BORING LOG NO. 10-B9

CLIENT: **USACE, Galveston District Galveston, Texas**	PROJECT: **Galveston Channel Deepening, TO-0010**
BORING LOCATION: **N: 13689002.73 E: 3316301.9**	SITE: **San Jacinto Placement Area Galveston, Texas**

Approx. Surface Elevation: 12.1 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: CLAYEY SAND brown, w/ wood, very soft	1	SC	ST	8		0.0		42					33			
	10.1 — 2.0	2															
	FILL: FAT CLAY dark bluish gray, w/ sand pockets, very soft	3	CH	ST	22		0.0	0.1	62	58	107	32	75	99			
		4															
		5		ST	24		0.0	0.05									
		6															
	4.6 — 7.5	7		ST	17		0.0	0.05									
	FILL: SILTY SAND dark bluish gray, with thin interbedded layers of fat clay, some cohesion, very loose to loose	8	SM														
		9		SS	8	0			32					15			
		10															
		11		SS	18	5			30								
		12															
		13		SS	12	0			32								
		14															
		15		SS	12	5			26								
		16															
	-5.9 — 18.0	17		SS	18	0			31								
	POORLY GRADED SAND w/ SILT dark bluish gray, w/ interbeded thin fat clay layer, dense	18	SP-SM														
		19		SS	9	39			27								
		20															
	-9.9 — 22.0	21		SS	17	44			25					8			
	SILTY SAND gray, with shell and clay pockets, dense	22	SM														
		23		SS	8	21			32								
		24															
		25		SS	11	30			27								
		26															
		27		SS	8	38			27								
		28															
	-17.9 — 30.0	29		SS	11	30			29					32			
	Boring terminated at 30 feet.	30															

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

REMARKS: **Dry auger to 8 feet; wet rotary thereafter.**

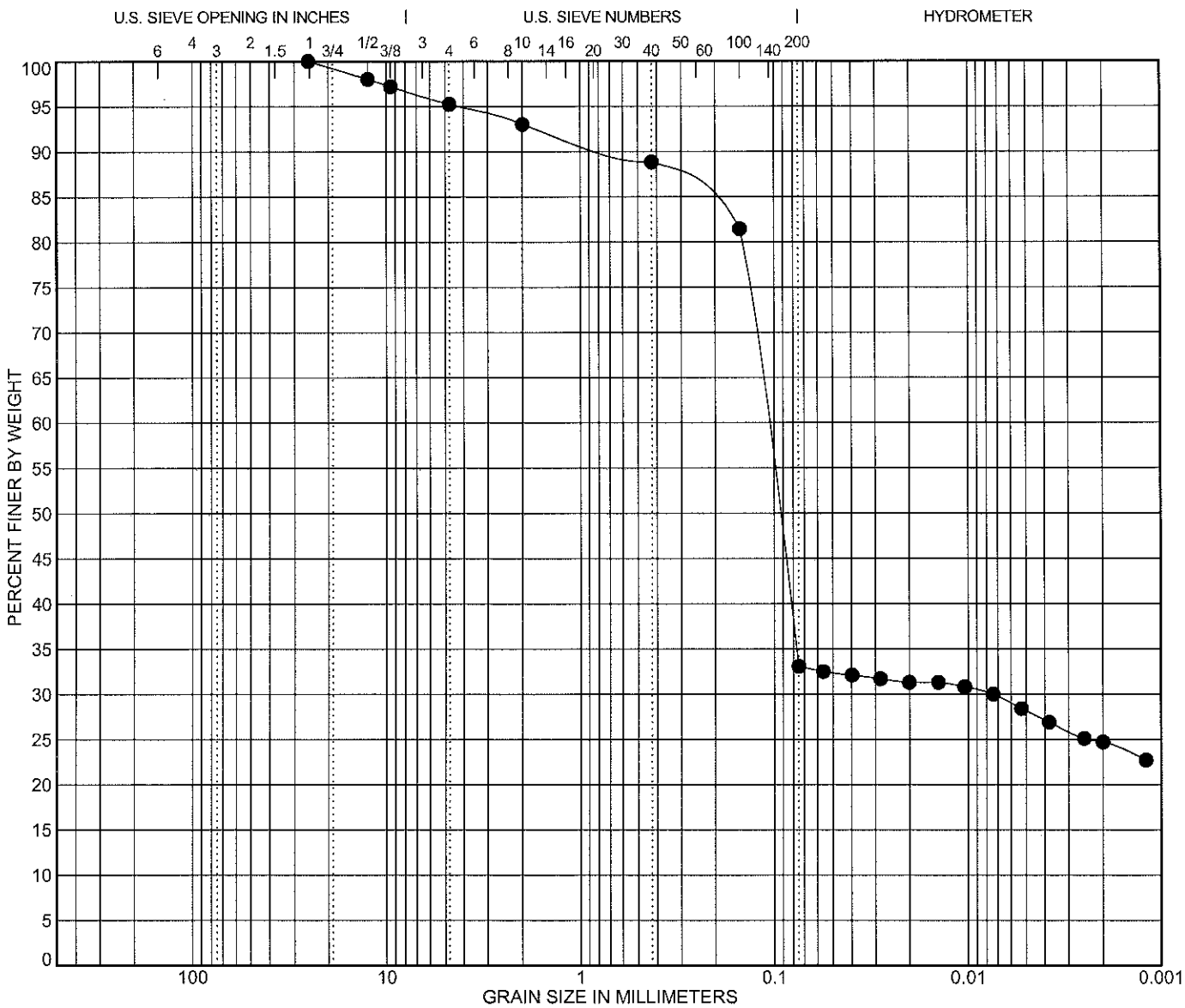
WATER LEVEL OBSERVATIONS			
▽ **7 ft**	WS	▼ **6.5 ft**	at 5 min
▼ **4.5 ft**	at 10 min	▼ **4 ft**	at 15 min

