MAXIM
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GEOTECHNICAL EXPLORATION PROGRAM
LAKE WISSOTA BUSINESS PARK
CHIPPEWA COUNTY, WISCONSIN

MAXIM #2001062

April 10, 2000

From:

Maxim Technologies, Inc.®
1837 County Highway J
Chippewa Falls, WI 54729

Requested By:

Short Elliott Hendrickson, Inc.
Mr. Phil Newman
421 Frenette Drive
Chippewa Falls, WI 54729

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April 10, 2000

Short Elliott Hendrickson, Inc.
Attn: Mr. Phil Newman
421 Frenette Drive
Chippewa Falls, WI 54729

Subject: Geotechnical Exploration Program
Lake Wissota Business Park
Chippewa County, Wisconsin
Maxim #2001062

Dear Mr. Newman:

Per your request, we have conducted a subsurface exploration program for the above referenced project. We are sending you three copies of this report. This work was performed in accordance with your acceptance of our March 16, 2000, proposal (MAXIM #00-321).

This report summarizes our exploration and findings and presents our recommendations for site development and foundation design. The soil samples obtained in the field will be retained at our office for one month. The samples will then be discarded unless we are requested to hold them for a longer period.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this project or if we can be of further assistance as this project develops, please contact us at (715) 832-0282.

Sincerely,

MAXIM TECHNOLOGIES, INC.®

Gregory J. Stelmack
Geotechnical Engineer
Branch Manager

GJS/bjk

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REPORT OF
GEOTECHNICAL EXPLORATION PROGRAM
LAKE WISSOTA BUSINESS PARK
CHIPPEWA COUNTY, WISCONSIN

#2001062

1.0 INTRODUCTION

This report has been prepared to aid in the evaluation and design of the proposed roadway system planned for the new Lake Wissota Business Park. The new business park is located on the east side of STH 178, between CTH I and CTH S, just northeast of Chippewa Falls, Chippewa County, Wisconsin. This report includes geotechnical exploration data, groundwater information, results of our laboratory and engineering analysis, recommendations for pavement design and utility construction, and other information that could affect construction and earthwork operations for the proposed business park development.

The primary purpose of the geotechnical exploration was to determine the stratigraphy and physical properties of the soils underlying the roadway, particularly the strength and deformation characteristics, so that a satisfactory and economical pavement system may be designed.

The analysis and recommendations presented in this report are based upon our interpretation of the subsurface information revealed by the test borings. The report does not reflect variations in subsurface conditions which may exist between or beyond these borings. Variations in soil conditions should be expected, the nature and extent of which may not become evident until construction is undertaken. If variations are encountered, and/or the scope of the project altered, we should be consulted for additional recommendations.

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This report is intended for geotechnical purposes only, and not to document or detect the presence, or absence, of any environmental conditions at the site, or to perform an environmental assessment of the site.

1.1 Project Information

We understand that the project consists of designing and constructing a roadway network throughout the new Wissota Business Park. The roadway development will involve relatively minor cuts and fills (one to three feet), throughout the approximate one mile square area. The above project data has been provided by Mr. Phil Newman representing Short Elliott Hendrickson, Inc.

2.0 EXPLORATION PROGRAM RESULTS

2.1 Scope of Exploration

On March 28, 29, and April 4, 2000, sixteen standard penetration, soil borings were performed along the proposed roadway development. The borings were drilled to depths of between nine feet and 28½ feet below the existing ground surface with a truck mounted, and an ATV mounted, CME 55, rotary drive, drill rigs. The locations and the number of soil borings required, along with the surface elevations at the boring locations, were provided by Mr. Phil Newman representing Short Elliott Hendrickson, Inc. A boring location diagram is included in the appendix.

Water level measurements were taken in the boreholes both during and upon completion of boring operations. The results are indicated on the attached soil boring logs. The borings were then abandoned with bentonite in accordance with the Wisconsin Administrative Code, Chapter NR 141.25.

The samples recovered from the drilling program were visually classified in the field by our crew chief, and in our laboratory by a soil technician in accordance with the Unified Soil Classification System (USCS).

2.2 Boring Program - Subsurface Conditions

The subsurface soil conditions along the proposed roadway consist of between 12 and 20 inches of topsoil, underlain by up to one foot of a silty or sandy clay soil, or directly by sands. The topsoil and clayey soils are followed by alluvial deposits consisting predominantly of intermittent layers of sands and silty sands, containing variable fractions of gravel and fractured rock, which extended to boring terminus at depths of between nine feet and 28½ feet below the existing ground surface. The density of the native granular soils are typically medium dense to very dense, based on standard penetration resistance values ("N" values). Detailed descriptions of the soils encountered are provided on the boring logs in the appendix.

2.3 Water Level Observations

Water level readings, taken in the boreholes both during and upon completion of drilling operations, are noted on the boring logs. All of the soil borings were found to be caved and dry at completion of boring operations. In relatively pervious soils, like those found at this site, the borehole levels are usually reliable indications of the water level at the time the work was performed. Groundwater levels should be expected to fluctuate with the season and prevailing precipitation rates.

2.4 Laboratory Test Program

The laboratory testing program included supplementary visual classification of the various soil types in accordance with the Unified Soil Classification System (USCS), and moisture content testing (ASTM D2216). The laboratory testing program was conducted in general accordance with applicable ASTM specifications, and the results are noted on the boring logs included in the appendix.

3.0 DISCUSSION AND RECOMMENDATIONS

The following paragraphs present our recommendations relative to design and construction. As the project moves to final design, these recommendations should be reviewed by Maxim, at which time more specific design criteria can be presented, if necessary.

3.1 Discussion

We understand that the proposed roadway construction will consist of a new typical asphaltic concrete section. Site grade changes are expected to be minor, with cut and fill depths of approximately one to three feet.

3.2 Soil Profile - Literature Review

The soils encountered in this area are comprised mainly of outwash plains, terraces, fans and valley trains, consisting mainly of well sorted and stratified sands/or sands with gravel, as identified by the Glacial Deposits of Wisconsin.

The soils present along the proposed alignment were mapped by the USDA Soil Conservation Service of Chippewa County in June of 1989, and presented in a publication titled "Soil Survey of Chippewa County, Wisconsin". The soil classifications were determined throughout the planned development area. The classification boundaries are approximate, and variations and exceptions are to be expected. Four soil types were identified by the survey along the proposed alignment, listed from the most prevalent to the least. The soil types indicated by the soil survey are listed below:

1. SbA - Sattre Loam
2. BuA - Burkhardt Sandy Loam
3. RpA - Rosholt Loam
4. CkB - Chetek Sandy Loam

The soil profiles identified are typically characterized as being well drained, loamy deposits over acid sands and gravel. USCS soil classifications range from SP, SM, and SP-SM with gravel, while AASHTO classifications range from A-2 to A-3. The WDOT design manual provides values for the two upper soil horizons ranging from 14 to 0 for the Design Group Index (DGI), F-3 to F-0 for the Frost Index (FI), 125 to 300 for the K Factor, with a predominant Drainage Factor of W (well). These soils typically represent "good" roadbed materials, posses moderate frost action potential, and have a seasonally moderate water table.

