

December 29, 2021

Project No. 21451440

Paul Cederquist Grand Haven Board of Light & Power 1700 Eaton Drive Grand Haven, Michigan 49417

DEWATERING AND LIQUIDS MANAGEMENT PLAN, FORMER UNIT 3 IMPOUNDMENT AND COAL YARD, J.B. SIMS GENERATING STATION, GRAND HAVEN, MICHIGAN

Dear Paul:

Golder Associates USA Inc. (Golder) is providing this letter to describe requirements to complete the dewatering and liquids disposal to complete the ongoing closure activities for the coal yard and former Unit 3 surface impoundment (Unit 3 Clay Area) at the former J.B. Sims Generating Station site (JBS, Site). This plan provides a summary of anticipated site conditions and recommendations for liquid handling and disposal. It intended to provide the necessary background for a dewatering and treatment contractor to develop and implement a successful dewatering and treatment system to allow impacted material removal and site grading in the coal yard and Unit 3 Clay Area.

BACKGROUND

Ongoing closure activities underway at JBS related to the former coal yard area and Unit 3 Clay Area will require surface water removal and likely groundwater depression to allow closure to proceed. Storm water currently accumulates in Unit 3 Clay Area and must be removed to complete closure. This liquid is considered wastewater because this water potentially contacts PFAS and other materials that have percolated from below since the clay was cleaned November 2020. Therefore, the surface water must be treated and disposed of by discharging to the public owned treatment works (POTW) or to the surrounding water bodies in accordance with a permit obtained under the National Pollution Discharge Elimination System (NPDES). Surface water also collects in the stormwater basin portion located in the eastern portion of the of the coal yard. It will likely be necessary to dewater this basin and lower the groundwater table to complete removal of coal impacted soil withing the coal yard. This water will also have to be disposed of via the POTW or under a NPDES permit due to documented impact to the groundwater in the vicinity.

The former Unit 3 Clay Area has had visible CCR materials removed down to the original Unit 3 clay liner system. Storm water currently collects in low areas on the remaining clay liner. It is anticipated that the BLP will seek Michigan Department of Environment, Great Lakes and Energy (EGLE) approval, to regrade this area and place appropriate cover materials (soils and/or geosynthetics) to isolate the residual impact and allow non-contact stormwater to drain away from this area. The location and general topography of Unit 3 Clay Area is shown by Figure 1 (Site Map – Attachment 1). The coal yard soils are generally fill material overlying the original lacustrine deposits that consist of inter layered sand and organic soils. The fills are generally sandy material but with some thin clay and silty layers. Limited areas of historical municipal waste fill are present in the coal yard. The surface of the western areas of the coal yard are generally free of standing water and is observed to be several feet above the ground water level. However, stormwater can collect in this area for a period following a storm event. The stormwater basin area located in the eastern portion of the coal yard generally has a layer of fine sediments over a thin clay layer up to approximately 1-foot thick. This clay overlays sandy and organic soil layers. This area is at lower elevations than the western area of the coal yard and is generally below the groundwater surface that is thought to be represented by the existing water level. Soil logs of borings completed in the coal yard are presented in Attachment 2.

A thin layer of coal impacted soil exists across on the surface of the coal yard that must be removed to achieve closure under the applicable regulations and to allow reuse of the site. Dewatering of some areas will likely be required to achieve this removal effort. Groundwater contamination exists in the vicinity of the coal yard that must be considered in completing the removal. A summary of known groundwater contamination is provided in Table 1.

Hazardous Substance	CAS Number	Maximum Detected Concentration (mg/L)	Part 201 GRCC Exceeded ¹
Arsenic	7440382	.008	DW/GSIP
Ammonia	7664417	260	DW/GSIP
Barium	7440393	1.6	GSIP
Total Chromium	166065831/ 18540299	.007	GSIP
Cyanide	57125	0.085	GSIP
Lead	7439921	.021	DW/GSIP
Lithium	7439932	2.5	DW/GSIP
Molybdenum	7439987	0.23	DW

Table 1: Known Contaminants E	Exceeding Part 201	Residential Cleanup	Criteria in	Groundwater	at the JBS
Facility					



Hazardous Substance	CAS Number	Maximum Detected Concentration (mg/L)	Part 201 GRCC Exceeded ¹
Perfluorohexanesulfonic Acid (PFHxS)	355464	80.47 x 10 ⁻⁶	DW
Perfluorooctanoic Acid (PFOA)	335671	48.93 x 10 ⁻⁶	DW
Perfluorooctanesulfonic Acid (PFOS)	1763231	289.83 x 10 ⁻⁶	DW
Total Inorganic Nitrogen	7727379	260	DW/GSI

¹Residential Cleanup Criteria definitions:

DW = Drinking Water Criteria

GSIP = Groundwater Surface Water Interface Criteria

Additional sampling of the water contained in the coal yard and Unit 3 Clay Area is ongoing and more complete analytical data will be available soon to complete the final dewatering and treatment system design.

DEWATERING SYSTEM REQUIREMENTS

The dewatering will be completed using two methods: decanting of free (ponded) water in Unit 3 Clay Area and if present in the coal yard and dewatering of pore water to lower the water table within the coal yard excavation area.

Surface Water Decanting

The standing water accumulated in Unit 3 Clay Area will need to be removed by the dewatering contractor to allow construction activities. Additionally, standing water may need to be removed from several low areas where stormwater collects within the coal yard during cleanup depending on weather conditions during the project.

