



**2018 Annual Groundwater Monitoring  
Report**

**JH Campbell Power Plant  
Pond A CCR Unit  
West Olive, Michigan**

**January 2019**



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JH Campbell Power Plant  
Pond A CCR Unit

*West Olive, Michigan*

**January 2019**

*Prepared For  
Consumers Energy Company*

A handwritten signature in black ink, appearing to read "Sarah B. Holmstrom".

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Sarah B. Holmstrom, P.G.  
Project Hydrogeologist

A handwritten signature in black ink, appearing to read "Graham Crockford".

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Graham Crockford, C.P.G.  
Program Manager

TRC | Consumers Energy Company

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# Table of Contents

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Executive Summary .....	iii
1. Introduction.....	1
1.1 Program Summary .....	1
1.2 Site Overview.....	2
1.3 Geology/Hydrogeology.....	3
2. Groundwater Monitoring.....	4
2.1 Monitoring Well Network .....	4
2.2 Preliminary Assessment Monitoring.....	5
2.2.1 Data Summary .....	5
2.2.2 Data Quality Review.....	6
2.2.3 Groundwater Flow Rate and Direction.....	6
2.3 Semiannual Groundwater Monitoring .....	7
2.3.1 Data Summary .....	7
2.3.2 Data Quality Review.....	8
2.3.3 Groundwater Flow Rate and Direction.....	8
3. Statistical Evaluation.....	9
3.1 Establishing Groundwater Protection Standards.....	9
3.2 Data Comparison to Groundwater Protection Standards.....	9
4. Conclusions and Recommendations.....	11
5. References .....	12

## List of Tables

Table 1	Summary of Groundwater Elevation Data – April & June 2018
Table 2	Summary of Field Parameter Results – April & June 2018
Table 3	Summary of Groundwater Sampling Results (Analytical) – April & June 2018

## List of Figures

Figure 1	Site Location Map
Figure 2	Site Plan With CCR Monitoring Well Locations
Figure 3	Groundwater Contour Map – April 24, 2018
Figure 4	Groundwater Contour Map – June 18, 2018

## List of Appendices

Appendix A	Monitoring Well Installation & Decommissioning Logs
Appendix B	Data Quality Reviews
Appendix C	Groundwater Protection Standards

# Executive Summary

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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) Pond A CCR unit 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 Pond A CCR unit.

In the January 31, 2018 *Annual Groundwater Monitoring Report for the JH Campbell Power Plant Pond A CCR Unit*, covering calendar year 2017 activities CEC reported that boron and sulfate 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 JHC Pond A 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 in June 2018 for the Appendix III and Appendix IV constituents 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 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

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### 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) Pond A CCR unit 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 Pond A CCR unit.

In the January 31, 2018 *Annual Groundwater Monitoring Report for the JH Campbell Power Plant Pond A CCR Unit* (2017 Annual Report), covering calendar year 2017 activities CEC reported that boron and sulfate 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 JHC Pond A 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, 156<sup>th</sup> 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 Pond A CCR unit.

### **1.3 Geology/Hydrogeology**

The upgradient/background wells are located to the north-northwest of the JHC Pond A 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 Site toward the Pigeon River. Mounding of groundwater is observed in the immediate vicinity of the CCR unit, such that there is a localized radial flow component around the unit. 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 feet 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 feet bgs.

# Section 2

## Groundwater Monitoring

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### 2.1 Monitoring Well Network

In accordance with 40 CFR 257.91, CEC established a groundwater monitoring system for the JHC Pond A CCR unit, which consists of 12 monitoring wells (six background monitoring wells and six downgradient monitoring wells) that are screened in the uppermost aquifer. The monitoring well locations are shown on Figure 2. Six monitoring wells located north-northwest of the JHC Pond A CCR unit 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 and sulfate 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 JHC Unit Pond A 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-15006 through JHC-MW-15011 and background monitoring wells JHC-MW-15023 through JHC-MW-15028 were sampled during this monitoring 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 constituents, field parameters including dissolved oxygen, oxidation reduction potential, specific conductivity, temperature, and turbidity were collected at each well. Samples were collected and analyzed according to 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 6 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 was performed on November 12 through November 16, 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 6 downgradient 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 laboratory analysis is complete 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 measured during these assessment monitoring events 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 parameters that could potentially migrate from the Pond A CCR unit.

# Section 3

## Statistical Evaluation

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### 3.1 Establishing Groundwater Protection Standards

In accordance with §257.95(h) and the *Groundwater Statistical Evaluation Plan* (Stats Plan) (TRC, October 2017), groundwater protection standards (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 Pond A 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). Notifications of the statistical analysis of the assessment monitoring data, if necessary, will be made in accordance with §257.106(h) and §257.107(h).

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

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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 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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# Tables

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**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)		
<b>Background</b>															
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
<b>Unit 1N, 1S, 2N, 2S</b>															
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 <sup>(1)</sup>	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
<b>Unit 3N, 3S</b>															
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 <sup>(2)</sup>	Sand	28.0	to	38.0	603.8	to	593.8	40.0	591.81	32.24	602.40	29.23	603.29 <sup>(3)</sup>
<b>Landfill</b>															
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 <sup>(1)</sup>	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 <sup>(1)</sup>	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
<b>Pond A</b>															
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 Pond A – RCRA CCR Monitoring Program  
 West Olive, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
<b>Background</b>							
JHC-MW-15023	4/25/2018	5.80	249.5	6.1 <sup>(1)</sup>	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 <sup>(1)</sup>	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 <sup>(1)</sup>	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 <sup>(1)</sup>	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 <sup>(1)</sup>	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 <sup>(1)</sup>	67	8.7	3.5
	6/18/2018	5.95	56.6	8.1	72	15.2	3.1
<b>Pond A</b>							
JHC-MW-15006	4/25/2018	1.79	45.6	8.0	355	10.2	3.4
	6/20/2018	6.24	123.2	7.4	350	13.6	4.8
JHC-MW-15007	4/26/2018	5.80	318.0	8.4 <sup>(1)</sup>	421	8.9	<1.0
	6/20/2018	6.96	118.9	7.4	362	14.4	5.3
JHC-MW-15008	4/26/2018	9.19	296.5	7.9 <sup>(1)</sup>	409	8.4	2.1
	6/20/2018	8.78	117.9	7.2	379	9.3	1.4
JHC-MW-15009	4/26/2018	8.10	299.0	8.4 <sup>(1)</sup>	399	7.3	3.0
	6/20/2018	1.97	113.6	7.7	387	8.7	3.2
JHC-MW-15010	4/26/2018	4.50	276.0	8.0 <sup>(1)</sup>	409	7.9	5.0
	6/20/2018	3.78	107.9	7.3	416	9.2	2.6
JHC-MW-15011	4/25/2018	0.25	-151.8	8.5	293	12.5	1.7
	6/19/2018	0.40	17.1	8.1	326	12.4	2.5

**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.

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

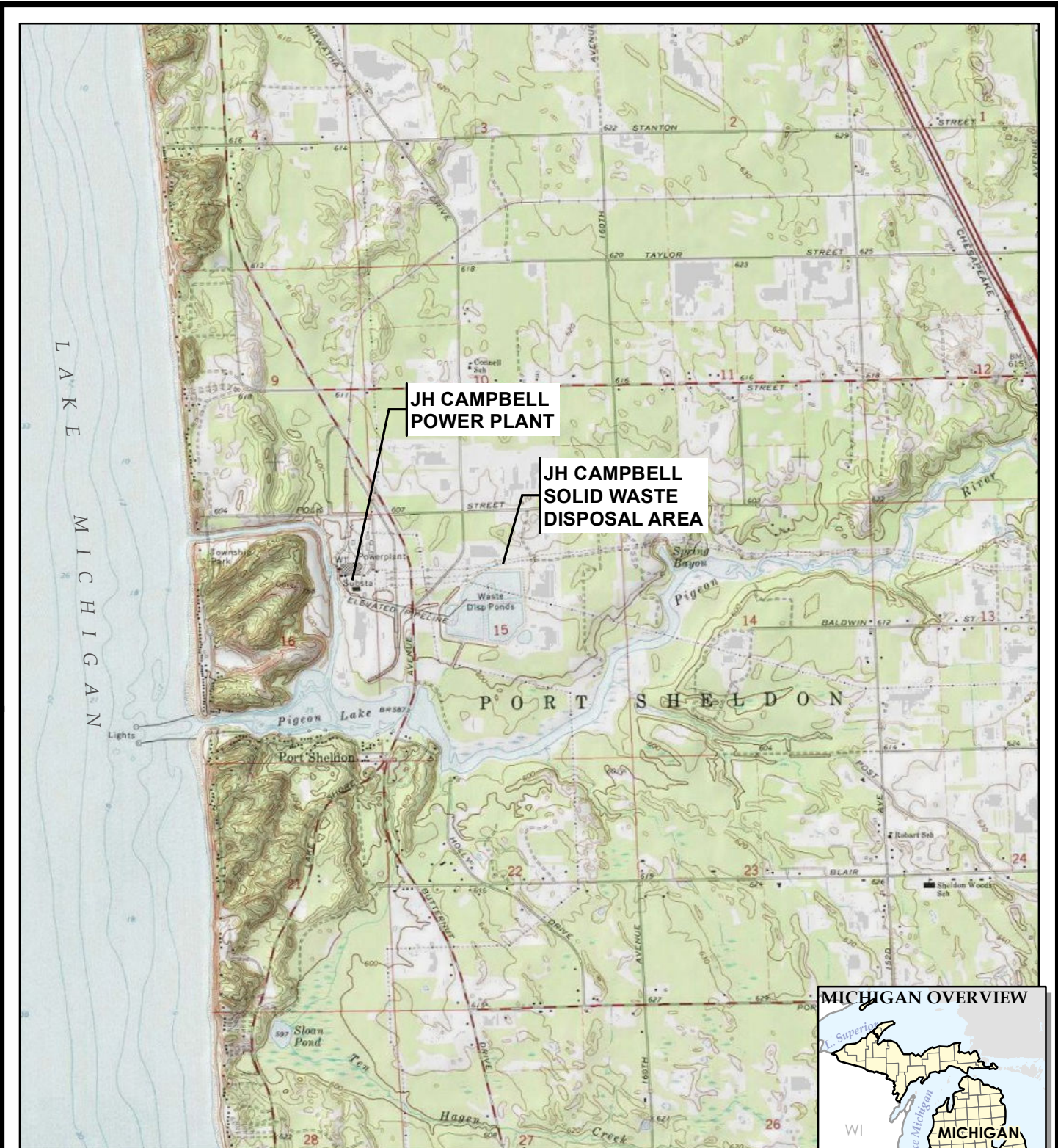
		Sample Location:				JHC-MW-15006		JHC-MW-15007		JHC-MW-15008		JHC-MW-15009		JHC-MW-15010		JHC-MW-15011	
		Sample Date:				4/25/18	6/20/18	4/26/18	6/20/18	4/26/18	6/20/18	4/26/18	6/20/18	4/26/18	6/20/18	4/25/18	6/19/18
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient											
<b>Appendix III</b>																	
Boron	ug/L	NC	500	500	7,200	--	144	--	157	--	87.7	--	91.4	--	98.4	--	229
Calcium	mg/L	NC	NC	NC	500	--	38.5	--	38.7	--	39.0	--	41.2	--	40.9	--	30.3
Chloride	mg/L	250**	250	250	500	--	17.2	--	17.5	--	20.4	--	22.9	--	22.2	--	23.0
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
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	8.0	7.4	8.4 <sup>(1)</sup>	7.4	7.9 <sup>(1)</sup>	7.2	8.0 <sup>(1)</sup>	7.7	8.0 <sup>(1)</sup>	7.3	8.5 <sup>(1)</sup>	8.1
Sulfate	mg/L	250**	250	250	500	--	27.5	--	26.2	--	25.5	--	18.2	--	39.9	--	26.1
Total Dissolved Solids	mg/L	500**	500	500	500	--	376	--	298	--	210	--	214	--	294	--	180
<b>Appendix IV</b>																	
Antimony	ug/L	6	6	6	130	< 1.0	< 1.0	< 1.0	< 1.0	1.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	<b>10</b>	<b>10</b>	<b>10</b>	<b>10</b>	4.8	4.3	3.3	2.9	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	<b>16.8</b>	<b>15.0</b>
Barium	ug/L	2,000	2,000	2,000	820	158	141	121	115	118	120	130	130	137	122	116	123
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	1.5	1.5	< 1.0	1.2	1.3	1.5	1.3	< 1.0	1.4	1.1	< 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	13	12	11	15	14	15	< 10	< 10	10	< 10	14	11
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	5.4	< 5.0	< 5.0	5.8	5.1	5.5	< 5.0	11.0	7.6	8.2	8.2
Radium-226	pCi/L	NC	NC	NC	NC	< 0.896	< 0.540	< 1.03	< 0.736	< 0.493	0.928	< 0.169	< 0.631	0.505	< 0.489	< 0.702	< 0.463
Radium-226/228	pCi/L	5	NC	NC	NC	< 1.68	< 1.50	< 2.05	< 1.86	< 1.34	1.56	< 1.43	< 1.27	< 1.20	< 1.14	< 1.27	< 1.34
Radium-228	pCi/L	NC	NC	NC	NC	< 0.779	< 0.963	< 1.02	< 1.12	< 0.847	< 0.698	< 1.26	< 0.634	< 1.03	< 0.655	< 0.568	0.931
Selenium	ug/L	50	50	50	<b>5</b>	1.3	< 1.0	< 1.0	1.3	1.7	2.0	< 1.0	<b>10.3</b>	3.0	<b>11.0</b>	< 1.0	1.6
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.

# Figures

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BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.



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

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**

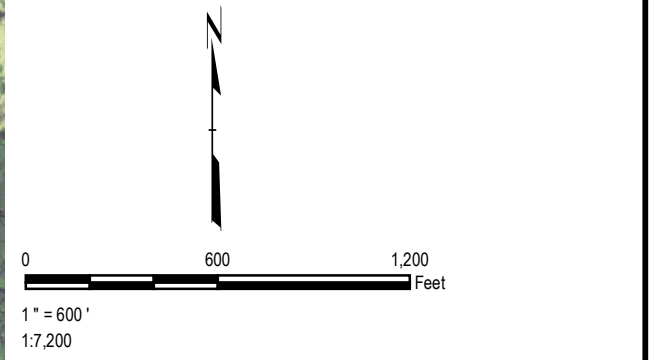




**LEGEND**

- 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)

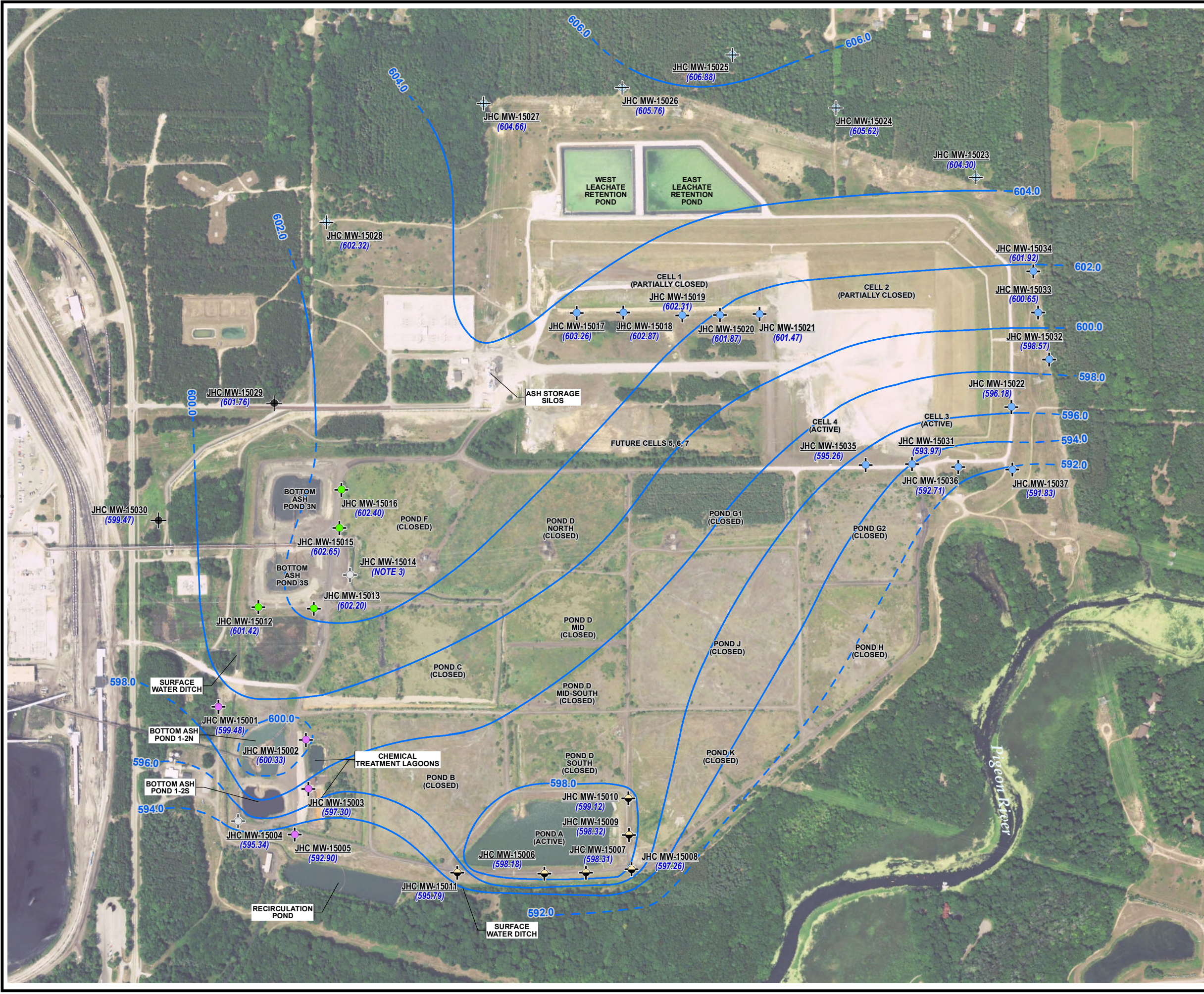
- NOTES**
1. BASE MAP IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/20/2016.
  2. WELL LOCATIONS SURVEYED BY NEDERVELD ON 11/25/2015.
  3. MONITORING WELL DECOMMISSIONED NOVEMBER 13, 2017.
  4. MONITORING WELL DECOMMISSIONED JUNE 14, 2018.
  5. MONITORING WELL DECOMMISSIONED OCTOBER 10,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



