2022 Annual Groundwater Monitoring and Corrective Action Report

JH Campbell Power Plant
Pond 3 North and 3 South CCR Unit

West Olive, Michigan

January 2023

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Executive Summary

On behalf of Consumers Energy, TRC has prepared this report for the JH Campbell Pond 3 to cover the period of January 1, 2022 to December 31, 2022 and document the status of groundwater monitoring and corrective action for 2022 in accordance with §257.90(e).

Consumers Energy first reported the potential for statistically significant increases (SSIs) for Appendix III constituents in the *Annual Groundwater Monitoring Report, JH Campbell Power Plant, Unit 3 North and 3 South CCR Unit* (TRC, January 2018). The statistical evaluation of the Appendix III indicator parameters confirming SSIs over background were as follows:

- Boron at JHC-MW-15012, JHC-MW-15013, JHC-MW-15015 and JHC-MW-15016;
- Calcium at JHC-MW-15015 and JHC-MW-15016;
- Sulfate at JHC-MW-15012, JHC-MW-15013, JHC-MW-15015 and JHC-MW-15016; and
- Total dissolved solids (TDS) at JHC-MW-15015 and JHC-MW-15016.

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 compared the assessment monitoring data to the groundwater protection standards (GWPSs) to determine whether or not Appendix IV constituents are detected at statistically significant levels above the GWPSs in accordance with §257.95.

The subsequent semiannual statistical evaluations performed to date, including those in the 2022 reporting period, have shown that no Appendix IV constituents were present at statistically significant levels above the GWPSs. Therefore, Consumers Energy remains in assessment monitoring and will not seek to initiate an assessment of corrective measures pursuant to 257.95(g)(3).

Consumers Energy will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98. The next semiannual assessment monitoring events are tentatively scheduled for the second and fourth calendar quarter of 2023.

1.0 Introduction

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule) (USEPA, April 2015 as amended). Standards for groundwater monitoring and corrective action codified in the CCR Rule (40 CFR 257.90 – 257.98), apply to the Consumers Energy Company (Consumers Energy) Ponds 3 North and 3 South at the JH Campbell Power Plant Site (Pond 3). 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 calendar year 2022 activities at Pond 3 from January 1, 2022 to December 31, 2022. Pond 3 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 2022 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, Unit 3 North and 3 South CCR Unit* (TRC, January 2018). The statistical evaluation of the Appendix III indicator parameters confirming SSIs over background were as follows:

- Boron at JHC-MW-15012, JHC-MW-15013, JHC-MW-15015 and JHC-MW-15016;
- Calcium at JHC-MW-15015 and JHC-MW-15016;
- Sulfate at JHC-MW-15012, JHC-MW-15013, JHC-MW-15015 and JHC-MW-15016; and
- Total dissolved solids (TDS) at JHC-MW-15015 and JHC-MW-15016.

As discussed in the *2018 Annual Groundwater Monitoring Report for the JH Campbell Power Plant Units 3 North and 3 South CCR Unit* (2018 Annual Report) (TRC, January 2019), upon determining that an Alternate Source Demonstration for the Appendix III constituents was not successful, Consumers Energy initiated an Assessment Monitoring Program for the Pond 3 CCR unit on April 25, 2018 pursuant to §257.95 of the CCR Rule. The assessment monitoring program includes sampling and analyzing groundwater within the groundwater monitoring system for all constituents listed in Appendix III and Appendix IV.

In accordance with §257.93(h)(2) and within the compliance schedule clarified by the USEPA in April 2018, the first round of semiannual assessment monitoring data was statistically evaluated against the Groundwater Protection Standards (GWPSs) as reported on January 14, 2019 and placed in the operating record in accordance with §257.105(h)(8). This comparison showed that no Appendix IV constituents were present at statistically significant levels above the GWPSs. Therefore, Consumers Energy remained in assessment monitoring. The subsequent assessment monitoring evaluations, including those in the 2022 reporting period, have also indicated that no Appendix IV constituents have been present in downgradient monitoring wells

at statistically significant levels exceeding the GWPSs. Therefore, the Pond 3 monitoring system remained in assessment monitoring and has continued to be sampled for the Appendix III and Appendix IV constituents and statistically evaluated on a semiannual basis in accordance with §257.95. Assessment monitoring data that have been collected and evaluated in 2022 are presented in this report.

1.2 Site Overview

The JH Campbell 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, and Pond A. Site features are shown on Figure 2.

The surface impoundments in the wet ash pond areas (Pond 3 and Ponds 1-2) were decommissioned throughout 2017 and 2018 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 former Pond 3 CCR Unit.

1.3 Geology/Hydrogeology

The upgradient/background wells are located to the north-northwest of the Dry Ash Landfill. Groundwater is typically encountered at elevations ranging from 604 feet near the background wells to 590 feet along the southeast corner of the Dry Ash Landfill and south of the former Ponds 1-2 and Pond A CCR surface impoundments and generally flows to the south-southeast toward the Pigeon River. The subsurface materials encountered at the JH Campbell site generally consist of approximately 40 to 60 feet of poorly graded, fine-grained lacustrine sand. A laterally extensive clay-rich till is generally encountered within approximately 40 to 60 ft bgs across the site that according to deep drilling logs conducted at the JH Campbell Power Plant (just west of the CCR units) is on the order of 80 feet thick and extends to the top of shale bedrock approximately 140 ft bgs.

2.0 Groundwater Monitoring

2.1 Monitoring Well Network

In accordance with 40 CFR 257.91, Consumers Energy established a groundwater monitoring system for Pond 3, which currently consists of 12 monitoring wells (6 background monitoring wells, 4 downgradient monitoring wells, and 2 upgradient monitoring wells) that are screened in the uppermost aquifer. The monitoring well locations are shown on Figure 2. No changes to the Pond 3 monitoring well network were made in 2022.

Six monitoring wells located north-northwest of the Dry Ash Landfill provide data on background groundwater quality that has not been affected by CCR management at the site (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.

Four monitoring wells (JHC-MW-15013 and JHC-MW-18001 through JHC-MW-18003) located along the western and southern perimeter of Pond 3 provide data on groundwater quality downgradient of Pond 3. As documented in the *2019 Annual Groundwater Monitoring Report for the JH Campbell Power Plant Units 3 North and 3 South CCR Unit* (2019 Annual Report) (TRC, January 2020), due to the cessation of hydraulic loading and decommissioning of Pond 3, the groundwater flow direction changed significantly from the previous baseline and assessment monitoring events such that groundwater flow is generally toward the south/southwest at Pond 3. As a result, Pond 3 monitoring wells JHC-MW-15015 and JHC-MW-15016 are no longer positioned downgradient from Pond 3. Monitoring wells JHC-MW-15015 and JHC-MW-15016 were historically located downgradient of Pond 3 when groundwater flow was radially outward and will continue to be sampled and evaluated as part of the assessment monitoring program to evaluate groundwater quality post-CCR removal.

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(d), all wells in the CCR unit monitoring program must be sampled at least semiannually. One semiannual event must include analysis for all constituents from Appendix III and Appendix IV constituents and one semiannual event may include analysis for those constituents in Appendix IV of the CCR Rule that were detected during prior sampling. In addition to the Appendix III and IV constituents, field parameters including dissolved oxygen, oxidation reduction potential, specific conductivity, temperature, and turbidity were collected at each well. Samples were collected and analyzed in accordance with the *Sample Analysis Plan for JH Campbell Ponds 1-2 and Pond 3* (SAP) (TRC, 2021).

2.2.1 Data Summary

The first semiannual groundwater assessment monitoring event for 2022 was performed on April 11 through 14, 2022 and the second semiannual groundwater assessment monitoring event for 2022 was performed on October 17 through 20, 2022. Both events were performed by Consumers Energy, and samples were analyzed by Consumers Energy Laboratory Services in Jackson, Michigan, with radium samples analyzed by Eurofins Environment Testing Laboratories in St Louis, Missouri in accordance with the SAP. Static water elevation data were collected at all monitoring well locations. Groundwater samples were collected from the background monitoring wells and Pond 3 monitoring wells for the Appendix III and Appendix IV constituents and field parameters.

A summary of the groundwater data collected during April and October 2022 events are provided on Table 1 (static groundwater elevation data), Table 2 (field data), Table 3 (background analytical results), and Table 4 (Pond 3 analytical results).

2.2.2 Data Quality Review

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

2.2.3 Groundwater Flow Rate and Direction

Groundwater elevations measured across the Site during the April and October 2022 events are provided on Table 1. April 2022 and October 2022 groundwater elevations were used to construct the groundwater contour maps provided on Figure 3 and Figure 4, respectively. The average hydraulic gradient was calculated using the following well pairs: JHC-MW-15026/PZ-23S, MW-15017/PZ-24S, and JHC-MW-15024/JHC-MW-15031 and JHC-MW-15023/JHC-MW-15037 (Figure 2). The average hydraulic gradient was 0.0035 ft/ft in April 2022 and 0.0035 ft/ft in October 2022. 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 0.54 ft/day or 200 ft/year for the April 2022 event, and approximately 0.55 ft/day or 200 ft/year for the October 2022 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 3.

3.0 Statistical Evaluation

Assessment monitoring is continuing at Pond 3 in accordance with §257.95. The following section summarizes the statistical approach applied to assess the 2022 groundwater data in accordance with the assessment monitoring program. The statistical evaluations details are provided in Appendix B *(Statistical Evaluation of April 2022 Assessment Monitoring Sampling Event)* and Appendix C *(Statistical Evaluation of October 2022 Assessment Monitoring Sampling Event)*.

3.1 Establishing Groundwater Protection Standards

The Groundwater Protection Standards (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 (TRC, January 2019).

3.2 Data Comparison to Groundwater Protection Standards

Consistent with the Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance (Unified Guidance) (USEPA, 2009), the preferred method for comparisons to a fixed standard are confidence limits. An exceedance of the standard occurs when the 99 percent lower confidence level of the downgradient data exceeds the GWPS. As presented in the *2021 Annual Groundwater Monitoring Report for the JH Campbell Power Plant Units 3 North and 3 South CCR Unit* (2021 Annual Report) (TRC, January 2022), the statistical data comparison for the 2021 semiannual assessment monitoring events indicated that no Appendix IV constituents were present at statistically significant levels exceeding the GWPSs. Therefore, assessment monitoring continued in 2022.

The statistical data comparison for the April 2022 (Appendix B) and October 2022 (Appendix C) semiannual assessment monitoring events continue to indicate that no Appendix IV constituents were present at statistically significant levels exceeding the GWPSs. Therefore, Consumers Energy has continued assessment monitoring.

Overall, the statistical assessments have confirmed that no Appendix IV constituents are present at statistically significant levels above the GWPSs. A summary of the confidence intervals for April 2022 and October 2022 are provided in Table 5 and Table 6, respectively.

Per §257.95(e), Consumers Energy can return to detection monitoring at Pond 3 if the concentrations of all of the Appendix III and IV constituents are at or below background values for two consecutive events, using the statistical procedures included in §257.93(g). As shown on Table 4, several Appendix III and Appendix IV constituents are above the background upper tolerance limits (UTLs). Therefore, Consumers Energy will continue semiannual assessment monitoring per §257.95(d).

4.0 Corrective Action

There were no corrective actions needed or performed for Pond 3 within the calendar year 2022. The semiannual assessment monitoring analysis completed to-date indicate that no Appendix IV constituents are present at statistically significant levels exceeding the GWPSs. Therefore, Consumers Energy has continued semiannual assessment monitoring at Pond 3 per §257.95(d) and will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

5.0 Conclusions and Recommendations

Assessment monitoring groundwater samples are collected semiannually from the Pond 3 groundwater monitoring system wells and analyzed for Appendix III and Appendix IV constituents pursuant to §257.95(d). Pond 3 has been decommissioned and CCRs have been removed. The semiannual assessment monitoring analysis completed to-date indicates that no Appendix IV constituents are present at statistically significant levels exceeding the GWPSs. Therefore, Consumers Energy has continued semiannual assessment monitoring at Pond 3 and continues to evaluate groundwater quality post-CCR removal. Data that has been collected and evaluated in 2022 are presented in this report.

Per §257.95(e), Consumers Energy can return to detection monitoring at the Pond 3 if the concentrations of all of the Appendix III and IV constituents are at or below background values for two consecutive events, using the statistical procedures included in §257.93(g). Several Appendix III and Appendix IV constituents remain above the background levels. Therefore, Consumers Energy will continue semiannual assessment monitoring per §257.95(d) and 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 2023.

6.0 References

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

Tables

Table 1
Summary of Groundwater Elevation Data - April - October 2022
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 11, 2022		October 17, 2022	
							Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Background										
JHC-MW-15023	617.01	619.98	Sand	603.0	to	593.0	17.61	602.37	19.25	600.73
JHC-MW-15024	613.79	616.62	Sand	606.8	to	596.8	13.39	603.23	14.58	602.04
JHC-MW-15025	614.14	617.17	Sand	607.1	to	597.1	12.78	604.39	13.85	603.32
JHC-MW-15026	615.09	618.04	Sand	607.1	to	597.1	14.86	603.18	15.57	602.47
JHC-MW-15027	614.77	617.30	Sand	604.8	to	594.8	15.49	601.81	16.08	601.22
JHC-MW-15028	611.02	613.80	Sand	603.0	to	593.0	16.70	597.10	15.27	598.53
JHC-MW-15029	608.08	610.95	Sand	600.1	to	590.1	12.39	598.56	12.32	598.63
JHC-MW-15030	604.05	607.17	Sand	600.1	to	590.1	9.91	597.26	10.50	596.67
Pond 1N, 1S, 2N, 2S										
JHC-MW-15001	607.02	609.53	Sand	603.5	to	598.5	--		NM	
JHC-MW-15002	618.18	621.27	Sand	590.2	to	580.2	25.40	595.87	25.28	595.99
JHC-MW-15003	623.16	627.20	Sand	595.2	to	585.2	33.40	593.80	33.40	593.80
JHC-MW-15005	606.22	609.99	Sand	579.2	to	569.2	18.39	591.60	18.48	591.51
JHC-MW-18004	602.92	605.72	Sand	596.9	to	586.9	12.00	593.72	12.48	593.24
JHC-MW-18005	600.30	603.16	Sand	595.3	to	585.3	10.63	592.53	11.01	592.15
JHC-MW-22001	601.52	604.28	Sand	596.5	to	586.5			11.70	592.58
Pond 3N, 3S										
JHC-MW-15013	632.40	635.25	Sand	604.4	to	594.4	36.45	598.80	36.16	599.09
JHC-MW-15015	632.46	635.20	Sand	604.5	to	594.5	36.14	599.06	35.85	599.35
JHC-MW-15016	631.81	632.52	Sand	603.8	to	593.8	33.51	599.01	33.42	599.10
JHC-MW-18001	609.09	611.98	Sand	603.1	to	593.1	13.26	598.72	12.98	599.00
JHC-MW-18002	605.53	608.93	Sand	602.0	to	592.0	9.85	599.08	9.55	599.38
JHC-MW-18003	605.36	608.78	Sand	601.9	to	591.9	9.79	598.99	9.65	599.13
Landfill										
JHC-MW-15017	613.69	616.61	Sand	603.7	to	593.7	16.54	600.07	16.83	599.78
JHC-MW-15018	614.26	617.02	Sand	604.3	to	594.3	17.30	599.72	17.52	599.50
JHC-MW-15022	620.92	623.79	Sand	597.9	to	587.9	--		NM	
JHC-MW-15031	632.94	635.87	Sand	599.9	to	589.9	43.71	592.16	43.90	591.97
JHC-MW-15032	611.32	614.29	Sand	598.3	to	588.3	16.76	597.53	18.14	596.15
JHC-MW-15033	618.08	620.99	Sand	602.1	to	592.1	--		NM	
JHC-MW-15034	612.90	615.97	Sand	601.9	to	591.9	15.50	600.47	17.19	598.78
JHC-MW-15035	632.53	634.28	Sand	599.5	to	589.5	41.37	592.91	41.45	592.83
JHC-MW-15036	617.94	618.34	Sand	597.9	to	587.9	26.95	591.39	27.35	590.99
JHC-MW-15037	614.28	616.06	Sand	591.3	to	586.3	25.17	590.89	25.60	590.46
MW-B3	630.51	634.17	Sand	598.5	to	593.5	39.06	595.11	39.90	594.27
MW-B4	633.80	635.67	Sand	593.8	to	588.8	41.81	593.86	41.77	593.90
Pond A										
JHC-MW-15006	624.74	627.58	Sand	599.7	to	589.7	35.08	592.50	36.05	591.53
JHC-MW-15007R[(2)]	625.73	628.26	Sand	595.7	to	585.7	36.01	592.25	37.18	591.08
JHC-MW-15008R[(1)]	632.32	634.67	Sand	597.3	to	587.3	42.95	591.72	44.05	590.62
JHC-MW-15009R[(2)]	632.15	635.05	Sand	595.2	to	585.2	43.29	591.76	44.01	591.04
JHC-MW-15011R[(2)]	627.73	629.79	Sand	594.7	to	584.7	37.50	592.29	38.31	591.48
Downgradient Wells										
MW-13	593.40	595.37	Clayey Silt	587.9	to	585.4	DRY		NM	
MW-14S	587.36	590.98	Sand	582.9	to	577.9	10.32	580.66	10.51	580.47
PZ-23S	602.84	604.97	Sand	591.8	to	586.8	13.29	591.68	15.59	589.38
PZ-24S	586.56	590.15	Sand	584.6	to	579.6	7.17	582.98	8.90	581.25
PZ-40S	589.51	593.25	Sand	585.5	to	575.5	10.02	583.23	12.48	580.77
TW-19-05	603.44	606.36	Sand	592.8	to	587.8	15.41	590.95	17.15	589.21
TW-19-06A	599.61	602.54	Sand	592.3	to	587.3	12.52	590.02	14.21	588.33

Notes:
Survey conducted by Nederveld, November 2015, October 2018, December 2018, August 2019, and July 2021.
Elevation in feet relative to North American Vertical Datum 1988 (NAVD 88).
TOC: Top of well casing.
ft BTOC: Feet below top of well casing.
--: Not measured
(1) JHC-MW-15008R installed in June 2019.
(2) JHC-MW-15007R, JHC-MW-15009R, and JHC-MW-15011R installed in July 2021.

