2023 ANNUAL WATER QUALITY REPORT

FOR THE

MONONA COUNTY SANITARY LANDFILL

67-SDP-01-75C

TURIN, IOWA

by:
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November, 2023

6036-23A.320

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Section 1.0 Background Information

1.1 Report Priority

This report is considered to be low priority for review. SSI were identified in MW-1 for barium, nickel, chloride, and cis-1,2-dichloroethylene. The SSI do not approached a GWPS. IAC 567, Chapter 114 does not have a requirement to collect Appendix II samples in the event of a detected SSI. Additional testing requirements are at the discretion of the IDNR based on any perceived release from the facility. The sample parameters were changed in 2023 based on the IDNR request to do so. No release is interpreted based on water quality findings to date.

1.2 Period of Report Coverage

Water quality data evaluation is based on a running compilation of data beginning October 4, 2018. Statistical evaluations herein are based on the 2023 water quality data collected April 19, 2023 and October 25, 2023.

1.3 Current Site Map

Figure 1 is attached illustrating the current site features, monitoring well locations, and subsurface gas probe locations.

1.4 Site Status and Applicable Rules

Site Location

The Monona County Sanitary Landfill is located in the SW¼ of the SW¼ lying north and east of Monona County Road L-16, and the south 100 feet of the south 20 rods of the NW¼ of the SW¼ of Section 13, T83N, R44W, Monona County, Iowa. The site encompasses approximately 23 acres. The facility is closed under the Iowa Department of Natural Resources (IDNR) Permit Number 67-SDP-01-75C.

Landfill Layout & History

The site is situated in rolling terrain on land that was previously a ravine. Drainage from the site is predominantly to ditches outside of the waste boundary that pass through the sedimentation basin in the north-central portion of the site. The facility was closed in 2016.

Applicable Rules

Iowa Administrative Code (IAC) 567-114 is applicable to the site.

1.5 Summary of the Hydrologic Monitoring System Plan (HMSP)

The geology and hydrogeology at the site are described in the Hydrogeologic Assessment Report dated January 6, 2012 by Terracon (Doc #68181). Previous land use is agricultural land.

The Hydrogeologic Assessment Report dated January 6, 2012 (Doc #68181) concluded that the water table at the landfill is located within the uppermost aquifer (see Hydrogeologic Assessment Report in Attachment A, Section 6.5, page 9). There are five (5) monitoring wells existing in the Uppermost Aquifer system (MW-1, MW-3R, MW-4, MW-5, and MW-7).

MW-3R, MW-4, and MW-5 are the background wells for the uppermost aquifer at this site (Figure 2). Flow paths across the site (Figure 2) appear to converge toward MW-1 and MW-7 near the north waste boundary (downgradient). The rule (IAC 114.22(1)) allows the convergence of flow paths to be appropriate in the minimization of the overall length of the downgradient dimension of the facility. MW-1 and MW-7 appear to be appropriately located as downgradient uppermost aquifer wells.

The IDNR Letter dated July 5, 2018 (Doc # 92740) required the collection of water samples for total metals. The total metal analyses were added to the water quality testing beginning October 4, 2018. The sample portion collected for total metals analyses is collected by No-Purge methods.

A variance request dated November 21, 2018, was submitted to IDNR requesting the elimination of several testing parameters previously required at the site under Iowa Administrative Code (IAC) 567, Chapter 114 and the Closure Permit. The variance request was approved by IDNR on March 25, 2019 (Doc #94705) and was incorporated into the Closure Permit on March 26, 2019 (Doc # 94716). A second variance request requesting the use of three (3) upgradient wells and two (2) downgradient wells was submitted on April 24, 2019 (Doc #94983). This variance was approved on August 2, 2019 (Doc #95638) and was incorporated into the Revised Closure Permit issued August 2, 2019 (Doc #95637).

The January 24, 2023 IDNR Comment letter pertaining to the 2022 Annual Water Quality Report (Doc #105574) required that a leachate sample be collected from leachate piezometer LW-1 and analyzed for Appendix I compounds. Further, the January 24, 2023 IDNR Comment letter (Doc #105574) required that the testing parameters in all HMSP monitoring wells be changed to include any Appendix I compound that was detected in the leachate (at peizometer LW-1). The initial sampling of LW-1 was completed April 19, 2023. The following Appendix I compounds were detected in leachate from LW-1 on *April 19, 2023*:

Compound	LW-1
Antimony, total (ug/L)	5.2
Arsenic, total (ug/L)	217.0
Barium, total (ug/L)	3,140.0
Cadmium, total (ug/L)	2.4
Chromium, total (ug/L)	30.2
Cobalt, total (ug/L)	60.9
Copper, total (ug/L)	619.0
Nickel, total (ug/L)	803.0
Lead, total (ug/L)	37.3
Selenium, total (ug/L)	6.3
Vanadium, total (ug/L)	27.2
Zinc, total (ug/L)	1,440

Note that were no VOC compounds detected in leachate at LW-1.

In addition, MW-1 was also analyzed for Appendix I compounds (in addition to the historically tested parameters) on April 19, 2023 based on the fact that there were known historic impacts to MW-1 over time. Barium, cobalt, nickel, and cis-1,2-dichloroethene were the only Appendix I compounds detected at MW-1 on *April 19, 2023*.

The HMSP sampling parameters were amended based on the April 19, 2023 water quality results completed at leachate piezometer LW-1. Beginning on October 25, 2023 the water samples collected at all site monitoring wells are analyzed for the compounds listed in the Table above. Water collected at MW-1 is also analyzed for cis-1,2-dichloroethene and chloride based on recent detections at MW-1.

The statistical evaluation of the total metals analyses is completed based on up to eleven (11) episodes of total metals testing completed through October 25, 2023.

The Site Plan and the approved monitoring network are illustrated on Figure 1. The Water Table Contour Map is included as Figure 2.

The current HMSP is summarized in Table 1. The HMSP Implementation Schedule for 2024 is itemized in Table 2.

MONITORING WELL MAINTENANCE PERFORMANCE REEVALUATION

Table 3 outlines the status of well performance and maintenance activities performed as required by IAC 567-114.21.

Formal Monitoring Well Maintenance Performance Reevaluations have been performed in November 1992; October 1998; October 2003; November 2008; October 2013; and April 2019.

Review of the water elevation data for 2023 does not indicate excessive variability compared to historic water elevation data. Water elevation data is summarized in Table 4. Based on the available water elevation data, the semi-annual water level measurements are interpreted to be sufficient to gauge notable changes in the site hydrology. The October 2023 Water Table Contour Map is included as Figure 2.

High & Low Water Levels
Current year water elevation data is included in Table 4. Historic water elevation data is included in the Table 4 Supplement. The maximum depth to water and the minimum depth to water are included on Table 4.

Well Depth & Sedimentation
Well depth measurements were made in October 2023. Review of the well depth data included on Table 4 indicate that well sedimentation is estimated to be less than one (1) foot at all site monitoring wells, except MW-4. The well depth discrepancy at MW-4 is recorded as 6.19 feet on Table 4. Efforts to remove the sedimentation will be made in 2024.

Well Recharge Rates & Chemistry
The Hydrogeologic Assessment Report dated January 6, 2012 (Doc #68181) includes a summary of horizontal hydraulic conductivity testing results from 1992 and 2012 (Appendix A) for numerous monitoring wells that exist on site. Horizontal hydraulic conductivities ranged between 10^{-4} cm/sec and 10^{-5} cm/sec.

Hydraulic conductivity testing results for April 15, 2019 also ranged between 10^{-4} cm/sec and 10^{-5} cm/sec (Table 4 and Appendix A). Well recovery information indicates that recharge to the individual wells remained sufficient to promote collection of representative water quality samples and the wells were functioning as intended. Monitoring well recharge reevaluation is due every five (5) years according to 114.21(2)"d" and should be evaluated again is 2024.

Based on the apparent static condition of the water surfaces across the site, it appears that the semi-annual water elevation data is sufficient to adequately monitor the hydrologic condition of the site. Further, the wells are interpreted to be appropriately located to detect any impact, should it occur.

No changes or modifications to the site monitoring wells are recommended.

Section 2.0 Reporting Period Monitoring Activities

Field sampling information for the April 19, 2023 and October 25, 2023 sampling episodes is included on the field forms (IDNR Form 542-1322) in Appendix B.

A comprehensive summary of Analytical Data for the episodes between October 4, 2018 and October 25, 2023 is included in Table 9.

The background wells are MW-3R, MW-4, and MW-5. Downgradient wells include MW-1 and MW-7.

Section 3.0 Data Evaluation and Summary

Statistical Evaluation is prepared by Otter Creek Environmental Services for the April 19, 2023 and October 25, 2023 monitoring episodes. The Groundwater Statistics Report for the Monona County Landfill, First Semi-Annual Monitoring Event in 2023, dated May, 2023 is included in Appendix C.1. The Groundwater Statistics Report for the Monona County Landfill, Second Semi-Annual Monitoring Event in 2023, dated November, 2023 is included in Appendix C.2.

The Keystone Analytical Reports for the laboratory testing for sampling episodes on April 19, 2023 and October 25, 2023 are included in Appendix D.

QUALITY ASSURANCE/QUALITY CONTROL

A blind duplicate sample was collected at MW-5 during the April 19, 2023 sampling episode. A blind duplicate was collected at MW-3R during the October 25, 2023 sampling episode.

The purpose of the field duplicate is to evaluate the precision of sample collection and analysis process from the field through the laboratory. The calculation of the Relative Percent Difference (RPD) for duplicate pair results is used as a means to evaluate the precision. Iron is excluded from use in duplication due to the rapid oxidation rate, as it is problematic to duplicate.

The Quality Control (QC) limit for the RPD on field duplicates is established at thirty percent (30%) for duplicate pairs that have reported concentrations five (5) times greater than the laboratory Reporting Limit. For samples and respective duplicates with reported analyte concentrations nearer the Reporting Limit, the RPD calculations demonstrate greater variability and the RPD can be very large. RPD values are considered non-representative in the following conditions:

a) Both the original and/or the duplicate results are less than five (5) times the Reporting Limit.
b) One or both results are qualified, flagged, or estimated.

c) One or both results are non-detected.

The results of the blind duplicate and the monitoring well results (both April 19, 2023 and October 25, 2023) were within the limits established and indicate that the data quality is acceptable without restriction.

BACKGROUND DATA VALIDATION

The background data utilized herein has been restricted to include only sample results that have been collected by "No Purge" methods. A summary of the recorded field turbidity measurements is included in Appendix E.

Upgradient Data, Table 1, Attachment B to Fall Statistical Evaluation Report (Appendices C) includes a summary of the background data. The site prediction limits established are based on the background collected since October 4, 2018.

SITE SPECIFIC GWPS

The Statewide Standards for Protected Groundwater as published in IAC 567, Chapter 137, are utilized as the Groundwater Protection Standards (GWPS) for all compounds, except arsenic, cobalt, and lead. The calculated prediction limits for arsenic, cobalt, and lead (based on the site background) exceed the published in IAC 567, Chapter 137 Statewide Standards.

Table 5 indicates that the prediction limit for the following compounds *exceed* the published IAC 567, Chapter 137 Statewide Standard:

Compound	***Prediction Limit***	***IAC 137 GWPS***
Arsenic	57.3 ug/L	10.0 ug/L
Cobalt	6.3 ug/L	2.1 ug/L
Lead	15.5 ug/L	15.0 ug/L

The Site-Specific GWPS should not be set lower than the Site Prediction Limit calculated from the site background data. For this report, the prediction limits itemized above are utilized as the Site-Specific GWPS for the HMSP Systems. For all other compounds the published IAC 567, Chapter 137 Statewide Standard are utilized as the GWPS. Note that there are no published GWPS for chloride. The Site-Specific GWPS were approved by IDNR on July 8, 2021 (Doc #100801) and again on May 20, 2022 (Doc #103262).

EXCEEDANCE OF A BACKGROUND STANDARD

The detected concentrations of each compound are compared to the site prediction limit for each respective compound calculated based on the background data set. A detected and verified concentration for a compound that is in excess of the calculated site prediction limit is recorded on Table 6 and Table 7. Table 6 is a summary of all compounds at site monitoring wells that

have exceeded the prediction limit *in the current year* (highlighted in light brown). Table 7 is a summary of all compounds at site monitoring wells that have exceeded the prediction limit *to date* (highlighted in light brown).

As reported in Table 6, there are four (4) compounds that have exceeded a background standard (Prediction Limit) to date. There are no detected compounds to date that exceed a GWPS (Table 7). IAC 567, Chapter 114 does not have a requirement to collect Appendix II samples in the event of a detected SSI. Additional testing requirements are at the discretion of the IDNR based on any perceived release from the facility. IDNR amended the required sampling in 2023. No release is interpreted based on water quality findings to date.

CONFIDENCE INTERVAL EVALUATION

The detections that exceed the current site prediction limits are utilized to calculate the 95% lower confidence limits (LCL) in accordance with the 2009 Unified Guidance for Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities by US EPA. The 95% LCL values are compared to applicable GWPS. Any 95% LCL value that exceeds an applicable GWPS is recorded as an SSL.

Table 7 includes a summary of the Confidence Limits (95% LCL). *There are no Statistically Significant Levels (SSL) recorded to date.* The Confidence Intervals (95% LCL and 95% UCL) for inorganic compounds are summarized in Table 1 of Attachment C of the Otter Creek Reports (Appendix C.1 and Appendix C.2).

RESPONSES TO WATER QUALITY RESULTS

Based on the minor nature of the recorded exceedances, there is no recommendation to perform additional sampling in accordance with IAC 114.26(7) at this time.

CORRECTIVE ACTION EVALUATIONS & MONITORING

Corrective Action and Corrective Action Monitoring are not required at this time.

Section 4.0 Leachate Collection System Performance Evaluation

The site was not constructed with a formal leachate collection system (LCS). The current LCS consists of a leachate piezometer (LW-1). Leachate levels are measured at LW-1 on a quarterly basis. If leachate levels exceed 12", the leachate is required to be pumped from LW-1 until levels drop down below 12". Leachate removed from LW-1 would be hauled to a holding tank at the transfer station building and disposed of at the City of Onawa POTW. Leachate has not been extracted from LW-1 since closure was completed in 2016. Leachate thickness measurements in LW-1 did not exceed 12 inches in 2023.

The 2023 leachate liquid elevation at LW-1 and extraction volumes (0 gallons) are summarized in Table 12. The leachate thickness in LW-1 has been recorded during 2023 as ranging from 0.0 feet to 0.5 feet.

Based on the available quarterly data collected since closure in 2016, it is apparent that leachate levels are consistently well below 12 inches and that there are no significant findings during any monitoring episode. We request that the frequency of leachate measurements be reduced to a semi-annual frequency (to occur during semi-annual well sampling visits). Examples of other closed facilities where the frequency of leachate monitoring has been reduced to a semi-annual frequency include Jones County Sanitary Landfill (Doc #102804) and Clarke County Sanitary Landfill (Doc 97364).

Section 5.0 Gas Monitoring

Explosive gas monitoring was performed quarterly through October, 2023, per IAC 567-114.26(15). Results of the explosive gas monitoring indicate that explosive gases were within applicable limits along the entire site perimeter and in the equipment building. Gas monitoring results are summarized in the Table 13.

Based on the available quarterly data collected since closure in 2016, it is apparent that explosive gas concentrations have not been detected. We request that the frequency of gas monitoring be reduced to a semi-annual frequency (to occur during semi-annual well sampling visits). Examples of other closed facilities where the frequency of gas monitoring has been reduced to a semi-annual frequency include Jones County Sanitary Landfill (Doc #102804) and Jackson County Sanitary Landfill (Doc 92771). Both example sites also include a “pole building” in the gas monitoring plan, similar to Monona County Landfill.

Section 6.0 Recommendations/Requests

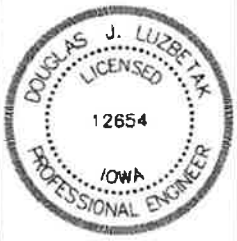
Continue to perform water sampling in accordance with the plan summarized in Table 2. Review the forthcoming Permit Amendment approving the sampling parameters in Table 2.

Continue to perform semi-annual water level measurements in April and October of each year and reevaluate the data in the Annual Groundwater Quality Report in January of each year.

Continue to perform leachate level measurements quarterly in accordance with Special Provision X.9.C of the August 2, 2019 Permit (Doc #95637), *unless* the requested Permit Amendment is issued that changes the frequency to semi-annual. Continue to re-evaluate leachate levels in the Annual Groundwater Quality Report/Leachate Control System Performance Evaluation in November of each year.

Continue to perform quarterly explosive gas monitoring in accordance with Special Provision X.8 of the August 2, 2019 Permit (Doc #95637) *unless* the requested Permit Amendment is issued that changes the frequency to semi-annual. Continue to re-evaluate gas monitoring in the Annual Groundwater Quality Report in November of each year.

Perform Monitoring Well Maintenance Performance Reevaluation in 2024.



I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

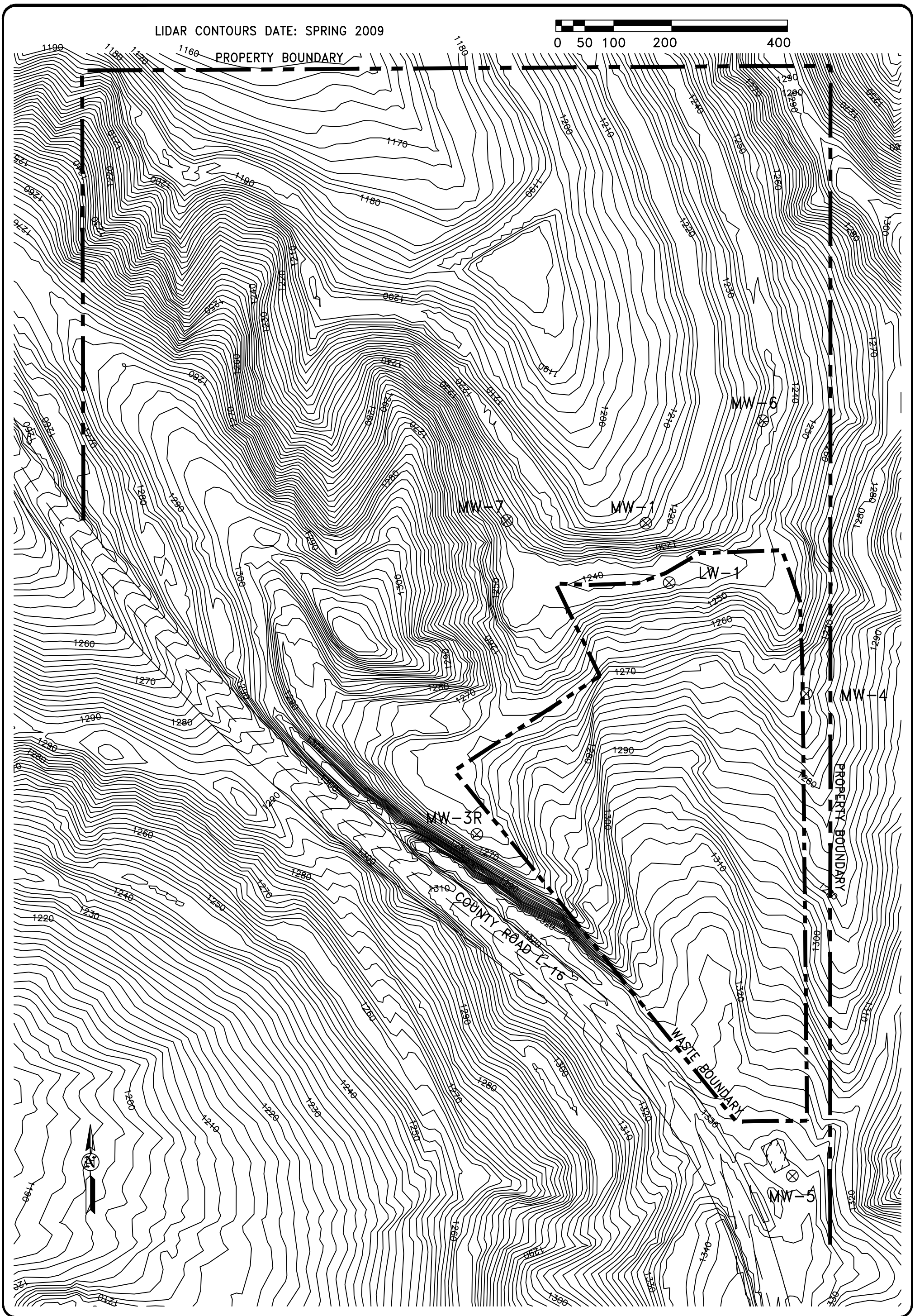
11/28/23

DOUGLAS J. LUZBETAK, P.E. DATE
License number 12654

My license renewal date is December 31, 2024.

Pages or sheets covered by this seal:
All except Appendices C+D

Figures



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SITE PLAN

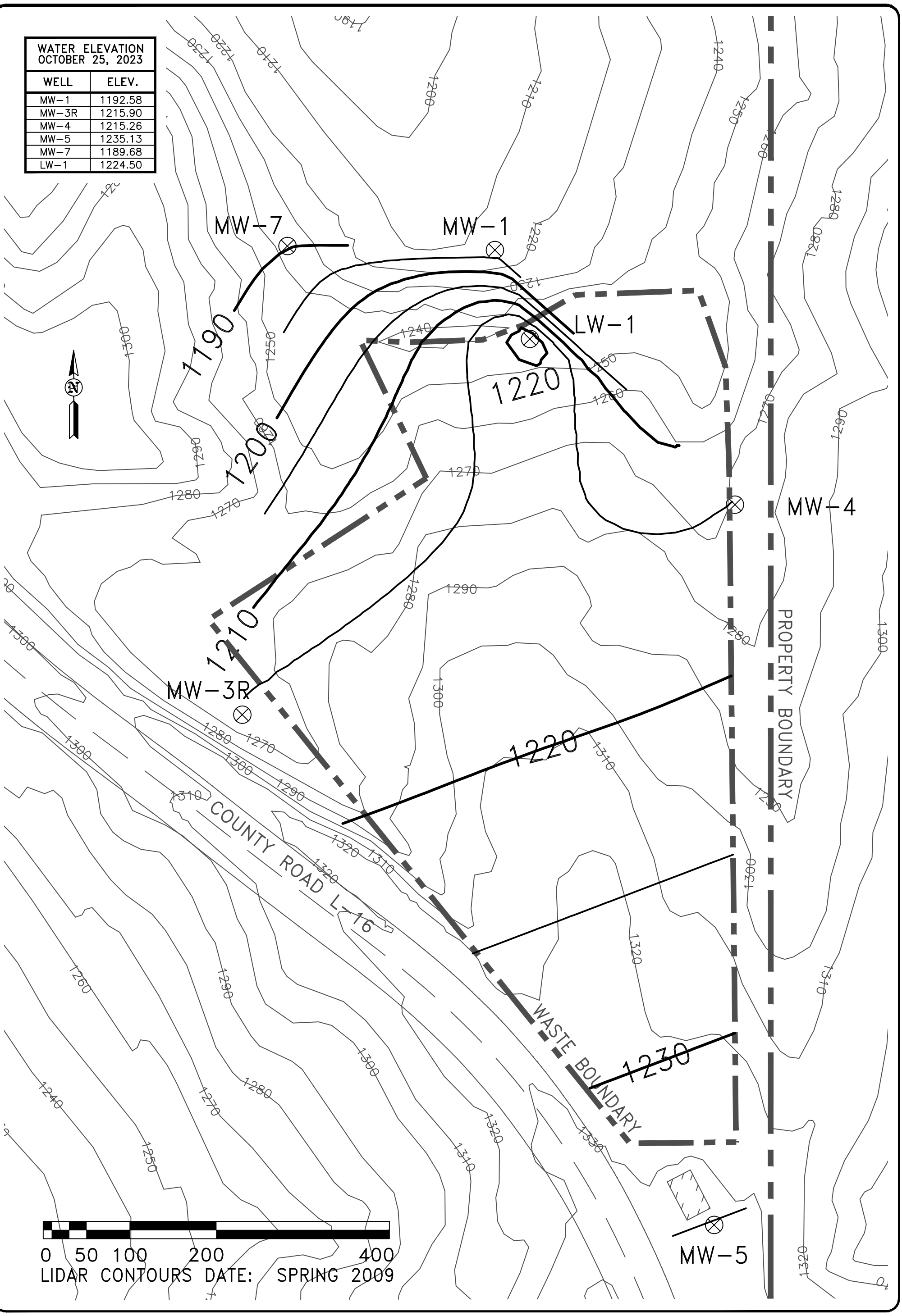
MONONA COUNTY SANITARY LANDFILL
TURIN, IOWA

FIGURE: 1

REVISION	NO.	DATE

DRAWN	PROJECT NO.	DATE
DRA	6036	10-27-23

WATER ELEVATION OCTOBER 25, 2023	
WELL	ELEV.
MW–1	1192.58
MW–3R	1215.90
MW–4	1215.26
MW–5	1235.13
MW–7	1189.68
LW–1	1224.50



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WATER TABLE MAP

MONONA COUNTY SANITARY LANDFILL
TURIN, IOWA

FIGURE: 1		
REVISION	NO.	DATE
DRAWN DRA	PROJECT NO. 6036	DATE 10–27–23

Tables
(in IDNR Format)

Table Index

Table 1 – Monitoring Program Summary

Table 1
Monitoring Program Summary
Annual Water Quality Report
Monona County Sanitary Landfill
Permit No. 67-SDP-01-75C

Monitoring Well	Formation	Current Monitoring Program	Change for next sampling event	Historic - Constituents over the Prediction Limit	Spring 2023 - Constituents over the Prediction Limit	Fall 2023 - Constituents over the Prediction Limit	Historic - Constituents w/95% LCL over GWPS	Spring 2023 - Constituents w/95% LCL over GWPS	Fall 2023 - Constituents w/95% LCL over GWPS	Total # of Samples in each monitoring program since October 4, 2018		
										Detection	Assessment	Corrective Action
MW-3R (b)	Loess	Background	NC	None	None	None	None	None	None	11	0	0
MW-4 (b)	Loess	Background	NC	None	None	None	None	None	None	11	0	0
MW-5 (b)	Loess	Background	NC	None	None	None	None	None	None	11	0	0
MW-1	Loess	Detection	NC	**barium, nickel, chloride, cis-1,2-DCE**	**barium, nickel, chloride, cis-1,2-DCE**	**barium, nickel, chloride, cis-1,2-DCE**	None	None	None	11	0	0
MW-7	Loess	Detection	NC	**cadmium**	None	None	None	None	None	11	0	0

Table 2 – Monitoring Program Implementation Schedule

Table 2
Monitoring Program Implementation Schedule
Annual Water Quality Report
Monona County Sanitary Landfill
Permit No. 67-SDP-01-75C

Monitoring Well	Recent Sampling Dates and Constituents	Upcoming Sampling Dates and Constituents		Supplemental Sample Dates	
		April, 2024	October, 2024	Previously Collected	Next Event
MW-3R (b)	10/4/18, 4/15/19, 10/8/19, 4/8/20, 10/2/20, 4/12/21, 10/26/21, 4/12/2022, 10/7/2022, 4/19, 2023, 10/25/2023	List #1	List #1	N/A	N/A
MW-4 (b)	10/4/18, 4/15/19, 10/8/19, 4/8/20, 10/2/20, 4/12/21, 10/26/21, 4/12/2022, 10/7/2022, 4/19, 2023, 10/25/2023	List #1	List #1	N/A	N/A
MW-5 (b)	10/4/18, 4/15/19, 10/8/19, 4/8/20, 10/2/20, 4/12/21, 10/26/21, 4/12/2022, 10/7/2022, 4/19, 2023, 10/25/2023	List #1	List #1	N/A	N/A
MW-1	10/4/18, 4/15/19, 10/8/19, 4/8/20, 10/2/20, 4/12/21, 10/26/21, 4/12/2022, 10/7/2022, 4/19, 2023, 10/25/2023	List #1 & List #2	List #1 & List #2	N/A	N/A
MW-7	10/4/18, 4/15/19, 10/8/19, 4/8/20, 10/2/20, 4/12/21, 10/26/21, 4/12/2022, 10/7/2022, 4/19, 2023, 10/25/2023	List #1	List #1	N/A	N/A

(b) background well

List #1 - Total Metals (Sb, As, Ba, Cd, Cr, Co, Cu, Pb, Ni, Se, V, Zn)
List #2 - Chloride, cis-1,2-dichloroethene

TABLE 2 Supplement - Sampling to Date

	10/4/2018	4/15/2019	10/8/2019	4/8/2020	10/2/2020
MW-1	List 1+List 2	List 1+List 2	List 1+List 2	List 1+List 2	List 1+List 2
MW-3R	List 1	List 1	List 1	List 1	List 1
MW-4	List 1	List 1	List 1	List 1	List 1
MW-5	List 1	List 1	List 1	List 1	List 1
MW-7	List 1	List 1	List 1	List 1	List 1
Duplicate	MW-7	MW-1	MW-7	MW-3R	MW-1

	4/12/2021	10/26/2021	4/12/2022	10/7/2022
MW-1	List 1+List 2	List 1+List 2	List 1+List 2	List 1+List 2
MW-3R	List 1	List 1	List 1	List 1+List 2
MW-4	List 1	List 1	List 1	List 1+List 2
MW-5	List 1	List 1	List 1	List 1+List 2
MW-7	List 1	List 1	List 1	List 1+List 2
Duplicate	MW-7	MW-5	MW-7	MW-3R

	4/19/2023	10/25/2023
MW-1	Appendix I+ List 1+List 2	List 3+List 4
MW-3R	List 1	List 3
MW-4	List 1	List 3
MW-5	List 1	List 3
MW-7	List 1	List 3
LW-1	Appendix I	---
Duplicate	MW-5	MW-3R

List #1 – Total Metals (As, Ba, Cd, Cr, Cu, Pb, Fe, Hg, Mg, Zn)
List #2 – Chloride, COD, Nitrogen (as Ammonia)
List #3 – Total Metals (Sb, As, Ba, Cd, Cr, Co, Cu, Pb, Ni, Se, V, Zn)
List #4 – Chloride, cis-1,2-dichloroethene

Table 3 – Monitoring Well Maintenance Performance Reevaluation Schedule

Table 3
Monitoring Well Maintenance and Performance Revaluation Schedule
Annual Water Quality Report
Monona County Sanitary Landfill
Permit No. 67-SDP-01-75C

Compliance with:	Monitoring Calendar Years									
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
567 IAC 114.21(2)"a" - high and low water levels (biennial)	X	X	X	X	X	X	X	X	X	X
567 IAC 114.21(2)"b" - changes in the hydrologic setting and flow paths (biennial)	X	X	X	X	X	X	X	X	X	X
567 IAC 114.21(2)"c" - well depths (annual)	X	X	X	X	X	X	X	X	X	X
567 IAC 114.21(2)"d" - in-situ permeability testing (1 per 5 years)	X						X			

Compliance with:	Monitoring Calendar Years									
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
567 IAC 114.21(2)"a" - high and low water levels (biennial)	X	X	X	X	X	X	X	X	X	X
567 IAC 114.21(2)"b" - changes in the hydrologic setting and flow paths (biennial)	X	X	X	X	X	X	X	X	X	X
567 IAC 114.21(2)"c" - well depths (annual)	X	X	X	X	X	X	X	X	X	X
567 IAC 114.21(2)"d" - in-situ permeability testing (1 per 5 years)		X					X			

Compliance with:	Monitoring Calendar Years									
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
567 IAC 114.21(2)"a" - high and low water levels (biennial)	X	X	X	X	X	X	X	X	X	X
567 IAC 114.21(2)"b" - changes in the hydrologic setting and flow paths (biennial)	X	X	X	X	X	X	X	X	X	X
567 IAC 114.21(2)"c" - well depths (annual)	X	X	X	X	X	X	X	X	X	X
567 IAC 114.21(2)"d" - in-situ permeability testing (1 per 5 years)		X						X		

Compliance with:	Monitoring Calendar Years									
	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
567 IAC 114.21(2)"a" - high and low water levels (biennial)	X	X	P	P	P	P	P	P	P	P
567 IAC 114.21(2)"b" - changes in the hydrologic setting and flow paths (biennial)	X	X	P	P	P	P	P	P	P	P
567 IAC 114.21(2)"c" - well depths (annual)	X	X	P	P	P	P	P	P	P	P
567 IAC 114.21(2)"d" - in-situ permeability testing (1 per 5 years)			P					P		

X = completed
P = Planned
N/A = Not Applicable

Table 4 – Monitoring Well Maintenance Performance Reevaluation Summary

Table 4
Monitoring Well Maintenance and Performance Summary
Annual Water Quality Report
Monona County Sanitary Landfill
Permit No. 67-SDP-01-75C

Well	Top of casing	Top of Screen	Total Depth		Date of Measurements		Maximum Depth	Hydraulic Cond.	Most Recent Hydraulic Conductivity	
					4/19/2023	10/25/2023	Discrepancy (ft)	(cm/sec)/date	**4/15/2019**	Change
MW-3R (b)	1266.2	1215.2	66.7	Groundwater Level (ft)	48.62	50.3	0	4.20E-05 11/24/1992	3.71E-05	Minor
				Groundwater Elevation (Ft MSL)	1217.58	1215.9				
				Measured Well Depth (ft)	66.7	66.7				
				Submerged (+) or Exposed screen (-)	2.38	0.7				
MW-4 (b)	1275.6	1208.6	82	Groundwater Level (ft)	57.45	56.36	6.19	3.00E-05 11/24/1992	4.16E-05	Minor
				Groundwater Elevation (Ft MSL)	1218.15	1219.24				
				Measured Well Depth (ft)	78.7	75.81				
				Submerged (+) or Exposed screen (-)	9.55	10.64				
MW-5 (b)	1335.64	1229	121.64	Groundwater Level (ft)	99.8	100.6	0.14	1.60E-05 11/24/1992	4.43E-05	Minor
				Groundwater Elevation (Ft MSL)	1235.84	1235.04				
				Measured Well Depth (ft)	121.5	121.5				
				Submerged (+) or Exposed screen (-)	6.84	6.04				
MW-1	1219.49	1192.3	42.19	Groundwater Level (ft)	26.67	27.15	-0.31	8.10E-05 11/24/1992	1.81E-04	Minor
				Groundwater Elevation (Ft MSL)	1192.82	1192.34				
				Measured Well Depth (ft)	42.5	42.5				
				Submerged (+) or Exposed screen (-)	0.52	0.04				
MW-7	1236.98	1197.2	54.78	Groundwater Level (ft)	46.7	47.3	0.28	2.40E-05 1/6/2012	5.15E-05	Minor
				Groundwater Elevation (Ft MSL)	1190.28	1189.68				
				Measured Well Depth (ft)	54.5	54.5				
				Submerged (+) or Exposed screen (-)	-6.92	-7.52				

Water Elevation Data
Monona County Landfill
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Well/TOC	MW-1	1219.73	MW-3R	1266.2	MW-4	1271.62	MW-5	1335.73	MW-7	1236.98
	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation
04/01/13	NT	NT	NT	NT	65.70	1205.92	104.45	1231.28	NT	NT
05/01/13	15.00	1204.73	NT	NT	64.50	1207.12	104.80	1230.93	NT	NT
06/01/13	15.00	1204.73	NT	NT	64.45	1207.17	104.65	1231.08	NT	NT
07/01/13	15.10	1204.63	NT	NT	64.45	1207.17	104.66	1231.07	NT	NT
08/01/13	18.30	1201.43	NT	NT	64.40	1207.22	104.65	1231.08	NT	NT
09/01/13	18.85	1200.88	50.90	1215.30	64.55	1207.07	104.80	1230.93	NT	NT
10/01/13	19.94	1199.79	51.11	1215.09	64.61	1207.01	104.78	1230.95	NT	NT
04/16/14	30.35	1189.38	52.20	1214.00	64.40	1207.22	105.00	1230.73	49.80	1187.18
10/21/14	29.15	1190.58	46.35	1219.85	64.70	1206.92	105.20	1230.53	49.30	1187.68
04/15/15	29.10	1190.63	48.50	1217.70	64.70	1206.92	105.25	1230.48	49.30	1187.68
10/07/15	28.45	1191.28	49.00	1217.20	65.45	1206.17	105.00	1230.73	49.00	1187.98
04/12/16	27.67	1192.06	50.07	1216.13	64.55	1207.07	105.00	1230.73	48.27	1188.71
10/11/16	27.40	1192.33	50.10	1216.10	63.51	1208.11	104.33	1231.40	47.82	1189.16
04/10/17	28.25	1191.48	50.80	1215.40	63.92	1207.70	104.04	1231.69	47.32	1189.66
10/12/17	28.00	1191.73	51.03	1215.17	62.20	1209.42	103.47	1232.26	48.20	1188.78
04/10/18	28.25	1191.48	50.10	1216.10	61.70	1209.92	103.10	1232.63	48.30	1188.68
10/04/18	27.68	1192.05	48.81	1217.39	61.20	1210.42	103.03	1232.70	48.15	1188.83
04/15/19	28.25	1191.48	50.10	1216.10	60.33	1211.29	102.32	1233.41	47.32	1189.66
10/08/19	25.85	1193.88	46.94	1219.26	59.63	1211.99	102.15	1233.58	46.80	1190.18
04/08/20	25.07	1194.66	46.22	1219.98	58.47	1213.15	101.66	1234.07	46.41	1190.57
10/02/20	25.53	1194.20	46.27	1219.93	57.91	1213.71	101.65	1234.08	46.26	1190.72
04/12/21	25.90	1193.83	46.90	1219.30	56.87	1214.75	101.05	1234.68	46.38	1190.60
10/26/21	26.25	1193.48	47.41	1218.79	55.89	1215.73	100.44	1235.29	46.56	1190.42
04/12/22	26.43	1193.30	47.65	1218.55	55.50	1216.12	99.81	1235.92	46.36	1190.62
10/07/22	26.89	1192.84	49.09	1217.11	56.25	1215.37	100.50	1235.23	47.17	1189.81
04/19/23	26.67	1193.06	48.62	1217.58	57.45	1214.17	99.80	1235.93	46.70	1190.28
10/25/23	27.15	1192.58	50.30	1215.90	56.36	1215.26	100.60	1235.13	47.30	1189.68

Table 5 – Background and GWPS Summary

Table 5
Background and GWPS Summary
Annual Water Quality Report
Monona County Sanitary Landfill
Permit No. 67-SDP-01-75C

Interwell Background Well (MW-3R, MW-4, and MW-5)

Inorganics - Appendix I										
Constituent	**Units**	**Model Type**	**Samples - N**	**Detections**	**Mean**	**SD**	**Prediction Limit**	**Confidence**	**GWPS**	**Source**
Antimony (Sb)	µg/l	*	3	0					6	SS
Arsenic (As)	µg/l	nonparametric	33	15			57.3000	0.99	**57.3**	**Site**
Barium (Ba)	µg/l	lognormal	33	33	5.6452	0.475	991.2112		2000	SS
Cadmium (Cd)	µg/l	nonparametric	33	2			2.2000	0.99	5	SS
Chromium (Cr)	µg/l	nonparametric	30	16			19.5000	0.99	100	SS
Cobalt (Co)	µg/l	nonparametric	6	4			6.3000	0.99	**6.3**	**Site**
Copper (Cu)	µg/l	nonparametric	33	16			26.5000	0.99	1300	SS
Lead (Pb)	µg/l	nonparametric	30	6			15.5000	0.99	**15.5**	**Site**
Nickel	µg/l	nonparametric	6	3			19.6000	0.99	100	SS
Selenium	µg/l	nonparametric	6	0			4.0000	0.99	50	SS
Vanadium	µg/l	*	3	0					20	SS
Zinc (Zn)	µg/l	nonparametric	33	13			67.9000	0.99	2000	SS

= Prediction limit exceeds the GWPS. A Site-Specific GWPS is warranted

* = insufficant data

Table 6 – Summary of Detections Relative to Background and GWPS

Table 6
Summary of Well/Detected Constituent Pairs that Exceed the Background Standard
Annual Water Quality Report
Monona County Sanitary Landfill
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Well	Constituent	Date	Units	Most recent result	Background Standard	GWPS
MW-1	Barium	4/19/2023	ug/L	1020	975.7976	2000
MW-1	Barium	10/25/2023	ug/L	1090	921.2112	2000
MW-1	Nickel	4/19/2023	ug/L	21.70	19.60	100
MW-1	Nickel	10/25/2023	ug/L	21.90	19.60	100
MW-1	chloride	4/19/2023	ug/L	223	50.00	---
MW-1	chloride	10/25/2023	ug/L	239	50.00	---
MW-1	cis-1,2-dichloroethene	4/19/2023	ug/L	2.30	1.00	70
MW-1	cis-1,2-dichloroethene	10/25/2023	ug/L	2.60	1.00	70

Table 7 – Summary of Ongoing and Newly Identified SSI

Table 7
Summary of Ongoing & Newly Identified SSI
Annual Water Quality Report
Monona County Sanitary Landfill
Permit No. 67-SDP-01-75C

KEY:	SSI	SSL LCL>GWPS

Note: The absence of shading indicates that the condition does not exist.

Monitoring Well	Compound	Sample Date	Each Result (ug/L)	Prediction Limit (ug/L)	95% LCL (ug/L)	GWPS Limit (ug/L)	Initial Exceedance	Resamples Due	5th Background Sample
MW-1	Barium	10/4/2018	1000.0	1265.4698	---	2000	10/26/2021	NA	10/2/2020
MW-1	Barium	4/15/2019	1060.0	1265.4698	---	2000	10/26/2021	NA	10/2/2020
MW-1	Barium	10/8/2019	1020.0	1265.4698	---	2000	10/26/2021	NA	10/2/2020
MW-1	Barium	4/8/2020	995.0	1265.4698	993.163	2000	10/26/2021	NA	10/2/2020
MW-1	Barium	10/2/2020	1000.0	1265.4698	993.163	2000	10/26/2021	NA	10/2/2020
MW-1	Barium	4/12/2021	1060.0	1265.4698	993.163	2000	10/26/2021	NA	10/2/2020
MW-1	Barium	10/26/2021	960.0	824.2049	954.925	2000	10/26/2021	NA	10/2/2020
MW-1	Barium	4/12/2022	1030.0	793.2172	962.249	2000	10/26/2021	NA	10/2/2020
MW-1	Barium	10/7/2022	1000.0	995.9742	962.249	2000	10/26/2021	NA	10/2/2020
MW-1	Barium	4/19/2023	1020.0	975.7976	966.086	2000	10/26/2021	NA	10/2/2020
MW-1	Barium	10/25/2023	1090.0	921.2112	989.443	2000	10/26/2021	NA	10/2/2020
MW-1	Nickel	4/19/2023	21.7	19.6000	---	100	4/19/2023	NA	10/2/2020
MW-1	Nickel	10/25/2023	21.9	19.6000	---	100	4/19/2023	NA	10/2/2020
MW-1	Chloride	10/4/2018	176.0	50.0000	---	---	10/4/2018	NA	10/2/2020
MW-1	Chloride	4/15/2019	191.0	50.0000	---	---	10/4/2018	NA	10/2/2020
MW-1	Chloride	10/8/2019	201.0	50.0000	---	---	10/4/2018	NA	10/2/2020
MW-1	Chloride	4/8/2020	212.0	50.0000	181.752	---	10/4/2018	NA	10/2/2020
MW-1	Chloride	10/2/2020	178.0	50.0000	182.960	---	10/4/2018	NA	10/2/2020
MW-1	Chloride	4/12/2021	160.0	50.0000	167.571	---	10/4/2018	NA	10/2/2020
MW-1	Chloride	10/26/2021	170.0	50.0000	160.455	---	10/4/2018	NA	10/2/2020
MW-1	Chloride	4/12/2022	187.0	50.0000	163.791	---	10/4/2018	NA	10/2/2020
MW-1	Chloride	10/7/2022	204.0	50.0000	163.481	---	10/4/2018	NA	10/2/2020
MW-1	Chloride	4/19/2023	223.0	50.0000	169.263	---	10/4/2018	NA	10/2/2020
MW-1	Chloride	10/25/2023	239.0	50.0000	193.675	---	10/4/2018	NA	10/2/2020
MW-1	cis-1,2-dichloroethene	4/19/2023	2.3	1.0	---	70	4/19/2023	NA	10/2/2020
MW-1	cis-1,2-dichloroethene	10/25/2023	2.6	1.0	---	70	4/19/2023	NA	10/2/2020

Bold GWPS *= A Site Specific GWPS that is equal to the Prediction Limit. All other GWPS are IAC 567-137 Statewide Standards for Protected Groundwater.*

Table 7
Summary of Ongoing & Newly Identified SSI
Annual Water Quality Report
Monona County Sanitary Landfill
Permit No. 67-SDP-01-75C

KEY:	SSI	SSL LCL>GWPS

Note: The absence of shading indicates that the condition does not exist.

