BORING LOG NO. 09-B98

CLIENT: USACE Galveston District
Galveston, Texas

PROJECT: TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume II

BORING LOCATION: N: 691700.671
E: 3278535.664

SITE: Atkinson Island PA16
Texas

Approx. Surface Elevation: 16.6 feet

Graphic Log	DESCRIPTION	DEPTH, FEET	USCS SYMBOL	SAMPLES TYPE	RECOVERY, IN	SPT, BLOWS/FT	CALIBRATED HAND PENETROM., TSF	TORVANE, TSF	TESTS MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, TSF	FAILURE STRAIN, %	CONFINING PRESSURE, PSI
	FILL: SANDY LEAN CLAY brown, stiff, with roots, dry, medium plasticity	1	CL	SS	7	9			12								
14.6	2.0	2															
	FILL: SANDY FAT CLAY light brown and gray, medium to very stiff, with shell sand and silt seams, pockets and thin layers, moist, high plasticity	3	CH	SS	6	11			19		50	17	33	58			
		4															
		5		SS	6	8			21								
		6															
		7		SS	9	18			25								
		8															
6.6	10.0	9		SS	8	14			17								
	FILL: SANDY LEAN CLAY light brown, stiff, with shell layers, moist, high plasticity	10	CL														
4.6	12.0	11		SS	8	13			22		46	16	30	56			
	FILL: SANDY FAT CLAY light gray, dark gray and brown, stiff	12	CH														
2.6	14.0	13		SS	10	12			23								
	FILL: SILTY SAND light gray and brown, medium dense, fine grain, wet, slight plasticity	14	SM														
		15		SS	12	10			22					31			
		16															
		17		SS	8	12			29								
-1.4	18.0	18															
	FILL: FAT CLAY dark gray, medium stiff, with broken shell, moist, very high plasticity	19	CH	SS	10	7			25								
-3.4	20.0	20															
	FILL: CLAYEY SAND gray, light gray and light brown, loose to medium dense, fine grain, with interbedded clay layers, wet, high plasticity	21	SC	SS	8	8			30		42	14	28	48			
		22															
		23		SS	10	11			26								
-7.4	24.0	24															
	FILL: SANDY LEAN CLAY light gray and light brown, stiff, moist, high plasticity	25	CL	SS	10	13			23		39	13	26	56			
-9.4	26.0	26															

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 8 feet; wet rotary thereafter.

WATER LEVEL OBSERVATIONS			
▽ 7 ft	WS	▼ 7 ft	at 5 min
▼ 7 ft	at 10 min	▼ 7 ft	at 15 min

Terracon

DATE DRILLED 4/13/2010

PROJECT NUMBER 92105186-B

09-B98

EXHIBIT A-

BORING LOG NO. 09-B98

CLIENT: **USACE Galveston District Galveston, Texas**

PROJECT: **TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume II**

BORING LOCATION: **N: 691700.671 E: 3278535.664**

SITE: **Atkinson Island PA16 Texas**

Approx. Surface Elevation: 16.6 feet

Graphic Log	DESCRIPTION	DEPTH, FEET	USCS SYMBOL	SAMPLES TYPE	RECOVERY, IN	SPT, BLOWS/FT	CALIBRATED HAND PENETROM., TSF	TORVANE, TSF	TESTS MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, TSF	FAILURE STRAIN, %	CONFINING PRESSURE, PSI
	FILL: SILTY SAND dark gray, very loose to medium dense, fine grain, with clay seams, wet, medium plasticity	27	SM	SS	9	13			44								
		28															
	-13.4	29		SS	9	4			24								
		30															
	SANDY FAT CLAY dark gray, medium stiff to stiff, with interbedded sand layers and seams, moist, high to very high plasticity	31	CH	SS	8	7			36					59			
		32															
		33		SS	8	8			26								
		34															
		35		SS	10	9			33								
		36															
	-21.4	37		SS	10	6			24								
		38															
	FAT CLAY w/ SAND dark gray, soft to medium stiff, with sand seams, organic matter and scattered finely broke shell, moist, high plasticity	39	CH	SS	10	7			29					82			
		40															
	-25.4	41		SS	8	4			34								
		42															
	LEAN CLAY gray and dark gray, medium stiff, wet, high plasticity	43	CL	SS	8	5			52		47	17	30	91			
		44															
		45		SS	10	8			28								
	-29.4	46															
	FAT CLAY gray, medium stiff, wet, high	47	CH	SS	9	6			57								
	-31.4 plasticity	48															
	SILTY, CLAYEY SAND dark gray, loose, fine grain, wet,	49	SC-SM	SS	10	6			23		23	19	4	42			
	-33.4 none plasticity	50															
	Boring terminated at 50 feet.																

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

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

WATER LEVEL OBSERVATIONS			
▽ 7 ft	WS	▼ 7 ft	at 5 min
▼ 7 ft	at 10 min	▼ 7 ft	at 15 min

