GEOTEK ENGINEERING
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Sioux Falls, South Dakota 57104
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January 3, 2017

Codington County
14 1st Avenue SE
Watertown, South Dakota 57201

Attn: Lee Gabel

Subj: Preliminary Geotechnical Exploration
Proposed Justice Facility
Codington County
1st Avenue SW
Watertown, South Dakota
GeoTek #16-E55

Introduction

This correspondence presents our reporting of the preliminary geotechnical exploration program for the referenced project. Our work was performed in accordance with your authorization.

Project Location & Description

The project site is located southwest of the intersection of 1st Avenue SW and S. Broadway Street in Watertown, South Dakota. Currently, the site is an asphalt surfaced parking lot. A grade change of approximately 6 feet occurs across the site. The site slopes downward from the northeast to the southwest.

Test Borings

We performed six (6) test borings at the site on December 20 and December 21, 2016. A test boring location map is attached showing the relative location of the test borings. The ground surface elevations at the test boring locations were determined by using the top of the fire hydrant located southwest of the intersection of 1st Avenue SW and S. Broadway Street as a benchmark. An arbitrary elevation of 100.0 feet was used for the benchmark. A test boring location map, showing the relative location of the test borings, is attached at the conclusion of this report.

Subsurface Conditions

The subsurface conditions encountered at the test boring locations consisted of 4 ½ feet to 7 feet of existing fill materials overlying coarse alluvium soils. The coarse alluvium soils extended to the termination depth of the test borings.

The existing fill materials consisted of clay soils and sand soils. The coarse alluvium soils consisted of sand soils.

The consistency or relative density of the soils is indicated by the standard penetration resistance ("N") values as shown on the boring logs. A description of the soil consistency or relative density based on the "N" values can be found on the attached Soil Boring Symbols and Descriptive Terminology data sheet.

Groundwater Levels

Measurements to record the groundwater levels were made at the test boring locations. The time and level of the groundwater readings are recorded on the boring logs. Groundwater was measured at depths varying from 18 feet and 19 feet. Groundwater did not enter the borehole at test boring 2 at the time of our measurements.

Laboratory Testing

Select samples from the test borings were submitted to the laboratory for testing. The tests consisted of moisture content, dry density and sieve analysis (fine content only). The results of the laboratory tests are shown on the boring logs adjacent to the samples upon which the tests were performed.

Project Information

We understand that a new justice facility may be constructed at the site. The proposed justice facility will consist of a building and pavement areas. No loading information is available and no grading plans have been developed. We understand that two (2) buildings once occupied the site. We understand that both previously demolished buildings had basements.

Discussion

The test borings encountered 4 ½ feet to 7 feet of existing fill materials overlying coarse alluvium soils. It is our opinion that the existing fill materials are not suitable for support of the footings of the proposed building. Regarding the floor slab, it is our opinion that the existing fill materials could be suitable for indirect support of the floor slab.

In the footing areas of the building, the site preparation would likely consist of removing the asphalt, existing fill materials and any remnants from the previous buildings in order to expose the coarse alluvium soils. If the excavation required to expose the coarse alluvium soils extends below the bottom-of-footing elevation, then granular structural fill would need to be placed and compacted up to the bottom-of-footing elevation. In our opinion, a net allowable soil bearing capacity of up to 4,000 pounds per square foot (psf) could be expected for the coarse alluvium soils.

If light floor loads are expected, then the existing fill materials could be used for indirect support. For this option, the site preparation in the floor slab areas would likely consist of removing the pavement section and any remnants from the previous buildings. Following the removals, we will likely recommend excavating to a minimum depth of 2 feet below the bottom-of-floor elevation. We would then recommend performing observations and testing on the exposed subgrade. Granular structural fill materials would need to be placed and compacted up to the bottom-of-floor elevation.

