APPENDIX A

Subsurface Exploration Data

SUBSURFACE EXPLORATION DATA

General Notes for Test Boring Logs

Identification of Soil

Test Boring Log(8)

Cone Penetrometer Data (28)

Dilatometer Data (14)

Field Vane Shear Data (28)

Location Plan, Figure A-1

TEST BORINGS

The test borings were drilled with hollow stem auger equipment. The Standard Penetration Test (SPT) was performed at the depths indicated on the test boring log. Water level data is indicated on the log.

LOCATION AND ELEVATION SURVEY

The field exploration locations were surveyed by Pennoni Associates, Inc., using a GPS system and should be considered accurate to one foot. The test boring elevations were obtained from the site topographic plan prepared by Robert L. Kimball and Associates, dated 1996, and should be considered accurate to the nearest one foot.

GENERAL NOTES FOR TEST BORING LOGS

1. NUMBERS IN SAMPLING DATA COLUMN (3+6+27) INDICATE BLOWS REQUIRED TO DRIVE A 2 INCH O.D., 1⅜ INCH I.D. SAMPLING SPOON 6 INCHES USING A 140 POUND HAMMER FALLING 30 INCHES ACCORDING TO ASTM D1586.

2. VISUAL CLASSIFICATION OF SOIL IS IN ACCORDANCE WITH TERMINOLOGY SET FORTH IN "IDENTIFICATION OF SOIL". THE GROUP CLASSIFICATION SYMBOLS SHOWN IN THE CLASSIFICATION COLUMN ARE BASED ON VISUAL INSPECTION AND AVAILABLE LABORATORY DATA.

3. GROUNDWATER OBSERVATIONS: THE DEPTH OF WATER BELOW GRADE WAS MEASURED AT THE TIMES INDICATED. THE DEPTHS MAY VARY WITH PRECIPITATION, POROSITY OF THE SOIL, SITE TOPOGRAPHY, ETC.

4. REFUSAL AT THE SURFACE OF ROCK, BOULDER, OR OBSTRUCTION IS DEFINED AS A RESISTANCE OF 100 BLOWS FOR 2 INCHES PENETRATION OR LESS.

5. THE BORING LOGS AND RELATED INFORMATION DEPICT SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC LOCATIONS AND AT THE PARTICULAR TIME WHEN DRILLED. SOIL CONDITIONS AT OTHER LOCATIONS MAY DIFFER FROM CONDITIONS OCCURRING AT THESE BORING LOCATIONS. ALSO, THE PASSAGE OF TIME MAY RESULT IN A CHANGE IN THE SUBSURFACE SOIL AND GROUNDWATER CONDITIONS AT THESE BORING LOCATIONS.

6. THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL AND ROCK TYPES AS DETERMINED FROM THE DRILLING AND SAMPLING OPERATION. SOME VARIATION MAY ALSO BE EXPECTED VERTICALLY BETWEEN SAMPLES TAKEN. THE SOIL PROFILE, WATER LEVEL OBSERVATIONS, AND PENETRATION RESISTANCES PRESENTED ON THESE BORING LOGS HAVE BEEN MADE WITH REASONABLE CARE AND ACCURACY AND MUST BE CONSIDERED ONLY AS AN APPROXIMATE REPRESENTATION OF SUBSURFACE CONDITIONS TO BE ENCOUNTERED AT THE PARTICULAR LOCATION.

7. TEST BORINGS DRILLED BY **HARDIN-HUBER INC., BALTIMORE, MARYLAND,** UNDER THE INSPECTION OF **SCHNABEL ENGINEERING ASSOCIATES**.

8. KEY TO SYMBOLS AND ABBREVIATIONS:

3+6+27	STANDARD PENETRATION TEST, ASTM D1586 DESIGNATION	DO	=	DITTO
		RQD	=	ROCK QUALITY DESIGNATION
3T 24/18	2" OR 3" UNDISTURBED TUBE SAMPLE, ASTM D1587 (LENGTH SAMPLED INCHES/SAMPLE RECOVERED INCHES)	REC	=	RECOVERY (%) (LENGTH RECOVERED/ LENGTH SAMPLED)
		w	=	NATURAL MOISTURE CONTENT (%)
REC RQD	NQ2, NX OR 2 INCH O.D. ROCK CORE RUN, ASTM D2113 (RECOVERY AND RQD AS SHOWN)	*	=	NO SAMPLE RECOVERY

SCHNABEL ENGINEERING ASSOCIATES

Consulting Geotechnical Engineers

IDENTIFICATION OF SOIL

DEFINITION OF SOIL GROUP NAMES	ASTM D2487-93		Symbol	Group Name
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels - More than 50% of coarse fraction retained on No. 4 sieve Coarse, ¾ to 3" Fine, No. 4 to ¾"	Clean Gravels Less than 5% fines	GW	Well graded gravel
			GP	Poorly graded gravel
		Gravels with Fines More than 12% fines	GM	Silty gravel
			GC	Clayey gravel
	Sands - 50% or more of coarse fraction passes No. 4 sieve Coarse, No. 10 to No. 4 Medium, No. 40 to No. 10 Fine, No. 200 to No. 40	Clean Sands Less than 5% fines	SW	Well graded sand
			SP	Poorly graded sand
		Sands with Fines More than 12% fines	SM	Silty sand
			SC	Clayey sand
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays - Liquid Limit less than 50 Low to medium plasticity	Inorganic	CL	Lean clay
			ML	Silt
		Organic	OL	Organic clay
				Organic silt
	Silts and Clays - Liquid Limit 50 or more Medium to high plasticity	Inorganic	CH	Fat clay
			MH	Elastic silt
		Organic	OH	Organic clay
				Organic silt
Highly Organic Soils	Primarily organic matter, dark in color, and organic odor		PT	Peat

II. DEFINITION OF MINOR COMPONENT PROPORTIONS

Minor Component	Approximate Percentage of Fraction by Weight
Adjective Form	
Gravelly, Sandy	30 % or more coarse grained
With	
Sand, Gravel	15% or more coarse grained
Silt, Clay	5% to 12% fine grained
Trace	
Sand, Gravel	Less than 15% coarse grained
Silt, Clay	Less than 5% fine grained

III. GLOSSARY OF MISCELLANEOUS TERMS

SYMBOLS: Unified Soil Classification Symbols are shown above as group symbols. Use A Line Chart for laboratory identification. Dual symbols are used for borderline classifications.

BOULDERS & COBBLES: Boulders are considered rounded pieces of rock larger than 12 inches, while cobbles range from 3 to 12 inch size.

DISINTEGRATED ROCK: Residual rock material with Standard Penetration Resistance (SPT) of more than 60 blows per foot, and less than refusal. Refusal is defined as a SPT of 100 blows for 2" or less penetration.

ROCK FRAGMENTS: Angular pieces of rock, distinguished from transported gravel, which have separated from original vein or strata and are present in a soil matrix.

QUARTZ: A hard silica mineral often found in residual soils.

IRONITE: Iron oxide deposited within a soil layer forming cemented deposits.

CEMENTED SAND: Usually localized rock-like deposits within a soil stratum composed of sand grains cemented by calcium carbonate or other materials.

MICA: A soft plate of silica mineral found in many rocks, and in residual or transported soil derived therefrom.

ORGANIC MATERIALS (Excluding Peat):
- Topsoil - Surface soils that support plant life and which contain considerable amounts of organic matter;
- Organic Matter - Soil containing organic colloids throughout its structure;
- Lignite - Hard, brittle decomposed organic matter with low fixed carbon content (a low grade of coal).

FILL: Man-made deposit containing soil, rock and often foreign matter.

PROBABLE FILL: Soils which contain no visually detected foreign matter but which are suspect with regard to origin.

LENSES: 0 to ½ inch seam of minor soil component.

LAYERS: ½ to 12 inch seam of minor soil component.

POCKET: Discontinuous body of minor soil component.

COLOR SHADES: Light to dark to indicate substantial difference in color.

MOISTURE CONDITIONS: Wet, moist, or dry to indicate visual appearance of specimen.

SCHNABEL ENGINEERING ASSOCIATES CONSULTING GEOTECHNICAL ENGINEERS TEST BORING LOG	**Project:** NORTHERN SOLID WASTE MGMT CTR PIGEON POINT LANDFILL WILMINGTON, DELAWARE	**Contract Number:** 985176 **Boring Number:** SEA-1 **Sheet:** 1 of 1

Boring Contractor: HARDIN-HUBER INC.
BALTIMORE, MARYLAND

Boring Foreman: R. RIDER

Drilling Method: 4¼" HOLLOW STEM AUGER

Drilling Equipment: MOBILE B-61

SEA Representative: M. GILL

Dates Started: 8/12/98 **Finished:** 8/12/98

Location: SEE TEST BORING LOCATION PLAN

Ground Surface Elevation: 22.0±

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	8/12	3:45	17.3'	20.0'	--
Completion	8/12	4:50	29.7'	45.0'	--
Casing Pulled	8/12	5:00	9.3'	--	45.0'

DEPTH (FT.)	STRATA DESCRIPTION	CLASS.	ELEV. (FT.)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	W (%)	REMARKS
	ELASTIC SILT FILL, TRACE FABRIC, GLASS AND WOOD FRAGMENTS, MOIST TO WET - DARK GRAY	FILL		A		3+4+30		FILL
						3+4+11		
					5	10+50/2		
					10	5+8+5		
					15	3+3+3		
					20	12+11+15		
					25	3+3+3		
					30	9+16+16		
31.0	DO, FABRIC FRAGMENTS		-9.0					
	ELASTIC SILT, CONTAINS SAND LENSES AND ORGANIC MATTER, MOIST TO WET - DARK GRAY	MH		B				RECENT DEPOSITS
35.5			-13.5		35	4+7+8		
	WELL GRADED SAND, WET - LIGHT BROWN	SW		C	40	7+8+7		COLUMBIA FM.
					45	10+10+11		
46.5	BOTTOM OF BORING @ 46.5 FT.		-24.5					

Comments:
1. BACKFILLED UPON COMPLETION.

SCHNABEL ENGINEERING ASSOCIATES CONSULTING GEOTECHNICAL ENGINEERS TEST BORING LOG	**Project:** NORTHERN SOLID WASTE MGMT CTR PIGEON POINT LANDFILL WILMINGTON, DELAWARE	**Contract Number:** 985176 **Boring Number:** SEA-3 **Sheet:** 1 of 1

Boring Contractor: HARDIN-HUBER INC.
BALTIMORE, MARYLAND

Boring Foreman: R. RIDER

Drilling Method: 4¼" HOLLOW STEM AUGER

Drilling Equipment: MOBILE B-61

SEA Representative: M. GILL

Dates Started: 8/13/98 **Finished:** 8/13/98

Location: SEE TEST BORING LOCATION PLAN

Ground Surface Elevation: 12.0±

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	8/13	2:30	15.0'	15.0'	--

DEPTH (FT.)	STRATA DESCRIPTION	CLASS.	ELEV. (FT.)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	W (%)	REMARKS
	LEAN CLAY WITH SAND FILL, MOIST - GRAY AND BROWN	FILL		A	5	6+7+6 4+4+5 2+2+3		FILL
7.0	FAT CLAY, MOIST - RED AND GRAY	CH	5.0	B	10	3+3+4		RECENT DEPOSITS
14.0	SILTY SAND, WET - LIGHT BROWN	SM	-2.0		15	1+2+1		
17.0	ELASTIC SILT, CONTAINS FINE SAND LENSES AND ORGANIC MATTER, MOIST TO WET - GRAY	MH	-5.0		20 25 30 35 40	WOH+2+2 2+2+2 1+2+2 1+2+2 WOH+3+3		
45.0	WELL GRADED SAND WITH GRAVEL, WET - GRAY	SW	-33.0	C	45 50	1+1+2 100/9		COLUMBIA FM.
51.5	BOTTOM OF BORING @ 51.5 FT.		-39.5					

Comments:
1. DUE TO INTRUSION OF SAND BELOW THE WATER TABLE INTO THE BOTTOM OF THE AUGERS, WATER WAS PUMPED INTO THE BORING TO FLUSH THE SOIL OUT. NO GROUNDWATER LEVELS WERE TAKEN.
2. BACKFILLED UPON COMPLETION.

SCHNABEL ENGINEERING ASSOCIATES CONSULTING GEOTECHNICAL ENGINEERS TEST BORING LOG	**Project:** NORTHERN SOLID WASTE MGMT CTR PIGEON POINT LANDFILL WILMINGTON, DELAWARE	**Contract Number:** 985176 **Boring Number:** SEA-6 **Sheet:** 1 of 1

Boring Contractor: HARDIN-HUBER INC.
BALTIMORE, MARYLAND

Boring Foreman: R. RIDER

Drilling Method: 4¼" HOLLOW STEM AUGER

Drilling Equipment: MOBILE B-61

SEA Representative: M. GILL

Dates Started: 8/13/98 **Finished:** 8/13/98

Location: SEE TEST BORING LOCATION PLAN

Ground Surface Elevation: 19.0±

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	8/13	6:00	33.0'	35.0'	--
Completion	8/14	7:00	3.3'	45.0'	--
Casing Pulled	8/14	8:00	DRY	--	1.0'

DEPTH (FT.)	STRATA DESCRIPTION	CLASS.	ELEV. (FT.)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	W (%)	REMARKS
	CRUSHED STONE, GRAY					2+4+17		
2.0	SANDY SILT FILL, CONTAINS PLASTIC FRAGMENTS AND ORGANIC MATTER, MOIST TO WET - DARK GRAY	FILL	17.0	A		2+3+2		FILL
					5	3+1+1		
6.0	ELASTIC SILT, CONTAINS ORGANIC MATTER, MOIST TO WET - DARK GRAY	MH	13.0	B	10	1/12+1		RECENT DEPOSITS
					15	1+1+1		
					20	1+2+2		
					25	1+2+3		
					30	WOH+1+2		
					35	2+2+2		
					40	WOR/12+6		
41.0	FINE POORLY GRADED SAND, WET - BROWN	SP	-22.0	C				COLUMBIA FM.
45.0	FAT CLAY, MOIST - RED	CH	-26.0	D	45	8+12+19		POTOMAC FM.
46.5	BOTTOM OF BORING @ 46.5 FT.		-27.5					

Comments:
1. BACKFILLED UPON COMPLETION.

SCHNABEL ENGINEERING ASSOCIATES CONSULTING GEOTECHNICAL ENGINEERS TEST BORING LOG	**Project:** NORTHERN SOLID WASTE MGMT CTR PIGEON POINT LANDFILL WILMINGTON, DELAWARE	**Contract Number:** 985176 **Boring Number:** SEA-9 **Sheet:** 1 of 1

Boring Contractor: HARDIN-HUBER INC.
BALTIMORE, MARYLAND

Boring Foreman: R. RIDER

Drilling Method: 4¼" HOLLOW STEM AUGER

Drilling Equipment: MOBILE B-61

SEA Representative: M. GILL

Dates Started: 8/14/98 **Finished:** 8/14/98

Location: SEE TEST BORING LOCATION PLAN

Ground Surface Elevation: 16.0±

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	8/14	3:00	50.0'	50.0'	--
Completion	8/14	3:05	8.6'	50.0'	--
Casing Pulled	8/15	9:00	5.0'	--	10.0'

DEPTH (FT.)	STRATA DESCRIPTION	CLASS.	ELEV. (FT.)	STRATUM	SAMPLING DATA (DEPTH)	SAMPLING DATA	W (%)	REMARKS
	SANDY CLAY FILL, CONTAINS GRAVEL, MOIST - BROWN AND GRAY	FILL		A		6+7+5		FILL
3.0	ELASTIC SILT, CONTAINS ORGANIC MATTER, MOIST - DARK GRAY	MH	13.0	B	5	2+1+1		RECENT DEPOSITS
						3T 24/24		
					10	2+1+1		
						3T 24/24		
	DO, CONTAINS LARGE WOOD FRAGMENTS				15	1+1+1		
						3T 24/24		
	DO, FINE SAND LENS				20	2+2+2		
					25	3T 24/24		
						3T 24/24		
					30	3T 24/24		
	DO, FINE SAND LENS				35	WOH+1+2		
						3T 24/24		
	DO, CONTAINS VEGETATIVE LAYER WITH LARGE WOOD FRAGMENTS				40	2+2+2		
						3T 24/24		
	DO, FINE SAND LENS				45	WOH/10+2+3		
49.0	MEDIUM POORLY GRADED SAND, WET - BROWN	SP	-33.0	C	50	18+22+18		COLUMBIA FM.
51.5	BOTTOM OF BORING @ 51.5 FT.		-35.5					

Comments:
1. BACKFILLED UPON COMPLETION.

SCHNABEL ENGINEERING ASSOCIATES CONSULTING GEOTECHNICAL ENGINEERS TEST BORING LOG	**Project:** NORTHERN SOLID WASTE MGMT CTR PIGEON POINT LANDFILL WILMINGTON, DELAWARE	**Contract Number:** 985176 **Boring Number:** SEA-9A **Sheet:** 1 of 1

Boring Contractor: HARDIN-HUBER INC.
BALTIMORE, MARYLAND

Boring Foreman: R. RIDER

Drilling Method: 4¼" HOLLOW STEM AUGER

Drilling Equipment: MOBILE B-61

SEA Representative: M. GILL

Dates Started: 8/17/98 **Finished:** 8/17/98

Location: SEE TEST BORING LOCATION PLAN

Ground Surface Elevation: 16.0±

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	8/17	--	DRY	41.5'	--
Completion	8/17	--	DRY	41.5'	--
Casing Pulled	8/17	--	DRY	--	5.0'

DEPTH (FT.)	STRATA DESCRIPTION	CLASS.	ELEV. (FT.)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	W (%)	REMARKS
	SANDY CLAY FILL, CONTAINS GRAVEL, MOIST - BROWN AND GRAY	FILL		A				FILL
3.0	ELASTIC SILT, CONTAINS ORGANIC MATTER, MOIST - DARK GRAY	MH	13.0		5			
					10	VANE #1 @ 8 ft		Su = 600 psf**
						VANE #2 @ 13 ft		Su = 830 psf
	DO, CONTAINS LARGE WOOD FRAGMENTS				15	FRIC #1 @ 15.5 ft		
					20	VANE #3 @ 19 ft		Su = 540 psf
	DO, FINE SAND LENS			B		FRIC #2 @ 21.5 ft		RECENT DEPOSITS
					25	VANE #4 @ 24.5 ft		Su = 460 psf
						VANE #5 @ 28 ft		Su = 650 psf
					30	VANE #6 @ 31 ft		Su = 500 psf
	DO, FINE SAND LENS				35			
						VANE #7 @ 37 ft		Su = 800 psf
	DO, CONTAINS VEGETATIVE LAYER WITH LARGE WOOD FRAGMENTS				40	FRIC #3 @ 39.5 ft		
						VANE #8 @ 44 ft		Su = 1380 psf
44.5	BOTTOM OF BORING @ 44.5 FT.		-28.5					

Comments:
1. BACKFILLED UPON COMPLETION.
** THE UNDRAINED SHEAR STRENGTH FOR VANE #1 WAS NOT CORRECTED FOR FRICTION.

SCHNABEL ENGINEERING ASSOCIATES CONSULTING GEOTECHNICAL ENGINEERS TEST BORING LOG	**Project:** NORTHERN SOLID WASTE MGMT CTR PIGEON POINT LANDFILL WILMINGTON, DELAWARE	**Contract Number:** 985176 **Boring Number:** SEA-13 **Sheet:** 1 of 1

Boring Contractor: HARDIN-HUBER INC.
BALTIMORE, MARYLAND

Boring Foreman: R. RIDER

Drilling Method: 4¼" HOLLOW STEM AUGER

Drilling Equipment: MOBILE B-61

SEA Representative: M. GILL

Dates Started: 8/19/98 **Finished:** 8/20/98

Location: SEE TEST BORING LOCATION PLAN

Ground Surface Elevation: 18.0±

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	8/20	9:05	22.0'	25.0'	--
Completion	8/20	9:10	19.5'	25.0'	--
Casing Pulled	8/20	9:20	DRY	--	2.0'

DEPTH (FT.)	STRATA DESCRIPTION	CLASS.	ELEV. (FT.)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	W (%)	REMARKS
	SILT FILL, CONTAINS CRUSHED STONE AND ORGANIC MATTER, MOIST - GRAY AND BROWN	FILL		A				FILL
3.0	ELASTIC SILT, CONTAINS ORGANIC MATTER, MOIST - DARK GRAY	MH	15.0	B	5	2+1+1		
					10	VANE #1 @ 8 ft		Su = 420 psf
						FRIC #1 @ 12 ft		RECENT DEPOSITS
					15	VANE #2 @ 16 ft		Su = 540 psf
					20	WOH+1+2		
25.0	MEDIUM POORLY GRADED SAND, WET - RED-BROWN	SP	-7.0	C	25	5+9+9		COLUMBIA FM.
26.5	BOTTOM OF BORING @ 26.5 FT.		-8.5					

Comments:
1. BACKFILLED UPON COMPLETION.

SCHNABEL ENGINEERING ASSOCIATES CONSULTING GEOTECHNICAL ENGINEERS TEST BORING LOG	**Project:** NORTHERN SOLID WASTE MGMT CTR PIGEON POINT LANDFILL WILMINGTON, DELAWARE	**Contract Number:** 985176 **Boring Number:** SEA-14 **Sheet:** 1 of 1

Boring Contractor: HARDIN-HUBER INC.
BALTIMORE, MARYLAND

Boring Foreman: R. RIDER

Drilling Method: 4¼" HOLLOW STEM AUGER

Drilling Equipment: MOBILE B-61

SEA Representative: M. GILL

Dates Started: 8/10/98 **Finished:** 8/10/98

Location: SEE TEST BORING LOCATION PLAN
58.0

Ground Surface Elevation: 59.0±

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	8/10	11:30	27.0'	30.0'	--

DEPTH (FT.)	STRATA DESCRIPTION	CLASS.	ELEV. (FT.)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	W (%)	REMARKS
	MUNICIPAL SOLID WASTE WITH ELASTIC SILT SOIL, AUGER PROBE TO 52.0 FT	FILL		A	5, 10, 15, 20, 25, 30, 35, 40, 45, 50	7+5+8; 5+1+1; 1/12+1		LANDFILL MATERIALS
52.0	ELASTIC SILT, CONTAINS ORGANIC MATTER, WET - DARK GRAY	MH	7.0	B	55			RECENT DEPOSITS
55.0	BOTTOM OF BORING @ 55.0 FT.		4.0					

Comments:
1. DRILLING MUD USED AT 30.0 FT DEPTH TO BOTTOM OF BORING BECAUSE OF HIGH LEL READINGS. NO GROUNDWATER LEVELS TAKEN.
2. BACKFILLED UPON COMPLETION.

SCHNABEL ENGINEERING ASSOCIATES CONSULTING GEOTECHNICAL ENGINEERS TEST BORING LOG	**Project:** NORTHERN SOLID WASTE MGMT CTR PIGEON POINT LANDFILL WILMINGTON, DELAWARE	**Contract Number:** 985176 **Boring Number:** SEA-16 **Sheet:** 1 of 1

Boring Contractor: HARDIN-HUBER INC.
BALTIMORE, MARYLAND

Boring Foreman: R. RIDER

Drilling Method: 4¼" HOLLOW STEM AUGER

Drilling Equipment: MOBILE B-61

SEA Representative: M. GILL

Dates Started: 8/11/98 **Finished:** 8/11/98

Location: SEE TEST BORING LOCATION PLAN

Ground Surface Elevation: 60.0±

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	8/11	3:00	26.3'	30.0'	--

DEPTH (FT.)	STRATA DESCRIPTION	CLASS.	ELEV. (FT.)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	W (%)	REMARKS
	MUNICIPAL SOLID WASTE WITH ELASTIC SILT SOIL, AUGER PROBE TO 54.0 FT	FILL		A	5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55	8+34/10; 18+19+5+4; 5+5+4+5		LANDFILL MATERIALS
54.0	ELASTIC SILT, CONTAINS ORGANIC MATTER, WET - DARK GRAY	MH	6.0	B				RECENT DEPOSITS
56.0	BOTTOM OF BORING @ 56.0 FT.		4.0					

Comments:
1. DRILLING MUD USED AT 30.0 FT DEPTH TO THE BOTTOM OF THE BORING BECAUSE OF HIGH LEL READINGS. NO GROUNDWATER LEVELS TAKEN.
2. BACKFILLED UPON COMPLETION.