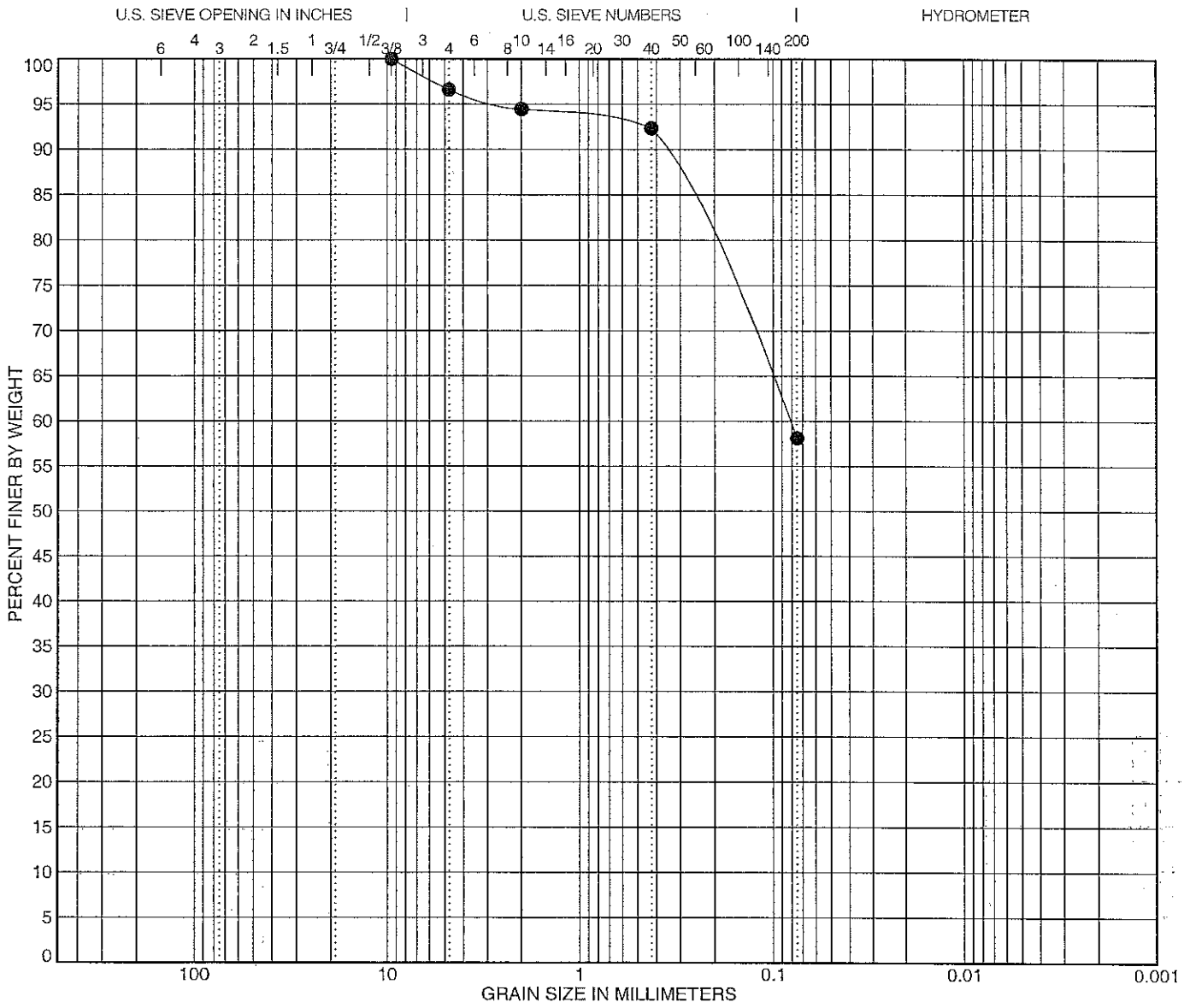
Terracon

DATE DRILLED 4/13/2010

PROJECT NUMBER 92105186-B

09-B98

EXHIBIT A-



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B98**	**2.5**						

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
9.5				**3.4**	**38.5**	**58.1**	

Percent Passing the Indicated Sieve

2"	1-1/2"	1"	3/4"	3/8"	#4	#8	#10	#16	#20	#30	#40	#50	#70	#100	#140	#200
				100	**96.6**		**94.5**				**92.3**					**58.1**

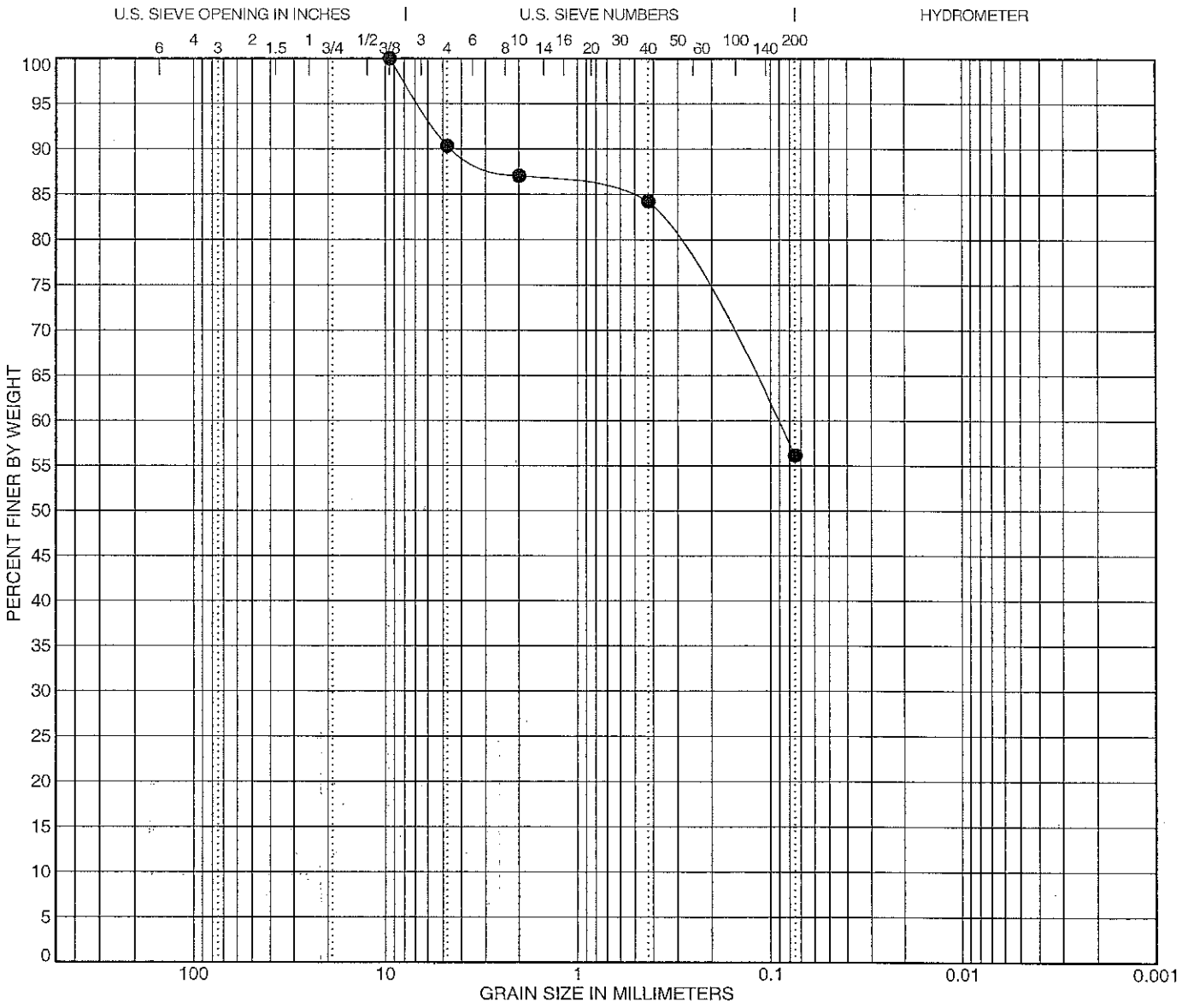
GRAIN SIZE DISTRIBUTION

TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume II
, Texas
Project Number 92105186-B

