BORING LOG NO. 09-B86

CLIENT:	USACE, Galveston District Galveston, Texas	PROJECT:	TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume I
BORING LOCATION:	N: 13826840 E: 3261683	SITE:	Cedar Bayou PA6 Baytown, Texas

Approx. Surface Elevation: 15.0 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 reddish brown, light brown, brown and gray, soft to very stiff, high to very high plasticity, with scattered gravel calcareous nodules and sand pockets and seams	1	CH	ST	9		1.75		22								
		3		ST	13		0.5		23	98	66	23	43	86			
		5		ST	13		1.25		29								
		7		ST	17		1.0		31								
		9		ST	12		0.5		37								
		11		ST	16		0.25	0.2	38	86	59	20	39	86			
	3.0 / 12.0																
	FAT CLAY dark gray, black and brownish yellow, very soft to hard, high plasticity, moist to wet	13	CH	ST	13		0.0	0.15	70								
		15		ST	12		2.0		17	112	58	20	38	87			
	-1.0 / 16.0																
	LEAN CLAY brownish yellow, light gray and yellow, medium stiff to stiff, medium to high plasticity, moist, with silt and sand seams	17	CL	ST	5		1.5		20								
		19		ST	6		1.75		25					88			
		21		ST	20		1.0		24								
	-7.0 / 22.0																
	FAT CLAY brown, brownish yellow, light gray and bluish gray, medium stiff to hard, very high plasticity, moist	23	CH	ST	18		2.75		28								
		25		ST	18		2.5		30	92	93	28	65	100			
		27		ST	14		2.5		32								
	- with slickensides 28 to 38 feet	29		ST	19		2.5		33								
		31		ST	17		3.0		35								
		33		ST	18		1.75		35								
		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 10 feet; wet rotary thereafter.

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

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DATE DRILLED	Page 1 of 2
3/30/2010	09-B86
PROJECT NUMBER 92105186-A	EXHIBIT A-

BORING LOG NO. 09-B86

CLIENT:	USACE, Galveston District Galveston, Texas	PROJECT:	TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume I
BORING LOCATION:	N: 13826840 E: 3261683	SITE:	Cedar Bayou PA6 Baytown, Texas

Approx. Surface Elevation: 15.0 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 brown, brownish yellow, light gray and bluish gray, medium stiff to hard, very high plasticity, moist	35		ST	16		2.5		38								
		36															
		37		ST	15		2.5		36	86	88	28	60	100			
		38															
		39		ST	18		2.0		35								
		40															
		41		ST	18		2.25		39								
		42															
		43		ST	12		1.5		40								
		44															
	- with calcareous nodules, organic matter and slickensides 44 to 46 feet	45		ST	17		2.25		41	81	101	32	69				
		46															
		47		ST	3		0.75		28								
-33.0	48.0	48															
	LEAN CLAY w/ SAND bluish gray, medium stiff, medium plasticity, moist, with sand seams	49	CL	ST	7		1.0		20								
-35.0	50.0	50															
	FAT CLAY bluish gray, stiff, very high plasticity, moist	51	CH	ST	12		1.75		24								
		52															
		53		ST	12		1.75		27								
-39.0	54.0	54															
	LEAN CLAY light bluish gray, medium stiff, high plasticity, moist, with silt seams	55	CL	ST	8		1.0		29	96	42	19	23	99			
-41.0	56.0	56															
	FAT CLAY light bluish gray, dark bluish gray and gray, medium stiff to stiff, high plasticity, moist, homogeneous	57	CH	ST	5		1.5		31								
		58															
		59		ST	15		1.25		43								
		60															
		61		ST	7		1.5		41								
		62															
		63		ST	11		1.0		35								
		64															
		65		ST	8		1.0		38								
-51.0	66.0																
	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 10 feet; wet rotary thereafter.

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

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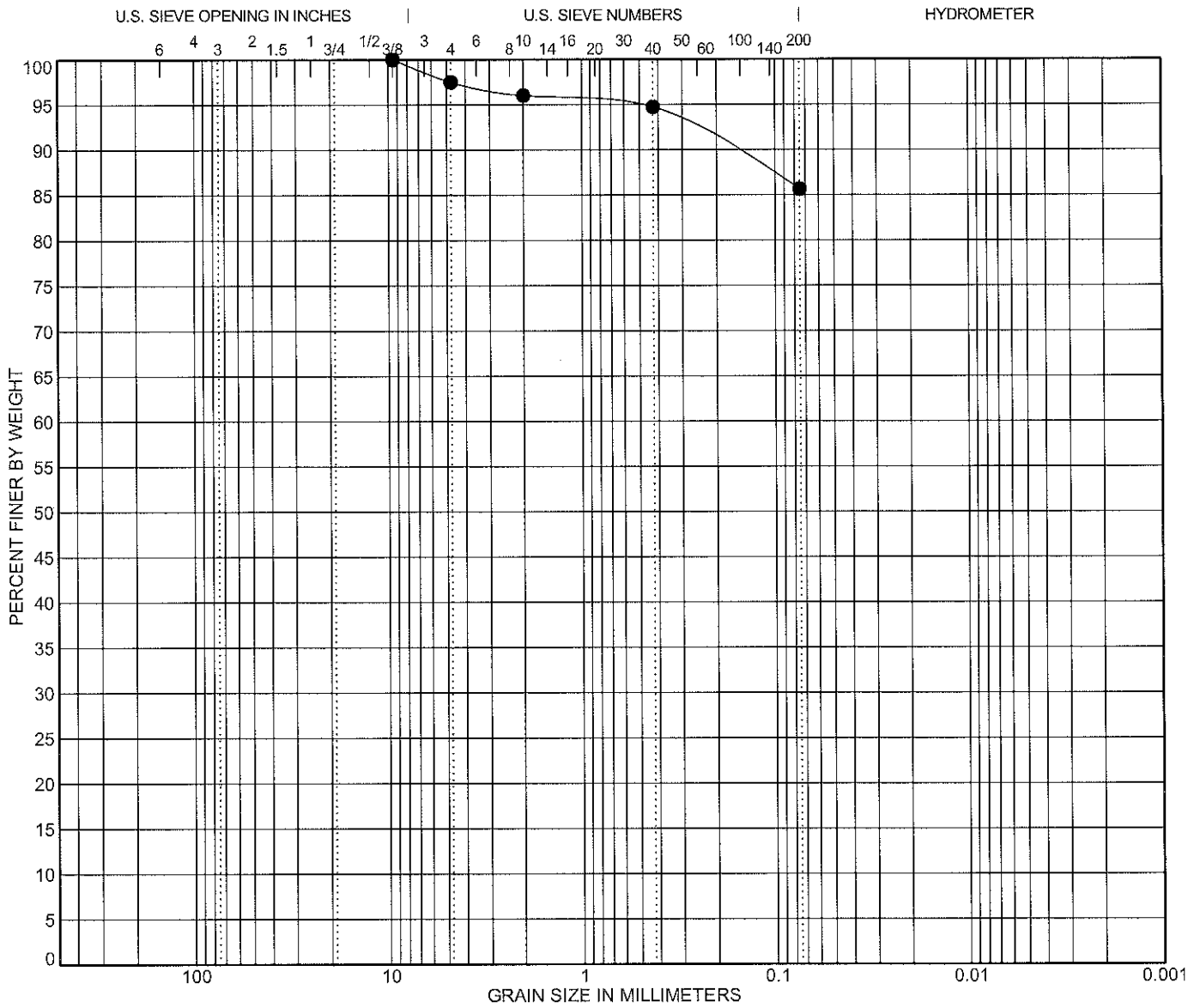
DATE DRILLED	Page 2 of 2
3/30/2010	09-B86
PROJECT NUMBER	EXHIBIT A-
92105186-A	



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● 09-B86	2.0	**FAT CLAY(CH)**	**66**	**23**	**43**		

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● 09-B86	2.0	**100**	**97.5**	**96**	**94.7**		**85.6**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● 09-B86	2.0	**9.5**				**2.5**	**11.9**	**85.6**	

GRAIN SIZE DISTRIBUTION

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

Terracon

Terracon Consultants, Inc.
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Houston, Texas 77043
Telephone: 713-690-8989
Fax: 713-690-8787

