2018 Annual Groundwater Monitoring Report

JH Campbell Power Plant
Dry Ash Landfill
West Olive, Michigan

January 2019

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Prepared For
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Executive Summary

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule), as amended July 30, 2018. The CCR Rule, which became effective on October 19, 2015 (amendment effective August 29, 2018), applies to the Consumers Energy Company (CEC) Dry Ash Landfill (Landfill) at the JH Campbell (JHC) Power Plant Site (the Site) located in West Olive, Michigan. Pursuant to the CCR Rule, no later than January 31, 2018, and annually thereafter, the owner or operator of a CCR unit must prepare an annual groundwater monitoring and corrective action report for the CCR unit documenting the status of groundwater monitoring and corrective action for the preceding year in accordance with §257.90(e). On behalf of CEC, TRC Environmental Corporation (TRC) has prepared this Annual Groundwater Monitoring Report for calendar year 2018 activities at the JHC Landfill CCR unit.

In the January 31, 2018 *Annual Groundwater Monitoring Report for the JH Campbell Power Plant Dry Ash Landfill CCR Unit*, covering calendar year 2017 activities, CEC reported that boron, calcium, chloride, sulfate and total dissolved solids (TDS) were observed during groundwater detection monitoring at one or more downgradient monitoring well(s) with potential statistically significant increases (SSIs) above background concentration levels. TRC performed an Alternate Source Demonstration (ASD) for the aforementioned constituents and did not find strong enough evidence within 90 days to determine the observation of constituents above background was attributable to a source other than the CCR unit. Therefore, CEC initiated an Assessment Monitoring Program for the Dry Ash Landfill CCR Unit pursuant to §257.95 of the CCR Rule that included sampling and analyzing groundwater within the groundwater monitoring system for all constituents listed in Appendix IV. The monitoring system was subsequently sampled for the Appendix III and Appendix IV constituents in June 2018, within 90 days from the initial assessment monitoring (Appendix IV only) sampling event. The results from the initial assessment monitoring sampling event were used to establish groundwater protection standards (GWPSs) for the Appendix IV constituents in accordance with §257.95(h), as presented in the *Groundwater Protection Standards* technical memorandum dated October 15, 2018. Assessment monitoring data that has been collected and evaluated in 2018, including the establishment of the GWPSs, are presented in this report.

In 2019, CEC compared the assessment monitoring data to the GWPSs to determine whether or not Appendix IV constituents are detected at statistically significant levels above the GWPSs in accordance with §257.95. The statistical comparison of the June 2018 data to the GWPSs was

completed on January 14, 2019, in accordance with §257.93(h)(2) and within the compliance schedule clarified by USEPA in April 2018.

According to §257.95(g)(3), if the facility determines pursuant to §257.93(h), that any Appendix IV constituents were detected at a statistically significant level exceeding the GWPSs, the facility will either conduct an alternate source demonstration or initiate an assessment of corrective measures according to §257.96 within 90 days. Based on the results of the statistical evaluation CEC will not be seeking to initiate an assessment of corrective measures within 90 days of the completion of the statistical analysis. CEC will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Section 1
Introduction

1.1 Program Summary

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule) (USEPA, April 2015), as amended (USEPA, July 2018). The CCR Rule, which became effective on October 19, 2015 (amendment effective August 29, 2018), applies to the Consumers Energy Company (CEC) Dry Ash Landfill (Landfill) at the JH Campbell (JHC) Power Plant Site (the Site). Pursuant to the CCR Rule, no later than January 31, 2018, and annually thereafter, the owner or operator of a CCR unit must prepare an annual groundwater monitoring and corrective action report for the CCR unit documenting the status of groundwater monitoring and corrective action for the preceding year in accordance with §257.90(e). On behalf of CEC, TRC Environmental Corporation (TRC) has prepared this Annual Groundwater Monitoring Report for calendar year 2018 activities at the JHC Landfill CCR unit.

In the January 31, 2018 *Annual Groundwater Monitoring Report for the JH Campbell Power Plant Dry Ash Landfill CCR Unit* (2017 Annual Report), covering calendar year 2017 activities, CEC reported that boron, calcium, chloride, sulfate and total dissolved solids (TDS) were observed during groundwater detection monitoring at one or more downgradient monitoring well(s) with potential statistically significant increases (SSIs) above background concentration levels. TRC performed an Alternate Source Demonstration (ASD) for the aforementioned constituents and did not find strong enough evidence within 90 days to determine the observation of constituents above background was attributable to a source other than the CCR unit. Therefore, CEC initiated an Assessment Monitoring Program for the Dry Ash Landfill CCR Unit pursuant to §257.95 of the CCR Rule that included sampling and analyzing groundwater within the groundwater monitoring system for all constituents listed in Appendix IV.

The results from the initial assessment monitoring sampling event were used to establish groundwater protection standards (GWPSs) for the Appendix IV constituents in accordance with §257.95(h), as presented in the *Groundwater Protection Standards* technical memorandum dated October 15, 2018 (Appendix C) (TRC, October 2018). The monitoring system was subsequently sampled for the Appendix III and Appendix IV constituents within 90 days from the initial Appendix IV sampling event. Assessment monitoring data that has been collected and evaluated in 2018 are presented in this report.

1.2 Site Overview

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

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

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

The surface impoundments in the wet ash pond areas were decommissioned starting in 2017 and replaced with concrete bottom ash treatment tanks. In June 2017, decommissioning of Unit 3 North began with recovery of CCR from the pond for beneficial reuse prior to backfilling with clean fill. The above-grade concrete treatment tanks were constructed within the footprint of the Unit 3 North pond area to manage bottom ash and became operational in July 2018. In addition, hydraulic loading was ceased at Unit 1-2 and Pond A in June 2018 and the southern portion of Unit 3 in July 2018 (when the concrete tanks were in service).

The wet ash pond area also had one lined and one unlined chemical treatment lagoon (not CCR units), collectively referred to as the Chemical Treatment Ponds, which were decommissioned in Spring 2018 during decommissioning of Unit 1-2. Removal of ash from Unit 1-2 for beneficial reuse began in June 2018 and continued through September 2018. CCR removal at Unit 3 South began in September 2018 and continued through October 2018. In addition, Pond A dewatering occurred throughout July 2018 and is in the process of being decommissioned in place. Bottom

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

The purpose of the dry ash disposal facility is to contain dry bottom and fly ash produced as a result of burning coal for power production. The facility consists of the existing CCR landfill Cells 1 through 4. The state permit also identifies Cells 5 through 9 for future construction and operation. Dry ash from all of the generating units is stored in silos until it is placed into the facility or is sold and shipped off site. At this time, the north faces of Cells 1 and 2 and the eastern face of Cell 2 have been closed along with Cell 3. Cell 4 is currently being filled with ash. Cell 5 construction began July 2018. Cells 6 through 9 have not yet been constructed.

This report focuses on the JHC Landfill dry ash disposal CCR unit.

1.3 Geology/Hydrogeology

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

Section 2
Groundwater Monitoring

2.1 Monitoring Well Network

In accordance with 40 CFR 257.91, CEC established a groundwater monitoring system for the JHC Dry Ash Landfill unit, which consists of 19 monitoring wells (6 background monitoring wells and 13 downgradient monitoring wells) that are screened in the uppermost aquifer. Two of the downgradient monitoring wells, JHC-MW-15020 and JHC-MW-15021, located downgradient from the Dry Ash Landfill Cell 1, were decommissioned to accommodate Cell 5 construction. Since these wells are in the footprint of Cell 5, they are unable to be replaced. The remaining downgradient monitoring wells will continue to be used for monitoring groundwater quality downgradient from the Dry Ash Landfill. The monitoring well locations are shown on Figure 2. Six monitoring wells located north-northwest of the JHC Landfill provide data on background groundwater quality that has not been affected by the CCR unit (JHC-MW-15023 through JHC-MW-15028). Background groundwater quality data from these six background wells are additionally used for the CCR groundwater monitoring program at three other CCR units on the JHC site.

As shown on Figure 2, monitoring wells JHC-MW-15029 and JHC-MW-15030 are used for water level measurements only. Static water level data are collected at additional wells throughout the JHC site at other CCR units and used to construct a site-wide groundwater contour map; therefore, the following discussion includes a comprehensive summary of wells removed and added within the preceding year.

2.1.1 Monitoring Wells Removed

Monitoring wells JHC-MW-15004, JHC-MW-15020, and JHC-MW-15021 were decommissioned on June 14, 2018 (subsequent to the completion of the April and June 2018 assessment monitoring events). Monitoring wells JHC-MW-15020 and JHC-MW-15021 were located downgradient from the Dry Ash Landfill Cell 1, within the unconstructed Cell 5 footprint. These two wells were decommissioned to accommodate Cell 5 construction and, due to their location within the Cell 5 footprint, are unable to be replaced. Monitoring well JHC-MW-15004 was located downgradient from Bottom Ash Pond Units 1-2 North and 1-2 South (Unit 1-2) and was decommissioned prior to CCR removal activities and deconstruction of Unit 1-2. In addition, monitoring well JHC-MW-15012 was decommissioned on October 10, 2018, during the deconstruction of Bottom Ash Pond Unit 3 South. Details of the well decommissioning procedures are documented in Appendix A.

2.1.2 Monitoring Wells Installed

Five new monitoring wells were installed downgradient of Unit 1-2 (JHC-MW-18004 and JHC-MW-18005) and Unit 3 (JHC-MW-18001 through JHC-MW-18003) in order to evaluate post-deconstruction groundwater conditions. The Unit 1-2 and Unit 3 monitoring system will be re-evaluated subsequent to the completion of the CCR removal activities, after groundwater flow patterns in the immediate vicinity of the CCR unit have equilibrated post-deconstruction, and will be used to collect additional static water level data to determine whether the monitoring wells are appropriately positioned to assess groundwater quality downgradient from the Unit 1-2 and Unit 3 CCR units. Well installation and construction details are documented in Appendix A.

2.2 Preliminary Assessment Monitoring

CEC reported in the 2017 Annual Report that Appendix III constituents boron, calcium, chloride, sulfate and TDS were observed within groundwater at one or more downgradient monitoring well(s) with potential SSIs above background concentration levels. TRC performed an ASD for the constituents and did not find strong enough evidence within 90 days to determine the observation of constituents above background was attributable to a source other than the CCR unit. Therefore, CEC initiated an Assessment Monitoring Program for the Dry Ash Landfill CCR Unit pursuant to §257.95 of the CCR Rule that included sampling and analyzing groundwater within the groundwater monitoring system for all constituents listed in Appendix IV. The monitoring was performed in accordance with the *JH Campbell Monitoring Program Sample and Analysis Plan* (SAP) (ARCADIS, 2016).

2.2.1 Data Summary

The preliminary Appendix IV only assessment monitoring event (per §257.95(b)) was performed on April 24 through April 30, 2018. Downgradient monitoring wells JHC-MW-15017 through JHC-MW-15022, JHC-MW-15031 through JHC-MW-15037 and background monitoring wells JHC-MW-15023 through JHC-MW-15028 were sampled during this event.

Static water elevation measurements were collected from all monitoring well locations. 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 or submersible pumps utilizing low-flow sampling methodology. Field parameters were stabilized at each monitoring well prior to collecting groundwater samples. Field parameters for each monitoring well are summarized in Table 2.

The groundwater samples were analyzed by Pace Analytical Services, LLC (Pace) for Appendix IV constituents during the preliminary assessment monitoring event in

accordance with the SAP. The analytical results from each event are summarized in Table 3.

It should be noted that pH measurements recorded at a number of wells were inconsistent with historical data during the preliminary event; this is likely attributed to a malfunctioning pH probe on one of the water quality meters used during that event. Therefore, pH data collected with the suspected malfunctioning meter during that event are considered not representative of groundwater conditions and have been qualified as such.

2.2.2 Data Quality Review

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

2.2.3 Groundwater Flow Rate and Direction

Groundwater elevation data collected during the preliminary (April 2018) event were generally similar to data collected previously in the background and detection monitoring events. The data showed that groundwater within the uppermost aquifer generally flows to the south-southeast across the Site, with a southwesterly groundwater flow component on the western edge of the Site. As expected, the groundwater mounding previously observed in the immediate vicinity of Unit 1-2 and Bottom Ash Ponds 3 North and 3 South (Unit 3) was significantly less prominent compared to prior sampling events. This is likely due to permanent cessation of ash sluicing and subsequent reduction of hydraulic loading into Unit 1-2, and the temporary cessation of hydraulic loading into Unit 3 South between March 14 and April 26, 2018. Groundwater elevations measured across the Site during the April 2018 sampling event are provided on Table 1 and were used to construct the groundwater contour map provided on Figure 3.

The figure shows that current groundwater flow is generally consistent with previous monitoring events since the background sampling events commenced in December 2015. The average hydraulic gradient throughout the Site during the April 2018 event is estimated at 0.0044 ft/ft. The gradient was calculated using the following well pairs: JHC-MW-15029/JHC-MW-15030, JHC-MW-15029/JHC-MW-15005, JHC-MW-15021/JHC-MW-15031 and JHC-MW-15023/JHC-MW-15037 (Figure 3). Using the mean hydraulic conductivity of 62 ft/day (ARCADIS, 2016) and an assumed effective porosity of 0.4, the

estimated average seepage velocity is approximately 0.69 ft/day or 250 ft/year for the April 2018 event.

2.3 Semiannual Groundwater Monitoring

Per §257.95(d), within 90 days of the preliminary assessment monitoring event and semiannually thereafter, all wells must be resampled and analyzed for all constituents from Appendix III and for those constituents in Appendix IV of the CCR Rule that were detected during prior sampling. In addition to the Appendix III and IV constituent, field parameters including dissolved oxygen, oxidation reduction potential, specific conductivity, temperature, and turbidity were collected at each well. Samples were collected and analyzed in accordance with the SAP.

2.3.1 Data Summary

The first semiannual groundwater assessment monitoring event for 2018 was performed over the course of three site visits on June 11, June 18 through June 20, and July 18, 2018 by TRC personnel, and samples were analyzed by Pace in accordance with the SAP. Static water elevation data were collected at all monitoring well locations. Groundwater samples were collected from the 6 background monitoring wells and 13 downgradient monitoring wells for the Appendix III and Appendix IV constituents and field parameters. A summary of the groundwater data collected during the June 2018 event is provided on Table 1 (static groundwater elevation data), Table 2 (field data), and Table 3 (analytical results).

The first semiannual event was performed over the course of three site visits due to construction activities at the site. Static water level measurements and samples were collected from monitoring wells JHC-MW-15020 and JHC-MW-15021 on June 11, 2018, prior to planned decommissioning to accommodate Dry Ash Landfill Cell 5 construction, ahead of the main sampling event performed on June 18 through June 20, 2018. Monitoring well JHC-MW-15016 was also in an area of active construction which resulted in the stick-up well being converted to a flush-mounted well, with water level measurements and sampling being conducted on July 18, 2018.

The second semiannual groundwater assessment monitoring event for 2018 was performed on November 12 through November 16, 2018. Static water elevation data were collected at all monitoring well locations. Groundwater samples were collected from the 6 background monitoring wells and 11 downgradient monitoring wells (less the two decommissioned monitoring wells) for the Appendix III and Appendix IV constituents and field parameters. As of the writing of this report, lab analysis and data quality review are ongoing. Therefore, a summary of groundwater data will be provided after final

laboratory analysis is complete for all Appendix III and IV constituents and results have been reviewed for usability. Consumers Energy will enter this information into the operating record as soon as it is available and report it in the 2019 Annual Groundwater Monitoring and Corrective Action Report

2.3.2 Data Quality Review

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

2.3.3 Groundwater Flow Rate and Direction

Groundwater elevations measured across the Site during the June 2018 event are provided on Table 1 and were used to construct the groundwater contour map provided on Figure 4. The results are similar to historical, and similar to the April 2018 event, with the exception of the reoccurrence of mounding in the area of Unit 3 as a result of resumed hydraulic loading. Groundwater in the vicinity of Unit 1-2 continues to equilibrate in response to discontinued hydraulic loading. The average hydraulic gradient throughout the Site during the June 2018 event is estimated at 0.0043 ft/ft. The gradient was calculated using the same well pairs, hydraulic conductivity and effective porosity as the aforementioned April 2018 event, and resulted in an estimated average seepage velocity of approximately 0.67 ft/day or 240 ft/year for the June 2018 event.

The general groundwater flow direction is similar to that identified in previous monitoring rounds and continues to demonstrate that the downgradient wells are appropriately positioned to detect the presence of Appendix IV constituents that could potentially migrate from the Dry Ash Landfill CCR Unit.

Section 3
Statistical Evaluation

3.1 Establishing Groundwater Protection Standards

In accordance with §257.95(h) and the *Groundwater Statistical Evaluation Plan* (Stats Plan) (TRC, October 2017), 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 JHC-MW-15023 through JHC-MW-15028 (December 2015 through April 2018). The calculation of the GWPSs is documented in the *Groundwater Protection Standards* technical memorandum included in Appendix C of this annual report (TRC, October 2018). The GWPS is established as the higher of the USEPA Maximum Contaminant Level (MCL) or statistically derived background level for constituents with MCLs and the higher of the USEPA Regional Screening Levels (RSLs) or background level for constituents with RSLs. The Appendix IV GWPSs will be used to assess whether groundwater has been impacted from the JHC Landfill CCR unit by statistically comparing concentrations in the downgradient wells to the GWPSs for each Appendix IV constituent.

3.2 Data Comparison to Groundwater Protection Standards

Consistent with the *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (Unified Guidance) (USEPA, 2009), the preferred method for comparisons to a fixed standard are confidence limits. An exceedance of the standard occurs when the 99 percent lower confidence level of the downgradient data exceeds the GWPS. The statistical data comparison was reported on January 14, 2019, within 90 days of establishing the GWPSs in accordance with §257.93(h)(2) and within the compliance schedule clarified by the USEPA in a letter dated April 30, 2018 (USEPA, April 2018).

The statistical evaluation report has been entered into the operating record by CEC on January 14, 2019 in accordance with §257.105(h)(8). Notification of the statistical analysis of the assessment monitoring data compared to the GWPS, if necessary, will be made in accordance with §257.106(h) and posting such notifications to the publicly accessible compliance website in accordance with §257.107(h) will be completed within 30 days of the completion of the statistical analysis. This evaluation will be included in the forthcoming 2019 Annual Groundwater Monitoring and Corrective Action Report since it was completed in calendar year 2019. Subsequently, following receipt of final laboratory reports for all Appendix IV constituents and completion of data quality review, the results from the November 2018 semiannual sampling event will also be statistically compared to the GWPSs using the same approach as the initial

event. It is anticipated that the statistical comparison of the second semiannual 2018 event will be completed in March/April 2019. Consumers Energy will enter this information into the operating record as soon as it is available and will include it in the forthcoming 2019 Annual Groundwater Monitoring and Corrective Action Report.

Section 4
Conclusions and Recommendations

Semiannually after triggering assessment monitoring, groundwater samples will be collected from the groundwater monitoring system wells and analyzed for Appendix III and Appendix IV constituents pursuant to §257.95(d). In accordance with §257.93(h)(2) and within the compliance schedule clarified by the USEPA in April 2018, the first round of semiannual assessment monitoring data were statistically evaluated against the GWPSs as reported on January 14, 2019. CEC has placed this analysis in the operating record in accordance with §257.105(h)(8) on January 14, 2019. Notification that one or more Appendix IV constituents have been detected at statistically significant levels above the GWPS will be submitted, if necessary, in accordance with §257.106(h) and CEC will post such notifications to the publicly accessible compliance website in accordance with §257.107(h) within 30 days of the completion of the statistical analysis. This evaluation will be included in the forthcoming 2019 Annual Groundwater Monitoring and Corrective Action Report since it was completed in calendar year 2019.

According to §257.95(g)(3), if the facility determines pursuant to §257.93(h), that any Appendix IV constituents were detected at a statistically significant level exceeding the GWPSs, the facility will either conduct an alternate source demonstration or initiate an assessment of corrective measures according to §257.96 within 90 days. Based on the results of the statistical evaluation, CEC will not be seeking to initiate an assessment of corrective measures within 90 days of the completion of the statistical analysis. CEC will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

In addition, the statistical evaluation of the second semiannual 2018 monitoring event is anticipated to be completed in March/April 2019 and will be posted to the public website within 30 days of being finalized. Consumers Energy will enter this information into the operating record as soon as it is available and will include it in the forthcoming 2019 Annual Groundwater Monitoring and Corrective Action Report.

The next semiannual monitoring event is tentatively scheduled for the second calendar quarter of 2019.

Section 5
References

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USEPA. July 2018. 40 CFR Part 257. Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals From Electric Utilities; Amendments to the National Minimum Criteria (Phase One, Part One); Final Rule. 83 Federal Register 146 (July 30, 2018), pp. 36435-36456 (83 FR 36435).

