



REPORT OF THE
GEOTECHNICAL INVESTIGATION FOR
M-72 INDUSTRIAL UNIT COMPLEX - PHASE B

ACME TOWNSHIP
GRAND TRAVERSE COUNTY
MICHIGAN

AUGUST 18, 2023



*J. Francis Properties LLC
5953 Scharmen Road
Traverse City, Michigan 49696*

Project No. 2023.0981



August 18, 2023

J. Francis Properties LLC
5953 Scharmen Road
Traverse City, Michigan 49696

Attention: Mr. Josh Francis

Regarding: M-72 Industrial Unit Complex – Phase B
Geotechnical Report
Acme Township, Grand Traverse County, Michigan
Project No. 2023.0981

Dear Mr. Francis:

Soils & Structures is pleased to present this geotechnical investigation report for the M-72 Industrial Unit Complex – Phase B project located at 6140 East Arnold Road in Acme Township, Grand Traverse County, Michigan.

The investigation included fourteen (14) test borings drilled to depths of 10.0 and 20.0 feet. The test borings were conducted in accordance with ASTM D 1586 procedures.

The report, test boring location plan, and test boring logs are enclosed. The report provides recommendations for site preparation, foundations, fill, floors, and pavement.

We appreciate the opportunity to provide engineering services to J. Francis Properties LLC. If you have any questions regarding this report, please contact our office.

Sincerely,
Soils & Structures, Inc.

A handwritten signature in black ink, appearing to read "Malea G. Tanner".

Malea G. Tanner, E.I.T.
MGT/mt

Reviewed by:

A handwritten signature in black ink, appearing to read "Malcolm P. Thompson".

Malcolm P. Thompson, P.E.

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- Laboratory Tests
- General Soil Information



Location of Soil Investigation

The soil investigation was conducted at the site located east of 6140 East Arnold Road in Section 32, Acme Township, Grand Traverse County, Michigan. The parcel number for the site is 01-015-005-06.

Purpose of Investigation

The purpose of this investigation is to provide geotechnical engineering recommendations for the design and construction of the proposed buildings and pavement.

Design Information

The two proposed buildings are anticipated to be single-story, steel-framed structures with slab on grade floors. The planned footprint of each of the new buildings is 12,000 square feet. Pavement for the project will include an access drive and a parking lot.

The maximum column and wall loads are anticipated to be less than 100,000 pounds and 5,000 pounds per linear foot, respectively. Allowable settlements of 0.6 inches for total settlement and 0.4 inches for differential settlement are assumed. If the actual design is significantly different than assumed in this report, then Soils & Structures should be contacted so that the recommendations included in this report may be reviewed and revised if necessary.

The floor elevation of the buildings has not been determined at the time of this report, but is anticipated to be approximately 752.0 feet. Excavation and fill will be required to remove topsoil and achieve the desired grade. Excavation and backfill will be required for construction of the foundations and utilities. The greatest depth of excavation for construction of the foundations and utilities is anticipated to be less than 4.0 feet below the proposed floor elevation. Groundwater controls and dewatering will probably not be necessary.

An equivalent single-axle load (ESAL) of 250,000 was used for the design of preliminary pavement sections. The final pavement sections should be based on site-specific traffic loading. Pavement is assumed to be subjected to automobile and truck traffic. A service life of twenty years was assumed for the pavement subgrade recommendations. The subgrade is assumed to be prepared as recommended in this report.

Tests Performed

The investigation included fourteen (14) test borings drilled to depths of 10.0 and 20.0 feet. The test borings are designated as Test Boring One (TB-01) through Test Boring Fourteen (TB-14). The locations were determined collaboratively by Soils & Structures and J. Francis Properties LLC. The test borings were conducted in accordance with ASTM D 1586 procedures. The ASTM D 1586 standard describes the procedure for sampling and testing soil using the Standard Penetration Test. An automatic hammer was used to obtain the soil samples.

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. Measurements of additional site-specific reference points were also obtained. Both the vertical and horizontal measurements typically have an accuracy of approximately 0.5 inches. The measured test boring locations and surface elevations can be found 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	748.9	533523.8	19408233.6	Topsoil
Test Boring Two	748.0	533525.4	19408293.6	Topsoil
Test Boring Three	749.5	533430.6	19408262.8	Topsoil
Test Boring Four	751.1	533324.8	19408235.6	Topsoil
Test Boring Five	751.2	533328.0	19408293.8	Topsoil
Test Boring Six	748.1	533532.0	19408370.5	Topsoil
Test Boring Seven	748.6	533532.2	19408427.8	Topsoil
Test Boring Eight	750.5	533447.8	19408400.7	Topsoil
Test Boring Nine	751.4	533331.4	19408377.0	Topsoil
Test Boring Ten	750.5	533334.5	19408436.7	Topsoil
Test Boring Eleven	749.7	533495.6	19408328.4	Topsoil
Test Boring Twelve	750.6	533388.5	19408331.0	Topsoil
Test Boring Thirteen	751.2	533253.9	19408319.3	Topsoil
Test Boring Fourteen	751.9	533258.7	19408407.5	Topsoil
Base Setup VRS1	749.9	533286.2	19408027.1	-

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 (ASTM D 2216) and sieve analysis (ASTM D 6913). The tests were performed on representative soil samples. The tests were performed in accordance with the ASTM standards listed above. The moisture content documents the presence of groundwater in the soil. The sieve analysis determines the particle distribution which is used to classify the soil and estimate its properties.

The U.S. Geological Survey Topographic map and the Quaternary Geology map of Michigan were reviewed. These maps provide general geological information about the region. Publicly available well log records were reviewed to determine the depth of bedrock.

Description of Soil

The general soil profile consists of a layer of sand which extends to a depth of at least 20.0 feet. The soil profile is a deposit of coarse-textured glacial till. A coarse-textured glacial till is a mixture of soil types in which sand is the primary soil type.

Bedrock is anticipated to be present at a depth greater than 100.0 feet. The bedrock is part of the Ellsworth Shale Deposit which consists of primarily gray and greenish gray shale. The Ellsworth Shale Deposit formed during the Devonian period which ended approximately 358.9 million years ago.

Topsoil is present at the surface. The topsoil thickness ranges from 6.0 to 16.0 inches. The average topsoil thickness is 11.0 inches.

The sand layer consists of light brown and brown, fine to medium sand with occasional lenses of gravel. The sand layer extends to a depth of at least 20.0 feet. The “N” values of the sand layer range from 3 to 87, indicating the sand is in a loose to extremely compact state. The loose portions of the sand layer are present in the upper 9.0 feet of the sand layer in the areas of Test Boring Three and Test Boring Eight. Most of the sand layer is in a compact to very compact state with the occasional pocket of loose to slightly compact sand. Compact sand is indicated by “N” values equal to or greater than 8. The sand should have an internal friction angle of greater than 30 degrees when it is compacted to 95.0 percent of its maximum density. The sand layer will support foundations, floors and pavement following site preparations.

Pockets of silty sand are present in the areas of Test Boring Four and Test Boring Eight. The sand pockets consist of light brown and brown, fine to medium silty sand with a trace of gravel. The sand pockets with a high silt content are present in the upper 9.0 feet of the soil profile. The “N” values of the sand pockets range from 4 to 14, indicating the sand is in a loose to compact state. The “N” values correspond to an internal friction angle between 26 and 31 degrees.

A pocket of silt is present in the area of Test Boring Three between depths of 9.0 and 13.0 feet. The silt pocket consists of brown sandy silt with a trace of clay. The “N” value of the silt pocket is 9, indicating the silt is in a stiff state. The internal friction angle of silt is between 24 and 28 degrees.

Description of Groundwater Conditions

The water table was not encountered in the test borings. The water table is probably present below a depth of 20.0 feet which was the maximum depth reached during drilling. The water table elevation is anticipated to fluctuate based on seasonal precipitation. Long term groundwater monitoring was not included as part of the investigation.

Description of Site

The site is located east of 6140 East Arnold Road in Acme Township, Grand Traverse County, Michigan. The site consists of a grassy lot. The site is bordered to the south, east, and west by commercial properties. The site is also bordered to the south by M-72 and to the north by an access drive. The surface elevation of the site in the area of the test borings ranges from approximately 748.0 to 751.9 feet. Photographs #1 and #2 show the site at the time of the investigation.



