2022 Annual Groundwater Monitoring and Corrective Action Report

Ottumwa Midland Landfill
Ottumwa, Iowa

Prepared for:

Alliant Energy

SCS ENGINEERS

25222073.00 | January 31, 2023

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OVERVIEW OF CURRENT STATUS

Ottumwa-Midland Landfill
2022 Annual Report

In accordance with §257.90(e)(6), this section at the beginning of the annual report provides an overview of the current status of groundwater monitoring and corrective action programs for the Coal Combustion Residual (CCR) unit. The groundwater monitoring system at the Ottumwa Midland Landfill (OML) monitors a single CCR unit. Supporting information is provided in the text of the annual report.

Category	Rule Requirement	Site Status
Monitoring Status – Start of Year	(i) At the start of the current annual reporting period, whether the CCR unit was operating under the detection monitoring program in §257.94 or the assessment monitoring program in §257.95;	Detection
Monitoring Status – End of Year	(ii) At the end of the current annual reporting period, whether the CCR unit was operating under the detection monitoring program in §257.94 or the assessment monitoring program in §257.95;	Detection
Statistically Significant Increases (SSIs)	(iii) If it was determined that there was an SSI over background for one or more constituents listed in appendix III to this part pursuant to §257.94(e):	
	(A) Identify those constituents listed in appendix III to this part and the names of the monitoring wells associated with such an increase; and	October 2021 No SSIs April 2022 No SSIs
	(B) Provide the date when the assessment monitoring program was initiated for the CCR unit.	Not applicable Assessment monitoring not required.

Category	Rule Requirement	Site Status
Statistically Significant Levels (SSL) Above Groundwater Protection Standard	(iv) If it was determined that there was an SSL above the groundwater protection standard for one or more constituents listed in appendix IV to this part pursuant to §257.95(g) include all of the following:	Not applicable In detection monitoring
	(A) Identify those constituents listed in appendix IV to this part and the names of the monitoring wells associated with such an increase;	
	(B) Provide the date when the assessment of corrective measures was initiated for the CCR unit;	
	(C) Provide the date when the public meeting was held for the assessment of corrective measures for the CCR unit; and	
	(D) Provide the date when the assessment of corrective measures was completed for the CCR unit.	
Selection of Remedy	(v) Whether a remedy was selected pursuant to §257.97 during the current annual reporting period, and if so, the date of remedy selection; and	Not applicable In detection monitoring
Corrective Action	(vi) Whether remedial activities were initiated or are ongoing pursuant to §257.98 during the current annual reporting period.	Not applicable In detection monitoring

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1.0 INTRODUCTION

This 2022 Annual Groundwater Monitoring and Corrective Action Report was prepared to support compliance with the groundwater monitoring requirements of the Coal Combustion Residuals (CCR) Rule [40 CFR 257.50-107]. Specifically, this report was prepared to fulfill the requirements of 40 CFR 257.90(e). The applicable sections of the Rule are provided below in *italics*, followed by applicable information relative to the 2022 Annual Groundwater Monitoring and Corrective Action Report for the CCR Units.

This report covers the period of groundwater monitoring from January 1, 2022, through December 31, 2022.

The groundwater monitoring system at the Ottumwa Midland Landfill (OML) monitors a single CCR unit with two phases:

- OML Landfill & OML Landfill Expansion - Phase 1 (existing landfill)

The system is designed to detect monitored constituents in the uppermost aquifer at the waste boundary of OML as required by 40 CFR 257.91(d). The groundwater monitoring system consists of two upgradient and three downgradient monitoring wells.

2.0 BACKGROUND

To provide context for the annual report, the following background information is provided in this section of the report, prior to the annual report requirement sections:

- Geologic and hydrogeologic setting
- CCR Rule monitoring system

2.1 GEOLOGIC AND HYDROGEOLOGIC SETTING

2.1.1 Regional Information

The uppermost bedrock unit in the site area consists of Pennsylvanian shales with minor siltstone, sandstone, limestone, and coal intervals. The continuity of these minor beds is highly variable. The thickness of the Pennsylvanian shale is variable; in some areas of Wapello County, it is over 100 feet thick, while in other areas it is absent. The variation in thickness is due to erosion of the bedrock surface. Underlying the Pennsylvanian shales are Mississippian limestone and dolomite, with some shale and sandstone. The Devonian units underlying the Mississippian are composed of shale, dolomite, and limestone, and are in turn underlain by Silurian dolomite (Montgomery Watson, 1994). A summary of the regional hydrogeologic stratigraphy is presented in **Appendix A**.

The Des Moines River and associated alluvial aquifers are a major source of surface water and shallow groundwater in the area; however, the alluvial aquifer is not present at the OML site. Unconsolidated deposits at the site consist of clays overlain by loess, which are not productive sources of groundwater. The uppermost Pennsylvanian bedrock unit is considered to be a regional aquitard. The Mississippian unit is the shallowest regional bedrock aquifer. The Cambrian-Ordovician aquifer, comprised of dolomite and sandstone, is commonly the source of municipal and industrial high-capacity wells in the region (Coble, 1971).

A summary of the regional hydrogeologic stratigraphy and a map showing regional bedrock surface topography and the top of the Mississippian limestone in Southeastern Iowa are included in Appendix A. The bedrock surface elevation is highly variable due to erosion. Regional information indicates that groundwater flow within the Mississippian limestone is to the south-southeast. A map showing the regional potentiometric surface in the Mississippian limestone is included with the hydrogeologic background information presented in Appendix A.

For the purposes of groundwater monitoring, the Mississippian limestone unit is considered to be the uppermost aquifer unit at the OML site as defined under 40 CFR 257.53.

2.1.2 Site information

Unconsolidated soils at the site include clay, loam, silt loam, silty clay, sandy loam, and intermediate types. Where present, these soils are generally 5 to 7 feet thick. Pennsylvanian shales and Mississippian limestone underlie the unconsolidated soils. Soils encountered during the drilling and installation of the existing background wells MW-102M and MW-122M, were described as 10 to 11 feet of lean clay, overlying 126 to 129 feet of shale with intermittent stringers of sandstone and coal. The shale was underlain by Mississippian limestone at 138 to 139 feet below ground surface.

During drilling of CCR wells MW-301, MW-302, and MW-303, soils were described as 4 to 11 feet of clay and silt, overlying 112 to 173 feet of shale with intermittent stringers of sandstone and coal. The shale was underlain by Mississippian limestone at 116 to 168 feet below ground surface.

The boring logs for the landfill CCR monitoring wells are provided in Appendix B. All CCR monitoring wells are screened within the Mississippian bedrock unit.

Shallow groundwater flow at the water table appears to be controlled partially by the landfill underdrain system and partially by the top of the Pennsylvanian shale. Shallow groundwater, near the current fill area, flows toward the landfill and the sedimentation pond. The landfill underdrain system includes a drainage layer and collection piping below the landfill liner, and is used to ensure that shallow groundwater does not affect performance of the landfill liner.

Based on water levels in the existing Mississippian piezometers at the OML site, a generally south-southeast flow direction has been identified in the Mississippian limestone aquifer, consistent with the regional flow information. The potentiometric surface elevations and groundwater flow directions for the April 2022 monitoring event are shown on Figure 3, and the potentiometric surface elevations and groundwater flow directions for the October 2022 monitoring event are shown on Figure 4. The groundwater elevation data for the CCR monitoring wells are provided in Table 3. Calculated horizontal gradients and flow velocities for each of the flow paths are provided in Table 4.

2.2 CCR RULE MONITORING SYSTEM

The groundwater monitoring system established within the CCR Rule consists of two upgradient (background) monitoring wells and three downgradient monitoring wells (Table 1 and Figure 2). The upgradient monitoring wells include MW-122M and MW-102M. The downgradient monitoring wells include MW-301, MW-302, and MW-303. The CCR Rule wells are installed in the upper portions of the Mississippian Limestone aquifer. Well depths range from approximately 150.0 to 204.5 feet, measured from the top of the well casing.

3.0 § 257.90(E) ANNUAL REPORT REQUIREMENTS

Annual groundwater monitoring and corrective action report. *For existing CCR landfills and existing CCR surface impoundments, no later than January 31, 2018, and annually thereafter, the owner or operator must prepare an annual groundwater monitoring and corrective action report. For new CCR landfills, new CCR surface impoundments, and all lateral expansions of CCR units, the owner or operator must prepare the initial annual groundwater monitoring and corrective action report no later than January 31 of the year following the calendar year a groundwater monitoring system has been established for such CCR unit as required by this subpart, and annually thereafter. For the preceding calendar year, the annual report must document the status of the groundwater monitoring and corrective action program for the CCR unit, summarize key actions completed, describe any problems encountered, discuss actions to resolve the problems, and project key activities for the upcoming year. For purposes of this section, the owner or operator has prepared the annual report when the report is placed in the facility's operating record as required by § 257.105(h)(1). At a minimum, the annual groundwater monitoring and corrective action report must contain the following information, to the extent available:*

3.1 §257.90(E)(1) SITE MAP

A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit;

A map showing the location of the site is provided as **Figure 1.** The OML CCR units and all background (or upgradient) and downgradient monitoring wells with identification numbers for the groundwater monitoring program are shown on **Figure 2**.

3.2 §257.90(E)(2) MONITORING SYSTEM CHANGES

Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken;

No new monitoring wells were installed and no wells were decommissioned as part of the groundwater monitoring program for OML in 2022.

3.3 §257.90(E)(3) SUMMARY OF SAMPLING EVENTS

In addition to all the monitoring data obtained under §§ 257.90 through 257.98, a summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs;

Two semiannual groundwater sampling events were completed in 2022 for OML as part of ongoing detection monitoring.

Groundwater samples collected during the semiannual events, in April and October 2022, were analyzed for the Appendix III constituents. A summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring program is included in **Table 2**.

The validation and evaluation of the April 2022 monitoring event data was completed and transmitted to IPL on July 11, 2022. The validation and evaluation of the October 2022 monitoring event data was in progress at the end of 2022 and will be transmitted to IPL in 2023; therefore, the October 2022 monitoring results will be included in the 2023 annual report. The October 2022 groundwater elevation data is included in this report.

The sampling results for Appendix III parameters in April 2022 are summarized in **Table 5.** Field parameter results for the April 2022 sampling events are provided in **Table 6**. The results of the April analytical laboratory analyses are provided in the laboratory reports in **Appendix C**. Historical results for each monitoring well through April 2022 are summarized in **Appendix D**.

3.4 § 257.90(E)(4) MONITORING TRANSITION NARRATIVE

A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels);

There were no transitions between monitoring programs during 2022. OML remained in the detection monitoring program.

In 2022, the monitoring results for the October 2021 and April 2022 monitoring events were evaluated for SSIs in detection monitoring parameters relative to background. For all parameters except chloride, the comparison to background was based on a prediction limit approach, comparing the results to interwell upper prediction limits (UPLs) based on background monitoring results from the upgradient wells (MW-122M and MW-102M). For chloride, the comparison to background used intrawell UPLs based on background monitoring results from the compliance wells (MW-301, MW-302, and MW-303).

The interwell and intrawell UPLs were most recently updated in January 2021 using background data collected through October 2020 for interwell UPLs and through April 2020 for intrawell UPLs. The January 2021 Statistical Analysis was included as an Appendix in the 2021 Annual Groundwater Monitoring Report. The Unified Guidance for Statistical Analysis of Groundwater Monitoring Data at Resource Conservation and Recovery Act (RCRA) Facilities (U.S. EPA, 2009; Section 5.3.1) recommends periodic updating of background for both intrawell and interwell analyses. For semiannual monitoring, an update interval of 2 to 3 years is recommended; therefore, the next UPL update is planned for 2023 or 2024.

No SSIs were identified based on the 2022 monitoring data evaluations.

3.5 § 257.90(E)(5) OTHER REQUIREMENTS

Other information required to be included in the annual report as specified in §§ 257.90 through 257.98.

Additional potentially applicable requirements for the annual report, and the location of the requirement within the Rule, are provided in the following sections. For each cited section of the Rule, the portion referencing the annual report requirement is provided below in italics, followed by applicable information relative to the 2022 Annual Groundwater Monitoring and Corrective Action Report for OML.

3.5.1 § 257.90(e) General Requirements

For the preceding calendar year, the annual report must document the status of the groundwater monitoring and corrective action program for the CCR unit, summarize key actions completed, describe any problems encountered, discuss actions to resolve the problems, and project key activities for the upcoming year.

Status of Groundwater Monitoring and Corrective Action Program. The groundwater monitoring and corrective action program is currently in detection monitoring.

Summary of Key Actions Completed.

- Statistical evaluation and determination of SSIs for the October 2021 and April 2022 monitoring events.
- Two semiannual detection monitoring events (April and October 2022).

Description of Any Problems Encountered. No problems were encountered in 2022.

Discussion of Actions to Resolve the Problems. Not applicable.

Projection of Key Activities for the Upcoming Year (2023):

- Statistical evaluation and determination of any SSIs for the October 2022 and April 2023 monitoring events.
- If an SSI is determined, then within 90 days either:
  - Complete Alternative Source Demonstration (ASD) (if applicable), or
  - Establish an assessment monitoring program.
- Two semiannual groundwater sampling and analysis events (April and October 2023).

3.5.2 § 257.94(d) Alternative Detection Monitoring Frequency

The owner or operator must include the demonstration providing the basis for the alternative monitoring frequency and the certification by a qualified professional engineer in the annual groundwater monitoring and corrective action report required by § 257.90(e).

Not applicable. No alternative detection monitoring frequency has been proposed.

3.5.3 § 257.94(e)(2) Alternative Source Demonstration for Detection Monitoring

The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer.

Not applicable. No ASDs were completed in 2022.

3.5.4 § 257.95(c) Alternative Assessment Monitoring Frequency

The owner or operator must include the demonstration providing the basis for the alternative monitoring frequency and the certification by a qualified professional engineer in the annual groundwater monitoring and corrective action report required by § 257.90(e).

Not applicable. Assessment monitoring has not been initiated.

3.5.5 § 257.95(d)(3) Assessment Monitoring Results and Standards

Include the recorded concentrations required by paragraph (d)(1) of this section, identify the background concentrations established under § 257.94(b), and identify the groundwater protection standards established under paragraph (d)(2) of this section in the annual groundwater monitoring and corrective action report required by § 257.90(e).

Not applicable. Assessment monitoring has not been initiated.

3.5.6 § 257.95(g)(3)(ii) Alternative Source Demonstration for Assessment Monitoring

The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer.

Not applicable. Assessment monitoring has not been initiated.

3.5.7 § 257.96(a) Extension of Time for Corrective Measures Assessment

The assessment of corrective measures must be completed within 90 days, unless the owner or operator demonstrates the need for additional time to complete the assessment of corrective measure due to site-specific conditions or circumstances. The owner or operator must obtain a certification from a qualified professional engineer attesting that the demonstration is accurate. The 90-day deadline to complete the assessment of corrective measures may be extended for longer than 60 days. The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer.

Not applicable. Corrective measures assessment has not been initiated.

3.6 §257.90(E)(6) OVERVIEW

A section at the beginning of the annual report that provides an overview of the current status of groundwater monitoring and corrective action programs for the CCR unit.

The specific requirements for the overview under §257.90(e)(6) are listed and the information is provided at the beginning of this report, before the Table of Contents.

4.0 REFERENCES

Coble, R.W., and Roberts, J.V., 1971, The Water Resources of Southeast Iowa: Iowa Geological Survey Water Atlas Number 4, 101 p.

Montgomery Watson, 1994, May 24, 1994, Hydrogeological Investigation Report and Hydrologic Monitoring System Plan, Ottumwa-Midland Commercial Landfill, Montgomery Watson, 1994.

U.S. Environmental Protection Agency (U.S. EPA), 2009, Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance, EPA 530-R-09-007, March 2009.

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Tables

Table 1. Groundwater Monitoring Well Network
Ottumwa Midland Landfill / SCS Engineers Project #25222073.00

Monitoring Well	Location in Monitoring Network	Role in Monitoring Network
MW-102M	Upgradient	Background
MW-122M	Upgradient	Background
MW-301	Downgradient	Compliance
MW-302	Downgradient	Compliance
MW-303	Downgradient	Compliance

Created by:	NDK	Date:	9/26/2022
Last revision by:	NDK	Date:	9/26/2022
Checked by:	RM	Date:	12/20/2022

Table 2. CCR Rule Groundwater Samples Summary
Ottumwa Midland Landfill / SCS Engineers Project #25222073.00

Sample Dates	Downgradient Wells			Background Wells	
	MW-301	MW-302	MW-303	MW-102M	MW-122M
4/13-14/2022	D	D	D	D	D
10/24-27/2022	D	D	D	D	D
Total Samples	2	2	2	2	2

Abbreviations:
D = Required by Detection Monitoring Program

Created by: NDK Date: 1/4/2019
Last revision by: NDK Date: 11/18/2022
Checked by: RM Date: 12/20/2022

Table 3. Groundwater Elevation - CCR Rule Monitoring Network
Ottumwa-Midland Landfill / SCS Engineers Project #25222073.00

Ground Water Elevation in feet above mean sea level (amsl)					
Well Number	**MW-301**	**MW-302**	**MW-303**	**MW-102M**	**MW-122M**
Top of Casing Elevation (feet amsl)	817.88	761.77	762.40	798.03	792.70
Screen Length (ft)	5.0	5.0	5.0	5.0	5.0
Total Depth (ft from top of casing)	204.5	157.7	150.0	152.1	155.3
Top of Well Screen Elevation (ft)	618.38	609.07	617.40	652.65	642.94
Measurement Date					
May 4, 2016	686.46	685.80	686.04	728.73	729.27
June 22, 2016	686.40	685.79	687.72	718.74	725.67
August 9, 2016	686.19	685.48	687.77	715.65	725.16
October 25-26, 2016	683.70	684.94	685.56	716.94	724.61
January 17, 2017	685.57	685.68	685.60	717.91	724.02
April 19-20, 2017	685.72	684.73	685.51	717.80	724.04
June 20-21, 2017	685.88	684.76	685.59	714.83	723.51
July 17, 2017	NM	NM	684.92	NM	NM
August 21-22, 2017	684.96	683.89	684.70	713.23	722.02
November 7-8, 2017	684.50	683.38	684.26	713.53	720.52
April 16-18, 2018	684.85	683.87	684.68	717.38	723.25
October 15-16, 2018	684.58	683.52	684.33	717.05	723.36
April 16-17, 2019	686.38	685.35	686.13	717.97	723.43
June 6, 2019	NA	NA	686.05	NA	NA
August 7, 2019	NA	NA	NA	712.00	720.42
October 14-15,2019	686.56	685.44	686.08	715.50	708.94
May 20-26, 2020	687.29	686.25	687.14	717.61	724.23
June 29, 2020	NA	NA	687.36	NA	NA
October 5-6, 2020	686.80	685.86	686.35	712.05	718.39
April 12 - 13, 2021	687.25	686.26	687.05	710.95	720.52
October 5, 2021	686.87	685.85	686.84	714.85	717.76
April 13-14, 2022	687.00	685.07	686.91	710.24	704.81
October 24-27, 2022	686.01	684.97	685.86	709.07	719.03
Bottom of Well Elevation (ft)	613.38	604.07	612.40	645.93	637.40

Notes:
NM = not measured

Created by: NDK Date: 4/2/20219
Last rev. by: RM Date: 10/28/2022
Checked by: DK Date: 10/28/2022

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Table 4. Horizontal Gradients and Flow Velocity
Ottumwa Midland Landfill / SCS Engineers Project #25222073.00
January - December 2022

	Flow Path A - South				
Sampling Dates	**h1 (ft)**	**h2 (ft)**	**Δl (ft)**	**Δh/Δl (ft/ft)**	**V (ft/d)**
April 13-14, 2022	700.00	685.07	1105.97	0.013	0.2

	Flow Path B - Southeast				
Sampling Dates	**h1 (ft)**	**h2 (ft)**	**Δl (ft)**	**Δh/Δl (ft/ft)**	**V (ft/d)**
October 24-27, 2022	705.00	684.97	1064.22	0.019	0.3

Well	**K Value (cm/sec)**	**K Value (ft/d)**
MW-102M	N/A	N/A
MW-122M	N/A	N/A
MW-301	8.0E-04	2.3
MW-302	3.6E-04	1.0
MW-303	1.1E-02	30
Geometric Mean	1.5E-03	4.1

Assumed Porosity, n
0.25

Groundwater flow velocity equation: V = [K*(Δh/Δl)] / n

ft = feet
ft/d = feet per day
K = hydraulic conductivity
n = effective porosity
V = groundwater flow velocity

h1, h2 = point interpreted groundwater elevation at locations 1 and 2
Δl = distance between location 1 and 2
Δh/Δl = hydraulic gradient
N/A = Not applicable, geometric mean K based on downgradient wells

Notes:
1. See Figures 3 and 4 for velocity calculation flow path locations.

Created by:	NDK	Date:	9/26/2022
Last revision by:	JJK	Date:	11/30/2022
Checked by:	RM	Date:	12/20/2022

Table 5. Groundwater Analytical Results Summary - 2022
Ottumwa Midland Landfill / SCS Engineers Project #25222073.00

Parameter Name	Interwell UPL	Background Wells		Compliance Wells					
		MW-102M	MW-122M	MW-301		MW-302		MW-303	
		4/14/2022	4/14/2022	Intrawell UPL	4/14/2022	Intrawell UPL	4/13/2022	Intrawell UPL	4/13/2022
Appendix III									
Boron, ug/L	5,560	1,400	4,800		710		730		680
Calcium, mg/L	599	32	420		150		50		100
Chloride, mg/L		14	8.5	62.7	24	10.1	5.3	11.5	7.0
Fluoride, mg/L	5.70	4.3	<0.22		<0.22		1.1		0.97
Field pH, Std. Units	8.63	7.91	6.70		6.84		7.30		6.89
Sulfate, mg/L	17,500	330	460		450		61		250
Total Dissolved Solids, mg/L	18,100	1,300	13,000		1,000		630		840

4.4 Blue shaded cell indicates the compliance well result exceeds the UPL and the LOQ.

Abbreviations:
UPL = Upper Prediction Limit
SSI = Statistically Significant Increase
LOQ = Limit of Quantitation
LOD = Limit of Detection
µg/L = micrograms per liter
mg/L = milligrams per liter

Notes:
1. An individual result above the UPL does not constitute an SSI above background. See the accompanying report text for identification of statistically significant results.
2. Interwell UPLs calculated based on results from background wells MW-102M and MW-122M for the period from May 2016 through October 2020. Interwell UPLs based on 1-of-2 retesting approach. The UPLs were updated in January 2021.
3. Intrawell UPL for chloride was calculated based on results from each monitoring well for the period from April 2019 through May 2020. Intrawell UPLs based on 1-of-2 retesting approach. The UPLs were updated in January 2021.