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

Tables

Table 1
Summary of Groundwater Elevation Data – April & June 2018
JH Campbell – RCRA CCR Monitoring Program
West Olive, Michigan

Well Location	Ground Surface Elevation (ft)	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Depth (ft BGS)			Screen Interval Elevation (ft)			Borehole Terminus Depth (ft BGS)	Borehole Terminus Elevation (ft)	April 24, 2018		June 18, 2018	
												Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Background															
JHC-MW-15023	617.01	619.98	Sand	14.0	to	24.0	603.0	to	593.0	25.0	592.01	15.68	604.30	16.02	603.96
JHC-MW-15024	613.79	616.62	Sand	7.0	to	17.0	606.8	to	596.8	20.0	593.79	11.00	605.62	11.12	605.50
JHC-MW-15025	614.14	617.17	Sand	7.0	to	17.0	607.1	to	597.1	20.0	594.14	10.29	606.88	10.38	606.79
JHC-MW-15026	615.09	618.04	Sand	8.0	to	18.0	607.1	to	597.1	20.0	595.09	12.28	605.76	12.02	606.02
JHC-MW-15027	614.77	617.30	Sand	10.0	to	20.0	604.8	to	594.8	20.0	594.77	12.64	604.66	12.30	605.00
JHC-MW-15028	611.02	613.80	Sand	8.0	to	18.0	603.0	to	593.0	20.0	591.02	11.48	602.32	16.80	597.00
JHC-MW-15029	608.08	610.95	Sand	8.0	to	18.0	600.1	to	590.1	20.0	588.08	9.19	601.76	8.83	602.12
JHC-MW-15030	604.05	607.17	Sand	4.0	to	14.0	600.1	to	590.1	20.0	584.05	7.70	599.47	7.00	600.17
Unit 1N, 1S, 2N, 2S															
JHC-MW-15001	607.02	609.53	Sand	3.5	to	8.5	603.5	to	598.5	15.0	592.02	10.05	599.48	9.38	600.15
JHC-MW-15002	625.97	628.87	Sand	28.0	to	38.0	598.0	to	588.0	38.0	587.97	28.54	600.33	28.40	600.47
JHC-MW-15003	628.31	630.63	Sand	28.0	to	38.0	600.3	to	590.3	38.0	590.31	33.33	597.30	33.33	597.30
JHC-MW-15004(1)	624.92	628.44	Sand	24.0	to	34.0	600.9	to	590.9	40.0	584.92	33.10	595.34	NM	NM
JHC-MW-15005	624.37	627.30	Sand	27.0	to	37.0	597.4	to	587.4	40.0	584.37	34.40	592.90	34.21	593.09
Unit 3N, 3S															
JHC-MW-15012	632.59	635.66	Sand	28.0	to	38.0	604.6	to	594.6	38.0	594.59	34.24	601.42	23.15	612.51
JHC-MW-15013	632.40	635.25	Sand	28.0	to	38.0	604.4	to	594.4	38.0	594.40	33.05	602.20	22.05	613.20
JHC-MW-15015	632.46	635.20	Sand	28.0	to	38.0	604.5	to	594.5	40.0	592.46	32.55	602.65	24.85	610.35
JHC-MW-15016	631.81	632.52(2)	Sand	28.0	to	38.0	603.8	to	593.8	40.0	591.81	32.24	602.40	29.23	603.29(3)
Landfill															
JHC-MW-15017	613.69	616.61	Sand	10.0	to	20.0	603.7	to	593.7	20.0	593.69	13.35	603.26	13.30	603.31
JHC-MW-15018	614.26	617.02	Sand	10.0	to	20.0	604.3	to	594.3	20.0	594.26	14.15	602.87	14.05	602.97
JHC-MW-15019	609.81	612.86	Sand	6.0	to	16.0	603.8	to	593.8	16.0	593.81	10.55	602.31	10.41	602.45
JHC-MW-15020(1)	609.04	611.90	Sand	6.0	to	16.0	603.0	to	593.0	16.0	593.04	10.03	601.87	9.87	602.03
JHC-MW-15021(1)	610.70	613.65	Sand	6.0	to	16.0	604.7	to	594.7	16.0	594.70	12.18	601.47	12.00	601.65
JHC-MW-15022	620.92	623.79	Sand	23.0	to	33.0	597.9	to	587.9	33.0	587.92	27.61	596.18	28.60	595.19
JHC-MW-15031	632.94	635.87	Sand	33.0	to	43.0	599.9	to	589.9	45.0	587.94	41.90	593.97	41.71	594.16
JHC-MW-15032	611.32	614.29	Sand	13.0	to	23.0	598.3	to	588.3	25.0	586.32	15.72	598.57	15.85	598.44
JHC-MW-15033	618.08	620.99	Sand	16.0	to	26.0	602.1	to	592.1	30.0	588.08	20.34	600.65	20.57	600.42
JHC-MW-15034	612.90	615.97	Sand	11.0	to	21.0	601.9	to	591.9	25.0	587.90	14.05	601.92	14.33	601.64
JHC-MW-15035	632.53	634.28	Sand	33.0	to	43.0	599.5	to	589.5	43.5	589.03	39.02	595.26	38.92	595.36
JHC-MW-15036	617.94	618.34	Sand	20.0	to	30.0	597.9	to	587.9	30.5	587.44	25.63	592.71	25.50	592.84
JHC-MW-15037	614.28	616.06	Sand	23.0	to	28.0	591.3	to	586.3	28.5	585.78	24.23	591.83	24.10	591.96
Pond A															
JHC-MW-15006	624.74	627.58	Sand	25.0	to	35.0	599.7	to	589.7	40.0	584.74	29.40	598.18	28.23	599.35
JHC-MW-15007	624.82	627.70	Sand	22.0	to	32.0	602.8	to	592.8	40.0	584.82	29.39	598..31	28.20	599.50
JHC-MW-15008	632.43	635.30	Sand	28.0	to	38.0	604.4	to	594.4	38.0	594.43	38.04	597.26	37.19	598.11
JHC-MW-15009	632.33	635.32	Sand	30.0	to	40.0	602.3	to	592.3	40.0	592.33	37.00	598.32	35.43	599.89
JHC-MW-15010	632.55	635.57	Sand	30.0	to	40.0	602.6	to	592.6	40.0	592.55	36.45	599.12	34.89	600.68
JHC-MW-15011	627.71	630.83	Sand	27.0	to	37.0	600.7	to	590.7	40.0	587.71	35.04	595.79	34.20	596.63

Notes:
Survey conducted by Nederveld, November 2015 and October 2018.
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.
ft BGS: Feet below ground surface.
NM = Not measured
NR = Not recorded
(1) - Monitoring well decommissioned on June 14, 2018.
(2) - TOC resurveyed October 2018 due to conversion to flushmounted pro-cover between the April and June sampling events. Previous TOC was 634.64 feet.
(3) - Depth to water was measured on July 18, 2018.

Table 2
Summary of Field Parameter Results – April & June 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Background							
JHC-MW-15023	4/25/2018	5.80	249.5	6.1(1)	103	9.5	4.5
	6/19/2018	3.43	72.1	6.0	94	12.2	1.6
JHC-MW-15024	4/25/2018	3.80	201.0	9.0(1)	480	8.1	5.5
	6/19/2018	0.51	69.1	7.4	377	11.5	5.4
JHC-MW-15025	4/25/2018	6.80	170.0	8.4(1)	245	7.8	11.5
	6/19/2018	6.08	69.1	7.0	167	11.4	2.2
JHC-MW-15026	4/25/2018	6.90	199.0	6.8(1)	78	8.5	5.0
	6/18/2018	4.45	63.9	6.9	94	11.7	1.5
JHC-MW-15027	4/25/2018	8.85	165.0	6.6(1)	70	8.0	12.0
	6/18/2018	4.92	67.5	6.8	101	11.0	2.5
JHC-MW-15028	4/25/2018	9.58	39.0	8.5(1)	67	8.7	3.5
	6/18/2018	5.95	56.6	8.1	72	15.2	3.1
Landfill							
JHC-MW-15017	4/26/2018	6.60	313.0	6.0(1)	621	8.5	2.4
	6/20/2018	3.17	82.6	6.0	584	12.6	1.5
JHC-MW-15018	4/26/2018	4.85	299.5	6.2(1)	420	9.4	4.8
	6/20/2018	2.44	67.2	6.1	398	12.8	1.5
JHC-MW-15019	4/26/2018	7.40	329.5	6.7(1)	375	8.7	1.8
	6/20/2018	2.86	67.7	6.6	488	13.6	<1.0
JHC-MW-15020(2)	4/26/2018	5.80	331.0	6.4(1)	354	8.5	11.5
	6/11/2018	4.11	162.5	6.3	331	12.6	2.9

Notes:

mg/L - Milligrams per Liter.

mV - Millivolts.

SU - Standard units.

umhos/cm - Micromhos per centimeter.

NTU - Nephelometric Turbidity Unit.

(1) - pH value potentially biased high due to groundwater quality meter malfunction.

(2) - JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14, 2018.

Table 2
Summary of Field Parameter Results – April & June 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Landfill							
JHC-MW-15021[2]	4/26/2018	6.80	331.5	6.3[1]	305	9.5	1.9
	6/11/2018	5.85	232.5	6.0	223	16.9	3.5
JHC-MW-15022	4/27/2018	6.65	223.0	7.6[1]	695	9.8	1.4
	6/20/2018	5.91	75.6	6.9	656	10.5	1.4
JHC-MW-15031	4/27/2018	2.30	251.0	7.6[1]	577	12.9	2.8
	6/20/2018	2.40	71.5	6.8	570	13.9	1.1
JHC-MW-15032	4/26/2018	6.60	228.0	5.9[1]	73	6.5	1.6
	6/19/2018	2.98	60.2	6.3	77	11.6	3.2
JHC-MW-15033	4/26/2018	5.40	152.0	6.8[1]	101	7.5	1.5
	6/19/2018	3.70	64.6	6.7	81	12.4	<1.0
JHC-MW-15034	4/25/2018	7.70	260.0	6.0[1]	67	8.3	2.5
	6/19/2018	5.79	70.2	6.0	57	11.8	1.2
JHC-MW-15035	4/27/2018	1.25	147.8	8.0[1]	674	14.6	4.0
	6/20/2018	0.80	72.7	7.0	644	15.8	1.9
JHC-MW-15036	4/27/2018	3.90	279.5	8.1[1]	450	10.3	4.3
	6/20/2018	2.69	73.3	7.1	519	13.5	1.0
JHC-MW-15037	4/27/2018	4.70	252.0	7.9[1]	609	9.1	4.2
	6/20/2018	2.76	83.1	7.1	514	11.9	1.3

Notes:

mg/L - Milligrams per Liter.

mV - Millivolts.

SU - Standard units.

umhos/cm - Micromhos per centimeter.

NTU - Nephelometric Turbidity Unit.

(1) - pH value potentially biased high due to groundwater quality meter malfunction.

(2) - JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14, 2018.

Table 3
Summary of Groundwater Sampling Results (Analytical) – April & June 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15017		JHC-MW-15018		JHC-MW-15019		JHC-MW-15020(2)		JHC-MW-15021(2)		JHC-MW-15022		JHC-MW-15031	
					Sample Date:	4/26/18	6/20/18	4/26/18	6/20/18	4/26/18	6/20/18	4/26/18	6/11/18	4/26/18	6/11/18	4/27/18	6/20/18	4/27/18	6/20/18
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient													
Appendix III																			
Boron	ug/L	NC	500	500	7,200	--	245	--	117	--	195	--	129	--	214	--	315	--	108
Calcium	mg/L	NC	NC	NC	500	--	44.0	--	44.8	--	64.1	--	39.2	--	26.6	--	109	--	66.9
Chloride	mg/L	250**	250	250	500	--	97.0	--	31.9	--	26.2	--	35.5	--	21.3	--	3.5	--	38.9
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	**6.0**(1)	**6.0**	**6.2**(1)	**6.1**	6.7(1)	6.6	**6.4**(1)	**6.3**	**6.3**(1)	**6.0**	7.6(1)	6.9	7.6(1)	6.8
Sulfate	mg/L	250**	250	250	500	--	60.6	--	62.3	--	40.8	--	24.3	--	22.1	--	26.0	--	40.0
Total Dissolved Solids	mg/L	500**	500	500	500	--	348	--	194	--	286	--	222	--	174	--	414	--	352
Appendix IV																			
Antimony	ug/L	6	6	6	130	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	10	10	10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	2,000	2,000	820	79.7	80.0	89.0	76.5	63.6	44.6	31.6	39.2	64.2	57.6	20.3	21.2	15.4	18.9
Beryllium	ug/L	4	4	4	11	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5	5	3.5	0.47	0.54	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	100	100	11	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.3	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	40	100	100	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4	4	33	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	2	2	0.20#	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	73	210	3,200	8.3	6.2	17.2	19.7	11.2	7.7	< 5.0	< 5.0	< 5.0	< 5.0	5.2	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NC	NC	NC	1.17	< 0.785	< 0.656	< 0.692	0.402	< 0.717	< 0.704	< 0.588	< 0.562	< 0.466	< 0.431	< 0.673	< 0.479	< 0.638
Radium-226/228	pCi/L	5	NC	NC	NC	1.94	3.02	< 1.23	< 1.83	0.911	< 1.67	< 1.83	1.92	< 1.45	< 1.28	< 1.01	< 1.37	< 1.19	< 1.66
Radium-228	pCi/L	NC	NC	NC	NC	0.773	2.74	< 0.572	< 1.14	< 0.638	< 0.951	< 1.13	1.48	< 0.888	< 0.818	< 0.583	< 0.697	< 0.708	< 1.02
Selenium	ug/L	50	50	50	**5**	**18.2**	**18.5**	**12.7**	**9.9**	**22.2**	**18.4**	2.9	4.0	2.7	3.0	4.1	2.8	4.0	3.0
Thallium	ug/L	2	2	2	3.7	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 180 mg CaCO3/L as measured at surface water sample SW-01 collected on April 9, 2018 from the Pigeon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

- If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ 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) - pH value potentially biased high due to groundwater quality meter malfunction.

(2) - Monitoring well was decommissioned on June 14, 2018.

Table 3
Summary of Groundwater Sampling Results (Analytical) – April & June 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15032		JHC-MW-15033		JHC-MW-15034		JHC-MW-15035		JHC-MW-15036		JHC-MW-15037	
					Sample Date:	4/26/18	6/19/18	4/26/18	6/19/18	4/25/18	6/19/18	4/27/18	6/20/18	4/27/18	6/20/18	4/27/18	6/20/18
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient											
Appendix III																	
Boron	ug/L	NC	500	500	7,200	--	45.7	--	33.0	--	62.6	--	111	--	88.3	--	153
Calcium	mg/L	NC	NC	NC	500	--	8.8	--	9.0	--	5.8	--	90.5	--	64.8	--	72.6
Chloride	mg/L	250**	250	250	500	--	3.4	--	3.4	--	3.1	--	27.1	--	24.3	--	7.9
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	**5.9**(1)	**6.3**	6.8(1)	6.7	**6.0**(1)	**6.0**	8.0(1)	7.0	8.0(1)	7.1	7.9(1)	7.1
Sulfate	mg/L	250**	250	250	500	--	11.8	--	8.1	--	12.5	--	26.7	--	26.1	--	36.3
Total Dissolved Solids	mg/L	500**	500	500	500	--	64	--	68	--	50	--	342	--	278	--	360
Appendix IV																	
Antimony	ug/L	6	6	6	130	< 1.0	< 1.0	< 1.0	< 1.0	1.7	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	10	10	10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	2,000	2,000	820	7.8	8.8	4.8	5.2	5.3	5.5	17.4	18.1	8.9	11.5	11.5	11.7
Beryllium	ug/L	4	4	4	11	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5	5	3.5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	100	100	11	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	4.8	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	40	100	100	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4	4	33	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	2	2	0.20#	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	73	210	3,200	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NC	NC	NC	< 0.514	< 0.464	< 0.460	< 0.570	< 0.775	< 0.514	< 0.733	< 0.548	< 0.618	< 0.555	< 0.549	< 0.648
Radium-226/228	pCi/L	5	NC	NC	NC	< 1.30	< 1.19	< 1.19	< 1.42	< 1.58	< 1.55	< 1.41	1.63	< 1.24	< 1.30	< 1.25	< 1.45
Radium-228	pCi/L	NC	NC	NC	NC	< 0.784	< 0.721	< 0.732	< 0.845	< 0.804	< 1.04	0.937	1.27	< 0.626	< 0.743	< 0.699	< 0.804
Selenium	ug/L	50	50	50	**5**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.6	< 1.0	1.1	**9.9**
Thallium	ug/L	2	2	2	3.7	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 180 mg CaCO3/L as measured at surface water sample SW-01 collected on April 9, 2018 from the Pigeon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

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

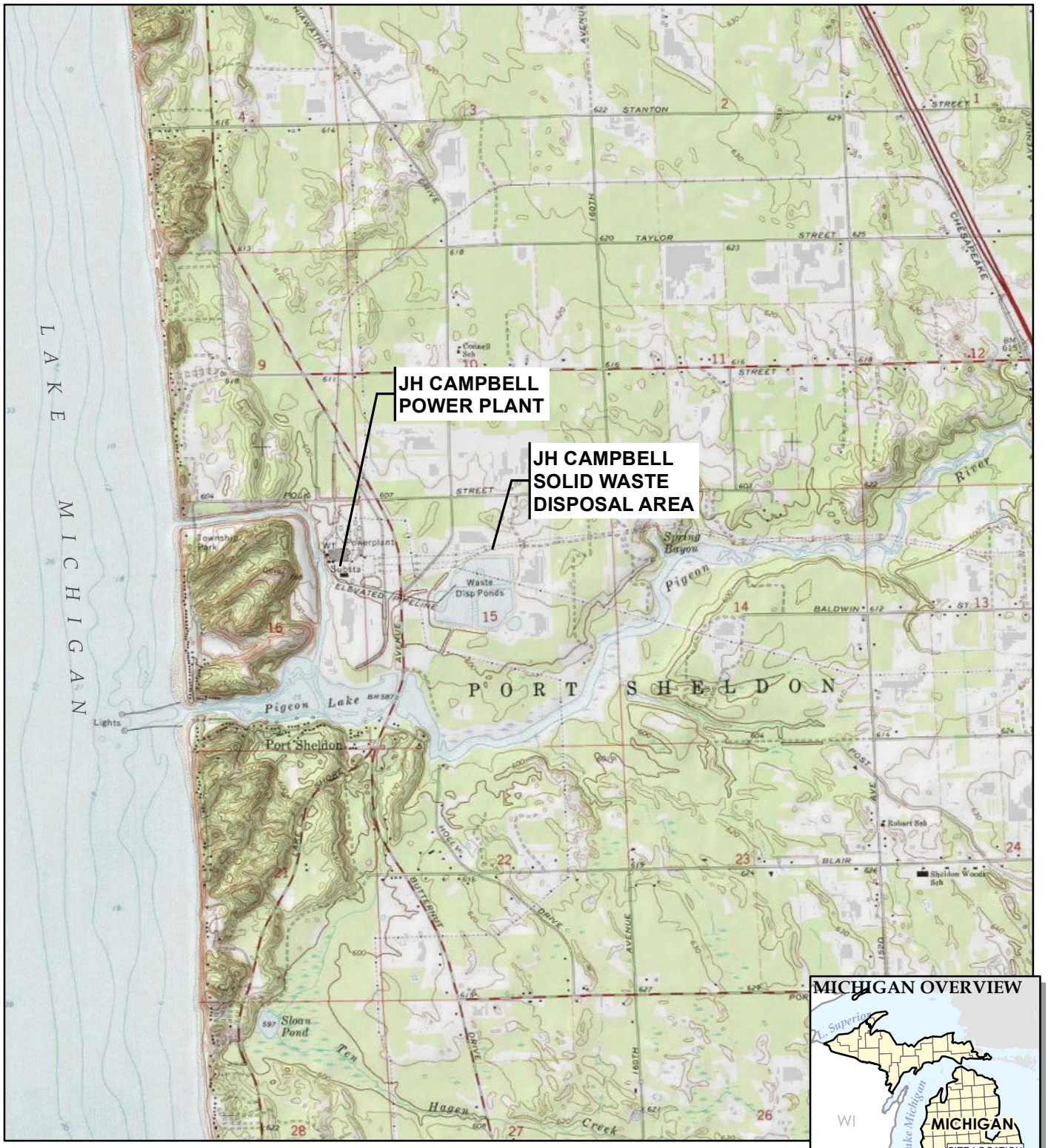
RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

(1) - pH value potentially biased high due to groundwater quality meter malfunction.

(2) - Monitoring well was decommissioned on June 14, 2018.

Figures



BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

N

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

0 3,000 6,000
FEET

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
TRC - GIS

PROJECT:

CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:

SITE LOCATION MAP

DRAWN BY:	J. PAPEZ
CHECKED BY:	S. HOLMSTROM
APPROVED BY:	G. CROCKFORD
DATE:	NOVEMBER 2018
PROJ. NO.:	269767-005
FILE:	269767-005-009SLM.mxd

FIGURE 1

E:\ConsumersEnergy\CCR_GW\2017_269767\269767-005-009SLM.mxd -- Saved By: SMAJOR on 11/29/2018, 12:55:00 PM

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Plot Date: 1/15/2019, 12:00:32 PM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\290806-001-015.mxd
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

JHC MW-15025
JHC MW-15026
JHC MW-15027
JHC MW-15024
JHC MW-15023
JHC MW-15028
WEST LEACHATE RETENTION POND
EAST LEACHATE RETENTION POND
CELL 1 (PARTIALLY CLOSED)
CELL 2 (PARTIALLY CLOSED)
JHC MW-15017
JHC MW-15018
JHC MW-15019
JHC MW-15021 (NOTE 4)
JHC MW-15020 (NOTE 4)
JHC MW-15034
JHC MW-15033
JHC MW-15032
ASH STORAGE SILOS
JHC MW-15029
SURFACE WATER DITCH
FUTURE CELLS 5, 6, 7
CELL 4 (ACTIVE)
CELL 3 (ACTIVE)
JHC MW-15022
JHC MW-15036
JHC MW-15031
JHC MW-15037
JHC MW-15035
JHC MW-15016
FORMER BOTTOM ASH POND 3N
POND F (CLOSED)
POND D NORTH (CLOSED)
POND G1 (CLOSED)
POND G2 (CLOSED)
JHC MW-15030
JHC MW-18001
JHC MW-15015
JHC MW-15014 (NOTE 3)
UNIT 3 DRAINAGE DITCH
BOTTOM ASH POND 3S
JHC MW-18002
JHC MW-18003
JHC MW-15012 (NOTE 5)
JHC MW-15013
POND D MID (CLOSED)
POND J (CLOSED)
POND H (CLOSED)
POND C (CLOSED)
SURFACE WATER DITCH
UNIT 1-2 DRAINAGE DITCH
JHC MW-15001
BOTTOM ASH POND 1-2N
POND D MID-SOUTH (CLOSED)
JHC MW-15002
CHEMICAL TREATMENT LAGOONS
POND D SOUTH (CLOSED)
POND K (CLOSED)
JHC MW-15003
JHC MW-18004
BOTTOM ASH POND 1-2S
POND B (CLOSED)
JHC MW-15010
JHC MW-15009
JHC MW-15004 (NOTE 4)
POND A (ACTIVE)
JHC MW-18005
JHC MW-15005
JHC MW-15008
JHC MW-15011
JHC MW-15006
JHC MW-15007
RECIRCULATION POND
SURFACE WATER DITCH
Lakeshore Dr
Pigeon River

LEGEND

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

NOTES

1. BASE MAP IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/20/2016.
2. WELL LOCATIONS SURVEYED BY NEDERVELD ON 11/25/2015.
3. MONITORING WELL DECOMMISSIONED NOVEMBER 13, 2017.
4. MONITORING WELL DECOMMISSIONED JUNE 14, 2018.
5. MONITORING WELL DECOMMISSIONED OCTOBER 10, 2018.
6. JHC-MW-1800X MONITORING WELLS INSTALLED IN DECEMBER 2018.

N

0 600 1,200 Feet

1 " = 600 '
1:7,200

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

TITLE:
SITE PLAN
WITH CCR MONITORING WELL LOCATIONS

DRAWN BY:	J. PAPEZ	PROJ NO.:	290806-001
CHECKED BY:	S. HOLMSTROM		
APPROVED BY:	G. CROCKFORD		**FIGURE 2**
DATE:	JANUARY 2019		

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FILE NO.: 290806-001-015.mxd

LEGEND

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

NOTES

1. BASE MAP IMAGERY FROM USDAL-NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/20/2016.
2. WELL LOCATIONS SURVEYED BY NEDERVELD ON 11/25/2015.
3. MONITORING WELL DECOMMISSIONED NOVEMBER 13, 2017.
4. GROUNDWATER ELEVATIONS DISPLAYED IN FEET RELATIVE TO THE NORTH AMERICAN VERTICAL DATUM OF 1988.
5. ASH SLUICING OPERATIONS AT UNIT 3 WERE TEMPORARILY CEASED FROM MARCH 14 TO APRIL 26, 2018.