3.3 Design Parameters

As indicated above, four different soil series were encountered within the planned business park area, however, the Sattre Loams are the most prevalent. Smaller zones of Burkhardt Sandy Loams and Rosholt loams are located near the southern end of the proposed project.

The USDA Soil Conservation Service generally identifies the existing project soils as being well drained, having moderate frost action potential, and are considered to be "good" for use as roadbed material. Because the proposed reconstruction will involve minimal cut and fill depths of approximately one to three feet, and because the subgrade soils appear consistent, and consist of relatively clean, granular soils through depth, the following parameters are recommended for both the "B-Horizon" and "C-Horizon" soils.

Design Parameters ("B & C-Horizon" and Fill Soils for Good Conditions)	
Frost Group	F-3
Design Group Index	14
Soil Support Value	3.7
K (psi/in)	125
Drainage Factor	W
Resilient Modulus (Mr)	4,000 psi

The above outlined design parameters should be used in cut sections, or in granular subgrade fills (ie. < 12% passing the #200 sieve) constructed exclusively for that roadway section. The resilient modulus (Mr) values given above are empirically estimated from the relationship MR=1500 (CBR). The roadbed resilient modulus varies significantly with changes in seasonal moisture conditions, with the winter/frozen condition being the highest and the saturated, spring thaw condition being the lowest. Resilient modulus values are estimated to range from 2,000 psi to 20,000 psi at both extremes. The 1986 AASHTO Guide recommends that an "effective" resilient modulus be determined by taking into account the climatic region, drainage characteristics and the quality of roadbed materials.

3.4 Subgrade Preparation

For construction of an asphaltic pavement, a uniform subgrade section is beneficial for the best pavement performance. Construction of closely monitored, engineered fill, consisting of clean granular soils extending to frost depth, will provide the best subgrade support and minimize detrimental frost action.

The most critical portion of the subgrade is the upper three feet. This zone provides the primary strength needed for support of pavement materials. Poorer soil conditions at greater depths may lead to general pavement subsidence, but typically would not lead directly to surficial breakup due to stability, provided that a highly stable engineered subgrade layer is achieved.

Therefore, prior to placement of any embankment fill, it is recommended that all topsoil and clay soils, or organic/detrimental material, be stripped from areas receiving fill for the roadway expansion. Exact removal depths of the topsoil and upper clay layer should be determined in the field at the time of construction. In addition, care should also be taken to remove all trees, including their root systems, prior to fill placement. Excavated unsuitable materials may be used for landscaping, or as non-structural fill.

Variations in the condition of the subgrade can result in uneven settlements of the soils when subjected to additional embankment fill and traffic loads. Therefore, following the topsoil and upper level clay removal, the exposed subgrade soils should be compacted in-place by a large "vibratory" roller traveling at a relatively slow rate, in accordance with Section 207.3.6.4 of the "Wisconsin DOT Standard Specifications for Road and Bridge Construction", prior to fill placement. This effort will serve as proofrolling and will assist in compacting subsoils loosened during stripping operations. Loose, yielding, or pumping soils, or any deleterious materials, will require undercutting and stabilization with engineered fill, prior to the placement of embankment fill, or aggregate base course.

After a stable subgrade layer has been achieved, base course aggregate or embankment fill may be placed directly over the existing soils. Embankment borrow and subgrade materials should consist of acceptable project soils, or locally available imported fill materials, consisting of granular soils having less than 12 percent passing a #200 sieve. Fill should be placed in accordance with Section 207.3.2 of the "Wisconsin DOT Standard Specifications for Road and Bridge Construction", and compacted in thin lifts such that the entire lift is compacted to the specified density. Compaction should be performed in accordance with Sections 207.3.6.2 and 212.4 of the WDOT, Standard Specifications.

3.5 Subgrade and Pavement Drainage

Positive effective drainage is essential for good pavement performance. Drainage helps to avoid loss of fines beneath pavement joints, reduces moisture buildup within the underlying subgrade and/or aggregate base materials, and reduces the effects of spring thaw weakening.

Improperly designed and installed underdrain systems are common factors associated with failed pavement sections. Outlets for subdrains should be placed deep enough within the subgrade to prevent ice buildup during critical winter draining periods. The underdrains should be placed within a properly graded filter medium, wrapped in fabric to prevent the pipe from becoming

clogged by the infiltration of fine grained soils. At a minimum, the pavement section should be provided with underdrains in vertical curve sags, on the low side of super-elevated horizontal curves, and at other problem drainage areas.

Because of the importance of proper drainage, we also recommend the installation of an open-graded aggregate base conforming to the requirements of section 304, gradation #2 of the WDOT Standard Specifications, between the subgrade and the pavement. An edge drainage system should be installed at the aggregate base-subgrade interface to collect and remove surface infiltration. Vehicle traffic on the open-graded aggregate base should be minimized during construction to maintain maximum drainage potential by preventing aggregate contamination.

3.6 Subsurface Water

For the proposed project, little difficulty with water is expected during shallow excavations and roadway construction. A sump pump should be sufficient to control any water that might collect in shallow trench excavations and for deep utility work. Any material softened by standing water should be removed prior to resuming construction activities. Site grades should be maintained during construction to prevent water flow toward excavations.

Ditches and other water control features should be used to keep the water as far below the planned pavement as practically possible. Where the water can not be effectively lowered, raising the planned road grade should be considered. Keeping water low is important to prevent a moisture source that can contribute to frost damage of the pavement.

4.0 CONSTRUCTION CONSIDERATIONS

4.1 Excavations

All excavations must comply with the requirements of OSHA 29 CFR, part 1926, Subpart P, "Excavations and Trenches". This document states that the excavation safety is the responsibility of the contractor. Reference to this OSHA requirement should be included in the Project Specifications.

4.2 Observation and Testing

A Maxim representative should be present to provide excavation observation and monitoring of the fill and asphalt concrete placement during the construction phase of the project. Please refer to Appendix A for additional information regarding "Site Observation and Testing".

5.0 CLOSING REMARKS

It is recommended that Maxim be retained to provide construction materials testing services during the project. This is to observe compliance with the design concept, specifications, recommendations, and to allow design changes in the event that subsurface conditions differ from those anticipated.

6.0 STANDARD OF CARE

The recommendations contained in this report represent our professional opinions. These opinions were arrived at in accordance with currently accepted engineering practices at this time and location. Other than this no warranty is implied or intended.

