BSLM KZOO, LLC
3663 Woodward Avenue, Suite 550
Detroit, Michigan 48201

GEOTECHNICAL INVESTIGATION

FOR

Proposed Retail Development
South Rochester Road & Hickory Lawn Road
Rochester Hills, Michigan

TEC Report: 64618

By:

Testing Engineers & Consultants, Inc.
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December 9, 2024

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TEC Report: 64618
Date Issued: December 9, 2024

Mr. Steve Robinson
BSLM KZOO, LLC
3663 Woodward Avenue, Suite 550
Detroit, Michigan 48201

Re: Geotechnical Investigation For
Proposed Retail Development
South Rochester Road & Hickory Lawn Road
Rochester Hills, Michigan

Dear Mr. Robinson:

Please find enclosed the results of a geotechnical investigation performed at the above referenced site. This geotechnical report presents our field and laboratory results; engineering analysis; and our recommendations for design of foundation and slabs, as well as important construction considerations.

Many lending institutions now require an environmental assessment of the site prior to construction. We can perform this service without delay. As you may know, Testing Engineers & Consultants, Inc. (TEC) has fifty-eight years of experience in Quality Control Testing and Construction Inspection. We would be pleased to provide any of these services on this project.

Should you have any questions regarding this report, please let us know. It has been a pleasure to be of service to you.

Respectfully submitted,
TESTING ENGINEERS & CONSULTANTS, INC.

Carey J. Suhan, P.E.,
Vice President, Geotechnical
& Environmental Services

CJS
Enclosure
cc: BSLM KZOO, LLC, Mr. Jacob Soyka

Testing Engineers & Consultants, Inc.

Mr. Steve Robinson
BSLM KZOO, LLC
December 9, 2024

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TEST BORING LOCATION PLAN

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INFILTRATION TEST RESULTS

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Mr. Steve Robinson
BSLM KZOO, LLC
December 9, 2024

TEC Report: 64618

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation for the proposed retail development at the northwest corner of South Rochester Road and Hickory Lawn Road, in Rochester Hills, Michigan. Authorization to perform this investigation was given with a signed copy of TEC Proposal No. 060-24-219Rev1.

The purpose of this investigation was to obtain information necessary to determine basic engineering properties of soils at the site through a series of test borings and laboratory tests performed on the soil samples obtained during the field investigation. This information has been evaluated to provide the general recommendations for site development preparations, foundation requirements, floor slab designs and other geotechnical information.

2.0 FIELD INVESTIGATION

Eleven test borings were drilled on the site at the locations shown on the Test Boring Location Plan. The locations are accurate to within a short distance of the locations shown on the location plan included in the appendix. Boring Nos. 1 and 2 were relocated 30 feet north of the proposed locations due to interference from the existing building. The test borings were drilled on November 11, 2024 with truck-mounted drilling equipment using solid-stem augers. The borings were drilled to depths of 5 to 15 feet below the existing grade.

Ground surface elevations at the boring locations were interpolated from the drawing entitled “Grading and SESC Plan” by Seiber Keast Lehner, dated 07/02/24. The elevations were approximated to the nearest one foot and are shown on the boring logs in the appendix.

Drilling methods and standard penetration tests were performed in general accordance with the current ASTM D1452 and D1586 procedures, respectively. These procedures specify that a standard 2-inch O.D. split-barrel sampler be driven by a 140-pound hammer with a free fall of 30 inches. The number of hammer blows required to drive the split-barrel sampler through three successive 6-inch increments is recorded on the Test Boring Log. The first 6-inch increment is used for setting the sampler firmly in the soil and the sum of the hammer blows for the second and third increments is referred to as the “Standard Penetration Index” (N). N values were obtained with an automatic trip hammer.

From the standard penetration test a soil sample is recovered in the liner sampler tubes that are located inside the split-barrel sampler. Upon recovery of a soil sample, the liner tubes are removed from the split-barrel sampler and placed in a container which is sealed to minimize moisture losses during transportation to the laboratory. Standard penetration tests are usually

2.0 FIELD INVESTIGATION (Cont'd)

made at depths of 2 ½, 5, 7 ½ and 10 feet and at 5-foot depth intervals thereafter. These parameters may vary for a given project depending on the nature of the subsoils and the geotechnical information required.

In addition, one cased borehole field infiltration test was performed adjacent to Boring No. 8. The casing was set in the firm clay with some silt at a depth of 12 feet below existing ground surface.

3.0 LABORATORY TESTING

The laboratory testing consisted of determining the unconfined compressive strength, the natural bulk density and the natural moisture content of the soil samples recovered in the liner sampler tubes. In the unconfined compression tests, the compressive strength of the soil is determined by axially loading a soil sample until failure is observed or 15% strain, whichever occurs first. The above referenced test data are recorded on the boring logs. Some test results may deviate from the norm because of variations in texture, imperfect samples, presence of pebbles and/or sand streaks, etc. The results are still reported although they may not be relevant.

The Atterberg Limits of three fine-grained soil samples were determined. The Atterberg Limits are water contents at which cohesive fine-grained soils change behavior. They are used for soil classification, and they have been correlated to several important engineering properties of a soil. As such, they can be used to obtain inexpensive estimates of fine-grained soil behavior. The Atterberg Limits are included in the corresponding boring logs shown in the appendix.

Samples taken in the field are retained in our laboratory for 60 days and are then destroyed unless special disposition is requested by the client. Samples retained over a long period of time are subject to moisture loss and are then no longer representative of the conditions initially encountered.

4.0 GENERAL SUBSURFACE CONDITIONS

4.1 Subsoil Conditions

The soil conditions encountered in the borings are presented on the individual boring logs. Each log presents the soil types encountered at that location as well as laboratory test data,

4.1 Subsoil Conditions (Cont'd)

ground water data, and other pertinent information. Descriptions of the various soil consistencies, relative densities and particle sizes are given in the Appendix. Definitions of the terms and symbols utilized in this report may be found in ASTM D653.