Created by: NDK Date: 5/1/2018
Last revision by: AJR Date: 11/22/2022
Checked by: RM Date: 11/22/2022
PM/Scient. QA/QC: NDK Date: 11/23/2022

Table 6. Groundwater Field Data Summary
Ottumwa Midland Landfill / SCS Engineers Project #25222073.00

Sample	Date	Groundwater Elevation (ft. amsl)	Temperature (Deg. C)	pH (Std. Units)	DO (mg/L)	Specific Conductivity (µmhos/cm)	ORP (mV)	Turbidity (NTU)
MW-102M	4/13/2022	710.24	8.5	7.91	4.40	1,954	-25.9	121.0
MW-122M	4/14/2022	704.81	15.3	6.70	2.43	1,322	22.3	56.9
MW-301	4/14/2022	687.00	11.3	6.84	0.27	1,581	-76.0	22.9
MW-302	4/13/2022	685.07	12.0	7.30	0.36	1,002	-43.2	75.3
MW-303	4/13/2022	686.91	12.5	6.89	0.35	1,344	-37.8	61.2

Abbreviations:
amsl = above mean sea level
µmhos/cm = microSiemens per centimeter
mg/L = milligrams per liter
mV = millivolts

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Last revision by: AJR Date: 11/21/2022
Checked by: RM Date: 11/22/2022

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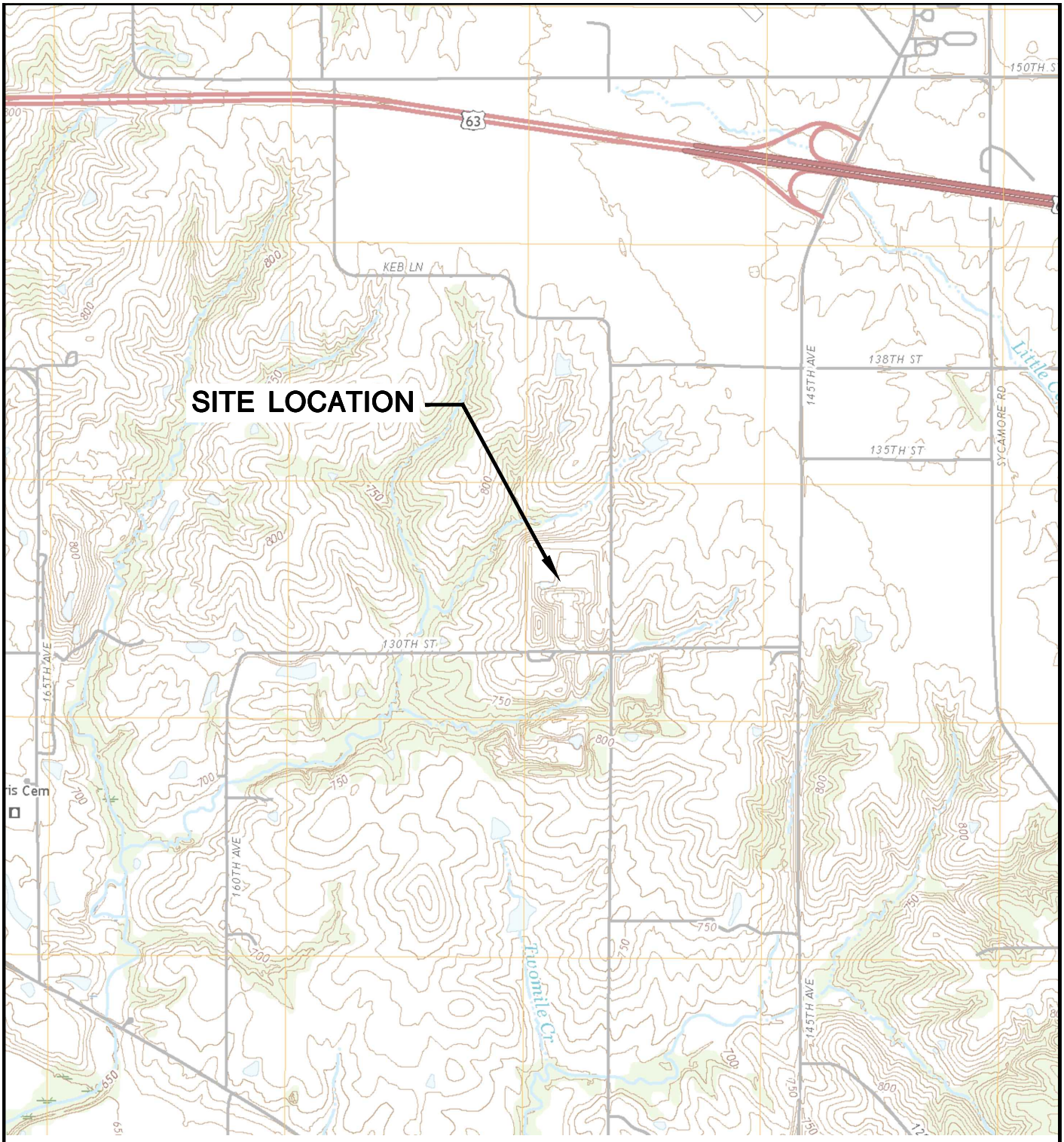
Figures



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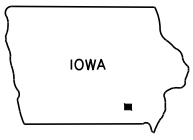
OTTUMWA NORTH QUADRANGLE
IOWA–WAPELLO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
2018
SCALE: 1" = 2,000'



CLIENT	INTERSTATE POWER AND LIGHT CO. 15300 130TH STREET OTTUMWA, IA 52501	SITE	ALLIANT ENERGY OTTUMWA MIDLAND LANDFILL OTTUMWA, IOWA

SITE LOCATION MAP

PROJECT NO.	252519073.00	DRAWN BY:	BSS
DRAWN:	11/18/2019	CHECKED BY:	MDB
REVISED:	01/13/2020	APPROVED BY:	TK 01/30/2020

ENGINEER

SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830

FIGURE
1

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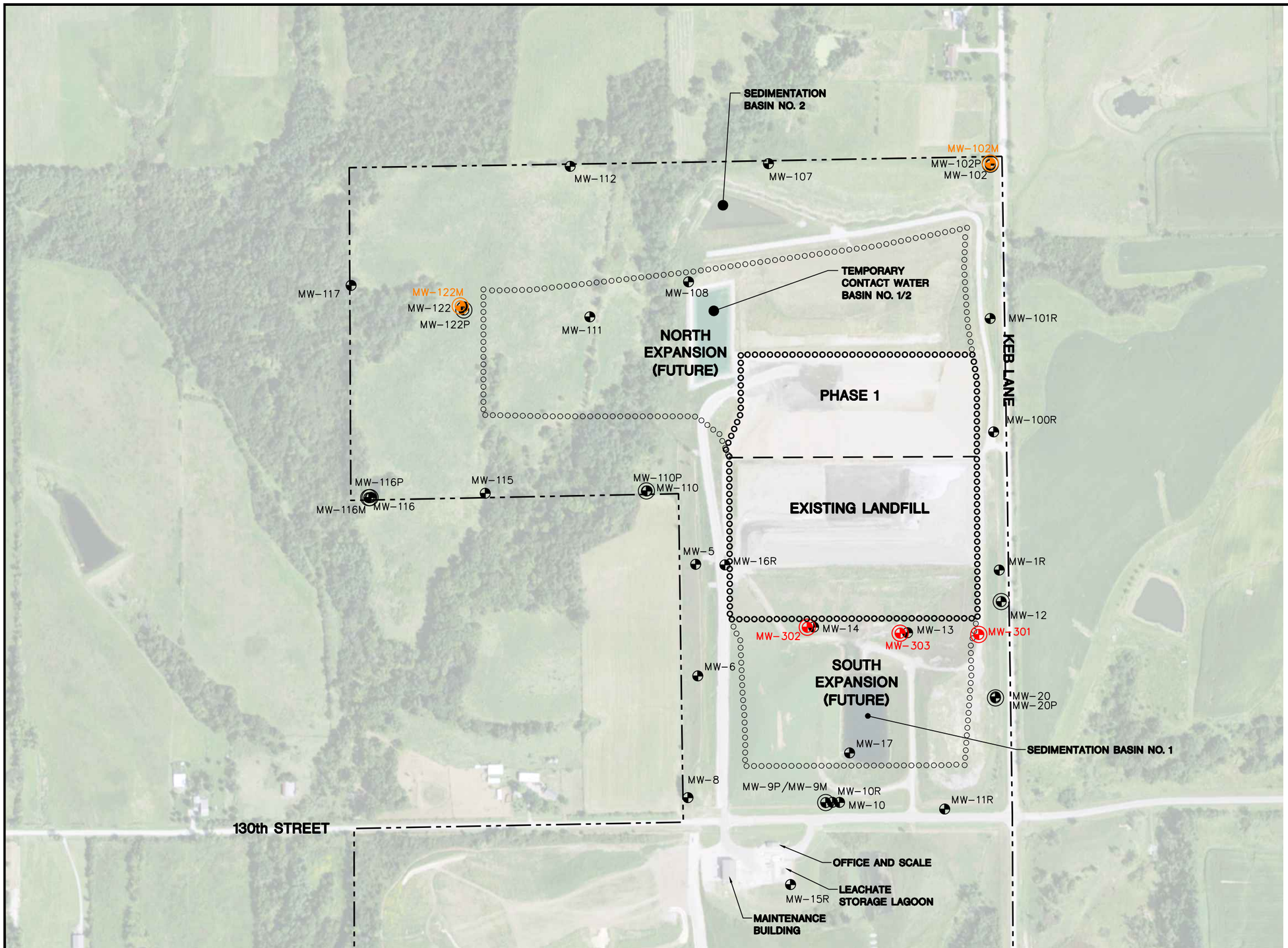


LEGEND

- APPROXIMATE PROPERTY LINE
- EXISTING WASTE LIMITS
- PERMITTED WASTE LIMITS
- CCR RULE PIEZOMETER
- CCR BACKGROUND MONITORING WELL
- MONITORING WELL
- ADDITIONAL PIEZOMETER

NOTES:

1. 2015 AERIAL PHOTOGRAPH IS FROM THE IOWA GEOGRAPHIC MAP SERVER–IOWA STATE UNIVERSITY GEOGRAPHIC INFORMATION SYSTEMS SUPPORT & RESEARCH FACILITY.
2. PROPERTY LINE SOUTH OF 130TH STREET FROM SURVEY MAP PREPARED BY GARDEN & ASSOCIATES, OSKALOOSA, IOWA, DATED DECEMBER 20, 1988.
3. PROPERTY LINE NORTH OF 130TH STREET FROM PLAT OF SURVEY MAP PREPARED BY SCS ENGINEERS, MADISON, WISCONSIN, DATED FEBRUARY 20, 2013.
4. EXISTING LIMITS OF WASTE ARE APPROXIMATE.
5. MONITORING WELLS MW–301 AND MW–302 WERE INSTALLED BY CASCADE DRILLING BETWEEN NOVEMBER 16, 2015, AND DECEMBER 3, 2015.
6. MONITORING WELL MW–303 WAS INSTALLED BY TEAM SERVICES BETWEEN APRIL 11, 2016 AND APRIL 26, 2016.
7. THE BACKGROUND MONITORING WELLS FOR THE OTTUMWA MIDLAND LANDFILL ARE: MW–122M AND MW–102M.

N

400 0 400

SCALE: 1" = 400'

PROJECT NO.	25219073.00	DRAWN BY:	BSS
DRAWN:	11/18/2019	CHECKED BY:	MDB
REVISED:	01/30/2020	APPROVED BY:	TK 01/28/2021

ENGINEER: SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830

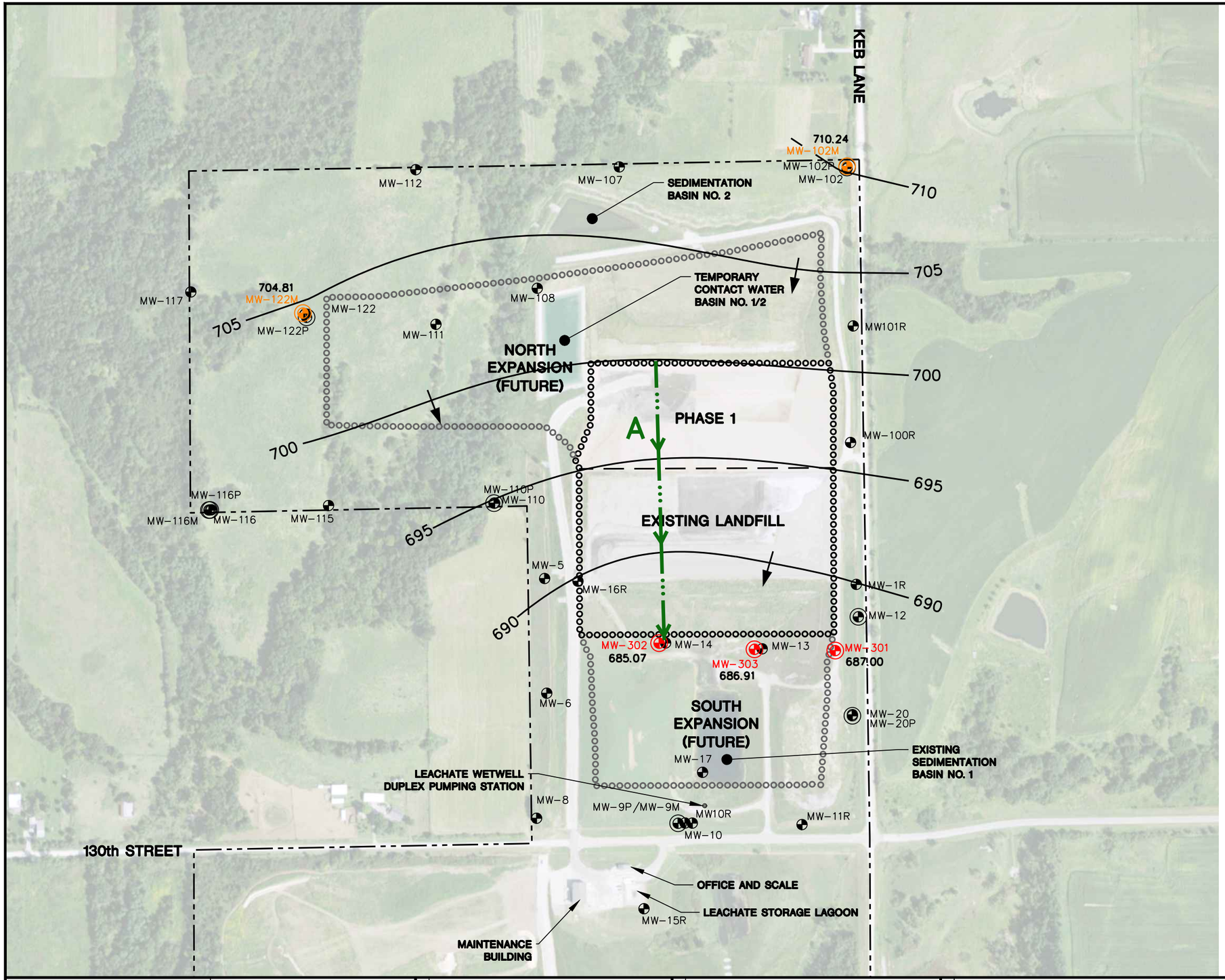
CLIENT: INTERSTATE POWER AND LIGHT CO.
15300 130TH STREET
OTTUMWA, IA 52501

SITE: ALLIANT ENERGY
OTTUMWA MIDLAND LANDFILL
OTTUMWA, IOWA

SITE PLAN AND MONITORING WELL LOCATIONS

FIGURE 2

I:\25219073.00\Drawings\CCR 2019 Annual Report\Site Plan and Monitoring Well Locations.dwg, 1/26/2021 2:09:49 PM



LEGEND

- APPROXIMATE PROPERTY LINE
- APPROVED WASTE LIMITS
- EXISTING WASTE LIMITS
- PHASE LIMIT
- EXISTING MONITORING WELL
- EXISTING PIEZOMETER
- CCR MONITORING WELL
- CCR BACKGROUND MONITORING WELL
- 687.25 — WATER TABLE ELEVATION MEASURED ON APRIL 13–14, 2022
- POTENTIOMETRIC SURFACE CONTOUR (DASHED WHERE INFERRED)
- FLOW PATH FOR VELOCITY CALCULATION (SEE TABLE 4)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTES:

1. 2015 AERIAL PHOTOGRAPH IS FROM THE IOWA GEOGRAPHIC MAP SERVER–IOWA STATE UNIVERSITY GEOGRAPHIC INFORMATION SYSTEMS SUPPORT & RESEARCH FACILITY.
2. PROPERTY LINE SOUTH OF 130TH STREET FROM SURVEY MAP PREPARED BY GARDEN & ASSOCIATES, OSKALOOSA, IOWA, DATED DECEMBER 20, 1988.
3. PROPERTY LINE NORTH OF 130TH STREET FROM PLAT OF SURVEY MAP PREPARED BY SCS ENGINEERS, MADISON, WISCONSIN, DATED FEBRUARY 20, 2013.
4. EXISTING LIMITS OF WASTE ARE APPROXIMATE.
5. THE BACKGROUND MONITORING WELLS FOR THE OTTUMWA MIDLAND LANDFILL ARE: MW–122M AND MW–102M.

400 0 400

SCALE: 1" = 400'

N

PROJECT NO.	25222073.00	DRAWN BY:	KP
DRAWN:	08/23/2022	CHECKED BY:	RM
REVISED:	01/20/2023	APPROVED BY:	TK, 1/27/2023

ENGINEER: SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830

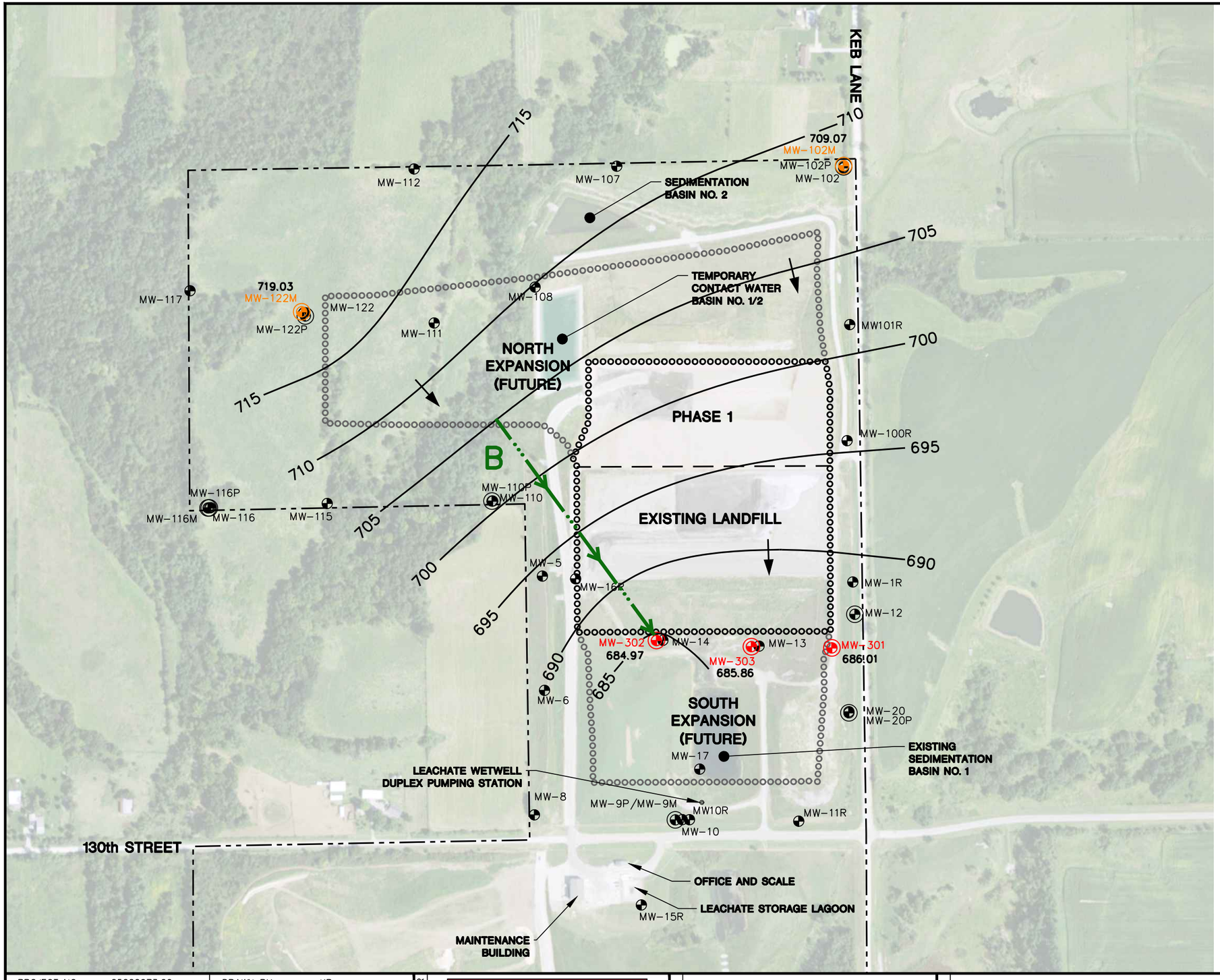
CLIENT: INTERSTATE POWER AND LIGHT CO.
15300 130th STREET
OTTUMWA, IA 52501

SITE: OTTUMWA MIDLAND LANDFILL
OTTUMWA, IOWA

POTENTIOMETRIC SURFACE MAP
APRIL 13–14, 2022

FIGURE 3

I:\25222073.00\Drawings\Wtbl.dwg, 1/20/2023 1:31:20 PM



LEGEND

- APPROXIMATE PROPERTY LINE
- APPROVED WASTE LIMITS
- EXISTING WASTE LIMITS
- PHASE LIMIT
- EXISTING MONITORING WELL
- EXISTING PIEZOMETER
- CCR MONITORING WELL
- CCR BACKGROUND MONITORING WELL
- **686.01** WATER TABLE ELEVATION MEASURED ON OCTOBER 24–27 2022
- POTENTIOMETRIC SURFACE CONTOUR (DASHED WHERE INFERRED)
- FLOW PATH FOR VELOCITY CALCULATION (SEE TABLE 4)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTES:

1. 2015 AERIAL PHOTOGRAPH IS FROM THE IOWA GEOGRAPHIC MAP SERVER–IOWA STATE UNIVERSITY GEOGRAPHIC INFORMATION SYSTEMS SUPPORT & RESEARCH FACILITY.
2. PROPERTY LINE SOUTH OF 130TH STREET FROM SURVEY MAP PREPARED BY GARDEN & ASSOCIATES, OSKALOOSA, IOWA, DATED DECEMBER 20, 1988.
3. PROPERTY LINE NORTH OF 130TH STREET FROM PLAT OF SURVEY MAP PREPARED BY SCS ENGINEERS, MADISON, WISCONSIN, DATED FEBRUARY 20, 2013.
4. EXISTING LIMITS OF WASTE ARE APPROXIMATE.
5. THE BACKGROUND MONITORING WELLS FOR THE OTTUMWA MIDLAND LANDFILL ARE: MW–122M AND MW–102M.

