2018 Annual Groundwater Monitoring Report

Former JR Whiting Power Plant
Ponds 1 and 2
Erie, Michigan

January 2019

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Prepared For
Consumers Energy Company

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Executive Summary

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule), as amended July 30, 2018. The CCR Rule, which became effective on October 19, 2015 (amendment effective August 29, 2018), applies to the Consumers Energy Company (CEC) Ponds 1 and 2 existing surface impoundment (Ponds 1 and 2) at the former JR Whiting (JRW) 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 2018 Annual Groundwater Monitoring Report for the JRW Ponds 1 and 2 on behalf of CEC. This 2018 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 constituents (Appendix III to Part 257 of the CCR Rule) for the May and November 2018 semiannual groundwater monitoring events for Ponds 1 and 2. As part of the statistical evaluation, the data collected during detection monitoring events are evaluated to identify statistically significant increases (SSIs) in detection monitoring constituents to determine if concentrations in detection monitoring well samples exceed background levels.

Potential SSIs over background limits were noted for various Appendix III constituents in one or more downgradient wells during the May and November 2018 monitoring events. Verification resampling demonstrated that these potential SSIs were not statistically significant (i.e., verification resampling did not confirm the exceedance). Therefore, no SSIs were recorded for the 2018 monitoring period and detection monitoring will be continued at Ponds 1 and 2 in conformance with §257.90 - §257.94.

Additionally, it is recognized that due to lack of groundwater flow potential there is limited temporal independence in the background dataset, and, due to limitations on CCR Rule implementation timelines, the data sets are of relatively short duration for capturing natural temporal changes in the aquifer that may occur on a seasonal basis.

No corrective actions were performed in 2018. The next semiannual monitoring event for the Ponds 1 and 2 is scheduled for the second calendar quarter of 2019.

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), as amended July 30, 2018. The CCR Rule, which became effective on October 19, 2015 (amendment effective August 29, 2018), applies to the Consumers Energy Company (CEC) Ponds 1 and 2 existing surface impoundment (Ponds 1 and 2) at the former JR Whiting (JRW) Power Plant Site (the Site). Ponds 1 and 2 are monitored using a multiunit groundwater monitoring system (in accordance with 40 CFR §257.91). 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 2018 Annual Groundwater Monitoring Report (2018 Annual Report) for the JRW Ponds 1 and 2 on behalf of CEC. This 2018 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 constituents (Appendix III to Part 257 of the CCR Rule) for the May and November 2018 semiannual groundwater monitoring events for Ponds 1 and 2. The monitoring was performed in accordance with the *JR Whiting Monitoring Program Sample Analysis Plan* (SAP) (ARCADIS, 2016) and the updated *JR Whiting Monitoring Program Sample and Analysis Plan* (TRC, May 2017), 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 constituents compared to background levels.

1.2 Site Overview

The JR Whiting Plant was a coal-fired power generation facility located in Erie, Michigan, on the western shore of Lake Erie (Figure 1). The plant began producing electricity in 1952 from Units 1 and 2, with Unit 3 beginning operation in 1953. The plant ceased operation in April 2016. Figure 1 is a site location map showing the facility and the surrounding area. Site features are shown on Figure 2.

The JR Whiting Ash Disposal Area is in three general locations of the site and is regulated/licensed under Michigan Part 115 of the Natural Resources and Environmental Protection Act (NREPA), PA 451 of 1994, as amended. This report focuses on Ponds 1 and 2.

Ponds 1 and 2 are located to the east of the plant, north of the discharge canal, south of Erie Road, and west of Lake Erie. Ponds 1 and 2 was constructed in native clay soil and used historically for wet ash sluicing. The ash disposal area is contained by perimeter dikes that are also used as access roads upon which light utility trucks, large snowplows, and large haul trucks can be driven. Until April 2016, the ponds were maintained for occasional wet ash sluicing, serving as the backup system for dry ash handling and sump water discharge. Bottom ash and occasionally fly ash generated through the coal burning process was transported to the southwest corner of Pond 2. The ash would settle in Ponds 1 and 2 and the treated water would eventually discharge via the National Pollutant Discharge Elimination System (NPDES) outfall in Pond 1.

