2023 Annual Groundwater Monitoring and Corrective Action Report

JH Campbell Power Plant
Pond A CCR Unit

West Olive, Michigan

January 2024

Prepared For:

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Executive Summary

On behalf of Consumers Energy, TRC has prepared this report for the JH Campbell Pond A Coal Combustion Residual (CCR) unit to cover the period of January 1, 2023 to December 31, 2023. Pond A 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 2023 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, Pond A CCR Unit*. The statistical evaluation of the Appendix III indicator parameters confirming SSIs over background were as follows:

- Boron at JHC-MW-15006, JHC-MW-15007, JHC-MW-15008, JHC-MW-15009, JHC-MW-15010, and JHC-MW-15011; and
- Sulfate at JHC-MW-15006, JHC-MW-15007, JHC-MW-15008, JHC-MW-15009, JHC-MW-15010, and JHC-MW-15011

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 in the *Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g)* that arsenic was present at statistically significant levels above the federal groundwater protection standard (GWPS) established at 10 ug/L in one out of six downgradient monitoring wells at Pond A as follows:

- Arsenic at JHC-MW-15011.

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 federal GWPS. Groundwater monitoring downgradient from Pond A further demonstrates 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 Pond A.

Remedy selection for Pond A, prescribed by the CCR Rule, is being undertaken in coordination with the EGLE Consent Agreement WMRPD No. 115-01-2018, which was executed on December 28, 2018. The January 2024 semiannual progress report describing the progress in selecting and designing the remedy required pursuant to §257.97(a) is included in this report. As documented in the *Pond A Construction Documentation and Certification Report*, Pond A was closed with final cover in place in the summer of 2019.

The general decrease in arsenic concentrations suggest that the pond closure 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 Pond A well network. The groundwater management remedy for Pond A 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 2024.

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) Pond A CCR Unit at the JH Campbell Power Plant Site (Pond A). 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 Pond A to cover the period of January 1, 2023 to December 31, 2023. Pond A 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 2023 under §257.90 - §257.98 are presented in this report.

1.1 Program Summary

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, Pond A 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-15006, JHC-MW-15007, JHC-MW-15008, JHC-MW-15009, JHC-MW-15010, and JHC-MW-15011; and
- Sulfate at JHC-MW-15006, JHC-MW-15007, JHC-MW-15008, JHC-MW-15009, JHC-MW-15010, and JHC-MW-15011.

As discussed in the *2018 Annual Groundwater Monitoring Report for the JH Campbell Power Plant Pond A CCR Unit* (2018 Annual Report) (TRC, January 2019), Consumers Energy initiated an Assessment Monitoring Program for Pond A pursuant to §257.95 of the CCR 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 in the *Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g)* (Consumers Energy, January 2019) that arsenic was present at statistically significant levels above the federal groundwater protection standard (GWPS) established at 10 ug/L in one out of six downgradient monitoring wells at Pond A as follows:

- Arsenic at JHC-MW-15011.

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*

(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 Pond A. In addition, Pond A was closed with final cover in place in the summer of 2019.

The groundwater management remedy for Pond A 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. In addition to the semiannual assessment monitoring performed in accordance with §257.95, Consumers Energy is also conducting quarterly monitoring in accordance with the *Pond A Hydrogeological Monitoring Plan, JH Campbell Power Plant, West Olive, Michigan* (Pond A HMP) (TRC, March 2019; Revised July 2019), which includes the *Pond A Assessment Monitoring Plan* (Pond A AMP). Quarterly monitoring results are reported under a separate cover in accordance with the requirements of the Michigan Natural Resources and Environmental Protection Act, also known as Part 115 of PA 451 of 1994, as amended (a.k.a., Michigan Part 115 Solid Waste Management) and the Pond A HMP. This report covers the semiannual assessment monitoring performed in accordance with §257.95.

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 JH Campbell solid waste disposal facility. The CCR surface impoundments located within the former wet ash pond area are Pond 1-2 North and Pond 1-2 South Bottom Ash Ponds (collectively 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 Dry Ash Landfill or is sold and shipped off site. This report focuses on the Pond A CCR unit.

1.3 Geology/Hydrogeology

Groundwater is typically encountered at elevations ranging from 604 feet near the background wells (located to the north/northwest of the Dry Ash Landfill) 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 Pond A, which currently consists of 11 monitoring wells (6 background monitoring wells and 5 downgradient monitoring 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 units (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.

As documented in the *2021 Annual Groundwater Monitoring and Corrective Action Report for the JH Campbell Power Plant Pond A CCR Unit* (2021 Annual Report) (TRC, January 2022), the groundwater flow direction changed significantly following permanent discontinuation of hydraulic loading in June 2018 and completion of the final cover installation in 2019 such that groundwater mounding is no longer observed around Pond A and groundwater has equilibrated to a lower static water elevation. As a result, replacement monitoring wells JHC-MW-15007R, JHC-MW-15009R, and JHC-MW-15011R were installed and monitoring wells JHC-MW-15007, JHC-MW-15009, JHC-MW-15010, and JHC-MW-15011 were decommissioned in July 2021. The groundwater monitoring network certification was included in the 2021 Annual Report. The Pond A monitoring well network currently includes five downgradient wells (JHC-MW-15006, JHC-MW-15007R, JHC-MW-15008R, JHC-MW-15009R, and JHC-MW-15011R) located south and southeast of Pond A.

No changes were made to the Pond A well network in 2023.

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 and Analysis Plan* for JH Campbell Power Plan Pond A (SAP) (TRC, January 2021).

2.2.1 Data Summary

The first semiannual groundwater assessment monitoring event for 2023 was performed on April 10 through 13, 2023 and the second semiannual groundwater assessment monitoring event for 2023 was performed on October 16 through 18, 2023. Both events were performed by Consumers Energy. Samples were analyzed by Consumers Energy Laboratory Services in Jackson, Michigan, with radium samples analyzed by Eurofins Environmental Testing 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 Pond A 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 2023 events are provided on Table 1 (static groundwater elevation data), Table 2 (field data), Table 3 (background well analytical results), and Table 4 (Pond A 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 elevation data collected site-wide during the 2023 semiannual assessment monitoring events were generally similar to data collected previously since the background sampling events commenced in December 2015. The data showed that groundwater within the uppermost aquifer generally flows to the south-southeast across the site, with a southwesterly groundwater flow component on the western edge of the site. Groundwater flow in the immediate vicinity of Pond A is predominately toward the south-southeast, consistent with previous assessment monitoring events completed after pond closure. The groundwater mounding previously observed in the immediate vicinity of Pond A early on in the program is no longer apparent subsequent to completing decommissioning activities in Summer 2019.

Groundwater elevations measured across the site during the April and October 2023 events are provided on Table 1. April 2023 and October 2023 groundwater elevations were used to construct the groundwater contour maps provided on Figure 3 and Figure 4, respectively. The average hydraulic gradient for each sampling event 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). The average hydraulic gradient was 0.0037 ft/ft in April 2023 and 0.0035 in October 2023. 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 0.58 ft/day or 210 ft/year for the April 2023 event, and approximately 0.54 ft/day or 200 ft/year for the October 2023 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 Pond A.

3.0 Statistical Evaluation

Assessment monitoring is continuing at Pond A, 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 2023 groundwater data in accordance with the assessment monitoring program. The statistical evaluation details are provided in Appendix B (*Statistical Evaluation of April 2023 Assessment Monitoring Sampling Event*) and Appendix C (*Statistical Evaluation of October 2023 Assessment Monitoring Sampling Event*).

3.1 Establishing Groundwater Protection Standards

The federal 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 limit 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 one of the downgradient wells at Pond A based on the statistical data comparison for the initial semiannual assessment monitoring event (June 2018). Therefore, Consumers Energy initiated the ACM. Assessment monitoring is ongoing.

Arsenic was identified at downgradient monitoring well JHC-MW-15011 at statistically significant levels exceeding the GWPS during the initial assessment monitoring event conducted in June 2018. Arsenic at JHC-MW-15011/R (combined dataset from the original well and the replacement well as denoted by the "/R") continued to be present at statistically significant levels at or above the GWPS through second quarter 2021. As shown in the data tables and trend tests included in Appendix B and Appendix C, arsenic concentrations at JHC-MW-15011/R declined in 2020 and 2021 such that the arsenic concentration at JHC-MW-15011R was below the GWPS in fourth quarter 2021 and second quarter 2022 and the lower confidence limit (LCL) for JHC-MW-15011/R has been below the GWPS since the second semiannual event of 2021. A slight rebound was observed in 2022, with the fourth quarter 2022 arsenic concentration being slightly above the GWPS; however, the second and fourth quarter 2023 arsenic concentrations were once again below the GWPS and the LCL remains below the GWPS.

The statistical data comparison for the April 2023 (Appendix B) and October 2023 (Appendix C) semiannual assessment monitoring events indicate that no Appendix IV constituents were present at statistically significant levels exceeding the GWPSs.

The decrease in arsenic concentrations since 2019 demonstrates the effectiveness of the cap on addressing the arsenic concentrations associated with operations at Pond A. However, as the groundwater flow regime has changed and Pond A has been dewatered with site conditions stabilized through capping, changes in groundwater concentrations for Appendix III and Appendix IV constituents within the Pond A monitoring network associated with influence from historical Ponds B-K are being observed post-closure. Trends continue to be monitored and statistical significance relative to applicable GWPSs continues to be evaluated during the post-closure period as groundwater continues to reach its new equilibrium and groundwater travel times allow upgradient Ponds B-K groundwater to fully reach the entire Pond A well network.

A summary of the confidence intervals for April 2023 and October 2023 are provided in Table 5 and Table 6, respectively.

4.0 Corrective Action

Consumers Energy provided notification in January 2019 that arsenic was present at statistically significant levels above the federal GWPS established at 10 ug/L in one out of six downgradient monitoring wells at Pond A as follows:

- Arsenic at JHC-MW-15011.

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 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 Pond A HMP monitoring well network. Nature and extent sampling in 2023 included shallow temporary step-out wells TW-19-05 and TW-19-06A in addition to wells and parameters monitored as part of the Pond A HMP and nature and extent sampling program at MW-14S, PZ-23S, PZ-24, PZ-24S, PZ-40, and PZ-40S. Locations of the monitoring wells used for nature and extent groundwater sampling are shown on Figure 2. A summary of the nature and extent groundwater data collected in 2023 are provided on Table 7. 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 Groundwater Monitoring and Corrective Action Report and Fourth Quarter 2019 Hydrogeological Monitoring Report, JH Campbell Power Plant, Pond A CCR Unit* (2019 Annual Report) (TRC, January 2020).

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. This was further confirmed by the additional 2021 grab groundwater sampling data that shows arsenic is well below the GWPS at all five of the soil boring locations immediately downgradient from Pond A as detailed in the 2021 Annual Report. 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 Pond A 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 supplemental Pond A HMP wells and the National Pollutant Discharge Elimination System (NPDES) outfall at the Recirculation Pond. Compliance for the GSI pathway will continue to be monitored in accordance with the EGLE-approved Pond A AMP.

4.2 Assessment of Corrective Measures

The ACM was submitted 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 in conjunction with closure in place for Pond A:

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

Consumers Energy is following an adaptive management strategy for selecting the final groundwater remedy for Pond A in conjunction 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 Pond A, prescribed by the CCR Rule, is being undertaken in coordination with the EGLE Consent Agreement WMRPD No. 115-01-2018, which was executed on December 28, 2018. The January 2024 semiannual progress report describing the progress in selecting and designing the remedy required pursuant to §257.97(a) is included in Appendix D of this report. Pond A has been closed according to the *JH Campbell Generating Facility Pond A Closure Plan, West Olive, Michigan* (Golder, October 2016) and the updated closure plan detailing the final cover system that was submitted to the EGLE in February 2019. Pond A was closed with waste in place in accordance with the requirements for CCR landfills under RCRA (§257.102(d)). Cover construction was completed in summer 2019 and the *Construction Documentation and Certification Report* (Golder, October 2019) was approved by the EGLE on November 25, 2019.

Changes in groundwater chemistry continue to be evaluated following the completion of capping at Pond A. The arsenic exceedance at JHC-MW-15011, which initially triggered corrective action, continues to attenuate following the completion of the final cover for Pond A. Since the

installation of the final cover, groundwater monitoring data for several other constituents 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.

5.0 Conclusions and Recommendations

Assessment monitoring is ongoing at the Pond A CCR unit while corrective action continues to be assessed. Pond A has been closed in place. 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 Pond A.

The ACM report provides 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 capping at Pond A indicate that the system is establishing a new equilibrium following closure and that the immediately upgradient closed CCR units are impacting groundwater quality in the Pond A well network.

The groundwater management remedy for Pond A 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 2024.

6.0 References

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

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Tables

Table 1

Summary of Groundwater Elevation Data - April - October 2023
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 10, 2023		October 16, 2023	
							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	16.57	603.41	19.34	600.64
JHC-MW-15024	613.79	616.62	Sand	606.8	to	596.8	12.41	604.21	14.64	601.98
JHC-MW-15025	614.14	617.17	Sand	607.1	to	597.1	11.87	605.30	13.95	603.22
JHC-MW-15026	615.09	618.04	Sand	607.1	to	597.1	14.02	604.02	15.73	602.31
JHC-MW-15027	614.77	617.30	Sand	604.8	to	594.8	14.63	602.67	16.26	601.04
JHC-MW-15028	611.02	613.80	Sand	603.0	to	593.0	14.33	599.47	15.92	597.88
JHC-MW-15029	608.08	610.95	Sand	600.1	to	590.1	11.54	599.41	12.97	597.98
JHC-MW-15030	604.05	607.17	Sand	600.1	to	590.1	9.15	598.02	10.69	596.48
Pond 1N, 1S, 2N, 2S										
JHC-MW-15001	607.02	609.53	Sand	603.5	to	598.5	NM		NM	
JHC-MW-15002	618.18	621.27	Sand	590.2	to	580.2	24.50	596.77	NM	
JHC-MW-15003	623.16	627.20	Sand	595.2	to	585.2	32.69	594.51	NM	
JHC-MW-15005	606.22	609.99	Sand	579.2	to	569.2	18.13	591.86	NM	
JHC-MW-18004	602.92	605.72	Sand	596.9	to	586.9	11.37	594.35	NM	
JHC-MW-18005	600.30	603.16	Sand	595.3	to	585.3	10.30	592.86	NM	
JHC-MW-22001	601.52	604.28	Sand	596.5	to	586.5	10.68	593.60	NM	
Pond 3N, 3S										
JHC-MW-15013	632.40	635.25	Sand	604.4	to	594.4	35.39	599.89	NM	
JHC-MW-15015	632.46	635.20	Sand	604.5	to	594.5	34.96	600.24	NM	
JHC-MW-15016	631.81	632.52	Sand	603.8	to	593.8	32.42	600.10	NM	
JHC-MW-18001	609.09	611.98	Sand	603.1	to	593.1	12.26	599.72	NM	
JHC-MW-18002	605.53	608.93	Sand	602.0	to	592.0	9.09	599.84	NM	
JHC-MW-18003	605.36	608.78	Sand	601.9	to	591.9	9.00	599.78	NM	
Landfill										
JHC-MW-15017	613.69	616.61	Sand	603.7	to	593.7	15.90	600.71	17.14	599.47
JHC-MW-15018	614.26	617.02	Sand	604.3	to	594.3	16.67	600.35	17.74	599.28
JHC-MW-15022	620.92	623.79	Sand	597.9	to	587.9	NM		NM	
JHC-MW-15031	632.94	635.87	Sand	599.9	to	589.9	43.20	592.67	43.94	591.93
JHC-MW-15032	611.32	614.29	Sand	598.3	to	588.3	16.02	598.27	18.17	596.12
JHC-MW-15033	618.08	620.99	Sand	602.1	to	592.1	NM		NM	
JHC-MW-15034	612.90	615.97	Sand	601.9	to	591.9	14.59	601.38	17.26	598.71
JHC-MW-15035	632.53	634.28	Sand	599.5	to	589.5	40.84	593.44	41.46	592.82
JHC-MW-15036	617.94	618.34	Sand	597.9	to	587.9	26.49	591.85	27.34	591.00
JHC-MW-15037	614.28	616.06	Sand	591.3	to	586.3	24.68	591.38	25.73	590.33
MW-B3	630.51	634.17	Sand	598.5	to	593.5	38.53	595.64	38.97	595.20
MW-B4	633.80	635.67	Sand	593.8	to	588.8	41.28	594.39	41.80	593.87
Pond A										
JHC-MW-15006	624.74	627.58	Sand	599.7	to	589.7	34.39	593.19	36.04	591.54
JHC-MW-15007R[(2)]	625.73	628.26	Sand	595.7	to	585.7	35.33	592.93	37.08	591.18
JHC-MW-15008R[(1)]	632.32	634.67	Sand	597.3	to	587.3	42.25	592.42	44.06	590.61
JHC-MW-15009R[(2)]	632.15	635.05	Sand	595.2	to	585.2	42.55	592.5	44.00	591.05
JHC-MW-15011R[(2)]	627.73	629.79	Sand	594.7	to	584.7	36.94	592.85	38.21	591.58
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	10.74	580.24	10.92	580.06
PZ-23S	602.84	604.97	Sand	591.8	to	586.8	14.72	590.25	15.49	589.48
PZ-24S	586.56	590.15	Sand	584.6	to	579.6	7.33	582.82	8.98	581.17
PZ-40S	589.51	593.25	Sand	585.5	to	575.5	10.16	583.09	12.55	580.70
TW-19-05	603.44	606.36	Sand	592.8	to	587.8	14.86	591.50	17.20	589.16
TW-19-06A	599.61	602.54	Sand	592.3	to	587.3	11.91	590.63	14.20	588.34

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.

NM: 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.