400 0 400

SCALE: 1" = 400'

N

PROJECT NO.	25222073.00	DRAWN BY:	KP
DRAWN:	11/23/2022	CHECKED BY:	RM
REVISED:	01/20/2023	APPROVED BY:	TK, 1/27/2023

ENGINEER: SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718–6751
PHONE: (608) 224–2830

CLIENT: INTERSTATE POWER AND LIGHT CO.
15300 130th STREET
OTTUMWA, IA 52501

SITE: OTTUMWA MIDLAND LANDFILL
OTTUMWA, IOWA

POTENTIOMETRIC SURFACE MAP
OCTOBER 24–27, 2022

FIGURE
4

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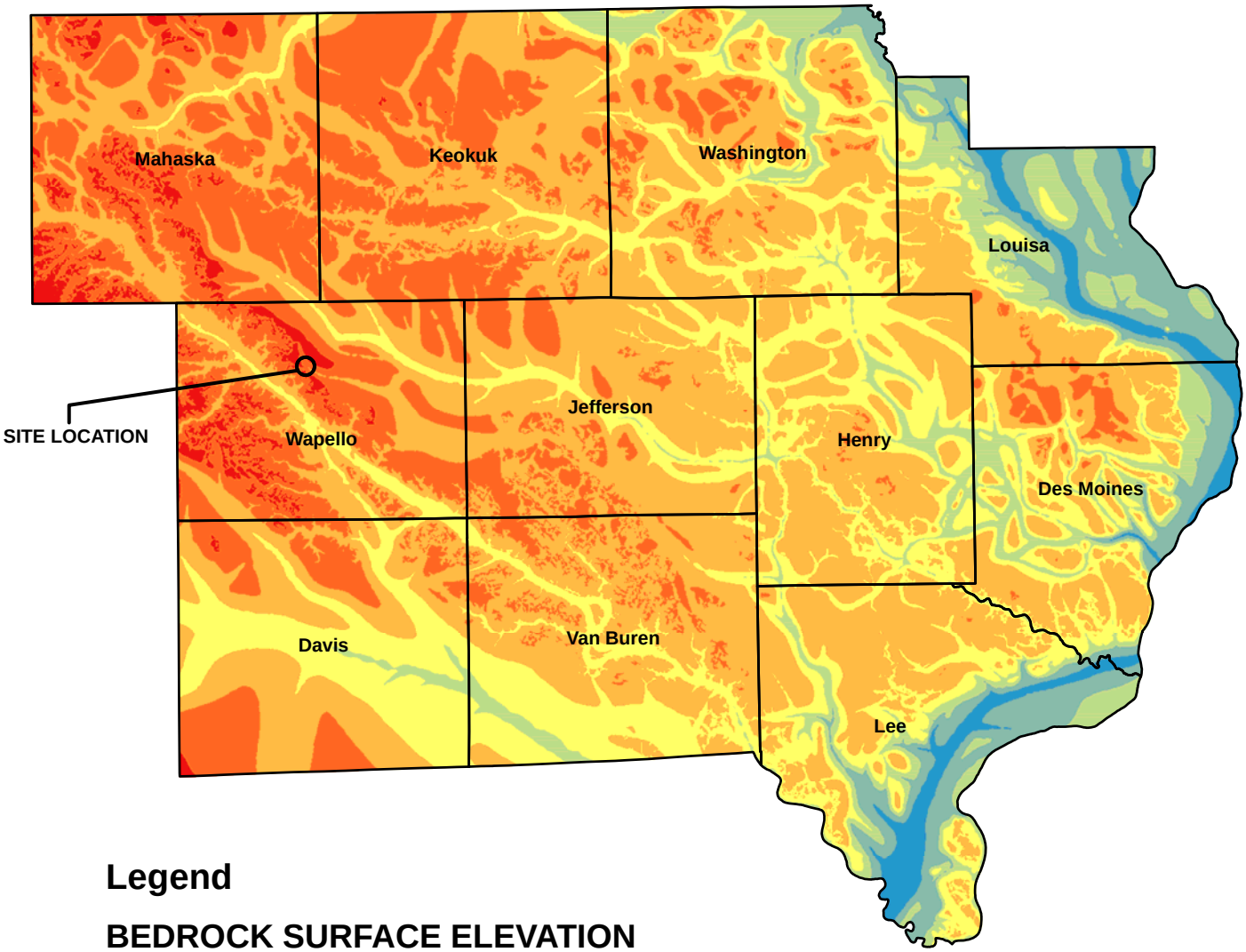
Appendix A

Regional Hydrogeologic Information



Legend

BEDROCK SURFACE ELEVATION

ELEVATION ABOVE MEAN SEA LEVEL IN FEET

- BELOW 300
- 300 TO 400
- 400 TO 500
- 500 TO 600
- 600 TO 700
- 700 TO 800
- 800 TO 900

N

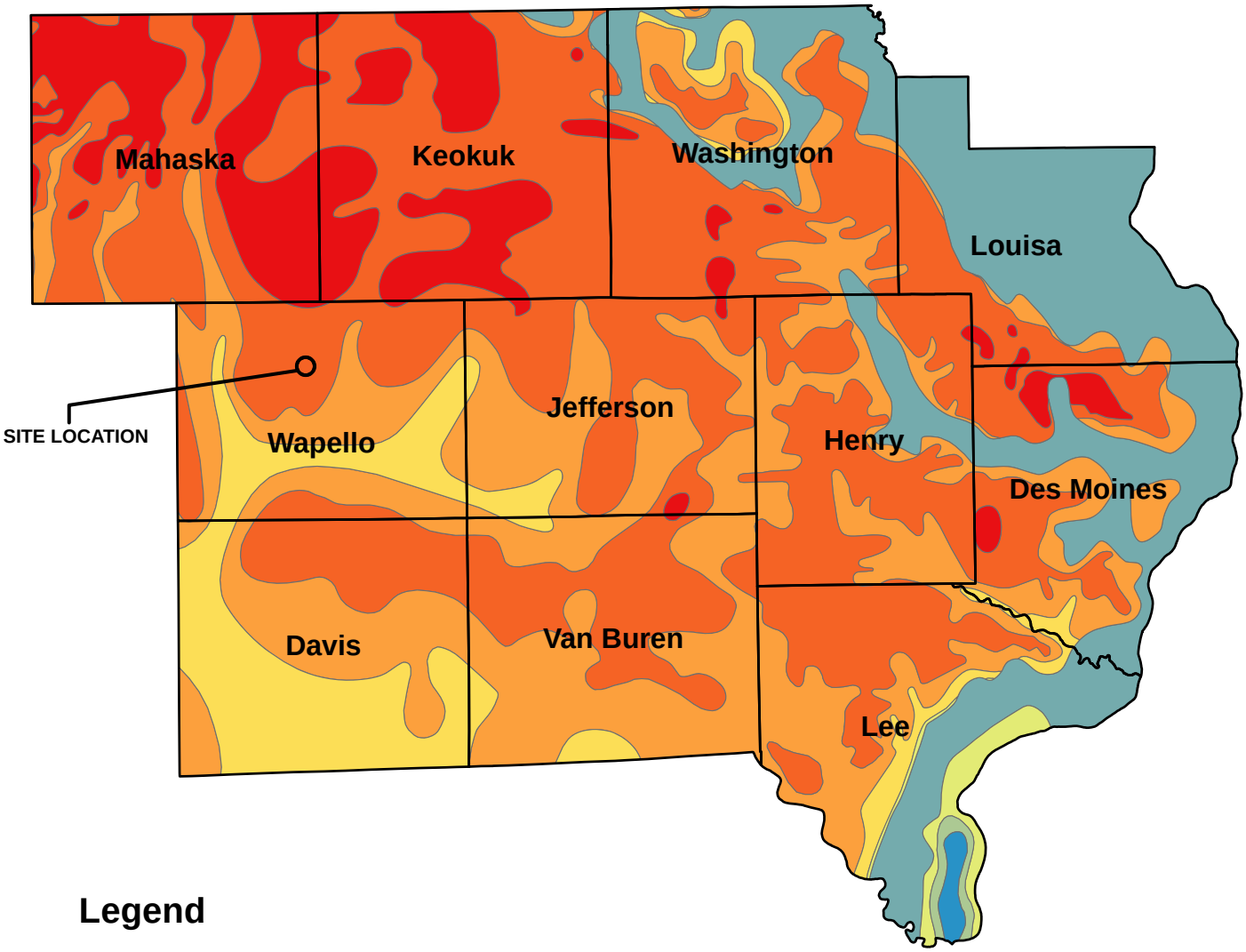
0 5 10 20 Miles

MAP DATA DERIVED FROM IOWA GEOLOGICAL AND WATER SURVEY
IOWA BEDROCK SURFACE ELEVATION AS OBTAINED
FROM IOWA NATURAL RESOURCES
GEOGRAPHIC INFORMATION SYSTEMS LIBRARY

CLIENT	INTERSTATE POWER AND LIGHT CO. 15300 130TH STREET OTTUMWA, IA 52501	SITE	OTTUMWA MIDLAND LANDFILL OTTUMWA, IOWA
	SE IOWA REGIONAL BEDROCK SURFACE ELEVATION		

PROJECT NO.	25215053.03	DRAWN BY:	JB	ENGINEER	FIGURE
DRAWN:	07/29/13	CHECKED BY:	MDB	SCS ENGINEERS 2830 DAIRY DRIVE MADISON, WI 53718-6751 PHONE: (608) 224-2830 FAX: (608) 224-2839	4
REVISED:	08/02/13	APPROVED BY:			

I:\25215053\Drawings\OML\ArcMAP files\OML-BEDROCK TOPO 8.5X11 portrait.mxd



Legend

MISSISSIPIAN AQUIFER ELEVATION

ELEVATION ABOVE MEAN SEA LEVEL IN FEET

- MISSISSIPPIAN NOT PRESENT
- 150
- 250
- 350
- 450
- 550
- 650
- 750

N

0 5 10 20 Miles

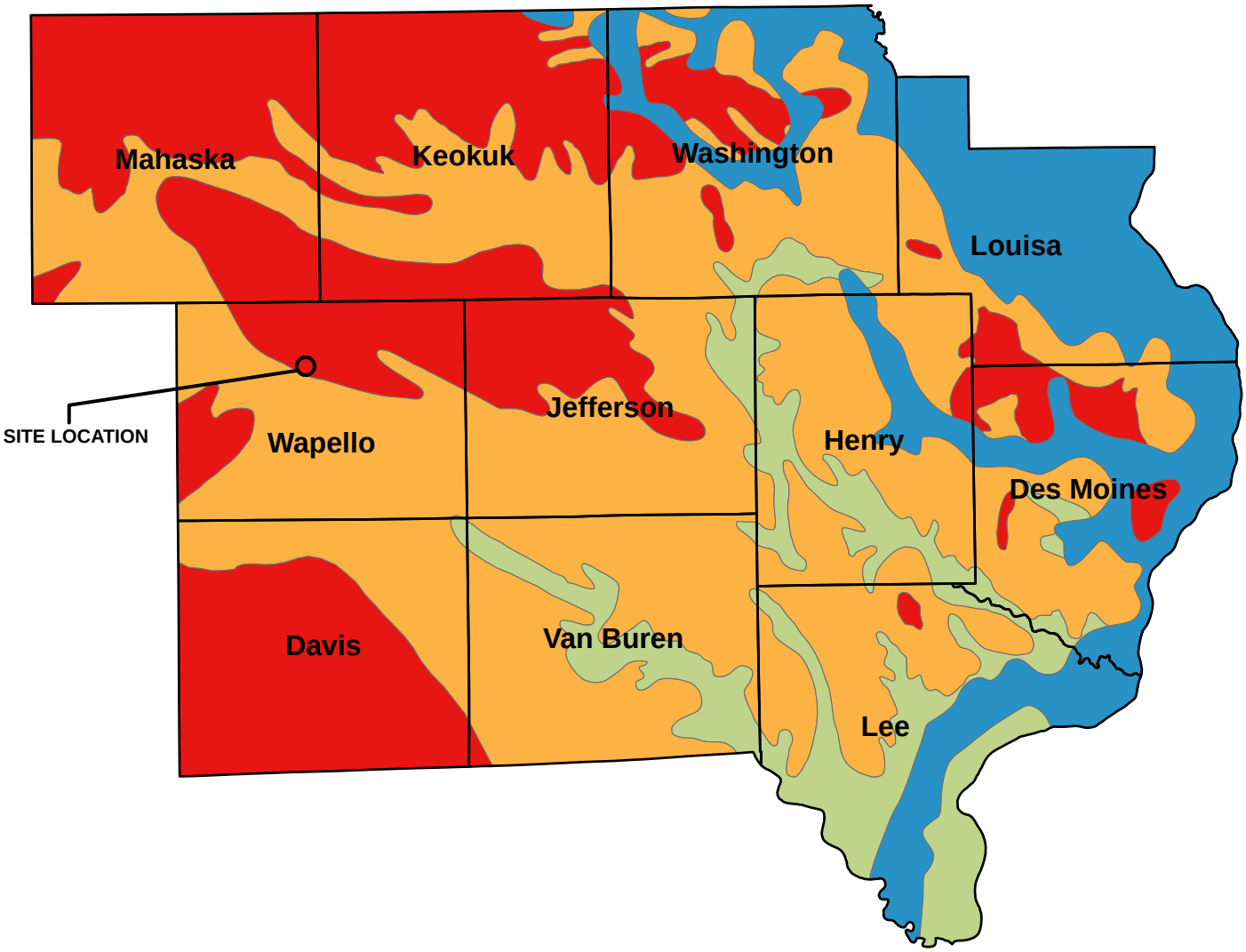
MAP DATA DERIVED FROM IOWA GEOLOGICAL AND WATER SURVEY
MISSISSIPPIAN AQUIFER SURFACE ELEVATION AS OBTAINED
FROM IOWA NATURAL RESOURCES
GEOGRAPHIC INFORMATION SYSTEMS LIBRARY

CLIENT	INTERSTATE POWER AND LIGHT CO. 15300 130TH STREET OTTUMWA, IA 52501	SITE	OTTUMWA MIDLAND LANDFILL OTTUMWA, IOWA
	SE IOWA REGIONAL MISSISSIPIAN AQUIFER SURFACE ELEVATION		

PROJECT NO.	25215053.03	DRAWN BY:	JB	ENGINEER	SCS ENGINEERS
DRAWN:	07/29/13	CHECKED BY:	MDB		2830 DAIRY DRIVE MADISON, WI 53718-6751 PHONE: (608) 224-2830 FAX: (608) 224-2839
REVISED:	08/02/13	APPROVED BY:			

FIGURE 5

I:\25215053\Drawings\OML\ArcMAP files\OML-MISSISS TOPO 8.5X11 portrait.mxd



Legend

MISSISSIPIAN AQUIFER POTENTIOMETRIC SURFACE

ELEVATION ABOVE MEAN SEA LEVEL IN FEET

- MISSISSIPPIAN NOT PRESENT
- 550
- 650
- 750

N

0 5 10 20 Miles

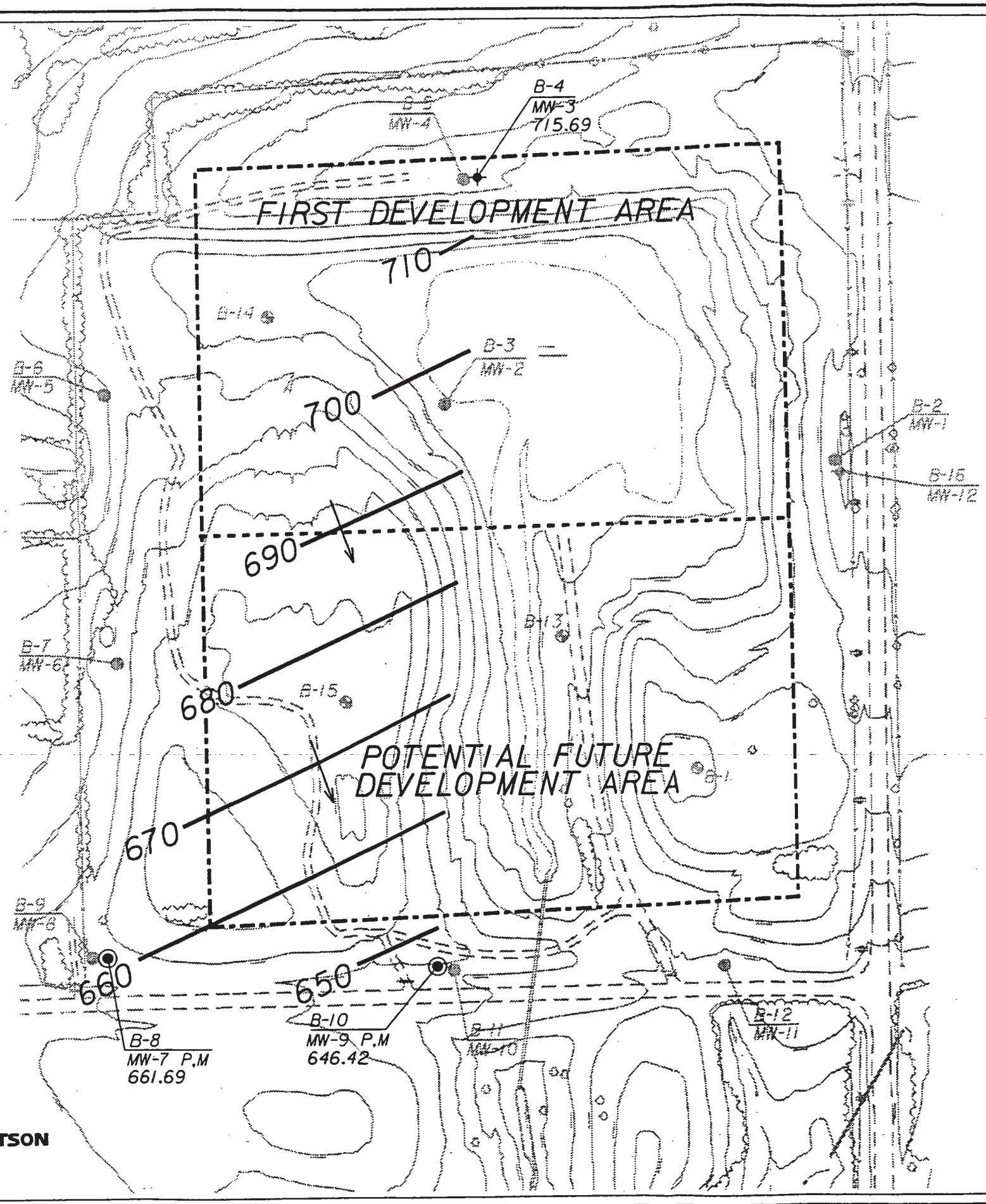
MAP DATA DERIVED FROM IOWA GEOLOGICAL AND WATER SURVEY
MISSISSIPIAN AQUIFER POTENTIOMETRIC SURFACE ELEVATION AS OBTAINED
FROM IOWA NATURAL RESOURCES
GEOGRAPHIC INFORMATION SYSTEMS LIBRARY

CLIENT	INTERSTATE POWER AND LIGHT CO. 15300 130TH STREET OTTUMWA, IA 52501	SITE	OTTUMWA MIDLAND LANDFILL OTTUMWA, IOWA
	SE IOWA REGIONAL MISSISSIPIAN AQUIFER POTENTIOMETRIC SURFACE ELEVATION		

PROJECT NO.	25215053.03	DRAWN BY:	JB	ENGINEER	FIGURE
DRAWN:	07/29/13	CHECKED BY:	MDB		
REVISED:	08/02/13	APPROVED BY:			7

SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830 FAX: (608) 224-2839

I:\25215053\Drawings\OML\ArcMAP files\OML-MISSISS POTENT 8.5X11 portrait.mxd



MONTGOMERY WATSON

N

0 - 200

SCALE IN FEET

LEGEND:

- BORING
- DEEP MONITORING WELL
- MULTIPLE-CASED DEEP WELL
- SHALLOW MONITORING WELL
- PROPOSED LANDFILL BOUNDARY
- 661.69 POTENTIOMETRIC SURFACE ELEVATION ON 03-02-94
- INFERRED DIRECTION OF GROUNDWATER FLOW

NOTES:

1. CONTOUR INTERVAL = 10 FT.
2. ALL ELEVATIONS ARE REFERENCED TO NGVD.

OTTUMWA-MIDLAND
DEVELOPMENT CORPORATION

POTENTIOMETRIC SURFACE CONTOURS – MISSISSIPPIAN (03-02-94)

FIGURE 4-18

Appendix B

Boring Logs and Well Construction Documentation

SCS ENGINEERS
Civil & Environmental Engineering

SOIL BORING LOG INFORMATION
10-92

Facility/Project Name: Ottumwa Midland Landfill SCS # 25211509.03		License/Permit/Monitoring Number	Boring Number: B-102
Boring Drilled By (Firm name and name of crew chief): Boart Longyear — Paul Dickinson		Drilling Started: 08/20/2012	Drilling Completed: 08/27/2012 / Drilling Method: HSA, Air Hammer, Core
Facility Well No.	Unique Well No. / Common Well Name: MW-102M	Static Water Level: Feet	Surface Elevation: 795.0 Feet / Borehole Diam.: 10.5/6 Inches
Boring Location: State Plane N, E; NE 1/4 of SE 1/4 of Section 34, T. 73 N., R. 14 W.		Lat. / Long.	Local Grid Location (If applicable)
County: Wapello	Location Code	Civil Town/City/or Village: Ottumwa	

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
S1	8	05,07 09,12		SILTY CLAY, dark brown (10YR 3/3), stiff, massive, few roots (topsoil/loess).	CL-ML				1.25	M		begin drilling with 6-1/4" hollow stem augers and sampling with split-spoons and 140 lb hammer
S2	8	06,13 09,18	5	LEAN CLAY, mottled olive yellow (2.5Y 6/8) and light olive brown (2.5Y 5/3), hard, blocky (loess).	CL				>4.5	M		
S3	14	12,17 10,14		LEAN CLAY, very dark grayish brown (2.5Y 3/2) mottled dark red (2.5YR 3/6), with silt, very stiff, cobble at 6' (till).	CL				>4.5 4.0	M M		
S4 ST	24									M		pushed shelby tube from 7.5' to 9.5'

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Tyler Munson — Firm: SCS ENGINEERS Tyler Munson

SCS ENGINEERS

Boring Number B-102

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
S5	10	12,21 38, 30/2"		CLAY, grayish brown (10YR 5/2) with black (10YR 2/1) and dark reddish brown (2.5YR 2.5/4) mottles, hard.	CL				4.25	M		
				WEATHERED SHALE, gray (2.5Y 5/1), trace to few black (2.5Y 2.5/1) zones, massive, with silt (Pennsylvanian).					>4.5	M		
S6	12	22,17 61/4"		As above, except silty with pale red zones instead of black zones.	Shale				>4.5	M		at 15' auger refusal, begin drilling with 6" air hammer and sample drill cuttings
			15	SHALE, light brownish gray (10YR 6/2) and brownish yellow (10YR 6/6).								
S7												
			20	As above, except trace very dark grayish brown (10YR 3/2).								
S8					Shale							
			25	As above, except gray (10YR 6/1 to 10YR 5/1).								
S9												

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
				As above.								
S10					Shale							
			35	SHALE with coal, black (10YR 2/1) to very dark brown (10YR 2/2).								
S11					Shale							
			40	COAL, black (10YR 2/1).								
S12					Coal							
			45	SHALE, light gray (10YR 7/1) to gray (10YR 6/1).								
S13					Shale							

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
				SHALE, gray (10YR 5/1)								
S14			55									
S15			60	As above, except gray (10YR 6/1) to dark gray (10YR 4/1).	Shale							
S16			65	As above, except very dark gray (10YR 3/1).								
S17												

SCS ENGINEERS

10-92

Boring Number B-102

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
				SHALE, gray (10YR 6/1).								
S18					Shale							
												at 74', begin NQ3 coring
				SILTY SHALE, gray (10YR 5/1), 1mm to 3mm-thick lamina, intensely fractured.	Shale							
			75	SANDSTONE, gray (10YR 5/1) with some light yellowish brown (10YR 6/4) lamina, strong, moderately fractured.	Sand-stone							
				SILTY SHALE, gray (10YR 5/1), 1mm to 3mm-thick lamina, moderately fractured, moderate to strong.	Shale							
				SANDSTONE, gray (10YR 5/1) with some light yellowish brown (10YR 6/4) lamina, strong, moderately fractured.	Sand-stone							Run 1 (74' to 81.5') TCR=74% SCR=74% MCR=45% RQD=Poor
Run 1	58/78			SILTY SHALE, gray (10YR 5/1), 1mm to 3mm-thick lamina, moderately fractured, moderate to strong.	Shale							
				SANDSTONE, gray (10YR 5/1), strong, moderately fractured.	Sand-stone							
			80	VOID or FRACTURES in possible shale.								lost circulation at 80'
					Shale							Run 2 (81.5' to 83.5') TCR=33% SCR=0% MCR=0% RQD=Very Poor
Run 2	8/24			WEATHERED SHALE (clay).	Shale							
				SHALE, very dark gray (10YR 3/1), moderate strength, intensely fractured, few pyrite nodules up to 1mm by 3mm in size, some highly decomposed zones.								
			85									
					Shale							Run 3 (83.5' to 91.5') TCR=59% SCR=53% MCR=8% RQD=Very Poor
Run 3	57/96											

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
				As above.	Shale							
				SILTY SHALE, black (10YR 2/1), weak to moderate strength, intensely fractured.								
			95									
Run 4	31/ 120				Shale							Run 4 (91.5' to 101.5') TCR=26% SCR=21% MCR=3% RQD=Very Poor
			100									
				SILTY SHALE, dark brown (7.5YR 3/2), very weak, 1mm to 3mm-thick lamina, highly decomposed.	Shale							
				SILTY SHALE, dark gray (7.5YR 4/1), moderate strength to strong, massive, few weak zones, no decomposition.								
			105									
Run 5	88/ 120				Shale							Run 5 (101.5'-111.5') TCR=73% SCR=73% MCR=35% RQD=Poor

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
Run 6	119/ 120		115	As above, except calcitic, pyrite nodules 5mm by 20mm in size at 112.8' and 117.3', slightly disintegrated and decomposed, slightly fractured, with some pyrite infilling.	Shale							Run 6 (111.5'-121.5') TCR=99% SCR=99% MCR=84% RQD=Good
			120	SHALE, greenish gray (5GY 6/1), weak to moderate strength, pyrite mineralization along laminated zones, few disintegrated zones.								
Run 7	44/ 120		125	As above, except dark gray (7.5YR 4/1), massive, aphanitic.	Shale							Run 7 (121.5'-131.5') TCR=37% SCR=35% MCR=27% RQD=Poor
				SHALE, reddish brown (2.5YR 4/3), highly decomposed.	Shale							
				SHALE, gray (7.5YR 5/1), weak to moderate strength, with white limestone	Shale							

SCS ENGINEERS

Boring Number B-102

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
				gravel, slighty to moderately disintegrated.	Shale							
				WEATHERED SHALE, highly decomposed, possibly soft shale in clay.								
			135									
Run 8	0/120				Shale							Run 8 (131.5'-141.5') TCR=0% SCR=0% MCR=0% RQD=Very Poor
				Possible limestone at 138'.								at 138', driller reports change in drilling
			140									
				LIMESTONE, gray (10YR 5/1), strong (Mississippian).								
Run 9	29/60				Lime-stone							Run 9 (141.5'-146.5') TCR=48% SCR=38% MCR=15% RQD=Very Poor
			145									
				Blind drill.								after coring, reamed hole with 6" air hammer to 153'
					.							