We anticipate this will be accomplished by using a portable pumping system. This pumping system could be either a suction pump or a submersible pump system due to the low lift head requirements anticipated to be needed. A suction pump may be preferred to allow for better control of the water quality at the intake point, ability to vary the pumping rate and to allow the pumping location to be moved from area to area as construction progresses. We anticipate flow will be in the 100 to 200 gallon per minute range to dewater these areas with a much lower or intermittent rate once the areas are dewatered as groundwater inflow to these areas will be minimal.

Water would be transferred to the temporary on-site treatment system via a temporary pipeline or hose system.



Subsurface Dewatering

Subsurface dewatering of the unconfined water bearing stratum below the coal yard will likely be required to complete coal impacted soil removal in the stormwater basin area and possibly the western portion of the coal yard. The selected dewatering contractor is expected to complete this by actively pumping through a network of well points around the perimeter of the area to be dewatered. Well points are typically installed by drilling or jetting the pipe in-place at equal spacing around perimeter of the area to be dewatered. A header system connected to a multi-phase vacuum pump is installed to collect water from the well points. The pump will be connected to the treatment system using hoses or a temporary pipeline. A system installed and operated in this manner are expected to extract water to a depth of 15 feet below the surface. A well point system used to lower the phreatic surface below the excavation grade to complete the dewatering goal anticipated. The selected contractor may choose other methods, such as trench drains, based on their available equipment and experience or to supplement the well point system by pumping from the ponded surface water.

The groundwater elevation at the coal yard is currently at approximately 582-feet with a surface elevation ranging from about 579-feet in the stormwater infiltration area to about 585-feet in the northwestern portion of the coal yard. On average, coal impacted materials were encountered during Golder's drilling investigation to an elevation of 579-feet. However, isolated areas with depths of coal impacted extending to 574-feet were encountered. Golder has assumed excavation activities will continue to 573-feet across the in these areas (1-foot below lowest extent of coal impact), and the excavation area will be required to be dewatered to 572-feet. Following these assumptions, Golder estimates based on the area to be dewatered and soil boring information that an approximate stabilized pumping rate of 765 gallons per minute to dewater the stormwater basin for excavation. The contractor may opt to dewater the excavation site in stages to address the varying depths of coal impacted materials removal and allow use of a lower pumping rate resulting in the need for smaller treatment system. This would allow the contractor to adjust the dewatering process as needed based on their specific equipment and treatment system requirements for the area being dewatered to provide the most efficient system.

WATER TREATMENT SYSTEM

Water from dewatering operations must be disposed of properly and it is anticipated that the water will be discharged to the local POTW (Grand Haven – Spring Lake Wastewater Treatment Plant) for disposal. However, the POTW has indicated that the discharge water may not contain Per- and polyfluoroalkyl substances (PFAS), which includes PFHxS, PFOA and PFOS. Therefore, the water treatment contractor will be required to install an appropriate pretreatment of the water to remove PFAS compounds prior to discharge to the public sanitary sewer. The contractor will determine the final water treatment configuration for the site based upon the parameter concentrations in the groundwater, and their experience with similar systems and local conditions.

The contractor is anticipated to complete bench scale treatment studies prior to installing the treatment system on site to confirm their treatment concept. The contractor will be required to run a startup test by recirculating treated water back to the dewatered area to demonstrate the system is achieving the POTW's limits. Flow will be directed to the POTW's sewer system through a temporary pipeline once system performance has been verified.

The anticipated components of the treatment system are described below is based on the anticipated POTW requirements for PFAS removal. However, final configuration will be developed by the contractor based upon bench scale testing and their experience in treatment of groundwater from similar sites.

Settlement Tanks

Water will be pumped from the site to a system of large settling tanks to allow the large sediments to be collected prior to chemical treatment to prevent solids from clogging the later stages. Typically, this is done using multiple 21,000-gallon frac tanks in a series. The number of tanks and system configuration is determined based on the flow rate of the pumping system. The treatment contractor will determine what is needed in more detail based upon their local experience and may choose to include chemical adjustment to balance pH and increase settlement of solids in the water in this stage, if necessary, to meet treatment goals.

Pre-Filters

After settling or in lieu of settling in tanks, the water may be pumped through a system of pre-filter bags to remove any remaining suspended solids. Typical pre-filters consist of bag filters starting as high as 25-micron bags stepping down to as low as 0.5-micron bags. Contractor to determine pre-filter bag configuration and quantity to best remove solids based on analytical testing, their bench scale testing if performed and local experience on similar projects.

Liquid Phase Granular Activated Carbon

A granular activated carbon system (GAC) will be required to remove PFOS, and volatile organic compounds, dissolved mercury and PCBs if found to be present in ongoing analytical testing. The system will consist of several trains of 2 or 3 stage carbon vessels operated in parallel. Each carbon vessel will be sized to contain sufficient virgin GAC to allow for 12 minutes of empty bed contact time (EBTC) to allow sufficient PFOS adsorption. Several sets of vessels may be operated in series to achieve treatment goals for the flow required to achieve dewatering. Contractor to determine the number of vessels required and amount of carbon to be used in the adsorber based on the actual pumping rates and EBCT required based on analytical results and anticipated groundwater quality.

NPDES Permit Considerations

The water treatment system described above is based on Golder's experience with sites having similar conditions to the JBS coal yard. Golder has assumed that conditions will allow for the discharge of water to the POTW after treatment and further testing of ponded water will be consistent with groundwater testing completed in the area. If discharge to the POTW is not allowed, then a NPDES permit would be required that would have additional treatment requirements the contractor will be required to meet to discharge to the surface water.

