

Geotechnical Engineering Report

Prairie View High School Track

13731 KS Hwy 152

LaCygne, Kansas

August 17, 2011

Project No. 02115118

Prepared for:

Prairie View School #362

La Cygne, Kansas

Prepared by:

Terracon Consultants, Inc.

Lenexa, Kansas

Offices Nationwide
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August 17, 2011

Prairie View Schools #362
13731 Kansas Highway 152
LaCygne, KS 66044

Attn: Mr. Bobby Johnson

RE: Geotechnical Engineering Report
Prairie Valley High School Track
13731 KS Hwy 152
LaCygne, KS
Project No. 02115118

Dear Mr. Johnson:

Terracon Consultants, Inc. (Terracon) has completed the Geotechnical Engineering Services for the Prairie View High School Track project. This study was performed in general accordance with our Agreement for Services dated June 7, 2011. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and development of track subgrades.

We appreciate the opportunity to work with you on this project and are prepared to provide the recommended construction testing services. If you have any questions regarding this report, please contact us.

Sincerely,
Terracon Consultants, Inc.

Brett W. Larsen, P.E.
Project Manager

John A. Thomas, Jr., P.E.
Geotechnical Services Manager
KS: 20694



Enclosures
copy: 2 – Above
1 – File



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GEOTECHNICAL ENGINEERING REPORT

PRAIRIE VIEW HIGH SCHOOL TRACK

13731 KS Highway 152

LACYGNE, KANSAS

Project No. 02115118

August 17, 2011

1.0 INTRODUCTION

A geotechnical exploration has been performed for the proposed replacement of the existing track at Prairie View High School located at 13731 KS Highway 152 in LaCygne, KS. Terracon performed six (6) borings to depths ranging from approximately 5 to 10 feet below the existing ground surface. A boring location diagram and logs of the borings with laboratory data are included in Appendix A of this report.

The purpose of this report is to describe the subsurface conditions, present the test data and provide recommendations to develop subgrade support for proposed track replacement planned in the future.

2.0 PROJECT INFORMATION

2.1 Site Location

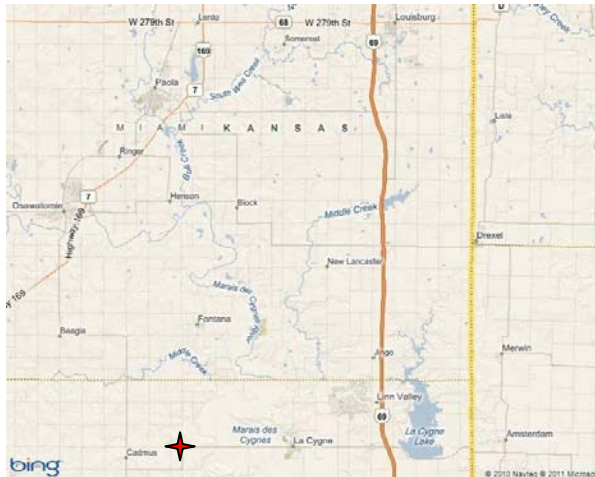


Figure 1. Site Location



Figure 2. Aerial of Project Location

ITEM	DESCRIPTION
Location	13731 Kansas Highway 152 in LaCygne, KS.
Existing improvements	Currently the site is developed with an existing asphalt paved running track, which was originally constructed in 1994. There are signs of distress in the track.

2.2 Project Description

ITEM	DESCRIPTION
New track	The new track will be constructed in a similar alignment of the existing track.
Expected site grading	Proposed grades will closely match existing grades. Cuts and fills required to develop proposed site grading will not exceed one foot.
Pavements	The existing track pavements will be removed, the subgrades will be prepared, and the track surface will be constructed.

3.0 SUBSURFACE CONDITIONS

3.1 Typical Profile

Based on the results of the borings, subsurface conditions on the project site can be generalized as follows:

Stratum	Material Encountered	Borings	Approximate Depth to Bottom of Stratum (feet)	Comments
1	Track Surface/ Asphalt/ Gravel ¹	All locations	0.3 to 0.7	Generally consisting of ½-inch rubber track surface, over approximately 4 inches of asphalt
2	Lean and Fat Clay	All locations	1.5 to 7	Lean and Fat Clay, generally stiff to very stiff
3	Limestone	All locations	Not encountered ²	Limestone, broken to moderately weathered, gray

1. At Borings B-1, B-2, B-3, and B-4 the asphalt was underlain by approximately 2 to 3 inches of gravel.
2. Borings B-1 through B-6 were terminated in limestone upon auger refusal.

Conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual.

3.2 Water Level Observation

The boreholes were observed while drilling and after completion for the presence and level of water. Water not observed in the borings during or after the completion of drilling. Due to the low permeability of the soils encountered in the borings, a relatively long period of time may be necessary for a groundwater level to develop and stabilize in a borehole in these materials. Long term observations in piezometers or observation wells sealed from the influence of surface water are often required to define groundwater levels in materials of this type.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater may be higher or lower than the levels indicated on the boring logs at other times.

4.0 GEOTECHNICAL CONSIDERATIONS

We recommend that the exposed subgrade be thoroughly evaluated after the existing track has been removed and cut areas have been graded, but prior to the start of fill operations. We recommend that the geotechnical engineer be retained to evaluate the subgrades.

5.0 TRACK SUBGRADE RECOMMENDATIONS

Site preparation should commence with removal of existing track materials. Based on our boring information we anticipate the soils exposed following the removal of the existing track materials will be very stiff to hard lean and fat clay soils. Prior to placing any new fill, deleterious materials and unsuitable material, where encountered, should be removed from the construction areas. Wet or dry material should be removed if it cannot be moisture conditioned and compacted in place. Then the subgrade should be proof-rolled where possible to aid in locating loose or soft areas. Proof-rolling can be performed with a loaded, tandem-axle dump truck, or similar equipment with a gross weight of 20 tons. Soft, dry and low-density soil should be removed or compacted in place prior to placing fill. As a minimum, we recommend that the exposed subgrade be scarified to a depth of 9 inches, moisture conditioned to at or above the optimum water content and recompacted to at least 95% of the standard Proctor maximum dry density.

Compacted engineered fill should meet the following material property requirements:

Fill Type ¹	USCS Classification	Acceptable Location for Placement
Well graded granular	GM ²	All locations and elevations
On-site soils	CL, CH	The on-site soil appears suitable for use as fill, provided they are free of deleterious materials.

1. Compacted engineered fill should consist of approved materials that are free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Terracon for evaluation.
2. Similar to KDOT AB-3 crushed limestone aggregate or crushed stone containing at least 18% low plasticity fines may also be used. Material should be approved by the geotechnical engineer.

Terracon has not been provided performance specifications or drawings of the proposed track surface. We recommend that Terracon be provided copies of project related drawings and specifications for our review prior to construction. If the track surface manufacturer/installer's specifications explicitly require additional subgrade improvement, chemical treatment with 5% lime or 15% class C fly-ash could be considered. Alternatively, existing clays could be undercut

at least 9 inches and replaced with low plasticity lean clay or crushed limestone base similar to KDOT AB3. If additional recommendations are required, Terracon should be contacted.