Table 2

Summary of Field Parameter Results - April - October 2022
JH Campbell Ponds 3N/3S - RCRA CCR Monitoring Program
West Olive, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Background							
JHC-MW-15023	4/12/2022	2.38	182.9	5.5	119	11.2	2.1
	10/18/2022	3.00	275.2	5.7	60	9.4	2.1
JHC-MW-15024	4/12/2022	1.47	100.2	7.4	418	10.7	2.6
	10/18/2022	0.52	207.4	7.8	372	10.0	3.7
JHC-MW-15025	4/11/2022	3.70	144.8	7.9	254	8.0	2.9
	10/18/2022	0.82	89.7	8.1	323	10.0	2.1
JHC-MW-15026	4/11/2022	2.56	172.0	5.9	43	10.2	2.2
	10/18/2022	2.33	283.7	5.9	41	12.2	3.0
JHC-MW-15027	4/11/2022	7.08	192.7	6.2	141	9.8	5.2
	10/18/2022	4.78	263.6	6.3	166	12.4	5.7
JHC-MW-15028	4/12/2022	4.64	107.9	8.5	153	12.8	1.8
	10/18/2022	3.90	132.0	8.5	155	12.2	3.2
Ponds 3N/3S							
JHC-MW-15013	4/11/2022	2.93	-0.5	7.0	1,208	14.0	0.0
	10/19/2022	0.47	-56.0	7.0	604	12.9	4.4
JHC-MW-15015	4/11/2022	3.18	-42.1	7.1	999	15.1	0.0
	10/18/2022	0.51	-64.8	7.2	575	13.4	1.5
JHC-MW-15016	4/11/2022	0.85	0.3	7.1	783	13.7	0.7
	10/18/2022	0.39	-28.1	7.0	524	11.8	9.0
JHC-MW-18001	4/11/2022	0.48	87.9	7.9	738	9.6	0.0
	10/19/2022	0.55	-1.8	8.0	555	15.0	5.2
JHC-MW-18002	4/12/2022	1.01	111.6	6.9	550	9.4	0.0
	10/19/2022	0.58	72.0	6.9	356	15.8	1.2
JHC-MW-18003	4/12/2022	0.32	83.0	6.8	1,291	9.7	1.9
	10/19/2022	0.58	11.2	6.7	574	15.1	4.7

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) - April - October 2022
JH Campbell Background – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15023		JHC-MW-15024		JHC-MW-15025		JHC-MW-15026		JHC-MW-15027		JHC-MW-15028	
					Sample Date:	4/12/2022	10/18/2022	4/12/2022	10/18/2022	4/11/2022	10/18/2022	4/11/2022	10/18/2022	4/11/2022	10/18/2022	4/12/2022	10/18/2022
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background											
Appendix III[(1)]																	
Boron	ug/L	NC	500	500	7,200	54	36	21	< 20	24	22	< 20	< 20	< 20	< 20	< 20	< 20
Calcium	mg/L	NC	NC	NC	500[EE]	15.3	7.88	42.9	37.7	27.4	25.9	4.65	3.48	16.6	21.6	20.3	20.2
Chloride	mg/L	250**	250[E]	250[E]	500[EE]	5.24	3.22	41.4	27.1	22.7	20.1	1.75	< 1.00	1.76	1.21	< 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]	16.7	13.4	6.52	7.52	7.52	9.8	5.92	7.89	8.25	7.30	5.80	5.89
Total Dissolved Solids	mg/L	500**	500[E]	500[E]	500	88	76	233	226	145	187	31	44	83	131	80	110
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5[E]**	**6.5 - 8.5[E]**	**6.5 - 9.0**	**5.5**	**5.7**	7.4	7.8	7.9	8.1	**5.9**	**5.9**	**6.2**	**6.3**	8.5	8.5
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	49	27	26	22	7	8	12	8	28	20	8	8
Beryllium	ug/L	4	4.0	4.0	18	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	5.0	5.0	3.5	0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	100	100	11	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1	< 1
Cobalt	ug/L	NC	40	100	100	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4.0	4.0	39	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	170	350	440	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	2.0	2.0	0.20[#]	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	73	210	3,200	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Radium-226	pCi/L	NC	NC	NC	NC	0.124	0.153	< 0.0963	< 0.124	< 0.0857	< 0.112	< 0.0921	< 0.106	< 0.103	< 0.127	< 0.0996	< 0.103
Radium-228	pCi/L	NC	NC	NC	NC	0.438	0.704	< 0.449	< 0.625	< 0.447	< 0.499	0.465	< 0.504	< 0.378	0.792	< 0.398	< 0.467
Radium-226/228	pCi/L	5	NC	NC	NC	0.562	0.857	< 0.449	< 0.625	< 0.447	< 0.499	0.552	< 0.504	< 0.378	0.822	< 0.398	0.534
Selenium	ug/L	50	50	50	5.0	1	< 1	2	< 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.
** - 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 Pond 3 Groundwater Sampling Results (Analytical) - April - October 2022
JH Campbell Ponds 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15013		JHC-MW-15015[2]		JHC-MW-15016[2]		JHC-MW-18001		JHC-MW-18002		JHC-MW-18003	
						Sample Date:	4/11/2022	10/19/2022	4/11/2022	10/18/2022	4/11/2022	10/18/2022	4/11/2022	10/19/2022	4/12/2022	10/19/2022	4/12/2022	10/19/2022
Constituent	Unit	UTL	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient		upgradient				downgradient					
Appendix III[1]																		
Boron	ug/L	51	NC	**500**	**500**	7,200	358	363	**2,710**	**2,780**	**5,940**	**4,270**	460	**510**	216	241	**540**	384
Calcium	mg/L	46	NC	NC	NC	500[EE]	153	141	138	165	88.6	133	66.6	85.5	67.7	45.3	206	120
Chloride	mg/L	43	250**	250[E]	250[E]	500[EE]	16.7	15.9	12.5	15.0	11.0	15.0	9.62	9.15	10.1	13.4	< 1.00	< 1.00
Fluoride	ug/L	1,000	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	14	**250****	**250[E]**	**250[E]**	**500[EE]**	**275**	223	93.6	144	28.1	87.4	115	109	139	39.9	**539**	**317**
Total Dissolved Solids	mg/L	258	**500****	**500[E]**	**500[E]**	**500**	**821**	**733**	**588**	**712**	445	**604**	453	**533**	349	238	**1,010**	**646**
pH, Field	SU	4.8 - 9.2	6.5 - 8.5**	6.5 - 8.5[E]	6.5 - 8.5[E]	6.5 - 9.0	7.0	7.0	7.1	7.2	7.1	7.0	7.9	8.0	6.9	6.9	6.8	6.7
Appendix IV[1]																		
Antimony	ug/L	2	6	6.0	6.0	130	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	1	10	10	10	10	1	1	< 1	< 1	1	2	2	2	5	< 1	< 1	< 1
Barium	ug/L	35	2,000	2,000	2,000	**820**	97	81	99	135	162	198	705	**826**	154	81	206	143
Beryllium	ug/L	1	4	4.0	4.0	18	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	0.2	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	2	100	100	100	11	2	1	< 1	< 1	1	2	< 1	< 1	1	< 1	< 1	< 1
Cobalt	ug/L	15	NC	40	100	100	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6
Fluoride	ug/L	1,000	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	1	NC	4.0	4.0	39	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	10	NC	170	350	440	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	10	24
Mercury	ug/L	0.2	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	5	NC	**73**	**210**	3,200	7	16	52	**351**	**75**	37	10	8	10	13	< 5	9
Radium-226	pCi/L	NA	NC	NC	NC	NC	0.224	0.201	0.167	0.228	0.220	0.489	0.421	0.387	0.152	0.199	0.138	0.174
Radium-228	pCi/L	NA	NC	NC	NC	NC	< 0.346	< 0.564	0.459	1.14	< 0.358	< 0.575	< 0.360	1.06	< 0.413	< 0.599	< 0.382	0.556
Radium-226/228	pCi/L	1.93	5	NC	NC	NC	0.486	< 0.564	0.626	1.37	< 0.358	0.948	< 0.360	1.45	< 0.413	< 0.599	< 0.382	0.731
Selenium	ug/L	5	**50**	**50**	**50**	**5.0**	2	< 1	2	1	1	1	**63**	**33**	**42**	**13**	1	< 1
Thallium	ug/L	2	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.
UTL - Upper Tolerance Limit of the background data set. Appendix III UTLs established in TRC's technical memorandum dated January 15, 2018. Appendix IV UTLs established in TRC's technical memorandum dated October 15, 2018.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 21, 2020.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 180 mg CaCO3/L as measured at surface water sample SW-01 collected on April 9, 2018 from the Pigeon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
[E] - Criterion is the aesthetic drinking water value per footnote {E}.
[EE] - Criterion is based on the total dissolved solids GSI value per footnote {EE}.
(1) 40 CFR Part 257 Appendix III Detection Monitoring Constituents and Appendix IV Assessment Monitoring Constituents.
(2) Monitoring wells JHC-MW-15015 and JHC-MW-15016 have been upgradient of Pond 3 since 2018 due to post-pond decommissioning groundwater flow direction changes. These wells are no longer considered downgradient wells.
Indicates that the concentration in one or more wells exceeds the background level. If concentrations of all Appendix III and Appendix IV constituents are below the background level for two consecutive events, the unit may return to detection monitoring.
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 2022

JH Campbell Ponds 3N/3S – RCRA CCR Monitoring Program

West Olive, Michigan

Constituent	Units	GWPS	JHC-MW-15015[(1)] (Upgradient)		JHC-MW-18001 (Downgradient)		JHC-MW-18002 (Downgradient)	
			LCL	UCL	LCL	UCL	LCL	UCL
Molybdenum	ug/L	100	15	140	--	--	--	--
Selenium	ug/L	50	--	--	3.3	48	5.6	69

Notes:

ug/L - micrograms per Liter.

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

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

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

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

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

(1) Monitoring wells JHC-MW-15015 and JHC-MW-15016 have been upgradient of Pond 3 since 2018 due to post-pond decommissioning groundwater flow direction changes. These wells are no longer considered downgradient monitoring wells.

Table 6

Summary of Groundwater Protection Standard Exceedances – October 2022

JH Campbell Ponds 3N/3S – RCRA CCR Monitoring Program

West Olive, Michigan

Constituent	Units	GWPS	JHC-MW-15015[(1)] (Upgradient)		JHC-MW-18001 (Downgradient)		JHC-MW-18002 (Downgradient)	
			LCL	UCL	LCL	UCL	LCL	UCL
Molybdenum	ug/L	100	19	190	--	--	--	--
Selenium	ug/L	50	--	--	5.3	51	2.9	69

Notes:

ug/L - micrograms per Liter.

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

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

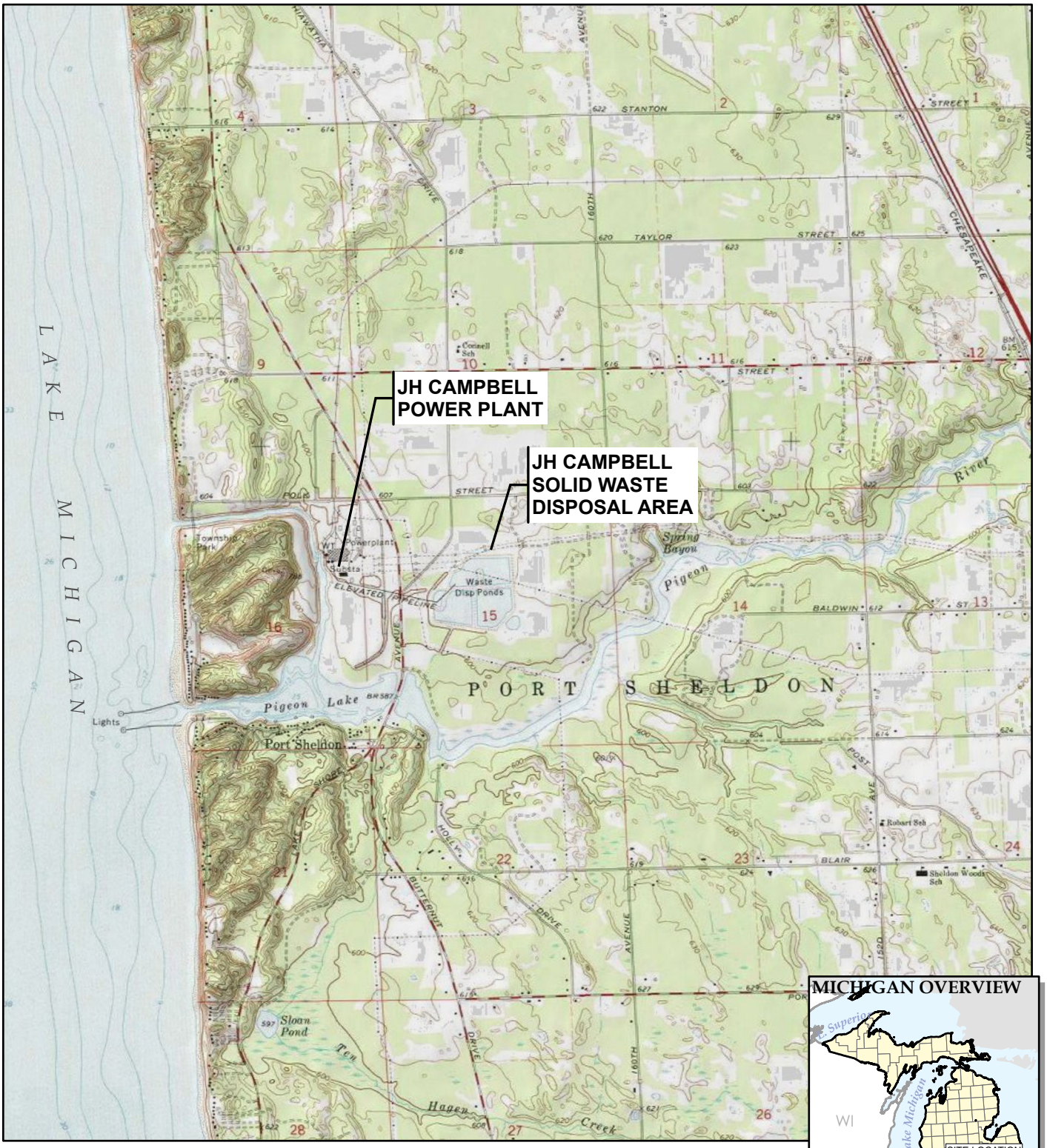
UCL - Upper Confidence Limit (α = 0.01) of the downgradient data set.

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

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

(1) Monitoring wells JHC-MW-15015 and JHC-MW-15016 have been upgradient of Pond 3 since 2018 due to post-pond decommissioning groundwater flow direction changes. These wells are no longer considered downgradient monitoring wells.

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 2023
PROJ. NO.:	464090.0001
FILE:	464090_JHC.mxd

FIGURE 1

-- Saved By: AFOJTIK on 1/11/2023, 16:01:20 PM

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

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.

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.: 464090.0001
CHECKED BY: H. SCHNAIDT	FIGURE 2
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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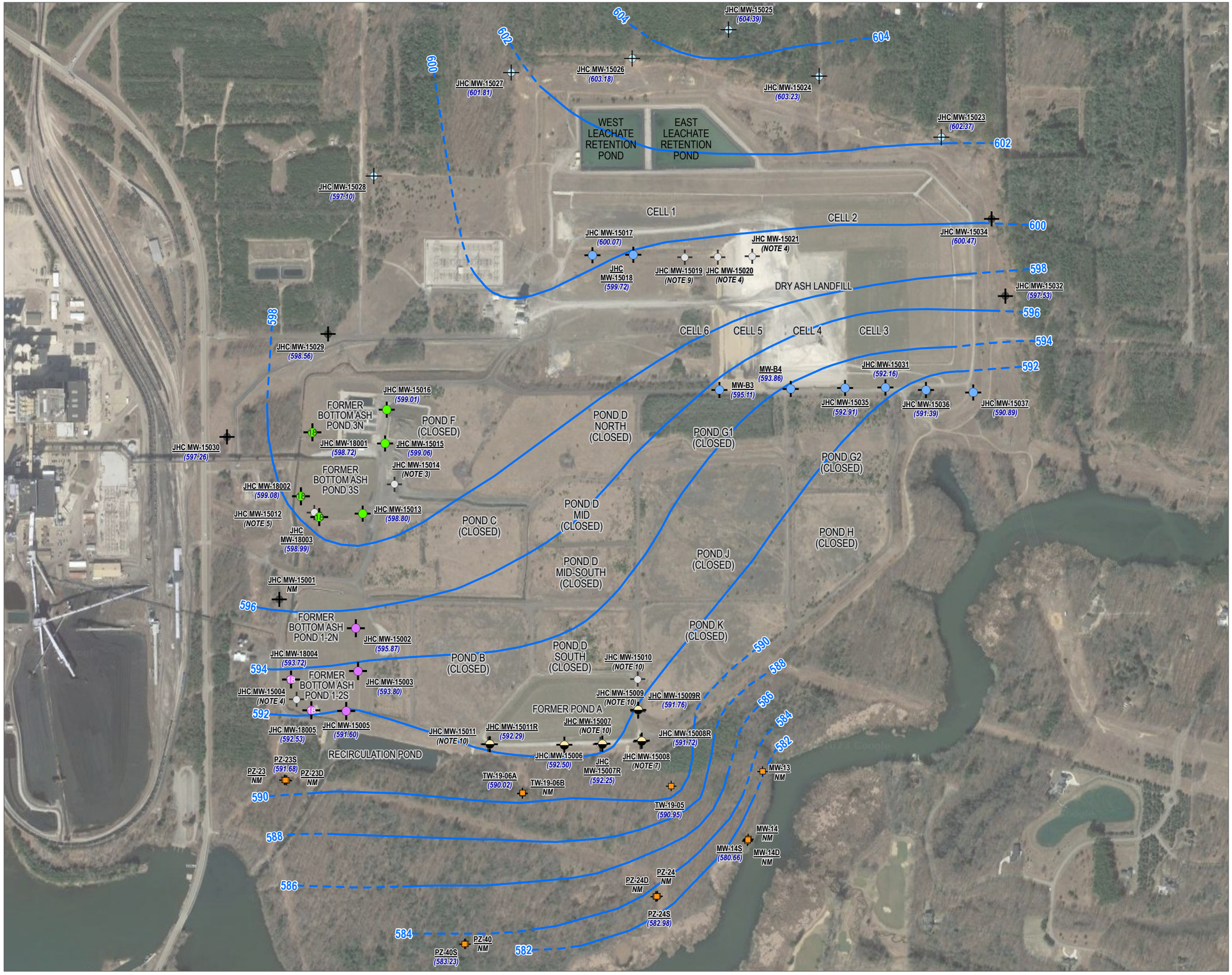

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 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 3 N/S MONITORING WELL (2018)
- NATURE AND EXTENT/DOWNGRADIENT MONITORING WELLS
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)

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.

