 2 Monitoring Well and Piezometer Survey and Construction Data
Table 3 Ponds B-K Static Water Elevation Data

Figure 1 Site Location Map
Figure 2 Site Plan with Monitoring Well Locations
Figure 3 Groundwater Contour Map 2017 (pre-dewatering)
Figure 4 Groundwater Contour Map 2018 (post-dewatering)
Figure 5 Groundwater Contour Map 2019 (post-dewatering)
Figure 6 Groundwater Contour Map 2020 (post-dewatering)
Figure 7 Groundwater Contour Map 2021 (post-dewatering)
Figure 8 Time-Series – Analyte Group 1
Figure 9 Time-Series – Analyte Group 2
Figure 10 Time-Series – Field Parameters

Appendix A Historic Pond A Area Figures
Appendix B Soil Boring Logs
Appendix C T-Test Results
Appendix D References

Tables

Table 1
Summary of Groundwater Protection Standard Exceedances – April 2021
JH Campbell Ponds 1-2N/1-2S
West Olive, Michigan

Constituent	Units	GWPS	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
Arsenic	ug/L	10	28	110	8.2	14	--	--	7.2	9.6
Cobalt	ug/L	15	--	--	6.0	47	--	--	--	--
Lithium	ug/L	40	12	160	--	--	27	57	--	--
Molybdenum	ug/L	100	--	--	19	110	16	470	--	--
Selenium	ug/L	50	--	--	--	--	58	310	9.2	102
Thallium	ug/L	2	--	--	--	--	1.2	5.5	--	--

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 wells 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 2
Monitoring Well and Piezometer Survey and Construction Data
JH Campbell
West Olive, Michigan

Well Location	Northing	Easting	Ground Surface Elevation (ft NAVD 88)	TOC Elevation (ft NAVD 88)	Date Installed	Geologic Unit of Screen Interval	Well Construction	Screen Interval Depth (ft BGS)			Screen Interval Elevation (ft)			Borehole Terminus Depth (ft BGS)	Borehole Terminus Elevation (ft)
Background															
JHC-MW-15023	521927.21	12638205.16	617.01	619.98	10/1/2015	Sand	2" PVC, 10 Slot	14.0	to	24.0	603.0	to	593.0	25.0	592.0
JHC-MW-15024	522366.01	12637322.68	613.79	616.62	10/1/2015	Sand	2" PVC, 10 Slot	7.0	to	17.0	606.8	to	596.8	20.0	593.8
JHC-MW-15025	522702.98	12636668.15	614.14	617.17	10/1/2015	Sand	2" PVC, 10 Slot	7.0	to	17.0	607.1	to	597.1	20.0	594.1
JHC-MW-15026	522495.09	12635971.82	615.09	618.04	10/2/2015	Sand	2" PVC, 10 Slot	8.0	to	18.0	607.1	to	597.1	20.0	595.1
JHC-MW-15027	522394.86	12635097.51	614.77	617.30	10/2/2015	Sand	2" PVC, 10 Slot	10.0	to	20.0	604.8	to	594.8	20.0	594.8
JHC-MW-15028	521646.20	12634105.34	611.02	613.80	10/2/2015	Sand	2" PVC, 10 Slot	8.0	to	18.0	603.0	to	593.0	20.0	591.0
JHC-MW-15029	520503.52	12633774.30	608.08	610.95	10/5/2015	Sand	2" PVC, 10 Slot	8.0	to	18.0	600.1	to	590.1	20.0	588.1
JHC-MW-15030	519760.83	12633044.37	604.05	607.17	10/5/2015	Sand	2" PVC, 10 Slot	4.0	to	14.0	600.1	to	590.1	20.0	584.1
Pond 1N, 1S, 2N, 2S															
JHC-MW-15001	518586.88	12633422.01	607.02	609.53	9/16/2015	Sand	2" PVC, 10 Slot	3.5	to	8.5	603.5	to	598.5	15.0	592.0
JHC-MW-15002(1)	518378.92	12633974.82	618.18	621.27	9/16/2015	Sand	2" PVC, 10 Slot	20.2	to	30.2	598.0	to	588.0	30.2	588.0
JHC-MW-15003(1)	518069.86	12633990.37	623.16	627.20	9/17/2015	Sand	2" PVC, 10 Slot	22.8	to	32.8	600.3	to	590.3	32.8	590.3
JHC-MW-15004	*517864.56*	*12633547.12*	*624.92*	*628.44*	*9/17/2015*	*Sand*	*2" PVC, 10 Slot*	*24.0*	*to*	*34.0*	*600.9*	*to*	*590.9*	*40.0*	*584.9*
JHC-MW-15005(1)	517781.42	12633905.01	606.22	609.99	9/18/2015	Sand	2" PVC, 10 Slot	8.8	to	18.8	597.4	to	587.4	21.8	584.4
JHC-MW-18004	518008.46	12633506.26	602.92	605.72	12/4/2018	Sand	2" PVC, 10 Slot	6.0	to	16.0	596.9	to	586.9	16.0	586.9
JHC-MW-18005	517786.01	12633652.86	600.30	603.16	12/5/2018	Sand	2" PVC, 10 Slot	5.0	to	15.0	595.3	to	585.3	15.0	585.3
Cells B-K Piezometers															
PZ-1203	519899.11	12637640.74	628.97	631.41	6/7/2012	Sand/Silt	2" PVC, 10 Slot	23.0	to	28.0	606.0	to	601.0	30.0	599.0
PZ-1204	519795.71	12636150.86	628.16	631.08	6/7/2012	Silty Sand	2" PVC, 10 Slot	30.0	to	35.0	598.2	to	593.2	38.0	590.2
PZ-1205	519055.39	12637550.96	626.71	629.08	6/7/2012	Silty Sand	2" PVC, 10 Slot	27.0	to	32.0	599.7	to	594.7	34.0	592.7
PZ-1206	517989.93	12636306.77	623.36	626.26	6/7/2012	Silt	2" PVC, 10 Slot	19.0	to	24.0	604.4	to	599.4	26.0	597.4
PZ-1207	518881.99	12636545.82	628.45	631.47	6/8/2012	Silt	2" PVC, 10 Slot	24.5	to	29.5	604.0	to	599.0	32.0	596.5
PZ-1208	518744.27	12635662.83	629.32	633.05	6/11/2012	Sand	2" PVC, 10 Slot	28.5	to	33.5	600.8	to	595.8	34.0	595.3
PZ-1210	517887.21	12634948.30	626.43	629.07	6/11/2012	Sandy Silt	2" PVC, 10 Slot	17.0	to	22.0	609.4	to	604.4	24.0	602.4
PZ-1212	518280.88	12634521.36	626.92	628.74	6/11/2012	Sandy Silt	2" PVC, 10 Slot	18.0	to	23.0	608.9	to	603.9	25.0	601.9
PZ-21-01	518976.4	12634661.8	629.9	632.7	3/15/2021	Sand	2" PVC, 10 Slot	30.0	to	35.0	599.9	to	594.9	39.0	590.9
PZ-21-02	518335.3	12635691.8	629.2	631.8	3/16/2021	Sand	2" PVC, 10 Slot	36.0	to	41.0	593.2	to	588.2	48.5	580.7
PZ-21-03	518494.9	12636907.0	625.9	628.5	3/16/2021	Sand	2" PVC, 10 Slot	36.0	to	41.0	589.9	to	584.9	41.0	584.9
PZ-21-04	519757.0	12636972.7	628.9	631.6	3/17/2021	Sand	2" PVC, 10 Slot	37.0	to	42.0	591.9	to	586.9	42.0	586.9
PZ-21-05	519701.9	12635379.6	629.3	631.9	3/18/2021	Sand	2" PVC, 10 Slot	35.0	to	40.0	594.3	to	589.3	40.0	589.3
PZ-21-06	519095.3	12636607.1	628.6	631.2	3/17/2021	Sand	2" PVC, 10 Slot	38.0	to	43.0	590.6	to	585.6	48.0	580.6

Notes:

Survey conducted November 2016, October 2017, April 2018, December 2018, August 2019, and April 2021 by Nederveld Inc., Grand Rapids, Michigan.

Staff gauges were surveyed by Nederveld on July 16, 2020.

Recovery Wells RW1 through RW7 surveyed at top of steel well cover.

Elevation in feet relative to National American Vertical Datum of 1988 (NAVD 88)

TOC: Top of well casing.

ft BTOC: Feet below top of well casing.

ft BGS: Feet below ground surface.

(1) - Ground surface has been altered post well installation during pond decommissioning.

(2) - TOC elevation has been altered post well installation during pond decommissioning.

(3) - Staff gauge reference elevations corrected to the zero mark for purpose of calculating surface water elevation.

* - MW-B4 was originally installed on 03/26/2007. It was decommissioned and replaced on 05/23/2011 utilizing the same name.

All *gray and italized text* are indicative of wells that have been decommissioned and are no longer part of the active well network.

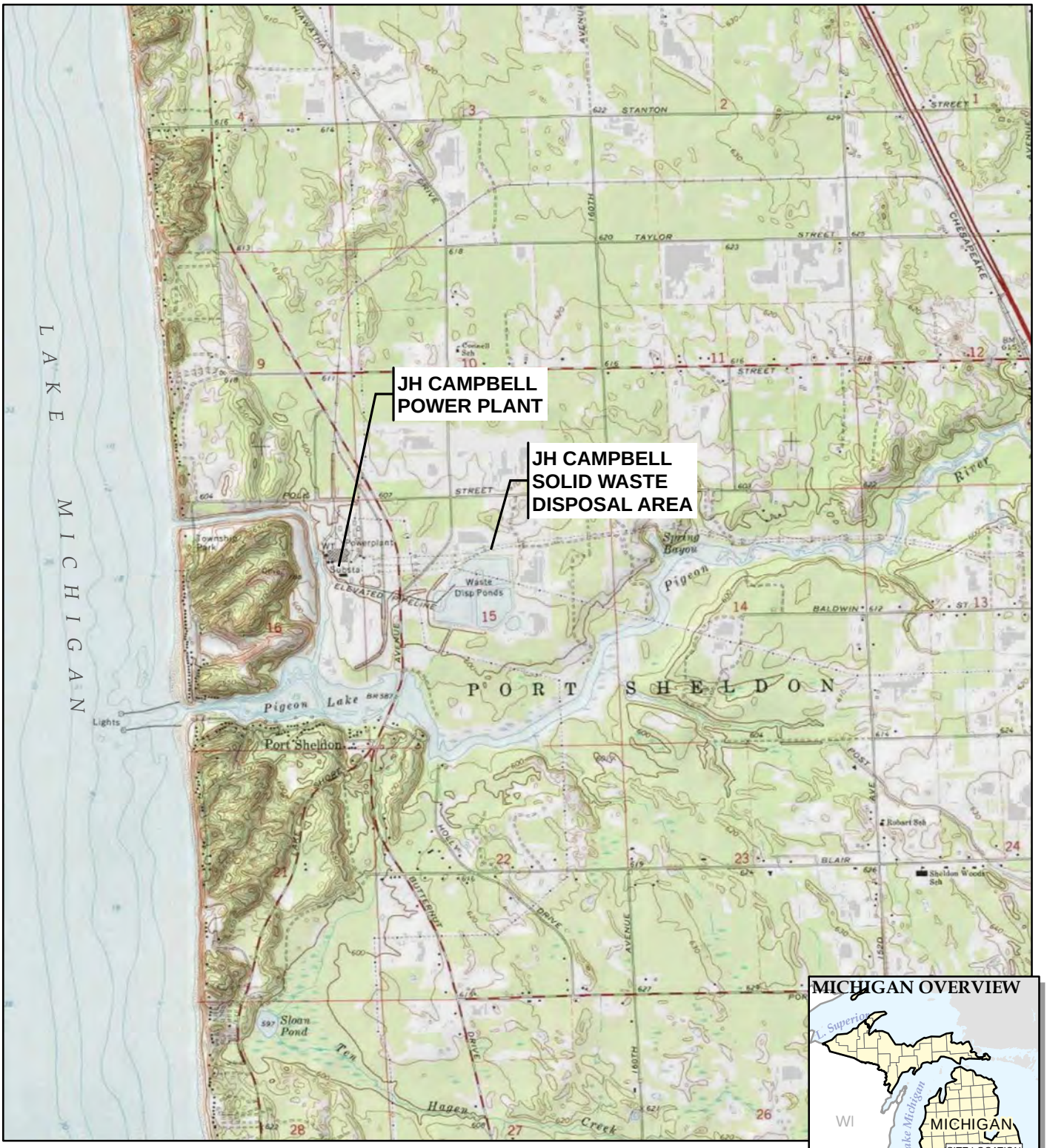
Table 3
Ponds B-K Static Water Elevation Data
JH Campbell
West Olive, Michigan

Closed Ponds B-K Piezometers	Pond Name	TOC (ft)	Top of Screen (ft)	Bottom of Screen (ft)	Bottom Elevation of Ash (ft)	10/3/2018		7/14/2020		10/19/2020		2/22/2021		4/12/2021		8/16/2021	
						Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)
PZ-1203	Pond G1	631.41	606.0	601.0	600.2	37.72	593.69	36.04	595.37	37.82	593.59	Dry		Dry		Dry	
PZ-1204	Pond G2	631.08	598.2	593.2	593.8	--		29.40	601.68	Dry		Dry		Dry		Dry	
PZ-1205	Pond H	629.08	599.7	594.7	593.4	35.46	593.62	33.40	595.68	Dry		Dry		35.91	593.17	Dry	
PZ-1207	Pond J	631.47	604.0	599.0	598.9	--		Dry		Dry		Dry		Dry		Dry	
PZ-1208	Pond D Middle South	633.05	600.8	595.8	607.6	34.53	598.52	33.34	599.71	35.90	597.15	37.10	595.95	37.23	595.82	Dry	
PZ-1210	Pond B	629.07	609.4	604.4	602.6	--		--		--		--		--		--	
PZ-1212	Pond B	628.74	608.9	603.9	604.2	--		Dry		Dry		24.65	604.09	Dry		Dry	
PZ-1215	Pond H	631.25	585.9	580.9	630.7	42.73	588.52	--		--		--		--		--	
PZ-21-01	Pond C	632.71	599.9	594.9	603.0	--		--		--		--		33.83	598.88	33.17	599.54
PZ-21-02	Pond D South	631.80	593.2	588.2	605.0	--		--		--		--		37.15	594.65	36.91	594.89
PZ-21-03	Pond K	628.50	589.9	584.9	601.0	--		--		--		--		37.74	590.76	37.77	590.73
PZ-21-04	Pond G1	631.62	591.9	586.9	596.0	--		--		--		--		38.34	593.28	38.27	593.35
PZ-21-05	Pond D North	631.85	594.3	589.3	601.0	--		--		--		--		33.28	598.57	32.89	598.96
PZ-21-06	Pond J	631.23	590.6	585.6	597.5	--		--		--		--		38.37	592.86	38.20	593.03

Notes

Elevation in feet relative to North American Vertical Datum 1988 (NAVD 88).
TOC = Top of Casing (Survey conducted by Nederveld Inc. April 2021)
ft = Feet; ft BTOC = Feet below top of well casing.
-- Not Measured
Denotes static water elevation > or within 1 foot of bottom elevation of ash.

Figures



BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

N

1 " = 3,000 '
1:36,000

0 3,000 6,000 FEET

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TRC - GIS

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

S:\1-PROJECTS\Consumers_Energy_Company\Michigan\CCR_GW\2017_269767\367390-001-007.mxd -- Saved By: SMAJOR on 1/13/2021, 09:37:27 AM

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL
- DOWNGRADIENT LANDFILL MONITORING WELL
- PIEZOMETER 2021
- 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)
- DOWNGRADIENT MONITORING WELLS
- STAFF GAUGE
- TEMPORARY WELL/ PIEZOMETER
- HMP WELL

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2021.
2. WELL LOCATIONS BASED ON SURVEY DATA THROUGH 8/14/2019.
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. MONITORING WELLS DECOMMISSIONED MAY 25, 2021.
9. MONITORING WELLS DECOMMISSIONED JULY 20-21, 2021.

0 700 1,400 Feet

1 " = 700 '

1:8,400

N

PROJECT:

CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:

SITE PLAN

DRAWN BY:	A. FOJTIK	PROJ NO.:	418422-0003
CHECKED BY:	B. YELEN		
APPROVED BY:	S. HOLMSTROM		**FIGURE 2**
DATE:	OCTOBER 2021		

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Map Rotation: 0
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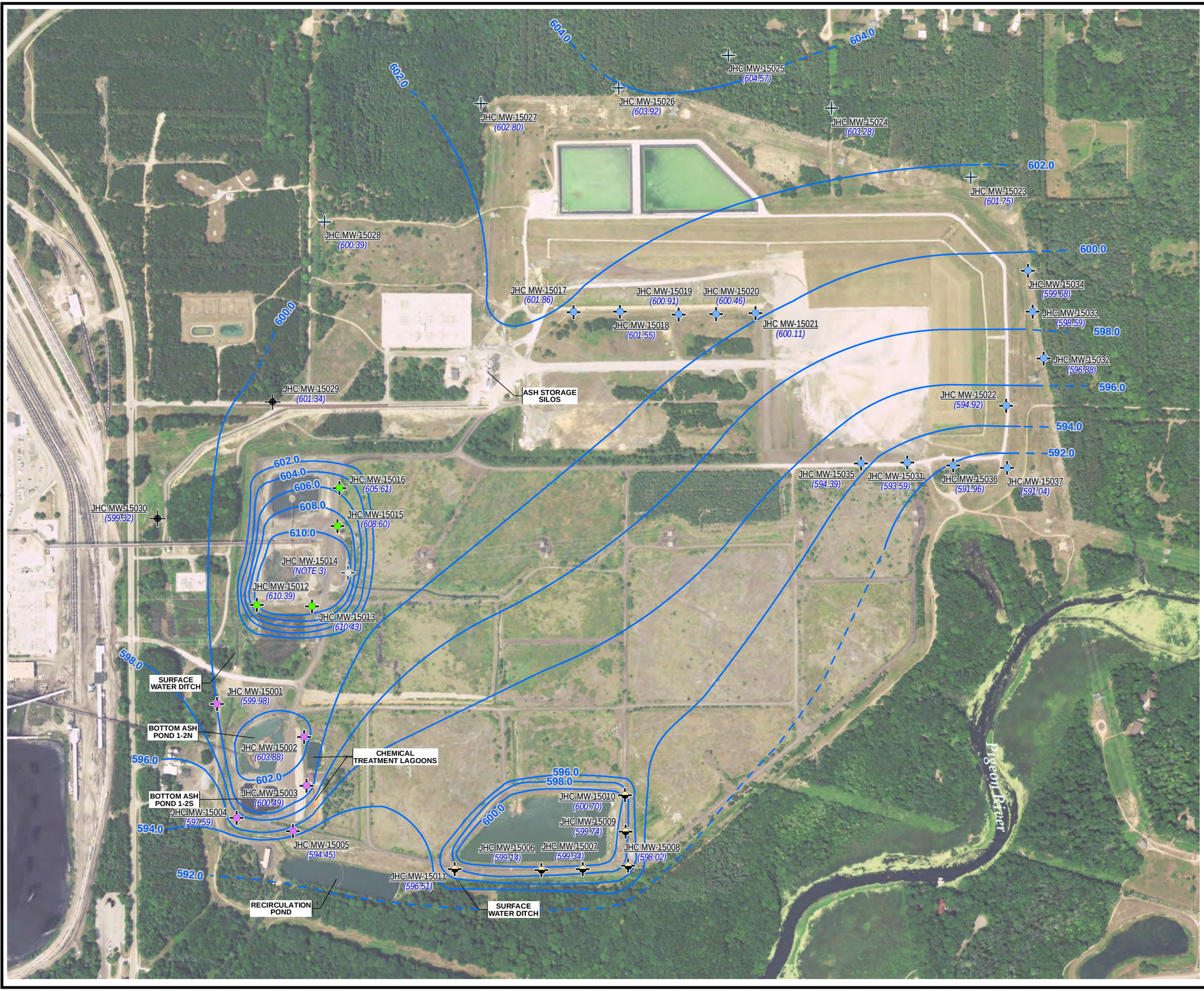
Map Rotation: 0



LEGEND

- BACKGROUND MONITORING WELL
- DECOMISSIONED MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL
- DOWNGRADIENT LANDFILL MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- POND A MONITORING WELL
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- (600.97) GROUNDWATER ELEVATION (FEET)

NOTES

1. BASE MAP IMAGERY FROM USDAL-NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/20/2016.
2. WELL LOCATIONS SURVEYED BY NEDERVELD ON 11/25/2015.
3. MONITORING WELL DECOMMISSIONED NOVEMBER 13, 2017.
4. GROUNDWATER ELEVATIONS DISPLAYED IN FEET RELATIVE TO THE NORTH AMERICAN VERTICAL DATUM OF 1988.

