Infrastructure Engineering Solutions

3031 W. Grand Blvd. • Suite 228 • Detroit, Michigan 48202

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GEOTECHNICAL DATA REPORT

NORTH AND SOUTH HENNEPIN MARSH HABITAT RESTORATION GROSSE ILE TOWNSHIP, MICHIGAN

Owner:

Friends of the Detroit River

Prepared for:

Environmental Consulting & Technology, Inc.
2200 Commonwealth Blvd., suite 300
Ann Arbor, Michigan 48105

ECT
Environmental Consulting & Technology, Inc.

2018109A

August 17, 2020 *(Revised September 11, 2020)*

Somat Engineering, INCORPORATED

Somat Engineering, INCORPORATED

September 11, 2020
2018109A

Ms. Alice Bailey, P.E.
Environmental Consulting & Technology, Inc. (ECT)
2200 Commonwealth Blvd., Suite 300
Ann Arbor, MI 48105

RE: Geotechnical Data Report
North and South Hennepin Marsh
Habitat Restoration
Grosse Ile Township, Michigan

Dear Ms. Bailey:

We have completed the geotechnical field investigation associated with the habitat restorations at Hennepin Marsh in Grosse Ile Township, Michigan. This report presents the data obtained from our field and laboratory investigation.

The geotechnical soil samples collected during our field investigation will be retained in our laboratory for 90 days after the date of this report, at which time these samples will be discarded unless otherwise directed by you.

It was a pleasure working with you on this project. If you have any questions regarding this report, please do not hesitate to contact us.

Sincerely,
Somat Engineering, Inc.

C.Weirauch

Catherine J. Weirauch, P.E.
Project Manager

Jonathan D. Zaremski, P.E.
Geotechnical Services Manager

CJW/JA/JDZ/nf

GEOTECHNICAL DATA REPORT
NORTH AND SOUTH HENNEPIN MARSH
HABITAT RESTORATION
GROSSE ILE TOWNSHIP, MICHIGAN

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GROSSE ILE TOWNSHIP, MICHIGAN

1.0 INTRODUCTION

1.1 GENERAL

Upon authorization from the Environmental Consulting & Technology, Inc. (ECT), Somat Engineering, Inc. (Somat) has conducted the geotechnical investigation for the proposed Hennepin Marsh habitat restoration project in Grosse Ile Township, Michigan. This geotechnical investigation was performed in accordance with SOMAT Proposal No. P180296R dated September 5, 2018 and revised February 4, 2020.

The following sections of this report provide our understanding of the project, a description of our field investigation, the results of the field and laboratory tests, and the logs of test borings obtained during our investigation.

1.2 PROJECT INFORMATION

The project consists of the habitat rehabilitation of the Trenton Channel at Hennepin Marsh. The marsh is located off the west shoreline of Grosse Ile. The north habitat is located north of Bridge Road, and the south habitat is located south of Bridge Road. The rehabilitation will consist of the design of shoals with the objective to restore the habitat that was once present. The shoals themselves will provide habitat, and will also create and protect back water habitat areas.

The south habitat includes existing protective shoals creating the marsh and submergent areas of the existing wetlands. The existing shoals exhibit erosion which is reducing their footprint and elevation, resulting in them becoming situated below the existing water level. The anticipated habitat restoration will include rebuilding the protective shoal islands, including erosion protection, and installation of habitat improvements.

The north habitat area restoration will include the creation of protective shoal islands for the area; including erosion protection, and installation of habitat improvements. We understand the

habitat improvements will include the shoals, as well as other design elements including standard riprap, habitat emergent, and tern habitat.

The geotechnical investigation is required to aid in design of the proposed shoal foundations, which will need to withstand the water current and ice flow. The geotechnical recommendations for the design are presented under a separate letter. This data report provides the results of our field investigation and laboratory testing.

2.0 SUBSURFACE INVESTIGATIONS

2.1 FIELD EXPLORATION

The field exploration program for the geotechnical investigation consisted of performing a total of four (4) soil borings from a barge in the Trenton Channel. The borings were located near the proposed shoal alignments. Three (3) soil borings are located at the north habitat area and one (1) located at the south habitat area. The soil borings were designated as B-01 through B-04. The soil borings extended to depths ranging between 30.5 and 45.5 feet below existing grade, as measured from the bottom of the channel.

The number, depth, and location of the soil borings were selected by Somat with input and approval from ECT. The field locations were determined by Somat, taking into consideration water depths and site access. The coordinates of the as drilled locations were estimated using a Trimble Geo7X GPS unit with an accuracy of about 1 meter±. The channel bottom elevations at the soil boring locations were estimated by Somat from the existing site topographic information provided to us by ECT. All elevations are based on the NAVD88 datum, unless specified otherwise. A soil boring location diagram is presented in Appendix A for reference. The Logs of Test Borings are presented in Appendix B.

2.1.1 Drilling Operations

The field operations for this investigation were performed on June 18 and 19, 2020. The drilling operations were conducted from a barge. Prior to drilling, the water depth at the soil boring location was noted. The soil borings were drilled using an ATV-mounted drill rig. The soil

borings were drilled by advancing hollow stem augers to the termination depths of the borings. Upon completion, the boreholes were backfilled with soil cuttings, using reverse augering procedures.

Note that during the field investigation, the logging was performed with respect to the top of the barge surface. The depths were adjusted to account for the thickness of the barge depth, and the measured depth of the water at the time of drilling; as such, the data is presented with respect to depth below the bottom of the channel. The adjustment factors are included in the "remarks" section on each log of test boring.

2.1.2 Standard Penetration Test (SPT)

Soil samples collected during the field portion of the subsoil exploration were labeled with the soil boring designation and a unique sample number. Soil samples were obtained from the soil borings by Standard Penetration Tests in general accordance with ASTM D-1586 procedures, whereby a conventional 2-inch O.D. split-spoon sampler is driven into the soil with a 140-pound hammer repeatedly dropped through a free-fall distance of 30 inches. The sampler is generally driven three successive 6-inch increments, with the blows for each 6-inch increment being recorded. The number of blows required to advance the sampler through 12 inches after an initial penetration of 6 inches is termed the Standard Penetration Test resistance (N-value) and is presented graphically on the individual Logs of Test Borings. As added information, the umber of blows for each 6-inch increment is also presented on the boring logs.

The N-values reported on the Logs of Test Borings are the direct blow counts from the field and are uncorrected. The efficiency of each specific hammer is dependent on many factors, including type (auto vs. manual), material quality, regularity of maintenance, drill rig mechanics, etc., and can change with time. As such, SPT hammers on each drill rig are required to be calibrated every two (2) years. Certificates are provided to us indication each hammer's measured energy transfer ratio. For this project, 7NT used a CME 550X ATV (serial number 365503) drill rig. Based on the current certificate for this drill rig, the energy transfer ratio for the SPT hammer on this rig is 91.9%.

2.1.3 Sampling

Soil boring samples were recovered using split-spoon sampling procedures in accordance with ASTM Standard D1586 ("Standard Method for Penetration Tests and Spit Barrel Sampling of Soils"). In general, the samples were obtained at a regular interval of 2½ feet to a depth of 20 feet and then at 5 feet intervals thereafter to the exploration depth of the borings.

All soil samples were transported to Somat's laboratory for further analysis and testing. The soil samples collected for this investigation will be retained in our laboratory for a period of ninety (90) days from the date of this report, after which they will be discarded unless we are notified otherwise.

2.1.4 Groundwater Level Observation Procedures

Groundwater level observations were made during the drilling operations and are shown on the individual Logs of Test Borings. During drilling, the depth at which free water was observed, where drill cuttings became saturated or where saturated samples were collected, was indicated as the groundwater level during drilling. For barge drilling operations, the depth of the water was measured from the free surface to the bottom of the river. Since the measured water level is above the bottom of the channel, the depth is presented on the log as a negative value.

It should be noted that seasonal variations and recent precipitation condition may influence the level of the groundwater table significantly. Groundwater observations wells are generally used if precise groundwater table information is needed, however the installation of groundwater monitoring wells was not included in the scope of the investigation. Therefore, the discussion and recommendations provided withing the report are based on our knowledge of the soil and groundwater conditions in this area, which should provide for a reasonable approximation of the groundwater level.

2.2 LABORATORY TESTING

Soil samples were classified in accordance with the Unified Soil Classification System (USCS). Representative soil samples were subjected to laboratory tests consisting of moisture content determinations, hand penetrometer tests, laboratory torvane tests, unconfined compressive strength tests, and Organic content determinations. Select samples were tested for grain size analysis to aid with classification of the material. The laboratory tests were performed in accordance with their applicable ASTM procedures.