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 2022

DRAWN BY:	A. FOJTIK	PROJ. NO.:	464090.0001
CHECKED BY:	H. SCHNAIDT		
APPROVED BY:	S. HOLMSTROM		FIGURE 3
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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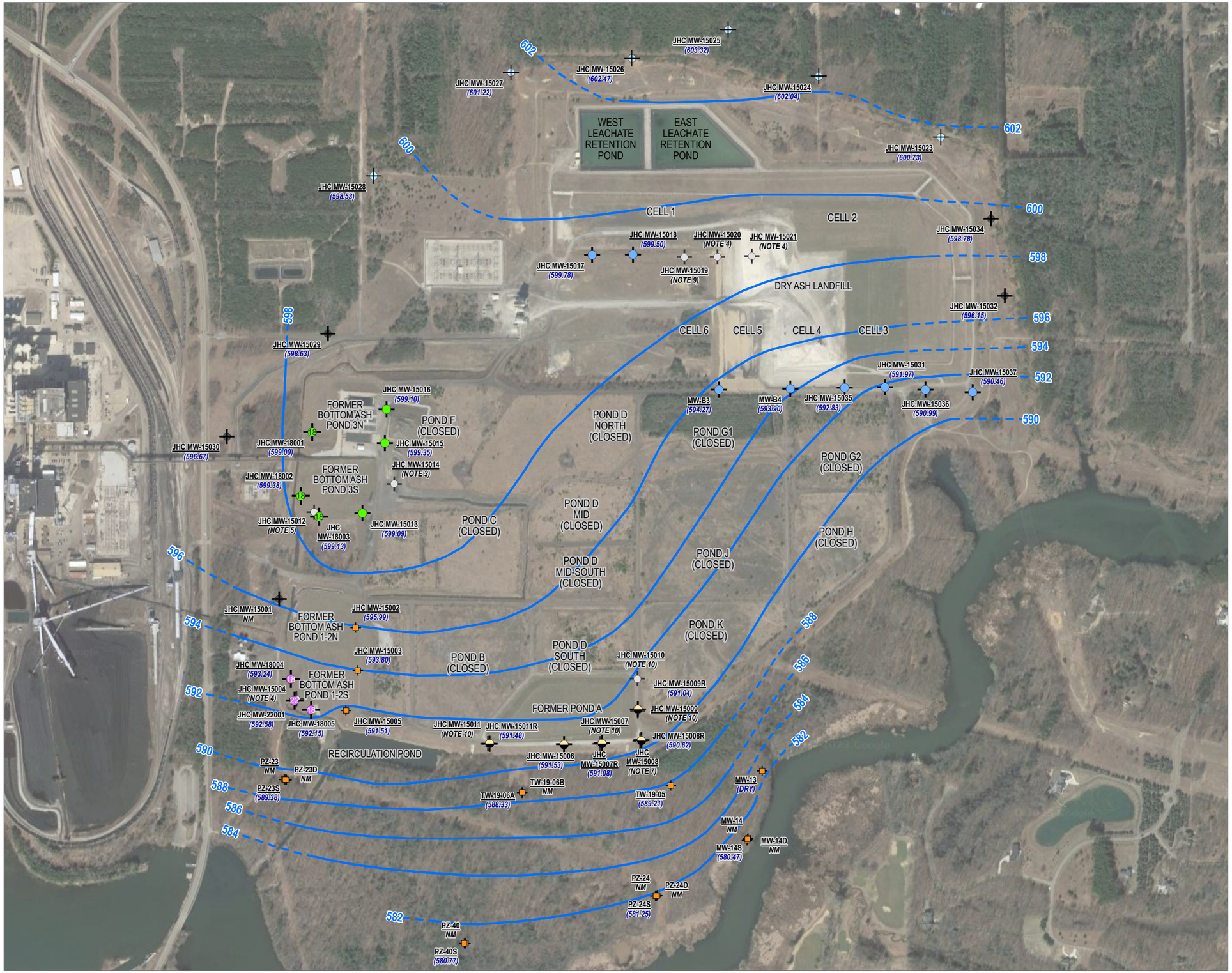

LEGEND

- 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)

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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10. MONITORING WELLS DECOMMISSIONED AND REPLACED JULY 20-22, 2021.
11. JHC-MW-22001 MONITORING WELL INSTALLED MAY 12, 2022.

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 2022

DRAWN BY:	A. FOJTIK	PROJ. NO.:	464090.0001
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DATE:	JANUARY 2023		

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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 2022
CEC JH Campbell Background Wells

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the April 2022 sampling event. Samples were analyzed for total metals, anions, alkalinity, and total dissolved solids (TDS) by CE Laboratory Services in Jackson, Michigan. The radium analyses were subcontracted to Eurofins in St. Louis, Missouri (Eurofins - St. Louis). The laboratory analytical results were reported in laboratory sample delivery groups (SDGs) 22-0342R and 160-45244-1.

During the April 2022 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
Radium (Ra-226, Ra-228, Combined Ra-226 & Ra-228)	EPA 903.0, EPA 904.0

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

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA, 2020) and the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

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

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

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

This data usability report addresses the following items:

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

Review Summary

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

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

QA/QC Sample Summary

- A method blank was analyzed with each analytical batch for radium. Radium was not detected in the method blanks.
- The LCS and LCSD recoveries and relative percent differences (RPDs) for radium were within QC limits.
- One equipment blank (EB-01) and one field blank (FB-01) were collected. Target analytes were not detected in these blank samples.

- MS and MSD analyses were performed on sample JHC-MW-15025 for mercury, total metals, and anions. The recoveries were within the acceptance limits. Relative percent differences (RPDs) were not provided by the laboratory and therefore were not evaluated; further, MS/MSD concentrations were not provided by the laboratory. However, since all recoveries were within the acceptance limits, there is no impact on data usability due to this issue.
- The field duplicate pair samples were DUP-01/JHC-MW-15023 for total metals, anions, alkalinity, TDS, and radium. All criteria were met.
- Carrier recoveries, where applicable, were within 40-110%.

Laboratory Data Quality Review
Groundwater Monitoring Event April 2022
Consumers Energy JH Campbell Pond 3

Groundwater samples were collected by Consumers Energy Laboratory Services for the April 2022 sampling event. Samples were analyzed for select total metals, anions, total dissolved solids, and alkalinity by Consumers Energy Laboratory Services in Jackson, Michigan. The laboratory analytical results were reported in sample delivery group (SDG) 22-0344.

During the April 2022 sampling event, a groundwater sample was collected from each of the following wells:

- JHC-MW-15013
- JHC-MW-15015
- JHC-MW-15016
- JHC-MW-18001
- JHC-MW-18002
- JHC-MW-18003

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 300.0
Total Dissolved Solids (TDS)	SM 2540C
Total Metals	SW-846 6020B, SW-846 7470A
Alkalinity	SM 2320B

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

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund 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;
- Field and equipment blanks are used to assess potential contamination arising from field procedures;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Data for laboratory duplicates, when performed on project samples. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;

- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

It should be noted that results for method blanks and LCSs were not provided for review by CE Laboratory Services. Therefore, potential contamination arising from laboratory sample preparation and/or analytical procedures and the accuracy of the analytical method using a clean matrix could not be evaluated for total metals, anions, alkalinity, and TDS analyses.

This data usability report addresses the following items:

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

Review Summary

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

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

QA/QC Sample Summary

- One equipment blank (EB-03) and one field blank (FB-03) were collected. Target analytes were not detected in these blank samples with following exception.
    - Selenium was detected at 1 ug/L in FB-03. Potential false positive results exist for select groundwater samples as summarized in the attached table, Attachment A.
- MS and MSD analyses were performed on sample JHC-MW-18002 for total metals and anions. 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. All recoveries were within the acceptance limits and there is no impact on data usability due to this issue.
- The field duplicate pair samples were DUP-03/JHC-MW-15015 for total metals, anions, TDS, and alkalinity. All criteria were met.

Attachment A
Summary of Data Non-Conformances for Groundwater Analytical Data
JH Campbell Pond 3 – RCRA CCR Monitoring Program
West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-15013	4/11/2022	Selenium	Potential false positive results due to field blank contamination.
JHC-MW-15015	4/11/2022		
JHC-MW-15016	4/11/2022		
JHC-MW-18003	4/12/2022		
DUP-03	4/11/2022		

Laboratory Data Quality Review
Groundwater Monitoring Event April 2022
CEC JH Campbell Pond 3

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the April 2022 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) 160-45246-1.

During the April 2022 sampling event, a groundwater sample was collected from each of the following wells:

- JHC-MW-15013
- JHC-MW-15015
- JHC-MW-15016
- JHC-MW-18001
- JHC-MW-18002
- JHC-MW-18003

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 radium data will be used 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

- Radium was not detected in the method blanks.
- The LCS and LCSD recoveries and relative percent differences were within QC limits.
- One equipment blank (EB-03) and one field blank (FB-03) were collected. Target analytes were not detected in these blank samples.
- The field duplicate pair samples were DUP-03/JHC-MW-15015 for radium. All criteria were met.
- Carrier recoveries, where applicable, were within 40-110%.

Laboratory Data Quality Review
Groundwater Monitoring Event October 2022
CEC JH Campbell Background Wells

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the October 2022 sampling event. Samples were analyzed for total metals, anions, alkalinity, and total dissolved solids (TDS) by CE Laboratory Services in Jackson, Michigan. The radium analyses were subcontracted to Eurofins in St. Louis, Missouri (Eurofins - St. Louis). The laboratory analytical results were reported in laboratory sample delivery groups (SDGs) 22-1096 and 160-47680-1.

During the October 2022 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
Radium (Ra-226, Ra-228, Combined Ra-226 & Ra-228)	EPA 903.0, EPA 904.0

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

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA, 2020) and the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

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

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

It should be noted that results for method blanks and LCSs were not provided for review by CE Laboratory Services. Therefore, potential contamination arising from laboratory sample preparation and/or analytical procedures and the accuracy of the analytical method using a clean matrix could not be evaluated for 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.
- A method blank was analyzed with each analytical batch for radium. Radium was not detected in the method blanks.
- The LCS recoveries for radium were within QC limits.
- 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-15023 for total metals, anions, alkalinity, TDS, and radium. All criteria were met.
- Carrier recoveries, where applicable, were within 40-110%.

Laboratory Data Quality Review
Groundwater Monitoring Event October 2022
Consumers Energy JH Campbell Pond 3

Groundwater samples were collected by Consumers Energy Laboratory Services for the October 2022 sampling event. Samples were analyzed for select total metals, anions, and total dissolved solids by Consumers Energy Laboratory Services in Jackson, Michigan. The radium analyses were subcontracted to Eurofins in St. Louis, Missouri (Eurofins - St. Louis). The laboratory analytical results were reported in sample delivery groups (SDGs) 22-1098 and 160-47683-1.

During the October 2022 sampling event, a groundwater sample was collected from each of the following wells:

- JHC-MW-15013
- JHC-MW-15015
- JHC-MW-15016
- JHC-MW-18001
- JHC-MW-18002
- JHC-MW-18003

Each sample was analyzed for the following constituents:

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

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

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA, 2020) and the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

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

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

It should be noted that results for method blanks and LCSs were not provided for review by CE Laboratory Services. Therefore, potential contamination arising from laboratory sample preparation and/or analytical procedures and the accuracy of the analytical method using a clean matrix could not be evaluated for total metals, anions, and TDS analyses.

This data usability report addresses the following items:

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

Review Summary

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

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

QA/QC Sample Summary

- One equipment blank (EB-03) and one field blank (FB-03) were collected. Target analytes were not detected in these blank samples except as noted below.
  - Radium-226 was detected in FB-03 at 0.108 pCi/L +/- 0.0713. Potential false positive exists for radium-226 results with normalized absolute differences (NADs) <1.96 and potential high bias exists for radium-226 results with NADs >1.96 but $\leq$2.48, as summarized in Attachment A.
- A method blank was analyzed with each analytical batch for radium. Radium was not detected in the method blanks.
- The LCS recoveries (%Rs) for radium were within QC limits with the following exceptions.

- The %R for radium 228 in LCS 160-588679/2-A was 136%. The detections of radium 228 in associated samples JHC-MW-15015, JHC-MW-18001, and JHC-MW-18003 should be considered potentially uncertain, as summarized in attachment A.
- The %R for radium 228 in LCS 160-588683/2-A was 147%. The detection of radium 228 in associated sample DUP-03 should be considered potentially uncertain, as summarized in attachment A.

- MS and MSD analyses were performed on sample JHC-MW-18002 for total metals and anions. 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. All recoveries were within the acceptance limits and there is no impact on data usability due to this issue.
- The field duplicate pair samples were DUP-03/JHC-MW-15016 for total metals, anions, TDS, and radium. All criteria were met.
- Carrier recoveries, where applicable, were within 40-110%.

Attachment A

Summary of Data Non-Conformances for Groundwater Analytical Data
JH Campbell Pond 3 – CRCRA CR Monitoring Program
West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-15013	10/19/2022	Radium 226	Detected result is potentially a false positive due to field blank contamination
JHC-MW-15015	10/18/2022		
JHC-MW-18002	10/19/2022		
JHC-MW-18003	10/19/2022		
DUP-03	10/18/2022		
JHC-MW-15016	10/18/2022	Radium 226	Detected result is potentially biased high due to field blank contamination
JHC-MW-18001	10/19/2022		
JHC-MW-15015	10/18/2022	Radium 228	Detected result is potentially uncertain due to high LCS recovery
JHC-MW-18001	10/19/2022		
JHC-MW-18003	10/19/2022		
DUP-03	10/18/2022		

Appendix B
April 2022 Assessment Monitoring Statistical Evaluation

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Technical Memorandum

Date:	July 21, 2022
To:	Bethany Swanberg, Consumers Energy
From:	Sarah Holmstrom, TRC Kristin Lowery, TRC
Project No.:	464090.0000.0000 Phase 1 Task 2
Subject:	Statistical Evaluation of April 2022 Assessment Monitoring Sampling Event, JH Campbell Bottom Ash Pond 3 North and 3 South CCR Unit, Consumers Energy Company, West Olive, Michigan

During the statistical evaluation of the initial assessment monitoring event, no Appendix IV constituents were present at statistically significant levels exceeding the Groundwater Protections Standards (GWPSs). Therefore, Consumers Energy Company (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 3 North and 3 South (Pond 3). The first semiannual assessment monitoring event for 2022 was conducted on April 11 through 14, 2022. In accordance with §257.95, the assessment monitoring data must be compared to GWPSs to determine whether or not Appendix IV constituents are detected at statistically significant levels above the GWPSs. GWPSs were established in accordance with §257.95(h), as described 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 data for 2022 indicates that no constituents are present at statistically significant levels exceeding the GWPSs in downgradient monitoring wells at the JHC Pond 3 CCR unit. This result is consistent with the results of previous assessment monitoring data statistical evaluations and concentrations remain above background levels. Therefore, Consumers Energy will continue semiannual assessment monitoring per §257.95 and execute 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 assessment monitoring well network at the JHC Pond 3 CCR Unit boundary consists of six monitoring wells (four downgradient and two upgradient monitoring wells). Due to the cessation of hydraulic loading to Pond 3 in 2018, the groundwater flow direction changed significantly from the previous baseline and assessment monitoring events. Because of the changes in site conditions and groundwater flow direction, monitoring wells JHC-MW-15015 and JHC-MW-15016 along the east edge of Pond 3 are no longer positioned downgradient from Pond 3 and are no longer representative of groundwater downgradient from Pond 3. As documented in the 2018 Annual Report, Consumers Energy installed three new downgradient wells (JHC-MW-18001 through JHC-MW-18003) on the west and southwest edge of former Pond 3 from December 3 through December 5, 2018 to reassess groundwater flow and ensure sufficient wells are appropriately located to assess groundwater quality downgradient from the Pond 3 CCR Unit. Data collected from December 2018 through April 2020 confirm that the monitoring wells are appropriately positioned to assess groundwater quality downgradient from Pond 3. Therefore, JHC-MW-18001 through JHC-MW-18003 were added to the downgradient monitoring network for Pond 3, and in addition to JHC-MW-15013, make up the four downgradient monitoring wells included in the statistical evaluations. Monitoring wells JHC-MW-15015 and JHC-MW-15016 were historically located downgradient of Pond 3 when flow was radially outward and have continued to be sampled and evaluated as part of the assessment monitoring program to evaluate groundwater quality immediately upgradient from Pond 3 post-CCR removal.

Following the first semiannual assessment monitoring event for 2022, compliance well data for Pond 3 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

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

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

For each detected Appendix IV constituent, the concentrations for each well were first compared directly to the GWPS, as shown on Table 1. Constituent-well combinations with a direct exceedance of the GWPS within the past 8 events for JHC-MW-15013, JHC-MW-15015 (upgradient), and JHC-MW-15016 (upgradient) (February 2019 through April 2022) and JHC-MW-18001 through JHC-MW-18003 (April 2019 through April 2022) were retained for further analysis. Molybdenum in JHC-MW-15015 (upgradient) and selenium in JHC-MW-18001 and JHC-MW-18002 at Pond 3 had individual results exceeding the GWPS within the past 8 sampling events.

As discussed above, JHC-MW-15015 and JHC-MW-15016 are located hydraulically upgradient of Pond 3 since 2018. During the timeframe between the last background monitoring event in August 2017 and the assessment monitoring events in 2018 (JHC-MW-15016) and 2019 (JHC-MW-15015), molybdenum concentrations at these wells showed an initial increase followed by a general decrease that has generally stabilized over the last five monitoring events (see time-series charts in Attachment 1). Groundwater quality measured at monitoring wells JHC-MW-15015 and JHC-MW-15016 is more representative of groundwater flowing toward the CCR unit from the northeast, prior to being influenced by the Pond 3 CCR unit. CCR removal activities in the southern portion of JHC Pond 3 were completed in October 2018, so groundwater conditions were re-equilibrating at the time of the assessment monitoring sampling events during which the molybdenum concentration in JHC-MW-15015 and JHC-MW-15016 exceeded their GWPS by direct comparison. These data continue to be monitored to evaluate upgradient groundwater conditions that may influence groundwater quality downgradient from Pond 3.

Groundwater data for the monitoring wells with individual results exceeding a GWPS by direct comparison were 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 confidence intervals were calculated for each of the CCR Appendix IV data sets with a direct exceedance of a GWPS using a 99 percent confidence level, i.e., a significance level (α) of 0.01. The following narrative describes the methods employed and the results obtained. The Sanitas™ output files are included as an attachment.

The statistical data evaluation included the following steps:

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

- Evaluation of percentage of non-detects for each well-constituent pair;
- Distribution of the data; and
- Calculation of the confidence intervals for each cumulative dataset.

The results of these evaluations are presented and discussed below.