Table 2
Summary of Field Parameters
JH Campbell Pond A - 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	4/13/2023	4.42	245.3	5.3	111	12.8	4.1
	10/16/2023	2.17	268.6	6.0	104	11.6	4.5
JHC-MW-15024	4/13/2023	2.73	163.3	7.6	349	11.6	3.8
	10/16/2023	0.56	178.8	7.4	369	11.6	1.9
JHC-MW-15025	4/12/2023	6.16	129.1	7.6	239	10.8	5.5
	10/16/2023	1.25	176.3	7.9	409	11.8	2.1
JHC-MW-15026	4/13/2023	7.73	234.8	5.8	32	11.2	4.3
	10/16/2023	5.29	318.8	5.9	40	12.6	2.9
JHC-MW-15027	4/13/2023	8.75	227.4	6.2	129	10.5	4.9
	10/16/2023	5.97	167.1	6.4	133	12.9	2.8
JHC-MW-15028	4/12/2023	6.81	134.3	8.1	129	10.7	6.4
	10/16/2023	6.57	134.5	8.3	142	13.0	0.2
Pond A							
JHC-MW-15006	4/11/2023	0.68	45.0	7.8	585	13.7	0.8
	10/17/2023	0.86	113.8	8.2	770	14.2	1.2
JHC-MW-15007R	4/11/2023	1.30	-64.8	7.7	687	13.4	1.4
	10/17/2023	0.79	97.6	7.9	715	13.9	1.8
JHC-MW-15008R	4/10/2023	2.38	103.6	6.9	660	13.9	3.1
	10/17/2023	1.70	193.6	7.2	545	14.0	1.4
JHC-MW-15009R	4/10/2023	1.23	106.8	6.7	613	13.6	1.5
	10/17/2023	1.45	223.4	6.9	523	13.6	1.6
JHC-MW-15011R	4/11/2023	1.37	60.6	6.8	542	13.0	0.9
	10/17/2023	0.66	64.5	7.0	395	13.3	1.2

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 Background Groundwater Sampling Results (Analytical)
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:	4/13/2023	10/16/2023	4/13/2023	10/16/2023	4/12/2023	10/16/2023	4/13/2023	10/16/2023	4/13/2023	10/16/2023	4/12/2023	10/16/2023
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background											
Appendix III[(1)]																	
Boron	ug/L	NC	500	500	7,200	29	35	< 20	23	< 20	22	< 20	< 20	< 20	25	< 20	< 20
Calcium	mg/L	NC	NC	NC	500[EE]	12.7	11.4	33.1	37.2	20.4	35.5	2.98	3.85	15.3	17.0	16.3	18.9
Chloride	mg/L	250**	250[E]	250[E]	500[EE]	3.81	5.35	24.1	33.7	17.1	37.2	1.27	2.08	< 1.00	1.44	< 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]	14.4	12.7	9.14	9.81	6.29	10.6	5.78	6.06	4.71	7.59	5.15	5.45
Total Dissolved Solids	mg/L	500**	500[E]	500[E]	500	97	88	176	214	114	226	50	40	81	96	60	85
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5[E]**	**6.5 - 8.5[E]**	**6.5 - 9.0**	**5.3**	**6.0**	7.6	7.4	7.6	7.9	**5.8**	**5.9**	**6.2**	**6.4**	8.1	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	59	25	18	20	6	10	7	8	37	20	7	6
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	0.182	< 0.106	< 0.148	< 0.117	< 0.199	< 0.104	< 0.312	0.157	< 0.152	< 0.0896	< 0.165	< 0.115
Radium-228	pCi/L	NC	NC	NC	NC	< 0.556	< 0.644	< 0.478	< 0.746	< 0.577	1.03	< 1.10	< 0.545	< 0.519	0.683	< 0.605	0.934
Radium-226/228	pCi/L	5	NC	NC	NC	< 0.556	< 0.644	< 0.478	< 0.746	< 0.577	1.07	< 1.10	0.638	< 0.519	0.765	< 0.605	0.949
Selenium	ug/L	50	50	50	5.0	< 1	< 1	< 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	< 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, updated October 12, 2023.
** - 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)
JH Campbell Pond A – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15006		JHC-MW-15007R		JHC-MW-15008R		JHC-MW-15009R		JHC-MW-15011R	
					Sample Date:	4/11/2023	10/17/2023	4/11/2023	10/17/2023	4/10/2023	10/17/2023	4/10/2023	10/17/2023	4/11/2023	10/17/2023
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient									
Appendix III[(1)]															
Boron	ug/L	NC	**500**	**500**	7,200	**670**	**757**	**1,290**	**1,630**	**1,300**	**1,260**	**1,010**	**1,230**	**2,310**	**3,420**
Calcium	mg/L	NC	NC	NC	500[EE]	68.8	75.7	77.9	68.3	75.7	52.9	90.8	74.1	79.1	47.2
Chloride	mg/L	250**	250[E]	250[E]	500[EE]	13.3	18.3	13.1	17.0	13.4	15.5	9.24	11.2	8.05	8.27
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]	98.3	204	143	118	107	67.0	57.8	33.1	87.5	56.7
Total Dissolved Solids	mg/L	**500****	**500[E]**	**500[E]**	**500**	385	**552**	475	453	402	323	368	318	373	238
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5[E]	6.5 - 8.5[E]	6.5 - 9.0	7.8	8.2	7.7	7.9	6.9	7.2	6.7	6.9	6.8	7.0
Appendix IV[(1)]															
Antimony	ug/L	6	6.0	6.0	130	< 1	< 1	< 1	< 1	1	1	2	< 1	2	< 1
Arsenic	ug/L	10	10	10	10	7	8	5	7	< 1	< 1	< 1	< 1	5	7
Barium	ug/L	2,000	2,000	2,000	820	144	162	281	233	172	121	281	273	342	264
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	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
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	12	14	15	14	18	18	14	13	23	17
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	19	23	27	27	18	19	9	21	19
Radium-226	pCi/L	NC	NC	NC	NC	0.288	0.174	0.371	0.456	0.248	0.169	0.323	0.258	0.230	0.204
Radium-228	pCi/L	NC	NC	NC	NC	< 0.879	< 0.548	< 0.608	< 0.545	< 0.640	< 0.517	< 0.610	0.711	< 0.552	< 0.496
Radium-226/228	pCi/L	5	NC	NC	NC	< 0.879	0.643	< 0.608	0.862	< 0.640	< 0.517	< 0.610	0.969	< 0.552	0.547
Selenium	ug/L	**50**	**50**	**50**	**5.0**	**16**	**32**	4	**9**	**6**	**11**	**64**	**155**	**64**	**79**
Thallium	ug/L	2	2.0	2.0	3.7	< 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, updated October 12, 2023.
** - 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 5

Summary of Groundwater Protection Standard Exceedances – April 2023

JH Campbell Pond A – RCRA CCR Monitoring Program

West Olive, Michigan

Constituent	Units	GWPS	JHC-MW-15008R		JHC-MW-15009/R		JHC-MW-15011/R	
			LCL	UCL	LCL	UCL	LCL	UCL
Arsenic	ug/L	10	--	--	--	--	1.8	31
Selenium	ug/L	50	4.9	54	7.0	78	13	180

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.

Table 6

Summary of Groundwater Protection Standard Exceedances – October 2023

JH Campbell Pond A – RCRA CCR Monitoring Program

West Olive, Michigan

Constituent	Units	GWPS	JHC-MW-15008R		JHC-MW-15009/R		JHC-MW-15011/R	
			LCL	UCL	LCL	UCL	LCL	UCL
Arsenic	ug/L	10	--	--	--	--	3.1	20
Selenium	ug/L	50	6.0	68	15	110	14	180

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.

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

						MW-14S		PZ-23S		PZ-24		PZ-24S	
					Sample Location:								
					Sample Date:	4/13/2023	10/17/2023	4/13/2023	10/17/2023	4/11/2023	10/17/2023	4/13/2023	10/17/2023
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^								
Appendix III[(1)]													
Boron	ug/L	NC	500	500	7,200	< 20	31	< 20	< 20	144	169	< 20	25
Calcium	mg/L	NC	NC	NC	500[EE]	2.15	2.12	3.56	5.60	41.7	30.5	2.11	3.58
Chloride	mg/L	250**	250[E]	250[E]	500[EE]	1.26	< 1.00	< 1.00	< 1.00	2.40	3.36	1.20	< 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
Sulfate	mg/L	250**	250[E]	250[E]	500[EE]	7.01	7.62	2.01	2.50	108	67.7	7.72	10.9
Total Dissolved Solids	mg/L	500**	500[E]	500[E]	500	36	44	25	32	244	200	34	55
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5[E]**	**6.5 - 8.5[E]**	**6.5 - 9.0**	**5.6**	**5.5**	6.9	6.9	6.8	7.6	**5.3**	**5.7**
Appendix IV[(1)]													
Antimony	ug/L	6	6.0	6.0	130	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	10	10	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1	2
Barium	ug/L	2,000	2,000	2,000	820	11	14	< 5	< 5	32	18	48	16
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
Cobalt	ug/L	NC	40	100	100	< 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
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
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	8	10	< 5	< 5
Radium-226	pCi/L	NC	NC	NC	NC	< 0.167	< 0.145	< 0.164	< 0.139	< 0.180	< 0.226	0.143	0.250
Radium-228	pCi/L	NC	NC	NC	NC	0.847	< 0.615	< 0.568	0.507	< 0.640	< 0.601	< 0.490	0.678
Radium-226/228	pCi/L	5	NC	NC	NC	0.840	0.690	< 0.568	0.587	< 0.640	< 0.601	< 0.490	0.928
Selenium	ug/L	**50**	**50**	**50**	**5.0**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Thallium	ug/L	2	2.0	2.0	3.7	< 2	< 2	< 2	< 2	< 2	< 2	< 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, updated October 12, 2023.

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

						PZ-40		PZ-40S		TW-19-05		TW-19-06A	
					Sample Location:								
					Sample Date:	4/11/2023	10/17/2023	4/13/2023	10/17/2023	4/13/2023	10/16/2023	4/13/2023	10/16/2023
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^								
Appendix III[(1)]													
Boron	ug/L	NC	500	500	7,200	215	140	23	60	55	182	43	79
Calcium	mg/L	NC	NC	NC	500[EE]	11.8	8.06	1.81	2.00	19.6	60.2	19.1	21.8
Chloride	mg/L	250**	250[E]	250[E]	500[EE]	5.38	2.48	< 1.00	1.46	1.38	1.33	< 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
Sulfate	mg/L	250**	250[E]	250[E]	500[EE]	13.0	8.31	6.30	7.39	12.0	14.0	6.95	6.93
Total Dissolved Solids	mg/L	500**	500[E]	500[E]	500	81	64	45	42	91	316	91	94
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5[E]**	**6.5 - 8.5[E]**	**6.5 - 9.0**	6.6	6.7	**5.1**	**5.1**	7.0	7.4	6.8	7.2
Appendix IV[(1)]													
Antimony	ug/L	6	6.0	6.0	130	< 1	< 1	< 1	< 1	2	< 1	< 1	< 1
Arsenic	ug/L	10	10	10	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Barium	ug/L	2,000	2,000	2,000	820	15	11	24	30	9	74	7	8
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	2	< 1	< 1	< 1	1	< 1
Cobalt	ug/L	NC	40	100	100	< 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
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	21	34	< 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	24	42	< 5	< 5	< 5	11	14	13
Radium-226	pCi/L	NC	NC	NC	NC	< 0.123	< 0.139	< 0.111	< 0.147	< 0.149	< 0.151	< 0.181	< 0.147
Radium-228	pCi/L	NC	NC	NC	NC	< 0.479	< 0.576	0.571	< 0.496	< 0.716	0.511	< 0.755	< 0.475
Radium-226/228	pCi/L	5	NC	NC	NC	< 0.479	< 0.576	0.619	< 0.496	< 0.716	0.620	< 0.755	< 0.475
Selenium	ug/L	**50**	**50**	**50**	**5.0**	< 1	3	< 1	< 1	**27**	**37**	**39**	**137**
Thallium	ug/L	2	2.0	2.0	3.7	< 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.

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* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 21, 2020, updated October 12, 2023.

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^ - 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}.

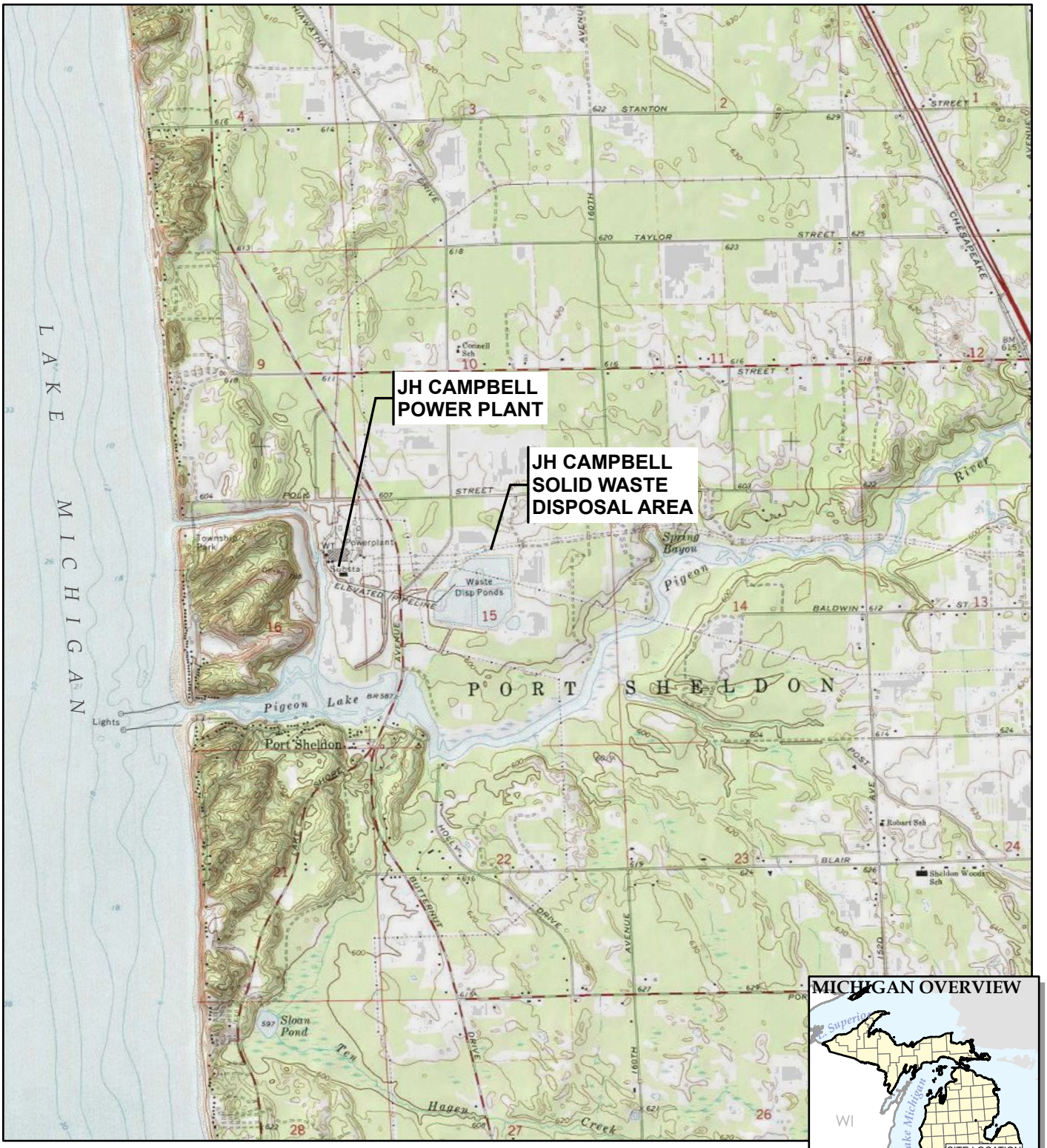
(1) 40 CFR Part 257 Appendix III Detection Monitoring Constituents and Appendix IV Assessment Monitoring Constituents.

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.

Figures



BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

N

1:36,000
1:36,000

0 3,000 6,000 FEET

TRC

999 Fourier Drive
Suite 101
Madison, WI 53717
Phone: 608.826.3663

TRC - GIS

PROJECT:

CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:

SITE LOCATION MAP

DRAWN BY:	A. FOJTIK
CHECKED BY:	H. SCHNAIDT
APPROVED BY:	S. HOLMSTROM
DATE:	JANUARY 2024
PROJ. NO.:	514398.0000
FILE:	T:\1-PROJECTS\Consumers_Energy\464090_JHC\2-APRX\464090_JHC.aprx

FIGURE 1

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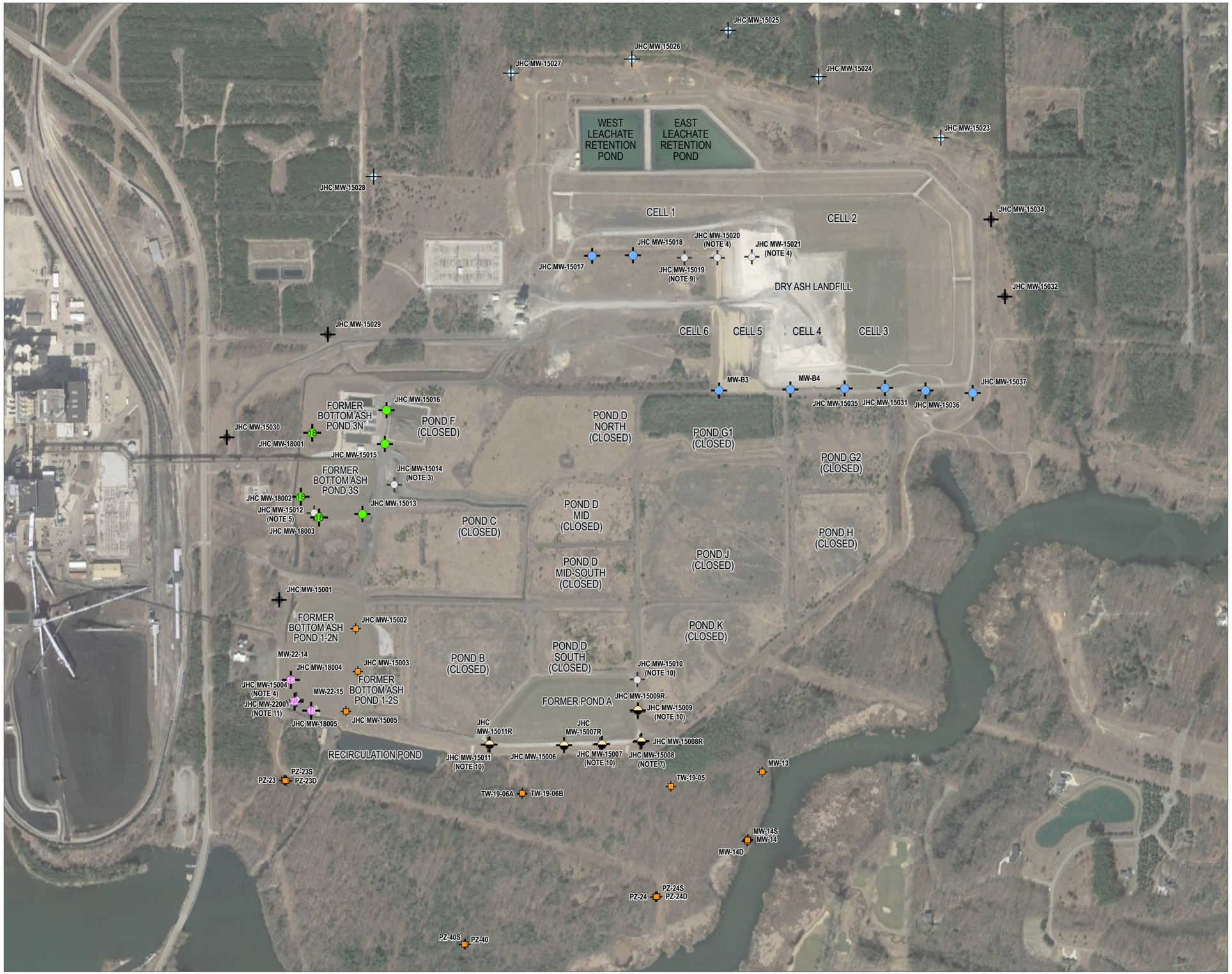

LEGEND

- 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
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL (2018)
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL (2022)
- DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL (2018)
- NATURE AND EXTENT/DOWNGRADIENT MONITORING WELLS

NOTES:

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2021.
2. WELL LOCATIONS BASED ON SURVEY DATA THROUGH JUNE 15, 2022.
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 AND REPLACED JULY 20-22, 2021.
11. JHC-MW-22001 MONITORING WELL INSTALLED MAY 12, 2022.