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-B98**	**10.5**						

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
9.5				**9.7**	**34.2**	**56.2**	

Percent Passing the Indicated Sieve

2"	1-1/2"	1"	3/4"	3/8"	#4	#8	#10	#16	#20	#30	#40	#50	#70	#100	#140	#200
				100	**90.3**		**87**				**84.2**					**56.2**

GRAIN SIZE DISTRIBUTION

TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume II , Texas
Project Number 92105186-B

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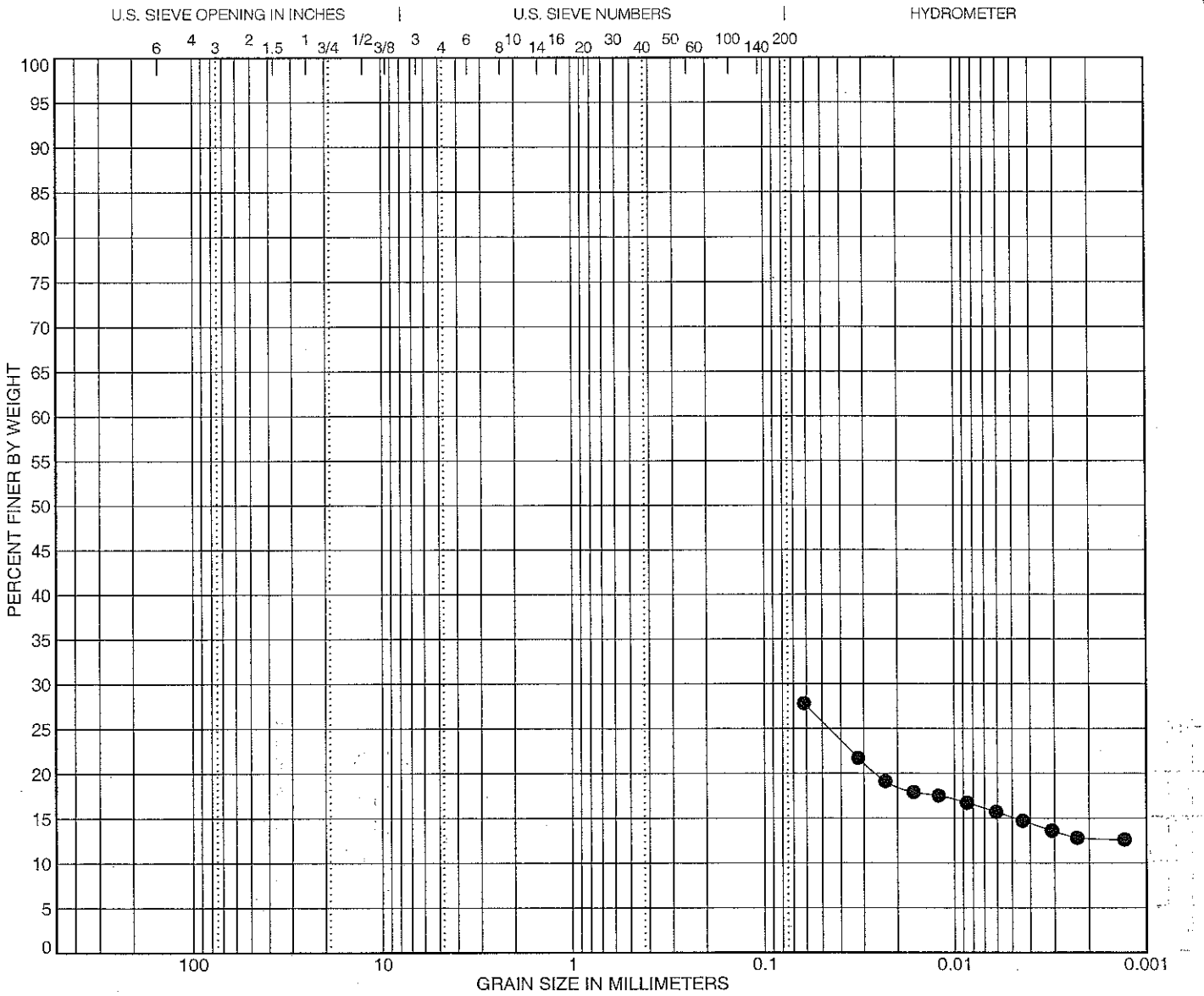

