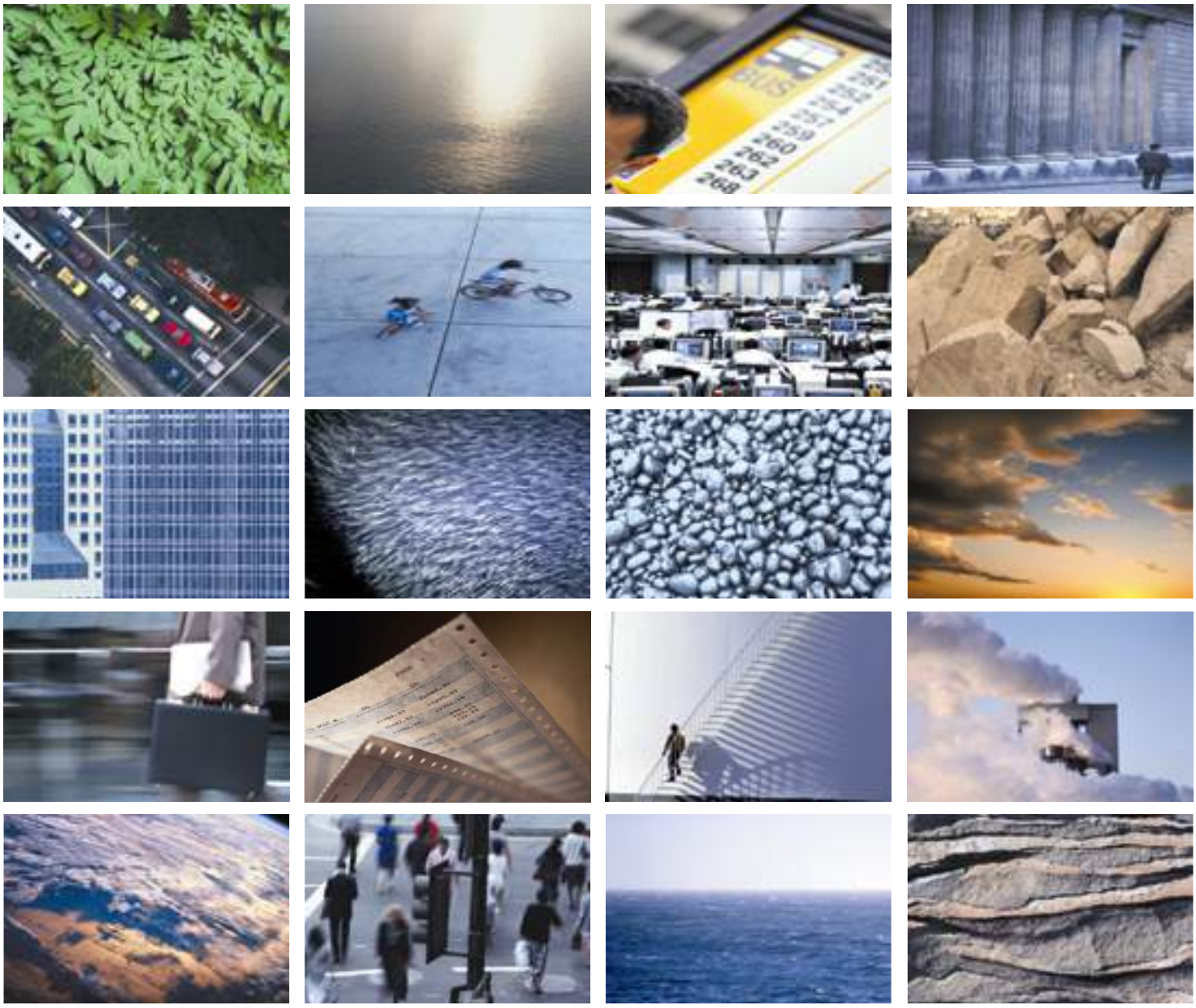

Groundwater Monitoring System Certification

Grand Haven Board of Light and Power
JB Sims Generation Station
1231 North 3rd Street
Grand Haven, Michigan

October 2017

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Certification

In accordance with the requirements of 40 CFR §257.91(f), I hereby certify that the groundwater monitoring system for the active unit at the Grand Haven Board of Light and Power - JB Sims Generating Station has been designed and constructed to meet the requirements specified in Section 257.91 of the Federal Coal Combustion Residuals (CCR) Rule. I certify that the monitoring system, consisting of one upgradient and three downgradient monitoring wells is adequate for the active unit because the wells are screened in the uppermost aquifer system and the downgradient wells are located directly downgradient of the CCR unit and adjacent to the Grand River.

I further certify that I am a duly Licensed Professional Engineer under the laws of the State of Michigan.

Th P. O'Ll

Thomas P. O'Connell, P.E.

PE#: 6201040085

My license renewal date is 31 October 2019

1.0 INTRODUCTION

1.1 INTRODUCTION

On behalf of the Grand Haven Board of Light and Power (GHBLP), Environmental Resour**ces M**anagement Michigan, Inc. (ERM) prepared this report to certify that the groundwater monitoring system at the JB Sims Generation Station complies with the federal Coal Combustion Residuals (CCR) Rule (40 CFR Part 257), which went into effect on October 19, 2015.

Section 257.91 of the CCR Rule outlines the requirements of the groundwater monitoring system, including performance standards. This Certification is intended to support the certification that the groundwater monitoring system installed at the Site is in compliance with the Rule.

1.2 SYSTEM CERTIFICATION REQUIREMENT SUMMARY

Table 1 below provides details of the system certification requirements outlined in §257.91 of the CCR Rule and this Site's compliance with the rule.

