



Eaton County
**Road
Commission**

May 18, 2022

Duane A. Eldred

Chair

NOTICE TO BIDDERS

Timothy J. Lamoreaux

Vice Chair

EATON COUNTY ROAD COMMISSION

BUTTERFIELD HIGHWAY CULVERT INSTALLATION

Lauren K. Aitch-Guerrant

Member

Addendum No. 1

This Addendum provides the soil boring information provided by the Drain Commissioners Office.

Benjamin S. Lyons

Member

If you have any questions, please contact me at 517-543-1630.

Jerry L. Frazier

Member

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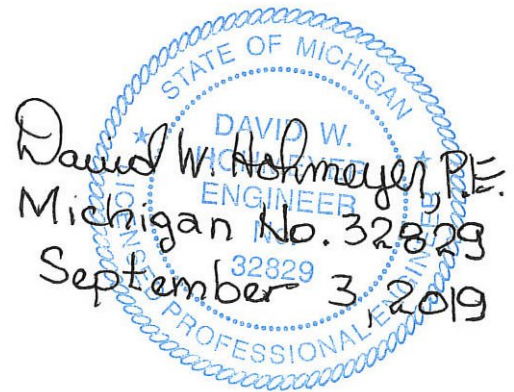
Email
ecrc@eatoncountyrroad.com



**REPORT OF
GEOTECHNICAL INVESTIGATION
FOR
PAGE, BIG CREEK, AND SLEEPER DRAIN
REPLACEMENT**

**OLIVET
EATON COUNTY
MICHIGAN**

AUGUST 20, 2019



*Land and Resource Engineering
2121 3 Mile Road
Walker, Michigan 49544*

Project No. 2019.1040



Location of Soil Investigation

The soil investigation was located at Butterfield Highway over Big Creek between Sections 25 and 36, Walton Township, Eaton County, Michigan.

Purpose of Investigation

The purpose of this investigation is to provide soil related recommendations for the replacement of the Butterfield Highway culvert over Big Creek between Mathews Road and South Cochran Road.

Design Information

The project consists of a culvert replacement. The existing culvert consists of a 168.0 inch by 72.0 inch wooden box culvert. The new design will consist of a 144.0 inch corrugated metal pipe (CMP) culvert. An allowable maximum settlement of 1.0 inch and an allowable differential settlement of 0.75 inches have been assumed. The creek bottom is located approximately 8.5 feet below the existing pavement.

Tests Performed

The investigation included two test borings to depths of 50.0 and 55.0 feet. The test borings are designated as Test Boring One and Test Boring Two. The test borings were conducted in accordance with ASTM D 1586 procedures. The boring locations were determined by Land and Resource Engineering. An automatic hammer was used to obtain the soil samples. The ASTM D 1586 standard describes the procedure for sampling and testing soil using the Standard Penetration Test.

The surface elevations at the test boring locations and additional points of reference were obtained with a Global Navigation Satellite System (GNSS) Receiver. The receiver was connected to the local MDOT CORS base station. Through this system, vertical measurements are obtained and referenced to the North American Vertical Datum (NAVD88). Horizontal measurements are also obtained at the test boring locations which are referenced to the Michigan State Plane Coordinate System. Both the vertical and horizontal measurements typically have an accuracy of approximately 0.5 inches. The measured test boring locations and surface elevations are represented in Table 1.



Table 1: Measured Test Boring and Points of Reference Locations and Surface Elevations

Test Boring / Location	Elevation (feet)	Northing (feet)	Easting (feet)	Surface Cover
Test Boring One	900.6	341634.0	12992774.0	Asphalt
Test Boring Two	901.0	341621.0	12992819.3	Asphalt
Center of Butterfield Highway	901.0	341627.5	12992790.0	Asphalt
Big Creek Water Level	894.2	341571.3	12992770.4	-
Base Setup VRS1	955.4	341631.0	12988710.4	-

Soil samples were classified according to the Unified Soil Classification System. This method is a standardized system for classifying soil according to its engineering properties. Please refer to the appendix of this report for the Unified Classification System Chart. The classification is shown in the “Material Description” column of the test boring logs.

The soil strength and the allowable soil bearing value were evaluated using the “N” value. The “N” value is the number of blows required to drive a soil sampler one foot with a standard 140 pound drop hammer. The sampler is driven a distance of 18.0 inches. The number of blows for each 6.0 inch increment is recorded. The sum of the second and third intervals is the “N” value. The number of blows for each 6.0 inch interval is shown on the test boring logs under the column labeled “Blow Counts”. The “N” value for each sample is shown in the adjacent column.

Laboratory testing consisted of natural moisture content, sieve (particle size) analysis, Atterberg limits, and loss on ignition testing. The tests were performed on representative soil samples. The tests were performed in accordance with applicable ASTM standards. The water content documents the presence of groundwater in the soil. The sieve test determines the particle distribution which is used to classify the soil and estimate its properties. The Atterberg limit tests aid in determining the properties of cohesive soils. Loss on ignition testing determines the amount of organic material present in a soil sample.

The U.S. Geological Survey Topographic map and the Quaternary Geology map of Southern Michigan were reviewed. These maps provide general geological information about the region.



SOILS & STRUCTURES

Description of Soil

The general soil profile consists of fill overlying layers of organic material, clay, sand, and gravel. The peat and organic silt are younger deposits formed in a protected shallow body of water. The underlying clay and sand layers are glacial till left behind by the movement of a glacier.

Asphalt is present at the surface of the site in the vicinity of Test Borings One and Two. The asphalt is 4.5 inches thick in the vicinity of Test Boring One and 6.0 inches thick in the vicinity of Test Boring Two. The asphalt bears on 24.0 inches of gravel.

The fill layer consists of sand with silt and extends to depths of 5.5 and 7.0 feet. The “N” values of the fill range from 4 to 34, indicating the fill is in a loose to very compact state. The very compact fill is present in the vicinity of Test Boring One. The “N” values of this fill range from 25 to 34. The “N” values correspond to an internal friction angle of 32 to 36 degrees. The loose to slightly compact fill is present in the vicinity of Soil Boring Two. The “N” values of this fill range from 4 to 7. The “N” values correspond to an internal friction angle of less than 29 degrees. The fill does not appear to meet MDOT Class II Specifications.

The peat layer is present at depths of 5.5 and 7.0 feet and extends to depths between 10.5 and 13.5 feet. The “N” values of the peat layer range from 2 to 3, indicating the peat is soft. The moisture content of the peat ranges from 50.7 to 198.3 percent, indicating the peat is highly compressible. The peat will not support abutments.