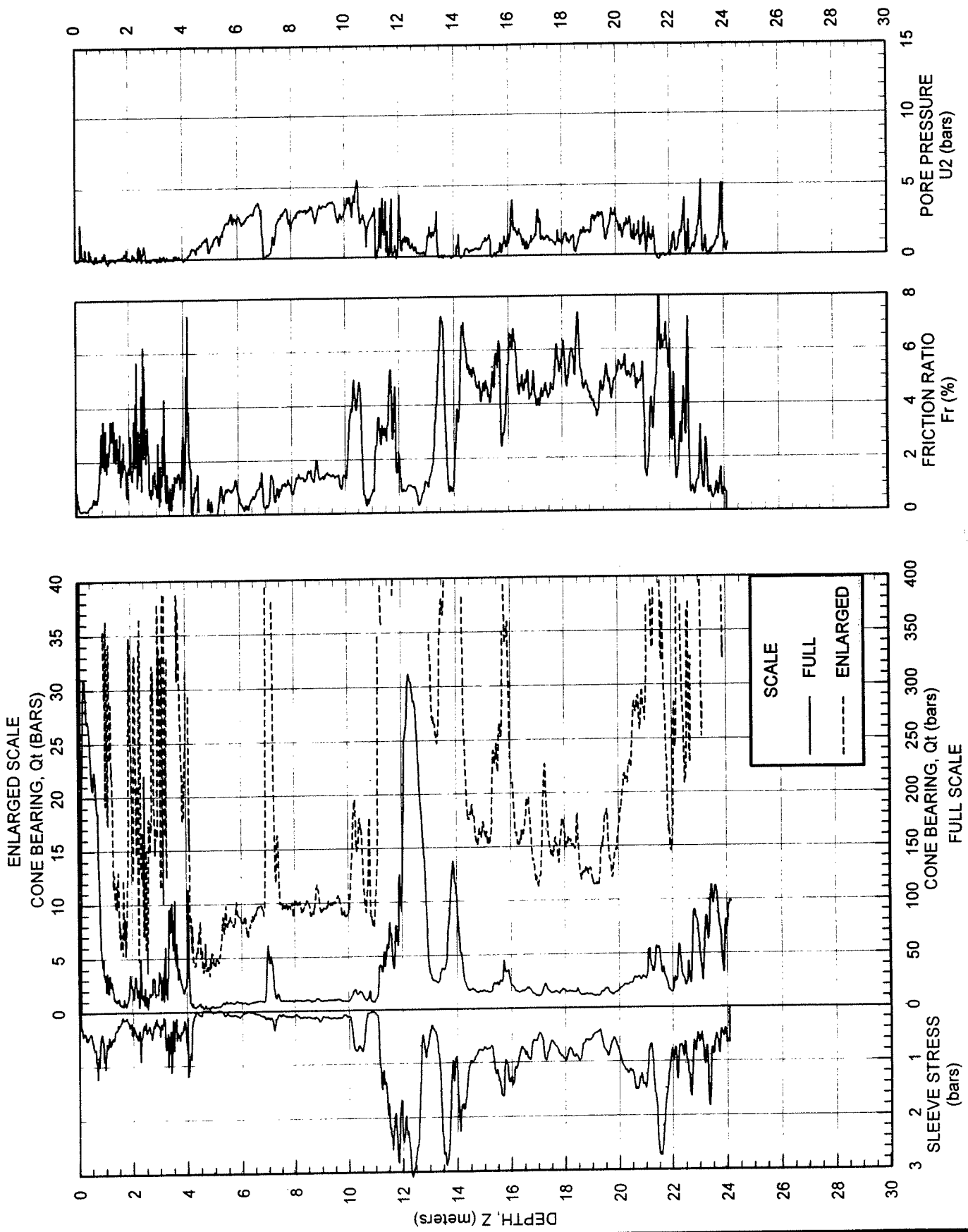
PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

IN-SITU SOIL TESTING, L.C.
ENGINEER: R. Fallmezger
SOUNDING DATE: 8-10-98

SOUNDING
CPT-7

ELECTRIC CONE PENETROMETER RESULTS

Ground Surface Elev.:
Water Depth: 1.37m

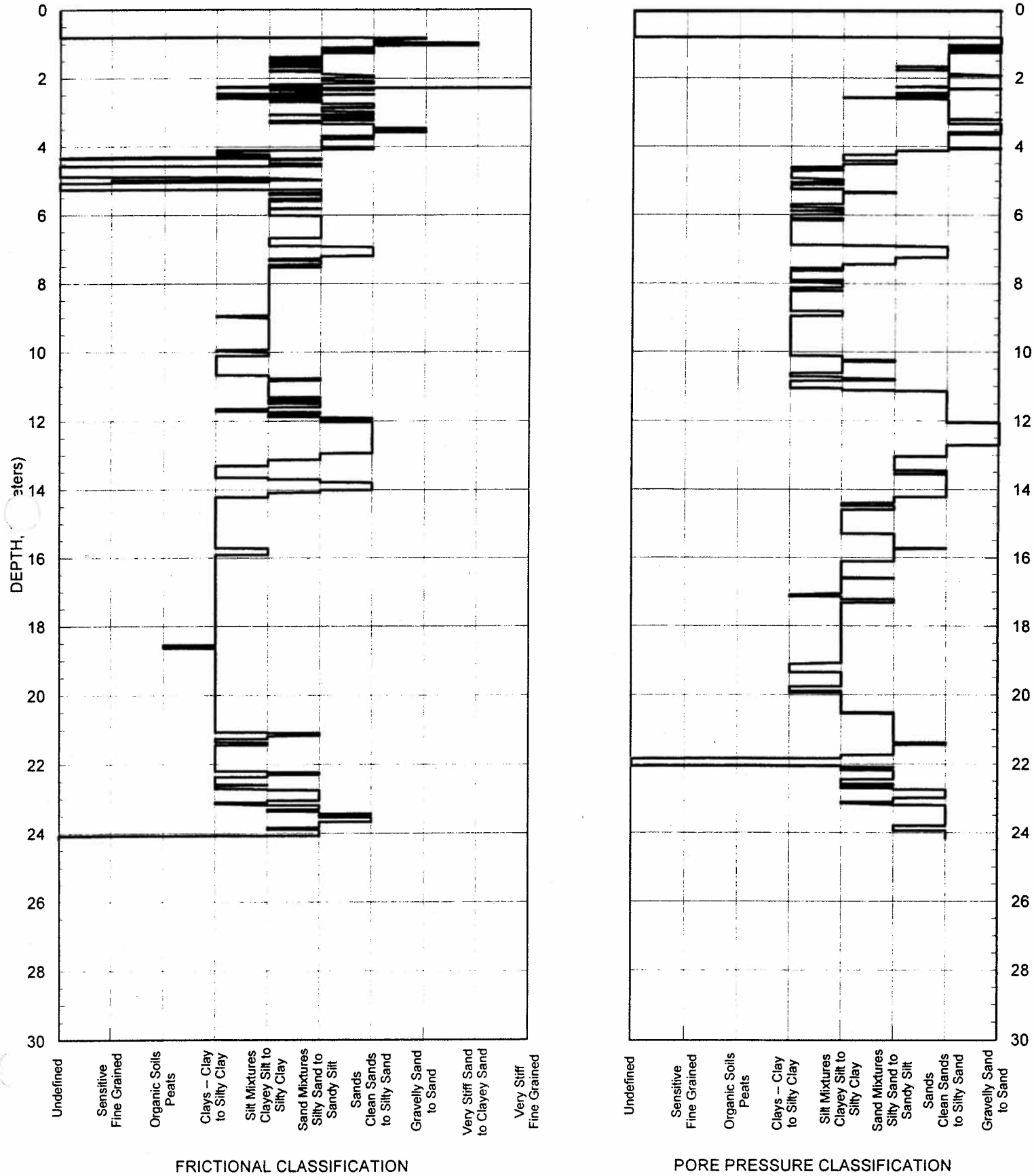


PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

IN-SITU SOIL TESTING, L.C.
ENGINEER: R. Failmezger
SOUNDING DATE: 8-10-98

SOUNDING
CPT-7

SOIL BEHAVIOR CLASSIFICATION (ROBERTSON, 1990)



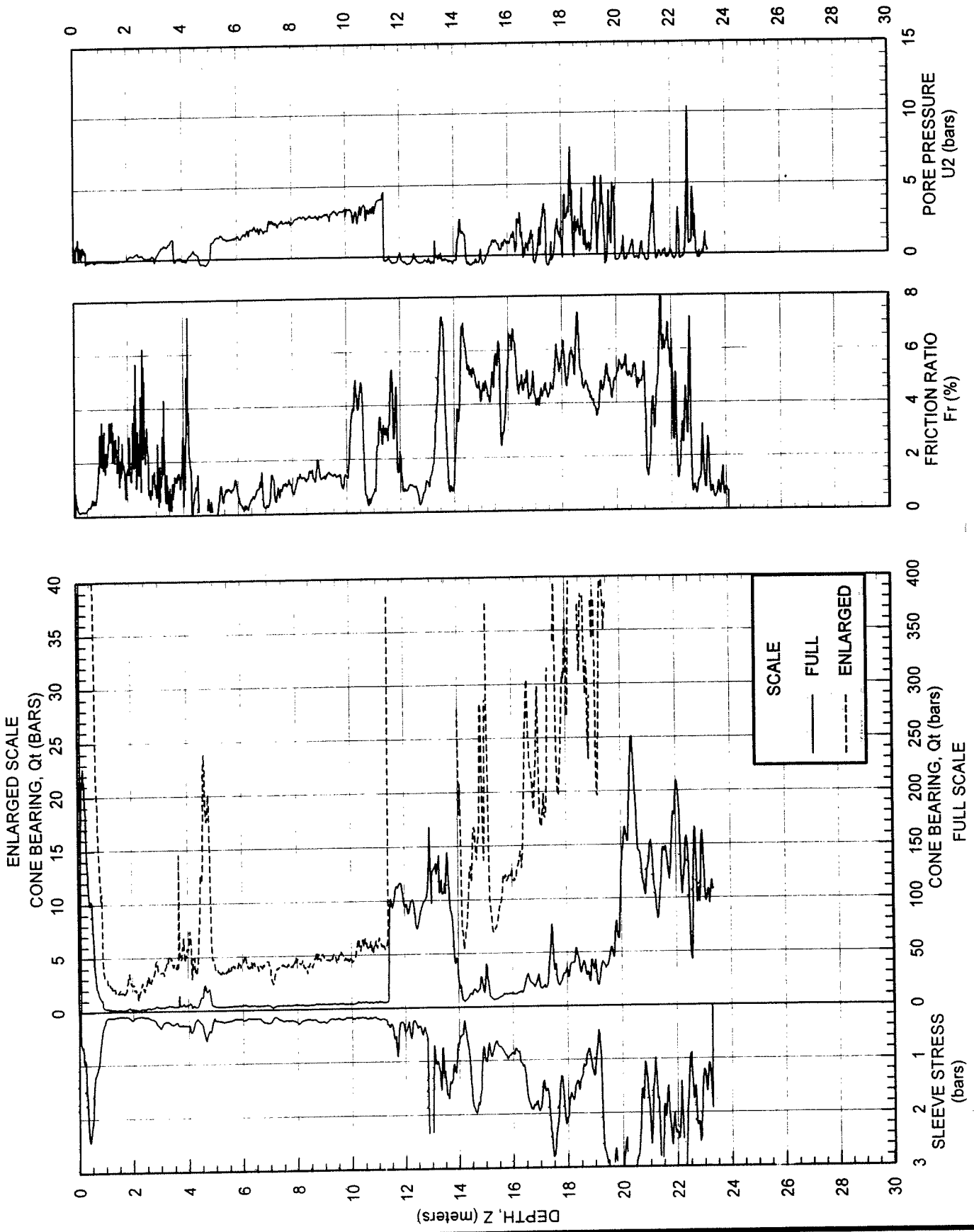
PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

IN-SITU SOIL TESTING, L.C.
ENGINEER: R. Failmezger
SOUNDING DATE: 8-11-98

SOUNDING
CPT-8

ELECTRIC CONE PENETROMETER RESULTS

Ground Surface Elev.:
Water Depth: 2.89 m

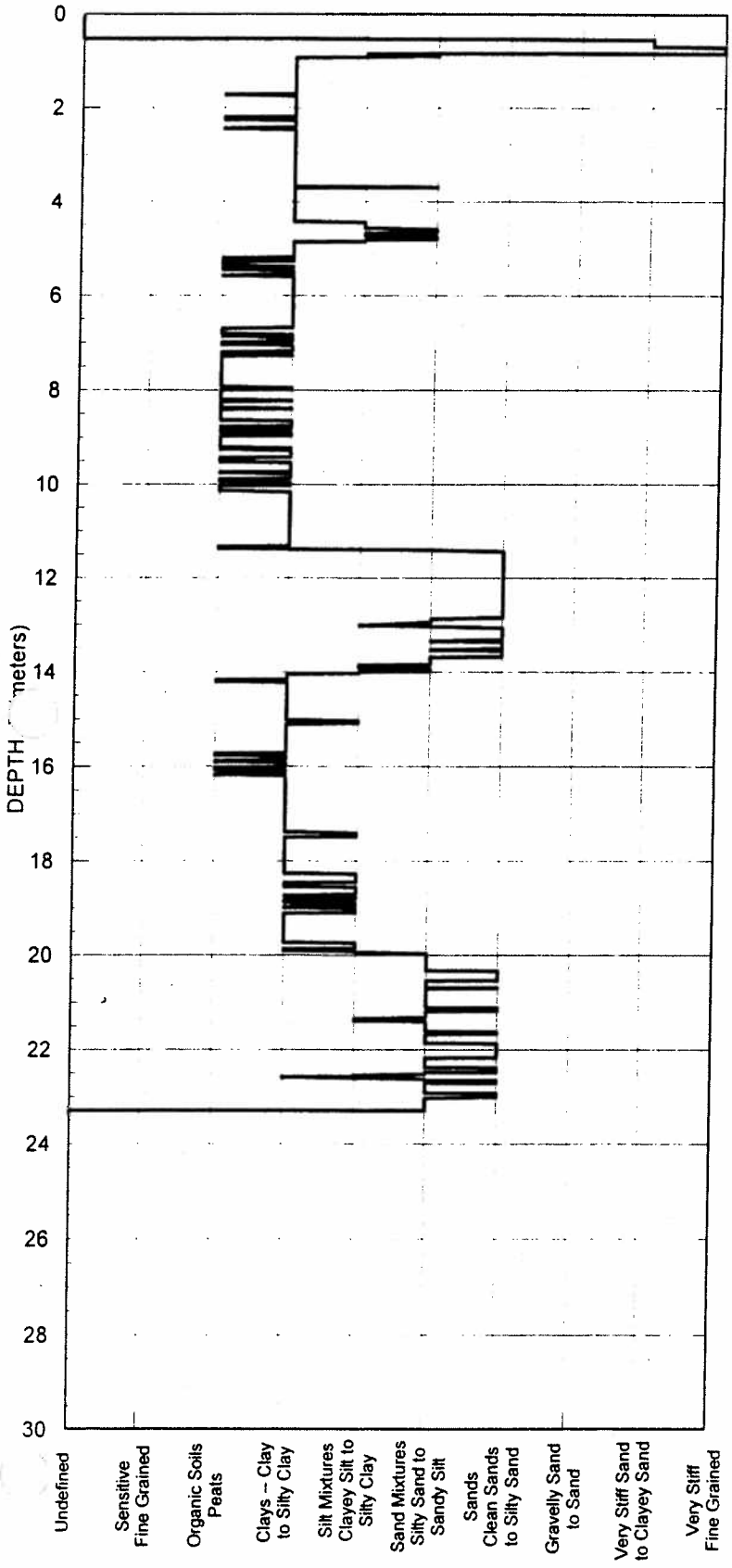


PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

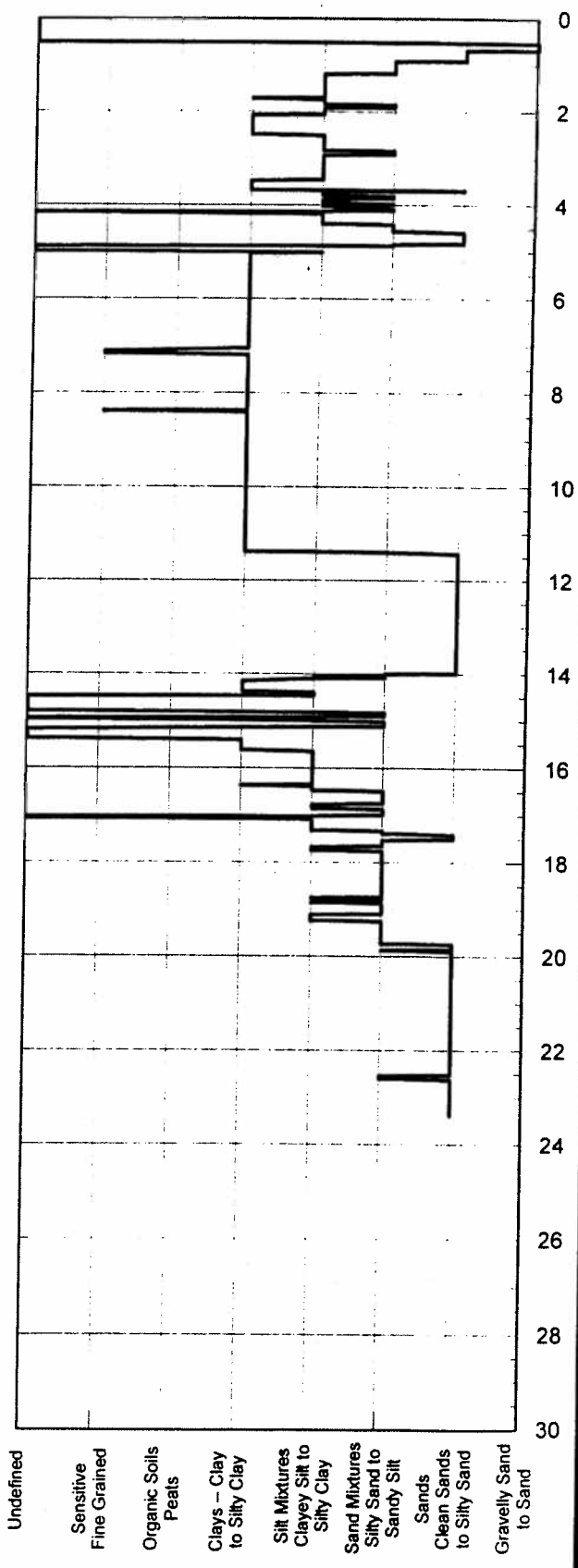
IN-SITU SOIL TESTING, L
ENGINEER: R. Fallmazgor
SOUNDING DATE: 8-11-98

SOUNDING
CPT-8

SOIL BEHAVIOR CLASSIFICATION (ROBERTSON, 1990)

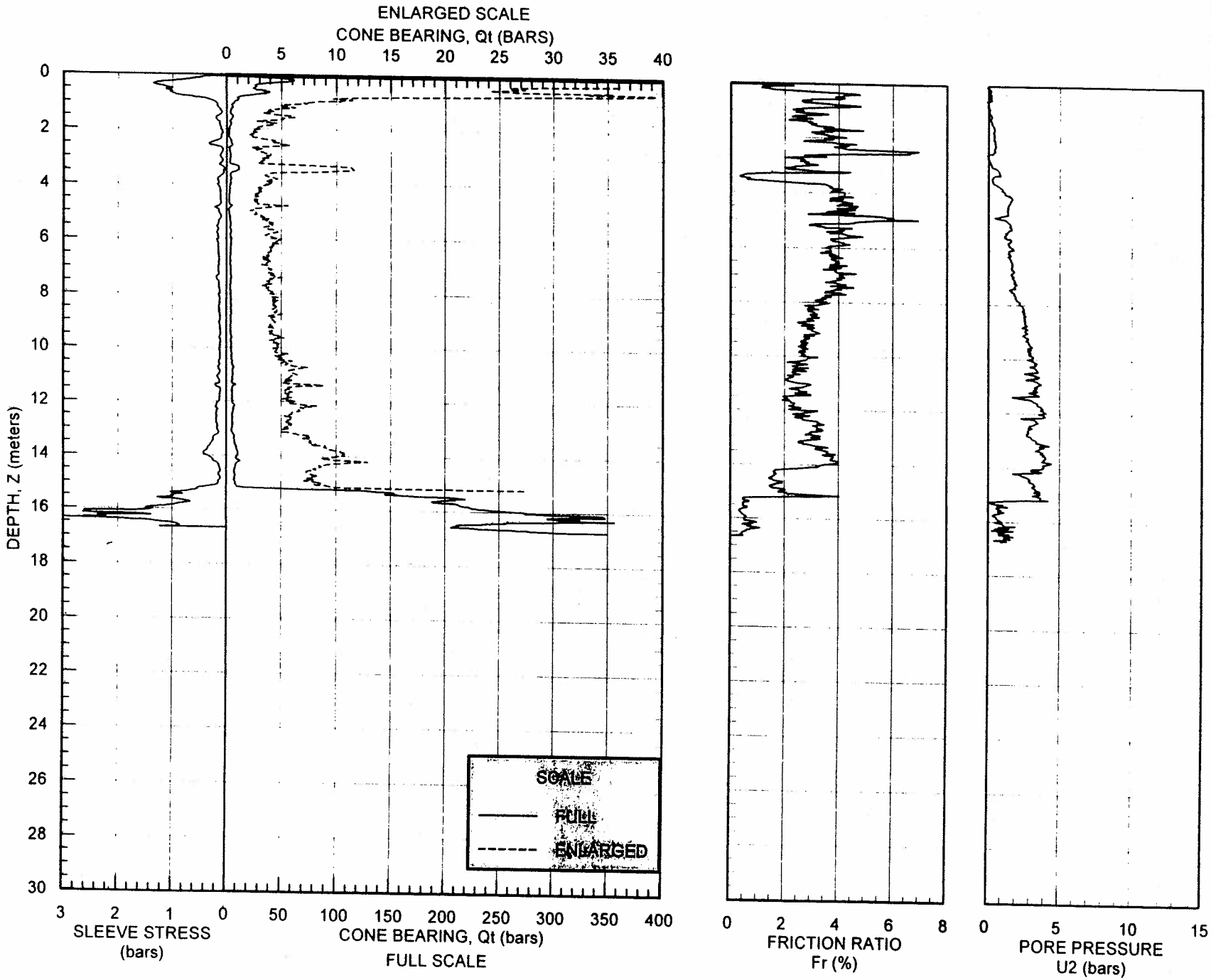


FRICTIONAL CLASSIFICATION



PORE PRESSURE CLASSIFICATION

Ground Surface Elev.:
Water Depth: 2.47 m



PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

ELECTRIC CONE PENETROMETER RESULTS

IN-SITU SOIL TESTING, L.C.
ENGINEER: R. Fallmezger
SOUNDING DATE: 8-11-98

SOUNDING
CPT-C

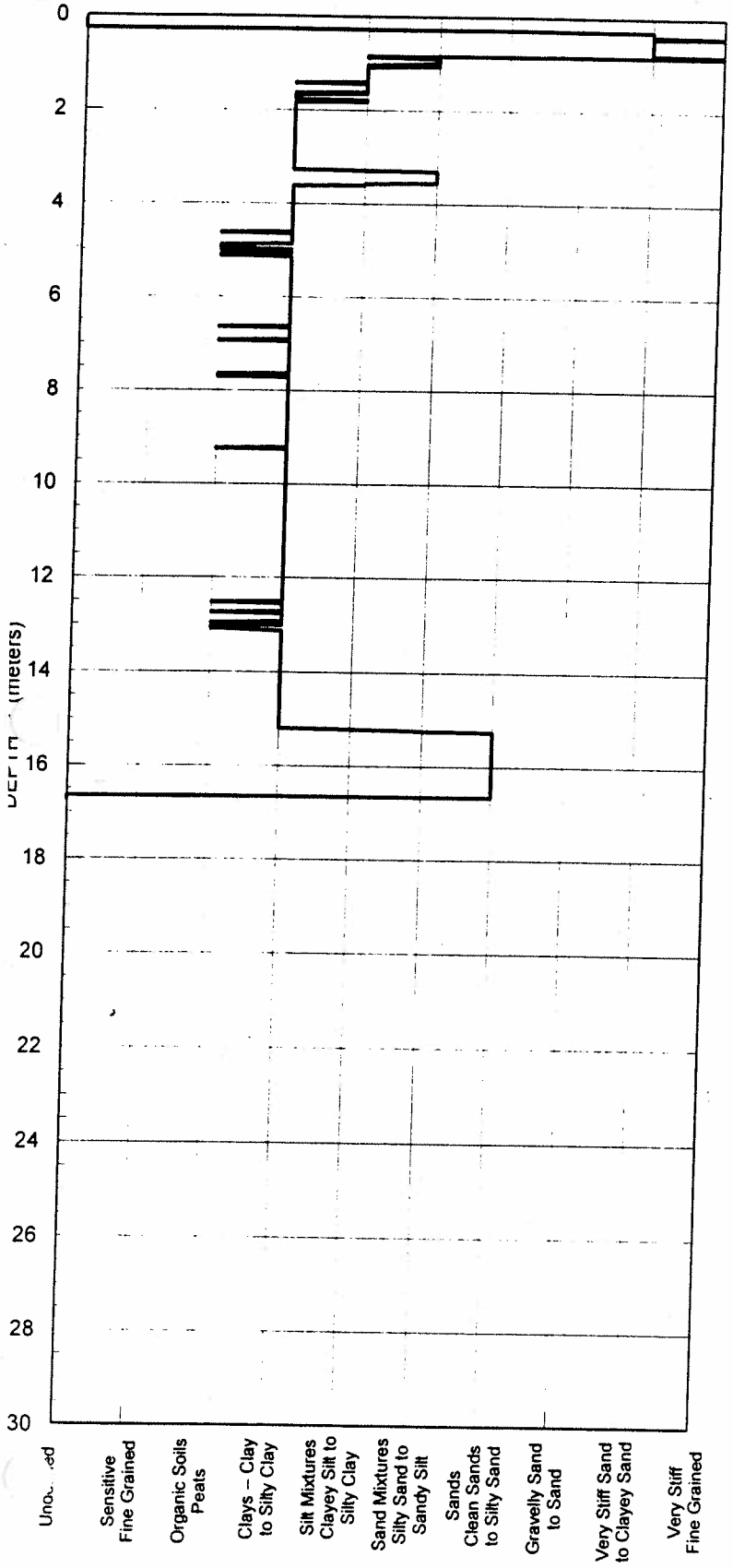
SEA-9

PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

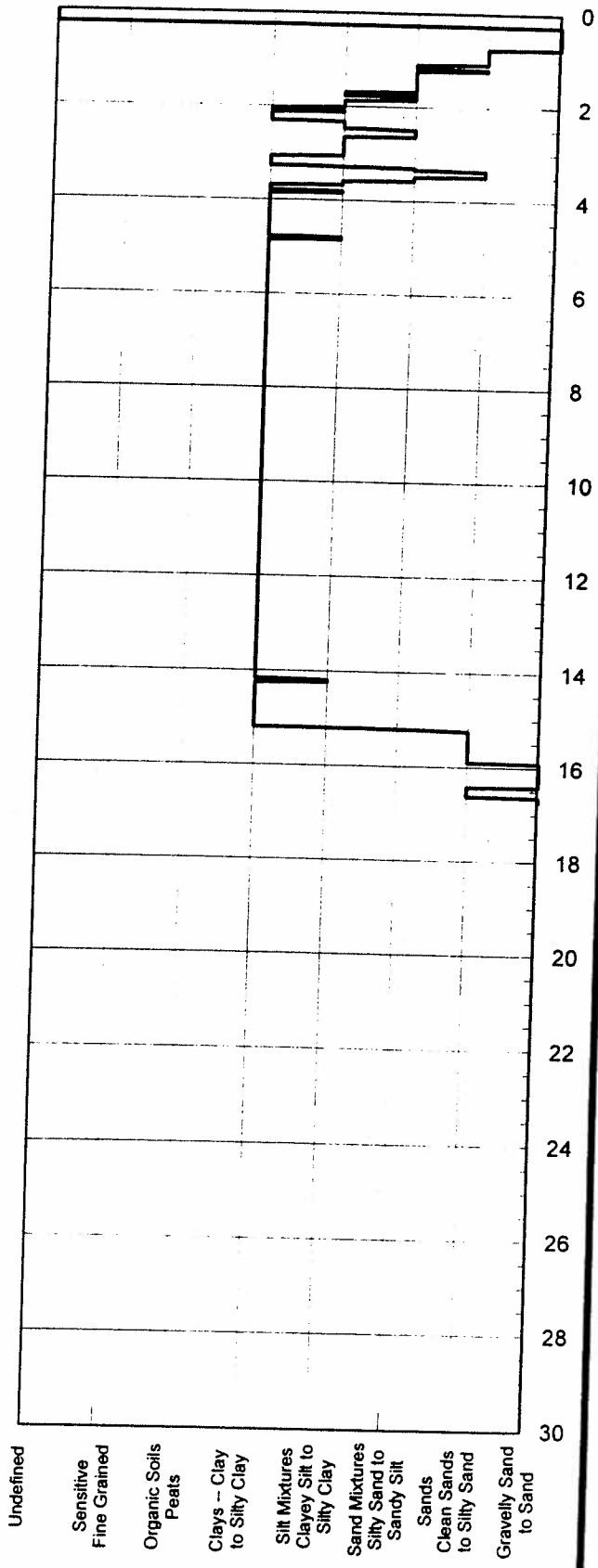
IN-SITU SOIL TESTING, L.C.
ENGINEER: R. Fallmezger
SOUNDING DATE: 8-11-98