Terracon

DATE DRILLED	4/12/2010
PROJECT NUMBER	92105154

10-B9

EXHIBIT A-9



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**10-B9**	**0.0**						

Percent Passing the Indicated Sieve

	Specimen Identification		3/8"	#4	#10	#40	#100	#200
●	**10-B9**	**0.0**	**97.2**	**95.2**	**93**	**88.8**	**81.4**	**33.1**

	Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**10-B9**	**0.0**	**25.4**	**0.096**	**0.007**		**4.8**	**62.2**	**8.4**	**24.7**

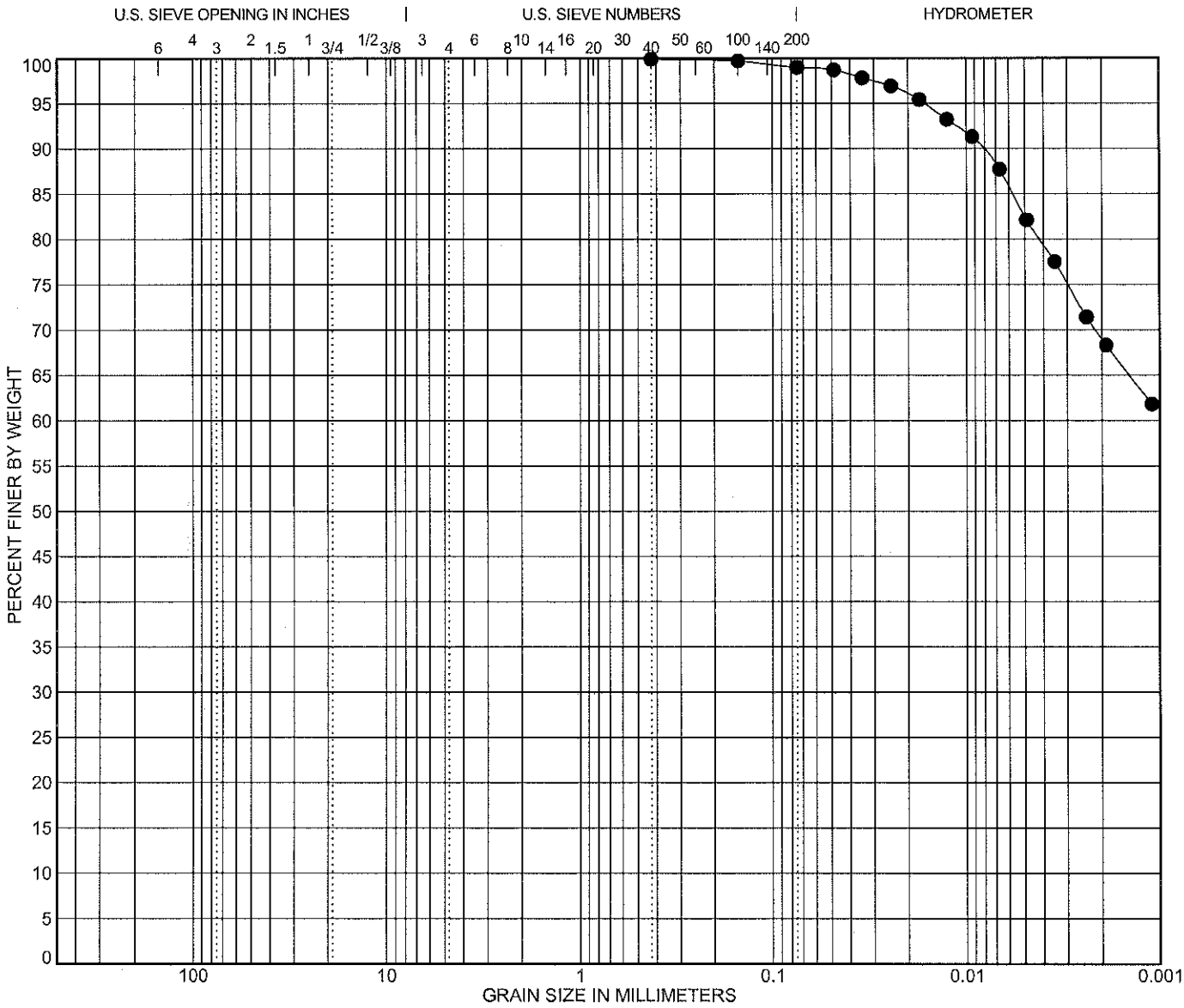
GRAIN SIZE DISTRIBUTION

Galveston Channel Deepening,
TO-0010
Galveston, Texas
Project Number 92105154

Terracon

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

SPECIMEN ID
10-B9, 0.0



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**10-B9**	**2.0**	**FAT CLAY(CH)**	**107**	**32**	**75**		

Percent Passing the Indicated Sieve

	Specimen Identification		3/8"	#4	#10	#40	#100	#200
●	**10-B9**	**2.0**				**99.9**	**99.7**	**99**

	Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**10-B9**	**2.0**	**0.425**				**0.0**	**0.9**	**30.0**	**69.0**

