March 28, 2025

City of Horseshoe Bay
1 Community Drive
P.O. Box 7765
Horseshoe Bay, Texas. 78745

Re: GEOTECHNICAL DATA REPORT
FM 2147 Crossing – Additional Borings
Horseshoe Bay, Texas
UES Report No. Y250900

Dear Mr. Rick Williams

UES Professional Services 44, LLC (UES) performed four borings to assess the surface conditions at the proposed boring locations (Appendix B - Boring Location Diagram). These borings were drilled near the proposed tunnel crossing beneath FM 2147. Laboratory tests were performed on selected samples retrieved from the borings.

Project Location. The site is located approximately 0.02-Miles West of the intersection of FM 2147 and Summit Rock Boulevard, Texas.

Project Authorization. This geotechnical study was authorized by Jeff Koska representing City of Horseshoe Bay on February 18, 2025, and performed in accordance with UES Proposal No. 110888 dated February 18, 2025.

Subsurface study. The subsurface study for this project is summarized in the following table. Boring locations are provided in Appendix B - Boring Location Diagram.

Boring Nos.	Depth, feet bgs [1]	Date Drilled	Location [2]
B-01 to B-04	25	3/3/2025 to 3/13/2025	Proposed Tunnel Crossing Area

Stratigraphy. Descriptions of the various strata, along with their approximate depths and thicknesses per the Unified Soil Classification System (USCS), are provided in the boring logs included in Appendix C - Boring Logs and Laboratory Results. Terms and symbols used in the USCS are presented in “Appendix G - Unified Soil Classification System”. Groundwater was not encountered at the borings.

Generalized Subsurface Conditions on North Side of FM 2147 Boring B-01 and B-03			
Nominal Depth, feet		General Description	Detailed Description of Soils/Materials Encountered
Top of Layer	Bottom of Layer		
0	6.5 to 7	SAND	Medium dense to very dense CLAYEY SAND (SC)/ SILTY SAND (SM)
6.5 to 7	25	SCHIST	DECOMPOSED SCHIST WEATHERED SCHIST

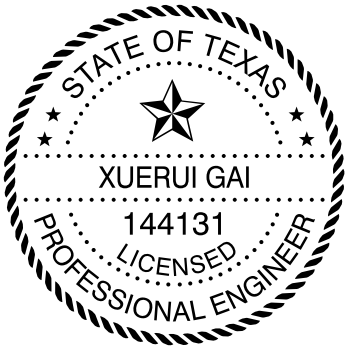
Generalized Subsurface Conditions on South Side of FM 2147 Boring B-02 and B-04			
Nominal Depth, feet		General Description	Detailed Description of Soils/Materials Encountered
Top of Layer	Bottom of Layer		
0	6.5 to 8.5	CLAY and SAND	Firm to very stiff SANDY FAT CLAY (CH) Medium dense to dense CLAYEY SAND (SC) Very dense CLAYEY SAND (SC)/ SILTY SAND (SM)
6.5 to 8.5	20 to 25	SCHIST	DECOMPOSED SCHIST
20	25	GRANITE	GRANITE.

Representative samples were evaluated and classified by a qualified member of the Geotechnical Division and the boring logs were edited as necessary. The laboratory-testing program included performing supplementary visual classification (ASTM D2487) and water content tests (ASTM D2216) on samples obtained and in addition, selected samples were subjected to Atterberg limits tests (ASTM D4318), and percent material finer than the #200 sieve tests (ASTM D1140). Results of these laboratory tests are provided on the Log of Boring sheets.

UES appreciates the opportunity to be of service on this project. Please contact our office if you have any questions.

Please contact us if you have any questions.