PROJECT:		<b>CONSUMERS ENERGY COMPANY JH CAMPBELL POWER PLANT WEST OLIVE, MICHIGAN</b>	
TITLE:		<b>SITE PLAN WITH CCR MONITORING WELL LOCATIONS</b>	
DRAWN BY:	J. PAPEZ	PROJ NO.:	290806-001
CHECKED BY:	S. HOLMSTROM	<b>FIGURE 2</b>	
APPROVED BY:	G. CROCKFORD		
DATE:	JANUARY 2019	FILE NO.: 290806-001-015.mxd	

1540 Eisenhower Place  
Ann Arbor, MI 48108-3284  
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www.trcsolutions.com



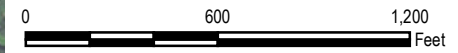


**LEGEND**

- BACKGROUND MONITORING WELL
- DECOMMISSIONED MONITORING WELL
- DOWNGRAIDENT BOTTOM ASH POND 1/2 N/S MONITORING WELL
- DOWNGRAIDENT BOTTOM ASH POND 3 N/S MONITORING WELL
- DOWNGRAIDENT 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**

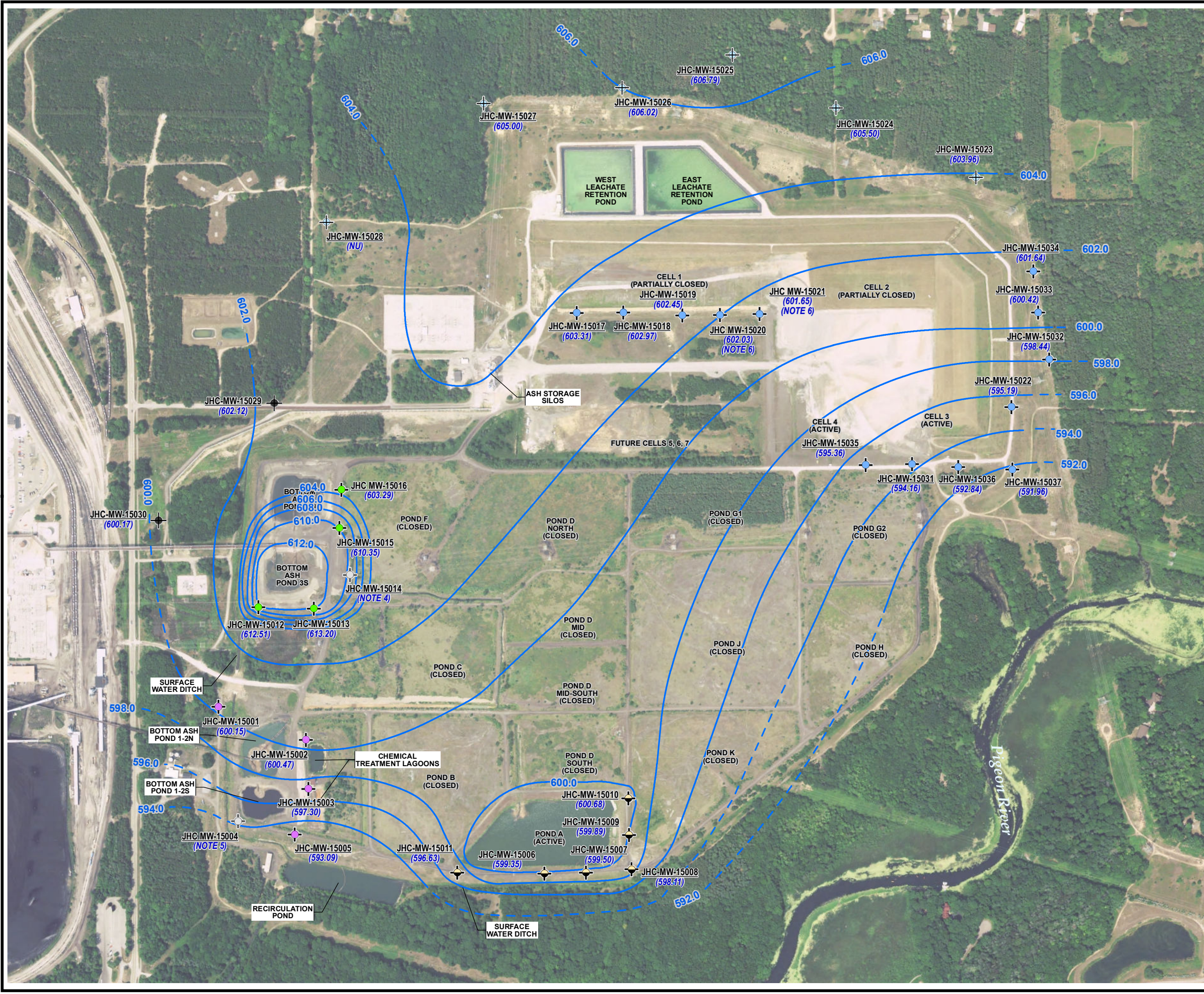
1. BASE MAP IMAGERY FROM USDAL-NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/20/2016.
2. WELL LOCATIONS SURVEYED BY NEDERVELD ON 11/25/2015.
3. MONITORING WELL DECOMMISSIONED NOVEMBER 13, 2017.
4. GROUNDWATER ELEVATIONS DISPLAYED IN FEET RELATIVE TO THE NORTH AMERICAN VERTICAL DATUM OF 1988.
5. ASH SLUICING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



1" = 600'  
1:7,200

PROJECT:		<b>CONSUMERS ENERGY COMPANY JH CAMPBELL POWER PLANT WEST OLIVE, MICHIGAN</b>	
TITLE:		<b>GROUNDWATER CONTOUR MAP APRIL 24, 2018</b>	
DRAWN BY:	S. MAJOR	PROJ NO.:	290806-001
CHECKED BY:	C. SCIESZKA	<b>FIGURE 3</b>	
APPROVED BY:	S. HOLMSTROM		
DATE:	NOVEMBER 2018		
		1540 Eisenhower Place Ann Arbor, MI 48108-3284 Phone: 734.971.7080 www.trcsolutions.com	
FILE NO.:	290806-001-007.mxd		



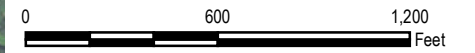


**LEGEND**

- BACKGROUND MONITORING WELL
- DECOMMISSIONED MONITORING WELL
- DOWNGRADEMENT BOTTOM ASH POND 1/2 N/S MONITORING WELL
- DOWNGRADEMENT BOTTOM ASH POND 3 N/S MONITORING WELL
- DOWNGRADEMENT 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.



1" = 600'  
1:7,200

<b>PROJECT:</b>	
<b>CONSUMERS ENERGY COMPANY JH CAMPBELL POWER PLANT WEST OLIVE, MICHIGAN</b>	
<b>TITLE:</b>	
<b>GROUNDWATER CONTOUR MAP JUNE 18, 2018</b>	
<b>DRAWN BY:</b> S. MAJOR	<b>PROJ NO.:</b> 290806-001
<b>CHECKED BY:</b> C. SCIESZKA	
<b>APPROVED BY:</b> S. HOLMSTROM	<b>FIGURE 4</b>
<b>DATE:</b> NOVEMBER 2018	
1540 Eisenhower Place Ann Arbor, MI 48108-3284 Phone: 734.971.7080 www.trcsolutions.com	
<b>FILE NO.:</b> 290806-001-010.mxd	



# Appendix A

## Monitoring Well Installation & Decommissioning Logs

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**WELL CONSTRUCTION LOG**

**WELL NO. JHC-MW-18001**

Facility/Project Name: <b>CEC JH Campbell</b>		Date Drilling Started: <b>12/3/18</b>	Date Drilling Completed: <b>12/3/18</b>	Project Number: <b>290806.0000 P1T5</b>	
Drilling Firm: <b>Stearns Drilling Company</b>	Drilling Method: <b>Geoprobe</b>	Surface Elev. (ft) <b>609.1</b>	TOC Elevation (ft) <b>611.98</b>	Total Depth (ft bgs) <b>17.0</b>	Borehole Dia. (in) <b>4</b>
Boring Location: Southwest corner of Pond 3N N: 519793.32 E: 12633635.68		Personnel Logged By - P. Lancaster Driller - R. Christiansen		Drilling Equipment: <b>6620 DT</b>	
Civil Town/City/or Village: <b>West Olive</b>	County: <b>Ottawa</b>	State: <b>Michigan</b>	Water Level Observations: While Drilling: Date/Time <b>12/3/18 00:00</b> ▽ Depth (ft bgs) <u>9.0</u> After Drilling: Date/Time <b>12/3/18 15:25</b> ▽ Depth (ft bgs) <u>8.0</u>		

SAMPLE	NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
	1 GP	95		0 - 5	<p><b>SILTY SAND</b> mostly medium sand, little fine sand, few to little silt, very dark grayish brown (10YR 3/2), moist, loose with vegetation debris. Change to no vegetation debris at 0.3 inches.</p> <p><b>SAND</b> mostly medium sand, little fine sand, light yellowish brown (10YR 6/4), moist, loose.</p>	SM			
	2 GP	95		5 - 10	<p>Change to mostly fine to medium sand at 5.0 feet.</p> <p>▼</p> <p>▽</p> <p>Change to very moist at 9.0 feet.</p> <p>Change to wet at 10.0 feet.</p>	SP			
	3 GP	100		10 - 15	<p>Grades to very pale brown (10YR 7/3) at 13.5 feet.</p>	SP			
	4 GP	0		15 - 17.0	<p>Blind push between 15.0 and 17.0 feet; lithology assumed sand based on prior investigations at site.</p> <p>End of boring at 17.0 feet below ground surface.</p>	SP			

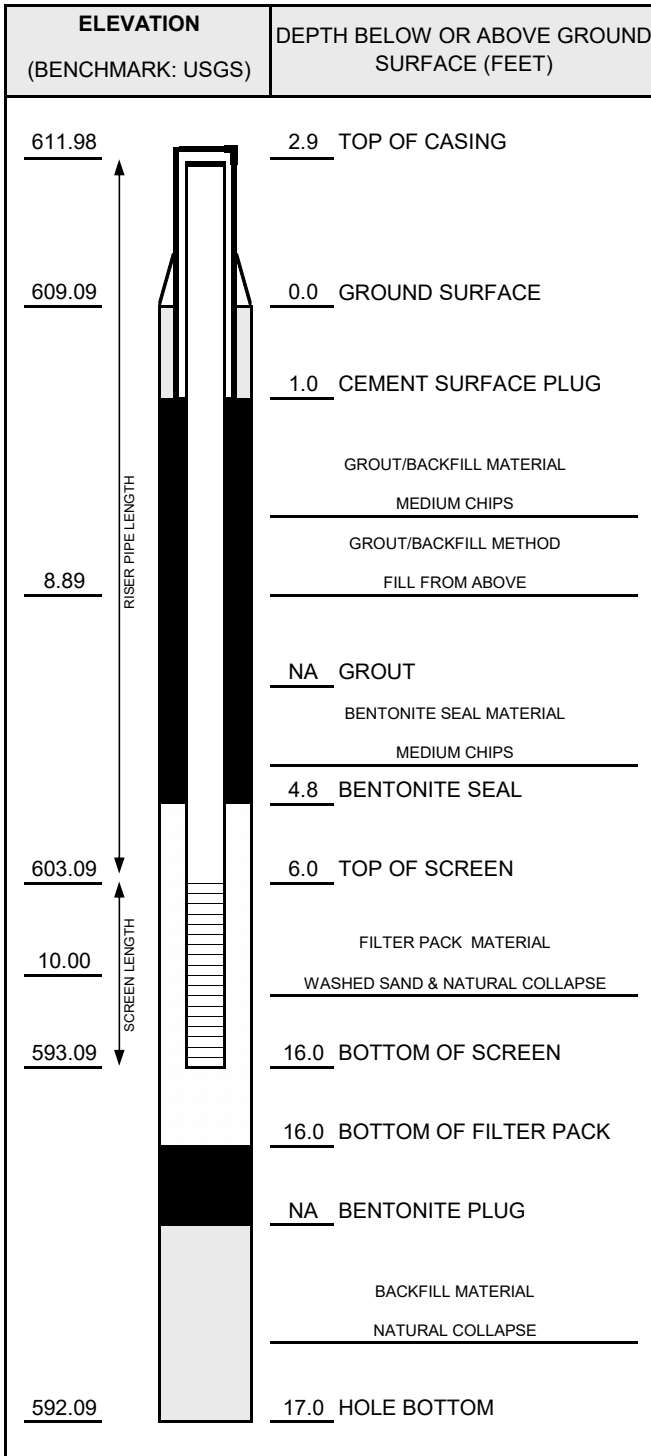
SOIL BORING WELL CONSTRUCTION LOG 290806.0000\_P1\_T5.GPJ TRC\_CORP.GDT 290806.0000 P1T5 1/24/19

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



CASING AND SCREEN DETAILS	
TYPE OF RISER:	<u>2-INCH PVC</u>
PIPE SCHEDULE:	<u>40</u>
PIPE JOINTS:	<u>THREADED O-RINGS</u>
SOLVENT USED?	<u>NO</u>
SCREEN TYPE:	<u>2-INCH PVC</u>
SCR. SLOT SIZE:	<u>0.01-INCH</u>
BOREHOLE DIAMETER:	<u>4.0</u> IN. FROM <u>0</u> TO <u>17</u> FT. <u>NA</u> IN. FROM <u>NA</u> TO <u>NA</u> FT.
SURF. CASING DIAMETER:	<u>NA</u> IN. FROM <u>NA</u> TO <u>NA</u> FT. <u>NA</u> IN. FROM <u>NA</u> TO <u>NA</u> FT.

