GOLDER
MEMBER OF WSP

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).

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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.

Table 1: Known Contaminants 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]
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

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

[1]Residential 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.
2. 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.

Blaine Litteral, P.E.
Practice Leader

Tiffany Johnson, P.E.
Principal

BL/TJ

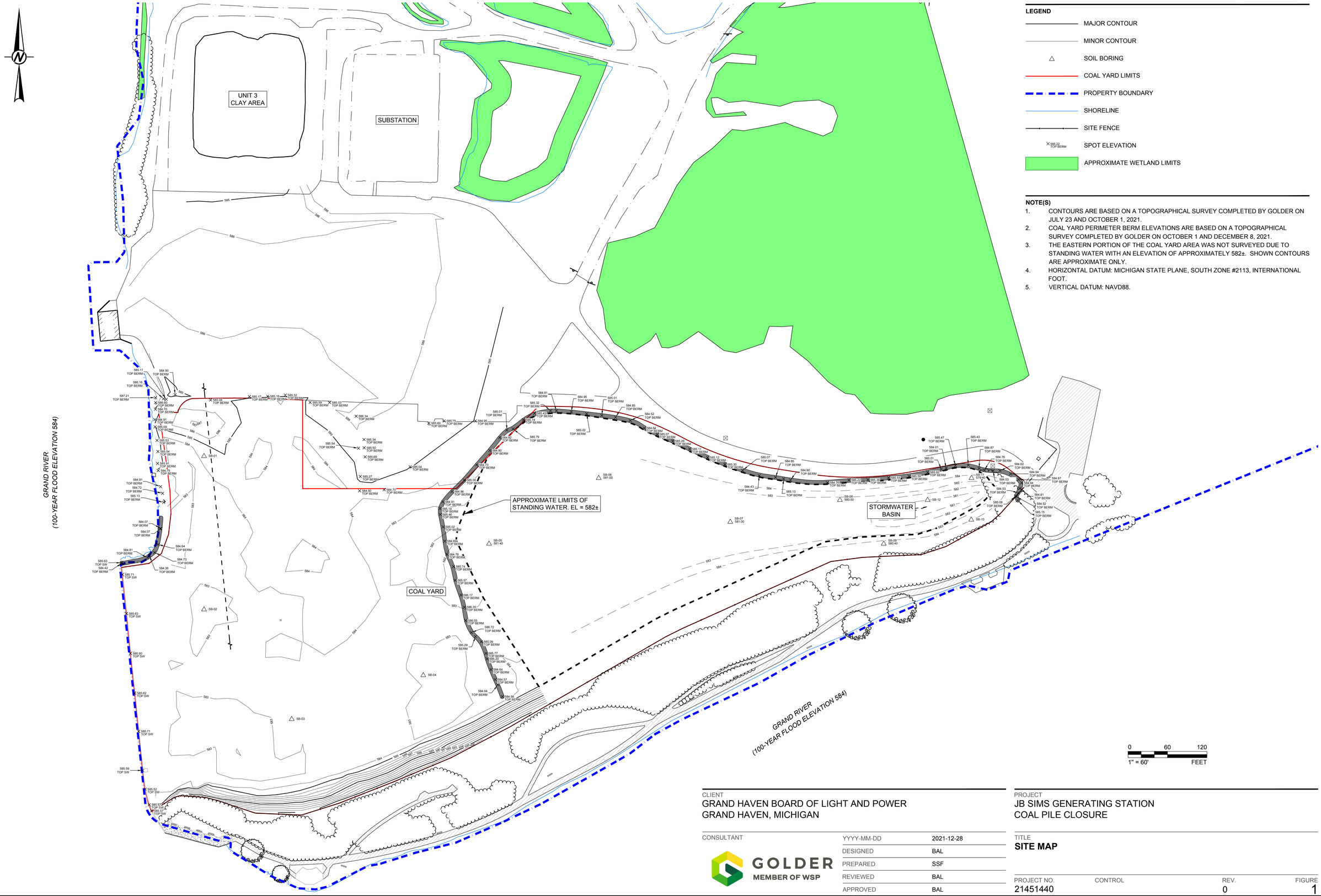
CC: Eric Booth, GHBL&P
Arthur Siegal
File

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

Attachment 1

Site Map



LEGEND

- MAJOR CONTOUR
- MINOR CONTOUR
- △ SOIL BORING
- COAL YARD LIMITS
- PROPERTY BOUNDARY
- SHORELINE
- SITE FENCE
- ×685.22 TOP BERM — SPOT ELEVATION
- APPROXIMATE WETLAND LIMITS

