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National
Design,
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Mechanics
Center

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Subject: ENG - Soil Mechanics Report
Unconfined Compressive Strength – Headcut
Erodibility Index (K_h)
Plum Creek No. 21
Caldwell County, Texas

Date: JUN 22 2015

To: John Mueller, P.E.
State Conservation Engineer
NRCS, Temple, TX

File Code: 210-22
Job No: 7564

INTRODUCTION

Plum Creek No. 21 is an existing embankment dam located in Caldwell County, Texas, approximately five miles north of the City of Lockhart. Figure 1 shows the location of the dam.

Seven boreholes (BH), Nos. 250 through 256, were advanced to depths ranging from 5.5 to 31 feet, along the western, inside edge of the auxiliary spillway. The borehole locations are depicted in Figure 2.

A total of 24 Shelby tubes were delivered to the Fort Worth Soil Mechanics Lab (SML) for testing. Requested testing included: index, dry unit weight, and unconfined compressive strength. The results of the unconfined compressive strength testing will be utilized to determine the headcut erodibility index, K_h . The SML's scope of work was to perform the testing and provide the results.

The Shelby tubes were transported to the Lincoln SML for unconfined compressive strength (UCC) testing. Index testing of the samples was completed at the Ft. Worth SML.

INTERPRETATION AND DISCUSSION OF DATA

Index Tests and Water Content

The auxiliary spillway samples were classified in the field during drilling operations. The Texas State Geologist indicated that the profile of the spillway consisted of a thin layer of soil overlying siltstone/claystone. The soil layer was described as either silt or clay.

The submitted samples were classified in accordance with ASTM D2487, *Classification of Soils for Engineering Purposes* (Unified Soil Classification System). The samples classified as either lean clay to lean clay with sand (CL) or fat clay (CH).

Based upon the index testing the existing auxiliary spillway grade has the following profile:

Borehole Location	Surficial soil
250	CH
251	CL
252	CL
253	CH
254	CL
255	CL
256	CH

In addition, review of the boring logs indicate that the siltstone/claystone contact occurs at the following approximate elevation within each borehole.

Borehole	Elevation (ft)
B-250	516.5
B-251	517.8
B-252	506.4
B-253	499.4
B-254	496.8
B-255	491.3
B-256	Siltstone/claystone not encountered

Furthermore, although soil surveys provide a generalized indication of the soils that may be encountered at a site, they can assist in borehole placement. The Web Soil Survey identified two soil series within the auxiliary spillway: Crockett and Crockett Sandy Loam. The Web Soil Survey classifies these soils, per the Unified Soil Classification system (USCS) as lean clay (CL) and inelastic silt (ML). The boreholes were only advanced within the Crockett soil series (CL). A soil survey map of the spillway is provided as Figure 3.

The full complement of the samples' index properties are provided as Attachment 1, Form NRCS-ENG-354.

Dispersion Tests

Crumb and Double Hydrometer (ASTM D6572 and D4221) tests were performed on each of the samples. A crumb test result of 1 indicates that dispersion is not present or is minimal, but a result of 3 or 4 is an indicator that the clays are dispersive.

The Crumb sometimes provides a negative indication of dispersion for dispersive clays, so the Double Hydrometer test is utilized as a validation of the Crumb Test result. Double Hydrometer results less than about 60 indicate that dispersion is not a problem.

Most samples' Crumb Test results were a 1 or 2, for both the one and four hour readings, with an associated low double hydrometer reading. The following sample test results were mixed and could be an indication of dispersive soils.

Ft. Worth Lab Sample No.	Field Sample No.	Depth (ft)	Crumb Test Result (1 hr/4hr)	Double Hydrometer (%)
342	250.1	5.0 – 7.5	2 / 3	31
346	251.3	5.0 – 7.5	2 / 3	18
347	251.4	7.5 – 10.0	3 / 4	24
361	254.1	5.0 – 7.5	3 / 4	41

Unconfined Compressive Strength (q_u)

The Unconfined Compressive Strength test (UCC) (ASTM D2166) was performed on 21 samples at the Lincoln SML. The samples were sheared at their natural moisture content and associated saturation level. The samples were also sheared at their extruded diameters which allowed for any remnant parent material structure such as fractures to impact the results of the test. That is the UCC is a conservative estimate of compressive and shear strength.

ASTM D2166-13 requires a height-to-diameter ratio (H/D) of 2 to 2.5; however, some of the samples did not meet the H/D requirement. The strengths from samples with an

H/D ratio less than 2.0 were not included in the table below. Additionally these samples are denoted by an asterisk (*) in Attachment 1. The results of the unconfined compressive strength tests are provided in the table below:

Ft. Worth Lab Sample No.	Field Sample No.	USCS	Depth (ft)	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Percent Saturation (%)	q_u (psf)
343	250.2	CH	10.0-12.5	25.0	94.4	84	4,015
345	251.2	CL	2.5-5.0	13.1	108	62	12,110*
348	251.5	CH	10.0-12.5	20.7	101	81	6,268
349	251.6	CH	12.5-15.0	18.0	96.9	65	1,947
351	251.8	CH	20.0-22.5	22.1	93.3	72	3,347
355	252.2	CH	5.0-7.5	18.4	97.8	68	8,732
357	252.4	CL	15.0-17.5	16.4	90.0	50	1,598
361	254.1	CL	5.0-5.9	11.7	106	53	9,222
361B	254.1	--	5.9-6.55	12.6	110	64	9,501
362	254.2	CL	15.0-17.5	18.9	95.9	67	5,177
364	255.2	CL	10.0-12.5	22.0	101	88	6,656
365	256.1	CH	3.0-5.5	19.6	97.9	72	6,349

* Sample 345 maxed out the load cell before failing.

The dry densities of the samples were obtained by measuring the dimensions of the UCC slugs and moisture content, prior to testing. The saturation level of the UCC samples ranged from 25.7% to 87.8% with an average of 63.2%. It is worth noting that

the Plum Creek 21 samples were considerably drier than samples from previous K_h investigations (Upper Brushy 32, Lower Brushy 20, Williams 3) which had saturation levels greater than 80%.

Additionally, UCC testing could not be performed on the following samples due to the accompanying reason:

Field Sample Nos.	Reason
250.1	In order to extrude sample, tube was cut multiple times. Resulting sample was not large enough to perform shear test.
251.1	Sample consisted of mainly topsoil and a shear sample could not be obtained.
251.6	In order to extrude sample, tube was cut multiple times. Resulting sample was not large enough to perform shear test.
251.9	Sample fell apart after extrusion.
253.1	In order to extrude sample, tube was cut multiple times. Resulting sample crumbled upon extrusion.

CONCLUSIONS AND RECOMMENDATIONS

The following are conclusions regarding the results of the testing:

1. The Web Soil Survey identified the soil within the existing auxiliary spillway predominantly as CL (Crockett soil series); however, it also noted the potential presence of a ML in the outside curve of the spillway.
 - a. Boreholes were not advanced along the outside edge of the spillway and the presence of an ML could not be determined.
 - b. CLs and MLs possess different erosion resistance characteristics.
2. The Crumb and Double Hydrometer testing identified most samples as being non-dispersive.
 - a. Mixed test results were obtained in the surficial soils at Boreholes 250, 251, and 254.
 - b. These soils may possess dispersive characteristics that would influence headcut erodibility.

- c. ASTM D4647 Pinhole Test could be performed on these samples to make clear the mixed test results.
- 3. The unconfined compressive strength test results ranged from 1,598 psf to 12,110 psf.
 - a. Most samples (81%) failed at a vertical strain of 5% or less.
 - i. Sample Nos. 251.4, 252.5, 253.2, 255.1 failed at vertical strains slightly above 5%.
 - b. Boreholes 251, 252 and 254 showed a loss of strength with depth.
 - i. This is atypical for cohesive shear strength which generally increases with depth.
- 4. The calculation of the headcut erodibility index (K_h) should be thought of in terms of a sensitivity analysis and all the factors contained within this report and the field documents should be take into account.

If you would like to discuss this report or if you need to request further testing, please contact me at (817) 509-3322.

Prepared by:



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Head, Soil Mechanics Lab
NRCS, Fort Worth, TX

Figures:

- Figure 1 – Site Map
- Figure 2 – Borehole Locations
- Figure 3 – Soils Map

Attachments:

1. Form NRCS-ENG-354, Soil Mechanics Laboratory Test Data, 2 sheets
2. Undisturbed Sample Characteristics, 12 sheets
3. Unconfined Compression Test Reports, 21 sheets

cc: John Hrebik, Design Engineer, NRCS, Temple, TX
Stephen Reinsch, Co-Director, NDCSMC, NRCS, Lincoln, NE
Noller Herbert, Director, CED, NRCS, Washington, DC

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FIGURES

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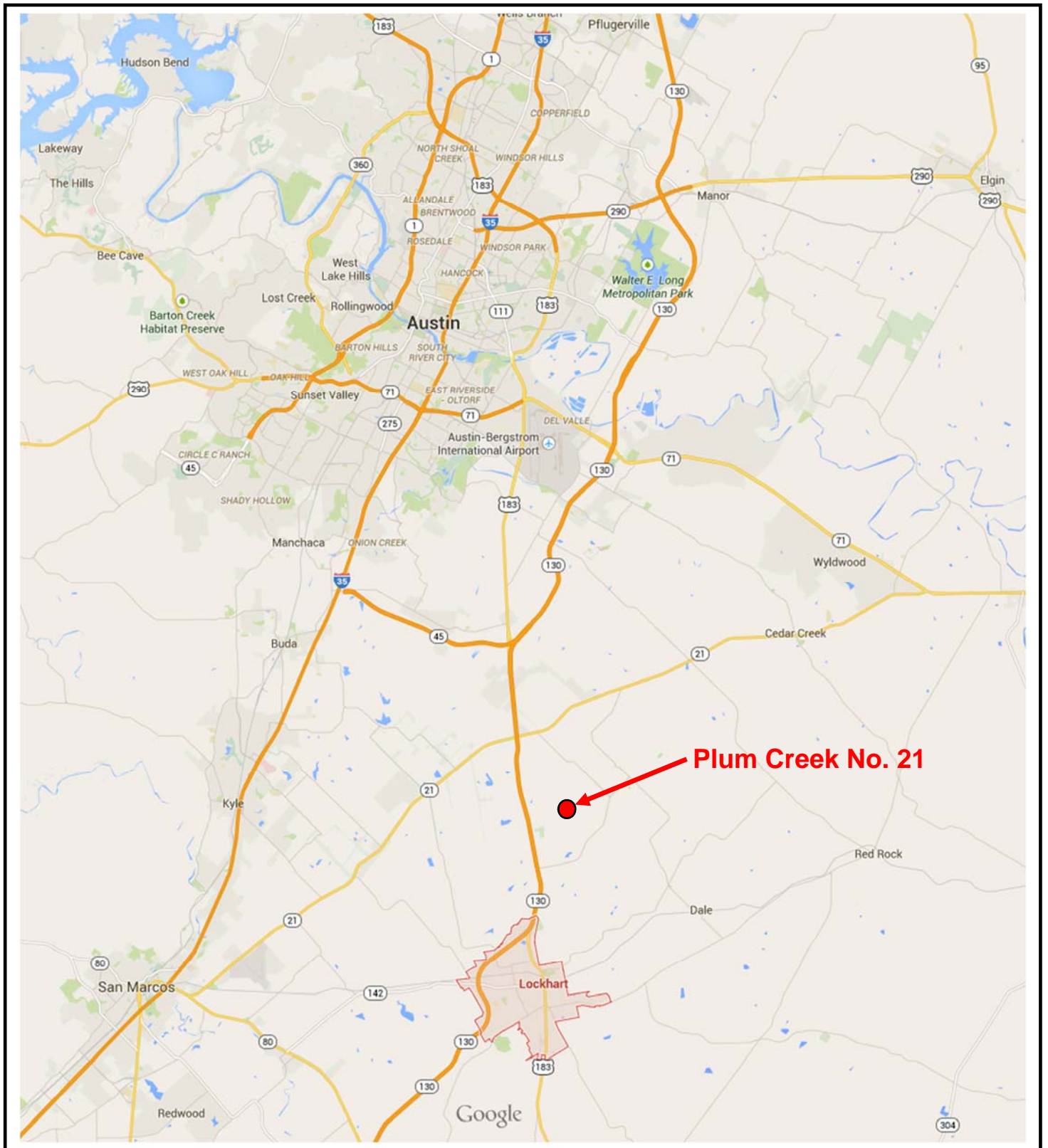


Figure 1 – Site Map

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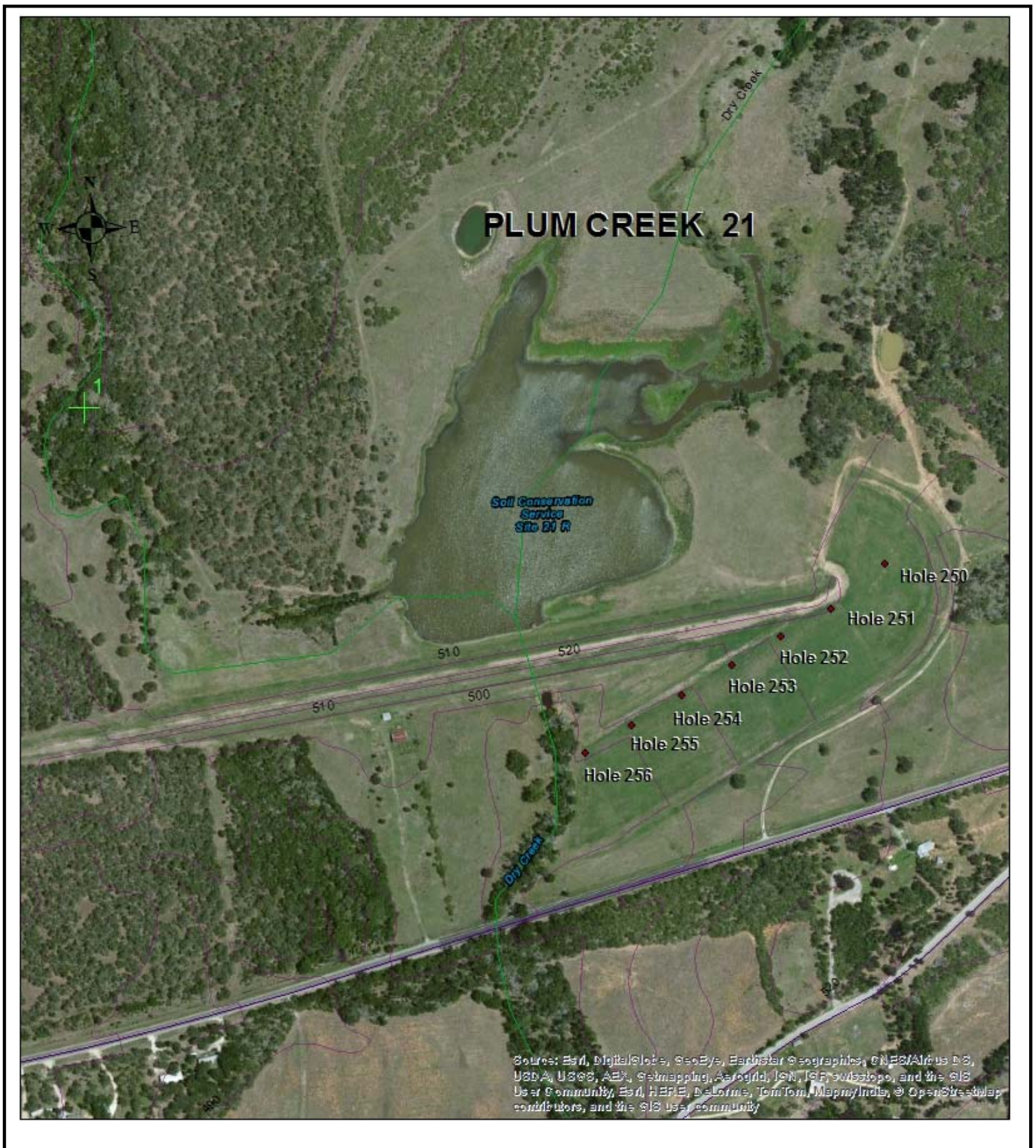


Figure 2 – Borehole Locations

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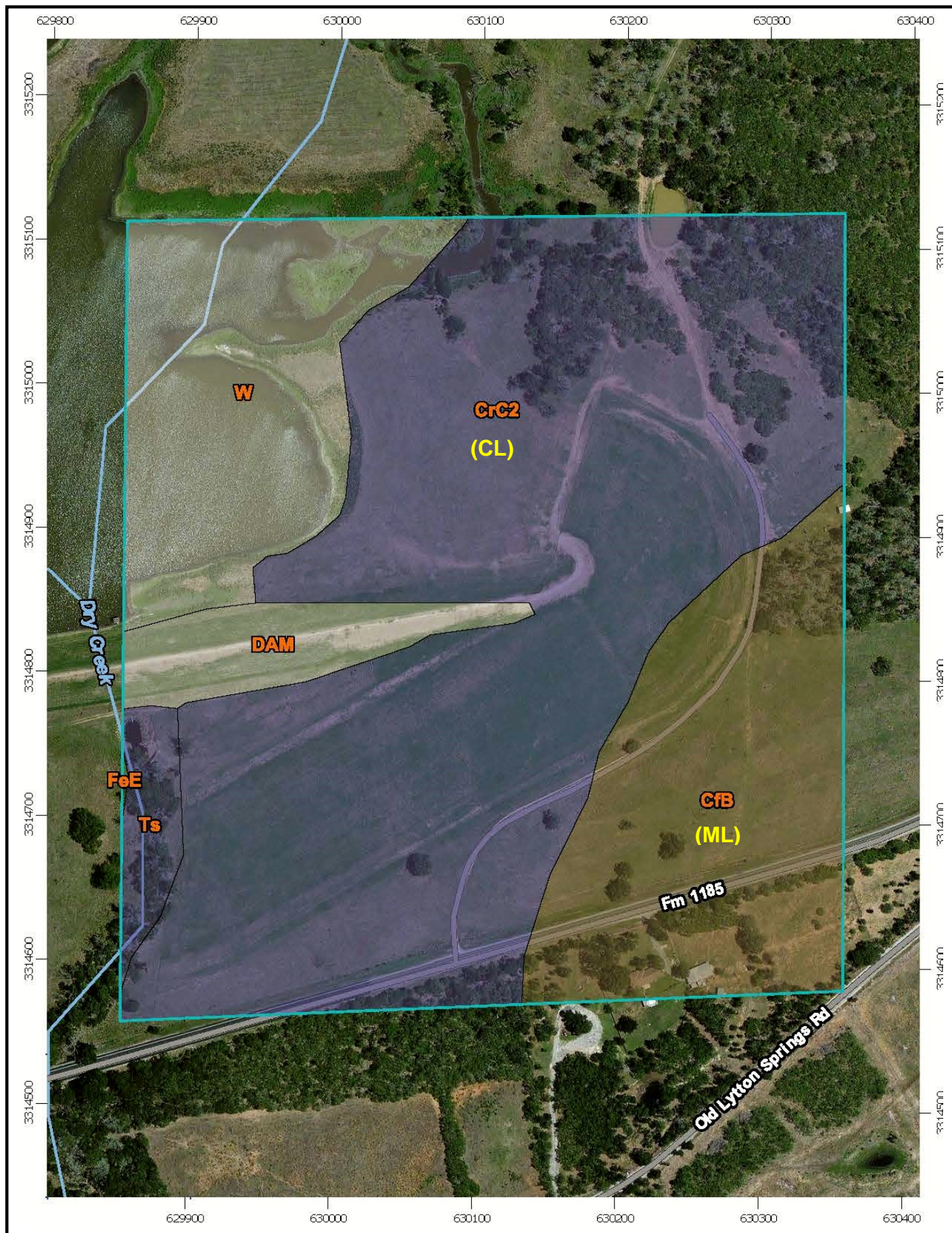