WELL DEVELOPMENT	
DEVELOPMENT METHOD:	<u>SURGE AND PUMP</u>
TIME DEVELOPING:	<u>0.25</u> HOURS
WATER REMOVED:	<u>27</u> GALLONS
WATER ADDED:	<u>&lt; 5</u> GALLONS
WATER CLARITY BEFORE / AFTER DEVELOPMENT	
CLARITY BEFORE:	<u>OPAQUE</u>
COLOR BEFORE:	<u>YELLOWISH-BROWN</u>
CLARITY AFTER:	<u>CLEAR: 9.31 NTUs</u>
COLOR AFTER:	<u>NONE</u>
ODOR (IF PRESENT):	<u>NONE</u>

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		

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

PROTECTIVE CASING DETAILS	
PERMANENT, LEGIBLE WELL LABEL ADDED?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
PROTECTIVE COVER AND LOCK INSTALLED?	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
LOCK KEY NUMBER:	_____



**WELL CONSTRUCTION LOG**

**WELL NO. JHC-MW-18002**

Facility/Project Name: <b>CEC JH Campbell</b>		Date Drilling Started: <b>12/4/18</b>	Date Drilling Completed: <b>12/4/18</b>	Project Number: <b>290806.0000 P1T5</b>	
Drilling Firm: <b>Stearns Drilling Company</b>	Drilling Method: <b>Geoprobe</b>	Surface Elev. (ft) <b>605.5</b>	TOC Elevation (ft) <b>608.93</b>	Total Depth (ft bgs) <b>15.0</b>	Borehole Dia. (in) <b>4</b>
Boring Location: <b>West side of Pond 3S</b>		Personnel Logged By - <b>P. Lancaster</b> Driller - <b>R. Christiansen</b>		Drilling Equipment: <b>6620 DT</b>	
N: <b>519331.45</b> E: <b>12633552.77</b>		Civil Town/City/or Village: <b>West Olive</b>		County: <b>Ottawa</b>	State: <b>Michigan</b>
Water Level Observations:		While Drilling: Date/Time <b>12/4/18 00:00</b>		Depth (ft bgs) <b>5.0</b>	
		After Drilling: Date/Time <b>12/4/18 10:00</b>		Depth (ft bgs) <b>4.4</b>	

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

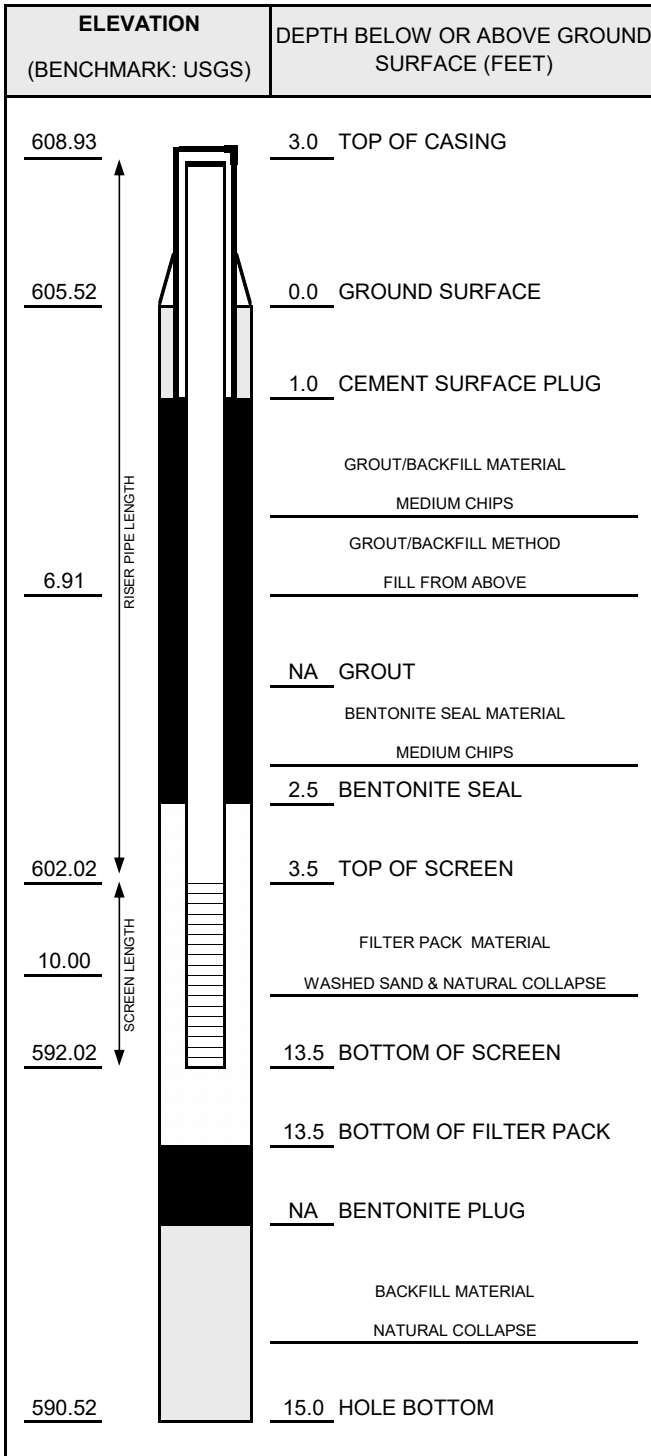
SOIL BORING WELL CONSTRUCTION LOG 290806.0000\_P1\_T5.GPJ TRC\_CORP.GDT 290806.0000 P1T5 1/24/19

Signature: *P. 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-18002
PROJ. NO: 290806.0002	DATE INSTALLED: 12/4/2018 INSTALLED BY: Paula Lancaster CHECKED BY: J. Krenz



CASING AND SCREEN DETAILS	
TYPE OF RISER:	<u>2-INCH PVC</u>
PIPE SCHEDULE:	<u>40</u>
PIPE JOINTS:	<u>THREADED O-RINGS</u>
SOLVENT USED?	<u>NO</u>
SCREEN TYPE:	<u>2-INCH PVC</u>
SCR. SLOT SIZE:	<u>0.01-INCH</u>
BOREHOLE DIAMETER:	<u>4.0</u> IN. FROM <u>0</u> TO <u>15</u> FT.
	<u>NA</u> IN. FROM <u>NA</u> TO <u>NA</u> FT.
SURF. CASING DIAMETER:	<u>NA</u> IN. FROM <u>NA</u> TO <u>NA</u> FT.
	<u>NA</u> IN. FROM <u>NA</u> TO <u>NA</u> FT.

WELL DEVELOPMENT	
DEVELOPMENT METHOD:	<u>SURGE AND PUMP</u>
TIME DEVELOPING:	<u>0.25</u> HOURS
WATER REMOVED:	<u>30</u> GALLONS
WATER ADDED:	<u>&lt; 5</u> GALLONS
WATER CLARITY BEFORE / AFTER DEVELOPMENT	
CLARITY BEFORE:	<u>OPAQUE</u>
COLOR BEFORE:	<u>GRAYISH-BROWN</u>
CLARITY AFTER:	<u>CLEAR: 9.86 NTUs</u>
COLOR AFTER:	<u>NONE</u>
ODOR (IF PRESENT):	<u>NONE</u>

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		

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

PROTECTIVE CASING DETAILS	
PERMANENT, LEGIBLE WELL LABEL ADDED?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
PROTECTIVE COVER AND LOCK INSTALLED?	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
LOCK KEY NUMBER:	_____





**WELL CONSTRUCTION LOG**

**WELL NO. JHC-MW-18003**

Facility/Project Name: <b>CEC JH Campbell</b>		Date Drilling Started: <b>12/4/18</b>	Date Drilling Completed: <b>12/4/18</b>	Project Number: <b>290806.0000 P1T5</b>	
Drilling Firm: <b>Stearns Drilling Company</b>	Drilling Method: <b>Geoprobe</b>	Surface Elev. (ft) <b>605.4</b>	TOC Elevation (ft) <b>608.78</b>	Total Depth (ft bgs) <b>15.0</b>	Borehole Dia. (in) <b>4</b>
Boring Location: <b>South side of Pond 3S</b>		Personnel Logged By - <b>P. Lancaster</b> Driller - <b>R. Christiansen</b>		Drilling Equipment: <b>6620 DT</b>	
N: <b>519181.31</b> E: <b>12633684.82</b>		Civil Town/City/or Village: <b>West Olive</b>		County: <b>Ottawa</b>	State: <b>Michigan</b>
Water Level Observations:		While Drilling: Date/Time <b>12/4/18 00:00</b>		Depth (ft bgs) <b>5.0</b>	
		After Drilling: Date/Time <b>12/4/18 10:45</b>		Depth (ft bgs) <b>4.2</b>	

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

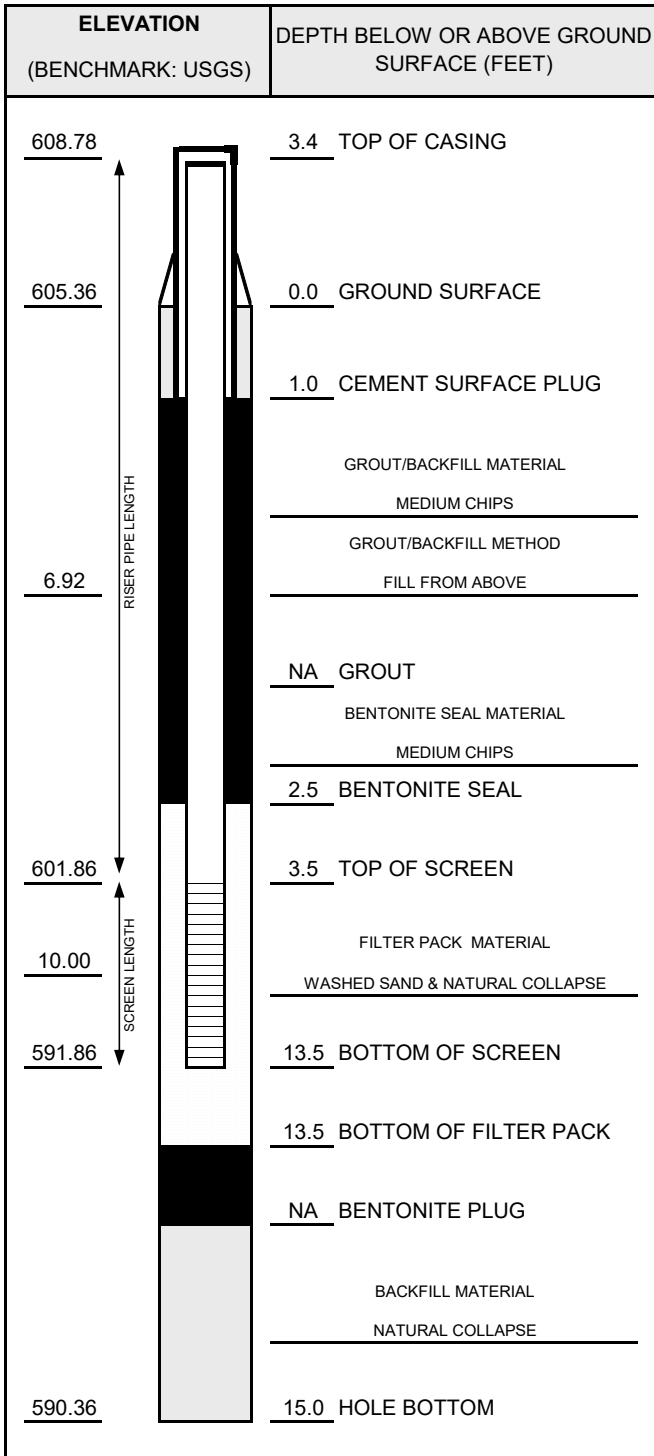
SOIL BORING WELL CONSTRUCTION LOG 290806.0000\_P1\_T5.GPJ TRC\_CORP.GDT 290806.0000 P1T5 1/24/19

Signature: 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



CASING AND SCREEN DETAILS	
TYPE OF RISER:	<u>2-INCH PVC</u>
PIPE SCHEDULE:	<u>40</u>
PIPE JOINTS:	<u>THREADED O-RINGS</u>
SOLVENT USED?	<u>NO</u>
SCREEN TYPE:	<u>2-INCH PVC</u>
SCR. SLOT SIZE:	<u>0.01-INCH</u>
BOREHOLE DIAMETER:	<u>4.0</u> IN. FROM <u>0</u> TO <u>15</u> FT. <u>NA</u> IN. FROM <u>NA</u> TO <u>NA</u> FT.
SURF. CASING DIAMETER:	<u>NA</u> IN. FROM <u>NA</u> TO <u>NA</u> FT. <u>NA</u> IN. FROM <u>NA</u> TO <u>NA</u> FT.

WELL DEVELOPMENT	
DEVELOPMENT METHOD:	<u>SURGE AND PUMP</u>
TIME DEVELOPING:	<u>0.3</u> HOURS
WATER REMOVED:	<u>50</u> GALLONS
WATER ADDED:	<u>&lt; 5</u> GALLONS
WATER CLARITY BEFORE / AFTER DEVELOPMENT	
CLARITY BEFORE:	<u>OPAQUE</u>
COLOR BEFORE:	<u>YELLOWISH-BROWN</u>
CLARITY AFTER:	<u>CLEAR: 9.88 NTUs</u>
COLOR AFTER:	<u>NONE</u>
ODOR (IF PRESENT):	<u>NONE</u>

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		

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

PROTECTIVE CASING DETAILS	
PERMANENT, LEGIBLE WELL LABEL ADDED?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
PROTECTIVE COVER AND LOCK INSTALLED?	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
LOCK KEY NUMBER:	_____



**WELL CONSTRUCTION LOG**

**WELL NO. JHC-MW-18004**

Facility/Project Name: <b>CEC JH Campbell</b>		Date Drilling Started: <b>12/4/18</b>	Date Drilling Completed: <b>12/4/18</b>	Project Number: <b>290806.0000 P1T5</b>	
Drilling Firm: <b>Stearns Drilling Company</b>	Drilling Method: <b>Geoprobe</b>	Surface Elev. (ft) <b>602.9</b>	TOC Elevation (ft) <b>605.71</b>	Total Depth (ft bgs) <b>15.0</b>	Borehole Dia. (in) <b>4</b>
Boring Location: <b>West side of Pond 1-2S</b>		Personnel Logged By - <b>P. Lancaster</b> Driller - <b>R. Christiansen</b>		Drilling Equipment: <b>6620 DT</b>	
N: <b>518007.60</b> E: <b>12633480.87</b>		Water Level Observations:			
Civil Town/City/or Village: <b>West Olive</b>	County: <b>Ottawa</b>	State: <b>Michigan</b>	While Drilling: Date/Time <b>12/4/18 00:00</b>	Depth (ft bgs) <b>8.0</b>	
			After Drilling: Date/Time <b>12/4/18 08:45</b>	Depth (ft bgs) <b>8.1</b>	

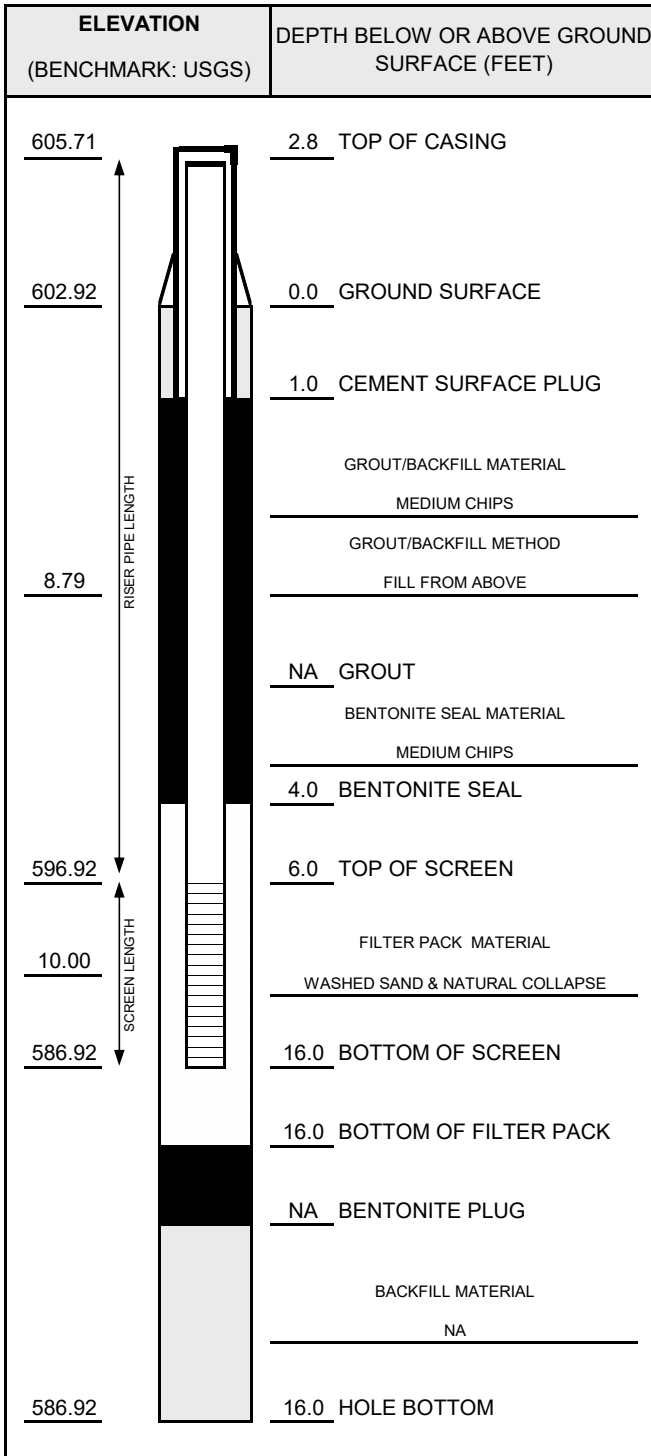
SAMPLE	NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
	1	85			<b>SILTY SAND</b> mostly fine sand, little medium sand, little silt, dark grayish brown (10YR 3/2), moist, loose.	SM			
					<b>SAND</b> mostly fine to medium sand, light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

SOIL BORING WELL CONSTRUCTION LOG 290806.0000\_P1\_T5.GPJ TRC\_CORP.GDT 290806.0000 P1T5 1/24/19



# 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



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

CASING AND SCREEN DETAILS	
<b>TYPE OF RISER:</b>	<u>2-INCH PVC</u>
PIPE SCHEDULE:	<u>40</u>
PIPE JOINTS:	<u>THREADED O-RINGS</u>
SOLVENT USED?	<u>NO</u>
<b>SCREEN TYPE:</b>	<u>2-INCH PVC</u>
SCR. SLOT SIZE:	<u>0.01-INCH</u>
BOREHOLE DIAMETER:	<u>4.0</u> IN. FROM <u>0</u> TO <u>16</u> FT. <u>NA</u> IN. FROM <u>NA</u> TO <u>NA</u> FT.
SURF. CASING DIAMETER:	<u>NA</u> IN. FROM <u>NA</u> TO <u>NA</u> FT. <u>NA</u> IN. FROM <u>NA</u> TO <u>NA</u> FT.