N

0 600 1,200
Feet

1 " = 600 '
1:7,200

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

TITLE:
GROUNDWATER CONTOUR MAP SEPTEMBER 25, 2017

DRAWN BY:	S. MAJOR	PROJ NO.:	269767-001
CHECKED BY:	C. SCIESZKA		
APPROVED BY:	S. HOLMSTROM		**FIGURE 3**
DATE:	JANUARY 2018		

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FILE NO.: 269767-005-012.mxd

TRC - GIS

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Map Rotation: 0

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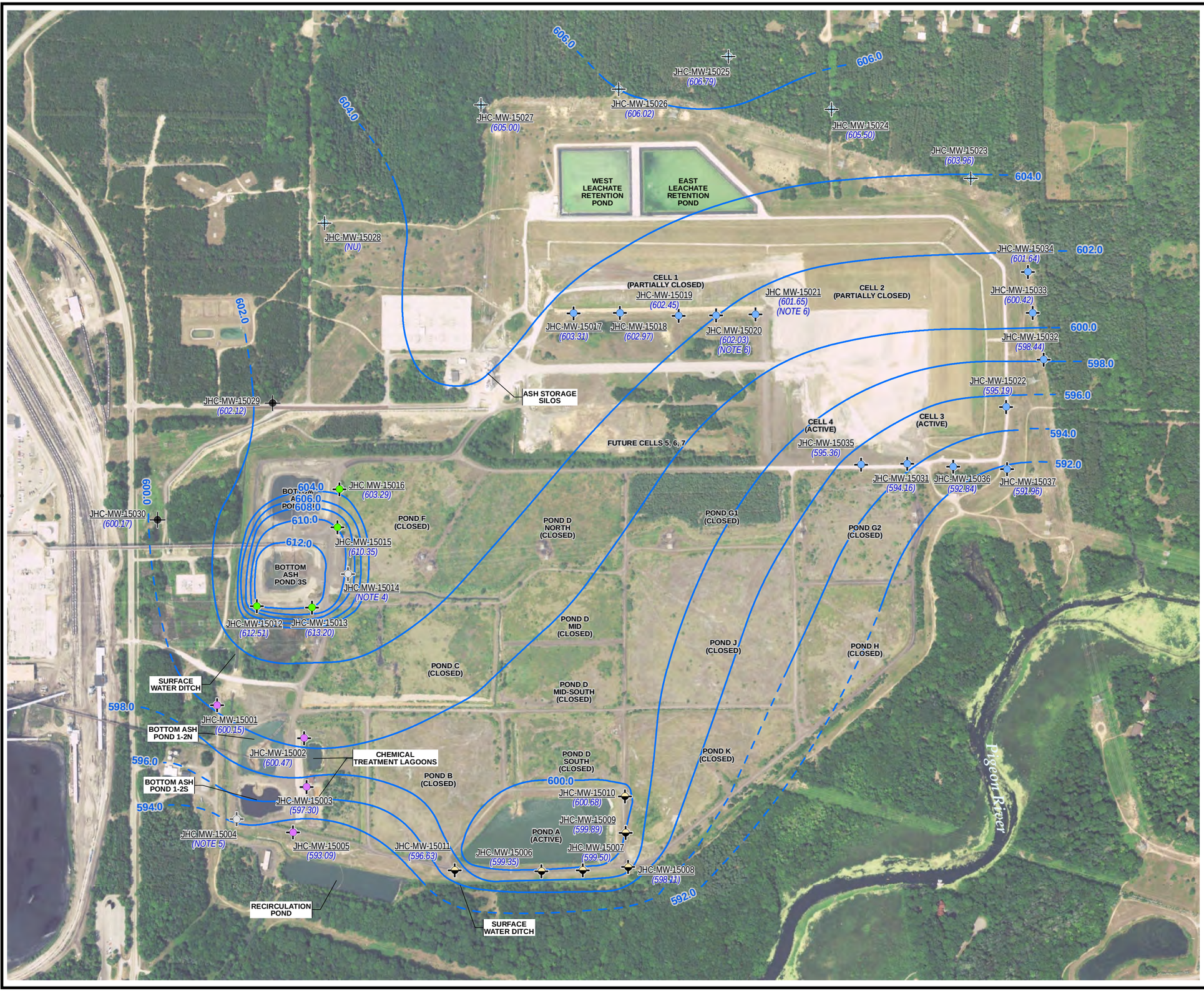

LEGEND

- BACKGROUND MONITORING WELL
- DECOMMISSIONED MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL
- DOWNGRADIENT LANDFILL MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- POND A MONITORING WELL
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- (600.97) GROUNDWATER ELEVATION (FEET)
- (NU) ANOMALOUS DATA NOT USED TO CONSTRUCT CONTOUR MAP

NOTES

1. BASE MAP IMAGERY FROM USDAL-NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/20/2016.
2. WELL LOCATIONS SURVEYED BY NEDERVELD ON 11/25/2015.
3. GROUNDWATER ELEVATIONS DISPLAYED IN FEET RELATIVE TO THE NORTH AMERICAN VERTICAL DATUM OF 1988.
4. MONITORING WELL DECOMMISSIONED NOVEMBER 13, 2017.
5. MONITORING WELL DECOMMISSIONED JUNE 14, 2018.
6. GROUNDWATER ELEVATION DATA COLLECTED ON JUNE 11, 2018, MONITORING WELL DECOMMISSIONED ON JUNE 14, 2018.

N

0 600 1,200 Feet

1 " = 600 '
1:7,200

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

TITLE:
GROUNDWATER CONTOUR MAP JUNE 18, 2018

DRAWN BY:	S. MAJOR	PROJ NO.:	290806-001
CHECKED BY:	C. SCIESZKA		
APPROVED BY:	S. HOLMSTROM		**FIGURE 4**
DATE:	NOVEMBER 2018		

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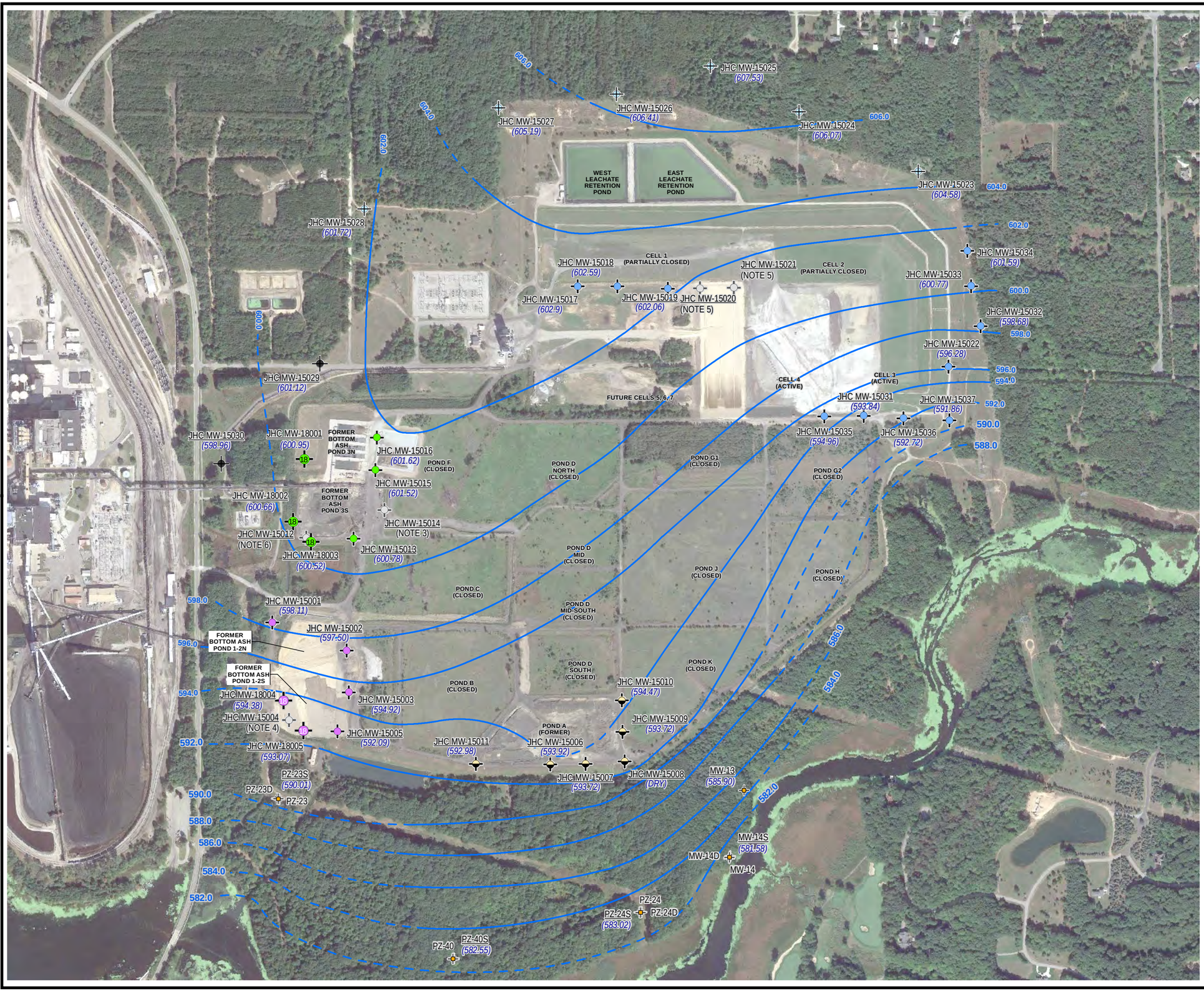
FILE NO.: 290806-001-010.mxd



LEGEND

- BACKGROUND MONITORING WELL
- DECOMMISSIONED MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL
- DOWNGRADIENT LANDFILL MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- POND A 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 WELLS
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- (600.97) GROUNDWATER ELEVATION (FEET)

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. GROUNDWATER ELEVATIONS DISPLAYED IN FEET RELATIVE TO THE NORTH AMERICAN VERTICAL DATUM OF 1988.

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 APRIL 2019

DRAWN BY:	S. MAJOR	PROJ NO.:	322174-001
CHECKED BY:	B. YELEN		
APPROVED BY:	S. HOLMSTROM		**FIGURE 5**
DATE:	JANUARY 2020		

TRC

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FILE NO.: 322174-001-024.mxd

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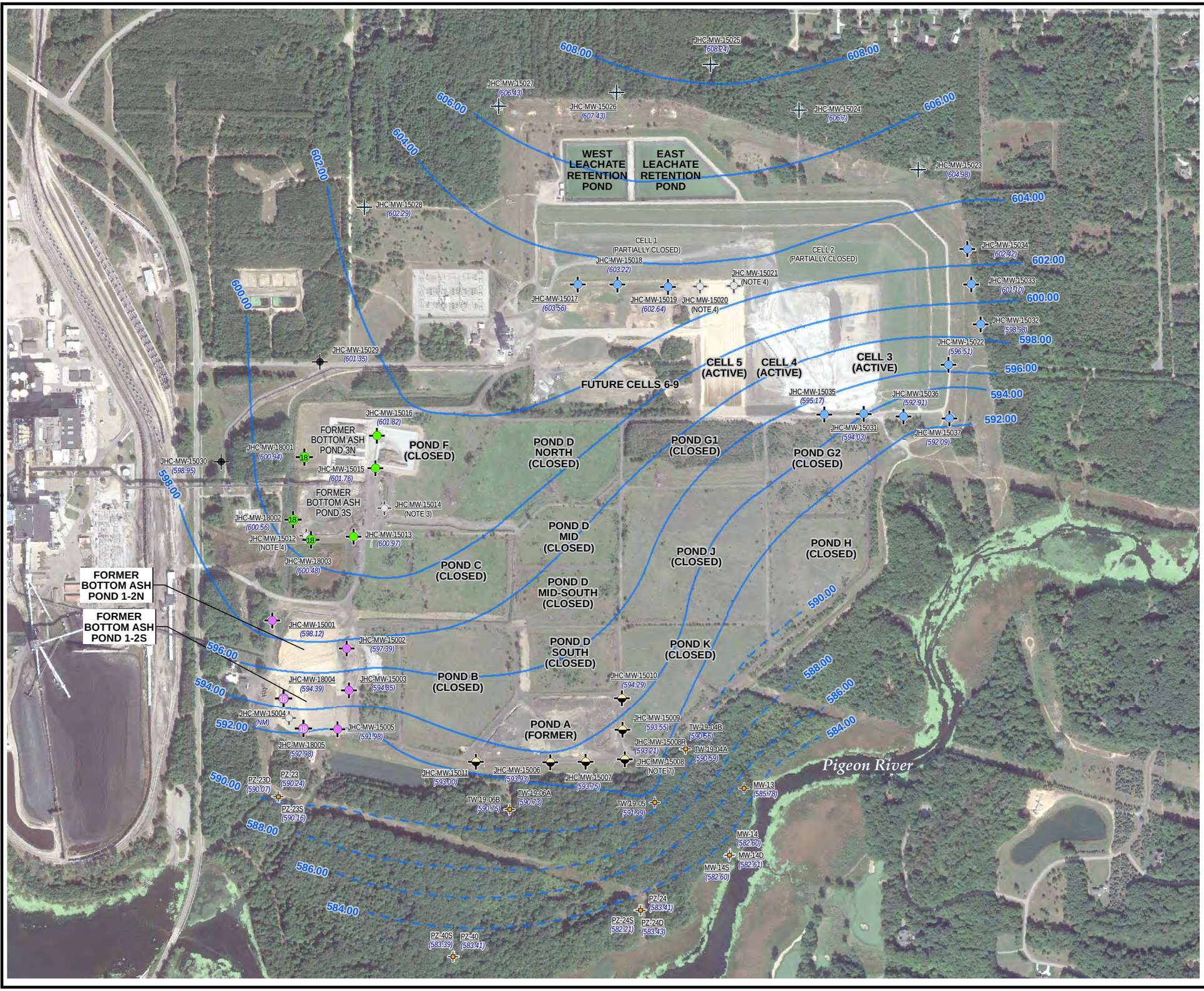
TRC - GIS



LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL
- DOWNGRADIENT 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.

N

0 700 1,400 Feet

1 " = 700 '

1:8,400

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

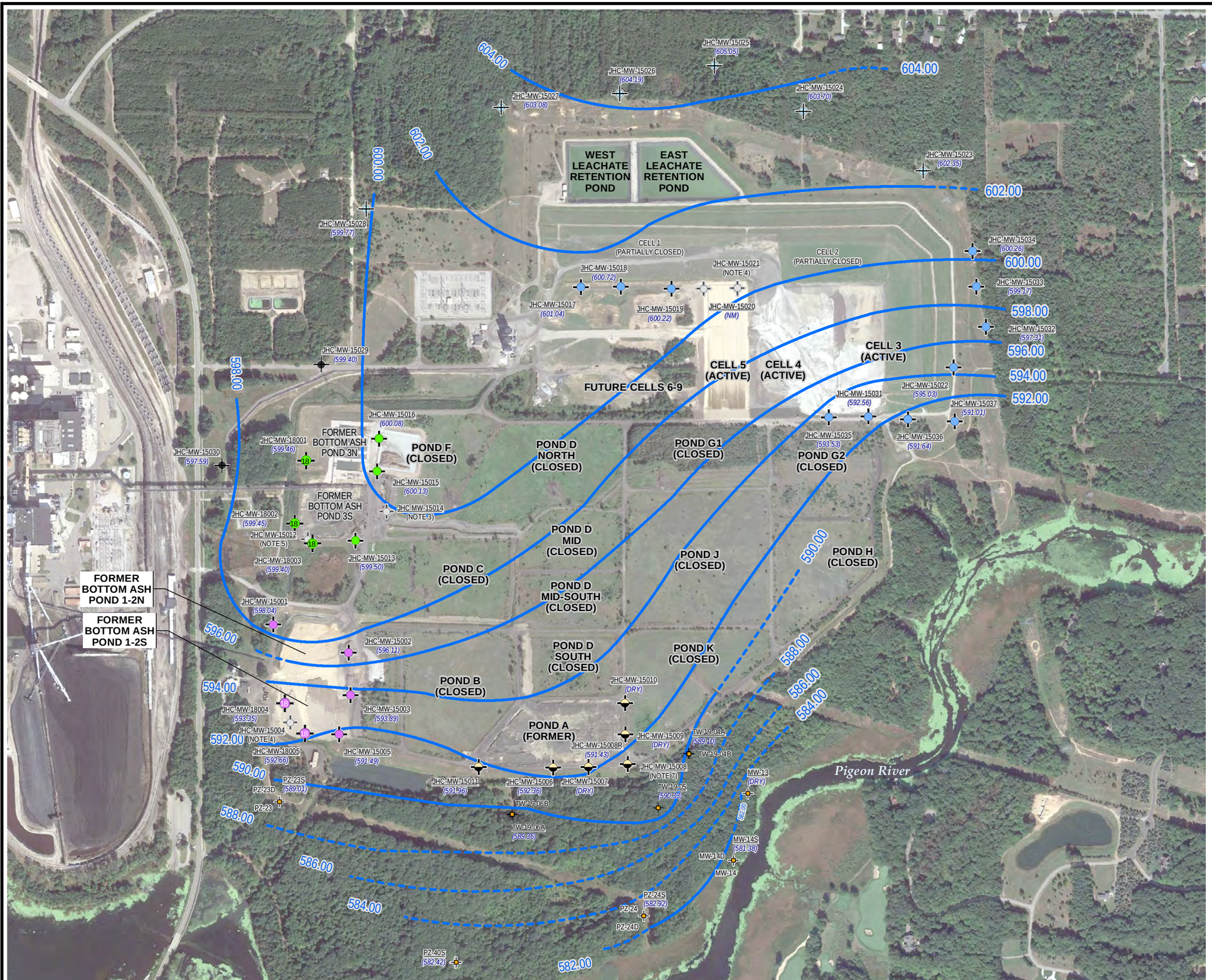
TITLE:
GROUNDWATER CONTOUR MAP APRIL 2020