SOUNDING
CPT-9

SOIL BEHAVIOR CLASSIFICATION (ROBERTSON, 1990)



FRICTIONAL CLASSIFICATION



PORE PRESSURE CLASSIFICATION

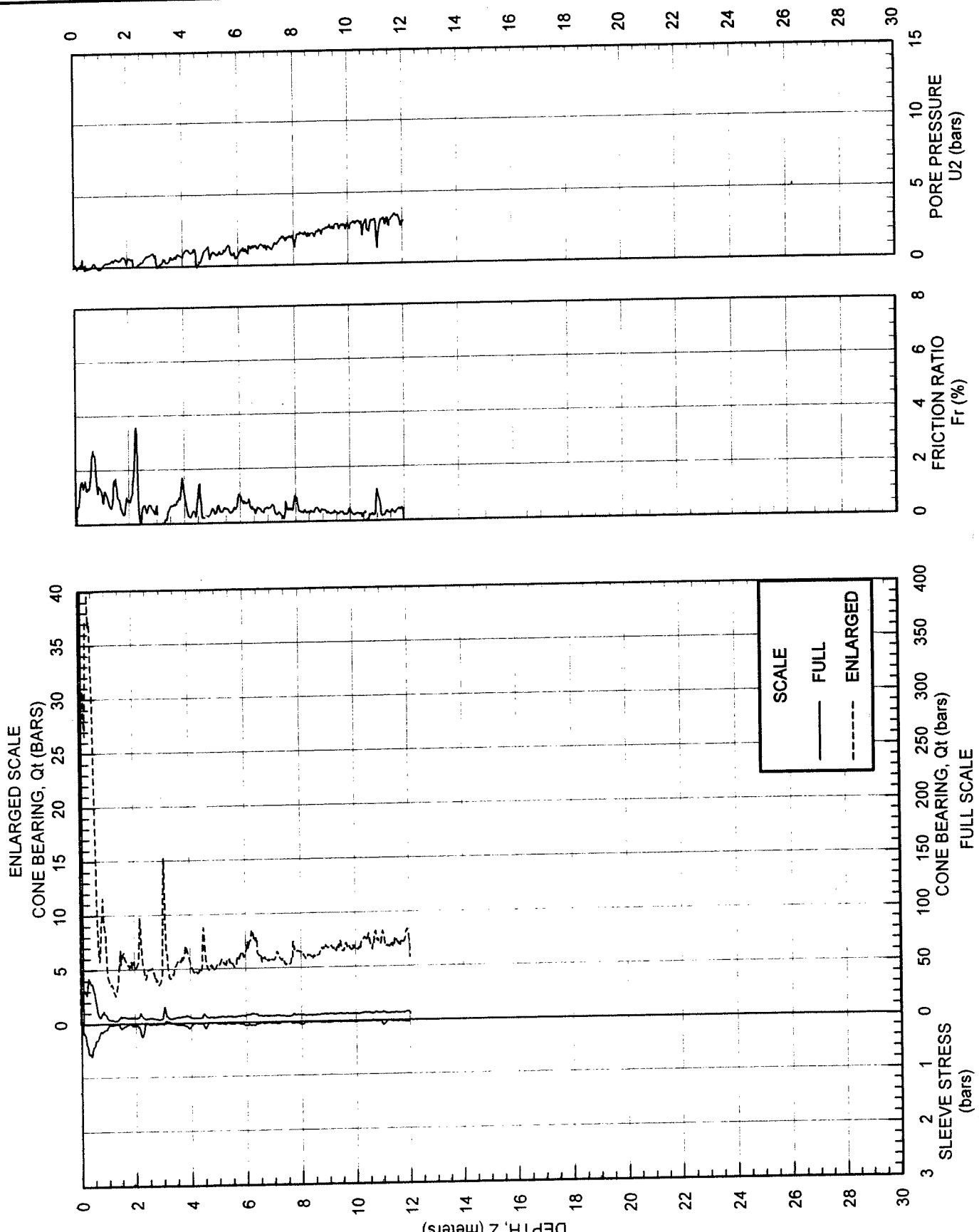
PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

IN-SITU SOIL TESTING, L.C.
ENGINEER: R. Fallmezger
SOUNDING DATE: 8-20-98

SOUNDING
SCPT-9

ELECTRIC CONE PENETROMETER RESULTS

Ground Surface Elev.:
Water Depth: 2.47 m

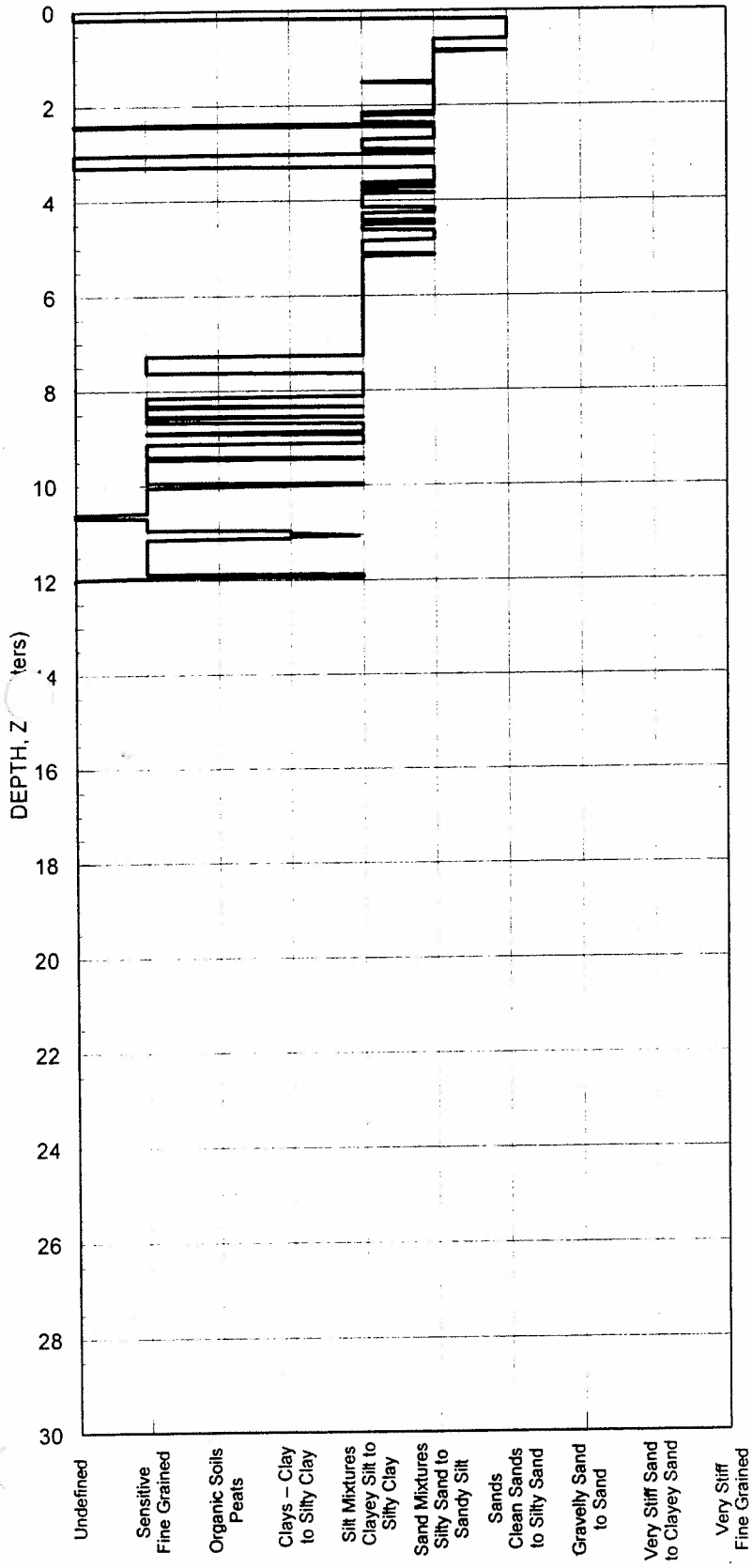


PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

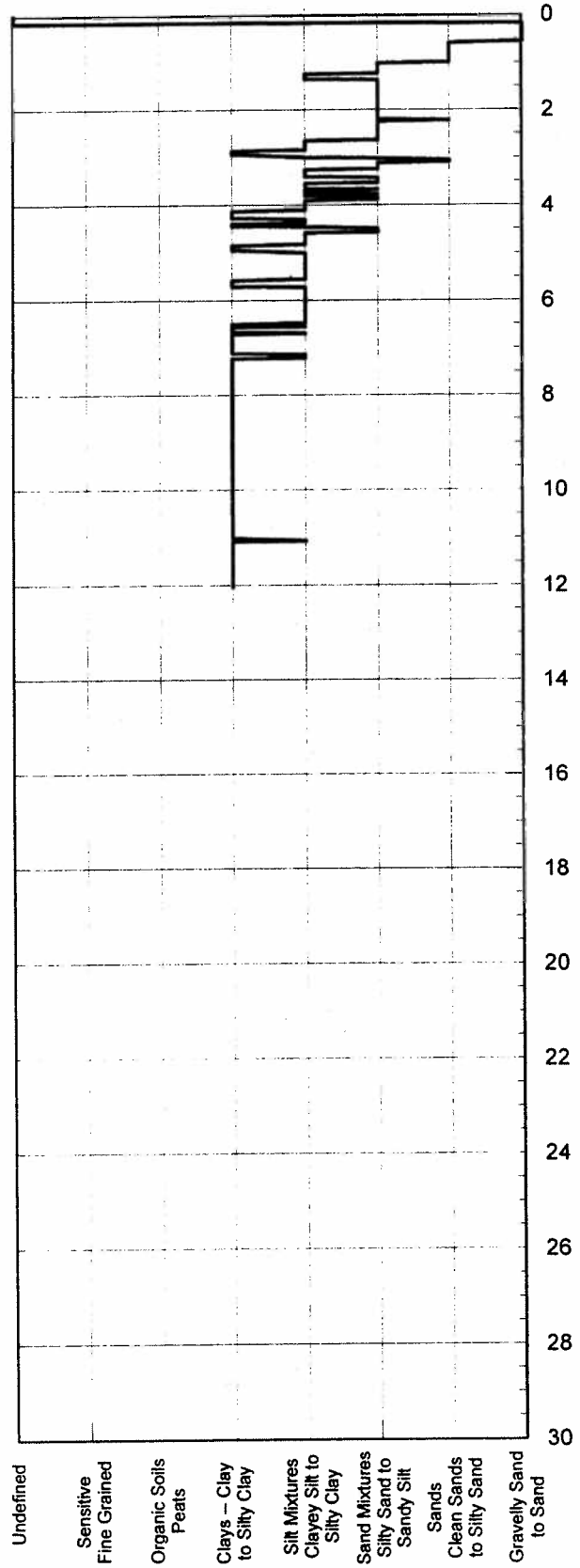
IN-SITU SOIL TESTING, LLC.
ENGINEER: R. Fallmezger
SOUNDING DATE: 8-20-98

SOUNDING
SCPT-9

SOIL BEHAVIOR CLASSIFICATION (ROBERTSON, 1990)



FRICTIONAL CLASSIFICATION



PORE PRESSURE CLASSIFICATION

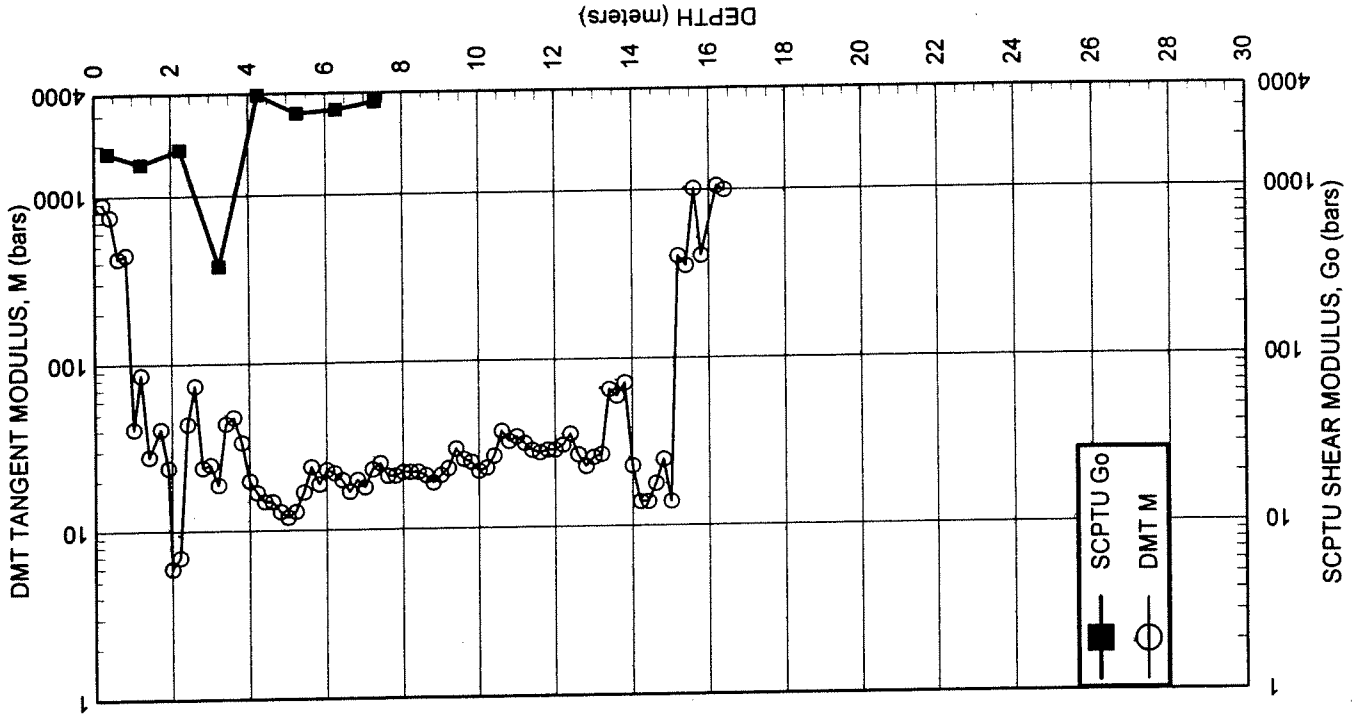
PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

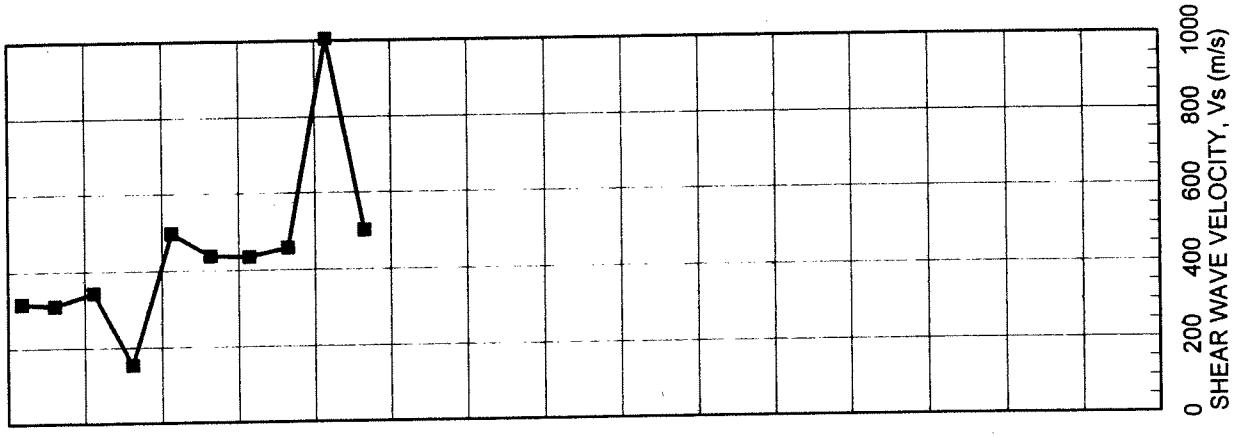
IN-SITU SOIL TESTING, L.C.
ENGINEER: R. Fallmezger
SOUNDING DATE: 8-20-98

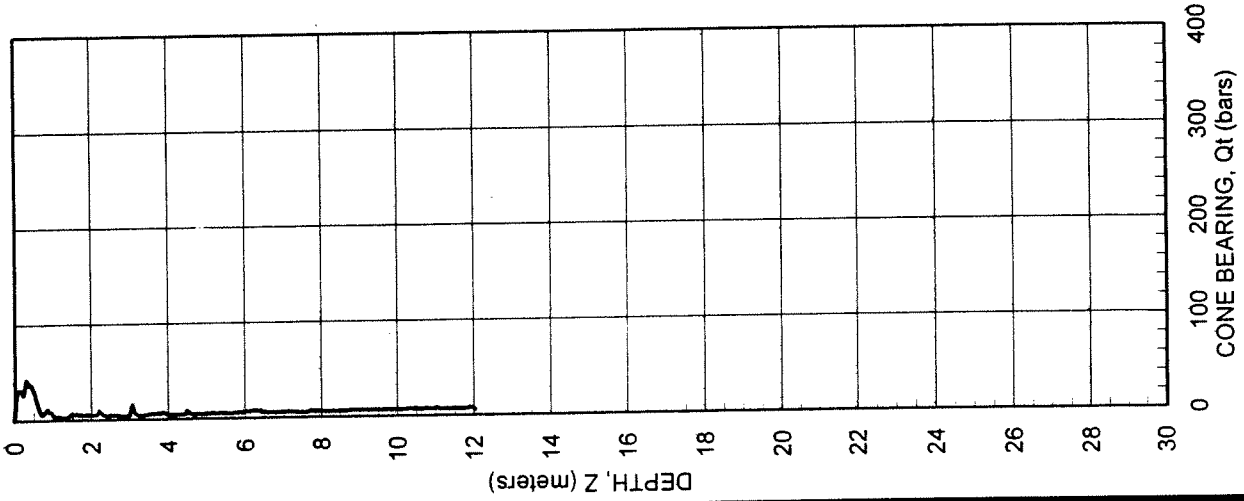
SOUNDING
SCPT-9

SEISMIC CONE TEST RESULTS

Ground Surface Elev.:
Water Depth: ~2.57 m







SEISMIC TESTS -- SOUNDING NO. SCPT-9 Pigeon Point Landfill

Horizontal Distance for S-Wave	2.41 ft =	0.73 m
Distance of Geophones above Tip	0.67 ft =	0.20 m

Tip Depth		ρ	S-Wave	S1 or S2-Wave Arrival Times (msec)			Method	Delta Time	Shear Wave	Go	Average Vs	Average Go
(ft)	(m)	(kN/m³)	Distance (m)	First	Peak	Valley	(F,P,V)	(msec)	Velocity (m/s)	(bars)	(m/s)	(bars)
2.943	0.90	1.8	1.01	3.2	4.2		F	3.2	316	1792		
6.339	1.93	1.6	1.88	6.2	7	9.5	P	2.8	310	1537		
9.665	2.95	1.6	2.84	8	9.8	11.5	P	2.8	343	1884	323	1665
12.979	3.96	1.6	3.82		16.2	20.8	P	6.4	154	379		
16.289	4.96	1.6	4.82		18.2	22.2	P	2	497	3952		
19.619	5.98	1.6	5.82		20.5		P	2.3	437	3056		
22.92	6.99	1.7	6.82		22.8		P	2.3	434	3209	306	1596
26.236	8.00	1.7	7.83		25		P	2.2	457	3552		
29.553	9.01	1.7	8.83		26		P	1	1007	17245		
32.852	10.01	1.7	9.84		28		P	2	501	4270	580	5715

SEA-10

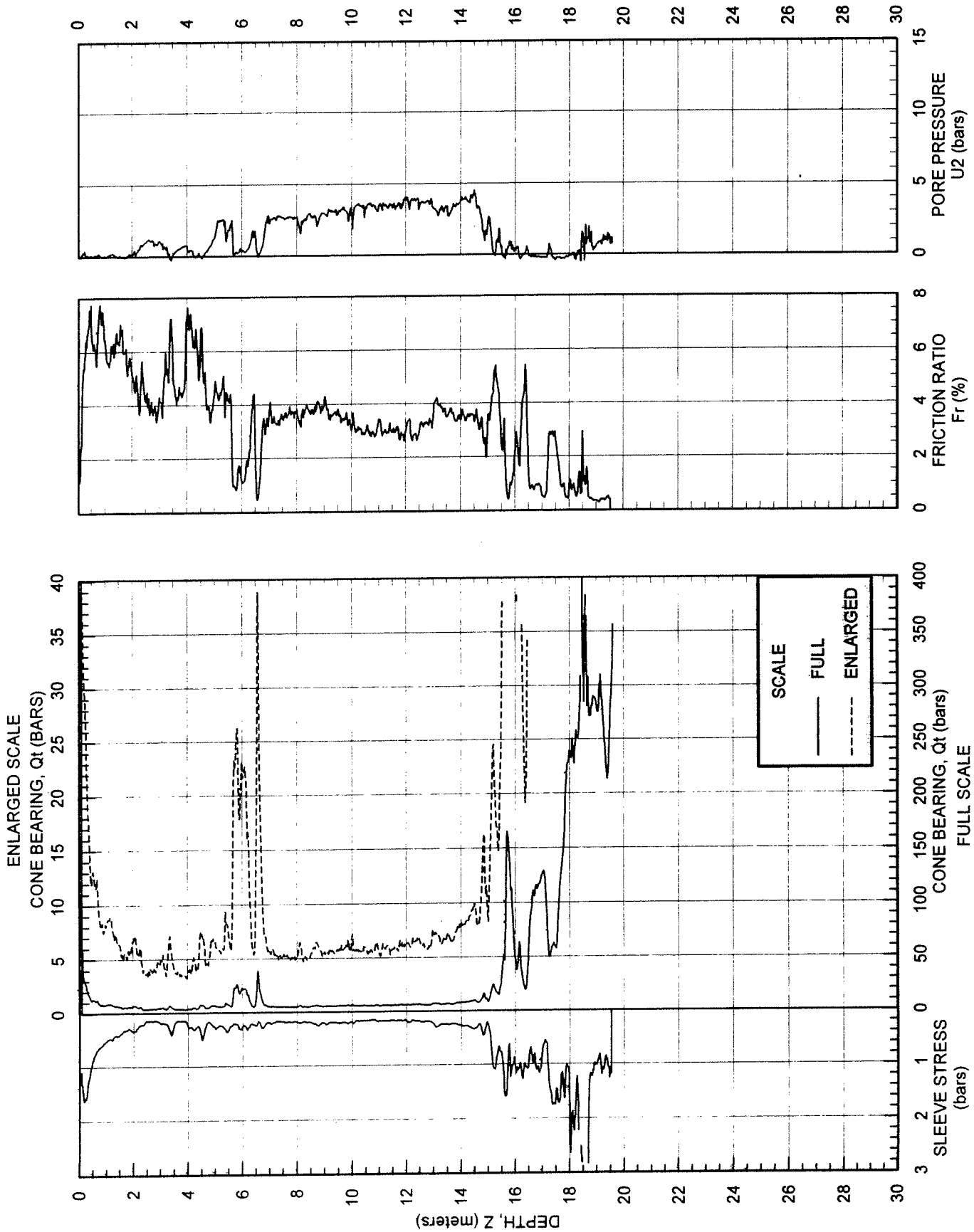
PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

IN-SITU SOIL TESTING, LLC.
ENGINEER: R. Failmezger
SOUNDING DATE: 8-11-98

SOUNDING
CPT-10

ELECTRIC CONE PENETROMETER RESULTS

Ground Surface Elev.:
Water Depth: Caved 1.60 m



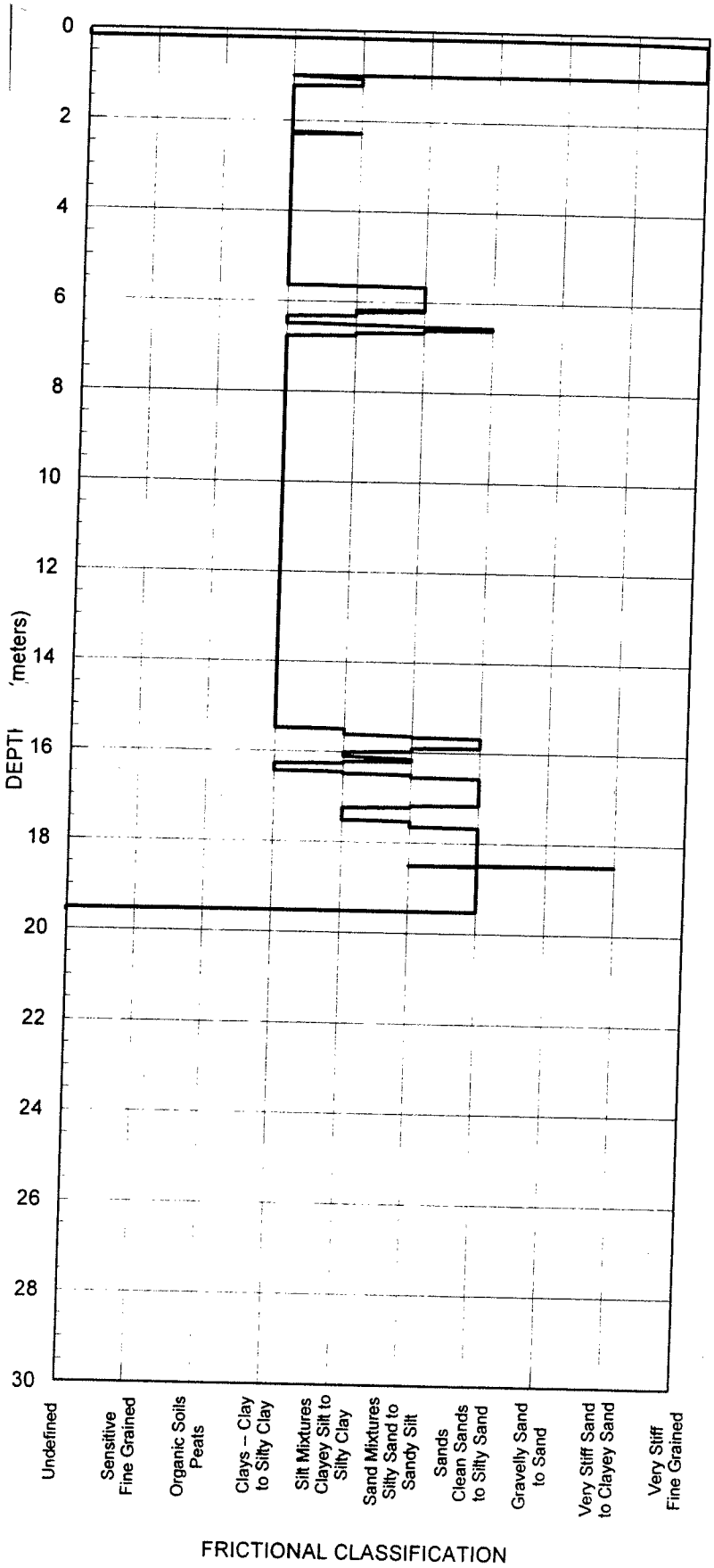
SEA-10

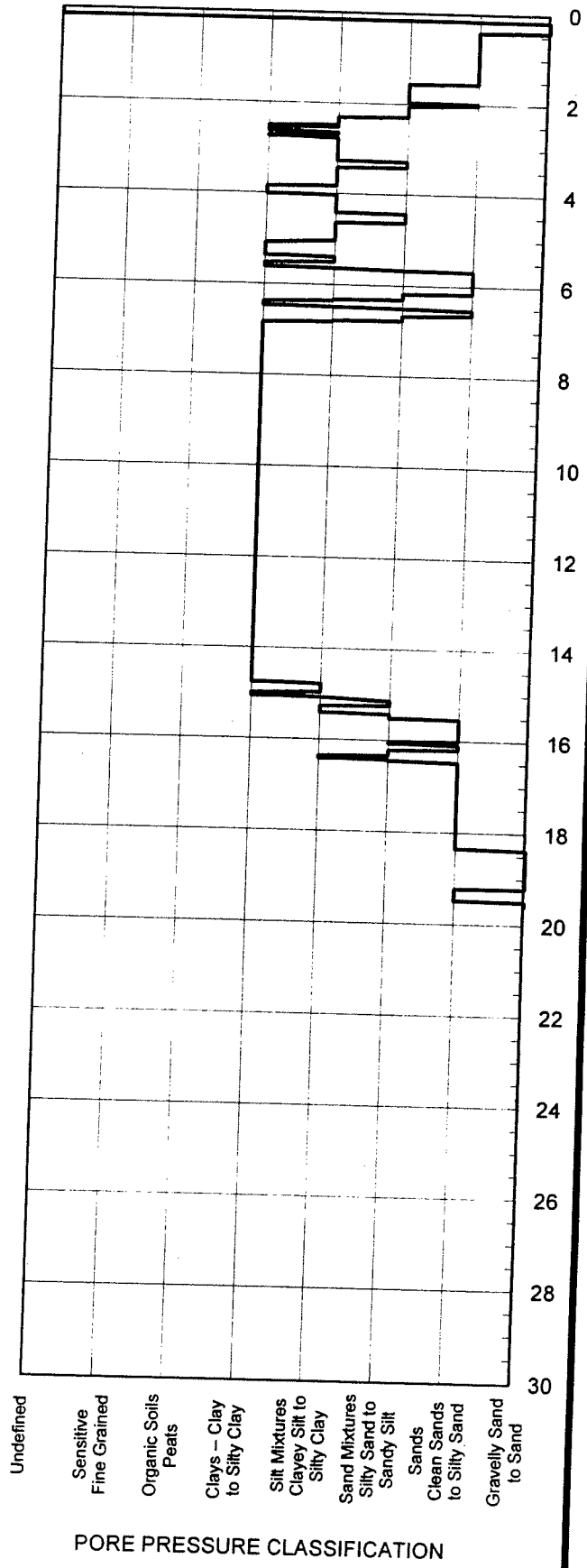
PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

