Annual Groundwater Monitoring Report

JR Whiting Pond 6

Erie, Michigan

July 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) inactive Pond 6 at the former JR Whiting Power Plant Site (JRW Pond 6). On August 5, 2016, the USEPA published the CCR Rule companion *Extension of Compliance Deadlines for Certain Inactive Surface Impoundments*, which established the compliance deadlines for inactive CCR surface impoundments. As required for inactive CCR surface impoundments, Pond 6 was certified closed with a final cover system prior to April 17, 2018. Pursuant to the CCR Rule, no later than August 1, 2019, and annually thereafter, the owner or operator of an inactive 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 JRW Pond 6 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 constituents (Appendix III to Part 257 of the CCR Rule) for the March 2019 semiannual groundwater monitoring event, in addition to the background data collection, for the JRW Pond 6. 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 constituents to determine if concentrations in detection monitoring well samples exceed background levels.

Potential SSIs over background limits were noted for pH and sulfate in one or more downgradient wells for the March 2019 monitoring event. This is the initial detection monitoring event; therefore, it is the initial identification of a potential SSI over background levels. Pursuant to the USEPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (Unified Guidance, USEPA, 2009) and the *Groundwater Statistical Evaluation Plan* (Stats Plan) (TRC, April 2019), verification resampling was performed in June 2019 in order to confirm or refute the statistical significance of the potential SSI. Based on the results of the verification resampling, the initial exceedance is not statistically significant; therefore, no SSIs are recorded for the initial detection monitoring event.

Since no confirmed SSIs over background limits were identified for any of the Appendix III constituents during the March 2019 monitoring event, CEC will continue with the detection monitoring program at the JRW Pond 6 in conformance with §257.90 - §257.94. The next semiannual monitoring event at the JRW Pond 6 is scheduled for the third 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) Pond 6 at the former JR Whiting Power Plant Site (JRW Pond 6). On August 5, 2016, the USEPA published the CCR Rule companion *Extension of Compliance Deadlines for Certain Inactive Surface Impoundments,* which established the compliance deadlines for inactive CCR surface impoundments. As required for inactive CCR surface impoundments, Pond 6 was certified closed with a final cover system prior to April 17, 2018. Pursuant to the CCR Rule, no later than August 1, 2019, 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 JRW Pond 6 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 constituents (Appendix III to Part 257 of the CCR Rule) for the March 2019 semiannual groundwater monitoring event for the JRW Pond 6. This event is the initial detection monitoring event performed to comply with §257.94. The monitoring was performed in accordance with the *JR Whiting Monitoring Program Sample and Analysis Plan* (TRC, May 2017) and statistically evaluated per the *Groundwater Statistical Evaluation Plan* (Stats Plan) (TRC, April 2019). 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 the JRW Pond 6.

Pond 6 is located to the north of the plant and was constructed in native clay soil. It was an inactive surface impoundment at the time the CCR Rule became effective on October 19, 2015, and was capped with final cover certified pursuant to the CCR Rule on December 5, 2017 and certified by the Michigan Department of Environmental Quality on August 24, 2018.

1.3 Geology/Hydrogeology

Pond 6 is located adjacent to the western shore of Lake Erie. The subsurface materials encountered at the JRW Pond 6 are predominately clay-rich lacustrine and glacial till deposits underlain by limestone bedrock. The surficial CCR fill material is underlain by approximately 40 to 50 feet of laterally extensive till that acts as a natural hydraulic barrier across the site. The limestone bedrock is present beneath the till (approximately 50 to 70 feet below ground surface (ft bgs)) and is considered the uppermost aquifer at the Pond 6 CCR unit.

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 ft bgs in the limestone (beneath the till). Potentiometric surface elevation data from groundwater within the monitoring wells exhibits an extremely low hydraulic gradient across the site with no consistent or discernible flow. There are minor differences in hydraulic head across the monitoring wells (ranging from zero up to 0.24 feet across Pond 6 from event to event from November 2016 through March 2019), indicating that the potentiometric surface is generally 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 south and west.

Given that the hydraulic gradient is often so low, groundwater flow across Pond 6 is frequently incalculable and often stagnant. The most pronounced potentiometric head differential of 0.24 feet was observed on February 28, 2018 between JRW-MW-16001 on the north edge of Pond 6 and JRW-MW-16004 on the south edge of the Pond 6 CCR unit. Although, when considering the potentiometric surface elevation data from all of the Pond 6 CCR unit wells, the general groundwater flow direction inferred across the pond at that time is to the southwest, in order to be conservative, the maximum head difference was used to calculate the maximum groundwater flow velocity at the Pond 6 CCR unit throughout the background monitoring period. This results in a very slight horizontal gradient of approximately 0.000099 ft/ft to the south.

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 appropriate 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 JRW Pond 6 CCR unit, which established the monitoring well locations for detection monitoring. The detection monitoring well network for the JRW Pond 6 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-16001 through JRW-MW-16006 are located around the perimeter of the JRW Pond 6 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-16007 through JRW-MW-16009 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-16007 through JRW-MW-16009 for statistical evaluation.

2.2 Background Sampling

Background groundwater monitoring was conducted at the JRW Pond 6 from November 2016 through November 2018 in accordance with the SAP. Data collection included twelve rounds (Rounds 1 through 12) of static water elevation measurements, analysis for constituents 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 six monitoring wells installed for the JRW Pond 6, in addition to JRW-MW-16007 through JRW-MW-16009. The Rounds 1 through 5 groundwater samples were analyzed by CEC's Laboratory Services in Jackson, Michigan. The Rounds 6 through 12 groundwater samples were

analyzed by Pace Analytical Services, LLC (Pace). Background data are included in Appendix A Tables A1 through A3, where: Table A1 is a summary of static water elevation data (site-wide water level data from CCR program monitoring wells); Table A2 is a summary of field data; and Table A3 is a summary of groundwater analytical data compared to potentially relevant criteria.

In addition to the data tables, groundwater potentiometric elevation data are summarized for each background monitoring event in Appendix A Figure 1.

2.3 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.

2.3.1 Data Summary

The initial semiannual groundwater detection monitoring event for 2019 was performed on March 11 to 13, 2019, by TRC personnel and samples were analyzed by Test America Laboratories, Inc. in accordance with the October 2016 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 March 2019 event is provided on Table 1 (static groundwater elevation data), Table 2 (field data), and Table 3 (analytical results).

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 events showed that the hydraulic gradient for groundwater within the uppermost aquifer is often so low, groundwater flow across the Pond 6 is frequently incalculable and often stagnant. The most pronounced groundwater gradient of 0.24 feet was observed on

February 28, 2018, between JRW-MW-16001 on the north edge of Pond 6 and JRW-MW-16004 on the south edge of the Pond 6, showed a very slight horizontal gradient of approximately 0.000099 ft/ft towards the south. Using the highest hydraulic conductivity measured at the Pond 6 CCR unit monitoring wells (11.9 feet/day from the 2016 TRC well installation report) and an assumed effective porosity of 0.1, this results in a groundwater flow rate of approximately 0.012 feet/day (approximately 4.4 feet per year).

During the March 2019 event, the average hydraulic gradient of 0.000060 ft/ft was calculated using well pairs JRW-MW-16002/JRW-MW-16006, JRW-MW-16001/JRW-MW-16005, and JRW-MW-16003/JRW-MW-16004 toward the southwest. Using the aforementioned hydraulic conductivity and effective porosity assumptions, this results in an average groundwater flow rate of approximately 0.0072 feet/day (approximately 2.6 feet/year). Groundwater elevations measured across the Site during the March 2019 sampling event are provided on Table 1 and are summarized in plan view on Figure 3.

The extremely low gradient and/or lack of general flow direction is similar to that identified in previous monitoring rounds since the background sampling events commenced in November 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 the JRW Pond 6.

Section 3
Statistical Evaluation

3.1 Establishing Background Limits

Per the Stats Plan, background limits were established for the Appendix III constituents following the twelfth round of background monitoring using data collected from each of the six established detection monitoring wells (JRW-MW-16001 through JRW-MW-16006). The statistical evaluation of the background data is presented in detail in Appendix C. 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 Pond 6 by comparing concentrations in the detection monitoring wells to their respective background limits for each Appendix III constituent.

3.2 Data Comparison to Background Limits

The concentrations of the constituents in each of the detection monitoring wells (JRW-MW-16001 through JRW-MW-16006) 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-16001 is compared to the background limit developed using the background dataset from JRW-MW-16001, and so forth). The comparisons are presented on Table 4.

The statistical evaluation of the March 2019 Appendix III constituents shows potential SSIs over background for:

- pH at JRW-MW-16002 and JRW-MW-16003; and
- Sulfate at JRW-MW-16001.

The initial observation of a constituent 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 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 TDS.

3.3 Verification Resampling

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, verification resampling was conducted on June 25, 2019, by TRC personnel. Groundwater samples were collected for pH (field reading) at monitoring wells JRW-MW-16002, and JRW-MW-16003 and sulfate at JRW-MW-16001 in accordance with the SAP. A summary of the groundwater data collected during the verification resampling event is provided on Table 2 (field data) and Table 4 (Appendix III resample results). The associated data quality review is included in Appendix B.

All of the pH verification results are within the prediction limits, consequently the initial pH SSIs from the March 2019 event are not confirmed. The sulfate verification result was below the prediction limit; the initial sulfate SSI was not confirmed. Therefore, in accordance with the Stats Plan and the Unified Guidance, the initial exceedance is not statistically significant, and no SSIs will be recorded for the March 2019 monitoring event.

Section 4
Conclusions and Recommendations

Potential SSIs over background limits were noted for pH and sulfate in one or more downgradient wells for the March 2019 monitoring event. This is the initial detection monitoring event; therefore, it is the initial identification of a potential SSI over background levels. Pursuant to the Unified Guidance and the Stats Plan, verification resampling was performed in June 2019 in order to confirm or refute the potential SSIs. The results of the verification resampling showed that the initial exceedance is not statistically significant; therefore, no SSIs are recorded for the initial detection monitoring event. Additionally, as discussed in the statistical evaluation (Appendix C), 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.

Since no confirmed SSIs over background limits were identified for any of the Appendix III constituents during the March 2019 monitoring event, CEC will continue with the detection monitoring program at the JRW Pond 6 CCR unit in conformance with §257.90 - §257.94. The next semiannual monitoring event for the Pond 6 CCR unit is scheduled for the third calendar quarter of 2019.

Section 5
References

TRC Environmental Corporation. October 2016. Electric Generation Facilities RCRA CCR Detection Monitoring Program for the Ponds 1&2 and Pond 6 Areas. Sample and Analysis Plan. JR Whiting Monitoring Program – Erie, Michigan. Prepared for Consumers Energy Company.

TRC Environmental Corporation. December 2016. 2016 Monitoring Well Design, Installation, Development, and Decommissioning. JR Whiting Electric Generation Facility – Erie, Michigan. Prepared for Consumers Energy Company.

TRC Environmental Corporation. May 2017. Electric Generation Facilities RCRA CCR Detection Monitoring Program for the Ponds 1&2 and Pond 6 Areas. Sample and Analysis Plan. JR Whiting Monitoring Program – Erie, Michigan. Prepared for Consumers Energy Company.

TRC Environmental Corporation. April 2019. Groundwater Statistical Evaluation Plan – Former JR Whiting Power Plant, Pond 6, Erie, Michigan. Prepared for Consumers Energy Company.

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

USEPA. 2016. Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals From Electric Utilities; Extension of Compliance Deadlines for Certain Inactive Surface Impoundments; Response to Partial Vacatur. Office of Conservation and Recovery. EPA 81-FR-51082.

Tables

Table 1
Summary of Groundwater Elevation Data – March 2019
JR Whiting Pond 6 – 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)			March 11, 2019	
										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	6.64	575.68
JRW-MW-16008	579.95	582.84	Limestone	68.0	to	73.0	512.0	to	507.0	7.13	575.71
JRW-MW-16009	579.90	582.59	Limestone	69.0	to	79.0	510.9	to	500.9	6.85	575.74
Pond 6											
JRW-MW-16001	589.19	592.32	Limestone	71.0	to	81.0	518.2	to	508.2	16.46	575.86
JRW-MW-16002	585.78	588.68	Limestone	81.0	to	91.0	504.8	to	494.8	12.80	575.88
JRW-MW-16003	586.19	589.02	Limestone	73.0	to	83.0	513.2	to	503.2	13.15	575.87
JRW-MW-16004	586.48	589.35	Limestone	75.0	to	85.0	511.5	to	501.5	13.54	575.81
JRW-MW-16005	589.29	592.13	Limestone	78.0	to	88.0	511.3	to	501.3	16.30	575.83
JRW-MW-16006	588.26	591.03	Limestone	79.0	to	89.0	509.3	to	499.26	15.24	575.79

Notes:

Survey conducted by Sheridan Surveying Co., 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.

-- = Not measured

Table 2
Summary of Field Parameters – March to June 2019
JR Whiting Pond 6 – 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-16001	3/13/2019	1.08	57.6	7.8	827	6.72	4.07
	6/25/2019(1)	0.22	-40.5	8.0	617	15.40	5.01
JRW-MW-16002	3/14/2019	1.00	52.9	7.0	892	10.76	3.80
	6/25/2019(1)	0.52	-143.6	8.0	763	13.68	52.40
JRW-MW-16003	3/14/2019	0.84	-62.8	7.1	967	10.83	2.33
	6/25/2019(1)	0.26	-141.4	7.6	817	13.93	4.47
JRW-MW-16004	3/14/2019	0.62	-132	7.6	1,013	10.76	6.0
JRW-MW-16005	3/13/2019	0.76	-64.1	7.6	1,058	6.09	2.06
JRW-MW-16006	3/13/2019	1.35	-12	7.6	915	5.47	1.25

Notes:

mg/L - Milligrams per Liter.

mV - Millivolts.

SU - Standard units.

umhos/cm - Micromhos per centimeter.

°C - Degrees Celsius.

NTU - Nephelometric Turbidity Unit.

(1) Results shown for verification sampling performed on 6/25/2019.

Table 3
Summary of Groundwater Sampling Results (Analytical) – March 2019
Pond 6 – RCRA CCR Monitoring Program
Erie, Michigan

						Sample Location:	JRW-MW-16001	JRW-MW-16002	JRW-MW-16003	JRW-MW-16004	JRW-MW-16005	JRW-MW-16006
						Sample Date:	3/13/2019	3/14/2019	3/14/2019	3/14/2019	3/13/2019	3/13/2019
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^							
Appendix III												
Boron	ug/L	NC	500	500	7,200		170	190	200	210	200	180
Calcium	mg/L	NC	NC	NC	500		80	120	130	130	120	96
Chloride	mg/L	250**	250	250	500		20	22	30	39	26	24
Fluoride	ug/L	4,000	NC	NC	NC		1,400	1,100	1,300	1,200	1,200	1,400
Sulfate	mg/L	250**	**250**	**250**	500		**280**	**420**	**450**	**460**	**400**	**330**
Total Dissolved Solids	mg/L	500**	**500**	**500**	**500**		**550**	**730**	**800**	**840**	**750**	**620**
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0		7.8	7.0	7.1	7.6	7.6	7.6

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 site-specific hardness of 150 mg CaCO3/L per footnote {G} of Michigan Part 201 criteria tables. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. GSI criterion for chloride is 50 mg/L when 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 4
Comparison of Appendix III Parameter Results to Background Limits – March to June 2019
JR Whiting Pond 6 – RCRA CCR Monitoring Program
Erie, Michigan

Sample Location:		JRW-MW-16001			JRW-MW-16002			JRW-MW-16003			JRW-MW-16004		JRW-MW-16005		JRW-MW-16006	
Sample Date:		3/13/2019	6/25/2019[1]	PL	3/14/2019	6/25/2019[1]	PL	3/14/2019	6/25/2019[1]	PL	3/14/2019		3/13/2019		3/13/2019	
Constituent	Unit	Data			Data			Data			Data	PL	Data	PL	Data	PL
Appendix III																
Boron	ug/L	170	--	203	190	--	209	200	--	257	210	262	200	244	180	226
Calcium	mg/L	80	--	111	120	--	149	130	--	156	130	181	120	182	96	117
Chloride	mg/L	20	--	23.6	22	--	25.4	30	--	32.4	39	43.7	26	29.4	24	38.6
Fluoride	ug/L	1,400	--	2,300	1,100	--	1,400	1,300	--	1,600	1,200	1,700	1,200	1,800	1,400	2,200
pH, Field	SU	7.8	--	7.5 - 8.9	**7.0**	8.0	7.5 - 8.3	**7.1**	7.6	7.4 - 7.9	7.6	7.4 - 8.2	7.6	7.3 - 8.0	7.6	7.5 - 8.2
Sulfate	mg/L	**280**	250	278	420	--	426	450	--	470	460	507	400	498	330	399
Total Dissolved Solids	mg/L	550	--	770	730	--	832	800	--	1,040	840	1,110	750	1,030	620	904

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 6/25/2019.

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:	JUNE 2019
PROJ. NO.:	332751
FILE:	332751-001-001cslm.mxd

FIGURE 1

E:\ConsumersEnergy\CCR_GW\2017_269767\332751-001-001cslm.mxd -- Saved By: SMAJOR on 6/20/2019, 11:40:54 AM

LEGEND

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

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 4/28/2018.
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.:	332751
CHECKED BY:	B. YELEN		
APPROVED BY:	S. HOLMSTROM		**FIGURE 2**
DATE:	JUNE 2019		

TRC

1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
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FILE NO.: 332751-001-002c.mxd

Plot Date: 6/20/2019, 11:58:07 AM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\332751-001-002c.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)

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 4/28/2018.
2. WELL LOCATIONS SURVEYED BY SHERIDAN SURVEYING CO. ON 11/19/2015.

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

DRAWN BY:	S. MAJOR	PROJ NO.:	332751
CHECKED BY:	B. YELEN		
APPROVED BY:	S. HOLMSTROM		**FIGURE 3**
DATE:	JUNE 2019		

TRC

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

FILE NO.: 332751-001-006.mxd

Plot Date: 6/27/2019, 15:24:44 PM by SMAJOR -- LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\332751-001-006.mxd
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

TRC - GIS

Appendix A
Background Data

Table A1
Summary of Groundwater Elevation Data
JR Whiting Pond 6 – 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)			November 21, 2016		February 1, 2017		March 8, 2017		April 12, 2017		May 23, 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)	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	7.58	574.74	--	--	6.78	575.54	6.18	576.14	6.14	576.18
JRW-MW-16008	579.95	582.84	Limestone	68.0	to	73.0	512.0	to	507.0	7.93	574.91	--	--	7.34	575.50	6.82	576.02	6.66	576.18
JRW-MW-16009	579.90	582.59	Limestone	69.0	to	79.0	510.9	to	500.9	7.70	574.89	--	--	7.09	575.50	6.54	576.05	6.40	576.19
Pond 6																			
JRW-MW-16001	589.19	592.32	Limestone	71.0	to	81.0	518.2	to	508.2	17.41	574.91	17.38	574.94	16.77	575.55	16.30	576.02	16.08	576.24
JRW-MW-16002	585.78	588.68	Limestone	81.0	to	91.0	504.8	to	494.8	13.80	574.88	13.78	574.90	13.14	575.54	12.66	576.02	12.46	576.22
JRW-MW-16003	586.19	589.02	Limestone	73.0	to	83.0	513.2	to	503.2	14.10	574.92	14.14	574.88	13.44	575.58	12.94	576.08	12.75	576.27
JRW-MW-16004	586.48	589.35	Limestone	75.0	to	85.0	511.5	to	501.5	14.45	574.90	14.57	574.78	13.80	575.55	13.28	576.07	13.11	576.24
JRW-MW-16005	589.29	592.13	Limestone	78.0	to	88.0	511.3	to	501.3	17.22	574.91	17.31	574.82	16.56	575.57	16.09	576.04	15.89	576.24
JRW-MW-16006	588.26	591.03	Limestone	79.0	to	89.0	509.3	to	499.26	16.11	574.92	16.26	574.77	15.45	575.58	14.96	576.07	14.78	576.25

Notes:
Survey conducted by Sheridan Surveying Co., 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.
-- = Not measured

Table A1
Summary of Groundwater Elevation Data
JR Whiting Pond 6 – 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)			June 27, 2017		July 31, 2017		September 5, 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)
Static Water Level Monitoring Wells															
JRW-MW-16007	579.47	582.32	Limestone	68.0	to	78.0	511.5	to	501.5	7.33	574.99	6.87	575.45	7.14	575.18
JRW-MW-16008	579.95	582.84	Limestone	68.0	to	73.0	512.0	to	507.0	7.84	575.00	7.41	575.43	7.63	575.21
JRW-MW-16009	579.90	582.59	Limestone	69.0	to	79.0	510.9	to	500.9	7.59	575.00	7.15	575.44	7.35	575.24
Pond 6															
JRW-MW-16001	589.19	592.32	Limestone	71.0	to	81.0	518.2	to	508.2	17.14	575.18	16.82	575.50	17.08	575.24
JRW-MW-16002	585.78	588.68	Limestone	81.0	to	91.0	504.8	to	494.8	13.50	575.18	13.23	575.45	13.48	575.20
JRW-MW-16003	586.19	589.02	Limestone	73.0	to	83.0	513.2	to	503.2	13.85	575.17	13.55	575.47	13.80	575.22
JRW-MW-16004	586.48	589.35	Limestone	75.0	to	85.0	511.5	to	501.5	14.25	575.10	13.90	575.45	14.15	575.20
JRW-MW-16005	589.29	592.13	Limestone	78.0	to	88.0	511.3	to	501.3	17.03	575.10	16.69	575.44	16.93	575.20
JRW-MW-16006	588.26	591.03	Limestone	79.0	to	89.0	509.3	to	499.26	15.94	575.09	15.58	575.45	15.80	575.23

Notes:
Survey conducted by Sheridan Surveying Co., 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.
-- = Not measured

Table A1
Summary of Groundwater Elevation Data
JR Whiting Pond 6 – 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)			February 27, 2018		May 1, 2018		August 20, 2018		November 27, 2018	
										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)
Static Water Level Monitoring Wells																	
JRW-MW-16007	579.47	582.32	Limestone	68.0	to	78.0	511.5	to	501.5	7.45	574.87	6.45	575.87	6.85	575.47	7.45	574.87
JRW-MW-16008	579.95	582.84	Limestone	68.0	to	73.0	512.0	to	507.0	7.96	574.88	6.91	575.93	7.30	575.54	7.96	574.88
JRW-MW-16009	579.90	582.59	Limestone	69.0	to	79.0	510.9	to	500.9	7.71	574.88	6.70	575.89	7.11	575.48	7.71	574.88
Pond 6																	
JRW-MW-16001	589.19	592.32	Limestone	71.0	to	81.0	518.2	to	508.2	17.22	575.10	16.30	576.02	16.68	575.64	17.19	575.13
JRW-MW-16002	585.78	588.68	Limestone	81.0	to	91.0	504.8	to	494.8	13.61	575.07	12.70	575.98	13.05	575.63	13.57	575.11
JRW-MW-16003	586.19	589.02	Limestone	73.0	to	83.0	513.2	to	503.2	14.00	575.02	12.99	576.03	13.39	575.63	13.95	575.07
JRW-MW-16004	586.48	589.35	Limestone	75.0	to	85.0	511.5	to	501.5	14.49	574.86	13.32	576.03	13.75	575.60	14.34	575.01
JRW-MW-16005	589.29	592.13	Limestone	78.0	to	88.0	511.3	to	501.3	17.14	574.99	16.15	575.98	16.52	575.61	17.10	575.03
JRW-MW-16006	588.26	591.03	Limestone	79.0	to	89.0	509.3	to	499.26	16.05	574.98	15.07	575.96	15.45	575.58	16.04	574.99

Notes:
Survey conducted by Sheridan Surveying Co., 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.
-- = Not measured

Table A2
Summary of Field Parameters
JR Whiting Pond 6 – 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-16001	11/21/2016	0.23	-121.1	7.8	636	10.8	9.31
	2/1/2017(1)	0.3	-226.5	9.1	753	10.1	6.4
	2/3/2017(1)	0.5	-74.3	8.3	800	8.6	1.4
	3/8/2017	0.1	-127.6	8.1	800	11.8	1.2
	4/12/2017	0.3	-40.1	8.2	704	12.4	<1
	5/23/2017	0.0	-41.2	8.0	778	13.3	<1
	6/27/2017	0.15	-153.5	8.1	700	13.1	6.4
	8/1/2017	0.40	35.2	8.4	550	14.45	91.2
	9/6/2017	0.14	-121.9	8.2	687	13.46	2.89
	2/27/2018	0.43	84.1	NU(2)	902	11.63	3.31
	5/2/2018	1.20	-2.10	NU(2)	911	15.80	5.65
	8/20/2018	0.36	79.1	8.3	721	14.01	9.21
	11/28/2018	1.35	66.2	8.7	535	10.29	3.35
JRW-MW-16002	11/22/2016	0.17	-120.8	7.8	948	10.3	8.15
	2/1/2017	0.5	-201.3	7.8	940	9.0	9.9
	3/8/2017	0.5	-147.2	8.0	947	11.2	7.7
	4/13/2017	0.6	-122.4	7.8	870	10.8	7.4
	5/24/2017	0.2	-155.2	7.8	974	13.9	7.6
	6/27/2017	0.22	-192.7	7.7	920	14.6	10.6
	8/1/2017	0.23	-85.2	7.9	743	15.40	22.2
	9/6/2017	0.17	-167.7	7.8	898	14.67	2.64
	2/27/2018	0.20	-135.4	NU(2)	873	14.97	3.77
	5/2/2018	0.16	-52.1	NU(2)	1,134	14.61	8.77
	8/20/2018	0.30	-37.2	8.2	947	13.42	9.34
	11/27/2018	4.85	9.8	8.0	642	11.32	4.90
JRW-MW-16003	11/22/2016	0.18	-107.6	7.7	1,019	10.8	7.05
	2/1/2017	0.5	-129.7	7.6	1,066	10.2	7.3
	3/9/2017	0.7	-52.0	7.6	1,060	11.6	1.3
	4/13/2017	0.4	-103.1	7.7	962	11.4	<1
	5/24/2017	0.1	-130.6	7.6	1,057	13.7	3.4
	6/27/2017	0.17	-49.5	7.8	804	13.41	2.80
	8/1/2017	0.29	-61.2	7.7	804	14.56	3.35
	9/6/2017	0.16	-112.0	7.6	1,007	13.65	1.72
	2/27/2018	0.18	-124.7	7.6	1,018	13.84	1.34
	5/3/2018	0.20	-147.8	7.5	1,047	14.85	7.51
	8/20/2018	0.22	-35.4	7.8	1,005	13.51	2.76
	11/27/2018	0.16	19.1	7.6	768	10.62	4.56

Notes:

mg/L - Milligrams per Liter.

mV - Millivolts.

SU - Standard units.

umhos/cm - Micromhos per centimeter.

°C - Degrees Celsius.

NTU - Nephelometric Turbidity Unit.

NU- Not Usable.

(1) - The sample taken on February 1, 2017 had elevated pH that was not representative of groundwater conditions, so JRW-MW-16001 was resampled on February 3, 2017. The data from February 3, 2017 is used in place of the the February 1, 2017 data.

(2) - Field pH data is not representative of groundwater conditions.