Respectfully submitted,



UES PROFESSIONAL SOLUTIONS 44, LLC
TBPE Firm No. 2101

Ricardo Casas
Geotechnical Project Manager

Gary Gai, Ph.D., P.E.
Engineering Manager

APPENDICES

APPENDIX A - PROJECT LOCATION DIAGRAMS

APPENDIX B - BORING LOCATION DIAGRAM

APPENDIX C - BORING LOGS AND LABORATORY RESULTS

APPENDIX D – BORING CROSS SECTION

APPENDIX E – ROCK CORE PHOTOGRAPHS

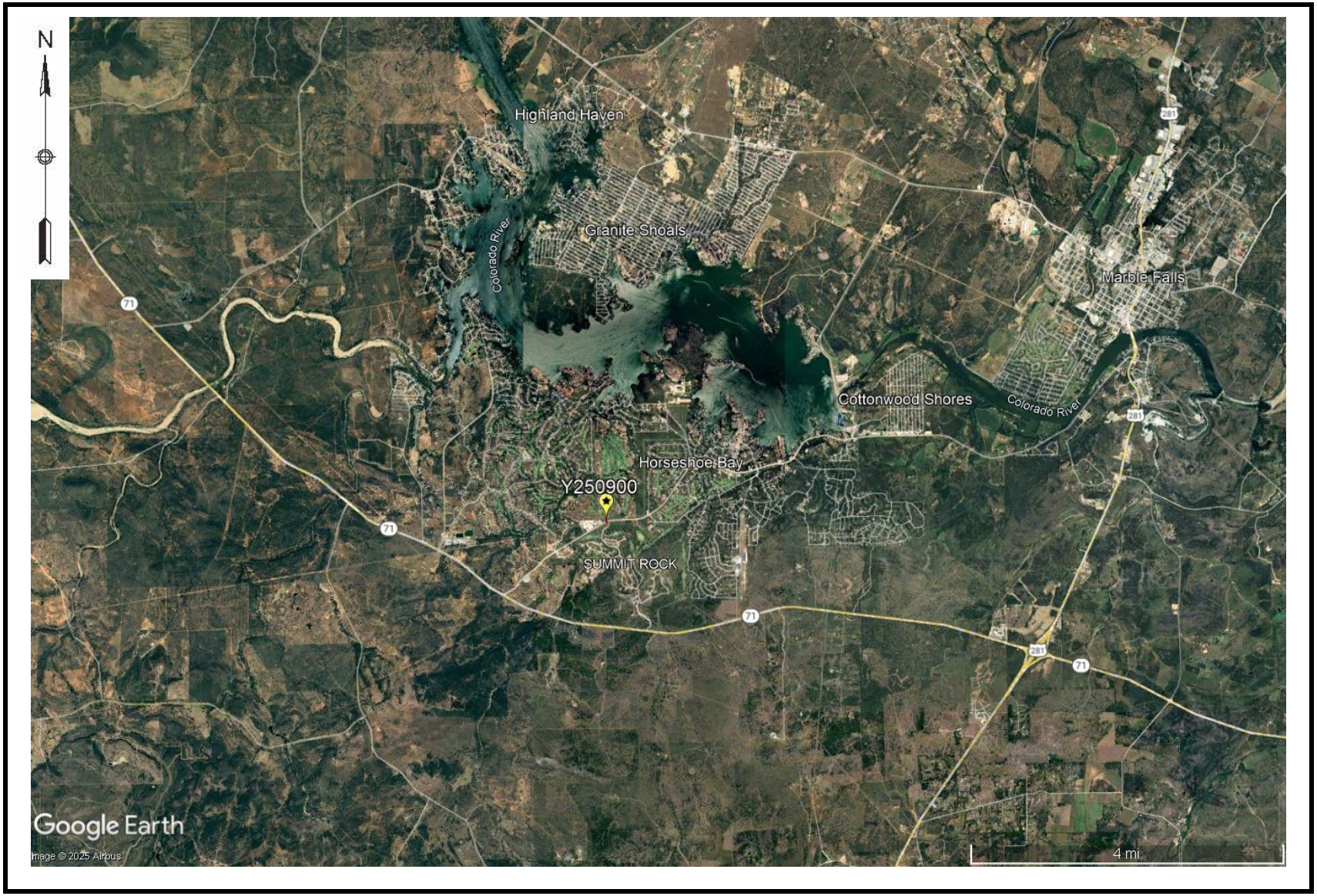
APPENDIX F - USGS TOPOGRAPHIC MAP

APPENDIX G - GEOLOGIC INFORMATION

APPENDIX H - UNIFIED SOIL CLASSIFICATION SYSTEM

Appendix A - Project Location Diagrams

PROJECT LOCATION DIAGRAM - GENERAL



UES Project No. Y250900

FM 2147 Crossing-Additional Borings

PROJECT LOCATION DIAGRAM - LOCAL

UES Project No. Y250900

FM 2147 Crossing-Additional Borings

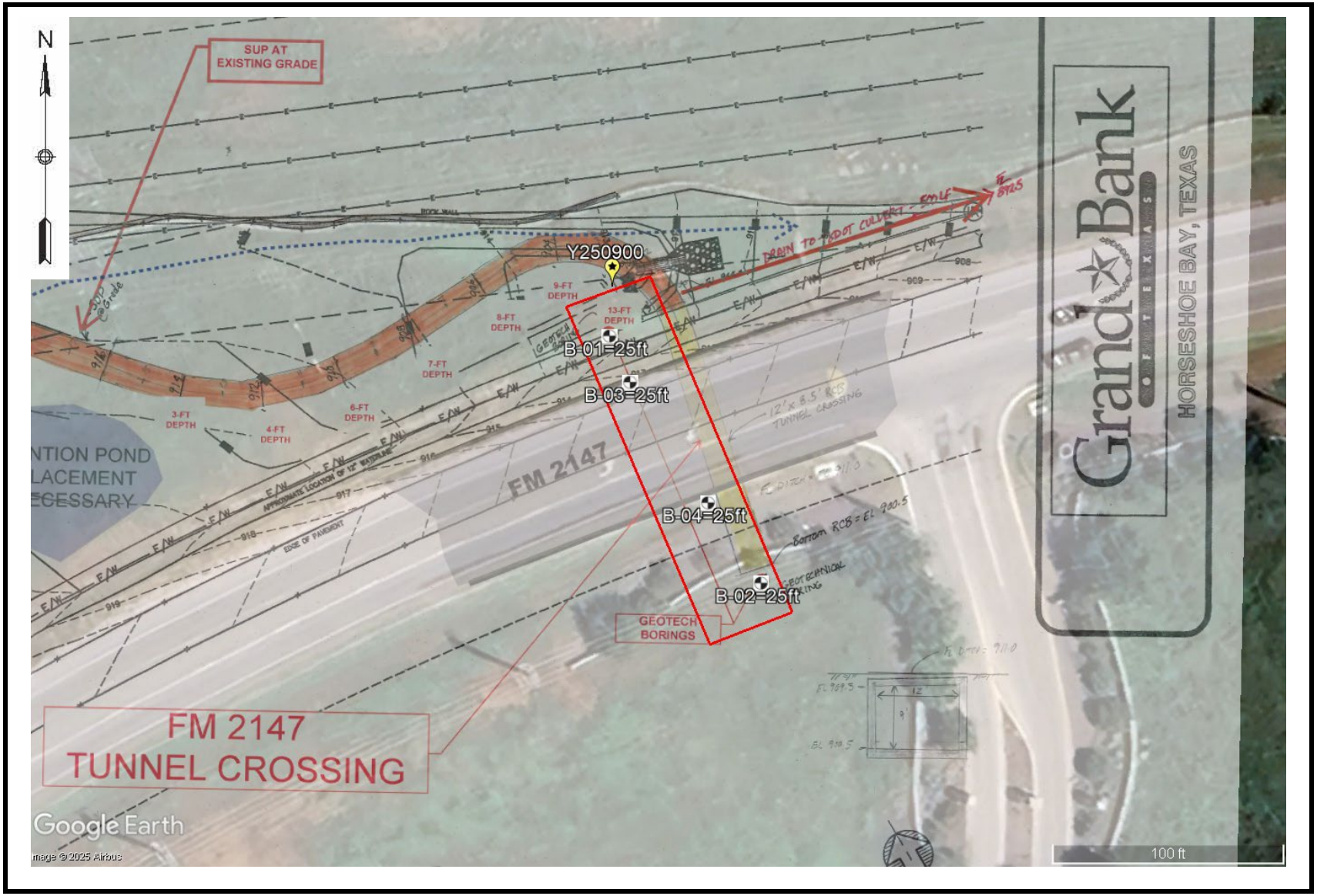
Appendix B - Boring Location Diagram

BORING LOCATION DIAGRAM

UES Project No. Y250900

FM 2147 Crossing-Additional Borings

BORING LOCATION DIAGRAM WITH OVERLAY



UES Project No. Y250900

FM 2147 Crossing-Additional Borings

Appendix C - Boring Logs and Laboratory Results

BORING NUMBER: B - 01

CLIENT City of Horseshoe Bay
PROJECT NAME FM 2147 Crossing - Additional Borings
PROJECT NUMBER Y250900
PROJECT LOCATION Horseshoe Bay, TX
DATE STARTED 03/13/2025 **COMPLETED** 03/13/2025
GROUND ELEVATION 914' **NORTHING** -
CONTRACTOR -
GROUND WATER LEVELS: **EASTING** -
METHOD Air Rotary 0 to 10-ft, Rock Coring 10 to 25-ft
INITIALLY ENCOUNTERED Not encountered