Additional treatment system components to meet anticipated NPDES permit requirements may include:

- 1. Additional chemical addition prior to settling and aeration of settling tanks may be required to target specific metals, ammonia/nitrogen, cyanide, etc. along with addition of flocculants to increase settling efficiency.
- An activated alumina adsorber systems are commonly used at CCR sites and may be necessary to remove dissolved arsenic and selenium from the discharge. It is expected that this will require 2 stage vessels in parallel trains, each filled with granular activated alumina sized to provide the necessary EBCT to handle the proposed flow.
- 3. Post-Filters may be recommended for the removal of fine particulates associated with insoluble metals. Typical post filters consist of high efficiency filters starting as high as 1-micron and possibly progressing down to as low as 0.1-micron based upon parameters to be removed.



Final configuration of the treatment system to achieve NPDES permit requirements will be based upon the treatment contractors bench scale testing and experience at similar facilities.

DEWATERING AND TREATMENT PLAN SUMMARY

Completion of the coal yard closure is anticipated to take place the spring and summer (2nd and 3rd quarter) of 2022. Therefore, contractor selection and approvals should proceed during the 1st quarter 2022. Implementation requires the following items be completed based on dewatering liquids being discharged to the POTW.

- 1. Completion of analytical testing on ponded water in Unit 3 Clay Area and the coal yard.
- 2. Selection of dewatering and water treatment contractors and development of final dewatering and treatment process.
- 3. Apply for and obtain discharge authorization from POTW concurrently with step 2.
- 4. Obtain coal soil mixture disposal approval from receiving landfill.
- 5. Coordinate work with earthwork and dewatering/treatment contractors and implement project.
- 6. Field verification of removal activities and verification testing of discharge water.

Please feel free to contact one of the undersigned with any questions or concerns you have relative to the information provided and our recommendations. We look forward to hearing from you and continuing this important work with you.

Golder Associates Inc.

Dein Attart

Blaine Litteral, P.E. *Practice Leader*

BL/TJ

- CC: Eric Booth, GHBL&P Arthur Siegal File
- Attachments: Site Map Attachment 1 Coal Yard Boring Logs – Attachment 2

https://golderassociates.sharepoint.com/sites/140296/project files/5 technical work/dewatering quote/12292021dewatering and liquid managment plan.docx



Tiffany Johnson, P.E. *Principal*



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Attachment 1





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Attachment 2

Coal Yard Soil Boring Logs

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- 9						:						
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						573.3						
— 10 -			End of hole at 10.0 ft.									
-			Backfilled with bentonite chips. No coal observed in borehole									
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Golder - 3	Imperial US	/ Golder US /	uto (common in US) / 2021-11-01			MEMB	ER O	FWSP			UNE	UNED. Runis van Appieuoni DATE. NOV 01, 2021

			RECORD	OF	BC	DRE	H	OLE	Ξ:	S	6B-0	4	Sheet 1 of 1
CLIE	ENT:	-	Grand Haven Board of Light & Power DATE:		Augu	ıst 03, 2	2021					ELEVATION: 582.9 ft (Ground)	
PRC	JECI	: " NO:	GHBLP Coal Removal 21451440									COORD INATES: N: 577216.7 π E: 12624583.4 π COORD SYS: SP MI South FIPS 2113 Ft	
LOC	ATIO	N:	Grand Haven, MI CONTRA	CTOR	: Mate	ECO Dr	illing					HORZ DATUM: NAD83	
							<u> </u>	0.4.4.0					
(tt)	ß	. НОВ	MATERIAL PROFILE				_	SAMP	LES		ATER	NAL	
EPTH	SILL F	LME	DESCRIPTION	scs	ATA OT	ELEV.	ж			s щ	UNDW		
ā	ō	DRIL		ñ	STI	(ft)	NUMBE	ТҮРЕ	REC 9	BLOW N-VALI	GRO OBS	AD	
-			Gray CLAY, some sand, dry, >5% coal observed.	ц	///	0.0							
-			Red gravelly SAND, dry, no coal observed.	-		0.5							
- 1				P									
-						501.2							
- 2			Dark brown silty SAND, wet, organics present, no coal			1.8							
-								ube	6				
				Σ				5: T	6				
- 3				0									
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- 4			Gray SAND, wet, loose, no coal observed.			578.9 4.0							
-	2DT	lole Dia											
5	be 782:	- 4-in ⊢				:							
	Geoprol	t Push											
-	U	Direc		SP									
- 6													
- 7													
-			Dark gray silty SAND, wet, organics present, no coal			575.4	5	Tube	80				
- 8			observed.			:		CJ					
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				SM									
- 9													
- 10 -			End of hole at 10.0 ft.			572.9	++		+	+			
Ē			Backfilled with bentonite chips. Coal observed down to 0.50' BGS.										
- 11													
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HAN	1MER	TYPI	E: Automatic Historic										0
						<u>د م</u>		רבי רבי	D		LOG	GED: Parker Sutton DATE: Aug 03	, 2021
Golder - 3	Imperial US	Golder US /	uto (common in US) / 2021-11-03			MEME	BER O	F WSP	1		CHE	CKED: Kurtis Van Appledorn DATE: Nov 01	, 2021