Table A2
Summary of Field Parameters
JR Whiting Pond 6 – 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-16004	11/22/2016	0.20	-112.3	7.7	1,217	11.2	8.91
	2/1/2017	0.6	-142.1	7.8	1,161	9.6	5.3
	3/8/2017	0.5	-81.8	7.8	1,177	10.9	4.0
	4/13/2017	0.4	-115.0	7.8	1,065	11.6	<1
	5/24/2017	0.2	-125.0	7.8	1,178	14.4	301
	6/27/2017	0.16	-95.1	7.9	877	13.80	4.86
	8/1/2017	0.22	-89.8	7.9	852	15.01	3.12
	9/7/2017	0.21	-76.4	7.6	1,099	12.74	1.83
	2/27/2018	0.21	-141.3	7.8	1,091	13.88	1.43
	5/2/2018	0.17	-254.6	8.3	1,103	15.01	8.78
	8/20/2018	0.24	-21.4	7.9	1,101	13.69	2.62
	11/28/2018	0.17	-178.6	7.7	1,071	11.11	2.91
JRW-MW-16005	11/21/2016	0.52	-23.7	7.7	704	10.5	9.62
	2/1/2017	0.4	-120.0	8.0	1,105	10.7	4.7
	3/9/2017	0.5	-50.5	7.6	1,080	11.7	<1
	4/12/2017	0.4	-70.1	7.8	998	12.9	<1
	5/24/2017	0.2	-78.0	7.6	1,132	13.6	3.0
	6/27/2017	0.49	-34.7	7.6	742	13.10	4.75
	8/2/2017	0.34	-32.7	7.7	786	13.78	2.67
	9/6/2017	0.20	-98.3	7.6	932	14.37	2.08
	2/28/2018	0.21	-79.2	7.4	935	12.42	2.82
	5/2/2018	0.21	-127.5	7.6	974	14.65	7.82
	8/22/2018	0.34	35.4	7.6	912	12.73	5.11
	11/27/2018	0.19	-101.3	7.6	886	10.64	3.26
JRW-MW-16006	11/21/2016	6.18	21.0	7.6	630	10.0	8.84
	2/1/2017	0.5	-155.2	8.1	820	10.4	1.2
	3/9/2017	0.5	-61.3	7.8	810	11.0	<1
	4/12/2017	0.4	-98.3	7.9	752	12.9	<1
	5/24/2017	0.2	-104.6	7.8	825	13.7	<1
	6/27/2017	0.17	-167.1	7.8	790	13.4	4.8
	8/1/2017	0.38	-63.2	7.9	647	15.90	2.36
	9/6/2017	0.23	-124.9	7.8	781	13.78	2.94
	2/27/2018	0.21	-177.4	7.9	804	13.23	1.89
	5/2/2018	0.20	-184.3	7.8	814	17.96	5.11
	8/22/2018	0.51	4.6	7.8	806	12.57	1.44
	11/27/2018	0.28	-93.6	7.7	793	10.71	3.48

Notes:

mg/L - Milligrams per Liter.

mV - Millivolts.

SU - Standard units.

umhos/cm - Micromhos per centimeter.

°C - Degrees Celcius.

NTU - Nephelometric Turbidity Unit.

NU- Not Usable.

(1) - The sample taken on February 1, 2017 had elevated pH that was not representative of groundwater conditions, so JRW-MW-16001 was resampled on February 3, 2017 and replaces the February 1, 2017 data.

(2) - Field pH data is not representative of groundwater conditions.

Table A3
Summary of Analytical Results for Pond 6 Groundwater Samples
JR Whiting – RCRA CCR Monitoring Program
Erie, Michigan

						Sample Location:	JRW-MW-16001											
						Sample Date:	11/21/2016	2/1/2017(1)	2/3/2017(1)	3/8/2017	4/12/2017	5/23/2017	6/27/2017	8/1/2017	9/6/2017	2/27/2018	5/2/2018	8/20/2018	11/28/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^													
Appendix III																		
Boron	ug/L	NC	500	500	7,200		163	172	164	178	163	170	180	155	161	148	146	178	175
Calcium	mg/L	NC	NC	NC	500		93.3	83.4	94.5	90.1	84.5	94.4	64.3	77.1	68.4	63.9	67.2	64.9	69.5
Chloride	mg/L	250**	250	250	50		20.6	20.5	20.2	18.4	18.1	18.8	21.2	22.1	21.8	17.9	18.8	19.6	19.8
Fluoride	ug/L	4,000	NC	NC	NC		2,030	1,300	1,270	1,420	1,140	1,300	1,300	1,600	1,600	< 1,000	1,000	1,500	1,400
Sulfate	mg/L	**250****	**250**	**250**	**500**		237	224	249	239	242	235	234	**251**	**257**	195	228	235	230
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**		**700**	500	**540**	**530**	**520**	**550**	**598**	362	**588**	408	428	**532**	**548**
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**		7.8	**9.1**	8.3	8.1	8.2	8.0	8.1	8.4	8.2	NU(2)	NU(2)	8.3	**8.7**
Appendix IV																		
Antimony	ug/L	6	6.0	6.0	130		2	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0
Arsenic	ug/L	10	10	10	10		7	6	3	2	1	1	2.9	3.1	2.7	< 1.0	< 1.0	2.2	1.4
Barium	ug/L	2,000	2,000	2,000	670		21	60	29	45	31	29	34.6	40.8	32.5	161	155	38.2	30
Beryllium	ug/L	4	4.0	4.0	13		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5.0	5.0	3		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	100	100	11		< 1	1	1	1	< 1	1	< 1.0	1.4	1.3	< 1.0	1.2	< 1.0	< 1.0
Cobalt	ug/L	NC	40	100	100		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NC	NC	NC		2,030	1,300	1,270	1,420	1,140	1,300	1,300	1,600	1,600	< 1,000	1,000	1,500	1,400
Lead	ug/L	NC	4.0	4.0	34		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440		29	34	36	35	29	35	35	37	36	69	62	39	39
Mercury	ug/L	2	2.0	2.0	0.20#		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	73	210	3,200		14	19	12	11	10	14	14.2	16.3	14.9	16.2	15.3	14.8	13.4
Radium-226	pCi/L	NC	NC	NC	NC		0.638	0.235	0.921	0.768	0.967	0.864	1.36	2.00	1.18	< 0.595	0.302	0.831	1.98
Radium-228	pCi/L	NC	NC	NC	NC		3.40	0.455	< 0.739	0.887	0.634	< 0.341	< 0.571	< 0.802	< 0.818	< 0.801	< 0.822	< 0.841	1.05
Radium-226/228	pCi/L	**5**	NC	NC	NC		4.04	0.69	1.36	1.66	1.6	1.08	1.66	2.28	< 1.86	< 1.40	< 0.986	< 1.61	3.03
Selenium	ug/L	50	50	50	5		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0
Thallium	ug/L	2	2.0	2.0	3.7		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

NU - Not usable.

* - 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.
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.

(1) The sample taken on February 1, 2017 had elevated pH that was not representative of groundwater conditions, so JRW-MW-16001 was resampled on February 3, 2017 and replaces the February 1, 2017 data.

(2) Field pH data is not representative of groundwater conditions.

All metals were analyzed as total unless otherwise specified.

Table A3
Summary of Analytical Results for Pond 6 Groundwater Samples
JR Whiting – RCRA CCR Monitoring Program
Erie, Michigan

						Sample Location:	JRW-MW-16002											
						Sample Date:	11/22/2016	2/1/2017	3/8/2017	4/13/2017	5/24/2017	6/27/2017	8/1/2017	9/6/2017	2/27/2018	5/2/2018	8/20/2018	11/27/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^													
Appendix III																		
Boron	ug/L	NC	500	500	7,200		164	165	179	161	172	180	141	153	146	125	184	167
Calcium	mg/L	NC	NC	NC	500		116	119	122	124	135	108	111	103	100	141	117	114
Chloride	mg/L	250**	250	250	50		24.2	22.3	20.5	21.2	20.6	22.6	23.2	23.2	21.0	19.8	20.1	21.0
Fluoride	ug/L	4,000	NC	NC	NC		1,150	1,070	1,100	1,070	< 1,000	1,000	1,300	1,300	1,100	< 1,000	1,200	1,100
Sulfate	mg/L	**250****	**250**	**250**	**500**		**347**	**330**	**336**	**342**	**368**	**341**	**398**	**392**	**345**	**320**	**396**	**343**
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**		**680**	**670**	**670**	**670**	**690**	**804**	**706**	**752**	**658**	**638**	**766**	**710**
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**		7.8	7.8	8.0	7.8	7.8	7.7	7.9	7.8	NU(2)	NU(2)	8.2	8.0
Appendix IV																		
Antimony	ug/L	6	6.0	6.0	130		< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0
Arsenic	ug/L	10	10	10	10		2	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	2,000	2,000	670		25	26	25	21	21	20.5	19.4	17.0	31.0	142	34.8	22.3
Beryllium	ug/L	4	4.0	4.0	13		< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5.0	5.0	3		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	100	100	11		< 1	1	< 1	< 1	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	40	100	100		< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NC	NC	NC		1,150	1,070	1,100	1,070	< 1,000	1,000	1,300	1,300	1,100	< 1,000	1,200	1,100
Lead	ug/L	NC	4.0	4.0	34		< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440		25	23	26	25	30	29	30	31	31	61	34	35
Mercury	ug/L	2	2.0	2.0	0.20#		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	73	210	3,200		8	< 5	< 5	< 5	< 5	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NC	NC	NC		0.608	0.378	1.09	0.591	0.417	< 0.767	< 0.779	< 0.950	< 0.914	0.966	0.944	4.16
Radium-228	pCi/L	NC	NC	NC	NC		0.692	< 0.499	0.549	0.536	< 2.49	0.736	< 0.802	< 0.801	< 0.722	< 0.885	< 0.748	0.851
Radium-226/228	pCi/L	**5**	NC	NC	NC		1.30	0.614	1.64	1.13	< 2.49	1.39	< 1.58	< 1.75	< 1.64	< 1.41	1.56	**5.01**
Selenium	ug/L	50	50	50	5		< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0
Thallium	ug/L	2	2.0	2.0	3.7		< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
NU - Not usable.
* - 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.
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.
(1) The sample taken on February 1, 2017 had elevated pH that was not representative of groundwater conditions, so JRW-MW-16001 was resampled on February 3, 2017 and replaces the February 1, 2017 data.
(2) Field pH data is not representative of groundwater conditions.
All metals were analyzed as total unless otherwise specified.

Table A3
Summary of Analytical Results for Pond 6 Groundwater Samples
JR Whiting – RCRA CCR Monitoring Program
Erie, Michigan

						Sample Location:	JRW-MW-16003											
						Sample Date:	11/22/2016	2/1/2017	3/9/2017	4/13/2017	5/24/2017	6/27/2017	8/1/2017	9/6/2017	2/27/2018	5/3/2018	8/20/2018	11/27/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^													
Appendix III																		
Boron	ug/L	NC	500	500	7,200		184	187	201	181	199	211	170	145	187	173	214	255
Calcium	mg/L	NC	NC	NC	500		128	142	136	137	145	121	120	122	137	116	122	123
Chloride	mg/L	250**	250	250	50		28.4	27.8	27	27.7	28	30.4	30.7	31.2	29.3	29.2	28.0	28.9
Fluoride	ug/L	4,000	NC	NC	NC		1,190	1,240	1,260	1,020	1,000	1,100	1,400	1,400	1,300	1,400	1,300	1,200
Sulfate	mg/L	**250****	**250**	**250**	**500**		**373**	**416**	**389**	**406**	**404**	**380**	**453**	**445**	**386**	**389**	**408**	**418**
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**		**720**	**770**	**780**	**780**	**790**	**1,020**	**896**	**796**	**876**	**924**	**796**	**762**
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**		7.7	7.6	7.6	7.7	7.6	7.8	7.7	7.6	7.6	7.5	7.8	7.6
Appendix IV																		
Antimony	ug/L	6	6.0	6.0	130		1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0
Arsenic	ug/L	10	10	10	10		3	2	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	2,000	2,000	670		18	13	12	11	11	11.0	10.2	9.0	8.7	8.8	9.7	9.8
Beryllium	ug/L	4	4.0	4.0	13		< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5.0	5.0	3		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	< 1.0	< 0.20	< 0.20
Chromium	ug/L	100	100	100	11		< 1	1	1	2	2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	40	100	100		< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NC	NC	NC		1,190	1,240	1,260	1,020	1,000	1,100	1,400	1,400	1,300	1,400	1,300	1,200
Lead	ug/L	NC	4.0	4.0	34		< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440		41	45	46	39	47	47	47	51	48	43	45	49
Mercury	ug/L	2	2.0	2.0	0.20#		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	73	210	3,200		7	< 5	< 5	< 5	< 5	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NC	NC	NC		1.40	1.43	1.46	1.35	0.656	1.44	1.69	1.18	1.73	1.24	1.16	1.6
Radium-228	pCi/L	NC	NC	NC	NC		< 0.575	< 0.448	0.499	0.632	< 0.522	0.604	< 0.857	< 0.936	< 1.90	< 0.754	< 0.733	< 0.763
Radium-226/228	pCi/L	**5**	NC	NC	NC		1.40	1.6	1.96	1.98	1.12	2.04	1.76	< 1.77	< 2.31	1.67	1.53	2.28
Selenium	ug/L	50	50	50	5		< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0
Thallium	ug/L	2	2.0	2.0	3.7		< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

NU - Not usable.

* - 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.
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.

(1) The sample taken on February 1, 2017 had elevated pH that was not representative of groundwater conditions, so JRW-MW-16001 was resampled on February 3, 2017 and replaces the February 1, 2017 data.

(2) Field pH data is not representative of groundwater conditions.

All metals were analyzed as total unless otherwise specified.

Table A3
Summary of Analytical Results for Pond 6 Groundwater Samples
JR Whiting – RCRA CCR Monitoring Program
Erie, Michigan

						Sample Location:	JRW-MW-16004											
						Sample Date:	11/22/2016	2/1/2017	3/8/2017	4/13/2017	5/24/2017	6/27/2017	8/1/2017	9/7/2017	2/27/2018	5/2/2018	8/20/2018	11/28/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^													
Appendix III																		
Boron	ug/L	NC	500	500	7,200		211	194	210	192	200	190	162	183	188	193	217	259
Calcium	mg/L	NC	NC	NC	500		158	144	147	153	157	113	106	115	131	119	123	125
Chloride	mg/L	250**	250	250	50		37.1	37.8	36.1	36.7	37.8	40.6	41.5	41.7	39.6	38.7	36.0	38.4
Fluoride	ug/L	4,000	NC	NC	NC		1,410	1,160	1,210	1,110	< 1,000	1,100	1,400	1,400	1,300	1,400	1,300	1,200
Sulfate	mg/L	**250****	**250**	**250**	**500**		**474**	**440**	**433**	**455**	**441**	**393**	**466**	**472**	**425**	**411**	**451**	**416**
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**		**890**	**870**	**860**	**860**	**860**	**1,110**	**926**	**858**	**886**	**874**	**980**	**780**
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**		7.7	7.8	7.8	7.8	7.8	7.9	7.9	7.6	7.8	8.3	7.9	7.7
Appendix IV																		
Antimony	ug/L	6	6.0	6.0	130		< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0
Arsenic	ug/L	10	10	10	10		1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	2,000	2,000	670		16	20	19	16	18	22.4	17.9	17.7	17.1	17.5	16.9	16.9
Beryllium	ug/L	4	4.0	4.0	13		< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5.0	5.0	3		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	100	100	11		< 1	1	< 1	< 1	2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	40	100	100		< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NC	NC	NC		1,410	1,160	1,210	1,110	< 1,000	1,100	1,400	1,400	1,300	1,400	1,300	1,200
Lead	ug/L	NC	4.0	4.0	34		< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440		63	56	59	52	57	57	55	63	60	58	61	61
Mercury	ug/L	2	2.0	2.0	0.20#		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	73	210	3,200		< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NC	NC	NC		0.567	0.743	0.596	0.804	0.820	< 0.880	0.911	1.02	< 0.555	1.15	1.12	< 0.715
Radium-228	pCi/L	NC	NC	NC	NC		< 0.422	< 0.439	0.864	0.351	0.506	0.541	< 0.781	< 0.938	< 0.793	< 0.781	0.991	< 0.621
Radium-226/228	pCi/L	**5**	NC	NC	NC		0.874	1.08	1.46	1.16	1.33	< 1.41	< 1.26	1.75	< 1.35	1.92	2.11	< 1.34
Selenium	ug/L	50	50	50	5		< 1	< 1	1	< 1	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0
Thallium	ug/L	2	2.0	2.0	3.7		< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

NU - Not usable.

* - 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.
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.

(1) The sample taken on February 1, 2017 had elevated pH that was not representative of groundwater conditions, so JRW-MW-16001 was resampled on February 3, 2017 and replaces the February 1, 2017 data.

(2) Field pH data is not representative of groundwater conditions.

All metals were analyzed as total unless otherwise specified.

Table A3
Summary of Analytical Results for Pond 6 Groundwater Samples
JR Whiting – RCRA CCR Monitoring Program
Erie, Michigan

						Sample Location:	JRW-MW-16005											
						Sample Date:	11/21/2016	2/1/2017	3/9/2017	4/12/2017	5/24/2017	6/27/2017	8/2/2017	9/6/2017	2/28/2018	5/2/2018	8/22/2018	11/27/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^													
Appendix III																		
Boron	ug/L	NC	500	500	7,200		188	195	203	185	204	170	158	156	183	173	193	233
Calcium	mg/L	NC	NC	NC	500		101	148	142	150	161	114	102	109	90.3	110	103	106
Chloride	mg/L	250**	250	250	50		27.3	26	25.1	25.2	25.7	27.8	27.6	27.6	25.1	24.5	24.1	24.8
Fluoride	ug/L	4,000	NC	NC	NC		1,020	1,150	1,170	< 1,000	< 1,000	1,100	1,500	1,400	1,300	1,400	1,400	1,300
Sulfate	mg/L	**250****	**250**	**250**	**500**		**258**	**396**	**409**	**409**	**429**	**358**	**396**	**396**	**333**	**387**	**354**	**322**
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**		**660**	**780**	**800**	**800**	**830**	**964**	**926**	**734**	**686**	**760**	**804**	**710**
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**		7.7	8.0	7.6	7.8	7.6	7.6	7.7	7.6	7.4	7.6	7.6	7.6
Appendix IV																		
Antimony	ug/L	6	6.0	6.0	130		< 1	< 1	3	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0
Arsenic	ug/L	10	10	10	10		2	2	1	< 1	< 1	1.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	2,000	2,000	670		33	19	18	17	17	18.2	14.1	12.5	13.1	11.9	11.1	12.0
Beryllium	ug/L	4	4.0	4.0	13		< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5.0	5.0	3		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	100	100	11		< 1	< 1	< 1	< 1	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	40	100	100		< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NC	NC	NC		1,020	1,150	1,170	< 1,000	< 1,000	1,100	1,500	1,400	1,300	1,400	1,400	1,300
Lead	ug/L	NC	4.0	4.0	34		< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440		35	51	50	44	53	47	43	52	37	45	46	48
Mercury	ug/L	2	2.0	2.0	0.20#		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	73	210	3,200		9	< 5	< 5	< 5	< 5	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NC	NC	NC		< 0.367	0.448	0.647	0.660	0.570	< 0.769	1.05	1.13	0.681	0.727	< 0.632	0.979
Radium-228	pCi/L	NC	NC	NC	NC		< 0.488	< 0.426	0.592	< 0.356	0.713	< 0.554	< 0.756	0.623	< 0.704	< 0.854	< 0.812	0.726
Radium-226/228	pCi/L	**5**	NC	NC	NC		< 0.488	0.53	1.24	0.883	1.28	< 1.32	< 1.68	1.75	< 1.29	1.14	< 1.44	1.71
Selenium	ug/L	50	50	50	5		< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0
Thallium	ug/L	2	2.0	2.0	3.7		< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

NU - Not usable.

* - 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.
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.

(1) The sample taken on February 1, 2017 had elevated pH that was not representative of groundwater conditions, so JRW-MW-16001 was resampled on February 3, 2017 and replaces the February 1, 2017 data.

(2) Field pH data is not representative of groundwater conditions.

All metals were analyzed as total unless otherwise specified.

Table A3
Summary of Analytical Results for Pond 6 Groundwater Samples
JR Whiting – RCRA CCR Monitoring Program
Erie, Michigan

						Sample Location:	JRW-MW-16006											
						Sample Date:	11/21/2016	2/1/2017	3/9/2017	4/12/2017	5/24/2017	6/27/2017	8/1/2017	9/6/2017	2/27/2018	5/2/2018	8/22/2018	11/27/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^													
Appendix III																		
Boron	ug/L	NC	500	500	7,200		124	172	174	161	172	154	153	157	154	175	180	220
Calcium	mg/L	NC	NC	NC	500		93.3	100	96.7	96.9	107	78.3	79.0	83.5	< 1.0	82.3	85.1	89.4
Chloride	mg/L	250**	250	250	50		38.6	23.4	23	22.8	23.2	25.3	26.0	25.9	23.7	23.0	24.7	23.5
Fluoride	ug/L	4,000	NC	NC	NC		< 1,000	1,240	1,290	1,130	1,070	1,200	1,600	1,500	1,400	1,500	1,800	1,300
Sulfate	mg/L	**250****	**250**	**250**	**500**		178	**259**	**260**	**276**	**271**	**271**	**319**	**317**	**306**	**307**	**338**	**319**
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**		500	**560**	**560**	**560**	**560**	**680**	**600**	**678**	**612**	**584**	264	**778**
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**		7.6	8.1	7.8	7.9	7.8	7.8	7.9	7.8	7.9	7.8	7.8	7.7
Appendix IV																		
Antimony	ug/L	6	6.0	6.0	130		< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0
Arsenic	ug/L	10	10	10	10		1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	2,000	2,000	670		47	24	22	18	20	18.6	19.3	16.0	14.7	15.2	15.5	14.6
Beryllium	ug/L	4	4.0	4.0	13		< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5.0	5.0	3		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	100	100	11		< 1	2	< 1	< 1	2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	40	100	100		< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NC	NC	NC		< 1,000	1,240	1,290	1,130	1,070	1,200	1,600	1,500	1,400	1,500	1,800	1,300
Lead	ug/L	NC	4.0	4.0	34		< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440		14	36	36	36	36	36	35	42	< 10	35	38	41
Mercury	ug/L	2	2.0	2.0	0.20#		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	73	210	3,200		8.0	20	18	16	17	16.6	17.5	15.6	16.8	16.3	16.7	17.9
Radium-226	pCi/L	NC	NC	NC	NC		< 0.337	0.514	0.956	0.926	0.512	1.32	0.587	< 0.872	< 0.636	< 0.521	0.522	< 1.03
Radium-228	pCi/L	NC	NC	NC	NC		< 0.533	< 0.499	0.513	0.478	< 0.458	< 0.546	< 0.688	< 0.716	< 0.793	< 0.917	< 0.887	0.811
Radium-226/228	pCi/L	**5**	NC	NC	NC		< 0.533	0.797	1.47	1.4	0.873	1.65	< 1.17	< 1.59	< 1.43	< 1.44	< 1.31	< 1.70
Selenium	ug/L	50	50	50	5		< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0
Thallium	ug/L	2	2.0	2.0	3.7		< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

NU - Not usable.

* - 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.
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.

(1) The sample taken on February 1, 2017 had elevated pH that was not representative of groundwater conditions, so JRW-MW-16001 was resampled on February 3, 2017 and replaces the February 1, 2017 data.

(2) Field pH data is not representative of groundwater conditions.

All metals were analyzed as total unless otherwise specified.

TRC - GIS

JRW MW-16001
574.91' (11/21/2016)
574.94' (02/01/2017)
575.55' (03/08/2017)
576.02' (04/12/2017)
576.24' (05/23/2017)
575.18' (06/27/2017)
575.50' (07/31/2017)
575.24' (09/05/2017)
575.10' (02/27/2018)
576.02' (05/01/2018)
575.64' (08/20/2018)
575.13' (11/27/2018)

JRW MW-16005
574.91' (11/21/2016)
574.82' (02/01/2017)
575.57' (03/08/2017)
576.04' (04/12/2017)
576.24' (05/23/2017)
575.10' (06/27/2017)
575.44' (07/31/2017)
575.20' (09/05/2017)
574.99' (02/27/2018)
575.98' (05/01/2018)
575.61' (08/20/2018)
575.03' (11/27/2018)

JRW MW-16002
574.88' (11/21/2016)
574.90' (02/01/2017)
575.54' (03/08/2017)
576.02' (04/12/2017)
576.22' (05/23/2017)
575.18' (06/27/2017)
575.45' (07/31/2017)
575.20' (09/05/2017)
575.07' (02/27/2018)
575.98' (05/01/2018)
575.63' (08/20/2018)
575.11' (11/27/2018)

JRW MW-16007
574.74' (11/21/2016)
NM (02/01/2017)
575.54' (03/08/2017)
576.14' (04/12/2017)
576.18' (05/23/2017)
574.99' (06/27/2017)
575.45' (07/31/2017)
575.18' (09/05/2017)
574.87' (02/27/2018)
575.87' (05/01/2018)
575.47' (08/20/2018)
574.87' (11/27/2018)

JRW MW-16006
574.92' (11/21/2016)
574.77' (02/01/2017)
575.58' (03/08/2017)
576.07' (04/12/2017)
576.25' (05/23/2017)
575.09' (06/27/2017)
575.45' (07/31/2017)
575.23' (09/05/2017)
574.98' (02/27/2018)
575.96' (05/01/2018)
575.58' (08/20/2018)
574.99' (11/27/2018)

JRW MW-16003
574.92' (11/21/2016)
574.88' (02/01/2017)
575.58' (03/08/2017)
576.08' (04/12/2017)
576.27' (05/23/2017)
575.17' (06/27/2017)
575.47' (07/31/2017)
575.22' (09/05/2017)
575.02' (02/27/2018)
576.03' (05/01/2018)
575.63' (08/20/2018)
575.07' (11/27/2018)

JRW MW-16008
574.91' (11/21/2016)
NM (02/01/2017)
575.50' (03/08/2017)
576.02' (04/12/2017)
576.18' (05/23/2017)
575.00' (06/27/2017)
575.43' (07/31/2017)
575.21' (09/05/2017)
574.88' (02/27/2018)
575.93' (05/01/2018)
575.54' (08/20/2018)
574.88' (11/27/2018)

JRW MW-16004
574.90' (11/21/2016)
574.78' (02/01/2017)
575.55' (03/08/2017)
576.07' (04/12/2017)
576.24' (05/23/2017)
575.10' (06/27/2017)
575.45' (07/31/2017)
575.20' (09/05/2017)
574.86' (02/27/2018)
576.03' (05/01/2018)
575.60' (08/20/2018)
575.01' (11/27/2018)

JRW MW-16009
574.89' (11/21/2016)
NM (02/01/2017)
575.50' (03/08/2017)
576.05' (04/12/2017)
576.19' (05/23/2017)
575.00' (06/27/2017)
575.44' (07/31/2017)
575.24' (09/05/2017)
574.88' (02/27/2018)
575.89' (05/01/2018)
575.48' (08/20/2018)
574.88' (11/27/2018)

Whitewood Creek
22Nd St
Grand Blvd
Grodi Rd
E Erie Rd
Lake Erie
FORMER POND 6
POND 1
POND 2
FORMER JRW PLANT
RETIRED FILL AREA 2
RETIRED FILL AREA 1
DISCHARGE CHANNEL
COAL PILE AREA
75

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...