LOGGED BY R.C. **CHECKED BY** G.G.
UPON COMPLETION Not encountered
NOTES -
HAMMER WEIGHT / DROP 140 / 30-in.

Depth (ft)	Graphic Log	Material Description	Samples: Sample Graphic	Samples: N-Value	Samples: % Recovery	Samples: % RQD	Lab: Compressive Strength (tsf)	Lab: Dry Density (PCF)	Lab: Moisture Content (%)	Lab: Liquid Limit	Lab: Plastic Limit	Lab: Plasticity Index	Lab: Minus #200
		CLAYEY SAND (SC)/ SILTY SAND (SM) - Very dense, reddish brown and light brown, with gravel.		8-15-50 (65/10")					3	28	16	12	35
				26-50 (50/3")					3				
5				50 (50/1")					14				
		7.0		50 (50/4")					6				
		DECOMPOSED SCHIST - Dark gray, friable texture with properties resembling cemented sand.											
				50 (50/ 0")									
10					52	12							
							12.7	184.6	1				
		15.0											
15		WEATHERED SCHIST - Gray and dark gray, with granitic veins.					244.5	192.7	0				
		Possible clay filled voids at about 17-ft			48	18							
20													
					73	0							
25		25.0											

BORING NUMBER: B - 02

CLIENT City of Horseshoe Bay
PROJECT NAME FM 2147 Crossing - Additional Borings
PROJECT NUMBER Y250900
PROJECT LOCATION Horseshoe Bay, TX
DATE STARTED 03/03/2025 **COMPLETED** 03/03/2025
GROUND ELEVATION 912' **NORTHING** -
CONTRACTOR -
GROUND WATER LEVELS: **EASTING** -
METHOD Air Rotary 0 to 15-ft, Rock Coring 15 to 25-ft
INITIALLY ENCOUNTERED Not encountered
LOGGED BY R.C. **CHECKED BY** G.G.
UPON COMPLETION Not encountered
NOTES -
HAMMER WEIGHT / DROP 140 / 30-in.

