



Annual Groundwater Monitoring Report

JC Weadock Power Plant
Landfill CCR Unit
Essexville, Michigan

January 2018



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*Prepared For
Consumers Energy Company*

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Final

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Executive Summary

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule). The CCR Rule, which became effective on October 19, 2015, applies to the Consumers Energy Company (CEC) ash landfill at the JC Weadock (JCW) 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).

TRC Environmental Corporation (TRC) prepared this Annual Groundwater Monitoring Report for the JCW landfill CCR unit on behalf of CEC. This Annual Report was prepared in accordance with the requirements of §257.90(e) and presents the monitoring results and the statistical evaluation of the detection monitoring parameters (Appendix III to Part 257 of the CCR Rule) for the September 2017 semiannual groundwater monitoring event for the JCW landfill CCR unit. This event is the initial detection monitoring event performed to comply with §257.94. As part of the statistical evaluation, the data collected during detection monitoring events are evaluated to identify statistically significant increases (SSIs) in detection monitoring parameters to determine if concentrations in detection monitoring well samples exceed background levels.

Potential SSIs over background limits were noted for boron and pH in one or more downgradient wells for the September 2017 monitoring event. This is the initial detection monitoring event; therefore, it is the initial identification of a SSI over background levels. According to §257.94(e), if the facility determines, pursuant to §257.93(h), that there is a SSI over background levels for one or more of the Appendix III constituents, the facility will, within 90 days of detecting a SSI, establish an assessment monitoring program ~~or~~ demonstrate that:

- A source other than the CCR unit caused the SSI, or
- The SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.

In response to the potential SSIs over background limits noted during September 2017, CEC plans to prepare an Alternative Source Demonstration (ASD) to evaluate whether a source other than the CCR unit caused the SSIs prior to initiating assessment monitoring.

Section 1

Introduction

1.1 Program Summary

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule). The CCR Rule, which became effective on October 19, 2015, applies to the Consumers Energy Company (CEC) Bottom Ash Pond at the former JC Weadock (JCW) 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).

TRC Environmental Corporation (TRC) prepared this Annual Groundwater Monitoring Report (Annual Report) for the JCW landfill CCR unit on behalf of CEC. This Annual Report was prepared in accordance with the requirements of §257.90(e) and presents the monitoring results and the statistical evaluation of the detection monitoring parameters (Appendix III to Part 257 of the CCR Rule) for the September 2017 semiannual groundwater monitoring event for the JCW landfill CCR unit. This event is the initial detection monitoring event performed to comply with §257.94. The monitoring was performed in accordance with the *JC Weadock Monitoring Program Sample Analysis Plan (SAP)* (ARCADIS, May 2016) and statistically evaluated per the *Groundwater Statistical Evaluation Plan (Stats Plan)* (TRC, October 2017). As part of the statistical evaluation, the data collected during detection monitoring events are evaluated to identify statistically significant increases (SSIs) of detection monitoring parameters compared to background levels.

1.2 Site Overview

The JC Weadock (JCW) coal-fired Power Plant site (the site) is located south of the DE Karn Power Plant site (DEK site), east of the Saginaw River, west of Underwood Drain and Saginaw Bay, and north of Tacey Drain and agricultural land (Figure 1). A discharge channel separates the site from the DEK site to the north. The plant, located on the western edge of the property, began generating electricity in 1940. Six power generating units were in operation from 1940 until they were retired in 1980. In 1958 and 1959, two additional units were added. JC Weadock ceased generating electricity on April 15, 2016.

The area authorized for disposal of solid waste is located east of the JCW plant (Figure 2). The JCW Solid Waste Disposal Area is a 292-acre Type III low hazard industrial waste landfill,

permitted for construction in 1992, and is governed by the Part 115 Solid Waste Disposal Area Operating License No. 9440 dated June 26, 2015.

The landfill is being monitored in accordance with the MDEQ approved Part 115 *Hydrogeological Monitoring Plan Rev. 2: JC Weadock Solid Waste Disposal Area* (June 5, 2015). This existing CCR Landfill is delineated by the acreage of the solid waste disposal area permitted for the vertical expansion and bounded by a soil-bentonite slurry wall constructed along the centerline of the perimeter embankment dike to a depth that it is keyed in the competent confining clay underlying the unit.

An additional unit subject to the CCR rule is the JCW Bottom Ash Pond (BAP), which is located immediately west of the historic pond/landfill area and outside of the soil-bentonite slurry wall. The bottom ash pond is the primary settling/detention structure for the National Pollutant Discharge Elimination System (NPDES) treatment system prior to discharge and characterized as an existing CCR surface impoundment. This report focuses on the JCW landfill.

1.3 Geology/Hydrogeology

The majority of JCW Landfill area is comprised of surficial CCR and sand fill. USGS topographic maps and aerial photographs dating back to 1938, in addition to field descriptions of subsurface soil at the site, indicate that the site was largely developed by reclaiming low-lands through construction of perimeter dikes and subsequent ash filling.

The surficial fill consists of a mixture of varying percentages of ash, sand, and clay-rich fill ranging from 5 to 15 feet thick. Below the surficial fill, native alluvium and lacustrine soils are present at varying depths. Generally, there is a well graded sand unit present to depths of 10-30 feet below ground surface (ft bgs) overlying a clay till which is observed at depths ranging from 25 to 75 ft-bgs. A sandstone unit, which is part of the Saginaw formation, was generally encountered at 80-90 ft bgs.

The site is bound by several surface water features (Figure 1): the Saginaw River to the west, a discharge channel and Saginaw Bay (Lake Huron) to the north, Underwood Drain to the east, and Tacey Drain to the south. Groundwater flow in the upper aquifer is largely controlled by the surface water elevations of Saginaw River and Saginaw Bay. In general, shallow groundwater is encountered at a similar or slightly higher elevation relative to the surrounding surface water features. The shallow groundwater flow beneath the JCW Landfill is directed north to the discharge channel due to the bentonite/soil slurry wall.

Based on the hydrogeology and operational history at the site, particularly the conductive properties of the sandy aquifer, the prominent and consistent groundwater flow direction in the area of the JCW Landfill, in addition to the history of CCR-related operations throughout the JC Weadock Site, an inter-well statistical approach is recommended for detection monitoring as outlined in the Stats Plan.

Section 2

Groundwater Monitoring

2.1 Monitoring Well Network

A groundwater monitoring system has been established for the JCW landfill unit, which defined the monitoring well network for detection monitoring. The detection monitoring well network for the JCW landfill CCR unit currently consists of seven monitoring wells that are screened in the uppermost aquifer (four background monitoring wells and three downgradient monitoring wells). The monitoring well locations are shown on Figure 2.

Four monitoring wells located south of the JCW landfill provide data on background groundwater quality that has not been affected by the CCR unit (MW-15002, MW-15008, MW-15016, and MW-15019). Due to the site hydrogeology and operational history of the site, a hydraulically upgradient location was not available to monitor this CCR unit. The area where background wells are located, while not upgradient, is not affected by any CCR units and therefore meets the requirements of § 257.91(a)(1). Background groundwater quality data from these four background wells are additionally used for groundwater monitoring program for the JCW BAP CCR unit as well as the DEK BAP unit.

Since the CCR Landfill Unit is almost entirely surrounded by a soil/bentonite slurry wall, three groundwater monitoring wells were installed within the vent area to monitor downgradient water quality (JCW-MW-15011, JCW-MW-15012, and JCW-MW-15023).

As shown on Figure 2, monitoring well MW-15018, MW-15020, MW-15024, and MW-15027 are used for water level measurements only. These wells were originally installed as a part of the background well network, but because of the relatively close lateral spacing of the eight background wells, the results for each well may not be as statistically independent as desired for evaluation of CCR monitoring data. Regardless, if background can be appropriately characterized with fewer wells [a minimum of one upgradient (background) and three downgradient wells are required per § 257.91(c)(1)], it is appropriate to select a smaller number of wells to represent background for the site. As presented in the Stats Plan monitoring wells MW-15002, MW-15008, MW-15016, and MW-15019 have been selected to represent background groundwater quality at the Karn and Weadock sites.

2.2 Background Sampling

Background groundwater monitoring was conducted at the JCW landfill CCR unit from December 2015 through August 2017 in accordance with the SAP. Data collection included eight rounds (Rounds 1 through 8) of static water elevation measurements, analysis for parameters

required in the CCR Rule's Appendix III and Appendix IV to Part 257, and field parameters (dissolved oxygen, oxidation reduction potential, pH, specific conductivity, temperature, and turbidity) from all 14 monitoring wells installed at the site. The Rounds 1 through 7 groundwater samples were collected and analyzed by CEC's Laboratory Services, Jackson, Michigan. Round 8 groundwater sampling was conducted by TRC from August 1 through 4, 2017, and analyzed by Pace Analytical Services, LLC (Pace). Background data are included in Appendix A Tables 1 through 4, where: Table 1 is a summary of static water elevation data; Table 2 (background) and Table 3 (downgradient) are each a summary of groundwater analytical data compared to potentially relevant criteria; and Table 4 is a summary of field data.

In addition to the data tables, groundwater contour maps were developed for each of the background events to evaluate groundwater flow directions. The contour maps for each background monitoring event are also included in Appendix A as Figures 1 through 8.

2.3 Semiannual Groundwater Monitoring

The semiannual monitoring parameters for the detection groundwater monitoring program were selected per the CCR Rule's Appendix III to Part 257 – Constituents for Detection Monitoring. The Appendix III indicator parameters consist of boron, calcium, chloride, fluoride, pH (field reading), sulfate, and total dissolved solids (TDS) and were analyzed in accordance with the SAP. In addition to pH, the collected field parameters included dissolved oxygen, oxidation reduction potential, specific conductivity, temperature, and turbidity.

2.3.1 Data Summary

The initial semiannual groundwater detection monitoring event for 2017 was performed on September 18 and 19, 2017, 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 four background monitoring wells and six downgradient monitoring wells for the Appendix III indicator parameters and field parameters. A summary of the groundwater data collected during the September 2017 event is provided on Table 1 (static groundwater elevation data), Table 2 (analytical results), and Table 3 (field data).

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. Particular data non-conformances are summarized in Appendix B.

2.3.3 Groundwater Flow Rate and Direction

Groundwater elevation data collected during the most recent background sampling event were similar to data collected during the initial eight rounds of sampling that commenced in October 2015. Groundwater elevations at the site are generally within the range of 580 to 584 feet above mean sea level (ft AMSL) and groundwater is typically encountered at a similar or slightly higher elevation relative to the surrounding surface water features, flowing outward toward the bounding surface water features. Groundwater elevations measured during the September 2017 sampling event are provided on Table 1 and were used to construct a groundwater contour map (Figure 3).

The map indicates that groundwater flow beneath the JCW landfill is directed north to the discharge channel due to the bentonite/soil slurry wall. The geometric mean hydraulic gradient through the JCW landfill CCR unit slurry wall vent during this event is estimated at 0.0043 ft/ft. The gradient was calculated using the well pair JCW-MW-15011 and JCW-MW-15023, as well as the water elevation differences and distances between JCW-MW-15012 and the discharge channel (Figure 3). Using the mean hydraulic conductivity of 16 ft/day (ARCADIS, 2016) and an assumed effective porosity of 0.3, the estimated average seepage velocity is approximately 0.23 ft/day or 84 ft/year for this event.

The general flow direction is similar to that identified in previous monitoring rounds and continues to demonstrate that the downgradient wells are appropriately positioned to detect the presence of Appendix III parameters that could potentially migrate from the JCW landfill CCR unit.

Section 3

Statistical Evaluation

3.1 Establishing Background Limits

Per the Stats Plan, background limits were established for the Appendix III indicator parameters following the eighth round of background monitoring using data collected from the four established background monitoring wells (MW-15002, MW-15008, MW-15016, and MW-15019). The statistical evaluation of the background data is presented in detail in Appendix C. The Appendix III background limits will be used throughout the detection monitoring period to determine whether groundwater has been impacted from the JCW landfill CCR unit by comparing concentrations in the downgradient wells to the background limits for each Appendix III indicator parameter.

3.2 Data Comparison to Background Limits

The concentrations of the indicator parameters in the downgradient wells were compared to the statistical background limits calculated from the background data collected from MW-15002, MW-15008, MW-15016, and MW-15019. The comparisons are presented on Table 4.

The statistical evaluation of the September 2017 Appendix III indicator parameters shows potential SSIs over background for:

- Boron at JCW-MW-15011, JCW-MW-15012, JCW-MW-15023; and
- Field pH at JCW-MW-15023 (high)

The initial observation of an indicator parameter concentration above the established background limits does not necessarily constitute a SSI. Per the Stats Plan, if there is an exceedance of a prediction limit for one or more of the parameters, the well(s) of concern can be resampled within 30 days of the completion of the initial statistical analysis for verification purposes. There were no SSIs compared to background for calcium, chloride, fluoride, sulfate, or TDS at any of the downgradient wells.

Section 4

Conclusions and Recommendations

Potential SSIs over background limits were noted for boron, fluoride, pH, and sulfate in one or more downgradient wells during September 2017. This is the initial detection monitoring event; therefore, it is the initial identification of a SSI over background levels. According to §257.94(e), if the facility determines, pursuant to §257.93(h), that there is a SSI over background levels for one or more of the Appendix III constituents, the facility will, within 90 days of detecting a SSI, establish an assessment monitoring program ~~or~~ demonstrate that:

- A source other than the CCR unit caused the SSI, or
- The SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.

The owner or operator must complete a written demonstration (i.e., Alternative Source Demonstration, ASD), of the above within 90 days of confirming the SSI. Based on the outcome of the ASD the following steps will be taken:

- If a successful ASD is completed, a certification from a qualified professional engineer is required, and the CCR unit may continue with detection monitoring.
- If a successful ASD is not completed within the 90-day period, the owner or operator of the CCR unit must initiate an assessment monitoring program as required under §257.95. The facility must also include the ASD in the annual groundwater monitoring and corrective action report required by §257.90(e), in addition to the certification by a qualified professional engineer.

During the 90-day period after triggering assessment monitoring, groundwater samples will be collected from the groundwater monitoring system wells and analyzed for Appendix IV constituents pursuant to §257.95(b). Within 90 days of obtaining the results from the first assessment monitoring event, groundwater samples will be collected from the groundwater monitoring system wells and analyzed for Appendix III parameters and the detected Appendix IV parameters in the initial assessment monitoring event.

In response to the potential SSIs over background limits noted during September 2017, CEC plans to prepare an ASD to evaluate whether a source other than the JCW landfill CCR unit caused the SSIs prior to initiating assessment monitoring. Based on the results from the ASD, CEC will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Section 5 References

ARCADIS. May 13, 2016. Summary of Monitoring Well Design, Installation, and Development. JC Weadock Electric Generation Facility – Essexville, Michigan. Prepared for Consumers Energy Company.

ARCADIS. May 18, 2016. Electric Generation Facilities RCRA CCR Detection Monitoring Program. JC Weadock Monitoring Program Sample Analysis Plan, Essexville, Michigan. Prepared for Consumers Energy Company.

TRC Environmental Corporation. October 2017. Groundwater Statistical Evaluation Plan – JC Weadock Power Plant, Bottom Ash Pond, Essexville, Michigan. Prepared for Consumers Energy Company.

Consumers Energy Company. June 9, 2015. Hydrogeological Monitoring Plan Rev. 2: JC Weadock Solid Waste Disposal Area.