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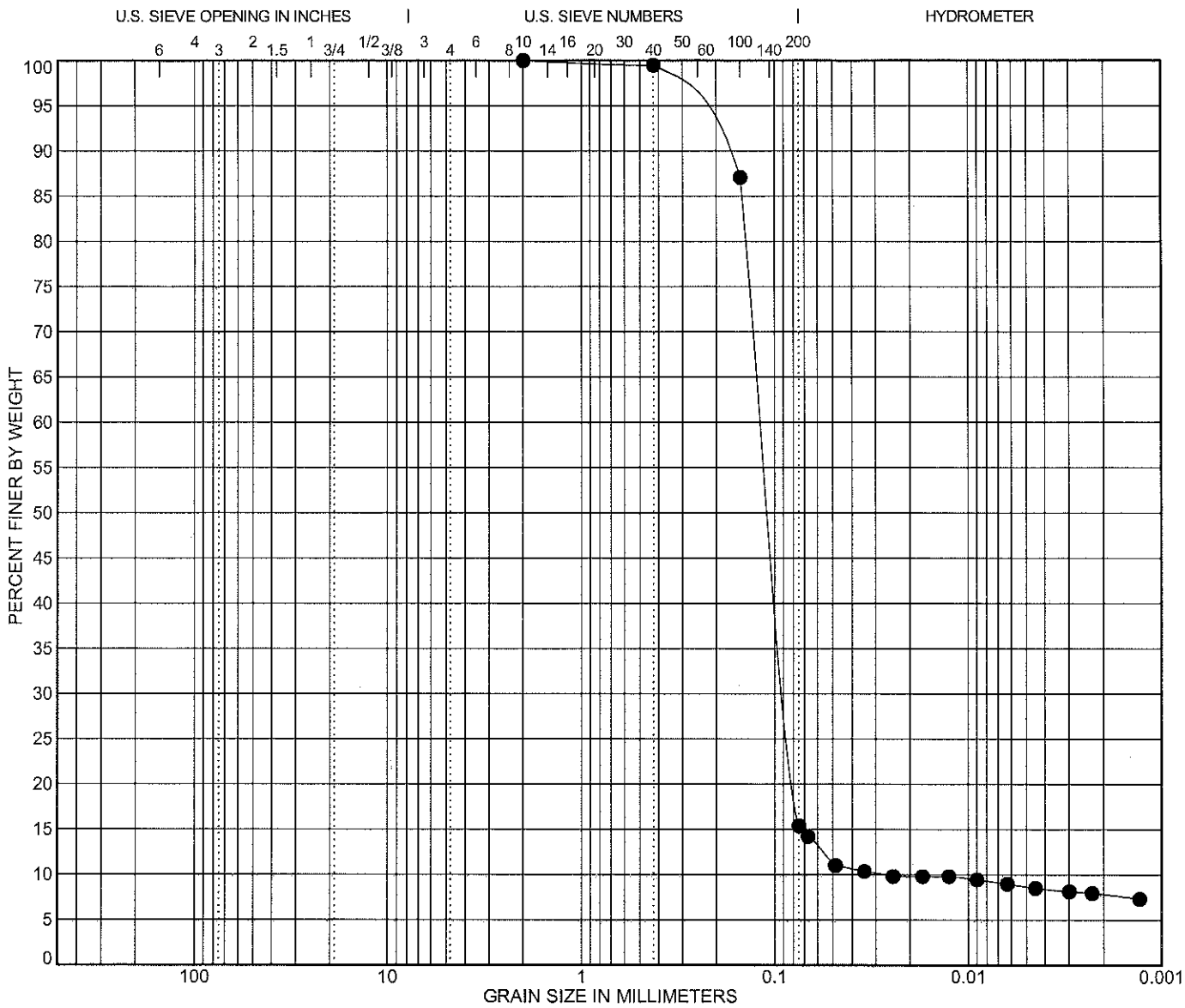
SPECIMEN ID
10-B9, 2.0



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **10-B9**	**8.5**					**2.33**	**4.16**

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● **10-B9**	**8.5**			**100**	**99.5**	**87.1**	**15.4**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **10-B9**	**8.5**	**2**	**0.105**	**0.086**	**0.028**	**0.0**	**84.6**	**7.6**	**7.8**