DRAWN BY:	S. MAJOR	PROJ NO.:	367390.0001.0000
CHECKED BY:	K. LOWERY		
APPROVED BY:	S. HOLMSTROM		**FIGURE 6**
DATE:	JULY 2020		

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trccompanies.com

FILE NO.: 367390-001-003.mxd

Plot Date: 7/26/2020, 19:03:02 PM by AHORRIE -- LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\367390-001-003.mxd
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
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

(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 APRIL 2021

DRAWN BY:	A. ADAIR	PROJ NO.:	418422.0000
CHECKED BY:	K. LOWERY		
APPROVED BY:	K. LOWERY		**FIGURE 7**
DATE:	JULY 2021		

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trccompanies.com

FILE NO.: 418422_200_003.mxd

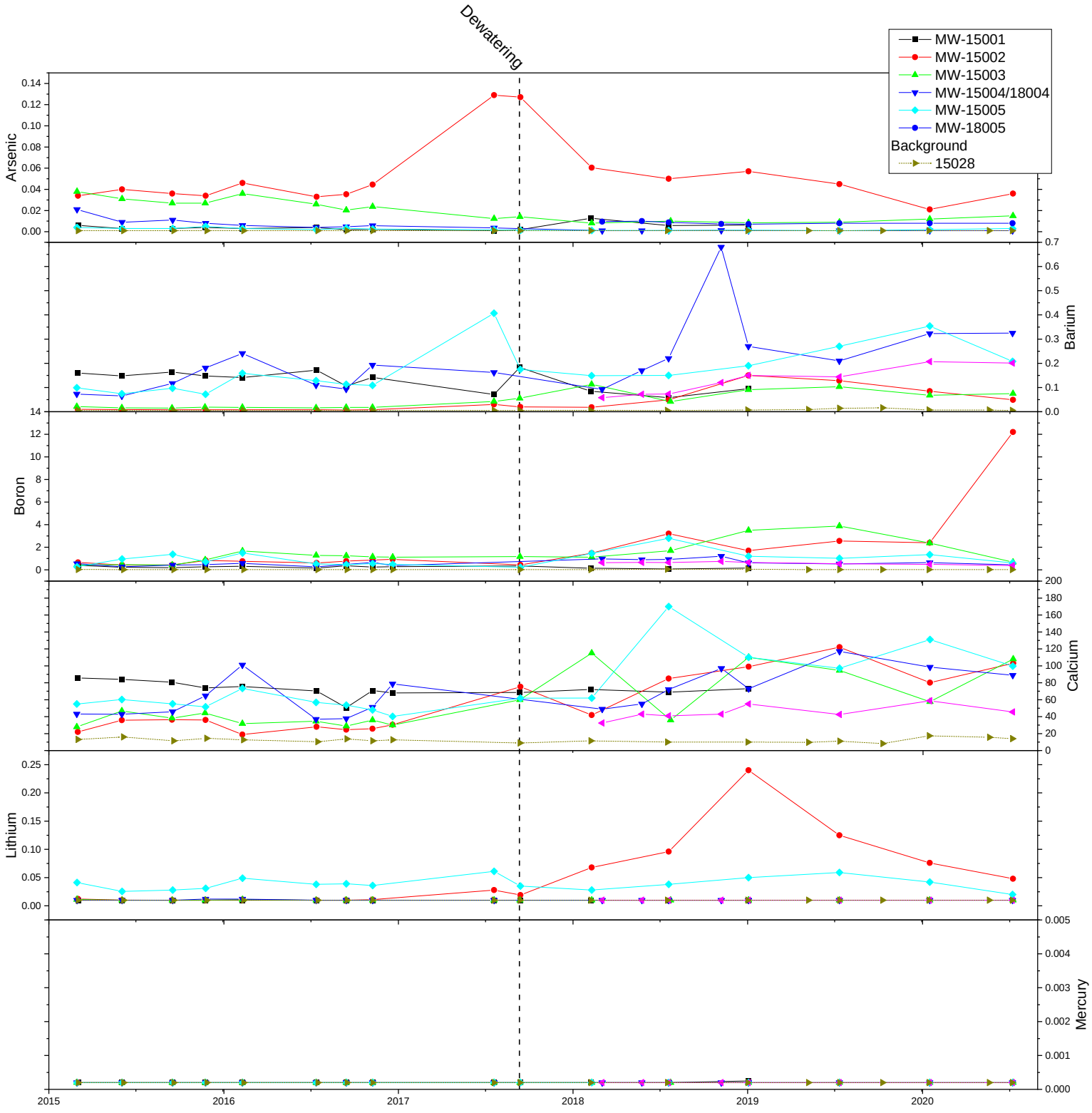


FIGURE 8
Time-Series - Analyte Group 1
JH Campbell Ponds 1-2 - West Olive, MI

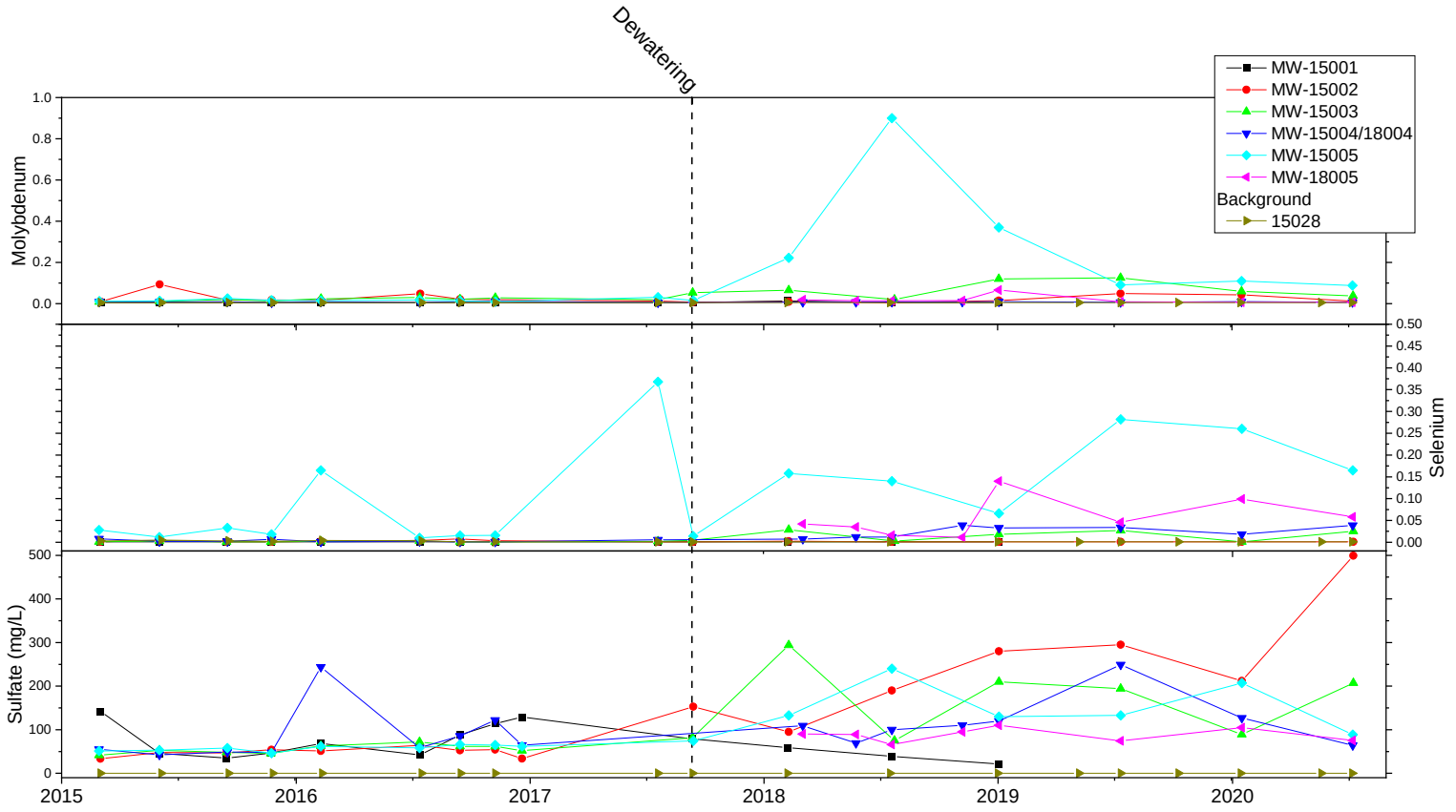


FIGURE 9
Time-Series - Analyte Group 2
JH Campbell Ponds 1-2 - West Olive, MI

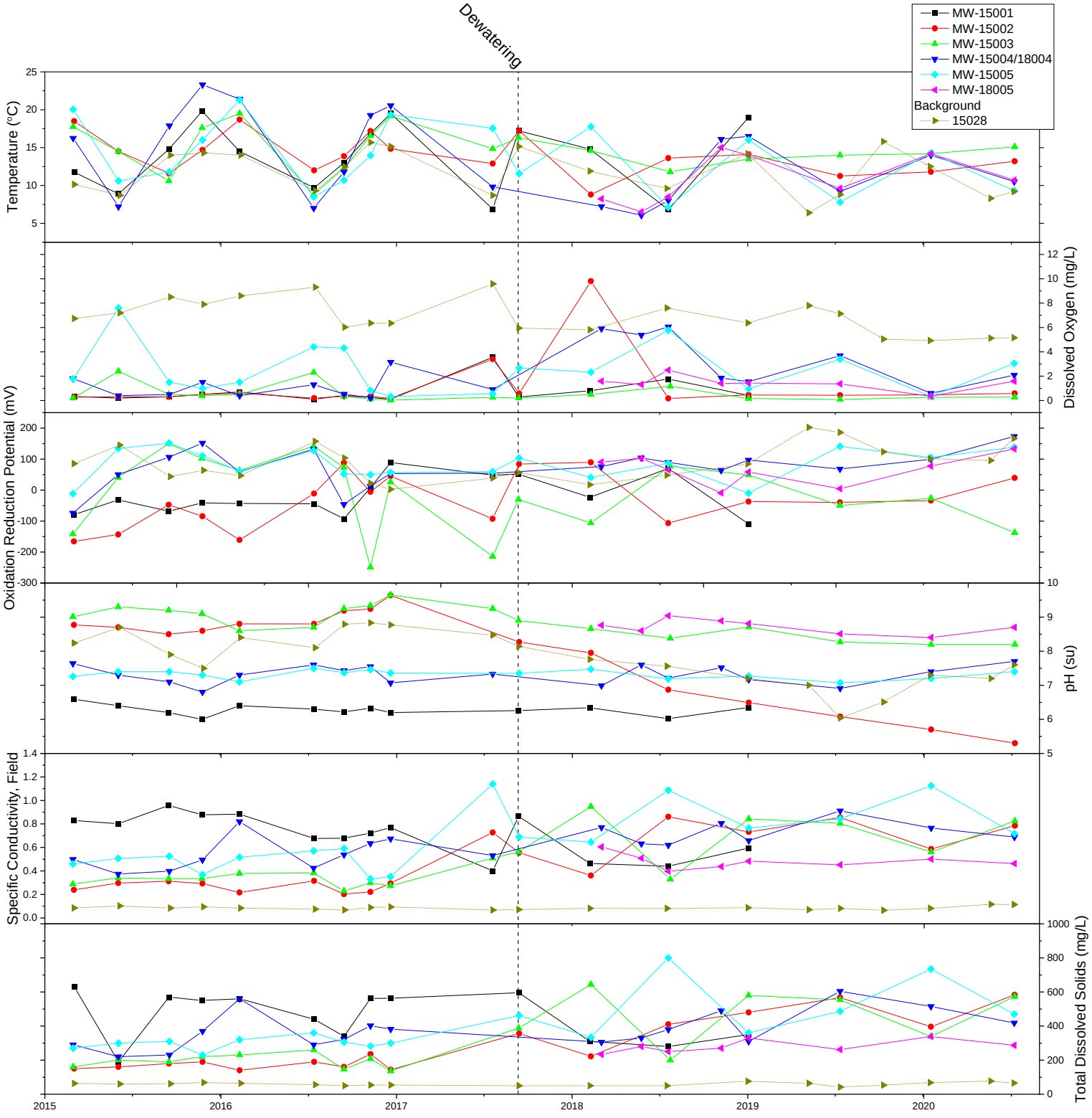


FIGURE 10
Time-Series - Field Parameters
JH Campbell Ponds 1-2 - West Olive, MI

Appendix A
Historic Pond A Area Figures

LEGEND

- EXISTING MAJOR CONTOUR (10' INTERVAL)
- EXISTING MINOR CONTOUR (2' INTERVAL)
- EXISTING CLAY LAYER MAJOR CONTOUR (10' INTERVAL)
- EXISTING CLAY LAYER MINOR CONTOUR (2' INTERVAL)
- APPROXIMATE CELL BOUNDARY
- APPROXIMATE ROAD LOCATION
- APPROXIMATE OVERHEAD WIRE LOCATION
- IRRIGATION LINE
- DITCH LINE
- CLOSED AREA
- OBSCURED AREA
- PERMANENT SURFACE WATER
- CROSS SECTION LINE
- TREE/TREE LINE
- POWER POLE
- POWER LINE TOWER
- MONITORING WELL
- TEST PIT
- SOIL BORING
- CONTROL POINT

NOTES

1. EXISTING TOP OF ASH CONTOURS FOR THE NORTHERN SITE WERE GENERATED FROM SURVEYS COMPLETED BY ENGINEERING & ENVIRONMENTAL SOLUTIONS, LLC ON NOVEMBER 11, 2011 AND APRIL 3, 2012 AND DEPICT THE PHASE 4 COVER COMPLETION.
2. CONTOURS WITHIN EXISTING CLOSURE BOUNDARIES REPRESENT FINAL COVER GRADES AT THE TIME OF CLOSURE.
3. CONTOURS WITHIN CELL 4 REPRESENT TOP OF BOTTOM ASH DRAINAGE LAYER (BOTTOM OF WASTE) FROM TIME OF CONSTRUCTION.
4. CELL BOUNDARIES, ROADS, AND LAKE/RIVER LOCATIONS ARE APPROXIMATE ONLY.
5. EXISTING CONTOURS FOR THE SOUTHERN SITE WERE GENERATED FROM AN AERIAL SURVEY PERFORMED BY ROWE PROFESSIONAL SERVICES IN APRIL 2012.
6. SOIL BORINGS SB-1201 THRU SB-1217 WERE SURVEYED BY ENGINEERING & ENVIRONMENTAL SOLUTIONS, LLC IN JULY 2012 AND AUGUST 2012. ALL OTHER SOIL BORING AND WELL LOCATIONS ARE APPROXIMATE OFF OF OLD PLANS AND FIELD MEASUREMENTS.
7. CLAY CONTOURS FROM HISTORIC INFORMATION AND SOIL BORINGS.

0 300 600
SCALE: 1"=300'

Engineering & Environmental Solutions, LLC
400 136th Avenue, Building 100, Suite B, Holland, Michigan 49424
Phone/Fax: (616) 994-6541
www.goEESolutions.com

RCRA VERTICAL EXPANSION FEASIBILITY

J.H. CAMPBELL ASH STORAGE FACILITY

SECTIONS 10, 11, 14, 15 T. 6 N., R. 16 W., PORT SHELDON TOWNSHIP, OTTAWA COUNTY

CONSUMERS ENERGY COMPANY

WEST OLIVE, MICHIGAN

MARK	DATE	DESCRIPTION
	12-05-2012	ISSUED WITH FINAL REPORT
	11-16-2012	ISSUED FOR FINAL REVIEW

DESIGNED BY:	---
DRAWN BY:	DJS
CHECKED BY:	BAL
PROJECT NO:	005-12-003

SHEET TITLE

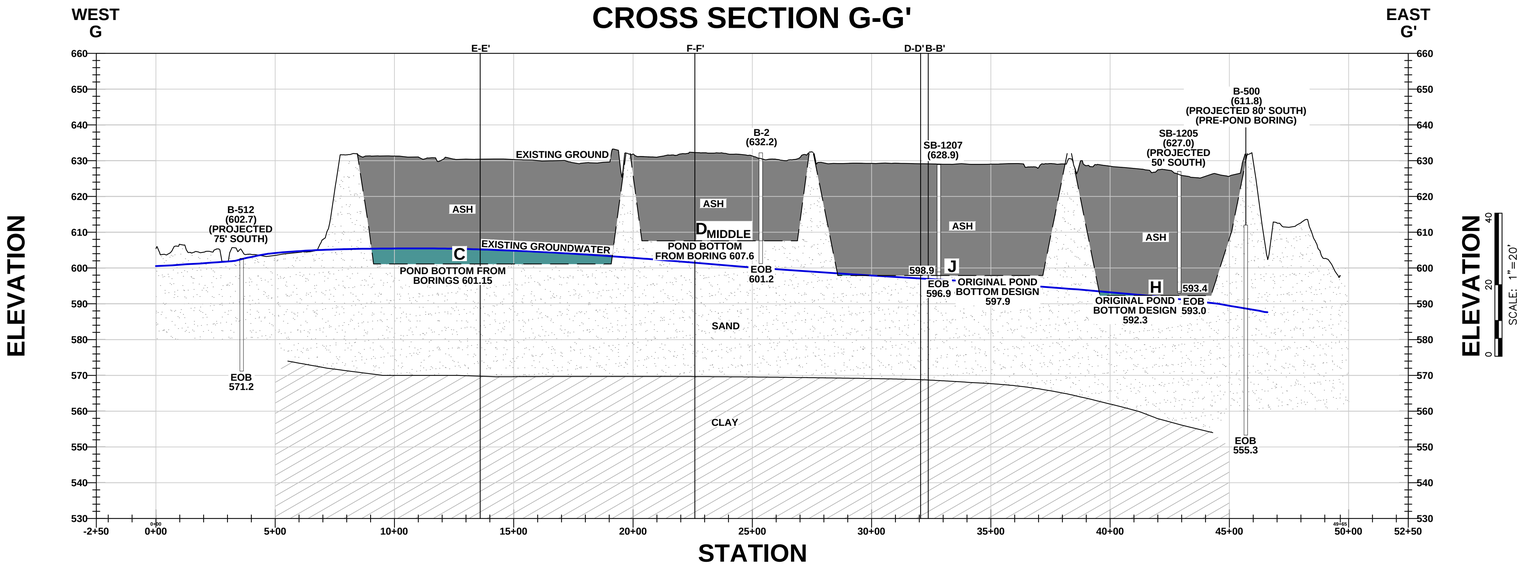
EXISTING CLAY LAYER CONTOURS

SHEET 4 OF 15

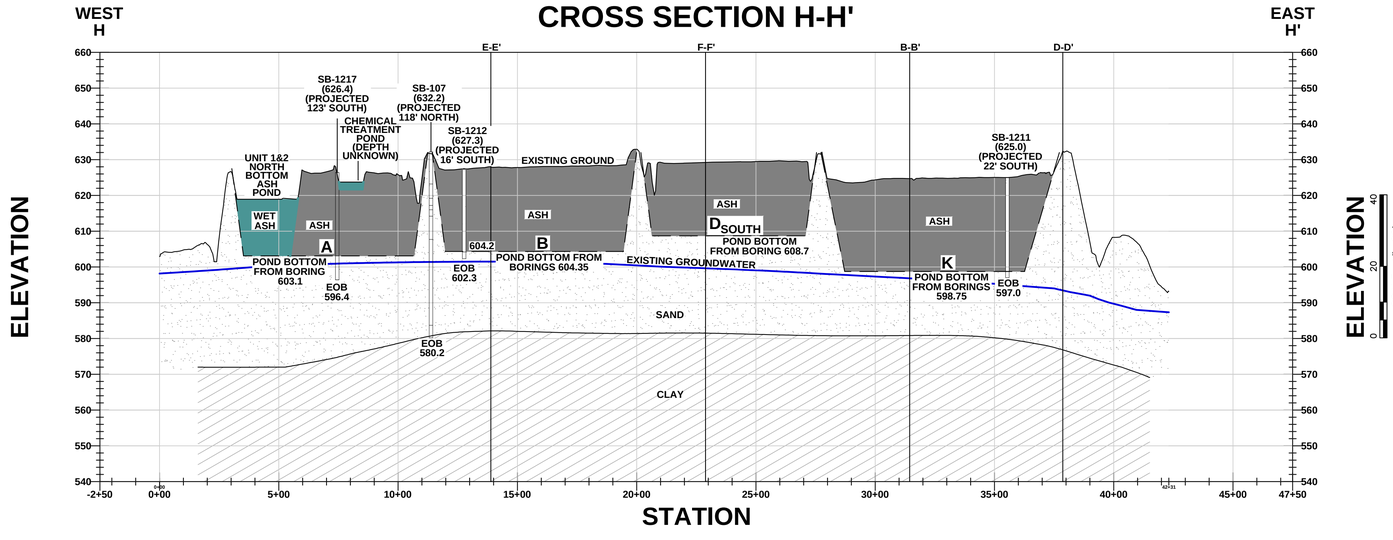
V-102

C:\Civil 3D Projects\Vault\005-12-003\005-12-003-CLAY-A.dwg 11/20/2012 9:48 AM

CROSS SECTION G-G'