Tables

Table 1
 Summary of Groundwater Elevation Data – September 2017
 DE Karn and JC Weadock – RCRA CCR Monitoring Program
 Essexville, 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)	September 18, 2017			
										Depth to Water (ft BTOC)	Groundwater Elevation (ft)		
Background													
MW-15002	584.9	587.71	Sand	4.0	to	14.0	580.9	to	570.9	15.0	569.9	6.89	580.82
MW-15008	582.7	585.36	Sand with clay from 8 - 8.5 ft bgs	4.0	to	14.0	578.7	to	568.7	39.0	543.7	4.26	581.10
MW-15016	583.7	586.49	Sand	2.5	to	5.5	581.2	to	578.2	9.0	574.7	5.77	580.72
MW-15018	583.6	586.42	Sand	3.0	to	7.0	580.6	to	576.6	9.0	574.6	5.60	580.82
MW-15019	583.5	586.17	Sand (4 - 7.5 ft bgs) and Sand/Clay (7.5 - 14 ft bgs)	4.0	to	14.0	579.5	to	569.5	19.0	564.5	5.20	580.97
MW-15020	582.5	585.95	Sand	4.0	to	14.0	578.5	to	568.5	19.0	563.5	4.87	581.08
MW-15024	583.7	586.56	Sand	4.0	to	14.0	579.7	to	569.7	19.5	564.2	5.53	581.03
MW-15027	583.2	586.25	Sand	5.0	to	15.0	578.2	to	568.2	15.5	567.7	5.18	581.07
JCW Bottom Ash Pond													
JCW-MW-15007	585.2	587.40	Sand	2.5	to	6.0	582.7	to	579.2	19.0	566.2	4.42	582.98
JCW-MW-15009	586.9	589.64	Sand	5.0	to	10.0	581.9	to	576.9	10.0	576.9	8.80	580.84
JCW-MW-15010	595.2	597.76	Sand	15.5	to	17.0	579.7	to	578.2	19.0	576.2	15.61	582.15
JCW-MW-15028	586.7	589.37	Sand	19.0	to	22.0	567.7	to	564.7	22.0	564.7	8.50	580.87
JCW Landfill													
JCW-MW-15011	594.9	597.07	Sand	12.5	to	16.0	582.4	to	578.9	18.0	576.9	14.24	582.83
JCW-MW-15012	592.2	595.07	Sand (10.8 - 15 ft bgs) and Clay (15 - 15.8 ft bgs)	10.8	to	15.8	581.4	to	576.4	19.0	573.2	14.00	581.07
JCW-MW-15023	592.7	595.32	Sand	13.0	to	18.0	579.7	to	574.7	19.0	573.7	13.15	582.17
DEK Bottom Ash Pond													
DEK-MW-15001	592.1	594.64	Sand	16.0	to	17.0	576.1	to	575.1	19.0	573.1	8.35	586.29
DEK-MW-15002	588.3	590.87	Sand	10.0	to	13.0	578.3	to	575.3	19.0	569.3	4.31	586.56
DEK-MW-15003	599.9	602.79	Sand	21.0	to	25.0	578.9	to	574.9	29.0	570.9	12.95	589.84
DEK-MW-15004 ⁽¹⁾	604.9	607.40	Sand	30.0	to	35.0	574.9	to	569.9	39.0	565.9	21.51	590.29
DEK-MW-15005	586.8	589.72	Sand	14.5	to	19.5	572.3	to	567.3	19.5	567.3	8.02	581.70
DEK-MW-15006	586.5	589.24	Sand	13.5	to	18.5	573.0	to	568.0	19.5	567.0	8.61	580.63

Notes:

Survey conducted by Rowe Professional Services Company, November 2015.

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.

(1) Approximately 4.4-ft of riser added to DEK-MW-15004 subsequent to Round 7. Groundwater elevations adjusted accordingly. New TOC survey pending.

Table 2
 Summary of Groundwater Sampling Results (Analytical) – September 2017
 JC Weadock Landfill – RCRA CCR Monitoring Program
 Essexville, Michigan

						Sample Location:	JCW-MW-15011	JCW-MW-15012	JCW-MW-15023
						Sample Date:	9/19/2017	9/19/2017	9/19/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient			
Appendix III									
Boron	ug/L	NC	500	500	7,200	1,680	2,110	1,060	
Calcium	mg/L	NC	NC	NC	500	168	127	86.6	
Chloride	mg/L	250**	250	250	50	70.1	69.1	72.3	
Fluoride	ug/L	4,000	NC	NC	NC	<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	7.2	6.9	7.4	
Sulfate	mg/L	250**	250	250	500	304	98.0	99.2	
Total Dissolved Solids	mg/L	500**	500	500	500	810	638	490	

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

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

NC - no criteria.

* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 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 default hardness of 150 mg CaCO₃/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium and sulfate is the total dissolved solids criterion. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters, based on footnote {FF}.

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

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
 Summary of Groundwater Sampling Results (Analytical) – September 2017
 JC Weadock Landfill – RCRA CCR Monitoring Program
 Essexville, Michigan

Sample Location:						MW-15002	MW-15008	MW-15016	MW-15018	MW-15019	MW-15020	MW-15024	MW-15027
Sample Date:						9/19/2017	9/19/2017	9/19/2017	9/19/2017	9/19/2017	9/19/2017	9/19/2017	9/19/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	500	500	7,200	313	183	602	105	324	178	217	223
Calcium	mg/L	NC	NC	NC	500	249	109	160	113	155	82.2	102	103
Chloride	mg/L	250**	250	250	50	2,270	329	99.5	79.4	438	298	418	379
Fluoride	ug/L	4,000	NC	NC	NC	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000
pH, Field	SU	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	6.9	6.8	7.1	7.2	6.9	7.0	7.1	7.0
Sulfate	mg/L	250**	250	250	500	<2.0	3.9	13.3	7.1	99.7	39.3	5.6	15.0
Total Dissolved Solids	mg/L	500**	500	500	500	4,280	848	756	478	1,200	794	1,000	968

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

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

NC - no criteria.

* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 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 default hardness of 150 mg CaCO₃/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium and sulfate is the total dissolved solids criterion. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters, based on footnote {FF}.

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

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 3
 Summary of Field Parameter Results – September 2017
 JC Weadock Landfill – RCRA CCR Monitoring Program
 Essexville, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Background							
MW-15002	9/19/2017	0.19	-39.6	6.9	7,725	15.85	5.44
MW-15008	9/19/2017	0.14	-10.5	6.8	1,533	14.88	3.67
MW-15016	9/19/2017	0.16	-6.4	7.1	1,243	18.55	5.37
MW-15018	9/19/2017	0.14	-51.1	7.2	852	17.70	2.32
MW-15019	9/19/2017	0.14	-42.3	6.9	2,001	16.05	1.69
MW-15020	9/19/2017	0.48	-16.6	7.0	1,377	15.40	2.12
MW-15024	9/19/2017	0.17	9.2	7.1	1,648	15.27	<1
MW-15027	9/19/2017	0.15	10.1	7.0	1,607	15.73	<1
Landfill							
JCW-MW-15011	9/19/2017	0.20	-289.4	7.2	1,287	15.15	3.00
JCW-MW-15012	9/19/2017	0.25	73.1	6.9	1,105	16.43	2.35
JCW-MW-15023	9/19/2017	0.19	-232.1	7.4	847	17.02	3.34

Notes:

- mg/L - Milligrams per Liter.
- mV - Millivolts.
- SU - Standard units.
- umhos/cm - Micromhos per centimeter.
- °C - Degrees Celcius
- NTU - Nephelometric Turbidity Unit.

Table 4
 Comparison of Appendix III Parameter Results to Background Limits – September 2017
 JC Weadock Landfill – RCRA CCR Monitoring Program
 Essexville, Michigan

		Sample Location:	JCW-MW-15011	JCW-MW-15012	JCW-MW-15023
		Sample Date:	9/19/2017	9/19/2017	9/19/2017
Constituent	Unit	UTL	downgradient		
Appendix III					
Boron	ug/L	619	1,680	2,110	1,060
Calcium	mg/L	302	168	127	86.6
Chloride	mg/L	2,440	70.1	69.1	72.3
Fluoride	ug/L	1,000	<1,000	<1,000	<1,000
pH, Field	SU	6.5-7.3	7.2	6.9	7.4
Sulfate	mg/L	407	304	98.0	99.2
Total Dissolved Solids	mg/L	4,600	810	638	490

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

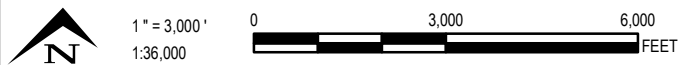
All metals were analyzed as total unless otherwise specified.

RESULT	Shading and bold font indicates an exceedance of the Upper Tolerance Limit (UTL) using the number of significant figures in the UTL.
---------------	--

Figures



BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.



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

TRC - GIS

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

TITLE:
SITE LOCATION MAP

DRAWN BY:	J. PAPEZ
CHECKED BY:	D. LITZ
APPROVED BY:	G. CROCKFORD
DATE:	OCTOBER 2017
PROJ. NO.:	269767-002/3
FILE:	269767-002_3-007SLM.mxd

FIGURE 1

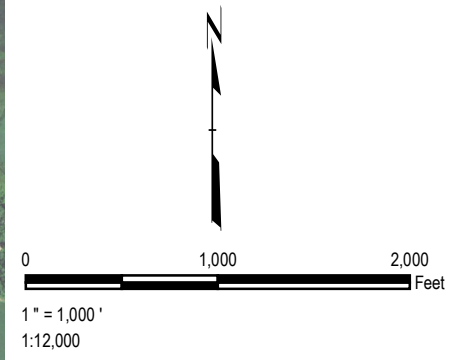


LEGEND

- BACKGROUND MONITORING WELL
- JCW BOTTOM ASH POND MONITORING WELL
- JCW LANDFILL MONITORING WELL
- SURFACE WATER GAUGING STATION
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- SLURRY WALL (APPROXIMATE)

NOTES

1. BASE MAP IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/10/2016.
2. WELL LOCATIONS SURVEYED BY ROWE PROFESSIONAL SERVICES COMPANY ON 11/4/2015.
3. NOAA/NATIONAL OCEANIC SERVICE GREAT LAKES GAUGING STATION, ESSEXVILLE, MI (ID: 9075035).



PROJECT:	
CONSUMERS ENERGY COMPANY JC WEADOCK POWER PLANT ESSEXVILLE, MICHIGAN	
TITLE:	
SITE PLAN WITH CCR MONITORING WELL LOCATIONS	
DRAWN BY: J. PAPEZ	PROJ NO.: 269767-003
CHECKED BY: D.LITZ	FIGURE 2
APPROVED BY: G.CROCKFORD	
DATE: JANUARY 2018	
1540 Eisenhower Place Ann Arbor, MI 48108-3284 Phone: 734.971.7080 www.trcsolutions.com	
FILE NO.: 269767-003-002.mxd	

Plot Date: 1/3/2018, 16:55:59 PM by SMAJOR -- LAYOUT: ANSIB(11"x17")
 Path: E:\ConsumersEnergy\GIS\2017_269767\269767_002_3_021.mxd
 Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
 Map Rotation: 0



LEGEND

- BACKGROUND MONITORING WELL
- DEK BOTTOM ASH POND MONITORING WELL
- JCW BOTTOM ASH POND MONITORING WELL
- JCW LANDFILL MONITORING WELL
- SURFACE WATER GAUGING STATION
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- SLURRY WALL (APPROXIMATE)
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)

- ### NOTES
1. BASE MAP IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/10/2016.
 2. WELL LOCATIONS SURVEYED BY ROWE PROFESSIONAL SERVICES COMPANY ON 11/4/2015.
 3. NOAA/NATIONAL OCEANIC SERVICE GREAT LAKES GAUGING STATION, ESSEXVILLE, MI (ID: 9075035).

0 1,000 2,000
Feet

1" = 1,000'
1:12,000

PROJECT: CONSUMERS ENERGY COMPANY DE KARN AND JC WEADOCK POWER PLANTS ESSEXVILLE, MICHIGAN	
TITLE: SHALLOW GROUNDWATER CONTOUR MAP SEPTEMBER 2017	
DRAWN BY: S. MAJOR CHECKED BY: D. LITZ APPROVED BY: G. CROCKFORD DATE: JANUARY 2018	PROJ NO.: 269767-002 FIGURE 3
1540 Eisenhower Place Ann Arbor, MI 48108-3284 Phone: 734.971.7080 www.trcsolutions.com	
FILE NO.: 269767-002_3-021.mxd	

Appendix A

Background Data

Table 1
 Summary of Groundwater Elevation Data
 DE Karn and JC Weadock – RCRA CCR Monitoring Program
 Essexville, 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)	Round 1		Round 2		Round 3		Round 4			
								December 8, 2015		March 28, 2016		May 23, 2016		August 22, 2016			
								Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)		
Background																	
MW-15002	584.9	587.71	Sand	4.0 to 14.0	580.9 to 570.9	15.0	569.9	7.22	580.49	6.20	581.51	6.83	580.88	6.79	580.92		
MW-15008	582.7	585.36	Sand with clay from 8 - 8.5 ft bgs	4.0 to 14.0	578.7 to 568.7	39.0	543.7	4.68	580.68	4.34	581.02	4.45	580.91	4.52	580.84		
MW-15016	583.7	586.49	Sand	2.5 to 5.5	581.2 to 578.2	9.0	574.7	3.76	582.73	3.10	583.39	5.18	581.31	3.85	582.64		
MW-15018	583.6	586.42	Sand	3.0 to 7.0	580.6 to 576.6	9.0	574.6	5.92	580.50	5.03	581.39	5.60	580.82	5.38	581.04		
MW-15019	583.5	586.17	Sand (4 - 7.5 ft bgs) and Sand/Clay (7.5 - 14 ft bgs)	4.0 to 14.0	579.5 to 569.5	19.0	564.5	5.78	580.39	5.06	581.11	5.31	580.86	5.27	580.90		
MW-15020	582.5	585.95	Sand	4.0 to 14.0	578.5 to 568.5	19.0	563.5	5.34	580.61	4.99	580.96	5.11	580.84	5.17	580.78		
MW-15024	583.7	586.56	Sand	4.0 to 14.0	579.7 to 569.7	19.5	564.2	6.29	580.27	5.50	581.06	5.74	580.82	5.70	580.86		
MW-15027	583.2	586.25	Sand	5.0 to 15.0	578.2 to 568.2	15.5	567.7	5.65	580.60	5.29	580.96	5.42	580.83	5.48	580.77		
JCW Bottom Ash Pond																	
JCW-MW-15007	585.2	587.40	Sand	2.5 to 6.0	582.7 to 579.2	19.0	566.2	3.82	583.58	2.98	584.42	4.28	583.12	3.66	583.74		
JCW-MW-15009	586.9	589.64	Sand	5.0 to 10.0	581.9 to 576.9	10.0	576.9	8.80	580.84	7.05	582.59	8.10	581.54	7.56	582.08		
JCW-MW-15010	595.2	597.76	Sand	15.5 to 17.0	579.7 to 578.2	19.0	576.2	15.75	582.01	14.64	583.12	15.13	582.63	15.34	582.42		
JCW-MW-15028	586.7	589.37	Sand	19.0 to 22.0	567.7 to 564.7	22.0	564.7	6.97	582.40	4.46	584.91	6.80	582.57	5.70	583.67		
JCW Landfill																	
JCW-MW-15011	594.9	597.07	Sand	12.5 to 16.0	582.4 to 578.9	18.0	576.9	12.67	584.40	12.39	584.68	12.87	584.20	13.26	583.81		
JCW-MW-15012	592.2	595.07	Sand (10.8 - 15 ft bgs) and Clay (15 - 15.8 ft bgs)	10.8 to 15.8	581.4 to 576.4	19.0	573.2	14.53	580.54	13.33	581.74	13.64	581.43	14.13	580.94		
JCW-MW-15023	592.7	595.32	Sand	13.0 to 18.0	579.7 to 574.7	19.0	573.7	11.15	584.17	10.40	584.92	11.01	584.31	11.99	583.33		
DEK Bottom Ash Pond																	
DEK-MW-15001	592.1	594.64	Sand	16.0 to 17.0	576.1 to 575.1	19.0	573.1	8.67	585.97	6.80	587.84	8.55	586.09	6.34	588.30		
DEK-MW-15002	588.3	590.87	Sand	10.0 to 13.0	578.3 to 575.3	19.0	569.3	4.85	586.02	3.98	586.89	4.62	586.25	4.10	586.77		
DEK-MW-15003	599.9	602.79	Sand	21.0 to 25.0	578.9 to 574.9	29.0	570.9	13.97	588.82	12.96	589.83	13.42	589.37	12.40	590.39		
DEK-MW-15004 ⁽¹⁾	604.9	607.40	Sand	30.0 to 35.0	574.9 to 569.9	39.0	565.9	18.54	588.86	18.00	589.40	18.03	589.37	17.49	589.91		
DEK-MW-15005	586.8	589.72	Sand	14.5 to 19.5	572.3 to 567.3	19.5	567.3	10.00	579.72	8.95	580.77	8.98	580.74	8.65	581.07		
DEK-MW-15006	586.5	589.24	Sand	13.5 to 18.5	573.0 to 568.0	19.5	567.0	9.59	579.65	8.56	580.68	8.52	580.72	8.23	581.01		

Notes:

Survey conducted by Rowe Professional Services Company, November 2015.