Five of the borings were drilled on existing hot mix asphalt (HMA) pavement. The pavement thickness was approximately 2 inches at the boring locations. The pavement is underlain by sand fill that extends to depths ranging from 8 inches to 3 feet below the existing pavement surface. Some crushed concrete and asphalt were encountered in the fill at Boring No. 10. Boring Nos. 1, 2, 5 and 11 were drilled on lawn areas. The ground surface was covered with 2 to 11 inches of topsoil.

At Boring Nos. 3 and 7 the surface covering was brown sand fill and included some crushed aggregate at Boring No. 7. The fill extended to depths of 2 feet in Boring No. 3 and to 8 inches in Boring No. 7.

The topsoil was underlain by clay fill at Boring Nos. 1, 2 and 11 extending to depths of 2 to 4 ½ feet below existing grade. At Boring No. 5 it was underlain by sand with some crushed concrete fill extending to 4 feet below existing fill.

The native soils were clay with some silt extending to the terminal depth of the borings. The color changes from brown to gray with depth. The clays become gray at depths of about 12 ½ to 13 feet. The consistency varies from soft to hard. Some sand seams were encountered in the upper clays.

Standard penetration values range from 3 blows per foot to 29 blows for 6 inches of penetration with unconfined compressive strength of 1,320 to 14,480 pounds per square foot (psf). Bulk densities range from 100 to 144 pounds per cubic foot with moisture contents of 7.6 to 23.7 percent of the dry weight of the soil.

4.2 Ground Water Observations

Water level readings were taken in the bore holes during and after the completion of drilling. These observations are noted on the respective Test Boring Logs.

Ground water was encountered only in Boring No. 7. During drilling, water was encountered at a depth of 8 feet. Upon the completion of drilling, water was observed at a depth of 13 feet. The source of the water appears to be seams of wet sand within the soil that is primarily clay. No ground water was encountered during drilling or after completion of the other borings.

5.0 ANALYSIS AND RECOMMENDATIONS

5.1 Proposed Development

The site currently has a single-family home that was used as a business along with a separate garage. The home has a basement. There is surrounding old pavement.

The proposed development is to consist of the construction of a single-story slab on grade retail building. The building will have a footprint of 8,593 square feet (sf).

We do not know the framing system for the building but we assume the interior framing would be columns and exterior framing would be either exterior columns with non-load-bearing walls or bearing walls. The surrounding areas will be paved for drives and parking. The site will also include utilities. Finish floor elevation of the building is currently set at 753.0 feet. The existing grade at the site generally slopes downward from north to south from about elevation 753 feet to 749 feet. Based upon this, minimal cut will be required, with about 1 ½ to 2 feet of fill required at the southern end of the proposed building.

An underground storm water detention system will be constructed on the east side of the site.

5.2 Ground Water Conditions

The position of water levels found in test borings may vary somewhat depending on seasonal precipitation. At the level encountered in the borings, it should present little problems for design or construction of foundations and utilities.

Ground water should be controllable by direct pumping from excavations or from properly prepared sumps as needed.

5.3 Recommended Earthwork Operations

The goal of site preparation and earthwork is to provide a stable base on which to place fill or backfill, or floor slabs and pavements. The typical site preparation procedure starts with removing any existing pavement, topsoil, other native soils with organic matter, and fill. Once that has been completed, the site grading is performed. The stability of the base depends on the soil type, moisture contents, and consistency / relative density. It also depends on the presence of organic matter and debris, if the soil is fill.

For this project, the main concerns are the existing development and the presence of undocumented fill. The southern end of the building and site will require some fill and the demolition of the existing construction will involve cut and backfill. The upper soils were identified as fill.

5.3 Recommended Earthwork Operations (Cont'd)

Within the limits of areas to be developed, the surface vegetation, HMA, topsoil and all existing foundations, floor slabs and abandoned utilities, should be removed prior to the site being graded. The resulting excavations from the removal of deeper elements, such as foundations, utilities and the basement of the home, should be backfilled with compacted engineered fill. Ideally, the existing fill should be removed and replaced. The terminal depth of the fill varies from less than 1 foot to 4 ½ feet. For the shallower areas, this soil would be removed to achieve the subgrade elevation for the floor slabs or pavements.

Once the demolition and backfill has been completed, the site should be graded. Ideally, the existing fill should be removed in its entirety and replaced with engineered fill. Considering the fill extends to as much as 4 ½ feet, it may be uneconomical to remove and replace it. Alternatively, the site could be cut to finish grade and the fill should be evaluated to be left in place. The stability would be based on:

- Composition, i.e., debris, organic content, and moisture content
- Stability during proofrolling, which depends, in part, on soil type and moisture content

No debris was identified in the fill during the soil borings. Fill could be left in place if the organic content is less than 4% and it passes proofrolling. In most areas, the moisture content of the upper soil is about 15.5 to 22.9 percent, which is near or above the plastic limit. A specific concern is that, clay soils tend to become unstable during earthwork operations if the moisture content is above the plastic limit.

The site preparation and earthwork need to be performed in the presence of a qualified geotechnical consultant to evaluate the existing fill.

Engineered backfill required for construction excavations or fill required to achieve desired grades should preferably consist of clean and well graded granular soils. Fill should be placed in uniform layers not more than 9 inches in thickness with the soils in each layer compacted to a minimum of 95% of the maximum density as determined by ASTM D1557. Fill should be at approximately the optimum moisture content during placement and compaction. Furthermore, frozen material must not be used as fill and fill should not be placed on frozen ground. It is imperative that the fill placed in the proposed building footprint be properly placed and compacted under continuous density monitoring.

Since the soils vary from soft clay to sand to firm clay and fill, lateral support structure or side sloping with a minimum 1H:1V ratio will be required for anticipated excavations. However, shallow trenched foundations should be stable through the firm clay and compacted engineered fill. We recommend budgeting a contingency for formed foundations.

5.3 Recommended Earthwork Operations (Cont'd)

Soils exposed in the bases of all satisfactory foundation excavations should be protected against any detrimental change in conditions such as from disturbances, rain or freezing. Surface run-off water should be drained away from the excavations and not be allowed to pond. If possible, all footing concrete should be placed the same day the excavation is made. If this is not possible, the footing excavations should be adequately protected.

