BORING LOG NO. 09-B84

CLIENT:	USACE, Galveston District Galveston, Texas	PROJECT:	TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume I
BORING LOCATION:	N: 13827442 E: 3261298	SITE:	Cedar Bayou PA6 Baytown, Texas

Approx. Surface Elevation: 15.1 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 dark gray, gray and brown, very stiff, very high plasticity, moist, with scattered gravel	1	CH	ST	12		2.5		28	93	71	23	48	92			
		3		ST	11		4.5		15								
	9.1 — 6.0	5		ST	13		3.0		27								
	FAT CLAY dark gray and greenish gray, stiff to very stiff, very high plasticity, moist	7	CH	ST	10		1.0		38	81	95	32	63	95			
	5.1 — 10.0	9		ST	10		1.5		37								
	LEAN CLAY w/ SAND yellow and brown, soft to medium stiff, high plasticity, wet - with calcareous nodules 10 to 12 feet - with silt seams below 14 feet	11	CL	ST	12		1.0		23	103	45	17	28	80			
		13		ST	23		0.25		26								
	-0.9 — 16.0	15		ST	16		0.25		27								
	LEAN CLAY brown, light brown and light gray, medium stiff to very stiff, with silt seams	17	CL	ST	12		0.25		25	100	36	21	15	91			
		19		ST	15		1.0		37								
		21		ST	17		0.75		28								
		23		ST	10		0.5		25	98	39	19	20	98			
	- with clay layers 24 to 28 feet	25		ST	18		1.5		34								
		27		ST	15		3.0		31								
	-14.9 — 30.0	29		ST	16		1.25		24								
		31	CH	ST	16		2.75		33								
		33		ST	5		2.0		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 14 feet; wet rotary thereafter.

WATER LEVEL OBSERVATIONS			
▽ 14 ft	WD	▼ 13.5 ft	at 5 min
▼ 10.5 ft	at 10 min	▼ 9.5 ft	at 15 min

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DATE DRILLED	3/24/2010
PROJECT NUMBER	92105186-A

09-B84

EXHIBIT A-

BORING LOG NO. 09-B84

CLIENT:	USACE, Galveston District Galveston, Texas	PROJECT:	TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume I
BORING LOCATION:	N: 13827442 E: 3261298	SITE:	Cedar Bayou PA6 Baytown, Texas

Approx. Surface Elevation: 15.1 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 reddish brown, yellowish brown and greenish gray, stiff to very stiff, high to very high plasticity, moist - with slickensides 34 to 38 feet and ferrous stains 34 to 36 feet	35		ST	14		2.25		35	88	88	28	60	100			
		36															
		37		ST	7		1.25		26								
		38															
		39		ST	15		2.0		33								
		40															
		41		ST	8		1.75		33								
		42															
		43		ST	19		2.0		38								
		44															
		45		ST	5		2.25		41								
		46															
	- with slickensides below 46 feet and ferrous stains 46 to 48 feet	47		ST	16		2.25		38	81	102	33	69				
		48															
		49		ST	7		1.75		40								
		50															
		51		ST	19		2.0		43								
		52															
		53		ST	19		1.75		31	95	58	24	34	98			
		54															
		55		ST	3		2.0		30								
		56															
		57		ST	17		2.25		31								
		58															
		59		ST	5		2.25		31								
		60															
		61		ST	9		3.25		27								
		62															
		63		ST	9		2.0		24								
	-48.9 64.0	64															
	-49.9 **LEAN CLAY w/ SAND** 65.0 greenish gray and brown, stiff, high plasticity, moist	65	CL	ST	8		1.5		23	104	44	16	28	80			
	Boring terminated at 65 feet.																

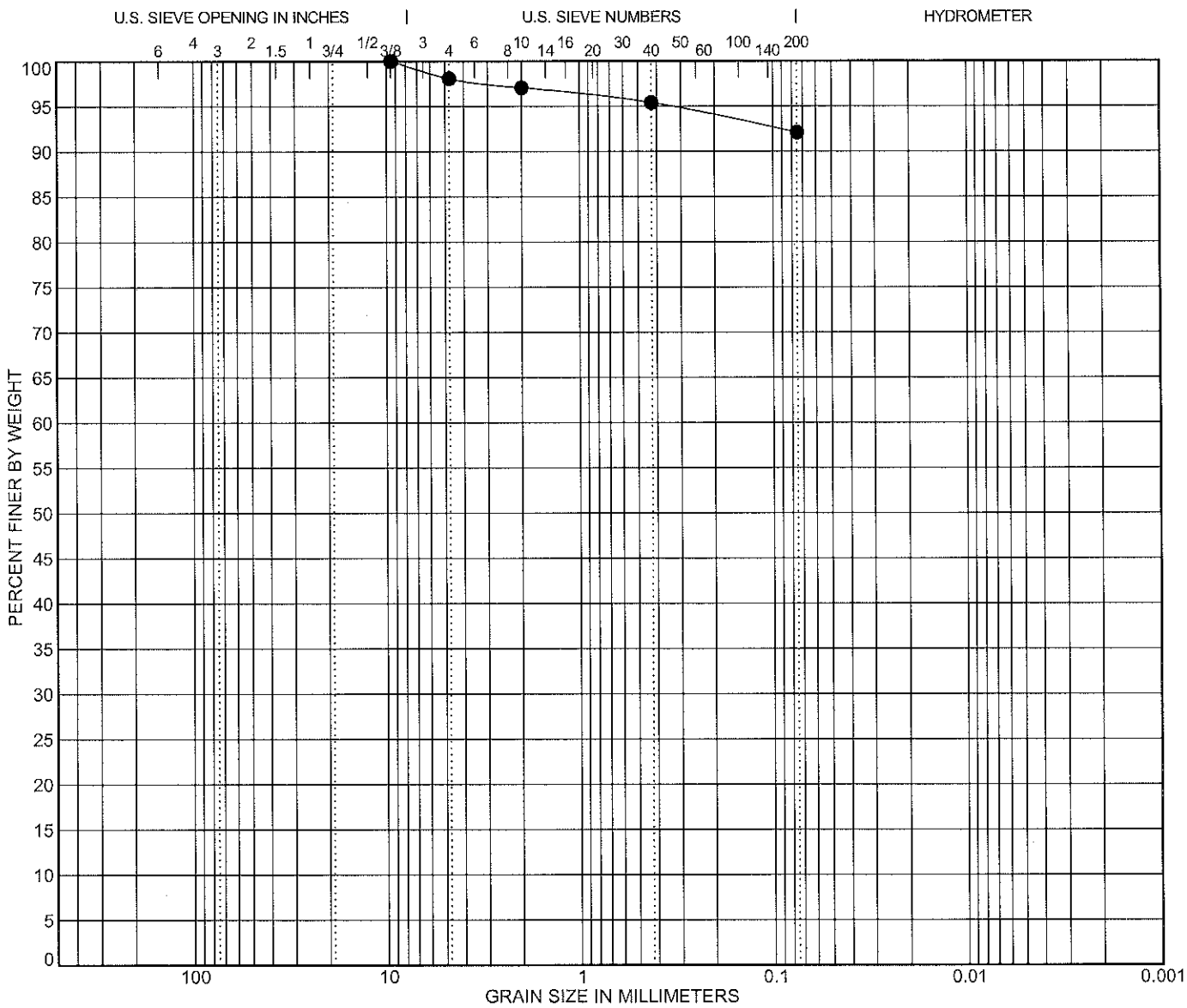
STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: **Dry augered to 14 feet; wet rotary thereafter.**

WATER LEVEL OBSERVATIONS			
▽ 14 ft	WD	▼13.5 ft	at 5 min
▼10.5 ft	at 10 min	▼ 9.5 ft	at 15 min

Terracon

DATE DRILLED	Page 2 of 2
3/24/2010	09-B84
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-B84**	**0.0**	**FAT CLAY(CH)**	**71**	**23**	**48**		

Percent Passing the Indicated Sieve

	Specimen Identification		3/8"	#4	#10	#40	#100	#200
●	**09-B84**	**0.0**	**100**	**98.1**	**97.1**	**95.4**		**92.1**

	Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**09-B84**	**0.0**	**9.5**				**1.9**	**6.0**	**92.1**	