The organic silt layer is present at depths of 10.5 and 13.5 feet and extends to depths between 18.0 and 22.5 feet. The “N” values of the organic silt range from 2 to 3, indicating the organic silt is soft. The moisture content of the organic silt ranges from 126.5 to 171.0, indicating the organic silt is compressible. The organic silt will not support deep foundations.

The clay layer is present at depths of 18.0 and 22.5 feet and extends to depths between 37.5 and 38.0 feet. The “N” value of the clay is 2, indicating the clay is soft. The clay is characterized by a plasticity index of 21 and a liquid limit of 37. The moisture content of the clay ranges from 30.4 to 43.0 percent. The clay is near or in excess of its liquid limit and is highly compressible. The clay will not support deep foundations.

The sand layer is present at depths of 37.5 and 38.0 feet and extends to a depth of approximately 50.0 feet. The “N” values of the sand layer range from 3 to 36, indicating the sand is in a loose to very compact state. The level of compaction is uniform with depth.



SOILS & STRUCTURES

The upper portion of the sand layer extends to a depth of 42.0 and 45.0 feet. The “N” values of this sand range from 3 to 7 indicating the sand is in a loose to slightly compact state. The “N” values correspond to an internal friction angle of 26 to 31 degrees. This portion of the sand layer will not support deep foundations.

The lower portion of the sand layer extends to a depth of approximately 50.0 feet. The “N” values of this sand range from 10 to 36, indicating the sand is in a compact to very compact state. The “N” values correspond to an internal friction angle of 31 to 37 degrees. This portion of the sand will partially support deep foundations.

The gravel layer is present at a depth of 50.0 feet and extends to a depth of at least 55.0 feet. The “N” value of the gravel is 5, indicating the gravel is loose. It is assumed that soil beneath the gravel layer will be suitable to support deep foundations.

Description of Groundwater Conditions

The water table is present at a depth of approximately 7.0 feet below the pavement surface. This depth corresponds to an elevation of approximately 894.0 feet. Dewatering will be necessary during the construction of foundations.

Description of Site

The site is located on Butterfield Highway over Big Creek. The existing culvert consists of a 168.0 inch by 72.0 inch box culvert beneath a bridge. The bridge appears to be supported at both ends and by a pier in the middle of the bridge running the width of the bridge. The bridge spans approximately 18.0 feet. The deck width is approximately 30.0 feet. The distance from the deck to the water was 6.0 feet at the time the Test Borings were performed. The maximum water depth in the area of the bridge is approximately 30.0 inches. The surface elevation of Butterfield highway is 901.0 feet. The site is surrounded by farm fields. The site is shown in Photographs #1 and #2.



General Conditions & Reliance

The report was prepared in accordance with generally accepted practices of the geotechnical engineering profession. The scope of work consisted of performing two test borings and providing soil related recommendations for the culvert replacement. The scope of work did not include an environmental study or wetland determination.

The report and the associated test borings were prepared specifically for the previously described project and site. Soils & Structures should be consulted if a significant change in the scope of the project is made.

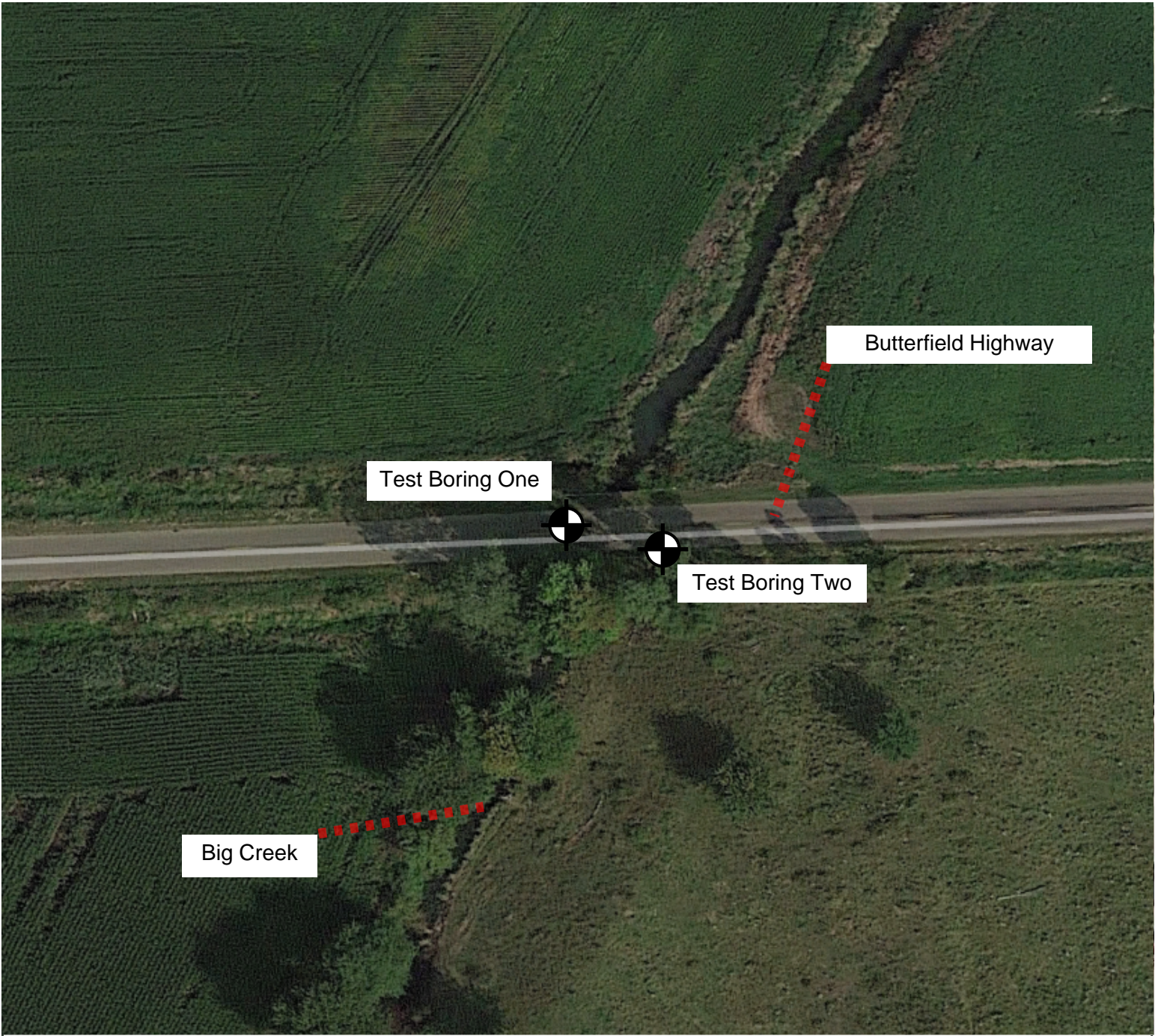
The test borings represent point information and may not have encountered all of the soil types and materials present on this site. This report does not constitute a guarantee of the soil or groundwater conditions or that the test boring is an exact representation of the soil or groundwater conditions at all points on this site.

