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GHD ref: 11215105-LTR-10

October 07, 2021

Mr. Amer Safadi
Remedial Project Manager
Iowa/Nebraska Remedial Branch
Superfund Division
U.S. Environmental Protection Agency, Region VII
11201 Renner Boulevard
Lenexa, Kansas 66219

Proposed Monitoring Wells to Delineate Impact at MW-123
Former Coal Gasification Plant Site - Waterloo, Iowa

Dear Mr. Safadi:

On behalf of MidAmerican Energy Company (MidAmerican), GHD has prepared this letter to propose installation of two additional monitoring wells at the Waterloo, Iowa former coal gasification plant site. The purpose of the proposed wells is to delineate groundwater impact detected in monitoring well MW-123. Monitoring well MW-123 was installed in February 2021 as part of recent evaluation activities at the site.

1. Summary of Recent Evaluation Activities

GHD installed monitoring wells MW-122, MW-123, MW-219, MW-220, and MW-221 in February 2021 and MW-218 in June 2021 (Figure 1) in accordance with the October 30, 2020 Natural Attenuation Study Work Plan for Manganese and the January 26, 2021 Technical Impracticability (TI) Zone Modification Evaluation Work Plan. Lithologic logs and well construction diagrams are provided in Attachment 1.

GHD completed the first two quarterly sampling events during the weeks of March 22, 2021 and June 28, 2021. Results from these sampling events show the Performance Standards for ethylbenzene, several PAHs, and manganese were exceeded at monitoring well MW-123 (Table 1). Because of these exceedances, two new monitoring wells (MW-124 and MW-125) are proposed to delineate the extent of impact detected at MW-123.

The fall 2021 semiannual monitoring event was completed the week of September 20, 2021, but the results have not yet been received from the laboratory.

As a general update, the Cedar River and soil sampling results collected as part of the manganese natural attenuation study, are provided in Table 2 and Table 3, respectively. These results are not addressed in this letter, but will be addressed in the monitored natural attenuation evaluation to be included in the annual report due in February 2022.

2. Proposed Monitoring Wells

The proposed location of MW-124 is approximately 175 feet north-northeast of MW-123. The location has been chosen to provide upgradient delineation while minimizing disruption to Crystal Distribution Service Inc.'s (Crystal's) activities.

Monitoring well MW-125 will be installed approximately 300 feet east of MW-123. Frequent truck traffic prevents placement of MW-125 at a location closer to MW-123 due to the likelihood that the high volume of large truck traffic that drives over that area on a daily basis would damage the well and render it unusable. The proposed location is outside of the gravel traffic and parking lot area and near a building, protecting it from damage and disturbance by traffic.

The intent is that new wells MW-124 and MW-125 will be screened in the shallow portion of the alluvial aquifer at similar depth to MW-123 such that the wells are monitoring similar hydrologic conditions and thus providing data to delineate the impact detected at MW-123.

A summary of the well location rationale is provided in Table 4.

2.1 Well Construction

The wells will be constructed with 2-inch inner diameter well materials, consisting of a 10-foot long stainless steel screen and Schedule 40 polyvinyl chloride (PVC) casing. The wells will be completed with a stick-up protective casing and protective bollards. Installation, development, and survey activities will follow the procedures described in the August 2008 Monitoring Well Installation Work Plan (MWH, 2008).

Well construction will be completed in accordance with state of Iowa well drilling requirements. Drilling and well construction will be completed by an Iowa-licensed well driller.

2.2 Future Groundwater Monitoring

Groundwater monitoring will be completed in accordance with the methods specified in the Revised Groundwater Monitoring Plan (GMP) (MWH, 2013) and the current revisions to the Quality Assurance Project Plan (GHD, 2019). Groundwater elevations will be measured, and groundwater samples will be collected and analyzed for COPCs, and the data from the two new wells will be used to further delineate the groundwater impact observed at MW-123.

3. Schedule

Following USEPA approval, it is anticipated the additional wells will be installed during the fourth quarter of 2021 and the new wells will be sampled on a quarterly basis following installation. The final well locations are subject to the approval of Crystal. Following the first two quarterly sampling events, the results from the new wells will be evaluated to determine the need for continued sampling at these locations.

If you have any questions, please contact Jenny Coughlin of MidAmerican Energy Company at 515-281-2344 or me at 515-414-3935.