Table 1. CCR Rule Requirements and Compliance

CCR Rule Requirements (§257.91)	**Compliance with CCR Rule**
(a) **Performance Standard:** The owner or operator of a CCR unit must install a groundwater monitoring system that consists of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer" that: (1) Accurately represent the quality of background groundwater that has not been affected by leakage from a CCR unit. A determination of background quality may include sampling of wells that are not hydraulically upgradient of the CCR management area where: a. Hydrogeologic conditions do not allow the owner or operator of the CCR Unit to determine what wells are hydraulically upgradient; or b. Sampling at other wells will provide an indication	**Yes.** The direction of groundwater flow has been determined at the site: the groundwater monitoring system includes the minimum number of wells at appropriate locations and depths to yield groundwater samples necessary

of background groundwater quality that is representative or more representative than that provided by the upgradient wells; and (2) Accurately represent the quality of groundwater passing the waste boundary of the CCR unit. The downgradient monitoring system must be installed at the waste boundary that ensures detection of groundwater contamination in the uppermost aquifer. All potential contamination must be monitored.	to meet performance standards (a)(1) and (a)(2) See Section 3.0
(b) **Well Spacing and Site Specific Information:** The number, spacing, and depths of monitoring systems shall be determined based upon site-specific technical information that must include thorough characterization of: (1) Aquifer thickness, groundwater flow rate, seasonal and temporal fluctuations in groundwater flow; and (2) Saturated and unsaturated geologic units and fill materials overlying the uppermost aquifer, materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the uppermost aquifer, including, but not limited to, thickness, stratigraphy, lithology, hydraulic conductivities, porosities, and effective porosities.	**Yes.** The monitoring system was designated based on results of technical, site-specific data, including (b)(1) and (b)(2). See Sections 2.0 and 3.0
(c) **Number of Monitoring Wells:** The groundwater monitoring system must include the minimum number of monitoring wells necessary to meet the performance standards specified in paragraph (a) of this section, based on the site-specific information specified in paragraph (b) of this section. The groundwater monitoring system must contain: (1) A minimum of one upgradient and three downgradient monitoring wells; and (2) Additional monitoring wells as necessary to accurately represent the quality of background groundwater that has not been affected by leakage from the CCR unit and the quality of groundwater passing the waste boundary of the CCR unit.	**Yes.** One upgradient and three downgradient wells that meet the performance standards are being monitored in compliance with the CCR Rule. See Section 3.0
(d) Multiunit Groundwater Systems: The owner or operator of multiple CCR units may install a multiunit groundwater monitoring system instead of separate groundwater monitoring systems for each CCR unit.	**Not Applicable.** This Site does not contain multiple active CCR units; therefore, the system does not need to meet the requirements of this paragraph.

(e) **Monitoring Well Construction**: Monitoring wells must be cased in a manner that maintains the integrity of the monitoring well borehole. This casing must be screened or perforated and packed with gravel or sand, where necessary, to enable collection of groundwater samples. The annular space (i.e. the space between the borehole and well casing) above the sampling depth must be sealed to prevent contaminating of samples and the groundwater. (1) The owner or operator of the CCR unit must document and include in the operating record the design, installation, development, and decommissioning of any monitoring wells, piezometers, and other measurements, sampling, and analytical devices. The qualified professional engineer must be given access to this documentation when completing the groundwater monitoring system certification required under paragraph (f) of this section. (2) The monitoring wells, piezometers, and other measurements, sampling, and analytical devices must be operated and maintained so that they perform to the design specifications throughout the life of the monitoring program.	**Yes.** Well design meets requirements of (e). See Section 3.0 Groundwater monitoring system will be operated and maintained per (e)(2).
(f) Certification: The owner or operator must obtain a certification from a qualified professional engineer stating that the groundwater monitoring system has been designed and constructed to meet the requirements of this section. If the groundwater monitoring system includes the minimum number of monitoring wells specified in paragraph (c)(1) of this section, the certification must document the basis supporting this determination.	**Yes.** System designed and constructed to meet the requirements of Section 257.91. Technical information to support certification and number of wells, per (c)(1). See Section 4.0 and Certifications page.

2.0 SITE SETTING

2.1 SITE SETTING

The J.B. Sims Generating Station ("Site") is a coal fired, steam-generating plant with a net capacity of approximately 70.5 megawatts. The Site is located on the southwestern portion of Harbor Island at 1231 North 3rd Street in Grand Haven, Michigan (**Figure 1**). The Grand River and South Channel of the Grand River surround Harbor Island and flow in a westerly direction to Lake Michigan which lies about one mile west of the Site.

The Site has two CCR surface impoundments (ash ponds) that are used to contain the bottom ash captured by the facility's precipitator. The impoundments are located in the northwest corner of the Site, are similar in size and are situated adjacent to each other with a common embankment between them (see **Figure 2**). According to the *Grand Haven BLP – Ash Impoundment Evaluation* (Soils & Structures, July 2016), the ponds are 175 to 190 feet long, 71 to 80 feet wide and 4 to 6 feet deep. Based on Google Earth Pro (imagery date 4/14/2016), the western edge of the west pond is about 75 feet from the banks of the Grand River.

2.2 SITE GEOLOGY

Based on the *Quaternary Geology of Southern Michigan* (Ferrand and Bell, 1982), the Site is located in an area of glacial sand and gravel, which consists of fine to medium sand with occasional beds of small gravel. The sands were deposited as former beach and near-offshore littoral deposits from the glacial Great Lakes. The *Hydrogeologic Atlas of Michigan* (Western Michigan University, 1981) indicates that there is 100 to 200 feeet of glacial drift in the area which is underlain by Marshall Sandstone.

Soil borings conducted in the northeast portion of the Site in 2015 showed fill material including a former trash dump and coal ash extending to a depth of up to 10 feet below ground surface (bgs). Two native depositional layers were identified underlying the trash dump: a silt loam and a fine grained native sand deposit.

Borings completed for the installation of the groundwater monitoring system wells (Attachment A) show that the dominant geology observed at

the Site in the upper 20 feet consists primarily unconsolidated fine sand with intervals of silt and blends of sand and silt. Silt or clay was encountered at the bottom of each boring and represent the confining unit beneath the ash ponds and the uppermost aquifer.

Sands in the uppermost aquifer are described as poorly-graded and well-graded fine sand. Based on the U.S. Environmental Protection Agency (USEPA) document SW-846 – *Test Methods for Evaluating Solid Waste*, Volume 1C, Table C, poorly-graded fine sand has an estimated hydraulic conductivity of 27 feet per day and well-graded fine sand has a hydraulic conductivity of 53 feet per day.

Static water levels were measured from January through August, 2017 to determine the groundwater gradient and flow direction. The groundwater flow direction across the monitoring area was shown to consistently be in a westerly direction toward the Grand River. The flow gradient ranged from 0.0004 to 0.008.