Monitoring Well	Compound	Sample Date	Each Result (ug/L)	Prediction Limit (ug/L)	95% LCL (ug/L)	GWPS Limit (ug/L)	Initial Exceedance	Resamples Due	5th Background Sample
MW-7	Cadmium	10/4/2018	<0.8	0.8	---	5	10/26/2021	NA	10/2/2020
MW-7	Cadmium	4/15/2019	<0.8	0.8	---	5	10/26/2021	NA	10/2/2020
MW-7	Cadmium	10/8/2019	<0.8	0.8	---	5	10/26/2021	NA	10/2/2020
MW-7	Cadmium	4/8/2020	<0.8	0.8	0.4	5	10/26/2021	NA	10/2/2020
MW-7	Cadmium	10/2/2020	0.9	0.8	0.309	5	10/26/2021	NA	10/2/2020
MW-7	Cadmium	4/12/2021	1.3	0.8	0.373	5	10/26/2021	NA	10/2/2020
MW-7	Cadmium	10/26/2021	<0.8	2.2	0.373	5	10/26/2021	NA	10/2/2020
MW-7	Cadmium	4/12/2022	<0.8	2.2	0.373	5	10/26/2021	NA	10/2/2020
MW-7	Cadmium	10/7/2022	<0.8	2.2	0.235	5	10/26/2021	NA	10/2/2020
MW-7	Cadmium	4/19/2023	<0.8	2.2	0.400	5	10/26/2021	NA	10/2/2020
MW-7	Cadmium	10/25/2023	<0.8	2.2	0.400	5	10/26/2021	NA	10/2/2020

Bold GWPS *= A Site Specific GWPS that is equal to the Prediction Limit. All other GWPS are IAC 567-137 Statewide Standards for Protected Groundwater.*

Table 8 – **NOT USED**

Table 9 – Analytical Data Summary

Table 9

Analytical Data Summary for LW-1

Constituents	Units	4/19/2023
1,1,1,2-Tetrachloroethane	ug/L	<5
1,1,1-Trichloroethane	ug/L	<5
1,1,2,2-Tetrachloroethane	ug/L	<5
1,1,2-Trichloroethane	ug/L	<5
1,1-Dichloroethane	ug/L	<5
1,1-Dichloroethylene	ug/L	<5
1,2,3-Trichloropropane	ug/L	<5
1,2-Dibromo-3-chloropropane	ug/L	<25
1,2-Dibromoethane	ug/L	<5
1,2-Dichlorobenzene	ug/L	<5
1,2-Dichloroethane	ug/L	<5
1,2-Dichloropropane	ug/L	<5
1,4-Dichlorobenzene	ug/L	<5
2-Butanone (MEK)	ug/L	<50
2-Hexanone (MBK)	ug/L	<25
4-Methyl-2-pentanone (MIBK)	ug/L	<25
Acetone	ug/L	<50
Acrylonitrile	ug/L	<25
Antimony, total	ug/L	5.2
Arsenic, total	ug/L	217
Barium, total	ug/L	3140
Benzene	ug/L	<5
Beryllium, total	ug/L	<4
Bromochloromethane	ug/L	<5
Bromodichloromethane	ug/L	<5
Bromoform	ug/L	<5
Bromomethane	ug/L	<5
Cadmium, total	ug/L	2.4
Carbon Disulfide	ug/L	<5
Carbon Tetrachloride	ug/L	<5
Chlorobenzene	ug/L	<5
Chloroethane	ug/L	<5
Chloroform	ug/L	<5
Chloromethane	ug/L	<5
Chromium, total	ug/L	30.2
cis-1,2-Dichloroethylene	ug/L	<5
cis-1,3-Dichloropropene	ug/L	<5
Cobalt, total	ug/L	60.9
Copper, total	ug/L	619
Dibromochloromethane	ug/L	<5
Dibromomethane	ug/L	<5
Ethylbenzene	ug/L	<5
Lead, total	ug/L	37.3
Methyl Iodide	ug/L	<5
Methylene Chloride	ug/L	<25
Nickel, total	ug/L	803
Selenium, total	ug/L	6.3
Silver, total	ug/L	<4
Styrene	ug/L	<5
Tetrachloroethylene	ug/L	<5
Thallium, total	ug/L	<2
Toluene	ug/L	<5
trans-1,2-Dichloroethylene	ug/L	<5
trans-1,3-Dichloropropene	ug/L	<5
trans-1,4-Dichloro-2-butene	ug/L	<25
Trichloroethylene	ug/L	<5
Trichlorofluoromethane	ug/L	<5
Vanadium, total	ug/L	27.2
Vinyl Acetate	ug/L	<25
Vinyl Chloride	ug/L	<5
Xylenes, total	ug/L	<10
Zinc, total	ug/L	1440

* - The displayed value is the arithmetic mean of multiple database matches.

Table 9

Analytical Data Summary for MW-1

Constituents	Units	4/16/2014	10/21/2014	4/15/2015	10/7/2015	4/12/2016	10/11/2016	4/10/2017	10/12/2017
1,1,1,2-Tetrachloroethane	ug/L								
1,1,1-Trichloroethane	ug/L								
1,1,2,2-Tetrachloroethane	ug/L								
1,1,2-Trichloroethane	ug/L								
1,1-Dichloroethane	ug/L								
1,1-Dichloroethylene	ug/L								
1,2,3-Trichloropropane	ug/L								
1,2-Dibromo-3-chloropropane	ug/L								
1,2-Dibromoethane	ug/L								
1,2-Dichlorobenzene	ug/L								
1,2-Dichloroethane	ug/L								
1,2-Dichloropropane	ug/L								
1,4-Dichlorobenzene	ug/L								
2-Butanone (MEK)	ug/L								
2-Hexanone (MBK)	ug/L								
4-Methyl-2-pentanone (MIBK)	ug/L								
Acetone	ug/L								
Acrylonitrile	ug/L								
Antimony, total	ug/L								
Arsenic, total	ug/L								
Barium, total	ug/L								
Benzene	ug/L								
Beryllium, total	ug/L								
Boron, total	ug/L								
Bromochloromethane	ug/L								
Bromodichloromethane	ug/L								
Bromoform	ug/L								
Bromomethane	ug/L								
Cadmium, total	ug/L								
Carbon Disulfide	ug/L								
Carbon Tetrachloride	ug/L								
Chemical Oxygen Demand	mg/L	58	26	40	45	30	44	17	48
Chloride	mg/L	141	117	145	121	149	205	121	154
Chlorobenzene	ug/L								
Chloroethane	ug/L								
Chloroform	ug/L								
Chloromethane	ug/L								
Chromium, total	ug/L								
cis-1,2-Dichloroethylene	ug/L								
cis-1,3-Dichloropropene	ug/L								
Cobalt, total	ug/L								
Copper, total	ug/L								
Dibromochloromethane	ug/L								
Dibromomethane	ug/L								
Ethylbenzene	ug/L								
Iron, dissolved	ug/L	2630	2510	2880	3350	3240	2630	2320	2190
Iron, total	ug/L								
Lead, total	ug/L								
Magnesium, total	mg/L								
Manganese, total	ug/L								
Mercury, total	ug/L								
Methyl Iodide	ug/L								
Methylene Chloride	ug/L								
Molybdenum, total	ug/L								
Nickel, total	ug/L								
Nitrogen, Ammonia	mg/L	<1	<1	<1	<1	<1	<1	<1	<1
Phenols, total	mg/L		<.1		<.1		<.1		<.1
Phosphorus, total	mg/L								
Selenium, total	ug/L								
Silver, total	ug/L								
Styrene	ug/L								
Tetrachloroethylene	ug/L								
Thallium, total	ug/L								
Toluene	ug/L								
Total Organic Halogens (TOX)	mg/L		.067		.053		.135		.073
trans-1,2-Dichloroethylene	ug/L								
trans-1,3-Dichloropropene	ug/L								
trans-1,4-Dichloro-2-butene	ug/L								
Trichloroethylene	ug/L								
Trichlorofluoromethane	ug/L								
Vanadium, total	ug/L								
Vinyl Acetate	ug/L								
Vinyl Chloride	ug/L								
Xylenes, total	ug/L								
Zinc, total	ug/L								

* - The displayed value is the arithmetic mean of multiple database matches.

Table 9

Analytical Data Summary for MW-1

Constituents	4/10/2018	10/4/2018	4/15/2019	10/8/2019	4/8/2020	10/2/2020	4/12/2021	10/26/2021	4/12/2022
1,1,1,2-Tetrachloroethane									
1,1,1-Trichloroethane									
1,1,2,2-Tetrachloroethane									
1,1,2-Trichloroethane									
1,1-Dichloroethane									
1,1-Dichloroethylene									
1,2,3-Trichloropropane									
1,2-Dibromo-3-chloropropane									
1,2-Dibromoethane									
1,2-Dichlorobenzene									
1,2-Dichloroethane									
1,2-Dichloropropane									
1,4-Dichlorobenzene									
2-Butanone (MEK)									
2-Hexanone (MBK)									
4-Methyl-2-pentanone (MIBK)									
Acetone									
Acrylonitrile									
Antimony, total									
Arsenic, total		<4.0	<4.0	<4.0	4.2	<4.0	<4.0	<4.0	<4.0
Barium, total		1000	1060	1020	995	1000	1060	960	1030
Benzene									
Beryllium, total									
Boron, total		<100							
Bromochloromethane									
Bromodichloromethane									
Bromoform									
Bromomethane									
Cadmium, total		<.8	<.8	<.8	<.8	<.8	<.8	<.8	<.8
Carbon Disulfide									
Carbon Tetrachloride									
Chemical Oxygen Demand	52	32	<20	38	30	<20	<20	<20	24
Chloride	126	176	191	201	212	178	160	170	187
Chlorobenzene									
Chloroethane									
Chloroform									
Chloromethane									
Chromium, total			<8	<8	<8	<8	<8	<8	<8
cis-1,2-Dichloroethylene									
cis-1,3-Dichloropropene									
Cobalt, total		4.5							
Copper, total		<4	<4	<4	<4	<4	<4	<4	<4
Dibromochloromethane									
Dibromomethane									
Ethylbenzene									
Iron, dissolved	2070	1740							
Iron, total		1370	1440	1320	1470	1350	1260	1200	1090
Lead, total			<4	<4	<4	<4	<4	<4	<4
Magnesium, total		128	135	134	123	112	116	123	121
Manganese, total		2140	1770						
Mercury, total		<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5
Methyl Iodide									
Methylene Chloride									
Molybdenum, total		<4							
Nickel, total		33.1							
Nitrogen, Ammonia	<1	<1	<1	<1	<1	<1	<1	<1	<1
Phenols, total									
Phosphorus, total		<1							
Selenium, total		<4							
Silver, total									
Styrene									
Tetrachloroethylene									
Thallium, total									
Toluene									
Total Organic Halogens (TOX)									
trans-1,2-Dichloroethylene									
trans-1,3-Dichloropropene									
trans-1,4-Dichloro-2-butene									
Trichloroethylene									
Trichlorofluoromethane									
Vanadium, total									
Vinyl Acetate									
Vinyl Chloride									
Xylenes, total									
Zinc, total		44.9	<20.0	29.9	<20.0	<20.0	<20.0	<20.0	<20.0

* - The displayed value is the arithmetic mean of multiple database matches.

Table 9

Analytical Data Summary for MW-1

Constituents	10/7/2022	4/19/2023	10/25/2023
1,1,1,2-Tetrachloroethane		<1	
1,1,1-Trichloroethane		<1	
1,1,2,2-Tetrachloroethane		<1	
1,1,2-Trichloroethane		<1	
1,1-Dichloroethane		<1	
1,1-Dichloroethylene		<1	
1,2,3-Trichloropropane		<1	
1,2-Dibromo-3-chloropropane		<5	
1,2-Dibromoethane		<1	
1,2-Dichlorobenzene		<1	
1,2-Dichloroethane		<1	
1,2-Dichloropropane		<1	
1,4-Dichlorobenzene		<1	
2-Butanone (MEK)		<10	
2-Hexanone (MBK)		<5	
4-Methyl-2-pentanone (MIBK)		<5	
Acetone		<10	
Acrylonitrile		<5	
Antimony, total		<2	<2
Arsenic, total	<4.0	<4.0	<4.0
Barium, total	1000	1020	1090
Benzene		<1	
Beryllium, total		<4	
Boron, total			
Bromochloromethane		<1	
Bromodichloromethane		<1	
Bromoform		<1	
Bromomethane		<1	
Cadmium, total	<.8	<.8	<.8
Carbon Disulfide		<1	
Carbon Tetrachloride		<1	
Chemical Oxygen Demand	<20	<20	
Chloride	204	223	239
Chlorobenzene		<1	
Chloroethane		<1	
Chloroform		<1	
Chloromethane		<1	
Chromium, total	<8	<8	<8
cis-1,2-Dichloroethylene		2.3	2.6
cis-1,3-Dichloropropene		<1	
Cobalt, total		3.0	3.1
Copper, total	<4	<4	<4
Dibromochloromethane		<1	
Dibromomethane		<1	
Ethylbenzene		<1	
Iron, dissolved			
Iron, total	1190	1090	
Lead, total	<4	<4	<4
Magnesium, total	129	118	
Manganese, total			
Mercury, total	<.5	<.5	
Methyl Iodide		<1	
Methylene Chloride		<5	
Molybdenum, total			
Nickel, total		21.7	21.9
Nitrogen, Ammonia	<1	<1	
Phenols, total			
Phosphorus, total			
Selenium, total		<4	<4
Silver, total		<4	
Styrene		<1	
Tetrachloroethylene		<1	
Thallium, total		<2	
Toluene		<1	
Total Organic Halogens (TOX)			
trans-1,2-Dichloroethylene		<1	
trans-1,3-Dichloropropene		<1	
trans-1,4-Dichloro-2-butene		<5	
Trichloroethylene		<1	
Trichlorofluoromethane		<1	
Vanadium, total		<20	<20
Vinyl Acetate		<5	
Vinyl Chloride		<1	
Xylenes, total		<2	
Zinc, total	<20.0	<20.0	44.1

* - The displayed value is the arithmetic mean of multiple database matches.

Table 9

Analytical Data Summary for MW-2

Constituents	Units	4/16/2014	10/21/2014	4/15/2015	10/7/2015
Chemical Oxygen Demand	mg/L	35	23	27	25
Chloride	mg/L	60	73	73	67
Iron, dissolved	ug/L	688	594	251	358
Nitrogen, Ammonia	mg/L	<1	<1	<1	<1
Phenols, total	mg/L		<.1		<.1
Total Organic Halogens (TOX)	mg/L		.065		.051

* - The displayed value is the arithmetic mean of multiple database matches.

Table 9

Analytical Data Summary for MW-3

Constituents	Units	4/16/2014	10/21/2014	4/15/2015	10/7/2015
Chemical Oxygen Demand	mg/L	<10	<10	<10	<10
Chloride	mg/L	15	<10	<10	<10
Iron, dissolved	ug/L	<100	<100	<100	<100
Nitrogen, Ammonia	mg/L	<1	<1	<1	<1
Phenols, total	mg/L		<.1		<.1
Total Organic Halogens (TOX)	mg/L		.012		<.010

* - The displayed value is the arithmetic mean of multiple database matches.

Table 9

Analytical Data Summary for MW-3R

Constituents	Units	4/12/2016	10/11/2016	4/10/2017	10/12/2017	4/10/2018	10/4/2018	4/15/2019	10/8/2019
Antimony, total	ug/L								
Arsenic, total	ug/L						<4	<4	<4
Barium, total	ug/L						325	175	352
Boron, total	ug/L						103		
Cadmium, total	ug/L						<.8	<.8	<.8
Chemical Oxygen Demand	mg/L	<10	<10	<10	<10	<10	<20		
Chloride	mg/L	<10.0	<10.0	<10.0	10.0	<10.0	<10.0		
Chromium, total	ug/L							<8.0	10.4
Cobalt, total	ug/L						<.8		
Copper, total	ug/L						<4.0	15.4	<4.0
Iron, dissolved	ug/L	<100	<100	<100	<100	<100	<100		
Iron, total	ug/L						<100	517	<100
Lead, total	ug/L							5.6	<4.0
Magnesium, total	mg/L						39.1	14.8	38.0
Manganese, total	ug/L						5	214	
Mercury, total	ug/L						<.5	<.5	<.5
Molybdenum, total	ug/L						<4		
Nickel, total	ug/L						<4		
Nitrogen, Ammonia	mg/L	<1	<1	<1	<1	<1	<1		
Phenols, total	mg/L		<.1		<.1				
Phosphorus, total	mg/L						<1		
Selenium, total	ug/L						<4		
Total Organic Halogens (TOX)	mg/L		.012		<.010				
Vanadium, total	ug/L								
Zinc, total	ug/L						<20.0	59.3	14.1

* - The displayed value is the arithmetic mean of multiple database matches.

Table 9

Analytical Data Summary for MW-3R

Constituents	4/8/2020	10/2/2020	4/12/2021	10/26/2021	4/12/2022	10/7/2022	4/19/2023	10/25/2023
Antimony, total								<2
Arsenic, total	<4	<4	<4	<4	<4	<4	<4	<4
Barium, total	350	328	324	302	332	307	324	306
Boron, total								
Cadmium, total	<.8	<.8	<.8	<.8	<.8	<.8	<.8	<.8
Chemical Oxygen Demand						<20		
Chloride						6.3		
Chromium, total	11.2	10.7	11.1	10.6	11.6	11.0	11.5	11.8
Cobalt, total								<.4
Copper, total	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Iron, dissolved								
Iron, total	212	<100	<100	<100	<100	<100	<100	
Lead, total	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Magnesium, total	37.3	39.5	34.3	36.1	36.7	36.2	34.7	
Manganese, total								
Mercury, total	<.5	<.5	<.5	<.5	<.5	<.5	<.5	
Molybdenum, total								
Nickel, total								<4
Nitrogen, Ammonia						<1		
Phenols, total								
Phosphorus, total								
Selenium, total								<4
Total Organic Halogens (TOX)								
Vanadium, total								<20
Zinc, total	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0

* - The displayed value is the arithmetic mean of multiple database matches.

Table 9

Analytical Data Summary for MW-4

Constituents	Units	4/16/2014	10/21/2014	4/15/2015	10/7/2015	4/12/2016	10/11/2016	4/10/2017	10/12/2017
Antimony, total	ug/L								
Arsenic, total	ug/L								
Barium, total	ug/L								
Boron, total	ug/L								
Cadmium, total	ug/L								
Chemical Oxygen Demand	mg/L	33	11	<10	<10	<10	<10	<10	<10
Chloride	mg/L	14	<10	<10	<10	<10	<10	<10	<10
Chromium, total	ug/L								
Cobalt, total	ug/L								
Copper, total	ug/L								
Iron, dissolved	ug/L	<100	<100	<100	<100	<100	<100	<100	<100
Iron, total	ug/L								
Lead, total	ug/L								
Magnesium, total	mg/L								
Manganese, total	ug/L								
Mercury, total	ug/L								
Molybdenum, total	ug/L								
Nickel, total	ug/L								
Nitrogen, Ammonia	mg/L	<1	<1	<1	<1	<1	<1	<1	<1
Phenols, total	mg/L		<.1		<.1		<.1		<.1
Phosphorus, total	mg/L								
Selenium, total	ug/L								
Total Organic Halogens (TOX)	mg/L		.013		.010		<.010		<.010
Vanadium, total	ug/L								
Zinc, total	ug/L								

* - The displayed value is the arithmetic mean of multiple database matches.

Table 9

Analytical Data Summary for MW-4

Constituents	4/10/2018	10/4/2018	4/15/2019	10/8/2019	4/8/2020	10/2/2020	4/12/2021	10/26/2021	4/12/2022
Antimony, total									
Arsenic, total		57.3	<4.0	49.0	16.7	36.3	31.2	20.8	20.4
Barium, total		228	154	218	295	922	744	251	442
Boron, total		103							
Cadmium, total		<.8	<.8	<.8	<.8	<.8	<.8	<.8	<.8
Chemical Oxygen Demand	<10	<20							
Chloride	<10	<10							
Chromium, total			<8.0	<8.0	<8.0	<8.0	9.0	<8.0	<8.0
Cobalt, total		1.4							
Copper, total		6.9	<4.0	6.9	4.1	15.1	16.7	4.3	7.0
Iron, dissolved	<100	<100							
Iron, total		1480	2770		2930	3860	9090	1210	782
Lead, total			<4.0	<4.0	<4.0	<4.0	4.2	<4.0	<4.0
Magnesium, total		27.6	34.7	34.7	36.4	39.2	41.5	24.4	37.1
Manganese, total		3880	202						
Mercury, total		<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5
Molybdenum, total		16							
Nickel, total		<4.0							
Nitrogen, Ammonia	<1	<1							
Phenols, total									
Phosphorus, total		<1							
Selenium, total		<4							
Total Organic Halogens (TOX)									
Vanadium, total									
Zinc, total		31.9	<20.0	24.6	<20.0	32.5	40.9	<20.0	<20.0

* - The displayed value is the arithmetic mean of multiple database matches.

Table 9

Analytical Data Summary for MW-4

Constituents	10/7/2022	4/19/2023	10/25/2023
Antimony, total			<2
Arsenic, total	19.8	23.9	21.4
Barium, total	395	445	347
Boron, total			
Cadmium, total	<.8	<.8	<.8
Chemical Oxygen Demand	<20		
Chloride	5		
Chromium, total	<8.0	<8.0	10.4
Cobalt, total			.4
Copper, total	5.6	4.8	<4.0
Iron, dissolved			
Iron, total	665	1040	
Lead, total	<4.0	<4.0	<4.0
Magnesium, total	31.4	30.6	
Manganese, total			
Mercury, total	<.5	<.5	
Molybdenum, total			
Nickel, total			9.7
Nitrogen, Ammonia	<1		
Phenols, total			
Phosphorus, total			
Selenium, total			<4
Total Organic Halogens (TOX)			
Vanadium, total			<20
Zinc, total	22.0	<20.0	<20.0

* - The displayed value is the arithmetic mean of multiple database matches.

Table 9

Analytical Data Summary for MW-5

Constituents	Units	4/16/2014	10/21/2014	4/15/2015	10/7/2015	4/12/2016	10/11/2016	4/10/2017	10/12/2017
Antimony, total	ug/L								
Arsenic, total	ug/L								
Barium, total	ug/L								
Boron, total	ug/L								
Cadmium, total	ug/L								
Chemical Oxygen Demand	mg/L	44	38	13	40	19	<10	<10	15
Chloride	mg/L	33.0	41.0	44.0	36.0	43.0	36.0	49.0	50.0
Chromium, total	ug/L								
Cobalt, total	ug/L								
Copper, total	ug/L								
Iron, dissolved	ug/L	476	<100	<100	<100	<100	<100	<100	<100
Iron, total	ug/L								
Lead, total	ug/L								
Magnesium, total	mg/L								
Manganese, total	ug/L								
Mercury, total	ug/L								
Molybdenum, total	ug/L								
Nickel, total	ug/L								
Nitrogen, Ammonia	mg/L	<1	<1	<1	<1	<1	<1	<1	<1
Phenols, total	mg/L		<.1		<.1		<.1		<.1
Phosphorus, total	mg/L								
Selenium, total	ug/L								
Total Organic Halogens (TOX)	mg/L		.020		.012		.061		<.010
Vanadium, total	ug/L								
Zinc, total	ug/L								

* - The displayed value is the arithmetic mean of multiple database matches.

Table 9

Analytical Data Summary for MW-5

Constituents	4/10/2018	10/4/2018	4/15/2019	10/8/2019	4/8/2020	10/2/2020	4/12/2021	10/26/2021	4/12/2022
Antimony, total									
Arsenic, total		6.4	<4.0	<4.0	6.0	<4.0	4.0	5.6	<4.0
Barium, total		317.0	80.7	166.0	484.0	177.0	254.0	341.0	195.0
Boron, total		190							
Cadmium, total		<.8	<.8	<.8	.8	<.8	<.8	2.2	<.8
Chemical Oxygen Demand	22	<20							
Chloride	48.0	50.0							
Chromium, total			<8.0	<8.0	13.4	<8.0	14.3	10.8	16.8
Cobalt, total		6.3							
Copper, total		16.4	<4.0	<4.0	26.5	<4.0	8.4	14.7	4.6
Iron, dissolved	<100	<100							
Iron, total		18600	1940	1070	32700	1790	10100	15000	2170
Lead, total			<4.0	<4.0	15.5	<4.0	4.9	7.6	<4.0
Magnesium, total		35.3	24.1	23.6	48.8	23.6	28.5	30.7	25.5
Manganese, total		428	<4						
Mercury, total		<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5
Molybdenum, total		<4							
Nickel, total		19.5							
Nitrogen, Ammonia	<1	<1							
Phenols, total									
Phosphorus, total		<1							
Selenium, total		<4							
Total Organic Halogens (TOX)									
Vanadium, total									
Zinc, total		67.9	<20.0	44.6	65.8	<20.0	24.5	46.4	<20.0

* - The displayed value is the arithmetic mean of multiple database matches.

Table 9

Analytical Data Summary for MW-5

Constituents	10/7/2022	4/19/2023	10/25/2023
Antimony, total			<2
Arsenic, total	<4.0	<4.0	4.6
Barium, total	155.0	146.0	243.0
Boron, total			
Cadmium, total	<.8	<.8	<.8
Chemical Oxygen Demand	<20		
Chloride	38.3		
Chromium, total	<8.0	<8.0	19.5
Cobalt, total			3.5
Copper, total	<4.0	<4.0	8.9
Iron, dissolved			
Iron, total	1640	373	
Lead, total	<4.0	<4.0	4.6
Magnesium, total	22.2	22.6	
Manganese, total			
Mercury, total	<.5	<.5	
Molybdenum, total			
Nickel, total			19.6
Nitrogen, Ammonia	<1		
Phenols, total			
Phosphorus, total			
Selenium, total			<4
Total Organic Halogens (TOX)			
Vanadium, total			<20
Zinc, total	<20.0	<20.0	36.5

* - The displayed value is the arithmetic mean of multiple database matches.

Table 9

Analytical Data Summary for MW-7

Constituents	Units	4/16/2014	10/21/2014	4/15/2015	10/7/2015	4/12/2016	10/11/2016	4/10/2017	10/12/2017
Antimony, total	ug/L								
Arsenic, total	ug/L								
Barium, total	ug/L								
Boron, total	ug/L								
Cadmium, total	ug/L								
Chemical Oxygen Demand	mg/L	<10	<10	<10	11	<10	<10	<10	<10
Chloride	mg/L	16.0	10.0	12.0	10.0	<10.0	<10.0	<10.0	<10.0
Chromium, total	ug/L								
Cobalt, total	ug/L								
Copper, total	ug/L								
Iron, dissolved	ug/L	<100	160	173	146	259	<100	230	<100
Iron, total	ug/L								
Lead, total	ug/L								
Magnesium, total	mg/L								
Manganese, total	ug/L								
Mercury, total	ug/L								
Molybdenum, total	ug/L								
Nickel, total	ug/L								
Nitrogen, Ammonia	mg/L	<1	<1	<1	<1	<1	<1	<1	<1
Phenols, total	mg/L		<.1		<.1		<.1		<.1
Phosphorus, total	mg/L								
Selenium, total	ug/L								
Total Organic Halogens (TOX)	mg/L		.010		<.010		.014		<.010
Vanadium, total	ug/L								
Zinc, total	ug/L								

* - The displayed value is the arithmetic mean of multiple database matches.

Table 9

Analytical Data Summary for MW-7

Constituents	4/10/2018	10/4/2018	4/15/2019	10/8/2019	4/8/2020	10/2/2020	4/12/2021	10/26/2021	4/12/2022
Antimony, total									
Arsenic, total		<4.0	27.2	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Barium, total		150	279	178	187	190	195	163	190
Boron, total		<100							
Cadmium, total		<.8	<.8	<.8	<.8	.9	1.3	<.8	<.8
Chemical Oxygen Demand	<10	<20							
Chloride	<10.0	10.0							
Chromium, total			<8	<8	<8	<8	<8	<8	<8
Cobalt, total		<.8							
Copper, total		<4	<4	<4	<4	<4	<4	<4	<4
Iron, dissolved	<100	<100							
Iron, total		<100	<100	<100	<100	<100	<100	<100	<100
Lead, total			<4	<4	<4	<4	<4	<4	<4
Magnesium, total		22.2	25.6	26.8	27.4	32.1	28.8	28.2	28.6
Manganese, total		583	687						
Mercury, total		<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5
Molybdenum, total		7.2							
Nickel, total		<4							
Nitrogen, Ammonia	<1	<1							
Phenols, total									
Phosphorus, total		<1							
Selenium, total		<4							
Total Organic Halogens (TOX)									
Vanadium, total									
Zinc, total		23.6	31.5	<8.0	<20.0	<20.0	<20.0	<20.0	<20.0

* - The displayed value is the arithmetic mean of multiple database matches.

Table 9

Analytical Data Summary for MW-7

Constituents	10/7/2022	4/19/2023	10/25/2023
Antimony, total			<2
Arsenic, total	<4.0	<4.0	<4.0
Barium, total	153	159	172
Boron, total			
Cadmium, total	<.8	<.8	<.8
Chemical Oxygen Demand	<20		
Chloride	7.1		
Chromium, total	<8	<8	<8
Cobalt, total			<.4
Copper, total	<4	<4	<4
Iron, dissolved			
Iron, total	<100	<100	
Lead, total	<4	<4	<4
Magnesium, total	24.2	23.8	
Manganese, total			
Mercury, total	<.5	<.5	
Molybdenum, total			
Nickel, total			<4
Nitrogen, Ammonia	<1		
Phenols, total			
Phosphorus, total			
Selenium, total			<4
Total Organic Halogens (TOX)			
Vanadium, total			<20
Zinc, total	<20.0	<20.0	<20.0

* - The displayed value is the arithmetic mean of multiple database matches.

Table 10 – **NOT USED**

Table 11 – **NOT USED**

Table 12 – Leachate Summary

Table 12
Leachate Elevation Data
Annual Water Quality Report
Monona County Landfill
67-SDP-1-75P

	LW-1 (Starting October, 2015) 26.35		Top PVC	**1250.98**
	Leachate * Depth (ft)	Leachate Thickness (ft)	Gallons Extracted	Leachate Elevation (MSL)
01/04/23	25.85	0.50	0.00	1225.13
04/19/23	26.12	0.23	0.00	1224.86
07/04/23	26.35	0.00	0.00	1224.63
10/25/23	26.48	-0.13	0.00	1224.50
* April and October measurements by HLW. All other measurements by Monona County Transfer Station staff				
			0.00 total gallons extracted	

Table 13 – Gas Monitoring Summary

Table 13
Explosive Gas Monitoring
Annual Water Quality Report
Monona County Landfill
Permit No. 67-SDP-01-75C

6-Jan-23		
Ambient Air Location	**Oxygen %**	**Lower Explosive Limit %**
MW-1	NA	0
MW-2	NA	0
MW-3R	NA	0
MW-4	NA	0
MW-5	NA	0
Shop	NA	0
Collected by: Transfer Station staff		

19-Apr-23		
Ambient Air Location	**Oxygen %**	**Lower Explosive Limit %**
MW-1	20.9	0
MW-2	20.9	0
MW-3R	20.9	0
MW-4	20.9	0
MW-5	20.9	0
Shop	20.9	0
Collected by: HLW		

5-Jul-23		
Ambient Air Location	**Oxygen %**	**Lower Explosive Limit %**
MW-1	NA	0
MW-2	NA	0
MW-3R	NA	0
MW-4	NA	0
MW-5	NA	0
Shop	NA	0
Collected by: Transfer Station staff		

25-Oct-23		
Ambient Air Location	**Oxygen %**	**Lower Explosive Limit %**
MW-1	20.9	0
MW-2	20.9	0
MW-3R	20.9	0
MW-4	20.9	0
MW-5	20.9	0
Shop	20.9	0
Collected by: HLW		

Appendix A

Hydraulic Conductivity Data

Hydraulic Conductivity Summary Data
Monona County Sanitary Landfill

Well No.	Installation Date	11/24/1992 K cm/sec	1/6/2012 K cm/sec	4/15/2019 K cm/sec
MW-1	3/24/1992	8.10E-05	8.10E-05	1.81E-04
MW-3R	9/10/2013	4.20E-05	4.20E-05	3.71E-05
MW-4	11/6/1992	3.00E-05	3.00E-05	4.16E-05
MW-5	11/12/1992	1.60E-05	1.60E-05	4.43E-05
MW-7	10/6/2011	DNE	2.40E-05	5.15E-05

DNE = Does not exist

Appendix B

Field Sampling Forms

Monona County Sanitary Landfill
PERMIT # 67-SDP-1-75C

4/19/2023 | Sampled by: G. Hunter | Weather conditions: Partly cloudy, windy, 43-64 degrees

IDNR Form 542-1322

Monitoring Well: MW 1 (dg)

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1219.49
Well Depth	42.19
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1219.49
Well Depth	42.19
Top Screen	1192.30
Bottom Screen	1177.30
Bottom Well	1176.99
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	36.00
Top sample	1183.49
Bottom sample	1179.49
Turbidity(NTU)	1.26

Date	Time	Water Level	Water Elevation	Notes
4/19/2023	10:02	26.67	1192.82	

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		1.26
Appendix I	Metals	250	250		1.26
Appendix I	VOC	120	120		
Full Appendix II	10 more containers	5620			
Fe, dissolved - filtered	dissolved metals	250			
chloride, ammonia	chloride, ammonia	250	250		
COD	COD	125	125		
Total			755	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1219.49	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	42.19	Before purging	4/19/2023	10:02	26.67	1192.82		0.0	
		After purging				1219.49			
		Top of Screen after construction				1192.30			
						27.19	feet above (+) or below (-) top screen		
		Bottom of Well after construction				1177.30			
		Bottom of Well	4/19/2023		42.50	1176.99			
						-0.31	feet sedimentation		
		Recovery				1219.49			
		Recovery				1219.49			
		Recovery				1219.49			
		Recovery				1219.49			
		Recovery				1219.49			
		Recovery				1219.49	pH	Conductivity	Temp.(C)
		Recovery				1219.49			

IDNR Form 542-1322

Monitoring Well: MW 3R

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1266.2
Well Depth	66.70
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1266.2
Well Depth	66.70
Top Screen	1215.20
Bottom Screen	1200.20
Bottom Well	1199.50
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	60.00
Top sample	1206.20
Bottom sample	1202.20
Turbidity(NTU)	2.25

Date	Time	Water Level	Water Elevation	Notes
4/19/2023	10:31	48.62	1217.58	

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		2.25
Appendix I	Metals	250	250		2.25
Appendix I	VOC	120			
Full Appendix II	10 more containers	5620			
Fe, dissolved - filtered	dissolved metals	250			
chloride, ammonia	chloride, ammonia	250			
COD	COD	250			
Total			260	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1266.2
Well Depth	66.00

2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Before purging	4/19/2023	10:31	48.62	1217.58			
After purging				1266.20			
Top of Screen after construction				1215.20			
				51.00	feet above (+) or below (-) top screen		
Bottom of Well after construction				1199.50			
Bottom of Well	4/19/2023		66.70	1199.50			
				0.00	feet sedimentation		
Recovery				1266.20			
Recovery				1266.20			
Recovery				1266.20			
Recovery				1266.20			
Recovery				1266.20			
Recovery				1266.20			
Recovery				1266.20			
Recovery				1266.20	pH	Conductivity	Temp.(C)
Recovery				1266.20			

IDNR Form 542-1322

Monitoring Well: MW 4

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1275.6
Well Depth	82.00
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1275.6
Well Depth	82.00
Top Screen	1208.60
Bottom Screen	1193.60
Bottom Well	1193.60
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	72.00
Top sample	1203.60
Bottom sample	1199.60
Turbidity(NTU)	13.30

Date	Time	Water Level	Water Elevation	Notes
4/19/2023	9:29	57.45	1218.15	

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		13.30
Appendix I	Metals	250	250		13.30
Appendix I	VOC	120	0		
Full Appendix II	10 more containers	5620			
Fe, dissolved - filtered	dissolved metals	250			
chloride, ammonia	chloride, ammonia	250			
COD	COD	125			
Total			260	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1275.6	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	82.00	Before purging	4/19/2023	9:29	57.45	1218.15			
		After purging				1275.60			
		Top of Screen after construction				1208.60			
						67.00	feet above (+) or below (-) top screen		
		Bottom of Well after construction				1193.60			
		Bottom of Well	4/19/2023		78.70	1196.90			
						3.30	feet sedimentation		
		Recovery				1275.60			
		Recovery				1275.60			
		Recovery				1275.60			
		Recovery				1275.60			
		Recovery				1275.60			
		Recovery				1275.60			
		Recovery				1275.60			
		Recovery				1275.60	pH	Conductivity	Temp.(C)
		Recovery				1275.60			

IDNR Form 542-1322

Monitoring Well: MW-5

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1335.64
Well Depth	121.64
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1335.64
Well Depth	121.64
Top Screen	1229.00
Bottom Screen	1214.00
Bottom Well	1214.00
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	115.00
Top sample	1220.64
Bottom sample	1216.64
Turbidity(NTU)	11.30

Date	Time	Water Level	Water Elevation	Notes
4/19/2023	9:08	99.8	1235.84	

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		11.30
Appendix I	Metals	250	250		11.30
Appendix I	VOC	120			
Full Appendix II	10 more containers	5620			
Fe, dissolved - filtered	dissolved metals	250			
chloride, ammonia	chloride, ammonia	250			
COD	COD	125			
Total			260	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1335.64	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	121.64	Before purging	4/19/2023	9:08	99.8	1235.84			
		After purging				1335.64			
		Top of Screen after construction				1229.00			
						106.64	feet above (+) or below (-) top screen		
		Bottom of Well after construction				1214.00			
		Bottom of Well	4/19/2023		121.50	1214.14			
						0.14	feet sedimentation		
		Recovery				1335.64			
		Recovery				1335.64			
		Recovery				1335.64			
		Recovery				1335.64			
		Recovery				1335.64			
		Recovery				1335.64			
		Recovery				1335.64			
		Recovery				1335.64	pH	Conductivity	Temp.(C)
		Recovery				1335.64			

IDNR Form 542-1322

Monitoring Well: MW 7

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1236.98
Well Depth	54.78
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1236.98
Well Depth	54.78
Top Screen	1197.20
Bottom Screen	1182.20
Bottom Well	1182.20
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	48.00
Top sample	1188.98
Bottom sample	1184.98
Turbidity(NTU)	1.11

Date	Time	Water Level	Water Elevation	Notes
4/19/2023	10:15	46.7	1190.28	

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		1.11
Appendix I	Metals	250	250		1.11
Appendix I	VOC	120			
Full Appendix II	10 more containers	5620			
Fe, dissolved - filtered	dissolved metals	250			
chloride, ammonia	chloride, ammonia	250			
COD	COD	125			
Total			260	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1236.98
Well Depth	54.78

2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Before purging	4/19/2023	10:15	46.7	1190.28			
After purging				1236.98			
Top of Screen after construction				1197.20			
				39.78	feet above (+) or below (-) top screen		
Bottom of Well after construction				1182.20			
Bottom of Well	4/19/2023		54.50	1182.48			
				0.28	feet sedimentation		
Recovery				1236.98			
Recovery				1236.98			
Recovery				1236.98			
Recovery				1236.98			
Recovery				1236.98			
Recovery				1236.98			
Recovery				1236.98			
Recovery				1236.98	pH	Conductivity	Temp.(C)
Recovery				1236.98			

Monona County Sanitary Landfill
PERMIT # 67-SDP-1-75C

10/25/2023 | Sampled by: Todd Whipple | Weather conditions: Overcast, calm, foggy, 55 degrees

IDNR Form 542-1322

Monitoring Well: MW 1 (dg)

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1219.49
Well Depth	42.19
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1219.49
Well Depth	42.19
Top Screen	1192.30
Bottom Screen	1177.30
Bottom Well	1176.99
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	36.00
Top sample	1183.49
Bottom sample	1179.49
Turbidity(NTU)	4.18

Date	Time	Water Level	Water Elevation	Notes
10/25/2023	10:15	27.15	1192.34	

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		4.18
Appendix I	Metals	250	250		4.18
Appendix I	VOC	120	120		
Full Appendix II	10 more containers	5620			
Fe, dissolved - filtered	dissolved metals	250			
chloride, ammonia	chloride, ammonia	250	250		
COD	COD	125	125		
Total			755	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1219.49	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	42.19	Before purging	10/25/2023	10:15	27.15	1192.34		0.0	
		After purging				1219.49			
		Top of Screen after construction				1192.30			
						27.19	feet above (+) or below (-) top screen		
		Bottom of Well after construction				1177.30			
		Bottom of Well	10/25/2023		42.50	1176.99			
						-0.31	feet sedimentation		
		Recovery				1219.49			
		Recovery				1219.49			
		Recovery				1219.49			
		Recovery				1219.49			
		Recovery				1219.49			
		Recovery				1219.49	pH	Conductivity	Temp.(C)
		Recovery				1219.49			

IDNR Form 542-1322

Monitoring Well: MW 3R

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1266.2
Well Depth	66.70
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1266.2
Well Depth	66.70
Top Screen	1215.20
Bottom Screen	1200.20
Bottom Well	1199.50
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	60.00
Top sample	1206.20
Bottom sample	1202.20
Turbidity(NTU)	2.92

Date	Time	Water Level	Water Elevation	Notes
10/25/2023	9:08	50.3	1215.9	

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		2.92
Appendix I	Metals	250	250		2.92
Appendix I	VOC	120			
Full Appendix II	10 more containers	5620			
Fe, dissolved - filtered	dissolved metals	250			
chloride, ammonia	chloride, ammonia	250			
COD	COD	250			
Total			260	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1266.2
Well Depth	66.00

2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Before purging	10/25/2023	9:08	50.3	1215.90			
After purging				1266.20			
Top of Screen after construction				1215.20			
				51.00	feet above (+) or below (-) top screen		
Bottom of Well after construction				1199.50			
Bottom of Well	10/25/2023		66.70	1199.50			
				0.00	feet sedimentation		
Recovery				1266.20			
Recovery				1266.20			
Recovery				1266.20			
Recovery				1266.20			
Recovery				1266.20			
Recovery				1266.20			
Recovery				1266.20			
Recovery				1266.20	pH	Conductivity	Temp.(C)
Recovery				1266.20			

IDNR Form 542-1322

Monitoring Well: MW 4

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1275.6
Well Depth	82.00
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1275.6
Well Depth	82.00
Top Screen	1208.60
Bottom Screen	1193.60
Bottom Well	1193.60
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	72.00
Top sample	1203.60
Bottom sample	1199.60
Turbidity(NTU)	5.07

Date	Time	Water Level	Water Elevation	Notes
10/25/2023	9:35	56.36	1219.24	

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		5.07
Appendix I	Metals	250	250		5.07
Appendix I	VOC	120	0		
Full Appendix II	10 more containers	5620			
Fe, dissolved - filtered	dissolved metals	250			
chloride, ammonia	chloride, ammonia	250			
COD	COD	125			
Total			260	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1275.6	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	82.00	Before purging	10/25/2023	9:35	56.36	1219.24			
		After purging				1275.60			
		Top of Screen after construction				1208.60			
						67.00	feet above (+) or below (-) top screen		
		Bottom of Well after construction				1193.60			
		Bottom of Well	10/25/2023		75.81	1199.79			
						6.19	feet sedimentation		
		Recovery				1275.60			
		Recovery				1275.60			
		Recovery				1275.60			
		Recovery				1275.60			
		Recovery				1275.60			
		Recovery				1275.60			
		Recovery				1275.60			
		Recovery				1275.60	pH	Conductivity	Temp.(C)
		Recovery				1275.60			

IDNR Form 542-1322

Monitoring Well: MW-5

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1335.64
Well Depth	121.64
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1335.64
Well Depth	121.64
Top Screen	1229.00
Bottom Screen	1214.00
Bottom Well	1214.00
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	114.00
Top sample	1221.64
Bottom sample	1217.64
Turbidity(NTU)	99.26

Date	Time	Water Level	Water Elevation	Notes
10/25/2023	8:42	100.6	1235.04	

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		99.26
Appendix I	Metals	250	250		99.26
Appendix I	VOC	120			
Full Appendix II	10 more containers	5620			
Fe, dissolved - filtered	dissolved metals	250			
chloride, ammonia	chloride, ammonia	250			
COD	COD	125			
Total			260	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1335.64	2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Well Depth	121.64	Before purging	10/25/2023	8:42	100.6	1235.04			
		After purging				1335.64			
		Top of Screen after construction				1229.00			
						106.64	feet above (+) or below (-) top screen		
		Bottom of Well after construction				1214.00			
		Bottom of Well	10/25/2023		121.50	1214.14			
						0.14	feet sedimentation		
		Recovery				1335.64			
		Recovery				1335.64			
		Recovery				1335.64			
		Recovery				1335.64			
		Recovery				1335.64			
		Recovery				1335.64			
		Recovery				1335.64			
		Recovery				1335.64	pH	Conductivity	Temp.(C)
		Recovery				1335.64			

IDNR Form 542-1322

Monitoring Well: MW 7

Primary Sampling Method: No-Purge for Appendix I
Secondary Sampling Method: Purge & Sample for all analytes beyond Appendix I

GENERAL INFORMATION

TOC	1236.98
Well Depth	54.78
Capped	YES
Standing Water	NO
Litter	NO
Level Tape	Solinst 101
NTU Meter	Hach 2100P
No-Purge Equipment -	Solinst 429
Purge Equipment -	Waterra

NO PURGE METHOD

TOC	1236.98
Well Depth	54.78
Top Screen	1197.20
Bottom Screen	1182.20
Bottom Well	1182.20
Sampler Length (ft)	4.00
Sampler Volume (mL)	440.00
Feet cordage	48.00
Top sample	1188.98
Bottom sample	1184.98
Turbidity(NTU)	2.37

Date	Time	Water Level	Water Elevation	Notes
10/25/2023	10:00	47.3	1189.68	

ANALYTES, CONTAINERS, AND VOLUMES

Analyte		Required Volume (mL)	Volume Collected No-Purge (mL)	Volume Collected Purge & Sample (mL)	Turbidity this Container (NTU)
All	Field NTU	10	10		2.37
Appendix I	Metals	250	250		2.37
Appendix I	VOC	120			
Full Appendix II	10 more containers	5620			
Fe, dissolved - filtered	dissolved metals	250			
chloride, ammonia	chloride, ammonia	250			
COD	COD	125			
Total			260	0	

PURGE & SAMPLE METHOD - Purge by Waterra Inertial Lift Pump, then well rest, then sample collection

TOC	1236.98
Well Depth	54.78

2" dia.	Date	Time	Depth	Elevation	Gallons	# of Vol.	Purged Dry?
Before purging	10/25/2023	10:00	47.3	1189.68			
After purging				1236.98			
Top of Screen after construction				1197.20			
				39.78	feet above (+) or below (-) top screen		
Bottom of Well after construction				1182.20			
Bottom of Well	10/25/2023		54.50	1182.48			
				0.28	feet sedimentation		
Recovery				1236.98			
Recovery				1236.98			
Recovery				1236.98			
Recovery				1236.98			
Recovery				1236.98			
Recovery				1236.98			
Recovery				1236.98			
Recovery				1236.98	pH	Conductivity	Temp.(C)
Recovery				1236.98			

Appendix C

Statistical Reports

Results of the Ground Water Statistics

for Monona County Sanitary Landfill

First Semi-Annual Monitoring Event in 2023

Prepared for:
Monona County Sanitary Landfill
31342 Hwy 37
Turin, IA 51040

Prepared by:
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May 2023

INTRODUCTION

This report contains the results of the statistical analyses used to evaluate the ground water data obtained during the first semi-annual monitoring event in 2023 at Monona County Sanitary Landfill. The ground water at Monona County Sanitary Landfill is monitored by a network of wells including MW-1, MW-3R (upgradient), MW-4 (upgradient), MW-5 (upgradient), and MW-7. Monitoring wells MW-1, MW-3R, MW-4, MW-5, and MW-7 were sampled on April 19, 2023 and analyzed for the parameters required by permit. The statistical plan is designed to detect a release from the facility at the earliest indication so that it is protective of human health and the environment. The interwell methodology is described and then applied to the Monona County Sanitary Landfill data. The statistical plan conforms with IAC 567, Chapter 113.10, USEPA Guidance document ("*Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Unified Guidance"*, March 2009), and the American Society for Testing and Materials (ASTM) standard D6312-98, *Developing Appropriate Statistical Approaches for Ground-Water Detection Monitoring Programs.*

Ground Water Monitoring Program

The groundwater monitoring network for Monona County Sanitary Landfill includes MW-1, MW-3R, MW-4, MW-5, and MW-7. Each of the groundwater monitoring wells is to be sampled at least semiannually and analyzed for the trace metals including arsenic, barium, cadmium, chromium, copper, iron, lead, magnesium, mercury, and zinc. The ground water data obtained during the first semi-annual monitoring event in 2023 are summarized in Attachment A.