Initially, the assessment monitoring results for molybdenum in JHC-MW-15015 (February 2019 through April 2022) and selenium in JHC-MW-18001 and JHC-MW-18002 (April 2019 through April 2022) were observed visually for a potential trend. A visual decreasing trend is present in molybdenum concentrations at JHC-MW-15015; however, no statistically significant trends were identified (Attachment 1 trend tests). Similarly, visual increasing trends are present in selenium concentrations at JHC-MW-18001 and JHC-MW-18002; however, no statistically significant trends were identified (Attachment 1 trend tests). Due to the changes in site conditions discussed above, potential trends in data will continue to be assessed as more data are collected. Data from each round were evaluated for completeness, overall quality, and usability and were deemed appropriate for the purposes of the CCR assessment monitoring program. The Sanitas™ software was then used to test compliance at the downgradient monitoring wells using the confidence interval method for the most recent eight sampling events. Eight independent sampling events provide the appropriate density of data as recommended per the Unified Guidance yet are collected recently enough to provide an indication of current condition. The test was run with a per-well significance of $\alpha = 0.01$. The software outputs are included in Attachment 1 along with data reports showing the values used for the evaluation. The percentage of non-detect observations are also included in Attachment 1. 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. The data sets for molybdenum at JHC-MW-15015 and selenium at JHC-MW-18002 were normally distributed and the data set for selenium at JH-MW-18001 was normalized using a square root transformation. The confidence interval test compares the lower confidence limit to the GWPS. The evaluation of the Appendix IV constituents shows no statistically significant exceedances of the GWPSs. This result is consistent with the results of the initial assessment monitoring data statistical evaluation and concentrations remain above background levels. Consumers Energy will continue semiannual assessment monitoring per §257.95 and execute 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

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15013								
						Sample Date:	2/27/2019	2/27/2019	4/29/2019	10/10/2019	4/16/2020	10/22/2020	10/22/2020	4/13/2021	10/20/2021	4/11/2022
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS											
Appendix III								Field Dup					Field Dup			
Boron	ug/L	NC	NA	51	NA		330	330	320	300	55	279	278	259	274	358
Calcium	mg/L	NC	NA	46	NA		45	45	46	100	146	143	140	133	140	153
Chloride	mg/L	250*	NA	43	NA		18	18	16	17	9.48	11.7	11.6	11.5	16.1	16.7
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		30	30	30	230	276	205	202	103	230	275
Total Dissolved Solids	mg/L	500*	NA	258	NA		220	220	190	490	741	659	669	592	740	821
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.7 (1)	--	7.0	7.2	6.6	6.7	--	7.0	7.0	7.0
Appendix IV																
Antimony	ug/L	6	NA	2	6		< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	NA	1	10		< 1.0	< 1.0	< 1.0	1.1	< 1	< 1	< 1	< 1	1	1
Barium	ug/L	2,000	NA	35	2,000		25	23	25	53	73	66	65	64	79	97
Beryllium	ug/L	4	NA	1	4		< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5		< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	NA	2	100		< 1.0	< 1.0	2.0	7.3	< 1	1	1	11	5	2
Cobalt	ug/L	NC	6	15	15		< 6.0	< 6.0	< 6.0	< 6.0	< 15	< 15	< 15	< 6	< 6	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	5	**100**		11	10	8.5	7.2	6	7	6	9	15	7
Radium-226	pCi/L	NC	NA	NA	NA		< 0.101	0.0854	0.121	0.485	0.222	< 0.368	< 0.326	0.319	< 0.336	0.224
Radium-228	pCi/L	NC	NA	NA	NA		< 0.373	< 0.423	< 0.377	0.960	< 0.580	< 0.398	< 0.496	< 0.334	0.861	< 0.346
Radium-226/228	pCi/L	5	NA	1.93	5		0.402	0.436	< 0.377	1.45	0.729	0.603	< 0.496	0.548	1.18	0.486
Selenium	ug/L	50	NA	5	**50**		< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	1	2
Thallium	ug/L	2	NA	2	2		< 2.0	< 2.0	< 2.0	< 2.0	< 2	< 2	< 2	< 2	< 2	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.
(2) Monitoring wells JHC-MW-15015 and JHC-MW-15016 have been upgradient of Pond 3 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15015[2]									
					Sample Date:	2/27/2019	4/29/2019	10/10/2019	4/16/2020	4/16/2020	10/23/2020	4/14/2021	10/20/2021	4/11/2022	4/11/2022
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS										
Appendix III										Field Dup					Field Dup
Boron	ug/L	NC	NA	51	NA	860	1,000	1,300	1,400	1,360	1,770	1,980	1,910	2,710	2,840
Calcium	mg/L	NC	NA	46	NA	110	100	110	162	162	142	127	138	138	142
Chloride	mg/L	250*	NA	43	NA	22	15	14	11.0	11.2	7.21	6.69	17.70	12.5	13.8
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	41	38	39	56.6	57.0	36.6	33.2	41.6	93.6	94.1
Total Dissolved Solids	mg/L	500*	NA	258	NA	420	430	430	597	600	510	480	577	588	590
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.7 [1]	7.1	7.2	6.7	--	6.8	7.1	7.0	7.1	--
Appendix IV															
Antimony	ug/L	6	NA	2	6	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	NA	1	10	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Barium	ug/L	2,000	NA	35	2,000	47	44	49	67	66	53	61	85	99	104
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	NA	2	100	1.7	< 1.0	4.3	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cobalt	ug/L	NC	6	15	15	< 6.0	< 6.0	< 6.0	< 15	< 15	< 15	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	40	10	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	5	**100**	**170**	**140**	**110**	52	50	27	32	22	52	52
Radium-226	pCi/L	NC	NA	NA	NA	< 0.0793	< 0.0921	0.207	< 0.125	< 0.125	< 0.428	< 0.106	0.235	0.167	0.218
Radium-228	pCi/L	NC	NA	NA	NA	< 0.360	< 0.419	< 0.432	< 0.577	0.576	< 0.361	0.360	< 0.546	0.459	< 0.396
Radium-226/228	pCi/L	5	NA	1.93	5	< 0.360	< 0.419	< 0.432	< 0.577	0.682	< 0.428	0.441	< 0.546	0.626	0.488
Selenium	ug/L	50	NA	5	**50**	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	2	2
Thallium	ug/L	2	NA	2	2	< 2.0	< 2.0	< 2.0	< 2	< 2	< 2	< 2	< 2	< 2	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.
(2) Monitoring wells JHC-MW-15015 and JHC-MW-15016 have been upgradient of Pond 3 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15016[2]							
						Sample Date:	2/28/2019	4/29/2019	10/10/2019	10/10/2019	4/16/2020	10/23/2020	4/14/2021	10/20/2021	4/11/2022
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS					Field Dup					
Appendix III															
Boron	ug/L	NC	NA	51	NA		1,100	2,100	4,200	4,200	5,060	6,390	4,950	5,400	5,940
Calcium	mg/L	NC	NA	46	NA		120	110	110	110	134	95.9	86.8	94	88.6
Chloride	mg/L	250*	NA	43	NA		27	26	16	17	8.76	5.88	11.8	15.5	11.0
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		23	23	26	26	18.2	15.8	17.6	20.9	28.1
Total Dissolved Solids	mg/L	500*	NA	258	NA		530	470	450	450	526	405	399	435	445
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.6 [1]	6.9	7.2	--	6.7	6.9	7.1	7.0	7.1
Appendix IV															
Antimony	ug/L	6	NA	2	6		< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	NA	1	10		< 1.0	2.6	< 1.0	< 1.0	2	1	< 1	< 1	1
Barium	ug/L	2,000	NA	35	2,000		110	99	88	83	100	100	107	131	162
Beryllium	ug/L	4	NA	1	4		< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5		< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	NA	2	100		3.3	2.5	1.6	1.7	< 1	1	< 1	< 1	1
Cobalt	ug/L	NC	6	15	15		< 6.0	< 6.0	< 6.0	< 6.0	< 15	< 15	< 6	< 6	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	5	**100**		44	42	27	25	59	75	59	52	75
Radium-226	pCi/L	NC	NA	NA	NA		0.149	0.239	0.322	--	0.274	< 0.355	0.205	0.263	0.220
Radium-228	pCi/L	NC	NA	NA	NA		0.520	< 0.482	< 0.482	--	< 0.751	< 0.453	< 0.390	< 0.652	< 0.358
Radium-226/228	pCi/L	5	NA	1.93	5		0.669	0.711	0.540	--	< 0.751	0.506	0.560	0.692	< 0.358
Selenium	ug/L	50	NA	5	**50**		< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	1
Thallium	ug/L	2	NA	2	2		< 2.0	< 2.0	< 2.0	< 2.0	< 2	< 2	< 2	< 2	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.
(2) Monitoring wells JHC-MW-15015 and JHC-MW-15016 have been upgradient of Pond 3 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-18001							
						Sample Date:	4/25/2019	8/13/2019	10/10/2019	4/15/2020	10/23/2020	4/13/2021	4/13/2021	10/20/2021	4/11/2022
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS								Field Dup		
Appendix III															
Boron	ug/L	NC	NA	51	NA		300	330	390	376	476	388	411	459	460
Calcium	mg/L	NC	NA	46	NA		77	76	66	71.7	74.8	62.3	62.2	65.6	66.6
Chloride	mg/L	250*	NA	43	NA		11	2.6	2.2	5.01	9.24	9.32	9.64	1.06	9.62
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		130	140	82	94.1	174	109	111	36	115
Total Dissolved Solids	mg/L	500*	NA	258	NA		430	460	360	418	528	401	397	412	453
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		8.3	8.2	8.1	8.2	7.8	8.2	--	8.1	7.9
Appendix IV															
Antimony	ug/L	6	NA	2	6		< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	NA	1	10		1.4	1.7	1.5	2	2	1	1	2	2
Barium	ug/L	2,000	NA	35	2,000		440	610	390	529	659	451	457	634	705
Beryllium	ug/L	4	NA	1	4		< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5		< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	NA	2	100		< 1.0	< 1.0	< 1.0	< 1	1	< 1	< 1	< 1	< 1
Cobalt	ug/L	NC	6	15	15		< 6.0	< 6.0	< 6.0	< 15	< 15	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	5	**100**		8.1	16	17	18	17	11	11	13	10
Radium-226	pCi/L	NC	NA	NA	NA		0.321	0.469	0.296	0.284	0.464	0.398	0.321	0.359	0.421
Radium-228	pCi/L	NC	NA	NA	NA		0.345	0.822	0.406	< 0.355	< 0.408	< 0.370	< 0.382	< 0.411	< 0.360
Radium-226/228	pCi/L	5	NA	1.93	5		0.667	1.29	0.702	0.463	0.621	0.639	0.611	0.734	< 0.360
Selenium	ug/L	50	NA	5	**50**		1.3	15	18	27	7	6	6	**57**	**63**
Thallium	ug/L	2	NA	2	2		< 2.0	< 2.0	< 2.0	< 2	< 2	< 2	< 2	< 2	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.
(2) Monitoring wells JHC-MW-15015 and JHC-MW-15016 have been upgradient of Pond 3 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-18002						
						Sample Date:	8/13/2019	10/10/2019	4/15/2020	10/22/2020	4/13/2021	10/20/2021	4/12/2022
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	4/25/2019							
Appendix III													
Boron	ug/L	NC	NA	51	NA	290	340	330	273	272	207	273	216
Calcium	mg/L	NC	NA	46	NA	57	51	68	45.9	32.6	59.5	67.9	67.7
Chloride	mg/L	250*	NA	43	NA	15	18	17	3.32	< 1.00	6.82	12	10.1
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	83	67	58	45.9	11.8	68.8	84.1	139
Total Dissolved Solids	mg/L	500*	NA	258	NA	310	300	430	230	140	277	340	349
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.3	7.3	7.3	7.3	7.2	7.1	6.9	6.9
Appendix IV													
Antimony	ug/L	6	NA	2	6	< 1.0	1.0	2.7	< 1	1	1	1	< 1
Arsenic	ug/L	10	NA	1	10	< 1.0	1.4	< 1.0	< 1	< 1	< 1	< 1	5
Barium	ug/L	2,000	NA	35	2,000	110	130	130	108	53	108	136	154
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	0.24	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	NA	2	100	< 1.0	< 1.0	< 1.0	< 1	1	< 1	< 1	1
Cobalt	ug/L	NC	6	15	15	< 6.0	< 6.0	< 6.0	< 15	< 15	< 6	< 6	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	40	10	40	< 10	12	< 10	< 10	< 10	< 10	11	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	5	**100**	10	13	15	15	20	17	12	10
Radium-226	pCi/L	NC	NA	NA	NA	0.144	< 0.195	0.198	< 0.105	< 0.323	0.129	0.274	0.152
Radium-228	pCi/L	NC	NA	NA	NA	< 0.610	< 0.607	< 0.413	< 0.415	< 0.501	< 0.368	< 0.487	< 0.413
Radium-226/228	pCi/L	5	NA	1.93	5	< 0.610	< 0.607	< 0.413	< 0.415	< 0.501	< 0.368	< 0.487	< 0.413
Selenium	ug/L	50	NA	5	**50**	26	23	31	**57**	12	**101**	8	42
Thallium	ug/L	2	NA	2	2	< 2.0	< 2.0	< 2.0	< 2	< 2	< 2	< 2	< 2

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.
(2) Monitoring wells JHC-MW-15015 and JHC-MW-15016 have been upgradient of Pond 3 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

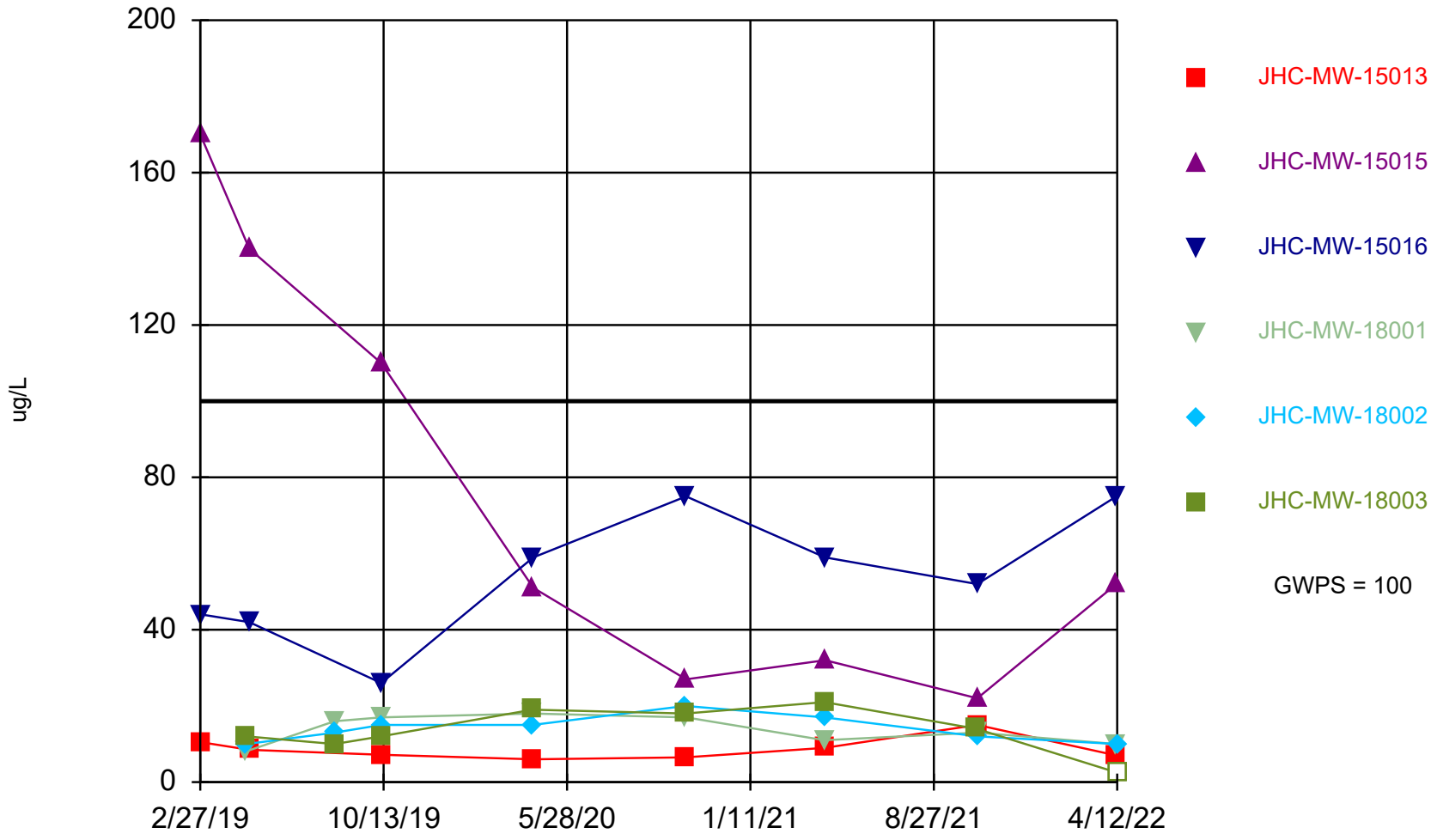
					Sample Location:	JHC-MW-18003									
					Sample Date:	4/25/2019	8/13/2019	8/13/2019	10/10/2019	4/15/2020	10/22/2020	4/13/2021	10/19/2021	10/19/2021	4/12/2022
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS										
Appendix III								Field Dup						Field Dup	
Boron	ug/L	NC	NA	51	NA	270	330	340	510	283	310	193	336	336	540
Calcium	mg/L	NC	NA	46	NA	160	100	110	140	78.5	75.1	90.4	151	153	206
Chloride	mg/L	250*	NA	43	NA	11	10	11	10	11.7	3.18	2.13	< 1.00	< 1.00	< 1.00
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	450	250	250	340	88.9	74.5	194	359	362	539
Total Dissolved Solids	mg/L	500*	NA	258	NA	810	510	520	660	352	324	463	881	777	1,010
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	6.9	7.0	--	6.9	7.2	6.9	7.2	7.2	--	6.8
Appendix IV															
Antimony	ug/L	6	NA	2	6	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	NA	1	10	< 1.0	< 1.0	< 1.0	1.4	< 1	< 1	< 1	< 1	< 1	< 1
Barium	ug/L	2,000	NA	35	2,000	120	100	96	130	97	92	75	103	106	206
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	NA	2	100	< 1.0	< 1.0	< 1.0	< 1.0	< 1	1	< 1	< 1	< 1	< 1
Cobalt	ug/L	NC	6	15	15	< 6.0	< 6.0	< 6.0	< 6.0	< 15	< 15	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	40	10	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	10
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	5	**100**	12	10	10	12	19	18	21	14	15	< 5
Radium-226	pCi/L	NC	NA	NA	NA	0.270	< 0.235	< 0.160	< 0.161	< 0.118	< 0.276	< 0.122	0.239	0.415	0.138
Radium-228	pCi/L	NC	NA	NA	NA	0.623	< 0.570	< 0.360	< 0.556	< 0.465	0.405	< 0.380	0.573	< 0.529	< 0.382
Radium-226/228	pCi/L	5	NA	1.93	5	0.892	< 0.570	< 0.360	< 0.556	< 0.465	0.557	0.417	0.812	0.721	< 0.382
Selenium	ug/L	50	NA	5	**50**	< 1.0	< 1.0	< 1.0	< 1.0	4	1	< 1	< 1	< 1	1
Thallium	ug/L	2	NA	2	2	< 2.0	< 2.0	< 2.0	< 2.0	< 2	< 2	< 2	< 2	< 2	< 2

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.
(2) Monitoring wells JHC-MW-15015 and JHC-MW-15016 have been upgradient of Pond 3 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Attachment 1
Sanitas™ Output

Hollow symbols indicate censored values.