NM = NOT MEASURED

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:
GROUNDWATER POTENTIOMETRIC ELEVATION SUMMARY

DRAWN BY:	S. MAJOR	PROJ NO.:	332751
CHECKED BY:	K. LOWERY		
APPROVED BY:	S. HOLMSTROM		**FIGURE 1**
DATE:	MARCH 2019		

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

FILE NO.: 332751-001-003.mxd

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

Plot Date: 3/27/2019, 17:17:26 PM by SMAJOR -- LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\332751-001-003.mxd

Appendix B
Data Quality Review

Laboratory Data Quality Review
Groundwater Sample Event March 2019
CEC JR Whiting Pond 6

Groundwater samples were collected by TRC for the March 2019 JR Whiting Pond 6 sampling event. Samples were analyzed for anions, total metals, and total dissolved solids by Test America Laboratories, Inc. (Test America), located in Irvine, California. The laboratory analytical results are reported in laboratory report 240-109542-1.

During the March 2019 sampling event, a groundwater sample was collected from each of the following wells:

- JRW-MW-16001
- JRW-MW-16002
- JRW-MW-16003
- JRW-MW-16004
- JRW-MW-16005
- JRW-MW-16006

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Chloride, Fluoride, Sulfate)	EPA 300.0
Boron, Calcium	EPA 6010B
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, field blanks, and equipment blanks, if applicable. 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;

- Data for matrix spike and matrix spike duplicate samples (MS/MSDs), if applicable. The MS/MSDs are used to assess the accuracy and precision of the analytical method using a sample from the dataset;
- Data for laboratory duplicates, if applicable. The laboratory duplicates are used to assess the precision of the analytical method using a sample from the dataset;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes;
- Overall usability of the data.

This data usability report addresses the following items:

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

Review Summary

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

- Appendix 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:

- All holding time criteria were met.
- Target analytes were not detected in the equipment blank (EB-2_20190313) and field blank (FB-2_20190313).
- Target analytes were not detected in the method blanks.
- LCS recoveries for all target analytes were within laboratory control limits.
- The field duplicate pair samples were DUP-2 and JRW-MW-16005. The relative percent differences (RPDs) between the parent and duplicate sample were within the acceptance limits.

- MS/MSD analyses were performed on sample JRW-MW-16003 for anions, boron, and calcium; the percent recoveries (%Rs) and RPDs were within the acceptance limits with the following exception:
  - The recovery of calcium in the MSD was below the acceptance criteria. However, the calcium concentration in the parent sample JRW-MW-16003 was >4x the spike concentration; therefore, the laboratory control limits are not applicable. Data usability was not affected.
- Laboratory duplicate analyses were performed on samples DUP-2 and JRW-MW-16003 for TDS; the RPDs were within the acceptance limits.

Laboratory Data Quality Review
Groundwater Sample Event Verification Resampling June 2019
CEC JR Whiting Pond 6

Groundwater samples were collected by TRC for the June 2019 detection monitoring verification resampling event. Samples were analyzed for the anions (sulfate) by Test America Laboratories, Inc. located in Irvine, California. The laboratory analytical results are reported in laboratory report 440-244617-1.

During the June 2019 sampling event, a groundwater sample was collected from the following well:

- JRW-MW-16001

Samples were analyzed for the following constituents:

Analyte Group	Method
Anions (Sulfate)	EPA 300.0

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

Data 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) was collected. No target analytes were detected in sample EB-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-16001 for sulfate; relative percent differences (RPDs) were within QC limits.
- The field duplicate sample was Dup-01 and JRW-MW-16001. The RPDs between the parent and duplicate sample were <5% for sulfate.

Field Parameter Data Quality Review
Groundwater Sampling Event June 2019 Verification Resampling
CEC JR Whiting Pond 6

On June 25, 2019, TRC Environmental Corporation (TRC) collected groundwater samples at monitoring wells JRW-MW-16002 and JRW-MW-16003 to verify initial pH (field measured) results that were outside of prediction limits during the March 2019 detection monitoring event. Prior to sample collection, 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;
- Compare field parameters to prediction limits, 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.
- Field parameters met stabilization criteria for three successive readings.
- Field parameter readings were comparable to historical data.
- Field parameter readings were within prediction limits.
- Data are usable for purposes of verification resampling.

Appendix C
Statistical Background Limits

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TRCcompanies.com

Technical Memorandum

Date: July 16, 2019

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

From: Sarah Holmstrom, TRC
Darby Litz, TRC
Kristin Lowery, TRC

Project No.: 332751.0000 Phase 001, Task 003

Subject: Background Statistical Evaluation (R1-R12) – Consumers Energy, JR Whiting Pond 6

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 (effective October 19, 2015), as amended July 30, 2018, 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). On August 5, 2016, the U.S. EPA published the CCR Rule companion *Extension of Compliance Deadlines for Certain Inactive Surface Impoundments,* which established the compliance deadlines for inactive CCR surface impoundments. As required for inactive CCR surface impoundments, Pond 6 was certified closed with a final cover system prior to April 17, 2018. This memorandum presents the background statistical limits derived for Consumers Energy Company (CEC) inactive Pond 6 at the JR Whiting (JRW) Power Plant Site (the Site).

The JRW Pond 6 CCR unit is located adjacent to Lake Erie. Groundwater present within the uppermost aquifer at the CCR unit is confined and protected from CCR constituents by the overlying clay-rich aquitard and is typically encountered around 50 feet below ground surface (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. Based on the hydrogeology at the Site, particularly the extremely low to non-existent gradient or lack of flow direction at the JRW 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 being implemented for detection monitoring. A series of six monitoring wells surrounds the pond and makes up the detection monitoring well network for the Pond 6 CCR unit.

Following the baseline data collection period (November 2016 through November 2018), the background data for JRW Pond 6 CCR unit were evaluated in accordance with the Groundwater Statistical Evaluation Plan (Stats Plan) (TRC, April 2019). Consideration was made regarding the independence of each of these samples relative to horizontal time of travel within the aquifer. Potentiometric surface elevation data from groundwater within the monitoring wells exhibits an extremely low hydraulic gradient across the site with no consistent or discernible flow. There are minor differences in hydraulic head across the monitoring wells (ranging from zero up to 0.24 feet across the Pond 6 CCR unit from event to event), indicating that the potentiometric surface is mostly flat the majority of the time. In the few instances where a slight gradient was observed and calculable, the direction of the flow potential was slightly to the south and west.

The most pronounced potentiometric head differential of 0.24 feet was observed on February 28, 2018 between JRW MW-16001 on the north edge of Pond 6 and JRW MW-16004 on the south edge of the Pond 6 CCR unit. Although, when considering the potentiometric surface elevation data from all of the Pond 6 CCR unit wells, the general groundwater flow direction inferred across the pond at that time is to the southwest, in order to be conservative, the maximum head difference was used to calculate the maximum groundwater flow velocity at the Pond 6 CCR unit throughout the background monitoring period. This results in a very slight horizontal gradient of approximately 0.000099 to the south. Using the highest hydraulic conductivity measured at the Pond 6 CCR unit monitoring wells (11.9 feet/day from the 2016 TRC well installation report) and an assumed effective porosity of 0.1, this results in a groundwater flow rate of approximately 0.012 feet/day (approximately 4.4 feet per year). Based on potentiometric data, it is more likely that groundwater proximal to the monitoring wells is stagnant or slightly moving back and forth across the borehole, potentially extending the residence time of groundwater in the vicinity of each monitoring well.

Due to the limitations on CCR Rule implementation timelines, the background data collection monitoring events for JR Whiting were timed at a frequency of 1 to 2 months apart prior to September 2017. Based on this frequency, it is likely that the initial eight rounds in the background data set represent limited temporal independence at this site, hence the low variability throughout the initial rounds. This limited temporal variability can only be corrected with the collection of additional groundwater data, and the inclusion of the additional data in the background data set updated in the future, as long as data continue to show no impacts from the CCR unit. For this reason, additional data were continued to be collected semiannually throughout the background monitoring period in order to accumulate more than the minimum eight data points to establish background and, although still limited, incorporate additional temporal variability within the implementation timeline for inactive basins.

The JRW 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), intrawell prediction limits were selected to perform the statistical calculation for background/baseline limits. Use of prediction limits is recommended by the UG to provide high

statistical power and is an acceptable approach for intrawell detection monitoring under the CCR rule. Upper prediction limits (UPLs) were calculated for each of the CCR Appendix III parameters based on a single future value. The following narrative describes the methods employed and the results obtained and the Sanitas™ output files are included as an attachment.

The set of downgradient monitoring wells utilized for compliance in the JRW Pond 6 CCR unit detection monitoring program includes JRW-MW-16001 through JRW-MW-16006. 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/baseline dataset from that same well. The baseline 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;
- 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 intrawell UPL for each monitoring well for each Appendix III constituent data set (upper and lower prediction limits were calculated for field pH).

The results of these evaluations are presented and discussed below.

Data Quality

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 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, with the exception of pH on a few instances where samples exhibiting elevated pH readings were observed. The SAP has been modified to include procedures for additional purging to account for instances where pH appears to not be stabilized or above anticipated levels due to potential grout influence. However, upon further review of the data, several samples were collected before pH levels within the well appeared to have stabilized. The JRW-MW-16001 resample on February 3, 2017, is used in place of the February 1, 2017 data; and the JRW-MW-16001 and JRW-MW-16002 pH data from February 27, 2018 and May 2, 2018 are not considered representative of groundwater conditions. This

conclusion is also supported by the pH levels measured subsequent to the February and March 2018 events that indicate groundwater pH is typically less than 9.0 standard units. Based on the consistency of the results for the constituents other than pH during the February 2017 resample, the other constituents are kept in the data set for the JRW-MW-16001 and JRW-MW-16002 samples from February 27, 2018 and May 2, 2018.

Time versus Concentration Graphs

The time versus concentration (T v. C) graphs (Figure 1) show potential outliers for calcium in JRW-MW-16006 (single non-detect value in February 2017). The T v. C graphs do not show potential or suspect outliers for the remaining Appendix III constituents.

While variations in results are present, the graphs show consistent baseline data and do not suggest that data sets, as a whole, likely have overall trending or seasonality. However, as discussed above, due to lack of groundwater flow potential and limitations on CCR Rule implementation timelines, the data sets are of relatively short duration for making such observations regarding overall trending or seasonality.

Outlier Testing

The Dixon's Outlier Test in Sanitas™ was used to evaluate the potential outlier for calcium in JRW-MW-16006. The suspect data point was found to be an outlier as the 0.05 significance level. In addition, the suspect data point was more than an order of magnitude less than the rest of the data set. The outlier data point will be excluded from the baseline UTL calculations.

Percentage of Nondetects

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

Table 1
Summary of Percentage of Baseline Results Below Reporting Limit

WELL	CONSTITUENT	PERCENT NON-DETECT
JRW-MW-16001	Boron	0
	Calcium	0
	Chloride	0
	Fluoride	8
	Field pH	0
	Sulfate	0
	Total Dissolved Solids	0
JRW-MW-16002	Boron	0
	Calcium	0
	Chloride	0

Table 1
Summary of Percentage of Baseline Results Below Reporting Limit

WELL	CONSTITUENT	PERCENT NON-DETECT
JRW-MW-16002 *(cont'd)*	Fluoride	17
	Field pH	0
	Sulfate	0
	Total Dissolved Solids	0
JRW-MW-16003	Boron	0
	Calcium	0
	Chloride	0
	Fluoride	0
	Field pH	0
	Sulfate	0
	Total Dissolved Solids	0
JRW-MW-16004	Boron	0
	Calcium	0
	Chloride	0
	Fluoride	8
	Field pH	0
	Sulfate	0
	Total Dissolved Solids	0
JRW-MW-16005	Boron	0
	Calcium	0
	Chloride	0
	Fluoride	17
	Field pH	0
	Sulfate	0
	Total Dissolved Solids	0
JRW-MW-16006	Boron	0
	Calcium (without outlier)	0
	Chloride	0
	Fluoride	8
	Field pH	0
	Sulfate	0
	Total Dissolved Solids	0

Distribution of the Data Sets

The distribution of the data sets is determined by the Sanitas™ software during calculation of the upper prediction limit. The Shapiro-Wilk test is used for samples sizes fewer than 50. Nondetect/censored data were not present in the data sets, with the exception of fluoride. 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.

Upper Prediction Limits

Table 2 presents the calculated UPLs (with one future event) for the baseline data sets. The UPL is calculated based on the distribution listed on the table. For nonnormal background datasets, a nonparametric prediction limit is utilized, resulting in the highest value from the background dataset as the UPL. 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 prediction limits. Verification resampling (1 of 2) is recommended per the Stats Plan and UG to achieve the performance standards specified in the CCR rules.

Table 2
Summary of Baseline Data Distributions and Intrawell Upper Prediction Limits

WELL	CONSTITUENT	DISTRIBUTION	UPPER PREDICTION LIMIT – FROM SANITAS™
JRW-MW-16001	Boron	Normal	203
	Calcium	Normal	111
	Chloride	Normal	23.6
	Fluoride	Normal	2,300
	Field pH	Normal	7.5 – 8.9
	Sulfate	Normal	278
	Total Dissolved Solids	Normal	770
JRW-MW-16002	Boron	Normal	209
	Calcium	Normal	149
	Chloride	Normal	25.4
	Fluoride	Normal	1,400
	Field pH	Normal	7.5 – 8.3
	Sulfate	Normal	426
	Total Dissolved Solids	Normal	832
JRW-MW-16003	Boron	Normal	257
	Calcium	Normal	156
	Chloride	Normal	32.4
	Fluoride	Normal	1,600
	Field pH	Normal	7.4 – 7.9
	Sulfate	Normal	470
	Total Dissolved Solids	Normal	1,040

Table 2
Summary of Baseline Data Distributions and Intrawell Upper Prediction Limits

WELL	CONSTITUENT	DISTRIBUTION	UPPER PREDICTION LIMIT – FROM SANITAS™
JRW-MW-16004	Boron	Normal	262
	Calcium	Normal	181
	Chloride	Normal	43.7
	Fluoride	Normal	1,700
	Field pH	Normal	7.4 – 8.2
	Sulfate	Normal	507
	Total Dissolved Solids	Normal	1,110
JRW-MW-16005	Boron	Normal	244
	Calcium	Normal	182
	Chloride	Normal	29.4
	Fluoride	Normal	1,800
	Field pH	Normal	7.3 – 8.0
	Sulfate	Normal	498
	Total Dissolved Solids	Normal	1,030
JRW-MW-16006	Boron	Normal	226
	Calcium (without outlier)	Normal	117
	Chloride	Non-normal	38.6*
	Fluoride	Normal	2,200
	Field pH	Normal	7.5 – 8.2
	Sulfate	Normal	399
	Total Dissolved Solids	Normal	904

* Nonparametric Prediction Limit

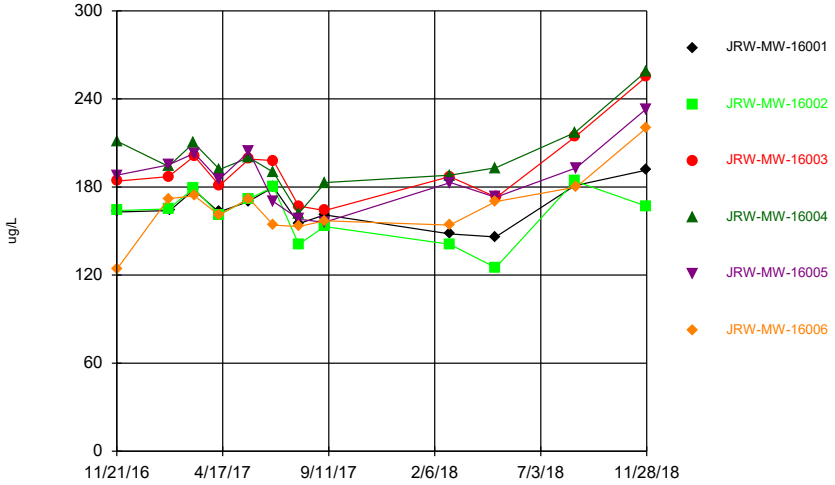
Attachments

Figure 1 – Background Concentration Time-Series Charts
Sanitas™ Output Files

Figure 1

Sanitas™ v.9.6.18 Sanitas software licensed to Consumers Energy. UG

Boron, Total



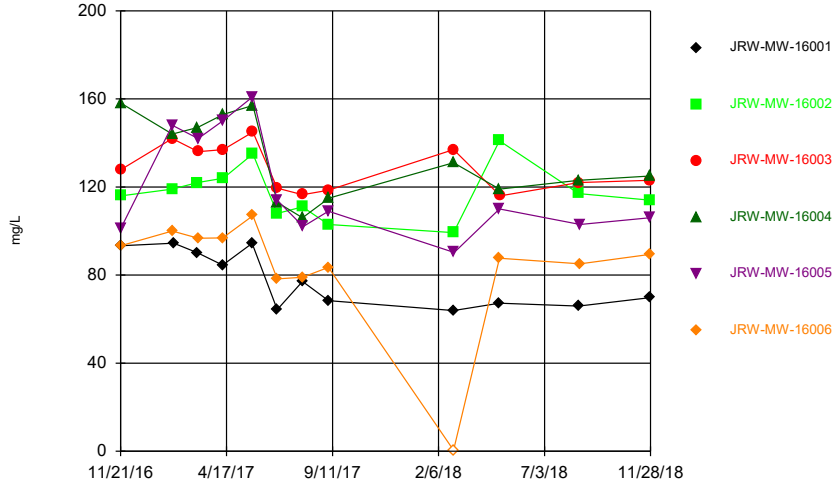
Time Series Analysis Run 6/21/2019 1:26 PM

Client: Consumers Energy Data: JRW_Sanitas_190312

Sanitas™ v.9.6.18 Sanitas software licensed to Consumers Energy. UG

Hollow symbols indicate censored values.

Calcium, Total

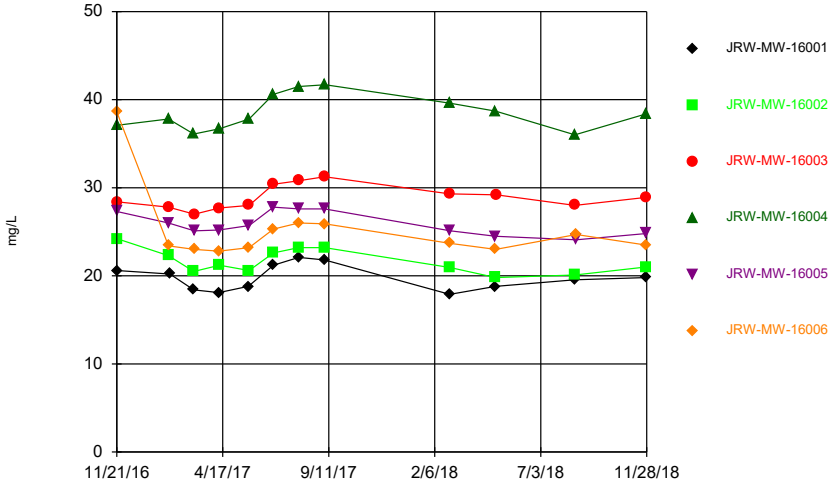


Time Series Analysis Run 6/21/2019 1:27 PM

Client: Consumers Energy Data: JRW_Sanitas_190312

Sanitas™ v.9.6.18 Sanitas software licensed to Consumers Energy. UG

Chloride



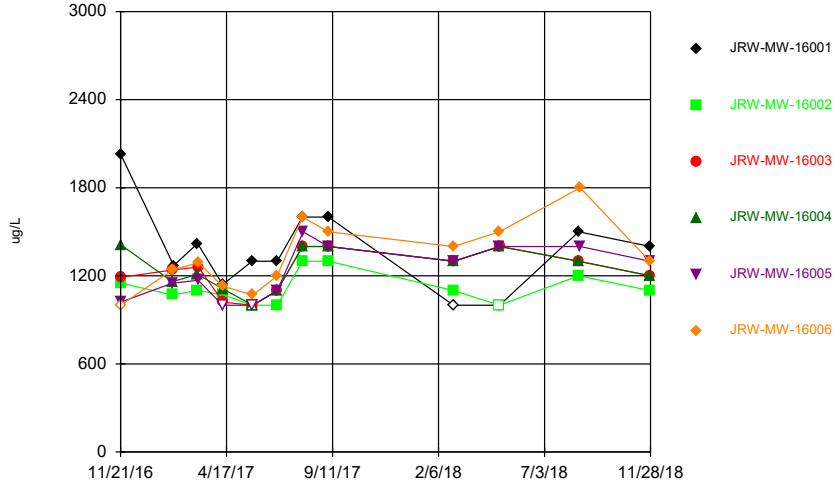
Time Series Analysis Run 6/21/2019 1:28 PM

Client: Consumers Energy Data: JRW_Sanitas_190312

Sanitas™ v.9.6.18 Sanitas software licensed to Consumers Energy. UG

Hollow symbols indicate censored values.

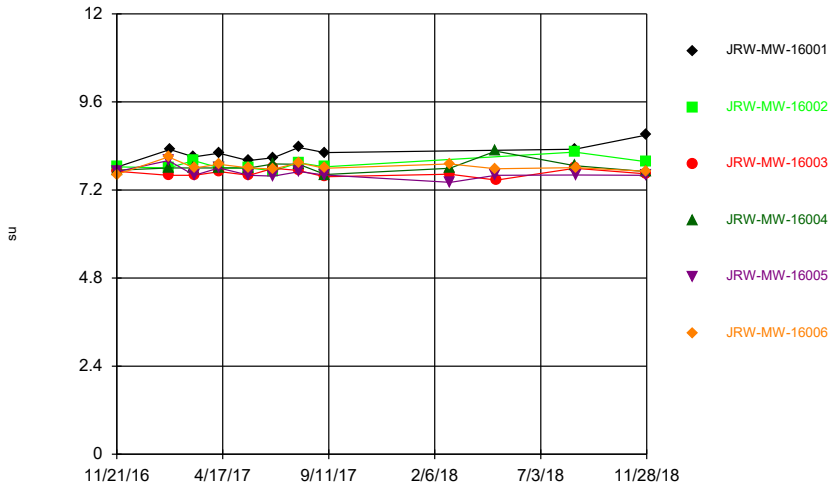
Fluoride



Time Series Analysis Run 6/21/2019 1:29 PM

Client: Consumers Energy Data: JRW_Sanitas_190312

pH, Field

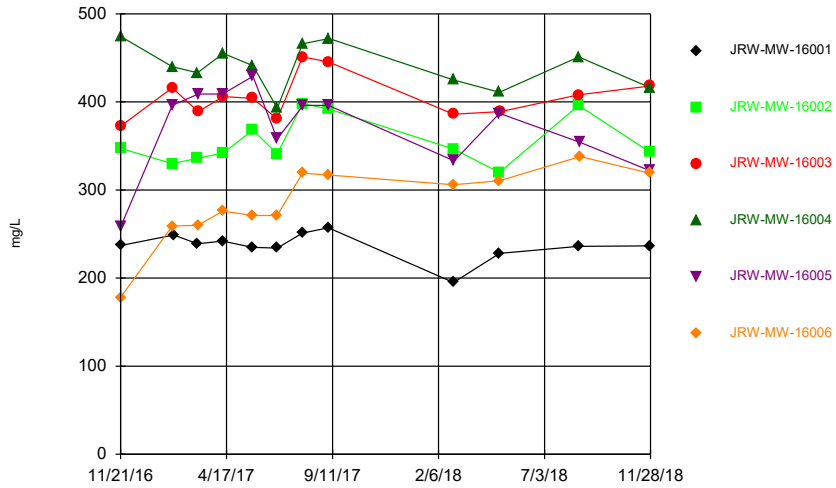


Time Series Analysis Run 6/21/2019 1:33 PM

Client: Consumers Energy Data: JRW_Sanitas_190312

Sanitas™ v.9.6.18 Sanitas software licensed to Consumers Energy. UG

Sulfate

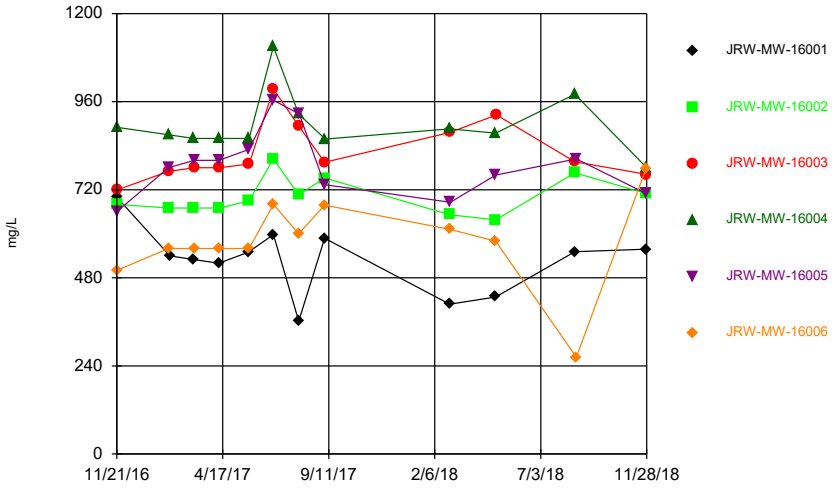


Time Series Analysis Run 6/21/2019 1:33 PM

Client: Consumers Energy Data: JRW_Sanitas_190312

Sanitas™ v.9.6.18 Sanitas software licensed to Consumers Energy. UG

Total Dissolved Solids, Dissolved



Time Series Analysis Run 6/21/2019 1:34 PM

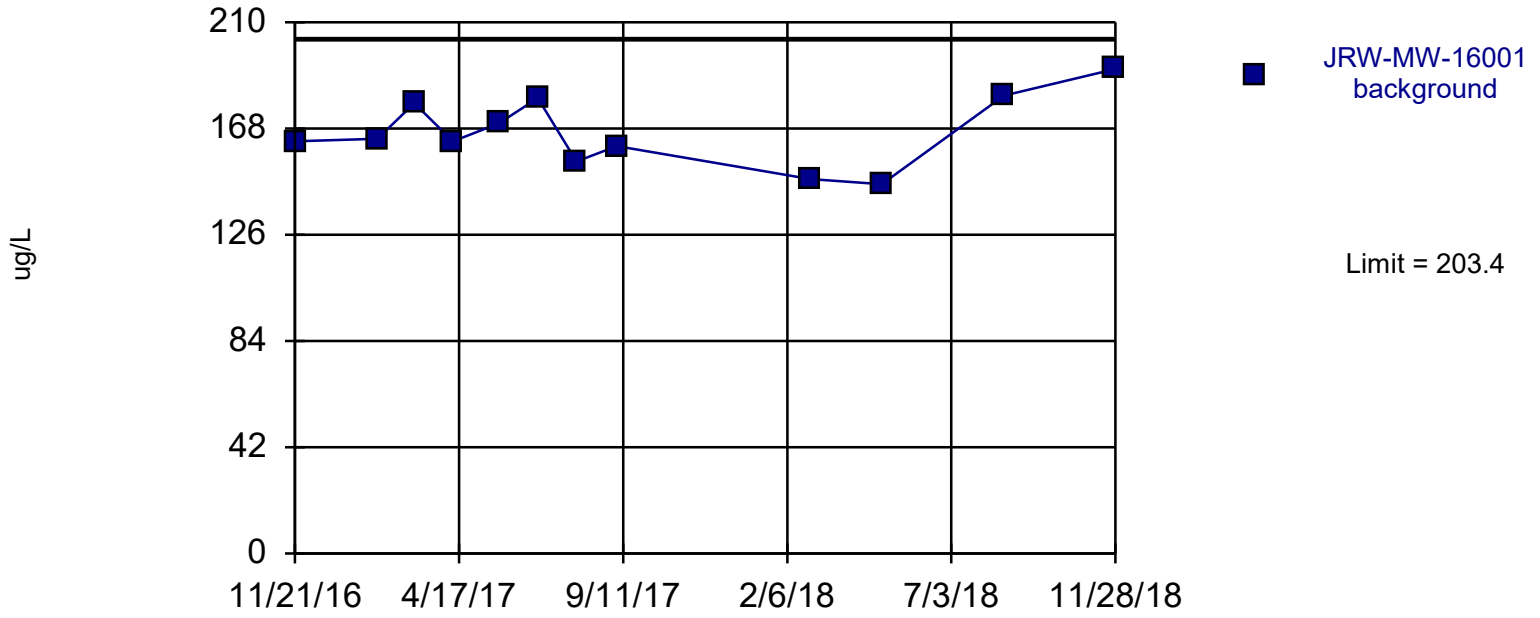
Client: Consumers Energy Data: JRW_Sanitas_190312