The groundwater flow rate (seepage velocity) in the vicinity of the ash ponds was calculated using the equation:

$V = Ki/n$
Where:
V = velocity
K = hydraulic conductivity
I = hydraulic gradient
N = porosity

Assuming an effective porosity of 30% (Driscoll, 1986), a hydraulic conductivity of 27 to 53 ft/day and hydraulic gradients from 0.0004 to 0.008 ft/day, the groundwater fow rate ranges from 0.036 to 1.41 ft/day.

3.0 MONITORING SYSTEM

3.1 MONITORING SYSTEM

Thee monitoring well system around the CCR unit consists of one upgradient well (MW-01) and three downgradient wells (MW-02, MW-03, and MW-04). The well locations are shown in **Figure 2**. The upgradient monitoring well is hydraulically upgradient of the CCR unit and accurately represents background groundwater quality. The downgradient monitoring wells are located hydraulically downgradient of the ash ponds. The downgradient monitoring wells are spaced approximately 100 feet apart. **Figure 3** depicts the observed groundwater flow direction based on measurements collected in August 2017.

The number, spacing, and hydraulic positions of the monitoring wells comply with requirements outlined in §257.91 (a)-(c) of the CCR Rule.

3.2 MONITORING WELL CONSTRUCTION AND PERFORMANCE

Based on our understanding of the Site geology, all of the monitoring wells at the Site are screened within the uppermost aquifer. Additionally, they were constructed in a manner which complies with CCR Rule §257.91 (e). All of the monitoring wells on the Site were developed to improve clarity of the water and reduce suspended solids prior to initial baseline sampling. Supporting documentation is provided in Section 7.0 of the 10 March 2017 *Sampling and Analysis Plan*. A summary of monitoring well construction details and geospatial information is provided in Table 2 below.

Table 2 *CCR Monitoring Well Details*

Well ID	Northing (UTM)	Easting (UTM)	Ground Elevation	Top of Casing elevation	Length of Well Stick-up	Measured depth to bottom from TOC	Screened interval
MW-01	176201.037	3847934.632	96.08	99.35	3.27	12.32	4 - 9
MW-02	176247.026	3847865.054	104.49	107.75	3.26	23.37	15 - 20
MW-03	176214.1	3847846.674	102.17	105.20	3.03	20.34	12 - 17
MW-04	176182.574	3847848.69	100.60	103.59	2.99	18.00	10 - 15

Notes

Elevation data measured from a referenced benchmark set at 100.00 feet

Benchmark set at Fire hydrant located just south of CCR ponds (ID # E150706); bolt on south side of hydrant.

Geospatial data is referenced to the Michigan South State Plane coordinate system.

Wells installed via hollow-stem-augers, constructed using 2" diameter PVC with 5' section of 0.10-slot PVC screen.

Wells installed on 1/18/2017.

4.0 SYSTEM CERTIFICATION

The monitoring well network is adequate and conforms to the system certification requirements outlined in §257.91 of the CCR Rule. A professionally licensed engineer has certified this network (see Certification page).

5.0 REFERENCES

Driscoll, F.G., Ph.D. Groundwater and Wells. Johnson Filtration Systems Inc., St. Paul, Minnesota. © 1986.

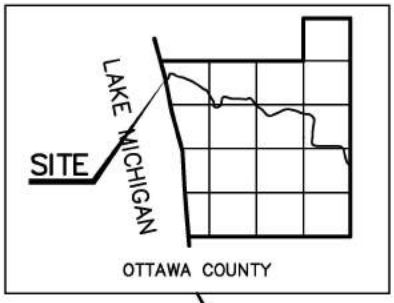
Ferrand, W.R., and Bell, D.L., "Quaternary Geology of Sourthern Michigan". Michigan Department of Natural Resources. Geological Publication QG-01. © 1982.

Soils & Structures. "Grand Haven BLP – Ash Impoundment Evaluation". Soils & Structures, July 2016.

United States Environmental Protection Agency. "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods". EPA Publication SW-846, Third Edition, Final Updates I (1993), II (1995), IIA (1994), IIB (1995), III (1997), IIIA (1999), IIIB (2005), IV (2008) and V (2015).

Western Michigan University, Department of Geology. "Hydrogeologic Atlas of Michigan, Volume 1". The Deparment of Geology, Kalamazoo, Michigan. © 1981.