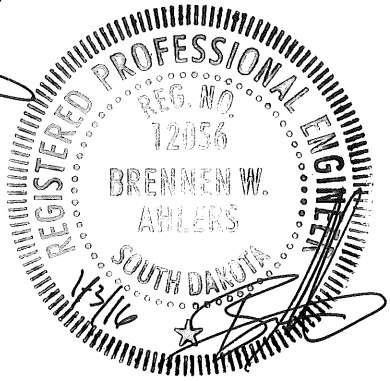
If heavy floor slab loads are expected or performance of the floor slab is critical, then the site preparation would be similar to the site preparation discussed for the footings (removal of the existing fill materials).

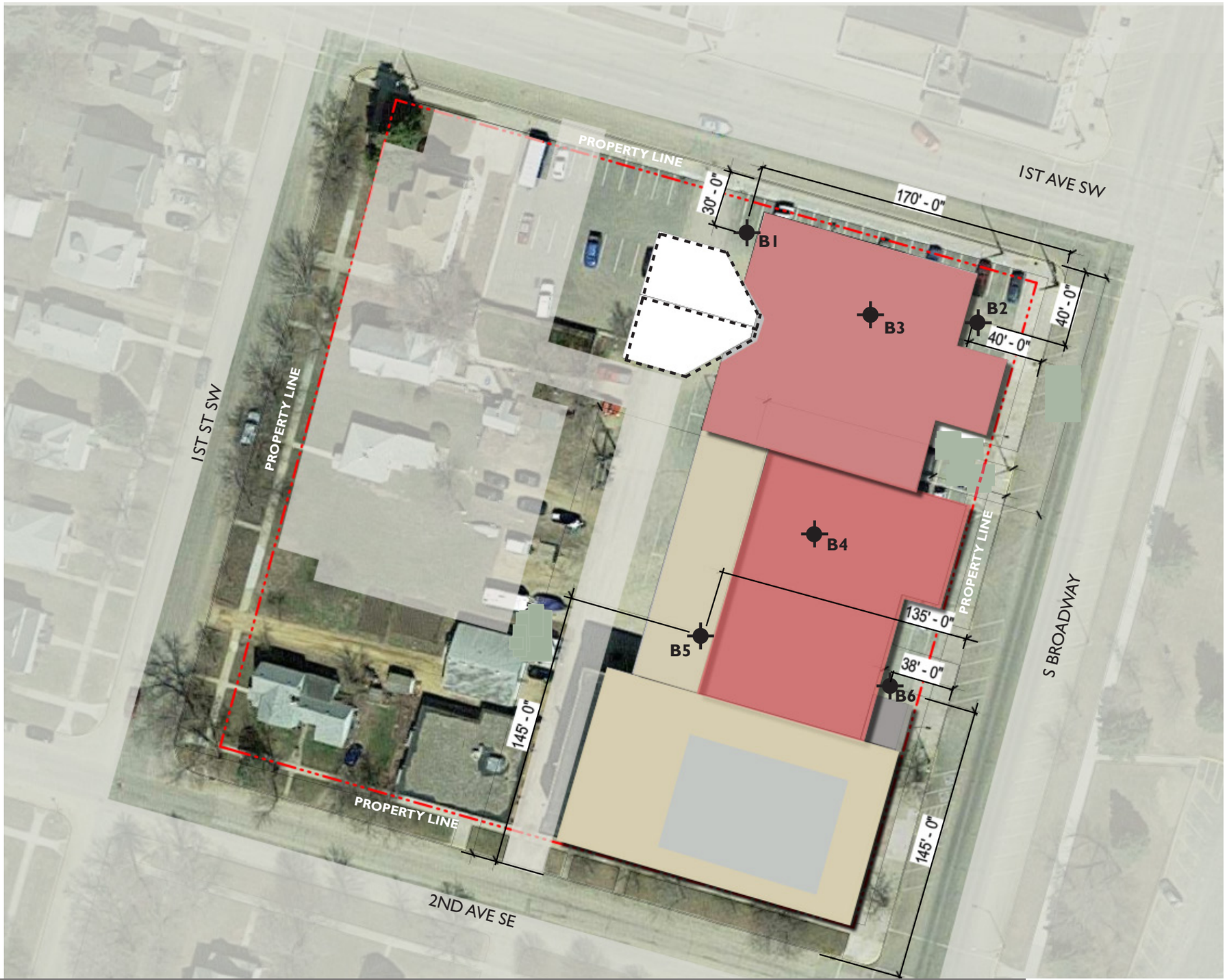
Remarks

As specific plans are developed, we recommend that additional test borings and laboratory tests be performed for each lot. We trust this report provides you with the necessary information for the project. If you have any questions or require additional information, please contact our office.

GeoTek Engineering & Testing Services, Inc.

Brennen Ahlers, PE
Project Manager





Codington County Justice Facilities Study

SOIL BORING LOCATIONS

November 22, 2016 Project #: 2117.01

SCALE: 1" = 50'-0"

Codington County South Dakota

BKV GROUP

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **16-E55** BORING NO. **1 (1 of 1)**

PROJECT **Preliminary Geotechnical Exploration, Proposed Codington County Justice Facility, Near 1st Avenue SW & S. Broadway Street, Watertov**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 93.1 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	FILL, MOSTLY CLAY: a little gravel, dark brown, frozen to 2' then moist, 5" of asphalt and 4" of gravel at the surface	FILL			1	HSA					
			5		2	SPT	12				
4½	**SAND**: with gravel, fine to coarse grained, brown, moist to waterbearing, medium dense to very dense, (SP)	COARSE ALLUVIUM	28		3	SPT					
					9	BAG					
			48		4	SPT					
			40		5	SPT					
			35		6	SPT					
			31		7	SPT					
				▼							
			13		8	SPT					
21	Bottom of borehole at 21 feet.										

WATER LEVEL MEASUREMENTS

START 12-20-16 COMPLETE 12-20-16 10:11 am

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
12-20-16	10:11 am	21	--	18	▼ 18
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--

METHOD
3.25" ID Hollow Stem Auger

CREW CHIEF Mike Wagner

GEOTECHNICAL TEST BORING 16-E55.GPJ GEOTEKENG.GDT 1/3/17