Technical Memorandum

Sanitas™ Output Files

Prediction Limit

Intrawell Parametric, JRW-MW-16001



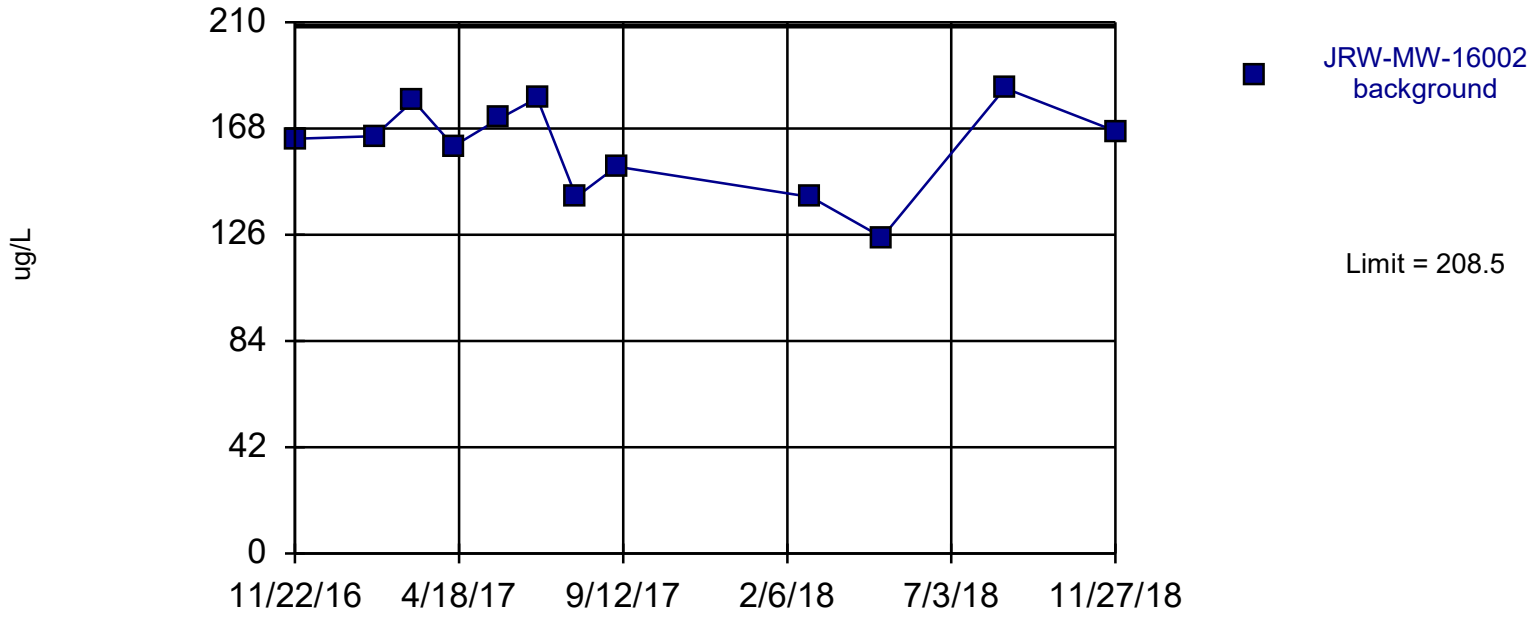
Background Data Summary: Mean=166.7, Std. Dev.=13.87, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9617, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Boron, Total Analysis Run 3/11/2019 2:48 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16002



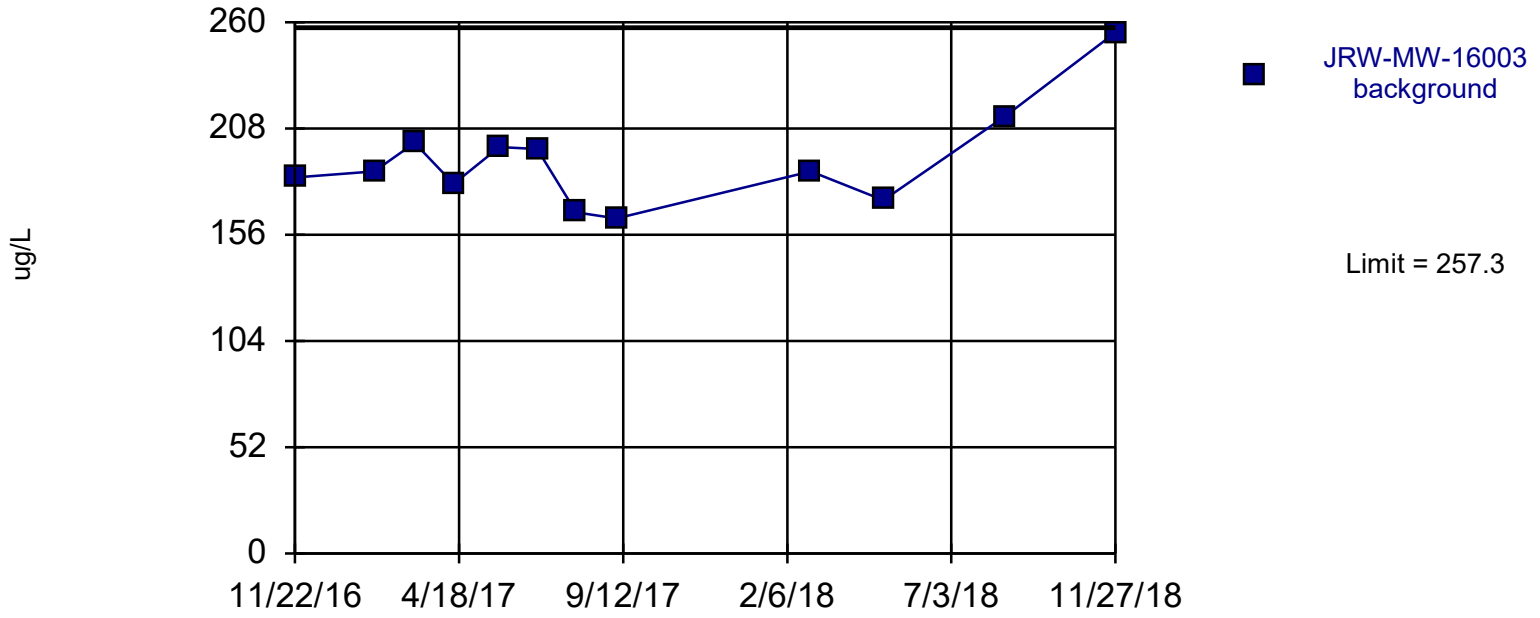
Background Data Summary: Mean=161, Std. Dev.=17.98, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.939, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Boron, Total Analysis Run 3/11/2019 2:49 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16003



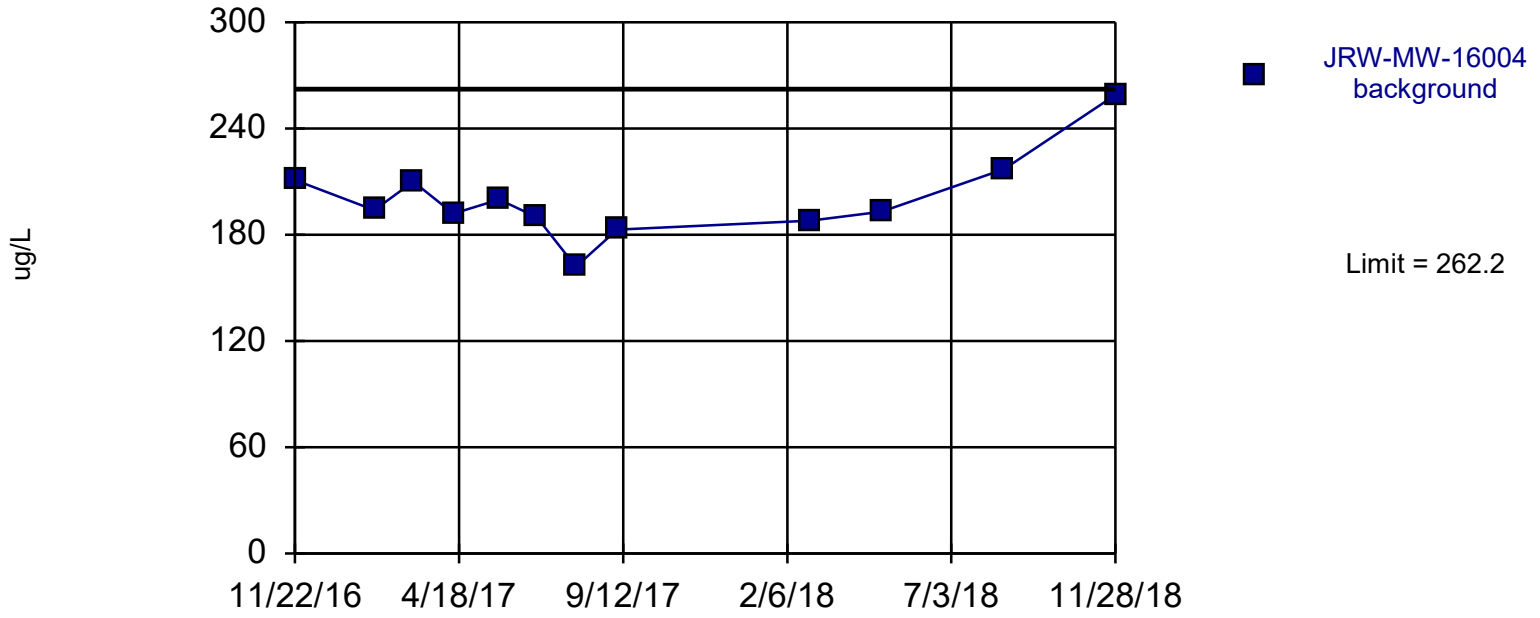
Background Data Summary: Mean=192.5, Std. Dev.=24.53, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8762, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Boron, Total Analysis Run 3/11/2019 2:49 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16004



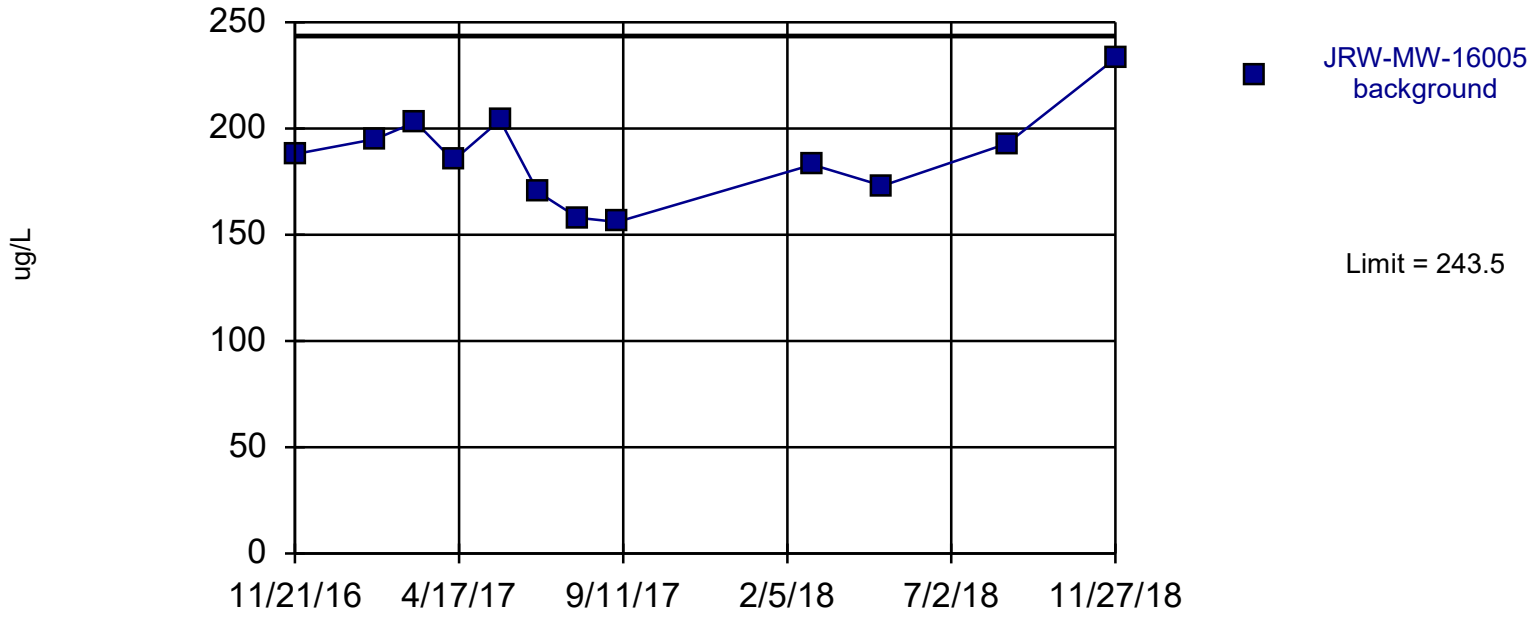
Background Data Summary: Mean=199.9, Std. Dev.=23.58, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8892, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Boron, Total Analysis Run 3/11/2019 2:49 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16005



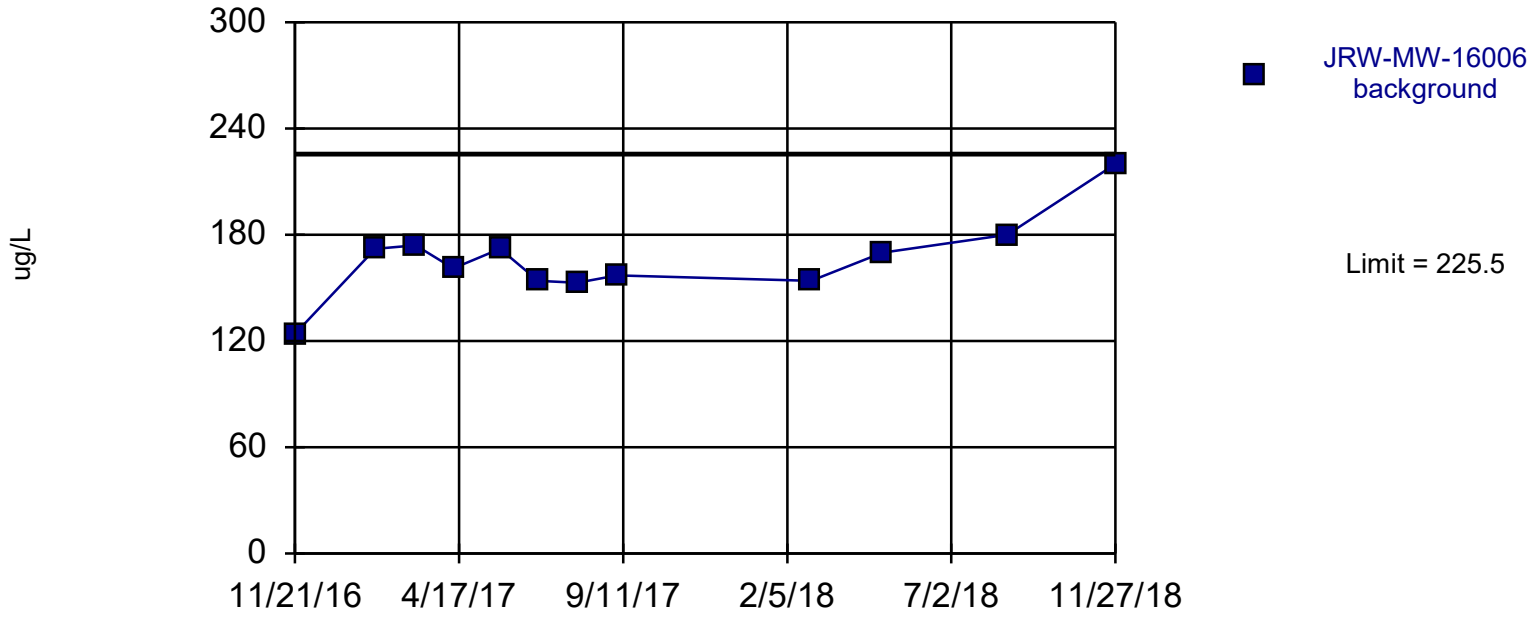
Background Data Summary: Mean=186.8, Std. Dev.=21.47, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9585, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Boron, Total Analysis Run 3/11/2019 2:50 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16006



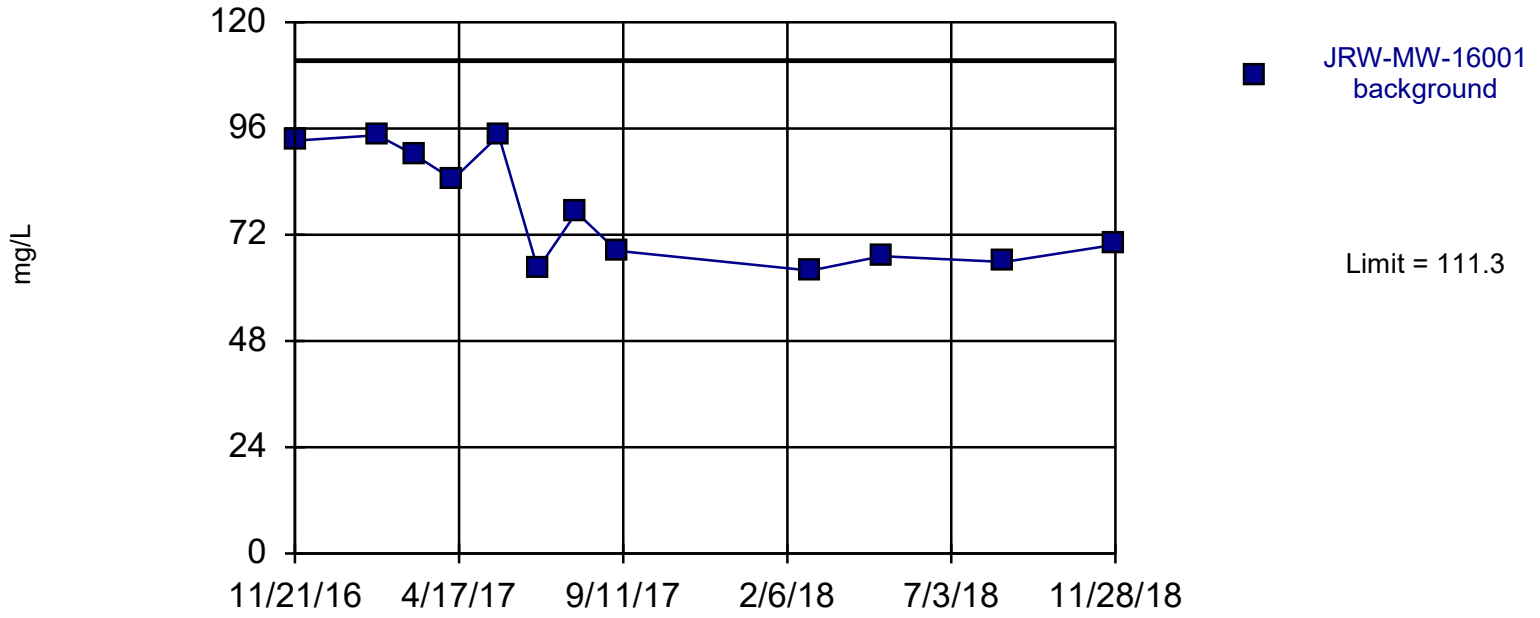
Background Data Summary: Mean=165.9, Std. Dev.=22.54, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8951, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Boron, Total Analysis Run 3/11/2019 2:50 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16001



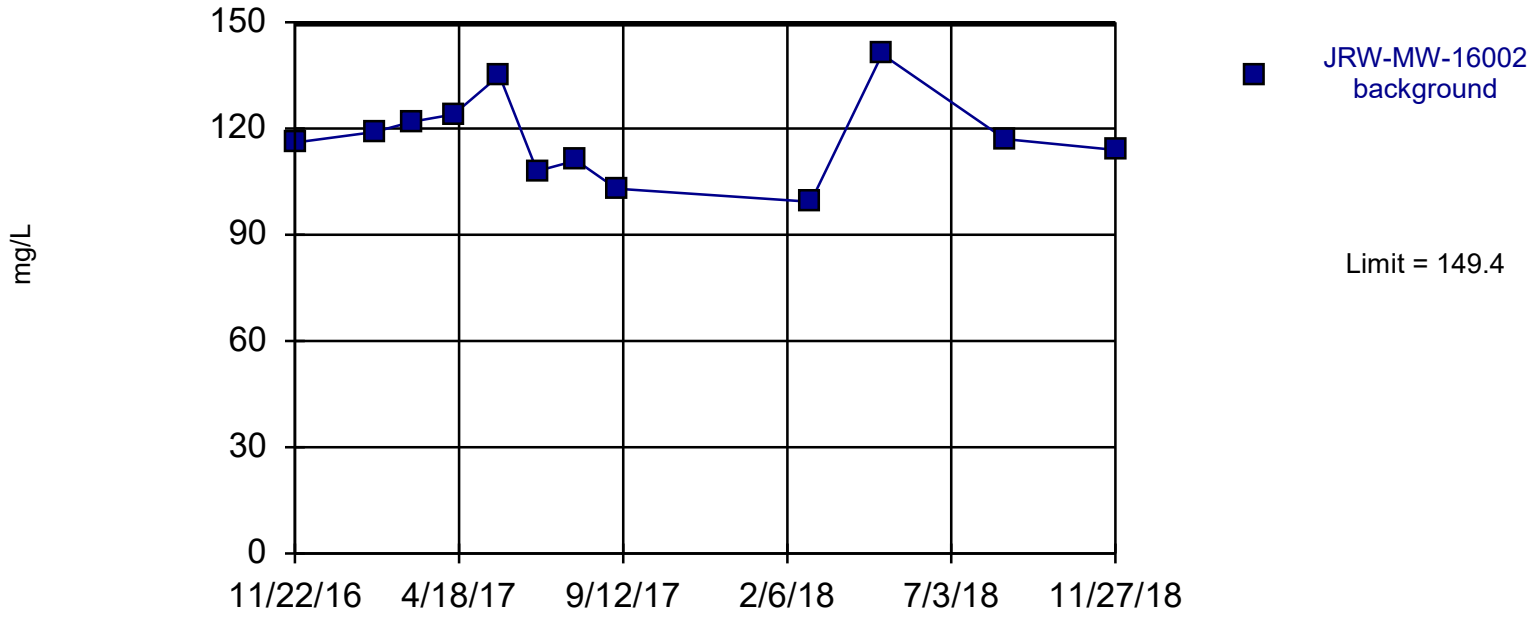
Background Data Summary: Mean=77.78, Std. Dev.=12.7, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8372, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Calcium, Total Analysis Run 3/11/2019 2:51 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16002



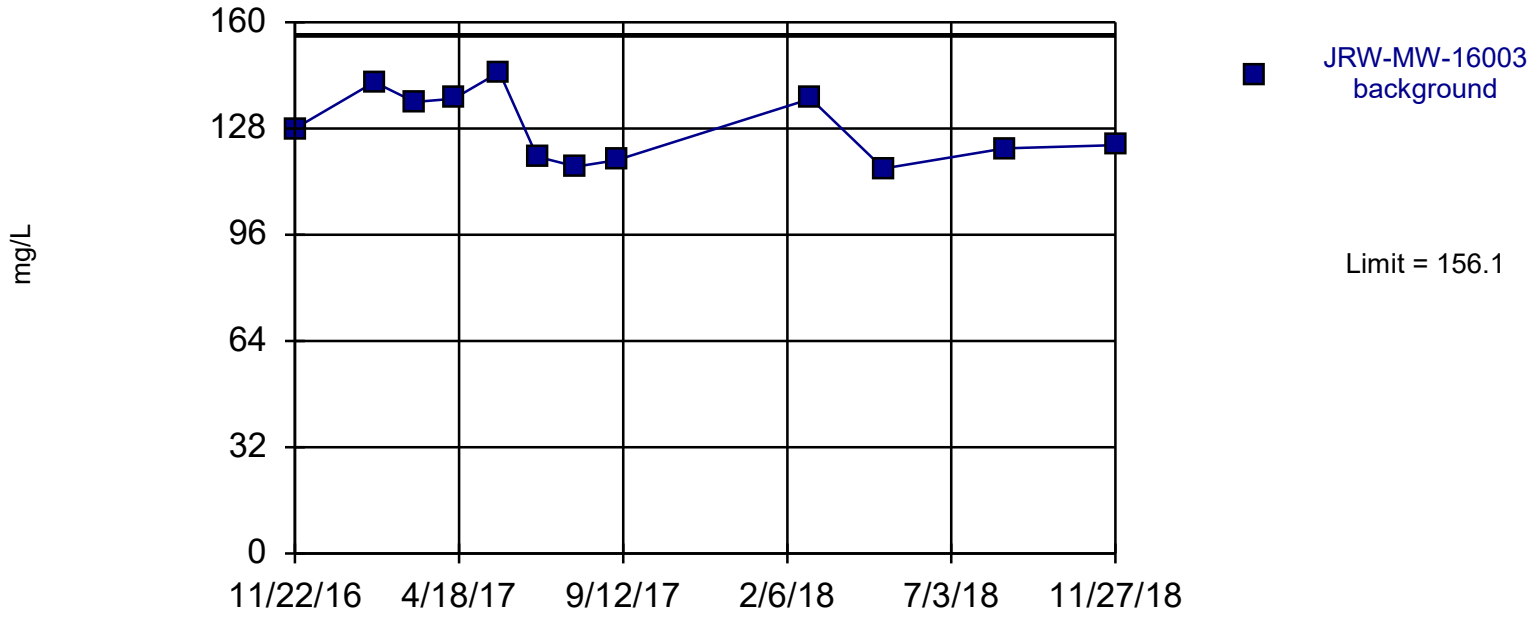
Background Data Summary: Mean=117.4, Std. Dev.=12.11, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9661, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Calcium, Total Analysis Run 3/11/2019 2:52 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16003