CROSS SECTION H-H'



LEGEND

SB-1206
(623.8)

BORING/WELL

- EXISTING SAND
- EXISTING CLAY
- EXISTING ASH
- PERMANENT WATER
- EXISTING WET ASH
- PERMITTED ASH
- EXISTING SURFACE PROFILE
- ORIGINAL POND DESIGN PROFILE
- AUGUST 2012 GROUNDWATER PROFILE

0 300 600
HORIZONTAL SCALE: 1"=300'

NOTES

1. STATIONING IS RELATIVE TO CROSS-SECTION LINE AND IS NOT TIED TO PLANT COORDINATES.

Engineering & Environmental Solutions, LLC
400 136th Avenue, Building 100, Suite B, Holland, Michigan 49424
Phone/Fax: (616) 994-6541
www.goEESolutions.com

RCRA VERTICAL EXPANSION FEASIBILITY
J.H. CAMPBELL ASH STORAGE FACILITY
SECTIONS 10, 11, 14, 15 T. 6 N., R. 16 W., PORT SHELDON TOWNSHIP, OTTAWA COUNTY
CONSUMERS ENERGY COMPANY
WEST OLIVE, MICHIGAN

MARK	DATE	DESCRIPTION
	11-16-2012	ISSUED FOR FINAL REVIEW
	12-05-2012	ISSUED WITH FINAL REPORT

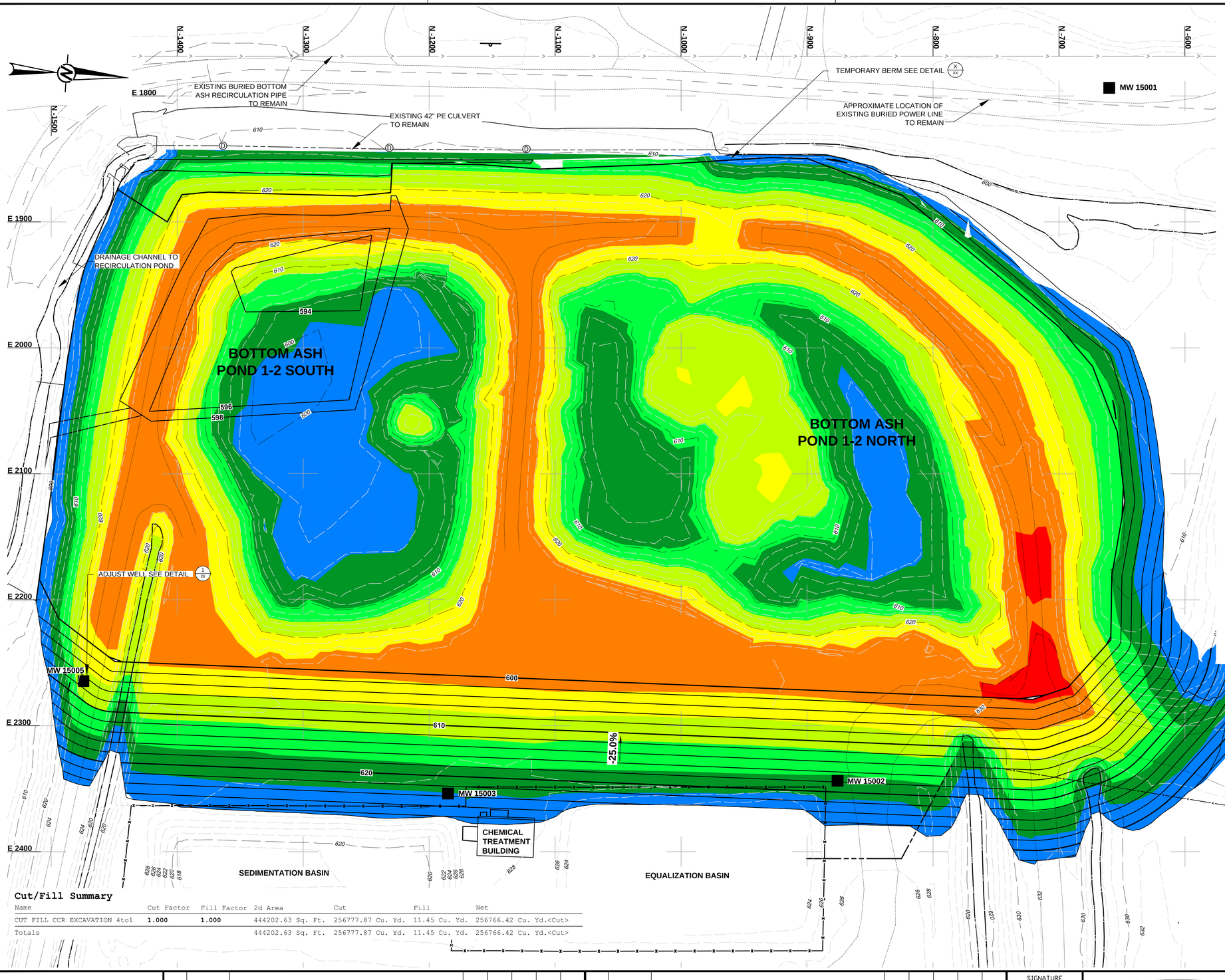
DESIGNED BY:	---
DRAWN BY:	DJS
CHECKED BY:	BAL
PROJECT NO:	005-12-003

SHEET TITLE

EXISTING CROSS SECTIONS G-G' AND H-H'

SHEET 8 OF 15

V-106



LEGEND

- EXISTING GROUND TOPOGRAPHY
- PROPOSED GROUND TOPOGRAPHY
- EXISTING STORM LINE
- EXISTING UNDERGROUND PIPE
- EXISTING DITCH
- EXISTING BURIED POWER LINE
- EXISTING FENCE
- EXISTING BOTTOM ASH RECIRCULATION LINE
- EXISTING ROAD
- EXISTING MONITORING WELL
- EXISTING LIGHT POLE
- EXISTING SIGN
- EXISTING DRAIN INLET

NOTE(S)

1. EXISTING CONDITIONS MAY VARY FROM THOSE SHOWN DUE TO ONGOING CCR DISPOSAL OPERATIONS.
2. CONTRACTOR IS RESPONSIBLE FOR DEVELOPING AND IMPLEMENTING STORMWATER MANAGEMENT AND EROSION CONTROL PLANS CONSISTENT WITH THE SITE SWPPP.
3. CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ADHERENCE TO CONSUMERS ENERGY COMPANY'S HEALTH AND SAFETY PROCEDURES AS WELL AS ANY STATE AND FEDERAL HEALTH AND SAFETY REQUIREMENTS.
4. CONSTRUCTION MATERIALS, SUBCONTRACTORS, AND STOCKPILE LOCATIONS SHALL BE SUBJECT TO APPROVAL BY CONSUMERS ENERGY COMPANY OR ITS DESIGNATED REPRESENTATIVE.
5. TEMPORARY ROADS FOR SITE ACCESS AND STOCKPILE ACCESS TO BE APPROVED BY CONSUMERS ENERGY COMPANY OR ITS DESIGNATED REPRESENTATIVE.
6. CONTRACTOR SHALL VERIFY ALL DIMENSIONS, ELEVATIONS, AND SITE CONDITIONS PRIOR TO STARTING WORK AND SHALL NOTIFY THE ENGINEER IF CONFLICTS EXIST ON THE DRAWINGS.
7. CONTRACTOR IS RESPONSIBLE FOR SURVEY CONTROL AND FOR RECORD-KEEPING REQUIRED TO PRODUCE AS-BUILT DRAWINGS.
8. CONTRACTOR SHALL PERFORM HOUSEKEEPING DUTIES ON A DAILY BASIS TO KEEP WORK AREAS CLEAN. HOUSEKEEPING SHALL BE PERFORMED AT THE COMPLETION OF THE WORK TO THE SATISFACTION OF THE OWNER.
9. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL MATERIALS REQUIRED TO FULLY CONSTRUCT THE SYSTEM ACCORDING TO THE DESIGNS IN THESE DRAWINGS.
10. EXCAVATIONS SHALL CONFORM TO CONSUMERS ENERGY COMPANY AND OSHA REQUIREMENTS.
11. WELLS MW15002 AND MW15003 SHOULD NOT BE REMOVED OR DAMAGED DURING CONSTRUCTION. IF DAMAGED DURING CONSTRUCTION THE CONTRACTOR WILL BE RESPONSIBLE FOR THE OWNER'S COST FOR INSTALLATION OF A NEW REPLACEMENT WELL. CONTRACTOR TO LOWER WELL MW15005 AS PER DETAIL 1/29. CONTRACTOR IS RESPONSIBLE FOR FIXING OR REPLACING WELL IF ANY DAMAGE IS BELOW THE BENTONITE SEAL.
12. EXISTING VEGETATION NOT SHOWN ON THIS PLAN FOR CLARITY. SEE "EXISTING CONDITIONS" DRAWING FOR LOCATIONS AND NOTES.

REFERENCE(S)

1. SITE LOCATION: SECTION 15, T6N, R16W, OTTAWA COUNTY, MICHIGAN.
2. EXISTING GROUND TOPOGRAPHY WAS PROVIDED BY A GROUND SURVEY PERFORMED BY ENGINEERING AND ENVIRONMENTAL SOLUTIONS, LLC IN MAY 2016 AND SEPTEMBER 2016.
3. COORDINATE SYSTEM:
   VERTICAL: CONSUMERS ENERGY J.H. CAMPBELL LOCAL PLANT DATUM, NGVD29.
   HORIZONTAL: CONSUMERS ENERGY J.H. CAMPBELL LOCAL PLANT DATUM.

0 1200 2400
1" = 1200' FEET

Cut/Fill Summary

Name	Cut Factor	Fill Factor	2d Area	Cut	Fill	Net
CUT FILL CCR EXCAVATION 4to1	1.000	1.000	444202.63 Sq. Ft.	256777.87 Cu. Yd.	11.45 Cu. Yd.	256766.42 Cu. Yd.<Cut>
Totals			444202.63 Sq. Ft.	256777.87 Cu. Yd.	11.45 Cu. Yd.	256766.42 Cu. Yd.<Cut>

CUT/FILL TABLE (- = CUT, + = FILL)

NUMBER	MIN. DEPTH (FT)	MAX. DEPTH (FT)	COLOR
1	-32	-30	
2	-30	-25	
3	-25	-20	
4	-20	-15	
5	-15	-10	
6	-10	-5	
7	-5	0	

REV	DATE	DESCRIPTION	DR	BY	CHK	APP	CO
	04-27-16	ISSUED FOR 60% DESIGN REVIEW MEETING	AM	DS	BW	JP	

REFERENCE DRAWINGS

SIGNATURE
NAME
MICHIGAN P.E. No.

Consumers Energy
JH CAMPBELL PLANT
WEST OLIVE, MI

BOTTOM ASH PONDS 1-2 N/S EXCAVATION PLAN

SCALE:
JOB:
DRAWING NO. 690-XXXXX
SHEET 4
REV.

Appendix B
Soil Boring Logs

Date Start: 9/15/15
Date Finish: 9/16/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mouver
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): NA
Water Level Finish (ft. btoc.): 9.31

Northing: 158586.883
Easting: 12633422.01
Casing Elevation: 609.532

Borehole Depth (ft. bgs.): 15.0
Surface Elevation: 607.017

Descriptions By: A. Westhuis

Well/Boring ID: JHC MW-15001

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgl.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
610									TOC = 609.532 (ft. above msl)
0 / 605							(0.0 - 0.3') Grass, Topsoil. (0.3 - 10.0') SAND, fine to medium, subrounded; trace silt; well sorted.		2" PVC Well Casing (-3.0-3.5' bgs) Concrete (0.0-1.0' bgs) Bentonite Pellets (1.0-2.5' bgs)
5 / 600	1	0.0-10.0'	10	NA					Sand Pack K&E WP1 (2.5-15' bgs) 2" PVC 10 Slot Well Screen (3.5-8.5' bgs)
10 / 595	2	10.0-15.0'	3	NA			(10.0 - 15.0') SAND, fine to medium, subrounded; trace silt; well sorted; wet; brown (10YR 4/3) to yellowish brown (10YR 5/4).		
15 / 590							End of boring 15.0' bgs.		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 6.0' bgs.
Groundwater encountered at 10.0' bgs during drilling.
Water level at development was 9.31' btoc
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 600.28 feet

Date Start: 9/16/15
Date Finish: 9/16/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mouver
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 11.0
Water Level Finish (ft. btoc.): 24.51

Northing: 518378.917
Easting: 12633974.82
Casing Elevation: 628.867

Borehole Depth (ft. bgs.): 38.0
Surface Elevation: 625.967

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15002**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
0 / 625							(0.0 - 0.3') Grass, Topsoil.		TOC = 625.967 (ft. above msl); Concrete (0.0-1.0' bgs)
5 / 620	1	0.0-10.0'	10	NA			(0.3 - 11.0') ASH; trace fine sand, subrounded; well sorted; moist to wet; dark gray (10YR 4/1). NOTE: Fill material.		
10 / 615							(11.0 - 24.0') ASH; well sorted; soft; wet; light gray (10YR 7/1) to dark gray (10YR 4/1). NOTE: Fill material.		Bentonite/Cement Grout (1.0-24.0' bgs); 2" PVC Well Casing (-3.0-28.0' bgs)
15 / 610	2	10.0-20.0'	1.8	NA					

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 24.0' bgs during drilling.
Water level at development was 24.51' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 604.04 feet

Date Start: 9/16/15
Date Finish: 9/16/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mouver
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 11.0
Water Level Finish (ft. btoc.): 24.51

Northing: 518378.917
Easting: 12633974.82
Casing Elevation: 628.867

Borehole Depth (ft. bgs.): 38.0
Surface Elevation: 625.967

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15002**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
20 / 605									
25 / 600	3	20.0-30.0'	8	NA			(24.0 - 25.0') SAND, fine, little very fine sand, subrounded; trace silt; well sorted; wet; yellowish brown (10YR 5/6). (25.0 - 38.0') SAND, fine, little very fine, subrounded; trace silt; well sorted; wet; very pale brown (10YR 7/4).		Bentonite Pellets (24.0-26.0' bgs)
30 / 595	4	30.0-38.0'	6	NA					Sand Pack K&E WP1 (26.0-38.0' bgs) 2" PVC 10 Slot Well Screen (28.0-38.0 bgs)
35 / 590							End of boring 38.0' bgs.		
40									

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 24.0' bgs during drilling.
Water level at development was 24.51' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 604.04 feet

Date Start: 9/16/15
Date Finish: 9/17/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 28.0
Water Level Finish (ft. btoc.): 30.57

Northing: 518069.863
Easting: 12633990.37
Casing Elevation: 630.632

Borehole Depth (ft. bgs.): 38.0
Surface Elevation: 628.307

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15003**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
630									TOC = 628.307 (ft. above msl)
0							(0.0 - 0.3') Grass, Topsoil.		Concrete (0.0-1.0' bgs)
							(0.3 - 12.0') ASH; trace fine sand, subrounded; well sorted; moist to wet; dark gray (10YR 4/1). NOTE: Fill material.		
625									
5	1	0.0-10.0'	10	NA					
620									
10									
							(12.0 - 20.0') ASH; well sorted; soft; moist to wet; light gray (10YR 7/1) to dark gray (10YR 4/1). NOTE: Fill material.		Bentonite/Cement Grout (1.0-24.0' bgs)
615									2" PVC Well Casing (-3.0-28.0' bgs)
15	2	10.0-20.0'	9	NA					

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 28.0' bgs during drilling.
Water level at development was 30.57' btoc
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 602.48 feet

Date Start: 9/16/15
Date Finish: 9/17/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 28.0
Water Level Finish (ft. btoc.): 30.57

Northing: 518069.863
Easting: 12633990.37
Casing Elevation: 630.632

Borehole Depth (ft. bgs.): 38.0
Surface Elevation: 628.307

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15003**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
610									
20							(20.0 - 21.0') SAND, fine, subrounded; trace silt; well sorted; moist; brownish yellow (10YR 6/8). NOTE: Trace small roots at this depth.		
							(21.0 - 28.0') SAND, fine, subrounded; trace silt; well sorted; moist; very pale brown (10YR 7/4).		
605									
25	3	20.0-30.0'	5	NA					Bentonite Pellets (24.0-26.0' bgs)
600							(28.0 - 38.0') SAND, fine, little medium; trace granules, subrounded; trace silt; well sorted; wet; brownish yellow (10YR 6/6).		
30									
595									Sand Pack K&E WP1 (26.0-38.0' bgs)
									2" PVC 10 Slot Well Screen (28.0-38.0' bgs)
35	4	30.0-38.0'	8	NA					
590							End of boring at 38.0' bgs.		
40									

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 28.0' bgs during drilling.
Water level at development was 30.57' btoc
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 602.48 feet

Date Start: 9/17/15
Date Finish: 9/17/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 27.0
Water Level Finish (ft. btoc.): 31.67

Northing: 517864.558
Easting: 12633547.12
Casing Elevation: 628.422

Borehole Depth (ft. bgs.): 40.0
Surface Elevation: 624.917

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15004**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
0	625							(0.0 - 0.3') Grass, Topsoil.		TOC = 628.442 (ft. above msl)
								(0.3 - 10.0') ASH and SAND, fine to medium, subrounded; stiff; dry to moist; dark grayish brown (10YR 4/2). NOTE: Fill material.		Concrete (0.0-1.0' bgs)
5	620	1	0.0-10'	10	NA					
10	615							(10.0 - 19.0') ASH and SAND, fine to medium, subrounded; soft; moist to wet; dark grayish brown (10YR 4/2). NOTE: Fill material.		Bentonite/Cement Grout (1.0-20.0' bgs)
		2	10.0-15.0'	4	NA			NOTE: Trace small pebbles from 12.0 to 13.0' bgs.		2" PVC Well Casing (-3.0-24.0' bgs)
15	610									
		3	15.0-20.0'	4	NA					

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 27.0' bgs during drilling.
Water level at development was 31.67' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 598.77 feet

Date Start: 9/17/15
Date Finish: 9/17/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 27.0
Water Level Finish (ft. btoc.): 31.67

Northing: 517864.558
Easting: 12633547.12
Casing Elevation: 628.422

Borehole Depth (ft. bgs.): 40.0
Surface Elevation: 624.917

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15004**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
								(19.0 - 20.0') SAND, fine; trace medium sand, subrounded; trace silt; well sorted; dry to moist; brownish yellow (10YR 6/8).		
20	605							(20.0 - 30.0') SAND, fine, trace medium, subrounded; trace silt; well sorted; dry; very pale brown (10YR 7/4).		
25	600	4	20.0-30.0'	4	NA			NOTE: Wet at 27.0' bgs.		
30	595							(30.0 - 40.0') SAND, fine to medium; trace coarse sand; trace granules; subrounded; well sorted; wet; pale brown (10YR 6/3).		
35	590	5	30.0-40.0'	8	NA					
40	585							End of boring at 40.0' bgs.		