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
				Blind drill.								
				End of boring @ 153'. Set MW-102M with 5' PVC screen to 148'.								
			155									
			160									
			165									

SCS ENGINEERS
Civil & Environmental Engineering

SOIL BORING LOG INFORMATION
10-92

Facility/Project Name: Ottumwa Midland Landfill SCS # 25211509.03			License/Permit/Monitoring Number		Boring Number: B-122
Boring Drilled By (Firm name and name of crew chief): Boart Longyear — Paul Dickinson			Drilling Started: 12/06/2012	Drilling Completed: 12/09/2012	Drilling Method: HSA, Air Hammer, Core
Facility Well No.	Unique Well No.	Common Well Name: MW-122M	Static Water Level: Feet	Surface Elevation: 790.6 Feet	Borehole Diam.: 10.5/6 Inches
Boring Location: State Plane N, E; NW 1/4 of SE 1/4 of Section 34, T. 73 N., R. 14 W.			Lat. / Long.	Local Grid Location (If applicable)	
County: Wapello		Location Code	Civil Town/City/or Village: Ottumwa		

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
				SILT, dark yellowish brown (10YR 4/4), massive, few roots (topsoil/loess).	ML							
S1	9	06-10 14-20		LEAN CLAY, olive yellow (2.5Y 6/6) mottled gray (2.5Y 6/1) and reddish brown (5YR 4/4), trace fine to coarse sand (till).	CL				1.5 2.75 2.0	M		
S2	24	06-17 20-26		CLAY, gray (5Y 5/1), few olive yellow (2.5Y 6/6) and dark reddish brown (5YR 3/4) layers, hard, 1mm to 5mm-thick lamina (weathered shale).					4.5	M		
			5									
S3 ST	20				CL							pushed shelby tube from 5' to 7'
S4	24	07-17 27-34		As above, except less gray and with black layers/lamina.					3.5	M		at 10', auger refusal, and begin drilling with 6" air hammer and sampling drill cuttings
				CLAY, black (2.5Y 2.5/1), 1mm to 2mm-thick lamina (weathered shale)	CL							

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Meghan Blodgett — Firm: SCS ENGINEERS Meghan Blodgett

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
S5				WEATHERED SHALE, black (2.5Y 2.5/1), lamina up to 5mm-thick.								
			15	WEATHERED SHALE, dark gray (2.5Y 4/1) to black (2.5Y 2.5/1).								
S6												
			20	SHALE and WEATHERED SHALE, dark gray (2.5Y 4/1).	Shale							
S7												
			25	SHALE and WEATHERED SHALE, dark gray (2.5Y 4/1) to black (2.5Y 2.5/1).								
S8												

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
				As above.								
S9												
			35	SHALE, dark gray (2.5Y 4/1).								
S10												
			40	As above.	Shale							
S11												
			45	As above.								
S12												

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
				SHALE, dark gray (2.5Y 4/1) to black (2.5Y 2.5/1).								
S13												
			55	As above.								
S14												
			60	As above, except 6" coal seam at approximately 64.5'.	Shale							
S15												
			65	SHALE, light gray (2.5Y 7/1) to very dark gray (2.5y 3/1).								
S16												

SCS ENGINEERS

10-92

Boring Number B-122

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
				SHALE, very dark gray (2.5Y 3/1) to gray (2.5Y 5/1), weak to moderate strength, 1mm to 5mm-thick lamina, moderatly decomposed (clay along fractures), intensely fractured, some sand at 70' to 71'.								begin NQ3 coring at 70'
Run 1	68/78											Run 1 (70' to 76.5') TCR=87% SCR=82% MCR=46% RQD=Poor
			75	As above, except few sandy intervals up to 2" in length at 77.5' to 78.5'.								
Run 2	54/60											Run 2 (76.5' to 81.5') TCR=90% SCR=75% MCR=8% RQD=Very Poor
			80	SHALE, very dark gray (2.5Y 3/1) with little gray (2.5Y 5/1 & 6/1), 1mm to 5mm-thick lamina, moderately weathered (clay along fractures), trace pyrite nodules throughout.	Shale							
Run 3	40/60											Run 3 (81.5' to 86.5') TCR=67% SCR=55% MCR=0% RQD= Very Poor
			85	As above.								
Run 4	36/60											Run 4 (86.5' to 91.5') TCR=60% SCR=53% MCR=40% RQD=Poor

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
Run 4 (cont)				As above.	Shale							
				SILTSTONE, very dark gray (2.5Y 3/1), moderately strong, massive, trace fractures infilled with calcite.	Silt-stone							four 6" to 8" bit drops one foot apart indicated possible voids from 93' to 97'
				SHALE, very dark gray (2.5Y 3/1), very weak to weak, 1mm to 5mm-thick lamina, moderately to highly decomposed (highly decomposed in top 2' of recovered shale), trace pyrite throughout, possible voids from approximately 93' to 97', bedding planes are horizontal where present.								
			95									
Run 5	59/ 120											Run 5 (91.5'-101.5') TCR=49% SCR=29% MCR=7% RQD=Very Poor
			100		Shale							
				SHALE, light to dark gray (2.5Y 7/1 to 4/1), weak, 1mm to 3mm-thick lamina, massive from 104' to 105', trace coal on fracture planes, trace pyrite throughout.								
Run 6	48/60											Run 6 (101.5'-106.5') TCR=80% SCR=68% MCR=48% RQD=Poor
			105									
				SHALE, gray (2.5Y 5/1), weak to moderate strength, 1mm to 3mm-thick lamina, silty.								
Run 7	6/60											Run 7 (106.5'-111.5') TCR=10% SCR=10% MCR=7% RQD=Very Poor

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
Run 7 (cont)				As above.								
Run 8	30/30		115	SHALE, dark gray (2.5Y 4/1) with gray (2.5Y 5/1), weak to moderate strength, bedding vairable, 1mm-thick lamina to 2cm-thick beds, moderately decomposed (clay in fractures), few 1cm to 3cm-thick sandy zones, trace pyrite nodules throughout.								Run 8 (111.5'-114') TCR=100% SCR=80% MCR=60% RQD=Fair
Run 9	65/90			Interbedded SHALE, SILTSTONE, and SANDSTONE, gray (10YR 6/1) to very dark gray (10YR 3/1), weak strength to strong, sandstone/siltstone/shale intervals are 1" to 10"-thick, bedding ranges from 1mm-thick lamina in shale to massive in siltstones, some slump/flame structures in sand, intensely fractured, fresh to moderately decomposed (clay in fractures), trace pyrite throughout.	Shale							Run 9 (114'-121.5') TCR=72% SCR=70% MCR=9% RQD=Very Poor
			120									
Run 10	12/12			SHALY SILTSTONE and SANDSTONE, black (2.5Y 2.5/1) with bands of light gray (2.5Y 7/1), moderate strength, 1mm to 10mm-thick lamina, trace pyrite throughout, moderately to intensely fractured.								Run 10 (121.5'-122.5') TCR=100% SCR=92% MCR=0% RQD=Very Poor
			125		Silt-stone							
Run 11	108/ 108											Run 11 (122.5'-131.5') TCR=100% SCR=95% MCR=60% RQD=Fair
				SHALE, black (2.5Y 2.5/1), weak, 1mm to 5mm-thick lamina, some silt and sand, moderatly decomposed, moderately fractured, trace pyrite throughout.	Shale							

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
Run 11 (cont)				As above.	Shale							
				SHALE, dark greensih gray (5GY 4/1), weak to moderate strength, 1mm to 5mm-thick lamina, moderately to highly decomposed.	Shale							
			135									
Run 12	110/ 120											Run 12 (131.5'-141.5') TCR=92% SCR=86% MCR=63% RQD=Fair
				LIMESTONE CONGLOMERATE, reddish brown (5YR 5/3) with gray shale between clasts, weak, massive.	Lime-stone							
			140									
				SHALY LIMESTONE, greenish gray (5GY 5/1), weak, massive, 2" of light gray clay at interface with above conglomerate.	Lime-stone							
				SHALY LIMESTONE, reddish brown (5YR 4/3), few greenish gray zones, moderate strength, few clasts of hard competent limestone up to 1.5" in diameter, moderately decomposed.								
			145									
Run 13	114/ 120				Lime-stone							Run 13 (141.5'-151.5') TCR=95% SCR=95% MCR=73% RQD=Fair

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
Run 13 (cont)				SHALY LIMESTONE, yellowish gray (5GY 5/1), weak, massive, fresh to slightly decomposed.	Lime-stone							
Run 14	30/30			As above.								Run 14 (151.5'-154') TCR=100% SCR=90% MCR=90% RQD=Good
			155	End of Boring @ 154'. Set MW-122M with 5' PVC screen to 152'.								
			160									
			165									

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: IPL - Ottumwa Midland Landfill Permit No.: 90-SDP-8-92P

Well or Piezometer No: MW-301

Dates Started: 11/23/15 Date Completed: 11/24/15

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft):

Specify corner of site: SE

Distance & direction along boundary: 700'N

Distance & direction from boundary to wall: 90' W

Elevations (± 0.01 ft MSL):

Ground Surface: 815.51'

Top of protective casing: 818.36'

Top of well casing: 817.88'

Benchmark elevation: 818.70

Benchmark description: Control Point #2

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Cascade Drilling, LP
301 Alderson St
Schofield, WI 54476

Name of Driller: Todd Schmalfeld

Drilling Method: 4.25' HSA to 24.5'/Air Rotary to 164'/coring

Drilling Fluid: NA

Bore Hole Diameter: 8.50 inch/ 6 inch

Soil Sampling Method: Split Spoon/cuttings/core

Depth of Boring: 202'

C. MONITORING WELL INSTALLATION

Casing material: sch 80 PVC

Length of casing: 196'

Outside casing diameter: 2.38"

Inside casing diameter: 1.9"

Casing joint type: threaded

Casing/screen joint type: threaded

Screen material: PVC

Screen opening size: 0.010

Screen length: 5 ft

Depth of well: 201 ft

Filter Pack:

Material: Red Flint

Grain size: #40

Volume: 2 cubic ft

Seal (minimum 3 ft length above filter pack):

Material: AquaGuard grout

Placement method: tremie

Volume: 400 gallons

Backfill (if different from seal):

Material: 3/8" bentonite chips and Aqua Guard grout

Placement method: gravity/tremie

Volume:

Surface seal design:

Material of protective casing: Steel 6 inch

Material of grout between protective casing and well casing: sand

Protective cap:

Material: Steel

Vented: ☒ Yes ☐ No Locking: ■ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ■ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 125.9 Stabilization Time: 20 HR

Well development method: Surged and bailed, then pumped to reduce turbidity.

Average depth of frostline: 3.5'

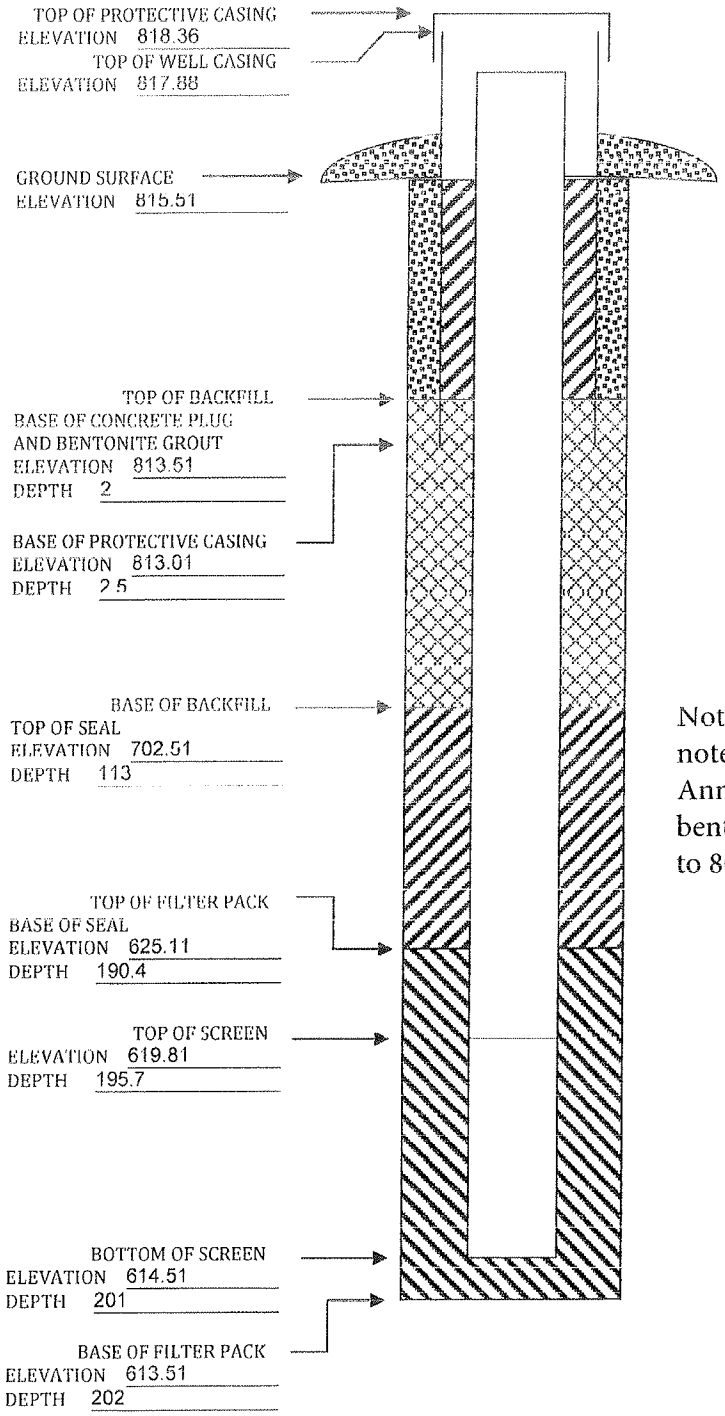
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Note: Grout placed from 190.4' bgs to 113' bgs. Void noted from 105' bgs to 113'. Grout basket placed at 95'bgs. Annular space above grout basket sealed with 3/8" bentonite chips (80'-95' bgs) and bentonite grout (3' bgs to 80' bgs).

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: IPL - Ottumwa Midland Landfill Permit No.: 90-SDP-8-92P

Well or Piezometer No: MW-302

Dates Started: 12/1/15 Date Completed: 12/3/15

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft):

Specify corner of site: SE

Distance & direction along boundary: 700' N

Distance & direction from boundary to wall: 725' W

Elevations (± 0.01 ft MSL):

Ground Surface: 759.50'

Top of protective casing: 762.31'

Top of well casing: 761.77'

Benchmark elevation: 818.70

Benchmark description: Control Point #2

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Cascade Drilling, LP
301 Alderson St
Schofield, WI 54476

Name of Driller: Todd Schmalfeld

Drilling Method: 4.25'HSA to 14.5'/Air Rotary to 95'/coring

Drilling Fluid: NA

Bore Hole Diameter: 8.5 inch/6 inch

Soil Sampling Method: Spoon/cuttings/core

Depth of Boring: 156.5'

C. MONITORING WELL INSTALLATION

Casing material: sch 80 PVC

Length of casing: 150'

Outside casing diameter: 2.38"

Inside casing diameter: 1.9"

Casing joint type: threaded

Casing/screen joint type: threaded

Screen material: PVC

Screen opening size: 0.010

Screen length: 5'

Depth of well: 155'

Filter Pack:

Material: Red Flint

Grain size: #40

Volume: 2 cubic ft

Seal (minimum 3 ft length above filter pack):

Material: 3/8" bentonite chips

Placement method: gravity

Volume: 0.5 cubic ft

Backfill (if different from seal):

Material: Agua Guard Grout

Placement method: Tremie

Volume: 300 gallons

Surface seal design:

Material of protective casing: Steel 6 inch

Material of grout between protective casing and well casing: sand

Protective cap:

Material: Steel

Vented: ☒ Yes ☐ No Locking: ■ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ■ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 75.97' Stabilization Time: <1 hour

Well development method: Surged and bailed then pumped to reduce turbidity

Average depth of frostline: 3.5'

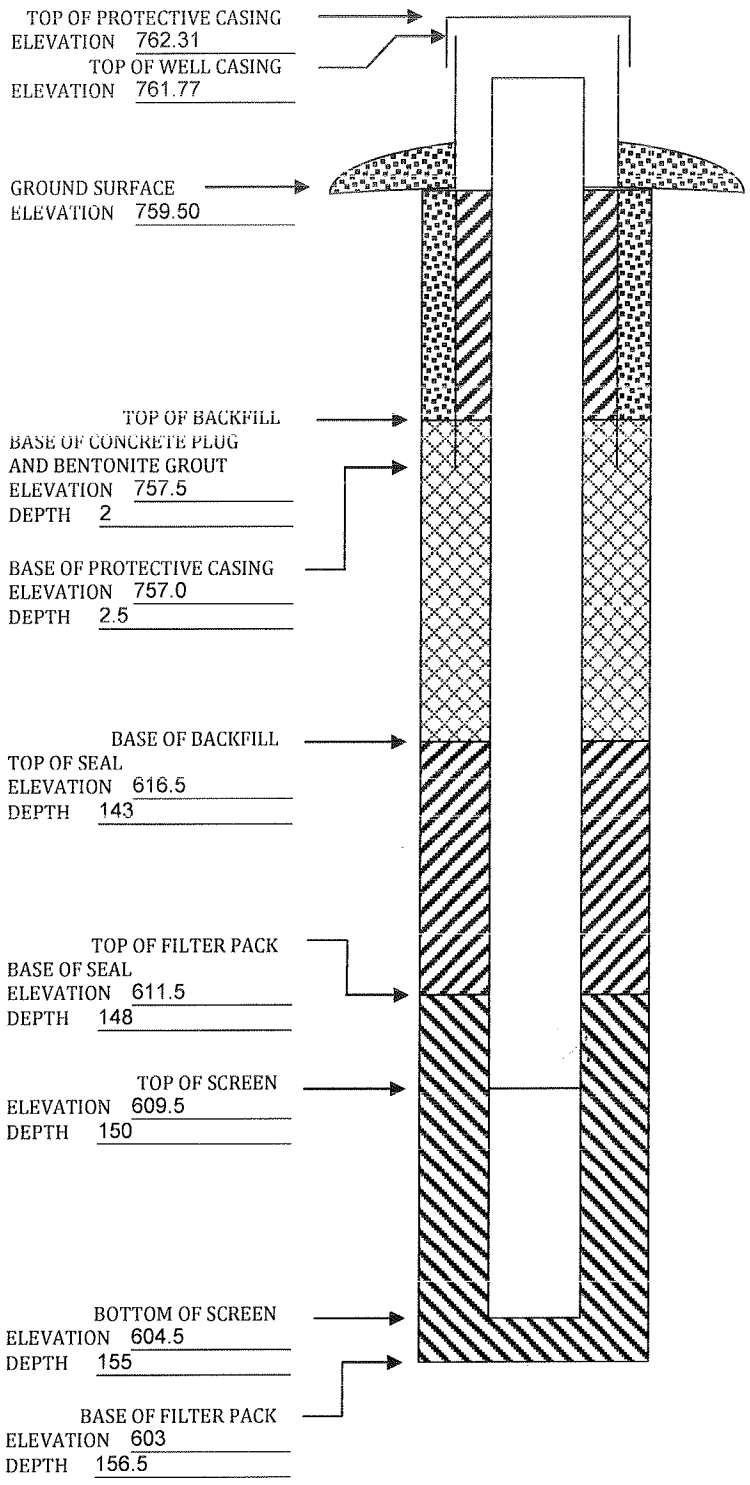
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: IPL - Ottumwa Midland Landfill Permit No.: 90-SDP-8-92P

Well or Piezometer No: MW-303

Dates Started: 4/25/16 Date Completed: 4/26/16

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft):

Specify corner of site: SE

Distance & direction along boundary: 700' N

Distance & direction from boundary to wall: 350' W

Elevations (± 0.01 ft MSL):

Ground Surface: 759.93

Top of protective casing: 762.94

Top of well casing: 762.40

Benchmark elevation: 818.70

Benchmark description: Control Point #2

B. SOIL BORING INFORMATION

Name & Address of Construction Company:

Name of Driller:

Drilling Method: 4.25'HSA to/Air Rotary/coring

Drilling Fluid: NA

Bore Hole Diameter: 8.5 inch/6 inch

Soil Sampling Method: Spoon/cuttings/core

Depth of Boring:

C. MONITORING WELL INSTALLATION

Casing material: sch 80 PVC

Length of casing: 142'

Outside casing diameter: 2.40"

Inside casing diameter: 1.9"

Casing joint type: threaded

Casing/screen joint type: threaded

Screen material: PVC sch 80

Screen opening size: 0.010

Screen length: 5'

Depth of well: 147'

Filter Pack:

Material: Unamin Filtersil

Grain size: 10/20 mesh

Volume: 2.5 cubic ft

Seal (minimum 3 ft length above filter pack):

Material: 3/8" bentonite chips

Placement method: tremie

Volume: 300 gal

Backfill (if different from seal):

Material: 3/8" bentonite chips

Placement method: gravity

Volume: 15 cubic ft

Surface seal design:

Material of protective casing: steel

Material of grout between protective casing and well casing: bentonite chips and sand

Protective cap:

Material: steel

Vented: ☒ Yes ☐ No Locking: ■ Yes ☐ No

Well Cap:

Material: Plastic

Vented: ■ Yes ☐ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 76.36 Stabilization Time: <1hr.

Well development method: surged and bailed, then pumped to reduce turbidity.