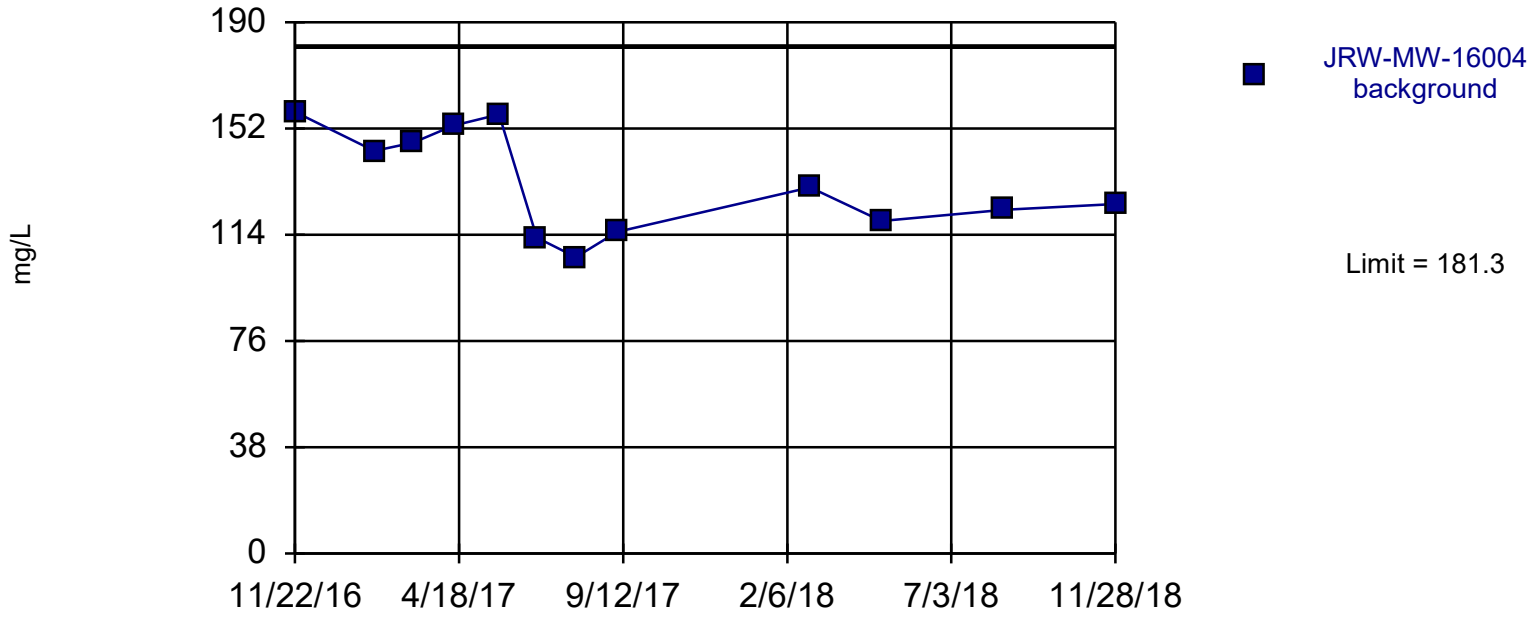
Background Data Summary: Mean=128.4, Std. Dev.=10.48, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8961, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Calcium, Total Analysis Run 3/11/2019 2:52 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16004



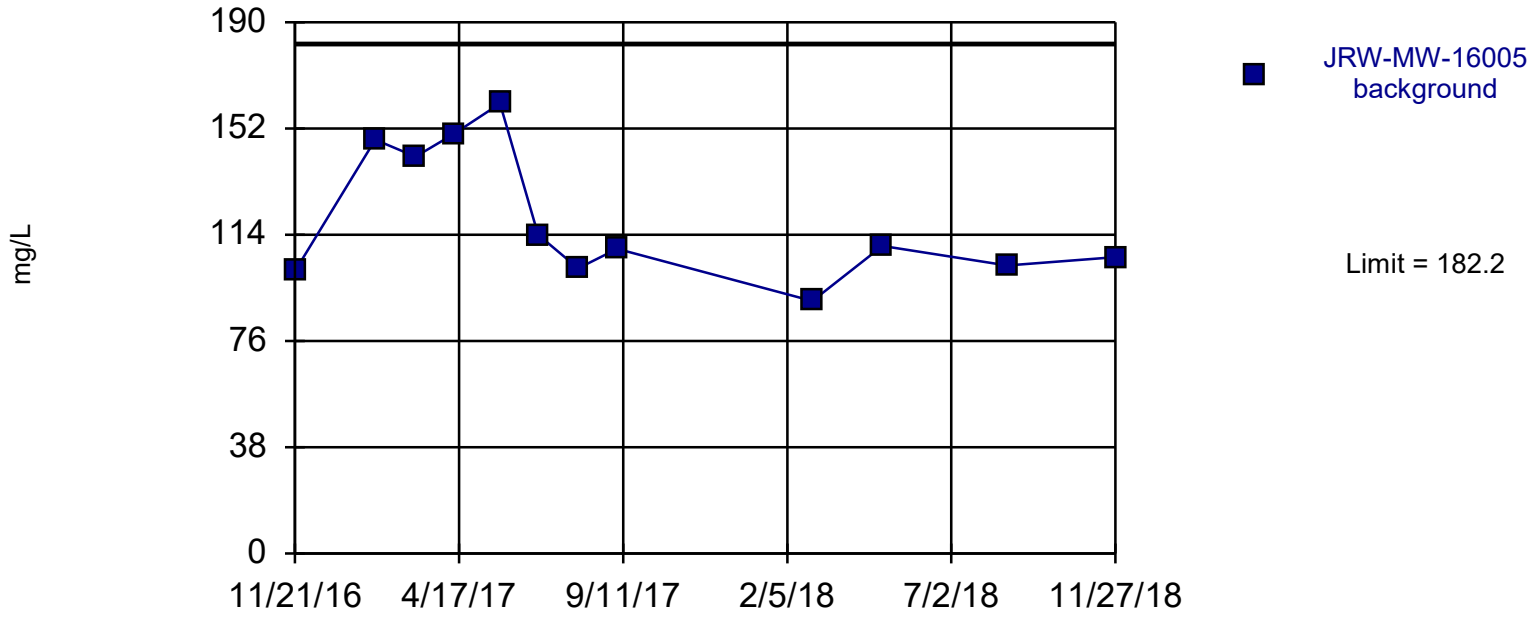
Background Data Summary: Mean=132.6, Std. Dev.=18.42, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9192, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Calcium, Total Analysis Run 3/11/2019 2:53 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16005



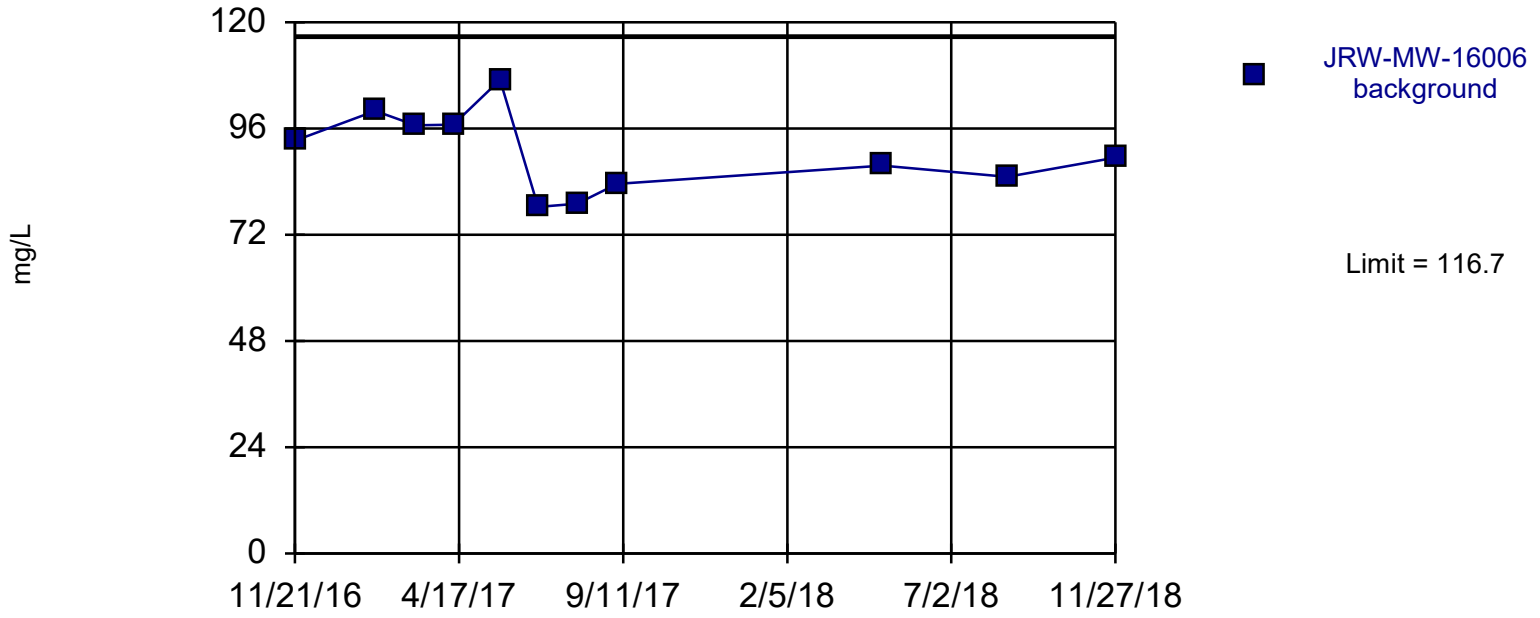
Background Data Summary: Mean=119.7, Std. Dev.=23.66, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8596, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Calcium, Total Analysis Run 3/11/2019 2:53 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16006



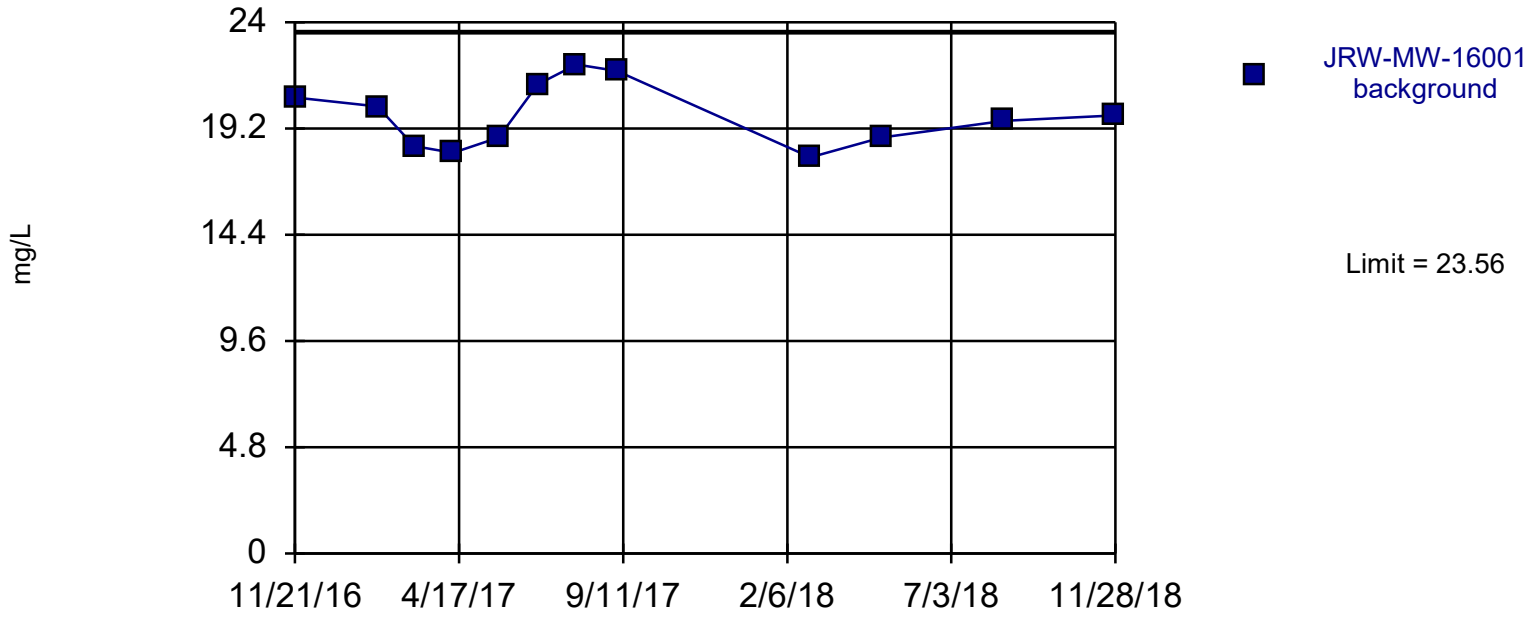
Background Data Summary: Mean=90.62, Std. Dev.=9.045, n=11. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9661, critical = 0.792. Report alpha = 0.01. Assumes 1 future value.

Constituent: Calcium, Total Analysis Run 3/20/2019 8:39 AM

Client: Consumers Energy Data: JRW_Sanitas_190312

Prediction Limit

Intrawell Parametric, JRW-MW-16001



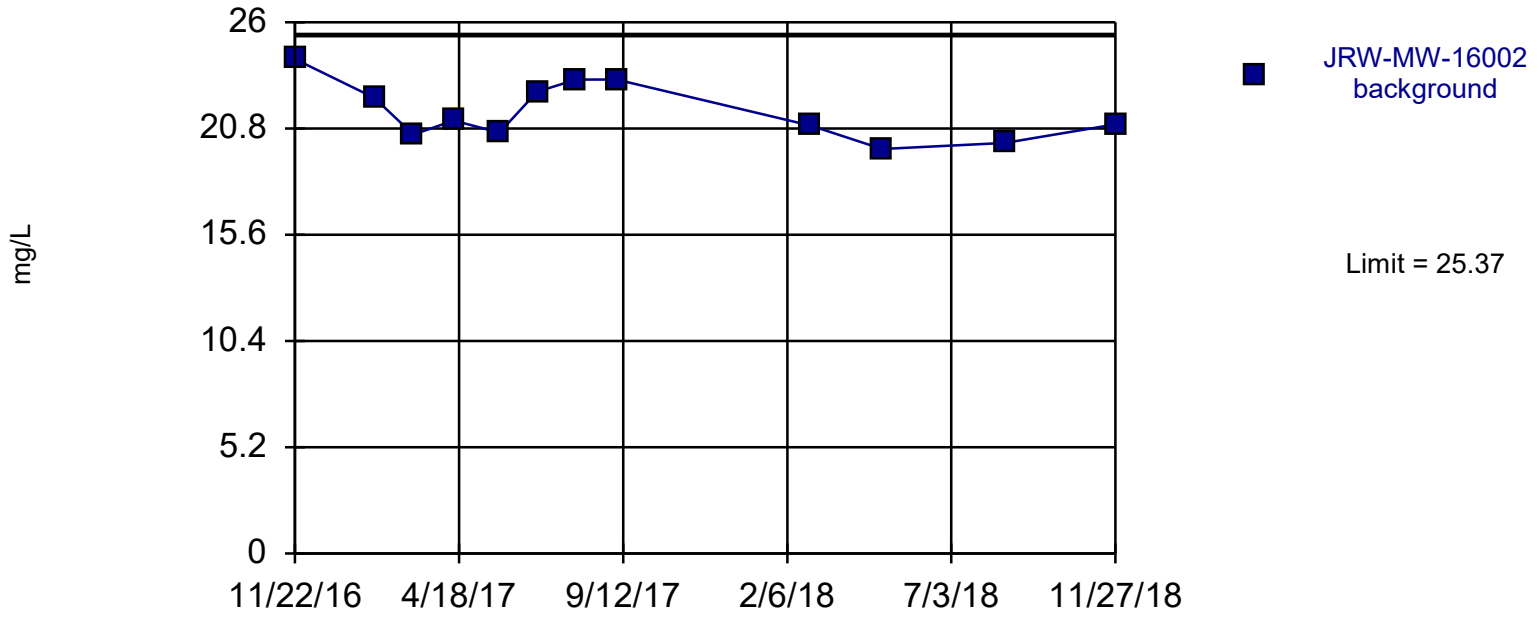
Background Data Summary: Mean=19.77, Std. Dev.=1.432, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9415, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Chloride Analysis Run 3/11/2019 2:56 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16002



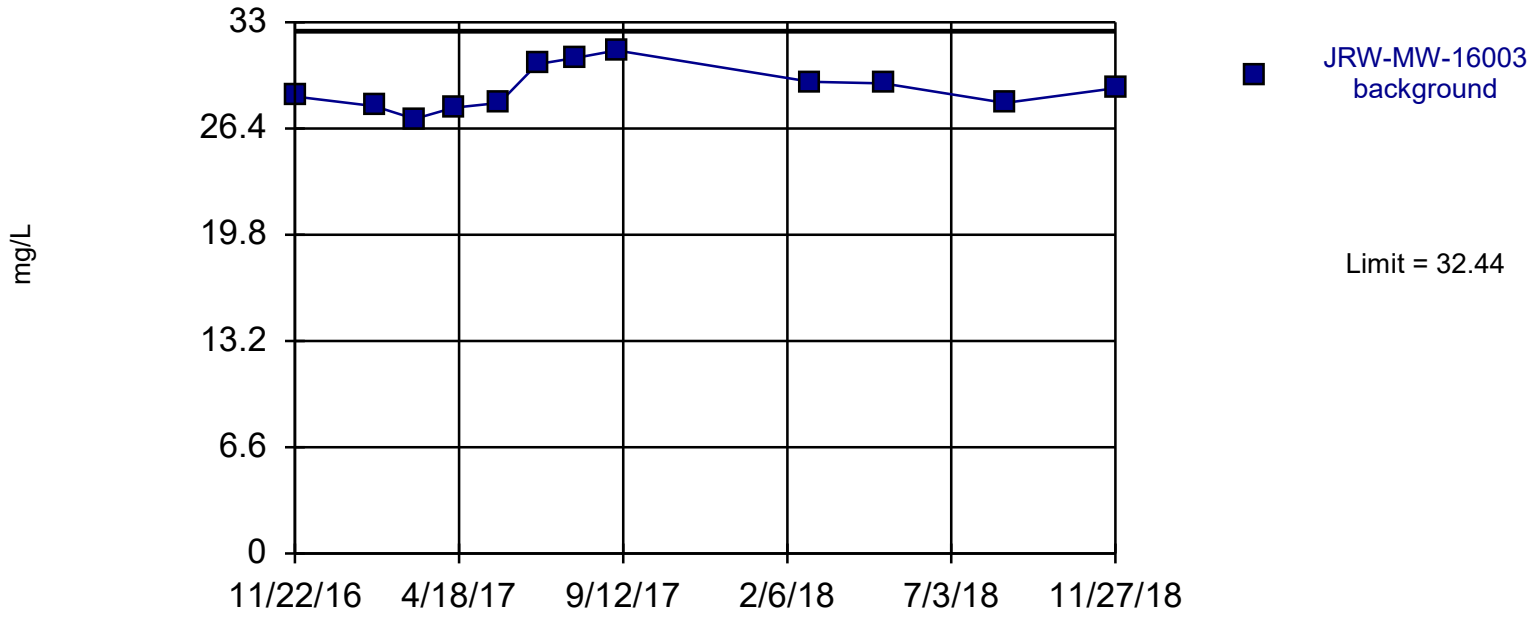
Background Data Summary: Mean=21.64, Std. Dev.=1.414, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9293, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Chloride Analysis Run 3/11/2019 2:57 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16003



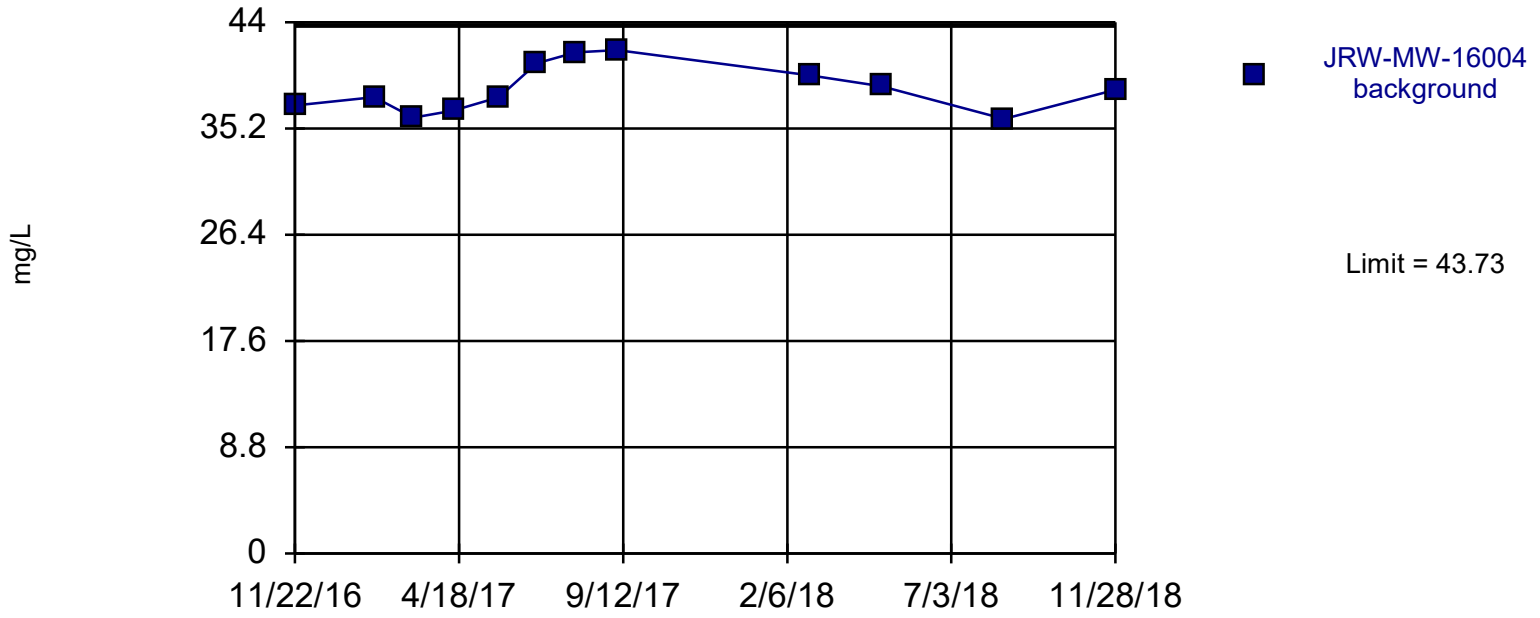
Background Data Summary: Mean=28.9, Std. Dev.=1.34, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9355, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Chloride Analysis Run 3/11/2019 2:57 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16004



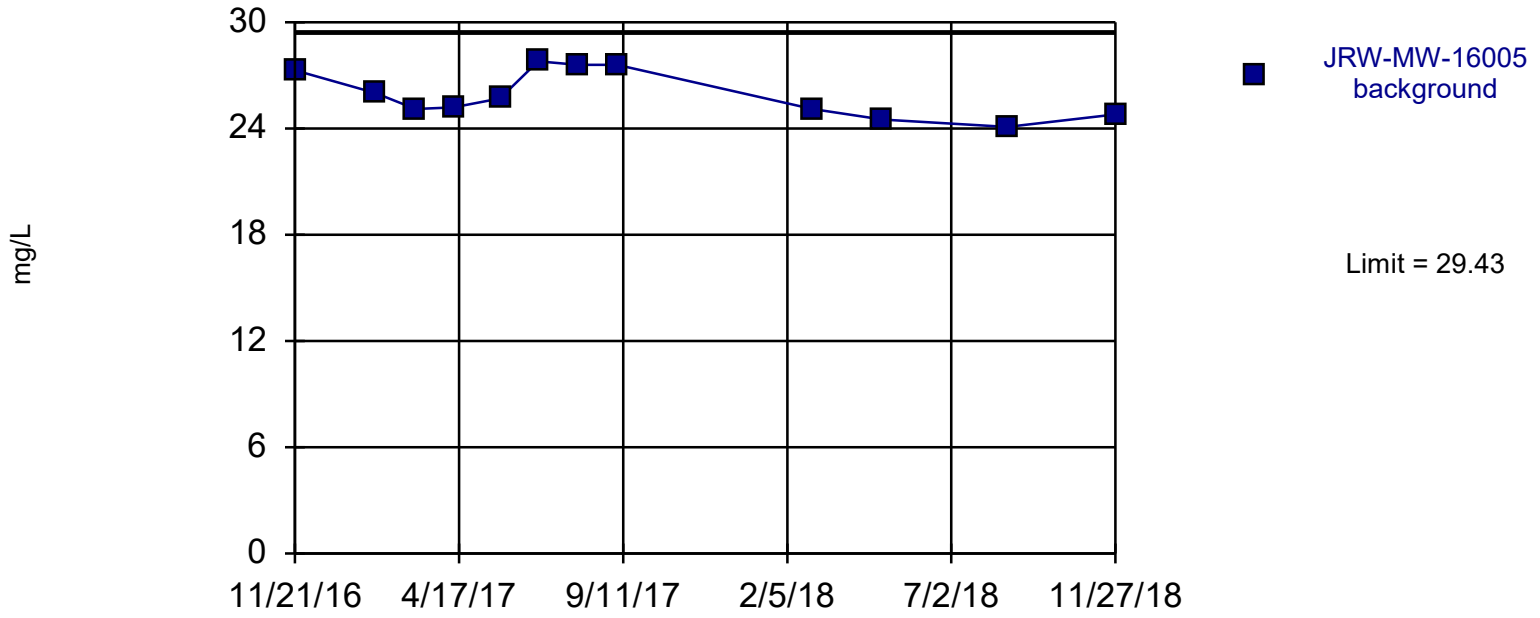
Background Data Summary: Mean=38.5, Std. Dev.=1.979, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9294, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Chloride Analysis Run 3/11/2019 2:57 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16005



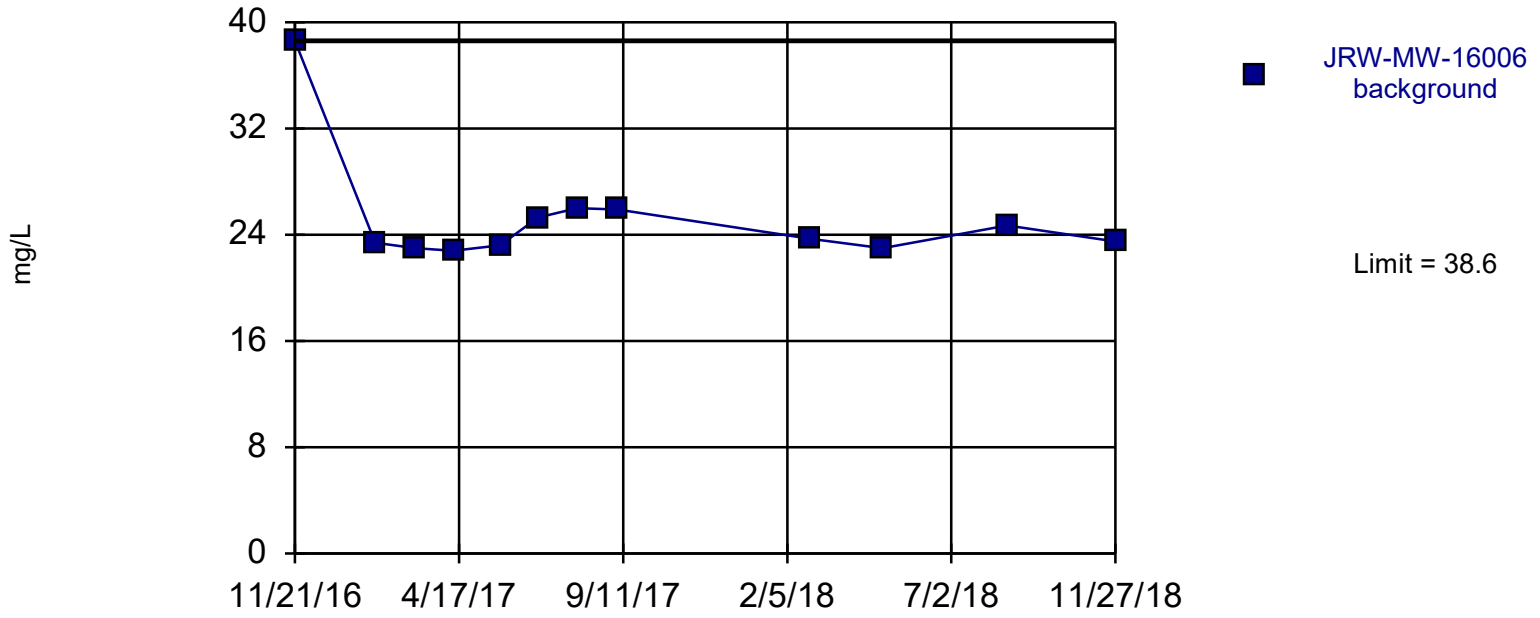
Background Data Summary: Mean=25.9, Std. Dev.=1.334, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8841, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Chloride Analysis Run 3/11/2019 2:57 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Non-parametric, JRW-MW-16006



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 12 background values. Well-constituent pair annual alpha = 0.02143. Individual comparison alpha = 0.01077 (1 of 2). Assumes 1 future value. Insufficient data to test for seasonality: data were not deseasonalized.

