BORING LOG NO. 09-B79

CLIENT:	USACE, Galveston District Galveston, Texas	PROJECT:	TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume I
BORING LOCATION:	N: 13827206 E: 3259250	SITE:	Cedar Bayou PA6 Baytown, Texas

Approx. Surface Elevation: 15.3 feet

Graphic Log	DESCRIPTION	DEPTH, FEET	USCS SYMBOL	TYPE	RECOVERY, IN	SPT, BLOWS/FT	CALIBRATED HAND PENETROM., TSF	TORVANE, TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, TSF	FAILURE STRAIN, %	CONFINING PRESSURE, PSI
	FILL: FAT CLAY brown, reddish brown, gray and dark gray, medium stiff to stiff, high plasticity, moist	1	CH	ST	9		2.25		25	101	52	15	37	87			
		2–3		ST	9		1.75		19								
	- with broken shell 4 to 6 feet	4–5		ST	11		4.5		16								
	- with sand 6 to 8 feet	6–7		ST	20		1.5		22	93	55	17	38	85			
		8–9		ST	7		0.75		28								
	- with broken shell 10 to 12 feet	10–11		ST	14		0.75		32								
3.3	12.0	12															
2.3	**FILL: LEAN CLAY** gray and brown, stiff, medium plasticity, moist	13.0	CL	ST	13		1.5		34								
1.3	14.0	13	CH														
	FILL: FAT CLAY dark brown, stiff, high plasticity, moist	14–15	CL	ST	6		2.5		29								
-2.7	**FILL: LEAN CLAY w/SAND** dark gray and black, stiff to very stiff, high plasticity, moist, with sand seams	16–17		ST	8		0.5		34	88	42	17	25	83			
	18.0	18–19	CH	ST	17		1.0		23								
	FAT CLAY dark gray, greenish gray, light gray, brown and bluish gray, very soft to very stiff, high to very high plasticity, with sand and silt pockets	20–21		ST	10		0.5		38								
		22–23		ST	14		0.0	0.25	27								
		24–25		ST	5		0.25		33								
		26–27		BS	11				36								
		28–29		ST	12		0.75		29	95	55	19	36	93			
		30–31		ST	8		0.5		30								
		32–33		ST	8		0.0		36								
		34															

Continued Next Page

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry augered to 22 feet; wet rotary thereafter.

WATER LEVEL OBSERVATIONS			
∇ 22 ft	WD	▼ 19.5 ft	at 5 min
▼ 19 ft	at 10 min	▼ 19 ft	at 15 min

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DATE DRILLED	3/29/2010
PROJECT NUMBER	92105186-A

09-B79

EXHIBIT A-

BORING LOG NO. 09-B79

CLIENT:	USACE, Galveston District Galveston, Texas	PROJECT:	TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume I
BORING LOCATION:	N: 13827206 E: 3259250	SITE:	Cedar Bayou PA6 Baytown, Texas

Approx. Surface Elevation: 15.3 feet

Graphic Log	DESCRIPTION	DEPTH, FEET	USCS SYMBOL	TYPE	RECOVERY, IN	SPT, BLOWS/FT	CALIBRATED HAND PENETROM., TSF	TORVANE, TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, TSF	FAILURE STRAIN, %	CONFINING PRESSURE, PSI
	FAT CLAY dark gray, greenish gray, light gray, brown and bluish gray, very soft to very stiff, high to very high plasticity, with sand and silt pockets - with slickensides 34 to 42 feet	35		ST	17		1.75		38								
		36															
		37		ST	7		1.25		33								
		38															
		39		ST	24		1.5		38	86	94	28	66	100			
		40															
		41		ST	19		1.75		40								
		42															
		43		ST	18		0.75		50								
		44															
		45		ST	23		1.75		46								
	-30.7 46.0	46															
	SILTY CLAY light gray and brown, stiff, slight plasticity, wet, with sand seams -32.7 48.0	47	CL-ML	ST	12		1.5		25	103	25	19	6				
		48															
	LEAN CLAY w/ SAND gray and greenish gray, medium stiff to very stiff, high plasticity, moist -36.7 52.0	49	CL	ST	14		0.5		24		41	15	26	75			
		50															
		51		ST	20		1.0		24								
	FAT CLAY dark bluish gray, soft to stiff, very high plasticity, moist - with sand seams 52 to 54 feet	52	CH														
		53		ST	14		1.25		23	98	78	25	53	87			
		54															
		55		ST	13		1.25		28								
		56															
		57		ST	4		0.5		29								
		58															
		59		ST	10		1.5		32								
		60															
		61		ST	10		1.5		32	89	77	25	52				
		62															
		63		ST	21		1.25		32								
		64															
	-49.7 65.0	65		ST	10		1.0		37								
	Boring terminated at 65 feet.																

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry augered to 22 feet; wet rotary thereafter.

WATER LEVEL OBSERVATIONS			
▽ 22 ft	WD	▼ 19.5 ft	at 5 min
▼ 19 ft	at 10 min	▼ 19 ft	at 15 min

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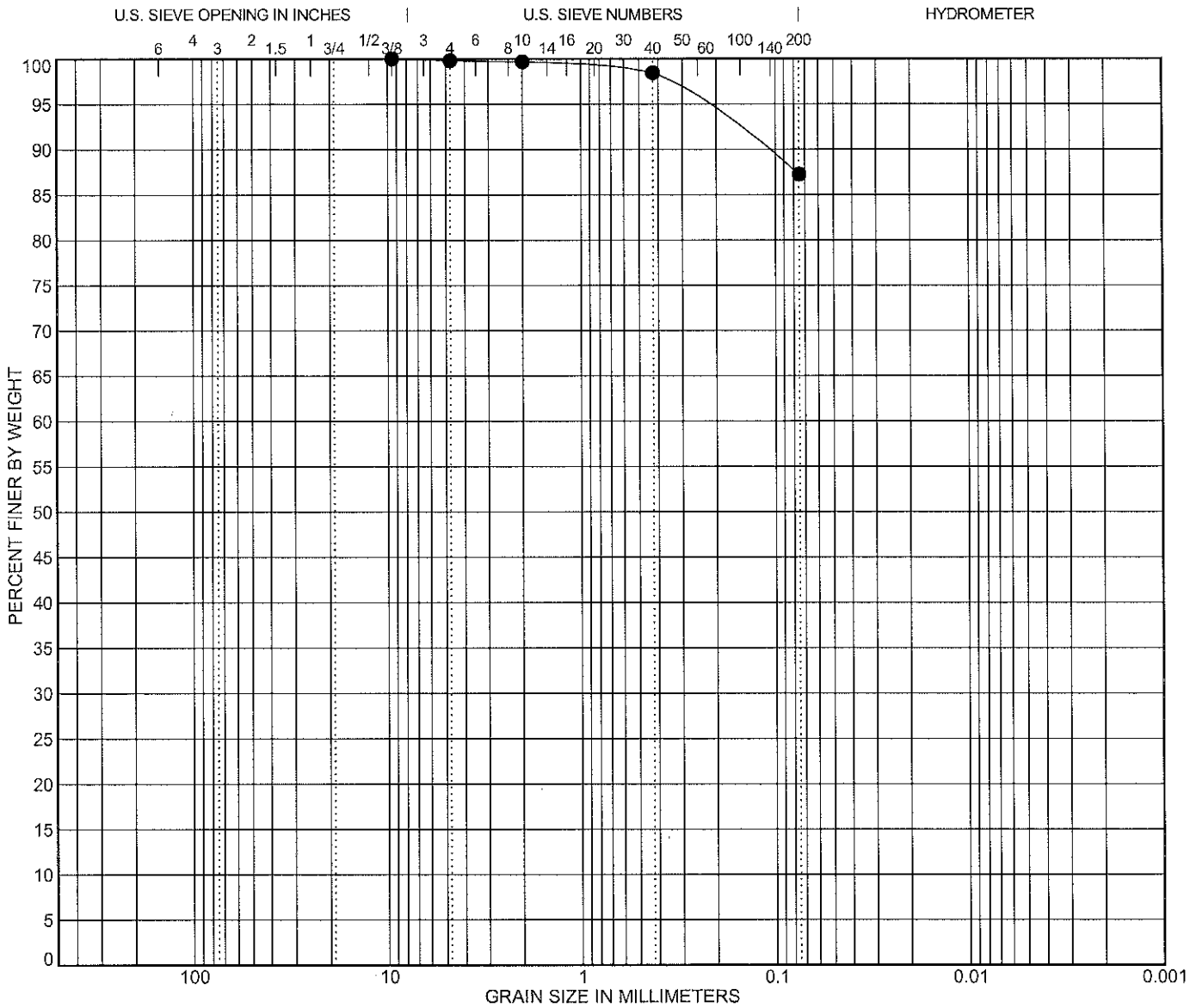
DATE DRILLED	Page 2 of 2
3/29/2010	09-B79
PROJECT NUMBER 92105186-A	EXHIBIT A-



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B79**	**0.0**	**FAT CLAY(CH)**	**52**	**15**	**37**		

Percent Passing the Indicated Sieve

	Specimen Identification		3/8"	#4	#10	#40	#100	#200
●	**09-B79**	**0.0**	**100**	**99.8**	**99.7**	**98.4**		**87.3**

	Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**09-B79**	**0.0**	**9.5**				**0.2**	**12.6**	**87.3**	

GRAIN SIZE DISTRIBUTION

TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume I
Baytown, Texas
Project Number 92105186-A

Terracon

Terracon Consultants, Inc.
11555 Clay Road, Suite 100
Houston, Texas 77043
Telephone: 713-690-8989
Fax: 713-690-8787