1.3 Geology/Hydrogeology

Ponds 1 and 2 is located adjacent to Lake Erie. The subsurface materials encountered at the JR Whiting site are predominately clay-rich till. The surficial CCR fill material is underlain by approximately 40 to 50 feet of laterally extensive clay-rich till that acts as a natural hydraulic barrier across the site. Limestone bedrock is present beneath the till and is considered the uppermost aquifer at the site. Groundwater present within the uppermost aquifer is confined and protected from CCR constituents by the overlying clay-rich aquitard and is typically encountered around 50 feet below ground surface (ft bgs) in the limestone (beneath the till). Potentiometric surface elevation data from groundwater within the CCR monitoring wells exhibit an extremely low hydraulic gradient across the site with no apparent flow direction. There are minor differences in hydraulic head across the monitoring wells (ranging from zero up to 0.13 feet across Ponds 1 and 2 from event to event from November 2016 through July 2017), indicating that the potentiometric surface is flat the majority of the time. In the few instances since November 2016 where a slight gradient was observed and calculable, the direction of the flow potential was slightly to the northwest (2 events) and to the east (one event).

Given that the hydraulic gradient is often so low, groundwater flow across Ponds 1 and 2 is frequently incalculable and often stagnant. The most pronounced groundwater gradient between November 2016 and November 2018 was observed in December 19, 2016, which showed a slight horizontal gradient of approximately 0.00016 to the northwest across Ponds 1 and 2.

Based on the hydrogeology at the Site, particularly the extremely low to non-existent gradient or lack of flow direction at the JR Whiting site in addition to the presence of 40 to 50 feet of laterally extensive clay-rich till that acts as a natural hydraulic barrier across the site, an intrawell 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 Ponds 1 and 2, which established the monitoring well locations for detection monitoring. The detection monitoring well network for Ponds 1 and 2 currently consists of six monitoring wells that are screened in the uppermost aquifer. The monitoring well locations are shown on Figure 2.

As discussed in the Stats Plan, intrawell statistical methods for JR Whiting were selected based on the geology and hydrogeology at the Site (primarily the presence of clay/hydraulic barrier, no apparent flow direction and lack of flow potential across the aquifer), in addition to other supporting lines of evidence that the aquifer is unaffected by the CCR unit (such as the consistency in concentrations of water quality data and similarities in concentrations in background and downgradient wells). An intrawell statistical approach requires that each of the downgradient wells doubles as the background and compliance well, where data from each individual well during a detection monitoring event is compared to a statistical limit developed using the background dataset from that same well. Monitoring wells JRW-MW-15001 through JRW-MW-15006 are located around the perimeter of Ponds 1 and 2 and provide data on both background and downgradient groundwater quality that has not been affected by the CCR unit (total of six background/downgradient monitoring wells).

As shown on Figure 2, monitoring wells JRW-MW-15007 through JRW-MW-15009 are used for water level measurements only. These wells were initially installed as potential background monitoring wells during the initial stages of characterizing the site. However, based on further hydrogeological characterization of the uppermost aquifer, an intrawell statistical approach was selected which does not rely on JRW-MW-15007 through JRW-MW-15009 for statistical evaluation.

2.2 Semiannual Groundwater Monitoring

The semiannual monitoring constituents 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 constituents 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.

2.2.1 Data Summary

The first semiannual groundwater detection monitoring event for 2018 was performed on May 1 through May 2, 2018, by TRC personnel and samples were analyzed by Pace Analytical Services, LLC (Pace) in accordance with the May 2017 SAP. Static water elevation data were collected at all nine monitoring well locations. Groundwater samples were collected from the six detection monitoring wells for the Appendix III constituents and field parameters. A summary of the groundwater data collected during the May 2018 event is provided on Table 1 (static groundwater elevation data), Table 2 (field data), and Table 3 (analytical results).

The second semiannual groundwater detection monitoring event for 2018 was performed on November 27 to November 28, 2018, by TRC personnel and samples were analyzed by Pace in accordance with the May 2017 SAP. Static water elevation data were collected at all nine monitoring well locations. Groundwater samples were collected from the six detection monitoring wells for the Appendix III constituents and field parameters. A summary of the groundwater data collected during the November 2018 event is provided on Table 1 (static groundwater elevation data), Table 2 (field data), and Table 4 (analytical results).

2.2.2 Data Quality Review

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

2.2.3 Groundwater Flow Rate and Direction

Groundwater elevation data collected during the background sampling events showed that the hydraulic gradient for groundwater within the uppermost aquifer is often so low, groundwater flow across the Ponds 1 and 2 is frequently incalculable and often stagnant.

The average groundwater gradient observed on May 1, 2018, using well pairs JRW-MW-15005/JRW-MW-15001 and JRW-MW-15004/JRW-MW-15002, showed a very slight horizontal gradient of approximately 0.000072 ft/ft with minimal discernable overall flow direction across Ponds 1 and 2 in the northwest direction. Using the highest hydraulic conductivity measured at the Ponds 1 and 2 monitoring wells of 20 feet/day (ARCADIS, 2016), and an assumed effective porosity of 0.1, this results in a groundwater flow rate of approximately 0.014 feet/day (approximately 5 feet/year). Groundwater

elevations measured across the Site during the May 2018 sampling event are provided on Table 1 and are summarized in plan view on Figure 3.