Figure 3 – Soil Map

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Attachment 1

NRCS-ENG-354

Soil Mechanics Data

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9/12/14		TX Plum Creek No. 21 7564 Caldwell Co.	WF-07		Mechanical Analysis Grain Size Distribution Expressed as Percent Finer by Dry Weight																		Atterberg Limits		Unified Classification	Soluble Salts %	Natural Moisture (%)	Natural Dry Unit Weight (lb/ft ³)	Percent Saturation	Dispersion				Moisture-Density		G _s	Unconfined Compressive Strength (psf)	pH
Lab. Sample No.	Field Sample No.		Depth (ft)	Sample Type	Fines					Sand					Gravel								L.L.	P.I.						Crumb Test		Pinhole	ASTM D698					
					0.002 mm	0.005 mm	0.02 mm	0.05 mm	#200 0.074 mm	#140 0.105 mm	#60 0.250 mm	#40 0.42 mm	#20 0.84 mm	#10 2.0 mm	#4 4.76 mm	3/8" 9.525 mm	1/2" 12.7 mm	3/4" 19.05 mm	1" 25.4 mm	1 1/2" 38.1 mm	3" 76.2 mm	1 Hr								4 Hr	Max γ _d (pcf)		w ₀ %					
F14	342	250.1	Approx. 10+85 CL AS 21' left	5' - 7.5'	Undist.	26	36	43	63	75	89	98	99	99	100								50	31	CH	<0.5	22.1			31	2	3				2.73		
	343	250.2	Approx. 10+85 CL AS 21' left	10' - 12.5'	Undist.	31	43	60	79	90	-	-	-	-	100								52	33	CH	<0.5	25.0	94.4	84.0	26	1	1				2.75	4,015	
	344	251.1	Approx. 14+05 CL AS 115' left	0' - 2.5'	Undist.	38	49	55	71	82	-	-	-	-	100								45	26	CL	<0.5	6.3			12	1	1				2.73		
	345	251.2	Approx. 14+05 CL AS 115' left	2.5' - 5'	Undist.	33	41	49	63	73	85	97	98	99	100								45	25	CL	<0.5	13.1	108	61.6	15	1	2				2.72	12,110	
	346	251.3	Approx. 14+05 CL AS 115' left	5' 7.5'	Undist.	27	34	42	64	78	99	100											42	20	CL	<0.5	12.8	88.6	37.8	18	2	3				2.73	2,182*	
	347	251.4	Approx. 14+05 CL AS 115' left	7.5' - 10'	Undist.	31	42	55	74	92	-	-	-	-	100								52	32	CH	<0.5	17.6	91.6	55.2	24	3	4				2.75	2,303*	
	348	251.5	Approx. 14+05 CL AS 115' left	10' - 12.5'	Undist.	37	52	69	83	92	-	-	-	-	100								60	38	CH	<0.5	20.7	101	81.4	21	1	1				2.76	6,268	
	349	251.6	Approx. 14+05 CL AS 115' left	12.5' - 15'	Undist.	37	50	69	85	93	-	-	-	-	100								63	41	CH	<0.5	18.0	96.9	64.5	20	1	2				2.74	1,947	
	350	251.7	Approx. 14+05 CL AS 115' left	15' - 17.5'	Undist.	32	42	60	80	91	-	-	-	-	100								51	29	CH	<0.5	14.0	93.1	45.5	12	1	1				2.76	1,757*	
	351	251.8	Approx. 14+05 CL AS 115' left	20' - 22.5'	Undist.	41	56	75	92	98	-	-	-	-	100								63	41	CH	<0.5	22.1	93.3	71.9	18	1	1				2.76	3,347	
	352	251.9	Approx. 14+05 CL AS 115' left	25' - 26.5'	Undist.	24	35	52	67	81	-	-	-	-	100								46	25	CL	<0.5	15.7			17	1	1				2.78		
	353	251.10	Approx. 14+05 CL AS 115' left	30' - 31'	Undist.	23	33	50	79	91	-	-	-	-	100								48	24	CL	1.0	16.6	97.9	62.0	12	1	1				2.70	6,391	
	354	252.1	Approx. 16+04 CL AS118' Left	0' - 2.5'	Undist.	24	31	44	65	78	-	-	-	-	100								30	14	CL	<0.5	8.2	89.6	25.7	16	1	1				2.64	8,974*	

9/12/14		TX Plum Creek No. 21 7564 Caldwell Co. Location and Description	WF-07		Mechanical Analysis Grain Size Distribution Expressed as Percent Finer by Dry Weight																Atterberg Limits		Unified Classification	Soluble Salts %	Natural Moisture (%)	Natural Dry Unit Weight (lb/ft³)	Percent Saturation	Dispersion				Moisture-Density		G _s	Unconfined Compressive Strength (psf)	pH	
Lab. Sample No.	Field Sample No.		Depth (ft)	Sample Type	Fines					Sand					Gravel						L.L.	P.I.						Double Hydrometer	Crumb Test		Pinhole	ASTM D698					
					0.002 mm	0.005 mm	0.02 mm	0.05 mm	#200 0.074 mm	#140 0.105 mm	#60 0.250 mm	#40 0.42 mm	#20 0.84 mm	#10 2.0 mm	#4 4.76 mm	3/8" 9.525 mm	1/2" 12.7 mm	3/4" 19.05 mm	1" 25.4 mm	1 1/2" 38.1 mm									3" 76.2 mm	1 Hr		4 Hr	Max γ _d (pcf)				w ₀ %
355	252.2	Approx. 16+04 CL AS118' Left	5' - 7.5'	Undist.	45	57	78	92	95	-	-	-	-	100							66	45	CH	1.2	18.4	97.8	67.6	9	1	2			2.74	8,732			
356	252.3	Approx. 16+04 CL AS118' Left	10' - 12.5'	Undist.	42	59	79	92	96	-	-	-	-	100							66	43	CH	<0.5	22.2	92.6	71.7	32	2	2			2.74	3,640*			
357	252.4	Approx. 16+04 CL AS118' Left	15' - 17.5'	Undist.	23	34	50	80	92	-	-	-	-	100							46	25	CL	<0.5	16.4	90	50.3	35	2	2			2.72	1,598			
358	252.5	Approx. 16+04 CL AS118' Left	25' - 26'	Small	25	35	45	63	78	-	-	-	-	100							45	24	CL	0.5	18.1	94.3	61.7	16	1	1			2.72	2,498*			
359	253.1	Approx. 18+04 CL AS120' Left	10' - 12.5'	Small	36	49	49	92	98	-	-	-	-	100							59	37	CH	<0.5	17.0			20	1	2			2.71				
360	253.2	Approx. 18+04 CL AS120' Left	20'- 22'	Small	29	42	53	77	86	-	-	-	-	100							52	30	CH	1.5	19.1	97.1	68.7	12	1	1			2.74	8,837*			
361	254.1	Approx. 20+03 CL AS117' Left	5' - 7.5'	Small	25	32	42	53	66	73	96	99	100								35	19	CL	<0.5	11.7	106	52.7	41	3	4			2.71	9,222			
362	254.2	Approx. 20+03 CL AS117' Left	15' - 17.5'	Small	31	42	54	78	87	-	-	-	-	100							49	28	CL	2.1	18.9	95.9	66.5	14	1	1			2.73	5,177			
363	255.1	Approx. 22+03 CL AS 116' Left	5' - 7.5'	Small	25	36	48	78	89	-	-	-	-	100							47	24	CL	<0.5	20.2	98.2	73.6	33	2	2			2.77	3,908*			
364	255.2	Approx. 22+03 CL AS 116' Left	10' - 12.5'	Small	31	39	52	77	87	-	-	-	-	100							49	27	CL	<0.5	22.0	101	87.8	15	2	2			2.74	6,656			
365	256.1	Approx. 22+04 CL AS 117' Left	3' - 5.5'	Small	37	48	65	85	91	-	-	-	-	100							56	35	CH	<0.5	19.6	97.9	72.4	23	1	1			2.73	6,349			

Attachment 2

Undisturbed Sample Characteristics

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MATERIALS TESTING REPORT		U.S. DEPARTMENT of AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		UNDISTURBED SAMPLE CHARACTERISTICS	
PROJECT and STATE <u>Plum Creek 21, TX</u>					
TESTED AT <u>NDCSme - Lincoln, NE</u>			APPROVED BY		DATE <u>1-12-14</u>
FIELD SAMPLE NO.	DEPTH (FT.) FROM TO		SAMPLE LOCATION		TYPE OF SAMPLE
<u>250.1</u>	<u>5 7.5'</u>		<u>Forebay (A) Aux. Spwy</u>		<u>2.8" Shelby</u>
COLOR		RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE
<u>Tan</u>		<u>Moist</u>	<u>—</u>	<u>—</u>	<u>Gritty Silty</u>
POCKET PENETROMETER (T.S.F.)		VISUAL CLASSIFICATION (USCS)			
<u>—</u>		<u>SM</u>			
ω <u>21.8</u> % γ _d <u>152</u> g/cc		DESCRIBED BY <u>SKK, RM</u>			

REMARKS

Would not push out tube several times.

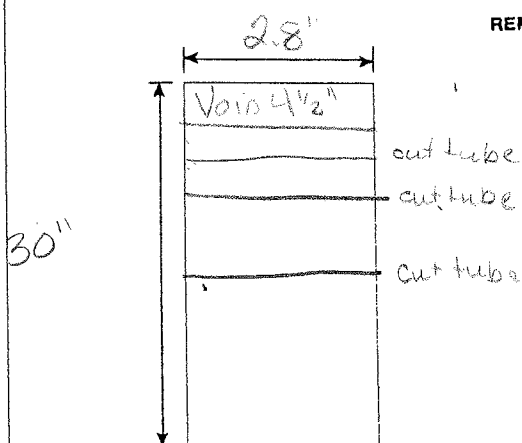
Sample sections all peeled when extruded. Bottom half was approximately 12" when in the tube and expanded to 16" when extruded.

Silty, sandy material

Index only, nothing usable for complex tests

Unit weight & H₂O taken

Photos 2+2+2



FIELD SAMPLE NO.	DEPTH (FT.) FROM TO		SAMPLE LOCATION		TYPE OF SAMPLE	LABORATORY NO.
<u>250.2</u>	<u>10 12.5'</u>		<u>Forebay (A) Aux. Spwy</u>		<u>2.8" Shelby</u>	<u>15-59</u>
COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (T.S.F.)	VISUAL CLASSIFICATION (USCS)
<u>Tanish/Gray</u>	<u>Moist</u>	<u>—</u>	<u>—</u>	<u>Gritty Silty</u>	<u>—</u>	<u>SM</u>
ω <u>24.99</u> % γ _d <u>151</u> g/cc (From Qu)		DESCRIBED BY <u>SKK, RM</u>				

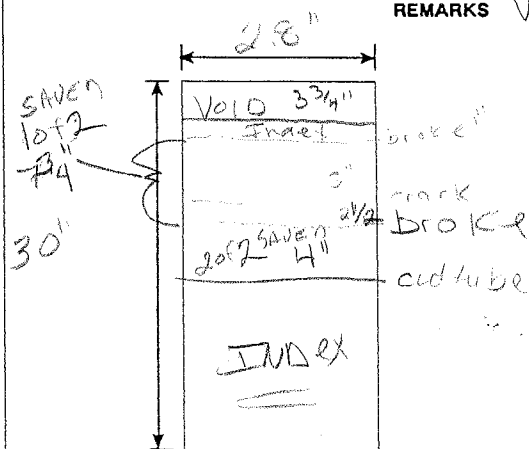
REMARKS

Would not push out tube.

SAVED 7 3/4" (1 of 2) from top half and SAVED 4" (2 of 2) from top half. Bottom half peeled and had several breaks & cracks so this half is INDEX only.

Try to get complex test from 1 of 2 first.

Photos 4



MATERIALS TESTING REPORT	U.S. DEPARTMENT of AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	UNDISTURBED SAMPLE CHARACTERISTICS	

PROJECT and STATE

Plum Creek 21, TX

TESTED AT

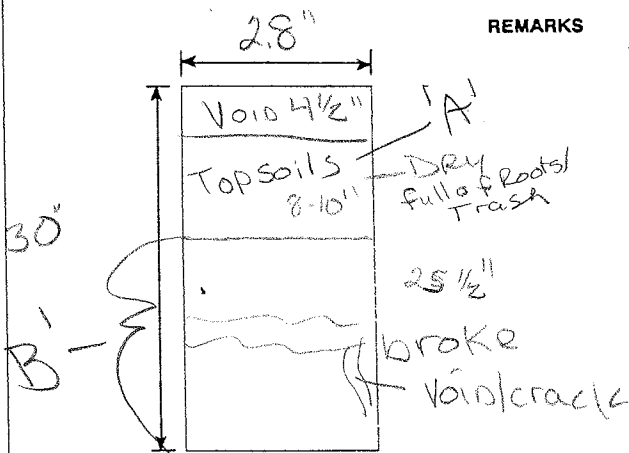
APPROVED BY

DATE

1-12-15

FIELD SAMPLE NO.	DEPTH (FT.)		SAMPLE LOCATION	TYPE OF SAMPLE	LABORATORY NO.	
	FROM	TO				
251.1	0	5'	F: Material crest - Aux. Spwy F14-344	28" Shelby	15-60	
COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (T.S.F.)	VISUAL CLASSIFICATION (USCS)
Lt Brown	DRY	V. STIFF	Roots/Trash	SMOOTH	—	CH
MD. Brown	DAMP	V. STIFF	Roots/Trash	SMOOTH	—	CH
ω 14.9 % γ _d 1.71 g/cc						
DESCRIBED BY SKK, R/M						

REMARKS



Top 8-10" TOPSOIL with dry roots/trash - 'A'

Bottom 12-15" lots of breaks, cracks & voids w/ roots - 'B'

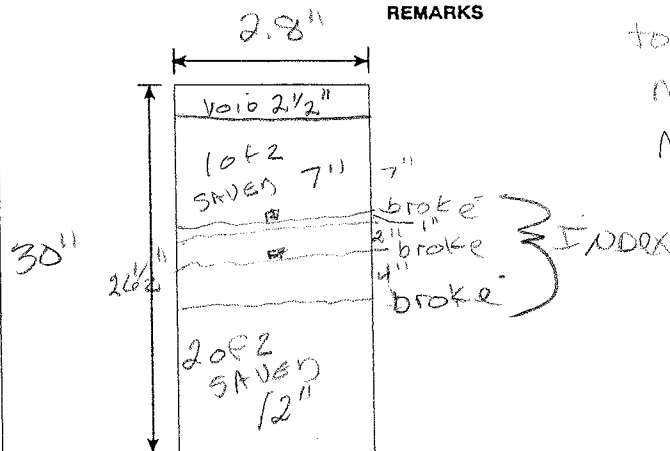
INDEX ONLY

Unit weight & H₂O taken

Photos 2

FIELD SAMPLE NO.	DEPTH (FT.)		SAMPLE LOCATION	TYPE OF SAMPLE	LABORATORY NO.	
	FROM	TO				
251.2	2.5	5'	crest Aux. Spwy	28" Shelby	15-61	
COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (T.S.F.)	VISUAL CLASSIFICATION (USCS)
Tannish Brown	DAMP	V. STIFF	Fine Roots Throughout	SMOOTH	4.5+	CH
ω 13.11 % γ _d 1.72 g/cc (From Q4)						
DESCRIBED BY SKK						

REMARKS



top 7" slightly darker brown & more moisture than rest of sample (1 of 2)

Middle of sample broke, use for INDEX

Bottom 12" some cracks & dryer (2 of 2)

Recommend 1 of 2 for complex tests.

Photos 2

1-20-15

MATERIALS TESTING REPORT	U.S. DEPARTMENT of AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	UNDISTURBED SAMPLE CHARACTERISTICS	

PROJECT and STATE

Plum Creek 21, TX

TESTED AT

NDCSMC - Lincoln, NE

APPROVED BY

DATE

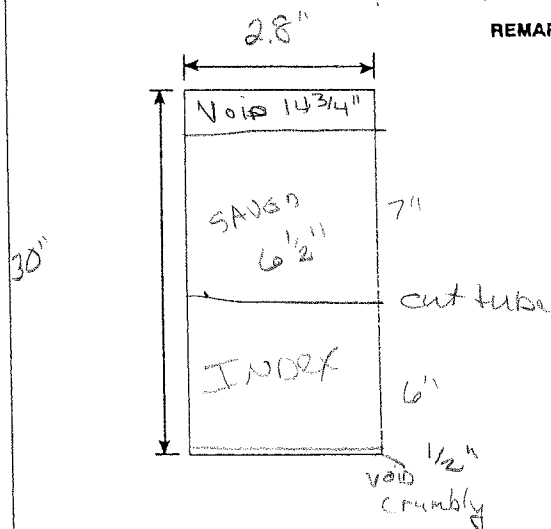
1-20-15

FIELD SAMPLE NO.	DEPTH (FT.)		SAMPLE LOCATION	TYPE OF SAMPLE	LABORATORY NO.	
	FROM	TO				
251.3	5	6.5'	Crest Aux. Spwy F14-346	28" Shelby	15-62	
COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (T.S.F.)	VISUAL CLASSIFICATION (USCS)
Tan	DRY	V. STIFF	—	Smooth	—	CH
ω 127.6% γ _d 142 g/cc (From QU)						
DESCRIBED BY SKK						

REMARKS

Bottom consolidated ^{approx.} 1 1/2", then would not push.
cut tube

Very dry crumbly sample.