WELL DEVELOPMENT	
DEVELOPMENT METHOD:	<u>SURGE AND PUMP</u>
TIME DEVELOPING:	<u>0.3</u> HOURS
WATER REMOVED:	<u>17</u> GALLONS
WATER ADDED:	<u>&lt; 5</u> GALLONS
WATER CLARITY BEFORE / AFTER DEVELOPMENT	
CLARITY BEFORE:	<u>OPAQUE</u>
COLOR BEFORE:	<u>BROWN</u>
CLARITY AFTER:	<u>CLEAR: 8.07 NTUs</u>
COLOR AFTER:	<u>NONE</u>
ODOR (IF PRESENT):	<u>NONE</u>

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?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
PROTECTIVE COVER AND LOCK INSTALLED?	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
LOCK KEY NUMBER:	_____



**WELL CONSTRUCTION LOG**

**WELL NO. JHC-MW-18005**

Facility/Project Name: <b>CEC JH Campbell</b>		Date Drilling Started: <b>12/5/18</b>	Date Drilling Completed: <b>12/5/18</b>	Project Number: <b>290806.0000 P1T5</b>	
Drilling Firm: <b>Stearns Drilling Company</b>	Drilling Method: <b>Geoprobe</b>	Surface Elev. (ft) <b>600.3</b>	TOC Elevation (ft) <b>603.16</b>	Total Depth (ft bgs) <b>15.0</b>	Borehole Dia. (in) <b>4</b>
Boring Location: South side of Pond 1-2S N: 517784.97 E: 12633627.70		Personnel Logged By - P. Lancaster Driller - R. Christiansen		Drilling Equipment: <b>6620 DT</b>	
Civil Town/City/or Village: <b>West Olive</b>	County: <b>Ottawa</b>	State: <b>Michigan</b>	Water Level Observations: While Drilling: Date/Time <b>12/5/18 00:00</b> $\nabla$ Depth (ft bgs) <u>8.0</u> After Drilling: Date/Time <b>12/5/18 23:00</b> $\nabla$ Depth (ft bgs) <u>7.7</u>		

SAMPLE	NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
	1 GP	100		0 - 3	<b>SILTY SAND</b> mostly fine sand, few to little silt, very dark grayish brown (10YR 3/2), moist, loose.	SM			
				3 - 5	Change to light brownish gray at 3.0 feet.				
	2 GP	100		5 - 8	Change to brownish yellow (10YR 6/6) at 5.0 feet.				
				8 - 10	Change to wet with 1" coarse sand seam at 8.0 feet.	SP			
				10 - 15	Change to mostly coarse sand, little medium sand, trace fine gravel, wet at 10.0 feet.				
	3 GP	100		15 - 15	End of boring at 15.0 feet below ground surface.				

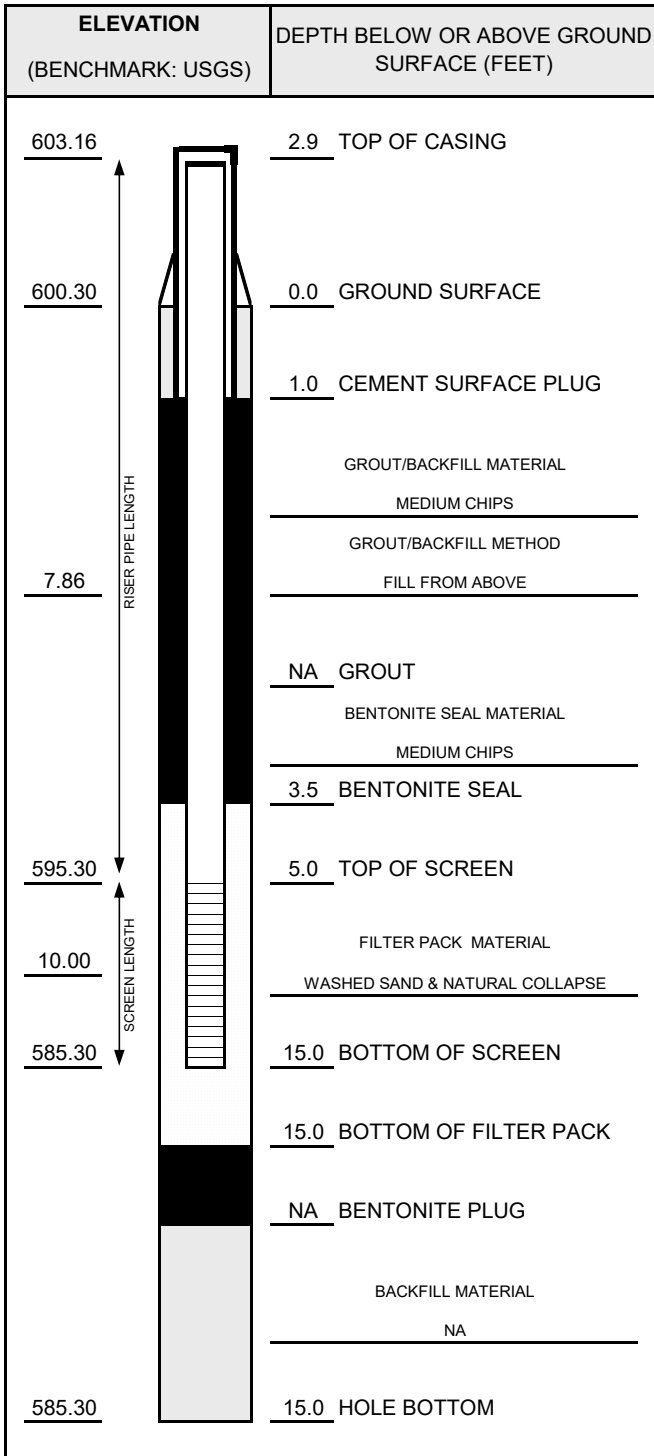
SOIL BORING WELL CONSTRUCTION LOG 290806.0000\_P1\_T5.GPJ TRC\_CORP.GDT 290806.0000 P1T5 1/24/19

Signature: 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-18005
PROJ. NO: 290806.0002	DATE INSTALLED: 12/5/2018 INSTALLED BY: Paula Lancaster CHECKED BY: J. Krenz



CASING AND SCREEN DETAILS	
TYPE OF RISER:	<u>2-INCH PVC</u>
PIPE SCHEDULE:	<u>40</u>
PIPE JOINTS:	<u>THREADED O-RINGS</u>
SOLVENT USED?	<u>NO</u>
SCREEN TYPE:	<u>2-INCH PVC</u>
SCR. SLOT SIZE:	<u>0.01-INCH</u>
BOREHOLE DIAMETER:	<u>4.0</u> IN. FROM <u>0</u> TO <u>15</u> FT. <u>NA</u> IN. FROM <u>NA</u> TO <u>NA</u> FT.
SURF. CASING DIAMETER:	<u>NA</u> IN. FROM <u>NA</u> TO <u>NA</u> FT. <u>NA</u> IN. FROM <u>NA</u> TO <u>NA</u> FT.

WELL DEVELOPMENT	
DEVELOPMENT METHOD:	<u>SURGE AND PUMP</u>
TIME DEVELOPING:	<u>0.25</u> HOURS
WATER REMOVED:	<u>27</u> GALLONS
WATER ADDED:	<u>&lt; 5</u> GALLONS
WATER CLARITY BEFORE / AFTER DEVELOPMENT	
CLARITY BEFORE:	<u>OPAQUE</u>
COLOR BEFORE:	<u>YELLOWISH-BROWN</u>
CLARITY AFTER:	<u>CLEAR: 8.39 NTUs</u>
COLOR AFTER:	<u>NONE</u>
ODOR (IF PRESENT):	<u>NONE</u>

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		

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

PROTECTIVE CASING DETAILS	
PERMANENT, LEGIBLE WELL LABEL ADDED?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
PROTECTIVE COVER AND LOCK INSTALLED?	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
LOCK KEY NUMBER:	_____



# 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
OBSERVED BY: David Hutchinson			E: 12633547.12
DRILLING CONTRACTOR: None		TOP OF CASING ELEV.: <u>628.44</u>	SURFACE ELEV.: <u>624.92</u>
CREW CHIEF: NA			


PROTECTIVE COVER TYPE:	<input checked="" type="checkbox"/> STICK-UP	<input type="checkbox"/> FLUSH MOUNT	<input type="checkbox"/> TRAF. BOX	<input type="checkbox"/> OTHER _____
PROTECTIVE COVER DIAMETER:	<input checked="" type="checkbox"/> 4"	<input type="checkbox"/> 8"	<input type="checkbox"/> 9"	<input type="checkbox"/> 10" <input type="checkbox"/> 12" <input type="checkbox"/> OTHER _____
WELL MATERIAL:	<input checked="" type="checkbox"/> PVC	<input type="checkbox"/> SS	<input type="checkbox"/> IRON	<input type="checkbox"/> GALVANIZED STEEL <input type="checkbox"/> OTHER _____
WELL CASING DIAMETER:	<input type="checkbox"/> 1"	<input checked="" type="checkbox"/> 2"	<input type="checkbox"/> 4"	<input type="checkbox"/> 6" <input type="checkbox"/> 8" <input type="checkbox"/> OTHER _____
WELL SCREEN MATERIAL:	<input checked="" type="checkbox"/> PVC	<input type="checkbox"/> SS	<input type="checkbox"/> IRON	<input type="checkbox"/> GALVANIZED STEEL <input type="checkbox"/> OTHER _____
WELL SCREEN LENGTH:	<input type="checkbox"/> 5-FT	<input checked="" type="checkbox"/> 10-FT	<input type="checkbox"/> UNKNOWN	<input type="checkbox"/> OTHER _____
WELL SCREEN SLOT SIZE:	<input type="checkbox"/> 0.01"	<input type="checkbox"/> 0.02"	<input checked="" type="checkbox"/> UNKNOWN	<input type="checkbox"/> OTHER _____
				DTW: <u>NA</u> T/ PVC
				DTB: <u>NA</u> 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.

<b>GROUTING PROCEDURE:</b>	<b>NOTES:</b>
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:**

	6.14.2018	JRP 09/20/2018	
SIGNED	DATE	CHECKED	DATE

## MONITORING WELL DECOMMISSIONING LOG

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

PROTECTIVE COVER TYPE:	<input checked="" type="checkbox"/> STICK-UP	<input type="checkbox"/> FLUSH MOUNT	<input type="checkbox"/> TRAF. BOX	<input type="checkbox"/> OTHER _____
PROTECTIVE COVER DIAMETER:	<input checked="" type="checkbox"/> 4"	<input type="checkbox"/> 8"	<input type="checkbox"/> 9"	<input type="checkbox"/> 10" <input checked="" type="checkbox"/> 12" <input type="checkbox"/> OTHER _____
WELL MATERIAL:	<input checked="" type="checkbox"/> PVC	<input type="checkbox"/> SS	<input checked="" type="checkbox"/> IRON	<input type="checkbox"/> GALVANIZED STEEL <input type="checkbox"/> OTHER _____
WELL CASING DIAMETER:	<input type="checkbox"/> 1"	<input checked="" type="checkbox"/> 2"	<input type="checkbox"/> 4"	<input type="checkbox"/> 6" <input type="checkbox"/> 8" <input type="checkbox"/> OTHER _____
WELL SCREEN MATERIAL:	<input checked="" type="checkbox"/> PVC	<input type="checkbox"/> SS	<input type="checkbox"/> IRON	<input type="checkbox"/> GALVANIZED STEEL <input type="checkbox"/> OTHER _____
WELL SCREEN LENGTH:	<input type="checkbox"/> 5-FT	<input checked="" type="checkbox"/> 10-FT	<input type="checkbox"/> UNKNOWN	<input type="checkbox"/> OTHER _____
WELL SCREEN SLOT SIZE:	<input checked="" type="checkbox"/> 0.01"	<input type="checkbox"/> 0.02"	<input type="checkbox"/> UNKNOWN	<input type="checkbox"/> OTHER _____
				<b>DTW:</b> <u>NM</u> T/ PVC
				<b>DTB:</b> <u>NM</u> T/ PVC

<b>DECOMMISSIONING PROCEDURE:</b>
<p><b>NOTES:</b>          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.</p>

<b>GROUTING PROCEDURE:</b>	<b>NOTES:</b>
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	

<b>ADDITIONAL COMMENTS:</b>
None

*Bethany Swanberg*

SIGNED

1/28/19

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
OBSERVED BY: Aaron Bickel		LOCATION COORDINATES: N: 1762 E: 5002
DRILLING CONTRACTOR: None		
CREW CHIEF: NA	TOP OF CASING ELEV.: 612.4 (PLANT) SURFACE ELEV.: 609.54	

PROTECTIVE COVER TYPE:	<input checked="" type="checkbox"/> STICK-UP	<input type="checkbox"/> FLUSH MOUNT	<input type="checkbox"/> TRAF. BOX	<input type="checkbox"/> OTHER _____
PROTECTIVE COVER DIAMETER:	<input checked="" type="checkbox"/> 4"	<input type="checkbox"/> 8"	<input type="checkbox"/> 9"	<input type="checkbox"/> 10" <input type="checkbox"/> 12" <input type="checkbox"/> OTHER _____
WELL MATERIAL:	<input checked="" type="checkbox"/> PVC	<input type="checkbox"/> SS	<input type="checkbox"/> IRON	<input type="checkbox"/> GALVANIZED STEEL <input type="checkbox"/> OTHER _____
WELL CASING DIAMETER:	<input type="checkbox"/> 1"	<input checked="" type="checkbox"/> 2"	<input type="checkbox"/> 4"	<input type="checkbox"/> 6" <input type="checkbox"/> 8" <input type="checkbox"/> OTHER _____
WELL SCREEN MATERIAL:	<input checked="" type="checkbox"/> PVC	<input type="checkbox"/> SS	<input type="checkbox"/> IRON	<input type="checkbox"/> GALVANIZED STEEL <input type="checkbox"/> OTHER _____
WELL SCREEN LENGTH:	<input type="checkbox"/> 5-FT	<input checked="" type="checkbox"/> 10-FT	<input type="checkbox"/> UNKNOWN	<input type="checkbox"/> OTHER _____
WELL SCREEN SLOT SIZE:	<input type="checkbox"/> 0.01"	<input type="checkbox"/> 0.02"	<input checked="" type="checkbox"/> UNKNOWN	<input type="checkbox"/> 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);  
 $19.01 \text{ feet} \times 1.6 \text{ lbs/foot} = 30.4 \text{ lbs}$   
 $30.4 \text{ lbs}/50 \text{ lbs} = 60\% \text{ of 1 bag}$
- 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*

6-14-2018

SIGNED \_\_\_\_\_ DATE \_\_\_\_\_

## 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:
OBSERVED BY: Aaron Bickel			N: 1764
DRILLING CONTRACTOR: None			E: 5251
CREW CHIEF: NA		TOP OF CASING ELEV.: 614.15 (PLANT)	SURFACE ELEV.: 611.2

PROTECTIVE COVER TYPE:	<input checked="" type="checkbox"/> STICK-UP	<input type="checkbox"/> FLUSH MOUNT	<input type="checkbox"/> TRAF. BOX	<input type="checkbox"/> OTHER _____
PROTECTIVE COVER DIAMETER:	<input checked="" type="checkbox"/> 4"	<input type="checkbox"/> 8"	<input type="checkbox"/> 9"	<input type="checkbox"/> 10" <input type="checkbox"/> 12" <input type="checkbox"/> OTHER _____
WELL MATERIAL:	<input checked="" type="checkbox"/> PVC	<input type="checkbox"/> SS	<input type="checkbox"/> IRON	<input type="checkbox"/> GALVANIZED STEEL <input type="checkbox"/> OTHER _____
WELL CASING DIAMETER:	<input type="checkbox"/> 1"	<input checked="" type="checkbox"/> 2"	<input type="checkbox"/> 4"	<input type="checkbox"/> 6" <input type="checkbox"/> 8" <input type="checkbox"/> OTHER _____
WELL SCREEN MATERIAL:	<input checked="" type="checkbox"/> PVC	<input type="checkbox"/> SS	<input type="checkbox"/> IRON	<input type="checkbox"/> GALVANIZED STEEL <input type="checkbox"/> OTHER _____
WELL SCREEN LENGTH:	<input type="checkbox"/> 5-FT	<input checked="" type="checkbox"/> 10-FT	<input type="checkbox"/> UNKNOWN	<input type="checkbox"/> OTHER _____
WELL SCREEN SLOT SIZE:	<input type="checkbox"/> 0.01"	<input type="checkbox"/> 0.02"	<input checked="" type="checkbox"/> UNKNOWN	<input type="checkbox"/> 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);  
 $18.33 \text{ feet} \times 1.6 \text{ lbs/foot} = 29.3 \text{ lbs}$   
 $29.3 \text{ lbs}/50 \text{ lbs} = 59\% \text{ of 1 bag}$
- 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

# Appendix B

## Data Quality Reviews

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# 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-15025
- JHC-MW-15027
- JHC-MW-15024
- JHC-MW-15026
- 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  $0.175 \pm 0.266$  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-15025
- JHC-MW-15027
- JHC-MW-15024
- JHC-MW-15026
- 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 Pond A

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 4611403 and 4611404.