Average depth of frostline: 3.5

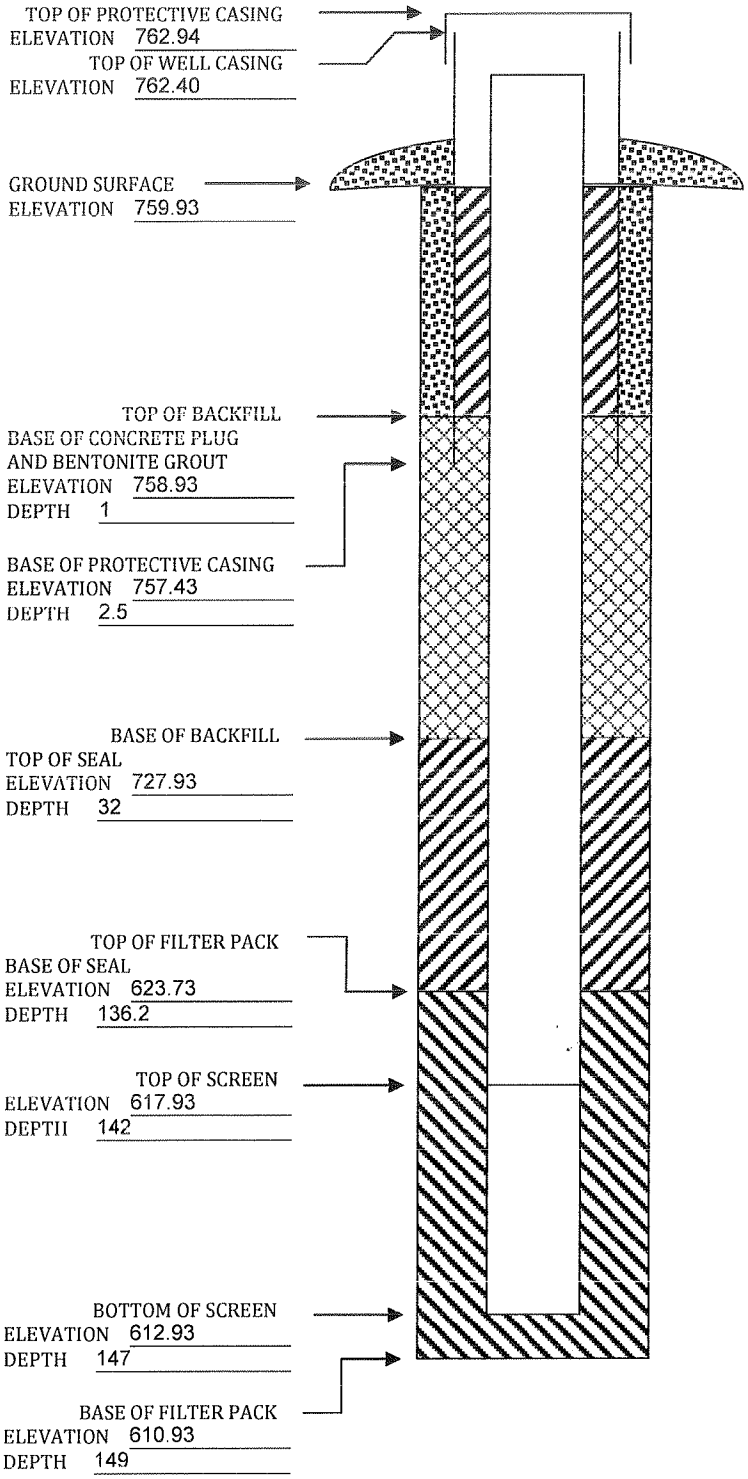
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL-Ottumwa Midland Landfill SCS#: 25215135.50	90-SDP-8-92P	MW-301

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Todd Schmalfeld Cascade Drilling	11/16/2015	11/19/2015	4.25'HSA /6"air rot/core

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
N/A	N/A	MW-301	Feet	815.5 Feet	8.5"/6" in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,930,292 N, 394,330 E S / C / N
NE 1/4 of SE 1/4 of Section 34, T 73 N, R 14 W
Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
S1	16	5 6 8 10	1	FAT CLAY, very dark grayish brown, (2.5Y 3/2).	CH					M				
			2											
S2	16	5 6 6 9	3	FAT CLAY, black (2.5Y 2.5/1).						M				
			4											
			5											
S3	22	5 5 6 7	6	Same as above, except very dark grayish brown (2.5Y 3/2).						M				
			7											
S4	5	8 7 8 12	8	Same as above, except black (2.5Y 2.5/1).	CH					M				
			9											
			10											
S5	20	3 6 7 11	11							M				
			12											
			13											
S6	21	3 5 7 9	14	Same as above, except very dark grayish brown (2.5Y 3/2).						M				
			15											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm SCS Engineers
2830 Dairy Drive Madison, WI 53711

Tel: (608) 224-2830
Fax:

Boring Number MW-301 Page 2 of 9

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
S7	23	3 4 8 9	16 17	LEAN CLAY WITH SAND, gray (2.5Y 5/1), fine grained sand.	CL					M				
S8	20	4 9 9 11	18 19 20	FAT CLAY, primary color-black (2.5Y 2.5/1), secondary color-yellowish brown (10YR 5/6).	CH					M				
S9	24	8 27 22 24	21 22	SILT, ash, black (2.5Y 2.5/1).	ML					M				
S10	16	18 28 34 44	23 24	SHALE, gray (10YR 5/1) matrix, moderate strength, massive.						M				Saturation @ 23.5 ft bgs
S11			25 26 27 28 29 30							S				Air Rotary
S12			31 32 33 34 35	Same as above, except light yellowish brown (10YR 6/4).						S				
S13			36 37 38 39 40	Same as above, except gray (10YR 5/1).						S				

Boring Number MW-301

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Vane Shear	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			40	SHALE, gray (10YR 5/1) matrix, moderate strength, massive. *(continued)*										
			41											
			42											
S14			43							S				
			44	Same as above, except yellowish brown (10YR 6/4).										
			45											
			46											
			47											
S15			48							S				
			49											
			50											
			51											
			52											
S16			53							S				
			54											
			55											
			56											
			57											
S17			58	Same as above, except dark gray (10YR 4/1).						S				
			59											
			60											
			61											
			62											
S18			63							S				
			64	Same as above, except black (10YR 2/1).										
			65											

Boring Number MW-301

Sample										Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Vane Shear		Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			65	SHALE, gray (10YR 5/1) matrix, moderate strength, massive. *(continued)*											
			66												
			67												
S19			68								S				
			69												
			70												
			71												
			72												
S20			73								S				
			74												
			75												
			76												
			77												
S21			78	Same as above, except light gray (2.5Y 7/1).							S				
			79												
			80												
			81												
			82												
S22			83	Same as above, except very dark gray (5Y 3/1).							S				
			84												
			85												
			86												
			87												
S23			88								S				
			89												
			90												

Boring Number MW-301 Page 5 of 9

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			90	SHALE, gray (10YR 5/1) matrix, moderate strength, massive. *(continued)*										
			91											
			92											
S24			93							S				
			94											
			95											
			96	Same as above, except black (10YR 2/1).										
			97											
S25			98							S				
			99											
			100											
			101											
			102											
S26			103							S				
			104											
			105	VOID.										Void @ 105 ft bgs, sulfur smell.
			106											
			107											
			108											
			109											
			110											
			111											
			112											
			113	SHALE, black (10YR 2/1).										
S27			114							S				
			115											

Boring Number MW-301

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Vane Shear	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			115	SHALE, black (10YR 2/1). *(continued)*										
			116											
			117											
S28			118							S				
			119											
			120											
			121											
			122											
S29			123							S				
			124											
			125											
			126											
			127											
S30			128							S				
			129											
			130											
			131											
			132											
S31			133							S				
			134											
			135											
			136											
			137											
S32			138							S				
			139											
			140											

Boring Number MW-301

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			140	SHALE, black (10YR 2/1). *(continued)*										
			141											
			142											
S33			143							S				
			144											
			145											
			146											
			147											
S34			148							S				
			149											
			150	Same as above, except drak grayish brown (10YR 3/2).										
			151											
			152											
S35			153							S				
			154											
			155	WEATHERED SHALE AND LIMESTONE, dark grayish brown (10YR 3/2), gray limestone (10YR 6/1).										
			156											
			157											
S36			158							S				
			159											
			160	NO RECOVERY.										
			161											
			162											
			163											
			164	WEATHERED SHALE, gray (2.5Y 6/1),soft shale in clay.										
			165											

Boring Number MW-301

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			166	WEATHERED SHALE, gray (2.5Y 6/1),soft shale in clay. *(continued)*										
R1	62/72		167											Run 1 164'-170' bgs TCR=86% SCR=73% MCR=33%
			168	LIMESTONE, gray (10YR 5/1), strong, massive.										
			169											
			170											
R2	22/24		171											Run 2 170'-172'bgs TCR=92% SCR=92% MCR=66%
			172											
			173	SHALE, greenish gray (5G 5/1), with pyrite, weak.										
R3	32/36		174											Run 3 172'-175' bgs TCR=88% SCR=88% MCR=82%
			175											
			176	LIMESTONE, gray (10YR 5/1), interbedded with shale laminations, strong.										
			177											
			178											
			179											
R4	18/120		180											Run 4 175'-185' bgs TCR=98% SCR=98% MCR=89%
			181											
			182											
			183											
			184	SHALE, greenish gray (5G 5/1), weak.										
			185	LIMESTONE, gray (10YR 5/1), strong.										
			186											
			187	SHALE, grayish green (5G 4/2), weak.										
			188											
			189	LIMESTONE, gray (10YR 5/1), strong.										
			190											

Boring Number MW-301 Page 9 of 9

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
R5	16/120		191	LIMESTONE, gray (10YR 5/1), strong. *(continued)*										Run 5 185'-195' bgs TCR=97% SCR=93% MCR=84%
			192	SHALE, greenish gray (5G 5/1), clayey.										
			193											
			194	SANDSTONE, greenish gray (5G 6/1), strong, well cemented.										
			195											
			196											
			197	Very weak.										
R6	33/60		198											Run 6 195'-200' bgs TCR=55% SCR=47% MCR=13%
			199											
			200											
			201											
			202	End of Boring at 202 feet bgs. Boring reamed to 202' bgs prior to installation of MW-301.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL-Ottumwa Midland Landfill SCS#: 25215135.50	90-SDP-8-92P	MW-302

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Todd Schmalfeld Cascade Drilling	12/1/2015	12/3/2015	4.25'HSA /6"air rot/core

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
N/A	N/A	MW-302	Feet	759.5 Feet	8.5"/6" in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,929,605 N, 394,359 E S / C / N
NW 1/4 of SE 1/4 of Section 34, T 73 N, R 14 W
Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
S1	20	2 3 5 8	1	TOPSOIL	TOPSOIL									
			2	FAT CLAY, dark gray (10YR 4/1), secondary color- Dark yellowish brown (10YR 4/4), organics, fill.						M				
S2	6	3 50	3	Weathered Shale	CH					M				
			4											
			5	SHALE, dark gray (10YR 4/1), moderate strength, massive.										
S3	18	6 17 44 50	6							M				
			7											
S4	16	3 15 26 28	8											
			9							M				
			10											
S5	5	6 50	11											
			12											
S6	12	2 50	13											
			14							S				Saturation @12.5 ft bgs.
			15											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature 

Firm SCS Engineers
2830 Dairy Drive Madison, WI 53711

Tel: (608) 224-2830
Fax:

Boring Number MW-302

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			16	SHALE, dark gray (10YR 4/1), moderate strength, massive. *(continued)*										
			17											
S7			18	same as above, except black (2.5Y 2.5/1), clayey.						S				
			19											
			20											
			21											
			22											
S8			23							S				
			24											
			25											
			26											
			27											
S9			28	same as above, except dark gray (2.5Y 4/1), clayey.						S				
			29											
			30											
			31											
			32											
S10			33							S				
			34											
			35											
			36											
			37											
S11			38							S				
			39											
			40											

Boring Number MW-302

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			41	SHALE, dark gray (10YR 4/1), moderate strength, massive. *(continued)* same as above, except black (2.5Y 2.5/1).										
			42											
S12			43							S				
			44											
			45											
			46											
			47											
S13			48							S				
			49											
			50											
			51											
			52											
S14			53							S				
			54											
			55											
			56											
			57											
S15			58							S				
			59											
			60											
			61											
			62											
S16			63							S				a lot of water @ 62 ft bgs.
			64											
			65											

Boring Number MW-302

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Vane Shear	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			66	SHALE, dark gray (10YR 4/1), moderate strength, massive. *(continued)*										
			67											
S17			68	Shale, black (2.5Y2.5/1), not as clayey as above.										
			69											
			70											
			71											
			72											
S18			73											
			74											
			75											
			76	same as above, except dark gray (2.5Y 4/1).										
			77											
S19			78											
			79											
			80											
			81											
			82											
S20			83											
			84											
			85											
			86											
			87											
S21			88											
			89											
			90											

Boring Number MW-302

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			90	SHALE, dark gray (10YR 4/1), moderate strength, massive. *(continued)*										
			91	same as above, except gray (2.5Y 5/1).										
S22			92											
			93											
			94											
			95											
			96	WEATHERED SHALE, greenish gray (5G 5/1), clayey.										
R1	24/36		97											Run 1 96'-99' bgs TCR=66% SCR=66% MCR=47%
			98	SHALE, greenish gray (5G 5/1), weak, massive.										
			99											
			100											
			101	SHALE, very dark brown (2.5YR 2.5/3), very weak.										
			102											
			103											
R2	02/120		104	SHALE, clayey, greenish gray (5G 5/1), very weak.										Run 2 99'-109' bgs TCR=85% SCR=77% MCR=52%
			105											
			106											
			107											
			108											
			109											
			110											
			111											
			112											
R3	68/72		113											Run 3 109'-117' bgs TCR=95% SCR=90%
			114											
			115											

Boring Number MW-302

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			116	SHALE, clayey, greenish gray (5G 5/1), very weak. *(continued)*										MCR=75%
			117											
R4	24/24		118											Run 4 117'-119' bgs TCR=100% SCR=100% MCR=92%
			119	not as clayey, weak.										
			120											
			121											
			122											
			123											
R5	16/120		124											Run 5 119'-129' bgs TCR=97% SCR=97% MCR=93%
			125											
			126											
			127											
			128											
			129	LIMESTONE, gray (10YR 6/1), interbedded with shale laminations, strong.										
			130											
			131											
			132											
			133											
R6	20/120		134											Run 6 129'-139' bgs TCR=100% SCR=100% MCR=95%
			135											
			136											
			137											
			138	SHALE, greenish gray (5G 5/1), weak.										
			139											
			140											

Boring Number MW-302 Page 7 of 7

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			141	LIMESTONE, gray (10YR 6/1), strong.										
			142	SHALE, greenish gray (5G 5/1), weak.										
			143											
R7	03/120		144											Run 7 139'-149' bgs TCR=88% SCR=85% MCR=74%
			145	SANDSTONE, greenish gray (5G 5/1), very weak, fine grained.										
			146											
			147											
			148											
			149											
			150											
			151											
R8	45/60		152											Run 8 149'-154' bgs TCR=75% SCR=75% MCR=57%
			153											
			154											
			155											
			156											
				End of Boring at 156.5 ft bgs. Boring reamed with air rotary prior to installation of MW-302.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL-Ottumwa Midland Landfill SCS#: 25215135.50	90-SDP-8-92P	MW-303

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Don Carlson Team Services	4/11/2016	4/26/2016	4.25'HSA /6"air rot/core

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
N/A	N/A	MW-303	Feet	759.9 Feet	8.5"/6" in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,929,977 N, 394,335 E S / C / N
NW 1/4 of SE 1/4 of Section 34, T 73 N, R 14 W
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1	TOPSOIL.	TOPSOIL									
S1	11	2 4 6	2	FAT CLAY, light gray (10YR 7/1).	CH					M				
S2	16	2 3 16	3							M				
			4	SHALE, Gray (10YR 6/1), very weak, massive, clayey.										
S3	0	50/5	5											No return-refusal.
			6											
			7	Same as above except, dark gray (10YR 4/1).										
S4			8											
			9											
			10											
			11											
S5			12											
			13											
			14											
			15											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm SCS Engineers
2830 Dairy Drive Madison, WI 53711

Tel: (608) 224-2830
Fax:

Boring Number MW-303

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			16	SHALE, Gray (10YR 6/1), very weak, massive, clayey. *(continued)*										
			16	Same as above except, black (10YR 3/1).										
S6			17											
			18											
			19											
			20	Same as above except, light gray (10YR 1/1).										
			21											
S7			22											
			23											
			24											
			25	Same as above except, gray (10YR 6/1).										
			26											
S8			27											
			28											
			29											
			30	Same as above except, light gray (10YR 7/1).										
			31											
S9			32											Cave-in 32' to 45' bgs.
			33											
			34											
			35	Same as above except, gray (10YR 6/1).										
			36											
S10			37											
			38											
			39											
			40											

Boring Number MW-303

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			40	SHALE, Gray (10YR 6/1), very weak, massive, clayey. *(continued)*										
			41											
			42											
S11			43											38'-45' no return. need to add water.
			44											
			45	Same as above except, dark gray (10YR 4/1), clayey.										
			46											
			47											
S12			48											
			49											
			50											
			51											
			52											
S13			53											
			54											
			55	Same as above except, black (10YR 2/1), less clayey.										
			56											
			57											
S14			58											Borehole producing a lot of water.
			59											
			60											
			61											
			62											
S15			63											
			64											
			65											

Boring Number MW-303 Page 4 of 7

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			66	SHALE, Gray (10YR 6/1), very weak, massive, clayey. *(continued)*										
			67	Same as above except, black (10YR 2/1) and gray (10YR 6/1), laminated.										
S16			68											
			69											
			70											
			71											
			72											
S17			73											
			74											
			75											
			76											
			77											
S18			78											
			79											
			80	Same as above except, gray (10YR 6/1), clayey.										
			81											
			82											
S19			83											Sulfur smell.
			84											
			85	Same as above except, gray (10YR 6/1), black (10YR 2/1), Reddish brown (5YR 4/3).										
			86											
			87											
S20			88											
			89											
			90											

Boring Number MW-303

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			90	SHALE, Gray (10YR 6/1), very weak, massive, clayey. *(continued)*										
			91	Same as above except, black (10YR 2/1), reddish brown (5YR 4/3), dark greenish gray (5GY 4/1).										
S21			92											
			93											
			94											
			95											
			96											
S22			97											
			98											
			99											
			100											
			101	Same as above with laminations.										
			102											
S23			103											Sulfur smell.
			104											
			105	SHALE, black (10YR 2/1), reddish brown (5YR 4/3), dark greenish gray (5G 4/1), clayey.										
			106											
			107											
S24			108											
			109											
			110	Same as above except, black (10YR 3/1), pale brown (10YR 6/3), reddish brown (5YR 4/3), Dark Greenish Gray (5GY 4/1), clayey.											
			111											
			112											
S25			113											
			114	Same as above except, limestone fragments are encountered.										
			115											

Boring Number MW-303

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			116	SHALE, Gray (10YR 6/1), very weak, massive, clayey. *(continued)*										
			117	LIMESTONE, dark greenish gray (5G 4/1), clayey, clay is pale brown (10YR 6/3) and reddish brown (5YR 4/3), shale fragments, shale is black (10YR 3/1).										
S26			118											Air rotary drilling complete.
			119											
			120	SHALE, greensih gray (5GY 6/1), strong, massive, clayey.										
R1	8/12		121											Run 1 120'-121'. Run 1 TCR=66% SCR=66% MCR=42%
R2	12/12		122	LIMESTONE, gray (10YR 6/1), interbedded with shale laminations, strong, shells.										Run 2 121'-122'. Run 2 TCR=100% SCR=100% MCR=77%.
R3	36/36		123											Run 3 122'-125'. Run 3 TCR=100% SCR=100% MCR=92%.
			124	SHALE, greenish gray (5GY 6/1), shells, very weak, clayey, massive.										
			125											
			126	LIMESTONE, gray (10YR 5/1), strong.										
			127											
			128	SHALE, greenish gray (5GY 6/1), weak.										
			129	LIMESTONE, gray (10YR 5/1), strong, interbedded with shale laminations.										
			130											
R4	100/120		131											Run 4 125.5'-135.5'. Run4 TCR=83% SCR=83% MCR= 76%.
			132											
			133											
			134											
			135											
			136	SHALE, dark greenish gray (5GY 4/1), clayey, weak, interbedded with limestone-gray (10YR 5/1).										
			137											
R5	59/60		138											Run 5 135.5'-140.5'. TCR= 99% SCR=94% MCR= 75%.
			139											
			140											

Boring Number MW-303 Page 7 of 7

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			141	SANDSTONE, greenish gray (5GY 6/1), very weak, fine grained.										
			142											
			143											
			144											
			145											
R6	87/120		146											Run 6 140.5'-150.5'. Run 6 TCR=73% SCR=69% MCR=59%.
			147											
			148											
			149	SHALE, dark greenish gray (5GY 4/1), clayey, weak, interbedded with limestone-gray (10YR 5/1).										
			150											
				End of boring at 150.5 ft bgs. Boring reamed with 6" rotary before installation of MW-303.										