EXHIBIT
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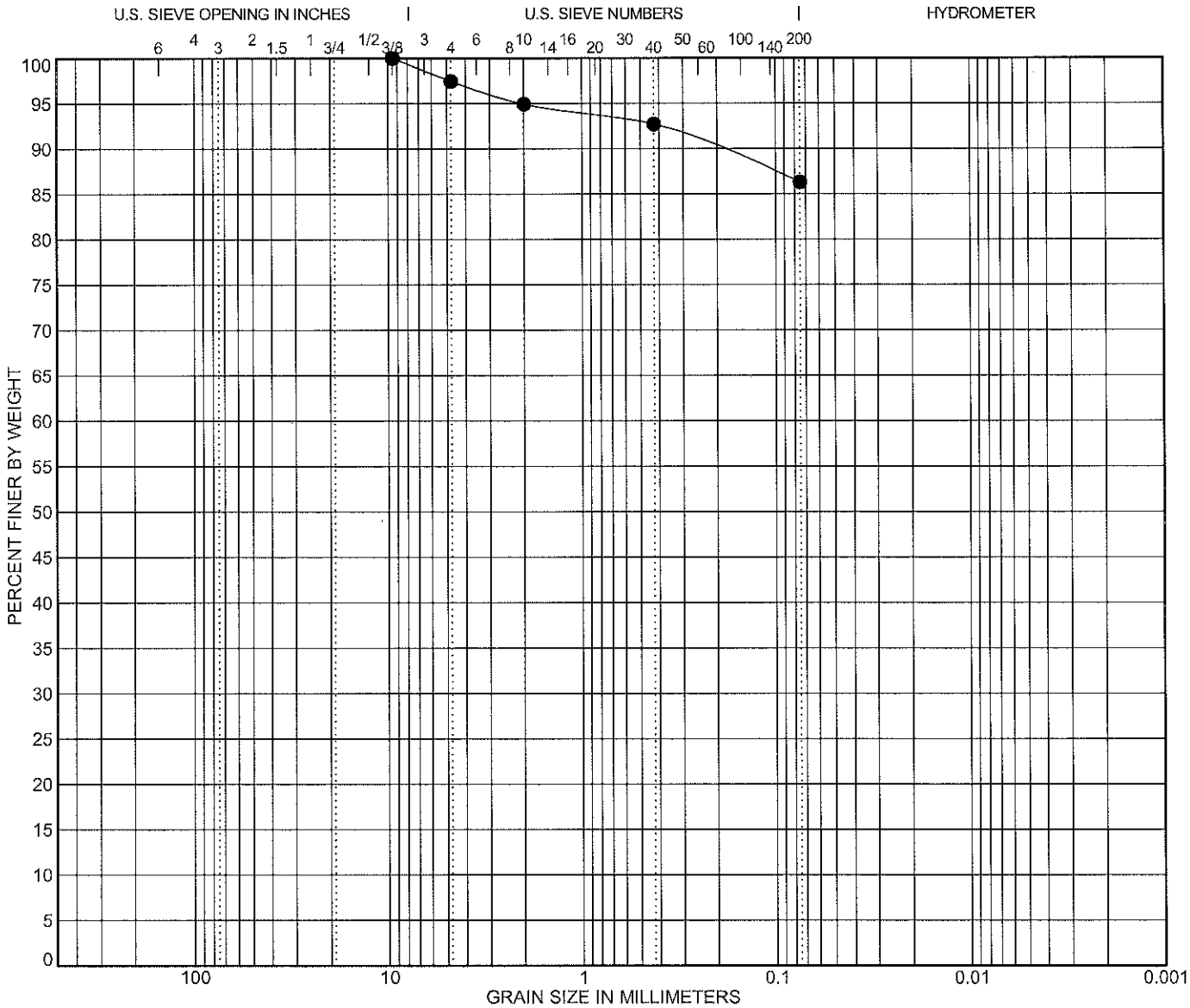

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B86**	**10.0**	**FAT CLAY(CH)**	**59**	**20**	**39**		

Percent Passing the Indicated Sieve

	Specimen Identification		3/8"	#4	#10	#40	#100	#200
●	**09-B86**	**10.0**	**100**	**97.4**	**94.9**	**92.7**		**86.3**

	Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**09-B86**	**10.0**	**9.5**				**2.6**	**11.2**	**86.3**	

GRAIN SIZE DISTRIBUTION

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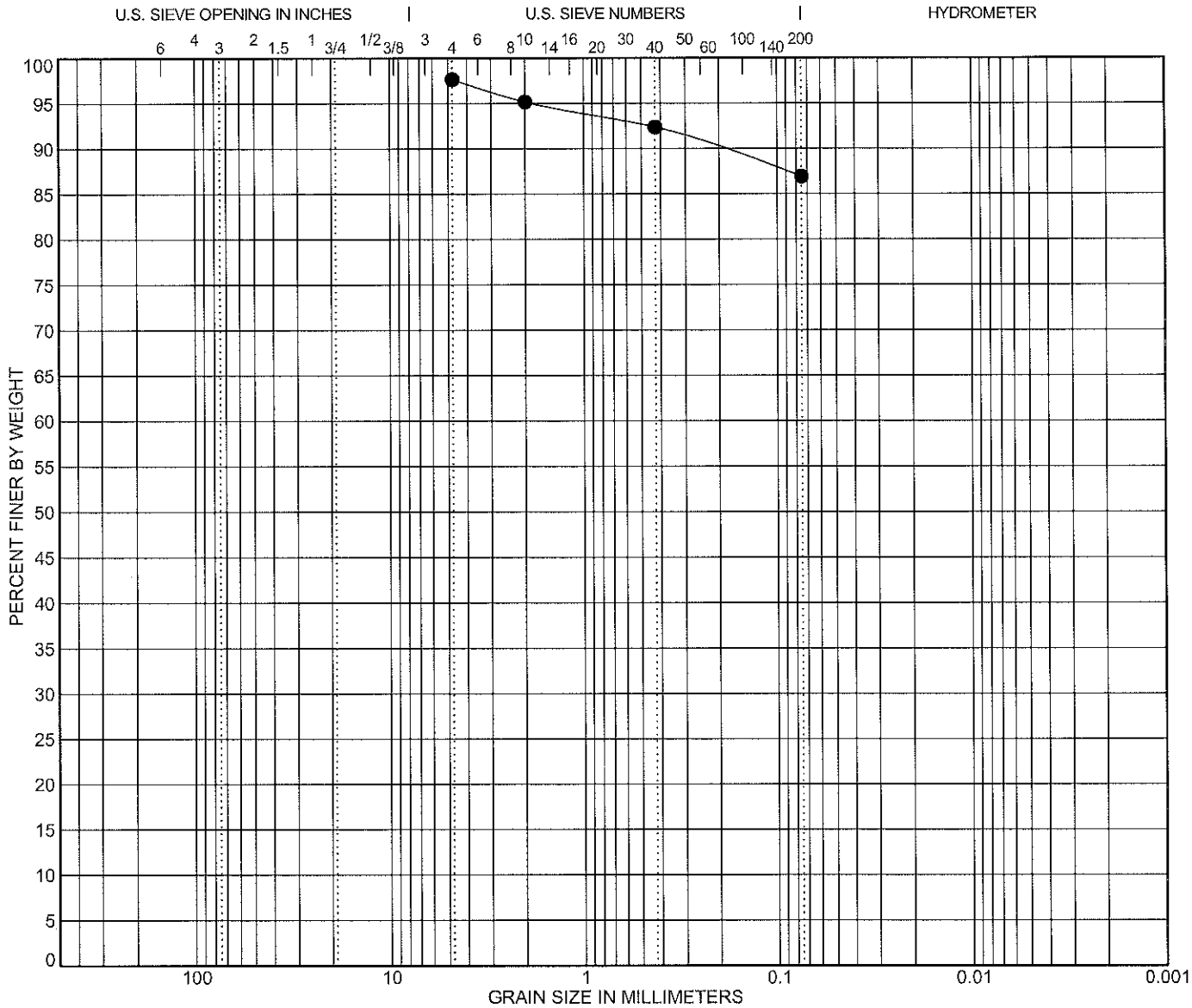

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B86**	**14.0**	**FAT CLAY(CH)**	**58**	**20**	**38**		

Percent Passing the Indicated Sieve

	Specimen Identification		3/8"	#4	#10	#40	#100	#200
●	**09-B86**	**14.0**		**97.7**	**95.2**	**92.4**		**86.9**

	Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**09-B86**	**14.0**	**4.75**				**0.0**	**10.7**	**86.9**	

GRAIN SIZE DISTRIBUTION

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Telephone: 713-690-8989
Fax: 713-690-8787

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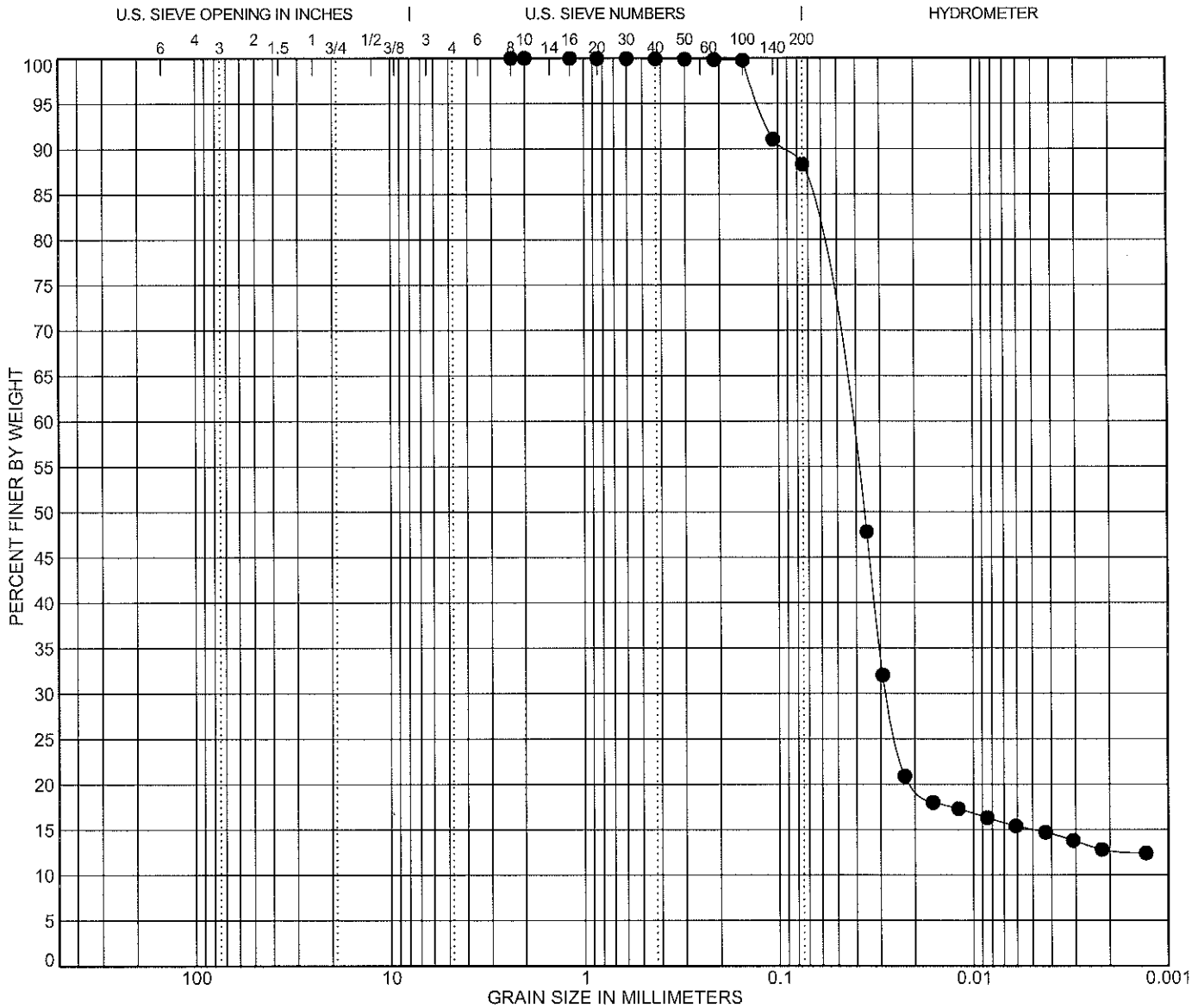

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **09-B86**	**18.0**						

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● **09-B86**	**18.0**			**100**	**99.9**	**99.7**	**88.3**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **09-B86**	**18.0**	**2.36**	**0.037**	**0.028**		**0.0**	**11.7**	**75.6**	**12.7**

GRAIN SIZE DISTRIBUTION

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Project Number 92105186-A

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Houston, Texas 77043
Telephone: 713-690-8989
Fax: 713-690-8787

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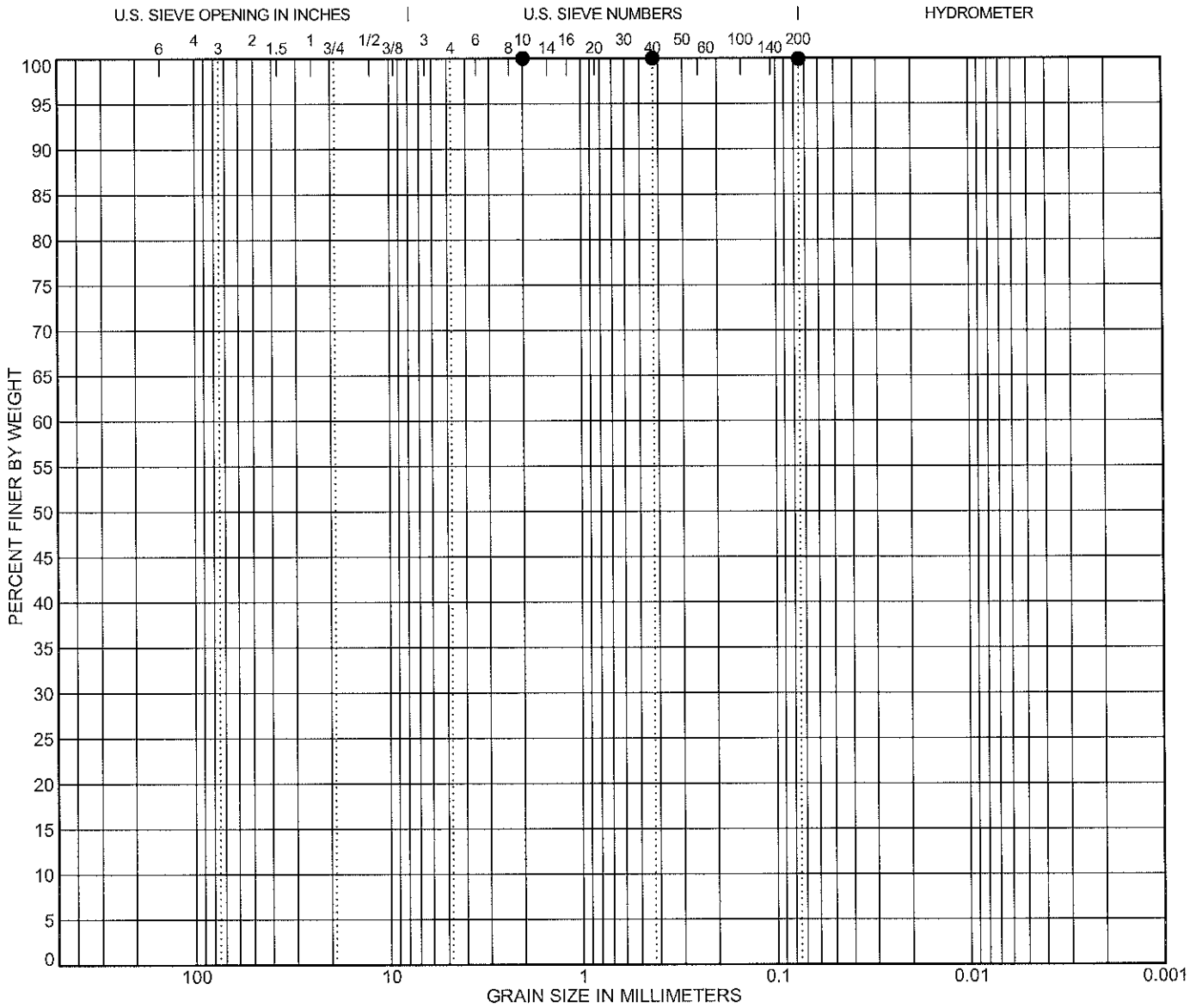