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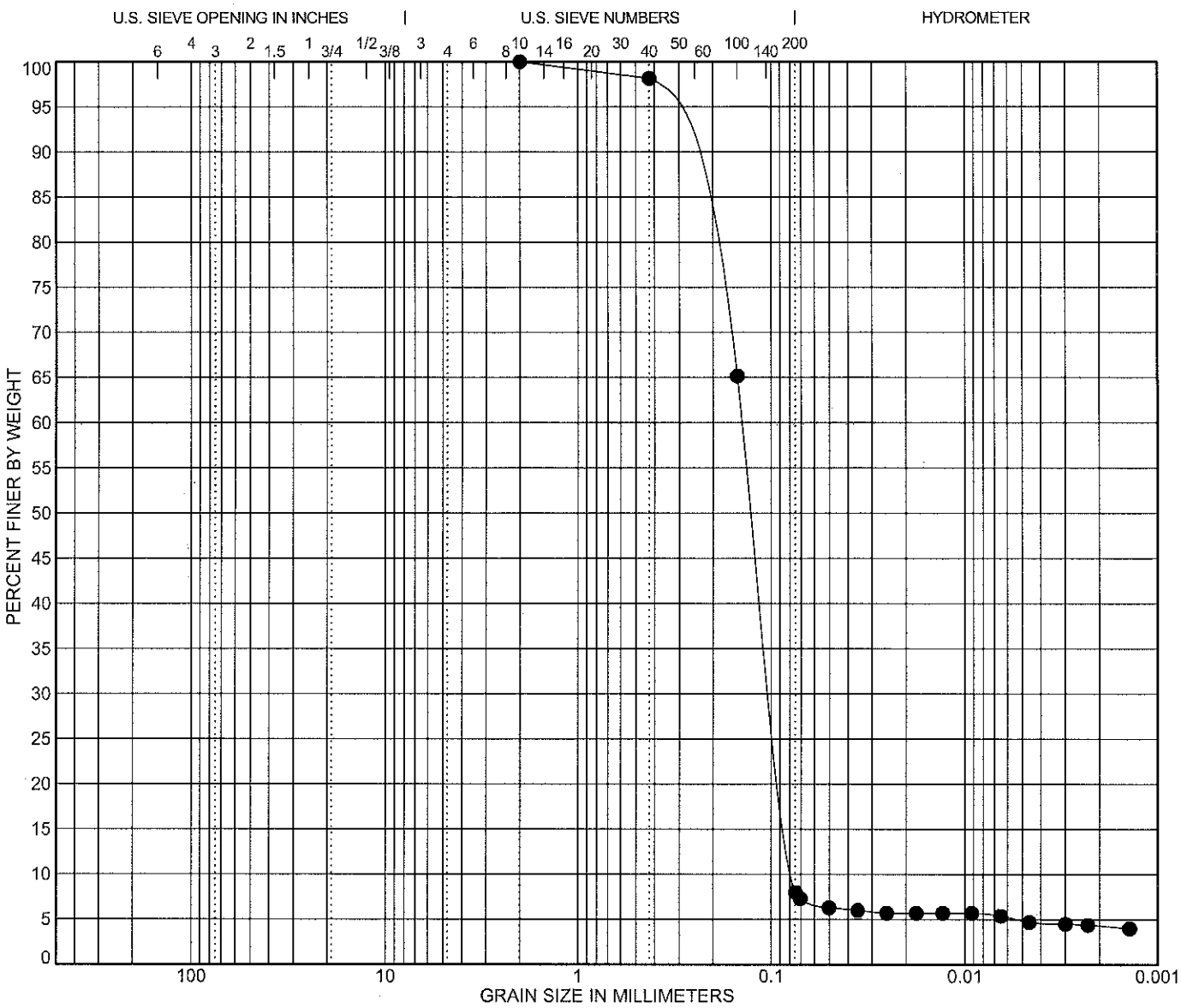
SPECIMEN ID
10-B9, 8.5



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**10-B9**	**20.5**					**0.89**	**1.83**

Percent Passing the Indicated Sieve

	Specimen Identification		3/8"	#4	#10	#40	#100	#200
●	**10-B9**	**20.5**			**100**	**98.2**	**65.1**	**8**

	Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**10-B9**	**20.5**	**2**	**0.125**	**0.098**	**0.077**	**0.0**	**92.0**	**3.7**	**4.3**