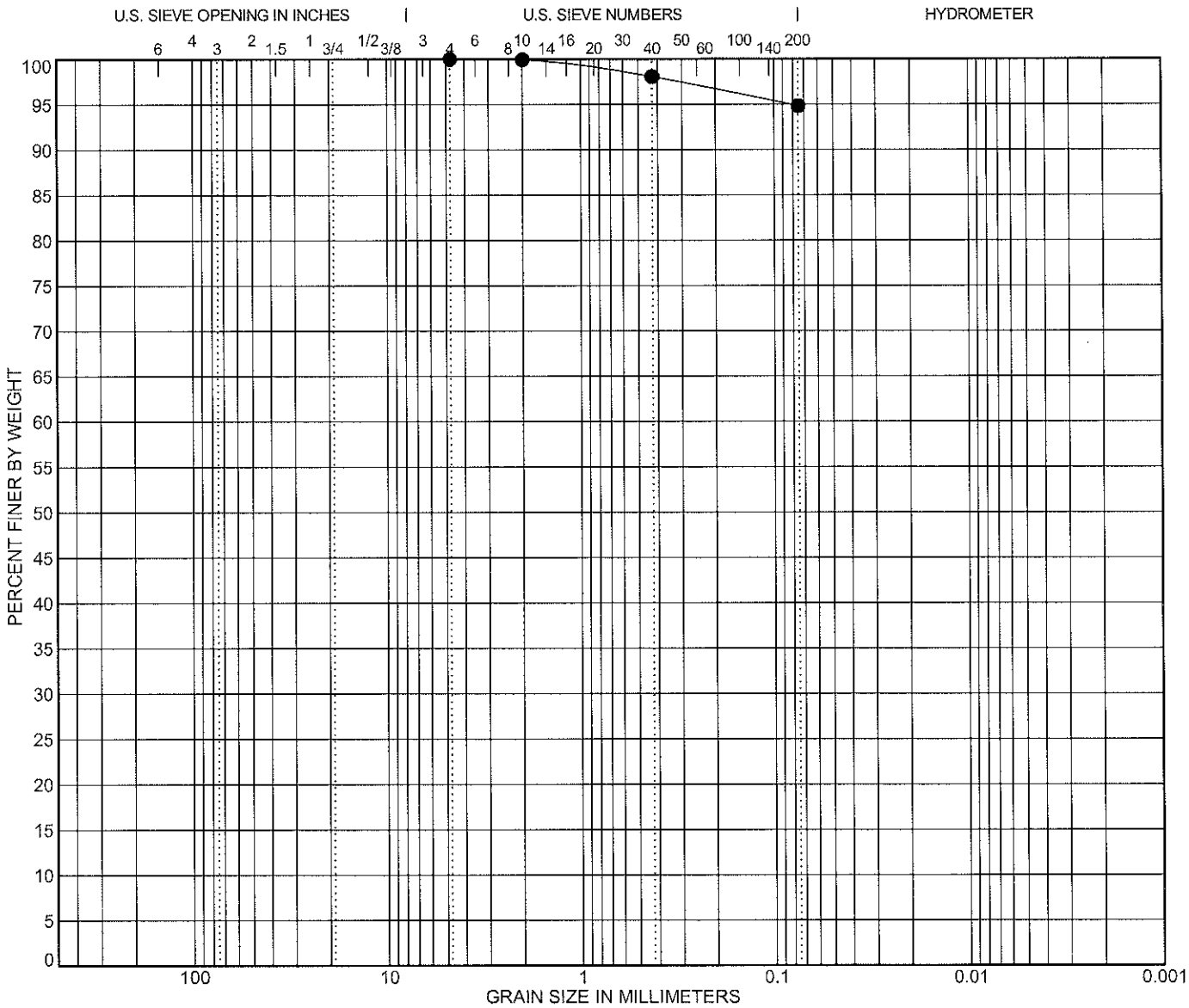
GRAIN SIZE DISTRIBUTION

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 ?



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **09-B84**	**6.0**	**FAT CLAY(CH)**	**95**	**32**	**63**		

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● **09-B84**	**6.0**		**100**	**99.9**	**98.1**		**94.8**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **09-B84**	**6.0**	**4.75**				**0.0**	**5.2**	**94.8**	

GRAIN SIZE DISTRIBUTION

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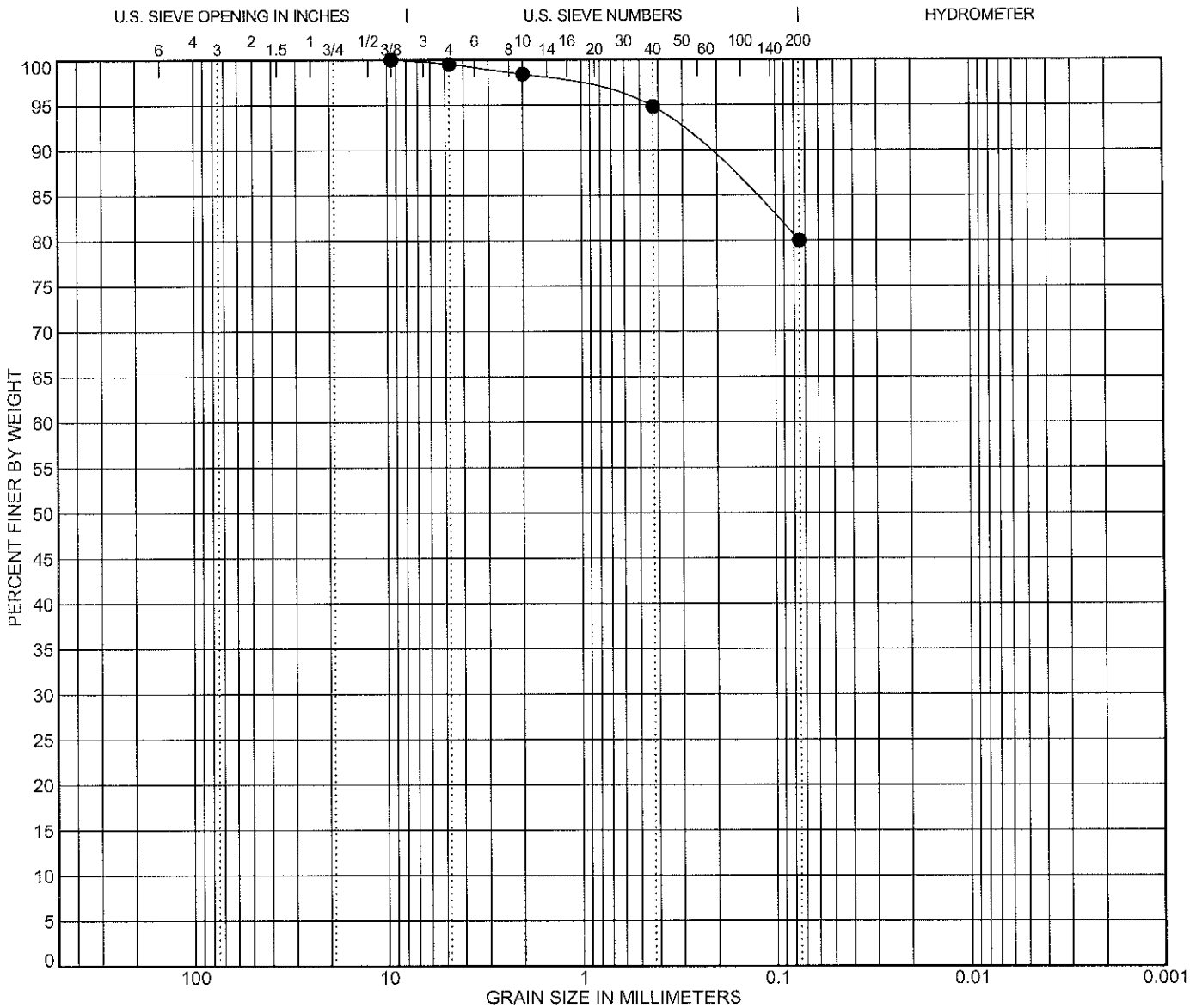

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B84**	**10.0**	**LEAN CLAY with SAND(CL)**	**45**	**17**	**28**		

Percent Passing the Indicated Sieve

	Specimen Identification		3/8"	#4	#10	#40	#100	#200
●	**09-B84**	**10.0**	**100**	**99.5**	**98.4**	**94.8**		**80**

	Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**09-B84**	**10.0**	**9.5**				**0.5**	**19.5**	**80.0**	

