BORING LOG NO. 09-B90

CLIENT:	USACE, Galveston District Galveston, Texas	PROJECT:	TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume I
BORING LOCATION:	N: 13826659 E: 3261430	SITE:	Cedar Bayou PA6 Baytown, Texas

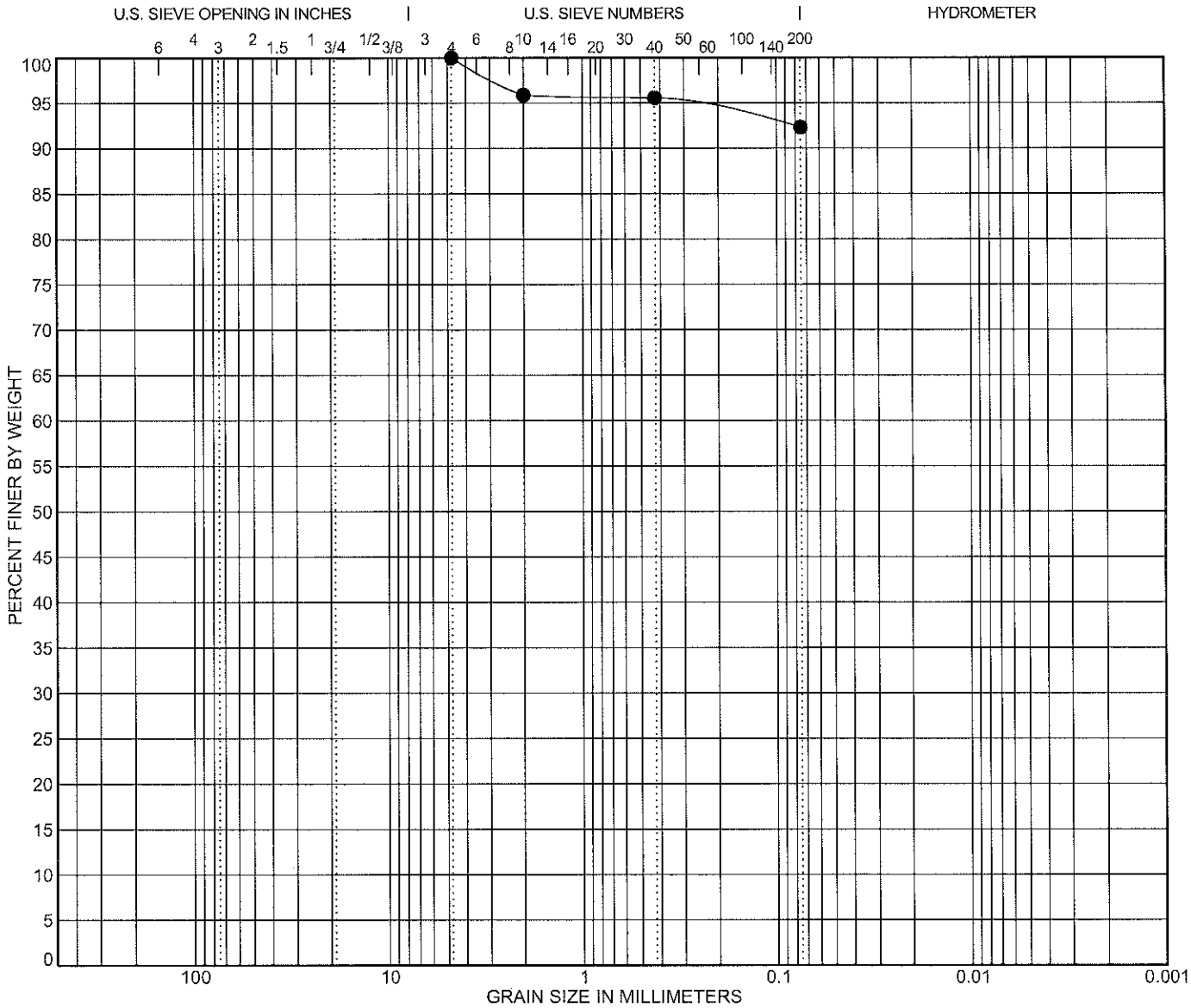
Approx. Surface Elevation: 11.5 feet

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 gray and dark gray, very soft to stiff, very high plasticity, wet	1	CH	ST	7		0.5		45								
		3		ST	17		0.25		56	67	95	28	67	92			
		5		ST	13		0.75		44	79	77	24	53	91			
		7		ST	4		0.25	0.1	61								
	3.5 / 8.0	8															