5.4 Foundation Recommendations

Foundations should bear on soil deposits that have adequate strength to develop bearing capacity and sufficient stiffness to limit settlement for reasonably-sized footings with the anticipated loads. Local building codes and climatic conditions require that exterior foundations be placed at a minimum depth of 3 ½ feet below finished grade to provide for adequate frost protection. Interior foundations may be below the floor at a lesser depth if not exposed to frost penetration and bear on suitable soils. Regardless of the loads, the foundations must be larger than the superstructure they support along with construction tolerances.

The native site soils are acceptable for support of the proposed structure on shallow foundations. Foundations constructed on the firm to extremely stiff clay can be designed for a net allowable bearing pressure of 3,000 psf. These soils were encountered at depths of 1 to 5 feet below the existing grade or elevations 746.5 to 751 feet. The deepest fill appears to be at the north end of the building and at the south/southwest area of the building. At the north some of the fill may be backfill against the existing building basement. Foundations can be placed on engineered fill where it is placed over suitable soils to backfill the former house basement or to achieve finish grade if they are constructed as shown in Figure 1.

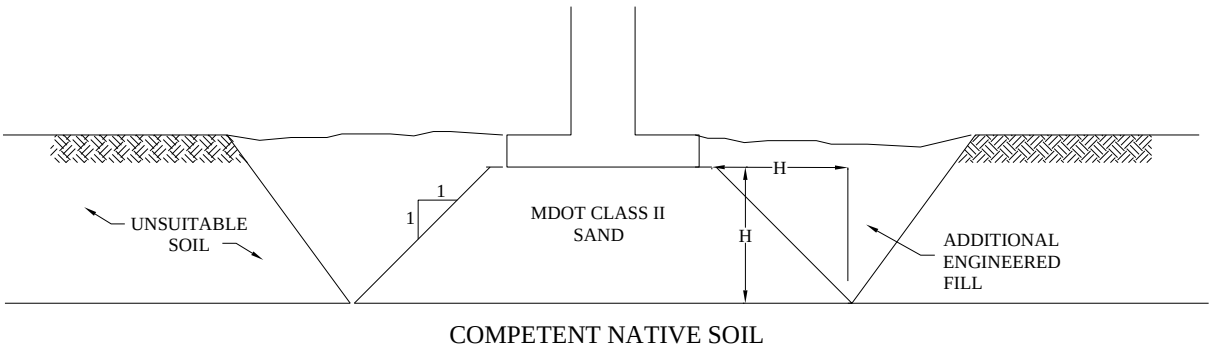

Figure 1: Detail showing footings on engineered fill

5.4 Foundation Recommendations (Cont'd)

Footing constructed as shown in Figure 1 can be designed for an allowable net bearing pressure of 3,000 psf.

The recommended design bearing pressure should provide a factor of safety of about 2.5 to 3 against shear failure and limit differential settlements between adjacent columns or walls to less than ¾ inch.

From a review of the borings and assumptions made about the lower lying soils a seismic site class of D is recommended for design. It is assumed that the lower lying soils below the bottom of the borings have an average N value between 15 and 50 and shear strengths between 1000 psf and 2000 psf. This appears to be a reasonable assumption from general geology of the area. This is based off of the Michigan Building Code, which incorporates the International Building Code.

5.5 Floor Slabs and Pavements

The subgrade resulting from the site preparation, as outlined in the recommended earthwork operations section, will provide a fair subgrade for support of pavements and floor slabs. Note that if the floor slabs and pavements will be constructed over existing fill, they may experience more than normal long-term settlement than if they were placed on native soil free of organic matter. Key concerns for the design and construction of floor slabs are structural support of the slab, stability of the subgrade during construction, and drainage of the cross-section in service.

The floor slab should be placed on 6 inches of compacted MDOT 21AA aggregate. Other concrete pavements should be placed on a minimum of 4 inches of clean compacted sand meeting MDOT Class II specifications or MDOT 21AA which will remain more stable during concrete placement.

For automobile drives and minimal truck traffic the following section is recommended:

1 ½ inch bituminous concrete wearing course (MDOT 5E1 or 4E1)
2 ½ inch bituminous concrete leveling course (MDOT 4E1)
10 inches untreated aggregate base (MDOT 21AA)

The aggregate base may be reduced to 8 inches in automobile parking areas.

Portland cement concrete is recommended for areas of sustained loads such as dumpster pads and the approach to the pad for the front wheels of the refuse truck.

5.5 Floor Slabs and Pavements (Cont'd)

Air entrained MDOT P1 grade concrete with partial slag cement replacement is recommended for new curb and gutter, mainline pavement at intersections & drive approaches or miscellaneous flatwork. If a high-performance concrete pavement is desired, MDOT P1M concrete is recommended. TEC recommends that the proposed concrete mixes effectively mitigate the potential for ASR reactivity utilizing a combination of methods such as partial slag cement substitution, use of low alkali Portland cement, and verification testing of the ASR expansion potential of the proposed fine aggregates and/or combinations of cementitious materials.

The pavement should be properly crowned and shaped in order to provide effective surface drainage and prevent water ponding. A 1.5 percent slope is recommended. Edge drains along the perimeter of the pavement and finger drains around catch basins are recommended to prevent water from infiltrating the subgrade. All drains should be connected to storm sewer or other outlets.

The pavement recommendations presented above are intended to provide a serviceable pavement for an extended period of time. However, all pavements show deterioration with time and require regular maintenance such as occasional repairs of cracks and pot holes. The need for such maintenance efforts is not necessarily indicative of premature pavement failure. The serviceable life of the pavement can be substantially reduced if maintenance and minor repair is not performed in a timely manner.

6.0 CASED BOREHOLE INFILTRATION TEST

A cased borehole test was performed in one borehole. The cased borehole test consists of installing a steel casing in an augered hole. The casing is pushed within the augered hole to the infiltration interface depth and filled with water. In this case the casing was set at a depth of 12 feet below existing ground surface at Boring No. 8 which is the approximate design infiltration depth. The testing was performed in general accordance with the low impact design (LID) Manual for Michigan.