Top half stayed together when extruded,
horizontal cracks though.Bottom half fell apart - Index only
on this section.

Photos 2

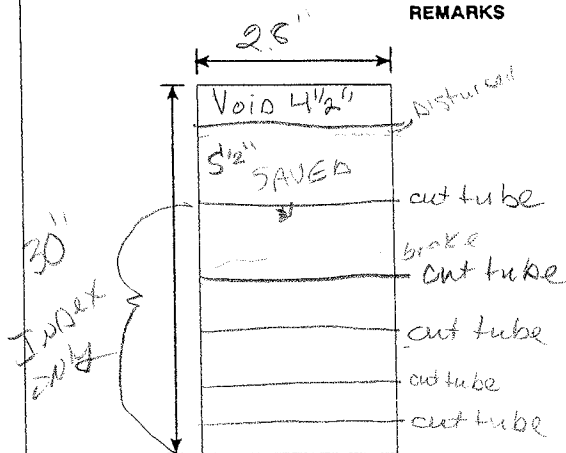
FIELD SAMPLE NO.	DEPTH (FT.)		SAMPLE LOCATION	TYPE OF SAMPLE	LABORATORY NO.	
	FROM	TO				
251.4	7.5	10'	Crest Aux Spwy F14-347	28" Shelby	15-63	
COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (T.S.F.)	VISUAL CLASSIFICATION (USCS)
TAN	DAMP	V. STIFF	—	Smooth	4.5+	CH
ω 17.5% γ _d 147 g/cc (From QU)						
DESCRIBED BY SKK, RM						

REMARKS

Would not push, cut tube 5 times

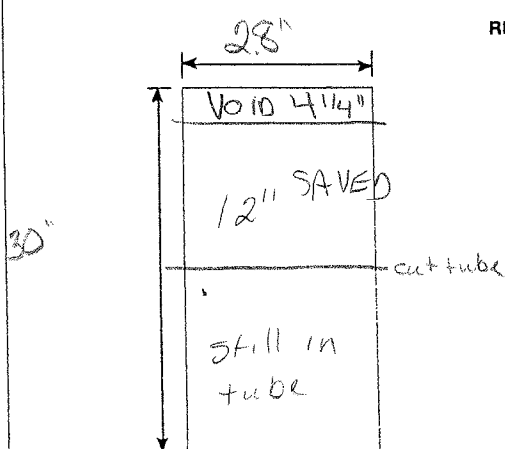
Only able to salvage top 5", will try
to run complex test on this section.

Rest of sample Index only.



Photos 2

MATERIALS TESTING REPORT		U.S. DEPARTMENT of AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		UNDISTURBED SAMPLE CHARACTERISTICS		
PROJECT and STATE Plum Creek 21, TX						
TESTED AT NDCS mc - Lincoln NE			APPROVED BY		DATE 1-20-15	
FIELD SAMPLE NO.	DEPTH (FT.) FROM TO		SAMPLE LOCATION		TYPE OF SAMPLE	LABORATORY NO.
251.5	10	12.5'	Crest Aux. Spwy F14-348			15-64
COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (T.S.F.)	VISUAL CLASSIFICATION (USCS)
TAN	DAMP	V. STIFF	—	Smooth	—	CH
ω 20.71 % γ _d 162 g/cc (From QU) DESCRIBED BY SAK, RM						

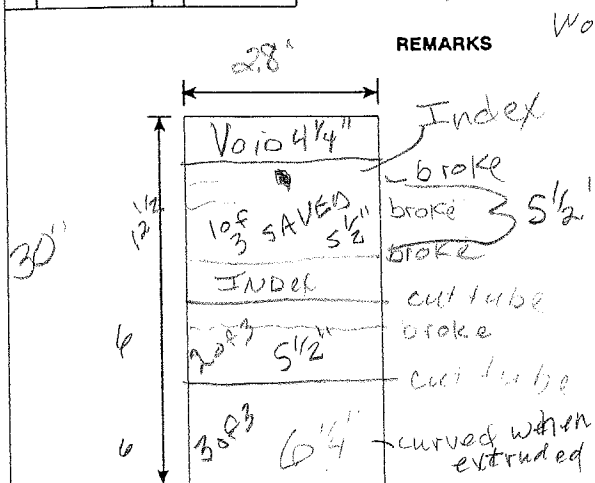


REMARKS Would not push, cut tube

Top half pushed, bottom half would not push. Left bottom half in tube as there is enough of top half to run complex tests. Top & bottom of sample look the same so assuming bottom half is same material as top half.

Photos 2

FIELD SAMPLE NO.	DEPTH (FT.) FROM TO		SAMPLE LOCATION		TYPE OF SAMPLE	LABORATORY NO.
251.6	12.5	15'	Aux Spwy Crest F14-349		28" Shelby	15-65
COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (T.S.F.)	VISUAL CLASSIFICATION (USCS)
Marbled Tan/Grays	DAMP	V STIFF	—	SMOOTH	4.5 ⁺	CH
ω 18.00 % γ _d 155 g/cc (From QU) DESCRIBED BY SKK						



REMARKS Would not push, cut tube

Sample cracked & broke in several places when extruded. Use lot 3 for complex tests, first if that doesn't stay together use 2 of 3 next, last resort 3 of 3.

Photos 2

1-21-15

MATERIALS TESTING REPORT	U.S. DEPARTMENT of AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	UNDISTURBED SAMPLE CHARACTERISTICS	

PROJECT and STATE

Plum Creek 21, TX

TESTED AT

NDCSMC - Lincoln, NE

APPROVED BY

DATE

1-21-15

FIELD SAMPLE NO.	DEPTH (FT.)		SAMPLE LOCATION	TYPE OF SAMPLE	LABORATORY NO.	
	FROM	TO				
251.7	15	17.5'	Crest Aux Spw F14-350	2.8" Shelby	15-66	
COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (T.S.F.)	VISUAL CLASSIFICATION (USCS)
Tannish	Damp	V. Stiff	—	Smooth	4.5 ⁺	CH

 ω 139.9% γ_d 1.49 g/cc (From QU)

DESCRIBED BY

SKK

REMARKS Would not push, cut tube, several times. Bottom half of top section would not push still in tube. Was able to extrude 3 sections of this sample, all have horizontal cracks & breaks. Use 1 of 3 or 2 of 3 first for complex tests, then 3 of 3 if needed.

30"

Photos 2

FIELD SAMPLE NO.	DEPTH (FT.)		SAMPLE LOCATION	TYPE OF SAMPLE	LABORATORY NO.	
	FROM	TO				
251.8	20	22.5'	Crest Aux Spw F14-351	2.8" Shelby	15-67	
COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (T.S.F.)	VISUAL CLASSIFICATION (USCS)
Tannish/ Gray	Damp	V. Stiff	—	Smooth	4.5 ⁺	CH

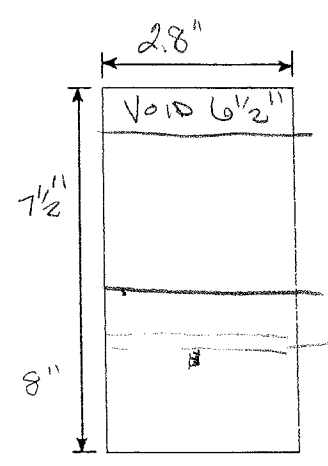
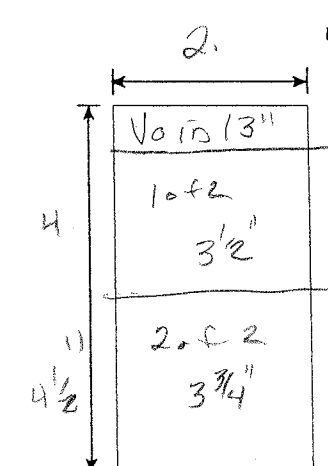
ω 22.06% γ_d 1.49 g/cc (From QU)

DESCRIBED BY SKK

REMARKS Push 20-22.5 Rec. 95% Would not push, cut tube. Horizontal breaks in every section of sample, crumbly & flaky. Use 1 of 3 or 3 of 3 first for complex tests. Very fragile.

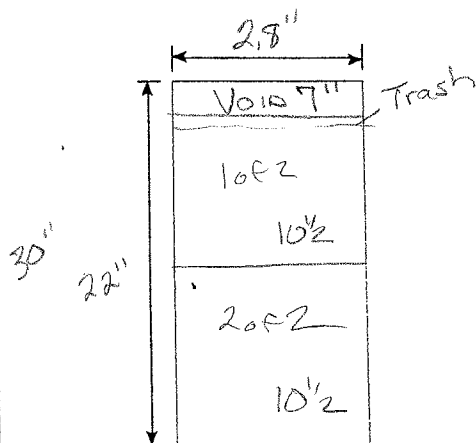
30"

Photos 3

MATERIALS TESTING REPORT		U.S. DEPARTMENT of AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		UNDISTURBED SAMPLE CHARACTERISTICS		
PROJECT and STATE Plum Creek 21, TX						
TESTED AT NDCSMC-LINCOLN, NE				APPROVED BY		DATE 1-22-15
FIELD SAMPLE NO.	DEPTH (FT.) FROM TO		SAMPLE LOCATION		TYPE OF SAMPLE	LABORATORY NO.
251.9	25	26.5'	Crest Aux Spwy F14-352		2.8" Shelby	15-68
COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (T.S.F.)	VISUAL CLASSIFICATION (USCS)
LT. BROWN	DRY	V. St. FF	—	Gritty	4.5+	SC
ω 17.1 % γ _d 1.50 g/cc				DESCRIBED BY SK/C		
<div><div><p>2.8"</p><p>Void 6 1/2"</p><p>7 1/2"</p><p>24"</p><p>8"</p><p>cut tube</p><p>unit wt</p></div><div><p>REMARKS</p><p>Refusal @ 26.5' in siltstone Would not push, cut tube.</p><p>Gritty, silty material, fell apart when removed from cradle. <u>INDEX only</u>, unit weight & H₂O taken</p><p>Photos 3</p></div></div>						
FIELD SAMPLE NO.	DEPTH (FT.) FROM TO		SAMPLE LOCATION		TYPE OF SAMPLE	LABORATORY NO.
251.10	30	31'	Crest Aux Spwy F14-353		2.8" Shelby	15-69
COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (T.S.F.)	VISUAL CLASSIFICATION (USCS)
Med Gray	DAMP	V. St. FF	—	Gritty	—	SC
ω 16.55 % γ _d 1.57 g/cc (From Qu)				DESCRIBED BY SK/C		
<div><div><p>2"</p><p>Void 13"</p><p>10 + 2</p><p>3 1/2"</p><p>cut tube</p><p>2.5 + 2</p><p>3 3/4"</p><p>4"</p><p>11"</p><p>24"</p></div><div><p>REMARKS</p><p>Refusal @ 31'</p><p>Would not push, cut tube, consolidated 1" on bottom when trying to push before cutting tube.</p><p>Very crumbly material, limited amount of material.</p><p>Photos 2</p></div></div>						

MATERIALS TESTING REPORT		U.S. DEPARTMENT of AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		UNDISTURBED SAMPLE CHARACTERISTICS		
PROJECT and STATE Plum Creek 21 TX						
TESTED AT NDC Smc - Lincoln, NE				APPROVED BY		DATE 1-22-15
FIELD SAMPLE NO.	DEPTH (FT.) FROM TO		SAMPLE LOCATION		TYPE OF SAMPLE	LABORATORY NO.
252.1	0	2.5'	Aux. Spwy Slope 200' DS. Crest F14-354		2.8" Shelby	15-70
COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (T.S.F.)	VISUAL CLASSIFICATION (USCS)
BROWN	DRY	V Stiff	Roots, Trash	Smooth	—	CL
ω 8.17 % γ _d 1.43 g/cc (From Qu)						
DESCRIBED BY SKK						

REMARKS

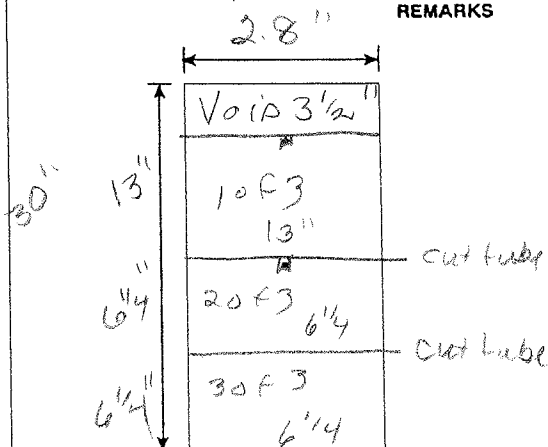


Dry material Roots throughout Sample. Topsoil type material Vertical & horizontal cracks.

Photos 2

FIELD SAMPLE NO.	DEPTH (FT.) FROM TO		SAMPLE LOCATION		TYPE OF SAMPLE	LABORATORY NO.
252.5	S	7.5'	Slope Aux Spwy 200' DS. Crest F14-355		2.8" Shelby	15-71
COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (T.S.F.)	VISUAL CLASSIFICATION (USCS)
TANNISH	Moist	V Stiff	—	Smooth	4.5+	CL
ω 18.44 % γ _d 1.57 g/cc (From Qu)						
DESCRIBED BY SKK						

REMARKS



Would not push, cut tube

Very stiff clay material.
Use 10F3 or 20F3 First for complex tests. Some horizontal cracks on 30F3.

Photos 2

MATERIALS TESTING REPORT	U.S. DEPARTMENT of AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	UNDISTURBED SAMPLE CHARACTERISTICS	

PROJECT and STATE

Plum Creek 21, TX

TESTED AT

PDCSNC - Lincoln, NE

APPROVED BY

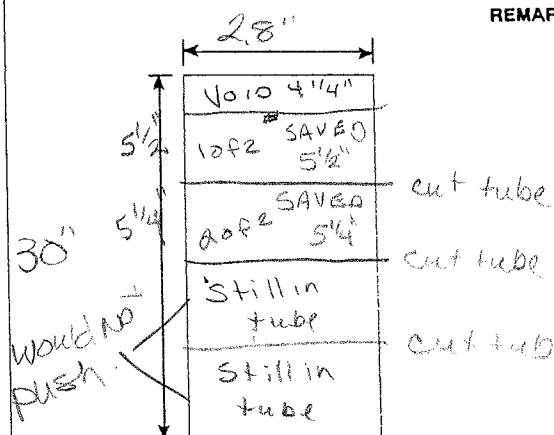
DATE

11/23/15

FIELD SAMPLE NO.	DEPTH (FT.)		SAMPLE LOCATION	TYPE OF SAMPLE	LABORATORY NO.	
	FROM	TO				
252.3	10	12.5'	Exit slope Aux Spwy 2200' DS crest F14356	28" Shelby	15-72	
COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (T.S.F.)	VISUAL CLASSIFICATION (USCS)
Tannish gray	DRY	V. stiff	—	Smooth (some gritty)	4.5	CH
ω 22.15 % γ _d 1.48 g/cc (From 0-4) Siltstone						
DESCRIBED BY JAK						

REMARKS

Would not push, cut tube.



Top half finally pushed after
cutting in half, bottom half would
not push - still in tube.

Crumbly material, flakes off,
Clay but some gritty feel also.
Use either 1 of 2 or 2 of 2
for complex tests

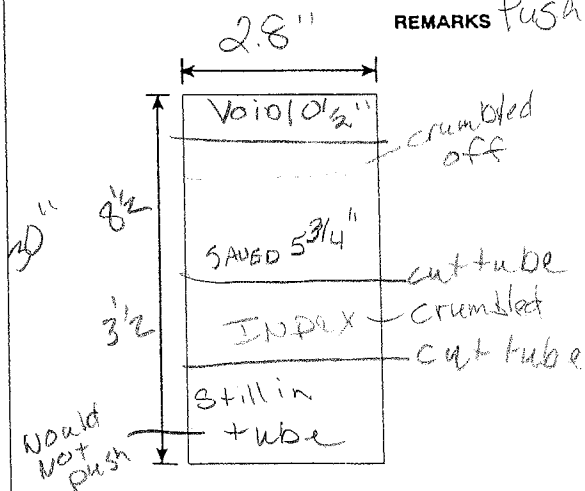
Photos 2

FIELD SAMPLE NO.	DEPTH (FT.)		SAMPLE LOCATION	TYPE OF SAMPLE	LABORATORY NO.	
	FROM	TO				
252.4	15	17'	Exit slope Aux Spwy	F14-357	28" Shelby	
COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (T.S.F.)	VISUAL CLASSIFICATION (USCS)
H. Tan	DRY	—	Very Crumbly	Smooth	—	CH
ω 14.41 % γ _d 1.44 g/cc (From 0-4)						
DESCRIBED BY JAK						

REMARKS

Push 15-17.5' Refusal @ 17'

Would not push, cut tube



Very crumbly material, DRY.

Bottom section would not push,
still in tube.