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

- JHC-MW-15006
- JHC-MW-15008
- JHC-MW-15010
- JHC-MW-15007
- JHC-MW-15009
- JHC-MW-15011

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; 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:

- 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 297663 at a concentration of  $0.330 \pm 0.504$  pCi/L. Radium-226 results for samples analyzed in the same batch as the method blank are potentially impacted (see attached table); however, the concentration of radium-226 detected in JHC-MW-15010 (only sample in batch 297663 in which radium-226 was detected) was within the range of historical radium-226 concentrations observed in that well.

- One equipment blank (EB-01) and one field blank (FB-01) were collected; no analytes were detected in the blank samples.
- LCS recoveries: the mercury recoveries in the LCS associated with batches 22463 and 22465 were above the upper laboratory control limit. Mercury was not detected in any sample analyzed in these batches; therefore, data usability was not affected.
- MS/MSDs were performed on sample JHC-MW-15007 for radium, metals, and fluoride.
  - The fluoride recoveries in the MS/MSD performed on JHC-MW-15007 for batch 21529 were above the upper laboratory control limit. The fluoride concentrations for samples analyzed in this batch were below the detection limit; therefore, data usability was not affected.
  - The mercury recovery in the MS performed on JHC-MW-15007 for batch 22465 was above the upper laboratory control limit. The mercury concentrations for samples analyzed this batch were below the detection limit; therefore, data usability was not affected.
- Laboratory duplicate analyses were performed on samples JHC-MW-15007 and JHC-MW-15008; 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-15009; RPDs between the parent and duplicate sample were within the QC limits.

**Attachment B**

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

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-15010_20180426	4/26/2018	Radium-226	Detection in method blank. Normalized absolute difference between blank and sample <1.96; indicates a possible false positive result.

# Laboratory Data Quality Review

## Groundwater Monitoring Event June 2018

### CEC JH Campbell Pond A

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 4613841 and 4613843.

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

- JHC-MW-15006
- JHC-MW-15008
- JHC-MW-15010
- JHC-MW-15007
- JHC-MW-15009
- JHC-MW-15011

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; 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:**

- Sample receipt: Although the temperature was recorded as <6°C for the temperature blank, six samples had measured temperatures >6°C (ranging from 6.9-11.0°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.
- No target analytes were detected in the method blank.
- One equipment blank (EB-01) and one field blank (FB-01) were collected; no analytes were detected in the blank samples.
- LCS recoveries were within laboratory control limits.

- MS/MSDs were performed on sample JHC-MW-15010 for radium, metals, and anions.
  - The chloride and sulfate recoveries in the MS performed on JHC-MW-15010 for batch 26955 were below the lower laboratory control limit. The chloride and sulfate concentrations for samples analyzed in this batch may be biased low (see attached table); however they were within the range of historical chloride and sulfate concentrations observed in the wells in this batch.
- Laboratory duplicate analyses were performed on sample JHC-MW-15010 for anions and total dissolved solids and on sample EB-01 for anions; 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-15006; relative percent differences (RPDs) between the parent and duplicate sample were within the QC limits (20%), with the exception of total dissolved solids (34%). Potential uncertainty exists for total dissolved solids results for the field duplicate pair (see attached table); additionally, the concentrations of total dissolved solids detected in both the duplicate and primary sample exceed the range of historical total dissolved solids concentrations observed in JHC-MW-15006. Potential uncertainty exists for total dissolved solids result due to the field duplicate variability.

**Attachment B**

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

<b>Samples</b>	<b>Collection Date</b>	<b>Analyte</b>	<b>Non-Conformance/Issue</b>
EB-01_20180620	6/20/2018	Chloride	MS recovery below the lower laboratory control limit. Sample result may be be biased low.
JHC-MW-15008_20180620	6/20/2018		
JHC-MW-15009_20180620	6/20/2018		
JHC-MW-15010_20180620	6/20/2018		
EB-01_20180620	6/20/2018	Sulfate	MS recovery below the lower laboratory control limit. Sample result may be be biased low.
JHC-MW-15008_20180620	6/20/2018		
JHC-MW-15009_20180620	6/20/2018		
JHC-MW-15010_20180620	6/20/2018		
Dup-01_20180620	6/20/2018	Total Dissolved Solids	RPD for the field duplicate pair exceeded the 20% acceptance limit. Potential uncertainty exists for total dissolved solids result due to the field duplicate variability.
JHC-MW-15006_20180620	6/20/2018		

# Appendix C

## Groundwater Protection Standards

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## Technical Memorandum

**Date:** October 15, 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, Pond A CCR Unit

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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)<sup>1</sup>, the MCLs will be the GWPSs for those constituents that have established MCLs. For Appendix IV

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<sup>1</sup> As amended per Phase One, Part One of the CCR Rule (83 FR 36435).

## Technical Memorandum

constituents 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 GWPSs 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, JHC-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;

## Technical Memorandum

- 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.

## Technical Memorandum

### 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

## Technical Memorandum

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

WELL	CONSTITUENT	PERCENT NON-DETECT
JHC-MW-15025 <i>(cont'd)</i>	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
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
	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

## Technical Memorandum

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

## Technical Memorandum

### 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 four 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

## Technical Memorandum

### 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

DL = Detection Limit

NC = No Criteria

NA = Not Applicable

### Attachments

Table A1 – Summary of Groundwater Sampling Results (Analytical)

Figure 1 – Background Concentration Time-Series Charts

Figure 2 – Combined Background Distribution

Sanitas™ Output Files



**Technical Memorandum**

**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										
<b>Appendix III</b>												
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
<b>Appendix IV</b>												
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										
<b>Appendix III</b>												
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
<b>Appendix IV</b>												
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										
<b>Appendix III</b>												
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
<b>Appendix IV</b>												
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											
<b>Appendix III</b>													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
<b>Appendix IV</b>													
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											
<b>Appendix III</b>												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
<b>Appendix IV</b>													
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										
<b>Appendix III</b>												
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
<b>Appendix IV</b>												
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.

# Technical Memorandum

## Figures



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

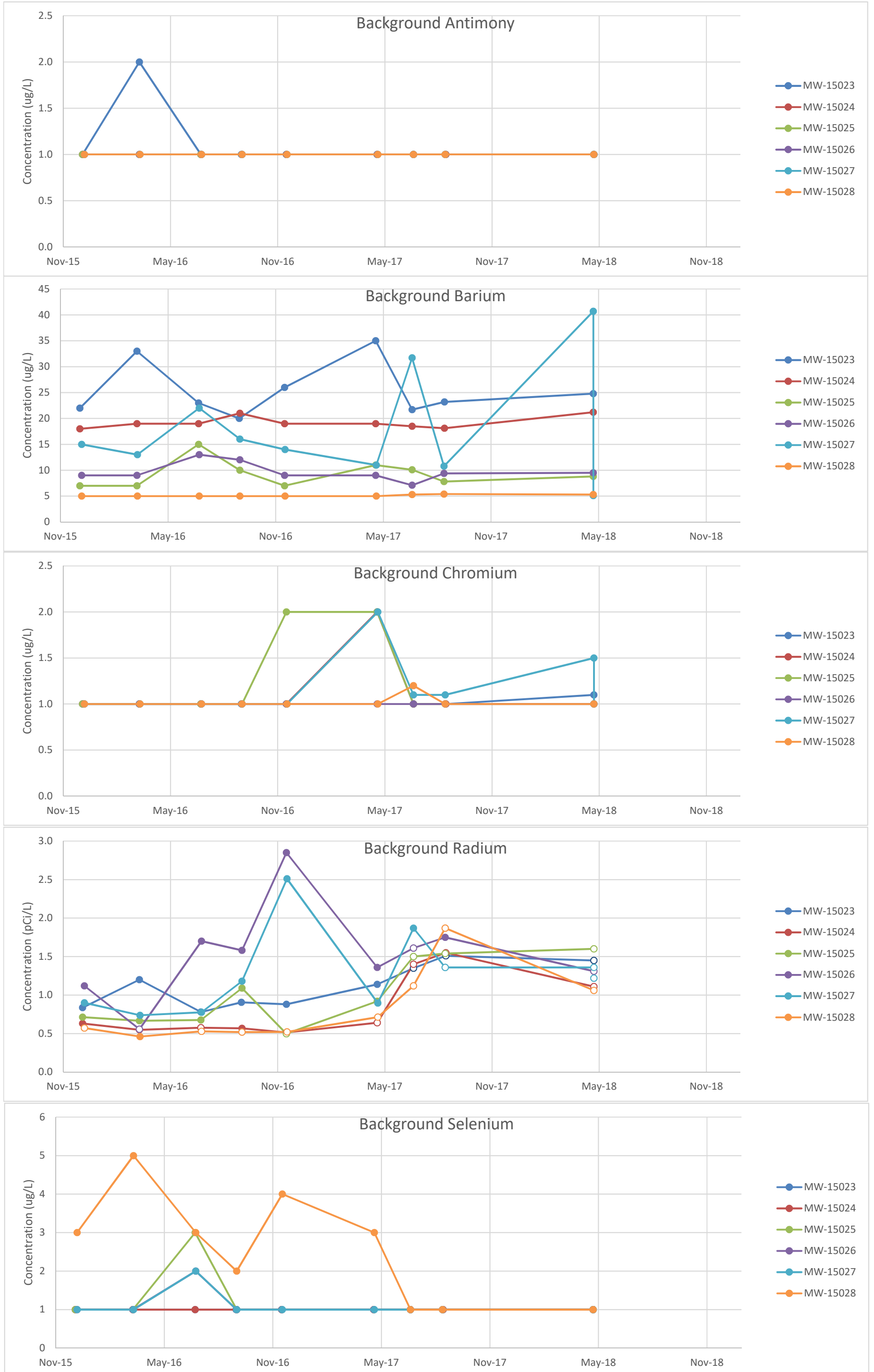
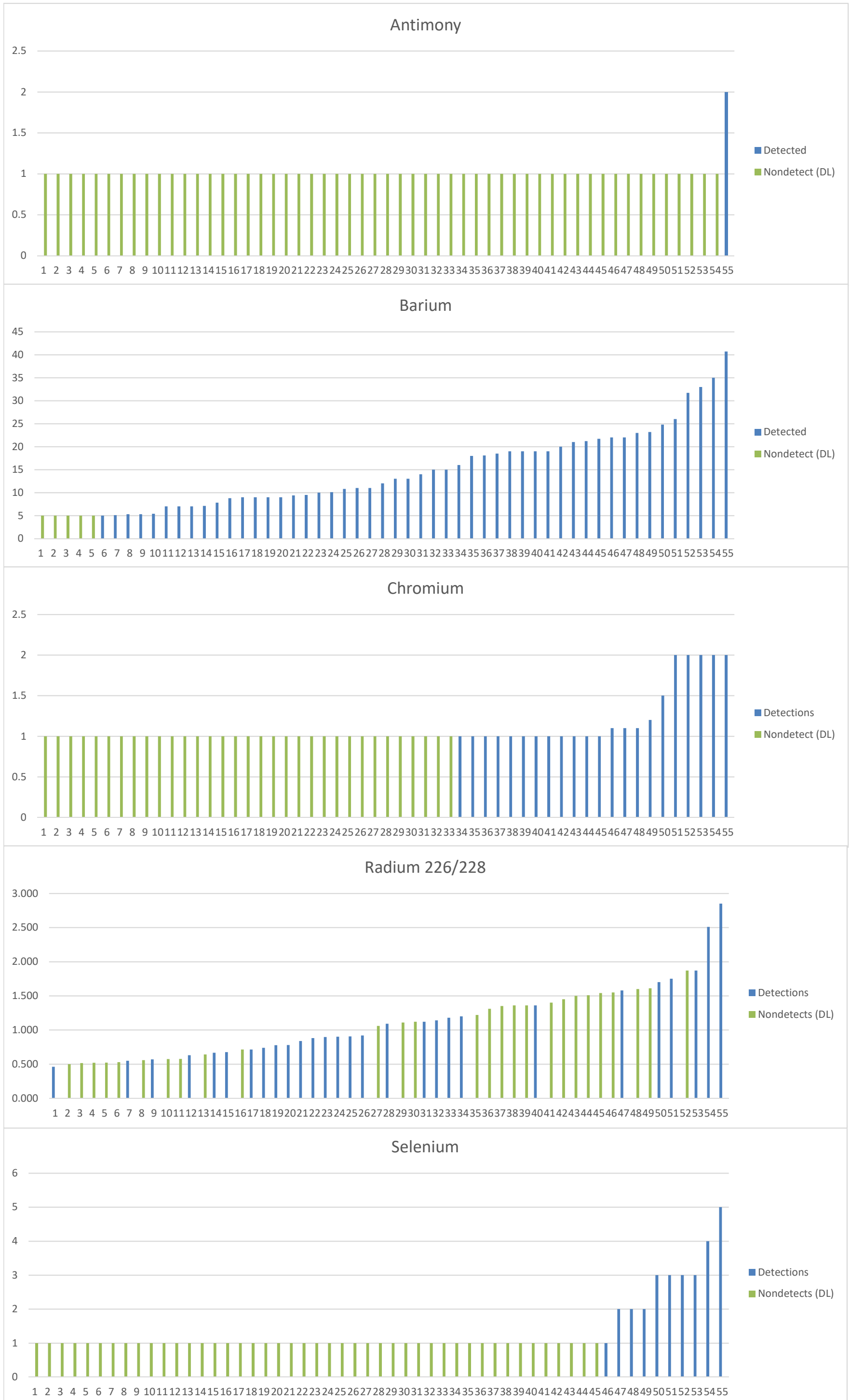


Figure 2  
 Cumulative Background Concentrations - Appendix IV  
 JH Campbell Site