This report was prepared by:

Gregory J. Stelmack
Geotechnical Engineer

This report was reviewed by:

Patrick J. Harrison, P.E.
Regional Vice President

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APPENDICES

FIELD EXPLORATION AND LABORATORY TESTING PROGRAM

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IMPORTANT INFORMATION ABOUT YOUR
GEOTECHNICAL ENGINEERING REPORT

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FIELD EXPLORATION AND LABORATORY TESTING PROGRAM

GENERAL SPECIFICATION

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FIELD EXPLORATION AND LABORATORY TESTING PROGRAM

The base field exploration consisted of test borings drilled at 16 locations selected by Short Elliott Hendrickson, Inc. The borings were drilled using a CME-55, rotary drive, drill rig and hollow-stem augers. The soil borings were drilled to depths of between approximately nine and 28½ feet below the existing surface grades.

In each boring, soil samples were obtained at 2½ foot intervals to the terminal depth of the boring. The soil samples were obtained in general accordance with specifications for standard penetration testing, ASTM D 1587. The specific procedures used for drilling and sampling are described below.

1. **BORING PROCEDURES BETWEEN SAMPLES**

   The boring is extended downward, between samples, by hollow stem augers.

2. **STANDARD PENETRATION TEST AND SPLIT-BARREL SAMPLING OF SOILS**
   (ASTM Designation: D-1586)

   This method consists of driving a 2 inch outside diameter, split barrel sampler using a 140 pound weight falling freely through a distance of 30 inches. The sampler is first seated 6 inches into the material to be sampled, and then driven 12 inches. The number of blows required to drive the sampler the final 12 inches is recorded on the log of borings and is known as the Standard Penetration Resistance Value (N-value).

3. **THIN-WALLED TUBE SAMPLING OF SOILS**
   (ASTM Designation: D-1587)

   This method consists of forcing a 2 inch or 3 inch outside diameter thin wall tube by hydraulic, or other means into soils, usually cohesive types. Relatively undisturbed samples are recovered.

During the field exploration, the driller visually classifies the soil and prepares a field log. Water level observations are made in each boring during, and after drilling, and are shown at the bottom of each boring log. Upon completion of drilling, the soil samples are delivered to our laboratory for visual classification and laboratory testing. The soils are visually classified by a soils technician using the Unified Soil Classification System and Munsell color charts, attached. The final logs are then reviewed by the project engineer.

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GENERAL SPECIFICATION #1

COMPACTED FILL SPECIFICATIONS

FILL MATERIALS

Any material used for fill shall contain no vegetation, ash, wood, frozen material, organic soils, or any material which by decay, or otherwise, might cause settlement. Materials to be placed within 10 feet of the construction areas shall be free from rock, stone or broken concrete larger than 6 inches in the largest dimension. Outside structural areas, larger rocks or boulders may be placed in fills without being broken up, provided they are not placed within 2 feet of the final fill surface, and that they are well embedded and the interstices filled with smaller material, as approved by the Engineer.

PLACEMENT METHOD

The approved fill material shall be deposited, spread and leveled, at optimum moisture content in layers generally not exceeding 8 inches in thickness before compaction. In areas containing granular soils, and where the compaction equipment is adaptable for the purpose, the thickness of the layer may be increased provided the required density is obtained. Moisture shall be added, or the material dried out, as required to permit proper compaction.

It is the responsibility of the Contractor to provide all of the necessary compaction equipment and other grading equipment that may be required to obtain the specified compaction. Compaction by travel of grading equipment will not be considered adequate for uniform compaction. Hand guided vibratory or tamping compactors will be required whenever fill is placed adjacent to walls, footings, columns, or in confined areas.

COMPACTION SPECIFICATIONS

Maximum dry density of the fill soil shall be determined in accordance with ASTM Test Designation D-1557, Modified Proctor. The recommended minimum field compaction as a percentage of the maximum dry density is 95% for all structural areas.

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BORING LOCATION DIAGRAM

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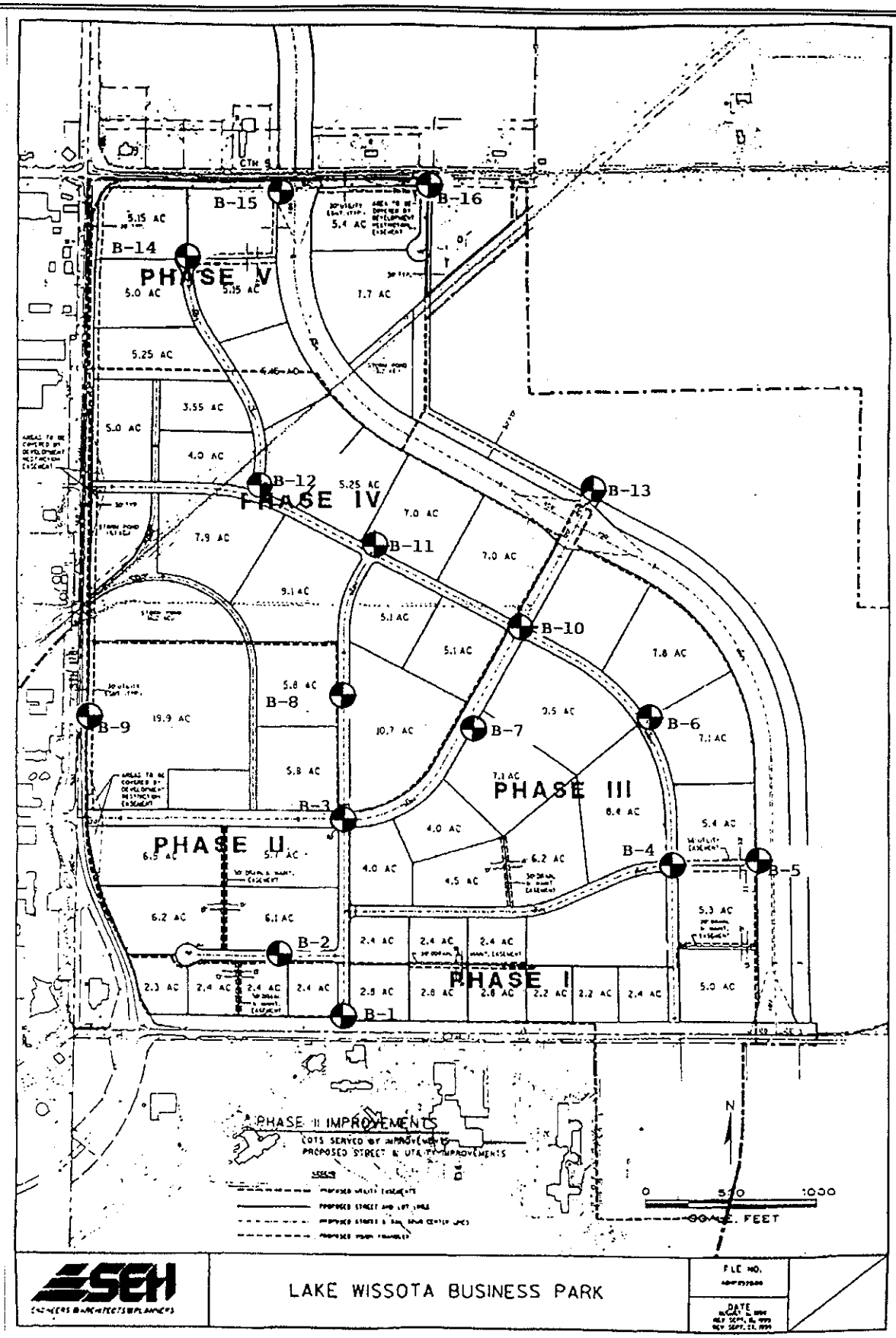