GRAIN SIZE DISTRIBUTION

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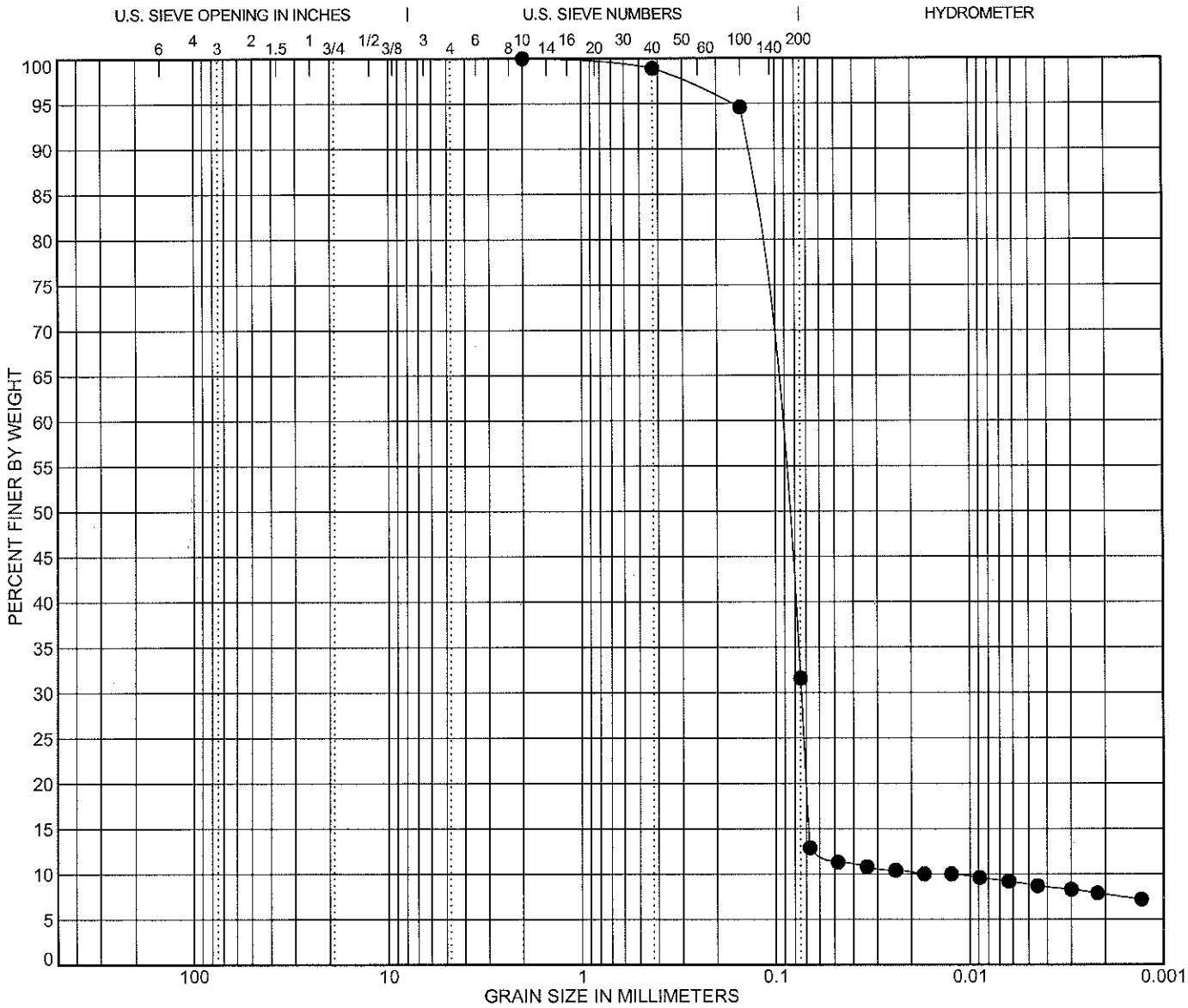
SPECIMEN ID
10-B9, 20.5



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **10-B9**	**28.5**					**4.31**	**8.20**

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● **10-B9**	**28.5**			**100**	**98.9**	**94.6**	**31.6**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **10-B9**	