Preliminary Geotechnical Evaluation Report

Confidential Project
Part of Government Lot 3 – Section 19, T55N, R25W
Grand Rapids, Minnesota

Prepared for

Benchmark Engineering, Inc.

Professional Certification:
I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Mark W. Gothard, PE
Principal/Senior Engineer
License Number: 44926
December 6, 2010

Project HB-10-09951

Braun Intertec Corporation

BRAUN
INTERTEC

Braun Intertec Corporation
3404 15th Avenue East
Suite 9
Hibbing, MN 55746

Phone: 218.263.8869
Fax: 218.263.6700
Web: braunintertec.com

December 6, 2010

Project HB-10-09951

Paul R. Tokarczyk, PE/PLS
Benchmark Engineering, Inc.
8878 Main Street
PO Box 261
Mountain Iron, MN 55768

Re: Preliminary Geotechnical Evaluation
Confidential Project
Part of Government Lot 3 – Section 19, T55N, R25W
Grand Rapids, Minnesota

Dear Mr. Tokarczyk:

We have completed a preliminary geotechnical evaluation for the above-referenced confidential project in Grand Rapids, Minnesota. The following presents a summary of our results and preliminary recommendations. More detailed results, analyses and recommendations follow.

Summary of Results

We completed six standard penetration test borings as part of our preliminary evaluation. The borings generally encountered 1/2-foot of topsoil underlain by poorly graded sand and poorly graded sand with silt. Penetration resistances indicated the sands were generally very loose to medium dense. Groundwater was observed in the borings at depths ranging from 7 1/2 to 12 1/2 feet.

Summary of Preliminary Recommendations

Based on the soil borings, this site appears to be well suited for the proposed development. The on-site soils below the topsoil should generally be suitable for use as fill and backfill soils. The structure foundations may be sized for net allowable bearing pressures ranging from about 2,000 to 4,000 pounds per square foot, depending on final design location and elevations of the proposed structures. Some of the sand soils were very loose to loose, thereby limiting the bearing capacity of these soils.

Remarks

Thank you for making Braun Intertec your geotechnical consultant for this project. If you have questions about this report, or if there are other services that we can provide in support of our work to date, please contact Mark Gothard at 800.828.7313 (Hibbing office), at 218.259.550 (cell) or by email at

mgothard@braunintertec.com.

Sincerely,

BRAUN INTERTEC CORPORATION

Mark W. Gothard, PE
Principal/Senior Engineer

James P. Bonner, PE
Senior Engineer

Attachment:
Preliminary Geotechnical Evaluation Report

Table of Contents

A. Introduction

A.1. Project Description

An unidentified party is considering developing a vacant parcel of land located southeast of Itasca County State Aid Highway (CSAH) 63 and Itasca Eco-Industrial Park Joint Access Road in Grand Rapids, Minnesota. The parcel is identified as Government Lot 3, Section 19, T 55N, R25W. This report presents findings and recommendations from a preliminary geotechnical evaluation performed on this site.

A.2. Purpose

The purpose of our preliminary geotechnical evaluation was to obtain preliminary subsurface soil and groundwater information and provide general geotechnical recommendations regarding design and construction of the proposed development.

A.3. Site Conditions

The project site is approximately 21.7 acres of undeveloped land located on the south side of Itasca CSAH 63 and abuts the Mississippi River Reservoir to the east. The site is currently wooded with a series of meandering trails throughout.

A.4. Soil Boring Location and Elevations

The boring locations were chosen and staked in the field by Benchmark Engineering, Inc. Ground surface elevations at the boring locations were also provided by Benchmark Engineering, Inc.

A.5. Scope of Services

Our scope of services for this project was submitted as a Proposal to Paul Tokarczyk, PE/PLS of Benchmark Engineering, Inc. on November 11, 2010. Mr. Tokarczyk authorized us to proceed on November 16. Geotechnical tasks performed in accordance with our authorized scope of services included:

- Performing six standard penetration test borings, each to a depth of 15 feet.
- Classifying the samples and preparing boring logs.

- Preparing this preliminary report containing a sketch, exploration logs, a summary of the soils encountered, results of laboratory tests, and preliminary geotechnical recommendations for site development.

B. Results

B.1. Exploration Logs

B.1.a. Log of Boring Sheets

Log of Boring sheets for our penetration test borings are included in the Appendix. The logs identify and describe the geologic materials that were penetrated, and present the results of penetration resistance and other in-situ tests performed within them, laboratory tests performed on penetration test samples retrieved from them, and groundwater measurements.