			RECORD ()F	BC	RE	Η	OLI	Ξ:	S	SB-C)5	Sheet 1 of 1
CLIE	ENT:		Grand Haven Board of Light & Power DATE:		Septe	mber ()2, 2	2021			-	ELEVATION: 581.4 ft (Ground)	
PRC	JECT	Γ:	GHBLP Coal Removal									COORDINATES: N: 577416.9 ft E: 12624683.4 ft	
PRC	JECT	r NO:	21451440									COORD SYS: SP MI South FIPS 2113 Ft	
LOC	ATIO	N:	Grand Haven, MI CONTRACT	OR	MATE	CO Dri	lling	J				HORZ DATUM: NAD83	
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		DD	MATERIAL PROFILE					SAMP	LES		ЩŠ	S Z L	
H (ff	RIG	ETH			4	ELEV.					MATI	ATIC	
EPT	RILL	LLM	DESCRIPTION	scs	LOT		ЧЦ	ш	%	SN⊟		LI DO	
		DRII			L S T	(ft)	NUMB	ΤYΡ	REC	BLOV	E B B	AD	
-			Brown CLAY, moist, soft, no coal observed.	2	111	0.0	-		+	-	-		
Ē			Brown fine SAND, wet, loose, trace gravel, no coal observed.			581.1							
-						0.5							
- 1													
-													
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2				Ч									
-				"			-	Lube	95				
-								5,]					
- 3													
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Ē						577 4							
- 4			Black clayey SAND, wet, loose, glass present, no coal		1/	4.0							
-	probe	le Dia	observed.	ပ္တ									
Ē	Geop	-in Ho		SP	ļ (,								
5	laster	sh - 4-				576.2	H						
-	Irsh N	ct Pus	Dark gray sandy PEAT, moist, soft to firm, no coal observed.		<u> 36 36</u>	5.2							
	Ma	Dire			<u> 36 36</u>								
- 6					<u> 26 26</u>	1							
-					<u> 26 26 2</u>								
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- 7				F	6 <u>36 3</u>								
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- 8					6 76 7 26 76								
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- 9			Gray fine SAND, wet, loose, no coal observed.			572.3 9.1							
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E 10						571.4							
			End of hole at 10.0 ft.										
-			No coal observed in borehole.										
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					(GO	LI	DE	R		LOG	GED: Parker Sutton DATE: Sep 02	2, 2021
Golder - 3	Imperial US	/ Golder US	Auto (common in US) / 2021-11-01			MEMB	ERO	OF WSP	-		CHE	CKED: Kurtis Van Appledorn DATE: Nov 01	1, 2021