N

1:8,400
1" = 700'

0 500 1,000 FEET

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.: 514398.0000
CHECKED BY: H. SCHNAIDT	FIGURE 2
APPROVED BY: S. HOLMSTROM	
DATE: JANUARY 2024	

TRC
999 FOURIER DRIVE
SUITE 101
MADISON, WI 53717
PHONE: 608.826.3663

FILE: 464090_JHC.aprx

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl; Map Rotation: 0
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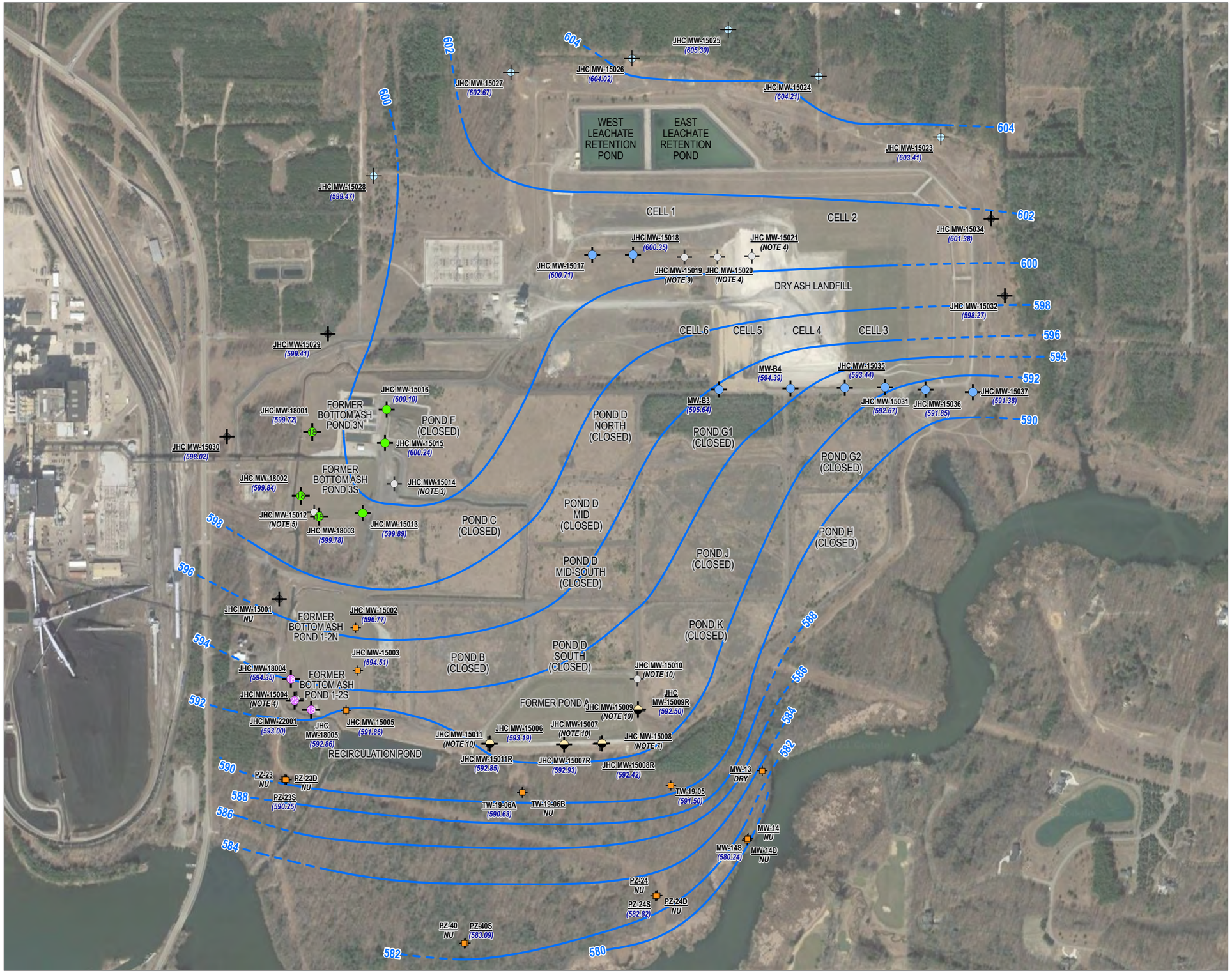

LEGEND

- BACKGROUND 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
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL (2018)
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL (2022)
- DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL (2018)
- NATURE AND EXTENT/DOWNGRADIENT MONITORING WELLS
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- *NU* NOT USED/NOT APPLICABLE

NOTES:

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2021.
2. WELL LOCATIONS BASED ON SURVEY DATA THROUGH JUNE 15, 2022.
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 AND REPLACED JULY 20-22, 2021.
11. JHC-MW-22001 MONITORING WELL INSTALLED MAY 12, 2022.
12. STATIC WATER ELEVATIONS IN NORTH AMERICAN VERTICAL DATUM 1988, NAVD 88.

1:8,400
1" = 700'
0 500 1,000 FEET

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

TITLE: GROUNDWATER CONTOUR MAP
APRIL 2023

DRAWN BY:	A. FOJTIK	PROJ. NO.:	514398.0000
CHECKED BY:	H. SCHNAIDT		FIGURE 3
APPROVED BY:	S. HOLMSTROM		
DATE:	JANUARY 2023		

TRC
999 FOURIER DRIVE
SUITE 101
MADISON, WI 53717
PHONE: 608.826.3663

FILE: 464090_JHC.aprx

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl; Map Rotation: 0
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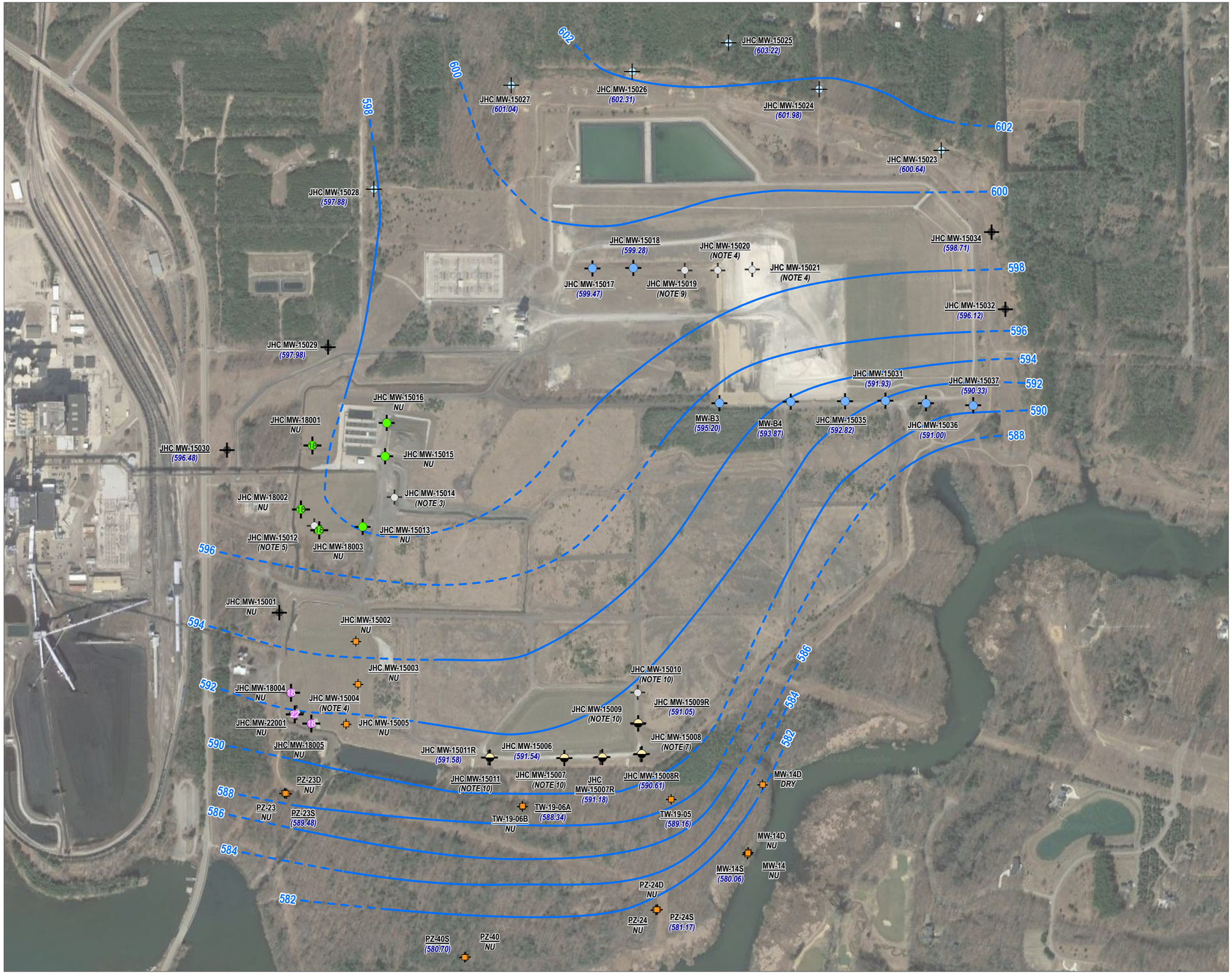

LEGEND

- BACKGROUND 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
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL (2018)
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL (2022)
- DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL (2018)
- NATURE AND EXTENT/DOWNGRADIENT MONITORING WELLS
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- *NU* NOT USED/NOT APPLICABLE

NOTES:

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2021.
2. WELL LOCATIONS BASED ON SURVEY DATA THROUGH JUNE 15, 2022.
3. MONITORING WELL DECOMMISSIONED NOVEMBER 13, 2017.
4. MONITORING WELL DECOMMISSIONED JUNE 14, 2018.
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9. MONITORING WELLS DECOMMISSIONED MAY 25, 2021.
10. MONITORING WELLS DECOMMISSIONED AND REPLACED JULY 20-22, 2021.
11. JHC-MW-22001 MONITORING WELL INSTALLED MAY 12, 2022.
12. STATIC WATER ELEVATIONS IN NORTH AMERICAN VERTICAL DATUM 1988, NAVD 88.

1:8,400
1" = 700'
0 500 1,000 FEET

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

TITLE: GROUNDWATER CONTOUR MAP
OCTOBER 2023

DRAWN BY:	A. FOJTIK	PROJ. NO.:	514398.0000
CHECKED BY:	H. SCHNAIDT		
APPROVED BY:	S. HOLMSTROM		FIGURE 4
DATE:	JANUARY 2024		

TRC
999 FOURIER DRIVE
SUITE 101
MADISON, WI 53717
PHONE: 608.826.3663

FILE: 464090_JHC.aprx

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl; Map Rotation: 0
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Appendix A
Data Quality Reviews

Laboratory Data Quality Review
Groundwater Monitoring Event April 2023
CEC JH Campbell Background Wells

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the April 2023 sampling event. Samples were analyzed for total metals, anions, alkalinity, and total dissolved solids (TDS) by CE Laboratory Services in Jackson, Michigan. The laboratory analytical results were reported in laboratory sample delivery group (SDG) 23-0320.

During the April 2023 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 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 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 alkalinity, magnesium, potassium, and sodium 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 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-15027 for total metals, anions, alkalinity, and TDS. All criteria were met.

Laboratory Data Quality Review
Groundwater Monitoring Event April 2023
CEC JH Campbell Background Wells

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the April 2023 sampling event. Samples were analyzed for radium by Eurofins in St. Louis, Missouri (Eurofins - St. Louis). The laboratory analytical results were reported in laboratory sample delivery group (SDG) 160-49762-1.

During the April 2023 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 (MBs) with the following exception.
  - Radium-228 was detected in MB 160-610088/1-A at 0.5308 +/- 0.333 pCi/L; however, radium-228 was not detected in the associated samples, thus no data are affected.
- One equipment blank (EB-01) and one field blank (FB-01) were collected. Target analytes were not detected in these blank samples.
- LCS/LCSD 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-01/JHC-MW-15027. All criteria were met.
- Carrier recoveries were within 40-110%.

Laboratory Data Quality Review
Groundwater Monitoring Event April 2023
CEC JH Campbell Pond A

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the April 2023 sampling event. Samples were analyzed for total metals, anions, alkalinity, and total dissolved solids by CE Laboratory Services in Jackson, Michigan. The laboratory analytical results were reported in laboratory sample delivery group (SDG) 23-0323.

During the April 2023 sampling event, a groundwater sample was collected from each of the following wells:

- JHC-MW-15006
- JHC-MW-15007R
- JHC-MW-15008R
- JHC-MW-15009R
- JHC-MW-15011R

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 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.

- The reviewed Appendix III and IV constituents as well as alkalinity, magnesium, potassium, and sodium 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-04) and one field blank (FB-04) were collected. Target analytes were not detected in these blank samples with the following exception. Boron was detected in the field blank (FB-04) at a concentration of 21 µg/L. There is no impact on the data usability due to this issue since the detected results for boron in the samples in this data set were greater than 10x the blank concentration.
- MS and MSD analyses were performed on sample JHC-MW-15007R for total metals and anions. The recoveries were within the acceptance limits. Relative percent differences (RPDs) were not provided by the laboratory and therefore were not evaluated; further, MS/MSD concentrations were not provided by the laboratory. However, since all recoveries were within the acceptance limits, there is no impact on data usability due to this issue.
- The field duplicate pair samples were DUP-04/JHC-MW-15009R for total metals, anions, alkalinity, and TDS. All criteria between the parent and duplicate samples were within the QC limits with the following exception: antimony was detected in the parent sample but was not detected in the duplicate sample and the absolute difference was equal to the RL.

Therefore, the positive and nondetect results for antimony should be considered estimated in all groundwater samples in this data set, as summarized in the attached table, Attachment A.

Attachment A

Summary of Data Non-Conformances for Groundwater Analytical Data

JH Campbell Pond A Wells

West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-15006	4/11/2023	Antimony	Field duplicate variability (absolute difference above criteria); potential uncertainty exists.
JHC-MW-15007R	4/11/2023		
JHC-MW-15008R	4/10/2023		
JHC-MW-15009R	4/10/2023		
JHC-MW-15011R	4/11/2023		
DUP-04	4/10/2023		

Laboratory Data Quality Review
Groundwater Monitoring Event April 2023
CEC JH Campbell Pond A

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the April 2023 sampling event. Samples were analyzed for radium by Eurofins in St. Louis, Missouri (Eurofins - St. Louis). The laboratory analytical results were reported in laboratory sample delivery group (SDG) 160-49759-1.

During the April 2023 sampling event, a groundwater sample was collected from each of the following wells:

- JHC-MW-15006
- JHC-MW-15007R
- JHC-MW-15008R
- JHC-MW-15009R
- JHC-MW-15011R

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-04) and one field blank (FB-04) were collected. Target analytes were not detected in these blank samples.
- LCS/LCSD recoveries and relative percent differences (RPDs) for all target analytes were within the laboratory's statistical control limits.
- MS/MSD and laboratory duplicate analyses were not performed on a sample from this SDG.
- The field duplicate pair samples were DUP-04/JHC-MW-15009R. All criteria were met.
- Carrier recoveries were within 40-110%.

Laboratory Data Quality Review
Groundwater Monitoring Event October 2023
Consumers Energy JH Campbell Background Wells

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the October 2023 sampling event. Samples were analyzed for total metals, anions, and total dissolved solids (TDS) by CE Laboratory Services in Jackson, Michigan. The laboratory analytical results were reported in laboratory sample delivery group (SDG) 23-1002.

During the October 2023 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

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 spikes (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 the total metals, anions, 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

- 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 total metals and anions. The recoveries were within the acceptance limits. Relative percent differences 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.
- Samples DUP-01/JHC-MW-15023 were submitted as the field duplicate pair with this data set; all criteria were met.

Laboratory Data Quality Review
Groundwater Monitoring Event October 2023
Consumers Energy JH Campbell Background Wells

Groundwater samples were collected by Consumers Energy (CE) Laboratory Samples and were analyzed for radium by Eurofins Environment Testing in Earth City, Missouri. The laboratory analytical results were reported in laboratory sample delivery group (SDG) 160-52007-1.

During the October 2023 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 blank samples with the following exceptions:
  - Radium-228 (0.743 +/- 0.366 pCi/L) and radium-226/228 (0.705 +/- 0.369 pCi/L) were detected in sample EB-01 at the listed concentrations. Potential false positive exists for positive radium-228 and/or radium-226/228 results with normalized absolute differences <1.96, as summarized in attachment A.
- LCS recoveries for all target analytes were within laboratory control limits.
- MS/MSD and laboratory duplicate analyses were not performed on a sample from this data set.
- Samples DUP-01/JHC-MW-15023 were submitted as the field duplicate pair with this data set; all criteria were met.
- Carrier recoveries were within 40-110%.

Attachment A

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

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-15025	10/16/2023	Radium-228 and Radium-226/288	Equipment blank contamination; potential false positive.
JHC-MW-15027	10/16/2023		
JHC-MW-15028	10/16/2023		
JHC-MW-15026	10/16/2023	Radium-226/228	

Laboratory Data Quality Review
Groundwater Monitoring Event October 2023
Consumers Energy JH Campbell Pond A and GSI Wells

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the October 2023 sampling event. Samples were analyzed for total and/or dissolved metals, anions, and total dissolved solids by CE Laboratory Services in Jackson, Michigan. The laboratory analytical results were reported in laboratory sample delivery groups (SDGs) 23-1003 and 23-1005.

During the October 2023 sampling event, a groundwater sample was collected from each of the following wells:

- JHC-MW-15006
- JHC-MW-15007R
- JHC-MW-15008R
- JHC-MW-15009R
- JHC-MW-15011R
- MW-14S
- PZ-23S
- PZ-24
- PZ-24S
- PZ-40
- PZ-40S
- TW-19-05
- TW-19-06A

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 and/or Dissolved Metals	SW-846 6020B/7470A

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 and dissolved metals, anions, 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

- 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 samples JHC-MW-15007R and TW-19-06A for total metals and anions. The recoveries were within the acceptance limits. Relative percent differences 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.
- Samples DUP-02/JHC-MW-15009R and DUP-07/PZ-40S were submitted as the field duplicate pairs with this data set; all criteria were met.

Laboratory Data Quality Review
Groundwater Monitoring Event October 2023
Consumers Energy JH Campbell Pond A and GSI Wells

Groundwater samples were collected by Consumers Energy (CE) Laboratory Samples and were analyzed for radium by Eurofins Environment Testing in Earth City, Missouri. The laboratory analytical results were reported in laboratory sample delivery groups (SDGs) 160-52008-1 and 160-52010-1.

During the October 2023 sampling event, a groundwater sample was collected from each of the following wells:

- JHC-MW-15006
- JHC-MW-15007R
- JHC-MW-15008R
- JHC-MW-15009R
- JHC-MW-15011R
- MW-14S
- PZ-23S
- PZ-24
- PZ-24S
- PZ-40
- PZ-40S
- TW-19-05
- TW-19-06A

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-02) and one field blank (FB-02) were collected. Target analytes were not detected in these blank samples.
- LCS recoveries for all target analytes were within laboratory control limits.
- MS/MSD and laboratory duplicate analyses were not performed on a sample from this data set.
- Samples DUP-02/JHC-MW-15009R were submitted as the field duplicate pair with this data set; all criteria were met.
- Carrier recoveries were within 40-110%.