GRAIN SIZE DISTRIBUTION

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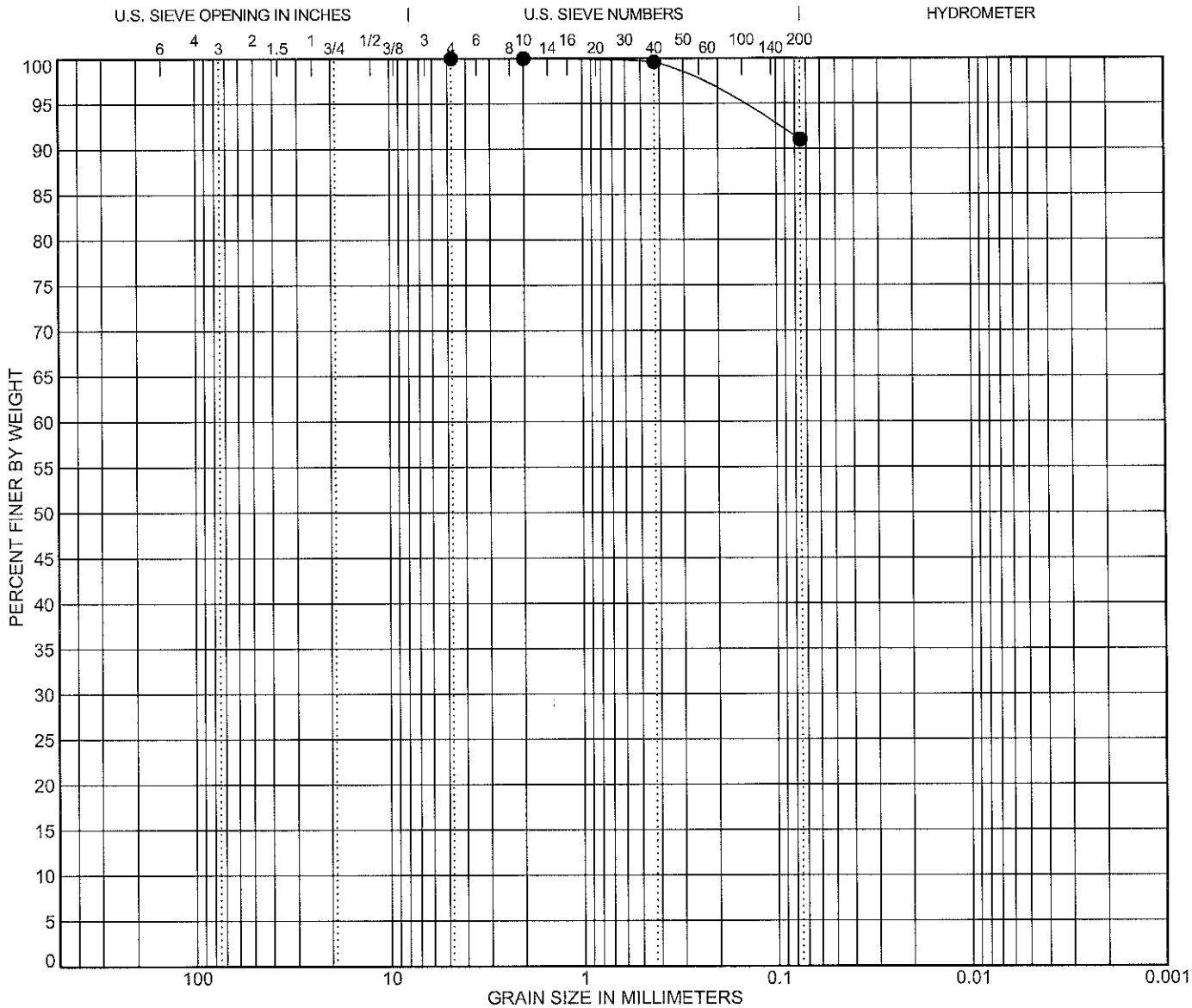

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **09-B84**	**16.0**	**LEAN CLAY(CL)**	**36**	**21**	**15**		

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● **09-B84**	**16.0**		**100**	**100**	**99.6**		**91**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **09-B84**	**16.0**	**4.75**				**0.0**	**9.0**	**91.0**	

GRAIN SIZE DISTRIBUTION

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Project Number 92105186-A

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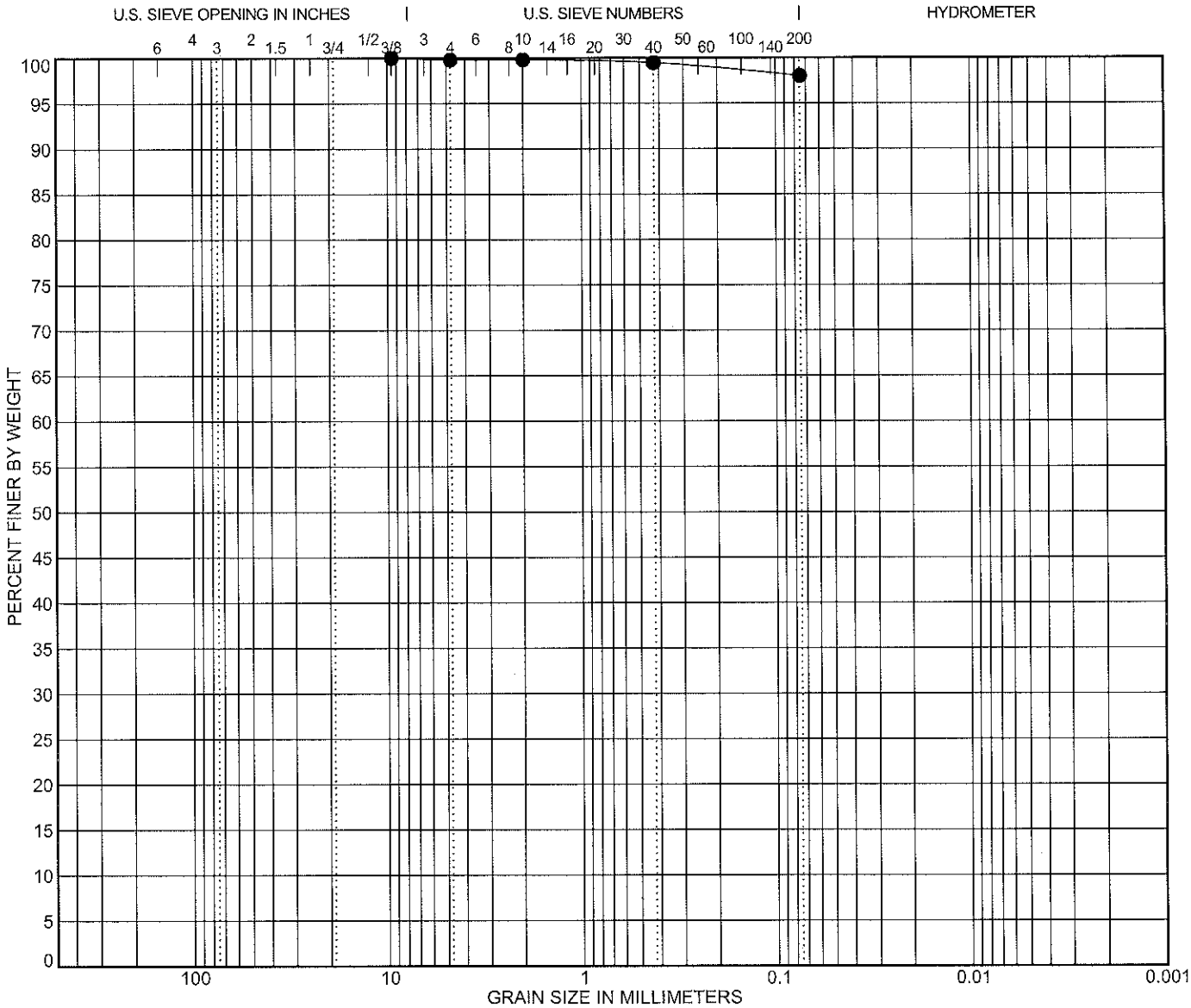

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● 09-B84	22.0	**LEAN CLAY(CL)**	**39**	**19**	**20**		

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● 09-B84	22.0	**100**	**99.8**	**99.8**	**99.5**		**98**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● 09-B84	22.0	**9.5**				**0.2**	**1.8**	**98.0**	

GRAIN SIZE DISTRIBUTION

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Baytown, Texas
Project Number 92105186-A