The table below outlines the encountered soil, the depth at which the test was performed and the determined infiltration rate in inches per hour.

Boring No.	Soil Description	Test Depth (A)	Infiltration Rate, Inches Per Hour	Design Infiltration Rate, Inches Per Hour
8	Gray clay with some silt & trace of gravel	12	0	0

A. Below existing ground surface
B. Based on a safety factor of 2

6.0 CASED BOREHOLE INFILTRATION TEST (Cont'd)

The native soils at the site are all clay. The clay soils should be considered impermeable for design considerations.

A safety factor of 2 should be incorporated in the design of the infiltration by the designer.

7.0 DESIGN REVIEW AND FIELD MONITORING

The evaluations and recommendations presented in this report relative to site preparation and building foundations have been formulated on the basis of assumed and provided data relating to the location, type and finished grades for the proposed structure and adjacent areas. Any significant change in this data should be brought to our attention for review and evaluation with respect to the prevailing subsoil conditions.

When the building and foundation plans are finalized, a consultation should be arranged with us for a review to verify that the evaluations and recommendations have been properly interpreted.

Soil conditions at the site could vary from those generalized on the basis of test borings made at specific locations. It is therefore recommended that Testing Engineers & Consultants, Inc. be retained to provide soil engineering services during the site preparation, excavation and foundation phases of the proposed project. This is to observe compliance with the design concepts, specifications and recommendations. Also, this provides opportunity for design changes to be made in the event that subsurface conditions differ from those anticipated prior to the start of construction.

Gary E. Putt, P.E.
Senior Project Engineer

Carey J. Suhan, P.E.
Vice President, Geotechnical
& Environmental Services

GEP/CJS/ln
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Testing Engineers & Consultants, Inc.

Mr. Steve Robinson
BSLM KZOO, LLC
December 9, 2024

TEC Report: 64618

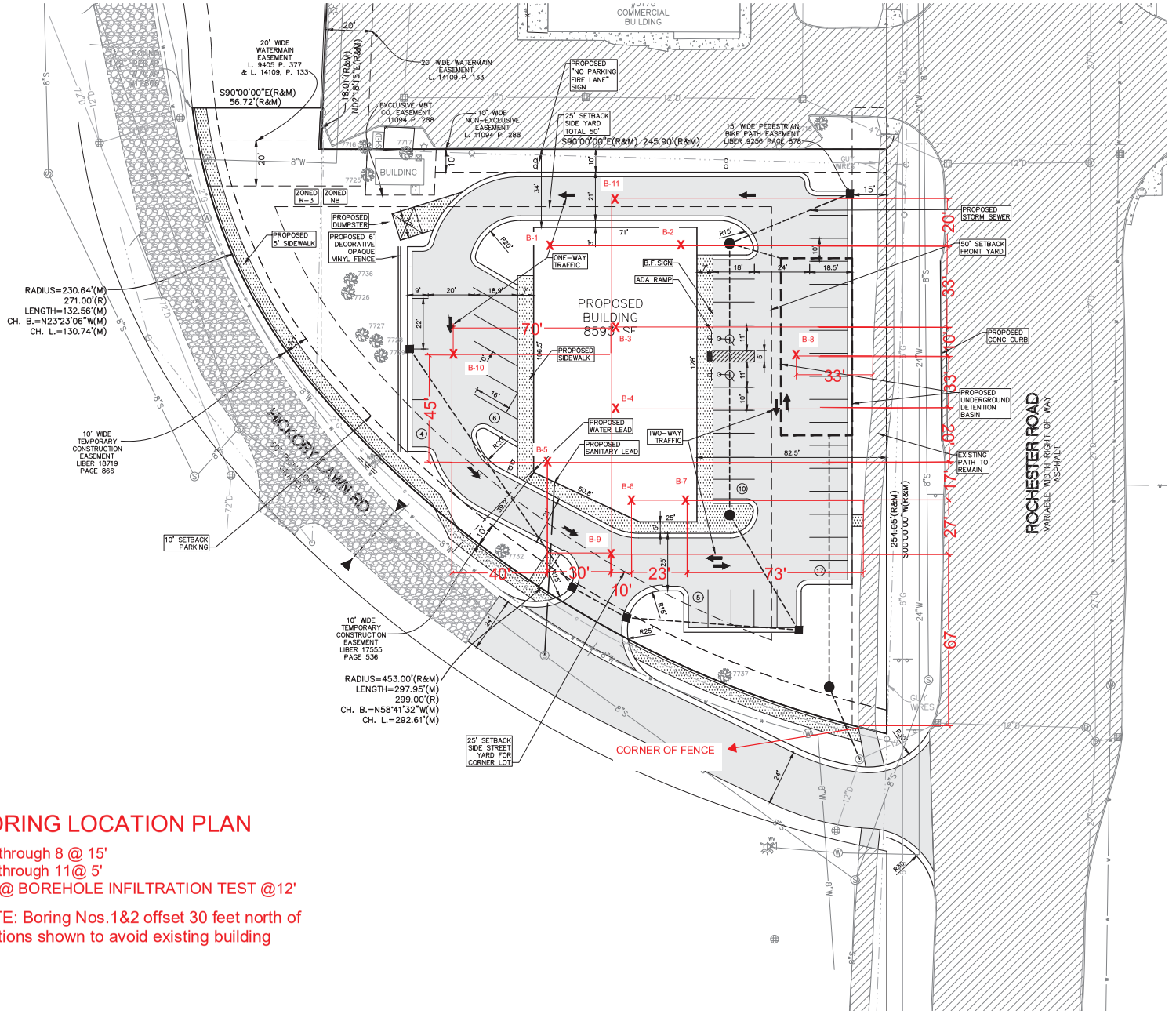
APPENDIX

Test Boring Location Plan

Logs Of Test Borings

Infiltration Test Results

General Notes For Soil Classification



BORING LOCATION PLAN

B-1 through 8 @ 15'
B 9 through 11@ 5'
B-8 @ BOREHOLE INFILTRATION TEST @12'