The average groundwater gradient observed on November 27, 2018, using the same well pairs as the May 2018 event, showed a very slight horizontal gradient of approximately 0.00015 ft/ft with minimal discernable overall flow direction across the Ponds 1 and 2 in the northwest direction. Using the aforementioned hydraulic conductivity and porosity assumptions, this results in a groundwater flow rate of approximately 0.030 feet/day (approximately 11 feet/year). Groundwater elevations measured across the Site during the November 2018 sampling event are provided on Table 1 and are summarized in plan view on Figure 4.

The extremely low gradient and lack of general flow direction is similar to that identified in previous monitoring rounds (since the background sampling events commenced in December 2016) and continues to demonstrate that the downgradient compliance wells are appropriately positioned to detect the presence of Appendix III constituents that could potentially migrate from Ponds 1 and 2.

Section 3
Statistical Evaluation

3.1 Establishing Background Limits

Per the Stats Plan, background limits were established for the Appendix III constituents following the ninth round of background monitoring using data collected from each of the six established detection monitoring wells (JRW-MW-15001 through JRW-MW-15006). The statistical evaluation of the background data is presented in the *Annual Groundwater Monitoring Report* (TRC, January 2018). The Appendix III background limits for each monitoring well will be used throughout the detection monitoring period to determine whether groundwater has been impacted from the JRW Ponds 1 and 2 by comparing concentrations in the detection monitoring wells to their respective background limits for each Appendix III constituents.

3.2 Data Comparison to Background Limits – First Semiannual Event (May 2018)

The concentrations of the constituents in each of the detection monitoring wells (JRW-MW-15001 through JRW-MW-15006) were compared to their respective statistical background limits calculated from the background data collected from each individual well (i.e., monitoring data from JRW-MW-15001 is compared to the background limit developed using the background dataset from JRW-MW-15001, and so forth). The comparisons are presented on Table 3.

The preliminary statistical evaluation of the May 2018 Appendix III constituents showed potential SSIs over background for:

- Sulfate at JRW-MW-15001 (field duplicate result was below the prediction limit); and
- Total dissolved solids (TDS) at JRW-MW-15006.

The initial observation of a constituent concentration above the established background limits does not necessarily constitute an SSI. Per the Stats Plan, if there is an exceedance of a prediction limit for one or more of the constituents, 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 boron, calcium, chloride, fluoride, or pH.

3.3 Verification Resampling for the First Semiannual Event

Verification resampling is recommended per the Stats Plan and the *USEPA's Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (Unified Guidance, USEPA, 2009) to achieve performance standards as specified by §257.93(g) in the CCR rules. Per the Stats Plan, if there is an exceedance of a prediction limit for one or more of the constituents, the

well(s) of concern will be resampled within 30 days of the completion of the initial statistical analysis. Only constituents that initially exceed their statistical limit (i.e., have no previously recorded SSIs) will be analyzed for verification purposes. As such, on June 13, 2018, TRC personnel conducted verification sampling for sulfate at monitoring well JRW-MW-15001 and for TDS at monitoring well JRW-MW-15006, and samples were analyzed by Pace in accordance with the SAP. A summary of the groundwater data collected during the verification resampling event is provided on Table 3. The associated data quality review is included in Appendix A.

The results of the June 2018 verification sampling event did not confirm the initial exceedances from the May 2018 event. Therefore, in accordance with the Stats Plan and the Unified Guidance, the initial exceedance is not statistically significant, and no SSIs will be recorded during the May 2018 detection monitoring event. CEC will continue detection monitoring per 40 CFR 257.94 at Ponds 1 and 2.

3.4 Data Comparison to Background Limits – Second Semiannual Event (November 2018)

The data comparisons for the November 2018 groundwater monitoring event are presented on Table 4. The statistical evaluation of the November 2018 Appendix III constituents shows potential initial SSIs over background for:

- Boron at JRW-MW-15004 and JRW-MW-15005; and
- pH at JRW-MW-15004 and JRW-MW-15005.

There were no SSIs compared to background for calcium, chloride, fluoride, sulfate, and TDS.