Samples were sealed in the field to retain the natural moisture content of the soil specimen. Moisture content determination tests were performed on cohesive samples in accordance with ASTM D2216.

Standard tests methods for unconfined compressive strength of cohesive soil were performed in accordance with ASTM D2166 on selected cohesive samples from the soil borings. The unconfined compression test consists of axially loading a small cylindrical soil sample at a slow rate of strain, until failure occurs. Failure is defined as the maximum stress level in the soil sample or the stress level at 15 percent strain, whichever is less.

Estimation of unconfined compressive strength on remaining cohesive samples was obtained by performing either a hand penetrometer test or a Torvane shear test. In the hand penetrometer test, the shear strength of a cohesive soil sample is estimated by measuring the resistance of the sample to the penetration of a small, calibrated spring-loaded cylinder. The maximum capacity of the penetrometer is 4.5 tons per square foot. In the Torvane shear test, the shear strength of a cohesive soil sample is estimated in the laboratory by measuring the resistance of the sample in shear when twisting a small, calibrated spring-loaded vane pressed into the sample.

Standard Test Methods of Loss on Ignition (LOI) of Solid Combustion Residues were performed according to ASTM D7348 on soil samples suspected to contain organics. The soil sample is

super-heated as a means to burn off all present organic matter and the percentage of organic matter is then calculated.

Grain size and hydrometer analysis were performed in general accordance to ASTM D422 (2007) in order to determine the distribution of grain sizes within a soil sample to aid with classification of the material. Grain size and hydrometer analyses were performed on two (2) samples obtained from boring B-01 at a depth of 4 and 19 feet below the channel bed.

The results of these tests are shown on the respective logs of test borings in Appendix B. Graphical results of the grain size analyses and unconfined compressive strength tests are presented in Appendix C.

2.3 LIMITATIONS

The scope of our services was strictly geotechnical and did not include any environmental assessment or investigation for the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater or air, on, below or around this site. Any statement in this report or on the boring logs regarding odors, colors, unusual or suspicious contents or conditions are strictly for informational purposes.

3.0 SUBSURFACE CONDITIONS

3.1 SOIL STRATIFICATION

Soil conditions encountered at the boring locations have been evaluated and are presented in the form of Logs of Test Borings. The Logs of Test Borings presented in Appendix B include approximate soil stratification with detailed soil descriptions and selected physical properties for each stratum encountered in the test borings. In addition to the observed subsoil stratigraphy, the Logs of Test Borings present information relating to sample data, Standard Penetration Test results, groundwater conditions observed in the boring, personnel involved, and other pertinent data. For information, and to aid in understanding the data as presented on the boring logs, general Notes defining nomenclature used in soil descriptions are presented immediately

following the logs in Appendix B. It should be noted that the Logs of Test Borings included with this report have been prepared on the basis of laboratory classifications and testing as well as field logs of the soils encountered.

A generalized description of the soils encountered in the soil borings performed for the Hennepin Marsh habitats investigation, beginning at the existing ground surface at the channel bottom (referred to as "grade") and proceeding downward, is provided below:

Stratum 1: Unknown material / Weight of Augers
Upon lowering the augers into the Trenton Channel, the weight of the augers sunk into the materials at the bottom of the channel and/or displaced the material. The depth was measured ranging from 1 to 2 feet, as such no samples could be collected for verification of surface material. This was reported at all boring locations.

Stratum 2: Muck/Peat
Muck consisting of amorphous peat was encountered below the soft material at B-04 and extended to a depth of 3 feet (EL. 566 feet±) below grade. The organic content based on laboratory testing at a depth of 3 feet indicated 42.4%.

Stratum 2: Silt/Clay
A mixture of silt and clay (possibly river sediment) was encountered below the unknown surficial material in boring B-01 and below the peat layer in boring B-04. The apparent density of the silt was very loose. A Loss-On-Ignition (LOI) test performed on a sample of this silt and clay mixture at a depth of about 3 feet and 6 feet below grade in borings B-01 and B-04 indicated an organic content of 2.5% and 3.7%, respectively. The silt and clay mixture extended to depths ranging between 7 and 9.5 feet (EL. 559.5 – 562 feet±) below grade.

Stratum 3: Sand
Native fine to medium sand with silt was encountered below the silt/clay in B-01. The sand extended to a depth of 25 feet (EL. 544 feet±) below existing grade. The apparent density of the sand ranged from very loose to medium dense.

Stratum 4: Clay
Native lean clay was encountered in all of the soil borings below the native sand, silt/clay mixture, or below the unknown surficial material. The native clay soils extended to the exploration depths of the soil borings at depths of 30.5 and 45.5 feet below existing grade. The consistency of the clay ranged from very soft to hard and the moisture content of the clay samples ranged between 14 and 26%. At boring B-01, limestone pieces were observed in the clay in the sample obtained at a depth of 45.5 feet (EL. 523.5 feet±) below grade.

Stratum 5: Refusal/Hard Drilling
Boring B-02 and B-03 terminated at hard drilling stratum, indicating possible/apparent top of rock or hardpan at depths of 37 feet and 38.5 feet (EL. 528.5 to 529 feet±), respectively.

Please refer to the boring logs for the soil conditions at the specific boring locations. It is emphasized that the stratification lines shown on the Logs of Test Borings are approximate indications of change from one soil type to another at the location of the boreholes. The actual transition from one stratum to the next may be gradual and may vary within the area represented by the test boring.

3.2 GROUNDWATER LEVEL OBSERVATIONS

The water depth of the Trenton Channel observed at the soil boring locations during the fieldwork operations ranged from 6 to 9 feet below water surface. Water elevations recorded on the days of the fieldwork as reported by the NOAA water level Station #09044020 at Gibraltar, Michigan indicated water levels ranging from 574.6 to 575.1 feet IGLD and levels of 575.9 it 576.1 feet IGLD as reported at Station #9044030 at Wyandotte, Michigan.

It should be noted that the elevation of the Trenton channel water level and groundwater table is likely to vary throughout the year depending on the amount of precipitation, runoff, evaporation and percolation in the area, as well as on the water level, tide and currents of the Trenton Channel and Detroit River within the vicinity of the project area affecting the groundwater levels and flow pattern.

4.0 GENERAL QUALIFICATIONS

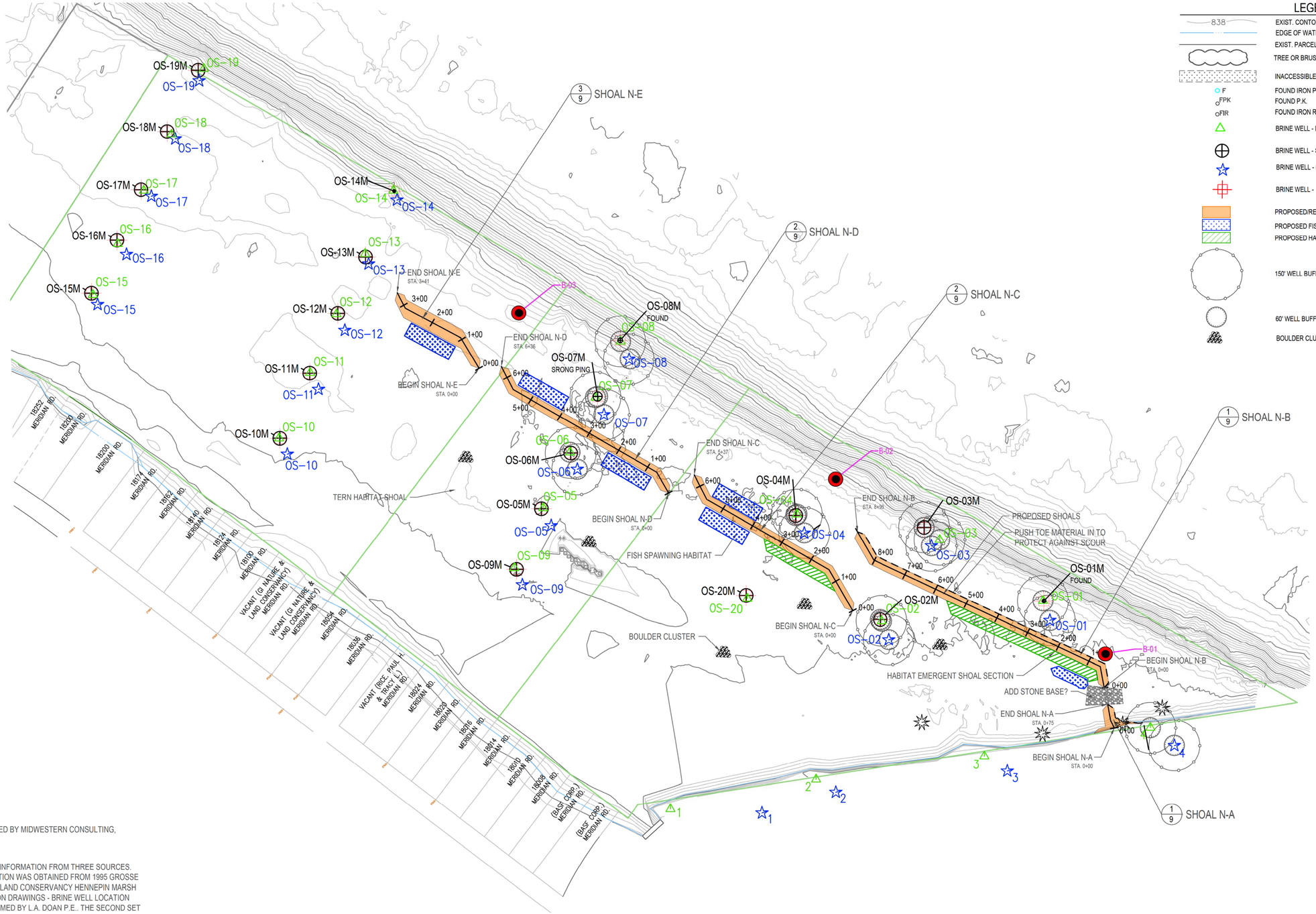
This report and the attached Logs of Test Borings are instruments of service, which have been prepared in accordance with generally accepted soil and foundation engineering practices. We make no other warranties either expressed or implied as to the information presented in this report.