**28.5**	**2**	**0.092**	**0.074**	**0.013**	**0.0**	**68.4**	**23.8**	**7.8**

GRAIN SIZE DISTRIBUTION

Galveston Channel Deepening,
TO-0010
Galveston, Texas
Project Number 92105154

Terracon

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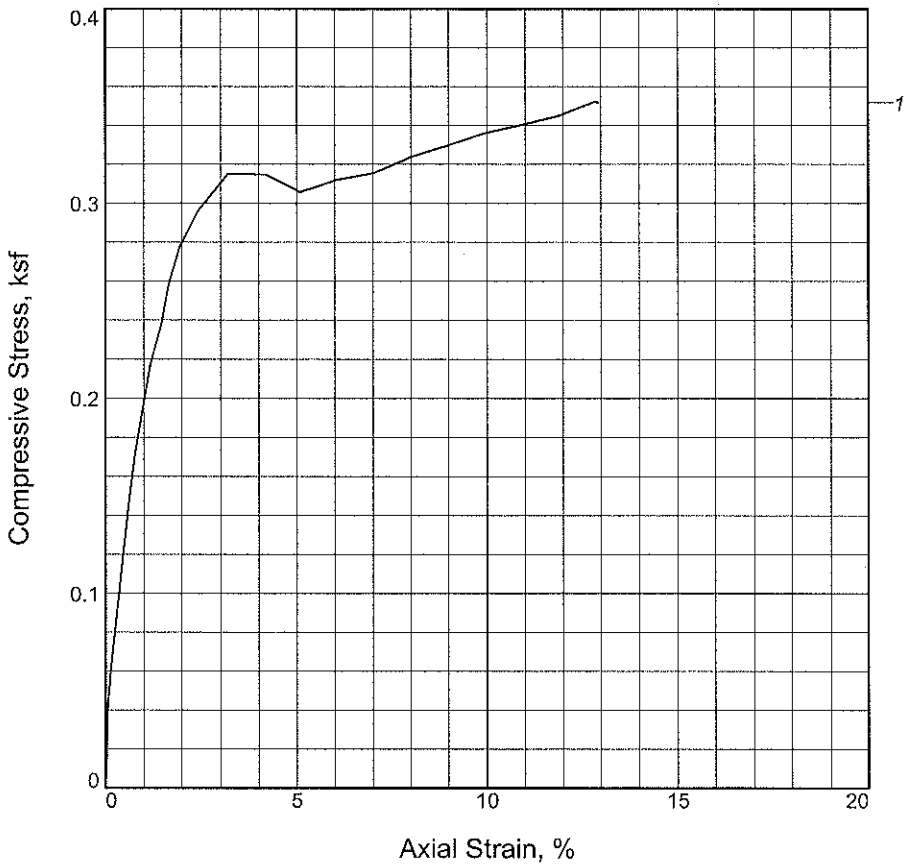
Houston, Texas 77043
Telephone: 713-690-8989
Fax: 713-690-8787