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B98**	**14.0**						

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
							12.8

Percent Passing the Indicated Sieve

2"	1-1/2"	1"	3/4"	3/8"	#4	#8	#10	#16	#20	#30	#40	#50	#70	#100	#140	#200

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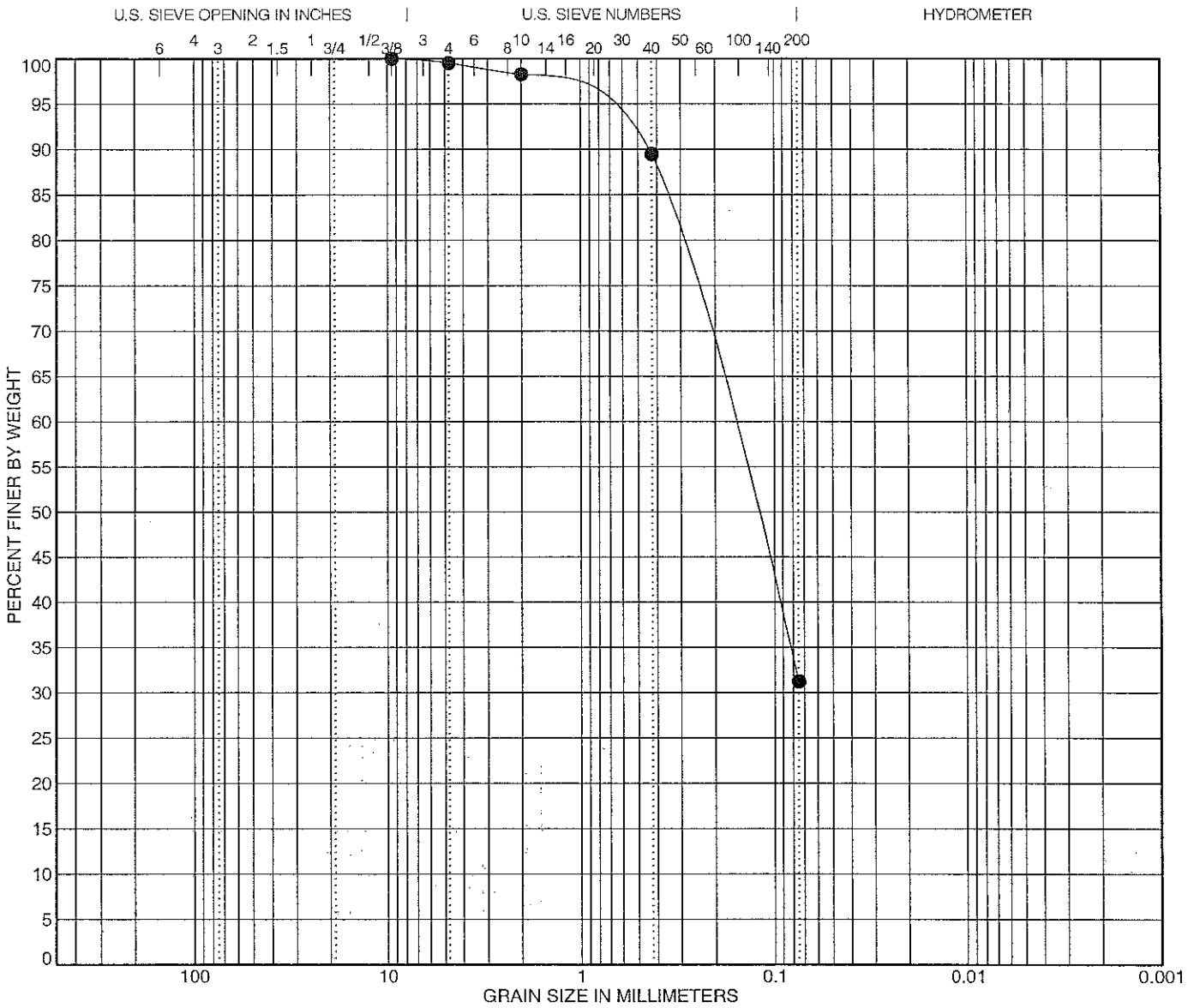

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B98**	**14.5**						

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
9.5	**0.131**			**0.5**	**68.3**	**31.2**	

Percent Passing the Indicated Sieve

2"	1-1/2"	1"	3/4"	3/8"	#4	#8	#10	#16	#20	#30	#40	#50	#70	#100	#140	#200
				100	**99.5**		**98.3**				**89.5**					**31.2**

GRAIN SIZE DISTRIBUTION

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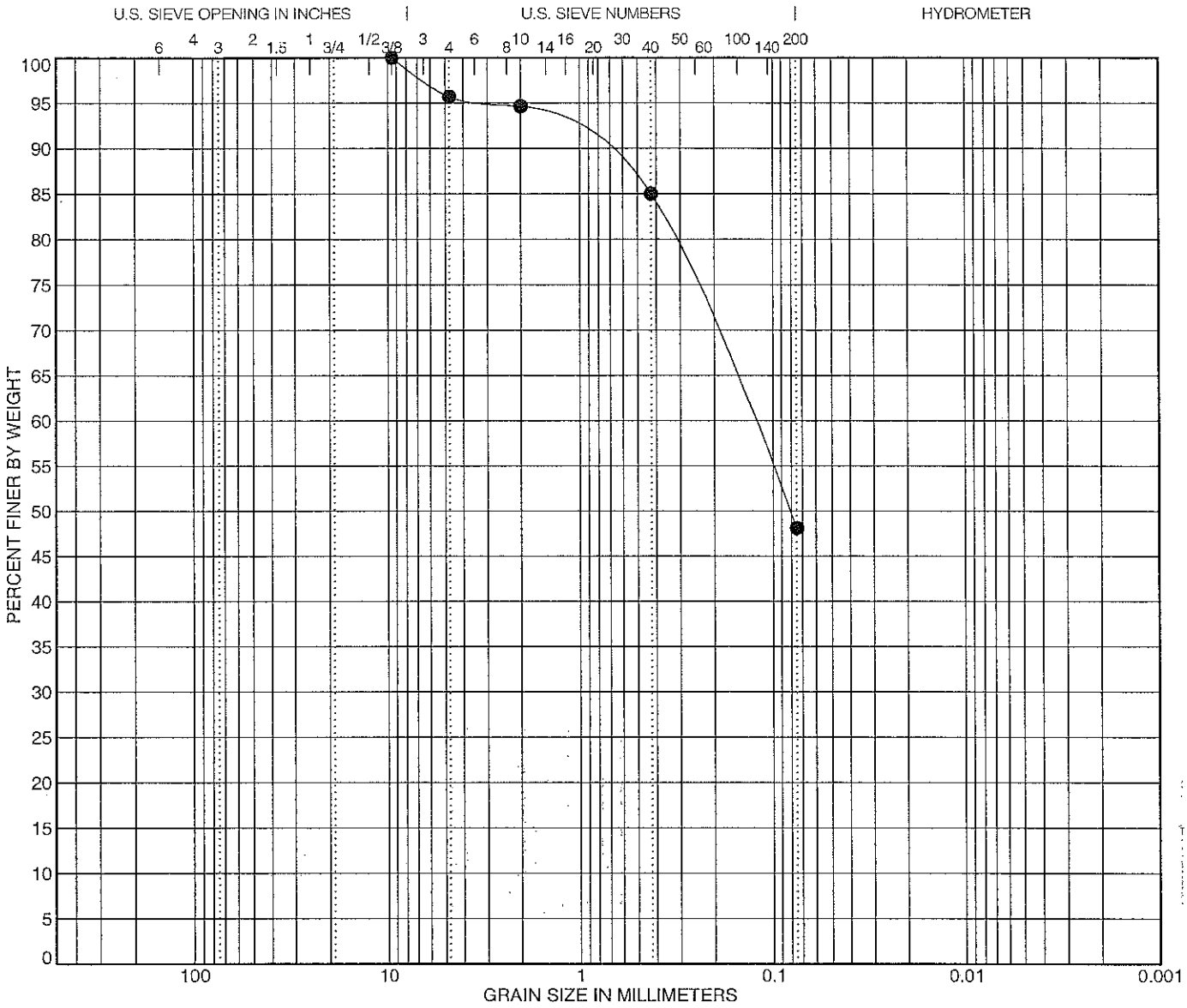