Strata boundaries were inferred from changes in the penetration test samples and the auger cuttings. Because sampling was not performed continuously, the strata boundary depths are only approximate. The boundary depths likely vary away from the boring locations, and the boundaries themselves may also occur as gradual rather than abrupt transitions. A fence diagram summarizing the borings is included in the Appendix.

B.1.b. Geologic Origins

Geologic origins assigned to the materials shown on the logs and referenced within this report were based on visual classification of the various geologic material samples retrieved during the course of our subsurface exploration, penetration resistances, and available common knowledge of the geologic processes and environments that have impacted the site and surrounding area in the past.

B.2. Soil Profile

We completed six borings on the site. The borings encountered about 1/2-foot of topsoil underlain by poorly graded sand and poorly graded sand with silt. Penetration resistances in the poorly graded sand ranged from only 1 to 17 blows per foot (BPF), indicating it ranged from very loose to medium dense.

B.2.a. Groundwater

Groundwater was observed in the borings at depths ranging from 7 1/2 to 12 1/2 feet. The groundwater table, however, should be expected to fluctuate seasonally and annually.

B.3. Laboratory Tests

Several laboratory tests were performed on samples obtained during drilling. The tests on the samples from the borings consisted of percent passing the number 200 (P200) sieve tests. The results of the P200 tests are shown on the attached Log of Boring sheets.

B.3.a. Percent Passing Number 200 Sieve Tests

To assist in classifying the soils, three percent passing the number 200 sieve tests were conducted on samples retrieved during drilling from Borings SB-1, SB-3 and SB-5 at depths of about 2 1/2- to 6-feet.

The percents passing the number 200 sieve ranged between 1.8 and 8.9 percent. Based upon the test results, the soils tested were then classified in accordance with the American Society for Testing and Materials (ASTM) classification system. The samples tested were classified as poorly graded sand (SP) and poorly graded sand with silt (SP-SM).

C. Proposed Construction

The proposed development likely includes construction of a new building(s) and associated infrastructure. Structure locations and preliminary configurations and elevations are not available at this time.

D. Preliminary Recommendations

D.1. Site Grading and Structure Pad Preparations

We recommend removing vegetation and topsoil from proposed building, structure and pavement areas prior to placing footings or additional fill required to reach desired grades. The resulting subgrades will consist of loose to medium dense poorly graded sand and poorly graded sand with silt.

On-site soils below the topsoil may be used as fill and backfill material below structures and in other areas of the site. If material needs to be imported to the site, we recommend using granular material containing fewer than 20 percent by weight particles passing the number 200 sieve (Mn/DOT Specification 3149.2B1, Granular Borrow).

We recommend placing fill and backfill material in loose lifts not exceeding 12 inches, and compacting to a minimum of 95 percent of standard Proctor maximum dry density, as determined in accordance with ASTM International Test Method D 698. Within 3 feet of pavement subgrades, the minimum compaction level should be increased to 100 percent of standard Proctor maximum dry density.

D.2. Structure Foundations

D.2.a. Embedment Depth

For frost protection, we recommend embedding structure foundations 60 inches below the lowest exterior grade. Interior footings may be placed directly below floor slabs. We recommend embedding foundations not heated during winter construction, and other unheated foundations associated with canopies, stoops or sidewalks 72 inches below the lowest exterior grade.

D.2.b. Subgrade Improvement

We anticipate that the soils present at foundation subgrades will consist of native granular soils with varying levels of relative density, or compacted granular fill material. We recommend compacting foundation subgrade soils with a plate compactor prior to placing foundations.

D.2.c. Net Allowable Bearing Pressure

Depending on structure location and foundation elevations, the recommended net allowable bearing pressure will range from about 2,000 to 4,000 pounds per square foot (psf).

D.3. Additional Investigation

If development of this site proceeds, we recommend further subsurface exploration be performed. The additional subsurface exploration should include soil borings in the proposed structure areas and pavement areas, once the proposed building locations, foundation loads and proposed grades have been determined. The additional soil borings and laboratory testing will provide additional subsurface information in the proposed building areas and will allow us to finalize the recommendations regarding site development, grading, foundations, floor slabs, exterior slabs, utilities and pavements.