SPECIMEN ID
10-B9, 28.5

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, ksf	0.352			
Undrained shear strength, ksf	0.176			
Failure strain, %	12.8			
Strain rate, in./min.	0.055			
Water content, %	83.5			
Wet density, pcf	102.8			
Dry density, pcf	56.0			
Saturation, %	110.3			
Void ratio	2.1216			
Specimen diameter, in.	2.703			
Specimen height, in.	5.675			
Height/diameter ratio	2.10			

Description: Gray Fat Clay

LL =	**PL =**	**PI =**	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 92105154

Date Sampled:

Remarks:
ASTM D2166

Client: USACE

Project: Galveston Channel Deepening San Jacinto Placement Area
Contract #W912HY-09-D-0021, Task Order #0010

Location: 10-B9

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

UNCONFINED COMPRESSION TEST
Terracon, Inc.
Houston, TX

UNCONFINED COMPRESSION TEST

7/21/2010

Date:
Client: USACE
Project: Galveston Channel Deepening San Jacinto Placement Area
Contract #W912HY-09-D-0021, Task Order #0010
Project No.: 92105154
Location: 10-B9
Depth: 6-8 ft. **Sample Number:** 4
Description: Gray Fat Clay
Remarks: ASTM D2166
Type of Sample: Undisturbed
Assumed Specific Gravity=2.80 **LL=** **PL=** **PI=**

Parameters for Specimen No. 1

Specimen Parameter	Initial
Moisture content: Moist soil+tare, gms.	176.670
Moisture content: Dry soil+tare, gms.	122.940
Moisture content: Tare, gms.	58.630
Moisture, %	83.5
Moist specimen weight, gms.	878.58
Diameter, in.	2.703
Area, in.^{2}	5.738
Height, in.	5.675
Wet density, pcf	102.8
Dry density, pcf	56.0
Void ratio	2.1216
Saturation, %	110.3

Test Readings for Specimen No. 1

Strain rate, in./min. = 0.055
Unconfined compressive strength = 0.352 ksf **at reading no.** 25

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	0.627	0.6	0.0	0.016
2	0.0023	1.458	1.5	0.0	0.037
3	0.0080	2.454	2.5	0.1	0.061
4	0.0150	3.282	3.3	0.3	0.082
5	0.0217	4.171	4.2	0.4	0.104
6	0.0288	5.102	5.1	0.5	0.127
7	0.0354	5.956	6.0	0.6	0.149
8	0.0439	6.897	6.9	0.8	0.172
9	0.0539	7.743	7.7	0.9	0.192
10	0.0662	8.758	8.8	1.2	0.217
11	0.0827	9.632	9.6	1.5	0.238
12	0.0936	10.447	10.4	1.6	0.258
13	0.1102	11.267	11.3	1.9	0.277
14	0.1376	12.096	12.1	2.4	0.296
15	0.1816	12.981	13.0	3.2	0.315