LAKE WISSOTA BUSINESS PARK - CHIPPEWA COUNTY, WISCONSIN

Boring Location Diagram	Job No. 2001062	Scale: - -	Drawn By: - - Checked By: - -

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LOGS OF TEST BORINGS

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LOG OF TEST BORING

JOB NO. 2001062 VERTICAL SCALE 1" = 4' BORING NO. B-1

PROJECT PROPOSED WISSOTA BUSINESS PARK; CHIPPEWA FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 925.0')	GEOLOGIC ORIGIN	N or CR	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS W	D	LL	PL	Qu or RQD
1.0	TOPSOIL (12")	Topsoil			1	FA					
2.0	SILTY CLAY, trace organics, dark brown, moist (CL)	Alluvium									
	SAND WITH GRAVEL AND FRACTURED ROCK, fine to medium grained, brown, moist, very dense (SP)		44		2	SB	4				
			43		3	SB	3				
7.0	SAND, trace gravel, fine to medium grained, brown, moist, dense (SP)		17		4	SB					
			19		5	SB					
12.0	SAND, fine to medium grained, brown, moist, loose to dense (SP)		7		6	SB					
			12		7	SB					
			21		8	SB					
21.5	End of Boring @ 21.5'										

WATER LEVEL MEASUREMENTS (Feet)

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
3-29-00	9:00	21.5	19.5	N/A		NONE
3-29-00	9:15	21.5	NONE	8.1		NONE

START 3-29-00 COMPLETE 3-29-00 @ 9:00

METHOD 3.25" HSA 0' to 19.5'

EAST: NORTH:

CREW CHIEF FIELDS

MAXIM TECHNOLOGIES INC

LOG OF TEST BORING

JOB NO. 2001062 VERTICAL SCALE 1" = 4' BORING NO. B-2

PROJECT PROPOSED WISSOTA BUSINESS PARK; CHIPPEWA FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 923.6')	GEOLOGIC ORIGIN	N or CR	WL	SAMPLE NO.	SAMPLE TYPE	LAB TESTS W	D	LL	PL	Qu or RQD
	TOPSOIL (20")	Topsoil			1	FA					
1.7											
2.0	SILTY SAND, brown, moist (SM)	Alluvium									
	SAND WITH GRAVEL AND FRACTURED ROCK, fine to medium grained, brown, moist, dense to very dense (SP)		20		2	SB					
			48		3	SB	2				
7.0											
	SAND, fine to medium grained, brown, moist, dense to medium dense (SP)		16		4	SB	2				
			13		5	SB					
			11		6	SB					
			13		7	SB					
17.5											
	End of Boring @ 17.5'										

WATER LEVEL MEASUREMENTS (Feet)

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
3-28-00	9:00	17.5	15.5	N/A		NONE
3-28-00	9:15	17.5	NONE	7.2		NONE

START 3-28-00 COMPLETE 3-28-00 @ 9:00

METHOD 3.25" HSA 0' to 15.5'

EAST: NORTH:

CREW CHIEF FIELDS

MAXIM TECHNOLOGIES INC

LOG OF TEST BORING

JOB NO. 2001062 VERTICAL SCALE 1" = 4' BORING NO. B-3

PROJECT PROPOSED WISSOTA BUSINESS PARK; CHIPPEWA FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 928.0')	GEOLOGIC ORIGIN	N or CR	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS W	D	LL	PL	Qu or RQD
1.3	TOPSOIL (16")	Topsoil			1	FA					
2.0	SILTY CLAY, dark brown, moist (CL)	Alluvium									
	SAND WITH A LITTLE GRAVEL, fine to medium grained, brown, moist, dense (SP)		17		2	SB	2				
4.5											
	SAND WITH GRAVEL AND FRACTURED ROCK, fine to medium grained, brown, moist, dense to very dense (SP)		24		3	SB	2				
			42		4	SB					
9.5											
11.0	SAND, fine to medium grained, brown, moist, dense (SP)		22		5	SB					
	SAND WITH GRAVEL AND FRACTURED ROCK, fine to medium grained, brown, moist, dense (SP)		27		6	SB					
14.5											
	SAND, fine to medium grained, brown, moist, dense (SP)		19		7	SB					
			24		8	SB					
			25		9	SB					
23.0	End of Boring @ 23'										

WATER LEVEL MEASUREMENTS (Feet)

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
3-29-00	10:00	23	21	N/A		NONE
3-29-00	10:15	23	NONE	7.9		NONE

START 3-29-00 COMPLETE 3-29-00 @ 10:00

METHOD 3.25" HSA 0' to 21'

EAST: NORTH:

CREW CHIEF FIELDS

MAXIM TECHNOLOGIES INC

LOG OF TEST BORING

JOB NO. 2001062 VERTICAL SCALE 1" = 4' BORING NO. B-4

PROJECT PROPOSED WISSOTA BUSINESS PARK; CHIPPEWA FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 928.4')	GEOLOGIC ORIGIN	N or CR	WL	SAMPLE NO.	SAMPLE TYPE	LAB TESTS W	D	LL	PL	Qu or RQD
	TOPSOIL (15")	Topsoil			1	FA					
1.2											
2.0	SILTY CLAY, trace organics, dark brown, moist (CL)	Alluvium	51		2	SB	2				
	SAND WITH GRAVEL AND FRACTURED ROCK, fine to medium grained, brown, moist, very dense (SP)		34		3	SB					
7.0											
	SAND, trace gravel, fine to medium grained, brown, moist, dense (SP)		18		4	SB	3				
9.5											
	SAND, fine to medium grained, brown, moist, medium dense (SP)		12		5	SB					
			10		6	SB					
			14		7	SB					
			14		8	SB					
19.0	End of Boring @ 19'										

WATER LEVEL MEASUREMENTS (Feet)

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
3-29-00	11:00	19	17	N/A		NONE
3-29-00	11:154	19	NONE	6.8		NONE

START 3-29-00 COMPLETE 3-29-00 @ 11:00

METHOD 3.25" HSA 0' to 17'

EAST: NORTH:

CREW CHIEF FIELDS

MAXIM TECHNOLOGIES INC

LOG OF TEST BORING

JOB NO. 2001062 VERTICAL SCALE 1" = 4' BORING NO. B-5

PROJECT PROPOSED WISSOTA BUSINESS PARK; CHIPPEWA FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 929.4')	GEOLOGIC ORIGIN	N or CR	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS W	D	LL	PL	Qu or RQD
	TOPSOIL (20")	Topsoil			1	FA					
1.7											
	SAND WITH GRAVEL AND FRACTURED ROCK, fine to medium grained, brown, moist, very dense to dense (SP)	Alluvium	31		2	SB	3				
			44		3	SB	3				
			46		4	SB					
			48		5	SB					
			44		6	SB					
			42		7	SB					
16.5	End of Boring @ 16.5'										