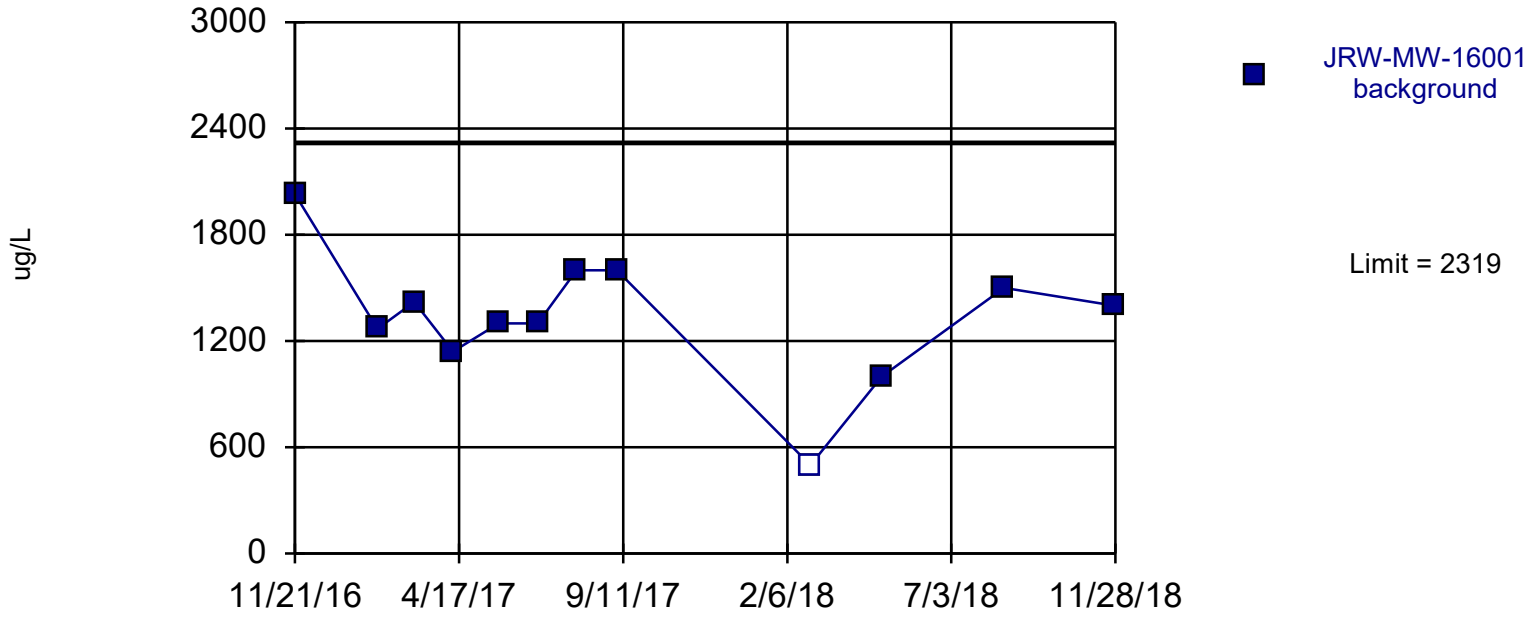
Constituent: Chloride Analysis Run 3/11/2019 2:57 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Hollow symbols indicate censored values.

Prediction Limit

Intrawell Parametric, JRW-MW-16001



Background Data Summary: Mean=1338, Std. Dev.=371.3, n=12, 8.333% NDs. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.943, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

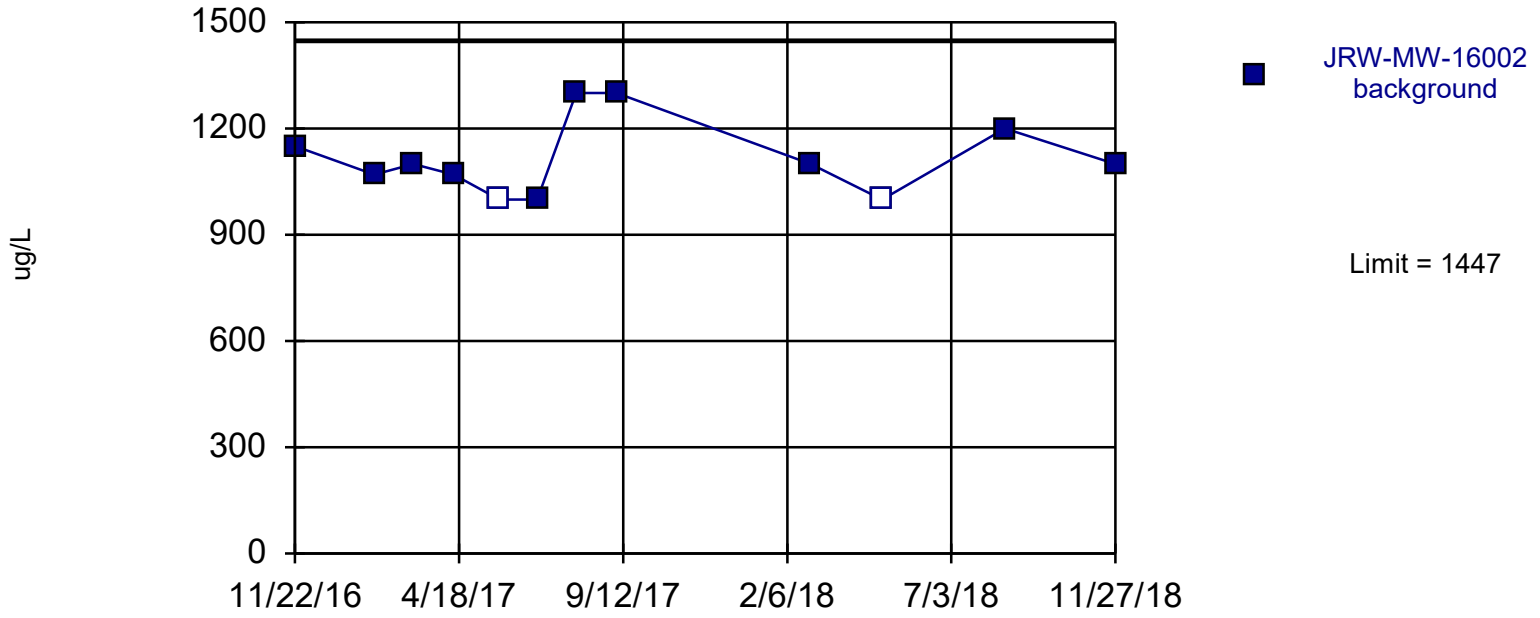
Constituent: Fluoride Analysis Run 3/11/2019 4:16 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Hollow symbols indicate censored values.

Prediction Limit

Intrawell Parametric, JRW-MW-16002



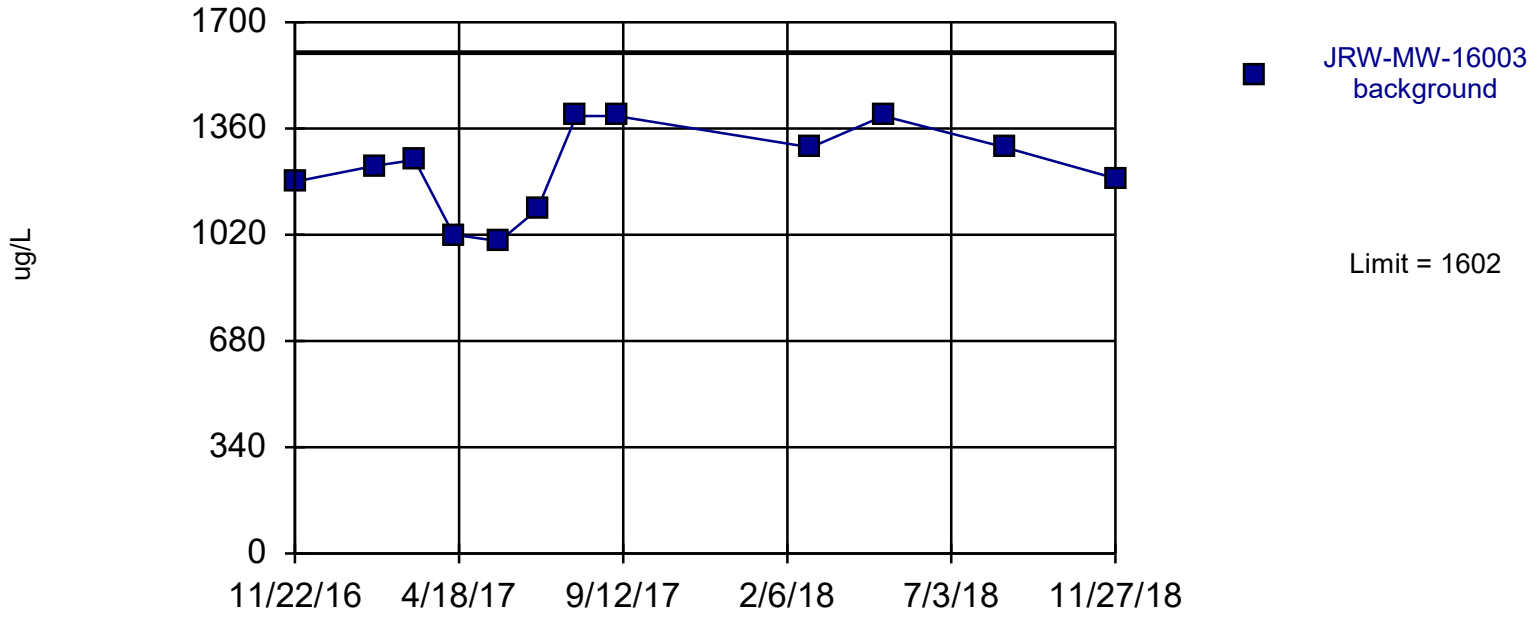
Background Data Summary (after Cohen`s Adjustment): Mean=1105, Std. Dev.=121.2, n=12, 16.67% NDs. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8783, critical = 0.805. Report alpha = 0.01. Assumes 1 future value.

Constituent: Fluoride Analysis Run 3/20/2019 8:41 AM

Client: Consumers Energy Data: JRW_Sanitas_190312

Prediction Limit

Intrawell Parametric, JRW-MW-16003



Background Data Summary: Mean=1234, Std. Dev.=139.4, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9185, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

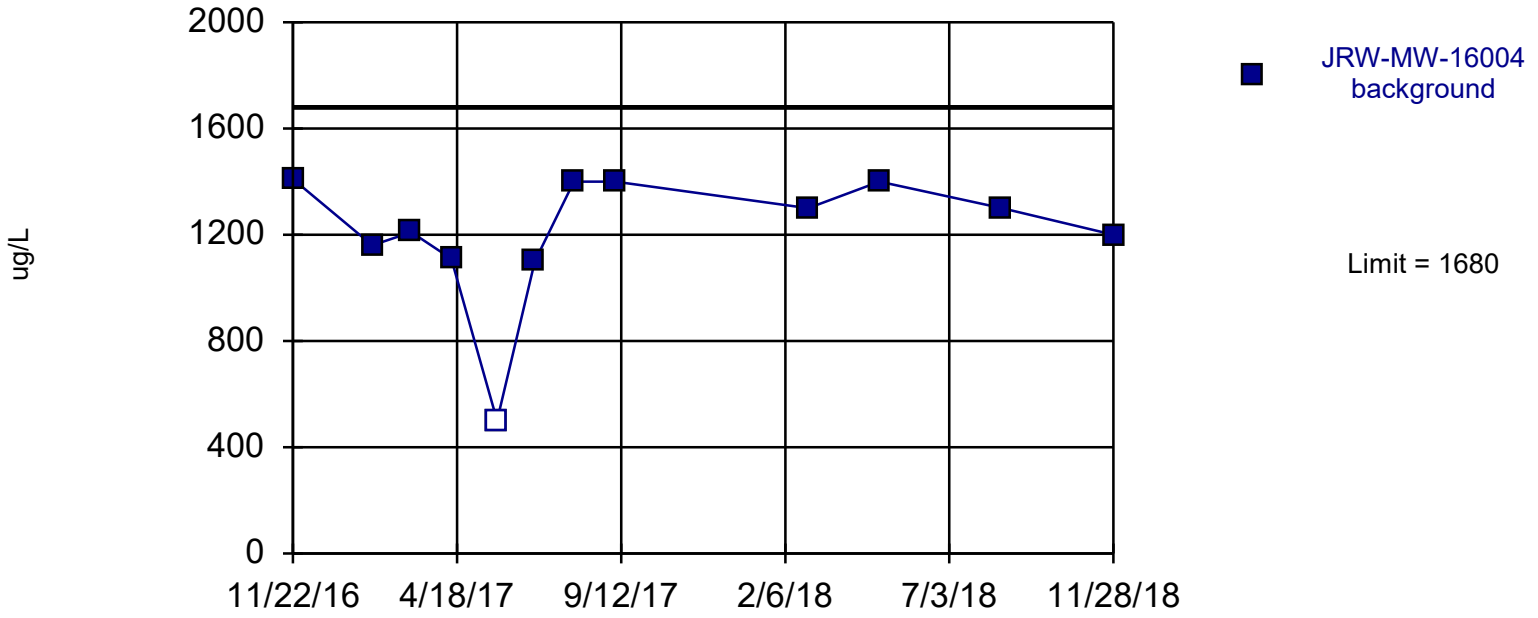
Constituent: Fluoride Analysis Run 3/11/2019 4:17 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Hollow symbols indicate censored values.

Prediction Limit

Intrawell Parametric, JRW-MW-16004



Background Data Summary (based on square transformation): Mean=1515825, Std. Dev.=494454, n=12, 8.333% NDs. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8357, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

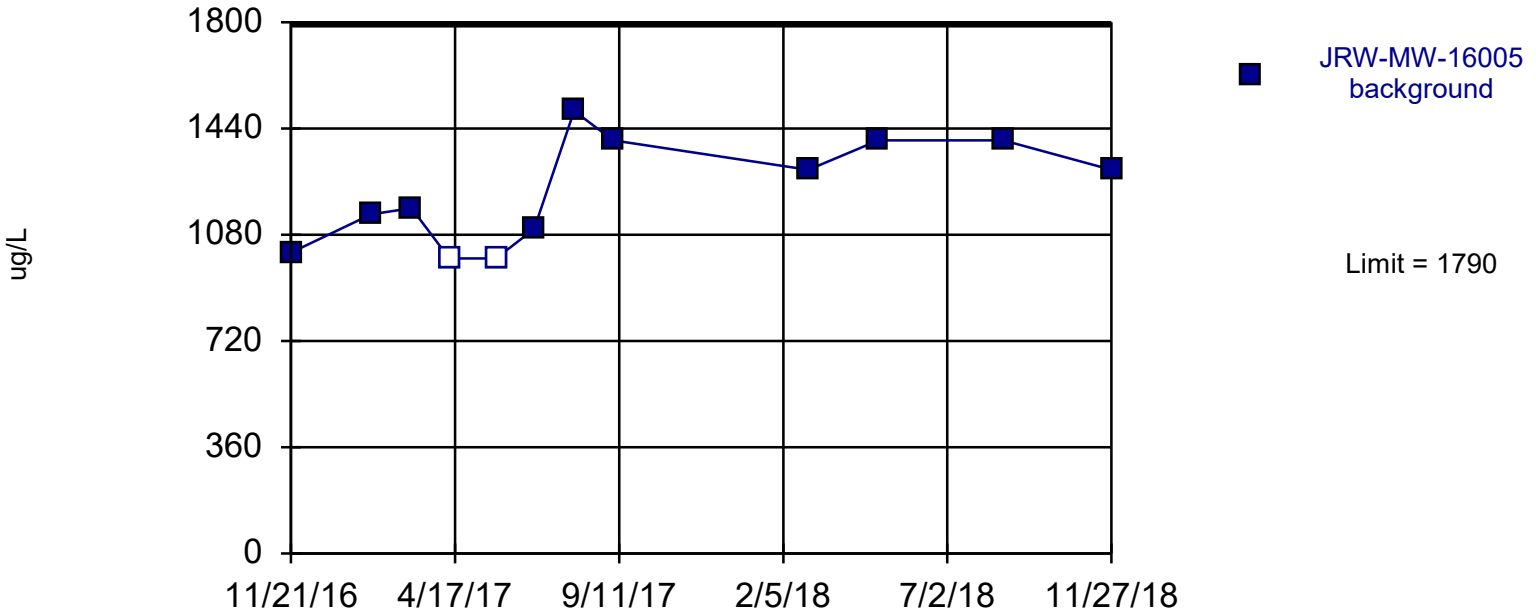
Constituent: Fluoride Analysis Run 3/11/2019 4:17 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Hollow symbols indicate censored values.

Prediction Limit

Intrawell Parametric, JRW-MW-16005



Background Data Summary (after Cohen`s Adjustment): Mean=1210, Std. Dev.=204.9, n=12, 16.67% NDs. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9101, critical = 0.805. Report alpha = 0.01. Assumes 1 future value.

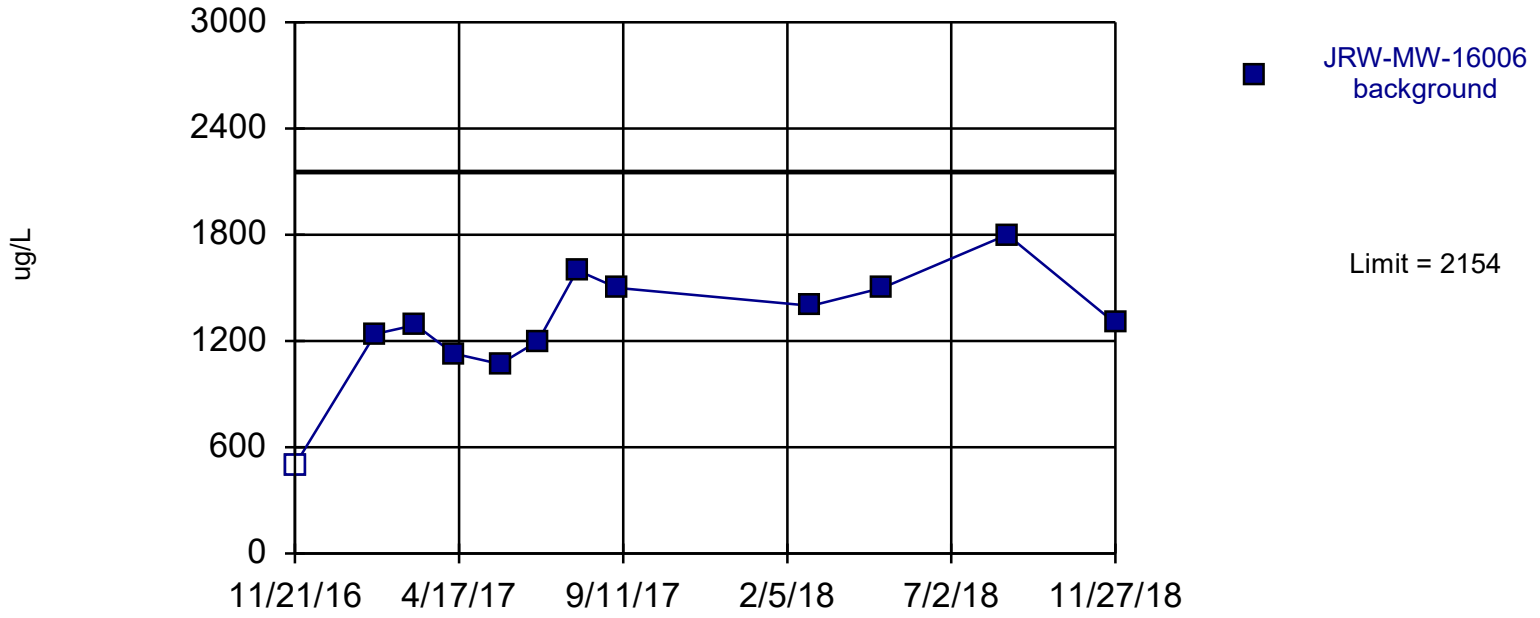
Constituent: Fluoride Analysis Run 3/20/2019 8:41 AM

Client: Consumers Energy Data: JRW_Sanitas_190312

Hollow symbols indicate censored values.

Prediction Limit

Intrawell Parametric, JRW-MW-16006



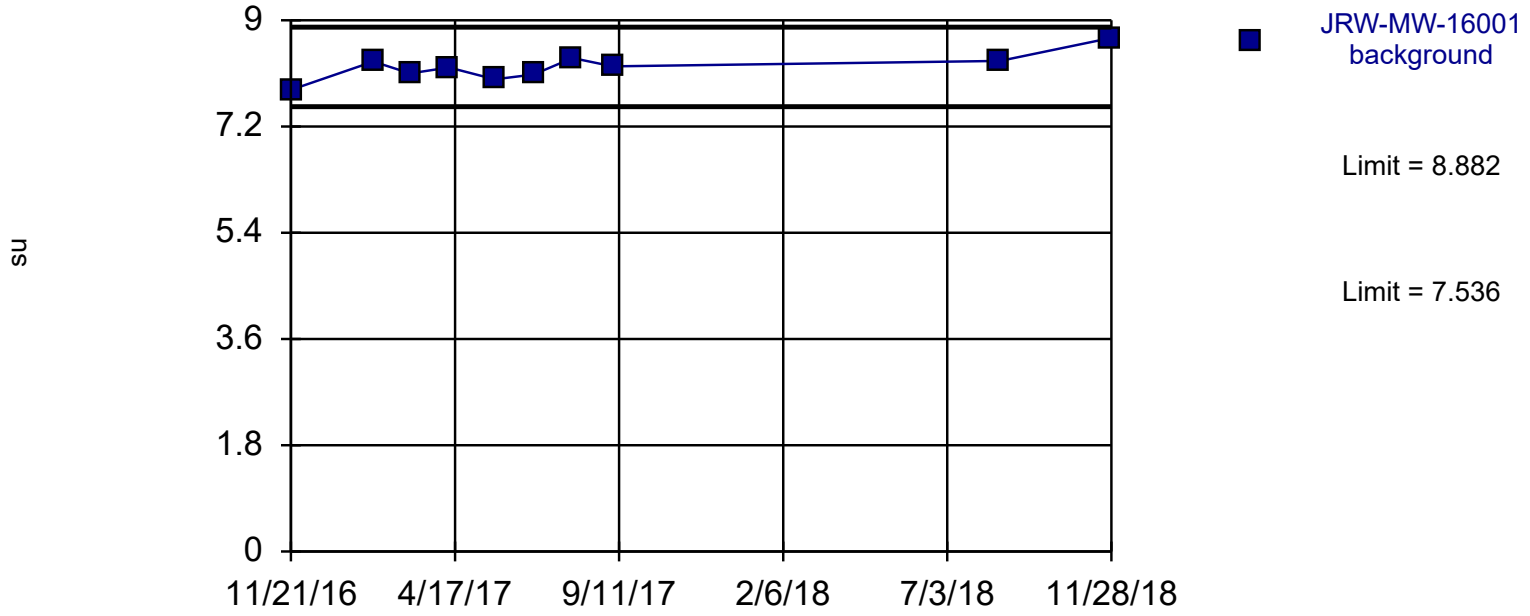
Background Data Summary: Mean=1294, Std. Dev.=325.4, n=12, 8.333% NDs. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9238, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Fluoride Analysis Run 3/11/2019 4:18 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16001