EXHIBIT
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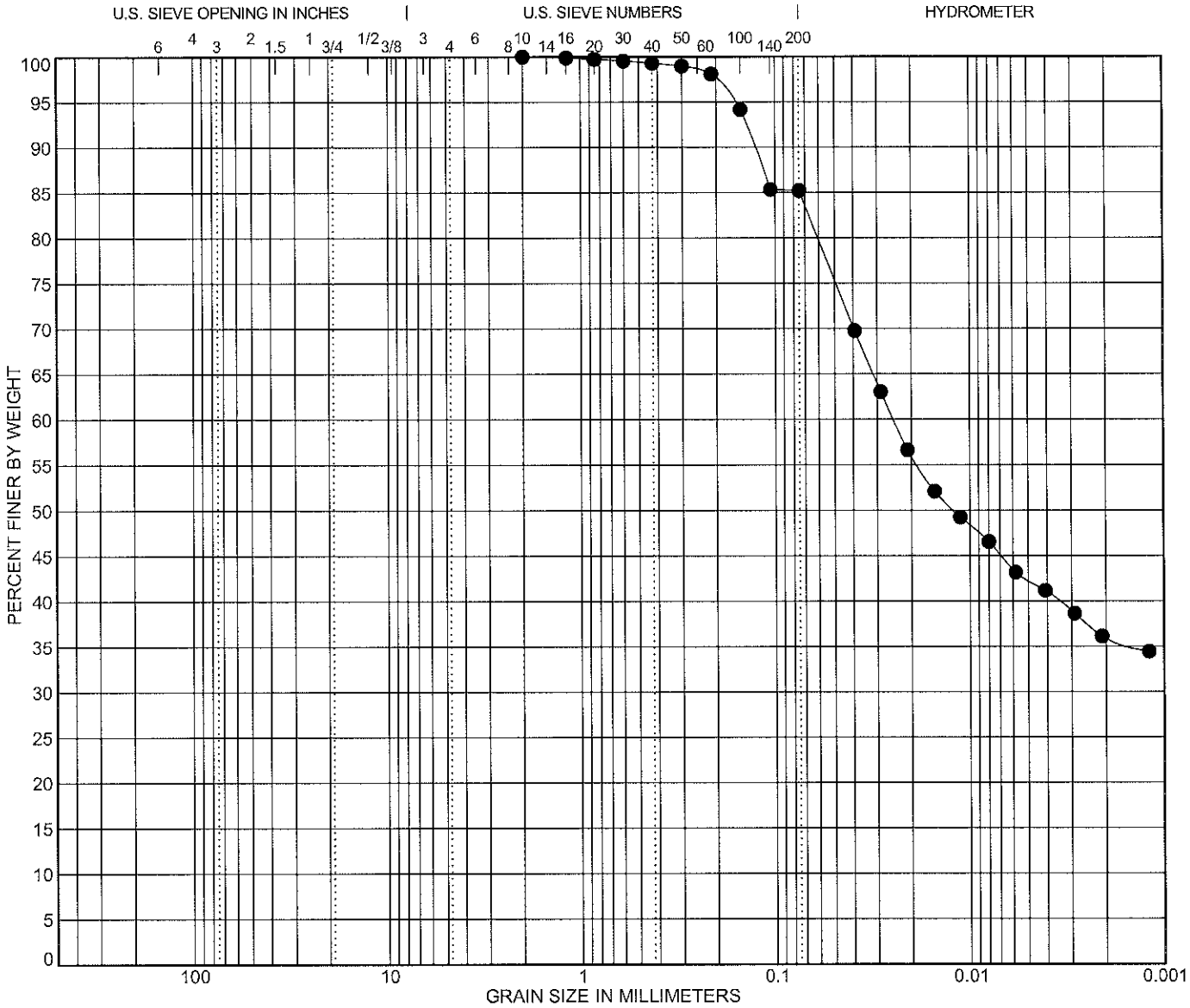

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B79**	**6.0**	**FAT CLAY(CH)**	**55**	**17**	**38**		

Percent Passing the Indicated Sieve

	Specimen Identification		3/8"	#4	#10	#40	#100	#200
●	**09-B79**	**6.0**			**100**	**99.3**	**94.1**	**85.2**

	Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**09-B79**	**6.0**	**2**	**0.012**			**0.0**	**14.8**	**49.2**	**36.0**

GRAIN SIZE DISTRIBUTION

TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume I
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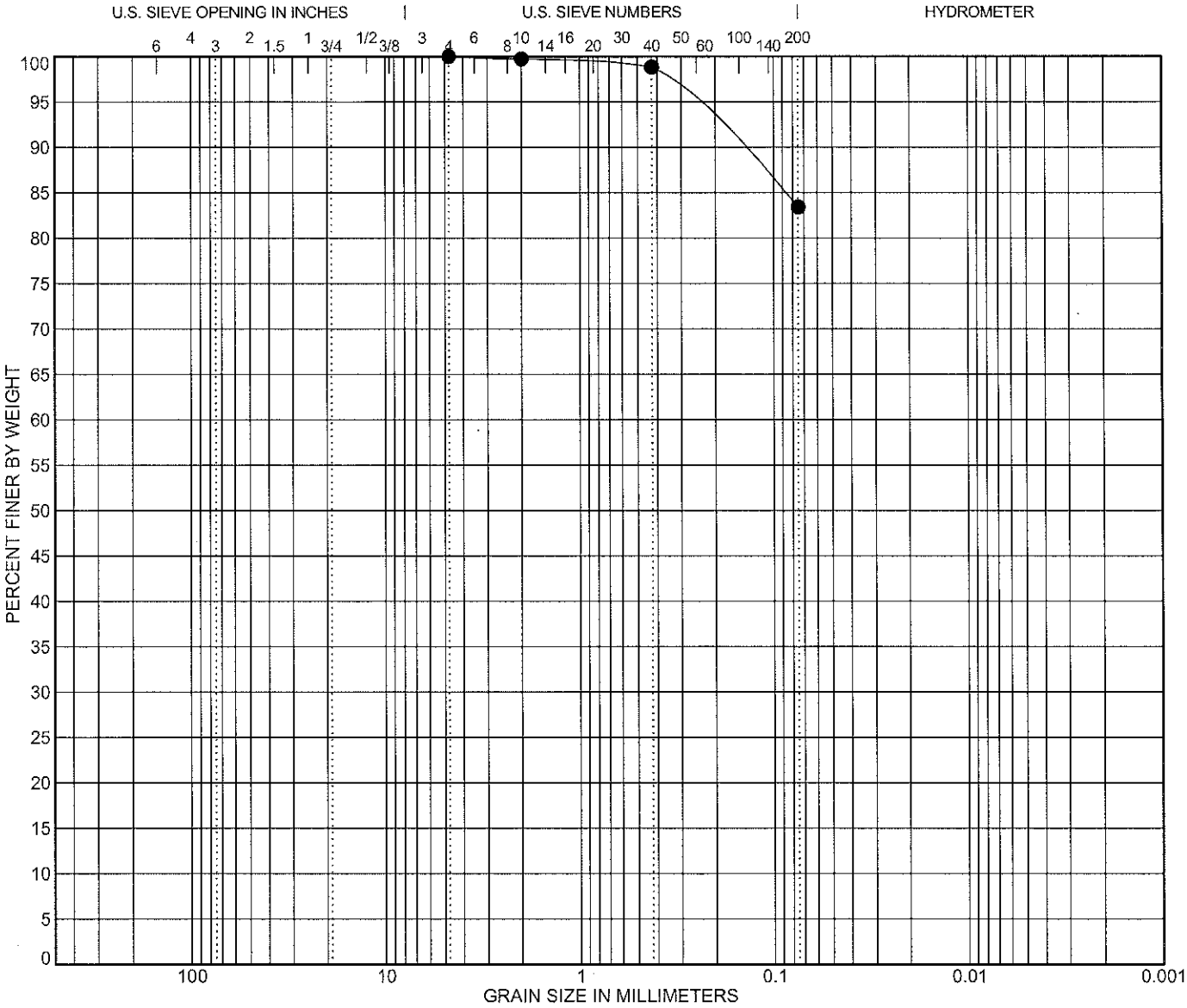

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **09-B79**	**16.0**	**LEAN CLAY with SAND(CL)**	**42**	**17**	**25**		

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● **09-B79**	**16.0**		**100**	**99.7**	**98.8**		**83.4**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **09-B79**	**16.0**	**4.75**				**0.0**	**16.6**	**83.4**	

GRAIN SIZE DISTRIBUTION

TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume I
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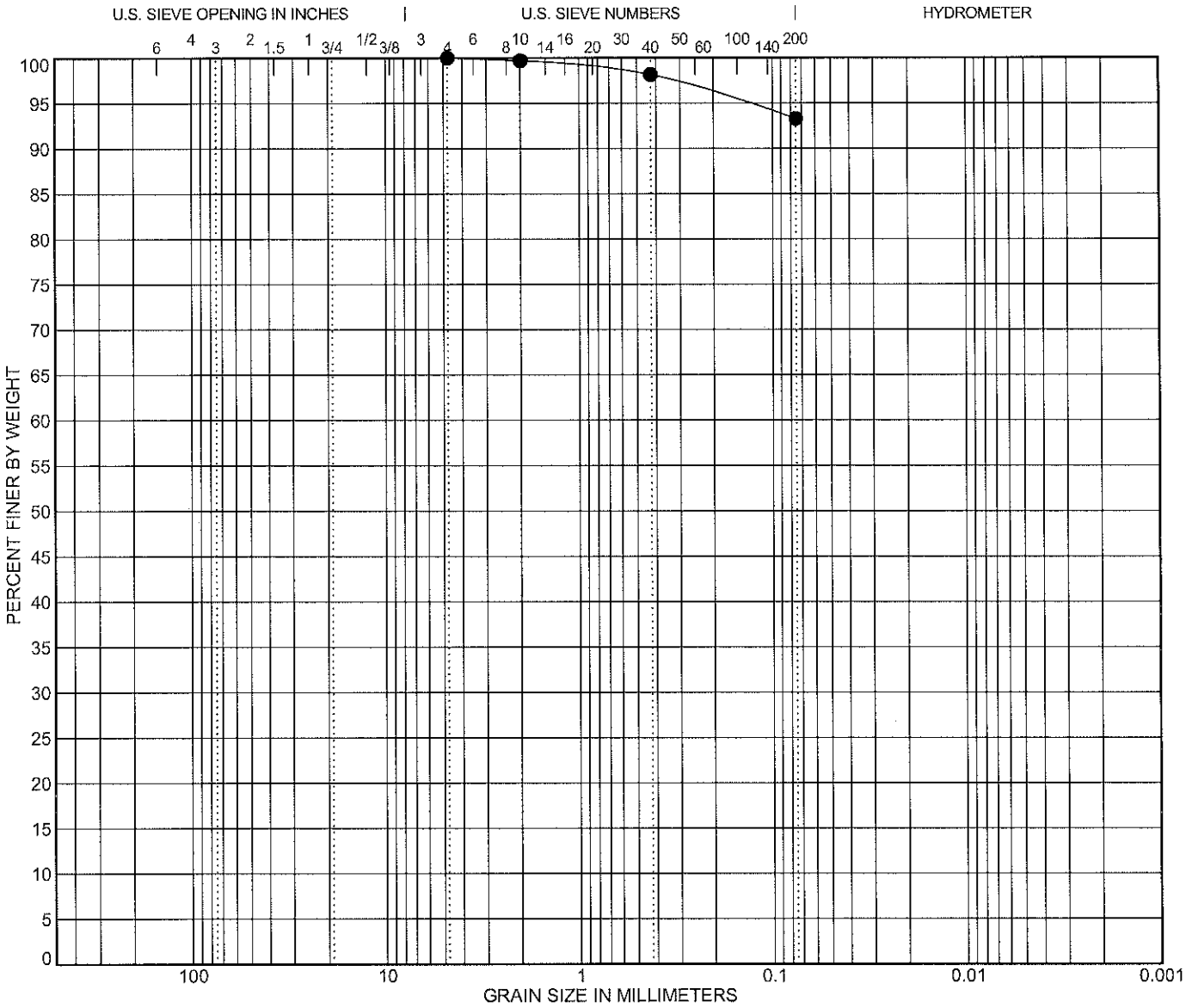

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **09-B79**	**28.0**	**FAT CLAY(CH)**	**55**	**19**	**36**		

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● **09-B79**	**28.0**		**100**	**99.7**	**98.1**		**93.3**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **09-B79**	**28.0**	**4.75**				**0.0**	**6.7**	**93.3**	