WATER LEVEL MEASUREMENTS (Feet)

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
3-29-00	12:00	16.5	14.5	N/A		NONE
3-29-00	12:15	16.5	NONE	7.4		NONE

START 3-29-00 COMPLETE 3-29-00 @ 12:00

METHOD 3.25" HSA 0' to 14.5'

EAST: NORTH:

CREW CHIEF FIELDS

MAXIM TECHNOLOGIES INC

LOG OF TEST BORING

JOB NO. 2001062 VERTICAL SCALE 1" = 4' BORING NO. B-6

PROJECT PROPOSED WISSOTA BUSINESS PARK; CHIPPEWA FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 930.4')	GEOLOGIC ORIGIN	N or CR	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS W	D	LL	PL	Qu or RQD
	TOPSOIL (20")	Topsoil			1	FA					
1.7	SAND, fine to medium grained, brown, moist, dense (SP)	Alluvium	22		2	SB	2				
3.0	SAND WITH GRAVEL AND FRACTURED ROCK, fine to medium grained, brown, moist, dense (SP)		12		3	SB	2				
4.5	SAND, fine to medium grained, brown, moist, medium dense (SP)		14		4	SB					
7.0	SAND WITH GRAVEL AND FRACTURED ROCK, fine to medium grained, brown, moist, medium dense (SP)										
9.0	End of Boring @ 9'										

WATER LEVEL MEASUREMENTS (Feet)

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
3-29-00	13:00	9	7	N/A		NONE
3-29-00	13:10	9	NONE	2.8		NONE

START 3-29-00 COMPLETE 3-29-00 @ 13:00

METHOD 3.25" HSA 0' to 7'

EAST: NORTH:

CREW CHIEF FIELDS

MAXIM TECHNOLOGIES INC

LOG OF TEST BORING

JOB NO. 2001062 VERTICAL SCALE 1" = 4' BORING NO. B-7

PROJECT PROPOSED WISSOTA BUSINESS PARK; CHIPPEWA FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 929.0')	GEOLOGIC ORIGIN	N or CR	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS W	D	LL	PL	Qu or RQD
1.2	TOPSOIL (15")	Topsoil			1	FA					
2.0	SILTY CLAY, brown, moist (CL)	Alluvium									
	SAND WITH GRAVEL AND FRACTURED ROCK, fine to medium grained, brown, moist, very dense to dense (SP)		40		2	SB					
			29		3	SB	2				
7.0	SAND WITH A LITTLE GRAVEL, fine to medium grained, brown, moist, dense (SP)		24		4	SB	3				
			19		5	SB					
12.0	SAND, fine to medium grained, brown, moist, dense (SP)		17		6	SB					
			22		7	SB					
19.5	SAND, fine to medium grained, brown, moist, medium dense (SP)		13		8	SB					
21.5	SAND WITH A LITTLE GRAVEL, fine to medium grained, brown, moist, medium dense (SP)		15		9	SB					
23.5	End of Boring @ 23.5'										

WATER LEVEL MEASUREMENTS (Feet)

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
3-29-00	14:00	23.5	21.5	N/A		NONE
3-29-00	14:15	23.5	NONE	7.4		NONE

START 3-29-00 COMPLETE 3-29-00 @ 14:00

METHOD 3.25" HSA 0' to 21.5'

EAST: NORTH:

CREW CHIEF FIELDS

MAXIM TECHNOLOGIES INC

LOG OF TEST BORING

JOB NO. 2001062 VERTICAL SCALE 1" = 4' BORING NO. B-8

PROJECT PROPOSED WISSOTA BUSINESS PARK; CHIPPEWA FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 930.3')	GEOLOGIC ORIGIN	N or CR	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS W	D	LL	PL	Qu or RQD
1.2	TOPSOIL (14")	Topsoil			1	FA					
2.0	SILTY CLAY WITH SAND, brown, moist (CL)	Alluvium									
	SAND WITH GRAVEL, fine to medium grained, brown, moist, very dense to dense (SP)		42		2	SB	3				
			23		3	SB	2				
7.0	SAND WITH GRAVEL AND FRACTURED ROCK, fine to medium grained, brown, moist, dense (SP)		25		4	SB					
			30		5	SB					
12.0	SAND WITH A LITTLE GRAVEL, fine to medium grained, brown, moist, dense (SP)		20		6	SB					
14.5	SAND, fine to medium grained, brown, moist, medium dense (SP)		15		7	SB					
19.5	SAND WITH A LITTLE GRAVEL, fine to medium grained, brown, moist, medium dense (SP)		14		8	SB					
21.0			14		9	SB					
22.5	SAND, fine to medium grained, brown, moist, medium dense (SP)										
	End of Boring @ 22.5'										

WATER LEVEL MEASUREMENTS (Feet)

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
3-29-00	15:00	22.5	21	N/A		NONE
3-29-00	15:15	22.5	NONE	8.1		NONE

START 3-29-00 COMPLETE 3-29-00 @ 15:00

METHOD 3.25" HSA 0' to 21'

EAST: NORTH:

CREW CHIEF FIELDS

MAXIM TECHNOLOGIES INC

LOG OF TEST BORING

JOB NO. 2001062 VERTICAL SCALE 1" = 4' BORING NO. B-9

PROJECT PROPOSED WISSOTA BUSINESS PARK; CHIPPEWA FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 933.1')	GEOLOGIC ORIGIN	N or CR	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS W	D	LL	PL	Qu or RQD
0.5	TOPSOIL (6")	Topsoil			1	FA					
2.0	SILTY SAND WITH GRAVEL, brown, moist (SM)	Alluvium									
	SAND WITH A LITTLE GRAVEL, fine to medium grained, brown, moist, very dense (SP)		33		2	SB	2				
4.5											
	SAND WITH GRAVEL AND FRACTURED ROCK, fine to medium grained, brown, moist, very dense (SP)		43		3	SB	2				
7.0											
	SAND WITH A LITTLE GRAVEL, fine to medium grained, brown, moist, dense (SP)		18		4	SB					
9.0											
	End of Boring @ 9'										

WATER LEVEL MEASUREMENTS (Feet)

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
3-28-00	10:00	9	7	N/A		NONE
3-28-00	10:15	9	NONE	5		NONE

START 3-28-00 COMPLETE 3-28-00 @ 10:00

METHOD 3.25" HSA 0' to 7'

EAST: NORTH:

CREW CHIEF FIELDS

MAXIM TECHNOLOGIES INC

LOG OF TEST BORING

JOB NO. 2001062 VERTICAL SCALE 1" = 4' BORING NO. B-10

PROJECT PROPOSED WISSOTA BUSINESS PARK; CHIPPEWA FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 929.8')	GEOLOGIC ORIGIN	N or CR	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS W	D	LL	PL	Qu or RQD
	TOPSOIL (20")	Topsoil			1	FA					
1.7	SAND WITH GRAVEL AND FRACTURED ROCK, fine to medium grained, brown, moist, very dense to dense (SP)	Alluvium	32		2	SB					
			27		3	SB	3				
7.0	SAND WITH GRAVEL AND FRACTURED ROCK, fine to medium grained, brown, moist, very dense to dense (SP)		50/.4		4	SB	5				
			30		5	SB					
12.0	SAND, fine to medium grained, brown, moist, dense to loose (SP)		24		6	SB					
			8		7	SB					
19.5	SAND WITH GRAVEL, some cobbles, fine to medium grained, brown, moist, dense to very dense (SP)		19		8	SB					
			81/.9		9	SB					
23.4	End of Boring @ 24'										

WATER LEVEL MEASUREMENTS (Feet)

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
3-28-00	11:00	24	22	N/A		NONE
3-28-00	11:15	24	NONE	7.9		NONE

START 3-28-00 COMPLETE 3-28-00 @ 11:00

METHOD 3.25" HSA 0' to 22'

EAST: NORTH:

CREW CHIEF FIELDS

MAXIM TECHNOLOGIES INC

LOG OF TEST BORING

JOB NO. 2001062 VERTICAL SCALE 1" = 4' BORING NO. B-11

PROJECT PROPOSED WISSOTA BUSINESS PARK; CHIPPEWA FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 928.6')	GEOLOGIC ORIGIN	N or CR	WL	SAMPLE NO.	SAMPLE TYPE	LAB TESTS W	D	LL	PL	Qu or RQD
	TOPSOIL (15")	Topsoil			1	FA					
1.2											
2.0	SILTY CLAY, brown, moist (CL)	Alluvium									
	SAND WITH GRAVEL AND FRACTURED ROCK, fine to medium grained, brown, moist, very dense (SP)		42		2	SB	2				
			45		3	SB	3				
			45		4	SB					
9.5											
	SAND WITH A LITTLE GRAVEL, fine to medium grained, brown, moist, dense (SP)		18		5	SB					
			17		6	SB					
			23		7	SB					
			21		8	SB					
21.0											
	SAND, fine to medium grained, brown, moist, dense (SP)		19		9	SB					
23.0											
	End of Boring @ 23'										

WATER LEVEL MEASUREMENTS (Feet)

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
3-28-00	12:00	23	21	N/A		NONE
3-28-00	12:15	23	NONE	7.8		NONE

START 3-28-00 COMPLETE 3-28-00 @ 12:00

METHOD 3.25" HSA 0' to 21'

EAST: NORTH:

CREW CHIEF FIELDS

MAXIM TECHNOLOGIES INC

LOG OF TEST BORING

JOB NO. 2001062 VERTICAL SCALE 1" = 4' BORING NO. B-12

PROJECT PROPOSED WISSOTA BUSINESS PARK; CHIPPEWA FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 927.6')	GEOLOGIC ORIGIN	N or CR	WL	SAMPLE NO.	SAMPLE TYPE	LAB W	LAB D	LAB LL	LAB PL	LAB Qu or RQD
1.2	TOPSOIL (15")	Topsoil			1	FA					
2.0	SILTY SAND, brown, moist (SM)	Alluvium									
	SAND WITH A LITTLE GRAVEL, fine to medium grained, brown, moist, dense (SP)		21		2	SB					
			24		3	SB	2				
7.0	SAND WITH GRAVEL AND FRACTURED ROCK, fine to medium grained, brown, moist, very dense (SP)		34		4	SB	4				
			50/.4		5	SB					
12.0	SAND WITH A LITTLE GRAVEL, some fractured rock, fine to medium grained, brown, moist, dense (SP)		29		6	SB					
14.5	SAND, fine to medium grained, brown, moist, medium dense (SP)		12		7	SB					
			13		8	SB					
20.0	End of Boring @ 20'										

WATER LEVEL MEASUREMENTS (Feet)

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
3-28-00	13:00	20	18	N/A		NONE
3-28-00	13:15	20	NONE	7		NONE

START 3-28-00 COMPLETE 3-28-00 @ 13:00

METHOD 3.25" HSA 0' to 18'

EAST: NORTH:

CREW CHIEF FIELDS

MAXIM TECHNOLOGIES INC

LOG OF TEST BORING

JOB NO. 2001062 VERTICAL SCALE 1" = 4' BORING NO. B-13

PROJECT PROPOSED WISSOTA BUSINESS PARK; CHIPPEWA FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 935.0')	GEOLOGIC ORIGIN	N or CR	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS W	D	LL	PL	Qu or RQD
	TOPSOIL (18")	Topsoil			1	FA					
1.5	SILTY SAND, brown to orangish brown, moist, medium dense (SM)	Glacial Till	15		2	SB	13				
3.5	SAND WITH GRAVEL AND FRACTURED ROCK, fine to medium grained, brown, moist, very dense (SP)		53		3	SB	2				
			46		4	SB					
			46		5	SB					
			35		6	SB					
14.5	SAND WITH A LITTLE GRAVEL, fine to medium grained, brown, moist, dense (SP)		24		7	SB					
			27		8	SB					
			17		9	SB					
26.5	SAND, fine to medium grained, brown, moist, medium dense (SP)		15		10	SB					
28.5	End of Boring @ 28.5'										

WATER LEVEL MEASUREMENTS (Feet)

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
4-4-00	12:00	28.5	26.5	N/A		NONE
4-4-00	12:15	28.5	NONE	10.9		NONE

START 4-4-00 COMPLETE 4-4-00 @ 12:00

METHOD 3.25" HSA 0' to 26.5'

EAST: NORTH:

CREW CHIEF FIELDS

MAXIM TECHNOLOGIES INC

LOG OF TEST BORING

JOB NO. 2001062 VERTICAL SCALE 1" = 4' BORING NO. B-14

PROJECT PROPOSED WISSOTA BUSINESS PARK; CHIPPEWA FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 929.6')	GEOLOGIC ORIGIN	N or CR	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS W	D	LL	PL	Qu or RQD
1.0	TOPSOIL (12")	Topsoil			1	FA					
2.0	SANDY SILT, trace organics, dark brown, moist (ML)	Glacial Till									
	SAND WITH GRAVEL AND FRACTURED ROCK, fine to medium grained, brown, moist, very dense (SP)		55		2	SB					
4.5	SAND WITH A LITTLE GRAVEL, fine to medium grained, brown, moist, dense (SP)		26		3	SB	2				
			27		4	SB	4				
9.5	SAND, fine to medium grained, brown, moist, dense to medium dense (SP)		17		5	SB					
			20		6	SB					
			21		7	SB					
			15		8	SB					
21.5	End of Boring @ 21.5'										

WATER LEVEL MEASUREMENTS (Feet)

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
4-4-00	13:00	21.5	19.5	N/A		NONE
4-4-00	13:15	21.5	NONE	7.9		NONE