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.

(1) Approximately 4.4-ft of riser added to DEK-MW-15004 subsequent to Round 7. Groundwater elevations adjusted accordingly. New TOC survey pending.

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

Well Location	Ground Surface Elevation (ft)	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Depth (ft BGS)		Screen Interval Elevation (ft)		Round 5		Round 6		Round 7		Round 8			
								November 29, 2016		February 20, 2017		May 16, 2017		August 1, 2017			
								Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)		
Background																	
MW-15002	584.9	587.71	Sand	4.0	to	14.0	580.9	to	570.9	6.62	581.09	6.89	580.82	6.67	581.04	6.77	580.94
MW-15008	582.7	585.36	Sand with clay from 8 - 8.5 ft bgs	4.0	to	14.0	578.7	to	568.7	4.60	580.76	4.45	580.91	4.36	581.00	4.11	581.25
MW-15016	583.7	586.49	Sand	2.5	to	5.5	581.2	to	578.2	3.22	583.27	3.11	583.38	3.93	582.56	5.45	581.04
MW-15018	583.6	586.42	Sand	3.0	to	7.0	580.6	to	576.6	5.35	581.07	5.66	580.76	5.49	580.93	5.44	580.98
MW-15019	583.5	586.17	Sand (4 - 7.5 ft bgs) and Sand/Clay (7.5 - 14 ft bgs)	4.0	to	14.0	579.5	to	569.5	5.41	580.76	5.57	580.60	5.28	580.89	5.14	581.03
MW-15020	582.5	585.95	Sand	4.0	to	14.0	578.5	to	568.5	5.21	580.74	5.09	580.86	5.03	580.92	4.79	581.16
MW-15024	583.7	586.56	Sand	4.0	to	14.0	579.7	to	569.7	5.96	580.60	6.07	580.49	5.69	580.87	5.43	581.13
MW-15027	583.2	586.25	Sand	5.0	to	15.0	578.2	to	568.2	5.56	580.69	5.40	580.85	5.31	580.94	5.10	581.15
JCW Bottom Ash Pond																	
JCW-MW-15007	585.2	587.40	Sand	2.5	to	6.0	582.7	to	579.2	3.25	584.15	3.74	583.66	3.98	583.42	4.34	583.06
JCW-MW-15009	586.9	589.64	Sand	5.0	to	10.0	581.9	to	576.9	9.19	580.45	9.35	580.29	8.33	581.31	8.23	581.41
JCW-MW-15010	595.2	597.76	Sand	15.5	to	17.0	579.7	to	578.2	16.69	581.07	16.70	581.06	15.48	582.28	15.31	582.45
JCW-MW-15028	586.7	589.37	Sand	19.0	to	22.0	567.7	to	564.7	7.05	582.32	7.62	581.75	6.90	582.47	7.77	581.60
JCW Landfill																	
JCW-MW-15011	594.9	597.07	Sand	12.5	to	16.0	582.4	to	578.9	14.68	582.39	14.42	582.65	12.59	584.48	13.25	583.82
JCW-MW-15012	592.2	595.07	Sand (10.8 - 15 ft bgs) and Clay (15 - 15.8 ft bgs)	10.8	to	15.8	581.4	to	576.4	15.48	579.59	15.15	579.92	14.00	581.07	13.45	581.62
JCW-MW-15023	592.7	595.32	Sand	13.0	to	18.0	579.7	to	574.7	13.95	581.37	13.75	581.57	11.60	583.72	12.25	583.07
DEK Bottom Ash Pond																	
DEK-MW-15001	592.1	594.64	Sand	16.0	to	17.0	576.1	to	575.1	7.38	587.26	8.31	586.33	8.49	586.15	8.40	586.24
DEK-MW-15002	588.3	590.87	Sand	10.0	to	13.0	578.3	to	575.3	4.20	586.67	4.42	586.45	4.42	586.45	4.57	586.30
DEK-MW-15003	599.9	602.79	Sand	21.0	to	25.0	578.9	to	574.9	13.21	589.58	13.64	589.15	13.51	589.28	12.97	589.82
DEK-MW-15004 ⁽¹⁾	604.9	607.40	Sand	30.0	to	35.0	574.9	to	569.9	18.35	589.05	18.60	588.80	17.61	589.79	21.54	590.26
DEK-MW-15005	586.8	589.72	Sand	14.5	to	19.5	572.3	to	567.3	10.33	579.39	9.84	579.88	8.98	580.74	8.43	581.29
DEK-MW-15006	586.5	589.24	Sand	13.5	to	18.5	573.0	to	568.0	9.95	579.29	9.43	579.81	8.51	580.73	7.87	581.37

Notes:

Survey conducted by Rowe Professional Services Company, November 2015.

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.

(1) Approximately 4.4-ft of riser added to DEK-MW-15004 subsequent to Round 7. Groundwater elevations adjusted accordingly. New TOC survey pending.

Table 2
 Summary of Analytical Results for Background Groundwater Samples
 DE Karn and JC Weadock – RCRA CCR Monitoring Program
 Essexville, Michigan

Sample Location:						MW-15002							
Sample Date:						12/8/2015	3/28/2016	5/23/2016	8/22/2016	11/30/2016	2/22/2017	5/17/2017	8/1/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	500	500	7,200	275	22	163	79	48	133	138	205
Calcium	mg/L	NC	NC	NC	500	198	174	288	114	84.7	260	267	255
Chloride	mg/L	250**	250	250	50	1,130	773	2,140	420	260	1,470	1,970	2,290
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	7.04	7	6.6	6.9	7.2	7	6.8	6.87
Sulfate	mg/L	250**	250	250	500	9.63	40.3	5.25	39.8	23.4	13.1	11.5	<2.0
Total Dissolved Solids	mg/L	500**	500	500	500	2,400	1,700	4,500	1,300	980	3,100	4,300	4,600
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	10	10	10	10	4	<1	7	<1	2	2	3	4.8
Barium	ug/L	2,000	2,000	2,000	670	1,010	216	796	167	212	851	580	912
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	1	1	2	<1	1	1	2	1.3
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	37.7	<10	21	<10	<10	24	22	31
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	73	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.637	0.330	0.893	<0.264	<0.402	0.556	0.879	1.72
Radium-226/228	pCi/L	5	NC	NC	NC	2.05	<0.644	2.52	<1.05	<0.433	2.04	2.98	4.65
Radium-228	pCi/L	5	NC	NC	NC	1.41	<0.644	1.63	<1.05	<0.433	1.48	2.10	2.93
Selenium	ug/L	50	50	50	5	<1	<1	1	<1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<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.

NA - Result not yet available.

* - 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 default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium and sulfate is the total dissolved solids criterion. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters, based on footnote {FF}. 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.

Table 2
 Summary of Analytical Results for Background Groundwater Samples
 DE Karn and JC Weadock – RCRA CCR Monitoring Program
 Essexville, Michigan

Sample Location:						MW-15008							
Sample Date:						12/9/2015	3/29/2016	5/24/2016	8/23/2016	11/30/2016	2/22/2017	5/17/2017	8/2/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	500	500	7,200	236	169	176	202	204	174	187	164
Calcium	mg/L	NC	NC	NC	500	114	126	113	114	113	107	114	108
Chloride	mg/L	250**	250	250	50	292	231	246	214	192	200	149	300
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	6.82	6.7	6.5	6.7	6.8	6.8	7	6.90
Sulfate	mg/L	250**	250	250	500	5.15	26.7	8.60	17.9	25.6	27.7	10.1	13.4
Total Dissolved Solids	mg/L	500**	500	500	500	860	720	880	730	790	760	840	866
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	10	10	10	10	<1	1	1	1	1	<1	<1	<1.0
Barium	ug/L	2,000	2,000	2,000	670	69	64	63	58	69	57	60	58.2
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	3	2	3	2	2	1	2	1.1
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	22.3	19.7	17	20	22	20	19	22
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	73	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.481	0.546	0.411	0.320	0.444	<0.419	0.228	<0.937
Radium-226/228	pCi/L	5	NC	NC	NC	1.53	1.42	1.61	1.96	1.46	0.826	1.45	<1.79
Radium-228	pCi/L	5	NC	NC	NC	1.05	0.874	1.20	1.64	1.01	0.717	1.22	<0.848
Selenium	ug/L	50	50	50	5	<1	<1	<1	<1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<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.

NA - Result not yet available.

* - 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 default hardness of 150 mg CaCO₃/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium and sulfate is the total dissolved solids criterion. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters, based on footnote {FF}. 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.

Table 2
 Summary of Analytical Results for Background Groundwater Samples
 DE Karn and JC Weadock – RCRA CCR Monitoring Program
 Essexville, Michigan

Sample Location:						MW-15016							
Sample Date:						12/8/2015	3/29/2016	5/24/2016	8/22/2016	11/30/2016	2/22/2017	5/17/2017	8/1/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	500	500	7,200	490	56	472	660	435	463	491	590
Calcium	mg/L	NC	NC	NC	500	178	204	188	216	192	295	221	208
Chloride	mg/L	250**	250	250	50	89.7	264	91.1	93.6	83.0	160	110	113
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	7.06	7.1	6.8	6.8	7	7.2	6.9	7.00
Sulfate	mg/L	250**	250	250	500	35.1	151	75.0	70.6	18.1	817	243	294
Total Dissolved Solids	mg/L	500**	500	500	500	670	1,000	900	920	840	1,700	1,100	1,090
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	10	10	10	10	11	2	16	18	16	2	12	20.5
Barium	ug/L	2,000	2,000	2,000	670	237	114	233	299	241	109	151	197
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	1	1	1	<1	<1	2	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	31.2	16.9	33	48	28	181	88	83
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	73	210	3,200	6	<5	<5	<5	<5	6	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.311	0.303	0.292	<0.199	<0.304	<0.312	0.479	<1.01
Radium-226/228	pCi/L	5	NC	NC	NC	1.58	0.750	1.40	<1.41	1.08	0.736	0.958	<2.34
Radium-228	pCi/L	5	NC	NC	NC	1.27	<0.673	1.11	<1.41	0.871	0.573	<0.619	<1.33
Selenium	ug/L	50	50	50	5	<1	<1	<1	<1	<1	2	1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<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.

NA - Result not yet available.

* - 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 default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium and sulfate is the total dissolved solids criterion. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters, based on footnote {FF}. 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.

Table 2
 Summary of Analytical Results for Background Groundwater Samples
 DE Karn and JC Weadock – RCRA CCR Monitoring Program
 Essexville, Michigan

Sample Location:						MW-15018							
Sample Date:						12/9/2015	3/29/2016	5/24/2016	8/23/2016	11/30/2016	2/22/2017	5/16/2017	8/2/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	500	500	7,200	105	341	89	157	76	72	85	101
Calcium	mg/L	NC	NC	NC	500	167	203	110	176	177	138	124	104
Chloride	mg/L	250**	250	250	50	121	90.1	123	139	125	120	89.2	47.7
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	6.96	7.1	7	6.9	7.1	7	6.9	7.23
Sulfate	mg/L	250**	250	250	500	74.6	161	37.3	66.6	121	51.7	28.0	10.3
Total Dissolved Solids	mg/L	500**	500	500	500	720	880	650	760	840	690	580	478
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	10	10	10	10	2	12	4	7	5	4	6	4.4
Barium	ug/L	2,000	2,000	2,000	670	136	223	98	189	145	158	135	135
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	1	1	2	<1	<1	1	1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	19	38.7	14	21	19	18	16	14
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	73	210	3,200	<5	6	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	<0.214	0.463	<0.140	<0.317	<0.326	<0.283	<0.242	0.731
Radium-226/228	pCi/L	5	NC	NC	NC	0.701	1.38	<0.368	<1.15	0.749	<0.371	<0.608	1.80
Radium-228	pCi/L	5	NC	NC	NC	0.539	0.918	<0.368	<1.15	0.495	<0.371	<0.608	1.07
Selenium	ug/L	50	50	50	5	<1	2	<1	<1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<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.

NA - Result not yet available.

* - 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 default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium and sulfate is the total dissolved solids criterion. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters, based on footnote {FF}. 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.

Table 2
 Summary of Analytical Results for Background Groundwater Samples
 DE Karn and JC Weadock – RCRA CCR Monitoring Program
 Essexville, Michigan

Sample Location:						MW-15019							
Sample Date:						12/9/2015	3/29/2016	5/24/2016	8/23/2016	11/30/2016	2/22/2017	5/16/2017	8/2/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	500	500	7,200	304	244	279	343	300	317	299	293
Calcium	mg/L	NC	NC	NC	500	171	150	179	227	154	149	146	165
Chloride	mg/L	250**	250	250	50	437	387	408	358	359	379	357	380
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	6.84	6.8	6.7	6.7	6.8	6.8	6.7	6.86
Sulfate	mg/L	250**	250	250	500	99.7	51.2	116	195	67.3	54.2	49.5	120
Total Dissolved Solids	mg/L	500**	500	500	500	1,400	1,100	1,300	1,300	1,100	1,200	1,100	1,250
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	10	10	10	10	<1	<1	1	<1	<1	<1	<1	<1.0
Barium	ug/L	2,000	2,000	2,000	670	293	263	269	319	275	289	283	265
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	2	2	2	<1	<1	1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	15.8	11	14	21	13	13	14	16
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	73	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	1.02	0.477	0.515	0.759	0.524	<0.300	0.360	<0.844
Radium-226/228	pCi/L	5	NC	NC	NC	1.84	1.24	1.50	1.68	1.01	1.05	1.74	<1.57
Radium-228	pCi/L	5	NC	NC	NC	0.815	0.766	0.987	0.918	<0.666	0.814	1.38	<0.722
Selenium	ug/L	50	50	50	5	<1	<1	<1	<1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<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.

NA - Result not yet available.

* - 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 default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium and sulfate is the total dissolved solids criterion. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters, based on footnote {FF}. 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.

Table 2
 Summary of Analytical Results for Background Groundwater Samples
 DE Karn and JC Weadock – RCRA CCR Monitoring Program
 Essexville, Michigan

Sample Location:						MW-15020							
Sample Date:						12/9/2015	3/29/2016	5/24/2016	8/23/2016	11/30/2016	2/22/2017	5/17/2017	8/2/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	500	500	7,200	191	139	151	214	154	146	173	174
Calcium	mg/L	NC	NC	NC	500	112	101	104	118	92.9	103	123	102
Chloride	mg/L	250**	250	250	50	281	203	259	186	147	177	230	310
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	7.03	7	6.8	6.9	7	7	7	7.05
Sulfate	mg/L	250**	250	250	500	50.7	33.8	43.7	83.5	41.7	33.0	30.3	49.6
Total Dissolved Solids	mg/L	500**	500	500	500	900	680	830	720	640	670	760	894
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	10	10	10	10	<1	<1	<1	<1	1	1	<1	<1.0
Barium	ug/L	2,000	2,000	2,000	670	76	63	68	67	52	66	81	80.3
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	2	1	1	<1	2	1	1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	25.5	19.7	20	24	24	23	23	25
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	73	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.456	0.398	<0.201	0.353	<0.230	<0.329	0.283	<0.781
Radium-226/228	pCi/L	5	NC	NC	NC	1.42	1.50	0.972	1.29	1.24	1.03	1.04	<1.74
Radium-228	pCi/L	5	NC	NC	NC	0.966	1.10	0.784	<1.16	1.07	0.723	0.761	1.28
Selenium	ug/L	50	50	50	5	<1	<1	<1	<1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<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.