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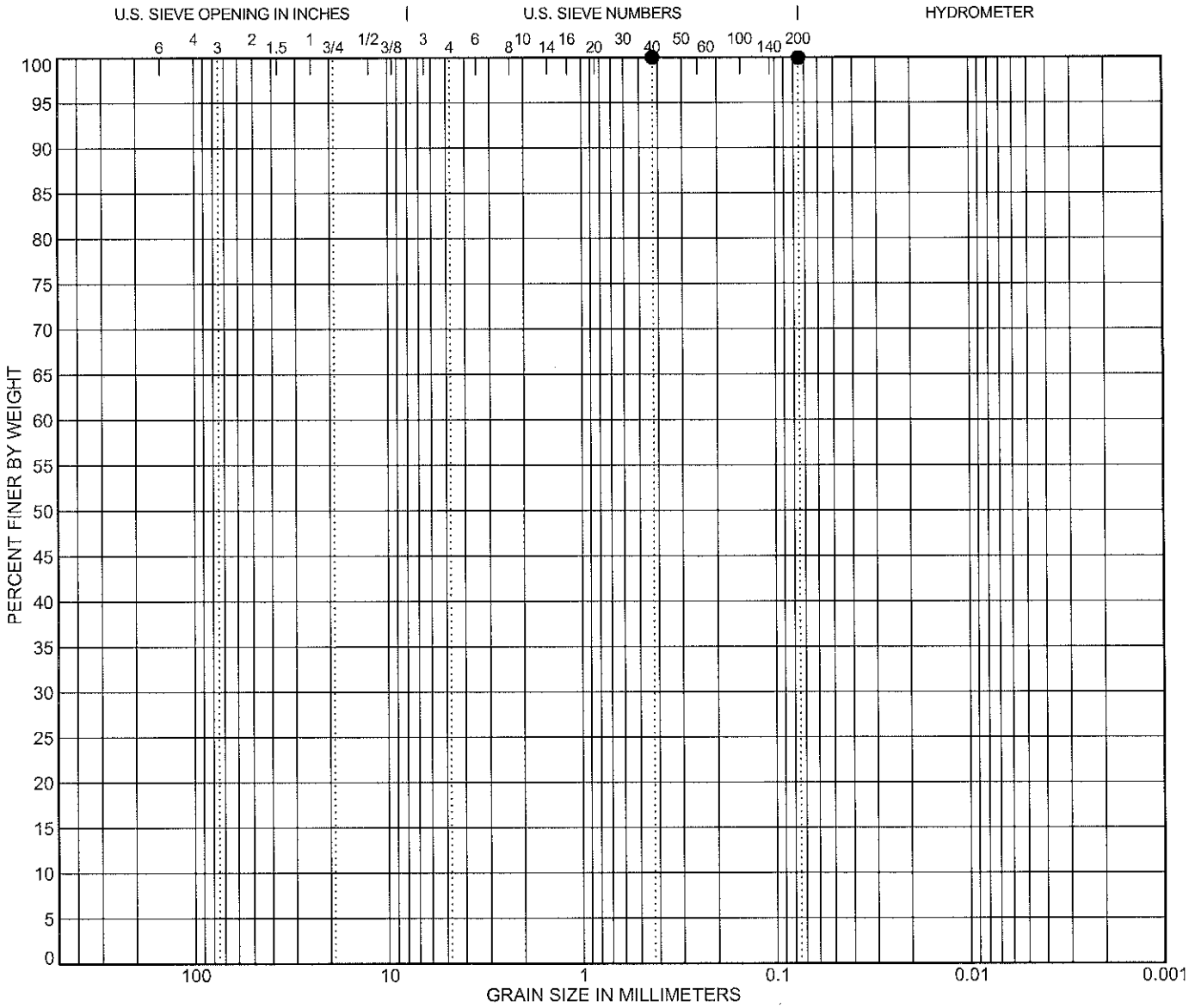

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● 09-B84	34.0	**FAT CLAY(CH)**	**88**	**28**	**60**		

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● 09-B84	34.0				**100**		**99.9**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● 09-B84	34.0	**0.425**				**0.0**	**0.1**	**99.9**	

GRAIN SIZE DISTRIBUTION

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Project Number 92105186-A

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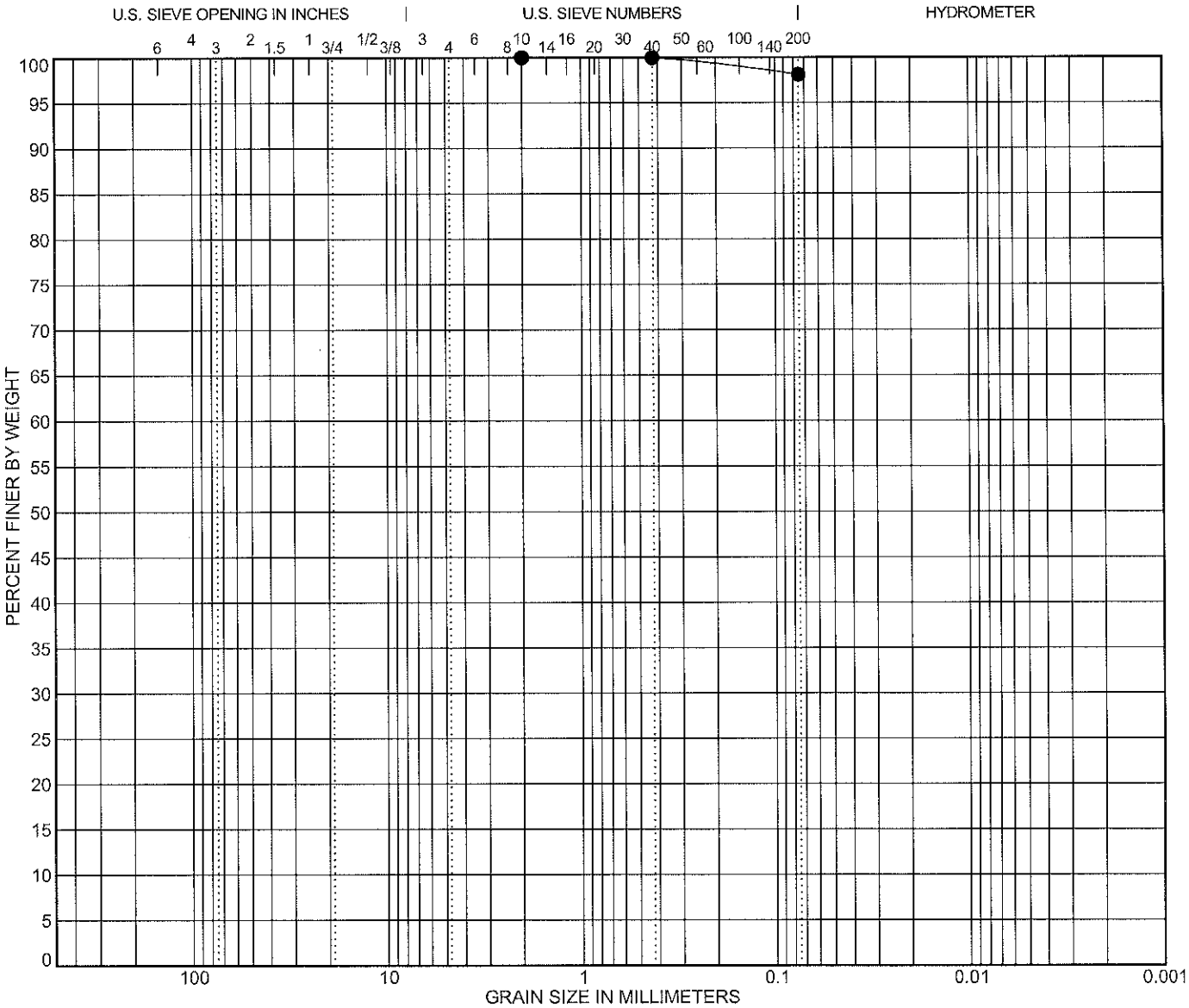

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● 09-B84	52.0	**FAT CLAY(CH)**	**58**	**24**	**34**		

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● 09-B84	52.0			**100**	**100**		**98.1**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● 09-B84	52.0	**2**				**0.0**	**1.9**	**98.1**	