GRAIN SIZE DISTRIBUTION

TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume I
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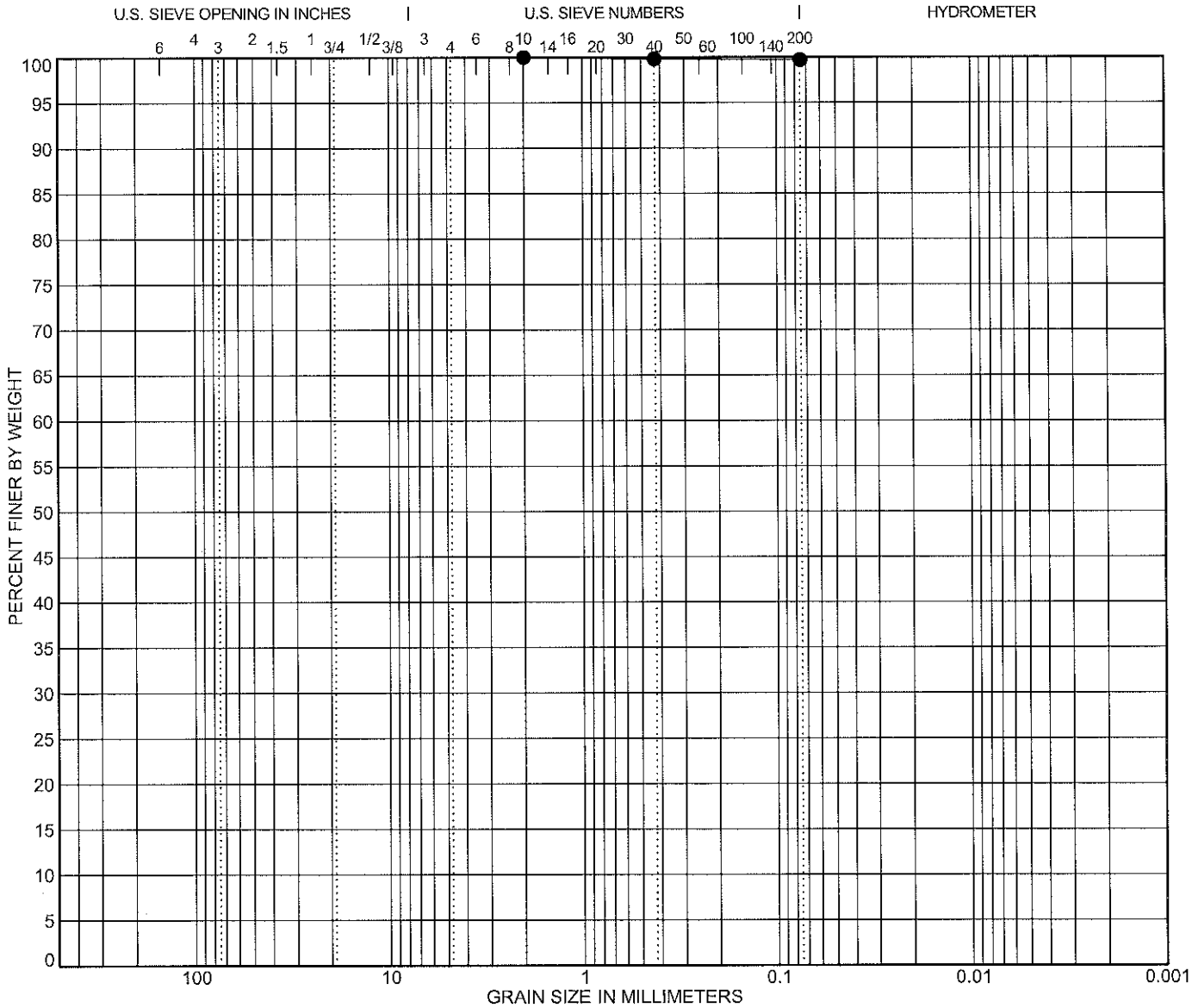

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **09-B79**	**38.0**	**FAT CLAY(CH)**	**94**	**28**	**66**		

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● **09-B79**	**38.0**			**100**	**99.8**		**99.7**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **09-B79**	**38.0**	**2**				**0.0**	**0.3**	**99.7**	

GRAIN SIZE DISTRIBUTION

TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume I
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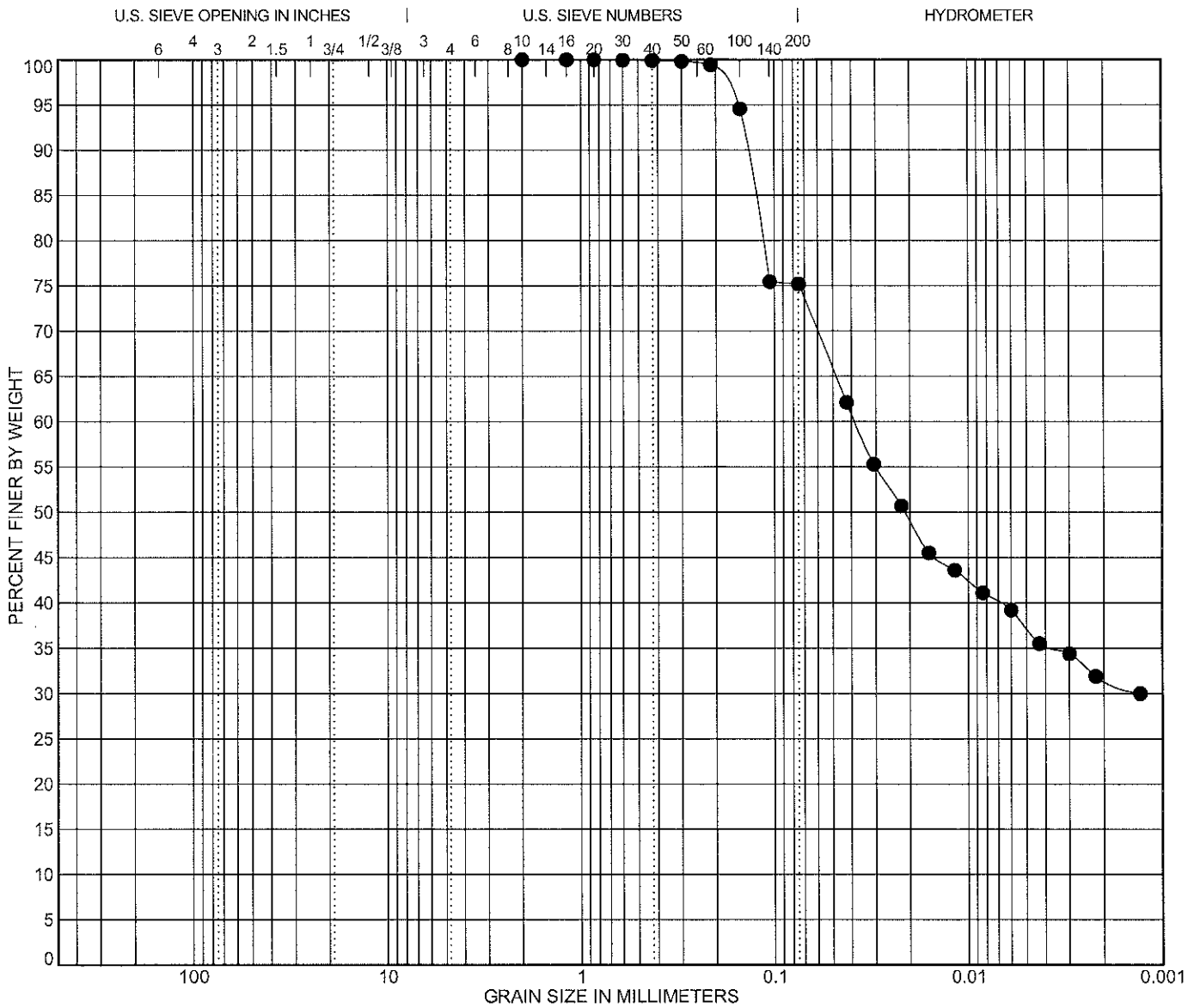

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B79**	**48.0**	**LEAN CLAY with SAND(CL)**	**41**	**15**	**26**		

Percent Passing the Indicated Sieve

	Specimen Identification		3/8"	#4	#10	#40	#100	#200
●	**09-B79**	**48.0**			**100**	**99.9**	**94.6**	**75.2**

	Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**09-B79**	**48.0**	**2**	**0.021**	**0.001**		**0.0**	**24.8**	**43.6**	**31.6**

GRAIN SIZE DISTRIBUTION

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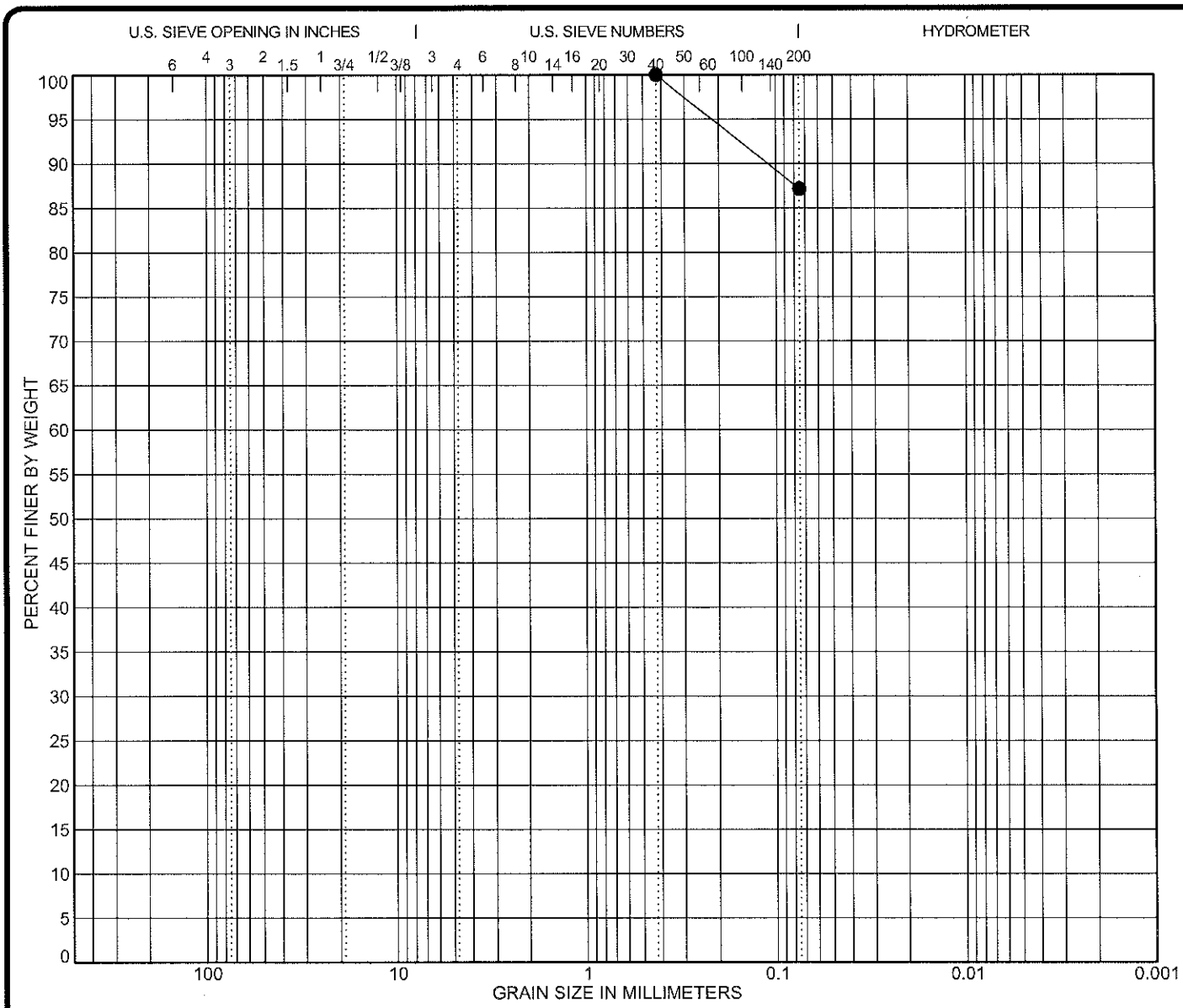