Appendix B
April 2023 Assessment Monitoring Statistical Evaluation

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Technical Memorandum

Date:	July 24, 2023
To:	Bethany Swanberg, Consumers Energy
From:	Sarah Holmstrom, TRC Kristin Lowery, TRC Henry Schnaidt, TRC
Project No.:	514398.0000.0000 Phase 1 Task 2
Subject:	Statistical Evaluation of April 2023 Assessment Monitoring Sampling Event, JH Campbell Bottom Ash Pond A 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 Pond A. The first semiannual assessment monitoring event of 2023 was conducted on April 10 through 13, 2023. 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 first semiannual assessment monitoring event for 2023 indicates that no constituents are present at statistically significant levels exceeding the GWPSs in downgradient monitoring wells at the Pond A CCR Unit.

Constituent	GWPS	# Downgradient Wells Observed

No constituents are present at statistically significant levels above the GWPSs.

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.

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

Assessment Monitoring Statistical Evaluation

The downgradient compliance well network at Pond A consists of five wells (JHC-MW-15006, JHC-MW-15007R, JHC-MW-15008R, JHC-MW-15009R and JHC-MW-150011R) located south and east of Pond A. As discussed in the *2019 Annual Groundwater Monitoring and Corrective Action Report and Fourth Quarter 2019 Hydrogeological Monitoring Report* for the Pond A CCR Unit dated January 2020, monitoring well JHC-MW-15008 was decommissioned and replacement monitoring well JHC-MW-15008R was installed in June 2019. As detailed in the *2021 Annual Groundwater Monitoring and Corrective Action Report, JH Campbell Power Plant, Pond A* (TRC, January 2022), monitoring wells JHC-MW-15007, JHC-MW-15009, and JHC-MW-15011 were decommissioned and replacement monitoring wells JHC-MW-15007R, JHC-MW-15009R, and JHC-MW-15011R were installed in July 2021 and JHC-MW-15010 was removed from the monitoring program. For the purposes of statistical evaluation, the data sets from the replacement monitoring wells have been pooled with the former monitoring wells given that the wells were replaced to reset the screens at a lower elevation and data integrity was maintained before and after replacement. Use of the combined dataset is denoted with the "/R" to denote data from the original and replacement well are being used in the analysis.

Following the first semiannual assessment monitoring sampling event for 2023, compliance well data for Pond A 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 1. Constituent-well combinations that included a direct exceedance of the GWPS within the past eight monitoring events (October 2019 through April 2023 for JHC-MW-15006 JHC-MW-15008R, and JHC-MW-15011/R, and June 2018 through April 2023 for JHC-MW-15007/R and JHC-MW-15009/R) were retained for further analysis (Attachment 1). Direct comparison GWPS exceedances included the following constituent-well combinations:

- Selenium at JHC-MW-15008R;
- Selenium at JHC-MW-15009/R; and,
- Arsenic and selenium at JHC-MW-15011/R.

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 or 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 results for these well-constituent pairs were observed visually for potential outliers and trends. No outliers were apparent. Visual decreasing trends were observed for arsenic in JH-MW-15011/R and selenium in JHC-MW-15008R (time-series plots in Attachment 1); however, the trends were not statistically significant. Groundwater conditions are re-equilibrating following capping activities at Pond A that were completed in Summer 2019. Because hydrogeologic conditions are in the process of stabilizing, temporary trending and sporadic outlier data are not unexpected. Therefore, all data is used in the statistical evaluation.

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 compliance 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 α = 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-15011/R
Normalized by natural log transformation	Selenium at JHC-MW-15008R
Normalized by square root transformation	Selenium at JHC--MW-15011/R
Non-Parametric (not able to be normalized)	Selenium at JHC-MW-15009/R

The confidence interval test compares the lower confidence limit to the GWPS. The statistical evaluation of the Appendix IV constituents shows no statistically significant exceedances of the GWPSs. Arsenic was identified at downgradient monitoring well JHC-MW-15011 at statistically significant levels exceeding the GWPS during the initial assessment monitoring event conducted in June 2018. As shown in Table 1 and Attachment 1, arsenic concentrations in this well have declined since 2019 such that concentrations have been observed below the GWPS in 2020 and 2021 and the lower confidence limit has been below the GWPS since the second semiannual event of 2021. 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 1 Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation

Attachment 1 Sanitas™ Output

Table 1

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Pond A – RCRA CCR Monitoring Program
West Olive, Michigan

		Sample Location:	JHC-MW-15006								
		Sample Date:	10/10/2019	4/14/2020	10/22/2020	10/22/2020	4/13/2021	10/21/2021	4/14/2022	10/18/2022	4/11/2023
Constituent	Unit	GWPS	Downgradient								
Appendix III						Field Dup					
Boron	ug/L	NA	230	284	272	331	288	371	676	765	670
Calcium	mg/L	NA	35	102	87.2	84.3	82.0	84.5	59.2	67.2	68.8
Chloride	mg/L	NA	22	24.9	22.0	22.2	22.9	19.6	17.0	18.3	13.3
Fluoride	ug/L	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	NA	55	260	253	251	257	217	101	179	98.3
Total Dissolved Solids	mg/L	NA	190	562	515	511	497	485	341	458	385
pH, Field	SU	NA	7.8	7.2	7.5	--	7.7	7.8	7.8	8.3	7.8
Appendix IV											
Antimony	ug/L	6	< 1.0	1	1	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	**10**	4.3	5	9	6	3	6	7	7	7
Barium	ug/L	2,000	180	353	382	194	188	211	139	151	144
Beryllium	ug/L	4	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	< 1.0	1	5	1	3	2	1	< 1	1
Cobalt	ug/L	15	< 6.0	< 15	< 6	< 6	< 6	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	15	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	40	< 10	13	15	14	12	13	13	13	12
Mercury	ug/L	2	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	100	9.1	16	38	37	54	48	17	24	12
Radium-226/228	pCi/L	5.00	< 0.524	0.944	0.318	0.453	0.673	0.634	0.395	0.663	< 0.879
Selenium	ug/L	**50**	1.3	9	2	1	< 1	1	5	4	16
Thallium	ug/L	2	< 2.0	< 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.

-- - not analyzed.

GWPS - Groundwater Protection Standard. GWPS is the higher of the Maximum Contaminant Level/Regional Screening Level and Upper Tolerance Limit as established in TRC's Technical Memorandum dated October 15, 2018.

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) JHC-MW-15008 was decommissioned on June 24, 2019. Replacement well JHC-MW-15008R was installed on June 25, 2019.

(2) Not sampled; insufficient amount of groundwater present to collect sample.

(3) JHCW-MW-15007, JHC-MW-15009, and JHC-MW-15011 were decommissioned in July 2021. Replacement wells JHC-MW-15007R, JHC-MW-15009R, and JHC-MW-15011R were installed on July 20-22, 2021.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Pond A – RCRA CCR Monitoring Program
West Olive, Michigan

		Sample Location:	JHC-MW-15007[3]							JHC-MW-15007R[3]				
		Sample Date:	6/20/2018	11/15/2018	4/24/2019	10/9/2019[2]	4/14/2020	10/22/2020[2]	4/13/2021[2]	10/21/2021	10/21/2021	4/14/2022	10/18/2022	4/11/2023
Constituent	Unit	GWPS	Downgradient								Field Dup			
Appendix III														
Boron	ug/L	NA	157	142	190	--	242	--	--	956	1,000	1,370	1,350	1,290
Calcium	mg/L	NA	38.7	42.6	79	--	62.1	--	--	68.5	72.6	66.5	69.5	77.9
Chloride	mg/L	NA	17.5	20.6	23	--	14.1	--	--	13.9	14.2	11.3	12.4	13.1
Fluoride	ug/L	NA	< 1,000	< 1,000	< 1,000	--	< 1,000	--	--	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	NA	26.2	19.2	54	--	83.0	--	--	101	104	69.3	102	143
Total Dissolved Solids	mg/L	NA	298	166	360	--	336	--	--	418	419	355	430	475
pH, Field	SU	NA	7.4	7.6	7.4	--	7.0	--	--	8.0	--	8.1	8.0	7.7
Appendix IV														
Antimony	ug/L	6	< 1.0	< 1.0	< 1.0	--	< 1	--	--	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	**10**	2.9	4.0	4.0	--	3	--	--	7	7	8	7	5
Barium	ug/L	2,000	115	177	320	--	266	--	--	219	224	215	249	281
Beryllium	ug/L	4	< 1.0	< 1.0	< 1.0	--	< 1	--	--	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	< 0.20	< 0.20	< 0.20	--	< 0.2	--	--	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	1.2	31.3	35	--	2	--	--	1	2	2	< 1	< 1
Cobalt	ug/L	15	< 15.0	< 6.0	< 6.0	--	< 15	--	--	< 6	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	< 1,000	< 1,000	< 1,000	--	< 1,000	--	--	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	15	< 1.0	< 1.0	< 1.0	--	< 1	--	--	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	40	15	16	12	--	14	--	--	13	13	16	14	15
Mercury	ug/L	2	< 0.20	< 0.20	< 0.20	--	< 0.2	--	--	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	100	< 5.0	7.6	7.2	--	< 5	--	--	16	16	14	18	23
Radium-226/228	pCi/L	5.00	< 1.86	1.40	0.609	--	< 0.456	--	--	0.583	0.483	0.780	0.786	< 0.608
Selenium	ug/L	**50**	1.3	< 1.0	4.1	--	22	--	--	4	4	2	7	4
Thallium	ug/L	2	< 2.0	< 2.0	< 2.0	--	< 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.

-- - not analyzed.

GWPS - Groundwater Protection Standard. GWPS is the higher of the Maximum Contaminant Level/Regional Screening Level and Upper Tolerance Limit as established in TRC's Technical Memorandum dated October 15, 2018.

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) JHC-MW-15008 was decommissioned on June 24, 2019. Replacement well JHC-MW-15008R was installed on June 25, 2019.

(2) Not sampled; insufficient amount of groundwater present to collect sample.

(3) JHCW-MW-15007, JHC-MW-15009, and JHC-MW-15011 were decommissioned in July 2021. Replacement wells JHC-MW-15007R, JHC-MW-15009R, and JHC-MW-15011R were installed on July 20-22, 2021.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Pond A – RCRA CCR Monitoring Program
West Olive, Michigan

		Sample Location:	JHC-MW-15008R[1]									
		Sample Date:	10/9/2019	10/9/2019	4/14/2020	10/22/2020	4/13/2021	4/13/2021	10/21/2021	4/14/2022	10/18/2022	4/10/2023
Constituent	Unit	GWPS	Downgradient									
Appendix III				Field Dup				Field Dup				
Boron	ug/L	NA	130	130	505	285	352	360	786	1,320	1,680	1,300
Calcium	mg/L	NA	100	100	99.9	109	85.4	87.0	77.2	61.6	71.6	75.7
Chloride	mg/L	NA	16	16	25.0	18.8	17.2	17.1	15.7	12.2	13.6	13.4
Fluoride	ug/L	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	NA	220	220	235	215	185	186	112	80.3	85.3	107
Total Dissolved Solids	mg/L	NA	< 50	430	566	577	517	512	443	337	397	402
pH, Field	SU	NA	7.3	--	6.9	7.0	7.1	--	7.2	7.1	7.3	6.9
Appendix IV												
Antimony	ug/L	6	< 1.0	< 1.0	1	1	1	< 1	1	1	1	1
Arsenic	ug/L	**10**	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Barium	ug/L	2,000	340	320	252	216	200	195	167	151	167	172
Beryllium	ug/L	4	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	4.5	4.5	< 1	< 1	41	56	< 1	2	< 1	< 1
Cobalt	ug/L	15	< 6.0	< 6.0	< 15	< 6	< 6	< 6	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	15	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	40	15	15	19	19	20	21	19	20	20	18
Mercury	ug/L	2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	100	< 5.0	< 5.0	< 5	5	17	19	26	26	27	27
Radium-226/228	pCi/L	5.00	1.27	1.49	0.549	0.883	0.496	0.780	0.661	0.485	1.26	< 0.640
Selenium	ug/L	**50**	**110**	**110**	6	**68**	6	6	20	10	16	6
Thallium	ug/L	2	< 2.0	< 2.0	< 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.

-- - not analyzed.

GWPS - Groundwater Protection Standard. GWPS is the higher of the Maximum Contaminant Level/Regional Screening Level and Upper Tolerance Limit as established in TRC's Technical Memorandum dated October 15, 2018.

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) JHC-MW-15008 was decommissioned on June 24, 2019. Replacement well JHC-MW-15008R was installed on June 25, 2019.

(2) Not sampled; insufficient amount of groundwater present to collect sample.

(3) JHCW-MW-15007, JHC-MW-15009, and JHC-MW-15011 were decommissioned in July 2021. Replacement wells JHC-MW-15007R, JHC-MW-15009R, and JHC-MW-15011R were installed on July 20-22, 2021.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Pond A – RCRA CCR Monitoring Program
West Olive, Michigan

	Sample Location:		JHC-MW-15009[3]										JHC-MW-15009R[3]					
	Sample Date:		6/20/2018	11/15/2018	11/15/2018	4/24/2019	4/24/2019	10/9/2019[2]	4/14/2020	4/14/2020	10/22/2020[2]	4/13/2021[2]	10/21/2021	4/13/2022	10/18/2022	10/18/2022	4/10/2023	4/10/2023
Constituent	Unit	GWPS	Downgradient															
Appendix III					Field Dup		Field Dup			Field Dup						Field Dup		Field Dup
Boron	ug/L	NA	91.4	188	187	200	190	--	874	881	--	--	1,680	1,670	928	969	1,010	1,010
Calcium	mg/L	NA	41.2	46.2	46.4	92	89	--	78.7	79.9	--	--	58.7	64.8	58.8	59.4	90.8	89.4
Chloride	mg/L	NA	22.9	17.7	17.7	17	16	--	6.95	6.78	--	--	12.1	15.4	13.3	13.3	9.24	9.88
Fluoride	ug/L	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	--	< 1,000	< 1,000	--	--	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	NA	18.2	26.9	27.1	130	130	--	49.1	49.9	--	--	25.7	38.3	28.1	28.3	57.8	57.9
Total Dissolved Solids	mg/L	NA	214	234	202	430	440	--	354	341	--	--	301	292	298	271	368	380
pH, Field	SU	NA	7.7	7.6	--	7.4	--	--	7.2	--	--	--	7.1	6.9	7.2	--	6.7	--
Appendix IV																		
Antimony	ug/L	6	< 1.0	1.2	< 1.0	< 1.0	< 1.0	--	1	1	--	--	< 1	< 1	1	< 1	2	< 1
Arsenic	ug/L	**10**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1	< 1	--	--	1	1	< 1	< 1	< 1	< 1
Barium	ug/L	2,000	130	178	181	360	360	--	307	298	--	--	286	206	225	234	281	282
Beryllium	ug/L	4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1	< 1	--	--	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	--	< 0.2	< 0.2	--	--	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	< 1.0	14.1	11.8	17	14	--	1	1	--	--	< 1	< 1	< 1	< 1	< 1	< 1
Cobalt	ug/L	15	< 15.0	< 6.0	< 6.0	< 6.0	< 6.0	--	< 15	< 15	--	--	< 6	< 6	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	--	< 1,000	< 1,000	--	--	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	15	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1	< 1	--	--	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	40	< 10	14	14	11	11	--	14	14	--	--	15	15	12	12	14	15
Mercury	ug/L	2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	--	< 0.2	< 0.2	--	--	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	100	< 5.0	6.1	6.1	5.7	5.6	--	< 5	< 5	--	--	5	9	10	9	19	20
Radium-226/228	pCi/L	5.00	< 1.27	< 1.47	< 1.37	1.02	0.798	--	0.967	0.767	--	--	0.728	0.622	< 0.465	< 0.520	< 0.610	< 0.490
Selenium	ug/L	**50**	10.3	12.6	12.6	**61**	**63**	--	**77**	**79**	--	--	**62**	7	**58**	**64**	**64**	**63**
Thallium	ug/L	2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	--	< 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.

-- - not analyzed.

GWPS - Groundwater Protection Standard. GWPS is the higher of the Maximum Contaminant Level/Regional Screening Level and Upper Tolerance Limit as established in TRC's Technical Memorandum dated October 15, 2018.

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) JHC-MW-15008 was decommissioned on June 24, 2019. Replacement well JHC-MW-15008R was installed on June 25, 2019.

(2) Not sampled; insufficient amount of groundwater present to collect sample.

(3) JHCW-MW-15007, JHC-MW-15009, and JHC-MW-15011 were decommissioned in July 2021. Replacement wells JHC-MW-15007R, JHC-MW-15009R, and JHC-MW-15011R were installed on July 20-22, 2021.

Table 1

Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation

JH Campbell Pond A – RCRA CCR Monitoring Program

West Olive, Michigan

			Sample Location:	JHC-MW-15011[3]			JHC-MW-15011R[3]				
			Sample Date:	10/10/2019	4/15/2020	10/22/2020	4/13/2021	10/21/2021	4/13/2022	4/13/2022	10/18/2022	4/11/2023
Constituent	Unit	GWPS		Downgradient								
Appendix III										Field Dup		
Boron	ug/L	NA		690	2,870	4,120	5,070	2,150	3,780	3,910	3,050	2,310
Calcium	mg/L	NA		110	112	122	78.7	51.0	57.6	56.2	45.5	79.1
Chloride	mg/L	NA		9.4	4.16	3.79	2.65	13.5	14.6	14.6	9.79	8.05
Fluoride	ug/L	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	NA		180	183	141	113	45.0	56.6	56.3	46.2	87.5
Total Dissolved Solids	mg/L	NA		550	542	546	359	195	276	269	253	373
pH, Field	SU	NA		8.4	7.6	7.6	7.2	8.0	7.0	--	7.7	6.8
Appendix IV												
Antimony	ug/L	6		< 1.0	4	2	< 1	< 1	1	1	< 1	2
Arsenic	ug/L	**10**		**44**	**25**	**22**	**13**	3	7	7	**11**	5
Barium	ug/L	2000		360	514	430	399	131	197	203	185	342
Beryllium	ug/L	4		< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5		< 0.20	0.2	0.5	0.8	< 0.2	0.2	0.2	< 0.2	0.2
Chromium	ug/L	100		1.4	< 1	< 1	5	< 1	< 1	< 1	< 1	< 1
Cobalt	ug/L	15		< 6.0	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	15		< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	40		14	21	17	14	< 10	18	19	16	23
Mercury	ug/L	2		< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	100		11	7	< 5	8	13	16	15	16	21
Radium-226/228	pCi/L	5.00		0.963	0.848	0.497	0.923	0.585	0.434	0.402	< 0.462	< 0.552
Selenium	ug/L	**50**		**76**	29	**308**	**143**	4	40	40	**76**	**64**
Thallium	ug/L	2		< 2.0	< 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.

-- - not analyzed.

GWPS - Groundwater Protection Standard. GWPS is the higher of the Maximum Contaminant Level/Regional Screening Level and Upper Tolerance Limit as established in TRC's Technical Memorandum dated October 15, 2018.

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) JHC-MW-15008 was decommissioned on June 24, 2019. Replacement well JHC-MW-15008R was installed on June 25, 2019.