NA - Result not yet available.

* - 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 default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium and sulfate is the total dissolved solids criterion. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters, based on footnote {FF}. 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.

Table 2
 Summary of Analytical Results for Background Groundwater Samples
 DE Karn and JC Weadock – RCRA CCR Monitoring Program
 Essexville, Michigan

Sample Location:						MW-15024							
Sample Date:						12/9/2015	3/29/2016	5/24/2016	8/23/2016	11/30/2016	2/22/2017	5/16/2017	8/2/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	500	500	7,200	268	213	205	249	203	240	213	182
Calcium	mg/L	NC	NC	NC	500	109	108	103	113	90.8	97.3	116	119
Chloride	mg/L	250**	250	250	50	448	354	333	349	268	297	284	380
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	7.11	7	6.9	6.9	7.1	7	6.8	7.07
Sulfate	mg/L	250**	250	250	500	<2	<2	13.5	<2	2.53	<2	11.3	14.9
Total Dissolved Solids	mg/L	500**	500	500	500	1,100	990	940	950	800	870	920	958
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	1.1
Arsenic	ug/L	10	10	10	10	<1	<1	1	<1	<1	<1	<1	<1.0
Barium	ug/L	2,000	2,000	2,000	670	112	100	88	101	78	88	97	91.7
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	1	1	2	1	1	2	4	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	2	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	22.6	18.3	16	20	17	19	19	22
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	73	210	3,200	<5	<5	<5	<5	6	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.312	0.506	0.348	<0.301	0.368	0.410	0.412	<0.899
Radium-226/228	pCi/L	5	NC	NC	NC	1.23	1.52	1.18	1.01	1.66	1.31	1.12	1.79
Radium-228	pCi/L	5	NC	NC	NC	0.922	1.01	0.835	0.751	1.29	0.901	0.706	1.04
Selenium	ug/L	50	50	50	5	<1	<1	<1	<1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<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.

NA - Result not yet available.

* - 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 default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium and sulfate is the total dissolved solids criterion. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters, based on footnote {FF}. 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.

Table 2
 Summary of Analytical Results for Background Groundwater Samples
 DE Karn and JC Weadock – RCRA CCR Monitoring Program
 Essexville, Michigan

Sample Location:						MW-15027							
Sample Date:						12/9/2015	3/29/2016	5/24/2016	8/23/2016	11/30/2016	2/22/2017	5/17/2017	8/2/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	500	500	7,200	208	144	181	253	169	135	178	199
Calcium	mg/L	NC	NC	NC	500	103	109	108	111	95.8	93.6	120	113
Chloride	mg/L	250**	250	250	50	348	285	348	293	223	225	275	386
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	7.02	6.9	6.8	6.8	7	7	7.1	6.97
Sulfate	mg/L	250**	250	250	500	16.0	30.7	12.9	20.8	25.4	19.5	22.9	10.8
Total Dissolved Solids	mg/L	500**	500	500	500	800	890	980	850	790	750	910	982
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	10	10	10	10	<1	<1	1	<1	<1	<1	<1	<1.0
Barium	ug/L	2,000	2,000	2,000	670	95	89	95	94	78	79	103	107
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	2	1	2	1	1	1	2	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	27.2	21.3	21	23	20	19	23	26
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	73	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.386	0.461	0.485	0.359	<0.305	0.396	0.431	<0.878
Radium-226/228	pCi/L	5	NC	NC	NC	1.36	1.40	1.31	1.28	0.962	1.61	1.27	2.15
Radium-228	pCi/L	5	NC	NC	NC	0.970	0.934	0.823	0.918	0.706	1.21	0.836	1.56
Selenium	ug/L	50	50	50	5	<1	<1	<1	<1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<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.

NA - Result not yet available.

* - 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 default hardness of 150 mg CaCO₃/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium and sulfate is the total dissolved solids criterion. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters, based on footnote {FF}. 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.

Table 3
 Summary of Analytical Results for Landfill Groundwater Samples
 JC Weadock – RCRA CCR Monitoring Program
 Essexville, Michigan

Sample Location:						JCW-MW-15011							
Sample Date:						12/10/2015	3/31/2016	5/25/2016	8/25/2016	11/30/2016	2/22/2017	5/17/2017	8/3/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	500	500	7,200	1,260	878	883	1,470	1,690	1,970	1,310	1,390
Calcium	mg/L	NC	NC	NC	500	222	226	182	199	125	112	182	158
Chloride	mg/L	250**	250	250	50	70.3	60.9	54.3	77.5	84.2	84.3	69.3	74.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	7.08	7.3	7.4	7.4	7.4	7.3	7.1	7.15
Sulfate	mg/L	250**	250	250	500	386	386	310	220	110	79.4	376	267
Total Dissolved Solids	mg/L	500**	500	500	500	960	910	820	800	630	580	880	768
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	10	10	10	10	8	6	4	7	4	3	7	5.8
Barium	ug/L	2,000	2,000	2,000	670	61	67	85	166	110	104	65	97.8
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	1	1	2	<1	1	1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	25.6	18.5	15	16	16	16	23	22
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	73	210	3,200	<5	<5	<5	<5	<5	<5	5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	<0.140	<0.260	0.237	<0.261	<0.301	0.359	<0.260	<0.599
Radium-226/228	pCi/L	5	NC	NC	NC	0.679	<0.471	<0.753	<0.71	5.63	0.776	1.48	<1.48
Radium-228	pCi/L	5	NC	NC	NC	0.540	<0.471	<0.753	<0.71	5.53	<0.584	1.38	<0.876
Selenium	ug/L	50	50	50	5	<1	<1	<1	<1	<1	2	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<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.

NA - Result not yet available.

* - Michigan Part 201 Generic Cleanup Groundwater 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 default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium and sulfate is the total dissolved solids criterion. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters, based on footnote (FF). 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) JCW-MW-15012 was resampled 8/11/2017 for metals and radium due to insufficient sample volume for analysis collected 8/3/2017.

Table 3
 Summary of Analytical Results for Landfill Groundwater Samples
 JC Weadock – RCRA CCR Monitoring Program
 Essexville, Michigan

Sample Location:						JCW-MW-15012							
Sample Date:						12/10/2015	4/1/2016	5/25/2016	8/25/2016	11/30/2016	2/22/2017	5/17/2017	8/3 - 8/11/2017 ⁽¹⁾
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI [^]	downgradient							
Appendix III													
Boron	ug/L	NC	500	500	7,200	1,760	1,220	1,540	2,000	2,260	1,570	1,540	1,790
Calcium	mg/L	NC	NC	NC	500	94.5	121	107	92.3	129	113	124	148
Chloride	mg/L	250**	250	250	50	69.3	43.3	58.0	68.4	61.9	40.5	42.8	59.3
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	7.14	7.1	7	7.2	7	7.3	7	6.69
Sulfate	mg/L	250**	250	250	500	70.9	86.0	81.7	45.6	65.4	74.6	90.6	116
Total Dissolved Solids	mg/L	500**	500	500	500	510	530	510	460	610	520	570	626
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	10	10	10	10	25	12	13	36	26	19	40	28.0
Barium	ug/L	2,000	2,000	2,000	670	90	73	69	89	152	123	140	150
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	1	2	1	<1	<1	1	1	3.5
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	53.1	46.6	50	51	79	66	70	79
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	73	210	3,200	27	27	34	44	13	13	47	18.7
Radium-226	pCi/L	5	NC	NC	NC	0.254	<0.375	<0.316	<0.19	<0.373	0.508	<0.18	0.443
Radium-226/228	pCi/L	5	NC	NC	NC	0.970	<0.475	<0.700	<0.479	1.68	1.05	0.850	1.42
Radium-228	pCi/L	5	NC	NC	NC	0.716	<0.475	<0.700	<0.479	1.64	0.54	0.816	0.975
Selenium	ug/L	50	50	50	5	<1	26	7	<1	<1	<1	1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<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.

NA - Result not yet available.

* - Michigan Part 201 Generic Cleanup Groundwater 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 default hardness of 150 mg CaCO₃/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium and sulfate is the total dissolved solids criterion. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters, based on footnote {FF}. 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) JCW-MW-15012 was resampled 8/11/2017 for metals and radium due to insufficient sample volume for analysis collected 8/3/2017.

Table 3
 Summary of Analytical Results for Landfill Groundwater Samples
 JC Weadock – RCRA CCR Monitoring Program
 Essexville, Michigan

Sample Location:						JCW-MW-15023							
Sample Date:						12/10/2015	4/1/2016	5/25/2016	8/25/2016	11/30/2016	2/22/2017	5/17/2017	8/3/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	500	500	7,200	761	765	1,220	1,410	1,320	1,390	1,340	1,320
Calcium	mg/L	NC	NC	NC	500	73.0	76.1	74.2	66.2	67.2	82.0	146	122
Chloride	mg/L	250**	250	250	50	67.9	59.5	56.3	68.1	69.8	70.5	36.7	56.5
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	7.38	7.6	7.4	7.5	7.5	7.6	7.4	7.31
Sulfate	mg/L	250**	250	250	500	46.8	69.2	60.7	50.7	65.1	138	224	174
Total Dissolved Solids	mg/L	500**	500	500	500	440	430	430	390	440	520	710	612
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	10	10	10	10	20	25	47	78	117	102	38	122
Barium	ug/L	2,000	2,000	2,000	670	210	218	222	222	180	255	326	342
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	1	2	<1	<1	<1	<1	<1	3.2
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	33.8	22	27	27	32	28	45	58
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	73	210	3,200	<5	<5	<5	<5	<5	6	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.293	<0.239	0.201	<0.162	0.281	0.336	0.204	0.880
Radium-226/228	pCi/L	5	NC	NC	NC	0.947	<0.449	0.607	<0.459	2.11	0.771	1.97	1.98
Radium-228	pCi/L	5	NC	NC	NC	0.654	<0.449	<0.592	<0.459	1.83	<0.629	1.77	1.10
Selenium	ug/L	50	50	50	5	<1	<1	<1	<1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<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.

NA - Result not yet available.

* - Michigan Part 201 Generic Cleanup Groundwater 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 default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium and sulfate is the total dissolved solids criterion. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters, based on footnote (FF). 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) JCW-MW-15012 was resampled 8/11/2017 for metals and radium due to insufficient sample volume for analysis collected 8/3/2017.

Table 4
 Summary of Field Parameters
 JC Weadock Landfill – RCRA CCR Monitoring Program
 Essexville, Michigan

Sample Location	Sample Date	Dissolved Oxygen	Oxidation Reduction Potential	pH	Specific Conductivity	Temperature	Turbidity
		mg/L	mV	SU	umhos/cm	°C	NTU
Background Monitoring Wells							
MW-15002	12/08/15	0.75	-104.4	7.04	3,628	11.07	<1
	03/28/16	0.30	-53.7	7.00	3,044	7.30	1.3
	05/23/16	0.20	-84.5	6.60	7,225	13.20	<1
	08/22/16	0.60	-66.1	6.90	2,330	17.90	2.9
	11/30/16	0.80	-84.1	7.20	1,761	12.00	4.3
	02/22/17	0.10	-119.5	7.00	5,727	7.60	6.4
	05/17/17	0.00	-77.5	6.85	7,063	14.66	<1
MW-15008	08/01/17	0.18	-60.2	6.87	7,486	17.16	6.3
	12/09/15	0.28	-56.9	6.82	1,320	10.88	8.3
	03/29/16	0.20	-87.1	6.70	1,542	6.90	7.0
	05/24/16	0.20	-77.3	6.50	1,565	10.40	5.2
	08/23/16	0.50	-112.7	6.70	1,373	15.00	3.3
	11/30/16	0.60	-80.9	6.80	1,352	12.90	5.0
	02/22/17	0.10	-146.2	6.80	1,465	9.20	6.1
MW-15016	05/17/17	0.03	-58.2	6.70	1,553	13.73	<1
	08/02/17	0.41	-35.2	6.90	1,283	15.48	<1
	12/08/15	0.57	-87.3	7.06	1,205	6.31	4.6
	03/29/16	0.20	-106.7	7.10	1,593	6.00	3.3
	05/24/16	0.30	-100.1	6.80	1,493	15.20	3.1
	08/22/16	0.40	-133.3	6.80	1,573	21.60	4.8
	11/30/16	0.60	-75.7	7.00	1,450	8.60	9.0
MW-15018	02/22/17	0.30	12.7	7.20	2,551	4.80	8.4
	05/17/17	0.10	-84.2	7.01	1,747	15.14	8.3
	08/01/17	0.18	-90.6	7.00	1,663	21.51	3.7
	12/09/15	0.66	57.6	6.96	1,051	9.20	2.6
	03/29/16	0.30	-49.2	7.10	1,565	7.10	2.1
	05/24/16	0.20	-74.4	7.00	1,115	15.40	1.8
	08/23/16	0.40	-109.8	6.90	1,418	19.80	<1
MW-15019	11/30/16	0.70	-73.8	7.10	1,387	11.00	2.3
	02/22/17	0.10	-114.2	7.00	1,285	7.80	6.5
	05/16/17	0.09	-82.5	7.09	1,041	12.97	7.0
	08/02/17	0.19	-92.9	7.23	769	17.71	4.7
	12/09/15	0.47	-40.8	6.84	1,838	10.01	1.2
	03/29/16	0.20	-74.9	6.80	2,220	8.40	1.0
	05/24/16	0.20	-83.9	6.70	2,210	13.60	2.3
MW-15019	08/23/16	0.40	-98.6	6.70	2,364	17.70	<1
	11/30/16	0.60	-55.2	6.80	2,161	12.00	5.1
	02/22/17	0.10	-118.0	6.80	2,317	8.00	3.2
	05/16/17	0.07	-79.3	6.82	2,223	13.28	<1
	08/02/17	0.20	-76.7	6.86	2,158	16.49	2.8

Notes:

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

Table 4
 Summary of Field Parameters
 JC Weadock Landfill – RCRA CCR Monitoring Program
 Essexville, Michigan

Sample Location	Sample Date	Dissolved Oxygen	Oxidation Reduction Potential	pH	Specific Conductivity	Temperature	Turbidity
		mg/L	mV	SU	umhos/cm	°C	NTU
Background Monitoring Wells							
MW-15020	12/09/15	0.30	-62.2	7.03	1,278	10.86	6.7
	03/29/16	0.20	-89.1	7.00	1,338	6.80	3.7
	05/24/16	0.20	-99.4	6.80	1,465	11.60	4.5
	08/23/16	0.40	-112.7	6.90	1,306	16.20	1.8
	11/30/16	0.50	-83.7	7.00	1,155	13.50	4.8
	02/22/17	0.20	-117.6	7.00	1,312	8.70	8.2
	05/17/17	0.04	-89.5	6.93	1,560	12.48	<1
	08/02/17	0.62	-29.9	7.05	24	16.80	<1
MW-15024	12/09/15	0.48	-30.6	7.11	1,632	11.53	4.8
	03/29/16	0.20	-42.2	7.00	1,866	8.80	<1
	05/24/16	0.30	-68.9	6.90	1,711	12.90	<1
	08/23/16	0.40	-71.7	6.90	1,798	16.90	<1
	11/30/16	0.70	-30.8	7.10	1,493	13.20	3.1
	02/22/17	0.10	-100.3	7.00	1,771	9.90	1.7
	05/16/17	0.06	-64.7	6.99	1,792	13.88	<1
	08/02/17	0.20	-38.8	7.07	1,810	14.94	1.4
MW-15027	12/09/15	0.29	-53.2	7.02	1,404	10.81	7.2
	03/29/16	0.20	-64.1	6.90	1,696	8.20	<1
	05/24/16	0.20	-73.3	6.80	1,751	11.40	<1
	08/23/16	0.40	-94.2	6.80	1,663	17.40	<1
	11/30/16	0.60	-51.6	7.00	1,393	12.80	1.5
	02/22/17	0.10	-126.9	7.00	1,483	8.70	3.2
	05/17/17	1.20	-72.5	6.88	1,780	13.05	<1
	08/02/17	0.28	-65.1	6.97	1,760	16.74	3.5

