BORING LOG NO. 09-B96

CLIENT:	USACE, Galveston District Galveston, Texas	PROJECT:	TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume I
BORING LOCATION:	N: 13826885 E: 3259381	SITE:	Cedar Bayou PA6 Baytown, Texas

Approx. Surface Elevation: 11.3 feet

Elevation	Description	Depth
9.3	**FILL: FAT CLAY w/SAND** gray and brown, very soft, high plasticity, moist, with roots and organic matter	2.0
6.3	**FILL: FAT CLAY** yellowish brown and light gray, soft to stiff, very high plasticity, moist	5.0
1.3	**FILL: SANDY, SILTY CLAY** light gray and brown, very soft, slight plasticity, moist	10.0
-0.7	**LEAN CLAY w/SAND** dark gray, soft, high plasticity, moist, with ferrous stains and sand seams	12.0
-4.7	**LEAN CLAY** gray and greenish gray, medium stiff to stiff, high plasticity, moist, with sand seams	16.0
-8.7	**LEAN CLAY w/ SAND** light gray, light brown and greenish gray, medium stiff, high plasticity, moist, with sand seams and pockets	20.0

Boring terminated at 20 feet.

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
1	CH	ST	11		0.25	0.25	37								
3	CH	ST	17		0.75		41	84	83	23	60	90			
5		ST	5		0.5		55								
7	CL-ML	BS	6				26		26	20	6	50			
9		ST	0												
11	CL	ST	21		0.5		32								
13	CL	ST	9		0.75		25	97	55	18	37	88			
15		ST	9		1.75		23								
17	CL	ST	12		0.75		26					72			
19		ST	18		0.75		29								

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

REMARKS: **Dry augered to 20 feet.**

WATER LEVEL OBSERVATIONS	
▽	▼
▼	▼

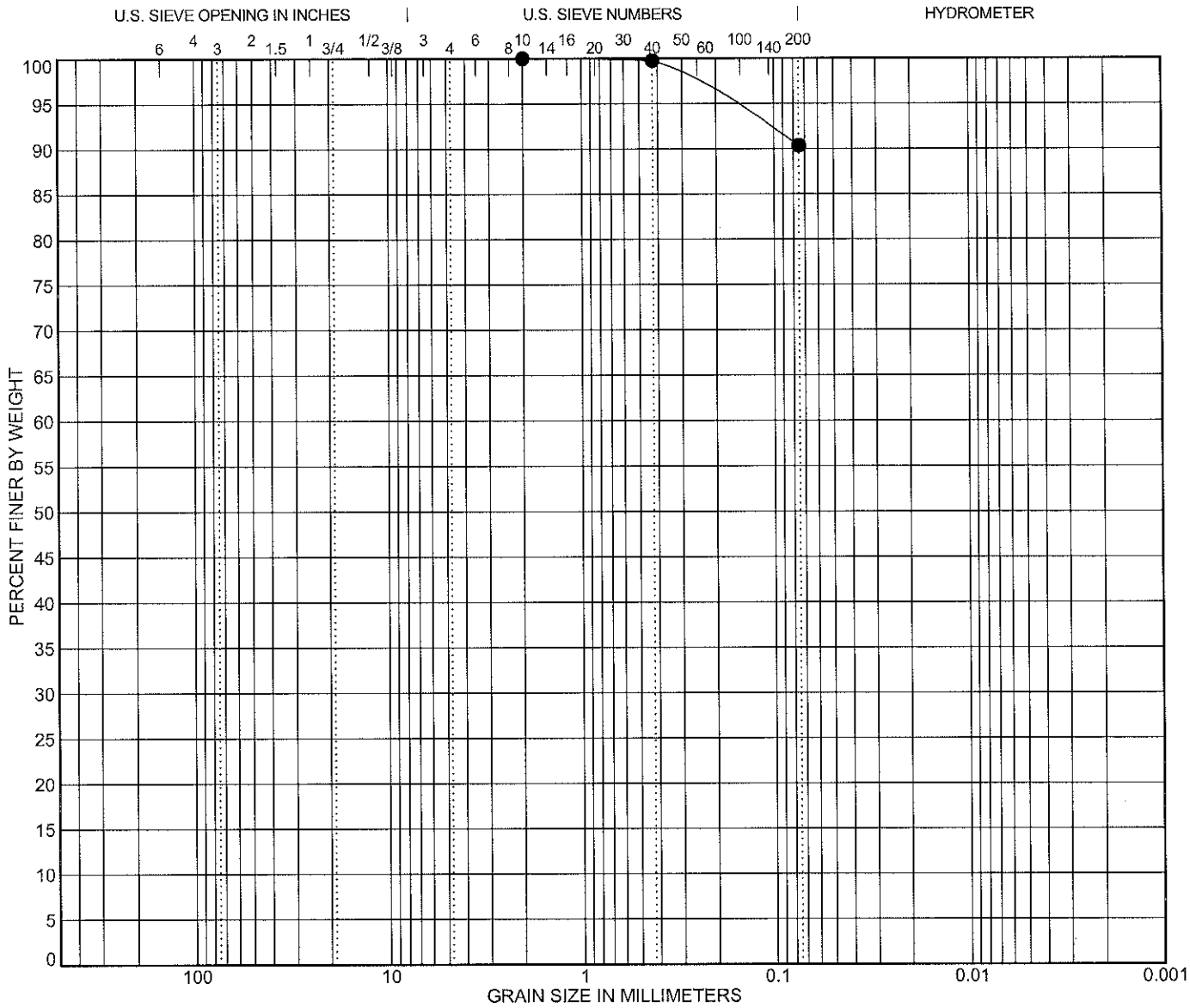
FREE WATER WAS NOT OBSERVED DURING DRY DRILLING OPERATIONS