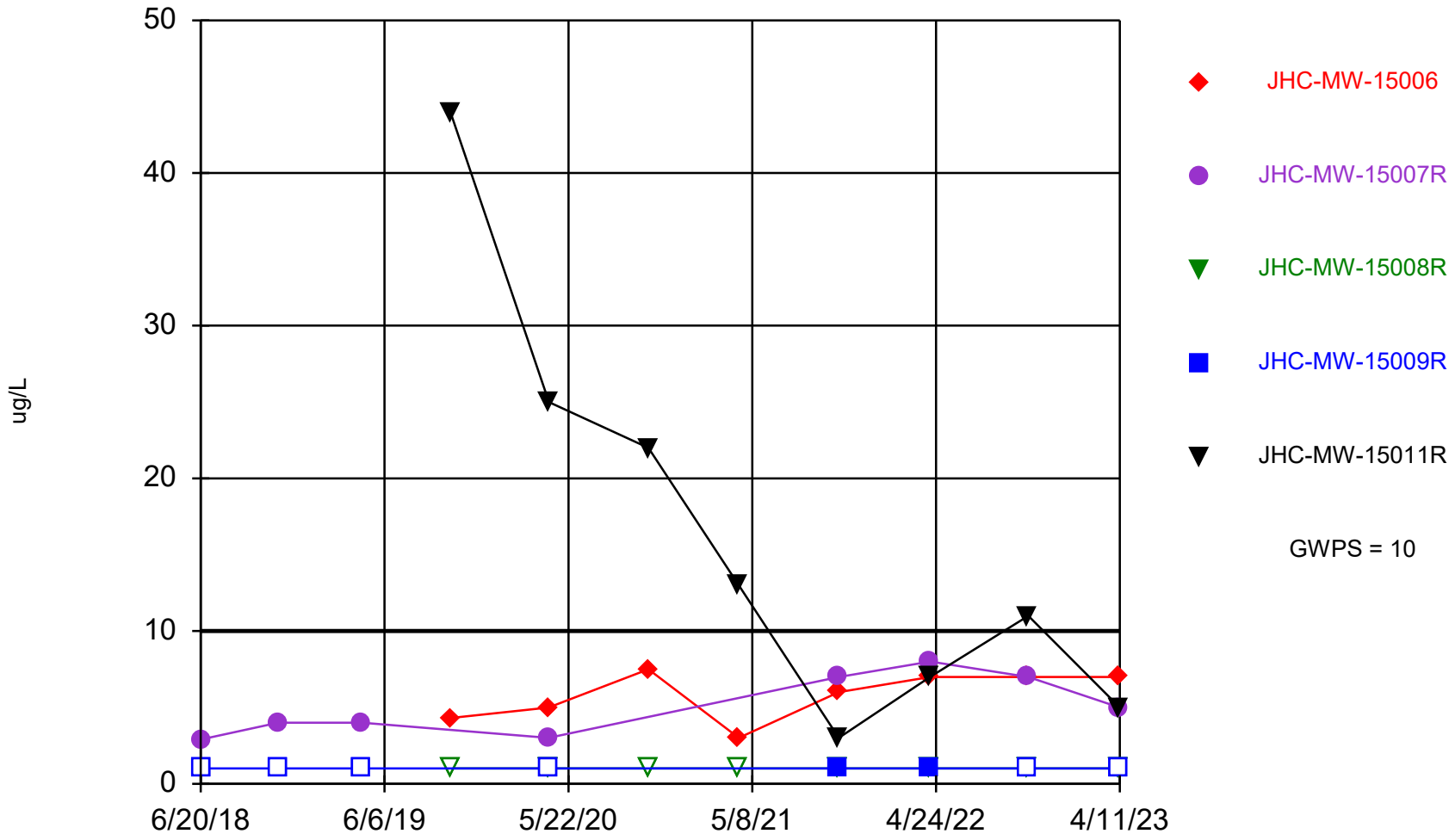
(2) Not sampled; insufficient amount of groundwater present to collect sample.

(3) JHCW-MW-15007, JHC-MW-15009, and JHC-MW-15011 were decommissioned in July 2021. Replacement wells JHC-MW-15007R, JHC-MW-15009R, and JHC-MW-15011R were installed on July 20-22, 2021.

Attachment 1
Sanitas™ Output

Hollow symbols indicate censored values.

Arsenic Comparison to GWPS

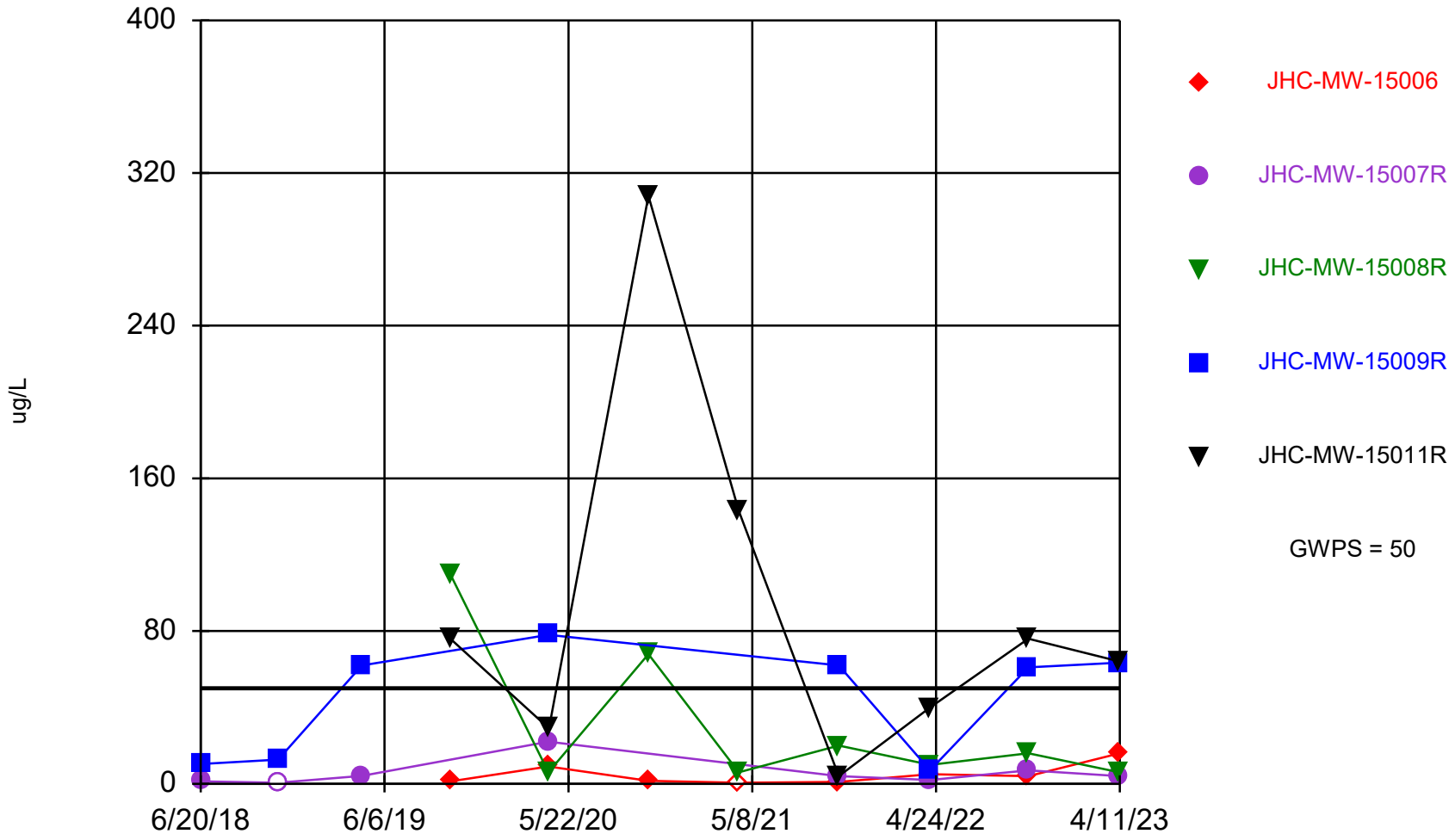


Time Series Analysis Run 5/22/2023 2:54 PM

Client: Consumers Energy Data: 2Q23_JHC_Sanitas

Hollow symbols indicate censored values.

Selenium Comparison to GWPS



Time Series Analysis Run 5/22/2023 2:58 PM

Client: Consumers Energy Data: 2Q23_JHC_Sanitas

Summary Report

Constituent: Arsenic, Total Analysis Run 5/22/2023 2:59 PM
Client: Consumers Energy Data: 2Q23_JHC_Sanitas

For observations made between 6/20/2018 and 4/11/2023, a summary of the selected data set:

Observations = 40
NDs = 35%
Wells = 5
Minimum Value = 1
Maximum Value = 44
Mean Value = 5.843
Median Value = 3.5
Standard Deviation = 8.16
Coefficient of Variation = 1.397
Skewness = 3.126

Well	#Obs.	NDs	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15006	8	0%	3	7.5	5.85	6.5	1.602	0.2738	-0.6848
JHC-MW-15007R	8	0%	2.9	8	5.113	4.5	1.975	0.3863	0.2876
JHC-MW-15008R	8	100%	1	1	1	1	0	0	NaN
JHC-MW-15009R	8	75%	1	1	1	1	0	0	NaN
JHC-MW-15011R	8	0%	3	44	16.25	12	13.66	0.8404	1.05

Summary Report

Constituent: Selenium, Total Analysis Run 5/22/2023 2:57 PM
Client: Consumers Energy Data: 2Q23_JHC_Sanitas

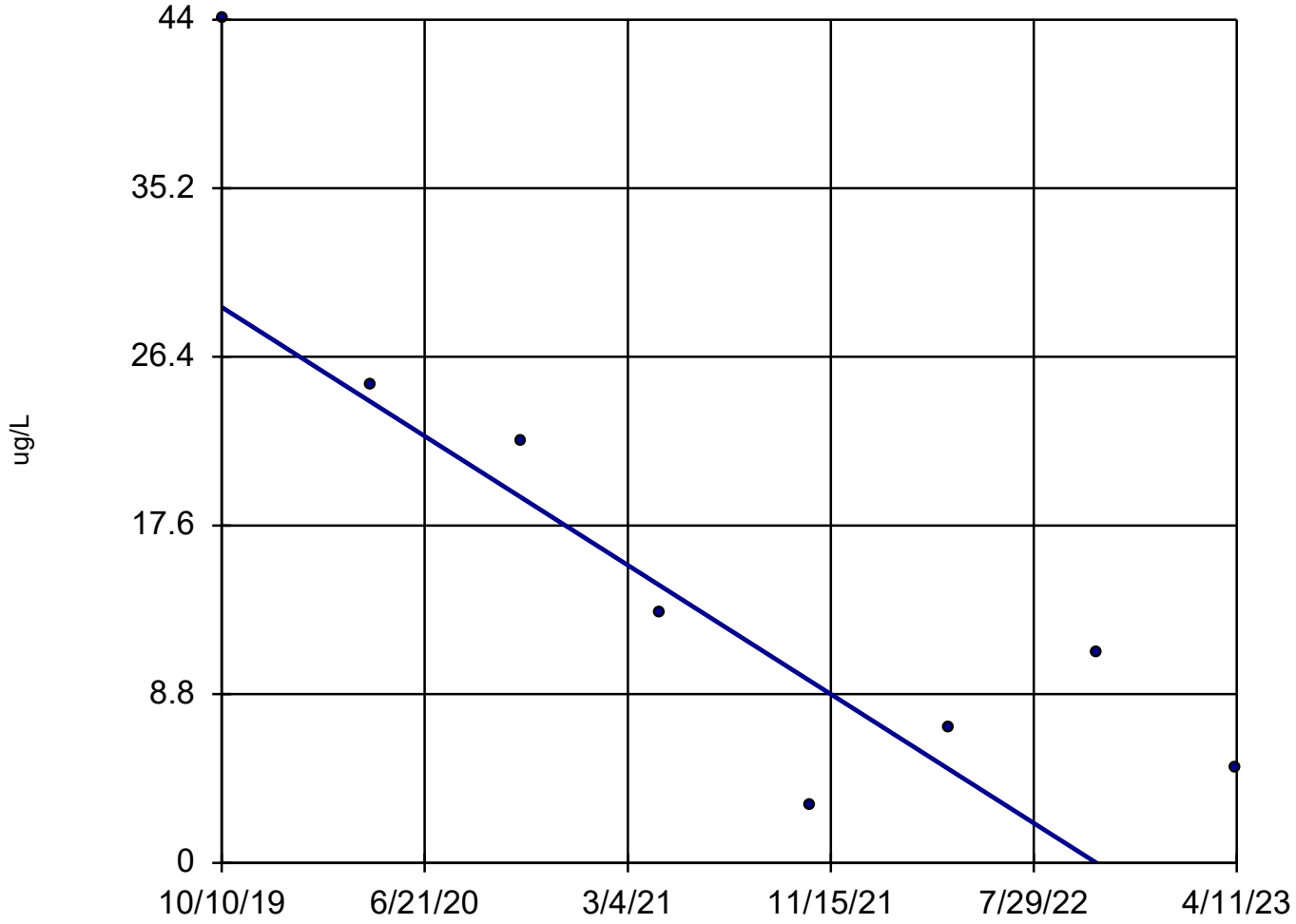
For observations made between 6/20/2018 and 4/11/2023, a summary of the selected data set:

Observations = 40
NDs = 5%
Wells = 5
Minimum Value = 1
Maximum Value = 308
Mean Value = 35.57
Median Value = 10.15
Standard Deviation = 56.21
Coefficient of Variation = 1.58
Skewness = 3.149

Well	#Obs.	NDs	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15006	8	12%	1	16	4.85	2.75	5.288	1.09	1.302
JHC-MW-15007R	8	12%	1	22	5.675	4	6.875	1.211	1.929
JHC-MW-15008R	8	0%	6	110	30.25	13	38.3	1.266	1.375
JHC-MW-15009R	8	0%	7	78	44.55	61.5	29.18	0.6551	-0.4082
JHC-MW-15011R	8	0%	4	308	92.5	70	96.34	1.041	1.539

Arsenic, Total

JHC-MW-15011R



n = 8

Slope = -9.601 units per year.

Mann-Kendall statistic = -20
critical = -20

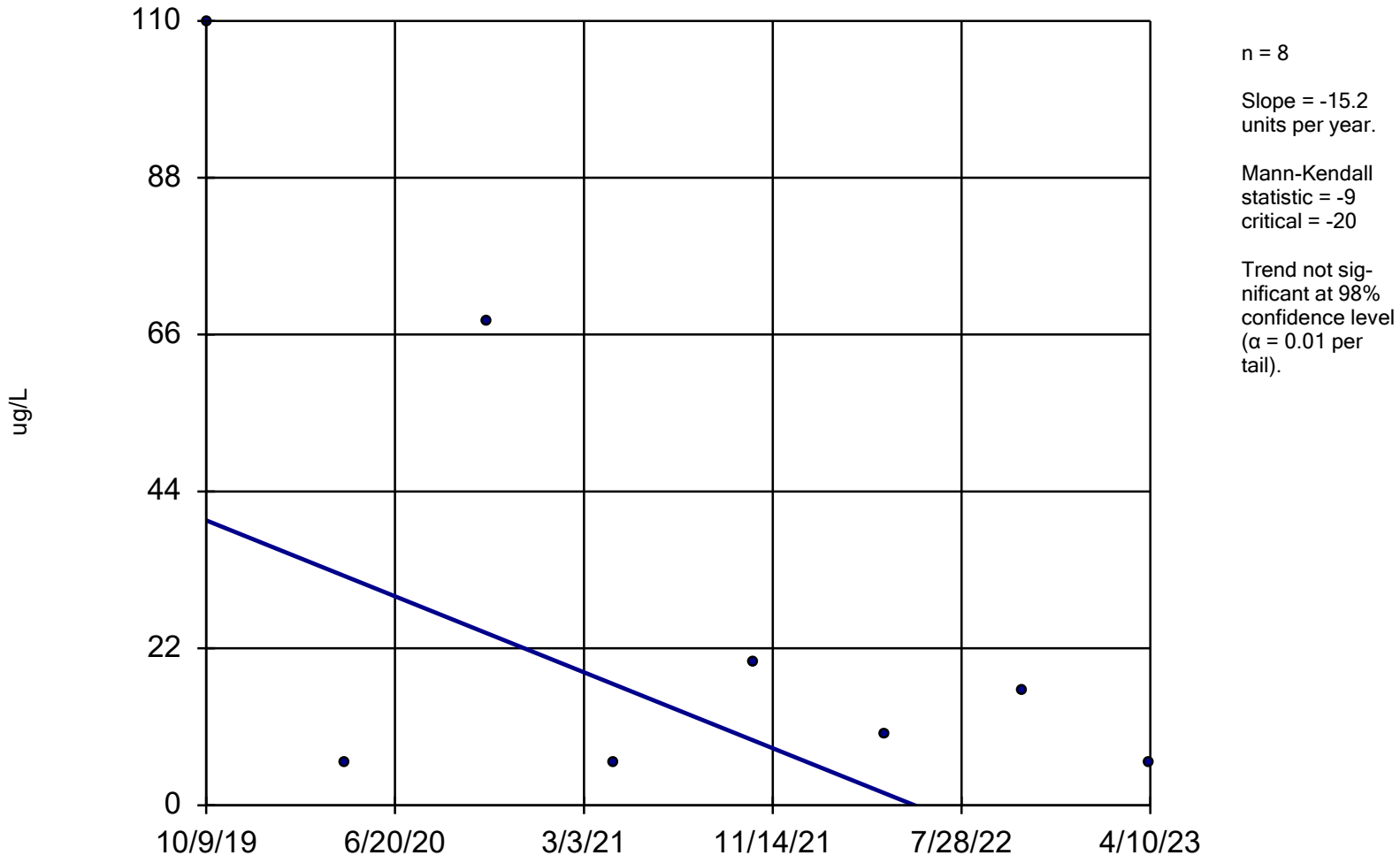
Trend not significant at 98% confidence level (α = 0.01 per tail).

Sen's Slope Estimator Analysis Run 5/22/2023 3:04 PM

Client: Consumers Energy Data: 2Q23_JHC_Sanitas

Selenium, Total

JHC-MW-15008R



n = 8

Slope = -15.2 units per year.