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **16-E55** BORING NO. **2 (1 of 1)**

PROJECT **Preliminary Geotechnical Exploration, Proposed Codington County Justice Facility, Near 1st Avenue SW & S. Broadway Street, Watertov**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 96.1 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	FILL, MOSTLY CLAY: a little gravel, dark brown, frozen to 2' then moist, 6" of asphalt and 4" of gravel at the surface	FILL			1	HSA					
			15		2	SPT	17	106			
			4		3	SPT	17	112			
6	**SAND**: a little gravel, fine to coarse grained, brown, moist, very dense, (SP)	COARSE ALLUVIUM									
			37		4	SPT					
			46		5	SPT					
			40		6	SPT					
			30		7	SPT					
			31		8	SPT					
21	Bottom of borehole at 21 feet.										

WATER LEVEL MEASUREMENTS

START 12-20-16 COMPLETE 12-20-16 11:38 am

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
12-20-16	11:38 am	21	--	19	none
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--

METHOD
3.25" ID Hollow Stem Auger

CREW CHIEF Mike Wagner

GEOTECHNICAL TEST BORING 16-E55.GPJ GEOTEKENG.GDT 1/3/17

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **16-E55** BORING NO. **3 (1 of 1)**

PROJECT **Preliminary Geotechnical Exploration, Proposed Codington County Justice Facility, Near 1st Avenue SW & S. Broadway Street, Watertov**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 90.0 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	FILL, MOSTLY CLAY: a little gravel, dark brown, frozen to 2' then moist, 5" of asphalt and 4" of gravel at the surface	FILL			1	HSA					
			5		2	SPT	28				
			8		3	SPT					
6	**SAND**: with gravel, fine to coarse grained, brown, moist to waterbearing, dense to very dense, (SP)	COARSE ALLUVIUM									
			41		4	SPT					
			52		5	SPT					
			39		6	SPT					
			27		7	SPT					
				▼							
			20		8	SPT					
21	Bottom of borehole at 21 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
12-20-16	1:04 pm	21	--	19	▼ 19
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START 12-20-16 COMPLETE 12-20-16 1:04 pm