Terracon

DATE DRILLED	3/19/2010
PROJECT NUMBER	92105186-A

09-B96

EXHIBIT A-



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **09-B96**	**2.0**	**FAT CLAY(CH)**	**83**	**23**	**60**		

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● **09-B96**	**2.0**			**100**	**99.7**		**90.4**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **09-B96**	**2.0**	**2**				**0.0**	**9.6**	**90.4**	

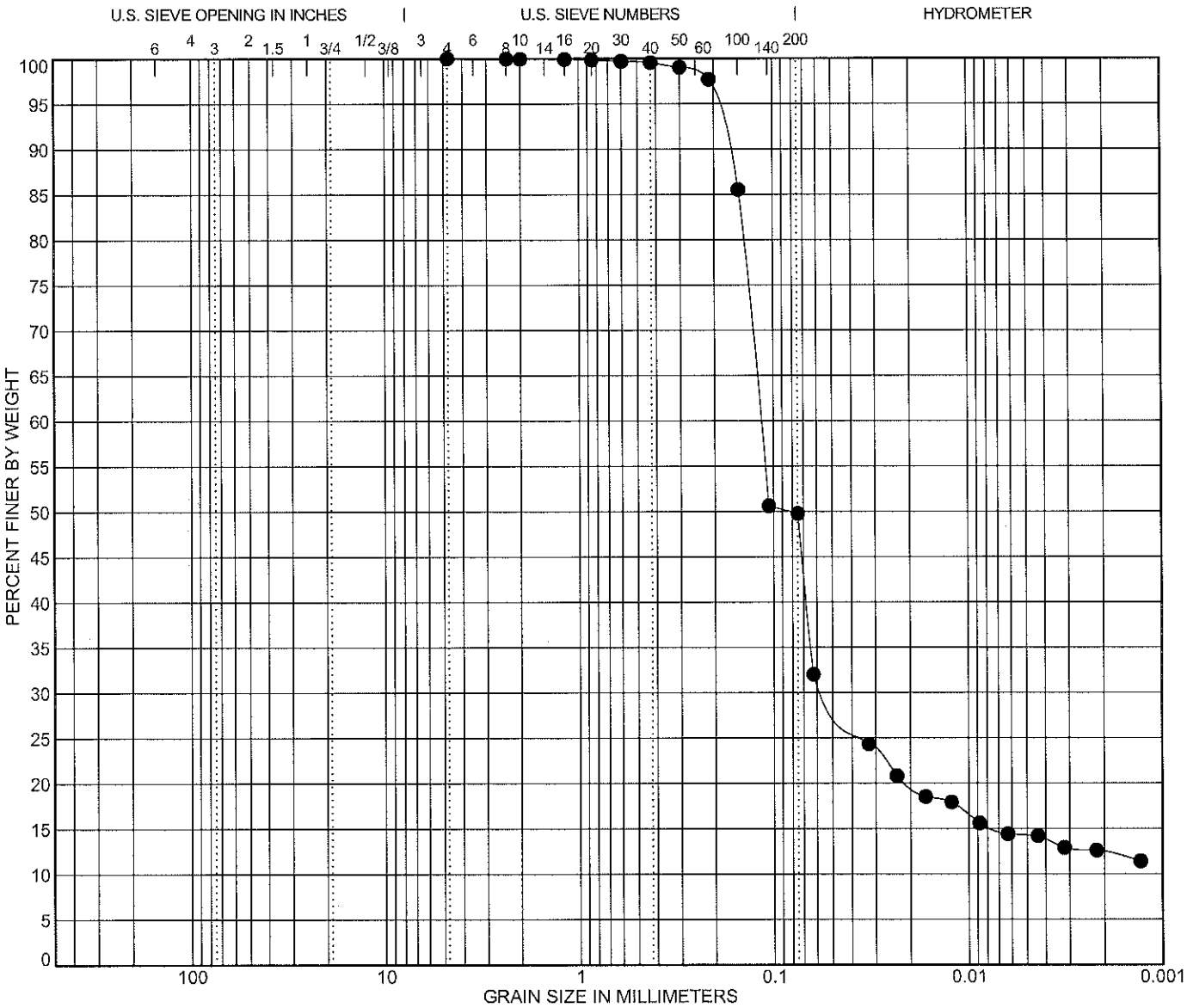
GRAIN SIZE DISTRIBUTION

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 D



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **09-B96**	**6.0**	**SILTY, CLAYEY SAND(SC-SM)**	**26**	**20**	**6**		

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● **09-B96**	**6.0**		**100**	**100**	**99.5**	**85.5**	**49.8**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **09-B96**	**6.0**	**4.75**	**0.082**	**0.053**		**0.0**	**50.2**	**37.4**	**12.4**