IN-SITU SOIL TESTING, L.C.
ENGINEER: R. Failmezger
SOUNDING DATE: 8-11-98

SOUNDING
CPT-10

SOIL BEHAVIOR CLASSIFICATION (ROBERTSON, 1990)





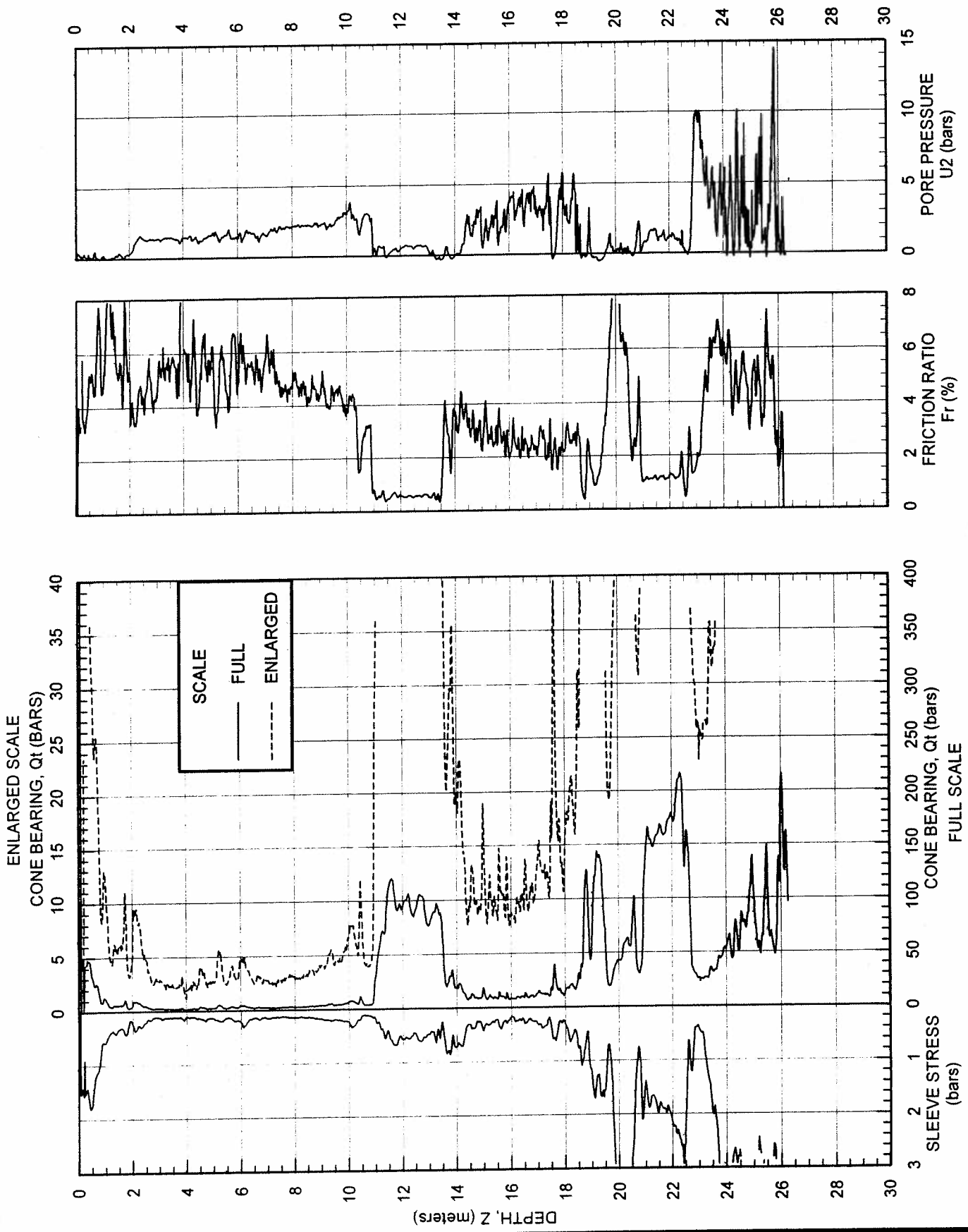
PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

IN-SITU SOIL TESTING, L.C.
ENGINEER: R. Fallmezger
SOUNDING DATE: 8-11-98

SOUNDING
CPT-11

ELECTRIC CONE PENETROMETER RESULTS

Ground Surface Elev.:
Water Depth: Caved 3.00 m

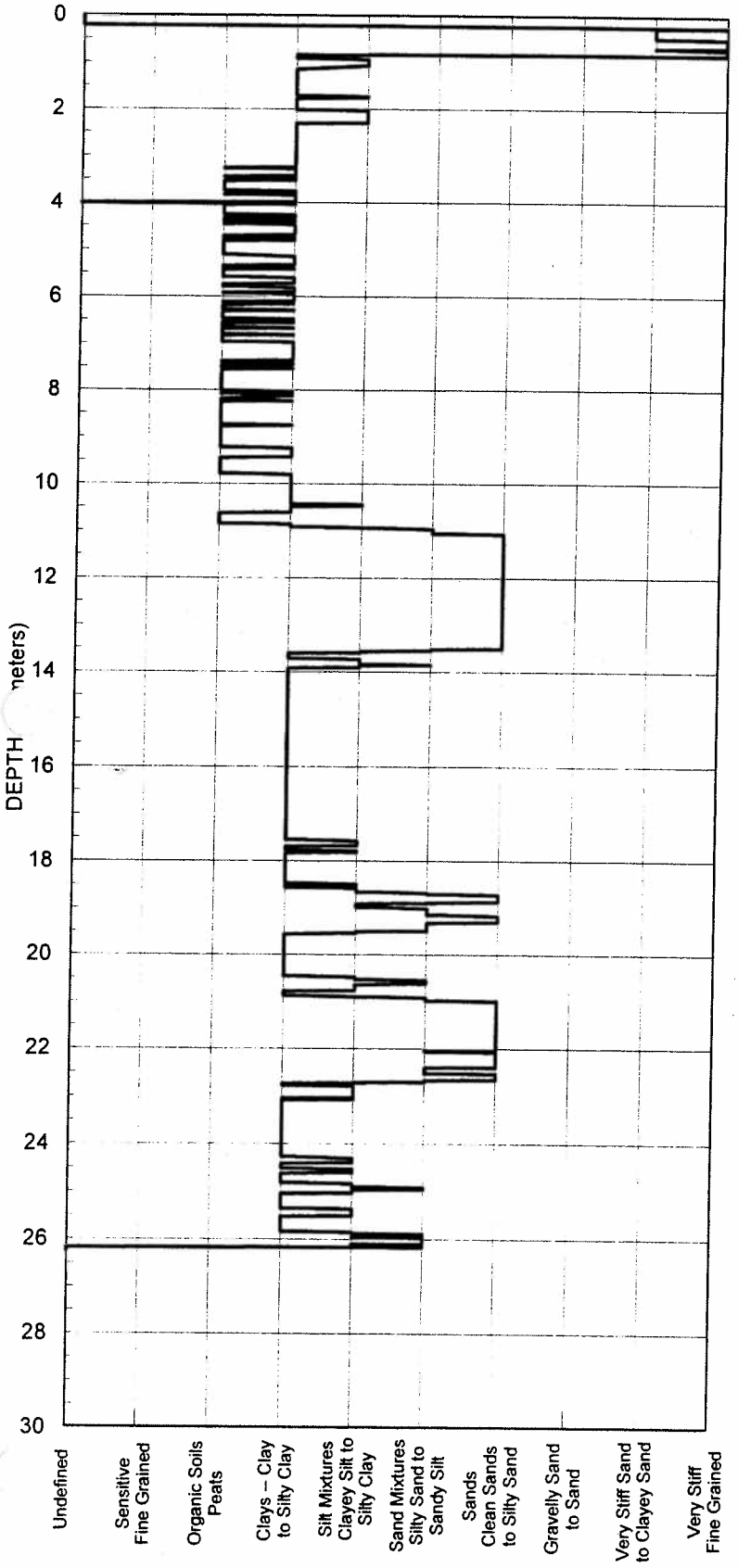


PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

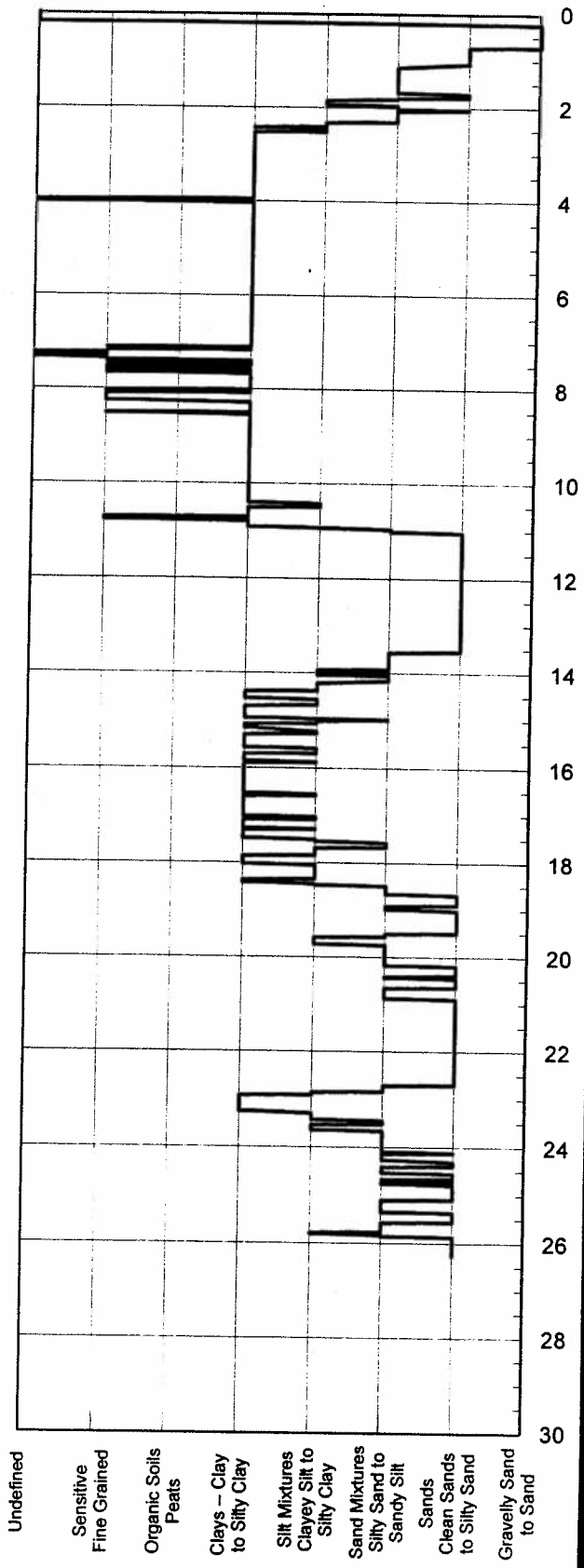
IN-SITU SOIL TESTING, L.C.
ENGINEER: R. Fallmezger
SOUNDING DATE: 8-11-98

SOUNDING
CPT-11

SOIL BEHAVIOR CLASSIFICATION (ROBERTSON, 1990)



FRICTIONAL CLASSIFICATION



PORE PRESSURE CLASSIFICATION

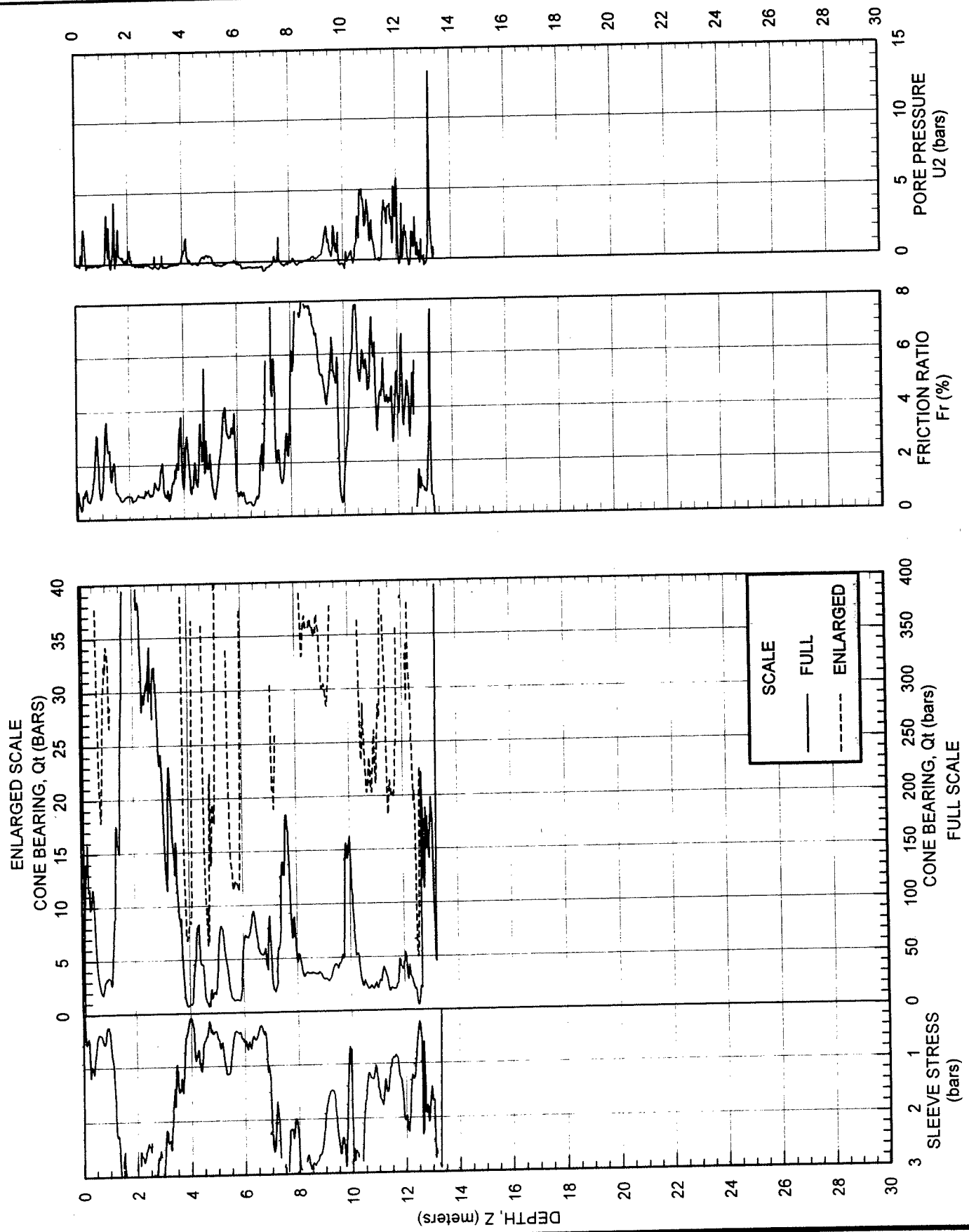
PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

IN-SITU SOIL TESTING, LC.
ENGINEER: R. Failmezger
SOUNDING DATE: 8-11-98

SOUNDING
CPT-12

ELECTRIC CONE PENETROMETER RESULTS

Ground Surface Elev.:
Water Depth: 6.10 m

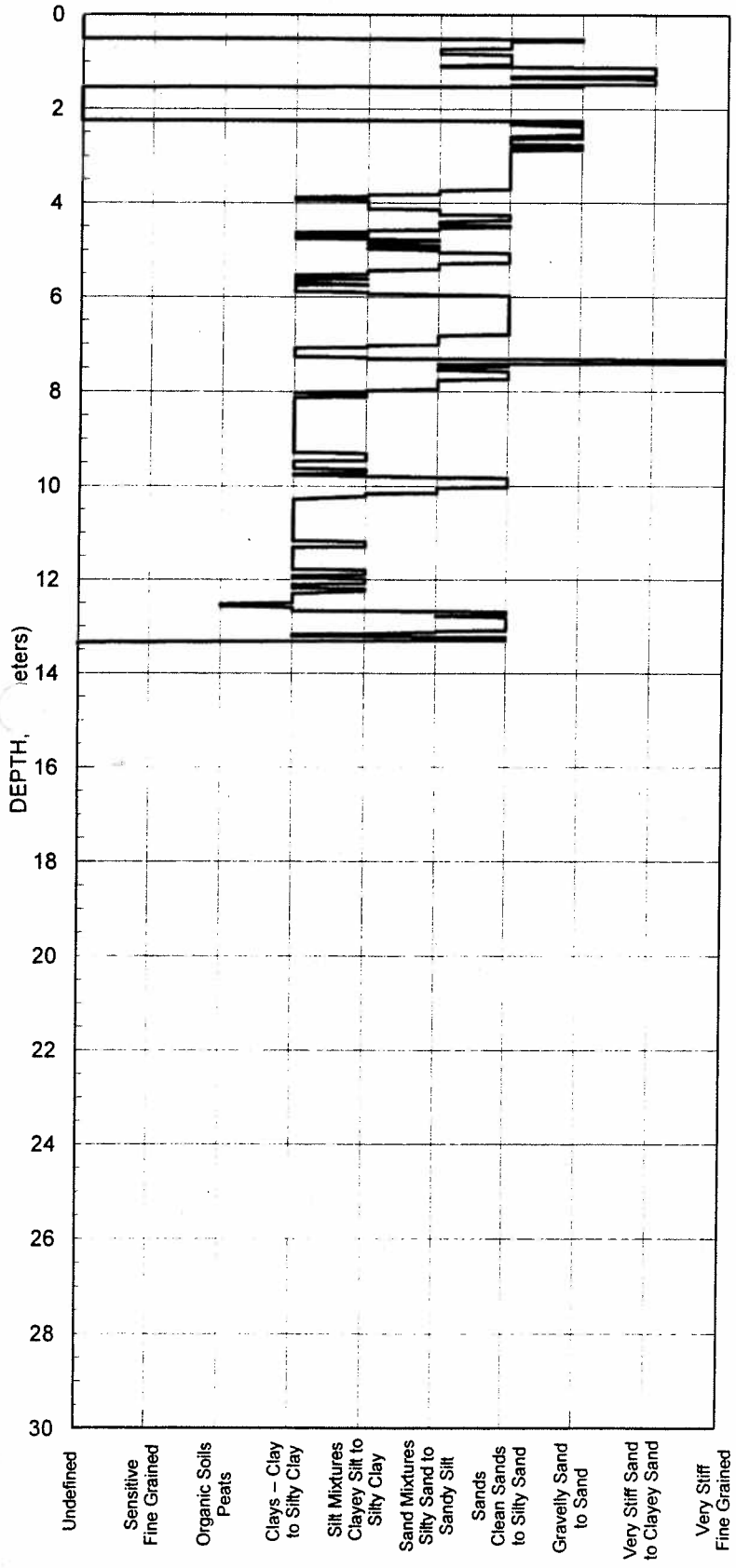


PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

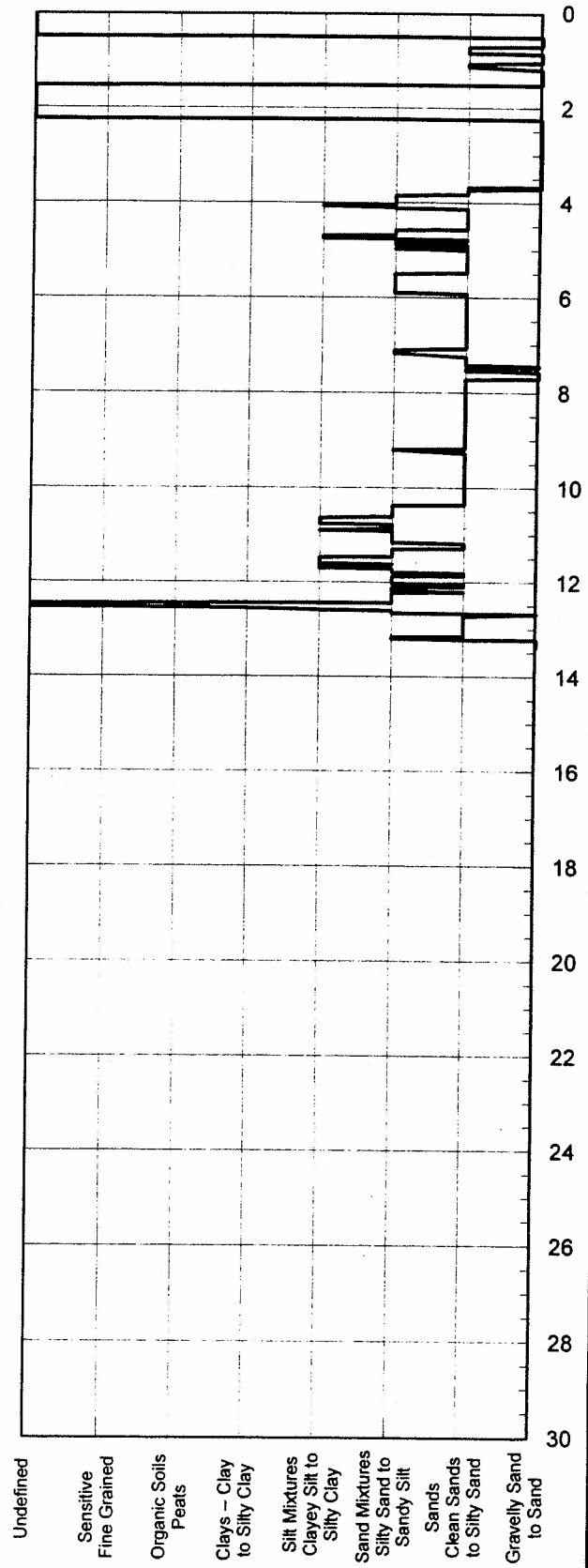
IN-SITU SOIL TESTING, L.C.
ENGINEER: R. Fallmezger
SOUNDING DATE: 8-11-98

SOUNDING
CPT-12

SOIL BEHAVIOR CLASSIFICATION (ROBERTSON, 1990)



FRICTIONAL CLASSIFICATION



PORE PRESSURE CLASSIFICATION

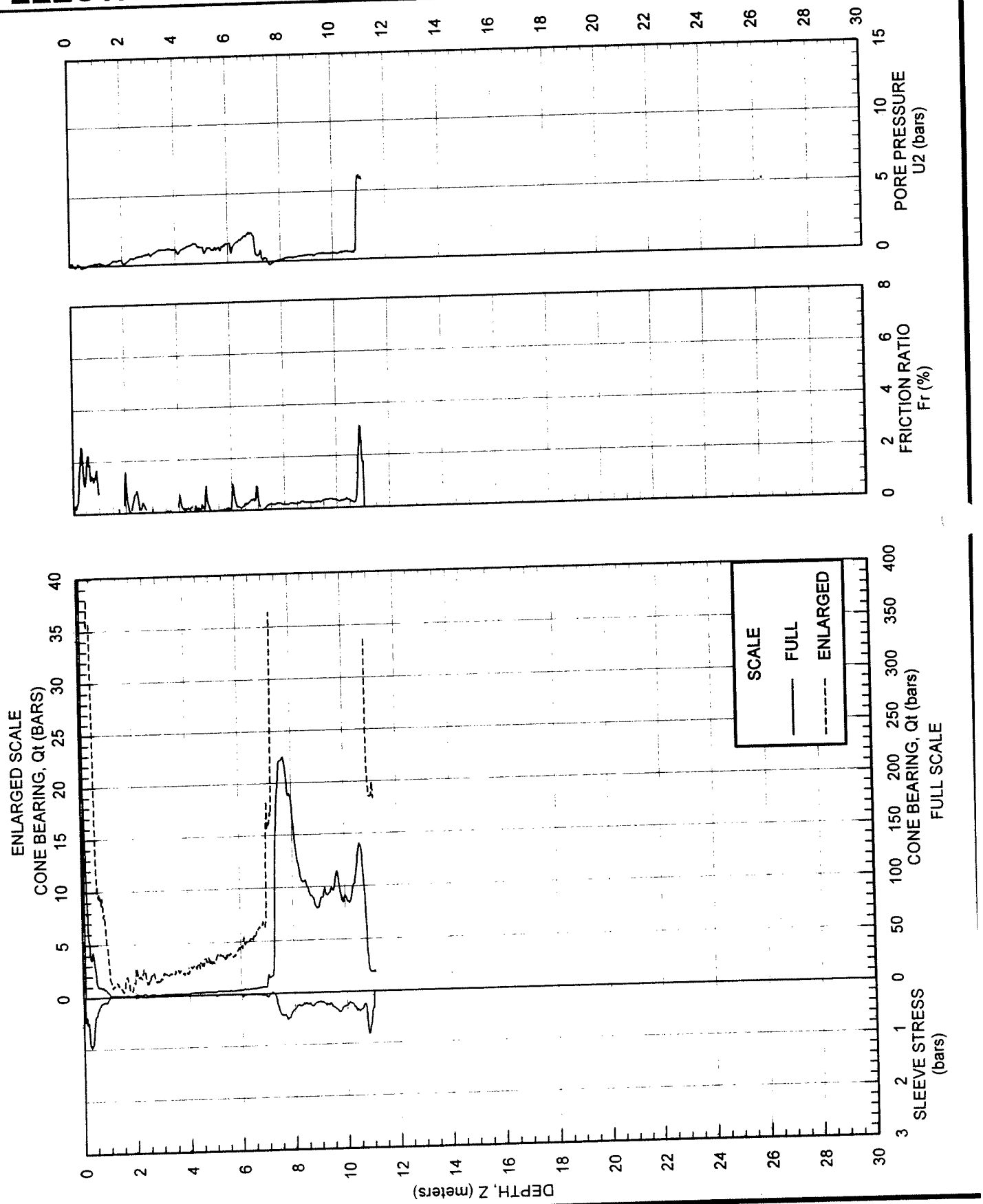
PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