Bentonite Pellets (20.0-22.0' bgs)
Sand Pack K&E WP1 (22.0-40.0' bgs)
2" PVC 10 Slot Well Screen (24.0-34.0 bgs)

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 27.0' bgs during drilling.
Water level at development was 31.67' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 598.77 feet

Date Start: 9/18/15
Date Finish: 9/18/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 29.0
Water Level Finish (ft. btoc.): 33.26

Northing: 517781.423
Easting: 12633905.01
Casing Elevation: 627.297

Borehole Depth (ft. bgs.): 40.0
Surface Elevation: 624.367

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15005**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 70 F Cloudy

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
625									TOC = 627.297 (ft. above msl)
0							(0.0 - 0.3') Grass, Topsoil.		Concrete (0.0-1.0' bgs)
							(0.3 - 10.0') ASH and SAND, fine to medium; trace granules, subrounded; moist; soft to stiff; poorly sorted; brown (10YR 5/3) to dark grayish brown (10YR 4/2). NOTE: Fill material.		
620									
5	1	0.0-10.0'	10	NA					
615									
10							(10.0 - 11.0') ASH; well sorted; medium stiff to stiff; moist; dark gray (10YR 4/1). NOTE: Fill material.		
							(11.0 - 13.0') SAND, medium, little to some fine sand, subrounded; trace silt; well sorted; dry; brown (10YR 5/3) to yellowish brown (10YR 5/4).		Bentonite/Cement Grout (1.0-23.0' bgs)
							(13.0 - 16.0') SAND, medium; little fine sand, subrounded; trace silt; well sorted; dry; very pale brown (10YR 7/4).		2" PVC Well Casing (-3.0-27.0' bgs)
610									
15	2	10.0-20.0'	6	NA					
							(16.0 - 19.5') SAND, medium; trace fine, subrounded; trace silt; dry; light yellowish brown (10YR 6/4).		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 29.0' bgs during drilling.
Water level at development encountered at 33.26' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 595.77 feet

Date Start: 9/18/15
Date Finish: 9/18/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 29.0
Water Level Finish (ft. btoc.): 33.26

Northing: 517781.423
Easting: 12633905.01
Casing Elevation: 627.297

Borehole Depth (ft. bgs.): 40.0
Surface Elevation: 624.367

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15005**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 70 F Cloudy

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
605							(19.5 - 19.8') SAND, medium; trace fine, subrounded; little to some silt; moist, brown (10YR 4/3).		
20							(19.8 - 29.0') SAND, medium, trace fine, subrounded; trace silt; well sorted; dry; very pale brown (10YR 7/4).		
600	3	20.0-30.0'	6	NA					Bentonite Pellets (23.0-25.0' bgs)
25									
595							(29.0 - 31.0') SAND, medium, little fine, trace coarse, subrounded; trace silt; well sorted; wet; pale brown (10YR 6/3).		
30									Sand Pack K&E WP1 (25.0-40.0' bgs)
							(31.0 - 33.0') SAND, medium to coarse, little fine, subrounded; trace silt; well sorted; wet; pale brown (10YR 6/3).		2" PVC 10 Slot Well Screen (27.0-37.0 bgs)
							(33.0 - 40.0') SAND, fine, some medium, subrounded; well sorted; wet; pale brown (10YR 6/3).		
590									
35	4	30.0-40.0'	9	NA					
585									Sand Pack K&E WP1 (37-40' bgs)
40							End of boring at 40.0' bgs.		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 29.0' bgs during drilling.
Water level at development encountered at 33.26' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 595.77 feet

WELL CONSTRUCTION LOG

WELL NO. JHC-MW-18004

Facility/Project Name	Date Drilling Started	Date Drilling Completed	Project Number
CEC JH Campbell	12/4/18	12/4/18	290806.0000 P1T5

Drilling Firm	Drilling Method	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns Drilling Company	Geoprobe	602.9	605.71	15.0	4

Boring Location: West side of Pond 1-2S

N: 518007.60 E: 12633480.87

Personnel
Logged By - P. Lancaster
Driller - R. Christiansen

Drilling Equipment: 6620 DT

Civil Town/City/or Village	County	State
West Olive	Ottawa	Michigan

Water Level Observations:
While Drilling: Date/Time 12/4/18 00:00 ▽ Depth (ft bgs) 8.0
After Drilling: Date/Time 12/4/18 08:45 ▼ Depth (ft bgs) 8.1

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 GP	85		0	**SILTY SAND** mostly fine sand, little medium sand, little silt, dark grayish brown (10YR 3/2), moist, loose.	SM			
				SAND mostly fine to medium sand, light yellowish brown (10YR 6/4), moist, loose.	SP			
			5	Change to medium sand, very pale brown (10YR 7/2) at 5.0 feet.				
2 GP	100			▼ Change to very moist at 8.0 feet.				
			10	Change to yellowish brown (10YR 5/6), wet at 9.8 feet. Change to medium sand, trace to few coarse sand, yellowish brown (10YR 6/5) at 10.0 feet.				
3 GP	100			Grades to coarse sand, light yellowish brown (10YR 6/4) at 13.0 feet.				
4 GP	0		15	Blind push from 15.0 to 16.0 feet; lithology assumed sand based on prior investigations at site.				
				End of boring at 16.0 feet below ground surface.				
			20					

SOIL BORING WELL CONSTRUCTION LOG 290806.0000_P1_T5.GPJ TRC_CORP.GDT 290806.0000 P1T5 1/24/19

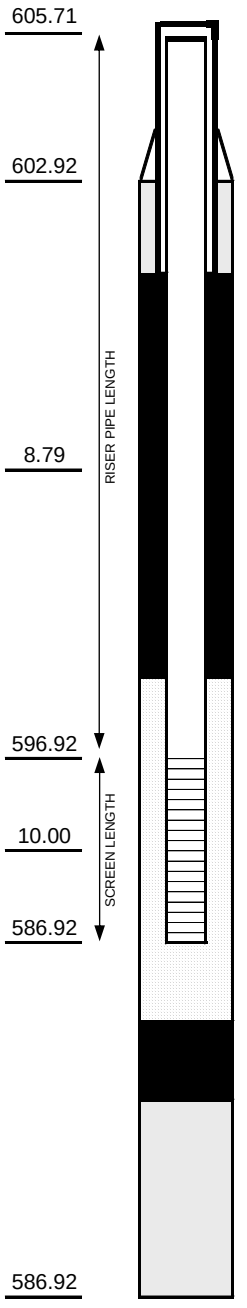
Signature:

Firm: TRC Environmental Corporation
1540 Eisenhower Place Ann Arbor, MI 48108
734-971-7080
Fax 734-971-9022

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC JH Campbell		WELL ID:	**JHC-MW-18004**
PROJ. NO: 290806.0002	DATE INSTALLED: 12/4/2018 INSTALLED BY: Paula Lancaster	CHECKED BY:	J. Krenz

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)



605.71	2.8	TOP OF CASING
602.92	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL: MEDIUM CHIPS
		GROUT/BACKFILL METHOD: FILL FROM ABOVE
8.79		
	NA	GROUT
		BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	4.0	BENTONITE SEAL
596.92	6.0	TOP OF SCREEN
		FILTER PACK MATERIAL: WASHED SAND & NATURAL COLLAPSE
10.00		
586.92	16.0	BOTTOM OF SCREEN
	16.0	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL: NA
586.92	16.0	HOLE BOTTOM

NOTES:
Well pro-cover filled with sand, and labeled using paint marker. No lock installed at time of installation.

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SOLVENT USED? NO

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 4.0 IN. FROM 0 TO 16 FT.
NA IN. FROM NA TO NA FT.

SURF. CASING DIAMETER: NA IN. FROM NA TO NA FT.
NA IN. FROM NA TO NA FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP
TIME DEVELOPING: 0.3 HOURS
WATER REMOVED: 17 GALLONS
WATER ADDED: < 5 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: OPAQUE
COLOR BEFORE: BROWN
CLARITY AFTER: CLEAR; 8.07 NTUs
COLOR AFTER: NONE

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	19.50	T/PVC	12/5/2018	1425
DTB AFTER DEVELOPING:	19.05	T/PVC	12/7/2018	945
SWE BEFORE DEVELOPING:	11.00	T/PVC	12/5/2018	1425
SWE AFTER DEVELOPING:	11.02	T/PVC	12/7/2018	945
OTHER SWE:		T/PVC		
OTHER SWE:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO
PROTECTIVE COVER AND LOCK INSTALLED? ☐ YES ☑ NO
LOCK KEY NUMBER: _____

WELL CONSTRUCTION LOG

WELL NO. JHC-MW-18005

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
CEC JH Campbell	12/5/18	12/5/18	290806.0000 P1T5

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns Drilling Company	Geoprobe	600.3	603.16	15.0	4

Boring Location: South side of Pond 1-2S N: 517784.97 E: 12633627.70	Personnel Logged By - P. Lancaster Driller - R. Christiansen	Drilling Equipment: 6620 DT

Civil Town/City/or Village:	County:	State:	Water Level Observations:
West Olive	Ottawa	Michigan	While Drilling: Date/Time 12/5/18 00:00 ▽ Depth (ft bgs) 8.0 After Drilling: Date/Time 12/5/18 23:00 ▼ Depth (ft bgs) 7.7

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 GP	100		0	**SILTY SAND** mostly fine sand, few to little silt, very dark grayish brown (10YR 3/2), moist, loose.	SM			
				SAND mostly medium sand, brownish yellow (10YR 6/6), moist, loose.				
				Change to light brownish gray at 3.0 feet.				
			5	Change to brownish yellow (10YR 6/6) at 5.0 feet.				
2 GP	100			▽ Change to wet with 1" coarse sand seam at 8.0 feet.	SP			
3 GP	100		10	Change to mostly coarse sand, little medium sand, trace fine gravel, wet at 10.0 feet.				
			15	End of boring at 15.0 feet below ground surface.				
			20					

SOIL BORING WELL CONSTRUCTION LOG 290806.0000_P1_T5.GPJ TRC_CORP.GDT 290806.0000 P1T5 1/24/19

Signature:	Firm: TRC Environmental Corporation 1540 Eisenhower Place Ann Arbor, MI 48108	734-971-7080 Fax 734-971-9022

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC JH Campbell		WELL ID:	**JHC-MW-18005**
PROJ. NO: 290806.0002	DATE INSTALLED: 12/5/2018 INSTALLED BY: Paula Lancaster	CHECKED BY:	J. Krenz

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
603.16	2.9	TOP OF CASING
600.30	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL
		MEDIUM CHIPS
		GROUT/BACKFILL METHOD
7.86		FILL FROM ABOVE
	NA	GROUT
		BENTONITE SEAL MATERIAL
		MEDIUM CHIPS
	3.5	BENTONITE SEAL
595.30	5.0	TOP OF SCREEN
		FILTER PACK MATERIAL
10.00		WASHED SAND & NATURAL COLLAPSE
585.30	15.0	BOTTOM OF SCREEN
	15.0	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL
		NA
585.30	15.0	HOLE BOTTOM

RISER PIPE LENGTH

SCREEN LENGTH

NOTES:
Well pro-cover filled with sand, and labeled using paint marker. No lock installed at time of installation.

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SOLVENT USED? NO

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 4.0 IN. FROM 0 TO 15 FT.
NA IN. FROM NA TO NA FT.

SURF. CASING DIAMETER: NA IN. FROM NA TO NA FT.
NA IN. FROM NA TO NA FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP
TIME DEVELOPING: 0.25 HOURS
WATER REMOVED: 27 GALLONS
WATER ADDED: < 5 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: OPAQUE
COLOR BEFORE: YELLOWISH-BROWN
CLARITY AFTER: CLEAR; 8.39 NTUs
COLOR AFTER: NONE

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	17.95	T/PVC	12/5/2018	1340
DTB AFTER DEVELOPING:	17.97	T/PVC	12/7/2018	1230
SWE BEFORE DEVELOPING:	7.40	T/PVC	12/5/2018	1340
SWE AFTER DEVELOPING:	9.77	T/PVC	12/7/2018	1230
OTHER SWE:		T/PVC		
OTHER SWE:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☐ YES ☑ NO

LOCK KEY NUMBER: _____

Engineering & Environmental Solutions, LLC

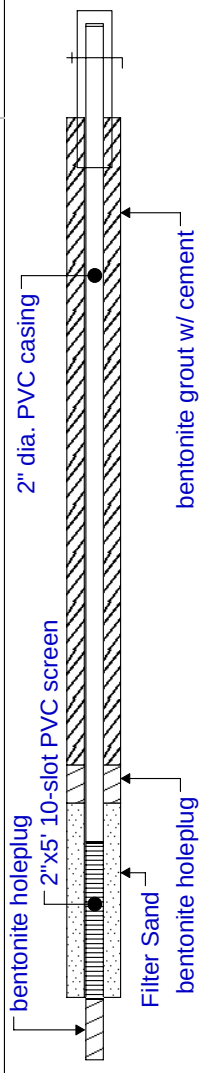
400 136th Avenue
Building 100, Suite B
Holland, Michigan 49424
Phone/Fax: (616) 994-6541
www.goEESolutions.com

Project Name: RCRA Vertical Exp. Feasibility
Project Number: 005-12-003
Site Location: J.H. Campbell, West Olive, MI
Drilling Method: 8.25" OD HSA
Sampling Method: 2' Split Spoon
Ground Elevation (feet): 628.7
Top of Casing Elevation (feet): 631.60
Logged By: Kurt Van Appledorn
Comments:

Log of Borehole: PZ/SB-1203

Start Date: 6-7-12
End Date: 6-7-12
Driller: Remedial Services Division
Crew Chief: Dave Hill
Depth to Water (ft BGS during drilling): 25
Easting: 4542.2
Northing: 505.8

Depth (feet BGS)	Symbol	Description	Depth/Elev.	Sample Length (feet)	Recovery (feet)	Blow Counts (per 6 in)	N	Water Content (Percent) 10 30 50	Well Completion Details
		Ground Surface	628.7						
		0-0.7' Fine sand size ASH, dry	0.0						
		0.7-3' Silt size ASH, with 2-3" seams of fine sand size ash, moist.		2	2.0	0-1-1-1	2		
			625.7						
		3-26' Gray fine sand size ASH, dry, with wet dark gray 0.2 to 0.4' silt size ash seams.	3.0						
				2	1.3	0-1-1-1	2		
				2	1.7	0-0-1-1	1		
				2	1.6	0-0-0-1	0		
				2	0	0-1-0-1	1		
				2	2.0	0-1-1-2	2		
		Wet at 25'	603.7 25.0	2	1.9	0-1-0-1	1		
		26.0-28.5' Silt size ASH, little fine sand size ash, wet		2	1.9	0	0		
		Thin (~1/8") black material between ash and sand	600.2 28.5	2	1.5	0-3-8-15	11		
		28.5-30' Brown fine SAND	598.7						
		End of Boring	30.0						



Sheet: 1 of 1

Engineering & Environmental Solutions, LLC

400 136th Avenue
Building 100, Suite B
Holland, Michigan 49424
Phone/Fax: (616) 994-6541
www.goEESolutions.com

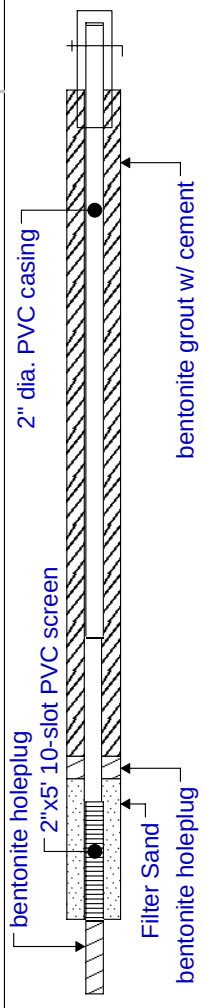
Project Name: RCRA Vertical Exp. Feasibility
Project Number: 005-12-003
Site Location: J.H. Campbell, West Olive, MI
Drilling Method: 8.25" OD HSA
Sampling Method: 2' Split Spoon
Ground Elevation (feet): 629.3
Top of Casing Elevation (feet): 631.92
Logged By: Kurt Van Appledorn
Comments:

Log of Borehole: PZ/SB-1204

Start Date: 6-7-12
End Date: 6-7-12
Driller: Remedial Services Division
Crew Chief: Dave Hill
Depth to Water (ft BGS during drilling):
Easting: 6033.8
Northing: 585.6