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **09-B79**	**52.0**	**FAT CLAY(CH)**	**78**	**25**	**53**		

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● **09-B79**	**52.0**				**100**		**87.2**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **09-B79**	**52.0**	**0.425**				**0.0**	**12.8**	**87.2**	

GRAIN SIZE DISTRIBUTION

TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume I
Baytown, Texas
Project Number 92105186-A

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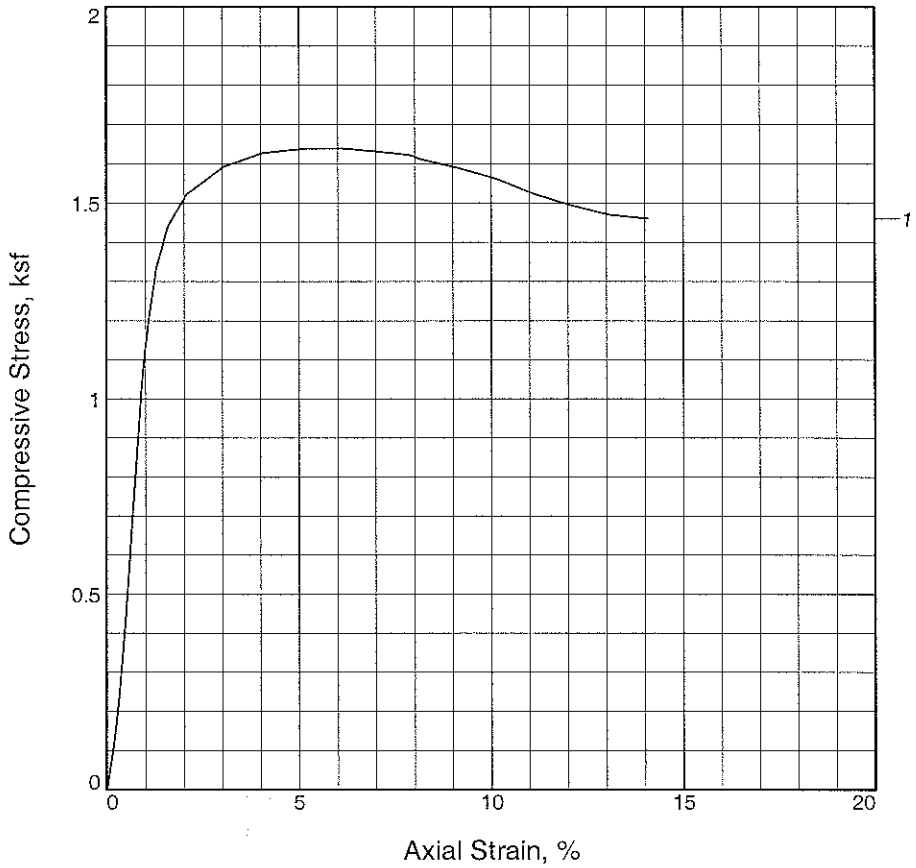
EXHIBIT ?

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, ksf	1.639			
Undrained shear strength, ksf	0.820			
Failure strain, %	6.2			
Strain rate, in./min.	0.055			
Water content, %	33.9			
Wet density, pcf	117.6			
Dry density, pcf	87.8			
Saturation, %	97.5			
Void ratio	0.9547			
Specimen diameter, in.	2.663			
Specimen height, in.	5.574			
Height/diameter ratio	2.09			

Description: Gray Clay

LL =	**PL =**	**PI =**	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 92105186-B

Date Sampled:

Remarks:
ASTM D2166

Client: USACE

Project: Pipeline Dredging, Cedar Bayou and Anahuac Channel, PA 16. Contract no. W912HY-09-D-0021, Task Order No. 0012

Location: 09-B79

Sample Number: 9 **Depth:** 16-18 ft.

UNCONFINED COMPRESSION TEST
Terracon, Inc.
Houston, TX

UNCONFINED COMPRESSION TEST

11/5/2010

Date:
Client: USACE
Project: Pipeline Dredging, Cedar Bayou and Anahuac Channel, PA 16.
Contract no. W912HY-09-D-0021, Task Order No. 0012
Project No.: 92105186-B
Location: 09-B79
Depth: 16-18 ft. **Sample Number:** 9
Description: Gray Clay
Remarks: ASTM D2166
Type of Sample: Undisturbed
Assumed Specific Gravity=2.75 **LL=** **PL=** **PI=**

Parameters for Specimen No. 1

Specimen Parameter	Initial
Moisture content: Moist soil+tare, gms.	177.360
Moisture content: Dry soil+tare, gms.	145.210
Moisture content: Tare, gms.	50.240
Moisture, %	33.9
Moist specimen weight, gms.	958.05
Diameter, in.	2.663
Area, in.^{2}	5.570
Height, in.	5.574
Wet density, pcf	117.6
Dry density, pcf	87.8
Void ratio	0.9547
Saturation, %	97.5

Test Readings for Specimen No. 1

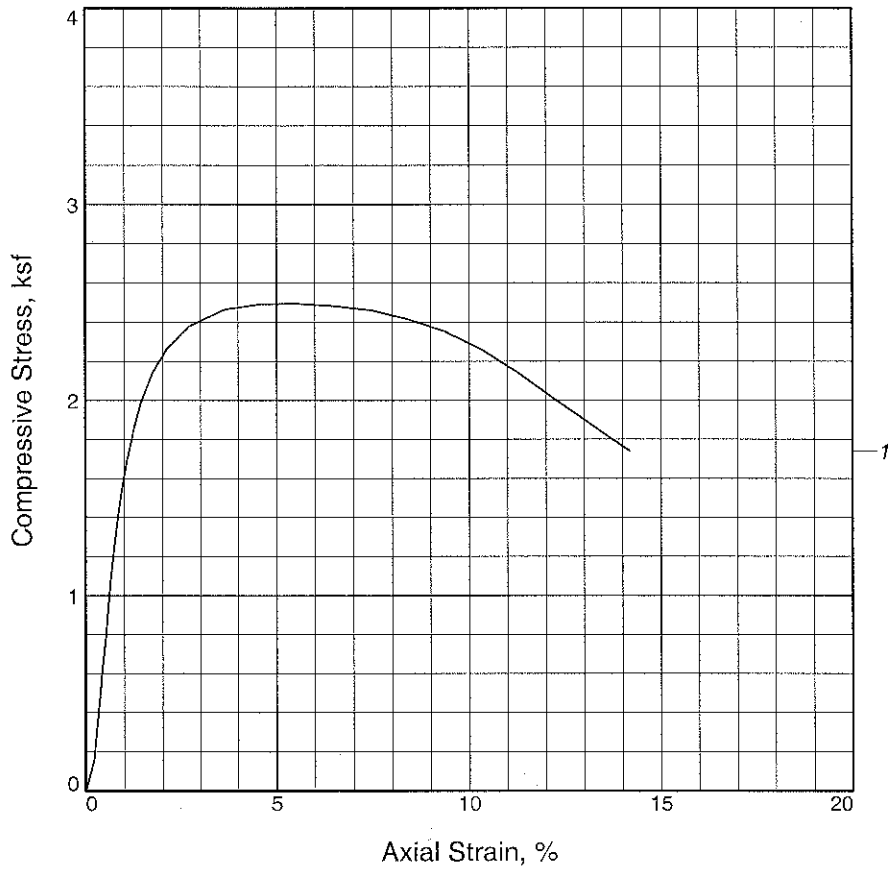
Strain rate, in./min. = 0.055
Unconfined compressive strength = 1.639 ksf **at reading no.** 19

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
0	0.0000	0.000	0.0	0.0	0.000
1	0.0020	0.394	0.4	0.0	0.010
2	0.0106	4.475	4.5	0.2	0.115
3	0.0177	8.924	8.9	0.3	0.230
4	0.0234	13.332	13.3	0.4	0.343
5	0.0276	16.972	17.0	0.5	0.437
6	0.0314	21.412	21.4	0.6	0.550
7	0.0357	26.241	26.2	0.6	0.674
8	0.0414	31.650	31.6	0.7	0.812
9	0.0456	35.909	35.9	0.8	0.921
10	0.0494	39.634	39.6	0.9	1.016
11	0.0551	43.798	43.8	1.0	1.121
12	0.0607	47.257	47.3	1.1	1.208
13	0.0716	52.382	52.4	1.3	1.337
14	0.0882	56.652	56.7	1.6	1.442
15	0.1156	60.105	60.1	2.1	1.522

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
16	0.1704	63.557	63.6	3.1	1.593
17	0.2257	65.617	65.6	4.0	1.628
18	0.2890	66.866	66.9	5.2	1.639
19	0.3439	67.574	67.6	6.2	1.639
20	0.3987	67.897	67.9	7.2	1.630
21	0.4403	68.094	68.1	7.9	1.621
22	0.4540	67.886	67.9	8.1	1.612
23	0.5089	67.666	67.7	9.1	1.590
24	0.5637	67.222	67.2	10.1	1.562
25	0.6191	66.293	66.3	11.1	1.524
26	0.6739	65.742	65.7	12.1	1.494
27	0.7287	65.445	65.4	13.1	1.471
28	0.7840	65.744	65.7	14.1	1.461

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, ksf	2.494			
Undrained shear strength, ksf	1.247			
Failure strain, %	5.5			
Strain rate, in./min.	0.055			
Water content, %	29.2			
Wet density, pcf	122.9			
Dry density, pcf	95.1			
Saturation, %	99.8			
Void ratio	0.8052			
Specimen diameter, in.	2.723			
Specimen height, in.	5.730			
Height/diameter ratio	2.10			

Description: Gray and tan Clay w/calc. nodules

LL =	**PL =**	**PI =**	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 92105186-B

Date Sampled:

Remarks:
ASTM D2166

Client: USACE

Project: Pipeline Dredging, Cedar Bayou and Anahuac Channel, PA 16. Contract no. W912HY-09-D-0021, Task Order No. 0012

Location: 09-B79

Sample Number: 15 **Depth:** 28-30 ft.

