



2018 Annual Groundwater Monitoring
Report

JC Weadock Power Plant
Landfill CCR Unit
Essexville, Michigan

January 2019



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*Prepared For
Consumers Energy Company*

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Executive Summary

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

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

In 2019, CEC compared the assessment monitoring data to the GWPSs to determine whether or not Appendix IV constituents are detected at statistically significant levels above the GWPSs in accordance with §257.95. The statistical comparison of the May 2018 data to the GWPSs was completed on January 14, 2019, in accordance with §257.93(h)(2) and within the compliance schedule clarified by EPA in April 2018.

According to §257.95(g)(3), if the facility determines pursuant to §257.93(h), that any Appendix IV constituents were detected at a statistically significant level exceeding the GWPSs, the facility will either conduct an alternate source demonstration or initiate an assessment of corrective measures according to §257.96 within 90 days. Based on the results of the statistical evaluation CEC will be seeking to initiate an assessment of corrective measures within 90 days of the completion of the statistical analysis. CEC will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Section 1

Introduction

1.1 Program Summary

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

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

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

1.2 Site Overview

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

The area authorized for disposal of solid waste is located east of the JCW plant (Figure 2). The JCW Solid Waste Disposal Area is a 292-acre Type III low hazard industrial waste landfill, permitted for construction in 1992, and is governed by the Part 115 Solid Waste Disposal Area Operating License No. 9440 dated June 26, 2015. The JCW Solid Waste Disposal Area is currently authorized under a permit (Groundwater Discharge Authorization GWE-0005) issued pursuant to Part 31¹ to discharge to the unusable aquifer directly underlying the solid waste that vents almost immediately to the Saginaw River and Saginaw Bay. Interim monitoring and compliance monitoring pursuant to Part 31 and Part 115² detailed in the MDEQ approved Part 115 *Hydrogeological Monitoring Plan Rev. 2: JC Weadock Solid Waste Disposal Area* (June 5, 2015). This existing CCR Landfill is delineated by the acreage of the solid waste disposal area permitted for the vertical expansion and bounded by a soil-bentonite slurry wall constructed along the centerline of the perimeter embankment dike to a depth that it is keyed in the competent confining clay underlying the unit.

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

1.3 Geology/Hydrogeology

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

¹ Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act (NREPA), Public Act 451 of 1994.

² Part 115, Solid Waste Management, of the Natural Resources and Environmental Protection Act (NREPA), Public Act 451 of 1994.

The surficial fill consists of a mixture of varying percentages of ash, sand, and clay-rich fill ranging from 5 to 15 feet thick. Below the surficial fill, native alluvium and lacustrine soils are present at varying depths. Along the perimeter of the landfill, there is a well-graded sand present at depths ranging from 10 to 20 feet below ground surface (ft bgs). The sand is variable in thickness, ranging from <1 to ~6.5 feet, and is discontinuous along the landfill perimeter, as evidenced by the soil boring logs and slurry wall construction documentation. Beneath the surficial fill and sand unit (where present) is 70 to 80 feet of clay till, which acts as an aquiclude and separates the shallow groundwater from the confined sandstone unit, generally encountered at 80-90 ft bgs. Along the southern perimeter of the landfill, some of the upper portion of the clay till (generally >20 ft-bgs) is sand-rich.

In order to reduce porewater flux from the land disposal area, CEC completed construction of a soil-bentonite slurry wall at the site in December 2008. Originally, the slurry wall enclosed the historical fly ash disposal area except for a small segment along the perimeter dike that was designed to vent along the discharge channel immediately upgradient from the NPDES external outfall to prevent water from building up within the site. In July 2018, this vent was closed and the slurry wall reduced porewater flux around the entire perimeter of the JCW landfill. A final cover system will be constructed on the JCW landfill as a part of final closure.

The site is bound by several surface water features (Figure 1): the Saginaw River to the west, a discharge channel and Saginaw Bay (Lake Huron) to the north, Underwood Drain to the east, and Tacey Drain to the south. Groundwater flow in the upper aquifer is largely controlled by the surface water elevations of Saginaw River and Saginaw Bay. In general, shallow groundwater is encountered at a similar or slightly higher elevation relative to the surrounding surface water features. Prior to July 2018, the shallow groundwater flow beneath the JCW Landfill was directed north to the discharge channel due to the vent (e.g. opening) in the bentonite/soil slurry wall. In July 2018, this vent was closed and the slurry wall is now continuous along the entire perimeter of the JCW landfill, thereby reducing the flux of porewater from the landfill.

Section 2

Groundwater Monitoring

2.1 Monitoring Well Network

In accordance with §257.91, CEC established a groundwater monitoring system for the JCW Landfill Unit in October 2017, which consisted of seven monitoring wells that are screened in the uppermost aquifer (four background monitoring wells and three downgradient monitoring wells). The monitoring well locations are shown on Figure 2.

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

When the monitoring well network was first established in October 2017, there was a 1,600-linear-foot section of the perimeter embankment dike that did not have a slurry wall in place. Groundwater flow beneath the JCW landfill was directed towards the discharge channel through this vent in the slurry wall for management under the existing NPDES discharge permit. The downgradient monitoring well network was established as three monitoring wells located in the vent area to assess the quality of groundwater passing the waste boundary (JCW-MW-15011, JCW-MW-15012, and JCW-MW-15023). The seven well monitoring well network was sampled during the preliminary assessment monitoring that occurred in April 2018 as well as the subsequent semi-annual assessment monitoring event in May 2018.

In June 2018, the slurry wall vent was closed to reduced porewater flux around the entire perimeter of the JCW landfill. The three existing downgradient CCR compliance wells were decommissioned by overdrilling, removing the well material, and sealing the borehole in order to allow for the slurry wall construction. The monitoring well decommissioning logs are attached in Appendix A.

Given the change in groundwater flow conditions, a revised groundwater monitoring system has been established to assess slurry wall integrity and determine if there have been any releases from the JCW Landfill CCR unit. The monitoring well network has been designed to provide appropriate coverage for water level and water quality data collection along the

perimeter of the landfill. CEC installed an additional nine (9) monitoring wells in August 2018 to supplement the preexisting groundwater well network currently used under the approved 2015 HMP for Michigan Part 115 compliance to provide appropriate coverage for the collection of groundwater levels and water quality data along the perimeter of the JCW landfill.

Therefore, the modified CCR monitoring well network now consists of the four (4) background as discussed above, and eleven (11) downgradient monitoring wells as discussed in the *Sample and Analysis Plan* (2018 SAP) (TRC, 2018) and *Statistical Analysis Plan* (2018 Stats Plan) (TRC, 2018b). The downgradient monitoring wells include:

JCW-MW-18001	JCW-MW-18004	JCW-MW-18005	JCW-MW-18006
MW-50	MW-51	MW-52	MW-53
MW-54R	MW-55	OW-57R Out	

These monitoring well locations are shown on Figure 5. Soil boring logs and well construction diagrams are included in Appendix A.

2.2 Preliminary Assessment Monitoring

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

2.2.1 Data Summary

The preliminary Appendix IV only assessment monitoring event (per §257.95(b)) was performed on April 9 through April 12, 2018. Downgradient monitoring JCW-MW-15011, JCW-MW-15012, and JCW-MW-15023, and background monitoring wells MW-15002, MW-15008, MW-15016, and MW-15019 were sampled during this monitoring event.

Static water elevation measurements were collected from all monitoring well locations. Static water elevation data are summarized in Table 1 and groundwater elevation data are shown on Figure 3. Monitoring wells were purged with peristaltic pumps or submersible pumps utilizing low-flow sampling methodology. Field parameters were

stabilized at each monitoring well prior to collecting groundwater samples. Field parameters for each monitoring well are summarized in Table 2.

The groundwater samples were analyzed by Pace Analytical Services, LLC (Pace) for Appendix IV constituents during the preliminary assessment monitoring event in accordance with the 2016 SAP. The analytical results are summarized in Table 3.

2.2.2 Data Quality Review

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

2.2.3 Groundwater Flow Rate and Direction

Groundwater elevation data collected during the April 2018 assessment monitoring event were generally similar to data collected previously in the background and detection monitoring events.

Groundwater elevations at the site are generally within the range of 580 to 584 feet above mean sea level (ft AMSL) and groundwater is typically encountered at a similar or slightly higher elevation relative to the surrounding surface water features, flowing outward toward the bounding surface water features. Groundwater elevations measured during the April 2018 sampling event are provided on Table 1 and were used to construct groundwater contour map (Figure 3).

The figure shows that current groundwater flow continues to flow to the north toward the discharge channel due to the bentonite/soil slurry wall. The geometric mean hydraulic gradient throughout the JCW Landfill CCR unit area during these events is estimated at 0.0077 ft/ft. The gradient was calculated using the well pair JCW-MW-15011/JCW-MW-15023, as well as the well water elevation difference and distance between JCW-MW-15012 and the discharge channel. Using the mean hydraulic conductivity of 16 ft/day (ARCADIS, 2016) and an assumed effective porosity of 0.3, the estimated average seepage velocity was approximately 0.41 ft/day or 150 ft/year, which is consistent with previous estimates. The general flow direction is similar to that identified in previous monitoring rounds and continues to demonstrate that the downgradient wells are appropriately positioned to detect the presence of Appendix IV constituents that could potentially migrate from the JCW Landfill CCR unit.

2.3 Semiannual Groundwater Monitoring

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

2.3.1 Data Summary

The first semiannual groundwater assessment monitoring event for 2018 was performed on May 21 through May 24, 2018 by TRC personnel and samples were analyzed by Pace in accordance with the 2016 SAP. Static water elevation data were collected at all monitoring well locations. Groundwater samples were collected from the four background monitoring wells and three downgradient monitoring wells for the Appendix III and Appendix IV constituents and field parameters. A summary of the groundwater data collected during the May 2018 event is provided on Table 1 (static groundwater elevation data), Table 2 (field data), and Table 3 (analytical results).

The second semiannual groundwater assessment monitoring event for 2018 was performed on November 5 through November 9, 2018 by TRC personnel and samples were analyzed by Pace in accordance with the 2018 SAP. Static water elevation data were collected at all monitoring well locations. Groundwater samples were collected from the four background monitoring wells and three downgradient monitoring wells for the Appendix III and Appendix IV constituents and field parameters. As of the writing of this report, lab analysis and data quality review are ongoing. Therefore, a summary of groundwater data will be provided under separate cover after laboratory analysis is complete and results have been reviewed for usability. Consumers Energy will enter this information into the operating record as soon as it is available and will include it in the forthcoming 2019 Annual Groundwater Monitoring and Corrective Action Report.

2.3.2 Data Quality Review

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

2.3.3 Groundwater Flow Rate and Direction

Groundwater elevation data collected during the May 2018 assessment monitoring events were generally similar to data collected previously in the background and detection monitoring events.

Groundwater elevations at the site are generally within the range of 580 to 584 feet above mean sea level (ft AMSL) and groundwater is typically encountered at a similar or slightly higher elevation relative to the surrounding surface water features, flowing outward toward the bounding surface water features. Groundwater elevations measured during the May 2018 sampling event are provided on Table 1 and were used to construct groundwater contour map (Figure 4).

The figure shows that current groundwater flow continues to flow to the north toward the discharge channel due to the bentonite/soil slurry wall. The geometric mean hydraulic gradient throughout the JCW Landfill CCR unit area during these events is estimated at 0.0091 ft/ft. The gradient was calculated using the same well pairs as the aforementioned April 2018 event. Using the mean hydraulic conductivity of 16 ft/day (ARCADIS, 2016) and an assumed effective porosity of 0.3, the estimated average seepage velocity ranged from approximately 0.48 ft/day or 180 ft/year, which is consistent with previous estimates. The general flow direction is similar to that identified in previous monitoring rounds and continues to demonstrate that the downgradient wells are appropriately positioned to detect the presence of Appendix IV constituents that could potentially migrate from the JCW Landfill CCR unit.

Section 3

Statistical Evaluation

3.1 Establishing Groundwater Protection Standards

In accordance with §257.95(h) and the *Groundwater Statistical Evaluation Plan* (2017 Stats Plan) (TRC, October 2017), groundwater protection standards (GWPSs) were established for the Appendix IV constituents following the preliminary assessment monitoring event using nine rounds of data collected from the background monitoring wells MW-15002, MW-15008, MW-15016, and MW-15019 (December 2015 through April 2018). The calculation of the GWPSs is documented in the *Groundwater Protection Standards* technical memorandum included in Appendix C of this annual report (TRC, October 2018). The GWPS is established as the higher of the EPA Maximum Contaminant Level (MCL) or statistically derived background level for constituents with MCLs and the higher of the EPA Regional Screening Levels (RSLs) or background level for constituents with RSLs. The Appendix IV GWPSs will be used to assess whether groundwater has been impacted from the JCW Landfill CCR unit by statistically comparing concentrations in the downgradient wells to the GWPSs for each Appendix IV constituents.

3.2 Data Comparison to Groundwater Protection Standards

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

The statistical evaluation report has been entered into operating record by CEC on January 14, 2019 in accordance with §257.105(h)(8). Notification of the statistical analysis of the assessment monitoring data compared to the GWPS, if necessary, will be made in accordance with §257.106(h) and posting such notification to the publicly accessible compliance website in accordance with §257.107(h) will be completed within 30 days of the completion of the statistical analysis. This evaluation will be included in the forthcoming 2019 Annual Groundwater Monitoring and Corrective Action Report since it was completed in calendar year 2019.

Subsequently, following receipt of final laboratory reports for all Appendix IV constituents and completion of data quality review, the results from the November 2018 semiannual sampling

event will also be statistically compared to the GWPSs using the same approach as the initial event. It is anticipated that the statistical comparison of the second semiannual 2018 event will be completed in March/April 2019.

Consumers Energy will enter this information into the operating record as soon as it is available and include it in the forthcoming 2019 Annual Groundwater Monitoring and Corrective Action Report.

Section 4

Conclusions and Recommendations

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

According to §257.95(g)(3), if the facility determines pursuant to §257.93(h), that any Appendix IV constituents were detected at a statistically significant level exceeding the GWPSs, the facility will either conduct an alternate source demonstration or initiate an assessment of corrective measures according to §257.96 within 90 days. Based on the results of the statistical evaluation CEC will be seeking to initiate an assessment of corrective measures within 90 days of the completion of the statistical analysis. CEC will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

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

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

Section 5

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

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

Tables

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

Well Location	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Elevation (ft)		April 9, 2018		May 14, 2018		
					Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	
Background									
MW-15002	587.71	Sand	580.9	to	570.9	6.65	581.06	6.57	581.14
MW-15008	585.36	Sand with clay	578.7	to	568.7	4.38	580.98	4.15	581.21
MW-15016	586.49	Sand	581.2	to	578.2	4.06	582.43	4.34	582.15
MW-15018	586.42	Sand	580.6	to	576.6	5.07	581.35	5.33	581.09
MW-15019	586.17	Sand and Sand/Clay	579.5	to	569.5	5.21	580.96	5.13	581.04
MW-15020	585.95	Sand	578.5	to	568.5	5.08	580.87	4.81	581.14
MW-15024	586.56	Sand	579.7	to	569.7	5.80	580.76	5.50	581.06
MW-15027	586.25	Sand	578.2	to	568.2	5.37	580.88	5.11	581.14
DEK Bottom Ash Pond									
DEK-MW-15001 ⁽¹⁾	594.64	Sand	576.1	to	575.1	11.44	583.20	--	--
DEK-MW-18001 ⁽¹⁾	593.47	Sand	579.2	to	574.2	--	--	8.49	584.98
DEK-MW-15002	590.87	Sand	578.3	to	575.3	4.57	586.30	4.41	586.46
DEK-MW-15003	602.80	Sand	578.8	to	574.8	14.24	588.56	14.11	588.69
DEK-MW-15004	611.05	Sand	576.6	to	571.6	22.91	588.14	22.87	588.18
DEK-MW-15005	589.72	Sand	572.3	to	567.3	9.10	580.62	8.67	581.05
DEK-MW-15006	589.24	Sand	573.0	to	568.0	8.60	580.64	8.20	581.04
JCW Bottom Ash Pond									
JCW-MW-15007	587.40	Sand	582.7	to	579.2	3.69	583.71	3.89	583.51
JCW-MW-15009	589.64	Sand	581.9	to	576.9	8.48	581.16	8.09	581.55
JCW-MW-15010	597.76	Sand	579.7	to	578.2	16.37	581.39	15.55	582.21
JCW-MW-15028	589.37	Sand	567.7	to	564.7	6.93	582.44	6.84	582.53
JCW Landfill									
JCW-MW-15011	597.07	Sand	582.4	to	578.9	14.36	582.71	13.59	583.48
JCW-MW-15012	595.07	Sand and Clay	581.4	to	576.4	14.48	580.59	13.75	581.32
JCW-MW-15023	595.32	Sand	579.7	to	574.7	13.36	581.96	12.66	582.66

Notes:

Survey data from: Rowe Professional Services Company (Nov. 2015) and Consumers Energy Company drawings: SG-21733, Sheet 1, Rev. G (Karn, 11/27/18); and SG-21733, Sheet 2, Rev. C (Weadock, 11/27/18).

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.

--: Not measured.

(1) - DEK-MW-15001 was decommissioned on April 18, 2018 due to the installation of the new Karn Lined Impoundment. DEK-MW-18001 was installed on May 21, 2018.

Table 2
 Summary of Field Parameter Results – April and May 2018
 JC Weadock Landfill – RCRA CCR Monitoring Program
 Essexville, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Background							
MW-15002	4/9/2018	0.31	23.4	6.7	9,267	7.4	2.3
	5/22/2018	0.32	-29.7	7.0	6,259	11.0	4.8
MW-15008	4/10/2018	0.19	-5.6	6.6	1,507	6.4	4.9
	5/22/2018	0.24	-33.8	6.8	1,456	9.4	4.6
MW-15016	4/10/2018	1.33	45.7	7.3	1,675	4.7	3.8
	5/22/2018	0.34	45.4	7.3	1,547	13.3	1.7
MW-15019	4/9/2018	0.25	-58.1	6.8	2,091	5.9	3.8
	5/22/2018	0.23	-53.1	6.9	2,030	9.4	3.9
Landfill							
JCW-MW-15011	4/11/2018	0.21	-100.6	7.1	946	10.5	1.2
	5/21/2018	0.22	-277.9	7.0	1,095	12.1	1.6
JCW-MW-15012	4/11/2018	0.34	12.7	6.9	897	9.2	2.7
	5/21/2018	0.34	-8.6	7.0	830	11.3	2.9
JCW-MW-15023	4/11/2018	0.21	-85.1	7.4	869	10.4	3.7
	5/21/2018	0.31	-89.8	7.5	715	11.2	4.3

Notes:

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

Table 3
 Summary of Groundwater Sampling Results (Analytical) – April and May 2018
 JC Weadock Landfill – RCRA CCR Monitoring Program
 Essexville, Michigan

Sample Location:						JCW-MW-15011		JCW-MW-15012		JCW-MW-15023	
Sample Date:						4/11/2018	5/21/2018	4/11/2018	5/21/2018	4/11/2018	5/21/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient					
Appendix III											
Boron	ug/L	NC	500	500	4,000	--	1,790	--	1,040	--	1,170
Calcium	mg/L	NC	NC	NC	500	--	131	--	102	--	62.2
Chloride	mg/L	250**	250	250	50	--	65.5	--	32.7	--	70.1
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	7.08	7.04	6.93	6.98	7.35	7.54
Sulfate	mg/L	250**	250	250	500	--	85.2	--	72.1	--	92.9
Total Dissolved Solids	mg/L	500**	500	500	500	--	666	--	506	--	402
Appendix IV											
Antimony	ug/L	6	6	6	2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	10	10	10	< 1.0	1.7	20.0	22.9	101	110
Barium	ug/L	2,000	2,000	2,000	1,200	99.7	98.9	116	109	244	166
Beryllium	ug/L	4	4	4	25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5	5	2.5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	100	100	11	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	40	100	100	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4	4	14	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440	35	31	71	61	34	26
Mercury	ug/L	2	2	2	0.20#	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	73	210	120	< 5.0	< 5.0	12.0	15.7	< 5.0	< 5.0
Radium-226	pCi/L	NC	NC	NC	NC	< 0.807	< 0.867	< 0.847	< 0.676	< 0.908	< 0.745
Radium-226/228	pCi/L	5	NC	NC	NC	< 1.72	< 1.71	< 1.74	< 1.50	< 1.79	< 1.83
Radium-228	pCi/L	NC	NC	NC	NC	< 0.910	< 0.842	1.03	< 0.826	< 0.884	< 1.08
Selenium	ug/L	50	50	50	5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	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.

* - 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 hardness of 258 mg CaCO3/L (average of SW-01 [Lake Huron] and SW-02 [Saginaw River] collected in April 2018) per footnote {G} of Michigan Part 201 criteria tables. Chromium GSI criterion based on hexavalent chromium per footnote {H}. GSI criterion is protective for surface water used as a drinking water source as described in footnote {X}. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters per footnote {FF}

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

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

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Figures



BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.



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

TRC - GIS

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

TITLE:
SITE LOCATION MAP

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

FIGURE 1



LEGEND

- BACKGROUND MONITORING WELL
- DEK BOTTOM ASH POND & LINED IMPOUNDMENT MONITORING WELL
- DEK BOTTOM ASH POND MONITORING WELL
- DEK LINED IMPOUNDMENT MONITORING WELL
- DECOMMISSIONED MONITORING WELL
- JCW BOTTOM ASH POND MONITORING WELL
- JCW LANDFILL MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- SURFACE WATER GAUGING STATION
- SLURRY WALL (APPROXIMATE)
- EXTENT OF GEOSYNTHETICS (KARN LINED IMPOUNDMENT)

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

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

PROJECT:	
CONSUMERS ENERGY COMPANY DE KARN AND JC WEADOCK POWER PLANTS ESSEXVILLE, MICHIGAN	
TITLE:	
SITE PLAN	
DRAWN BY: S. MAJOR	PROJ NO.: 290805-001
CHECKED BY: D. LITZ	FIGURE 2
APPROVED BY: G. CROCKFORD	
DATE: JANUARY 2019	
1540 Eisenhower Place Ann Arbor, MI 48108-3284 Phone: 734.971.7080 www.trcsolutions.com	
FILE NO.: 290805-001-018.mxd	



LEGEND

- BACKGROUND MONITORING WELL
- DEK BOTTOM ASH POND & LINED IMPOUNDMENT MONITORING WELL
- DEK BOTTOM ASH POND MONITORING
- DECOMMISSIONED MONITORING
- JCW BOTTOM ASH POND MONITORING
- JCW LANDFILL MONITORING
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- SLURRY WALL (APPROXIMATE)
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- GROUNDWATER ELEVATION (FEET, MSL)

- ### NOTES
- BASE MAP IMAGERY FROM USDA - NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/10/2016.
 - WELL LOCATIONS SURVEYED BY ROWE PROFESSIONAL SERVICES COMPANY ON 11/4/2015.
 - NOAA/NATIONAL OCEANIC SERVICE GREAT LAKES GAUGING STATION, ESSEXVILLE, MI (ID: 9075035).
 - MONITORING WELL DEK- MW-18001 INSTALLED IN MAY 2018. SURVEY DATA NOT YET AVAILABLE.

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

PROJECT:		CONSUMERS ENERGY COMPANY DE KARN AND JC WEADOCK POWER PLANTS ESSEXVILLE, MICHIGAN	
TITLE:		SHALLOW GROUNDWATER CONTOUR MAP APRIL 2018	
DRAWN BY:	S. MAJOR	PROJ NO.:	290805-001
CHECKED BY:	D. LITZ	FIGURE 3	
APPROVED BY:	G. CROCKFORD		
DATE:	JANUARY 2019		
FILE NO.:		290805-001-017.mxd	



LEGEND

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

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

0 1,000 2,000 Feet

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

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

TITLE: **SHALLOW GROUNDWATER CONTOUR MAP
MAY 2018**

DRAWN BY: S. MAJOR	PROJ NO.: 290805-001
CHECKED BY: D. LITZ	FIGURE 4
APPROVED BY: G. CROCKFORD	
DATE: JANUARY 2019	

TRC

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FILE NO.: 290805-001-019.mxd

Appendix A

Monitoring Well Records



WELL CONSTRUCTION LOG

WELL NO. JCW-MW-18001

Facility/Project Name: CEC Weadock: JCW HMP Well Installation		Date Drilling Started: 8/23/18	Date Drilling Completed: 8/23/18	Project Number: 290805.0001.0000
Drilling Firm: Stearns Drilling	Drilling Method: Hollow Stem Auger	Surface Elev. (ft) 593.8	TOC Elevation (ft) 596.73	Total Depth (ft bgs) 20.5
Boring Location: North side of the road that borders the discharge channel. Adjacent to JCW-OW-18001.		Personnel Logged By - Jake Krenz Driller - Mike Heffernan		Drilling Equipment: CME-55
Civil Town/City/or Village: Essexville	County: Bay County	State: Michigan	Water Level Observations: While Drilling: Date/Time 8/23/18 10:00 ▽ Depth (ft bgs) <u>12.00</u> After Drilling: Date/Time 8/24/18 10:51 ▾ Depth (ft bgs) <u>13.68</u>	

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 SS	80	4 4 4 6	0 0 0 2	GRAVEL WITH SAND mostly medium to coarse gravel, little fine to medium sand, light brownish gray (10YR 6/2), dry, loose.	GW			
2 SS	80	11 8 7 7	2 0 0 0	CLAY WITH SAND mostly clay, little fine sand, trace fine gravel, low plasticity, brown (10YR 5/3), dry, medium stiff to stiff. SAND mostly fine to medium sand, trace medium gravel, very dark gray (10YR 3/1), moist, loose.	CL SP			
3 SS	90	5 10 15 14	4 0 0 0	CLAY WITH SAND mostly clay, little fine sand, trace fine gravel, low plasticity, brown (10YR 5/3), dry, medium stiff to stiff. SAND mostly medium sand, trace fine to medium gravel, very dark grayish brown (10YR 3/2), dry, loose, trace slag and coal fragments.	CL SP			
4 SS	100	2 4 4 4	6 0 0 0	SANDY CLAY mostly clay, some fine to medium sand, low plasticity, brown (10YR 5/3), moist, soft. SAND mostly fine to medium sand, trace fine to medium gravel, brown (10YR 4/3), dry, loose.	CL SP			
5 SS	80	3 4 4 6	8 0 0 0	Change to no gravel, brownish yellow (10YR 6/6) at 8.0 feet. CLAY WITH SAND mostly clay, little fine sand, trace fine gravel, low plasticity, dark yellowish brown (10YR 4/4), dry, stiff, sand seams (less than 0.25 inches thick) from 10 to 12 feet.	SP CL			
6 SS	100	3 3 5 5	10 0 0 0	COAL ASH mostly ash, black (10YR 2/1), saturated, loose.	CL			
7 SS	10	1 1 1 1	12 0 0 0					
8 SS	100	0 1 3	14 0 0	PEAT mostly organic material, trace silt, very dark brown (10YR 2/2), moist, soft.	PT			
9 SS	100	3 5 7 7	16 0 0 0	SAND mostly medium sand, dark gray (10YR 4/1), saturated, loose.	SW			
10 SS	100	0 3 5 1	18 0 0 0	CLAY WITH SAND mostly clay, few to little fine sand, trace fine to medium gravel, low plasticity, gray (10YR 5/1), moist, stiff.	CL			
11 NR	0		20	End of boring at 20.5 feet below ground surface.				

