July 30, 2020

Ms. Lori Babcock
Michigan Department of Environment, Great Lakes, and Energy
Materials Management Division
Saginaw Bay District Office
401 Ketchum St, Suite B
Bay City, Michigan 48708

SUBJECT: **Semiannual Progress Report – Selection of Final Remedy pursuant to §257.97(a)**
JC Weadock Bottom Ash Pond and Landfill Coal Combustion Residuals (CCR) Units

Dear Ms. Babcock,

Consumers Energy prepared and submitted to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) a closure work plan for the Weadock Bottom Ash Pond (Weadock Bottom Ash Pond Work Plan) and a Response Action Plan developed for the Weadock Bottom Ash Pond and Weadock Landfill in accordance with Part 115 dated November 30, 2018 and March 15, 2019, respectively. These plans were developed in anticipation of supporting the Assessment of Corrective Measures that would be necessary for evaluating and selecting a remedy for the Weadock Bottom Ash Pond and Weadock Landfill. Consumers Energy provided notification of exceeding a Groundwater Protection Standard (GWPS) per §257.95(g), which documented beryllium and lithium were present at statistically significant levels above the GWPS in one downgradient well at the Weadock Bottom Ash Pond and arsenic was present at one downgradient monitoring well in the original Weadock Landfill groundwater monitoring system on January 14, 2019.

EGLE approved the Weadock Bottom Ash Pond Work Plan on December 20, 2018 based on expectation that a report documenting the removal activities and certifying solid waste has been removed in accordance with the work plan would be submitted at the completion of activities. Subsequently, EGLE approved the Response Action Plan on May 14, 2019 based on the anticipated submittal of the Assessment of Corrective Measures. Consumers Energy has completed the excavation activities described in the Weadock Bottom Ash Pond Work Plan and expects to submit a final excavation certification report by August 28, 2020 to satisfy requirements for completing the removal of solid waste which rendered the need for a solid waste operating license was unnecessary.

For the Weadock Landfill, Consumers Energy completed construction of a soil-bentonite slurry wall (Weadock Slurry Wall) that enclosed the landfill with the exception of a 1,600 ft venting feature (NTH Consultants, Ltd., 2009). Later, construction of the Weadock Slurry Wall was extended to include the previous vent (Golder, 2018). EGLE approved the construction certification reports on June 24, 2009 and December 19, 2018, respectively.

This Semiannual Progress Report, prepared as a requirement of §257.97(a) of the Federal Coal Combustion Residual (CCR) Rule, describes progress towards selecting and implementing any additional remedy for the Weadock Bottom Ash Pond and Weadock Landfill after the completion of the *Assessment of Corrective Measures, JC Weadock Bottom Ash Pond and Landfill Coal Combustion Residual Unit*, dated September, 11, 2019 (Weadock ACM) (TRC, 2019). Groundwater management alternatives considered to be technically feasible following source removal activities for the Weadock Bottom Ash Pond that could potentially address the residual arsenic under *known* groundwater conditions were identified in the report as: 1) Post-remedy monitoring, 2) Groundwater capture/control, 3) Impermeable barrier, 4) Active geochemical sequestration, and 5) Passive geochemical sequestration. These groundwater corrective strategies also apply to the Weadock Landfill upon completing source containment through the construction of the soil-bentonite slurry wall and construction of an impermeable final cover system.

Results of May 2020 Sampling Event

Statistical analysis from the May 2020 assessment groundwater monitoring event verified that the that there were no constituents of concern present at statistically significant levels above the established Groundwater Protection Standard (GWPS) within the Weadock Bottom Ash Pond groundwater monitoring system and only one monitoring well within the Weadock Landfill groundwater monitoring system where arsenic is present at statistically significant levels exceeding the GWPS. Results are presented in the enclosed *May 2020 Assessment Monitoring Data Summary and Statistical Evaluation Consumers Energy, JC Weadock Site, Landfill and Bottom Ash Pond CCR Units* (May 2020 Event Summary) (TRC, 2020). Additionally, monitoring performed under the Weadock Groundwater Surface-Water Interface (GSI) Compliance Plan demonstrates protection of human health and the environment with criteria determined to be protective at the point of exposure. These results are depicted in Figure 4 of the May 2020 Event Summary.

Significant observations from the event summary are as follows:

- Beryllium and lithium are no longer present at statistically significant levels in the Weadock Bottom Ash Pond groundwater monitoring system, leaving only arsenic present in one monitoring well within the Weadock Landfill groundwater monitoring well system present at statistically significant levels;
- No additional Appendix IV constituents have been observed at statistically significant levels above GWPS for the Weadock Bottom Ash Pond or Weadock Landfill groundwater monitoring systems;
- Arsenic is present at a statistically significant levels above the GWPS at JCW-MW-18006; however, this well is located adjacent to dewatering and excavation work for the Weadock Bottom Ash Pond and expected to improve once source removal work is completed; and
- Arsenic and molybdenum concentrations at monitoring well MW-55 have been reviewed through an Alternate Source Demonstration provided in Appendix G of the *2020 Annual Groundwater Monitoring and Corrective Action Report* (TRC, January 2020) indicating elevated levels of constituents at that location are not related to materials management of the Weadock Landfill.

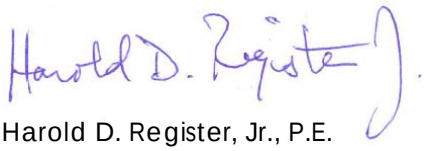
Conclusions

Source removal activities for the Weadock Bottom Ash Pond have been completed and will be documented in the Weadock Bottom Ash Pond Closure Report targeted for submittal to EGLE by August 28, 2020. Improvements in groundwater quality have been observed in the groundwater monitoring system, but observations of ongoing changes in groundwater potentiometric surface that may influence groundwater flow characteristics and/or alter groundwater redox conditions at monitoring locations that could influence constituent concentrations still require further evaluation before a groundwater remedy can be selected. Subsequent sampling events will inform the on-going improvements and retention of monitoring-only, passive, or active remedial options following the source removal. As conditions continue to be evaluated post-source removal, the drinking water and groundwater-surface water interface (GSI) pathway are protected by quarterly monitoring performed under the Michigan-approved hydrogeological monitoring plan that includes a GSI Compliance Monitoring Program.

The final remedy for the Weadock Bottom Ash Pond and Weadock Landfill will be formally selected per §257.97 and Michigan Solid Waste requirements once the selected option is reviewed and commented on by EGLE and a public meeting is conducted at least 30-days prior to the final selection as required under §257.96(e).

The next semiannual progress report will be submitted in six months by January 31, 2020. Please feel free to contact me with any questions or clarifications.

Sincerely,



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Mr. Caleb Batts, Consumers Energy
Ms. Darby Litz, TRC
Mr. Jacob Krenz, TRC

Enclosure: *May 2020 Assessment Monitoring Data Summary and Statistical Evaluation Consumers Energy, JC Weadock Site, Landfill and Bottom Ash Pond CCR Units*. (TRC, July 30, 2020).

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July 30, 2020

Harold Register
Environmental Services
Consumers Energy Company
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Jackson, MI 49201

Subject: May 2020 Assessment Monitoring Data Summary and Statistical Evaluation, Consumers Energy, JC Weadock Site, Landfill and Bottom Ash Pond CCR Units

Dear Mr. Register:

Consumers Energy is continuing assessment monitoring in accordance with §257.95 of the CCR Rule[1] for the JC Weadock (Weadock) site in Essexville, Michigan (Figure 1). Statistical evaluation from the May 2018 assessment monitoring event data determined that beryllium and lithium were present at statistically significant levels above the federal Groundwater Protection Standard (GWPS) in one downgradient monitoring well within the Weadock Bottom Ash Pond groundwater monitoring system and arsenic was present at a statistically significant levels above the federal GWPS in one downgradient monitoring well within the Weadock Landfill groundwater monitoring system. This letter report has been prepared to provide the summary of the May 2020 assessment of groundwater monitoring results, data quality review, and statistical data evaluation for the Weadock Landfill and Weadock Bottom Ash Pond groundwater monitoring systems.

Assessment Monitoring Sampling Summary

TRC conducted the first semiannual assessment monitoring event of 2020 for Appendix III and IV constituents at the Weadock Landfill and Bottom Ash Pond CCR Units in accordance with the *JC Weadock Monitoring Program Sample Analysis Plan* (TRC, 2018) (SAP). The semiannual assessment monitoring event was performed on May 11 through May 20, 2020. The landfill downgradient monitoring well network (JCW-MW-18001, JCW-MW-18004, JCW-MW-18005, JCW-MW-18006, OW-57R Out, MW-50, MW-51, MW-52, MW-53, MW-54R, and MW-55), Bottom Ash Pond down gradient monitoring well network (JCW-MW-15007, JCW-MW-15009, JCW-MW-15010, and JCW-MW-15028), and background monitoring wells (MW-15002, MW-15008, MW-15016, and MW-15019) were sampled during the semiannual assessment monitoring event. The locations of the monitoring wells are depicted on Figure 2.

The May 2020 sampling event consisted of collecting static water level measurements from the Weadock Landfill and Weadock Bottom Ash Pond groundwater monitoring system, respectively. Static water elevation data are summarized in Table 1 and groundwater elevation data are shown on Figure 3. Monitoring wells were purged with peristaltic pumps utilizing low-flow sampling methodology. Field parameters were stabilized at each monitoring well prior to collecting groundwater samples.

[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.

Stabilized field parameters for each monitoring well are summarized in Table 2.

Eurofins TestAmerica Inc. (TestAmerica) provided the radiological analysis of the groundwater samples. The remaining Appendix III and IV constituents were analyzed by Consumers Energy Laboratory Services in Jackson, Michigan in accordance with the SAP. The analytical results for the background monitoring wells are summarized in Table 3. The analytical results for the Landfill and Bottom Ash Pond downgradient monitoring wells are summarized in Tables 4 and 5 respectively

Groundwater Flow Rate and Direction

Groundwater elevation data collected during the May 2020 assessment monitoring event are provided in Table 1, as well as additional groundwater elevation data collected from March 2020 (two months prior to the assessment monitoring event). These data were used to construct the groundwater contour map (Figure 3).

Groundwater elevations at the Weadock site are generally within the range of 581 to 594 feet above mean sea level (ft NAVD88) and groundwater is typically encountered at a similar or slightly higher elevation relative to the surrounding surface water features measured by the NOAA gauging station data.

The static water level elevations inside of the Weadock Landfill perimeter slurry wall are generally significantly different (>1 ft) than static water levels outside of the slurry wall, which demonstrates the presence of a low permeability feature between the well pairings inside and outside of the constructed slurry wall. The monitoring well network is structured such that there are eleven (11) monitoring well pairs used to evaluate the hydraulic gradient and potential for water flux across the slurry wall. As such, the water level elevations indicate that the slurry wall is performing as designed. The general flow direction observed within the confinement of the slurry wall is similar to that identified in previous monitoring rounds. Due to the potential for radial flow, the downgradient wells are appropriately positioned to detect the presence of Appendix IV parameters that could potentially migrate from the Weadock Landfill.

Figure 3 shows that groundwater near the Weadock Bottom Ash Pond continues to flow to the north toward the discharge channel and to the west near the Saginaw River. The average hydraulic gradient throughout the bottom ash pond area during the May 2020 event is estimated at 0.0016 ft/ft. The gradient was calculated using the well pairs JCW-MW-15028/JCW-MW-15009, JCW-MW-15007/JCW-MW-15010, and MW-15016/MW-15002. Using the mean hydraulic conductivity of 16 ft/day (ARCADIS, 2016) and an assumed effective porosity of 0.3, the estimated average seepage velocity ranged from approximately 0.086 ft/day or 32 ft/year, which is lower than previous estimates due to the recent dewatering and removal of CCR material from the JCW Bottom Ash Pond. The general 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 III/IV constituents that could potentially migrate from the Weadock Bottom Ash Pond.

Data Quality

Analytical data were found to be usable for assessment monitoring and were generally consistent with previous sampling events. The Data Quality Reviews are included as Attachment A.

Assessment Monitoring Statistical Evaluation

Based on the results from the May 2020 assessment monitoring event, both the Weadock Bottom Ash Pond and Weadock Landfill will remain in assessment monitoring in accordance with §257.95. The following section summarizes the statistical approach applied to assess the May 2020 groundwater data in accordance with the assessment monitoring program.

Establishing Groundwater Protection Standards

The 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. In accordance with §257.95(h) and the unit-specific Stats Plans[2,3], GWPSs were established for the Appendix IV constituents following the preliminary assessment monitoring event using nine rounds of data collected from the background monitoring wells MW-15002, MW-15008, MW-15016, and MW-15019 (December 2015 through April 2018). The calculation of the GWPSs is documented in the Groundwater Protection Standards technical memorandum included as Appendix C of the *2018 Annual Groundwater Monitoring Report* (TRC, 2019). The GWPS is established as the higher value of the EPA Maximum Contaminant Level (MCL) or statistically derived background level for constituents with MCLs and the higher of the EPA Regional Screening Levels (RSLs) or background level for constituents with RSLs.

Data Comparison to Groundwater Protection Standards

The compliance well groundwater concentrations for Appendix IV constituents were compared to the GWPSs to determine if a statistically significant exceedance had occurred in accordance with §257.95. Consistent with the *Unified Guidance*[4], 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 monitoring well data exceeds the GWPS for any Appendix IV constituent. As documented in the January 14, 2019 Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g), beryllium and lithium were present at statistically significant levels above the federal GWPS in one downgradient monitoring well within the Weadock Bottom Ash Pond groundwater monitoring system and arsenic was present at one downgradient monitoring well within the original Weadock Landfill groundwater monitoring system. Completion of closing the slurry wall vent in

[2] TRC. 2017. *Groundwater Statistical Evaluation Plan* – JC Weadock Power Plant, Bottom Ash Pond, Essexville, Michigan. October.
[3] TRC. 2018. *Groundwater Statistical Evaluation Plan Rev. 1* – JC Weadock Power Plant, Landfill, Essexville, Michigan. December.
[4] USEPA. 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance.* Office of Conservation and Recovery. EPA 530/R-09-007.

2018 necessitated modifications to the groundwater monitoring system to adequately monitor for releases of Appendix III/Appendix IV constituents along potential groundwater flow pathways[5].

Confidence intervals were established per the statistical methods detailed in the *Statistical Evaluation of May 2020 Assessment Monitoring Sampling Event* technical memorandum provided in Attachment B. For each Appendix IV constituent, the concentrations were first compared directly to the respective GWPSs. Constituent-well combinations that included a direct exceedance of the GWPSs were retained for further statistical analysis using confidence limits.

Weadock Bottom Ash Pond

Overall, the assessment monitoring statistical evaluations have confirmed that beryllium, and lithium are the only Appendix IV constituents that have been present at statistically significant levels above the GWPS. The statistical evaluation of this semiannual assessment monitoring event data indicate that no appendix IV constituents are present at statistically significant levels exceeding the GWPS in downgradient monitoring wells at the Weadock Bottom Ash Pond:

Constituent	GWPS	#Downgradient Wells Observed
No constituents are present at statistically significant levels exceeding the GWPS		

Previously, beryllium and lithium were present in downgradient well JCW-MW-15009 at a statistically significant levels; however, the May 2020 statistical evaluation shows that the lower confidence limit for beryllium and lithium is currently below the GWPSs. A summary of the confidence intervals for May 2020 is provided in Table 6.

Weadock Landfill

Overall, the assessment monitoring statistical evaluations have confirmed that arsenic is the only Appendix IV constituent that has been present at statistically significant levels above the GWPS. The statistical evaluation of this semiannual assessment monitoring event data indicates that arsenic is present at statistically significant levels above the GWPSs in one downgradient monitoring well at the JCW Landfill.

Constituent	GWPS	#Downgradient Wells Observed
Arsenic	21 ug/L	1 of 12

The statistically significant GWPS exceedance at JCW-MW-18006 was not previously observed as this is the first statistical analysis completed on JCW-MW-18006 following the accumulation of the minimum of four data points. The results of the statistical analysis for other wells/constituents are consistent with previous evaluations using the

[5] TRC. 2018. *Revised Groundwater Monitoring System Summary Report – Consumers Energy, JC Weadock Landfill.* December 19.

modified well network. A summary of the confidence intervals for May 2020 is provided in Table 6.

Nature and Extent of Affected Groundwater

Since beryllium and lithium have been detected at the Weadock Bottom Ash Pond and arsenic has been detected at the Weadock Landfill at statistically significant levels above the GWPSs, the nature and extent of the releases were characterized in accordance with the requirements of §257.95(g)(1) and characterized in the *Assessment of Corrective Measures, JC Weadock Bottom Ash Pond and Landfill Coal Combustion Residual Unit* (Weadock ACM) (TRC, 2019). The nature and extent characterization of groundwater was performed using data collected from existing site monitoring wells. Additionally, site hydrogeological investigations have demonstrated that a shallow water-bearing unit is not present towards the southern portion of the property. Although arsenic, beryllium, lithium concentrations exceed the GWPS in on-site groundwater monitoring locations, these COCs are delineated within the limits of the property owned by Consumers Energy and there are currently no adverse effects on human health or the environment from either surface water or groundwater due to CCR management at the Weadock Bottom Ash Pond. The property is owned and operated by Consumers Energy and groundwater is not used for drinking water. There are no on-site drinking water wells, so the drinking water pathway is not complete. A shallow water-bearing unit is not observed to the south of the landfill, which prevents offsite migration of Appendix III and Appendix IV constituents.

The distribution of arsenic, beryllium, and lithium in the shallow water-bearing unit as compared to the GWPS is presented in Figure 4. Three categories were assigned to groundwater data collected from November 2018 to April 2020, as follows:

- White – No Exceedances: all concentrations were below the GWPS
- Yellow – Two or More Exceedances: individual observations above the GWPS[6]
- Orange – Statistically Significant GWPS Exceedances[7]

As shown on Figure 4, the following is a summary of the RCRA CCR comparison results organized by constituent:

Arsenic

Although during the statistical evaluation of the May 2020 semi-annual data the lower confidence limits of arsenic did not exceed the GWPS of 21 ug/L at the Weadock Bottom Ash Pond, the observed upper confidence limit is at or above the GWPS at two wells near the (JCW-MW-15010 and JCW-MW-15007). Since sluicing to the Weadock Bottom Ash Pond ceased in April 2016, concentrations of arsenic in JCW-MW-15010 appear to exhibit a downward trend.

[6] Although an exceedance is defined as a single detection above the GWPS, confidence intervals will be used to determine compliance per the CCR Rule. Once corrective action is triggered (i.e., the lower confidence limit is above the GWPS), the upper confidence limit must be below the GWPS to demonstrate achievement of the GWPS for units that were not closed by removal. For units that are closed by removal, two consecutive rounds of data below the GWPS are needed to demonstrate closure.

[7] Lower confidence limit is above the GWPS based upon most recent assessment monitoring statistical evaluation.

The downward trends are anticipated to continue as source material removal activities have begun at the Weadock Bottom Ash Pond. The influence of the source removal combined with or changes in redox geochemistry impacted by the cessation of sluice water loading to the Weadock Bottom Ash Pond is still being evaluated as additional data collection events are completed.

Additionally, arsenic concentrations have at times exceeded the GWPS four groundwater monitoring wells located along the Weadock Landfill perimeter (MW-51, MW-53R, MW-55, and JCW-MW-18006). These areas of elevated arsenic concentrations are limited in extent and are dependent upon geochemical conditions, which are changing either due to lake levels rising or in the case of JCW-MW-18006, activities related to the Bottom Ash Pond closure. Also, an Alternate Source Demonstration for arsenic at MW-55 was included in Appendix G of the 2019 *Annual Groundwater Monitoring and Corrective Action Report for the Weadock Landfill* (TRC, January 2020).

Beryllium and Lithium

Beryllium and lithium were previously present at statistically significant levels above their respective GWPSs at JCW-MW-15009 at the Weadock Bottom Ash Pond. Since sluicing to the Weadock Bottom Ash Pond ceased in April 2016, concentrations of beryllium and lithium appear to exhibit a downward trend. The influence of the bottom ash sluice water loading or changes in redox geochemistry impacted by the cessation of sluice water loading to the Weadock Bottom Ash Pond is still being evaluated as additional data collection events are completed.

Additionally, JCW-MW-15009 is the westernmost downgradient monitoring well in the groundwater monitoring system at the Weadock Bottom Ash Pond and located the farthest from the waste limit of the Weadock Bottom Ash Pond. JCW-MW-15009 is located in the general vicinity of the power plant and observations of groundwater quality may be more closely related to industrial activities rather than material management at the Weadock Bottom Ash Pond. The pH measured in JCW-MW-15009 (between 4.1 and 5.4 S.U.) is much lower than the other compliance wells for the Weadock Bottom Ash Pond (between 7 and 8 S.U.). Decreased pH in groundwater, such as that observed at JCW-MW-15009, can result in mobilization of metals, including those found naturally in soil as well as those found in coal and ash. Consumers Energy continues to evaluate the potential for an alternative source of the low pH, beryllium, and lithium in this area.