METHOD
3.25" ID Hollow Stem Auger

CREW CHIEF Mike Wagner

GEOTECHNICAL TEST BORING 16-E55.GPJ GEOTEKENG.GDT 1/3/17

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **16-E55** BORING NO. **4 (1 of 1)**

PROJECT **Preliminary Geotechnical Exploration, Proposed Codington County Justice Facility, Near 1st Avenue SW & S. Broadway Street, Watertov**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 91.5 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	FILL, MOSTLY CLAY: a little gravel, dark brown, frozen to 2' then moist, 4" of asphalt and 4" of gravel at the surface	FILL			1	HSA					
			7		2	SPT	15	118			
5½	**SAND**: a little gravel, fine to coarse grained, brown, moist to waterbearing, medium dense to very dense, (SP)	COARSE ALLUVIUM	26		3	SPT	18	109			
			46		4	SPT					
			51		5	SPT					
			47		6	SPT					
			31		7	SPT					
				▼							
			15		8	SPT					
21	Bottom of borehole at 0 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
12-20-16	3:01 pm	21	--	18	▼ 18
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--	--	--	--	--	--

START 12-20-16 COMPLETE

METHOD
3.25" ID Hollow Stem Auger

CREW CHIEF Mike Wagner

GEOTECHNICAL TEST BORING 16-E55.GPJ GEOTEKENG.GDT 1/3/17

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **16-E55** BORING NO. **5 (1 of 1)**

PROJECT **Preliminary Geotechnical Exploration, Proposed Codington County Justice Facility, Near 1st Avenue SW & S. Broadway Street, Watertov**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 94.1 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	FILL, MOSTLY CLAY: a little clay, fine to medium grained, brown, frozen to 2' then moist, 3" of asphalt and 4" of gravel at the surface	FILL			1	HSA					
			7		2	SPT	15	115			
4½	**SAND**: a little gravel, fine to coarse grained, brown, moist to waterbearing, medium dense to very dense, (SP)	COARSE ALLUVIUM	45		3	SPT					
			44		4	SPT					
			46		5	SPT					
			34		6	SPT					
			23		7	SPT					
				▼							
			17		8	SPT					
21	Bottom of borehole at 21 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
12-21-16	9:06 am	21	--	19	▼ 19
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START 12-21-16 COMPLETE 12-21-16 9:06 am

METHOD
3.25" ID Hollow Stem Auger

CREW CHIEF Mike Wagner

GEOTECHNICAL TEST BORING 16-E55.GPJ GEOTEKENG.GDT 1/3/17

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GEOTECHNICAL TEST BORING LOG

GEOTEK # **16-E55** BORING NO. **6 (1 of 1)**

PROJECT **Preliminary Geotechnical Exploration, Proposed Codington County Justice Facility, Near 1st Avenue SW & S. Broadway Street, Watertov**

DEPTH in FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION 92.6 ft)	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS WC	D	LL	PL	QU
	FILL, MIXTURE OF SAND AND CLAY: a trace of gravel, brown, frozen to 2' then moist, 4" of asphalt and 4" of gravel at the surface, 50% passing the #200 sieve from 2' to 3 1/2'	FILL			1	HSA					
			22		2	SPT	4				
			20		3	SPT					
7	**SAND**: a little gravel, medium grained, brown, moist to waterbearing, dense to very dense, (SP)	COARSE ALLUVIUM	57		4	SPT					
			48		5	SPT					
			45		6	SPT					
			44		7	SPT					
				▼							
			17		8	SPT					
21	Bottom of borehole at 21 feet.										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL
12-20-16	4:45 pm	21	--	19	▼ 19
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--