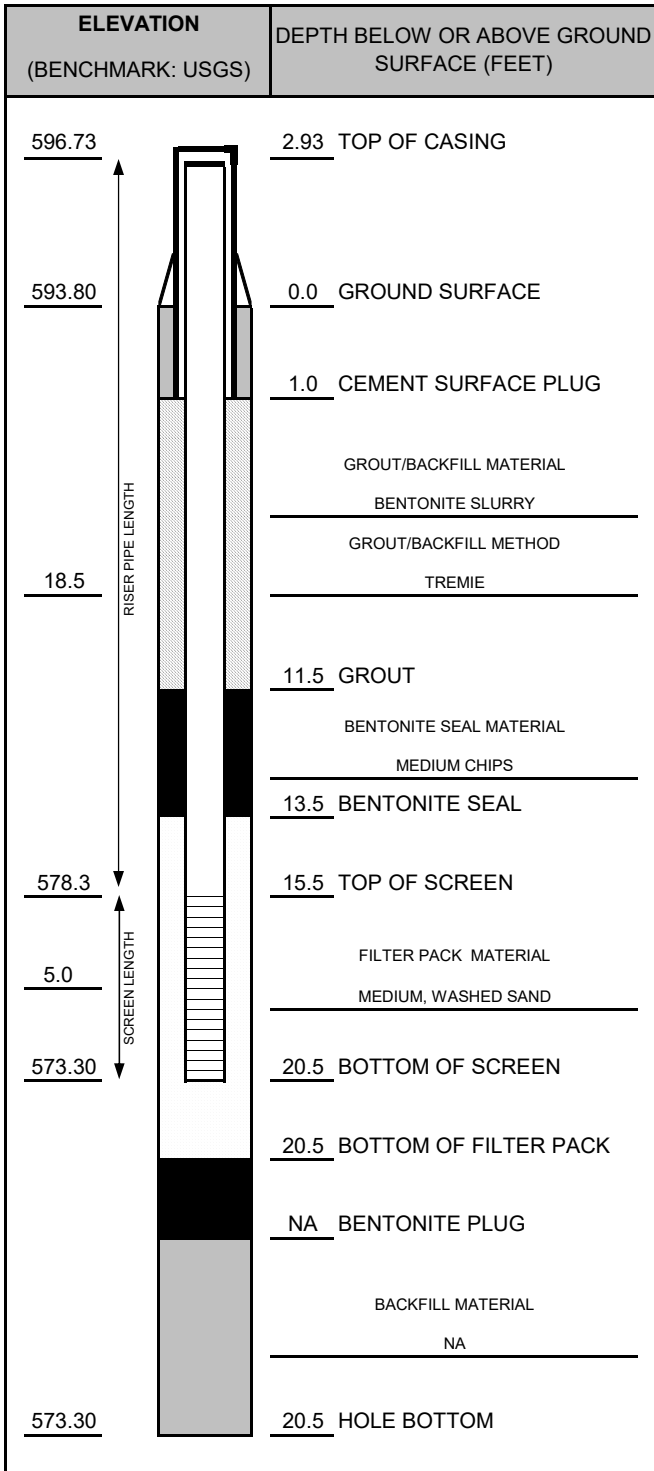
SOIL BORING WELL CONSTRUCTION LOG 290805.0001 WEADOCK HMP REVISIONS.GPJ TRC CORP.GDT 290805.0001.0000 12/5/18

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



WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC Weadock: JCW HMP Well Installation	WELL ID: JCW-MW-18001
PROJ. NO: 290805.0001	DATE INSTALLED: 8/23/2018 INSTALLED BY: Jake Krenz CHECKED BY: CS



CASING AND SCREEN DETAILS	
TYPE OF RISER:	<u>2-INCH PVC</u>
PIPE SCHEDULE:	<u>40</u>
PIPE JOINTS:	<u>THREADED O-RINGS</u>
SOLVENT USED?	<u>NO</u>
SCREEN TYPE:	<u>2-INCH PVC</u>
SCR. SLOT SIZE:	<u>0.01-INCH</u>
BOREHOLE DIAMETER:	<u>9</u> IN. FROM <u>0</u> TO <u>20.5</u> FT.
	<u> </u> IN. FROM <u> </u> TO <u> </u> FT.
SURF. CASING DIAMETER:	<u> </u> IN. FROM <u> </u> TO <u> </u> FT.
	<u> </u> IN. FROM <u> </u> TO <u> </u> FT.

WELL DEVELOPMENT	
DEVELOPMENT METHOD:	<u>SURGE AND PUMP</u>
TIME DEVELOPING:	<u>0.75</u> HOURS
WATER REMOVED:	<u>30</u> GALLONS
WATER ADDED:	<u>0</u> GALLONS
WATER CLARITY BEFORE / AFTER DEVELOPMENT	
CLARITY BEFORE:	<u>VERY TURBID</u>
COLOR BEFORE:	<u>BLACK</u>
CLARITY AFTER:	<u>CLEAR</u>
COLOR AFTER:	<u>NONE</u>
ODOR (IF PRESENT):	<u>NONE</u>

WATER LEVEL SUMMARY				
	MEASUREMENT (FEET)		DATE	TIME
DTB BEFORE DEVELOPING:	23.67	T/PVC	8/24/2018	1051
DTB AFTER DEVELOPING:	23.66	T/PVC	8/27/2018	1550
SWE BEFORE DEVELOPING:	16.68	T/PVC	8/24/2018	1051
SWE AFTER DEVELOPING:	16.05	T/PVC	8/27/2018	1550
OTHER SWE:	NA	T/PVC	NA	NA
OTHER SWE:	NA	T/PVC	NA	NA

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

NOTES:



WELL CONSTRUCTION LOG

WELL NO. JCW-MW-18004

Facility/Project Name: CEC Weadock: JCW HMP Well Installation		Date Drilling Started: 8/22/18	Date Drilling Completed: 8/22/18	Project Number: 290805.0001.0000
Drilling Firm: Stearns Drilling	Drilling Method: Hollow Stem Auger	Surface Elev. (ft) 590.4	TOC Elevation (ft) 593.04	Total Depth (ft bgs) 20.0
Boring Location: Approximately 400 feet north of the southeast corner of site on the east side of the road.		Personnel Logged By - Jake Krenz Driller - Mike Heffernan		Drilling Equipment: CME-55
Civil Town/City/or Village: Essexville	County: Bay County	State: Michigan	Water Level Observations: While Drilling: Date/Time 8/22/18 11:00 ▽ Depth (ft bgs) <u>7.00</u> After Drilling: Date/Time 8/27/18 14:39 ▾ Depth (ft bgs) <u>9.20</u>	

SOIL BORING WELL CONSTRUCTION LOG 290805.0001 WEADOCK HMP REVISIONS.GPJ TRC_CORP_INCHES.GDT 290805.0001.0000 12/13/18

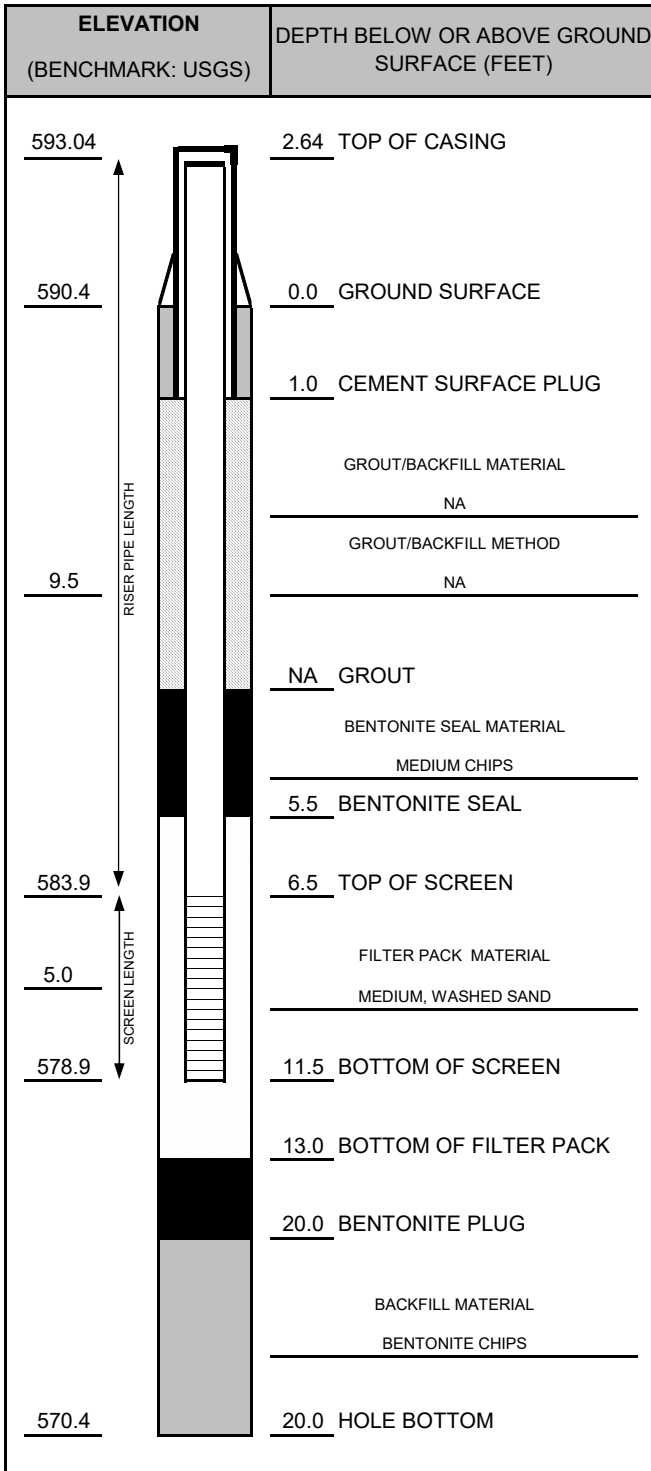
SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 SS	50	1	1	CLAY Mostly clay, few fine sand, trace silt, trace fine gravel, dark grayish brown (10YR 4/2), low plasticity, dry, stiff.	CL			
2 SS	100	3	2					
3 SS	80	2	4					
4 SS	100	3	6	CLAY WITH SAND Mostly clay, little fine sand, trace fine to medium gravel, low to medium plasticity, brown (10YR 4/3), moist, medium stiff.	CL			
5 SS	90	3	8					
6 SS	100	1	9.25	SANDY CLAY mostly clay, some fine to medium sand, trace fine to medium gravel, low to medium plasticity, brown (10YR 4/3), moist, medium stiff, plant roots present. Change to soft, no plant roots present at 8.75 feet. Change to moist, stiff, no plant roots present at 9.5 feet.	CL			
7 SS	100	3	10					
8 SS	100	4	12	CLAY WITH SAND Mostly clay, few to little fine sand, trace fine to medium gravel, low to medium plasticity, brown (10YR 4/3), moist, medium stiff. Change to soft to medium stiff at 13.0 feet.	CL			
9 SS	100	4	14					
10 SS	100	5	16	SANDY CLAY Mostly clay, little to some fine sand, trace fine gravel, low plasticity, yellowish brown (10YR 5/4), moist, medium stiff to stiff. Change to dry, very stiff at 16.0 feet.	CL			
		11	18					
		13	20					
				End of boring at 20.0 feet below ground surface.				

Signature: Firm: TRC Environmental Corporation 734.971.7080
1540 Eisenhower Place Ann Arbor, MI 48108 Fax 734.971.9022



WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC Weadock: JCW HMP Well Installation		WELL ID: JCW-MW-18004
PROJ. NO: 290805.0001	DATE INSTALLED: 8/22/2018	INSTALLED BY: Jake Krenz
		CHECKED BY: CS



CASING AND SCREEN DETAILS	
TYPE OF RISER:	<u>2-INCH PVC</u>
PIPE SCHEDULE:	<u>40</u>
PIPE JOINTS:	<u>THREADED O-RINGS</u>
SOLVENT USED?	<u>NO</u>
SCREEN TYPE:	<u>2-INCH PVC</u>
SCR. SLOT SIZE:	<u>0.01-INCH</u>
BOREHOLE DIAMETER:	<u>9</u> IN. FROM <u>0</u> TO <u>18</u> FT. <u>2</u> IN. FROM <u>18</u> TO <u>20</u> FT.
SURF. CASING DIAMETER:	<u> </u> IN. FROM <u> </u> TO <u> </u> FT. <u> </u> IN. FROM <u> </u> TO <u> </u> FT.

WELL DEVELOPMENT	
DEVELOPMENT METHOD:	<u>NA</u>
TIME DEVELOPING:	<u>NA</u> HOURS
WATER REMOVED:	<u>NA</u> GALLONS
WATER ADDED:	<u>NA</u> GALLONS
WATER CLARITY BEFORE / AFTER DEVELOPMENT	
CLARITY BEFORE:	<u>NA</u>
COLOR BEFORE:	<u>NA</u>
CLARITY AFTER:	<u>NA</u>
COLOR AFTER:	<u>NA</u>
ODOR (IF PRESENT):	<u>NA</u>

WATER LEVEL SUMMARY				
	MEASUREMENT (FEET)		DATE	TIME
DTB BEFORE DEVELOPING:	14.75	T/PVC	8/23/2018	7:28
DTB AFTER DEVELOPING:	NM	T/PVC	NA	NA
SWE BEFORE DEVELOPING:	14.30	T/PVC	8/23/2018	7:28
SWE AFTER DEVELOPING:	NM	T/PVC	NA	NA
OTHER SWE:		T/PVC		
OTHER SWE:		T/PVC		

NOTES:
Insufficient volume to develop.

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



WELL CONSTRUCTION LOG

WELL NO. JCW-MW-18005

Facility/Project Name: CEC Weadock: JCW HMP Well Installation		Date Drilling Started: 8/21/18	Date Drilling Completed: 8/21/18	Project Number: 290805.0001.0000
Drilling Firm: Stearns Drilling	Drilling Method: Hollow Stem Auger	Surface Elev. (ft) 588.0	TOC Elevation (ft) 590.89	Total Depth (ft bgs) 20.0
Boring Location: Adjacent to MW-20, on the south side of the road.		Personnel Logged By - Jake Krenz Driller - Mike Heffernan		Drilling Equipment: CME-55
Civil Town/City/or Village: Essexville	County: Bay County	State: Michigan	Water Level Observations: While Drilling: Date/Time 8/21/18 15:30 ∇ Depth (ft bgs) 9.50 After Drilling: Date/Time 8/23/18 07:36 ∇ Depth (ft bgs) 8.31	

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 SS	100	1	1	TOPSOIL mostly fine sand, some organic material, very dark gray (10YR 3/1), dry, loose, roots present.	SP			
		2	2					
2 SS	50	3	3	SAND mostly fine to medium sand, brown (10YR 4/3), dry, loose.	SC			
		4	4					
		5	5					
3 SS	50	6	6	SAND WITH CLAY mostly fine to medium sand, few clay, yellowish brown (10YR 3/2), dry, soft.	SP			
		4	4					
		2	4					
4 SS	80	2	4	SAND mostly fine to medium sand, very dark grayish brown (10YR 3/2), dry, loose. Change to few fine to medium gravel, very dark brown (10YR 2/2) at 3.0 feet. Change to brown (10YR 4/4) at 5.25 feet.	CL			
		2	2					
		3	3					
5 SS	50	2	6	SANDY CLAY mostly clay, little to some fine to medium sand, low plasticity, dry, medium stiff, trace roots.	PT			
		3	2					
		2	3					
6 SS	100	2	8	PEAT mostly peat, few fine sand, black (10YR 2/1), moist, loose.	SP			
		3	2					
		2	3					
7 SS	100	1	10	SAND mostly medium sand, gray (10YR 5/1), moist, loose.	CL			
		3	1					
		6	3					
8 SS	100	6	10	SANDY CLAY mostly clay, little to some fine sand, trace fine gravel, low to medium plasticity, dark gray (10YR 4/1), saturated, soft. Change to moist at 11.0 feet.	CL			
		8	6					
		11	8					
9 SS	100	5	12	Change to few to little fine sand, very stiff at 12.5 feet.	CL			
		10	6					
		15	10					
10 SS	100	5	14	Change to few to little silt, dry at 14.0 feet.	CL-ML			
		10	5					
		15	10					
		9	16	SILTY CLAY mostly clay, few to little silt, trace to few fine sand, low plasticity, dark gray (10YR 4/1), dry, very stiff.	CL-ML			
		17	9					
		21	17					
		6	18	Change to very dark gray (10YR 3/1) at 18.0 feet.	CL-ML			
		11	6					
		15	11					
			23	20	End of boring at 20.0 feet below ground surface.			

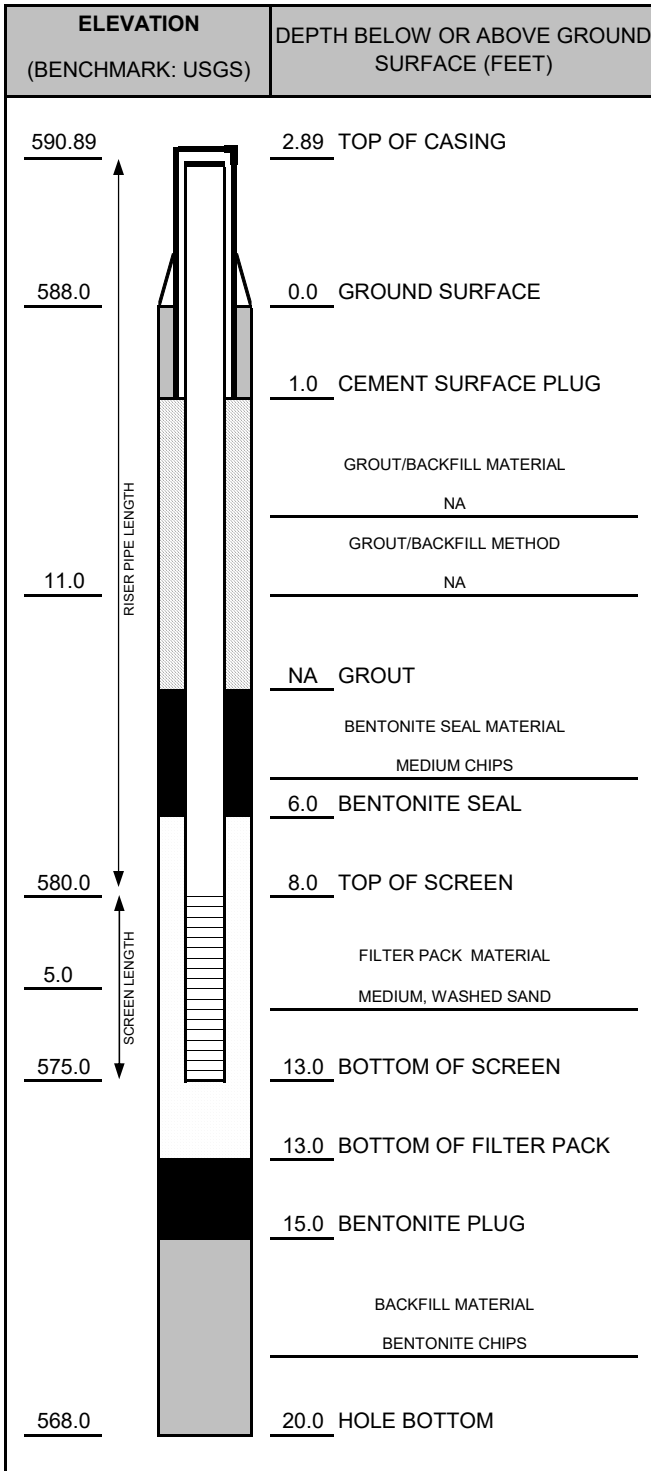
SOIL BORING WELL CONSTRUCTION LOG 290805.0001 WEADOCK HMP REVISIONS.GPJ TRC CORP.GDT 290805.0001.0000 12/5/18

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

PROJ. NAME: CEC Weadock: JCW HMP Well Installation		WELL ID: JCW-MW-18005
PROJ. NO: 290805.0001	DATE INSTALLED: 8/21/2018	INSTALLED BY: Jake Krenz
		CHECKED BY: CS



CASING AND SCREEN DETAILS	
TYPE OF RISER:	<u>2-INCH PVC</u>
PIPE SCHEDULE:	<u>40</u>
PIPE JOINTS:	<u>THREADED O-RINGS</u>
SOLVENT USED?	<u>NO</u>
SCREEN TYPE:	<u>2-INCH PVC</u>
SCR. SLOT SIZE:	<u>0.01-INCH</u>
BOREHOLE DIAMETER:	<u>9</u> IN. FROM <u>0</u> TO <u>18</u> FT. <u>2</u> IN. FROM <u>18</u> TO <u>20</u> FT.
SURF. CASING DIAMETER:	<u> </u> IN. FROM <u> </u> TO <u> </u> FT. <u> </u> IN. FROM <u> </u> TO <u> </u> FT.

WELL DEVELOPMENT	
DEVELOPMENT METHOD:	<u>NA</u>
TIME DEVELOPING:	<u>NA</u> HOURS
WATER REMOVED:	<u>NA</u> GALLONS
WATER ADDED:	<u>NA</u> GALLONS
WATER CLARITY BEFORE / AFTER DEVELOPMENT	
CLARITY BEFORE:	<u>NA</u>
COLOR BEFORE:	<u>NA</u>
CLARITY AFTER:	<u>NA</u>
COLOR AFTER:	<u>NA</u>
ODOR (IF PRESENT):	<u>NA</u>

WATER LEVEL SUMMARY				
	MEASUREMENT (FEET)		DATE	TIME
DTB BEFORE DEVELOPING:	16.36	T/PVC	8/23/2018	7:36
DTB AFTER DEVELOPING:	NM	T/PVC	NA	NA
SWE BEFORE DEVELOPING:	11.31	T/PVC	8/23/2018	7:36
SWE AFTER DEVELOPING:	NM	T/PVC	NA	NA
OTHER SWE:		T/PVC		
OTHER SWE:		T/PVC		

NOTES:
Insufficient volume to develop.

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



WELL CONSTRUCTION LOG

WELL NO. JCW-MW-18006

Facility/Project Name: CEC Weadock: JCW HMP Well Installation		Date Drilling Started: 8/20/18	Date Drilling Completed: 8/20/18	Project Number: 290805.0001.0000
Drilling Firm: Stearns Drilling	Drilling Method: Hollow Stem Auger	Surface Elev. (ft) 597.8	TOC Elevation (ft) 600.72	Total Depth (ft bgs) 22.0
Boring Location: Outside of the westernmost section of the slurry wall, southwest of OW-61.		Personnel Logged By - Jake Krenz Driller - Mike Heffernan		Drilling Equipment: CME-55
Civil Town/City/or Village: Essexville	County: Bay County	State: Michigan	Water Level Observations: While Drilling: Date/Time 8/20/18 14:30 ▾ Depth (ft bgs) <u>13.00</u> After Drilling: Date/Time 8/22/18 07:41 ▾ Depth (ft bgs) <u>13.29</u>	

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 SS	100	1 5 10 10		COAL ASH mostly coal ash, trace to few fine sand, black (10YR 2/1), dry, loose.				
2 SS	100	7 5 7 6						
3 SS	75	2 2 1 3	5					
4 SS	100	1 2 1 2						
5 SS	100	0 0 1 1	10		Change to moist to wet at 9.0 feet.			
6 SS	100	1 1 1 1			Change to wet at 11.5 feet.			
7 SS	80	1 0 0 0			▼ Change to saturated at 13.0 feet.			
8 SS	100	0 1 0 0	15					
9 SS	85	1 0 0 0						
10 SS	10	0 1 1 1	20		SAND mostly medium to coarse sand, trace fine gravel, dark gray (10YR 4/1), saturated, loose.	SW		
11 SS	100	3 3 4 3			CLAY mostly clay, trace fine sand, trace medium gravel, medium plasticity, brown (10YR 5/3), moist, medium stiff.	CL		
				End of boring at 22.0 feet below ground surface.				

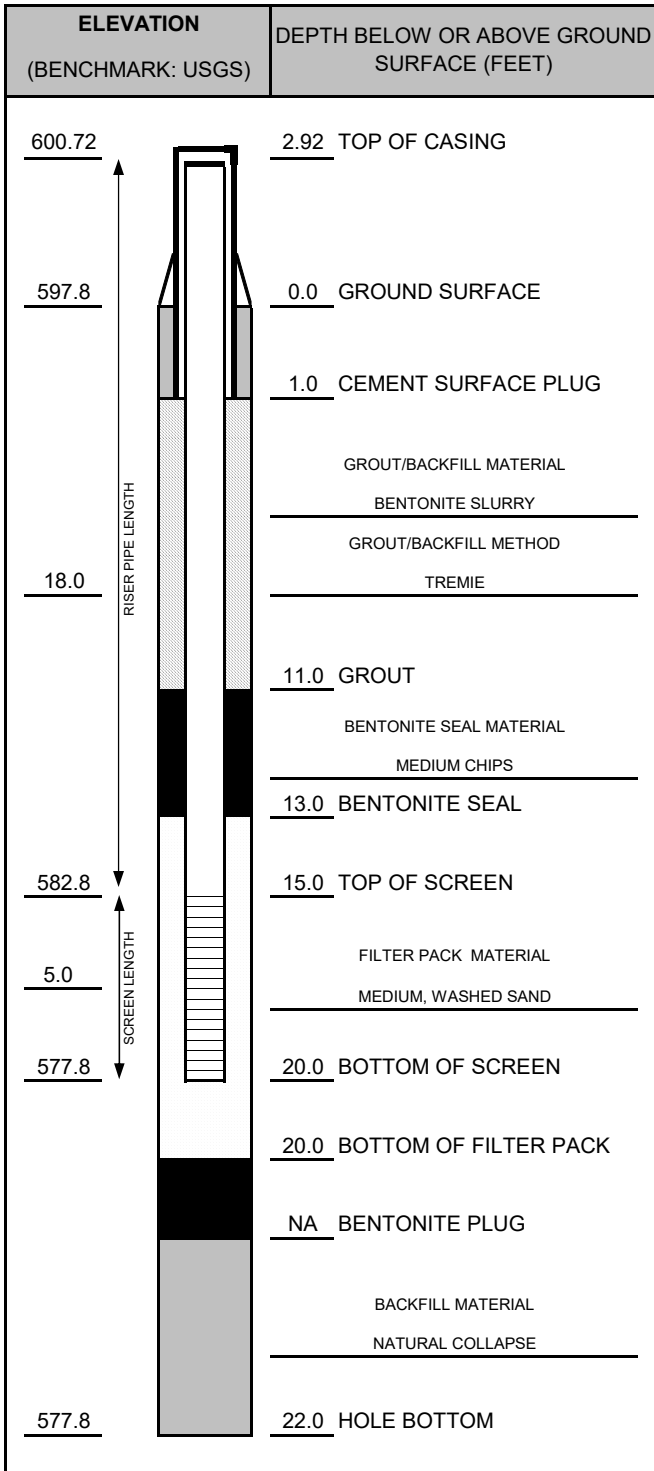
SOIL BORING WELL CONSTRUCTION LOG 290805.0001 WEADOCK HMP REVISIONS.GPJ TRC_CORP_INCHES.GDT 290805.0001.0000 12/13/18

Signature:	Firm: TRC Environmental Corporation 1540 Eisenhower Place Ann Arbor, MI 48108	734.971.7080 Fax 734.971.9022
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WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC Weadock: JCW HMP Well Installation	WELL ID: JCW-MW-18006
PROJ. NO: 290805.0001	DATE INSTALLED: 8/20/2018 INSTALLED BY: Jake Krenz CHECKED BY: CS



CASING AND SCREEN DETAILS	
TYPE OF RISER:	<u>2-INCH PVC</u>
PIPE SCHEDULE:	<u>40</u>
PIPE JOINTS:	<u>THREADED O-RINGS</u>
SOLVENT USED?	<u>NO</u>
SCREEN TYPE:	<u>2-INCH PVC</u>
SCR. SLOT SIZE:	<u>0.01-INCH</u>
BOREHOLE DIAMETER:	<u>9</u> IN. FROM <u>0</u> TO <u>20</u> FT. <u>2</u> IN. FROM <u>20</u> TO <u>22</u> FT.
SURF. CASING DIAMETER:	<u> </u> IN. FROM <u> </u> TO <u> </u> FT. <u> </u> IN. FROM <u> </u> TO <u> </u> FT.