The descriptions and recommendations contained in this report are based on an interpretation of the test borings and laboratory tests. The test borings should not be used independently of the report. If soil conditions are encountered which are significantly different from the test borings, Soils & Structures should be consulted for additional recommendations. The report and test borings may be relied upon by Land and Resource Engineering for the design, construction, permitting and financing associated with the Page, Big Creek, and Sleeper Drain Replacement project located at Butterfield Highway over Big Creek, Olivet, Eaton County, Michigan. The use of the report and test borings by third parties not associated with this project or for other sites has not been agreed upon by Soils & Structures. Soils & Structures does not recommend or consent to third party use or reliance of the report or test borings unless allowed to review the proposed use of these materials. Unless obtained in writing, consent to third party use should not be assumed. Third parties using the report or test boring logs do so at their own risk and are offered no guarantee or promise of indemnity.



Appendix

Test Boring Location Plan
General Soil Profile
Test Boring Logs
Laboratory Tests
General Soil Information



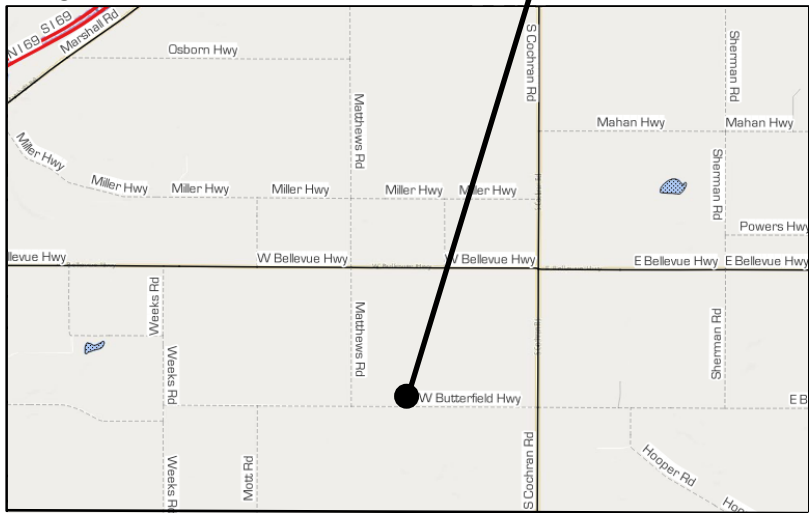
Big Creek

Test Boring One

Test Boring Two

Butterfield Highway

VICINITY MAP
NTS



SITE

TEST BORING LOCATION MAP
NTS



Note: The background of the test boring plan is an aerial photo of the site from Google Earth.

Page, Big Creek, and Sleeper Drain Replacement
Butterfield Highway over Big Creek