NOTE(S)

1. CONTOURS ARE BASED ON A TOPOGRAPHICAL SURVEY COMPLETED BY GOLDER ON JULY 23 AND OCTOBER 1, 2021.
2. COAL YARD PERIMETER BERM ELEVATIONS ARE BASED ON A TOPOGRAPHICAL SURVEY COMPLETED BY GOLDER ON OCTOBER 1 AND DECEMBER 8, 2021.
3. THE EASTERN PORTION OF THE COAL YARD AREA WAS NOT SURVEYED DUE TO STANDING WATER WITH AN ELEVATION OF APPROXIMATELY 582±. SHOWN CONTOURS ARE APPROXIMATE ONLY.
4. HORIZONTAL DATUM: MICHIGAN STATE PLANE, SOUTH ZONE #2113, INTERNATIONAL FOOT.
5. VERTICAL DATUM: NAVD88.

0 60 120
1" = 60' FEET

CLIENT
GRAND HAVEN BOARD OF LIGHT AND POWER
GRAND HAVEN, MICHIGAN

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-12-28
DESIGNED	BAL
PREPARED	SSF
REVIEWED	BAL
APPROVED	BAL

PROJECT
JB SIMS GENERATING STATION
COAL PILE CLOSURE

TITLE
SITE MAP

PROJECT NO.	CONTROL	REV.	FIGURE
21451440		0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ARCH D

0 1 in

Path: \\golder.gds\Complex\Data\office\Holland\cad\Projects\MAJOR CLIENTS\GHBLP\21451440_JB Sims Coal Pile Removal\PRODUCTION\A-Work Plan\ | File Name: 21451440A0003.dwg | Last Edited By: sfulmer Date: 2021-12-28 Time: 10:51:58 AM | Printed By: SFulmer Date: 2021-12-28 Time: 10:52:50 AM

Attachment 2

Coal Yard Soil Boring Logs

RECORD OF BOREHOLE: SB-01

CLIENT: Grand Haven Board of Light & Power
PROJECT: GHBLP Coal Removal
PROJECT NO: 21451440
LOCATION: Grand Haven, MI
DATE: August 03, 2021
CONTRACTOR: MATECO Drilling
ELEVATION: 583.9 ft (Ground)
COORDINATES: N: 577550.0 ft E: 12624250.0 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	GROUNDWATER OBSERVATIONS	ADDITIONAL OBSERVATIONS
0	Geoprobe 7822DT	Direct Push - 4-in Hole Dia.	Dark gray SAND, fill, dry, >5% coal observed down to 1' BGS.	SP		0.0 582.9							
1			Gray CLAY, moist, firm	CL		1.0 582.5							
1			Dark gray SAND, wet, >5% coal observed.	SP		1.4	1	5' Tube	50				
5						577.9							
6			Black silty SAND, wet, organics present, no coal observed.	SM		6.0	2	5' Tube	50				
10			End of hole at 10.0 ft. Backfilled with bentonite chips. Coal observed down to 5' BGS.			573.9							

HAMMER TYPE: Automatic Historic

REV: 0

GOLDER
MEMBER OF WSP

LOGGED: Parker Sutton DATE: Aug 03, 2021
CHECKED: Kurtis Van Appledorn DATE: Nov 01, 2021

RECORD OF BOREHOLE: SB-02

CLIENT: Grand Haven Board of Light & Power
PROJECT: GHBLP Coal Removal
PROJECT NO: 21451440
LOCATION: Grand Haven, MI
DATE: August 03, 2021
CONTRACTOR: MATECO Drilling

ELEVATION: 582.2 ft (Ground)
COORDINATES: N: 577316.7 ft E: 12624250.0 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	GROUNDWATER OBSERVATIONS	ADDITIONAL OBSERVATIONS
0	Geoprobe 7822DT	Direct Push - 4-in Hole Dia.	Dark brown silty SAND, fill, >5% coal observed.	SM		0.0	1	5' Tube	52				
7			Gray SAND, wet, organics present, no coal observed.	SP		575.2 7.0	2	5' Tube	52				
10			End of hole at 10.0 ft. Backfilled with bentonite chips. Coal observed down to 7' BGS			572.2							

HAMMER TYPE: Automatic Historic

REV: 0

GOLDER
MEMBER OF WSP

LOGGED: Parker Sutton DATE: Aug 03, 2021
CHECKED: Kurtis Van Appledorn DATE: Nov 01, 2021