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Ottumwa Midland Landfill Permit No.: 38223

Well or Piezometer No: MW-102M

Dates Started: August 20, 2012 Date Completed: August 27, 2012

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft):

Specify corner of site: NE

Distance & direction along boundary: 29 S

Distance & direction from boundary to wall: 7 W

Elevations (± 0.01 ft MSL):

Ground Surface: 795.50

Top of protective casing: 798.23

Top of well casing: 798.03

Benchmark elevation: 820.39

Benchmark description: Brass cap in concrete, 408 ft N of MW-20

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Boart Longyear
901D Grossman Drive
Schofield, WI 54476

Name of Driller: Paul Dickinson

Drilling Method: HSA, Air Hammer, NQ3 Core

Drilling Fluid: Air, Water

Bore Hole Diameter: 10.5/6.0 in

Soil Sampling Method: Split spoon, screen chips, core

Depth of Boring: 153 ft

C. MONITORING WELL INSTALLATION

Casing material: Flush threaded PVC schedule 80

Length of casing: 152.1

Outside casing diameter: 2.4 in

Inside casing diameter: 1.9 in

Casing joint type: Flush Threaded

Casing/screen joint type: Flush Threaded

Screen material: Sch 80 PVC

Screen opening size: 0.01 in

Screen length: 5 ft

Depth of well: 147.9 ft

Filter Pack:

Material: Red Flint Filter Sand

Grain size: #40

Volume: 1.5 ft^3

Seal (minimum 3 ft length above filter pack):

Material: 3/8 inch bentonite chips

Placement method: Gravity

Volume: 0.7 ft^3

Backfill (if different from seal):

Material: Bentonite Slurry

Placement method: Tremie pumped

Volume: 40.1 ft^3

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: bentonite & concrete

Protective cap:

Material: Aluminum

Vented: ☑ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: plastic with rubber gasket

Vented: ☑ Yes ☐ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 100.81 Stabilization Time: 1 week

Well development method: Surged & bailed with bailer and pump

Average depth of frostline: 3 feet

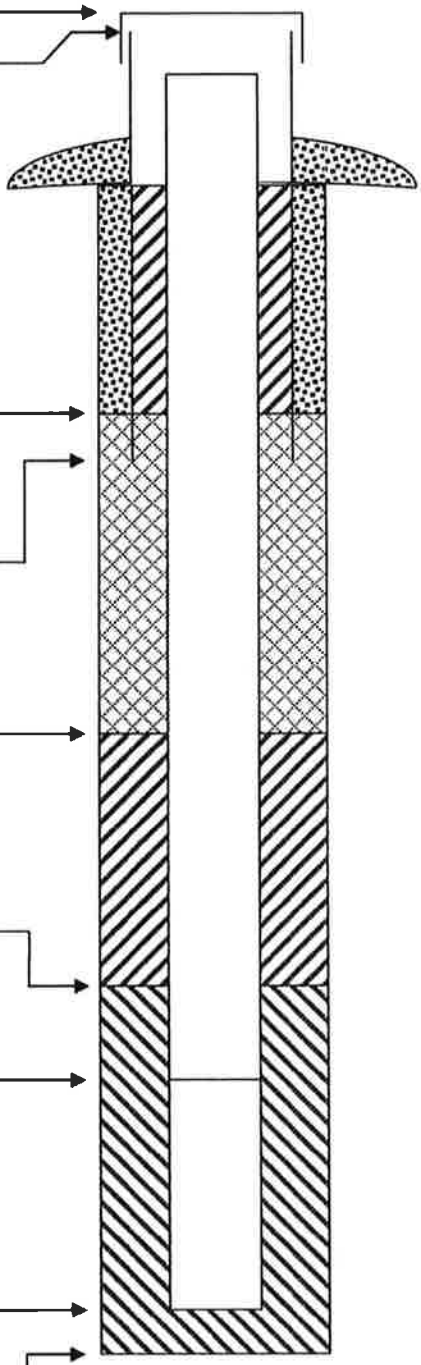
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



TOP OF PROTECTIVE CASING
ELEVATION 798.33
TOP OF WELL CASING
ELEVATION 798.03

GROUND SURFACE
ELEVATION 795.50

TOP OF BACKFILL
BASE OF CONCRETE PLUG
AND BENTONITE GROUT
ELEVATION 791.50
DEPTH 4.0

BASE OF PROTECTIVE CASING
ELEVATION 790.95
DEPTH 4.5

BASE OF BACKFILL
TOP OF SEAL
ELEVATION 659.50
DEPTH 136

TOP OF FILTER PACK
BASE OF SEAL
ELEVATION 654.50
DEPTH 141.0

TOP OF SCREEN
ELEVATION 652.65
DEPTH 142.9

BOTTOM OF SCREEN
ELEVATION 647.65
DEPTH 147.9 ft

BASE OF FILTER PACK
ELEVATION 643.50
DEPTH 152.0 ft

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Ottumwa Midland Landfill Permit No.: 38230

Well or Piezometer No: MW-122M

Dates Started: December 6, 2012 Date Completed: December 9, 2012

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft):

Specify corner of site: NW

Distance & direction along boundary: 553 S

Distance & direction from boundary to wall: 462 E

Elevations (± 0.01 ft MSL):

Ground Surface: 790.74

Top of protective casing: 792.94

Top of well casing: 792.70

Benchmark elevation: 820.39

Benchmark description: Brass cap in concrete, 408 ft N of MW-20

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Boart Longyear
901D Grossman Drive
Schofield, WI 54476

Name of Driller: Paul Dickinson

Drilling Method: Rotary, HSA

Drilling Fluid: Air

Bore Hole Diameter: 10.5" to 10', 6" below 10'

Soil Sampling Method: Split spoon, screen air rotary chips

Depth of Boring: 154 ft

C. MONITORING WELL INSTALLATION

Casing material: Flush threaded PVC schedule 80

Length of casing: 155.3

Outside casing diameter: 2.4 in

Inside casing diameter: 1.89 in

Casing joint type: Flush Threaded

Casing/screen joint type: Flush Threaded

Screen material: PVC

Screen opening size: 0.01 in

Screen length: 5 ft

Depth of well: 152.8 ft

Filter Pack:

Material: Red Flint Filter Sand

Grain size: #40

Volume: 1.5 ft^3

Seal (minimum 3 ft length above filter pack):

Material: 3/8 inch bentonite chips

Placement method: Gravity

Volume: 0.67 ft^3

Backfill (if different from seal):

Material: Bentonite Slurry / 3/8" Chips

Placement method: Tremie Pumped / Gravity

Volume: 400 gal. Slurry / 6 ft^3 Chips

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: bentonite & concrete

Protective cap:

Material: aluminum

Vented: ☒ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: plastic with rubber gasket

Vented: ☒ Yes ☐ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 68.81 Stabilization Time: 1 week

Well development method: Surged & bailed with bailer and pump

Average depth of frostline: 3 feet

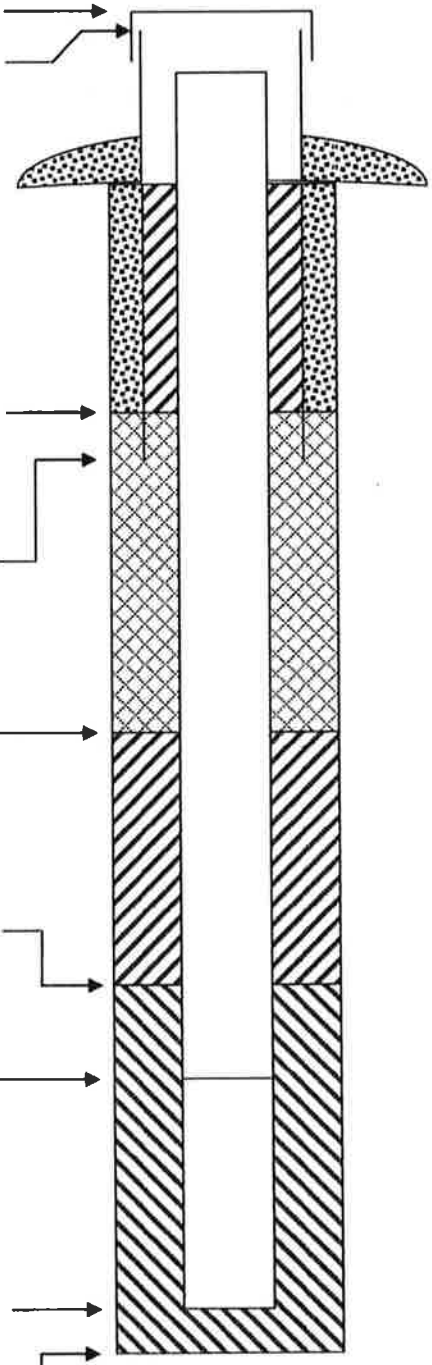
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



TOP OF PROTECTIVE CASING
ELEVATION 792.94
TOP OF WELL CASING
ELEVATION 792.70

GROUND SURFACE
ELEVATION 790.74

TOP OF BACKFILL
BASE OF CONCRETE PLUG
AND BENTONITE GROUT
ELEVATION 786.74
DEPTH 4.0

BASE OF PROTECTIVE CASING
ELEVATION 785.94
DEPTH 4.8

BASE OF BACKFILL
TOP OF SEAL
ELEVATION 651.24
DEPTH 139.5 ft

TOP OF FILTER PACK
BASE OF SEAL
ELEVATION 646.24
DEPTH 144.5 ft

TOP OF SCREEN
ELEVATION 642.94
DEPTH 147.8 ft

BOTTOM OF SCREEN
ELEVATION 637.94
DEPTH 152.8 ft

BASE OF FILTER PACK
ELEVATION 636.74
DEPTH 154.0 ft

Appendix C

Laboratory Reports

eurofins | Environment Testing

ANALYTICAL REPORT

Eurofins Cedar Falls
3019 Venture Way
Cedar Falls, IA 50613
Tel: (319)277-2401

Laboratory Job ID: 310-229342-1
Client Project/Site: Ottumwa Midland LF 25222073
Revision: 1

For:
SCS Engineers
2830 Dairy Drive
Madison, Wisconsin 53718

Attn: Meghan Blodgett

Authorized for release by:
10/31/2022 7:33:09 PM

Sandie Fredrick, Project Manager II
(920)261-1660
Sandra.Fredrick@et.eurofinsus.com

LINKS

Review your project results through my EOL

Have a Question? Ask The Expert

Visit us at: www.eurofinsus.com/Env

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Case Narrative

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25222073

Job ID: 310-229342-1

Job ID: 310-229342-1

Laboratory: Eurofins Cedar Falls

Narrative

Job Narrative
310-229342-1

Comments
No additional comments.

Receipt
The samples were received on 4/15/2022 5:10 PM. Unless otherwise noted below, the samples arrived in good condition, and where required, properly preserved and on ice. The temperature of the cooler at receipt was 1.1° C.

HPLC/IC
Method 9056A: The following samples were diluted due to the nature of the sample matrix: MW-301 (310-229342-1) and MW-122M (310-229342-5). Elevated reporting limits (RLs) are provided.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Metals
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

General Chemistry
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Sample Summary

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25222073

Job ID: 310-229342-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
310-229342-1	MW-301	Water	04/14/22 08:32	04/15/22 17:10
310-229342-2	MW-302	Water	04/13/22 15:30	04/15/22 17:10
310-229342-3	MW-303	Water	04/13/22 17:30	04/15/22 17:10
310-229342-4	MW-102M	Water	04/13/22 09:35	04/15/22 17:10
310-229342-5	MW-122M	Water	04/14/22 13:16	04/15/22 17:10
310-229342-6	Field Blank	Water	04/14/22 11:10	04/15/22 17:10

Detection Summary

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25222073

Job ID: 310-229342-1

Client Sample ID: MW-301 — Lab Sample ID: 310-229342-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chloride	24		5.0	2.3	mg/L	5		9056A	Total/NA
Sulfate	450		5.0	2.0	mg/L	5		9056A	Total/NA
Calcium	150		0.50	0.19	mg/L	1		6020A	Total/NA
Boron	710		100	58	ug/L	1		6020A	Total/NA
Total Dissolved Solids	1000		250	130	mg/L	1		SM 2540C	Total/NA
pH	6.8	HF	0.1	0.1	SU	1		SM 4500 H+ B	Total/NA
Ground Water Elevation	687.00				ft	1		Field Sampling	Total/NA
Oxidation Reduction Potential	-76.0				millivolts	1		Field Sampling	Total/NA
Oxygen, Dissolved, Client Supplied	0.27				mg/L	1		Field Sampling	Total/NA
pH, Field	6.84				SU	1		Field Sampling	Total/NA
Specific Conductance, Field	1581				umhos/cm	1		Field Sampling	Total/NA
Temperature, Field	11.3				Degrees C	1		Field Sampling	Total/NA
Turbidity, Field	22.9				NTU	1		Field Sampling	Total/NA

Client Sample ID: MW-302 — Lab Sample ID: 310-229342-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chloride	5.3		5.0	2.3	mg/L	5		9056A	Total/NA
Fluoride	1.1		0.50	0.22	mg/L	5		9056A	Total/NA
Sulfate	61		5.0	2.0	mg/L	5		9056A	Total/NA
Calcium	50		0.50	0.19	mg/L	1		6020A	Total/NA
Boron	730		100	58	ug/L	1		6020A	Total/NA
Total Dissolved Solids	630		50	26	mg/L	1		SM 2540C	Total/NA
pH	7.5	HF	0.1	0.1	SU	1		SM 4500 H+ B	Total/NA
Ground Water Elevation	685.07				ft	1		Field Sampling	Total/NA
Oxidation Reduction Potential	-43.2				millivolts	1		Field Sampling	Total/NA
Oxygen, Dissolved, Client Supplied	0.36				mg/L	1		Field Sampling	Total/NA
pH, Field	7.30				SU	1		Field Sampling	Total/NA
Specific Conductance, Field	1002				umhos/cm	1		Field Sampling	Total/NA
Temperature, Field	12.0				Degrees C	1		Field Sampling	Total/NA
Turbidity, Field	75.3				NTU	1		Field Sampling	Total/NA

Client Sample ID: MW-303 — Lab Sample ID: 310-229342-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chloride	7.0		5.0	2.3	mg/L	5		9056A	Total/NA
Fluoride	0.97		0.50	0.22	mg/L	5		9056A	Total/NA
Sulfate	250		5.0	2.0	mg/L	5		9056A	Total/NA
Calcium	100		0.50	0.19	mg/L	1		6020A	Total/NA
Boron	680		100	58	ug/L	1		6020A	Total/NA
Total Dissolved Solids	840		50	26	mg/L	1		SM 2540C	Total/NA
pH	7.0	HF	0.1	0.1	SU	1		SM 4500 H+ B	Total/NA
Ground Water Elevation	686.91				ft	1		Field Sampling	Total/NA
Oxidation Reduction Potential	-37.8				millivolts	1		Field Sampling	Total/NA
Oxygen, Dissolved, Client Supplied	0.35				mg/L	1		Field Sampling	Total/NA
pH, Field	6.89				SU	1		Field Sampling	Total/NA
Specific Conductance, Field	1344				umhos/cm	1		Field Sampling	Total/NA
Temperature, Field	12.5				Degrees C	1		Field Sampling	Total/NA
Turbidity, Field	61.2				NTU	1		Field Sampling	Total/NA

This Detection Summary does not include radiochemical test results.

Detection Summary

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25222073

Job ID: 310-229342-1

Client Sample ID: MW-102M — Lab Sample ID: 310-229342-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chloride	14		5.0	2.3	mg/L	5		9056A	Total/NA
Fluoride	4.3		0.50	0.22	mg/L	5		9056A	Total/NA
Sulfate	330		5.0	2.0	mg/L	5		9056A	Total/NA
Calcium	32		0.50	0.19	mg/L	1		6020A	Total/NA
Boron	1400		100	58	ug/L	1		6020A	Total/NA
Total Dissolved Solids	1300		250	130	mg/L	1		SM 2540C	Total/NA
pH	7.9	HF	0.1	0.1	SU	1		SM 4500 H+ B	Total/NA
Ground Water Elevation	710.24				ft	1		Field Sampling	Total/NA
Oxidation Reduction Potential	-25.9				millivolts	1		Field Sampling	Total/NA
Oxygen, Dissolved, Client Supplied	4.40				mg/L	1		Field Sampling	Total/NA
pH, Field	7.91				SU	1		Field Sampling	Total/NA
Specific Conductance, Field	1954				umhos/cm	1		Field Sampling	Total/NA
Temperature, Field	8.5				Degrees C	1		Field Sampling	Total/NA
Turbidity, Field	121.0				NTU	1		Field Sampling	Total/NA

Client Sample ID: MW-122M — Lab Sample ID: 310-229342-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chloride	8.5		5.0	2.3	mg/L	5		9056A	Total/NA
Sulfate	460		5.0	2.0	mg/L	5		9056A	Total/NA
Calcium	420		3.5	1.3	mg/L	7		6020A	Total/NA
Boron	4800		700	410	ug/L	7		6020A	Total/NA
Total Dissolved Solids	13000		2500	1300	mg/L	1		SM 2540C	Total/NA
pH	6.7	HF	0.1	0.1	SU	1		SM 4500 H+ B	Total/NA
Ground Water Elevation	704.81				ft	1		Field Sampling	Total/NA
Oxidation Reduction Potential	22.3				millivolts	1		Field Sampling	Total/NA
Oxygen, Dissolved, Client Supplied	2.43				mg/L	1		Field Sampling	Total/NA
pH, Field	6.70				SU	1		Field Sampling	Total/NA
Specific Conductance, Field	13222				umhos/cm	1		Field Sampling	Total/NA
Temperature, Field	15.3				Degrees C	1		Field Sampling	Total/NA
Turbidity, Field	56.9				NTU	1		Field Sampling	Total/NA

Client Sample ID: Field Blank — Lab Sample ID: 310-229342-6

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sulfate	0.43	J	1.0	0.40	mg/L	1		9056A	Total/NA
pH	6.0	HF	0.1	0.1	SU	1		SM 4500 H+ B	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25222073

Job ID: 310-229342-1

Client Sample ID: MW-301

Date Collected: 04/14/22 08:32
Date Received: 04/15/22 17:10

Lab Sample ID: 310-229342-1

Matrix: Water

Method: SW846 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	24		5.0	2.3	mg/L			04/26/22 18:08	5
Fluoride	<0.22		0.50	0.22	mg/L			04/26/22 18:08	5
Sulfate	450		5.0	2.0	mg/L			04/26/22 18:08	5

Method: SW846 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Calcium	150		0.50	0.19	mg/L		04/25/22 09:00	05/10/22 18:19	1
Boron	710		100	58	ug/L		04/25/22 09:00	05/10/22 18:19	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids (SM 2540C)	1000		250	130	mg/L			04/20/22 14:22	1
pH (SM 4500 H+ B)	6.8	HF	0.1	0.1	SU			04/18/22 11:53	1

Method: EPA Field Sampling - Field Sampling

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ground Water Elevation	687.00				ft			04/14/22 08:32	1
Oxidation Reduction Potential	-76.0				millivolts			04/14/22 08:32	1
Oxygen, Dissolved, Client Supplied	0.27				mg/L			04/14/22 08:32	1
pH, Field	6.84				SU			04/14/22 08:32	1
Specific Conductance, Field	1581				umhos/cm			04/14/22 08:32	1
Temperature, Field	11.3				Degrees C			04/14/22 08:32	1
Turbidity, Field	22.9				NTU			04/14/22 08:32	1

Client Sample Results

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25222073

Job ID: 310-229342-1

Client Sample ID: MW-302

Date Collected: 04/13/22 15:30
Date Received: 04/15/22 17:10

Lab Sample ID: 310-229342-2

Matrix: Water

Method: SW846 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	5.3		5.0	2.3	mg/L			04/26/22 18:23	5
Fluoride	1.1		0.50	0.22	mg/L			04/26/22 18:23	5
Sulfate	61		5.0	2.0	mg/L			04/26/22 18:23	5

Method: SW846 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Calcium	50		0.50	0.19	mg/L		04/25/22 09:00	05/10/22 18:23	1
Boron	730		100	58	ug/L		04/25/22 09:00	05/10/22 18:23	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids (SM 2540C)	630		50	26	mg/L			04/20/22 14:22	1
pH (SM 4500 H+ B)	7.5	HF	0.1	0.1	SU			04/18/22 11:55	1

Method: EPA Field Sampling - Field Sampling

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ground Water Elevation	685.07				ft			04/13/22 15:30	1
Oxidation Reduction Potential	-43.2				millivolts			04/13/22 15:30	1
Oxygen, Dissolved, Client Supplied	0.36				mg/L			04/13/22 15:30	1
pH, Field	7.30				SU			04/13/22 15:30	1
Specific Conductance, Field	1002				umhos/cm			04/13/22 15:30	1
Temperature, Field	12.0				Degrees C			04/13/22 15:30	1
Turbidity, Field	75.3				NTU			04/13/22 15:30	1

Client Sample Results

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25222073

Job ID: 310-229342-1

Client Sample ID: MW-303

Date Collected: 04/13/22 17:30
Date Received: 04/15/22 17:10

Lab Sample ID: 310-229342-3

Matrix: Water

Method: SW846 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	7.0		5.0	2.3	mg/L			04/26/22 18:39	5
Fluoride	0.97		0.50	0.22	mg/L			04/26/22 18:39	5
Sulfate	250		5.0	2.0	mg/L			04/26/22 18:39	5

Method: SW846 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Calcium	100		0.50	0.19	mg/L		04/25/22 09:00	05/10/22 18:27	1
Boron	680		100	58	ug/L		04/25/22 09:00	05/10/22 18:27	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids (SM 2540C)	840		50	26	mg/L			04/20/22 14:22	1
pH (SM 4500 H+ B)	7.0	HF	0.1	0.1	SU			04/18/22 11:57	1

Method: EPA Field Sampling - Field Sampling

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ground Water Elevation	686.91				ft			04/13/22 17:30	1
Oxidation Reduction Potential	-37.8				millivolts			04/13/22 17:30	1
Oxygen, Dissolved, Client Supplied	0.35				mg/L			04/13/22 17:30	1
pH, Field	6.89				SU			04/13/22 17:30	1
Specific Conductance, Field	1344				umhos/cm			04/13/22 17:30	1
Temperature, Field	12.5				Degrees C			04/13/22 17:30	1
Turbidity, Field	61.2				NTU			04/13/22 17:30	1

Client Sample Results

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25222073

Job ID: 310-229342-1

Client Sample ID: MW-102M

Date Collected: 04/13/22 09:35
Date Received: 04/15/22 17:10

Lab Sample ID: 310-229342-4

Matrix: Water

Method: SW846 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	14		5.0	2.3	mg/L			04/26/22 19:26	5
Fluoride	4.3		0.50	0.22	mg/L			04/26/22 19:26	5
Sulfate	330		5.0	2.0	mg/L			04/26/22 19:26	5

Method: SW846 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Calcium	32		0.50	0.19	mg/L		04/25/22 09:00	05/10/22 18:46	1
Boron	1400		100	58	ug/L		04/25/22 09:00	05/10/22 18:46	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids (SM 2540C)	1300		250	130	mg/L			04/20/22 14:22	1
pH (SM 4500 H+ B)	7.9	HF	0.1	0.1	SU			04/18/22 11:56	1

Method: EPA Field Sampling - Field Sampling

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ground Water Elevation	710.24				ft			04/13/22 09:35	1
Oxidation Reduction Potential	-25.9				millivolts			04/13/22 09:35	1
Oxygen, Dissolved, Client Supplied	4.40				mg/L			04/13/22 09:35	1
pH, Field	7.91				SU			04/13/22 09:35	1
Specific Conductance, Field	1954				umhos/cm			04/13/22 09:35	1
Temperature, Field	8.5				Degrees C			04/13/22 09:35	1
Turbidity, Field	121.0				NTU			04/13/22 09:35	1

Client Sample Results

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25222073

Job ID: 310-229342-1

Client Sample ID: MW-122M

Date Collected: 04/14/22 13:16
Date Received: 04/15/22 17:10

Lab Sample ID: 310-229342-5

Matrix: Water

Method: SW846 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	8.5		5.0	2.3	mg/L			04/26/22 19:41	5
Fluoride	<0.22		0.50	0.22	mg/L			04/26/22 19:41	5
Sulfate	460		5.0	2.0	mg/L			04/27/22 13:37	5

Method: SW846 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Calcium	420		3.5	1.3	mg/L		04/25/22 09:00	05/10/22 18:50	7
Boron	4800		700	410	ug/L		04/25/22 09:00	05/10/22 18:50	7

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids (SM 2540C)	13000		2500	1300	mg/L			04/20/22 14:22	1
pH (SM 4500 H+ B)	6.7	HF	0.1	0.1	SU			04/18/22 11:54	1

Method: EPA Field Sampling - Field Sampling

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ground Water Elevation	704.81				ft			04/14/22 13:16	1
Oxidation Reduction Potential	22.3				millivolts			04/14/22 13:16	1
Oxygen, Dissolved, Client Supplied	2.43				mg/L			04/14/22 13:16	1
pH, Field	6.70				SU			04/14/22 13:16	1
Specific Conductance, Field	13222				umhos/cm			04/14/22 13:16	1
Temperature, Field	15.3				Degrees C			04/14/22 13:16	1
Turbidity, Field	56.9				NTU			04/14/22 13:16	1

Client Sample Results

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25222073

Job ID: 310-229342-1

Client Sample ID: Field Blank

Date Collected: 04/14/22 11:10
Date Received: 04/15/22 17:10

Lab Sample ID: 310-229342-6

Matrix: Water

Method: SW846 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	<0.45		1.0	0.45	mg/L			04/26/22 19:57	1
Fluoride	<0.044		0.10	0.044	mg/L			04/26/22 19:57	1
Sulfate	**0.43**	**J**	1.0	0.40	mg/L			04/26/22 19:57	1

Method: SW846 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Calcium	<0.19		0.50	0.19	mg/L		04/25/22 09:00	05/10/22 18:54	1
Boron	<58		100	58	ug/L		04/25/22 09:00	05/10/22 18:54	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids (SM 2540C)	<26		50	26	mg/L			04/20/22 14:22	1
pH (SM 4500 H+ B)	**6.0**	**HF**	0.1	0.1	SU			04/18/22 11:58	1

Definitions/Glossary

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25222073

Job ID: 310-229342-1

Qualifiers

HPLC/IC

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

General Chemistry

Qualifier	Qualifier Description
HF	Field parameter with a holding time of 15 minutes. Test performed by laboratory at client's request.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Method: 9056A - Anions, Ion Chromatography

Lab Sample ID: MB 310-351278/3
Matrix: Water
Analysis Batch: 351278

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	<0.45		1.0	0.45	mg/L			04/26/22 16:34	1
Fluoride	<0.044		0.10	0.044	mg/L			04/26/22 16:34	1
Sulfate	<0.40		1.0	0.40	mg/L			04/26/22 16:34	1