IN-SITU SOIL TESTING, L.C.
ENGINEER: R. Failmezger
SOUNDING DATE: 8-20-98

SOUNDING
SCPT-13

ELECTRIC CONE PENETROMETER RESULTS

Ground Surface Elev.:
Water Depth: 2.47 m

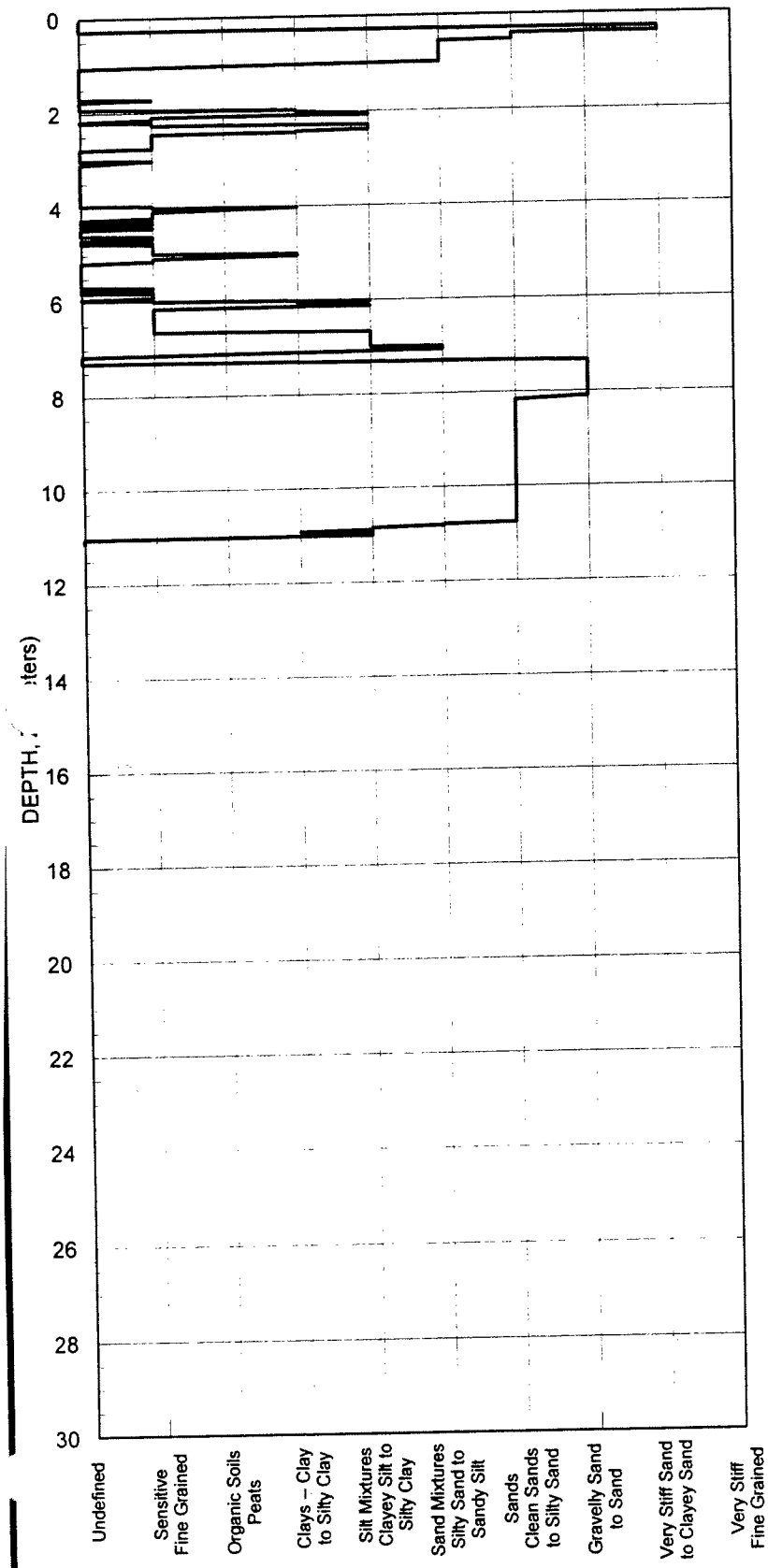


PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

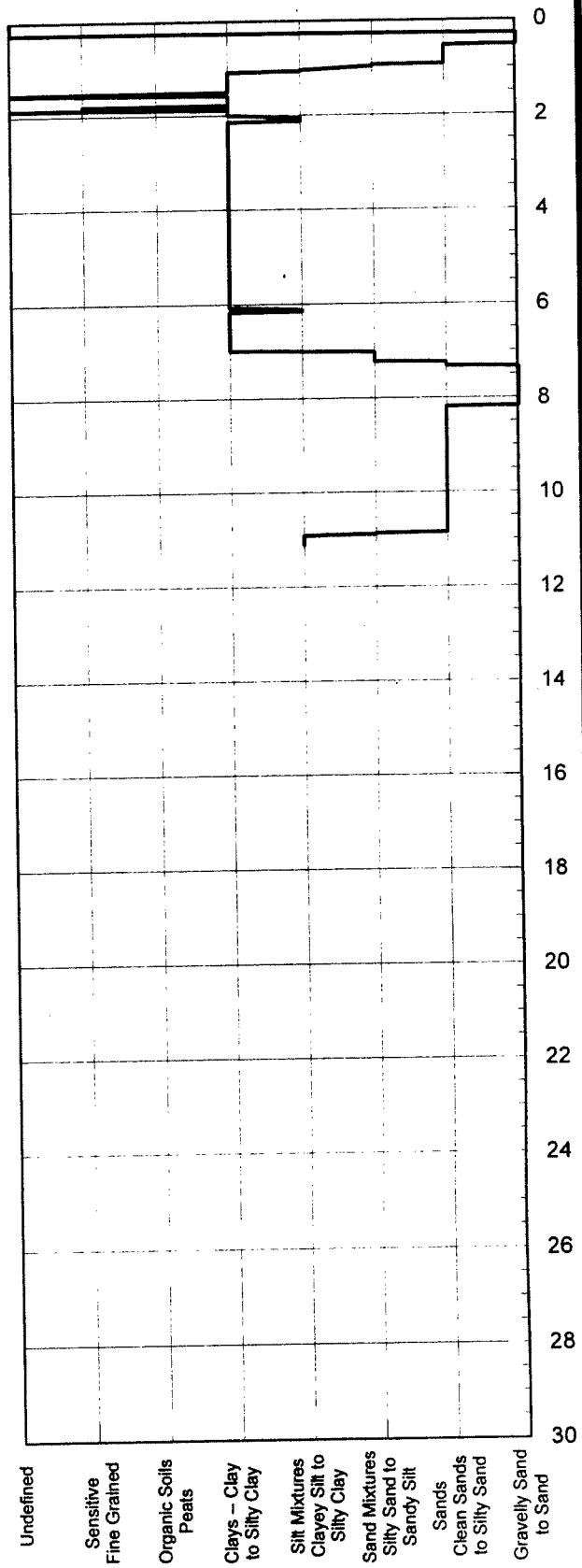
IN-SITU SOIL TESTING, L.C.
ENGINEER: R. Fallmezger
SOUNDING DATE: 8-20-98

SOUNDING
SCPT-13

SOIL BEHAVIOR CLASSIFICATION (ROBERTSON, 1990)



FRICTIONAL CLASSIFICATION



PORE PRESSURE CLASSIFICATION

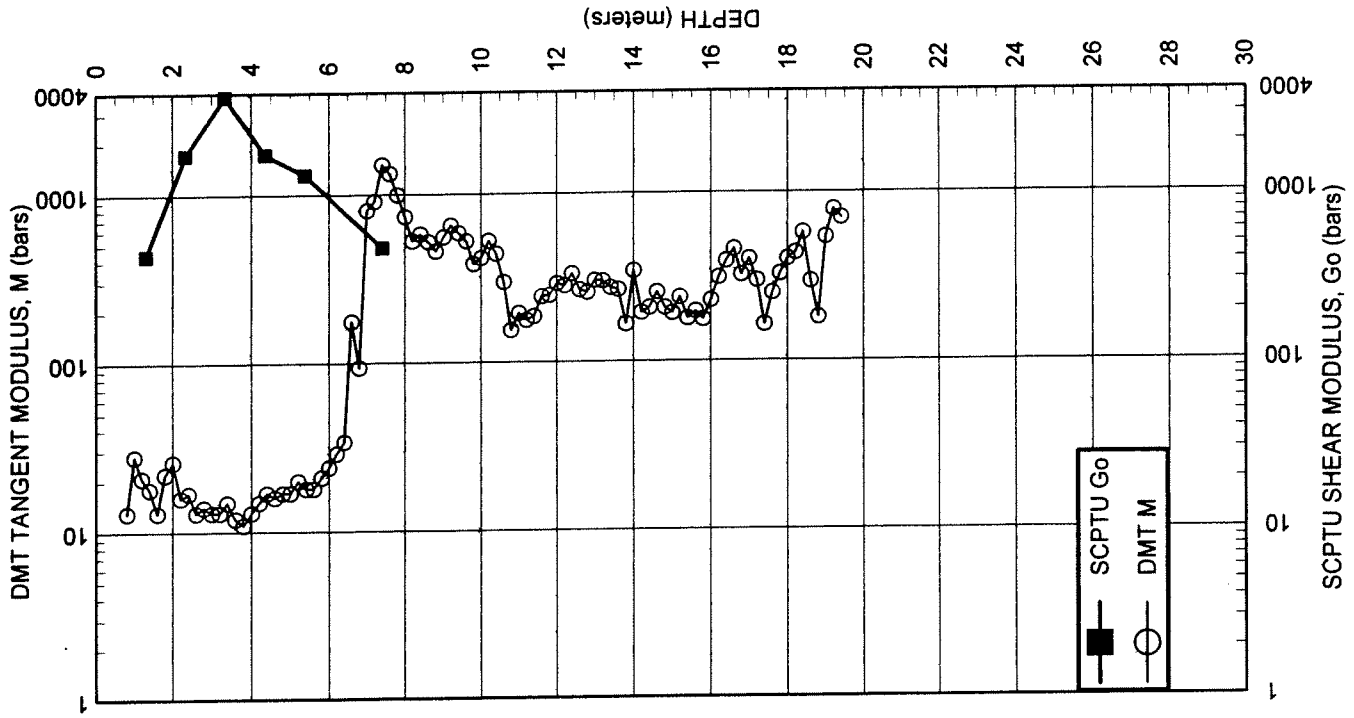
PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

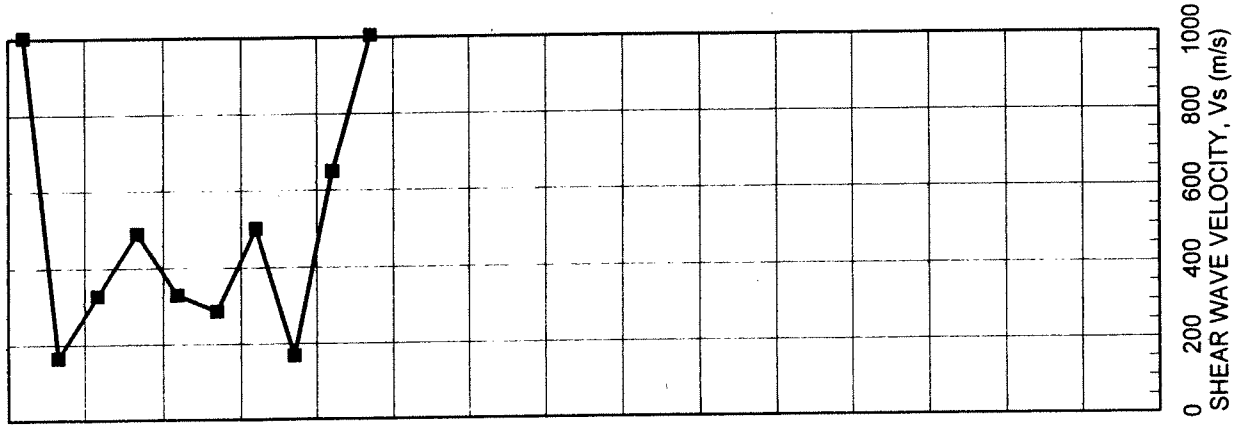
IN-SITU SOIL TESTING, L.C.
ENGINEER: R. Fallmezger
SOUNDING DATE: 8-20-98

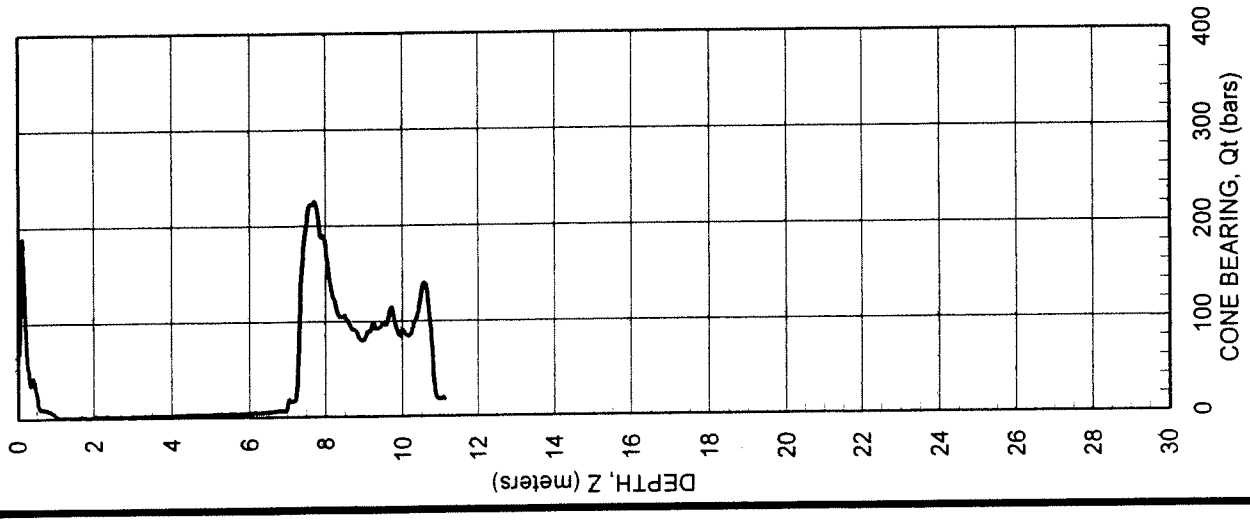
SOUNDING
SCPT-1

SEISMIC CONE TEST RESULTS

Ground Surface Elev.:
Water Depth: ~2.47 m







SEISMIC TESTS -- SOUNDING NO. SCPT-13 Pigeon Point Landfill

Horizontal Distance for S-Wave 2.97 ft = 0.91 m
Distance of Geophones above Tip 0.67 ft = 0.20 m

Tip Depth		ρ	S-Wave	S1 or S2-Wave Arrival Times (msec)			Method	Delta Time	Shear Wave	Go	Average Vs	Average Go
(ft)	(m)	(kN/m^3)	Distance (m)	First	Peak	Valley	(F,P,V)	(msec)	Velocity (m/s)	(bars)	(m/s)	(bars)
3.288	1.00	1.8	1.21	1.2	4.2		F	1.2	1006	18203	1006	18203
6.635	2.02	1.6	2.03	6.2	8.1		F	5	165	435		
9.99	3.04	1.6	2.98		11		P	2.9	328	1719		
13.323	4.06	1.6	3.96		13		P	2	490	3841		
16.636	5.07	1.6	4.95		16		P	3	329	1737	290	1347
19.97	6.09	1.6	5.95		19.5		P	3.5	286	1311		
23.29	7.10	1.7	6.95		21.5		P	2	501	4266		
26.63	8.12	1.7	7.96		27.5		P	6	168	482		
29.847	9.10	1.7	8.94		29		P	1.5	650	7181	307	1601
33.169	10.11	1.7	9.95		30	35	P	1	1008	17269	1008	17269

SEA-14

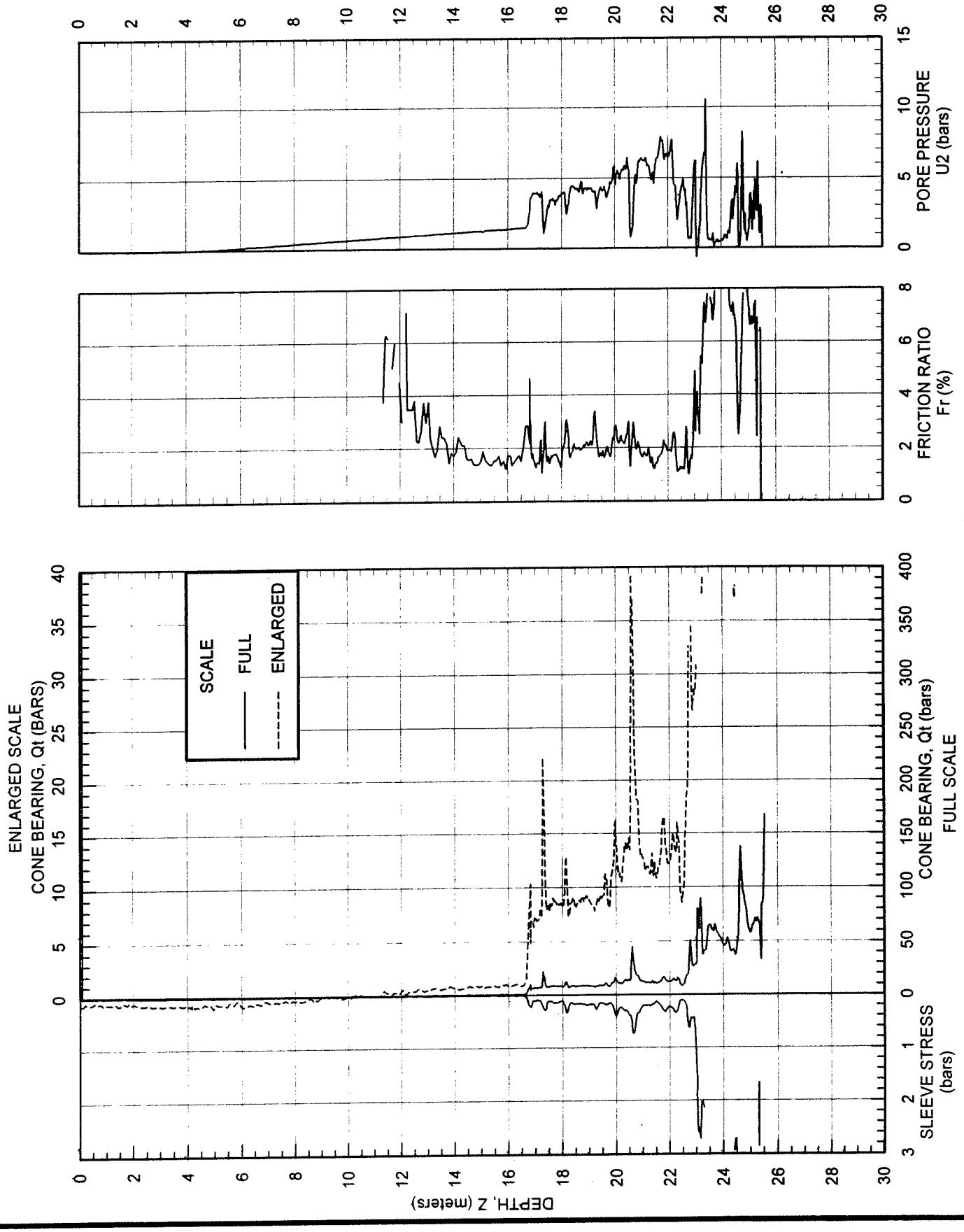
PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

IN-SITU SOIL TESTING, L.C.
ENGINEER: R. Fallmezger
SOUNDING DATE: 8-11-98

SOUNDING
CPT-14

ELECTRIC CONE PENETROMETER RESULTS

Ground Surface Elev.:
Water Depth: ~8.2 m

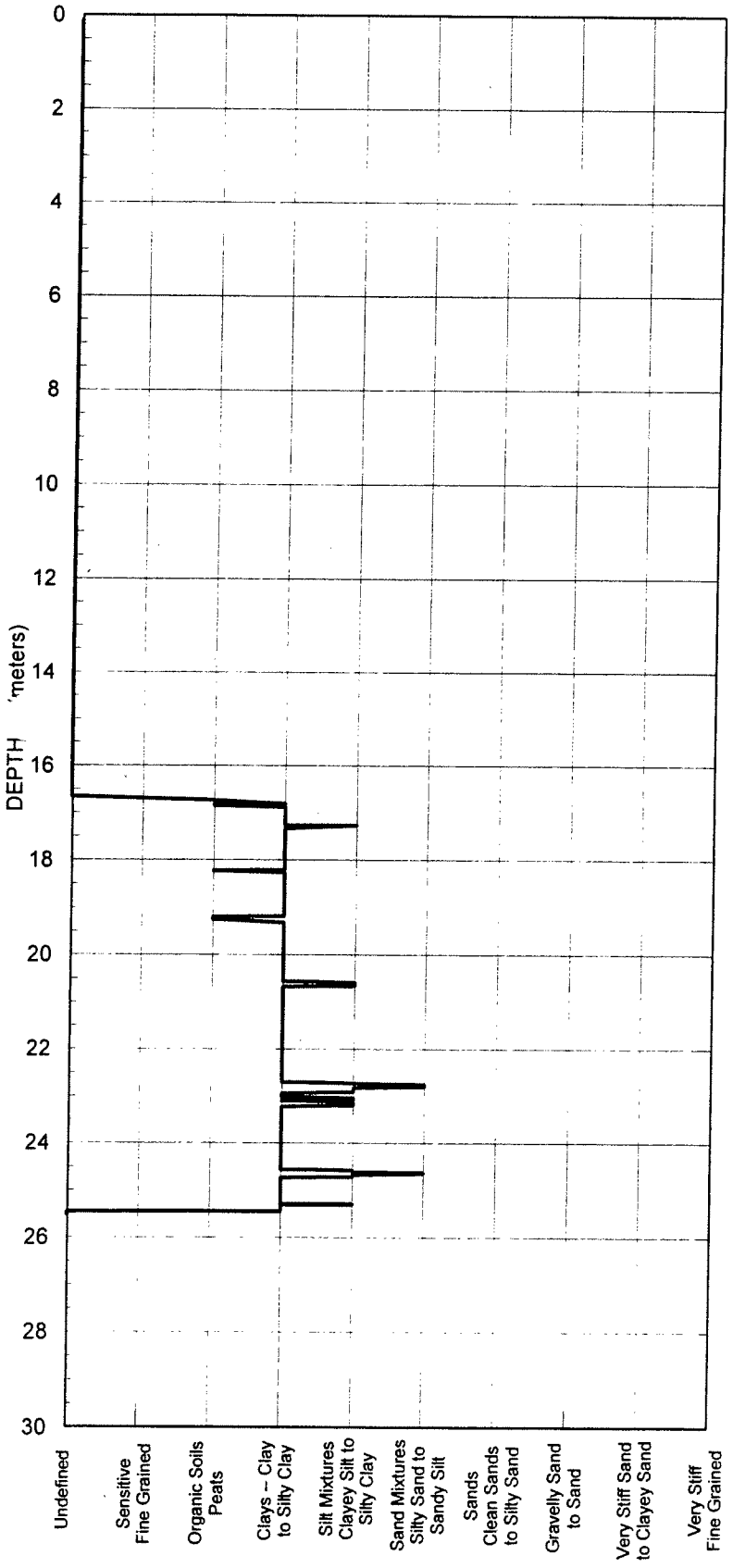


PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

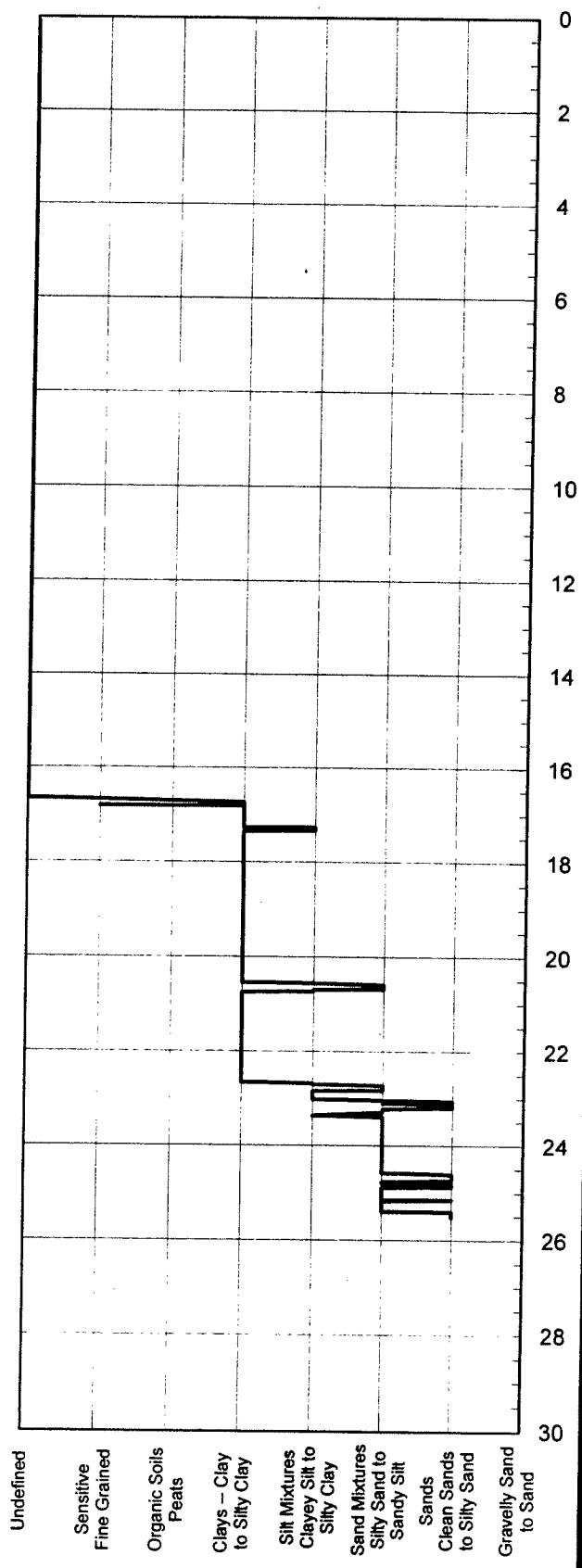
IN-SITU SOIL TESTING, LLC.
ENGINEER: R. Fallmezger
SOUNDING DATE: 8-11-98