Sincerely,

Kevin G. Armstrong, C.P.G., P.M.P.
Project Manager

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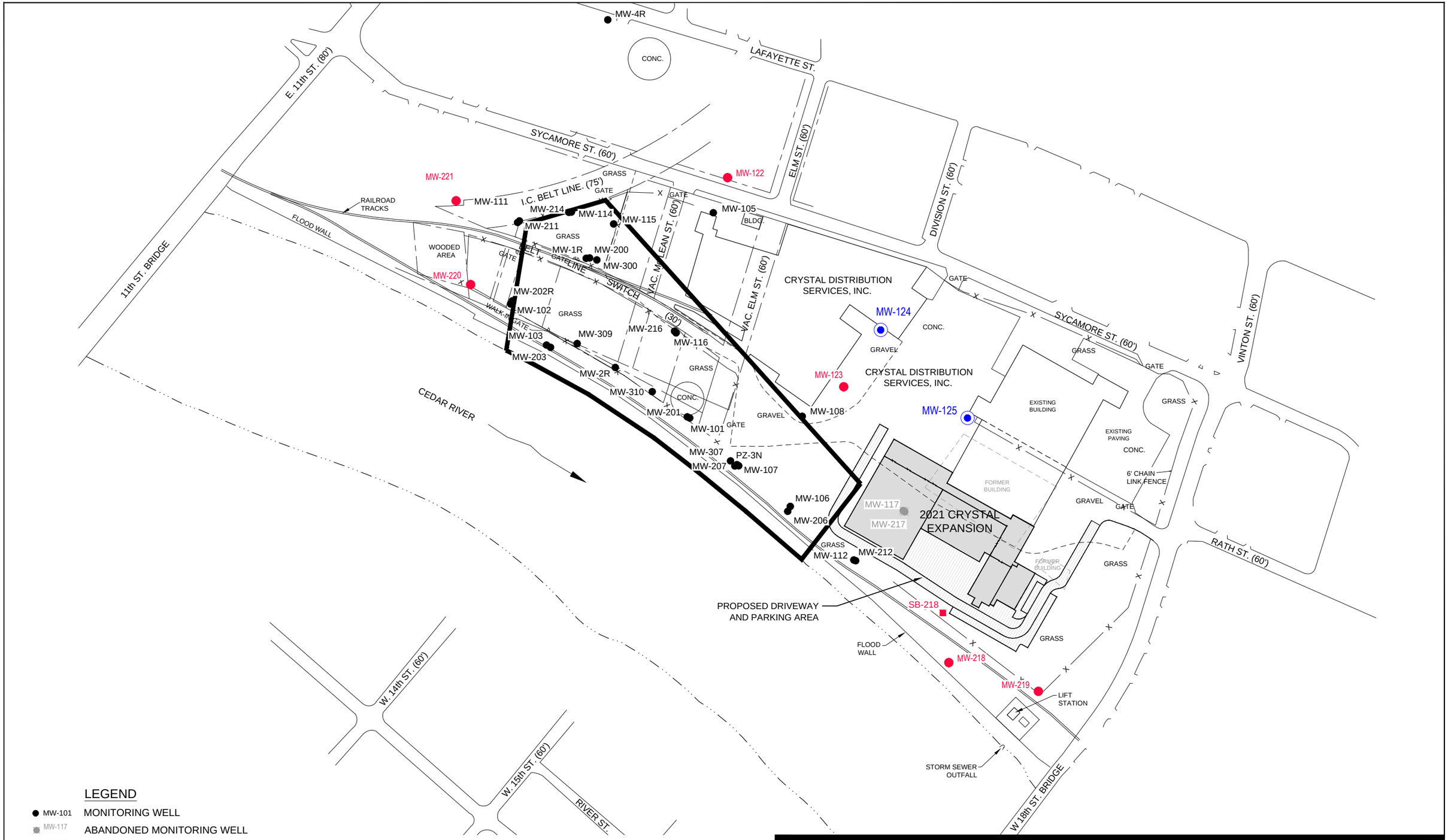
kevin.armstrong@ghd.com

JB/KA/md/LTR-10

Encl.



LEGEND

- MW-101 MONITORING WELL
- MW-117 ABANDONED MONITORING WELL
- RAILROAD TRACKS
- CHAIN LINK FENCE
- TECHNICAL IMPRACTICABILITY ZONE
- MW-125 PROPOSED MONITORING WELL LOCATION

NOTE: DRILLING LOCATIONS COMPLETED DURING 2021 SHOWN IN RED

0 112.5 225 ft

Coordinate System:
STATE PLANE IOWA NORTH
Elevation NGVD29

N

GHD

MIDAMERICAN ENERGY COMPANY
FORMER COAL GASIFICATION PLANT SITE
WATERLOO, IOWA

PROPOSED DELINEATION WELL LOCATIONS

Project No. **11215105**
Date **September 2021**

FIGURE 1

Filename: N:\US\Des Moines\Projects\563\11215105\Digital_Design\ACAD 2018\Figures\LTR-010\11215105-GHD-0000-LTR-EN-0101_DE-010.DWG
Plot Date: 30 September 2021 11:40 PM

Table 1

Groundwater Analytical Results Summary
Additional Characterization Wells
MidAmerican Energy Company
Former Coal Gasification Plant Site - Waterloo, Iowa

Sample Location:			MW-122	MW-122	MW-123	MW-123	MW-207	MW-207	MW-207	MW-218
Sample Date:			03/25/2021	06/28/2021	03/25/2021	06/29/2021	03/25/2021	03/25/2021	06/29/2021	06/28/2021
Sample ID:		Performance	MW122-GW-0321	MW122-GW-0621	MW123-GW-0321	MW123-GW-0621	MW207-GW-0321	DP-02-GW-0321	MW207-GW-0621	MW218-GW-0621
Sample Type:		Standard						(Duplicate)		
Location Relative To TI Zone:			Upgradient	Upgradient	Upgradient	Upgradient	Within	Within	Within	Crossgradient
Screened Unit:			Shallow	Shallow	Shallow	Shallow	Deep	Deep	Deep	Deep
Parameters	**Units**									
Volatile Organic Compounds										
Benzene	ug/L	5	0.500 U	0.500 U	0.615	5.00 U	**7.91**	**8.55**	--	--
Ethylbenzene	ug/L	700	1.00 U	1.00 U	**2930**	**4770**	**1690**	**1720**	--	--
Toluene	ug/L		1.00 U	1.00 U	1.00 U	10.0 U	30.9	33.4	--	--
Xylenes (total)	ug/L		3.00 U	3.00 U	2130	2890	1410	1480	--	--
Polynuclear Aromatic Hydrocarbons (PAHs)										
2-Methylnaphthalene	ug/L	61.2	0.132 U	0.112 U	3.70	2.95	6.04	6.45	--	--
Benzo(a)anthracene	ug/L	0.13	0.132 U	0.112 U	**0.279**	**0.545**	**0.152**	**0.170**	--	--
Benzo(a)pyrene	ug/L	0.2	0.132 U	0.112 U	0.129	**0.380**	0.105 U	0.106 U	--	--
Benzo(b)fluoranthene	ug/L	0.1	0.0961 U	0.0562 U	**0.101 J**	**0.239**	0.0768 U	0.0777 U	--	--
Benzo(k)fluoranthene	ug/L	0.14	0.132 U	0.112 U	0.118 U	0.112 U	0.105 U	0.106 U	--	--
Chrysene	ug/L	0.852	0.132 U	0.112 U	0.234	0.470	0.105 U	0.118	--	--
Dibenz(a,h)anthracene	ug/L	0.033	0.0737 U	0.0449 U	0.0659 U	**0.0458 J**	0.0589 U	0.0596 U	--	--
Indeno(1,2,3-cd)pyrene	ug/L	0.1	0.0658 U	0.0562 U	0.0588 U	**0.120**	0.0526 U	0.0532 U	--	--
Naphthalene	ug/L	6.2	0.725	0.562 U	**1780**	**2590**	**566**	**631**	--	--
Inorganics										
Chromium	ug/L	100	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	--	
Iron	ug/L	10893	112 J+	100 U	2790 J+	3490	1150	1190 J+	1430	4370
Manganese	ug/L	775	85.4 J+	10.0 U	**1170 J+**	**1300**	634	645 J+	**788**	**937**
Natural Attenuation Parameters										
Iron (dissolved)	ug/L		100 U	100 U	2620	3010	--	--	1200	3730
Manganese (dissolved)	ug/L		75.2	10.0 U	1190	1200	--	--	690	877
Nitrate (as N)	mg/L		3.61	3.29	0.240	0.100 U	--	--	0.100 U	0.100 U
Nitrite (as N)	mg/L		0.100 U	0.100 U	0.100 U	0.100 U	--	--	0.100 U	0.100 U
Sulfate	mg/L		65.4	71.9	19.1	23.3	--	--	18.7	70.5
Total kjeldahl nitrogen (TKN)	mg/L		1.00 U	1.00 U	1.00 U	1.00 U	--	--	1.00 U	1.00 U
Total organic carbon (TOC)	mg/L		1.00 U	1.00 U	3.10	3.09	--	--	1.87	1.02
Field Parameters										
Conductance, specific	mS/cm		--	0.91	--	1.14	0.69	--	0.92	1.03
Dissolved oxygen (DO)	mg/L		--	1.56	--	0.14	0.04	--	0.06	0.12
Oxidation reduction potential (ORP)	millivolts		213.2	148.6	-34.6	-115.5	-225.8	--	-144.4	-125.8
pH	s.u.		7.03	6.93	7.07	7.22	7.45	--	7.27	7.27
Temperature, field	Deg C		6.69	13.12	6.54	13.78	9.19	--	12.1	14.31
Turbidity	NTU		4	1	5	9.1	1	--	6.33	9