Since the information obtained from the test borings is specific to the *exact* test boring locations, soil and water depth information could be different from those occurring at other locations of the site. This report does not reflect variations which may occur between the borings. The nature and extent of these variations may not become evident until the time of construction.

This report and the associated soil boring logs should be made available to bidders prior to submitting their proposals and to the successful contractor and subcontractors for their information only, and to supply them with facts relative to the subsurface investigation, laboratory tests, etc. Please refer to Appendix D for important information about the geotechnical investigation report. If you have any questions regarding this report, please contact us.

APPENDIX A

SOIL BORING LOCATION DIAGRAMS



LEGEND

- EXIST. CONTOUR
- EDGE OF WATER (ON DATE OF FIELD WORK)
- EXIST. PARCEL BOUNDARY
- TREE OR BRUSH LIMIT
- INACCESSIBLE MARSH LAND
- FOUND IRON PIPE
- FOUND P.K.
- FOUND IRON ROD
- BRINE WELL - MAP PLACEMENT
- BRINE WELL - SEAWORKS MAGNETOMETER COORDINATES (APRIL 2020)
- BRINE WELL - MDEQ COORDINATES PLACEMENT
- BRINE WELL - INITIAL FIELD INVESTIGATION (SEPT. 2019)
- PROPOSED/RESTORED SHOAL
- PROPOSED FISH SPAWNING HABITAT
- PROPOSED HABITAT EMERGENT SHOAL SECTION
- 150' WELL BUFFER
- 60' WELL BUFFER
- BOULDER CLUSTER

SURVEY PROVIDED BY MIDWESTERN CONSULTING, NOVEMBER 2018

WELL LOCATION INFORMATION FROM THREE SOURCES. INITIAL INFORMATION WAS OBTAINED FROM 1995 GROSSE ILE NATURE AND LAND CONSERVANCY HENNEPIN MARSH RECONSTRUCTION DRAWINGS - BRINE WELL LOCATION SURVEY PERFORMED BY L.A. DOAN P.E.. THE SECOND SET OF WELL LOCATION WAS OBTAINED FROM EGLE RECORDS. THE THIRD SET OF WELL LOCATION DATA WAS OBTAINED THROUGH FIELD INVESTIGATION BY SEAWORKS. ALL THREE DATA SETS ARE SHOWN IN THE PLANS.

WELL LOCATIONS TO BE FIELD VERIFIED BY CONTRACTOR PRIOR TO START OF CONSTRUCTION AND ANY DISTURBANCES TO BE AVOIDED.

LEGEND:

- APPROXIMATE LOCATION OF SOIL BORINGS (B-01 TO B-03)

SOIL BORING LOCATION DIAGRAM ADAPTED FROM EXISTING "PROPOSED CONDITIONS- NORTH" DRAWING PROVIDED BY ECT.

SOIL BORING LOCATION DIAGRAM
NORTH AND SOUTH HENNEPIN MARSH
HABITAT RESTORATION PROJECT
GROSSE ILE TOWNSHIP, MICHIGAN

2018109A AUGUST 25, 2020

2200 Commonwealth Blvd, Suite 300
Ann Arbor, Michigan 48105
734.769.3004
734.769.3164 fax
www.ectinc.com

Herpetological Resource and Management

DETROIT RIVER AOC- HENNEPIN MARSH HABITAT RESTORATION PROJECT

FRIENDS OF THE DETROIT RIVER

WAYNE COUNTY, MICHIGAN

DRAFT	06-2020
DRAFT	05-2020
DRAFT	04-2020
DRAFT	01-2020
PRELIMINARY	01-25-19

180641
ECT PROJECT NUMBER

DESIGNED BY	CHECKED BY
AB/SR	JO
DRAWN BY	APPROVED BY
SR	JO

SHEET TITLE

PROPOSED CONDITIONS - NORTH

SCALE: 1" = 150' @ 22" x 34"

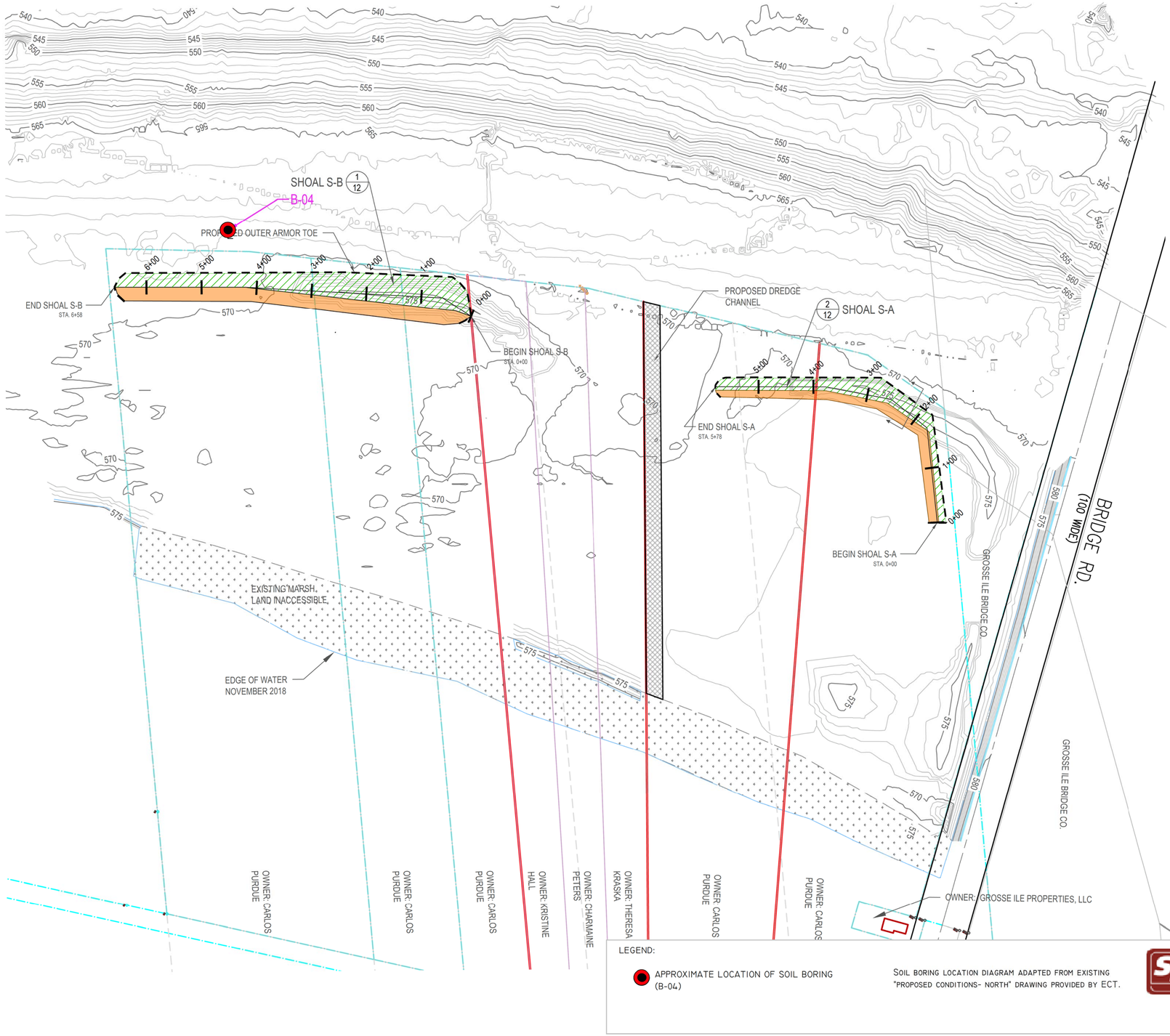
0 75' 150' 300'