START 4-4-00 COMPLETE 4-4-00 @ 13:00

METHOD 3.25" HSA 0' to 19.5'

EAST: NORTH:

CREW CHIEF FIELDS

MAXIM TECHNOLOGIES INC

LOG OF TEST BORING

JOB NO. 2001062 VERTICAL SCALE 1" = 4' BORING NO. B-15

PROJECT PROPOSED WISSOTA BUSINESS PARK; CHIPPEWA FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 928.6')	GEOLOGIC ORIGIN	N or CR	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS W	D	LL	PL	Qu or RQD
1.0	TOPSOIL (12")	Topsoil			1	FA					
2.0	SILTY CLAY WITH A LITTLE GRAVEL, brown, moist (CL)	Glacial Till									
	SAND WITH GRAVEL AND FRACTURED ROCK, fine to medium grained, brown, moist, very dense (SP)		38		2	SB	4				
			57		3	SB	6				
			76		4	SB					
9.5											
11.0	SAND WITH GRAVEL, some fractured rock, fine to coarse grained, brown, moist, dense (SP)		26		5	SB					
	SAND, fine to medium grained, brown, moist, medium dense to dense (SP)		9		6	SB					
			9		7	SB					
			16		8	SB					
19.0	End of Boring @ 19'										

WATER LEVEL MEASUREMENTS (Feet)

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
4-4-00	14:00	19	17	N/A		NONE
4-4-00	14:15	19	NONE	8.5		NONE

START 4-4-00 COMPLETE 4-4-00 @ 14:00

METHOD 3.25" HSA 0' to 17'

EAST: NORTH:

CREW CHIEF FIELDS

MAXIM TECHNOLOGIES INC

LOG OF TEST BORING

JOB NO. 2001062 VERTICAL SCALE 1" = 4' BORING NO. B-16

PROJECT PROPOSED WISSOTA BUSINESS PARK; CHIPPEWA FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 929.8')	GEOLOGIC ORIGIN	N or CR	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS W	D	LL	PL	Qu or RQD
1.0	TOPSOIL (12")	Topsoil			1	FA					
2.0	SILTY CLAY, dark brown, moist (CL)	Glacial Till									
4.5	SAND WITH GRAVEL AND FRACTURED ROCK, fine to medium grained, brown, moist, very dense (SP)		47		2	SB					
7.0	SAND WITH A LITTLE GRAVEL, fine to medium grained, brown, moist, very dense (SP)		34		3	SB	2				
	SAND, fine to medium grained, brown, moist, dense (SP)		25		4	SB	4				
			18		5	SB					
			19		6	SB					
15.0	End of Boring @ 15'										

WATER LEVEL MEASUREMENTS (Feet)

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
4-4-00	15:00	15	13	N/A		NONE
4-4-00	15:15	15	NONE	6.5		NONE

START 4-4-00 COMPLETE 4-4-00 @ 15:00

METHOD 3.25" HSA 0' to 13'

EAST: NORTH:

CREW CHIEF FIELDS

MAXIM TECHNOLOGIES INC

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GENERAL NOTES

AND

CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

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MAXIM

CORRELATION OF PENETRATION RESISTANCE WITH RELATIVE DENSITY AND CONSISTENCY

DESCRIPTIVE TERMINOLOGY

DENSITY TERM	"N" VALUE	CONSISTENCY TERM
Very Loose	0-4	Soft
Loose	5-8	Medium
Medium Dense	9-15	Rather Stiff
Dense	16-30	Stiff
Very Dense	Over 30	Very Stiff

Standard "N" Penetration: Blows per foot of a 140 pound Hammer Falling 30 inches on a 2 inch OD Split Barrel Sampler

Lamination	Up to 1/2" thick stratum
Layer	1/2" to 6" thick stratum
Lens	1/2" to 6" discontinuous stratum, pocket
Varved	Alternating laminations of clay, silt, and/or fine grained sand, or colors thereof
Dry	Powdery, no noticeable water
Moist	Below Saturation
Wet	Saturated, above liquid limit
Waterbearing	Previous soil below water

TERMS FOR GRAVEL PROPORTIONS

Term	Gravel Percent
A Little Gravel	1 - 14
With Gravel	15 - 50

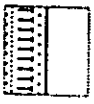
RELATIVE SIZES

Boulder	Over 12"
Cobble	3" - 12"
Gravel	
Coarse	3/4" - 3"
Fine	#4 - 3/4"
Sand	
Coarse	#4 - #10
Medium	#10 - #40
Fine	#40 - #200
Silt & Clay	-#200, Based on Plasticity

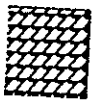
KEY TO DRILLING SYMBOLS

SB - Split Spoon Sampler

3T - 3" Thin Wall



NX - Rock Coring



FA - Flight Auger

Water Level

NMR - No Measurement Recorded

NSR - No Sample Recovered

CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES
ASTM Designation: D 2487 - 83
(Based on Unified Soil Classification System)

SOIL ENGINEERING

			Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]	Soil Classification: Group Symbol	Soil Classification: Group Name[B]
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3^E$	GW	Well graded gravel[F]
			$Cu < 4$ and/or $1 > Cc > 3^E$	GP	Poorly graded gravel[F]
		Gravels with Fines More than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	$Cu \geq 6$ and $1 \leq Cc \leq 3^E$	SW	Well-graded sand[I]
			$Cu < 6$ and/or $1 > Cc > 3^E$	SP	Poorly graded sand[I]
		Sands with Fines More than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G,H,I]
			Fines classify as CL or CH	SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	PI > 7 and plots on or above "A" line[J]	CL	Lean clay[K,L,M]
			PI < 4 or plots below "A" line[J]	ML	Silt[K,L,M]
		organic	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OL	Organic clay[K,L,M,N] Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K,L,M]
			PI plots below "A" line	MH	Elastic silt[K,L,M]
		organic	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OH	Organic clay[K,L,M,P] Organic silt[K,L,M,O]
Highly organic soils		Primarily organic matter, dark in color, and organic odor		PT	Peat
Fibric Peat >67% Fibers		Hemic Peat 33%-67% Fibers			Sapric Peat < 33% Fibers

[A] Based on the material passing the 3-in. (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay

[D] Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains $\geq 15\%$ sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains $\geq 30\%$ plus no. 200, predominantly sand, add "sandy" to to group name.