Next Steps

Consumers Energy will continue assessment monitoring and evaluate corrective measures in accordance with §257.96 and §257.97 as outlined in the Weadock ACM. The groundwater management remedy for the Weadock Bottom Ash Pond and Weadock Landfill will be selected as soon as feasible to meet the federal standards of §257.96(b) of the CCR Rule and state standards in R299.4444(2) of PA 640. Consumers Energy will continue the assessment of corrective measures, per §257.95(g), and execute the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Sincerely,

TRC

Darby Litz
Hydrogeologist/Project Manager

Jacob Krenz
Staff Geologist

Attachments:

Table 1	Summary of Groundwater Elevation Data
Table 2	Summary of Field Parameter Results
Table 3	Summary of Background Well Groundwater Sampling Results (Analytical)
Table 4	Summary of Groundwater Sampling Results (Analytical) – JCW Bottom Ash Pond – May 2020
Table 5	Summary of Groundwater Sampling Results (Analytical) – JCW Landfill – May 2020
Table 6	Summary of Groundwater Protection Standard Exceedances – May 2020
Figure 1	Site Location Map
Figure 2	Karn and Weadock Complex Map
Figure 3	Shallow Groundwater Contour Map – May 2020
Figure 4	Nature and Extent Summary GWPS Exceedances
Attachment A	Data Quality Reviews
Attachment B	Weadock Bottom Ash Pond: Statistical Evaluation of May 2020 Assessment Monitoring Sampling Event
Attachment C	Weadock Landfill: Statistical Evaluation of May 2020 Assessment Monitoring Sampling Event

cc: Brad Runkel, Consumers Energy
Bethany Swanberg, Consumers Energy
Central Files

Tables

Table 1
Summary of Groundwater Elevation Data
JC Weadock – RCRA CCR Monitoring Program
Essexville, Michigan

Well Location	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Elevation (ft)			March 9, 2020		May 11, 2020	
						Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Background									
MW-15002	587.71	Sand	580.9	to	570.9	6.11	581.60	5.53	582.18
MW-15008	585.36	Sand with clay	578.7	to	568.7	3.66	581.70	3.01	582.35
MW-15016	586.49	Sand	581.2	to	578.2	4.26	582.23	3.73	582.76
MW-15019	586.17	Sand and Sand/Clay	579.5	to	569.5	4.60	581.57	3.95	582.22
JCW Bottom Ash Pond									
JCW-MW-15007	587.40	Sand	582.7	to	579.2	3.57	583.83	4.35	583.05
JCW-MW-15009	589.64	Sand	581.9	to	576.9	7.40	582.24	7.31	582.33
JCW-MW-15010	597.76	Sand	579.7	to	578.2	15.00	582.76	15.64	582.12
JCW-MW-15028	589.64	Sand	567.7	to	564.7	6.15	583.49	6.88	582.76
JCW Landfill									
JCW-MW-18001	596.73	Sand and Sandy Clay	578.3	to	573.3	15.28	581.45	14.53	582.20
JCW-MW-18004	593.04	Sandy Clay	583.9	to	578.9	11.18	581.86	10.08	582.96
JCW-MW-18005	590.89	Sand and Sandy Clay	580.0	to	575.0	7.81	583.08	7.34	583.55
JCW-MW-18006	600.72	Fly Ash and Sandy Clay	582.8	to	577.8	12.00	588.72	12.32	588.40
MW-50	593.36	Sand	577.8	to	574.8	11.93	581.43	11.40	581.96
MW-51	594.29	Sand and Clay	577.8	to	574.8	12.74	581.55	12.07	582.22
MW-52	594.90	Sand	579.3	to	576.3	13.42	581.48	12.65	582.25
MW-53	593.68	Sand and Clay	579.1	to	576.1	12.25	581.43	11.53	582.15
MW-53R	594.25	Sand and Clay	580.4	to	575.4	12.82	581.43	12.10	582.15
MW-54R	593.89	Clay and Sand	581.3	to	576.3	12.35	581.54	11.70	582.19
MW-55	593.82	Sand	581.5	to	578.5	12.43	581.39	11.68	582.14
OW-57ROUT	591.00	Sandy Clay	577.0	to	572.0	11.78	579.22	9.50	581.50

Notes:
Survey data from: Rowe Professional Services Company (Nov. 2015) and Consumers Energy Company drawings: SG-21733, Sheet 1, Rev. G (Karn, 11/27/18); and SG-21733, Sheet 2, Rev. C (Weadock, 11/27/18).
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.

Table 1
Summary of Groundwater Elevation Data
JC Weadock – RCRA CCR Monitoring Program
Essexville, Michigan

Well Location	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Elevation (ft)			March 9, 2020		May 11, 2020	
						Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)
JCW Landfill (water level only)									
JCW-OW-18001	595.84	Fly Ash and Sand	581.1	to	576.1	6.28	589.56	6.16	589.68
JCW-OW-18002	593.63	Sand	578.9	to	573.9	9.50	584.13	11.22	582.41
JCW-OW-18003	593.99	Sand and Clay	580.5	to	575.5	7.92	586.07	9.07	584.92
JCW-OW-18004	594.19	Sandy Clay	584.6	to	579.6	5.88	588.31	6.93	587.26
JCW-OW-18006	600.61	Fly Ash and Clay with Sand	582.9	to	577.9	7.33	593.28	8.06	592.55
MW-20	592.73	NR	~581.1	to	~578.1	6.82	585.91	7.03	585.70
OW-51	593.62	Clay and Sand	578.9	to	575.9	9.55	584.07	10.11	583.51
OW-53	593.64	Clay and Sand	579.0	to	576.0	7.52	586.12	9.53	584.11
OW-54	594.10	Clay and Sand	580.0	to	577.0	7.30	586.80	8.18	585.92
OW-55	594.67	Clay (or Sand and Clay)	580.9	to	577.9	5.95	588.72	6.40	588.27
OW-56R	592.01	Ash and Sand	577.5	to	572.5	7.08	584.94	7.18	584.84
OW-57R IN	590.86	Sandy Clay	575.7	to	570.7	6.81	584.05	7.23	583.63
OW-61	612.37	Ash and Sand	588.0	to	585.0	NM	NM	19.24	593.13
OW-63	612.53	Ash and Sand	594.2	to	591.2	NM	NM	24.45	588.08
OW-64	593.37	Ash and Sand	576.4	to	573.4	NM	NM	NM	NM
JCW Leachate Headwells									
LH-103	603.49	Fly Ash	30.2	to	33.2	13.91	589.58	14.53	588.96
LH-104	596.56	Fly Ash	8.0	to	11.0	5.80	590.76	8.43	588.13

Notes:
Survey data from: Rowe Professional Services Company (Nov. 2015) and Consumers Energy Company drawings: SG-21733, Sheet 1, Rev. G (Karn, 11/27/18); and SG-21733, Sheet 2, Rev. C (Weadock, 11/27/18).
Elevation in feet relative to North American Vertical Datum 1988 (NAVD 88).
TOC: Top of well casing.
ft BTOC: Feet below top of well casing.
NM: Not Measured; NR: Not Recorded

Table 2
Summary of Field Parameters: March 2020 - May 2020
DE Karn JC Weadock Complex - Essexville - RCRA CCR Monitoring Program
Essexville, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Background							
MW-15002	5/15/2020	1.55	-59.3	7.8	1,110	10.8	6.6
MW-15008	5/14/2020	0.16	-50.7	6.7	1,809	9.3	4.2
MW-15016	5/15/2020	1.36	9.9	7.5	1,344	9.9	1.3
MW-15019	5/15/2020	0.59	19.6	6.6	1,310	8.2	1.3
Bottom Ash Pond							
JCW-MW-15007	5/14/2020	1.49	-10.7	7.6	9,185	9.9	9.9
JCW-MW-15009	5/14/2020	2.69	46.7	7.2	1,595	9.4	8.9
JCW-MW-15010	5/14/2020	1.99	-20.7	7.7	2,024	11.7	4.1
JCW-MW-15028	5/14/2020	1.38	-10.5	8.1	3,689	10.0	0.5
Landfill							
JCW-MW-18001	3/9/2020	1.02	-95.1	7.4	1,710	11.9	2.3
	5/18/2020	1.46	-25.3	7.4	1,915	11.0	1.8
JCW-MW-18004	3/10/2020	2.43	4.9	7.2	2,070	5.4	5.0
	5/19/2020	4.40	68.3	7.3	2,145	9.7	2.5
JCW-MW-18005	3/10/2020	1.19	-33.5	7.1	2,414	7.8	6.2
	5/19/2020	1.37	3.7	7.2	2,375	9.7	10.0
JCW-MW-18006	3/10/2020	1.12	-68.1	7.2	1,676	9.6	2.6
	5/20/2020	1.19	-69.5	7.4	1,635	11.2	9.6
MW-50	3/9/2020	1.05	-69.0	7.4	2,709	10.6	1.2
	5/19/2020	1.23	28.0	7.4	2,795	10.4	2.0
MW-51	3/9/2020	1.25	-68.0	7.4	2,152	9.0	1.1
	5/19/2020	1.33	-7.0	7.4	2,287	8.9	2.2
MW-52	3/10/2020	1.29	-19.5	7.3	1,816	7.2	0.8
	5/19/2020	1.36	31.0	7.5	1,974	9.1	1.0
MW-53	3/10/2020	1.21	-68.1	7.4	1,587	6.9	0.9
	5/19/2020	1.39	30.3	7.3	2,421	8.9	2.6
MW-53R	3/10/2020	1.06	-39.1	7.2	1,639	6.9	5.6
	5/19/2020	1.27	-8.0	7.4	1,719	9.1	4.6
MW-54R	3/10/2020	1.12	-38.1	7.3	1,124	5.9	1.2
	5/19/2020	1.31	19.8	7.4	1,249	8.8	2.5
MW-55	3/9/2020	1.08	-123.0	7.5	1,614	7.6	4.1
	5/19/2020	1.29	-90.0	7.6	1,604	9.6	4.1
OW-57ROUT	3/10/2020	2.90	58.1	7.4	1,339	8.7	10.0
	5/20/2020	2.27	111.3	7.5	1,392	9.6	9.8

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

Table 3
Summary of Groundwater Sampling Results (Analytical): May 2020
DE Karn JC Weadock Background – RCRA CCR Monitoring Program
Essexville, Michigan

					Sample Location:	**MW-15002**	**MW-15008**	**MW-15016**	**MW-15019**
					Sample Date:	5/15/2020	5/14/2020	5/15/2020	5/15/2020
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	Background			
Appendix III									
Boron	ug/L	NC	500	500	4,000	< 20	129	278	221
Calcium	mg/L	NC	NC	NC	500	35.2	124	182	163
Chloride	mg/L	**250****	**250**	**250**	**50**	**160**	**305**	**69.1**	**287**
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	**250****	**250**	**250**	500	5.87	5.68	**300**	103
Total Dissolved So	mg/L	**500****	**500**	**500**	**500**	**577**	**1,110**	**922**	**1,190**
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	7.8	6.7	7.5	6.6
Appendix IV									
Antimony	ug/L	6	6.0	6.0	2.0	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	10	10	10	1	< 1	1	< 1
Barium	ug/L	2,000	2,000	2,000	1,200	43	79	48	287
Beryllium	ug/L	4	4.0	4.0	33	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	5.0	5.0	2.5	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	100	100	11	< 1	< 1	< 1	< 1
Cobalt	ug/L	NC	40	100	100	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4.0	4.0	14	3	< 1	< 1	< 1
Lithium	ug/L	NC	170	350	440	< 10	19	70	14
Mercury	ug/L	2	2.0	2.0	0.20#	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	73	210	120	< 5	< 5	< 5	< 5
Radium-226	pCi/L	NC	NC	NC	NC	< 0.132	0.403	0.167	0.282
Radium-228	pCi/L	NC	NC	NC	NC	< 0.568	0.976	< 0.546	< 0.649
Radium-226/228	pCi/L	5	NC	NC	NC	< 0.568	1.38	< 0.546	0.911
Selenium	ug/L	50	50	50	5.0	< 1	< 1	< 1	< 1
Thallium	ug/L	2	2.0	2.0	2.0	< 2	< 2	< 2	< 2
MI Part 115 Parameters									
Iron	ug/L	**300****	**300**(1)	**300**(1)	500,000	**1,080**	**13,700**	**988**	**14,300**
Copper	ug/L	1,000**	1,000(1)	1,000(1)	20	2	< 1	2	< 1
Nickel	ug/L	NC	100	100	120	< 2	< 2	2	< 2
Silver	ug/L	100**	34	98	0.2	< 0.2	< 0.2	< 0.2	< 0.2
Vanadium	ug/L	NC	**4.5**	62	27	3	**6**	< 2	2
Zinc	ug/L	5,000**	2,400	5,000(1)	260	< 10	< 10	< 10	< 10

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using hardness of 258 mg CaCO3/L (average of SW-01 [Lake Huron] and SW-02 [Saginaw River] collected in April 2018) per footnote {G} of Michigan Part 201 criteria tables. Chromium GSI criterion based on hexavalent chromium per footnote {H}. GSI criterion is protective for surface water used as a drinking water source as described in footnote {X}. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters per footnote {FF}
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.
(1) - Criterion is the aesthetic drinking water value per footnote {E}.

Table 4
Summary of Groundwater Sampling Results (Analytical): May 2020
JC Weadock Bottom Ash Pond – RCRA CCR Monitoring Program
Essexville, Michigan

					Sample Location:	**JCW-MW-15007**	**JCW-MW-15009**	**JCW-MW-15010**	**JCW-MW-15028**
					Sample Date:	5/14/2020	5/14/2020	5/14/2020	5/14/2020
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	Downgradient			
Appendix III									
Boron	ug/L	NC	**500**	**500**	4,000	335	141	**2,070**	**570**
Calcium	mg/L	NC	NC	NC	500	217	314	286	205
Chloride	mg/L	**250****	**250**	**250**	**50**	**2,870**	3.19	**90.4**	**823**
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	**250****	**250**	**250**	**500**	57.2	**611**	**553**	128
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**5,080**	**1,370**	**1,500**	**2,210**
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	7.6	7.2	7.7	8.1
Appendix IV									
Antimony	ug/L	6	6.0	6.0	2.0	< 1	< 1	< 1	< 1
Arsenic	ug/L	**10**	**10**	**10**	**10**	**19**	< 1	4	< 1
Barium	ug/L	2,000	2,000	2,000	1,200	1,180	58	400	324
Beryllium	ug/L	4	4.0	4.0	33	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	5.0	5.0	2.5	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	100	100	11	< 1	2	< 1	< 1
Cobalt	ug/L	NC	40	100	100	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4.0	4.0	14	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	170	350	440	103	18	116	60
Mercury	ug/L	2	2.0	2.0	0.20#	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	73	210	120	< 5	10	< 5	< 5
Radium-226	pCi/L	NC	NC	NC	NC	0.728	< 0.125	0.409	0.515
Radium-228	pCi/L	NC	NC	NC	NC	0.698	< 0.491	< 0.467	0.733
Radium-226/228	pCi/L	5	NC	NC	NC	1.43	< 0.491	0.781	1.25
Selenium	ug/L	50	50	50	5.0	< 1	1	< 1	< 1
Thallium	ug/L	2	2.0	2.0	2.0	< 2	< 2	< 2	< 2
MI Part 115 Parameters									
Iron	ug/L	**300****	**300**(1)	**300**(1)	500,000	**1,010**	**968**	**343**	186
Copper	ug/L	1,000**	1,000(1)	1,000(1)	20	1	7	1	< 1
Nickel	ug/L	NC	100	100	120	8	7	3	4
Silver	ug/L	100**	34	98	0.2	< 0.2	< 0.2	< 0.2	< 0.2
Vanadium	ug/L	NC	**4.5**	62	27	**19**	< 2	< 2	**5**
Zinc	ug/L	5,000**	2,400	5,000(1)	260	< 10	< 10	< 10	< 10

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.

NC - no criteria.

* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.

** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using hardness of 258 mg CaCO3/L (average of SW-01 [Lake Huron] and SW-02 [Saginaw River] collected in April 2018) per footnote {G} of Michigan Part 201 criteria tables. Chromium GSI criterion based on hexavalent chromium per footnote {H}. GSI criterion is protective for surface water used as a drinking water source as described in footnote {X}. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters per footnote {FF}

- If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE policy and procedure 09-014 dated June 20, 2012.

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

(1) - Criterion is the aesthetic drinking water value per footnote {E}.

Table 5
Summary of Groundwater Sampling Results (Analytical): May 2020
JC Weadock Landfill – RCRA CCR Monitoring Program
Essexville, Michigan

					Sample Location:	**JCW-MW-18001**	**JCW-MW-18004**	**JCW-MW-18005**	**JCW-MW-18006**	**MW-50**
					Sample Date:	5/18/2020	5/19/2020	5/19/2020	5/20/2020	5/19/2020
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	Downgradient				
Appendix III										
Boron	ug/L	NC	**500**	**500**	4,000	**1,360**	265	**1,150**	**3,030**	**1,300**
Calcium	mg/L	NC	NC	NC	500	232	308	419	179	380
Chloride	mg/L	250**	250	250	**50**	**71.5**	10.9	23.2	**71.2**	**80.5**
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	**250****	**250**	**250**	**500**	**352**	**361**	**817**	94.5	**1,010**
Total Dissolved So	mg/L	**500****	**500**	**500**	**500**	**1,330**	**1,720**	**1,950**	**988**	**1,710**
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	7.4	7.3	7.2	7.4	7.4
Appendix IV										
Antimony	ug/L	6	6.0	6.0	2.0	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	**10**	**10**	**10**	**10**	3	< 1	**12**	**33**	1
Barium	ug/L	2,000	2,000	2,000	1,200	252	28	141	500	163
Beryllium	ug/L	4	4.0	4.0	33	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	5.0	5.0	2.5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	100	100	**11**	< 1	< 1	< 1	< 1	< 1
Cobalt	ug/L	NC	40	100	100	< 6	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4.0	4.0	14	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	170	350	440	60	31	53	70	97
Mercury	ug/L	2	2.0	2.0	0.20#	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	**73**	**210**	**120**	< 5	< 5	< 5	< 5	8
Radium-226	pCi/L	NC	NC	NC	NC	0.372	< 0.256	0.381	0.649	0.512
Radium-228	pCi/L	NC	NC	NC	NC	0.385	< 0.368	0.457	0.346	< 0.402
Radium-226/228	pCi/L	5	NC	NC	NC	0.757	< 0.368	0.838	0.995	0.814
Selenium	ug/L	50	50	50	5.0	< 1	1	1	< 1	2
Thallium	ug/L	2	2.0	2.0	2.0	< 2	< 2	< 2	< 2	< 2
MI Part 115 Parameters										
Iron	ug/L	**300****	**300**(1)	**300**(1)	500,000	277	29	**9,310**	**7,280**	**1,240**
Copper	ug/L	1,000**	1,000(1)	1,000(1)	20	1	3	3	< 1	3
Nickel	ug/L	NC	100	100	120	< 2	< 2	4	4	3
Silver	ug/L	100**	34	98	0.2	< 0.3	< 0.2	< 0.2	< 0.2	< 0.2
Vanadium	ug/L	NC	**4.5**	62	27	< 2	< 2	< 2	3	< 2
Zinc	ug/L	5,000**	2,400	5,000(1)	260	< 10	< 10	< 10	< 10	< 10

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.

NC - no criteria.

-- - not analyzed.

* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.

** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using hardness of 258 mg CaCO3/L (average of SW-01 [Lake Huron] and SW-02 [Saginaw River] collected in April 2018) per footnote {G} of Michigan Part 201 criteria tables. Chromium GSI criterion based on hexavalent chromium per footnote {H}. GSI criterion is protective for surface water used as a drinking water source as described in footnote {X}. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters per footnote {FF}

- If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE policy and procedure 09-014 dated June 20, 2012.

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

(1) - Criterion is the aesthetic drinking water value per footnote {E}.

Table 5
Summary of Groundwater Sampling Results (Analytical): May 2020
JC Weadock Landfill – RCRA CCR Monitoring Program
Essexville, Michigan

					Sample Location:	**MW-51**	**MW-52**	**MW-53**	**MW-53R**	**MW-54R**	**MW-55**	**OW-57ROUT**
					Sample Date:	5/19/2020	5/19/2020	5/19/2020	5/19/2020	5/19/2020	5/19/2020	5/20/2020
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	Downgradient			Nature and Extent	Downgradient		
Appendix III												
Boron	ug/L	NC	**500**	**500**	4,000	**944**	**1,160**	**1,750**	**1,460**	**1,730**	441	**1,600**
Calcium	mg/L	NC	NC	NC	500	331	226	308	228	181	188	130
Chloride	mg/L	250**	250	250	**50**	**93.8**	15.1	**118**	30.7	20.4	14.6	**64.9**
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	**250****	**250**	**250**	**500**	**487**	< 1	**549**	177	95.7	210	89.4
Total Dissolved So	mg/L	**500****	**500**	**500**	**500**	**1,970**	**1,800**	**1,660**	**1,470**	**755**	**1,010**	**834**
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	7.4	7.5	7.3	7.4	7.4	7.6	7.5
Appendix IV												
Antimony	ug/L	6	6.0	6.0	2.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	**10**	**10**	**10**	**10**	**12**	< 1	2	**27**	2	**85**	< 1
Barium	ug/L	2,000	2,000	2,000	1,200	150	144	144	252	95	223	72
Beryllium	ug/L	4	4.0	4.0	33	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	5.0	5.0	2.5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	0.4	< 0.2
Chromium	ug/L	100	100	100	**11**	< 1	< 1	6	< 1	< 1	< 1	2
Cobalt	ug/L	NC	40	100	100	< 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
Lead	ug/L	NC	4.0	4.0	14	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	170	350	440	55	32	58	60	58	27	24
Mercury	ug/L	2	2.0	2.0	0.20#	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	**73**	**210**	**120**	< 5	< 5	< 5	< 5	< 5	**214**	7
Radium-226	pCi/L	NC	NC	NC	NC	0.461	< 0.241	0.386	0.356	< 0.192	0.448	< 0.305
Radium-228	pCi/L	NC	NC	NC	NC	0.719	0.626	< 0.385	0.846	0.499	< 0.460	0.468
Radium-226/228	pCi/L	5	NC	NC	NC	1.18	0.740	0.725	1.20	0.546	0.858	0.688
Selenium	ug/L	50	50	50	5.0	1	< 1	2	< 1	< 1	< 1	< 1
Thallium	ug/L	2	2.0	2.0	2.0	< 2	< 2	< 2	< 2	< 2	< 2	< 2
MI Part 115 Parameters												
Iron	ug/L	**300****	**300**(1)	**300**(1)	500,000	**2,830**	**1,140**	**2,070**	**1,910**	**1,530**	**22,000**	135
Copper	ug/L	1,000**	1,000(1)	1,000(1)	20	2	2	4	1	1	1	2
Nickel	ug/L	NC	100	100	120	2	< 2	3	< 2	4	< 2	16
Silver	ug/L	100**	34	98	0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.3	< 0.2
Vanadium	ug/L	NC	**4.5**	62	27	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Zinc	ug/L	5,000**	2,400	5,000(1)	260	< 10	< 10	< 10	< 10	< 10	< 10	< 10

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.