	FILL: SANDY LEAN CLAY gray, very soft, high plasticity, wet	9	CL	ST	6		0.25	0.05	35								
	-0.5 / 12.0	11		ST	9		0.0	0.2	29	90	38	16	22	63			
	FAT CLAY gray and dark gray, very soft to soft, very high plasticity, moist - with organic matter and roots 12 to 14 feet	13	CH	ST	24		0.0	0.1	85								
		15		ST	17		0.5	0.4	36								
		17		ST	18		0.25	0.4	40								
	-8.5 / 20.0	19		ST	24		0.25	0.3	105		145	39	106	92			
	Boring terminated at 20 feet.	20															

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

REMARKS: Wet rotary from ground surface due to the presence of surface water ponded.

WATER LEVEL OBSERVATIONS				
▽	▼	Terracon	DATE DRILLED 3/19/2010	Page 1 of 1
▼	▼		PROJECT NUMBER 92105186-A	09-B90
				EXHIBIT A-



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B90**	**2.0**	**FAT CLAY(CH)**	**95**	**28**	**67**		

Percent Passing the Indicated Sieve

	Specimen Identification		3/8"	#4	#10	#40	#100	#200
●	**09-B90**	**2.0**		**100**	**95.9**	**95.6**		**92.3**

	Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**09-B90**	**2.0**	**4.75**				**0.0**	**7.7**	**92.3**	

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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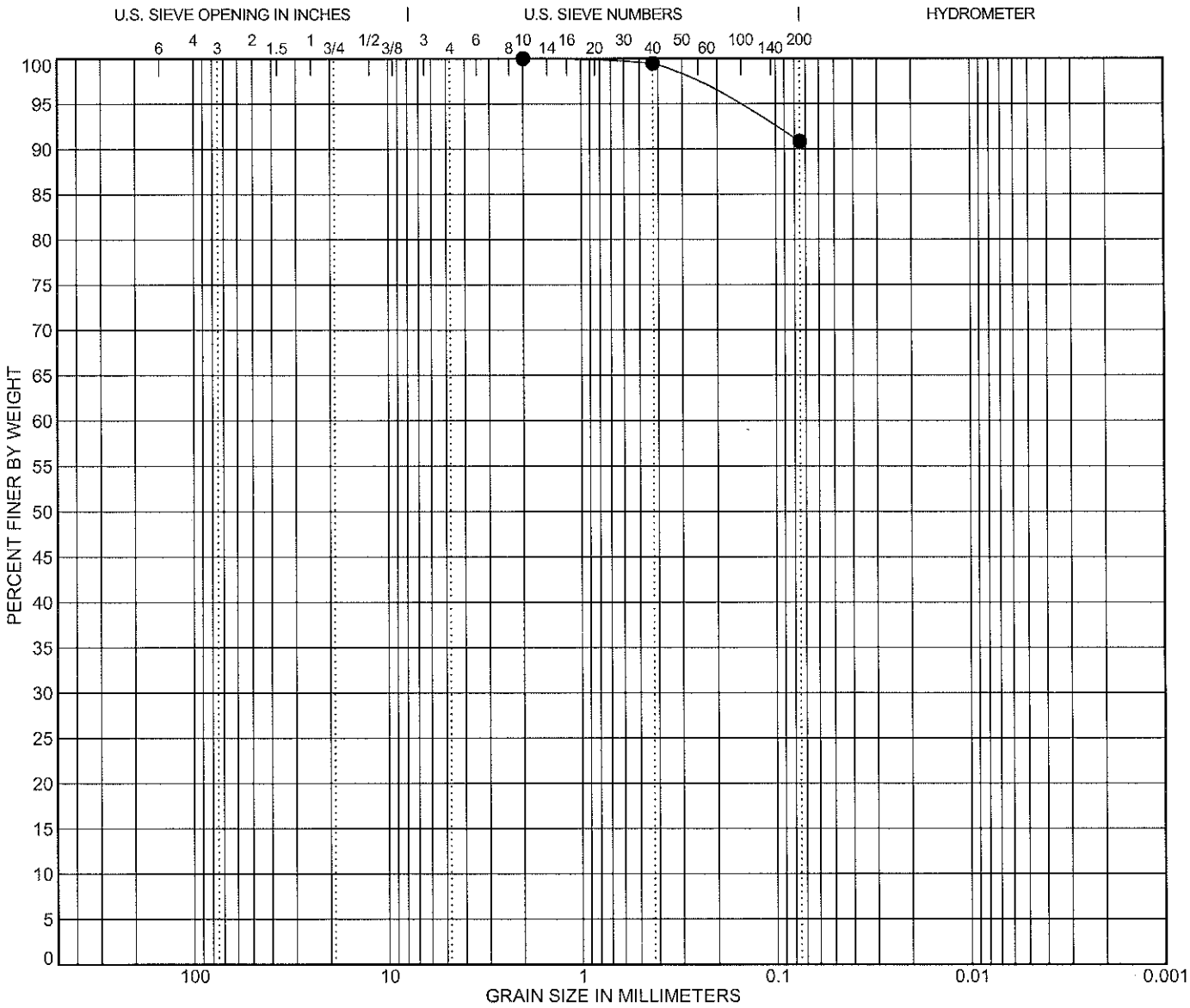