3.5 Verification Resampling for the Second Semiannual Event

Verification resampling for the November 2018 event was conducted on January 9, 2019 by TRC personnel. Groundwater samples were collected for boron and pH at JRW-MW-15004 and JRW-MW-15005. A summary of the analytical results collected during the second semiannual verification resampling event is provided on Table 4. The associated data quality reviews are included in Appendix A.

The boron and pH resample results are within the prediction limits; consequently, the initial potential SSIs from the November 2018 event are not confirmed. Therefore, in accordance with the stats plan and the Unified Guidance, the initial exceedances are not statistically significant, and no SSIs will be recorded for the November 2018 monitoring event.

Section 4
Conclusions and Recommendations

Potential SSIs over background limits were noted for various Appendix III constituents in one or more downgradient wells during the May and November 2018 monitoring events. Verification resampling demonstrated that these potential SSIs were not statistically significant (i.e., verification resampling did not confirm the exceedance). Therefore, no SSIs were recorded for the 2018 monitoring period and detection monitoring will be continued at Ponds 1 and 2 in conformance with §257.90 - §257.94.

Additionally, it is recognized that due to lack of groundwater flow potential there is limited temporal independence in the background dataset, and, due to limitations on CCR Rule implementation timelines, the data sets are of relatively short duration for capturing natural temporal changes in the aquifer that may occur on a seasonal basis.

No corrective actions were needed or performed in 2018. The next semiannual monitoring event for the Ponds 1 and 2 is scheduled for the second calendar quarter of 2019.

Section 5
References

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USEPA. April 2015. 40 CFR Parts 257 and 261. Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule. 80 Federal Register 74 (April 17, 2015), pp. 21301-21501 (80 FR 21301).

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

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

Tables

Table 1
Summary of Groundwater Elevation Data – May & November 2018
JR Whiting Ponds 1 and 2 – RCRA CCR Monitoring Program
Erie, Michigan

Well Location	Ground Surface Elevation (ft)	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Depth (ft BGS)			Screen Interval Elevation (ft)			May 1, 2018		November 27, 2018	
										Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Static Water Level Monitoring Wells													
JRW-MW-16007	579.47	582.32	Limestone	68.0	to	78.0	511.5	to	501.5	6.45	575.87	7.45	574.87
JRW-MW-16008	579.95	582.84	Limestone	68.0	to	73.0	512.0	to	507.0	6.91	575.93	7.96	574.88
JRW-MW-16009	579.90	582.59	Limestone	69.0	to	79.0	510.9	to	500.9	6.70	575.89	7.71	574.88
Ponds 1 & 2													
JRW-MW-15001	589.6	590.71	Limestone	78.0	to	88.0	511.6	to	501.6	14.70	576.01	15.66	575.05
JRW-MW-15002	590.6	592.31	Limestone	81.0	to	91.0	509.6	to	499.6	16.25	576.06	17.21	575.10
JRW-MW-15003	589.6	591.36	Limestone	81.0	to	91.0	508.6	to	498.6	15.29	576.07	16.19	575.17
JRW-MW-15004	590.8	592.52	Limestone	86.0	to	96.0	504.8	to	494.8	16.44	576.08	17.32	575.20
JRW-MW-15005	592.7	594.25	Limestone	86.0	to	96.0	506.7	to	496.7	18.13	576.12	19.03	575.22
JRW-MW-15006	590.3	592.01	Limestone	81.0	to	91.0	509.3	to	499.3	15.97	576.04	16.89	575.12

Notes:

Survey conducted by Sheridan Surveying Co., November 2015 (2015 wells), and November 2016 (2016 wells)

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.

Table 2
Summary of Field Parameter Results – May & November 2018
JR Whiting Ponds 1 and 2 – RCRA CCR Monitoring Program
Erie, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
JRW-MW-15001	5/1/2018	0.24	-134.2	7.4	1,071	15.55	9.24
	11/27/2018	0.17	20.7	7.6	816	11.23	3.21
JRW-MW-15002	5/1/2018	0.30	-104.0	7.5	1,126	15.39	4.57
	11/27/2018	0.21	26.7	7.6	819	10.27	2.22
JRW-MW-15003	5/1/2018	0.26	-121.3	7.7	1,000	16.00	7.48
	11/27/2018	1.34	31.6	7.8	735	10.62	2.82
JRW-MW-15004	5/1/2018	1.22	-130.5	7.6	961	15.83	4.89
	11/27/2018	0.28	20.6	7.2	901	10.96	4.17
JRW-MW-15005	5/1/2018	3.22	-134.8	7.9	872	17.45	5.83
	11/27/2018	0.27	-49.6	7.6	833	12.17	4.25
JRW-MW-15006	5/2/2018	0.81	-176.6	7.9	963	16.09	2.43
	11/27/2018	0.51	-90.1	7.6	914	10.58	4.37

Notes:

mg/L - Milligrams per Liter.

mV - Millivolts.