0 600 1,200 Feet

1 " = 600 '

1:7,200

PROJECT:

CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:

GROUNDWATER CONTOUR MAP APRIL 24, 2018

DRAWN BY:	S. MAJOR	PROJ NO.:	290806-001
CHECKED BY:	C. SCIESZKA		
APPROVED BY:	S. HOLMSTROM		**FIGURE 3**
DATE:	NOVEMBER 2018		

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FILE NO.: 290806-001-007.mxd

Plot Date: 11/28/2018, 13:36:00 PM by SMAJOR -- LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\290806-001-007.mxd
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

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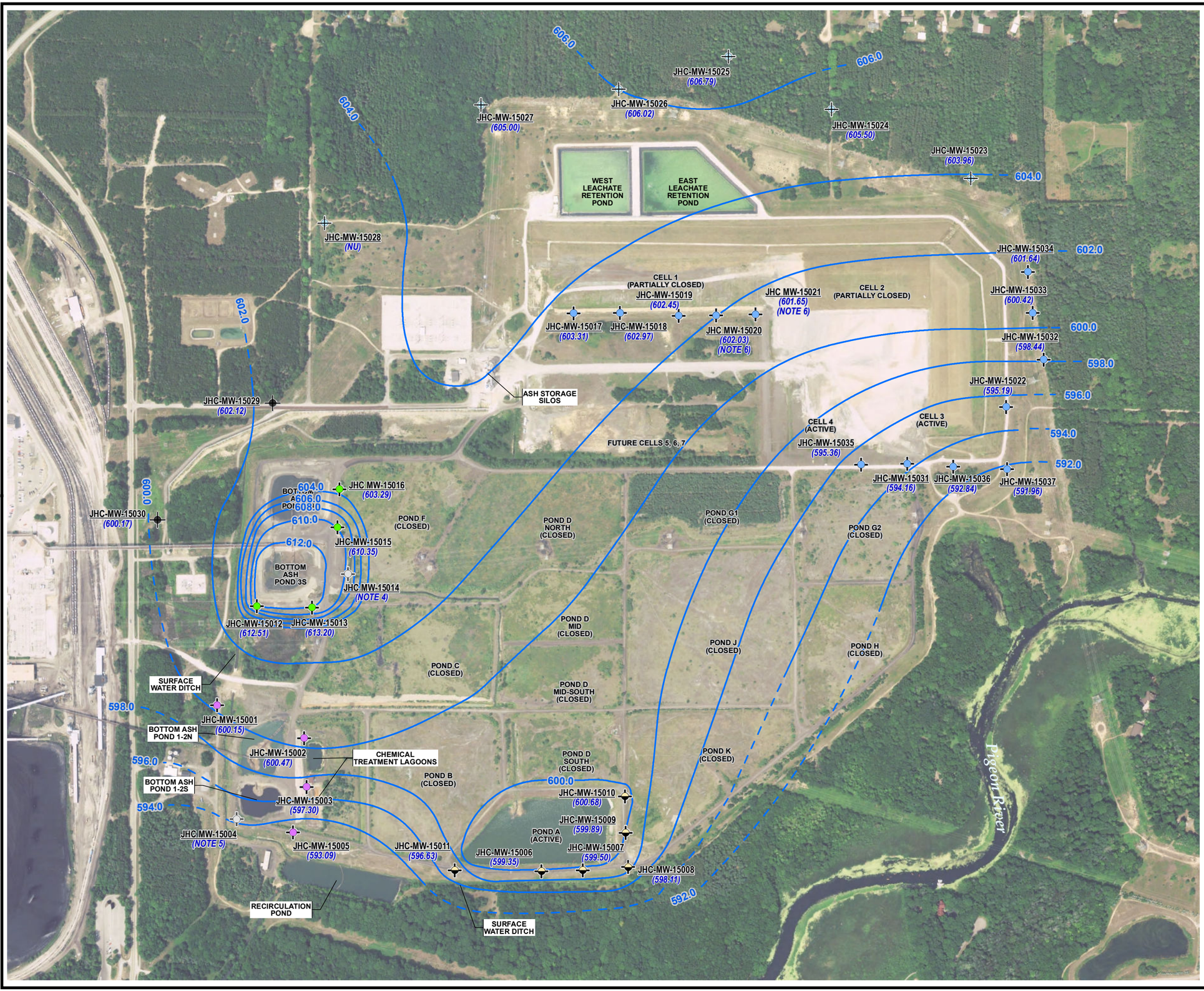
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

Plot Date: 11/30/2018, 09:15:20 AM by SMAJOR -- LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\290806-001-010.mxd



LEGEND

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

NOTES

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

N

0 600 1,200 Feet

1 " = 600 '
1:7,200

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

TITLE:
GROUNDWATER CONTOUR MAP JUNE 18, 2018

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

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FILE NO.: 290806-001-010.mxd

Appendix A
Monitoring Well Installation & Decommissioning Logs

WELL CONSTRUCTION LOG

WELL NO. JHC-MW-18001

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
CEC JH Campbell	12/3/18	12/3/18	290806.0000 P1T5

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns Drilling Company	Geoprobe	609.1	611.98	17.0	4

Boring Location: Southwest corner of Pond 3N N: 519793.32 E: 12633635.68	Personnel Logged By - P. Lancaster Driller - R. Christiansen	Drilling Equipment: 6620 DT

Civil Town/City/or Village:	County:	State:	Water Level Observations:
West Olive	Ottawa	Michigan	While Drilling: Date/Time 12/3/18 00:00 ▽ Depth (ft bgs) 9.0 After Drilling: Date/Time 12/3/18 15:25 ▼ Depth (ft bgs) 8.0

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 GP	95		0	**SILTY SAND** mostly medium sand, little fine sand, few to little silt, very dark grayish brown (10YR 3/2), moist, loose with vegetation debris.	SM			
				Change to no vegetation debris at 0.3 inches.				
				SAND mostly medium sand, little fine sand, light yellowish brown (10YR 64), moist, loose.				
			5	Change to mostly fine to medium sand at 5.0 feet.				
2 GP	95			▼	SP			
				▽ Change to very moist at 9.0 feet.				
			10	Change to wet at 10.0 feet.				
3 GP	100			Grades to very pale brown (10YR 7/3) at 13.5 feet.				
			15	Blind push between 15.0 and 17.0 feet; lithology assumed sand based on prior investigations at site.				
4 GP	0				SP			
				End of boring at 17.0 feet below ground surface.				
			20					

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

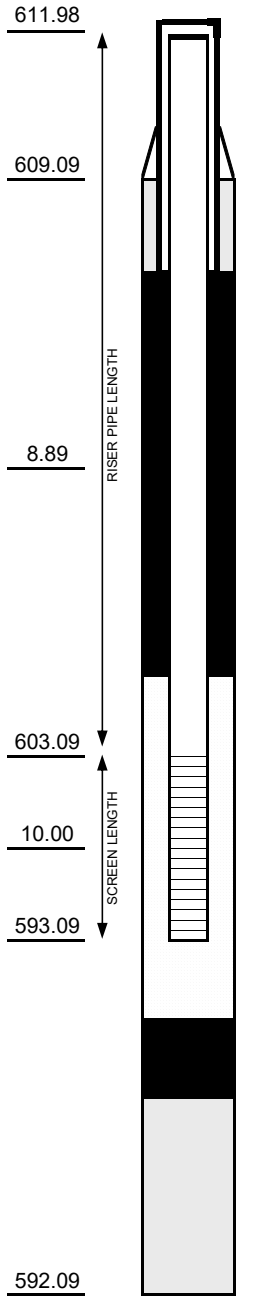
Signature: Paula C. Lancaster

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

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC JH Campbell		WELL ID:	**JHC-MW-18001**
PROJ. NO: 290806.0002	DATE INSTALLED: 12/3/2018 INSTALLED BY: Paula Lancaster	CHECKED BY:	J. Krenz

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
611.98	2.9	TOP OF CASING
609.09	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL
		MEDIUM CHIPS
		GROUT/BACKFILL METHOD
8.89		FILL FROM ABOVE
	NA	GROUT
		BENTONITE SEAL MATERIAL
		MEDIUM CHIPS
	4.8	BENTONITE SEAL
603.09	6.0	TOP OF SCREEN
		FILTER PACK MATERIAL
10.00		WASHED SAND & NATURAL COLLAPSE
593.09	16.0	BOTTOM OF SCREEN
	16.0	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL
		NATURAL COLLAPSE
592.09	17.0	HOLE BOTTOM



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

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SOLVENT USED? NO

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER:	4.0	IN. FROM	0	TO	17	FT.
	NA	IN. FROM	NA	TO	NA	FT.
SURF. CASING DIAMETER:	NA	IN. FROM	NA	TO	NA	FT.
	NA	IN. FROM	NA	TO	NA	FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.25 HOURS

WATER REMOVED: 27 GALLONS

WATER ADDED: < 5 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: OPAQUE

COLOR BEFORE: YELLOWISH-BROWN

CLARITY AFTER: CLEAR; 9.31 NTUs

COLOR AFTER: NONE

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	19.30	T/PVC	12/6/2018	1605
DTB AFTER DEVELOPING:	19.35	T/PVC	12/12/2018	1020
SWE BEFORE DEVELOPING:	10.83	T/PVC	12/6/2018	1605
SWE AFTER DEVELOPING:	10.96	T/PVC	12/12/2018	1020
OTHER SWE:		T/PVC		
OTHER SWE:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☐ YES ☑ NO

LOCK KEY NUMBER: _____

REVISED 06/2011

WELL CONSTRUCTION LOG

WELL NO. JHC-MW-18002

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

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns Drilling Company	Geoprobe	605.5	608.93	15.0	4

Boring Location: West side of Pond 3S N: 519331.45 E: 12633552.77	Personnel Logged By - P. Lancaster Driller - R. Christiansen	Drilling Equipment: 6620 DT

Civil Town/City/or Village:	County:	State:	Water Level Observations:
West Olive	Ottawa	Michigan	While Drilling: Date/Time 12/4/18 00:00 ▽ Depth (ft bgs) 5.0 After Drilling: Date/Time 12/4/18 10:00 ▼ Depth (ft bgs) 4.4

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 GP	60		0	**SAND** mostly fine to medium sand, very dark grayish brown (10YR 3/2), very moist, loose. 3" seam of very pale brown (10YR 7/3) at 6 inches.				
				▼ Grades to yellowish brown (10YR 5/4) at 4.0 feet.				
			5	▽ Change to light yellowish brown (10YR 6/4), wet at 5.0 feet.	SP			
2 GP	80							
			10	**SILTY SAND** mostly fine sand, some silt, light gray (10YR 7/2), wet, loose.				
3 GP	100				SM			
			15	End of boring at 15.0 feet below ground surface.				
			20					

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

Signature: Pamela C. Lancaster

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

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC JH Campbell		WELL ID:	**JHC-MW-18002**
PROJ. NO: 290806.0002	DATE INSTALLED: 12/4/2018 INSTALLED BY: Paula Lancaster	CHECKED BY:	J. Krenz

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)
608.93	3.0 TOP OF CASING
605.52	0.0 GROUND SURFACE
	1.0 CEMENT SURFACE PLUG
	GROUT/BACKFILL MATERIAL: MEDIUM CHIPS
	GROUT/BACKFILL METHOD: FILL FROM ABOVE
6.91	NA GROUT
	BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	2.5 BENTONITE SEAL
602.02	3.5 TOP OF SCREEN
	FILTER PACK MATERIAL: WASHED SAND & NATURAL COLLAPSE
592.02	13.5 BOTTOM OF SCREEN
	13.5 BOTTOM OF FILTER PACK
	NA BENTONITE PLUG
	BACKFILL MATERIAL: NATURAL COLLAPSE
590.52	15.0 HOLE BOTTOM

RISER PIPE LENGTH: 596.91

SCREEN LENGTH: 10.00

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

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SOLVENT USED? NO

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

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

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.25 HOURS

WATER REMOVED: 30 GALLONS

WATER ADDED: < 5 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: OPAQUE

COLOR BEFORE: GRAYISH-BROWN

CLARITY AFTER: CLEAR; 9.86 NTUs

COLOR AFTER: NONE

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	17.20	T/PVC	12/4/2018	1435
DTB AFTER DEVELOPING:	17.16	T/PVC	12/12/2018	1140
SWE BEFORE DEVELOPING:	8.01	T/PVC	12/4/2018	1435
SWE AFTER DEVELOPING:	8.22	T/PVC	12/12/2018	1140
OTHER SWE:		T/PVC		
OTHER SWE:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☐ YES ☑ NO

LOCK KEY NUMBER: _____

REVISED 06/2011

WELL CONSTRUCTION LOG

WELL NO. JHC-MW-18003

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

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns Drilling Company	Geoprobe	605.4	608.78	15.0	4

Boring Location: South side of Pond 3S N: 519181.31 E: 12633684.82	Personnel Logged By - P. Lancaster Driller - R. Christiansen	Drilling Equipment: 6620 DT

Civil Town/City/or Village:	County:	State:	Water Level Observations:
West Olive	Ottawa	Michigan	While Drilling: Date/Time 12/4/18 00:00 ▽ Depth (ft bgs) 5.0 After Drilling: Date/Time 12/4/18 10:45 ▼ Depth (ft bgs) 4.2

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 GP	80		0	**SAND** mostly fine to medium sand, yellowish brown (10YR 5/6) moist, loose.	SP			
				Change to very dark grayish brown (10YR 3/1) at 3.0 feet.				
				Change to dark brown (10YR 3/3) at 3.3 feet. ▼ ▽				
2 GP	100		5	**SILTY SAND** mostly fine sand, little to some silt, yellowish brown (10YR 5/6), wet, loose.				
3 GP	100		10	Change to light brownish gray (10YR 6/2) at 10.0 feet.	SM			
			15	End of boring at 15.0 feet below ground surface.				
			20					

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

Signature: Pamela C. Lancaster

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

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC JH Campbell		WELL ID:	**JHC-MW-18003**
PROJ. NO: 290806.0002	DATE INSTALLED: 12/4/2018 INSTALLED BY: Paula Lancaster	CHECKED BY:	J. Krenz

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)
608.78	3.4 TOP OF CASING
605.36	0.0 GROUND SURFACE
	1.0 CEMENT SURFACE PLUG
	GROUT/BACKFILL MATERIAL: MEDIUM CHIPS
	GROUT/BACKFILL METHOD: FILL FROM ABOVE
6.92	NA GROUT
	BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	2.5 BENTONITE SEAL
601.86	3.5 TOP OF SCREEN
	FILTER PACK MATERIAL: WASHED SAND & NATURAL COLLAPSE
10.00	
591.86	13.5 BOTTOM OF SCREEN
	13.5 BOTTOM OF FILTER PACK
	NA BENTONITE PLUG
	BACKFILL MATERIAL: NATURAL COLLAPSE
590.36	15.0 HOLE BOTTOM

RISER PIPE LENGTH

SCREEN LENGTH

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

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SOLVENT USED? NO

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

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

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.3 HOURS

WATER REMOVED: 50 GALLONS

WATER ADDED: < 5 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: OPAQUE

COLOR BEFORE: YELLOWISH-BROWN

CLARITY AFTER: CLEAR; 9.88 NTUs

COLOR AFTER: NONE

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	17.10	T/PVC	12/4/2018	1456
DTB AFTER DEVELOPING:	17.01	T/PVC	12/7/2018	1430
SWE BEFORE DEVELOPING:	7.89	T/PVC	12/4/2018	1456
SWE AFTER DEVELOPING:	8.00	T/PVC	12/7/2018	1430
OTHER SWE:		T/PVC		
OTHER SWE:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☐ YES ☑ NO

LOCK KEY NUMBER: _____

REVISED 06/2011

WELL CONSTRUCTION LOG

WELL NO. JHC-MW-18004

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

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

Boring Location: West side of Pond 1-2S N: 518007.60 E: 12633480.87	Personnel Logged By - P. Lancaster Driller - R. Christiansen	Drilling Equipment: 6620 DT

Civil Town/City/or Village:	County:	State:	Water Level Observations:
West Olive	Ottawa	Michigan	While Drilling: Date/Time 12/4/18 00:00 ▽ Depth (ft bgs) 8.0 After Drilling: Date/Time 12/4/18 08:45 ▼ Depth (ft bgs) 8.1

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

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

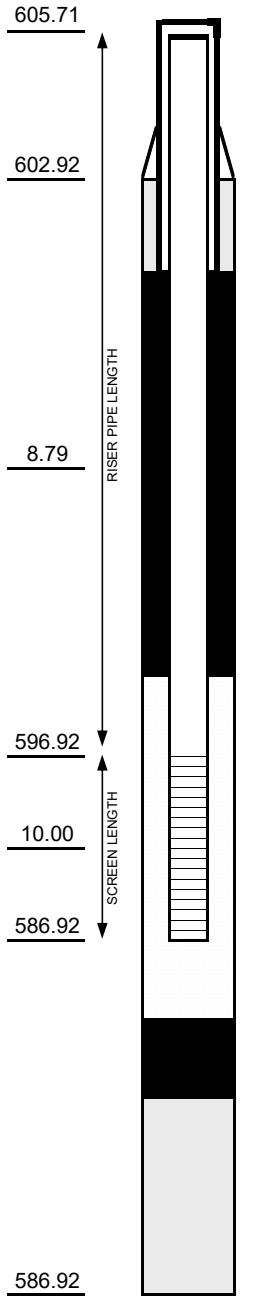
Signature: Paula C. Lancaster

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

WELL CONSTRUCTION DIAGRAM

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

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



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

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SOLVENT USED? NO

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

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

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.3 HOURS

WATER REMOVED: 17 GALLONS

WATER ADDED: < 5 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: OPAQUE

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR; 8.07 NTUs

COLOR AFTER: NONE

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

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

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☐ YES ☑ NO

LOCK KEY NUMBER: _____

WELL CONSTRUCTION LOG

WELL NO. JHC-MW-18005

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

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

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

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

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

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

Signature: Pamela C. Lancaster

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

WELL CONSTRUCTION DIAGRAM

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

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

RISER PIPE LENGTH: 595.30

SCREEN LENGTH: 10.00

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

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SOLVENT USED? NO

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

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

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.25 HOURS

WATER REMOVED: 27 GALLONS

WATER ADDED: < 5 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: OPAQUE

COLOR BEFORE: YELLOWISH-BROWN

CLARITY AFTER: CLEAR; 8.39 NTUs

COLOR AFTER: NONE

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

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

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☐ YES ☑ NO

LOCK KEY NUMBER: _____

REVISED 06/2011

MONITORING WELL DECOMMISSIONING LOG

PROJECT NAME:	CEC JHC Ash Pond Closures Ponds 1-2	**MONITORING WELL ID:** MW-15004	
PROJECT NUMBER: 1896102	DATE: 6.14.2018	LOCATION: SW corner of Pond 1-2S	LOCATION COORDINATES: N: 517864.56 E: 12633547.12
OBSERVED BY:	David Hutchinson		
DRILLING CONTRACTOR:	None		
CREW CHIEF:	NA	TOP OF CASING ELEV.: 628.44	SURFACE ELEV.: 624.92

PROTECTIVE COVER TYPE:	☑ STICK-UP	☐ FLUSH MOUNT	☐ TRAF. BOX	☐ OTHER					
PROTECTIVE COVER DIAMETER:	☑ 4"	☐ 8"	☐ 9"	☐ 10"	☐ 12"	☐ OTHER			
WELL MATERIAL:	☑ PVC	☐ SS	☐ IRON	☐ GALVANIZED STEEL	☐ OTHER				
WELL CASING DIAMETER:	☐ 1"	☑ 2"	☐ 4"	☐ 6"	☐ 8"	☐ OTHER			
WELL SCREEN MATERIAL:	☑ PVC	☐ SS	☐ IRON	☐ GALVANIZED STEEL	☐ OTHER				
WELL SCREEN LENGTH:	☐ 5-FT	☑ 10-FT	☐ UNKNOWN	☐ OTHER					
WELL SCREEN SLOT SIZE:	☐ 0.01"	☐ 0.02"	☑ UNKNOWN	☐ OTHER					

DTW: NA T/ PVC

DTB: NA T/ PVC

DECOMMISSIONING PROCEDURE:

NOTES:

NOTES: Removed silicone low flow sampling tubing from well, filled well casing with one bag of 3/8" Bentonite Pellets. The protective cover, concrete pad, and full extent of the well casing was removed during CCR removal operation when closing Ponds 1-2.

GROUTING PROCEDURE:	NOTES:
GROUT TYPE: NA	
GROUT MIX: NA	
GROUT INTERVAL: NA FT-BGS TO NA FT-BGS	
BENTONITE SEAL: MEDIUM CHIPS	
SEAL INTERVAL: -3.5 FT-BGS TO 34 FT-BGS	

ADDITIONAL COMMENTS:

David Hutchinson 6.14.2018

SIGNED DATE

JRP 09/20/2018

CHECKED DATE

REVISED 06/2011

MONITORING WELL DECOMMISSIONING LOG

PROJECT NAME: CEC JHC Pond 3 South		**MONITORING WELL ID**: JHC-MW-15012	
PROJECT NUMBER: NA	DATE: 10/10/2018	LOCATION: Southwest corner of Bottom Ash Pond 3S	LOCATION COORDINATES: N: 519214.84 E: 12633675.28
OBSERVED BY: Bethany Swanberg			
DRILLING CONTRACTOR: None			
CREW CHIEF: NA		TOP OF CASING ELEV.: 635.66	SURFACE ELEV.: 632.59

PROTECTIVE COVER TYPE:	☑ STICK-UP ☐ FLUSH MOUNT ☐ TRAF. BOX ☐ OTHER _____		
PROTECTIVE COVER DIAMETER:	☑ 4" ☐ 8" ☐ 9" ☐ 10" ☑ 12" ☐ OTHER _____		
WELL MATERIAL:	☑ PVC ☐ SS ☑ IRON ☐ GALVANIZED STEEL ☐ OTHER _____		
WELL CASING DIAMETER:	☐ 1" ☑ 2" ☐ 4" ☐ 6" ☐ 8" ☐ OTHER _____		
WELL SCREEN MATERIAL:	☑ PVC ☐ SS ☐ IRON ☐ GALVANIZED STEEL ☐ OTHER _____		
WELL SCREEN LENGTH:	☐ 5-FT ☑ 10-FT ☐ UNKNOWN ☐ OTHER _____	**DTW:** NM	T/ PVC
WELL SCREEN SLOT SIZE:	☑ 0.01" ☐ 0.02" ☐ UNKNOWN ☐ OTHER _____	**DTB:** NM	T/ PVC

DECOMMISSIONING PROCEDURE:

NOTES:

The monitoring well, including pro-cover and concrete pad, was removed in its entirety using an excavator during excavation of the Bottom Ash Pond 3 South.