Depth (ft)	Graphic Log	Material Description	Samples: Sample Graphic	Samples: N-Value	Samples: % Recovery	Samples: % RQD	Lab: Compressive Strength (tsf)	Lab: Dry Density (PCF)	Lab: Moisture Content (%)	Lab: Liquid Limit	Lab: Plastic Limit	Lab: Plasticity Index	Lab: Minus #200
		SANDY FAT CLAY (CH) - Very stiff, reddish brown.		8-19-20 (39)					11	70	15	55	68
		2.5											
		CLAYEY SAND (SC)/ SILTY SAND (SM) - Very dense, reddish brown and brown, with gravel.		26-37-24 (61)					7				
5				50 (50/5")					7				
				40-50 (50/5")					5	31	14	17	36
		8.5											
		DECOMPOSED SCHIST - Dark gray, with clay seams, friable texture, and properties resembling cemented sand.		50 (50/5")					9				
10													
				50 (50/5")					10	41	11	30	40
15					0	0							
		20.0											
20		GRANITE - Light gray.			90	60	1225.0	159.0	1				
		25.0											
25													

BORING NUMBER: B - 03

CLIENT City of Horseshoe Bay
PROJECT NAME FM 2147 Crossing - Additional Borings
PROJECT NUMBER Y250900
PROJECT LOCATION Horseshoe Bay, TX
DATE STARTED 03/13/2025 **COMPLETED** 03/13/2025
GROUND ELEVATION 913' **NORTHING** -
CONTRACTOR -
GROUND WATER LEVELS: **EASTING** -
METHOD Air Rotary 0 to 10-ft, Solid Flight 16.5 to 20-ft, Rock
INITIALLY ENCOUNTERED Not encountered
LOGGED BY R.C. **CHECKED BY** G.G.
UPON COMPLETION Not encountered
NOTES -
HAMMER WEIGHT / DROP 140 / 30-in.

Depth (ft)	Graphic Log	Material Description	Samples: Sample Graphic	Samples: N-Value	Samples: % Recovery	Samples: % RQD	Lab: Compressive Strength (tsf)	Lab: Dry Density (PCF)	Lab: Moisture Content (%)	Lab: Liquid Limit	Lab: Plastic Limit	Lab: Plasticity Index	Lab: Minus #200
		CLAYEY SAND (SC)/ SILTY SAND (SM) - Medium dense to very dense, brown and light brown, with gravel.		6-27-30 (57)					2				
				40-40-13 (53)					5	53	18	35	38
5				14-37-50 (87/11")					3				
		6.5											
		DECOMPOSED SCHIST - Gray and dark gray, friable texture with properties resembling cemented sand.		31-39-29 (68)					4	25	9	16	20
				50 (50/3")					5				
10					12	0			3				
		Boring walls collapsed at about 13-ft.											
15		Quartz enountered at 15-ft.			0	0							
				50 (50/3")					12				
20					0	0			4				
25		25.5		50 (50/5")									

BORING NUMBER: B - 04

CLIENT City of Horseshoe Bay
PROJECT NAME FM 2147 Crossing - Additional Borings
PROJECT NUMBER Y250900
PROJECT LOCATION Horseshoe Bay, TX
DATE STARTED 03/07/2025 **COMPLETED** 03/07/2025
GROUND ELEVATION 912' **NORTHING** -
CONTRACTOR -
GROUND WATER LEVELS: **EASTING** -
METHOD Air Rotary 0 to 15-ft, Rock Coring 15 to 25-ft
INITIALLY ENCOUNTERED Not encountered
LOGGED BY R.C. **CHECKED BY** G.G.
UPON COMPLETION Not encountered
NOTES -
HAMMER WEIGHT / DROP 140 / 30-in.

Depth (ft)	Material Description	Samples: N-Value	Samples: % Recovery	Samples: % RQD	Lab: Compressive Strength (tsf)	Lab: Dry Density (PCF)	Lab: Moisture Content (%)	Lab: Liquid Limit	Lab: Plastic Limit	Lab: Plasticity Index	Lab: Minus #200
	SANDY FAT CLAY (CH) - Firm, brown, with gravel.	2-4-6 (10)					7				
	2.0										
	CLAYEY SAND (SC) - Medium dense, dark brown.	11-10-11 (21)					13				
5		12-14-22 (36)					11	34	18	16	33
	6.5										
	DECOMPOSED SCHIST - Dark gray, friable texture with properties resembling cemented sand.	37-50 (50/3")					8	NV	NP	NP	34
		50 (50/5")					4				
10		50 (50/1")									
	With clay seams at 12.5-ft.	50 (50/5")									
15			85	22	258.8	178.2	2				
20	Possible clay filled voids at about 22-ft		0	0							
25	25.5	50 (50/5")									

Environmental
Geotechnical Engineering
Materials Testing
Field Inspections & Code Compliance
Geophysical Technologies

Uniaxial Compressive Strength Test Report

Project: FM 2147 Crossing-Additional Borings
Sample ID.: B-01 @ 14-feet

Project No.: Y250900
Test Date.: 3/19/2025
Test Method: ASTM D7012 - Method C
Type of Specimen: Intact Rock Core
Deformation Rate: 0.5 %/min