Photograph #1: Central portion of the site. (Project No. 2023.0981, M-72 Industrial Unit Complex – Phase B, Acme Township, Grand Traverse County, Michigan, July 2023)



Photograph #2: Central portion of the site. View is to the east. (Project No. 2023.0981, M-72 Industrial Unit Complex – Phase B, Acme Township, Grand Traverse County, Michigan, July 2023)

Recommendations

Site & Subgrade Preparation

Trees and vegetation in the building and pavement areas should be cleared and removed as part of subgrade preparation. The topsoil should be removed to the extent that all soil with an organic content of 3.0 percent or greater is removed. In the area of Test Boring Eight, topsoil is present within the sand layer to a depth of 3.5 feet and should be removed. Soil containing roots should be removed to the extent that the root content by volume is 5.0 percent or less. All roots over 0.5 inches in diameter should be removed. The average thickness of topsoil anticipated to be removed is approximately 1.0 foot.

Fill or excavation may be required to achieve the desired grade. Excavation and backfill will be required for construction of foundations and utilities. The maximum depth of excavation is anticipated to be 4.0 feet below the floor elevation. Excavated sand with a low fines content may be retained for use as fill. Fill should be placed following the recommendations in the “Fill” section of this report. Fill should be compacted to 95.0 percent of the soil’s maximum density to its full depth. Compaction tests are recommended to verify the level of compaction.

The subgrade below the building and pavement should be proof rolled prior to construction. The proof roll should consist of single, overlapping passes. Areas that experience yielding during the proof roll should be recompacted. If these areas still experience yielding following compaction, undercutting or the use of geogrid may be required to stabilize the subgrade.



Soil brought to the site for fill should be clean sand and gravel meeting MDOT specifications. The soil which will be used for fill should be kept free of topsoil and other organic materials. Compaction tests are recommended to check the compaction of the new fill.

Foundations

Spread foundations are recommended to support the buildings provided the subgrade is prepared as discussed in this section as well as the "Site & Subgrade Preparation" and "Fill" sections of this report including compaction. The foundations are anticipated to be supported on the in-situ soil or fill following site preparation.

Fill below the building should be compacted to a density of 95.0 percent of the soil's maximum density to its full depth. In-situ sand should be compacted to 95.0 percent of the sand's maximum density prior to placement of fill or construction of the buildings or pavement. Compaction tests should be performed in the foundation subgrade to verify these levels of compaction. Soils not exceeding the minimum density should be recompacted.

The recommended minimum cover over the bottom of exterior foundations is 42 inches for protection against frost heave. Foundations should not be constructed on frozen soil. During cold weather construction, the foundation subgrade and foundations should be protected from freezing with insulated blankets until backfill is placed over both sides of the foundation. Foundations that are damaged by frost heave should be replaced.

The site classification for seismic design is "D" based on the Michigan Building Code provided the recommendations in this report are observed. The site has a peak ground acceleration of 0.053g with a 2.0 percent probability of exceedance in 50 years. The mapped spectral accelerations are 0.049 for the short-term response (S_s) and 0.031 for the one second response (S_1). The corresponding numeric seismic design values for the site classification and spectral response acceleration parameters above are 0.052g (S_{DS}) and 0.050g (S_{D1}) respectively.

Foundations may be designed using an allowable bearing value of 3,000 pounds per square foot for column footings and 2,500 pounds per square foot for wall foundations provided the recommendations for subgrade preparation in the previous section are followed including compaction. A minimum width of 16.0 inches is recommended for new foundations. The allowable bearing values may be increased 25.0 percent when considering transient loads such as earthquakes and wind.

Settlement

The maximum settlement of the buildings is anticipated to be less than 0.4 inches provided the recommendations in this report are observed. Differential settlement will be approximately one half of the maximum value. These levels of settlement are within the recommended acceptable limits of 0.6 inches of total settlement and 0.4 inches of differential settlement.

Floors

A slab on grade is recommended for the floor. A modulus of subgrade reaction of 150 pounds per cubic inch is recommended for the design of slabs on grade.

A base of 6.0 inches of clean sand is recommended under the floors. The sand should meet MDOT Class II specifications. Fill under floors should be compacted as specified in the "Fill" section of this report. The clean sand layer present near the surface may be used for the sand base. Soil that contains organic materials or has a high silt content should be replaced.

Lateral Earth Pressure

Foundation walls with different soil levels on either side should be designed as retaining walls. Sand should be used as backfill behind retaining and foundation walls. The sand should meet MDOT Class II specifications. The walls should be designed using a soil density of 120 pounds per cubic foot, a coefficient of active earth pressure of 0.35 for level sand backfill and a coefficient of at rest earth pressure of 0.50. The effects of any surcharge or sloping backfill should also be included in the design. The passive resistance of the existing sand should be calculated using an earth pressure coefficient of 2.8.

Excavations

The in-situ soils are OSHA type "C" soils. Excavations that will be entered by personnel should be based on OSHA requirements for a type "C" soil. Based on OSHA requirements, a maximum allowable side slope of 34 degrees [1.5H:1V] is recommended for excavations 4.0 to 15.0 feet deep. Excavations less than 4.0 feet deep may have vertical side slopes. Excavations adjacent to structures or property lines may require temporary shoring.

Fill

Fill, including the aggregate layers under pavement, should be compacted to a density of 95.0 percent of its maximum density. The maximum density should be determined in accordance with the ASTM D 1557 standard. A maximum thickness per lift of 6.0 inches is recommended. The maximum thickness may be increased to 12.0 inches if a vibratory roller or hoe-pack is used. Compaction tests are recommended to confirm that the fill is compacted to the required density.

Soil brought to the site for structural fill should be sand meeting MDOT Class II requirements or ASTM requirements for a SP or SW which are the designations for clean sand. Excavated sand with a low fines content may be retained for use as fill.

Fill should not be placed over frozen ground, snow, or ice. Soil which contains frozen material should not be used as fill. During winter construction, removal of frozen ground may be necessary prior to placing fill.

Groundwater Management

Dewatering will probably not be necessary for construction of the foundations and groundwater will probably not be encountered in excavations. If groundwater is encountered in excavations for utilities and foundations, the excavation bottom may be stabilized by placing a 6.0 to 8.0-inch layer of porous aggregate over the bottom of the excavation. The aggregate will stabilize the bottom of the excavation.

A vapor barrier is recommended under the floor in areas that will be enclosed and heated. The vapor barrier should consist of a 10-mil polyethylene sheet and should be located immediately below the floor slab. The vapor barrier may be omitted in portions of the buildings that will not be heated.

Drains around the exterior foundations are recommended. The drains should consist of a 4.0-inch diameter slotted plastic pipe wrapped in filter fabric. Pea gravel should be used for backfill within a 6.0-inch circumference of the drain. The drain should outlet a minimum of 30.0 inches below the floor elevation. Pavement areas should be properly drained to minimize the effects of frost heaving and the loss of subgrade due to water infiltration. Pavement should be sloped toward regional low points and catch basins.

Hot Mix Asphalt (HMA) Pavement

The recommended preliminary HMA pavement sections listed in Table 2 were developed based on the discussions and assumptions included in this report and the design procedures outlined in the "AASHTO Guide for Design of Pavement Structures." The subgrade should be prepared as described in the "Site & Pavement Subgrade Preparation" and "Fill" sections of this report. The recommended pavement section materials listed in Table 2 refer to and should comply with the standard material designations included in applicable MDOT specifications and guidelines including the 2020 MDOT "Standard Specifications for Construction."

The following recommendations assume that maintenance repairs such as joint sealing, patching, and overlays are regularly performed throughout the lifespan of the pavement and that proper drainage has been established throughout the site. Proper drainage may include the installation of stormwater controls, underdrains, and establishing positive drainage in the subgrade and pavement layers.

Table 2: Recommended Pavement Sections

Pavement Cross Section Materials	Standard Duty		Heavy Duty	
	Material	Thickness (in)	Material	Thickness (in)
HMA Wearing Course	4EML	2.0	4EML	2.5
HMA Base Course	4EML	2.0	4EML	2.5
Aggregate Base	22A, 21AA	8.0	22A, 21AA	10.0
Sand Subbase	Class II	12.0	Class II	12.0

The recommended asphaltic binder is PG 64-28 for “E” mixes. Tier 1 recycled asphalt (RAP) specifications may be used in combination with the PG 64-28 binder for the wearing course. Tier 2 RAP may be used for the base course. The compacted asphalt should be between 94.0 and 97.0 percent of the Theoretical Maximum Density, as determined via the Superpave “Rice” Method. The target void content should be 3.5 percent for both the leveling and wearing course. A tack or “bond coat” of SS-1h emulsion shall be applied between the base and wearing course layers at a rate of 0.1 gallons per square yard.