6.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A

FIELD EXPLORATION

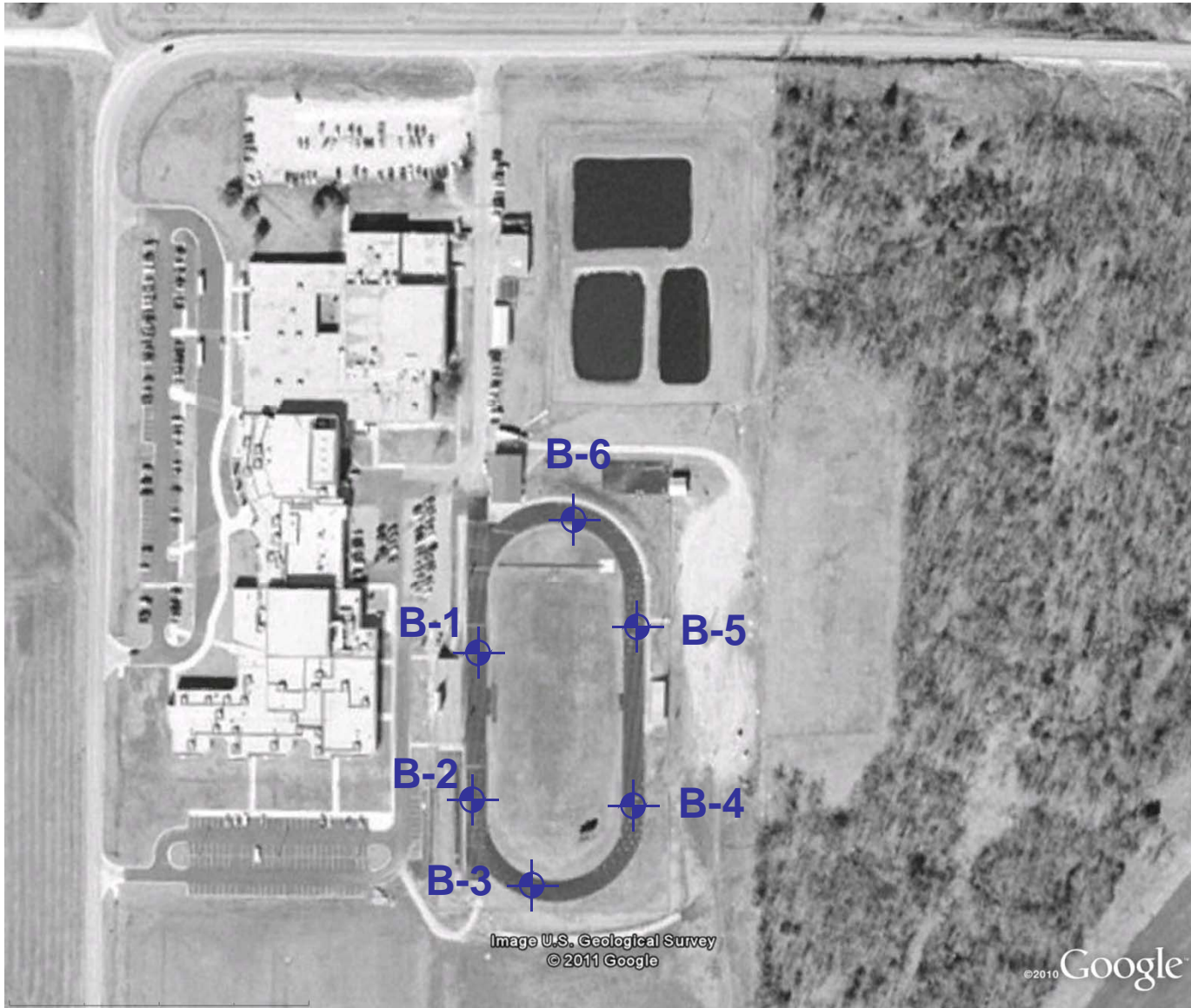


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager:	BWL	Project No.	02115118
Drawn by:	BWL	Scale:	N.T.S.
Checked by:	BWL	File Name:	Boring Location (11x8.5).ppt
Approved by:	BWL	Date:	8/10/2011

Terracon
Consulting Engineers & Scientists

13910 West 96th Terrace Lenexa, Kansas 66215
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BORING LOCATION DIAGRAM
PRAIRIE VIEW HIGH SCHOOL TRACK 13731 KS Hwy 152 LACYGNE, KANSAS

Exhibit
A-1

LOG OF BORING NO. B-3

OWNER
Prairie View School District

SITE
**13731 KS Hwy 152
La Cygne, KS**

PROJECT
Prairie View High School Track

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	SAMPLES				TESTS				
			USCS SYMBOL	NUMBER	TYPE	RECOVERY, in	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf	Atterberg Limits LL, PL, PI
	Approx. Surface Elev.: 925 ft										
0.7	0.5" RUBBER TRACK SURFACE 4" ASPHALT 2" GRAVEL	924.5			PA						
1	FAT CLAY, shaley, with limestone fragments, stiff to very stiff, brown		CH	1	ST	14		25		7000*	
					PA						
			CH	2	ST	12		28	90	3607	51, 24, 27
					PA						
		5			PA						
			CH	3	ST	10		32	89	3275	
					PA						
	- with broken limestone		CH	4	ST	11		33	82	3298	
9		916			PA						
10	***LIMESTONE, broken, gray - moderately weathered below 7.5'	915			PA						
	BOTTOM OF BORING AUGER REFUSAL at 10' ***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.	10									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual. *Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ NONE	WD	▽
WL	▽		▽
EXHIBIT A-4			