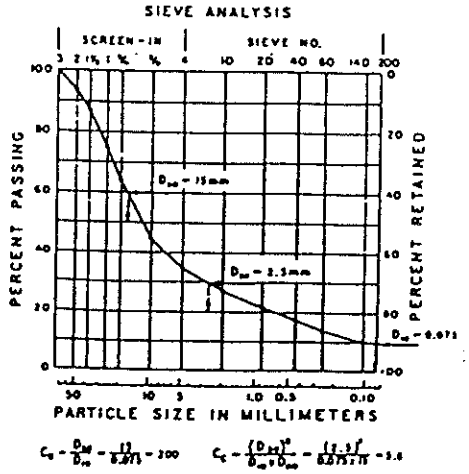
[M] If soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

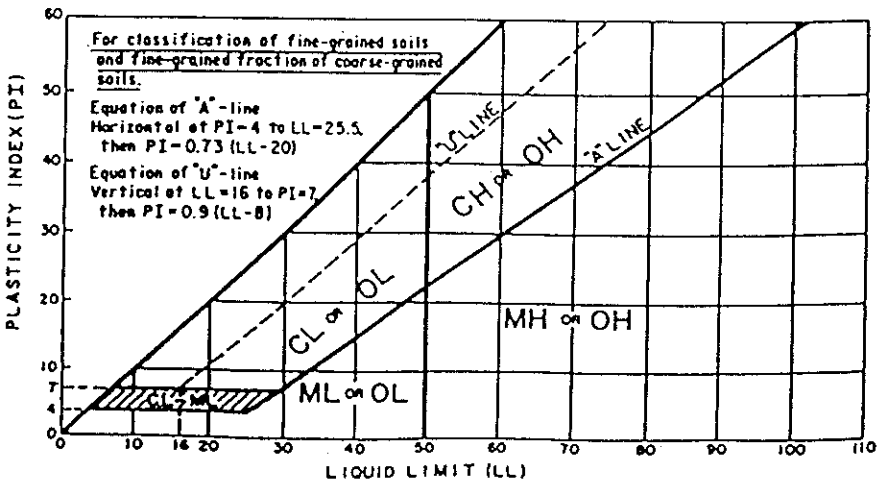
[N] $PI \geq 4$ and plots on or above "A" line.

[O] $PI < 4$ or plots below "A" line.

[P] PI plots on or above "A" line

[Q] PI plots below "A" line.





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IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

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IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

As the client of a consulting geotechnical engineer, you should know that site subsurface conditions cause more construction problems than any other factor. ASFE/The Association of Engineering Firms Practicing in the Geosciences offers the following suggestions and observations to help you manage your risks.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

Your geotechnical engineering report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. These factors typically include: the general nature of the structure involved, its size, and configuration; the location of the structure on the site; other improvements, such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask your geotechnical engineer to evaluate how factors that change subsequent to the date of the report may affect the report's recommendations.

Unless your geotechnical engineer indicates otherwise, do not use your geotechnical engineering report:

- when the nature of the proposed structure is changed, for example, if an office building will be erected instead of a parking garage, or a refrigerated warehouse will be built instead of an unrefrigerated one;
- when the size, elevation, or configuration of the proposed structure is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership; or
- for application to an adjacent site.

Geotechnical engineers cannot accept responsibility for problems that may occur if they are not consulted after factors considered in their report's development have changed.

SUBSURFACE CONDITIONS CAN CHANGE

A geotechnical engineering report is based on conditions that existed at the time of subsurface exploration. Do not base construction decisions on a geotechnical engineering report whose adequacy may have been affected by time. Speak with your geotechnical consultant to learn if additional tests are advisable before construction starts. Note, too, that additional tests may be required when subsurface conditions are affected by construction operations at or adjacent to the site, or by natural events such as floods, earthquakes, or ground water fluctuations. Keep your geotechnical consultant apprised of any such events.

MOST GEOTECHNICAL FINDINGS ARE PROFESSIONAL JUDGMENTS

Site exploration identifies actual subsurface conditions only at those points where samples are taken. The data were extrapolated by your geotechnical engineer who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your geotechnical engineer can work together to help minimize their impact. Retaining your geotechnical engineer to observe construction can be particularly beneficial in this respect.

A REPORT'S RECOMMENDATIONS CAN ONLY BE PRELIMINARY

The construction recommendations included in your geotechnical engineer's report are preliminary, because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Because actual subsurface conditions can be discerned only during earthwork, you should retain your geotechnical engineer to observe actual conditions and to finalize recommendations. Only the geotechnical engineer who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations are valid and whether or not the contractor is abiding by applicable recommendations. The geotechnical engineer who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS

Consulting geotechnical engineers prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your geotechnical engineer prepared your report expressly for you and expressly for purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the geotechnical engineer. No party should apply this report for any purpose other than that originally contemplated without first conferring with the geotechnical engineer.

GEOENVIRONMENTAL CONCERNS ARE NOT AT ISSUE

Your geotechnical engineering report is not likely to relate any findings, conclusions, or recommendations

about the potential for hazardous materials existing at the site. The equipment, techniques, and personnel used to perform a geoenvironmental exploration differ substantially from those applied in geotechnical engineering. Contamination can create major risks. If you have no information about the potential for your site being contaminated, you are advised to speak with your geotechnical consultant for information relating to geoenvironmental issues.

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid misinterpretations, retain your geotechnical engineer to work with other project design professionals who are affected by the geotechnical report. Have your geotechnical engineer explain report implications to design professionals affected by them, and then review those design professionals' plans and specifications to see how they have incorporated geotechnical factors. Although certain other design professionals may be familiar with geotechnical concerns, none knows as much about them as a competent geotechnical engineer.

BORING LOGS SHOULD NOT BE SEPARATED FROM THE REPORT

Geotechnical engineers develop final boring logs based upon their interpretation of the field logs (assembled by site personnel) and laboratory evaluation of field samples. Geotechnical engineers customarily include only final boring logs in their reports. Final boring logs should not under any circumstances be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimize the possibility of contractors misinterpreting the logs during bid preparation. When this occurs, delays, disputes, and unanticipated costs are the all-too-frequent result.

To minimize the likelihood of boring log misinterpretation, give contractors ready access to the complete geotechnical engineering report prepared or authorized for their use. (If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared and that developing construction cost estimates was not one of the specific purposes for which it was prepared. In other words, while a contractor may gain important knowledge from a report prepared for another party, the contractor would be well-advised to discuss the report with your geotechnical engineer and to perform the additional or alternative work that the contractor believes may be needed to obtain the data specifically appropriate for construction cost estimating purposes.) Some clients believe that it is unwise or unnecessary to give contractors access to their geotechnical engineering reports because they hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems. It also helps reduce the adversarial attitudes that can aggravate problems to disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY

Because geotechnical engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against geotechnical engineers. To help prevent this problem, geotechnical engineers have developed a number of clauses for use in their contracts, reports, and other documents. Responsibility clauses are not exculpatory clauses designed to transfer geotechnical engineers' liabilities to other parties. Instead, they are definitive clauses that identify where geotechnical engineers' responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your geotechnical engineering report. Read them closely. Your geotechnical engineer will be pleased to give full and frank answers to any questions.

RELY ON THE GEOTECHNICAL ENGINEER FOR ADDITIONAL ASSISTANCE

Most ASFE-member consulting geotechnical engineering firms are familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a construction project, from design through construction. Speak with your geotechnical engineer not only about geotechnical issues, but others as well, to learn about approaches that may be of genuine benefit. You may also wish to obtain certain ASFE publications. Contact a member of ASFE of ASFE for a complimentary directory of ASFE publications.

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