WELL DEVELOPMENT	
DEVELOPMENT METHOD:	<u>SURGE AND PUMP</u>
TIME DEVELOPING:	<u>1.5</u> HOURS
WATER REMOVED:	<u>60</u> GALLONS
WATER ADDED:	<u>0</u> GALLONS
WATER CLARITY BEFORE / AFTER DEVELOPMENT	
CLARITY BEFORE:	<u>VERY TURBID</u>
COLOR BEFORE:	<u>BLACK</u>
CLARITY AFTER:	<u>CLEAR</u>
COLOR AFTER:	<u>NONE</u>
ODOR (IF PRESENT):	<u>NONE</u>

WATER LEVEL SUMMARY				
MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	23.72	T/PVC	8/22/2018	7:41
DTB AFTER DEVELOPING:	23.75	T/PVC	8/27/2018	16:10
SWE BEFORE DEVELOPING:	16.19	T/PVC	8/22/2018	7:41
SWE AFTER DEVELOPING:	15.90	T/PVC	8/27/2018	16:10
OTHER SWE:		T/PVC		
OTHER SWE:		T/PVC		

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

NOTES:



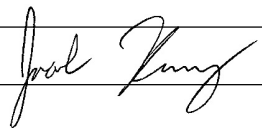
WELL CONSTRUCTION LOG

WELL NO. JCW-OW-18001

Facility/Project Name: CEC Weadock: JCW HMP Well Installation		Date Drilling Started: 8/23/18	Date Drilling Completed: 8/23/18	Project Number: 290805.0001.0000
Drilling Firm: Stearns Drilling	Drilling Method: Hollow Stem Auger	Surface Elev. (ft) 593.1	TOC Elevation (ft) 595.84	Total Depth (ft bgs) 20.0
Boring Location: South side of the road that borders the discharge channel. Adjacent to JCW-MW-18001.		Personnel Logged By - Jake Krenz Driller - Mike Heffernan		Drilling Equipment: CME-55
Civil Town/City/or Village: Essexville	County: Bay County	State: Michigan	Water Level Observations: While Drilling: Date/Time 8/23/18 09:00 ▽ Depth (ft bgs) <u>7.50</u> After Drilling: Date/Time 8/24/18 09:27 ▽ Depth (ft bgs) <u>7.30</u>	

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 SS	100	3		SAND WITH GRAVEL mostly medium sand, few to little fine to medium to gravel, black (10YR 2/1), dry, loose.	SP			
		4		CLAY WITH SAND mostly clay, few to little fine to medium sand, trace to few fine gravel, low plasticity, very dark gray (10YR 3/1), dry, medium stiff to stiff.	CL			
		4		SAND WITH GRAVEL mostly medium sand, few to little fine to medium gravel, black (10YR 2/1), dry, loose.	SP			
2 SS	80	5	2	SAND WITH GRAVEL mostly medium sand, few to little fine to medium gravel, black (10YR 2/1), dry, loose.	SP			
		4		CLAY WITH SAND mostly clay, few to little fine to medium sand, trace to few fine gravel, low plasticity, very dark gray (10YR 3/1), dry, medium stiff to stiff.	CL			
		3		SAND mostly fine to medium sand, trace fine gravel, very dark gray (10YR 3/1), dry, loose.	SP			
3 SS	60	2	4	SAND mostly fine to medium sand, trace fine gravel, very dark gray (10YR 3/1), dry, loose.	SP			
		1		Change to dark gray (10YR 4/1) at 5.0 feet.				
		1		SILT WITH PEAT mostly silt, little to some peat, black (10YR 2/1), moist, no plasticity, soft.	ML			
4 SS	100	1	6	SAND mostly fine to medium sand, trace fine to medium gravel, very dark gray (10YR 3/1), dry, loose.	SP			
		1		COAL ASH mostly ash, very dark gray (10YR 3/1), wet, loose.				
		1		Change to saturated, slag fragments present at 7.5 feet.				
5 SS	80	1	8					
		0		Change to few to little clay present at 9.5 feet.				
		0		CLAYEY SAND mostly fine sand, little to some clay, low plasticity, dark gray (10YR 4/1), saturated, soft.	SC			
6 SS	80	1	10					
		0		CLAY WITH SAND mostly clay, little fine sand, trace fine gravel, dark grayish brown (10YR 4/2), saturated, soft.	CL			
		0						

SOIL BORING WELL CONSTRUCTION LOG 290805.0001 WEADOCK HMP REVISIONS.GPJ TRC CORP.GDT 290805.0001.0000 12/5/18

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



WELL CONSTRUCTION LOG

WELL NO. JCW-OW-18001

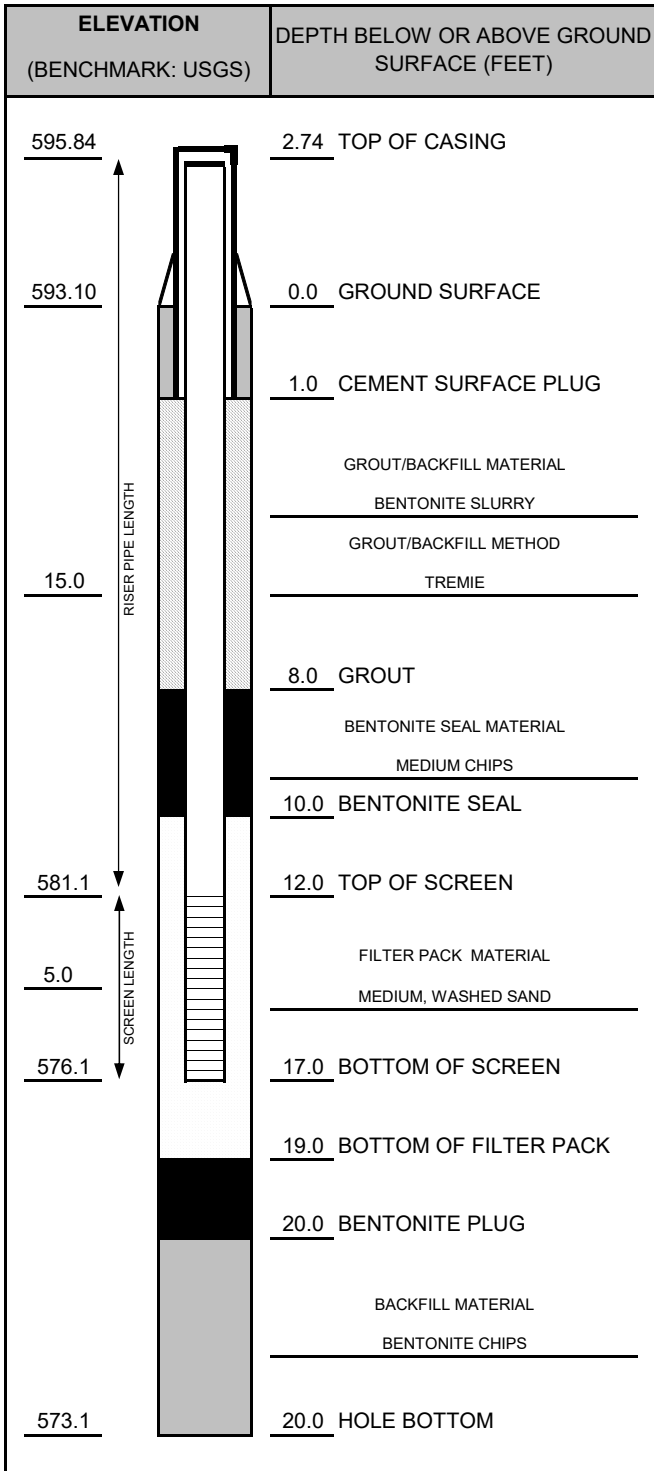
SOIL BORING WELL CONSTRUCTION LOG 290805.0001 WEADOCK HMP REVISIONS.GPJ TRC_CORP.GDT 290805.0001.0000 12/5/18

SAMPLE		BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
NUMBER AND TYPE	RECOVERY (%)							
7 SS	100	1		COAL ASH mostly ash, very dark gray (10YR 3/1), saturated, loose.				
		0						
		0						
		0						
8 SS	100	14		PEAT mostly organic material, trace silt, very dark brown (10YR 2/2), moist, soft. SAND mostly fine to medium sand, dark gray (10YR 4/1), saturated, loose	PT			
		1						
		2						
		2						
9 SS	100	16		SANDY CLAY mostly clay, little to some fine to medium sand, trace medium gravel, low plasticity, gray (10YR 5/1), soft to medium stiff, moist to saturated.	SP			
		1						
		2						
		2						
10 SS	100	18		Change to moist, stiff at 19.0 feet. Change to very stiff at 19.5 feet.	CL			
		3						
		6						
		9						
		12		End of boring at 20.0 feet.				
		20						
		22						
		24						
		26						



WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC Weadock: JCW HMP Well Installation		WELL ID: JCW-OW-18001
PROJ. NO: 290805.0001	DATE INSTALLED: 8/23/2018	INSTALLED BY: Jake Krenz
		CHECKED BY: CS



CASING AND SCREEN DETAILS	
TYPE OF RISER:	<u>2-INCH PVC</u>
PIPE SCHEDULE:	<u>40</u>
PIPE JOINTS:	<u>THREADED O-RINGS</u>
SOLVENT USED?	<u>NO</u>
SCREEN TYPE:	<u>2-INCH PVC</u>
SCR. SLOT SIZE:	<u>0.01-INCH</u>
BOREHOLE DIAMETER:	<u>9</u> IN. FROM <u>0</u> TO <u>18</u> FT. <u>2</u> IN. FROM <u>18</u> TO <u>20</u> FT.
SURF. CASING DIAMETER:	<u> </u> IN. FROM <u> </u> TO <u> </u> FT. <u> </u> IN. FROM <u> </u> TO <u> </u> FT.

WELL DEVELOPMENT	
DEVELOPMENT METHOD:	<u>SURGE AND PUMP</u>
TIME DEVELOPING:	<u>0.75</u> HOURS
WATER REMOVED:	<u>35</u> GALLONS
WATER ADDED:	<u>0</u> GALLONS
WATER CLARITY BEFORE / AFTER DEVELOPMENT	
CLARITY BEFORE:	<u>VERY TURBID</u>
COLOR BEFORE:	<u>BLACK</u>
CLARITY AFTER:	<u>CLEAR</u>
COLOR AFTER:	<u>NONE</u>
ODOR (IF PRESENT):	<u>NONE</u>

WATER LEVEL SUMMARY				
	MEASUREMENT (FEET)		DATE	TIME
DTB BEFORE DEVELOPING:	20.35	T/PVC	8/23/2018	1446
DTB AFTER DEVELOPING:	20.35	T/PVC	8/27/2018	1548
SWE BEFORE DEVELOPING:	10.86	T/PVC	8/23/2018	1446
SWE AFTER DEVELOPING:	10.32	T/PVC	8/27/2018	1548
OTHER SWE:	NA	T/PVC	NA	NA
OTHER SWE:	NA	T/PVC	NA	NA

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

NOTES:



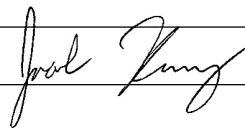
WELL CONSTRUCTION LOG

WELL NO. JCW-OW-18002

Facility/Project Name: CEC Weadock: JCW HMP Well Installation		Date Drilling Started: 8/23/18	Date Drilling Completed: 8/23/18	Project Number: 290805.0001.0000
Drilling Firm: Stearns Drilling	Drilling Method: Hollow Stem Auger	Surface Elev. (ft) 590.4	TOC Elevation (ft) 593.63	Total Depth (ft bgs) 20.0
Boring Location: Adjacent to MW-50, on the south side of the road.		Personnel Logged By - Jake Krenz Driller - Mike Heffernan		Drilling Equipment: CME-55
Civil Town/City/or Village: Essexville	County: Bay County	State: Michigan	Water Level Observations: While Drilling: Date/Time 8/23/18 08:15 ∇ Depth (ft bgs) <u>12.00</u> After Drilling: Date/Time 8/24/18 10:33 ∇ Depth (ft bgs) <u>10.12</u>	

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 SS	100	3	1	SANDY CLAY mostly clay, little to some fine to medium sand, low plasticity, brownish yellow (10YR 6/6), dry, medium stiff.	CL			
		5						
2 SS	100	5	2	SAND mostly medium sand, few medium gravel, trace clay, very dark grayish brown (10YR 3/2), dry, loose.	SP			
		6						
		7						
3 SS	100	4	4	SANDY CLAY mostly clay, little to some fine to medium sand, trace fine to medium gravel, low plasticity, brown (10YR 5/3), moist, stiff.	CL			
		5						
		10						
4 SS	100	5	6	SAND mostly fine to medium sand, few fine to medium gravel, trace coal ash. very dark grayish brown (10YR 3/2), dry, loose.	SP			
		12						
		20						
5 SS	90	6	8	Change to no gravel, no ash, strong brown (7.5YR 5/6), at 6.0 feet.	SP			
		8						
		2						
6 SS	100	2	10	Change to mostly medium sand, trace fine to medium gravel, yellowish brown (10YR 5/6) at 6.5 feet.	CL			
		3						
		2						
7 SS	100	1	12	CLAY WITH SAND mostly clay, few to little fine sand, medium plasticity, gray (10YR 5/1), moist, medium stiff.	SP			
		1						
		1						
8 SS	100	2	14	SAND mostly medium sand, yellowish brown (10YR 5/6), moist to wet, loose. Change to saturated at 10.5 feet.	ML			
		1						
		3						
9 SS	100	4	16	SILT WITH SAND mostly silt, little fine sand, black (10YR 2/1), saturated, loose.	SP			
		7						
		4						
10 SS	100	3	18	SAND mostly fine sand, very dark gray (10YR 3/1), saturated, loose. Change to mostly medium sand, dark gray (10YR 4/1) at 13.0 feet.	CL			
		4						
		5						
		3	20	CLAY mostly clay, trace fine sand, trace fine gravel, medium plasticity, gray (10YR 5/1), moist to wet, medium stiff to stiff.				
		5						
		8						
		3		End of boring at 20.0 feet below ground surface.				
		6						
		9						
		14						

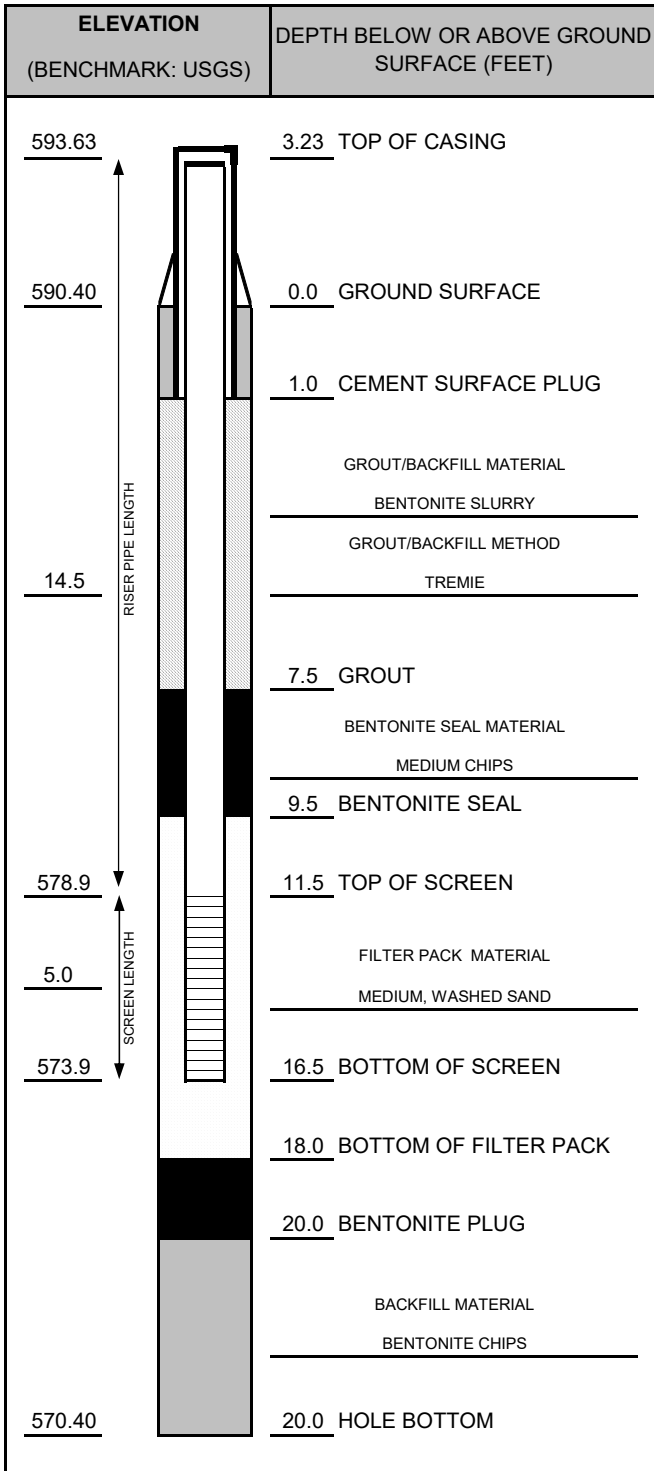
SOIL BORING WELL CONSTRUCTION LOG 290805.0001 WEADOCK HMP REVISIONS.GPJ TRC CORP.GDT 290805.0001.0000 12/5/18

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



WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC Weadock: JCW HMP Well Installation	WELL ID: JCW-OW-18002
PROJ. NO: 290805.0001	DATE INSTALLED: 8/23/2018 INSTALLED BY: Jake Krenz CHECKED BY: CS



CASING AND SCREEN DETAILS	
TYPE OF RISER:	<u>2-INCH PVC</u>
PIPE SCHEDULE:	<u>40</u>
PIPE JOINTS:	<u>THREADED O-RINGS</u>
SOLVENT USED?	<u>NO</u>
SCREEN TYPE:	<u>2-INCH PVC</u>
SCR. SLOT SIZE:	<u>0.01-INCH</u>
BOREHOLE DIAMETER:	<u>9</u> IN. FROM <u>0</u> TO <u>18</u> FT. <u>2</u> IN. FROM <u>18</u> TO <u>20</u> FT.
SURF. CASING DIAMETER:	<u> </u> IN. FROM <u> </u> TO <u> </u> FT. <u> </u> IN. FROM <u> </u> TO <u> </u> FT.

WELL DEVELOPMENT	
DEVELOPMENT METHOD:	<u>SURGE AND PUMP</u>
TIME DEVELOPING:	<u>0.75</u> HOURS
WATER REMOVED:	<u>35</u> GALLONS
WATER ADDED:	<u>0</u> GALLONS
WATER CLARITY BEFORE / AFTER DEVELOPMENT	
CLARITY BEFORE:	<u>VERY TURBID</u>
COLOR BEFORE:	<u>BLACK</u>
CLARITY AFTER:	<u>CLEAR</u>
COLOR AFTER:	<u>NONE</u>
ODOR (IF PRESENT):	<u>NONE</u>

WATER LEVEL SUMMARY				
	MEASUREMENT (FEET)		DATE	TIME
DTB BEFORE DEVELOPING:	19.84	T/PVC	8/24/2018	1033
DTB AFTER DEVELOPING:	NM	T/PVC	NA	NA
SWE BEFORE DEVELOPING:	13.12	T/PVC	8/24/2018	1033
SWE AFTER DEVELOPING:	NM	T/PVC	NA	NA
OTHER SWE:		T/PVC		
OTHER SWE:		T/PVC		

NOTES:

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



WELL CONSTRUCTION LOG

WELL NO. JCW-OW-18003

Facility/Project Name: CEC Weadock: JCW HMP Well Installation		Date Drilling Started: 8/22/18	Date Drilling Completed: 8/22/18	Project Number: 290805.0001.0000
Drilling Firm: Stearns Drilling	Drilling Method: Hollow Stem Auger	Surface Elev. (ft) 591.0	TOC Elevation (ft) 593.99	Total Depth (ft bgs) 20.0
Boring Location: Northeast corner of site, across the road from MW-52.		Personnel Logged By - Jake Krenz Driller - Mike Heffernan		Drilling Equipment: CME-55
Civil Town/City/or Village: Essexville	County: Bay County	State: Michigan	Water Level Observations: While Drilling: Date/Time 8/22/18 15:00 ▽ Depth (ft bgs) <u>14.00</u> After Drilling: Date/Time 8/23/18 07:28 ▾ Depth (ft bgs) <u>11.64</u>	

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 SS	10	7 2 2 5	0-2	GRAVEL WITH SAND mostly medium to coarse gravel, little fine to medium sand, gray (10YR 5/1), dry, loose.	GP			
2 SS	80	7 6 5 7	2-4	SANDY CLAY mostly clay, little to some fine sand, few medium to coarse gravel, low plasticity, dark brown (10YR 3/3), dry, medium stiff. SAND mostly fine sand, very dark grayish brown (10YR 3/2), dry, loose, trace coal ash, slag, and coal fragments. Change to no slag or coal at 4.5 feet.	CL SP			
3 SS	80	2 2 3 3	4-6	SAND mostly medium sand, brown (10YR 5/3), moist, loose.	SP			
4 SS	50	4 4 9 6	6-8	SAND mostly medium sand, brown (10YR 5/3), moist, loose.	SP			
5 SS	100	2 2 4	8-10	CLAY mostly clay, trace to few fine sand, trace fine gravel, low plasticity, very dark gray (10YR 3/1), moist, medium stiff.	CL			
6 SS	100	2 2 3	10-12	SAND mostly medium sand, trace medium to coarse gravel, dark gray (10YR 4/1), moist, loose. CLAY mostly clay, trace to few fine sand, trace fine gravel, low plasticity, very dark gray (10YR 3/1), moist, medium stiff.	SP CL			
7 SS	100	2 2 4 8	12-14	SAND mostly medium sand, trace fine gravel, very dark gray (10YR 4/1), wet, loose. Change to saturated at 14.0 feet.	SP			
8 SS	100	3 8 8	14-16	CLAY WITH SAND mostly clay, few to little fine to medium sand, trace fine gravel, low to medium plasticity, dark gray (10YR 4/1), moist, medium stiff.	CL			
9 SS	90	4 6 8 14	16-18	CLAY WITH SAND mostly clay, few to little fine to medium sand, trace fine gravel, low to medium plasticity, dark gray (10YR 4/1), moist, medium stiff.	CL			
10 SS	100	3 8 11 15	18-20	End of boring at 20.0 feet below ground surface.				

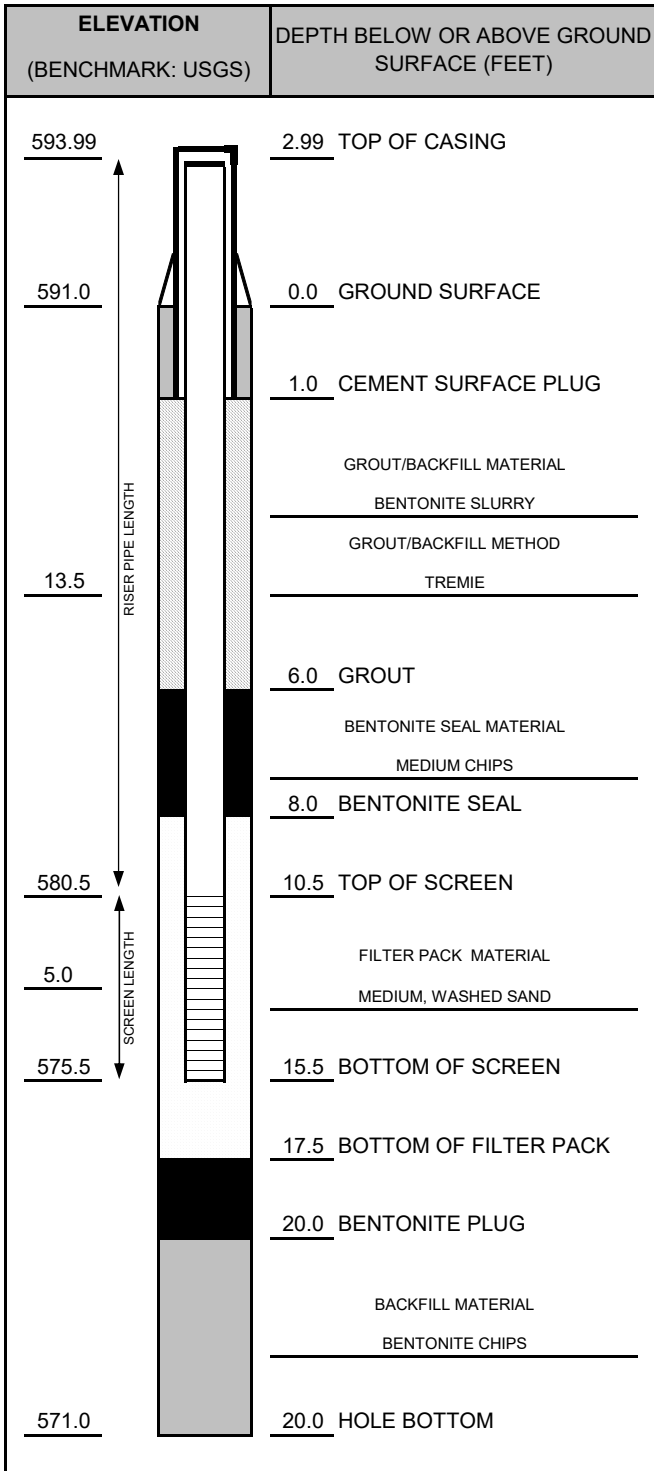
SOIL BORING WELL CONSTRUCTION LOG 290805.0001 WEADOCK HMP REVISIONS.GPJ TRC CORP.GDT 290805.0001.0000 12/5/18

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

PROJ. NAME: CEC Weadock: JCW HMP Well Installation		WELL ID: JCW-OW-18003
PROJ. NO: 290805.0001	DATE INSTALLED: 8/22/2018	INSTALLED BY: Jake Krenz
		CHECKED BY: CS



CASING AND SCREEN DETAILS	
TYPE OF RISER:	<u>2-INCH PVC</u>
PIPE SCHEDULE:	<u>40</u>
PIPE JOINTS:	<u>THREADED O-RINGS</u>
SOLVENT USED?	<u>NO</u>
SCREEN TYPE:	<u>2-INCH PVC</u>
SCR. SLOT SIZE:	<u>0.01-INCH</u>
BOREHOLE DIAMETER:	<u>9</u> IN. FROM <u>0</u> TO <u>18</u> FT. <u>2</u> IN. FROM <u>18</u> TO <u>20</u> FT.
SURF. CASING DIAMETER:	<u> </u> IN. FROM <u> </u> TO <u> </u> FT. <u> </u> IN. FROM <u> </u> TO <u> </u> FT.