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **09-B86**	**24.0**	**FAT CLAY(CH)**	**93**	**28**	**65**		

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● **09-B86**	**24.0**			**100**	**100**		**99.9**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **09-B86**	**24.0**	**2**				**0.0**	**0.1**	**99.9**	

GRAIN SIZE DISTRIBUTION

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Baytown, Texas
Project Number 92105186-A

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Houston, Texas 77043
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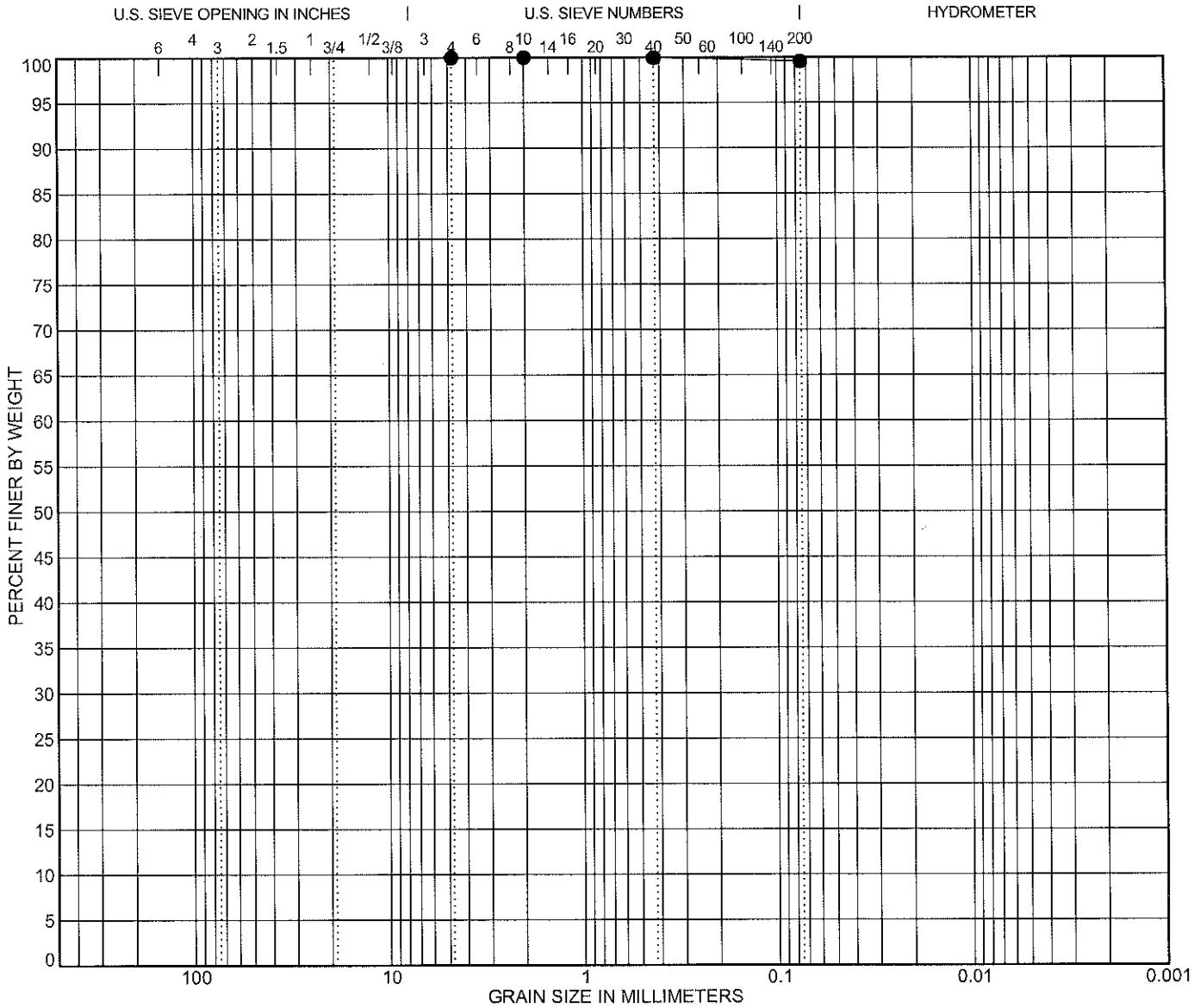

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	**09-B86**	**36.0**	**FAT CLAY(CH)**	**88**	**28**	**60**		

Percent Passing the Indicated Sieve

Specimen Identification			3/8"	#4	#10	#40	#100	#200
●	**09-B86**	**36.0**		**100**	**100**	**100**		**99.5**

Specimen Identification			D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**09-B86**	**36.0**	**4.75**				**0.0**	**0.5**	**99.5**	

GRAIN SIZE DISTRIBUTION

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Baytown, Texas
Project Number 92105186-A

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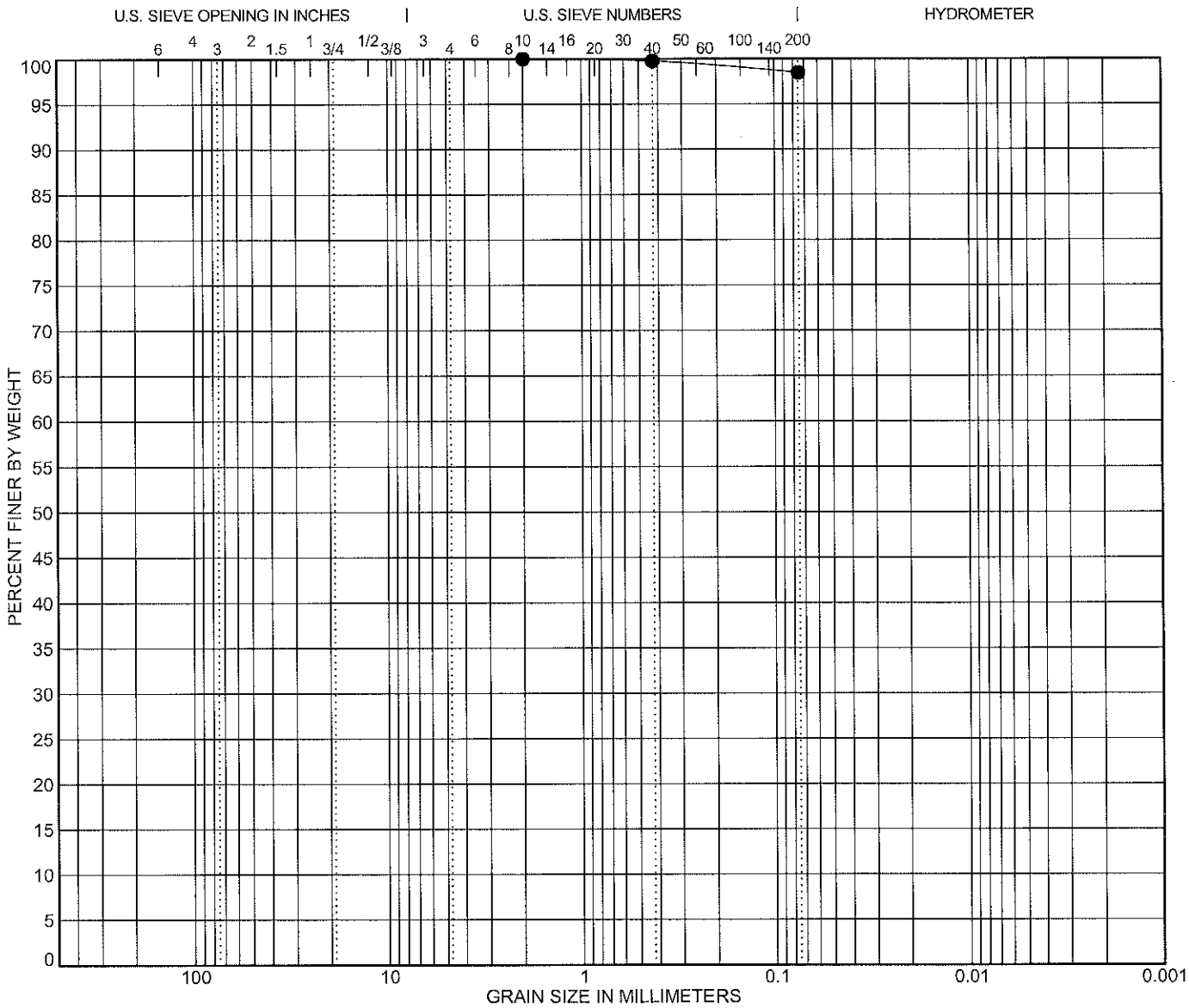