NOTE: Boring Nos.1&2 offset 30 feet north of locations shown to avoid existing building

SITE DATA

CURRENT ZONING	NB/R-3
SITE AREA (AC) =	1.22
SETBACKS	
FRONT (FT)	50
SIDE TOTAL [0' MIN] (FT)	50
PARKING (FT)	10

PARKING CALCULATION

OFFICE MEDICAL (1 SPACE PER 350 SF)	
PROPOSED SF	4709
SPACES REQUIRED	13.5
USE	14
RESTAURANT (1 SPACE PER 2 OCCUPANCY)	
PROPOSED SF	3884
MAXIMUM OCCUPANCY	56
SPACES REQUIRED	28.0
USE	28
TOTAL PARKING SPACES REQUIED	42
TOTAL PARKING SPACES PROVIDED	42
MINIMUM NUMBER OF GARRIER-FREE SPACE	
26-50 SPACES REQUIRES	2
SPACES PROVIDED	2

BUILDING SF < 20,000
NO LOADING SPACE REQUIRED

PROPOSED LEGEND

SANITARY SEWER
WATER MAIN
STORM SEWER
TREE PROTECTION FENCE
SILT FENCE
CURB AND GUTTER
SANITARY MANHOLE
STORM MANHOLE
CATCH BASIN
END SECTION
FIRE HYDRANT
GATE VALVE AND WELL
PAVEMENT (ASPHALT)
PAVEMENT (CONCRETE SIDEWALK)
1000 CONTOUR
1000.00 GRADE

SEIBER KEAST LEHNER
ENGINEERING | SURVEYING
SKL

REVISIONS
NO | DESCRIPTION | DATE

3 WORKING DAYS BEFORE YOU DIG CALL MISS DIG 1-800-482-7171 811 FOR LOCATION OF UNDERGROUND FACILITIES

PROJECT NUMBER: 24-100
PROJECT MANAGER:
DRAWN BY: N.G.
CHECKED BY: J.R.
SUBMITTAL DATE: 07/07/2021
OFFICE: FARMINGTON HILLS

CLIENT INFO:
BRODER SACHSE REAL ESTATE
3663 WOODWARD AVE, SUITE 550
DETROIT, MICHIGAN 48201
PHONE: 313.765.1000

PROJECT NAME:
ROCHESTER ROAD
SECTION 34, TOWN 3 NORTH - RANGE 11 EAST
ROCHESTER HILLS, OAKLAND COUNTY, MICHIGAN

SHEET TITLE:
OVERALL SITE PLAN

PAGE No.:
C4

Testing Engineers & Consultants, Inc.

1343 Rochester Road - PO Box 249 - Troy, Michigan - 48099-0249
(248) 588-6200
Fax (248) 588-6232

Boring No.: 1 **Job No.:** 64618

Client: BSLM KZOO, LLC

Type of Rig: Truck

Drilling Method: Solid Stem Augers

Ground Surface Elevation: 753

Project: Proposed Retail Building

Location: Rochester Hills, Michigan

Drilled By: I. Mickle

Started: 11/11/2024

Completed: 11/11/2024

Depth (ft)	Sample Type	N	Strata Change	Soil Classification	w	d	qu
	LS	2 1 2	.92	Moist Dark Brown Clayey TOPSOIL (11")	13.1	140	1130
2.5			3	Plastic Moist Dark Brown Silty Clay-FILL			
	LS	1 1 3	4.5	Soft Moist Dark Brown Silty Clay-FILL LL=23 PL=18 PI=5	19.9	128	910
5.0				Extremely Stiff Moist Brown Oxidized CLAY With Some Silt			
	LS	5 8 12			12.9	140	15410
7.5							
	LS	6 12 16			12.1	132	10140
10.0							
12.5			12.5				
	LS	5 7 8	15	Stiff Moist Gray Silty CLAY	10.9	131	4370
15.0				Moved 30' North Due To Existing House Bottom of Boring at 15'			
17.5							
20.0							
22.5							

"N" - Standard Penetration Resistance
SS - 2").D. Split Spoon Sample
LS - Sectional Liner Sample
ST - Shelby Tube Sample
AS - Auger Sample

w - H2O, % of dry weight
d - Bulk Density, pcf
qu - Unconfined Compression, psf
DP - Direct Push

Water Encountered: None

At Completion: None

Boring No. 1

Testing Engineers & Consultants, Inc.

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Boring No.: 2 **Job No.:** 64618

Client: BSLM KZOO, LLC

Type of Rig: Truck

Drilling Method: Solid Stem Augers

Ground Surface Elevation: 752

Project: Proposed Retail Building

Location: Rochester Hills, Michigan

Drilled By: I. Mickle

Started: 11/11/2024

Completed: 11/11/2024

Depth (ft)	Sample Type	N	Strata Change	Soil Classification	w	d	qu
			.25	Moist Dark Brown Clayey TOPSOIL (3")			
	LS	2 3 4	2.5	Firm Moist Dark Brown Silty Clay-FILL	22.9	122	2140
2.5	LS	2 2 2		Plastic Moist Brown Silty CLAY With Sand Seams LL=24 PL=19 PI=5	23.7	116	1320
5.0			5.5				
	LS	5 7 9		Stiff Moist Brown CLAY With Some Silt	12.6	130	6020
7.5							
	LS	6 10 17			11.7	134	6840
10.0							
12.5			13				
	LS	5 6 7		Firm Moist Gray Silty CLAY	10.9	133	3870
15.0			15				
				Moved 30' North Due To Existing House Bottom of Boring at 15'			
17.5							
20.0							
22.5							

"N" - Standard Penetration Resistance
SS - 2").D. Split Spoon Sample
LS - Sectional Liner Sample
ST - Shelby Tube Sample
AS - Auger Sample

w - H2O, % of dry weight
d - Bulk Density, pcf
qu - Unconfined Compression, psf
DP - Direct Push

Water Encountered: None

At Completion: None

Boring No. 2

Testing Engineers & Consultants, Inc.