UNCONFINED COMPRESSION TEST
Terracon, Inc.
Houston, TX

UNCONFINED COMPRESSION TEST

11/5/2010

Date:
Client: USACE
Project: Pipeline Dredging, Cedar Bayou and Anahuac Channel, PA 16.
Contract no. W912HY-09-D-0021, Task Order No. 0012
Project No.: 92105186-B
Location: 09-B79
Depth: 28-30 ft. **Sample Number:** 15
Description: Gray and tan Clay w/calc. nodules
Remarks: ASTM D2166
Type of Sample: Undisturbed
Assumed Specific Gravity=2.75 **LL=** **PL=** **PI=**

Parameters for Specimen No. 1

Specimen Parameter	Initial
Moisture content: Moist soil+tare, gms.	159.960
Moisture content: Dry soil+tare, gms.	135.170
Moisture content: Tare, gms.	50.310
Moisture, %	29.2
Moist specimen weight, gms.	1076.36
Diameter, in.	2.723
Area, in.^{2}	5.824
Height, in.	5.730
Wet density, pcf	122.9
Dry density, pcf	95.1
Void ratio	0.8052
Saturation, %	99.8

Test Readings for Specimen No. 1

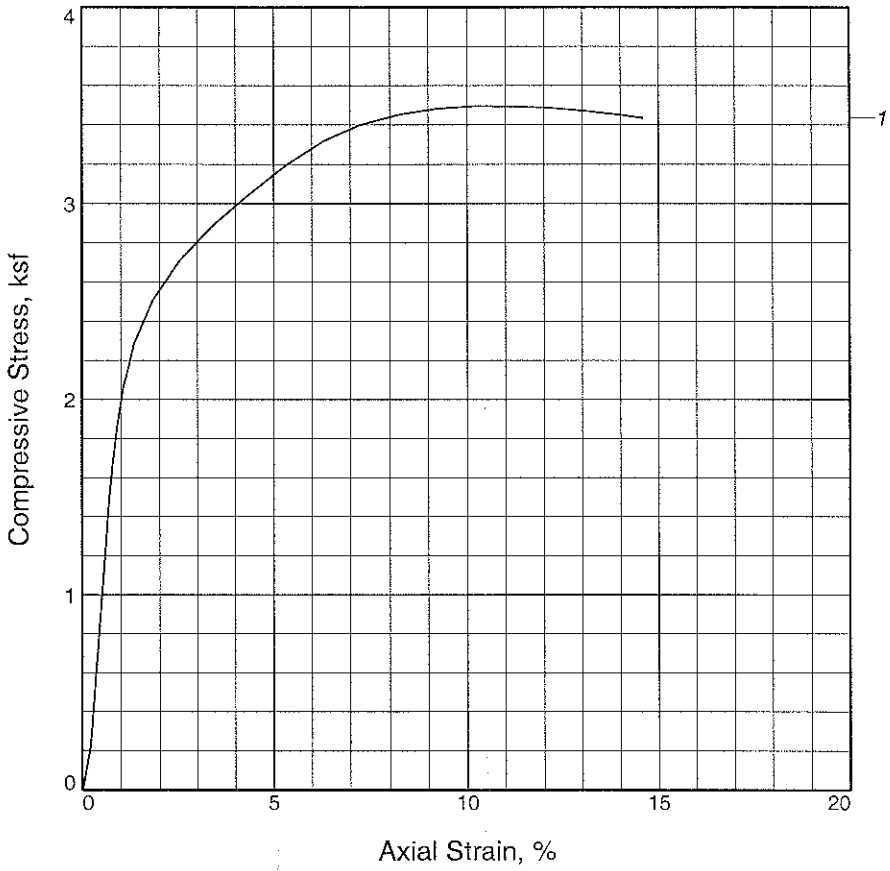
Strain rate, in./min. = 0.055
Unconfined compressive strength = 2.494 ksf **at reading no.** 21

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
0	0.0000	0.000	0.0	0.0	0.000
1	0.0000	0.407	0.4	0.0	0.010
2	0.0011	0.250	0.2	0.0	0.006
3	0.0124	6.410	6.4	0.2	0.158
4	0.0167	13.108	13.1	0.3	0.323
5	0.0209	19.416	19.4	0.4	0.478
6	0.0247	25.941	25.9	0.4	0.639
7	0.0290	31.431	31.4	0.5	0.773
8	0.0332	38.101	38.1	0.6	0.937
9	0.0370	44.328	44.3	0.6	1.089
10	0.0413	49.738	49.7	0.7	1.221
11	0.0469	56.278	56.3	0.8	1.380
12	0.0521	61.756	61.8	0.9	1.513
13	0.0607	68.654	68.7	1.1	1.680
14	0.0715	75.778	75.8	1.2	1.850
15	0.0824	81.502	81.5	1.4	1.986

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
16	0.0989	87.781	87.8	1.7	2.133
17	0.1212	93.432	93.4	2.1	2.261
18	0.1542	98.836	98.8	2.7	2.378
19	0.2091	103.453	103.5	3.6	2.465
20	0.2639	105.669	105.7	4.6	2.493
21	0.3164	106.752	106.8	5.5	2.494
22	0.3712	107.342	107.3	6.5	2.482
23	0.4128	107.461	107.5	7.2	2.466
24	0.4265	107.559	107.6	7.4	2.462
25	0.4813	106.685	106.7	8.4	2.416
26	0.5362	105.045	105.0	9.4	2.354
27	0.5915	101.955	102.0	10.3	2.261
28	0.6463	97.611	97.6	11.3	2.141
29	0.7016	92.331	92.3	12.2	2.004
30	0.7565	87.317	87.3	13.2	1.874
31	0.8113	82.041	82.0	14.2	1.741

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, ksf	3.495			
Undrained shear strength, ksf	1.747			
Failure strain, %	10.2			
Strain rate, in./min.	0.055			
Water content, %	22.6			
Wet density, pcf	119.5			
Dry density, pcf	97.5			
Saturation, %	81.6			
Void ratio	0.7615			
Specimen diameter, in.	2.715			
Specimen height, in.	5.666			
Height/diameter ratio	2.09			

Description: Gray Fat Clay w/sand pockets

LL =	**PL =**	**PI =**	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 92105186-B

Date Sampled:

Remarks:
ASTM D2166

Client: USACE

Project: Pipeline Dredging, Cedar Bayou and Anahuac Channel, PA 16. Contract no. W912HY-09-D-0021, Task Order No. 0012

Location: 09-B79

Sample Number: 27 **Depth:** 52-54 ft.

UNCONFINED COMPRESSION TEST
Terracon, Inc.
Houston, TX

UNCONFINED COMPRESSION TEST

11/5/2010

Date:
Client: USACE
Project: Pipeline Dredging, Cedar Bayou and Anahuac Channel, PA 16.
Contract no. W912HY-09-D-0021, Task Order No. 0012
Project No.: 92105186-B
Location: 09-B79
Depth: 52-54 ft. **Sample Number:** 27
Description: Gray Fat Clay w/sand pockets
Remarks: ASTM D2166
Type of Sample: Undisturbed
Assumed Specific Gravity=2.75 **LL=** **PL=** **PI=**

Parameters for Specimen No. 1

Specimen Parameter	Initial
Moisture content: Moist soil+tare, gms.	172.860
Moisture content: Dry soil+tare, gms.	150.220
Moisture content: Tare, gms.	49.970
Moisture, %	22.6
Moist specimen weight, gms.	1028.72
Diameter, in.	2.715
Area, in.^{2}	5.789
Height, in.	5.666
Wet density, pcf	119.5
Dry density, pcf	97.5
Void ratio	0.7615
Saturation, %	81.6

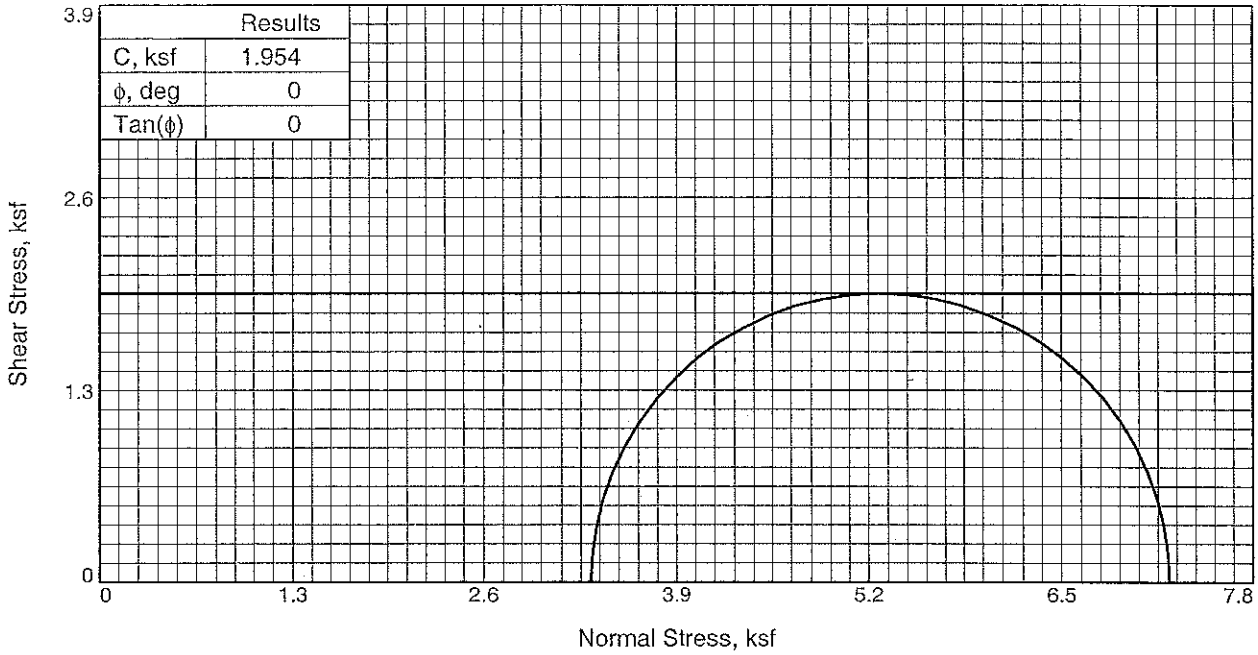
Test Readings for Specimen No. 1

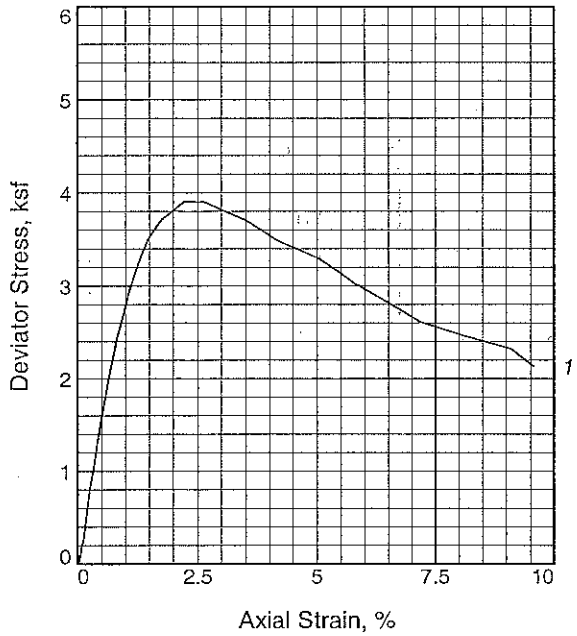
Strain rate, in./min. = 0.055
Unconfined compressive strength = 3.495 ksf **at reading no.** 21