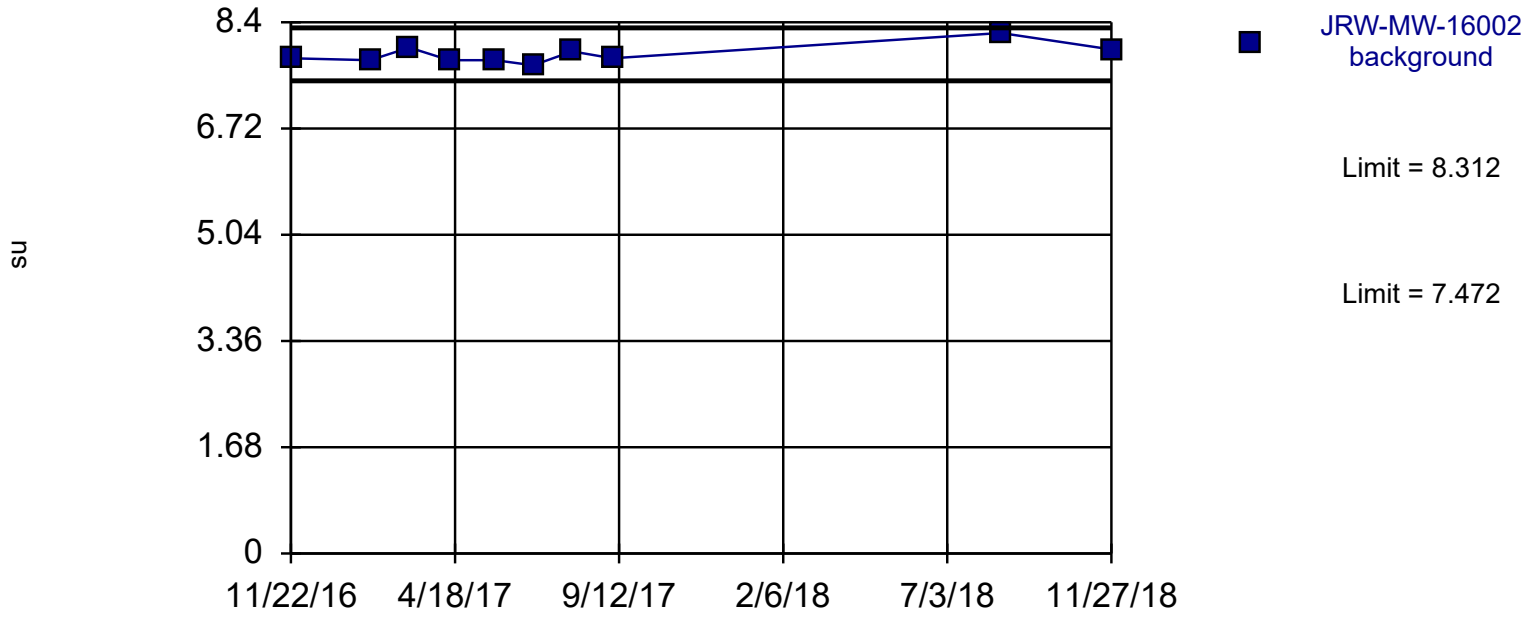
Background Data Summary: Mean=8.209, Std. Dev.=0.2371, n=10. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9628, critical = 0.781. Kappa = 2.838 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: pH, Field Analysis Run 6/21/2019 1:46 PM

Client: Consumers Energy Data: JRW_Sanitas_190312

Prediction Limit

Intrawell Parametric, JRW-MW-16002



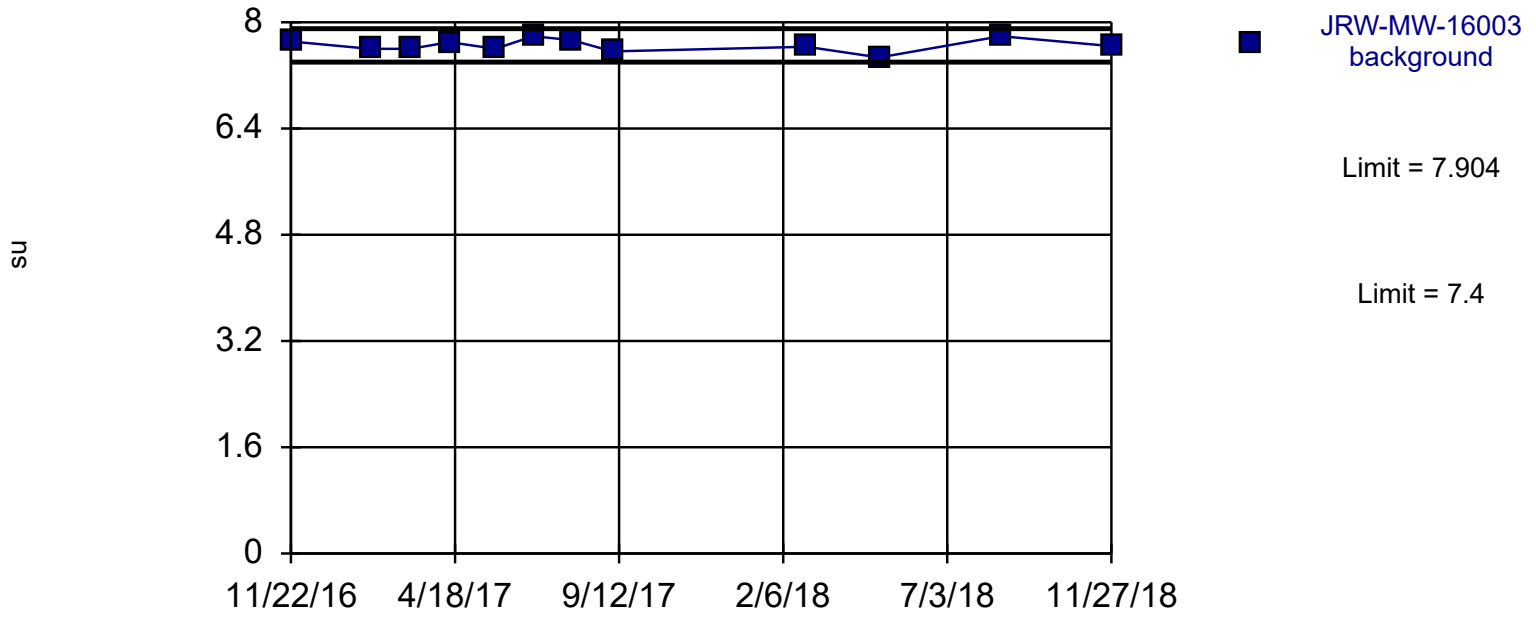
Background Data Summary: Mean=7.892, Std. Dev.=0.1479, n=10. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.862, critical = 0.781. Kappa = 2.838 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: pH, Field Analysis Run 6/21/2019 1:47 PM

Client: Consumers Energy Data: JRW_Sanitas_190312

Prediction Limit

Intrawell Parametric, JRW-MW-16003



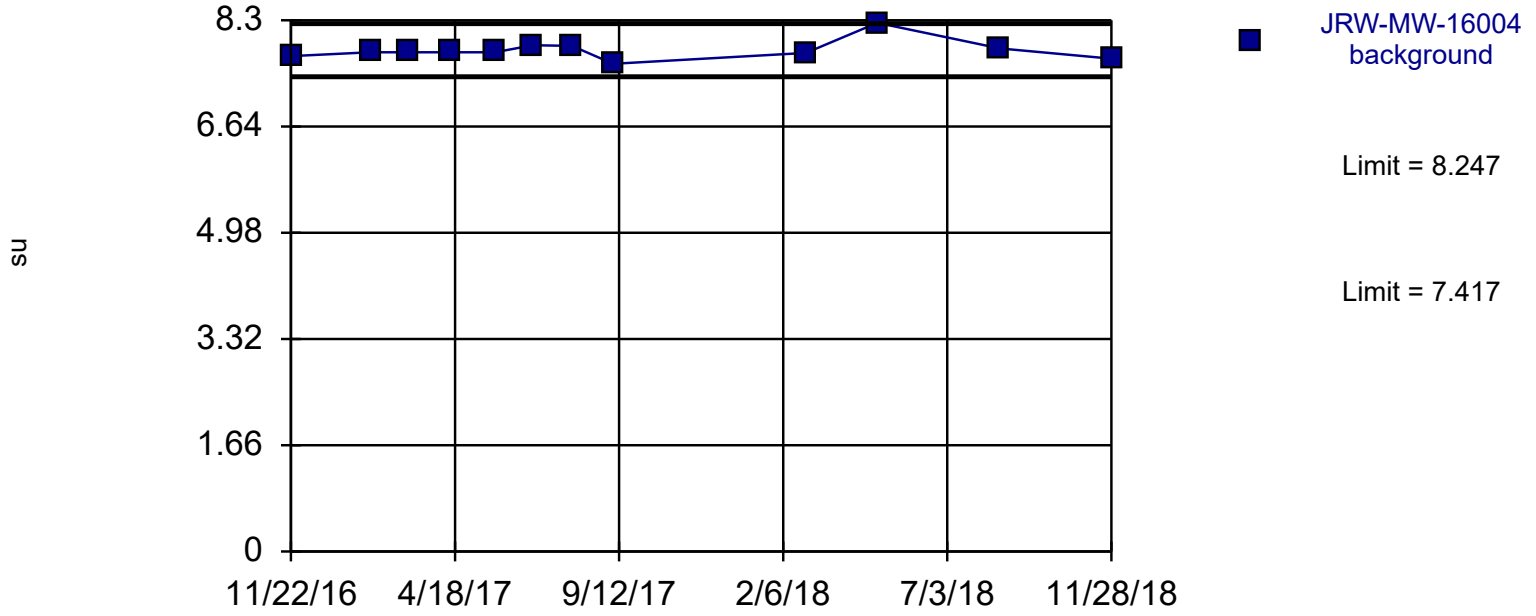
Background Data Summary: Mean=7.652, Std. Dev.=0.09543, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9542, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: pH, Field Analysis Run 6/21/2019 2:52 PM

Client: Consumers Energy Data: JRW_Sanitas_190312

Prediction Limit

Intrawell Parametric, JRW-MW-16004



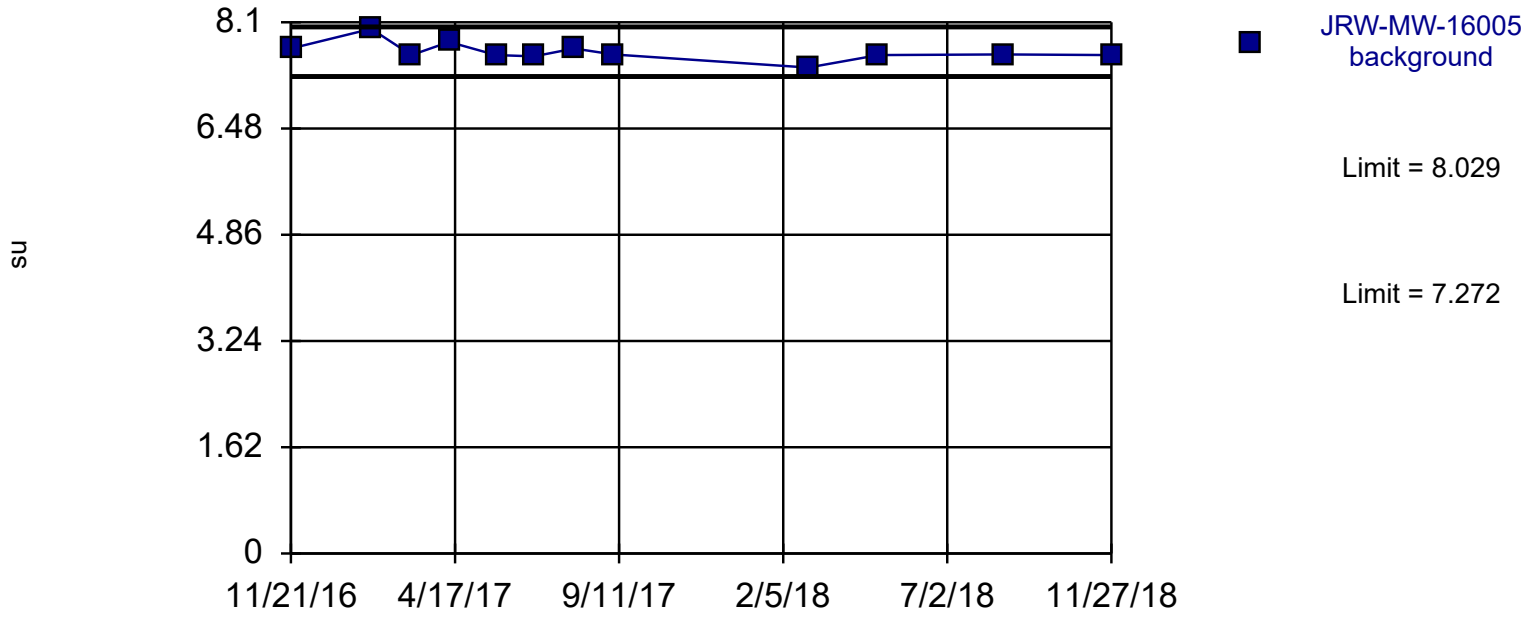
Background Data Summary: Mean=7.832, Std. Dev.=0.1571, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8101, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: pH, Field Analysis Run 6/21/2019 2:53 PM

Client: Consumers Energy Data: JRW_Sanitas_190312

Prediction Limit

Intrawell Parametric, JRW-MW-16005



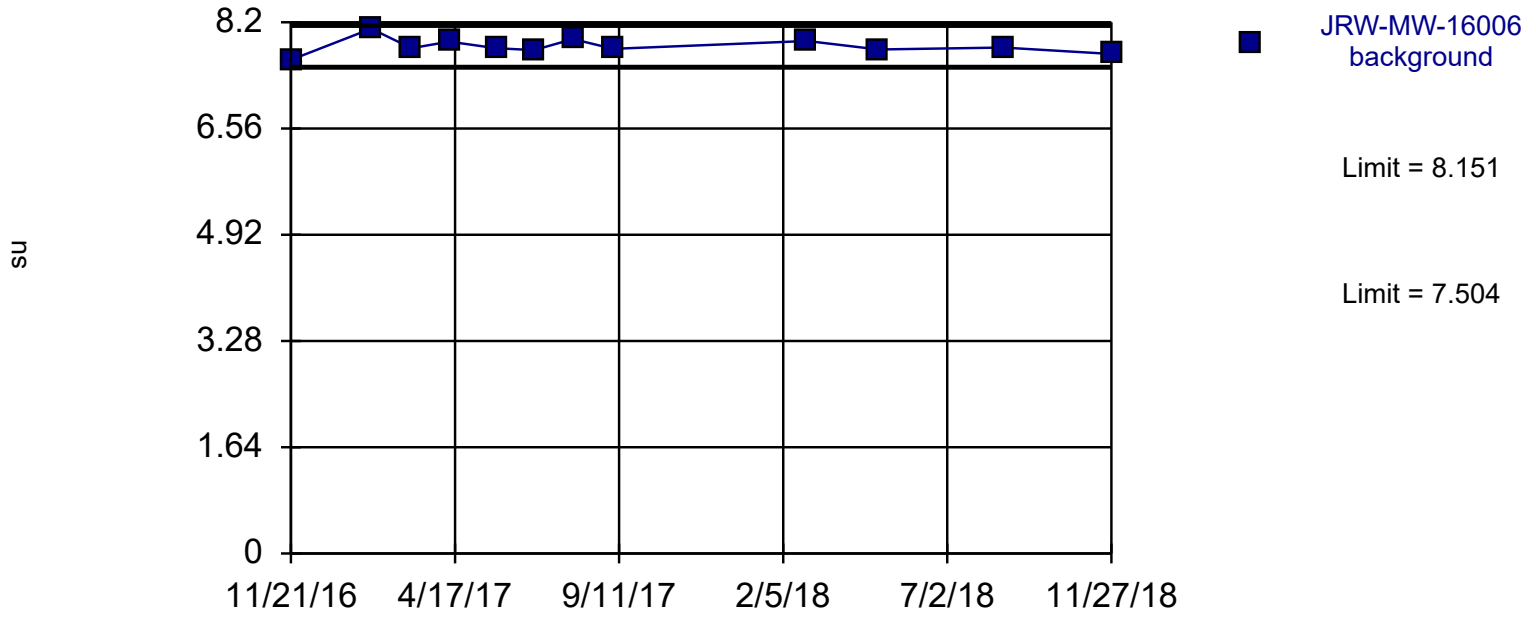
Background Data Summary: Mean=7.651, Std. Dev.=0.1432, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8451, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: pH, Field Analysis Run 6/21/2019 2:53 PM

Client: Consumers Energy Data: JRW_Sanitas_190312

Prediction Limit

Intrawell Parametric, JRW-MW-16006



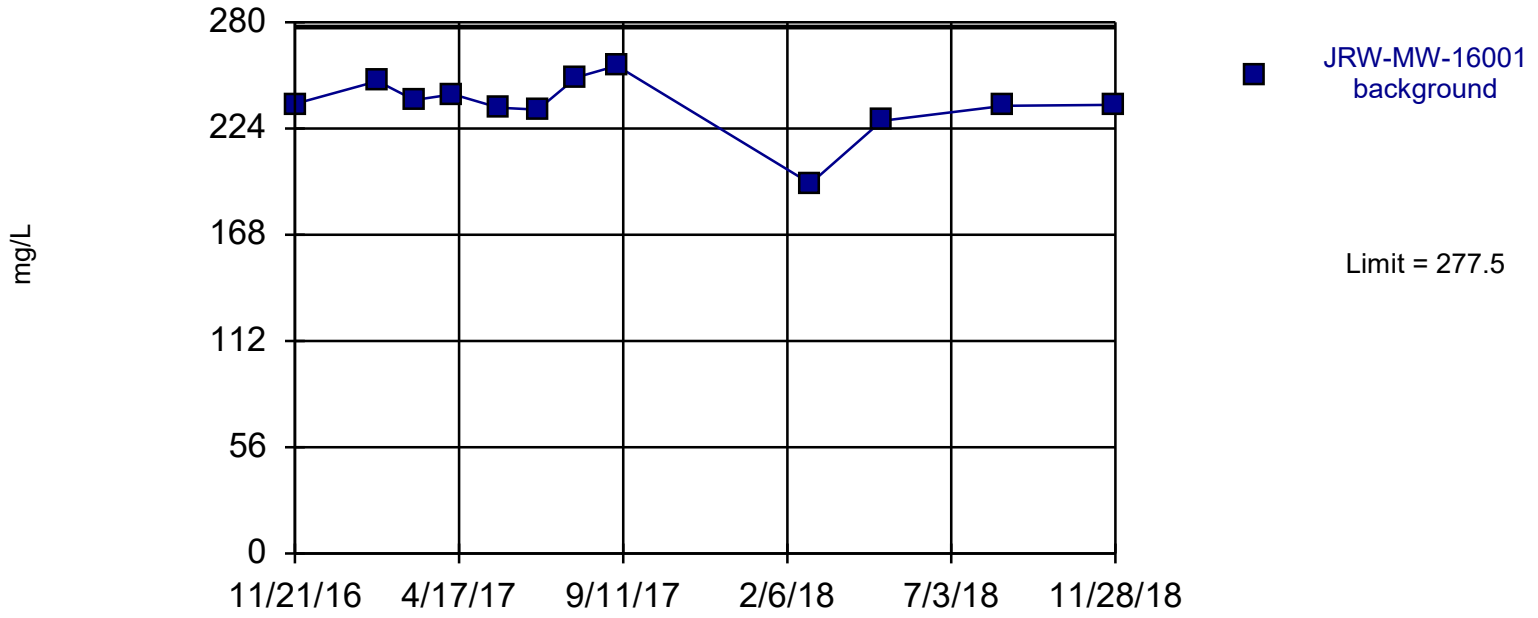
Background Data Summary: Mean=7.828, Std. Dev.=0.1223, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9382, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: pH, Field Analysis Run 6/21/2019 2:54 PM

Client: Consumers Energy Data: JRW_Sanitas_190312

Prediction Limit

Intrawell Parametric, JRW-MW-16001



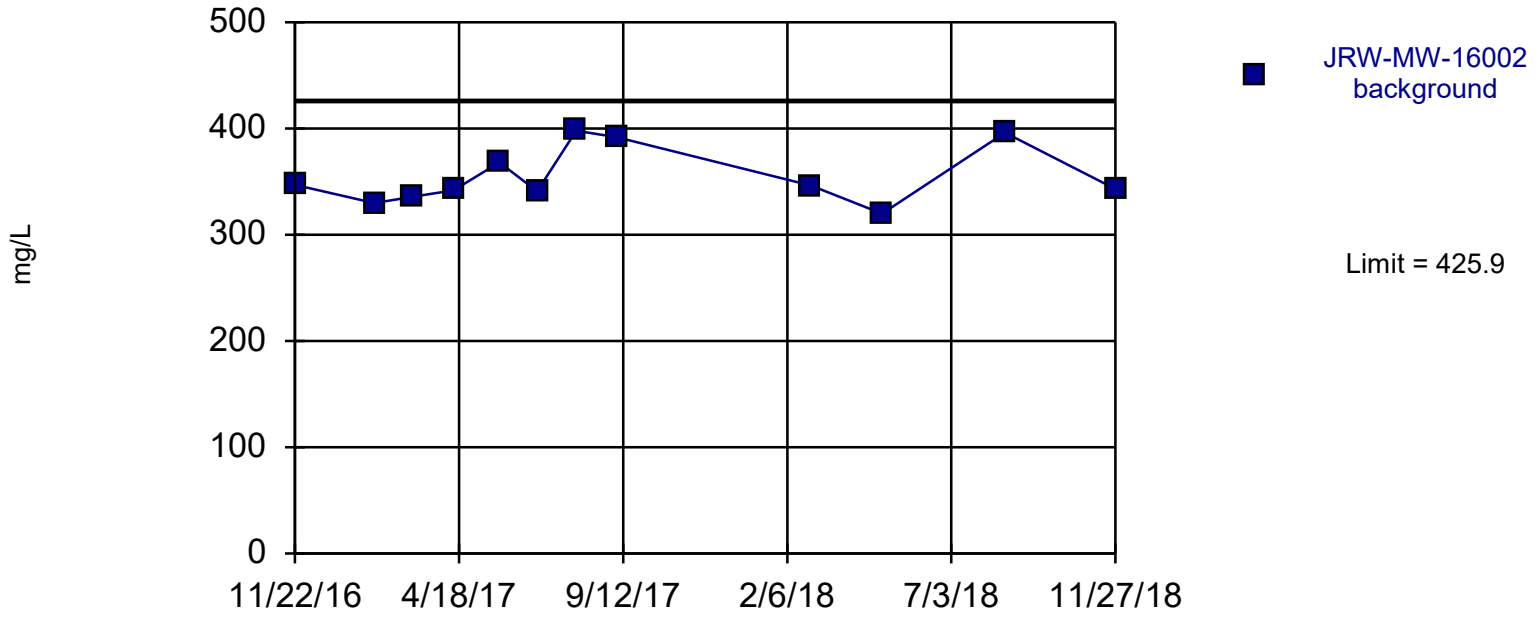
Background Data Summary: Mean=236.6, Std. Dev.=15.45, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8238, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Sulfate Analysis Run 3/11/2019 4:18 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16002



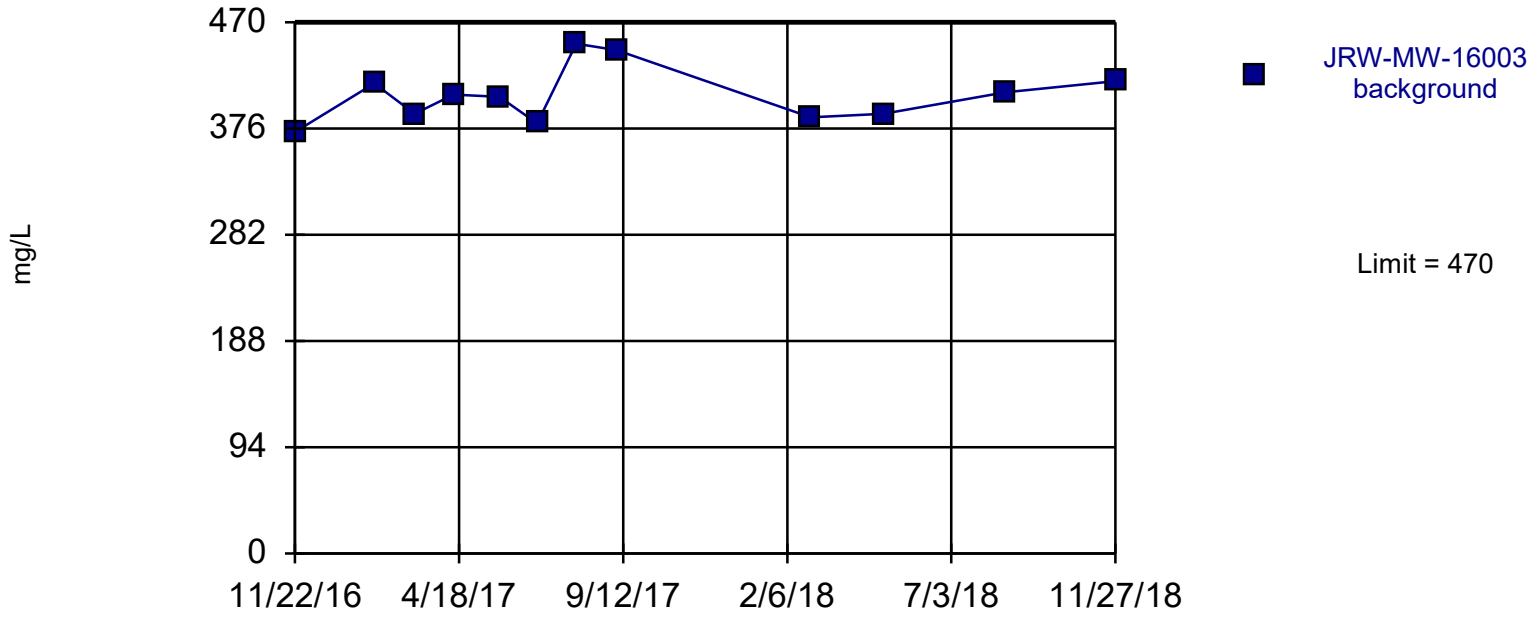
Background Data Summary: Mean=355, Std. Dev.=26.84, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8619, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Sulfate Analysis Run 3/11/2019 4:18 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16003



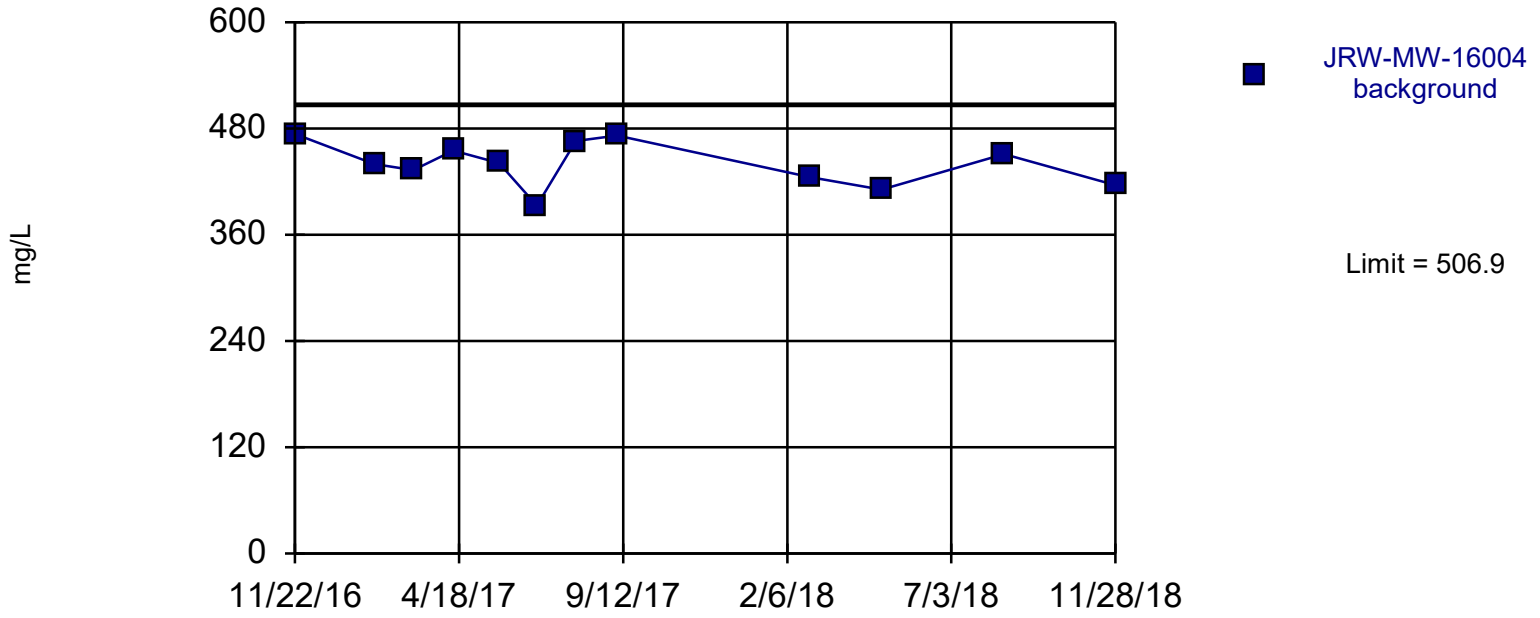
Background Data Summary: Mean=405.5, Std. Dev.=24.4, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9268, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Sulfate Analysis Run 3/11/2019 4:19 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16004