The paving contractor should submit the proposed mix design to the owner for review and approval prior to placement. The HMA pavement should be placed in at least two lifts. The pavement section should be constructed in accordance with MDOT guidelines and specifications as well as applicable state and local requirements.

Paved areas that display poor workmanship, which may include segregation, “cold screed scrapes”, wearing courses not flush with curbs or rims, roller marks, shoving, smearing or tearing of the mat, flushing, or excessive cold joints should be repaired or replaced by the contractor immediately.

Pavement subgrade, subbase, and aggregate base should be proof rolled prior to aggregate base and pavement placement. The in-situ sand may be used as a subbase material.

The subgrade, sand subbase and aggregate base should be constructed and prepared in accordance with the “Site & Subgrade Preparation” and “Fill” sections of this report and applicable MDOT guidelines and specifications.

Portland Cement Concrete (PCC) Pavement

The subgrade should be prepared in accordance with the “Site & Subgrade Preparation” and “Fill” sections of this report.

A base of 12.0 inches of clean sand or aggregate is recommended under the slab on grade concrete pavement. The base thickness may be reduced to 6.0 inches for sidewalk slabs. The sand or aggregate should meet MDOT Class II or 21AA specifications respectively. The in-situ sand may be used as a base material. A minimum slab on grade concrete pavement thickness of 4.0 to 6.0 inches is recommended for standard and heavy-duty concrete pavement. In areas of dumpster pads or loading docks, the minimum thickness should be increased to 8.0 inches and the concrete should be reinforced. The reinforced slab should be designed by a licensed structural engineer. The recommended minimum concrete pavement thickness is 4.0 inches for sidewalks surrounded by greenbelt and 5.0 inches for revealed-face slabs.

A modulus of subgrade reaction of 150 pounds per cubic inch is recommended for the design of slabs on grade, provided the recommendations in this report are observed. The paving contractor should submit the proposed mix design to the owner for review and approval prior to concrete placement.

Quality Control Testing

The subgrade should be examined and tested after the topsoil is removed and before fill is placed. A density gauge and probe rod should be used to verify that the subgrade possesses the required compaction.

Compaction tests in accordance with ASTM D 6938 specifications are recommended to confirm that sand and fill in the building areas are compacted to the specified density. While fill is being placed, compaction tests should be performed at the rate of one test per 400 cubic yards of fill and throughout the depth of the fill with a minimum of five tests at each 1.0-foot elevation interval. Full time inspection is recommended while sand and fill are compacted in the building area. Compaction tests should be performed under foundations at the rate of one test per 50 linear feet for wall foundations and one test per column foundation. The recommended testing frequency in the floor and pavement subgrade is one test per 2,500 square feet. Tests should also be performed in the backfill over foundations and utilities. The maximum density should be determined in accordance with ASTM D 1557 or ASTM D 4253 procedures.

Unless otherwise specified in the design documents, the following testing procedures and frequencies should be observed for HMA and slab on grade concrete floors. Both asphalt and concrete quality testing should adhere to the 2020 MDOT Standards for Construction.

Asphalt quality control testing should adhere to the 2020 MDOT Standards for Construction. Asphalt temperatures during placement should be at least 275 degrees Fahrenheit; material that arrives at temperatures below 250 degrees Fahrenheit shall be rejected. Asphalt density testing should be performed with a nuclear density gauge at a minimum rate of one test per 500 square feet of pavement. At least five total verification cores in each course are recommended to assess relative compaction, calibrate the nuclear density gauge, and evaluate thickness. A minimum of two loose mix samples per mix per day should be taken at the plant and delivered to the quality-assurance firm's laboratory for vacuum extraction-gradations. The asphalt contractor should provide a minimum of two (2) theoretical maximum density verifications per day.

Concrete quality control testing for pavement and floors should adhere to the 2012 MDOT Standards for Construction. Concrete testing should be performed by a certified concrete technician (MCA Michigan Level I or II). One set of concrete tests should be performed for every fifty (50) cubic yards of concrete placed. Concrete should be sampled in accordance with ASTM C172. A set of concrete tests should consist of a concrete slump, air content, and concrete temperature. Slump testing should be performed in accordance with ASTM C143. Air content testing should be performed in accordance with ASTM C231. Concrete temperature testing should be performed in accordance with ASTM C1064. Air temperature should also be recorded at the time of testing. At the time of testing, a set of test cylinders should be molded as well. A minimum of two (2) test cylinders should be molded per cylinder set for 28-day compressive strength testing. Test cylinders should be prepared in accordance with ASTM C31 and tested in accordance with ASTM C39.



A smooth 0.5 to 0.75-inch diameter rod should be used in conjunction with compaction tests to probe for loose areas under foundations, in fill, and under floors. A dynamic cone should not be substituted for compaction tests for evaluating fill. Testing should be performed by technicians supervised by a registered geotechnical engineer.

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 fourteen (14) test borings and providing soil related recommendations for the design and construction of the proposed buildings. 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 borings are 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 for the design, construction, permitting, and financing associated with the M-72 Industrial Unit Complex – Phase B project located east of 6140 East Arnold Road in Acme Township, Grand Traverse 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.

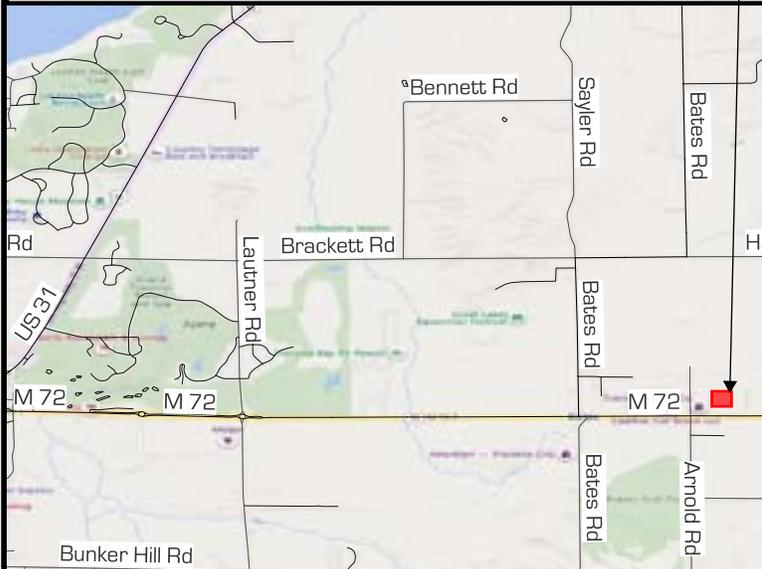
Appendix

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



VICINITY MAP (NTS)

SITE



TEST BORING LOCATION PLAN

NTS



Note: The background of the test boring plan is a portion of an aerial photograph from Google Earth.