1343 Rochester Road - PO Box 249 - Troy, Michigan - 48099-0249
(248) 588-6200
Fax (248) 588-6232

Boring No.: 3 **Job No.:** 64618

Client: BSLM KZOO, LLC

Type of Rig: Truck

Drilling Method: Solid Stem Augers

Ground Surface Elevation: 752

Project: Proposed Retail Building

Location: Rochester Hills, Michigan

Drilled By: I. Mickle

Started: 11/11/2024

Completed: 11/11/2024

Depth (ft)	Sample Type	N	Strata Change	Soil Classification	w	d	qu
	LS	2 2 4	2	Loose Moist Dark Brown Sand With Trace Of Gravel-FILL	9.3		
2.5				Firm Moist Brown CLAY With Some Silt			
	LS	4 6 8			11.8	100	
5.0			6				
	LS	4 7 9		Stiff Moist Brown CLAY With Some Silt	11.8	143	4610
7.5			8				
	LS	5 12 17		Extremely Stiff Moist Brown CLAY With Some Silt	11.0	146	14480
10.0							
12.5			12.5				
	LS	4 5 8		Stiff Moist Gray Silty CLAY LL=19 PL=13 PI=6	11.3	136	6350
15.0			15				
				Bottom of Boring at 15'			
17.5							
20.0							
22.5							

"N" - Standard Penetration Resistance
SS - 2").D. Split Spoon Sample
LS - Sectional Liner Sample
ST - Shelby Tube Sample
AS - Auger Sample

w - H2O, % of dry weight
d - Bulk Density, pcf
qu - Unconfined Compression, psf
DP - Direct Push

Water Encountered: None

At Completion: None

Boring No. 3

Testing Engineers & Consultants, Inc.

1343 Rochester Road - PO Box 249 - Troy, Michigan - 48099-0249
(248) 588-6200
Fax (248) 588-6232

Boring No.: 4 **Job No.:** 64618

Client: BSLM KZOO, LLC

Type of Rig: Truck

Drilling Method: Solid Stem Augers

Ground Surface Elevation: 752

Project: Proposed Retail Building

Location: Rochester Hills, Michigan

Drilled By: I. Mickle

Started: 11/11/2024

Completed: 11/11/2024

Depth (ft)	Sample Type	N	Strata Change	Soil Classification	w	d	qu
			.17				
			.83	ASPHALT (2")			
	LS	2			17.7	132	4120
		5					
2.5		8	3	Moist Dark Brown Sand-FILL (8")			
	LS	6		Stiff Moist Brown CLAY With Some Silt & Sand Seams	8.6	131	2310
		13					
5.0		17		Firm Moist Brown CLAY With Some Silt			
	LS	6			11.2	120	3380
		8					
7.5		11					
	LS	6	9		11.3	128	4120
		16					
10.0		21		Stiff Moist Brown CLAY With Some Silt			
12.5			13				
	LS	4		Stiff Moist Gray CLAY With Some Silt & Trace Of Gravel	11.7	145	5770
		5					
15.0		6	15				
				Bottom of Boring at 15'			
17.5							
20.0							
22.5							

"N" - Standard Penetration Resistance
SS - 2").D. Split Spoon Sample
LS - Sectional Liner Sample
ST - Shelby Tube Sample
AS - Auger Sample

w - H2O, % of dry weight
d - Bulk Density, pcf
qu - Unconfined Compression, psf
DP - Direct Push

Water Encountered: None

At Completion: None

Boring No. 4

Testing Engineers & Consultants, Inc.

1343 Rochester Road - PO Box 249 - Troy, Michigan - 48099-0249
(248) 588-6200
Fax (248) 588-6232

Boring No.: 5 **Job No.:** 64618

Client: BSLM KZOO, LLC

Type of Rig: Truck

Drilling Method: Solid Stem Augers

Ground Surface Elevation: 751

Project: Proposed Retail Building

Location: Rochester Hills, Michigan

Drilled By: I. Mickle

Started: 11/11/2024

Completed: 11/11/2024

Depth (ft)	Sample Type	N	Strata Change	Soil Classification	w	d	qu
			.42	Moist Dark Brown Sandy TOPSOIL (5")			
	LS	5			7.6		
		12					
2.5		10		Medium Compact Moist Brown Sand With Crushed Concrete-FILL			
	LS	8	4		9.2		
		14					
5.0		16		Stiff Moist Brown CLAY With Some Silt			
	LS	4			11.3	141	6260
		7					
7.5		11	8				
	LS	15		Hard Moist Brown CLAY With Some Silt & Trace Of Gravel	8.7	109	
		29/6"					
10.0							
12.5			13				
	LS	6		Extremely Stiff Moist Gray Silty CLAY	9.6	144	12200
		8					
15.0		11	15				
				Bottom of Boring at 15'			
17.5							
20.0							
22.5							

"N" - Standard Penetration Resistance
SS - 2").D. Split Spoon Sample
LS - Sectional Liner Sample
ST - Shelby Tube Sample
AS - Auger Sample

w - H2O, % of dry weight
d - Bulk Density, pcf
qu - Unconfined Compression, psf
DP - Direct Push

Water Encountered: None

At Completion: None

Boring No. 5

Testing Engineers & Consultants, Inc.