LINIT: Grand House Read / Lipit & Poort: Description Elevation:				RECORD	OF	BC	DRE	Η	OLE	Ξ:	S	SB-0	6	Sheet 1 of 1
HOLECT 0 GHAP P Call Removal COUNTRACTOR: MATECO DHING COUNTRACTOR: MATECO DHING COUNTRACTOR: MATECO DHING Image: Countral Hands COUNTRACTOR: MATECO DHING COUNTRACTOR: MATECO DHING COUNTRACTOR: MATECO DHING COUNTRACTOR: MATECO DHING Image: Countral Hands Image: Countral Hands COUNTRACTOR: MATECO DHING Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands Image: Countral Hands<	CLIE	ENT:		Grand Haven Board of Light & Power DATE:		Septe	ember ()2, 2	2021				ELEVATION: 581.0 ft (Ground)	
MULEE TOPE: Automate Heaters MULEE TOPE: Automate Heaters	PRC	JECT	Г: г. N.O.	GHBLP Coal Removal									COORDINATES: N: 577515.7 ft E: 12624850.0 ft	
	IPRC		i no: n·	21451440 Grand Haven MI CONTRAC	TOR		-CO Dri	illind	n				COORD SYS: SP MI South FIPS 2113 Ft HORZ DATUM: NAD83	
Image: Process of the state of the									2					
Bit of the contract metric with the contract test of the contr			Q	MATERIAL PROFILE					SAMP	ES		н s	u se	
Bit DECORPTION State	H (ff)	RIG	ЕТНО			4	ELEV.					MATE	ATIOIA	
a a b	EPT	RILL	LL MI	DESCRIPTION	scs	'RAT/	DEPTH	ER	ш	%	ŝШ	OUND SERV/	EERV.	
Nome: CLAY music for its control distance 0 /// 0 <td></td> <td></td> <td>DRI</td> <td></td> <td></td> <td>LS T</td> <td>(ft)</td> <td>NUME</td> <td>ΥL</td> <td>REC</td> <td>N-VAL</td> <td>R B</td> <td>AL</td> <td></td>			DRI			LS T	(ft)	NUME	ΥL	REC	N-VAL	R B	AL	
Image: Substance of the car function of the car f	-			Brown CLAY, moist, soft, no coal observed.	С	///	0.0							
1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 3 1 1 1 1 1 1 1 4 1 1 1 1 1 1 1 5 1 1 1 1 1 1 1 6 1 1 1 1 1 1 1 7 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 <td>-</td> <td></td> <td></td> <td>Brown gravelly SAND, wet, compact, trash present, glass present, no coal observed.</td> <td></td> <td></td> <td>0.3</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	-			Brown gravelly SAND, wet, compact, trash present, glass present, no coal observed.			0.3							
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- 4 - 4 - 4 - 5 - 7 -	Ē													
a a b	- 4													
a a b	E	adc	Dia.											
a b		Geopro	n Hole											
a a a b Crew fine SAND, wet, losse, shell fragments, no coal 574.0 a b c c a c a a b c c a c a a c c c c a c c a c c c c c c c c a c	- 5 [aster (ih - 4-ir		P ^N			H						
3 5 5 5 7 1	-	arsh M	ct Pus											
1 Gray fine SAND, wel, loose, shell fragments, no coal 574.0 2 0 572.0 4 0 573.0 10 End of hole at 10.0 ft. 10 No coal observed in borehole. 11 No coal observed in borehole. 12 14 14 15 15 16 16 10 17 10 18 10 19 End of hole at 10.0 ft. 10 No coal observed in borehole. 11 10 12 10 13 10 14 10 15 10 16 10 17 10 18 10 19 10 10 10 11 10 12 10 13 10 14 10 15 10 16 10 17 10 18 10 19 10 <td></td> <td>Ma</td> <td>Dire</td> <td></td>		Ma	Dire											
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- 7 -	-													
10 End of hole at 10.0 ft. 11 No coal observed in borehole. 12 No coal observed in borehole. 13 Image: State St	- 7			Grav fine SAND wet loose shell fragments no coal	_		574.0							
- a - b - b - b - b - b - c -	-			observed.			7.0		ube	4				
- 8 - 9 - 10 - End of hole at 10.0 ft. - 10 - End of hole at 10.0 ft. - 10 - 10 - 11 - 10 - 10 - 10 - 12 - 10 - 10 - 10 - 13 - 10 - 10 - 10 - 14 - 10 - 10 - 10 - 14 - 10 - 10 - 10 - 14 - 10 - 10 - 10 - 14 - 10 - 10 - 10 - 14 - 10 - 10 - 10 - 14 - 10 - 10 - 10 - 15 - 10 - 10 - 10 - 14 - 10 - 10 - 10 - 14 - 10 - 10 - 10 - 15 - 10 - 10 - 10 - 10 - 14 - 10 - 10 - 10 - 10 - 10 - 15 - 10 - 10 - 10 - 10 - 10 - 10 - 14 - 10 - 10 - 10 - 10 - 10 - 10 - 10 - 10	-								5' T	2				
	- 8													
- 0 End of hole at 10.0 ft. - 10 End of hole at 10.0 ft. - 11 No coal observed in borehole. - 13 Image: Comparison of the com	-													
AdMER TYPE: Automatic Historic REV: 0 REV: 0	- 9													
10 End of hole at 10.0 ft. 10 No coal observed in borehole. 11 No coal observed in borehole. 12 Image: State of the state of														
10 End of hole at 10.0 ft. 11 No coal observed in borehole. 12 Image: Strate Strat	-													
Image: Section of the section of th	- 10			End of hole at 10.0 ft.	-		571.0				-			
41 13 13 13 14 14 15 16 16 16 16 17 17 18 17 18 18 18 18 18 18 19 19 10 <td< td=""><td>E</td><td></td><td></td><td>No coal observed in borehole.</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	E			No coal observed in borehole.										
Image: Separate US description DATE: Sep 02, 2021 DATE: Nov 01, 2021 DATE: Nov 01, 2021	- 11													
AMMER TYPE: Automatic Historic REV: 0 AMMER TYPE: Automatic Historic REV: 0 COGGED: Parker Sutton DATE: Sep 02, 2021 DATE: Nov 01, 2021	ŧ ''													
AMMER TYPE: Automatic Historic REV: 0 REV: 0 COGGED: Parker Sutton DATE: Sep 02, 2021 DATE: Nov 01, 2021	Ē													
A - 13 - 14 - 15 HAMMER TYPE: Automatic Historic HAMMER TYPE: Automatic Historic REV: 0 COGGED: Parker Sutton CHECKED: Kurtis Van Appledorn DATE: Sep 02, 2021 DATE: Nov 01, 2021	- 12													
- 13 - 14 - 15 HAMMER TYPE: Automatic Historic HAMMER TYPE: Automatic Historic CECEPER LOGGED: Parker Sutton CHECKED: Kurtis Van Appledorn DATE: Sep 02, 2021 DATE: Nov 01, 2021	E													
- 13 - 13 - 14 - 14 - 15 - 15 HAMMER TYPE: Automatic Historic Image: Compared US / 021-110 Vedee - 3 Imperiate US / 024er US Auto (common in US) / 202-1101 Image: Compared US / 024er US Auto (common in US) / 202-1101														
- 14 - 14 - 15 - 15 HAMMER TYPE: Automatic Historic Image: Compared to the state of the state o	- 13 -													
- 14 - 15 HAMMER TYPE: Automatic Historic Automatic Historic CO CO CHECKED: Kurtis Van Appledorn DATE: Sep 02, 2021 DATE: Nov 01, 2021														
- 15 HAMMER TYPE: Automatic Historic HAMMER TYPE: Automatic Historic CO CO CO CO CHECKED: Kurtis Van Appledorn DATE: Sep 02, 2021 DATE: Nov 01, 2021	- 14													
- 15 HAMMER TYPE: Automatic Historic GOLDER MEMBER OF WSP LOGGED: Parker Sutton CHECKED: Kurtis Van Appledorn DATE: Sep 02, 2021 DATE: Nov 01, 2021	Ë													
- 15 HAMMER TYPE: Automatic Historic GOLDER MEMBER OF WSP LOGGED: Parker Sutton CHECKED: Kurtis Van Appledorn DATE: Sep 02, 2021 DATE: Nov 01, 2021	Ē													
HAMMER TYPE: Automatic Historic REV: 0 GOLDER MEMBER OF WSP LOGGED: Parker Sutton DATE: Sep 02, 2021 CHECKED: Kurtis Van Appledorn DATE: Nov 01, 2021	- 15													
HAMMER I YPE: Automatic Historic 0 GOLDER LOGGED: Parker Sutton DATE: Sep 02, 2021 Index - 3 Imperial US / Golder US Auto (common in US)/2021-11-01 DATE: Nov 01, 2021													R	EV:
GOLDER LOGGED: Parker Sutton DATE: Sep 02, 2021 CHECKED: Kurtis Van Appledorn DATE: Nov 01, 2021	HAN	1MER	TYP	E: Automatic Historic										0
Adder - 3 Imperial US / Golder US Auto (common in US) / 2021-11-01 DATE: Nov 01, 2021							60		יםר	C		LOG	GED: Parker Sutton DATE: Sep 02	2, 2021
	Golder - 3	Imperial US	/ Golder US	Auto (common in US) / 2021-11-01				ER (-		CHE	CKED: Kurtis Van Appledorn DATE: Nov 01	, 2021