Molybdenum Comparison to GWPS

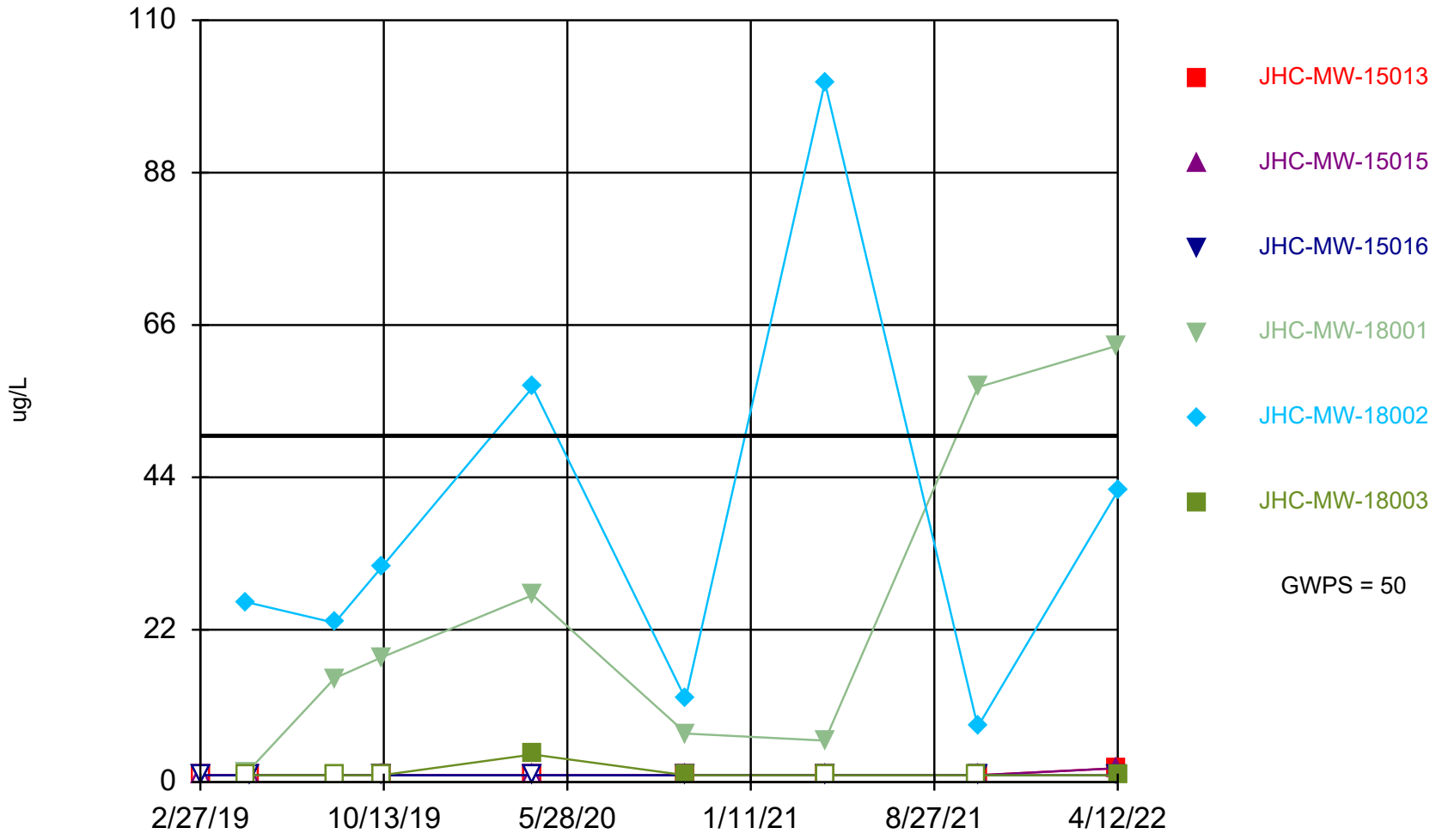


Time Series Analysis Run 6/9/2022 1:47 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22

Hollow symbols indicate censored values.

Selenium Comparison to GWPS



Time Series Analysis Run 6/9/2022 1:56 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22

Summary Report

Constituent: Molybdenum, Total Analysis Run 6/9/2022 2:00 PM
Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22

For observations made between 2/27/2019 and 4/12/2022, a summary of the selected data set:

Observations = 48
ND/Trace = 1
Wells = 6
Minimum Value = 2.5
Maximum Value = 170
Mean Value = 29.92
Median Value = 16.5
Standard Deviation = 34.55
Coefficient of Variation = 1.155
Skewness = 2.43

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15013	8	0	6	15	8.713	7.85	2.936	0.337	1.298
JHC-MW-15015	8	0	22	170	75.5	51.5	56.75	0.7516	0.6487
JHC-MW-15016	8	0	26	75	54	55.5	16.75	0.3102	-0.1922
JHC-MW-18001	8	0	8.1	18	13.76	14.5	3.748	0.2724	-0.2934
JHC-MW-18002	8	0	10	20	14	14	3.464	0.2474	0.3968
JHC-MW-18003	8	1	2.5	21	13.56	13	5.913	0.436	-0.5519

Summary Report

Constituent: Selenium, Total Analysis Run 6/9/2022 1:59 PM
Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22

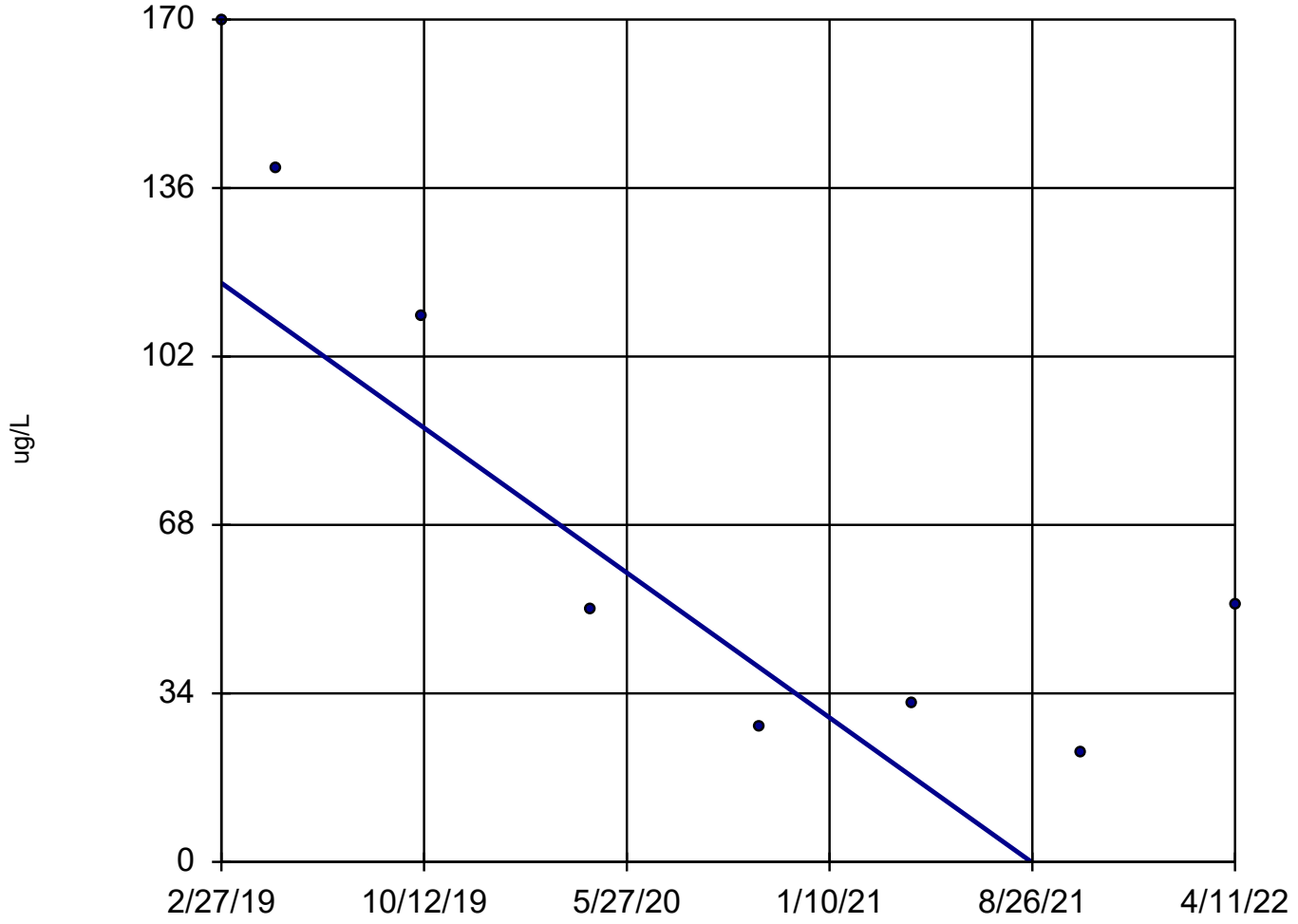
For observations made between 2/27/2019 and 4/12/2022, a summary of the selected data set:

Observations = 48
ND/Trace = 25
Wells = 6
Minimum Value = 1
Maximum Value = 101
Mean Value = 11.07
Median Value = 1
Standard Deviation = 20.8
Coefficient of Variation = 1.88
Skewness = 2.568

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15013	8	6	1	2	1.125	1	0.3536	0.3143	2.268
JHC-MW-15015	8	7	1	2	1.125	1	0.3536	0.3143	2.268
JHC-MW-15016	8	7	1	1	1	1	0	0	NaN
JHC-MW-18001	8	0	1.3	63	24.29	16.5	23.49	0.9673	0.8075
JHC-MW-18002	8	0	8	101	37.5	28.5	30.09	0.8024	1.213
JHC-MW-18003	8	5	1	4	1.375	1	1.061	0.7714	2.268

Molybdenum, Total

JHC-MW-15015



n = 8

Slope = -46.85 units per year.

Mann-Kendall statistic = -18
critical = -20

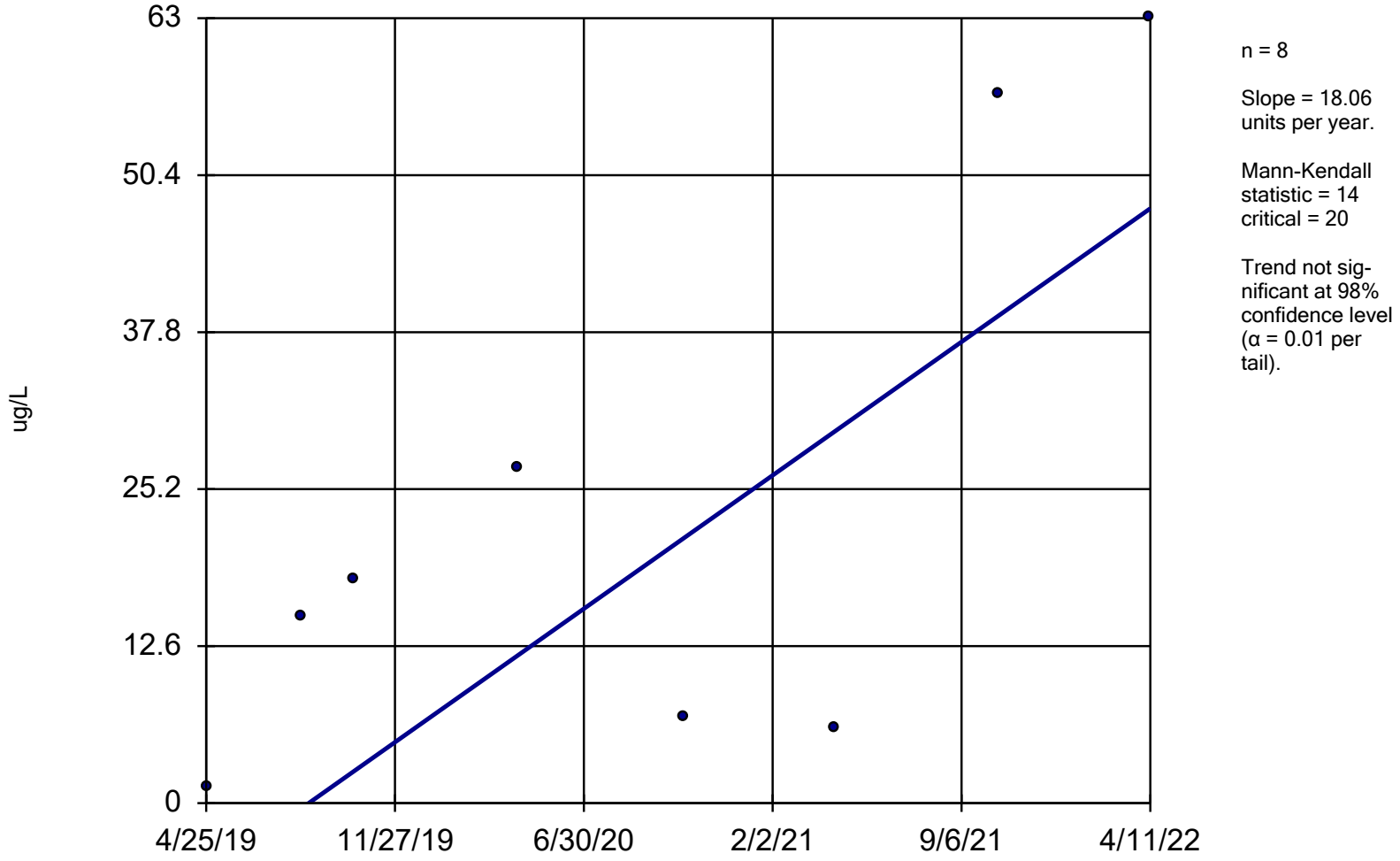
Trend not significant at 98% confidence level (α = 0.01 per tail).

Sen's Slope Estimator Analysis Run 6/9/2022 2:11 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22

Selenium, Total

JHC-MW-18001



n = 8

Slope = 18.06 units per year.

Mann-Kendall statistic = 14
critical = 20

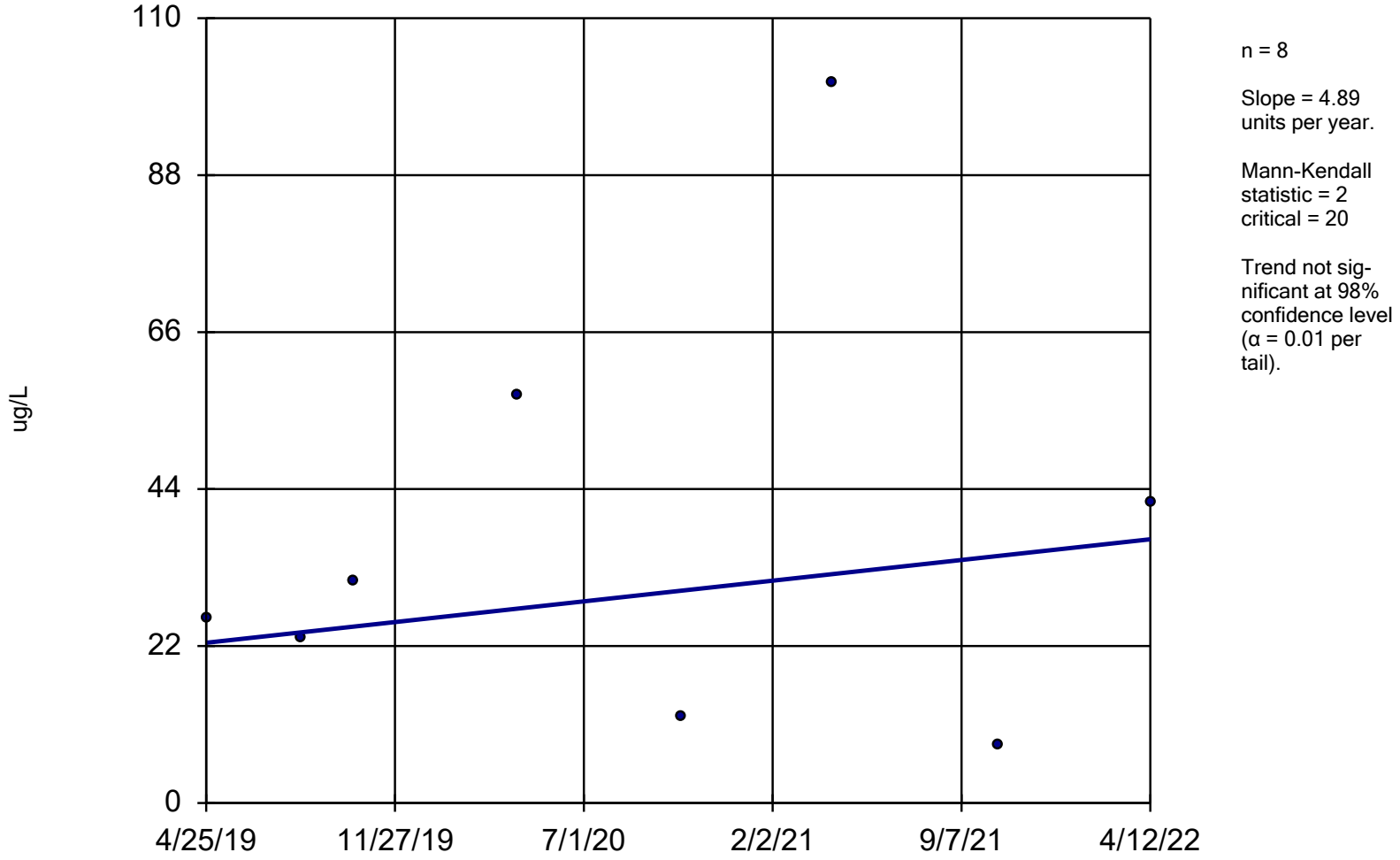
Trend not significant at 98% confidence level (α = 0.01 per tail).

Sen's Slope Estimator Analysis Run 6/9/2022 2:13 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22

Selenium, Total

JHC-MW-18002



n = 8

Slope = 4.89 units per year.