WELL DEVELOPMENT	
DEVELOPMENT METHOD:	<u>SURGE AND PUMP</u>
TIME DEVELOPING:	<u>1</u> HOURS
WATER REMOVED:	<u>40</u> GALLONS
WATER ADDED:	<u>0</u> GALLONS
WATER CLARITY BEFORE / AFTER DEVELOPMENT	
CLARITY BEFORE:	<u>VERY TURBID</u>
COLOR BEFORE:	<u>BROWN</u>
CLARITY AFTER:	<u>CLEAR</u>
COLOR AFTER:	<u>NONE</u>
ODOR (IF PRESENT):	<u>NONE</u>

WATER LEVEL SUMMARY				
	MEASUREMENT (FEET)		DATE	TIME
DTB BEFORE DEVELOPING:	18.70	T/PVC	8/23/2018	728
DTB AFTER DEVELOPING:	18.80	T/PVC	8/27/2018	1517
SWE BEFORE DEVELOPING:	14.64	T/PVC	8/23/2018	728
SWE AFTER DEVELOPING:	14.00	T/PVC	8/27/2018	1517
OTHER SWE:	NA	T/PVC	NA	NA
OTHER SWE:	NA	T/PVC	NA	NA

NOTES:

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



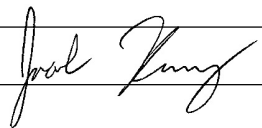
WELL CONSTRUCTION LOG

WELL NO. JCW-OW-18004

Facility/Project Name: CEC Weadock: JCW HMP Well Installation		Date Drilling Started: 8/22/18	Date Drilling Completed: 8/22/18	Project Number: 290805.0001.0000
Drilling Firm: Stearns Drilling	Drilling Method: Hollow Stem Auger	Surface Elev. (ft) 591.1	TOC Elevation (ft) 594.19	Total Depth (ft bgs) 20.0
Boring Location: Approximately 400 feet north of the southeast corner of site on the west side of the road.		Personnel Logged By - Jake Krenz Driller - Mike Heffernan		Drilling Equipment: CME-55
Civil Town/City/or Village: Essexville	County: Bay County	State: Michigan	Water Level Observations: While Drilling: Date/Time After Drilling: Date/Time 8/23/18 07:33 ▼ Depth (ft bgs) Depth (ft bgs) 10.78	

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 SS	60	3		CLAY mostly clay, trace to few fine sand, trace silt, low plasticity, grayish brown (10YR 5/2), dry, medium stiff.	CL			
		5						
2 SS	50	5	2	GRAVEL WITH SAND mostly medium to coarse gravel, little medium sand, gray (10YR 5/1), dry, loose.	GP			
		8						
3 SS	50	5	4	Change to soft at 4.0 feet below ground surface.	CL			
		2						
4 SS	75	2	6	CLAY WITH SAND mostly clay, little fine sand, trace silt, trace fine gravel, low plasticity, dark grayish brown (10YR 4/2), dry, stiff.	CL			
		3						
5 SS	100	3	8	Change to low to medium plasticity, moist, medium stiff at 8.0 feet.	CL			
		4						
6 SS	100	2	10	▼	CL			
		2						
7 SS	100	2	12	Change to few to little fine sand at 14.0 feet.	CL			
		2						
8 SS	100	3	14	Change to stiff at 16.0 feet.	CL			
		4						
9 SS	100	4	16	Change to dry at 19.0 feet.	CL			
		5						
10 SS	100	6	18	End of boring at 20.0 feet.	CL			
		12						
		37	20					

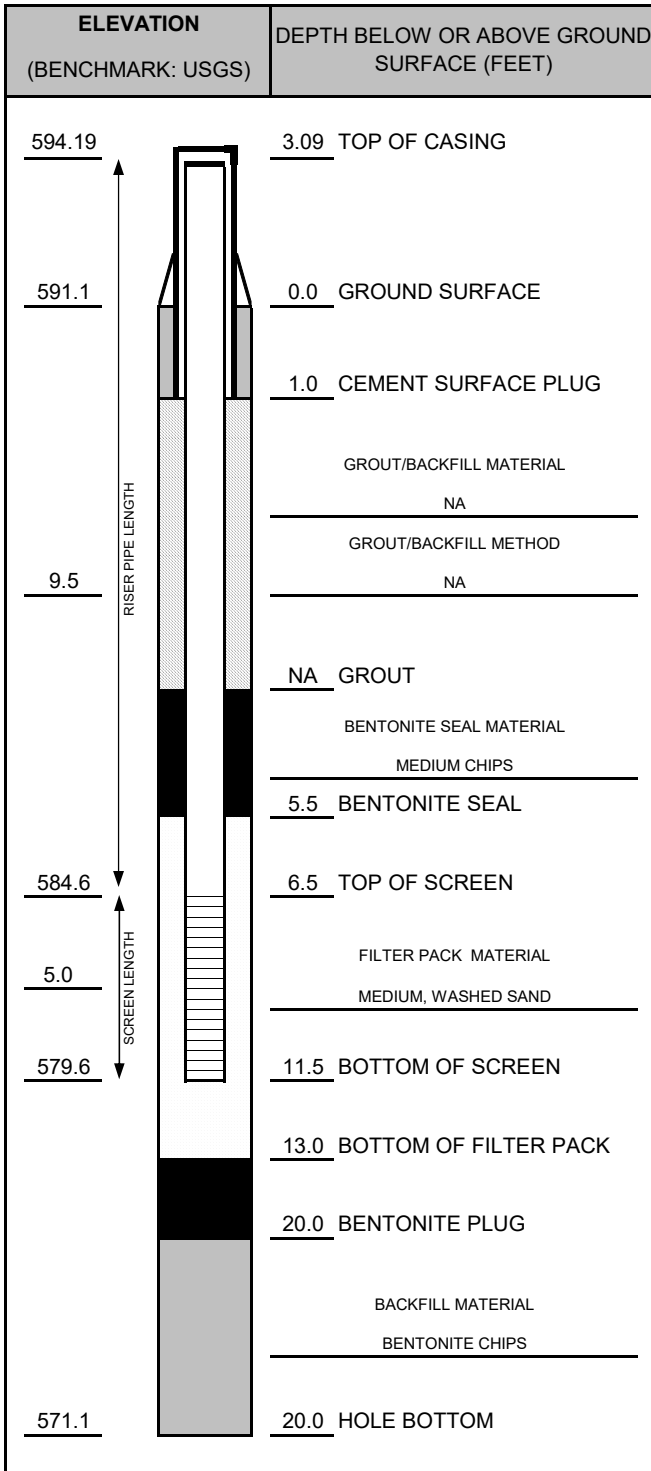
SOIL BORING WELL CONSTRUCTION LOG 290805.0001 WEADOCK HMP REVISIONS.GPJ TRC_CORP.GDT 290805.0001.0000 12/5/18

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



WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC Weadock: JCW HMP Well Installation		WELL ID: JCW-OW-18004
PROJ. NO: 290805.0001	DATE INSTALLED: 8/22/2018	INSTALLED BY: Jake Krenz
		CHECKED BY: CS



CASING AND SCREEN DETAILS	
TYPE OF RISER:	<u>2-INCH PVC</u>
PIPE SCHEDULE:	<u>40</u>
PIPE JOINTS:	<u>THREADED O-RINGS</u>
SOLVENT USED?	<u>NO</u>
SCREEN TYPE:	<u>2-INCH PVC</u>
SCR. SLOT SIZE:	<u>0.01-INCH</u>
BOREHOLE DIAMETER:	<u>9</u> IN. FROM <u>0</u> TO <u>18</u> FT. <u>2</u> IN. FROM <u>18</u> TO <u>20</u> FT.
SURF. CASING DIAMETER:	<u> </u> IN. FROM <u> </u> TO <u> </u> FT. <u> </u> IN. FROM <u> </u> TO <u> </u> FT.

WELL DEVELOPMENT	
DEVELOPMENT METHOD:	<u>NA</u>
TIME DEVELOPING:	<u>NA</u> HOURS
WATER REMOVED:	<u>NA</u> GALLONS
WATER ADDED:	<u>NA</u> GALLONS
WATER CLARITY BEFORE / AFTER DEVELOPMENT	
CLARITY BEFORE:	<u>NA</u>
COLOR BEFORE:	<u>NA</u>
CLARITY AFTER:	<u>NA</u>
COLOR AFTER:	<u>NA</u>
ODOR (IF PRESENT):	<u>NA</u>

WATER LEVEL SUMMARY				
	MEASUREMENT (FEET)		DATE	TIME
DTB BEFORE DEVELOPING:	14.86	T/PVC	8/23/2018	7:33
DTB AFTER DEVELOPING:	NM	T/PVC	NA	NA
SWE BEFORE DEVELOPING:	13.78	T/PVC	8/23/2018	7:33
SWE AFTER DEVELOPING:	NM	T/PVC	NA	NA
OTHER SWE:	11.80	T/PVC	8/27/2018	14:39
OTHER SWE:		T/PVC		

NOTES:
Insufficient volume to develop.

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



WELL CONSTRUCTION LOG

WELL NO. JCW-OW-18006

Facility/Project Name: CEC Weadock: JCW HMP Well Installation		Date Drilling Started: 8/20/18	Date Drilling Completed: 8/21/18	Project Number: 290805.0001.0000
Drilling Firm: Stearns Drilling	Drilling Method: Hollow Stem Auger	Surface Elev. (ft) 597.9	TOC Elevation (ft) 600.61	Total Depth (ft bgs) 22.0
Boring Location: Inside of the westernmost section of the slurry wall, southwest of OW-61.		Personnel Logged By - Jake Krenz Driller - Mike Heffernan		Drilling Equipment: CME-55
Civil Town/City/or Village: Essexville	County: Bay County	State: Michigan	Water Level Observations: While Drilling: Date/Time 8/20/18 16:15 ▾ Depth (ft bgs) <u>6.50</u> After Drilling: Date/Time 8/23/18 07:42 ▾ Depth (ft bgs) <u>10.53</u>	

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 SS	60	2 6 10 10		COAL ASH mostly coal ash, trace to few fine sand, black (10YR 2/1), dry, loose.				
2 SS	50	6 4 5		CLAY WITH SAND mostly clay, few to little fine sand, trace to few fine gravel, low to medium plasticity, dark gray (10YR 4/1), dry, medium stiff. Change to little fine to medium sand at 2.0 feet.	CL			
3 SS	100	2 1 1	5	SAND mostly fine to medium sand, trace to few fine gravel, very dark grayish brown (10YR 3/2), dry, loose.	SP			
4 SS	100	2 1 1		COAL ASH mostly coal ash, trace fine sand, dark gray (10YR 4/1), moist, loose.	SP			
5 SS	100	0 0 1		SAND mostly fine sand, few to little ash, gray (10YR 5/1), moist, loose.				
6 SS	100	0 0 0	10	COAL ASH mostly coal ash, trace fine sand, dark gray (10YR 4/1), saturated, loose.				
7 SS	100	0 0 0						
8 SS	50	1 0 0	15	COAL ASH mostly coal ash, few to little fine sand, trace silt, gray (10YR 5/1), saturated, loose, interbedded fine sands from 15.0 feet to 16.0 feet.				
9 SS	100	0 0 0						
10 SS	100	0 0 3						
11 SS	100	3 3 5 5	20	CLAY WITH SAND mostly clay, few to little fine sand, trace to few medium gravel, low to medium plasticity, grayish brown (10YR 5/2), moist, soft. CLAYEY SAND mostly medium to coarse sand, few to little clay, trace to few medium gravel, brown (10YR 5/3), moist, medium stiff. CLAY mostly clay, few fine to medium sand, low to medium plasticity, brown (10YR 5/3), moist, medium stiff.	CL SC CL			
				End of boring at 22.0 feet below ground surface.				

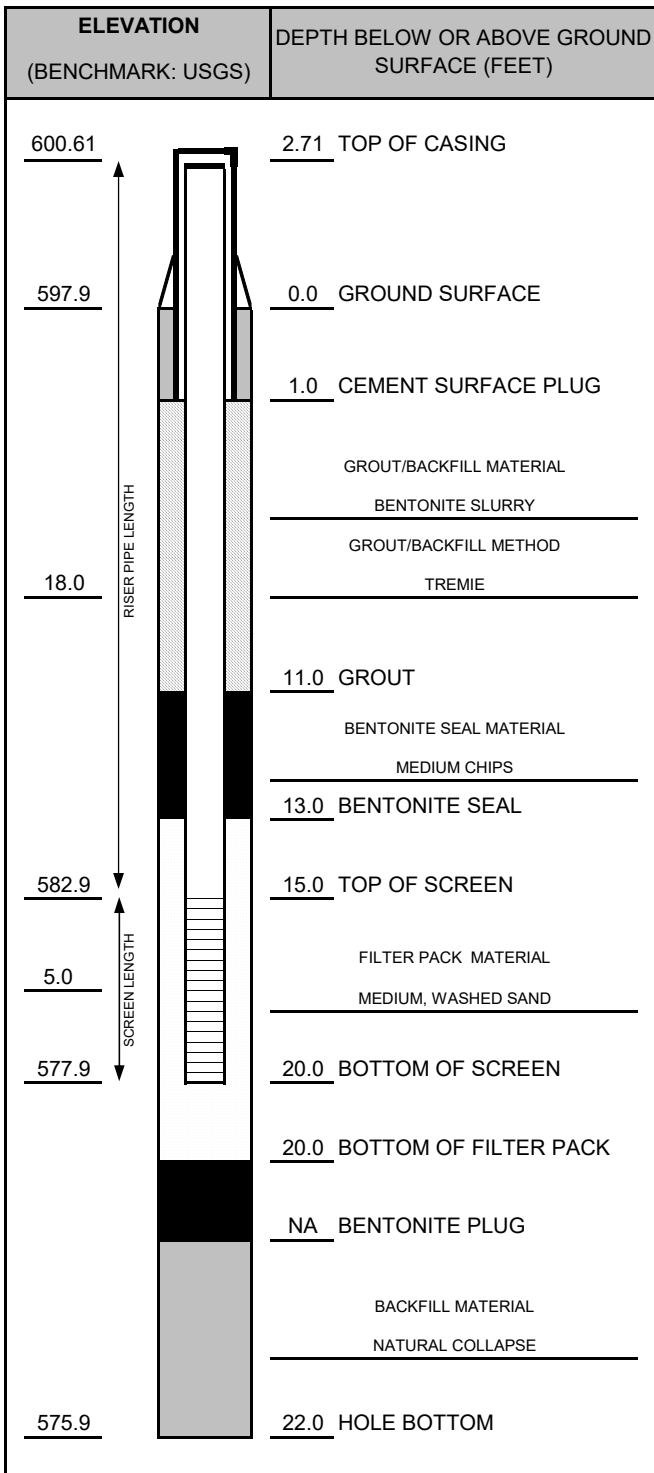
SOIL BORING WELL CONSTRUCTION LOG 290805.0001 WEADOCK HMP REVISIONS.GPJ TRC CORP.GDT 290805.0001.0000 12/5/18

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

PROJ. NAME: CEC Weadock: JCW HMP Well Installation	WELL ID: JCW-OW-18006
PROJ. NO: 290805.0001	DATE INSTALLED: 8/20/2018 INSTALLED BY: Jake Krenz CHECKED BY: CS



CASING AND SCREEN DETAILS	
TYPE OF RISER:	<u>2-INCH PVC</u>
PIPE SCHEDULE:	<u>40</u>
PIPE JOINTS:	<u>THREADED O-RINGS</u>
SOLVENT USED?	<u>NO</u>
SCREEN TYPE:	<u>2-INCH PVC</u>
SCR. SLOT SIZE:	<u>0.01-INCH</u>
BOREHOLE DIAMETER:	<u>9</u> IN. FROM <u>0</u> TO <u>20</u> FT. <u>2</u> IN. FROM <u>20</u> TO <u>22</u> FT.
SURF. CASING DIAMETER:	<u> </u> IN. FROM <u> </u> TO <u> </u> FT. <u> </u> IN. FROM <u> </u> TO <u> </u> FT.

WELL DEVELOPMENT	
DEVELOPMENT METHOD:	<u>SURGE AND PUMP</u>
TIME DEVELOPING:	<u>1</u> HOURS
WATER REMOVED:	<u>45</u> GALLONS
WATER ADDED:	<u>0</u> GALLONS
WATER CLARITY BEFORE / AFTER DEVELOPMENT	
CLARITY BEFORE:	<u>VERY TURBID</u>
COLOR BEFORE:	<u>BLACK</u>
CLARITY AFTER:	<u>CLEAR</u>
COLOR AFTER:	<u>NONE</u>
ODOR (IF PRESENT):	<u>NONE</u>

WATER LEVEL SUMMARY				
	MEASUREMENT (FEET)		DATE	TIME
DTB BEFORE DEVELOPING:	23.46	T/PVC	8/22/2018	7:42
DTB AFTER DEVELOPING:	24.35	T/PVC	8/27/2018	16:14
SWE BEFORE DEVELOPING:	13.53	T/PVC	8/22/2018	7:42
SWE AFTER DEVELOPING:	13.30	T/PVC	8/27/2018	16:14
OTHER SWE:		T/PVC		
OTHER SWE:		T/PVC		

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

NOTES:



SOIL BORING LOG

BORING NO. JCW-SB-18007

Facility/Project Name: CEC Weadock: JCW HMP Well Installation		Date Drilling Started: 8/21/18	Date Drilling Completed: 8/21/18	Project Number: 290805.0001.0000
Drilling Firm: Stearns Drilling	Drilling Method: Hollow Stem Auger	Surface Elev. (ft) ---	TOC Elevation (ft) ---	Total Depth (ft bgs) 20.0
Boring Location: Adjacent to OW-56, on the south side of the road.		Personnel Logged By - Jake Krenz Driller - Mike Heffernan		Drilling Equipment: CME-55
Civil Town/City/or Village: Essexville	County: Bay County	State: Michigan	Water Level Observations: While Drilling: Date/Time After Drilling: Date/Time	
				Depth (ft bgs) Depth (ft bgs)

SOIL BORING WELL CONSTRUCTION LOG 290805.0001 WEADOCK HMP REVISIONS.GPJ TRC CORP.GDT 290805.0001.0000 12/5/18

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	COMMENTS
1 SS	50	1	1	SAND mostly fine to medium sand, dark grayish brown (10YR 4/2), dry, loose.	SP		A water-bearing zone was not observed. No well was installed.
		2	2				
		3	2				
2 SS	100	1	2	CLAY WITH SAND mostly clay, few to little fine sand, low plasticity, pale brown (10YR 6/3), moist, medium stiff.	CL		
		2	2				
		3	2				
3 SS	80	2	4	SAND mostly fine to medium sand, strong brown (7.5YR 4/6), dry, loose. Change to brown (10YR 4/3) at 2.5 feet. Change to very dark brown (10YR 2/2) at 3.0 feet.	SP		
		2	4				
		2	4				
4 SS	80	2	6	CLAY mostly clay, trace silt, low plasticity, brown (10YR 5/3), moist, medium stiff.	CL		
		2	6				
		2	6				
5 SS	100	2	8	SAND mostly medium sand, very dark grayish brown (10YR 3/2), dry, loose. Change to yellowish brown (10YR 5/4) at 7.5 feet. Change to very dark brown (10YR 2/2) at 8.25 feet.	SP		
		2	8				
		2	8				
6 SS	100	2	10	CLAY mostly clay, few fine sand, trace medium gravel, low plasticity, grayish brown (10YR 5/2), moist, stiff.	CL		
		2	10				
		2	10				
7 SS	100	2	12	SILTY CLAY mostly clay, little to some silt, trace fine sand, trace medium gravel, low plasticity, grayish brown (10YR 5/2), moist, stiff.	CL-ML		
		2	12				
		2	12				
8 SS	100	2	14	CLAY WITH SAND mostly clay, few to little fine sand, trace to few fine to medium gravel, low plasticity, grayish brown (10YR 5/2), moist, stiff.	CL		
		2	14				
		2	14				
9 SS	100	2	16	CLAY WITH SAND mostly clay, few to little fine sand, trace to few fine to medium gravel, low plasticity, grayish brown (10YR 5/2), moist, stiff.	CL		
		2	16				
		2	16				
10 SS	100	2	18				
		2	18				
		2	18				
			20	End of boring at 20.0 feet below ground surface.			

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

WELL NO. OW-56R

Facility/Project Name: JC Weadock: 2018 Well Reinstall		Date Drilling Started: 11/6/18	Date Drilling Completed: 11/6/18	Project Number: 290805.0001	
Drilling Firm: Stearns Drilling	Drilling Method: Hollow Stem Auger	Surface Elev. (ft) 589.5	TOC Elevation (ft) 592.01	Total Depth (ft bgs) 17.0	Borehole Dia. (in) 9"
Boring Location: Adjacent to OW-56R.		Personnel Logged By - Jake Krenz Driller - Mike Heferan		Drilling Equipment: CME-55	
Civil Town/City/or Village: Essexville	County: Bay County	State: Michigan	Water Level Observations: While Drilling: Date/Time 11/6/18 10:00 ▾ Depth (ft bgs) 5.5 After Drilling: Date/Time 11/7/18 07:19 ▾ Depth (ft bgs) 4.02		

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 HA	100		0	SAND mostly fine to medium sand, trace to few fine to medium gravel, dark gray (10YR 4/1), dry to moist, loose, plant roots. Change to no gravel at 2.0 feet.	SW			
2 SS	100	1	4	COAL ASH WITH CLAY few to little clay, low to medium plasticity, dark gray (10YR 4/1), moist to saturated, very soft.				
3 SS	90	1	6	SAND mostly fine to medium sand, dark gray (10YR 4/1), saturated, loose. Trace coal ash at 6.0 feet.	SW			
4 SS	90	1	8					
5 SS	90	1	10	SANDY CLAY mostly clay, little to some fine to medium sand, low to medium plasticity, gray (10YR 6/1), moist to saturated, medium stiff to stiff.				
6 SS	80	4	12					
7 SS	100	6	14	Change to mottled with yellowish brown (10YR 5/4) at 13.5 feet.	CL			
			16					
			18	End of boring at 17 below ground surface.				

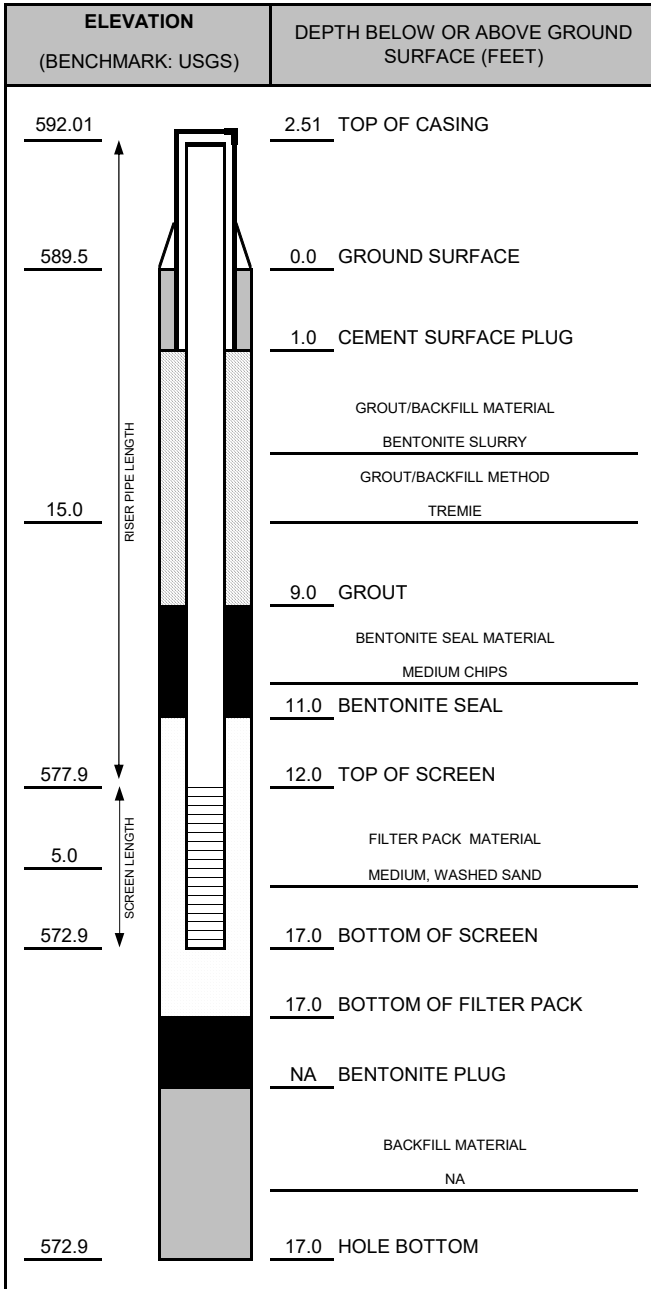
SOIL BORING WELL CONSTRUCTION LOG 290805.0001 WEADOCK WELL REINSTALL 11.2018.GPJ TRC_CORP.GDT 290805.0001 12/3/18

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



WELL CONSTRUCTION DIAGRAM

PROJ. NAME: JC Weadock: 2018 Well Reinstall	WELL ID: OW-56R
PROJ. NO: 290805.0001	DATE INSTALLED: 11/6/18
INSTALLED BY: Jake Krenz	CHECKED BY: DL



NOTES:

CASING AND SCREEN DETAILS	
TYPE OF RISER:	<u>2-INCH PVC</u>
PIPE SCHEDULE:	<u>40</u>
PIPE JOINTS:	<u>THREADED O-RINGS</u>
SOLVENT USED?	<u>NO</u>
SCREEN TYPE:	<u>2-INCH PVC</u>
SCR. SLOT SIZE:	<u>0.01-INCH</u>
BOREHOLE DIAMETER:	<u>9</u> IN. FROM <u>0</u> TO <u>17</u> FT. <u>NA</u> IN. FROM <u>NA</u> TO <u>NA</u> FT.
SURF. CASING DIAMETER:	<u>NA</u> IN. FROM <u>NA</u> TO <u>NA</u> FT. <u>NA</u> IN. FROM <u>NA</u> TO <u>NA</u> FT.