Notes
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated.
J+ - Estimated concentration, result may be biased high.
1300 - Red/Bold cell denotes exceedance of Performance Standard.

Table 1

Groundwater Analytical Results Summary
Additional Characterization Wells
MidAmerican Energy Company
Former Coal Gasification Plant Site - Waterloo, Iowa

Sample Location:			MW-219	MW-219	MW-220	MW-220	MW-221	MW-221	MW-221	MW-4R	MW-4R
Sample Date:			03/25/2021	06/29/2021	03/23/2021	06/29/2021	03/23/2021	06/28/2021	06/29/2021	03/23/2021	06/29/2021
Sample ID:		Performance	MW219-GW-0321	MW219-GW-0621	MW220-GW-0321	MW220-GW-0621	MW221-GW-0321	MW221-GW-0621	DP01-GW-0621	MW4R-GW-0321	MW4R-GW-0621
Sample Type:		Standard							Duplicate		
Location Relative To TI Zone:			Crossgradient	Crossgradient	Crossgradient	Crossgradient	Crossgradient	Crossgradient	Crossgradient	Upgradient	Upgradient
Screened Unit:			Deep	Deep	Deep	Deep	Deep	Deep	Deep	Shallow	Shallow
Parameters	**Units**										
Volatile Organic Compounds											
Benzene	ug/L	5	--	--	--	--	0.500 U	0.500 U	0.500 U	--	--
Ethylbenzene	ug/L	700	--	--	--	--	1.00 U	1.00 U	1.00 U	--	--
Toluene	ug/L		--	--	--	--	1.00 U	1.00 U	1.00 U	--	--
Xylenes (total)	ug/L		--	--	--	--	3.00 U	3.00 U	3.00 U	--	--
Polynuclear Aromatic Hydrocarbons (PAHs)											
2-Methylnaphthalene	ug/L	61.2	--	--	--	--	0.105 U	0.110 U	0.111 U	--	--
Benzo(a)anthracene	ug/L	0.13	--	--	--	--	0.105 U	0.110 U	0.111 U	--	--
Benzo(a)pyrene	ug/L	0.2	--	--	--	--	0.105 U	0.110 U	0.111 U	--	--
Benzo(b)fluoranthene	ug/L	0.1	--	--	--	--	0.0768 U	0.0549 U	0.0556 U	--	--
Benzo(k)fluoranthene	ug/L	0.14	--	--	--	--	0.105 U	0.110 U	0.111 U	--	--
Chrysene	ug/L	0.852	--	--	--	--	0.105 U	0.110 U	0.111 U	--	--
Dibenz(a,h)anthracene	ug/L	0.033	--	--	--	--	0.0589 U	0.0440 U	0.0444 U	--	--
Indeno(1,2,3-cd)pyrene	ug/L	0.1	--	--	--	--	0.0526 U	0.0549 U	0.0556 U	--	--
Naphthalene	ug/L	6.2	--	--	--	--	0.526 U	0.549 U	0.556 U	--	--
Inorganics											
Chromium	ug/L	100	--	--	--	--	5.00 U	5.00 U	5.00 U		
Iron	ug/L	10893	100 U	100 U	5820	5690	6420	6440	6080	121	210
Manganese	ug/L	775	562 J+	564	**1180**	**1120**	**1140**	**986**	**937**	27.1	107
Natural Attenuation Parameters											
Iron (dissolved)	ug/L		100 U	100 U	6070	5260	6770	5690	5640	100 U	100 U
Manganese (dissolved)	ug/L		514	529	1210	1080	1240	892	887	54.2	95.5
Nitrate (as N)	mg/L		0.831	3.68	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.110	2.15
Nitrite (as N)	mg/L		0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U
Sulfate	mg/L		60.4	51.5	103	95.8	86.8	80.9	81.3	34.7	39.2
Total kjeldahl nitrogen (TKN)	mg/L		1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Total organic carbon (TOC)	mg/L		1.00 U	1.00 U	1.19	1.21	1.00 U	1.00 U	1.00 U	1.38	1.47
Field Parameters											
Conductance, specific	mS/cm		0.72	0.93	1.43	1.67	1.16	1.19	--	0.66	0.85
Dissolved oxygen (DO)	mg/L		0.14	0.13	0.2	0.19	0.31	0.15	--	11.69	4.51
Oxidation reduction potential (ORP)	millivolts		215.4	120.5	-146.8	-102.7	-87.4	-122.4	--	216.1	125.3
pH	s.u.		7.25	7.39	7.26	7.16	7.14	7.27	--	5.37	7.31
Temperature, field	Deg C		11.13	13.55	13.03	14.51	12.74	15.51	--	11.79	17.3
Turbidity	NTU		6	2	9.2	1.8	6.03	2	--	5.1	9.9

Notes
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated.
J+ - Estimated concentration, result may be biased high.
1300 - Red/Bold cell denotes exceedance of Performance Standard.