Mann-Kendall statistic = 2
critical = 20

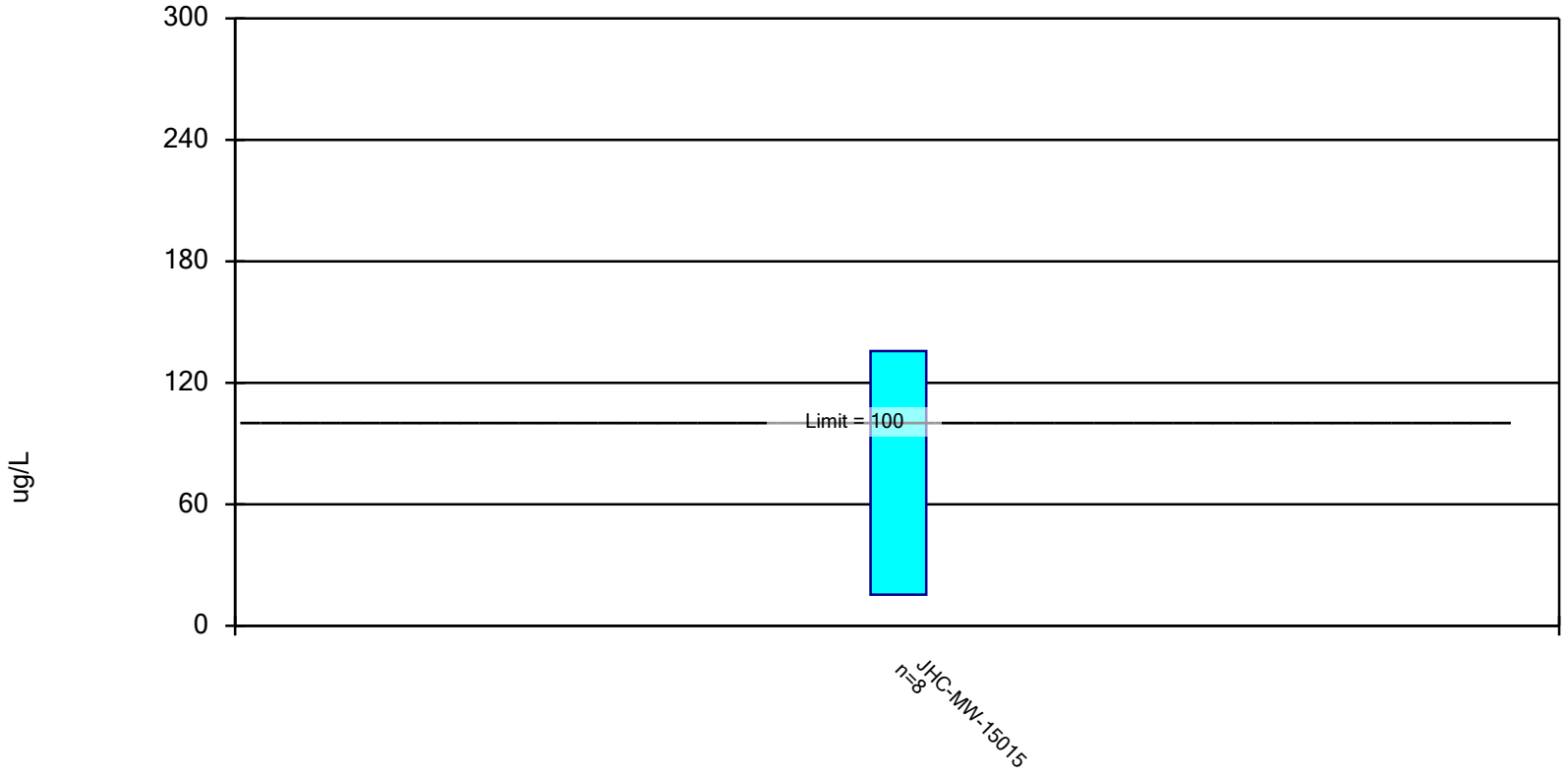
Trend not significant at 98% confidence level (α = 0.01 per tail).

Sen's Slope Estimator Analysis Run 6/9/2022 2:13 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22

Parametric Confidence Interval

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



Constituent: Molybdenum, Total Analysis Run 6/13/2022 1:12 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_

Confidence Interval

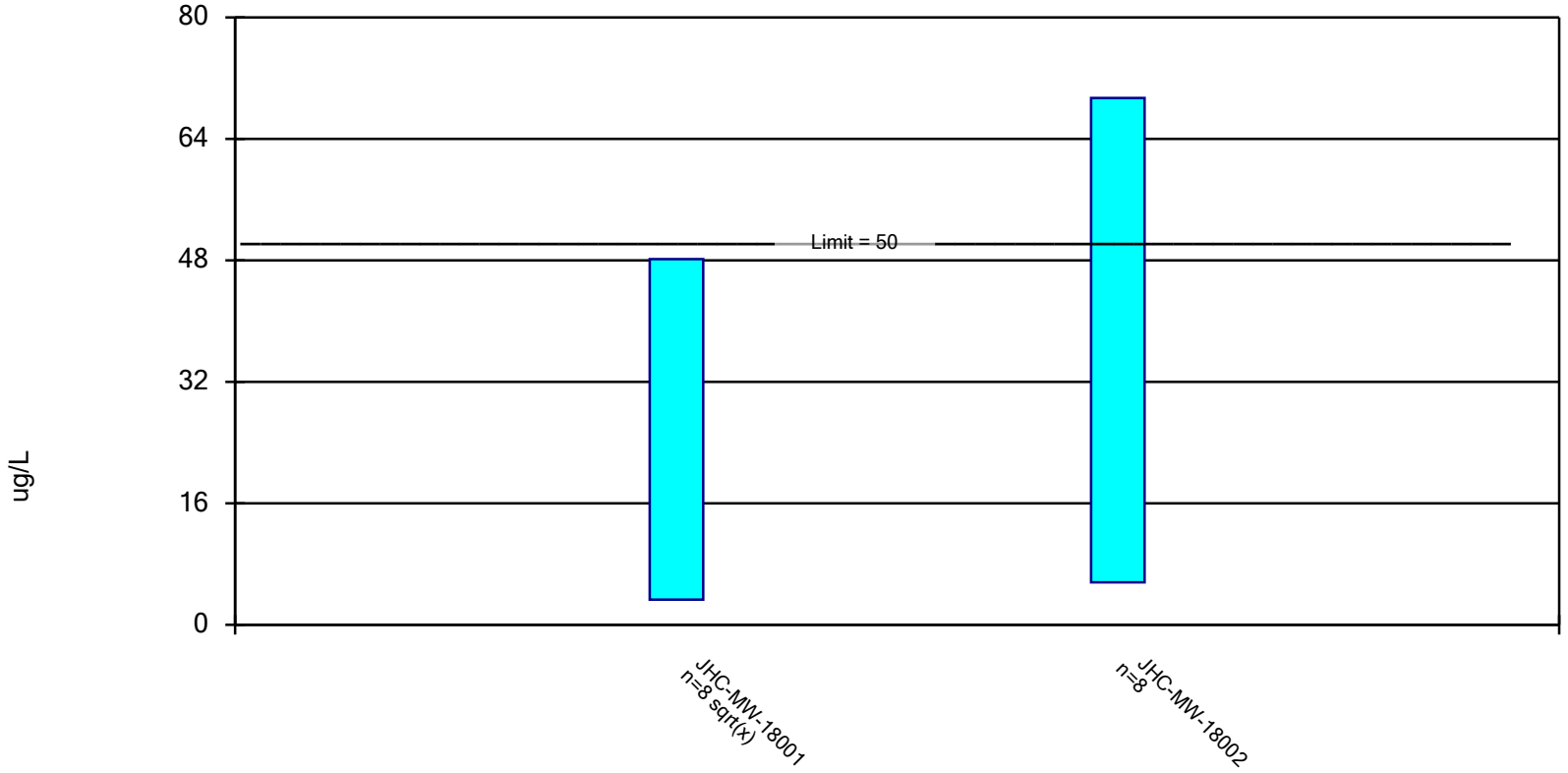
Constituent: Molybdenum, Total (ug/L) Analysis Run 6/13/2022 1:13 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_

	JHC-MW-15015
2/27/2019	170
4/29/2019	140
10/10/2019	110
4/16/2020	51 (D)
10/23/2020	27
4/14/2021	32
10/20/2021	22
4/11/2022	52 (D)
Mean	75.5
Std. Dev.	56.75
Upper Lim.	135.6
Lower Lim.	15.35

Parametric Confidence Interval

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



Constituent: Selenium, Total Analysis Run 6/13/2022 1:12 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_

Confidence Interval

Constituent: Selenium, Total (ug/L) Analysis Run 6/13/2022 1:13 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_

	JHC-MW-18001	JHC-MW-18002
4/25/2019	1.3	26
8/13/2019	15	23
10/10/2019	18	31
4/15/2020	27	57
10/22/2020		12
10/23/2020	7	
4/13/2021	6 (D)	101
10/20/2021	57	8
4/11/2022	63	
4/12/2022		42
Mean	24.29	37.5
Std. Dev.	23.49	30.09
Upper Lim.	48.17	69.39
Lower Lim.	3.305	5.606

Appendix C
October 2022 Assessment Monitoring Statistical Evaluation

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Technical Memorandum

Date:	January 11, 2023
To:	Bethany Swanberg, Consumers Energy
From:	Sarah Holmstrom, TRC Kristin Lowery, TRC Henry Schnaidt, TRC
Project No.:	464090.0000.0000 Phase 1 Task 2
Subject:	Statistical Evaluation of October 2022 Assessment Monitoring Sampling Event, JH Campbell Bottom Ash Pond 3 North and 3 South CCR Unit, Consumers Energy Company, West Olive, Michigan

During the statistical evaluation of the initial assessment monitoring event (June 2018), no Appendix IV constituents were present at statistically significant levels exceeding the Groundwater Protections Standards (GWPSs). Therefore, Consumers Energy Company (Consumers Energy) is continuing semiannual assessment monitoring in accordance with §257.95 of the CCR Rule[1] at the JH Campbell Power Plant Bottom Ash Pond 3 North and 3 South (Pond 3). The second semiannual assessment monitoring event for 2022 was conducted on October 17 through 20, 2022. In accordance with §257.95, the assessment monitoring data must be compared to GWPSs to determine whether or not Appendix IV constituents are detected at statistically significant levels above the GWPSs. GWPSs were established in accordance with §257.95(h), as described 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 data for 2022 indicates that no constituents are present at statistically significant levels exceeding the GWPSs in downgradient monitoring wells at the Pond 3 CCR unit.

Constituent	GWPS	# Downgradient Wells Observed
No constituents are present at statistically significant levels above the GWPSs.		

[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.

This result is consistent with the results of previous assessment monitoring data statistical evaluations. Concentrations remain above background levels. Therefore, Consumers Energy will continue semiannual assessment monitoring per §257.95 and execute the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Assessment Monitoring Statistical Evaluation

The assessment monitoring well network at the Pond 3 CCR Unit boundary consists of six monitoring wells (four downgradient and two upgradient monitoring wells). Due to the cessation of hydraulic loading to Pond 3 in 2018, the groundwater flow direction changed significantly from the previous baseline and assessment monitoring events. Because of the changes in site conditions and groundwater flow direction, monitoring wells JHC-MW-15015 and JHC-MW-15016 along the east edge of Pond 3 are no longer positioned downgradient from Pond 3 and are no longer representative of groundwater downgradient from Pond 3. Monitoring wells JHC-MW-15015 and JHC-MW-15016 were historically located downgradient of Pond 3 when flow was radially outward and have continued to be sampled and evaluated as part of the assessment monitoring program to evaluate groundwater quality immediately upgradient from Pond 3 post-CCR removal.

Following the second semiannual assessment monitoring event for 2022, compliance well data for Pond 3 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 well 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 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

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

or a fixed standard (such as a GWPS in an assessment monitoring program).

For each detected Appendix IV constituent, the concentrations for each well were first compared directly to the GWPS, as shown on Table 1. Constituent-well combinations with a direct exceedance of the GWPS within the past 8 events for JHC-MW-15013, JHC-MW-15015 (upgradient), and JHC-MW-15016 (upgradient) (April 2019 through October 2022) and JHC-MW-18001 through JHC-MW-18003 (August 2019 through October 2022) were retained for further analysis. Molybdenum in JHC-MW-15015 (upgradient) and selenium in JHC-MW-18001 and JHC-MW-18002 at Pond 3 had individual results exceeding the GWPS within the past 8 sampling events.

As discussed above, JHC-MW-15015 and JHC-MW-15016 are located hydraulically upgradient of Pond 3 since 2018. During the timeframe between the last background monitoring event in August 2017 and the assessment monitoring events in 2018 (JHC-MW-15016) and 2019 (JHC-MW-15015), molybdenum concentrations at these wells showed an initial increase followed by a general decrease that has generally stabilized over the last five monitoring events (see time-series charts in Attachment 1). Groundwater quality measured at monitoring wells JHC-MW-15015 and JHC-MW-15016 is more representative of groundwater flowing toward the CCR unit from the northeast, prior to being influenced by the Pond 3 CCR unit. CCR removal activities in the southern portion of Pond 3 were completed in October 2018, so groundwater conditions were re-equilibrating at the time of the assessment monitoring sampling events during which the molybdenum concentration in JHC-MW-15015 and JHC-MW-15016 exceeded their GWPS by direct comparison. These data continue to be monitored to evaluate upgradient groundwater conditions that may influence groundwater quality downgradient from Pond 3.

Groundwater data for the monitoring wells with individual results exceeding a GWPS by direct comparison were 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 confidence intervals were calculated for each of the CCR Appendix IV data sets with a direct exceedance of a GWPS using a 99 percent confidence level, i.e., a significance level (α) of 0.01. The following narrative describes the methods employed and the results obtained. 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 monitoring results for molybdenum in JHC-MW-15015 and selenium in JHC-MW-18001 and JHC-MW-18002 were observed visually for a potential trend. No visual trend is present in molybdenum concentrations at JHC-MW-15015 and no statistically significant trends were identified (Attachment 1 trend tests). Similarly, selenium concentrations at JHC-MW-18001 and JHC-MW-18002 have increases since 2019; however, no statistically significant trends were identified (Attachment 1 trend tests). Due to the changes in site conditions discussed above, potential trends in data will continue to be assessed as more data are collected. Data from each round were evaluated for completeness, overall quality, and usability and were deemed appropriate for the purposes of the CCR assessment monitoring program. The Sanitas™ software was then used to test compliance at the downgradient monitoring wells using the confidence interval method for the most recent eight sampling events. Eight independent sampling events provide the appropriate density of data as recommended per the Unified Guidance yet are collected recently enough to provide an indication of current condition. The test was run with a per-well significance of $\alpha = 0.01$. The software outputs are included in Attachment 1 along with data reports showing the values used for the evaluation. The percentage of non-detect observations are also included in Attachment 1. 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. The data sets for selenium at JHC-MW-18001 and JHC-MW-18002 were normally distributed and the data set for molybdenum at JH-MW-15015 was normalized using a power transformation (1/3). The confidence interval test compares the lower confidence limit to the GWPS. The evaluation of the Appendix IV constituents shows no statistically significant exceedances of the GWPSs. This result is consistent with the results of the initial assessment monitoring data statistical evaluation and concentrations remain above background levels. Consumers Energy will continue semiannual assessment monitoring per §257.95 and execute 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

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

		Sample Location:	JHC-MW-15013								
		Sample Date:	4/29/2019	10/10/2019	4/16/2020	10/22/2020	10/22/2020	4/13/2021	10/20/2021	4/11/2022	10/19/2022
Constituent	Unit	GWPS					Field Dup				
Appendix III											
Boron	ug/L	NA	320	300	55	279	278	259	274	358	363
Calcium	mg/L	NA	46	100	146	143	140	133	140	153	141
Chloride	mg/L	NA	16	17	9.48	11.7	11.6	11.5	16.1	16.7	15.9
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	30	230	276	205	202	103	230	275	223
Total Dissolved Solids	mg/L	NA	190	490	741	659	669	592	740	821	733
pH, Field	SU	NA	7.0	7.2	6.6	6.7	--	7.0	7.0	7.0	7.0
Appendix IV											
Antimony	ug/L	6	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	< 1.0	1.1	< 1	< 1	< 1	< 1	1	1	1
Barium	ug/L	2,000	25	53	73	66	65	64	79	97	81
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	2.0	7.3	< 1	1	1	11	5	2	1
Cobalt	ug/L	15	< 6.0	< 6.0	< 15	< 15	< 15	< 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	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
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**	8.5	7.2	6	7	6	9	15	7	16
Radium-226/228	pCi/L	5	< 0.377	1.45	0.729	0.603	< 0.496	0.548	1.18	0.486	< 0.564
Selenium	ug/L	**50**	< 1.0	< 1.0	< 1	< 1	< 1	< 1	1	2	< 1
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.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
-- - 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) Monitoring wells JHC-MW-15015 and JHC-MW-15016 have been upgradient of Pond 3 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

		Sample Location:	JHC-MW-15015(1)									
		Sample Date:	4/29/2019	10/10/2019	4/16/2020	4/16/2020	10/23/2020	4/14/2021	10/20/2021	4/11/2022	4/11/2022	10/18/2022
Constituent	Unit	GWPS				Field Dup					Field Dup	
Appendix III												
Boron	ug/L	NA	1,000	1,300	1,400	1,360	1,770	1,980	1,910	2,710	2,840	2,780
Calcium	mg/L	NA	100	110	162	162	142	127	138	138	142	165
Chloride	mg/L	NA	15	14	11.0	11.2	7.21	6.69	17.7	12.5	13.8	15.0
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	38	39	56.6	57.0	36.6	33.2	41.6	93.6	94.1	144
Total Dissolved Solids	mg/L	NA	430	430	597	600	510	480	577	588	590	712
pH, Field	SU	NA	7.1	7.2	6.7	--	6.8	7.1	7.0	7.1	--	7.2
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	44	49	67	66	53	61	85	99	104	135
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	< 1.0	4.3	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cobalt	ug/L	15	< 6.0	< 6.0	< 15	< 15	< 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	< 1,000
Lead	ug/L	15	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
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**	**140**	**110**	52	50	27	32	22	52	52	**351**
Radium-226/228	pCi/L	5	< 0.419	< 0.432	< 0.577	0.682	< 0.428	0.441	< 0.546	0.626	0.488	1.37
Selenium	ug/L	**50**	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	2	2	1
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.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

NA - not applicable.

-- - 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) Monitoring wells JHC-MW-15015 and JHC-MW-15016 have been upgradient of Pond 3 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

	Sample Location:		JHC-MW-15016[(1)]									
	Sample Date:		4/29/2019	10/10/2019	10/10/2019	4/16/2020	10/23/2020	4/14/2021	10/20/2021	4/11/2022	10/18/2022	10/18/2022
Constituent	Unit	GWPS			Field Dup							Field Dup
Appendix III												
Boron	ug/L	NA	2,100	4,200	4,200	5,060	6,390	4,950	5,400	5,940	4,270	4,110
Calcium	mg/L	NA	110	110	110	134	95.9	86.8	94.0	88.6	133	133
Chloride	mg/L	NA	26	16	17	8.76	5.88	11.8	15.5	11.0	15.0	15.3
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	23	26	26	18.2	15.8	17.6	20.9	28.1	87.4	89.1
Total Dissolved Solids	mg/L	NA	470	450	450	526	405	399	435	445	604	556
pH, Field	SU	NA	6.9	7.2	--	6.7	6.9	7.1	7.0	7.1	7.0	--
Appendix IV												
Antimony	ug/L	6	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	2.6	< 1.0	< 1.0	2	1	< 1	< 1	1	2	2
Barium	ug/L	2,000	99	88	83	100	100	107	131	162	198	193
Beryllium	ug/L	4	< 1.0	< 1.0	< 1.0	< 1	< 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	< 0.2
Chromium	ug/L	100	2.5	1.6	1.7	< 1	1	< 1	< 1	1	2	1
Cobalt	ug/L	15	< 6.0	< 6.0	< 6.0	< 15	< 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	< 1,000
Lead	ug/L	15	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	**100**	42	27	25	59	75	59	52	75	37	37
Radium-226/228	pCi/L	5	0.711	0.540	--	< 0.751	0.506	0.560	0.692	< 0.358	0.948	1.43
Selenium	ug/L	**50**	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	1	1	< 1
Thallium	ug/L	2	< 2.0	< 2.0	< 2.0	< 2	< 2	< 2	< 2	< 2	< 2	< 2

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

NA - not applicable.