Figures

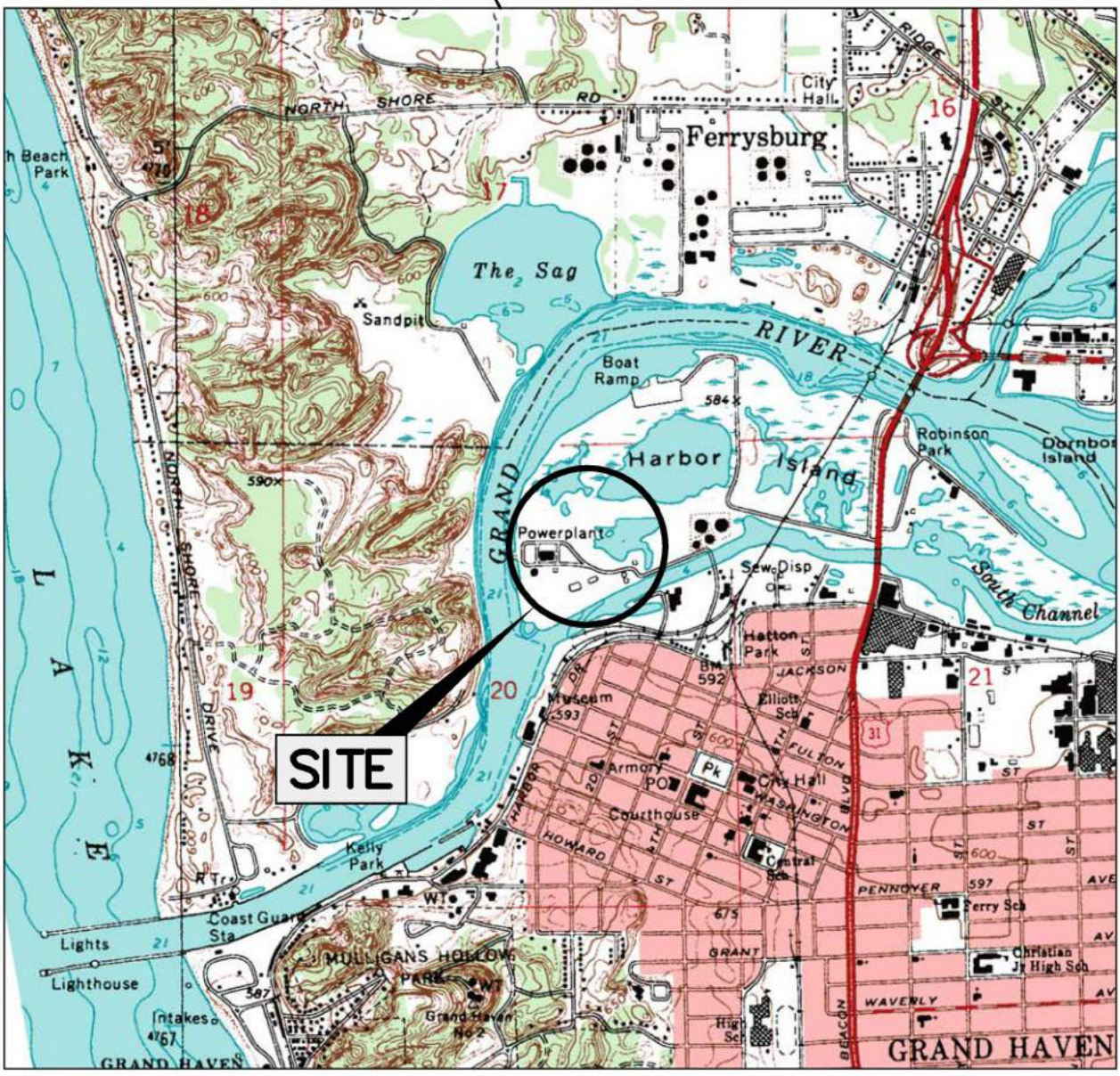


SECTION 20
T.8N. – R.16W.
CITY OF GRAND HAVEN
OTTAWA COUNTY
MICHIGAN

N

0 2000

SCALE (IN FEET)



SITE LOCATION MAP

ADAPTED FROM USGS
GRAND HAVEN/1980

REVISIONS ARE TO BE MADE ON THE CADD FILE ONLY

ERM.	GRAND HAVEN BOARD OF LIGHT AND POWER 1231 NORTH 3rd STREET GRAND HAVEN, MICHIGAN	CADD Review RMK CHK'D BAB 0318810
Drawn By GML 12/16/15	Environmental Resources Management	FIGURE 1

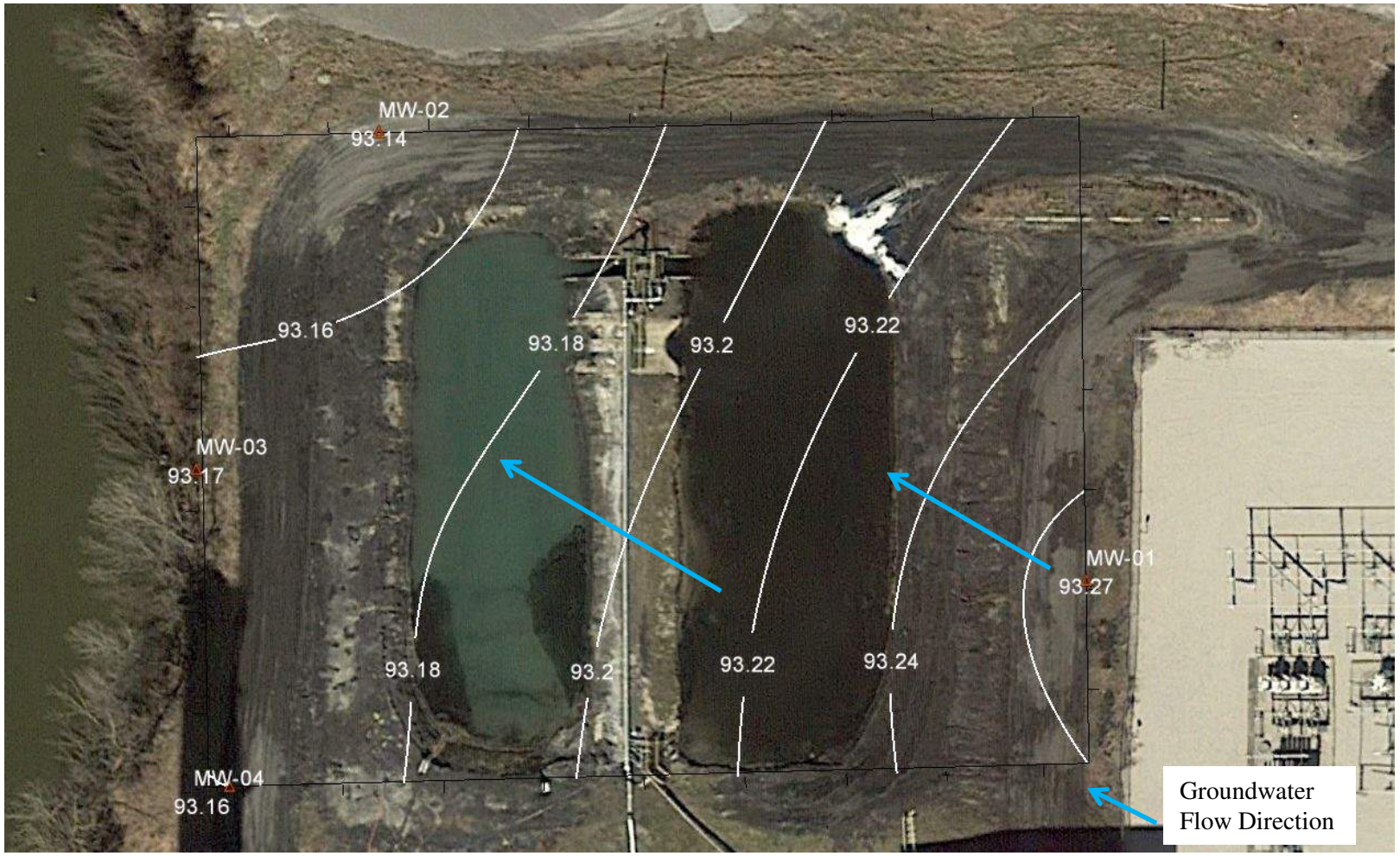
R:\Cadd\CintE-H\Grand Haven BLP\0318810\0318810-SLM.dwg, SLM, 12/16/2015 2:59:57 PM, GML