Table 2

Cedar River Surface Water Analytical Results Summary
MidAmerican Energy Company
Former Coal Gasification Plant Site - Waterloo, Iowa

Sample Location		**CR-01**	**CR-01**	**CR-02**	**CR-02**
Sample Date		**03/23/2021**	**06/29/2021**	**03/23/2021**	**06/29/2021**
Sample Identification		**CR01-SW-0321**	**CR01-SW-0621**	**CR02-SW-0321**	**CR02-SW-0621**
Parameters	**Units**				
Iron	ug/L	232	190	224	202
Iron (dissolved)	ug/L	--	100 U	--	100 U
Manganese	ug/L	46.9	102	47.9	99.0
Manganese (dissolved)	ug/L	--	25.4	--	10.0 U
Nitrate (as N)	mg/L	--	1.57	--	1.64
Nitrite (as N)	mg/L	--	0.100 U	--	0.100 U
Sulfate	mg/L	--	35.6	--	35.6
Total kjeldahl nitrogen (TKN)	mg/L	--	1.12	--	1.07
Total organic carbon (TOC)	mg/L	--	3.61	--	3.47
Field Parameters					
Conductance, specific	mS/cm	0.51	0.58	0.50	0.59
Dissolved oxygen (DO)	mg/L	13.48	9.41	13.38	8.8
Oxidation reduction potential (ORP)	millivolts	81.0	49.7	97.7	34.4
pH	s.u.	8.48	8.6	8.34	8.55
Temperature, field	Deg C	8.75	26.96	8.84	26.54
Turbidity, field	NTU	--	14.6	--	15.1

Notes:
U - Not detected at the associated reporting limit.

Table 3

Soil Analytical Results Summary
MidAmerican Energy Company
Former Coal Gasification Plant Site - Waterloo, Iowa

Sample Location:		MW-122	MW-122	MW-122	MW-123	MW-123	MW-218	MW-218	MW-218	MW-218
Sample Date:		02/24/2021	02/24/2021	02/24/2021	02/25/2021	02/25/2021	06/17/2021	06/17/2021	06/17/2021	06/17/2021
Sample ID:		MW122-SL-10.5	MW122-SL-15.5	MW122-SL-17	MW123-SL-20	MW123-SL-25	MW218-SL-20-0621	MW218-SL-27-0621	MW218-SL-47-0621	MW218-SL-53-0621
Sample Type										
Sample Depth		(10.5) ft	(15.5) ft	(17) ft	(20) ft	(25) ft	(20) ft	(27) ft	(47) ft	(53) ft
Parameters	**Units**									
Iron	mg/kg	9660	4390	27400	5900	3800	9740	9980	7650	30400
Manganese	mg/kg	183	239	188	214	112	356	112	168	276

Table 3

Soil Analytical Results Summary
MidAmerican Energy Company
Former Coal Gasification Plant Site - Waterloo, Iowa

Sample Location:		MW-219	MW-219	MW-219	MW-220	MW-220	MW-221	MW-221	SB-218	SB-218	SB-218
Sample Date:		02/24/2021	02/25/2021	02/25/2021	02/24/2021	02/24/2021	02/24/2021	02/24/2021	02/25/2021	02/25/2021	02/25/2021
Sample ID:		MW219-SL-15.5	MW219-SL-36	MW219-SL-41	MW220-SL-20.5	MW220-SL-41	MW221-SL-21.25	MW221-SL-46	SB218-SL-20	SB218-SL-31	SB218-SL-41
Sample Type											
Sample Depth		(15.5) ft	(36) ft	(41) ft	(20.5) ft	(41) ft	(21.25) ft	(46) ft	(20) ft	(31) ft	(41) ft
Parameters	**Units**										
Iron	mg/kg	8790	8160	5570	4650	5500	7450	8220	8880	8560	5250
Manganese	mg/kg	287	126	56.4	101	143	477	155	86.0	94.7	107

Table 4

Proposed Monitoring Well Rationale
MidAmerican Energy Company
Former Coal Gasification Plant Site - Waterloo, Iowa

Well ID	Proposed Screened Zone	Anticipated Screened Interval (ft bgs)	Well Location Rationale	Screen Placement Rationale
MW-124	Shallow Portion of Alluvial Aquifer	17-27	Proposed monitoring well MW-124 will be located upgradient of MW-123 to delineate impact detected at MW-123.	Monitoring well MW-123 is screened in the shallow portion of the Alluvial Aquifer from 17-27 ft bgs, above the bedrock residuum encountered at 31 ft bgs. Proposed monitoring well MW-124 will be screened to intersect the water table at an anticipated screened interval of 17-27 ft bgs. Screen depth may be adjusted based on depth to the confining layer and the observed water table.
MW-125	Shallow Portion of Alluvial Aquifer	17-27	Proposed monitoring well MW-125 with be located side gradient to the east of MW-123 to delineate impact detected at MW-123.	Monitoring well MW-123 is screened in the shallow portion of the Alluvial Aquifer from 17-27 ft bgs, above the bedrock rediduum encountered at 31 ft bgs. Proposed monitoring well MW-125 will be screened to intersect the water table at an anticipated screened interval of 17-27 ft bgs. Screen depth may be adjusted based on depth to the confining layer and the observed water table.