STATISTICAL METHODOLOGIES FOR DETECTION MONITORING

IAC 567, Chapter 113.10(4) provides several options for statistically evaluating the ground water data at those wells that monitor the open cells or contiguous MSWLF units. The preferred methods for comparing ground water data are using either prediction limits or using control charts. The site prediction limit method was applied to the Monona County Sanitary Landfill data using the DUMPStat® statistical program. DUMPStat® is a program for the statistical analysis of groundwater monitoring data using methods described in "Statistical Methods for Groundwater Monitoring" by Dr. Robert D. Gibbons. The DUMPStat program is completely consistent with all USEPA regulations and guidance and the ASTM D6312-98 guidance.

Interwell Statistics: Upgradient versus Downgradient Comparisons

Interwell statistics are appropriate when the upgradient and downgradient wells monitor the same ground water formation and there is similar variability in the upgradient and downgradient zones. Site prediction limits are determined by pooling the historical ground water data from hydraulically upgradient wells. This statistical method compares the current downgradient determinations to site prediction limits and checks for exceedances. The type of prediction limit utilized (e.g., parametric or nonparametric) is based on the detection frequency and the data distribution of each parameter in the background data. The distribution of the background data is tested for normality using the Shapiro-Wilk test (Gibbons, 1994 and USEPA 1992). If the constituent is normally distributed, a normal prediction limit is used. If normality is rejected by the

Shapiro-Wilk test, the background data is transformed by taking the natural logarithm. The Shapiro-Wilk test is then reapplied on the transformed data. If it is not rejected, lognormal prediction limits are used. If after transforming the data, normality is still rejected, nonparametric prediction limits are used for that analyte. The nonparametric prediction limit is the largest determination in the background measurements. For constituents where the background detection frequency is greater than 0% but less than 50%, nonparametric prediction limits will be used. If the detection frequency is 0% after thirteen samples have been collected, the practical quantitation limit (PQL) becomes the nonparametric prediction limit.

Results of the Interwell Statistics – Trace Metals

The background data used in this statistical analysis includes the ground water data collected from ground water wells MW-3R, MW-4, and MW-5 during the period from October 2018 through the current data. A summary of the background data from monitoring wells MW-3R, MW-4, and MW-5 is listed in Attachment B, Table 1 "Upgradient Data". This statistical method compares the current downgradient determinations to site prediction limits and checks for exceedances.

Table 2 "Most Current Downgradient Monitoring Data", summarizes the current data from downgradient wells MW-1 and MW-7, compared to the site prediction limits. Prediction limit exceedances are flagged with asterisks. For the most current data, the site prediction limit exceedances detected are summarized in the table below.

Prediction Limit Exceedances during the First Semi-Annual Monitoring Event in 2023

Well	Parameter	Result	Prediction Limit	Prediction Limit Type	Verified/ Awaiting verification
MW-1	Barium, µg/L	1020	975.7976	Lognormal	Verified
	Magnesium, mg/L	118	48.8000	Nonparametric	Verified

The detection frequencies of the parameters in the up and down gradient monitoring wells are summarized in Table 3. Barium, chromium, copper, iron, and magnesium were detected at a frequency greater than or equal to 50% in the upgradient well so these metals were tested for normality. The remainder of the metals are rarely detected (less than 50%) in the upgradient wells so nonparametric prediction limits were be used in those cases.

Table 4 summarizes the results of the Shapiro-Wilk test. Table 5 is a summary of the statistics and prediction limits determined for the metals. Table 8 is a historical summary of the data at those wells that have indicated an exceedance. Time series graphs of each of the parameters at each well with the corresponding prediction limits are attached.

A statistical power curve indicates the expected false assessments for the site as a whole. The false positive rate for interwell analyses is the percentage of failures when the upgradient versus downgradient true mean difference equals zero. False negative rate indicates the chance of missing contamination at a single well for a single constituent. The statistical power is a function of the number of wells included, the number of constituents compared, the detection frequencies, and the data distributions involved. For interwell

analysis, the site-wide false positive rate is 2% and the test becomes sensitive to 4 standard deviation unit increases over background.

The current and previous verified exceedances were evaluated against the ground water protection standards (GWPS) using confidence limits calculated in accordance with the Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, USEPA, March 2009 (Attachment C). The analysis was conducted to evaluate whether verified concentrations are significantly above the water quality standard. The 95% lower confidence limit (LCL) for the mean of the historical data was used to evaluate whether the regulated unit is in compliance with the ground-water protection standards under 40 CFR 264 (e.g. whether the verified constituent is detected at a significant level above the GWPS). An exceedance is verified if the LCL is above the Regulatory GWPS.

The calculated 95% LCLs do not exceed the GWPS.

Results of the Interwell Statistics - Inorganic Parameters

In addition to the trace metals monitored for, MW-1 was sampled and analyzed for inorganic constituents including chemical oxygen demand, chloride, and ammonia. The data obtained at MW-1 was compared to previously obtained data at upgradient wells MW-3R, MW-4, and MW-5. The background data used in this statistical analysis includes the ground water data collected during the period from 2014 through the current data. A summary of the background data from monitoring wells MW-3R, MW-4, and MW-5 is listed in Attachment D, Table 1 "Upgradient Data". This statistical method compares the current downgradient determinations to site prediction limits and checks for exceedances.

Table 2 "Most Current Downgradient Monitoring Data", summarizes the current data from downgradient well MW-1, compared to the site prediction limits. Prediction limit exceedances are flagged with asterisks. For the most current data, the site prediction limit exceedances detected are summarized in the table below.

Prediction Limit Exceedances during the First Semi-Annual Monitoring Event in 2023

Well	Parameter	Result	Prediction Limit	Prediction Limit Type	Verified/ Awaiting verification
MW-1	Chloride, mg/L	223	50.0000	Nonparametric	Verified

The detection frequencies of the parameters in the up and down gradient monitoring wells are summarized in Table 3. The inorganic parameters were detected at a frequency less than 50% in the upgradient wells so nonparametric prediction limits were used.

Table 4 summarizes the results of the Shapiro-Wilk test. Table 5 is a summary of the statistics and prediction limits determined for the metals. Table 8 is a historical summary of the data at those wells that have indicated an exceedance. Time series graphs of each of the parameters at each well with the corresponding prediction limits are attached.

A statistical power curve indicates the expected false assessments for the site as a whole. The false positive rate for interwell analyses is the percentage of failures when the upgradient versus downgradient true mean difference equals zero. False negative rate indicates the chance of missing contamination at a single well

for a single constituent. The statistical power is a function of the number of wells included, the number of constituents compared, the detection frequencies, and the data distributions involved. For interwell analysis, the site-wide false positive rate is 1% and the test becomes sensitive to 3 standard deviation unit increases over background.

The current verified exceedances were evaluated against the GWPS using confidence limits (Attachment E). The calculated 95% LCLs do not exceed the GWPS.

Volatile Organic Compounds

Volatile Organic Compounds (VOCs) are generally man-made compounds not present in ambient ground water. If VOCs are detected above their statistical limit (i.e., the laboratory PQL or reporting limit), a verification resample will be conducted at the next scheduled sampling event. A statistical exceedance will be indicated if the VOC detection is confirmed by the subsequent monitoring.

Ground water well MW-1 and LW-1 were monitored for VOCs during the first semi-annual monitoring event in 2023. The only VOC detection above the site-specific reporting limits was for *cis*-1,2-dichloroethene (2.3 µg/L) at MW-1. The *cis*-1,2-dichloroethene detection is not statistically significant unless confirmed by subsequent monitoring.

CONCLUSIONS

This document describes a comprehensive statistical plan designated for the Monona County Sanitary Landfill. The groundwater monitoring network for Monona County Sanitary Landfill includes wells MW-1, MW-3R (upgradient), MW-4 (upgradient), MW-5 (upgradient), and MW-7. Each of the groundwater monitoring wells is to be sampled at least semiannually and analyzed for arsenic, barium, cadmium, chromium, copper, iron, lead, magnesium, mercury, and zinc. Inorganic constituents and VOCs were also monitored for at MW-1.

The ground water data was compared to background using prediction limits (interwell). For the most current data, there are verified site prediction limit exceedances for barium, magnesium, and chloride at MW-1. Additionally, there is a *cis*-1,2-dichloroethene detection at MW-1 awaiting verification.

Attachment A

Ground Water Data obtained during the First Semi-Annual Monitoring Event in 2023

Table 1

Analytical Data Summary for 4/19/2023

Constituents	Units	LW-1	MW-1	MW-3R	MW-4	MW-5	MW-7
1,1,1,2-Tetrachloroethane	ug/L	<5	<1				
1,1,1-Trichloroethane	ug/L	<5	<1				
1,1,2,2-Tetrachloroethane	ug/L	<5	<1				
1,1,2-Trichloroethane	ug/L	<5	<1				
1,1-Dichloroethane	ug/L	<5	<1				
1,1-Dichloroethylene	ug/L	<5	<1				
1,2,3-Trichloropropane	ug/L	<5	<1				
1,2-Dibromo-3-chloropropane	ug/L	<25	<5				
1,2-Dibromoethane	ug/L	<5	<1				
1,2-Dichlorobenzene	ug/L	<5	<1				
1,2-Dichloroethane	ug/L	<5	<1				
1,2-Dichloropropane	ug/L	<5	<1				
1,4-Dichlorobenzene	ug/L	<5	<1				
2-Butanone (MEK)	ug/L	<50	<10				
2-Hexanone (MBK)	ug/L	<25	<5				
4-Methyl-2-pentanone (MIBK)	ug/L	<25	<5				
Acetone	ug/L	<50	<10				
Acrylonitrile	ug/L	<25	<5				
Antimony, total	ug/L	5.2	<2.0				
Arsenic, total	ug/L	217.0	<4.0	<4.0	23.9	<4.0	<4.0
Barium, total	ug/L	3140	1020	324	445	146	159
Benzene	ug/L	<5	<1				
Beryllium, total	ug/L	<4	<4				
Bromochloromethane	ug/L	<5	<1				
Bromodichloromethane	ug/L	<5	<1				
Bromoform	ug/L	<5	<1				
Bromomethane	ug/L	<5	<1				
Cadmium, total	ug/L	2.4	<.8	<.8	<.8	<.8	<.8
Carbon Disulfide	ug/L	<5	<1				
Carbon Tetrachloride	ug/L	<5	<1				
Chemical Oxygen Demand	mg/L		<20				
Chloride	mg/L		223				
Chlorobenzene	ug/L	<5	<1				
Chloroethane	ug/L	<5	<1				
Chloroform	ug/L	<5	<1				
Chloromethane	ug/L	<5	<1				
Chromium, total	ug/L	30.2	<8.0	11.5	<8.0	<8.0	<8.0
cis-1,2-Dichloroethylene	ug/L	<5.0	2.3				
cis-1,3-Dichloropropene	ug/L	<5	<1				
Cobalt, total	ug/L	60.9	3.0				
Copper, total	ug/L	619.0	<4.0	<4.0	4.8	<4.0	<4.0
Dibromochloromethane	ug/L	<5	<1				
Dibromomethane	ug/L	<5	<1				
Ethylbenzene	ug/L	<5	<1				
Iron, total	ug/L		1090	<100	1040	373	<100
Lead, total	ug/L	37.3	<4.0	<4.0	<4.0	<4.0	<4.0
Magnesium, total	mg/L		118.0	34.7	30.6	22.6	23.8
Mercury, total	ug/L		<.5	<.5	<.5	<.5	<.5
Methyl Iodide	ug/L	<5	<1				
Methylene Chloride	ug/L	<25	<5				
Nickel, total	ug/L	803.0	21.7				
Nitrogen, Ammonia	mg/L		<1				
Selenium, total	ug/L	6.3	<4.0				
Silver, total	ug/L	<4	<4				
Styrene	ug/L	<5	<1				
Tetrachloroethylene	ug/L	<5	<1				
Thallium, total	ug/L	<2	<2				
Toluene	ug/L	<5	<1				
trans-1,2-Dichloroethylene	ug/L	<5	<1				
trans-1,3-Dichloropropene	ug/L	<5	<1				
trans-1,4-Dichloro-2-butene	ug/L	<25	<5				
Trichloroethylene	ug/L	<5	<1				
Trichlorofluoromethane	ug/L	<5	<1				
Vanadium, total	ug/L	27.2	<20.0				
Vinyl Acetate	ug/L	<25	<5				
Vinyl Chloride	ug/L	<5	<1				
Xylenes, total	ug/L	<10	<2				
Zinc, total	ug/L	1440	<20	<20	<20	<20	<20

* - The displayed value is the arithmetic mean of multiple database matches.

Attachment B

Summary Tables and Graphs for the Interwell Comparisons

Table 1

Upgradient Data

Constituent	Units	Well	Date		Result	Adjusted
Arsenic, total	ug/L	MW-3R	10/04/2018	ND	4.0000	
Arsenic, total	ug/L	MW-3R	04/15/2019	ND	4.0000	
Arsenic, total	ug/L	MW-3R	10/08/2019	ND	4.0000	
Arsenic, total	ug/L	MW-3R	04/08/2020	ND	4.0000	
Arsenic, total	ug/L	MW-3R	10/02/2020	ND	4.0000	
Arsenic, total	ug/L	MW-3R	04/12/2021	ND	4.0000	
Arsenic, total	ug/L	MW-3R	10/26/2021	ND	4.0000	
Arsenic, total	ug/L	MW-3R	04/12/2022	ND	4.0000	
Arsenic, total	ug/L	MW-3R	10/07/2022	ND	4.0000	
Arsenic, total	ug/L	MW-3R	04/19/2023	ND	4.0000	
Arsenic, total	ug/L	MW-4	10/04/2018		57.3000	
Arsenic, total	ug/L	MW-4	04/15/2019	ND	4.0000	
Arsenic, total	ug/L	MW-4	10/08/2019		49.0000	
Arsenic, total	ug/L	MW-4	04/08/2020		16.7000	
Arsenic, total	ug/L	MW-4	10/02/2020		36.3000	
Arsenic, total	ug/L	MW-4	04/12/2021		31.2000	
Arsenic, total	ug/L	MW-4	10/26/2021		20.8000	
Arsenic, total	ug/L	MW-4	04/12/2022		20.4000	
Arsenic, total	ug/L	MW-4	10/07/2022		19.8000	
Arsenic, total	ug/L	MW-4	04/19/2023		23.9000	
Arsenic, total	ug/L	MW-5	10/04/2018		6.4000	
Arsenic, total	ug/L	MW-5	04/15/2019	ND	4.0000	
Arsenic, total	ug/L	MW-5	10/08/2019	ND	4.0000	
Arsenic, total	ug/L	MW-5	04/08/2020		6.0000	
Arsenic, total	ug/L	MW-5	10/02/2020	ND	4.0000	
Arsenic, total	ug/L	MW-5	04/12/2021		4.0000	
Arsenic, total	ug/L	MW-5	10/26/2021		5.6000	
Arsenic, total	ug/L	MW-5	04/12/2022	ND	4.0000	
Arsenic, total	ug/L	MW-5	10/07/2022	ND	4.0000	
Arsenic, total	ug/L	MW-5	04/19/2023	ND	4.0000	
Barium, total	ug/L	MW-3R	10/04/2018		325.0000	
Barium, total	ug/L	MW-3R	04/15/2019		175.0000	
Barium, total	ug/L	MW-3R	10/08/2019		352.0000	
Barium, total	ug/L	MW-3R	04/08/2020		350.0000	
Barium, total	ug/L	MW-3R	10/02/2020		328.0000	
Barium, total	ug/L	MW-3R	04/12/2021		324.0000	
Barium, total	ug/L	MW-3R	10/26/2021		302.0000	
Barium, total	ug/L	MW-3R	04/12/2022		332.0000	
Barium, total	ug/L	MW-3R	10/07/2022		307.0000	
Barium, total	ug/L	MW-3R	04/19/2023		324.0000	
Barium, total	ug/L	MW-4	10/04/2018		228.0000	
Barium, total	ug/L	MW-4	04/15/2019		154.0000	
Barium, total	ug/L	MW-4	10/08/2019		218.0000	
Barium, total	ug/L	MW-4	04/08/2020		295.0000	
Barium, total	ug/L	MW-4	10/02/2020		922.0000	
Barium, total	ug/L	MW-4	04/12/2021		744.0000	
Barium, total	ug/L	MW-4	10/26/2021		251.0000	
Barium, total	ug/L	MW-4	04/12/2022		442.0000	
Barium, total	ug/L	MW-4	10/07/2022		395.0000	
Barium, total	ug/L	MW-4	04/19/2023		445.0000	
Barium, total	ug/L	MW-5	10/04/2018		317.0000	
Barium, total	ug/L	MW-5	04/15/2019		80.7000	
Barium, total	ug/L	MW-5	10/08/2019		166.0000	
Barium, total	ug/L	MW-5	04/08/2020		484.0000	
Barium, total	ug/L	MW-5	10/02/2020		177.0000	
Barium, total	ug/L	MW-5	04/12/2021		254.0000	
Barium, total	ug/L	MW-5	10/26/2021		341.0000	
Barium, total	ug/L	MW-5	04/12/2022		195.0000	
Barium, total	ug/L	MW-5	10/07/2022		155.0000	
Barium, total	ug/L	MW-5	04/19/2023		146.0000	
Cadmium, total	ug/L	MW-3R	10/04/2018	ND	0.8000	
Cadmium, total	ug/L	MW-3R	04/15/2019	ND	0.8000	
Cadmium, total	ug/L	MW-3R	10/08/2019	ND	0.8000	
Cadmium, total	ug/L	MW-3R	04/08/2020	ND	0.8000	
Cadmium, total	ug/L	MW-3R	10/02/2020	ND	0.8000	
Cadmium, total	ug/L	MW-3R	04/12/2021	ND	0.8000	
Cadmium, total	ug/L	MW-3R	10/26/2021	ND	0.8000	
Cadmium, total	ug/L	MW-3R	04/12/2022	ND	0.8000	
Cadmium, total	ug/L	MW-3R	10/07/2022	ND	0.8000	
Cadmium, total	ug/L	MW-3R	04/19/2023	ND	0.8000	
Cadmium, total	ug/L	MW-4	10/04/2018	ND	0.8000	
Cadmium, total	ug/L	MW-4	04/15/2019	ND	0.8000	
Cadmium, total	ug/L	MW-4	10/08/2019	ND	0.8000	
Cadmium, total	ug/L	MW-4	04/08/2020	ND	0.8000	

* - Outlier for that well and constituent.
** - ND value replaced with median RL.
*** - ND value replaced with manual RL.
ND = Not detected, Result = detection limit.

Table 1

Upgradient Data

Constituent	Units	Well	Date		Result	Adjusted
Cadmium, total	ug/L	MW-4	10/02/2020	ND	0.8000	
Cadmium, total	ug/L	MW-4	04/12/2021	ND	0.8000	
Cadmium, total	ug/L	MW-4	10/26/2021	ND	0.8000	
Cadmium, total	ug/L	MW-4	04/12/2022	ND	0.8000	
Cadmium, total	ug/L	MW-4	10/07/2022	ND	0.8000	
Cadmium, total	ug/L	MW-4	04/19/2023	ND	0.8000	
Cadmium, total	ug/L	MW-5	10/04/2018	ND	0.8000	
Cadmium, total	ug/L	MW-5	04/15/2019	ND	0.8000	
Cadmium, total	ug/L	MW-5	10/08/2019	ND	0.8000	
Cadmium, total	ug/L	MW-5	04/08/2020		0.8000	
Cadmium, total	ug/L	MW-5	10/02/2020	ND	0.8000	
Cadmium, total	ug/L	MW-5	04/12/2021	ND	0.8000	
Cadmium, total	ug/L	MW-5	10/26/2021		2.2000	
Cadmium, total	ug/L	MW-5	04/12/2022	ND	0.8000	
Cadmium, total	ug/L	MW-5	10/07/2022	ND	0.8000	
Cadmium, total	ug/L	MW-5	04/19/2023	ND	0.8000	
Chromium, total	ug/L	MW-3R	04/15/2019	ND	8.0000	
Chromium, total	ug/L	MW-3R	10/08/2019		10.4000	
Chromium, total	ug/L	MW-3R	04/08/2020		11.2000	
Chromium, total	ug/L	MW-3R	10/02/2020		10.7000	
Chromium, total	ug/L	MW-3R	04/12/2021		11.1000	
Chromium, total	ug/L	MW-3R	10/26/2021		10.6000	
Chromium, total	ug/L	MW-3R	04/12/2022		11.6000	
Chromium, total	ug/L	MW-3R	10/07/2022		11.0000	
Chromium, total	ug/L	MW-3R	04/19/2023		11.5000	
Chromium, total	ug/L	MW-4	04/15/2019	ND	8.0000	
Chromium, total	ug/L	MW-4	10/08/2019	ND	8.0000	
Chromium, total	ug/L	MW-4	04/08/2020	ND	8.0000	
Chromium, total	ug/L	MW-4	10/02/2020	ND	8.0000	
Chromium, total	ug/L	MW-4	04/12/2021		9.0000	
Chromium, total	ug/L	MW-4	10/26/2021	ND	8.0000	
Chromium, total	ug/L	MW-4	04/12/2022	ND	8.0000	
Chromium, total	ug/L	MW-4	10/07/2022	ND	8.0000	
Chromium, total	ug/L	MW-4	04/19/2023	ND	8.0000	
Chromium, total	ug/L	MW-5	04/15/2019	ND	8.0000	
Chromium, total	ug/L	MW-5	10/08/2019	ND	8.0000	
Chromium, total	ug/L	MW-5	04/08/2020		13.4000	
Chromium, total	ug/L	MW-5	10/02/2020	ND	8.0000	
Chromium, total	ug/L	MW-5	04/12/2021		14.3000	
Chromium, total	ug/L	MW-5	10/26/2021		10.8000	
Chromium, total	ug/L	MW-5	04/12/2022		16.8000	
Chromium, total	ug/L	MW-5	10/07/2022	ND	8.0000	
Chromium, total	ug/L	MW-5	04/19/2023	ND	8.0000	
Copper, total	ug/L	MW-3R	10/04/2018	ND	4.0000	
Copper, total	ug/L	MW-3R	04/15/2019		15.4000	
Copper, total	ug/L	MW-3R	10/08/2019	ND	4.0000	
Copper, total	ug/L	MW-3R	04/08/2020	ND	4.0000	
Copper, total	ug/L	MW-3R	10/02/2020	ND	4.0000	
Copper, total	ug/L	MW-3R	04/12/2021	ND	4.0000	
Copper, total	ug/L	MW-3R	10/26/2021	ND	4.0000	
Copper, total	ug/L	MW-3R	04/12/2022	ND	4.0000	
Copper, total	ug/L	MW-3R	10/07/2022	ND	4.0000	
Copper, total	ug/L	MW-3R	04/19/2023	ND	4.0000	
Copper, total	ug/L	MW-4	10/04/2018		6.9000	
Copper, total	ug/L	MW-4	04/15/2019	ND	4.0000	
Copper, total	ug/L	MW-4	10/08/2019		6.9000	
Copper, total	ug/L	MW-4	04/08/2020		4.1000	
Copper, total	ug/L	MW-4	10/02/2020		15.1000	
Copper, total	ug/L	MW-4	04/12/2021		16.7000	
Copper, total	ug/L	MW-4	10/26/2021		4.3000	
Copper, total	ug/L	MW-4	04/12/2022		7.0000	
Copper, total	ug/L	MW-4	10/07/2022		5.6000	
Copper, total	ug/L	MW-4	04/19/2023		4.8000	
Copper, total	ug/L	MW-5	10/04/2018		16.4000	
Copper, total	ug/L	MW-5	04/15/2019	ND	4.0000	
Copper, total	ug/L	MW-5	10/08/2019	ND	4.0000	
Copper, total	ug/L	MW-5	04/08/2020		26.5000	
Copper, total	ug/L	MW-5	10/02/2020	ND	4.0000	
Copper, total	ug/L	MW-5	04/12/2021		8.4000	
Copper, total	ug/L	MW-5	10/26/2021		14.7000	
Copper, total	ug/L	MW-5	04/12/2022		4.6000	
Copper, total	ug/L	MW-5	10/07/2022	ND	4.0000	
Copper, total	ug/L	MW-5	04/19/2023	ND	4.0000	
Iron, total	ug/L	MW-3R	10/04/2018	ND	100.0000	

* - Outlier for that well and constituent.
** - ND value replaced with median RL.
*** - ND value replaced with manual RL.
ND = Not detected, Result = detection limit.

Table 1

Upgradient Data

Constituent	Units	Well	Date		Result	Adjusted
Iron, total	ug/L	MW-3R	04/15/2019		517.0000	
Iron, total	ug/L	MW-3R	10/08/2019	ND	100.0000	
Iron, total	ug/L	MW-3R	04/08/2020		212.0000	
Iron, total	ug/L	MW-3R	10/02/2020	ND	100.0000	
Iron, total	ug/L	MW-3R	04/12/2021	ND	100.0000	
Iron, total	ug/L	MW-3R	10/26/2021	ND	100.0000	
Iron, total	ug/L	MW-3R	04/12/2022	ND	100.0000	
Iron, total	ug/L	MW-3R	10/07/2022	ND	100.0000	
Iron, total	ug/L	MW-3R	04/19/2023	ND	100.0000	
Iron, total	ug/L	MW-4	10/04/2018		1480.0000	
Iron, total	ug/L	MW-4	04/15/2019		2770.0000	
Iron, total	ug/L	MW-4	04/08/2020		2930.0000	
Iron, total	ug/L	MW-4	10/02/2020		3860.0000	
Iron, total	ug/L	MW-4	04/12/2021		9090.0000	
Iron, total	ug/L	MW-4	10/26/2021		1210.0000	
Iron, total	ug/L	MW-4	04/12/2022		782.0000	
Iron, total	ug/L	MW-4	10/07/2022		665.0000	
Iron, total	ug/L	MW-4	04/19/2023		1040.0000	
Iron, total	ug/L	MW-5	10/04/2018		18600.0000	
Iron, total	ug/L	MW-5	04/15/2019		1940.0000	
Iron, total	ug/L	MW-5	10/08/2019		1070.0000	
Iron, total	ug/L	MW-5	04/08/2020		32700.0000	
Iron, total	ug/L	MW-5	10/02/2020		1790.0000	
Iron, total	ug/L	MW-5	04/12/2021		10100.0000	
Iron, total	ug/L	MW-5	10/26/2021		15000.0000	
Iron, total	ug/L	MW-5	04/12/2022		2170.0000	
Iron, total	ug/L	MW-5	10/07/2022		1640.0000	
Iron, total	ug/L	MW-5	04/19/2023		373.0000	
Lead, total	ug/L	MW-3R	04/15/2019		5.6000	
Lead, total	ug/L	MW-3R	10/08/2019	ND	4.0000	
Lead, total	ug/L	MW-3R	04/08/2020	ND	4.0000	
Lead, total	ug/L	MW-3R	10/02/2020	ND	4.0000	
Lead, total	ug/L	MW-3R	04/12/2021	ND	4.0000	
Lead, total	ug/L	MW-3R	10/26/2021	ND	4.0000	
Lead, total	ug/L	MW-3R	04/12/2022	ND	4.0000	
Lead, total	ug/L	MW-3R	10/07/2022	ND	4.0000	
Lead, total	ug/L	MW-3R	04/19/2023	ND	4.0000	
Lead, total	ug/L	MW-4	04/15/2019	ND	4.0000	
Lead, total	ug/L	MW-4	10/08/2019	ND	4.0000	
Lead, total	ug/L	MW-4	04/08/2020	ND	4.0000	
Lead, total	ug/L	MW-4	10/02/2020	ND	4.0000	
Lead, total	ug/L	MW-4	04/12/2021		4.2000	
Lead, total	ug/L	MW-4	10/26/2021	ND	4.0000	
Lead, total	ug/L	MW-4	04/12/2022	ND	4.0000	
Lead, total	ug/L	MW-4	10/07/2022	ND	4.0000	
Lead, total	ug/L	MW-4	04/19/2023	ND	4.0000	
Lead, total	ug/L	MW-5	04/15/2019	ND	4.0000	
Lead, total	ug/L	MW-5	10/08/2019	ND	4.0000	
Lead, total	ug/L	MW-5	04/08/2020		15.5000	
Lead, total	ug/L	MW-5	10/02/2020	ND	4.0000	
Lead, total	ug/L	MW-5	04/12/2021		4.9000	
Lead, total	ug/L	MW-5	10/26/2021		7.6000	
Lead, total	ug/L	MW-5	04/12/2022	ND	4.0000	
Lead, total	ug/L	MW-5	10/07/2022	ND	4.0000	
Lead, total	ug/L	MW-5	04/19/2023	ND	4.0000	
Magnesium, total	mg/L	MW-3R	10/04/2018		39.1000	
Magnesium, total	mg/L	MW-3R	04/15/2019		14.8000	
Magnesium, total	mg/L	MW-3R	10/08/2019		38.0000	
Magnesium, total	mg/L	MW-3R	04/08/2020		37.3000	
Magnesium, total	mg/L	MW-3R	10/02/2020		39.5000	
Magnesium, total	mg/L	MW-3R	04/12/2021		34.3000	
Magnesium, total	mg/L	MW-3R	10/26/2021		36.1000	
Magnesium, total	mg/L	MW-3R	04/12/2022		36.7000	
Magnesium, total	mg/L	MW-3R	10/07/2022		36.2000	
Magnesium, total	mg/L	MW-3R	04/19/2023		34.7000	
Magnesium, total	mg/L	MW-4	10/04/2018		27.6000	
Magnesium, total	mg/L	MW-4	04/15/2019		34.7000	
Magnesium, total	mg/L	MW-4	10/08/2019		34.7000	
Magnesium, total	mg/L	MW-4	04/08/2020		36.4000	
Magnesium, total	mg/L	MW-4	10/02/2020		39.2000	
Magnesium, total	mg/L	MW-4	04/12/2021		41.5000	
Magnesium, total	mg/L	MW-4	10/26/2021		24.4000	
Magnesium, total	mg/L	MW-4	04/12/2022		37.1000	
Magnesium, total	mg/L	MW-4	10/07/2022		31.4000	

* - Outlier for that well and constituent.
** - ND value replaced with median RL.
*** - ND value replaced with manual RL.
ND = Not detected, Result = detection limit.

Table 1

Upgradient Data

Constituent	Units	Well	Date		Result	Adjusted
Magnesium, total	mg/L	MW-4	04/19/2023		30.6000	
Magnesium, total	mg/L	MW-5	10/04/2018		35.3000	
Magnesium, total	mg/L	MW-5	04/15/2019		24.1000	
Magnesium, total	mg/L	MW-5	10/08/2019		23.6000	
Magnesium, total	mg/L	MW-5	04/08/2020		48.8000	
Magnesium, total	mg/L	MW-5	10/02/2020		23.6000	
Magnesium, total	mg/L	MW-5	04/12/2021		28.5000	
Magnesium, total	mg/L	MW-5	10/26/2021		30.7000	
Magnesium, total	mg/L	MW-5	04/12/2022		25.5000	
Magnesium, total	mg/L	MW-5	10/07/2022		22.2000	
Magnesium, total	mg/L	MW-5	04/19/2023		22.6000	
Mercury, total	ug/L	MW-3R	10/04/2018	ND	0.5000	
Mercury, total	ug/L	MW-3R	04/15/2019	ND	0.5000	
Mercury, total	ug/L	MW-3R	10/08/2019	ND	0.5000	
Mercury, total	ug/L	MW-3R	04/08/2020	ND	0.5000	
Mercury, total	ug/L	MW-3R	10/02/2020	ND	0.5000	
Mercury, total	ug/L	MW-3R	04/12/2021	ND	0.5000	
Mercury, total	ug/L	MW-3R	10/26/2021	ND	0.5000	
Mercury, total	ug/L	MW-3R	04/12/2022	ND	0.5000	
Mercury, total	ug/L	MW-3R	10/07/2022	ND	0.5000	
Mercury, total	ug/L	MW-3R	04/19/2023	ND	0.5000	
Mercury, total	ug/L	MW-4	10/04/2018	ND	0.5000	
Mercury, total	ug/L	MW-4	04/15/2019	ND	0.5000	
Mercury, total	ug/L	MW-4	10/08/2019	ND	0.5000	
Mercury, total	ug/L	MW-4	04/08/2020	ND	0.5000	
Mercury, total	ug/L	MW-4	10/02/2020	ND	0.5000	
Mercury, total	ug/L	MW-4	04/12/2021	ND	0.5000	
Mercury, total	ug/L	MW-4	10/26/2021	ND	0.5000	
Mercury, total	ug/L	MW-4	04/12/2022	ND	0.5000	
Mercury, total	ug/L	MW-4	10/07/2022	ND	0.5000	
Mercury, total	ug/L	MW-4	04/19/2023	ND	0.5000	
Mercury, total	ug/L	MW-5	10/04/2018	ND	0.5000	
Mercury, total	ug/L	MW-5	04/15/2019	ND	0.5000	
Mercury, total	ug/L	MW-5	10/08/2019	ND	0.5000	
Mercury, total	ug/L	MW-5	04/08/2020	ND	0.5000	
Mercury, total	ug/L	MW-5	10/02/2020	ND	0.5000	
Mercury, total	ug/L	MW-5	04/12/2021	ND	0.5000	
Mercury, total	ug/L	MW-5	10/26/2021	ND	0.5000	
Mercury, total	ug/L	MW-5	04/12/2022	ND	0.5000	
Mercury, total	ug/L	MW-5	10/07/2022	ND	0.5000	
Mercury, total	ug/L	MW-5	04/19/2023	ND	0.5000	
Zinc, total	ug/L	MW-3R	10/04/2018	ND	20.0000	
Zinc, total	ug/L	MW-3R	04/15/2019		59.3000	
Zinc, total	ug/L	MW-3R	10/08/2019		14.1000	
Zinc, total	ug/L	MW-3R	04/08/2020	ND	20.0000	
Zinc, total	ug/L	MW-3R	10/02/2020	ND	20.0000	
Zinc, total	ug/L	MW-3R	04/12/2021	ND	20.0000	
Zinc, total	ug/L	MW-3R	10/26/2021	ND	20.0000	
Zinc, total	ug/L	MW-3R	04/12/2022	ND	20.0000	
Zinc, total	ug/L	MW-3R	10/07/2022	ND	20.0000	
Zinc, total	ug/L	MW-3R	04/19/2023	ND	20.0000	
Zinc, total	ug/L	MW-4	10/04/2018		31.9000	
Zinc, total	ug/L	MW-4	04/15/2019	ND	20.0000	
Zinc, total	ug/L	MW-4	10/08/2019		24.6000	
Zinc, total	ug/L	MW-4	04/08/2020	ND	20.0000	
Zinc, total	ug/L	MW-4	10/02/2020		32.5000	
Zinc, total	ug/L	MW-4	04/12/2021		40.9000	
Zinc, total	ug/L	MW-4	10/26/2021	ND	20.0000	
Zinc, total	ug/L	MW-4	04/12/2022	ND	20.0000	
Zinc, total	ug/L	MW-4	10/07/2022		22.0000	
Zinc, total	ug/L	MW-4	04/19/2023	ND	20.0000	
Zinc, total	ug/L	MW-5	10/04/2018		67.9000	
Zinc, total	ug/L	MW-5	04/15/2019	ND	20.0000	
Zinc, total	ug/L	MW-5	10/08/2019		44.6000	
Zinc, total	ug/L	MW-5	04/08/2020		65.8000	
Zinc, total	ug/L	MW-5	10/02/2020	ND	20.0000	
Zinc, total	ug/L	MW-5	04/12/2021		24.5000	
Zinc, total	ug/L	MW-5	10/26/2021		46.4000	
Zinc, total	ug/L	MW-5	04/12/2022	ND	20.0000	
Zinc, total	ug/L	MW-5	10/07/2022	ND	20.0000	
Zinc, total	ug/L	MW-5	04/19/2023	ND	20.0000	

* - Outlier for that well and constituent.
** - ND value replaced with median RL.
*** - ND value replaced with manual RL.
ND = Not detected, Result = detection limit.

Table 2

Most Current Downgradient Monitoring Data

Constituent	Units	Well	Date		Result		Pred. Limit
Arsenic, total	ug/L	MW-1	04/19/2023	ND	4.0000		57.3000
Arsenic, total	ug/L	MW-7	04/19/2023	ND	4.0000		57.3000
Barium, total	ug/L	MW-1	04/19/2023		1020.0000	***	975.7976
Barium, total	ug/L	MW-7	04/19/2023		159.0000		975.7976
Cadmium, total	ug/L	MW-1	04/19/2023	ND	0.8000		2.2000
Cadmium, total	ug/L	MW-7	04/19/2023	ND	0.8000		2.2000
Chromium, total	ug/L	MW-1	04/19/2023	ND	8.0000		16.8000
Chromium, total	ug/L	MW-7	04/19/2023	ND	8.0000		16.8000
Copper, total	ug/L	MW-1	04/19/2023	ND	4.0000		26.5000
Copper, total	ug/L	MW-7	04/19/2023	ND	4.0000		26.5000
Iron, total	ug/L	MW-1	04/19/2023		1090.0000		32700.0000
Iron, total	ug/L	MW-7	04/19/2023	ND	100.0000		32700.0000
Lead, total	ug/L	MW-1	04/19/2023	ND	4.0000		15.5000
Lead, total	ug/L	MW-7	04/19/2023	ND	4.0000		15.5000
Magnesium, total	mg/L	MW-1	04/19/2023		118.0000	***	48.8000
Magnesium, total	mg/L	MW-7	04/19/2023		23.8000		48.8000
Mercury, total	ug/L	MW-1	04/19/2023	ND	0.5000		0.5000
Mercury, total	ug/L	MW-7	04/19/2023	ND	0.5000		0.5000
Zinc, total	ug/L	MW-1	04/19/2023	ND	20.0000		67.9000
Zinc, total	ug/L	MW-7	04/19/2023	ND	20.0000		67.9000

* - Current value failed - awaiting verification.
** - Current value passed - previous exceedance not verified.
*** - Current value failed - exceedance verified.
**** - Current value passed - awaiting one more verification.
***** - Insufficient background data to compute prediction limit.
ND = Not Detected, Result = detection limit.

Table 3

Detection Frequencies in Upgradient and Downgradient Wells

Constituent	Detect	Upgradient N	Proportion	Detect	Downgradient N	Proportion
Arsenic, total	13	30	0.433	2	20	0.100
Barium, total	30	30	1.000	20	20	1.000
Cadmium, total	2	30	0.067	2	20	0.100
Chromium, total	13	27	0.481	0	18	0.000
Copper, total	15	30	0.500	0	20	0.000
Iron, total	21	29	0.724	10	20	0.500
Lead, total	5	27	0.185	0	18	0.000
Magnesium, total	30	30	1.000	20	20	1.000
Mercury, total	0	30	0.000	0	20	0.000
Zinc, total	12	30	0.400	4	20	0.200

N = Total number of measurements in all wells.
Detect = Total number of detections in all wells.
Proportion = Detect/N.