WELL DEVELOPMENT	
DEVELOPMENT METHOD:	<u>SURGE AND PUMP</u>
TIME DEVELOPING:	<u>1.5</u> HOURS
WATER REMOVED:	<u>12</u> GALLONS
WATER ADDED:	<u>0</u> GALLONS
WATER CLARITY BEFORE / AFTER DEVELOPMENT	
CLARITY BEFORE:	<u>VERY TURBID</u>
COLOR BEFORE:	<u>BROWN</u>
CLARITY AFTER:	<u>CLEAR</u>
COLOR AFTER:	<u>CLEAR</u>
ODOR (IF PRESENT):	<u>NONE</u>

WATER LEVEL SUMMARY				
	MEASUREMENT (FEET)		DATE	TIME
DTB BEFORE DEVELOPING:	20.27	T/PVC	11/6/2018	15:18
DTB AFTER DEVELOPING:	20.27	T/PVC	11/7/2018	9:00
SWE BEFORE DEVELOPING:	7.02	T/PVC	11/7/2018	7:19
SWE AFTER DEVELOPING:	7.55	T/PVC	11/7/2018	9:54
OTHER SWE:	7.03	T/PVC	11/6/2018	15:18
OTHER SWE:	NA	T/PVC	NA	NA

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



WELL CONSTRUCTION LOG

WELL NO. OW-57R IN

Facility/Project Name: JC Weadock: 2018 Well Reinstall		Date Drilling Started: 11/5/18	Date Drilling Completed: 11/5/18	Project Number: 290805.0001	
Drilling Firm: Stearns Drilling	Drilling Method: Hollow Stem Auger	Surface Elev. (ft) 588.7	TOC Elevation (ft) 590.86	Total Depth (ft bgs) 19.0	Borehole Dia. (in) 9"
Boring Location: Adjacent to OW-57 IN.		Personnel Logged By - Jake Krenz Driller - Mike Heferan		Drilling Equipment: CME-55	
Civil Town/City/or Village: Essexville	County: Bay County	State: Michigan	Water Level Observations: While Drilling: Date/Time 11/5/18 12:30 ▽ Depth (ft bgs) <u>5</u> After Drilling: Date/Time 11/7/18 07:14 ▽ Depth (ft bgs) <u>5.02</u>		

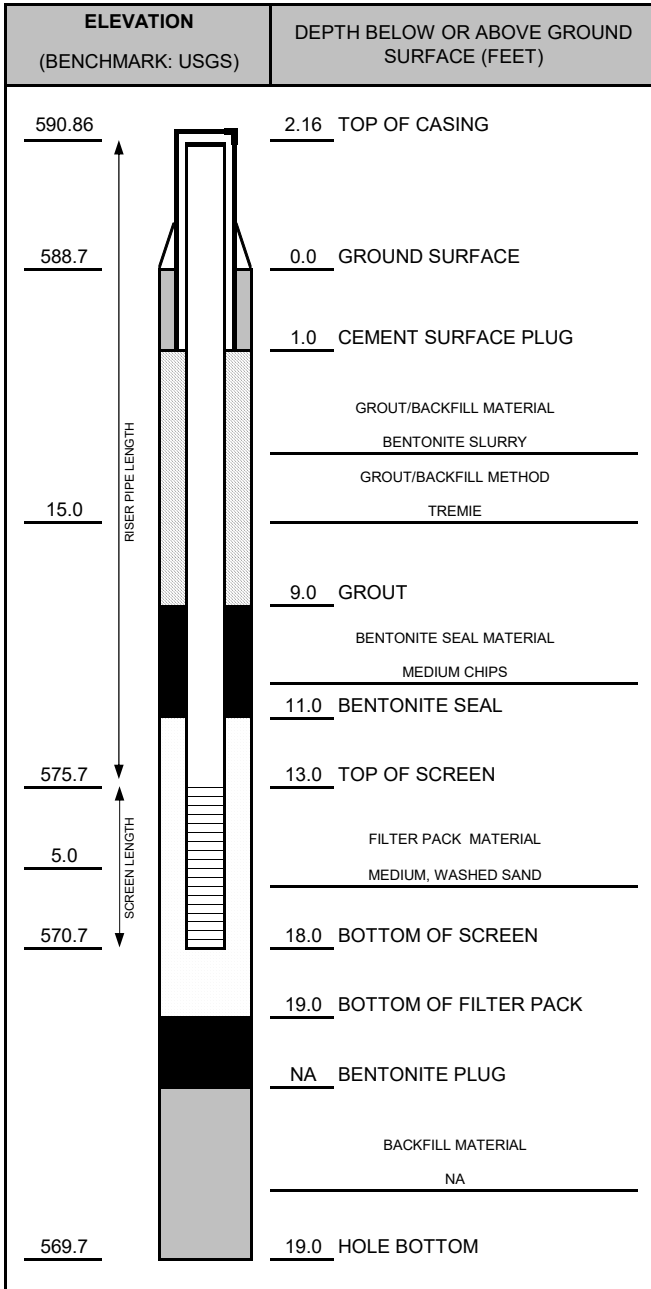
SAMPLE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 HA	100		0	SAND mostly fine to coarse sand, trace fine gravel, dark gray (10YR 4/1), dry, loose.	SW			
			2	SAND WITH GRAVEL mostly fine to coarse sand, few to little fine to medium gravel, dark gray (10YR 4/1), dry, loose.	SP			
			4	CLAY mostly clay, few to little fine sand, medium plasticity, brown (10YR 5/3), moist, medium stiff.	CL			
			4	COAL ASH mostly coal ash, black (10YR 2/1), moist, loose, trace roots.				
		1	6					
2 SS	60	1	6					
		1	7					
		1	8					
3 SS	90	0	8					
		0	9					
		0	10					
4 SS	90	0	10	SANDY CLAY mostly clay, little to some fine sand, medium plasticity, gray (10YR 5/1), moist, soft.				
		2	11	Change to few medium sand, medium stiff, plant roots at 11.0 feet.				
5 SS	100	3	12					
		5	13					
		9	14					
6 SS	100	5	14	Change to grayish brown (10YR 5/2), stiff at 13.0 feet.				
		10	15					
		13	16					
		18	17	Change to yellowish brown (10YR 5/4) at 14.5 feet.	CL			
7 SS	100	4	16					
		10	17					
		16	18	Change to yellowish brown (10YR 5/2) mottled with dark yellowish brown (10YR 4/4) at 16.0 feet.				
		19	19	Change to very stiff at 17.0 feet.				
8 SS	100	3	18					
		10	19					
		15	19					
		22	19					
			19	End of boring at 19.0 feet below ground surface.				

SOIL BORING WELL CONSTRUCTION LOG 290805.0001 WEADOCK WELL REINSTALL 11.2018.GPJ TRC_CORP.GDT 290805.0001 12/3/18



WELL CONSTRUCTION DIAGRAM

PROJ. NAME: JC Weadock: 2018 Well Reinstall	WELL ID: OW-57R IN
PROJ. NO: 290805.0001	DATE INSTALLED: 11/5/18
INSTALLED BY: Jake Krenz	CHECKED BY: DL



NOTES:

CASING AND SCREEN DETAILS	
TYPE OF RISER:	<u>2-INCH PVC</u>
PIPE SCHEDULE:	<u>40</u>
PIPE JOINTS:	<u>THREADED O-RINGS</u>
SOLVENT USED?	<u>NO</u>
SCREEN TYPE:	<u>2-INCH PVC</u>
SCR. SLOT SIZE:	<u>0.01-INCH</u>
BOREHOLE DIAMETER:	<u>9</u> IN. FROM <u>0</u> TO <u>18</u> FT.
	<u>2</u> IN. FROM <u>18</u> TO <u>19</u> FT.
SURF. CASING DIAMETER:	<u>NA</u> IN. FROM <u>NA</u> TO <u>NA</u> FT.
	<u>NA</u> IN. FROM <u>NA</u> TO <u>NA</u> FT.

WELL DEVELOPMENT	
DEVELOPMENT METHOD:	<u>SURGE AND PUMP</u>
TIME DEVELOPING:	<u>0.75</u> HOURS
WATER REMOVED:	<u>6</u> GALLONS
WATER ADDED:	<u>0</u> GALLONS
WATER CLARITY BEFORE / AFTER DEVELOPMENT	
CLARITY BEFORE:	<u>VERY TURBID</u>
COLOR BEFORE:	<u>VERY DARK GRAY</u>
CLARITY AFTER:	<u>CLEAR</u>
COLOR AFTER:	<u>CLEAR</u>
ODOR (IF PRESENT):	<u>NONE</u>

WATER LEVEL SUMMARY				
	MEASUREMENT (FEET)		DATE	TIME
DTB BEFORE DEVELOPING:	20.23	T/PVC	11/5/2018	15:31
DTB AFTER DEVELOPING:	20.27	T/PVC	11/7/2018	10:35
SWE BEFORE DEVELOPING:	7.02	T/PVC	11/7/2018	7:14
SWE AFTER DEVELOPING:	17.05	T/PVC	11/7/2018	10:46
OTHER SWE:	7.21	T/PVC	11/6/2018	7:17
OTHER SWE:	NA	T/PVC	NA	NA

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



WELL CONSTRUCTION LOG

WELL NO. OW-57R OUT

Facility/Project Name: JC Weadock: 2018 Well Reinstall		Date Drilling Started: 11/5/18	Date Drilling Completed: 11/5/18	Project Number: 290805.0001	
Drilling Firm: Stearns Drilling	Drilling Method: Hollow Stem Auger	Surface Elev. (ft) 589.0	TOC Elevation (ft) 591.00	Total Depth (ft bgs) 17.0	Borehole Dia. (in) 9"
Boring Location: Adjacent to OW-57 OUT.		Personnel Logged By - Jake Krenz Driller - Mike Heferan		Drilling Equipment: CME-55	
Civil Town/City/or Village: Essexville	County: Bay County	State: Michigan	Water Level Observations: While Drilling: _____ Date/Time _____ After Drilling: _____ Date/Time 11/7/18 00:00 Depth (ft bgs) _____ Depth (ft bgs) 6.58		

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 HA	100		2	SAND mostly fine to medium sand, trace to few fine to medium gravel, dark gray (10YR 4/1), dry, loose. Change to no gravel, brownish yellow (10YR 6/6), moist at 1.0 feet.				
			4	Change to yellowish brown (10YR 5/4) at 2.5 feet.				
			6	Change to brownish yellow (10YR 6/6) at 3.5 feet.				
2 SS	80	2 4 12 10	6	▼ Change to red (2.5YR 4/6) at 6.5 feet.	SP			
3 SS	90	2 1 1	8	Change to pale brown (10YR 6/3) a 8.0 feet.				
		2	8.5	Change to brown (10YR 5/3) 8.5 feet.				
4 SS	75	1 1 2	10	PEAT mostly organic material, trace fine to medium sand, very dark gray (10YR 3/1), moist, soft to medium stiff.	PT			
			10	SANDY CLAY mostly, little to some, fine to medium sand, gray (10YR 5/1), moist, medium plasticity, soft.				
5 SS	100	12 6 10 12	12	Change to medium stiff, plant roots at 12.0 feet.				
6 SS	90	4 9 11 16	14	Change to yellowish brown (10YR 5/4) mottled with dark yellowish brown (10YR 4/4), stiff, no plant roots at 13.0 feet.	CL			
7 SS	100	7 11 15 21	16	Change to trace fine to medium gravel, light brownish gray (10YR 6/2), medium stiff at 15.0 feet.				
			18	End of boring at 17.0 feet below ground surface.				

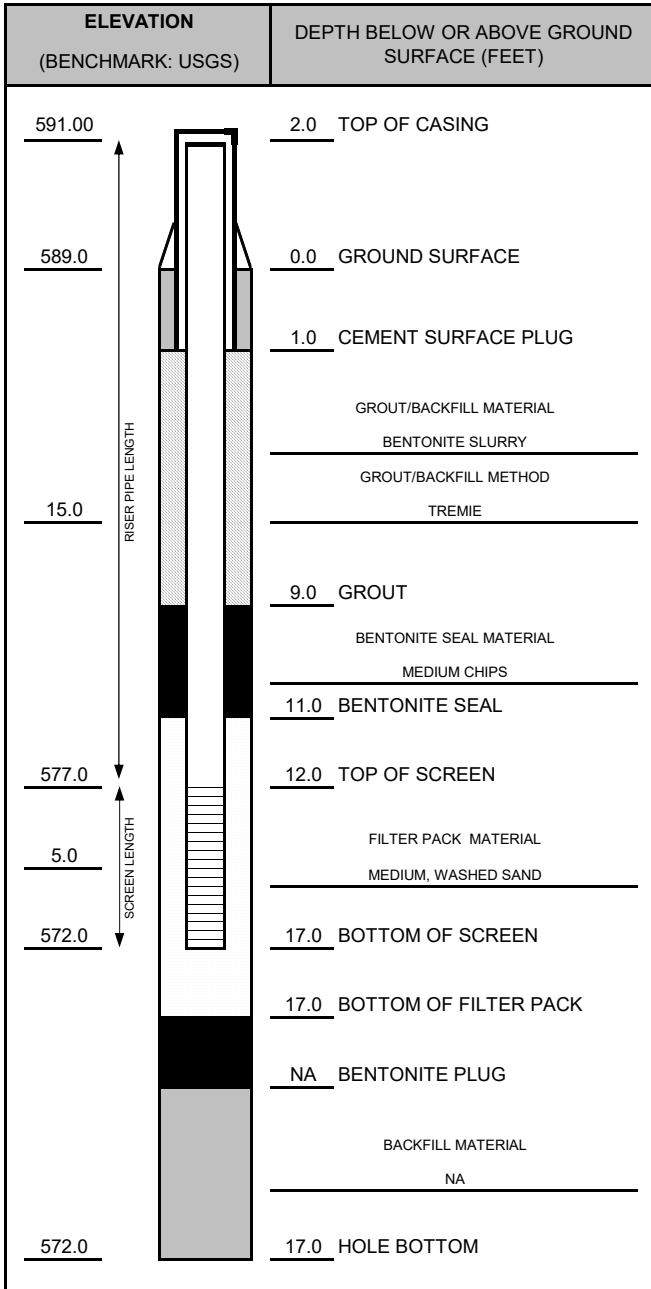
SOIL BORING WELL CONSTRUCTION LOG 290805.0001 WEADOCK WELL REINSTALL 11.2018.GPJ TRC_CORP.GDT 290805.0001 12/3/18

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



WELL CONSTRUCTION DIAGRAM

PROJ. NAME: JC Weadock: 2018 Well Reinstall	WELL ID: OW-57R OUT
PROJ. NO: 290805.0001	DATE INSTALLED: 11/5/18
INSTALLED BY: Jake Krenz	CHECKED BY: DL



NOTES:

CASING AND SCREEN DETAILS	
TYPE OF RISER:	<u>2-INCH PVC</u>
PIPE SCHEDULE:	<u>40</u>
PIPE JOINTS:	<u>THREADED O-RINGS</u>
SOLVENT USED?	<u>NO</u>
SCREEN TYPE:	<u>2-INCH PVC</u>
SCR. SLOT SIZE:	<u>0.01-INCH</u>
BOREHOLE DIAMETER:	<u>9</u> IN. FROM <u>0</u> TO <u>17</u> FT.
	<u>NA</u> IN. FROM <u>NA</u> TO <u>NA</u> FT.
SURF. CASING DIAMETER:	<u>NA</u> IN. FROM <u>NA</u> TO <u>NA</u> FT.
	<u>NA</u> IN. FROM <u>NA</u> TO <u>NA</u> FT.

WELL DEVELOPMENT	
DEVELOPMENT METHOD:	<u>SURGE AND PUMP</u>
TIME DEVELOPING:	<u>0.75</u> HOURS
WATER REMOVED:	<u>6</u> GALLONS
WATER ADDED:	<u>0</u> GALLONS
WATER CLARITY BEFORE / AFTER DEVELOPMENT	
CLARITY BEFORE:	<u>VERY TURBID</u>
COLOR BEFORE:	<u>BROWN</u>
CLARITY AFTER:	<u>CLEAR</u>
COLOR AFTER:	<u>CLEAR</u>
ODOR (IF PRESENT):	<u>NONE</u>

WATER LEVEL SUMMARY				
	MEASUREMENT (FEET)		DATE	TIME
DTB BEFORE DEVELOPING:	20.27	T/PVC	11/6/2018	7:19
DTB AFTER DEVELOPING:	20.27	T/PVC	11/7/2018	11:30
SWE BEFORE DEVELOPING:	9.58	T/PVC	11/7/2018	7:15
SWE AFTER DEVELOPING:	19.00	T/PVC	11/7/2018	11:31
OTHER SWE:	10.03	T/PVC	11/6/2018	7:19
OTHER SWE:	NA	T/PVC	NA	NA

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



MONITORING WELL DECOMMISSIONING LOG

PROJECT NAME: CEC: JC Weadock		MONITORING WELL ID: JCW-MW-15023	
PROJECT NUMBER: 290805 P2 T4	DATE: 05/23/2018	LOCATION:	LOCATION COORDINATES:
OBSERVED BY: Jacob Krenz		Located N of Pond B1 on the left side of the access road running along the discharge channel.	N: 780840.7
DRILLING CONTRACTOR: STEARNS DRILLING			E: 13265275.9
CREW CHIEF: Gary Geerligs		TOP OF CASING ELEV.: <u>595.32</u>	SURFACE ELEV.: <u>592.7</u>

PROTECTIVE COVER TYPE:	<input checked="" type="checkbox"/> STICK-UP	<input type="checkbox"/> FLUSH MOUNT	<input type="checkbox"/> TRAF. BOX	<input type="checkbox"/> OTHER _____
PROTECTIVE COVER DIAMETER:	<input checked="" type="checkbox"/> 4"	<input type="checkbox"/> 8"	<input type="checkbox"/> 9"	<input type="checkbox"/> 10" <input type="checkbox"/> 12" <input type="checkbox"/> OTHER _____
WELL MATERIAL:	<input checked="" type="checkbox"/> PVC	<input type="checkbox"/> SS	<input type="checkbox"/> IRON	<input type="checkbox"/> GALVANIZED STEEL <input type="checkbox"/> OTHER _____
WELL CASING DIAMETER:	<input type="checkbox"/> 1"	<input checked="" type="checkbox"/> 2"	<input type="checkbox"/> 4"	<input type="checkbox"/> 6" <input type="checkbox"/> 8" <input type="checkbox"/> OTHER _____
WELL SCREEN MATERIAL:	<input checked="" type="checkbox"/> PVC	<input type="checkbox"/> SS	<input type="checkbox"/> IRON	<input type="checkbox"/> GALVANIZED STEEL <input type="checkbox"/> OTHER _____
WELL SCREEN LENGTH:	<input checked="" type="checkbox"/> 5-FT	<input type="checkbox"/> 10-FT	<input type="checkbox"/> UNKNOWN	<input type="checkbox"/> OTHER _____
WELL SCREEN SLOT SIZE:	<input checked="" type="checkbox"/> 0.01"	<input type="checkbox"/> 0.02"	<input type="checkbox"/> UNKNOWN	<input type="checkbox"/> OTHER _____
				DTW: <u>12.66</u> T/ PVC
				DTB: <u>20.80</u> T/ PVC

DECOMMISSIONING PROCEDURE: OVERDRILL AND GROUT	
NOTES: The protective cover and bollards were pulled using a skid loader. Hollow stem augers were advanced to the total depth of the well. The entire well casing was removed from the bore hole. Bentonite slurry was used to grout the bore hole from the bottom up using the tremie method to within one foot below ground surface. The bore hole was then topped with bentonite chips and the ground surface was restored to its original condition using surrounding gravel.	

GROUTING PROCEDURE: TREMIE	NOTES:
GROUT TYPE: BENTONITE SLURRY	
GROUT MIX:	
GROUT INTERVAL: 18 FT-BGS TO 1 FT-BGS	
BENTONITE SEAL: MEDIUM CHIPS	
SEAL INTERVAL: 1 FT-BGS TO 0 FT-BGS	

ADDITIONAL COMMENTS:

10/24/18

 SIGNED DATE

10/24/18

 CHECKED DATE



MONITORING WELL DECOMMISSIONING LOG

PROJECT NAME: CEC: JC Weadock		MONITORING WELL ID: JCW-MW-15011	
PROJECT NUMBER: 290805 P2 T4	DATE: 05/23/2018	LOCATION:	LOCATION COORDINATES:
OBSERVED BY: Jacob Krenz		Located N of Pond B1 on the left side of the access road running along the discharge channel.	N: 780807.4
DRILLING CONTRACTOR: STEARNS DRILLING			E: 13265133.1
CREW CHIEF: Gary Geerligs		TOP OF CASING ELEV.: <u>597.07</u>	SURFACE ELEV.: <u>594.9</u>

PROTECTIVE COVER TYPE:	<input checked="" type="checkbox"/> STICK-UP	<input type="checkbox"/> FLUSH MOUNT	<input type="checkbox"/> TRAF. BOX	<input type="checkbox"/> OTHER _____
PROTECTIVE COVER DIAMETER:	<input checked="" type="checkbox"/> 4"	<input type="checkbox"/> 8"	<input type="checkbox"/> 9"	<input type="checkbox"/> 10" <input type="checkbox"/> 12" <input type="checkbox"/> OTHER _____
WELL MATERIAL:	<input checked="" type="checkbox"/> PVC	<input type="checkbox"/> SS	<input type="checkbox"/> IRON	<input type="checkbox"/> GALVANIZED STEEL <input type="checkbox"/> OTHER _____
WELL CASING DIAMETER:	<input type="checkbox"/> 1"	<input checked="" type="checkbox"/> 2"	<input type="checkbox"/> 4"	<input type="checkbox"/> 6" <input type="checkbox"/> 8" <input type="checkbox"/> OTHER _____
WELL SCREEN MATERIAL:	<input checked="" type="checkbox"/> PVC	<input type="checkbox"/> SS	<input type="checkbox"/> IRON	<input type="checkbox"/> GALVANIZED STEEL <input type="checkbox"/> OTHER _____
WELL SCREEN LENGTH:	<input type="checkbox"/> 5-FT	<input type="checkbox"/> 10-FT	<input type="checkbox"/> UNKNOWN	<input checked="" type="checkbox"/> OTHER <u>3-FT</u>
WELL SCREEN SLOT SIZE:	<input checked="" type="checkbox"/> 0.01"	<input type="checkbox"/> 0.02"	<input type="checkbox"/> UNKNOWN	<input type="checkbox"/> OTHER _____
				DTW: <u>13.59</u> T/ PVC
				DTB: <u>18.29</u> T/ PVC

DECOMMISSIONING PROCEDURE: OVERDRILL AND GROUT

NOTES:
 The protective cover and bollards were pulled using a skid loader. Hollow stem augers were advanced to the total depth of the well. The entire well casing was removed from the bore hole. Bentonite slurry was used to grout the bore hole from the bottom up using the tremie method to within one foot below ground surface. The bore hole was then topped with bentonite chips and the ground surface was restored to its original condition using surrounding gravel.

GROUTING PROCEDURE: TREMIE	<u>NOTES:</u>
GROUT TYPE: BENTONITE SLURRY	
GROUT MIX:	
GROUT INTERVAL: 16 FT-BGS TO 1 FT-BGS	
BENTONITE SEAL: MEDIUM CHIPS	
SEAL INTERVAL: 1 FT-BGS TO 0 FT-BGS	

ADDITIONAL COMMENTS:




SIGNED _____ DATE 10/24/18 CHECKED _____ DATE 10/24/18



MONITORING WELL DECOMMISSIONING LOG

PROJECT NAME: CEC: JC Weadock		MONITORING WELL ID: JCW-MW-15012	
PROJECT NUMBER: 290805 P2 T4	DATE: 05/23/2018	LOCATION:	LOCATION COORDINATES:
OBSERVED BY: Jacob Krenz		Located N of Pond B1 on the left side of the access road running along the discharge channel.	N: 780995.6
DRILLING CONTRACTOR: STEARNS DRILLING			E: 13265672.5
CREW CHIEF: Gary Geerligs		TOP OF CASING ELEV.: 595.07	SURFACE ELEV.: 592.2

PROTECTIVE COVER TYPE:	<input checked="" type="checkbox"/> STICK-UP	<input type="checkbox"/> FLUSH MOUNT	<input type="checkbox"/> TRAF. BOX	<input type="checkbox"/> OTHER _____
PROTECTIVE COVER DIAMETER:	<input checked="" type="checkbox"/> 4"	<input type="checkbox"/> 8"	<input type="checkbox"/> 9"	<input type="checkbox"/> 10" <input type="checkbox"/> 12" <input type="checkbox"/> OTHER _____
WELL MATERIAL:	<input checked="" type="checkbox"/> PVC	<input type="checkbox"/> SS	<input type="checkbox"/> IRON	<input type="checkbox"/> GALVANIZED STEEL <input type="checkbox"/> OTHER _____
WELL CASING DIAMETER:	<input type="checkbox"/> 1"	<input checked="" type="checkbox"/> 2"	<input type="checkbox"/> 4"	<input type="checkbox"/> 6" <input type="checkbox"/> 8" <input type="checkbox"/> OTHER _____
WELL SCREEN MATERIAL:	<input checked="" type="checkbox"/> PVC	<input type="checkbox"/> SS	<input type="checkbox"/> IRON	<input type="checkbox"/> GALVANIZED STEEL <input type="checkbox"/> OTHER _____
WELL SCREEN LENGTH:	<input type="checkbox"/> 5-FT	<input type="checkbox"/> 10-FT	<input type="checkbox"/> UNKNOWN	<input checked="" type="checkbox"/> OTHER 3-FT
WELL SCREEN SLOT SIZE:	<input checked="" type="checkbox"/> 0.01"	<input type="checkbox"/> 0.02"	<input type="checkbox"/> UNKNOWN	<input type="checkbox"/> OTHER _____
				DTW: 13.75 T/ PVC
				DTB: 18.75 T/ PVC

DECOMMISSIONING PROCEDURE: OVERDRILL AND GROUT

NOTES:
 The protective cover and bollards were pulled using a skid loader. Hollow stem augers were advanced to the total depth of the well. The entire well casing was removed from the bore hole. Bentonite slurry was used to grout the bore hole from the bottom up using the tremie method to within one foot below ground surface. The bore hole was then topped with bentonite chips and the ground surface was restored to its original condition using surrounding gravel.

GROUTING PROCEDURE: TREMIE	NOTES:
GROUT TYPE: BENTONITE SLURRY	
GROUT MIX:	
GROUT INTERVAL: 16 FT-BGS TO 1 FT-BGS	
BENTONITE SEAL: MEDIUM CHIPS	
SEAL INTERVAL: 1 FT-BGS TO 0 FT-BGS	

ADDITIONAL COMMENTS:

Christina 10/24/18
 SIGNED DATE

Dale 10/24/18
 CHECKED DATE

Appendix B

Data Quality Reviews

Laboratory Data Quality Review

Groundwater Monitoring Event April 2018

CEC DE Karn and JC Weadock Background Wells

Groundwater samples were collected by TRC for the April 2018 sampling event. Samples were analyzed for anions and total metals by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan, and for radium by Pace located in Greensburg, Pennsylvania. The laboratory analytical results are reported in laboratory reports 4610843 and 4610844.

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

- MW-15002
- MW-15008
- MW-15016
- MW-15019

Each sample was analyzed for the following constituents:

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

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

Data Usability Review Procedure

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

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

This data usability report addresses the following items:

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

Review Summary

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

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

QA/QC Sample Summary:

- A method blank was analyzed with each analytical batch; no analytes were detected in the blank samples.
- The LCS recoveries for all analytes were within QC limits.
- A field blank (FB-20180410) was collected; no analytes were detected in the blank samples.
- Dup_20180410 corresponds to MW-15008_20180410; relative percent differences (RPDs) between the parent and duplicate sample were within the QC limits.
- Laboratory duplicates analyses were performed on non-project samples; RPDs were within QC limits.
- MS/MSD analyses were performed on non-project samples.

Laboratory Data Quality Review

Groundwater Monitoring Event May 2018

CEC DE Karn and JC Weadock Background Wells

Groundwater samples were collected by TRC for the May 2018 sampling event. Samples were analyzed for anions, total dissolved solids, and total metals by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan, and for radium by Pace located in Greensburg, Pennsylvania. The laboratory analytical results are reported in laboratory reports 4612624 and 4612625.

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

- MW-15002
- MW-15008
- MW-15016
- MW-15019

Each sample was analyzed for the following constituents:

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

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

Data Usability Review Procedure

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

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

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

This data usability report addresses the following items:

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

Review Summary

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

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

QA/QC Sample Summary:

- A method blank was analyzed with each analytical batch; no analytes were detected in the blank samples.
- The LCS recoveries for all analytes were within QC limits.
- A field blank (FB_20180522) was collected; no analytes were detected in the blank samples.
- The field duplicate pair samples were Dup_20180522 with MW-15019_20180522; relative percent differences (RPDs) between the parent and duplicate sample were within the QC limits (20%), with the exception of sulfate (25%). Potential uncertainty exists for sulfate results for the field duplicate pair (see attached Table); however, the concentrations of sulfate detected in both the duplicate and primary sample were within the range of historical sulfate concentrations observed in MW-15019.

- Laboratory duplicates analyses were performed on non-project samples; thus, these QC samples were not evaluated.
- MS/MSD analyses were performed on non-project samples; thus, these QC samples were not evaluated.