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B98**	**20.5**						

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
9.5	**0.082**			**4.3**	**47.6**	**48.1**	

Percent Passing the Indicated Sieve

2"	1-1/2"	1"	3/4"	3/8"	#4	#8	#10	#16	#20	#30	#40	#50	#70	#100	#140	#200
				100	**95.7**		**94.6**				**85**					**48.1**

GRAIN SIZE DISTRIBUTION

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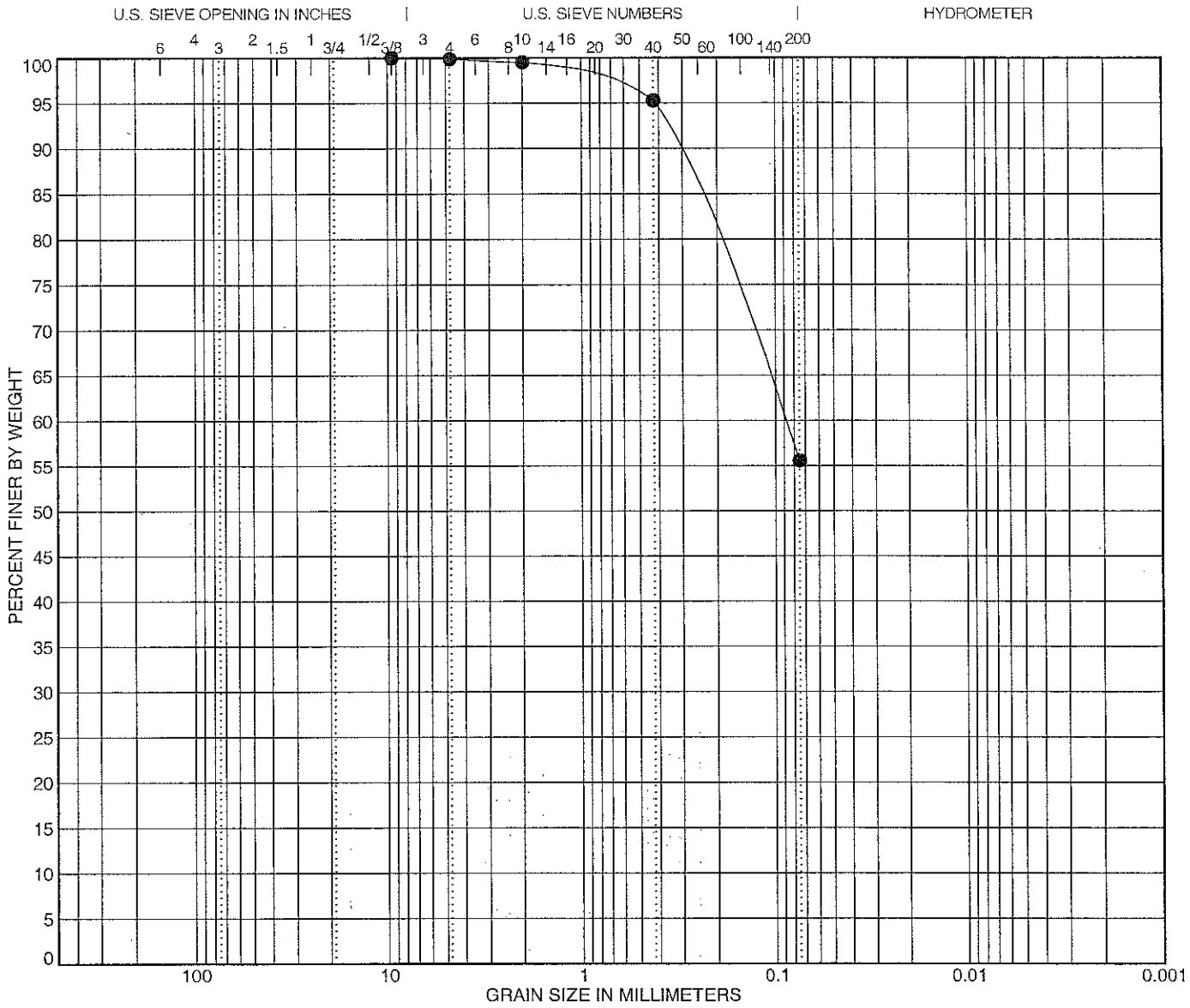

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B98**	**24.5**						

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
9.5				**0.1**	**44.3**	**55.6**	

Percent Passing the Indicated Sieve

2"	1-1/2"	1"	3/4"	3/8"	#4	#8	#10	#16	#20	#30	#40	#50	#70	#100	#140	#200
				100	**99.9**		**99.5**				**95.3**					**55.6**