GROUTING PROCEDURE:	NOTES:
GROUT TYPE: NA	None
GROUT MIX: NA	
GROUT INTERVAL: NA FT-BGS TO NA FT-BGS	
BENTONITE SEAL: NA	
SEAL INTERVAL: NA FT-BGS TO NA FT-BGS	

ADDITIONAL COMMENTS:

None

Bethany Swanberg 1/28/19

SIGNED DATE

MONITORING WELL DECOMMISSIONING LOG

PROJECT NAME: CEC JHC CELL 5		MONITORING WELL ID: *JHC-MW_15020*	
PROJECT NUMBER: 18101379	DATE: 6-14-18	LOCATION: *Northwest corner of Cell 5*	LOCATION COORDINATES: N: *1762* E: *5002*
OBSERVED BY: Aaron Bickel			
DRILLING CONTRACTOR: None			
CREW CHIEF: NA		TOP OF CASING ELEV.: *612.4 (PLANT)*	SURFACE ELEV.: *609.54*

PROTECTIVE COVER TYPE:	☑ STICK-UP	☐ FLUSH MOUNT	☐ TRAF. BOX	☐ OTHER			
PROTECTIVE COVER DIAMETER:	☑ 4"	☐ 8"	☐ 9"	☐ 10"	☐ 12"	☐ OTHER	
WELL MATERIAL:	☑ PVC	☐ SS	☐ IRON	☐ GALVANIZED STEEL	☐ OTHER		
WELL CASING DIAMETER:	☐ 1"	☑ 2"	☐ 4"	☐ 6"	☐ 8"	☐ OTHER	
WELL SCREEN MATERIAL:	☑ PVC	☐ SS	☐ IRON	☐ GALVANIZED STEEL	☐ OTHER		
WELL SCREEN LENGTH:	☐ 5-FT	☑ 10-FT	☐ UNKNOWN	☐ OTHER			
WELL SCREEN SLOT SIZE:	☐ 0.01"	☐ 0.02"	☑ UNKNOWN	☐ OTHER			

DTW: *NA* T/ PVC

DTB: *19.01 (FT)* T/ PVC

DECOMMISSIONING PROCEDURE:

NOTES:

- *Began 4:15 pm;*
- *Calculated required amount of 3/8" Bentonite Plug (50lb bags);*
  19.01 feet x 1.6 lbs/foot = 30.4 lbs
  30.4 lbs/50 lbs = 60% of 1 bag
- *Removed silicone low flow sampling tubing from well;*
- *Filled well to the brim with 3/8" Bentonite Plug, using ~60% of 1 Bag;*
- *Removed protective cover and concrete pad;*
- *Cut casing 2 feet below ground.*

GROUTING PROCEDURE: *NONE*	NOTES: **NONE**
GROUT TYPE: *NONE*	
GROUT MIX:	
GROUT INTERVAL: *NA* FT-BGS TO *NA* FT-BGS	
BENTONITE SEAL: *NONE*	
SEAL INTERVAL: *NA* FT-BGS TO *NA* FT-BGS	

ADDITIONAL COMMENTS: **NONE**

Aaron Bickel

SIGNED

6-14-2018

DATE

REVISED 06/2011

MONITORING WELL DECOMMISSIONING LOG

PROJECT NAME: CEC JHC CELL 5		MONITORING WELL ID: JHC MW-15021	
PROJECT NUMBER: 18101379	DATE: 6-14-18	LOCATION: Northeast corner of Cell 5	LOCATION COORDINATES: N: 1764 E: 5251
OBSERVED BY: Aaron Bickel			
DRILLING CONTRACTOR: None			
CREW CHIEF: NA		TOP OF CASING ELEV.: 614.15 (PLANT)	SURFACE ELEV.: 611.2

PROTECTIVE COVER TYPE:	☑ STICK-UP	☐ FLUSH MOUNT	☐ TRAF. BOX ☐ OTHER _____
PROTECTIVE COVER DIAMETER:	☑ 4" ☐ 8"	☐ 9" ☐ 10" ☐ 12"	☐ OTHER _____
WELL MATERIAL:	☑ PVC	☐ SS ☐ IRON	☐ GALVANIZED STEEL ☐ OTHER _____
WELL CASING DIAMETER:	☐ 1" ☑ 2"	☐ 4" ☐ 6" ☐ 8"	☐ OTHER _____
WELL SCREEN MATERIAL:	☑ PVC	☐ SS ☐ IRON	☐ GALVANIZED STEEL ☐ OTHER _____
WELL SCREEN LENGTH:	☐ 5-FT ☑ 10-FT	☐ UNKNOWN	☐ OTHER _____
WELL SCREEN SLOT SIZE:	☐ 0.01" ☐ 0.02"	☑ UNKNOWN	☐ OTHER _____

DTW: *NA* T/ PVC

DTB: T/ PVC

DECOMMISSIONING PROCEDURE:

NOTES:

- *Began 4:25 pm;*
- *Calculated required amount of 3/8" Bentonite Plug (50lb bags);*
  18.33 feet x 1.6 lbs/foot = 29.3 lbs
  29.3 lbs/50 lbs = 59% of 1 bag
- *Removed silicone low flow sampling tubing from well;*
- *Filled well to the brim with 3/8" Bentonite Plug, using ~59% of 1 Bag;*
- *Removed protective cover and concrete pad;*
- *Cut casing 2 feet below ground.*

GROUTING PROCEDURE: *NONE*	NOTES: **NONE**
GROUT TYPE: *NONE*	
GROUT MIX:	
GROUT INTERVAL: *NA* FT-BGS TO *NA* FT-BGS	
BENTONITE SEAL: *NONE*	
SEAL INTERVAL: *NA* FT-BGS TO *NA* FT-BGS	

ADDITIONAL COMMENTS: **NONE**

Aaron Bickel 6-14-2018

SIGNED DATE

REVISED 06/2011

Appendix B
Data Quality Review

Laboratory Data Quality Review
Groundwater Monitoring Event April 2018
CEC JH Campbell Background

Groundwater samples were collected by TRC for the April 2018 sampling event. Samples were analyzed for anions and total metals by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan, and for radium by Pace located in Greensburg, Pennsylvania. The laboratory analytical results are reported in laboratory reports 4611336 and 4611337.

During the April 2018 sampling event, a groundwater sample was collected from each of the following wells:

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

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride)	EPA 300.0
Total Metals	EPA 6020A, EPA 6010C, EPA 7470A
Radium (Radium-226, Radium-228, Total Radium)	EPA 903.1, EPA 904.0

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

Data Usability Review Procedure

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

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

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

This data usability report addresses the following items:

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

Review Summary

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

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

QA/QC Sample Summary:

- A method blank was analyzed with each analytical batch. Radium-226 was detected in the method blank batch 297662 at a concentration of 0.175 ± 0.266 pCi/L. Radium-226 was not detected in samples analyzed in this batch; therefore, data usability was not affected.
- No target analytes were detected in equipment blank EB-05 and field blank FB-05.
- The mercury recovery in the LCS associated with batch 22463 was above the upper laboratory control limit. Mercury was not detected in samples analyzed in this batch; therefore, data usability was not affected.
- The field duplicate pair samples were Dup-05 and JHC-MW-15028; relative percent differences (RPDs) between the parent and duplicate sample were within the QC limits.

Laboratory Data Quality Review
Groundwater Monitoring Event June 2018
CEC JH Campbell Background

Groundwater samples were collected by TRC for the June 2018 sampling event. Samples were analyzed for anions, total dissolved solids, and total metals by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan, and for radium by Pace located in Greensburg, Pennsylvania. The laboratory analytical results are reported in laboratory reports 4613761 and 4613762.

During the June 2018 sampling event, a groundwater sample was collected from each of the following wells:

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

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride)	EPA 300.0
Total Dissolved Solids	SM 2540C-11
Total Metals	EPA 6020A, EPA 6010C, EPA 7470A
Radium (Radium-226, Radium-228, Total Radium)	EPA 903.1, EPA 904.0

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

Data Usability Review Procedure

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

- Sample receipt, as noted in the cover page or case narrative;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;
- Data for method blanks, equipment blanks, and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field blanks 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;
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method; and
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

This data usability report addresses the following items:

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

Review Summary

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

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

QA/QC Sample Summary:

- No target analytes were detected in the method blanks.
- No target analytes were detected in equipment blank EB-5. Antimony was detected in field blank FB-5 at 1.6 ug/L. Antimony was not detected in any of the associated samples; therefore, data usability was not affected.
- LCS recoveries were within laboratory control limits.
- A laboratory duplicate sample was performed on JHC-MW-15028 for anions. The relative percent differences (RPDs) were within laboratory control limits.
- The field duplicate pair samples were Dup-05 and JHC-MW-15026; RPDs between the parent and duplicate sample were within the QC limits.

Laboratory Data Quality Review
Groundwater Monitoring Event April 2018
CEC JH Campbell Landfill

Groundwater samples were collected by TRC for the April 2018 sampling event. Samples were analyzed for anions and total metals by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan, and for radium by Pace located in Greensburg, Pennsylvania. The laboratory analytical results are reported in laboratory reports 4611405 and 4611406.

During the April 2018 sampling event, a groundwater sample was collected from each of the following wells:

- JHC-MW-15017
- JHC-MW-15018
- JHC-MW-15019
- JHC-MW-15020
- JHC-MW-15021
- JHC-MW-15022
- JHC-MW-15031
- JHC-MW-15032
- JHC-MW-15033
- JHC-MW-15034
- JHC-MW-15035
- JHC-MW-15036
- JHC-MW-15037

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride)	EPA 300.0
Total Metals	EPA 6020A, EPA 6010C, EPA 7470A
Radium (Radium-226, Radium-228, Total Radium)	EPA 903.1, EPA 904.0

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

Data Usability Review Procedure

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

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

- Data for method blanks, equipment blanks, and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field and equipment blanks are used to assess potential contamination arising from field procedures.
- Data for laboratory control samples (LCSs). 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). Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects.
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method.
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes.
- Overall usability of the data.

This data usability report addresses the following items:

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

Review Summary

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

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

QA/QC Sample Summary:

- Sample receipt: Although the temperature was recorded as <6°C for the temperature blank, three samples had measured temperatures >6°C (ranging from 6.7-9.7°C). However, the coolers were hand delivered to the courier/received by the lab on the same day they were collected and contained ice; thus, there was no impact to data usability.

- Blank detections: 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, as summarized in the attached table.
  - Radium-226 was detected in the method blank associated with batch 297662 at a concentration of 0.175 ± 0.266 pCi/L. Radium-226 results for samples analyzed in the same batch as the method blanks are potentially biased high (see attached table).
  - One equipment blank (EB-02) and one field blank (EB-02) were collected. Radium-226 was detected in EB-02 at a concentration of 0.296 ± 0.272 pCi/L, which is likely a false positive due to the method blank detection; thus there is no further impact to data usability then that already discussed from the method blank contamination.
- LCS recoveries:
  - The mercury recoveries in the LCS's associated with batches 22463 and 22465 were above the upper laboratory control limit. The mercury results for samples analyzed in these batches were below the detection limit; therefore, the high LCS recoveries did not impact data usability.
  - The thallium recovery in the LCS associated with batch 21626 was above the upper laboratory control limit. Thallium was not detected in the sample analyzed in this batch; therefore, the high LCS recovery did not impact data usability.
- MS/MSDs were performed on sample JHC-MW-15017 for radium, metals, and fluoride; and on sample JHC-MW-15020 for lithium.
  - The recovery of mercury in the MS performed on JHC-MW-15017 in batch 22465 was above the upper laboratory control limit. Mercury was not detected in samples analyzed in this batch; therefore, data usability was not affected.
- Laboratory duplicate analyses were performed on sample JHC-MW-15017 for fluoride. The relative percent differences (RPDs) between the parent and duplicate sample were within the QC limits.
- The field duplicate pair samples were Dup-02 and JHC-MW-15033; RPDs between the parent and duplicate sample were within the QC limits.

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

Samples	Collection Date	Analyte	Non-Conformance/Issue
EB#02_20180427	4/27/2018	Radium-226	Detection in method blank. Normalized absolute difference between blank and sample <1.96; indicates a possible false positive result.
JHC-MW-15017_20180426	4/26/2018	Radium-226	Detection in the method blank. Normalized absolute difference between sample and blank >1.96 and <2.48; indicates a possible false positive result.

Laboratory Data Quality Review
Groundwater Monitoring Event June 2018
CEC JH Campbell Landfill

Groundwater samples were collected by TRC for the June 2018 sampling event. Samples were analyzed for anions, total dissolved solids, and total metals by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan, and for radium by Pace located in Greensburg, Pennsylvania. The laboratory analytical results are reported in laboratory reports 4613329, 4613331, 4613763, and 4613764.

During the June 2018 sampling event, a groundwater sample was collected from each of the following wells:

- JHC-MW-15017
- JHC-MW-15018
- JHC-MW-15019
- JHC-MW-15020
- JHC-MW-15021
- JHC-MW-15022
- JHC-MW-15031
- JHC-MW-15032
- JHC-MW-15033
- JHC-MW-15034
- JHC-MW-15035
- JHC-MW-15036
- JHC-MW-15037

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 300.0
Total Dissolved Solids	SM 2540C-11
Total Metals	EPA 6020A, EPA 6010C, EPA 7470A
Radium (Radium-226, Radium-228, Total Radium)	EPA 903.1, EPA 904.0

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

Data Usability Review Procedure

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

- Sample receipt, as noted in the cover page or case narrative
- Technical holding times for analyses

- Reporting limits (RLs) compared to project-required RLs.
- Data for method blanks, equipment blanks, and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field and equipment blanks are used to assess potential contamination arising from field procedures.
- Data for laboratory control samples (LCSs). 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). Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects.
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method.
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes.
- Overall usability of the data.

This data usability report addresses the following items:

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

Review Summary

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

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

QA/QC Sample Summary:

- Sample receipt: Although the temperature was recorded as <6°C for the temperature blank, three samples had measured temperatures >6°C (ranging from 11.7-13.1°C). However, the coolers were hand delivered to the courier/received on the same day they were collected and contained ice upon receipt; thus, there was no impact to data usability.

- Two equipment blanks (EB-01 and EB-2) and two field blanks (FB-01 and FB-2) were collected.
    - For radium results, 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 the method blank associated with batch 302940 at a concentration of 2.86 ± 1.71 pCi/L. Radium-228 results for samples analyzed in the same batch as the method blanks are potentially impacted (see attached table).
            - Radium-228 was detected in the primary sample (JHC-MW-15020) associated with batch 302940 at a concentration within the range of historical radium-228 concentrations.
        - Radium-228 was detected in EB-01 at a concentration of 0.834 ± 0.425 pCi/L, which is likely a false positive due to the method blank detection; thus, there was no further impact to data usability than that already discussed from the method blank contamination.
    - Barium was detected in the method blank associated with batch 26026 at a concentration of 2.4 µg/L. Barium results for samples analyzed in the same batch with concentrations ≤10x the method blank concentration may be false positives. Barium concentrations for samples analyzed in this batch were either nondetect or >10x the method blank concentration; therefore, there was no impact to data usability.
    - Barium was detected in the field blank (FB-01) at 8.7 µg/L. Barium results for samples that are associated with FB-01 with concentrations ≤10x the concentration in FB-01 may be false positives (see attached table); however, barium concentrations observed in samples associated with FB-01 were within the range of historical barium data.
- LCS recoveries were within laboratory control limits.
- MS/MSDs were performed on sample JHC-MW-15020 for metals and anions; and on sample JHC-MW-15036 for anions, metals, and radium.
    - The chloride and sulfate recoveries in the MSD performed on JHC-MW-15020 in batch 25701 were above the upper laboratory control limit. The positive chloride and sulfate results for samples analyzed in the same batch may be biased high (see attached table); however, the concentrations of chloride and sulfate detected in batch 25701 samples were within the range of historical chloride and sulfate concentrations.
    - The fluoride recovery in the MSD in batch 25701 was below the lower laboratory control limit. The fluoride results for samples analyzed in this batch may be biased low (see attached table); however, the concentrations of fluoride detected in batch 25701 samples were within the range of historical fluoride concentrations.

- The chloride, fluoride, and sulfate recoveries in the MS/MSD performed on JHC-MW-15036 in batch 27217 were below the lower laboratory control limits. The chloride, fluoride, and sulfate results for the sample analyzed in the same batch may be biased low (see attached table); however, the concentrations of chloride, fluoride, and sulfate in batch 27217 samples were within the range of historical chloride, fluoride, and sulfate concentrations.
- The boron recovery in the MS performed on JHC-MW-15036 in batch 26787 was below the lower laboratory control limit. The boron results for samples analyzed in this batch may be biased low (see attached table); however, the concentrations of boron in batch 26787 samples were within the range of historical boron concentrations, with the exception of JHC-MW-15017. The boron concentration at JHC-MW-15017 was slightly below the range of historical boron concentrations.

- Laboratory duplicate analyses were performed on samples JHC-MW-15020 and JHC-MW-15036 for total dissolved solids and anions. The relative percent differences (RPDs) between the parent and duplicate sample were within the QC limits.
- The field duplicate pair samples were Dup-01 and JHC-MW-15020 and Dup-02 and JHC-MW-15032; RPDs between the parent and duplicate sample were within the QC limits.

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

Samples	Collection Date	Analyte	Non-Conformance/Issue
DUP-01_20180611	6/11/2018	Radium-228	Detection in method blank. Normalized absolute difference between blank and sample <1.96; indicates a possible false positive result.
EB-01_20180611	6/11/2018		
JHC-MW-15020_20180611	6/11/2018		
DUP-01_20180611	6/11/2018	Barium	Detection in the field blank (FB-01). Sample result is ≤10x blank concentrations; indicates a possible false positive result.
JHC-MW-15020_20180611	6/11/2018		
JHC-MW-15021_20180611	6/11/2018		
EB-2_20180620	6/20/2018	Boron	MS recovery below the lower laboratory control limits. Sample result may be biased low.
FB-2_20180620	6/20/2018		
JHC-MW-15017_20180620	6/20/2018		
JHC-MW-15018_20180620	6/20/2018		
JHC-MW-15019_20180620	6/20/2018		
JHC-MW-15022_20180620	6/20/2018		
JHC-MW-15031_20180620	6/20/2018		
JHC-MW-15035_20180620	6/20/2018		
JHC-MW-15036_20180620	6/20/2018		
JHC-MW-15037_20180620	6/20/2018		
DUP-01_20180611	6/11/2018	Chloride	MSD recovery above the upper laboratory control limits. Sample result may be biased high.
JHC-MW-15020_20180611	6/11/2018		
JHC-MW-15021_20180611	6/11/2018		
JHC-MW-15036_20180620	6/20/2018	Chloride	MS/MSD recoveries below the lower laboratory control limits. Sample result may be biased low.
DUP-01_20180611	6/11/2018	Sulfate	MSD recovery above the upper laboratory control limits. Sample result may be biased high.
JHC-MW-15020_20180611	6/11/2018		
JHC-MW-15021_20180611	6/11/2018		
JHC-MW-15036_20180620	6/20/2018	Sulfate	MS/MSD recoveries below the lower laboratory control limits. Sample result may be biased low.
DUP-01_20180611	6/11/2018	Fluoride	MSD recovery below the lower laboratory control limits. Sample result may be biased low.
EB-01_20180611	6/11/2018		
FB-01_20180611	6/11/2018		
JHC-MW-15020_20180611	6/11/2018		
JHC-MW-15021_20180611	6/11/2018		
JHC-MW-15036_20180620	6/20/2018	Fluoride	MS/MSD recoveries below the lower laboratory control limits. Sample result may be biased low.

Appendix C
Groundwater Protection Standards

Technical Memorandum

Date:	October 15, 2018; Revised December 7, 2018
To:	Beth Swanberg, CEC Brad Runkel, CEC
From:	Darby Litz, TRC Sarah Holmstrom, TRC Joyce Peterson, TRC
Project No.:	290806.0000 Phase 001, Task 002
Subject:	Groundwater Protection Standards – Consumers Energy, JH Campbell Site, Dry Ash Landfill

Pursuant to the United States Environmental Protection Agency's (U.S. EPA's) Resource Conservation and Recovery Act (RCRA) Coal Combustion Residual rule ("CCR Rule") promulgated on April 17, 2015, the owner or operator of a CCR Unit must collect a minimum of eight rounds of background groundwater data to initiate a detection monitoring program and evaluate statistically significant increases above background (40 CFR §257.94). The first detection monitoring event for the Consumers Energy Company (CEC) JH Campbell Power Plant (JHC site) in West Olive, Michigan, was conducted on September 25 through 27, 2017. During this event several Appendix III constituents were observed in downgradient monitoring wells at concentrations constituting statistically significant increases (SSIs) over the background concentrations established for the site (2017 Annual Report). Alternative Source Demonstrations (ASDs) were unsuccessful for one or more SSI, thereby triggering the requirement for establishing an Assessment Monitoring Program in accordance with 40 CFR 257.95. Groundwater samples were collected on April 25 through 30, 2018, that were analyzed for Appendix IV parameters pursuant to §257.95(b). In compliance with §257.95(d), additional groundwater samples were collected on June 18 and 19, 2018, and were analyzed for Appendix III and IV parameters. Analytical data collected from the background monitoring wells are presented in attached Table A1.

If assessment monitoring is triggered pursuant to §257.94(e)(1), data are compared to Groundwater Protection Standards (GWPSs). The CCR Rule [§257.95(h)] requires GWPSs to be established for Appendix IV constituents that have been detected during baseline sampling. Per §257.95(h)[1], the MCLs will be the GWPSs for those constituents that have established MCLs. For Appendix IV constituents

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

that do not have established MCLs, the GWPSs are based upon the EPA Regional Screening Levels (RSLs). For constituents that have statistically derived background levels higher than the MCL and/or RSL, the GWPS becomes the background level.

This memorandum presents the background statistical limits and GWPS derived for the Appendix IV parameters for the JHC site using the aforementioned approach pursuant to §257.95(h). However, it should be noted that in the future, risk-based standards may be used in place of the GWPSs presented in this memorandum based on promulgated rule changes and/or authorization for the state of Michigan to administer and enforce compliance with the CCR Rule.

Following the Appendix IV baseline data collection period (December 2015 through April 2018), the background data for the JHC site were evaluated in accordance with the Groundwater Statistical Evaluation Plan (Stats Plan) (TRC, October 2017). The June 2018 data were not included in the baseline dataset and were not used to establish background limits. The JHC site groundwater data are maintained within a database accessible through Sanitas™ statistical software. Sanitas™ is a software tool that is commercially available for performing statistical evaluation consistent with procedures outlined in U.S. EPA's Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities (Unified Guidance; UG). Within the Sanitas™ statistical program (and the UG), tolerance limits were selected to perform the statistical calculation for background limits. Use of tolerance limits is a streamlined approach that offers adequate statistical power under the current, initial stage of establishing background and developing the monitoring program. Additionally, tolerance limits are recommended by the UG as an acceptable approach to establish background-based groundwater protection standards for assessment monitoring under the CCR rule. Upper tolerance limits (UTLs) were calculated for each of the CCR Appendix IV parameters. The following narrative describes the methods employed and the results obtained and the Sanitas™ output files are included as an attachment.

The set of background wells utilized for the JHC CCR units at the JHC site includes JHC-MW-15023, JHC-MW-15024, JHC-MW-15025, JHCC-MW-15026, JHC-MW-15027, and JHC-MW-15028. The background evaluation included the following steps:

- Review of data quality reports for the baseline/background data sets for CCR Appendix IV constituents;
- Graphical representation of the baseline data as time versus concentration (T v. C) by well/constituent pair;
- Graphical representation of cumulative baseline background data sorted from lowest to highest concentration for each constituent;
- Outlier testing of individual data points that appear from the graphical representations as potential outliers;
- Evaluation of percentage of nondetects for each background well-constituent (w/c) pair;

- Distribution of the data;
- Calculation of the UTL for each cumulative background data set; and
- Establishment of GWPS as the higher of the MCL, RSL or the UTL for each Appendix IV constituent.