Table 4

Shapiro-Wilk Multiple Group Test of Normality

Constituent	Detect	N	Detect Freq	G raw	G log	G cbrt	G sqrt	G sqr	G cub	Crit Value	Dist Form	Model Type
Arsenic, total	13	30	0.433	3.952	4.712					2.326	non-norm	nonpar
Barium, total	30	30	1.000	3.157	1.247					2.326	lognor	lognor
Cadmium, total	2	30	0.067	5.650	5.650					2.326	non-norm	nonpar
Chromium, total	13	27	0.481	12.722	12.977					2.326	non-norm	nonpar
Copper, total	15	30	0.500	5.083	4.232					2.326	non-norm	nonpar
Iron, total	21	29	0.724	6.000	2.809					2.326	non-norm	nonpar
Lead, total	5	27	0.185	22.511	22.123					2.326	non-norm	nonpar
Magnesium, total	30	30	1.000	2.962	3.579					2.326	non-norm	nonpar
Mercury, total	0	30	0.000	5.650	5.650					2.326	non-norm	nonpar
Zinc, total	12	30	0.400	6.327	5.480					2.326	non-norm	nonpar

* - Distribution override for that constituent.
Fit to distribution is confirmed if G <= critical value.
Model type may not match distributional form when detection frequency < 50%.

Table 5

Summary Statistics and Prediction Limits

Constituent	Units	Detect	N	Mean	SD	alpha	Factor	Pred Limit	Type		Conf
Arsenic, total	ug/L	13	30					57.3000	nonpar		0.99
Barium, total	ug/L	30	30	5.6409	0.4965	0.0100	2.5024	975.7976	lognor		
Cadmium, total	ug/L	2	30					2.2000	nonpar		0.99
Chromium, total	ug/L	13	27					16.8000	nonpar		0.99
Copper, total	ug/L	15	30					26.5000	nonpar		0.99
Iron, total	ug/L	21	29					32700.0000	nonpar		0.99
Lead, total	ug/L	5	27					15.5000	nonpar		0.99
Magnesium, total	mg/L	30	30					48.8000	nonpar		0.99
Mercury, total	ug/L	0	30					0.5000	nonpar	***	0.99
Zinc, total	ug/L	12	30					67.9000	nonpar		0.99

Conf = confidence level for passing initial test or one verification resample at all downgradient wells for a single constituent (nonparametric test only).
* - Insufficient Data.
** - Calculated limit raised to Manual Reporting Limit.
*** - Nonparametric limit based on ND value.
For transformed data, mean and SD in transformed units and prediction limit in original units.
All sample sizes and statistics are based on outlier free data.
For nonparametric limits, median reporting limits are substituted for extreme reporting limit values.

Table 6

Dixon's Test Outliers
1% Significance Level

Constituent	Units	Well	Date	Result	ND Qualifier	Date Range	N	Critical Value

N = Total number of independent measurements in background at each well.
Date Range = Dates of the first and last measurements included in background at each well.
Critical Value depends on the significance level and on N-1 when the two most extreme values are tested or N for the most extreme value.

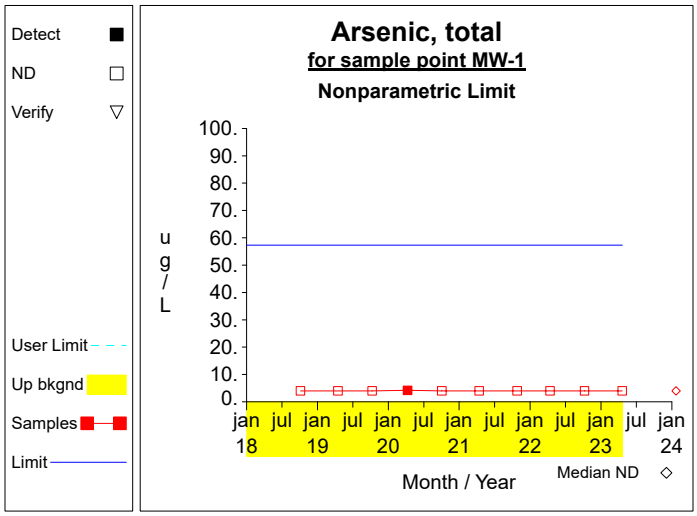
Table 8

Historical Downgradient Data for Constituent-Well Combinations that Failed the Current Statistical Evaluation or are in Verification Resampling Mode

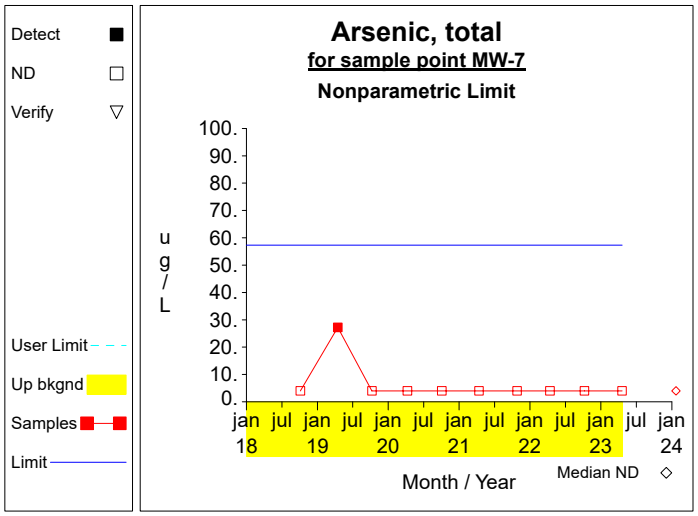
Constituent	Units	Well	Date	Result		Pred. Limit
Barium, total	ug/L	MW-1	10/04/2018	1000.0000	*	975.7976
Barium, total	ug/L	MW-1	04/15/2019	1060.0000	*	975.7976
Barium, total	ug/L	MW-1	10/08/2019	1020.0000	*	975.7976
Barium, total	ug/L	MW-1	04/08/2020	995.0000	*	975.7976
Barium, total	ug/L	MW-1	10/02/2020	1000.0000	*	975.7976
Barium, total	ug/L	MW-1	04/12/2021	1060.0000	*	975.7976
Barium, total	ug/L	MW-1	10/26/2021	960.0000		975.7976
Barium, total	ug/L	MW-1	04/12/2022	1030.0000	*	975.7976
Barium, total	ug/L	MW-1	10/07/2022	1000.0000	*	975.7976
Barium, total	ug/L	MW-1	04/19/2023	1020.0000	*	975.7976
Magnesium, total	mg/L	MW-1	10/04/2018	128.0000	*	48.8000
Magnesium, total	mg/L	MW-1	04/15/2019	135.0000	*	48.8000
Magnesium, total	mg/L	MW-1	10/08/2019	134.0000	*	48.8000
Magnesium, total	mg/L	MW-1	04/08/2020	123.0000	*	48.8000
Magnesium, total	mg/L	MW-1	10/02/2020	112.0000	*	48.8000
Magnesium, total	mg/L	MW-1	04/12/2021	116.0000	*	48.8000
Magnesium, total	mg/L	MW-1	10/26/2021	123.0000	*	48.8000
Magnesium, total	mg/L	MW-1	04/12/2022	121.0000	*	48.8000
Magnesium, total	mg/L	MW-1	10/07/2022	129.0000	*	48.8000
Magnesium, total	mg/L	MW-1	04/19/2023	118.0000	*	48.8000

* - Significantly increased over background.
** - Detect at limit for 100% NDs in background (NPPL only).
*** - Manual exclusion.
ND = Not Detected, Result = detection limit.

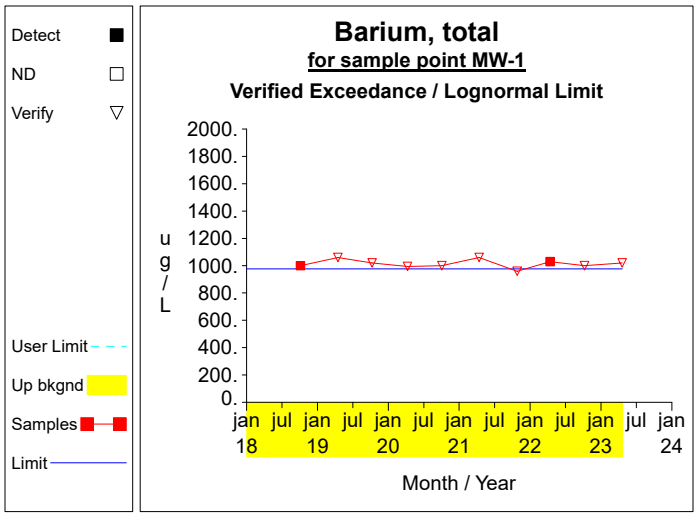
Up vs. Down Prediction Limits



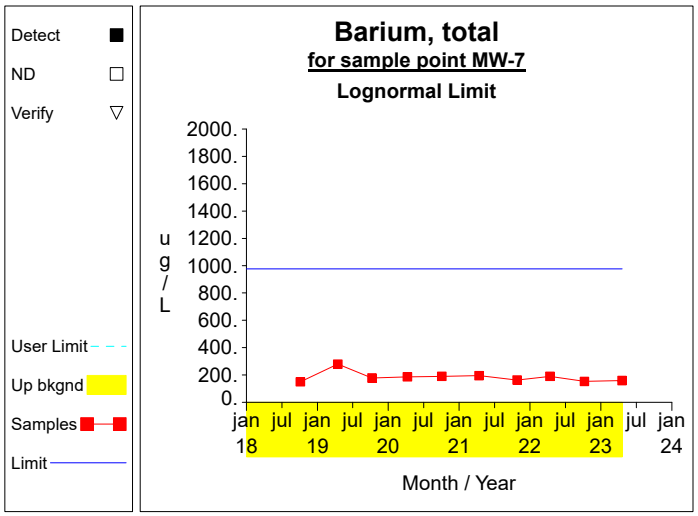
Graph 1



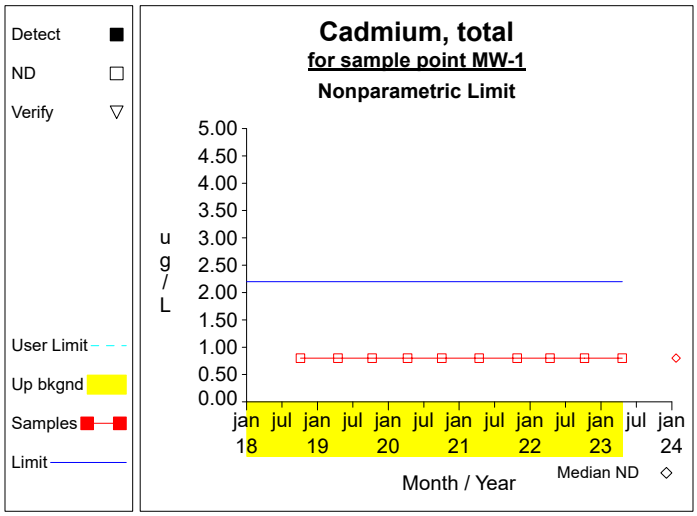
Graph 2



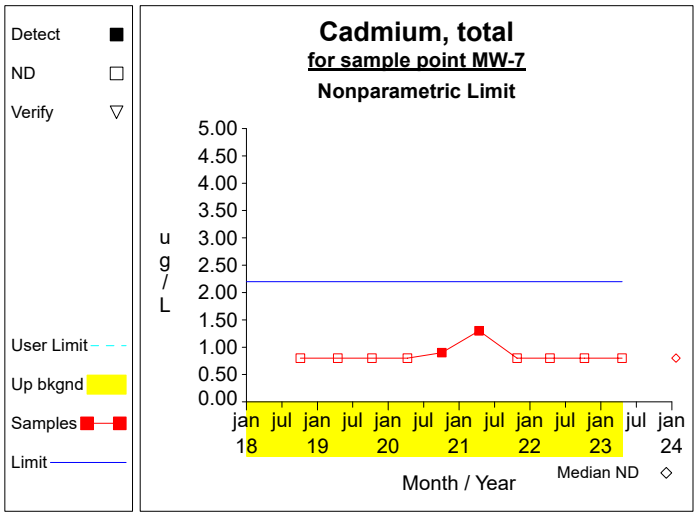
Graph 3



Graph 4



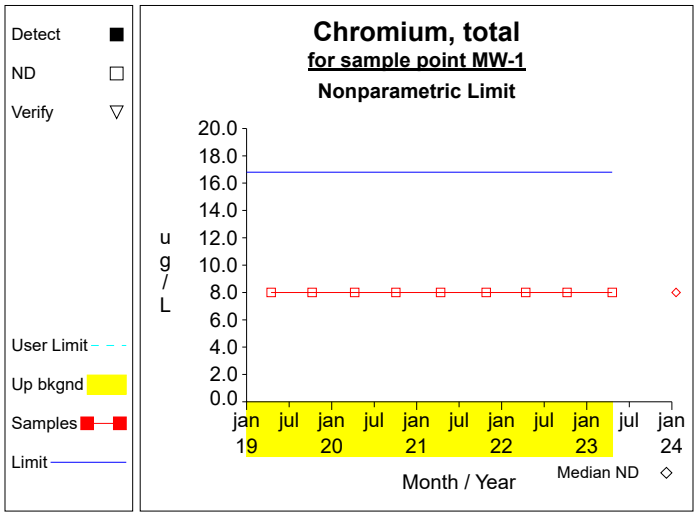
Graph 5



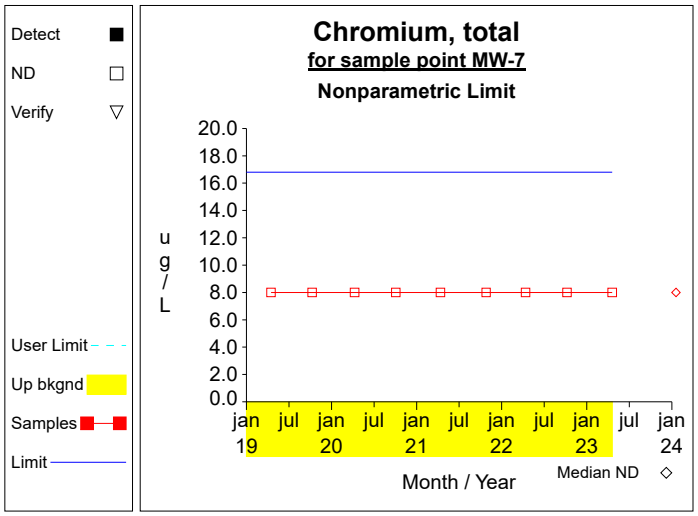
Graph 6

Prepared by: Otter Creek Environmental

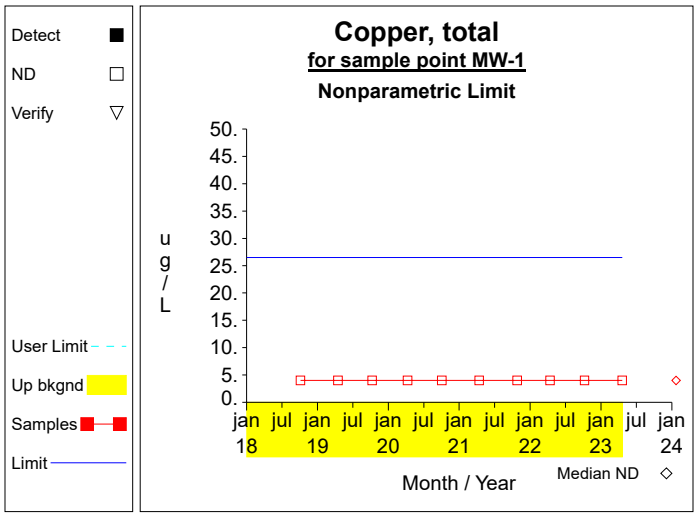
Up vs. Down Prediction Limits



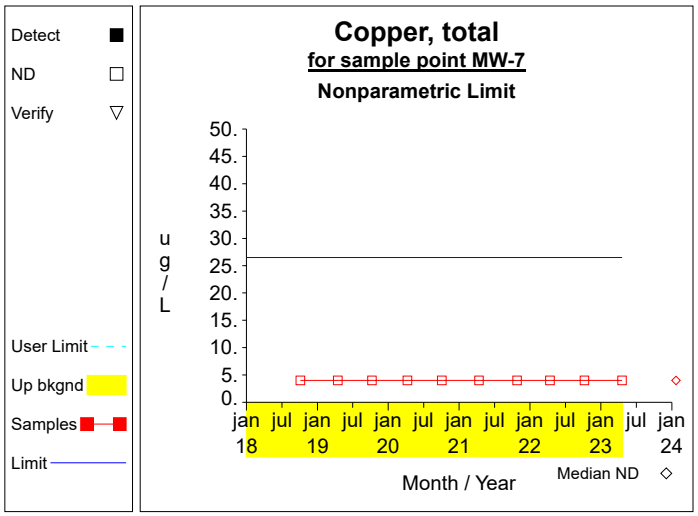
Graph 7



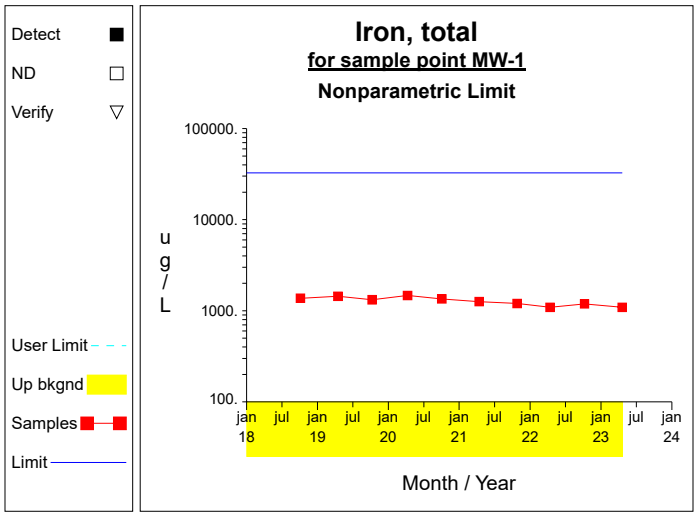
Graph 8



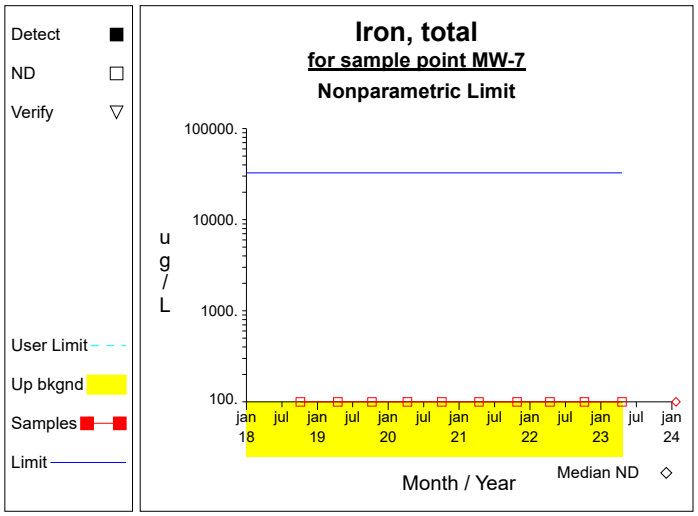
Graph 9



Graph 10



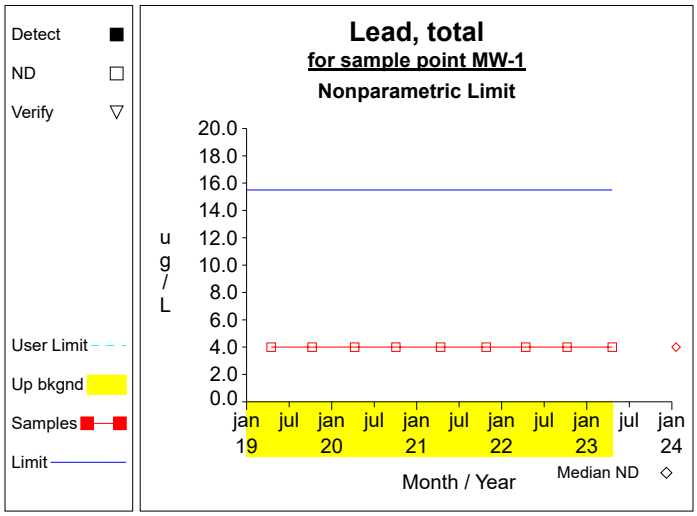
Graph 11



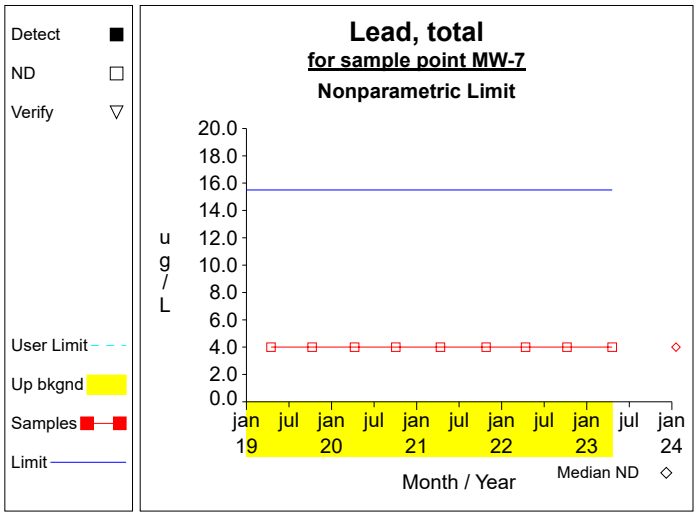
Graph 12

Prepared by: Otter Creek Environmental

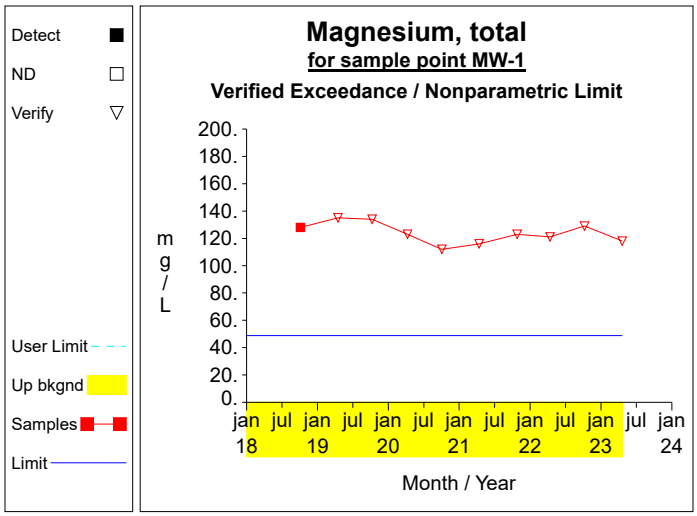
Up vs. Down Prediction Limits



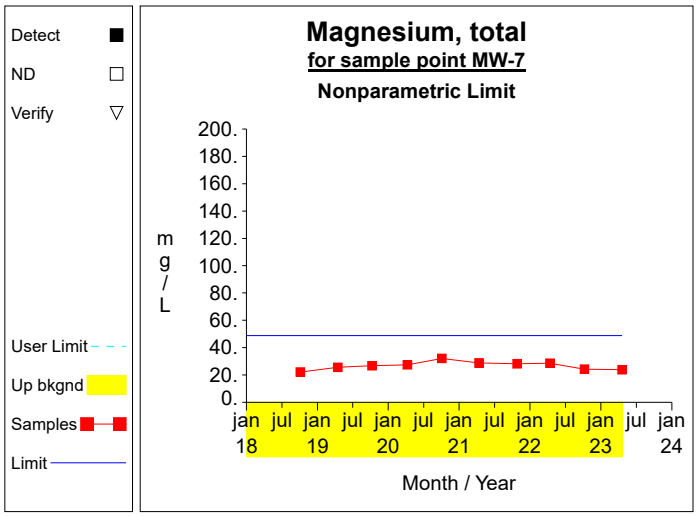
Graph 13



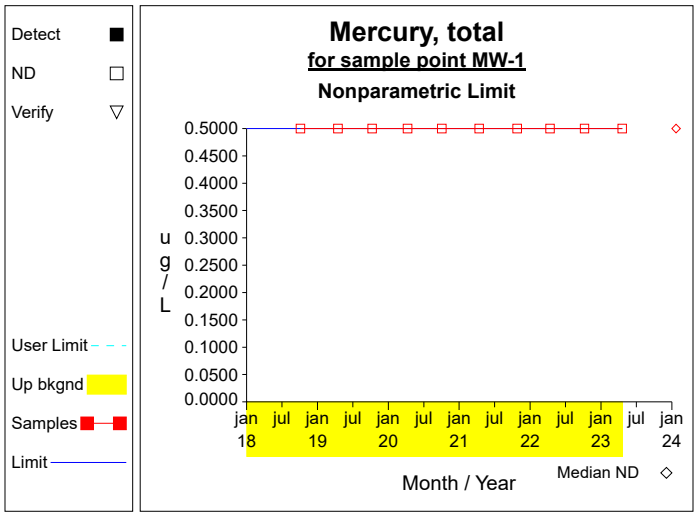
Graph 14



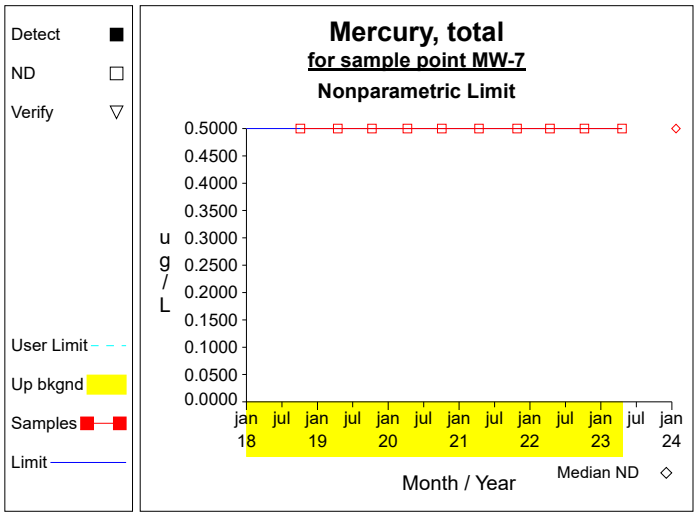
Graph 15



Graph 16



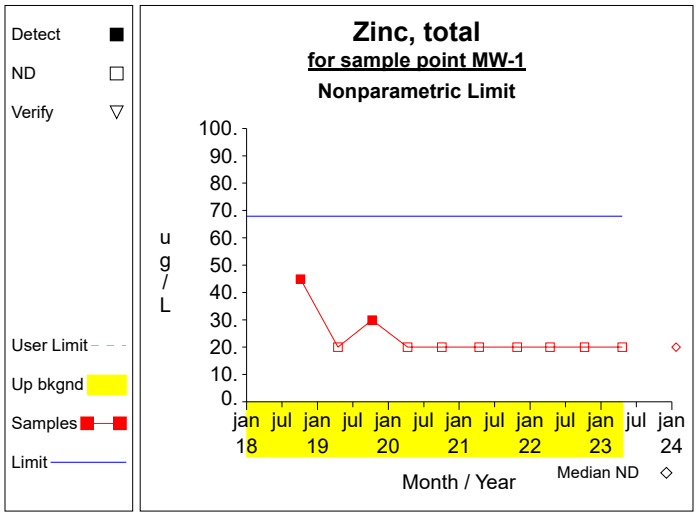
Graph 17



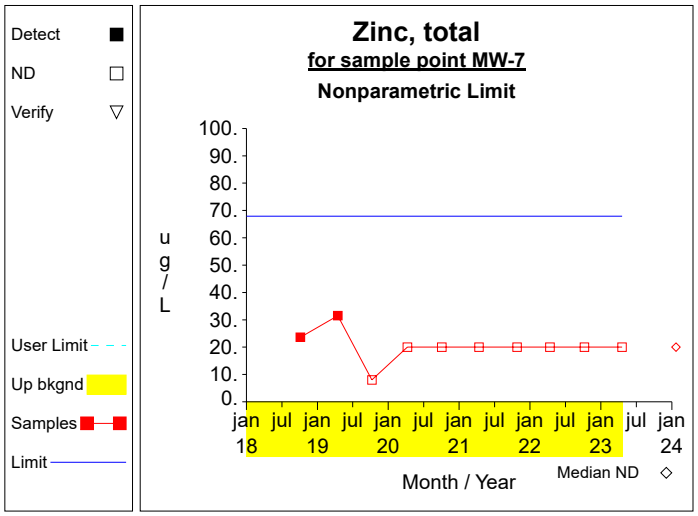
Graph 18

Prepared by: Otter Creek Environmental

Up vs. Down Prediction Limits



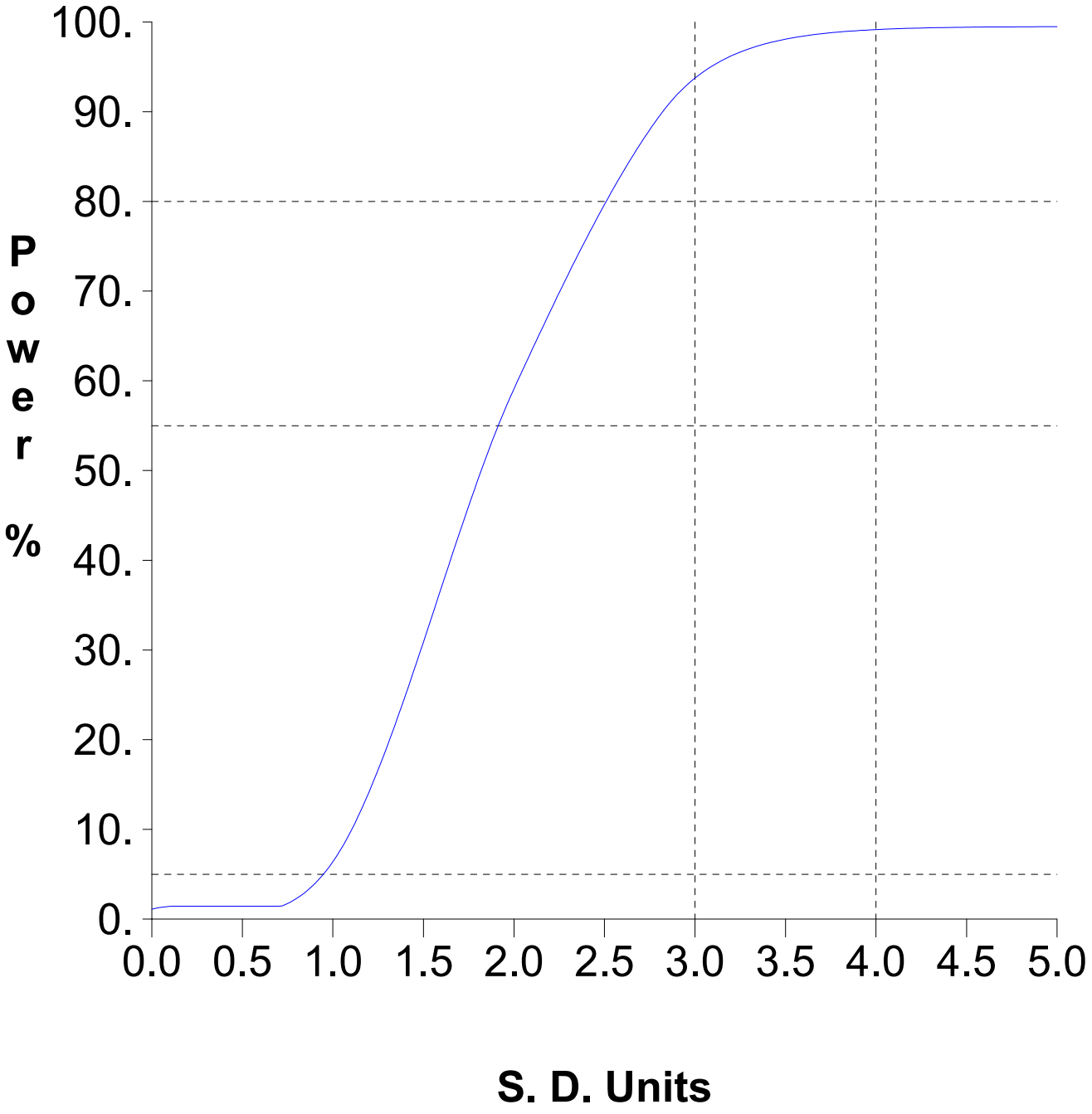
Graph 19



Graph 20

False Positive and False Negative Rates for Current

Upgradient vs. Downgradient Monitoring Program



Attachment C

Assessment Statistics for Trace Metals

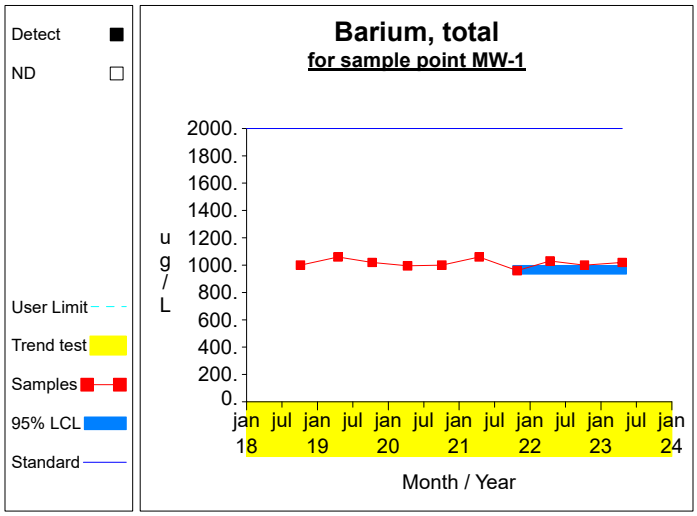
Table 1

Confidence Intervals for Comparing the Mean of the Last 4 Measurements to an Assessment Monitoring Standard

Constituent	Units	Well	N	Mean	SD	Factor	95% LCL	95% UCL	Standard	Trend
Barium, total	ug/L	MW-1	4	1002.500	30.957	1.176	966.086	1038.914	2000.000	

* - Insufficient Data
** - Significant Exceedance
LCL = Lower Confidence Limit
UCL = Upper Confidence Limit

Confidence Limits (Assessment)



Graph 1

Attachment D

Summary Tables and Graphs for the Interwell Comparisons - Inorganics

Table 1

Upgradient Data

Constituent	Units	Well	Date		Result	Adjusted	
Chemical Oxygen Demand	mg/L	MW-3R	04/12/2016	ND	10.0000		
Chemical Oxygen Demand	mg/L	MW-3R	10/11/2016	ND	10.0000		
Chemical Oxygen Demand	mg/L	MW-3R	04/10/2017	ND	10.0000		
Chemical Oxygen Demand	mg/L	MW-3R	10/12/2017	ND	10.0000		
Chemical Oxygen Demand	mg/L	MW-3R	04/10/2018	ND	10.0000		
Chemical Oxygen Demand	mg/L	MW-3R	10/04/2018	ND	20.0000	10.0000	**
Chemical Oxygen Demand	mg/L	MW-3R	10/07/2022	ND	20.0000	10.0000	**
Chemical Oxygen Demand	mg/L	MW-4	04/16/2014		33.0000		
Chemical Oxygen Demand	mg/L	MW-4	10/21/2014		11.0000		
Chemical Oxygen Demand	mg/L	MW-4	04/15/2015	ND	10.0000		
Chemical Oxygen Demand	mg/L	MW-4	10/07/2015	ND	10.0000		
Chemical Oxygen Demand	mg/L	MW-4	04/12/2016	ND	10.0000		
Chemical Oxygen Demand	mg/L	MW-4	10/11/2016	ND	10.0000		
Chemical Oxygen Demand	mg/L	MW-4	04/10/2017	ND	10.0000		
Chemical Oxygen Demand	mg/L	MW-4	10/12/2017	ND	10.0000		
Chemical Oxygen Demand	mg/L	MW-4	04/10/2018	ND	10.0000		
Chemical Oxygen Demand	mg/L	MW-4	10/04/2018	ND	20.0000	10.0000	**
Chemical Oxygen Demand	mg/L	MW-4	10/07/2022	ND	20.0000	10.0000	**
Chemical Oxygen Demand	mg/L	MW-5	04/16/2014		44.0000		
Chemical Oxygen Demand	mg/L	MW-5	10/21/2014		38.0000		
Chemical Oxygen Demand	mg/L	MW-5	04/15/2015		13.0000		
Chemical Oxygen Demand	mg/L	MW-5	10/07/2015		40.0000		
Chemical Oxygen Demand	mg/L	MW-5	04/12/2016		19.0000		
Chemical Oxygen Demand	mg/L	MW-5	10/11/2016	ND	10.0000		
Chemical Oxygen Demand	mg/L	MW-5	04/10/2017	ND	10.0000		
Chemical Oxygen Demand	mg/L	MW-5	10/12/2017		15.0000		
Chemical Oxygen Demand	mg/L	MW-5	04/10/2018		22.0000		
Chemical Oxygen Demand	mg/L	MW-5	10/04/2018	ND	20.0000	10.0000	**
Chemical Oxygen Demand	mg/L	MW-5	10/07/2022	ND	20.0000	10.0000	**
Chloride	mg/L	MW-3R	04/12/2016	ND	10.0000		
Chloride	mg/L	MW-3R	10/11/2016	ND	10.0000		
Chloride	mg/L	MW-3R	04/10/2017	ND	10.0000		
Chloride	mg/L	MW-3R	10/12/2017		10.0000		
Chloride	mg/L	MW-3R	04/10/2018	ND	10.0000		
Chloride	mg/L	MW-3R	10/04/2018	ND	10.0000		
Chloride	mg/L	MW-3R	10/07/2022		6.3000		
Chloride	mg/L	MW-4	04/16/2014		14.0000		
Chloride	mg/L	MW-4	10/21/2014	ND	10.0000		
Chloride	mg/L	MW-4	04/15/2015	ND	10.0000		
Chloride	mg/L	MW-4	10/07/2015	ND	10.0000		
Chloride	mg/L	MW-4	04/12/2016	ND	10.0000		
Chloride	mg/L	MW-4	10/11/2016	ND	10.0000		
Chloride	mg/L	MW-4	04/10/2017	ND	10.0000		
Chloride	mg/L	MW-4	10/12/2017	ND	10.0000		
Chloride	mg/L	MW-4	04/10/2018	ND	10.0000		
Chloride	mg/L	MW-4	10/04/2018	ND	10.0000		
Chloride	mg/L	MW-4	10/07/2022		5.0000		
Chloride	mg/L	MW-5	04/16/2014		33.0000		
Chloride	mg/L	MW-5	10/21/2014		41.0000		
Chloride	mg/L	MW-5	04/15/2015		44.0000		
Chloride	mg/L	MW-5	10/07/2015		36.0000		

* - Outlier for that well and constituent.
** - ND value replaced with median RL.
*** - ND value replaced with manual RL.
ND = Not detected, Result = detection limit.

Table 1

Upgradient Data

Constituent	Units	Well	Date		Result	Adjusted	
Chloride	mg/L	MW-5	04/12/2016		43.0000		
Chloride	mg/L	MW-5	10/11/2016		36.0000		
Chloride	mg/L	MW-5	04/10/2017		49.0000		
Chloride	mg/L	MW-5	10/12/2017		50.0000		
Chloride	mg/L	MW-5	04/10/2018		48.0000		
Chloride	mg/L	MW-5	10/04/2018		50.0000		
Chloride	mg/L	MW-5	10/07/2022		38.3000		
Nitrogen, Ammonia	mg/L	MW-3R	04/12/2016	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-3R	10/11/2016	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-3R	04/10/2017	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-3R	10/12/2017	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-3R	04/10/2018	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-3R	10/04/2018	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-3R	10/07/2022	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-4	04/16/2014	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-4	10/21/2014	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-4	04/15/2015	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-4	10/07/2015	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-4	04/12/2016	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-4	10/11/2016	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-4	04/10/2017	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-4	10/12/2017	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-4	04/10/2018	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-4	10/04/2018	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-4	10/07/2022	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-5	04/16/2014	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-5	10/21/2014	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-5	04/15/2015	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-5	10/07/2015	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-5	04/12/2016	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-5	10/11/2016	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-5	04/10/2017	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-5	10/12/2017	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-5	04/10/2018	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-5	10/04/2018	ND	1.0000		
Nitrogen, Ammonia	mg/L	MW-5	10/07/2022	ND	1.0000		

* - Outlier for that well and constituent.
** - ND value replaced with median RL.
*** - ND value replaced with manual RL.
ND = Not detected, Result = detection limit.

Table 2

Most Current Downgradient Monitoring Data

Constituent	Units	Well	Date		Result		Pred. Limit
Chemical Oxygen Demand	mg/L	MW-1	04/19/2023	ND	20.0000		44.0000
Chloride	mg/L	MW-1	04/19/2023		223.0000	***	50.0000
Nitrogen, Ammonia	mg/L	MW-1	04/19/2023	ND	1.0000		1.0000

* - Current value failed - awaiting verification.
** - Current value passed - previous exceedance not verified.
*** - Current value failed - exceedance verified.
**** - Current value passed - awaiting one more verification.
***** - Insufficient background data to compute prediction limit.
ND = Not Detected, Result = detection limit.

Table 3

Detection Frequencies in Upgradient and Downgradient Wells

Constituent	Detect	Upgradient N	Proportion	Detect	Downgradient N	Proportion
Chemical Oxygen Demand	9	29	0.310	13	19	0.684
Chloride	15	29	0.517	19	19	1.000
Nitrogen, Ammonia	0	29	0.000	0	19	0.000

N = Total number of measurements in all wells.
Detect = Total number of detections in all wells.
Proportion = Detect/N.

Table 4

Shapiro-Wilk Multiple Group Test of Normality

Constituent	Detect	N	Detect Freq	G raw	G log	G cbrt	G sqrt	G sqr	G cub	Crit Value	Dist Form	Model Type
Chemical Oxygen Demand	9	29	0.310	7.712	6.847					2.326	non-norm	nonpar
Chloride	15	29	0.517	4.000	4.275					2.326	non-norm	nonpar
Nitrogen, Ammonia	0	29	0.000	5.384	5.384					2.326	non-norm	nonpar

* - Distribution override for that constituent.
Fit to distribution is confirmed if G <= critical value.
Model type may not match distributional form when detection frequency < 50%.

Table 5

Summary Statistics and Prediction Limits

Constituent	Units	Detect	N	Mean	SD	alpha	Factor	Pred Limit	Type		Conf
Chemical Oxygen Demand	mg/L	9	29					44.0000	nonpar		0.99
Chloride	mg/L	15	29					50.0000	nonpar		0.99
Nitrogen, Ammonia	mg/L	0	29					1.0000	nonpar	***	0.99

Conf = confidence level for passing initial test or one verification resample at all downgradient wells for a single constituent (nonparametric test only).
* - Insufficient Data.
** - Calculated limit raised to Manual Reporting Limit.
*** - Nonparametric limit based on ND value.
For transformed data, mean and SD in transformed units and prediction limit in original units.
All sample sizes and statistics are based on outlier free data.
For nonparametric limits, median reporting limits are substituted for extreme reporting limit values.