Notes:

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Table 4
 Summary of Field Parameters
 JC Weadock Landfill – RCRA CCR Monitoring Program
 Essexville, Michigan

Sample Location	Sample Date	Dissolved Oxygen	Oxidation Reduction Potential	pH	Specific Conductivity	Temperature	Turbidity
		mg/L	mV	SU	umhos/cm	°C	NTU
JC Weadock Landfill							
JCW-MW-15011	12/10/15	0.11	-315.3	7.08	1,350	14.85	1.6
	03/31/16	0.20	-282.6	7.30	1,257	13.80	<1
	05/25/16	0.20	-286.3	7.40	1,202	15.00	<1
	08/25/16	0.40	-278.7	7.40	1,374	15.20	<1
	11/30/16	0.20	-272.7	7.40	962	14.00	<1
	02/22/17	0.20	-268.3	7.30	978	14.20	<1
	05/17/17	0.47	-76.9	7.08	1,414	15.29	< 1
	08/03/17	0.19	-293.8	7.15	1,147	14.16	3.0
JCW-MW-15012	12/10/15	0.07	-264.1	7.14	868	13.51	4.7
	04/01/16	1.00	-28.1	7.10	821	7.90	<1
	05/25/16	0.40	-62.1	7.00	885	15.40	<1
	08/25/16	0.60	-127.5	7.20	833	17.70	<1
	11/30/16	0.40	-93.1	7.00	965	14.50	<1
	02/22/17	0.20	-222.5	7.30	895	11.30	<1
	05/17/17	0.57	-13.9	7.01	1,027	18.42	6.8
	08/11/17	0.30	25.0	6.69	1,057	16.97	6.3
JCW-MW-15023	12/10/15	0.08	-272.4	7.38	780	11.37	3.6
	04/01/16	0.60	-114.7	7.60	709	4.90	<1
	05/25/16	0.30	-177.8	7.40	756	13.80	<1
	08/25/16	0.50	-239.3	7.50	709	16.60	<1
	11/30/16	0.30	-216.3	7.50	695	15.50	<1
	02/22/17	0.20	-247.3	7.60	875	12.70	<1
	05/17/17	0.38	-197.8	7.40	1,146	15.51	< 1
	08/03/17	1.07	-111.6	7.31	939	17.66	3.3

Notes:

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



LEGEND

- BACKGROUND MONITORING WELL
- BEDROCK MONITORING WELL
- DEK BOTTOM ASH POND MONITORING WELL
- JCW BOTTOM ASH POND MONITORING WELL
- JCW LANDFILL MONITORING WELL
- SURFACE WATER GAUGING STATION
- SLURRY WALL (APPROXIMATE)
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)

- NOTES**
1. BASE MAP IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/10/2016.
 2. WELL LOCATIONS SURVEYED BY ROWE PROFESSIONAL SERVICES COMPANY ON 11/4/2015.
 3. NOAA/NATIONAL OCEANIC SERVICE GREAT LAKES GAUGING STATION, ESSEXVILLE, MI (ID: 9075035).

0 1,000 2,000 Feet

1" = 1,000'
1:12,000

PROJECT:		CONSUMERS ENERGY COMPANY DE KARN AND JC WEADOCK POWER PLANTS ESSEXVILLE, MICHIGAN	
TITLE:		SHALLOW GROUNDWATER CONTOUR MAP DECEMBER 2015	
DRAWN BY:	J. PAPEZ	PROJ NO.:	269767-002/3
CHECKED BY:	D. LITZ	FIGURE 1	
APPROVED BY:	G. CROCKFORD		
DATE:	OCTOBER 2017		

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FILE NO.: 269767-002_3-001.mxd

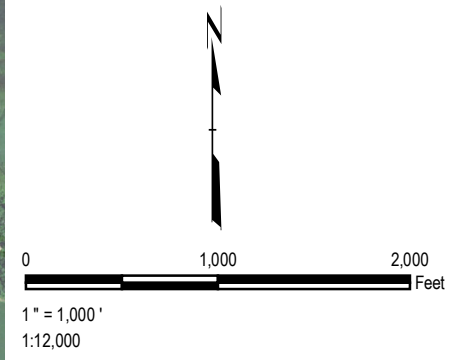


LEGEND

- BACKGROUND MONITORING WELL
- BEDROCK MONITORING WELL
- DEK BOTTOM ASH POND MONITORING WELL
- JCW BOTTOM ASH POND MONITORING WELL
- JCW LANDFILL MONITORING WELL
- SURFACE WATER GAUGING STATION
- SLURRY WALL (APPROXIMATE)
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)

NOTES

1. BASE MAP IMAGERY FROM USDA - NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/10/2016.
2. WELL LOCATIONS SURVEYED BY ROWE PROFESSIONAL SERVICES COMPANY ON 11/4/2015.
3. NOAA/NATIONAL OCEANIC SERVICE GREAT LAKES GAUGING STATION, ESSEXVILLE, MI (ID: 9075035).



PROJECT:		CONSUMERS ENERGY COMPANY DE KARN AND JC WEADOCK POWER PLANTS ESSEXVILLE, MICHIGAN	
TITLE:		SHALLOW GROUNDWATER CONTOUR MAP MARCH 2016	
DRAWN BY:	J. PAPEZ	PROJ NO.:	269767-002/3
CHECKED BY:	D. LITZ	FIGURE 2	
APPROVED BY:	G. CROCKFORD		
DATE:	OCTOBER 2017		
		1540 Eisenhower Place Ann Arbor, MI 48108-3284 Phone: 734.971.7080 www.trcsolutions.com	
FILE NO.:	269767-002_3-002.mxd		

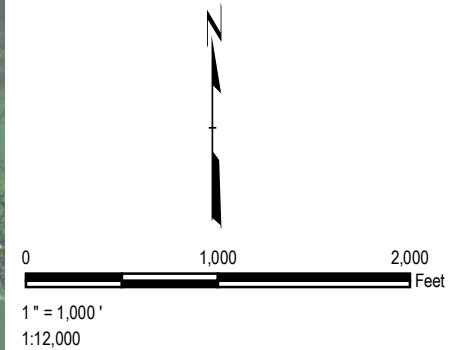


LEGEND

- BACKGROUND MONITORING WELL
- BEDROCK MONITORING WELL
- DEK BOTTOM ASH POND MONITORING WELL
- JCW BOTTOM ASH POND MONITORING WELL
- JCW LANDFILL MONITORING WELL
- SURFACE WATER GAUGING STATION
- SLURRY WALL (APPROXIMATE)
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)

NOTES

1. BASE MAP IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/10/2016.
2. WELL LOCATIONS SURVEYED BY ROWE PROFESSIONAL SERVICES COMPANY ON 11/4/2015.
3. NOAA/NATIONAL OCEANIC SERVICE GREAT LAKES GAUGING STATION, ESSEXVILLE, MI (ID: 9075035).



PROJECT:	
CONSUMERS ENERGY COMPANY DE KARN AND JC WEADOCK POWER PLANTS ESSEXVILLE, MICHIGAN	
TITLE:	
SHALLOW GROUNDWATER CONTOUR MAP MAY 2016	
DRAWN BY: J. PAPEZ	PROJ NO.: 269767-002/3
CHECKED BY: D. LITZ	FIGURE 3
APPROVED BY: G. CROCKFORD	
DATE: OCTOBER 2017	
1540 Eisenhower Place Ann Arbor, MI 48108-3284 Phone: 734.971.7080 www.trcsolutions.com	
FILE NO.: 269767-002_3-003.mxd	

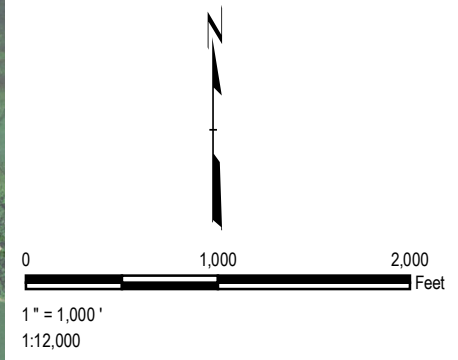


LEGEND

- BACKGROUND MONITORING WELL
- BEDROCK MONITORING WELL
- DEK BOTTOM ASH POND MONITORING WELL
- JCW BOTTOM ASH POND MONITORING WELL
- JCW LANDFILL MONITORING WELL
- SURFACE WATER GAUGING STATION
- SLURRY WALL (APPROXIMATE)
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)

NOTES

1. BASE MAP IMAGERY FROM USDA - NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/10/2016.
2. WELL LOCATIONS SURVEYED BY ROWE PROFESSIONAL SERVICES COMPANY ON 11/4/2015.
3. NOAA/NATIONAL OCEANIC SERVICE GREAT LAKES GAUGING STATION, ESSEXVILLE, MI (ID: 9075035).



PROJECT:		CONSUMERS ENERGY COMPANY DE KARN AND JC WEADOCK POWER PLANTS ESSEXVILLE, MICHIGAN	
TITLE:		SHALLOW GROUNDWATER CONTOUR MAP AUGUST 2016	
DRAWN BY:	J. PAPEZ	PROJ NO.:	269767-002/3
CHECKED BY:	D. LITZ	FIGURE 4	
APPROVED BY:	G. CROCKFORD		
DATE:	OCTOBER 2017		
		1540 Eisenhower Place Ann Arbor, MI 48108-3284 Phone: 734.971.7080 www.trcsolutions.com	
FILE NO.:	269767-002_3-004.mxd		



LEGEND

- BACKGROUND MONITORING WELL
- BEDROCK MONITORING WELL
- DEK BOTTOM ASH POND MONITORING WELL
- JCW BOTTOM ASH POND MONITORING WELL
- JCW LANDFILL MONITORING WELL
- SURFACE WATER GAUGING STATION
- SLURRY WALL (APPROXIMATE)
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)

- NOTES**
1. BASE MAP IMAGERY FROM USDA - NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/10/2016.
 2. WELL LOCATIONS SURVEYED BY ROWE PROFESSIONAL SERVICES COMPANY ON 11/4/2015.
 3. NOAA/NATIONAL OCEANIC SERVICE GREAT LAKES GAUGING STATION, ESSEXVILLE, MI (ID: 9075035).

0 1,000 2,000
Feet

1" = 1,000'
1:12,000

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

TITLE:
**SHALLOW GROUNDWATER CONTOUR MAP
NOVEMBER 2016**

DRAWN BY:	J. PAPEZ	PROJ NO.:	269767-002/3
CHECKED BY:	D. LITZ	FIGURE 5	
APPROVED BY:	G. CROCKFORD		
DATE:	OCTOBER 2017		

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FILE NO.: 269767-002_3-005.mxd



LEGEND

- BACKGROUND MONITORING WELL
- BEDROCK MONITORING WELL
- DEK BOTTOM ASH POND MONITORING WELL
- JCW BOTTOM ASH POND MONITORING WELL
- JCW LANDFILL MONITORING WELL
- SURFACE WATER GAUGING STATION
- SLURRY WALL (APPROXIMATE)
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)

- NOTES**
1. BASE MAP IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/10/2016.
 2. WELL LOCATIONS SURVEYED BY ROWE PROFESSIONAL SERVICES COMPANY ON 11/4/2015.
 3. NOAA/NATIONAL OCEANIC SERVICE GREAT LAKES GAUGING STATION, ESSEXVILLE, MI (ID: 9075035).

0 1,000 2,000
Feet

1" = 1,000'
1:12,000

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

TITLE:
**SHALLOW GROUNDWATER CONTOUR MAP
FEBRUARY 2017**

DRAWN BY:	J. PAPEZ	PROJ NO.:	269767-002/3
CHECKED BY:	D. LITZ	FIGURE 6	
APPROVED BY:	G. CROCKFORD		
DATE:	OCTOBER 2017		

FILE NO.: 269767-002_3-006.mxd

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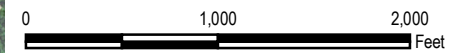
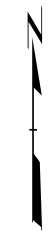


LEGEND

- BACKGROUND MONITORING WELL
- BEDROCK MONITORING WELL
- DEK BOTTOM ASH POND MONITORING WELL
- JCW BOTTOM ASH POND MONITORING WELL
- JCW LANDFILL MONITORING WELL
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- SLURRY WALL (APPROXIMATE)
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)

NOTES

1. BASE MAP IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/10/2016.
2. WELL LOCATIONS SURVEYED BY ROWE PROFESSIONAL SERVICES COMPANY ON 11/4/2015.
3. NOAA/NATIONAL OCEANIC SERVICE GREAT LAKES GAUGING STATION, ESSEXVILLE, MI (ID: 9075035).



1" = 1,000'
1:12,000

PROJECT:		CONSUMERS ENERGY COMPANY DE KARN AND JC WEADOCK POWER PLANTS ESSEXVILLE, MICHIGAN	
TITLE:		SHALLOW GROUNDWATER CONTOUR MAP MAY 2017	
DRAWN BY:	J. PAPEZ	PROJ NO.:	269767-002/3
CHECKED BY:	D. LITZ	FIGURE 7	
APPROVED BY:	G. CROCKFORD		
DATE:	OCTOBER 2017		



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LEGEND

- BACKGROUND MONITORING WELL
- BEDROCK MONITORING WELL
- DEK BOTTOM ASH POND MONITORING WELL
- JCW BOTTOM ASH POND MONITORING WELL
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- NOTES**
1. BASE MAP IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/10/2016.
 2. WELL LOCATIONS SURVEYED BY ROWE PROFESSIONAL SERVICES COMPANY ON 11/4/2015.
 3. NOAA/NATIONAL OCEANIC SERVICE GREAT LAKES GAUGING STATION, ESSEXVILLE, MI (ID: 9075035).

0 1,000 2,000 Feet
1" = 1,000'
1:12,000

PROJECT:		CONSUMERS ENERGY COMPANY DE KARN AND JC WEADOCK POWER PLANTS ESSEXVILLE, MICHIGAN	
TITLE:		SHALLOW GROUNDWATER CONTOUR MAP AUGUST 2017	
DRAWN BY:	J. PAPEZ	PROJ NO.:	269767-002/3
CHECKED BY:	D. LITZ	FIGURE 8	
APPROVED BY:	G. CROCKFORD		
DATE:	OCTOBER 2017		

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FILE NO.: 269767-002_3-019.mxd

Appendix B

Data Quality Review

Laboratory Data Quality Review

Groundwater Monitoring Event September 2017

CEC DE Karn and JC Weadock Background Wells

Groundwater samples were collected by TRC for the September 2017 sampling event. Samples were analyzed for anions, total metals, and total dissolved solids by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan. The laboratory analytical results are reported in laboratory report 462721.

During the September 2017 sampling event, a groundwater sample was collected from each of the following wells:

- MW-15002
- MW-15018
- MW-15024
- MW-15008
- MW-15019
- MW-15027
- MW-15016
- MW-15020

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Chloride, Fluoride, Sulfate)	EPA 300.0
Total Metals	EPA 6020A, EPA 6010C
Total Dissolved Solids	SM 2540C

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). 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;
- Data for method blanks and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field blanks are used to assess potential contamination arising from field procedures;
- Reporting limits (RLs) compared to project-required RLs;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes;

- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix; 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 III constituents will be utilized for the purposes of a detection monitoring program.
- Data are usable for the purposes of the detection monitoring program.
- When the data are evaluated through a detection monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary:

- A field blank (FB-05) was collected; no analytes were detected in the blank samples.
- Dup-05 corresponds to MW-15024; relative percent differences (RPDs) between the parent and duplicate sample were within the QC limits.
- Laboratory duplicates analyses were performed on non-project samples; RPDs were within QC limits.
- MS/MSD analyses were performed on non-project samples.