Photos 2

MATERIALS TESTING REPORT	U.S. DEPARTMENT of AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	UNDISTURBED SAMPLE CHARACTERISTICS	

PROJECT and STATE

Plum Creek 21, TX

TESTED AT

NDCS MC - Lincoln, NE

APPROVED BY

DATE

1/26/15

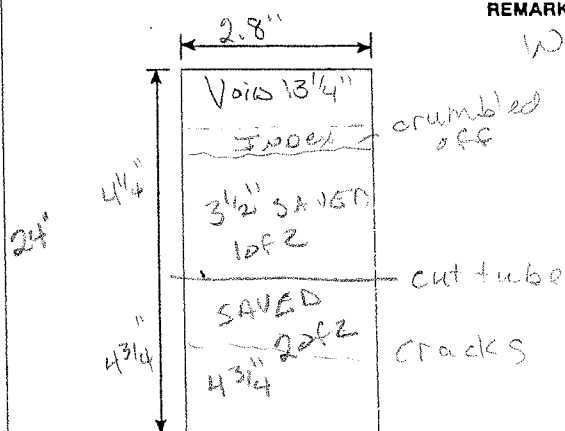
FIELD SAMPLE NO.	DEPTH (FT.)		SAMPLE LOCATION	TYPE OF SAMPLE	LABORATORY NO.	
	FROM	TO				
252.5	25	26'	Exit Slope Aux Spwy ~ 200' S of Crest F14-358	28" Shelby	15-74	
COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (T.S.F.)	VISUAL CLASSIFICATION (USCS)
Grayish	Damp	Y.S. Stiff		Gritty		SC

 ω 18.13 % γ_d 151 g/cc (FROM QU)

DESCRIBED BY

SKK

REMARKS

SL - MOD - GRAY - 40% silty sand
Would not push, cut tube

Crumbly material,
Limited amount of material.
Use 20F2 first, for complex tests.

Photos 2

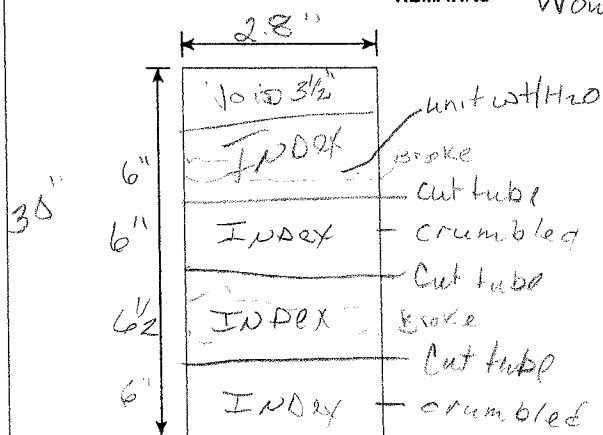
FIELD SAMPLE NO.	DEPTH (FT.)		SAMPLE LOCATION	TYPE OF SAMPLE	LABORATORY NO.	
	FROM	TO				
253.1	10	12.5'	Exit Slope Aux Spwy ~ 400' S of Crest F14-359	28" Shelby	15-75	
COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (T.S.F.)	VISUAL CLASSIFICATION (USCS)
Light Tan	DRY	Y.S. Stiff	—	Smooth		CH

ω 14.8 % γ_d 159 g/cc

DESCRIBED BY SKK

REMARKS

Would not push, cut tube.



Sample ^{broke} crumbled when extruding
and removing from cradle
DRY material

Unit weight & H₂O taken.INDEX ONLY

Photos 5

MATERIALS TESTING REPORT	U.S. DEPARTMENT of AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	UNDISTURBED SAMPLE CHARACTERISTICS
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PROJECT and STATE

Plum Creek 21, TX

TESTED AT

NRCSMC - Lincoln, NE

APPROVED BY

DATE

1-26-15

FIELD SAMPLE NO.	DEPTH (FT.) FROM TO	SAMPLE LOCATION	TYPE OF SAMPLE	LABORATORY NO.		
2532	20 22'	Exit slope Aux Spwy 340' D.S. crest F14-360	2.8" Shelby	15-76		
COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (T.S.F.)	VISUAL CLASSIFICATION (USCS)
Brownish Gray	DAMP	V. Stiff	—	Smooth	4.5+	CL

w 19.08%	γ _d 1.54 g/cc (from Qu)	REMARKS	DESCRIBED BY SKK
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Transitional contact of weathered slightly weathered intube

Would not push, cut tube

Top section (lof 2) crumbly on top. Bottom half of core would not push. Use either lof 2 or 2 of 2 for complex tests.

Photos 2

FIELD SAMPLE NO.	DEPTH (FT.) FROM TO	SAMPLE LOCATION	TYPE OF SAMPLE	LABORATORY NO.		
254.1	5 7.5'	Exit slope Aux Spwy 360' D.S. crest F14-361	2.8" Shelby	15-77		
COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (T.S.F.)	VISUAL CLASSIFICATION (USCS)
Tan	DAMP	V. Stiff	Trace Roots	Gritty	—	SC
DK. Tan	DAMP	V. Stiff	Trace Roots	Smooth to Gritty	—	CL

w 11.67%	γ _d 1.69 g/cc (from Qu)	REMARKS	DESCRIBED BY SKK
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CS Top of tube. SS bottom of tube

Top half has more gritty material called 'A' use lof 2 for complex test. Bottom half has more clay material - called 'B'.

Photos 2

MATERIALS TESTING REPORT	U.S. DEPARTMENT of AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	UNDISTURBED SAMPLE CHARACTERISTICS	

PROJECT and STATE

Plum Creek 21, TX

TESTED AT

NDCSMC - Lincoln, NE

APPROVED BY

DATE

1-28-15

FIELD SAMPLE NO.	DEPTH (FT.)		SAMPLE LOCATION	TYPE OF SAMPLE	LABORATORY NO.	
	FROM	TO				
254.2	15	17.5'	Exit Slope Aux Spwy @ 600 DSS road F14-362	2.8" Shelby	15-78	
COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (T.S.F.)	VISUAL CLASSIFICATION (USCS)
Brown	DR UP	V STIFF		Smooth		CH

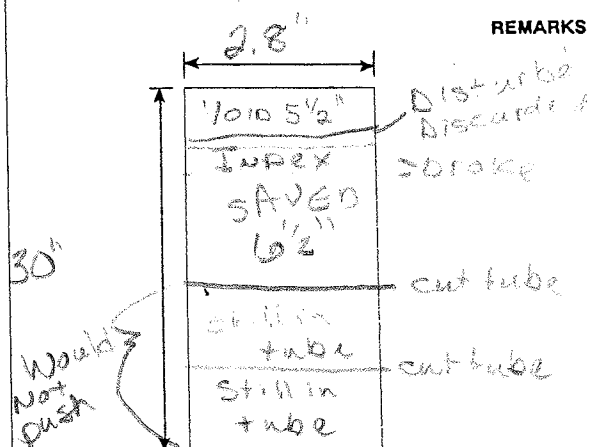
 ω 18.91 % γ_d 1.54 g/cc (From Qu)

DESCRIBED BY

SKK

REMARKS

Would not push, cut tube



Crumbly but v stiff material
Bottom half would not push -
Stiff in tube

Photos 3

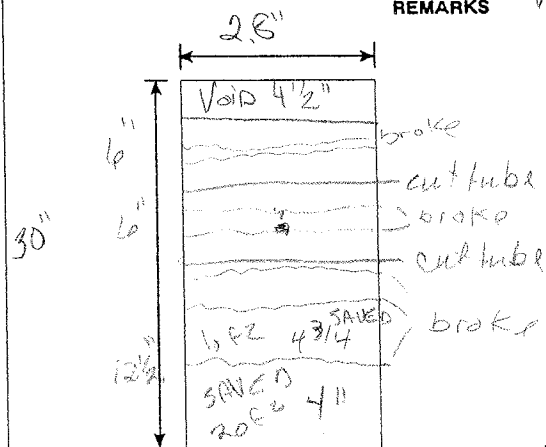
FIELD SAMPLE NO.	DEPTH (FT.)		SAMPLE LOCATION	TYPE OF SAMPLE	LABORATORY NO.	
	FROM	TO				
255.1	5	7.5'	Exit slope Aux Spwy @ 800 DSS road F14-363	2.8" Shelby	15-79	
COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (T.S.F.)	VISUAL CLASSIFICATION (USCS)
TAN	Moist	V. Stiff	Fine Roots	Gritty	4.5+	SC

ω 20.21 % γ_d 1.57 g/cc (From Qu)

DESCRIBED BY SKK

REMARKS

Would not push, cut tube

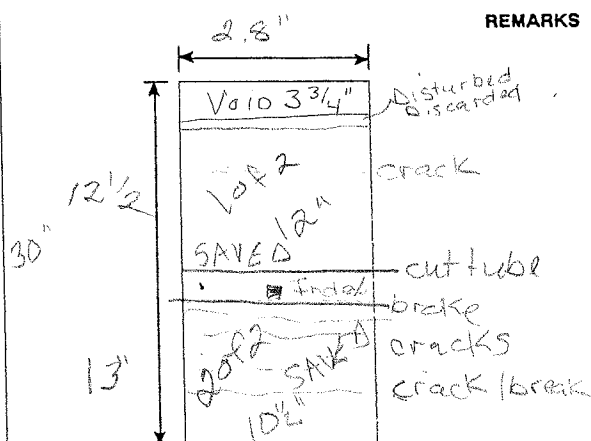


Crumbly material, sample broke
& crumbled when trying to handle
2 sections saved are very fragile
Use lot 2 first for complex tests
Rest of core is index only

1 of 2 fell apart used 2 of 2 for Qu. Photos 6

MATERIALS TESTING REPORT			U.S. DEPARTMENT of AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		UNDISTURBED SAMPLE CHARACTERISTICS		
PROJECT and STATE Plum Creek 21, TX							
TESTED AT NDCS/MC-Lincoln, NE					APPROVED BY		DATE 1-29-15
FIELD SAMPLE NO.	DEPTH (FT.) FROM TO		SAMPLE LOCATION			TYPE OF SAMPLE	LABORATORY NO.
255.2	10	12.5'	Exit Slope, Aux Spwy ~ 800' S of crest F14-364			2.8" Shelby	15-80
COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (T.S.F.)	VISUAL CLASSIFICATION (USCS)	
Med Brown	Moist	V. Stiff	Trace, Roots (fine)	Smooth gritty	4.5+	CL	
ω 21.98% γ _d 1.42 g/cc (From Qu)					DESCRIBED BY SKK		

REMARKS would not push, cut tube

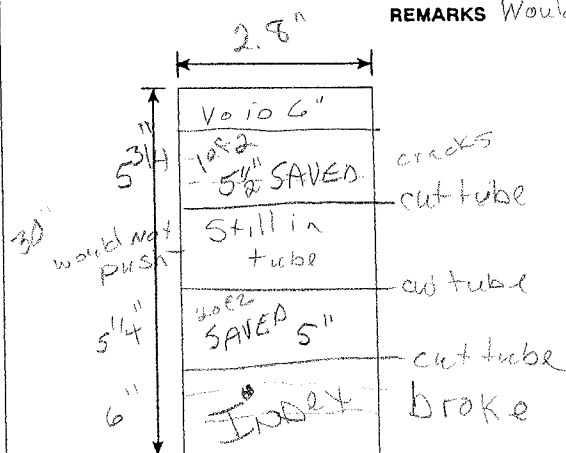


CL type material with some grit.
Use lot 2 first for complex tests.
Lots of cracks (horizontal) in lot 2

Photos 6

FIELD SAMPLE NO.			DEPTH (FT.) FROM TO		SAMPLE LOCATION			TYPE OF SAMPLE	LABORATORY NO.
256.1			3	5.5'	Exit Aux Spwy S. 11 (Alluvium)			F14-365	2.8" Shelby 15-81
COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (T.S.F.)	VISUAL CLASSIFICATION (USCS)			
Tannish	DAMP	V. Stiff	Trace fine Roots	Smooth	4.5+	CLP			
ω 19.63% γ _d 1.57 g/cc (From Qu)					DESCRIBED BY SKK				

REMARKS Would not push, cut tube.



Very stiff but crumbly material
Bottom half of top section
would not push - still in tube.
Use either lot 2 or 2 of 2
for complex tests

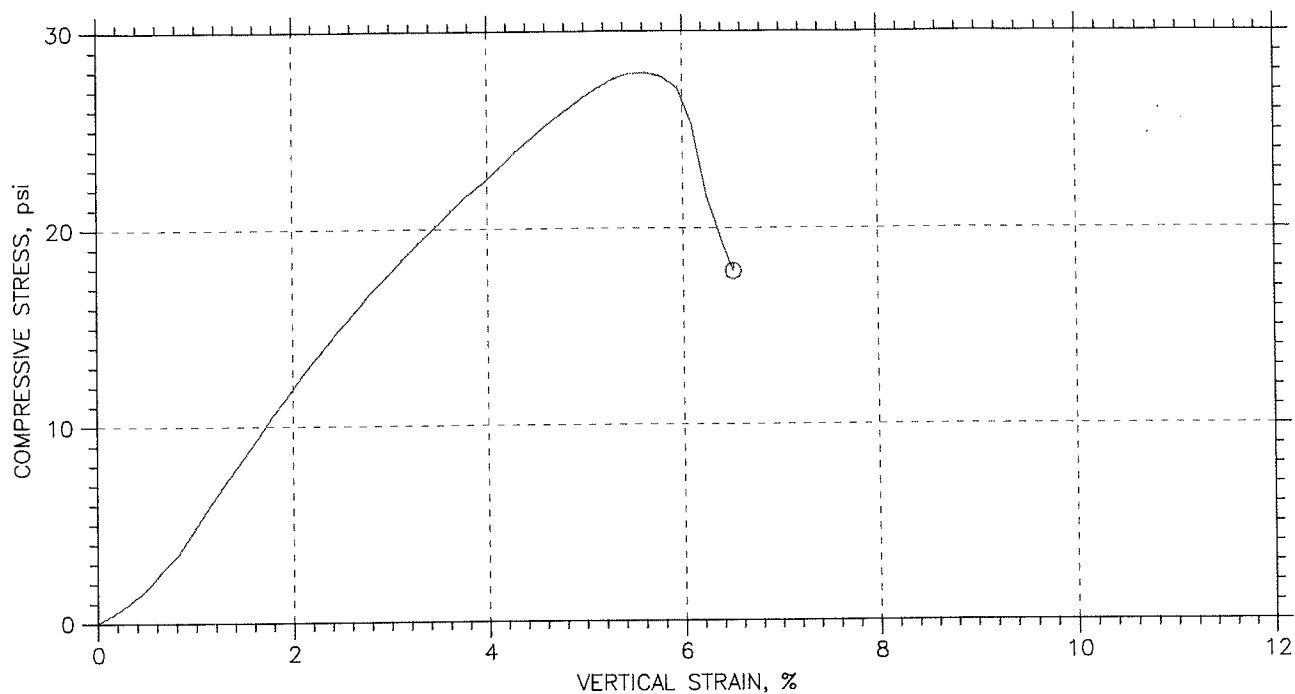
Photos 3





Attachment 3


Unconfined Compressive Strength Test Results (q_u)

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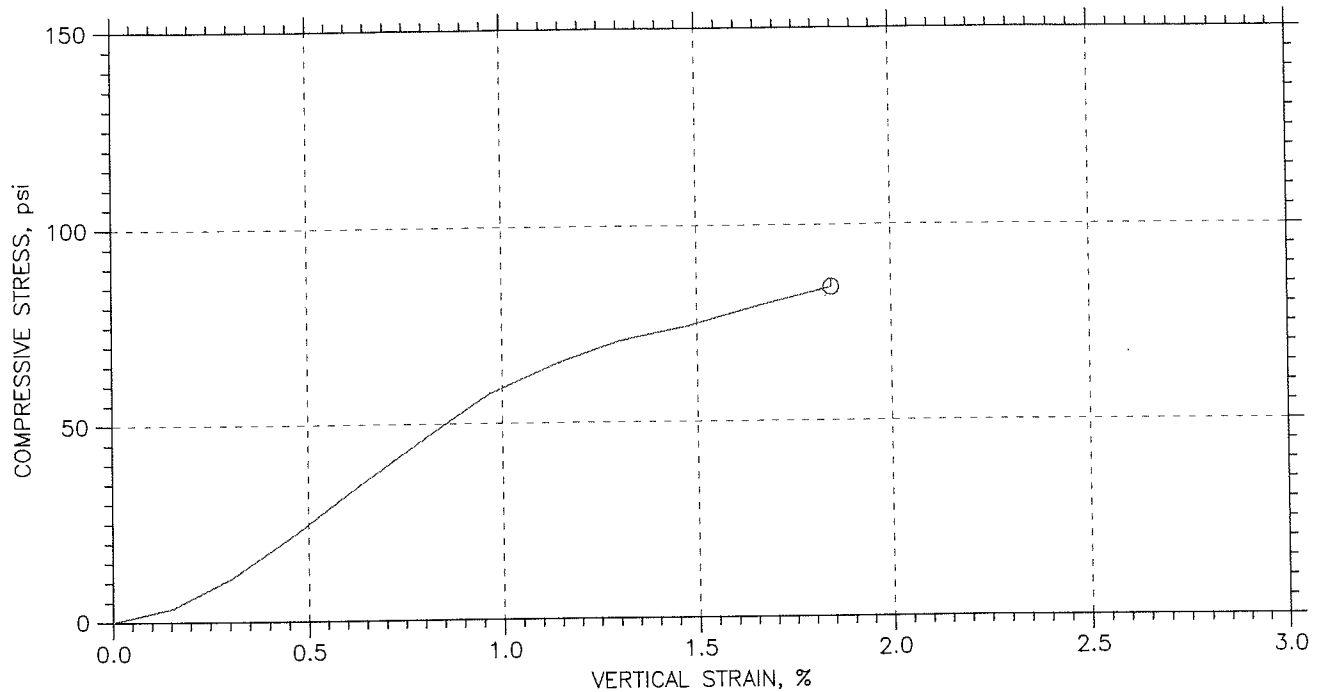
UNCONFINED COMPRESSION TEST REPORT







Symbol		⊙			
Test No.		1			
Initial	Diameter, in	2.748			
	Height, in	5.84			
	Water Content, %	24.99			
	Dry Density, pcf	94.39			
	Saturation, %	83.92			
	Void Ratio	0.819			
Unconfined Compressive Strength, psi		27.88			
Undrained Shear Strength, psi		13.94			
Time to Failure, min		5.6707			
Strain Rate, %/min		1			
Measured Specific Gravity		2.75			
Liquid Limit		---			
Plastic Limit		---			
Plasticity Index		---			
Failure Sketch					

 Natural Resources Conservation Service	Project: PLUM CREEK 21
	Location: TX
	Project No.: 15-59
	Boring No.: 250.2
	Sample Type: CORE
	Description: AUX. SPWY, F14-343
Remarks:	