Olivet, Eaton County, Michigan

Soils & Structures, Inc.
6480 Grand Haven Road
Muskegon, Michigan 49441

JOB NO. 1040

DATE: August 9, 2019

Project Id: 2019.1040

Project Title: Page, Big Creek, and Sleeper Drain Replacement

Location: Olivet, Michigan

Client: Land and Resource Engineering

Title: Section line 1

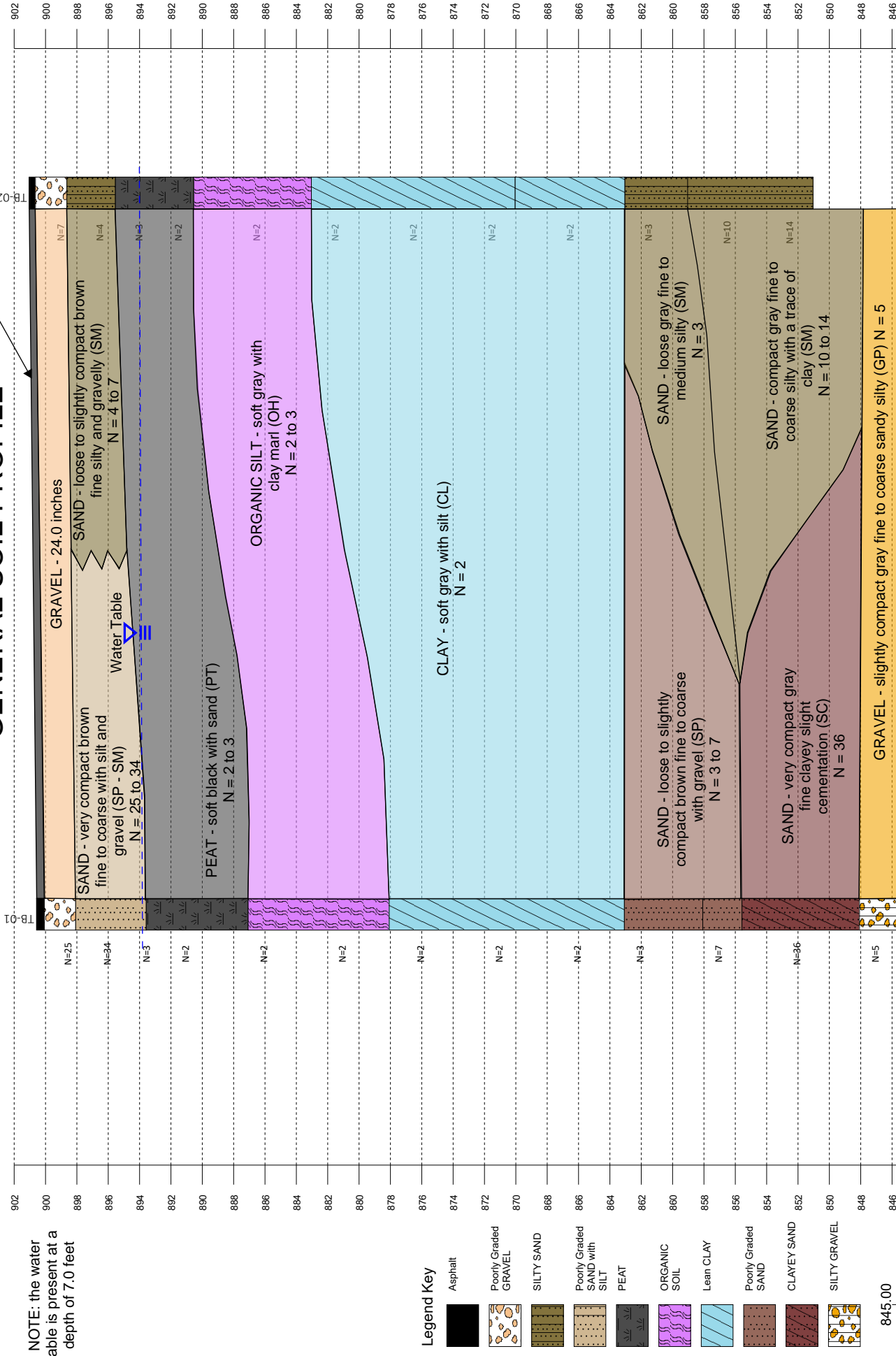
Vertical Scale: 1:337

Horizontal Scale: 1:105

Engineer: Malcom Thompson

ASPHALT - 4.5 to 6.0 inches

GENERAL SOIL PROFILE



NOTE: the water table is present at a depth of 7.0 feet

Legend Key

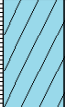
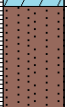
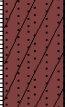
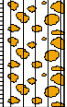
- Asphalt
- Poorly Graded GRAVEL
- SILTY SAND
- Poorly Graded SAND with SILT
- PEAT
- ORGANIC SOIL
- Lean CLAY
- Poorly Graded SAND
- CLAYEY SAND
- SILTY GRAVEL

845.00







Project Name: Page, Big Creek, and Sleeper Drain Replacement **Project Number:** 2019.1040
Project Location: Olivet, Michigan **Logged By:** C Christopher **Reviewed By:** W. Stambaugh
Client: Land and Resource Engineering **Survey Datum:** NAD 1983 StatePlane Michigan South **Hole Depth:** 55.00
Date Started: Jul 12 2019 **Completed:** Jul 12 2019 **Northing:** 341634.0 **Easting:** 12992774.0 **Elevation:** 900.58
Drilling Method: 3-1/4" Hollow Stem Auger **Ground Water Levels**
Equipment: Diedrich D-25 At Time of Drilling 10.00 on Jul 12 2019
Hammer Type: Automatic Hammer End of Drilling 7.00 on Jul 12 2019
Notes:

Depth	Graphic	Material Description	Cautionary Condition	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits			USCS
											Liquid Limit	Plastic Limit	Plasticity Index	
1		ASPHALT - (6.0")						100						
2		GRAVEL - very compact brown fine to coarse sandy (24.0")												
3		SAND - very compact brown fine to coarse with gravel and silt		SPT-A	100	11-16-9	25							SP-SM
4				SPT-B	100	7-18-16	34							SP-SM
5		PEAT - soft black sandy and clayey Organic Content=45.9%		SPT-C	67	1-1-2	3			93.4				PT
6				SPT-D	100	1-1-1	2			198.3				PT
7														
8		ORGANIC SILT - soft gray with a trace of sand and clay (marl)		SPT-E	100	1-1-1	2			171.0				OH
9														
10		CLAY - soft gray with silt		SPT-F	100	1-1-1	2							OH
11														
12				SPT-G	100	1-1-1	2							CL
13														
14														
15														
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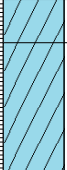
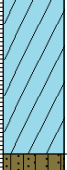
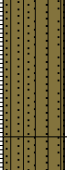
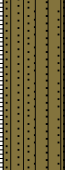
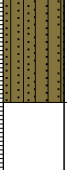
Project Name: Page, Big Creek, and Sleeper Drain Replacement **Project Number:** 2019.1040
Project Location: Olivet, Michigan **Logged By:** C Christopher **Reviewed By:** W. Stambaugh
Client: Land and Resource Engineering **Survey Datum:** NAD 1983 StatePlane Michigan South **Hole Depth:** 55.00
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Equipment: Diedrich D-25 At Time of Drilling 10.00 on Jul 12 2019
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Notes:

Depth	Graphic	Material Description	Cautionary Condition	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits			USCS
											Liquid Limit	Plastic Limit	Plasticity Index	
31		CLAY - soft gray with silt		▲	SPT-H	100	1-1-1	2		39.0	37	16	21	CL
32														
33														
34														
35				▲	SPT-I	100	1-1-1	2		31.7				CL
36														
37														
38		SAND - loose brown fine to coarse gravelly		▲	SPT-J	100	1-1-2	3						SP
39														
40														
41														
42														
43		SAND - slightly compact brown fine to coarse with gravel and a trace of silt		▲	SPT-K	100	3-3-4	7						SP
44														
45		SAND - very compact gray fine clayey with a trace of silt slight cementation		▲	SPT-L	100	7-16-20	36		11.8				SC
46														
47														
48														
49				▲	SPT-M to	13	2-2-3	5					GP	
50														
51														
52														
53		GRAVEL - slightly compact gray fine to coarse sandy silty		▲	SPT-M to	13	2-2-3	5						GP
54														
55														
56														
57														
58														
59														
60														

Project Name: Page, Big Creek, and Sleeper Drain Replacement **Project Number:** 2019.1040
Project Location: Olivet, Michigan **Logged By:** C Christopher **Reviewed By:** W. Stambaugh
Client: Land and Resource Engineering **Survey Datum:** NAD 1983 StatePlane Michigan South **Hole Depth:** 50.00
Date Started: Jul 12 2019 **Completed:** Jul 12 2019 **Northing:** 341621.0 **Easting:** 12992819.2 **Elevation:** 901.04
Drilling Method: 3-1/4" Hollow Stem Auger **Ground Water Levels**
Equipment: Diedrich D-25 At Time of Drilling 10.00 on Jul 12 2019
Hammer Type: Automatic Hammer End of Drilling 7.00 on Jul 12 2019
Notes:

Depth	Graphic	Material Description	Cautionary Condition	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits				USCS
											Liquid Limit	Plastic Limit	Plasticity Index		
1		ASPHALT - (4.5")													
2		GRAVEL - slightly compact brown sandy with a trace of clay (24.0")													
3		SAND - loose to slightly compact brown fine silty and gravelly with a trace of clay		▲▼	SPT-A	100	3-4-3	7		12.2					SM
4															
5				▲▼	SPT-B	67	2-1-3	4							SM
6		PEAT - soft black with sand and organic silt Organic Content=10.3%													
7				▲▼	SPT-C	0	2-1-2	3							PT
8															
9				▲▼	SPT-D	47	1-1-1	2		50.7					PT
10															
11		ORGANIC SILT - soft gray with clay (marl) Organic Content=11.2%													
12															
13															
14				▲▼	SPT-E	100	1-1-1	2		126.5					OH
15															
16															
17				▲▼	SPT-F	100	1-1-1	2		43.0					CL
18		CLAY - soft gray with silt													
19															
20				▲▼	SPT-G	100	1-1-1	2							CL
21															
22															
23															
24															
25				▲▼											
26															
27															
28															
29															
30				▲▼											