Laboratory Data Quality Review

Groundwater Monitoring Event September 2017

CEC JC Weadock Landfill

Groundwater samples were collected by TRC for the September 2017 sampling event. Samples were analyzed for anions, total metals, and total dissolved solids by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan. The laboratory analytical results are reported in laboratory report 462723.

During the September 2017 sampling event, a groundwater sample was collected from each of the following wells:

- JCW-MW-15011
- JCW-MW-15012
- JCW-MW-15023

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Chloride, Fluoride, Sulfate)	EPA 300.0
Total Metals	EPA 6020A, EPA 6010C
Total Dissolved Solids	SM 2540C

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). 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;
- 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;
- 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;
- Reporting limits (RLs) compared to project-required RLs;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes;

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

QA/QC Sample Summary:

- One equipment blank (EB-2) and one field blank (FB-2) were collected; no analytes were detected in the blank samples.
- Dup-2 corresponds to JCW-MW-15023; relative percent differences (RPDs) between the parent and duplicate sample were within the QC limits.
- Laboratory duplicate analyses were performed on sample JCW-MW-15011; RPDs were within QC limits.
- MS/MSDs were performed on sample JCW-MW-15011.
 - MS/MSD analyses were performed on sample JCW-MW-15011 for sulfate in batch 5641. The sulfate recoveries in the MS/MSD were below the lower laboratory control limits. The sulfate results for samples analyzed in the same batch may be biased low.
 - MS/MSD analyses were performed on sample JCW-MW-15011 for boron in batch 5472. The boron recoveries were above the upper laboratory control limit in the MS and below the lower laboratory control limit in the MSD. The boron concentration in the parent sample was >4x the spike concentration; therefore, the laboratory control limits were not applicable. Data usability was not affected.

Appendix C

Statistical Background Limits

Technical Memorandum

Date: January 15, 2018

To: J.R. Register, CEC
Brad Runkel, CEC

From: Darby Litz, TRC
Sarah Holmstrom, TRC
Joyce Peterson, TRC

Project No.: 269767.0000 Phase 003, Task 003

Subject: Background Statistical Evaluation (R1-R8) – Consumers Energy, JC Weadock Landfill

Pursuant to the United States Environmental Protection Agency's (U.S. EPA's) Resource Conservation and Recovery Act (RCRA) Coal Combustion Residual rule ("CCR Rule") promulgated on April 17, 2015, the owner or operator of a CCR Unit must collect a minimum of eight rounds of background groundwater data to initiate a detection monitoring program and evaluate statistically significant increases above background (40 CFR §257.94). This memorandum presents the background statistical limits derived for the landfill CCR Unit at the Consumers Energy Company (CEC) JC Weadock Power Plant (JC Weadock site) in Essexville, Michigan.

There are two coal ash management facilities associated with the JC Weadock site—a wet ash dewatering area (bottom ash pond – BAP), which is the primary settling/detention structure for the NPDES treatment system prior to discharge, and an ash landfill. The focus of this memorandum is the landfill CCR unit. In response to the CCR Rule, CEC had 3 groundwater monitoring wells installed at locations downgradient of the JC Weadock landfill and 8 background wells installed on the site property to the south to serve as a groundwater monitoring system (in accordance with 40 CFR 257.91).

Following the baseline data collection period (December 2015 through August 2017), the background data for the JC Weadock site were evaluated in accordance with the Groundwater Statistical Evaluation Plan (Stats Plan) (TRC, October 2017). The JC Weadock 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

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establishing background and developing the monitoring program and is an acceptable approach for detection monitoring under the CCR rule. Upper tolerance limits (UTLs) were calculated for each of the CCR Appendix III 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 CCR BAP unit at the JC Weadock site includes MW-15002, MW-15008, MW-15016, and MW-15019. These wells were selected from among a larger set of 8 potential background wells as detailed in a memo dated October 3, 2017 (TRC), based on representativeness and coverage for the CCR Appendix III parameters. Background wells MW-15002, MW-15008, MW-15016, and MW-15019 are also part of the groundwater monitoring system for the BAP CCR unit at the JC Weadock site as well as a CCR unit at the neighboring DE Karn site. The background evaluation included the following steps:

- Review of data quality reports for the baseline/background data sets for CCR Appendix III 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 baseline/background well-constituent (w/c) pair;
- Distribution of the data; and
- Calculation of the UTL for each cumulative baseline/background data set (upper and lower tolerance limits were calculated for field pH).

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, laboratory duplicates. The data were found to be complete and usable for the purposes of the CCR monitoring program.

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Time versus Concentration Graphs

The T v. C graphs show potential outliers for boron (low value for MW-15016 in March 2016) and sulfate (high value for MW-15016 in February 2017). These data sets will be tested by the Sanitas™ software to assess whether the potential outliers are statistically significant.

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 Karn and Weadock complex. When sorted by concentration, the data generally group by well. Most of the parameters have a relatively consistent distribution, but chloride and TDS clearly have some wells with higher values than the other background wells. These results need to be taken into consideration as they represent potential non-CCR upgradient contributions to downgradient wells.

Outlier Testing

The Dixon's Outlier Test in Sanitas™ was used to test the potential outlier in the boron data set for MW-15016 that was identified in the T v. C graphs (Figure 1) and in the cumulative concentration distribution (Figure 2). The suspect data point was found to be an outlier at the 0.05 significance level (see attached Sanitas™ output file). With the outlier removed, Sanitas found that the boron data set at MW-15016 was normally distributed at the 0.01 significance level. The outlier data point will be excluded from the background/baseline UTL calculations. The Dixon's Outlier Test in Sanitas™ was also conducted for the potential outlier in the sulfate data set for MW-15016. In this case, the suspect was not found to be an outlier, but the data set was found to be lognormally distributed. The data point will be retained for the background/baseline UTL calculations.

Percentage of Nondetects

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

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Table 1
Summary of Percentage of Baseline Results Below Reporting Limit

WELL	CONSTITUENT	PERCENT NON-DETECT
MW-15002	Boron	0
	Calcium	0
	Chloride	0
	Fluoride	100
	Field pH	0
	Sulfate	12.5
	Total Dissolved Solids	0
	MW-15008	Boron
Calcium		0
Chloride		0
Fluoride		100
Field pH		0
Sulfate		0
Total Dissolved Solids		0
MW-15016		Boron
	Calcium	0
	Chloride	0
	Fluoride	100
	Field pH	0
	Sulfate	0
	Total Dissolved Solids	0
	MW-15019	Boron
Calcium		0
Chloride		0
Fluoride		100
Field pH		0
Sulfate		0
Total Dissolved Solids		0
COMBINED		Boron
	Calcium	0
	Chloride	0
	Fluoride	100
	Field pH	0
	Sulfate	3.125
	Total Dissolved Solids	0

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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 non-normal, 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
Boron	Normal
Boron (outlier removed)	Normal
Calcium	Normal
Chloride	Normalized by natural log transformation
Fluoride	All ND – use highest RL
Field pH	Normal
Sulfate	Normalized by cube root transformation
Total Dissolved Solids	Nonnormal

Upper Tolerance Limits

Table 3 presents the calculated upper tolerance limits for the background/baseline data sets. The data set with an observed outlier is included both with and without the outlier value included in the data set. For normal and lognormal distributions, 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 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.

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Table 3
Summary of Baseline Upper Tolerance Limits

CONSTITUENT	UPPER TOLERANCE LIMIT – FROM SANITAS™
Boron (outlier removed)	619 µg/L
Calcium	302 mg/L
Chloride	2,440 mg/L
Fluoride	1,000 µg/L
Field pH	6.5 – 7.3 s.u.
Sulfate	407 mg/L
Total Dissolved Solids	4,600 mg/L*

* Nonparametric Tolerance Limit

Attachments

Figure 1 – Background Concentration Time-Series Charts

Figure 2 – Combined Background Distribution

Sanitas™ Output Files

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Figures

Figure 1
Background Concentration Time-Series Charts
Karn/Weadock Site - RCRA CCR Monitoring Program

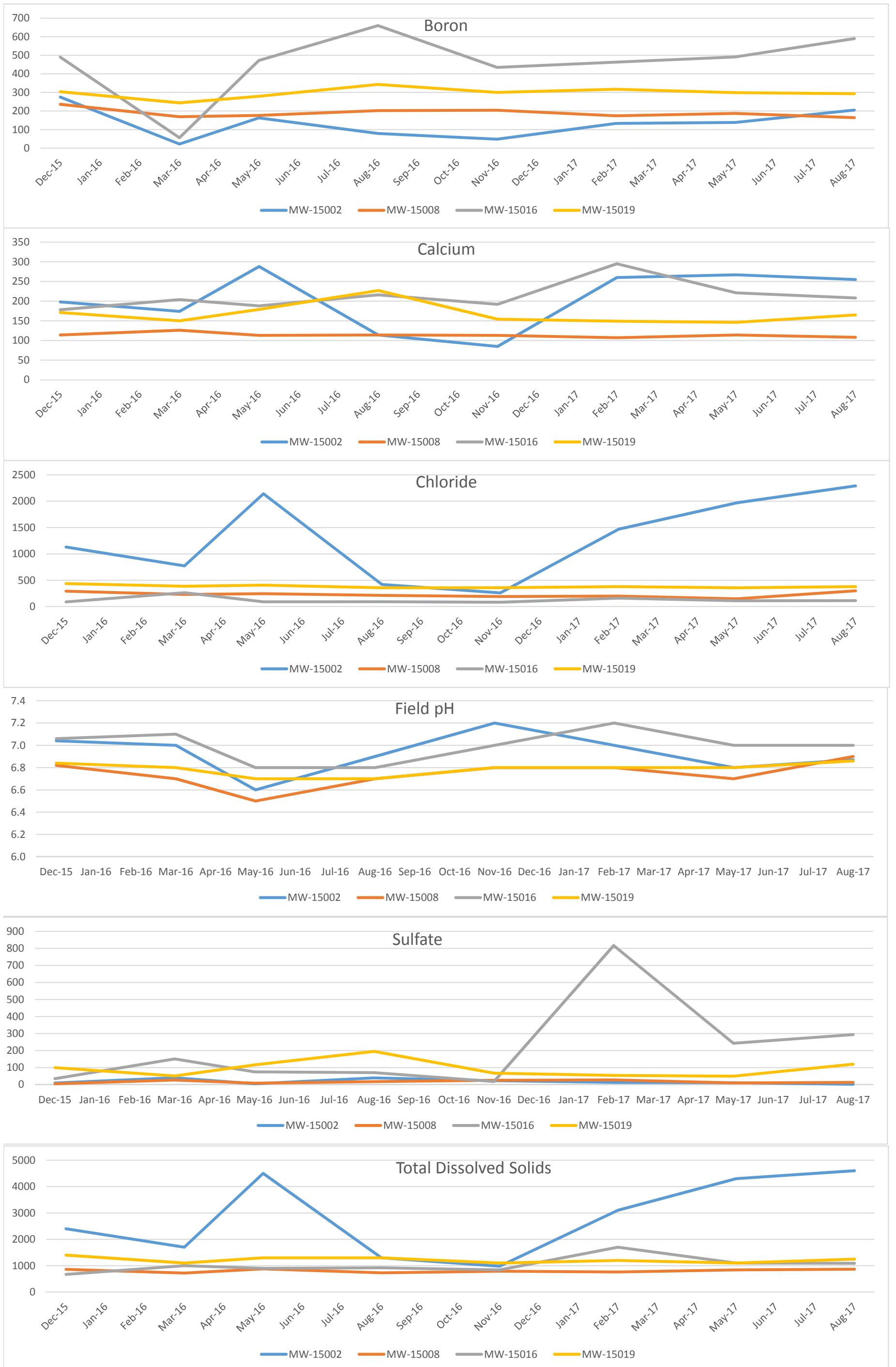
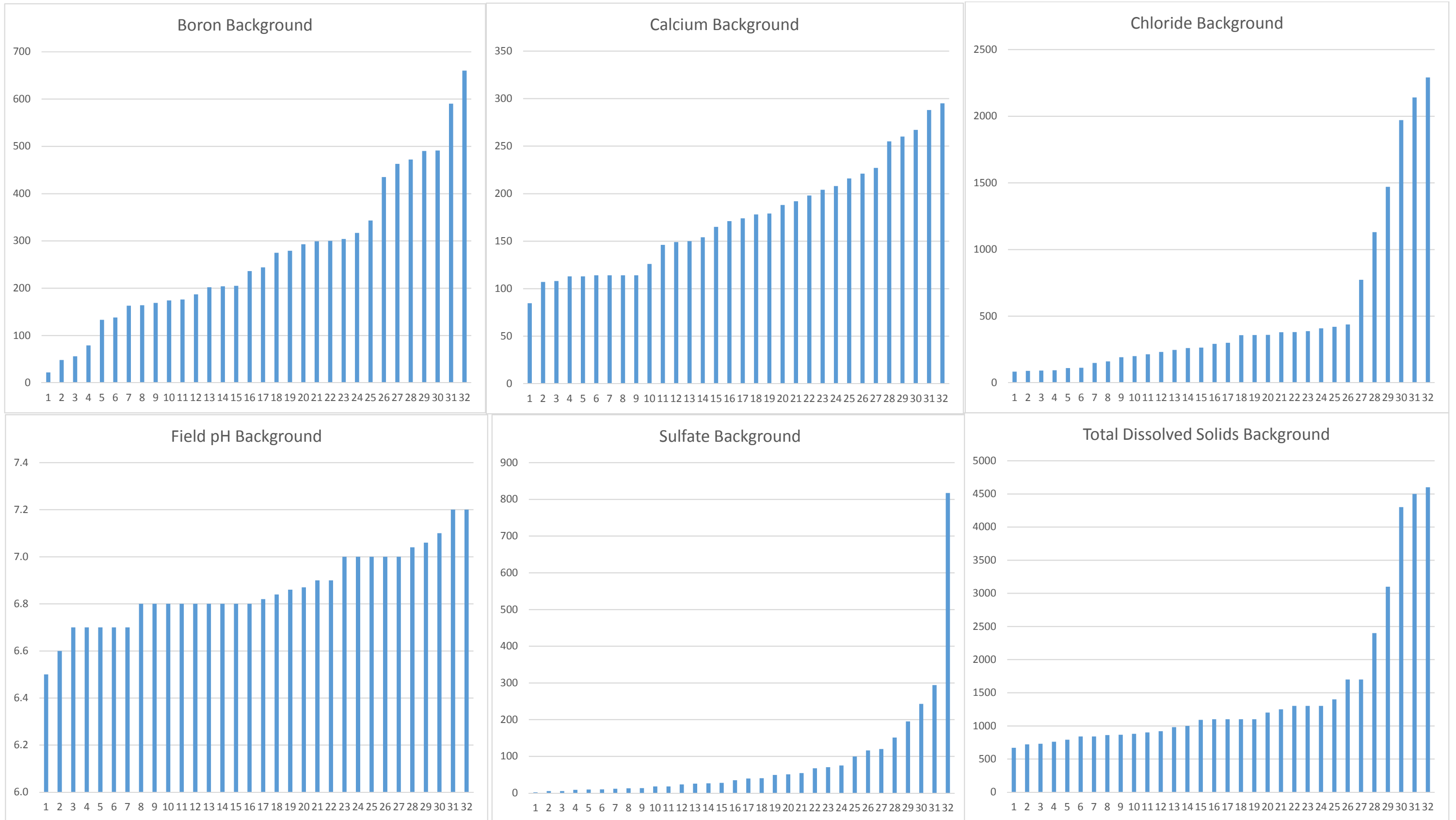


Figure 2
 Cumulative Background Concentrations
 Karn/Weadock Complex - RCRA CCR Monitoring Program