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B90**	**4.0**	**FAT CLAY(CH)**	**77**	**24**	**53**		

Percent Passing the Indicated Sieve

	Specimen Identification		3/8"	#4	#10	#40	#100	#200
●	**09-B90**	**4.0**			**100**	**99.5**		**90.8**

	Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**09-B90**	**4.0**	**2**				**0.0**	**9.2**	**90.8**	

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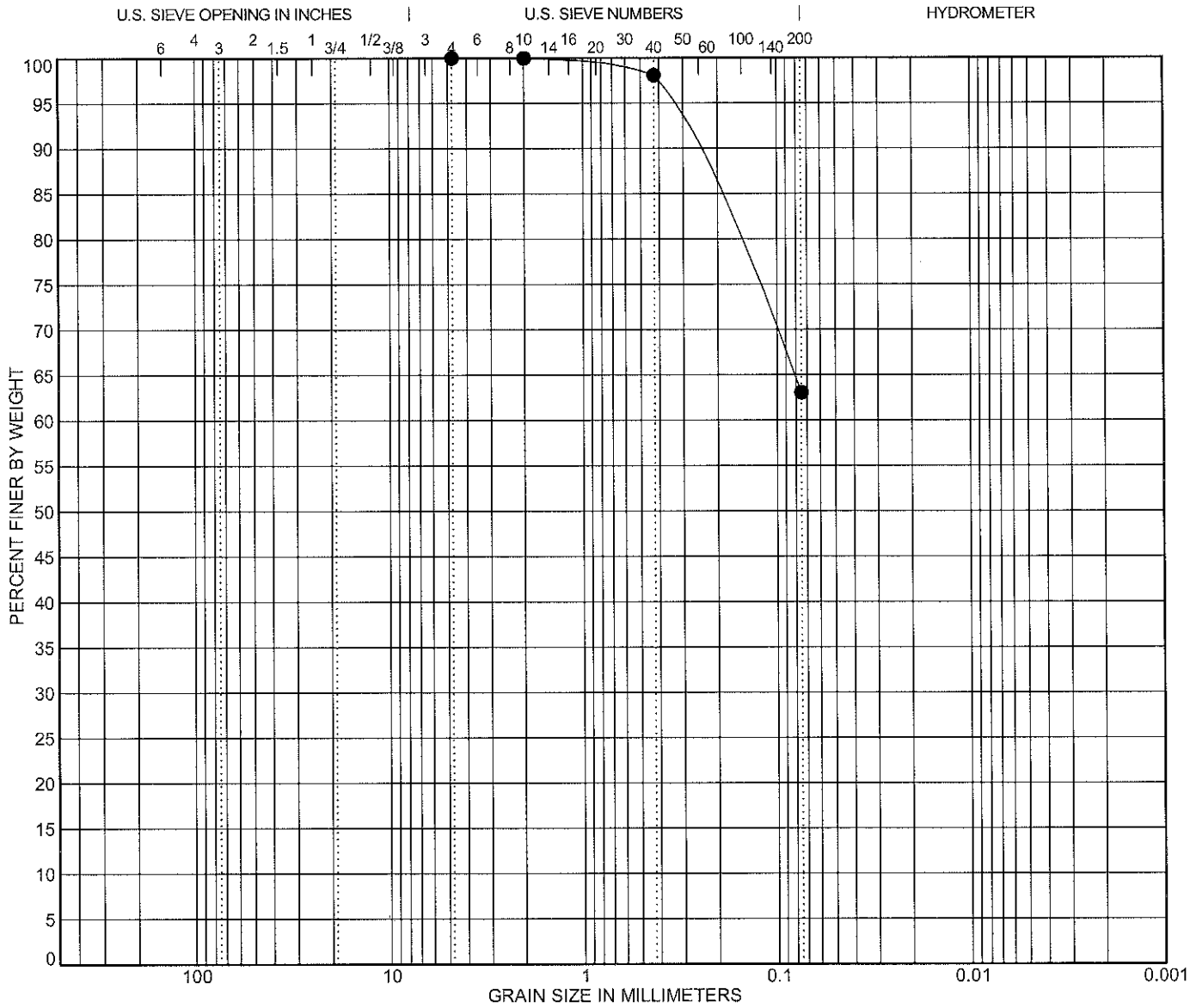
EXHIBIT
3/4



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **09-B90**	**10.0**	**SANDY LEAN CLAY(CL)**	**38**	**16**	**22**		

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● **09-B90**	**10.0**		**100**	**100**	**98.1**		**63**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **09-B90**	**10.0**	**4.75**				**0.0**	**37.0**	**63.0**	