-- - 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) Monitoring wells JHC-MW-15015 and JHC-MW-15016 have been upgradient of Pond 3 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

		Sample Location:	JHC-MW-18001								
		Sample Date:	8/13/2019	10/10/2019	4/15/2020	10/23/2020	4/13/2021	4/13/2021	10/20/2021	4/11/2022	10/19/2022
Constituent	Unit	GWPS						Field Dup			
Appendix III											
Boron	ug/L	NA	330	390	376	476	388	411	459	460	510
Calcium	mg/L	NA	76	66	71.7	74.8	62.3	62.2	65.6	66.6	85.5
Chloride	mg/L	NA	2.6	2.2	5.01	9.24	9.32	9.64	1.06	9.62	9.15
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	140	82	94.1	174	109	111	36.0	115	109
Total Dissolved Solids	mg/L	NA	460	360	418	528	401	397	412	453	533
pH, Field	SU	NA	8.2	8.1	8.2	7.8	8.2	--	8.1	7.9	8.0
Appendix IV											
Antimony	ug/L	6	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	1.7	1.5	2	2	1	1	2	2	2
Barium	ug/L	2,000	610	390	529	659	451	457	634	705	826
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	< 1.0	< 1.0	< 1	1	< 1	< 1	< 1	< 1	< 1
Cobalt	ug/L	15	< 6.0	< 6.0	< 15	< 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	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
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**	16	17	18	17	11	11	13	10	8
Radium-226/228	pCi/L	5	1.29	0.702	0.463	0.621	0.639	0.611	0.734	< 0.360	1.45
Selenium	ug/L	**50**	15	18	27	7	6	6	**57**	**63**	33
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.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

NA - not applicable.

-- - 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) Monitoring wells JHC-MW-15015 and JHC-MW-15016 have been upgradient of Pond 3 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

	Sample Location:		JHC-MW-18002							
	Sample Date:		8/13/2019	10/10/2019	4/15/2020	10/22/2020	4/13/2021	10/20/2021	4/12/2022	10/19/2022
Constituent	Unit	GWPS								
Appendix III										
Boron	ug/L	NA	340	330	273	272	207	273	216	241
Calcium	mg/L	NA	51	68	45.9	32.6	59.5	67.9	67.7	45.3
Chloride	mg/L	NA	18	17	3.32	< 1.00	6.82	12.0	10.1	13.4
Fluoride	ug/L	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	NA	67	58	45.9	11.8	68.8	84.1	139	39.9
Total Dissolved Solids	mg/L	NA	300	430	230	140	277	340	349	238
pH, Field	SU	NA	7.3	7.3	7.3	7.2	7.1	6.9	6.9	6.9
Appendix IV										
Antimony	ug/L	6	1.0	2.7	< 1	1	1	1	< 1	< 1
Arsenic	ug/L	10	1.4	< 1.0	< 1	< 1	< 1	< 1	5	< 1
Barium	ug/L	2,000	130	130	108	53	108	136	154	81
Beryllium	ug/L	4	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	< 0.20	0.24	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	< 1.0	< 1.0	< 1	1	< 1	< 1	1	< 1
Cobalt	ug/L	15	< 6.0	< 6.0	< 15	< 15	< 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
Lead	ug/L	15	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	40	12	< 10	< 10	< 10	< 10	11	< 10	< 10
Mercury	ug/L	2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	**100**	13	15	15	20	17	12	10	13
Radium-226/228	pCi/L	5	< 0.607	< 0.413	< 0.415	< 0.501	< 0.368	< 0.487	< 0.413	< 0.599
Selenium	ug/L	**50**	23	31	**57**	12	**101**	8	42	13
Thallium	ug/L	2	< 2.0	< 2.0	< 2	< 2	< 2	< 2	< 2	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
-- - 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) Monitoring wells JHC-MW-15015 and JHC-MW-15016 have been upgradient of Pond 3 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

	Sample Location:		JHC-MW-18003									
	Sample Date:		8/13/2019	8/13/2019	10/10/2019	4/15/2020	10/22/2020	4/13/2021	10/19/2021	10/19/2021	4/12/2022	10/19/2022
Constituent	Unit	GWPS										
Appendix III				Field Dup						Field Dup		
Boron	ug/L	NA	330	340	510	283	310	193	336	336	540	384
Calcium	mg/L	NA	100	110	140	78.5	75.1	90.4	151	153	206	120
Chloride	mg/L	NA	10	11	10	11.7	3.18	2.13	< 1.00	< 1.00	< 1.00	< 1.00
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	250	250	340	88.9	74.5	194	359	362	539	317
Total Dissolved Solids	mg/L	NA	510	520	660	352	324	463	881	777	1,010	646
pH, Field	SU	NA	7.0	--	6.9	7.2	6.9	7.2	7.2	--	6.8	6.7
Appendix IV												
Antimony	ug/L	6	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	< 1.0	< 1.0	1.4	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Barium	ug/L	2,000	100	96	130	97	92	75	103	106	206	143
Beryllium	ug/L	4	< 1.0	< 1.0	< 1.0	< 1	< 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	< 0.2
Chromium	ug/L	100	< 1.0	< 1.0	< 1.0	< 1	1	< 1	< 1	< 1	< 1	< 1
Cobalt	ug/L	15	< 6.0	< 6.0	< 6.0	< 15	< 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	< 1,000
Lead	ug/L	15	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	10	24
Mercury	ug/L	2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	**100**	10	10	12	19	18	21	14	15	< 5	9
Radium-226/228	pCi/L	5	< 0.570	< 0.360	< 0.556	< 0.465	0.557	0.417	0.812	0.721	< 0.382	0.731
Selenium	ug/L	**50**	< 1.0	< 1.0	< 1.0	4	1	< 1	< 1	< 1	1	< 1
Thallium	ug/L	2	< 2.0	< 2.0	< 2.0	< 2	< 2	< 2	< 2	< 2	< 2	< 2

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

NA - not applicable.

-- - 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.

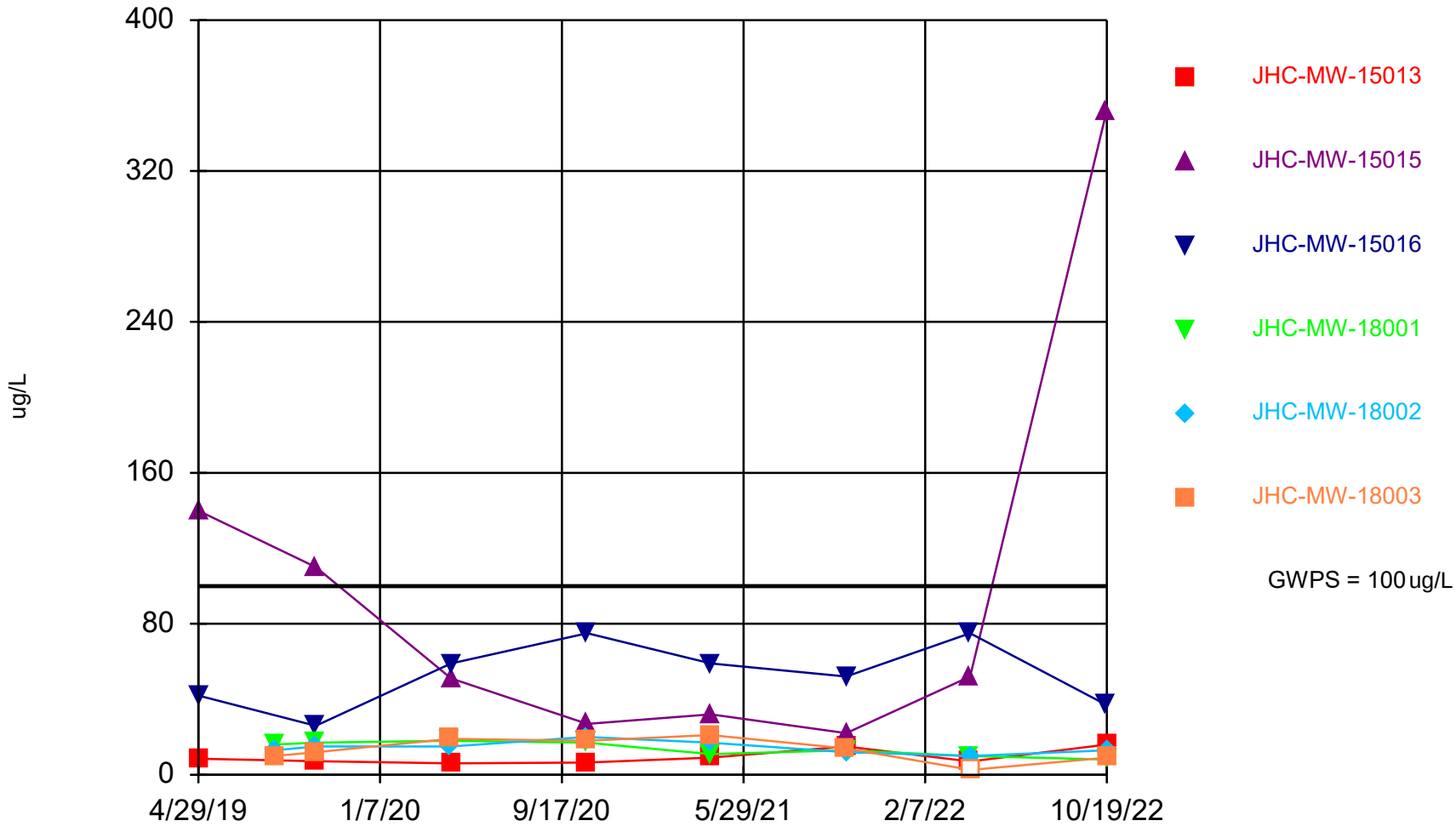
All metals were analyzed as total unless otherwise specified.

(1) Monitoring wells JHC-MW-15015 and JHC-MW-15016 have been upgradient of Pond 3 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Attachment 1
Sanitas™ Output

Hollow symbols indicate censored values.

Molybdenum Comparison to GWPS

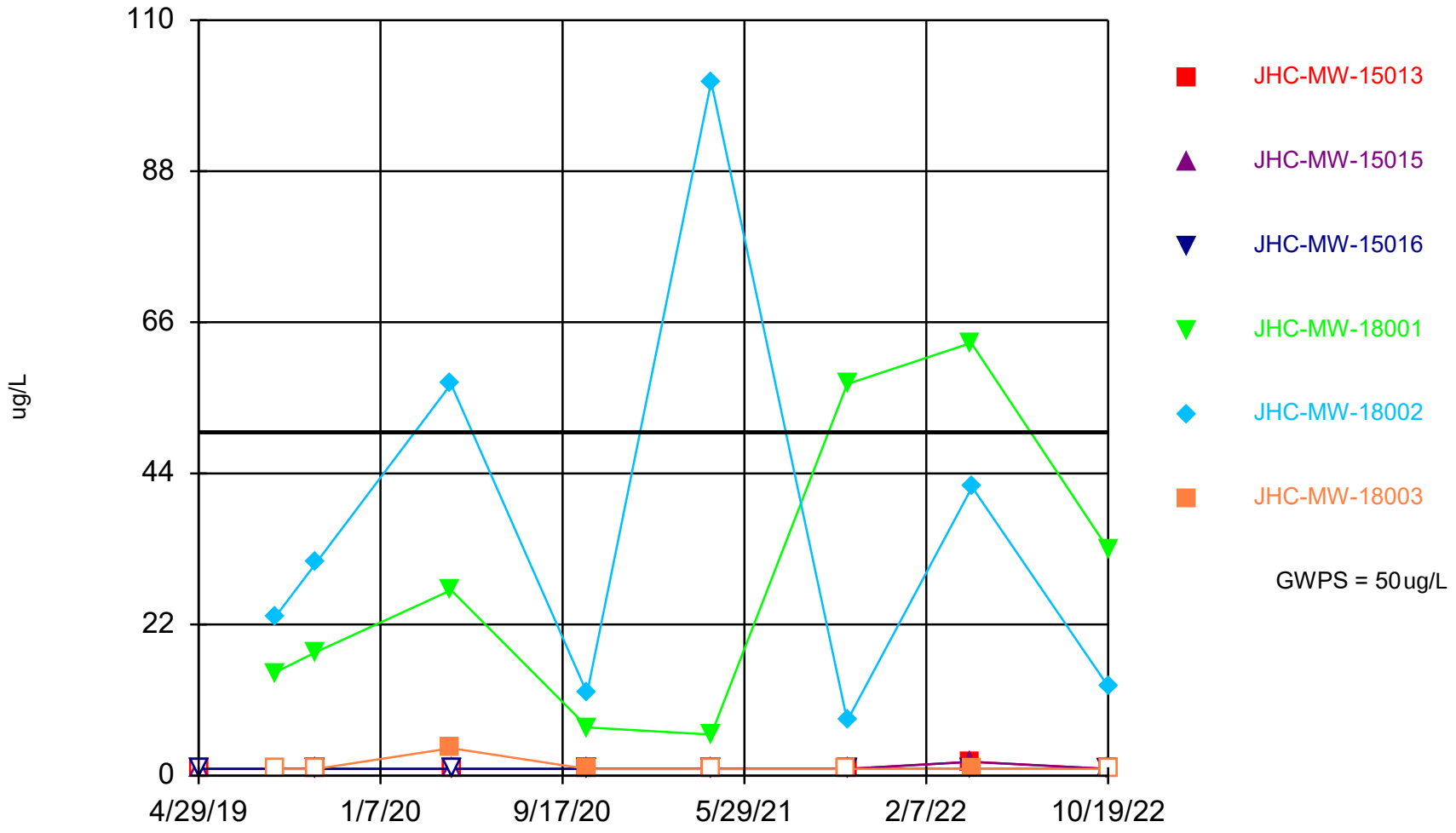


Time Series Analysis Run 11/21/2022 1:41 PM

Client: Consumers Energy Data: JHC_CCR Sanitas_4Q22

Hollow symbols indicate censored values.

Selenium Comparision to GWPS



Time Series Analysis Run 11/21/2022 1:36 PM

Client: Consumers Energy Data: JHC_CCR Sanitas_4Q22

Summary Report

Constituent: Molybdenum, Total Analysis Run 11/21/2022 1:43 PM
Client: Consumers Energy Data: JHC_CCR Sanitas_4Q22

For observations made between 4/29/2019 and 10/19/2022, a summary of the selected data set:

Observations = 48
NDs = 2%
Wells = 6
Minimum Value = 2.5
Maximum Value = 351
Mean Value = 33.66
Median Value = 16.5
Standard Deviation = 54.3
Coefficient of Variation = 1.613
Skewness = 4.493

Well	#Obs.	NDs	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15013	8	0%	6	16	9.4	7.85	3.9	0.4149	0.9634
JHC-MW-15015	8	0%	22	351	98.13	51.5	110.5	1.126	1.694
JHC-MW-15016	8	0%	26	75	53.13	55.5	17.51	0.3297	-0.1191
JHC-MW-18001	8	0%	8	18	13.75	14.5	3.77	0.2742	-0.3056
JHC-MW-18002	8	0%	10	20	14.38	14	3.114	0.2166	0.4766
JHC-MW-18003	8	12%	2.5	21	13.19	13	6.118	0.4639	-0.3622

Summary Report

Constituent: Selenium, Total Analysis Run 11/21/2022 1:38 PM
Client: Consumers Energy Data: JHC_CCR Sanitas_4Q22

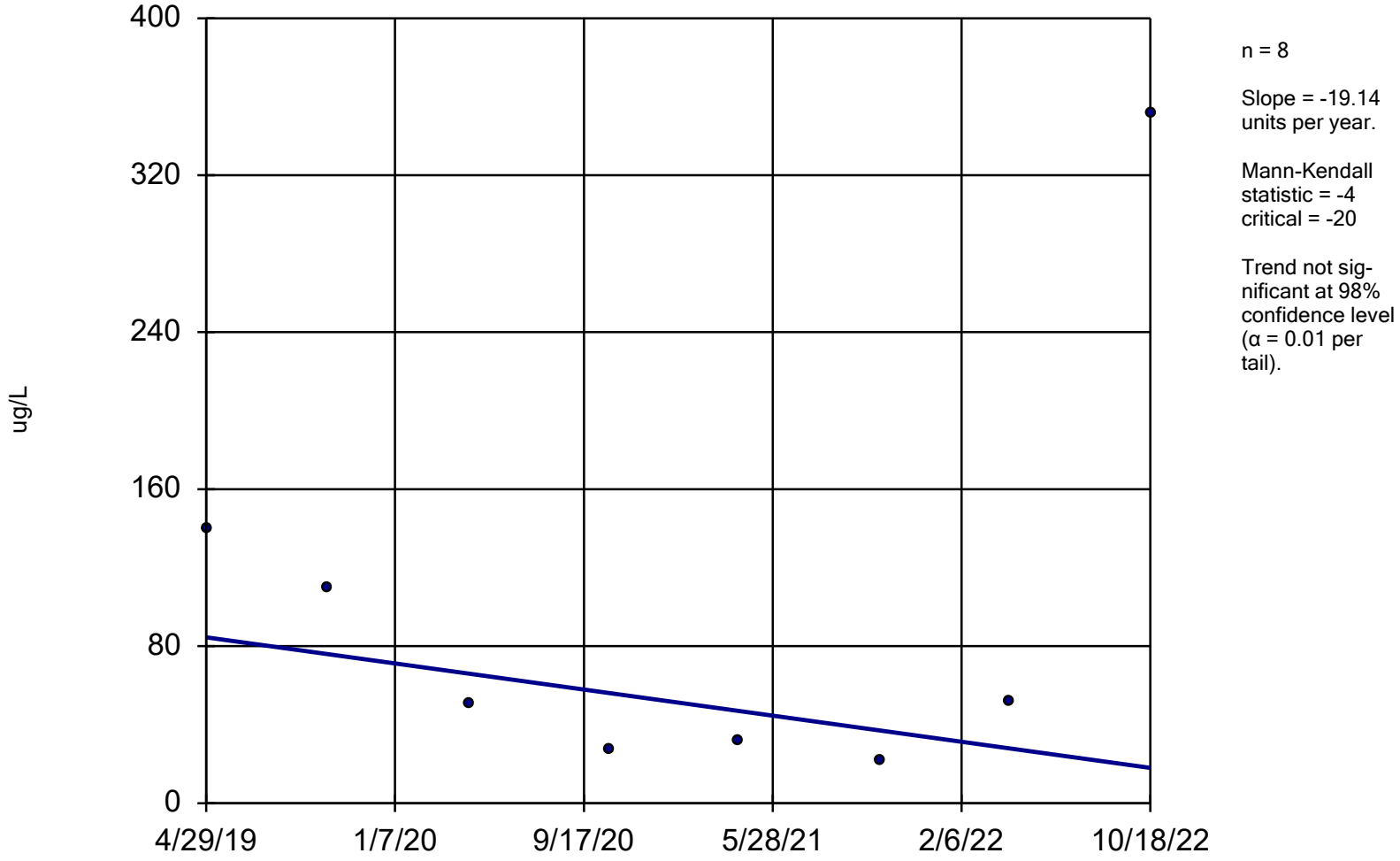
For observations made between 4/29/2019 and 10/19/2022, a summary of the selected data set:

Observations = 48
NDs = 47%
Wells = 6
Minimum Value = 1
Maximum Value = 101
Mean Value = 11.46
Median Value = 1
Standard Deviation = 20.89
Coefficient of Variation = 1.823
Skewness = 2.501

Well	#Obs.	NDs	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15013	8	75%	1	2	1.125	1	0.3536	0.3143	2.268
JHC-MW-15015	8	75%	1	2	1.125	1	0.3536	0.3143	2.268
JHC-MW-15016	8	75%	1	1	1	1	0	0	NaN
JHC-MW-18001	8	0%	6	63	28.25	22.5	21.66	0.7669	0.6281
JHC-MW-18002	8	0%	8	101	35.88	27	31.13	0.8678	1.196
JHC-MW-18003	8	62%	1	4	1.375	1	1.061	0.7714	2.268

Molybdenum, Total

JHC-MW-15015



n = 8

Slope = -19.14 units per year.