NORTH

SHEET NUMBER 8

P:\Friends of Detroit River -Hennepin\CAD\Hennepin.dwg

SURVEY PROVIDED BY MIDWESTERN CONSULTING,
NOVEMBER 2018



LEGEND

- EXIST. CONTOUR
- EDGE OF WATER (ON DATE OF FIELD WORK)
- EXIST. WATER MAIN
- EXIST. PARCEL BOUNDARY
- TREE OR BRUSH LIMIT
- INACCESSIBLE MARSH LAND
- FOUND IRON PIPE
- FOUND P.K.
- FOUND IRON ROD
- PROPOSED/RESTORED SHOAL
- PROPOSED DREDGE CHANNEL
- PROPOSED HABITAT EMERGENT SHOAL SECTION

LEGEND:

- APPROXIMATE LOCATION OF SOIL BORING (B-04)

SOIL BORING LOCATION DIAGRAM ADAPTED FROM EXISTING "PROPOSED CONDITIONS- NORTH" DRAWING PROVIDED BY ECT.

SOIL BORING LOCATION DIAGRAM
NORTH AND SOUTH HENNEPIN MARSH
HABITAT RESTORATION PROJECT
GROSSE ILE TOWNSHIP, MICHIGAN

2018109A AUGUST 25, 2020

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Herpetological Resource and Management

DETROIT RIVER AOC- HENNEPIN MARSH HABITAT RESTORATION PROJECT

FRIENDS OF THE DETROIT RIVER

WAYNE COUNTY, MICHIGAN

DRAFT	06-2020
DRAFT	05-2020
DRAFT	04-2020
DRAFT	01-2020
PRELIMINARY	01-25-19

180641
ECT PROJECT NUMBER

DESIGNED BY	CHECKED BY
AB/SR	JQ

DRAWN BY	APPROVED BY
SR	JQ

SHEET TITLE

PROPOSED CONDITIONS - SOUTH

SCALE: 1" = 100' @ 22" x 34"
0 50' 100' 200'

NORTH

SHEET NUMBER
11

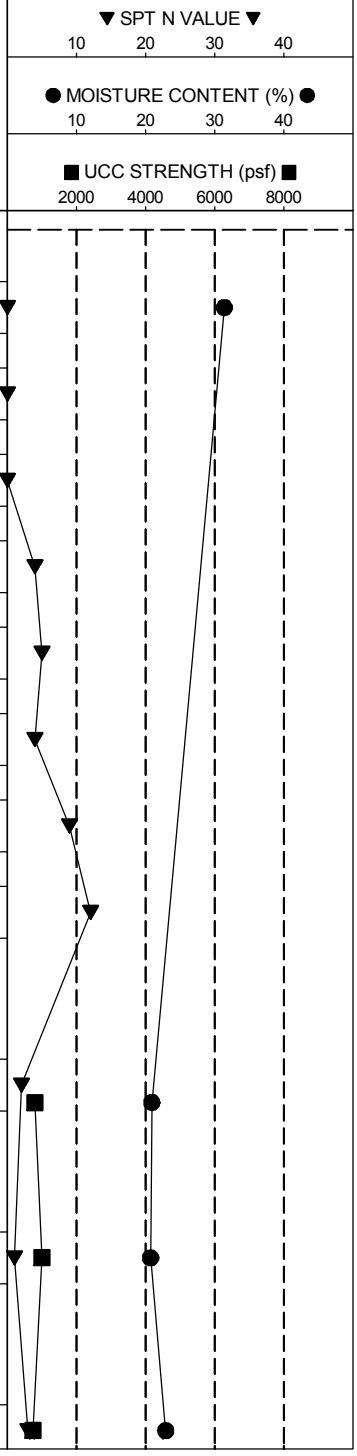
P:\Friends of Detroit River -Hennepin\CAD\Hennepin.dwg

APPENDIX B

LOGS OF TEST BORINGS AND GENERAL NOTES

PROJECT NO. 2018109A **DATE STARTED:** 6/19/2020 **DATE COMPLETED:** 6/19/2020 **LOG OF TEST BORING B-01**

ELEVATION ft	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	SAMPLE RECOVERY (in)	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT	PLASTICITY INDEX	% PASSING #200
	Ground Surface Elevation 569 ft	0											
567.5	(weight of augers) 1.5												
	Very loose SILT with sand/CLAY with sand, trace orgranics, trace roots, gray, wet (ML)/(CL) (River Sediment)		SS1	16	0-0-0	0	3.0		31.4				
	(Organic Content at 3 ft. = 2.5%)	5	SS2	18	0-0-0	0	5.5						77
			SS3	18	0-0-0	0	8.0						
559.5	9.5												
	Very loose to loose poorly graded FINE SAND with silt, trace gravel, gray, wet (SP-SM)	10	SS4	18	0-2-2	4	10.5						
			SS5	18	2-2-3	5	13.0						
555.0	NOTE: Sample at 13 ft. contained small pockets of white mucky substance 14.0												
		15	SS6	18	3-2-2	4	15.5						
			SS7	18	4-5-4	9	18.0						
	Very loose to medium dense well graded FINE TO MEDIUM SAND with silt, trace gravel, gray, wet (SW-SM)	20	SS8	18	5-5-7	12	20.5						12
544.0	25.0	25	SS9	18	1-1-1	2	25.5	800#	20.9				
	Soft to stiff LEAN CLAY, few sand, trace gravel, limestone pieces at 45.5 ft.	30	SS10	18	0-0-1	1	30.5	1000#	20.7				
		35	SS11	18	1-1-2	3	35.5	740	22.9	108			



GROUNDWATER READINGS
First Encountered: -6 feet
Upon Completion: n/a

BORING LOCATION INFORMATION
Northing: 251915.4
Easting: 13452911.0

Coordinates/GSE determined by:
Estimated with GPS/Existing Drawing

KEY
Torvane
* Penetrometer
<> Disturbed Sample

Drilling Company: 7NT
Drill Rig: CME 550X (Rig 365503)
Logged By: R. Calkins
Drilling Method: 3 1/4 inch HSA
Method Notes: Drilling from barge
Hammer Type: Automatic
Backfilled With: Cuttings/hole collapse
Checked By: ALOG
QA/QC By: CJW
Remarks:
Field logged with respect to top of barge deck, adjusted by -16 feet for reporting with respect to depth below river bottom.
Depth of water above river bottom measured at 6 ft. at time of drilling.

Somat Engineering

North and South Hennepin Marsh Habitat Restoration Project
Grosse Ile Township, Michigan

8/17/20

LOG OF TEST BORING HENNEPIN MARSH HABITAT RESTORATION.GPJ SOMAT.GDT 8/17/20

PROJECT NO. 2018109A **DATE STARTED:** 6/19/2020 **DATE COMPLETED:** 6/19/2020 **LOG OF TEST BORING B-01**

LOG OF SOIL PROFILE				FIELD DATA						LABORATORY DATA						
ELEVATION ft			DEPTH (ft)	SAMPLE NO.	SAMPLE RECOVERY (in)	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT	PLASTICITY INDEX	% PASSING #200	▼ SPT N VALUE ▼ 10 20 30 40 ● MOISTURE CONTENT (%) ● 10 20 30 40 ■ UCC STRENGTH (psf) ■ 2000 4000 6000 8000
		Ground Surface Elevation 569 ft	35												
		Soft to stiff LEAN CLAY, few sand, trace gravel, limestone pieces at 45.5 ft.	40	SS12	18	4-4-4	8	40.5	<>	15.2					
523.5			45	SS13		5-6-113	119	45.5	2000*	16.5					>>▼
		45.5 End of Boring at 45.5 feet (Boring terminated due to observation of limestone pieces in splitspoon sampler)	50												
			55												
			60												
			65												
			70												

GROUNDWATER READINGS
First Encountered: -6 feet
Upon Completion: n/a

BORING LOCATION INFORMATION
Northing: 251915.4
Easting: 13452911.0

Coordinates/GSE determined by:
Estimated with GPS/Existing Drawing

KEY
Torvane
* Penetrometer
<> Disturbed Sample

Drilling Company: 7NT
Drill Rig: CME 550X (Rig 365503)
Logged By: R. Calkins
Drilling Method: 3 1/4 inch HSA
Method Notes: Drilling from barge
Hammer Type: Automatic
Backfilled With: Cuttings/hole collapse
Checked By: ALOG
QA/QC By: CJW
Remarks:
Field logged with respect to top of barge deck, adjusted by -16 feet for reporting with respect to depth below river bottom.
Depth of water above river bottom measured at 6 ft. at time of drilling.