Lab Sample ID: LCS 310-351278/4
Matrix: Water
Analysis Batch: 351278

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Chloride	10.0	9.37		mg/L		94	90 - 110
Fluoride	2.00	2.09		mg/L		105	90 - 110
Sulfate	10.0	9.67		mg/L		97	90 - 110

Method: 6020A - Metals (ICP/MS)

Lab Sample ID: MB 310-350698/1-A
Matrix: Water
Analysis Batch: 352699

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 350698

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Calcium	<0.19		0.50	0.19	mg/L		04/25/22 09:00	05/10/22 16:37	1

Lab Sample ID: MB 310-350698/1-A
Matrix: Water
Analysis Batch: 352783

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 350698

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	<58		100	58	ug/L		04/25/22 09:00	05/11/22 14:00	1

Lab Sample ID: LCS 310-350698/2-A
Matrix: Water
Analysis Batch: 352699

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 350698

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Calcium	2.00	1.81		mg/L		90	80 - 120

Lab Sample ID: LCS 310-350698/2-A
Matrix: Water
Analysis Batch: 352783

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 350698

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Boron	200	184		ug/L		92	80 - 120

Method: SM 2540C - Solids, Total Dissolved (TDS)

Lab Sample ID: MB 310-350518/1
Matrix: Water
Analysis Batch: 350518

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	<26		50	26	mg/L			04/20/22 14:22	1

Lab Sample ID: LCS 310-350518/2
Matrix: Water
Analysis Batch: 350518

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Total Dissolved Solids			1000	946		mg/L		95	90 - 110		

Lab Sample ID: 310-229342-2 DU
Matrix: Water
Analysis Batch: 350518

Client Sample ID: MW-302
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Total Dissolved Solids	630			616		mg/L				2	20

Method: SM 4500 H+ B - pH

Lab Sample ID: LCS 310-350217/1
Matrix: Water
Analysis Batch: 350217

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
pH			7.00	7.1		SU		101	98 - 102		

Lab Sample ID: LCS 310-350217/28
Matrix: Water
Analysis Batch: 350217

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
pH			7.00	7.1		SU		101	98 - 102		

QC Association Summary

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25222073

Job ID: 310-229342-1

HPLC/IC

Analysis Batch: 351278

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-229342-1	MW-301	Total/NA	Water	9056A	
310-229342-2	MW-302	Total/NA	Water	9056A	
310-229342-3	MW-303	Total/NA	Water	9056A	
310-229342-4	MW-102M	Total/NA	Water	9056A	
310-229342-5	MW-122M	Total/NA	Water	9056A	
310-229342-5	MW-122M	Total/NA	Water	9056A	
310-229342-6	Field Blank	Total/NA	Water	9056A	
MB 310-351278/3	Method Blank	Total/NA	Water	9056A	
LCS 310-351278/4	Lab Control Sample	Total/NA	Water	9056A	

Metals

Prep Batch: 350698

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-229342-1	MW-301	Total/NA	Water	3005A	
310-229342-2	MW-302	Total/NA	Water	3005A	
310-229342-3	MW-303	Total/NA	Water	3005A	
310-229342-4	MW-102M	Total/NA	Water	3005A	
310-229342-5	MW-122M	Total/NA	Water	3005A	
310-229342-6	Field Blank	Total/NA	Water	3005A	
MB 310-350698/1-A	Method Blank	Total/NA	Water	3005A	
LCS 310-350698/2-A	Lab Control Sample	Total/NA	Water	3005A	

Analysis Batch: 352699

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-229342-1	MW-301	Total/NA	Water	6020A	350698
310-229342-2	MW-302	Total/NA	Water	6020A	350698
310-229342-3	MW-303	Total/NA	Water	6020A	350698
310-229342-4	MW-102M	Total/NA	Water	6020A	350698
310-229342-5	MW-122M	Total/NA	Water	6020A	350698
310-229342-6	Field Blank	Total/NA	Water	6020A	350698
MB 310-350698/1-A	Method Blank	Total/NA	Water	6020A	350698
LCS 310-350698/2-A	Lab Control Sample	Total/NA	Water	6020A	350698

Analysis Batch: 352783

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 310-350698/1-A	Method Blank	Total/NA	Water	6020A	350698
LCS 310-350698/2-A	Lab Control Sample	Total/NA	Water	6020A	350698

General Chemistry

Analysis Batch: 350217

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-229342-1	MW-301	Total/NA	Water	SM 4500 H+ B	
310-229342-2	MW-302	Total/NA	Water	SM 4500 H+ B	
310-229342-3	MW-303	Total/NA	Water	SM 4500 H+ B	
310-229342-4	MW-102M	Total/NA	Water	SM 4500 H+ B	
310-229342-5	MW-122M	Total/NA	Water	SM 4500 H+ B	
310-229342-6	Field Blank	Total/NA	Water	SM 4500 H+ B	
LCS 310-350217/1	Lab Control Sample	Total/NA	Water	SM 4500 H+ B	
LCS 310-350217/28	Lab Control Sample	Total/NA	Water	SM 4500 H+ B	

QC Association Summary

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25222073

Job ID: 310-229342-1

General Chemistry

Analysis Batch: 350518

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-229342-1	MW-301	Total/NA	Water	SM 2540C	
310-229342-2	MW-302	Total/NA	Water	SM 2540C	
310-229342-3	MW-303	Total/NA	Water	SM 2540C	
310-229342-4	MW-102M	Total/NA	Water	SM 2540C	
310-229342-5	MW-122M	Total/NA	Water	SM 2540C	
310-229342-6	Field Blank	Total/NA	Water	SM 2540C	
MB 310-350518/1	Method Blank	Total/NA	Water	SM 2540C	
LCS 310-350518/2	Lab Control Sample	Total/NA	Water	SM 2540C	
310-229342-2 DU	MW-302	Total/NA	Water	SM 2540C	

Field Service / Mobile Lab

Analysis Batch: 350954

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-229342-1	MW-301	Total/NA	Water	Field Sampling	
310-229342-2	MW-302	Total/NA	Water	Field Sampling	
310-229342-3	MW-303	Total/NA	Water	Field Sampling	
310-229342-4	MW-102M	Total/NA	Water	Field Sampling	
310-229342-5	MW-122M	Total/NA	Water	Field Sampling	

Lab Chronicle

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25222073

Job ID: 310-229342-1

Client Sample ID: MW-301

Date Collected: 04/14/22 08:32
Date Received: 04/15/22 17:10

Lab Sample ID: 310-229342-1

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	9056A		5	351278	J7CK	EET CF	04/26/22 18:08
Total/NA	Prep	3005A			350698	QTZ5	EET CF	04/25/22 09:00
Total/NA	Analysis	6020A		1	352699	DHM5	EET CF	05/10/22 18:19
Total/NA	Analysis	SM 2540C		1	350518	ENB7	EET CF	04/20/22 14:22
Total/NA	Analysis	SM 4500 H+ B		1	350217	W9YR	EET CF	04/18/22 11:53
Total/NA	Analysis	Field Sampling		1	350954	BJ0R	EET CF	04/14/22 08:32

Client Sample ID: MW-302

Date Collected: 04/13/22 15:30
Date Received: 04/15/22 17:10

Lab Sample ID: 310-229342-2

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	9056A		5	351278	J7CK	EET CF	04/26/22 18:23
Total/NA	Prep	3005A			350698	QTZ5	EET CF	04/25/22 09:00
Total/NA	Analysis	6020A		1	352699	DHM5	EET CF	05/10/22 18:23
Total/NA	Analysis	SM 2540C		1	350518	ENB7	EET CF	04/20/22 14:22
Total/NA	Analysis	SM 4500 H+ B		1	350217	W9YR	EET CF	04/18/22 11:55
Total/NA	Analysis	Field Sampling		1	350954	BJ0R	EET CF	04/13/22 15:30

Client Sample ID: MW-303

Date Collected: 04/13/22 17:30
Date Received: 04/15/22 17:10

Lab Sample ID: 310-229342-3

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	9056A		5	351278	J7CK	EET CF	04/26/22 18:39
Total/NA	Prep	3005A			350698	QTZ5	EET CF	04/25/22 09:00
Total/NA	Analysis	6020A		1	352699	DHM5	EET CF	05/10/22 18:27
Total/NA	Analysis	SM 2540C		1	350518	ENB7	EET CF	04/20/22 14:22
Total/NA	Analysis	SM 4500 H+ B		1	350217	W9YR	EET CF	04/18/22 11:57
Total/NA	Analysis	Field Sampling		1	350954	BJ0R	EET CF	04/13/22 17:30

Client Sample ID: MW-102M

Date Collected: 04/13/22 09:35
Date Received: 04/15/22 17:10

Lab Sample ID: 310-229342-4

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	9056A		5	351278	J7CK	EET CF	04/26/22 19:26
Total/NA	Prep	3005A			350698	QTZ5	EET CF	04/25/22 09:00
Total/NA	Analysis	6020A		1	352699	DHM5	EET CF	05/10/22 18:46
Total/NA	Analysis	SM 2540C		1	350518	ENB7	EET CF	04/20/22 14:22
Total/NA	Analysis	SM 4500 H+ B		1	350217	W9YR	EET CF	04/18/22 11:56
Total/NA	Analysis	Field Sampling		1	350954	BJ0R	EET CF	04/13/22 09:35

Lab Chronicle

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25222073

Job ID: 310-229342-1

Client Sample ID: MW-122M

Date Collected: 04/14/22 13:16
Date Received: 04/15/22 17:10

Lab Sample ID: 310-229342-5

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	9056A		5	351278	J7CK	EET CF	04/26/22 19:41
Total/NA	Analysis	9056A		5	351278	J7CK	EET CF	04/27/22 13:37
Total/NA	Prep	3005A			350698	QTZ5	EET CF	04/25/22 09:00
Total/NA	Analysis	6020A		7	352699	DHM5	EET CF	05/10/22 18:50
Total/NA	Analysis	SM 2540C		1	350518	ENB7	EET CF	04/20/22 14:22
Total/NA	Analysis	SM 4500 H+ B		1	350217	W9YR	EET CF	04/18/22 11:54
Total/NA	Analysis	Field Sampling		1	350954	BJ0R	EET CF	04/14/22 13:16

Client Sample ID: Field Blank

Date Collected: 04/14/22 11:10
Date Received: 04/15/22 17:10

Lab Sample ID: 310-229342-6

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	9056A		1	351278	J7CK	EET CF	04/26/22 19:57
Total/NA	Prep	3005A			350698	QTZ5	EET CF	04/25/22 09:00
Total/NA	Analysis	6020A		1	352699	DHM5	EET CF	05/10/22 18:54
Total/NA	Analysis	SM 2540C		1	350518	ENB7	EET CF	04/20/22 14:22
Total/NA	Analysis	SM 4500 H+ B		1	350217	W9YR	EET CF	04/18/22 11:58

Laboratory References:

EET CF = Eurofins Cedar Falls, 3019 Venture Way, Cedar Falls, IA 50613, TEL (319)277-2401

Accreditation/Certification Summary

Client: SCS Engineers
Job ID: 310-229342-1
Project/Site: Ottumwa Midland LF 25222073

Laboratory: Eurofins Cedar Falls

The accreditations/certifications listed below are applicable to this report.

Authority	Program	Identification Number	Expiration Date
Iowa	State	007	06-20-22

Method Summary

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25222073

Job ID: 310-229342-1

Method	Method Description	Protocol	Laboratory
9056A	Anions, Ion Chromatography	SW846	EET CF
6020A	Metals (ICP/MS)	SW846	EET CF
SM 2540C	Solids, Total Dissolved (TDS)	SM	EET CF
SM 4500 H+ B	pH	SM	EET CF
Field Sampling	Field Sampling	EPA	EET CF
3005A	Preparation, Total Metals	SW846	EET CF

Protocol References:

EPA = US Environmental Protection Agency

SM = "Standard Methods For The Examination Of Water And Wastewater"

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

EET CF = Eurofins Cedar Falls, 3019 Venture Way, Cedar Falls, IA 50613, TEL (319)277-2401

eurofins | Environment Testing America

310-229342 Chain of Custody

Cooler/Sample Receipt and Temperature Log Form

Client Information

Client: SCS Engineers

City/State: CITY Madison | STATE WI | Project:

Receipt Information

Date/Time Received: DATE 4-15-22 | TIME 1710 | Received By: HED

Delivery Type: ☐ UPS ☐ FedEx ☐ FedEx Ground ☐ US Mail ☐ Spee Dee ☒ Lab Courier ☐ Lab Field Services ☐ Client Drop-off ☐ Other._____

Condition of Cooler/Containers

Sample(s) received in Cooler? ☒ Yes ☐ No *If yes* Cooler ID TA-327

Multiple Coolers? ☐ Yes ☒ No *If yes* Cooler # ____ of ____

Cooler Custody Seals Present? ☐ Yes ☒ No *If yes* Cooler custody seals intact? ☐ Yes ☐ No

Sample Custody Seals Present? ☐ Yes ☒ No *If yes* Sample custody seals intact? ☐ Yes ☐ No

Trip Blank Present? ☐ Yes ☒ No *If yes* Which VOA samples are in cooler? ↓

Temperature Record

Coolant: ☒ Wet ice ☐ Blue ice ☐ Dry ice ☐ Other._____ ☐ NONE

Thermometer ID: P | Correction Factor (°C): -0.1

• Temp Blank Temperature – If no temp blank, or temp blank temperature above criteria, proceed to Sample Container Temperature

Uncorrected Temp (°C): 1.2 | Corrected Temp (°C): 1.1

• Sample Container Temperature

	CONTAINER 1	CONTAINER 2
Container(s) used		
Uncorrected Temp (°C)		
Corrected Temp (°C)		

Exceptions Noted

1) If temperature exceeds criteria, was sample(s) received same day of sampling? ☐ Yes ☐ No
   a) *If yes* Is there evidence that the chilling process began? ☐ Yes ☐ No

2) If temperature is <0°C, are there obvious signs that the integrity of sample containers is compromised? (e g , bulging septa, broken/cracked bottles, frozen solid?) ☐ Yes ☐ No

NOTE If yes, contact PM before proceeding. If no, proceed with login

Additional Comments

Eurofins Cedar Falls
3019 Venture Way
Cedar Falls, IA 50613
Phone (319) 277-2401 Phone (319) 277-2425

Chain of Custody Record

eurofins

Client Information	Sampler: Rosa Cruz	Lab PM: Fredrick, Sandie	Carrier Tracking No(s):	COC No: 310-70161-14130.1
Client Contact: Rosa Cruz	Phone: 515-864-9340	E-Mail: Sandra.Fredrick@et.eurofinsus.com	State of Origin:	Page: Page 1 of 1
Company: SCS Engineers	PWSID:			Job #:
Address: 8450 Hickman Road Suite 27	Due Date Requested:			
City: Clive	TAT Requested (days):			
State, Zip: IA, 50325	Compliance Project: Δ Yes Δ No			
Phone:	PO #: 25222073			
Emai: rcruz@scsengineers.com	WO #:			
Project Name: Ottumwa Midland LF 25222073	Project #: 31011020			
Site:	SSOW#:			

Analysis Requested

Preservation Codes:

A HCL M Hexane
B NaOH N None
C Zn Acetate O AsNaO2
D Nitric Acid P Na2O4S
E NaHSO4 Q Na2SO3
F MeOH R Na2S2O3
G Amchlor S H2SO4
H Ascorbic Acid T TSP Dodecahydrate
I Ice U Acetone
J DI Water V MCAA
K EDTA W pH 4-5
L EDA Z other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=grab)	Matrix (W=water S=solid, O=waste/oil BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	2540C_Calcd, SM4500_H+	6020A B/Ca	Total Number of containers	Special Instructions/Note:
			Preservation Code:				N	D		
MW-301	4-14-22	8 32	6	Water			X	X		
MW-302	4-13 22	15 30	6	Water			X	X		
MW-303	4-13-22	17 30	6	Water			X	X		
MW-102M	4-13-22	9 35	6	Water			X	X		
MW-122M	4-14-22	13 16	6	Water			X	X		
Field Blank	4-14-22	11 10	6	Water			X	X		
				Water						

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Deliverable Requested: I II III IV Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by: Date: 13 58 Time: Method of Shipment:

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
	4-15-22	SCS	James Vaux	4/25/22 1358	Eurofins/TK
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time: 4-15-22 1710	Company

Custody Seals Intact: Δ Yes Δ No | Custody Seal No.: | Cooler Temperature(s) °C and Other Remarks:

Ver: 01/16/2019

Table 2 Sampling Points and Parameters CCR Rule Sampling Program Detection Monitoring
Groundwater Monitoring Ottumwa Midland Landfill / SCS Engineers Project #25216073

	Parameter	MW-301	MW-302	MW-303	MW-102M	MW-122M	Field Blank	TOTAL
Appendix III Parameters	Boron	x	x	x	x	x	x	6
	Calcium	x	x	x	x	x	x	6
	Chloride	x	x	x	x	x	x	6
	Fluoride	x	x	x	x	x	x	6
	pH	x	x	x	x	x	x	6
	Sulfate	x	x	x	x	x	x	6
	TDS	x	x	x	x	x	x	6
Appendix IV Parameters	Antimony							0
	Arsenic							0
	Barium							0
	Beryllium							0
	Cadmium							0
	Chromium							0
	Cobalt							0
	Fluoride							0
	Lead							0
	Lithium							0
	Mercury							0
	Molybdenum							0
	Selenium							0
	Thallium							0
	Radium							0
Field Parameters	Groundwater Elevation	x	x	x	x	x		5
	Well Depth	x	x	x	x	x		5
	pH (field)	x	x	x	x	x		5
	Specific Conductance	x	x	x	x	x		5
	Dissolved Oxygen	x	x	x	x	x		5
	ORP	x	x	x	x	x		5
	Temperature	x	x	x	x	x		5
	Turbidity	x	x	x	x	x		5
	Color	x	x	x	x	x		5
	Odor	x	x	x	x	x		5

Notes All samples are unfiltered (total)

I:\25216073 00\Data and Calculations\Field Notes\Field Work Requests\[Table_2_OML_CCR_Rule_Sampling_Det

Table 2 page 1 of 1

Login Sample Receipt Checklist

Client: SCS Engineers

Job Number: 310-229342-1
SDG Number:

Login Number: 229342
List Number: 1
Creator: Homolar, Dana J

List Source: Eurofins Cedar Falls

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Groundwater Monitoring Results - Field Parameters
Ottumwa Midland Landfill / SCS Engineers Project #25222073.00
April 2022

Sample	Date	Groundwater Elevation (ft. amsl)	Temperature (Deg. C)	pH (Std. Units)	DO (mg/L)	Specific Conductivity (µmhos/cm)	ORP (mV)	Turbidity (NTU)
MW-301	4/14/2022	687.00	11.3	6.84	0.27	1,581	-76.0	22.9
MW-302	4/13/2022	685.07	12.0	7.30	0.36	1,002	-43.2	75.3
MW-303	4/13/2022	686.91	12.5	6.89	0.35	1,344	-37.8	61.2
MW-102M	4/13/2022	710.24	8.5	7.91	4.40	1,954	-25.9	121.0
MW-122M	4/14/2022	704.81	15.3	6.70	2.43	1,322	22.3	56.9

Abbreviations:
amsl = above mean sea level
mg/L = milligrams per liter
µmhos/cm = microSiemens per centimeter
NM = not measured.

Laboratory Notes/Qualifiers:
none

Created by: NDK Date: 10/11/2021
Last revision by: RM Date: 4/19/2022
Checked by: JAO Date: 4/22/2022

C:\Users\fredricks\AppData\Local\Microsoft\Windows\INetCache\Content.Outlook\D84274O8\[2204_OML_GW_Field Data.xlsx]GW Field Data

Appendix D

Historical Monitoring Results

Single Location

Name: IPL - Ottumwa Midland Landfill

Location ID: MW-102M
Number of Sampling Dates: 20

Parameter Name	Units	5/4/2016	6/22/2016	6/23/2016	8/10/2016	10/25/2016	10/26/2016	1/18/2017	4/20/2017	6/21/2017	8/22/2017	11/8/2017	4/17/2018	10/16/2018	4/18/2019	10/15/2019	5/21/2020	10/7/2020	4/15/2021	10/5/2021	4/13/2022
Boron	ug/L	1510	1440	--	1480	--	1420	1480	1460	1410	1440	1480	1550	1340	1400	1500	1500	1600	1600	1300	1400
Calcium	mg/L	45.9	147	--	129	--	31.5	23.6	26	67.7	79.7	10.4	25.3	12.9	51	14	38	150	43	71	32
Chloride	mg/L	16.3	13.8	--	13.4	--	13	12.3	12.5	12.8	13.1	12.3	13.5	13.6	14	15	16	14	14	16	14
Fluoride	mg/L	4.2	4.2	--	4.4	--	4.6	4.1	4	4.6	4.5	4.6	4.5	4.7	5.7	4.5	5	5.3	4.3	2.9	4.3
Field pH	Std. Units	8.09	7.68	--	--	--	--	7.62	7.35	7.64	6.89	8.16	8.34	7.8	8.55	7.81	7.82	8.29	7.85	7.81	7.91
Sulfate	mg/L	378	350	--	354	--	384	415	348	356	358	335	352	384	340	350	350	350	330	360	330
Total Dissolved Solids	mg/L	1670	1530	--	1620	--	1420	1530	1620	1480	1400	1410	1540	1500	1700	1400	3700	1700	1500	1300	1300
Antimony	ug/L	0.38	0.19	--	0.17	--	0.51	0.26	0.1	0.21	0.16	--	--	--	--	--	--	--	--	--	--
Arsenic	ug/L	0.64	0.68	--	0.78	--	0.9	0.89	0.92	0.9	0.9	--	--	--	--	--	--	--	--	--	--
Barium	ug/L	48.5	39.5	--	55.4	--	28.2	21.1	28.4	37.2	31	--	--	--	--	--	--	--	--	--	--
Beryllium	ug/L	0.74	1.4	--	1.1	--	0.37	0.19	0.34	0.54	0.41	--	--	--	--	--	--	--	--	--	--
Cadmium	ug/L	<0.029	0.12	--	0.078	--	0.11	<0.029	0.046	0.063	0.062	--	--	--	--	--	--	--	--	--	--
Chromium	ug/L	20.5	17.9	--	27.1	--	11.8	2.8	8.7	16	9.6	--	--	--	--	--	--	--	--	--	--
Cobalt	ug/L	3.5	4.5	--	7.3	--	2.4	0.74	1.7	2.1	2.5	--	--	--	--	--	--	--	--	--	--
Lead	ug/L	3.1	3.6	--	3.8	--	1.7	0.87	1.4	2.2	1.8	--	--	--	--	--	--	--	--	--	--
Lithium	ug/L	46.7	80.7	--	52.3	--	75.4	71.8	73.6	52.7	54	--	--	--	--	--	--	--	--	--	--
Mercury	ug/L	<0.039	<0.039	--	<0.039	--	<0.039	<0.039	<0.046	<0.046	<0.046	--	--	--	--	--	--	--	--	--	--
Molybdenum	ug/L	21.7	10.3	--	20.9	--	11.7	10.6	10.8	11.1	9.5	--	--	--	--	--	--	--	--	--	--
Selenium	ug/L	0.42	1	--	1.4	--	0.31	0.24	0.4	0.49	0.43	--	--	--	--	--	--	--	--	--	--
Thallium	ug/L	<0.5	<0.5	--	<0.5	--	<0.5	<0.5	0.04	0.084	0.067	--	--	--	--	--	--	--	--	--	--
Total Radium	pCi/L	2.64	--	1.66	1.17	--	0.814	0.567	1.57	1.12	0.594	--	--	--	--	--	--	--	--	--	--
Radium-226	pCi/L	-0.058	--	0.58	0.144	--	0.444	0.209	0.754	0.285	0.368	--	--	--	--	--	--	--	--	--	--
Radium-228	pCi/L	2.64	--	1.08	1.03	--	0.37	0.358	0.816	0.832	0.226	--	--	--	--	--	--	--	--	--	--
pH at 25 Degrees C	Std. Units	7.9	7.9	--	7.9	--	7.8	8.1	7.9	8	8	7.8	8	8	8.2	7.9	7.9	8.1	8	7.9	7.9
Groundwater Elevation	feet	728.73	718.74	--	730.49	716.94	--	717.91	717.8	714.83	713.23	713.53	717.38	717.05	717.97	715.5	717.61	712.05	710.95	714.85	710.24
Field Oxidation Potential	mV	128.2	-102.4	--	--	--	--	--	--	--	--	219.9	-77.8	-104.7	--	--	21.2	22	164	82.2	-25.9
Field Specific Conductance	umhos/cm	2197	2037	--	--	--	--	--	--	--	2751	2085	2113	0	--	--	2260	2123	2145	2041	1954
Field Temperature	deg C	14	14.2	--	--	--	--	--	--	--	13.4	12.9	10.1	12.9	--	--	13.1	14.5	11.5	13.5	--
Oxygen, Dissolved	mg/L	0.79	3.06	--	--	--	--	--	--	--	--	0.73	4.51	2.14	--	--	1.59	5.11	5.24	2.32	4.4
Turbidity	NTU	350.9	614.3	--	--	--	--	--	--	--	--	--	--	--	--	--	297	--	196	28.1	121
Temperature	deg C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	8.5