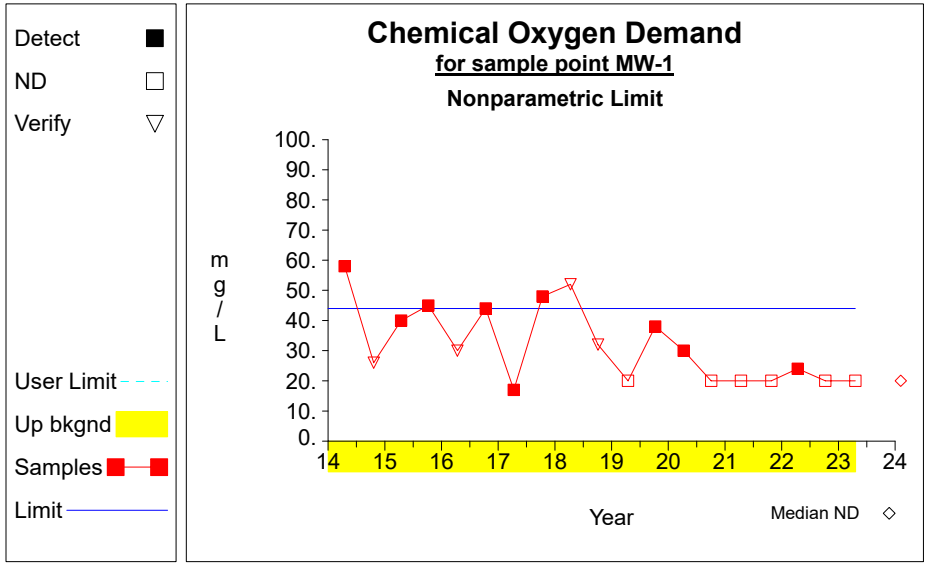
Table 8

Historical Downgradient Data for Constituent-Well Combinations that Failed the Current Statistical Evaluation or are in Verification Resampling Mode

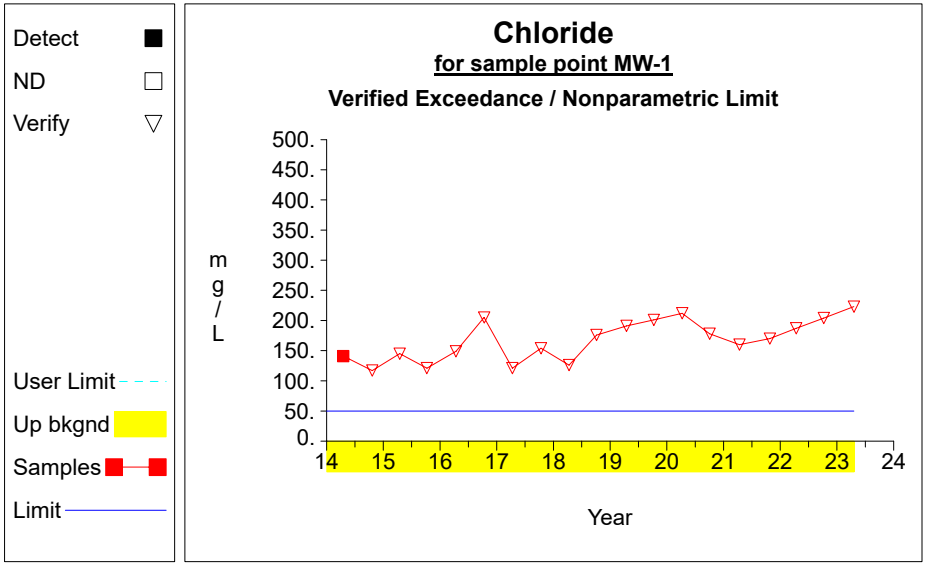
Constituent	Units	Well	Date	Result		Pred. Limit
Chloride	mg/L	MW-1	04/16/2014	141.0000	*	50.0000
Chloride	mg/L	MW-1	10/21/2014	117.0000	*	50.0000
Chloride	mg/L	MW-1	04/15/2015	145.0000	*	50.0000
Chloride	mg/L	MW-1	10/07/2015	121.0000	*	50.0000
Chloride	mg/L	MW-1	04/12/2016	149.0000	*	50.0000
Chloride	mg/L	MW-1	10/11/2016	205.0000	*	50.0000
Chloride	mg/L	MW-1	04/10/2017	121.0000	*	50.0000
Chloride	mg/L	MW-1	10/12/2017	154.0000	*	50.0000
Chloride	mg/L	MW-1	04/10/2018	126.0000	*	50.0000
Chloride	mg/L	MW-1	10/04/2018	176.0000	*	50.0000
Chloride	mg/L	MW-1	04/15/2019	191.0000	*	50.0000
Chloride	mg/L	MW-1	10/08/2019	201.0000	*	50.0000
Chloride	mg/L	MW-1	04/08/2020	212.0000	*	50.0000
Chloride	mg/L	MW-1	10/02/2020	178.0000	*	50.0000
Chloride	mg/L	MW-1	04/12/2021	160.0000	*	50.0000
Chloride	mg/L	MW-1	10/26/2021	170.0000	*	50.0000
Chloride	mg/L	MW-1	04/12/2022	187.0000	*	50.0000
Chloride	mg/L	MW-1	10/07/2022	204.0000	*	50.0000
Chloride	mg/L	MW-1	04/19/2023	223.0000	*	50.0000

* - Significantly increased over background.
** - Detect at limit for 100% NDs in background (NPPL only).
*** - Manual exclusion.
ND = Not Detected, Result = detection limit.

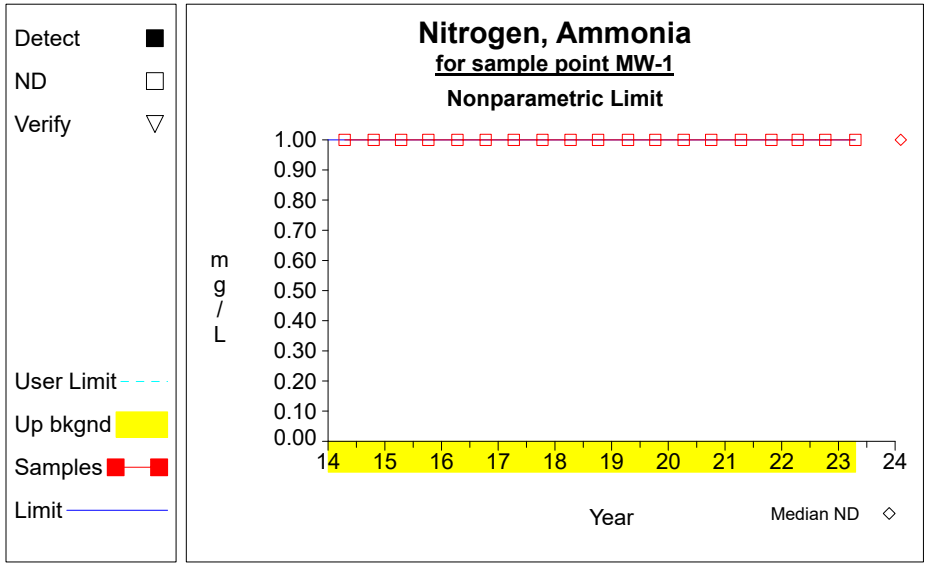
Up vs. Down Prediction Limits



Graph 1

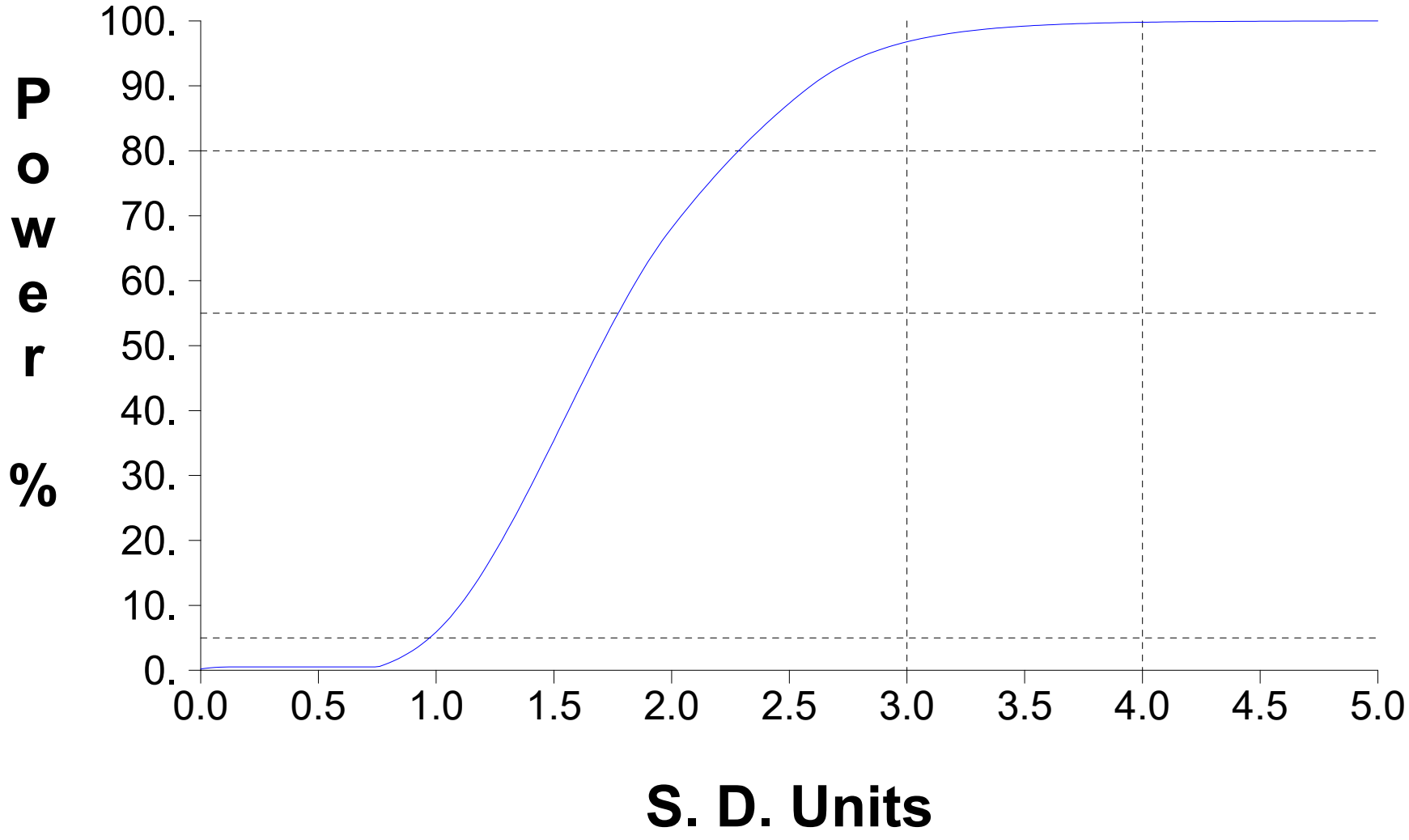


Graph 2



Graph 3

False Positive and False Negative Rates for Current Upgradient vs. Downgradient Monitoring Program



Attachment E

Assessment Statistics for Inorganic

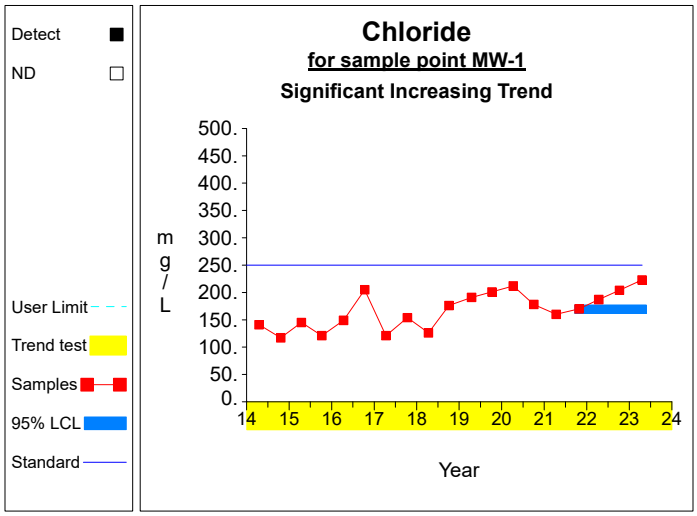
Table 1

Confidence Intervals for Comparing the Mean of the Last 4 Measurements to an Assessment Monitoring Standard

Constituent	Units	Well	N	Mean	SD	Factor	95% LCL	95% UCL	Standard	Trend
Chloride	mg/L	MW-1	4	196.000	22.730	1.176	169.263	222.737	250.000	inc

* - Insufficient Data
** - Significant Exceedance
LCL = Lower Confidence Limit
UCL = Upper Confidence Limit

Confidence Limits (Assessment)



Graph 1

Results of the Ground Water Statistics

for Monona County Sanitary Landfill

Second Semi-Annual Monitoring Event in 2023

Prepared for:
Monona County Sanitary Landfill
31342 Hwy 37
Turin, IA 51040

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November 2023

INTRODUCTION

This report contains the results of the statistical analyses used to evaluate the ground water data obtained during the second semi-annual monitoring event in 2023 at Monona County Sanitary Landfill. The ground water at Monona County Sanitary Landfill is monitored by a network of wells including MW-1, MW-3R (upgradient), MW-4 (upgradient), MW-5 (upgradient), and MW-7. Monitoring wells MW-1, MW-3R, MW-4, MW-5, and MW-7 were sampled on October 25, 2023 and analyzed for the parameters required by permit. The statistical plan is designed to detect a release from the facility at the earliest indication so that it is protective of human health and the environment. The interwell methodology is described and then applied to the Monona County Sanitary Landfill data. The statistical plan conforms with IAC 567, Chapter 113.10, USEPA Guidance document ("*Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Unified Guidance"*, March 2009), and the American Society for Testing and Materials (ASTM) standard D6312-98, *Developing Appropriate Statistical Approaches for Ground-Water Detection Monitoring Programs.*

Ground Water Monitoring Program

The groundwater monitoring network for Monona County Sanitary Landfill includes MW-1, MW-3R, MW-4, MW-5, and MW-7. Each of the groundwater monitoring wells is to be sampled at least semiannually and analyzed for the trace metals including antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, nickel, selenium, vanadium, and zinc. The ground water data obtained during the second semi-annual monitoring event in 2023 are summarized in Attachment A.

STATISTICAL METHODOLOGIES FOR DETECTION MONITORING

IAC 567, Chapter 113.10(4) provides several options for statistically evaluating the ground water data at those wells that monitor the open cells or contiguous MSWLF units. The preferred methods for comparing ground water data are using either prediction limits or using control charts. The site prediction limit method was applied to the Monona County Sanitary Landfill data using the DUMPStat® statistical program. DUMPStat® is a program for the statistical analysis of groundwater monitoring data using methods described in "Statistical Methods for Groundwater Monitoring" by Dr. Robert D. Gibbons. The DUMPStat program is completely consistent with all USEPA regulations and guidance and the ASTM D6312-98 guidance.

Interwell Statistics: Upgradient versus Downgradient Comparisons

Interwell statistics are appropriate when the upgradient and downgradient wells monitor the same ground water formation and there is similar variability in the upgradient and downgradient zones. Site prediction limits are determined by pooling the historical ground water data from hydraulically upgradient wells. This statistical method compares the current downgradient determinations to site prediction limits and checks for exceedances. The type of prediction limit utilized (e.g., parametric or nonparametric) is based on the detection frequency and the data distribution of each parameter in the background data. The distribution of the background data is tested for normality using the Shapiro-Wilk test (Gibbons, 1994 and USEPA 1992). If the constituent is normally distributed, a normal prediction limit is used. If normality is rejected by the Shapiro-Wilk test, the background data is transformed by taking the natural logarithm. The Shapiro-Wilk

test is then reapplied on the transformed data. If it is not rejected, lognormal prediction limits are used. If after transforming the data, normality is still rejected, nonparametric prediction limits are used for that analyte. The nonparametric prediction limit is the largest determination in the background measurements. For constituents where the background detection frequency is greater than 0% but less than 50%, nonparametric prediction limits will be used. If the detection frequency is 0% after thirteen samples have been collected, the practical quantitation limit (PQL) becomes the nonparametric prediction limit.

Results of the Interwell Statistics – Trace Metals

The background data used in this statistical analysis includes the ground water data collected from ground water wells MW-3R, MW-4, and MW-5 during the period from October 2018 through the current data. A summary of the background data from monitoring wells MW-3R, MW-4, and MW-5 is listed in Attachment B, Table 1 "Upgradient Data". This statistical method compares the current downgradient determinations to site prediction limits and checks for exceedances.

Table 2 "Most Current Downgradient Monitoring Data", summarizes the current data from downgradient wells MW-1 and MW-7, compared to the site prediction limits. Prediction limit exceedances are flagged with asterisks. For the most current data, the site prediction limit exceedances detected are summarized in the table below.

Prediction Limit Exceedances during the Second Semi-Annual Monitoring Event in 2023

Well	Parameter	Result	Prediction Limit	Prediction Limit Type	Verified/ Awaiting verification
MW-1	Barium, µg/L	1090	921.2112	Lognormal	Verified
	Nickel, mg/L	21.9	19.6000	Nonparametric	Verified

The detection frequencies of the parameters in the up and down gradient monitoring wells are summarized in Table 3. Barium, chromium, cobalt, and nickel were detected at a frequency greater than or equal to 50% in the upgradient well so these metals were tested for normality. The remainder of the metals are rarely detected (less than 50%) in the upgradient wells so nonparametric prediction limits were be used in those cases.

Table 4 summarizes the results of the Shapiro-Wilk test. Table 5 is a summary of the statistics and prediction limits determined for the metals. Table 8 is a historical summary of the data at those wells that have indicated an exceedance. Time series graphs of each of the parameters at each well with the corresponding prediction limits are attached.

A statistical power curve indicates the expected false assessments for the site as a whole. The false positive rate for interwell analyses is the percentage of failures when the upgradient versus downgradient true mean difference equals zero. False negative rate indicates the chance of missing contamination at a single well for a single constituent. The statistical power is a function of the number of wells included, the number of constituents compared, the detection frequencies, and the data distributions involved. For interwell analysis, the site-wide false positive rate is 5% and the test becomes sensitive to 4 standard deviation unit increases over background.

Volatile Organic Compounds

Volatile Organic Compounds (VOCs) are generally man-made compounds not present in ambient ground water. If VOCs are detected above their statistical limit (i.e., the laboratory PQL or reporting limit), a verification resample will be conducted at the next scheduled sampling event. A statistical exceedance will be indicated if the VOC detection is confirmed by the subsequent monitoring.

Ground water well MW-1 was monitored for *cis*-1,2-dichloroethene during the second semi-annual monitoring event in 2023, because it was previously detected in April 2023. There is a current detection of *cis*-1,2-Dichloroethene (2.6 µg/L) above the site-specific reporting limit at MW-1. The *cis*-1,2-dichloroethene detection is statistically since it confirms the April 2023 monitoring.

Exceedances

The current and previous verified exceedances were evaluated against the ground water protection standards (GWPS) using confidence limits calculated in accordance with the Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, USEPA, March 2009 (Attachment C). The analysis was conducted to evaluate whether verified concentrations are significantly above the water quality standard. The 95% lower confidence limit (LCL) for the mean of the historical data was used to evaluate whether the regulated unit is in compliance with the ground-water protection standards under 40 CFR 264 (e.g. whether the verified constituent is detected at a significant level above the GWPS). An exceedance is verified if the LCL is above the Regulatory GWPS.

The calculated 95% LCLs do not exceed the GWPS.

Attachment A

Ground Water Data obtained during the Second Semi-Annual Monitoring Event in 2023

Table 1

Analytical Data Summary for 10/25/2023

Constituents	Units	MW-1	MW-3R	MW-4	MW-5	MW-7
Antimony, total	ug/L	<2	<2	<2	<2	<2
Arsenic, total	ug/L	<4.0	<4.0	21.4	4.6	<4.0
Barium, total	ug/L	1090	306	347	243	172
Cadmium, total	ug/L	<.8	<.8	<.8	<.8	<.8
Chloride	mg/L	239				
Chromium, total	ug/L	<8.0	11.8	10.4	19.5	<8.0
cis-1,2-Dichloroethylene	ug/L	2.6				
Cobalt, total	ug/L	3.1	<.4	.4	3.5	<.4
Copper, total	ug/L	<4.0	<4.0	<4.0	8.9	<4.0
Lead, total	ug/L	<4.0	<4.0	<4.0	4.6	<4.0
Nickel, total	ug/L	21.9	<4.0	9.7	19.6	<4.0
Selenium, total	ug/L	<4	<4	<4	<4	<4
Vanadium, total	ug/L	<20	<20	<20	<20	<20
Zinc, total	ug/L	44.1	<20.0	<20.0	36.5	<20.0

* - The displayed value is the arithmetic mean of multiple database matches.

Attachment B

Summary Tables and Graphs for the Interwell Comparisons

Table 1

Upgradient Data

Constituent	Units	Well	Date		Result	Adjusted	
Antimony, total	ug/L	MW-3R	10/25/2023	ND	2.0000		
Arsenic, total	ug/L	MW-3R	10/04/2018	ND	4.0000		
Arsenic, total	ug/L	MW-3R	04/15/2019	ND	4.0000		
Arsenic, total	ug/L	MW-3R	10/08/2019	ND	4.0000		
Arsenic, total	ug/L	MW-3R	04/08/2020	ND	4.0000		
Arsenic, total	ug/L	MW-3R	10/02/2020	ND	4.0000		
Arsenic, total	ug/L	MW-3R	04/12/2021	ND	4.0000		
Arsenic, total	ug/L	MW-3R	10/26/2021	ND	4.0000		
Arsenic, total	ug/L	MW-3R	04/12/2022	ND	4.0000		
Arsenic, total	ug/L	MW-3R	10/07/2022	ND	4.0000		
Arsenic, total	ug/L	MW-3R	04/19/2023	ND	4.0000		
Arsenic, total	ug/L	MW-3R	10/25/2023	ND	4.0000		
Barium, total	ug/L	MW-3R	10/04/2018		325.0000		
Barium, total	ug/L	MW-3R	04/15/2019		175.0000		
Barium, total	ug/L	MW-3R	10/08/2019		352.0000		
Barium, total	ug/L	MW-3R	04/08/2020		350.0000		
Barium, total	ug/L	MW-3R	10/02/2020		328.0000		
Barium, total	ug/L	MW-3R	04/12/2021		324.0000		
Barium, total	ug/L	MW-3R	10/26/2021		302.0000		
Barium, total	ug/L	MW-3R	04/12/2022		332.0000		
Barium, total	ug/L	MW-3R	10/07/2022		307.0000		
Barium, total	ug/L	MW-3R	04/19/2023		324.0000		
Barium, total	ug/L	MW-3R	10/25/2023		306.0000		
Cadmium, total	ug/L	MW-3R	10/04/2018	ND	0.8000		
Cadmium, total	ug/L	MW-3R	04/15/2019	ND	0.8000		
Cadmium, total	ug/L	MW-3R	10/08/2019	ND	0.8000		
Cadmium, total	ug/L	MW-3R	04/08/2020	ND	0.8000		
Cadmium, total	ug/L	MW-3R	10/02/2020	ND	0.8000		
Cadmium, total	ug/L	MW-3R	04/12/2021	ND	0.8000		
Cadmium, total	ug/L	MW-3R	10/26/2021	ND	0.8000		
Cadmium, total	ug/L	MW-3R	04/12/2022	ND	0.8000		
Cadmium, total	ug/L	MW-3R	10/07/2022	ND	0.8000		
Cadmium, total	ug/L	MW-3R	04/19/2023	ND	0.8000		
Cadmium, total	ug/L	MW-3R	10/25/2023	ND	0.8000		
Chromium, total	ug/L	MW-3R	04/15/2019	ND	8.0000		
Chromium, total	ug/L	MW-3R	10/08/2019		10.4000		
Chromium, total	ug/L	MW-3R	04/08/2020		11.2000		
Chromium, total	ug/L	MW-3R	10/02/2020		10.7000		
Chromium, total	ug/L	MW-3R	04/12/2021		11.1000		
Chromium, total	ug/L	MW-3R	10/26/2021		10.6000		
Chromium, total	ug/L	MW-3R	04/12/2022		11.6000		
Chromium, total	ug/L	MW-3R	10/07/2022		11.0000		
Chromium, total	ug/L	MW-3R	04/19/2023		11.5000		
Chromium, total	ug/L	MW-3R	10/25/2023		11.8000		
Cobalt, total	ug/L	MW-3R	10/04/2018	ND	0.8000	0.4000	**
Cobalt, total	ug/L	MW-3R	10/25/2023	ND	0.4000		
Copper, total	ug/L	MW-3R	10/04/2018	ND	4.0000		
Copper, total	ug/L	MW-3R	04/15/2019		15.4000		
Copper, total	ug/L	MW-3R	10/08/2019	ND	4.0000		
Copper, total	ug/L	MW-3R	04/08/2020	ND	4.0000		
Copper, total	ug/L	MW-3R	10/02/2020	ND	4.0000		
Copper, total	ug/L	MW-3R	04/12/2021	ND	4.0000		
Copper, total	ug/L	MW-3R	10/26/2021	ND	4.0000		
Copper, total	ug/L	MW-3R	04/12/2022	ND	4.0000		
Copper, total	ug/L	MW-3R	10/07/2022	ND	4.0000		
Copper, total	ug/L	MW-3R	04/19/2023	ND	4.0000		
Copper, total	ug/L	MW-3R	10/25/2023	ND	4.0000		
Lead, total	ug/L	MW-3R	04/15/2019		5.6000		
Lead, total	ug/L	MW-3R	10/08/2019	ND	4.0000		
Lead, total	ug/L	MW-3R	04/08/2020	ND	4.0000		
Lead, total	ug/L	MW-3R	10/02/2020	ND	4.0000		
Lead, total	ug/L	MW-3R	04/12/2021	ND	4.0000		
Lead, total	ug/L	MW-3R	10/26/2021	ND	4.0000		
Lead, total	ug/L	MW-3R	04/12/2022	ND	4.0000		
Lead, total	ug/L	MW-3R	10/07/2022	ND	4.0000		
Lead, total	ug/L	MW-3R	04/19/2023	ND	4.0000		
Lead, total	ug/L	MW-3R	10/25/2023	ND	4.0000		
Nickel, total	ug/L	MW-3R	10/04/2018	ND	4.0000		
Nickel, total	ug/L	MW-3R	10/25/2023	ND	4.0000		
Selenium, total	ug/L	MW-3R	10/04/2018	ND	4.0000		
Selenium, total	ug/L	MW-3R	10/25/2023	ND	4.0000		
Vanadium, total	ug/L	MW-3R	10/25/2023	ND	20.0000		
Zinc, total	ug/L	MW-3R	10/04/2018	ND	20.0000		
Zinc, total	ug/L	MW-3R	04/15/2019		59.3000		

* - Outlier for that well and constituent.
** - ND value replaced with median RL.
*** - ND value replaced with manual RL.
ND = Not detected, Result = detection limit.

Table 1

Upgradient Data

Constituent	Units	Well	Date		Result	Adjusted	
Zinc, total	ug/L	MW-3R	10/08/2019		14.1000		
Zinc, total	ug/L	MW-3R	04/08/2020	ND	20.0000		
Zinc, total	ug/L	MW-3R	10/02/2020	ND	20.0000		
Zinc, total	ug/L	MW-3R	04/12/2021	ND	20.0000		
Zinc, total	ug/L	MW-3R	10/26/2021	ND	20.0000		
Zinc, total	ug/L	MW-3R	04/12/2022	ND	20.0000		
Zinc, total	ug/L	MW-3R	10/07/2022	ND	20.0000		
Zinc, total	ug/L	MW-3R	04/19/2023	ND	20.0000		
Zinc, total	ug/L	MW-3R	10/25/2023	ND	20.0000		
Antimony, total	ug/L	MW-4	10/25/2023	ND	2.0000		
Arsenic, total	ug/L	MW-4	10/04/2018		57.3000		
Arsenic, total	ug/L	MW-4	04/15/2019	ND	4.0000		
Arsenic, total	ug/L	MW-4	10/08/2019		49.0000		
Arsenic, total	ug/L	MW-4	04/08/2020		16.7000		
Arsenic, total	ug/L	MW-4	10/02/2020		36.3000		
Arsenic, total	ug/L	MW-4	04/12/2021		31.2000		
Arsenic, total	ug/L	MW-4	10/26/2021		20.8000		
Arsenic, total	ug/L	MW-4	04/12/2022		20.4000		
Arsenic, total	ug/L	MW-4	10/07/2022		19.8000		
Arsenic, total	ug/L	MW-4	04/19/2023		23.9000		
Arsenic, total	ug/L	MW-4	10/25/2023		21.4000		
Barium, total	ug/L	MW-4	10/04/2018		228.0000		
Barium, total	ug/L	MW-4	04/15/2019		154.0000		
Barium, total	ug/L	MW-4	10/08/2019		218.0000		
Barium, total	ug/L	MW-4	04/08/2020		295.0000		
Barium, total	ug/L	MW-4	10/02/2020		922.0000		
Barium, total	ug/L	MW-4	04/12/2021		744.0000		
Barium, total	ug/L	MW-4	10/26/2021		251.0000		
Barium, total	ug/L	MW-4	04/12/2022		442.0000		
Barium, total	ug/L	MW-4	10/07/2022		395.0000		
Barium, total	ug/L	MW-4	04/19/2023		445.0000		
Barium, total	ug/L	MW-4	10/25/2023		347.0000		
Cadmium, total	ug/L	MW-4	10/04/2018	ND	0.8000		
Cadmium, total	ug/L	MW-4	04/15/2019	ND	0.8000		
Cadmium, total	ug/L	MW-4	10/08/2019	ND	0.8000		
Cadmium, total	ug/L	MW-4	04/08/2020	ND	0.8000		
Cadmium, total	ug/L	MW-4	10/02/2020	ND	0.8000		
Cadmium, total	ug/L	MW-4	04/12/2021	ND	0.8000		
Cadmium, total	ug/L	MW-4	10/26/2021	ND	0.8000		
Cadmium, total	ug/L	MW-4	04/12/2022	ND	0.8000		
Cadmium, total	ug/L	MW-4	10/07/2022	ND	0.8000		
Cadmium, total	ug/L	MW-4	04/19/2023	ND	0.8000		
Cadmium, total	ug/L	MW-4	10/25/2023	ND	0.8000		
Chromium, total	ug/L	MW-4	04/15/2019	ND	8.0000		
Chromium, total	ug/L	MW-4	10/08/2019	ND	8.0000		
Chromium, total	ug/L	MW-4	04/08/2020	ND	8.0000		
Chromium, total	ug/L	MW-4	10/02/2020	ND	8.0000		
Chromium, total	ug/L	MW-4	04/12/2021		9.0000		
Chromium, total	ug/L	MW-4	10/26/2021	ND	8.0000		
Chromium, total	ug/L	MW-4	04/12/2022	ND	8.0000		
Chromium, total	ug/L	MW-4	10/07/2022	ND	8.0000		
Chromium, total	ug/L	MW-4	04/19/2023	ND	8.0000		
Chromium, total	ug/L	MW-4	10/25/2023		10.4000		
Cobalt, total	ug/L	MW-4	10/04/2018		1.4000		
Cobalt, total	ug/L	MW-4	10/25/2023		0.4000		
Copper, total	ug/L	MW-4	10/04/2018		6.9000		
Copper, total	ug/L	MW-4	04/15/2019	ND	4.0000		
Copper, total	ug/L	MW-4	10/08/2019		6.9000		
Copper, total	ug/L	MW-4	04/08/2020		4.1000		
Copper, total	ug/L	MW-4	10/02/2020		15.1000		
Copper, total	ug/L	MW-4	04/12/2021		16.7000		
Copper, total	ug/L	MW-4	10/26/2021		4.3000		
Copper, total	ug/L	MW-4	04/12/2022		7.0000		
Copper, total	ug/L	MW-4	10/07/2022		5.6000		
Copper, total	ug/L	MW-4	04/19/2023		4.8000		
Copper, total	ug/L	MW-4	10/25/2023	ND	4.0000		
Lead, total	ug/L	MW-4	04/15/2019	ND	4.0000		
Lead, total	ug/L	MW-4	10/08/2019	ND	4.0000		
Lead, total	ug/L	MW-4	04/08/2020	ND	4.0000		
Lead, total	ug/L	MW-4	10/02/2020	ND	4.0000		
Lead, total	ug/L	MW-4	04/12/2021		4.2000		
Lead, total	ug/L	MW-4	10/26/2021	ND	4.0000		
Lead, total	ug/L	MW-4	04/12/2022	ND	4.0000		
Lead, total	ug/L	MW-4	10/07/2022	ND	4.0000		

* - Outlier for that well and constituent.
** - ND value replaced with median RL.
*** - ND value replaced with manual RL.
ND = Not detected, Result = detection limit.

Table 1

Upgradient Data

Constituent	Units	Well	Date		Result	Adjusted	
Lead, total	ug/L	MW-4	04/19/2023	ND	4.0000		
Lead, total	ug/L	MW-4	10/25/2023	ND	4.0000		
Nickel, total	ug/L	MW-4	10/04/2018	ND	4.0000		
Nickel, total	ug/L	MW-4	10/25/2023		9.7000		
Selenium, total	ug/L	MW-4	10/04/2018	ND	4.0000		
Selenium, total	ug/L	MW-4	10/25/2023	ND	4.0000		
Vanadium, total	ug/L	MW-4	10/25/2023	ND	20.0000		
Zinc, total	ug/L	MW-4	10/04/2018		31.9000		
Zinc, total	ug/L	MW-4	04/15/2019	ND	20.0000		
Zinc, total	ug/L	MW-4	10/08/2019		24.6000		
Zinc, total	ug/L	MW-4	04/08/2020	ND	20.0000		
Zinc, total	ug/L	MW-4	10/02/2020		32.5000		
Zinc, total	ug/L	MW-4	04/12/2021		40.9000		
Zinc, total	ug/L	MW-4	10/26/2021	ND	20.0000		
Zinc, total	ug/L	MW-4	04/12/2022	ND	20.0000		
Zinc, total	ug/L	MW-4	10/07/2022		22.0000		
Zinc, total	ug/L	MW-4	04/19/2023	ND	20.0000		
Zinc, total	ug/L	MW-4	10/25/2023	ND	20.0000		
Antimony, total	ug/L	MW-5	10/25/2023	ND	2.0000		
Arsenic, total	ug/L	MW-5	10/04/2018		6.4000		
Arsenic, total	ug/L	MW-5	04/15/2019	ND	4.0000		
Arsenic, total	ug/L	MW-5	10/08/2019	ND	4.0000		
Arsenic, total	ug/L	MW-5	04/08/2020		6.0000		
Arsenic, total	ug/L	MW-5	10/02/2020	ND	4.0000		
Arsenic, total	ug/L	MW-5	04/12/2021		4.0000		
Arsenic, total	ug/L	MW-5	10/26/2021		5.6000		
Arsenic, total	ug/L	MW-5	04/12/2022	ND	4.0000		
Arsenic, total	ug/L	MW-5	10/07/2022	ND	4.0000		
Arsenic, total	ug/L	MW-5	04/19/2023	ND	4.0000		
Arsenic, total	ug/L	MW-5	10/25/2023		4.6000		
Barium, total	ug/L	MW-5	10/04/2018		317.0000		
Barium, total	ug/L	MW-5	04/15/2019		80.7000		
Barium, total	ug/L	MW-5	10/08/2019		166.0000		
Barium, total	ug/L	MW-5	04/08/2020		484.0000		
Barium, total	ug/L	MW-5	10/02/2020		177.0000		
Barium, total	ug/L	MW-5	04/12/2021		254.0000		
Barium, total	ug/L	MW-5	10/26/2021		341.0000		
Barium, total	ug/L	MW-5	04/12/2022		195.0000		
Barium, total	ug/L	MW-5	10/07/2022		155.0000		
Barium, total	ug/L	MW-5	04/19/2023		146.0000		
Barium, total	ug/L	MW-5	10/25/2023		243.0000		
Cadmium, total	ug/L	MW-5	10/04/2018	ND	0.8000		
Cadmium, total	ug/L	MW-5	04/15/2019	ND	0.8000		
Cadmium, total	ug/L	MW-5	10/08/2019	ND	0.8000		
Cadmium, total	ug/L	MW-5	04/08/2020		0.8000		
Cadmium, total	ug/L	MW-5	10/02/2020	ND	0.8000		
Cadmium, total	ug/L	MW-5	04/12/2021	ND	0.8000		
Cadmium, total	ug/L	MW-5	10/26/2021		2.2000		
Cadmium, total	ug/L	MW-5	04/12/2022	ND	0.8000		
Cadmium, total	ug/L	MW-5	10/07/2022	ND	0.8000		
Cadmium, total	ug/L	MW-5	04/19/2023	ND	0.8000		
Cadmium, total	ug/L	MW-5	10/25/2023	ND	0.8000		
Chromium, total	ug/L	MW-5	04/15/2019	ND	8.0000		
Chromium, total	ug/L	MW-5	10/08/2019	ND	8.0000		
Chromium, total	ug/L	MW-5	04/08/2020		13.4000		
Chromium, total	ug/L	MW-5	10/02/2020	ND	8.0000		
Chromium, total	ug/L	MW-5	04/12/2021		14.3000		
Chromium, total	ug/L	MW-5	10/26/2021		10.8000		
Chromium, total	ug/L	MW-5	04/12/2022		16.8000		
Chromium, total	ug/L	MW-5	10/07/2022	ND	8.0000		
Chromium, total	ug/L	MW-5	04/19/2023	ND	8.0000		
Chromium, total	ug/L	MW-5	10/25/2023		19.5000		
Cobalt, total	ug/L	MW-5	10/04/2018		6.3000		
Cobalt, total	ug/L	MW-5	10/25/2023		3.5000		
Copper, total	ug/L	MW-5	10/04/2018		16.4000		
Copper, total	ug/L	MW-5	04/15/2019	ND	4.0000		
Copper, total	ug/L	MW-5	10/08/2019	ND	4.0000		
Copper, total	ug/L	MW-5	04/08/2020		26.5000		
Copper, total	ug/L	MW-5	10/02/2020	ND	4.0000		
Copper, total	ug/L	MW-5	04/12/2021		8.4000		
Copper, total	ug/L	MW-5	10/26/2021		14.7000		
Copper, total	ug/L	MW-5	04/12/2022		4.6000		
Copper, total	ug/L	MW-5	10/07/2022	ND	4.0000		
Copper, total	ug/L	MW-5	04/19/2023	ND	4.0000		

* - Outlier for that well and constituent.
** - ND value replaced with median RL.
*** - ND value replaced with manual RL.
ND = Not detected, Result = detection limit.

Table 1

Upgradient Data

Constituent	Units	Well	Date		Result	Adjusted	
Copper, total	ug/L	MW-5	10/25/2023		8.9000		
Lead, total	ug/L	MW-5	04/15/2019	ND	4.0000		
Lead, total	ug/L	MW-5	10/08/2019	ND	4.0000		
Lead, total	ug/L	MW-5	04/08/2020		15.5000		
Lead, total	ug/L	MW-5	10/02/2020	ND	4.0000		
Lead, total	ug/L	MW-5	04/12/2021		4.9000		
Lead, total	ug/L	MW-5	10/26/2021		7.6000		
Lead, total	ug/L	MW-5	04/12/2022	ND	4.0000		
Lead, total	ug/L	MW-5	10/07/2022	ND	4.0000		
Lead, total	ug/L	MW-5	04/19/2023	ND	4.0000		
Lead, total	ug/L	MW-5	10/25/2023		4.6000		
Nickel, total	ug/L	MW-5	10/04/2018		19.5000		
Nickel, total	ug/L	MW-5	10/25/2023		19.6000		
Selenium, total	ug/L	MW-5	10/04/2018	ND	4.0000		
Selenium, total	ug/L	MW-5	10/25/2023	ND	4.0000		
Vanadium, total	ug/L	MW-5	10/25/2023	ND	20.0000		
Zinc, total	ug/L	MW-5	10/04/2018		67.9000		
Zinc, total	ug/L	MW-5	04/15/2019	ND	20.0000		
Zinc, total	ug/L	MW-5	10/08/2019		44.6000		
Zinc, total	ug/L	MW-5	04/08/2020		65.8000		
Zinc, total	ug/L	MW-5	10/02/2020	ND	20.0000		
Zinc, total	ug/L	MW-5	04/12/2021		24.5000		
Zinc, total	ug/L	MW-5	10/26/2021		46.4000		
Zinc, total	ug/L	MW-5	04/12/2022	ND	20.0000		
Zinc, total	ug/L	MW-5	10/07/2022	ND	20.0000		
Zinc, total	ug/L	MW-5	04/19/2023	ND	20.0000		
Zinc, total	ug/L	MW-5	10/25/2023		36.5000		

* - Outlier for that well and constituent.
** - ND value replaced with median RL.
*** - ND value replaced with manual RL.
ND = Not detected, Result = detection limit.

Table 2

Most Current Downgradient Monitoring Data

Constituent	Units	Well	Date		Result		Pred. Limit
Antimony, total	ug/L	MW-1	10/25/2023	ND	2.0000		*****
Arsenic, total	ug/L	MW-1	10/25/2023	ND	4.0000		57.3000
Barium, total	ug/L	MW-1	10/25/2023		1090.0000	***	921.2112
Cadmium, total	ug/L	MW-1	10/25/2023	ND	0.8000		2.2000
Chromium, total	ug/L	MW-1	10/25/2023	ND	8.0000		19.5000
Cobalt, total	ug/L	MW-1	10/25/2023		3.1000		6.3000
Copper, total	ug/L	MW-1	10/25/2023	ND	4.0000		26.5000
Lead, total	ug/L	MW-1	10/25/2023	ND	4.0000		15.5000
Nickel, total	ug/L	MW-1	10/25/2023		21.9000	***	19.6000
Selenium, total	ug/L	MW-1	10/25/2023	ND	4.0000		4.0000
Vanadium, total	ug/L	MW-1	10/25/2023	ND	20.0000		*****
Zinc, total	ug/L	MW-1	10/25/2023		44.1000		67.9000
Antimony, total	ug/L	MW-7	10/25/2023	ND	2.0000		*****
Arsenic, total	ug/L	MW-7	10/25/2023	ND	4.0000		57.3000
Barium, total	ug/L	MW-7	10/25/2023		172.0000		921.2112
Cadmium, total	ug/L	MW-7	10/25/2023	ND	0.8000		2.2000
Chromium, total	ug/L	MW-7	10/25/2023	ND	8.0000		19.5000
Cobalt, total	ug/L	MW-7	10/25/2023	ND	0.4000		6.3000
Copper, total	ug/L	MW-7	10/25/2023	ND	4.0000		26.5000
Lead, total	ug/L	MW-7	10/25/2023	ND	4.0000		15.5000
Nickel, total	ug/L	MW-7	10/25/2023	ND	4.0000		19.6000
Selenium, total	ug/L	MW-7	10/25/2023	ND	4.0000		4.0000
Vanadium, total	ug/L	MW-7	10/25/2023	ND	20.0000		*****
Zinc, total	ug/L	MW-7	10/25/2023	ND	20.0000		67.9000

* - Current value failed - awaiting verification.
** - Current value passed - previous exceedance not verified.
*** - Current value failed - exceedance verified.
**** - Current value passed - awaiting one more verification.
***** - Insufficient background data to compute prediction limit.
ND = Not Detected, Result = detection limit.

Table 3

Detection Frequencies in Upgradient and Downgradient Wells

Constituent	Detect	Upgradient N	Proportion	Detect	Downgradient N	Proportion
Antimony, total	0	3	0.000	0	3	0.000
Arsenic, total	15	33	0.455	2	22	0.091
Barium, total	33	33	1.000	22	22	1.000
Cadmium, total	2	33	0.061	2	22	0.091
Chromium, total	16	30	0.533	0	20	0.000
Cobalt, total	4	6	0.667	3	5	0.600
Copper, total	16	33	0.485	0	22	0.000
Lead, total	6	30	0.200	0	20	0.000
Nickel, total	3	6	0.500	3	5	0.600
Selenium, total	0	6	0.000	0	5	0.000
Vanadium, total	0	3	0.000	0	3	0.000
Zinc, total	13	33	0.394	5	22	0.227

N = Total number of measurements in all wells.
Detect = Total number of detections in all wells.
Proportion = Detect/N.

Table 4

Shapiro-Wilk Multiple Group Test of Normality

Constituent	Detect	N	Detect Freq	G raw	G log	G cbrt	G sqrt	G sqr	G cub	Crit Value	Dist Form	Model Type
Antimony, total	0	3	0.000									too few
Arsenic, total	15	33	0.455	4.261	4.805					2.326	non-norm	nonpar
Barium, total	33	33	1.000	3.189	0.934					2.326	lognor	lognor
Cadmium, total	2	33	0.061	6.036	6.036					2.326	non-norm	nonpar
Chromium, total	16	30	0.533	5.394	5.634					2.326	non-norm	nonpar
Cobalt, total	4	6	0.667									nonpar
Copper, total	16	33	0.485	5.356	4.396					2.326	non-norm	nonpar
Lead, total	6	30	0.200	6.439	5.963					2.326	non-norm	nonpar
Nickel, total	3	6	0.500									nonpar
Selenium, total	0	6	0.000									nonpar
Vanadium, total	0	3	0.000									too few
Zinc, total	13	33	0.394	6.691	5.789					2.326	non-norm	nonpar

* - Distribution override for that constituent.
Fit to distribution is confirmed if G <= critical value.
Model type may not match distributional form when detection frequency < 50%.