Initial Specimen Conditions		
Avg. Diameter (in)	D_o	1.96
Avg. Height (in)	H_o	3.91
Water Content (%)	w_o	1.2
Wet Unit Weight (pcf)	γ_{total}	186.8
Dry Unit Weight (pcf)	γ_{dry}	184.6

Stresses at Failure	
Uniaxial Compressive Strength, σ_u (tsf)	12.7

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Materials Testing
Field Inspections & Code Compliance
Geophysical Technologies

Uniaxial Compressive Strength Test Report

Project: FM 2147 Crossing-Additional Borings
Sample ID.: B-01 @ 16-feet

Project No.: Y250900
Test Date.: 3/19/2025
Test Method: ASTM D7012 - Method C
Type of Specimen: Intact Rock Core
Deformation Rate: 0.5 %/min

Initial Specimen Conditions		
Avg. Diameter (in)	D_o	2.00
Avg. Height (in)	H_o	4.06
Water Content (%)	w_o	0.2
Wet Unit Weight (pcf)	γ_{total}	193.1
Dry Unit Weight (pcf)	γ_{dry}	192.7

Stresses at Failure	
Uniaxial Compressive Strength, σ_u (tsf)	244.5

Environmental
Geotechnical Engineering
Materials Testing
Field Inspections & Code Compliance
Geophysical Technologies

Uniaxial Compressive Strength Test Report

Project: FM 2147 Crossing-Additional Borings
Sample ID.: B-02 @ 23-feet

Project No.: Y250900
Test Date.: 3/19/2025
Test Method: ASTM D7012 - Method C
Type of Specimen: Intact Rock Core
Deformation Rate: 0.5 %/min

Initial Specimen Conditions		
Avg. Diameter (in)	D_o	2.04
Avg. Height (in)	H_o	4.04
Water Content (%)	w_o	1.4
Wet Unit Weight (pcf)	γ_{total}	161.1
Dry Unit Weight (pcf)	γ_{dry}	159.0

Stresses at Failure	
Uniaxial Compressive Strength, σ_u (tsf)	1225.0

Environmental
Geotechnical Engineering
Materials Testing
Field Inspections & Code Compliance
Geophysical Technologies

Uniaxial Compressive Strength Test Report

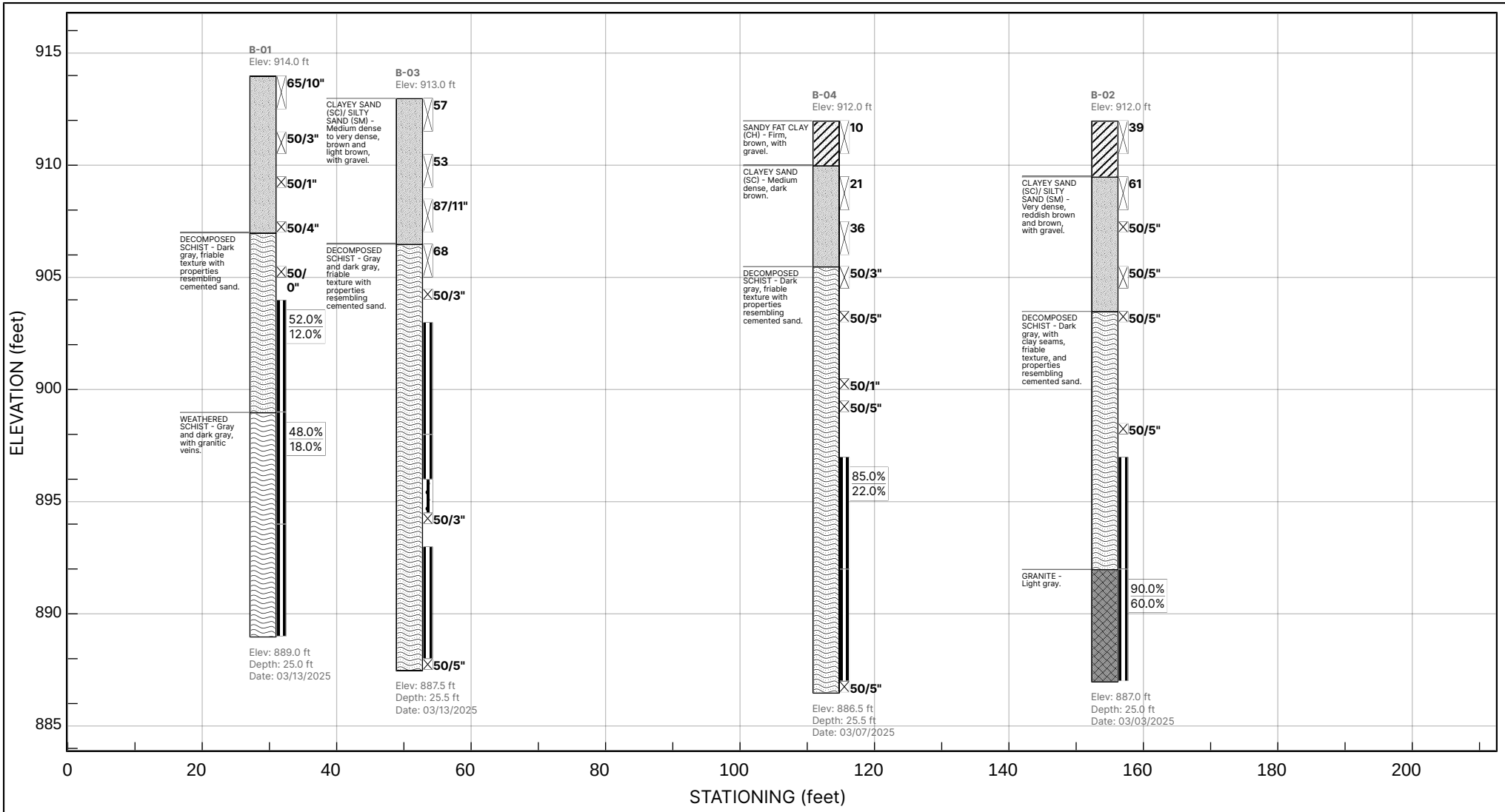
Project: FM 2147 Crossing-Additional Borings
Sample ID.: B-04 @ 18-feet