M-72 Industrial Unit Complex - Phase B

Acme Township, Grand Traverse County, Michigan

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

JOB NO.: 2023.0981

DATE: 07-13-2023

Project id: 2023.0981

Project Title: M-72 Industrial Unit Complex - Phase B

Location: Traverse City, Michigan

Client: J. Francis Properties LLC

Title: Section line 1

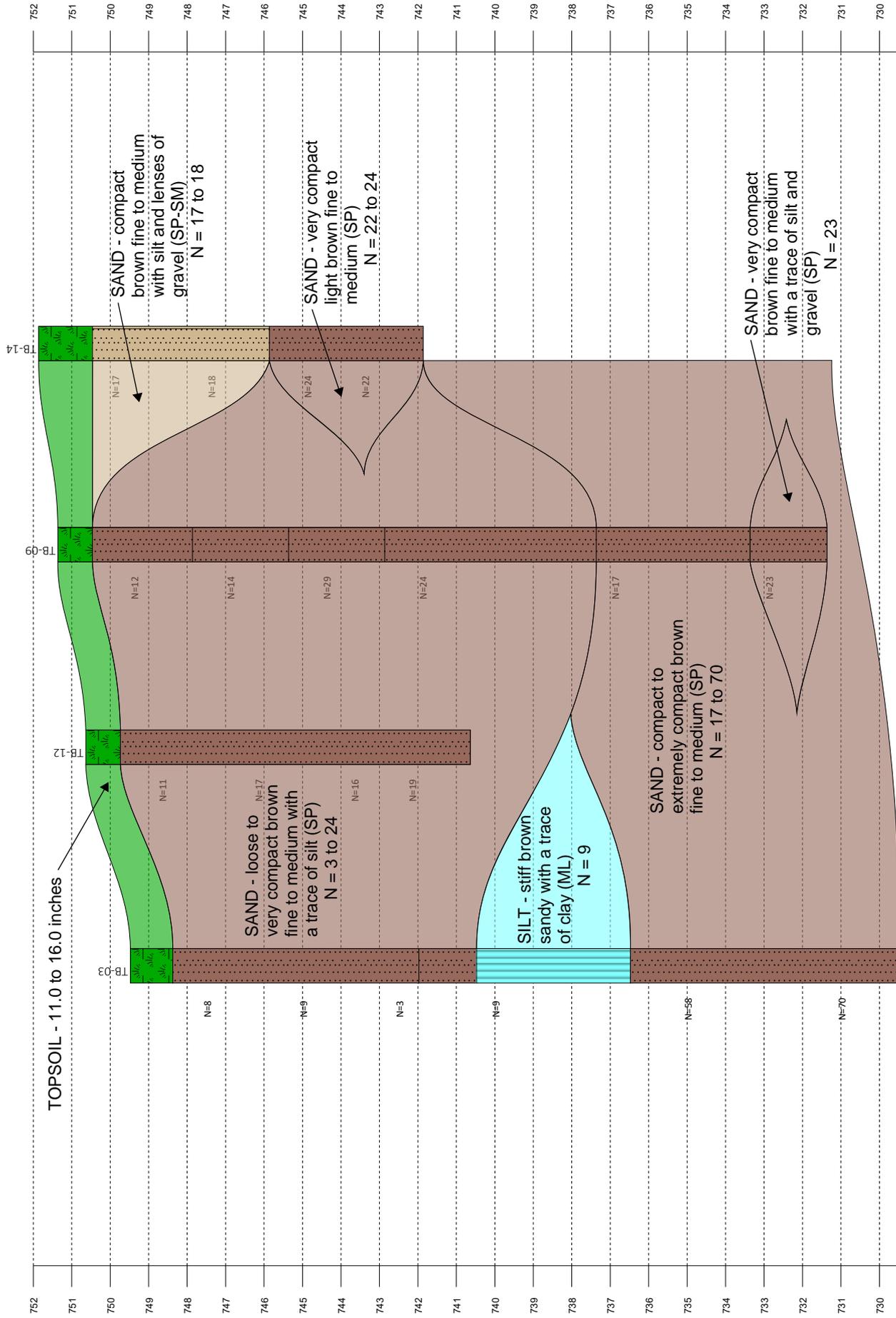
Vertical Scale: 1:43

Horizontal Scale: 1:589

Engineer: Malea Tanner, EIT

GENERAL SOIL PROFILE

NOTE: Groundwater was not encountered in the test borings.



Legend Key

-  Topsoil
-  Poorly Graded SAND
-  Poorly Graded SAND with SILT
-  SILT

Project Name: M-72 Industrial Unit Complex - Phase B	Project Number: 2023.0981
Project Location: Traverse City, Michigan	Logged By: D.Harrington Reviewed By: H.Barton
Client: J. Francis Properties LLC	Survey Datum: NAD 1983 StatePlane Michigan Central Hole Depth: 20.00
Date Started: Jul 18 2023 Completed: Jul 19 2023	Northing: 533523.8 Easting: 19408233.6 Elevation: 748.94
Drilling Method: 3-1/4" Hollow Stem Auger	Frost Depth _____
Equipment: Diedrich D-50	Ground Water Levels
Hammer Type: Automatic Hammer	▼
Notes:	▼ End of Drilling Jul 18 2023 - Water Not Encountered

Depth	Graphic	Material Description	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Pocket Pen (tsf)	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits					USCS	
											Liquid Limit	Plastic Limit	Plasticity Index				
1		TOPSOIL - light brown sandy (6.0")															
2		SAND - compact light brown fine to medium															
3			SPT-A	100	4-5-6	11				2.2							SP
4		SAND - compact light brown fine to medium with a lense of gravel at 4.5 feet															
5			SPT-B	100	7-7-8	15											SP
6		SAND - compact light brown fine to medium with a trace of gravel															
7			SPT-C	100	6-9-5	14				8.8							SP
8			SPT-D	0	6-9-9	18											SP
9		SAND - very compact light brown fine to medium															
10			SPT-E	100	11-17-27	44				0.7							SP
11			SPT-F	100	11-19-29	48											SP
12																	
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Project Name: M-72 Industrial Unit Complex - Phase B **Project Number:** 2023.0981
Project Location: Traverse City, Michigan **Logged By:** D.Harrington **Reviewed By:** H.Barton
Client: J. Francis Properties LLC **Survey Datum:** NAD 1983 StatePlane Michigan Central **Hole Depth:** 20.00
Date Started: Jul 18 2023 **Completed:** Jul 19 2023 **Northing:** 533525.4 **Easting:** 19408293.6 **Elevation:** 747.99
Drilling Method: 3-1/4" Hollow Stem Auger **Frost Depth**
Equipment: Diedrich D-50 **Ground Water Levels**
Hammer Type: Automatic Hammer At Time of Drilling Jul 18 2023 - Water Not Encountered
Notes:

Depth	Graphic	Material Description	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Pocket Pen (tsf)	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits			USCS
											Liquid Limit	Plastic Limit	Plasticity Index	
1		TOPSOIL - brown sandy (9.0")												
2		SAND - light brown fine to medium												
3		SAND - compact light brown fine to medium silty	▲	SPT-A	87	3-3-6	9							SM
4			▲											
5		SAND - compact brown fine to medium with a trace of silt and gravel	▲	SPT-B	100	5-6-5	11			9.8				SM
6			▲											
7		SAND - very compact light brown fine to medium	▲	SPT-C	100	4-8-10	18							SP
8			▲											
9		SAND - extremely compact light brown fine	▲	SPT-D	100	7-15-15	30			1.2				SP
10			▲											
11		SAND - extremely compact light brown fine	▲	SPT-E	100	9-18-27	45							SP
12			▲											
13		SAND - extremely compact light brown fine	▲	SPT-F	100	12-29-50	79			9.6				SP
14			▲											
15														
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														

Project Name: M-72 Industrial Unit Complex - Phase B	Project Number: 2023.0981
Project Location: Traverse City, Michigan	Logged By: D.Harrington Reviewed By: H.Barton
Client: J. Francis Properties LLC	Survey Datum: NAD 1983 StatePlane Michigan Central Hole Depth: 20.00
Date Started: Jul 18 2023 Completed: Jul 19 2023	Northing: 533430.6 Easting: 19408262.8 Elevation: 749.47
Drilling Method: 3-1/4" Hollow Stem Auger	Frost Depth
Equipment: Diedrich D-50	Ground Water Levels
Hammer Type: Automatic Hammer	<input checked="" type="checkbox"/> At Time of Drilling Jul 18 2023 - Water Not Encountered
Notes:	

Depth	Graphic	Material Description	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Pocket Pen (tsf)	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits			USCS
											Liquid Limit	Plastic Limit	Plasticity Index	
1		TOPSOIL - brown sandy (12.0")												
2		SAND - compact brown fine to medium with a trace of silt												
3			▼ SPT-A	100	4-4-4	8								SP
4														
5		SAND - loose brown fine to medium with a trace of silt												
6			▼ SPT-B	100	3-4-5	9			6.9					SP
7		SAND - extremely compact light brown fine to medium												
8			▼ SPT-C	67	3-1-2	3								SP
9		SILT- stiff brown sandy with a trace of clay												
10			▼ SPT-D	100	4-4-5	9			16.0					ML
11		SAND - extremely compact light brown fine to medium												
12														
13			▼ SPT-E	80	12-22-36	58								SP
14		SAND - extremely compact light brown fine to medium												
15			▼ SPT-F	100	11-23-47	70			6.8					SP
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														