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **09-B86**	**54.0**	**LEAN CLAY(CL)**	**42**	**19**	**23**		

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● **09-B86**	**54.0**			**100**	**99.8**		**98.5**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **09-B86**	**54.0**	**2**				**0.0**	**1.5**	**98.5**	

GRAIN SIZE DISTRIBUTION

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

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Houston, Texas 77043
Telephone: 713-690-8989
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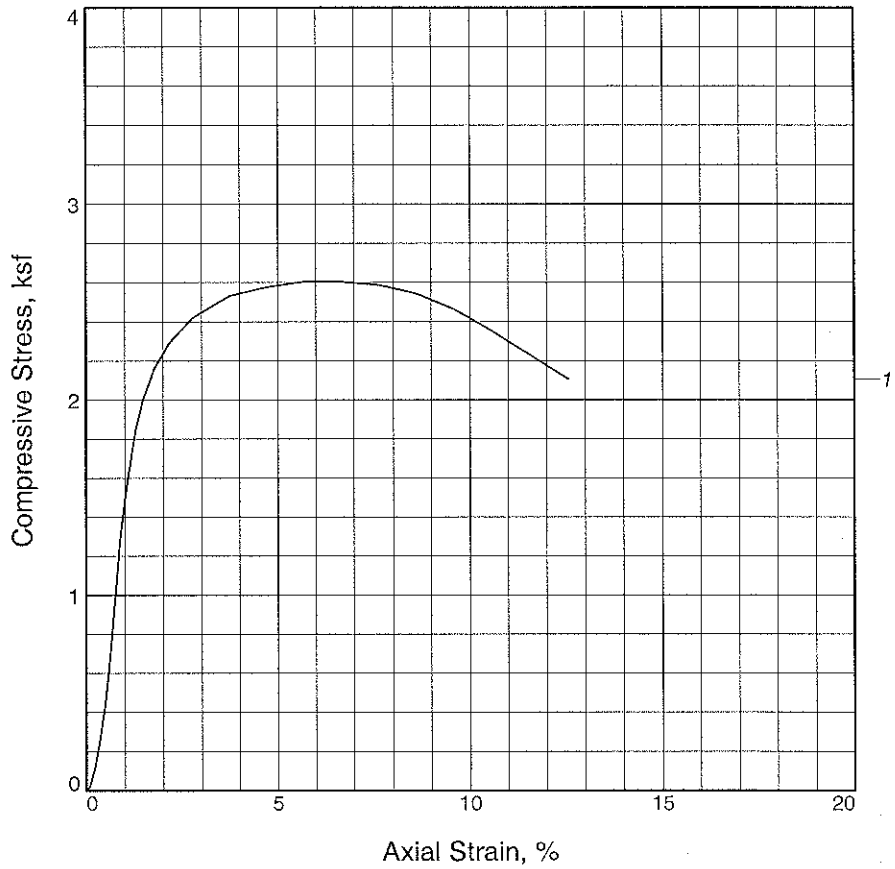
EXHIBIT
3

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, ksf	2.605			
Undrained shear strength, ksf	1.302			
Failure strain, %	6.7			
Strain rate, in./min.	0.055			
Water content, %	23.4			
Wet density, pcf	120.4			
Dry density, pcf	97.6			
Saturation, %	84.6			
Void ratio	0.7596			
Specimen diameter, in.	2.696			
Specimen height, in.	5.586			
Height/diameter ratio	2.07			

Description: brown and gray Fat Clay w/shell, 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-B86

Sample Number: 2 **Depth:** 2-4 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-B86
Depth: 2-4 ft. **Sample Number:** 2
Description: brown and gray Fat Clay w/shell, 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.	179.170
Moisture content: Dry soil+tare, gms.	154.700
Moisture content: Tare, gms.	49.990
Moisture, %	23.4
Moist specimen weight, gms.	1007.54
Diameter, in.	2.696
Area, in.^{2}	5.709
Height, in.	5.586
Wet density, pcf	120.4
Dry density, pcf	97.6
Void ratio	0.7596
Saturation, %	84.6

Test Readings for Specimen No. 1

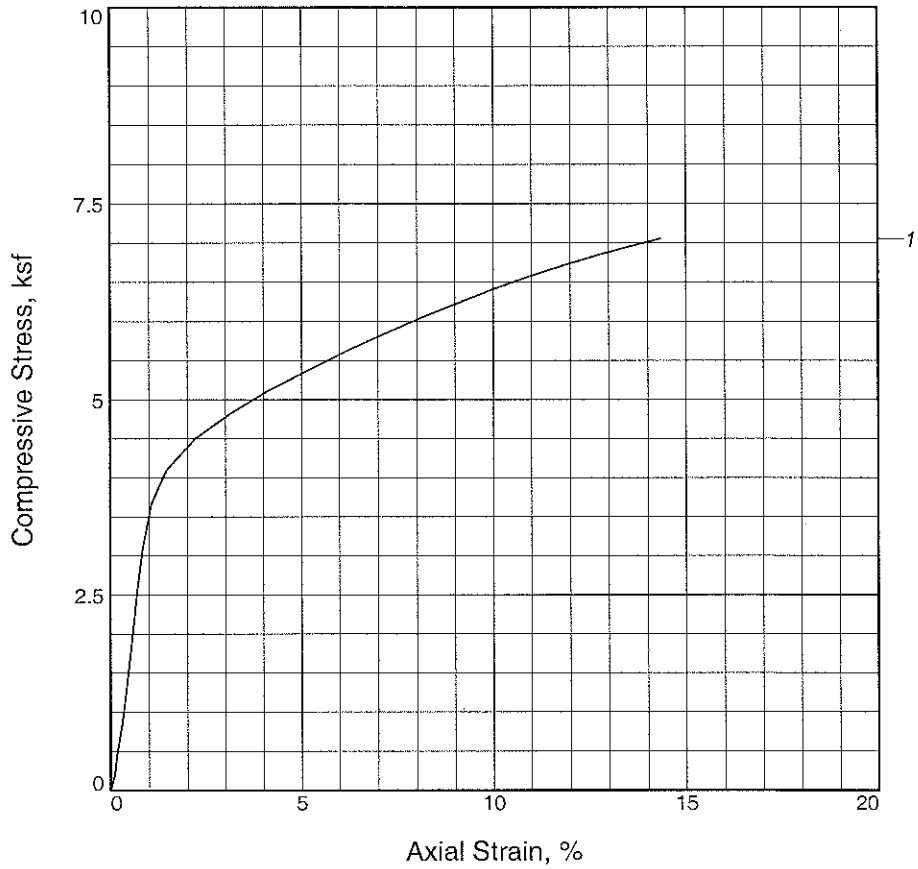
Strain rate, in./min. = 0.055
Unconfined compressive strength = 2.605 ksf **at reading no.** 20

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
0	0.0000	0.000	0.0	0.0	0.000
1	0.0050	0.740	0.7	0.1	0.019
2	0.0137	4.972	5.0	0.2	0.125
3	0.0203	10.583	10.6	0.4	0.266
4	0.0274	17.476	17.5	0.5	0.439
5	0.0326	24.794	24.8	0.6	0.622
6	0.0369	31.193	31.2	0.7	0.782
7	0.0411	38.142	38.1	0.7	0.955
8	0.0454	45.024	45.0	0.8	1.127
9	0.0492	51.331	51.3	0.9	1.283
10	0.0548	58.596	58.6	1.0	1.464
11	0.0605	64.698	64.7	1.1	1.614
12	0.0714	74.066	74.1	1.3	1.844
13	0.0823	80.320	80.3	1.5	1.996
14	0.0988	87.075	87.1	1.8	2.158
15	0.1210	92.933	92.9	2.2	2.293

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
16	0.1541	98.642	98.6	2.8	2.420
17	0.2089	104.259	104.3	3.7	2.532
18	0.2642	107.245	107.2	4.7	2.577
19	0.3162	109.436	109.4	5.7	2.604
20	0.3716	110.615	110.6	6.7	2.605
21	0.4127	110.945	110.9	7.4	2.592
22	0.4264	111.056	111.1	7.6	2.588
23	0.4812	110.355	110.4	8.6	2.544
24	0.5365	108.022	108.0	9.6	2.463
25	0.5914	104.301	104.3	10.6	2.352
26	0.6462	100.046	100.0	11.6	2.232
27	0.7015	95.530	95.5	12.6	2.107