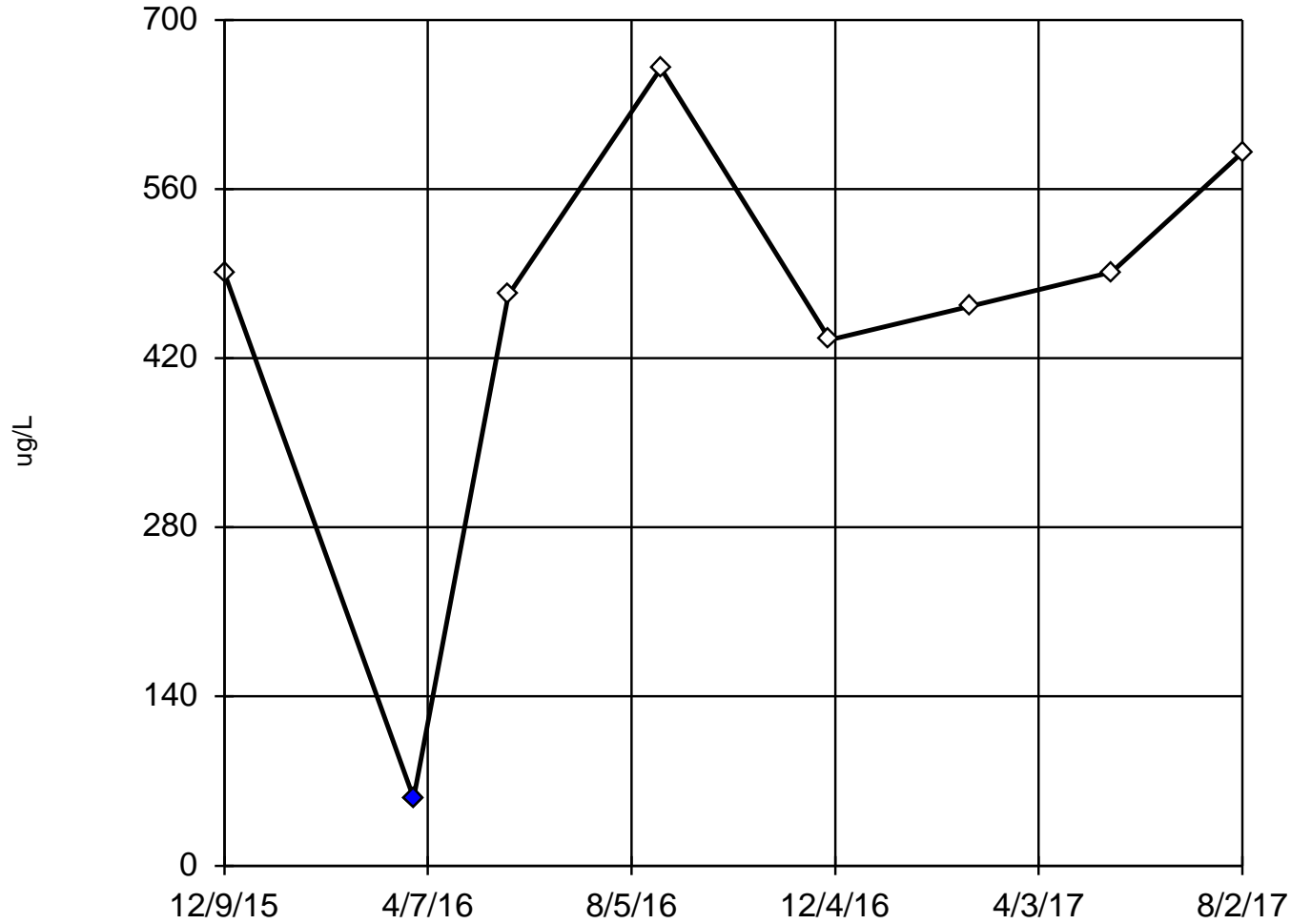


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Sanitas™ Output Files

EPA 1989 Outlier Screening

MW-15016 (bg)



n = 8

Statistical outlier is drawn as solid.
Mean 457.1, std. dev. 178.4, critical Tn 2.032.
After removing suspect data: mean 514.4, std. dev. 80.42, Tn 1.938.

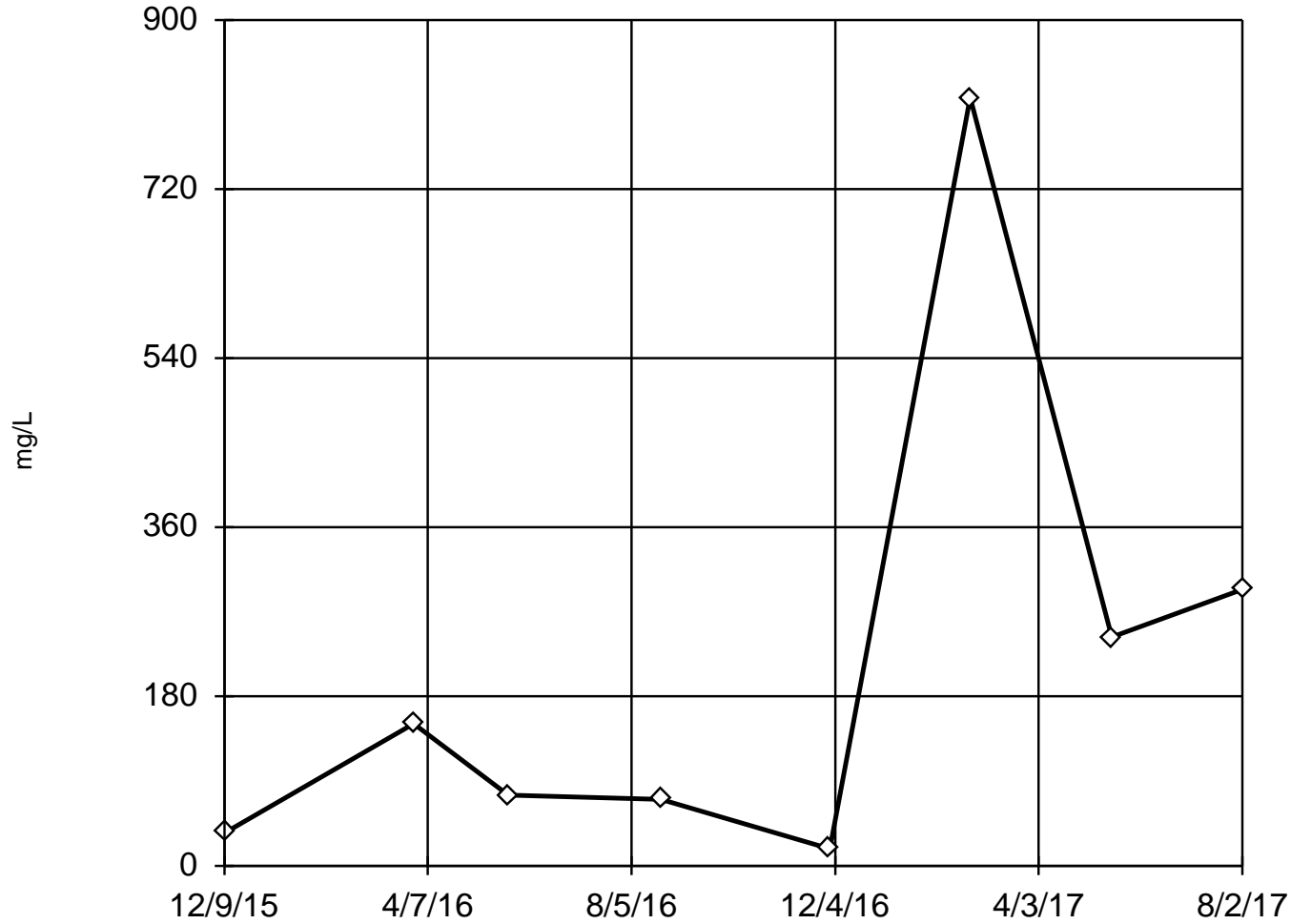
Normality test used:
Shapiro Wilk@alpha = 0.05
Calculated = 0.848
Critical = 0.803
The distribution, after removal of suspect value, was found to be normally distributed.

Constituent: Boron, Total Analysis Run 11/16/2017 4:25 PM

Client: Consumers Energy Data: DEK_BAP_CCR_Sanitas

EPA 1989 Outlier Screening

MW-15016 (bg)



n = 8

No statistical outliers.
Mean 213, std. dev. 263.2,
critical Tn 2.032

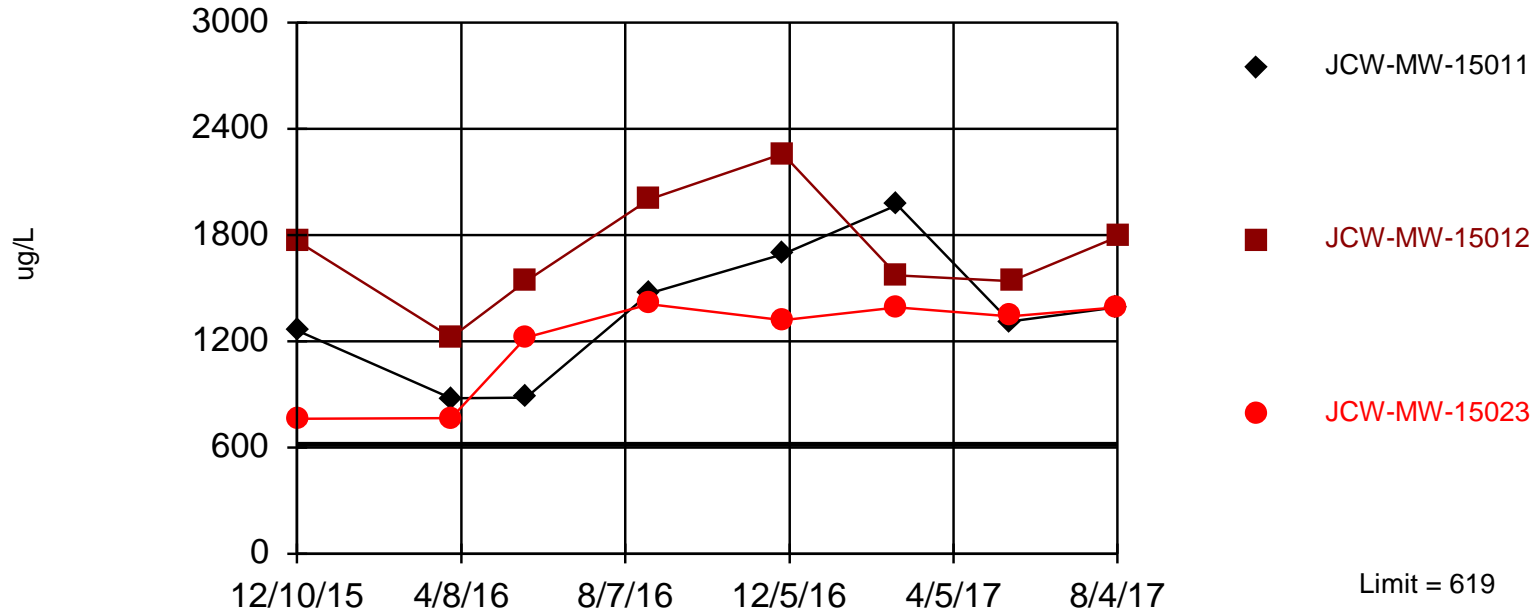
Normality test used:
Shapiro Wilk@alpha = 0.05
Calculated = 0.9853
Critical = 0.818 (after natural log transformation)
The distribution was found to be log-normal.

Constituent: Sulfate Analysis Run 11/16/2017 4:26 PM

Client: Consumers Energy Data: DEK_BAP_CCR_Sanitas

Exceeds Limit: JCW-MW-15011, JCW-MW-15012, JCW-MW-15023

Tolerance Limit Interwell Parametric



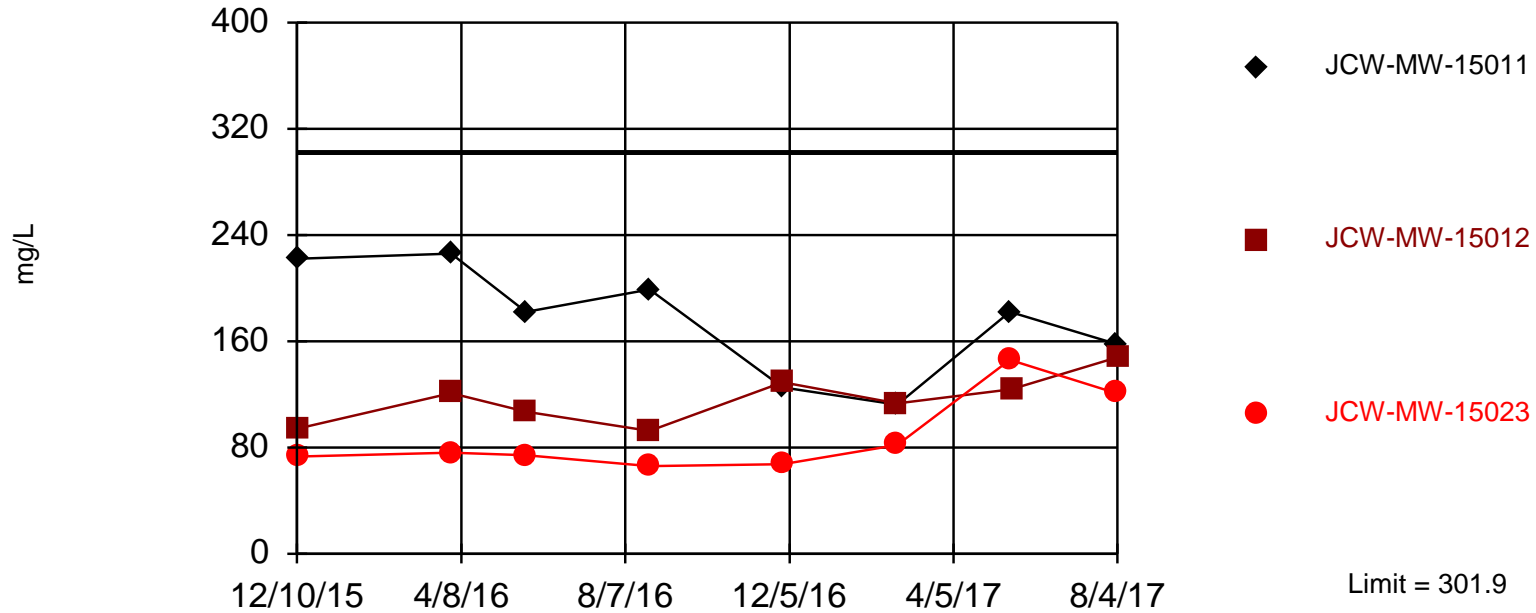
95% coverage. Most recent observation is compared with limit. Background Data Summary: Mean=276, Std. Dev.=155.3, n=31. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9427, critical = 0.902. Report alpha = 0.05.