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											Liquid Limit	Plastic Limit	Plasticity Index	
31		CLAY - soft gray with silt		▲	SPT-H	100	1-1-1	2						CL
32		CLAY - soft gray with silt and sand												
33														
34														
35				▼	SPT-I	100	1-1-1	2		30.4				CL
36														
37														
38		SAND - loose gray fine to medium silty with a trace of clay		▼	SPT-J	100	2-1-2	3		17.8				SM
39														
40														
41														
42		SAND - compact gray fine to coarse silty with a trace of clay		▼	SPT-K	100	4-5-5	10		13.4				SM
43														
44														
45														
46														
47														
48														
49				▼	SPT-L	100	5-7-7	14		11.7				SM
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60														

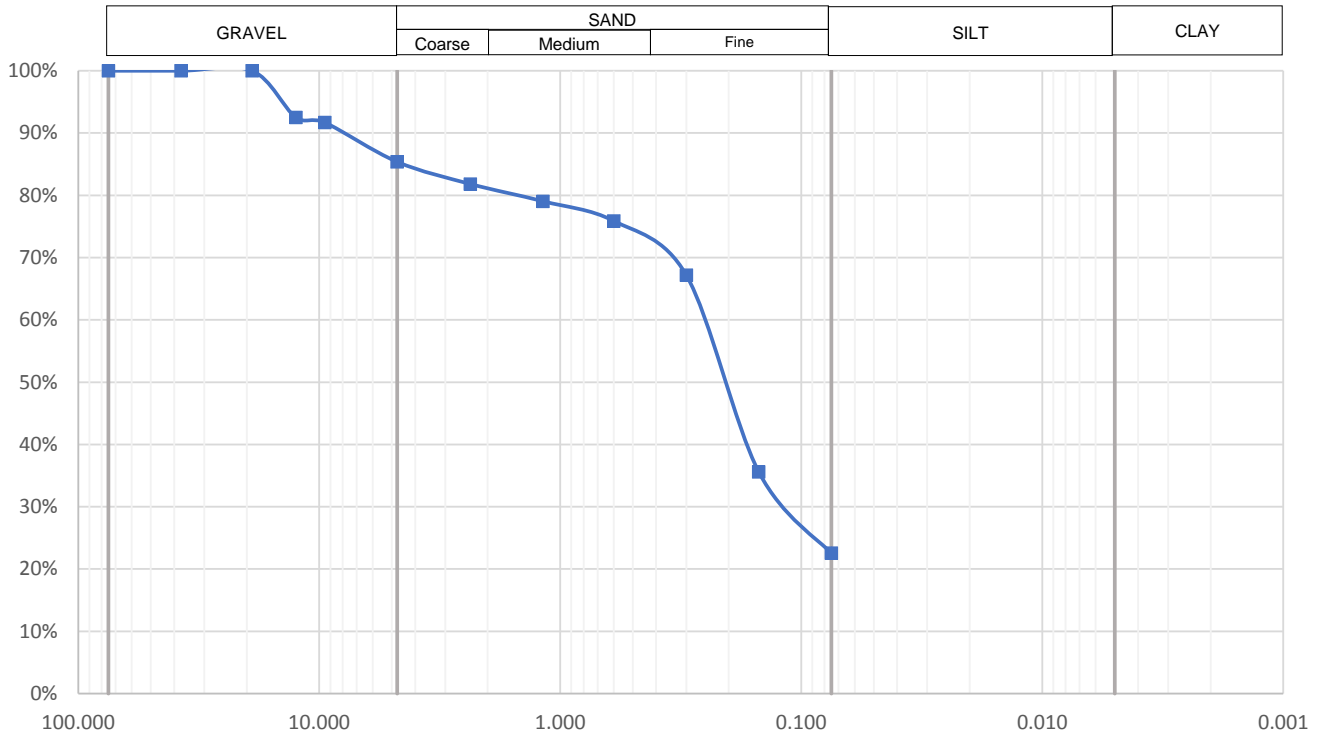


Particle Size Distribution Report

Page, Big Creek, and Sleeper Drain
Replacement
2019.104
Land and Resource Engineering
8/2/2019 15:38

Sample Location TB-02
Sample Depth (ft) 2
Sample ID MSK_2019072396

Project Name
Project Number
Client
Date



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0%	0.0%	14.6%	4.4%	10.2%	48.3%	0.0%	0.0%
D85	D60	D50	D30	D15	D10	Loss By Wash	
4.4977	0.2659	0.2184	0.1180	0.0499	0.0333	22.5%	

Sieve	
Particle Size (mm)	% Passing
75.000	100.0%
37.500	100.0%
19.000	100.0%
12.500	92.5%
9.500	91.7%
4.750	85.4%
2.360	81.8%
1.180	79.1%
0.600	75.9%
0.300	67.2%
0.150	35.6%
0.075	22.5%

Hydrometer	
Particle Size (mm)	% Passing

Material Description
SAND - fine silty and gravelly (SM)