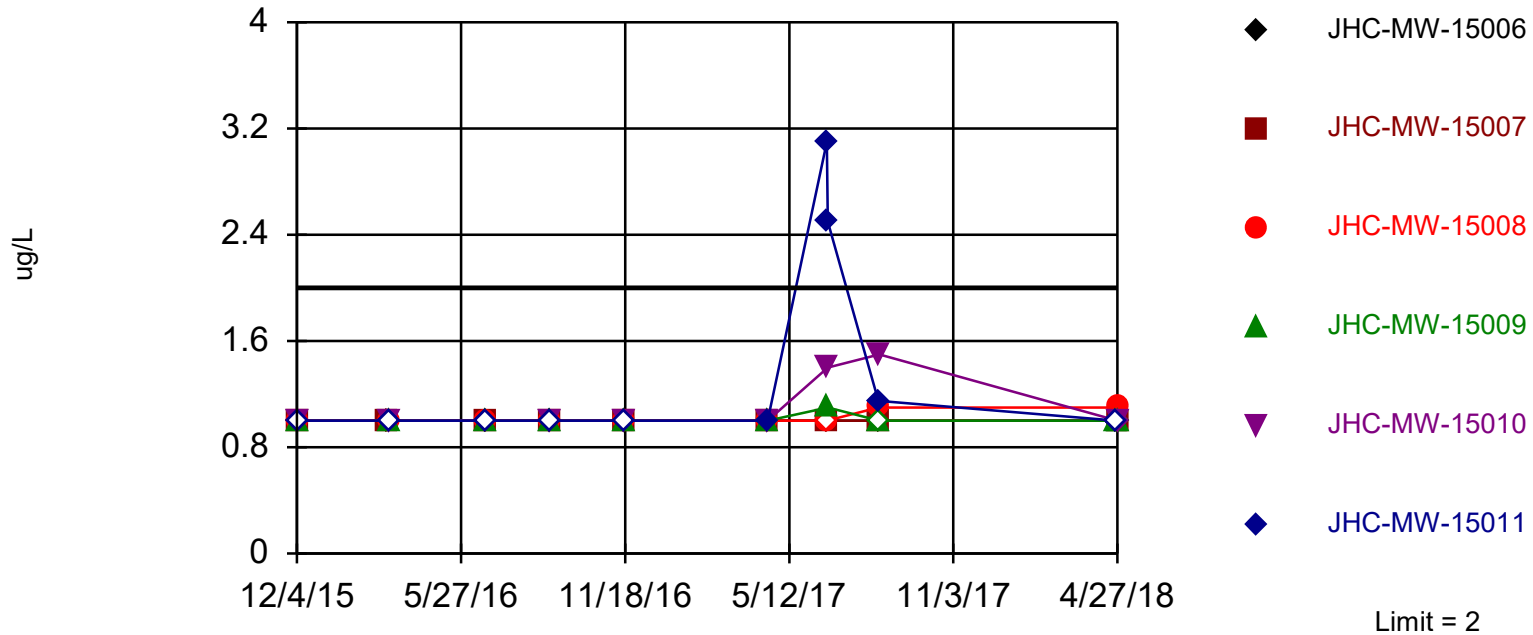


## **Technical Memorandum**

### **Sanitas™ Output Files**

Within Limit

## Tolerance Limit Interwell Non-parametric



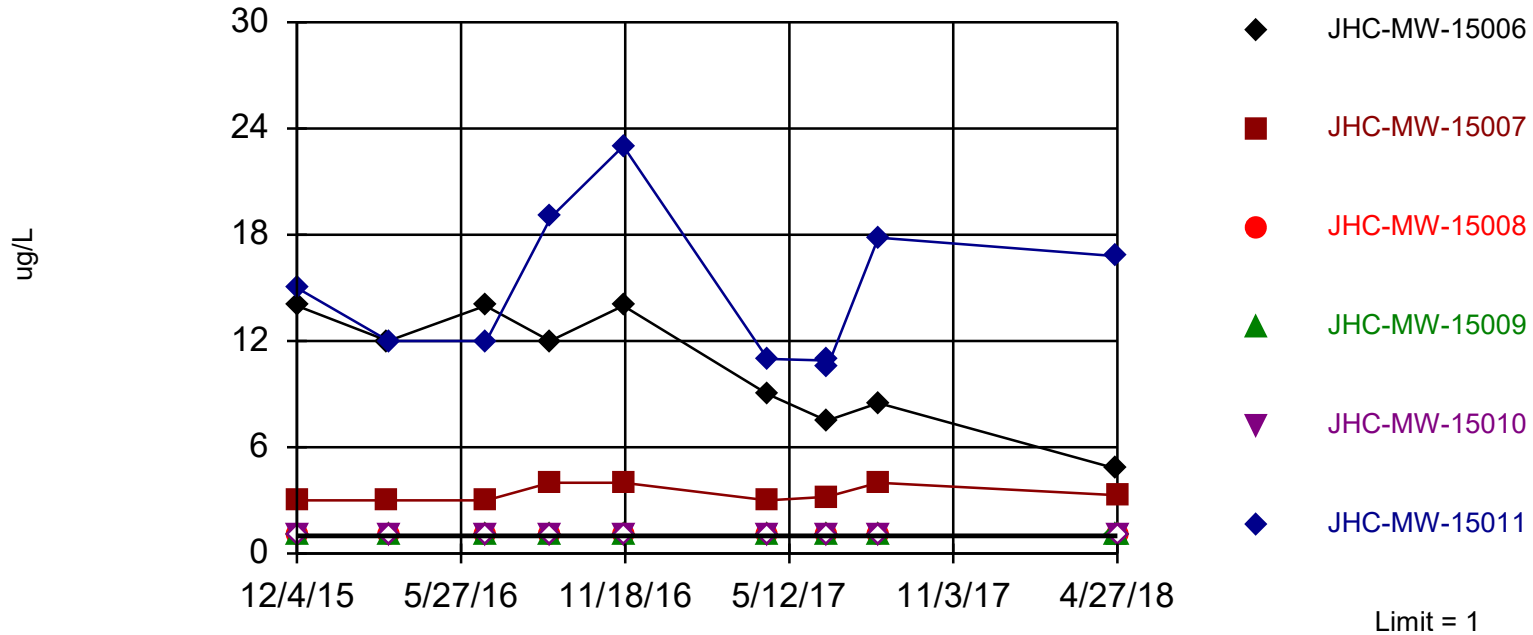
Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. Limit is highest of 54 background values. 98.15% NDs. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at alpha=0.5. Report alpha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

Constituent: Antimony, Total Analysis Run 6/11/2018 2:22 PM

Client: Consumers Energy Data: JHC\_Pond\_A\_Sanitas

Exceeds Limit: JHC-MW-15006, JHC-MW-15007, JHC-MW-15011

## Tolerance Limit Interwell Non-parametric



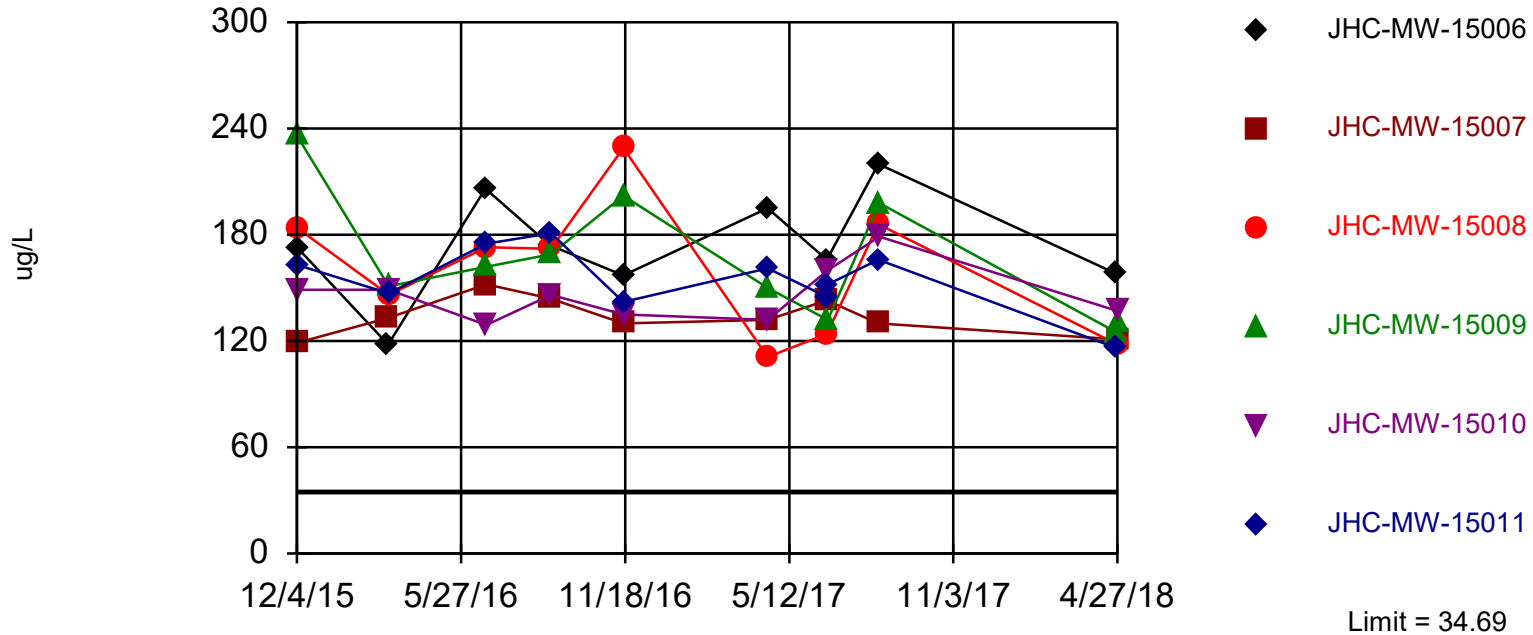
Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at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

Constituent: Arsenic, Total Analysis Run 6/11/2018 2:25 PM

Client: Consumers Energy Data: JHC\_Pond\_A\_Sanitas

Exceeds Limit: JHC-MW-15006, JHC-MW-15007, JHC-MW-15008, JHC-MW-15009,...

### Tolerance Limit Interwell Parametric



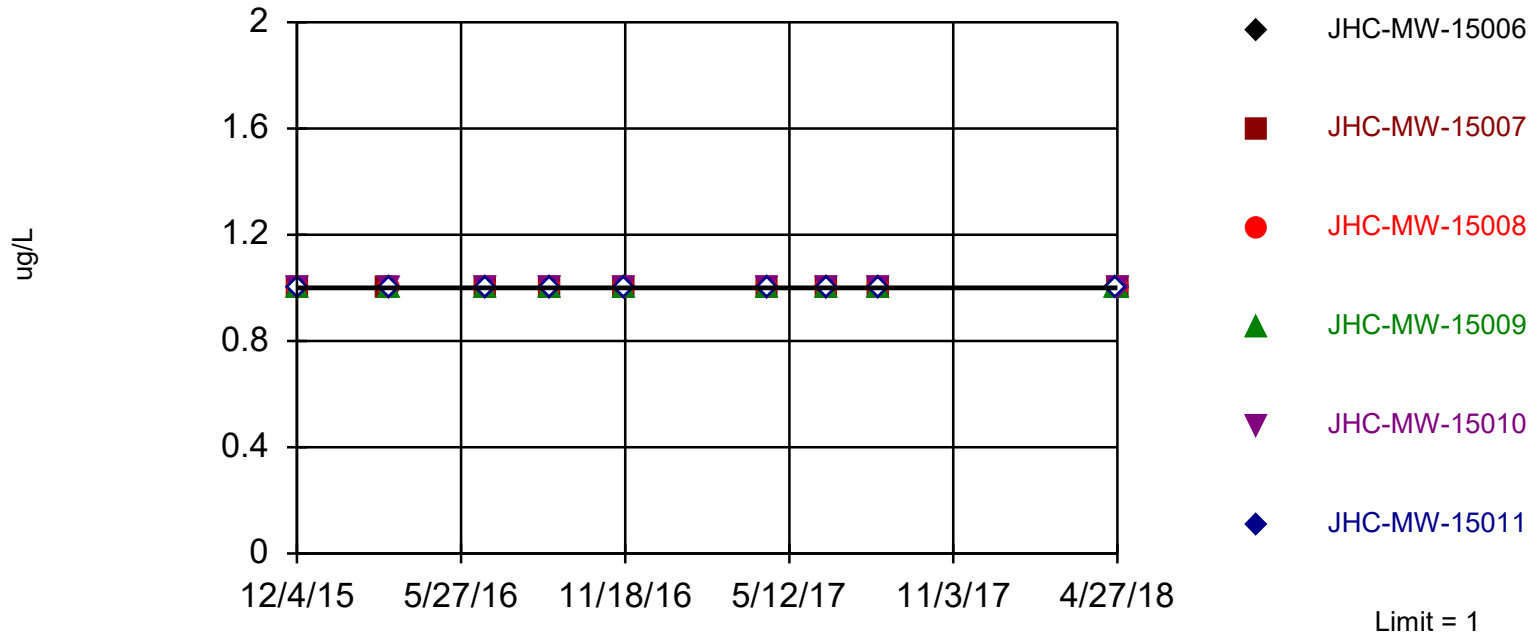
95% coverage. Most recent observation is compared with limit. Background Data Summary (based on square root transformation): Mean=3.677, Std. Dev.=1.084, n=54, 9.259% NDs. Normality test: Shapiro Francia @alpha = 0.01, calculated = 0.9563, critical = 0.939. Report alpha = 0.05.

Constituent: Barium, Total Analysis Run 6/11/2018 2:26 PM

Client: Consumers Energy Data: JHC\_Pond\_A\_Sanitas

Within Limit

## Tolerance Limit Interwell Non-parametric



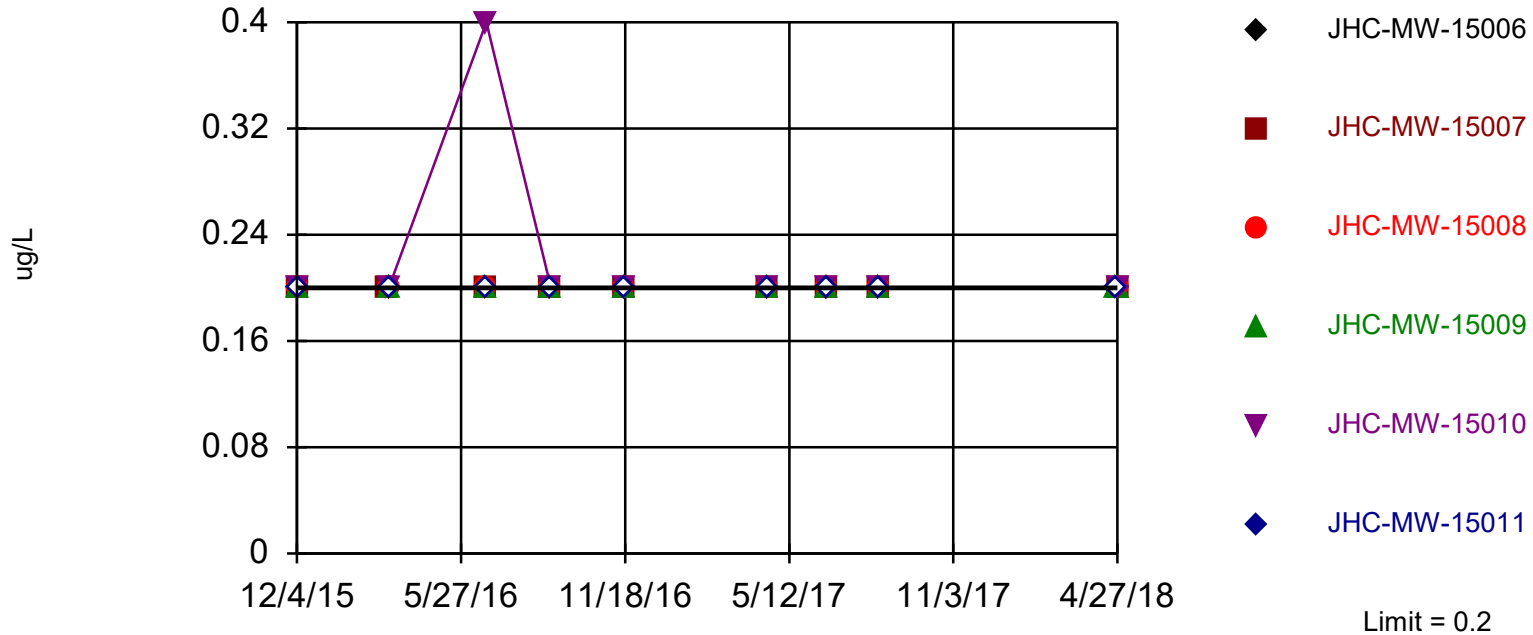
Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at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

Constituent: Beryllium, Total Analysis Run 6/11/2018 2:26 PM

Client: Consumers Energy Data: JHC\_Pond\_A\_Sanitas

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.