E. Procedures

E.1. Penetration Test Borings

The penetration test borings were drilled with a core and auger drill equipped with hollow-stem auger, mounted on an all-terrain carrier. The borings were performed in accordance with ASTM International D 1586. Penetration test samples were taken at 2 1/2- and 5-foot intervals. Actual sample intervals and corresponding depths are shown on the boring logs.

E.2. Material Classification and Testing

The geologic materials encountered were visually and manually classified in accordance with ASTM International Standard Practice D 2488. A chart explaining the classification system is attached. Samples were sealed in jars and returned to our facility for review and storage.

E.3. Groundwater Measurements

The drillers checked for groundwater as the penetration test borings were advanced, and again after auger withdrawal. The boreholes were then backfilled as noted on the logs.

F. Qualifications

F.1. Variations in Subsurface Conditions

F.1.a. Material Strata

Our evaluation, analyses and recommendations were developed from a limited amount of site and subsurface information. It is not standard engineering practice to retrieve material samples from exploration locations continuously with depth, and therefore strata boundaries and thicknesses must be inferred to some extent. Strata boundaries may also be gradual transitions, and can be expected to vary in depth, elevation and thickness away from the exploration locations.

Variations in subsurface conditions present between exploration locations may not be revealed until additional exploration work is completed, or construction commences. If any such variations are revealed,

our recommendations should be re-evaluated. Such variations could increase construction costs, and a contingency should be provided to accommodate them.

F.1.b. Groundwater Levels

Groundwater measurements were made under the conditions reported herein and shown on the exploration logs, and interpreted in the text of this report. It should be noted that the observation period was relatively short, and groundwater can be expected to fluctuate in response to rainfall, flooding, irrigation, seasonal freezing and thawing, surface drainage modifications and other seasonal and annual factors.

F.2. Continuity of Professional Responsibility

F.2.a. Plan Review

This report is based on a limited amount of information, and a number of assumptions were necessary to help us develop our recommendations. It is recommended that our firm review the geotechnical aspects of the designs and specifications, and evaluate whether the design is as expected, if any design changes have affected the validity of our recommendations, and if our recommendations have been correctly interpreted and implemented in the designs and specifications.

F.2.b. Construction Observations and Testing

It is recommended that we be retained to perform observations and tests during construction. This will allow correlation of the subsurface conditions encountered during construction with those encountered by the borings, and provide continuity of professional responsibility.

F.3. Use of Report

This report is for the exclusive use of Benchmark Engineering, Inc. and their design and construction team. Without written approval, we assume no responsibility to other parties regarding this report. Our evaluation, analyses and recommendations may not be appropriate for other parties or projects.

F.4. Standard of Care

In performing its services, Braun Intertec used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality. No warranty, express or implied, is made.

Appendix

BENCHMARK
ENGINEERING, INC.
8878 Main Street
P.O. Box 261
Mountain Iron, MN 55768
Phone: 218-735-6914
Fax: 218-735-6923
E-Mail: info@bm-eng.com
Website: www.bm-eng.com

SOIL BORING LOCATION MAP

GRAND RAPIDS, MN

SHEET NO.

1 OF 1

BRAUN INTERTEC

LOG OF BORING

Braun Project HB-10-09951
Preliminary Geotechnical Evaluation
Confidential Project
Part of Government Lot 3 - Section 19, T55N, R25W
Grand Rapids, Minnesota

BORING: **SB-1**
LOCATION: See Attached Sketch

DRILLER: J. Uremovich | METHOD: 3 1/4" HSA, Autohammer | DATE: 11/19/10 | SCALE: 1" = 4'

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	P200 %	Tests or Notes
1280.8	0.0						Benchmark: The ground surface elevations at the bore hole locations were provided by Benchmark Engineering, Inc.
1280.5	0.3	TS	TOPSOIL: 4 inches of Silty Sand, mostly fine-grained, with roots and fibers, dark brown, moist. (Topsoil)				
		SP	POORLY GRADED SAND, fine- to medium-grained, with a trace of Gravel, brown, moist to wet, medium dense to loose. (Glacial Outwash)	9		4.6	
				13			
				8			
				1	▽		An open triangle in the water level (WL) column indicates the depth at which groundwater was observed while drilling. Groundwater levels fluctuate.
				12			
				7			
1264.8	16.0		END OF BORING.				
			Water observed at a depth of 10 feet while drilling.				
			Water observed at a depth of 14 feet with 14 1/2 feet of hollow-stem auger in the ground.				
			Water not observed to cave-in depth of 8 1/2 feet immediately after withdrawal of auger.				
			Boring immediately backfilled.				