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
0	0.0000	0.000	0.0	0.0	0.000
1	0.0012	0.064	0.1	0.0	0.002
2	0.0120	8.793	8.8	0.2	0.218
3	0.0177	19.346	19.3	0.3	0.480
4	0.0229	28.754	28.8	0.4	0.712
5	0.0286	39.650	39.6	0.5	0.981
6	0.0328	48.006	48.0	0.6	1.187
7	0.0380	58.220	58.2	0.7	1.438
8	0.0437	66.766	66.8	0.8	1.648
9	0.0508	75.164	75.2	0.9	1.853
10	0.0602	83.691	83.7	1.1	2.060
11	0.0768	93.289	93.3	1.4	2.289
12	0.1042	102.806	102.8	1.8	2.510
13	0.1430	111.578	111.6	2.5	2.705
14	0.1921	120.004	120.0	3.4	2.884
15	0.2474	128.096	128.1	4.4	3.047

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
16	0.3023	135.773	135.8	5.3	3.197
17	0.3571	142.327	142.3	6.3	3.317
18	0.4124	147.521	147.5	7.3	3.402
19	0.4672	151.315	151.3	8.2	3.453
20	0.5221	154.230	154.2	9.2	3.483
21	0.5774	156.445	156.4	10.2	3.495
22	0.6322	158.130	158.1	11.2	3.494
23	0.6875	159.534	159.5	12.1	3.487
24	0.7424	160.594	160.6	13.1	3.471
25	0.7977	161.413	161.4	14.1	3.450
26	0.8251	161.650	161.7	14.6	3.435
27	0.8251	161.797	161.8	14.6	3.438





Sample No.		1
Initial	Water Content, %	37.6
	Dry Density, pcf	86.0
	Saturation, %	103.9
	Void Ratio	0.9955
	Diameter, in.	2.709
	Height, in.	5.795
At Test	Water Content, %	37.6
	Dry Density, pcf	86.0
	Saturation, %	103.9
	Void Ratio	0.9955
	Diameter, in.	2.709
	Height, in.	5.795
Strain rate, in./min.		0.055
Back Pressure, psi		0.000
Cell Pressure, psi		23.060
Fail. Stress, ksf		3.907
Ult. Stress, ksf		
σ_1 Failure, ksf		7.228
σ_3 Failure, ksf		3.321

Type of Test:
Unconsolidated Undrained
Sample Type: Undisturbed
Description: Light brown Fat Clay

Assumed Specific Gravity= 2.75
Remarks: ASTM D2850

Client: USACE

Project: Pipeline Dredging, Cedar Bayou and Anahuac Channel, PA 16.
Contract no. W912HY-09-D-0021, Task Order No. 0012
Location: 09-B79
Sample Number: 20 **Depth:** 38-40 ft.
Proj. No.: 92105186-B **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Terracon, Inc.
Houston, TX

TRIAXIAL COMPRESSION TEST

Unconsolidated Undrained

11/5/2010
2:29 PM

Date:
Client: USACE
Project: Pipeline Dredging, Cedar Bayou and Anahuac Channel, PA 16.
Contract no. W912HY-09-D-0021, Task Order No. 0012
Project No.: 92105186-B
Location: 09-B79
Depth: 38-40 ft. **Sample Number:** 20
Description: Light brown Fat Clay
Remarks: ASTM D2850
Type of Sample: Undisturbed
Assumed Specific Gravity=2.75 **LL=** **PL=** **PI=**
Test Method: ASTM D 2850

Parameters for Specimen No. 1

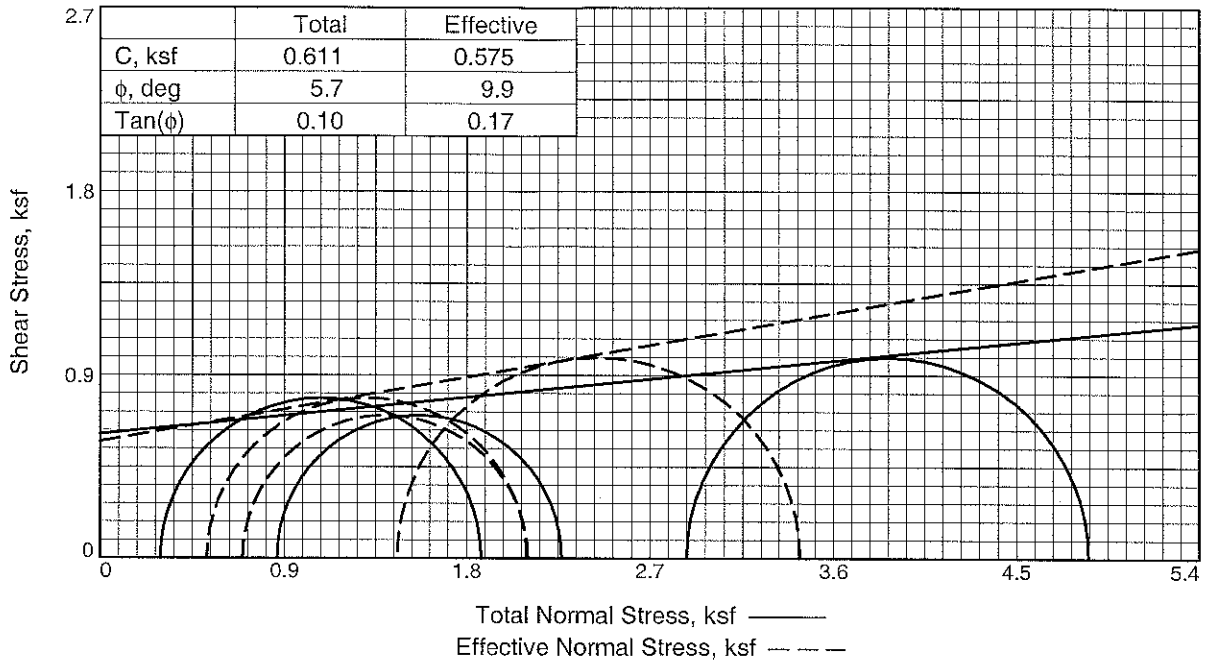
Specimen Parameter	Initial	Final
Moisture content: Moist soil+tare, gms.	163.820	163.820
Moisture content: Dry soil+tare, gms.	132.940	132.940
Moisture content: Tare, gms.	50.820	50.820
Moisture, %	37.6	37.6
Moist specimen weight, gms.	1037.93	
Diameter, in.	2.709	
Area, in.^{2}	5.764	
Height, in.	5.795	
Wet density, pcf	118.4	
Dry density, pcf	86.0	
Void ratio	0.9955	
Saturation, %	103.9	

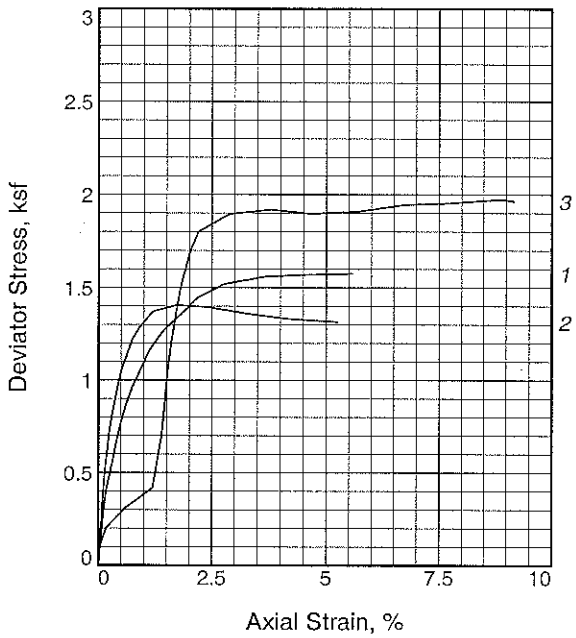
Test Readings for Specimen No. 1

Cell pressure = 23.060 psi (3.321 ksf)
Back pressure = 0.000 psi (0.000 ksf)
Strain rate, in./min. = 0.055
Fail. Stress = 3.907 ksf **at reading no.** 17

Test Results for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Princ. Stress ksf	Major Princ. Stress ksf	1:3 Ratio	P ksf	Q ksf
0	0.0000	-4.114	0.0	0.0	0.000	3.321	3.321	1.00	3.321	0.000
1	0.0014	-3.911	0.2	0.0	0.005	3.321	3.326	1.00	3.323	0.003
2	0.0072	7.023	11.1	0.1	0.278	3.321	3.599	1.08	3.460	0.139
3	0.0113	18.313	22.4	0.2	0.559	3.321	3.880	1.17	3.600	0.280
4	0.0154	29.123	33.2	0.3	0.828	3.321	4.149	1.25	3.735	0.414
5	0.0201	39.054	43.2	0.3	1.075	3.321	4.395	1.32	3.858	0.537
6	0.0242	48.523	52.6	0.4	1.310	3.321	4.630	1.39	3.975	0.655
7	0.0284	58.792	62.9	0.5	1.564	3.321	4.885	1.47	4.103	0.782
8	0.0331	67.240	71.4	0.6	1.773	3.321	5.093	1.53	4.207	0.886
9	0.0372	75.958	80.1	0.6	1.988	3.321	5.308	1.60	4.314	0.994
10	0.0432	85.825	89.9	0.7	2.230	3.321	5.551	1.67	4.436	1.115
11	0.0474	93.908	98.0	0.8	2.429	3.321	5.750	1.73	4.535	1.214
12	0.0543	103.522	107.6	0.9	2.664	3.321	5.985	1.80	4.653	1.332
13	0.0626	115.183	119.3	1.1	2.948	3.321	6.269	1.89	4.795	1.474
14	0.0738	127.743	131.9	1.3	3.252	3.321	6.573	1.98	4.947	1.626
15	0.0849	137.850	142.0	1.5	3.495	3.321	6.815	2.05	5.068	1.747
16	0.1018	147.055	151.2	1.8	3.710	3.321	7.031	2.12	5.176	1.855
17	0.1292	155.844	160.0	2.2	3.907	3.321	7.228	2.18	5.274	1.954
18	0.1461	156.074	160.2	2.5	3.901	3.321	7.222	2.17	5.271	1.951
19	0.1514	156.446	160.6	2.6	3.907	3.321	7.227	2.18	5.274	1.953
20	0.2016	149.829	153.9	3.5	3.712	3.321	7.033	2.12	5.177	1.856
21	0.2401	141.861	146.0	4.1	3.496	3.321	6.817	2.05	5.069	1.748
22	0.2927	134.616	138.7	5.1	3.291	3.321	6.612	1.99	4.966	1.645
23	0.3341	124.672	128.8	5.8	3.032	3.321	6.353	1.91	4.837	1.516
24	0.3757	116.511	120.6	6.5	2.818	3.321	6.139	1.85	4.730	1.409
25	0.4166	108.388	112.5	7.2	2.609	3.321	5.929	1.79	4.625	1.304
26	0.4715	103.045	107.2	8.1	2.459	3.321	5.780	1.74	4.550	1.230
27	0.5266	98.125	102.2	9.1	2.322	3.321	5.643	1.70	4.482	1.161
28	0.5541	90.275	94.4	9.6	2.133	3.321	5.453	1.64	4.387	1.066