Mann-Kendall statistic = -9
critical = -20

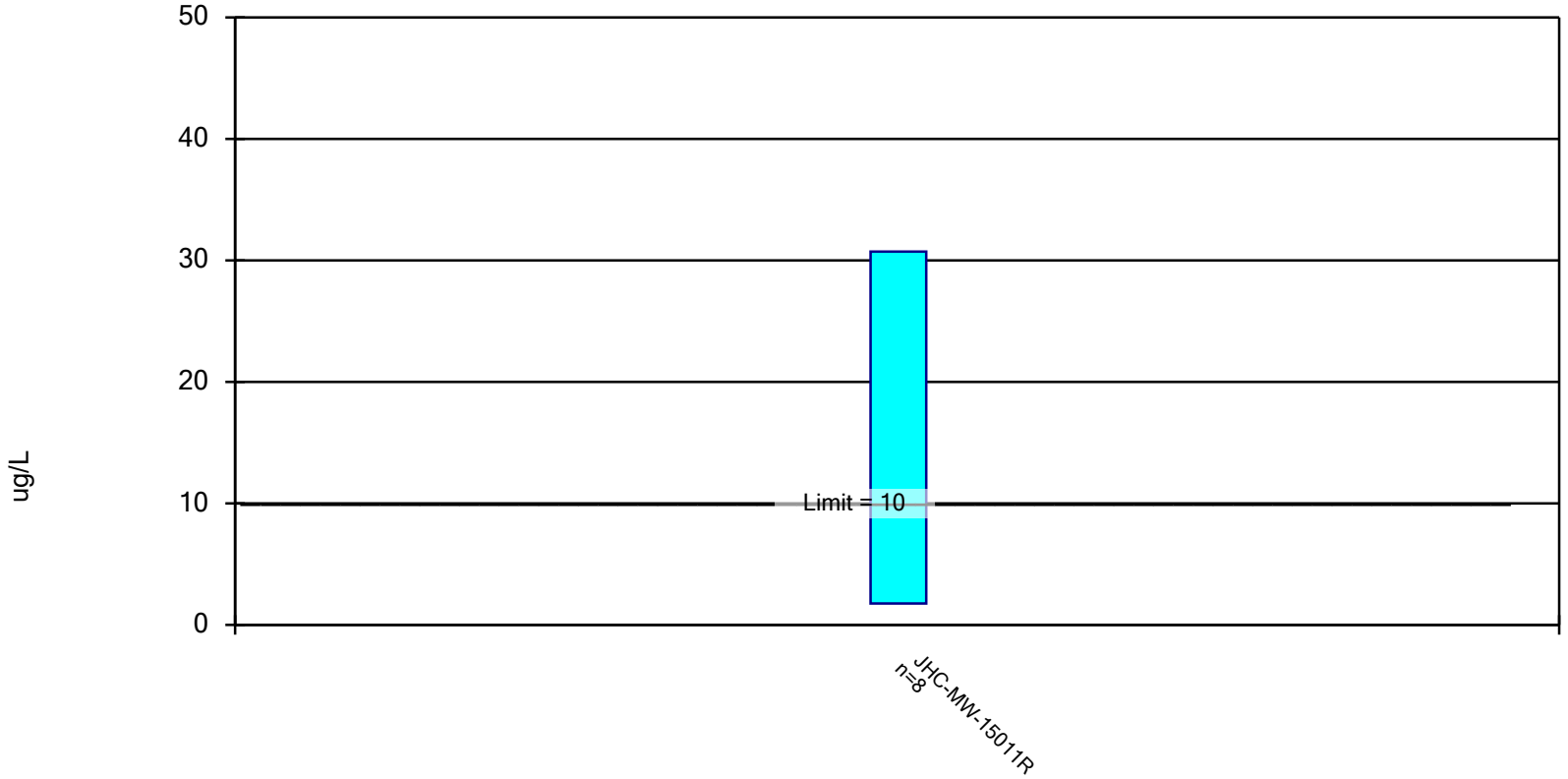
Trend not significant at 98% confidence level (α = 0.01 per tail).

Sen's Slope Estimator Analysis Run 5/22/2023 3:02 PM

Client: Consumers Energy Data: 2Q23_JHC_Sanitas

Parametric Confidence Interval

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



Constituent: Arsenic, Total Analysis Run 5/22/2023 3:05 PM

Client: Consumers Energy Data: 2Q23_JHC_Sanitas

Confidence Interval

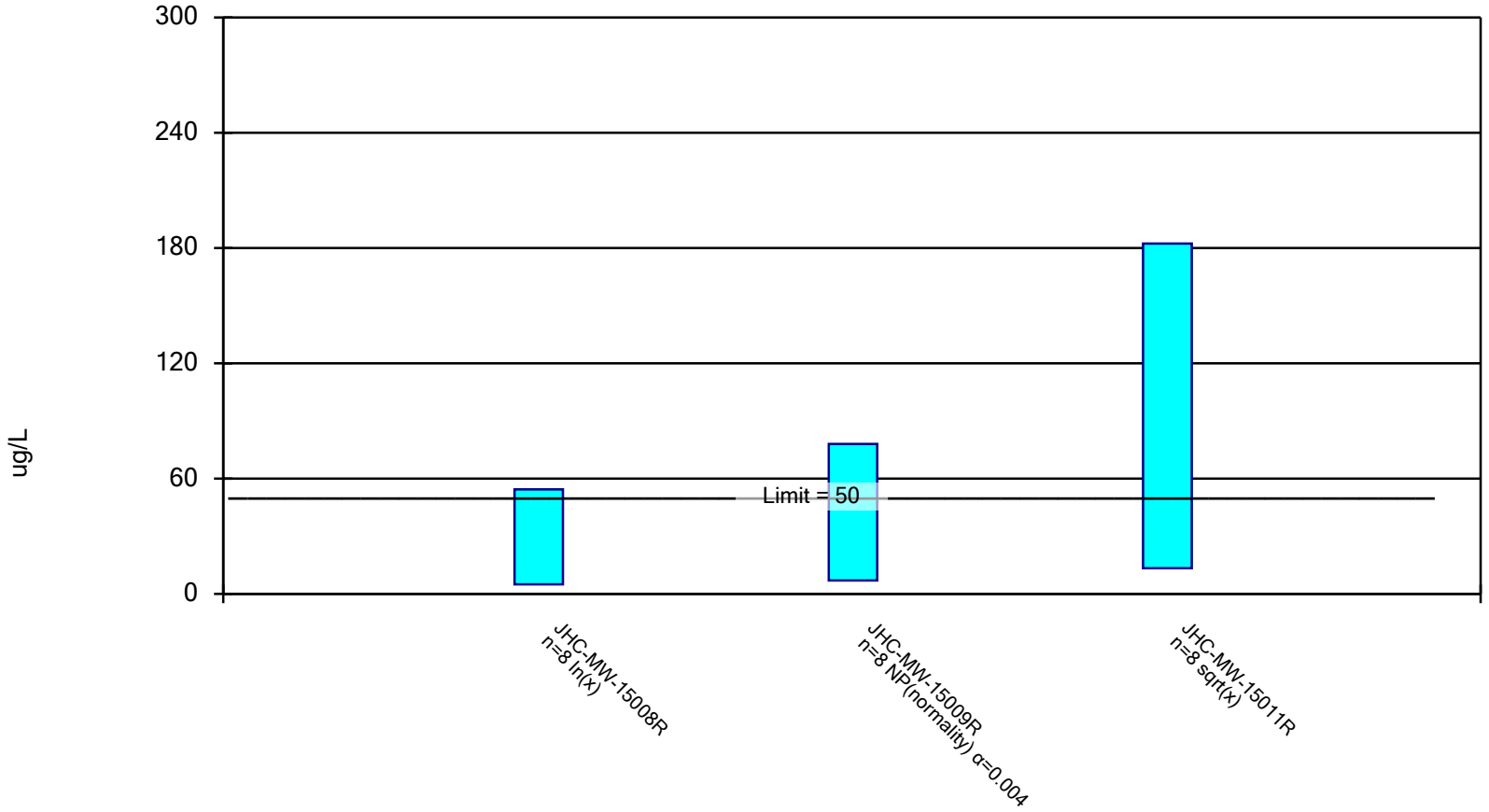
Constituent: Arsenic, Total (ug/L) Analysis Run 5/22/2023 3:05 PM

Client: Consumers Energy Data: 2Q23_JHC_Sanitas

	JHC-MW-15011R
10/10/2019	44
4/15/2020	25
10/22/2020	22
4/13/2021	13
10/21/2021	3
4/13/2022	7 (D)
10/18/2022	11
4/11/2023	5
Mean	16.25
Std. Dev.	13.66
Upper Lim.	30.73
Lower Lim.	1.775

Parametric and Non-Parametric (NP) Confidence Interval

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



Constituent: Selenium, Total Analysis Run 5/22/2023 3:01 PM

Client: Consumers Energy Data: 2Q23_JHC_Sanitas

Confidence Interval

Constituent: Selenium, Total (ug/L) Analysis Run 5/22/2023 3:01 PM

Client: Consumers Energy Data: 2Q23_JHC_Sanitas

	JHC-MW-15008R	JHC-MW-15009R	JHC-MW-15011R
6/20/2018		10.3	
11/15/2018		12.6 (D)	
4/24/2019		62 (D)	
10/9/2019	110 (D)		
10/10/2019			76
4/14/2020	6	78 (D)	
4/15/2020			29
10/22/2020	68		308
4/13/2021	6 (D)		143
10/21/2021	20	62	4
4/13/2022		7	40 (D)
4/14/2022	10		
10/18/2022	16	61 (D)	76
4/10/2023	6	63.5 (D)	
4/11/2023			64
Mean	30.25	44.55	92.5
Std. Dev.	38.3	29.18	96.34
Upper Lim.	54.33	78	182.3
Lower Lim.	4.935	7	13.41

Appendix C
October 2023 Assessment Monitoring Statistical Evaluation

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Technical Memorandum

Date:	January 18, 2024
To:	Harold D. Register, Jr., Consumers Energy
From:	Sarah Holmstrom, TRC Kristin Lowery, TRC Henry Schnaidt, TRC
Project No.:	514398.0000.0000 Phase 1 Task 2
Subject:	Statistical Evaluation of October 2023 Assessment Monitoring Sampling Event, JH Campbell Bottom Ash Pond A 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 Pond A. The second semiannual assessment monitoring event of 2023 was conducted on October 16 through 18, 2023. 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 2023 indicates that no constituents are present at statistically significant levels exceeding the GWPSs in downgradient monitoring wells at the Pond A CCR Unit.

Constituent	GWPS	# Downgradient Wells Observed

No constituents are present at statistically significant levels above the GWPSs.

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.

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

Assessment Monitoring Statistical Evaluation

The downgradient compliance well network at Pond A consists of five wells (JHC-MW-15006, JHC-MW-15007R, JHC-MW-15008R, JHC-MW-15009R and JHC-MW-150011R) located south and east of Pond A. As discussed in the *2019 Annual Groundwater Monitoring and Corrective Action Report and Fourth Quarter 2019 Hydrogeological Monitoring Report* for the Pond A CCR Unit dated January 2020, monitoring well JHC-MW-15008 was decommissioned and replacement monitoring well JHC-MW-15008R was installed in June 2019. As detailed in the *2021 Annual Groundwater Monitoring and Corrective Action Report, JH Campbell Power Plant, Pond A* (TRC, January 2022), monitoring wells JHC-MW-15007, JHC-MW-15009, and JHC-MW-15011 were decommissioned and replacement monitoring wells JHC-MW-15007R, JHC-MW-15009R, and JHC-MW-15011R were installed in July 2021 and JHC-MW-15010 was removed from the monitoring program. For the purposes of statistical evaluation, the data sets from the replacement monitoring wells have been pooled with the former monitoring wells given that the wells were replaced to reset the screens at a lower elevation and data integrity was maintained before and after replacement. Use of the combined dataset is denoted with the "/R" to denote data from the original and replacement well are being used in the analysis.

Following the second semiannual assessment monitoring sampling event for 2023, compliance well data for Pond A 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 1. Constituent-well combinations that included a direct exceedance of the GWPS within the past eight monitoring events (April 2020 through October 2023 for JHC-MW-15006, JHC-MW-15008/R, and JHC-MW-15011/R and November 2018 through October 2023 for JHC-MW-15007/R and JHC-MW-15009/R) were retained for further analysis (Attachment 1). Direct comparison GWPS exceedances included the following constituent-well combinations:

- Selenium at JHC-MW-15008/R;
- Selenium at JHC-MW-15009/R; and,
- Arsenic and selenium at JHC-MW-15011/R.

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 used to perform the statistical comparison of compliance data to a fixed standard. Parametric or 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 results for these well-constituent pairs were observed visually for potential outliers and trends. No outliers were apparent. Visual decreasing trends were observed for arsenic in JH-MW-15011/R and selenium in JHC-MW-15008/R (time-series plots in Attachment 1); however, the trends were not statistically significant. Groundwater conditions are re-equilibrating following capping activities at Pond A that were completed in Summer 2019. Because hydrogeologic conditions are in the process of stabilizing, temporary trending and sporadic outlier data are not unexpected. Therefore, all data is used in the statistical evaluation.

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 compliance 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 α = 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-15011/R Selenium at JHC-MW-15009/R
Normalized by square root transformation	Selenium at JHC-MW-15011/R
Nonparametric (not able to be normalized)	Selenium at JHC-MW-15008/R

The confidence interval test compares the lower confidence limit to the GWPS. The statistical evaluation of the Appendix IV constituents shows no statistically significant exceedances of the GWPSs. Arsenic was identified at downgradient monitoring well JHC-MW-15011 at statistically significant levels exceeding the GWPS during the initial assessment monitoring event conducted in June 2018. As shown in Table 1 and Attachment 1, arsenic concentrations in this well declined in 2020 and 2021 and the lower confidence limit has been below the GWPS since the second semiannual event of 2021. 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 1 Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation

Attachment 1 Sanitas™ Output

Table 1

Table 1

Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation

JH Campbell Pond A – RCRA CCR Monitoring Program

West Olive, Michigan

		Sample Location:	JHC-MW-15006								
		Sample Date:	4/14/2020	10/22/2020	10/22/2020	4/13/2021	10/21/2021	4/14/2022	10/18/2022	4/11/2023	10/17/2023
Constituent	Unit	GWPS									
Appendix III					Field Dup						
Boron	ug/L	NA	284	272	331	288	371	676	765	670	757
Calcium	mg/L	NA	102	87.2	84.3	82.0	84.5	59.2	67.2	68.8	75.7
Chloride	mg/L	NA	24.9	22.0	22.2	22.9	19.6	17.0	18.3	13.3	18.3
Fluoride	ug/L	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	NA	260	253	251	257	217	101	179	98.3	204
Total Dissolved Solids	mg/L	NA	562	515	511	497	485	341	458	385	552
pH, Field	SU	NA	7.2	7.5	--	7.7	7.8	7.8	8.3	7.8	8.2
Appendix IV											
Antimony	ug/L	6	1	1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	**10**	5	9	6	3	6	7	7	7	8
Barium	ug/L	2,000	353	382	194	188	211	139	151	144	162
Beryllium	ug/L	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	1	5	1	3	2	1	< 1	1	< 1
Cobalt	ug/L	15	< 15	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	40	13	15	14	12	13	13	13	12	14
Mercury	ug/L	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	100	16	38	37	54	48	17	24	12	19
Radium-226/228	pCi/L	5.00	0.944	0.318	0.453	0.673	0.634	0.395	0.663	< 0.879	0.643
Selenium	ug/L	**50**	9	2	1	< 1	1	5	4	16	32
Thallium	ug/L	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.

-- - not analyzed.

GWPS - Groundwater Protection Standard. GWPS is the higher of the Maximum Contaminant Level/Regional Screening Level and Upper Tolerance Limit as established in TRC's Technical Memorandum dated October 15, 2018.

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) JHC-MW-15008 was decommissioned on June 24, 2019. Replacement well JHC-MW-15008R was installed on June 25, 2019.

(2) Not sampled; insufficient amount of groundwater present to collect sample.

(3) JHCW-MW-15007, JHC-MW-15009, and JHC-MW-15011 were decommissioned in July 2021. Replacement wells JHC-MW-15007R, JHC-MW-15009R, and JHC-MW-15011R were installed on July 20-22, 2021.

Table 1

Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation

JH Campbell Pond A – RCRA CCR Monitoring Program

West Olive, Michigan

		Sample Location:	JHC-MW-15007[3]						JHC-MW-15007R[3]					
		Sample Date:	11/15/2018	4/24/2019	10/9/2019[2]	4/14/2020	10/22/2020[2]	4/13/2021[2]	10/21/2021	10/21/2021	4/14/2022	10/18/2022	4/11/2023	10/17/2023
Constituent	Unit	GWPS								Field Dup				
Appendix III														
Boron	ug/L	NA	142	190	--	242	--	--	956	1,000	1,370	1,350	1,290	1,630
Calcium	mg/L	NA	42.6	79	--	62.1	--	--	68.5	72.6	66.5	69.5	77.9	68.3
Chloride	mg/L	NA	20.6	23	--	14.1	--	--	13.9	14.2	11.3	12.4	13.1	17.0
Fluoride	ug/L	NA	< 1,000	< 1,000	--	< 1,000	--	--	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	NA	19.2	54	--	83.0	--	--	101	104	69.3	102	143	118
Total Dissolved Solids	mg/L	NA	166	360	--	336	--	--	418	419	355	430	475	453
pH, Field	SU	NA	7.6	7.4	--	7.0	--	--	8.0	--	8.1	8.0	7.7	7.9
Appendix IV														
Antimony	ug/L	6	< 1.0	< 1.0	--	< 1	--	--	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	**10**	4.0	4.0	--	3	--	--	7	7	8	7	5	7
Barium	ug/L	2,000	177	320	--	266	--	--	219	224	215	249	281	233
Beryllium	ug/L	4	< 1.0	< 1.0	--	< 1	--	--	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	< 0.20	< 0.20	--	< 0.2	--	--	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	31.3	35	--	2	--	--	1	2	2	< 1	< 1	< 1
Cobalt	ug/L	15	< 6.0	< 6.0	--	< 15	--	--	< 6	< 6	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	< 1,000	< 1,000	--	< 1,000	--	--	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	15	< 1.0	< 1.0	--	< 1	--	--	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	40	16	12	--	14	--	--	13	13	16	14	15	14
Mercury	ug/L	2	< 0.20	< 0.20	--	< 0.2	--	--	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	100	7.6	7.2	--	< 5	--	--	16	16	14	18	23	27
Radium-226/228	pCi/L	5.00	1.40	0.609	--	< 0.456	--	--	0.583	0.483	0.780	0.786	< 0.608	0.862
Selenium	ug/L	**50**	< 1.0	4.1	--	22	--	--	4	4	2	7	4	9
Thallium	ug/L	2	< 2.0	< 2.0	--	< 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.

-- - not analyzed.

GWPS - Groundwater Protection Standard. GWPS is the higher of the Maximum Contaminant Level/Regional Screening Level and Upper Tolerance Limit as established in TRC's Technical Memorandum dated October 15, 2018.

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) JHC-MW-15008 was decommissioned on June 24, 2019. Replacement well JHC-MW-15008R was installed on June 25, 2019.

(2) Not sampled; insufficient amount of groundwater present to collect sample.