GRAIN SIZE DISTRIBUTION

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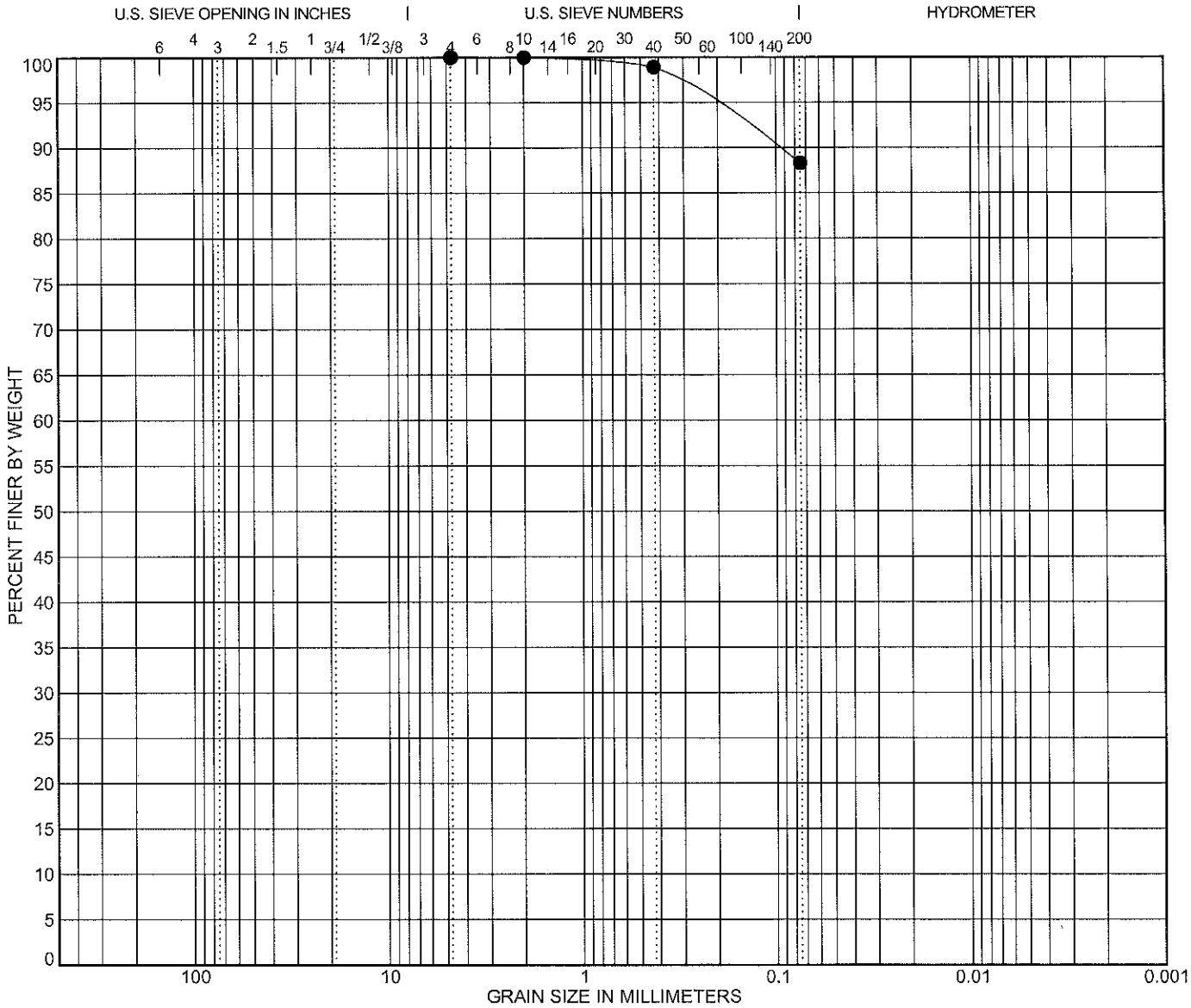
EXHIBIT Ñ



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **09-B96**	**12.0**	**FAT CLAY(CH)**	**55**	**18**	**37**		

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● **09-B96**	**12.0**		**100**	**100**	**98.9**		**88.3**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **09-B96**	**12.0**	**4.75**				**0.0**	**11.7**	**88.3**	