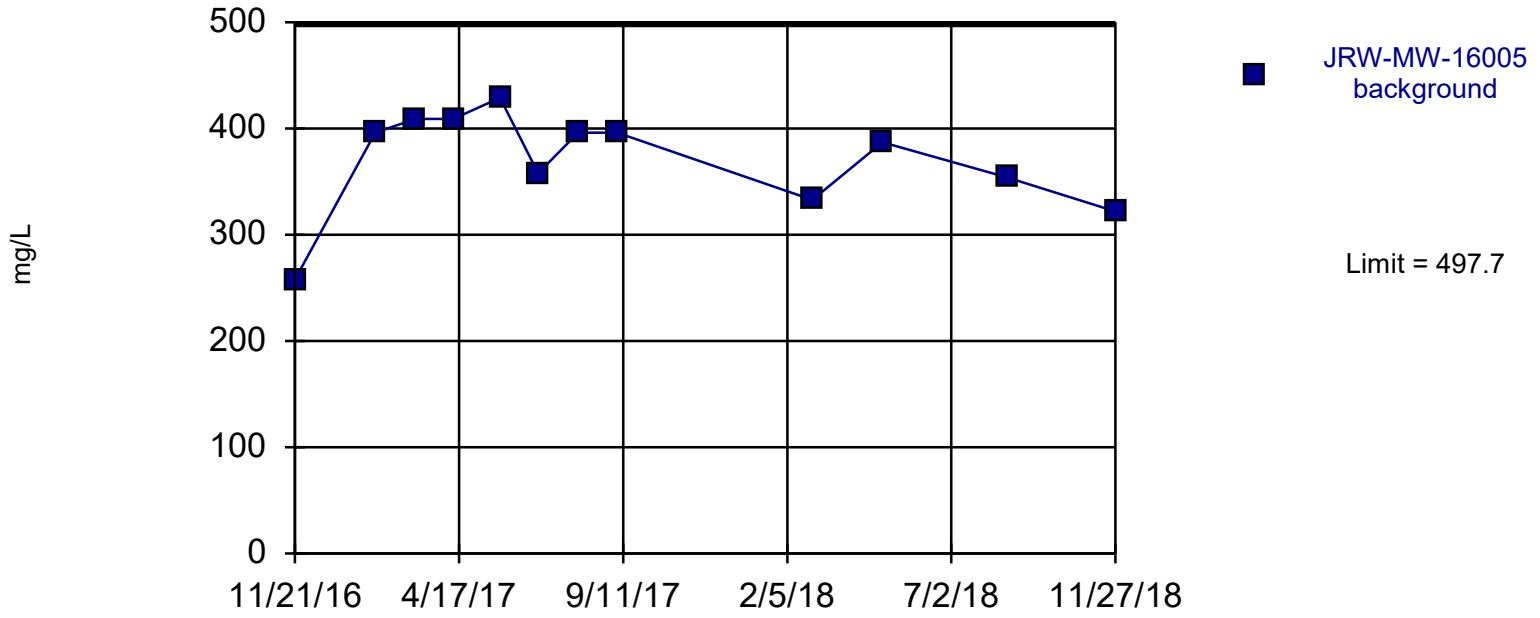
Background Data Summary: Mean=439.8, Std. Dev.=25.41, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9656, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Sulfate Analysis Run 3/11/2019 4:19 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16005



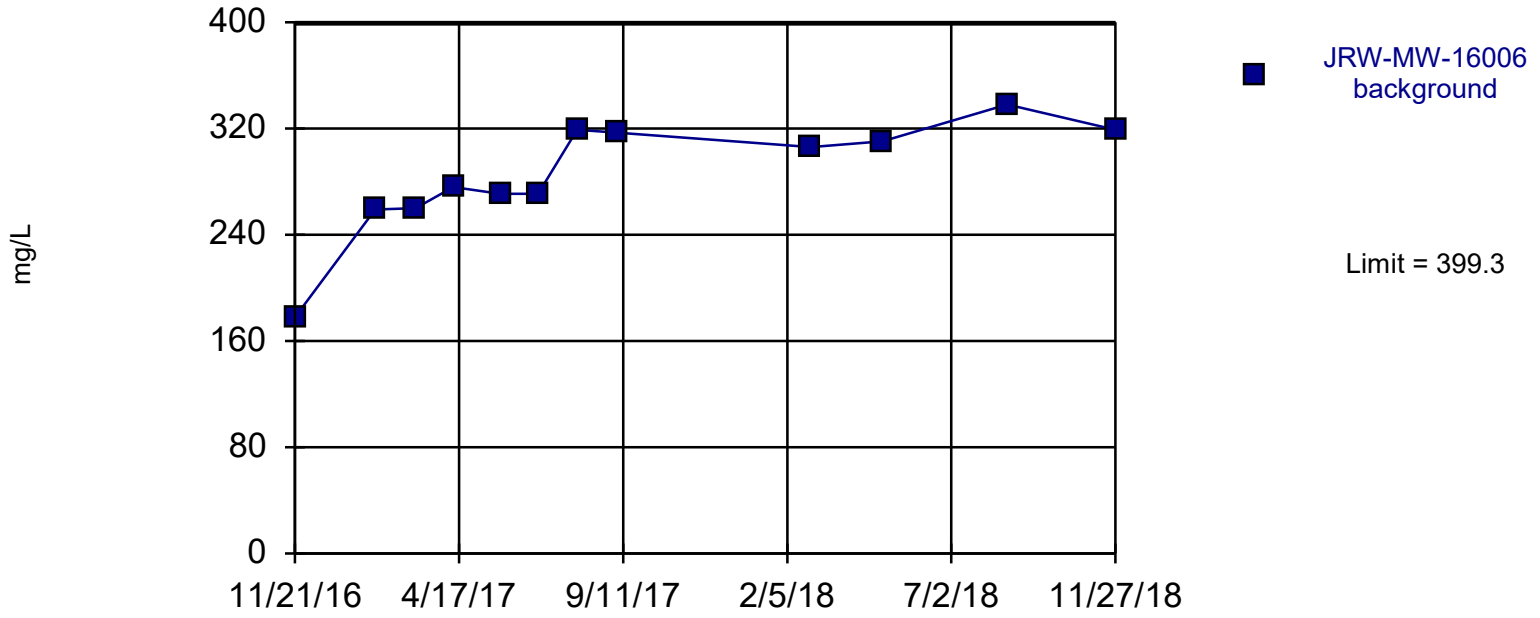
Background Data Summary: Mean=370.6, Std. Dev.=48.1, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8937, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Sulfate Analysis Run 3/11/2019 4:24 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16006



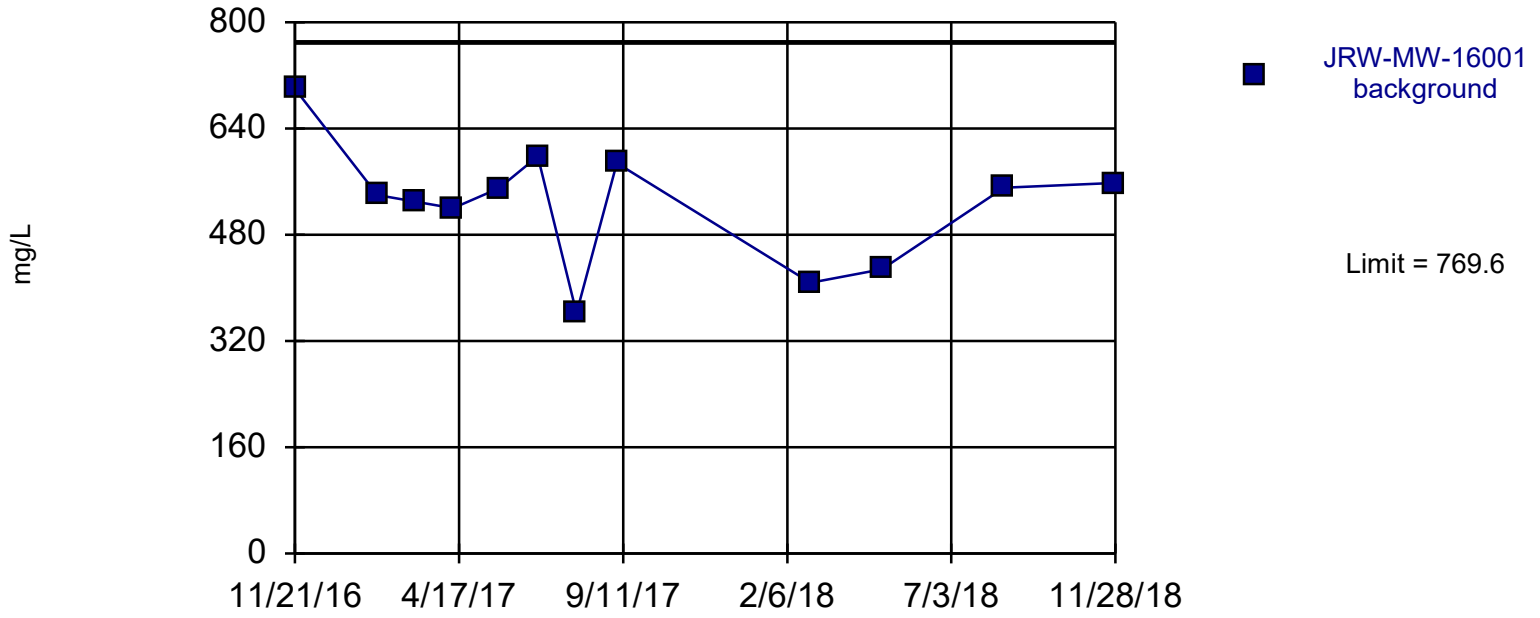
Background Data Summary: Mean=285.4, Std. Dev.=43.13, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8678, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Sulfate Analysis Run 3/11/2019 4:24 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16001



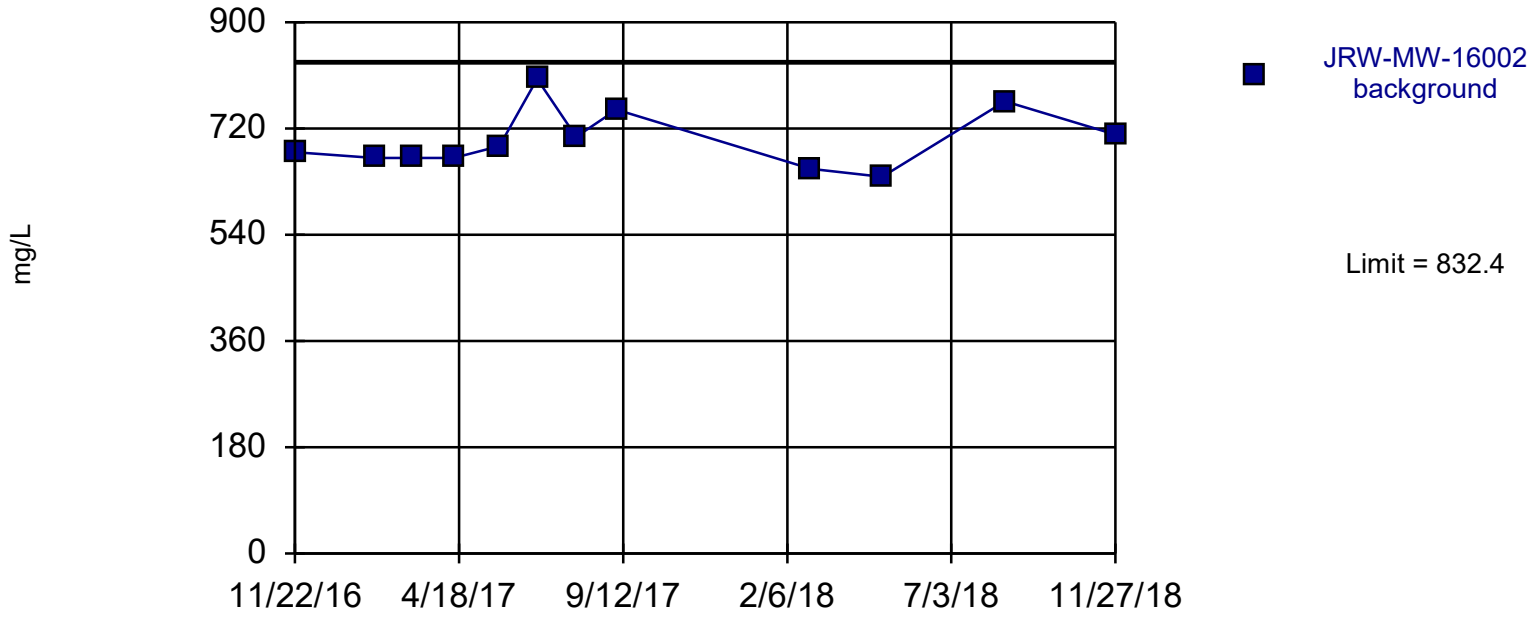
Background Data Summary: Mean=527.8, Std. Dev.=91.53, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9382, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Total Dissolved Solids, Dissolved Analysis Run 3/11/2019 4:24 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16002



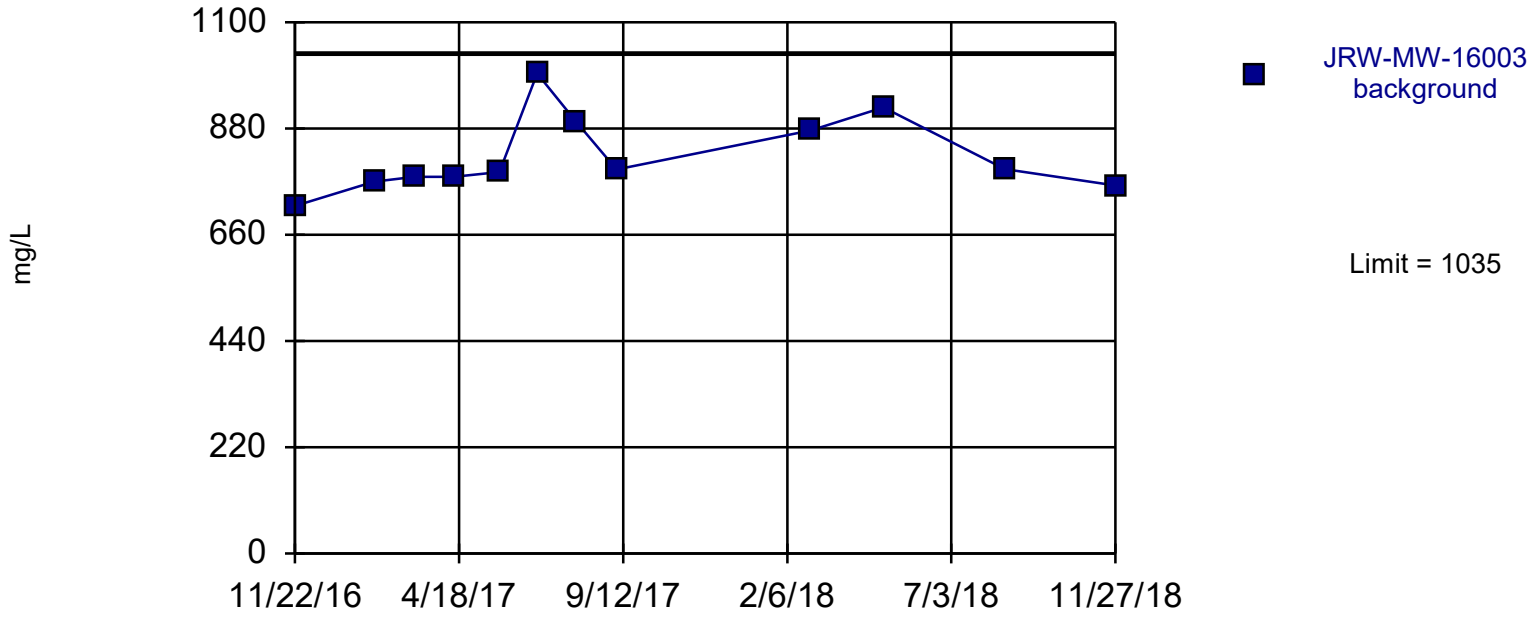
Background Data Summary: Mean=700.7, Std. Dev.=49.87, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9126, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Total Dissolved Solids, Dissolved Analysis Run 3/11/2019 4:25 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16003



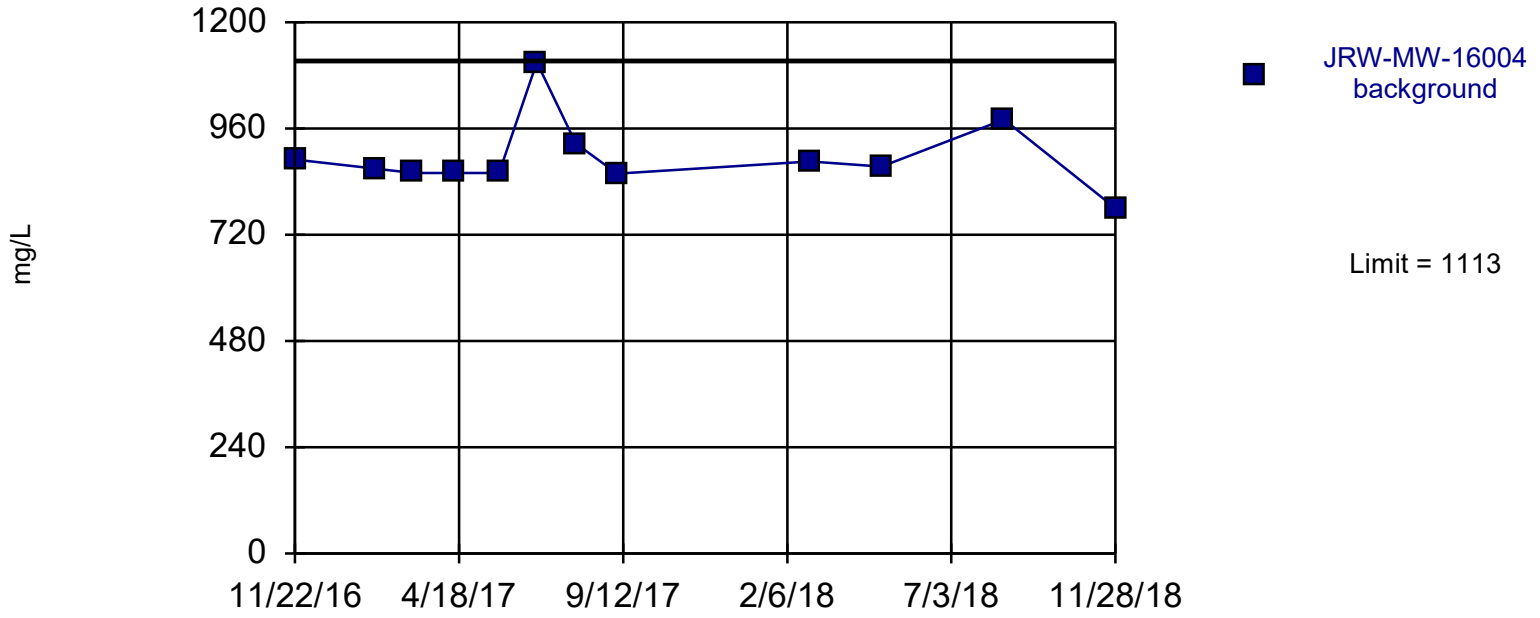
Background Data Summary: Mean=823.4, Std. Dev.=80.19, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8825, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Total Dissolved Solids, Dissolved Analysis Run 3/11/2019 4:25 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16004



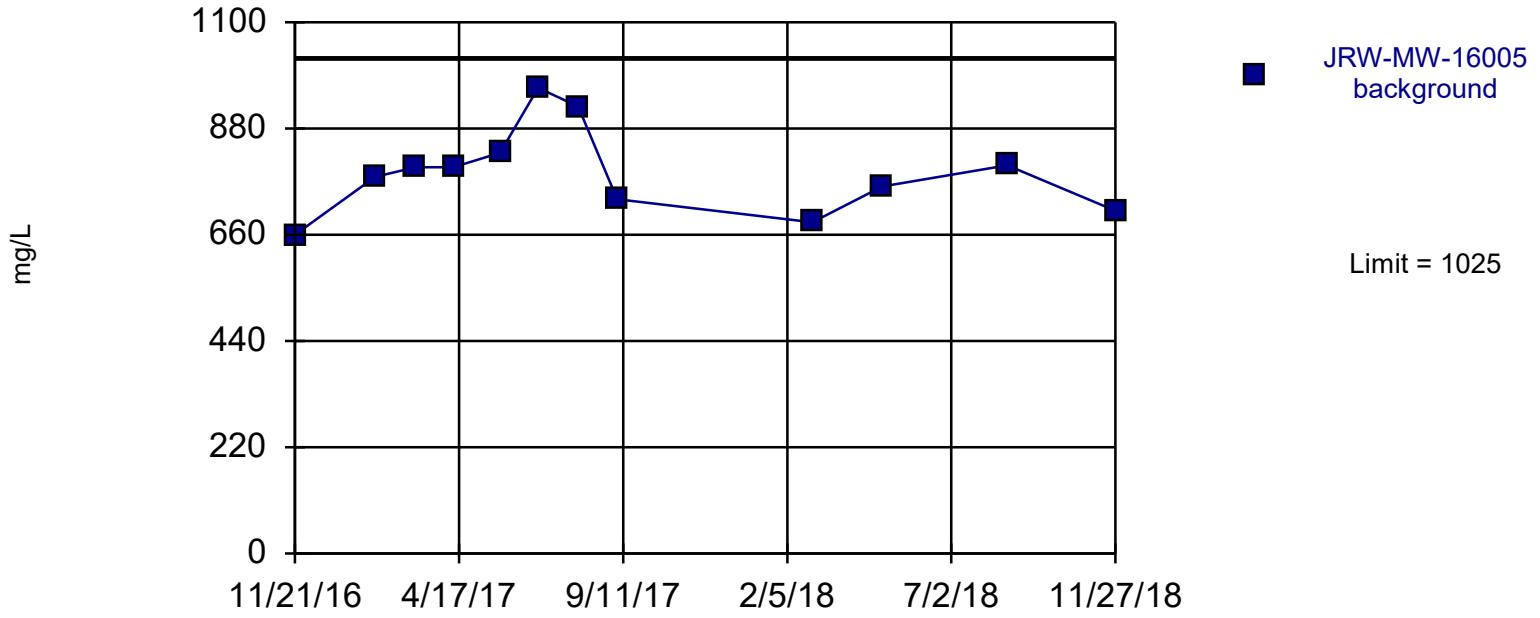
Background Data Summary: Mean=896.2, Std. Dev.=81.93, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8064, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Total Dissolved Solids, Dissolved Analysis Run 3/11/2019 4:39 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16005



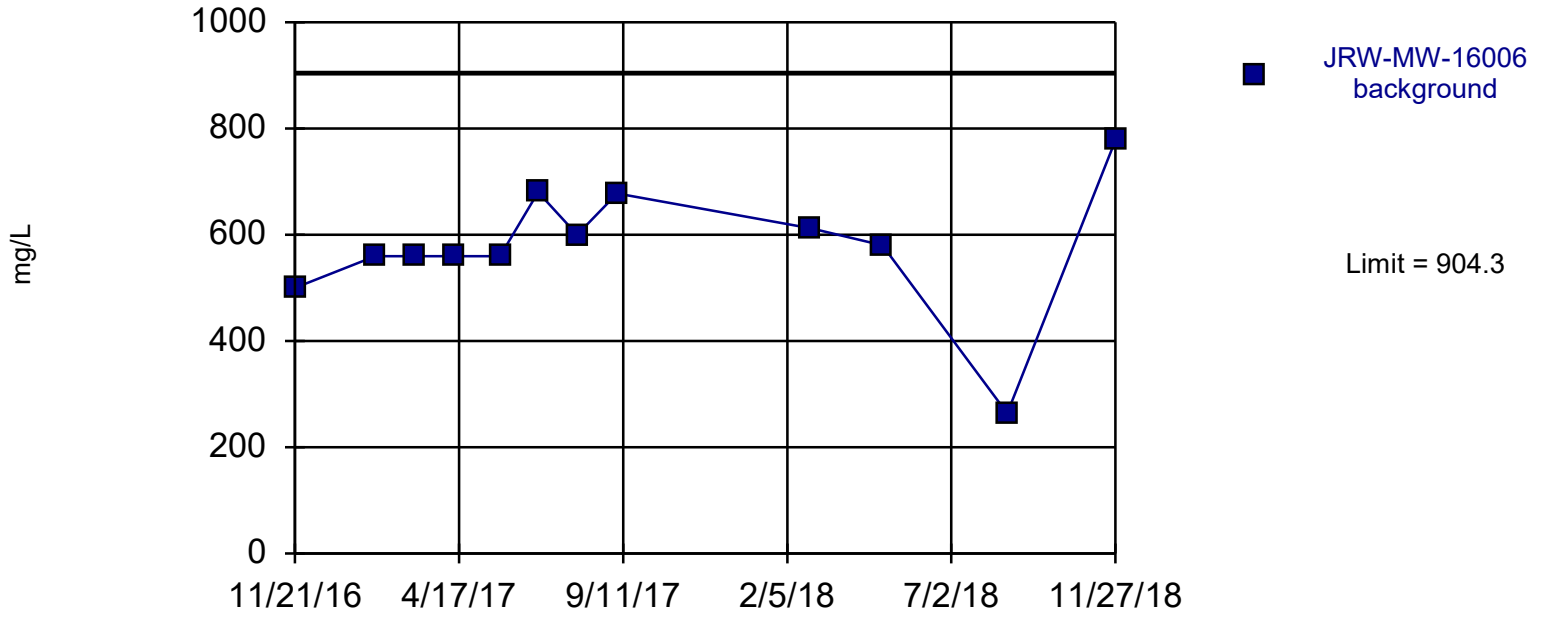
Background Data Summary: Mean=787.8, Std. Dev.=89.93, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.944, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Total Dissolved Solids, Dissolved Analysis Run 3/11/2019 4:39 PM

Client: Consumers Energy Data: JCW_Sanitas_190311

Prediction Limit

Intrawell Parametric, JRW-MW-16006



Background Data Summary: Mean=577.7, Std. Dev.=123.6, n=12. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8662, critical = 0.805. Kappa = 2.643 (c=7, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0006839. Assumes 1 future value.

Constituent: Total Dissolved Solids, Dissolved Analysis Run 3/11/2019 4:39 PM

Client: Consumers Energy Data: JCW_Sanitas_190311