SU - Standard units.

umhos/cm - Micromhos per centimeter.

°C - Degrees Celcius.

NTU - Nephelometric Turbidity Unit.

Table 3
Comparison of Appendix III Constituent Results to Background Limits – May 2018
JR Whiting Ponds 1 and 2 – RCRA CCR Monitoring Program
Erie, Michigan

Sample Location:		JRW-MW-15001				JRW-MW-15002		JRW-MW-15003		JRW-MW-15004		JRW-MW-15005		JRW-MW-15006		
Sample Date:		5/1/2018		6/13/2018[1]	PL	5/1/2018		5/1/2018		5/1/2018		5/1/2018		5/2/2018	6/13/2018[1]	PL
Constituent	Unit	Data				Data	PL	Data	PL	Data	PL	Data	PL	Data		
Appendix III		Primary	Duplicate													
Boron	ug/L	186	189	--	251	182	229	204	219	224	271	214	256	216	--	240
Calcium	mg/L	148	134	--	182	147	185	118	162	99.1	143	94.8	127	104	--	144
Chloride	mg/L	47.8	47.8	--	54.4	47.3	54.5	44.6	55.5	49.3	54.7	37.8	44.0	44.9	--	52.1
Fluoride	ug/L	1,500	1,500	--	1,560	1,600	1,870	1,600	1,810	1,500	1,860	1,400	1,730	1,500	--	1,710
pH, Field	SU	7.4	7.4	--	7.4 - 8.1	7.5	7.3 - 7.8	7.7	7.4 - 8.2	7.6	7.4 - 7.9	7.9	7.7 - 8.4	7.9	--	7.1 - 9.0
Sulfate	mg/L	**891**	387	388	469	405	495	380	454	350	389	313	347	368	--	404
Total Dissolved Solids	mg/L	798	784	--	974	492	1,020	714	969	664	900	592	844	**936**	694	922

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

-- = not analyzed

All metals were analyzed as total unless otherwise specified.

Bold font indicates an exceedance of the Prediction Limit (PL) using the number of significant figures in the PL.

RESULT Shading and bold font indicates a confirmed exceedance of the PL.

(1) Results shown for verification sampling performed on 6/13/2018.

Table 4
Comparison of Appendix III Constituent Results to Background Limits – November 2018
JR Whiting Ponds 1 and 2 – RCRA CCR Monitoring Program
Erie, Michigan

Sample Location:		JRW-MW-15001		JRW-MW-15002		JRW-MW-15003		JRW-MW-15004			JRW-MW-15005			JRW-MW-15006	
Sample Date:		11/27/2018		11/27/2018		11/27/2018		11/27/2018	1/9/2019[1]	PL	11/27/2018	1/9/2019 [1]	PL	11/27/2018	
Constituent	Unit	Data	PL	Data	PL	Data	PL	Data			Data			Data	PL
Appendix III															
Boron	ug/L	193	251	206	229	218	219	**282**	237	271	**272**	222	256	212	240
Calcium	mg/L	128	182	139	185	112	162	104	--	143	92.7	--	127	104	144
Chloride	mg/L	48.3	54.4	48.9	54.5	44.9	55.5	48.4	--	54.7	40.1	--	44.0	44.7	52.1
Fluoride	ug/L	1,300	1,560	1,400	1,870	1,400	1,810	1,300	--	1,860	1,300	--	1,730	1,200	1,710
pH, Field	SU	7.6	7.4 - 8.1	7.6	7.3 - 7.8	7.8	7.4 - 8.2	**7.2**	7.5	7.4 - 7.9	**7.6**	7.7	7.7 - 8.4	7.6	7.1 - 9.0
Sulfate	mg/L	435	469	417	495	365	454	348	--	389	307	--	347	332	404
Total Dissolved Solids	mg/L	772	974	798	1,020	736	969	658	--	900	596	--	844	694	922

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

-- = not analyzed

All metals were analyzed as total unless otherwise specified.

Bold font indicates an exceedance of the Prediction Limit (PL) using the number of significant figures in the PL.

RESULT Shading and bold font indicates a confirmed exceedance of the PL.

(1) Results shown for verification sampling performed on 1/9/2019.