(3) JHCW-MW-15007, JHC-MW-15009, and JHC-MW-15011 were decommissioned in July 2021. Replacement wells JHC-MW-15007R, JHC-MW-15009R, and JHC-MW-15011R were installed on July 20-22, 2021.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Pond A – RCRA CCR Monitoring Program
West Olive, Michigan

		Sample Location:	JHC-MW-15008R[(1)]								
		Sample Date:	4/14/2020	10/22/2020	4/13/2021	4/13/2021	10/21/2021	4/14/2022	10/18/2022	4/10/2023	10/17/2023
Constituent	Unit	GWPS									
Appendix III						Field Dup					
Boron	ug/L	NA	505	285	352	360	786	1,320	1,680	1,300	1,260
Calcium	mg/L	NA	99.9	109	85.4	87.0	77.2	61.6	71.6	75.7	52.9
Chloride	mg/L	NA	25.0	18.8	17.2	17.1	15.7	12.2	13.6	13.4	15.5
Fluoride	ug/L	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	NA	235	215	185	186	112	80.3	85.3	107	67.0
Total Dissolved Solids	mg/L	NA	566	577	517	512	443	337	397	402	323
pH, Field	SU	NA	6.9	7.0	7.1	--	7.2	7.1	7.3	6.9	7.2
Appendix IV											
Antimony	ug/L	6	1	1	1	< 1	1	1	1	1	1
Arsenic	ug/L	**10**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Barium	ug/L	2,000	252	216	200	195	167	151	167	172	121
Beryllium	ug/L	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	< 1	< 1	41	56	< 1	2	< 1	< 1	< 1
Cobalt	ug/L	15	< 15	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	40	19	19	20	21	19	20	20	18	18
Mercury	ug/L	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	100	< 5	5	17	19	26	26	27	27	18
Radium-226/228	pCi/L	5.00	0.549	0.883	0.496	0.780	0.661	0.485	1.26	< 0.640	< 0.517
Selenium	ug/L	**50**	6	**68**	6	6	20	10	16	6	11
Thallium	ug/L	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.

-- - not analyzed.

GWPS - Groundwater Protection Standard. GWPS is the higher of the Maximum Contaminant Level/Regional Screening Level and Upper Tolerance Limit as established in TRC's Technical Memorandum dated October 15, 2018.

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) JHC-MW-15008 was decommissioned on June 24, 2019. Replacement well JHC-MW-15008R was installed on June 25, 2019.

(2) Not sampled; insufficient amount of groundwater present to collect sample.

(3) JHCW-MW-15007, JHC-MW-15009, and JHC-MW-15011 were decommissioned in July 2021. Replacement wells JHC-MW-15007R, JHC-MW-15009R, and JHC-MW-15011R were installed on July 20-22, 2021.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Pond A – RCRA CCR Monitoring Program
West Olive, Michigan

	Sample Location:		JHC-MW-15009[3]									JHC-MW-15009R[3]						
	Sample Date:		11/15/2018	11/15/2018	4/24/2019	4/24/2019	10/9/2019[2]	4/14/2020	4/14/2020	10/22/2020[2]	4/13/2021[2]	10/21/2021	4/13/2022	10/18/2022	10/18/2022	4/10/2023	4/10/2023	10/17/2023	10/17/2023
Constituent	Unit	GWPS																	
Appendix III				Field Dup		Field Dup			Field Dup						Field Dup		Field Dup		Field Dup
Boron	ug/L	NA	188	187	200	190	--	874	881	--	--	1,680	1,670	928	969	1,010	1,010	1,230	1,250
Calcium	mg/L	NA	46.2	46.4	92	89	--	78.7	79.9	--	--	58.7	64.8	58.8	59.4	90.8	89.4	74.1	71.5
Chloride	mg/L	NA	17.7	17.7	17	16	--	6.95	6.78	--	--	12.1	15.4	13.3	13.3	9.24	9.88	11.2	11.2
Fluoride	ug/L	NA	< 1,000	< 1,000	< 1,000	< 1,000	--	< 1,000	< 1,000	--	--	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	NA	26.9	27.1	130	130	--	49.1	49.9	--	--	25.7	38.3	28.1	28.3	57.8	57.9	33.1	32.9
Total Dissolved Solids	mg/L	NA	234	202	430	440	--	354	341	--	--	301	292	298	271	368	380	318	310
pH, Field	SU	NA	7.6	--	7.4	--	--	7.2	--	--	--	7.1	6.9	7.2	--	6.7	--	6.9	--
Appendix IV																			
Antimony	ug/L	6	1.2	< 1.0	< 1.0	< 1.0	--	1	1	--	--	< 1	< 1	1	< 1	2	< 1	< 1	< 1
Arsenic	ug/L	**10**	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1	< 1	--	--	1	1	< 1	< 1	< 1	< 1	< 1	< 1
Barium	ug/L	2,000	178	181	360	360	--	307	298	--	--	286	206	225	234	281	282	273	270
Beryllium	ug/L	4	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1	< 1	--	--	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	< 0.20	< 0.20	< 0.20	< 0.20	--	< 0.2	< 0.2	--	--	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	14.1	11.8	17	14	--	1	1	--	--	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cobalt	ug/L	15	< 6.0	< 6.0	< 6.0	< 6.0	--	< 15	< 15	--	--	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	< 1,000	< 1,000	< 1,000	< 1,000	--	< 1,000	< 1,000	--	--	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	15	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1	< 1	--	--	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	40	14	14	11	11	--	14	14	--	--	15	15	12	12	14	15	13	13
Mercury	ug/L	2	< 0.20	< 0.20	< 0.20	< 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	100	6.1	6.1	5.7	5.6	--	< 5	< 5	--	--	5	9	10	9	19	20	9	9
Radium-226/228	pCi/L	5.00	< 1.47	< 1.37	1.02	0.798	--	0.967	0.767	--	--	0.728	0.622	< 0.465	< 0.520	< 0.610	< 0.490	0.969	< 0.491
Selenium	ug/L	**50**	12.6	12.6	**61**	**63**	--	**77**	**79**	--	--	**62**	7	**58**	**64**	**64**	**63**	**155**	**155**
Thallium	ug/L	2	< 2.0	< 2.0	< 2.0	< 2.0	--	< 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.

-- - not analyzed.

GWPS - Groundwater Protection Standard. GWPS is the higher of the Maximum Contaminant Level/Regional Screening Level and Upper Tolerance Limit as established in TRC's Technical Memorandum dated October 15, 2018.

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) JHC-MW-15008 was decommissioned on June 24, 2019. Replacement well JHC-MW-15008R was installed on June 25, 2019.

(2) Not sampled; insufficient amount of groundwater present to collect sample.

(3) JHCW-MW-15007, JHC-MW-15009, and JHC-MW-15011 were decommissioned in July 2021. Replacement wells JHC-MW-15007R, JHC-MW-15009R, and JHC-MW-15011R were installed on July 20-22, 2021.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Pond A – RCRA CCR Monitoring Program
West Olive, Michigan

		Sample Location:	JHC-MW-15011[3]			JHC-MW-15011R[3]					
		Sample Date:	4/15/2020	10/22/2020	4/13/2021	10/21/2021	4/13/2022	4/13/2022	10/18/2022	4/11/2023	10/17/2023
Constituent	Unit	GWPS						Field Dup			
Appendix III											
Boron	ug/L	NA	2,870	4,120	5,070	2,150	3,780	3,910	3,050	2,310	3,420
Calcium	mg/L	NA	112	122	78.7	51.0	57.6	56.2	45.5	79.1	47.2
Chloride	mg/L	NA	4.16	3.79	2.65	13.5	14.6	14.6	9.79	8.05	8.27
Fluoride	ug/L	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	NA	183	141	113	45.0	56.6	56.3	46.2	87.5	56.7
Total Dissolved Solids	mg/L	NA	542	546	359	195	276	269	253	373	238
pH, Field	SU	NA	7.6	7.6	7.2	8.0	7.0	--	7.7	6.8	7.0
Appendix IV											
Antimony	ug/L	6	4	2	< 1	< 1	1	1	< 1	2	< 1
Arsenic	ug/L	**10**	**25**	**22**	**13**	3	7	7	**11**	5	7
Barium	ug/L	2000	514	430	399	131	197	203	185	342	264
Beryllium	ug/L	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	0.2	0.5	0.8	< 0.2	0.2	0.2	< 0.2	0.2	< 0.2
Chromium	ug/L	100	< 1	< 1	5	< 1	< 1	< 1	< 1	< 1	< 1
Cobalt	ug/L	15	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	40	21	17	14	< 10	18	19	16	23	17
Mercury	ug/L	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	100	7	< 5	8	13	16	15	16	21	19
Radium-226/228	pCi/L	5.00	0.848	0.497	0.923	0.585	0.434	0.402	< 0.462	< 0.552	0.547
Selenium	ug/L	**50**	29	**308**	**143**	4	40	40	**76**	**64**	**79**
Thallium	ug/L	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.

-- - not analyzed.

GWPS - Groundwater Protection Standard. GWPS is the higher of the Maximum Contaminant Level/Regional Screening Level and Upper Tolerance Limit as established in TRC's Technical Memorandum dated October 15, 2018.

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) JHC-MW-15008 was decommissioned on June 24, 2019. Replacement well JHC-MW-15008R was installed on June 25, 2019.

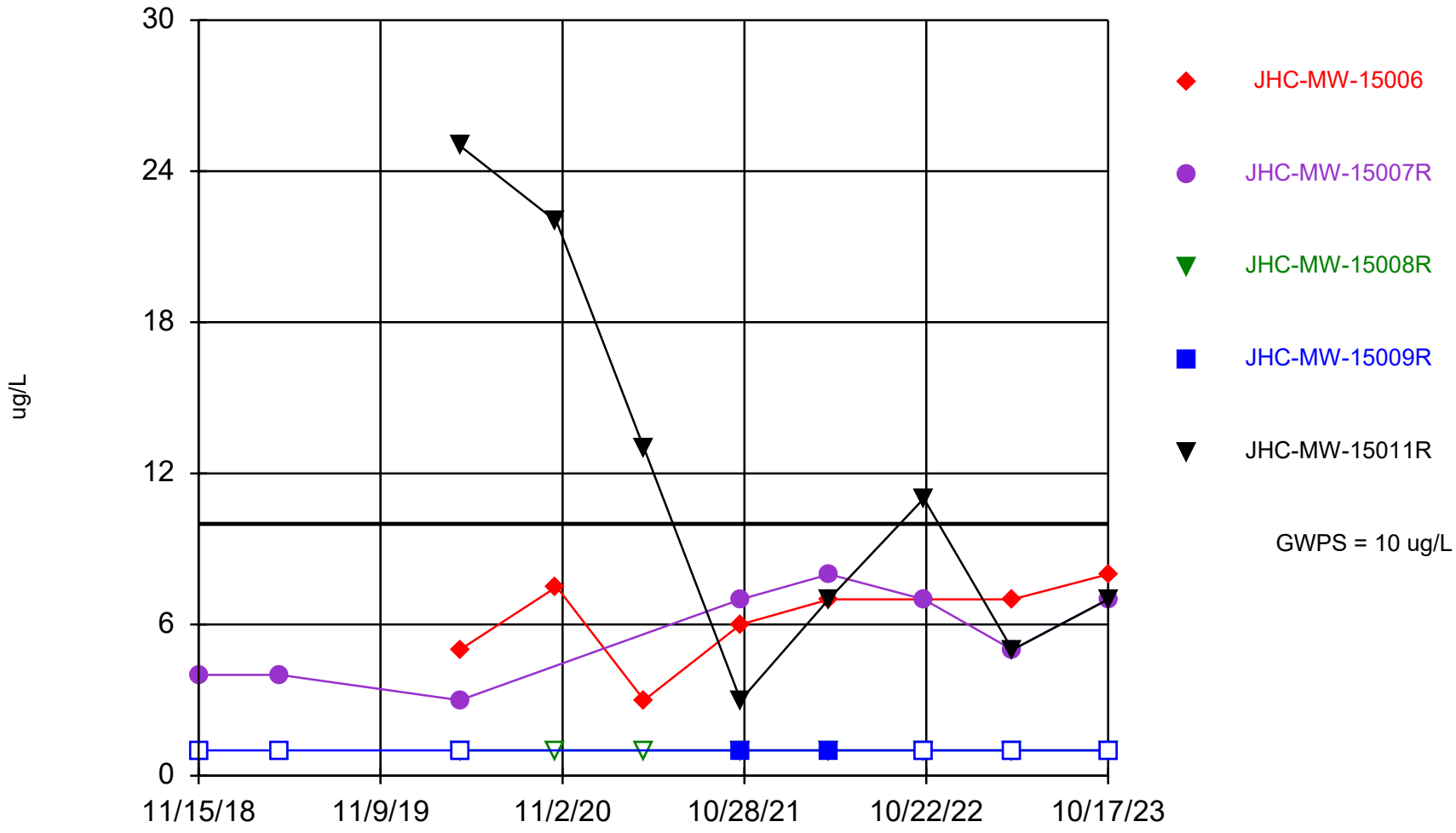
(2) Not sampled; insufficient amount of groundwater present to collect sample.

(3) JHCW-MW-15007, JHC-MW-15009, and JHC-MW-15011 were decommissioned in July 2021. Replacement wells JHC-MW-15007R, JHC-MW-15009R, and JHC-MW-15011R were installed on July 20-22, 2021.

Attachment 1
Sanitas™ Output

Hollow symbols indicate censored values.

Arsenic Comparison to GWPS

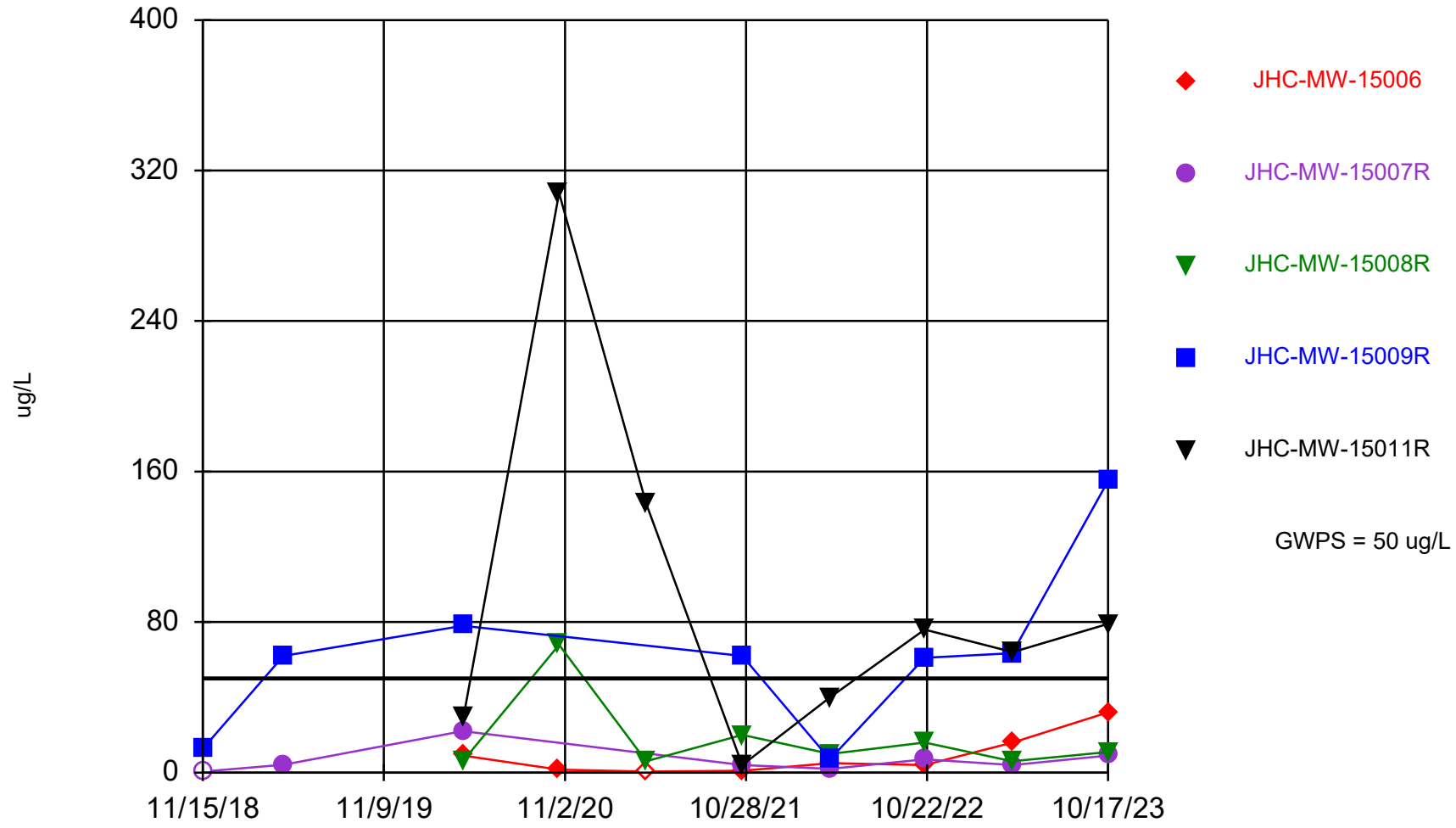


Time Series Analysis Run 12/1/2023 1:12 PM

Client: Consumers Energy Data: 4Q23_JHC_Sanitas

Hollow symbols indicate censored values.