GRAIN SIZE DISTRIBUTION

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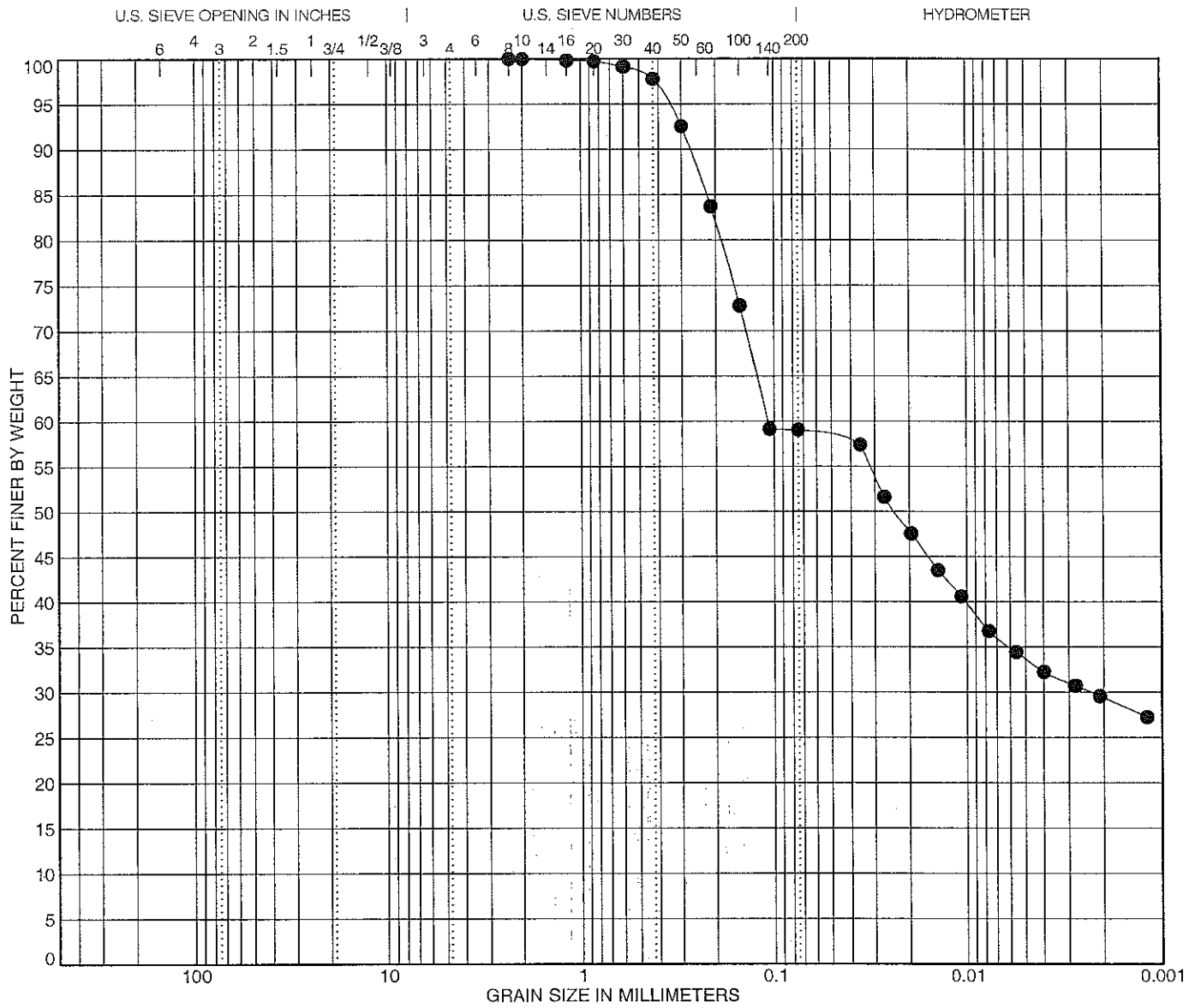

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B98**	**30.5**						

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
2.36	**0.024**	**0.002**		**0.0**	**40.9**	**29.7**	**29.3**

Percent Passing the Indicated Sieve

2"	1-1/2"	1"	3/4"	3/8"	#4	#8	#10	#16	#20	#30	#40	#50	#70	#100	#140	#200
						100	**100**	**99.8**	**99.7**	**99.1**	**97.8**	**92.5**	**83.7**	**72.8**	**59.1**	**59.1**

GRAIN SIZE DISTRIBUTION

TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume II , Texas
Project Number 92105186-B

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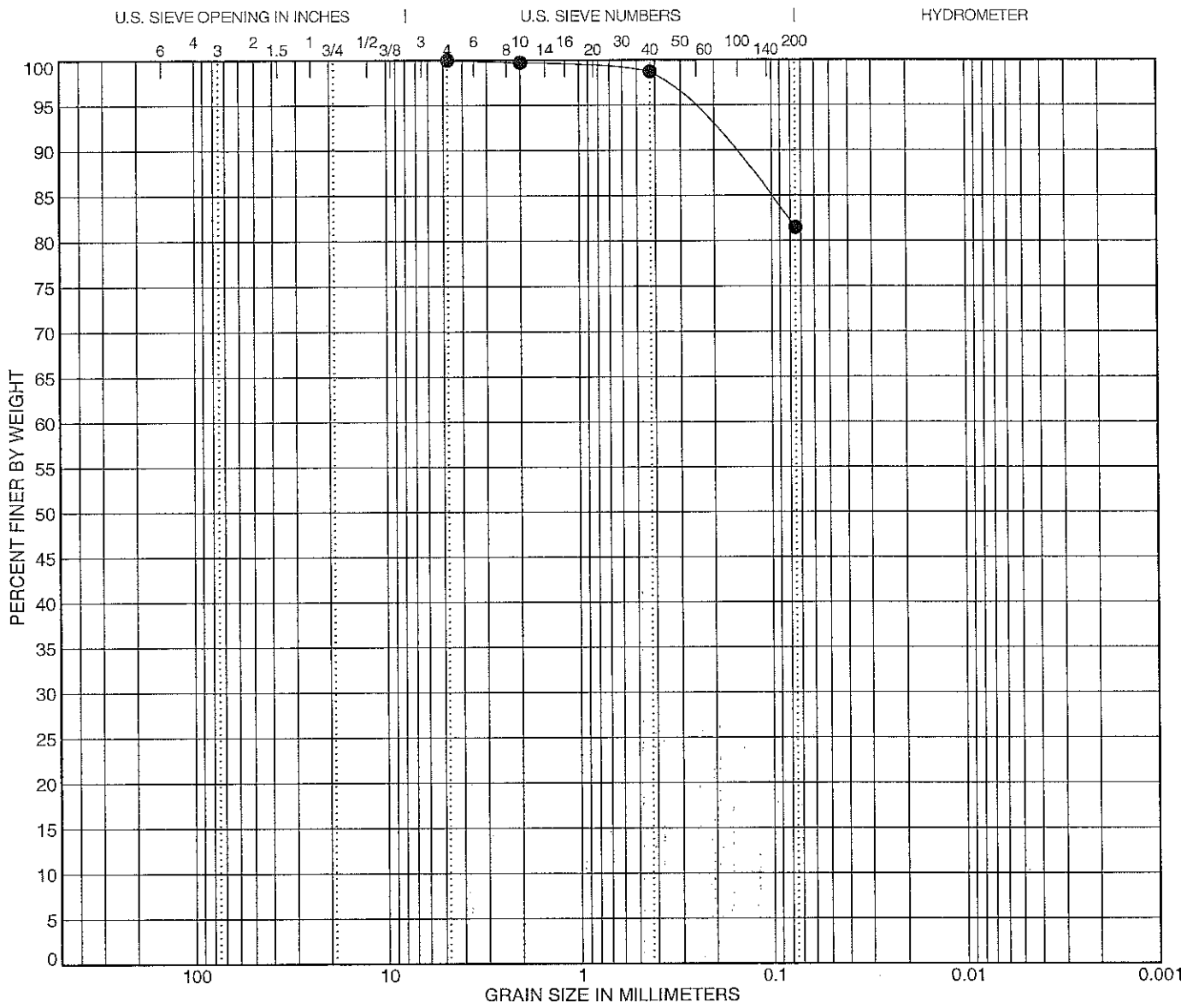