SOUNDING
CPT-14

SOIL BEHAVIOR CLASSIFICATION (ROBERTSON, 1990)



FRICTIONAL CLASSIFICATION



PORE PRESSURE CLASSIFICATION

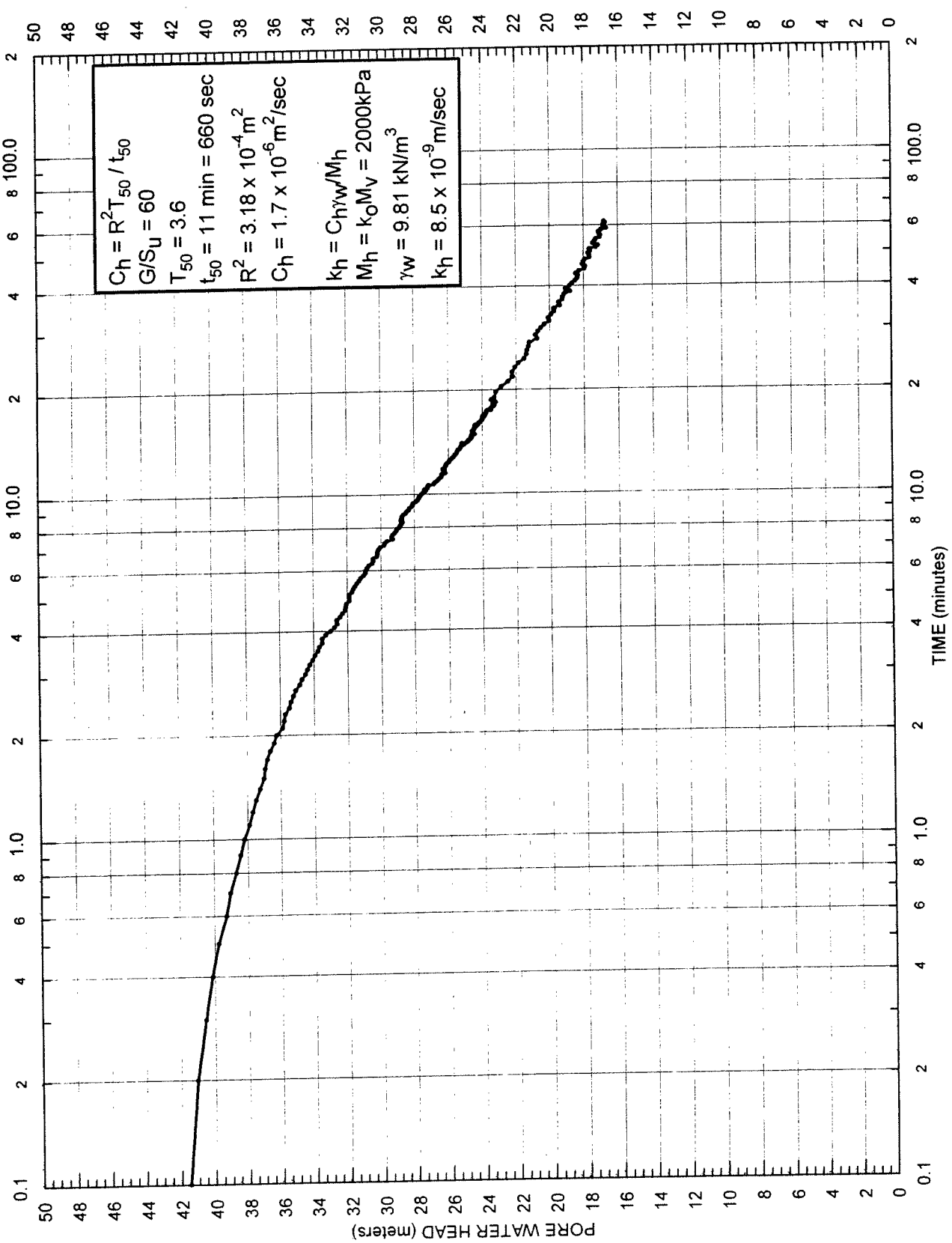
PROJECT: Pigeon Point Landfill
LOCATION: Wilmington, Delaware

IN-SITU SOIL TESTING, L.C.
ENGINEER: R. Failmezger
SOUNDING DATE: 8-11-98

SOUNDING
CPT-14

CPT DISSIPATION TEST RESULTS

Depth = 19.3 m



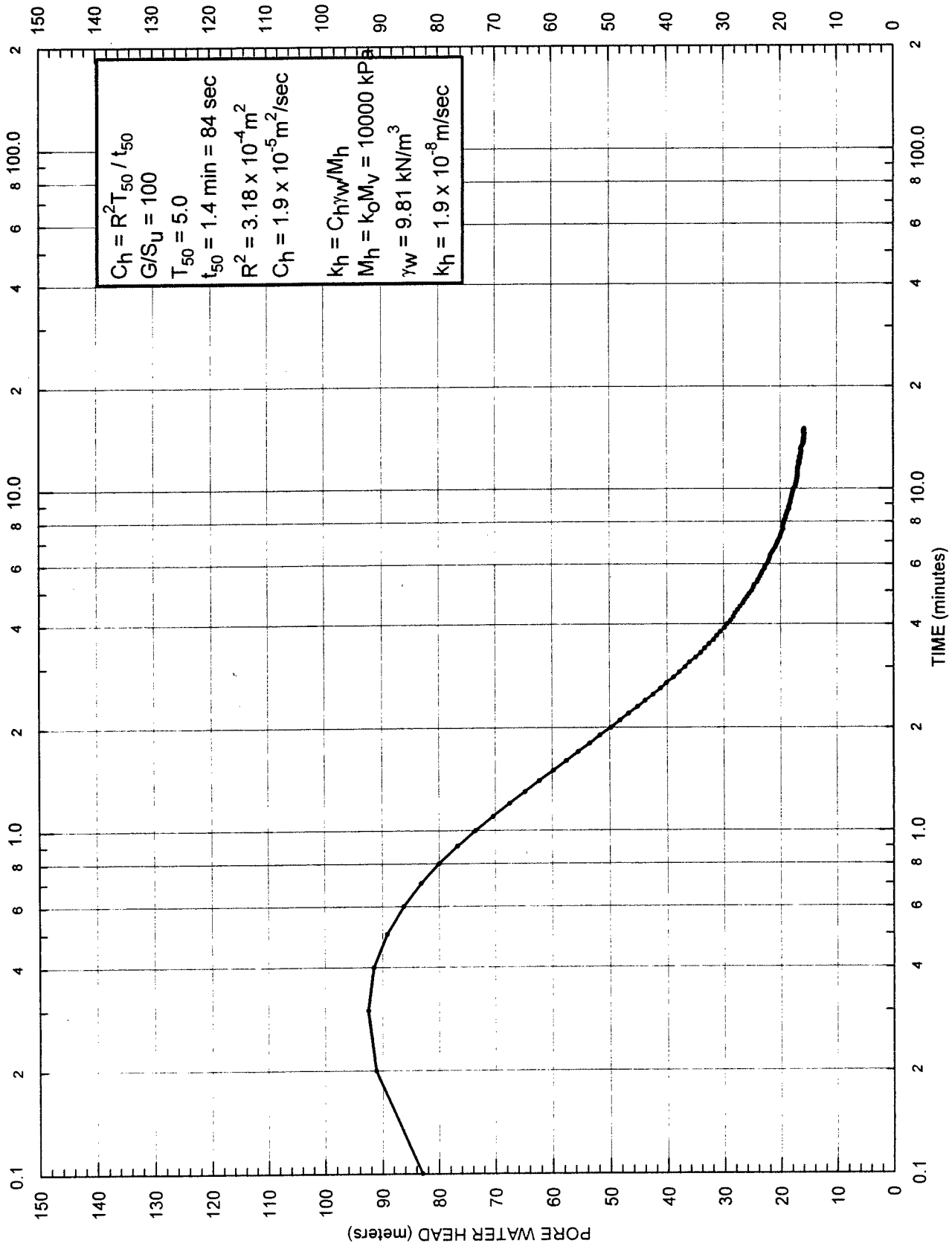
PROJECT: Pigeon Point Landfill
LOCATION: Wilmington, Delaware

IN-SITU SOIL TESTING, L.C.
ENGINEER: R. Failmezger
SOUNDING DATE: 8-11-98

SOUNDING
CPT-14

CPT DISSIPATION TEST RESULTS

Depth = 25.4 m



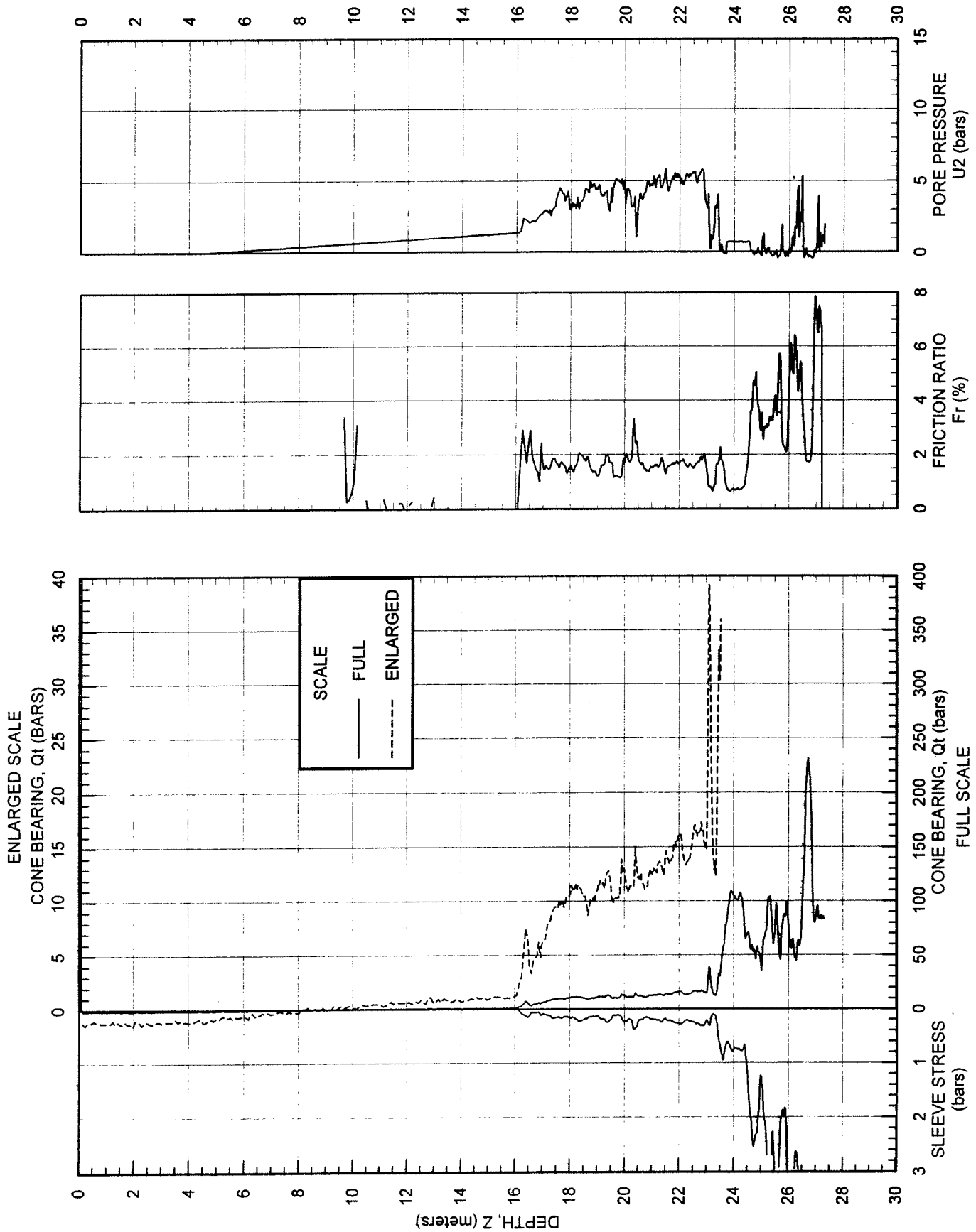
PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

IN-SITU SOIL TESTING, L.C.
ENGINEER: R. Fallmezger
SOUNDING DATE: 8-12-98

SOUNDING
CPT-16

ELECTRIC CONE PENETROMETER RESULTS

Ground Surface Elev.:
Water Depth: ~8.2 m

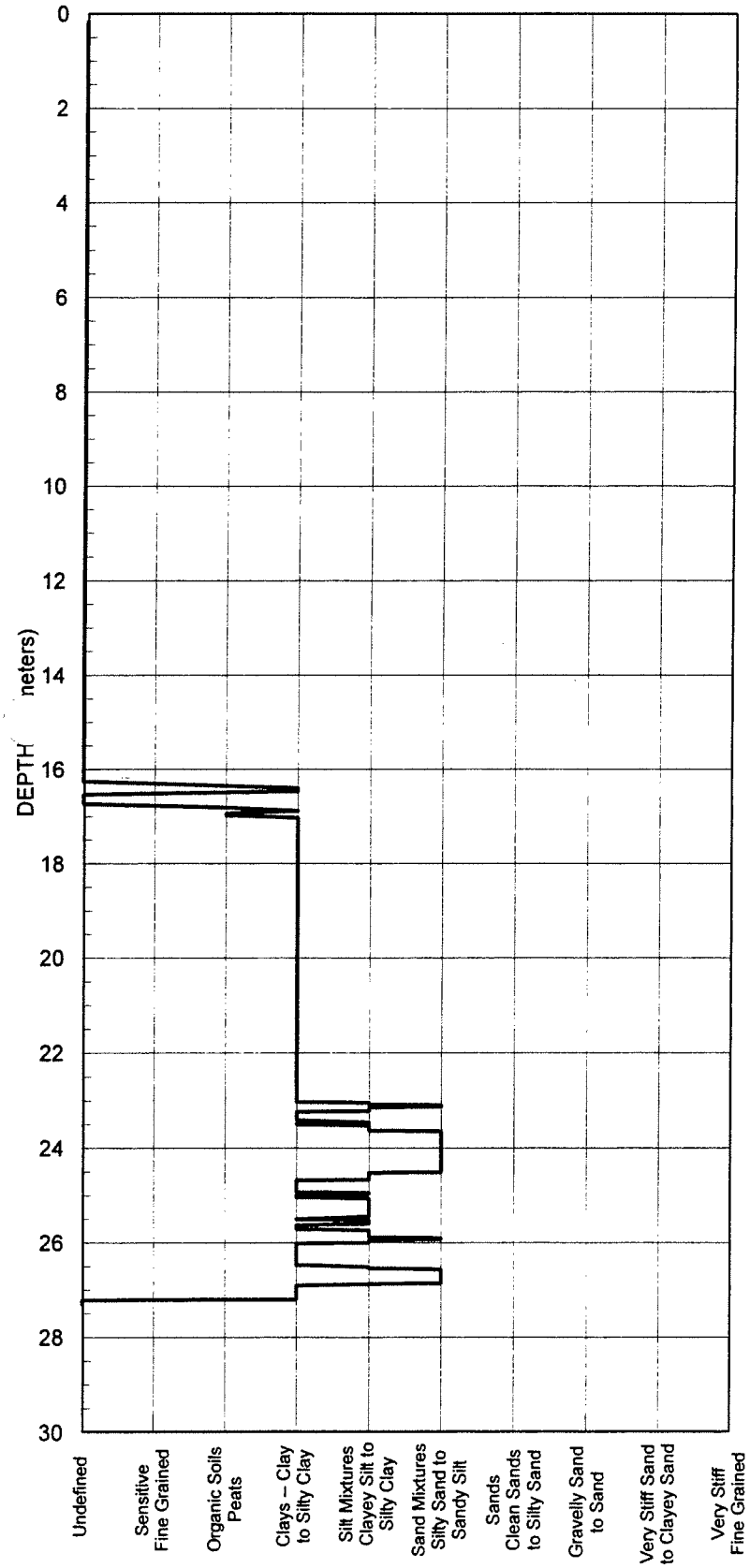


PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

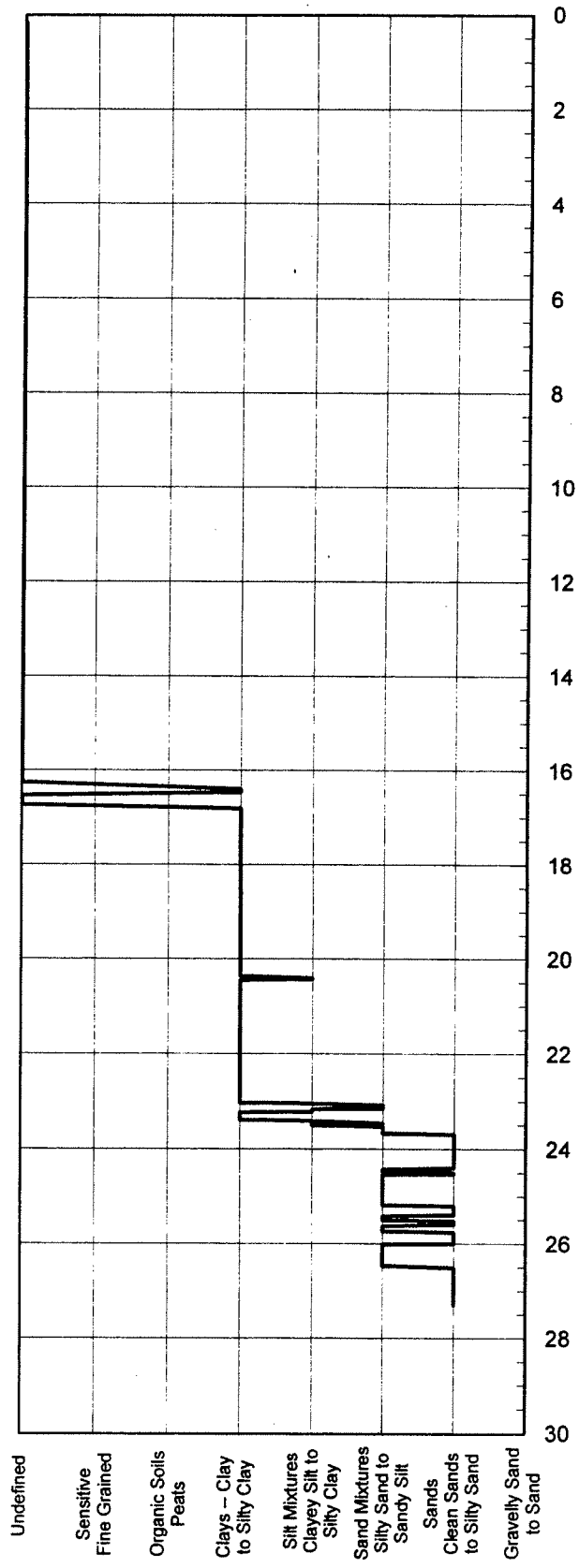
IN-SITU SOIL TESTING, L.C.
ENGINEER: R. Fallmezger
SOUNDING DATE: 8-12-98

SOUNDING
CPT-16

SOIL BEHAVIOR CLASSIFICATION (ROBERTSON, 1990)



FRICTIONAL CLASSIFICATION



PORE PRESSURE CLASSIFICATION

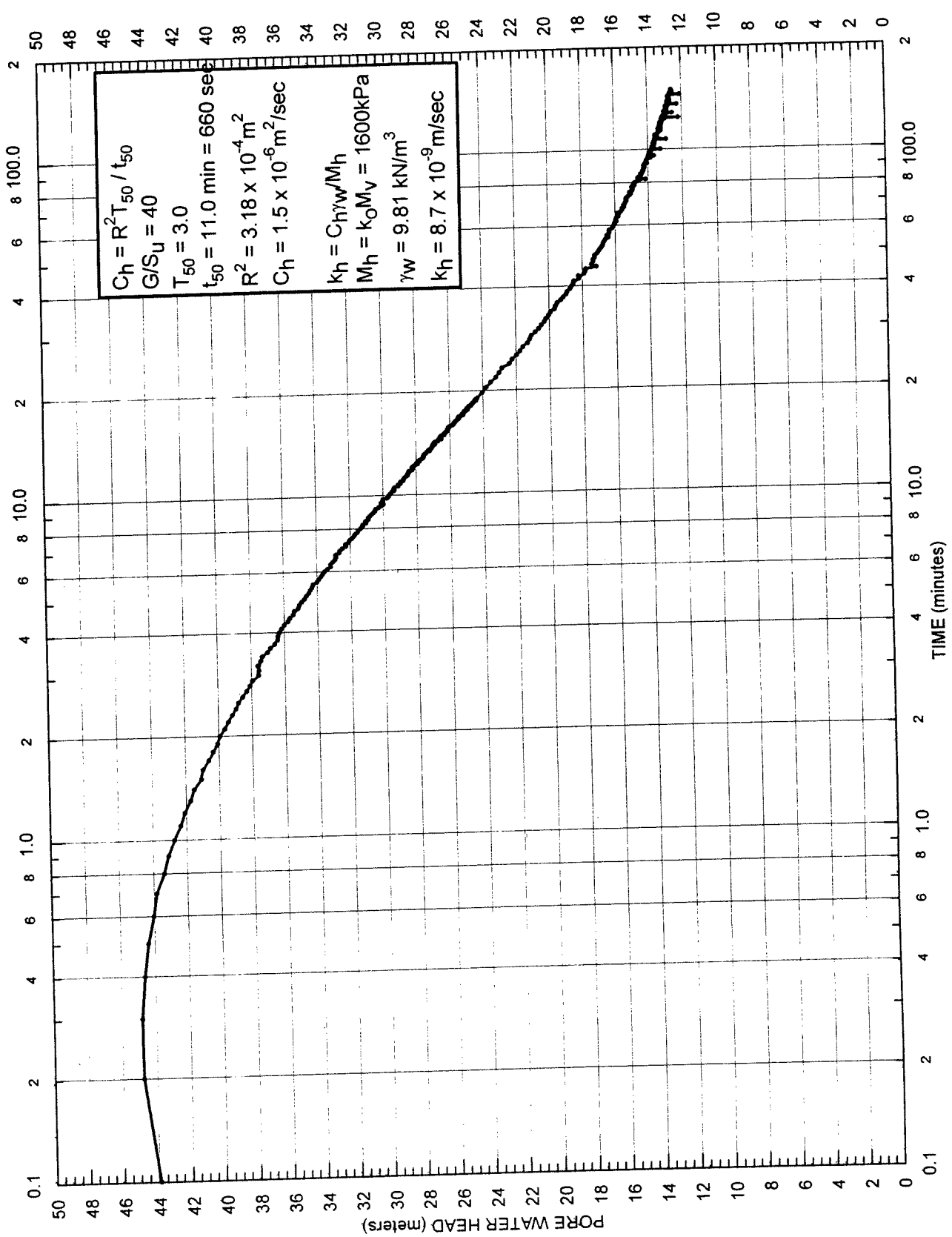
PROJECT: Pigeon Point Landfill
LOCATION: Wilmington, Delaware

IN-SITU SOIL TESTING, L.C.
ENGINEER: R. Failmezger
SOUNDING DATE: 8-12-98

SOUNDING
CPT-16

CPT DISSIPATION TEST RESULTS

Depth = 20.4 m



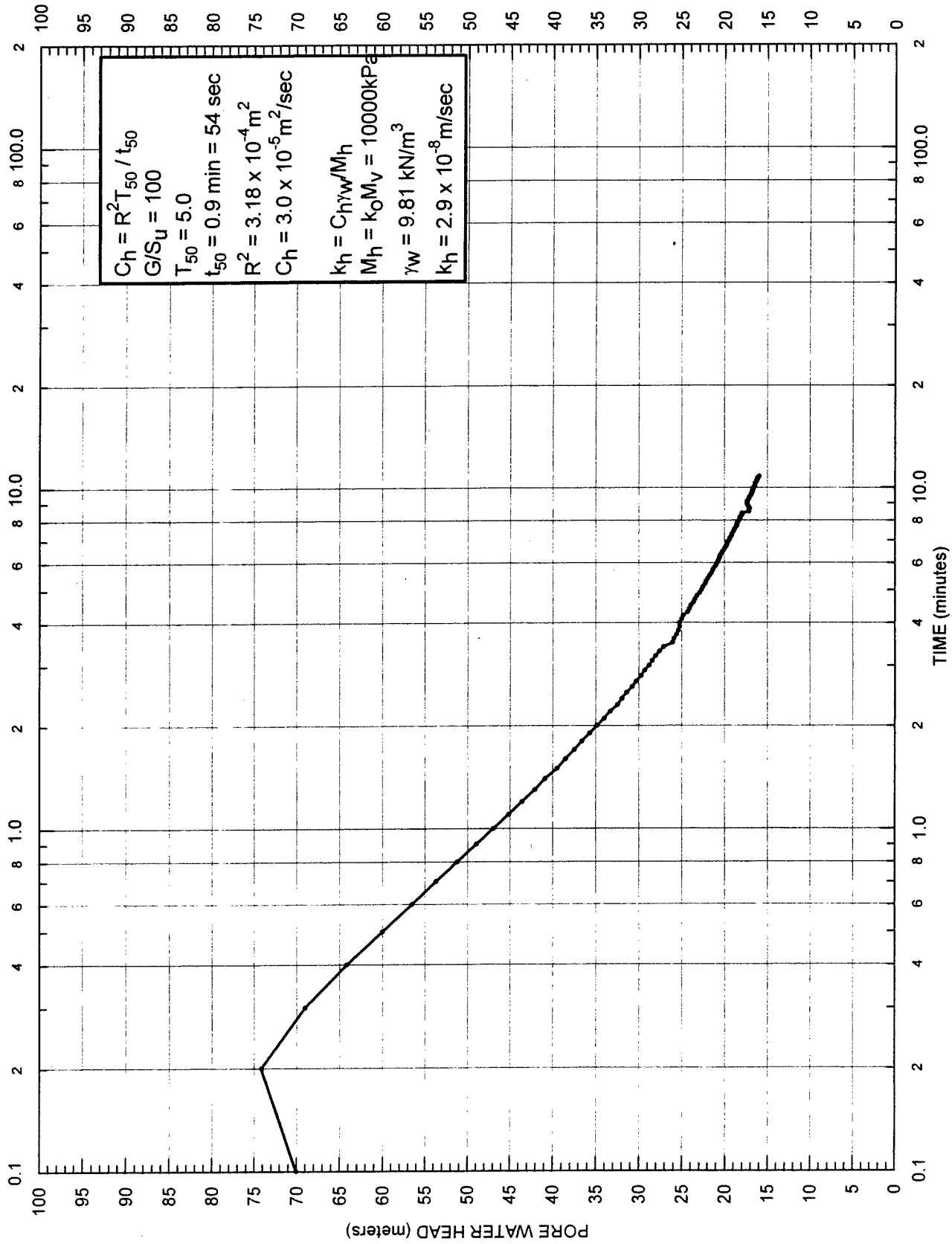
PROJECT: Pigeon Point Landfill
LOCATION: Wilmington, Delaware