The results of these evaluations are presented and discussed below.

Data Quality

Data from each sampling round were evaluated for completeness, overall quality and usability, method-specified sample holding times, precision and accuracy, and potential sample contamination. The review was completed using the following quality control (QC) information which at a minimum included chain-of-custody forms, investigative sample results including blind field duplicates, and matrix spike and matrix spike duplicates (MS/MSDs) recoveries, and, as provided by the laboratory, method blanks, laboratory control spikes, and laboratory duplicates. The data were found to be complete and usable for the purposes of the CCR monitoring program.

Time versus Concentration Graphs

The T v. C graphs show no potential outliers for Appendix IV constituents in the background well sets (Figure 1). While variations in results are present, the graphs do not suggest that data sets, as a whole, likely have overall trending or seasonality. The data sets are of relatively short duration for making such observations.

Cumulative Baseline Data Sets

Ideally, the background data sets provide a continuous concentration distribution. The ideal is rarely achieved by multiple background wells representing a relatively large geographic area such as is the case at the JH Campbell site. When sorted by concentration, the data generally group by well (Figure 2). Most of the parameters have a relatively consistent distribution. These results need to be taken into consideration as they represent potential non-CCR upgradient contributions to downgradient wells.

Outlier Testing

No suspect data points were identified in the T v. C graphs (Figure 1) or in the cumulative concentration distribution (Figure 2). The Dixon's Outlier Test in Sanitas™ was therefore not employed for outlier testing.

Percentage of Nondetects

Table 1 summarizes the percentage of results below the reporting limit for each w/c pair.

Table 1
Summary of Percentage of Appendix IV Baseline Results Below Reporting Limit

WELL	CONSTITUENT	PERCENT NON-DETECT
JHC-MW-15023	Antimony	89
	Arsenic	100
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	78
	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	100
	Mercury	100
	Molybdenum	100
	Selenium	100
	Thallium	100
	Radium 226 and 228 combined	33
JHC-MW-15024	Antimony	100
	Arsenic	100
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	78
	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	100
	Mercury	100
	Molybdenum	100
	Selenium	89
	Thallium	100
	Radium 226 and 228 combined	67
JHC-MW-15025	Antimony	100
	Arsenic	100
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	56

Table 1
Summary of Percentage of Appendix IV Baseline Results Below Reporting Limit

WELL	CONSTITUENT	PERCENT NON-DETECT
JHC-MW-15025 *(cont'd)*	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	100
	Mercury	100
	Molybdenum	100
	Selenium	89
	Thallium	100
	Radium 226 and 228 combined	44
JHC-MW-15026	Antimony	100
	Arsenic	100
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	67
	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	100
	Mercury	100
	Molybdenum	100
	Selenium	89
	Thallium	100
	Radium 226 and 228 combined	33
JHC-MW-15027	Antimony	100
	Arsenic	100
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	11
	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	100
	Mercury	100
	Molybdenum	100
	Selenium	89
	Thallium	100
	Radium 226 and 228 combined	22

Table 1
Summary of Percentage of Appendix IV Baseline Results Below Reporting Limit

WELL	CONSTITUENT	PERCENT NON-DETECT
JHC-MW-15028	Antimony	100
	Arsenic	100
	Barium	56
	Beryllium	100
	Cadmium	100
	Chromium	67
	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	100
	Mercury	100
	Molybdenum	100
	Selenium	33
	Thallium	100
	Radium 226 and 228 combined	89
COMBINED	Antimony	98
	Arsenic	100
	Barium	9
	Beryllium	100
	Cadmium	100
	Chromium	60
	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	100
	Mercury	100
	Molybdenum	100
	Selenium	82
	Thallium	100
	Radium 226 and 228 combined	49

Distribution of the Data Sets

The distribution of the data sets is determined by the Sanitas™ software during calculation of the upper tolerance limit. The Shapiro-Wilk normality test is used for samples sizes less than 50. Non-detect/censored data were handled in accordance with the Stats Plan. If the data appear to be nonnormal, mathematical transformations of the data may be utilized such that the transformed data follow a normal distribution (e.g., lognormal distributions). Alternatively, non-parametric tests may be utilized when data cannot be normalized. Table 2 summarizes the distributions determined by the Sanitas™ software. The distribution is based on the combined baseline results for all six background monitoring wells.

Table 2
Summary of Background/Baseline Data Distributions

CONSTITUENT	DISTRIBUTION
Antimony	Nonnormal (>50% censored data)
Arsenic	All ND – use highest RL
Barium	Normalized by square root transformation
Beryllium	All ND – use highest RL
Cadmium	All ND – use highest RL
Chromium	Nonnormal (>50% censored data)
Cobalt	All ND – use highest RL
Fluoride	All ND – use highest RL
Lead	All ND – use highest RL
Lithium	All ND – use highest RL
Mercury	All ND – use highest RL
Molybdenum	All ND – use highest RL
Selenium	Nonnormal (>50% censored data)
Thallium	All ND – use highest RL
Radium 226 and 228 combined	Normalized by square root transformation (NDs adjusted by Kaplan-Meier adjustment)

ND = Non-detect
RL = Reporting Limit

Upper Tolerance Limits

Table 3 presents the calculated upper tolerance limits for the background/baseline data sets. For data sets with normal distributions or distributions normalized by transformation, UTLs are calculated for 95 percent coverage and 95 percent confidence using parametric tolerance limits. For nonnormal background datasets, a nonparametric tolerance limit is utilized, resulting in the highest value from the background dataset as the UTL. The achieved confidence and/or coverage rates for nonparametric tests depend entirely on the number of background data points, and coverage rates for various confidence levels are shown in the Sanitas™ outputs for nonparametric tolerance limits. Verification resampling (1 of 2) is recommended per the Stats Plan and UG to achieve a site-wide false positive rate within the range specified in the CCR rules.

Table 3
Summary of Initial Groundwater Protection Standards

CONSTITUENT	UNITS	UPPER TOLERANCE LIMIT – FROM SANITAS™	MAXIMUM CONTAMINANT LEVEL	REGIONAL SCREENING LEVEL	GROUNDWATER PROTECTION STANDARD
Antimony	ug/L	2	6	NA	6
Arsenic	ug/L	RL (1)	10	NA	10
Barium	ug/L	35	2,000	NA	2,000
Beryllium	ug/L	RL (1)	4	NA	4
Cadmium	ug/L	RL (0.2)	5	NA	5
Chromium	ug/L	2	100	NA	100
Cobalt	ug/L	RL (15)	NC	6	15
Fluoride	ug/L	RL (1,000)	4,000	NA	4,000
Lead	ug/L	RL (1)	NC	15	15
Lithium	ug/L	RL (10)	NC	40	40
Mercury	ug/L	RL (0.2)	2	NA	2
Molybdenum	ug/L	RL (5)	NC	100	100
Selenium	ug/L	5	50	NA	50
Thallium	ug/L	RL (2)	2	NA	2
Radium 226 and 228 combined	pCi/L	1.93	5	NA	5

RL = Reporting Limit
NC = No Criteria
NA = Not Applicable

Revised 12/7/18

Attachments

Table A1 – Summary of Groundwater Sampling Results (Analytical)

Figure 1 – Background Concentration Time-Series Charts

Figure 2 – Combined Background Distribution

Sanitas™ Output Files

Table A1
Summary of Groundwater Sampling Results
(Analytical)

Table A1
Summary of Groundwater Sampling Results (Analytical) – December 2015 to June 2018
JH Campbell Background – RCRA CCR Monitoring Program
West Olive, Michigan

Sample Location:		JHC-MW-15023										
Sample Date:		12/4/2015	3/10/2016	6/23/2016	8/31/2016	11/16/2016	4/20/2017	6/21/2017	8/15/2017	9/26/2017	4/25/2018	6/19/2018
Constituent	Unit	Background										
Appendix III												
Boron	ug/L	51	43	37	42	48	49	37.9	48.0	40.1	--	42.4
Calcium	mg/L	16.1	16.9	9.89	12.3	15.5	9.6	5.3	5.8	7.9	--	9.3
Chloride	mg/L	6.44	5.92	2.17	2.9	5.44	2.25	< 1.0	1.8	4.3	--	5.0
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.3	5.8	5.5	5.6	5.8	5.5	5.8	5.8	5.8	6.1	6.0
Sulfate	mg/L	10.5	12.3	14.1	12.6	12.3	13.7	10	12.9	< 2.0	--	10.7
Total Dissolved Solids	mg/L	71	78	68	77	83	78	< 50.0	60	< 50.0	--	68
Appendix IV												
Antimony	ug/L	< 1	2	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	< 1	< 1	< 1	< 1	< 1	< 10	< 1.0	< 1.0	--	< 1.0	< 1.0
Barium	ug/L	22	33	23	20	26	35	21.7	23.2	--	24.8	21.5
Beryllium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	< 1	< 1	< 1	< 1	< 1	2	< 1.0	< 1.0	--	1.1	< 1.0
Cobalt	ug/L	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10
Mercury	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0
Radium-226	pCi/L	< 0.182	< 0.163	< 0.189	< 0.328	< 0.175	< 0.26	< 0.687	< 0.686	--	< 0.647	< 0.729
Radium-226/228	pCi/L	0.838	1.20	0.780	0.906	0.880	1.14	< 1.35	< 1.51	--	< 1.45	< 1.61
Radium-228	pCi/L	0.672	1.05	0.652	0.78	0.827	1.01	< 0.662	< 0.819	--	< 0.802	< 0.884
Selenium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Thallium	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

-- - not analyzed

All metals were analyzed as total unless otherwise specified.

Table A1
Summary of Groundwater Sampling Results (Analytical) – December 2015 to June 2018
JH Campbell Background – RCRA CCR Monitoring Program
West Olive, Michigan

Sample Location:		JHC-MW-15024										
Sample Date:		12/4/2015	3/10/2016	6/23/2016	9/1/2016	11/16/2016	4/20/2017	6/21/2017	8/15/2017	9/26/2017	4/25/2018	6/19/2018
Constituent	Unit	Background										
Appendix III												
Boron	ug/L	22	22	< 20	23	23	27	22.6	24.8	< 20.0	--	< 20.0
Calcium	mg/L	31	41.7	41.5	42.4	35	37.4	34.6	33.4	28.5	--	31.7
Chloride	mg/L	25.2	36.5	33	42	21.8	33.6	42.4	43.4	31.3	--	50.3
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	7.4	7.3	7.3	7.4	7.1	7.5	7.7	7.4	7.3	9.0	7.4
Sulfate	mg/L	9.85	9.32	9.2	9.59	8.38	9.2	8.1	10.9	< 2.0	--	9.1
Total Dissolved Solids	mg/L	180	200	210	270	180	210	176	218	142	--	258
Appendix IV												
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	< 1	< 1	< 1	< 1	< 1	< 10	< 1.0	< 1.0	--	< 1.0	< 1.0
Barium	ug/L	18	19	19	21	19	19	18.5	18.1	--	21.2	20.0
Beryllium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	< 1	< 1	< 1	< 1	1	2	< 1.0	< 1.0	--	< 1.0	< 1.0
Cobalt	ug/L	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10
Mercury	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0
Radium-226	pCi/L	< 0.179	< 0.238	< 0.196	0.317	< 0.245	0.245	< 0.701	< 0.709	--	< 0.416	< 0.738
Radium-226/228	pCi/L	0.631	0.548	< 0.576	0.568	< 0.514	< 0.641	< 1.40	< 1.55	--	< 1.11	< 1.46
Radium-228	pCi/L	0.523	0.548	< 0.576	< 0.473	< 0.514	< 0.641	< 0.697	< 0.841	--	< 0.689	< 0.723
Selenium	ug/L	< 1	< 1	< 1	< 1	1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Thallium	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

-- - not analyzed

All metals were analyzed as total unless otherwise specified.

Table A1
Summary of Groundwater Sampling Results (Analytical) – December 2015 to June 2018
JH Campbell Background – RCRA CCR Monitoring Program
West Olive, Michigan

Sample Location:		JHC-MW-15025										
Sample Date:		12/4/2015	3/10/2016	6/23/2016	9/1/2016	11/16/2016	4/20/2017	6/21/2017	8/14/2017	9/25/2017	4/25/2018	6/19/2018
Constituent	Unit	Background										
Appendix III												
Boron	ug/L	32	25	< 20	23	27	20	20.7	25.4	29.5	--	21.4
Calcium	mg/L	29.5	31	20.2	25.7	25.4	20.5	18.9	17.1	22.5	--	14.2
Chloride	mg/L	29.7	26.2	19.3	34.1	22.3	19.9	27.1	15.9	19.7	--	15.4
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	8.1	8.0	7.4	7.4	7.5	7.5	7.4	7.3	7.3	8.4	7.0
Sulfate	mg/L	10.6	8.07	8.03	8.19	8.83	7.56	7.3	10.4	< 2.0	--	8.6
Total Dissolved Solids	mg/L	170	160	120	200	150	120	66	154	132	--	112
Appendix IV												
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	< 1	< 1	< 1	< 1	< 1	< 10	< 1.0	< 1.0	--	< 1.0	< 1.0
Barium	ug/L	7	7	15	10	7	11	10.1	7.8	--	8.8	13.1
Beryllium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	< 1	1	< 1	1	2	2	< 1.0	< 1.0	--	< 1.0	< 1.0
Cobalt	ug/L	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10
Mercury	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0
Radium-226	pCi/L	< 0.313	< 0.176	< 0.191	< 0.27	< 0.198	< 0.36	< 0.820	< 0.763	--	< 0.748	< 0.576
Radium-226/228	pCi/L	0.714	0.666	0.676	1.09	< 0.498	0.919	< 1.50	< 1.54	--	< 1.60	< 1.33
Radium-228	pCi/L	0.629	0.623	0.565	0.997	< 0.498	0.69	0.794	< 0.772	--	< 0.848	< 0.758
Selenium	ug/L	< 1	< 1	3	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Thallium	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

-- - not analyzed

All metals were analyzed as total unless otherwise specified.

Table A1
Summary of Groundwater Sampling Results (Analytical) – December 2015 to June 2018
JH Campbell Background – RCRA CCR Monitoring Program
West Olive, Michigan

Sample Location:		JHC-MW-15026											
Sample Date:		12/7/2015	3/10/2016	6/24/2016	9/1/2016	11/16/2016	4/20/2017	6/21/2017	8/14/2017	9/25/2017	4/25/2018	6/18/2018	6/18/2018
Constituent	Unit	Background											
Appendix III													Field Dup
Boron	ug/L	< 20	< 20	< 20	< 20	< 20	< 20	< 20.0	< 20.0	< 20.0	--	< 20.0	< 20.0
Calcium	mg/L	< 1	7.83	11.1	11.9	7.68	5.81	4.1	8.6	4.7	--	9.8	9.2
Chloride	mg/L	1.13	2.32	5.95	6.94	3.03	4.37	3.0	5.9	2.2	--	5.4	5.4
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.4	6.2	5.7	6.6	6.2	5.9	6.2	6.8	6.1	6.8	6.9	--
Sulfate	mg/L	7.59	7.02	7.88	7.82	8.07	6.62	5.2	9.4	< 2.0	--	7.5	7.5
Total Dissolved Solids	mg/L	40	43	62	79	47	34	68	156	64	--	70	82
Appendix IV													
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	< 1	< 1	< 1	< 1	< 1	< 10	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	9	9	13	12	9	9	7.1	9.4	--	9.5	9.0	9.7
Beryllium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	< 1	1	< 1	< 1	1	1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10
Mercury	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	< 0.156	< 0.17	< 0.176	< 0.248	< 0.218	< 0.357	< 0.897	< 0.803	--	< 0.523	< 0.864	< 0.618
Radium-226/228	pCi/L	1.12	< 0.557	1.70	1.58	2.85	1.36	< 1.61	1.75	--	< 1.31	< 1.60	< 1.48
Radium-228	pCi/L	1.06	< 0.557	1.62	1.58	2.85	1.18	1.01	1.12	--	< 0.789	< 0.735	< 0.857
Selenium	ug/L	< 1	< 1	2	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Thallium	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

-- - not analyzed

All metals were analyzed as total unless otherwise specified.

Table A1
Summary of Groundwater Sampling Results (Analytical) – December 2015 to June 2018
JH Campbell Background – RCRA CCR Monitoring Program
West Olive, Michigan

Sample Location:		JHC-MW-15027											
Sample Date:		12/7/2015	3/11/2016	6/24/2016	9/1/2016	11/17/2016	4/21/2017	6/21/2017	8/14/2017	9/25/2017	4/25/2018	4/25/2018	6/18/2018
Constituent	Unit	Background											
Appendix III												Field Dup	
Boron	ug/L	23	< 20	< 20	< 20	< 20	< 20	< 20.0	< 20.0	< 20.0	--	--	< 20.0
Calcium	mg/L	27.3	16.4	19.6	18.3	18.2	9.06	6.0	8.7	9.7	--	--	11.5
Chloride	mg/L	7.25	3.04	11.7	8.93	5.9	2.64	1.4	1.6	1.8	--	--	7.1
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.8	6.9	6.7	6.2	6.8	6.5	6.5	6.8	6.7	6.6	--	6.8
Sulfate	mg/L	10.4	9.91	9.16	8.75	8.89	9.26	6.7	9.0	< 2.0	--	--	8.5
Total Dissolved Solids	mg/L	120	80	100	89	85	57	70	50	112	--	--	60
Appendix IV													
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	< 1	< 1	< 1	< 1	< 1	< 10	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	15	13	22	16	14	11	31.7	10.8	--	40.7	5.1	29.5
Beryllium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	1	< 1	1	1	1	2	1.1	1.1	--	1.5	< 1.0	< 1.0
Cobalt	ug/L	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10
Mercury	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	< 0.199	< 0.239	< 0.165	< 0.218	< 0.266	< 0.418	< 0.842	< 0.628	--	< 0.573	< 0.573	< 0.783
Radium-226/228	pCi/L	0.900	0.738	0.777	1.18	2.51	0.897	1.87	< 1.36	--	< 1.36	< 1.22	< 1.42
Radium-228	pCi/L	0.9	0.738	0.759	1.18	2.43	0.702	1.45	0.964	--	< 0.782	< 0.649	< 0.641
Selenium	ug/L	< 1	< 1	2	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Thallium	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

-- - not analyzed

All metals were analyzed as total unless otherwise specified.

Table A1
Summary of Groundwater Sampling Results (Analytical) – December 2015 to June 2018
JH Campbell Background – RCRA CCR Monitoring Program
West Olive, Michigan

Sample Location:		JHC-MW-15028										
Sample Date:		12/7/2015	3/11/2016	6/24/2016	9/1/2016	11/17/2016	4/21/2017	6/21/2017	8/14/2017	9/25/2017	4/25/2018	6/18/2018
Constituent	Unit	Background										
Appendix III												
Boron	ug/L	26	< 20	< 20	< 20	20	< 20	< 20.0	< 20.0	< 20.0	--	< 20.0
Calcium	mg/L	13.1	16	11.4	14.4	12.6	10.4	13.7	11.4	12.7	--	8.9
Chloride	mg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	--	3.0
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	8.2	8.7	7.9	7.5	8.4	8.1	8.8	8.8	8.8	8.5	8.1
Sulfate	mg/L	5.08	5.1	5.05	4.93	5.08	5.87	3.3	5.3	< 2.0	--	4.2
Total Dissolved Solids	mg/L	63	60	61	69	64	56	< 50.0	54	54	--	< 50.0
Appendix IV												
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	< 1	< 1	< 1	< 1	< 1	< 10	< 1.0	< 1.0	--	< 1.0	< 1.0
Barium	ug/L	< 5	< 5	< 5	< 5	< 5	5	5.3	5.4	--	5.3	5.3
Beryllium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	< 1	< 1	< 1	< 1	1	1	1.2	< 1.0	--	< 1.0	< 1.0
Cobalt	ug/L	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10
Mercury	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0
Radium-226	pCi/L	< 0.181	< 0.149	0.166	< 0.189	< 0.181	< 0.346	< 0.566	< 0.905	--	< 0.438	< 0.945
Radium-226/228	pCi/L	< 0.573	0.461	< 0.529	< 0.519	< 0.522	< 0.714	< 1.12	< 1.87	--	< 1.06	< 1.77
Radium-228	pCi/L	< 0.573	0.446	< 0.529	< 0.519	< 0.522	< 0.714	0.666	< 0.962	--	< 0.619	< 0.827
Selenium	ug/L	3	5	3	2	4	3	< 1.0	< 1.0	--	< 1.0	< 1.0
Thallium	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

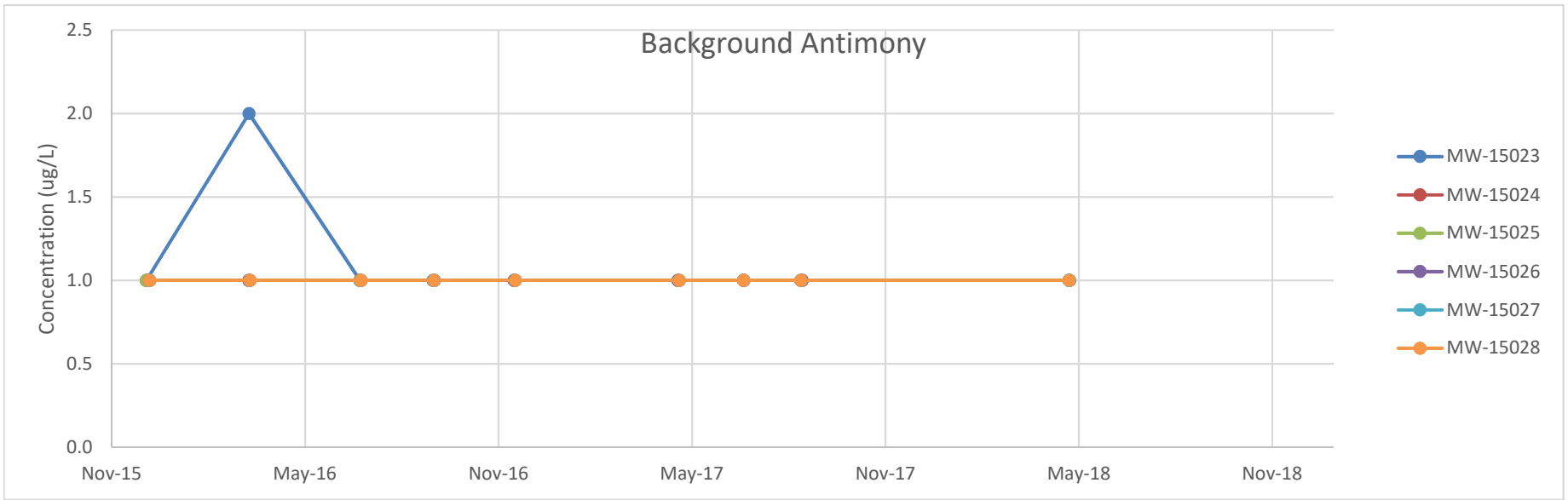
pCi/L - picocuries per liter.