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B98**	**38.5**						

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
4.75				**0.0**	**18.5**	**81.5**	

Percent Passing the Indicated Sieve

2"	1-1/2"	1"	3/4"	3/8"	#4	#8	#10	#16	#20	#30	#40	#50	#70	#100	#140	#200
					100		**99.7**				**98.7**					**81.5**

GRAIN SIZE DISTRIBUTION

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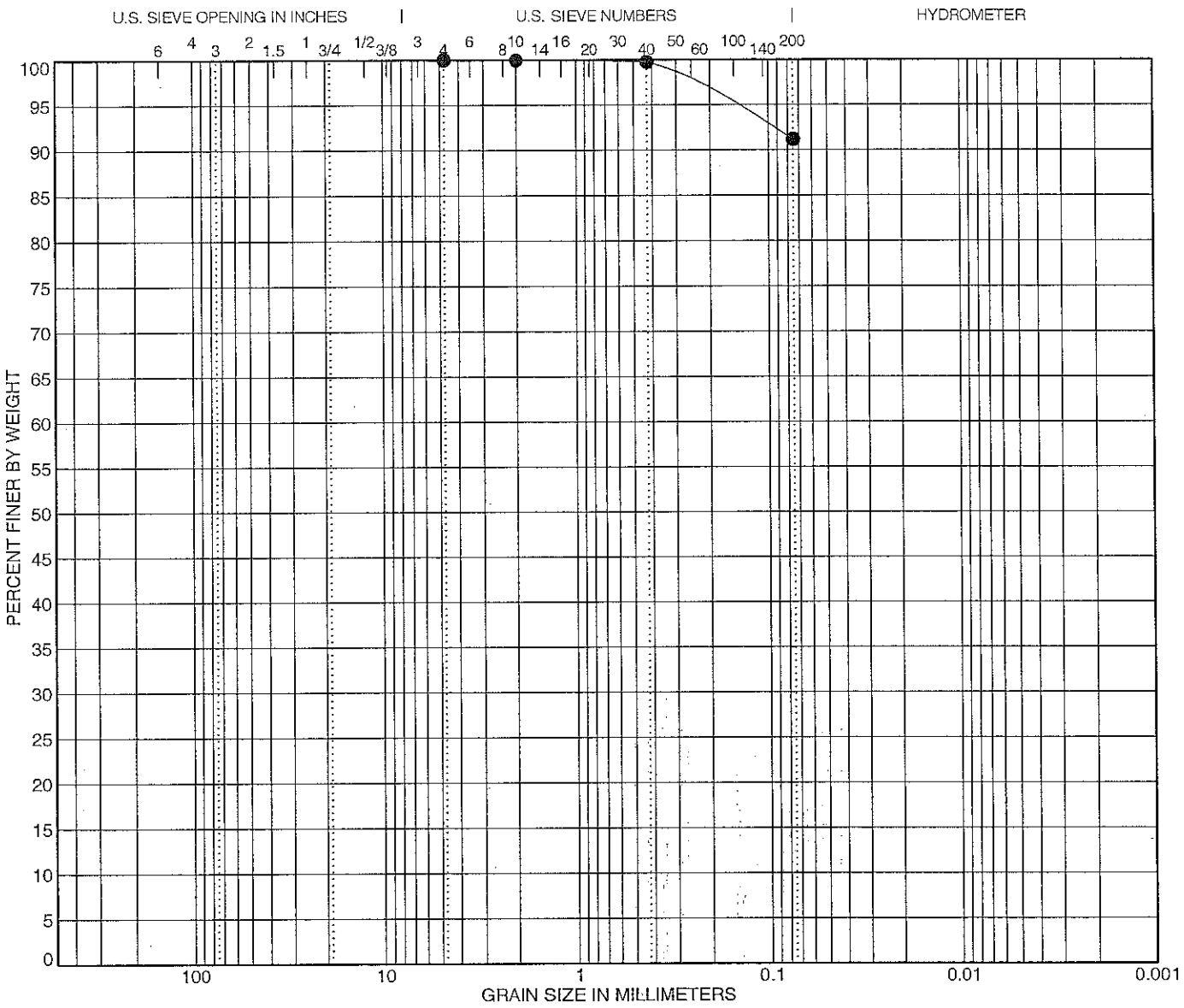

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	**09-B98**	**42.5**						

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
4.75				**0.0**	**8.8**	**91.2**	

Percent Passing the Indicated Sieve

2"	1-1/2"	1"	3/4"	3/8"	#4	#8	#10	#16	#20	#30	#40	#50	#70	#100	#140	#200
					100		**100**				**99.8**					**91.2**

GRAIN SIZE DISTRIBUTION

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, Texas
Project Number 92105186-B