GRAIN SIZE DISTRIBUTION

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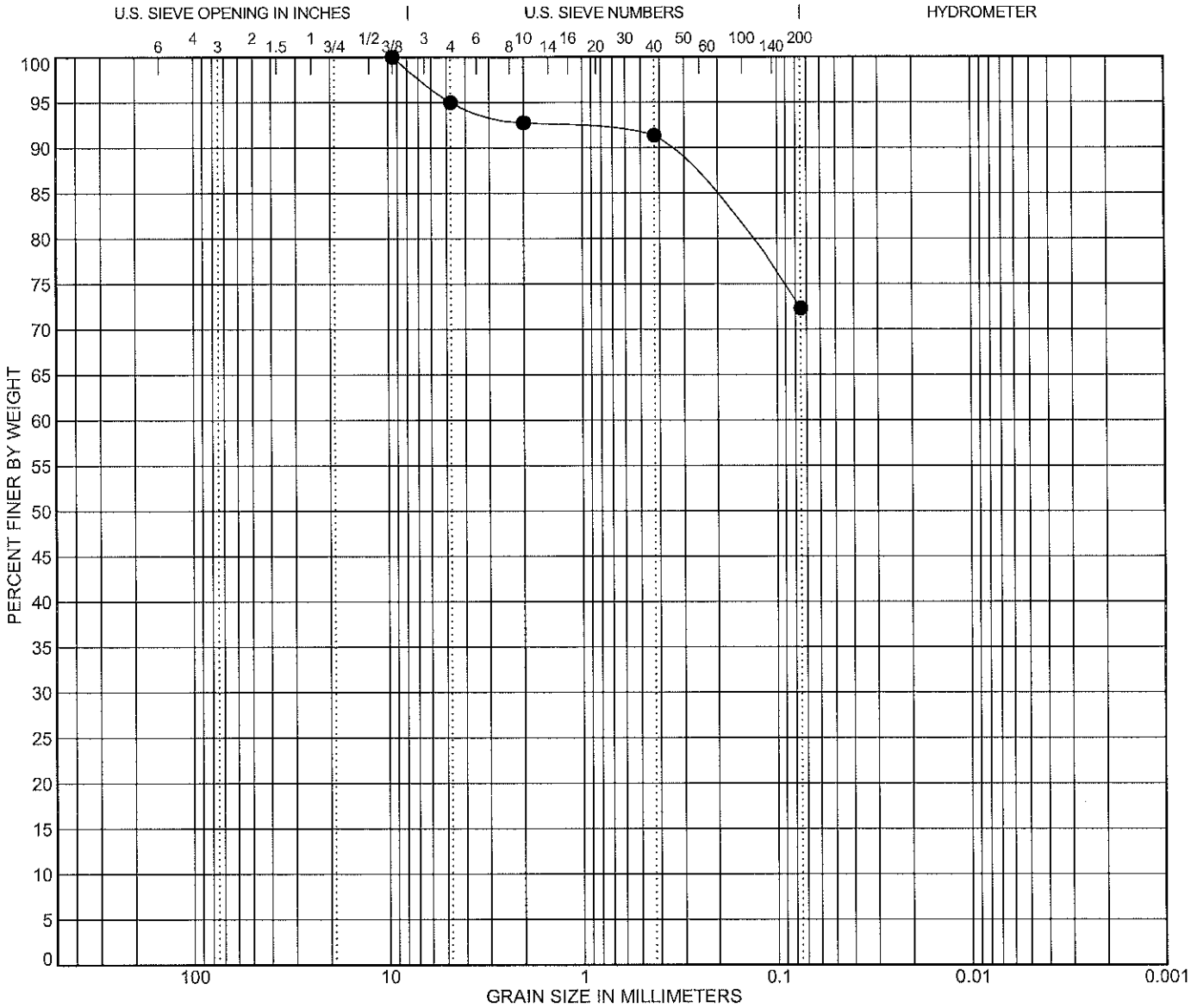
EXHIBIT Ò



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B96**	**16.0**						

Percent Passing the Indicated Sieve

	Specimen Identification		3/8"	#4	#10	#40	#100	#200
●	**09-B96**	**16.0**	**100**	**95**	**92.8**	**91.4**		**72.3**

	Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**09-B96**	**16.0**	**9.5**				**5.0**	**22.7**	**72.3**	