Attachment 1

Lithologic Logs and Monitoring Well Diagrams

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: Waterloo-Sycamore FMGP
PROJECT NUMBER: 11215105
CLIENT: MidAmerican Energy Company
LOCATION: Waterloo, Iowa

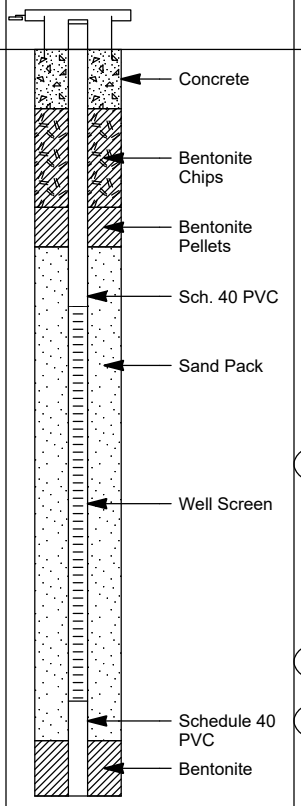
HOLE DESIGNATION: MW-122
DATE COMPLETED: 24 February 2021
DRILLING METHOD: Direct Push/Hollow Stem Auger
FIELD PERSONNEL: Tim Wineland

NORTHING: 4704689.5
EASTING: 555481.5

TOP OF RISER 843.69
GROUND SURFACE 842.00

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. FT.
0	GRAVEL, with fines	841.20
	SANDY CLAY, very low plasticity, dark brown/black, moist	
6	SILTY CLAY, high plasticity, dark brown/dark gray, moist	836.50
8	SAND, fine, brown, dry to moist	834.40
10	- dark brown to brown layers of fine sand and fine to coarse sand, loose, moist from 10.20 to 11.30ft BGS	
12	- gravel at 11.00ft BGS	830.70
	SAND, fine to coarse, fine gravel, reddish/orange, wet	
16	SAND, with fines, loose, brown, wet	826.20
	SILTY CLAY, high plasticity, brown grading to dark gray, moist	825.40
20	SILTY CLAY (TILL), with gravel, very stiff, high plasticity, gray, moist	822.00
24	END OF BOREHOLE @ 25.00ft BGS	817.00

MONITOR INSTALLATION



WELL DETAILS
Screened interval:
835.50 to 825.50FT.
6.50 to 16.50ft BGS
Length: 10ft
Diameter: 2in
Slot Size: #10
Material: Stainless Steel
Sand Pack:
837.00 to 824.50FT.
5.00 to 17.50ft BGS
Material: Silica

SAMPLE NUMBER	SAMPLE INTERVAL	REC (%)	'N' Value	PID (ppm)
				0.2
		74		-
				0.4
		72		0.1
10.5ft				0.2
		34		-
15.5ft				0.3
17ft		54		0.1
		74		-
				-

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS (oval)

File: \\GHDNET\GHD\US\DES MOINES\PROJECTS\563\11215105\TECH\LOG DATABASE\11215105-MI.GPJ Library File: GHD_ENVIRO_V04.GLB Report: OVERBURDEN LOG Date: 6/10/21

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: Waterloo-Sycamore FMGP
PROJECT NUMBER: 11215105
CLIENT: MidAmerican Energy Company
LOCATION: Waterloo, Iowa

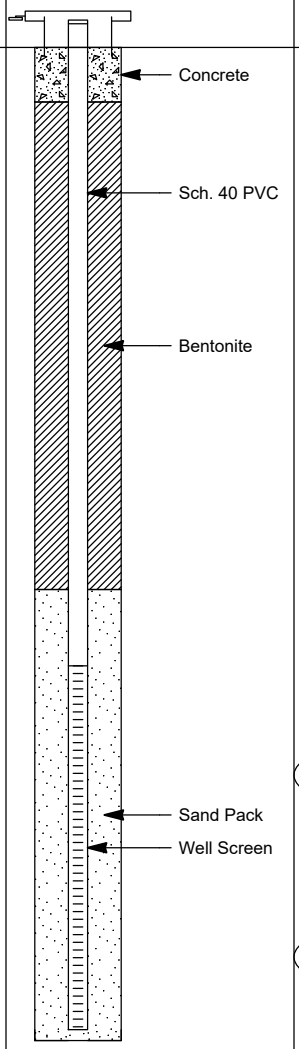
HOLE DESIGNATION: MW-123
DATE COMPLETED: 25 February 2021
DRILLING METHOD: Direct Push/Hollow Stem Auger
FIELD PERSONNEL: Tim Wineland

NORTHING: 4704531
EASTING: 555568.3

TOP OF RISER 847.82
GROUND SURFACE 845.37

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. FT.
0	FILL, brick, concrete, gravel, sand, mixed debris, loose, dry	
6		838.77
6	SILTY CLAY, soft, high plasticity, brown, moist	838.27
8	CLAYEY SAND, fine, soft, low plasticity, brown, moist	
10		834.27
12	SAND, fine, brown, interbedded with clayey sand to silty clay layers at 11.1, 11.4, 11.6, and 11.8ft BGS	833.57
14	SAND, fine, loose, brown, moist	
16		829.77
16	SAND, fine to medium, loose, light brown, moist - wet at 16.50ft BGS	
20		825.07
20	SAND, fine to medium, loose, black, wet, strong odor, sheen	
24		
26	- fine gravels at 25.50ft BGS	
26	- Bedrock, fracture carbonite from 26.50 to 26.60ft BGS	818.77
28	SILTY CLAY, with gravel, dark gray, wet	
30		
32	- Clayey Carbonate, yellowish brown, weathered, crushed, mostly clay residuum at 30.70ft BGS - gray fractured carbonate bedrock with fines at 31.30ft BGS	
34		
36		809.87
36	END OF BOREHOLE @ 35.50ft BGS	

MONITOR INSTALLATION



WELL DETAILS
Screened interval:
828.37 to 818.37FT.
17.00 to 27.00ft BGS
Length: 10ft
Diameter: 2in
Slot Size: #10
Material: Stainless Steel
Sand Pack:
830.47 to 818.07FT.
14.90 to 27.30ft BGS
Material: Silica

SAMPLE NUMBER	SAMPLE INTERVAL	REC (%)	'N' Value	PID (ppm)
				5.3
		46		-
				20.3
		48		-
				18.3
		44		-
				4.5
		32		-
20ft				27.5
		34		-
25ft				126.1
		36		-
				14.9
		29		-

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS (oval)