GRAIN SIZE DISTRIBUTION

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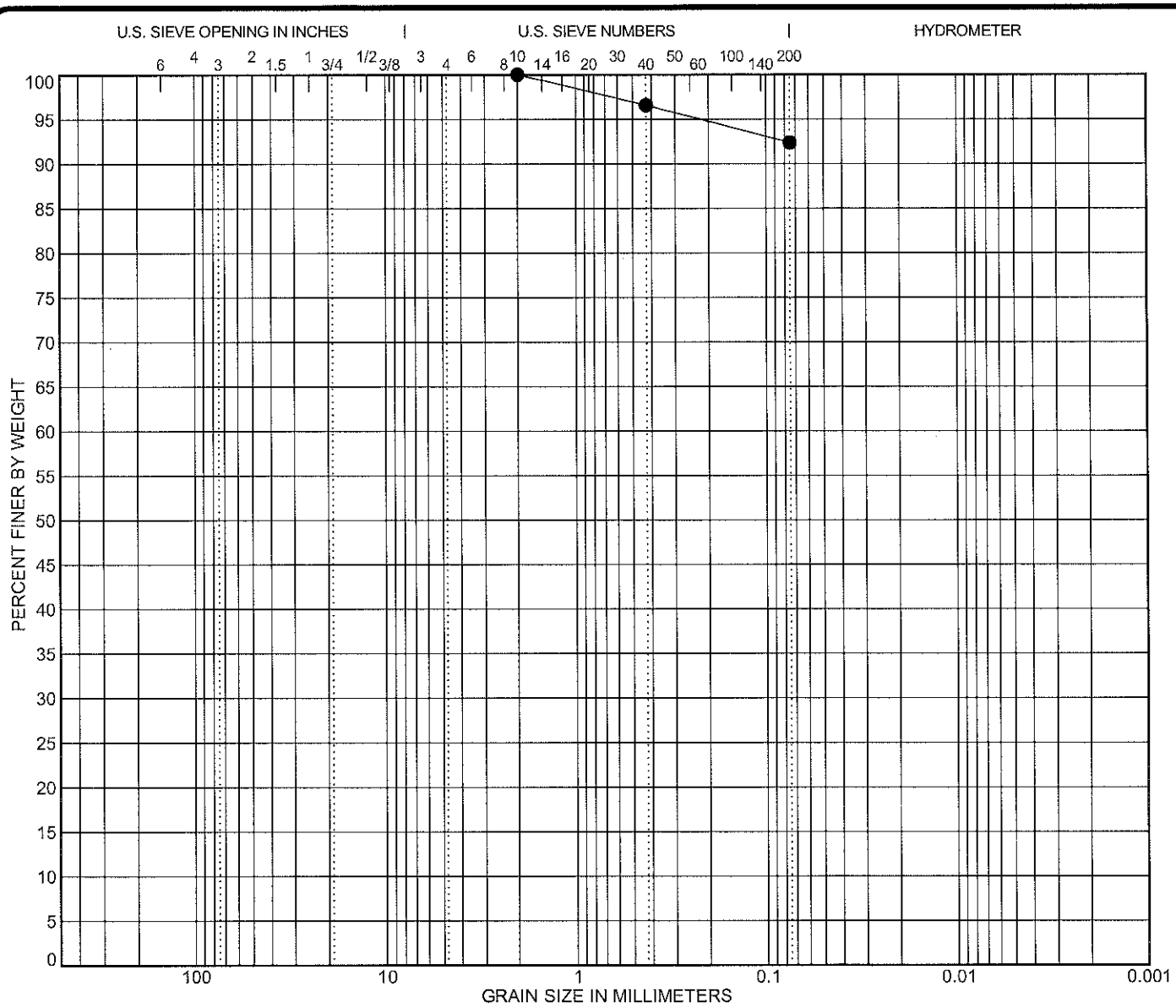

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B90**	**18.0**	**FAT CLAY(CH)**	**145**	**39**	**106**		

Percent Passing the Indicated Sieve

	Specimen Identification		3/8"	#4	#10	#40	#100	#200
●	**09-B90**	**18.0**			**100**	**96.6**		**92.4**

	Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**09-B90**	**18.0**	**2**				**0.0**	**7.6**	**92.4**	