Figures

BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

N

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

0 3,000 6,000
FEET

TRC

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

TRC - GIS

PROJECT:

CONSUMERS ENERGY COMPANY
JR WHITING POWER PLANT
ERIE, MICHIGAN

TITLE:

SITE LOCATION MAP

DRAWN BY:	S. MAJOR
CHECKED BY:	B. YELEN
APPROVED BY:	S. HOLMSTROM
DATE:	JANUARY 2019
PROJ. NO.:	297944
FILE:	297944-001-000slm.mxd

FIGURE 1

E:\ConsumersEnergy\CCR_GW\2017_269767\297944-001-000slm.mxd -- Saved By: SMAJOR on 1/24/2019, 11:20:52 AM

LEGEND

- MONITORING WELL (STATIC WATER LEVEL ONLY)
- CCR UNIT MONITORING WELL

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 4/12/2017.
2. WELL LOCATIONS SURVEYED BY SHERIDAN SURVEYING CO. ON 11/19/2015.

N

0 500 1,000 Feet

1 " = 500 '

1:6,000

PROJECT:

CONSUMERS ENERGY COMPANY
JR WHITING POWER PLANT
ERIE, MICHIGAN

TITLE:

SITE PLAN
WITH CCR MONITORING WELL LOCATIONS

DRAWN BY:	S. MAJOR	PROJ NO.:	297944
CHECKED BY:	B. YELEN		
APPROVED BY:	S. HOLMSTROM		**FIGURE 2**
DATE:	JANUARY 2019		

TRC

1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 297944-001-002.mxd

Plot Date: 1/24/2019, 10:11:47 AM by SMAJOR – LAYOUT: ANSI B(11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\297944-001-002.mxd

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

TRC - GIS

LEGEND

- MONITORING WELL (STATIC WATER LEVEL ONLY)
- CCR UNIT MONITORING WELL

LABEL FORMAT

MONITORING WELL ID
GROUNDWATER ELEVATION FT MSL (MEASUREMENT DATE)
GROUNDWATER ELEVATION FT MSL (MEASUREMENT DATE)
etc...

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 4/12/2017.
2. WELL LOCATIONS SURVEYED BY SHERIDAN SURVEYING CO. ON 11/19/2015 AND 11/30/2016.

N

0 500 1,000 Feet

1 " = 500 '

1:6,000

PROJECT:

CONSUMERS ENERGY COMPANY
JR WHITING POWER PLANT
ERIE, MICHIGAN

TITLE:

GROUNDWATER POTENTIOMETRIC ELEVATION SUMMARY MAY 2018

DRAWN BY:	S. MAJOR	PROJ NO.:	297944
CHECKED BY:	B.YELEN		
APPROVED BY:	S. HOLMSTROM		**FIGURE 3**
DATE:	JANUARY 2019		

TRC

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FILE NO.: 297944-001-003.mxd

TRC - GIS
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0
Plot Date: 1/24/2019, 10:15:36 AM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_2697\297944-001-003.mxd

LEGEND

- MONITORING WELL (STATIC WATER LEVEL ONLY)
- CCR UNIT MONITORING WELL

LABEL FORMAT

MONITORING WELL ID
GROUNDWATER ELEVATION FT MSL (MEASUREMENT DATE)
GROUNDWATER ELEVATION FT MSL (MEASUREMENT DATE)
etc...

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 4/12/2017.
2. WELL LOCATIONS SURVEYED BY SHERIDAN SURVEYING CO. ON 11/19/2015 AND 11/30/2016.

N

0 500 1,000 Feet

1 " = 500 '

1:6,000

PROJECT:

CONSUMERS ENERGY COMPANY
JR WHITING POWER PLANT
ERIE, MICHIGAN

TITLE:

GROUNDWATER POTENTIOMETRIC ELEVATION SUMMARY NOVEMBER 2018

DRAWN BY:	S. MAJOR	PROJ NO.:	297944
CHECKED BY:	B. YELEN		
APPROVED BY:	S. HOLMSTROM		**FIGURE 4**
DATE:	JANUARY 2019		

TRC

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FILE NO.: 297944-001-006.mxd

TRC - GIS
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0
Plot Date: 1/24/2019, 10:18:46 AM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_2697\297944-001-006.mxd

Appendix A
Data Quality Reviews

Laboratory Data Quality Review
Groundwater Sample Event May 2018
CEC JR Whiting Ponds 1 and 2

Groundwater samples were collected by TRC for the May 2018 detection monitoring sampling event. Samples were analyzed for anions, boron, calcium, and total dissolved solids by Pace Analytical located in Grand Rapids, Michigan. The laboratory analytical results are reported in laboratory reports 4611799 and 4611801.