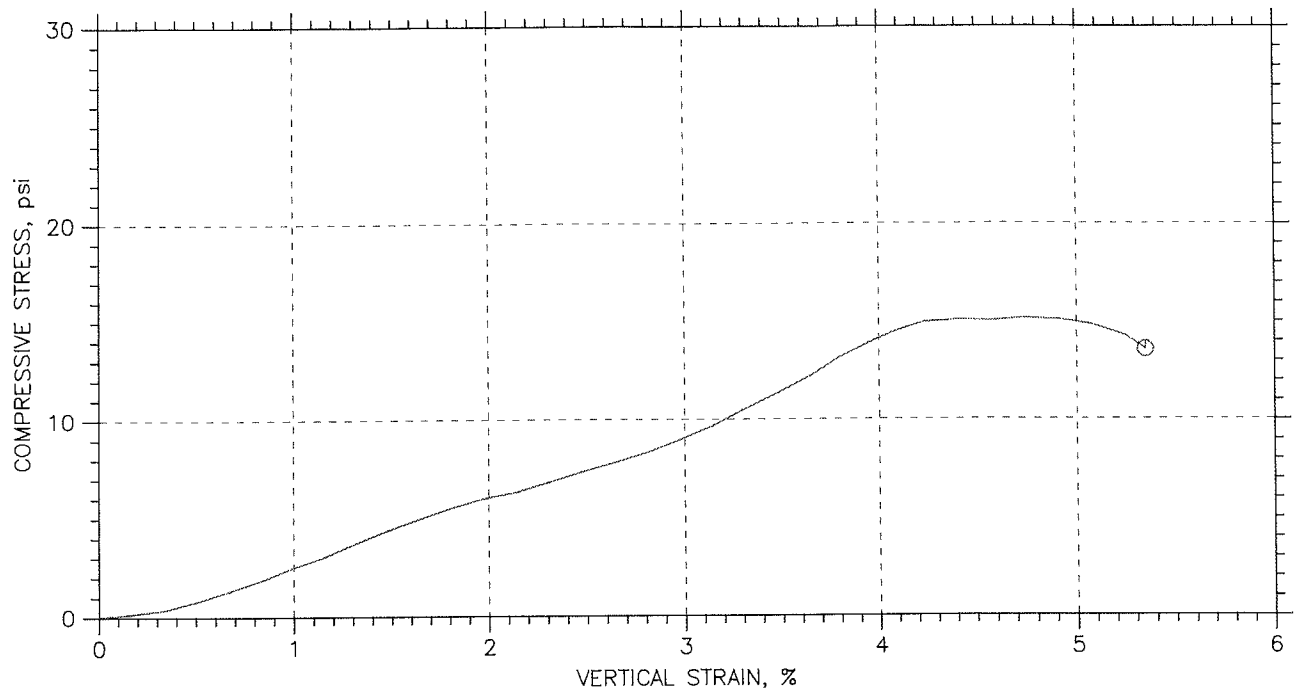
UNCONFINED COMPRESSION TEST REPORT



Symbol	⊙			
Test No.	1			
Initial	Diameter, in	2.727		
	Height, in	6.118		
	Water Content, %	13.11		
	Dry Density, pcf	107.5		
	Saturation, %	61.53		
	Void Ratio	0.58		
Unconfined Compressive Strength, psi		84.1		
Undrained Shear Strength, psi		42.05		
Time to Failure, min		1.8697		
Strain Rate, %/min		1		
Measured Specific Gravity		2.72		
Liquid Limit		---		
Plastic Limit		---		
Plasticity Index		---		
Failure Sketch				

 NRCS Natural Resources Conservation Service	Project: PLUM CREEK 21
	Location: TX
	Project No.: 15-61
	Boring No.: 251.2
	Sample Type: CORE
	Description: CREST AUX. SPWY, F14-345
Remarks: MAXED OUT LOAD CELL BEFORE SAMPLE FAILED	

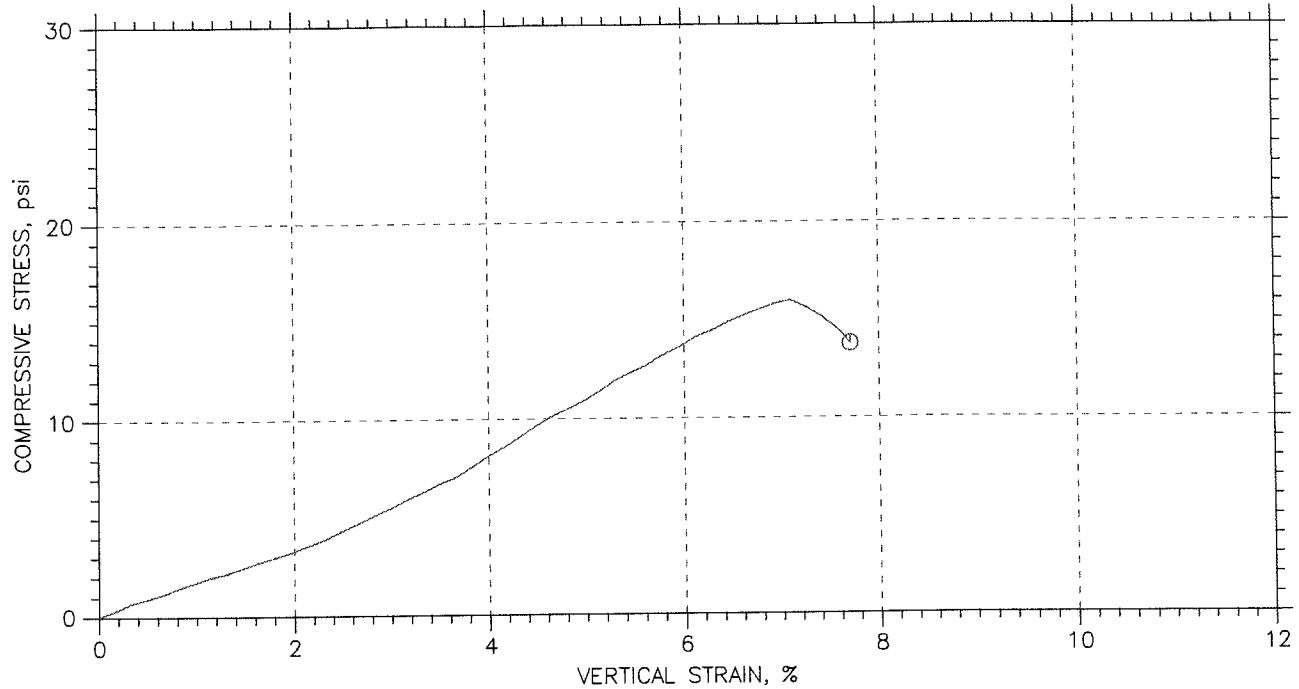
UNCONFINED COMPRESSION TEST REPORT


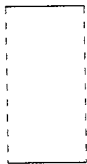




Symbol		⊙		
Test No.		1		
Initial	Diameter, in	2.723		
	Height, in	4.133		
	Water Content, %	12.76		
	Dry Density, pcf	88.63		
	Saturation, %	37.76		
	Void Ratio	0.923		
Unconfined Compressive Strength, psi		15.15		
Undrained Shear Strength, psi		7.573		
Time to Failure, min		4.8352		
Strain Rate, %/min		1		
Measured Specific Gravity		2.73		
Liquid Limit		---		
Plastic Limit		---		
Plasticity Index		---		
Failure Sketch				

 Natural Resources Conservation Service	Project: PLUM CREEK 21
	Location: TX
	Project No.: 15-62
	Boring No.: 251.3
	Sample Type: CORE
	Description: CREST AUX. SPWY, F14-346
Remarks: NOTE: HEIGHT DOES NOT MEET ASTM HEIGHT/DIAMETER REQUIREMENTS	

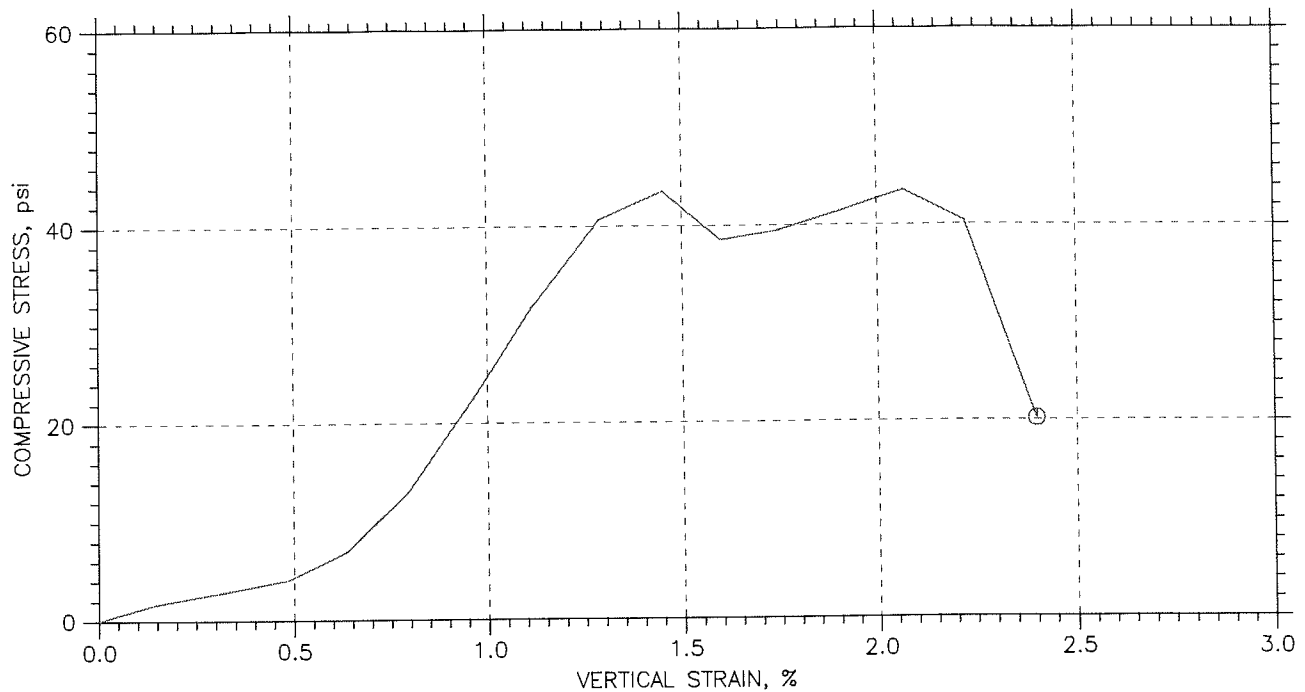
UNCONFINED COMPRESSION TEST REPORT



Symbol	①			
Test No.	1			
Initial	Diameter, in	2.758		
	Height, in	5.223		
	Water Content, %	17.55		
	Dry Density, pcf	91.59		
	Saturation, %	55.18		
	Void Ratio	0.874		
Unconfined Compressive Strength, psi		15.99		
Undrained Shear Strength, psi		7.997		
Time to Failure, min		7.169		
Strain Rate, %/min		1		
Measured Specific Gravity		2.75		
Liquid Limit		---		
Plastic Limit		---		
Plasticity Index		---		
Failure Sketch				

 Natural Resources Conservation Service	Project: PLUM CREEK 21
	Location: TX
	Project No.: 15-63
	Boring No.: 251.4
	Sample Type: CORE
	Description: CREST AUX. SPWY, F14-347
Remarks: NOTE: HEIGHT DOES NOT MEET ASTM HEIGHT/DIAMETER REQUIREMENTS	

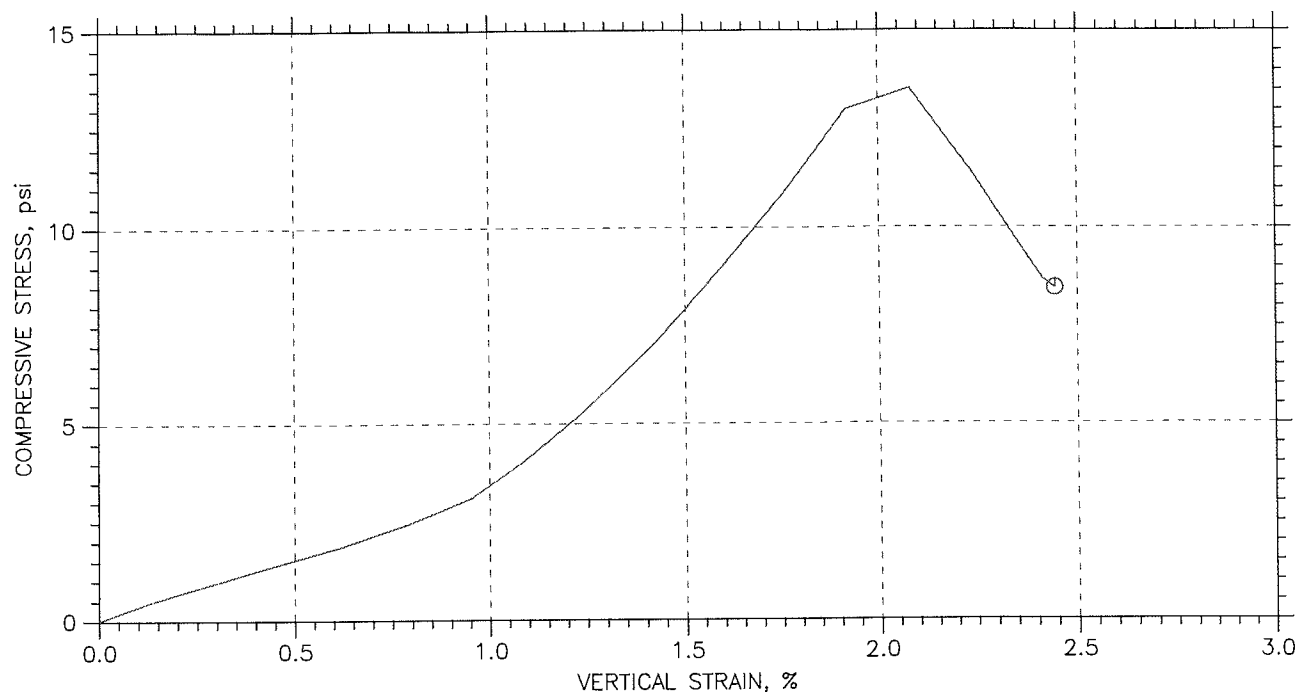
UNCONFINED COMPRESSION TEST REPORT






Symbol	⊙			
Test No.	1			
Initial	Diameter, in	2.756		
	Height, in	5.803		
	Water Content, %	20.71		
	Dry Density, pcf	101.2		
	Saturation, %	81.35		
	Void Ratio	0.703		
Unconfined Compressive Strength, psi		43.53		
Undrained Shear Strength, psi		21.76		
Time to Failure, min		2.1701		
Strain Rate, %/min		1		
Measured Specific Gravity		2.76		
Liquid Limit		---		
Plastic Limit		---		
Plasticity Index		---		
Failure Sketch				

 Natural Resources Conservation Service	Project: PLUM CREEK 21
	Location: TX
	Project No.: 15-64
	Boring No.: 251.5
	Sample Type: CORE
	Description: CREST AUX. SPWY, F14-348
Remarks:	

UNCONFINED COMPRESSION TEST REPORT

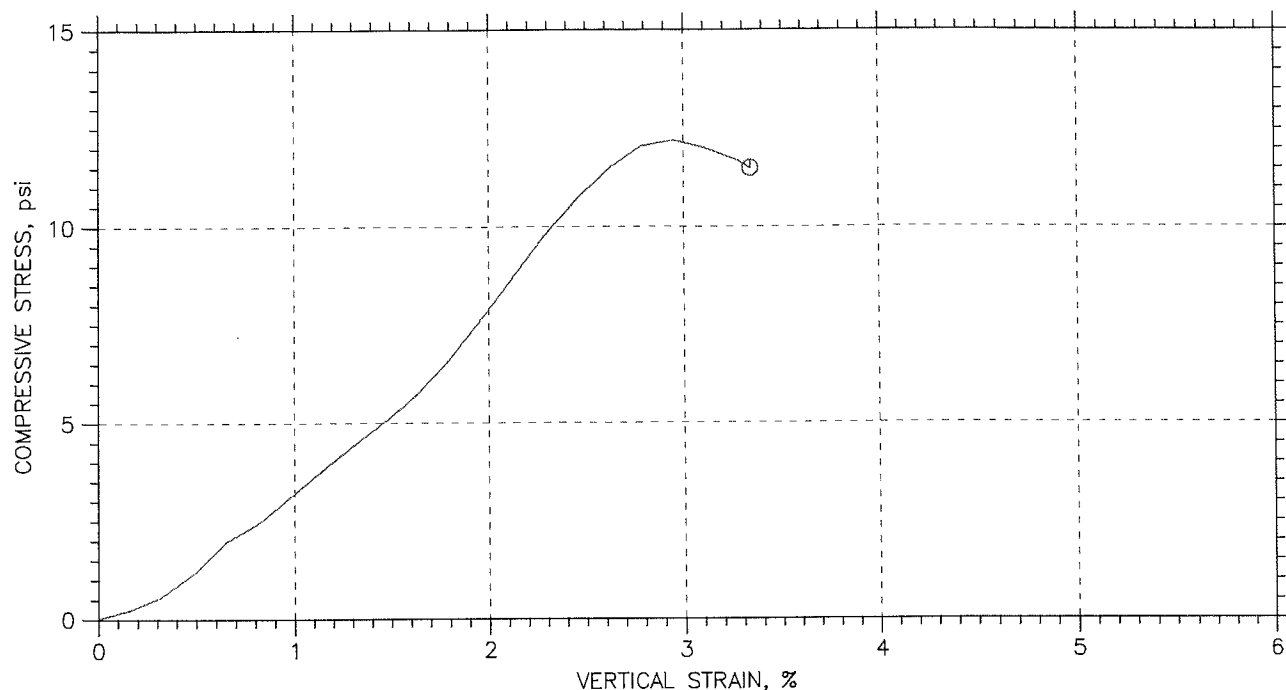


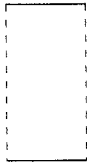


Symbol	⊖			
Test No.	1			
Initial	Diameter, in	2.736		
	Height, in	5.837		
	Water Content, %	18.00		
	Dry Density, pcf	96.86		
	Saturation, %	64.40		
	Void Ratio	0.766		
Unconfined Compressive Strength, psi		13.52		
Undrained Shear Strength, psi		6.761		
Time to Failure, min		2.1702		
Strain Rate, %/min		1		
Measured Specific Gravity		2.74		
Liquid Limit		---		
Plastic Limit		---		
Plasticity Index		---		
Failure Sketch				