Project Name: M-72 Industrial Unit Complex - Phase B	Project Number: 2023.0981
Project Location: Traverse City, Michigan	Logged By: D.Harrington Reviewed By: H.Barton
Client: J. Francis Properties LLC	Survey Datum: NAD 1983 StatePlane Michigan Central Hole Depth: 20.00
Date Started: Jul 18 2023 Completed: Jul 19 2023	Northing: 533324.8 Easting: 19408235.6 Elevation: 751.08
Drilling Method: 3-1/4" Hollow Stem Auger	Frost Depth
Equipment: Diedrich D-50	Ground Water Levels
Hammer Type: Automatic Hammer	<input checked="" type="checkbox"/> At Time of Drilling Jul 19 2023 - Water Not Encountered
Notes:	

Depth	Graphic	Material Description	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Pocket Pen (tsf)	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits					USCS		
											Liquid Limit	Plastic Limit	Plastic Limit	Plasticity Index				
1		TOPSOIL - brown sandy (15.0")																
2		SAND - loose to compact brown fine to medium silty																
3			SPT-A	100	3-4-4	8				8.2							SM	
4																		
5				SPT-B	100	4-2-2	4											SM
6		SAND - compact light brown fine to medium																
7																		
8			SPT-C	100	4-5-6	11				3.2							SP	
9		SAND - compact brown fine to medium with a trace of silt and gravel																
10																		
11			SPT-D	100	4-6-7	13												SP
12		SAND - very compact to extremely compact light brown fine to medium																
13																		
14																		
15			SPT-E	87	8-14-22	36				3.7								SP
16																		
17																		
18																		
19			SPT-F	100	13-26-45	71												SP
20																		
21																		
22																		
23																		
24																		
25																		
26																		
27																		
28																		
29																		
30																		

Project Name: M-72 Industrial Unit Complex - Phase B **Project Number:** 2023.0981
Project Location: Traverse City, Michigan **Logged By:** D.Harrington **Reviewed By:** H.Barton
Client: J. Francis Properties LLC **Survey Datum:** NAD 1983 StatePlane Michigan Central **Hole Depth:** 20.00
Date Started: Jul 18 2023 **Completed:** Jul 19 2023 **Northing:** 533328.0 **Easting:** 19408293.8 **Elevation:** 751.23
Drilling Method: 3-1/4" Hollow Stem Auger **Frost Depth** _____
Equipment: Diedrich D-50 **Ground Water Levels**
Hammer Type: Automatic Hammer At Time of Drilling Jul 19 2023 - Water Not Encountered
Notes:

Depth	Graphic	Material Description	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Pocket Pen (tsf)	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits				USCS
											Liquid Limit	Plastic Limit	Plasticity Index		
1		TOPSOIL - brown sandy (9.0")													
2		SAND - compact light brown fine													
3			▲	SPT-A	100	5-6-6	12								SP
4			▲												
5		SAND - compact light brown fine with a trace of silt	▲	SPT-B	100	5-8-9	17			7.3					SP
6			▲												
7			▲												
8		SAND - slightly compact brown fine	▲	SPT-C	87	2-2-3	5								SP
9			▲												
10			▲	SPT-D	100	3-3-2	5			13.7					SP
11			▲												
12															
13															
14		SAND - very compact to extremely compact brown fine to medium with a trace of silt	▲	SPT-E	100	10-12-17	29								SP
15			▲												
16															
17															
18			▲												
19			▲	SPT-F	80	11-24-41	65			9.0					SP
20			▲												
21															
22															
23															
24															
25															
26															
27															
28															
29															
30															

Project Name: M-72 Industrial Unit Complex - Phase B	Project Number: 2023.0981
Project Location: Traverse City, Michigan	Logged By: D.Harrington Reviewed By: H.Barton
Client: J. Francis Properties LLC	Survey Datum: NAD 1983 StatePlane Michigan Central Hole Depth: 20.00
Date Started: Jul 18 2023 Completed: Jul 19 2023	Northing: 533532.0 Easting: 19408370.5 Elevation: 748.11
Drilling Method: 3-1/4" Hollow Stem Auger	Frost Depth
Equipment: Diedrich D-50	Ground Water Levels
Hammer Type: Automatic Hammer	<input checked="" type="checkbox"/> At Time of Drilling Jul 18 2023 - Water Not Encountered
Notes:	

Depth	Graphic	Material Description	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Pocket Pen (tsf)	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits					USCS		
											Liquid Limit	Plastic Limit	Plasticity Index					
1	█	TOPSOIL - brown sandy (10.0")																
2	█	SAND - compact brown fine to medium with a trace of silt	▲	SPT-A	100	6-6-5	11			8.3						SP		
3	█		▲															
4	█	SAND - compact to very compact brown fine to medium with a trace of silt and lenses of gravel	▲	SPT-B	100	4-3-5	8									SP		
5	█		▲															
6	█		▲	SPT-C	100	12-9-11	20			17.0							SP	
7	█	SAND - extremely compact light brown fine to coarse with a trace of silt	▲															
8	█		▲	SPT-D	7	19-15-12	27										SP	
9	█		▲															
10	█		▲	SPT-E	100	18-32-49	81			3.5							SP	
11	█	SAND - extremely compact light brown fine with a trace of silt	▲															
12	█		▲	SPT-F	100	15-37-50	87										SP	
13	█																	
14	█																	
15	█																	
16	█																	
17	█																	
18	█																	
19	█																	
20	█																	
21	█																	
22	█																	
23	█																	
24	█																	
25	█																	
26	█																	
27	█																	
28	█																	
29	█																	
30	█																	

Project Name: M-72 Industrial Unit Complex - Phase B	Project Number: 2023.0981
Project Location: Traverse City, Michigan	Logged By: D.Harrington Reviewed By: H.Barton
Client: J. Francis Properties LLC	Survey Datum: NAD 1983 StatePlane Michigan Central Hole Depth: 20.00
Date Started: Jul 18 2023 Completed: Jul 19 2023	Northing: 533532.2 Easting: 19408427.8 Elevation: 748.61
Drilling Method: 3-1/4" Hollow Stem Auger	Frost Depth
Equipment: Diedrich D-50	Ground Water Levels
Hammer Type: Automatic Hammer	<input checked="" type="checkbox"/> At Time of Drilling Jul 18 2023 - Water Not Encountered
Notes:	

Depth	Graphic	Material Description	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Pocket Pen (tsf)	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits				USCS
											Liquid Limit	Plastic Limit	Plasticity Index		
1	█	TOPSOIL - brown sandy (11.0")													
2	█	SAND - slightly compact brown fine with a trace of silt	▲	SPT-A	87	2-2-3	5								SP
3	█		▲												
4	█	SAND - compact light brown fine to medium	▲	SPT-B	100	3-3-3	6			12.4					SP
5	█		▲												
6	█	SAND - very compact to extremely compact light brown fine with a trace of silt	▲	SPT-C	100	4-6-10	16								SP
7	█		▲												
8	█		▲	SPT-D	100	12-19-20	39			15.8					SP
9	█		▲												
10	█		▲	SPT-E	100	13-24-37	61								SP
11	█		▲												
12	█		▲	SPT-F	100	15-31-50	81			2.6					SP
13	█		▲												
14	█														
15	█														
16	█														
17	█														
18	█														
19	█														
20	█														
21	█														
22	█														
23	█														
24	█														
25	█														
26	█														
27	█														
28	█														
29	█														
30	█														

Project Name: M-72 Industrial Unit Complex - Phase B	Project Number: 2023.0981
Project Location: Traverse City, Michigan	Logged By: D.Harrington Reviewed By: H.Barton
Client: J. Francis Properties LLC	Survey Datum: NAD 1983 StatePlane Michigan Central Hole Depth: 20.00
Date Started: Jul 18 2023 Completed: Jul 19 2023	Northing: 533447.8 Easting: 19408400.7 Elevation: 750.48
Drilling Method: 3-1/4" Hollow Stem Auger	Frost Depth
Equipment: Diedrich D-50	Ground Water Levels
Hammer Type: Automatic Hammer	<input checked="" type="checkbox"/> At Time of Drilling Jul 18 2023 - Water Not Encountered
Notes:	