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

- JRW-MW-15001
- JRW-MW-15002
- JRW-MW-15003
- JRW-MW-15004
- JRW-MW-15005
- JRW-MW-15006

In addition, groundwater samples were collected in non-compliance monitoring wells (JRW-MW-16007, JRW-MW-16008 and JRW-MW-16009) which were submitted for analysis along with the Pond 1 and 2 area samples and are included for quality review purposes.

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Chloride, Fluoride, Sulfate)	EPA 300.0
Boron, Calcium	EPA 6020A, EPA 6010C
Total Dissolved Solids	SM 2540C-11

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

Data Quality Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund 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
- Reporting limits (RLs) compared to project-required RLs.
- Data for method blanks, equipment blanks, and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or

analytical procedures. Field and equipment blanks are used to assess potential contamination arising from field procedures.

- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix.
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD). Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects.
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method; and
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes.
- Overall usability of the data which addressed 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

Findings

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable, with the exceptions noted below. The discussion that follows describes the QA/QC results and evaluation.

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 method blank was analyzed with each analytical batch. No target analytes were detected in the method blanks.
- One equipment blank (EB-01) and one field blank (FB-01) were collected. No target analytes were detected in samples EB-01 and FB-01.
- LCS recoveries were within laboratory control limits for all analytes.

- MS/MSD analyses were performed on sample JRW-MW-16007 for anions and metals.
  - The calcium recoveries in the MS/MSD for batches 22725 and 22728 were above the upper laboratory control limits. The calcium result in the parent sample was >4x the spike concentration; therefore, the laboratory control limits are not applicable. Data usability was not affected.
  - The sulfate recoveries in the MS/MSD for batch 22254 was above the upper laboratory control limit. Sulfate results for samples analyzed in the same batch (JRW-MW-16007) may be biased high (see the attached table).
- Laboratory duplicate analyses were performed on samples JRW-MW-16007 and JRW-MW-16008 for total dissolved solids and/or anions; relative percent differences (RPDs) were within QC limits.
- The field duplicate samples were Dup-01 and JRW-MW-15001. The RPDs between the parent and duplicate sample were >20% for sulfate. Potential uncertainty exists for sulfate results for the field duplicate pair due to field duplicate variability (see the attached table).

Laboratory Data Quality Review
Groundwater Sample Event Verification Resampling June 2018
CEC JR Whiting Ponds 1 and 2

Groundwater samples were collected by TRC for the June 2018 detection monitoring verification resampling event. Samples were analyzed for anions (sulfate) and total dissolved solids by Pace Analytical located in Grand Rapids, Michigan. The laboratory analytical results are reported in laboratory reports 4613645.

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

- JRW-MW-15001
- JRW-MW-15006

Samples were analyzed for the following constituents:

Analyte Group	Method
Anions (Sulfate)	EPA 300.0
Total Dissolved Solids	SM 2540C-11

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

Data Quality Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund 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
- Reporting limits (RLs) compared to project-required RLs.
- Data for method blanks, equipment blanks, and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field and equipment blanks are used to assess potential contamination arising from field procedures.
- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix.

- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD). Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects.
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method; and
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes.
- Overall usability of the data which addressed 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

Findings

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable, with the exceptions noted below. The discussion that follows describes the QA/QC results and evaluation.

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 method blank was analyzed with each analytical batch. No target analytes were detected in the method blanks.
- One equipment blank (EB-01) and one field blank (FB-01) were collected. No target analytes were detected in samples EB-01 and FB-01.
- LCS recoveries were within laboratory control limits for all analytes.
- MS/MSD analyses were performed on non-project samples. As such, an evaluation of MS/MSD recoveries and relative percent differences was not performed.

- Laboratory duplicate analyses were performed on samples JRW-MW-15001 for sulfate and JRW-MW-15006 for total dissolved solids; relative percent differences (RPDs) were within QC limits.
- The field duplicate samples were Dup-01 and JRW-MW-15001 and Dup-02 and JRW-MW-15006. The RPDs between the parent and duplicate sample (Dup-02 and JRW-MW-15006) were >20% for total dissolved solids. Potential uncertainty exists for total dissolved solids results for the field duplicate pair due to field duplicate variability (see the attached table).

Laboratory Data Quality Review
Groundwater Sample Event November 2018
CEC JR Whiting Ponds 1 and 2

Groundwater samples were collected by TRC for the November 2018 detection monitoring sampling event. Samples were analyzed for anions, boron, calcium, and total dissolved solids by Pace Analytical located in Grand Rapids, Michigan. The laboratory analytical results are reported in laboratory report 4620785.