Project: PLUM CREEK 21
 Location: TX
 Project No.: 15-65
 Boring No.: 251.6
 Sample Type: CORE
 Description: CREST AUX. SPWY, F14-349
 Remarks:

UNCONFINED COMPRESSION TEST REPORT



Symbol	⊙			
Test No.	1			
Initial	Diameter, in	2.694		
	Height, in	5.06		
	Water Content, %	13.99		
	Dry Density, pcf	93.13		
	Saturation, %	45.43		
	Void Ratio	0.85		
Unconfined Compressive Strength, psi		12.2		
Undrained Shear Strength, psi		6.099		
Time to Failure, min		3.001		
Strain Rate, %/min		1		
Measured Specific Gravity		2.76		
Liquid Limit		---		
Plastic Limit		---		
Plasticity Index		---		
Failure Sketch				



Project: PLUM CREEK 21

Location: TX

Project No.: 15-66

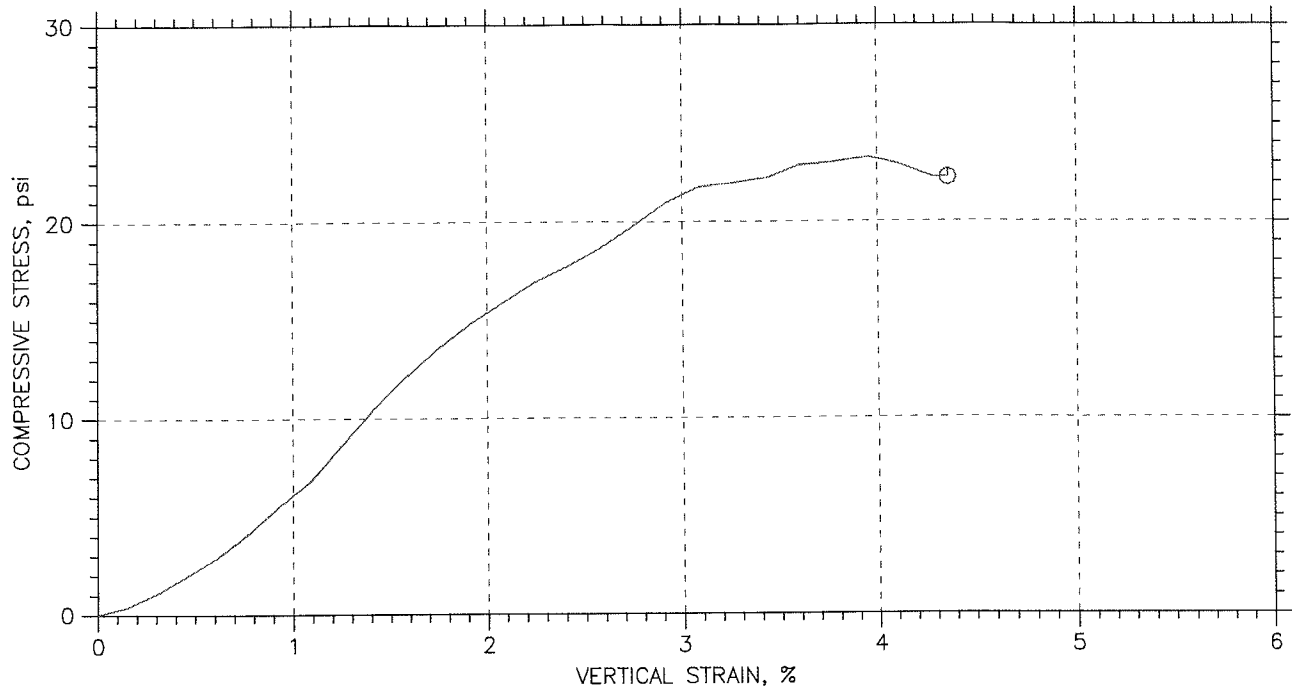
Boring No.: 251.7

Sample Type: CORE

Description: CREST AUX. SPWY, F14-350

Remarks: NOTE: HEIGHT DOES NOT MEET ASTM HEIGHT/DIAMETER REQUIREMENTS

UNCONFINED COMPRESSION TEST REPORT

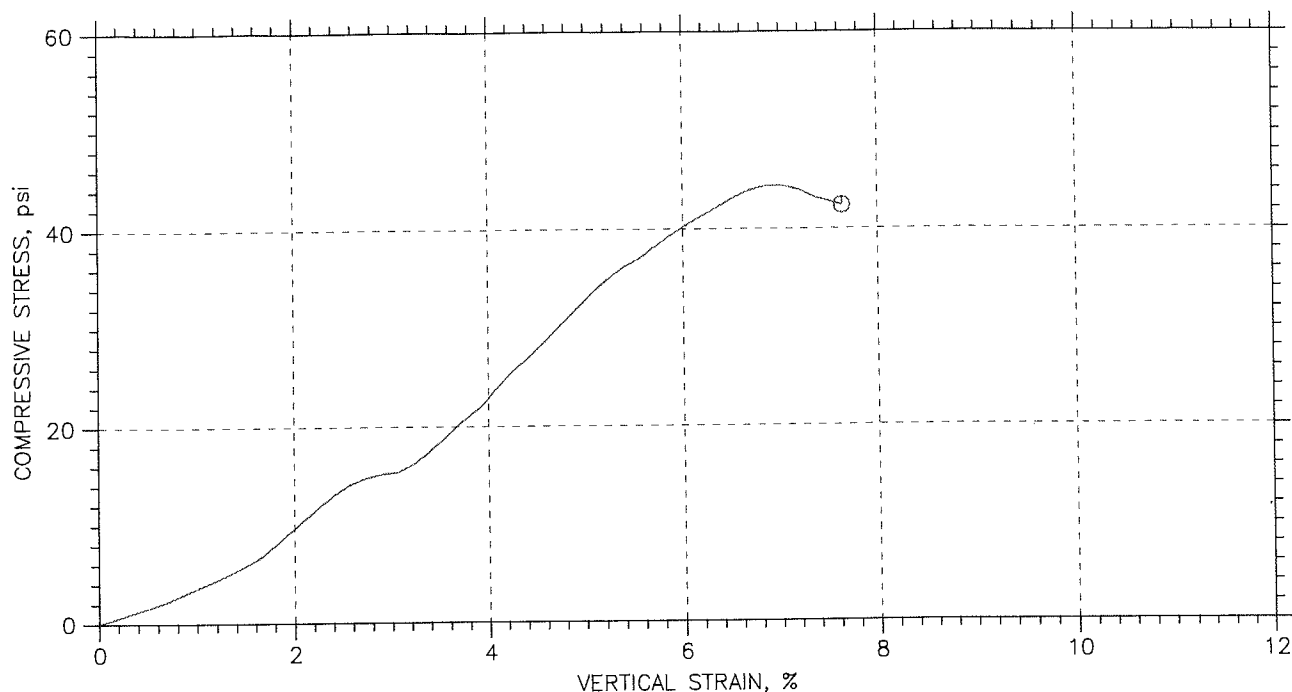





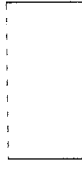
Symbol	⊙			
Test No.	1			
Initial	Diameter, in	2.69		
	Height, in	5.981		
	Water Content, %	22.06		
	Dry Density, pcf	93.27		
	Saturation, %	71.85		
	Void Ratio	0.847		
Unconfined Compressive Strength, psi		23.24		
Undrained Shear Strength, psi		11.62		
Time to Failure, min		4.0045		
Strain Rate, %/min		1		
Measured Specific Gravity		2.76		
Liquid Limit		---		
Plastic Limit		---		
Plasticity Index		---		
Failure Sketch				




Project: PLUM CREEK 21
 Location: TX
 Project No.: 15-67
 Boring No.: 251.8
 Sample Type: CORE
 Description: CREST AUX. SPWY, F14-351
 Remarks:

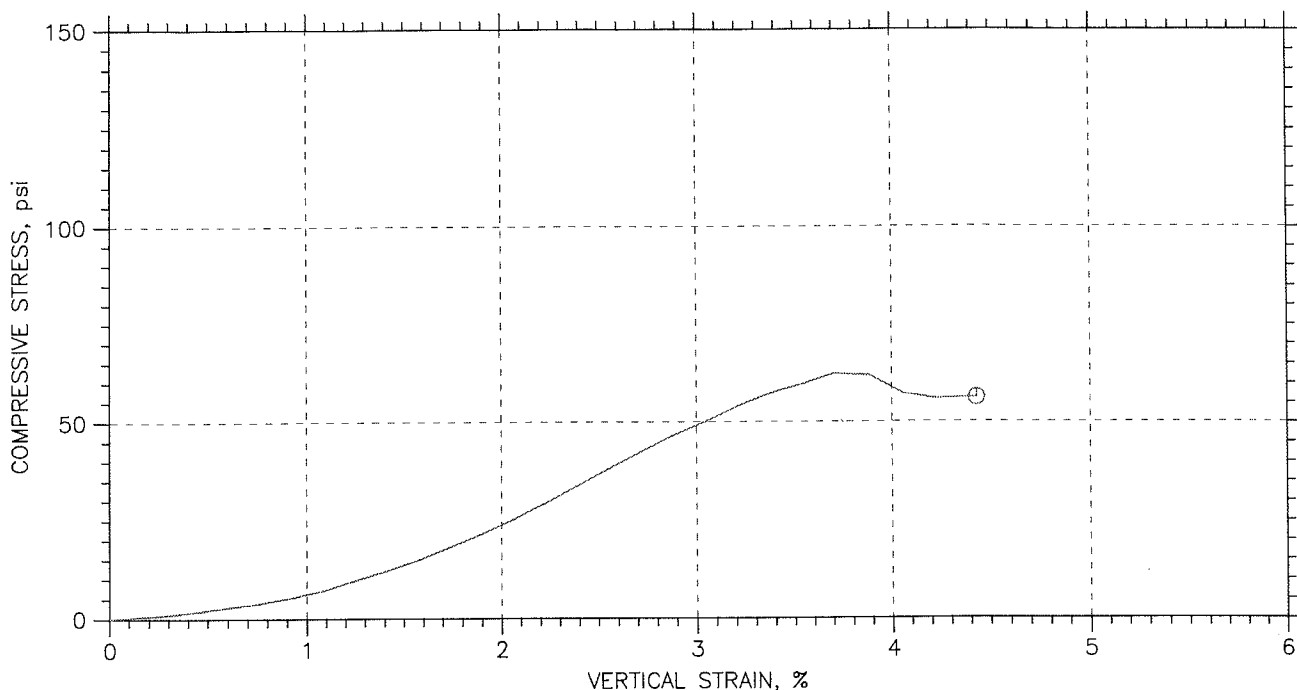
UNCONFINED COMPRESSION TEST REPORT



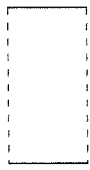



Symbol		Ø			
Test No.		1			
Initial	Diameter, in	2.68			
	Height, in	3.687			
	Water Content, %	16.55			
	Dry Density, pcf	97.92			
	Saturation, %	61.92			
	Void Ratio	0.721			
Unconfined Compressive Strength, psi		44.38			
Undrained Shear Strength, psi		22.19			
Time to Failure, min		7.0013			
Strain Rate, %/min		1			
Measured Specific Gravity		2.70			
Liquid Limit		---			
Plastic Limit		---			
Plasticity Index		---			
Failure Sketch					

 Natural Resources Conservation Service	Project: PLUM CREEK 21
	Location: TX
	Project No.: 15-69
	Boring No.: 251.10
	Sample Type: CORE
	Description: CREST AUX. SPWY, F14-353
Remarks: NOTE: HEIGHT DOES NOT MEET ASTM HEIGHT/DIAMETER REQUIREMENTS	

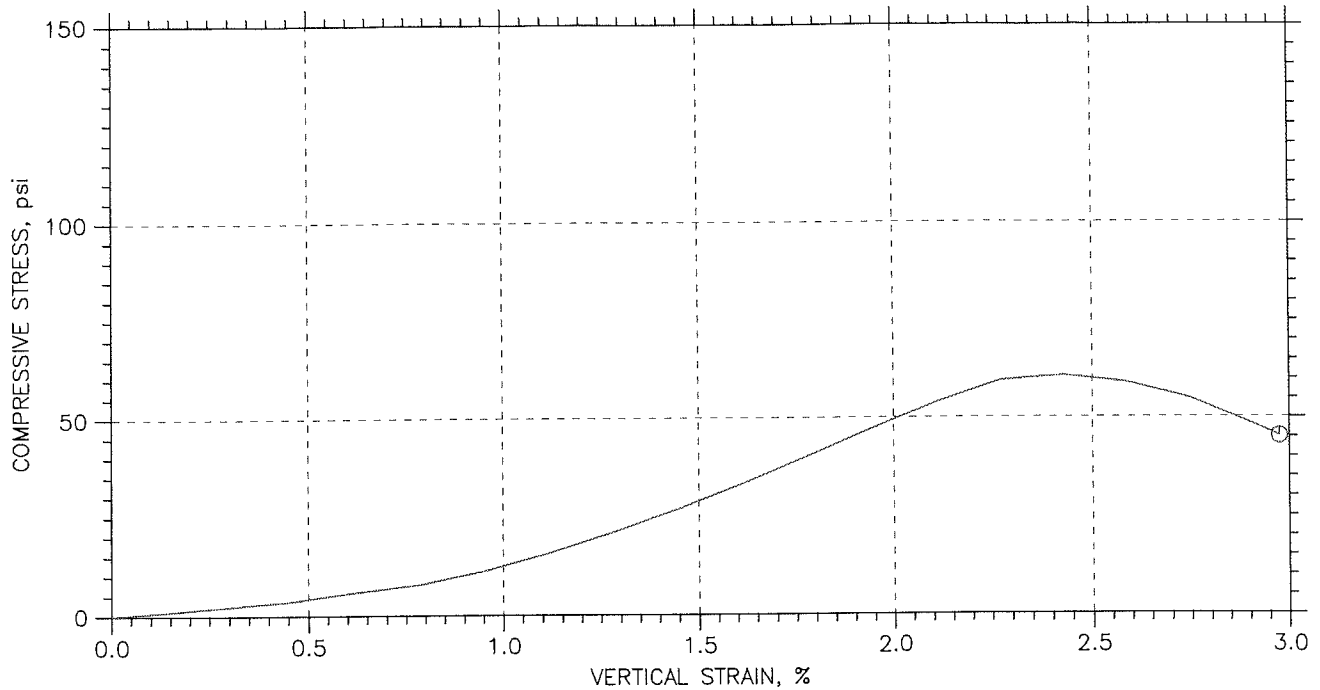
UNCONFINED COMPRESSION TEST REPORT



Symbol	⊙			
Test No.	1			
Initial	Diameter, in	2.694		
	Height, in	5.163		
	Water Content, %	8.17		
	Dry Density, pcf	89.56		
	Saturation, %	25.69		
	Void Ratio	0.84		
Unconfined Compressive Strength, psi		62.32		
Undrained Shear Strength, psi		31.16		
Time to Failure, min		3.8365		
Strain Rate, %/min		1		
Measured Specific Gravity		2.64		
Liquid Limit		---		
Plastic Limit		---		
Plasticity Index		---		
Failure Sketch				

 Natural Resources Conservation Service	Project: PLUM CREEK 21
	Location: TX
	Project No.: 15-70
	Boring No.: 252.1
	Sample Type: CORE
	Description: AUX. SPWY SLOPE ~ 200' D.S., F14-354
Remarks: NOTE: HEIGHT DOES NOT MEET ASTM HEIGHT/DIAMETER REQUIREMENTS	

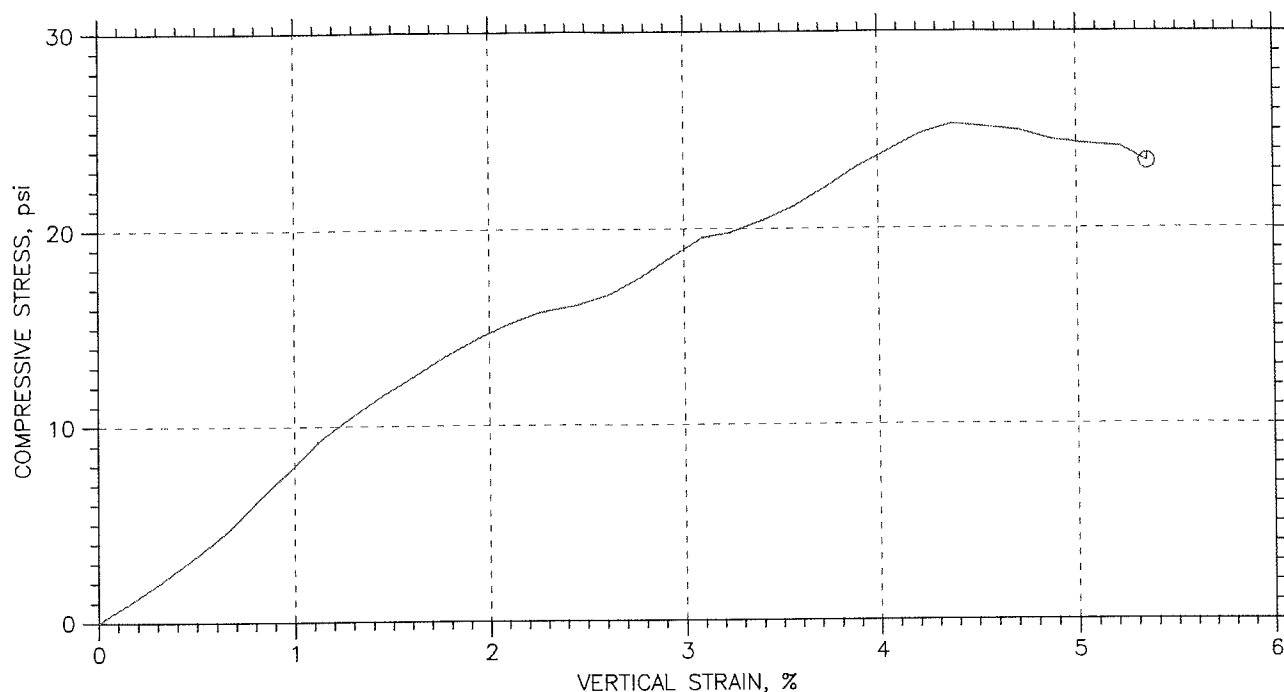
UNCONFINED COMPRESSION TEST REPORT



Symbol	⊙			
Test No.	1			
Initial	Diameter, in	2.755		
	Height, in	5.945		
	Water Content, %	18.44		
	Dry Density, pcf	97.82		
	Saturation, %	67.50		
	Void Ratio	0.749		
Unconfined Compressive Strength, psi		60.64		
Undrained Shear Strength, psi		30.32		
Time to Failure, min		2.5016		
Strain Rate, %/min		1		
Measured Specific Gravity		2.74		
Liquid Limit		---		
Plastic Limit		---		
Plasticity Index		---		
Failure Sketch				