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 09951.GPJ BRAUN.GDT 11/29/10 09:28

BRAUN INTERTEC

LOG OF BORING

Braun Project HB-10-09951
Preliminary Geotechnical Evaluation
Confidential Project
Part of Government Lot 3 - Section 19, T55N, R25W
Grand Rapids, Minnesota

BORING: **SB-2**

LOCATION: See Attached Sketch

DRILLER: J. Uremovich | METHOD: 3 1/4" HSA, Autohammer | DATE: 11/19/10 | SCALE: 1" = 4'

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
1279.0	0.0					
1278.7	0.3	TS	TOPSOIL: 4 inches of Silty Sand, mostly fine-grained, with roots and fibers, dark brown, moist. (Topsoil)			
		SP	POORLY GRADED SAND, fine- to medium-grained, with a trace of Gravel, brown, moist to wet, loose to medium dense. (Glacial Outwash)	9		
				9		
				9		
				8		
				12	▽	
				17		
1263.0	16.0		END OF BORING.			
			Water observed at a depth of 12 1/2 feet while drilling.			
			Water observed at a depth of 14 feet with 14 1/2 feet of hollow-stem auger in the ground.			
			Water not observed to cave-in depth of 10 feet immediately after withdrawal of auger.			
			Boring immediately backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 09951.GPJ BRAUN.GDT 11/29/10 09:28

BRAUN INTERTEC

LOG OF BORING

Braun Project HB-10-09951
Preliminary Geotechnical Evaluation
Confidential Project
Part of Government Lot 3 - Section 19, T55N, R25W
Grand Rapids, Minnesota

BORING: **SB-3**

LOCATION: See Attached Sketch

DRILLER: J. Uremovich | METHOD: 3 1/4" HSA, Autohammer | DATE: 11/19/10 | SCALE: 1" = 4'

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	P200 %	Tests or Notes
1279.4	0.0						
1279.1	0.3	TS	TOPSOIL: 4 inches of Silty Sand, mostly fine-grained, with roots and fibers, dark brown, moist. (Topsoil)				
		SP	POORLY GRADED SAND, fine- to medium-grained, with a trace of Gravel, brown, moist to wet, very loose to medium dense. (Glacial Outwash)	8			
				10		1.8	
				9			
				4	▽		
				8			
				17			
1263.4	16.0		END OF BORING.				
			Water observed at a depth of 10 feet while drilling.				
			Water observed at a depth of 13 feet with 14 1/2 feet of hollow-stem auger in the ground.				
			Water not observed to cave-in depth of 9 1/2 feet immediately after withdrawal of auger.				
			Boring immediately backfilled.				

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 09951.GPJ BRAUN.GDT 11/29/10 09:28

BRAUN INTERTEC

LOG OF BORING

Braun Project HB-10-09951
Preliminary Geotechnical Evaluation
Confidential Project
Part of Government Lot 3 - Section 19, T55N, R25W
Grand Rapids, Minnesota

BORING: **SB-4**

LOCATION: See Attached Sketch

DRILLER: J. Uremovich | METHOD: 3 1/4" HSA, Autohammer | DATE: 11/19/10 | SCALE: 1" = 4'

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
1278.4	0.0					
1278.1	0.3	TS	TOPSOIL: 4 inches of Silty Sand, mostly fine-grained, with roots and fibers, dark brown, moist. (Topsoil)			
		SP	POORLY GRADED SAND, fine- to medium-grained, with a trace of Gravel, brown, moist to wet, very loose to medium dense. (Glacial Outwash)	5		
				10		
				3	▽	
				7		
				8		
				13		
1262.4	16.0		END OF BORING.			
			Water observed at a depth of 7 1/2 feet while drilling.			
			Water observed at a depth of 14 feet with 14 1/2 feet of hollow-stem auger in the ground.			
			Water not observed to cave-in depth of 8 feet immediately after withdrawal of auger.			
			Boring immediately backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 09951.GPJ BRAUN.GDT 11/29/10 09:28

BRAUN INTERTEC

LOG OF BORING

Braun Project HB-10-09951
Preliminary Geotechnical Evaluation
Confidential Project
Part of Government Lot 3 - Section 19, T55N, R25W
Grand Rapids, Minnesota