Single Location

Name: IPL - Ottumwa Midland Landfill

Location ID: MW-122M
Number of Sampling Dates: 21

Parameter Name	Units	5/4/2016	5/5/2016	6/22/2016	6/23/2016	8/10/2016	10/25/2016	10/26/2016	1/18/2017	4/20/2017	6/21/2017	8/22/2017	11/8/2017	4/17/2018	10/16/2018	4/17/2019	10/15/2019	5/21/2020	10/7/2020	4/15/2021	10/5/2021	4/14/2022
Boron	ug/L	--	3140	--	1720	4550	--	4060	4720	4480	4710	4980	5220	5560	4580	5500	4100	5100	4100	5100	5500	4800
Calcium	mg/L	--	599	--	312	419	--	415	386	382	386	386	383	402	366	400	400	430	430	410	440	420
Chloride	mg/L	--	16.4	--	21.9	11.8	--	8.2	8.3	8	7.8	7.8	7.2	8	8.6	8.8	10	9	8.3	8	8.7	8.5
Fluoride	mg/L	--	1.1	--	0.89	0.74	--	0.48	<0.027	0.88	1.1	0.6	0.5	<0.063	<0.19	0.7	<0.23	0.23	<0.23	0.3	<0.28	<0.22
Field pH	Std. Units	--	6.97	--	6.68	--	--	--	6.06	--	6.42	6.32	6.16	6.65	6.31	7.34	6.6	6.91	7	6.78	7.18	6.7
Sulfate	mg/L	--	8260	--	5330	8950	--	8600	9680	14300	17500	9190	9440	10400	<0.24	8300	8400	9800	8700	8700	8800	460
Total Dissolved Solids	mg/L	--	11500	--	7430	14200	--	13200	14100	18100	12800	14300	13400	14400	13300	13000	13000	16000	14000	14000	12000	13000
Antimony	ug/L	--	0.36	--	1	0.26	--	0.29	0.12	<0.079	<0.13	<0.13	--	--	--	--	--	--	--	--	--	--
Arsenic	ug/L	--	<0.52	--	<0.52	<0.21	--	<0.52	0.11	0.19	<0.26	<0.26	--	--	--	--	--	--	--	--	--	--
Barium	ug/L	--	31.5	--	17.9	14.5	--	16.8	11.8	13	11.2	10.3	--	--	--	--	--	--	--	--	--	--
Beryllium	ug/L	--	<0.4	--	<0.24	<0.16	--	<0.24	<0.4	0.054	<0.035	<0.058	--	--	--	--	--	--	--	--	--	--
Cadmium	ug/L	--	<0.14	--	<0.14	<0.058	--	<0.14	<0.029	<0.053	<0.089	<0.089	--	--	--	--	--	--	--	--	--	--
Chromium	ug/L	--	<1.7	--	<1.7	<0.68	--	1.3	0.51	0.26	<0.27	0.56	--	--	--	--	--	--	--	--	--	--
Cobalt	ug/L	--	5.3	--	6.5	3.5	--	6	2.1	1.4	1.2	0.96	--	--	--	--	--	--	--	--	--	--
Lead	ug/L	--	<0.96	--	<0.96	<0.39	--	<1.9	<0.19	0.22	<0.16	<0.16	--	--	--	--	--	--	--	--	--	--
Lithium	ug/L	--	450	--	332	601	--	544	679	643	640	667	--	--	--	--	--	--	--	--	--	--
Mercury	ug/L	--	<0.039	--	<0.039	<0.039	--	<0.039	<0.039	<0.046	<0.046	<0.046	--	--	--	--	--	--	--	--	--	--
Molybdenum	ug/L	--	2.6	--	2.6	0.57	--	0.58	0.15	2.1	0.6	0.43	--	--	--	--	--	--	--	--	--	--
Selenium	ug/L	--	<0.92	--	<0.92	<0.37	--	<0.92	<0.18	0.33	<0.43	<0.43	--	--	--	--	--	--	--	--	--	--
Thallium	ug/L	--	<2.5	--	<2.5	<1	--	<5	<0.5	<0.11	<0.18	<0.18	--	--	--	--	--	--	--	--	--	--
Total Radium	pCi/L	--	2.12	--	1.25	2.26	--	1.83	1.07	1.1	1.55	1.09	--	--	--	--	--	--	--	--	--	--
Radium-226	pCi/L	--	0.157	--	0.56	0.75	--	0.392	0.32	0.796	0.333	0.559	--	--	--	--	--	--	--	--	--	--
Radium-228	pCi/L	--	1.96	--	0.691	1.51	--	1.44	0.752	0.305	1.22	0.532	--	--	--	--	--	--	--	--	--	--
pH at 25 Degrees C	Std. Units	--	6.5	--	6.7	6.1	--	6.2	6.1	6.4	6.2	6	6.2	6.4	6.4	6.6	6.7	7	6.9	6.7	7	6.7
Groundwater Elevation	feet	729.27	--	725.67	--	710.32	724.61	--	742.02	724.04	723.51	722.02	720.52	723.25	723.36	723.43	708.94	724.23	718.39	720.52	717.76	704.81
Field Oxidation Potential	mV	--	34.3	--	-50.7	--	--	--	--	--	--	-7.7	195.4	-61.1	-53.5	--	--	-4.4	-28.2	159.2	-5.9	22.3
Field Specific Conductance	umhos/cm	--	3025	--	8161	--	--	--	--	--	--	--	13375	13773	0	--	--	14090	13603	13983	13044	1322
Field Temperature	deg C	--	16.1	--	14.9	--	--	--	--	--	--	16.2	13.1	13.4	11.8	--	--	13	13.6	9	13.3	--
Oxygen, Dissolved	mg/L	--	1.92	--	2.29	--	--	--	--	--	--	--	0.49	0.36	1.48	--	--	0.61	0.56	5.03	0.84	2.43
Turbidity	NTU	--	212.1	--	-46.36	--	--	--	--	--	--	--	--	--	--	--	--	2.31	--	0	29	56.9
Temperature	deg C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	15.3

Single Location

Name: IPL - Ottumwa Midland Landfill

Location ID: MW-301
Number of Sampling Dates: 18

Parameter Name	Units	5/4/2016	6/22/2016	8/9/2016	10/26/2016	1/17/2017	4/20/2017	6/20/2017	8/22/2017	11/7/2017	4/17/2018	10/15/2018	4/16/2019	10/15/2019	5/26/2020	10/6/2020	4/12/2021	10/5/2021	4/14/2022
Boron	ug/L	2280	1860	1770	1410	1310	1040	1040	994	1010	854	784	660	600	660	770	790	700	710
Calcium	mg/L	596	472	479	393	337	224	202	158	161	131	135	110	100	120	180	160	150	150
Chloride	mg/L	42.4	112	46.6	43.4	32.6	58	38.9	40.8	28.9	33.9	26.9	45	46	61	24	28	29	24
Fluoride	mg/L	0.68	0.38	0.55	0.72	0.77	0.72	0.93	0.78	0.77	0.87	0.84	0.85	0.85	0.77	0.67	0.73	<0.28	<0.22
Field pH	Std. Units	6.44	6.62	7.81	6.33	6.31	6.15	6.73	6.51	6.56	7.09	6.59	7.1	6.67	5.67	7.22	6.62	6.71	6.84
Sulfate	mg/L	5160	5370	4050	2630	1780	1170	1180	902	926	638	837	360	310	390	620	530	590	450
Total Dissolved Solids	mg/L	6260	5380	5810	4030	2830	1990	2060	1870	1760	1400	1550	970	860	1100	1400	1300	1200	1000
Antimony	ug/L	<0.58	<0.12	<0.12	<0.058	0.089	<0.026	0.058	0.04	--	--	--	--	--	--	--	--	--	--
Arsenic	ug/L	<1	0.84	0.29	0.3	0.64	0.56	0.42	0.56	--	--	--	--	--	--	--	--	--	--
Barium	ug/L	28.1	26.6	24.2	32.1	41.5	41	47.1	45.7	--	--	--	--	--	--	--	--	--	--
Beryllium	ug/L	<0.8	<0.24	<0.16	<0.08	<0.08	<0.012	<0.012	<0.012	--	--	--	--	--	--	--	--	--	--
Cadmium	ug/L	<0.29	<0.058	<0.058	<0.029	<0.029	<0.018	<0.018	0.04	--	--	--	--	--	--	--	--	--	--
Chromium	ug/L	<3.4	<0.68	<0.68	0.46	0.5	0.31	0.16	0.2	--	--	--	--	--	--	--	--	--	--
Cobalt	ug/L	<5	<1	<1	<0.5	<0.5	0.21	0.22	0.17	--	--	--	--	--	--	--	--	--	--
Lead	ug/L	<1.9	<0.96	<0.39	<0.19	<0.19	0.046	0.038	0.091	--	--	--	--	--	--	--	--	--	--
Lithium	ug/L	274	268	195	171	156	110	111	114	--	--	--	--	--	--	--	--	--	--
Mercury	ug/L	<0.039	<0.039	<0.039	<0.039	<0.039	<0.046	<0.046	<0.046	--	--	--	--	--	--	--	--	--	--
Molybdenum	ug/L	4.6	2	2.1	2.9	2.9	6.3	5.3	6.5	--	--	--	--	--	--	--	--	--	--
Selenium	ug/L	<1.8	<0.37	<0.37	<0.18	<0.18	<0.086	<0.086	0.12	--	--	--	--	--	--	--	--	--	--
Thallium	ug/L	<5	<2.5	<1	<0.5	<0.5	<0.036	0.076	0.068	--	--	--	--	--	--	--	--	--	--
Total Radium	pCi/L	1.99	0.285	1.89	1.68	1.96	1.34	1.56	1.5	--	--	--	--	--	--	--	--	--	--
Radium-226	pCi/L	0.565	0.071	0.606	0.66	0.44	0.855	0.734	0.6	--	--	--	--	--	--	--	--	--	--
Radium-228	pCi/L	1.42	0.214	1.28	1.02	1.52	0.488	0.829	0.896	--	--	--	--	--	--	--	--	--	--
pH at 25 Degrees C	Std. Units	6.2	6.2	6.2	6.2	6.2	6.9	6.4	6.4	6.4	6.8	7.5	6.8	7	7.3	6.9	6.6	6.8	6.8
Groundwater Elevation	feet	686.46	686.4	686.19	683.7	685.57	685.72	685.88	684.96	684.5	684.85	684.58	686.38	686.56	687.29	686.8	687.25	686.87	687
Field Oxidation Potential	mV	-58.5	-49.7	-53	-79.4	-57.8	-49.8	-63.1	-20.6	144.3	-102.8	88.2	-50.2	-58.4	-57.8	-105.9	-79.6	-66.1	-76
Field Specific Conductance	umhos/cm	7267	5132	5607	4377	3607	2631	2384	3187	2395	1910	2112	1603	1512	1546	1820	1875	1717	1581
Field Temperature	deg C	13.4	14.3	13.9	13.5	13.1	13	13.8	13.9	13.4	13	13.6	13.87	13.68	15.8	14.5	13	13.8	--
Oxygen, Dissolved	mg/L	0.27	0.14	0.1	0.55	0.19	0.18	0.16	0.11	0.37	0.16	0.2	1.27	0.4	0.41	0.25	0.46	0.35	0.27
Turbidity	NTU	2.86	3.34	1.05	0.92	0.63	1.12	2.69	0.99	1.91	1.13	4.91	8.88	4.75	21.8	21.4	4.6	32.1	22.9
Temperature	deg C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	11.3

Single Location

Name: IPL - Ottumwa Midland Landfill

Location ID: MW-302
Number of Sampling Dates: 18

Parameter Name	Units	5/4/2016	6/22/2016	8/10/2016	10/26/2016	1/17/2017	4/19/2017	6/20/2017	8/22/2017	11/7/2017	4/17/2018	10/15/2018	4/16/2019	10/15/2019	5/21/2020	10/6/2020	4/12/2021	10/5/2021	4/13/2022
Boron	ug/L	853	796	802	784	824	777	767	783	848	834	752	760	780	780	870	820	740	730
Calcium	mg/L	72.1	56.6	48.8	42.8	42.9	41	46.1	50.2	74	77.3	66.9	44	68	41	65	58	52	50
Chloride	mg/L	9.2	8.1	7.5	6	7.7	8	8	8.5	7.8	8.6	9.2	10	7.3	8.9	7.2	6.6	7.1	5.3
Fluoride	mg/L	1.1	1	0.98	1	0.97	1	1.1	1	1.2	1	1.1	1.5	1.2	1	1.1	1.1	0.5	1.1
Field pH	Std. Units	7.38	7.76	9.55	7.22	7.23	7.6	7.29	7.12	7.41	7.8	7.25	7.49	7.21	7.05	7.14	7.13	7.2	7.3
Sulfate	mg/L	201	133	102	78.9	76.7	76.7	79.3	77.2	77.5	79.3	80.9	83	73	79	73	64	70	61
Total Dissolved Solids	mg/L	784	715	671	644	639	671	656	672	607	690	708	690	680	930	700	620	400	630
Antimony	ug/L	0.12	0.15	0.095	<0.058	0.1	<0.026	0.094	0.056	--	--	--	--	--	--	--	--	--	--
Arsenic	ug/L	0.19	0.39	0.28	0.24	0.31	0.23	0.25	0.38	--	--	--	--	--	--	--	--	--	--
Barium	ug/L	39.3	45.4	50	54	57.2	48.9	49.9	47.5	--	--	--	--	--	--	--	--	--	--
Beryllium	ug/L	0.22	0.16	<0.08	<0.08	<0.08	0.051	0.084	0.15	--	--	--	--	--	--	--	--	--	--
Cadmium	ug/L	<0.029	<0.029	<0.029	<0.029	<0.029	<0.018	0.018	<0.018	--	--	--	--	--	--	--	--	--	--
Chromium	ug/L	5.5	6.2	1.9	1.8	1.4	1.4	2.2	2.9	--	--	--	--	--	--	--	--	--	--
Cobalt	ug/L	1.1	1.1	<0.5	<0.5	<0.5	0.24	0.38	0.66	--	--	--	--	--	--	--	--	--	--
Lead	ug/L	1.1	0.9	0.32	0.26	0.26	0.25	0.36	0.54	--	--	--	--	--	--	--	--	--	--
Lithium	ug/L	81.1	81.2	75.9	79.8	80.8	79.6	78.5	82	--	--	--	--	--	--	--	--	--	--
Mercury	ug/L	<0.039	<0.039	<0.039	<0.039	<0.039	<0.046	<0.046	<0.046	--	--	--	--	--	--	--	--	--	--
Molybdenum	ug/L	0.32	0.49	0.31	0.18	0.24	0.2	0.17	0.24	--	--	--	--	--	--	--	--	--	--
Selenium	ug/L	0.19	0.39	<0.18	<0.18	<0.18	<0.086	0.21	0.21	--	--	--	--	--	--	--	--	--	--
Thallium	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.036	0.065	0.089	--	--	--	--	--	--	--	--	--	--
Total Radium	pCi/L	0.874	0.677	1.17	1.17	1.57	1.65	1.54	2.6	--	--	--	--	--	--	--	--	--	--
Radium-226	pCi/L	0.412	-0.066	0.426	0.505	0.525	0.872	0.987	1.74	--	--	--	--	--	--	--	--	--	--
Radium-228	pCi/L	0.462	0.677	0.744	0.663	1.04	0.777	0.549	0.863	--	--	--	--	--	--	--	--	--	--
pH at 25 Degrees C	Std. Units	7.3	7.1	7.3	7.4	7.6	7.5	7.6	7.4	7.2	7.6	7.5	7.4	7.5	7.5	7.6	6.7	7.6	7.5
Groundwater Elevation	feet	685.8	685.79	685.48	684.94	685.68	684.73	684.76	683.89	683.38	683.87	683.52	685.35	685.44	686.25	685.86	686.26	685.85	685.07
Field Oxidation Potential	mV	-153.3	-114.6	-100.7	-126.7	-109.6	-64	-66.8	-96.2	112.3	-138.7	-103.6	8.13	-56.4	-83.4	-169.4	-74.2	-66.5	-43.2
Field Specific Conductance	umhos/cm	1326	1132	1102	1075	1081	1081	1018	1429	1079	1091	1102	1168	1067	1129	1025	1079	993	1002
Field Temperature	deg C	13.6	14	13.9	13.5	12.9	14	14	13.7	13.1	12.7	13.4	13.63	14.26	13.1	13.5	13.2	13.5	--
Oxygen, Dissolved	mg/L	0.08	0.09	0.1	0.66	0.29	0.17	0.22	0.11	0.3	0.3	0.22	1.59	0.75	1.06	0.28	0.28	0.35	0.36
Turbidity	NTU	170.8	167.5	74.76	29.05	43.07	39.01	58.63	77.96	202.4	200.6	131.5	44.2	102.8	12.5	136	127	67.1	75.3
Temperature	deg C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	12

Single Location

Name: IPL - Ottumwa Midland Landfill

Location ID: MW-303
Number of Sampling Dates: 20

Parameter Name	Units	5/4/2016	6/22/2016	8/9/2016	10/26/2016	1/17/2017	4/19/2017	7/19/2017	8/22/2017	11/7/2017	4/17/2018	10/16/2018	4/16/2019	6/6/2019	10/15/2019	5/26/2020	6/29/2020	10/6/2020	4/12/2021	10/5/2021	4/13/2022
Boron	ug/L	3510	2430	1640	1100	955	800	755	737	738	738	661	850	--	760	770	--	740	730	630	680
Calcium	mg/L	686	462	250	157	116	97.4	87.7	94	94.9	103	90.5	150	--	120	120	--	100	100	92	100
Chloride	mg/L	13.5	11.5	8.7	7.5	7.1	6.9	7.2	7.3	6.9	7.3	7.4	8.1	8	7.5	8.5	6.9	7.3	7.6	8.3	7
Fluoride	mg/L	0.68	0.47	0.9	0.87	0.86	0.86	0.86	0.85	0.77	0.8	0.84	<0.23	--	0.87	0.81	--	0.88	0.74	0.39	0.97
Field pH	Std. Units	6.24	6.93	7.84	6.66	6.69	7.12	7.1	6.71	6.96	7.32	6.87	6.97	6.71	6.76	6.21	6.74	7.01	6.8	6.76	6.89
Sulfate	mg/L	6230	4690	1950	780	497	329	255	287	232	262	310	600	--	390	440	--	230	260	270	250
Total Dissolved Solids	mg/L	9540	7120	2750	1500	1080	931	809	868	783	839	891	1300	--	1100	1100	--	840	850	820	840
Antimony	ug/L	<0.58	<0.058	<0.12	<0.058	0.082	<0.026	0.042	0.041	--	--	--	--	--	--	--	--	--	--	--	--
Arsenic	ug/L	<1	0.3	<0.21	0.13	0.2	0.24	0.59	0.53	--	--	--	--	--	--	--	--	--	--	--	--
Barium	ug/L	55.8	47.6	19.3	13.4	11.7	11.9	12.8	13.1	--	--	--	--	--	--	--	--	--	--	--	--
Beryllium	ug/L	1.2	<0.24	0.16	0.11	0.099	0.13	0.24	0.24	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	ug/L	<0.29	<0.029	<0.058	0.037	<0.029	<0.018	0.019	0.026	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	ug/L	22.1	3.1	2.7	2.6	1.1	2.6	5.1	4.5	--	--	--	--	--	--	--	--	--	--	--	--
Cobalt	ug/L	12.7	1.6	1.2	1	<0.5	1.1	2.5	2.1	--	--	--	--	--	--	--	--	--	--	--	--
Lead	ug/L	5.7	1.6	0.51	0.57	0.3	0.57	1	1.2	--	--	--	--	--	--	--	--	--	--	--	--
Lithium	ug/L	289	270	126	102	96.5	92.4	90.8	92.8	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	ug/L	<0.039	<0.039	<0.039	<0.039	<0.039	<0.046	<0.046	<0.046	--	--	--	--	--	--	--	--	--	--	--	--
Molybdenum	ug/L	3	0.38	0.69	0.43	0.29	0.3	0.26	0.29	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	ug/L	<1.8	0.38	<0.37	<0.18	<0.18	0.26	0.4	0.42	--	--	--	--	--	--	--	--	--	--	--	--
Thallium	ug/L	<5	<2.5	<1	<0.5	<0.5	<0.036	0.049	0.048	--	--	--	--	--	--	--	--	--	--	--	--
Total Radium	pCi/L	10.6	7.5	3.59	2.18	1.47	1.82	1.33	0.803	--	--	--	--	--	--	--	--	--	--	--	--
Radium-226	pCi/L	2.51	2.96	1.26	0.634	0.199	0.481	0.273	0.559	--	--	--	--	--	--	--	--	--	--	--	--
Radium-228	pCi/L	8.08	4.54	2.33	1.55	1.27	1.34	1.06	0.244	--	--	--	--	--	--	--	--	--	--	--	--
pH at 25 Degrees C	Std. Units	6.2	6.2	6.4	6.6	6.9	7	7	6.9	6.8	7.2	7.1	6.8	--	7	7.3	--	7.2	7	7.3	7
Groundwater Elevation	feet	686.04	687.72	687.77	685.56	685.6	685.51	684.92	684.7	684.26	684.68	684.33	686.13	686.05	686.08	687.14	687.36	686.35	689.05	686.84	686.91
Field Oxidation Potential	mV	-50	-49.5	-76.7	-102.1	-93.5	-56.6	-83.6	-72.6	125.7	-103.8	-117.7	-20	-40	-55.6	-30	-53.3	-137.3	-64.6	-55	-37.8
Field Specific Conductance	umhos/cm	8206	6426	3419	2120	1681	1451	1300	1836	1307	1358	0	2209	1331	1628	1963	1739	1262	1431	1287	1344
Field Temperature	deg C	14	14	14	13.7	13	13.7	14.5	14	13.2	13.3	13.5	14.07	16.7	15.44	14.4	16.1	13.9	14.2	13.8	--
Oxygen, Dissolved	mg/L	0.16	0.11	0.08	0.46	0.16	0.17	0.5	0.31	0.45	0.38	0.41	1.41	0.42	0.43	2.31	0.49	0.3	0.38	0.48	0.35
Turbidity	NTU	677.5	160.2	169.9	84.13	113.7	120.3	179.4	161.5	258.2	248	61.64	99.2	169.9	27.9	57.1	59	240	168	79.6	61.2
Temperature	deg C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	12.5