Sample No.		1	2	3
Initial	Water Content, %	22.5	22.5	22.5
	Dry Density, pcf	92.9	92.9	92.9
	Saturation, %	73.5	73.5	73.5
	Void Ratio	0.8351	0.8351	0.8351
	Diameter, in.	2.694	2.694	2.694
	Height, in.	5.840	5.840	5.840
At Test	Water Content, %	30.6	30.6	30.6
	Dry Density, pcf	92.9	92.9	92.9
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.8351	0.8351	0.8351
	Diameter, in.	2.694	2.694	2.694
	Height, in.	5.840	5.840	5.840
Strain rate, in./min.		0.001	0.001	0.001
Back Pressure, psi		55.000	55.000	55.000
Cell Pressure, psi		57.050	60.990	75.010
Fail. Stress, ksf		1.575	1.405	1.973
Excess Pore Pr., ksf		-0.226	0.167	1.424
Ult. Stress, ksf				
Excess Pore Pr., ksf				
$\bar{\sigma}_1$ Failure, ksf		2.096	2.101	3.431
$\bar{\sigma}_3$ Failure, ksf		0.521	0.695	1.457

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Dark gray and tan Fat Clay w/sand

LL= 55 **PL=** 17 **PI=** 38

Assumed Specific Gravity= 2.73

Remarks: ASTM D4767
Specific gravity assumed
Percent pass #200 sieve = 71.7

Client: USACE

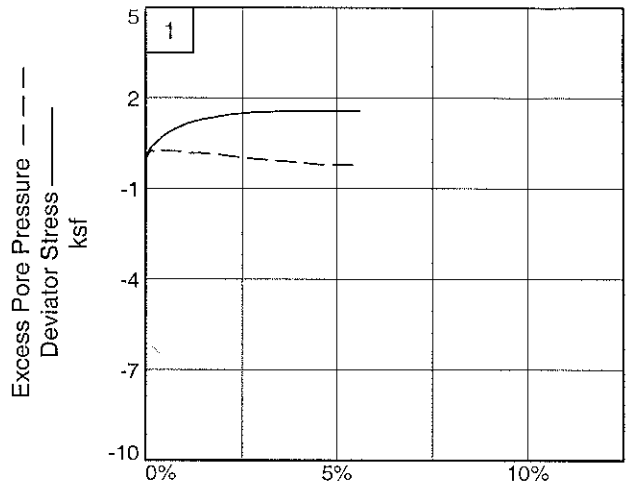
Project: Pipeline Dredging, Cedar Bayou and Anahuac Channel, PA 16.
Contract no. W912HY-09-D-0021, Task Order No. 0012

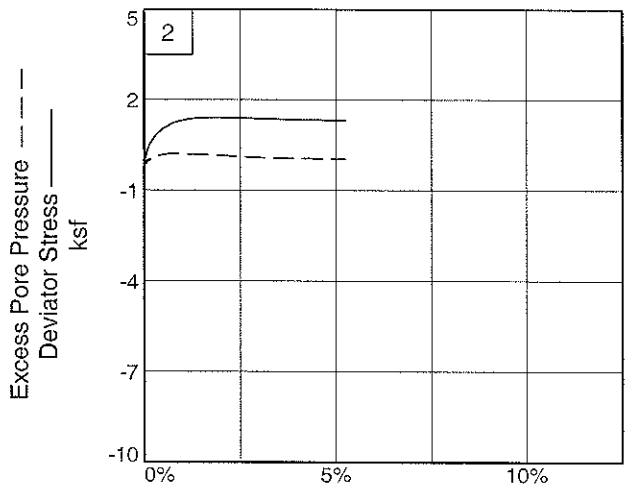
Location: 09-B79

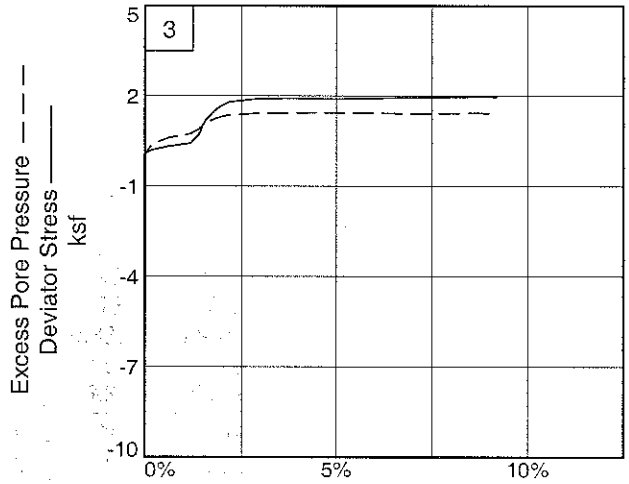
Sample Number: 4 **Depth:** 6-8 ft.

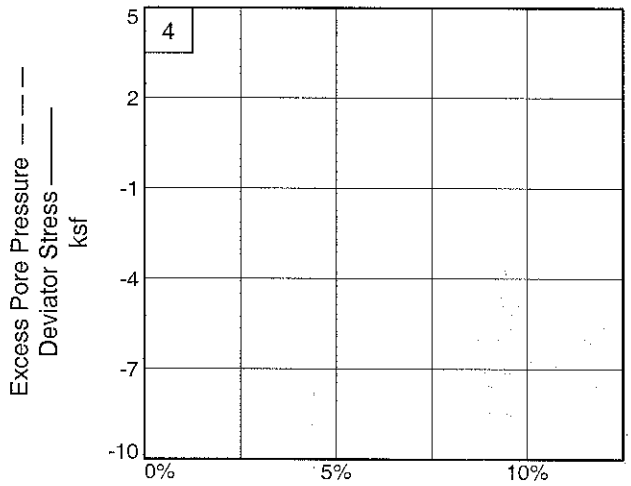
Proj. No.: 92105186 **Date Sampled:**

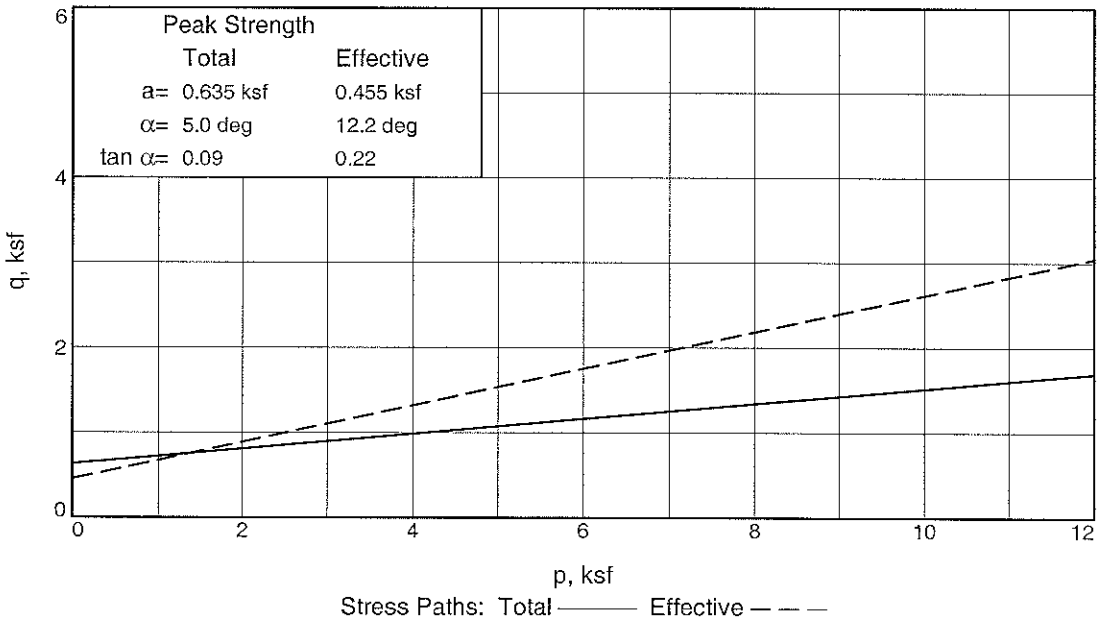
TRIAXIAL SHEAR TEST REPORT
Terracon, Inc.
Houston, TX











Client: USACE

Project: Pipeline Dredging, Cedar Bayou and Anahuac Channel, PA 16.

Location: 09-B79 **Depth:** 6-8 ft. **Sample Number:** 4

Project No.: 92105186

Terracon, Inc.

TRIAXIAL COMPRESSION TEST

CU with Pore Pressures

11/24/2010
10:48 AM

Date:
Client: USACE
Project: Pipeline Dredging, Cedar Bayou and Anahuac Channel, PA 16.
Contract no. W912HY-09-D-0021, Task Order No. 0012
Project No.: 92105186
Location: 09-B79
Depth: 6-8 ft. **Sample Number:** 4
Description: Dark gray and tan Fat Clay w/sand
Remarks: ASTM D4767
Specific gravity assumed
Percent pass #200 sieve = 71.7
Type of Sample: Undisturbed
Assumed Specific Gravity=2.73 **LL=**55 **PL=**17 **PI=**38
Test Method: COE uniform strain

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	161.330			130.930
Moisture content: Dry soil+tare, gms.	140.880			109.820
Moisture content: Tare, gms.	49.980			48.150
Moisture, %	22.5	30.6	30.6	34.2
Moist specimen weight, gms.	994.07			
Diameter, in.	2.694	2.694	2.694	
Area, in.^{2}	5.700	5.700	5.700	
Height, in.	5.840	5.840	5.840	
Net decrease in height, in.		0.000	0.000	
Wet density, pcf	113.8	121.3	121.3	
Dry density, pcf	92.9	92.9	92.9	
Void ratio	0.8351	0.8351	0.8351	
Saturation, %	73.5	100.0	100.0	

Test Readings for Specimen No. 1

Consolidation cell pressure = 57.050 psi (8.215 ksf)
Consolidation back pressure = 55.000 psi (7.920 ksf)
Consolidation effective confining stress = 0.295 ksf
Strain rate, in./min. = 0.001
Fail. Stress = 1.575 ksf **at reading no.** 20