BORING: SB-5

LOCATION: See Attached Sketch

DRILLER: J. Uremovich | METHOD: 3 1/4" HSA, Autohammer | DATE: 11/19/10 | SCALE: 1" = 4'

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	P200 %	Tests or Notes
1278.1	0.0						
1277.8	0.3	TS	TOPSOIL: 4 inches of Silty Sand, mostly fine-grained, with roots and fibers, dark brown, moist. (Topsoil)				
		SP-SM	POORLY GRADED SAND with SILT, fine- to medium-grained, with a trace of Gravel, brown, moist to wet, medium dense. (Glacial Outwash)	12		8.9	
				11			
1271.1	7.0	SP	POORLY GRADED SAND, fine- to medium-grained, with a trace of Gravel, brown, wet, loose to very loose. (Glacial Outwash)	7	▽		
				2			
				3			
				2			
1262.1	16.0		END OF BORING.				

Water observed at a depth of 7 1/2 feet while drilling.

Water observed at a depth of 14 feet with 14 1/2 feet of hollow-stem auger in the ground.

Water not observed to cave-in depth of 7 feet immediately after withdrawal of auger.

Boring immediately backfilled.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 09951.GPJ BRAUN.GDT 11/29/10 09:28

BRAUN INTERTEC

LOG OF BORING

Braun Project HB-10-09951
Preliminary Geotechnical Evaluation
Confidential Project
Part of Government Lot 3 - Section 19, T55N, R25W
Grand Rapids, Minnesota

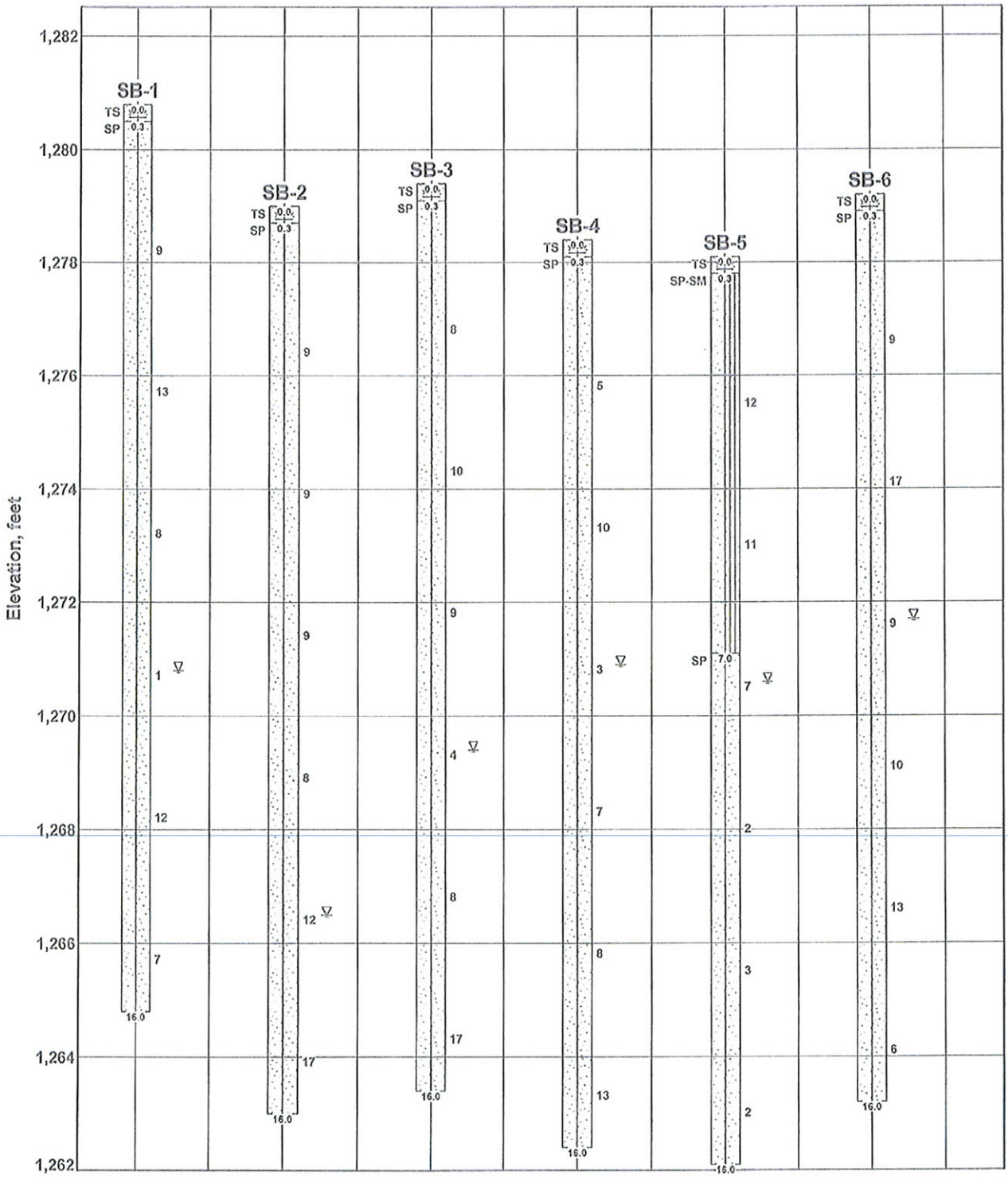
BORING: **SB-6**
LOCATION: See Attached Sketch