Selenium Comparison to GWPS



Time Series Analysis Run 12/1/2023 1:24 PM

Client: Consumers Energy Data: 4Q23_JHC_Sanitas

Summary Report

Constituent: Arsenic, Total Analysis Run 12/1/2023 1:16 PM
Client: Consumers Energy Data: 4Q23_JHC_Sanitas

For observations made between 11/15/2018 and 10/17/2023, a summary of the selected data set:

Observations = 40
NDs = 35%
Wells = 5
Minimum Value = 1
Maximum Value = 25
Mean Value = 5.113
Median Value = 4
Standard Deviation = 5.349
Coefficient of Variation = 1.046
Skewness = 2.096

Well	#Obs.	NDs	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15006	8	0%	3	8	6.313	7	1.624	0.2573	-1.111
JHC-MW-15007R	8	0%	3	8	5.625	6	1.847	0.3283	-0.1387
JHC-MW-15008R	8	100%	1	1	1	1	0	0	NaN
JHC-MW-15009R	8	75%	1	1	1	1	0	0	NaN
JHC-MW-15011R	8	0%	3	25	11.63	9	8.017	0.6896	0.7059

Summary Report

Constituent: Selenium, Total Analysis Run 12/1/2023 1:24 PM
Client: Consumers Energy Data: 4Q23_JHC_Sanitas

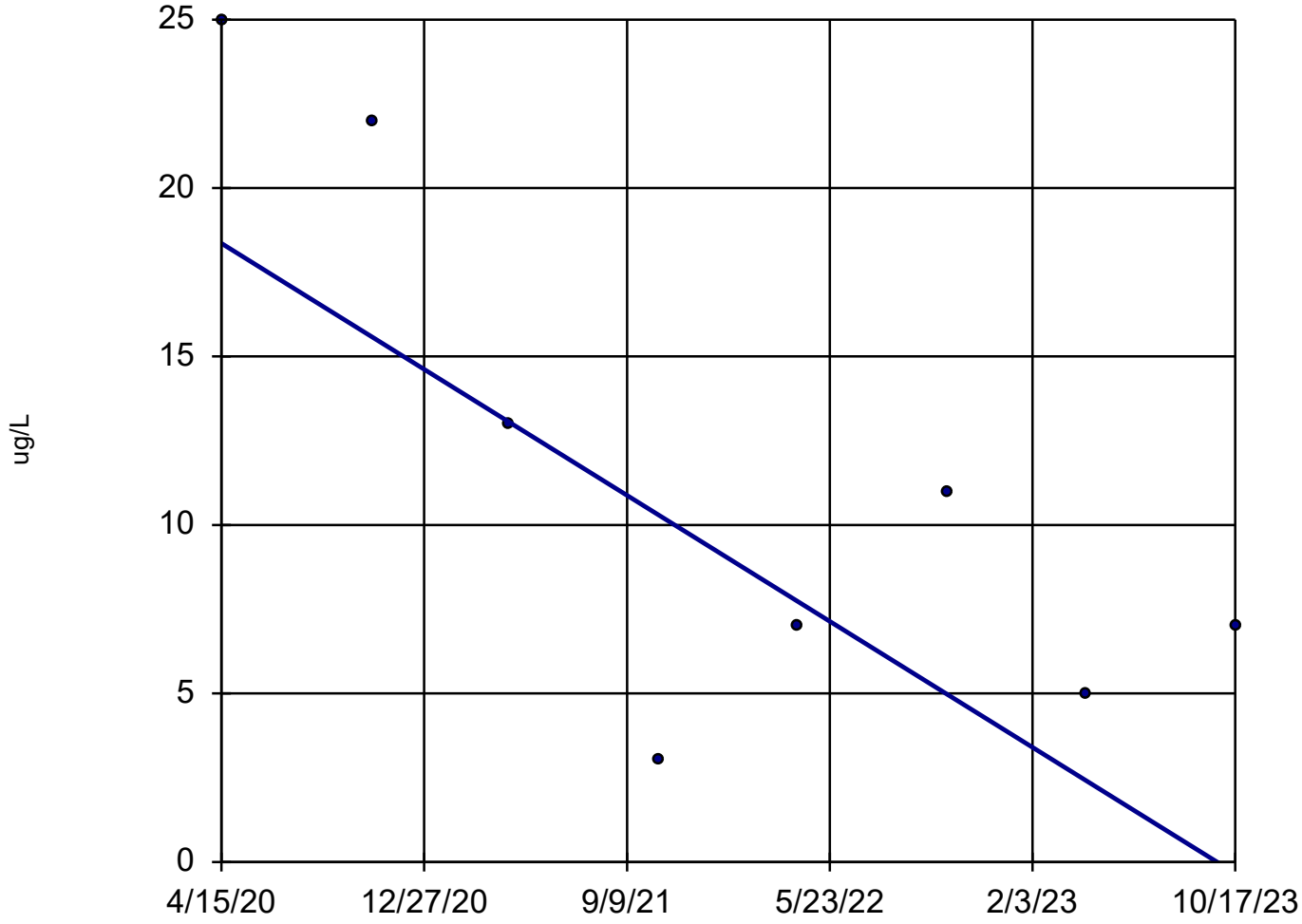
For observations made between 11/15/2018 and 10/17/2023, a summary of the selected data set:

Observations = 40
NDs = 5%
Wells = 5
Minimum Value = 1
Maximum Value = 308
Mean Value = 37.74
Median Value = 11.8
Standard Deviation = 57.81
Coefficient of Variation = 1.532
Skewness = 2.964

Well	#Obs.	NDs	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15006	8	12%	1	32	8.688	4.5	10.71	1.232	1.447
JHC-MW-15007R	8	12%	1	22	6.638	4.05	6.712	1.011	1.67
JHC-MW-15008R	8	0%	6	68	17.88	10.5	20.88	1.168	2.014
JHC-MW-15009R	8	0%	7	155	62.64	62	45.31	0.7234	0.8112
JHC-MW-15011R	8	0%	4	308	92.88	70	96.27	1.037	1.53

Arsenic, Total

JHC-MW-15011R



n = 8

Slope = -5.332 units per year.

Mann-Kendall statistic = -15
critical = -20

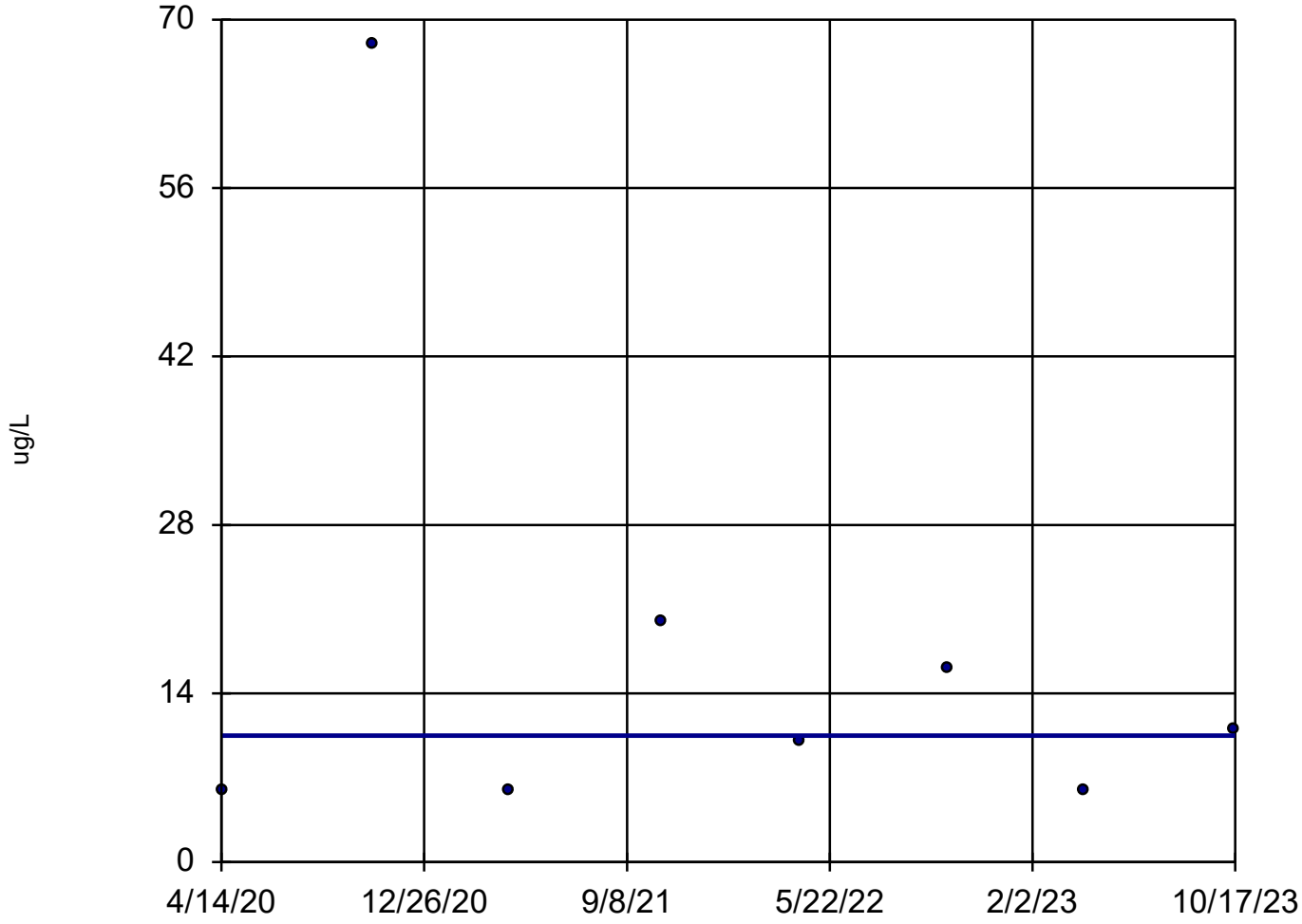
Trend not significant at 98% confidence level (α = 0.01 per tail).

Sen's Slope Estimator Analysis Run 12/1/2023 1:16 PM

Client: Consumers Energy Data: 4Q23_JHC_Sanitas

Selenium, Total

JHC-MW-15008R



n = 8

Slope = 0
units per year.

Mann-Kendall
statistic = -1
critical = -20

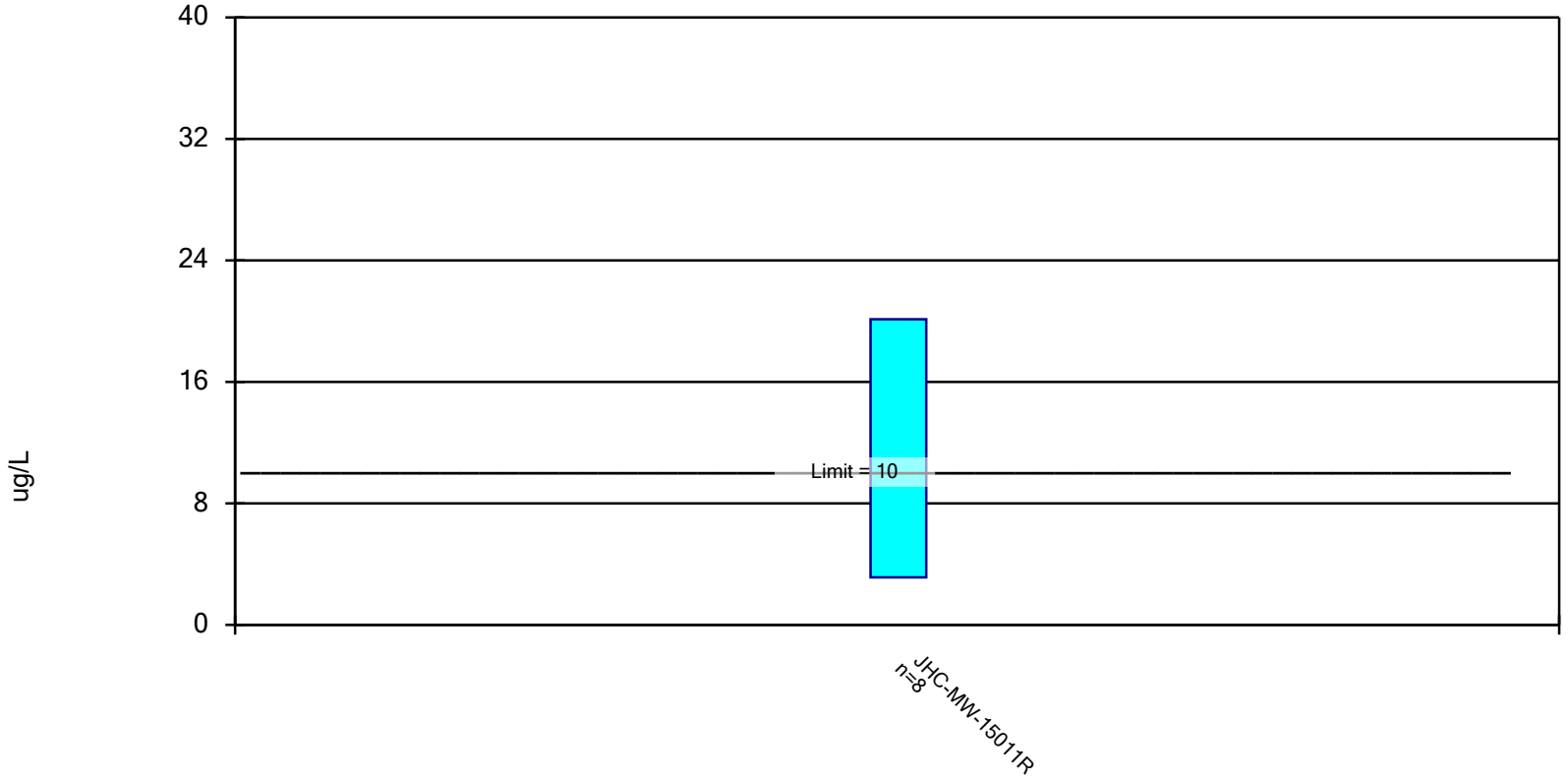
Trend not sig-
nificant at 98%
confidence level
(α = 0.01 per
tail).

Sen's Slope Estimator Analysis Run 12/1/2023 1:27 PM

Client: Consumers Energy Data: 4Q23_JHC_Sanitas

Parametric Confidence Interval

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



Constituent: Arsenic, Total Analysis Run 12/1/2023 3:33 PM

Client: Consumers Energy Data: 4Q23_JHC_Sanitas

Confidence Interval

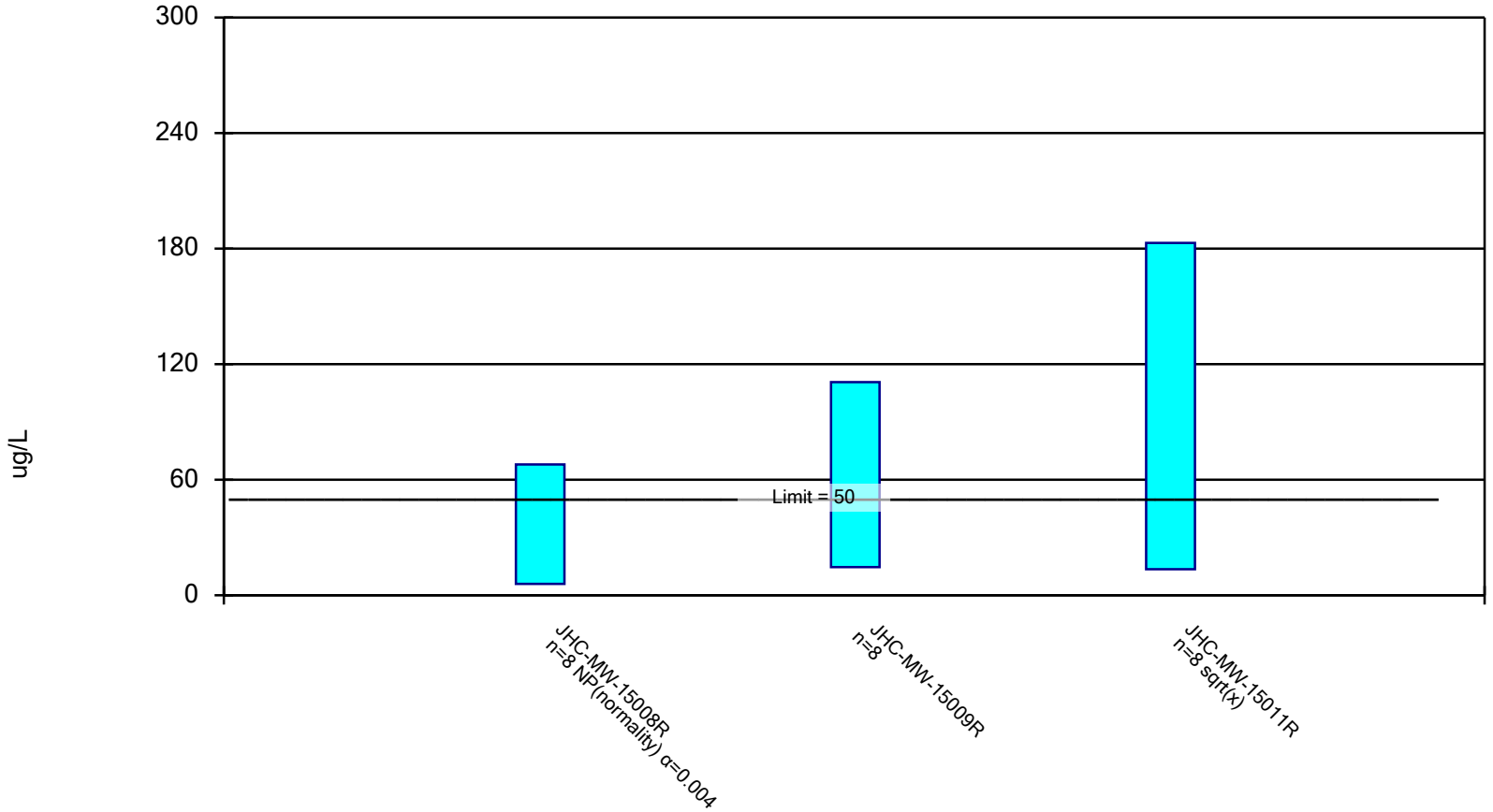
Constituent: Arsenic, Total (ug/L) Analysis Run 12/1/2023 3:34 PM

Client: Consumers Energy Data: 4Q23_JHC_Sanitas

	JHC-MW-15011R
4/15/2020	25
10/22/2020	22
4/13/2021	13
10/21/2021	3
4/13/2022	7 (D)
10/18/2022	11
4/11/2023	5
10/17/2023	7
Mean	11.63
Std. Dev.	8.017
Upper Lim.	20.12
Lower Lim.	3.128

Parametric and Non-Parametric (NP) Confidence Interval

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



Constituent: Selenium, Total Analysis Run 12/1/2023 3:14 PM

Client: Consumers Energy Data: 4Q23_JHC_Sanitas

Confidence Interval

Constituent: Selenium, Total (ug/L) Analysis Run 12/1/2023 3:14 PM

Client: Consumers Energy Data: 4Q23_JHC_Sanitas

	JHC-MW-15008R	JHC-MW-15009R	JHC-MW-15011R
11/15/2018		12.6 (D)	
4/24/2019		62 (D)	
4/14/2020	6	78 (D)	
4/15/2020			29
10/22/2020	68		308
4/13/2021	6 (D)		143
10/21/2021	20	62	4
4/13/2022		7	40 (D)
4/14/2022	10		
10/18/2022	16	61 (D)	76
4/10/2023	6	63.5 (D)	
4/11/2023			64
10/17/2023	11	155 (D)	79
Mean	17.88	62.64	92.88
Std. Dev.	20.88	45.31	96.27
Upper Lim.	68	110.7	182.9
Lower Lim.	6	14.61	13.55

Appendix D
Semiannual Progress Report

January 30, 2024

Subject:
Semiannual Progress Report - Selection of Remedy
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 the Pond A CCR unit that triggered Assessment of Corrective Measures (ACM) under the CCR Rule at the JH Campbell Solid Waste Disposal Area. 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 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

Subsequently, the Assessment of Corrective Measures Report (TRC, September 2019) was completed on September 11, 2019 for Pond A. Five remedial approaches were evaluated and presented based on source control by construction of a final cover and certifying the closure in place for Pond A.

Semi-annual progress reports have been completed by placing the document in the operating record and making it available on the CE public-facing website starting with the 2019 Annual Groundwater Monitoring and Corrective Action Report and Fourth Quarter Hydrogeological Monitoring Report (TRC, 2020).

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

Assessment Activities

CE 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 was 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.

Increases in Appendix III constituents (e.g. boron) at multiple well locations and direct exceedances of the selenium GWPS in JHC-MW-15011R, JHC-MW-15009R, 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 remedial action plan (RAP) for these units was submitted to EGLE on September 30, 2021. In a letter sent June 10, 2022, CE committed to revising elements of the RAP based on comments received and ongoing discussion with EGLE.

Conclusions

Arsenic at JHC-MW-15011/R continues to demonstrate attenuation in visual downward concentration trends. 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 indicates 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 a final cover system as the primary corrective action for Pond A, but also considered five technically feasible groundwater management alternatives to address the potential for residual arsenic. The first alternative was to monitor post-source control groundwater concentration improvements (e.g. no additional measures required once source control was completed), but four other alternatives were retained in the event GWPS could not be achieved for all constituents in all monitoring wells in the groundwater monitoring system.

The remedy for 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.

Golder Associates. October 2016. JH Campbell Generating Facility Pond A Closure Plan, West Olive, Michigan. Prepared for Consumers Energy Company.

TRC Environmental Corporation. September 2019. Assessment of Corrective Measures, Consumers Energy Company JH Campbell Ponds 1-2 North and 1-2 South and Pond A Coal Combustion Residual Units. Prepared for Consumers Energy Company.