MONITORING WELL LOCATION MAP

0 50 100
SCALE (IN FEET)

Drawn By GML	ERM®	GRAND HAVEN BOARD OF LIGHT & POWER	CHK'D TMB
CADD Review FGB		GRAND HAVEN, MICHIGAN	0432042
Date Drawn/Rev'd 10/26/17		Environmental Resources Management	FIGURE 2

Q:\Team\DMMV\Cnt\E-H\Grand Haven BLP\0432042\0432042-01.dwg, MW LOCATION MAP, 10/26/2017 9:16:39 AM, GML



Source: Google Earth

Figure 3 – August 2017 Groundwater Contour Map

Grand Haven Board of Light and Power – JB Sims Generating Station
1231 N 3rd Street Grand Haven, Michigan

Environmental Resources Management Michigan, Inc.
3352 128th Avenue
Holland, Michigan

ERM

Attachment A
Soil Boring and Well
Construction Logs

ERM
3352 128th Avenue
Holland, MI 49424
P: 616-399-3500

PROJECT:
Grand Haven Board of Light and Power
CCR ell Installation
1231 N 3rd Street
Grand Haven, Michigan

BORING # **MW-01**
ERM PROJECT # 0387368
SHEET 1 OF 1

DRILLING CONTRACTOR	EDAC Holland, MI	ERM REPRESENTATIVE	Brian Beach
DRILLING FOREMAN	Sean Smith	OFFICE LOCATION	Holland, MI
DRILLING METHOD	Hollow-Stem Augers	DATE: START	01/18/2017
DRILLING EQUIPMENT	Gus Peck	FINISH	01/18/2017
HORIZONTAL DATUM (NAD 1983 StatePlane Michigan South (US Feet))		BOREHOLE DEPTH	10 ft
NORTHING	176201.037	BOREHOLE DIAMETER	
EASTING	3847934.632	DEPTH TO ATER (INITIAL) ▼	5 ft
VERTICAL DATUM (NGVD 29 (US Feet)) ELEVATION	96.08 ft	DEPTH TO ATER (FINAL) ▽	

DEPTH	ELEVATION	STRATA DESCRIPTION	DEPTH	USCS	GRAPHIC LOG	SAMPLING DATA: SAMPLE TYPE	RECOVERY		Observations / Remarks
		SAND (SP) rly graded, fine grained SAND; l se, little gravel, m ist, dark br wn t black		SP					
	95	SAND (G -S) well graded, fine grained SAND; l se, some gravel, m ist, br wn t grayish br wn	1	G - S					
2		SAND (SP) fine grained SAND; l se, m ist, black, [B tt m ash.]	2	SP					
		SILTY SAND (SP) rly graded, fine grained SAND; l se, little clay, m ist t wet, dark br wn t black, [C ncrete, metal and w d fragments. et @ 5']	3						
4									
6	90			SP					
8									
		SILT (OL) soft, little clay, trace fine sand, wet t m ist, dark grayish br wn	9	OL					

REMARKS:
Elevation data established from referenced benchmark set at 100.00'.

LAB ANALYSIS:

BORING LOG GHBLP 0387368 CCR ELLS.GPJ ERM DATA TEMPLATE.GDT

3352 128th Avenue
Holland, MI 49424
P: 616-399-3500

PROJECT:
Grand Haven Board of Light and Power
CCR ell Installation
1231 N 3rd Street
Grand Haven, Michigan

BORING # MW-02

ERM PROJECT # 0387368

SHEET 1 OF 1

DRILLING CONTRACTOR	EDAC Holland, MI	ERM REPRESENTATIVE	Brian Beach
DRILLING FOREMAN	Sean Smith	OFFICE LOCATION	Holland, MI
DRILLING METHOD	Hollow-Stem Augers	DATE: START	01/18/2017
DRILLING EQUIPMENT	Gus Peck	FINISH	01/18/2017
HORIZONTAL DATUM (NAD 1983 StatePlane Michigan South (US Feet))		BOREHOLE DEPTH	21 ft
NORTHING	176247.026	BOREHOLE DIAMETER	
EASTING	3847865.054	DEPTH TO ATER (INITIAL) ▼	15 ft
VERTICAL DATUM (NGVD 29 (US Feet)) ELEVATION	104.49 ft	DEPTH TO ATER (FINAL) ▽	

DEPTH	ELEVATION	STRATA DESCRIPTION	DEPTH	USCS	GRAPHIC LOG	SAMPLING DATA: SAMPLE TYPE	RECOVERY		Observations / Remarks
		SILTY CLAY (CL) medium stiff, some silt, trace fine gravel, trace fine sand; m ist, m ttled, br wn and gray							
5	100			CL					
10	95								
		SAND (G -S) well graded, fine grained SAND; l se, some gravel, little silt, trace clay; m ist, dark br wnish gray t black, [d fragments]	11	G - S					
		SILTY CLAY (CL) soft, little fine sand, trace gravel, m ist, dark gray t black, [Glass, w d, lastic debris]	13	CL					
			14	CL					
15	90	SILTY CLAY (CL) soft, some silt, trace fine sand, m ist, dark gray t dark br wnish gray	14.9						
		SAND (SP) rly graded, fine grained SAND; l se, wet, light grayish br wn, [silt/clay stringers thr ugh ut.]		SP					
		SILTY CLAY (CL) soft, some silt, wet, dark gray t dark br wnish gray, [Grey fine sand seams thr ugh ut]	17.25	CL					
		SAND (SP) rly graded, fine grained SAND; l se, little clay, laminated, gray t dark gray	19	SP					
20	85	SILTY CLAY (CL) soft, some silt, wet, dark gray t dark br wnish gray	20	CL					
			21						
	80								

REMARKS:
Elevation data established from referenced benchmark set at 100.00'.