GRAIN SIZE DISTRIBUTION

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

Terracon

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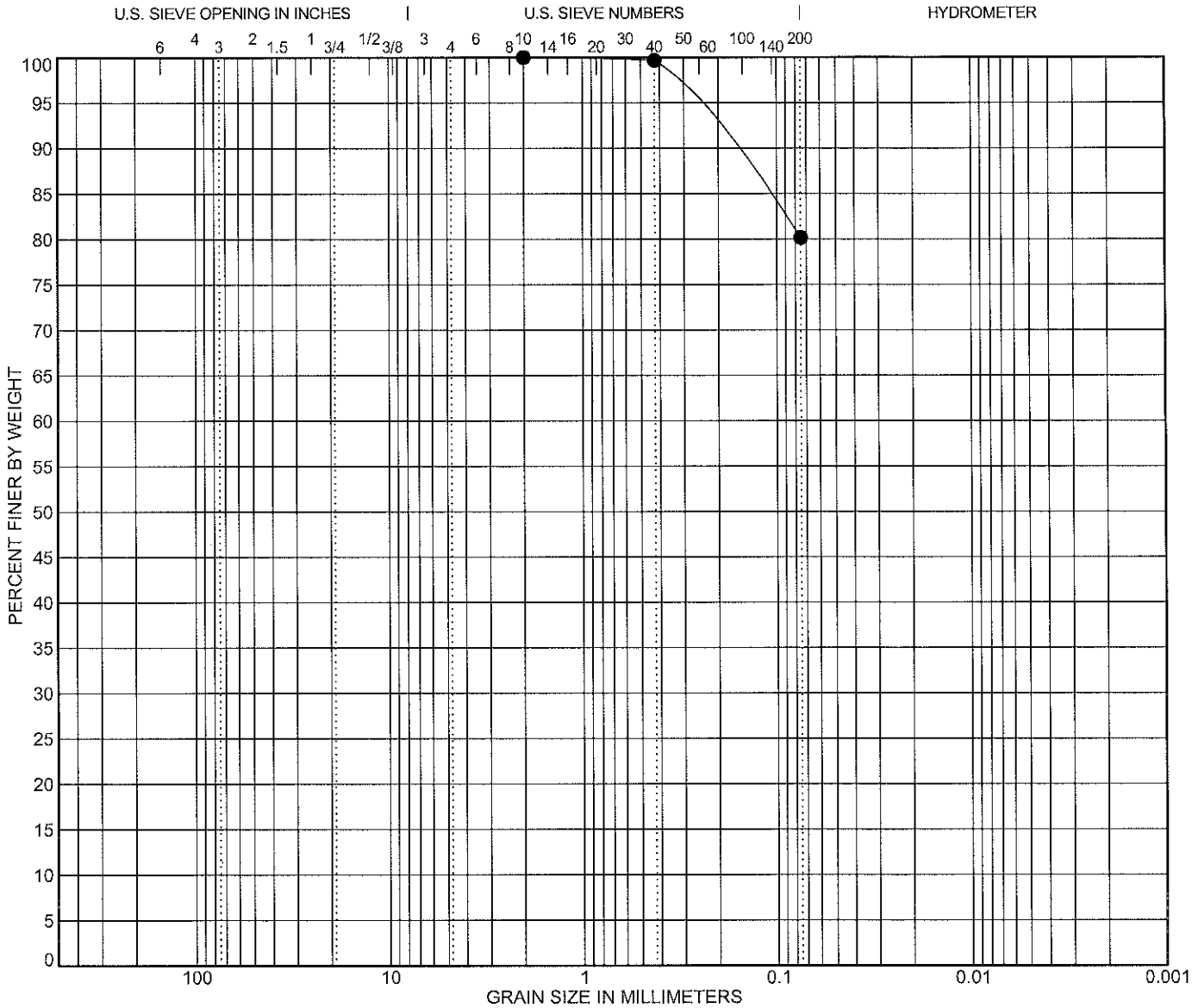

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **09-B84**	**64.0**	**LEAN CLAY with SAND(CL)**	**44**	**16**	**28**		

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● **09-B84**	**64.0**			**100**	**99.7**		**80.2**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **09-B84**	**64.0**	**2**				**0.0**	**19.8**	**80.2**	

GRAIN SIZE DISTRIBUTION

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

Terracon

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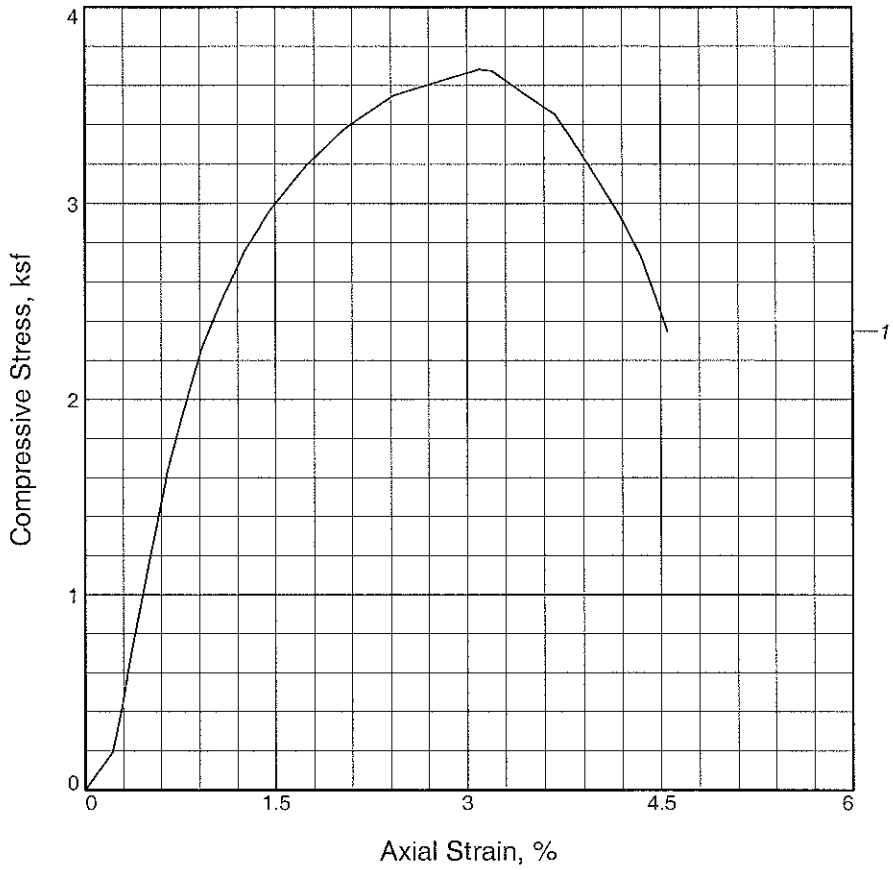
UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, ksf	3.682			
Undrained shear strength, ksf	1.841			
Failure strain, %	3.1			
Strain rate, in./min.	0.055			
Water content, %	38.0			
Wet density, pcf	111.1			
Dry density, pcf	80.5			
Saturation, %	92.2			
Void ratio	1.1317			
Specimen diameter, in.	2.751			
Specimen height, in.	5.680			
Height/diameter ratio	2.06			

Description: 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-B84

Sample Number: 4 **Depth:** 6-8 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-B84
Depth: 6-8 ft **Sample Number:** 4
Description: 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.	160.830
Moisture content: Dry soil+tare, gms.	130.400
Moisture content: Tare, gms.	50.230
Moisture, %	38.0
Moist specimen weight, gms.	984.62
Diameter, in.	2.751
Area, in.^{2}	5.944
Height, in.	5.680
Wet density, pcf	111.1
Dry density, pcf	80.5
Void ratio	1.1317
Saturation, %	92.2

Test Readings for Specimen No. 1

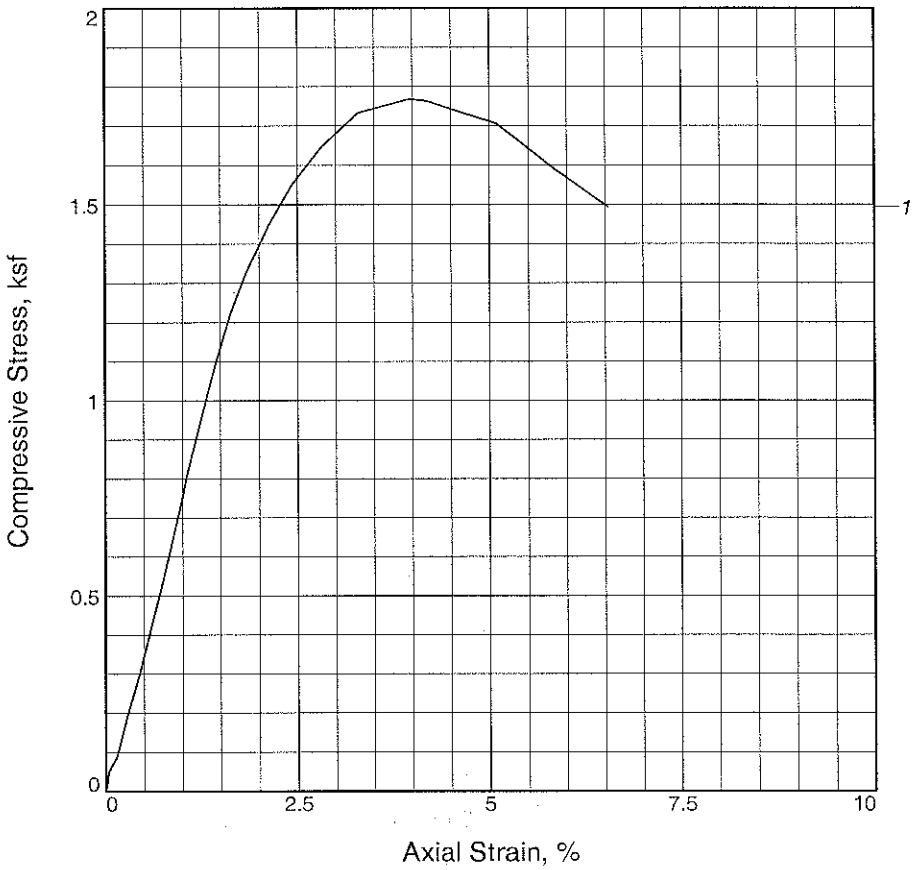
Strain rate, in./min. = 0.055
Unconfined compressive strength = 3.682 ksf **at reading no.** 18