Outlier Removed:
MW-15016 3/29/2016

Constituent: Boron, Total Analysis Run 11/21/2017 1:56 PM
Client: Consumers Energy Data: JCW_LF_CCR_Sanitas

Within Limit

Tolerance Limit Interwell Parametric



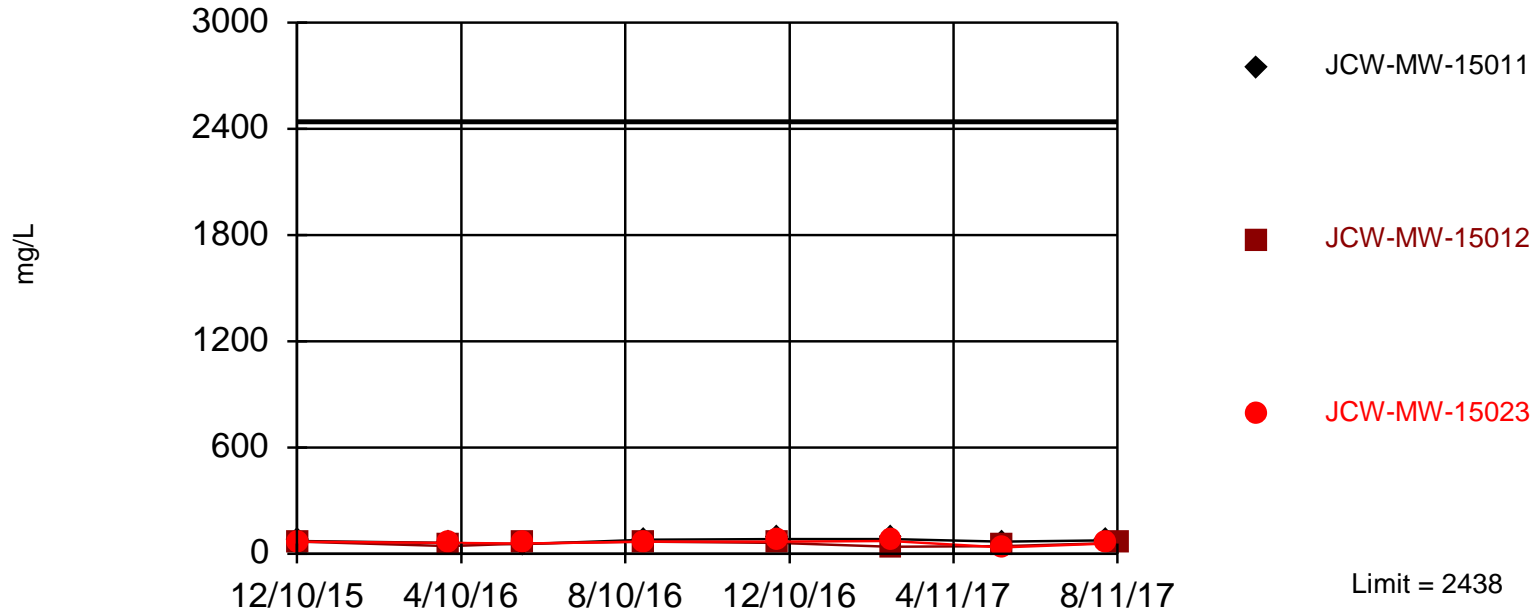
95% coverage. Most recent observation is compared with limit. Background Data Summary: Mean=174.8, Std. Dev.=57.82, n=32. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9402, critical = 0.904. Report alpha = 0.05.

Constituent: Calcium, Total Analysis Run 11/21/2017 1:56 PM

Client: Consumers Energy Data: JCW_LF_CCR_Sanitas

Within Limit

Tolerance Limit Interwell Parametric



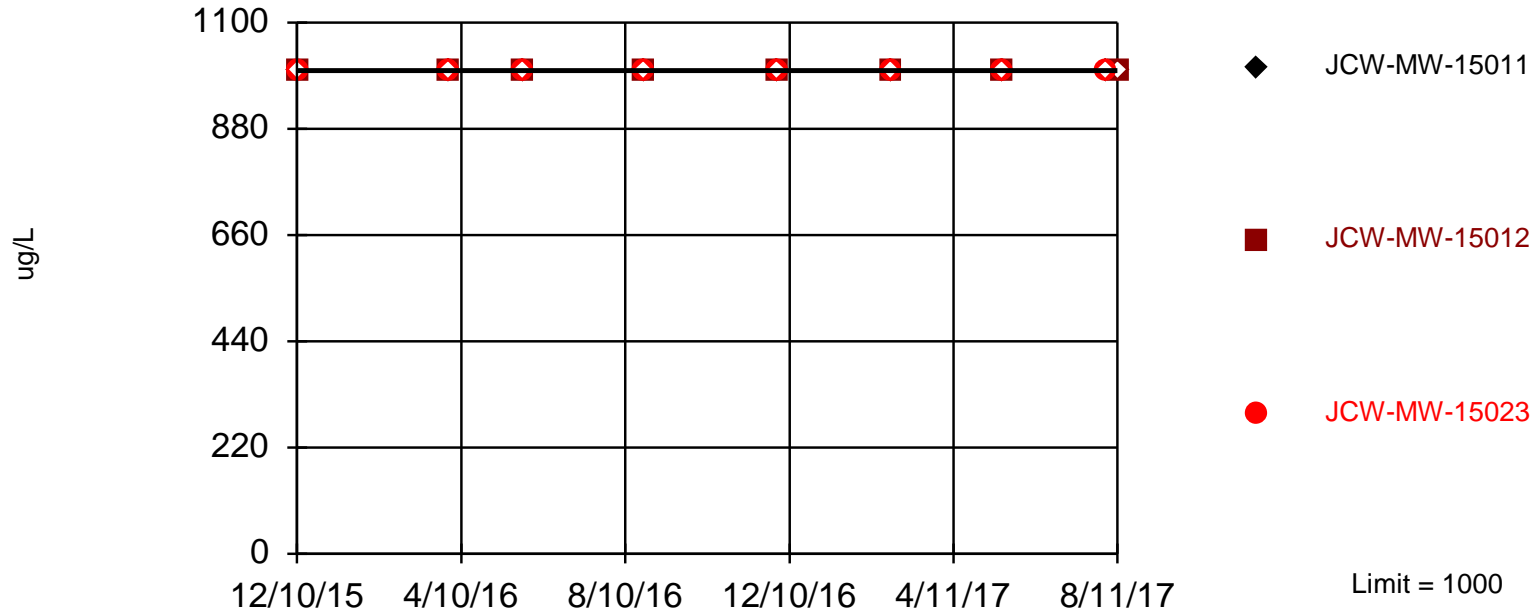
95% coverage. Most recent observation is compared with limit. Background Data Summary (based on natural log transformation): Mean=5.764, Std. Dev.=0.9258, n=32. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9196, critical = 0.904. Report alpha = 0.05.

Constituent: Chloride Analysis Run 11/21/2017 1:57 PM

Client: Consumers Energy Data: JCW_LF_CCR_Sanitas

Within Limit

Tolerance Limit Interwell Non-parametric



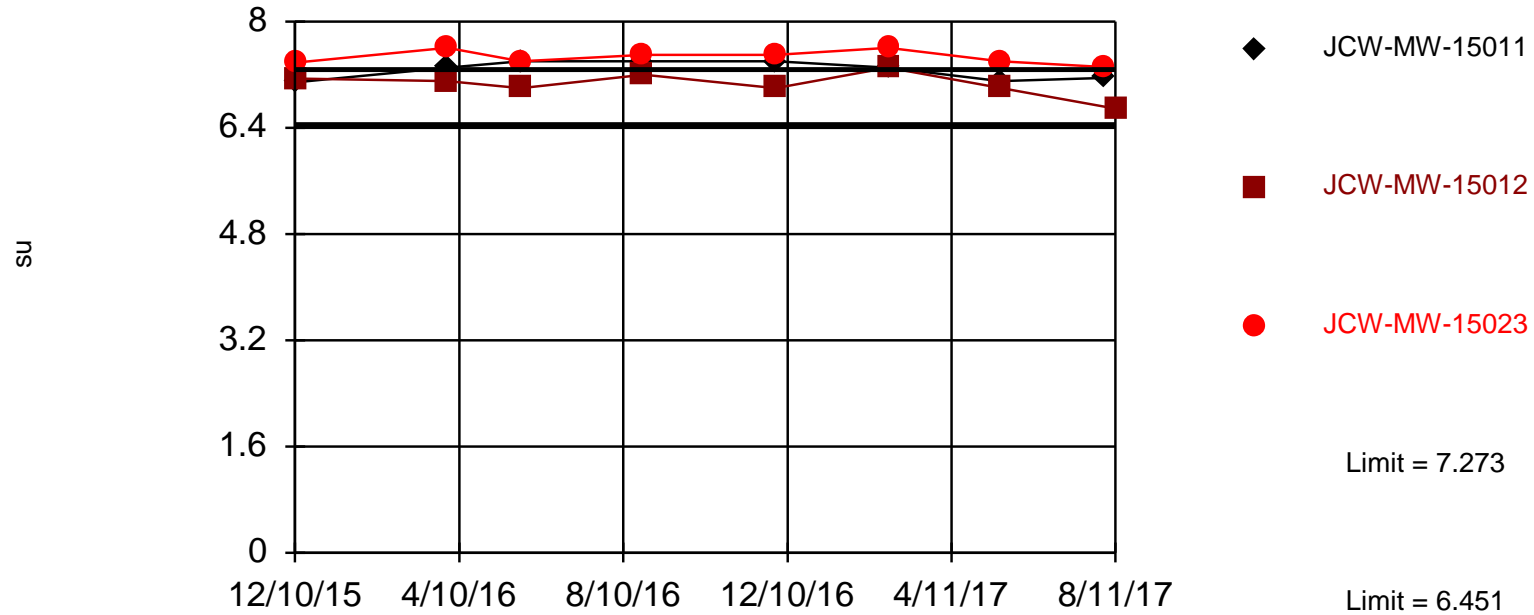
Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 75%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 86.52% coverage at alpha=0.01; 91.21% coverage at alpha=0.05; 97.85% coverage at alpha=0.5. Report alpha = 0.1937.

Constituent: Fluoride Analysis Run 11/21/2017 1:57 PM

Client: Consumers Energy Data: JCW_LF_CCR_Sanitas

Exceeds Limits: JCW-MW-15023

Tolerance Limit Interwell Parametric



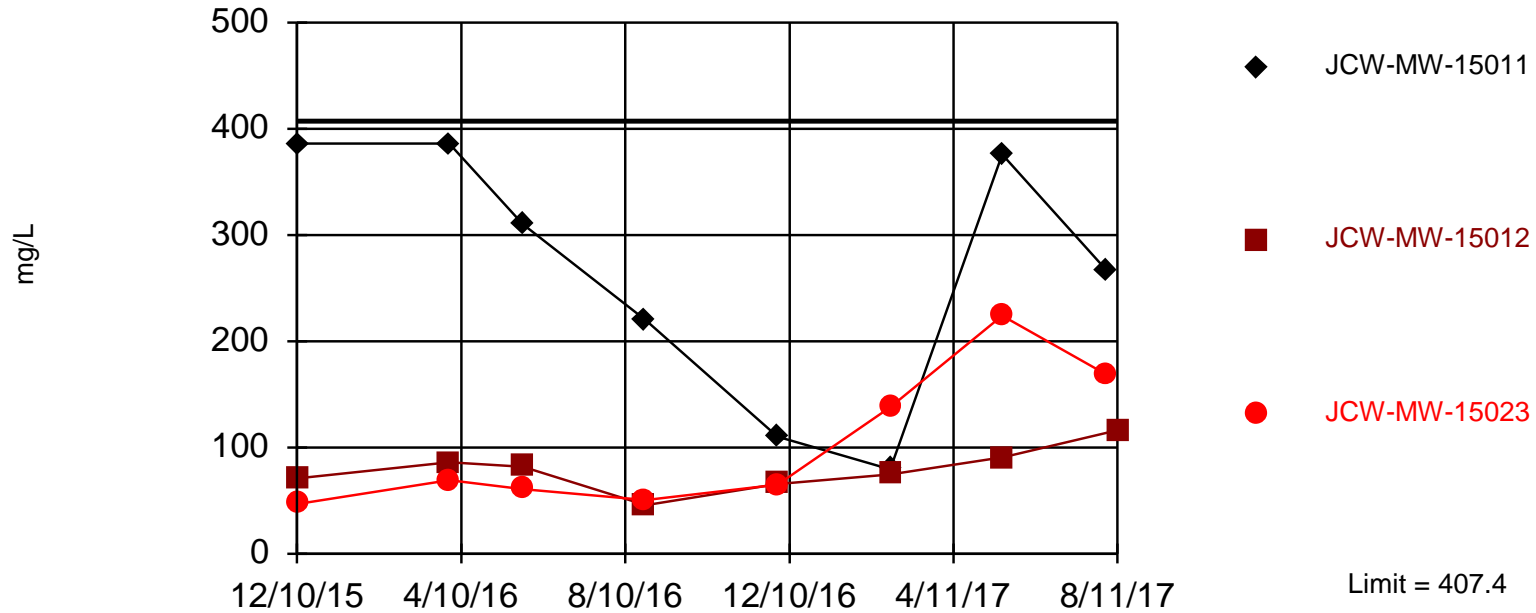
95% coverage. Most recent observation is compared with limit. Background Data Summary: Mean=6.862, Std. Dev.=0.1628, n=32. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9544, critical = 0.904. Report alpha = 0.025 per tail.

Constituent: pH, Field Analysis Run 11/21/2017 1:58 PM

Client: Consumers Energy Data: JCW_LF_CCR_Sanitas

Within Limit

Tolerance Limit Interwell Parametric



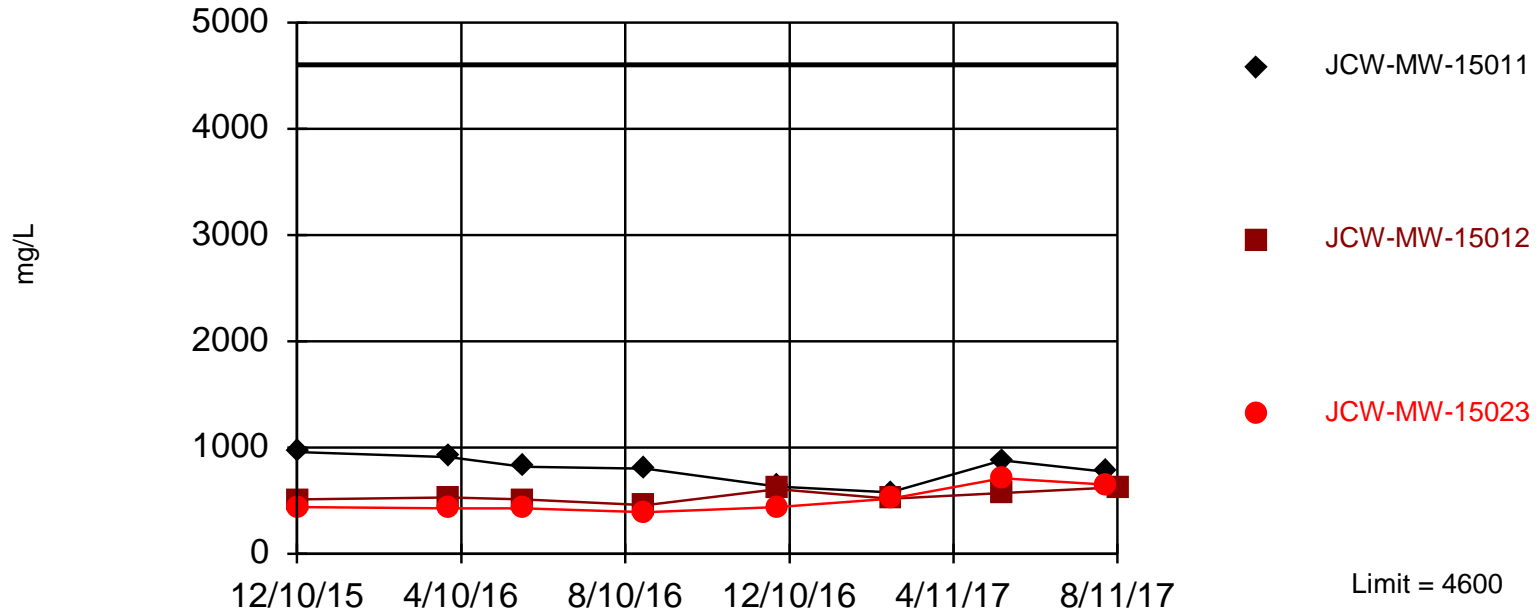
95% coverage. Most recent observation is compared with limit. Background Data Summary (based on cube root transformation): Mean=3.637, Std. Dev.=1.718, n=32, 3.125% NDs. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9137, critical = 0.904. Report alpha = 0.05.

Constituent: Sulfate Analysis Run 11/21/2017 1:59 PM

Client: Consumers Energy Data: JCW_LF_CCR_Sanitas

Within Limit

Tolerance Limit Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Most recent observation is compared with limit. Limit is highest of 32 background values. 86.52% coverage at alpha=0.01; 91.21% coverage at alpha=0.05; 97.85% coverage at alpha=0.5. Report alpha = 0.1937.

Constituent: Total Dissolved Solids, Dissolved Analysis Run 11/21/2017 1:58 PM

Client: Consumers Energy Data: JCW_LF_CCR_Sanitas