RECORD OF BOREHOLE: SB-03

CLIENT: Grand Haven Board of Light & Power
PROJECT: GHBLP Coal Removal
PROJECT NO: 21451440
LOCATION: Grand Haven, MI
DATE: August 03, 2021
CONTRACTOR: MATECO Drilling

ELEVATION: 583.3 ft (Ground)
COORDINATES: N: 577150.1 ft E: 12624383.2 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	GROUNDWATER OBSERVATIONS	ADDITIONAL OBSERVATIONS
0	Geoprobe 7822DT	Direct Push - 4-in Hole Dia.	Red SAND, some gravel, dry, no coal observed.	SP		0.0	1	5' Tube	70				
3			Black silty SAND, some gravel, wet, organics present, no coal observed.	SM		580.3 3.0	2	5' Tube	70				
10			End of hole at 10.0 ft. Backfilled with bentonite chips. No coal observed in borehole			573.3							

HAMMER TYPE: Automatic Historic

REV: 0

GOLDER
MEMBER OF WSP

LOGGED: Parker Sutton DATE: Aug 03, 2021
CHECKED: Kurtis Van Appledorn DATE: Nov 01, 2021

RECORD OF BOREHOLE: SB-04

CLIENT: Grand Haven Board of Light & Power
PROJECT: GHBLP Coal Removal
PROJECT NO: 21451440
LOCATION: Grand Haven, MI
DATE: August 03, 2021
CONTRACTOR: MATECO Drilling

ELEVATION: 582.9 ft (Ground)
COORDINATES: N: 577216.7 ft E: 12624583.4 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	GROUNDWATER OBSERVATIONS	ADDITIONAL OBSERVATIONS
0	Geoprobe 7822DT	Direct Push - 4-in Hole Dia.	Gray CLAY, some sand, dry, >5% coal observed.	CL		0.0 / 582.4							
1			Red gravelly SAND, dry, no coal observed.	SP		0.5 / 581.2							
2			Dark brown silty SAND, wet, organics present, no coal observed.	SM		1.8 / 578.9	1	5' Tube	96				
4			Gray SAND, wet, loose, no coal observed.	SP		4.0 / 575.4							
7			Dark gray silty SAND, wet, organics present, no coal observed.	SM		7.5 / 572.9	2	5' Tube	80				
10			End of hole at 10.0 ft. Backfilled with bentonite chips. Coal observed down to 0.50' BGS.										

HAMMER TYPE: Automatic Historic

REV: 0

GOLDER
MEMBER OF WSP

LOGGED: Parker Sutton DATE: Aug 03, 2021
CHECKED: Kurtis Van Appledorn DATE: Nov 01, 2021

RECORD OF BOREHOLE: SB-05

CLIENT: Grand Haven Board of Light & Power
PROJECT: GHBLP Coal Removal
PROJECT NO: 21451440
LOCATION: Grand Haven, MI
DATE: September 02, 2021
CONTRACTOR: MATECO Drilling
ELEVATION: 581.4 ft (Ground)
COORDINATES: N: 577416.9 ft E: 12624683.4 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	GROUNDWATER OBSERVATIONS	ADDITIONAL OBSERVATIONS
0	Marsh Master Geoprobe	Direct Push - 4-in Hole Dia.	Brown CLAY, moist, soft, no coal observed.	CL		0.0 / 581.1							
0			Brown fine SAND, wet, loose, trace gravel, no coal observed.	SP		0.3 / 577.4	1	5' Tube	46				
4			Black clayey SAND, wet, loose, glass present, no coal observed.	SP-SC		4.0 / 576.2							
5			Dark gray sandy PEAT, moist, soft to firm, no coal observed.	PT		5.2 / 572.3	2	5' Tube	44				
9			Gray fine SAND, wet, loose, no coal observed.	SP		9.1 / 571.4							
10			End of hole at 10.0 ft. No coal observed in borehole.										