Depth	Graphic	Material Description	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Pocket Pen (tsf)	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits					USCS	
											Liquid Limit	Plastic Limit	Plastic Limit	Plasticity Index			
1		TOPSOIL - brown sandy (10.0")															
2		SAND - loose brown to dark brown fine to medium with topsoil															
3			SPT-A	47	2-1-1	2				6.8							SP
4		SAND - compact light brown to brown fine silty															
5			SPT-B	100	4-5-6	11											SM
6																	
7		SAND - very compact light brown fine to medium with lenses of gravel and a trace of silt															
8			SPT-C	87	6-7-7	14				12.4							SM
9																	
10		SAND - very compact light brown fine to coarse															
11			SPT-D	100	8-15-13	28											SP
12		SAND - extremely compact light brown fine with a trace of silt															
13																	
14			SPT-E	80	12-17-20	37				2.1							SP
15																	
16																	
17																	
18																	
19																	
20																	
21																	
22																	
23																	
24																	
25																	
26																	
27																	
28																	
29																	
30																	

Project Name: M-72 Industrial Unit Complex - Phase B **Project Number:** 2023.0981
Project Location: Traverse City, Michigan **Logged By:** D.Harrington **Reviewed By:** H.Barton
Client: J. Francis Properties LLC **Survey Datum:** NAD 1983 StatePlane Michigan Central **Hole Depth:** 20.00
Date Started: Jul 18 2023 **Completed:** Jul 19 2023 **Northing:** 533331.4 **Easting:** 19408377.0 **Elevation:** 751.36
Drilling Method: 3-1/4" Hollow Stem Auger **Frost Depth**
Equipment: Diedrich D-50 **Ground Water Levels**
Hammer Type: Automatic Hammer At Time of Drilling Jul 19 2023 - Water Not Encountered
Notes:

Depth	Graphic	Material Description	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Pocket Pen (tsf)	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits					USCS
											Liquid Limit	Plastic Limit	Plasticity Index			
1		TOPSOIL - brown sandy (11.0")														
2		SAND - compact brown fine to medium with a trace of silt														
3			▲	SPT-A	87	5-6-6	12									SP
4		SAND - compact light brown fine														
5			▲	SPT-B	100	4-5-9	14			5.5						SP
6		SAND - very compact light brown fine with lenses of silt														
7			▲	SPT-C	100	6-13-16	29									SP
8		SAND - very compact fine to medium with a trace of silt														
9			▲	SPT-D	100	7-10-14	24			9.1						SP
10																
11																
12																
13																
14		SAND - compact light brown fine														
15			▲	SPT-E	87	6-7-10	17									SP
16																
17																
18		SAND - very compact brown fine to medium with a trace of silt and gravel														
19			▲	SPT-F	100	2-12-11	23			5.6						SP
20																
21																
22																
23																
24																
25																
26																
27																
28																
29																
30																

Project Name: M-72 Industrial Unit Complex - Phase B **Project Number:** 2023.0981
Project Location: Traverse City, Michigan **Logged By:** D.Harrington **Reviewed By:** H.Barton
Client: J. Francis Properties LLC **Survey Datum:** NAD 1983 StatePlane Michigan Central **Hole Depth:** 20.00
Date Started: Jul 18 2023 **Completed:** Jul 19 2023 **Northing:** 533334.5 **Eastng:** 19408436.7 **Elevation:** 750.54
Drilling Method: 3-1/4" Hollow Stem Auger **Frost Depth**
Equipment: Diedrich D-50 **Ground Water Levels**
Hammer Type: Automatic Hammer At Time of Drilling Jul 19 2023 - Water Not Encountered
Notes:

Depth	Graphic	Material Description	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Pocket Pen (tsf)	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits					USCS		
											Liquid Limit	Plastic Limit	Plasticity Index					
1		TOPSOIL - brown sandy (14.0")																
2		SAND - slightly compact to compact brown fine to medium with a trace of silt	▲	SPT-A	80	4-3-2	5										SP	
3			▲															
4		▲																
5		▲																
6		▲									15.0							SP
7			SAND - compact light brown fine to medium	▲	SPT-B	87	3-6-10	16										
8	▲																	
9	▲																	
10	▲																	
11			▲	SPT-C	67	8-7-7	14											SP
12			▲															
13			▲	SPT-D	100	4-5-4	9			3.7								SP
14			▲															
15			▲	SPT-E	13	6-7-8	15											SP
16			▲															
17			▲															
18		SAND - extremely compact brown fine to coarse with a trace of silt and gravel	▲															
19			▲	SPT-F	100	13-26-30	56			8.1								SP
20			▲															
21																		
22																		
23																		
24																		
25																		
26																		
27																		
28																		
29																		
30																		

Project Name: M-72 Industrial Unit Complex - Phase B	Project Number: 2023.0981
Project Location: Traverse City, Michigan	Logged By: D.Harrington Reviewed By: H.Barton
Client: J. Francis Properties LLC	Survey Datum: NAD 1983 StatePlane Michigan Central Hole Depth: 10.00
Date Started: Jul 18 2023 Completed: Jul 19 2023	Northing: 533495.6 Easting: 19408328.4 Elevation: 749.73
Drilling Method: 3-1/4" Hollow Stem Auger	Frost Depth
Equipment: Diedrich D-50	Ground Water Levels
Hammer Type: Automatic Hammer	<input checked="" type="checkbox"/> At Time of Drilling Jul 18 2023 - Water Not Encountered
Notes:	

Depth	Graphic	Material Description	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Pocket Pen (tsf)	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits					USCS	
											Liquid Limit	Plastic Limit	Plasticity Index				
1	■	TOPSOIL - brown sandy (10.0")															
2	■	SAND - slightly compact brown fine to medium with a trace of silt															
3	■		SPT-A	87	5-2-3	5				23.2						SP	
4	■																
5	■			SPT-B	87	2-2-5	7										SP
6	■	SAND - compact to very compact brown fine to medium															
7	■																
8	■		SPT-C	87	5-6-9	15				8.9						SP	
9	■		SPT-D	100	9-13-13	26										SP	
10	■																
11																	
12																	
13																	
14																	
15																	
16																	
17																	
18																	
19																	
20																	
21																	
22																	
23																	
24																	
25																	
26																	
27																	
28																	
29																	
30																	

Project Name: M-72 Industrial Unit Complex - Phase B **Project Number:** 2023.0981
Project Location: Traverse City, Michigan **Logged By:** D.Harrington **Reviewed By:** H.Barton
Client: J. Francis Properties LLC **Survey Datum:** NAD 1983 StatePlane Michigan Central **Hole Depth:** 10.00
Date Started: Jul 18 2023 **Completed:** Jul 19 2023 **Northing:** 533388.5 **Easting:** 19408331.0 **Elevation:** 750.64
Drilling Method: 3-1/4" Hollow Stem Auger **Frost Depth**
Equipment: Diedrich D-50 **Ground Water Levels**
Hammer Type: Automatic Hammer At Time of Drilling Jul 19 2023 - Water Not Encountered
Notes:

Depth	Graphic	Material Description	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Pocket Pen (tsf)	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits			USCS
											Liquid Limit	Plastic Limit	Plasticity Index	
1	TOPSOIL - brown sandy (11.0")													
2	SAND - compact brown fine to medium with a trace of silt and gravel		▲	SPT-A	100	6-5-6	11							SP
3			▲											
4			▲											
5			▲	SPT-B	100	6-8-9	17			8.5				SP
6			▲											
7			▲											
8			▲	SPT-C	100	3-5-11	16							SP
9			▲	SPT-D	100	8-10-9	19			6.2				SP
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														

Project Name: M-72 Industrial Unit Complex - Phase B **Project Number:** 2023.0981
Project Location: Traverse City, Michigan **Logged By:** D.Harrington **Reviewed By:** H.Barton
Client: J. Francis Properties LLC **Survey Datum:** NAD 1983 StatePlane Michigan Central **Hole Depth:** 10.00
Date Started: Jul 18 2023 **Completed:** Jul 19 2023 **Northing:** 533253.9 **Easting:** 19408319.3 **Elevation:** 751.21
Drilling Method: 3-1/4" Hollow Stem Auger **Frost Depth**
Equipment: Diedrich D-50 **Ground Water Levels**
Hammer Type: Automatic Hammer At Time of Drilling Jul 19 2023 - Water Not Encountered
Notes:

Depth	Graphic	Material Description	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Pocket Pen (tsf)	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits					USCS	
											Liquid Limit	Plastic Limit	Plasticity Index				
1		TOPSOIL - brown sandy (10.0")															
2		SAND - compact brown fine to medium with a trace of silt															
3			SPT-A	100	5-7-8	15				6.0						SP	
4																	
5			SAND - slightly compact to compact light brown fine to medium	SPT-B	80	5-6-8	14										SP
6																	
7																	
8		SPT-C		100	4-4-5	9				3.9							SP
9			SPT-D	100	3-3-3	6											SP
10																	
11																	
12																	
13																	
14																	
15																	
16																	
17																	
18																	
19																	
20																	
21																	
22																	
23																	
24																	
25																	
26																	
27																	
28																	
29																	
30																	

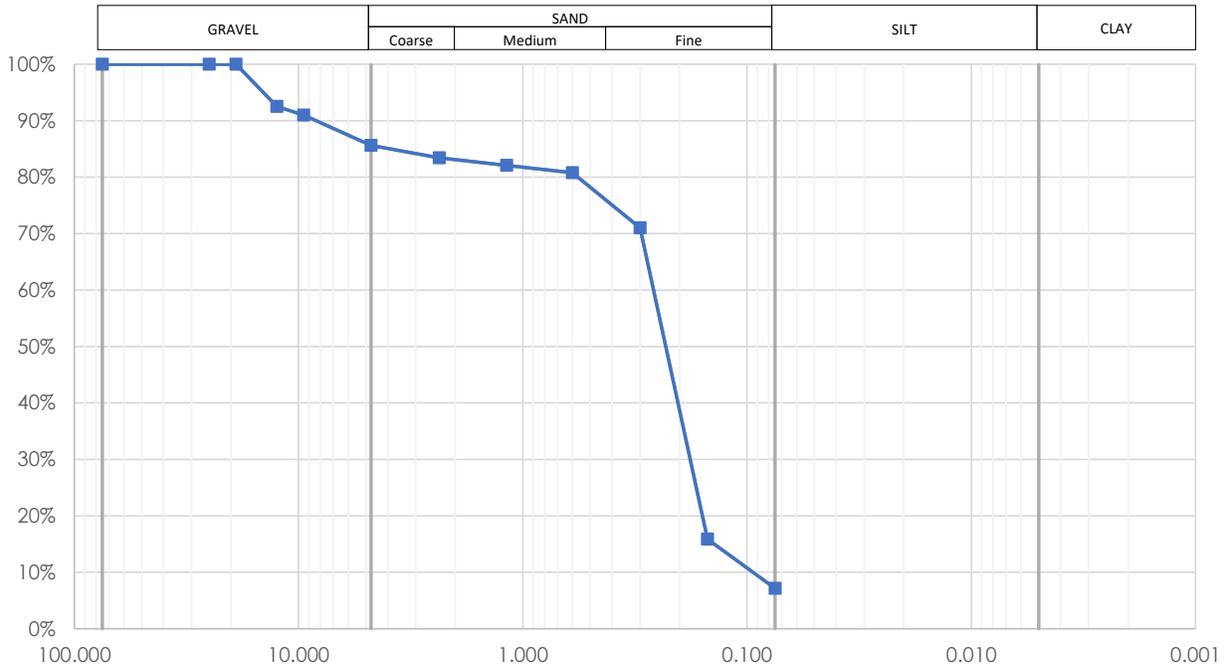
Project Name: M-72 Industrial Unit Complex - Phase B	Project Number: 2023.0981
Project Location: Traverse City, Michigan	Logged By: D.Harrington Reviewed By: H.Barton
Client: J. Francis Properties LLC	Survey Datum: NAD 1983 StatePlane Michigan Central Hole Depth: 10.00
Date Started: Jul 18 2023 Completed: Jul 19 2023	Northing: 533258.7 Easting: 19408407.5 Elevation: 751.86
Drilling Method: 3-1/4" Hollow Stem Auger	Frost Depth
Equipment: Diedrich D-50	Ground Water Levels
Hammer Type: Automatic Hammer	<input checked="" type="checkbox"/> At Time of Drilling Jul 19 2023 - Water Not Encountered
Notes:	

Depth	Graphic	Material Description	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Pocket Pen (tsf)	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits					USCS				
											Liquid Limit	Plastic Limit	Plasticity Index							
1		TOPSOIL - brown sandy (16.0")																		
2		SAND - compact brown fine to medium with silt and lenses of gravel	▲	SPT-A	87	8-8-9	17			3.5							SP-SM			
3																				
4																				
5				SPT-B														100	7-8-10	18
6		SAND - very compact light brown fine to medium	▲		67	7-10-14	24			2.2							SP			
7																				
8				SPT-C														100	6-9-13	22
9				SPT-D																
10																				
11																				
12																				
13																				
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Particle Size Distribution Report

Project Name M-72 Industrial Unit Complex - Phase B
 Project Number 2023.0981
 Client J. Francis Properties LLC
 Date 8/10/2023
 Sample Location TB-14 Sample ID B Depth (ft) 4.5



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0%	0.0%	14.4%	2.6%	7.9%	67.9%	0.0%	0.0%
D85	D60	D50	D30	D15	D10	Loss By Wash	
4.0601	0.2700	0.2428	0.1884	0.1426	0.0995	7.2%	

Particle Size	
Sieve	% Passing
3 in.	100%
1 in.	100%
3/4 in.	100%
1/2 in.	93%
3/8 in.	91%
No. 4	86%
No. 8	83%
No. 16	82%
No. 30	81%
No. 50	71%
No. 100	16%
No. 200	7.2%

Hydrometer	
Particle Size (mm)	% Passing

Material Description

SAND - brown fine to medium with silt and lenses of gravel (SP-SM)

Remarks

Technician
rroda

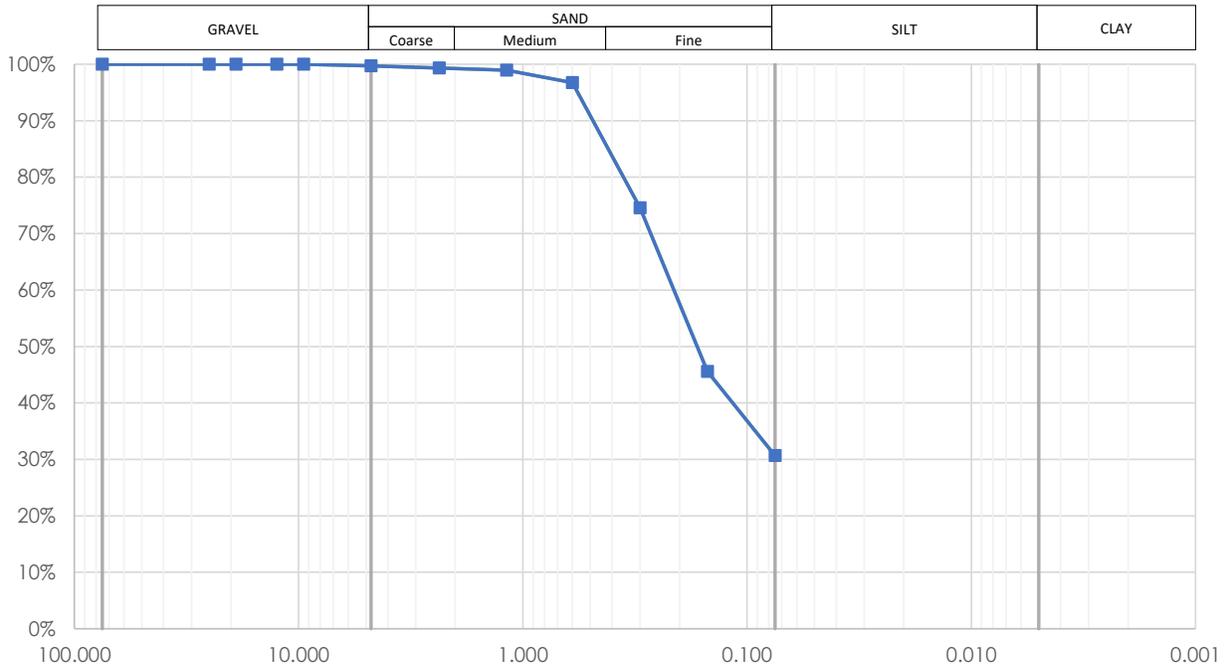
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rroda