Project No.: Y250900
Test Date.: 3/19/2025
Test Method: ASTM D7012 - Method C
Type of Specimen: Intact Rock Core
Deformation Rate: 0.5 %/min

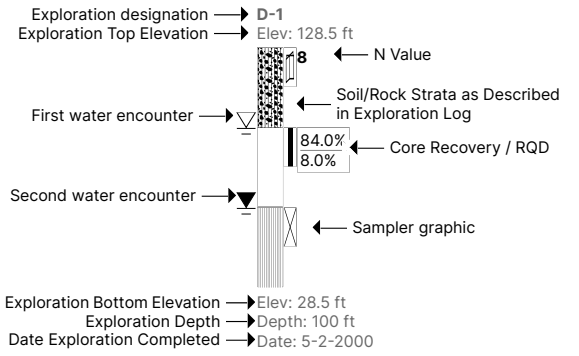
Initial Specimen Conditions		
Avg. Diameter (in)	D_o	2.00
Avg. Height (in)	H_o	4.01
Water Content (%)	w_o	1.6
Wet Unit Weight (pcf)	γ_{total}	181.0
Dry Unit Weight (pcf)	γ_{dry}	178.2

Stresses at Failure	
Uniaxial Compressive Strength, σ_u (tsf)	258.8

Appendix D - Boring Cross Section



EXPLORATION LOG LEGEND



LEGEND KEY

- Clayey Sand/Silty Sand
- Decomposed Schist
- Weathered Schist
- Sandy Fat Clay
- Granite

FM 2147 Crossing - Additional Borings
Horseshoe Bay, TX

CROSS SECTIONS REPORT

UES

Appendix E - Rock Core Photographs

ROCK CORE PHOTOGRAPHS

Boring B-01 (10- to 25-ft)

ROCK CORE PHOTOGRAPHS

Boring B-02 (20- to 25-ft)

ROCK CORE PHOTOGRAPHS

Boring B-03 (10- to 15-ft)

ROCK CORE PHOTOGRAPHS

Boring B-04 (15- to 20-ft)