BORING STARTED		7-27-11	
BORING COMPLETED		7-27-11	
RIG	CME 55	FOREMAN	KK
APPROVED	BWL	JOB #	02115118

BOREHOLE 02115118.GPJ TERRACON.GDT 8/17/11

LOG OF BORING NO. B-4

OWNER Prairie View School District											
SITE 13731 KS Hwy 152 La Cygne, KS		PROJECT Prairie View High School Track									
GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	NUMBER	TYPE	RECOVERY, in	SAMPLES			TESTS	
							SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf	Atterberg Limits LL, PL, PI
	Approx. Surface Elev.: 925 ft										
0.7	924.5				PA						
0.7	924.5			1	ST	15		30	86	3855*	82, 30, 52
	5			2	ST	19		37	78	2170	
	5.8				PA						
	8										
	8										

0.5" RUBBER TRACK SURFACE
 4.5" ASPHALT
 3" GRAVEL
 FAT CLAY, shaley, with limestone fragments, stiff, brown

***LIMESTONE, severely weathered, gray

- moderately weathered below 7.5'

BOTTOM OF BORING
 AUGER REFUSAL at 8'

***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
 **CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft

WL	∇ NONE	WD	∇
WL	∇		∇

EXHIBIT A-5



BORING STARTED		7-27-11	
BORING COMPLETED		7-27-11	
RIG	CME 55	FOREMAN	KK
APPROVED	BWL	JOB #	02115118

BOREHOLE 02115118.GPJ TERRACON.GDT 8/17/11

LOG OF BORING NO. B-5

OWNER **Prairie View School District**

SITE **13731 KS Hwy 152
La Cygne, KS** PROJECT **Prairie View High School Track**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	SAMPLES				TESTS				
			USCS SYMBOL	NUMBER	TYPE	RECOVERY, in	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf	Atterberg Limits LL, PL, PI
	Approx. Surface Elev.: 925 ft										
0.4	<u>0.5" RUBBER TRACK SURFACE</u> <u>3" ASPHALT</u> <u>FAT CLAY</u> , with limestone fragments, very stiff, brown	924.5			PA						
7	<u>***LIMESTONE</u> , severely weathered, gray - moderately weathered below 7.5'	918			PA						
8.5	BOTTOM OF BORING AUGER REFUSAL at 8.5' ***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.	916.5									
5			CH	1	ST	17		24	96	6005	50, 24, 26
3			CH	2	ST	17		28	94	5105	
3				3	SS	12	50/5"	7			

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual. *Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	∇ NONE	WD	∇
WL	∇		∇
EXHIBIT A-6			



BORING STARTED		7-27-11	
BORING COMPLETED		7-27-11	
RIG	CME 55	FOREMAN	KK
APPROVED	BWL	JOB #	02115118

BOREHOLE 02115118.GPJ TERRACON.GDT 8/17/11

LOG OF BORING NO. B-6

OWNER **Prairie View School District**

SITE **13731 KS Hwy 152
La Cygne, KS** PROJECT **Prairie View High School Track**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	SAMPLES				TESTS				
			USCS SYMBOL	NUMBER	TYPE	RECOVERY, in	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf	Atterberg Limits LL, PL, PI
	Approx. Surface Elev.: 925 ft										
0.4	<u>0.5" RUBBER TRACK SURFACE</u> <u>3" ASPHALT</u> <u>FAT CLAY</u> , stiff, brown	924.5			PA						
1			CH	1	ST	9		24	92	2446	
	- with broken rock below 3'										
2			CH	2	ST	12		28	91	3718	64, 26, 38
5					PA						
5.8	<u>***LIMESTONE</u> , moderately weathered, gray	919									
7.5	<u>BOTTOM OF BORING</u> <u>AUGER REFUSAL at 7.5'</u> ***Classification estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.	917.5									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual. *Calibrated Hand Penetrometer
**CME 140H SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	∇ NONE	WD	∇
WL	∇		∇
EXHIBIT A-7			



BORING STARTED		7-27-11	
BORING COMPLETED		7-27-11	
RIG	CME 55	FOREMAN	KK
APPROVED	BWL	JOB #	02115118

BOREHOLE 02115118.GPJ TERRACON.GDT 8/17/11

Field Exploration Description

Terracon personnel located the borings at locations determinate by the client. Ground surface elevations indicated on the boring logs are rounded to the nearest ½ foot and were obtained by the drill crew using a surveyor's level and rod. The boring elevations were referenced to the inlet located approximately 10 feet west of Boring B-1. The elevation marked on the inlet was 924.27 feet. The locations and elevations of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

The borings were drilled with a truck-mounted rotary drill rig using continuous flight hollow-stem augers to advance the boreholes. Samples of the soil encountered in the borings were obtained using the split barrel sampling procedures. In the thin-walled tube sampling procedure, a 2-inch diameter, thin-walled, seamless steel tube with a sharp cutting edge is pushed hydraulically into the soil to obtain a relatively undisturbed sample.