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.000	8.215	8.215	1.00	0.000	8.215	0.000
1	0.0010	3.581	3.6	0.0	0.090	0.314	0.404	1.29	54.873	0.359	0.045
2	0.0040	7.406	7.4	0.1	0.187	0.177	0.364	2.06	55.822	0.270	0.093
3	0.0069	11.988	12.0	0.1	0.302	0.085	0.387	4.56	56.461	0.236	0.151
4	0.0099	15.718	15.7	0.2	0.396	0.039	0.436	11.06	56.776	0.238	0.198
5	0.0144	19.277	19.3	0.2	0.486	0.130	0.616	4.73	56.145	0.373	0.243
6	0.0188	22.666	22.7	0.3	0.571	0.049	0.620	12.63	56.709	0.334	0.285
7	0.0233	26.653	26.7	0.4	0.671	0.034	0.705	20.77	56.814	0.369	0.335
8	0.0293	30.887	30.9	0.5	0.776	0.057	0.834	14.54	56.652	0.446	0.388
9	0.0367	35.023	35.0	0.6	0.879	0.057	0.937	16.34	56.652	0.497	0.440
10	0.0441	38.565	38.6	0.8	0.967	0.060	1.027	17.09	56.633	0.544	0.483
11	0.0546	42.390	42.4	0.9	1.061	0.074	1.134	15.43	56.539	0.604	0.530
12	0.0665	46.644	46.6	1.1	1.165	0.121	1.286	10.60	56.207	0.704	0.582
13	0.0843	51.091	51.1	1.4	1.272	0.121	1.393	11.48	56.207	0.757	0.636
14	0.1081	55.065	55.1	1.9	1.365	0.172	1.537	8.95	55.858	0.854	0.683
15	0.1260	58.380	58.4	2.2	1.443	0.223	1.666	7.48	55.504	0.944	0.722
16	0.1617	61.806	61.8	2.8	1.518	0.303	1.821	6.02	54.949	1.062	0.759
17	0.2152	64.098	64.1	3.7	1.560	0.400	1.959	4.90	54.275	1.179	0.780
18	0.2688	65.132	65.1	4.6	1.570	0.510	2.080	4.08	53.507	1.295	0.785
19	0.3135	65.811	65.8	5.4	1.573	0.523	2.096	4.01	53.419	1.310	0.787
20	0.3264	66.017	66.0	5.6	1.575	0.521	2.096	4.02	53.431	1.308	0.787

Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	161.330			130.930
Moisture content: Dry soil+tare, gms.	140.880			109.820
Moisture content: Tare, gms.	49.980			48.150
Moisture, %	22.5	30.6	30.6	34.2
Moist specimen weight, gms.	994.07			
Diameter, in.	2.694	2.694	2.694	
Area, in.^{2}	5.700	5.700	5.700	
Height, in.	5.840	5.840	5.840	
Net decrease in height, in.		0.000	0.000	
Wet density, pcf	113.8	121.3	121.3	
Dry density, pcf	92.9	92.9	92.9	
Void ratio	0.8351	0.8351	0.8351	
Saturation, %	73.5	100.0	100.0	

Test Readings for Specimen No. 2

Consolidation cell pressure = 60.990 psi (8.783 ksf)

Consolidation back pressure = 55.000 psi (7.920 ksf)

Consolidation effective confining stress = 0.863 ksf

Strain rate, in./min. = 0.001

Fail. Stress = 1.405 ksf **at reading no.** 16

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.000	8.783	8.783	1.00	0.000	8.783	0.000
1	0.0010	1.436	1.4	0.0	0.036	0.864	0.900	1.04	54.991	0.882	0.018
2	0.0024	5.380	5.4	0.0	0.136	0.967	1.103	1.14	54.272	1.035	0.068
3	0.0039	10.109	10.1	0.1	0.255	0.965	1.220	1.26	54.289	1.092	0.128
4	0.0053	14.057	14.1	0.1	0.355	0.856	1.210	1.41	55.049	1.033	0.177
5	0.0082	19.613	19.6	0.1	0.495	0.877	1.371	1.56	54.902	1.124	0.247
6	0.0111	23.772	23.8	0.2	0.599	0.836	1.435	1.72	55.186	1.135	0.300
7	0.0140	28.308	28.3	0.2	0.713	0.799	1.513	1.89	55.440	1.156	0.357
8	0.0169	31.586	31.6	0.3	0.796	0.765	1.561	2.04	55.675	1.163	0.398
9	0.0213	35.397	35.4	0.4	0.891	0.728	1.619	2.22	55.935	1.173	0.445
10	0.0256	38.917	38.9	0.4	0.979	0.701	1.680	2.40	56.120	1.191	0.489
11	0.0300	42.162	42.2	0.5	1.060	0.684	1.743	2.55	56.242	1.213	0.530
12	0.0372	45.369	45.4	0.6	1.139	0.658	1.797	2.73	56.422	1.227	0.569
13	0.0430	48.570	48.6	0.7	1.218	0.655	1.873	2.86	56.442	1.264	0.609
14	0.0532	51.450	51.5	0.9	1.288	0.654	1.942	2.97	56.445	1.298	0.644
15	0.0706	54.895	54.9	1.2	1.370	0.674	2.044	3.03	56.311	1.359	0.685
16	0.0996	56.599	56.6	1.7	1.405	0.695	2.101	3.02	56.161	1.398	0.703
17	0.1402	56.585	56.6	2.4	1.395	0.750	2.145	2.86	55.784	1.447	0.698
18	0.1924	55.584	55.6	3.3	1.358	0.803	2.161	2.69	55.411	1.482	0.679
19	0.2446	54.970	55.0	4.2	1.331	0.812	2.143	2.64	55.348	1.478	0.665
20	0.3056	54.923	54.9	5.2	1.315	0.829	2.144	2.59	55.232	1.487	0.657

Parameters for Specimen No. 3

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	161.330			130.930
Moisture content: Dry soil+tare, gms.	140.880			109.820
Moisture content: Tare, gms.	49.980			48.150
Moisture, %	22.5	30.6	30.6	34.2
Moist specimen weight, gms.	994.07			
Diameter, in.	2.694	2.694	2.694	
Area, in.^{2}	5.700	5.700	5.700	
Height, in.	5.840	5.840	5.840	
Net decrease in height, in.		0.000	0.000	
Wet density, pcf	113.8	121.3	121.3	
Dry density, pcf	92.9	92.9	92.9	
Void ratio	0.8351	0.8351	0.8351	
Saturation, %	73.5	100.0	100.0	

Test Readings for Specimen No. 3

Consolidation cell pressure = 75.010 psi (10.801 ksf)

Consolidation back pressure = 55.000 psi (7.920 ksf)

Consolidation effective confining stress = 2.881 ksf

Strain rate, in./min. = 0.001

Fail. Stress = 1.973 ksf **at reading no.** 19

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.000	10.801	10.801	1.00	0.000	10.801	0.000
1	0.0005	3.643	3.6	0.0	0.092	2.822	2.914	1.03	55.410	2.868	0.046
2	0.0107	8.016	8.0	0.2	0.202	2.505	2.707	1.08	57.614	2.606	0.101
3	0.0354	12.396	12.4	0.6	0.311	2.281	2.592	1.14	59.171	2.436	0.156
4	0.0702	16.756	16.8	1.2	0.418	2.142	2.560	1.20	60.133	2.351	0.209
5	0.0818	28.128	28.1	1.4	0.701	1.992	2.693	1.35	61.175	2.343	0.350
6	0.0876	40.347	40.3	1.5	1.004	1.876	2.880	1.54	61.985	2.378	0.502
7	0.0934	48.504	48.5	1.6	1.206	1.792	2.998	1.67	62.566	2.395	0.603
8	0.0992	54.672	54.7	1.7	1.358	1.719	3.077	1.79	63.073	2.398	0.679
9	0.1050	60.318	60.3	1.8	1.496	1.655	3.152	1.90	63.516	2.403	0.748
10	0.1166	68.174	68.2	2.0	1.688	1.568	3.256	2.08	64.123	2.412	0.844
11	0.1282	72.864	72.9	2.2	1.800	1.512	3.313	2.19	64.507	2.413	0.900
12	0.1688	77.241	77.2	2.9	1.895	1.466	3.360	2.29	64.832	2.413	0.947
13	0.2210	78.972	79.0	3.8	1.920	1.455	3.375	2.32	64.904	2.415	0.960
14	0.2732	78.811	78.8	4.7	1.898	1.440	3.338	2.32	65.008	2.389	0.949
15	0.3341	80.172	80.2	5.7	1.909	1.445	3.354	2.32	64.977	2.399	0.955
16	0.3922	82.535	82.5	6.7	1.945	1.470	3.415	2.32	64.802	2.442	0.973
17	0.4502	83.824	83.8	7.7	1.954	1.467	3.422	2.33	64.819	2.445	0.977
18	0.5082	85.467	85.5	8.7	1.971	1.456	3.427	2.35	64.900	2.442	0.986
19	0.5227	85.789	85.8	8.9	1.973	1.457	3.431	2.35	64.890	2.444	0.987
20	0.5352	85.628	85.6	9.2	1.965	1.460	3.425	2.35	64.870	2.443	0.982

Project name: TO-0012 Pipeline Dredging, Volume I, Cedar Bayou PA 6 | Client: USACE, Galveston District | Terracon Project # : 92105186-A

Boring	Depth	Field tests			Atterberg Limits			Grain Size Analysis														USCS Symbol (ASTM 2487)	Wc	γd	Strength tests																				
								Percent Pasing Sieve																	Direct Shear Test					Unconfined Compression				UU Triaxial Test				CU Triaxial Test						
		PP	TV	SPTn	LL	PL	PI	3/4"	3/8"	4	8	10	16	20	30	40	50	70	100	140	200				C	φ	Wc	γd	Symbol	C	Wc	γd	Symbol	C	Wc	γd	Symbol	C	φ	c'	φ'	Wc	γd	Symbol
	ft	tsf	tsf	bl/ft	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%		%	pcf	ksf	°	%	pcf		ksf	%	pcf		ksf	%	pcf		ksf	°	ksf	°	%	pcf	
09-B79	0-2	2.25			52	15	37		100	100		100				98					87	CH	25	101																					
	2-4	1.75																				CH**	19																						
	4-6	4.50																				CH**	16																						
	6-8	1.50			55	17	38			100		100				100					85	CH	23															0.6	6	0.6	10	23	93	CH**
	8-10	0.75																				CH**	28																						
	10-12	0.75																				CH**	32																						
	12-14	1.50																				CL**/CH**	34																						
	14-16	2.50																				CL**	29																						
	16-18	0.50			42	17	25			100		100				99					83	CL	34							0.8	34	88	CH**											
	18-20	1.00																				CH**	23																						
	20-22	0.50																				CH**	38																						
	22-24	0.00	0.25																			CH**	27																						
	24-26	0.25																				CH**	33																						
	26-28																					CH**	36																						
	28-30	0.75			55	19	36			100		100				98					93	CH	29							1.3	29	95	CH**											
	30-32	0.50																				CH**	30																						
	32-34	0.00																				CH**	36																						
	34-36	1.75																				CH**	38																						
	36-38	1.25																				CH**	33																						
	38-40	1.50			94	28	66					100				100					100	CH	38											2.0	38	86	CH**							
	40-42	1.75																				CH**	40																						
	42-44	0.75																				CH**	50																						
	44-46	1.75																				CH**	46																						
	46-48	1.50			25	19	6															CL-ML*	25	103																					
	48-50	0.50			41	15	26					100		100	100	100	100	99	95	75	75	CL	24																						
	50-52	1.00																				CL**	24																						
	52-54	1.25			78	25	53					100				100					87	CH	23							1.7	23	98	CH**											
	54-56	1.25																				CH**	28																						
	56-58	0.50																				CH**	29																						
	58-60	1.50																				CH**	32																						
	60-62	1.50			77	25	52															CH*	32	89																					
	62-64	1.25																				CH**	32																						
	64-66	1.00																				CH**	37																						