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

RECORD OF BOREHOLE: SB-06

CLIENT: Grand Haven Board of Light & Power
PROJECT: GHBLP Coal Removal
PROJECT NO: 21451440
LOCATION: Grand Haven, MI
DATE: September 02, 2021
CONTRACTOR: MATECO Drilling
ELEVATION: 581.0 ft (Ground)
COORDINATES: N: 577515.7 ft E: 12624850.0 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	GROUNDWATER OBSERVATIONS	ADDITIONAL OBSERVATIONS
0	Marsh Master Geoprobe	Direct Push - 4-in Hole Dia.	Brown CLAY, moist, soft, no coal observed.	CL		0.0 / 580.7							
1			Brown gravelly SAND, wet, compact, trash present, glass present, no coal observed.	SP		0.3	1	5' Tube	40				
2													
3													
4													
5													
6													
7			Gray fine SAND, wet, loose, shell fragments, no coal observed.			574.0 / 7.0	2	5' Tube	24				
8													
9													
10						571.0							
			End of hole at 10.0 ft.										
			No coal observed in borehole.										
11													
12													
13													
14													
15													

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

RECORD OF BOREHOLE: SB-07

CLIENT: Grand Haven Board of Light & Power
PROJECT: GHBLP Coal Removal
PROJECT NO: 21451440
LOCATION: Grand Haven, MI
DATE: September 02, 2021
CONTRACTOR: MATECO Drilling
ELEVATION: 581.0 ft (Ground)
COORDINATES: N: 577450.1 ft E: 12625049.3 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	GROUNDWATER OBSERVATIONS	ADDITIONAL OBSERVATIONS
0	Marsh Master Geoprobe	Direct Push - 4-in Hole Dia.	Black MUCK, >5% coal observed.			0.0 / 580.7							
1			Brown CLAY, moist, soft, no coal observed.	CL		0.3 / 579.8							
2			Gray fine SAND, wet, loose, shell fragments, no coal observed.	SP		1.2	1	5' Tube	68				
3													
4						576.9							
5			Black SAND, wet, loose, glass present, >5% coal observed down to 6.5' BGS.			4.1							
6						574.5							
7			Gray SAND, wet, loose, trace gravel, no coal observed.			6.5	2	5' Tube	20				
8													
9													
10			End of hole at 10.0 ft. Coal observed down to 6.5' BGS.			571.0							
11													
12													
13													
14													
15													

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

RECORD OF BOREHOLE: SB-08

CLIENT: Grand Haven Board of Light & Power
PROJECT: GHBLP Coal Removal
PROJECT NO: 21451440
LOCATION: Grand Haven, MI
DATE: September 02, 2021
CONTRACTOR: MATECO Drilling
ELEVATION: 580.5 ft (Ground)
COORDINATES: N: 577483.0 ft E: 12625216.4 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	GROUNDWATER OBSERVATIONS	ADDITIONAL OBSERVATIONS
0	Marsh Master Geoprobe	Direct Push - 4-in Hole Dia.	Black MUCK, wet, loose, >5% coal observed down to 2' BGS.			0.0 / 578.5							
2			Gray fine SAND, wet, loose, no coal observed.	SP		2.0 / 575.5	1	5' Tube	60				
5			Black PEAT, moist, soft, no coal observed.			5.0 / 570.5	2	5' Tube	26				
10			End of hole at 10.0 ft. Coal observed down to 2' BGS										

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

RECORD OF BOREHOLE: SB-09

CLIENT: Grand Haven Board of Light & Power
PROJECT: GHBLP Coal Removal
PROJECT NO: 21451440
LOCATION: Grand Haven, MI
DATE: September 01, 2021
CONTRACTOR: MATECO Drilling

ELEVATION: 580.4 ft (Ground)
COORDINATES: N: 577416.6 ft E: 12625283.8 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	GROUNDWATER OBSERVATIONS	ADDITIONAL OBSERVATIONS
0	Marsh Master Geoprobe	Direct Push - 4-in Hole Dia.	Black Muck, wet, soft, potential coal powder present in muck.			0.0 / 578.7							
2			Brown CLAY, moist, soft, no coal observed.	CL		1.7 / 577.6	1	5' Tube	46				
3			Gray fine SAND, wet, loose, no coal observed.	SP		2.8 / 577.2							
3			Red fine SAND, wet, loose, no coal observed.	SP		3.2 / 575.4							
5			Gray fine SAND, wet, loose, no coal observed.	SP		5.0 / 574.3	2	5' Tube	50				
6			Gray SILT, wet, soft, no coal observe.	ML		6.1 / 574.0							
6			Black PEAT, moist, soft, no coal observe.			6.4 / 570.4							
10			End of hole at 10.0 ft. Potential coal down to 1.70' BGS.										