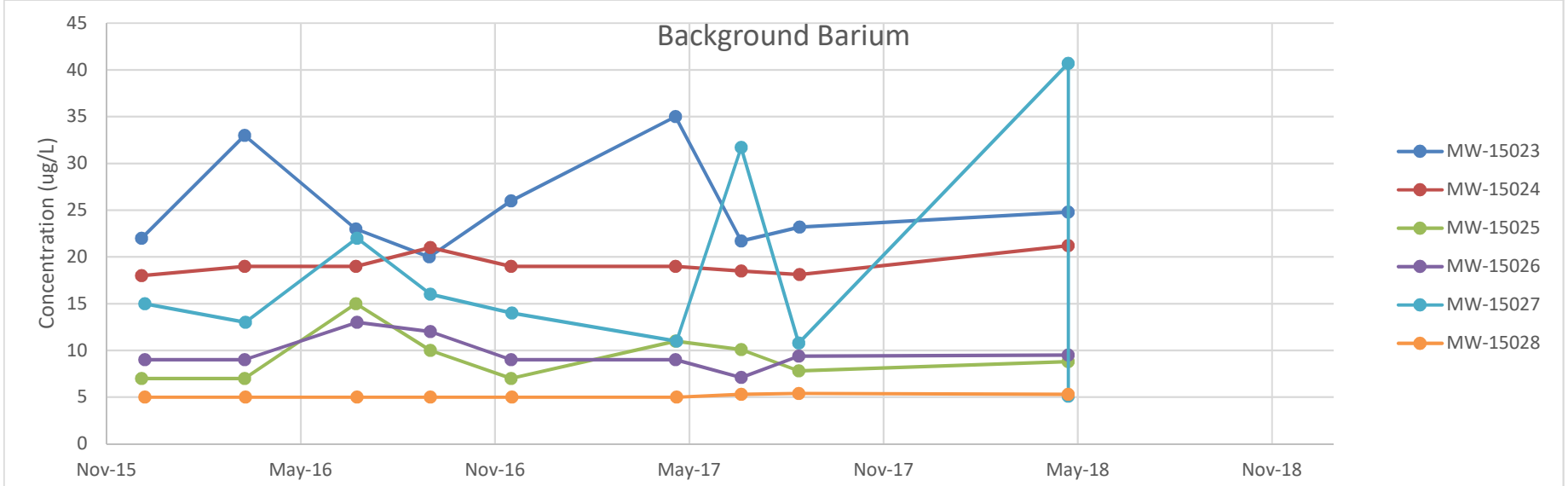
-- - not analyzed

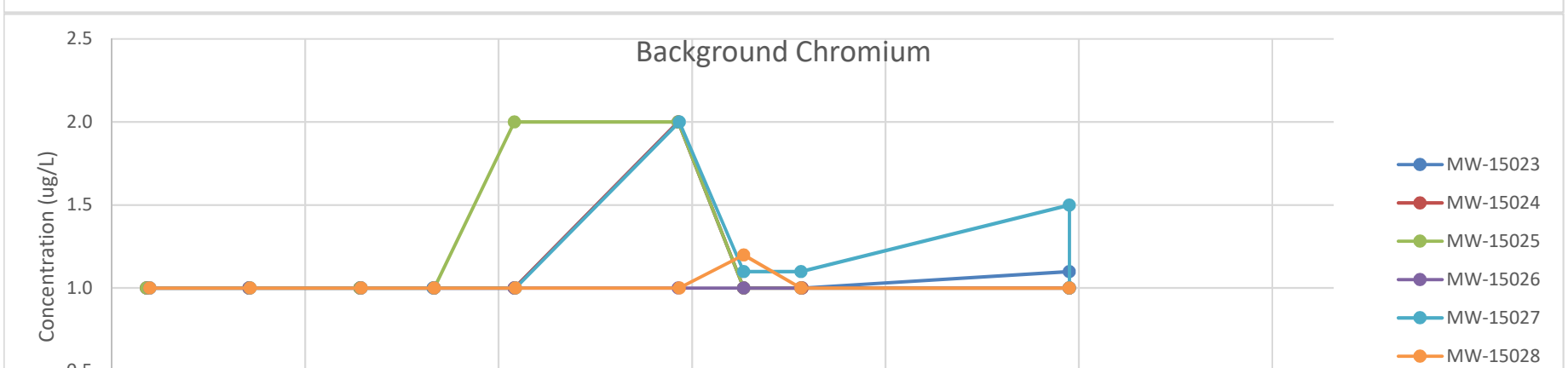
All metals were analyzed as total unless otherwise specified.

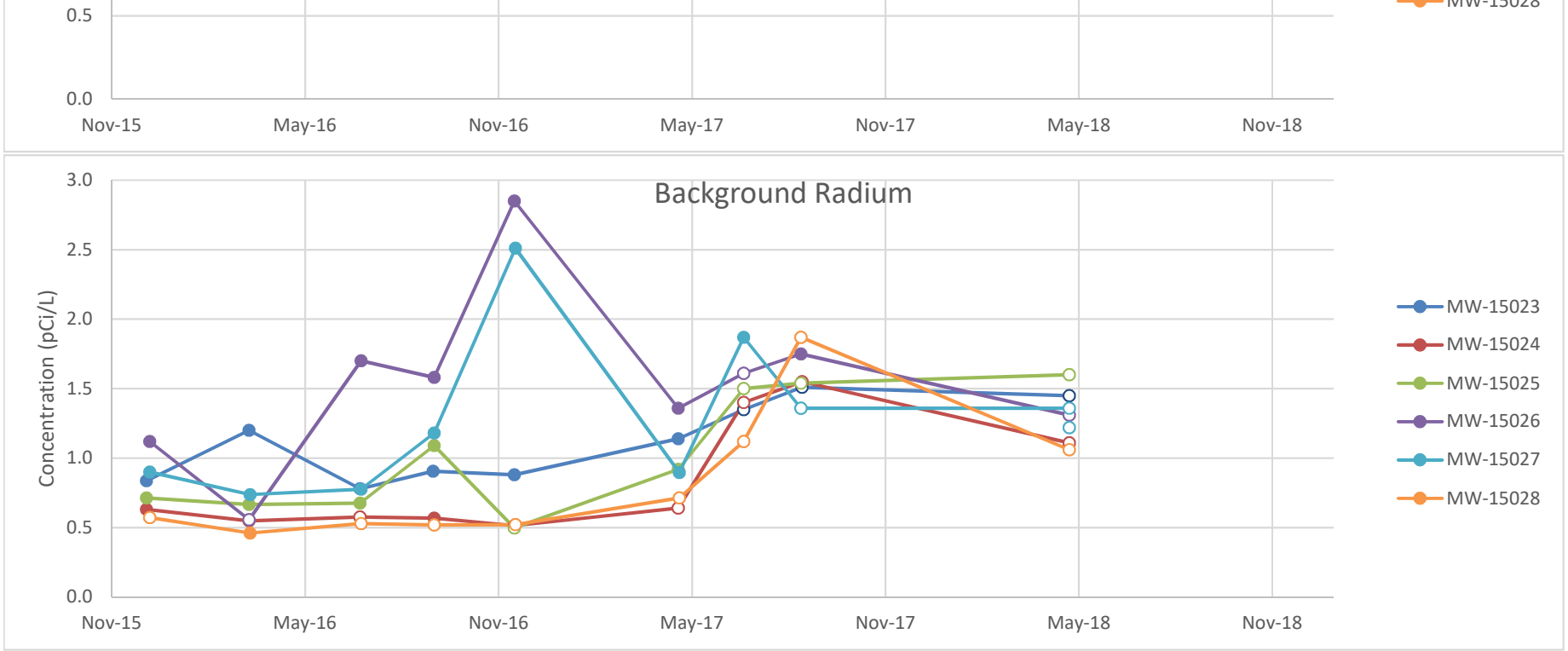
Figures

Figure 1
Background Concentration Time-Series Charts
JH Campbell Site - Appendix IV Constituents









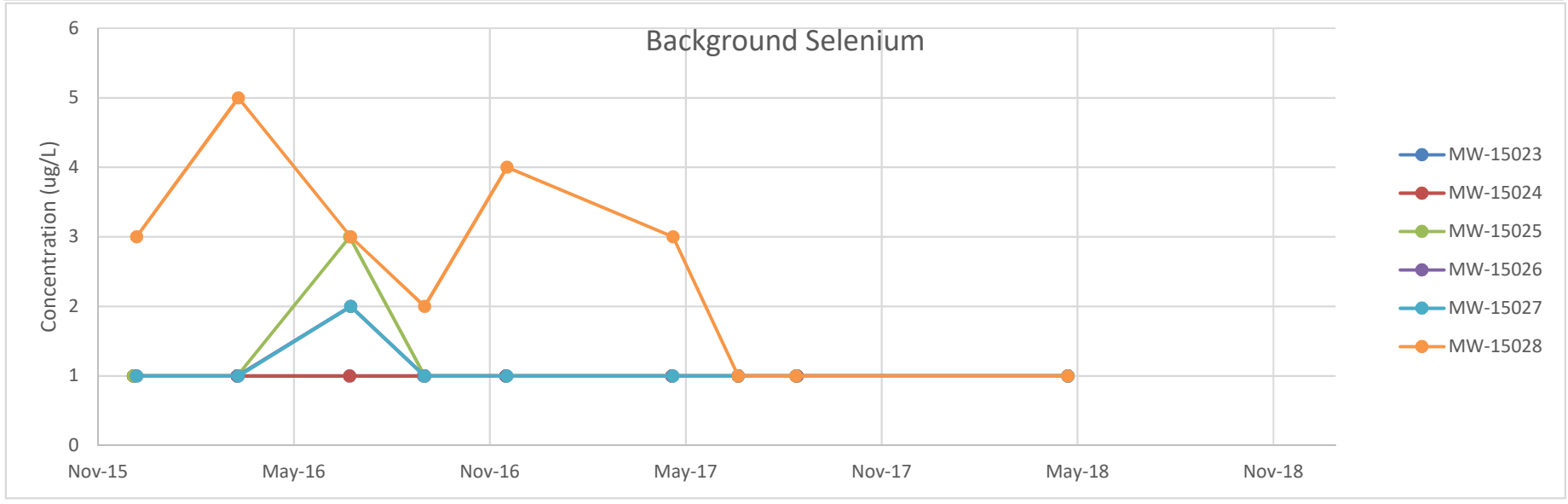
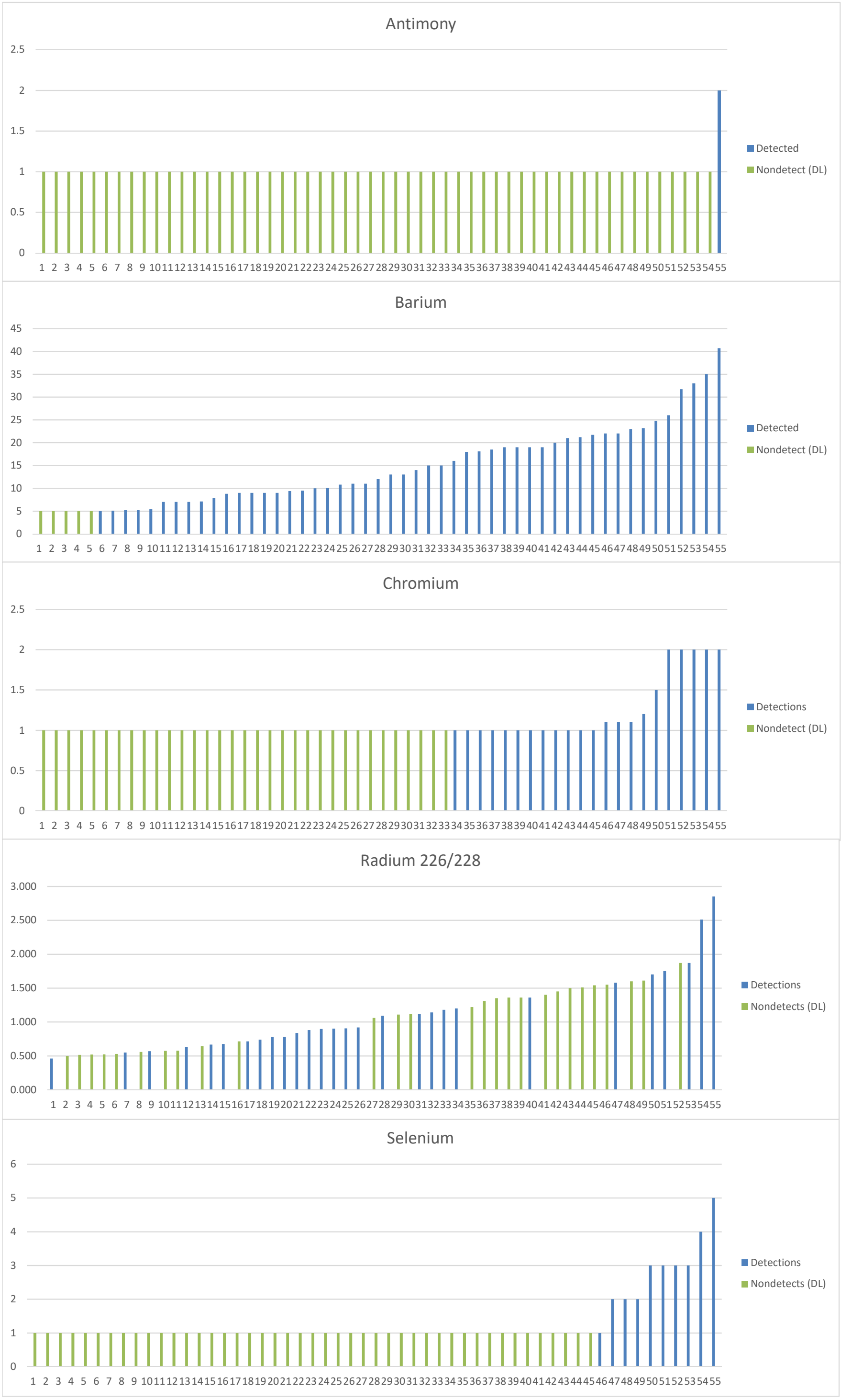


Figure 2
Cumulative Background Concentrations - Appendix IV
JH Campbell Site



Technical Memorandum

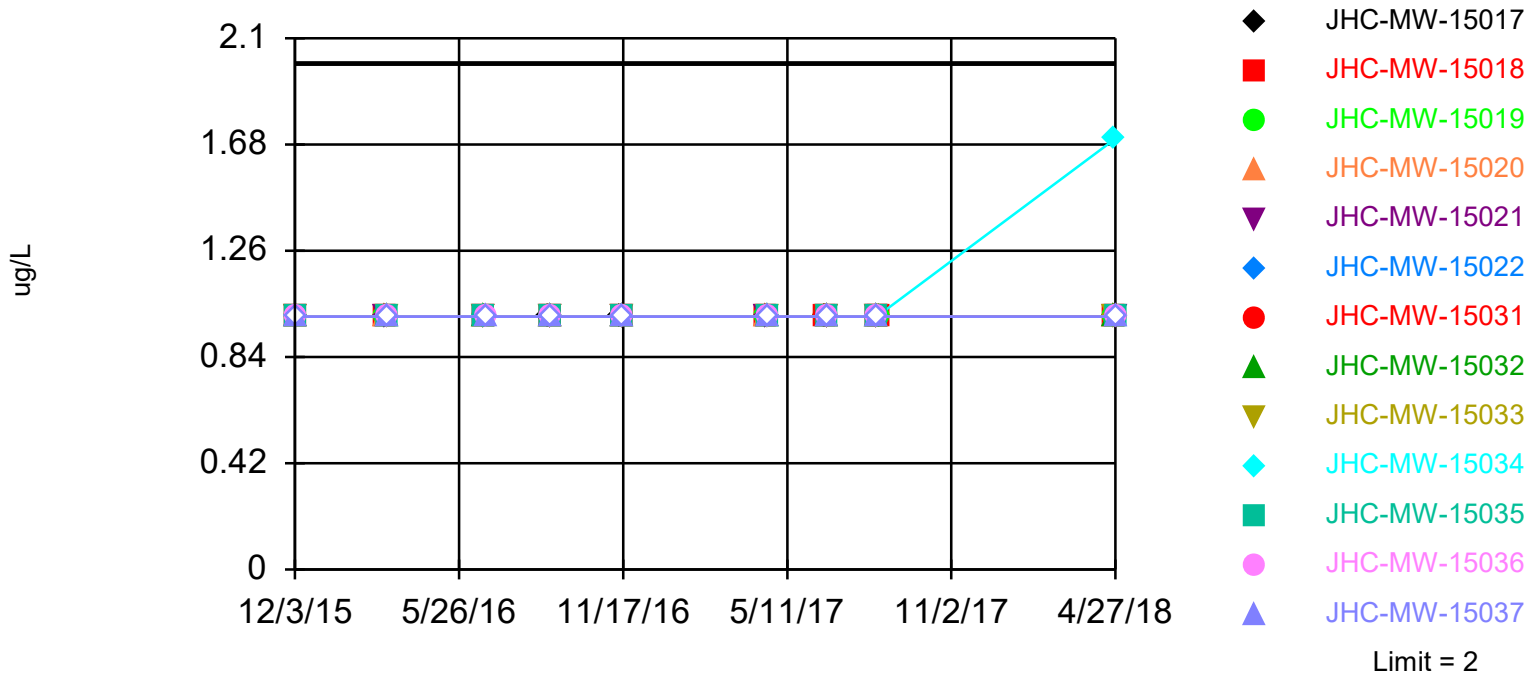
Sanitas™ Output Files

Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. Limit is highest of 54 background values. 98.15% NDs. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at alpha=0.5. Report alpha = 0.06267.

Constituent: Antimony, Total Analysis Run 6/12/2018 10:31 AM

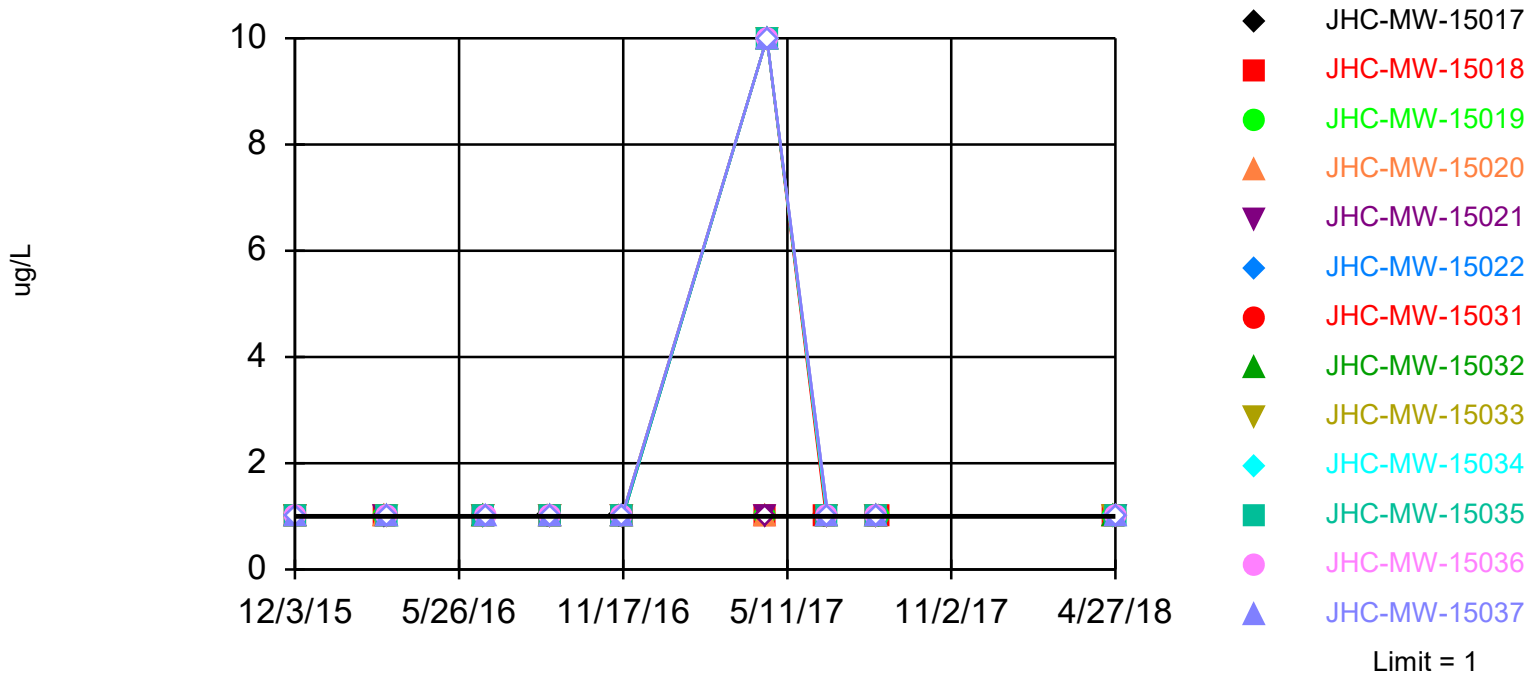
Client: Consumers Energy Data: JHC_Landfill_Sanitas

Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at alpha=0.5. Report alpha = 0.06267.