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, ksf	7.053			
Undrained shear strength, ksf	3.526			
Failure strain, %	14.3			
Strain rate, in./min.	0.055			
Water content, %	17.3			
Wet density, pcf	131.2			
Dry density, pcf	111.8			
Saturation, %	89.0			
Void ratio	0.5349			
Specimen diameter, in.	2.740			
Specimen height, in.	5.729			
Height/diameter ratio	2.09			

Description: Tan and gray 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-B86

Sample Number: 8 **Depth:** 14-16 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-B86
Depth: 14-16 ft. **Sample Number:** 8
Description: Tan and gray 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.	174.260
Moisture content: Dry soil+tare, gms.	155.950
Moisture content: Tare, gms.	50.170
Moisture, %	17.3
Moist specimen weight, gms.	1163.48
Diameter, in.	2.740
Area, in.^{2}	5.896
Height, in.	5.729
Wet density, pcf	131.2
Dry density, pcf	111.8
Void ratio	0.5349
Saturation, %	89.0

Test Readings for Specimen No. 1

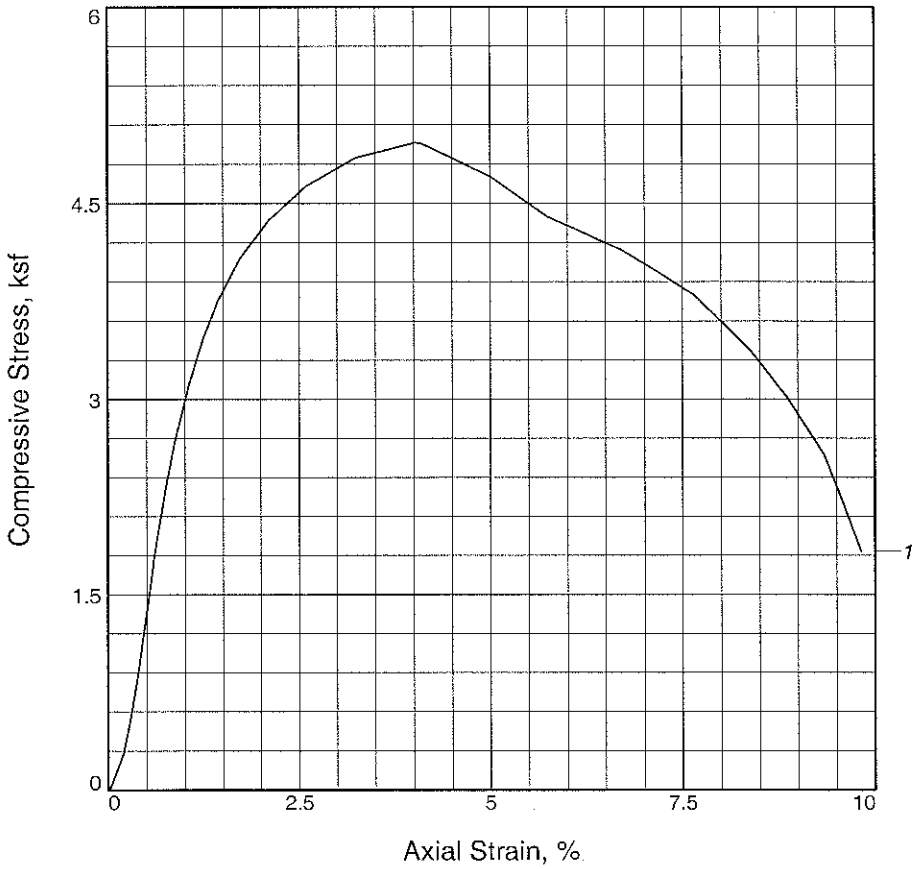
Strain rate, in./min. = 0.055
Unconfined compressive strength = 7.053 ksf **at reading no.** 24

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
0	0.0050	0.000	0.0	0.0	0.000
1	0.0112	8.000	8.0	0.1	0.195
2	0.0135	16.859	16.9	0.1	0.411
3	0.0220	34.595	34.6	0.3	0.842
4	0.0286	53.911	53.9	0.4	1.311
5	0.0343	71.820	71.8	0.5	1.745
6	0.0399	90.663	90.7	0.6	2.201
7	0.0456	108.936	108.9	0.7	2.642
8	0.0522	127.677	127.7	0.8	3.092
9	0.0659	151.401	151.4	1.1	3.658
10	0.0882	169.995	170.0	1.5	4.091
11	0.1321	188.738	188.7	2.2	4.507
12	0.1870	204.539	204.5	3.2	4.837
13	0.2423	218.601	218.6	4.1	5.117
14	0.3028	232.391	232.4	5.2	5.380
15	0.3576	245.032	245.0	6.2	5.616

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
16	0.4124	257.029	257.0	7.1	5.831
17	0.4677	269.051	269.1	8.1	6.040
18	0.5226	280.204	280.2	9.0	6.225
19	0.5779	291.642	291.6	10.0	6.410
20	0.6327	302.289	302.3	11.0	6.573
21	0.6875	312.777	312.8	11.9	6.728
22	0.7428	322.617	322.6	12.9	6.864
23	0.7977	332.309	332.3	13.8	6.993
24	0.8256	337.075	337.1	14.3	7.053

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, ksf	4.962			
Undrained shear strength, ksf	2.481			
Failure strain, %	4.0			
Strain rate, in./min.	0.055			
Water content, %	30.3			
Wet density, pcf	119.8			
Dry density, pcf	91.9			
Saturation, %	96.2			
Void ratio	0.8672			
Specimen diameter, in.	2.768			
Specimen height, in.	5.743			
Height/diameter ratio	2.07			

Description: Brown and gray Fat 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-B86

Sample Number: 13 **Depth:** 24-26 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-B86
Depth: 24-26 ft. **Sample Number:** 13
Description: Brown and gray Fat 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.	163.260
Moisture content: Dry soil+tare, gms.	136.870
Moisture content: Tare, gms.	49.890
Moisture, %	30.3
Moist specimen weight, gms.	1087.13
Diameter, in.	2.768
Area, in.^{2}	6.018
Height, in.	5.743
Wet density, pcf	119.8
Dry density, pcf	91.9
Void ratio	0.8672
Saturation, %	96.2

Test Readings for Specimen No. 1

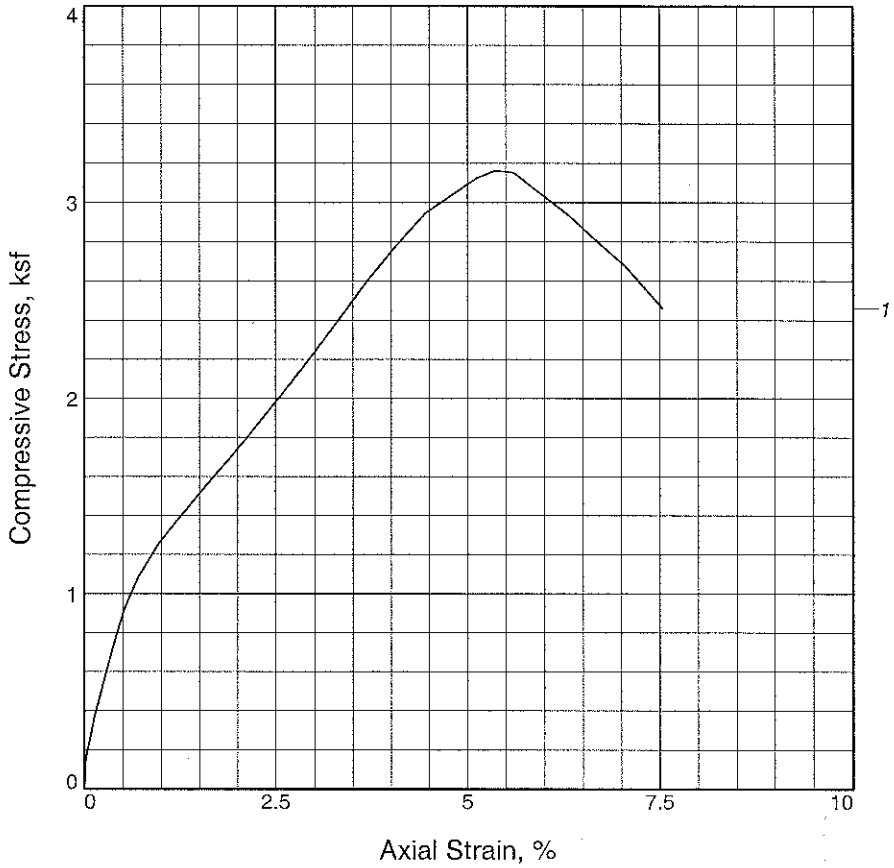
Strain rate, in./min. = 0.055
Unconfined compressive strength = 4.962 ksf **at reading no.** 18