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	1.315	1.3	0.0	0.032
2	0.0123	7.966	8.0	0.2	0.193
3	0.0166	17.652	17.7	0.3	0.426
4	0.0203	28.276	28.3	0.4	0.683
5	0.0246	38.590	38.6	0.4	0.931
6	0.0288	48.896	48.9	0.5	1.179
7	0.0331	58.518	58.5	0.6	1.409
8	0.0369	67.518	67.5	0.6	1.625
9	0.0411	75.535	75.5	0.7	1.817
10	0.0468	85.268	85.3	0.8	2.049
11	0.0520	94.016	94.0	0.9	2.257
12	0.0605	104.272	104.3	1.1	2.499
13	0.0714	115.265	115.3	1.3	2.757
14	0.0823	123.880	123.9	1.4	2.958
15	0.0988	134.223	134.2	1.7	3.195

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
16	0.1153	142.167	142.2	2.0	3.374
17	0.1376	150.130	150.1	2.4	3.549
18	0.1759	156.855	156.9	3.1	3.682
19	0.1815	156.649	156.6	3.2	3.674
20	0.2089	148.032	148.0	3.7	3.454
21	0.2255	136.078	136.1	4.0	3.166
22	0.2364	127.615	127.6	4.2	2.963
23	0.2472	117.300	117.3	4.4	2.718
24	0.2586	101.588	101.6	4.6	2.349

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, ksf	1.768			
Undrained shear strength, ksf	0.884			
Failure strain, %	4.0			
Strain rate, in./min.	0.055			
Water content, %	25.2			
Wet density, pcf	122.3			
Dry density, pcf	97.7			
Saturation, %	91.6			
Void ratio	0.7574			
Specimen diameter, in.	2.799			
Specimen height, in.	5.672			
Height/diameter ratio	2.03			

Description: Tan Clay w/silt and 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-B84

Sample Number: 12 **Depth:** 22-24 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-B84
Depth: 22-24 ft. **Sample Number:** 12
Description: Tan Clay w/silt and 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.	161.540
Moisture content: Dry soil+tare, gms.	139.210
Moisture content: Tare, gms.	50.710
Moisture, %	25.2
Moist specimen weight, gms.	1120.78
Diameter, in.	2.799
Area, in.^{2}	6.153
Height, in.	5.672
Wet density, pcf	122.3
Dry density, pcf	97.7
Void ratio	0.7574
Saturation, %	91.6

Test Readings for Specimen No. 1

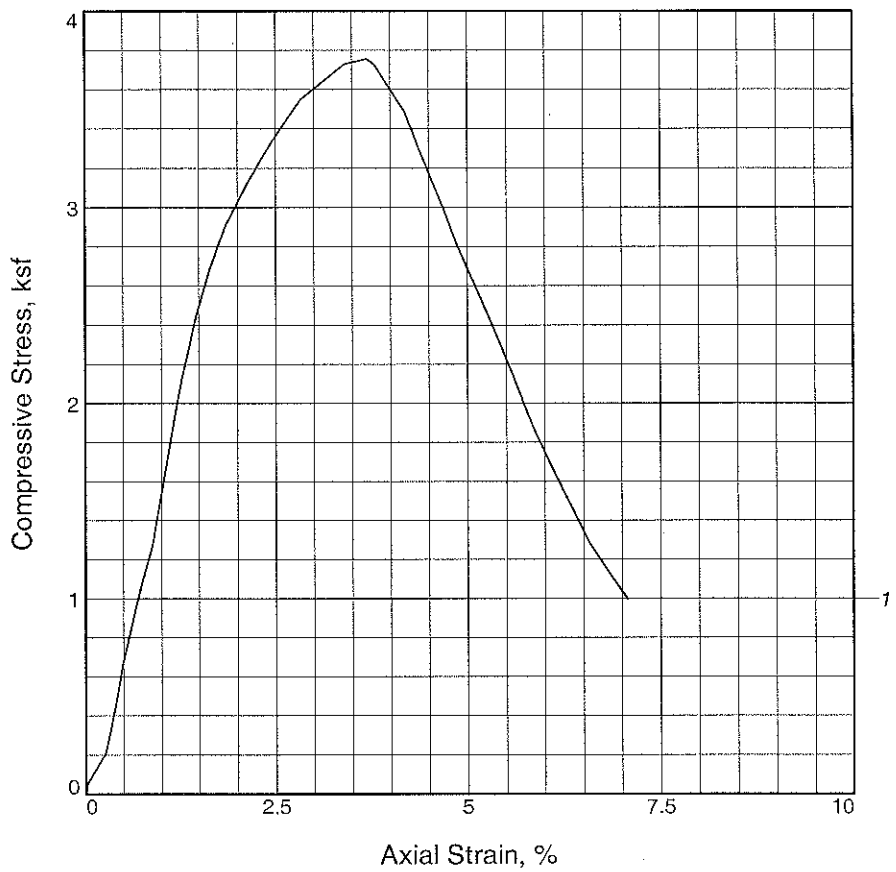
Strain rate, in./min. = 0.055
Unconfined compressive strength = 1.768 ksf **at reading no.** 18

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
0	0.0000	0.000	0.0	0.0	0.000
1	0.0025	2.200	2.2	0.0	0.051
2	0.0081	3.691	3.7	0.1	0.086
3	0.0161	8.277	8.3	0.3	0.193
4	0.0246	12.713	12.7	0.4	0.296
5	0.0326	17.421	17.4	0.6	0.405
6	0.0397	21.761	21.8	0.7	0.506
7	0.0464	25.835	25.8	0.8	0.600
8	0.0534	30.290	30.3	0.9	0.702
9	0.0601	34.834	34.8	1.1	0.807
10	0.0714	41.617	41.6	1.3	0.962
11	0.0823	47.756	47.8	1.5	1.101
12	0.0932	53.310	53.3	1.6	1.227
13	0.1040	57.812	57.8	1.8	1.328
14	0.1206	63.268	63.3	2.1	1.449
15	0.1371	67.809	67.8	2.4	1.549

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
16	0.1593	72.339	72.3	2.8	1.645
17	0.1867	76.567	76.6	3.3	1.733
18	0.2250	78.685	78.7	4.0	1.768
19	0.2364	78.647	78.6	4.2	1.764
20	0.2884	76.835	76.8	5.1	1.707
21	0.3300	72.305	72.3	5.8	1.594
22	0.3711	68.268	68.3	6.5	1.493

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, ksf	3.755			
Undrained shear strength, ksf	1.877			
Failure strain, %	3.7			
Strain rate, in./min.	0.055			
Water content, %	35.2			
Wet density, pcf	118.3			
Dry density, pcf	87.5			
Saturation, %	100.5			
Void ratio	0.9627			
Specimen diameter, in.	2.751			
Specimen height, in.	5.646			
Height/diameter ratio	2.05			

Description: Brown and light 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-B84

Sample Number: 18 **Depth:** 34-36 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-B84
Depth: 34-36 ft. **Sample Number:** 18
Description: Brown and light 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.	151.990
Moisture content: Dry soil+tare, gms.	125.710
Moisture content: Tare, gms.	51.030
Moisture, %	35.2
Moist specimen weight, gms.	1041.70
Diameter, in.	2.751
Area, in.^{2}	5.944
Height, in.	5.646
Wet density, pcf	118.3
Dry density, pcf	87.5
Void ratio	0.9627
Saturation, %	100.5