Constituent: Arsenic, Total Analysis Run 6/12/2018 10:32 AM

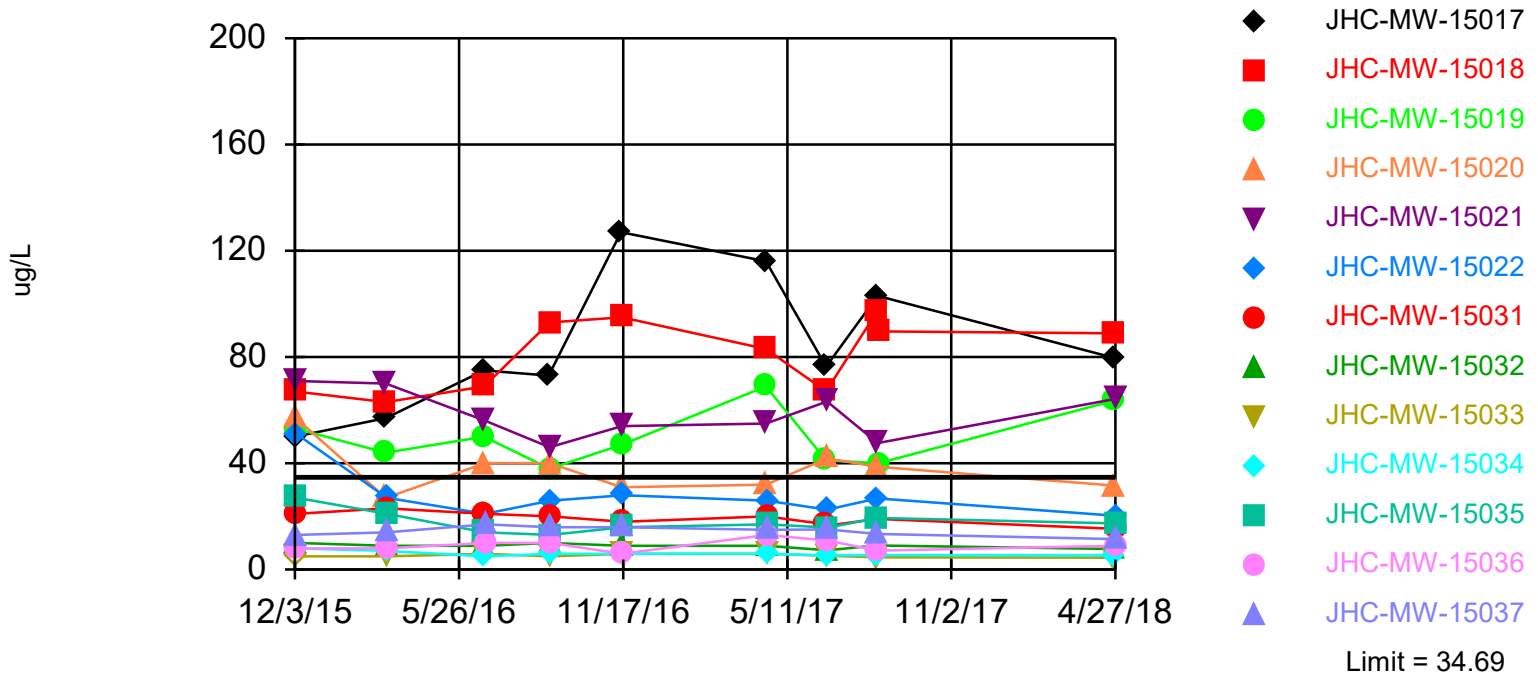
Client: Consumers Energy Data: JHC_Landfill_Sanitas

Hollow symbols indicate censored values.

Exceeds Limit: JHC-MW-15017, JHC-MW-15018, JHC-MW-15019, JHC-MW-15021

Tolerance Limit

Interwell Parametric



Limit = 34.69

95% coverage. Most recent observation is compared with limit. Background Data Summary (based on square root transformation): Mean=3.677, Std. Dev.=1.084, n=54, 9.259% NDs. Normality test: Shapiro Francia @alpha = 0.01, calculated = 0.9563, critical = 0.939. Report alpha = 0.05.

Constituent: Barium, Total Analysis Run 6/12/2018 10:32 AM

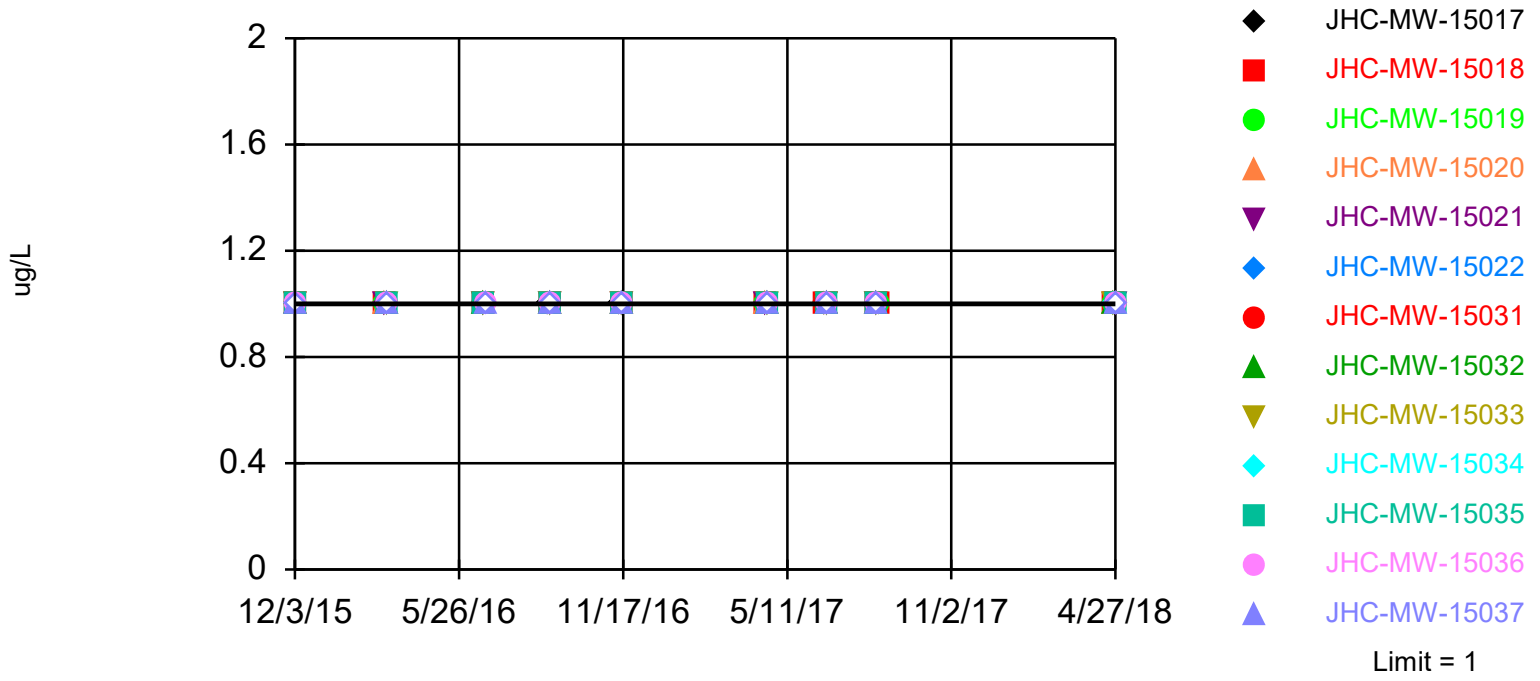
Client: Consumers Energy Data: JHC_Landfill_Sanitas

Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at alpha=0.5. Report alpha = 0.06267.

Constituent: Beryllium, Total Analysis Run 6/12/2018 10:33 AM

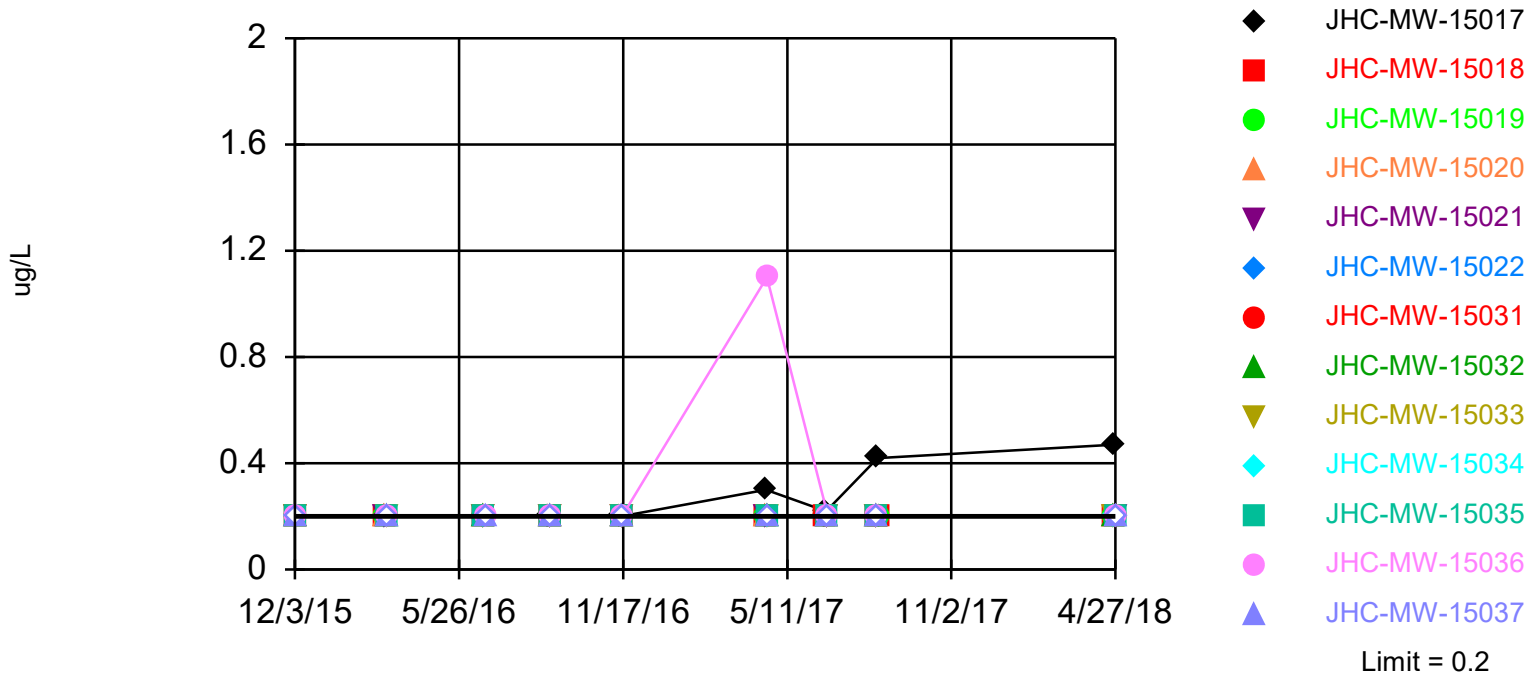
Client: Consumers Energy Data: JHC_Landfill_Sanitas

Hollow symbols indicate censored values.

Exceeds Limit: JHC-MW-15017

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at alpha=0.5. Report alpha = 0.06267.

Constituent: Cadmium, Total Analysis Run 6/12/2018 10:33 AM

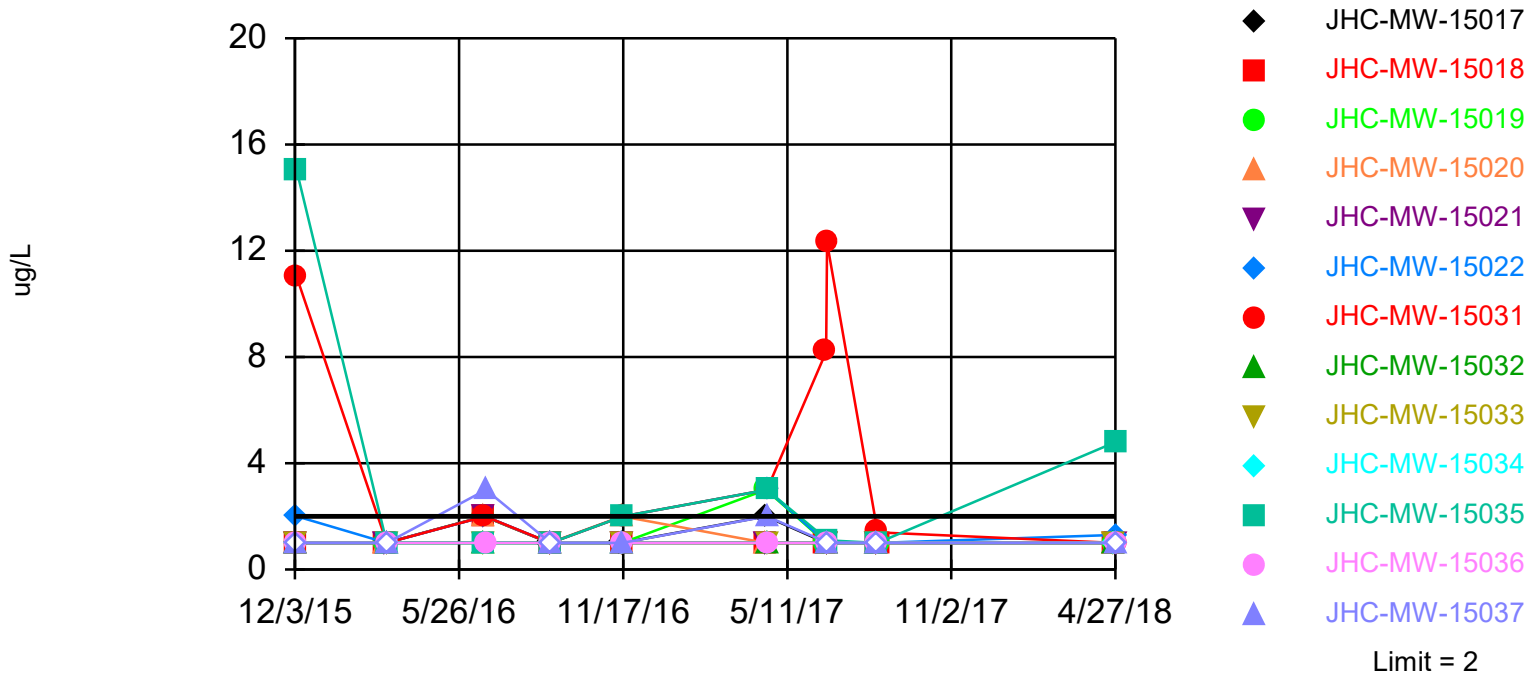
Client: Consumers Energy Data: JHC_Landfill_Sanitas

Hollow symbols indicate censored values.

Exceeds Limit: JHC-MW-15035

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. Limit is highest of 54 background values. 59.26% NDs. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at alpha=0.5. Report alpha = 0.06267.

Constituent: Chromium, Total Analysis Run 6/12/2018 10:34 AM

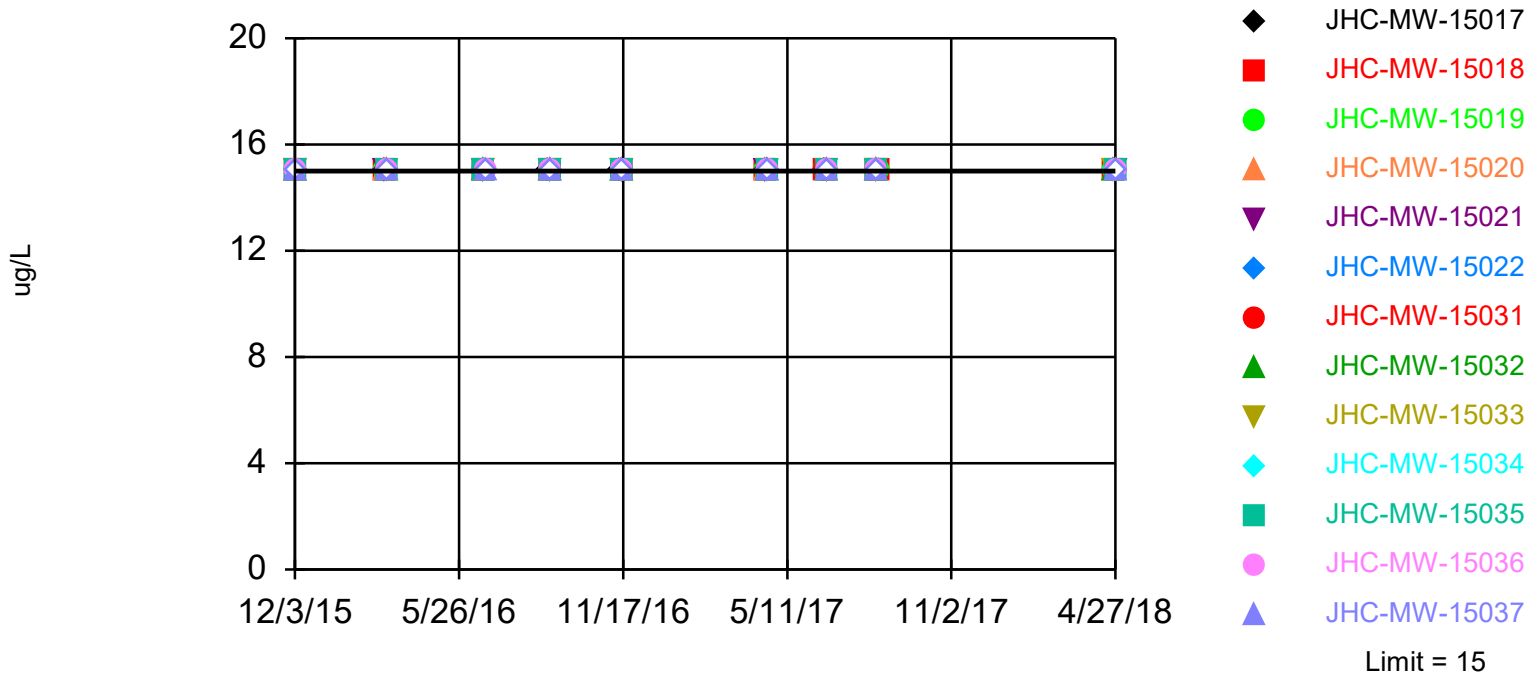
Client: Consumers Energy Data: JHC_Landfill_Sanitas

Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at alpha=0.5. Report alpha = 0.06267.

Constituent: Cobalt, Total Analysis Run 6/12/2018 10:34 AM

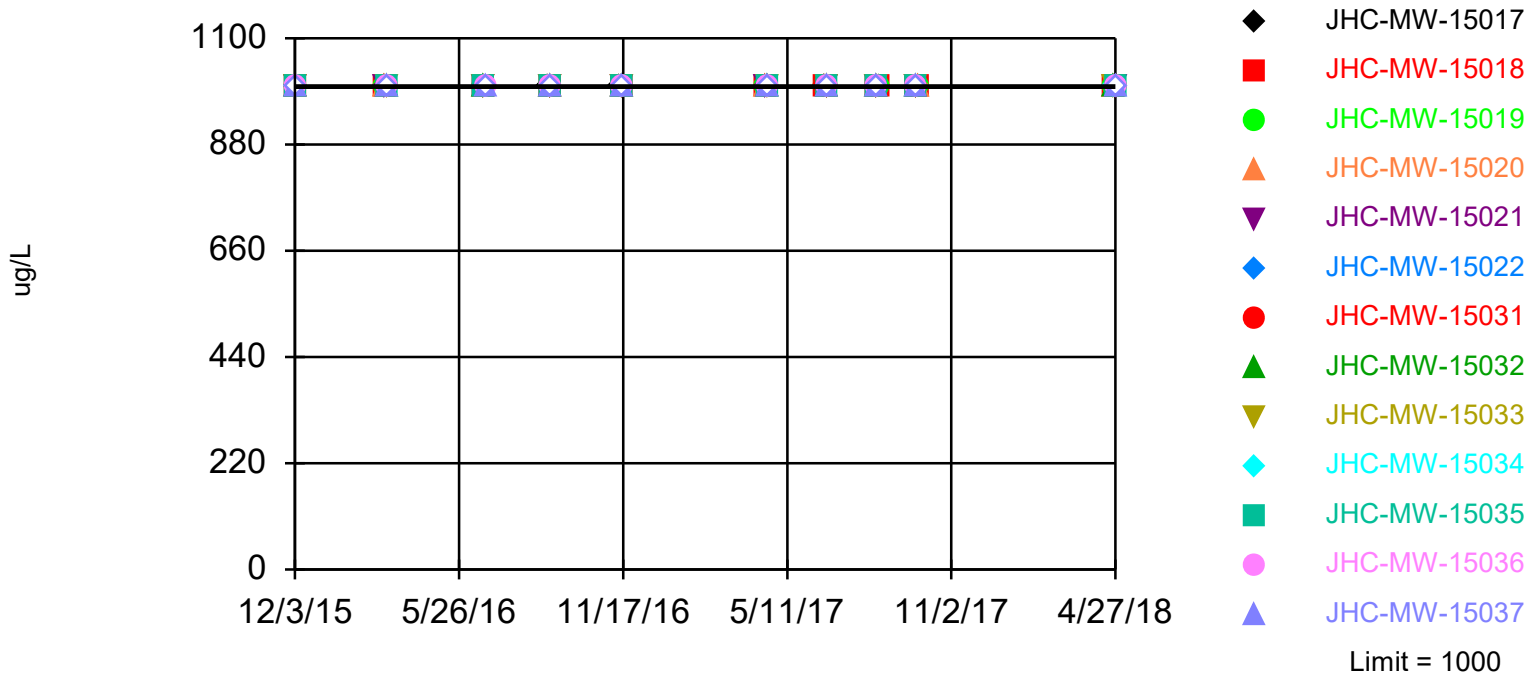
Client: Consumers Energy Data: JHC_Landfill_Sanitas

Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 92.77% coverage at alpha=0.01; 95.12% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.04607.

Constituent: Fluoride Analysis Run 6/12/2018 10:35 AM

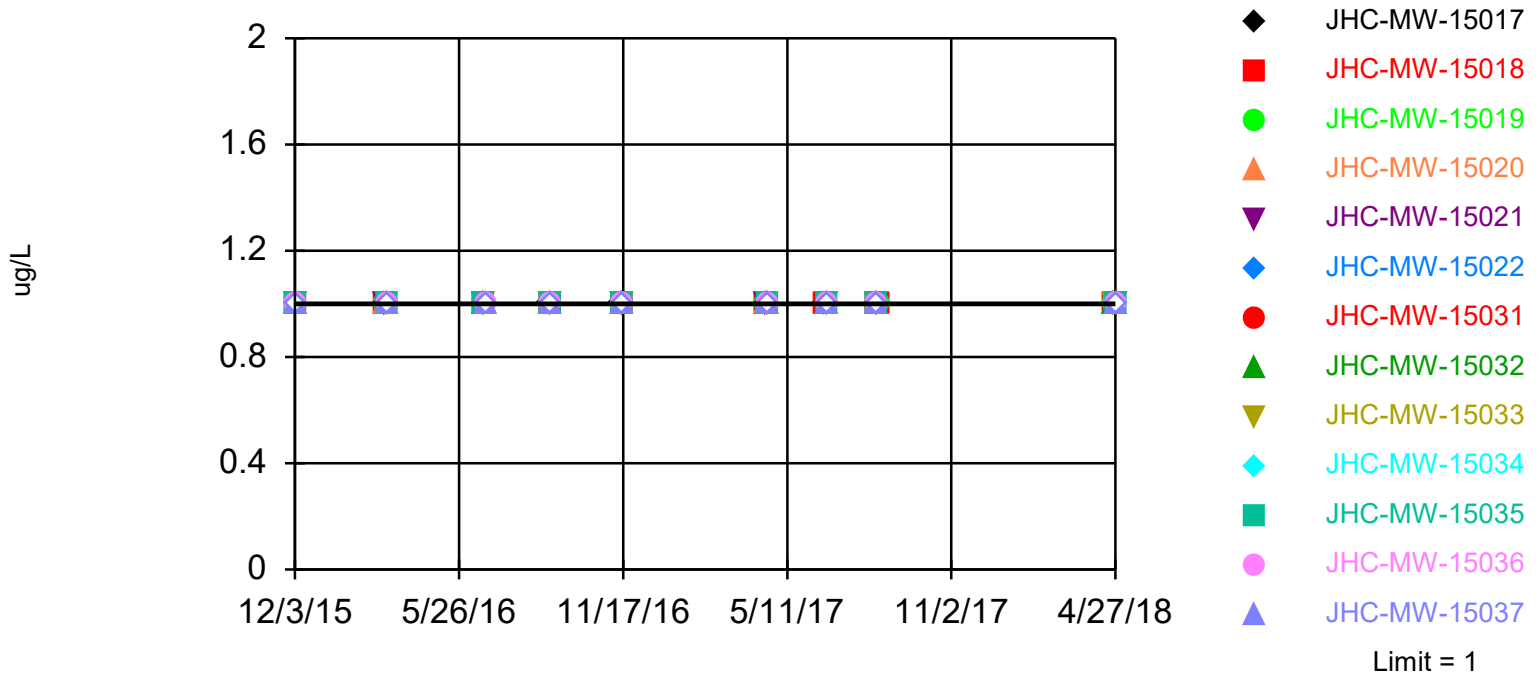
Client: Consumers Energy Data: JHC_Landfill_Sanitas

Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at alpha=0.5. Report alpha = 0.06267.