1343 Rochester Road - PO Box 249 - Troy, Michigan - 48099-0249
(248) 588-6200
Fax (248) 588-6232

Boring No.: 6 **Job No.:** 64618

Client: BSLM KZOO, LLC

Type of Rig: Truck

Drilling Method: Solid Stem Augers

Ground Surface Elevation: 751

Project: Proposed Retail Building

Location: Rochester Hills, Michigan

Drilled By: I. Mickle

Started: 11/11/2024

Completed: 11/11/2024

Depth (ft)	Sample Type	N	Strata Change	Soil Classification	w	d	qu
			.17	ASPHALT (2")			
	LS	2 2 3	2 3	Loose Moist Dark Brown Sand-FILL	18.8	120	1480
2.5	LS	4 8 10		Plastic Moist Brown CLAY With Some Silt	13.0	118	2970
5.0	LS	4 7 10	6 8	Firm Moist Brown CLAY With Some Silt & Trace Of Gravel	13.2	140	6760
7.5	LS	6 10 15		Stiff Moist Brown CLAY With Some Silt & Trace Of Gravel	11.9	140	10880
10.0	LS	3 5 6	13 15	Extremely Stiff Moist Brown CLAY With Some Silt & Trace Of Gravel	11.9	132	3540
12.5				Firm Moist Gray Silty CLAY			
15.0				Bottom of Boring at 15'			
17.5							
20.0							
22.5							

"N" - Standard Penetration Resistance
SS - 2").D. Split Spoon Sample
LS - Sectional Liner Sample
ST - Shelby Tube Sample
AS - Auger Sample

w - H2O, % of dry weight
d - Bulk Density, pcf
qu - Unconfined Compression, psf
DP - Direct Push

Water Encountered: None

At Completion: None

Boring No. 6

Testing Engineers & Consultants, Inc.

1343 Rochester Road - PO Box 249 - Troy, Michigan - 48099-0249
(248) 588-6200
Fax (248) 588-6232

Boring No.: 7 **Job No.:** 64618

Client: BSLM KZOO, LLC

Type of Rig: Truck

Drilling Method: Solid Stem Augers

Ground Surface Elevation: 751

Project: Proposed Retail Building

Location: Rochester Hills, Michigan

Drilled By: I. Mickle

Started: 11/11/2024

Completed: 11/11/2024

Depth (ft)	Sample Type	N	Strata Change	Soil Classification	w	d	qu
			.67	Moist Dark Brown Sand With Crushed Stone-FILL (8")			
	LS	4			10.1		
		6					
2.5		6		Firm Moist Brown CLAY With Some Silt & Sand Seams			
	LS	8			10.8	138	2470
		14					
5.0		10					
			5.5				
	LS	5		Stiff Moist Brown CLAY With Some Silt & Sand Seams, Wet At 8'	13.2	143	5110
		5					
7.5		7					
			8				
	LS	6		Extremely Stiff Moist Variegated CLAY With Some Silt & Trace Of Gravel	12.6	140	9890
		9					
10.0		11					
			12				
12.5				Stiff Moist Gray Silty CLAY			
	LS	3			12.7	137	4200
		5					
15.0		5	15				
				Bottom of Boring at 15'			
17.5							
20.0							
22.5							

"N" - Standard Penetration Resistance
SS - 2").D. Split Spoon Sample
LS - Sectional Liner Sample
ST - Shelby Tube Sample
AS - Auger Sample

w - H2O, % of dry weight
d - Bulk Density, pcf
qu - Unconfined Compression, psf
DP - Direct Push

Water Encountered: 8'0"

At Completion: 13'0"

Boring No. 7

Testing Engineers & Consultants, Inc.

1343 Rochester Road - PO Box 249 - Troy, Michigan - 48099-0249
(248) 588-6200
Fax (248) 588-6232

Boring No.: 8 **Job No.:** 64618

Client: BSLM KZOO, LLC

Type of Rig: Truck

Drilling Method: Solid Stem Augers

Ground Surface Elevation: 751

Project: Proposed Retail Building

Location: Rochester Hills, Michigan

Drilled By: I. Mickle

Started: 11/11/2024

Completed: 11/11/2024

Depth (ft)	Sample Type	N	Strata Change	Soil Classification	w	d	qu
			.17				
			.83	ASPHALT (2")			
	LS	2			17.0	122	1900
		4					
2.5		5	3	Moist Dark Brown Clayey Sand-FILL (8")			
	LS	8		Plastic Moist Brown CLAY With Some Silt, Trace Of Gravel & Sand Seams	8.4	132	4120
		7					
5.0		10					
				Stiff Moist Brown CLAY With Some Silt			
	LS	6			12.6	139	7990
		8					
7.5		13					
	LS	8			11.2	126	6920
		14					
10.0		20/4"					
			12				
12.5				Stiff Moist Gray CLAY With Some Silt & Trace Of Gravel			
	LS	3			11.4	141	5440
		5					
15.0		7	15				
				Bottom of Boring at 15'			
17.5							
20.0							
22.5							

"N" - Standard Penetration Resistance
SS - 2").D. Split Spoon Sample
LS - Sectional Liner Sample
ST - Shelby Tube Sample
AS - Auger Sample

w - H2O, % of dry weight
d - Bulk Density, pcf
qu - Unconfined Compression, psf
DP - Direct Push

Water Encountered: None

At Completion: None

Boring No. 8

Testing Engineers & Consultants, Inc.

1343 Rochester Road - PO Box 249 - Troy, Michigan - 48099-0249
(248) 588-6200
Fax (248) 588-6232

Boring No.: 9 **Job No.:** 64618

Client: BSLM KZOO, LLC

Type of Rig: Truck

Drilling Method: Solid Stem Augers

Ground Surface Elevation: 751

Project: Proposed Retail Building

Location: Rochester Hills, Michigan

Drilled By: I. Mickle

Started: 11/11/2024

Completed: 11/11/2024

Depth (ft)	Sample Type	N	Strata Change	Soil Classification	w	d	qu
			.17	ASPHALT (2")			
	LS	2	1.5		18.6	128	3710
		3		Loose Moist Dark Brown Clayey Sand-FILL			
2.5		4	3				
	LS	4		Firm Moist Brown CLAY With Some Silt & Dark Brown Layers-Possible Fill	13.7	125	7580
		7					
5.0		11	5				
				Stiff Moist Brown Oxidized CLAY With Some Silt			
				Bottom of Boring at 5'			
7.5							
10.0							
12.5							
15.0							
17.5							
20.0							
22.5							

"N" - Standard Penetration Resistance
SS - 2").D. Split Spoon Sample
LS - Sectional Liner Sample
ST - Shelby Tube Sample
AS - Auger Sample

w - H2O, % of dry weight
d - Bulk Density, pcf
qu - Unconfined Compression, psf
DP - Direct Push

Water Encountered: None

At Completion: None

Boring No. 9

Testing Engineers & Consultants, Inc.