NC - no criteria.

-- - not analyzed.

* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.

** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using hardness of 258 mg CaCO3/L (average of SW-01 [Lake Huron] and SW-02 [Saginaw River] collected in April 2018) per footnote {G} c Part 201 criteria tables. Chromium GSI criterion based on hexavalent chromium per footnote {H}. GSI criterion is protective for surface water used as a drinking water source as described in footnote {X}. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters per footnote {FF}

- If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE policy and procedure 09-014 dated June 20, 2012.

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

(1) - Criterion is the aesthetic drinking water value per footnote {E}.

Table 6

Summary of Groundwater Protection Standard Exceedances – May 2020

JC Weadock – RCRA CCR Monitoring Program

Essexville, Michigan

JC Weadock Bottom Ash Pond								
Constituent	Units	GWPS	JCW-MW-15007		JCW-MW-15009		JCW-MW-15010	
			LCL	UCL	LCL	UCL	LCL	UCL
Arsenic	ug/L	21	13	37	--	--	7.1	21
Beryllium	ug/L	4	--	--	3.8	7.3	--	--
Lithium	ug/L	180	--	--	83	260	--	--

JC Weadock Landfill						
Constituent	Units	GWPS	JCW-MW-18006		MW-51	
			LCL	UCL	LCL	UCL
Arsenic	ug/L	21	29	40	8	27

Notes:

ug/L - micrograms per Liter

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.

Figures

BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

N

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

0 3,000 6,000 FEET

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Phone: 734.971.7080
www.trccompanies.com
TRC - GIS

PROJECT:

CONSUMERS ENERGY COMPANY
DE KARN AND JC WEADOCK POWER PLANTS
ESSEXVILLE, MICHIGAN

TITLE:

SITE LOCATION MAP

DRAWN BY:	S. MAJOR
CHECKED BY:	J. KRENZ
APPROVED BY:	D. LITZ
DATE:	JULY 2020
PROJ. NO.:	367388.0001
FILE:	367388-001-004.mxd

FIGURE 1

S:\1-PROJECTS\Consumers_Energy_Company\Michigan\CCR_GW\2017_269767\367388-001-004.mxd -- Saved By: SMAJOR on 7/15/2020, 14:00:57 PM

LEGEND

- BACKGROUND MONITORING WELL
- DEK BOTTOM ASH POND & LINED IMPOUNDMENT MONITORING WELL
- DEK BOTTOM ASH POND MONITORING WELL
- DEK LINED IMPOUNDMENT MONITORING WELL
- DECOMMISSIONED MONITORING WELL
- JCW BOTTOM ASH POND MONITORING WELL
- JCW LANDFILL CCR WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- LEACHATE HEADWELL
- SURFACE WATER GAUGING STATION
- NATURE AND EXTENT WELL
- SLURRY WALL (APPROXIMATE)
- EXTENT OF GEOSYNTHETICS (KARN LINED IMPOUNDMENT)

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2018.
2. WELL LOCATIONS SURVEYED BY ROWE PROFESSIONAL SERVICES COMPANY ON 11/4/2015.
3. NOAA/NATIONAL OCEANIC SERVICE GREAT LAKES GAUGING STATION, ESSEXVILLE, MI (ID: 9075035).
4. A SINGLE WELL SYMBOL IS SHOWN FOR WELL PAIRS MW-01/MW-02, MW-03/MW-04, OW-02/MW-22, AND OW-07/MW-23 AS THE WELLS ARE LOCATED WITHIN 15-FT OF EACH OTHER.

0 1,000 2,000 Feet

1 " = 1,000 '

1:12,000

PROJECT:

CONSUMERS ENERGY COMPANY
DE KARN AND JC WEADOCK POWER PLANTS
ESSEXVILLE, MICHIGAN

TITLE:

KARN AND WEADOCK COMPLEX AREA

DRAWN BY:	S. MAJOR	PROJ NO.:	367388-001
CHECKED BY:	J. KRENZ		
APPROVED BY:	D. LITZ		**FIGURE 2**
DATE:	JULY 2020		

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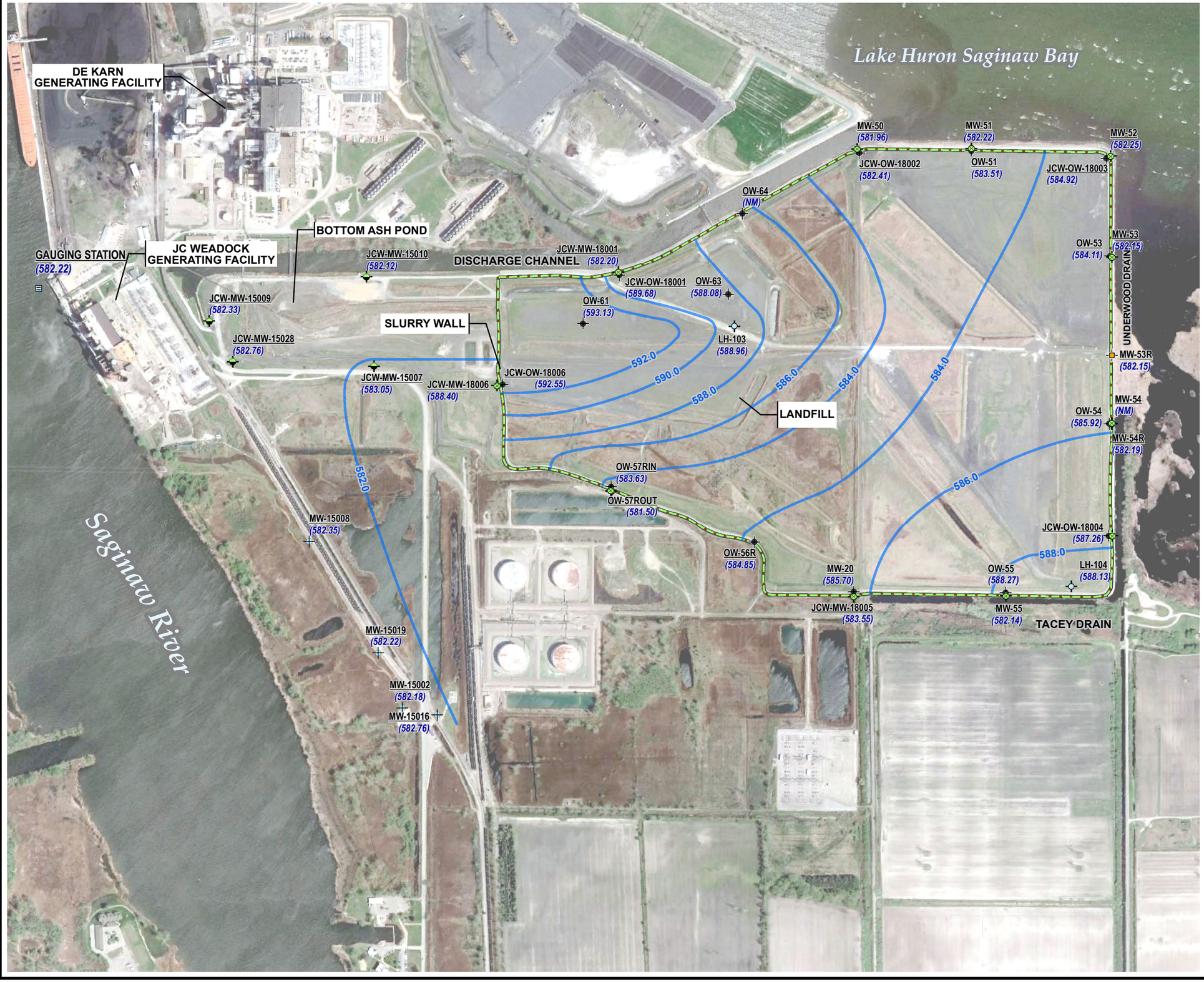
FILE NO.: 367388-001-005.mxd

TRC - GIS
Plot Date: 7/17/2020, 09:19:50 AM by SMAJOR -- LAYOUT: ANSI B (11"x17")
Path: S:\1-PROJECTS\Consumers Energy Company\Michigan\CCR_GW\2017 269767\367388-Map\Site
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

Plot Date: 7/17/2020, 08:51:47 AM by SMAJOR – LAYOUT: ANSI B (11"x17")
Path: S:\11-PROJECTS\Consumers_Energy_Company\Michigan\CCR_GW\2017_269767\367389-Map Rotation: 0
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)



LEGEND

- BACKGROUND MONITORING WELL
- JCW BOTTOM ASH POND MONITORING WELL
- JCW LANDFILL CCR WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- LEACHATE HEADWELL
- SURFACE WATER GAUGING STATION
- NATURE AND EXTENT WELL
- SLURRY WALL (APPROXIMATE)
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- (580.50) GROUNDWATER ELEVATION
- (NM) NOT MEASURED

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2018.
2. WELL LOCATIONS SURVEYED BY ROWE PROFESSIONAL SERVICES COMPANY ON 11/4/2015.
3. NOAA/NATIONAL OCEANIC SERVICE GREAT LAKES GAUGING STATION, ESSEXVILLE, MI (ID: 9075035).
4. GROUNDWATER ELEVATION DATA RECORDED MAY 11, 2020.
5. GROUNDWATER ELEVATIONS DISPLAYED IN FEET RELATIVE TO THE NORTH AMERICAN VERTICAL DATUM OF 1988.

N

0 700 1,400 Feet

1 " = 700 '
1:8,400

PROJECT:
CONSUMERS ENERGY COMPANY
JC WEADOCK POWER PLANTS
ESSEXVILLE, MICHIGAN

TITLE:
SHALLOW GROUNDWATER CONTOUR MAP MAY 2020

DRAWN BY:	S. MAJOR	PROJ NO.:	367389.0001
CHECKED BY:	J. KRENZ		
APPROVED BY:	D. LITZ		**FIGURE 3**
DATE:	JULY 2020		

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FILE NO.: 367389-001-004.mxd

LEGEND

- BACKGROUND MONITORING WELL
- JCW LANDFILL MONITORING WELL
- JCW BOTTOM ASH POND MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- LEACHATE HEADWELL
- NATURE AND EXTENT WELL
- NO EXCEEDANCES
- TWO OR MORE EXCEEDANCES (NOTES 4 & 5)
- STATISCTICALLY SIGNIFICANT GWPS EXCEEDANCE (NOTE 6)
- SLURRY WALL (APPROXIMATE)
- APPROXIMATE WATER-BEARING UNIT BOUNDARY

WELL ID
CONSTITUENT(S) EXCEEDING GWPS

* EXCEEDANCE TRIGGERING ASSESSMENT OF CORRECTIVE MEASURES PURSUANT TO §257.96

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2018.
2. MONITORING WELL AND SLURRY WALL LOCATIONS PROVIDED BY CEC; SG21733SHT2 REVB.DWG DATED 11/21/2018
3. GWPS (GROUNDWATER PROTECTION STANDARD) IS THE HIGHER OF THE MAXIMUM CONTAMINANT LEVEL (MCL)/REGIONAL SCREENING LEVEL FROM 83 FR 36435 (RSL) AND UPPER TOLERANCE LIMIT (UTL) AS ESTABLISHED IN TRC'S TECHNICAL MEMORANDUM DATED OCTOBER 15, 2018.
4. GROUNDWATER DATA FROM NOVEMBER 2018 TO APRIL 2020 ARE SCREENED AGAINST THE GWPS FOR EVALUATION PURPOSES ONLY. AN EXCEEDANCE IS DEFINED AS A SINGLE DETECTION ABOVE THE GWPS, HOWEVER, CONFIDENCE INTERVALS WILL BE USED TO DETERMINE COMPLIANCE PER THE CCR RULES.
5. AN EXCEEDANCE OF THE GWPS DOES NOT INDICATEDNACCEPTABLE RISK FROM GROUNDWATER EXPOSURE; THE DRINKING WATER PATHWAY IS NOT COMPLETE ON THE PROPERTY. GROUNDWATER CONDITIONS CONTINUE TO BE MONITORED TO INFORM THE JCW BOTTOM ASH POND AND LANDFILL REMEDY SELECTION.
6. LOWER CONFIDENCE LIMIT IS ABOVE GWPS.
7. ALTERNATE SOURCE DEMONSTRATION INCLUDED IN 2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT (TRC, JANUARY 2020).

Constituent	GWPS
Antimony	6 ug/L
Arsenic	21 ug/L
Barium	2,000 ug/L
Beryllium	4 ug/L
Cadmium	5 ug/L
Chromium	100 ug/L
Cobalt	15 ug/L
Fluoride	4,000 ug/L
Lead	15 ug/L
Lithium	180 ug/L
Mercury	2 ug/L
Molybdenum	100 ug/L
Radium-226/228	5 pCi/L
Selenium	50 ug/L
Thallium	2 ug/L

0 600 1,200 Feet

1 " = 600 '

1:7,200

PROJECT:

CONSUMERS ENERGY COMPANY
JC WEADOCK POWER PLANT
ESSEXVILLE, MICHIGAN

TITLE:

NATURE AND EXTENT SUMMARY GWPS EXCEEDANCES

DRAWN BY:	S. MAJOR	PROJ NO.:	322173-001
CHECKED BY:	K. AMONETTE		
APPROVED BY:	D. LITZ		**FIGURE 4**
DATE:	JULY 2020		

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FILE NO.: 367389-ExceedancesNE_ACM.mxd

Plot Date: 7/27/2020, 12:38:13 PM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: S:\1-PROJECTS\Consumers Energy Company\Michigan\CCR GW\2017 269767\367389-ExceedancesNE ACM.mxd
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0
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Attachment A
Data Quality Reviews

Laboratory Data Quality Review
Groundwater Monitoring Event May 2020
JC Weadock/Karn DEK Background

Groundwater samples were collected by TRC for the May 2020 sampling event. Samples were analyzed for total metals, anions, and total dissolved solids by Consumers Energy (CE) Laboratory Services, located in Jackson, Michigan. The radium analyses were subcontracted to Eurofins TA in St. Louis, Missouri (Eurofins TA – St. Louis). The laboratory analytical results were reported in laboratory sample delivery groups (SDGs) 20-0494 and 240-130407-1.

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

- MW-15002
- MW-15008
- MW-15016
- MW-15019

Each sample was analyzed for the following constituents:

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

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

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Data Review (USEPA, 2017) and 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 and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field and equipment blanks are used to assess potential contamination arising from field procedures;

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

It should be noted that results for method blanks and laboratory control samples 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 metals, anions, and TDS analyses.

This data usability report addresses the following items:

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

Review Summary

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

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

QA/QC Sample Summary

- A method blank was analyzed with each analytical batch for radium. Target analytes were not detected in the method blank samples with the following exception. Normalized absolute difference comparisons between blank and sample that are between 1.96 and 2.58 may indicate biased high results and normalized absolute differences <1.96 may indicate a false positive sample result.

- Radium-228 was detected in method blank 160-470963/20-A at 0.4163 +/- 0.243 pCi/L. The detected radium-228 result for sample MW-15008 associated with this method blank was potentially impacted, as summarized in the attached table, Attachment 1. However, results for radium-228 are consistent with historical results. Therefore, data usability is not affected.

- One field blank (FB-05) was collected. Target analytes were not detected in this blank sample.
- The LCS and LCSD recoveries and relative percent differences (RPDs) for radium were within QC limits.
- MS and MSD analyses were not performed on a sample from this data set.
- The field duplicate pair samples were DUP-05/ MW-15008. All criteria were met.
- Laboratory duplicate analyses were not performed on a sample from this data set.
- Carrier recoveries were within 40-110%.
- Samples did not undergo a 21-day wait period prior to radium-226 analysis; however, combined radium results were < 5 pCi/L so there is no impact on data usability.

Attachment 1

Summary of Data Non-Conformances for Groundwater Analytical Data
JC Weadock/Karn Background – RCRA CCR Monitoring Program
Essexville, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
MW-15008	5/14/2020	Radium-228	Detection in method blank. Normalized absolute difference between blank and sample <1.96; indicates possible false positive result. However, results were consistent with historical results; therefore, data usability is not affected.

Laboratory Data Quality Review
Groundwater Monitoring Event May 2020
JC Weadock Landfill

Groundwater samples were collected by TRC for the May 2020 sampling event. Samples were analyzed for total metals, anions, total dissolved solids, total phosphorus, and alkalinity by Consumers Energy (CE) Laboratory Services, located in Jackson, Michigan. The radium analyses were subcontracted to Eurofins TA in St. Louis, Missouri (Eurofins TA – St. Louis). The laboratory analytical results were reported in laboratory sample delivery groups (SDGs) 20-0501 and 240-130561-1.

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

- JCW-MW-18001
- JCW-MW-18004
- JCW-MW-18005
- JCW-MW-18006
- MW-50
- MW-51
- MW-52
- MW-53
- MW-53R
- MW-54R
- MW-55
- MW-58
- OW-57R Out
- LH-103

Each sample was analyzed for one or more of the following constituents:

Analyte Group	Method
Anions (Chloride, Fluoride, Sulfate)	EPA 300.0
Total Dissolved Solids	SM 2540C
Total Metals and/or Total Mercury	SW-846 6020B/7470A
Total Phosphorus	SM 4500-P
Alkalinity (Total, Bicarbonate, Carbonate)	SM 2320B
Radium (Radium-226, Radium-228, Combined Radium)	EPA 903.0, EPA 904.0

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

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Data Review (USEPA, 2017) and 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). The LCSs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Data for laboratory duplicates, when performed on project samples. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Percent recoveries for carriers. Carriers are used to assess the chemical yield for the preparation and/or instrument efficiency;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

It should be noted that results for method blanks and laboratory control samples 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 metals, anions, TDS, total phosphorus, and alkalinity analyses.

This data usability report addresses the following items:

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

Review Summary

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

- The reviewed Appendix III and IV constituents as well as iron, copper, nickel, silver, vanadium, zinc, total phosphorous, and alkalinity 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. Target analytes were not detected in the method blank samples with the following exception. Normalized

absolute difference comparisons between blank and sample that are between 1.96 and 2.58 may indicate biased high results and normalized absolute differences <1.96 may indicate a false positive sample result.

  - Radium-228 was detected in method blank 160-471392/17-A at 0.6623+/- 0.276 pCi/L. The detected radium-228 results for samples associated with this method blank were potentially impacted, as summarized in the attached table. Radium results are similar to historic concentrations and therefore are usable for their intended purpose.

- One equipment blank (EB-06) and one field blank (FB-06) were collected. Target analytes were not detected in these samples with the following exception. Normalized absolute difference comparisons between blank and sample that are between 1.96 and 2.58 may indicate biased high results and normalized absolute differences <1.96 may indicate a false positive sample result.

  - Radium-228 and combined radium were detected in EB-06 at 1.40 +/- 0.370 pCi/L and 1.49 +/- 0.399 pCi/L, respectively. The detected radium-228 result in this sample is a potential false positive due to method blank contamination and did not further impact any groundwater samples. The detected combined radium results for samples associated with this blank were potentially impacted, as summarized in the attached table. Radium results are similar to historic concentrations and therefore are usable for their intended purpose.

- The LCS recoveries for radium were within QC limits.
- MS and MSD analyses were performed on sample JCW-MW-18001 for metals, mercury, anions, total phosphorus, and alkalinity. Recoveries were within the acceptance limits. MS/MSD relative percent differences (RPDs) were not provided by the laboratory in SDG 20-0501 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-06/MW-51. All criteria were met.
- Laboratory duplicate analyses were performed on sample JCW-MW-18001 for radium-226 and radium-228. All criteria were met.
- Carrier recoveries were within 40-110%.
- Samples did not undergo a 21-day wait period prior to radium-226 analysis; however, combined radium results were < 5 pCi/L so there is no impact on data usability.
- The RLs for silver (0.3 µg/L) in samples JCW-MW-18001 and MW-55 were above the project-specified RL of 0.2 µg/L; the laboratory indicated that these RLs were raised due to matrix interference and/or possible carryover effects

Attachment A

Summary of Data Non-Conformances for Groundwater Analytical Data
JC Weadock/Karn Landfill – RCRA CCR Monitoring Program
Essexville, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
DUP-06	5/19/2020	Radium-228	Detection in method blank. Normalized absolute difference between blank and sample <1.96; indicates possible false positive result. However, results were consistent with historical results; therefore, data usability is not affected.
EB-06	5/20/2020		
JCW-MW-18001	5/18/2020		
JCW-MW-18005	5/19/2020		
JCW-MW-18006	5/20/2020		
MW-51	5/19/2020		
MW-52	5/19/2020		
MW-53R	5/19/2020		
MW-54R	5/19/2020		
OW-57R OUT	5/20/2020		
DUP-06	5/19/2020	Combined Radium	Detection in equipment blank (EB-06). Normalized absolute difference between blank and sample <1.96; indicates possible false positive result. However, results were consistent with historical results; therefore, data usability is not affected.
JCW-MW-18001	5/18/2020		
JCW-MW-18005	5/19/2020		
JCW-MW-18006	5/20/2020		
MW-50	5/19/2020		
MW-51	5/19/2020		
MW-52	5/19/2020		
MW-53	5/19/2020		
MW-53R	5/19/2020		
MW-54R	5/19/2020		
MW-55	5/19/2020		
OW-57R OUT	5/20/2020		

Attachment B
Weadock Bottom Ash Pond: Statistical Evaluation of May 2020 Assessment Monitoring Sampling Event

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Technical Memorandum

Date:	July 15, 2020
To:	J.R. Register, Consumers Energy
From:	Darby Litz, TRC Kristin Lowery, TRC
Project No.:	367389.0001 Phase 003, Task 002
Subject:	Statistical Evaluation of May 2020 Assessment Monitoring Sampling Event JC Weadock Bottom Ash Pond, Consumers Energy Company, Essexville, Michigan

During the statistical evaluation of the initial assessment monitoring event (May 2018), beryllium and lithium were present in one or more downgradient monitoring wells at statistically significant levels exceeding the Groundwater Protection Standards (GWPSs). Therefore, Consumers Energy Company (Consumers Energy) initiated an Assessment of Corrective Measures (ACM) within 90 days from when the Appendix IV exceedance was determined. The ACM was completed on September 11, 2019.