 Natural Resources Conservation Service	Project: PLUM CREEK 21
	Location: TX
	Project No.: 15-71
	Boring No.: 252.5
	Sample Type: CORE
	Description: AUX. SPWY SLOPE ~ 200' D.S. CREST, F14-355
Remarks:	

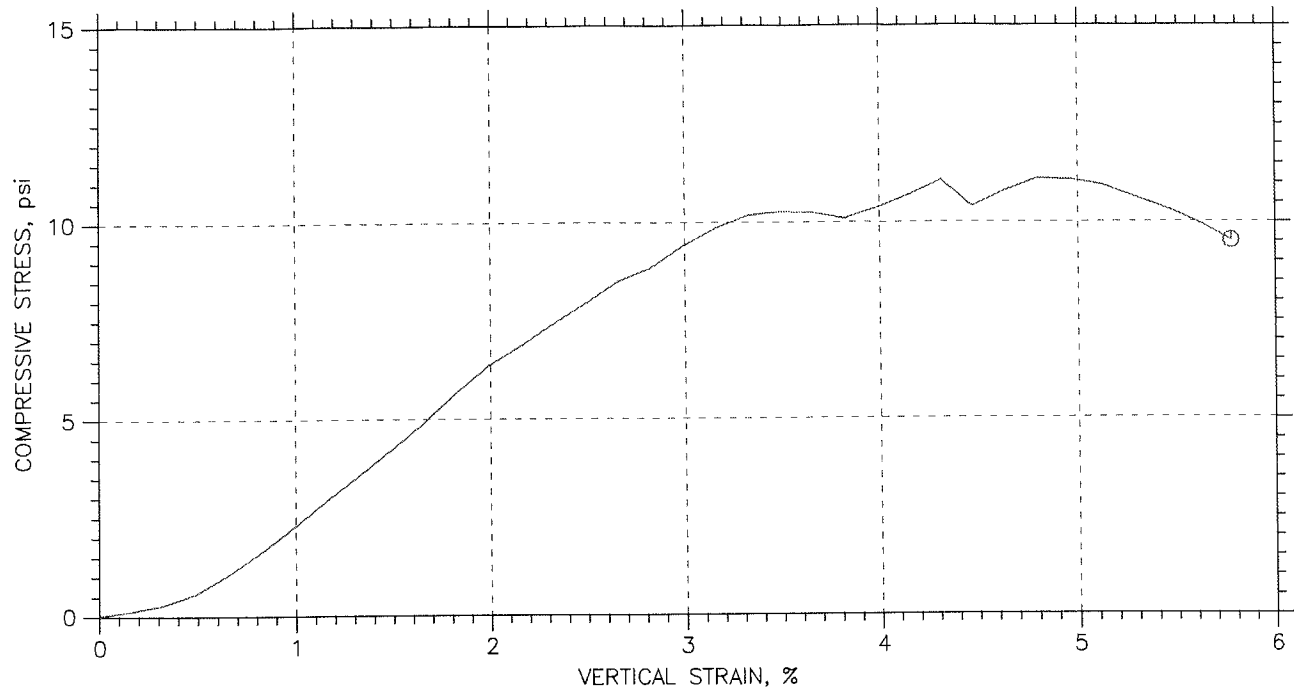
UNCONFINED COMPRESSION TEST REPORT







Symbol	⊙			
Test No.	1			
Initial	Diameter, in	2.74		
	Height, in	4.863		
	Water Content, %	22.15		
	Dry Density, pcf	92.61		
	Saturation, %	71.66		
	Void Ratio	0.847		
Unconfined Compressive Strength, psi		25.28		
Undrained Shear Strength, psi		12.64		
Time to Failure, min		4.5038		
Strain Rate, %/min		1		
Measured Specific Gravity		2.74		
Liquid Limit		---		
Plastic Limit		---		
Plasticity Index		---		
Failure Sketch				

 Natural Resources Conservation Service	Project: PLUM CREEK 21
	Location: TX
	Project No.: 15-72
	Boring No.: 252.3
	Sample Type: CORE
	Description: AUX. SPWY SLOPE ~ 200' DS CREST WEATHERED CLAYSTONE/SILTSTONE, F14-356
	Remarks: NOTE: HEIGHT DOES NOT MEET ASTM HEIGHT/DIAMETER REQUIREMENTS

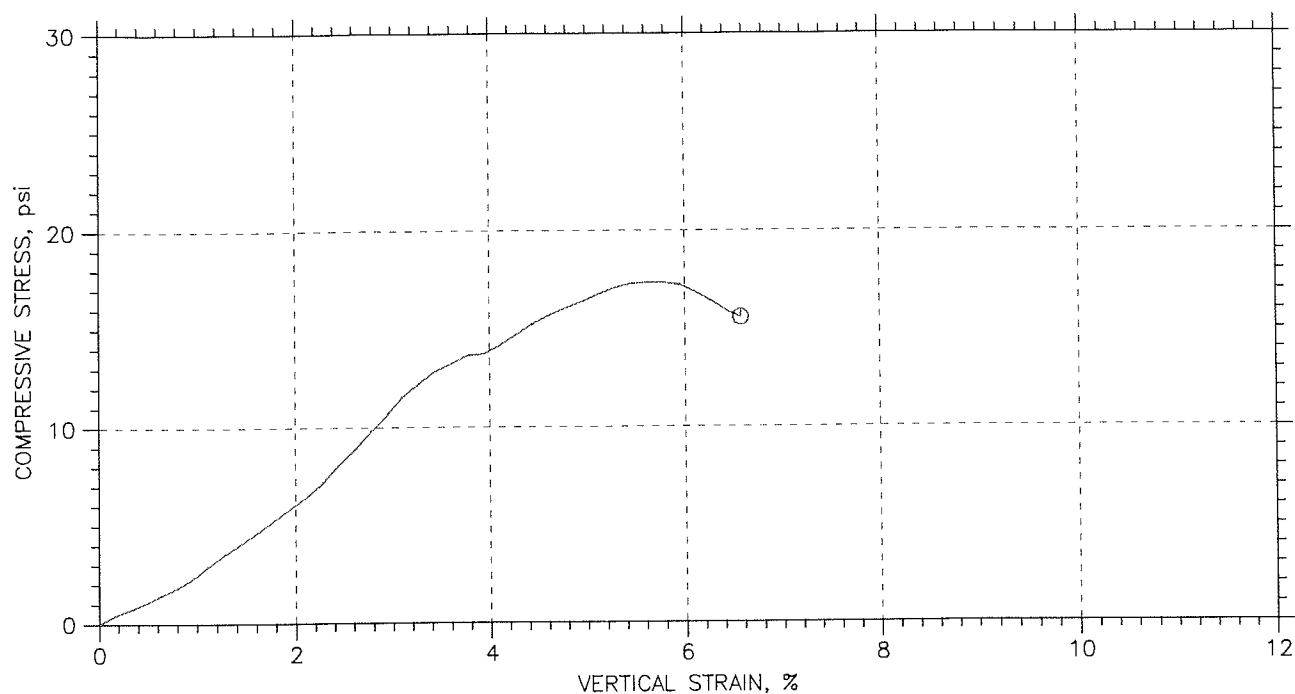
UNCONFINED COMPRESSION TEST REPORT







Symbol	⊙			
Test No.	1			
Initial	Diameter, in	2.779		
	Height, in	5.895		
	Water Content, %	16.41		
	Dry Density, pcf	89.95		
	Saturation, %	50.28		
	Void Ratio	0.888		
Unconfined Compressive Strength, psi		11.1		
Undrained Shear Strength, psi		5.552		
Time to Failure, min		4.8354		
Strain Rate, %/min		1		
Measured Specific Gravity		2.72		
Liquid Limit		---		
Plastic Limit		---		
Plasticity Index		---		
Failure Sketch				

 Natural Resources Conservation Service	Project: PLUM CREEK 21
	Location: TX
	Project No.: 15-73
	Boring No.: 252.4
	Sample Type: CORE
	Description: AUX. SPWY SLOPE ~ 200' DS CREST REFUSAL AT 17', F14-357
Remarks:	

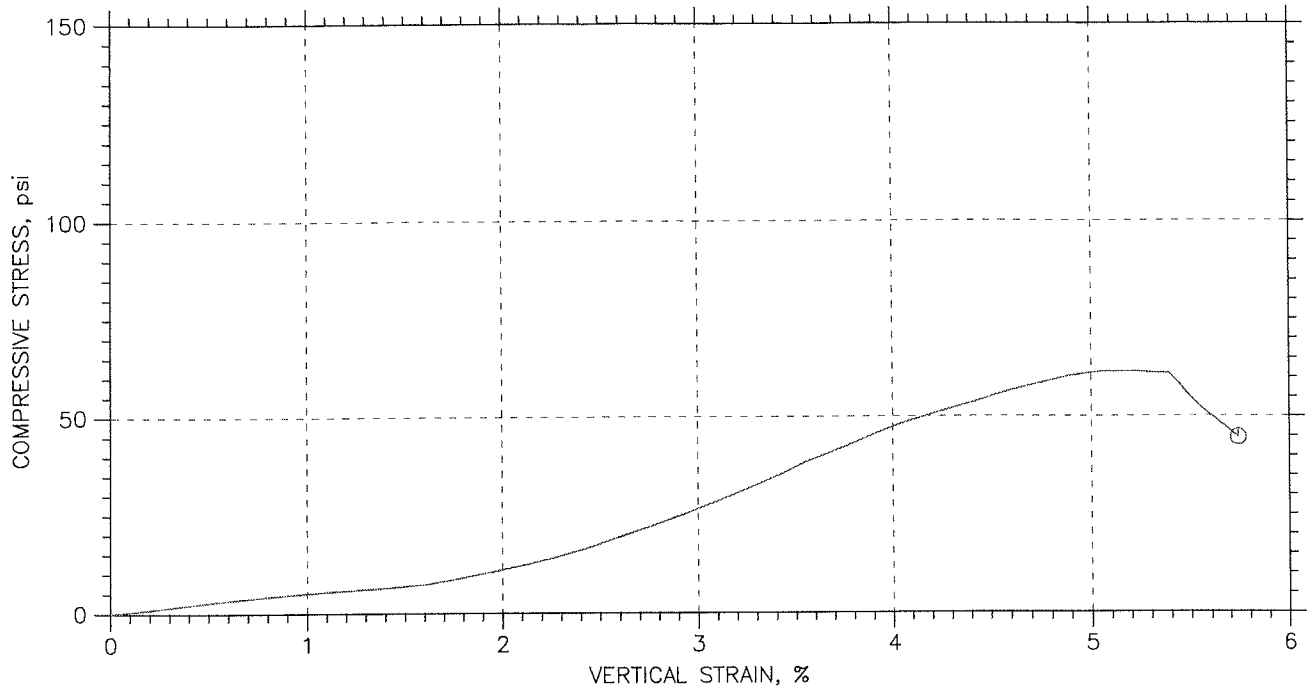
UNCONFINED COMPRESSION TEST REPORT



Symbol	①			
Test No.	1			
Initial	Diameter, in	2.664		
	Height, in	4.97		
	Water Content, %	18.13		
	Dry Density, pcf	94.33		
	Saturation, %	61.65		
	Void Ratio	0.8		
Unconfined Compressive Strength, psi		17.35		
Undrained Shear Strength, psi		8.676		
Time to Failure, min		5.8343		
Strain Rate, %/min		1		
Measured Specific Gravity		2.72		
Liquid Limit		---		
Plastic Limit		---		
Plasticity Index		---		
Failure Sketch				

 Natural Resources Conservation Service	Project: PLUM CREEK 21
	Location: TX
	Project No.: 15-74
	Boring No.: 252.5
	Sample Type: CORE
	Description: AUX. SPWY SLOPE ~ 200' DS CREST WEATHERED SILTSTONE, F14-358
Remarks: NOTE: HEIGHT DOES NOT MEET ASTM HEIGHT/DIAMETER REQUIREMENTS	

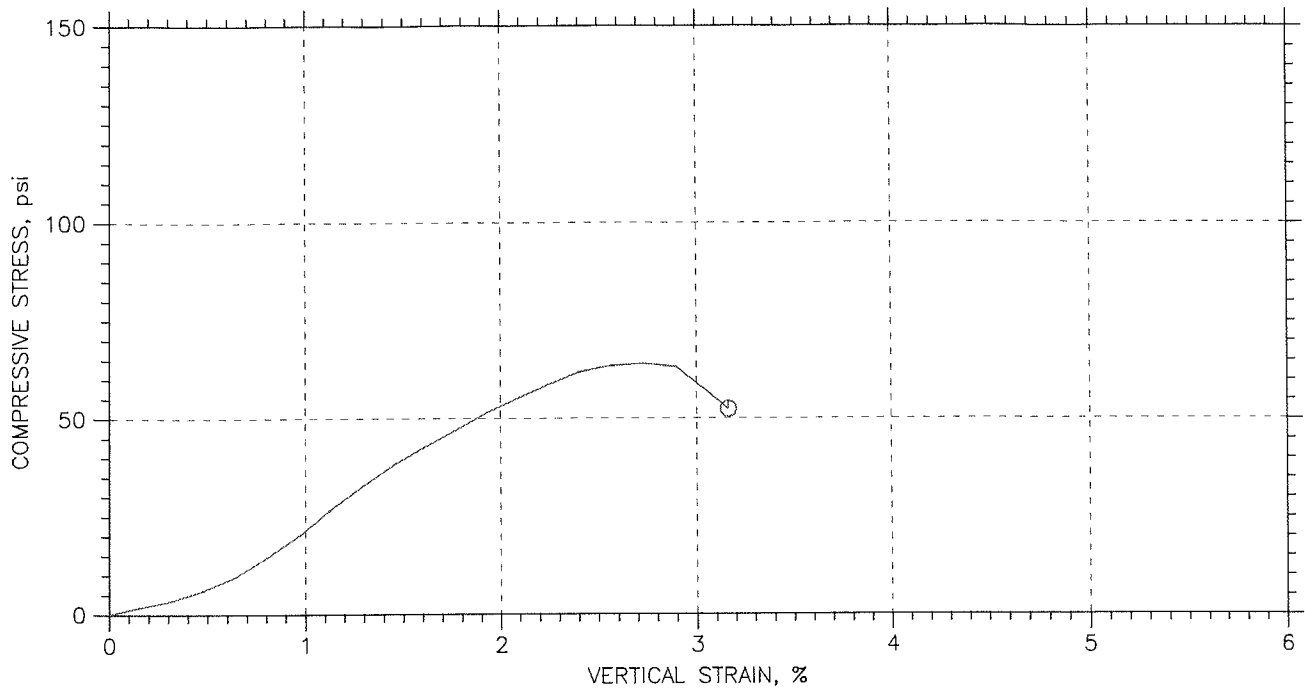
UNCONFINED COMPRESSION TEST REPORT



Symbol	⊙			
Test No.	1			
Initial	Diameter, in	2.7		
	Height, in	4.294		
	Water Content, %	19.08		
	Dry Density, pcf	97.1		
	Saturation, %	68.65		
	Void Ratio	0.762		
Unconfined Compressive Strength, psi		61.37		
Undrained Shear Strength, psi		30.68		
Time to Failure, min		5.3347		
Strain Rate, %/min		1		
Measured Specific Gravity		2.74		
Liquid Limit		---		
Plastic Limit		---		
Plasticity Index		---		
Failure Sketch				

 Natural Resources Conservation Service	Project: PLUM CREEK 21
	Location: TX
	Project No.: 15-76
	Boring No.: 253.2
	Sample Type: CORE
	Description: EXIT SLOPE AUX. SPWY ~ 400' DS CREST, F14-360
Remarks: NOTE: HEIGHT DOES NOT MEET ASTM HEIGHT/DIAMETER REQUIREMENTS	