CLIE	NT.		Grand Haven Board of Light & Power DATE:	OF	BC		H(=:	S	B-0	7 Sheet 1 o
PRO	JEC1	Г:	Grand Haven Board of Light & Power DATE. GHBLP Coal Removal		Septe		12, 2	021				COORDINATES: N: 577450.1 ft E: 12625049.3 ft
PRO LOC	JEC1 ATIO	r no: N:	21451440 Grand Haven, MI CONTRA	CTOR	: MATE	ECO Dri	lling					COORD SYS: SP MI South FIPS 2113 Ft HORZ DATUM: NAD83
		0						SAMP	FS			0
H (ft)	RIG	ЕТНОС			4	ELEV.		OANI			WATER	ATIONAL
DEPT	DRILL	RILL M	DESCRIPTION	nscs	STRAT	DEPTH	JMBER	LYPE	EC %	VALUE	GROUND OBSERV	ADDITI
-			Black MUCK, >5% coal observed.			0.0	ž			۵ż	_	Ö
-			Brown CLAY, moist, soft, no coal observed.		\overline{V}	0.3						
- 1			Grav fine SAND wet loose shell fragments no coal			579.8						
-			observed.			1.2						
- 2								Ð				
							-	5' Tub	68			
- 3												
						576 0						
- 4	robe	e Dia.	Black SAND, wet, loose, glass present, >5% coal observed down to 6.5' BGS.			4.1						
- 5	ter Geop	- 4-in Hol										
	arsh Mas	ct Push -		4								
6	Ma	Dire		N								
-			Grav SAND, wet, loose, trace gravel, no coal observed.	_		574.5						
- 7												
-							2	5' Tube	20			
8												
9												
-												
- 10			End of hole at 10.0 ft.		<u>·:·:·</u> :	571.0						
			Coal observed down to 6.5' BGS.									
- 11												
12												
13												
14												
- 15												
HAN	IMER	TYP	E: Automatic Historic									REV:
									_		1000	
Golder - 3	Imperial US	/ Golder US	Nuto (common in US) / 2021-11-03			G O MEMB		DEI	2		CHEC	CKED: Farker Sutton DATE: Sep 02, 2021 CKED: Kurtis Van Appledorn DATE: Nov 01, 2021

			RECORD	OF	BC	RE	H	OLE	Ξ:	S	B-0	8	Sheet 1 of 1
CLIE	ENT: DJECT	:	Grand Haven Board of Light & Power DATE: GHBLP Coal Removal	DATE: September 02, 2021 ELEVATION: 580.5 ft (Ground) COORDINATES: N: 577483.0 ft E: 126252									
PRC	JECT	NO:	21451440	COORD SYS: SP MI South FIPS 2113 Ft									
LOCATION: Grand Haven, MI CONTRACTOR: MATEC												HORZ DATUM: NAD83	
	(1)	QO	MATERIAL PROFILE					SAMP	LES		ER NS	AL SNC	
РТН (fi	ILL RIG	. METH	DESCRIPTION	S	ATA DT	ELEV.	er l		П	ъШ	INDWAT	LI TION	
DE	DR	DRILL	DESCRIPTION	NSI N	STR	DEPTH (ft)	NUMBE	TYPE	REC %	BLOWS N-VALUI	GROL OBSE	ADD	
-			Black MUCK, wet, loose, >5% coal observed down to 2' BGS.			0.0			Ħ	-			
-													
- 1													
-						570.5							
2			Gray fine SAND, wet, loose, no coal observed.		isisisisisi	578.5 2.0		Θ					
-							-	5' Tub	60				
- 3													
				Ъ									
- 4	Ð	ia.											
-	Seoprob	n Hole D											
- 5	Master (lsh - 4-ir	Black PEAT, moist, soft, no coal observed.		<u>2 26</u> 2	575.5 5.0							
-	Marsh	Direct Pu			<u>76 76</u> 7 76 7 76 76								
- 6					77 77 77 77 77 77								
-					6 96 7 96 96								
- 7					<u>76 76</u> 7 76 7 76 76								
-					<u> 26 26</u> 7 76 76		2	5' Tube	26				
- 8					6 26 7 26 26								
-					70 70 6 76 7 70 70								
- 9					<u> </u>								
					6 26 7 26 26								
- 10			End of hole at 10.0 ft.		76 76	570.5			H				
			Coal observed down to 2' BGS										
- 11													
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- - 15													
HAMMER TYDE: Automatic Historic											.EV:		
													0
Golder - 3	Imperial US	/ Golder US /	Nuto (common in US) / 2021-11-01		(G O			R		LOG(CHE(GED: Parker Sutton DATE: Sep 02 CKED: Kurtis Van Appledorn DATE: Nov 01	², 2021 1, 2021