HAMMER TYPE: Automatic Historic

REV: 0

GOLDER
MEMBER OF WSP

LOGGED: Parker Sutton DATE: Sep 01, 2021
CHECKED: Kurtis Van Appledorn DATE: Nov 01, 2021

RECORD OF BOREHOLE: SB-10

CLIENT: Grand Haven Board of Light & Power
PROJECT: GHBLP Coal Removal
PROJECT NO: 21451440
LOCATION: Grand Haven, MI
DATE: September 01, 2021
CONTRACTOR: MATECO Drilling

ELEVATION: N/A
COORDINATES: N: 577453.5 ft E: 12625417.6 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	GROUNDWATER OBSERVATIONS	ADDITIONAL OBSERVATIONS
0	Marsh Master Geoprobe	Direct Push - 4-in Hole Dia.	Black MUCK, wet, soft, trace organics, potential coal powder present in muck.			0.0							
0.3			Red fine SAND, wet, compact, trace gravel, no coal observed.	SP		0.3							
1			Brown CLAY, moist, hard, no coal observed.	CL		1.0							
2							1	5' Tube	50				
2.5			Gray fine SAND, wet, loose, no coal observe.	SP		2.5							
3													
4													
4.7			Black PEAT, moist, soft, no coal observe.			4.7							
5													
5.5			Gray fine SAND, wet, loose, shell fragments, no coal observe.	SP		5.5							
6							2	5' Tube	44				
7													
8													
9													
10			End of hole at 10.0 ft.										
			Potential coal down to 0.30' BGS.										
11													
12													
13													
14													
15													

HAMMER TYPE: Automatic Historic

Ground elevation was not collected due to depth of water at boring location.

REV: 0

GOLDER
MEMBER OF WSP

LOGGED: Parker Sutton DATE: Sep 01, 2021
CHECKED: Kurtis Van Appledorn DATE: Nov 01, 2021

RECORD OF BOREHOLE: SB-11

CLIENT: Grand Haven Board of Light & Power
PROJECT: GHBLP Coal Removal
PROJECT NO: 21451440
LOCATION: Grand Haven, MI
DATE: September 01, 2021
CONTRACTOR: MATECO Drilling
ELEVATION: 579.4 ft (Ground)
COORDINATES: N: 577516.5 ft E: 12625416.6 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	GROUNDWATER OBSERVATIONS	ADDITIONAL OBSERVATIONS
0	Marsh Master Geoprobe	Direct Push - 4-in Hole Dia.	Black MUCK, wet, soft, potential coal powder in muck.			0.0 / 579.2							
			Brown CLAY, moist, soft, no coal observed.	CL		0.2 / 578.6							
1			Gray fine SAND, wet, loose, trace organics, no coal observed.	SP		0.8 / 575.2	1	5' Tube	58				
4			Pale black PEAT, moist, soft, no coal observe.			4.2 / 574.0							
5			Gray fine SAND, wet, loose, shell fragments, no coal observed.	SP		5.4 / 569.4	2	5' Tube	40				
10			End of hole at 10.0 ft. Potential coal down to 0.20' BGS.										

HAMMER TYPE: Automatic Historic

REV: 0

GOLDER
MEMBER OF WSP

LOGGED: Parker Sutton DATE: Sep 01, 2021
CHECKED: Kurtis Van Appledorn DATE: Nov 01, 2021

RECORD OF BOREHOLE: SB-12

CLIENT: Grand Haven Board of Light & Power
PROJECT: GHBLP Coal Removal
PROJECT NO: 21451440
LOCATION: Grand Haven, MI
DATE: September 01, 2021
CONTRACTOR: MATECO Drilling

ELEVATION: N/A
COORDINATES: N: 577482.0 ft E: 12625351.2 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	GROUNDWATER OBSERVATIONS	ADDITIONAL OBSERVATIONS
0	Marsh Master Geoprobe	Direct Push - 4-in Hole Dia.	Black MUCK, wet, soft, potential coal powder in muck.			0.0							
1			Brown CLAY, moist, soft, no coal observed.	CL		0.2							
2			Gray fine SAND, wet, loose, no coal observed.	SP		1.5	1	5' Tube	76				
4			Gray sandy SILT, wet, soft, no coal observed.	ML		4.1							
5			Black PEAT, moist, soft, wood fragments, no coal observed.			4.5	2	5' Tube	40				
9			Black SAND, trace peat, wet, loose, no coal observed.	SP		9.0							
10			End of hole at 10.0 ft. Potential coal down to 0.20' BGS.										

HAMMER TYPE: Automatic Historic

Ground elevation was not collected due to depth of water at boring location.

REV: 0

GOLDER
MEMBER OF WSP

LOGGED: Parker Sutton DATE: Sep 01, 2021
CHECKED: Kurtis Van Appledorn DATE: Nov 01, 2021