Attachment B

Summary of Data Non-Conformances for Background Groundwater Analytical Data
DE Karn & JC Weadock – RCRA CCR Monitoring Program
Essexville, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
Dup_20180522	5/22/2018	Sulfate	RPD for the field duplicate pair exceeded the 20% acceptance limit. Potential uncertainty exists for sulfate results due to the field duplicate variability; however, concentrations are within range of historical sulfate concentrations. Data deemed usable for intended purpose.
MW-15019_20180522	5/22/2018		

Laboratory Data Quality Review

Groundwater Monitoring Event April 2018

CEC JC Weadock Landfill

Groundwater samples were collected by TRC for the April 2018 sampling event. Samples were analyzed for anions and total metals by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan, and for radium by Pace located in Greensburg, Pennsylvania. The laboratory analytical results are reported in laboratory reports 4610845 and 4610846.

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

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

Each sample was analyzed for the following constituents:

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

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

Data Usability Review Procedure

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

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

This data usability report addresses the following items:

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

Review Summary

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

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

QA/QC Sample Summary:

- A method blank was analyzed with each analytical batch. Normalized absolute difference comparisons between blank and sample that are between 1.96 and 2.58 may indicate biased high results and normalize absolute differences <1.96 may indicate a false positive sample result, as summarized in the attached table.
 - Radium-228 was detected in the method blank associated with batch 295492 at 0.864 ± 0.447 pCi/L. Radium results for samples analyzed in the same batch as the method blank are potentially impacted (see attached table); however, the concentrations of radium-228 detected in the sample associated with batch 295492 (JCW-MW-15012) was within the range of historical radium-228 concentrations.
- One equipment blank (EB-2) and one field blank (FB-2) were collected; no analytes were detected in the blank samples.
- The LCS recoveries for all analytes were within QC limits.

- MS/MSDs were performed on sample JCW-MW-15012 for fluoride, radium, and metals. All criteria were met.
- Dup-2 corresponds to JCW-MW-15011; relative percent differences (RPDs) between the parent and duplicate sample were within the QC limits.
- Laboratory duplicate analyses were performed on sample JCW-MW-15012 for fluoride; RPDs were within QC limits.

Attachment B

Summary of Data Non-Conformances for Landfill Groundwater Analytical Data
JC Weadock – RCRA CCR Monitoring Program
Essexville, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JCW-MW-15012_20180411	4/11/2018	Radium-228	Detection in method blank. Normalized absolute difference between blank and sample <1.96; indicates a possible false positive result; however, the concentration of radium-228 was within the range of historical radium-228 concentrations at JCW-MW-15012.

Laboratory Data Quality Review

Groundwater Monitoring Event May 2018

CEC JC Weadock Landfill

Groundwater samples were collected by TRC for the May 2018 sampling event. Samples were analyzed for anions, total dissolved solids, and total metals by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan, and for radium by Pace located in Greensburg, Pennsylvania. The laboratory analytical results are reported in laboratory reports 4612622 and 4612623.

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

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

Each sample was analyzed for the following constituents:

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

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

Data Usability Review Procedure

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

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

This data usability report addresses the following items:

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

Review Summary

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

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

QA/QC Sample Summary:

- A method blank was analyzed with each analytical batch. No analytes were detected in the method blanks.
- One equipment blank (EB-02) and one field blank (FB-02) were collected.
 - Radium-228 was detected in FB-02 at a concentration of 1.49 ± 0.560 pCi/L. Radium-228 was not detected in the associated samples. Data usability was not affected.
- The LCS recoveries for all analytes were within QC limits.
- MS/MSDs were performed on sample JCW-MW-15012 for metals.
 - The recoveries of boron in the MS/MSD were above the upper laboratory control limit in batch 24667. The boron concentration in the parent sample was >4x the spike concentration; therefore, the laboratory control limits are not applicable. Data usability was not affected.

- The recovery of calcium in the MSD was below the lower laboratory control limit in batch 246663. The calcium results for samples analyzed in this batch may be biased low (see attached Table); however, the concentrations of calcium detected in batch 246663 samples were within the range of historical calcium concentrations.
- Field duplicate pair samples were Dup-2 and JCW-MW-15023; relative percent differences (RPDs) between the parent and duplicate sample were within the QC limits.
- Laboratory duplicate analyses were performed on sample JCW-MW-15012 for anions and total dissolved solids; RPDs were within QC limits.

Attachment B

Summary of Data Non-Conformances for Landfill Groundwater Analytical Data
JC Weadock – RCRA CCR Monitoring Program
Essexville, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
Dup-02_20180521	5/21/2018	Calcium	Recovery in the MSD was below the lower laboratory control limits. The result may be biased low; however, the concentrations of calcium were within the range of historical calcium concentrations
EB-02_20180521	5/21/2018		
FB-02_20180521	5/21/2018		
JCW-MW-15011_20180521	5/21/2018		
JCW-MW-15012_20180521	5/21/2018		
JCW-MW-15023_20180521	5/21/2018		

Appendix C

Groundwater Protection Standards

Technical Memorandum

Date: October 15, 2018; Revised December 7, 2018

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

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

Project No.: 290805.0000 Phase 001, Task 002

Subject: Groundwater Protection Standards – Consumers Energy, JC Weadock Site,
Landfill Unit

Pursuant to the United States Environmental Protection Agency’s (U.S. EPA’s) Resource Conservation and Recovery Act (RCRA) Coal Combustion Residual rule (“CCR Rule”) promulgated on April 17, 2015, the owner or operator of a CCR Unit must collect a minimum of eight rounds of background groundwater data to initiate a detection monitoring program and evaluate statistically significant increases above background (40 CFR §257.94). The first detection monitoring event for the Consumers Energy Company (CEC) JC Weadock Power Plant (JCW site) in Essexville, Michigan, was conducted on September 18 and 19, 2017. During this event several Appendix III constituents were observed in downgradient monitoring wells at concentrations constituting statistically significant increases (SSIs) over the background concentrations established for the site (2017 Annual Report). Alternative Source Demonstrations (ASDs) were unsuccessful for one or more SSI, thereby triggering the requirement for establishing an Assessment Monitoring Program in accordance with 40 CFR §257.95. Groundwater samples were collected on April 10 through 12, 2018, that were analyzed for Appendix IV parameters pursuant to §257.95(b). In compliance with §257.95(d), additional groundwater samples were collected on May 21 through 24, 2018, and were analyzed for Appendix III and IV parameters. Analytical data collected from the background monitoring wells are presented in attached Table A1.

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

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

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

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

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

The set of background wells utilized for the DEK BAP, JCW BAP, and JCW LF sites includes MW-15002, MW-15008, MW-15016, and MW-15019. The background evaluation included the following steps:

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

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

The results of these evaluations are presented and discussed below.

Data Quality

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

Time versus Concentration Graphs

The T v. C graphs show a potential outlier for lithium (high value for MW-15016 in February 2017) (Figure 1). This data set will be tested by the Sanitas™ software to assess whether the potential outliers are statistically significant.

While variations in results are present, the graphs do not suggest that data sets, as a whole, likely have overall trending or seasonality. The data sets are of relatively short duration for making such observations.

Cumulative Baseline Data Sets

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

Outlier Testing

The Dixon's Outlier Test in Sanitas™ was used to test the potential outlier in the lithium data set for MW-15016 that was identified in the T v. C graphs (Figure 1) and in the cumulative concentration distribution (Figure 2). The suspect data point was found to not be an outlier at the 0.01 significance level (see attached Sanitas™ output file). The potential outlier was not confirmed and not removed from the data set. The data point will be retained for the Groundwater Protection Standards UTL calculations.

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Percentage of Nondetects

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

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

WELL	CONSTITUENT	PERCENT NON-DETECT
MW-15002	Antimony	100
	Arsenic	25
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	13
	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	38
	Mercury	100
	Molybdenum	100
	Selenium	88
	Thallium	100
	Radium 226 and 228 combined	38
MW-15008	Antimony	100
	Arsenic	50
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	0
	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	0
	Mercury	100
	Molybdenum	100
	Selenium	100
	Thallium	100
	Radium 226 and 228 combined	13
MW-15016	Antimony	100
	Arsenic	0
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	50
	Cobalt	100
	Fluoride	100

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

WELL	CONSTITUENT	PERCENT NON-DETECT
MW-15016 <i>(cont'd)</i>	Lead	100
	Lithium	0
	Mercury	100
	Molybdenum	75
	Selenium	75
	Thallium	100
	Radium 226 and 228 combined	25
MW-15019	Antimony	100
	Arsenic	88
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	50
	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	0
	Mercury	100
	Molybdenum	100
	Selenium	100
	Thallium	100
	Radium 226 and 228 combined	13
COMBINED	Antimony	100
	Arsenic	41
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	33
	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	9
	Mercury	100
	Molybdenum	94
	Selenium	91
	Thallium	100
	Radium 226 and 228 combined	22

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Distribution of the Data Sets

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

Table 2
Summary of Background/Baseline Data Distributions

CONSTITUENT	DISTRIBUTION
Antimony	All ND – use highest RL
Arsenic	Nonnormal
Barium	Normalized by natural log transformation
Beryllium	All ND – use highest RL
Cadmium	All ND – use highest RL
Chromium	Nonnormal
Cobalt	All ND – use highest RL
Fluoride	All ND – use highest RL
Lead	All ND – use highest RL
Lithium	Nonnormal
Mercury	All ND – use highest RL
Molybdenum	Nonnormal (>75% censored data)
Selenium	Nonnormal (>75% censored data)
Thallium	All ND – use highest RL
Radium 226 and 228 combined	Normalized by square root transformation

ND = Non-detect

RL = Reporting Limit

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Upper Tolerance Limits

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

Table 3
Summary of Initial Groundwater Protection Standards

CONSTITUENT	UNITS	UPPER TOLERANCE LIMIT - FROM SANITAS™	MAXIMUM CONTAMINANT LEVEL	REGIONAL SCREENING LEVEL	GROUNDWATER PROTECTION STANDARD
Antimony	ug/L	RL (1)	6	NA	6
Arsenic	ug/L	21	10	NA	21
Barium	ug/L	1,300	2,000	NA	2,000
Beryllium	ug/L	RL (1)	4	NA	4
Cadmium	ug/L	RL (0.2)	5	NA	5
Chromium	ug/L	3	100	NA	100
Cobalt	ug/L	RL (15)	NC	6	15
Fluoride	ug/L	RL (1,000)	4,000	NA	4,000
Lead	ug/L	RL (1)	NC	15	15
Lithium	ug/L	180	NC	40	180
Mercury	ug/L	RL (0.2)	2	NA	2
Molybdenum	ug/L	6	NC	100	100
Selenium	ug/L	2	50	NA	50
Thallium	ug/L	RL (2)	2	NA	2
Radium 226 and 228 combined	pCi/L	3.32	5	NA	5

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

Revised 12/7/18

Attachments

Table A1 – Summary of Groundwater Sampling Results (Analytical)

Figure 1 – Background Concentration Time-Series Charts

Figure 2 – Combined Background Distribution

Sanitas™ Output Files

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Table A1
Summary of Groundwater Sampling Results
(Analytical)

Table A1
 Summary of Groundwater Sampling Results (Analytical) – December 2015 to May 2018
 DE Karn & JC Weadock Background – RCRA CCR Monitoring Program
 Essexville, Michigan

Sample Location:		MW-15002										
Sample Date:		12/8/2015	3/28/2016	5/23/2016	8/22/2016	11/30/2016	2/22/2017	5/17/2017	8/1/2017	9/19/2017	4/9/2018	5/22/2018
Constituent	Unit	Background										
Appendix III												
Boron	ug/L	275	22	163	79	48	133	138	205	313	--	69.2
Calcium	mg/L	198	174	288	114	84.7	260	267	255	249	--	221
Chloride	mg/L	1,130	773	2,140	420	260	1,470	1,970	2,290	2,270	--	2,020
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	7.0	7.0	6.6	6.9	7.2	7.0	6.8	6.9	6.9	6.7	7.0
Sulfate	mg/L	9.63	40.3	5.25	39.8	23.4	13.1	11.5	< 2.0	< 2.0	--	37.8
Total Dissolved Solids	mg/L	2,400	1,700	4,500	1,300	980	3,100	4,300	4,600	4,280	--	3,810
Appendix IV												
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	4	< 1	7	< 1	2	2	3	4.8	--	< 1.0	< 1.0
Barium	ug/L	1,010	216	796	167	212	851	580	912	--	547	364
Beryllium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	1	1	2	< 1	1	1	2	1.3	--	< 1.0	< 1.0
Cobalt	ug/L	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	37.7	< 10	21	< 10	< 10	24	22	31	--	24	14
Mercury	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0
Radium-226	pCi/L	0.637	0.33	0.893	< 0.264	< 0.402	0.556	0.879	1.72	--	0.866	0.751
Radium-226/228	pCi/L	2.047	< 0.644	2.523	< 1.05	< 0.433	2.036	2.98	4.65	--	2.45	2.47
Radium-228	pCi/L	1.41	< 0.644	1.63	< 1.05	< 0.433	1.48	2.1	2.93	--	1.58	1.72
Selenium	ug/L	< 1	< 1	1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Thallium	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0

Notes:
 ug/L - micrograms per liter.
 mg/L - milligrams per liter.
 SU - standard units; pH is a field parameter.
 pCi/L - picocuries per liter.
 -- - not analyzed.
 All metals were analyzed as total
 unless otherwise specified.

Table A1
 Summary of Groundwater Sampling Results (Analytical) – December 2015 to May 2018
 DE Karn & JC Weadock Background – RCRA CCR Monitoring Program
 Essexville, Michigan

Sample Location:		MW-15008											
Sample Date:		12/9/2015	3/29/2016	5/24/2016	8/23/2016	11/30/2016	2/22/2017	5/17/2017	8/2/2017	9/19/2017	4/10/2018	4/10/2018	5/22/2018
Constituent	Unit	Background											
Appendix III												Field Dup	
Boron	ug/L	236	169	176	202	204	174	187	164	183	--	--	153
Calcium	mg/L	114	126	113	114	113	107	114	108	109	--	--	111
Chloride	mg/L	292	231	246	214	192	200	149	300	329	--	--	255
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.8	6.7	6.5	6.7	6.8	6.8	6.7	6.9	6.8	6.6	--	6.8
Sulfate	mg/L	5.15	26.7	8.6	17.9	25.6	27.7	10.1	13.4	3.9	--	--	4.3
Total Dissolved Solids	mg/L	860	720	880	730	790	760	840	866	848	--	--	744
Appendix IV													
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	< 1	1	1	1	1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	69	64	63	58	69	57	60	58.2	--	57.1	56.7	54.7
Beryllium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	3	2	3	2	2	1	2	1.1	--	< 1.0	1.1	2.0
Cobalt	ug/L	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	22.3	19.7	17	20	22	20	19	22	--	26	25	19
Mercury	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	0.481	0.546	0.411	0.32	0.444	< 0.419	0.228	< 0.937	--	< 0.621	< 0.420	< 0.929
Radium-226/228	pCi/L	1.531	1.42	1.611	1.96	1.454	0.826	1.45	< 1.79	--	< 1.26	< 1.15	2.00
Radium-228	pCi/L	1.05	0.874	1.2	1.64	1.01	0.717	1.22	< 0.848	--	0.795	< 0.727	1.94
Selenium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Thallium	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
 mg/L - milligrams per liter.
 SU - standard units; pH is a field parameter.
 pCi/L - picocuries per liter.
 -- - not analyzed.
 All metals were analyzed as total
 unless otherwise specified.

Table A1
 Summary of Groundwater Sampling Results (Analytical) – December 2015 to May 2018
 DE Karn & JC Weadock Background – RCRA CCR Monitoring Program
 Essexville, Michigan

Sample Location:		MW-15016										
Sample Date:		12/8/2015	3/29/2016	5/24/2016	8/22/2016	11/30/2016	2/22/2017	5/17/2017	8/1/2017	9/19/2017	4/10/2018	5/22/2018
Constituent	Unit	Background										
Appendix III												
Boron	ug/L	490	56	472	660	435	463	491	590	602	--	409
Calcium	mg/L	178	204	188	216	192	295	221	208	160	--	212
Chloride	mg/L	89.7	264	91.1	93.6	83	160	110	113	99.5	--	82.4
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	7.1	7.1	6.8	6.8	7.0	7.2	7.0	7.0	7.1	7.3	7.3
Sulfate	mg/L	35.1	151	75	70.6	18.1	817	243	294	13.3	--	539
Total Dissolved Solids	mg/L	670	1,000	900	920	840	1,700	1,100	1,090	756	--	1,230
Appendix IV												
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	11	2	16	18	16	2	12	20.5	--	< 1.0	< 1.0
Barium	ug/L	237	114	233	299	241	109	151	197	--	41.8	47.4
Beryllium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	1	1	1	< 1	< 1	2	< 1	< 1.0	--	< 1.0	< 1.0
Cobalt	ug/L	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	31.2	16.9	33	48	28	181	88	83	--	120	100
Mercury	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	6	< 5	< 5	< 5	< 5	6	< 5	< 5.0	--	5.4	6.5
Radium-226	pCi/L	0.311	0.303	0.292	< 0.199	< 0.304	< 0.312	0.479	< 1.01	--	< 0.658	< 0.711
Radium-226/228	pCi/L	1.581	0.75	1.402	< 1.41	1.079	0.736	0.958	< 2.34	--	< 1.36	< 1.48
Radium-228	pCi/L	1.27	< 0.673	1.11	< 1.41	0.871	0.573	< 0.619	< 1.33	--	< 0.697	< 0.765
Selenium	ug/L	< 1	< 1	< 1	< 1	< 1	2	1	< 1.0	--	1.7	1.2
Thallium	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0

Notes:
 ug/L - micrograms per liter.
 mg/L - milligrams per liter.
 SU - standard units; pH is a field parameter.
 pCi/L - picocuries per liter.
 -- - not analyzed.
 All metals were analyzed as total
 unless otherwise specified.

Table A1
 Summary of Groundwater Sampling Results (Analytical) – December 2015 to May 2018
 DE Karn & JC Weadock Background – RCRA CCR Monitoring Program
 Essexville, Michigan

Sample Location:		MW-15019											
Sample Date:		12/9/2015	3/29/2016	5/24/2016	8/23/2016	11/30/2016	2/22/2017	5/16/2017	8/2/2017	9/19/2017	4/9/2018	5/22/2018	5/22/2018
Constituent	Unit	Background											
Appendix III													Field Dup
Boron	ug/L	304	244	279	343	300	317	299	293	324	--	225	247
Calcium	mg/L	171	150	179	227	154	149	146	165	155	--	128	137
Chloride	mg/L	437	387	408	358	359	379	357	380	438	--	382	379
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.8	6.8	6.7	6.7	6.8	6.8	6.8	6.9	6.9	6.8	6.9	--
Sulfate	mg/L	99.7	51.2	116	195	67.3	54.2	49.5	120	99.7	--	51.6	66.4
Total Dissolved Solids	mg/L	1,400	1,100	1,300	1,300	1,100	1,200	1,100	1,250	1,200	--	1,080	1,120
Appendix IV													
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	< 1	< 1	1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	293	263	269	319	275	289	283	265	--	246	258	255
Beryllium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	2	2	2	< 1	< 1	1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	15.8	11	14	21	13	13	14	16	--	17	11	12
Mercury	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	1.02	0.477	0.515	0.759	0.524	< 0.3	0.36	< 0.844	--	0.444	< 0.690	< 0.799
Radium-226/228	pCi/L	1.835	1.243	1.502	1.677	1.006	1.045	1.74	< 1.57	--	1.03	< 1.56	< 1.59
Radium-228	pCi/L	0.815	0.766	0.987	0.918	< 0.666	0.814	1.38	< 0.722	--	< 0.589	< 0.874	0.964
Selenium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Thallium	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
 mg/L - milligrams per liter.
 SU - standard units; pH is a field parameter.
 pCi/L - picocuries per liter.
 -- - not analyzed.
 All metals were analyzed as total
 unless otherwise specified.

Table A1
 Summary of Groundwater Sampling Results (Analytical) – December 2015 to May 2018
 DE Karn & JC Weadock Background – RCRA CCR Monitoring Program
 Essexville, Michigan

Sample Location:		MW-15027								
Sample Date:		12/9/2015	3/29/2016	5/24/2016	8/23/2016	11/30/2016	2/22/2017	5/17/2017	8/2/2017	9/19/2017
Constituent	Unit	Background								
Appendix III										
Boron	ug/L	208	144	181	253	169	135	178	199	223
Calcium	mg/L	103	109	108	111	95.8	93.6	120	113	103
Chloride	mg/L	348	285	348	293	223	225	275	386	379
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	7.0	6.9	6.8	6.8	7.0	7.0	6.9	7.0	7.0
Sulfate	mg/L	16	30.7	12.9	20.8	25.4	19.5	22.9	10.8	15.0
Total Dissolved Solids	mg/L	800	890	980	850	790	750	910	982	968
Appendix IV										
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--
Arsenic	ug/L	< 1	< 1	1	< 1	< 1	< 1	< 1	< 1.0	--
Barium	ug/L	95	89	95	94	78	79	103	107	--
Beryllium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--
Cadmium	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--
Chromium	ug/L	2	1	2	1	1	1	2	< 1.0	--
Cobalt	ug/L	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--
Lithium	ug/L	27.2	21.3	21	23	20	19	23	26	--
Mercury	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--
Molybdenum	ug/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--
Radium-226	pCi/L	0.386	0.461	0.485	0.359	< 0.305	0.396	0.431	< 0.878	--
Radium-226/228	pCi/L	1.356	1.395	1.308	1.277	0.962	1.606	1.27	2.15	--
Radium-228	pCi/L	0.97	0.934	0.823	0.918	0.706	1.21	0.836	1.56	--
Selenium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--
Thallium	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--

Notes:

ug/L - micrograms per liter.
 mg/L - milligrams per liter.
 SU - standard units; pH is a field parameter.
 pCi/L - picocuries per liter.
 -- - not analyzed.
 All metals were analyzed as total
 unless otherwise specified.

Technical Memorandum

Figures

Figure 1
Background Concentration Time-Series Charts
Karn/Weadock Site - Appendix IV Constituents

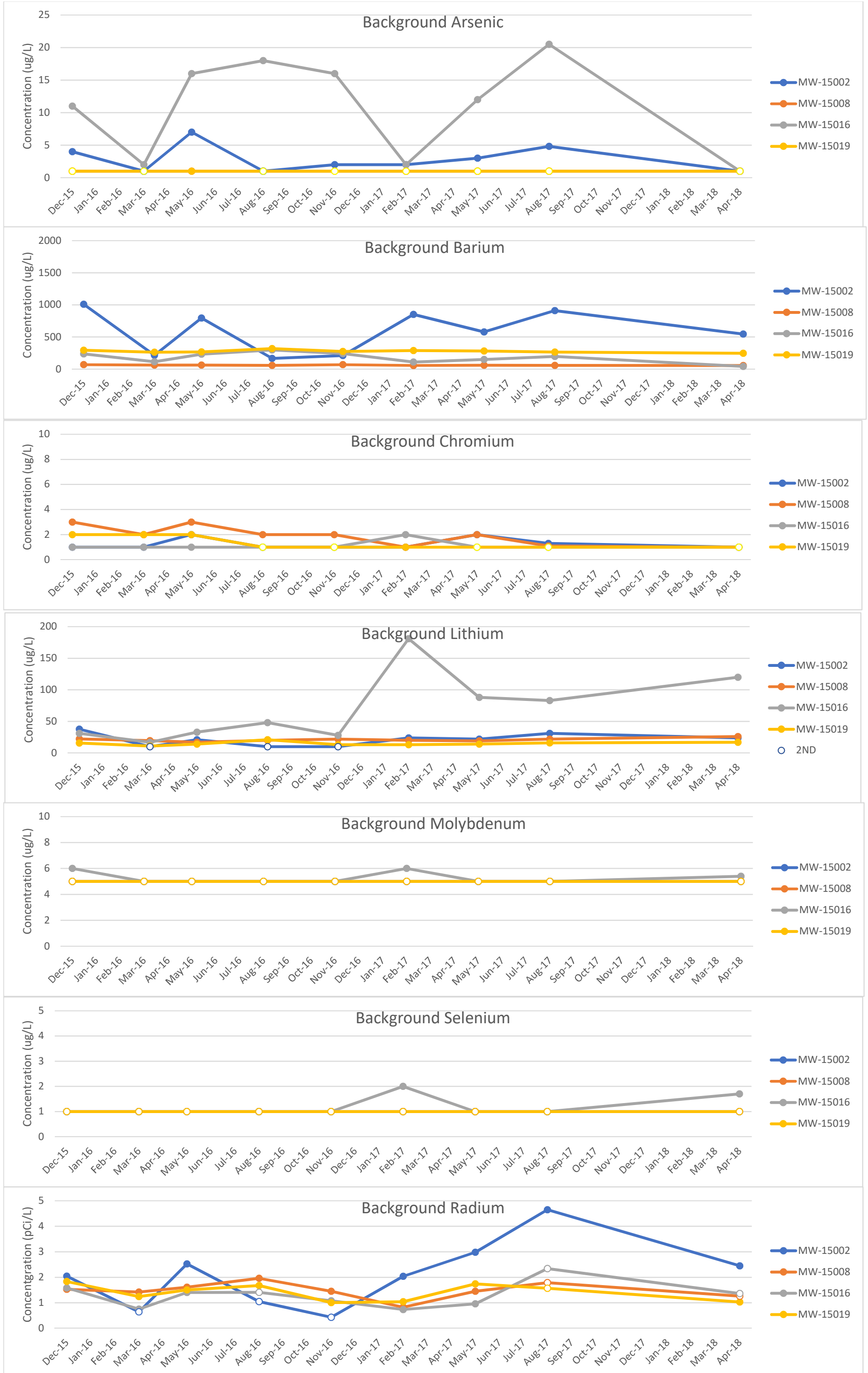
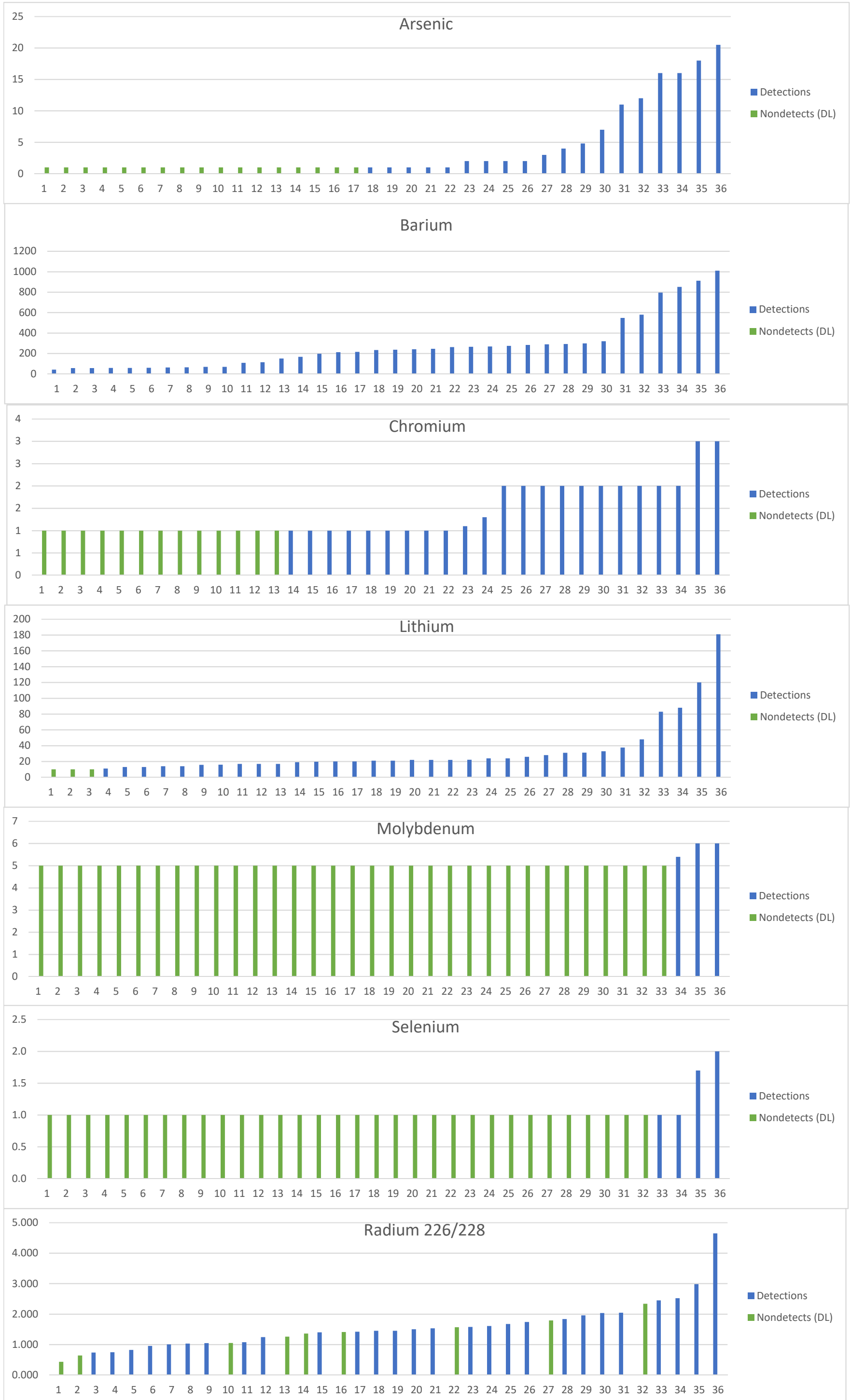