Table 5

Summary Statistics and Prediction Limits

Constituent	Units	Detect	N	Mean	SD	alpha	Factor	Pred Limit	Type		Conf
Antimony, total	ug/L	0	3							*	
Arsenic, total	ug/L	15	33					57.3000	nonpar		0.99
Barium, total	ug/L	33	33	5.6452	0.4750	0.0100	2.4853	921.2112	lognor		
Cadmium, total	ug/L	2	33					2.2000	nonpar		0.99
Chromium, total	ug/L	16	30					19.5000	nonpar		0.99
Cobalt, total	ug/L	4	6					6.3000	nonpar		0.93
Copper, total	ug/L	16	33					26.5000	nonpar		0.99
Lead, total	ug/L	6	30					15.5000	nonpar		0.99
Nickel, total	ug/L	3	6					19.6000	nonpar		0.93
Selenium, total	ug/L	0	6					4.0000	nonpar	***	0.93
Vanadium, total	ug/L	0	3							*	
Zinc, total	ug/L	13	33					67.9000	nonpar		0.99

Conf = confidence level for passing initial test or one verification resample at all downgradient wells for a single constituent (nonparametric test only).
* - Insufficient Data.
** - Calculated limit raised to Manual Reporting Limit.
*** - Nonparametric limit based on ND value.
For transformed data, mean and SD in transformed units and prediction limit in original units.
All sample sizes and statistics are based on outlier free data.
For nonparametric limits, median reporting limits are substituted for extreme reporting limit values.

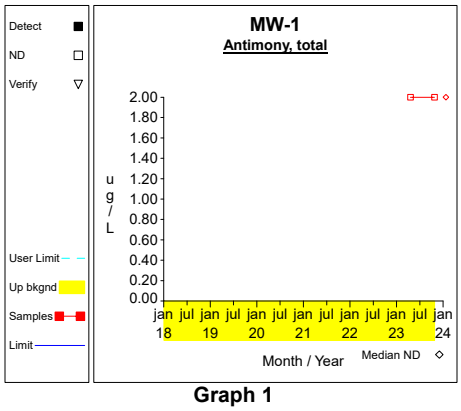
Table 8

Historical Downgradient Data for Constituent-Well Combinations that Failed the Current Statistical Evaluation or are in Verification Resampling Mode

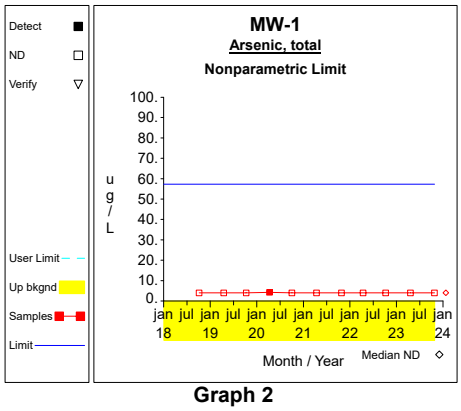
Constituent	Units	Well	Date	Result		Pred. Limit
Barium, total	ug/L	MW-1	10/04/2018	1000.0000	*	921.2112
Barium, total	ug/L	MW-1	04/15/2019	1060.0000	*	921.2112
Barium, total	ug/L	MW-1	10/08/2019	1020.0000	*	921.2112
Barium, total	ug/L	MW-1	04/08/2020	995.0000	*	921.2112
Barium, total	ug/L	MW-1	10/02/2020	1000.0000	*	921.2112
Barium, total	ug/L	MW-1	04/12/2021	1060.0000	*	921.2112
Barium, total	ug/L	MW-1	10/26/2021	960.0000	*	921.2112
Barium, total	ug/L	MW-1	04/12/2022	1030.0000	*	921.2112
Barium, total	ug/L	MW-1	10/07/2022	1000.0000	*	921.2112
Barium, total	ug/L	MW-1	04/19/2023	1020.0000	*	921.2112
Barium, total	ug/L	MW-1	10/25/2023	1090.0000	*	921.2112
Nickel, total	ug/L	MW-1	10/04/2018	33.1000	*	19.6000
Nickel, total	ug/L	MW-1	04/19/2023	21.7000	*	19.6000
Nickel, total	ug/L	MW-1	10/25/2023	21.9000	*	19.6000

* - Significantly increased over background.
** - Detect at limit for 100% NDs in background (NPPL only).
*** - Manual exclusion.
ND = Not Detected, Result = detection limit.

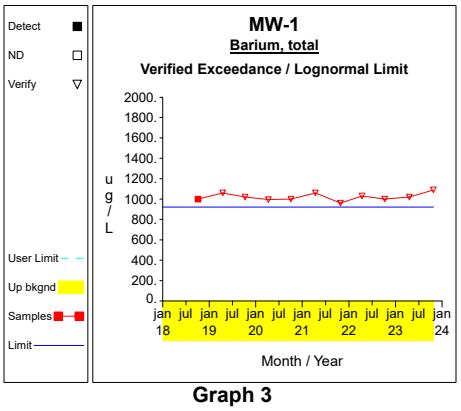
Up vs. Down Prediction Limits



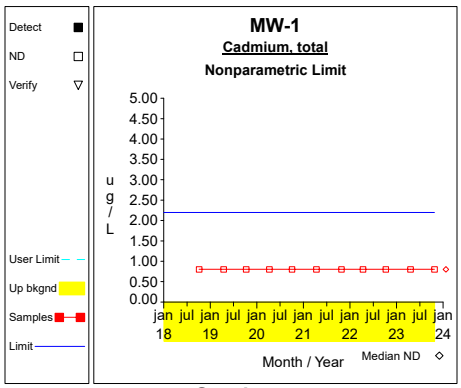
Graph 1



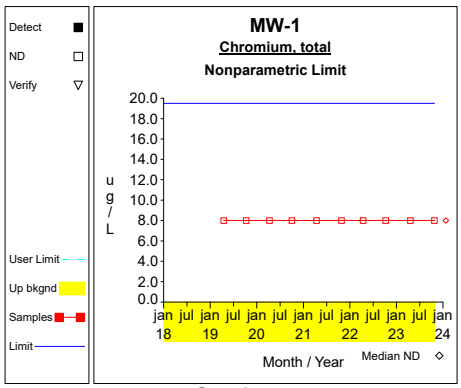
Graph 2



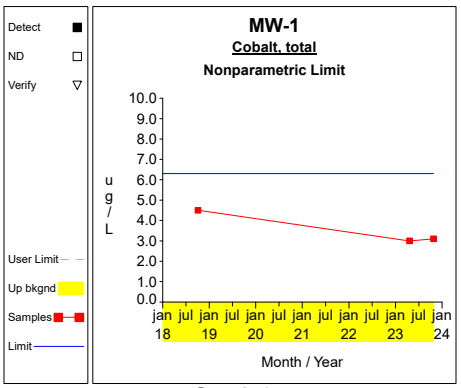
Graph 3



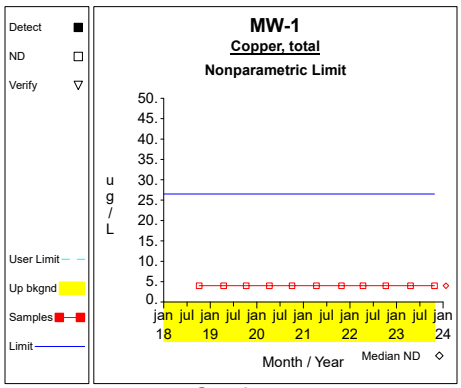
Graph 4



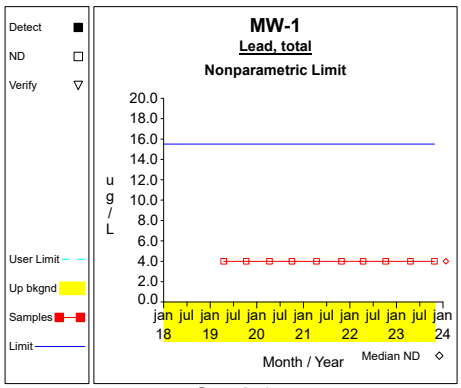
Graph 5



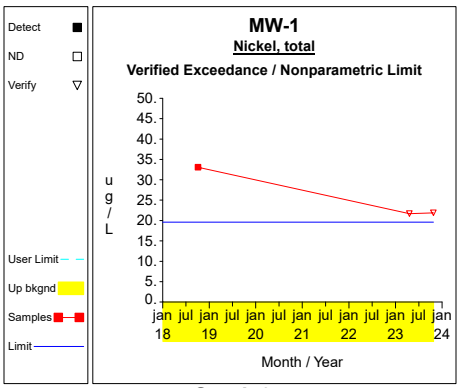
Graph 6



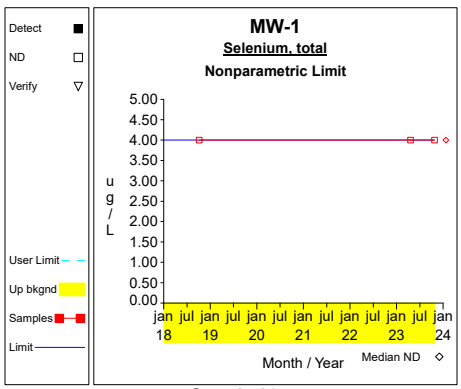
Graph 7



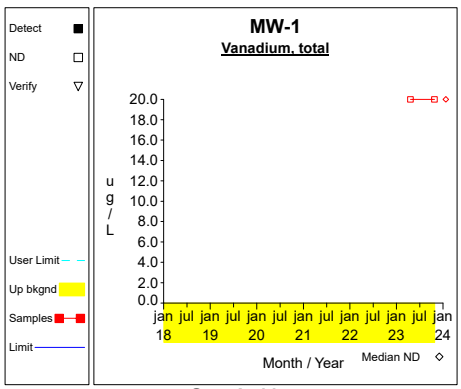
Graph 8



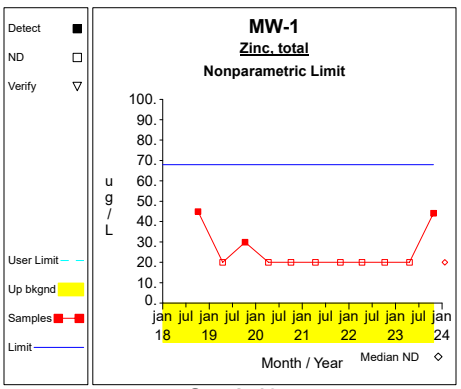
Graph 9



Graph 10



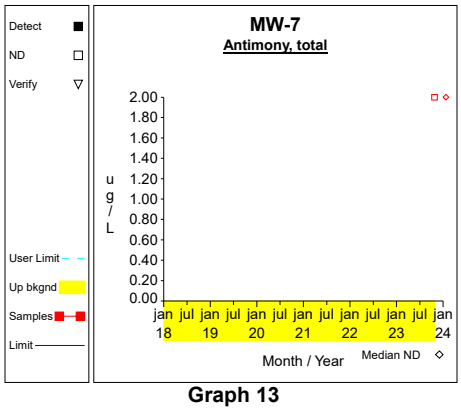
Graph 11



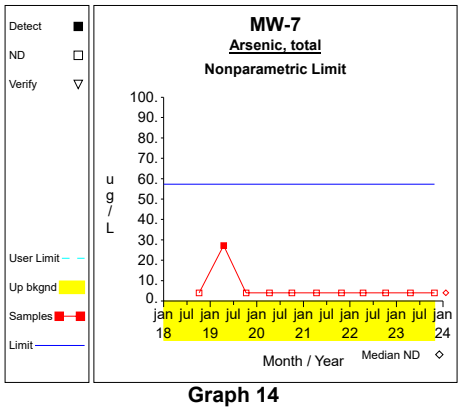
Graph 12

Prepared by: Otter Creek Environmental

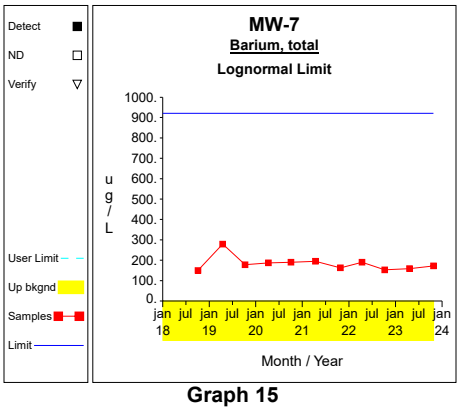
Up vs. Down Prediction Limits



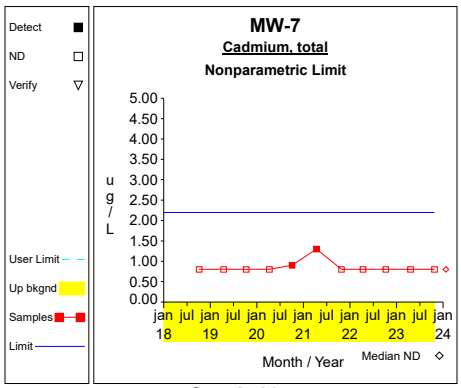
Graph 13



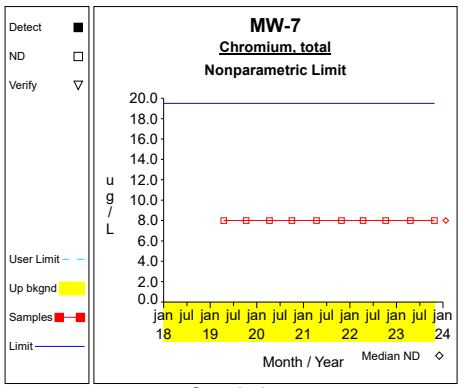
Graph 14



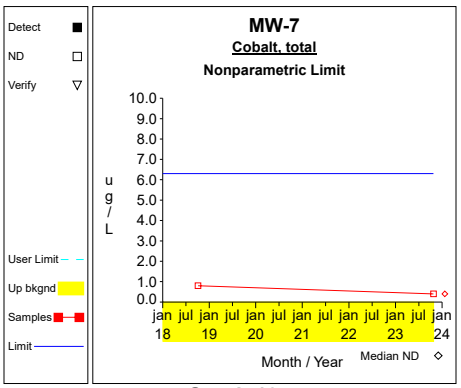
Graph 15



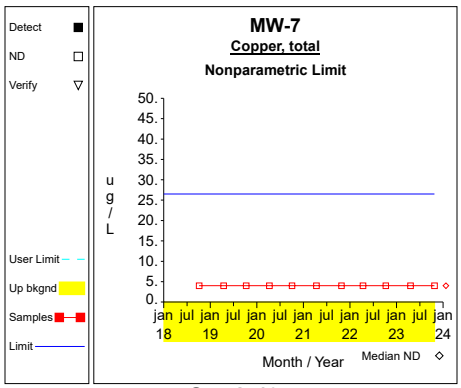
Graph 16



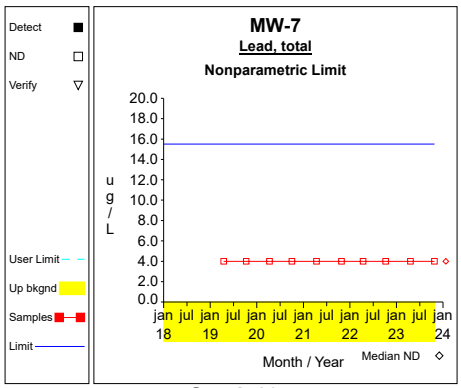
Graph 17



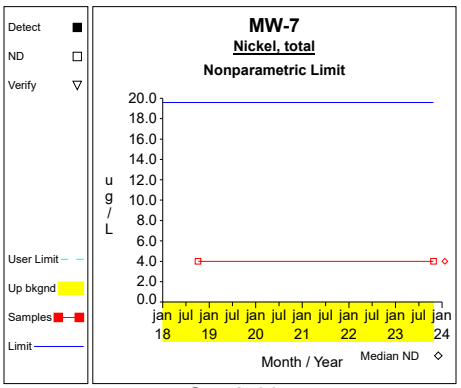
Graph 18



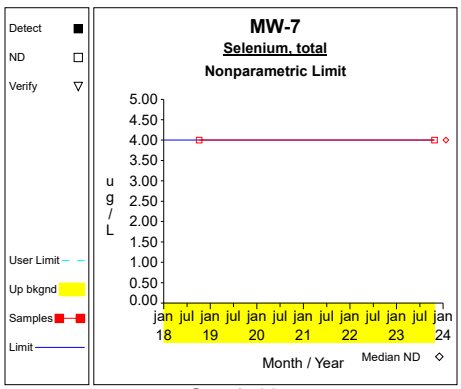
Graph 19



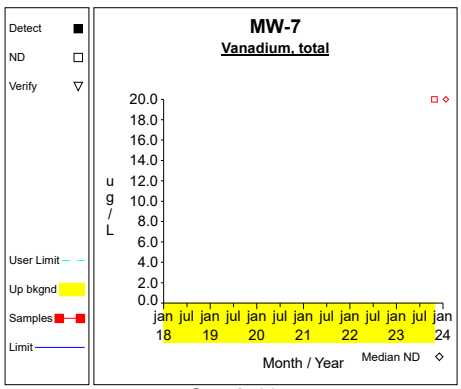
Graph 20



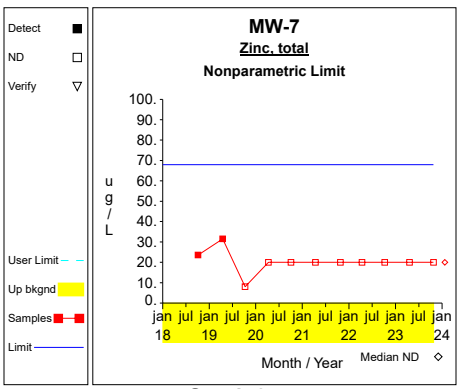
Graph 21



Graph 22



Graph 23

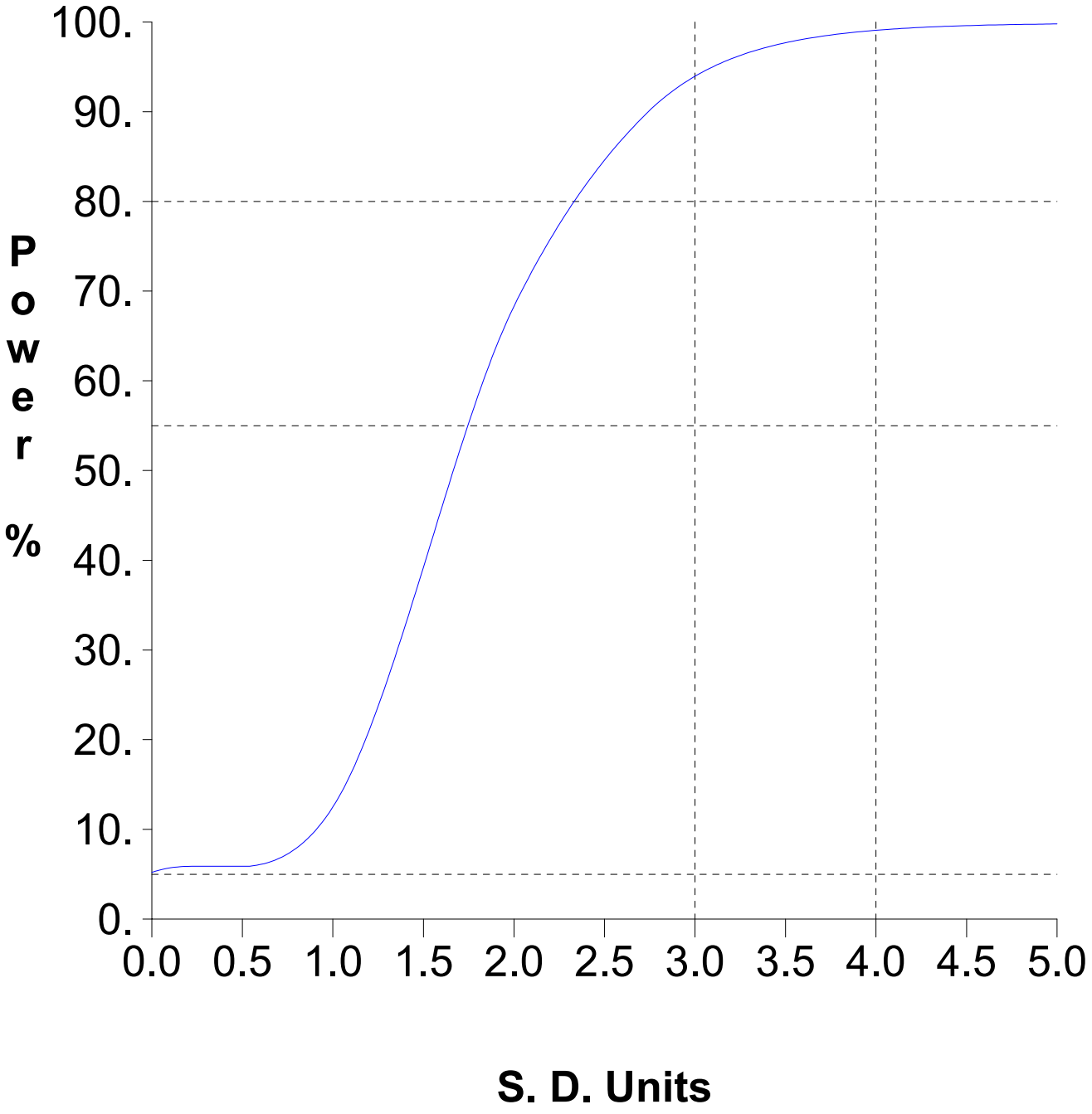


Graph 24

Prepared by: Otter Creek Environmental

False Positive and False Negative Rates for Current

Upgradient vs. Downgradient Monitoring Program



Attachment C

Assessment Statistics

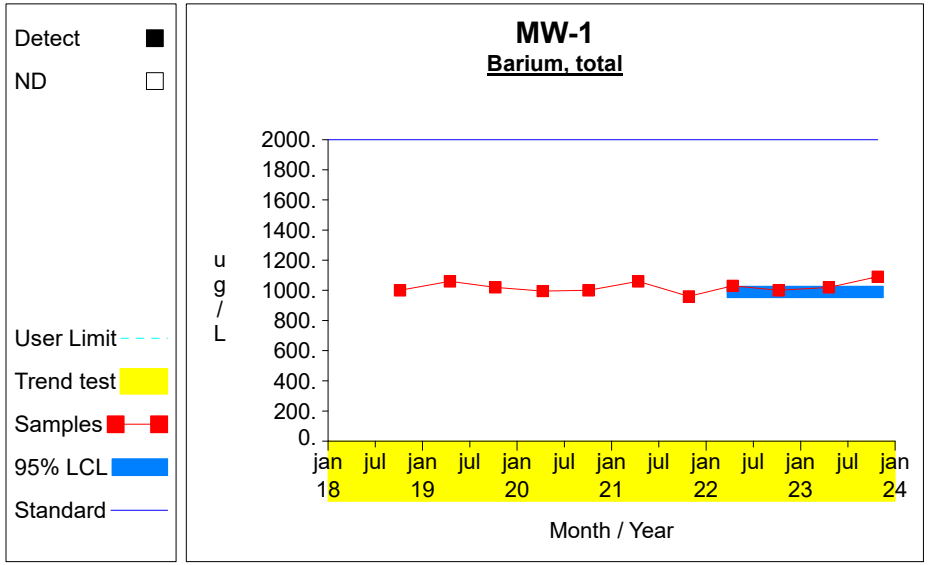
Table 1

Confidence Intervals for Comparing the Mean of the Last 4 Measurements to an Assessment Monitoring Standard

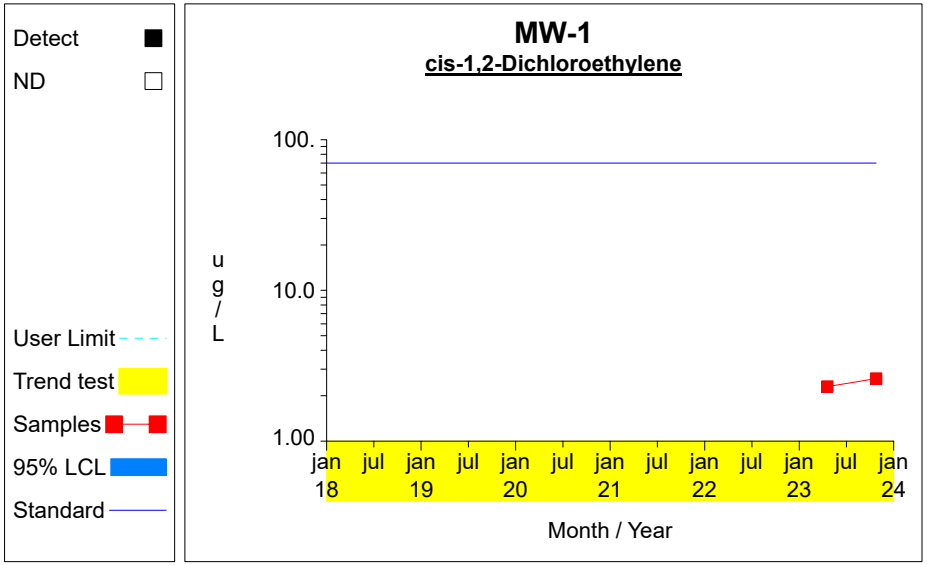
Constituent	Units	Well	N	Mean	SD	Factor	95% LCL	95% UCL	Standard	Trend	
Barium, total	ug/L	MW-1	4	1035.000	38.730	1.176	989.443	1080.557	2000.000		
cis-1,2-Dichloroethylene	ug/L	MW-1	2								*
Nickel, total	ug/L	MW-1	3								*

* - Insufficient Data
** - Significant Exceedance
LCL = Lower Confidence Limit
UCL = Upper Confidence Limit

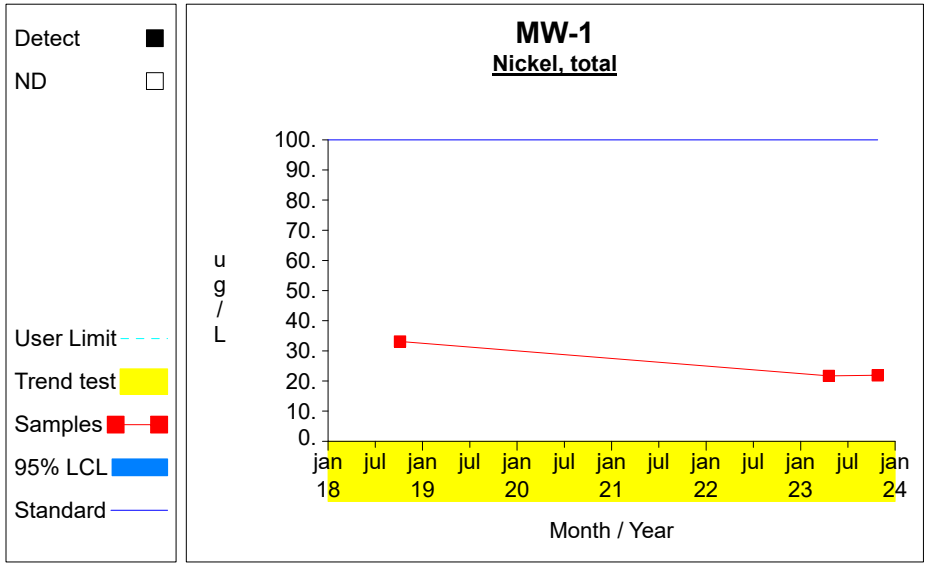
Confidence Limits (Assessment)



Graph 1



Graph 2



Graph 3

Appendix D

Laboratory Reports for Reporting Period

With Chain of Custody

ANALYTICAL REPORT

May 23, 2023

Work Order: 1GD2320

Report To	Work Order Information
Todd Whipple	Date Received: 4/21/2023 8:50:00AM
HLW Engineering	Collector: JGH
PO Box 314	Phone: (515) 733-4144
Story City, IA 50248	PO Number:

Project: Monona Co

Project Number: 6036

Analyte	Result	MRL	Batch	Method	Analyst	Analyzed	Qualifier
1GD2320-01 MW-1				Matrix: Water		Collected: 04/19/23 10:02	
Acrylonitrile	<5.0 ug/L	5.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Surrogate: Dibromofluoromethane	*115 %*			*80-126*	MSV	04/25/23 16:58	
Surrogate: 1,2-Dichloroethane-d4	*99.2 %*			*63-138*	MSV	04/25/23 16:58	
Surrogate: Toluene-d8	*99.1 %*			*87-116*	MSV	04/25/23 16:58	
Surrogate: 4-Bromofluorobenzene	*99.8 %*			*85-111*	MSV	04/25/23 16:58	
Chloromethane	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Vinyl Chloride	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Bromomethane	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Chloroethane	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Trichlorofluoromethane	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
1,1-Dichloroethylene	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Acetone	<10.0 ug/L	10.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Methyl Iodide	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Carbon Disulfide	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Methylene Chloride	<5.0 ug/L	5.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
trans-1,2-Dichloroethylene	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
1,1-Dichloroethane	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Vinyl Acetate	<5.0 ug/L	5.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
cis-1,2-Dichloroethylene	**2.3 ug/L**	**1.0**	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
2-Butanone (MEK)	<10.0 ug/L	10.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Bromochloromethane	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Chloroform	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
1,1,1-Trichloroethane	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Carbon Tetrachloride	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Benzene	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
1,2-Dichloroethane	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Trichloroethylene	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
1,2-Dichloropropane	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	

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Work Order: 1GD2320

Analyte	Result	MRL	Batch	Method	Analyst	Analyzed	Qualifier
1GD2320-01 MW-1				Matrix: Water		Collected: 04/19/23 10:02	
Dibromomethane	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Bromodichloromethane	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
cis-1,3-Dichloropropene	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
4-Methyl-2-pentanone (MIBK)	<5.0 ug/L	5.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Toluene	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
trans-1,3-Dichloropropene	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
1,1,2-Trichloroethane	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Tetrachloroethylene	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
2-Hexanone (MBK)	<5.0 ug/L	5.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Dibromochloromethane	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
1,2-Dibromoethane	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Chlorobenzene	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
1,1,1,2-Tetrachloroethane	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Ethylbenzene	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Xylenes, total	<2.0 ug/L	2.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Styrene	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Bromoform	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
1,2,3-Trichloropropane	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
trans-1,4-Dichloro-2-butene	<5.0 ug/L	5.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
1,1,2,2-Tetrachloroethane	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
1,4-Dichlorobenzene	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
1,2-Dichlorobenzene	<1.0 ug/L	1.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
1,2-Dibromo-3-chloropropane	<5.0 ug/L	5.0	1GD1304	EPA 8260B	MSV	04/25/23 16:58	
Surrogate: Dibromofluoromethane	*115 %*			*75-136*	MSV	04/25/23 16:58	
Surrogate: 1,2-Dichloroethane-d4	*99.2 %*			*61-142*	MSV	04/25/23 16:58	
Surrogate: Toluene-d8	*99.1 %*			*82-121*	MSV	04/25/23 16:58	
Surrogate: 4-Bromofluorobenzene	*99.8 %*			*80-116*	MSV	04/25/23 16:58	
COD, total	<20 mg/L	20	1GE0006	EPA 410.4	JLW	05/02/23 10:30	
Nitrogen, Ammonia	<1.00 mg/L	1.00	1GE0259	TIMBERLINE	TJB	05/04/23 13:07	
Chloride	**223 mg/L**	**5.0**	1GD1314	EPA 9056	MID	04/25/23 11:42	
Silver, total	<0.0040 mg/L	0.0040	1GD1463	EPA 6020A	RVV	04/28/23 21:40	
Arsenic, total	<0.0040 mg/L	0.0040	1GD1463	EPA 6020A	RVV	04/28/23 21:40	
Barium, total	**1.02 mg/L**	**0.0040**	1GD1463	EPA 6020A	RVV	04/28/23 21:40	
Beryllium, total	<0.0040 mg/L	0.0040	1GD1463	EPA 6020A	RVV	04/28/23 21:40	
Cadmium, total	<0.0008 mg/L	0.0008	1GD1463	EPA 6020A	RVV	04/28/23 21:40	
Cobalt, total	**0.0030 mg/L**	**0.0004**	1GD1463	EPA 6020A	RVV	04/28/23 21:40	
Chromium, total	<0.0080 mg/L	0.0080	1GD1463	EPA 6020A	RVV	04/28/23 21:40	
Copper, total	<0.0040 mg/L	0.0040	1GD1463	EPA 6020A	RVV	04/28/23 21:40	

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Work Order: 1GD2320

Analyte	Result	MRL	Batch	Method	Analyst	Analyzed	Qualifier
1GD2320-01 MW-1				Matrix: Water		Collected: 04/19/23 10:02	
Iron, total	**1.09 mg/L**	**0.100**	1GD1201	EPA 6010B	JAR	04/25/23 23:48	
Mercury, total	<0.00050 mg/L	0.00050	1GD1234	EPA 7470A	JAR	04/27/23 9:51	
Magnesium, total	**118 mg/L**	**0.100**	1GD1201	EPA 6010B	JAR	04/25/23 23:48	
Nickel, total	**0.0217 mg/L**	**0.0040**	1GD1463	EPA 6020A	RVV	04/28/23 21:40	
Lead, total	<0.0040 mg/L	0.0040	1GD1463	EPA 6020A	RVV	04/28/23 21:40	
Antimony, total	<0.0020 mg/L	0.0020	1GD1463	EPA 6020A	RVV	04/28/23 21:40	
Selenium, total	<0.0040 mg/L	0.0040	1GD1463	EPA 6020A	RVV	04/28/23 21:40	
Thallium, total	<0.0020 mg/L	0.0020	1GD1463	EPA 6020A	RVV	04/28/23 21:40	
Vanadium, total	<0.0200 mg/L	0.0200	1GD1463	EPA 6020A	RVV	04/28/23 21:40	
Zinc, total	<0.0200 mg/L	0.0200	1GD1463	EPA 6020A	RVV	04/28/23 21:40	
1GD2320-02 MW-3R				Matrix: Water		Collected: 04/19/23 10:31	
Arsenic, total	<0.0040 mg/L	0.0040	1GD1463	EPA 6020A	RVV	04/28/23 21:47	
Barium, total	**0.324 mg/L**	**0.0040**	1GD1463	EPA 6020A	RVV	04/28/23 21:47	
Cadmium, total	<0.0008 mg/L	0.0008	1GD1463	EPA 6020A	RVV	04/28/23 21:47	
Chromium, total	**0.0115 mg/L**	**0.0080**	1GD1463	EPA 6020A	RVV	04/28/23 21:47	
Copper, total	<0.0040 mg/L	0.0040	1GD1463	EPA 6020A	RVV	04/28/23 21:47	
Iron, total	<0.100 mg/L	0.100	1GD1201	EPA 6010B	JAR	04/25/23 23:53	
Mercury, total	<0.00050 mg/L	0.00050	1GD1234	EPA 7470A	JAR	04/27/23 9:53	
Magnesium, total	**34.7 mg/L**	**0.100**	1GD1201	EPA 6010B	JAR	04/25/23 23:53	
Lead, total	<0.0040 mg/L	0.0040	1GD1463	EPA 6020A	RVV	04/28/23 21:47	
Zinc, total	<0.0200 mg/L	0.0200	1GD1463	EPA 6020A	RVV	04/28/23 21:47	
1GD2320-03 MW-4				Matrix: Water		Collected: 04/19/23 09:29	
Arsenic, total	**0.0239 mg/L**	**0.0040**	1GD1463	EPA 6020A	RVV	04/28/23 21:53	
Barium, total	**0.445 mg/L**	**0.0040**	1GD1463	EPA 6020A	RVV	04/28/23 21:53	
Cadmium, total	<0.0008 mg/L	0.0008	1GD1463	EPA 6020A	RVV	04/28/23 21:53	
Chromium, total	<0.0080 mg/L	0.0080	1GD1463	EPA 6020A	RVV	04/28/23 21:53	
Copper, total	**0.0048 mg/L**	**0.0040**	1GD1463	EPA 6020A	RVV	04/28/23 21:53	
Iron, total	**1.04 mg/L**	**0.100**	1GD1201	EPA 6010B	JAR	04/25/23 23:59	
Mercury, total	<0.00050 mg/L	0.00050	1GD1234	EPA 7470A	JAR	04/27/23 9:55	
Magnesium, total	**30.6 mg/L**	**0.100**	1GD1201	EPA 6010B	JAR	04/25/23 23:59	
Lead, total	<0.0040 mg/L	0.0040	1GD1463	EPA 6020A	RVV	04/28/23 21:53	
Zinc, total	<0.0200 mg/L	0.0200	1GD1463	EPA 6020A	RVV	04/28/23 21:53	
1GD2320-04 MW-5				Matrix: Water		Collected: 04/19/23 09:08	
Arsenic, total	<0.0040 mg/L	0.0040	1GD1463	EPA 6020A	RVV	04/28/23 21:59	
Barium, total	**0.146 mg/L**	**0.0040**	1GD1463	EPA 6020A	RVV	04/28/23 21:59	
Cadmium, total	<0.0008 mg/L	0.0008	1GD1463	EPA 6020A	RVV	04/28/23 21:59	
Chromium, total	<0.0080 mg/L	0.0080	1GD1463	EPA 6020A	RVV	04/28/23 21:59	

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Analyte	Result	MRL	Batch	Method	Analyst	Analyzed	Qualifier
1GD2320-04 MW-5				Matrix: Water		Collected: 04/19/23 09:08	
Copper, total	<0.0040 mg/L	0.0040	1GD1463	EPA 6020A	RVV	04/28/23 21:59	
Iron, total	**0.373 mg/L**	**0.100**	1GD1201	EPA 6010B	JAR	04/26/23 0:09	
Mercury, total	<0.00050 mg/L	0.00050	1GD1234	EPA 7470A	JAR	04/27/23 9:57	
Magnesium, total	**22.6 mg/L**	**0.100**	1GD1201	EPA 6010B	JAR	04/26/23 0:09	
Lead, total	<0.0040 mg/L	0.0040	1GD1463	EPA 6020A	RVV	04/28/23 21:59	
Zinc, total	<0.0200 mg/L	0.0200	1GD1463	EPA 6020A	RVV	04/28/23 21:59	
1GD2320-05 MW-7				Matrix: Water		Collected: 04/19/23 10:15	
Arsenic, total	<0.0040 mg/L	0.0040	1GD1463	EPA 6020A	RVV	05/01/23 11:01	
Barium, total	**0.159 mg/L**	**0.0040**	1GD1463	EPA 6020A	RVV	05/01/23 11:01	
Cadmium, total	<0.0008 mg/L	0.0008	1GD1463	EPA 6020A	RVV	05/01/23 11:01	
Chromium, total	<0.0080 mg/L	0.0080	1GD1463	EPA 6020A	RVV	05/01/23 11:01	
Copper, total	<0.0040 mg/L	0.0040	1GD1463	EPA 6020A	RVV	05/01/23 11:01	
Iron, total	<0.100 mg/L	0.100	1GD1201	EPA 6010B	JAR	04/26/23 0:15	
Mercury, total	<0.00050 mg/L	0.00050	1GD1234	EPA 7470A	JAR	04/27/23 9:59	
Magnesium, total	**23.8 mg/L**	**0.100**	1GD1201	EPA 6010B	JAR	04/26/23 0:15	
Lead, total	<0.0040 mg/L	0.0040	1GD1463	EPA 6020A	RVV	05/01/23 11:01	
Zinc, total	<0.0200 mg/L	0.0200	1GD1463	EPA 6020A	RVV	05/01/23 11:01	
1GD2320-06 LW-1				Matrix: Water		Collected: 04/19/23 10:58	
Acrylonitrile	<5.0 ug/L	5.0	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Surrogate: Dibromofluoromethane	*111 %*			*80-126*	MSV	04/25/23 17:25	
Surrogate: 1,2-Dichloroethane-d4	*97.3 %*			*63-138*	MSV	04/25/23 17:25	
Surrogate: Toluene-d8	*98.3 %*			*87-116*	MSV	04/25/23 17:25	
Surrogate: 4-Bromofluorobenzene	*98.4 %*			*85-111*	MSV	04/25/23 17:25	
Chloromethane	<2.0 ug/L	2.0	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Vinyl Chloride	<1.6 ug/L	1.6	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Bromomethane	<3.0 ug/L	3.0	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Chloroethane	<2.6 ug/L	2.6	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Trichlorofluoromethane	<1.7 ug/L	1.7	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
1,1-Dichloroethylene	<2.4 ug/L	2.4	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Acetone	<50.0 ug/L	50.0	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Methyl Iodide	<5.0 ug/L	5.0	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Carbon Disulfide	<4.1 ug/L	4.1	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Methylene Chloride	<5.5 ug/L	5.5	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
trans-1,2-Dichloroethylene	<2.5 ug/L	2.5	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
1,1-Dichloroethane	<2.2 ug/L	2.2	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Vinyl Acetate	<14.3 ug/L	14.3	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
cis-1,2-Dichloroethylene	<3.1 ug/L	3.1	1GD1304	EPA 8260B	MSV	04/25/23 17:25	

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Work Order: 1GD2320

Analyte	Result	MRL	Batch	Method	Analyst	Analyzed	Qualifier
1GD2320-06 LW-1				Matrix: Water		Collected: 04/19/23 10:58	
						Sample Qualifier: R-06	
2-Butanone (MEK)	<7.0 ug/L	7.0	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Bromochloromethane	<2.5 ug/L	2.5	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Chloroform	<1.8 ug/L	1.8	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
1,1,1-Trichloroethane	<1.9 ug/L	1.9	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Carbon Tetrachloride	<2.0 ug/L	2.0	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Benzene	<1.7 ug/L	1.7	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
1,2-Dichloroethane	<2.1 ug/L	2.1	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Trichloroethylene	<2.1 ug/L	2.1	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
1,2-Dichloropropane	<1.7 ug/L	1.7	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Dibromomethane	<2.6 ug/L	2.6	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Bromodichloromethane	<1.9 ug/L	1.9	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
cis-1,3-Dichloropropene	<1.8 ug/L	1.8	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
4-Methyl-2-pentanone (MIBK)	<5.2 ug/L	5.2	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Toluene	<1.7 ug/L	1.7	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
trans-1,3-Dichloropropene	<2.2 ug/L	2.2	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
1,1,2-Trichloroethane	<2.1 ug/L	2.1	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Tetrachloroethylene	<2.3 ug/L	2.3	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
2-Hexanone (MBK)	<5.9 ug/L	5.9	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Dibromochloromethane	<2.0 ug/L	2.0	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
1,2-Dibromoethane	<1.7 ug/L	1.7	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Chlorobenzene	<2.1 ug/L	2.1	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
1,1,1,2-Tetrachloroethane	<2.1 ug/L	2.1	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Ethylbenzene	<2.2 ug/L	2.2	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Xylenes, total	<6.9 ug/L	6.9	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Styrene	<2.3 ug/L	2.3	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Bromoform	<2.2 ug/L	2.2	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
1,2,3-Trichloropropane	<4.4 ug/L	4.4	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
trans-1,4-Dichloro-2-butene	<11.4 ug/L	11.4	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
1,1,2,2-Tetrachloroethane	<2.0 ug/L	2.0	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
1,4-Dichlorobenzene	<2.4 ug/L	2.4	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
1,2-Dichlorobenzene	<2.1 ug/L	2.1	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
1,2-Dibromo-3-chloropropane	<3.4 ug/L	3.4	1GD1304	EPA 8260B	MSV	04/25/23 17:25	
Surrogate: Dibromofluoromethane	*111 %*			*75-136*	MSV	04/25/23 17:25	
Surrogate: 1,2-Dichloroethane-d4	*97.3 %*			*61-142*	MSV	04/25/23 17:25	
Surrogate: Toluene-d8	*98.3 %*			*82-121*	MSV	04/25/23 17:25	
Surrogate: 4-Bromofluorobenzene	*98.4 %*			*80-116*	MSV	04/25/23 17:25	
Silver, total	<0.0040 mg/L	0.0040	1GD1463	EPA 6020A	RVV	04/28/23 22:11	