Somat Engineering

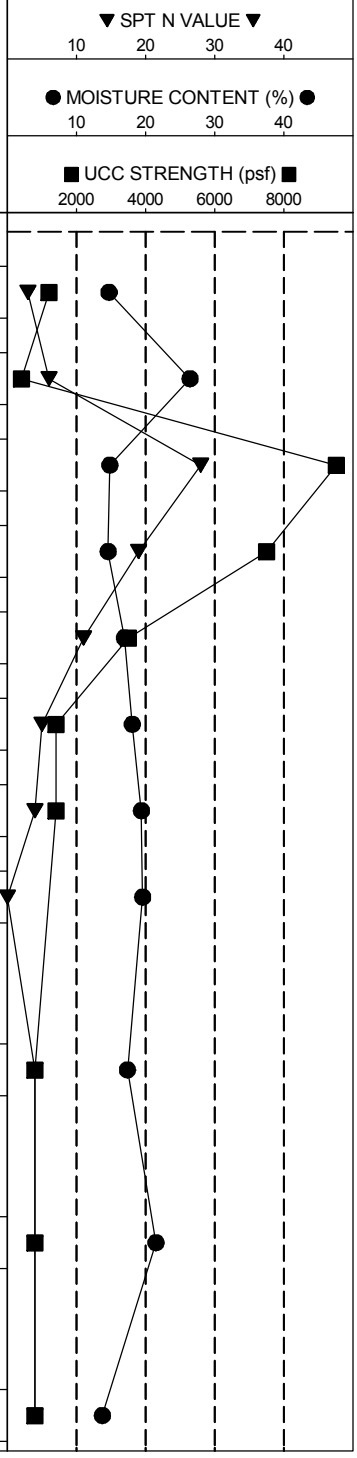
North and South Hennepin Marsh Habitat Restoration Project
Grosse Ile Township, Michigan

8/17/20

LOG OF TEST BORING HENNEPIN MARSH HABITAT RESTORATION.GPJ SOMAT.GDT 8/17/20

PROJECT NO. 2018109A **DATE STARTED:** 6/19/2020 **DATE COMPLETED:** 6/19/2020 **LOG OF TEST BORING B-02**

ELEVATION ft	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	SAMPLE RECOVERY (in)	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT	PLASTICITY INDEX	% PASSING #200
	Ground Surface Elevation 566 ft	0											
565.0	(weight of augers) 1.0												
	Medium to very soft LEAN CLAY, few sand, trace gravel, occasional brown fine sand, pockets, gray (CL)		SS1	13	1-1-2	3	2.5	1200#	14.7				
			SS2	18	1-2-4	6	5.0	400#	26.4				
560.0	6.0	5											
	Hard to stiff LEAN CLAY, few sand, trace gravel, brown-gray to gray (CL)		SS3	18	8-11-17	28	7.5	9520	14.8	122			
			SS4	18	6-8-11	19	10.0	7500*	14.6				
		10											
			SS5	18	4-5-6	11	12.5	3500*	16.9				
552.5	13.5												
	Medium to soft LEAN CLAY, few sand, trace gravel, gray (CL)		SS6	18	2-2-3	5	15.0	1400#	18.1				
		15											
			SS7	18	2-2-2	4	17.5	1400#	19.4				
			SS8	18	0-0-0	0	20.0	<>	19.6				
		20											
			SS9	18	3-2-2	4	25.0	800#	17.4				
		25											
			SS10	18	2-2-2	4	30.0	800#	21.5				
535.0	31.0	30											
	Soft LEAN CLAY with sand, trace gravel, gray (CL)		SS11	18	0-1-3	4	35.0	800#	13.7				
		35											



GROUNDWATER READINGS
First Encountered: -9 feet
Upon Completion: n/a

BORING LOCATION INFORMATION
Northing: 251125.0
Easting: 13452395.2

Coordinates/GSE determined by:
Estimated with GPS/Existing Drawing

KEY
Torvane
* Penetrometer
<> Disturbed Sample

Drilling Company: 7NT
Drill Rig: CME 550X (Rig 365503)
Logged By: R. Calkins
Drilling Method: 3 1/4 inch HSA
Method Notes: Drilling from barge
Hammer Type: Automatic
Backfilled With: Cuttings/hole collapse
Checked By: ALOG
QA/QC By: CJW
Remarks:
Field logged with respect to top of barge deck, adjusted by -19 feet for reporting with respect to depth below river bottom.
Depth of water above river bottom measured at 9 ft. at time of drilling.

Somat Engineering

North and South Hennepin Marsh Habitat Restoration Project
Grosse Ile Township, Michigan

8/17/20

LOG OF TEST BORING HENNEPIN MARSH HABITAT RESTORATION.GPJ SOMAT.GDT 8/17/20

PROJECT NO. 2018109A **DATE STARTED:** 6/19/2020 **DATE COMPLETED:** 6/19/2020 **LOG OF TEST BORING B-02**

ELEVATION ft	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	SAMPLE RECOVERY (in)	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT	PLASTICITY INDEX	% PASSING #200
	Ground Surface Elevation 566 ft	35											
529.0	Soft LEAN CLAY with sand, trace gravel, gray (CL) 37.0												
	End of Boring at 37 feet (Boring terminated at hard drilling, possible top of bedrock or hardpan)	40											
		45											
		50											
		55											
		60											
		65											
		70											

▼ SPT N VALUE ▼ 10 20 30 40

● MOISTURE CONTENT (%) ● 10 20 30 40

■ UCC STRENGTH (psf) ■ 2000 4000 6000 8000

GROUNDWATER READINGS
First Encountered: -9 feet
Upon Completion: n/a

BORING LOCATION INFORMATION
Northing: 251125.0
Easting: 13452395.2

Coordinates/GSE determined by:
Estimated with GPS/Existing Drawing

KEY
Torvane
* Penetrometer
<> Disturbed Sample

Drilling Company: 7NT
Drill Rig: CME 550X (Rig 365503)
Logged By: R. Calkins
Drilling Method: 3 1/4 inch HSA
Method Notes: Drilling from barge
Hammer Type: Automatic
Backfilled With: Cuttings/hole collapse
Checked By: ALOG
QA/QC By: CJW
Remarks:
Field logged with respect to top of barge deck, adjusted by -19 feet for reporting with respect to depth below river bottom.
Depth of water above river bottom measured at 9 ft. at time of drilling.

Somat Engineering

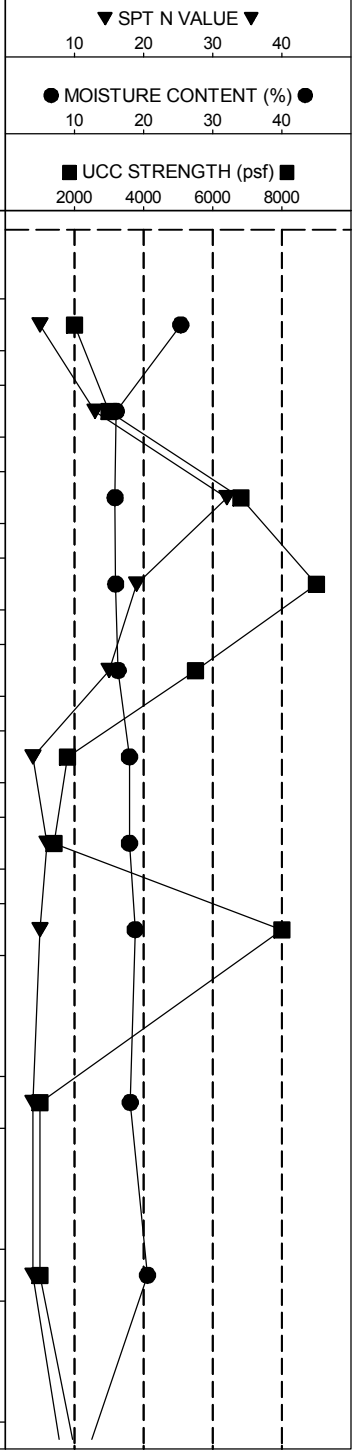
North and South Hennepin Marsh Habitat Restoration Project
Grosse Ile Township, Michigan