Currently, Consumers Energy is continuing semiannual assessment monitoring in accordance with §257.95 of the CCR Rule[1] at the JC Weadock Power Plant Bottom Ash Pond. The first semiannual assessment monitoring event for 2020 was conducted on May 14 through May 20, 2020. In accordance with §257.95, the assessment monitoring data must be compared to GWPSs to determine whether or not Appendix IV constituents are detected at statistically significant levels above the GWPSs. GWPSs were established in accordance with §257.95(h), as detailed in the October 15, 2018 Groundwater Protection Standards technical memorandum, which was also included in the 2018 Annual Groundwater Monitoring Report (TRC, January 2019). The following narrative describes the methods employed and the results obtained and the Sanitas™ output files are included as an attachment.

The statistical evaluation of the fifth semiannual assessment monitoring event data indicate no constituents are present at statistically significant levels that exceed the GWPSs in downgradient monitoring wells at the Weadock Bottom Ash Pond.

Constituent	GWPS	#Downgradient Wells Observed

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

Previously, lithium and beryllium were present in downgradient well JCW-MW-15009 at statistically significant levels; however, the May 2020 statistical evaluation shows that the lower confidence limits for lithium and beryllium are currently below the GWPSs. Although no Appendix IV constituents are

[1] USEPA final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) published April 17, 2015, as amended per Phase One, Part One of the CCR Rule (83 FR 36435).

present at statistically significant levels above the GWPS based on this data evaluation, corrective action has been triggered as a result of data collected during the previous assessment monitoring events. Once corrective action is triggered (i.e., the lower confidence limit is above the GWPS), the upper confidence limit must be below the GWPS to demonstrate achievement of the GWPS for units that were not closed by removal. For units that are closed by removal, two consecutive rounds of data below the GWPS are needed to demonstrate closure. Consumers Energy will continue to evaluate corrective measures per §257.96 and §257.97. Consumers Energy will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Assessment Monitoring Statistical Evaluation

The four downgradient wells (JCW-MW-15007, JCW-MW-15009, JCW-MW-15010, and JCW-MW-15028) are located in accessible areas along the downgradient perimeter of the Weadock Bottom Ash Pond. Following the first semiannual assessment monitoring sampling event for 2020, compliance well data for the Weadock Bottom Ash Pond were evaluated in accordance with the Groundwater Statistical Evaluation Plan (Stats Plan) (TRC, October 2017).

An assessment monitoring program was developed to evaluate concentrations of CCR constituents present in the uppermost aquifer relative to acceptable levels (i.e. GWPSs). To evaluate whether or not a GWPS exceedance is statistically significant, the difference in concentration observed at the downgradient wells during a given assessment monitoring event compared to the GWPS must be large enough, after accounting for variability in the sample data, that the result is unlikely to have occurred merely by chance. Consistent with the Unified Guidance[2], the preferred method for comparisons to a fixed standard are confidence limits. Based on the number of historical observations in the representative sample population, the population mean, the population standard deviation, and a selected confidence level (i.e., 99 percent), an upper and lower confidence limit is calculated. The true concentration, 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 no compelling evidence that the measured concentration is a result of a release from the CCR unit versus the inherent variability of the sample data. This statistical approach is consistent with the statistical methods for assessment monitoring presented in §257.93(f) and (g). Statistical evaluation methodologies built into the CCR Rule, and numerous other federal rules, are key in determining whether or not individually measured data points represent a concentration increase over the baseline or a fixed standard (such as a GWPS in an assessment monitoring program).

For each detected Appendix IV constituent, the concentrations from each well were first compared directly to the GWPS, as shown on Table 1. Parameter-well combinations that included a direct exceedance of the GWPS within the past eight sampling events (May 2017 through May 2020) were retained for further analysis. Arsenic in JCW-MW-15007 and JCW-MW-15010 and beryllium and

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

lithium in JCW-MW-15009 had individual results exceeding their respective GWPSs within this time period.

Groundwater data 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 and non-parametric confidence intervals, as appropriate, were calculated for each of the CCR Appendix IV constituents using a per test[3] 99 percent confidence level, i.e., a significance level (α) of 0.01. The following narrative describes the methods employed, the results obtained and the Sanitas™ output files are included as an attachment.

The statistical data evaluation included the following steps:

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

The results of these evaluations are presented and discussed below.

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. Initially, the baseline (December 2015 through August 2017) results and the assessment monitoring results (April 2018 through May 2020) were observed visually for potential trends. No outliers were identified. Arsenic concentrations in JCW-MW-15010 and beryllium and lithium concentrations in JCW-MW-15009 appear to exhibit a downward trend on the time series charts (Attachment 1). These data sets were tested further in Sanitas™ utilizing Sen's Slope to estimate the average rate of change in concentration over time and utilizing the Mann-Kendall trend test to test for significance of the trend at the 98% confidence level. The trend tests show that arsenic in JCW-MW-15010 and lithium in JCW-MW-15009 are generally decreasing with time, as evidenced by the negative Sen's Slope, and that the downward trend of beryllium in JCW-MW-15009 is statistically significant (Attachment 1). The decreases in constituent concentrations at JCW-MW-15009 and JCW-MW-15010 are causing the confidence intervals to widen. Calculating a confidence interval around a trending data set incorporates not only variability present naturally in the underlying dataset, but also incorporates variability due to the trend itself. Beryllium and lithium concentrations have already triggered assessment monitoring (e.g., not newly identified GWPS exceedances) and an interim measure has been initiated through cessation of hydraulic loading to the bottom ash pond in April 2018; therefore, traditional confidence interval calculations are presented in

[3] Confidence level is assessed for each individual comparison (i.e. per well and per constituent)

this statistical evaluation until more data are available. Once additional data are collected in the absence of hydraulic loading, confidence bands may be a more appropriate assessment to determine compliance with the CCR Rule. Confidence bands are selected by the UG as the appropriate method for calculating confidence intervals on trending data. A confidence band calculates upper and lower confidence limits at each point along the trend to reduce variability and create a narrower confidence interval. At least 8 to 10 measurements should be available when computing a confidence band around a linear regression.

The Sanitas™ software was then used to test compliance at the downgradient monitoring wells using the confidence interval method for the most recent 8 sampling events. Eight independent sampling events provide the appropriate density of data as recommended per the Unified Guidance yet are collected recently enough to provide an indication of current condition. The tests were run with a per-test 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 data transformations, as appropriate. In each case, the data sets were found to be normally distributed, with the exception of beryllium at JCW-MW-15009, which was first transformed with a Kaplan-Meier cubic transformation. The confidence interval test compares the lower confidence limit to the GWPS. The statistical evaluation of the Appendix IV parameters shows no constituents present at statistically significant levels that exceed the GWPSs. The results of the assessment monitoring statistical evaluation are consistent with the previous (October 2019) assessment monitoring data statistical evaluation. Although no Appendix IV constituents are present at statistically significant levels above the GWPS based on this data evaluation,. Once corrective action is triggered (i.e., the lower confidence limit is above the GWPS), the upper confidence limit must be below the GWPS to demonstrate achievement of the GWPS for units that were not closed by removal. For units that are closed by removal, two consecutive rounds of data below the GWPS are needed to demonstrate closure. Consumers Energy will continue to evaluate corrective measures per §257.96 and §257.97. Consumers Energy will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Attachments

Table 1 Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to May 2020

Attachment 1 Sanitas™ Output Files

Table

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to May 2020
JC Weadock Bottom Ash Pond – RCRA CCR Monitoring Program
Essexville, Michigan

						Sample Location:	JCW-MW-15007															
						Sample Date:	12/9/2015	4/1/2016	5/24/2016	8/23/2016	12/1/2016	2/23/2017	5/17/2017	8/3/2017	8/3/2017	9/19/2017	9/19/2017	4/10/2018	5/23/2018	11/7/2018	4/9/2019	10/15/2019	10/15/2019	5/14/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient																	
Appendix III															Field Dup		Field Dup					Field Dup	
Boron	ug/L	NC	NA	619	NA		296	163	238	547	439	270	263	< 20.0	345	384	479	--	308	656	290	470	460	335
Calcium	mg/L	NC	NA	302	NA		115	119	133	106	124	226	177	182	171	140	153	--	145	153	200	130	120	217
Chloride	mg/L	250*	NA	2,440	NA		763	1,220	990	333	521	1,720	1,570	1,870	1,830	1,340	1,370	--	1,660	788	1,600	1,200	1,200	2,870
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 10,000 (1)	< 5,000(1)	< 5,000(1)	< 1,000
Sulfate	mg/L	250*	NA	407	NA		48.3	20.1	21.0	30.5	26.3	20.9	22.9	34.5	34.6	8.8	9.2	--	19.6	23.9	< 20	44	43	57.2
Total Dissolved Solids	mg/L	500*	NA	4,600	NA		1,800	2,300	2,200	1,100	1,400	3,700	3,100	3,410	3,500	2,560	2,530	--	3,210	1,790	3,400	2,300	2,400	5,080
pH, Field	SU	6.5 - 8.5*	NA	6.5-7.3	NA		7.0	7.2	7.1	7.0	7.1	7.0	7.2	6.8	--	7.1	--	7.1	7.2	7.1	7.2	7.1	--	7.6
Appendix IV																								
Antimony	ug/L	6	NA	1	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Arsenic	ug/L	10	NA	21	**21**		13	15	20	**55**	**37**	**26**	**23**	< 1.0	**48.6**	--	--	16.7	**25.6**	**46.3**	9.8	**34**	**35**	19
Barium	ug/L	2,000	NA	1,300	2,000		392	443	472	733	821	1,150	719	< 1.0	934	--	--	957	941	1,060	950	970	970	1,180
Beryllium	ug/L	4	NA	1	**4**		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 1.0	< 0.20	< 0.20	< 0.20	< 0.2
Chromium	ug/L	100	NA	3	100		< 1	1	1	< 1	1	2	1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1
Cobalt	ug/L	NC	6	15	**15**		< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	--	< 15.0	< 15.0	< 30.0 (1)	< 6.0	< 6.0	< 6.0	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 10,000 (1)	< 5,000(1)	< 5,000(1)	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	3	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1
Lithium	ug/L	NC	40	180	**180**		50	52.3	61	65	61	77	75	100	97	--	--	80	88	87	67	70	67	103
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2
Molybdenum	ug/L	NC	100	6	100		20	8	8	10	10	9	7	< 5.0	< 5.0	--	--	6.4	7.6	< 25.0	6.2	9.7	9.6	< 5
Radium-226	pCi/L	NC	NA	NA	NA		0.380	0.467	0.700	0.355	0.365	1.08	0.476	1.82	1.23	--	--	0.878	0.239	1.33	0.628	0.659	0.442	0.728
Radium-228	pCi/L	NC	NA	NA	NA		0.872	0.786	0.997	1.11	0.893	1.53	1.32	1.07	< 0.671	--	--	0.761	0.795	0.975	0.492	0.796	0.543	0.698
Radium-226/228	pCi/L	5	NA	3.32	5		1.252	1.253	1.697	1.465	1.258	2.61	1.80	2.89	1.88	--	--	1.64	1.03	2.31	1.12	1.45	0.986	1.43
Selenium	ug/L	50	NA	2	50		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	1.2	< 1.0	< 1.0	3.2	< 1.0	< 1.0	< 1
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	--	< 2.0	< 2.0	< 10.0 (1)	< 2.0	< 2.0	< 2.0	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) Laboratory reporting limit exceeds GWPS due to sample dilutions performed as a result of sample matrix interferences. and/or concentrations of other constituents present.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to May 2020
JC Weadock Bottom Ash Pond – RCRA CCR Monitoring Program
Essexville, Michigan

						Sample Location:	JCW-MW-15009												
						Sample Date:	12/9/2015	3/31/2016	5/25/2016	8/23/2016	12/1/2016	2/23/2017	5/18/2017	8/2/2017	9/18/2017	4/10/2018	5/23/2018	11/7/2018	4/9/2019	10/15/2019	5/14/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient														
Appendix III																					
Boron	ug/L	NC	NA	619	NA		546	284	402	501	498	366	329	429	533	--	297	422	290	330	141
Calcium	mg/L	NC	NA	302	NA		520	526	546	622	549	618	558	554	470	--	530	589	510	520	314
Chloride	mg/L	250*	NA	2,440	NA		189	97.4	163	171	154	95.5	52.6	84.8	113	--	41.0	64.9	43	18	3.19
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 2,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	407	NA		2,520	1,790	2,650	2,030	2,280	1,880	1,710	2,680	3,090	--	1,690	1,980	1,600	1,400	611
Total Dissolved Solids	mg/L	500*	NA	4,600	NA		1,700	2,800	1,800	3,300	3,200	2,700	2,600	2,590	3,020	--	2,510	2,620	2,400	2,100	1,370
pH, Field	SU	6.5 - 8.5*	NA	6.5-7.3	NA		4.1	4.8	4.1	4.2	4.1	4.6	4.7	4.6	4.6	4.7	4.9	4.8	5.4	6.1	7.2
Appendix IV																					
Antimony	ug/L	6	NA	1	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Arsenic	ug/L	10	NA	21	**21**		2	< 1	2	< 1	< 1	< 1	< 1	< 1.0	--	1.6	1.4	< 5.0	< 1.0	< 1.0	< 1
Barium	ug/L	2,000	NA	1,300	2,000		20	17	14	23	18	15	15	16.6	--	12.3	14.4	14.8	14	66	58
Beryllium	ug/L	4	NA	1	**4**		**27**	**9**	**20**	**17**	**19**	**11**	**7**	**7.4**	--	**7.1**	**6.5**	**6.6**	**4.3**	< 1.0	< 1
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 1.0	0.24	< 0.20	< 0.2
Chromium	ug/L	100	NA	3	100		6	2	5	4	4	3	1	1.5	--	1.4	1.4	< 5.0	1.4	< 1.0	2
Cobalt	ug/L	NC	6	15	**15**		**22**	< 15	**21**	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 30.0 (1)	< 6.0	< 6.0	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 2,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1
Lithium	ug/L	NC	40	180	**180**		**367**	139	**238**	**280**	**300**	**216**	**182**	**270**	--	**210**	**190**	**240**	150	94	18
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2
Molybdenum	ug/L	NC	100	6	100		< 5	10	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0	< 25.0	< 5.0	9.3	10
Radium-226	pCi/L	NC	NA	NA	NA		0.274	< 0.234	< 0.186	0.159	< 0.318	0.403	< 0.27	< 0.644	--	< 0.703	< 0.723	< 0.803	< 0.0879	0.175	< 0.125
Radium-228	pCi/L	NC	NA	NA	NA		1.20	0.842	0.700	1.43	1.33	1.35	1.24	0.833	--	0.707	1.11	1.25	< 0.411	0.548	< 0.491
Radium-226/228	pCi/L	5	NA	3.32	5		1.474	1.069	0.683	1.589	1.608	1.753	1.31	< 1.39	--	< 1.37	< 1.37	< 1.54	< 0.411	0.723	< 0.491
Selenium	ug/L	50	NA	2	50		4	3	3	1	3	2	1	1.4	--	14.2	5.2	< 5.0	2.0	2.0	1
Thallium	ug/L	2	NA	2	2		< 2	< 2	2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 10.0 (1)	< 2.0	< 2.0	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) Laboratory reporting limit exceeds GWPS due to sample dilutions performed as a result of sample matrix interferences, and/or concentrations of other constituents present.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to May 2020
JC Weadock Bottom Ash Pond – RCRA CCR Monitoring Program
Essexville, Michigan

						Sample Location:	JCW-MW-15010														
						Sample Date:	12/10/2015	3/31/2016	5/25/2016	8/24/2016	12/1/2016	2/23/2017	5/17/2017	8/2/2017	9/19/2017	4/10/2018	5/22/2018	5/22/2018	11/7/2018	4/9/2019	10/14/2019	5/14/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient											Field Dup				
Appendix III																					
Boron	ug/L	NC	NA	619	NA		1,220	987	1,070	1,320	1,370	1,360	1,390	1,580	1,340	--	1,330	1,220	1,360	1,400	1,400	2,070
Calcium	mg/L	NC	NA	302	NA		68.0	85.4	74.3	74.0	79.1	103	84.8	69.9	63.6	--	78.3	78.8	84.4	120	110	286
Chloride	mg/L	250*	NA	2,440	NA		83.6	87.8	81.5	78.1	92.8	88.8	89.8	92.7	89.5	--	99.8	99.7	96.5	140	140	90.4
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	1,300	< 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	407	NA		72.3	91.6	62.8	53.9	80.7	57.9	72.9	59.0	39.9	--	24.3	23.2	22.3	36	30	553
Total Dissolved Solids	mg/L	500*	NA	4,600	NA		430	500	440	400	490	460	480	832	392	--	458	486	492	670	600	1,500
pH, Field	SU	6.5 - 8.5*	NA	6.5-7.3	NA		7.7	7.4	7.4	7.6	7.5	7.3	7.5	7.5	7.5	7.3	7.5	--	7.4	7.6	7.3	7.7
Appendix IV																					
Antimony	ug/L	6	NA	1	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Arsenic	ug/L	10	NA	21	**21**		**22**	**39**	**25**	**34**	**27**	**25**	**23**	**23.2**	--	12.5	11.4	11.1	9.5	16	13	4
Barium	ug/L	2,000	NA	1,300	2,000		99	115	99	98	125	111	123	109	--	121	123	116	114	190	180	400
Beryllium	ug/L	4	NA	1	**4**		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2
Chromium	ug/L	100	NA	3	100		< 1	1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	1.2	< 1.0	< 1.0	< 1
Cobalt	ug/L	NC	6	15	**15**		< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	1,300	< 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	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Lithium	ug/L	NC	40	180	**180**		63	52.7	55	53	60	57	61	61	--	77	72	72	70	73	84	116
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2
Molybdenum	ug/L	NC	100	6	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5
Radium-226	pCi/L	NC	NA	NA	NA		< 0.240	< 0.278	< 0.189	< 0.201	< 0.318	0.358	< 0.269	< 0.643	--	< 0.831	< 0.618	< 0.668	< 0.879	0.215	< 0.134	0.409
Radium-228	pCi/L	NC	NA	NA	NA		0.524	< 0.364	< 0.585	0.604	< 0.584	< 0.631	0.917	< 0.707	--	1.39	< 0.741	< 0.701	< 0.776	0.424	0.412	< 0.467
Radium-226/228	pCi/L	5	NA	3.32	5		0.58	< 0.364	< 0.585	0.731	< 0.584	0.683	0.981	< 1.35	--	< 2.04	< 1.36	< 1.37	< 1.66	0.639	0.536	0.781
Selenium	ug/L	50	NA	2	50		1	< 1	< 1	< 1	< 1	1	6	< 1.0	--	< 1.0	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Thallium	ug/L	2	NA	2	2		< 2	< 2	2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) Laboratory reporting limit exceeds GWPS due to sample dilutions performed as a result of sample matrix interferences. and/or concentrations of other constituents present.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to May 2020
JC Weadock Bottom Ash Pond – RCRA CCR Monitoring Program
Essexville, Michigan