Figure 2
 Cumulative Background Concentrations - Appendix IV
 Karn/Weadock Complex

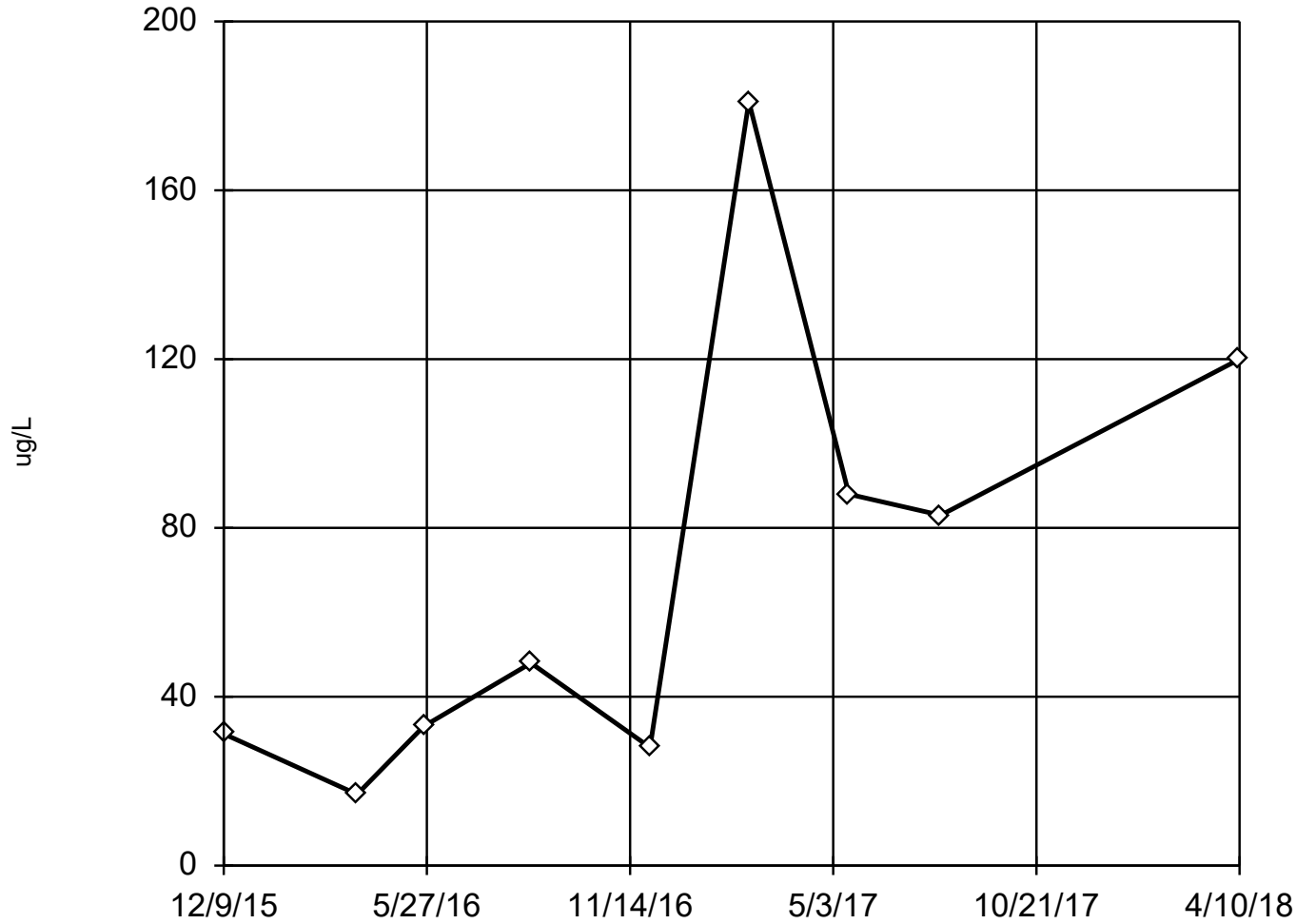


Technical Memorandum

Sanitas™ Output Files

EPA Screening (suspected outliers for Dixon's Test)

MW-15016 (bg)



n = 9

Dixon's will not be run.
Unable to establish suspect values.
Mean 69.9, std. dev. 53.92,
critical Tn 2.11

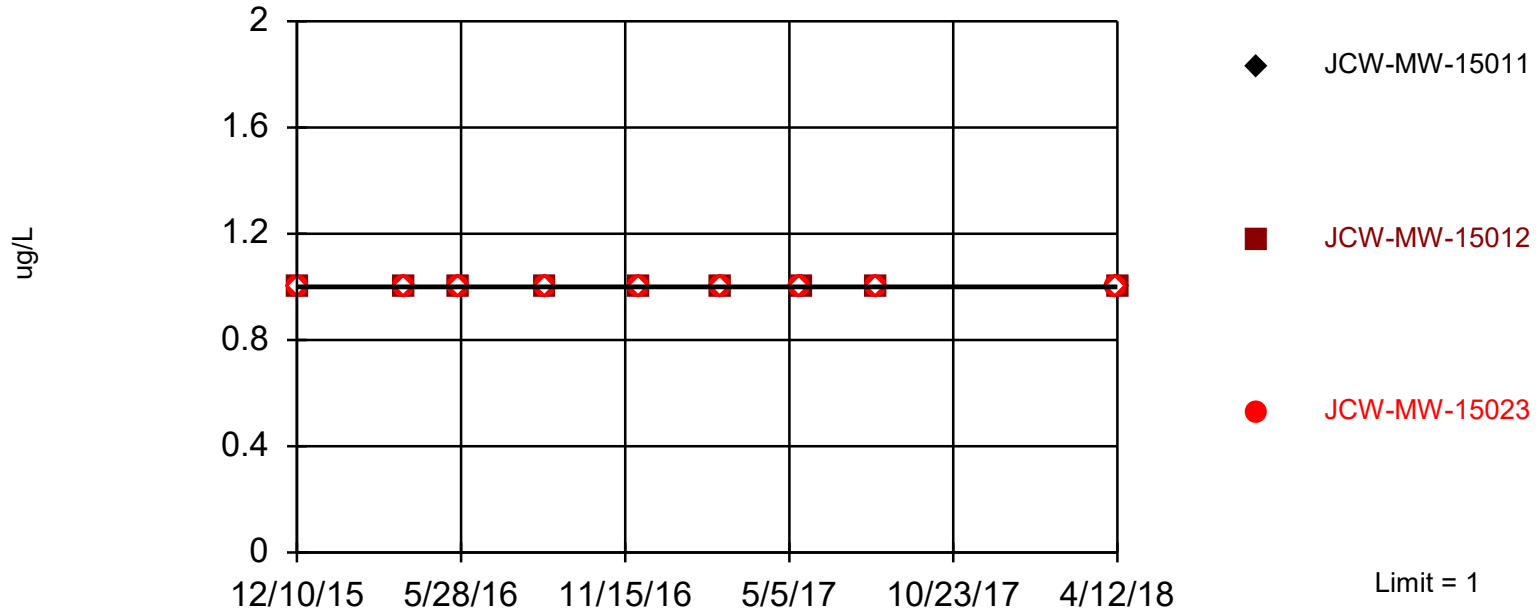
Normality test used:
Shapiro Wilk@alpha = 0.1
Calculated = 0.8723
Critical = 0.859
The distribution was found to be normally distributed.

Constituent: Lithium, Total Analysis Run 8/28/2018 10:45 AM

Client: Consumers Energy Data: JCW_BAP_CCR_Sanitas

Within Limit

Tolerance Limit Interwell Non-parametric



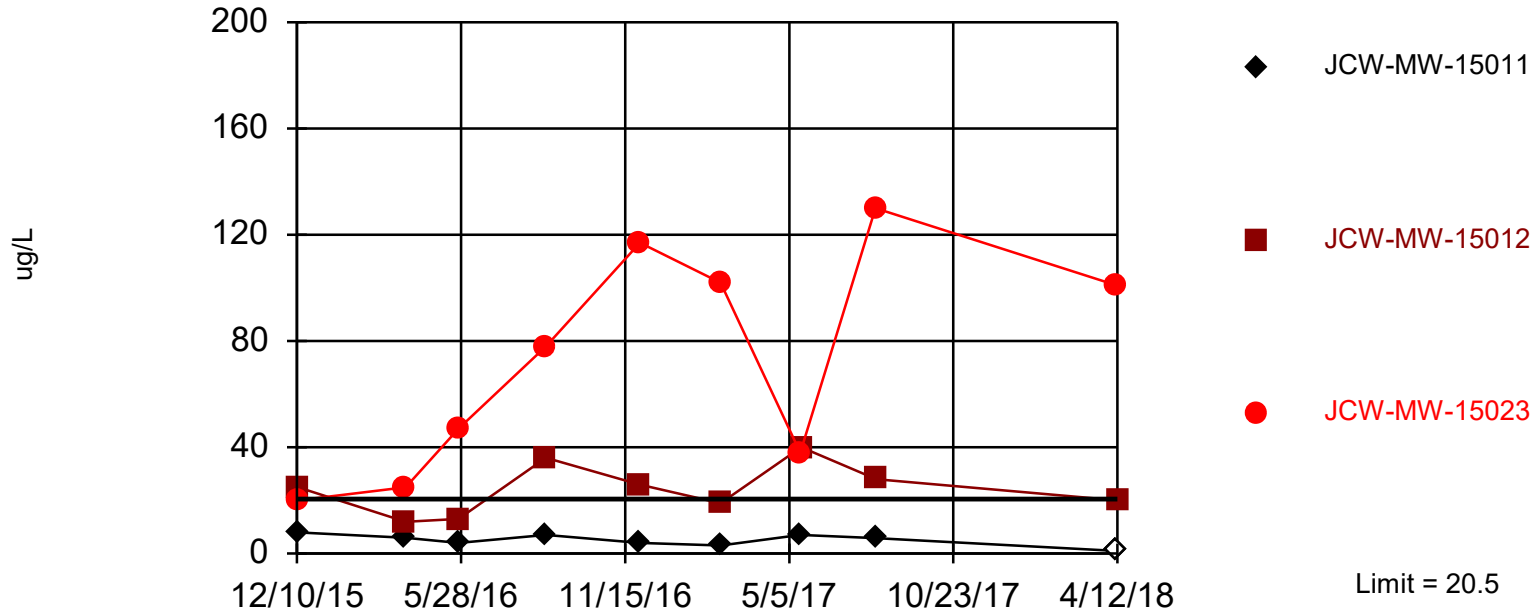
Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 88.09% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1578.

Constituent: Antimony, Total Analysis Run 6/12/2018 12:08 PM

Client: Consumers Energy Data: JCW_LF_CCR_Sanitas

Exceeds Limit: JCW-MW-15023

Tolerance Limit Interwell Non-parametric



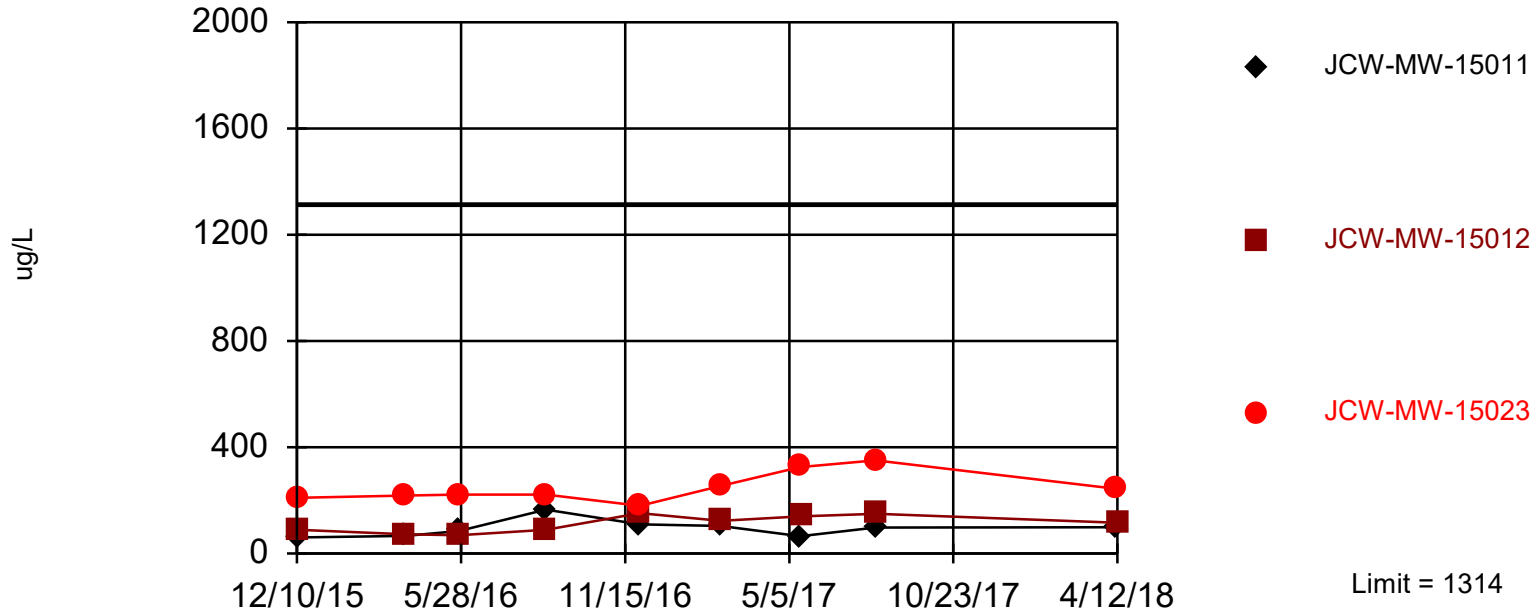
Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Most recent observation is compared with limit. Limit is highest of 36 background values. 47.22% NDs. 88.09% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1578.

Constituent: Arsenic, Total Analysis Run 5/24/2018 2:46 PM

Client: Consumers Energy Data: JCW_LF_CCR_Sanitas

Within Limit

Tolerance Limit Interwell Parametric

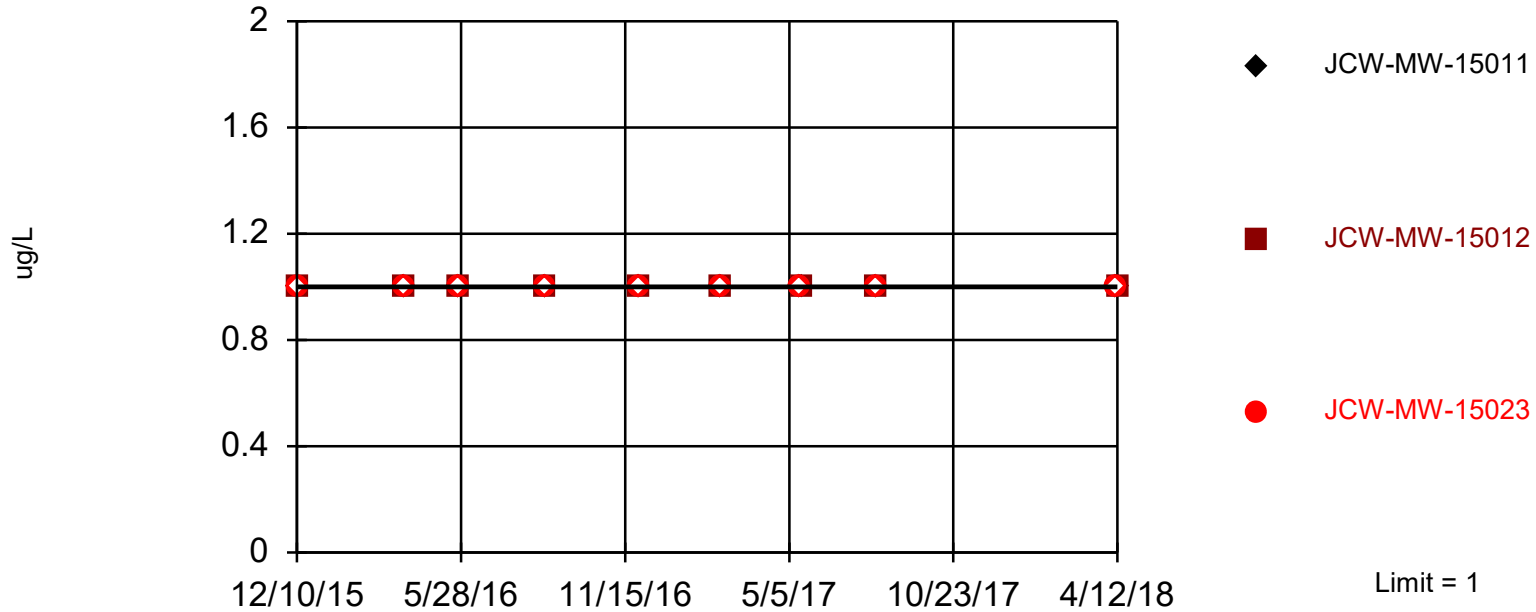


95% coverage. Most recent observation is compared with limit. Background Data Summary (based on natural log transformation): Mean=5.248, Std. Dev.=0.8953, n=36. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9227, critical = 0.912. Report alpha = 0.05.

Constituent: Barium, Total Analysis Run 5/24/2018 2:47 PM
Client: Consumers Energy Data: JCW_LF_CCR_Sanitas

Within Limit

Tolerance Limit Interwell Non-parametric



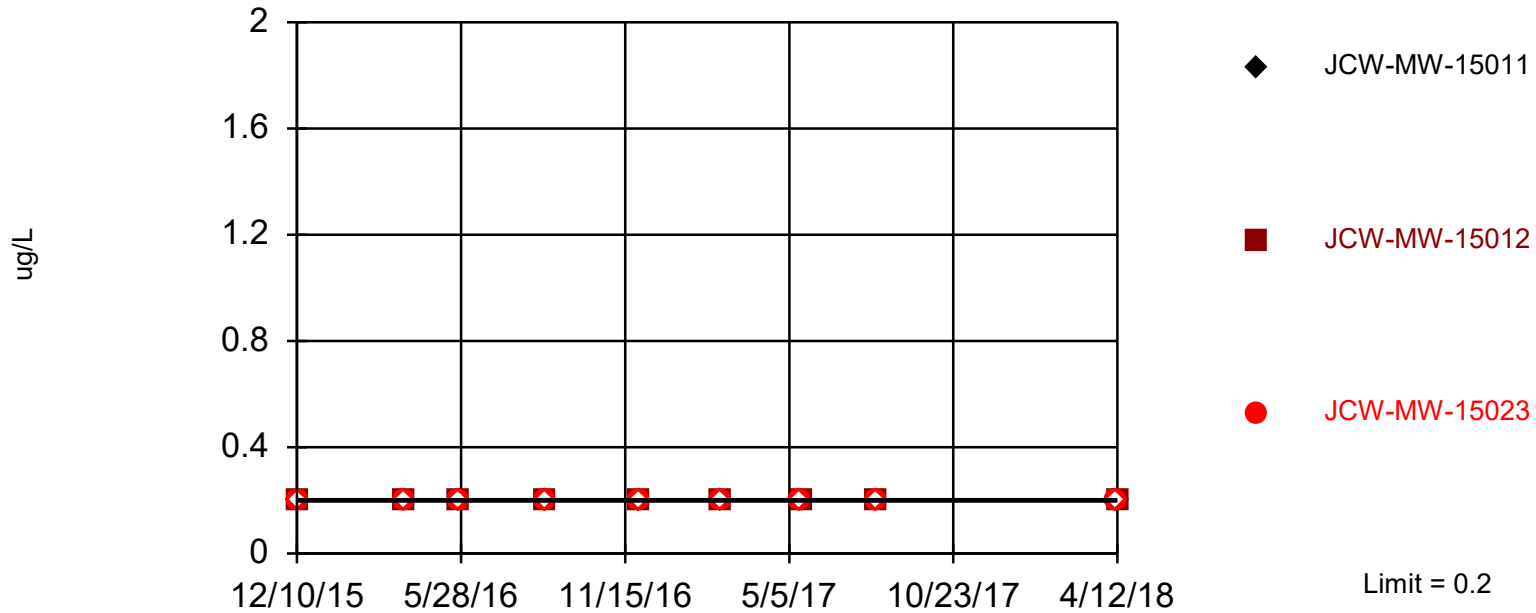
Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 88.09% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1578.

Constituent: Beryllium, Total Analysis Run 6/12/2018 12:09 PM

Client: Consumers Energy Data: JCW_LF_CCR_Sanitas

Within Limit

Tolerance Limit Interwell Non-parametric



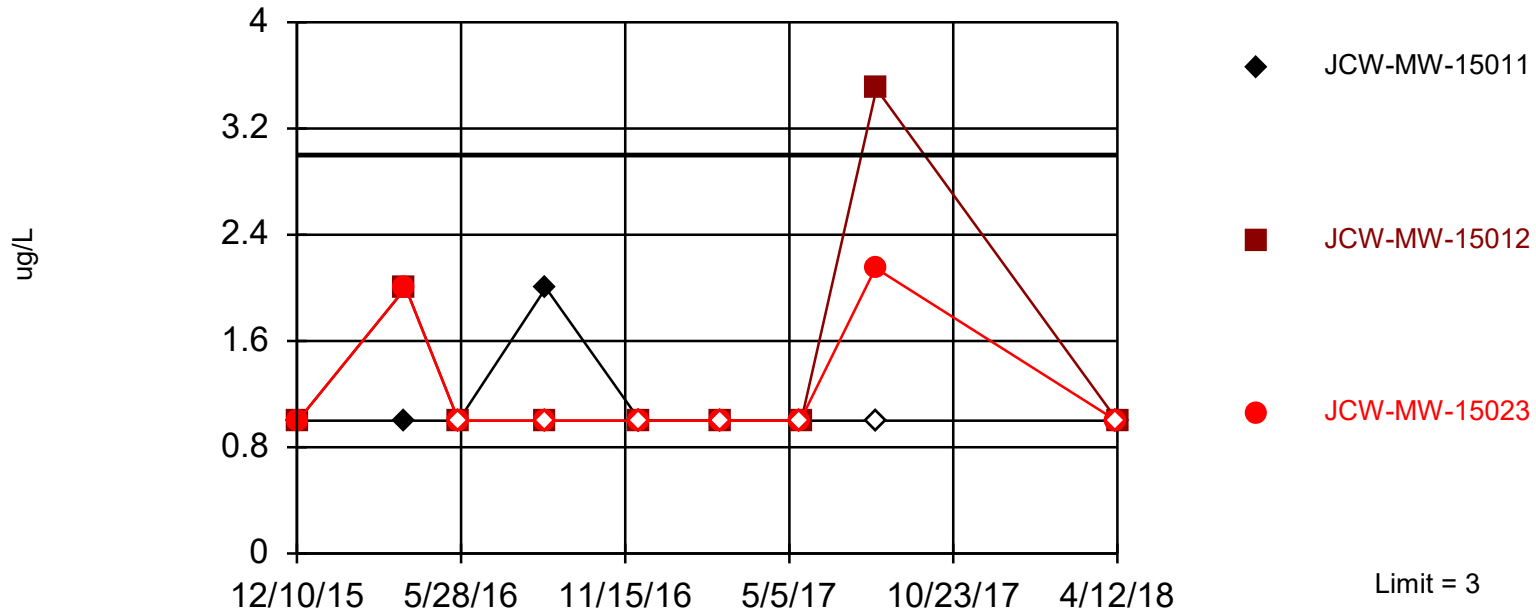
Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 88.09% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1578.

Constituent: Cadmium, Total Analysis Run 6/12/2018 12:09 PM

Client: Consumers Energy Data: JCW_LF_CCR_Sanitas

Within Limit

Tolerance Limit Interwell Non-parametric



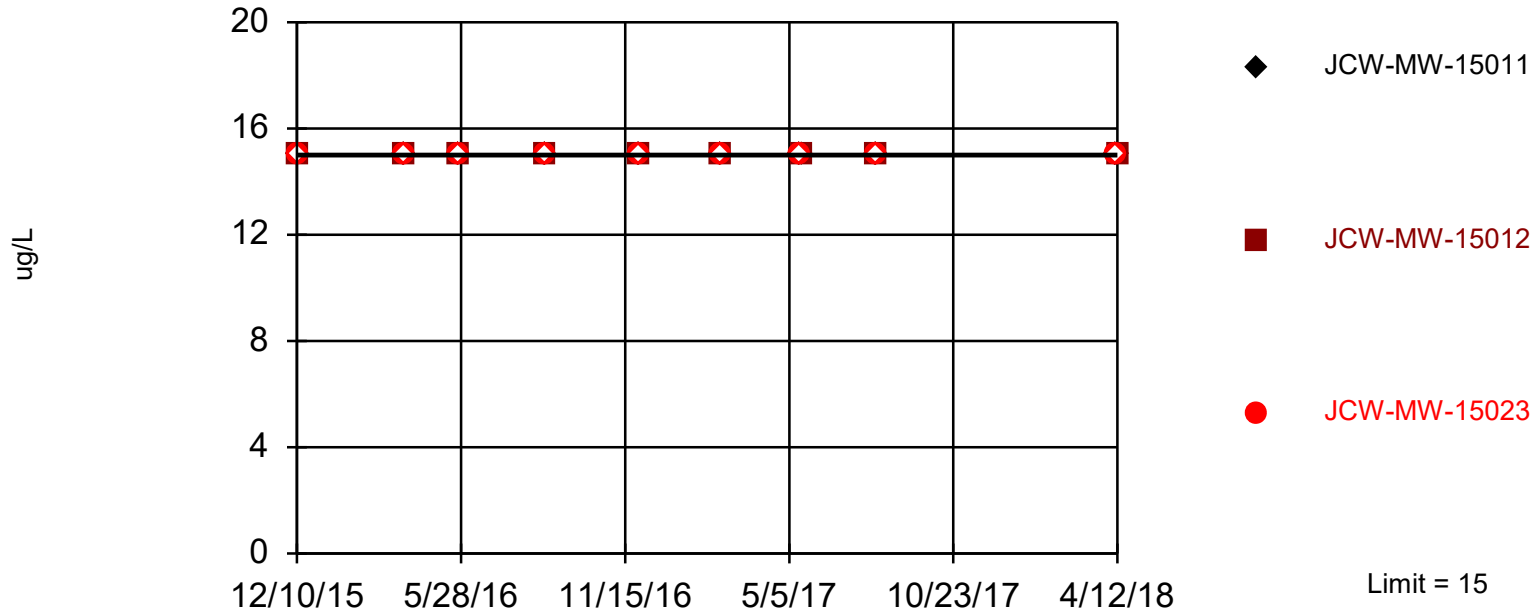
Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Most recent observation is compared with limit. Limit is highest of 36 background values. 33.33% NDs. 88.09% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1578.