8/17/20

LOG OF TEST BORING HENNEPIN MARSH HABITAT RESTORATION.GPJ SOMAT.GDT 8/17/20

PROJECT NO. 2018109A **DATE STARTED:** 6/18/2020 **DATE COMPLETED:** 6/18/2020 **LOG OF TEST BORING B-03**

ELEVATION ft	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	SAMPLE RECOVERY (in)	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT	PLASTICITY INDEX	% PASSING #200
	Ground Surface Elevation 567 ft	0											
565.0	(weight of augers) 2.0												
563.5	Stiff LEAN CLAY, trace roots, trace sand, trace gravel, gray (CL) 3.5		SS1	18	3-2-3	5	3.5	2000*	25.4				
		5	SS2	18	4-5-8	13	6.0	3000*	16.0				
	Stiff to hard LEAN CLAY, few sand, trace gravel, mottled brown and gray and brown (CL)		SS3	18	11-15-17	32	8.5	6820	15.9	120			
		10	SS4	18	7-8-11	19	11.0	9000+*	16.0				
555.0	12.0												
	Very stiff LEAN CLAY, few sand, trace gravel, occasional fine sand partings, brown-gray (CL)		SS5	18	6-7-8	15	13.5	5500*	16.3				
552.5	14.5	15	SS6	18	0-1-3	4	16.0	1800#	17.9				
			SS7	18	2-3-3	6	18.5	1400#	17.9				
	Medium to soft LEAN CLAY, few sand, trace gravel, gray (CL)	20	SS8	18	1-2-3	5	21.0	800#	18.8				
542.5	24.5												
	Medium to stiff LEAN CLAY, few sand, trace gravel, gray (CL)	25	SS9	18	2-2-2	4	26.0	1000#	18.1				
		30	SS10	18	2-2-2	4	31.0	1000#	20.5				
		35											



GROUNDWATER READINGS
First Encountered: -8 feet
Upon Completion: n/a

BORING LOCATION INFORMATION
Northing: 250187.2
Easting: 13451904.6

Coordinates/GSE determined by:
Estimated with GPS/Existing Drawing

KEY
Torvane
* Penetrometer
<> Disturbed Sample

Drilling Company: 7NT
Drill Rig: CME 550X (Rig 365503)
Logged By: R. Calkins
Drilling Method: 3 1/4 inch HSA
Method Notes: Drilling from barge
Hammer Type: Automatic
Backfilled With: Cuttings/hole collapse
Checked By: ALOG
QA/QC By: CJW
Remarks:
Field logged with respect to top of barge deck, adjusted by -18 feet for reporting with respect to depth below river bottom.
Depth of water above river bottom measured at 8 ft. at time of drilling.

Somat Engineering

North and South Hennepin Marsh Habitat Restoration Project
Grosse Ile Township, Michigan

8/17/20

LOG OF TEST BORING HENNEPIN MARSH HABITAT RESTORATION.GPJ SOMAT.GDT 8/17/20

PROJECT NO. 2018109A **DATE STARTED:** 6/18/2020 **DATE COMPLETED:** 6/18/2020 **LOG OF TEST BORING B-03**

ELEVATION ft	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	SAMPLE RECOVERY (in)	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT	PLASTICITY INDEX	% PASSING #200
	Ground Surface Elevation 567 ft	35	SS11	18	3-3-5	8	36.0	2000*	12.0				
528.5	Medium to stiff LEAN CLAY, few sand, trace gravel, gray (CL) 38.5												
	End of Boring at 38.5 feet (Boring terminated at hard drilling, possible top of bedrock or hardpan)	40											
		45											
		50											
		55											
		60											
		65											
		70											

▼ SPT N VALUE ▼ 10 20 30 40

● MOISTURE CONTENT (%) ● 10 20 30 40

■ UCC STRENGTH (psf) ■ 2000 4000 6000 8000

GROUNDWATER READINGS
First Encountered: -8 feet
Upon Completion: n/a

BORING LOCATION INFORMATION
Northing: 250187.2
Easting: 13451904.6

Coordinates/GSE determined by:
Estimated with GPS/Existing Drawing

KEY
Torvane
* Penetrometer
<> Disturbed Sample

Drilling Company: 7NT
Drill Rig: CME 550X (Rig 365503)
Logged By: R. Calkins
Drilling Method: 3 1/4 inch HSA
Method Notes: Drilling from barge
Hammer Type: Automatic
Backfilled With: Cuttings/hole collapse
Checked By: ALOG
QA/QC By: CJW
Remarks:
Field logged with respect to top of barge deck, adjusted by -18 feet for reporting with respect to depth below river bottom.
Depth of water above river bottom measured at 8 ft. at time of drilling.

Somat Engineering

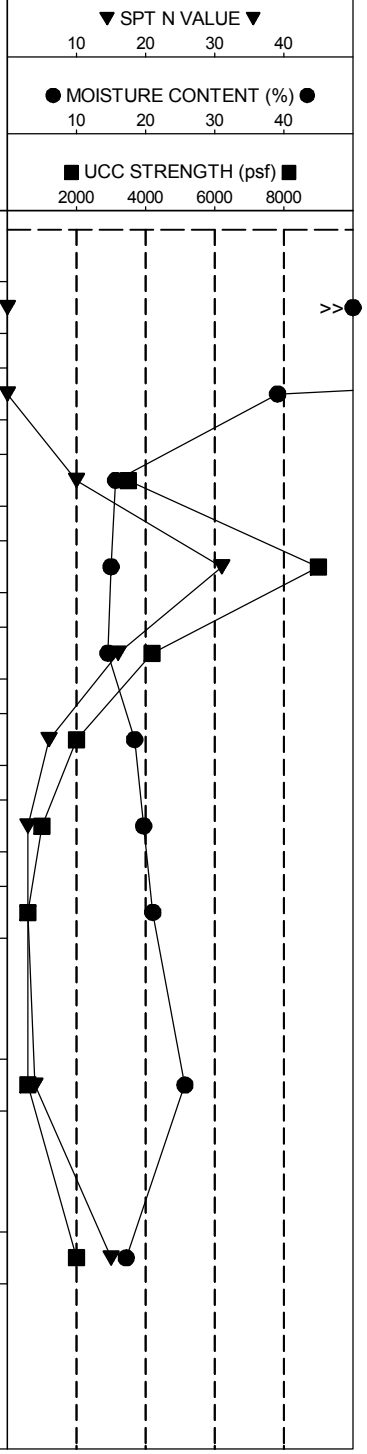
North and South Hennepin Marsh Habitat Restoration Project
Grosse Ile Township, Michigan

8/17/20

LOG OF TEST BORING HENNEPIN MARSH HABITAT RESTORATION.GPJ SOMAT.GDT 8/17/20

PROJECT NO. 2018109A **DATE STARTED:** 6/18/2020 **DATE COMPLETED:** 6/18/2020 **LOG OF TEST BORING B-04**

ELEVATION ft	LOG OF SOIL PROFILE	DEPTH (ft)	SAMPLE NO.	SAMPLE RECOVERY (in)	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT	PLASTICITY INDEX	% PASSING #200
	Ground Surface Elevation 569 ft	0											
567.5	(weight of augers) 1.5												
566.0	Muck - amorphous PEAT, black (Pt) 3.0		SS1	15	0-0-0	0	3.0		309.3				
	(Organic Content at 3 ft. = 42.4%)	5	SS2	16	0-0-0	0	5.5		39.1				
562.0	SILT/CLAY with sand, trace organics, trace roots, gray (ML)/(CL) (River Sediment) 7.0		SS3	18	0-4-6	10	8.0	3500*	15.7				
	(Organic Content at 6 ft. = 3.7%) Stiff to hard LEAN CLAY, few sand, trace gravel, gray with layers of brown (CL)	10	SS4	18	10-15-16	31	10.5	9000+*	15.0				
557.5	11.5		SS5	18	6-7-9	16	13.0	4180	14.5	123			
		15	SS6	18	3-3-3	6	15.5	2000*	18.4				
			SS7	18	0-0-3	3	18.0	1000#	19.7				
	Very stiff to soft LEAN CLAY, few sand, trace gravel, gray (CL)	20	SS8	18	0-1-2	3	20.5	600#	21.0				
		25	SS9	18	2-2-2	4	25.5	600#	25.7				
540.0	29.0												
538.5	Stiff LEAN CLAY, few sand, few gravel, gray (CL) 30.5	30	SS10	18	3-7-8	15	30.5	2000*	17.2				
	Field engineer reported black sand seam at bottom of sample.												
	End of Boring at 30.5 feet	35											