GRAIN SIZE DISTRIBUTION

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

Terracon

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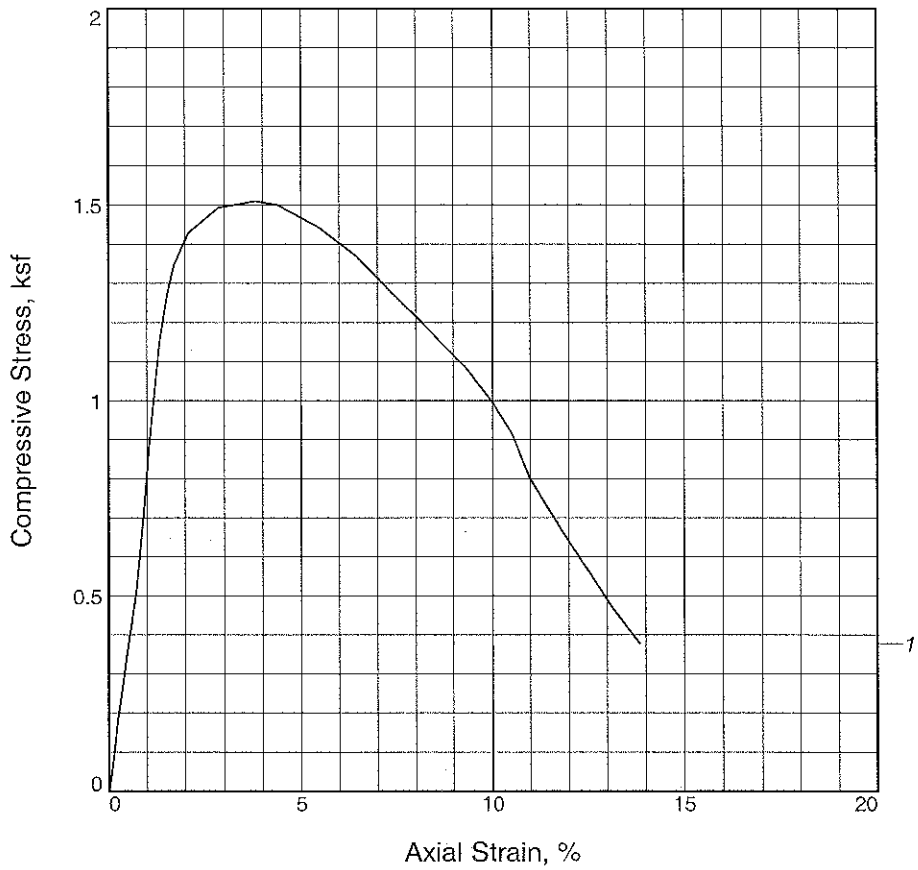
EXHIBIT Ó

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, ksf	1.509			
Undrained shear strength, ksf	0.755			
Failure strain, %	3.8			
Strain rate, in./min.	0.055			
Water content, %	40.8			
Wet density, pcf	117.9			
Dry density, pcf	83.7			
Saturation, %	106.8			
Void ratio	1.0506			
Specimen diameter, in.	2.676			
Specimen height, in.	5.759			
Height/diameter ratio	2.15			

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-B96

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-B96
Depth: 2-4 ft. **Sample Number:** 2
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.	158.090
Moisture content: Dry soil+tare, gms.	126.730
Moisture content: Tare, gms.	49.860
Moisture, %	40.8
Moist specimen weight, gms.	1002.20
Diameter, in.	2.676
Area, in.^{2}	5.624
Height, in.	5.759
Wet density, pcf	117.9
Dry density, pcf	83.7
Void ratio	1.0506
Saturation, %	106.8

Test Readings for Specimen No. 1

Strain rate, in./min. = 0.055
Unconfined compressive strength = 1.509 ksf **at reading no.** 19

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
0	0.0000	-1.627	0.0	0.0	0.000
1	0.0010	-1.538	0.1	0.0	0.002
2	0.0081	2.180	3.8	0.1	0.097
3	0.0133	5.531	7.2	0.2	0.183
4	0.0204	8.555	10.2	0.4	0.260
5	0.0274	12.157	13.8	0.5	0.351
6	0.0341	15.207	16.8	0.6	0.428
7	0.0412	18.612	20.2	0.7	0.514
8	0.0464	21.809	23.4	0.8	0.595
9	0.0506	25.028	26.7	0.9	0.676
10	0.0549	28.197	29.8	1.0	0.756
11	0.0601	32.594	34.2	1.0	0.867
12	0.0657	36.777	38.4	1.1	0.972
13	0.0714	40.622	42.2	1.2	1.068
14	0.0766	43.693	45.3	1.3	1.145
15	0.0880	48.539	50.2	1.5	1.265