						Sample Location:	JCW-MW-15028															
						Sample Date:	12/9/2015	3/31/2016	5/25/2016	8/23/2016	12/1/2016	2/23/2017	5/17/2017	8/2/2017	9/19/2017	4/11/2018	4/11/2018	5/23/2018	11/7/2018	11/7/2018	4/9/2019	4/9/2019	10/14/2019	5/14/2020	5/14/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient																	
Appendix III																	Field Dup			Field Dup		Field Dup		Field Dup
Boron	ug/L	NC	NA	619	NA		357	333	345	433	455	425	427	444	419	--	--	444	517	525	530	560	550	570	562
Calcium	mg/L	NC	NA	302	NA		63.4	72.2	71.2	97.7	90.7	98.5	86.2	92.4	75.5	--	--	125	153	153	170	180	170	205	204
Chloride	mg/L	250*	NA	2,440	NA		71.7	69.3	69.4	72.2	64.2	70.0	60.1	106	91.0	--	--	69.5	352	347	660	650	640	823	806
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 2,000	< 2,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	407	NA		62.5	49.3	69.8	113	142	116	62.8	93.0	85.7	--	--	32.2	111	110	120	120	120	128	122
Total Dissolved Solids	mg/L	500*	NA	4,600	NA		410	400	390	520	550	530	470	514	506	--	--	1,030	976	966	1,800	1,800	1,500	2,210	2,240
pH, Field	SU	6.5 - 8.5*	NA	6.5-7.3	NA		8.1	7.9	7.8	7.6	8.1	8.0	7.9	7.7	8.0	7.8	--	8.0	7.9	--	8.0	--	7.8	8.1	--
Appendix IV																								
Antimony	ug/L	6	NA	1	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Arsenic	ug/L	10	NA	21	**21**		2	< 1	1	1	2	2	1	1.2	--	1.2	1.4	< 1.0	< 1.0	1.1	1.1	1.1	< 1.0	< 1	1
Barium	ug/L	2,000	NA	1,300	2,000		65	63	69	90	102	92	82	97.4	--	148	145	148	156	158	250	240	230	324	331
Beryllium	ug/L	4	NA	1	**4**		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2
Chromium	ug/L	100	NA	3	100		< 1	1	1	< 1	< 1	1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Cobalt	ug/L	NC	6	15	**15**		< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 2,000	< 2,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Lithium	ug/L	NC	40	180	**180**		25.9	22.7	25	29	32	32	30	35	--	48	47	48	51	49	53	51	48	60	60
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	6	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5	< 5
Radium-226	pCi/L	NC	NA	NA	NA		< 0.182	< 0.448	< 0.189	< 0.220	< 0.361	0.285	< 0.247	< 0.952	--	< 0.934	< 0.450	< 0.739	1.13	0.786	0.621	0.384	0.576	0.515	< 0.136
Radium-228	pCi/L	NC	NA	NA	NA		< 0.646	0.571	0.479	0.441	< 0.374	0.674	0.819	< 0.772	--	0.988	0.874	< 0.676	< 0.685	<0.591	0.729	0.658	0.585	0.733	< 0.399
Radium-226/228	pCi/L	5	NA	3.32	5		< 0.646	0.673	0.63	0.565	< 0.374	0.959	0.829	< 1.72	--	1.65	1.30	< 1.42	1.60	1.26	1.35	1.04	1.16	1.25	< 0.399
Selenium	ug/L	50	NA	2	50		2	< 1	< 1	< 1	< 1	1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2	< 2

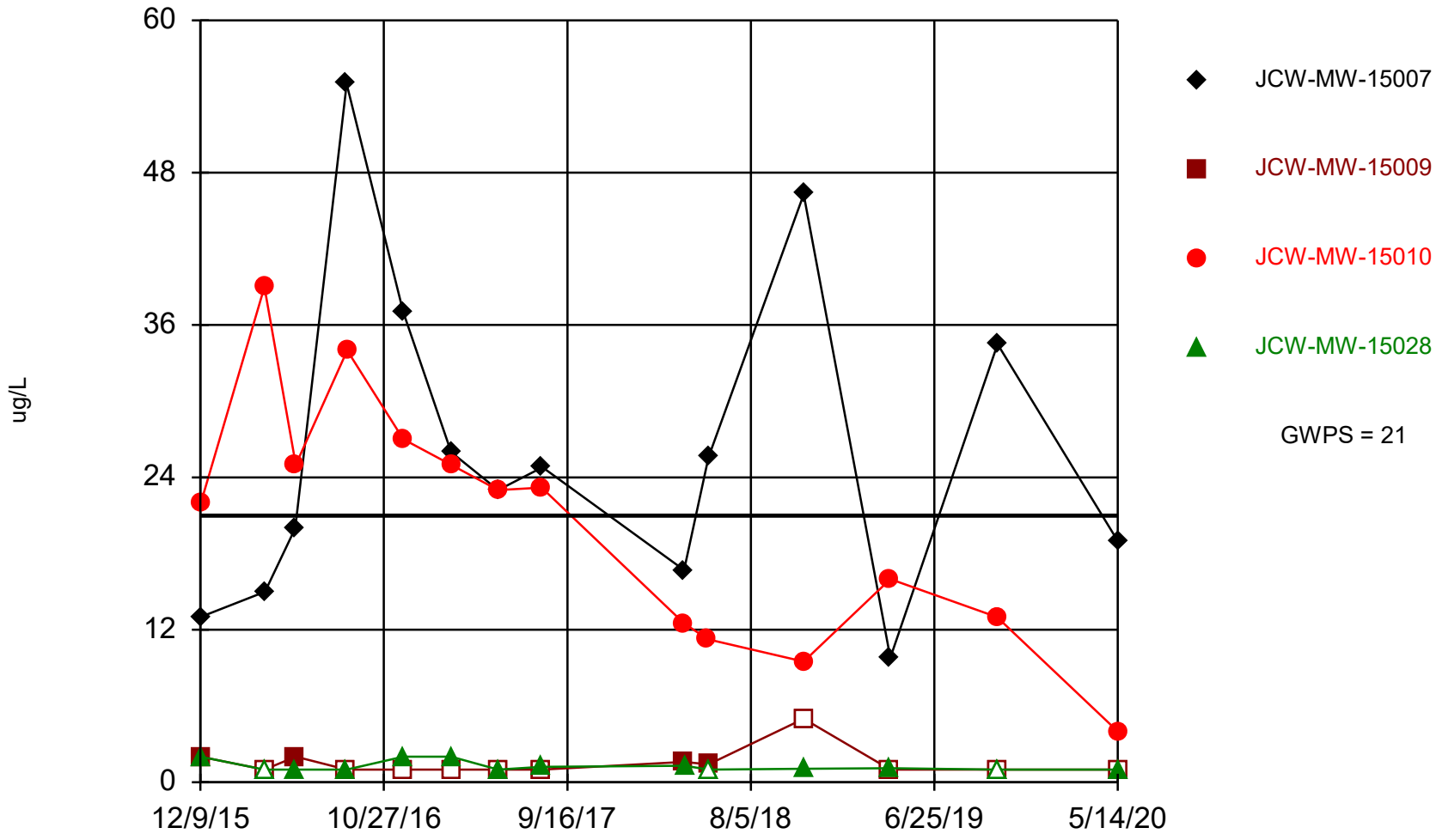
Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) Laboratory reporting limit exceeds GWPS due to sample dilutions performed as a result of sample matrix interferences. and/or concentrations of other constituents present.

Attachment 1
Sanitas™ Output Files

Hollow symbols indicate censored values.

Arsenic, Total

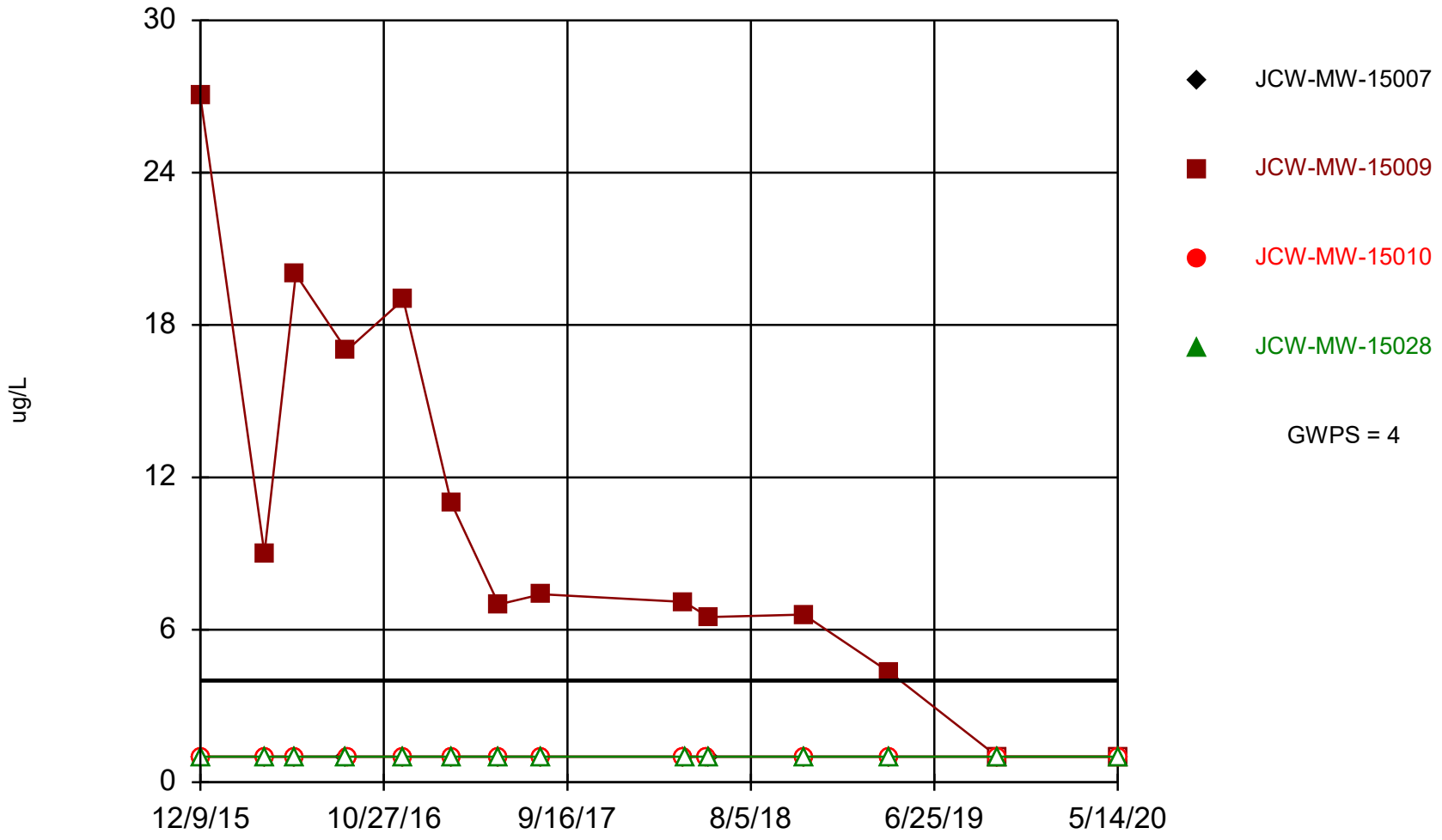


Time Series Analysis Run 6/24/2020 3:35 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.06.18

Hollow symbols indicate censored values.

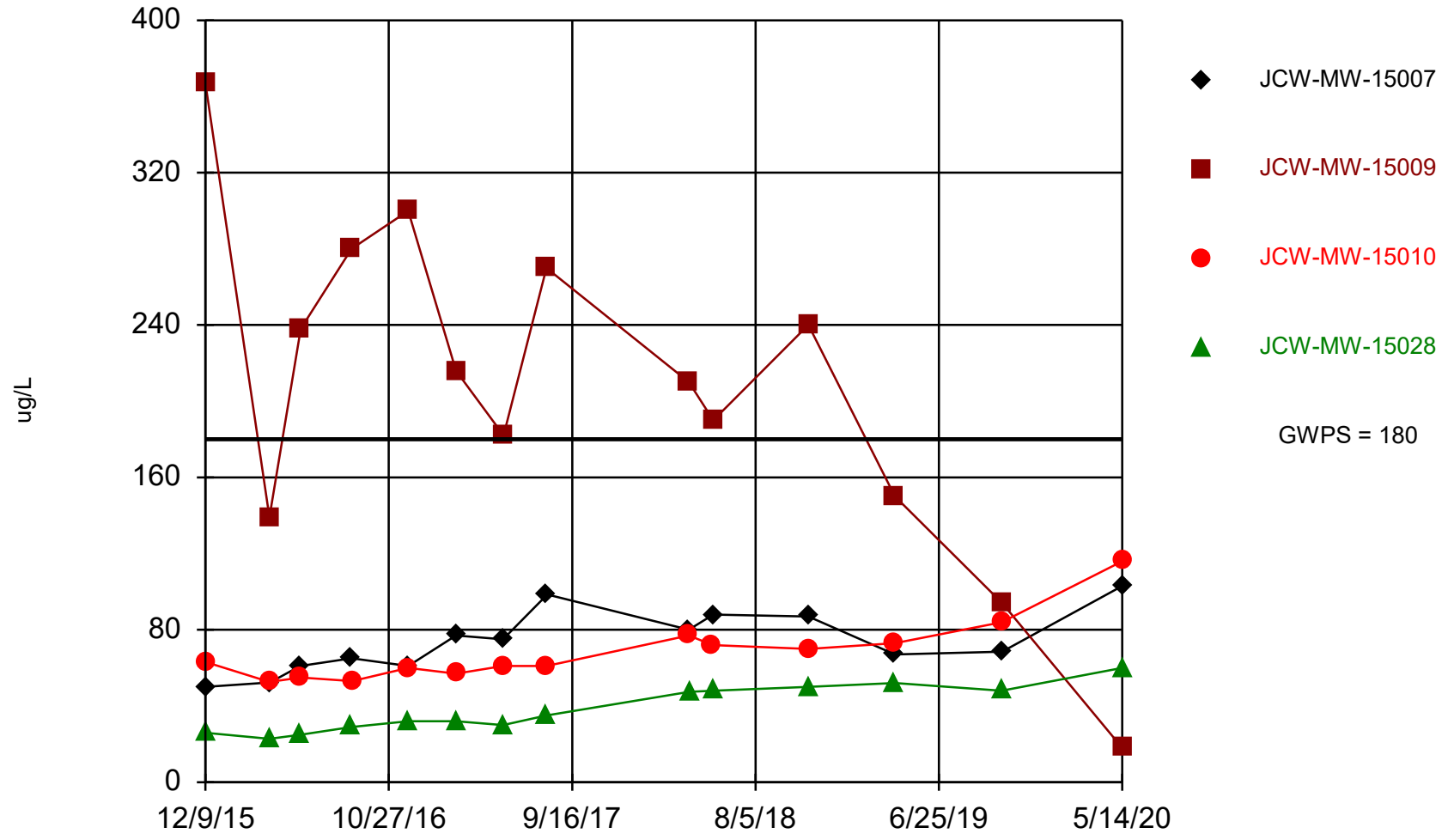
Beryllium, Total



Time Series Analysis Run 6/24/2020 3:37 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.06.18

Lithium, Total

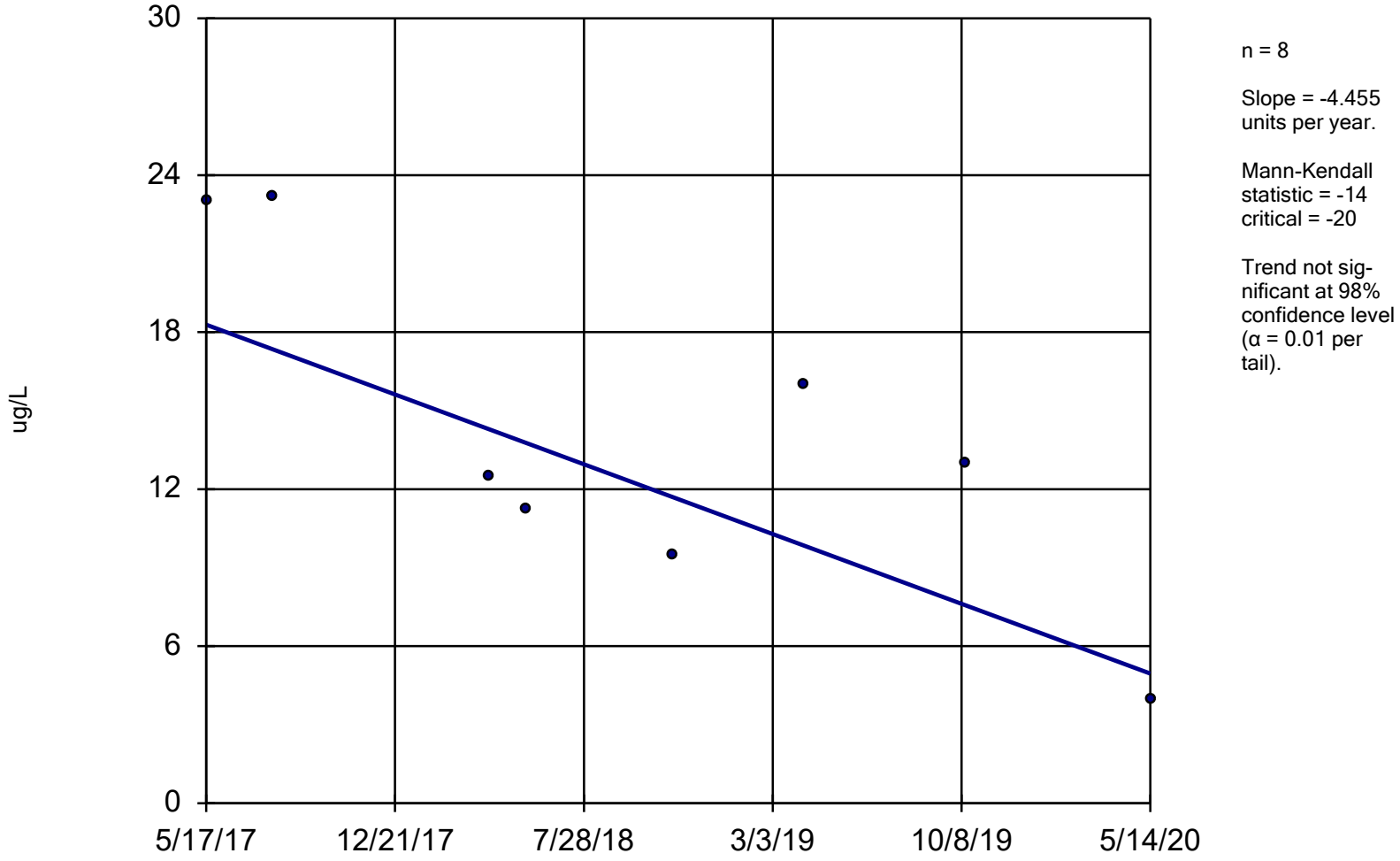


Time Series Analysis Run 6/24/2020 3:48 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.06.18

Arsenic, Total

JCW-MW-15010



n = 8

Slope = -4.455 units per year.

Mann-Kendall statistic = -14
critical = -20

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

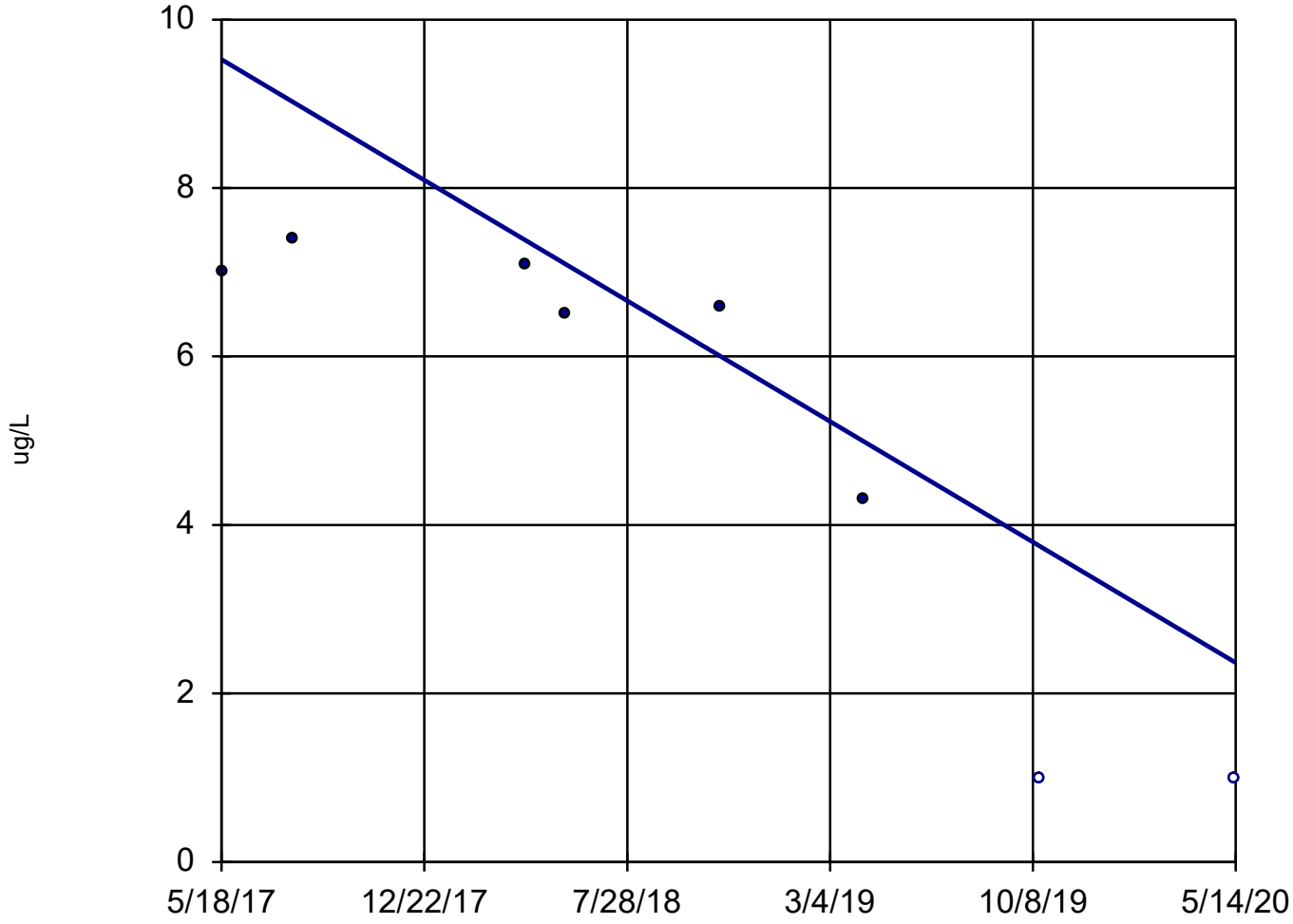
Sen's Slope Estimator Analysis Run 6/24/2020 3:51 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.06.18

Hollow symbols indicate censored values.