GRAIN SIZE DISTRIBUTION

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

Terracon

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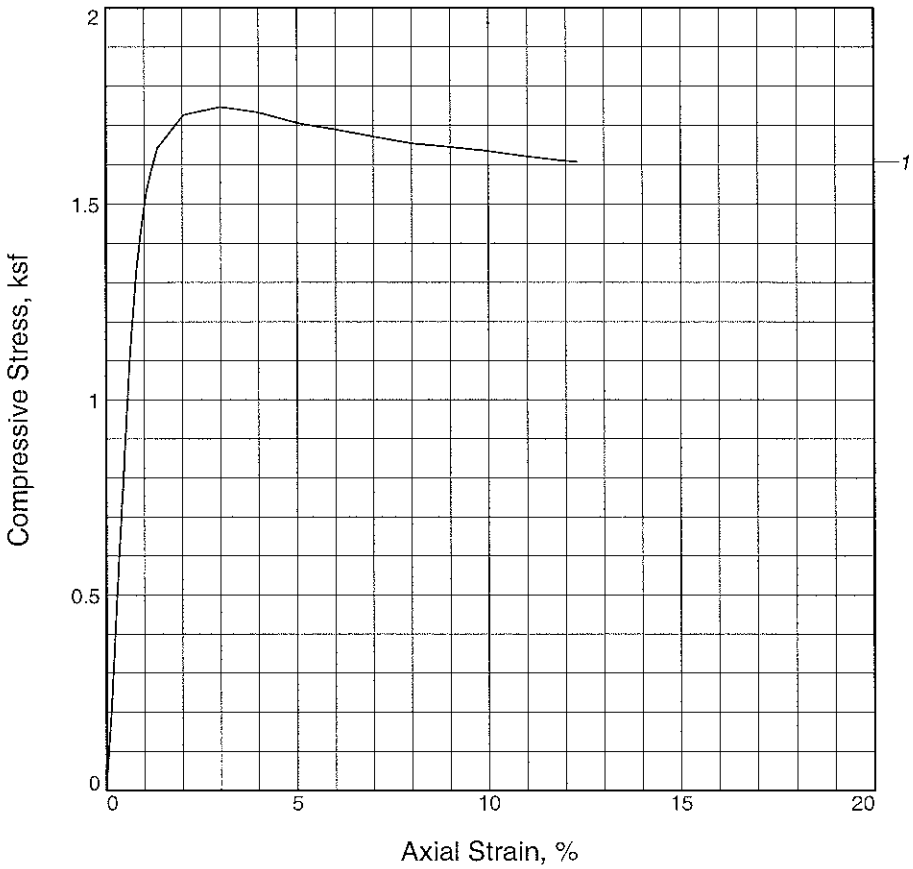
EXHIBIT A

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, ksf	1.747			
Undrained shear strength, ksf	0.874			
Failure strain, %	3.0			
Strain rate, in./min.	0.055			
Water content, %	44.3			
Wet density, pcf	116.8			
Dry density, pcf	80.9			
Saturation, %	108.6			
Void ratio	1.1214			
Specimen diameter, in.	2.693			
Specimen height, in.	5.687			
Height/diameter ratio	2.11			

Description: Gray and brown 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-B90

Sample Number: 3 **Depth:** 4-6 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-B90
Depth: 4-6 ft. **Sample Number:** 3
Description: Gray and brown 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.	177.860
Moisture content: Dry soil+tare, gms.	138.610
Moisture content: Tare, gms.	49.950
Moisture, %	44.3
Moist specimen weight, gms.	992.73
Diameter, in.	2.693
Area, in.^{2}	5.696
Height, in.	5.687
Wet density, pcf	116.8
Dry density, pcf	80.9
Void ratio	1.1214
Saturation, %	108.6

Test Readings for Specimen No. 1

Strain rate, in./min. = 0.055
Unconfined compressive strength = 1.747 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	0.0005	0.900	0.9	0.0	0.023
2	0.0028	3.307	3.3	0.0	0.084
3	0.0070	7.581	7.6	0.1	0.191
4	0.0108	12.677	12.7	0.2	0.320
5	0.0136	16.335	16.3	0.2	0.412
6	0.0165	20.205	20.2	0.3	0.509
7	0.0193	24.067	24.1	0.3	0.606
8	0.0221	27.697	27.7	0.4	0.697
9	0.0250	31.330	31.3	0.4	0.789
10	0.0273	34.971	35.0	0.5	0.880
11	0.0316	39.994	40.0	0.6	1.005
12	0.0359	44.515	44.5	0.6	1.118
13	0.0401	48.445	48.4	0.7	1.216
14	0.0453	52.986	53.0	0.8	1.329
15	0.0524	57.346	57.3	0.9	1.436

Test Readings for Specimen No.