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
16	0.0988	51.874	53.5	1.7	1.346
17	0.1206	55.338	57.0	2.1	1.428
18	0.1645	58.394	60.0	2.9	1.493
19	0.2198	59.668	61.3	3.8	1.509
20	0.2529	59.662	61.3	4.4	1.500
21	0.3158	57.957	59.6	5.5	1.442
22	0.3711	55.566	57.2	6.4	1.370
23	0.4259	52.122	53.7	7.4	1.274
24	0.4812	48.708	50.3	8.4	1.181
25	0.5361	45.148	46.8	9.3	1.086
26	0.5772	41.435	43.1	10.0	0.992
27	0.6047	38.435	40.1	10.5	0.918
28	0.6325	33.594	35.2	11.0	0.803
29	0.6600	30.345	32.0	11.5	0.725
30	0.6874	27.169	28.8	11.9	0.649
31	0.7285	22.647	24.3	12.7	0.543
32	0.7559	19.563	21.2	13.1	0.471
33	0.7975	15.512	17.1	13.8	0.378

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-B94	0-2	0.00	0.30																			CH**	60																						
	2-4	0.25	0.05		62	21	41			100		100				100					83	CH	45							0.2	45	78	CH**											
	4-6	0.25	0.30		113	33	80					100				100			99		99	OH	60																						
	6-8	0.25	0.30																			CH**	48																						
	8-10																					CL**	39																						
	10-12	0.25	0.05		48	18	30					100				99					85	CL	39	83																					
	12-14	0.25	0.10																			OH**	78																						
	14-16	1.00																				CL**	26																						
	16-18	0.50																				CL**	33																						
	18-20	0.25	0.30																			CH**	42																						
09-B95	0-2	0.25	0.20		96	28	68					100				100					95	CH	51							0.3	51	68	CH**											
	4-6	0.25	0.15																			CH**	48																						
	6-8	0.25	0.30																			CH**	31																						
	8-10	0.25	0.20		51	18	33					100	100	100	100	100	100	99	98	94	94	CH	54											0.5	54	71	CH**							
	10-12	0.25	0.05																			CH**	47																						
	12-14	0.50																				CH**	35																						
	14-16	1.50																				CH**	30																						
	16-18	1.00			67	19	48					100				100					97	CH	33							1.0	33	91	CH**											
	18-20	0.50																				CH**	35																						
09-B96	0-2	0.25	0.25																			CH**	37																						
	2-4	0.75			83	23	60					100				100					90	CH	41							0.8	41	84	CH**											
	4-6	0.50																				CL-ML**	55																						
	6-8				26	20	6					100	100	100	100	100	99	98	86	51	50	CL-ML	26																						
	10-12	0.50																				CL**	32																						
	12-14	0.75			55	18	37					100				99					88	CH	25	97																					
	14-16	1.75																				CH**	23																						
	16-18	0.75							100	95		93				91					72	CL*	26																						
	18-20	0.75																				CL**	29																						
09-B97	0-2	0.50			88	33	55			100		100				98					95	CH	46	74																					
	2-4	0.50																				CH**	39																						
	4-6	0.50																				CH**	43																						
	6-8	1.50																				CH**	30																						
	8-10	2.50																				CH**	24																						
	10-12	2.25			81	25	56		100	100		100				99					99	CH	29							1.7	29	96	CH**											
	12-14	0.50																				CH**	23																						
	14-16			8																		CL**	27																						
	16-18			7	29	20	9			100		100				98					69	CL	24																						

NOTES:

USCS Symbol - Classification based on laboratory test results.

USCS Symbol* - Classification based partially on laboratory test results together with visual description.

USCS Symbol** - Classification based only on visual descriptions.