Mann-Kendall statistic = -4
critical = -20

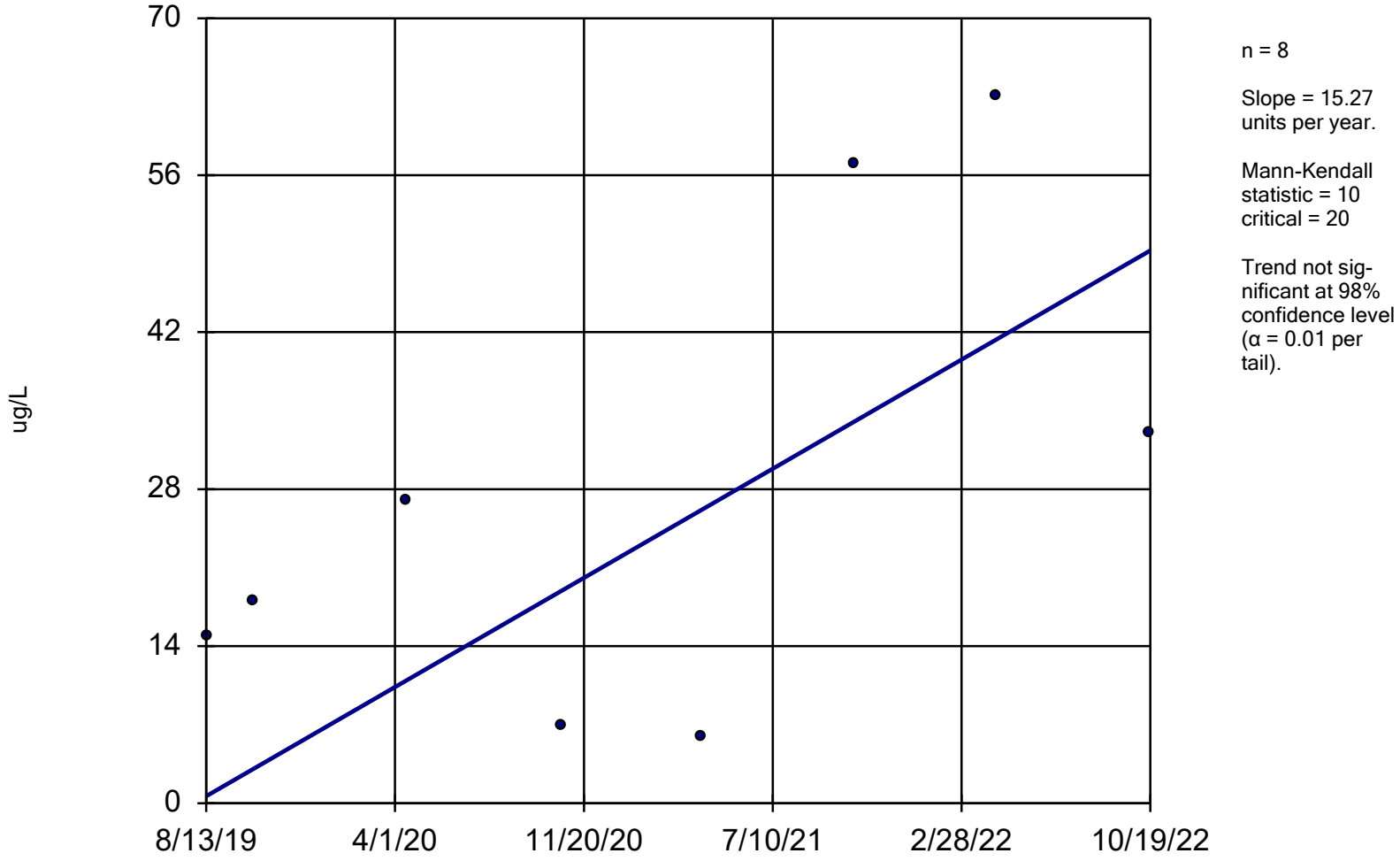
Trend not significant at 98% confidence level (α = 0.01 per tail).

Sen's Slope Estimator Analysis Run 11/21/2022 1:43 PM

Client: Consumers Energy Data: JHC_CCR Sanitas_4Q22

Selenium, Total

JHC-MW-18001



n = 8

Slope = 15.27 units per year.

Mann-Kendall statistic = 10
critical = 20

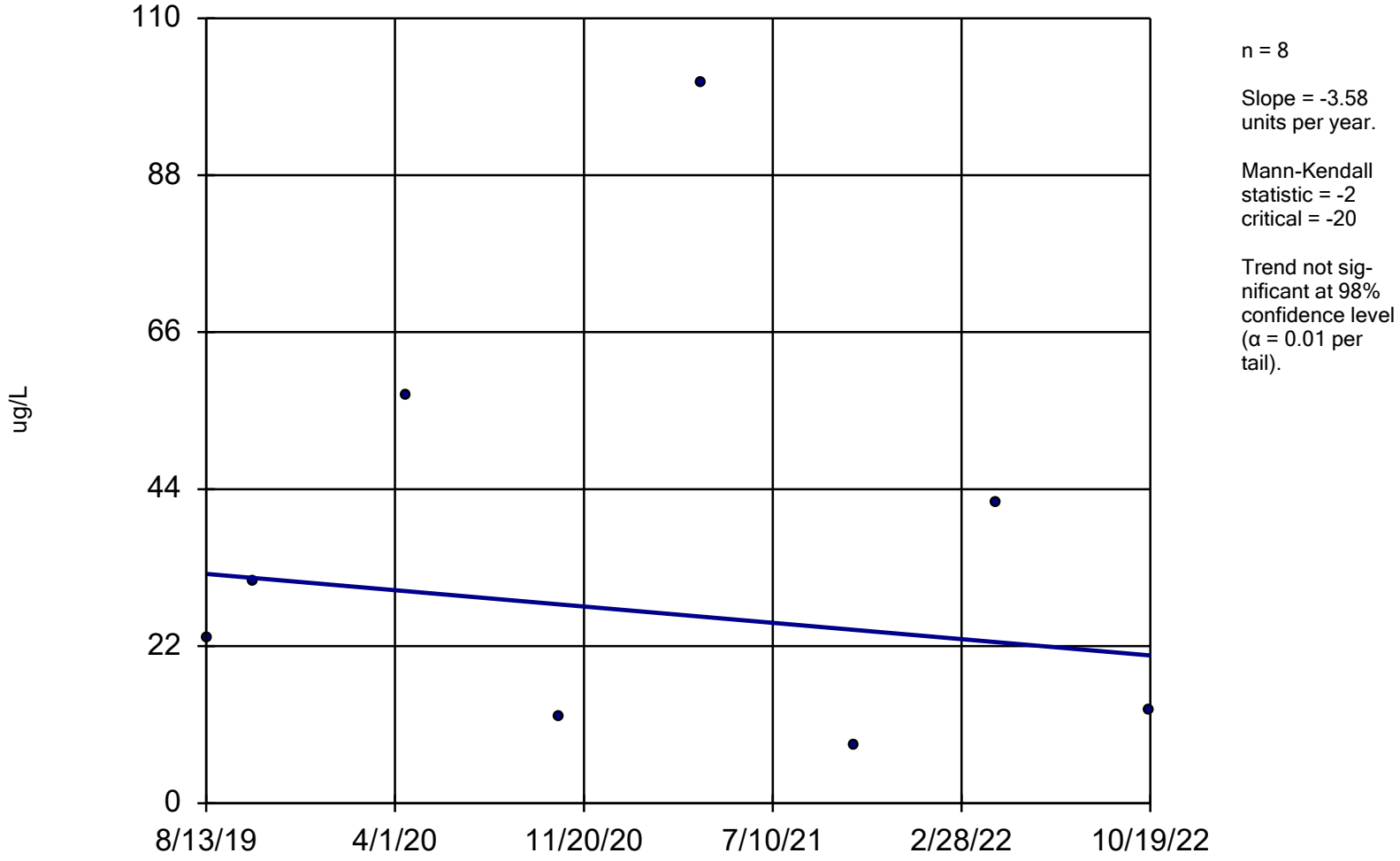
Trend not significant at 98% confidence level (α = 0.01 per tail).

Sen's Slope Estimator Analysis Run 11/22/2022 5:22 PM

Client: Consumers Energy Data: JHC_CCR Sanitas_4Q22

Selenium, Total

JHC-MW-18002



n = 8

Slope = -3.58 units per year.

Mann-Kendall statistic = -2
critical = -20

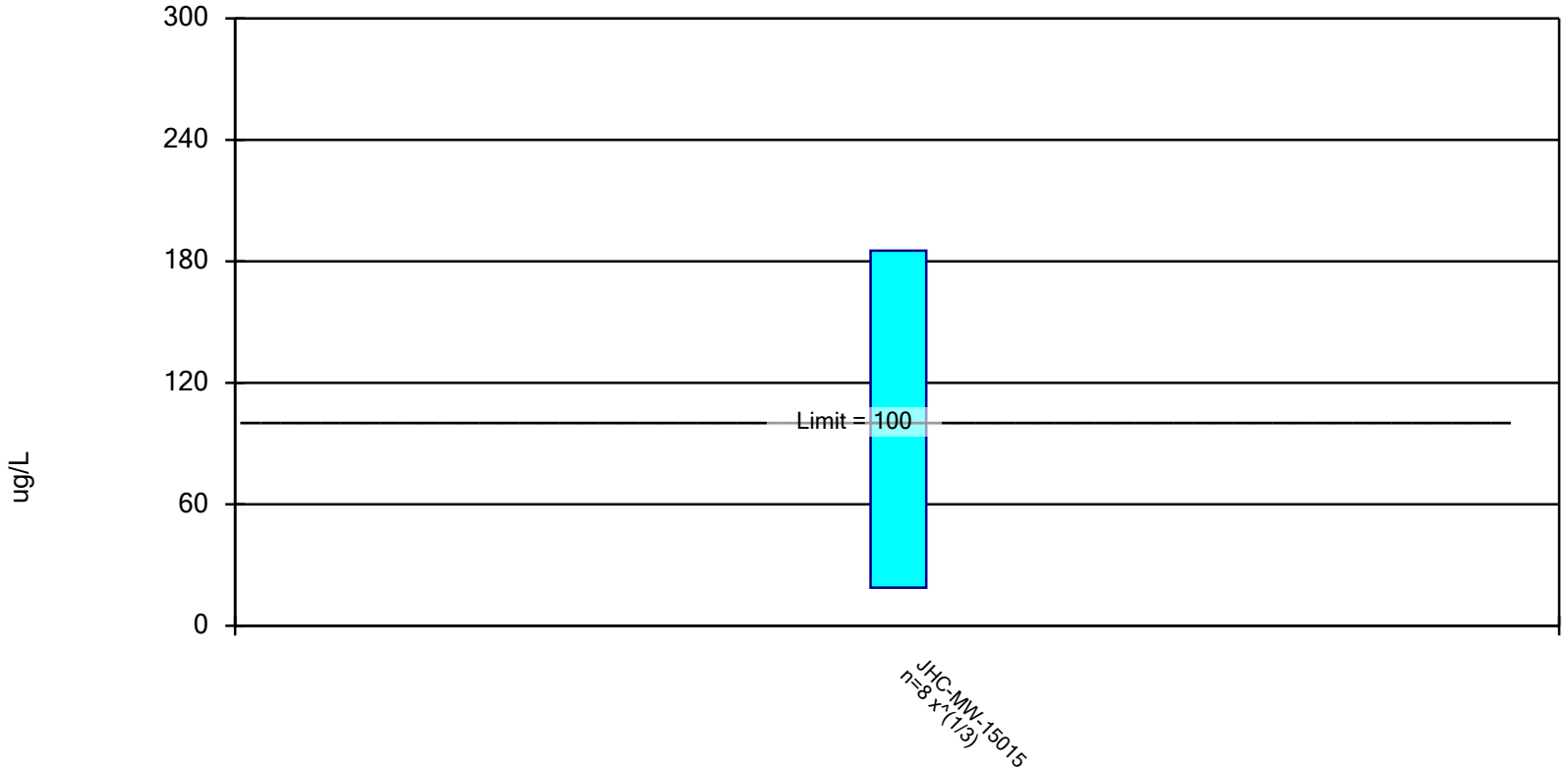
Trend not significant at 98% confidence level (α = 0.01 per tail).

Sen's Slope Estimator Analysis Run 11/21/2022 1:39 PM

Client: Consumers Energy Data: JHC_CCR Sanitas_4Q22

Parametric Confidence Interval

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



Constituent: Molybdenum, Total Analysis Run 11/21/2022 1:48 PM

Client: Consumers Energy Data: JHC_CCR Sanitas_4Q22

Confidence Interval

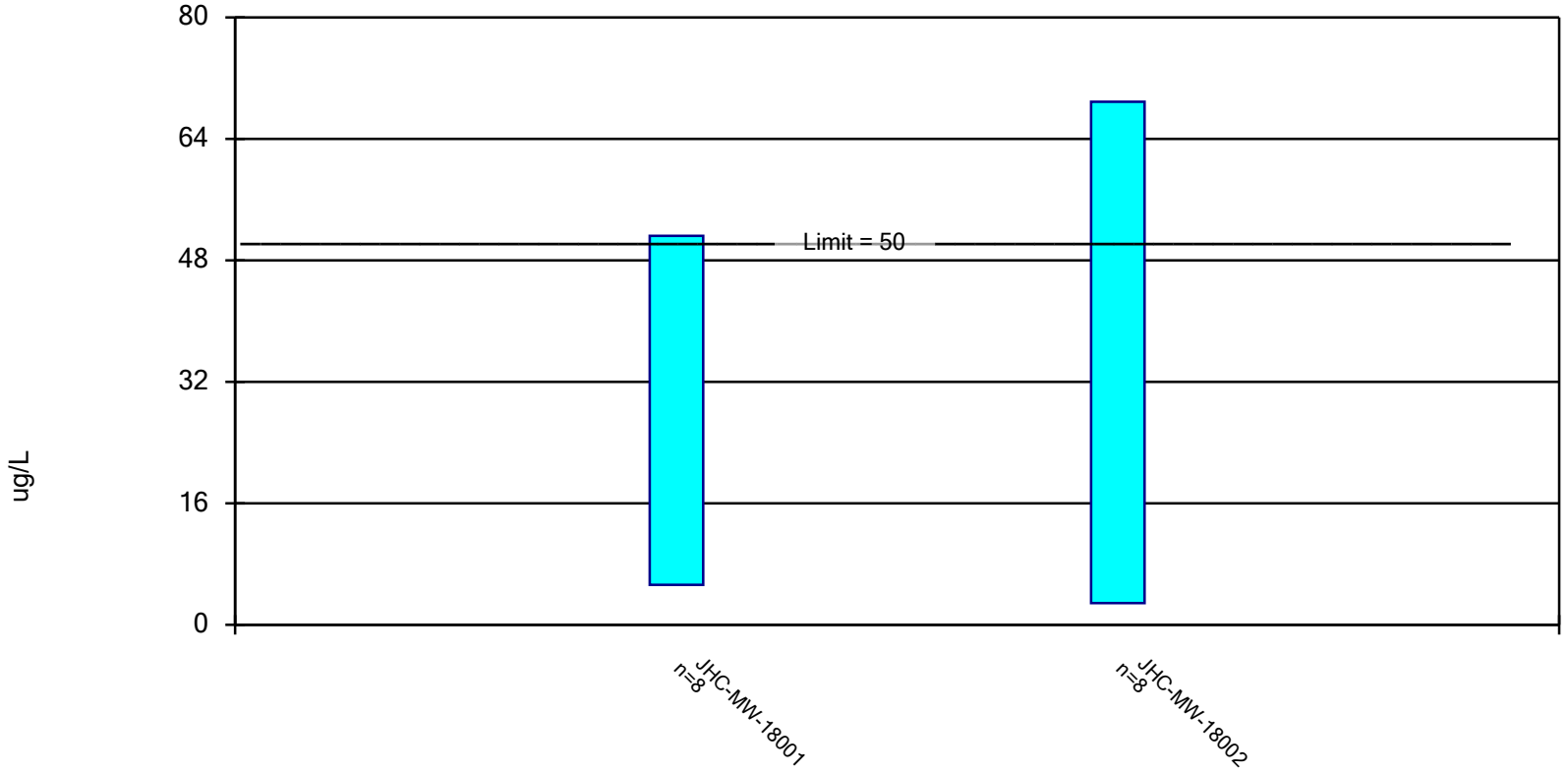
Constituent: Molybdenum, Total (ug/L) Analysis Run 11/21/2022 1:50 PM

Client: Consumers Energy Data: JHC_CCR Sanitas_4Q22

	JHC-MW-15015
4/29/2019	140
10/10/2019	110
4/16/2020	51 (D)
10/23/2020	27
4/14/2021	32
10/20/2021	22
4/11/2022	52 (D)
10/18/2022	351
Mean	98.13
Std. Dev.	110.5
Upper Lim.	185.3
Lower Lim.	18.88

Parametric Confidence Interval

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



Constituent: Selenium, Total Analysis Run 11/21/2022 1:47 PM

Client: Consumers Energy Data: JHC_CCR Sanitas_4Q22

Confidence Interval

Constituent: Selenium, Total (ug/L) Analysis Run 11/21/2022 1:48 PM

Client: Consumers Energy Data: JHC_CCR Sanitas_4Q22

	JHC-MW-18001	JHC-MW-18002
8/13/2019	15	23
10/10/2019	18	31
4/15/2020	27	57
10/22/2020		12
10/23/2020	7	
4/13/2021	6 (D)	101
10/20/2021	57	8
4/11/2022	63	
4/12/2022		42
10/19/2022	33	13
Mean	28.25	35.88
Std. Dev.	21.66	31.13
Upper Lim.	51.21	68.87
Lower Lim.	5.287	2.876