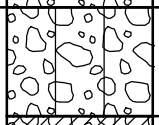
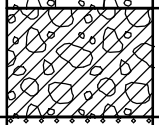
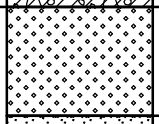
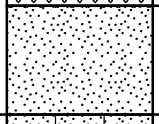
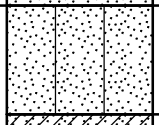
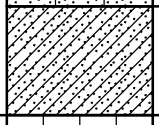
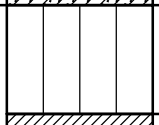
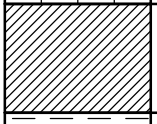
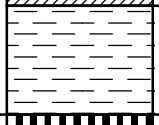
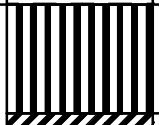
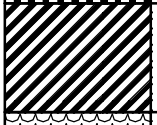
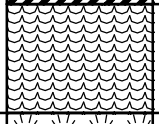
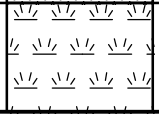
START 12-20-16 COMPLETE 12-20-16 4:42 pm

METHOD
3.25" ID Hollow Stem Auger

CREW CHIEF Mike Wagner

GEOTECHNICAL TEST BORING 16-E55.GPJ GEOTEKENG.GDT 1/3/17

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	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
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	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 OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF 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
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

BORING LOG SYMBOLS AND DESCRIPTIVE TERMINOLOGY

SYMBOLS FOR DRILLING AND SAMPLING

Symbol	Definition
Bag	Bag sample
CS	Continuous split-spoon sampling
DM	Drilling mud
FA	Flight auger; number indicates outside diameter in inches
HA	Hand auger; number indicates outside diameter in inches
HSA	Hollow stem auger; number indicates inside diameter in inches
LS	Liner sample; number indicates outside diameter of liner sample
N	Standard penetration resistance (N-value) in blows per foot
NMR	No water level measurement recorded, primarily due to presence of drilling fluid
NSR	No sample retrieved; classification is based on action of drilling equipment and/or material noted in drilling fluid or on sampling bit
SH	Shelby tube sample; 3-inch outside diameter
SPT	Standard penetration test (N-value) using standard split-spoon sampler
SS	Split-spoon sample; 2-inch outside diameter unless otherwise noted
WL	Water level directly measured in boring
▼	Water level symbol

SYMBOLS FOR LABORATORY TESTS

Symbol	Definition
WC	Water content, percent of dry weight; ASTM:D2216
D	Dry density, pounds per cubic foot
LL	Liquid limit; ASTM:D4318
PL	Plastic limit; ASTM:D4318
QU	Unconfined compressive strength, pounds per square foot; ASTM:D2166

DENSITY/CONSISTENCY TERMINOLOGY

Density		Consistency
Term	N-Value	Term
Very Loose	0-4	Soft
Loose	5-8	Firm
Medium Dense	9-15	Stiff
Dense	16-30	Very Stiff
Very Dense	Over 30	Hard

PARTICLE SIZES

Term	Particle Size
Boulder	Over 12”
Cobble	3” – 12”
Gravel	#4 – 3”
Coarse Sand	#10 – #4
Medium Sand	#40 – #10
Fine Sand	#200 – #40
Silt and Clay	passes #200 sieve

DESCRIPTIVE TERMINOLOGY

Term	Definition
Dry	Absence of moisture, powdery
Frozen	Frozen soil
Moist	Damp, below saturation
Waterbearing	Pervious soil below water
Wet	Saturated, above liquid limit
Lamination	Up to ½” thick stratum
Layer	½” to 6” thick stratum
Lens	½” to 6” discontinuous stratum

GRAVEL PERCENTAGES

Term	Range
A trace of gravel	2-4%
A little gravel	5-15%
With gravel	16-50%