Beryllium, Total

JCW-MW-15009



n = 8

Slope = -2.394 units per year.

Mann-Kendall statistic = -21
critical = -20

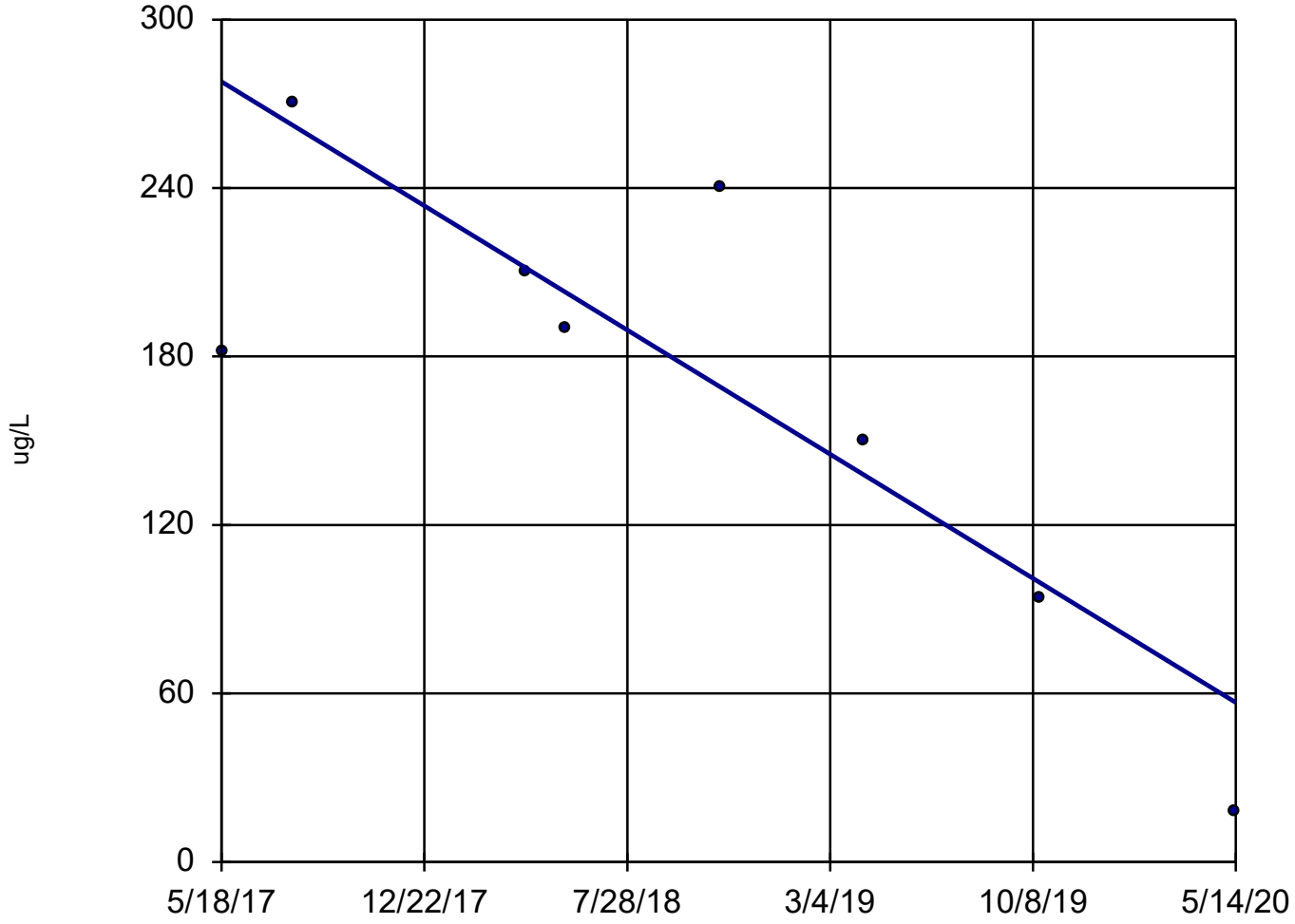
Decreasing trend significant at 98% confidence level (α = 0.01 per tail).

Sen's Slope Estimator Analysis Run 6/24/2020 3:51 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.06.18

Lithium, Total

JCW-MW-15009



n = 8

Slope = -73.89 units per year.

Mann-Kendall statistic = -16
critical = -20

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

Sen's Slope Estimator Analysis Run 6/24/2020 3:51 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.06.18

Summary Report

Constituent: Arsenic, Total Analysis Run 6/24/2020 3:53 PM
Client: Consumers Energy Data: JCW_CCR_Sanitas_20.06.18

For observations made between 5/17/2017 and 5/14/2020, a summary of the selected data set:

Observations = 32
ND/Trace = 8
Wells = 4
Minimum Value = 1
Maximum Value = 46.3
Mean Value = 10.43
Median Value = 4.5
Standard Deviation = 11.79
Coefficient of Variation = 1.131
Skewness = 1.22

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JCW-MW-15007	8	0	9.8	46.3	24.96	23.9	11.24	0.4502	0.6791
JCW-MW-15009	8	6	1	5	1.625	1	1.383	0.8513	2.147
JCW-MW-15010	8	0	4	23.2	14.06	12.75	6.554	0.4663	0.1891
JCW-MW-15028	8	2	1	1.3	1.081	1.025	0.1132	0.1047	1.05

Summary Report

Constituent: Beryllium, Total Analysis Run 6/24/2020 3:53 PM
Client: Consumers Energy Data: JCW_CCR_Sanitas_20.06.18

For observations made between 5/17/2017 and 5/14/2020, a summary of the selected data set:

Observations = 32
ND/Trace = 26
Wells = 4
Minimum Value = 1
Maximum Value = 7.4
Mean Value = 2.028
Median Value = 1
Standard Deviation = 2.22
Coefficient of Variation = 1.095
Skewness = 1.727

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JCW-MW-15007	8	8	1	1	1	1	0	0	NaN
JCW-MW-15009	8	2	1	7.4	5.113	6.55	2.709	0.5299	-0.8231
JCW-MW-15010	8	8	1	1	1	1	0	0	NaN
JCW-MW-15028	8	8	1	1	1	1	0	0	NaN

Summary Report

Constituent: Lithium, Total Analysis Run 6/24/2020 3:53 PM
Client: Consumers Energy Data: JCW_CCR_Sanitas_20.06.18

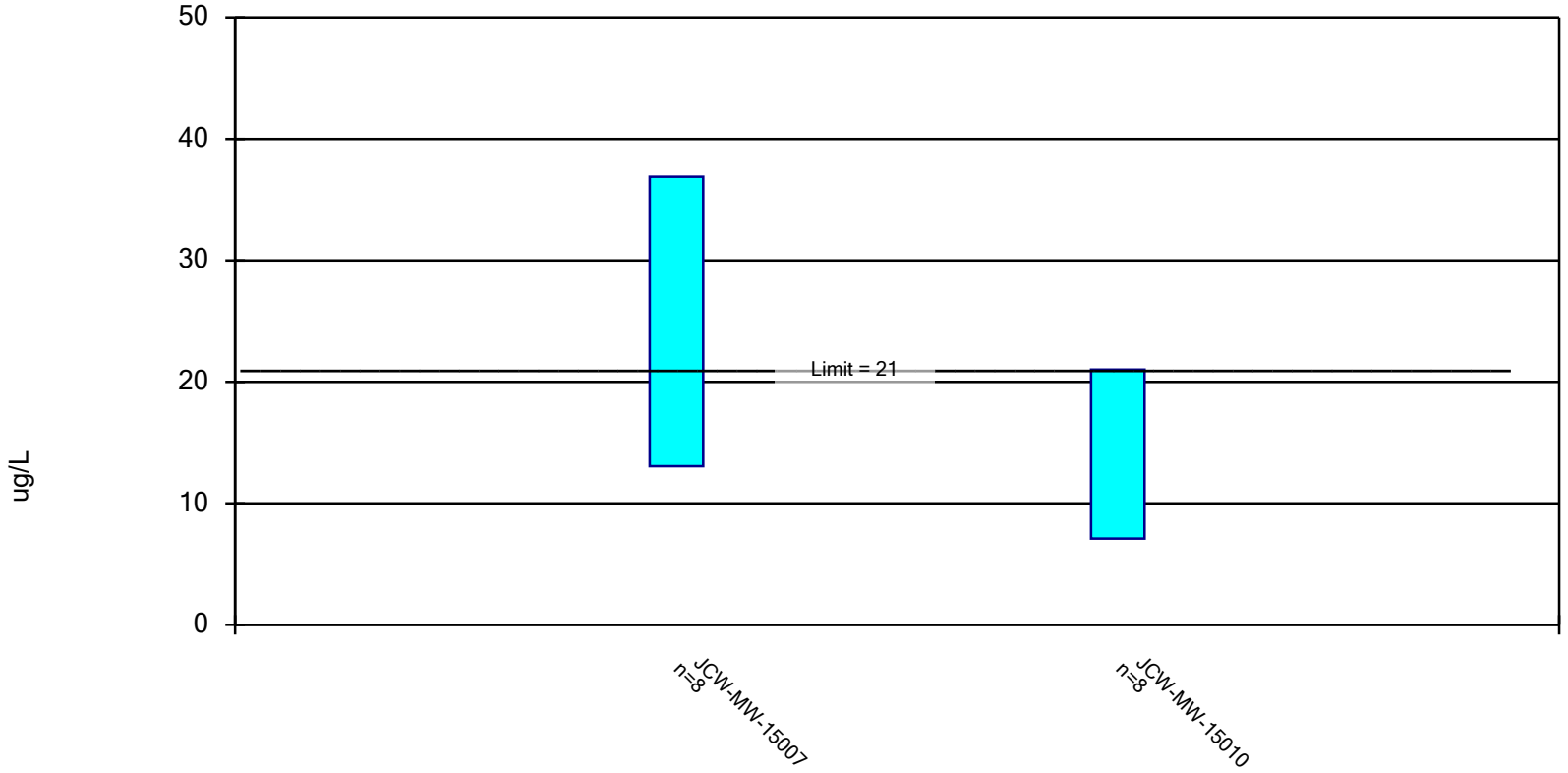
For observations made between 5/17/2017 and 5/14/2020, a summary of the selected data set:

Observations = 32
ND/Trace = 0
Wells = 4
Minimum Value = 18
Maximum Value = 270
Mean Value = 93.92
Median Value = 74
Standard Deviation = 61.47
Coefficient of Variation = 0.6544
Skewness = 1.46

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JCW-MW-15007	8	0	67	103	83.38	83.5	13.2	0.1583	0.1898
JCW-MW-15009	8	0	18	270	169.3	186	81.35	0.4806	-0.6917
JCW-MW-15010	8	0	61	116	76.75	72.5	17.61	0.2295	1.469
JCW-MW-15028	8	0	30	60	46.31	48	9.52	0.2056	-0.5272

Parametric Confidence Interval

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



Constituent: Arsenic, Total Analysis Run 6/24/2020 3:56 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.06.18

Confidence Interval

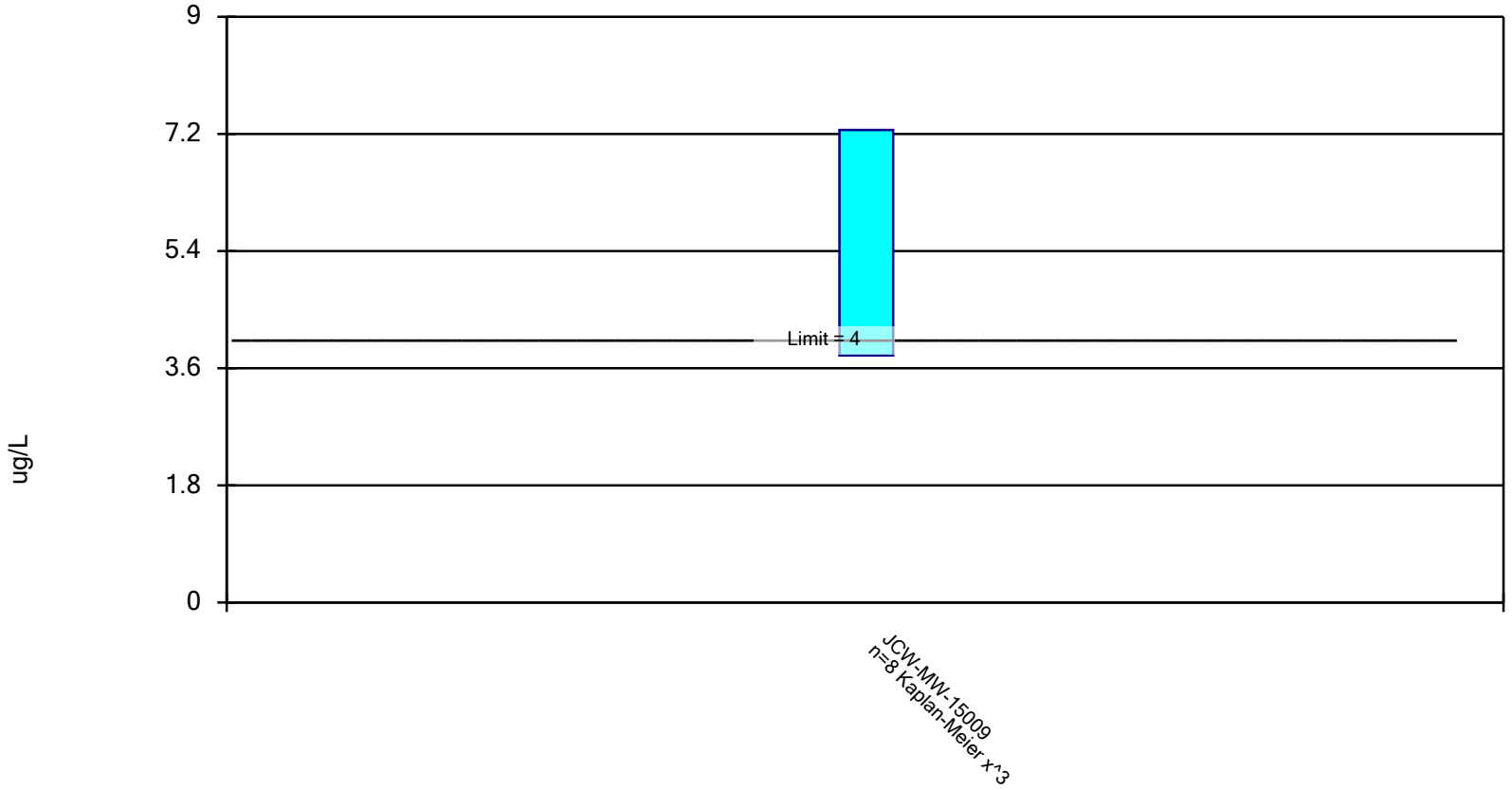
Constituent: Arsenic, Total (ug/L) Analysis Run 6/24/2020 3:57 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.06.18

	JCW-MW-15007	JCW-MW-15010
5/17/2017	23	23
8/2/2017		23.2
8/3/2017	24.8 (D)	
4/10/2018	16.7	12.5
5/22/2018		11.25 (D)
5/23/2018	25.6	
11/7/2018	46.3	9.5
4/9/2019	9.8	16
10/14/2019		13
10/15/2019	34.5 (D)	
5/14/2020	19	4
Mean	24.96	14.06
Std. Dev.	11.24	6.554
Upper Lim.	36.88	21
Lower Lim.	13.05	7.109

Parametric Confidence Interval

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



Constituent: Beryllium, Total Analysis Run 6/24/2020 3:56 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.06.18

Confidence Interval

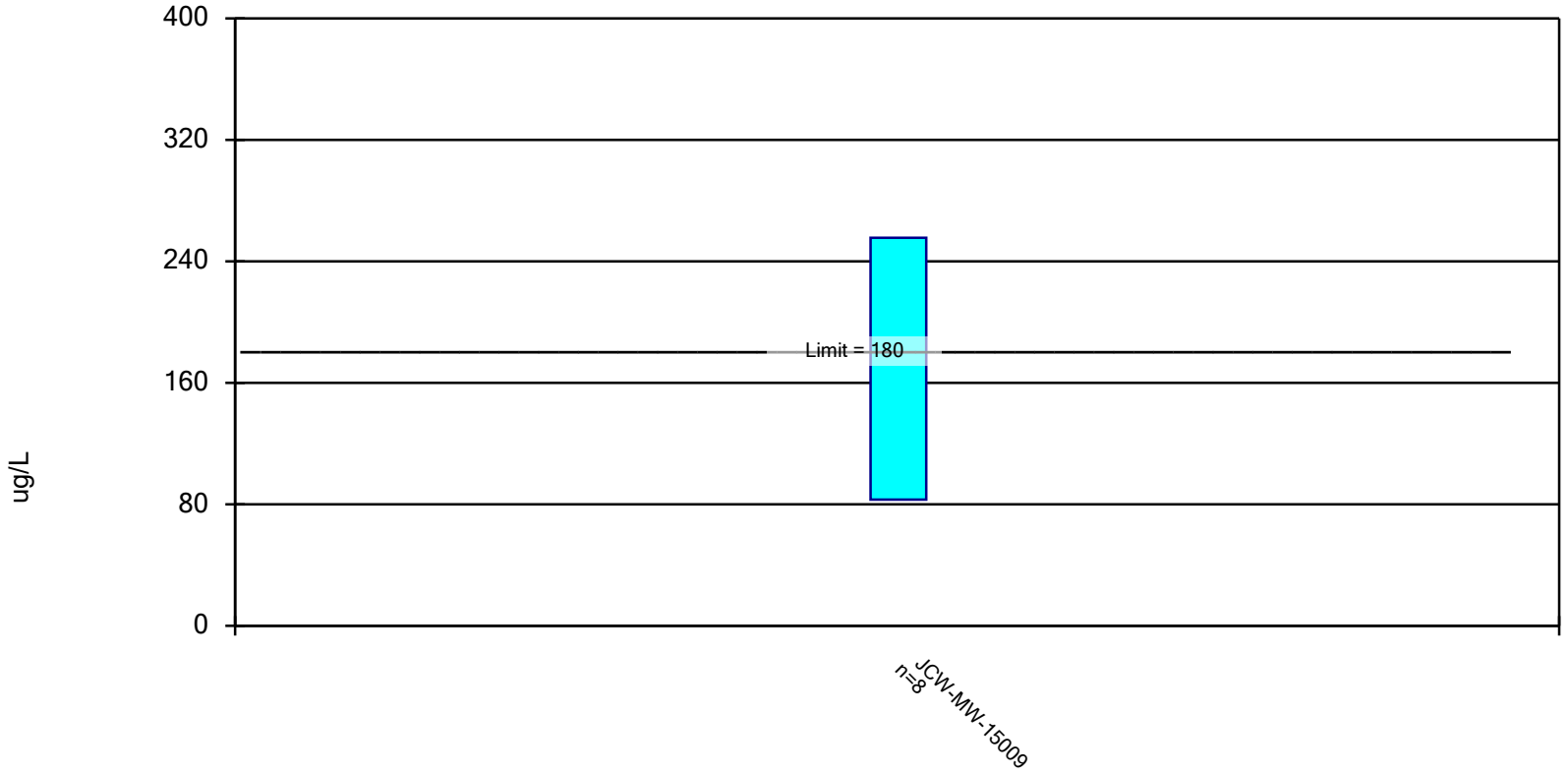
Constituent: Beryllium, Total (ug/L) Analysis Run 6/24/2020 3:57 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.06.18

	JCW-MW-15009
5/18/2017	7
8/2/2017	7.4
4/10/2018	7.1
5/23/2018	6.5
11/7/2018	6.6
4/9/2019	4.3
10/15/2019	<1
5/14/2020	<1
Mean	5.113
Std. Dev.	2.709
Upper Lim.	7.261
Lower Lim.	3.795

Parametric Confidence Interval

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



Constituent: Lithium, Total Analysis Run 6/24/2020 3:56 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.06.18

Confidence Interval

Constituent: Lithium, Total (ug/L) Analysis Run 6/24/2020 3:57 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.06.18

	JCW-MW-15009
5/18/2017	182
8/2/2017	270
4/10/2018	210
5/23/2018	190
11/7/2018	240
4/9/2019	150
10/15/2019	94
5/14/2020	18
Mean	169.3
Std. Dev.	81.35
Upper Lim.	255.5
Lower Lim.	83.03

Attachment C
Weadock Landfill: Statistical Evaluation of May 2020 Assessment Monitoring Sampling Event

1540 Eisenhower Pl.
Ann Arbor, MI 48108

T 734.971.7080
TRCcompanies.com

Technical Memorandum

Date:	July 15, 2020
To:	J.R. Register, Consumers Energy
From:	Darby Litz, TRC Kristin Lowery, TRC
Project No.:	367389.0000 Phase 003, Task 002
Subject:	Statistical Evaluation of May 2020 Assessment Monitoring Sampling Event JC Weadock Landfill, Consumers Energy Company, Essexville, Michigan

During the statistical evaluation of the initial assessment monitoring event (May 2018), arsenic was present in one or more downgradient monitoring wells at statistically significant levels exceeding the Groundwater Protection Standards (GWPSs). Therefore, Consumers Energy Company (Consumers Energy) initiated an Assessment of Corrective Measures (ACM) within 90 days from when the Appendix IV exceedance was determined. The ACM was completed on September 11, 2019.