File: \\GHDNET\GHD\US\DES MOINES\PROJECTS\563\11215105\TECH\LOG DATABASE\11215105-MI.GPJ Library File: GHD_ENVIRO_V04.GLB Report: OVERBURDEN LOG Date: 6/10/21

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: Waterloo-Sycamore FMGP
PROJECT NUMBER: 11215105
CLIENT: MidAmerican Energy Company
LOCATION: Waterloo, Iowa

HOLE DESIGNATION: MW-218
DATE COMPLETED: 17 June 2021
DRILLING METHOD: Direct Push/Hollow Stem Auger
FIELD PERSONNEL: Diane Pals

NORTHING: 4704322.1
EASTING: 555646.4

GROUND SURFACE 842.25
TOP OF CASING 841.83

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. FT.	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' Value	SAMPLE PID (ppm)
0	SILTY CLAY, dense, compact, tan, dry, with black mottles and some pebbles		Concrete			70		0.0
2								
4	FILL, mixed, crumbly, with some tan clay, concrete pieces, brick fragments, some sand, dry, no odor	838.25						0.0
6								0.0
8						40		
10	SILTY SAND, poorly sorted, dark brown, dry, no odor, fine pebbles - tan and more silt from 11.00 to 12.00ft BGS	833.25						-
12						55		0.0
14	SAND, with silt, medium to coarse grained, reddish brown, moist - light gray from 14.50 to 15.00ft BGS	828.25	Sch. 40 PVC					0.3
16								0.0
18	- light gray from 17.00 to 18.00ft BGS					50		
20	- wet and some gravel at 19.50ft BGS	822.25		20ft				0.0
22	SAND, with fines, coarse grained, poorly sorted, brown, wet, no odor		Bentonite Chips/Pellets			50		-
24								-
26	SAND, coarse grained, some fines and pebbles, rounded, loose, reddish brown, wet	817.25		27ft				0.0
28						60		
30								0.0
32	SAND, with silt, coarse grained, some gravel, rounded, loose, brownish gray, wet - more silt from 31.00 to 32.00ft BGS	811.25				50		0.0
34	SAND, fine grained, with fines, dense, well	808.25						0.1

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS (20ft)

File: \\GHDNET\GHD\US\DES MOINES\PROJECTS\563\11215105\TECH\LOG DATABASE\11215105-MI.GPJ Library File: GHD_ENVIRO_V04.GLB Report: OVERBURDEN LOG Date: 6/10/21

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: Waterloo-Sycamore FMGP
PROJECT NUMBER: 11215105
CLIENT: MidAmerican Energy Company
LOCATION: Waterloo, Iowa

HOLE DESIGNATION: MW-218
DATE COMPLETED: 17 June 2021
DRILLING METHOD: Direct Push/Hollow Stem Auger
FIELD PERSONNEL: Diane Pals

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. FT.	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' Value	SAMPLE PID (ppm)
36	rounded, wet - silt lenses from 35.00 to 36.00ft BGS							0.0
38								0.1
40								
42								0.0
44			Sand Pack					0.0
46	- increasing to medium/coarse sand from 45.00 to 49.50ft BGS		Well Screen					0.1
48				47ft				-
50	CLAY, medium stiff, gray, wet	792.75	WELL DETAILS Screened interval: 798.05 to 793.05FT. 44.20 to 49.20ft BGS Length: 5ft Diameter: 2in Slot Size: #10 Material: Stainless Steel Sand Pack: 800.05 to 793.05FT. 42.20 to 49.20ft BGS Material: Silica					-
52				53ft				-
54								-
	END OF BOREHOLE @ 55.00ft BGS	787.25						
56								
58								
60								
62								
64								
66								
68								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS (47ft, 53ft)

File: \\GHDNET\GHD\US\DES MOINES\PROJECTS\563\11215105\TECH\LOG DATABASE\11215105-MI.GPJ Library File: GHD_ENVIRO_V04.GLB Report: OVERBURDEN LOG Date: 6/10/21

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: Waterloo-Sycamore FMGP
PROJECT NUMBER: 11215105
CLIENT: MidAmerican Energy Company
LOCATION: Waterloo, Iowa

HOLE DESIGNATION: MW-219
DATE COMPLETED: 24 February 2021
DRILLING METHOD: Direct Push/Hollow Stem Auger
FIELD PERSONNEL: Tim Wineland

NORTHING: 4704300.1
EASTING: 555713.9

TOP OF RISER 846.49
GROUND SURFACE 844.13

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. FT.	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' Value	PID (ppm)
0	FILL, silty sandy clay, with gravel, brick and concrete, moist to dry		Concrete					0.1
2	- cinders at 2.50ft BGS					58		
4								0.2
6	SILT, with trace fine sand, trace clay, low plasticity, loose, black, moist	838.33						0.2
8						46		
10			Sch. 40 PVC					-
12	SAND, fine, loose, brown, moist - interbedded with the above materials	833.13 831.83						0.1
14	SAND, fine, loose, brown, moist					54		0.1
16	SAND, with gravel, fine to coarse sand, well rounded to angular gravel, loose, brown, moist, wet beginning near 20ft BGS	829.13		15.5ft				0.3
18						22		-
20	SAND, with angular to well rounded gravel, fine to coarse, loose, light orange-brown, wet	824.13	Bentonite					0.2
22						20		
24								-
26								0.1
28						36		
30								-
32	SAND, with fines, loose, brown, wet	812.33				40		0.1
34								-

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS (15.5ft)

File: \\GHDNET\GHD\US\DES MOINES\PROJECTS\563\11215105\TECH\LOG DATABASE\11215105-MI.GPJ Library File: GHD_ENVIRO_V04.GLB Report: OVERBURDEN LOG Date: 6/10/21

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: Waterloo-Sycamore FMGP
PROJECT NUMBER: 11215105
CLIENT: MidAmerican Energy Company
LOCATION: Waterloo, Iowa

HOLE DESIGNATION: MW-219
DATE COMPLETED: 24 February 2021
DRILLING METHOD: Direct Push/Hollow Stem Auger
FIELD PERSONNEL: Tim Wineland