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

- JRW-MW-15001
- JRW-MW-15002
- JRW-MW-15003
- JRW-MW-15004
- JRW-MW-15005
- JRW-MW-15006

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Chloride, Fluoride, Sulfate)	EPA 300.0
Boron, Calcium	EPA 6020A, EPA 6010C
Total Dissolved Solids	SM 2540C-11

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

Data Quality Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund 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
- Reporting limits (RLs) compared to project-required RLs.
- Data for method blanks, equipment blanks, and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field and equipment blanks are used to assess potential contamination arising from field procedures.
- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix.

- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD). Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects.
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method.
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes.
- Overall usability of the data which addressed 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

Findings

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable, with the exceptions noted below. The discussion that follows describes the QA/QC results and evaluation.

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 method blank was analyzed with each analytical batch. No target analytes were detected in the method blanks.
- One equipment blank (EB-1) and one field blank (FB-1) were collected. No target analytes were detected in sample FB-1.
  - Chloride was detected at 2.0 mg/L in EB-1. However, there was no impact on data usability since all associated sample results were >5x the blank concentration.
- LCS recoveries were within laboratory control limits for all analytes.

- MS/MSD analyses were performed on sample JRW-MW-15006 for anions, calcium, and boron. All recoveries and relative percent differences (RPDs) were within the acceptance limits.
- Laboratory duplicate analyses were performed on sample JRW-MW-15006 for total dissolved solids and anions; RPDs were within the acceptance limits.
- The field duplicate samples were DUP-01/JRW-MW-15002. The RPDs were within the acceptance criteria in samples DUP-01/JRW-MW-15002.

Laboratory Data Quality Review
Groundwater Sampling Event January 2019 Verification Resampling
CEC JR Whiting Ponds 1 and 2

Groundwater samples were collected by TRC for the January 2019 detection monitoring verification sampling event. Samples were analyzed for boron by Pace Analytical located in Grand Rapids, Michigan. The laboratory analytical results are reported in laboratory report 50214315.

During the January 2019 verification sampling event, a groundwater sample was collected from wells JRW-MW-15004 and JRW-MW-15005.

Each sample was analyzed for the following constituent:

Analyte	Method(s)
Boron	EPA 200.2/SW-846 6020

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

Data Quality Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund 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;
- Reporting limits (RLs) compared to project-required RLs;
- Data for method blanks, equipment blanks, and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field and equipment blanks are used to assess potential contamination arising from field procedures;
- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), where applicable. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;

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

Findings

The data quality objectives and laboratory completeness goals for the project were met and the data are usable. The discussion that follows describes the QA/QC results and evaluation.

Review Summary

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

- The reviewed Appendix III constituent 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 method blank was analyzed with each analytical batch. Boron was not detected in the method blank.
- One equipment blank (EB-01) and one field blank (FB-01) were collected. Boron was not detected in EB-01 and FB-01.
- The LCS recovery was within laboratory control limits for boron.
- MS/MSD analyses were not performed on a sample in this data set and thus were not evaluated.
- Laboratory duplicate analysis was not performed on a sample in this data set.
- The field duplicate samples were DUP-01/JRW-MW-15004. The relative percent difference (RPD) for boron was within the acceptance criteria.

Field Parameter Data Quality Review
Groundwater Sampling Event January 2019 Verification Resampling
CEC JR Whiting Ponds 1 and 2

On January 9, 2019, TRC Environmental Corporation (TRC) collected groundwater samples at monitoring wells JRW-MW-15004 and JRW-MW-15005 to verify initial pH (field measured) results that were outside of prediction limits during the November 2018 detection monitoring event. Prior to sample collection, groundwater was initially purged at a high flowrate until pH dropped below 8.0 standard units (su), then the groundwater was purged and stabilized using low flow sampling methods in accordance with the *JR Whiting Monitoring Program Sample and Analysis Plan* (SAP) (ARCADIS, 2016) and the updated *JR Whiting Monitoring Program Sample and Analysis Plan* (TRC, May 2017).

TRC routinely reviews the field parameter data to assess data usability. The following sections summarize the data review procedure and the results of this review.

Data Quality Review Procedure

The following items were included in the evaluation of the field parameter data:

- Review of sonde calibration data;
- Confirm field parameter stabilization criteria were met;
- Compare field parameters to historical data; and
- Overall usability of data based on these items.

Findings

The data quality objectives for the project were met and the data are usable. The discussion that follows describes the QA/QC results and evaluation.

- Sonde calibration readings were within the calibration range for all field parameters, with the following exception:
- Field parameters met stabilization criteria for three successive readings.
- Field parameter readings were comparable to historical data.
- Data are usable for purposes of verification resampling.