Test Readings for Specimen No. 1

Strain rate, in./min. = 0.055

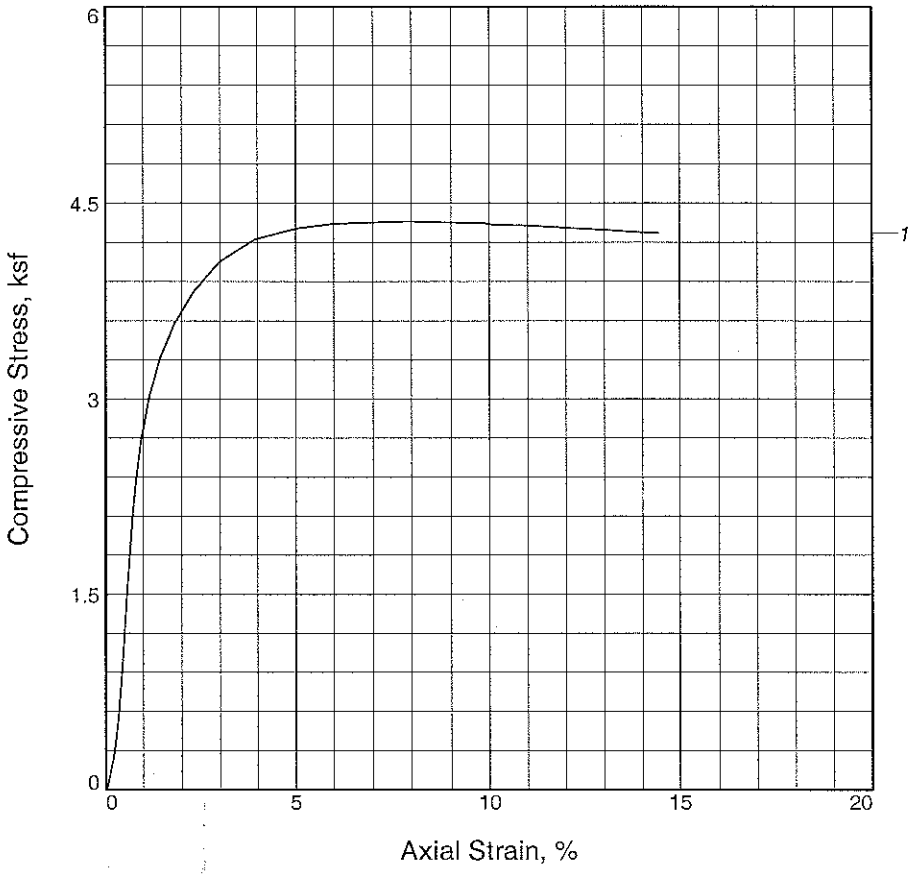
Unconfined compressive strength = 3.755 ksf **at reading no.** 19

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
0	0.0000	0.000	0.0	0.0	0.000
1	0.0002	0.052	0.1	0.0	0.001
2	0.0012	2.200	2.2	0.0	0.053
3	0.0149	8.570	8.6	0.3	0.207
4	0.0220	18.206	18.2	0.4	0.439
5	0.0273	26.960	27.0	0.5	0.650
6	0.0344	35.972	36.0	0.6	0.866
7	0.0410	44.259	44.3	0.7	1.064
8	0.0495	53.003	53.0	0.9	1.273
9	0.0604	70.237	70.2	1.1	1.683
10	0.0661	79.713	79.7	1.2	1.909
11	0.0712	87.972	88.0	1.3	2.104
12	0.0826	102.266	102.3	1.5	2.441
13	0.0935	113.439	113.4	1.7	2.703
14	0.1043	122.452	122.5	1.8	2.912
15	0.1209	132.144	132.1	2.1	3.133

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
16	0.1374	140.669	140.7	2.4	3.325
17	0.1596	150.670	150.7	2.8	3.547
18	0.1923	159.336	159.3	3.4	3.729
19	0.2088	160.935	160.9	3.7	3.755
20	0.2145	159.862	159.9	3.8	3.726
21	0.2362	150.169	150.2	4.2	3.486
22	0.2476	141.757	141.8	4.4	3.284
23	0.2641	130.169	130.2	4.7	3.006
24	0.2750	121.922	121.9	4.9	2.810
25	0.2887	112.575	112.6	5.1	2.588
26	0.3024	102.945	102.9	5.4	2.360
27	0.3161	93.161	93.2	5.6	2.131
28	0.3298	82.577	82.6	5.8	1.884
29	0.3435	73.802	73.8	6.1	1.679
30	0.3714	56.741	56.7	6.6	1.284
31	0.3988	44.298	44.3	7.1	0.997

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, ksf	4.359			
Undrained shear strength, ksf	2.180			
Failure strain, %	7.9			
Strain rate, in./min.	0.055			
Water content, %	30.6			
Wet density, pcf	124.6			
Dry density, pcf	95.4			
Saturation, %	105.3			
Void ratio	0.7989			
Specimen diameter, in.	2.721			
Specimen height, in.	5.717			
Height/diameter ratio	2.10			

Description: Grayb 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-B84

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-B84
Depth: 52-54 ft. **Sample Number:** 27
Description: Grayb 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.	181.800
Moisture content: Dry soil+tare, gms.	151.010
Moisture content: Tare, gms.	50.390
Moisture, %	30.6
Moist specimen weight, gms.	1087.63
Diameter, in.	2.721
Area, in.^{2}	5.815
Height, in.	5.717
Wet density, pcf	124.6
Dry density, pcf	95.4
Void ratio	0.7989
Saturation, %	105.3

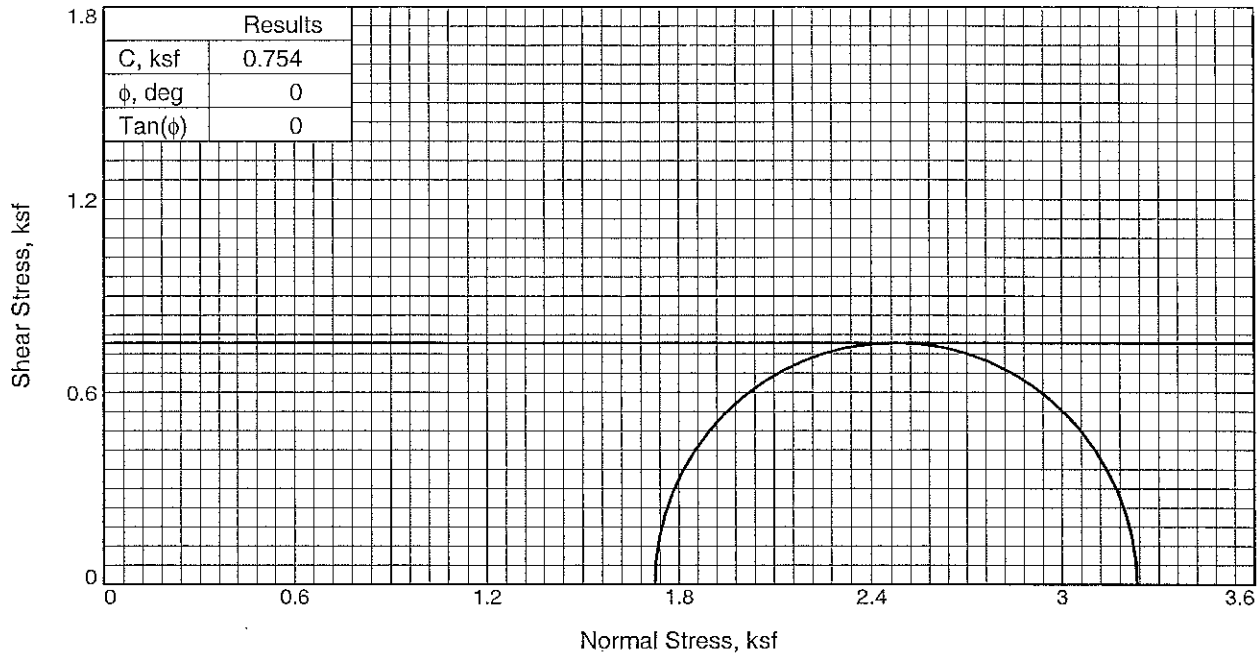
Test Readings for Specimen No. 1

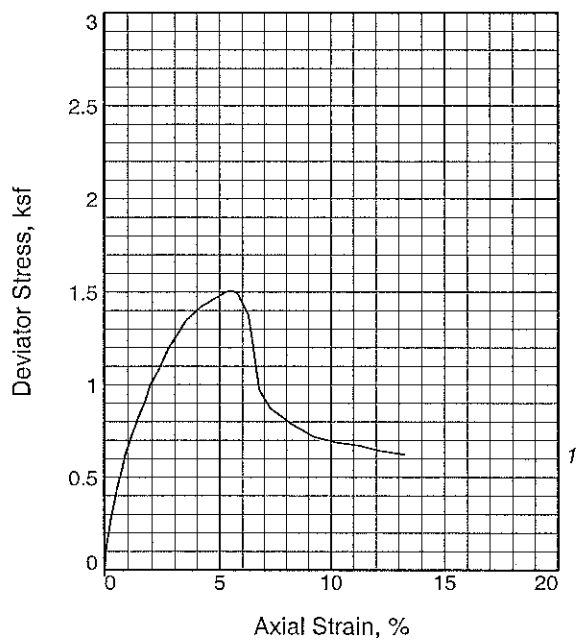
Strain rate, in./min. = 0.055
Unconfined compressive strength = 4.359 ksf **at reading no.** 20