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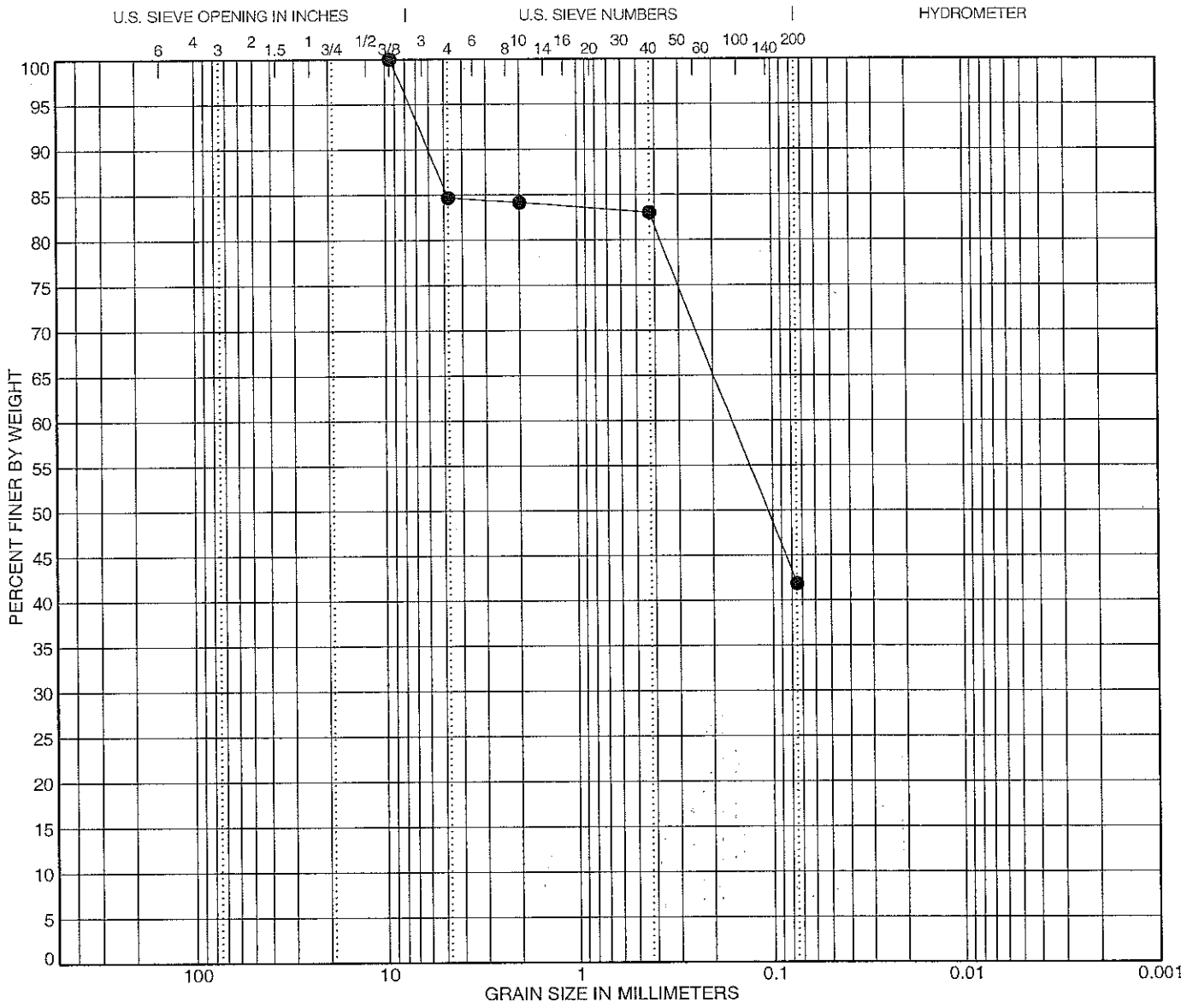

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B98**	**48.5**						

D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
9.5	**0.106**			**15.3**	**42.8**	**41.8**	

Percent Passing the Indicated Sieve																
2"	1-1/2"	1"	3/4"	3/8"	#4	#8	#10	#16	#20	#30	#40	#50	#70	#100	#140	#200
				100	**84.7**		**84.1**				**83**					**41.8**

GRAIN SIZE DISTRIBUTION

TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume II
, Texas
Project Number 92105186-B

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EXHIBIT
A

SUMMARY TABLE OF LABORATORY TEST DATA

Project name: TO-0012 Pipeline Dredging, Volume II, Atkinson Island, PA 16 | **Client: USACE, Galveston District** | **Terracon Project # : 92105186-B**

Boring	Depth	Field tests			Atterberg Limits			Grain Size Analysis – Percent Pasing Sieve														USCS Symbol (ASTM 2487)	Wc	γd	Strength tests – 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-B98	0-2			9																		CL**	12																			
	2-4			11	50	17	33		100	97		95				92					58	CH	19																		
	4-6			8																		CH**	21																		
	6-8			18																		CH**	25																		
	8-10			14																		CH**	17																		
	10-12			13	46	16	30		100	90		87				84					56	CL	22																		
	12-14			12																		CH**	23																		
	14-16			10					100	100		98				90					31	SM*	22																		
	16-18			12																		SM**	29																		
	18-20			7																		CH**	25																		
	20-22			8	42	14	28		100	96		95				85					48	SC	30																		
	22-24			11																		SC**	26																		
	24-26			13	39	13	26		100	100		100				95					56	CL	23																		
	26-28			13																		SM**	44																		
	28-30			4																		SM**	24																		
	30-32			7							100	100	100	100	99	98	93	84	73	59	59	CH*	36																		
	32-34			8																		CH**	26																		
	34-36			9																		CH**	33																		
	36-38			6																		CH**	24																		
	38-40			7						100		100				99					82	CH*	29																		
	40-42			4																		CH**	34																		
	42-44			5	47	17	30					100				100					91	CL	52																		
	44-46			8																		CL**	28																		
	46-48			6																		CH**	57																		
	48-50			6	23	19	4		100	85		84				83					42	SC-SM	23																		
09-B99	0-2			27																		SM**	4																		
	2-4			27																		SM**	12																		
	4-6			32				100	83	60	47	45	39	37	34	31	27	23	19	13	13	SM*	11																		
	6-8			25																		SM**	15																		
	8-10			10																		SP**	13																		
	10-12			20																		SP**	3																		
	12-14			16					100	64		51				27					4	SP*	13																		
	14-16			18																		SP**	16																		
	16-18			30	87	28	59		100	68		64				61					57	CH	31																		
	18-20			18																		CH**	43																		
	20-22			11																		CH**	34																		
	22-24			12																		CH**	48																		
	24-26			15					100	100	100	100	100	100	99	99	98	96	93	82	82	CH*	39																		
	26-28			14																		CH**	38																		
	28-30			15																		CH**	55																		
	30-32			8																		CH**	38																		
	32-34			10																		CH**	26																		
	34-36			10	82	29	53			100		100				100					99	CH	63																		
	36-38			17																		CH**	35																		
	38-40			13																		CH**	62																		
	40-42			10																		CH**	60																		
	42-44			11	25	18	7		100	64		54				47					17	SC-SM	20																		
	44-46			10																		SC-SM**	24																		
	46-48			12																		SC-SM**	20																		
	48-50			10					100	51		44				40					14	SC-SM*	18																		