Depth (feet BGS)	Symbol	Description	Depth/Elev.	Sample Length (feet)	Recovery (feet)	Blow Counts (per 6 in)	N	Water Content (Percent) 10 30 50
		Ground Surface	629.3					
0		0-3.0' Very dark gray silt size ASH with 1" fine sand size seams, wet seam at 1.8-2'.	0.0	2	2.0	0-1-2-2	3	
3		3.0-16.1' Fine sand with silt size ASH, moist wet at 5-5.7'	626.3 3.0	2	1.7	0-1-1-1	2	
11				2	2.0	0-0-0-1	0	
14			614.3					
15		dark gray and light brown at 15.9-16.1'	15.0	2	2.0	1-2-3-3	5	
16		16.1-35.5' Silt size ASH, moist Wet at 16.9'						
20		20-21.1' Find sand and silt size ASH, moist	609.3 20.0	2	2.0	1-2-3-2	5	
21		Wet at 21.1'						
22		1" to 2" fine sand size seam @ 22'		2	1.9	1-1-1-2	2	
23		1" to 2" fine sand size seam @ 23'		2	2.0	0-1-0-1	1	
25				2	2.0	0-1-0-1	1	
27				2	1.8	0	0	
28				2	2.0	0	0	
31			597.3					
32		32-35.5' Silty fine sand size ash	32.0	2	1.7	0	0	
33		1" dense fine material at bottom of ash.	593.8	2	2.0	0-1-3-10	4	
35		35.5-38.0' Black fine SAND, wet Gray to brown at 37' to tip	35.5 591.3	2	1.4	1-10-16-19	26	
38		End of Boring	38.0					

Well Completion Details



Engineering & Environmental Solutions, LLC

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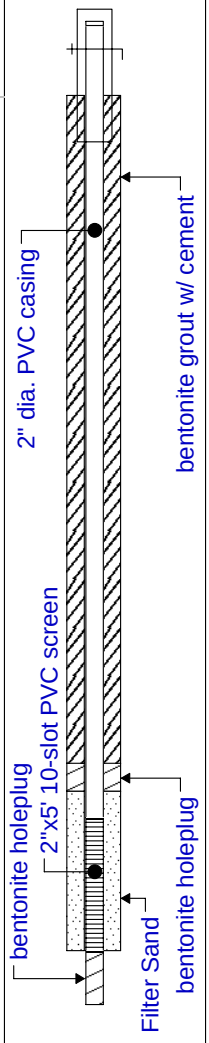
Phone/Fax: (616) 994-6541
www.goEESolutions.com

Project Name: RCRA Vertical Exp. Feasibility
Project Number: 005-12-003
Site Location: J.H. Campbell, West Olive, MI
Drilling Method: 8.25" OD HSA
Sampling Method: 2' Split Spoon
Ground Elevation (feet): 627.0
Top of Casing Elevation (feet): 629.60
Logged By: Kurt Van Appledorn
Comments:

Log of Borehole: PZ/SB-1205

Start Date: 6-7-12
End Date: 6-7-12
Driller: Remedial Services Division
Crew Chief: Dave Hill
Depth to Water (ft BGS during drilling):
Easting: 5930.8
Northing: -256.7

Depth (feet BGS)	Symbol	Description	Depth/Elev.	Sample Length (feet)	Recovery (feet)	Blow Counts (per 6 in)	N	Water Content (Percent) 10 30 50	Well Completion Details
		Ground Surface	627.0						
0		0-3.0' Dark gray silt size ASH, little fine sand size, moist.	0.0	2	1.8	1-1-2-2	3	•	
3		3.0-7.0' Gray fine sand and silt size ASH, slightly moist to dry, 1" seams of sandier size ash with thin black layers.	624.0 3.0						
6		wet at 5-5.7'		2	2.0	1-2-2-4	4	•	
7		7.0-18.0' Dark gray SILT size ash, some fine SAND size, 1/4" seams of sandier size ash, becomes sandier wth depth, slightly moist.	620.0 7.0						
10				2	1.9	1-3-4-5	7		
15		15.3-15.7' fine sand size seam. 15.8' 1" wet seam. 16.5-16.7' fine sand seam.	612.0 15.0	2	1.7	1-1-1-1	2	•	
18		18-23.7' Dark gray silt size ASH, wet at 20.4.	609.0 18.0						
				2	2.0	0	0		
23			603.3	2	1.8	0	0		
24		23.7-26.0' Dark gray fine sand size ASH, slightly moist.	23.7	2	1.4	0-1-2-1	3	•	
26		26.0-32.0' Alternating 3-5" seams of silt and fine sand size ASH, wet, 1-3" sand size seams below 28', wet	601.0 26.0	2	1.6	0-0-0-1	0		
29				2	2.0	0	0		
31			595.0	2	2.0	0	0		
32		32.0-33.6' Silty size ASH, wet. 1/4" -1/2" clay between ash and natural sand.	32.0 593.4	2	2.0	0-0-0-2	0	•	
34		33.6-34.0' Gray fine SAND, wet	33.6						
36		End of Boring							



Engineering & Environmental Solutions, LLC

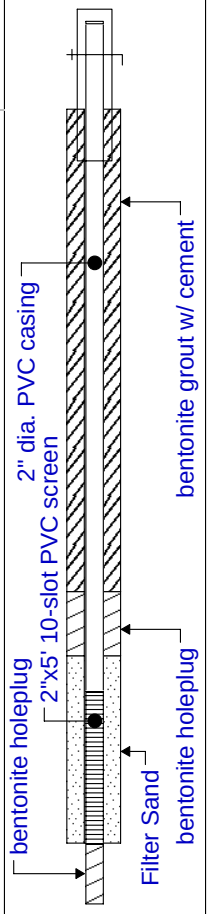
400 136th Avenue
Building 100, Suite B
Holland, Michigan 49424
Phone/Fax: (616) 994-6541
www.goEESolutions.com

Project Name: RCRA Vertical Exp. Feasibility
Project Number: 005-12-003
Site Location: J.H. Campbell, West Olive, MI
Drilling Method: 8.25" OD HSA
Sampling Method: 2' Split Spoon
Ground Elevation (feet): 623.8
Top of Casing Elevation (feet): 629.69
Logged By: Kurt Van Appledorn
Comments:

Log of Borehole: PZ/SB-1206

Start Date: 6-7-12
End Date: 6-7-12
Driller: Remedial Services Division
Crew Chief: Dave Hill
Depth to Water (ft BGS during drilling):
Easting: 4669.7
Northing: -1302.5

Depth (feet BGS)	Symbol	Description	Depth/Elev.	Sample Length (feet)	Recovery (feet)	Blow Counts (per 6 in)	N	Water Content (Percent) 10 30 50	Well Completion Details
		Ground Surface	623.8						
		0-03' Gray with thin black layers, sand size ASH, dry.	0.0	2	1.5	0-2-1-1	3		
		0.3-0.9' Dark gray silt size ASH, slightly moist.							
		0.9-3.0' Black and gray layers, fine sand size ASH.	620.8						
		3.0-8.0' Fine sand size ASH, some silt size, moist, dark gray 3-6.2' and gray 6.2-8'.	3.0	2	2.0	1-1-2-2	3		
			615.8						
		8.0-13.0' Gray with 1" black layers, fine sand size ASH, little silt size, slightly moist.	8.0	2	1.7	2-2-2-2	4		
			610.8						
		13.0-15.9' Gray with thin blacklayers, fine sand size ASH, slightly moist.	13.0						
			607.9	2	2.0	1-1-1-1	2		
		15.9-18.0' Dark Gray silt size ASH, wet.	15.9						
			605.8						
		18.0-25.1' Dark gray silt size ASH, wet.	18.0	2	20	0-1-0-1	1		
				2	1.8	1-1-1-1	2		
				2	1.9	1-1-2-6	3		
			598.7						
		25.1-26.0' Brown fine SAND, wet, 1/2" of sand directly below ash overlaying 1" clayey silt	25.1						
		End of Boring							



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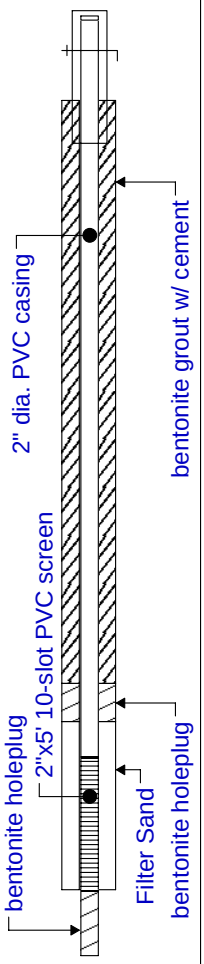
Project Name: RCRA Vertical Exp. Feasibility
Project Number: 005-12-003
Site Location: J.H.Campbell, West Olive, MI
Drilling Method: 8.25" OD HSA
Sampling Method: 2' Split Spoon
Ground Elevation (feet): 628.9
Top of Casing Elevation (feet): 631.98
Logged By: Kurt Van Appledorn
Comments:

Log of Borehole: PZ/SB-1207

Start Date: 6-8-12
End Date: 6-8-12
Driller: Remedial Services Division
Crew Chief: Dave Hill
Depth to Water (ft BGS during drilling):
Easting: 4922.8
Northing: -414.3

Depth (feet BGS)	Symbol	Description	Depth/Elev.	Sample Length (feet)	Recovery (feet)	Blow Counts (per 6 in)	N	Water Content (Percent) 10 30 50
		Ground Surface	628.9					
0		0-0.6' Gray fine sand size ASH, dry.	0.0	2	1.5	0-0-0-1	0	
1		0.6-1.1' Dark gray silt size ASH with 1" sand size ash.	625.9					
2		1.1-3.0' Gray fine sand size ASH.	3.0					
3		3.0-8.0' Fine sand size ASH, some silt size, moist, 2" seams of silt size ash.		2	2.0	1-1-1-1	2	
4			620.9					
5		8.0-10.5' Dark gray fine sandy silt size ASH, wet seam @ 10.3-10.4'.	8.0					
6			618.4					
7		10.5-13.0' Gray fine sand size ASH, moist.	10.5	2	1.4	0-1-2-2	3	
8			615.9					
9		13.0-15.7' Dark gray silty fine SAND size ASH, moist.	13.0					
10			613.2					
11		15.7-18.0' Black and gray thin layers, fine sand size ASH, moist.	15.7	2	1.8	1-1-1-1	2	
12			610.9					
13		18.0-22.0' Dark gray sandy silt size ASH, very moist with wet seam @ 20.4-20.7'.	18.0					
14				2	1.6	0-1-5-5	6	
15			606.9					
16		22.0-22.7' Dark gray and gray silty fine sand size ASH, moist.	22.0	2	2.0	0-1-0-1	1	
17			605.1					
18		22.7-23.8' Sandy silt size ASH, wet, loose 23.3-23.6'.	23.8	2	2.0	0	0	
19		23.8-24.0' Black fine sand size ASH, moist.						
20		24.0-30.0' Dark gray silt size ASH, wet, loose.		2	2.0	0	0	
21								
22				2	1.3	0	0	
23			598.9					
24		30.0-32.0' Black fine SAND, color grades into gray and brown below 30.7', very wet to wet.	30.0	2	1.6	5-10-19-30	29	
25			596.9					
26		End of Boring	32.0					
27								
28								
29								
30								
31								
32								
33								
34								
35								
36								

Well Completion Details



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Phone/Fax: (616) 994-6541
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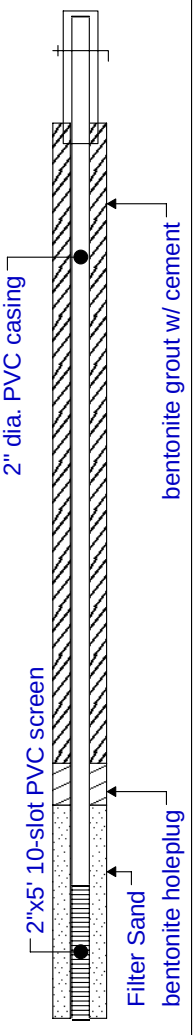
Project Name: RCRA Vertical Exp. Feasibility
Project Number: 005-12-003
Site Location: J.H. Campbell, West Olive, MI
Drilling Method: 8.25" OD HSA
Sampling Method: 2' Split Spoon
Ground Elevation (feet): 629.6
Top of Casing Elevation (feet): 633.57
Logged By: Kurt Van Appledorn
Comments:

Log of Borehole: PZ/SB-1208

Start Date: 6-11-12
End Date: 6-11-12
Driller: Remedial Services Division
Crew Chief: Dave Hill
Depth to Water (ft BGS during drilling): 29
Easting: 4037.5
Northing: -538.0

Depth (feet BGS)	Description	Depth/Elev.	Sample Length (feet)	Recovery (feet)	Blow Counts (per 6 in)	N	Water Content (Percent) 10 30 50
	Ground Surface	629.6					
0	0-3.0' Dark gray silt size ASH, moist, dry with roots @0-0.3', 1" fine sand size seam at 1.8'.	0.0	2	1.9	1-1-2-3	3	
3	3.0-12.4' Dark gray fine sandy silt size ASH, moist. Loose, wet seams at 5.5-5.7' and 6.1-6.5'.	626.6 / 3.0	2	1.9	0-1-0-1	1	
10	Loose, wet silt seam at 10.7-11.1'. Fine sand size seam at 11.1-11.2'.	618.9 / 10.7	2	1.7	1-1-1-1	2	
12	12.4-13.2' Dark gray silty fine sand size ASH, moist.	617.2 / 12.4	2	2.0	1-1-1-2	2	
15	13.2-16.0' Dark gray fine sandy silt size ASH, moist. Wet silt size seam @ 13.9'. 1" silty sand size seams at 14.1', 14.5', and 14.9'.	613.6	2	1.6	0-0-0-1	0	
16	16.0-22.0' Silt size ASH, wet. Loose at 17-18' and at 21-22'.	16.0	2	2.0	0	0	
20			2	2.0	0	0	
21			2	1.7	0	0	
22	22.0-34' Brown fine SAND, moist. Wet at 29'.	607.6 / 22.0	2	1.3	3-6-8-7	14	
25			2	1.0	3-4-5-5	9	
30			2	1.1	2-5-7-6	12	
34	End of Boring	595.6 / 34.0					

Well Completion Details



Engineering & Environmental Solutions, LLC

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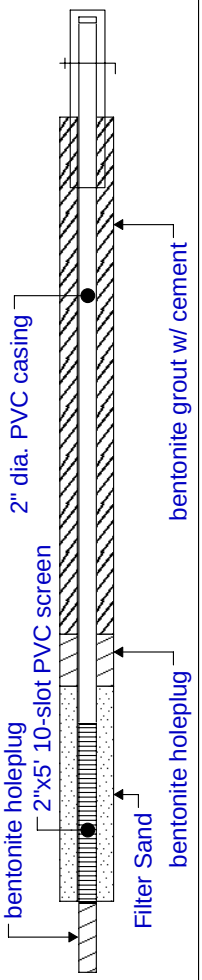
Project Name: RCRA Vertical Exp. Feasibility
Project Number: 005-12-003
Site Location: J.H. Campbell, West Olive, MI
Drilling Method: 8.25" OD HSA
Sampling Method: 2' Split Spoon
Ground Elevation (feet): 626.9
Top of Casing Elevation (feet): 629.52
Logged By: Kurt Van Appledorn
Comments:

Log of Borehole: PZ/SB-1210

Start Date: 6-11-12
End Date: 6-12-12
Driller: Remedial Services Division
Crew Chief: Bob
Depth to Water (ft BGS during drilling): 29
Easting: 3309.1
Northing: -1383.7

Depth (feet BGS)	Symbol	Description	Depth/Elev.	Sample Length (feet)	Recovery (feet)	Blow Counts (per 6 in)	N	Water Content (Percent) 10 30 50
		Ground Surface	625.0					
0		0-3.0' Dark gray silt size ASH, dry. 1" silty fine sand size seams.	0.0	2	1.5	1-2-3-3	5	
3		3.0-13.0' Dark gray silt size ASH, moist to wet. Wet seam at 4.6-4.8'	622.0 3.0	2	2.0	1-1-2-2	3	
9		Moist, sitly fine sand seams at 9.4-9.9', 10-10.1', 10.2-10.4'.	615.6 9.4	2	2.0	1-2-2-2	4	
13		13.0-18.0' Dark gray silt size ASH, little fine sand, moist. Wet at 14.5-16'. 1" silty fine sand size seam at 15.3'. Soft at 15.4-16'.	612.0 13.0	2	2.0	0-0-1-0	1	
16		Fine sand size seams at 16.2-16.7' and 17.0-17.2'. Wet sandy silt size seam at 17.5-18'.	608.8 16.2	2	1.9	1-1-1-1	2	
18		18.0-21.0' Dark gray sandy silt size ASH, wet. Little fine sand size at 19-20'	607.0 18.0	2	2.0	1-1-2-1	3	
21		21.0-22.4' Dark gray silt size ASH, wet.	604.0 21.0	2	2.0	0-1-2-1	3	
22		22.4-24.0' Brown fine SAND, moist. Darker brown 3" below ash.	602.6 22.4	2	1.4	0-2-3-5	5	
24		End of Boring	601.0 24.0					

Well Completion Details



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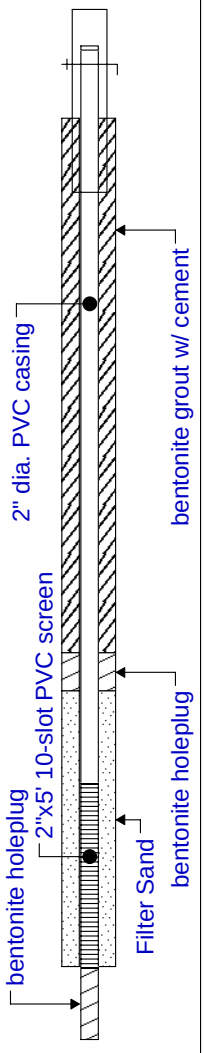
Holland, Michigan 49424
Phone/Fax: (616) 994-6541
www.goEESolutions.com

Project Name: RCRA Vertical Exp. Feasibility
Project Number: 005-12-003
Site Location: J.H. Campbell, West Olive, MI
Drilling Method: 8.25" OD HSA
Sampling Method: 2' Split Spoon
Ground Elevation (feet): 627.3
Top of Casing Elevation (feet): 629.14
Logged By: Kurt Van Appledorn
Comments:

Log of Borehole: PZ/SB-1212

Start Date: 6-11-12
End Date: 6-11-12
Driller: Remedial Services Division
Crew Chief: Bob
Depth to Water (ft BGS during drilling):
Easting: 2888.7
Northing: -983.0

Depth (feet BGS)	Symbol	Description	Depth/Elev.	Sample Length (feet)	Recovery (feet)	Blow Counts (per 6 in)	N	Water Content (Percent) 10 30 50
		Ground Surface	627.3					
0		0-6.6' Dark gray fine sandy silt size ASH, dry to 1', moist below 1'. 1/2" fine sand size seams at 0.6' and 0.7', and fine sand size seam at 1.0-1.2'.	0.0	2	2.0	0-4-4-3	8	
5		Gray and blackfine sand size ash seams at 5.2-5.4' and 6.0-6.1', moist.	622.1 5.2	2	2.0	0-1-1-1	2	
6		6.6-11.8' Dark gray silt size ASH, moist to wet.	620.7 6.6					
11			615.5	2	2.0	0-1-0-1	1	
12		11.8-17.0' Black silt size with thin layers of fine sand size ASH, moist. Brownish gray at 15-16.9'.	11.8					
16			610.3	2	2.0	0	0	
17		17.0-20.7' Sandy silt size ASH, wet.	17.0					
18		Brownish black silty fine sand size ash at 18.1-18.2, very moist.	609.1 18.2	2	1.9	1-3-2-1	5	
19		Brownish gray at 18.2-19'	608.0					
20		1/4" Black and gray layers, wet, at 19.5-20.7'	19.3 606.6	2	2.0	0-0-0-1	0	
21		20.7-22.1' Brownish gray silt size ASH, wet, soft.	20.7					
22			605.2	2	1.1	0-0-0-1	0	
23		23.1-23.1' Brownish gray and black layers, silty fine sand size ASH, wet. 1/8" black sandy silt layer above natural sand.	22.1					
24		23.1-25.0' Grayish brown fine SAND, wet.	602.3	2	1.1	3-4-5-4	9	
25		End of Boring	25.0					