	RECORD OF BOREHOLE: SB-09 Shee											Sheet 1 of 1	
CLIENT: Grand Haven Board of Light & Power DATE:							01, 20	021				ELEVATION: 580.4 ft (Ground)	
PRC	DJEC	ι: Γ NO:	GHBLP Coal Removal 21451440									COORDINATES: N: 57/416.6 ft E: 12625283.8 ft COORD SYS: SP MI South FIPS 2113 Ft	
LOC	ATIO	N:	Grand Haven, MI CONTRAC	: MATE	CO Dri	illing					HORZ DATUM: NAD83		
							1	0.4.4.0	50				
(ft)	RG	гнор	MATERIAL PROFILE					SAIVIPL	_ES		ATER	IONS	
ЕРТН	RILL F	L ME	DESCRIPTION	scs	RATA OT	ELEV.	R		» v	<u>,</u> Ц	UNDW	ERVA	
D	Ō	DRIL		ő	STI	(ft)	NUMBI	TYPE	REC 6	N-VAL	GRC OBS	OBSID	
-			Black Muck, wet, soft, potential coal powder present in muck.			0.0							
-						~							
- 1						\$ \$							
-						578.7							
- 2			Brown CLAY, moist, soft, no coal observed.		1///	1.7							
-				5	\///	1		ube	9				
-			Grav fine SAND, wet, loose, no coal observed,	-	[///	577.6		5 [.] T	4				
- 3			Red fine SAND, wet, loose, no coal observed.	_		577.2 3.2	$\left \right $						
-													
4		ġ											
	oprobe	Hole Di		SP									
5	ster Ge	I - 4-in I	Grav fine SAND, wet, loose, no coal observed	_		575.4							
-	ırsh Ma	ct Push	,,,,										
	Ma	Dire				574 3							
			Gray SILT, wet, soft, no coal observe.	٦		6.1 574.0							
-			Black PEAI, moist, soft, no coal observe.		20 20 20 20	6.4							
- 7					<u> 26 26</u> :			0					
-					<u> 26 26</u> :		2	5' Tube	50				
- 8					7 20								
-					<u> 26 26</u>								
- 9					6 26 3 96 76								
-					<u> 26 26</u>								
- 10					<u> 26 26</u> :	570.4							
- 10 -			End of hole at 10.0 ft.										
-			Potential coal down to 1.70' BGS.										
- 11													
- 12													
- 13													
- 14													
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- 15													
HAMMER TYDE: Automatic Historic												REV:	
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					(GΟ	LC) E F	R		LOGO	GED: Parker Sutton DATE: Sep 0	1, 2021
Golder - 3	Imperial US	/ Golder US	Auto (common in US) / 2021-11-01			MEME	BER O	F WSP			CHE	JNED: KUITIS VAN APPIEdorn DATE: Nov 0	1, 2021

			RECORD (DF	BC	RE	H	OLE	Ξ:	S	SB-1	0	Sheet 1 of 1
CLIE	LIENT: Grand Haven Board of Light & Power DATE: September 01							021				ELEVATION: N/A	
PRO	PROJECT: GHBLP Coal Removal											COORDINATES: N: 577453.5 ft E: 12625417.6 ft	
	PROJECTINO: 21451440 OCATION: Grand Haven MI CONTRACTOR:						llina					HORZ DATUM NAD83	
	ЛЮ	IN.		UIX.		00 011	iiiig						
			MATERIAL PROFILE					SAMP	LES		~	Ø	
(#) H	RIG	тно									VATER		
EPTH	RILL	L ME	DESCRIPTION	SCS	ZATA -OT		К		%	v Ц			
	Δ	DRIL		ő	STI	(ft)	NUMB	TYPI	REC	BLOW	GRG OBS	AD	
-			Black MUCK, wet, soft, trace organics, potential coal powder		£{{}}}	0.0			+	-			
-			Red fine SAND, wet, compact, trace gravel, no coal			0.3							
Ē,			observed.	S									
Ξ'			Brown CLAY, moist, hard, no coal observed.			1.0							
-													
- 2				0									
-								ube	0				
			Gray fine SAND, wet, loose, no coal observe.			2.5		5 T	5				
- 3													
Ē				4									
				S									
- 4	Ð	lia.											
	soprob	Hole [
- 5	ster Ge	- 4-in	Black PEAT, moist, soft, no coal observe.		<u> 76 76</u> 7 76 7	4.7			\square				
	sh Mas	Push			<u> 76 76</u> 7 76 7								
-	Mars	Direct	Gray fine SAND, wet, loose, shell fragments, no coal observe.			5.5							
- 6													
_													
- (Ð					
-							2	5' Tub	44				
- 8				S									
- 9													
-													
- 10													
- 10			End of hole at 10.0 ft.										
			Potential coal down to 0.30' BGS.										
- 11													
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HAM	IMER	TYP	E: Automatic Historic										0
			Ground elevation was not collected due to depth of water at boring location.			~ ~					106	GED: Parker Sutton DATE: Sen 01	. 2021
Golder - 3	Imperial US	/ Golder US	Auto (common in US)/ 2021-11-01		(ĸ		CHE	CKED: Kurtis Van Appledorn DATE: Nov 01	, 2021
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CHOLECT Optimize Tools of Light & Tome UNIC Optimize Tools of Light & ST7516.05 E 12825416.8 E REDECT: NO 2141140 CONTRACTOR MATEOD Dulling CONTRACTOR MATEOD Chilling CONTRACTOR CONTRACTOR MATEOD Chilling CONTRACTOR		ENIT:		RECORD O	١F	BO	RE	H(Ξ:	S	SB-1	1 Sheet 1 of Sheet 1 o
PHOLEL INC: 2119 H44 CONTRACTOR: MATECO Drilling DUDMUSTS: Series Model Image: Series Model Ended Haven, M CONTRACTOR: MATECO Drilling Update HORZ DATUK: NADEB Image: Series Model Image: Series	PRC		T:	GHBLP Coal Removal		Septen		1, 2	021				COORDINATES: N: 577516.5 ft E: 12625416.6 ft
Image: sector of the	LOC	CATIO	F NO: N:	21451440 Grand Haven, MI CONTRACTO	CO Dril	lling					COORD SYS: SP MI South FIPS 2113 Ft HORZ DATUM: NAD83		
Bit of the set of the			MATERIAL PROFILE						SAMP	LES		۳ ω	<u>.</u> ଜ
B B <td>TH (ft)</td> <td>LL RIG</td> <td>METHC</td> <td>ç</td> <td>ŝ</td> <td>TTA T</td> <td>ELEV.</td> <td>~</td> <td></td> <td>11</td> <td></td> <td>NDWATE RVATION:</td> <td>TIONAL</td>	TH (ft)	LL RIG	METHC	ç	ŝ	TTA T	ELEV.	~		11		NDWATE RVATION:	TIONAL
Biock Mick we define and any provint in call provint in call provint in call provider in muck Biock Mick we define and the call served. C	DEF	DRI	DRILL	DESCRIPTION	nso	STR/ PLC	DEPTH (ft)	NUMBER	ТҮРЕ	REC %	BLOWS N-VALUE	GROUI	ADDI
1 Gety time SAND, well losse, trade organes, no coal 1 1 0.5 2 9 9 1 0.5 3 9 1 1 0.5 4 9 1 1 1 5 1 1 1 1 6 1 1 1 1 7 1 1 1 1 8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	-			Black MUCK, wet, soft, potential coal powder in muck. Brown CLAY, moist, soft, no coal observed.	ರ ರ	*****	0.0 579.2 0.2						
1 1 Pair black PEAT, most, sof, no coil deserve. 5752 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	- 1			Gray fine SAND, wet, loose, trace organics, no coal observed.			0.8						
- 3 - 4 -	2												
1 1 Paie black PEAT, moist, soft, no coal observe. 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				3	S S			-	5' Tube	58			
1 1 <td></td>													
1 1 <td>4</td> <td>ЭС</td> <td>Dia.</td> <td>Pale black PEAT, moist, soft, no coal observe.</td> <td></td> <td><u>NIC NIC</u></td> <td>575.2 4.2</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	4	ЭС	Dia.	Pale black PEAT, moist, soft, no coal observe.		<u>NIC NIC</u>	575.2 4.2						
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	5	ster Geopro	- 4-in Hole		2	76 76 76 76 76 76 76 76							
a b	-	Marsh Ma	lirect Push	Gray fine SAND, wet, loose, shell fragments, no coal observed.	no coal	<u> </u>	574.0 5.4						
7 7 8 9	6												
8 8 9 9 9 9 10 End of hole at 10.0 ft. 569.4 9 9 10 End of hole at 10.0 ft. 569.4 1 1 11 Potential coal down to 0.20° BGS. 1 1 1 12 13 1 1 1 1 14 1 1 1 1 1	7												
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11 Potential coal down to 0.20' BGS. 11 12 13 14	- - - 10			End of hole at 10.0 ft			569.4						
				Potential coal down to 0.20' BGS.									
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HAMMER TYPE: Automatic Historic REV	HAN	REV: 0											
Golder - 3 more tal US (Golder US Auto Foreman in US) (2021-11-01 DATE: Sep 01, 20 CHECKED: Kurtis Van Appledorn DATE: Nov 01, 20	Goldan - 1	GED: Parker Sutton DATE: Sep 01, 2021 CKED: Kurtis Van Appledorn DATE: Nov 01. 2021											