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
0	0.0000	0.000	0.0	0.0	0.000
1	0.0020	0.300	0.3	0.0	0.007
2	0.0120	10.006	10.0	0.2	0.247
3	0.0191	22.528	22.5	0.3	0.556
4	0.0243	35.777	35.8	0.4	0.882
5	0.0285	49.516	49.5	0.5	1.220
6	0.0328	63.134	63.1	0.6	1.554
7	0.0370	75.366	75.4	0.6	1.854
8	0.0408	85.982	86.0	0.7	2.114
9	0.0465	97.451	97.5	0.8	2.394
10	0.0536	108.633	108.6	0.9	2.665
11	0.0659	122.819	122.8	1.2	3.006
12	0.0824	135.477	135.5	1.4	3.307
13	0.1046	147.482	147.5	1.8	3.585
14	0.1321	158.073	158.1	2.3	3.824
15	0.1704	168.544	168.5	3.0	4.049

Test Readings for Specimen No. 5

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
16	0.2257	177.621	177.6	3.9	4.225
17	0.2890	183.270	183.3	5.1	4.309
18	0.3438	186.590	186.6	6.0	4.343
19	0.3987	188.941	188.9	7.0	4.353
20	0.4540	191.208	191.2	7.9	4.359
21	0.5088	192.981	193.0	8.9	4.354
22	0.5636	194.763	194.8	9.9	4.348
23	0.5773	194.685	194.7	10.1	4.334
24	0.6326	196.463	196.5	11.1	4.327
25	0.6875	197.819	197.8	12.0	4.310
26	0.7428	199.409	199.4	13.0	4.297
27	0.7976	200.701	200.7	14.0	4.277
28	0.8250	201.588	201.6	14.4	4.272





Sample No.		1
Initial	Water Content, %	25.0
	Dry Density, pcf	99.6
	Saturation, %	95.1
	Void Ratio	0.7235
	Diameter, in.	2.782
	Height, in.	5.859
At Test	Water Content, %	25.0
	Dry Density, pcf	99.6
	Saturation, %	95.1
	Void Ratio	0.7235
	Diameter, in.	2.782
	Height, in.	5.859
Strain rate, in./min.		0.055
Back Pressure, psi		0.000
Cell Pressure, psi		11.970
Fail. Stress, ksf		1.508
Ult. Stress, ksf		
σ_1 Failure, ksf		3.232
σ_3 Failure, ksf		1.724

Type of Test:
Unconsolidated Undrained

Sample Type:

Description: Tan Clay w/sand pockets

Assumed Specific Gravity= 2.75

Remarks:

Client: USACE

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

Location: 09-B84

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

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

TRIAXIAL SHEAR TEST REPORT
Terracon, Inc.
Houston, TX

TRIAXIAL COMPRESSION TEST

Unconsolidated Undrained

11/5/2010
3:11 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-B84
Depth: 16-18 ft. **Sample Number:** 9
Description: Tan Clay w/sand pockets
Remarks:
Type of Sample:
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.	171.330	171.330
Moisture content: Dry soil+tare, gms.	146.920	146.920
Moisture content: Tare, gms.	49.370	49.370
Moisture, %	25.0	25.0
Moist specimen weight, gms.	1164.23	
Diameter, in.	2.782	
Area, in.^{2}	6.079	
Height, in.	5.859	
Wet density, pcf	124.5	
Dry density, pcf	99.6	
Void ratio	0.7235	
Saturation, %	95.1	

Test Readings for Specimen No. 1

Cell pressure = 11.970 psi (1.724 ksf)
Back pressure = 0.000 psi (0.000 ksf)
Strain rate, in./min. = 0.055
Fail. Stress = 1.508 ksf **at reading no.** 19

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	1.724	1.724	1.00	1.724	0.000
1	0.0000	-1.420	-1.4	0.0	-0.034	1.724	1.690	0.98	1.707	-0.017
2	0.0030	3.653	3.7	0.1	0.086	1.724	1.810	1.05	1.767	0.043
3	0.0087	7.408	7.4	0.1	0.175	1.724	1.899	1.10	1.811	0.088
4	0.0160	11.575	11.6	0.3	0.273	1.724	1.997	1.16	1.860	0.137
5	0.0249	15.144	15.1	0.4	0.357	1.724	2.081	1.21	1.902	0.179
6	0.0330	18.737	18.7	0.6	0.441	1.724	2.165	1.26	1.944	0.221
7	0.0435	22.826	22.8	0.7	0.537	1.724	2.260	1.31	1.992	0.268
8	0.0523	26.201	26.2	0.9	0.615	1.724	2.339	1.36	2.031	0.308
9	0.0658	30.484	30.5	1.1	0.714	1.724	2.438	1.41	2.081	0.357
10	0.0837	35.091	35.1	1.4	0.819	1.724	2.543	1.48	2.133	0.410
11	0.1009	39.410	39.4	1.7	0.918	1.724	2.641	1.53	2.182	0.459
12	0.1126	42.959	43.0	1.9	0.998	1.724	2.722	1.58	2.223	0.499
13	0.1360	46.849	46.8	2.3	1.084	1.724	2.808	1.63	2.266	0.542
14	0.1594	51.901	51.9	2.7	1.196	1.724	2.920	1.69	2.322	0.598
15	0.1828	55.356	55.4	3.1	1.270	1.724	2.994	1.74	2.359	0.635
16	0.2062	58.992	59.0	3.5	1.348	1.724	3.072	1.78	2.398	0.674
17	0.2473	62.773	62.8	4.2	1.424	1.724	3.148	1.83	2.436	0.712
18	0.3088	66.766	66.8	5.3	1.498	1.724	3.222	1.87	2.473	0.749
19	0.3236	67.391	67.4	5.5	1.508	1.724	3.232	1.88	2.478	0.754
20	0.3377	66.952	67.0	5.8	1.495	1.724	3.218	1.87	2.471	0.747
21	0.3667	61.823	61.8	6.3	1.373	1.724	3.097	1.80	2.410	0.686
22	0.3816	53.277	53.3	6.5	1.180	1.724	2.904	1.68	2.314	0.590
23	0.3963	44.009	44.0	6.8	0.972	1.724	2.696	1.56	2.210	0.486
24	0.4252	39.871	39.9	7.3	0.876	1.724	2.600	1.51	2.162	0.438
25	0.4832	36.098	36.1	8.2	0.785	1.724	2.508	1.46	2.116	0.392
26	0.5411	33.491	33.5	9.2	0.720	1.724	2.444	1.42	2.084	0.360
27	0.5991	32.395	32.4	10.2	0.689	1.724	2.413	1.40	2.068	0.344
28	0.6571	32.028	32.0	11.2	0.674	1.724	2.397	1.39	2.060	0.337
29	0.7156	30.854	30.9	12.2	0.642	1.724	2.365	1.37	2.044	0.321
30	0.7737	30.356	30.4	13.2	0.624	1.724	2.348	1.36	2.036	0.312

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-B84	0-2	2.50			71	23	48		100	98		97				95					92	CH	28	93																					
	2-4	4.50																				CH**	15																						
	4-6	3.00																				CH**	27																						
	6-8	1.00			95	32	63			100		100				98					95	CH	38							1.8	38	81	CH**											
	8-10	1.50																				CH**	37																						
	10-12	1.00			45	17	28		100	100		98				95					80	CL	23	103																					
	12-14	0.25																				CL**	26																						
	14-16	0.25																				CL**	27																						
	16-18	0.25			36	21	15					100				100					91	CL	25											0.8	25	100	CL**							
	18-20	1.00																				CL**	37																						
	20-22	0.75																				CL**	28																						
	22-24	0.50			39	19	20		100	100		100				100					98	CL	25							0.9	25	98	CL**											
	24-26	1.50																				CL**	34																						
	26-28	3.00																				CL**	31																						
	28-30	1.25																				CL**	24																						
	30-32	2.75																				CH**	33																						
	32-34	2.00																				CH**	36																						
	34-36	2.25			88	28	60									100					100	CH	35							1.9	35	88	CH**											
	36-38	1.25																				CH**	26																						
	38-40	2.00																				CH**	33																						
	40-42	1.75																				CH**	33																						
	42-44	2.00																				CH**	38																						
	44-46	2.25																				CH**	41																						
	46-48	2.25			102	33	69															CH*	38	82																					
	48-50	1.75																				CH**	40																						
	50-52	2.00																				CH**	43																						
	52-54	1.75			58	24	34					100				100					98	CH	31							2.2	31	95	CH**											
	54-56	2.00																				CH**	30																						
	56-58	2.25																				CH**	31																						
	58-60	2.25																				CH**	31																						
	60-62	3.25																				CH**	27																						
	62-64	2.00																				CH**	24																						
	64-66	1.50			44	16	28					100				100					80	CL	23	104																					