Constituent: Chromium, Total Analysis Run 5/24/2018 2:48 PM

Client: Consumers Energy Data: JCW_LF_CCR_Sanitas

Within Limit

Tolerance Limit Interwell Non-parametric



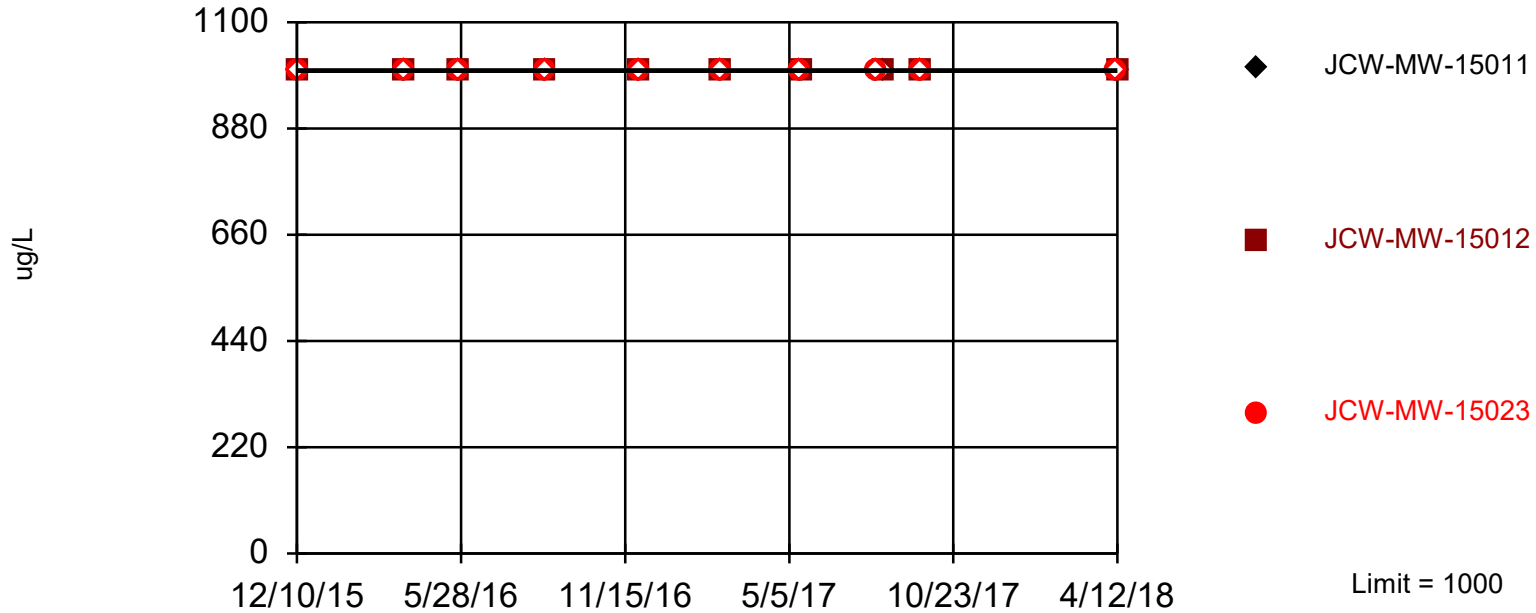
Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 88.09% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1578.

Constituent: Cobalt, Total Analysis Run 6/12/2018 12:09 PM

Client: Consumers Energy Data: JCW_LF_CCR_Sanitas

Within Limit

Tolerance Limit Interwell Non-parametric



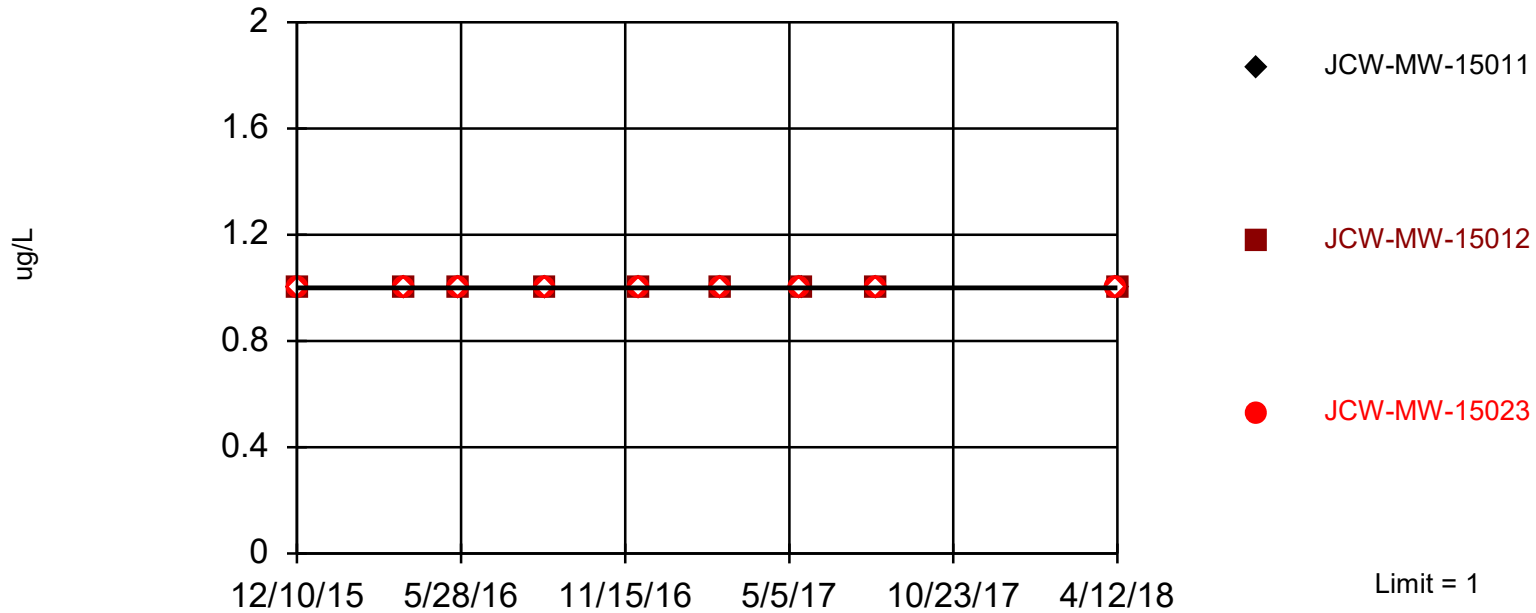
Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 89.26% coverage at alpha=0.01; 92.77% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1285.

Constituent: Fluoride Analysis Run 6/12/2018 12:10 PM

Client: Consumers Energy Data: JCW_LF_CCR_Sanitas

Within Limit

Tolerance Limit Interwell Non-parametric

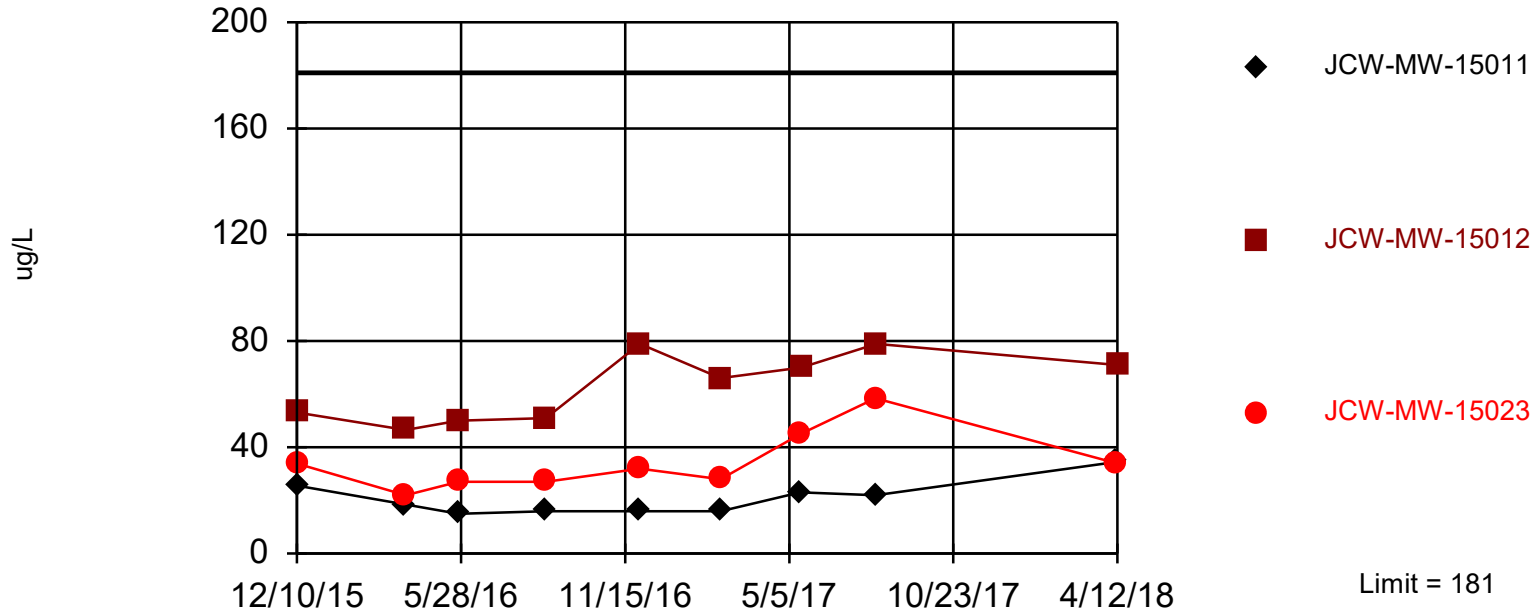


Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 88.09% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1578.

Constituent: Lead, Total Analysis Run 6/12/2018 12:10 PM
Client: Consumers Energy Data: JCW_LF_CCR_Sanitas

Within Limit

Tolerance Limit Interwell Non-parametric

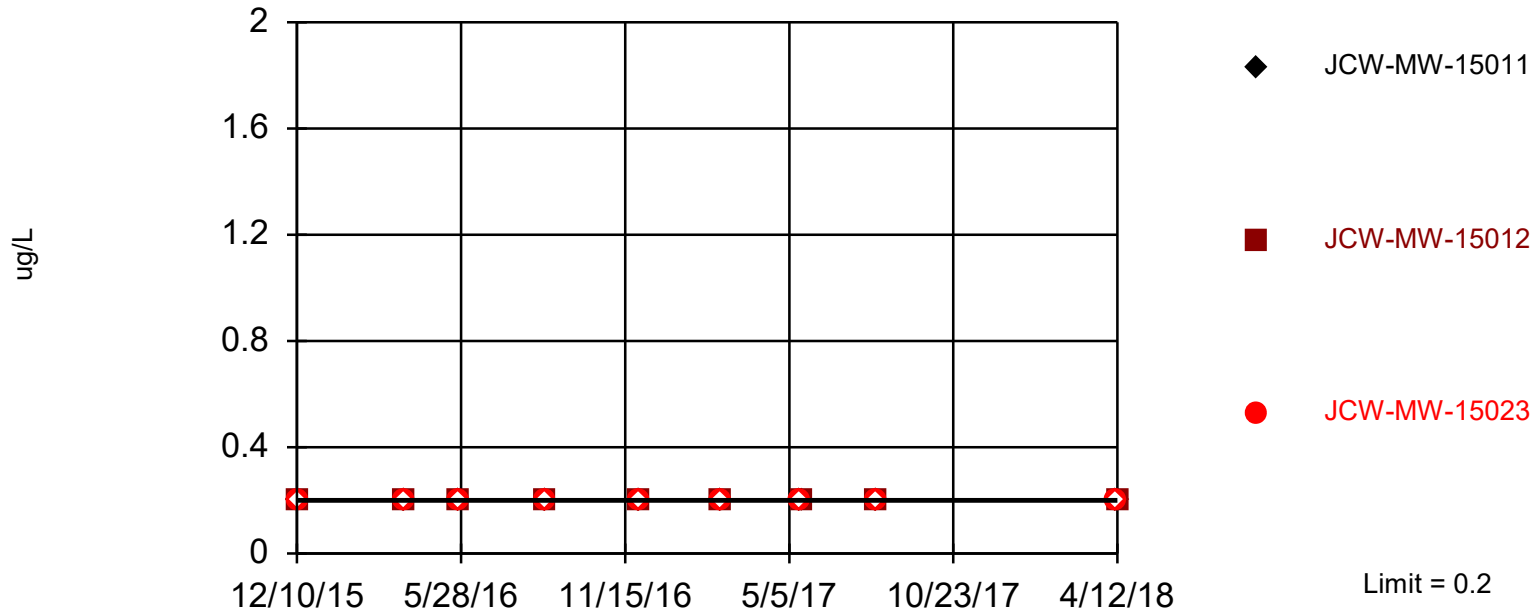


Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Most recent observation is compared with limit. Limit is highest of 36 background values. 8.333% NDs. 88.09% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1578.

Constituent: Lithium, Total Analysis Run 5/24/2018 2:48 PM
Client: Consumers Energy Data: JCW_LF_CCR_Sanitas

Within Limit

Tolerance Limit Interwell Non-parametric



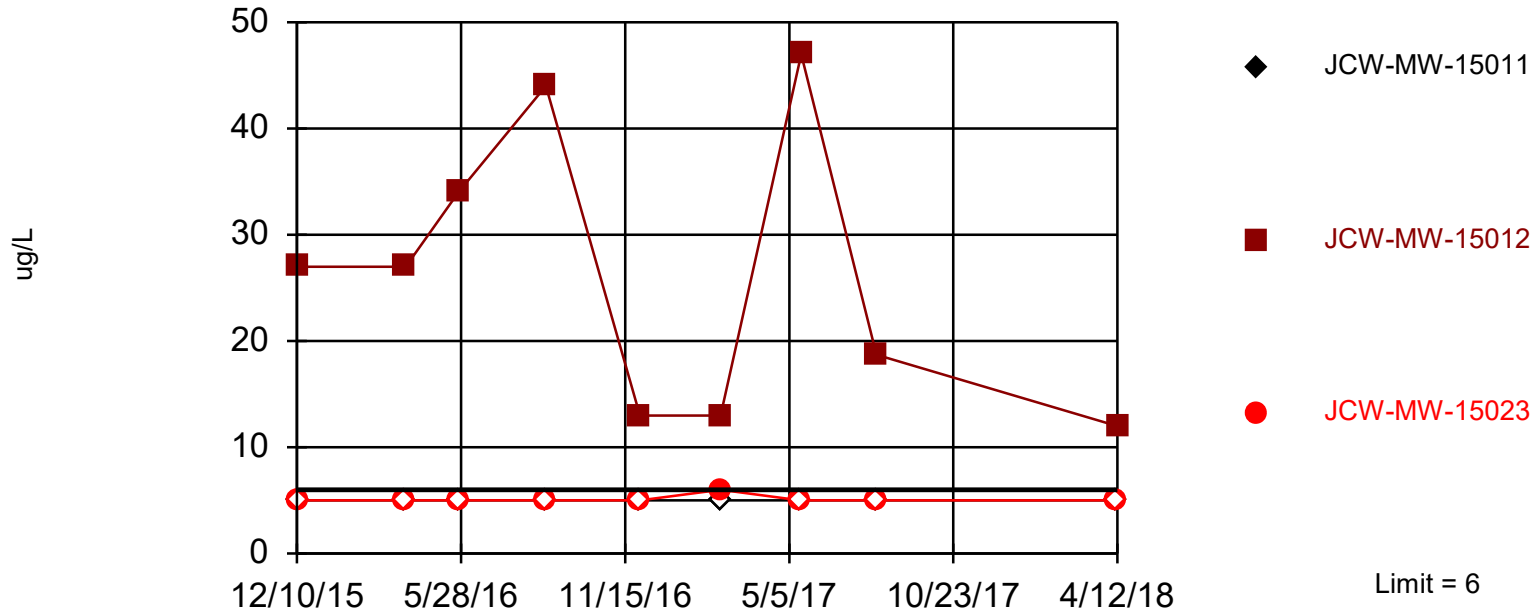
Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 88.09% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1578.

Constituent: Mercury, Total Analysis Run 6/12/2018 12:10 PM

Client: Consumers Energy Data: JCW_LF_CCR_Sanitas

Exceeds Limit: JCW-MW-15012

Tolerance Limit Interwell Non-parametric

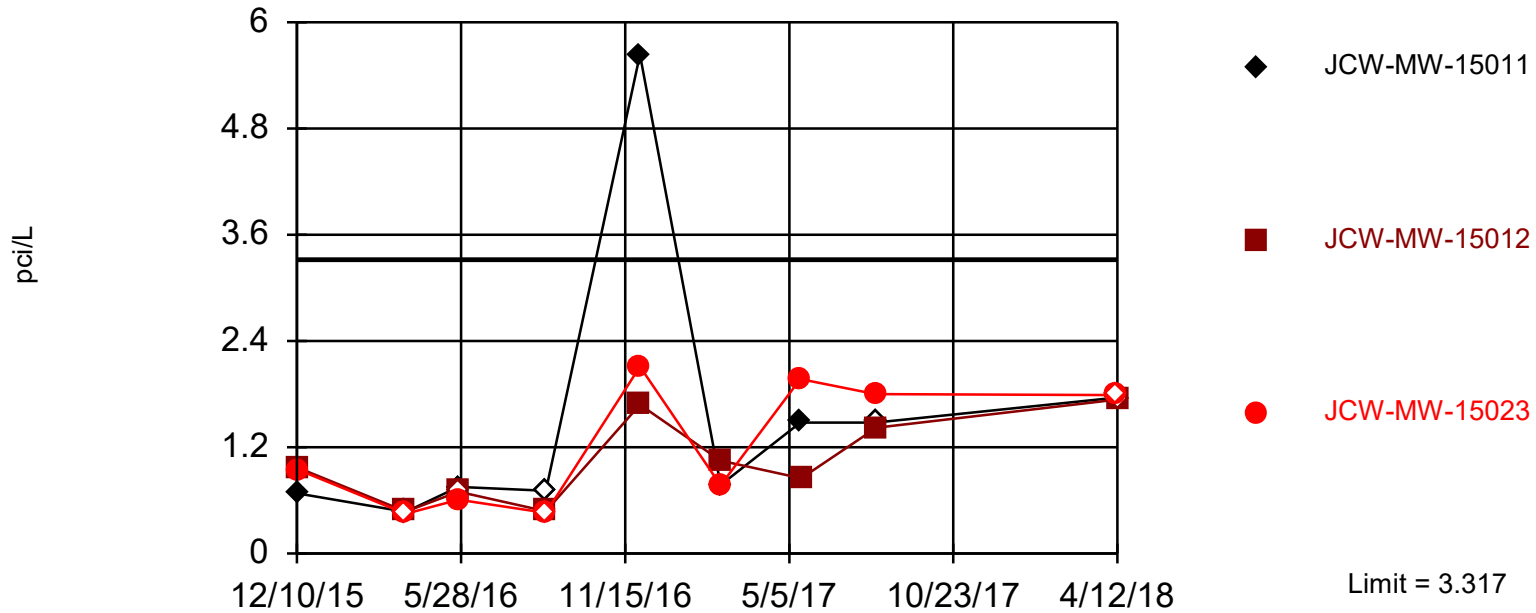


Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 75%. Most recent observation is compared with limit. Limit is highest of 36 background values. 91.67% NDs. 88.09% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1578.

Constituent: Molybdenum, Total Analysis Run 5/24/2018 2:49 PM
Client: Consumers Energy Data: JCW_LF_CCR_Sanitas

Within Limit

Tolerance Limit Interwell Parametric



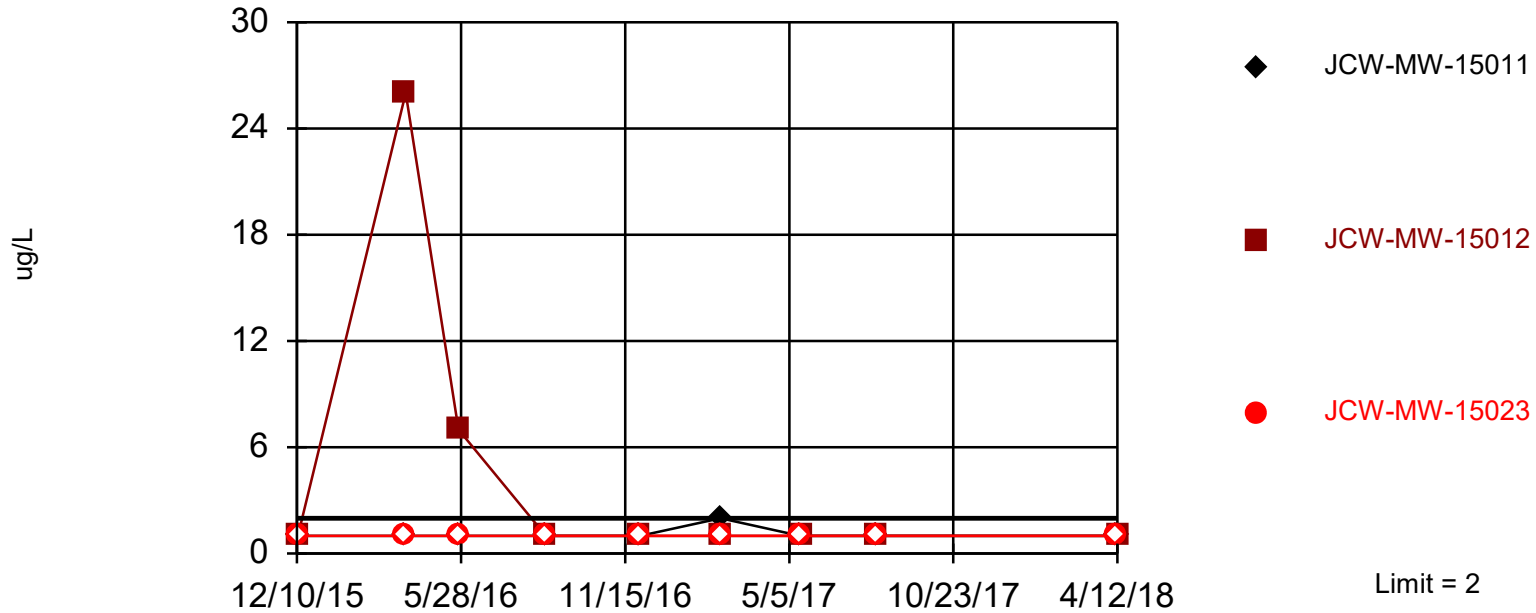
95% coverage. Most recent observation is compared with limit. Background Data Summary (based on square root transformation) (after Kaplan-Meier Adjustment): Mean=1.165, Std. Dev.=0.304, n=36, 25% NDs. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9558, critical = 0.912. Report alpha = 0.05.

Constituent: Radium-226/228 Analysis Run 5/24/2018 2:50 PM

Client: Consumers Energy Data: JCW_LF_CCR_Sanitas

Within Limit

Tolerance Limit Interwell Non-parametric



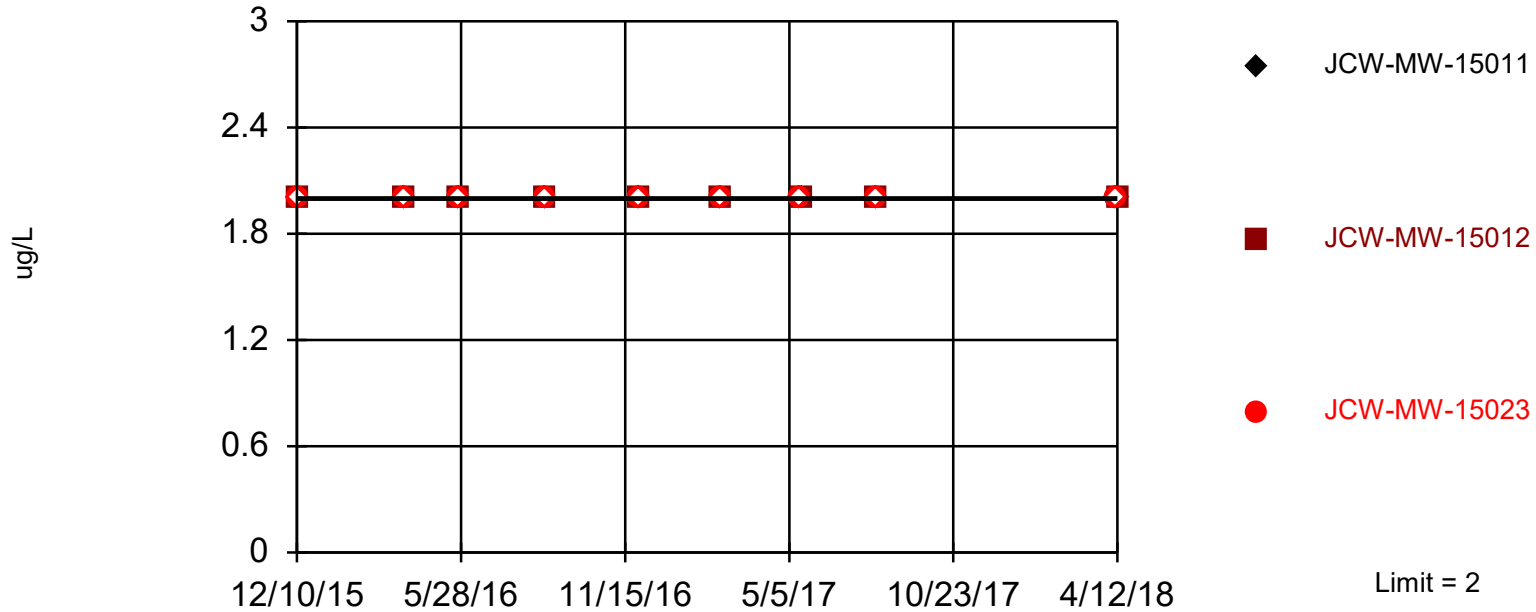
Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 75%. Most recent observation is compared with limit. Limit is highest of 36 background values. 88.89% NDs. 88.09% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1578.

Constituent: Selenium, Total Analysis Run 5/24/2018 2:49 PM

Client: Consumers Energy Data: JCW_LF_CCR_Sanitas

Within Limit

Tolerance Limit Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 88.09% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1578.

Constituent: Thallium, Total Analysis Run 6/12/2018 12:11 PM

Client: Consumers Energy Data: JCW_LF_CCR_Sanitas