Appendix F - USGS Topographic Map

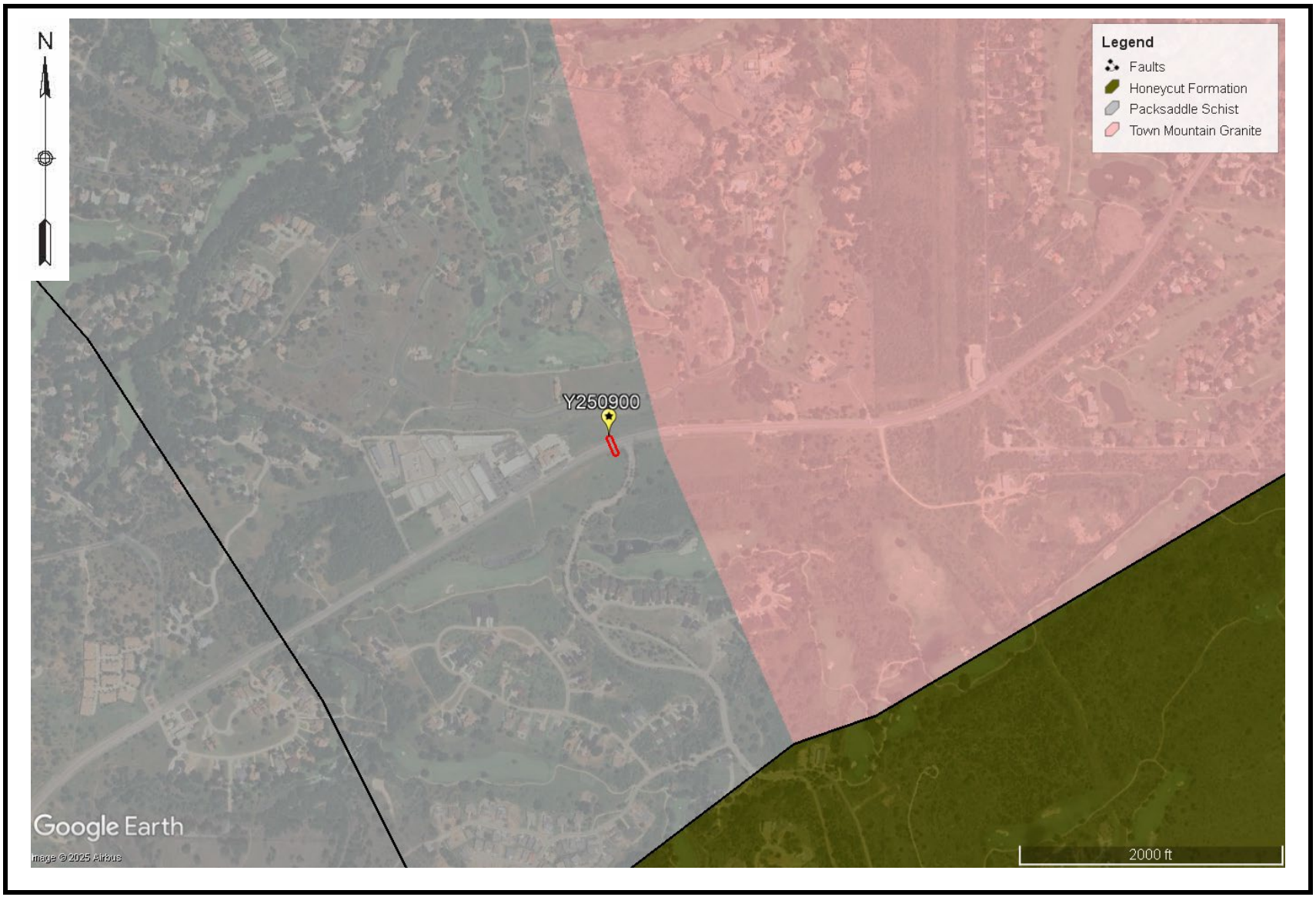
USGS TOPOGRAPHIC MAP

UES Project No. Y250900

FM 2147 Crossing-Additional Borings

Appendix G - Geologic Information

GEOLOGIC ATLAS



UES Project No. Y250900

FM 2147 Crossing-Additional Borings

Packsaddle Schist

XML (/geology/state/xml/TXpCAp;0) JSON (/geology/state/json/TXpCAp;0)
Shapefile (/geology/state/unit-shape.php?unit=TXpCAp;0)

Packsaddle Schist

State	Texas (/geology/state/state.php?state=TX)
Name	Packsaddle Schist
Geologic age	preCambrian (Proterozoic); Llano Series
Lithologic constituents	Major Metamorphic > Schist *(Amphibolite) Dominantly dark basic rocks including biotite, amphibolite, and graphitic schists and crystalline limestone also light-colored feldspathic bands resembling quartzite. Mostly feldspathic amphibole and biotite schist, predominantly dark colored. A sample described by Barnes composed of anthophyllite, plagioclase, and biotite. Opaque minerals include apatite, zircon, garnet, and staurolite?.*
Comments	Comstock and Dumble (1890) included unit in the Packsaddle series, described as metamorphosed shaly beds and marble (near base) forming top div. of Texan system. Barnes (1952) described the unit as mostly feldspathic amphibole and biotite schist and chiefly dark colored. (from Llano Sheet, Geol. Atlas of Texas) From top down: Click Fm.-mostly hornblende schist, underlain by leptite and qtz-feldspar-mica schist which grades into hornblende schist SE; thickness ca. 7,800 ft. Rough Rider Fm.-gray leptite, qtz-feldspar-mica schist, and biotite-cordierite gneiss local muscovite schist, biotite schist, and biotite-microcline gneiss; thickness ca. 5,200 ft. Sandy Fm.-alternating units of hornblende schist, and quartz-feldsparpmica schist and leptite; thickness ca.2,100 ft. Honey Fm.-upper part graphite schist, hornblende schist, and marble with graphite schist interbeds; middle part-muscovite schist, changes to leptite,graphite, schist, and hornblende schist toward SE, one prominent marble; lower part-hornblende schist, graphite schist, leptite, and marble; thickness ca 7,800 ft.
Stratigraphic units	from top down, Click Formation, Rough Ridge Formation, Sandy Formation, and Honey Formation

References

Barnes, V.E., Romberg, F., and Anderson, W.A., 1954, 19th International Geologic Congress, Algiers 1952, Comptes rendus, sec. 9, pt. 9, p. 152-153.

Wilmarth, M.G., 1938, Lexicon of geologic names of the United States: U.S. Geological Survey Bulletin 896, 2396 p.
https://pubs.er.usgs.gov/publication/b896
(https://pubs.er.usgs.gov/publication/b896)

Comstock, T.B., and Dumble, E.T., 1890, (title unknown) Texas Geol. Survey 1st annual report pl. 3 p. lvii, lviii, 276-281.