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	0.800	0.8	0.0	0.019
2	0.0111	11.506	11.5	0.2	0.275
3	0.0163	22.600	22.6	0.3	0.539
4	0.0220	36.990	37.0	0.4	0.882
5	0.0262	49.621	49.6	0.5	1.182
6	0.0305	62.456	62.5	0.5	1.487
7	0.0343	75.092	75.1	0.6	1.786
8	0.0385	86.563	86.6	0.7	2.058
9	0.0442	100.093	100.1	0.8	2.377
10	0.0494	111.846	111.8	0.9	2.653
11	0.0607	131.622	131.6	1.1	3.116
12	0.0716	147.070	147.1	1.2	3.475
13	0.0825	159.258	159.3	1.4	3.756
14	0.0990	173.358	173.4	1.7	4.077
15	0.1212	186.761	186.8	2.1	4.375

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
16	0.1487	198.559	198.6	2.6	4.629
17	0.1869	209.409	209.4	3.3	4.848
18	0.2309	216.059	216.1	4.0	4.962
19	0.2366	215.862	215.9	4.1	4.953
20	0.2886	206.570	206.6	5.0	4.695
21	0.3302	194.921	194.9	5.7	4.396
22	0.3850	185.744	185.7	6.7	4.147
23	0.4398	171.887	171.9	7.7	3.798
24	0.4814	153.920	153.9	8.4	3.375
25	0.5088	138.167	138.2	8.9	3.013
26	0.5363	118.601	118.6	9.3	2.573
27	0.5500	102.523	102.5	9.6	2.218
28	0.5637	84.884	84.9	9.8	1.832

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, ksf	3.161			
Undrained shear strength, ksf	1.581			
Failure strain, %	5.4			
Strain rate, in./min.	0.055			
Water content, %	29.4			
Wet density, pcf	124.1			
Dry density, pcf	95.9			
Saturation, %	102.3			
Void ratio	0.7903			
Specimen diameter, in.	2.720			
Specimen height, in.	5.707			
Height/diameter ratio	2.10			

Description: Gray 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-B86

Sample Number: 28 **Depth:** 54-56 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-B86
Depth: 54-56 ft. **Sample Number:** 28
Description: Gray 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.	160.950
Moisture content: Dry soil+tare, gms.	135.790
Moisture content: Tare, gms.	50.240
Moisture, %	29.4
Moist specimen weight, gms.	1080.21
Diameter, in.	2.720
Area, in.^{2}	5.811
Height, in.	5.707
Wet density, pcf	124.1
Dry density, pcf	95.9
Void ratio	0.7903
Saturation, %	102.3

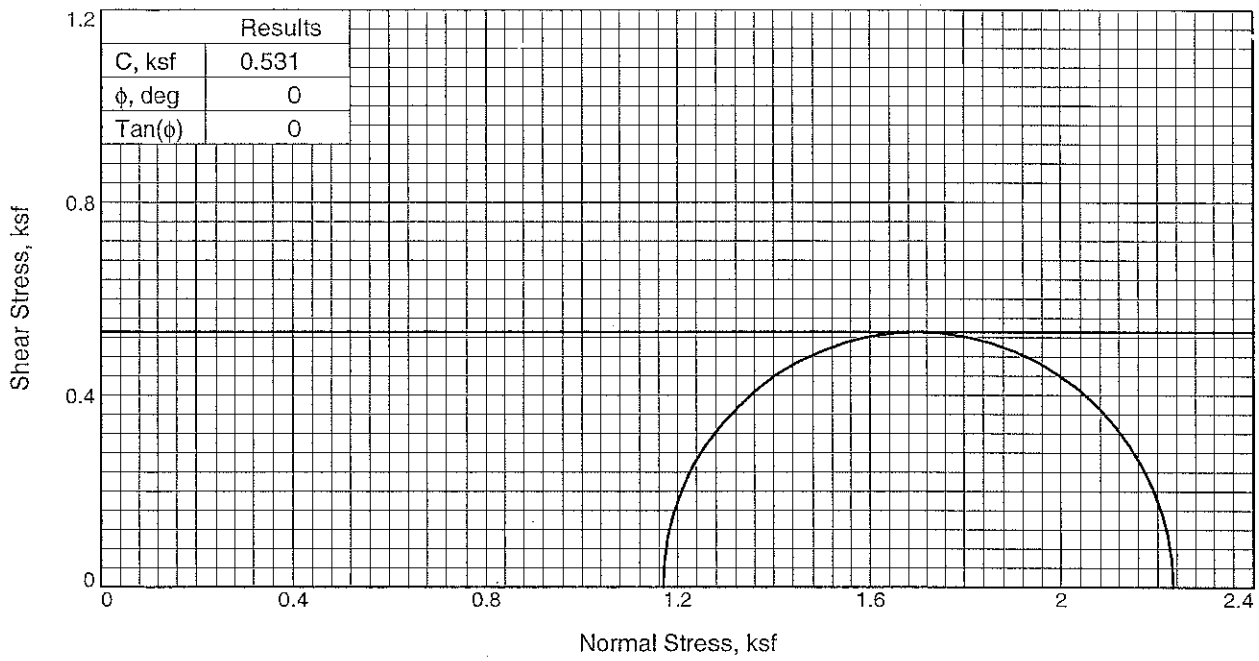
Test Readings for Specimen No. 1

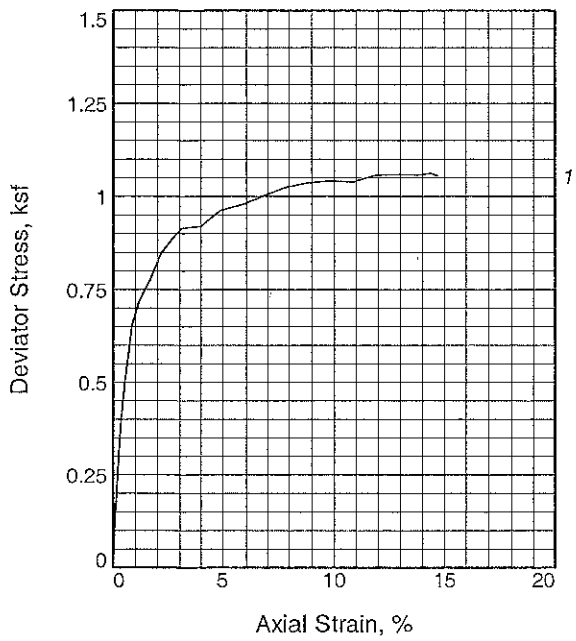
Strain rate, in./min. = 0.055
Unconfined compressive strength = 3.161 ksf **at reading no.** 20

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
0	0.0100	0.000	0.0	0.0	0.000
1	0.0105	1.100	1.1	0.0	0.027
2	0.0110	5.500	5.5	0.0	0.136
3	0.0122	7.478	7.5	0.0	0.185
4	0.0174	14.633	14.6	0.1	0.362
5	0.0245	22.573	22.6	0.3	0.558
6	0.0316	29.870	29.9	0.4	0.737
7	0.0396	37.222	37.2	0.5	0.918
8	0.0505	44.293	44.3	0.7	1.090
9	0.0656	51.410	51.4	1.0	1.262
10	0.0878	59.280	59.3	1.4	1.449
11	0.1096	66.746	66.7	1.7	1.625
12	0.1318	74.431	74.4	2.1	1.805
13	0.1535	82.382	82.4	2.5	1.990
14	0.1757	91.017	91.0	2.9	2.190
15	0.1980	99.807	99.8	3.3	2.392

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
16	0.2197	108.724	108.7	3.7	2.595
17	0.2419	116.945	116.9	4.1	2.780
18	0.2637	124.298	124.3	4.4	2.943
19	0.3024	132.939	132.9	5.1	3.126
20	0.3161	134.787	134.8	5.4	3.161
21	0.3298	134.705	134.7	5.6	3.151
22	0.3710	126.196	126.2	6.3	2.930
23	0.4121	116.263	116.3	7.0	2.678
24	0.4400	107.458	107.5	7.5	2.462





Sample No.		1
Initial	Water Content, %	38.1
	Dry Density, pcf	86.0
	Saturation, %	105.0
	Void Ratio	0.9971
	Diameter, in.	2.620
	Height, in.	5.777
At Test	Water Content, %	38.1
	Dry Density, pcf	86.0
	Saturation, %	105.0
	Void Ratio	0.9971
	Diameter, in.	2.620
	Height, in.	5.777
Strain rate, in./min.		0.055
Back Pressure, psi		0.000
Cell Pressure, psi		8.120
Fail. Stress, ksf		1.063
Ult. Stress, ksf		
σ_1 Failure, ksf		2.232
σ_3 Failure, ksf		1.169

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Brown and gray 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-B86

Sample Number: 6 **Depth:** 10-12 ft.