1343 Rochester Road - PO Box 249 - Troy, Michigan - 48099-0249
(248) 588-6200
Fax (248) 588-6232

Boring No.: 10 **Job No.:** 64618

Client: BSLM KZOO, LLC

Type of Rig: Truck

Drilling Method: Solid Stem Augers

Ground Surface Elevation: 752

Project: Proposed Retail Building

Location: Rochester Hills, Michigan

Drilled By: I. Mickle

Started: 11/11/2024

Completed: 11/11/2024

Depth (ft)	Sample Type	N	Strata Change	Soil Classification	w	d	qu
			.17	ASPHALT (2")			
	LS	8			16.3		
		17/6"					
2.5			3	Compact Moist Dark Brown Sand With Crushed Concrete & Asphalt-FILL			
	LS	5			10.3	130	5850
		13		Stiff Moist Brown Oxidized CLAY With Some Silt			
5.0		18	5				
				Bottom of Boring at 5'			
7.5							
10.0							
12.5							
15.0							
17.5							
20.0							
22.5							

"N" - Standard Penetration Resistance
SS - 2").D. Split Spoon Sample
LS - Sectional Liner Sample
ST - Shelby Tube Sample
AS - Auger Sample

w - H2O, % of dry weight
d - Bulk Density, pcf
qu - Unconfined Compression, psf
DP - Direct Push

Water Encountered: None

At Completion: None

Boring No. 10

Testing Engineers & Consultants, Inc.

1343 Rochester Road - PO Box 249 - Troy, Michigan - 48099-0249
(248) 588-6200
Fax (248) 588-6232

Boring No.: 11 **Job No.:** 64618

Client: BSLM KZOO, LLC

Type of Rig: Truck

Drilling Method: Solid Stem Augers

Ground Surface Elevation: 752

Project: Proposed Retail Building

Location: Rochester Hills, Michigan

Drilled By: I. Mickle

Started: 11/11/2024

Completed: 11/11/2024

Depth (ft)	Sample Type	N	Strata Change	Soil Classification	w	d	qu
			.17	Moist Dark Brown Clayey TOPSOIL (2")			
	LS	3 2 4	2		15.5	100	
2.5				Plastic Moist Dark Brown Clay With Some Silt-FILL			
	LS	4 6 8		Stiff Moist Brown CLAY With Some Silt	10.9	142	7230
5.0			5				
				Bottom of Boring at 5'			
7.5							
10.0							
12.5							
15.0							
17.5							
20.0							
22.5							

"N" - Standard Penetration Resistance
SS - 2").D. Split Spoon Sample
LS - Sectional Liner Sample
ST - Shelby Tube Sample
AS - Auger Sample

w - H2O, % of dry weight
d - Bulk Density, pcf
qu - Unconfined Compression, psf
DP - Direct Push

Water Encountered: None

At Completion: None

Boring No. 11

Testing Engineers Consultants, Inc.

CASED BOREHOLE INFILTRATION TEST

TEC Project No.: 64618

Client: BSLM

Project RETAIL BLDG.

Test Location: B-9

Date: 11/11/24

Comments:

Test

Time Interval (min.)	Water level from top of ring (in.)
0	
10	
20	
30	0
40	
50	
60	0
70	
80	
90	0
100	
110	
120	0

Casing DIA.(in): 4

Test Depth (ft): 12

Length of Stick-Up (ft): 3

Presoak

Time Interval (min.)	Water level from top of ring (in.)
30	0
60	0

Infiltation Rate (in/hr): 0

Testing Engineers & Consultants, Inc.

Mr. Steve Robinson
BSLM KZOO, LLC
December 9, 2024

TEC Report: 64618

SOIL DESCRIPTIONS

In order to provide uniformity throughout our projects, the following nomenclature has been adopted to describe soil characteristics:

CONSISTENCY AND RELATIVE DENSITY

COHESIVE SOILS			GRANULAR SOILS	
UNCONFINED COMPRESSIVE STRENGTH, PSF	**"N" VALUES**	**CONSISTENCY**	**"N" VALUES**	**RELATIVE DENSITY**
Below 500	0 – 2	Very Soft	0 – 4	Very Loose
500 – 1,000	3 – 4	Soft	5 – 10	Loose
1,000 – 2,000	5 – 8	Plastic	11 – 30	Medium Compact
2,000 – 4,000	9 – 15	Firm	31 – 50	Compact
4,000 – 8,000	16 – 30	Stiff	50+	Dense
8,000 – 16,000	31 – 50	Ex. Stiff		
Over 16,000	51+	Hard		

Material Types By Particle Size	**ASTM D2487**
BOULDERS	Stones Over 12" In Diameter
COBBLES	Stones 3" To 12" In Diameter
GRAVEL	#4 To 3" Diameter
COARSE SAND	#10 To #4 Sieves
MEDIUM SAND	#40 To #10 Sieves

Mr. Steve Robinson
BSLM KZOO, LLC
December 9, 2024

TEC Report: 64618

SOIL DESCRIPTIONS (Cont'd)

Material Types By Particle Size	**ASTM D2487**
FINE SAND	#200 To #40 Sieves
SILT	Minus #200 Sieve Material, Fairly Non-Plastic, Falls Below "A"-Line
CLAY	Minus #200 Sieve Material Plastic Material That Has A Tendency To Stick Together, Can Be Rolled Into Fine Rods When Moistened; Falls Above "A"-Line
PEAT	Black Organic Material Containing Partially Decayed Vegetable Matter
MARL	Fresh Water Deposits Of Calcium Carbonate, Often Containing Percentages Of Peat, Clay & Fine Sand
SWAMP BOTTOM DEPOSITS	Mixtures Of Peat, Marl, Vegetation & Fine Sand Containing Large Amounts Of Decayable Organic Material