Currently, Consumers Energy is continuing semiannual assessment monitoring in accordance with §257.95 of the CCR Rule[1] at the JC Weadock Power Plant Landfill. The first semiannual assessment monitoring event for 2020 was conducted on May 14 through May 20, 2020. In accordance with §257.95, the assessment monitoring data must be compared to GWPSs to determine whether or not Appendix IV constituents are detected at statistically significant levels above the GWPSs. GWPSs were established in accordance with §257.95(h), as detailed in the October 15, 2018 Groundwater Protection Standards technical memorandum, which was also included in the 2018 Annual Groundwater Monitoring Report (TRC, January 2019). The following narrative describes the methods employed and the results obtained and the Sanitas™ output files are included as an attachment.

The evaluation of the initial semiannual assessment monitoring event data (April and May 2018) indicated that arsenic was present at statistically significant levels above the GWPS at one of the three downgradient wells. The three downgradient wells were located within a vent (e.g., opening) of the perimeter soil/bentonite slurry wall to assess the quality of groundwater passing the waste boundary. As discussed in detail below, in July 2018, a vent (e.g., opening) in the perimeter soil/bentonite slurry wall was closed and the slurry wall is now continuous along the entire perimeter of the Weadock Landfill. As a result of the change in groundwater flow conditions, the groundwater monitoring system was revised[2] prior to the November 2018 sampling event. The modified CCR monitoring well network now consists of eleven (11) downgradient monitoring wells. The statistical evaluation of the fifth

[1] USEPA final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) published April 17, 2015, as amended per Phase One, Part One of the CCR Rule (83 FR 36435).

[2] TRC. 2018. *Revised Groundwater Monitoring System Summary Report Technical Memorandum.* December.

semiannual assessment monitoring event data indicates that the following Appendix IV constituents are present at statistically significant levels above the GWPSs in downgradient monitoring wells at the Weadock Landfill:

Constituent	GWPS	#Downgradient Wells Observed
Arsenic	21 µg/L	1 of 11

The statistically significant GWPS exceedance at JCW-MW-18006 was not previously observed as this is the first statistical analysis completed on JCW-MW-18006 following the accumulation of the minimum of four data points. The results of the statistical analysis for other wells/constituents are consistent with previous evaluations using the modified well network. Corrective action has been triggered as a result of data collected during the initial assessment monitoring event. Consumers Energy will continue to evaluate corrective measures per §257.96 and §257.97 and execute the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Assessment Monitoring Statistical Evaluation

When the monitoring well network was first established in October 2017, there was a 1,600-linear-foot section of the perimeter embankment dike that did not have a slurry wall in place. Groundwater flow beneath the Weadock Landfill was directed towards the discharge channel through this vent in the slurry wall for management under the existing NPDES discharge permit. The downgradient monitoring well network was established as three monitoring wells located in the vent area to assess the quality of groundwater passing the waste boundary (JCW-MW-15011, JCW-MW-15012, and JCW-MW-15023). In July 2018, the slurry wall vent was closed to reduced porewater flux around the entire perimeter of the Weadock Landfill. The three downgradient CCR compliance wells were decommissioned by over drilling, removing the well material, and sealing the borehole in order to allow for the slurry wall construction.

Given the change in groundwater flow conditions, a revised groundwater monitoring system has been established to assess slurry wall integrity and determine if there have been any releases from the Weadock Landfill. Consumers Energy installed an additional nine (9) monitoring wells in August 2018 to supplement the preexisting groundwater well network currently used under the approved 2015 HMP for Michigan Part 115 compliance to provide appropriate coverage for the collection of groundwater levels and water quality data along the perimeter of the Weadock Landfill.

Therefore, the modified CCR monitoring well network now consists of eleven (11) downgradient monitoring wells as discussed in the Sample and Analysis Plan (2018 SAP) and Statistical Analysis Plan (2018 Stats Plan). The downgradient monitoring wells include:

- JCW-MW-18001
- JCW-MW-18004
- JCW-MW-18005
- JCW-MW-18006
- MW-50
- MW-51
- MW-52
- MW-53
- MW-54R
- MW-55
- OW-57R Out

The statistical analysis for the new wells (JCW-MW-18001, JCW-MW-18004, JCW-MW-18005, and JCW-MW-18006; and OW-57R Out) commences with the May 2020 assessment monitoring event now

that sufficient data has been collected (a minimum of four independent sampling events). For the preexisting wells (MW-50 through MW-55), the statistical analysis is also completed on the four assessment monitoring events to use a consistent range of data for all wells. Data collected for the preexisting wells under the HMP monitoring program in 2017 and 2018 is not used for the assessment monitoring program.

Following the first semiannual assessment monitoring sampling event for 2020, compliance well data for the Weadock Landfill were evaluated in accordance with the *Groundwater Statistical Analysis Plan* (TRC, December 2018). 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 [3], the preferred method for comparisons to a fixed standard are confidence limits. Based on the number of historical observations in the representative sample population, the population mean, the population standard deviation, and a selected confidence level (i.e., 99 percent), an upper and lower confidence limit is calculated. The true concentration, 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 no compelling evidence that the measured concentration is a result of a release from the CCR unit versus the inherent variability of the sample data. This statistical approach is consistent with the statistical methods for assessment monitoring presented in §257.93(f) and (g). Statistical evaluation methodologies built into the CCR Rule, and numerous other federal rules, are key in determining whether or not individually measured data points represent a concentration increase over the baseline or a fixed standard (such as a GWPS in an assessment monitoring program).

For each detected Appendix IV constituent, the concentrations for each well were first compared directly to the GWPS, as shown on Table 1. Parameter-well combinations that included a direct exceedance of the GWPS within the most recent four sampling events (November 2018 to May 2020) were retained for further analysis. Arsenic in MW-51, MW-55, and JCW-MW-18006 and molybdenum in MW-55 had individual results exceeding the GWPS. The concentrations of arsenic and molybdenum at MW-55 are not a result of a release from the unit, as detailed in the *Alternate Source Demonstration* (TRC, December 2019); therefore, confidence intervals were not calculated.

Groundwater data 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 and non-

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

parametric confidence intervals were calculated for each of the CCR Appendix IV parameters using a per test[4] 99 percent confidence level, i.e., a significance level (α) of 0.01. The following narrative describes the methods employed, the results obtained and the Sanitas™ output files are included as an attachment.

The statistical data evaluation included the following steps:

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

The results of these evaluations are presented and discussed below.

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. Initially, the baseline (November 2018 through May 2020) results were observed visually for potential trends. No outliers were identified in the data set. The concentrations of arsenic and molybdenum at MW-55 are not a result of a release from the unit, as detailed in the Alternate Source Demonstration (TRC, December 2019); therefore, confidence intervals were not calculated.

The Sanitas™ software was then used to test compliance at the downgradient monitoring wells using the confidence interval method for the most recent 4 sampling events. Four independent sampling events provide the minimum density of data as recommended per the Unified Guidance. The tests were run with a per-test significance of α = 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 data transformations, as appropriate. The data sets were found to be normally distributed. The confidence interval test compares the lower confidence limit to the GWPS. The statistical evaluation of the Appendix IV parameters shows that arsenic is present at statistically significant levels that exceed the GWPS at JCW-MW-18006. This is the first statistical analysis completed on JCW-MW-18006 following the accumulation of the minimum of four data points. The results of the statistical analysis for other wells/constituents are consistent with previous evaluations using the new well network. Corrective action has been triggered as a result of data collected during the initial May 2018 assessment monitoring event. Consumers Energy will continue to

[4] Confidence level is assessed for each individual comparison (i.e. per well and per constituent).

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

Attachments

Table 1 Comparison of Groundwater Sampling Results to Groundwater Protection Standards – August 2017 to May 2020

Attachment 1 Sanitas™ Output Files

Table

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – November 2017 to May 2020
JC Weadock Landfill – RCRA CCR Monitoring Program
Essexville, Michigan

					Sample Location:	MW-50							
					Sample Date:	11/1/2017	3/5/2018	5/15/2018	8/15/2018	11/7/2018	4/9/2019	10/10/2019	5/19/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient							
Appendix III													
Boron	ug/L	NC	NA	619	NA	1,120	1,320	1,220	1,270	1,370	1,600	1,700	1,300
Calcium	mg/L	NC	NA	302	NA	--	--	250	--	249	200	280	380
Chloride	mg/L	250**	NA	2,440	NA	--	--	73.8	--	76.3	62	80	80.5
Fluoride	ug/L	4,000	NA	1,000	NA	--	--	< 1,000	--	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250**	NA	407	NA	580	370	550	490	518	370	660	1,010
Total Dissolved Solids	mg/L	500**	NA	4,600	NA	--	--	1,400	--	1,360	1,200	1,400	1,710
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 7.3	NA	7.1	7.5	7.3	7.0	7.2	7.3	7.1	7.4
Appendix IV													
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1
Arsenic	ug/L	10	NA	21	**21**	3	2	2	2	< 5.0	1.1	2.8	1
Barium	ug/L	2,000	NA	1,300	2,000	299	365	351	292	239	220	180	163
Beryllium	ug/L	4	NA	1	4	--	--	< 1	--	< 1.0	< 1.0	< 1.0	< 1
Cadmium	ug/L	5	NA	0.2	5	--	--	< 0.2	--	< 0.20	< 0.20	< 0.20	< 0.2
Chromium	ug/L	100	NA	3	100	< 1	< 1	< 1	< 1	< 5.0	< 1.0	1.4	< 1
Cobalt	ug/L	NC	6	15	15	--	--	< 15	--	< 30.0 (1)	< 6.0	< 6.0	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000	--	--	< 1,000	--	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 5.0	< 1.0	< 1.0	< 1
Lithium	ug/L	NC	40	180	180	72	63	74	77	94	69	79	97
Mercury	ug/L	2	NA	0.2	2	--	--	< 0.2	--	< 0.20	< 0.20	< 0.20	< 0.2
Molybdenum	ug/L	NC	100	6	**100**	10	6	6	8	8.0	< 5.0	6.6	8
Radium-226	pCi/L	NC	NA	NA	NA	--	--	--	--	1.40	0.347	0.572	0.512
Radium-228	pCi/L	NC	NA	NA	NA	--	--	--	--	1.88	0.828	1.49	< 0.402
Radium-226/228	pCi/L	5	NA	3.32	5	--	--	--	--	3.28	1.17	2.06	0.814
Selenium	ug/L	50	NA	2	50	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	2
Thallium	ug/L	2	NA	2	2	--	--	< 2	--	< 10.0 (1)	< 2.0	< 2.0	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) Laboratory reporting limit exceeds GWPS due to sample dilutions performed as a result of sample matrix interferences and/or concentrations of other constituents present.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – November 2017 to May 2020
JC Weadock Landfill – RCRA CCR Monitoring Program
Essexville, Michigan

					Sample Location:	MW-51									
					Sample Date:	11/1/2017	3/6/2018	5/16/2018	8/15/2018	11/8/2018	4/9/2019	10/10/2019	10/10/2019	5/19/2020	5/19/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient									
Appendix III													Field Dup		Field Dup
Boron	ug/L	NC	NA	619	NA	1,280	1,040	883	872	851	940	890	900	944	967
Calcium	mg/L	NC	NA	302	NA	--	--	378	--	331	310	340	350	331	322
Chloride	mg/L	250**	NA	2,440	NA	--	--	65	--	55.8	84	88	88	93.8	94.2
Fluoride	ug/L	4,000	NA	1,000	NA	--	--	< 1,000	--	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250**	NA	407	NA	560	430	592	450	505	500	570	580	487	474
Total Dissolved Solids	mg/L	500**	NA	4,600	NA	--	--	1,600	--	1,410	1,500	1,500	1,500	1,970	1,690
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 7.3	NA	6.8	6.8	6.7	6.6	6.6	7.0	6.7	--	7.4	--
Appendix IV															
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Arsenic	ug/L	10	NA	21	**21**	**28**	16	13	19	**21.8**	17	20	19	12	12
Barium	ug/L	2,000	NA	1,300	2,000	291	187	189	178	163	190	180	180	150	153
Beryllium	ug/L	4	NA	1	4	--	--	< 1	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5	--	--	< 0.2	--	< 1.0	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2
Chromium	ug/L	100	NA	3	100	1	< 1	< 1	< 1	< 5.0	1.0	< 1.0	< 1.0	< 1	< 1
Cobalt	ug/L	NC	6	15	15	--	--	< 15	--	< 30.0 (1)	< 6.0	< 6.0	< 6.0	< 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
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 5.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Lithium	ug/L	NC	40	180	180	64	55	62	57	71	59	49	50	55	57
Mercury	ug/L	2	NA	0.2	2	--	--	< 0.2	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	6	**100**	< 5	< 5	< 5	< 5	< 25.0	< 5.0	< 5.0	< 5.0	< 5	< 5
Radium-226	pCi/L	NC	NA	NA	NA	--	--	--	--	< 0.715	0.216	0.316	0.365	0.461	0.299
Radium-228	pCi/L	NC	NA	NA	NA	--	--	--	--	1.12	0.643	1.68	1.26	0.719	0.745
Radium-226/228	pCi/L	5	NA	3.32	5	--	--	--	--	< 1.64	0.859	1.99	1.63	1.18	1.04
Selenium	ug/L	50	NA	2	50	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	1	< 1
Thallium	ug/L	2	NA	2	2	--	--	< 2	--	< 10.0 (1)	< 2.0	< 2.0	< 2.0	< 2	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) Laboratory reporting limit exceeds GWPS due to sample dilutions performed as a result of sample matrix interferences and/or concentrations of other constituents present.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – November 2017 to May 2020
JC Weadock Landfill – RCRA CCR Monitoring Program
Essexville, Michigan

					Sample Location:	MW-52									
					Sample Date:	11/1/2017	3/6/2018	3/6/2018	5/15/2018	8/15/2018	11/8/2018	11/8/2018	4/9/2019	10/10/2019	5/19/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient									
Appendix III							Field Dup				Field Dup				
Boron	ug/L	NC	NA	619	NA	991	795	791	803	904	896	774	1,200	1,200	1,160
Calcium	mg/L	NC	NA	302	NA	--	--	--	241	--	263	256	210	220	226
Chloride	mg/L	250**	NA	2,440	NA	--	--	--	89.5	--	96.6	97.2	95	89	15.1
Fluoride	ug/L	4,000	NA	1,000	NA	--	--	--	< 1,000	--	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250**	NA	407	NA	480	530	510	536	500	512	517	480	520	< 1
Total Dissolved Solids	mg/L	500**	NA	4,600	NA	--	--	--	1,500	--	1,520	1,460	1,400	1,200	1,800
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 7.3	NA	7.0	--	7.0	7.0	6.9	--	6.8	7.1	6.9	7.5
Appendix IV															
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Arsenic	ug/L	10	NA	21	**21**	1	< 1	< 1	< 1	< 1	< 1.0	< 5.0	< 1.0	< 1.0	< 1
Barium	ug/L	2,000	NA	1,300	2,000	144	153	155	148	160	170	146	140	120	144
Beryllium	ug/L	4	NA	1	4	--	--	--	< 1	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Cadmium	ug/L	5	NA	0.2	5	--	--	--	< 0.2	--	< 0.20	< 1.0	< 0.20	< 0.20	< 0.2
Chromium	ug/L	100	NA	3	100	< 1	< 1	< 1	< 1	< 1	< 1.0	< 5.0	< 1.0	< 1.0	< 1
Cobalt	ug/L	NC	6	15	15	--	--	--	< 15	--	< 6.0	< 30.0 (1)	< 6.0	< 6.0	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000	--	--	--	< 1,000	--	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 1	< 1.0	< 5.0	< 1.0	< 1.0	< 1
Lithium	ug/L	NC	40	180	180	53	55	58	55	54	60	63	39	30	32
Mercury	ug/L	2	NA	0.2	2	--	--	--	< 0.2	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2
Molybdenum	ug/L	NC	100	6	**100**	< 5	< 5	< 5	< 5	< 5	< 5.0	< 25.0	< 5.0	< 5.0	< 5
Radium-226	pCi/L	NC	NA	NA	NA	--	--	--	--	--	0.840	< 0.651	0.211	0.252	< 0.241
Radium-228	pCi/L	NC	NA	NA	NA	--	--	--	--	--	0.683	< 0.850	1.14	< 0.772	0.626
Radium-226/228	pCi/L	5	NA	3.32	5	--	--	--	--	--	1.52	< 1.50	1.35	1.01	0.740
Selenium	ug/L	50	NA	2	50	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Thallium	ug/L	2	NA	2	2	--	--	--	< 2	--	< 2.0	< 10.0 (1)	< 2.0	< 2.0	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) Laboratory reporting limit exceeds GWPS due to sample dilutions performed as a result of sample matrix interferences and/or concentrations of other constituents present.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – November 2017 to May 2020
JC Weadock Landfill – RCRA CCR Monitoring Program
Essexville, Michigan

					Sample Location:	MW-53							
					Sample Date:	11/1/2017	3/6/2018	5/15/2018	8/15/2018	11/8/2018	4/10/2019	10/10/2019	5/19/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient							
Appendix III													
Boron	ug/L	NC	NA	619	NA	496	490	1,260	695	519	1,500	900	1,750
Calcium	mg/L	NC	NA	302	NA	--	--	158	--	465	200	420	308
Chloride	mg/L	250**	NA	2,440	NA	--	--	77.5	--	84.5	39	150	118
Fluoride	ug/L	4,000	NA	1,000	NA	--	--	< 1,000	--	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250**	NA	407	NA	830	510	208	570	811	330	960	549
Total Dissolved Solids	mg/L	500**	NA	4,600	NA	--	--	970	--	1,950	1,200	2,100	1,660
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 7.3	NA	6.7	6.8	7.2	6.7	6.6	7.1	6.7	7.3
Appendix IV													
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1
Arsenic	ug/L	10	NA	21	**21**	3	2	2	3	5.1	< 1.0	2.9	2
Barium	ug/L	2,000	NA	1,300	2,000	50	49	78	87	54.4	120	77	144
Beryllium	ug/L	4	NA	1	4	--	--	< 1	--	< 1.0	< 1.0	< 1.0	< 1
Cadmium	ug/L	5	NA	0.2	5	--	--	< 0.2	--	< 1.0	< 0.20	< 0.20	< 0.2
Chromium	ug/L	100	NA	3	100	1	< 1	< 1	< 1	< 5.0	1.6	< 1.0	6
Cobalt	ug/L	NC	6	15	15	--	--	< 15	--	< 30.0 (1)	< 6.0	< 6.0	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000	--	--	< 1,000	--	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 5.0	< 1.0	< 1.0	< 1
Lithium	ug/L	NC	40	180	180	45	35	49	48	59	53	45	58
Mercury	ug/L	2	NA	0.2	2	--	--	< 0.2	--	< 0.20	< 0.20	< 0.20	< 0.2
Molybdenum	ug/L	NC	100	6	**100**	< 5	< 5	< 5	< 5	< 25.0	< 5.0	< 5.0	< 5
Radium-226	pCi/L	NC	NA	NA	NA	--	--	--	--	< 0.664	0.161	0.263	0.386
Radium-228	pCi/L	NC	NA	NA	NA	--	--	--	--	< 0.655	0.500	< 0.750	< 0.385
Radium-226/228	pCi/L	5	NA	3.32	5	--	--	--	--	< 1.32	0.661	0.962	0.725
Selenium	ug/L	50	NA	2	50	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	2
Thallium	ug/L	2	NA	2	2	--	--	< 2	--	< 10.0 (1)	< 2.0	< 2.0	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) Laboratory reporting limit exceeds GWPS due to sample dilutions performed as a result of sample matrix interferences and/or concentrations of other constituents present.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – November 2017 to May 2020
JC Weadock Landfill – RCRA CCR Monitoring Program
Essexville, Michigan

						Sample Location:	MW-54R							
						Sample Date:	11/2/2017	3/6/2018	5/15/2018	8/16/2018	8/16/2018	11/8/2018	4/11/2019	10/10/2019	5/19/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient								
Appendix III											Field Dup				
Boron	ug/L	NC	NA	619	NA		1,280	1,060	1,150	1,340	1,240	1,290	960	1,500	1,730
Calcium	mg/L	NC	NA	302	NA		--	--	179	--	--	173	180	180	181
Chloride	mg/L	250**	NA	2,440	NA		--	--	20	--	--	18.0	16	18	20.4
Fluoride	ug/L	4,000	NA	1,000	NA		--	--	< 1,000	--	--	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250**	NA	407	NA		160	160	208	180	190	152	160	130	95.7
Total Dissolved Solids	mg/L	500**	NA	4,600	NA		--	--	890	--	--	710	770	710	755
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 7.3	NA		6.9	7.1	7.0	6.9	--	7.0	6.9	6.9	7.4
Appendix IV															
Antimony	ug/L	6	NA	1	6		< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1
Arsenic	ug/L	10	NA	21	**21**		< 1	1	< 1	< 1	< 1	< 1.0	1.6	2.3	2
Barium	ug/L	2,000	NA	1,300	2,000		74	70	74	79	80	59.9	74	88	95
Beryllium	ug/L	4	NA	1	4		--	--	< 1	--	--	< 1.0	< 1.0	< 1.0	< 1
Cadmium	ug/L	5	NA	0.2	5		--	--	< 0.2	--	--	< 0.20	< 0.20	< 0.20	< 0.2
Chromium	ug/L	100	NA	3	100		< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1
Cobalt	ug/L	NC	6	15	15		--	--	< 15	--	--	< 6.0	< 6.0	< 6.0	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000		--	--	< 1,000	--	--	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1
Lithium	ug/L	NC	40	180	180		58	52	57	58	56	62	48	53	58
Mercury	ug/L	2	NA	0.2	2		--	--	< 0.2	--	--	< 0.20	< 0.20	< 0.20	< 0.2
Molybdenum	ug/L	NC	100	6	**100**		5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	6.2	< 5
Radium-226	pCi/L	NC	NA	NA	NA		--	--	--	--	--	< 1.09	< 0.332	0.328	< 0.192
Radium-228	pCi/L	NC	NA	NA	NA		--	--	--	--	--	< 0.786	< 0.480	< 0.828	0.499
Radium-226/228	pCi/L	5	NA	3.32	5		--	--	--	--	--	< 1.88	0.568	0.86	0.546
Selenium	ug/L	50	NA	2	50		< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1
Thallium	ug/L	2	NA	2	2		--	--	< 2	--	--	< 2.0	< 2.0	< 2.0	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) Laboratory reporting limit exceeds GWPS due to sample dilutions performed as a result of sample matrix interferences and/or concentrations of other constituents present.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – November 2017 to May 2020
JC Weadock Landfill – RCRA CCR Monitoring Program
Essexville, Michigan