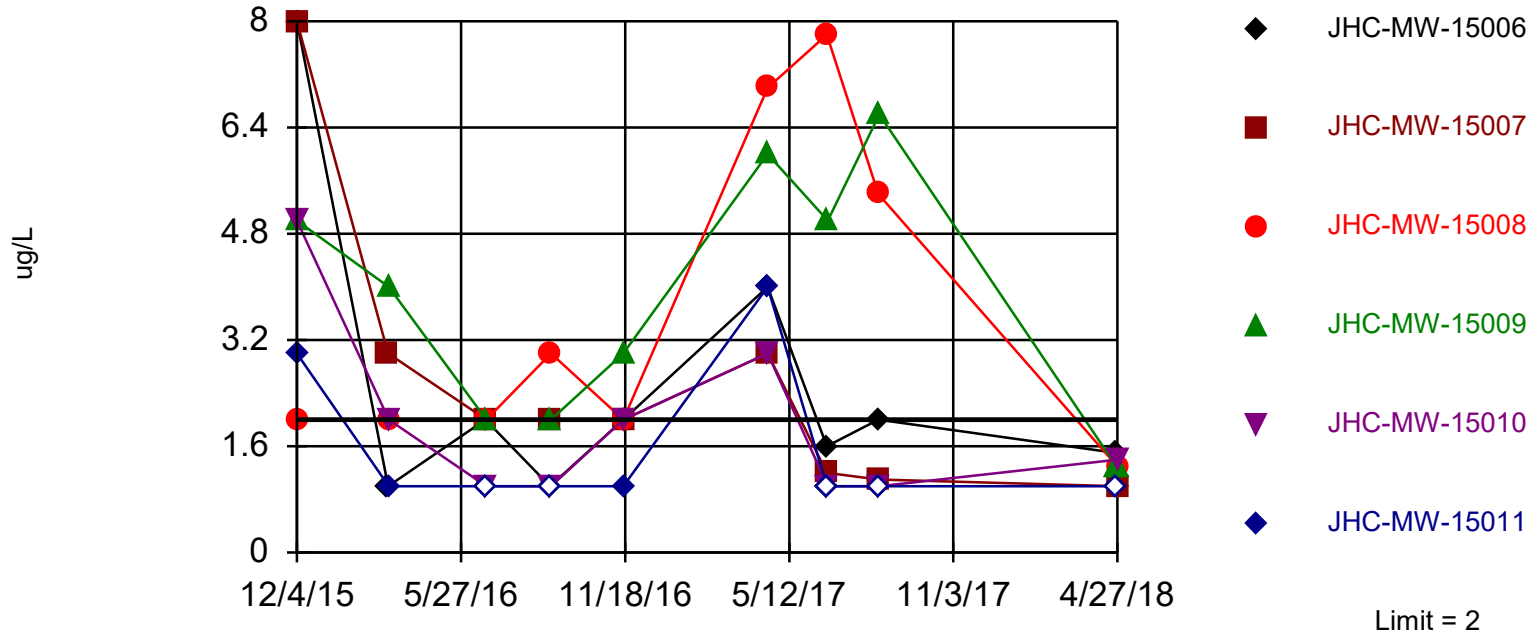
Constituent: Cadmium, Total Analysis Run 6/11/2018 2:27 PM

Client: Consumers Energy Data: JHC\_Pond\_A\_Sanitas



Within Limit

## Tolerance Limit Interwell Non-parametric



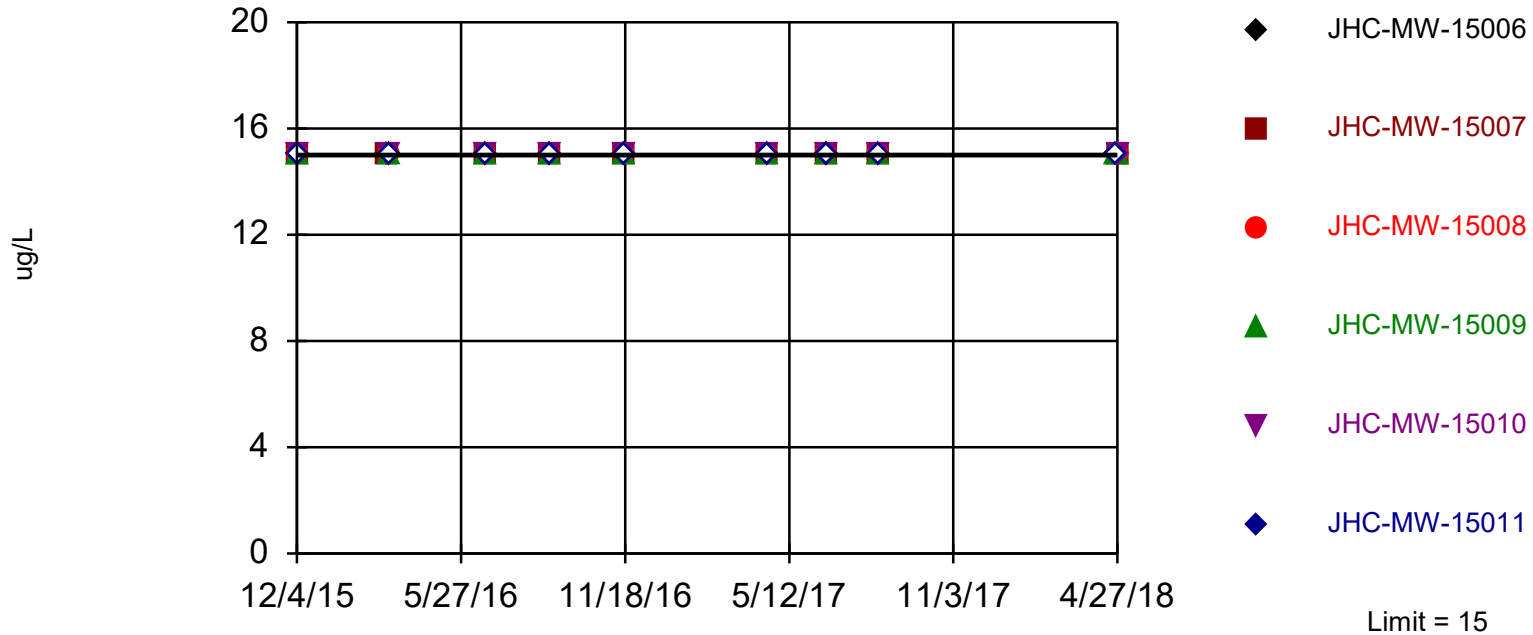
Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. Limit is highest of 54 background values. 59.26% NDs. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at alpha=0.5. Report alpha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

Constituent: Chromium, Total Analysis Run 6/11/2018 2:27 PM

Client: Consumers Energy Data: JHC\_Pond\_A\_Sanitas

Within Limit

## Tolerance Limit Interwell Non-parametric



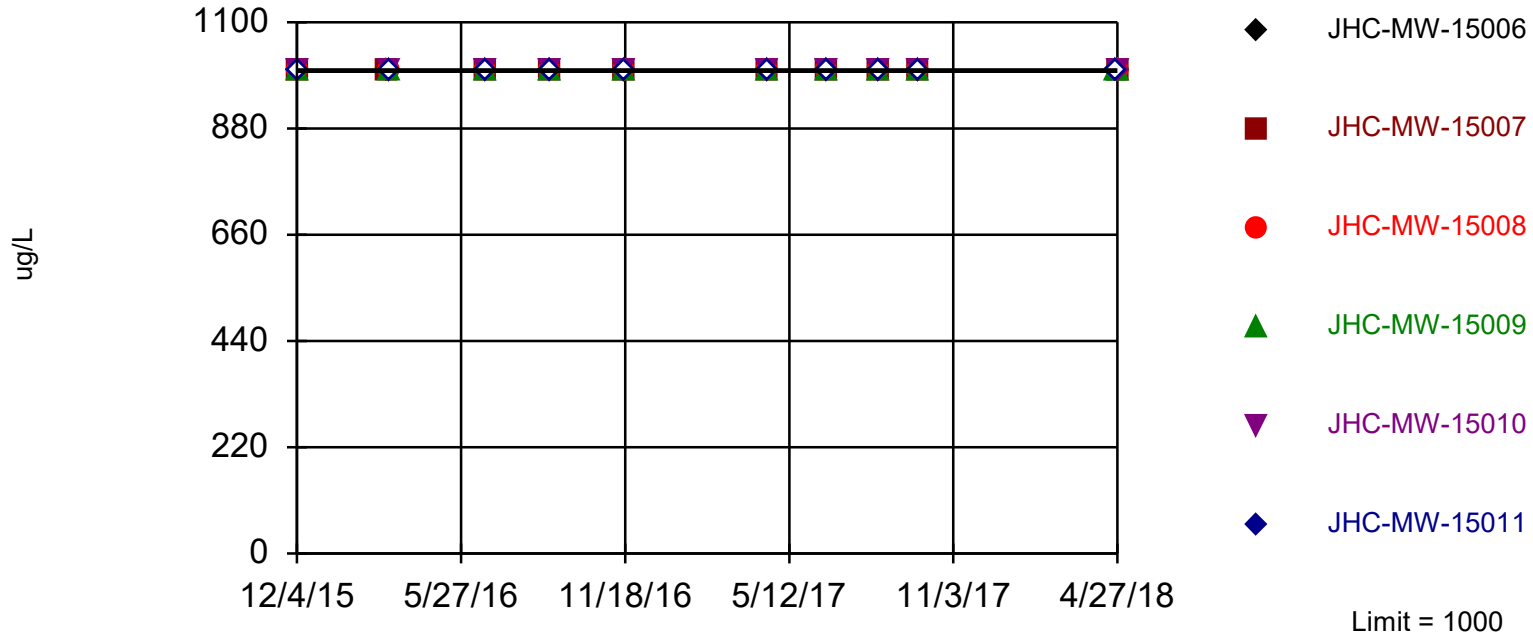
Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at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

Constituent: Cobalt, Total Analysis Run 6/11/2018 3:45 PM

Client: Consumers Energy Data: JHC\_Pond\_A\_Sanitas

Within Limit

## Tolerance Limit Interwell Non-parametric



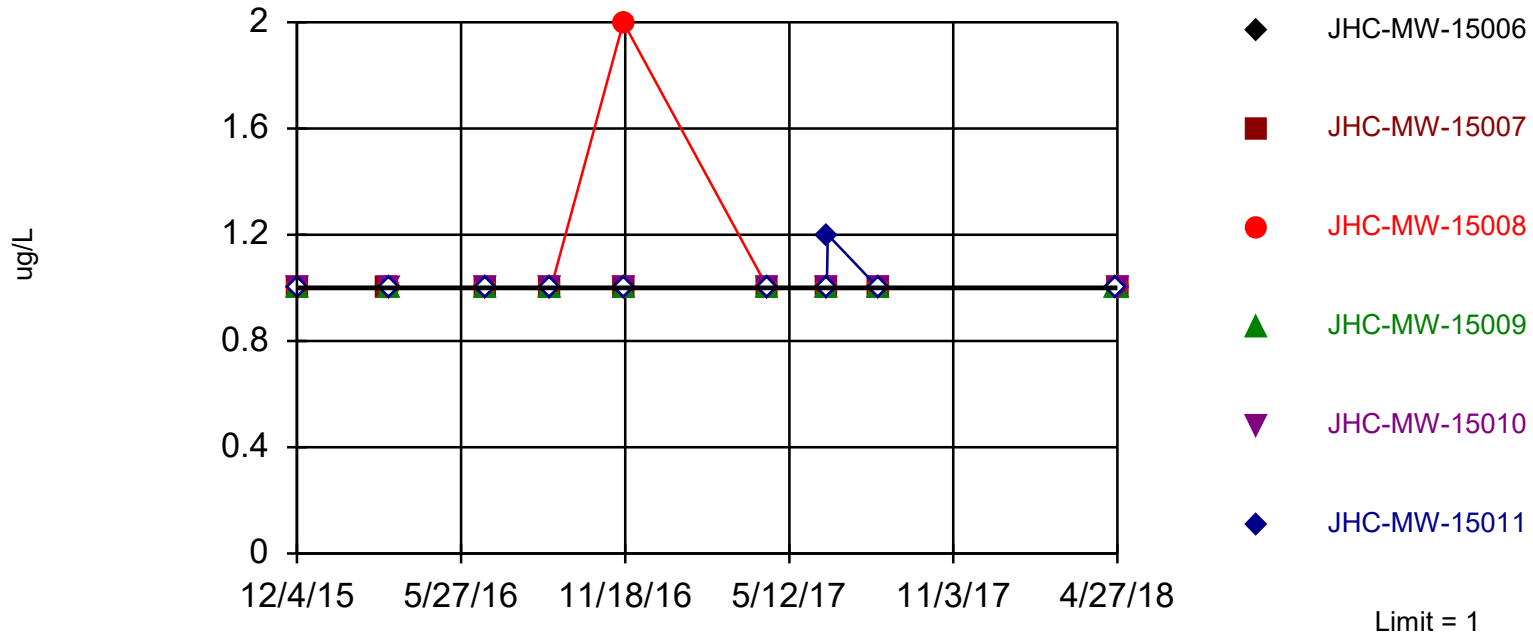
Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 92.77% coverage at alpha=0.01; 95.12% coverage at alpha=0.05; 99.02% coverage at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

Constituent: Fluoride Analysis Run 6/11/2018 2:28 PM

Client: Consumers Energy Data: JHC\_Pond\_A\_Sanitas

Within Limit

## Tolerance Limit Interwell Non-parametric



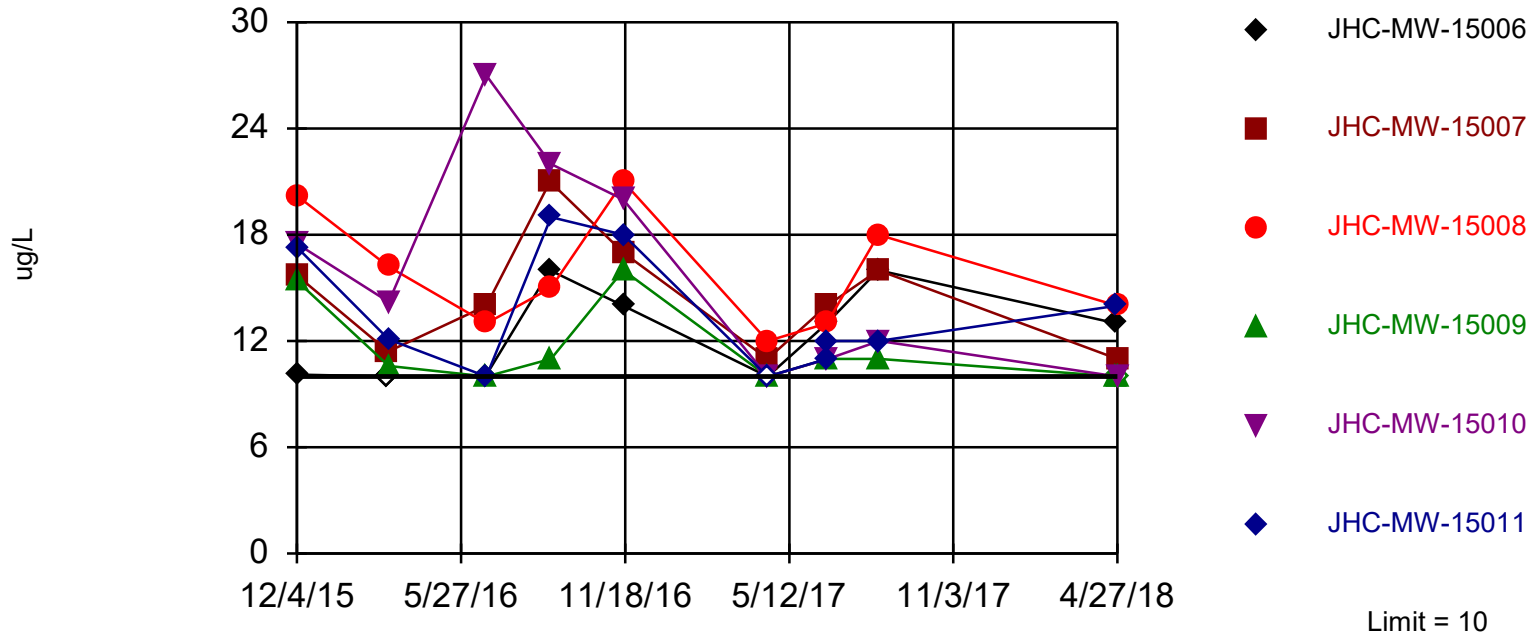
Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at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