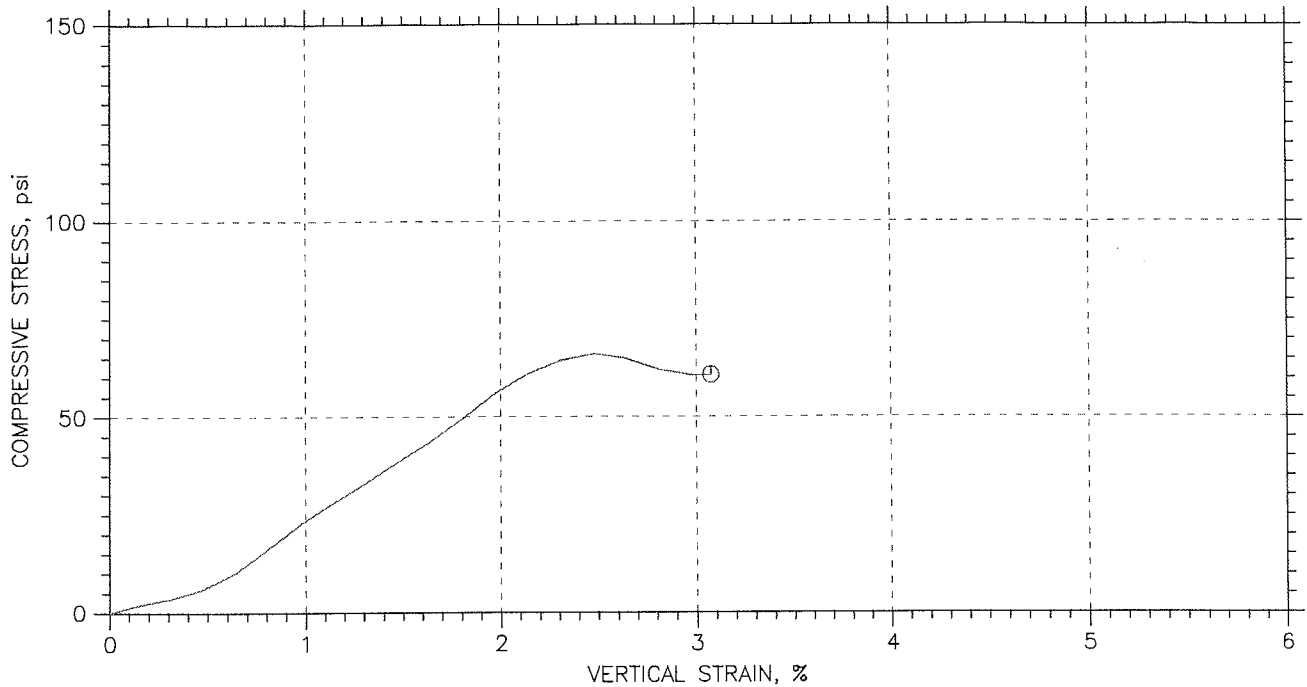
UNCONFINED COMPRESSION TEST REPORT







Symbol	⊙			
Test No.	1			
Initial	Diameter, in	2.735		
	Height, in	5.528		
	Water Content, %	11.67		
	Dry Density, pcf	105.7		
	Saturation, %	52.68		
	Void Ratio	0.6		
Unconfined Compressive Strength, psi		64.04		
Undrained Shear Strength, psi		32.02		
Time to Failure, min		2.8376		
Strain Rate, %/min		1		
Measured Specific Gravity		2.71		
Liquid Limit		---		
Plastic Limit		---		
Plasticity Index		---		
Failure Sketch				

 Natural Resources Conservation Service	Project: PLUM CREEK 21
	Location: TX
	Project No.: 15-77A
	Boring No.: 254.1
	Sample Type: CORE
	Description: EXIT SLOPE AUX. SPWY ~ 600' DS CREST CC TOP OF TUBE SS BOTTOM OF TUBE, F14-361
Remarks:	

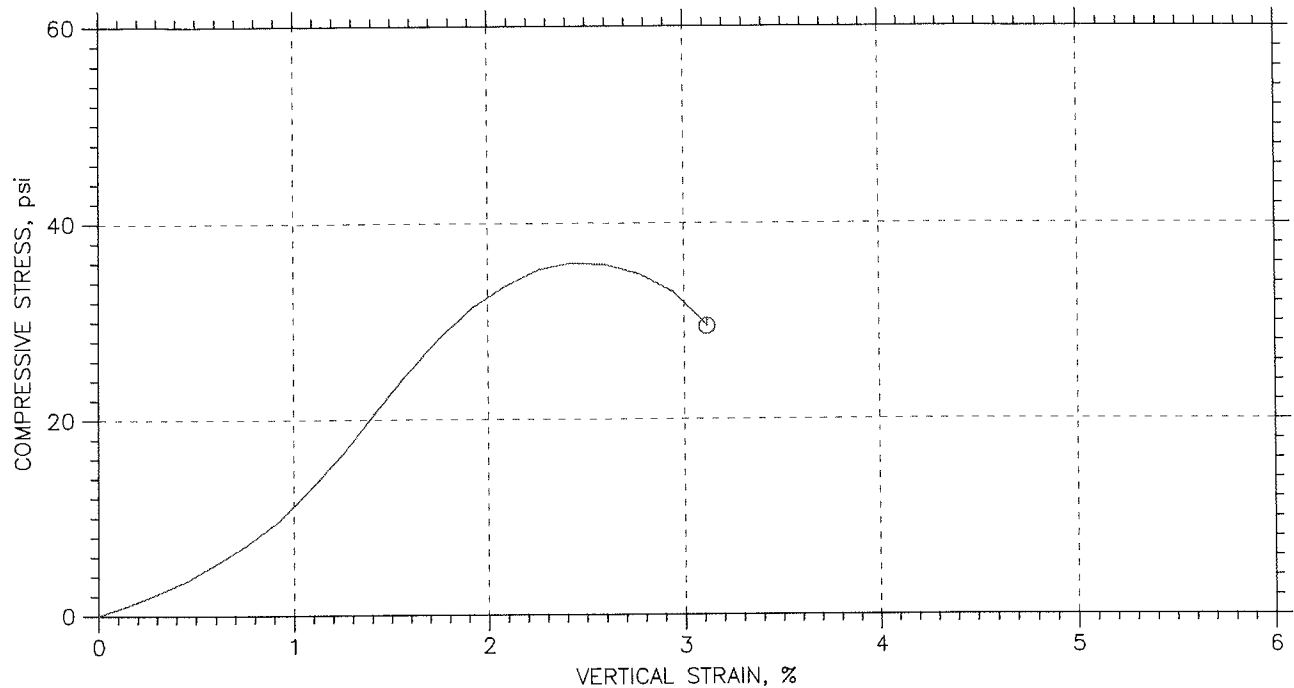
UNCONFINED COMPRESSION TEST REPORT




Symbol	⊙			
Test No.	1			
Initial	Diameter, in	2.763		
	Height, in	5.896		
	Water Content, %	12.60		
	Dry Density, pcf	110.2		
	Saturation, %	63.76		
	Void Ratio	0.536		
Unconfined Compressive Strength, psi		65.98		
Undrained Shear Strength, psi		32.99		
Time to Failure, min		2.5017		
Strain Rate, %/min		1		
Measured Specific Gravity		2.71		
Liquid Limit		---		
Plastic Limit		---		
Plasticity Index		---		
Failure Sketch				

 Natural Resources Conservation Service	Project: PLUM CREEK 21
	Location: TX
	Project No.: 15-77B
	Boring No.: 254.1
	Sample Type: CORE
	Description: EXIT SLOPE AUX. SPWY ~ 600' DS CREST CC TOP OF TUBE SS BOTTOM OF TUBE, F14-361
Remarks:	

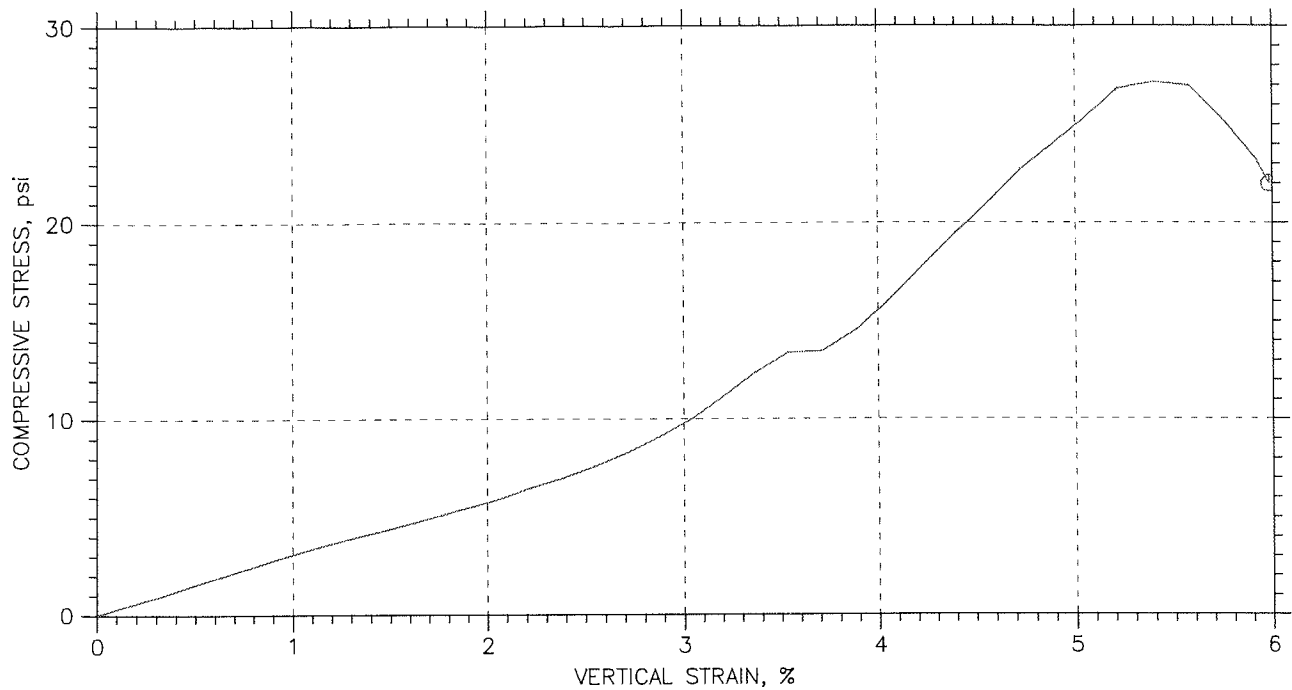
UNCONFINED COMPRESSION TEST REPORT



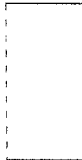



Symbol		①			
Test No.		1			
Initial	Diameter, in	2.759			
	Height, in	5.931			
	Water Content, %	18.91			
	Dry Density, pcf	95.88			
	Saturation, %	66.38			
	Void Ratio	0.777			
Unconfined Compressive Strength, psi		35.95			
Undrained Shear Strength, psi		17.97			
Time to Failure, min		2.5017			
Strain Rate, %/min		1			
Measured Specific Gravity		2.73			
Liquid Limit		---			
Plastic Limit		---			
Plasticity Index		---			
Failure Sketch					

 NRCS Natural Resources Conservation Service	Project: PLUM CREEK 21
	Location: TX
	Project No.: 15-78
	Boring No.: 254.2
	Sample Type: CORE
	Description: EXIT SLOPE AUX. SPWY ~ 600' DS CREST CLAYSTONE, F14-362
Remarks:	

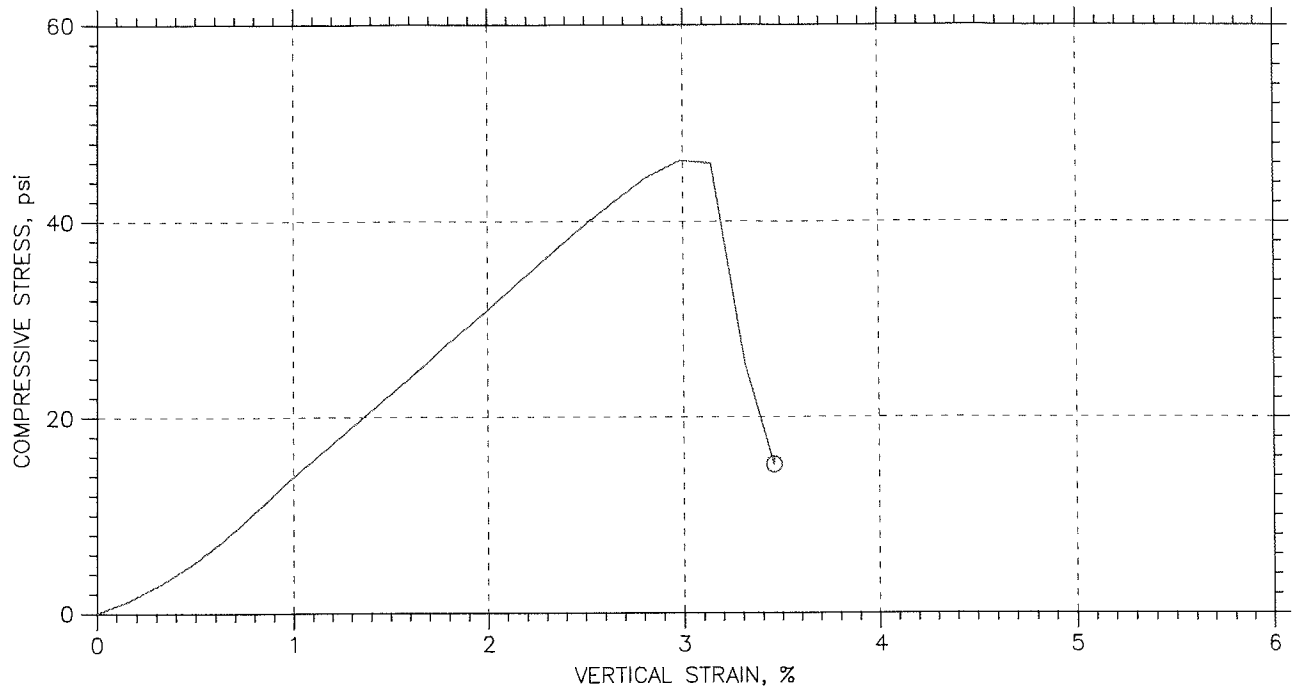
UNCONFINED COMPRESSION TEST REPORT



Symbol	⊙			
Test No.	1			
Initial	Diameter, in	2.776		
	Height, in	4.243		
	Water Content, %	20.21		
	Dry Density, pcf	98.17		
	Saturation, %	73.52		
	Void Ratio	0.761		
Unconfined Compressive Strength, psi		27.14		
Undrained Shear Strength, psi		13.57		
Time to Failure, min		5.5029		
Strain Rate, %/min		1		
Measured Specific Gravity		2.77		
Liquid Limit		---		
Plastic Limit		---		
Plasticity Index		---		
Failure Sketch				

 NRCS Natural Resources Conservation Service	Project: PLUM CREEK 21
	Location: TX
	Project No.: 15-79
	Boring No.: 255.1
	Sample Type: CORE
	Description: EXIT SLOPE AUX. SPWY ~800' DS CREST, F14-363
Remarks: NOTE: HEIGHT DOES NOT MEET ASTM HEIGHT/DIAMETER REQUIREMENTS	

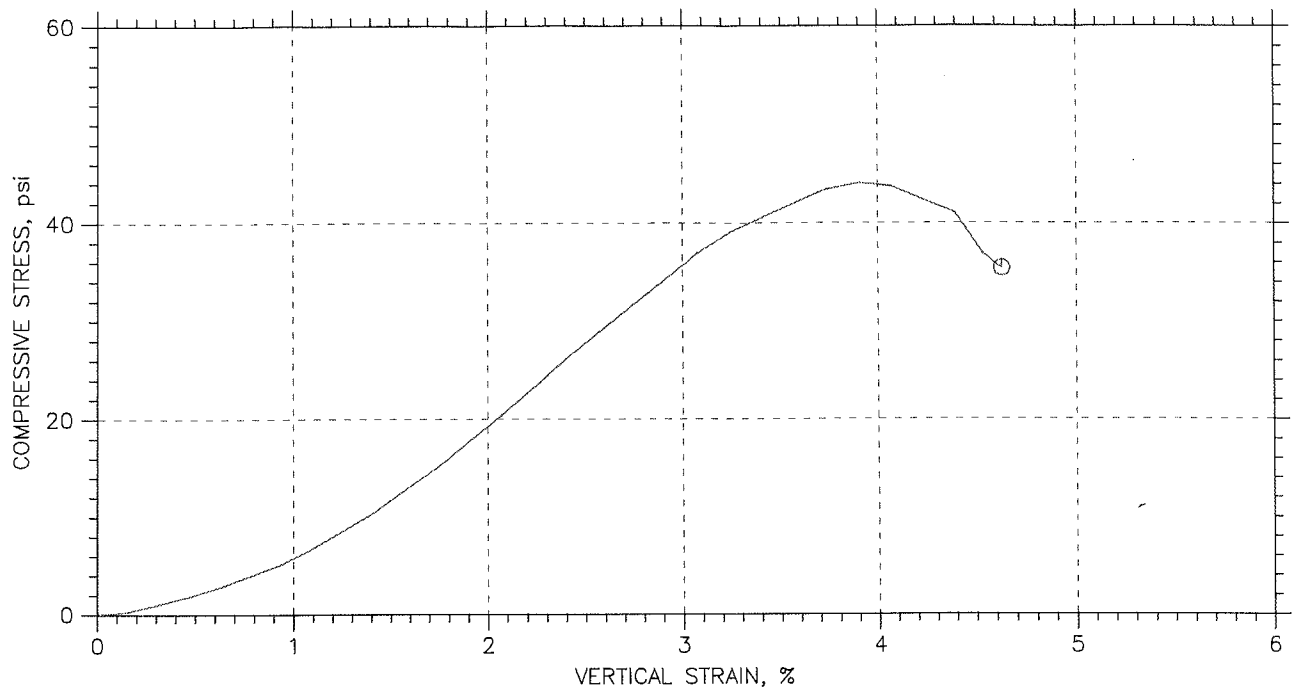
UNCONFINED COMPRESSION TEST REPORT



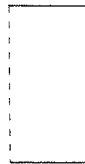



Symbol	⊙			
Test No.	1			
Initial	Diameter, in	2.766		
	Height, in	6.131		
	Water Content, %	21.98		
	Dry Density, pcf	101.4		
	Saturation, %	87.78		
	Void Ratio	0.686		
Unconfined Compressive Strength, psi		46.22		
Undrained Shear Strength, psi		23.11		
Time to Failure, min		3.0011		
Strain Rate, %/min		1		
Measured Specific Gravity		2.74		
Liquid Limit		---		
Plastic Limit		---		
Plasticity Index		---		
Failure Sketch				

 Natural Resources Conservation Service	Project: PLUM CREEK 21
	Location: TX
	Project No.: 15-80
	Boring No.: 255.2
	Sample Type: CORE
	Description: EXIT SLOPE AUX. SPWY ~800' DS CREST, F14-364
Remarks:	

UNCONFINED COMPRESSION TEST REPORT



Symbol	①			
Test No.	1			
Initial	Diameter, in	2.717		
	Height, in	5.546		
	Water Content, %	19.63		
	Dry Density, pcf	97.88		
	Saturation, %	72.29		
	Void Ratio	0.741		
Unconfined Compressive Strength, psi		44.09		
Undrained Shear Strength, psi		22.04		
Time to Failure, min		4.0001		
Strain Rate, %/min		1		
Measured Specific Gravity		2.73		
Liquid Limit		---		
Plastic Limit		---		
Plasticity Index		---		
Failure Sketch				

 Natural Resources Conservation Service	Project: PLUM CREEK 21
	Location: TX
	Project No.: 15-81
	Boring No.: 256.1
	Sample Type: CORE
	Description: EXIT SLOPE AUX. SPWY SILT, F14-365
Remarks:	