DRILLER: J. Uremovich | METHOD: 3 1/4" HSA, Autohammer | DATE: 11/19/10 | SCALE: 1" = 4'

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
1279.2	0.0					
1278.9	0.3	TS	TOPSOIL: 4 inches of Silty Sand, mostly fine-grained, with roots and fibers, dark brown, moist. (Topsoil)			
		SP	POORLY GRADED SAND, fine- to medium-grained, with a trace of Gravel, brown, moist to wet, loose to medium dense. (Glacial Outwash)	9		
				17		
				9	▽	
				10		
				13		
1263.2	16.0			6		
			END OF BORING.			
			Water observed at a depth of 7 1/2 feet while drilling.			
			Water observed at a depth of 14 feet with 14 1/2 feet of hollow-stem auger in the ground.			
			Water not observed to cave-in depth of 6 1/2 feet immediately after withdrawal of auger.			
			Boring immediately backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 09951.GPJ BRAUN.GDT 11/29/10 09:28



Fence Diagram

(Horizontal distance not to scale)

Braun Project HB-10-09951
Preliminary Geotechnical Evaluation
Confidential Project
Part of Government Lot 3 - Section 19, T55N, R25W
Grand Rapids, Minnesota

BRAUN INTERTEC

ELEVATION SCALE 09951.GPJ BRAUN_08.GDT 11/29/10 13:31

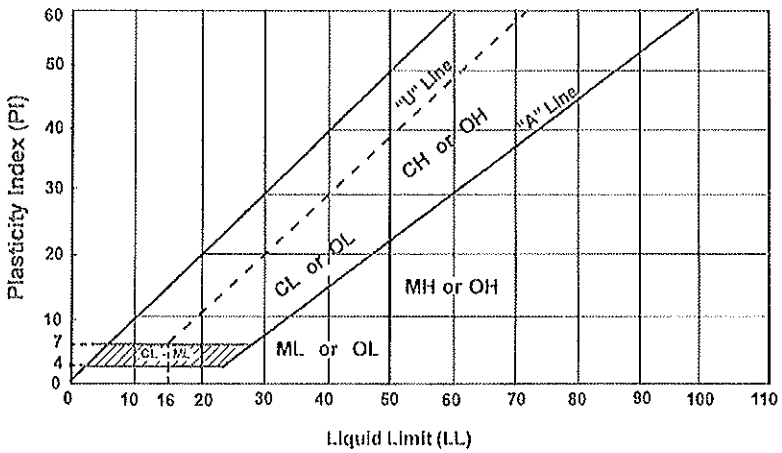
BRAUN INTERTEC

Descriptive Terminology of Soil

Standard D 2487 - 00
Classification of Soils for Engineering Purposes
(Unified Soil Classification System)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [a]				Soils Classification	
				Group Symbol	Group Name [b]
Coarse-grained Soils more than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels 5% or less fines [c]	$C_u \geq 4$ and $1 \leq C_c \leq 3$ [c]	GW	Well-graded gravel [d]
			$C_u < 4$ and/or $1 > C_c > 3$ [c]	GP	Poorly graded gravel [d]
		Gravels with Fines More than 12% fines [e]	Fines classify as ML or MH	GM	Silty gravel [d f g]
			Fines classify as CL or CH	GC	Clayey gravel [d f g]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands 5% or less fines [i]	$C_u \geq 6$ and $1 \leq C_c \leq 3$ [c]	SW	Well-graded sand [h]
			$C_u < 6$ and/or $1 > C_c > 3$ [c]	SP	Poorly graded sand [h]
		Sands with Fines More than 12% [f]	Fines classify as ML or MH	SM	Silty sand [f g h]
			Fines classify as CL or CH	SC	Clayey sand [f g h]
Fine-grained Soils 50% or more passed the No. 200 sieve	Silts and Clays Liquid limit less than 50	Inorganic	PI > 7 and plots on or above "A" line [j]	CL	Lean clay [k l m]
			PI < 4 or plots below "A" line [j]	ML	Silt [k l m]
		Organic	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OL	Organic clay [k l m n]
				OL	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	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OH	Organic clay [k l m p]
				OH	Organic silt [k l m q]
Highly Organic Soils		Primarily organic matter, dark in color and organic odor		PT	Peat