Remarks

Technician	wstambaugh
Checked	wstambaugh
Approved	wstambaugh

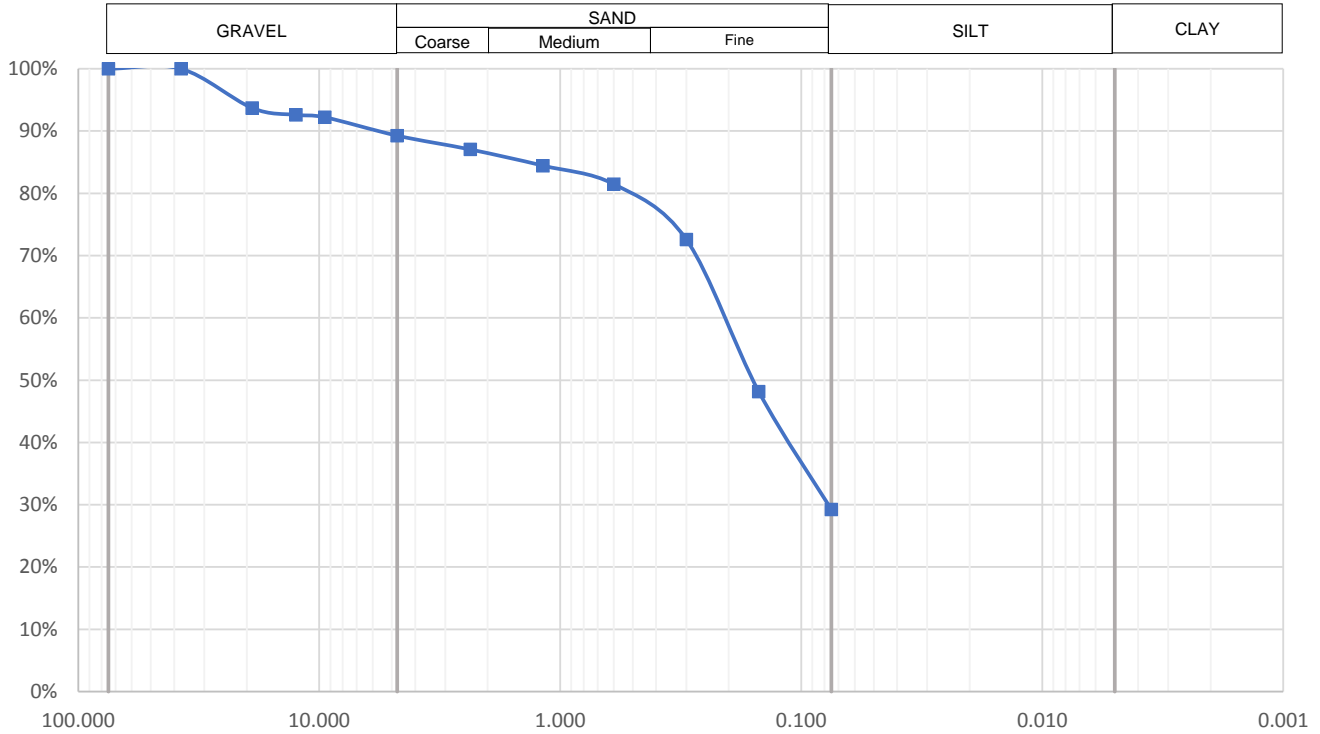


Particle Size Distribution Report

Page, Big Creek, and Sleeper Drain
Replacement
2019.104
Land and Resource Engineering
8/2/2019 15:38

Sample Location TB-02
Sample Depth (ft) 44.5
Sample ID MSK_20190723103

Project Name
Project Number
Client
Date



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0%	6.3%	4.4%	3.0%	9.9%	47.0%	0.0%	0.0%
D85	D60	D50	D30	D15	D10	Loss By Wash	
1.4329	0.2227	0.1614	0.0779	0.0384	0.0256	29.3%	

Sieve	
Particle Size (mm)	% Passing
75.000	100.0%
37.500	100.0%
19.000	93.7%
12.500	92.6%
9.500	92.2%
4.750	89.3%
2.360	87.0%
1.180	84.4%
0.600	81.5%
0.300	72.6%
0.150	48.1%
0.075	29.3%

Hydrometer	
Particle Size (mm)	% Passing

Material Description
SAND - fine silty with gravel and a trace of clay (SM)

Remarks

Technician	wstambaugh
Checked	wstambaugh
Approved	wstambaugh

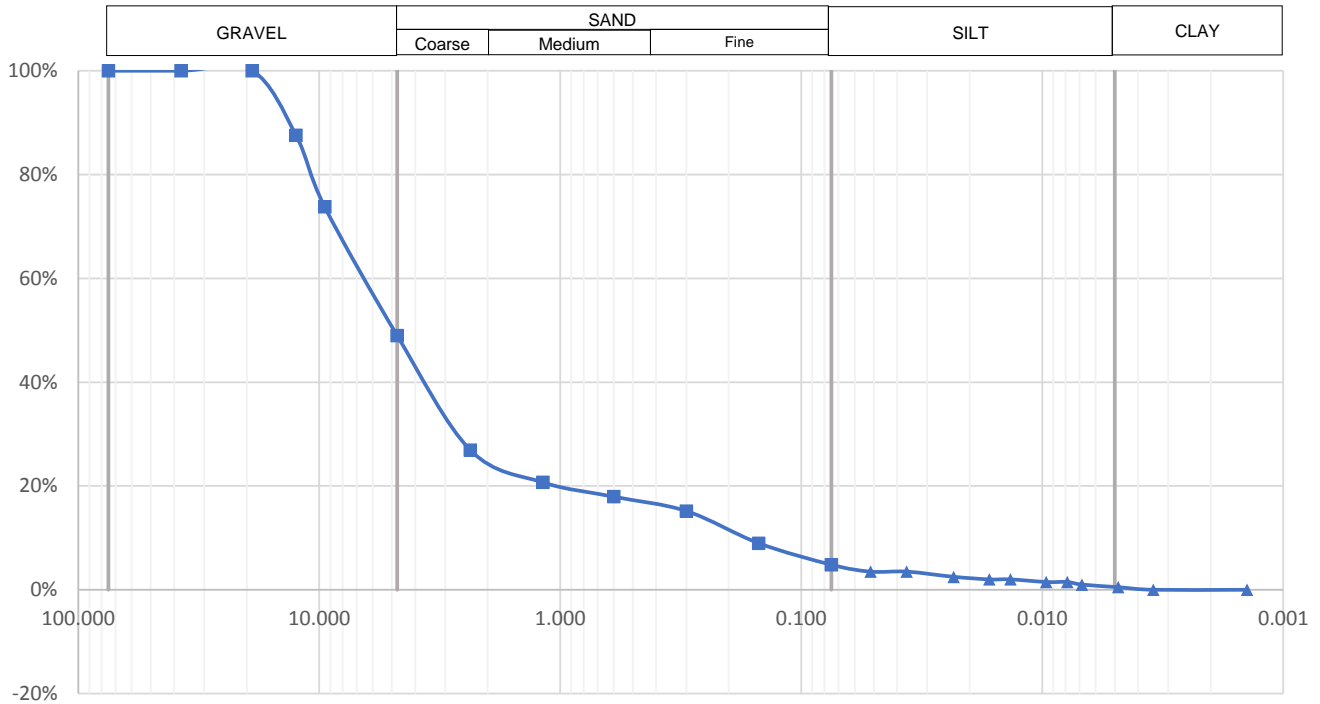


Particle Size Distribution Report

Page, Big Creek, and Sleeper Drain

Sample Location TB-01
 Sample Depth (ft) 0
 Sample ID MSK_2019080223

Project Name Replacement
 Project Number 2019.104
 Client Land and Resource Engineering
 Date 8/2/2019 16:06