Constituent: Lead, Total Analysis Run 6/12/2018 10:35 AM

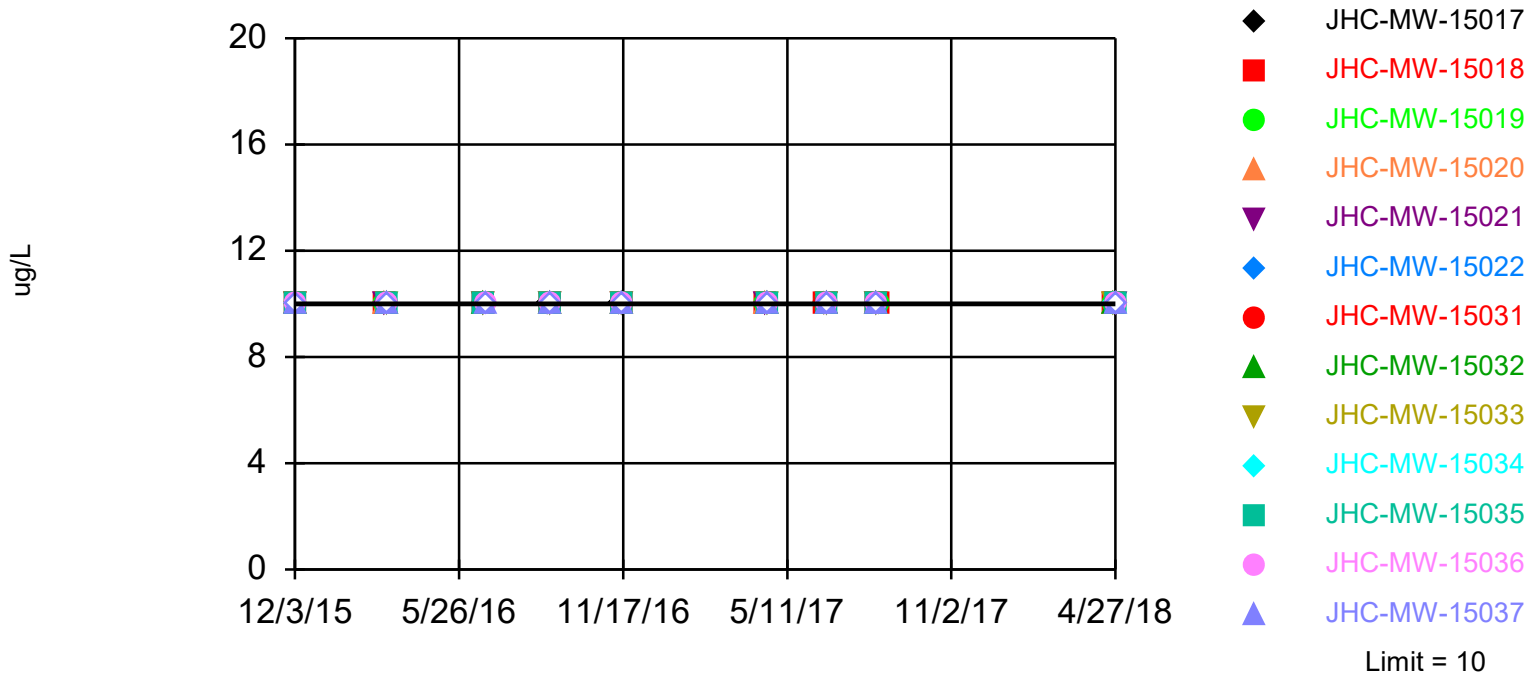
Client: Consumers Energy Data: JHC_Landfill_Sanitas

Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at alpha=0.5. Report alpha = 0.06267.

Constituent: Lithium, Total Analysis Run 6/12/2018 10:36 AM

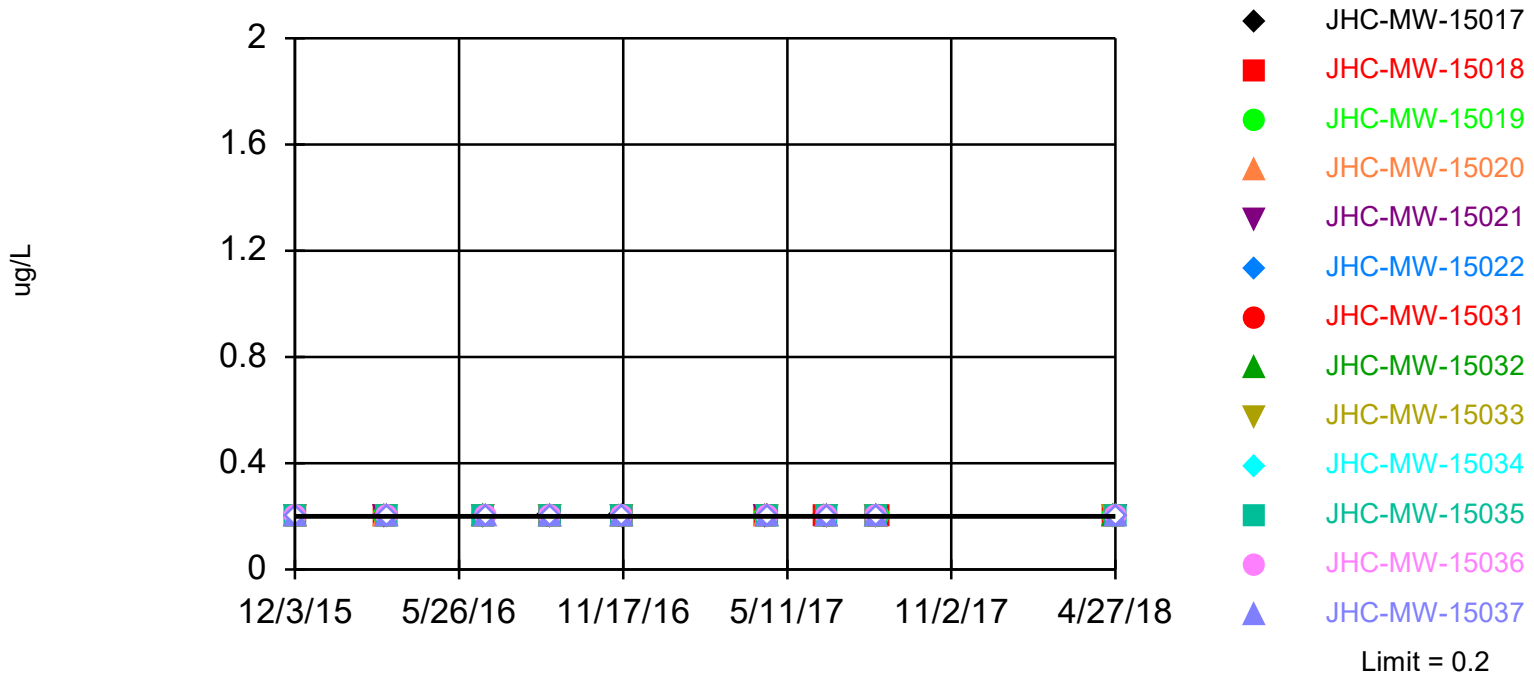
Client: Consumers Energy Data: JHC_Landfill_Sanitas

Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at alpha=0.5. Report alpha = 0.06267.

Constituent: Mercury, Total Analysis Run 6/12/2018 11:38 AM

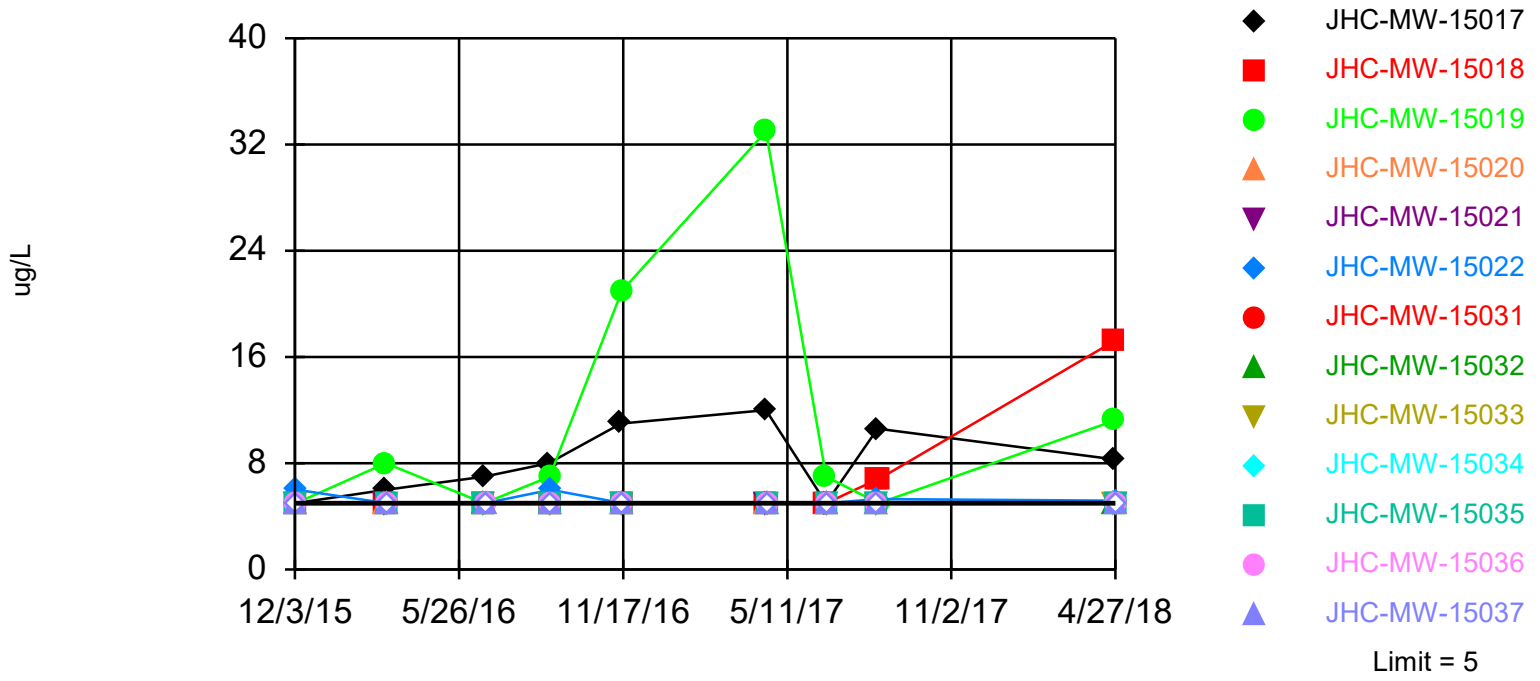
Client: Consumers Energy Data: JHC_Landfill_Sanitas

Hollow symbols indicate censored values.

Exceeds Limit: JHC-MW-15017, JHC-MW-15018, JHC-MW-15019, JHC-MW-15022

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at alpha=0.5. Report alpha = 0.06267.

Constituent: Molybdenum, Total Analysis Run 6/12/2018 10:36 AM

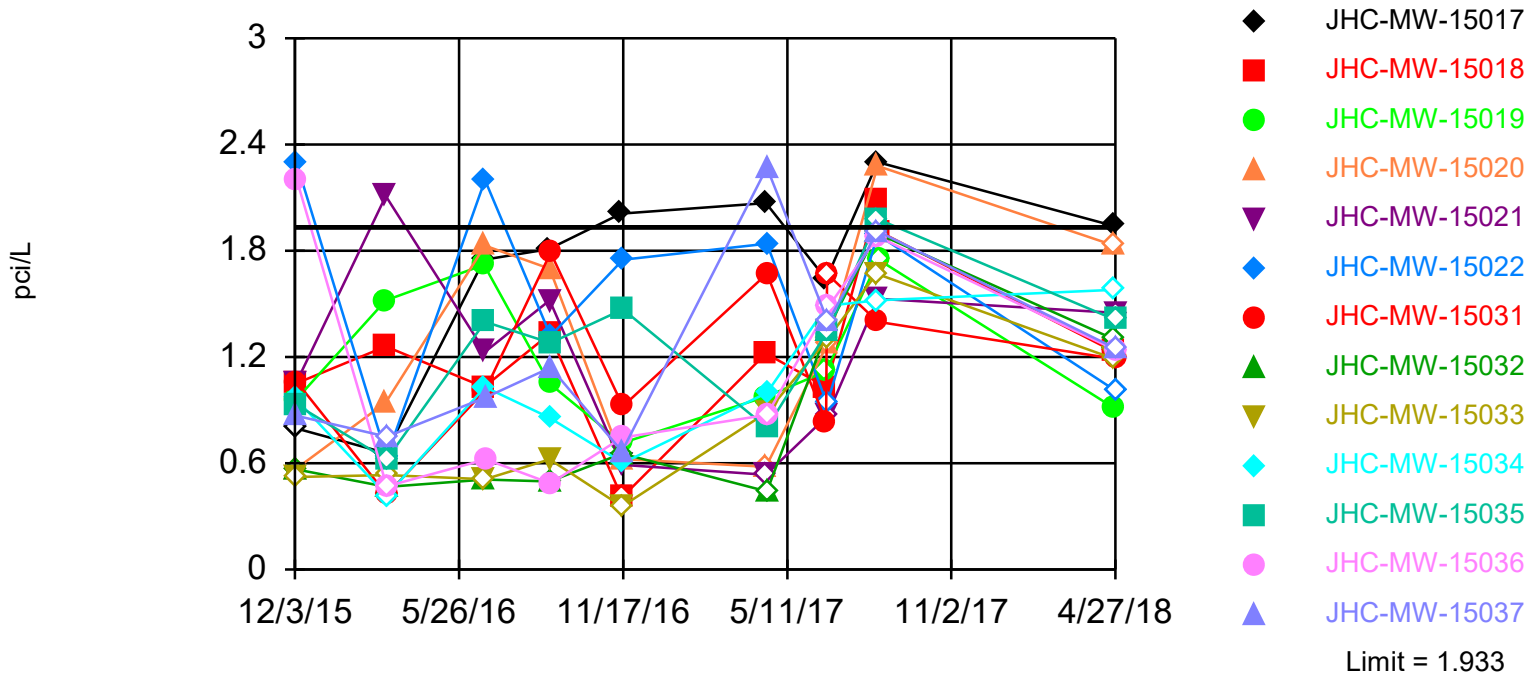
Client: Consumers Energy Data: JHC_Landfill_Sanitas

Hollow symbols indicate censored values.

Exceeds Limit: JHC-MW-15017

Tolerance Limit

Interwell Parametric



95% coverage. Most recent observation is compared with limit. Background Data Summary (based on square root transformation) (after Kaplan-Meier Adjustment): Mean=0.9101, Std. Dev.=0.2351, n=54, 48.15% NDs. Normality test: Shapiro Francia @alpha = 0.01, calculated = 0.9529, critical = 0.939. Report alpha = 0.05.

Constituent: Radium-226/228 Analysis Run 6/12/2018 10:37 AM

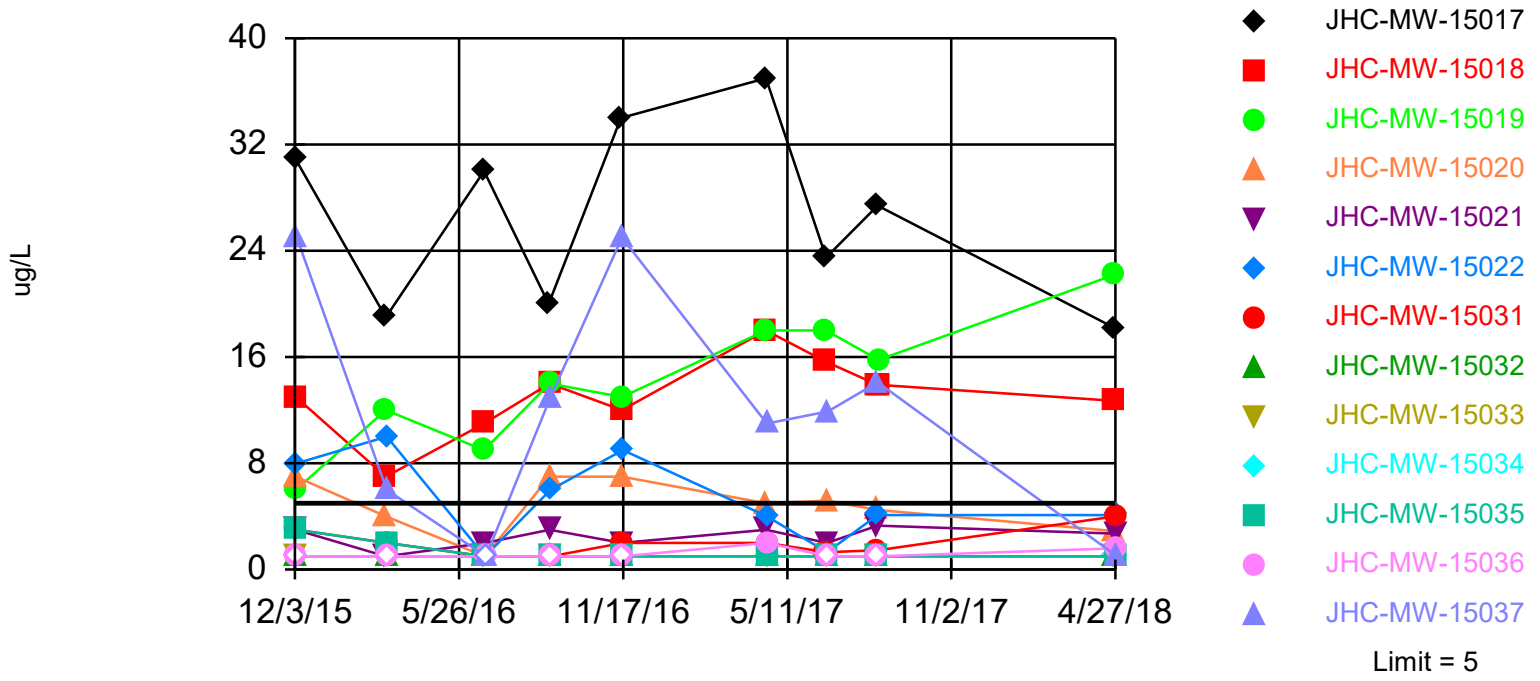
Client: Consumers Energy Data: JHC_Landfill_Sanitas

Hollow symbols indicate censored values.

Exceeds Limit: JHC-MW-15017, JHC-MW-15018, JHC-MW-15019

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. Limit is highest of 54 background values. 81.48% NDs. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at alpha=0.5. Report alpha = 0.06267.

Constituent: Selenium, Total Analysis Run 6/12/2018 10:37 AM

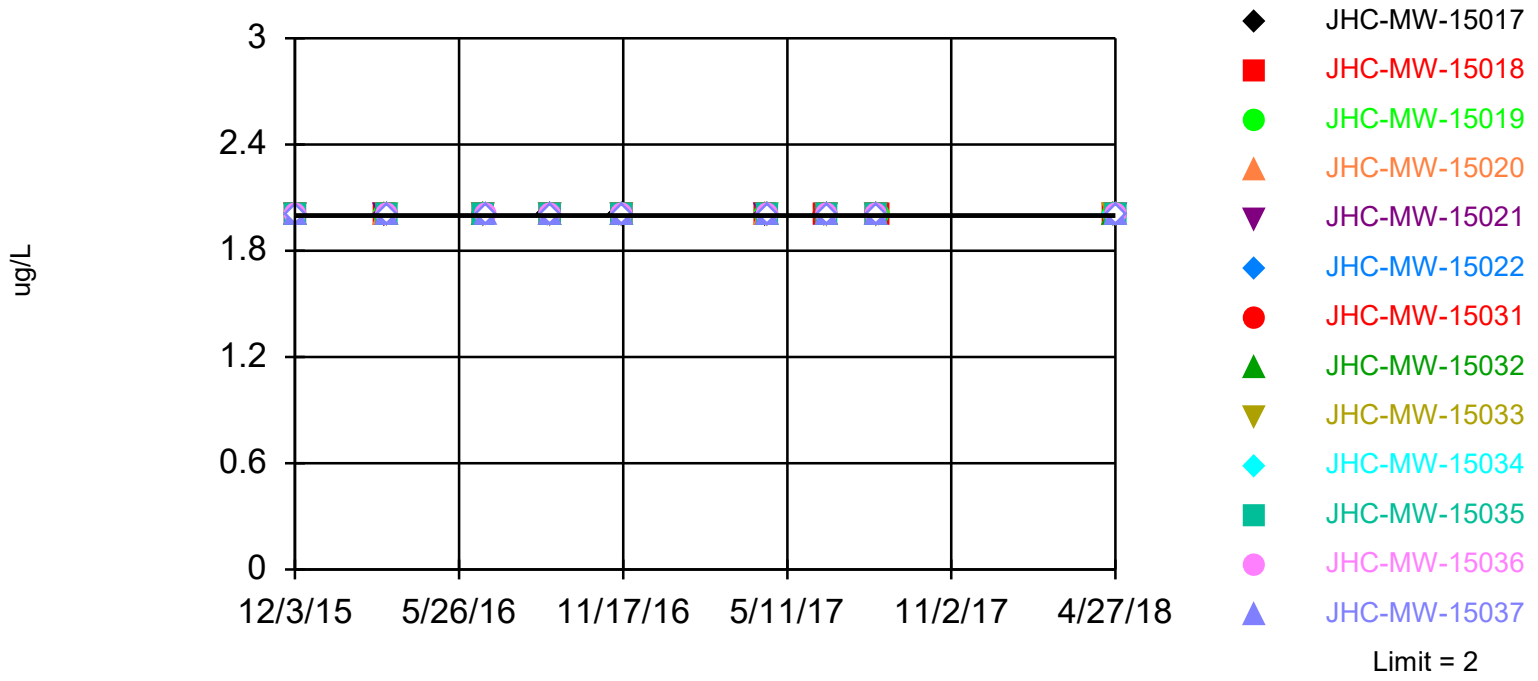
Client: Consumers Energy Data: JHC_Landfill_Sanitas

Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at alpha=0.5. Report alpha = 0.06267.

Constituent: Thallium, Total Analysis Run 6/12/2018 10:38 AM

Client: Consumers Energy Data: JHC_Landfill_Sanitas