					Sample Location:	MW-55									
					Sample Date:	11/2/2017	3/6/2018	5/15/2018	5/15/2018	8/16/2018	11/8/2018	4/11/2019	10/11/2019	5/19/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient									
Appendix III									Field Dup						
Boron	ug/L	NC	NA	619	NA	619	680	539	533	670	582	800	700	441	
Calcium	mg/L	NC	NA	302	NA	--	--	189	193	--	202	140	190	188	
Chloride	mg/L	250**	NA	2,440	NA	--	--	15.7	16.4	--	15.8	26	19	14.6	
Fluoride	ug/L	4,000	NA	1,000	NA	--	--	< 1,000	< 1,000	--	< 1,000	< 1,000	< 1,000	< 1,000	
Sulfate	mg/L	250**	NA	407	NA	280	100	257	260	250	157	70	190	210	
Total Dissolved Solids	mg/L	500**	NA	4,600	NA	--	--	980	940	--	894	770	950	1,010	
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 7.3	NA	6.8	7.0	7.0	--	6.8	7.0	7.1	6.9	7.56	
Appendix IV															
Antimony	ug/L	6	NA	1	6	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1	
Arsenic	ug/L	10	NA	21	**21**	19	18	17	16	**37**	**35.1**	**34**	**76**	**85**	
Barium	ug/L	2,000	NA	1,300	2,000	86	133	148	148	183	158	200	250	223	
Beryllium	ug/L	4	NA	1	4	--	--	< 1	< 1	--	< 1.0	< 1.0	< 1.0	< 1	
Cadmium	ug/L	5	NA	0.2	5	--	--	0.3	0.3	--	0.32	< 0.20	< 0.20	0.4	
Chromium	ug/L	100	NA	3	100	< 1	< 1	< 1	< 1	< 1	< 5.0	< 1.0	< 1.0	< 1	
Cobalt	ug/L	NC	6	15	15	--	--	< 15	< 15	--	< 30.0 (1)	< 6.0	< 6.0	< 6	
Fluoride	ug/L	4,000	NA	1,000	4,000	--	--	< 1,000	< 1,000	--	< 1,000	< 1,000	< 1,000	< 1,000	
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 1	< 5.0	< 1.0	< 1.0	< 1	
Lithium	ug/L	NC	40	180	180	28	16	20	21	32	40	17	27	27	
Mercury	ug/L	2	NA	0.2	2	--	--	< 0.2	< 0.2	--	< 0.20	< 0.20	< 0.20	< 0.2	
Molybdenum	ug/L	NC	100	6	**100**	**139**	**132**	**119**	**116**	**172**	**171**	93	**190**	**214**	
Radium-226	pCi/L	NC	NA	NA	NA	--	--	--	--	--	< 0.932	0.188	0.409	0.448	
Radium-228	pCi/L	NC	NA	NA	NA	--	--	--	--	--	< 0.679	< 0.660	1.05	< 0.460	
Radium-226/228	pCi/L	5	NA	3.32	5	--	--	--	--	--	< 1.61	< 0.660	1.45	0.858	
Selenium	ug/L	50	NA	2	50	< 1	< 1	1	1	2	< 1.0	< 1.0	< 1.0	< 1	
Thallium	ug/L	2	NA	2	2	--	--	< 2	< 2	--	< 10.0 (1)	< 2.0	< 2.0	< 2	

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) Laboratory reporting limit exceeds GWPS due to sample dilutions performed as a result of sample matrix interferences and/or concentrations of other constituents present.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – November 2017 to May 2020
JC Weadock Landfill – RCRA CCR Monitoring Program
Essexville, Michigan

					Sample Location:	**OW-57ROUT**				**JCW-MW-18001**			
					Sample Date:	11/8/2018	4/12/2019	10/14/2019	5/20/2020	11/7/2018	4/12/2019	10/10/2019	5/18/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient							
Appendix III													
Boron	ug/L	NC	NA	619	NA	1,850	1,700	1,700	1,600	1,330	1,400	1,500	1,360
Calcium	mg/L	NC	NA	302	NA	141	130	130	130	138	140	170	232
Chloride	mg/L	250**	NA	2,440	NA	70.3	68	58	64.9	51.5	67	58	71.5
Fluoride	ug/L	4,000	NA	1,000	NA	1,200	1,200	1,100	< 1,000	< 1,000	< 1,000	< 2,000	< 1,000
Sulfate	mg/L	250**	NA	407	NA	112	110	110	89.4	97.7	210	170	352
Total Dissolved Solids	mg/L	500**	NA	4,600	NA	808	780	750	834	678	860	870	1,330
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 7.3	NA	7.0	7.1	6.8	7.5	7.2	7.2	7.0	7.4
Appendix IV													
Antimony	ug/L	6	NA	1	6	< 1.0	< 1.0	< 1.0	< 1	< 1.0	< 1.0	< 1.0	< 1
Arsenic	ug/L	10	NA	21	**21**	1.4	< 1.0	1.7	< 1	5.8	2.3	2.5	3
Barium	ug/L	2,000	NA	1,300	2,000	73.7	72	73	72	169	200	220	252
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1	< 1.0	< 1.0	< 1.0	< 1
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2
Chromium	ug/L	100	NA	3	100	< 1.0	< 1.0	5.4	2	< 1.0	< 1.0	< 1.0	< 1
Cobalt	ug/L	NC	6	15	15	< 6.0	< 6.0	< 6.0	< 6	< 6.0	< 6.0	< 6.0	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000	1,200	1,200	1,100	< 1,000	< 1,000	< 1,000	< 2,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1.0	< 1.0	< 1.0	< 1	< 1.0	< 1.0	< 1.0	< 1
Lithium	ug/L	NC	40	180	180	35	23	25	24	51	43	53	60
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2
Molybdenum	ug/L	NC	100	6	**100**	8.9	7.9	7.4	7	< 5.0	< 5.0	< 5.0	< 5
Radium-226	pCi/L	NC	NA	NA	NA	< 1.09	0.181	0.195	< 0.305	< 0.542	0.300	0.434	0.372
Radium-228	pCi/L	NC	NA	NA	NA	< 0.718	< 0.501	< 0.373	0.468	< 0.808	< 0.449	< 0.715	0.385
Radium-226/228	pCi/L	5	NA	3.32	5	< 1.81	< 0.501	< 0.373	0.688	< 1.35	0.590	1.07	0.757
Selenium	ug/L	50	NA	2	50	< 1.0	< 1.0	< 1.0	< 1	< 1.0	< 1.0	< 1.0	< 1
Thallium	ug/L	2	NA	2	2	< 2.0	< 2.0	< 2.0	< 2	< 2.0	< 2.0	< 2.0	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) Laboratory reporting limit exceeds GWPS due to sample dilutions performed as a result of sample matrix interferences and/or concentrations of other constituents present.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – November 2017 to May 2020
JC Weadock Landfill – RCRA CCR Monitoring Program
Essexville, Michigan

					Sample Location:	JCW-MW-18004				JCW-MW-18005				JCW-MW-18006				
					Sample Date:	11/8/2018	4/11/2019	10/15/2019	5/19/2020	11/8/2018	4/11/2019	10/11/2019	5/19/2020	11/8/2018	4/11/2019	4/11/2019	10/14/2019	5/20/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient												
Appendix III																Field Dup		
Boron	ug/L	NC	NA	619	NA	366	320	430	265	1,300	1,300	1,700	1,150	2,990	2,900	2,800	2,800	3,030
Calcium	mg/L	NC	NA	302	NA	296	470	270	308	156	340	270	419	188	190	190	170	179
Chloride	mg/L	250**	NA	2,440	NA	17.1	34	39	10.9	81.8	59	82	23.2	96.9	97	98	97	71.2
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	1,100	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250**	NA	407	NA	727	840	930	361	125	680	470	817	75.8	120	120	100	94.5
Total Dissolved Solids	mg/L	500**	NA	4,600	NA	1,560	1,900	1,800	1,720	854	1,700	1,300	1,950	1,040	990	980	910	988
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 7.3	NA	6.8	6.6	6.6	7.3	6.9	6.6	6.7	7.2	6.8	6.9	--	6.8	7.4
Appendix IV																		
Antimony	ug/L	6	NA	1	6	< 1.0	< 1.0	< 1.0	< 1	< 1.0	< 1.0	< 1.0	< 1	< 1.0	< 2.0	< 2.0	< 1.0	< 1
Arsenic	ug/L	10	NA	21	**21**	< 5.0	4.4	< 1.0	< 1	2.2	5.3	11	12	**35.1**	**37**	**38**	**32**	**33**
Barium	ug/L	2,000	NA	1,300	2,000	36.3	80	43	28	103	180	180	141	534	420	450	480	500
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1	< 1.0	< 1.0	< 1.0	< 1	< 1.0	< 2.0	< 2.0	< 1.0	< 1
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.20	< 0.40	< 0.40	< 0.20	< 0.2
Chromium	ug/L	100	NA	3	100	< 5.0	19	< 1.0	< 1	< 1.0	2.0	12	< 1	< 1.0	< 2.0	< 2.0	< 1.0	< 1
Cobalt	ug/L	NC	6	15	15	< 30.0 (1)	< 6.0	< 6.0	< 6	< 6.0	< 6.0	< 6.0	< 6	< 6.0	< 12	<12	< 6.0	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	1,100	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 5.0	5.6	< 1.0	< 1	< 1.0	< 1.0	< 1.0	< 1	< 1.0	< 2.0	< 2.0	< 1.0	< 1
Lithium	ug/L	NC	40	180	180	36	38	37	31	36	49	50	53	88	67	66	72	70
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2
Molybdenum	ug/L	NC	100	6	**100**	< 5.0	< 5.0	< 5.0	< 5	5.8	< 5.0	< 5.0	< 5	< 5.0	< 10	< 10	< 5.0	< 5
Radium-226	pCi/L	NC	NA	NA	NA	< 1.04	< 0.310	< 0.135	< 0.256	0.785	0.369	0.397	0.381	0.646	0.294	0.365	0.454	0.649
Radium-228	pCi/L	NC	NA	NA	NA	< 0.633	< 1.47	< 0.495	< 0.368	1.02	< 0.704	< 0.635	0.457	1.85	< 0.510	0.741	0.500	0.346
Radium-226/228	pCi/L	5	NA	3.32	5	< 1.67	< 1.47	< 0.495	< 0.368	1.81	< 0.704	0.698	0.838	2.50	0.709	1.11	0.954	0.995
Selenium	ug/L	50	NA	2	50	< 1.0	1.5	< 1.0	1	< 1.0	< 1.0	< 1.0	1	< 1.0	< 2.0	< 2.0	< 1.0	< 1
Thallium	ug/L	2	NA	2	2	< 10.0 (1)	< 2.0	< 2.0	< 2	< 2.0	< 2.0	< 2.0	< 2	< 2.0	< 4.0 (1)	< 4.0 (1)	< 2.0	< 2

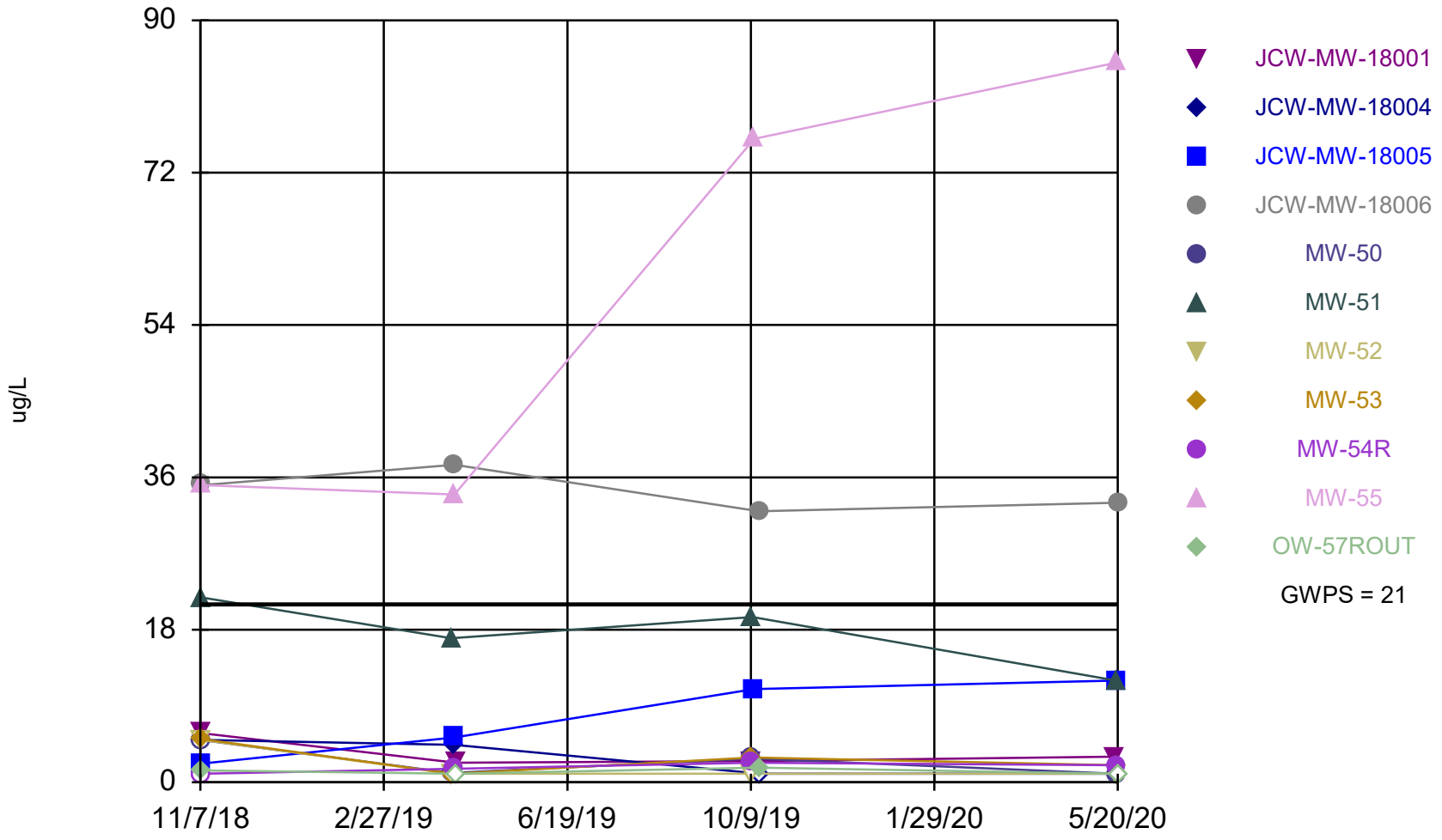
Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) Laboratory reporting limit exceeds GWPS due to sample dilutions performed as a result of sample matrix interferences and/or concentrations of other constituents present.

Attachment 1
Sanitas™ Output Files

Hollow symbols indicate censored values.

Arsenic, Total



Time Series Analysis Run 6/25/2020 3:17 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.06.18

Summary Report

Constituent: Arsenic, Total Analysis Run 6/25/2020 3:20 PM
Client: Consumers Energy Data: JCW_CCR_Sanitas_20.06.18

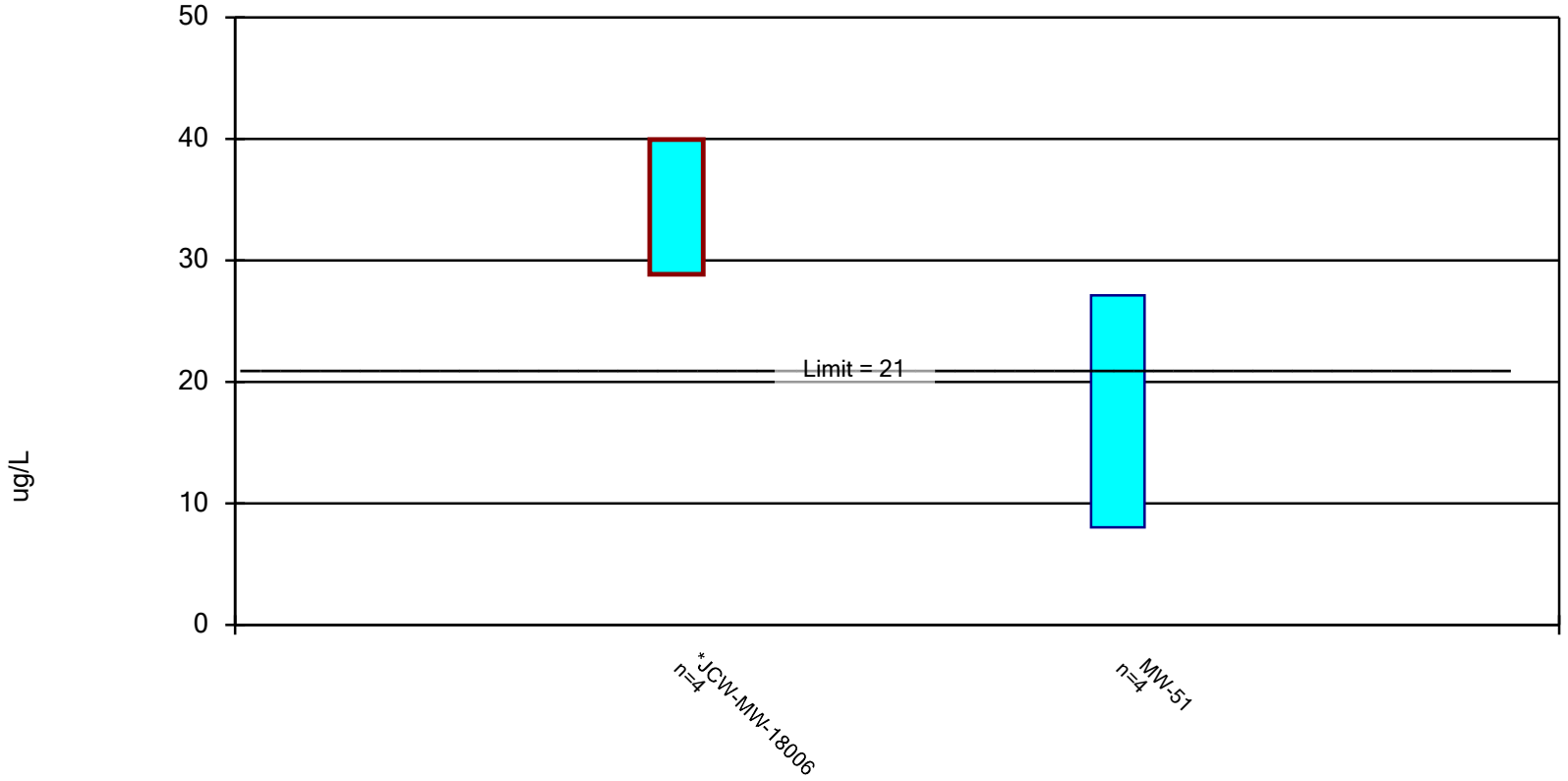
For observations made between 11/7/2018 and 5/20/2020, a summary of the selected data set:

Observations = 44
ND/Trace = 12
Wells = 11
Minimum Value = 1
Maximum Value = 85
Mean Value = 12.15
Median Value = 2.95
Standard Deviation = 18.96
Coefficient of Variation = 1.561
Skewness = 2.37

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JCW-MW-18001	4	0	2.3	5.8	3.4	2.75	1.627	0.4785	1.046
JCW-MW-18004	4	3	1	5	2.85	2.7	2.15	0.7545	0.03868
JCW-MW-18005	4	0	2.2	12	7.625	8.15	4.668	0.6122	-0.1894
JCW-MW-18006	4	0	32	37.5	34.4	34.05	2.437	0.07085	0.3607
MW-50	4	1	1	5	2.475	1.95	1.875	0.7576	0.6028
MW-51	4	0	12	21.8	17.58	18.25	4.202	0.2391	-0.4717
MW-52	4	4	1	5	2	1	2	1	1.155
MW-53	4	1	1	5.1	2.75	2.45	1.748	0.6358	0.5186
MW-54R	4	1	1	2.3	1.725	1.8	0.562	0.3258	-0.3733
MW-55	4	0	34	85	57.53	55.55	26.79	0.4656	0.05507
OW-57ROUT	4	2	1	1.7	1.275	1.2	0.3403	0.2669	0.3625

Parametric Confidence Interval

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



Constituent: Arsenic, Total Analysis Run 6/25/2020 3:32 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.06.18

Confidence Interval

Constituent: Arsenic, Total (ug/L) Analysis Run 6/25/2020 3:33 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.06.18

	JCW-MW-18006	MW-51
11/8/2018	35.1	21.8
4/9/2019		17
4/11/2019	37.5 (D)	
10/10/2019		19.5 (D)
10/14/2019	32	
5/19/2020		12 (D)
5/20/2020	33	
Mean	34.4	17.58
Std. Dev.	2.437	4.202
Upper Lim.	39.93	27.11
Lower Lim.	28.87	8.035