The samples were tagged for identification, sealed to reduce moisture loss, and taken to our laboratory for further examination, testing, and classification. Information provided on the boring logs attached to this report includes soil descriptions, consistency evaluations, boring depths, sampling intervals, and groundwater conditions. The borings were backfilled with auger cuttings prior to the drill crew leaving the site. A field log of each boring was prepared by the drill crew. These logs included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples.

APPENDIX B

LABORATORY TESTING

Laboratory Testing

Generally, soil samples were tested in the laboratory to measure their natural water content and dry unit weight. Unconfined compressive strength tests were also performed on some samples. A hand penetrometer was also used to estimate the unconfined compressive strength of some samples. The test results are provided on the boring logs included in Appendix A.

Descriptive classifications of the soils indicated on the boring logs are in accordance with the enclosed General Notes and the Unified Soil Classification System. Also shown are estimated Unified Soil Classification Symbols. A brief description of this classification system is attached to this report. All classification was by visual manual procedures.

APPENDIX C
SUPPORTING DOCUMENTS

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1- ³ / ₈ " I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube – 2" O.D., 3" O.D., unless otherwise noted	PA:	Power Auger (Solid Stem)
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring - 4", N, B	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB:	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the "Standard Penetration" or "N-value".

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling	BCR:	Before Casing Removal
WCI:	Wet Cave in	WD:	While Drilling	ACR:	After Casing Removal
DCI:	Dry Cave in	AB:	After Boring	N/E:	Not Encountered

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

CONSISTENCY OF FINE-GRAINED SOILS

<u>Unconfined Compressive Strength, Qu, psf</u>	<u>Standard Penetration or N-value (SS) Blows/Ft.</u>	<u>Consistency</u>
< 500	0 - 1	Very Soft
500 – 1,000	2 - 4	Soft
1,000 – 2,000	4 - 8	Medium Stiff
2,000 – 4,000	8 - 15	Stiff
4,000 – 8,000	15 - 30	Very Stiff
8,000+	> 30	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

<u>Standard Penetration or N-value (SS) Blows/Ft.</u>	<u>Relative Density</u>
0 – 3	Very Loose
4 – 9	Loose
10 – 29	Medium Dense
30 – 50	Dense
> 50	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

<u>Descriptive Term(s) of other constituents</u>	<u>Percent of Dry Weight</u>
Trace	< 15
With	15 – 29
Modifier	≥ 30

GRAIN SIZE TERMINOLOGY

<u>Major Component of Sample</u>	<u>Particle Size</u>
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75mm)
Sand	#4 to #200 sieve (4.75 to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

<u>Descriptive Term(s) of other constituents</u>	<u>Percent of Dry Weight</u>
Trace	< 5
With	5 – 12
Modifier	> 12

PLASTICITY DESCRIPTION

<u>Term</u>	<u>Plasticity Index</u>
Non-plastic	0
Low	1-10
Medium	11-30
High	> 30

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A				Soil 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: Less than 5% fines ^C	$Cu \geq 4$ and $1 \leq Cc \leq 3$ ^E	GW	Well-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
	Sands with Fines: More than 12% fines ^D		$Cu < 6$ and/or $1 > Cc > 3$ ^E	SP	Poorly graded sand ^I	
			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:			Liquid limit - oven dried	< 0.75	OL	Organic clay ^{K,L,M,N}
			Liquid limit - not dried		OH	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	< 0.75	OH	Organic clay ^{K,L,M,P}
			Liquid limit - not dried		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. (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

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

^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 shaded 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 group name.