LAB ANALYSIS:

BORING LOG GHBLP 0387368 CCR ELLS.GPJ ERM DATA TEMPLATE.GDT

3352 128th Avenue
Holland, MI 49424
P: 616-399-3500

PROJECT:
Grand Haven Board of Light and Power
CCR ell Installation
1231 N 3rd Street
Grand Haven, Michigan

BORING # MW-03

ERM PROJECT # 0387368

SHEET 1 OF 1

DRILLING CONTRACTOR	EDAC Holland, MI	ERM REPRESENTATIVE	Brian Beach
DRILLING FOREMAN	Sean Smith	OFFICE LOCATION	Holland, MI
DRILLING METHOD	Hollow-Stem Augers	DATE: START	01/18/2017
DRILLING EQUIPMENT	Gus Peck	FINISH	01/18/2017
HORIZONTAL DATUM (NAD 1983 StatePlane Michigan South (US Feet))		BOREHOLE DEPTH	17 ft
NORTHING	176214.1	BOREHOLE DIAMETER	
EASTING	3847846.674	DEPTH TO ATER (INITIAL) ▼	13 ft
VERTICAL DATUM (NGVD 29 (US Feet)) ELEVATION	102.17 ft	DEPTH TO ATER (FINAL) ▽	

DEPTH	ELEVATION	STRATA DESCRIPTION	DEPTH	USCS	GRAPHIC LOG	SAMPLING DATA: SAMPLE TYPE	RECOVERY		Observations / Remarks
2	100	SAND (S) well graded, fine grained SAND; l se, some silt, little gravel, m ist, grayish br wn, [Brick and concrete fragments.]		S					
4									
6			6						
	95	SAND (S) well graded, fine grained SAND; l se, little silt, little gravel, m ist, grayish br wn t dark br wn		S					
8			8						
		SAND (S) well graded, fine grained SAND; l se, some silt, some gravel, trace clay; m ist, grayish br wn t dark br wn, [d fragments.]		S					
10									
12	90	CLAYEY SILT (ML) soft, trace fine sand, m ist, dark grayish br wn t dark br wn	12	ML					
		SAND (SP) rly graded, fine grained SAND; l se, m ist t wet, gray, [et @ 13']	12.75	SP					
14			14.5						
		SANDY SILT (OL) soft, little clay, trace fine sand, m ist t wet, dark gray t dark br wnish gray, [Silt l am.]		OL					
16									
	85		17						
18									

REMARKS:
Elevation data established from referenced benchmark set at 100.00'.

LAB ANALYSIS:

BORING LOG GHBLP 0387368 CCR ELLS.GPJ ERM DATA TEMPLATE.GDT

3352 128th Avenue
Holland, MI 49424
P: 616-399-3500

PROJECT:
Grand Haven Board of Light and Power
CCR ell Installation
1231 N 3rd Street
Grand Haven, Michigan

BORING # MW-0

ERM PROJECT # 0387368

SHEET 1 OF 1

DRILLING CONTRACTOR	EDAC Holland, MI	ERM REPRESENTATIVE	Brian Beach
DRILLING FOREMAN	Sean Smith	OFFICE LOCATION	Holland, MI
DRILLING METHOD	Hollow-Stem Augers	DATE: START	01/18/2017
DRILLING EQUIPMENT	Gus Peck	FINISH	01/18/2017
HORIZONTAL DATUM (NAD 1983 StatePlane Michigan South (US Feet))		BOREHOLE DEPTH	17 ft
NORTHING	176182.574	BOREHOLE DIAMETER	
EASTING	3847848.69	DEPTH TO ATER (INITIAL) ▼	8.5 ft
VERTICAL DATUM (NGVD 29 (US Feet)) ELEVATION	100.60 ft	DEPTH TO ATER (FINAL) ▽	

DEPTH	ELEVATION	STRATA DESCRIPTION	DEPTH	USCS	GRAPHIC LOG	SAMPLING DATA: SAMPLE TYPE	RECOVERY		Observations / Remarks
	100	GRAVELLY SAND (S) well graded, fine grained SAND; l se, some gravel, m ist, br wn, [C ncrete fragments]		S					
2									
4									
	95	GRAVELLY SAND (SP) rly graded, fine grained SAND; l se, some gravel, m ist, dark br wn t black	5.5	SP					
6			6.5	S					
		SAND (S) well graded, fine grained SAND; l se, m ist, br wn	7	SC					
		CLAYEY SAND (SC) soft, some silt, little gravel, m ist, br wn t dark gray, [R ts]	7.5	S					
8		SAND (S) well graded, fine grained SAND; l se, some silt, some gravel, m ist, dark br wn, [C ncrete and w d fragments.]	8.5	S					
10		SAND (S) well graded, medium t coarse grained SAND; l se, wet, dark grayish br wn t black, [B tt m ash and concrete fragments.]	10	SP					
	90	SAND (SP) rly graded, fine grained SAND; l se, wet, dark grayish br wn	10.5	OL					
		SANDY SILT (OL) soft, m ist, dark grayish br wn, [Silt l am.]	11.5	SP					
12		SAND (SP) rly graded, fine grained SAND; l se, wet, gray	12.5	OL					
14		SANDY SILT (OL) soft, trace fine sand, trace clay, m ist, dark grayish br wn, [Clay stringer (14 - 14.25). Grey fine sand seam (14.25 - 14.5).]	14.5	MLS					
	85	SANDY SILT (MLS) soft, little clay, m ist, dark grayish br wn, [d fragments. Grey fine sand seam (15.75 - 16); (16.25 - 16.5); (16.75 - 17).]	17						
16									
18									

REMARKS:
Elevation data established from referenced benchmark set at 100.00'.