a. Based on the material passing the 3-in (75mm) sieve
b. If field sample contained cobbles or boulders, or both, add "with cobbles or boulders or both" to group name.
c. $C_u = D_{60}/D_{10}$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
d. If soil contains ≥15% sand, add "with sand" to group name.
e. 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
f. If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
g. If fines are organic, add "with organic fines" to group name.
h. If soil contains ≥ 15% gravel, add "with gravel" to group name.
i. 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
j. If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay
k. If soil contains 10 to 29% plus No. 200, add "with sand" or "with gravel" whichever is predominant
l. If soil contains ≥ 30% plus No. 200, predominantly sand, add "sandy" to group name.
m. If soil contains ≥ 30% plus No. 200 predominantly gravel, add "gravelly" to group name.
n. PI ≥ 4 and plots on or above "A" line.
o. PI < 4 or plots below "A" line
p. PI plots on or above "A" line.
q. PI plots below "A" line



Laboratory Tests

DD	Dry density, pcf	OC	Organic content, %
WD	Wet density, pcf	S	Percent of saturation, %
MC	Natural moisture content, %	SG	Specific gravity
LL	Liquid limit, %	C	Cohesion, psf
PL	Plastic limit, %	∅	Angle of internal friction
PI	Plasticity index, %	qu	Unconfined compressive strength, psf
P200	% passing 200 sieve	qp	Pocket penetrometer strength, tsf

Particle Size Identification

Boulders	over 12"
Cobbles	3" to 12"
Gravel	
Coarse	3/4" to 3"
Fine	No. 4 to 3/4"
Sand	
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Silt	< No. 200, PI < 4 or below "A" line
Clay	< No. 200, PI ≥ 4 and on or above "A" line

Relative Density of Cohesionless Soils

Very loose	0 to 4 BPF
Loose	5 to 10 BPF
Medium dense	11 to 30 BPF
Dense	31 to 50 BPF
Very dense	over 50 BPF

Consistency of Cohesive Soils

Very soft	0 to 1 BPF
Soft	2 to 3 BPF
Rather soft	4 to 5 BPF
Medium	6 to 8 BPF
Rather stiff	9 to 12 BPF
Stiff	13 to 16 BPF
Very stiff	17 to 30 BPF
Hard	over 30 BPF

Drilling Notes

Standard penetration test borings were advanced by 3 1/4" or 6 1/4" ID hollow-stem augers unless noted otherwise, Jetting water was used to clean out auger prior to sampling only where indicated on logs. Standard penetration test borings are designated by the prefix "ST" (Split Tube). All samples were taken with the standard 2" OD split-tube sampler, except where noted.

Power auger borings were advanced by 4" or 6" diameter continuous-flight, solid-stem augers. Soil classifications and strata depths were inferred from disturbed samples augered to the surface and are, therefore, somewhat approximate. Power auger borings are designated by the prefix "B."

Hand auger borings were advanced manually with a 1 1/2" or 3 1/4" diameter auger and were limited to the depth from which the auger could be manually withdrawn. Hand auger borings are indicated by the prefix "H."

BPF: Numbers indicate blows per foot recorded in standard penetration test, also known as "N" value. The sampler was set 6" into undisturbed soil below the hollow-stem auger. Driving resistances were then counted for second and third 6" increments and added to get BPF. Where they differed significantly, they are reported in the following form: 2/12 for the second and third 6" increments, respectively.

WH: WH indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

WR: WR indicates the sampler penetrated soil under weight of rods alone; hammer weight and driving not required.

TW indicates thin-walled (undisturbed) tube sample.

Note: All tests were run in general accordance with applicable ASTM standards.