LOG OF PIEZOMETER PZ-21-01

Barr Engineering Company
3005 Boardwalk St, Suite 100
Ann Arbor, MI 48103
Telephone: 734-922-4400

Project:	Consumers JH Campbell Piezometer Installation	Surface Elevation:	629.9 ft	Top of Casing Elev.:	632.7 ft
Project No.:	22/701071.01	Drilling Method:	Rotasonic	Unique Well No.:	PZ-21-01
Location:	West Olive, MI	Sampling Method:	Continuous		
Coordinates:	N 518,976.4 ft E 12,634,661.8 ft				
Datum:	NAD83 MI State Plane South International Feet	Completion Depth:	39.0 ft		

Depth, feet	Sample Type & Recovery	Sample No.	ENVIRONMENTAL DATA	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0						TOPSOIL.	Stick-up Protective Cover Installed in Sand	
		HA	**PID:**0.5 **D/O/S:**None/ None/ None			ASH: very fine to fine grained; gray; moist.		
5		1	**PID:**0.9 **D/O/S:**None/ None/ None			From 6-7 ft, wet; clay-like; very soft; cohesive.		625
10			**PID:**0.2 **D/O/S:**None/ None/ None			From 9-13 ft, loose; trace dark gray lenses.	Bentonite Grout 2-23.5 ft	620
15		2	**PID:**0.5 **D/O/S:**None/ None/ None			From 13-16 ft, very fine; blocky. At 14 ft, cave in. From 15-16 ft, moist to wet. From 16-27 ft, very fine; moist to wet; blocky; cohesive; less than 0.25-inch compacted layers visible.		615
20			**PID:**0.0 **D/O/S:**None/ None/ None					610
25		3	**PID:**0.0 **D/O/S:**None/ None/ None				Bentonite Seal 23.5-27.6 ft	605
						POORLY GRADED SAND WITH SILT (SP-SM): fine grained; tan with trace gray; moist to wet.	Sand Pack 27.6-35 ft	
30			**PID:**0.0 **D/O/S:**None/ None/ None **G/S/F:**0%/ 90%/ 10%	SP-SM			10-slot PVC Screen 30-35 ft	600
35		4	**PID:**0.2 **D/O/S:**None/ None/ None					595
			PID:0.0 **D/O/S:**None/ None/ None **G/S/F:**0%/ 95%/ 5%	SP		POORLY GRADED SAND (SP): fine to medium grained; tan to grayish tan; wet; few silt. From 37-39 ft, medium grained with trace coarse grained sand.		
40						End of piezometer 39.0 feet		590
45								585
50								580

Date Boring Started:	3/15/21 12:50 pm
Date Boring Completed:	3/15/21 3:45 pm
Logged By:	AMS3
Drilling Contractor:	Stearns
Drill Rig:	Geoprobe 8140LS

Remarks: Set piezometer from 30-35 feet (ft) below ground surface (bgs). Collected grab bag samples to hold for leach testing from 5-6 ft, 15-16 ft, 25-26 ft, and 35-36 ft bgs.

PID = Headspace; D/O/S = Discoloration/Odor/Sheen; FID/MC = FID/Methane Corrected; G/S/F = Gravel/Sand/Fines
Additional data may have been collected in the field which is not included on this log.

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LOG OF PIEZOMETER PZ-21-02

Barr Engineering Company
3005 Boardwalk St, Suite 100
Ann Arbor, MI 48103
Telephone: 734-922-4400

Project:	Consumers JH Campbell Piezometer Installation	Surface Elevation:	629.2 ft	Top of Casing Elev.:	631.8 ft
Project No.:	22/701071.01	Drilling Method:	Rotasonic	Unique Well No.:	PZ-21-02
Location:	West Olive, MI	Sampling Method:	Continuous		
Coordinates:	N 518,335.3 ft E 12,635,691.8 ft				
Datum:	NAD83 MI State Plane South International Feet	Completion Depth:	48.5 ft		

Depth, feet	Sample Type & Recovery	Sample No.	ENVIRONMENTAL DATA	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0		HA	**PID:**0.0 **D/O/S:**None/ None/ None			ASH: gray/brown gray; moist to wet. From 0-2 ft, gray with trace black; cohesive; blocky.	Stick-up Protective Cover Installed in Sand	
		1				From 2-6 ft, gray to brownish gray; loose; moist.		625
5			**PID:**0.0 **D/O/S:**None/ None/ None			From 6-7 ft, gray with brownish gray; moist; less than 0.25-inch compacted layers; cohesive. From 7-14 ft, grayish brown/brownish gray; loose to very loose; moist; trace black flecks.		
10			**PID:**0.0 **D/O/S:**None/ None/ None					620
		2				From 14-16 ft, gray and dark gray less than 0.25-inch alternating layers; moist.		615
15			**PID:**0.0 **D/O/S:**None/ None/ None			From 16-18 ft, gray; very fine; moist to wet; soft; cohesive; sponge-like texture.	Bentonite Grout 2-28.9 ft	
						From 18-21 ft, gray with dark gray layers; moist; cohesive; moderately compacted.		610
20			**PID:**0.0 **D/O/S:**None/ None/ None			From 21-23 ft, gray; fine to medium sand and ash mix; moist.		
		3				From 23-24 ft, brownish gray; moist to wet; very soft; cohesive.		605
25			**PID:**0.0 **D/O/S:**None/ None/ None **G/S/F:**0%/ 90%/ 10%	SP-SM		POORLY GRADED SAND WITH SILT (SP-SM): fine grained; tan; moist to wet; few silt.		
30			**PID:**0.0 **D/O/S:**None/ None/ None				Bentonite Seal 28.9-34 ft	600
			PID:0.0 **D/O/S:**None/ None/ None					
		4				At 34 ft, collapse.	Sand Pack 34-41 ft	595
35			**PID:**0.0 **D/O/S:**None/ None/ None					
40			**PID:**0.0 **D/O/S:**None/ None/ None	SW		WELL GRADED SAND (SW): fine to coarse grained; tan; moist to wet; few silt.	10-slot PVC Screen 36-41 ft	590
		5	**G/S/F:**0%/ 95%/ 5%			SILT (ML): gray; moist; stiff; few sand.		
45			**PID:**0.0 **D/O/S:**None/ None/ None **G/S/F:**0%/ 5%/ 95%	ML				585
50						End of piezometer 48.5 feet		580

Date Boring Started:	3/16/21 9:10 am
Date Boring Completed:	3/16/21 11:20 am
Logged By:	AMS3
Drilling Contractor:	Stearns
Drill Rig:	Geoprobe 8140LS

Remarks: Set piezometer from 36-41 feet (ft) below ground surface (bgs). Collected grab bag samples to hold for leach testing from 5-6 ft, 15-16 ft, 22-23 ft, 35-36 ft, and 45-46 ft bgs.

PID = Headspace; D/O/S = Discoloration/Odor/Sheen; FID/MC = FID/Methane Corrected; G/S/F = Gravel/Sand/Fines
Additional data may have been collected in the field which is not included on this log.

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LOG OF PIEZOMETER PZ-21-03

Barr Engineering Company
3005 Boardwalk St, Suite 100
Ann Arbor, MI 48103
Telephone: 734-922-4400

Project:	Consumers JH Campbell Piezometer Installation	Surface Elevation:	625.9 ft	Top of Casing Elev.:	628.5 ft
Project No.:	22/701071.01	Drilling Method:	Rotasonic	Unique Well No.:	PZ-21-03
Location:	West Olive, MI	Sampling Method:	Continuous		
Coordinates:	N 518,494.9 ft E 12,636,907.0 ft				
Datum:	NAD83 MI State Plane South International Feet	Completion Depth:	41.0 ft		

Depth, feet	Sample Type & Recovery	Sample No.	ENVIRONMENTAL DATA	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0		HA	**PID:**0.0 **D/O/S:**None/ None/ None			ASH: dark gray; moist to wet. From 0-4 ft, dark gray and gray mixed; fine to medium; moist; powdery.	Stick-up Protective Cover Installed in Sand	625
5		1	**PID:**0.1 **D/O/S:**None/ None/ None			From 4-10 ft, light gray; very fine; moist to wet; cohesive; waxy/silty-like.		620
10		2	**PID:**0.1 **D/O/S:**None/ None/ None			From 10-15 ft, light gray/gray alternating less than 0.25-inch compacted layers.		615
15			**PID:**0.3 **D/O/S:**None/ None/ None			From 15-23 ft, very dark gray; powdery; transitions to light gray and moist; to very dark gray "swirled" layers.	Bentonite Grout 2-29.8 ft	610
20		3	**PID:**0.0 **D/O/S:**None/ None/ None			From 23-25 ft, gray; moist; fine to medium grained sand and ash mix.		605
25			**PID:**0.0 **D/O/S:**None/ None/ None			POORLY GRADED SAND (SP): very fine to fine grained; light tan; moist to wet; trace to few silt.		600
30			**PID:**0.0 **D/O/S:**None/ None/ None	SP			Bentonite Seal 29.8-33.5 ft	595
35		4	**PID:**0.0 **D/O/S:**None/ None/ None **G/S/F:**0%/ 95%/ 5%			At 36 ft, changes to fine to medium; tan.	Sand Pack 33.5-41 ft	590
40			**PID:**0.0 **D/O/S:**None/ None/ None			NO SAMPLE COLLECTED. End of piezometer 41.0 feet	10-Slot PVC Screen 36-41 ft	585
45								580
50								

Date Boring Started:	3/16/21 1:45 pm
Date Boring Completed:	3/16/21 3:00 pm
Logged By:	AMS3
Drilling Contractor:	Stearns
Drill Rig:	Geoprobe 8140LS

Remarks: Set piezometer from 36-41 feet (ft) below ground surface (bgs). Collected grab bag samples to hold for leach testing from 5-6 ft, 13-14 ft, 22-23 ft, and 35-36 ft bgs.

PID = Headspace; D/O/S = Discoloration/Odor/Sheen; FID/MC = FID/Methane Corrected; G/S/F = Gravel/Sand/Fines
Additional data may have been collected in the field which is not included on this log.

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LOG OF PIEZOMETER PZ-21-04

Barr Engineering Company
3005 Boardwalk St, Suite 100
Ann Arbor, MI 48103
Telephone: 734-922-4400

Project:	Consumers JH Campbell Piezometer Installation	Surface Elevation:	628.9 ft	Top of Casing Elev.:	631.6 ft
Project No.:	22/701071.01	Drilling Method:	Rotasonic	Unique Well No.:	PZ-21-04
Location:	West Olive, MI	Sampling Method:	Continuous		
Coordinates:	N 519,757.0 ft E 12,636,972.7 ft				
Datum:	NAD83 MI State Plane South International Feet	Completion Depth:	42.0 ft		

Depth, feet	Sample Type & Recovery	Sample No.	ENVIRONMENTAL DATA	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0		HA	**PID:**0.8 **D/O/S:**None/ None/ None			ASH: gray; moist to wet. From 0-7 ft, dark gray/light gray; loose; moist; not compacted.	Stick-up Protective Cover Installed in Sand	
		1						625
5			**PID:**0.0 **D/O/S:**None/ None/ None			From 7-9 ft, dark gray; fine sand; sponge-like; moist to saturated.		
						From 9-17 ft, light gray and gray; loose; occasional compacted lens.		620
10			**PID:**0.1 **D/O/S:**None/ None/ None					
		2						615
15			**PID:**0.0 **D/O/S:**None/ None/ None				Bentonite Grout 2-31.4 ft	
						From 17-33 ft, brownish gray; very soft; very fine; saturated; liquid-like.		610
20								
		3						605
25								
								600
30								
		4		SP		POORLY GRADED SAND (SP): fine to medium grained; dark brown; moist; trace ash and wood debris.	Bentonite Seal 31.4-34.7 ft	595
35			**PID:**0.0 **D/O/S:**None/ None/ None **G/S/F:**0%/ 95%/ 5%	SP-SM		POORLY GRADED SAND WITH SILT (SP-SM): fine to medium grained; tan; moist to wet; loose; few silt.	Sand Pack 34.7-42.3 ft	
			PID:0.0 **D/O/S:**None/ None/ None **G/S/F:**0%/ 90%/ 10%			NO SAMPLE COLLECTED.	10-Slot PVC Screen 37-42 ft	590
40								
						End of piezometer 42.0 feet		585
45								
50								580

Date Boring Started:	3/17/21 1:00 pm
Date Boring Completed:	3/17/21 3:00 pm
Logged By:	AMS3
Drilling Contractor:	Stearns
Drill Rig:	Geoprobe 8140LS

Remarks: Set piezometer from 37-42 feet (ft) below ground surface (bgs). Collected grab bag samples to hold for leach testing from 7-8 ft, 16-17 ft, 27-28 ft, and 33-34 ft bgs.

PID = Headspace; D/O/S = Discoloration/Odor/Sheen; FID/MC = FID/Methane Corrected; G/S/F = Gravel/Sand/Fines
Additional data may have been collected in the field which is not included on this log.

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LOG OF PIEZOMETER PZ-21-05

Barr Engineering Company
3005 Boardwalk St, Suite 100
Ann Arbor, MI 48103
Telephone: 734-922-4400

Project:	Consumers JH Campbell Piezometer Installation	Surface Elevation:	629.3 ft	Top of Casing Elev.:	631.9 ft
Project No.:	22/701071.01	Drilling Method:	Rotasonic	Unique Well No.:	PZ-21-05
Location:	West Olive, MI	Sampling Method:	Continuous		
Coordinates:	N 519,701.9 ft E 12,635,379.6 ft				
Datum:	NAD83 MI State Plane South International Feet	Completion Depth:	40.0 ft		

Depth, feet	Sample Type & Recovery	Sample No.	ENVIRONMENTAL DATA	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0		HA	**PID:**0.0 **D/O/S:**None/ None/ None			ASH: gray; moist to wet. From 0-8.5 ft, gray; moist; powdery to slightly compacted; trace light gray layers less than 0.25-inch.	Stick-up Protective Cover Installed in Sand	
		1						625
5			**PID:**0.1 **D/O/S:**None/ None/ None					
						From 8.5-10.5 ft, gray; moist to wet; sponge-like; trace brownish gray alternated layers/swirls; trace roots.		620
10			**PID:**0.0 **D/O/S:**None/ None/ None			From 10.5-12 ft, gray to dark gray; moist; crumbles easily; loose.		
		2				From 12-16 ft, gray; moist; homogenous; cohesive; massive; trace brownish gray lenses/layers less than 0.25-inch.		
15			**PID:**0.0 **D/O/S:**None/ None/ None				Bentonite Grout 2-28.1 ft	615
						From 16-18.5 ft, dark gray; moist; crumbles easily; loose to very loose; trace light gray bands.		
20			**PID:**0.1 **D/O/S:**None/ None/ None			From 18.5-28 ft, gray; fine sand; moist to wet; very soft; liquid-like.		610
		3						
25			**PID:**0.0 **D/O/S:**None/ None/ None					605
			PID:0.1 **D/O/S:**None/ None/ None			POORLY GRADED SAND WITH SILT (SP-SM): fine to medium grained; tan; moist to wet; few silt (5-10%).		
30			**G/S/F:**0%/ 90%/ 10%				Bentonite Seal 28.1-32.6 ft	600
		4	**PID:**0.0 **D/O/S:**None/ None/ None	SP-SM			Sand Pack 32.6-40 ft	
35								595
			PID:0.0 **D/O/S:**None/ None/ None				10-Slot PVC Screen 35-40 ft	
40						NO SAMPLE COLLECTED.		590
						End of piezometer 40.0 feet		
45								585
50								580

Date Boring Started:	3/18/21 8:50 am
Date Boring Completed:	3/18/21 10:30 am
Logged By:	AMS3
Drilling Contractor:	Stearns
Drill Rig:	Geoprobe 8140LS

Remarks: Set piezometer from 35-40 feet (ft) below ground surface (bgs). Collected grab bag samples to hold for leach testing from 6-7 ft, 15-16 ft, 25-26 ft, and 35-36 ft bgs.

PID = Headspace; D/O/S = Discoloration/Odor/Sheen; FID/MC = FID/Methane Corrected; G/S/F = Gravel/Sand/Fines
Additional data may have been collected in the field which is not included on this log.

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LOG OF PIEZOMETER PZ-21-06

Barr Engineering Company
3005 Boardwalk St, Suite 100
Ann Arbor, MI 48103
Telephone: 734-922-4400

Project:	Consumers JH Campbell Piezometer Installation	Surface Elevation:	628.6 ft	Top of Casing Elev.:	631.2 ft
Project No.:	22/701071.01	Drilling Method:	Rotasonic	Unique Well No.:	PZ-21-06
Location:	West Olive, MI	Sampling Method:	Continuous		
Coordinates:	N 519,095.3 ft E 12,636,608.1 ft				
Datum:	NAD83 MI State Plane South International Feet	Completion Depth:	48.0 ft		

Depth, feet	Sample Type & Recovery	Sample No.	ENVIRONMENTAL DATA	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0		HA	**PID:**0.2 **D/O/S:**None/ None/ None			ASH: gray. From 0-18 ft, gray; very soft to soft; very fine; moist; homogenous; no layering visible.	Stick-up Protective Cover Installed in Sand	
		1						625
5			**PID:**0.3 **D/O/S:**None/ None/ None					
								620
10			**PID:**0.3 **D/O/S:**None/ None/ None					
		2						615
15			**PID:**0.1 **D/O/S:**None/ None/ None			From 16-17 ft, very soft; wet.	Bentonite Grout 2-29.8 ft	
						From 18-25 ft, gray; moist; more compacted; some alternating light gray/gray layering visible less than 0.25-inch; blocky, crumbles easily.		610
20			**PID:**0.2 **D/O/S:**None/ None/ None					
		3						605
25			**PID:**0.2 **D/O/S:**None/ None/ None			From 25-31 ft, gray; very soft; very fine; moist to wet; homogeneous; liquid-like.		
								600
30			**PID:**0.5 **D/O/S:**None/ None/ None **G/S/F:**0%/ 95%/ 5%	SP		POORLY GRADED SAND (SP): fine grained; dark gray to gray; moist; few silt, few ash.	Bentonite Seal 29.8-35.3 ft	
		4				POORLY GRADED SAND WITH SILT (SP-SM): fine to medium grained; light tan to tan; moist to wet; light tan from 32-37 ft; few silt.		595
35	▼		**PID:**0.1 **D/O/S:**None/ None/ None **G/S/F:**0%/ 90%/ 10%				Sand Pack 35.3-43 ft	
			PID:0.1 **D/O/S:**None/ None/ None					590
40			**PID:**0.2 **D/O/S:**None/ None/ None	SP-SM			10-Slot PVC Screen 38-43 ft	
		5						585
45			**PID:**0.2 **D/O/S:**None/ None/ None					
						End of piezometer 48.0 feet		580
50								

Date Boring Started:	3/17/21 8:45 am
Date Boring Completed:	3/17/21 10:15 am
Logged By:	AMS3
Drilling Contractor:	Stearns
Drill Rig:	Geoprobe 8140LS

Remarks: Set piezometer from 38-43 feet (ft) below ground surface (bgs). Collected grab bag samples to hold for leach testing from 0-8 ft, 12-13 ft, 26-27 ft, 31-32 ft, and 45-46 ft bgs.