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
16	0.2369	13.092	13.1	4.2	0.315
17	0.2890	12.841	12.8	5.1	0.306
18	0.3443	13.242	13.2	6.1	0.312
19	0.3991	13.528	13.5	7.0	0.316
20	0.4540	14.026	14.0	8.0	0.324
21	0.5093	14.439	14.4	9.0	0.330
22	0.5641	14.874	14.9	9.9	0.336
23	0.6190	15.229	15.2	10.9	0.340
24	0.6743	15.600	15.6	11.9	0.345
25	0.7292	16.112	16.1	12.8	0.352
26	0.7344	16.110	16.1	12.9	0.352

SUMMARY TABLE OF LABORATORY TEST DATA

Project name: TO-0010 Galveston Channel Deepening | Client: USACE, Galveston District | Terracon Project # : 92105154

Boring	Depth	Field tests			Atterberg Limits			Grain size Analysis										USCS Symbol	Wc	γd	Strenght tests																						
								% by weight passing sieve					Soil Particle Content								Direct Shear Test					Unconfined Compression				UU Triaxial Test				CU Triaxial Test							
		PP	TV	SPTn	LL	PL	PI	4	10	40	100	200	gravel	sand	silt	clay	sieve 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	
10-B9	44.5-46			52														SM**	23																						
	46.5-48			15														SM**	29																						
	48.5-50			8														SM**	31																						
	50.5-52			8														CL**	39																						
	52-54	0.00	0.50		38	16	22	100	99	99	97	68	0	32	29	39		CL																0.30	13	0.24	27	34	86	CL**
	54.5-56			5														SC**	31																						
	56-58	0.00	0.10															CH**	40																						
	58-60	0.00	0.15		52	19	33	100	100	100	99	89	0	11	53	36		CH	34	87																					
	60-62																	CH**	39																						
	62-64	0.00	0.25															CH**	46																						
	64-66	0.50	0.25															CH**	54																						
	66-68	0.00	0.20		41	16	25	100	100	100	81	43	0	57	15	28		SC								0.93	44	80	CH**												
	68-70	0.00	0.10															SC**	26																						
	70-72	0.50																SC**	28																						
	72-74	1.50																CL**	23																						
	74-76	0.00	0.10															CL**	28																						
	76-78	1.00						100	100	99	95	85	0	15	57	28		CL*	32																						
	78.5-80			14														CL**	30																						
10-B9	0-2	0.00						95	93	89	81	33	5	62	8	25		SC*	42																						
	2-4	0.00	0.10		107	32	75	100	100	100	100	99	0	1	30	69		CH	62	58																					
	4-6	0.00	0.05															CH**																							
	6-8	0.00	0.05															CH**								0.18	84	56	CH**												
	8.5-10			0				100	100	99	87	15	0	85	7	8		SM*	32																						
	10.5-12			5														SM**	30																						
	12.5-14			0														SM**	32																						
	14.5-16			5														SM**	26																						
	16.5-18			0														SM**	31																						
	18.5-20			39														SP-SM**	27																						
	20.5-22			44				100	100	98	65	8	0	92	4	4		SP-SM*	25																						
	22.5-24			21														SM**	32																						
	24.5-26			30														SM**	27																						
	26.5-28			38														SM**	27																						
	28.5-30			30				100	100	99	95	32	0	68	24	8		SM*	29																						
10-B10	0-2	1.50																SC**	26																						
	2-4	0.50																CH**	47	72																					
	4-6	0.00	0.25		93	28	65	100	100	100	100	95	0	5	27	68		CH								0.42	63	67	CH**												
	6.5-8			10														SC**	26																						
	8.5-10			24				100	100	100	92	16	0	84	6	10		SC*	31																						
	10.5-12			1														CH**	50																						
	12.5-14																	CH**	53																						
	14-16	0.00	0.05		59	20	39	100	100	100	99	94	0	6	48	46		CH								0.19	52	71	CH**												
	16.5-18			1														CH**	71																						
	18.5-20			30				100	100	99	87	7	0	93	4	3		SP-SM*	28																						
	20.5-22			17														SP-SM**	26																						
	22.5-24			10														SP-SM**	27																						
	24.5-26			5														SP-SM**	30																						
	26.5-28			15														SP-SM**	30																						
	28.5-30			28														SP-SM**	29																						
	0-2	0.75			81	30	51	100	100	100	100	92	0	8	27	65		CH	46							0.78	46	79	CH**												