IN-SITU SOIL TESTING, L.C.
ENGINEER: R. Failmezger
SOUNDING DATE: 8-12-98

SOUNDING
CPT-16

CPT DISSIPATION TEST RESULTS

Depth = 26.5 m



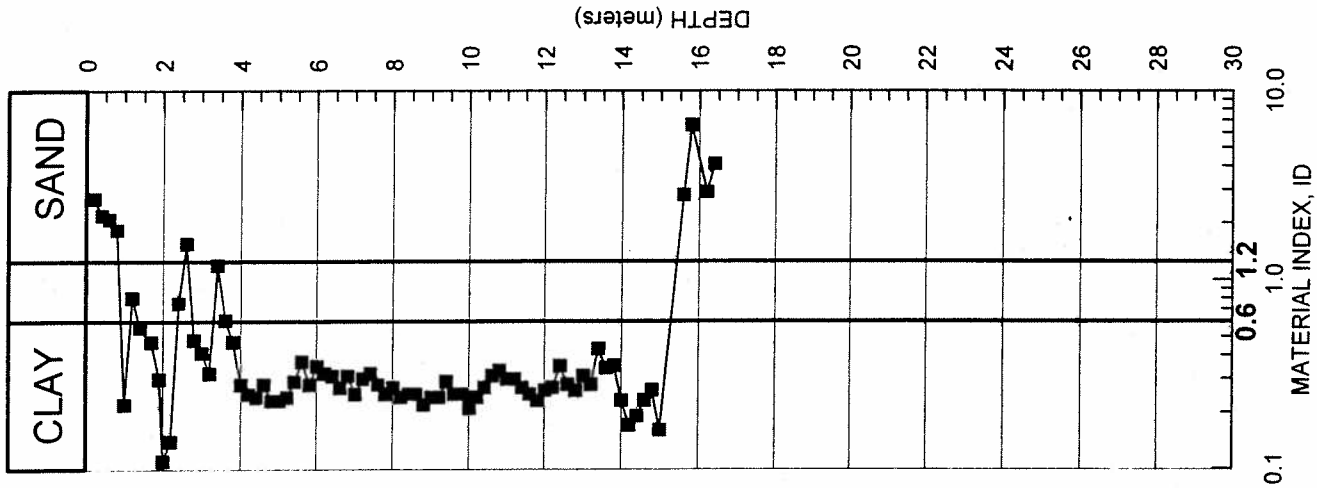
PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

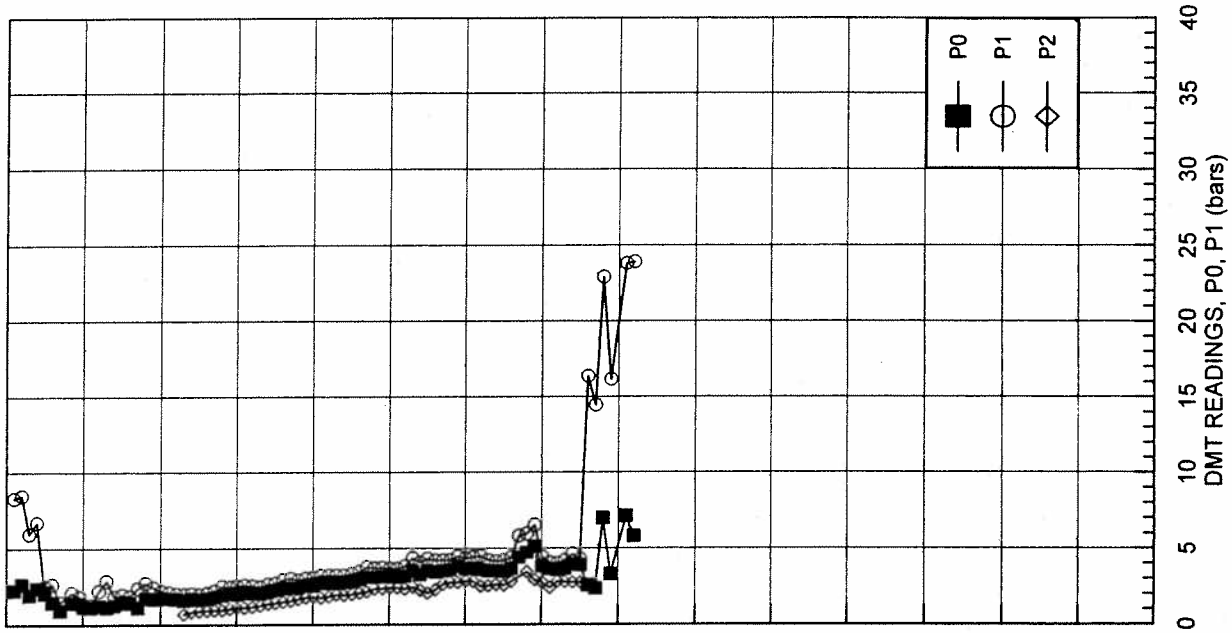
IN-SITU SOIL TESTING, L.C.
ENGINEER: R. Failmezger
SOUNDING DATE: 8-18-98

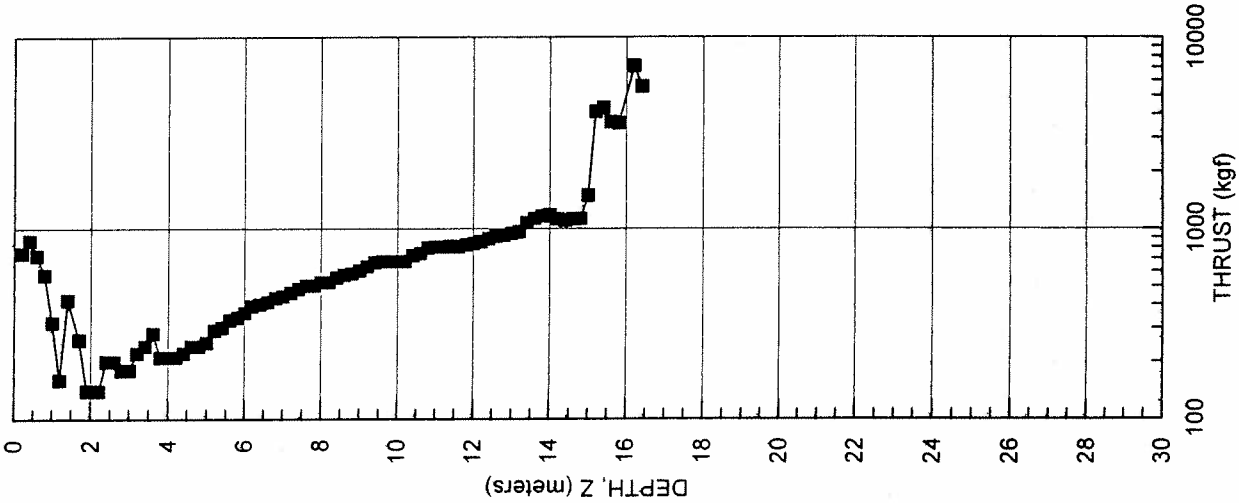
SOUNDING
D-9

DILATOMETER RESULTS

Ground Surface Elev.:
Water Depth: ~2.57 m







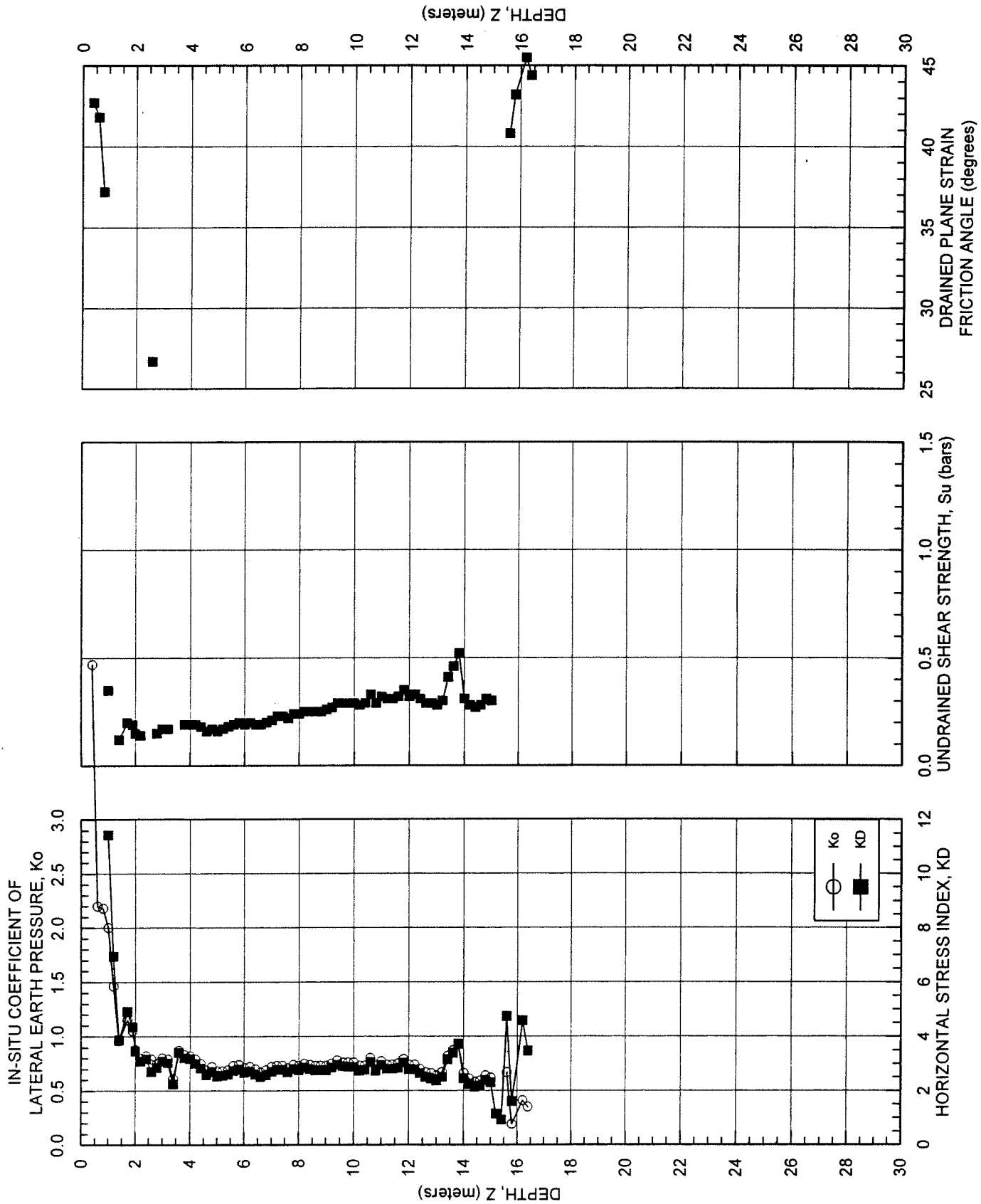
PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

IN-SITU SOIL TESTING, L.C.
ENGINEER: R. Fallmezger
SOUNDING DATE: 8-18-98

SOUNDING
D-9

INTERPRETED DMT STRENGTH PARAMETERS

Ground Surface Elev.:
Water Depth: ~2.57 m



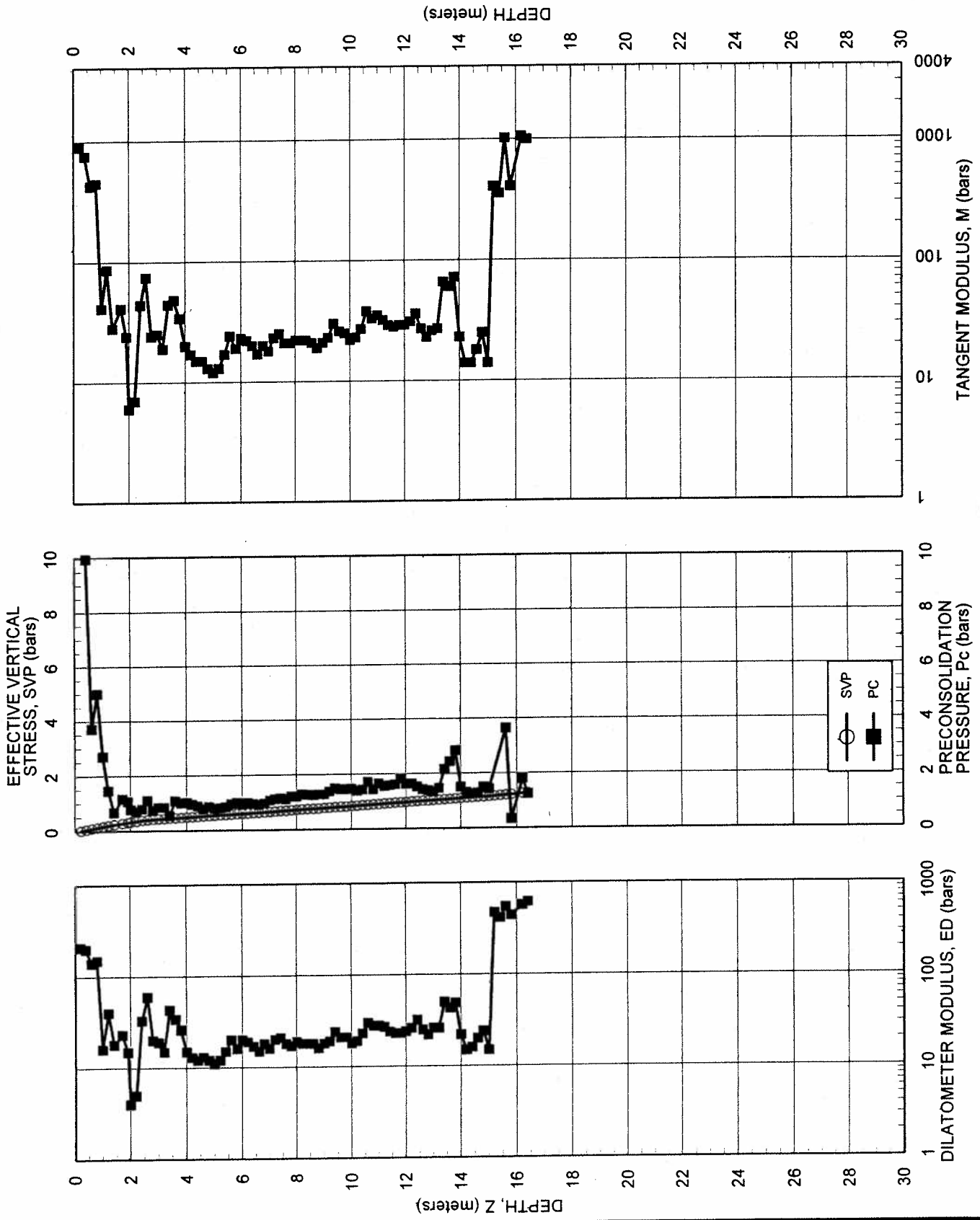
PROJECT: PIGEON POINT LANDFILL
LOCATION: Wilmington, Delaware

IN-SITU SOIL TESTING, L.C.
ENGINEER: R. Failmezger
SOUNDING DATE: 8-18-98

SOUNDING
D-9

INTERPRETED DMT DEFORMATION PARAMETERS

Ground Surface Elev.:
Water Depth: ~2.57 m



DILATOMETER DATA LISTING & INTERPRETATION (BASED ON THE 1988 DILATOMETER MANUAL)
IN-SITU SOIL TESTING, L.C.
JOB FILE: PIGEON POINT LANDFILL -- WILMINGTON, DELAWARE
LOCATION: As Planned
SNDG.BY : R. FAILMEZGER
ANAL.BY : R. FAILMEZGER

SNDG. NO. D-13
PAGE 1
FILE NO. : IST-9841

SNDG.DATE: 8-18-98
ANAL.DATE: 8-18-98

ANALYSIS PARAMETERS: LO RANGE =10.00 BARS ROD DIAM. = 3.57 CM BL.THICK. = 15.0 MM SU FACTOR = 1.00
SURF.ELEV. = 10.00 M LO GAGE 0 = 0.02 BARS FR.RED.DIA. = 4.00 CM BL.WIDTH = 96.0 MM PHI FACTOR = 1.00
WATER DEPTH = 6.00 M HI GAGE 0 = 0.15 BARS LIN.ROD WT. = 6.50 KGF/M DELTA-A = 0.25 BARS OCR FACTOR = 1.00
SP.GR.WATER = 1.000 CAL GAGE 0 = 0.00 BARS DELTA/PHI = 0.50 DELTA-B = 0.36 BARS M FACTOR = 1.00
MAX SU ID = 0.60 SU OPTION = MARCHETTI MIN PHI ID = 1.20 OCR OPTION= MARCHETTI K0 FACTOR = 1.00
UNIT CONVERSIONS: 1 BAR = 1.019 KGF/CM2 = 1.044 TSF = 14.51 PSI 1 M = 3.2808 FT

Z (M)	THRUST (KGF)	A (BAR)	B (BAR)	C (BAR)	DA (BAR)	DB (BAR)	ZMRNG (BAR)	ZMLO (BAR)	ZMHI (BAR)	ZMCAL (BAR)	P0 (BAR)	P1 (BAR)	P2 (BAR)	U0 (BAR)	GAMMA (T/M3)	SVP (BAR)
0.80	150.	1.23	1.98		0.25	0.36	10.00	0.02	0.15	0.00	1.45	1.60		0.000	1.50	0.140
1.00	120.	0.91	1.89		0.25	0.36	10.00	0.02	0.15	0.00	1.12	1.51		0.000	1.60	0.170
1.20	130.	1.05	1.94		0.25	0.36	10.00	0.02	0.15	0.00	1.27	1.56		0.000	1.50	0.201
1.40	130.	0.99	1.87		0.25	0.36	10.00	0.02	0.15	0.00	1.21	1.49		0.000	1.50	0.230
1.60	130.	0.90	1.72		0.25	0.36	10.00	0.02	0.15	0.00	1.12	1.34		0.000	1.50	0.260
1.80	160.	0.89	1.91		0.25	0.36	10.00	0.02	0.15	0.00	1.10	1.53		0.000	1.60	0.290
2.00	180.	1.00	2.09		0.25	0.36	10.00	0.02	0.15	0.00	1.21	1.71		0.000	1.60	0.322
2.20	150.	0.95	1.88		0.25	0.36	10.00	0.02	0.15	0.00	1.16	1.50		0.000	1.50	0.352
2.40	160.	1.11	2.06		0.25	0.36	10.00	0.02	0.15	0.00	1.32	1.68		0.000	1.60	0.382
2.60	170.	1.05	1.94		0.25	0.36	10.00	0.02	0.15	0.00	1.27	1.56		0.000	1.50	0.413
2.80	180.	1.11	2.02		0.25	0.36	10.00	0.02	0.15	0.00	1.32	1.64		0.000	1.50	0.442
3.00	190.	1.20	2.09		0.25	0.36	10.00	0.02	0.15	0.00	1.42	1.71		0.000	1.50	0.472
3.20	200.	1.27	2.17		0.25	0.36	10.00	0.02	0.15	0.00	1.49	1.79		0.000	1.50	0.501
3.40	210.	1.26	2.22		0.25	0.36	10.00	0.02	0.15	0.00	1.47	1.84		0.000	1.60	0.532
3.60	220.	1.26	2.16		0.25	0.36	10.00	0.02	0.15	0.00	1.48	1.78		0.000	1.50	0.562
3.80	230.	1.26	2.16		0.25	0.36	10.00	0.02	0.15	0.00	1.48	1.78		0.000	1.50	0.591
4.00	240.	1.32	2.26		0.25	0.36	10.00	0.02	0.15	0.00	1.53	1.88		0.000	1.60	0.622
4.20	250.	1.44	2.43		0.25	0.36	10.00	0.02	0.15	0.00	1.65	2.05		0.000	1.60	0.653
4.40	280.	1.56	2.59		0.25	0.36	10.00	0.02	0.15	0.00	1.77	2.21		0.000	1.60	0.685
4.60	290.	1.62	2.64	0.53	0.25	0.36	10.00	0.02	0.15	0.00	1.83	2.26	0.76	0.000	1.60	0.716
4.80	290.	1.66	2.70	0.68	0.25	0.36	10.00	0.02	0.15	0.00	1.87	2.32	0.91	0.000	1.60	0.747
5.00	310.	1.63	2.69		0.25	0.36	10.00	0.02	0.15	0.00	1.84	2.31		0.000	1.60	0.779
5.20	330.	1.71	2.87	0.80	0.25	0.36	10.00	0.02	0.15	0.00	1.91	2.49	1.03	0.000	1.60	0.810
5.40	350.	1.85	2.93	0.89	0.25	0.36	10.00	0.02	0.15	0.00	2.06	2.55	1.12	0.000	1.60	0.842
5.60	380.	1.89	2.98	0.92	0.25	0.36	10.00	0.02	0.15	0.00	2.10	2.60	1.15	0.000	1.60	0.873
5.80	370.	1.99	3.14	0.99	0.25	0.36	10.00	0.02	0.15	0.00	2.19	2.76	1.22	0.000	1.60	0.904
6.00	390.	2.18	3.39	1.12	0.25	0.36	10.00	0.02	0.15	0.00	2.38	3.01	1.35	0.000	1.60	0.936
6.20	420.	2.55	3.81	1.18	0.25	0.36	10.00	0.02	0.15	0.00	2.75	3.43	1.41	0.020	1.60	0.948
6.40	450.	2.80	4.14	1.44	0.25	0.36	10.00	0.02	0.15	0.00	2.99	3.76	1.67	0.039	1.70	0.960
6.60	610.	1.74	7.42		0.25	0.36	10.00	0.02	0.15	0.00	1.72	7.04		0.059	1.80	0.975
6.80	850.	1.56	5.20		0.25	0.36	10.00	0.02	0.15	0.00	1.64	4.82		0.079	1.80	0.991
7.00	4270.	3.17	21.40		0.25	0.36	10.00	0.02	0.15	0.00	2.53	20.89		0.098	1.90	1.008
7.20	5800.	4.40	20.55		0.25	0.36	10.00	0.02	0.15	0.00	3.86	20.04		0.118	2.00	1.026
7.40	5220.	7.69	27.75		0.25	0.36	10.00	0.02	0.15	0.00	6.95	27.24		0.137	2.00	1.046
7.60	4770.	7.32	25.75		0.25	0.36	10.00	0.02	0.15	0.00	6.67	25.24		0.157	2.00	1.065
7.80	3700.	5.98	21.25		0.25	0.36	10.00	0.02	0.15	0.00	5.48	20.74		0.177	2.00	1.085
8.00	3030.	4.78	17.70		0.25	0.36	10.00	0.02	0.15	0.00	4.40	17.19		0.196	2.00	1.105
8.20	2530.	3.78	14.65		0.25	0.36	10.00	0.02	0.15	0.00	3.50	14.14		0.216	1.90	1.123
8.40	2350.	4.09	15.55		0.25	0.36	10.00	0.02	0.15	0.00	3.78	15.04		0.236	1.90	1.141
8.60	2310.	3.79	14.80		0.25	0.36	10.00	0.02	0.15	0.00	3.51	14.29		0.255	1.90	1.159
8.80	2250.	3.55	13.80	0.04	0.25	0.36	10.00	0.02	0.15	0.00	3.30	13.29	0.27	0.275	1.90	1.176
9.00	2570.	3.86	15.80		0.25	0.36	10.00	0.02	0.15	0.00	3.53	15.29		0.294	1.90	1.194
9.20	2670.	5.10	16.95		0.25	0.36	10.00	0.02	0.15	0.00	4.77	16.44		0.314	2.00	1.213
9.40	2420.	4.41	16.10		0.25	0.36	10.00	0.02	0.15	0.00	4.09	15.59		0.334	1.90	1.231
9.60	2060.	4.14	15.20		0.25	0.36	10.00	0.02	0.15	0.00	3.85	14.69		0.353	1.90	1.249
9.80	1900.	3.63	12.75		0.25	0.36	10.00	0.02	0.15	0.00	3.44	12.24		0.373	1.90	1.267
10.00	1970.	3.69	13.50		0.25	0.36	10.00	0.02	0.15	0.00	3.47	12.99		0.393	1.90	1.284
10.20	2010.	4.33	15.45		0.25	0.36	10.00	0.02	0.15	0.00	4.04	14.94		0.412	1.90	1.302
10.40	2110.	3.66	14.45	0.11	0.25	0.36	10.00	0.02	0.15	0.00	3.39	13.94	0.34	0.432	1.90	1.320
10.60	1340.	3.66	11.45		0.25	0.36	10.00	0.02	0.15	0.00	3.54	10.94		0.451	1.90	1.337
10.80	820.	5.39	8.88		0.25	0.36	10.00	0.02	0.15	0.00	5.48	8.50		0.471	1.80	1.354
11.00	830.	6.76	10.65		0.25	0.36	10.00	0.02	0.15	0.00	6.83	10.14		0.491	1.80	1.370
11.20	800.	7.27	10.75		0.25	0.36	10.00	0.02	0.15	0.00	7.36	10.24		0.510	1.80	1.385
11.40	850.	6.89	10.65		0.25	0.36	10.00	0.02	0.15	0.00	6.97	10.14		0.530	1.80	1.401
11.60	940.	6.92	11.65		0.25	0.36	10.00	0.02	0.15	0.00	6.95	11.14		0.550	1.80	1.417
11.80	1020.	6.61	11.55		0.25	0.36	10.00	0.02	0.15	0.00	6.63	11.04		0.569	1.80	1.432
12.00	1140.	8.13	13.25		0.25	0.36	10.00	0.02	0.15	0.00	8.14	12.74		0.589	1.95	1.450
12.20	1240.	7.60	12.80		0.25	0.36	10.00	0.02	0.15	0.00	7.61	12.29		0.608	1.95	1.468
12.40	1440.	8.07	13.90		0.25	0.36	10.00	0.02	0.15	0.00	8.05	13.39		0.628	1.95	1.487