CLIENT: Grand Haven Board of Light & Power DATE: September 01 2021 ELEVATION: N/A									2 Sheet 1 of 7 ELEVATION: N/A			
PRC	JECI	Г: Г. МО	GHBLP Coal Removal		oopii		, ı, z	.021				COORDINATES: N: 577482.0 ft E: 12625351.2 ft
LOC	ATIO	NO: N:	Grand Haven, MI CONTRAC	CO Dri	lling	I				HORZ DATUM: NAD83		
t)	(7)	ЦОР	MATERIAL PROFILE	1		SAMP	LES		IER	AL DNS		
DEPTH (f	DRILL RIG	DRILL METH	DESCRIPTION	nscs	STRATA PLOT	ELEV. DEPTH (ft)	NUMBER	TYPE	REC %	BLOWS N-VALUE	GROUNDWA OBSERVATIC	ADDITION OBSERVATIO
-			Black MUCK, wet, soft, potential coal powder in muck. Brown CLAY, moist, soft, no coal observed.		6666666	0.0						
- - - - - - -				ц С		0.2						
- 2			Gray fine SAND, wet, loose, no coal observed.			1.5		¢,				
3				SP			-	5' Tube	76			
- 4			Grav candy SILT wat soft no coal observed			4.1						
	soprobe	Hole Dia	Black PEAT, moist, soft, wood fragments, no coal observed.	M	<u> 26 26</u>	4.1						
- 5	Master Ge	Ish - 4-in			$r = \overline{vr} = \frac{1}{2r} + \frac{1}{2r} + \frac{1}{2r} + \frac{1}{2r} = \frac{1}{2r} = \frac{1}{2r} + \frac{1}{2r}$		\vdash		+			
-	Marsh I	Direct Pu			<u>26 26</u> 6 <u>26</u> 2 26 26							
- 6					6 <u>26</u> : <u>26 26</u> 6 26 :							
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-				2	<u>8 96</u> : <u>86 86</u> :		2	5' Tu	40			
- 8					76 76 7 76 7 76 76 7							
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			Black SAND, trace peat, wet, loose, no coal observed.	R		9.0						
- 10			End of hole at 10.0 ft									
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нам	1MER	TYP	E: Automatic Historic				C					0
			Ground elevation was not collected due to depth of water at boring location.		(GO		DE	R		LOG	GED: Parker Sutton DATE: Sep 01, 2021
Golder - 3	Imperial US	/ Golder US	Auto (common in US) / 2021-11-01			MEMB	ERC	DF WSP	-		CHE	CKED: Kurtis Van Appledorn DATE: Nov 01, 2021