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0%	0.0%	51.0%	24.0%	8.7%	11.5%	4.8%	0.0%
D85	D60	D50	D30	D15	D10	Loss By Wash	
11.9375	6.8611	4.9479	2.6961	0.2958	0.1750	4.8%	

Sieve	
Particle Size (mm)	% Passing
75.000	100.0%
37.500	100.0%
19.000	100.0%
12.500	87.6%
9.500	73.8%
4.750	49.0%
2.360	26.9%
1.180	20.7%
0.600	17.9%
0.300	15.2%
0.150	9.0%
0.075	4.8%

Hydrometer	
Particle Size (mm)	% Passing
0.0516	3.5%
0.0365	3.5%
0.0233	2.5%
0.0166	2.0%
0.0135	2.0%
0.0096	1.5%
0.0079	1.5%
0.0068	1.0%
0.0048	0.5%
0.0035	
0.0014	

Material Description
Gravel - sandy with a trace of silt (GW)

Remarks

Technician	wstambaugh
Checked	wstambaugh
Approved	wstambaugh



LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX
(ASTM D4318-10, Multipoint test)

Job Ref	2019.104
Borehole/Pit No.	TB-01
Sample No.	H
Depth ft	29.5
Sample Type	SPT
KeyLAB ID	MSK_2019072393
Date started	

Site Name	Page, Big Creek, and Sleeper Drain Replacement	
Soil Description		
Specimen Reference	3	Specimen Depth ft
Specimen Description		
Test Method	ASTM D4318-10, Multipoint test	

Sample preparation:

Tested in natural condition after >425um removed by hand after washing to remove >425um

Total mass of sample lb Percentage retained 425µm %
 Mass, greater than 425µm sieve, removed lb Percentage passing 425µm %

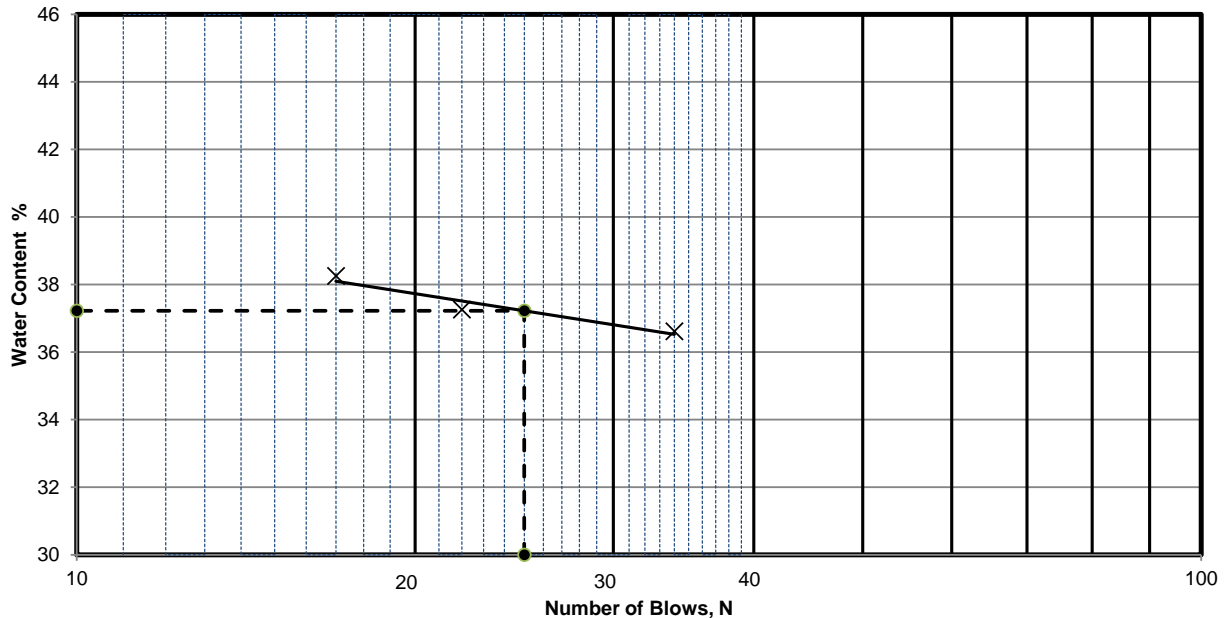
Liquid Limit

No. of blows, N	25 - 35	25 - 30	15 - 25
	34	22	17

Container No				LL Device No.	<input type="text"/>	
Mass of container	g	11.20	11.30	11.50	Mechanical or manual	<input type="text"/>
Mass of wet soil and container	g	30.60	33.40	32.10	Grooving tool No.	<input type="text"/>
Mass of dry soil and container (1)	g	25.40	27.40	26.40	Plastic or Metal	<input type="text"/>
Mass of dry soil and container (2)	g				Oven No.	<input type="text"/>
Water Content	%	36.6	37.3	38.3	Oven temperature	<input type="text"/> oC

Plastic Limit

Container No				Performed by hand	<input type="text"/>
Mass of container	g	11.60	11.60	Rolling device No.	<input type="text"/>
Mass of wet soil and container	g	17.00	17.00	Oven No.	<input type="text"/>
Mass of dry soil and container (1)	g	16.30	16.20	Oven temperature	<input type="text"/> oC
Mass of dry soil and container (2)	g			Average PL	<input type="text"/>
Water Content	%	14.9	17.4	16	



Remarks (added to preparation for report/ags data)

Lab Sheet Reference :

Tested	dknoll
Checked	wstambaugh
Approved	wstambaugh

LIQUID LIMIT	37
PLASTIC LIMIT	16
PLASTICITY INDEX	21



Organic Content (ASTM D2974)

Project Name	Page, Big Creek, and Sleeper Drain Replacement
Job Number	2019.104
Sample ID	TB-01
Sample Depth	9.5

Material Description
Sandy and Clayey PEAT

Tare ID	
Tare Weight	354
Weight of Wet Soil & Pan	511.2
Weight of Dry Soil & Pan	406.7
Weight of Burnt Soil & Pan	382.5
Weight of Wet Soil	157.2
Weight of Dry Soil	52.7
Weight of Burnt Soil	28.5
Percent Moisture	198.3%
Organic Content	45.9%

Remarks

Tested	bfritz
Checked	wstambaugh
Approved	wstambaugh



Organic Content (ASTM D2974)

Project Name	Page, Big Creek, and Sleeper Drain Replacement
Job Number	2019.104
Sample ID	TB-02
Sample Depth	9.5