Approved
rroda



Particle Size Distribution Report

Project Name M-72 Industrial Unit Complex - Phase B
 Project Number 2023.0981
 Client J. Francis Properties LLC
 Date 8/10/2023
 Sample Location TB-02 Sample ID B Depth (ft) 4.5



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0%	0.0%	0.3%	0.5%	15.4%	53.2%	0.0%	0.0%
D85	D60	D50	D30	D15	D10	Loss By Wash	
0.4412	0.2246	0.1728	0.0734	0.0367	0.0245	30.7%	

Particle Size	
Sieve	% Passing
3 in.	100%
1 in.	100%
3/4 in.	100%
1/2 in.	100%
3/8 in.	100%
No. 4	100%
No. 8	99%
No. 16	99%
No. 30	97%
No. 50	75%
No. 100	46%
No. 200	30.7%

Hydrometer	
Particle Size (mm)	% Passing

Material Description
SAND - light brown fine to medium silty (SM)

Remarks

Technician
rroda

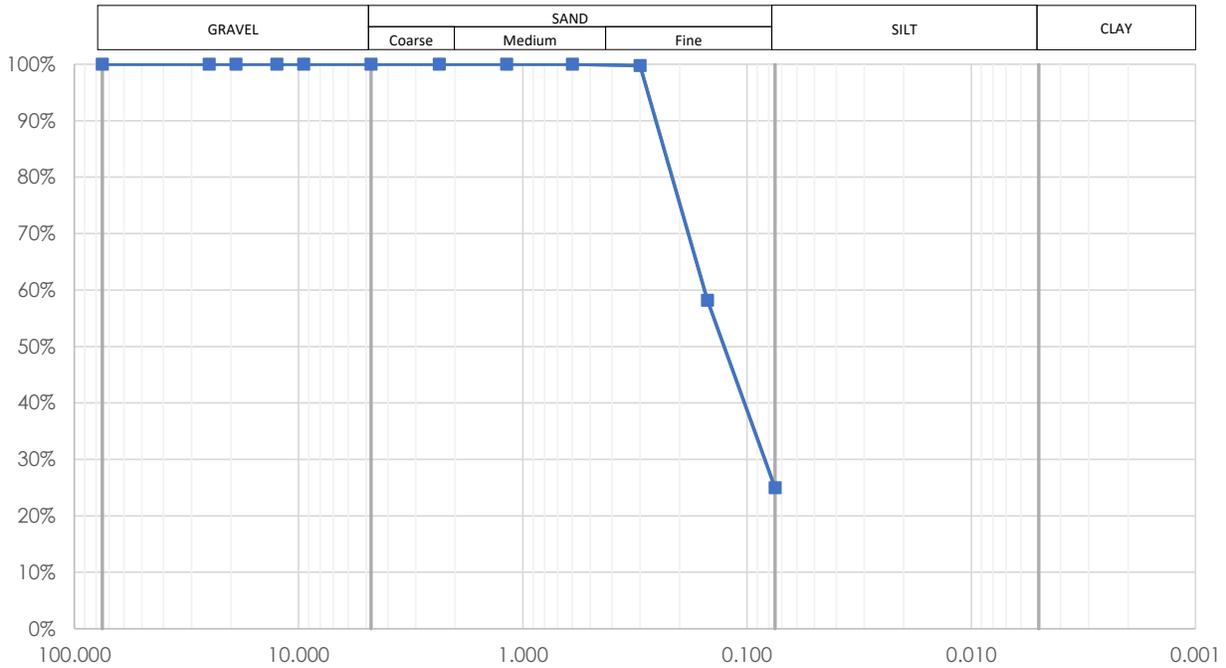
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Particle Size Distribution Report

Project Name M-72 Industrial Unit Complex - Phase B
 Project Number 2023.0981
 Client J. Francis Properties LLC
 Date 8/10/2023
 Sample Location TB-08 Sample ID C Depth (ft) 7.0



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0%	0.0%	0.0%	0.0%	0.1%	74.9%	0.0%	0.0%
D85	D60	D50	D30	D15	D10	Loss By Wash	
0.2468	0.1567	0.1316	0.0863	0.0450	0.0300	25.0%	

Particle Size	
Sieve	% Passing
3 in.	100%
1 in.	100%
3/4 in.	100%
1/2 in.	100%
3/8 in.	100%
No. 4	100%
No. 8	100%
No. 16	100%
No. 30	100%
No. 50	100%
No. 100	58%
No. 200	25.0%

Hydrometer	
Particle Size (mm)	% Passing

Material Description
SAND - brown to light brown fine silty (SM)

Remarks

Technician
rroda

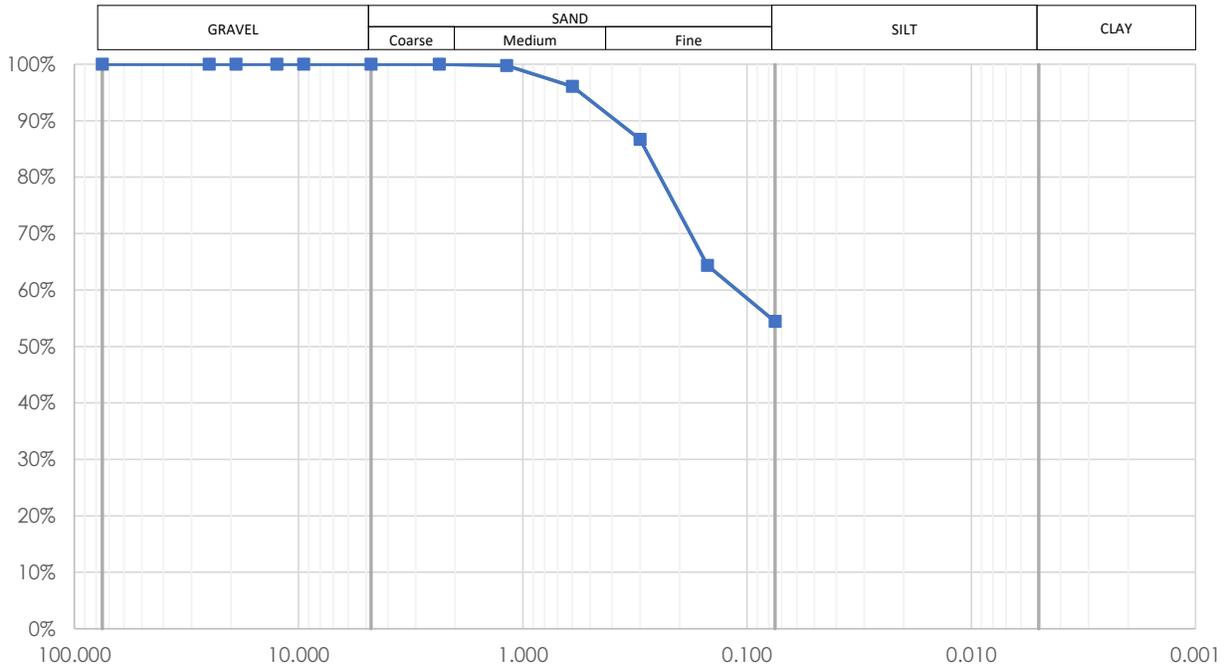
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Particle Size Distribution Report

Project Name M-72 Industrial Unit Complex - Phase B
 Project Number 2023.0981
 Client J. Francis Properties LLC
 Date 8/10/2023
 Sample Location TB-03 Sample ID D Depth (ft) 9.5



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0%	0.0%	0.0%	0.1%	9.3%	36.2%	0.0%	0.0%
D85	D60	D50	D30	D15	D10	Loss By Wash	
0.2887	0.1172	0.0689	0.0414	0.0207	0.0138	54.4%	

Particle Size	
Sieve	% Passing
3 in.	100%
1 in.	100%
3/4 in.	100%
1/2 in.	100%
3/8 in.	100%
No. 4	100%
No. 8	100%
No. 16	100%
No. 30	96%
No. 50	87%
No. 100	64%
No. 200	54.4%

Hydrometer	
Particle Size (mm)	% Passing

Material Description
SILT - brown sandy with a trace of clay (ML)

Remarks

Technician
rroda

Checked
rroda

Approved
rroda

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	
		More than 50% of coarse fraction passing No. 4 sieve	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