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Work Order: 1GD2320

Analyte		Result	MRL	Batch	Method	Analyst	Analyzed	Qualifier
1GD2320-06	LW-1				Matrix: Water		Collected: 04/19/23 10:58	
Arsenic, total		**0.217 mg/L**	**0.0040**	1GD1463	EPA 6020A	RVV	04/28/23 22:11	
Beryllium, total		<0.0040 mg/L	0.0040	1GD1463	EPA 6020A	RVV	04/28/23 22:11	
Cadmium, total		**0.0024 mg/L**	**0.0008**	1GD1463	EPA 6020A	RVV	04/28/23 22:11	
Cobalt, total		**0.0609 mg/L**	**0.0004**	1GD1463	EPA 6020A	RVV	04/28/23 22:11	
Chromium, total		**0.0302 mg/L**	**0.0080**	1GD1463	EPA 6020A	RVV	04/28/23 22:11	
Copper, total		**0.619 mg/L**	**0.0040**	1GD1463	EPA 6020A	RVV	04/28/23 22:11	
Nickel, total		**0.803 mg/L**	**0.0040**	1GD1463	EPA 6020A	RVV	04/28/23 22:11	
Lead, total		**0.0373 mg/L**	**0.0040**	1GD1463	EPA 6020A	RVV	04/28/23 22:11	
Antimony, total		**0.0052 mg/L**	**0.0020**	1GD1463	EPA 6020A	RVV	04/28/23 22:11	
Selenium, total		**0.0063 mg/L**	**0.0040**	1GD1463	EPA 6020A	RVV	04/28/23 22:11	
Thallium, total		<0.0020 mg/L	0.0020	1GD1463	EPA 6020A	RVV	04/28/23 22:11	
Vanadium, total		**0.0272 mg/L**	**0.0200**	1GD1463	EPA 6020A	RVV	04/28/23 22:11	
Zinc, total		**1.44 mg/L**	**0.0200**	1GD1463	EPA 6020A	RVV	04/28/23 22:11	
1GD2320-06RE1	LW-1				Matrix: Water		Collected: 04/19/23 10:58	
Barium, total		**3.14 mg/L**	**0.100**	1GD1463	EPA 6020A	RVV	05/01/23 11:07	
1GD2320-07	Duplicate				Matrix: Water		Collected: 04/19/23 09:08	
Arsenic, total		<0.0040 mg/L	0.0040	1GD1463	EPA 6020A	RVV	04/28/23 22:17	
Barium, total		**0.152 mg/L**	**0.0040**	1GD1463	EPA 6020A	RVV	04/28/23 22:17	
Cadmium, total		<0.0008 mg/L	0.0008	1GD1463	EPA 6020A	RVV	04/28/23 22:17	
Chromium, total		<0.0080 mg/L	0.0080	1GD1463	EPA 6020A	RVV	04/28/23 22:17	
Copper, total		<0.0040 mg/L	0.0040	1GD1463	EPA 6020A	RVV	04/28/23 22:17	
Iron, total		**0.453 mg/L**	**0.100**	1GD1201	EPA 6010B	JAR	04/26/23 0:32	
Mercury, total		<0.00050 mg/L	0.00050	1GD1234	EPA 7470A	JAR	04/27/23 10:01	
Magnesium, total		**22.8 mg/L**	**0.100**	1GD1201	EPA 6010B	JAR	04/26/23 0:32	
Lead, total		**0.0049 mg/L**	**0.0040**	1GD1463	EPA 6020A	RVV	04/28/23 22:17	
Zinc, total		<0.0200 mg/L	0.0200	1GD1463	EPA 6020A	RVV	04/28/23 22:17	
1GD2320-07RE2	Duplicate				Matrix: Water		Collected: 04/19/23 09:08	
Lead, total		<0.0040 mg/L	0.0040	1GE0600	EPA 6020A	RVV	05/10/23 19:01	

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Determination of Volatile Organic Compounds - Quality Control

Keystone Laboratories - Newton

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1GD1304 - EPA 5030B										
Blank (1GD1304-BLK1)				Prepared & Analyzed: 04/25/23						
Surrogate: Dibromofluoromethane	*57.6*		*ug/L*	*50.3520*		*114*	*80-126*			
Surrogate: Dibromofluoromethane	*57.6*		*"*	*50.3520*		*114*	*75-136*			
Surrogate: 1,2-Dichloroethane-d4	*50.5*		*"*	*50.4080*		*100*	*63-138*			
Surrogate: 1,2-Dichloroethane-d4	*50.5*		*"*	*50.4080*		*100*	*61-142*			
Surrogate: Toluene-d8	*49.1*		*"*	*50.2360*		*97.7*	*87-116*			
Surrogate: Toluene-d8	*49.1*		*"*	*50.2360*		*97.7*	*82-121*			
Surrogate: 4-Bromofluorobenzene	*49.9*		*"*	*50.4200*		*98.9*	*80-116*			
Surrogate: 4-Bromofluorobenzene	*49.9*		*"*	*50.4200*		*98.9*	*85-111*			
Chloromethane	ND	1.0	"							
Vinyl Chloride	ND	1.0	"							
Bromomethane	ND	1.0	"							
Chloroethane	ND	1.0	"							
Trichlorofluoromethane	ND	1.0	"							
1,1-Dichloroethylene	ND	1.0	"							
Acetone	ND	10.0	"							
Methyl Iodide	ND	1.0	"							
Carbon Disulfide	ND	1.0	"							
Methylene Chloride	ND	5.0	"							
Acrylonitrile	ND	5.0	"							
trans-1,2-Dichloroethylene	ND	1.0	"							
1,1-Dichloroethane	ND	1.0	"							
Vinyl Acetate	ND	5.0	"							
cis-1,2-Dichloroethylene	ND	1.0	"							
2-Butanone (MEK)	ND	10.0	"							
Bromochloromethane	ND	1.0	"							
Chloroform	ND	1.0	"							
1,1,1-Trichloroethane	ND	1.0	"							
Carbon Tetrachloride	ND	1.0	"							
Benzene	ND	1.0	"							
1,2-Dichloroethane	ND	1.0	"							
Trichloroethylene	ND	1.0	"							
1,2-Dichloropropane	ND	1.0	"							
Dibromomethane	ND	1.0	"							
Bromodichloromethane	ND	1.0	"							
cis-1,3-Dichloropropene	ND	1.0	"							
4-Methyl-2-pentanone (MIBK)	ND	5.0	"							
Toluene	ND	1.0	"							
trans-1,3-Dichloropropene	ND	1.0	"							

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Determination of Volatile Organic Compounds - Quality Control

Keystone Laboratories - Newton

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1GD1304 - EPA 5030B										
Blank (1GD1304-BLK1)				Prepared & Analyzed: 04/25/23						
1,1,2-Trichloroethane	ND	1.0	ug/L							
Tetrachloroethylene	ND	1.0	"							
2-Hexanone (MBK)	ND	5.0	"							
Dibromochloromethane	ND	1.0	"							
1,2-Dibromoethane	ND	1.0	"							
Chlorobenzene	ND	1.0	"							
1,1,1,2-Tetrachloroethane	ND	1.0	"							
Ethylbenzene	ND	1.0	"							
Xylenes, total	ND	2.0	"							
Styrene	ND	1.0	"							
Bromoform	ND	1.0	"							
1,2,3-Trichloropropane	ND	1.0	"							
trans-1,4-Dichloro-2-butene	ND	5.0	"							
1,1,2,2-Tetrachloroethane	ND	1.0	"							
1,4-Dichlorobenzene	ND	1.0	"							
1,2-Dichlorobenzene	ND	1.0	"							
1,2-Dibromo-3-chloropropane	ND	5.0	"							
LCS (1GD1304-BS1)				Prepared & Analyzed: 04/25/23						
Surrogate: Dibromofluoromethane	*56.6*		*ug/L*	*50.3520*		*112*	*80-126*			
Surrogate: Dibromofluoromethane	*56.6*		*"*	*50.3520*		*112*	*75-136*			
Surrogate: 1,2-Dichloroethane-d4	*49.4*		*"*	*50.4080*		*98.0*	*61-142*			
Surrogate: 1,2-Dichloroethane-d4	*49.4*		*"*	*50.4080*		*98.0*	*63-138*			
Surrogate: Toluene-d8	*50.3*		*"*	*50.2360*		*100*	*82-121*			
Surrogate: Toluene-d8	*50.3*		*"*	*50.2360*		*100*	*87-116*			
Surrogate: 4-Bromofluorobenzene	*49.2*		*"*	*50.4200*		*97.6*	*85-111*			
Surrogate: 4-Bromofluorobenzene	*49.2*		*"*	*50.4200*		*97.6*	*80-116*			
Chloromethane	29.93	1.0	"	30.0000		99.8	63-155			
Vinyl Chloride	29.82	1.0	"	30.0000		99.4	70-154			
Bromomethane	33.70	1.0	"	30.0000		112	52-176			
Chloroethane	35.25	1.0	"	30.0000		118	72-148			
Trichlorofluoromethane	31.86	1.0	"	30.0000		106	70-152			
1,1-Dichloroethylene	56.76	1.0	"	50.0000		114	70-148			
Acetone	110.5	10.0	"	104.100		106	43-172			
Methyl Iodide	134.9	1.0	"	112.563		120	69-170			
Carbon Disulfide	127.2	1.0	"	106.400		120	72-162			
Methylene Chloride	52.06	5.0	"	50.0000		104	68-142			
Acrylonitrile	105.2	5.0	"	100.500		105	67-144			
trans-1,2-Dichloroethylene	54.55	1.0	"	50.0000		109	66-148			

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HLW Engineering
PO Box 314
Story City, IA 50248

Work Order: 1GD2320

Determination of Volatile Organic Compounds - Quality Control

Keystone Laboratories - Newton

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1GD1304 - EPA 5030B										
LCS (1GD1304-BS1)				Prepared & Analyzed: 04/25/23						
1,1-Dichloroethane	54.60	1.0	ug/L	50.0000		109	66-143			
Vinyl Acetate	67.21	5.0	"	103.300		65.1	43-153			
cis-1,2-Dichloroethylene	53.11	1.0	"	50.0000		106	71-149			
2-Butanone (MEK)	104.2	10.0	"	106.200		98.2	52-159			
Bromochloromethane	54.03	1.0	"	50.0000		108	69-143			
Chloroform	53.30	1.0	"	50.0000		107	69-144			
1,1,1-Trichloroethane	48.94	1.0	"	49.9750		97.9	62-129			
Carbon Tetrachloride	62.08	1.0	"	50.0000		124	63-141			
Benzene	52.07	1.0	"	50.0000		104	71-134			
1,2-Dichloroethane	50.89	1.0	"	50.0000		102	72-132			
Trichloroethylene	44.50	1.0	"	50.0000		89.0	71-135			
1,2-Dichloropropane	51.86	1.0	"	50.0000		104	69-136			
Dibromomethane	55.09	1.0	"	50.0000		110	73-147			
Bromodichloromethane	51.93	1.0	"	50.0000		104	68-129			
cis-1,3-Dichloropropene	52.15	1.0	"	50.3250		104	65-134			
4-Methyl-2-pentanone (MIBK)	87.22	5.0	"	103.100		84.6	58-147			
Toluene	52.06	1.0	"	50.0000		104	72-133			
trans-1,3-Dichloropropene	50.94	1.0	"	50.4250		101	67-130			
1,1,2-Trichloroethane	51.86	1.0	"	50.0000		104	69-135			
Tetrachloroethylene	49.39	1.0	"	50.0000		98.8	69-130			
2-Hexanone (MBK)	88.30	5.0	"	110.300		80.1	55-144			
Dibromochloromethane	57.28	1.0	"	49.5000		116	73-127			
1,2-Dibromoethane	51.24	1.0	"	50.0000		102	67-132			
Chlorobenzene	50.21	1.0	"	50.0000		100	72-123			
1,1,1,2-Tetrachloroethane	54.75	1.0	"	50.0000		110	73-127			
Ethylbenzene	48.20	1.0	"	50.0000		96.4	71-127			
Xylenes, total	144.8	2.0	"	150.000		96.6	74-127			
Styrene	48.68	1.0	"	50.0000		97.4	66-126			
Bromoform	63.88	1.0	"	50.0000		128	68-130			
1,2,3-Trichloropropane	52.11	1.0	"	50.0000		104	63-136			
trans-1,4-Dichloro-2-butene	83.70	5.0	"	102.400		81.7	54-134			
1,1,2,2-Tetrachloroethane	49.83	1.0	"	49.8500		100	61-131			
1,4-Dichlorobenzene	50.11	1.0	"	50.0000		100	70-129			
1,2-Dichlorobenzene	49.52	1.0	"	50.0000		99.0	69-126			
1,2-Dibromo-3-chloropropane	48.52	5.0	"	50.0000		97.0	50-143			

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Work Order: 1GD2320

Determination of Volatile Organic Compounds - Quality Control

Keystone Laboratories - Newton

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1GD1304 - EPA 5030B										
LCS Dup (1GD1304-BSD1)				Prepared & Analyzed: 04/25/23						
Surrogate: Dibromofluoromethane	*55.7*		*ug/L*	*50.3520*		*111*	*75-136*			
Surrogate: Dibromofluoromethane	*55.7*		*"*	*50.3520*		*111*	*80-126*			
Surrogate: 1,2-Dichloroethane-d4	*48.9*		*"*	*50.4080*		*97.1*	*63-138*			
Surrogate: 1,2-Dichloroethane-d4	*48.9*		*"*	*50.4080*		*97.1*	*61-142*			
Surrogate: Toluene-d8	*50.6*		*"*	*50.2360*		*101*	*82-121*			
Surrogate: Toluene-d8	*50.6*		*"*	*50.2360*		*101*	*87-116*			
Surrogate: 4-Bromofluorobenzene	*49.4*		*"*	*50.4200*		*98.1*	*85-111*			
Surrogate: 4-Bromofluorobenzene	*49.4*		*"*	*50.4200*		*98.1*	*80-116*			
Chloromethane	27.72	1.0	"	30.0000		92.4	63-155	7.67	24	
Vinyl Chloride	27.41	1.0	"	30.0000		91.4	70-154	8.42	25	
Bromomethane	32.24	1.0	"	30.0000		107	52-176	4.43	27	
Chloroethane	32.86	1.0	"	30.0000		110	72-148	7.02	25	
Trichlorofluoromethane	29.73	1.0	"	30.0000		99.1	70-152	6.92	26	
1,1-Dichloroethylene	52.86	1.0	"	50.0000		106	70-148	7.12	24	
Acetone	111.4	10.0	"	104.100		107	43-172	0.775	30	
Methyl Iodide	131.9	1.0	"	112.563		117	69-170	2.23	30	
Carbon Disulfide	118.5	1.0	"	106.400		111	72-162	7.10	24	
Methylene Chloride	50.02	5.0	"	50.0000		100	68-142	4.00	21	
Acrylonitrile	105.2	5.0	"	100.500		105	67-144	0.0570	24	
trans-1,2-Dichloroethylene	52.04	1.0	"	50.0000		104	66-148	4.71	27	
1,1-Dichloroethane	52.62	1.0	"	50.0000		105	66-143	3.69	24	
Vinyl Acetate	81.90	5.0	"	103.300		79.3	43-153	19.7	30	
cis-1,2-Dichloroethylene	52.42	1.0	"	50.0000		105	71-149	1.31	26	
2-Butanone (MEK)	103.8	10.0	"	106.200		97.7	52-159	0.423	27	
Bromochloromethane	53.22	1.0	"	50.0000		106	69-143	1.51	23	
Chloroform	50.97	1.0	"	50.0000		102	69-144	4.47	23	
1,1,1-Trichloroethane	46.49	1.0	"	49.9750		93.0	62-129	5.13	24	
Carbon Tetrachloride	58.44	1.0	"	50.0000		117	63-141	6.04	25	
Benzene	50.10	1.0	"	50.0000		100	71-134	3.86	24	
1,2-Dichloroethane	50.14	1.0	"	50.0000		100	72-132	1.48	24	
Trichloroethylene	42.43	1.0	"	50.0000		84.9	71-135	4.76	24	
1,2-Dichloropropane	50.55	1.0	"	50.0000		101	69-136	2.56	24	
Dibromomethane	54.25	1.0	"	50.0000		108	73-147	1.54	25	
Bromodichloromethane	50.40	1.0	"	50.0000		101	68-129	2.99	22	
cis-1,3-Dichloropropene	50.33	1.0	"	50.3250		100	65-134	3.55	23	
4-Methyl-2-pentanone (MIBK)	90.80	5.0	"	103.100		88.1	58-147	4.02	27	
Toluene	50.14	1.0	"	50.0000		100	72-133	3.76	24	
trans-1,3-Dichloropropene	50.67	1.0	"	50.4250		100	67-130	0.531	24	

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HLW Engineering
PO Box 314
Story City, IA 50248

Work Order: 1GD2320

Determination of Volatile Organic Compounds - Quality Control

Keystone Laboratories - Newton

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1GD1304 - EPA 5030B										
LCS Dup (1GD1304-BSD1)				Prepared & Analyzed: 04/25/23						
1,1,2-Trichloroethane	51.80	1.0	ug/L	50.0000		104	69-135	0.116	23	
Tetrachloroethylene	47.56	1.0	"	50.0000		95.1	69-130	3.78	25	
2-Hexanone (MBK)	92.69	5.0	"	110.300		84.0	55-144	4.85	25	
Dibromochloromethane	57.50	1.0	"	49.5000		116	73-127	0.383	22	
1,2-Dibromoethane	51.90	1.0	"	50.0000		104	67-132	1.28	24	
Chlorobenzene	49.05	1.0	"	50.0000		98.1	72-123	2.34	23	
1,1,1,2-Tetrachloroethane	53.99	1.0	"	50.0000		108	73-127	1.40	24	
Ethylbenzene	46.72	1.0	"	50.0000		93.4	71-127	3.12	26	
Xylenes, total	141.0	2.0	"	150.000		94.0	74-127	2.67	25	
Styrene	49.32	1.0	"	50.0000		98.6	66-126	1.31	23	
Bromoform	63.78	1.0	"	50.0000		128	68-130	0.157	23	
1,2,3-Trichloropropane	52.24	1.0	"	50.0000		104	63-136	0.249	24	
trans-1,4-Dichloro-2-butene	85.29	5.0	"	102.400		83.3	54-134	1.88	27	
1,1,2,2-Tetrachloroethane	50.35	1.0	"	49.8500		101	61-131	1.04	29	
1,4-Dichlorobenzene	48.82	1.0	"	50.0000		97.6	70-129	2.61	24	
1,2-Dichlorobenzene	48.99	1.0	"	50.0000		98.0	69-126	1.08	26	
1,2-Dibromo-3-chloropropane	48.75	5.0	"	50.0000		97.5	50-143	0.473	30	
Matrix Spike (1GD1304-MS1)		**Source: 1GD2320-01**		Prepared & Analyzed: 04/25/23						
Surrogate: Dibromofluoromethane	*543*		*ug/L*	*503.520*		*108*	*80-126*			
Surrogate: Dibromofluoromethane	*543*		*"*	*503.520*		*108*	*75-136*			
Surrogate: 1,2-Dichloroethane-d4	*459*		*"*	*504.080*		*91.1*	*61-142*			
Surrogate: 1,2-Dichloroethane-d4	*459*		*"*	*504.080*		*91.1*	*63-138*			
Surrogate: Toluene-d8	*499*		*"*	*502.360*		*99.3*	*87-116*			
Surrogate: Toluene-d8	*499*		*"*	*502.360*		*99.3*	*82-121*			
Surrogate: 4-Bromofluorobenzene	*494*		*"*	*504.200*		*98.0*	*85-111*			
Surrogate: 4-Bromofluorobenzene	*494*		*"*	*504.200*		*98.0*	*80-116*			
Chloromethane	265.4	10.0	"	300.000	ND	88.5	61-152			
Vinyl Chloride	284.3	10.0	"	300.000	ND	94.8	66-149			
Bromomethane	276.4	10.0	"	300.000	ND	92.1	43-171			
Chloroethane	315.8	10.0	"	300.000	ND	105	69-148			
Trichlorofluoromethane	314.7	10.0	"	300.000	ND	105	62-163			
1,1-Dichloroethylene	535.8	10.0	"	500.000	ND	107	70-148			
Acetone	1037	100	"	1041.00	ND	99.6	45-173			
Methyl Iodide	1060	10.0	"	1125.63	ND	94.2	62-167			
Carbon Disulfide	1181	10.0	"	1064.00	ND	111	71-163			
Methylene Chloride	472.0	50.0	"	500.000	ND	94.4	69-140			
Acrylonitrile	917.7	50.0	"	1005.00	ND	91.3	58-151			
trans-1,2-Dichloroethylene	506.3	10.0	"	500.000	ND	101	69-144			

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Story City, IA 50248

Work Order: 1GD2320

Determination of Volatile Organic Compounds - Quality Control

Keystone Laboratories - Newton

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1GD1304 - EPA 5030B										
Matrix Spike (1GD1304-MS1)	**Source: 1GD2320-01**			Prepared & Analyzed: 04/25/23						
1,1-Dichloroethane	501.3	10.0	ug/L	500.000	ND	100	70-138			
Vinyl Acetate	802.5	50.0	"	1033.00	ND	77.7	58-142			
cis-1,2-Dichloroethylene	493.3	10.0	"	500.000	ND	98.7	68-151			
2-Butanone (MEK)	891.3	100	"	1062.00	ND	83.9	50-160			
Bromochloromethane	498.9	10.0	"	500.000	ND	99.8	65-143			
Chloroform	492.6	10.0	"	500.000	ND	98.5	71-143			
1,1,1-Trichloroethane	465.5	10.0	"	499.750	ND	93.1	63-133			
Carbon Tetrachloride	588.8	10.0	"	500.000	ND	118	63-142			
Benzene	508.0	10.0	"	500.000	ND	102	69-133			
1,2-Dichloroethane	491.6	10.0	"	500.000	ND	98.3	63-138			
Trichloroethylene	425.0	10.0	"	500.000	ND	85.0	71-133			
1,2-Dichloropropane	500.2	10.0	"	500.000	ND	100	69-132			
Dibromomethane	532.4	10.0	"	500.000	ND	106	70-147			
Bromodichloromethane	490.6	10.0	"	500.000	ND	98.1	67-130			
cis-1,3-Dichloropropene	490.9	10.0	"	503.250	ND	97.5	61-126			
4-Methyl-2-pentanone (MIBK)	821.1	50.0	"	1031.00	ND	79.6	55-147			
Toluene	510.2	10.0	"	500.000	ND	102	71-133			
trans-1,3-Dichloropropene	482.0	10.0	"	504.250	ND	95.6	63-124			
1,1,2-Trichloroethane	504.9	10.0	"	500.000	ND	101	69-133			
Tetrachloroethylene	503.1	10.0	"	500.000	ND	101	70-124			
2-Hexanone (MBK)	833.8	50.0	"	1103.00	ND	75.6	53-141			
Dibromochloromethane	556.7	10.0	"	495.000	ND	112	74-122			
1,2-Dibromoethane	499.9	10.0	"	500.000	ND	100	66-127			
Chlorobenzene	499.7	10.0	"	500.000	ND	99.9	76-116			
1,1,1,2-Tetrachloroethane	539.6	10.0	"	500.000	ND	108	77-121			
Ethylbenzene	478.9	10.0	"	500.000	ND	95.8	73-124			
Xylenes, total	1436	20.0	"	1500.00	ND	95.7	75-123			
Styrene	488.1	10.0	"	500.000	ND	97.6	70-120			
Bromoform	595.0	10.0	"	500.000	ND	119	70-124			
1,2,3-Trichloropropane	504.3	10.0	"	500.000	ND	101	62-135			
trans-1,4-Dichloro-2-butene	797.8	50.0	"	1024.00	ND	77.9	50-120			
1,1,2,2-Tetrachloroethane	523.2	10.0	"	498.500	ND	105	63-126			
1,4-Dichlorobenzene	492.6	10.0	"	500.000	ND	98.5	72-119			
1,2-Dichlorobenzene	486.1	10.0	"	500.000	ND	97.2	71-117			
1,2-Dibromo-3-chloropropane	450.3	50.0	"	500.000	ND	90.1	49-134			

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Determination of Volatile Organic Compounds - Quality Control

Keystone Laboratories - Newton

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1GD1304 - EPA 5030B										
Matrix Spike Dup (1GD1304-MSD1)	**Source: 1GD2320-01**			Prepared & Analyzed: 04/25/23						
Surrogate: Dibromofluoromethane	*541*		*ug/L*	*503.520*		*107*	*75-136*			
Surrogate: Dibromofluoromethane	*541*		*"*	*503.520*		*107*	*80-126*			
Surrogate: 1,2-Dichloroethane-d4	*462*		*"*	*504.080*		*91.6*	*61-142*			
Surrogate: 1,2-Dichloroethane-d4	*462*		*"*	*504.080*		*91.6*	*63-138*			
Surrogate: Toluene-d8	*498*		*"*	*502.360*		*99.2*	*87-116*			
Surrogate: Toluene-d8	*498*		*"*	*502.360*		*99.2*	*82-121*			
Surrogate: 4-Bromofluorobenzene	*496*		*"*	*504.200*		*98.3*	*80-116*			
Surrogate: 4-Bromofluorobenzene	*496*		*"*	*504.200*		*98.3*	*85-111*			
Chloromethane	273.1	10.0	"	300.000	ND	91.0	61-152	2.86	26	
Vinyl Chloride	285.8	10.0	"	300.000	ND	95.3	66-149	0.526	23	
Bromomethane	324.8	10.0	"	300.000	ND	108	43-171	16.1	29	
Chloroethane	327.0	10.0	"	300.000	ND	109	69-148	3.48	25	
Trichlorofluoromethane	311.0	10.0	"	300.000	ND	104	62-163	1.18	25	
1,1-Dichloroethylene	532.2	10.0	"	500.000	ND	106	70-148	0.674	22	
Acetone	1076	100	"	1041.00	ND	103	45-173	3.77	30	
Methyl Iodide	1240	10.0	"	1125.63	ND	110	62-167	15.6	24	
Carbon Disulfide	1179	10.0	"	1064.00	ND	111	71-163	0.220	22	
Methylene Chloride	477.3	50.0	"	500.000	ND	95.5	69-140	1.12	19	
Acrylonitrile	953.3	50.0	"	1005.00	ND	94.9	58-151	3.81	15	
trans-1,2-Dichloroethylene	503.2	10.0	"	500.000	ND	101	69-144	0.614	22	
1,1-Dichloroethane	500.6	10.0	"	500.000	ND	100	70-138	0.140	20	
Vinyl Acetate	899.9	50.0	"	1033.00	ND	87.1	58-142	11.4	24	
cis-1,2-Dichloroethylene	496.8	10.0	"	500.000	ND	99.4	68-151	0.707	22	
2-Butanone (MEK)	909.7	100	"	1062.00	ND	85.7	50-160	2.04	23	
Bromochloromethane	508.3	10.0	"	500.000	ND	102	65-143	1.87	22	
Chloroform	495.6	10.0	"	500.000	ND	99.1	71-143	0.607	21	
1,1,1-Trichloroethane	467.4	10.0	"	499.750	ND	93.5	63-133	0.407	23	
Carbon Tetrachloride	590.1	10.0	"	500.000	ND	118	63-142	0.221	22	
Benzene	503.6	10.0	"	500.000	ND	101	69-133	0.870	18	
1,2-Dichloroethane	490.6	10.0	"	500.000	ND	98.1	63-138	0.204	20	
Trichloroethylene	428.5	10.0	"	500.000	ND	85.7	71-133	0.820	23	
1,2-Dichloropropane	505.3	10.0	"	500.000	ND	101	69-132	1.01	20	
Dibromomethane	541.0	10.0	"	500.000	ND	108	70-147	1.60	22	
Bromodichloromethane	500.8	10.0	"	500.000	ND	100	67-130	2.06	21	
cis-1,3-Dichloropropene	496.0	10.0	"	503.250	ND	98.6	61-126	1.03	21	
4-Methyl-2-pentanone (MIBK)	854.0	50.0	"	1031.00	ND	82.8	55-147	3.93	23	
Toluene	510.4	10.0	"	500.000	ND	102	71-133	0.0392	19	
trans-1,3-Dichloropropene	490.7	10.0	"	504.250	ND	97.3	63-124	1.79	21	

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Determination of Volatile Organic Compounds - Quality Control

Keystone Laboratories - Newton

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1GD1304 - EPA 5030B										
Matrix Spike Dup (1GD1304-MSD1)	**Source: 1GD2320-01**			Prepared & Analyzed: 04/25/23						
1,1,2-Trichloroethane	510.4	10.0	ug/L	500.000	ND	102	69-133	1.08	19	
Tetrachloroethylene	496.8	10.0	"	500.000	ND	99.4	70-124	1.26	24	
2-Hexanone (MBK)	870.1	50.0	"	1103.00	ND	78.9	53-141	4.26	24	
Dibromochloromethane	553.6	10.0	"	495.000	ND	112	74-122	0.558	21	
1,2-Dibromoethane	511.5	10.0	"	500.000	ND	102	66-127	2.29	23	
Chlorobenzene	495.0	10.0	"	500.000	ND	99.0	76-116	0.945	21	
1,1,1,2-Tetrachloroethane	539.4	10.0	"	500.000	ND	108	77-121	0.0371	25	
Ethylbenzene	478.8	10.0	"	500.000	ND	95.8	73-124	0.0209	20	
Xylenes, total	1437	20.0	"	1500.00	ND	95.8	75-123	0.0696	20	
Styrene	488.9	10.0	"	500.000	ND	97.8	70-120	0.164	23	
Bromoform	608.6	10.0	"	500.000	ND	122	70-124	2.26	22	
1,2,3-Trichloropropane	518.2	10.0	"	500.000	ND	104	62-135	2.72	28	
trans-1,4-Dichloro-2-butene	818.3	50.0	"	1024.00	ND	79.9	50-120	2.54	26	
1,1,2,2-Tetrachloroethane	519.5	10.0	"	498.500	ND	104	63-126	0.710	24	
1,4-Dichlorobenzene	487.6	10.0	"	500.000	ND	97.5	72-119	1.02	24	
1,2-Dichlorobenzene	476.8	10.0	"	500.000	ND	95.4	71-117	1.93	24	
1,2-Dibromo-3-chloropropane	449.9	50.0	"	500.000	ND	90.0	49-134	0.0889	28	

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Determination of Conventional Chemistry Parameters - Quality Control

Keystone Laboratories - Newton

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1GE0006 - Wet Chem Preparation										
Blank (1GE0006-BLK1)				Prepared: 05/01/23 Analyzed: 05/02/23						
COD, total	ND	20	mg/L							
LCS (1GE0006-BS1)				Prepared: 05/01/23 Analyzed: 05/02/23						
COD, total	103	27	mg/L	100.000		103	90-110			
Matrix Spike (1GE0006-MS1)		**Source: 1GD2260-01**		Prepared: 05/01/23 Analyzed: 05/02/23						
COD, total	137	27	mg/L	100.000	40.1	96.6	90-110			
Matrix Spike Dup (1GE0006-MSD1)		**Source: 1GD2260-01**		Prepared: 05/01/23 Analyzed: 05/02/23						
COD, total	127	27	mg/L	100.000	40.1	87.4	90-110	6.96	10	QM-07
Batch 1GE0259 - General Prep HPLC/IC										
Blank (1GE0259-BLK1)				Prepared & Analyzed: 05/04/23						
Nitrogen, Ammonia	ND	1.00	mg/L							
Blank (1GE0259-BLK2)				Prepared & Analyzed: 05/04/23						
Nitrogen, Ammonia	ND	1.00	mg/L							
LCS (1GE0259-BS1)				Prepared & Analyzed: 05/04/23						
Nitrogen, Ammonia	4.83	1.00	mg/L	5.00000		96.6	90-114			
LCS (1GE0259-BS2)				Prepared & Analyzed: 05/04/23						
Nitrogen, Ammonia	4.97	1.00	mg/L	5.00000		99.3	90-114			
Matrix Spike (1GE0259-MS1)		**Source: 1GD2256-02**		Prepared & Analyzed: 05/04/23						
Nitrogen, Ammonia	4.70	1.00	mg/L	5.00000	ND	94.0	84-115			

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Determination of Conventional Chemistry Parameters - Quality Control

Keystone Laboratories - Newton

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1GE0259 - General Prep HPLC/IC										
Matrix Spike (1GE0259-MS2)		**Source: 1GD2341-02**		Prepared & Analyzed: 05/04/23						
Nitrogen, Ammonia	5.39	1.00	mg/L	5.00000	0.477	98.2	84-115			
Matrix Spike Dup (1GE0259-MSD1)		**Source: 1GD2256-02**		Prepared & Analyzed: 05/04/23						
Nitrogen, Ammonia	4.94	1.00	mg/L	5.00000	ND	98.8	84-115	5.00	20	
Matrix Spike Dup (1GE0259-MSD2)		**Source: 1GD2341-02**		Prepared & Analyzed: 05/04/23						
Nitrogen, Ammonia	5.50	1.00	mg/L	5.00000	0.477	100	84-115	2.01	20	

Determination of Inorganic Anions - Quality Control

Keystone Laboratories - Newton

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1GD1314 - General Prep HPLC/IC										
Blank (1GD1314-BLK1)				Prepared & Analyzed: 04/25/23						
Chloride	ND	1.0	mg/L							
Blank (1GD1314-BLK2)				Prepared & Analyzed: 04/25/23						
Chloride	ND	1.0	mg/L							
Blank (1GD1314-BLK3)				Prepared & Analyzed: 04/25/23						
Chloride	ND	1.0	mg/L							
LCS (1GD1314-BS1)				Prepared & Analyzed: 04/25/23						
Chloride	14.89	1.0	mg/L	15.2642		97.5	80-120			
LCS (1GD1314-BS2)				Prepared & Analyzed: 04/25/23						
Chloride	14.90	1.0	mg/L	15.2642		97.6	80-120			
LCS Dup (1GD1314-BSD1)				Prepared & Analyzed: 04/25/23						
Chloride	14.79	1.0	mg/L	15.2642		96.9	80-120	0.647	10	
LCS Dup (1GD1314-BSD2)				Prepared & Analyzed: 04/25/23						
Chloride	14.88	1.0	mg/L	15.2642		97.5	80-120	0.175	10	
MRL Check (1GD1314-MRL1)				Prepared & Analyzed: 04/25/23						
Chloride	0.60	1.0	mg/L	0.616331		97.4	50-150			
Matrix Spike (1GD1314-MS1)		**Source: 1GD1286-01**		Prepared & Analyzed: 04/25/23						
Chloride	446.3	10.0	mg/L	152.642	290.7	102	81-116			
Matrix Spike (1GD1314-MS2)		**Source: 1GD2457-05**		Prepared & Analyzed: 04/25/23						
Chloride	110.2	5.0	mg/L	76.3210	33.93	100	81-116			

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Determination of Inorganic Anions - Quality Control

Keystone Laboratories - Newton

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1GD1314 - General Prep HPLC/IC										
Matrix Spike Dup (1GD1314-MSD1)	**Source: 1GD1286-01**			Prepared & Analyzed: 04/25/23						
Chloride	446.4	10.0	mg/L	152.642	290.7	102	81-116	0.0179	10	
Matrix Spike Dup (1GD1314-MSD2)	**Source: 1GD2457-05**			Prepared & Analyzed: 04/25/23						
Chloride	109.6	5.0	mg/L	76.3210	33.93	99.1	81-116	0.610	10	

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Determination of Total Metals - Quality Control

Keystone Laboratories - Newton

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1GD1201 - EPA 3010A Digestion (Water)										
Blank (1GD1201-BLK1)				Prepared: 04/24/23 Analyzed: 04/25/23						
Iron, total	ND	0.100	mg/L							
Magnesium, total	ND	0.100	"							
LCS (1GD1201-BS1)				Prepared: 04/24/23 Analyzed: 04/25/23						
Iron, total	2.44	0.100	mg/L	2.20000		111	80-120			
Magnesium, total	2.25	0.100	"	2.20000		102	80-120			
Matrix Spike (1GD1201-MS1)		**Source: 1GD1664-01**		Prepared: 04/24/23 Analyzed: 04/25/23						
Iron, total	11.8	0.100	mg/L	2.20000	9.90	85.7	75-125			
Magnesium, total	14.0	0.100	"	2.20000	12.2	82.8	75-125			
Matrix Spike Dup (1GD1201-MSD1)		**Source: 1GD1664-01**		Prepared: 04/24/23 Analyzed: 04/25/23						
Iron, total	12.5	0.100	mg/L	2.20000	9.90	120	75-125	6.15	20	
Magnesium, total	14.9	0.100	"	2.20000	12.2	125	75-125	6.48	20	
Post Spike (1GD1201-PS1)		**Source: 1GD1664-01**		Prepared: 04/24/23 Analyzed: 04/25/23						
Iron, total	18.8		mg/L	8.80000	9.90	102	80-120			
Magnesium, total	20.9		"	8.80000	12.2	99.5	80-120			
Batch 1GD1234 - EPA 7470A Hg Water										
Blank (1GD1234-BLK1)				Prepared: 04/25/23 Analyzed: 04/27/23						
Mercury, total	ND	0.00050	mg/L							
LCS (1GD1234-BS1)				Prepared: 04/25/23 Analyzed: 04/27/23						
Mercury, total	0.00245	0.00050	mg/L	0.00250000		97.9	80-120			

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Determination of Total Metals - Quality Control

Keystone Laboratories - Newton

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1GD1234 - EPA 7470A Hg Water										
Matrix Spike (1GD1234-MS1)	**Source: 1GD2273-01**			Prepared: 04/25/23 Analyzed: 04/27/23						
Mercury, total	0.00228	0.00050	mg/L	0.00250000	ND	91.1	75-125			
Matrix Spike Dup (1GD1234-MSD1)	**Source: 1GD2273-01**			Prepared: 04/25/23 Analyzed: 04/27/23						
Mercury, total	0.00207	0.00050	mg/L	0.00250000	ND	83.0	75-125	9.30	20	
Batch 1GD1463 - EPA 3005A Total Recoverable Metals										
Blank (1GD1463-BLK1)				Prepared & Analyzed: 04/28/23						
Antimony, total	ND	0.0020	mg/L							
Arsenic, total	ND	0.0040	"							
Barium, total	ND	0.0040	"							
Beryllium, total	ND	0.0040	"							
Cadmium, total	ND	0.0008	"							
Chromium, total	ND	0.0080	"							
Cobalt, total	ND	0.0004	"							
Copper, total	ND	0.0040	"							
Lead, total	ND	0.0040	"							
Nickel, total	ND	0.0040	"							
Selenium, total	ND	0.0040	"							
Silver, total	ND	0.0040	"							
Thallium, total	ND	0.0020	"							
Vanadium, total	ND	0.0200	"							
Zinc, total	ND	0.0200	"							
LCS (1GD1463-BS1)				Prepared & Analyzed: 04/28/23						
Antimony, total	0.0950	0.0020	mg/L	0.100000		95.0	80-120			
Arsenic, total	0.0948	0.0040	"	0.100000		94.8	80-120			
Barium, total	0.102	0.0040	"	0.100000		102	80-120			
Beryllium, total	0.0952	0.0040	"	0.100000		95.2	80-120			
Cadmium, total	0.0963	0.0008	"	0.100000		96.3	80-120			
Chromium, total	0.0961	0.0080	"	0.100000		96.1	80-120			
Cobalt, total	0.0995	0.0004	"	0.100000		99.5	80-120			
Copper, total	0.0990	0.0040	"	0.100000		99.0	80-120			
Lead, total	0.0961	0.0040	"	0.100000		96.1	80-120			
Nickel, total	0.0983	0.0040	"	0.100000		98.3	80-120			
Selenium, total	0.0908	0.0040	"	0.100000		90.8	80-120			
Silver, total	0.0947	0.0040	"	0.100000		94.7	80-120			
Thallium, total	0.0808	0.0020	"	0.100000		80.8	80-120			
Vanadium, total	0.104	0.0200	"	0.100000		104	80-120			
Zinc, total	0.0978	0.0200	"	0.100000		97.8	80-120			

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Determination of Total Metals - Quality Control

Keystone Laboratories - Newton

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1GD1463 - EPA 3005A Total Recoverable Metals										
Matrix Spike (1GD1463-MS1)		**Source: 1GD2712-03**		Prepared & Analyzed: 04/28/23						
Antimony, total	0.0969	0.0020	mg/L	0.100000	ND	96.9	75-125			
Arsenic, total	0.101	0.0040	"	0.100000	0.0011	99.5	75-125			
Barium, total	0.137	0.0040	"	0.100000	0.0323	105	75-125			
Beryllium, total	0.0955	0.0040	"	0.100000	ND	95.5	75-125			
Cadmium, total	0.0941	0.0008	"	0.100000	ND	94.1	75-125			
Chromium, total	0.0947	0.0080	"	0.100000	ND	94.7	75-125			
Cobalt, total	0.100	0.0004	"	0.100000	ND	100	75-125			
Copper, total	0.0918	0.0040	"	0.100000	ND	91.8	75-125			
Lead, total	0.0900	0.0040	"	0.100000	ND	90.0	75-125			
Nickel, total	0.0963	0.0040	"	0.100000	ND	96.3	75-125			
Selenium, total	0.0959	0.0040	"	0.100000	ND	95.9	75-125			
Silver, total	0.0936	0.0040	"	0.100000	ND	93.6	75-125			
Thallium, total	0.0756	0.0020	"	0.100000	ND	75.6	75-125			
Vanadium, total	0.101	0.0200	"	0.100000	ND	101	75-125			
Zinc, total	0.0909	0.0200	"	0.100000	ND	90.9	75-125			
Matrix Spike Dup (1GD1463-MSD1)		**Source: 1GD2712-03**		Prepared: 04/28/23 Analyzed: 05/01/23						
Antimony, total	0.0934	0.0020	mg/L	0.100000	ND	93.4	75-125	3.67	20	
Arsenic, total	0.0955	0.0040	"	0.100000	0.0011	94.4	75-125	5.18	20	
Barium, total	0.125	0.0040	"	0.100000	0.0323	92.9	75-125	9.04	20	
Beryllium, total	0.0951	0.0040	"	0.100000	ND	95.1	75-125	0.382	20	
Cadmium, total	0.0902	0.0008	"	0.100000	ND	90.2	75-125	4.27	20	
Chromium, total	0.0918	0.0080	"	0.100000	ND	91.8	75-125	3.06	20	
Cobalt, total	0.0972	0.0004	"	0.100000	ND	97.2	75-125	3.26	20	
Copper, total	0.0881	0.0040	"	0.100000	ND	88.1	75-125	4.08	20	
Lead, total	0.0841	0.0040	"	0.100000	ND	84.1	75-125	6.85	20	
Nickel, total	0.0945	0.0040	"	0.100000	ND	94.5	75-125	1.82	20	
Selenium, total	0.0858	0.0040	"	0.100000	ND	85.8	75-125	11.1	20	
Silver, total	0.0876	0.0040	"	0.100000	ND	87.6	75-125	6.65	20	
Thallium, total	0.0700	0.0020	"	0.100000	ND	70.0	75-125	7.78	20	QM-07
Vanadium, total	0.0987	0.0200	"	0.100000	ND	98.7	75-125	2.07	20	
Zinc, total	0.0846	0.0200	"	0.100000	ND	84.6	75-125	7.20	20	

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HLW Engineering
PO Box 314
Story City, IA 50248

Work Order: 1GD2320

Determination of Total Metals - Quality Control

Keystone Laboratories - Newton

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1GD1463 - EPA 3005A Total Recoverable Metals										
Post Spike (1GD1463-PS1)		**Source: 1GD2712-03**		Prepared & Analyzed: 04/28/23						
Antimony, total	0.0785		mg/L	0.0800000	0.00003	98.1	80-120			
Arsenic, total	0.0814		"	0.0800000	0.0011	100	80-120			
Barium, total	0.112		"	0.0800000	0.0317	100	80-120			
Beryllium, total	0.0779		"	0.0800000	0.000006	97.4	80-120			
Cadmium, total	0.0754		"	0.0800000	0.00005	94.2	80-120			
Chromium, total	0.0755		"	0.0800000	0.0003	94.0	80-120			
Cobalt, total	0.0811		"	0.0800000	0.0002	101	80-120			
Copper, total	0.0737		"	0.0800000	0.0002	91.9	80-120			
Lead, total	0.0717		"	0.0800000	0.0005	89.0	80-120			
Nickel, total	0.0780		"	0.0800000	0.0002	97.3	80-120			
Selenium, total	0.0742		"	0.0800000	0.0003	92.3	80-120			
Silver, total	0.0752		"	0.0800000	0.0009	92.9	80-120			
Thallium, total	0.0610		"	0.0800000	-0.00002	76.2	80-120			PS-03
Vanadium, total	0.0818		"	0.0800000	0.0035	97.9	80-120			
Zinc, total	0.0724		"	0.0800000	0.0013	88.8	80-120			
Batch 1GE0600 - EPA 3005A Total Recoverable Metals										
Blank (1GE0600-BLK1)				Prepared & Analyzed: 05/10/23						
Lead, total	ND	0.0040	mg/L							
LCS (1GE0600-BS1)				Prepared & Analyzed: 05/10/23						
Lead, total	0.0968	0.0040	mg/L	0.100000		96.8	80-120			
Matrix Spike (1GE0600-MS1)		**Source: 1GD2320-04RE1**		Prepared & Analyzed: 05/10/23						
Lead, total	0.0930	0.0040	mg/L	0.100000	ND	93.0	75-125			

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Determination of Total Metals - Quality Control

Keystone Laboratories - Newton

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1GE0600 - EPA 3005A Total Recoverable Metals										
Matrix Spike Dup (1GE0600-MSD1)		**Source: 1GD2320-04RE1**		Prepared & Analyzed: 05/10/23						
Lead, total	0.0963	0.0040	mg/L	0.100000	ND	96.3	75-125	3.44	20	
Post Spike (1GE0600-PS1)		**Source: 1GD2320-04RE1**		Prepared & Analyzed: 05/10/23						
Lead, total	0.0751		mg/L	0.0800000	0.0003	93.5	80-120			

ND = Non Detect; REC= Recovery; RPD= Relative Percent Difference

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HLW Engineering
PO Box 314
Story City, IA 50248

Work Order: 1GD2320

Certified Analyses Included In This Report

Method/Matrix	Analyte	Certifications
EPA 410.4 in Water		
	COD, total	KS-NT,SIA1X
EPA 6010B in Water		
	Iron, total	KS-NT,SIA1X
	Magnesium, total	KS-NT,SIA1X
EPA 6020A in Water		
	Antimony, total	SIA1X,KS-NT
	Arsenic, total	SIA1X,KS-NT
	Barium, total	SIA1X,KS-NT
	Beryllium, total	SIA1X,KS-NT
	Cadmium, total	SIA1X,KS-NT
	Chromium, total	SIA1X,KS-NT
	Cobalt, total	SIA1X,KS-NT
	Copper, total	SIA1X,KS-NT
	Lead, total	SIA1X,KS-NT
	Nickel, total	SIA1X,KS-NT
	Selenium, total	SIA1X,KS-NT
	Silver, total	SIA1X,KS-NT
	Thallium, total	SIA1X,KS-NT
	Vanadium, total	SIA1X,KS-NT
	Zinc, total	SIA1X,KS-NT
EPA 7470A in Water		
	Mercury, total	KS-NT,SIA1X
EPA 8260B in Water		
	Chloromethane	KS-NT,SIA1X
	Vinyl Chloride	KS-NT,SIA1X
	Bromomethane	KS-NT,SIA1X
	Chloroethane	KS-NT,SIA1X
	Trichlorofluoromethane	KS-NT,SIA1X
	1,1-Dichloroethylene	KS-NT,SIA1X
	Acetone	KS-NT,SIA1X
	Methyl Iodide	SIA1X
	Carbon Disulfide	KS-NT,SIA1X
	Methylene Chloride	KS-NT,SIA1X
	Acrylonitrile	KS-NT,SIA1X
	trans-1,2-Dichloroethylene	KS-NT,SIA1X
	1,1-Dichloroethane	KS-NT,SIA1X
	Vinyl Acetate	KS-NT,SIA1X
	cis-1,2-Dichloroethylene	KS-NT,SIA1X
	2-Butanone (MEK)	KS-NT,SIA1X
	Bromochloromethane	KS-NT,SIA1X
	Chloroform	KS-NT,SIA1X
	1,1,1-Trichloroethane	KS-NT,SIA1X
	Carbon Tetrachloride	KS-NT,SIA1X
	Benzene	KS-NT,SIA1X
	1,2-Dichloroethane	KS-NT,SIA1X
	Trichloroethylene	KS-NT,SIA1X

HLW Engineering
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Story City, IA 50248

Work Order: 1GD2320

	1,2-Dichloropropane	KS-NT,SIA1X
	Dibromomethane	SIA1X
	Bromodichloromethane	KS-NT,SIA1X
	cis-1,3-Dichloropropene	KS-NT,SIA1X
	4-Methyl-2-pentanone (MIBK)	KS-NT,SIA1X
	Toluene	KS-NT,SIA1X
	trans-1,3-Dichloropropene	KS-NT,SIA1X
	1,1,2-Trichloroethane	KS-NT,SIA1X
	Tetrachloroethylene	KS-NT,SIA1X
	2-Hexanone (MBK)	KS-NT,SIA1X
	Dibromochloromethane	KS-NT,SIA1X
	1,2-Dibromoethane	KS-NT,SIA1X
	Chlorobenzene	KS-NT,SIA1X
	1,1,1,2-Tetrachloroethane	KS-NT,SIA1X
	Ethylbenzene	KS-NT,SIA1X
	Xylenes, total	KS-NT,SIA1X
	Styrene	KS-NT,SIA1X
	Bromoform	KS-NT,SIA1X
	1,2,3-Trichloropropane	KS-NT,SIA1X
	trans-1,4-Dichloro-2-butene	SIA1X
	1,1,2,2-Tetrachloroethane	KS-NT,SIA1X
	1,4-Dichlorobenzene	KS-NT,SIA1X
	1,2-Dichlorobenzene	KS-NT,SIA1X
	1,2-Dibromo-3-chloropropane	KS-NT,SIA1X
EPA 9056 in Water		
	Chloride	KS-NT,SIA1X
TIMBERLINE in Water		
	Nitrogen, Ammonia	SIA1X

Code	Description	Number	Expires
KS-KC	Kansas Department of Health and Environment-KC	E-10110	04/30/2024
KS-NT	Kansas Department of Health and Environment (NELAP)	E-10287	10/31/2023
MO-KC	Missouri Department of Natural Resources (KC)	140	04/30/2023
MO-NT	Missouri Department of Natural Resources (Newton)	10170	04/30/2026
SIA1X	Iowa Dept. of Natural Resources	95	02/01/2024

Notes and Definitions

PS-03	The post spike recovery was below acceptance limits.
QM-07	The spike recovery and/or RPD was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
R-06	The Reporting Limits for this analysis are elevated due to excessive sediment in the sample container.