GROUNDWATER READINGS
First Encountered: -6 feet
Upon Completion: n/a

BORING LOCATION INFORMATION
Northing: 246030.7
Easting: 13450159.2

Coordinates/GSE determined by:
Estimated with GPS/Existing Drawing

KEY
Torvane
* Penetrometer
<> Disturbed Sample

Drilling Company: 7NT
Drill Rig: CME 550X (Rig 365503)
Logged By: R. Calkins
Drilling Method: 3 1/4 inch HSA
Method Notes: Drilling from barge
Hammer Type: Automatic
Backfilled With: Cuttings/hole collapse
Checked By: ALOG
QA/QC By: CJW
Remarks:
Field logged with respect to top of barge deck, adjusted by -16 feet for reporting with respect to depth below river bottom.
Depth of water above river bottom measured at 6 ft. at time of drilling.

Somat Engineering

North and South Hennepin Marsh Habitat Restoration Project
Grosse Ile Township, Michigan

8/17/20

LOG OF TEST BORING HENNEPIN MARSH HABITAT RESTORATION.GPJ SOMAT.GDT 8/17/20

GENERAL NOTES

Unified Soil Classification System (USCS)
ASTM D2488 (Modified)

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon – 1 3/8" I.D., 2" O.D. (standard)
S :	Split Spoon – non-standard size, as noted
ST:	Thin-Walled Tube – 3" O.D., (unless otherwise noted)
LS:	Liner Sample
PA:	Power Auger
HA:	Hand Auger
AU:	Auger Sample
BS:	Bulk Sample
HSA:	Hollow Stem Auger
DP:	Direct Push
PS:	Piston Sample
PT:	Pitcher Sample
WS:	Wash Sample
RC:	Rock Core with diamond bit, NX size, (unless otherwise noted)
RB:	Rock Bit/Roller Bit
WR:	Wash Rotary
NR:	No Recovery
VS:	Vane Shear Test

Standard Penetration Test Resistance, N-Value: Sum of 2nd and 3rd 6-inch increments, in blows per foot of a 140-pound hammer falling 30 inches and driving an 18-inch to 30-inch long, 2-inch OD split spoon.

WATER LEVEL MEASUREMENT:
Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. In pervious soils, the indicated levels may reflect the location of a groundwater table. In low permeability soils (clays and silts), the accurate determination of groundwater levels may not be possible with only short-term observations. Groundwater levels at times and locations other than when and where individual borings were performed could vary.

DESCRIPTIVE SOIL CLASSIFICATION:
Soil classification is based on the Unified Soil Classification (USC) System and ASTM Standards D-2487 and D-2488. Coarse-grained soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: gravel or sand. Fine-grained soils have less than 50% of their dry weight retained on a #200 sieve; they are generally described as: clays, if they are plastic, and silts, if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their apparent in-place density and fine-grained soils on the basis of their apparent in-place density (silty soils) or consistency (clayey soils).

DESCRIPTORS OF MINOR CONSTITUENTS

Primary Constituent	Fine-Grained (Silt & Clay)	Coarse-Grained (Sand & Gravel)	
Descriptor of Other Constituents	Relative Portion of Coarse Grained Soils as a % of Dry Weight	Relative Portion of Fine Grained Soils as a % of Dry Weight	Relative Portion of Coarse Grained Soils as a % of Dry Weight
Trace	<5%	<5%	<5%
Few	≥5% - <15%	N/A	≥5% - <15%
With	≥15% - <30%	≥5% - 12%	≥15%
Modifier	≥30%	>12%	N/A

FINE-GRAINED SOILS **COARSE-GRAINED SOILS**

Unconfined Compressive Strength Qu, psf	Consistency	N-Value	Apparent Density
< 500	Very Soft	0 – 4	Very Loose
500 - <1,000	Soft	5 – 9	Loose
1,000 - <2,000	Medium	10 – 29	Medium Dense
2,000 - <4,000	Stiff	30 – 49	Dense
4,000 - <8,000	Very Stiff	50 – 80	Very Dense
≥ 8,000	Hard	>80	Extremely Dense

DEFINITIONS OF PAVEMENT CONDITION

Condition		Description
Good	ACC	Very slight or no raveling, surface shows some traffic wear. Longitudinal cracks and Transverse cracks (open ¼ inch). No patching or very few patches in excellent condition.
	PCC	Moderate scaling in several locations. A few isolated surface spalls. Shallow reinforcement causing cracks. Several corner cracks, tight or well sealed. Open (¼ inch wide) longitudinal or transverse joints.
Fair	ACC	Severe surface raveling. Multiple longitudinal and transverse cracking with slight raveling. Longitudinal cracking in wheel path. Block cracking (over 50% of surface). Patching in fair condition. Slight rutting or distortions (½ inch deep or less).
	PCC	Severe polishing, scaling, map cracking, or spalling over 50% of the area. Joints and cracks show moderate to severe spalling. Pumping and faulting of joints (½ inch with fair ride). Several slabs have multiple transverse or meander cracks with moderate spalling.
Poor	ACC	Alligator cracking (over 25% of surface). Severe distortions (over 2 inches deep) Extensive patching in poor condition. Potholes.
	PCC	Extensive slab cracking, severely spalled and patched. Joints failed. Patching in very poor condition. Severe and extensive settlement or frost heaves.

DEFINITIONS OF STRUCTURAL AND DEPOSITIONAL FEATURES

Term	Definition
Parting	≤ 1/16 inch (1.6 mm) thick
Seam	> 1/16 inch (1.6 mm) → ½ inch (12.7 mm) thick
Layer	> ½ inch (12.7 mm) to ≤ 12 inches (305 mm) thick
Pocket	Small, erratic deposits of limited lateral extent
Lens	Lenticular deposit
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay
Varved	Alternating partings or seams (1 mm – 12 mm) of silt and/or clay and sometimes fine sand
Stratified	Alternating layers of varying material or color with layers ≥ 6 mm thick
Laminated	Alternating layers of varying material or color with layers < 6 mm thick
Fissured	Contains shears or separations along planes of weakness
Slickensided	Shear planes appear polished or glossy, sometimes striated
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Homogeneous	Same color and appearance throughout
Occasional	One or less per foot (305 mm) of thickness
Frequent	More than one per foot (305 mm) of thickness
Interbedded	Applied to strata of soil lying between or alternating with other strata of a different nature

GRAIN SIZE TERMINOLOGY

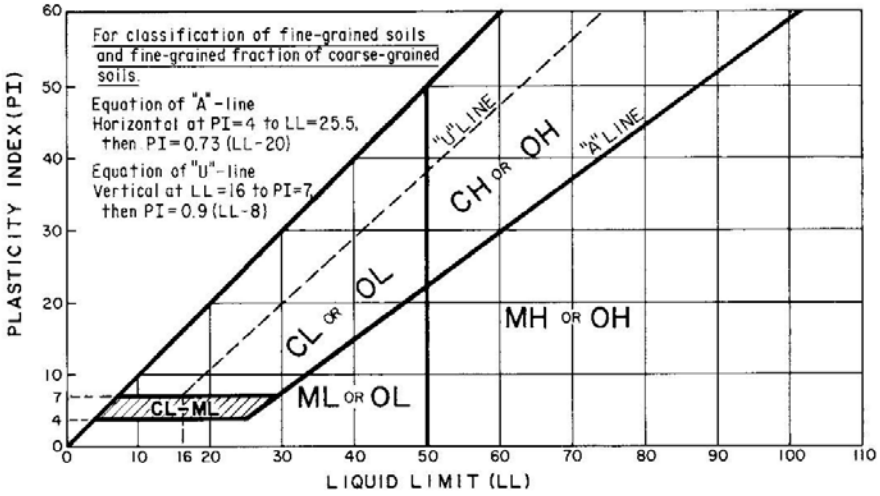
Major Component of Sample	Size Range
Boulders	≥ 12" (300 mm)
Cobbles	< 12" - 3" (300 mm – 75 mm)
Gravel - Coarse	< 3" - ¾" (75 mm – 19 mm)
Gravel – Fine	< ¾" - #4 (19 mm – 4.75 mm)
Sand – Coarse	< #4 - #10 (4.75 mm – 2 mm)
Sand – Medium	< #10 - #40 (2 mm - 0.425 mm)
Sand – Fine	< #40 - #200 (0.425 mm -0 .074 mm)
Silt	< 0.074 mm - 0.005 mm
Clay	<0 .005 mm