Paige, S., 1912a, Llano-Burnet, Texas: U.S. Geological Survey, Geologic Atlas of the United States, Folio 183.
https://pubs.er.usgs.gov/publication/gf183
(https://pubs.er.usgs.gov/publication/gf183)

Barnes, V.E., 1952, Hilltop quadrangle, Gillespie, Llano, and Mason Counties, Texas: Geologic Quadrangle Maps, Bureau of Economic Geology, The University of Texas, Austin, Texas, scale 1:31,680.

Mutis-Duplat, Emilio, 1982, Geology of the Purdy Hill quadrangle, Mason County, Texas: Bureau of Economic Geology, the University of Texas at Austin, Geologic Quadrangle Map 52, scale 1:24.000.

Bureau of Economic Geology, 1992, Geologic Map of Texas: University of Texas at Austin, Virgil E. Barnes, project supervisor, Hartmann, B.M. and Scranton, D.F., cartography, scale 1:500,000.

Bureau of Economic Geology, 1992, Geologic Map of Texas: University of Texas at Austin, Virgil E. Barnes, project supervisor, Hartmann, B.M. and Scranton, D.F., cartography, scale 1:500,000.

NGMDB product

NGMDB product page for 68390
(https://ngmdb.usgs.gov/Prodesc/proddesc_68390.htm)

Counties

Blanco (/geology/state/fips-unit.php?code=f48031) - Burnet (/geology/state/fips-unit.php?code=f48053) - Gillespie (/geology/state/fips-unit.php?code=f48171) - Llano (/geology/state/fips-unit.php?code=f48299) - McCulloch (/geology/state/fips-unit.php?code=f48307) - Mason (/geology/state/fips-unit.php?code=f48319) - San Saba (/geology/state/fips-unit.php?code=f48411)

Town Mountain Granite

XML (/geology/state/xml/TXpCAt;0) | JSON (/geology/state/json/TXpCAt;0)

Shapefile (/geology/state/unit-shape.php?unit=TXpCAt;0)

Town Mountain Granite

State	Texas (/geology/state/state.php?state=TX)
Name	Town Mountain Granite
Geologic age	preCambrian (Proterozoic)
Lithologic constituents	Major Igneous > Plutonic > Granitic > Granite *(Pluton)*
Comments	Coarse-grained, pink, quartz-plagioclase-microcline rock, in part porphyritic with large microcline phenocrysts. Occurs in plutons up to 13 mi in size that tend to be concordant circular vertical cylinders with concentric textural variaions; boundaries range from sharp and regular to highly irregular with wide zones of mixed rock. Makes up Enchanted Rock granite mass, Gillespie and Llano Counties.
References	Barnes, V.E., Romberg, F., and Anderson, W.A., 1954, 19th International Geologic Congress, Algiers 1952, Comptes rendus, sec. 9, pt. 9, p. 152-153. Bureau of Economic Geology, 1992, Geologic Map of Texas: University of Texas at Austin, Virgil E. Barnes, project supervisor, Hartmann, B.M. and Scranton, D.F., cartography, scale 1:500,000.
NGMDB product	NGMDB product page for 68390 (https://ngmdb.usgs.gov/Prodesc/proddesc_68390.htm)
Counties	Blanco (/geology/state/fips-unit.php?code=f48031) - Burnet (/geology/state/fips-unit.php?code=f48053) - Gillespie (/geology/state/fips-unit.php?code=f48171) - Llano (/geology/state/fips-unit.php?code=f48299) - McCulloch (/geology/state/fips-unit.php?code=f48307) - Mason (/geology/state/fips-unit.php?code=f48319)

Appendix H - Unified Soil Classification System

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% 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 (More than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more 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 of 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 50% or greater		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

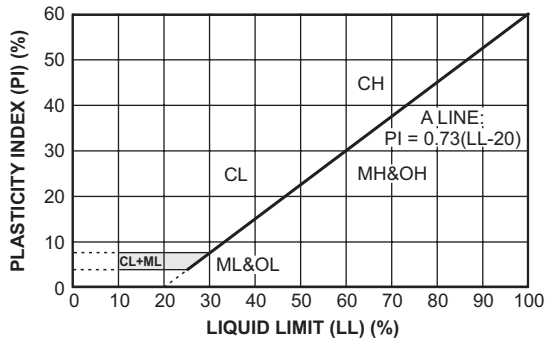
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for SW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent ..... GW, GP, SW, SP
More than 12 percent ..... GM, GC, SM, SC
5 to 12 percent ..... Borderline cases requiring dual symbols

PLASTICITY CHART



TERMS DESCRIBING SOIL CONSISTENCY

Fine Grained Soils		Coarse Grained Soils		
Description	Penetrometer Reading (tsf)	Penetration Resistance (blows/ft)	Description	Relative Density
Soft	0.0 to 1.0	0 to 4	Very Loose	0 to 20%
Firm	1.0 to 1.5	4 to 10	Loose	20 to 40%
Stiff	1.5 to 3.0	10 to 30	Medium Dense	40 to 70%
Very Stiff	3.0 to 4.5	30 to 50	Dense	70 to 90%
Hard	4.5+	Over 50	Very Dense	90 to 100%