HLW Engineering
PO Box 314
Story City, IA 50248

Work Order: 1GD2320

End of Report

Sue Thompson

Keystone Laboratories

Sue Thompson
Client Services Manager

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety. Samples were preserved in accordance with 40 CFR for pH adjustment unless otherwise noted. MRL= Method Reporting Limit.

CHAIN OF CUSTODY RECORD

Keystone LABORATORIES, INC.
600 East 17th Street
Newton, IA 50208
641-792-8451

1GD2320

HLW Engineering
PM: Sue Thompson

www.keystonelabs.com

SITE INFORMATION
Sampler: JAH
Project: Monona Co
6038

REPORT
Todd Whipple
HLW Engineering
PO Box 314
Story City, IA 50248

INVOICE TO
Logan Persinger
Monona County Sanitary Landfill
31342 Hwy 37
Turin, IA 51040

SPECIAL INSTRUCTIONS
None

Turn Around Time
☒ Standard ☐ RUSH, need by ___/___/___

LAB USE ONLY
Work Order 1GD2320
Temperature 0.0
Turn-Cooler: No

☐ Custody Seal
☒ Containers Intact
☒ COC/Labels Agree
☐ Preservation Confirmed
☐ Received on Ice

Number	Sample Identification / Client ID	Matrix	Sample Type	Date	Time	Number of Containers	Analyses	Lab Sample Number
01-001	MW-1	Water	GRAB	4/19/23	10:02	9	as-t-6020, ba-t-6020, cd-i-6020, cl-9056-w, cod-i-410.4, cr-i-6020, cu-i-6020, fe-i-6010, hg-i-7470, landfill-appI-voc-group, landfill-appI-metals-6020, mg-i-6010, nh3-timberline-lf, pb-i-6020, zn-i-6020	01
02-001	MW-3R	Water	GRAB	4/19/23	10:31	~~X~~ 1	as-t-6020, ba-t-6020, cd-i-6020, cr-i-6020, cu-i-6020, fe-i-6010, hg-i-7470, mg-i-6010, pb-i-6020, zn-i-6020	02

Relinquished By — Date/Time: 4/20/23

Received By — Date/Time

Relinquished By — Date/Time

Received for Lab By: Lacy Wood — Date/Time: 4-21-23 0850

Remarks:

Original - Lab Copy Yellow - Sampler Copy

Keystone LABORATORIES, INC.

CHAIN OF C

600 East 17th Street Sou
Newton, IA 50208
641-792-8451

1 G D 2 3 2 0

HLW Engineering
PM: Sue Thompson

Printed: 3/29/2023 4:21:14AM

www.keystonelabs.com

SITE INFORMATION

Sampler: Sent

Project: Monona Co

6036

REPORT TO

Todd Whipple
HLW Engineering
PO Box 314
Story City, IA 50248

INVOICE TO

Logan Persinger
Monona County Sanitary Landfill
31342 Hwy 37
Turin, IA 51040

SPECIAL INSTRUCTIONS

None

Turn Around Time

☒ Standard ☐ RUSH, need by ___/___/___

LAB USE ONLY

Work Order 1GD2320
Temperature 0.0
Turn-Cooler: No

☐ Custody Seal
☒ Containers Intact
☒ COC/Labels Agree
☐ Preservation Confirmed
☒ Received on Ice

Number	Sample Identification / Client ID	Matrix	Sample Type	Date	Time	Number of Containers	Analyses		Lab Sample Number
03-001	MW-4	Water	GRAB	4/19/23	9:29	1	as-t-6020 cd-t-6020 cu-t-6020 hg-t-7470 pb-t-6020	ba-t-6020 cr-t-6020 fe-t-6010 mg-t-6010 zn-t-6020	03
04-001	MW-5	Water	GRAB	4/19/23	9:08	1	as-t-6020 cd-t-6020 cu-t-6020 hg-t-7470 pb-t-6020	ba-t-6020 cr-t-6020 fe-t-6010 mg-t-6010 zn-t-6020	04
05-001	MW-7	Water	GRAB	4/19/23	10:15	1	as-t-6020 cd-t-6020 cu-t-6020 hg-t-7470 pb-t-6020	ba-t-6020 cr-t-6020 fe-t-6010 mg-t-6010 zn-t-6020	05
06-001	LW-1	Water	GRAB	4/19/23	10:58	7	indfill-appl-voc-group	indfill-appl-metals-6020	06

J. Holt 4/20/23
Relinquished By Date/Time

Received By Date/Time

Relinquished By Date/Time

Lacey Wood 4-21-23 0830
Received for Lab By Date/Time

Remarks:

Original - Lab Copy Yellow - Sampler Copy

CHAIN OF CU

Keystone LABORATORIES, INC.

600 East 17th Street Sou
Newton, IA 50208
641-792-8451

1 G D 2 3 2 0

HLW Engineering
PM: Sue Thompson

inted: 3/29/2023 4:21:14AM

www.keystonelabs.com

SITE INFORMATION

Sampler: JeH

Project: Monona Co
6036

SPECIAL INSTRUCTIONS

None

Turn Around Time

[X] Standard [ ] RUSH, need by ___/___/___

REPORT TO

Todd Whipple
HLW Engineering
PO Box 314
Story City, IA 50248

INVOICE TO

Logan Persinger
Monona County Sanitary Landfill
31342 Hwy 37
Turin, IA 51040

LAB USE ONLY

Work Order 1GD2320
Temperature 0.0
Turn-Cooler: No

[ ] Custody Seal
[X] Containers Intact
[X] COC/Labels Agree
[ ] Preservation Confirmed
[X] Received on Ice

Number	Sample Identification / Client ID	Matrix	Sample Type	Date	Time	Number of Containers	Analyses	Lab Sample Number
07-001	Duplicate	Water	GRAB	4/19/23	9:08	1	as-t-6020, ba-t-6020, cd-t-6020, cr-t-6020, cu-t-6020, fe-t-6010, hg-i-7470, mg-t-6010, pb-t-6020, zn-t-6020	07

Relinquished By 4/20/23 Date/Time

Received By Date/Time

Relinquished By Date/Time

Received for Lab By Tony Wood 4-21-23 0850 Date/Time

Original - Lab Copy Yellow - Sampler Copy

Remarks:

ANALYTICAL REPORT

October 27, 2022

Work Order: 1FJ0861

Report To	Work Order Information
Todd Whipple	Date Received: 10/10/2022 10:47:00AM
HLW Engineering	Collector: JGH
PO Box 314	Phone: (515) 733-4144
Story City, IA 50248	PO Number: Monona Co

Project: Monona Co

Project Number: 6036

Analyte	Result	MRL	Batch	Method	Analyst	Analyzed	Qualifier
1FJ0861-01 MW-1				Matrix: Water	Collected: 10/07/22 09:34		
COD, total	<20 mg/L	20	1FJ0687	EPA 410.4	AKW	10/14/22 12:52	
Nitrogen, Ammonia	<1.00 mg/L	1.00	1FJ0788	TIMBERLINE	TJB	10/17/22 15:05	
Chloride	**204 mg/L**	**5.0**	1FJ0863	EPA 9056	MID	10/18/22 1:05	
Arsenic, total	<0.0040 mg/L	0.0040	1FJ0920	EPA 6020A	JAR	10/21/22 18:38	
Barium, total	**1.00 mg/L**	**0.0040**	1FJ0920	EPA 6020A	JAR	10/21/22 18:38	
Cadmium, total	<0.0008 mg/L	0.0008	1FJ0920	EPA 6020A	JAR	10/21/22 18:38	
Chromium, total	<0.0080 mg/L	0.0080	1FJ0920	EPA 6020A	JAR	10/21/22 18:38	
Copper, total	<0.0040 mg/L	0.0040	1FJ0920	EPA 6020A	JAR	10/21/22 18:38	
Iron, total	**1.19 mg/L**	**0.100**	1FJ0613	EPA 6010B	JAR	10/15/22 1:52	
Mercury, total	<0.00050 mg/L	0.00050	1FJ0835	EPA 7470A	JAR	10/19/22 14:08	
Magnesium, total	**129 mg/L**	**0.100**	1FJ0613	EPA 6010B	JAR	10/15/22 1:52	
Lead, total	<0.0040 mg/L	0.0040	1FJ0920	EPA 6020A	JAR	10/21/22 18:38	
Zinc, total	<0.0200 mg/L	0.0200	1FJ0920	EPA 6020A	JAR	10/21/22 18:38	
1FJ0861-02 MW-3R				Matrix: Water	Collected: 10/07/22 08:51		
COD, total	<20 mg/L	20	1FJ0687	EPA 410.4	AKW	10/14/22 12:52	
Nitrogen, Ammonia	<1.00 mg/L	1.00	1FJ0788	TIMBERLINE	TJB	10/17/22 15:06	
Chloride	**6.3 mg/L**	**1.0**	1FJ0949	EPA 9056	MID	10/18/22 12:17	
Arsenic, total	<0.0040 mg/L	0.0040	1FJ0920	EPA 6020A	JAR	10/21/22 18:43	
Barium, total	**0.307 mg/L**	**0.0040**	1FJ0920	EPA 6020A	JAR	10/21/22 18:43	
Cadmium, total	<0.0008 mg/L	0.0008	1FJ0920	EPA 6020A	JAR	10/21/22 18:43	
Chromium, total	**0.0110 mg/L**	**0.0080**	1FJ0920	EPA 6020A	JAR	10/21/22 18:43	
Copper, total	<0.0040 mg/L	0.0040	1FJ0920	EPA 6020A	JAR	10/21/22 18:43	
Iron, total	<0.100 mg/L	0.100	1FJ0613	EPA 6010B	JAR	10/15/22 1:58	
Mercury, total	<0.00050 mg/L	0.00050	1FJ0835	EPA 7470A	JAR	10/19/22 14:08	
Magnesium, total	**36.2 mg/L**	**0.100**	1FJ0613	EPA 6010B	JAR	10/15/22 1:58	
Lead, total	<0.0040 mg/L	0.0040	1FJ0920	EPA 6020A	JAR	10/21/22 18:43	
Zinc, total	<0.0200 mg/L	0.0200	1FJ0920	EPA 6020A	JAR	10/21/22 18:43	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety. Samples were preserved in accordance with 40 CFR for pH adjustment unless otherwise noted. MRL= Method Reporting Limit.

HLW Engineering
PO Box 314
Story City, IA 50248

October 27, 2022
Page 2 of 13

Work Order: 1FJ0861

Analyte	Result	MRL	Batch	Method	Analyst	Analyzed	Qualifier
1FJ0861-03 MW-4				Matrix: Water		Collected: 10/07/22 09:19	
COD, total	<20 mg/L	20	1FJ0687	EPA 410.4	AKW	10/14/22 12:52	
Nitrogen, Ammonia	<1.00 mg/L	1.00	1FJ0788	TIMBERLINE	TJB	10/17/22 15:08	
Chloride	**5.0 mg/L**	**1.0**	1FJ0949	EPA 9056	MID	10/18/22 13:48	
Arsenic, total	**0.0198 mg/L**	**0.0040**	1FJ0920	EPA 6020A	JAR	10/21/22 18:49	
Barium, total	**0.395 mg/L**	**0.0040**	1FJ0920	EPA 6020A	JAR	10/21/22 18:49	
Cadmium, total	<0.0008 mg/L	0.0008	1FJ0920	EPA 6020A	JAR	10/21/22 18:49	
Chromium, total	<0.0080 mg/L	0.0080	1FJ0920	EPA 6020A	JAR	10/21/22 18:49	
Copper, total	**0.0056 mg/L**	**0.0040**	1FJ0920	EPA 6020A	JAR	10/21/22 18:49	
Iron, total	**0.665 mg/L**	**0.100**	1FJ0613	EPA 6010B	JAR	10/15/22 2:04	
Mercury, total	<0.00050 mg/L	0.00050	1FJ0835	EPA 7470A	JAR	10/19/22 14:08	
Magnesium, total	**31.4 mg/L**	**0.100**	1FJ0613	EPA 6010B	JAR	10/15/22 2:04	
Lead, total	<0.0040 mg/L	0.0040	1FJ0920	EPA 6020A	JAR	10/21/22 18:49	
Zinc, total	**0.0220 mg/L**	**0.0200**	1FJ0920	EPA 6020A	JAR	10/21/22 18:49	
1FJ0861-04 MW-5				Matrix: Water		Collected: 10/07/22 10:13	
COD, total	<20 mg/L	20	1FJ0687	EPA 410.4	AKW	10/14/22 12:52	
Nitrogen, Ammonia	<1.00 mg/L	1.00	1FJ0788	TIMBERLINE	TJB	10/17/22 15:09	
Chloride	**38.3 mg/L**	**5.0**	1FJ0863	EPA 9056	MID	10/18/22 3:19	
Arsenic, total	<0.0040 mg/L	0.0040	1FJ0920	EPA 6020A	JAR	10/21/22 18:55	
Barium, total	**0.155 mg/L**	**0.0040**	1FJ0920	EPA 6020A	JAR	10/21/22 18:55	
Cadmium, total	<0.0008 mg/L	0.0008	1FJ0920	EPA 6020A	JAR	10/21/22 18:55	
Chromium, total	<0.0080 mg/L	0.0080	1FJ0920	EPA 6020A	JAR	10/21/22 18:55	
Copper, total	<0.0040 mg/L	0.0040	1FJ0920	EPA 6020A	JAR	10/21/22 18:55	
Iron, total	**1.64 mg/L**	**0.100**	1FJ0613	EPA 6010B	JAR	10/15/22 2:13	
Mercury, total	<0.00050 mg/L	0.00050	1FJ0835	EPA 7470A	JAR	10/19/22 14:08	
Magnesium, total	**22.2 mg/L**	**0.100**	1FJ0613	EPA 6010B	JAR	10/15/22 2:13	
Lead, total	<0.0040 mg/L	0.0040	1FJ0920	EPA 6020A	JAR	10/21/22 18:55	
Zinc, total	<0.0200 mg/L	0.0200	1FJ0920	EPA 6020A	JAR	10/21/22 18:55	
1FJ0861-05 MW-7				Matrix: Water		Collected: 10/07/22 09:49	
COD, total	<20 mg/L	20	1FJ0687	EPA 410.4	AKW	10/14/22 12:52	
Nitrogen, Ammonia	<1.00 mg/L	1.00	1FJ0788	TIMBERLINE	TJB	10/17/22 15:11	
Chloride	**7.1 mg/L**	**1.0**	1FJ0949	EPA 9056	MID	10/18/22 14:06	
Arsenic, total	<0.0040 mg/L	0.0040	1FJ0920	EPA 6020A	JAR	10/21/22 19:00	
Barium, total	**0.153 mg/L**	**0.0040**	1FJ0920	EPA 6020A	JAR	10/21/22 19:00	
Cadmium, total	<0.0008 mg/L	0.0008	1FJ0920	EPA 6020A	JAR	10/21/22 19:00	
Chromium, total	<0.0080 mg/L	0.0080	1FJ0920	EPA 6020A	JAR	10/21/22 19:00	
Copper, total	<0.0040 mg/L	0.0040	1FJ0920	EPA 6020A	JAR	10/21/22 19:00	
Iron, total	<0.100 mg/L	0.100	1FJ0613	EPA 6010B	JAR	10/15/22 2:19	

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HLW Engineering
PO Box 314
Story City, IA 50248

October 27, 2022

Work Order: 1FJ0861

Analyte	Result	MRL	Batch	Method	Analyst	Analyzed	Qualifier
1FJ0861-05 MW-7				Matrix: Water		Collected: 10/07/22 09:49	
Mercury, total	<0.00050 mg/L	0.00050	1FJ0835	EPA 7470A	JAR	10/19/22 14:08	
Magnesium, total	**24.2 mg/L**	**0.100**	1FJ0613	EPA 6010B	JAR	10/15/22 2:19	
Lead, total	<0.0040 mg/L	0.0040	1FJ0920	EPA 6020A	JAR	10/21/22 19:00	
Zinc, total	<0.0200 mg/L	0.0200	1FJ0920	EPA 6020A	JAR	10/21/22 19:00	
1FJ0861-06 Duplicate				Matrix: Water		Collected: 10/07/22 08:51	
Arsenic, total	<0.0040 mg/L	0.0040	1FJ0920	EPA 6020A	JAR	10/21/22 19:06	
Barium, total	**0.318 mg/L**	**0.0040**	1FJ0920	EPA 6020A	JAR	10/21/22 19:06	
Cadmium, total	<0.0008 mg/L	0.0008	1FJ0920	EPA 6020A	JAR	10/21/22 19:06	
Chromium, total	**0.0115 mg/L**	**0.0080**	1FJ0920	EPA 6020A	JAR	10/21/22 19:06	
Copper, total	<0.0040 mg/L	0.0040	1FJ0920	EPA 6020A	JAR	10/21/22 19:06	
Iron, total	**0.113 mg/L**	**0.100**	1FJ0613	EPA 6010B	JAR	10/15/22 2:25	
Mercury, total	<0.00050 mg/L	0.00050	1FJ0835	EPA 7470A	JAR	10/19/22 14:08	
Magnesium, total	**37.8 mg/L**	**0.100**	1FJ0613	EPA 6010B	JAR	10/15/22 2:25	
Lead, total	<0.0040 mg/L	0.0040	1FJ0920	EPA 6020A	JAR	10/21/22 19:06	
Zinc, total	<0.0200 mg/L	0.0200	1FJ0920	EPA 6020A	JAR	10/21/22 19:06	

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HLW Engineering
PO Box 314
Story City, IA 50248

Work Order: 1FJ0861

Determination of Conventional Chemistry Parameters - Quality Control

Keystone Laboratories - Newton

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1FJ0687 - Wet Chem Preparation										
Blank (1FJ0687-BLK1)				Prepared & Analyzed: 10/14/22						
COD, total	ND	20	mg/L							
LCS (1FJ0687-BS1)				Prepared & Analyzed: 10/14/22						
COD, total	103	27	mg/L	100.000		103	90-110			
Matrix Spike (1FJ0687-MS1)		**Source: 1FJ0674-01**		Prepared & Analyzed: 10/14/22						
COD, total	60.1	20	mg/L	42.8571	17.7	98.8	90-110			
Matrix Spike Dup (1FJ0687-MSD1)		**Source: 1FJ0674-01**		Prepared & Analyzed: 10/14/22						
COD, total	60.5	20	mg/L	42.8571	17.7	99.7	90-110	0.629	10	
Batch 1FJ0788 - Wet Chem Preparation										
Blank (1FJ0788-BLK1)				Prepared & Analyzed: 10/17/22						
Nitrogen, Ammonia	ND	1.00	mg/L							
LCS (1FJ0788-BS1)				Prepared & Analyzed: 10/17/22						
Nitrogen, Ammonia	5.21	1.00	mg/L	5.00000		104	90-114			
Matrix Spike (1FJ0788-MS1)		**Source: 1FJ0928-02**		Prepared & Analyzed: 10/17/22						
Nitrogen, Ammonia	5.75	1.00	mg/L	5.00000	0.567	104	84-115			
Matrix Spike Dup (1FJ0788-MSD1)		**Source: 1FJ0928-02**		Prepared & Analyzed: 10/17/22						
Nitrogen, Ammonia	6.08	1.00	mg/L	5.00000	0.567	110	84-115	5.59	20	

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HLW Engineering
PO Box 314
Story City, IA 50248

October 27, 2022

Work Order: 1FJ0861

Determination of Inorganic Anions - Quality Control

Keystone Laboratories - Newton

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1FJ0863 - General Prep HPLC/IC										
Blank (1FJ0863-BLK1)				Prepared & Analyzed: 10/17/22						
Chloride	ND	1.0	mg/L							
Blank (1FJ0863-BLK2)				Prepared: 10/17/22 Analyzed: 10/18/22						
Chloride	ND	1.0	mg/L							
LCS (1FJ0863-BS1)				Prepared & Analyzed: 10/17/22						
Chloride	15.54	1.0	mg/L	15.4295		101	80-120			
LCS Dup (1FJ0863-BSD1)				Prepared & Analyzed: 10/17/22						
Chloride	15.42	1.0	mg/L	15.4295		100	80-120	0.730	10	
MRL Check (1FJ0863-MRL1)				Prepared & Analyzed: 10/17/22						
Chloride	0.73	1.0	mg/L	0.611236		119	50-150			
Matrix Spike (1FJ0863-MS1)		**Source: 1FJ0843-02**		Prepared & Analyzed: 10/17/22						
Chloride	643.8	10.0	mg/L	154.295	488.4	101	81-116			
Matrix Spike Dup (1FJ0863-MSD1)		**Source: 1FJ0843-02**		Prepared & Analyzed: 10/17/22						
Chloride	645.2	10.0	mg/L	154.295	488.4	102	81-116	0.219	10	
Batch 1FJ0949 - General Prep HPLC/IC										
Blank (1FJ0949-BLK1)				Prepared & Analyzed: 10/18/22						
Chloride	ND	1.0	mg/L							
Blank (1FJ0949-BLK2)				Prepared & Analyzed: 10/18/22						
Chloride	ND	1.0	mg/L							

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HLW Engineering
PO Box 314
Story City, IA 50248

October 27, 2022

Work Order: 1FJ0861

Determination of Inorganic Anions - Quality Control

Keystone Laboratories - Newton

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1FJ0949 - General Prep HPLC/IC										
LCS (1FJ0949-BS1)				Prepared & Analyzed: 10/18/22						
Chloride	14.84	1.0	mg/L	15.4295		96.2	80-120			
LCS Dup (1FJ0949-BSD1)				Prepared & Analyzed: 10/18/22						
Chloride	14.86	1.0	mg/L	15.4295		96.3	80-120	0.128	10	
MRL Check (1FJ0949-MRL1)				Prepared & Analyzed: 10/18/22						
Chloride	0.66	1.0	mg/L	0.611236		107	50-150			
Matrix Spike (1FJ0949-MS1)		**Source: 1FJ0861-02**		Prepared & Analyzed: 10/18/22						
Chloride	21.62	1.0	mg/L	15.4295	6.34	99.0	81-116			
Matrix Spike Dup (1FJ0949-MSD1)		**Source: 1FJ0861-02**		Prepared & Analyzed: 10/18/22						
Chloride	21.51	1.0	mg/L	15.4295	6.34	98.3	81-116	0.510	10	

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Determination of Total Metals - Quality Control

Keystone Laboratories - Newton

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1FJ0613 - EPA 3010A Digestion (Water)										
Blank (1FJ0613-BLK1)				Prepared: 10/13/22 Analyzed: 10/15/22						
Iron, total	ND	0.100	mg/L							
Magnesium, total	ND	0.100	"							
LCS (1FJ0613-BS1)				Prepared: 10/13/22 Analyzed: 10/15/22						
Iron, total	2.41	0.100	mg/L	2.20000		109	80-120			
Magnesium, total	2.41	0.100	"	2.20000		109	80-120			
Matrix Spike (1FJ0613-MS1)		**Source: 1FJ0440-01**		Prepared: 10/13/22 Analyzed: 10/15/22						
Iron, total	2.51	0.100	mg/L	2.20000	0.199	105	75-125			
Magnesium, total	24.0	0.100	"	2.20000	21.0	137	75-125			QM-4X
Matrix Spike Dup (1FJ0613-MSD1)		**Source: 1FJ0440-01**		Prepared: 10/13/22 Analyzed: 10/15/22						
Iron, total	2.59	0.100	mg/L	2.20000	0.199	109	75-125	3.30	20	
Magnesium, total	25.5	0.100	"	2.20000	21.0	204	75-125	6.03	20	QM-4X
Post Spike (1FJ0613-PS1)		**Source: 1FJ0440-01**		Prepared: 10/13/22 Analyzed: 10/15/22						
Iron, total	9.25		mg/L	8.80000	0.199	103	80-120			
Magnesium, total	30.7		"	8.80000	21.0	110	80-120			
Batch 1FJ0835 - EPA 7470A Hg Water										
Blank (1FJ0835-BLK1)				Prepared: 10/18/22 Analyzed: 10/19/22						
Mercury, total	ND	0.00050	mg/L							
LCS (1FJ0835-BS1)				Prepared: 10/18/22 Analyzed: 10/19/22						
Mercury, total	0.00252	0.00050	mg/L	0.00250000		101	80-120			

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HLW Engineering
PO Box 314
Story City, IA 50248

Work Order: 1FJ0861

Determination of Total Metals - Quality Control

Keystone Laboratories - Newton

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1FJ0835 - EPA 7470A Hg Water										
Matrix Spike (1FJ0835-MS1)	**Source: 1FJ0749-08**			Prepared: 10/18/22 Analyzed: 10/19/22						
Mercury, total	0.00258	0.00050	mg/L	0.00250000	ND	103	75-125			
Matrix Spike Dup (1FJ0835-MSD1)	**Source: 1FJ0749-08**			Prepared: 10/18/22 Analyzed: 10/19/22						
Mercury, total	0.00256	0.00050	mg/L	0.00250000	ND	102	75-125	0.856	20	
Batch 1FJ0920 - EPA 3005A Total Recoverable Metals										
Blank (1FJ0920-BLK1)				Prepared: 10/19/22 Analyzed: 10/21/22						
Arsenic, total	ND	0.0040	mg/L							
Barium, total	ND	0.0040	"							
Cadmium, total	ND	0.0008	"							
Chromium, total	ND	0.0080	"							
Copper, total	ND	0.0040	"							
Lead, total	ND	0.0040	"							
Zinc, total	ND	0.0200	"							
LCS (1FJ0920-BS1)				Prepared: 10/19/22 Analyzed: 10/21/22						
Arsenic, total	0.0890	0.0040	mg/L	0.100000		89.0	80-120			
Barium, total	0.0969	0.0040	"	0.100000		96.9	80-120			
Cadmium, total	0.0913	0.0008	"	0.100000		91.3	80-120			
Chromium, total	0.0924	0.0080	"	0.100000		92.4	80-120			
Copper, total	0.0945	0.0040	"	0.100000		94.5	80-120			
Lead, total	0.0938	0.0040	"	0.100000		93.8	80-120			
Zinc, total	0.0908	0.0200	"	0.100000		90.8	80-120			
Matrix Spike (1FJ0920-MS1)	**Source: 1FJ0856-01**			Prepared: 10/19/22 Analyzed: 10/21/22						
Arsenic, total	0.0929	0.0040	mg/L	0.100000	0.0009	92.0	75-125			
Barium, total	0.413	0.0040	"	0.100000	0.292	121	75-125			
Cadmium, total	0.0921	0.0008	"	0.100000	0.0005	91.6	75-125			
Chromium, total	0.0951	0.0080	"	0.100000	0.0006	94.5	75-125			
Copper, total	0.0913	0.0040	"	0.100000	0.0012	90.1	75-125			
Lead, total	0.0922	0.0040	"	0.100000	ND	92.2	75-125			
Zinc, total	0.0891	0.0200	"	0.100000	ND	89.1	75-125			

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HLW Engineering
PO Box 314
Story City, IA 50248

October 27, 2022

Work Order: 1FJ0861

Determination of Total Metals - Quality Control

Keystone Laboratories - Newton

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1FJ0920 - EPA 3005A Total Recoverable Metals										
Matrix Spike Dup (1FJ0920-MSD1)	**Source: 1FJ0856-01**			Prepared: 10/19/22 Analyzed: 10/21/22						
Arsenic, total	0.103	0.0040	mg/L	0.100000	0.0009	102	75-125	10.0	20	
Barium, total	0.439	0.0040	"	0.100000	0.292	147	75-125	6.11	20	QM-4X
Cadmium, total	0.103	0.0008	"	0.100000	0.0005	102	75-125	11.0	20	
Chromium, total	0.106	0.0080	"	0.100000	0.0006	106	75-125	11.0	20	
Copper, total	0.105	0.0040	"	0.100000	0.0012	104	75-125	13.7	20	
Lead, total	0.104	0.0040	"	0.100000	ND	104	75-125	12.1	20	
Zinc, total	0.0972	0.0200	"	0.100000	ND	97.2	75-125	8.66	20	
Post Spike (1FJ0920-PS1)	**Source: 1FJ0856-01**			Prepared: 10/19/22 Analyzed: 10/21/22						
Arsenic, total	0.0721		mg/L	0.0800000	0.0009	88.9	80-120			
Barium, total	0.360		"	0.0800000	0.286	92.0	80-120			
Cadmium, total	0.0720		"	0.0800000	0.0004	89.5	80-120			
Chromium, total	0.0723		"	0.0800000	0.0006	89.7	80-120			
Copper, total	0.0715		"	0.0800000	0.0012	87.9	80-120			
Lead, total	0.0720		"	0.0800000	0.0001	89.8	80-120			
Zinc, total	0.0685		"	0.0800000	0.0037	81.0	80-120			

ND = Non Detect; REC= Recovery; RPD= Relative Percent Difference

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety. Samples were preserved in accordance with 40 CFR for pH adjustment unless otherwise noted. MRL= Method Reporting Limit.

Certified Analyses Included In This Report

Method/Matrix	Analyte	Certifications
EPA 410.4 in Water		
	COD, total	KS-NT,SIA1X
EPA 6010B in Water		
	Iron, total	KS-NT,SIA1X
	Magnesium, total	KS-NT,SIA1X
EPA 6020A in Water		
	Arsenic, total	SIA1X,KS-NT
	Barium, total	SIA1X,KS-NT
	Cadmium, total	SIA1X,KS-NT
	Chromium, total	SIA1X,KS-NT
	Copper, total	SIA1X,KS-NT
	Lead, total	SIA1X,KS-NT
	Zinc, total	SIA1X,KS-NT
EPA 7470A in Water		
	Mercury, total	KS-NT,SIA1X
EPA 9056 in Water		
	Chloride	KS-NT,SIA1X
TIMBERLINE in Water		
	Nitrogen, Ammonia	SIA1X

Code	Description	Number	Expires
KS-KC	Kansas Department of Health and Environment-KC	E-10110	04/30/2023
KS-NT	Kansas Department of Health and Environment (NELAP)	E-10287	10/31/2022
MO-KC	Missouri Department of Natural Resources	140	04/30/2023
SIA1X	Iowa Dept. of Natural Resources (updated certificate pending)	95	02/01/2024

Notes and Definitions

QM-4X The spike recovery was outside of QC acceptance limits for the MS and/or MSD due to analyte concentration at 4 times or greater the spike concentration.

End of Report

Sue Thompson

Keystone Laboratories

Sue Thompson

Client Services Manager

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety. Samples were preserved in accordance with 40 CFR for pH adjustment unless otherwise noted. MRL= Method Reporting Limit.

CHAIN OF CUSTODY RECORD

Keystone LABORATORIES, INC.
600 East 17th Stre
Newton, IA 50208
641-792-8451

1 F J 0 8 6 1

HLW Engineering
PM: Sue Thompson

www.keystonelabs.cc

SITE INFORMATION

Sampler: JGH

Project: **Monona Co**

~~6036~~

SPECIAL INSTRUCTIONS

None

Turn Around Time

☒ Standard ☐ RUSH, need by ___/___/___

REPO... TO

Todd Whipple
HLW Engineering
PO Box 314
Story City, IA 50248

...VOICE TO

Logan Persinger
Monona County Sanitary Landfill
31342 Hwy 37
Turin, IA 51040

LAB USE ONLY

Work Order 1FJ0861

Temperature 0.0

Turn-Cooler: **No**

- ☐ Custody Seal
- ☐ Containers Intact
- ☐ COC/Labels Agree
- ☐ Preservation Confirmed
- ☐ Received on Ice

Number	Sample Identification / Client ID	Matrix	Sample Type	Date	Time	Number of Containers	Analyses	Lab Sample Number
01-001	**MW-1**	Water	GRAB	10/7/22	9:34	3	as-t-6020, ba-t-6020, cd-i-6020, cl-9056-w, cod-i-410.4, cr-i-6020, cu-i-6020, fe-i-6010, hg-i-7470, mg-i-6010, nh3-timberline-lf, pb-i-6020, zn-t-6020	01
02-001	**MW-3R**	Water	GRAB	10/7/22	8:51	3	as-t-6020, ba-t-6020, cd-i-6020, cl-9056-w, cod-i-410.4, cr-i-6020, cu-i-6020, fe-i-6010, hg-i-7470, mg-i-6010, nh3-timberline-lf, pb-i-6020, zn-t-6020	02

Relinquished By Date/Time

Received By Date/Time

Relinquished By Date/Time

Received for Lab By 10/10/22 10:47 Date/Time

Remarks:

Original - Lab Copy Yellow - Sampler Copy

CHAIN OF CUSTODY RECORD

Keystone LABORATORIES, INC.
600 East 17th Street S
Newton, IA 50208
641-792-8451

1FJ0861

HLW Engineering
PM: Sue Thompson

Printed: 9/11/2022 9:39:46AM
www.keystonelabs.cc

SITE INFORMATION
Sampler: JGH
Project: Monona Co
6036

REPORT T
Todd Whipple
HLW Engineering
PO Box 314
Story City, IA 50248

INVOICE TO
Logan Persinger
Monona County Sanitary Landfill
31342 Hwy 37
Turin, IA 51040

SPECIAL INSTRUCTIONS
None

Turn Around Time
☒ Standard ☐ RUSH, need by ___/___/___

LAB USE ONLY
Work Order 1FJ0861
Temperature 0.0
Turn-Cooler: No

☐ Custody Seal
☐ Containers Intact
☐ COC/Labels Agree
☐ Preservation Confirmed
☐ Received on Ice

Number	Sample Identification / Client ID	Matrix	Sample Type	Date	Time	Number of Containers	Analyses	Lab Sample Number
03-001	MW-4	Water	GRAB	10/7/22	9:19	3	as-t-6020, ba-t-6020, cd-t-6020, cl-9056-w, cod-t-410.4, cr-t-6020, cu-t-6020, fe-t-6010, hg-t-7470, mg-t-6010, nh3-timberline-lf, pb-t-6020, zn-t-6020	03
04-001	MW-5	Water	GRAB	10/7/22	10:13	3	as-t-6020, ba-t-6020, cd-t-6020, cl-9056-w, cod-t-410.4, cr-t-6020, cu-t-6020, fe-t-6010, hg-t-7470, mg-t-6010, nh3-timberline-lf, pb-t-6020, zn-t-6020	04

Relinquished By — Date/Time

Received By — Date/Time

Relinquished By — Date/Time

Received for Lab By 10/10/22 10:47 — Date/Time

Remarks:

Original - Lab Copy Yellow - Sampler Copy

CHAIN OF CUSTODY RECORD

Keystone LABORATORIES, INC.
600 East 17th Street South
Newton, IA 50208
641-792-8451

1FJ0861

HLW Engineering
PM: Sue Thompson

ted: 9/11/2022 9:39:46AM

www.keystonelabs.cc

SITE INFORMATION

Sampler: JGH

Project: Monona Co

6036

REPORT TO

Todd Whipple
HLW Engineering
PO Box 314
Story City, IA 50248

Logan Persinger
Monona County Sanitary Landfill
31342 Hwy 37
Turin, IA 51040

SPECIAL INSTRUCTIONS

None

Turn Around Time

☒ Standard ☐ RUSH, need by ___/___/___

LAB USE ONLY

Work Order 1FJ0861

Temperature 0.0

Turn-Cooler: No

- ☐ Custody Seal
- ☐ Containers Intact
- ☐ COC/Labels Agree
- ☐ Preservation Confirmed
- ☐ Received on Ice

Number	Sample Identification / Client ID	Matrix	Sample Type	Date	Time	Number of Containers	Analyses	Lab Sample Number
05-001	**MW-7**	Water	GRAB	10/7/22	9:49	3	as-t-6020, ba-t-6020, cd-t-6020, cl-9056-w, cod-t-410.4, cr-t-6020, cu-t-6020, fe-t-6010, hg-t-7470, mg-t-6010, nh3-timberline-lf, pb-t-6020, zn-t-6020	05
06-001	**Duplicate**	Water	GRAB	10/7/22	851	1	as-t-6020, ba-t-6020, cd-t-6020, cr-t-6020, cu-t-6020, fe-t-6010, hg-t-7470, mg-t-6010, pb-t-6020, zn-t-6020	06

J. Colgate

Relinquished By Date/Time

Received By Date/Time

Relinquished By Date/Time

Received for Lab By 10/11/22 10:07 Date/Time

Remarks:

Original - Lab Copy Yellow - Sampler Copy

Appendix E

Summary of Field Turbidity

Monona County Sanitary Landfill

Field Turbidity Over Time

No-Purge Sampling

	10/4/18	4/15/19	10/8/19	4/8/20	10/2/20	4/12/21	10/26/21	4/12/22	10/7/22	Max	Min	Ave	Std Dev
Well	**NTU**	**NTU**	**NTU**	**NTU**	**NTU**	**NTU**	**NTU**	**NTU**	**NTU**				
MW-1	**2.03**	**2.79**	**2.36**	**1.08**	**12.9**	**1.46**	**1.34**	**1.14**	**5.71**	**12.90**	**1.08**	**3.42**	**3.83**
MW-3R	**1.07**	**2.49**	**2.46**	**1.82**	**3.07**	**1**	**2.53**	**3.63**	**5.7**	**5.70**	**1.00**	**2.64**	**1.43**
MW-4	**16.1**	**42.4**	**69.6**	**37.9**	**101**	**151**	**17.63**	**30.3**	**10.5**	**151.00**	**10.50**	**52.94**	**46.71**
MW-5	**1.04**	**39.5**	**18.1**	**426**	**29.5**	**88.7**	**207.8**	**46**	**12.1**	**426.00**	**1.04**	**96.53**	**138.60**
MW-7	**1.25**	**1.6**	**1.06**	**0.66**	**0.86**	**0.92**	**1.33**	**2.07**	**1.55**	**2.07**	**0.66**	**1.26**	**0.44**
Max	**16.10**	**42.40**	**69.60**	**426.00**	**101.00**	**151.00**	**207.80**	**46.00**	**12.10**				
Min	**1.04**	**1.60**	**1.06**	**0.66**	**0.86**	**0.92**	**1.33**	**1.14**	**1.55**				
Median	**1.25**	**2.79**	**2.46**	**1.82**	**12.90**	**1.46**	**2.53**	**3.63**	**5.71**				
Average	**4.30**	**17.76**	**18.72**	**93.49**	**29.47**	**48.62**	**46.13**	**16.63**	**7.11**				