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

TRIAXIAL SHEAR TEST REPORT
Terracon, Inc.
Houston, TX

TRIAXIAL COMPRESSION TEST

Unconsolidated Undrained

11/8/2010
7:54 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-B
Location: 09-B86
Depth: 10-12 ft. **Sample Number:** 6
Description: Brown and gray 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.	166.970	166.970
Moisture content: Dry soil+tare, gms.	134.780	134.780
Moisture content: Tare, gms.	50.250	50.250
Moisture, %	38.1	38.1
Moist specimen weight, gms.	970.45	
Diameter, in.	2.620	
Area, in.^{2}	5.391	
Height, in.	5.777	
Wet density, pcf	118.7	
Dry density, pcf	86.0	
Void ratio	0.9971	
Saturation, %	105.0	

Test Readings for Specimen No. 1

Cell pressure = 8.120 psi (1.169 ksf)
Back pressure = 0.000 psi (0.000 ksf)
Strain rate, in./min. = 0.055
Fail. Stress = 1.063 ksf **at reading no.** 26

Test Readings for Specimen No.

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	0.000	0.0	0.0	0.000	1.169	1.169	1.00	1.169	0.000
1	0.0010	1.200	1.2	0.0	0.032	1.169	1.201	1.03	1.185	0.016
2	0.0015	1.728	1.7	0.0	0.046	1.169	1.215	1.04	1.192	0.023
3	0.0040	4.566	4.6	0.1	0.122	1.169	1.291	1.10	1.230	0.061
4	0.0090	7.918	7.9	0.2	0.211	1.169	1.380	1.18	1.275	0.106
5	0.0133	11.157	11.2	0.2	0.297	1.169	1.467	1.25	1.318	0.149
6	0.0194	14.330	14.3	0.3	0.381	1.169	1.551	1.33	1.360	0.191
7	0.0251	16.793	16.8	0.4	0.447	1.169	1.616	1.38	1.393	0.223
8	0.0314	19.275	19.3	0.5	0.512	1.169	1.681	1.44	1.425	0.256
9	0.0408	22.272	22.3	0.7	0.591	1.169	1.760	1.51	1.465	0.295
10	0.0482	24.622	24.6	0.8	0.652	1.169	1.821	1.56	1.495	0.326
11	0.0667	27.201	27.2	1.2	0.718	1.169	1.887	1.61	1.528	0.359
12	0.0957	29.535	29.5	1.7	0.776	1.169	1.945	1.66	1.557	0.388
13	0.1253	32.517	32.5	2.2	0.850	1.169	2.019	1.73	1.594	0.425
14	0.1777	35.323	35.3	3.1	0.914	1.169	2.084	1.78	1.627	0.457
15	0.2306	35.852	35.9	4.0	0.919	1.169	2.089	1.79	1.629	0.460
16	0.2830	37.880	37.9	4.9	0.962	1.169	2.131	1.82	1.650	0.481
17	0.3384	38.935	38.9	5.9	0.979	1.169	2.148	1.84	1.659	0.490
18	0.3964	40.305	40.3	6.9	1.003	1.169	2.172	1.86	1.671	0.501
19	0.4545	41.630	41.6	7.9	1.024	1.169	2.194	1.88	1.682	0.512
20	0.5125	42.619	42.6	8.9	1.037	1.169	2.207	1.89	1.688	0.519
21	0.5704	43.271	43.3	9.9	1.042	1.169	2.211	1.89	1.690	0.521
22	0.6284	43.655	43.7	10.9	1.039	1.169	2.208	1.89	1.689	0.520
23	0.6863	44.923	44.9	11.9	1.057	1.169	2.227	1.90	1.698	0.529
24	0.7443	45.506	45.5	12.9	1.059	1.169	2.228	1.91	1.699	0.529
25	0.8024	45.982	46.0	13.9	1.058	1.169	2.227	1.90	1.698	0.529
26	0.8313	46.474	46.5	14.4	1.063	1.169	2.232	1.91	1.701	0.531
27	0.8461	46.302	46.3	14.6	1.056	1.169	2.225	1.90	1.697	0.528

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-B86	0-2	1.75																				CH**	22																						
	2-4	0.50			66	23	43		100	98		96				95					86	CH	23							1.3	23	98	CH**											
	4-6	1.25																				CH**	29																						
	6-8	1.00																				CH**	31																						
	8-10	0.50																				CH**	37																						
	10-12	0.25	0.20		59	20	39		100	97		95				93					86	CH	38											0.5	38	86	CH**							
	12-14	0.00	0.15																			CH**	70																						
	14-16	2.00			58	20	38		100	98		95				92					87	CH	17							3.5	17	112	CL**											
	16-18	1.50																				CL**	20																						
	18-20	1.75										100		100	100	100	100	100	100	99	88	CL*	25																						
	20-22	1.00																				CL**	24																						
	22-24	2.75																				CH**	28																						
	24-26	2.50			93	28	65									100					100	CH	30							2.5	30	92	CH**											
	26-28	2.50																				CH**	32																						
	28-30	2.50																				CH**	33																						
	30-32	3.00																				CH**	35																						
	32-34	1.75																				CH**	35																						
	34-36	2.50																				CH**	38																						
	36-38	2.50			88	28	60									100					100	CH	36	86																				
	38-40	2.00																				CH**	35																						
	40-42	2.25																				CH**	39																						
	42-44	1.50																				CH**	40																						
	44-46	2.25			101	32	69															CH*	41	81																				
	46-48	0.75																				CH**	28																						
	48-50	1.00																				CL**	20																						
	50-52	1.75																				CH**	24																						
	52-54	1.75																				CH**	27																						
	54-56	1.00			42	19	23					100				100					99	CL	29							1.6	29	96	CL**											
	56-58	1.50																				CH**	31																						
	58-60	1.25																				CH**	43																						
	60-62	1.50																				CH**	41																						
	62-64	1.00																				CH**	35																						
	64-66	1.00																				CH**	38																						
09-B87	0-2	0.25	0.30		59	20	39			100		100				98					95	CH	38																						
	2-4	0.25	0.15		96	27	69					100				100					97	CH	81							0.2	81	58	CH**											
	4-6	0.50	0.30																			CH**	31																						
	6-8	0.50	0.25																			CH**	32																						
	8-10	0.50	0.40																			CH**	24																						
	10-12	0.25	0.20		110	32	78					100				100					100	CH	79	55																					
	12-14	1.00																				CH**	30																						
	14-16	0.25	0.20																			CH**	39																						
	16-18	1.00																				CH**	34																						
	18-20	0.75																				CH**	32																						
09-B88	0-2	0.25	0.25																			CH**	48																						
	2-4	0.25	0.20		114	27	87					100				100					98	CH	78	53																					
	4-6	0.25	0.25																			CH**	72																						
	6-8	0.25	0.35																			CH**	49																						
	8-10	0.25	0.10																			CH**	43																						
	10-12	0.25	0.10		83	27	56									100					100	CH	86							0.2	86	52	CH**											
	12-14	1.25																				CH**	37																						
	14-16	2.00																				CH**	19																						
	16-18	2.00			54	17	37		100	100		99				97					96	CH	20	108																					
	18-20	1.50																				CH**	23																						