LAB ANALYSIS:

BORING LOG GHBLP 0387368 CCR ELLS.GPJ ERM DATA TEMPLATE.GDT

3352 128th Avenue
Holland, MI 9424
P: 616-399-35

PROJECT:
Grand Haven Board of Light and Power
CCR Well Installation
1231 N 3rd Street
Grand Haven, Michigan

BORING # **MW-01**

ERM PROJECT # 38 7368

SHEET 1 OF 1

DRILLING CO TRACTOR	EDAC Holland, MI	ERM REPRESENTATIVE	Brian Beach
DRILLING FOREMA	Sean Smith	OFFICE LOCATIO	Holland, MI
DRILLING METHOD	Hollow-Stem Augers	DATE: START	1 /18/2017
DRILLING EQUIPME T	Gus Peck	FINISH	1 /18/2017

GEOGRAPHIC COORDINATES
(NAD 1983 StatePlane Michigan South (US Feet))
O RTHING 1762 1 . 37
EASTING 38 7 93 . 632
Elevation/Top of Casing Elev 96. 8 ft/ 99.35 ft

WELL CONSTRUCTIO

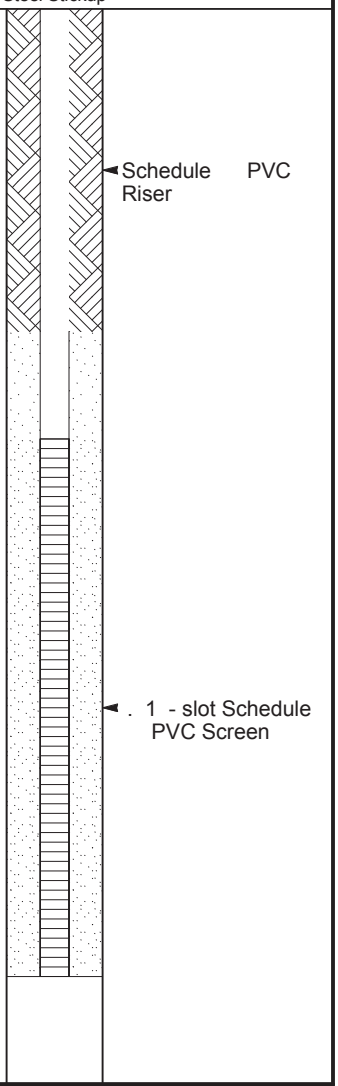
	Riser	Screen
Material:	*Schedule 40 PVC*	*Schedule 40 PVC, 0.010-slot*
Diameter (ID):	*2-inch*	*2-inch*
Coupling:	*Threaded*	*Threaded*

WELL DEVELOPMENT
Method: *Overpumping*
Duration: *0.5 hours*
Gals. Purged: *30*

Well Permit #: *No permi re uired.*

DEPTH	ELEVATIO	STRATA DESCRIPTIO	DEPTH	USCS	GRAPHIC LOG
		SAND (SP) poorly graded, fine grained SAND; loose, little gravel, moist, dark brown to black		SP	
	95	SAND (GW-SW) well graded, fine grained SAND; loose, some gravel, moist, brown to grayish brown	1	GW-SW	
2		SAND (SP) fine grained SAND; loose, moist, black, [Bottom ash.]	2	SP	
		SILTY SAND (SP) poorly graded, fine grained SAND; loose, little clay, moist to wet, dark brown to black, [Concrete, metal and wood fragments. Wet @ 5']	3		
6	9			SP	
8					
		SILT (OL) soft, little clay, trace fine sand, wet to moist, dark grayish brown	9	OL	

WELL CONSTRUCTIO



REMARKS:
Elevation data established from referenced benchmark set at 10 . '.

WELL INSTALLATION OTES:

WELL CONSTRUCTION GHBLP 3873 68 CCR WELLS.GPJ ERM DATA TEMPLATE.GDT

3352 128th Avenue
Holland, MI 9424
P: 616-399-35

PROJECT:
Grand Haven Board of Light and Power
CCR Well Installation
1231 N 3rd Street
Grand Haven, Michigan

BORING # **MW-02**

ERM PROJECT # 38 7368

SHEET 1 OF 1

DRILLING CO TRACTOR	EDAC Holland, MI	ERM REPRESENTATIVE	Brian Beach
DRILLING FOREMA	Sean Smith	OFFICE LOCATIO	Holland, MI
DRILLING METHOD	Hollow-Stem Augers	DATE: START	1 /18/2017
DRILLING EQUIPME T	Gus Peck	FINISH	1 /18/2017

GEOGRAPHIC COORDINATES
(NAD 1983 StatePlane Michigan South (US Feet))
O RTHING 1762 7 . 26
EASTING 38 7 865. 5
Elevation/Top of Casing Elev. 10 . 9 ft/ 107.75 ft

WELL CONSTRUCTIO

	Riser	Screen
Material:	*Schedule 40 PVC*	*Schedule 40 PVC, 0.010-slot*
Diameter (ID):	*2-inch*	*2-inch*
Coupling:	*Threaded*	*Threaded*

WELL DEVELOPMENT
Method: *Overpumping*
Duration: *0.5 hours*
Gals. Purged: *30*

Well Permit #: *No permi re uired.*

DEPTH	ELEVATIO	STRATA DESCRIPTIO	DEPTH	USCS	GRAPHIC LOG
		SILTY CLAY (CL) medium stiff, some silt, trace fine gravel, trace fine sand; moist, mottled, brown and gray		CL	
1 5	1				
1	95				
		SAND (GW-SW) well graded, fine grained SAND; loose, some gravel, little silt, trace clay; moist, dark brownish gray to black, [Wood fragments]	11	GW-SW	
		SILTY CLAY (CL) soft, little fine sand, trace gravel, moist, dark gray to black, [Glass, wood, plastic debris]	13	CL	
9			1	CL	
15		SILTY CLAY (CL) soft, some silt, trace fine sand, moist, dark gray to dark brownish gray	1 .9	SP	
		SAND (SP) poorly graded, fine grained SAND; loose, wet, light grayish brown, [silt/clay stringers throughout.]	17.25	CL	
	85	SILTY CLAY (CL) soft, some silt, wet, dark gray to dark brownish gray, [Grey fine sand seams throughout]	19	SP	
2		SAND (SP) poorly graded, fine grained SAND; loose, little clay, laminated, gray to dark gray	2	CL	
		SILTY CLAY (CL) soft, some silt, wet, dark gray to dark brownish gray	21		
	8				

WELL CONSTRUCTIO

Casing Type:
6-inch Diameter
Steel Stickup

Schedule PVC Riser

. 1 - slot Schedule PVC Screen

REMARKS:
Elevation data established from referenced benchmark set at 10 . '.