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
16	0.0604	61.206	61.2	1.1	1.531
17	0.0770	65.880	65.9	1.4	1.643
18	0.1157	69.692	69.7	2.0	1.726
19	0.1706	71.240	71.2	3.0	1.747
20	0.2254	71.412	71.4	4.0	1.734
21	0.2887	71.010	71.0	5.1	1.704
22	0.3436	71.092	71.1	6.0	1.689
23	0.3975	71.104	71.1	7.0	1.672
24	0.4537	71.120	71.1	8.0	1.655
25	0.5090	71.479	71.5	9.0	1.645
26	0.5639	71.830	71.8	9.9	1.636
27	0.6187	72.019	72.0	10.9	1.623
28	0.6740	72.301	72.3	11.9	1.611
29	0.6986	72.507	72.5	12.3	1.608

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-B89	0-2	0.25	0.30		100	25	75					100				99					96	CH	52	72																					
	2-4	0.25	0.15																			CH**	75																						
	4-6	0.25	0.15		63	20	43			100		100				99					79	CH	46	79																					
	6-8	0.25	0.10																			CH**	37																						
	8-10	0.25	0.50																			CH**/CL**	70																						
	10-12	3.25																				CL**	20																						
	12-14	0.50			34	18	16		100	100		99				96					88	CL	22							1.1	22	106	CL**											
	14-16	0.75																				CL**	30																						
	16-18	0.50																				CL**	28																						
	18-20	1.50																				CL**	29																						
09-B90	0-2	0.50																				CH**	44																						
	2-4	0.25			95	28	67			100		96				96					92	CH	56	67																					
	4-6	0.75			77	24	53					100				100					91	CH	44							0.9	44	79	CH**											
	6-8	0.25	0.10																			CH**	61																						
	8-10	0.25	0.05																			CL**	35																						
	10-12	0.00	0.20		38	16	22					100				98					63	CL	29	90																					
	12-14	0.00	0.10																			CH**	85																						
	14-16	0.50	0.40																			CH**	36																						
	16-18	0.25	0.40																			CH**	40																						
	18-20	0.25	0.30		145	39	106					100				97					92	CH	105																						
09-B91	0-2	0.25	0.30																			CH**	47																						
	2-4	0.00	0.15																			CH**	56																						
	4-6	0.50			90	29	61					100				100					93	CH	45							0.8	46	77	CH**											
	6-8	0.75																				CH**	41																						
	8-10	0.25	0.15																			CH**	41																						
	10-12	0.25	0.05																			CH**	52																						
	12-14	0.75			75	26	49		100	98		94				87					80	CH	39	82																					
	14-16	0.25	0.25																			CH**	52																						
	16-18	0.00	0.20		166	40	126			100		100				99					84	CH	50							0.4	50	59	CH**											
	18-20	0.25	0.30																			CH**	35																						
09-B92	0-2	0.25	0.20		98	29	69			100		100				99					96	CH	56	67																					
	2-4	0.25	0.05																			CH**	96																						
	4-6	0.25	0.30																			CH**	51																						
	6-8	0.50	0.30		61	20	41					100				99					83	CH	35							0.5	35	85	CH**											
	8-10																					CH**	79																						
	10-12	0.25	0.05																			CH**	56																						
	12-14	0.50																				CH**	31																						
	14-16	0.75			70	19	51			100		100				99					97	CH	33	90																					
	16-18	0.50																				CH**	35																						
	18-20	0.50	0.40																			CH**	45																						
09-B93	0-2	0.00	0.25																			CH**	59																						
	2-4	0.00	0.10																			CH**	62																						
	4-6	0.00	0.20		116	33	83					100				100					99	CH	68	59																					
	6-8	0.75																				CH**	35																						
	8-10	0.00	0.20																			CH**	60																						
	10-12	0.25	0.05																			CH**	41																						
	12-14	1.00			74	26	48		100	100		100				99					93	CH	37							1.2	37	84	CH**											
	14-16	1.25																				CL**	21																						
	16-18	1.00																				CL**	31																						
	18-20	1.25			41	18	23		100	99		98				96					83	CL	22	105																					