Constituent: Lead, Total Analysis Run 6/11/2018 2:28 PM

Client: Consumers Energy Data: JHC\_Pond\_A\_Sanitas

Exceeds Limit: JHC-MW-15006, JHC-MW-15007, JHC-MW-15008, JHC-MW-15011

## Tolerance Limit Interwell Non-parametric



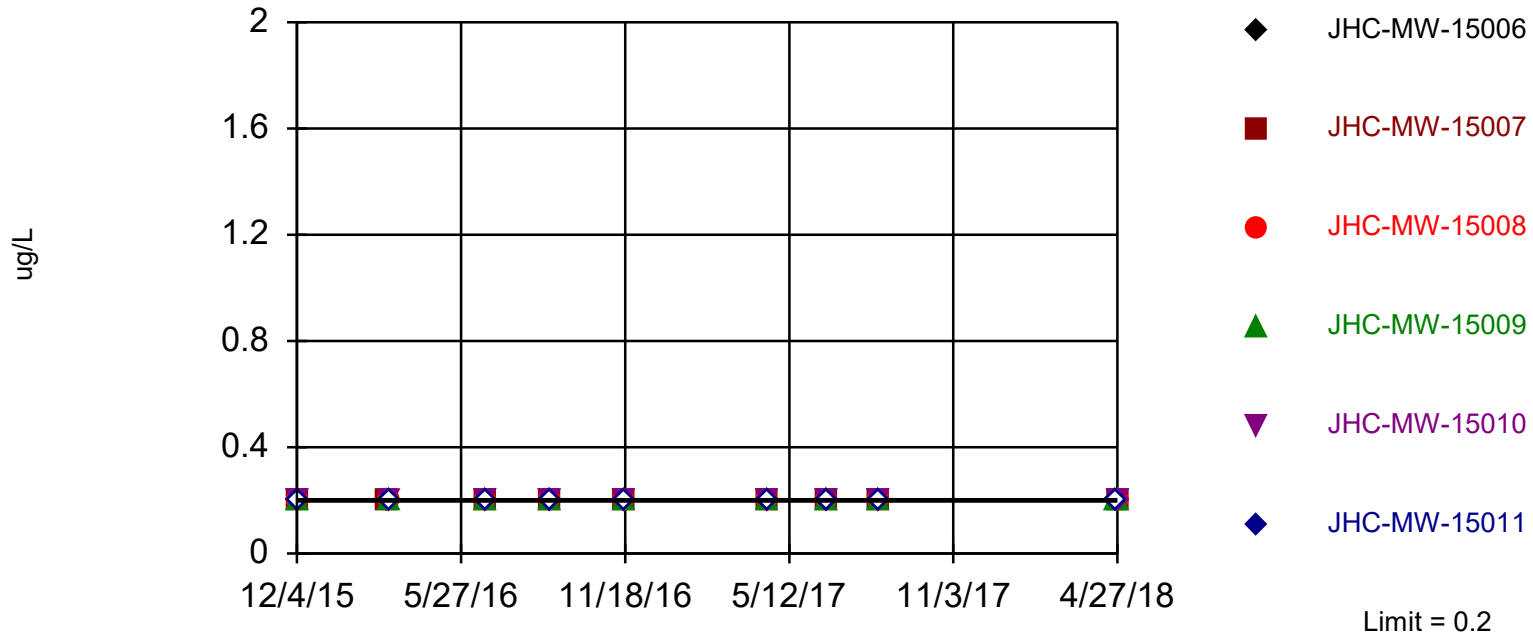
Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at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

Constituent: Lithium, Total Analysis Run 6/11/2018 2:29 PM

Client: Consumers Energy Data: JHC\_Pond\_A\_Sanitas

Within Limit

## Tolerance Limit Interwell Non-parametric



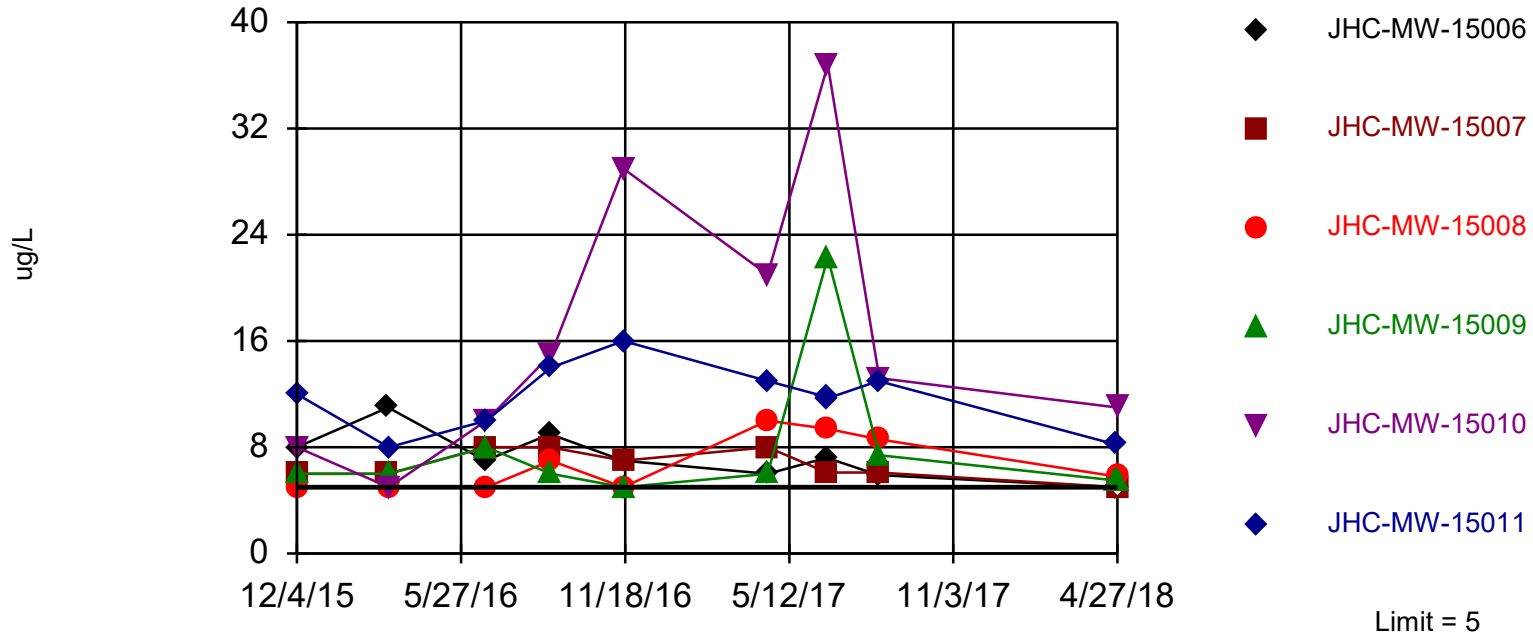
Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at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

Constituent: Mercury, Total Analysis Run 6/11/2018 2:38 PM

Client: Consumers Energy Data: JHC\_Pond\_A\_Sanitas

Exceeds Limit: JHC-MW-15008, JHC-MW-15009, JHC-MW-15010, JHC-MW-15011

## Tolerance Limit Interwell Non-parametric



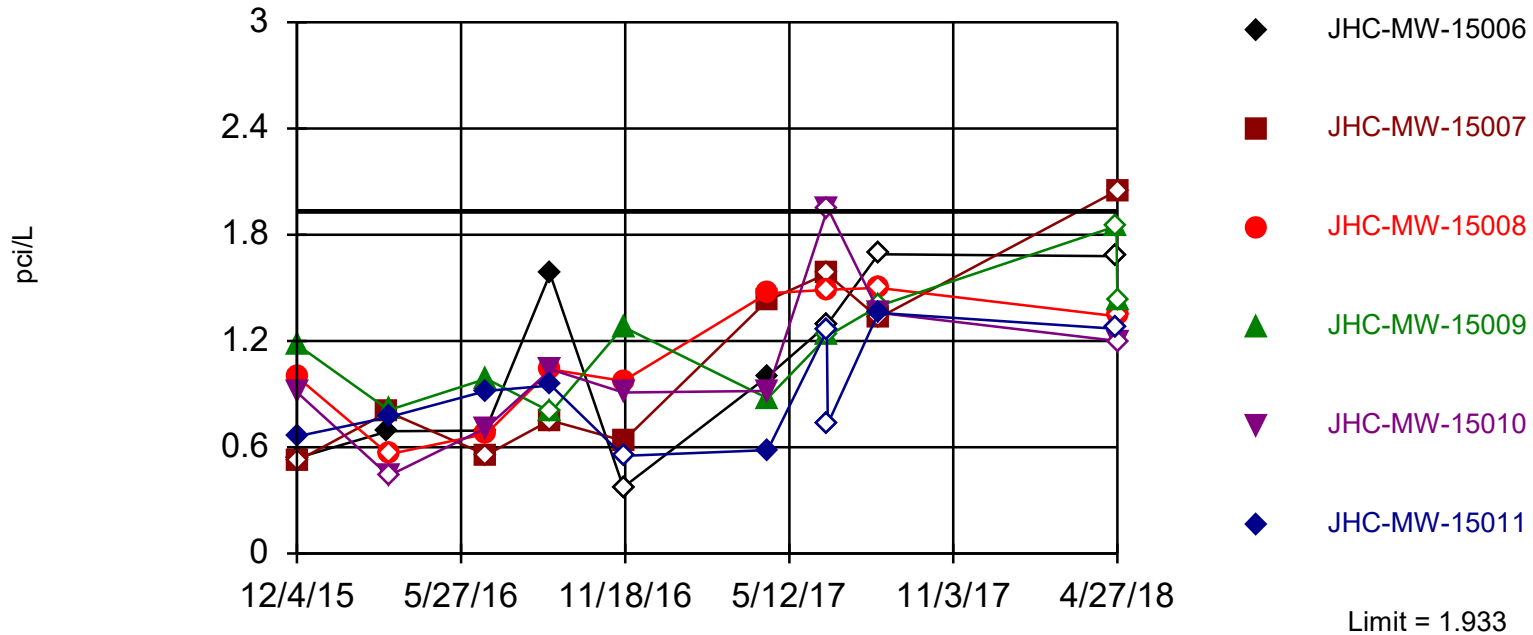
Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at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

Constituent: Molybdenum, Total Analysis Run 6/11/2018 2:29 PM

Client: Consumers Energy Data: JHC\_Pond\_A\_Sanitas

Within Limit

## 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.

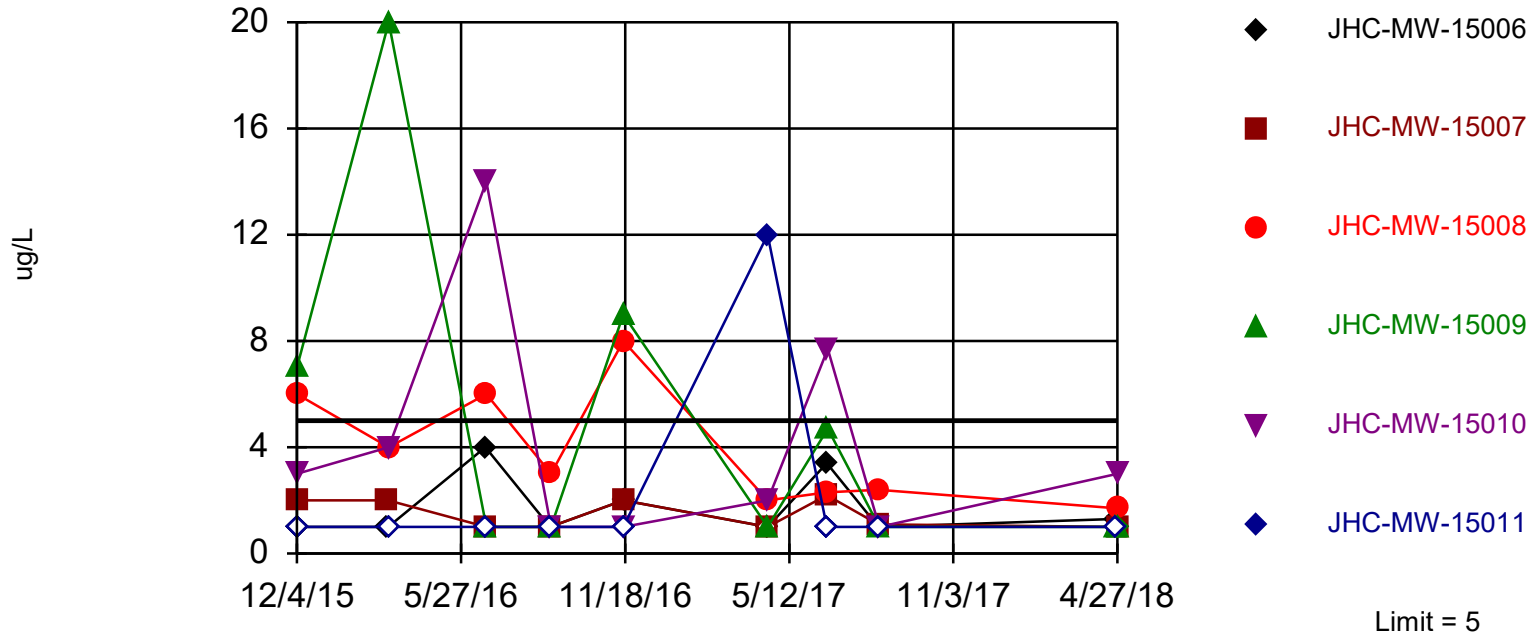
Constituent: Radium-226/228 Analysis Run 6/11/2018 2:30 PM

Client: Consumers Energy Data: JHC\_Pond\_A\_Sanitas



Within Limit

## Tolerance Limit Interwell Non-parametric



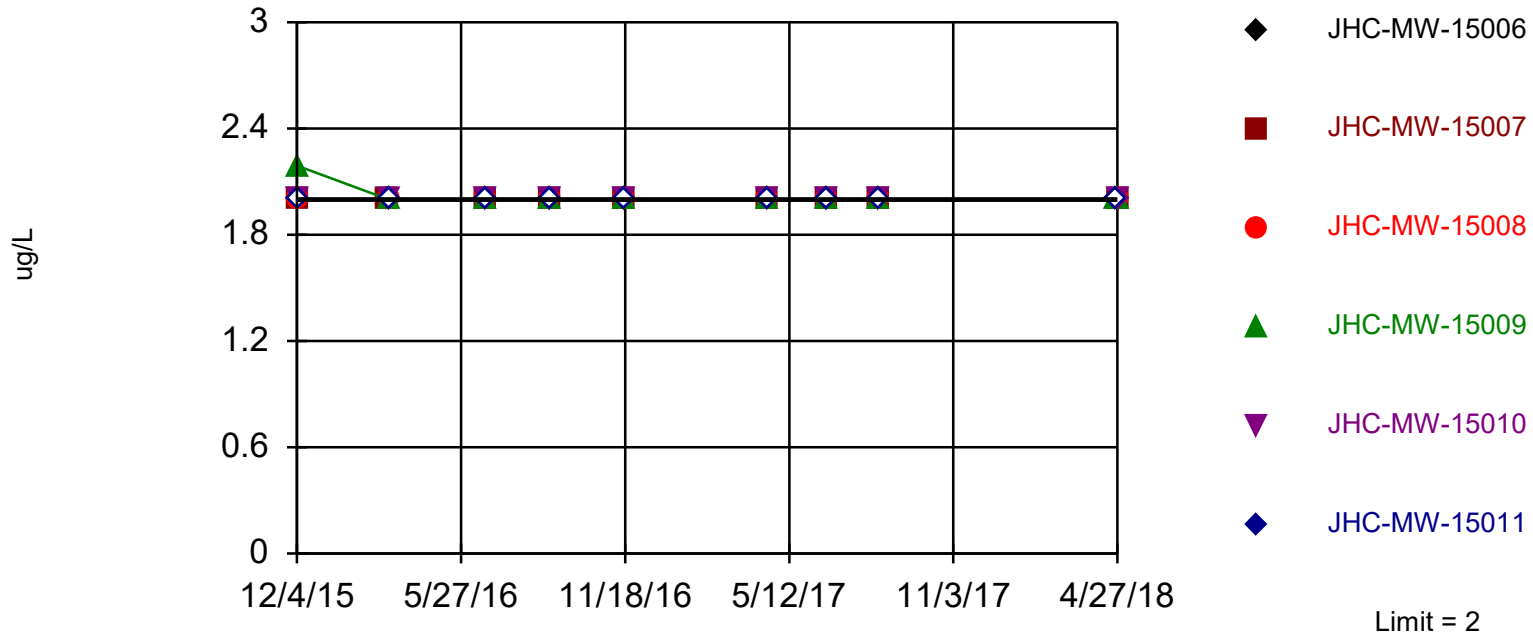
Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. Limit is highest of 54 background values. 81.48% NDs. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at alpha=0.5. Report alpha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

Constituent: Selenium, Total Analysis Run 6/11/2018 2:30 PM

Client: Consumers Energy Data: JHC\_Pond\_A\_Sanitas

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 6/11/2018 2:31 PM

Client: Consumers Energy Data: JHC\_Pond\_A\_Sanitas