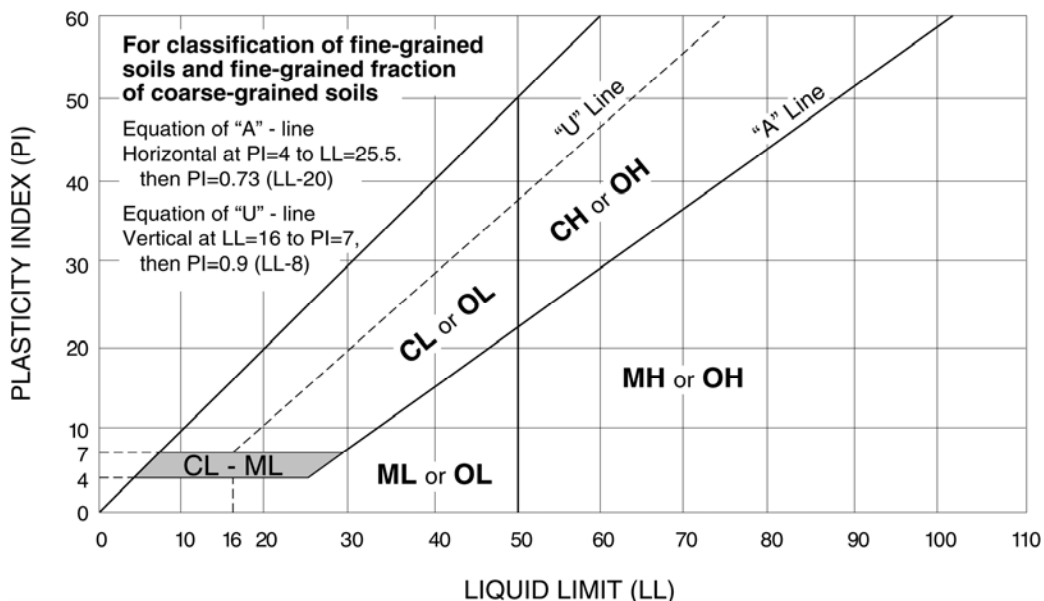
^M If soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^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.



GENERAL NOTES

Description of Rock Properties

WEATHERING

Fresh	Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.
Very slight	Rock generally fresh, joints stained, some joints may show thin clay coatings, crystals in broken face show bright. Rock rings under hammer if crystalline.
Slight	Rock generally fresh, joints stained, and discoloration extends into rock up to 1 in. Joints may contain clay. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.
Moderate	Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.
Moderately severe	All rock except quartz discolored or stained. In granitoid rocks, all feldspars dull and discolored and majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick.
Severe	All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.
Very severe	All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining.
Complete	Rock reduced to "soil". Rock "fabric" not discernible or discernible only in small, scattered locations. Quartz may be present as dikes or stringers.

HARDNESS (for engineering description of rock – not to be confused with Moh's scale for minerals)

Very hard	Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologist's pick.
Hard	Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
Moderately hard	Can be scratched with knife or pick. Gouges or grooves to ¼ in. deep can be excavated by hard blow of point of a geologist's pick. Hand specimens can be detached by moderate blow.
Medium	Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1-in. maximum size by hard blows of the point of a geologist's pick.
Soft	Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
Very soft	Can be carved with knife. Can be excavated readily with point of pick. Pieces 1-in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

Joint, Bedding and Foliation Spacing in Rock ^a

Spacing	Joints	Bedding/Foliation
Less than 2 in.	Very close	Very thin
2 in. – 1 ft.	Close	Thin
1 ft. – 3 ft.	Moderately close	Medium
3 ft. – 10 ft.	Wide	Thick
More than 10 ft.	Very wide	Very thick

Rock Quality Designator (RQD) ^b

Joint Openness Descriptors

RQD, as a percentage	Diagnostic description	Openness	Descriptor
Exceeding 90	Excellent	No Visible Separation	Tight
90 – 75	Good	Less than 1/32 in.	Slightly Open
75 – 50	Fair	1/32 to 1/8 in.	Moderately Open
50 – 25	Poor	1/8 to 3/8 in.	Open
Less than 25	Very poor	3/8 in. to 0.1 ft.	Moderately Wide
		Greater than 0.1 ft.	Wide

- a. Spacing refers to the distance normal to the planes, of the described feature, which are parallel to each other or nearly so.
 b. RQD (given as a percentage) = length of core in pieces 4 in. and longer/length of run.

References: American Society of Civil Engineers. Manuals and Reports on Engineering Practice - No. 56. Subsurface Investigation for Design and Construction of Foundations of Buildings. New York: American Society of Civil Engineers, 1976.
 U.S. Department of the Interior, Bureau of Reclamation, Engineering Geology Field Manual.