GENERAL NOTES

Unified Soil Classification System (USCS)
ASTM D2487

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification	
				Group Symbol	Group Name [B]
COARSE-GRAINED More than 50 % retained on No. 200 sieve	**Gravels** (More than 50 % of coarse fraction retained on No. 4 sieve)	**Clean Gravels**	Cu ≥ 4 and 1 ≤ Cc ≤ 3[D]	GW	Well-graded gravel [E]
		(Less than 5% fines [C])	Cu < 4 and/or [Cc < 1 or Cc > 3][D]	GP	Poorly graded gravel [E]
		Gravels with Fines	Fines classify as ML or MH	GM	Silty gravel [E,F,G]
		(More than 12 % fines [C])	Fines classify as CL or CH	GC	Clayey gravel [E,F,G]
	Sands (50 % or more of coarse fraction passes No. 4 sieve)	**Clean Sands**	Cu ≥ 6 and 1 ≤ Cc ≤ 3 [D]	SW	Well-graded sand [I]
		(Less than 5 % fines [H])	Cu < 6 and/or [Cc < 1 or Cc > 3] [D]	SP	Poorly graded sand [I]
		Sands with Fines	Fines classify as ML or MH	SM	Silty sand [F,G,I]
		(More than 12 % fines [H])	Fines classify as CL or CH	SC	Clayey sand [F,G,I]
FINE-GRAINED SOILS 50 % or more passes the No. 200 sieve	**Silts and Clays** Liquid limit less than 50	**inorganic**	PI > 7 and plots on or above "A" line [J]	CL	Lean clay [K,L,M]
			PI < 4 or plots below "A" line [J]	ML	Silt [K,L,M]
		organic	(Liquid Limit - oven dried) / (Liquid Limit - not dried) < 0.75	OL	Organic clay [K,L,M,N]
					Organic silt [K,L,M,O]
	Silts and Clays Liquid limit more than 50	**inorganic**	PI plots on or above "A" line	CH	Fat clay [K,L,M]
			PI plots below "A" line	MH	Elastic silt [K,L,M]
		organic	(Liquid Limit - oven dried) / (Liquid Limit - not dried) < 0.75	OH	Organic clay [K,L,M,P]
					Organic silt [K,L,M,Q]
HIGHLY ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor			Pt	Peat

A Based on the material passing the 3-in. (75-mm) sieve.
B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
C Gravels with 5 to 12 % fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay
D $Cu = D_{60}/D_{10}$ $Cc = (D_{30})^2/(D_{10} \times D_{60})$
E If soil contains ≥15 % sand, add "with sand" to group name.
F If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
G If fines are organic, add "with organic fines" to group name.
H Sands with 5 to 12 % fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay
I If soil contains ≥15 % gravel, add "with gravel" to group name.
J If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.
K If soil contains 15 to <30 % plus No. 200, add "with sand" or "with gravel," whichever is predominant.
L If soil contains ≥30 % plus No. 200, predominantly sand, add "sandy" to group name.
M If soil contains ≥30 % plus No. 200, predominantly gravel, add "gravelly" to group name.
N PI ≥ 4 and plots on or above "A" line.
O PI < 4 or plots below "A" line.
P PI plots on or above "A" line.
Q PI plots below "A" line.



Order of Classification: 1) Consistency or Apparent Density, 2) Type of Soil, 3) Minor Soil Type(s), 4) Inclusions, 5) Layered Soils, 6) Color, 7) Water Content, 8) USCS Symbol, 9) Geological Name

APPENDIX C

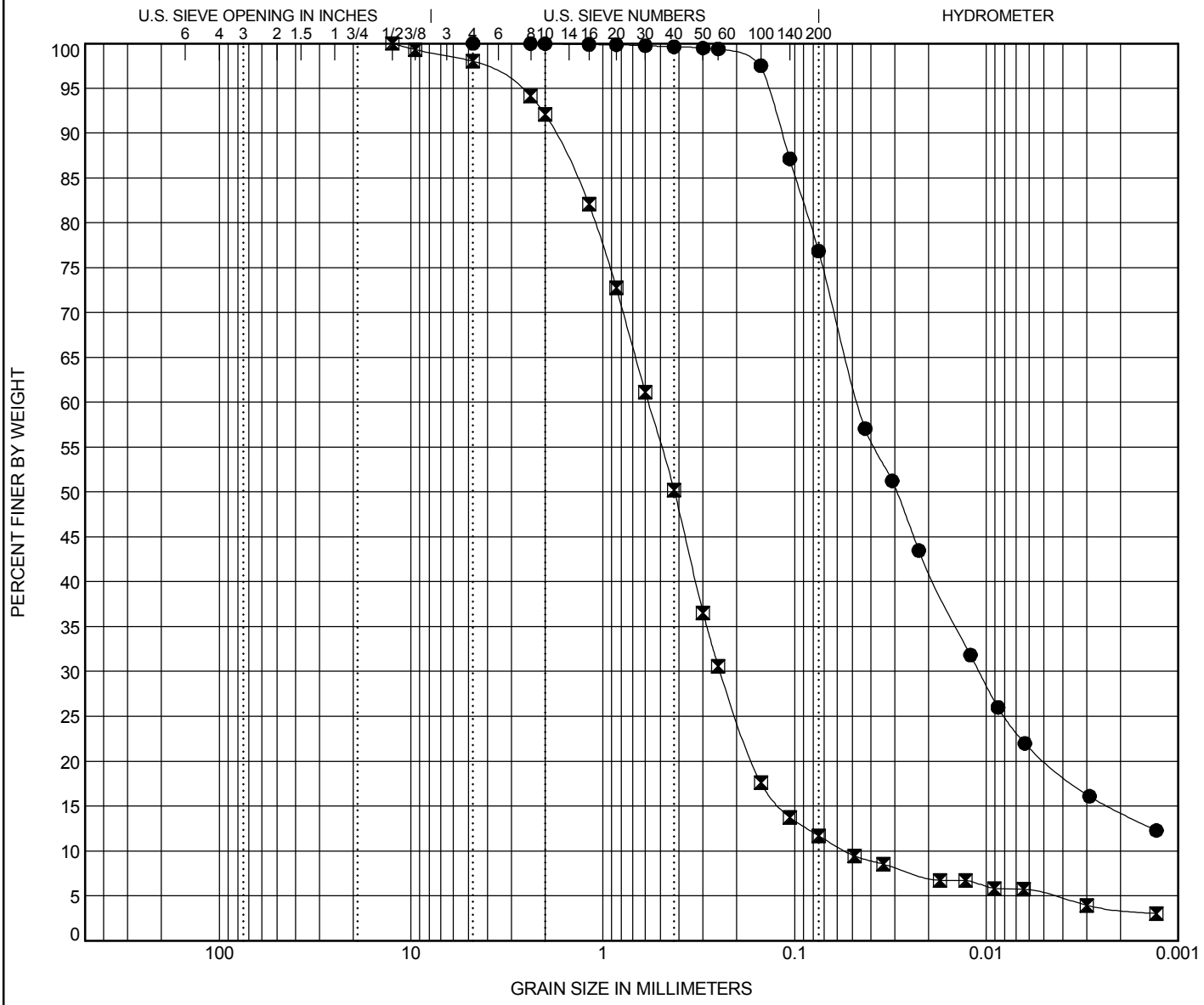
LABORATORY TEST RESULTS

Somat Engineering

North and South Hennepin Marsh
Habitat Restoration Project
Grosse Ile Township, Michigan

GRAIN SIZE DISTRIBUTION

PROJECT NO. 2018109A



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Depth ft.	Remarks	LL	PL	PI	Cc	Cu
●	**B-01**	**4.0**						
⊠	**B-01**	**19.0**					**1.90**	**10.67**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-01**	**4.0**	**4.75**	**0.047**	**0.011**		**0.0**	**23.1**	**56.6**	**20.2**
⊠	**B-01**	**19.0**	**12.5**	**0.579**	**0.244**	**0.054**	**2.0**	**86.3**	**6.6**	**5.1**

GRAIN SIZE HENNEPIN MARSH HABITAT RESTORATION.GPJ SOMAT.GDT 8/17/20

8/17/20

APPENDIX D

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL REPORT

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled*. No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed*. The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

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