WELL INSTALLATION OTES:

WELL CONSTRUCTION GHBLP 3873 68 CCR WELLS.GPJ ERM DATA TEMPLATE.GDT

3352 128th Avenue
Holland, MI 9424
P: 616-399-35

PROJECT:
Grand Haven Board of Light and Power
CCR Well Installation
1231 N 3rd Street
Grand Haven, Michigan

BORING # **MW-03**

ERM PROJECT # 38 7368

SHEET 1 OF 1

DRILLING CO TRACTOR	EDAC Holland, MI	ERM REPRESENTATIVE	Brian Beach
DRILLING FOREMA	Sean Smith	OFFICE LOCATIO	Holland, MI
DRILLING METHOD	Hollow-Stem Augers	DATE: START	1 /18/2017
DRILLING EQUIPME T	Gus Peck	FINISH	1 /18/2017

GEOGRAPHIC COORDINATES
(NAD 1983 StatePlane Michigan South (US Feet))
O RTHING 176214.1
EASTING 38 7 846.67
Elevation/Top of Casing Elev. 102.17 ft/ 105.2 ft

WELL CONSTRUCTIO

	Riser	Screen
Material:	*Schedule 40 PVC*	*Schedule 40 PVC, 0.010-slot*
Diameter (ID):	*2-inch*	*2-inch*
Coupling:	*Threaded*	*Threaded*

Well Permit #: *No permi re uired.*

WELL DEVELOPMENT
Method: *Overpumping*
Duration: *0.5 hours*
Gals. Purged: *30*

DEPTH	ELEVATIO	STRATA DESCRIPTIO	DEPTH	USCS	GRAPHIC LOG
2	1	SAND (SW) well graded, fine grained SAND; loose, some silt, little gravel, moist, grayish brown, [Brick and concrete fragments.]		SW	
6	95	SAND (SW) well graded, fine grained SAND; loose, little silt, little gravel, moist, grayish brown to dark brown	6	SW	
8	1	SAND (SW) well graded, fine grained SAND; loose, some silt, some gravel, trace clay; moist, grayish brown to dark brown, [Wood fragments.]	8	SW	
12	9	CLAYEY SILT (ML) soft, trace fine sand, moist, dark grayish brown to dark brown	12	ML	
			12.75		
1		SAND (SP) poorly graded, fine grained SAND; loose, moist to wet, gray, [Wet @ 13']		SP	
16	85	SANDY SILT (OL) soft, little clay, trace fine sand, moist to wet, dark gray to dark brownish gray, [Silt loam.]	1 .5	OL	
18			17		

WELL CONSTRUCTIO

Casing Type:
6-inch Diameter
Steel Stickup

Schedule PVC Riser

. 1 - slot Schedule PVC Screen

REMARKS:
Elevation data established from referenced benchmark set at 10 . '.

WELL INSTALLATION OTES:

WELL CONSTRUCTION GHBLP 3873 68 CCR WELLS.GPJ ERM DATA TEMPLATE.GDT

ERM
3352 128th Avenue
Holland, MI 9424
P: 616-399-35

PROJECT:
Grand Haven Board of Light and Power
CCR Well Installation
1231 N 3rd Street
Grand Haven, Michigan

BORING # **MW-0**
ERM PROJECT # 38 7368
SHEET 1 OF 1

DRILLING CO TRACTOR	EDAC Holland, MI	ERM REPRESENTATIVE	Brian Beach
DRILLING FOREMA	Sean Smith	OFFICE LOCATIO	Holland, MI
DRILLING METHOD	Hollow-Stem Augers	DATE: START	1 /18/2017
DRILLING EQUIPME T	Gus Peck	FINISH	1 /18/2017

GEOGRAPHIC COORDINATES
(NAD 1983 StatePlane Michigan South (US Feet))
O RTHING 176182.574
EASTING 38 7 848.69
Elevation/Top of Casing Elev 1 0 . 60 ft/ 103.59 ft

WELL CONSTRUCTIO

	Riser	Screen
Material:	*Schedule 40 PVC*	*Schedule 40 PVC, 0.010-slot*
Diameter (ID):	*2-inch*	*2-inch*
Coupling:	*Threaded*	*Threaded*

Well Permit #: *No permi re uired.*

WELL DEVELOPMENT
Method: *Overpumping*
Duration: *0.5 hours*
Gals. Purged: *30*

DEPTH	ELEVATIO	STRATA DESCRIPTIO	DEPTH	USCS
1		GRAVELLY SAND (SW) well graded, fine grained SAND; loose, some gravel, moist, brown, [Concrete fragments]		SW
2				
95		GRAVELLY SAND (SP) poorly graded, fine grained SAND; loose, some gravel, moist, dark brown to black	5.5	SP
6		SAND (SW) well graded, fine grained SAND; loose, moist, brown	6.5	SW
			7	SC
8		CLAYEY SAND (SC) soft, some silt, little gravel, moist, brown to dark gray, [Roots]	7.5	SW
		SAND (SW) well graded, fine grained SAND; loose, some silt, some gravel, moist, dark brown, [Concrete and wood fragments.]	8.5	SW
1			1	SP
9		SAND (SW) well graded, medium to coarse grained SAND; loose, wet, dark grayish brown to black, [Bottom ash and concrete fragments.]	1 .5	OL
12		SAND (SP) poorly graded, fine grained SAND; loose, wet, dark grayish brown	11.5	SP
		SANDY SILT (OL) soft, moist, dark grayish brown, [Silt loam.]	12.5	OL
1		SAND (SP) poorly graded, fine grained SAND; loose, wet, gray	1 .5	
85		SANDY SILT (OL) soft, trace fine sand, trace clay, moist, dark grayish brown, [Clay stringer (1 - 14.25). Grey fine sand seam (1 . 25 - 14.5).]		MLS
16				
		SANDY SILT (MLS) soft, little clay, moist, dark grayish brown, [Wood fragments. Grey fine sand seam (15.75 - 16); (16.25 - 16.5); (16.75 - 17).]	17	
18				

GRAPHIC LOG

WELL CONSTRUCTIO
Casing Type:
6-inch Diameter
Steel Stickup

Schedule PVC Riser

. 1 - slot Schedule PVC Screen

REMARKS:
Elevation data established from referenced benchmark set at 10 . '.

WELL INSTALLATION OTES:

WELL CONSTRUCTION GHBLP 3873 68 CCR WELLS.GPJ ERM DATA TEMPLATE.GDT