Material Description
SAND with Peat

Tare ID	
Tare Weight	325.7
Weight of Wet Soil & Pan	510.7
Weight of Dry Soil & Pan	448.5
Weight of Burnt Soil & Pan	435.8
Weight of Wet Soil	185
Weight of Dry Soil	122.8
Weight of Burnt Soil	110.1
Percent Moisture	50.7%
Organic Content	10.3%

Remarks

Tested	bfritz
Checked	wstambaugh
Approved	wstambaugh



Organic Content (ASTM D2974)

Project Name	Page, Big Creek, and Sleeper Drain Replacement
Job Number	2019.104
Sample ID	TB-02
Sample Depth	14.5

Material Description
CLAY with Organic Silt (Marl)

Tare ID	
Tare Weight	392.7
Weight of Wet Soil & Pan	561
Weight of Dry Soil & Pan	467
Weight of Burnt Soil & Pan	458.7
Weight of Wet Soil	168.3
Weight of Dry Soil	74.3
Weight of Burnt Soil	66
Percent Moisture	126.5%
Organic Content	11.2%

Remarks

Tested	bfritz
Checked	wstambaugh
Approved	wstambaugh

General Information for Method of Field Investigation

The soil investigation was performed in accordance with the American Society of Testing and Materials method ASTM D 1586, which is the “Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils”. Samples of compressible clays or organic soils are obtained in accordance with ASTM D 1587, which is the “Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes.” Rock may be cored in conjunction with the above methods as specified in ASTM D 2113 which is the “Standard Practice for Rock Core Drilling and Sampling of Rock for Site Investigation.”

Field Testing

Standard Penetration Tests (SPT) in accordance with ASTM D 1586 were generally performed at depths of 2.0', 4.5', 7.0', 9.5' and 5.0' intervals thereafter.

Laboratory Testing

Samples obtained from the Standard Penetration Test, ASTM D 1586 or thin walled tube method, ASTM D 1587, were tested in the laboratory for the moisture content and density and/or particle size, where applicable. When soils sampled possessed sufficient cohesive properties, it was tested for its compressive strength in the unconfined state.

Natural Percent Moisture content (N.P.M.) of the soil is the percentage by weight of water contained in the soil sample compared to the dry weight of the solids of which the soil is composed. The NPM of select samples is determined in accordance with ASTM D 2216.

Natural Density (N.D.) of soil as reported on the appended boring logs is the natural wet density of the soils expressed in pounds per cubic foot.

The unconfined compressive strength of cohesive soils is determined in the laboratory on “undisturbed” select samples in accordance with ASTM D 2166. This test determines the maximum load required at a specified rate to deform the cohesive soil specimen length twenty (20%) percent. The primary purpose of the unconfined compression test is to obtain approximate quantitative values of the compressive strength of soils possessing sufficient coherence to permit testing in the unconfined state. The shear strength of the cohesive soil can be calculated from the results of the unconfined compressive strength test.

Color

When the color of the soils is uniform throughout, the color recorded will be such as brown, gray, and black and may be modified by adjectives such as light and dark. If the soils predominant color is shaded by secondary color, the secondary color precedes the primary color, such as gray-brown, or yellow-brown. If two major and distinct colors are swirled throughout the soil, the colors will be modified by the term mottled; such as mottled brown and gray.

Water Observations

Depth of water recorded in the test boring is measured from the ground surface to the water surface. Initial depth indicates water level during boring, completing depth indicates water level immediately after boring, and depth after “X” number of hours indicates water level after allowing the groundwater rise or fall over a period of time. Water observations in pervious soils are considered reliable groundwater levels for accurate groundwater measurements at the time the test borings were performed unless records are made over several days' time. Factors such as weather, soils porosity, etc., will cause the groundwater level to fluctuate for both pervious and impervious soils.

Sample Type

If not otherwise indicated, the sample is a split-barrel liner sample ASTM D 1586.

"S.T." – Shelby tube sample, ASTM D 1587
"A" – disturbed augered sample
"C" – rock core sampled ASTM D 2113
N.P.M. – Natural Percent Moisture of in-situ soils sample
N.D. – Natural Density of in-situ soils sample in pcf.
S.S. – Shear Strength of cohesive soils samples as determined by the Unconfined Compression tests in ksf.

Classification Data – Laboratory data to assist in classification of soils and classification of soils characteristics; i.e., plastic limit or liquid limit

Test Boring Logs

Particle Size	Visual
Boulders	Larger than 12" (300 mm)
Cobbles	12" to 3" (300 to 75 mm)
Gravel - Coarse	3" to ¾" (75 to 19 mm)
Gravel - Fine	19.0 to 4.75 mm
Sand- Coarse	4.75 to 2.0 mm
Sand - Medium	2.0 to 0.425 mm
Sand - Fine	0.425 to 0.075 mm
Silt	0.075 to 0.002 mm
Clay	0.002 mm and smaller

Soils Components

Major Component	Minor Component
Gravel	Trace (1 - 10%)
Sand	Some (11 - 35%)
Silt/Clay	And (36 - 50%)

Condition of Soil Relative to Compactness

Granular Material	"N" Value
Loose	0 - 4
Slightly Compact	5 - 7
Compact	8 - 20
Very Compact	21 - 50
Extremely Compact	51 and above

Cohesive Material	"N" Value
Soft	0 - 4
Firm	5 - 7
Stiff	8 - 20
Very Stiff	21 - 50
Extremely Stiff	51 and above

"N" values in clay soils are not to be used as a measure of shear strength. However, they may be used as a general indication of strength.

Unified Soil Classification System Chart

Major Divisions			Letter Symbol	Typical Descriptions
Coarse Grained Soils	Gravel – Gravelly Soils	Clean gravels (little or no fines)	GW	Well-Graded gravels, gravel-sand mixtures, little or no fines
			GP	Poorly-Graded gravels, gravel-sand mixtures, little or no fines
	more than 50% of coarse fraction retained on No. 4 sieve	Gravel with Fines (appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sand and Sandy Soils	Clean Sand (little or no fines)	SW	Well-Graded sands, gravelly sands, little or no fines
			SP	Poorly-Graded sands, gravelly sands, little or no fines
		Sand with Fines (appreciable amount of fines)	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine Grained Soils	Silts and Clays	Liquid limit less than 50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
			CL	Inorganic clays or low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silty clays or low plasticity
	Silts and Clays	Liquid limit greater than 50	MH	Inorganic silts, micaceous or diatomaceous fine sand or silty soils
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays or medium to high plasticity, organic silts
	Highly organic soils		PT	Peat, humus, swamp soils with high organic contents

For Laboratory Classification of Fine Grained Soil
Plasticity Chart