PID = Headspace; D/O/S = Discoloration/Odor/Sheen; FID/MC = FID/Methane Corrected; G/S/F = Gravel/Sand/Fines
Additional data may have been collected in the field which is not included on this log.

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Appendix C
T-Test Results

Two sample t Test (8/19/2021 08:52:00)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 08:52:00
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book5]"JHC-MW-15003 Before"!I"Arsenic"	[1:10]
2nd Data Range	[Book5]"JHC-MW-15003 After"!I"Arsenic"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Arsenic"		9	0.02683	0.0078	0.0026	0.027
		7	0.01094	0.00279	0.00106	0.01
	Difference		0.01589		0.00311	
	Overall	16	0.01988	0.01009	0.00252	0.0177

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	5.10975	14	1.58817E-4
Equal Variance NOT Assumed (Welch Correction)	5.66497	10.47484	1.74934E-4

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is significantly different from 0

Two sample t Test (8/19/2021 08:44:07)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 08:44:07
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book5]"JHC-MW-15003 Before"!O"Boron"	[1:9]
2nd Data Range	[Book5]"JHC-MW-15003 After"!O"Boron"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Boron"		9	0.96244	0.44219	0.1474	1.12
		7	2.05914	1.23884	0.46824	1.7
	Difference		-1.0967		0.44207	
	Overall	16	1.44225	1.01681	0.2542	1.16

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-2.48085	14	0.02643
Equal Variance NOT Assumed (Welch Correction)	-2.2341	7.19504	0.05959

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is NOT significantly different from 0

Two sample t Test (8/19/2021 08:42:53)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 08:42:53
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book5]"JHC-MW-15003 Before"!T"Calcium"	[1:9]
2nd Data Range	[Book5]"JHC-MW-15003 After"!T"Calcium"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Calcium"		9	35.38889	6.68177	2.22726	34.6
		7	83.02857	31.34675	11.84796	94.6
	Difference		-47.63968		10.6504	
	Overall	16	56.23125	31.82158	7.9554	41.3

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-4.47304	14	5.25645E-4
Equal Variance NOT Assumed (Welch Correction)	-3.9517	6.42554	0.00656

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is significantly different from 0

Two sample t Test (8/19/2021 08:41:18)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 08:41:18
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book5]"JHC-MW-15003 Before" !E"Alkalinity Sum"	[1:8]
2nd Data Range	[Book5]"JHC-MW-15003 After"!E "Alkalinity Sum"	[2:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Alkalinity Sum"		8	68.7125	9.08255	3.21117	67.95
		3	127.66667	56.08327	32.37969	157
	Difference		-58.95417		18.70201	
	Overall	11	84.79091	38.01477	11.46189	68.9

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-3.15229	9	0.01169
Equal Variance NOT Assumed (Welch Correction)	-1.81183	2.03948	0.20926

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is NOT significantly different from 0

Two sample t Test (8/19/2021 08:48:51)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 08:48:51
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book5]"JHC-MW-15003 Before"!Y"Chloride"	[1:9]
2nd Data Range	[Book5]"JHC-MW-15003 After"!Y"Chloride"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Chloride"		9	24.44444	4.02185	1.34062	24
		7	26.08571	11.71828	4.42909	22.3
	Difference		-1.64127		4.15856	
	Overall	16	25.1625	8.01631	2.00408	23.15

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-0.39467	14	0.69903
Equal Variance NOT Assumed (Welch Correction)	-0.35467	7.10505	0.73313

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is NOT significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is NOT significantly different from 0

Two sample t Test (8/19/2021 08:45:00)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 08:45:00
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book5]"JHC-MW-15003 Before"!AJ"Magnesium"	[1:8]
2nd Data Range	[Book5]"JHC-MW-15003 After"!AJ"Magnesium"	[2:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Magnesium"		8	6.64875	1.2506	0.44216	6.545
		3	17.26667	8.82968	5.09782	20.9
	Difference		-10.61792		2.91518	
	Overall	11	9.54455	6.42537	1.93732	7.05

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-3.64229	9	0.00538
Equal Variance NOT Assumed (Welch Correction)	-2.07504	2.03017	0.17177

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is NOT significantly different from 0

Two sample t Test (8/19/2021 09:06:22)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 09:06:22
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book5]"JHC-MW-15003 Before" !AM"Molybdenum"	[1:10]
2nd Data Range	[Book5]"JHC-MW-15003 After"!AM"Molybdenum"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Molybdenum"		9	0.01951	0.00736	0.00245	0.02
		7	0.06861	0.03972	0.01501	0.059
	Difference		-0.0491		0.0134	
	Overall	16	0.04099	0.03596	0.00899	0.0261

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-3.66383	14	0.00255
Equal Variance NOT Assumed (Welch Correction)	-3.22764	6.32163	0.0167

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is significantly different from 0

Two sample t Test (8/19/2021 09:07:28)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 09:07:28
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book5]"JHC-MW-15003 Before"!AX"Selenium"	[1:10]
2nd Data Range	[Book5]"JHC-MW-15003 After"!AX"Selenium"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Selenium"		9	0.0017	8.68907E-4	2.89636E-4	0.0011
		7	0.01527	0.01219	0.00461	0.018
	Difference		-0.01357		0.00404	
	Overall	16	0.00764	0.0104	0.0026	0.00255

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-3.36202	14	0.00465
Equal Variance NOT Assumed (Welch Correction)	-2.93873	6.04741	0.02575

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is significantly different from 0

Two sample t Test (8/19/2021 08:50:06)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 08:50:06
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book5]"JHC-MW-15003 Before"!BE"Sulfate (mg/L)"	[1:9]
2nd Data Range	[Book5]"JHC-MW-15003 After"!BE"Sulfate (mg/L)"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Sulfate (mg/L)"		9	55.36667	9.83438	3.27813	52.7
		7	164.41429	83.716	31.64167	194
	Difference		-109.04762		27.87205	
	Overall	16	103.075	77.30729	19.32682	67.4

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-3.91244	14	0.00156
Equal Variance NOT Assumed (Welch Correction)	-3.42798	6.12896	0.01355

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is significantly different from 0

Two sample t Test (8/19/2021 09:44:47)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 09:44:47
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book7]"JHC-MW-15005 Before"!O"Boron"	[1:9]
2nd Data Range	[Book7]"JHC-MW-15005 After"!O"Boron"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Boron"		9	0.75878	0.4275	0.1425	0.546
		7	1.23614	0.8117	0.30679	1.2
	Difference		-0.47737		0.31342	
	Overall	16	0.96763	0.64871	0.16218	0.8325

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-1.52307	14	0.15001
Equal Variance NOT Assumed (Welch Correction)	-1.41118	8.56901	0.19345

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is NOT significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is NOT significantly different from 0

Two sample t Test (8/19/2021 09:46:16)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 09:46:16
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book7]"JHC-MW-15005 Before"!T"Calcium"	[1:9]
2nd Data Range	[Book7]"JHC-MW-15005 After"!T"Calcium"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Calcium"		9	54.88889	8.99548	2.99849	55
		7	104.5	38.16325	14.42435	99.7
	Difference		-49.61111		13.04863	
	Overall	16	76.59375	35.66246	8.91562	61

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-3.80202	14	0.00194
Equal Variance NOT Assumed (Welch Correction)	-3.36741	6.52063	0.01331

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is significantly different from 0

Two sample t Test (8/19/2021 09:43:16)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 09:43:16
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book7]"JHC-MW-15005 Before"!E"Alkalinity Sum"	[1:10]
2nd Data Range	[Book7]"JHC-MW-15005 After"!E"Alkalinity Sum"	[2:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Alkalinity Sum"		10	134.2	19.35516	6.12064	125.5
		5	198.74	72.14907	32.26604	229
	Difference		-64.54		23.62864	
	Overall	15	155.71333	52.15243	13.4657	140

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-2.73143	13	0.01713
Equal Variance NOT Assumed (Welch Correction)	-1.9652	4.29058	0.11602

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is NOT significantly different from 0

Two sample t Test (8/19/2021 09:51:44)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 09:51:44
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book7]"JHC-MW-15005 Before"!Y"Chloride"	[1:9]
2nd Data Range	[Book7]"JHC-MW-15005 After"!Y"Chloride"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Chloride"		9	36.51111	15.13245	5.04415	29.3
		7	36.91286	28.54045	10.78728	30
	Difference		-0.40175		11.04045	
	Overall	16	36.68688	21.16586	5.29147	29.65

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-0.03639	14	0.97149
Equal Variance NOT Assumed (Welch Correction)	-0.03374	8.60223	0.97386

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is NOT significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is NOT significantly different from 0

Two sample t Test (8/19/2021 09:48:30)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 09:48:30
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book7]"JHC-MW-15005 Before"!AJ"Magnesium"	[1:8]
2nd Data Range	[Book7]"JHC-MW-15005 After"!AJ"Magnesium"	[2:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Magnesium"		8	12.3625	1.61594	0.57132	11.8
		4	22.1	7.78117	3.89059	23.7
	Difference		-9.7375		2.73806	
	Overall	12	15.60833	6.41567	1.85204	12.75

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-3.55635	10	0.00521
Equal Variance NOT Assumed (Welch Correction)	-2.47628	3.13015	0.08604

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is NOT significantly different from 0

Two sample t Test (8/19/2021 09:56:15)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 09:56:15
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book7]"JHC-MW-15005 Before"!AM"Molybdenum"	[1:10]
2nd Data Range	[Book7]"JHC-MW-15005 After"!AM"Molybdenum"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Molybdenum"		9	0.01713	0.00681	0.00227	0.015
		7	0.25667	0.30643	0.11582	0.11
	Difference		-0.23954		0.10113	
	Overall	16	0.12193	0.22945	0.05736	0.0215

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-2.36865	14	0.03278
Equal Variance NOT Assumed (Welch Correction)	-2.06781	6.0046	0.08411

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is NOT significantly different from 0

Two sample t Test (8/19/2021 09:57:37)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 09:57:37
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book7]"JHC-MW-15005 Before"!AX"Selenium"	[1:10]
2nd Data Range	[Book7]"JHC-MW-15005 After"!AX"Selenium"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Selenium"		9	0.07391	0.12063	0.04021	0.018
		7	0.155	0.09599	0.03628	0.158
	Difference		-0.08109		0.05581	
	Overall	16	0.10939	0.11477	0.02869	0.0495

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-1.45294	14	0.16828
Equal Variance NOT Assumed (Welch Correction)	-1.49722	13.97666	0.15657

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is NOT significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is NOT significantly different from 0

Two sample t Test (8/19/2021 09:50:00)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 09:50:00
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book7]"JHC-MW-15005 Before"!BC"Sodium + Potassium"	[1:8]
2nd Data Range	[Book7]"JHC-MW-15005 After"!BC"Sodium + Potassium"	[2:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Sodium + Potassium"		8	28.575	10.07744	3.56291	29.675
		4	24.5575	5.70121	2.8506	24.28
	Difference		4.0175		5.50589	
	Overall	12	27.23583	8.79791	2.53974	28.825

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	0.72967	10	0.48233
Equal Variance NOT Assumed (Welch Correction)	0.88047	9.62631	0.40005

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is NOT significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is NOT significantly different from 0

Two sample t Test (8/19/2021 09:53:21)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 09:53:21
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book7]"JHC-MW-15005 Before"!BE"Sulfate (mg/L)"	[1:9]
2nd Data Range	[Book7]"JHC-MW-15005 After"!BE"Sulfate (mg/L)"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Sulfate (mg/L)"		9	57.94444	6.56527	2.18842	58.3
		7	143.72857	59.89938	22.63984	133
	Difference		-85.78413		19.91931	
	Overall	16	95.475	58.22266	14.55566	65.45

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-4.30658	14	7.24265E-4
Equal Variance NOT Assumed (Welch Correction)	-3.7715	6.11225	0.00896

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is significantly different from 0

Appendix D
References

References

Consumers Energy. July 30, 2021. Semiannual Progress Report – Selection of Remedy, JH Campbell Ponds 1-2 North and 1-2 South CCR Unit, JH Campbell Pond A CCR Unit.

Golder Associates Inc. December 2017. JH Campbell Generating Facility Bottom Ash Ponds 1-2 Closure Work Plan, West Olive, Michigan. Prepared for Consumers Energy Company.

Golder Associates Inc. 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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Lee, Seungyeol, Zhizhang Shen, and Huifang Xu. 2016. "Study on nanophase iron oxyhydroxides in freshwater ferromanganese nodules from Green Bay, Lake Michigan, with implications for the adsorption of As and heavy metals." American Mineralogist 101.9 (2016): 1986-1995.

Korkisch, J., I. Steffan, and G. Arrhenius. 1977. "Chemical analysis of manganese nodules: Part III. Determination of Thallium, Molybdenum and Vanadium after Anion-Exchange Separation." Analytica Chimica Acta 94.2 (1977): 237-244.

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TRC. January 2021. Sample Analysis Plan for JH Campbell Ponds 1-2 and Pond 3. Prepared for Consumers Energy Company.

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Appendix E
Semiannual Progress Report

January 30, 2022

Subject:
Semiannual Progress Report - Selection of Remedy
JH Campbell Ponds 1-2 North and 1-2 South 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: 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 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
Ponds 1-2	Arsenic	2 of 5

Subsequently, the Assessment of Corrective Measures Report (TRC, September 2019) was completed on September 11, 2019 for Ponds 1-2 and Pond A.

Semi-annual progress reports have been made available on the CE public-facing website. This is the fifth semi-annual update.

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

Assessment Activities

Ponds 1-2

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). 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 Ponds 1-2 based on multiple lines of evidence described in the approved closure work plan.

Consumers Energy continues to monitor Ponds 1-2 semiannually for Appendix III and IV constituents. Since the cessation of hydraulic loading and removal of CCR at the unit, groundwater flow direction has changed significantly and JHC-MW-15002 and JHC-MW-15003 are no longer downgradient of the former CCR unit. They will continue to be sampled as part of the assessment monitoring program to evaluate groundwater quality post-CCR removal while the use of these wells in the groundwater monitoring system is re-evaluated.

Consumers Energy conducted the first semiannual assessment monitoring event of 2021 at Ponds 1-2 on April 12 through 14, 2021 in accordance with the Sample Analysis Plan for JH Campbell Bottom Ash Ponds 1-2 and Pond 3 (SAP) (TRC, January 2021). As discussed in the Statistical Evaluation of April 2021 Assessment Monitoring Sampling Event technical memorandum (TRC, July 30, 2021) the results indicated a new statistically significant level (SSL) above the GWPS for selenium at JHC-MW-15005. The new SSL above the GWPS for selenium at JHC-MW-15005 resulted from increases in concentrations observed after the cessation of hydraulic loading at Ponds 1-2 in 2018 and an associated change in local groundwater flow. TRC developed an Alternate Source Demonstration (ASD) for the new SSL in accordance with §257.95(g)(3)(ii). The multiple lines of evidence presented in the ASD show that the SSL is from a source other than Ponds 1-2. The alternate source was determined to be a system of closed, pre-existing units licensed under Michigan solid waste rules which are adjacent to Ponds 1-2. The closed, pre-existing units are not regulated under the CCR Rule, but remedial action is being taken under Consent Agreement WMRPD No. 115-01-2018. A remedial action plan (RAP) was submitted to EGLE on September 30, 2021.

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, six 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.

The arsenic exceedance at JHC-MW-15011 which initially triggered corrective action continues to attenuate after reaching an apparent local maximum in late 2019, immediately following the completion of the final cover for Pond A. The arsenic concentration at JHC-MW-15011R decreased to below the GWPS in third and fourth quarter 2021 and the lower confidence limit for JHC-MW-15011/R was below the GWPS in third and fourth quarter 2021.

Nature and extent near Pond A was further characterized in March 2021 by collecting soil borings and grab groundwater samples immediately downgradient of Pond A. Details of the data collected are included in Appendix E of the *2021 Annual Groundwater Monitoring and Corrective Action Report* (TRC, January 2022) to which this progress report is also appended. Arsenic was below the GWPS (10 ug/L) at all five locations and was not detectable at a reporting limit of 1 ug/L at three of the five locations.

Increases in Appendix III constituents (e.g. boron) and direct exceedances of the selenium GWPS in JHC-MW-15011, JHC-MW-15010, JHC-MW-15009, and JHC-MW-15008R that have not yet resulted in a statistically significant exceedance suggest a detectable influence from the immediately adjacent, upgradient, closed, pre-existing CCR units on-site. The closed, pre-existing units are not regulated under the RCRA CCR Rule, but remedial action is being taken under Consent Agreement WMRPD No. 115-01-2018. A RAP for these units was submitted to EGLE on September 30, 2021.

Conclusions

Ponds 1-2

Changing constituent concentrations indicate that the system is establishing a new equilibrium following source removal. Nature and extent sampling results suggest that the GWPS exceedances do not pose an immediate threat to human health or the environment.

The ASD performed for JHC-MW-15005 demonstrates the influence of immediately adjacent, closed, pre-existing units not regulated by the CCR Rule on at least one well in the downgradient groundwater monitoring network developed for Ponds 1-2. Consumers Energy is re-evaluating the well network for Ponds 1-2 to account for the influence from the closed, pre-existing units. Continued monitoring at Ponds 1-2 is appropriate to understand the new geochemical equilibrium being established at the former unit and the influence from the adjacent alternate source.

Pond A

Arsenic at JHC-MW-15011/R continues to attenuate. The last two quarters of sampling at JHC-MW-15011R were below the GWPS. Nature and extent sampling data indicate that arsenic is not detected above the GWPS immediately downgradient from Pond A.

Groundwater monitoring data since the installation of the final cover indicate an observable influence from immediately adjacent, upgradient, closed, pre-existing units. Remedial action for the upgradient units is being taken under Consent Agreement WMRPD No. 115-01-2018.

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.

At Ponds 1-2, continued monitoring and a re-evaluation of the well network is appropriate to account for the changed groundwater flow and equilibrium established following the primary corrective action and to evaluate the influence of the alternate source on constituent concentrations in the Ponds 1-2 well network.

Arsenic continues to attenuate at Pond A following dewatering and the installation of the final cover. Groundwater monitoring data since the implementation of the primary corrective actions indicate an observable influence from immediately adjacent, upgradient, closed, pre-existing units. A formal demonstration of this influence is being developed in 2022.

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 14, 2019. Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g), 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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