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. FT.	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' Value	SAMPLE PID (ppm)
36	SAND, fine to medium, with fine gravel and fines, loose, brown, wet	808.93		36ft		30		0.2
38								-
40	SAND, fine to medium, loose, brown, wet, coarser intervals at 40.3 to 40.4 and 40.9 to 41.1ft BGS	804.13		41ft				0.1
42			Sand Pack			24		
44			Well Screen					-
46								0.1
48			WELL DETAILS Screened interval: 803.13 to 798.13FT. 41.00 to 46.00ft BGS Length: 5ft Diameter: 2in Slot Size: #10 Material: Stainless Steel Sand Pack: 805.03 to 797.63FT. 39.10 to 46.50ft BGS Material: Silica			34		
50								-
52	SAND, fine, loose, olive brown/brownish gray, wet	792.93 792.43						0.1
	SILT with fine sand, medium stiff, olive brown/brownish gray, wet	792.03				44		
54	CLAYEY SILT, medium stiff, low plasticity, olive brown/brownish gray, wet							-
56	BEDROCK, weathered with residual clays/fines	789.13				17		-
58	END OF BOREHOLE @ 58.00ft BGS	786.13						
60								
62								
64								
66								
68								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS (oval)

File: \\GHDNET\GHD\US\DES MOINES\PROJECTS\563\11215105\TECH\LOG DATABASE\11215105-MI.GPJ Library File: GHD_ENVIRO_V04.GLB Report: OVERBURDEN LOG Date: 6/10/21

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: Waterloo-Sycamore FMGP
PROJECT NUMBER: 11215105
CLIENT: MidAmerican Energy Company
LOCATION: Waterloo, Iowa

HOLE DESIGNATION: MW-220
DATE COMPLETED: 24 February 2021
DRILLING METHOD: Direct Push/Hollow Stem Auger
FIELD PERSONNEL: Tim Wineland

NORTHING: 4704609.9
EASTING: 555286.9

TOP OF RISER 846.72
GROUND SURFACE 844.28

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. FT.
0	SILTY SAND, black, dry, with roots	
		843.18
	SAND, dark brown, dry to moist	
		842.28
2	SAND, fine, loose, dark laminations, brown, moist	
4		
	- mixed debris, broken glass and sheet metal from 5.10 to 6.40ft BGS	
6		837.88
	SILTY CLAY, low plasticity, firm, dark brown/black, dry to moist	
8		
10		
12	- increase in plasticity at 12.00ft BGS - fine sands from 12.80 to 13.20ft BGS - occasional red precipitate along fractures at 13.20ft BGS	
14		
		828.78
16	SAND, fine, light brown, moist	828.18
	SAND, fine to coarse, reddish orange-brown, wet	
18		
20		824.08
	SAND, fine to medium, loose, light brown with fines, wet	
22		
24		
26		
28		
30		
		813.08
32	SAND, fine, loose with fines, light brown, wet - with gravel at 31.90ft BGS	
		811.42
	SAND, fine to coarse sand with fines and trace fine gravel, loose, brown, wet	810.94
34	SAND, fine, loose, brown, wet	

MONITOR INSTALLATION: Concrete; Sch. 40 PVC; Bentonite

SAMPLE NUMBER	SAMPLE INTERVAL	REC (%)	'N' Value	PID (ppm)
				0.5
		70		0.2
				0.2
		42		-
				0.1
		86		0.1
20.5ft				0.1
		42		-
				0.2
		34		-
				0.1
		38		-
				0.1
		42		-

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

File: \\GHDNET\GHD\US\DES MOINES\PROJECTS\563\11215105\TECH\LOG DATABASE\11215105-MI.GPJ Library File: GHD_ENVIRO_V04.GLB Report: OVERBURDEN LOG Date: 6/10/21

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: Waterloo-Sycamore FMGP
PROJECT NUMBER: 11215105
CLIENT: MidAmerican Energy Company
LOCATION: Waterloo, Iowa

HOLE DESIGNATION: MW-220
DATE COMPLETED: 24 February 2021
DRILLING METHOD: Direct Push/Hollow Stem Auger
FIELD PERSONNEL: Tim Wineland

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. FT.	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' Value	SAMPLE PID (ppm)
36	- medium to coarse sands at 36.50ft BGS - olive brown at 37.10ft BGS					54		0.3
38								0.2
40	- olive brown, loose wet from 40.30 to 40.50ft BGS	804.28	Sand Pack	41ft				0.1
42	SAND, with fines and gravel, fine to coarse, loose, olive brown, wet - olive brown, trace courser sands, fine gravel, loose, wet from 40.96 to 44.42ft BGS		Well Screen			52		0.1
44								
46	SAND and silty/sandy clay, low plasticity, loose, olive brown/light gray, wet	798.98 798.28	WELL DETAILS Screened interval: 804.28 to 799.28FT. 40.00 to 45.00ft BGS Length: 5ft Diameter: 2in Slot Size: #10 Material: Stainless Steel Sand Pack: 807.48 to 798.78FT. 36.80 to 45.50ft BGS Material: Silica					0.1
48	SILTY CLAY, with some fine sand layers, dark brown/light gray					50		-
50	END OF BOREHOLE @ 50.00ft BGS	794.28						
52								
54								
56								
58								
60								
62								
64								
66								
68								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS (41ft)

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: Waterloo-Sycamore FMGP
PROJECT NUMBER: 11215105
CLIENT: MidAmerican Energy Company
LOCATION: Waterloo, Iowa

HOLE DESIGNATION: MW-221
DATE COMPLETED: 24 February 2021
DRILLING METHOD: Direct Push/Hollow Stem Auger
FIELD PERSONNEL: Tim Wineland

NORTHING: 4704673.2
EASTING: 555276.3

TOP OF RISER 848.98
GROUND SURFACE 846.54

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. FT.	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' Value	SAMPLE PID (ppm)
0	SILTY CLAY, with gravel, topsoil, roots, black, moist	845.64	Concrete					0.1
2	SAND (FILL), fine, loose, brown, moist					40		
4	- crushed red brick from 5.00 to 6.07ft BGS	840.84						-
6	SILTY SAND, fine, stiff, brown, moist - crushed rock/concrete from 6.07 to 6.43ft BGS							0.4
8	- mixed silty clay and fine sand from 6.43 to 7.50ft BGS	836.54	Sch. 40 PVC			28		-
10	SAND, fine, with dark laminations, trace very fine gravel, dark brown, moist							0.1
12	- light brown, occasional black laminations from 10.50 to 13.10ft BGS					62		
14								0.2
16	- light brown, moist to wet from 16.20 to 17.30ft BGS	830.64						0.2
18	SAND, with clayey fine sand, loose, brown to dark brown, moist					46		
20			Bentonite					-
22	SAND, fine, light to dark brown, moist to wet	825.18		21.25ft		22		0.1
24	- trace fines in dark banding at 24.10ft BGS							-
26	SAND, fine, with trace medium to coarse grains, loose, orange-brown, wet	821.24						0.4
28						54		
30	SAND, fine to medium, with coarse grains, loose, brown, wet	817.84						0.2
32	SAND, fine, with darker laminations, loose, brown, wet	815.59				42		0.2
34	- trace fine gravel, well rounded from 34.05 to 34.29ft BGS							-

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS (21.25ft)

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: Waterloo-Sycamore FMGP
PROJECT NUMBER: 11215105
CLIENT: MidAmerican Energy Company
LOCATION: Waterloo, Iowa

HOLE DESIGNATION: MW-221
DATE COMPLETED: 24 February 2021
DRILLING METHOD: Direct Push/Hollow Stem Auger
FIELD PERSONNEL: Tim Wineland

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. FT.	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' Value	SAMPLE PID (ppm)
36	SAND, with fine grained gravel, sand is fine to coarse grained, loose, brown, wet	811.54				32		0.0
38	- no gravel, no fines from 38.75 to 40.00ft BGS							-
40	SAND, fine, occasional coarse sand/fine gravel laminations, loose, olive brown, wet	806.54						0.1
42	SAND, fine to coarse with fine to medium gravel, semi-rounded to angular, loose, dark olive-brown, wet	803.94	Sand Pack Well Screen	46ft		54		0.3
44								
46								0.4
48	SAND, fine to medium with trace fines, loose, olive brown to brown, wet	798.34	WELL DETAILS Screened interval: 805.14 to 800.14FT. 41.40 to 46.40ft BGS Length: 5ft Diameter: 2in Slot Size: #10 Material: Stainless Steel Sand Pack: 807.54 to 798.84FT. 39.00 to 47.70ft BGS Material: Silica			28		-
50	SAND, fine, clayey with angular gravel, very stiff, brown, wet	796.54						0.2
52	CLAYEY SAND, coarse, with fine gravel, loose, brown, wet	795.04				40		
54								-
	SILTY CLAY, high plasticity, gray, wet	791.79						
56	END OF BOREHOLE @ 55.00ft BGS	791.54						
58								
60								
62								
64								
66								
68								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS (oval)

File: \\GHDNET\GHD\US\DES MOINES\PROJECTS\563\11215105\TECH\LOG DATABASE\11215105-MI.GPJ Library File: GHD_ENVIRO_V04.GLB Report: OVERBURDEN LOG Date: 6/10/21

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: Waterloo-Sycamore FMGP
PROJECT NUMBER: 11215105
CLIENT: MidAmerican Energy Company
LOCATION: Waterloo, Iowa

HOLE DESIGNATION: SB-218
DATE COMPLETED: 25 February 2021
DRILLING METHOD: Direct Push
FIELD PERSONNEL: Tim Wineland

NORTHING: 4704350.8
EASTING: 555651.5
GROUND SURFACE 844.10

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. FT.	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' Value	SAMPLE PID (ppm)
0	No recovery						
20	SAND, with gravel, fine to coarse sand, semi rounded to semi angular gravel, trace fines, loose, reddish/orangish brown, wet	824.10	20ft		20		0.4
24							-
26							0.2
28	- angular carbonate gravel, loose, wet from 27.58 to 28.18ft BGS				66		0.2
30	SAND, with trace fine gravel, well rounded, fine to coarse sand, trace fines, loose, orange-brown, wet	814.10	31ft				0.5
32	- less gravel at 30.00ft BGS				40		
34							-

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS (20ft, 31ft)

File: \\GHDNET\GHD\US\DES MOINES\PROJECTS\563\11215105\TECH\LOG DATABASE\11215105-MI.GPJ Library File: GHD_ENVIRO_V04.GLB Report: OVERBURDEN LOG Date: 6/10/21

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: Waterloo-Sycamore FMGP
PROJECT NUMBER: 11215105
CLIENT: MidAmerican Energy Company
LOCATION: Waterloo, Iowa

HOLE DESIGNATION: SB-218
DATE COMPLETED: 25 February 2021
DRILLING METHOD: Direct Push
FIELD PERSONNEL: Tim Wineland

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. FT.	BOREHOLE	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' Value	SAMPLE PID (ppm)
36	SAND, fine, loose, with fines, light olive-gray, wet	809.10				36		0.1
38								-
40	CLAYEY SILT, with trace fine sand, low plasticity, soft, light olive-gray, wet	804.38 804.10		41ft				0.2
42	SAND, fine to medium, loose, with fine gravel, light olive-gray, wet	802.43				42		
44	SAND, with trace fines, loose, light olive-gray, wet CLAYEY SILT, moderate plasticity, soft, dark gray, wet	798.73						-
46	SAND, with trace fines, loose, light olive-gray, wet	796.51						0.4
48	CLAYEY SILT, low plasticity, soft, light olive-gray, wet, fine sand lense	796.14				54		0.1
50	SAND, fine to medium, fine gravel, loose, light olive-gray, wet	794.29						
52	SILTY CLAY, low plasticity, soft, light gray, moist SILTY CLAY, high plasticity, moderately firm, gray, moist	794.10				34		0.1
54	END OF BOREHOLE @ 55.00ft BGS	789.10						-
56								
58								
60								
62								
64								
66								
68								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS (oval)

File: \\GHDNET\GHD\US\DES MOINES\PROJECTS\563\11215105\TECH\LOG DATABASE\11215105-MI.GPJ Library File: GHD_ENVIRO_V04.GLB Report: OVERBURDEN LOG Date: 6/10/21