CONTINUED ON NEXT PAGE

DILATOMETER DATA LISTING & INTERPRETATION (BASED ON THE 1988 DILATOMETER MANUAL)
IN-SITU SOIL TESTING, L.C.
JOB FILE: PIGEON POINT LANDFILL -- WILMINGTON, DELAWARE
LOCATION: As Planned
SNDG.BY : R. FAILMEZGER
ANAL.BY : R. FAILMEZGER

SNDG. NO. D-13
PAGE 2
FILE NO. : IST-9841

SNDG.DATE: 8-18-98
ANAL.DATE: 8-18-98

ANALYSIS PARAMETERS:
SURF.ELEV. = 10.00 M
WATER DEPTH = 6.00 M
SP.GR.WATER = 1.000
MAX SU ID = 0.60

LO RANGE =10.00 BARS
LO GAGE 0 = 0.02 BARS
HI GAGE 0 = 0.15 BARS
CAL GAGE 0 = 0.00 BARS
SU OPTION = MARCHETTI

ROD DIAM. = 3.57 CM
FR.RED.DIA. = 4.00 CM
LIN.ROD WT. = 6.50 KGF/M
DELTA/PHI = 0.50
MIN PHI ID = 1.20

BL.THICK. = 15.0 MM
BL.WIDTH = 96.0 MM
DELTA-A = 0.25 BARS
DELTA-B = 0.36 BARS
OCR OPTION= MARCHETTI

SU FACTOR = 1.00
PHI FACTOR = 1.00
OCR FACTOR = 1.00
M FACTOR = 1.00
K0 FACTOR = 1.00

UNIT CONVERSIONS: 1 BAR = 1.019 KGF/CM2 = 1.044 TSF = 14.51 PSI 1 M = 3.2808 FT

Z (M)	THRUST (KGF)	A (BAR)	B (BAR)	C (BAR)	DA (BAR)	DB (BAR)	ZMRNG (BAR)	ZMLO (BAR)	ZMHI (BAR)	ZMCAL (BAR)	P0 (BAR)	P1 (BAR)	P2 (BAR)	U0 (BAR)	GAMMA (T/M3)	SVP (BAR)
12.60	1380.	8.32	13.10		0.25	0.36	10.00	0.02	0.15	0.00	8.35	12.59		0.648	1.90	1.505
12.80	1390.	8.03	12.80		0.25	0.36	10.00	0.02	0.15	0.00	8.06	12.29		0.667	1.90	1.523
13.00	1590.	8.17	13.65		0.25	0.36	10.00	0.02	0.15	0.00	8.16	13.14		0.687	1.95	1.541
13.20	1650.	8.33	13.75		0.25	0.36	10.00	0.02	0.15	0.00	8.33	13.24		0.707	1.95	1.560
13.40	1720.	7.55	12.85		0.25	0.36	10.00	0.02	0.15	0.00	7.55	12.34		0.726	1.95	1.578
13.60	1800.	7.82	12.95		0.25	0.36	10.00	0.02	0.15	0.00	7.83	12.44		0.746	1.95	1.597
13.80	1900.	6.58	10.45		0.25	0.36	10.00	0.02	0.15	0.00	6.65	9.94		0.765	1.80	1.614
14.00	2270.	6.47	13.75		0.25	0.36	10.00	0.02	0.15	0.00	6.37	13.24		0.785	1.95	1.631
14.20	2440.	5.92	10.70		0.25	0.36	10.00	0.02	0.15	0.00	5.95	10.19		0.805	1.80	1.648
14.40	2420.	7.37	11.80		0.25	0.36	10.00	0.02	0.15	0.00	7.42	11.29		0.824	1.80	1.664
14.60	2620.	6.05	12.10		0.25	0.36	10.00	0.02	0.15	0.00	6.01	11.59		0.844	1.80	1.680
14.80	2740.	6.18	11.20		0.25	0.36	10.00	0.02	0.15	0.00	6.20	10.69		0.864	1.80	1.695
15.00	2950.	6.86	11.30		0.25	0.36	10.00	0.02	0.15	0.00	6.90	10.79		0.883	1.80	1.711
15.20	3110.	6.39	12.00		0.25	0.36	10.00	0.02	0.15	0.00	6.38	11.49		0.903	1.80	1.727
15.40	3060.	6.42	10.85		0.25	0.36	10.00	0.02	0.15	0.00	6.47	10.34		0.922	1.80	1.743
15.60	3120.	7.14	11.65		0.25	0.36	10.00	0.02	0.15	0.00	7.18	11.14		0.942	1.80	1.758
15.80	3280.	7.27	11.35		0.25	0.36	10.00	0.02	0.15	0.00	7.33	10.84		0.962	1.80	1.774
16.00	3510.	8.07	12.85		0.25	0.36	10.00	0.02	0.15	0.00	8.10	12.34		0.981	1.90	1.791
16.20	3740.	7.73	14.20		0.25	0.36	10.00	0.02	0.15	0.00	7.67	13.69		1.001	1.95	1.809
16.40	4220.	7.43	15.60		0.25	0.36	10.00	0.02	0.15	0.00	7.29	15.09		1.021	1.95	1.827
16.60	4410.	8.78	17.35		0.25	0.36	10.00	0.02	0.15	0.00	8.62	16.84		1.040	1.95	1.846
16.80	4460.	7.28	14.40		0.25	0.36	10.00	0.02	0.15	0.00	7.19	13.89		1.060	1.95	1.865
17.00	4600.	8.62	16.40		0.25	0.36	10.00	0.02	0.15	0.00	8.50	15.89		1.079	1.95	1.883
17.20	4800.	7.23	14.00		0.25	0.36	10.00	0.02	0.15	0.00	7.16	13.49		1.099	1.95	1.902
17.40	4780.	6.05	10.75		0.25	0.36	10.00	0.02	0.15	0.00	6.08	10.24		1.119	1.80	1.919
17.60	4800.	6.72	13.00		0.25	0.36	10.00	0.02	0.15	0.00	6.67	12.49		1.138	1.95	1.936
17.80	4780.	7.89	14.95		0.25	0.36	10.00	0.02	0.15	0.00	7.80	14.44		1.158	1.95	1.955
18.00	5240.	8.11	16.50		0.25	0.36	10.00	0.02	0.15	0.00	7.96	15.99		1.178	1.95	1.974
18.20	5610.	8.68	17.35		0.25	0.36	10.00	0.02	0.15	0.00	8.51	16.84		1.197	1.95	1.992
18.40	5590.	9.13	20.00		0.25	0.36	10.00	0.02	0.15	0.00	8.85	19.49		1.217	1.95	2.011
18.60	5500.	7.88	14.55		0.25	0.36	10.00	0.02	0.15	0.00	7.81	14.04		1.237	1.95	2.030
18.80	5090.	6.70	11.70		0.25	0.36	10.00	0.02	0.15	0.00	6.72	11.19		1.256	1.80	2.047
19.00	5430.	7.42	19.40		0.25	0.36	10.00	0.02	0.15	0.00	7.09	18.89		1.276	2.00	2.064
19.20	6720.	9.22	24.00		0.25	0.36	10.00	0.02	0.15	0.00	8.75	23.49		1.295	2.00	2.084
19.40	6650.	8.07	22.60		0.25	0.36	10.00	0.02	0.15	0.00	7.61	22.09		1.315	2.00	2.104

END OF SOUNDING

(INTERPRETED SOIL PARAMETERS ON NEXT PAGE)

DILATOMETER DATA LISTING & INTERPRETATION (BASED ON THE 1988 DILATOMETER MANUAL)
IN-SITU SOIL TESTING, L.C.
JOB FILE: PIGEON POINT LANDFILL -- WILMINGTON, DELAWARE
LOCATION: As Planned
SNDG.BY : R. FAILMEZGER
ANAL.BY : R. FAILMEZGER

SNDG. NO. D-13
PAGE 3
FILE NO. : IST-9841

SNDG.DATE: 8-18-98
ANAL.DATE: 8-18-98

ANALYSIS PARAMETERS:
SURF.ELEV. = 10.00 M
WATER DEPTH = 6.00 M
SP.GR.WATER = 1.000
MAX SU ID = 0.60

LO RANGE =10.00 BARS
LO GAGE 0 = 0.02 BARS
HI GAGE 0 = 0.15 BARS
CAL GAGE 0 = 0.00 BARS
SU OPTION = MARCHETTI

ROD DIAM. = 3.57 CM
FR.RED.DIA. = 4.00 CM
LIN.ROD WT. = 6.50 KGF/M
DELTA/PHI = 0.50
MIN PHI ID = 1.20

BL.THICK. = 15.0 MM
BL.WIDTH = 96.0 MM
DELTA-A = 0.25 BARS
DELTA-B = 0.36 BARS
OCR OPTION= MARCHETTI

SU FACTOR = 1.00
PHI FACTOR = 1.00
OCR FACTOR = 1.00
M FACTOR = 1.00
K0 FACTOR = 1.00

UNIT CONVERSIONS: 1 BAR = 1.019 KGF/CM2 = 1.044 TSF = 14.51 PSI 1 M = 3.2808 FT

Z (M)	KD	ID	UD	ED (BAR)	K0	SU (BAR)	QD (BAR)	PHI (DEG)	SIGFF (BAR)	PHIO (DEG)	PC (BAR)	OCR	M (BAR)	SOIL TYPE
0.80	10.38	0.10	0.00	5.	1.88	0.24					1.83	13.0	13.	MUD
1.00	6.58	0.35	0.00	13.	1.40	0.17					1.09	6.4	28.	CLAY
1.20	6.30	0.23	0.00	10.	1.36	0.19					1.20	6.0	21.	MUD
1.40	5.24	0.23	0.00	10.	1.20	0.17					1.03	4.5	18.	MUD
1.60	4.31	0.20	0.00	8.	1.04	0.15					0.86	3.3	13.	MUD
1.80	3.79	0.39	0.00	15.	0.95	0.14					0.79	2.7	22.	SILTY CLAY
2.00	3.75	0.42	0.00	17.	0.94	0.16					0.86	2.7	26.	SILTY CLAY
2.20	3.31	0.29	0.00	12.	0.85	0.15					0.77	2.2	16.	MUD
2.40	3.46	0.27	0.00	12.	0.88	0.17					0.90	2.4	17.	CLAY
2.60	3.07	0.23	0.00	10.	0.80	0.15					0.80	1.9	13.	MUD
2.80	3.00	0.24	0.00	11.	0.78	0.16					0.83	1.9	14.	MUD
3.00	3.00	0.21	0.00	10.	0.79	0.17					0.89	1.9	13.	MUD
3.20	2.96	0.20	0.00	11.	0.78	0.18					0.93	1.8	13.	MUD
3.40	2.77	0.25	0.00	13.	0.73	0.18					0.88	1.7	15.	CLAY
3.60	2.63	0.21	0.00	11.	0.70	0.17					0.86	1.5	12.	MUD
3.80	2.49	0.21	0.00	11.	0.67	0.17					0.83	1.4	11.	MUD
4.00	2.47	0.23	0.00	12.	0.66	0.18					0.86	1.4	13.	CLAY
4.20	2.53	0.24	0.00	14.	0.68	0.19					0.94	1.4	15.	CLAY
4.40	2.58	0.25	0.00	15.	0.69	0.21					1.02	1.5	17.	CLAY
4.60	2.55	0.24	0.42	15.	0.68	0.21					1.05	1.5	16.	CLAY
4.80	2.50	0.24	0.49	16.	0.67	0.22					1.06	1.4	17.	CLAY
5.00	2.36	0.26	0.49	16.	0.64	0.21					1.01	1.3	17.	CLAY
5.20	2.36	0.30	0.54	20.	0.64	0.22					1.05	1.3	20.	CLAY
5.40	2.44	0.24	0.54	17.	0.66	0.24					1.15	1.4	18.	CLAY
5.60	2.40	0.24	0.55	17.	0.65	0.24					1.16	1.3	18.	CLAY
5.80	2.42	0.26	0.56	20.	0.65	0.25					1.22	1.4	21.	CLAY
6.00	2.54	0.26	0.57	22.	0.68	0.28					1.36	1.5	24.	CLAY
6.20	2.88	0.25	0.51	24.	0.76	0.33					1.67	1.8	29.	CLAY
6.40	3.08	0.26	0.55	27.	0.80	0.36					1.88	2.0	34.	CLAY
6.60	1.70	3.21	0.55	185.	0.56		23.4	30.7	1.47	29.5	1.39	1.4	177.	SILTY SAND
6.80	1.57	2.04	0.55	110.	0.48		34.4	33.6	1.54	32.6	1.12	1.1	94.	SILTY SAND
7.00	2.41	7.57	0.55	637.	0.17		185.4	45.2	1.72	44.6	0.26	0.3	805.	SAND
7.20	3.65	4.32	0.55	561.	0.24		247.1	46.4	1.77	45.8	0.52	0.5	912.	SAND
7.40	6.52	2.98	0.55	704.	0.77		201.3	43.4	1.76	42.7	4.62	4.4	1498.	SILTY SAND
7.60	6.11	2.85	0.55	645.	0.75		183.0	42.8	1.79	42.2	4.36	4.1	1332.	SILTY SAND
7.80	4.89	2.87	0.55	529.	0.66		141.9	41.6	1.81	41.0	3.27	3.0	992.	SILTY SAND
8.00	3.81	3.04	0.55	444.	0.56		118.3	40.7	1.83	40.1	2.32	2.1	737.	SILTY SAND
8.20	2.93	3.24	0.55	369.	0.48		101.2	39.9	1.84	39.3	1.68	1.5	529.	SILTY SAND
8.40	3.11	3.17	0.55	391.	0.53		91.7	39.1	1.86	38.5	2.01	1.8	580.	SILTY SAND
8.60	2.81	3.32	0.55	374.	0.49		91.7	39.1	1.89	38.5	1.76	1.5	522.	SAND
8.80	2.58	3.30	-0.00	346.	0.47		90.3	39.0	1.92	38.4	1.60	1.4	458.	SILTY SAND
9.00	2.71	3.63	-0.00	408.	0.46		103.7	39.8	1.96	39.3	1.61	1.4	557.	SAND
9.20	3.68	2.62	-0.00	405.	0.59		101.4	39.1	1.98	38.6	2.75	2.3	650.	SILTY SAND
9.40	3.05	3.06	-0.00	399.	0.53		94.2	38.8	2.00	38.3	2.17	1.8	586.	SILTY SAND
9.60	2.80	3.10	-0.00	376.	0.53		79.6	37.6	2.01	37.1	2.12	1.7	525.	SILTY SAND
9.80	2.42	2.87	-0.00	305.	0.50		74.8	37.2	2.03	36.7	1.83	1.4	384.	SILTY SAND
10.00	2.39	3.10	-0.00	330.	0.49		78.0	37.4	2.06	37.0	1.80	1.4	416.	SILTY SAND
10.20	2.79	3.00	-0.00	378.	0.54		77.0	37.1	2.09	36.6	2.27	1.7	526.	SILTY SAND
10.40	2.24	3.57	-0.03	366.	0.46		85.1	37.9	2.13	37.5	1.64	1.2	440.	SAND
10.60	2.31	2.40	-0.03	257.	0.56		50.4	34.0	2.09	33.5	2.19	1.6	300.	SILTY SAND
10.80	3.70	0.60	-0.03	105.	0.93						3.53	2.6	155.	CLAYEY SILT
11.00	4.63	0.52	-0.03	115.	1.10	0.86					5.07	3.7	196.	SILTY CLAY
11.20	4.95	0.42	-0.03	100.	1.15	0.95					5.69	4.1	178.	SILTY CLAY
11.40	4.60	0.49	-0.03	110.	1.09	0.87					5.13	3.7	187.	SILTY CLAY
11.60	4.52	0.65	-0.03	145.	1.08						5.05	3.6	245.	CLAYEY SILT
11.80	4.23	0.73	-0.03	153.	1.03						4.61	3.2	249.	CLAYEY SILT
12.00	5.21	0.61	-0.03	160.	1.20						6.45	4.5	292.	CLAYEY SILT
12.20	4.77	0.67	-0.03	163.	1.12						5.69	3.9	283.	CLAYEY SILT
12.40	4.99	0.72	-0.03	185.	1.16						6.19	4.2	332.	CLAYEY SILT

CONTINUED ON NEXT PAGE

DILATOMETER DATA LISTING & INTERPRETATION (BASED ON THE 1988 DILATOMETER MANUAL)
IN-SITU SOIL TESTING, L.C.
JOB FILE: PIGEON POINT LANDFILL -- WILMINGTON, DELAWARE
LOCATION: As Planned
SNDG.BY : R. FAILMEZGER
ANAL.BY : R. FAILMEZGER

SNDG. NO D-13
PAGE 4
FILE NO. : IST-9841

SNDG.DATE: 8-18-98
ANAL.DATE: 8-18-98

ANALYSIS PARAMETERS:
SURF.ELEV. = 10.00 M
WATER DEPTH = 6.00 M
SP.GR.WATER = 1.000
MAX SU ID = 0.60

LO RANGE =10.00 BARS
LO GAGE 0 = 0.02 BARS
HI GAGE 0 = 0.15 BARS
CAL GAGE 0 = 0.00 BARS
SU OPTION = MARCHETTI

ROD DIAM. = 3.57 CM
FR.RED.DIA. = 4.00 CM
LIN.ROD WT. = 6.50 KGF/M
DELTA/PHI = 0.50
MIN PHI ID = 1.20

BL.THICK. = 15.0 MM
BL.WIDTH = 96.0 MM
DELTA-A = 0.25 BARS
DELTA-B = 0.36 BARS
OCR OPTION= MARCHETTI

SU FACTOR = 1.00
PHI FACTOR = 1.00
OCR FACTOR = 1.00
M FACTOR = 1.00
K0 FACTOR = 1.00

UNIT CONVERSIONS: 1 BAR = 1.019 KGF/CM2 = 1.044 TSF = 14.51 PSI 1 M = 3.2808 FT

Z (M)	KD	ID	UD	ED (BAR)	K0	SU (BAR)	QD (BAR)	PHI (DEG)	SIGFF (BAR)	PHIO (DEG)	PC (BAR)	OCR	M (BAR)	SOIL TYPE
12.60	5.12	0.55	-0.03	147.	1.18	1.07					6.52	4.3	267.	SILTY CLAY
12.80	4.85	0.57	-0.03	147.	1.14	1.01					6.07	4.0	258.	SILTY CLAY
13.00	4.85	0.67	-0.03	173.	1.14						6.14	4.0	304.	CLAYEY SILT
13.20	4.89	0.64	-0.03	171.	1.14						6.28	4.0	301.	CLAYEY SILT
13.40	4.33	0.70	-0.03	166.	1.04						5.26	3.3	274.	CLAYEY SILT
13.60	4.44	0.65	-0.03	160.	1.06						5.53	3.5	267.	CLAYEY SILT
13.80	3.65	0.56	-0.03	114.	0.92	0.75					4.12	2.6	167.	SILTY CLAY
14.00	3.43	1.23	-0.03	238.	0.66		80.4	35.6	2.58	35.5	4.08	2.5	345.	SANDY SILT
14.20	3.12	0.82	-0.03	147.	0.81						3.30	2.0	195.	CLAYEY SILT
14.40	3.96	0.59	-0.03	134.	0.98	0.86					4.83	2.9	208.	SILTY CLAY
14.60	3.08	1.08	-0.03	193.	0.80						3.29	2.0	257.	SILT
14.80	3.15	0.84	-0.03	156.	0.82						3.44	2.0	208.	CLAYEY SILT
15.00	3.52	0.65	-0.03	135.	0.89						4.13	2.4	193.	CLAYEY SILT
15.20	3.17	0.93	-0.03	177.	0.82						3.54	2.1	239.	SILT
15.40	3.18	0.70	-0.03	134.	0.82						3.59	2.1	179.	CLAYEY SILT
15.60	3.55	0.63	-0.03	137.	0.90						4.30	2.4	198.	CLAYEY SILT
15.80	3.59	0.55	-0.03	122.	0.91	0.81					4.42	2.5	177.	SILTY CLAY
16.00	3.97	0.60	-0.03	147.	0.98	0.93					5.23	2.9	229.	SILTY CLAY
16.20	3.69	0.90	-0.03	209.	0.93						4.70	2.6	313.	SILT
16.40	3.43	1.24	-0.03	271.	0.55		164.3	39.7	2.99	39.8	3.56	1.9	392.	SANDY SILT
16.60	4.11	1.08	-0.03	285.	1.01						5.67	3.1	461.	SILT
16.80	3.29	1.09	-0.03	232.	0.85						4.05	2.2	324.	SILT
17.00	3.94	1.00	-0.03	257.	0.97						5.42	2.9	402.	SILT
17.20	3.19	1.04	-0.03	220.	0.82						3.93	2.1	299.	SILT
17.40	2.59	0.84	-0.03	144.	0.69						2.87	1.5	164.	CLAYEY SILT
17.60	2.86	1.05	-0.03	202.	0.75						3.38	1.7	253.	SILT
17.80	3.40	1.00	-0.03	230.	0.87						4.47	2.3	327.	SILT
18.00	3.44	1.18	-0.03	279.	0.88						4.59	2.3	403.	SILT
18.20	3.67	1.14	-0.03	289.	0.92						5.14	2.6	436.	SILT
18.40	3.80	1.39	-0.03	369.	0.55		219.2	40.8	3.33	41.1	4.18	2.1	575.	SANDY SILT
18.60	3.24	0.95	-0.03	216.	0.84						4.31	2.1	296.	SILT
18.80	2.67	0.82	-0.03	155.	0.71						3.21	1.6	181.	CLAYEY SILT
19.00	2.82	2.03	-0.03	410.	0.42		223.0	41.2	3.42	41.5	2.51	1.2	540.	SILTY SAND
19.20	3.58	1.98	-0.03	512.	0.48		271.7	42.1	3.48	42.4	3.38	1.6	787.	SILTY SAND
19.40	2.99	2.30	-0.03	502.	0.39		275.8	42.4	3.52	42.8	2.36	1.1	702.	SILTY SAND

END OF SOUNDING

Schnabel Engineering

Field Vane Shear Test Log

PROJECT NAME:	PIGEON POINT LANDFILL - DSWA 408
CONTRACT NUMBER:	985176
CONTRACTOR:	HARDIN-HUBER INC.
DATE:	August 17, 1998

BORING NUMBER:	B-9	TEST NUMBER:	VANE #4
GROUND SURFACE EL.:	17	VANE DIAMETER (in):	3.6
DEPTH TO VANE TIP (ft):	24.5	VANE SHAPE:	TAPERED
DEPTH BELOW AUGERS (ft):	2.5	ROD DIAMETER (in):	0.8

Description of test procedure: 4.25 inch I.D. auger was advanced to 2.5 feet above the desired vane tip depth.
A non-housed vane was pushed to 2.5 feet below the augers.
The torque was applied manually by a hand crank that turned a geared drive.
A force gauge set on a moment arm of known length measured the torque.

Time elapsed between vane insertion and shear testing = 10 minutes.

SOIL STRATUM TESTED: STRATUM B

UNDISTURBED TEST:

Maximum Torque (ft x lb):	52	Time to Failure (min):	4
Ave. Shear Rate (deg/sec):	0.08	Deflect. at Failure (deg)	20

REMOLDED TEST:

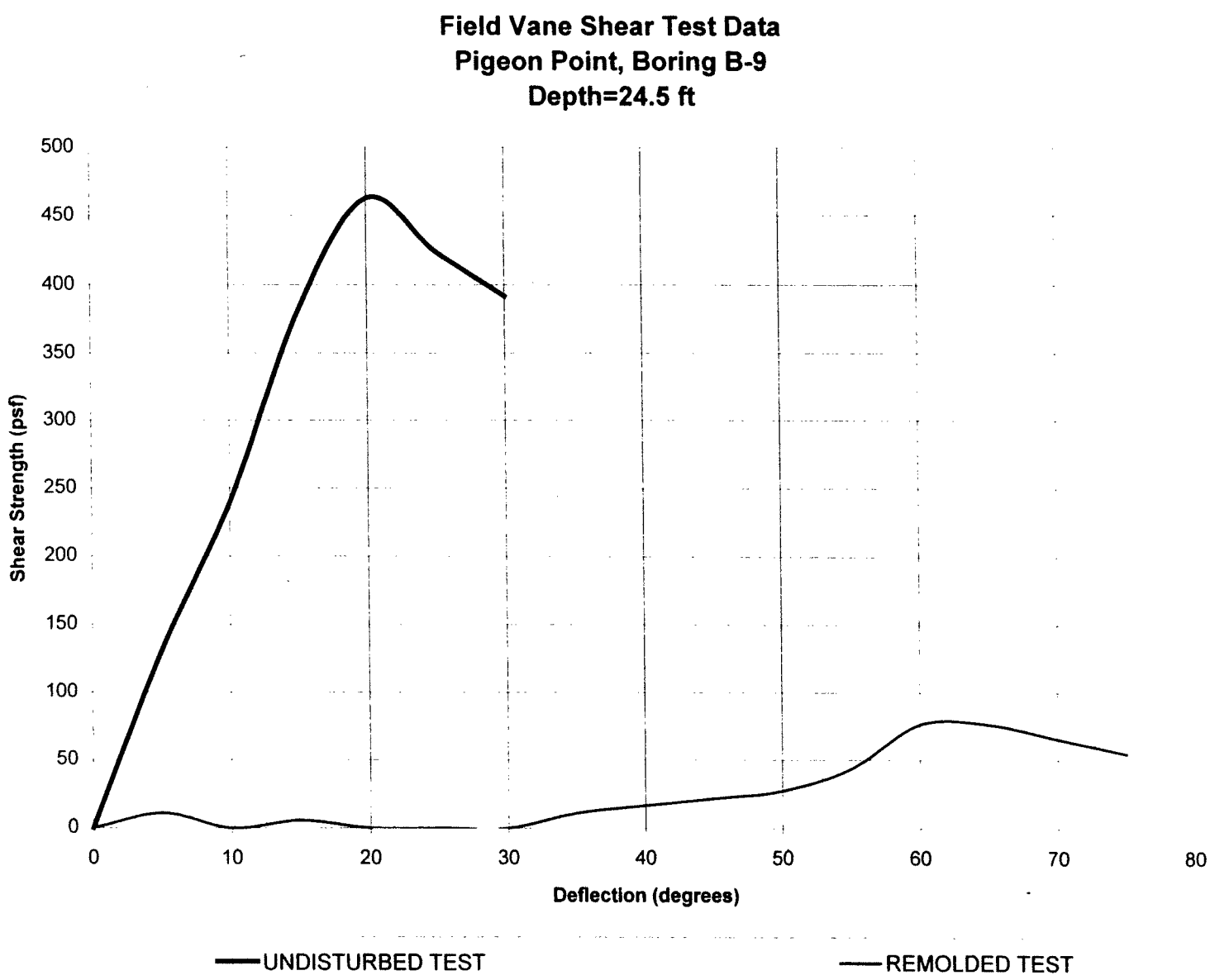
Maximum Torque (ft x lb):	16	Time to Failure (min):	11
Ave. Shear Rate (deg/sec):	0.09	Deflect. at Failure (deg)	61

Friction Correction (ft x lb):	10	from friction test at 21.5 feet

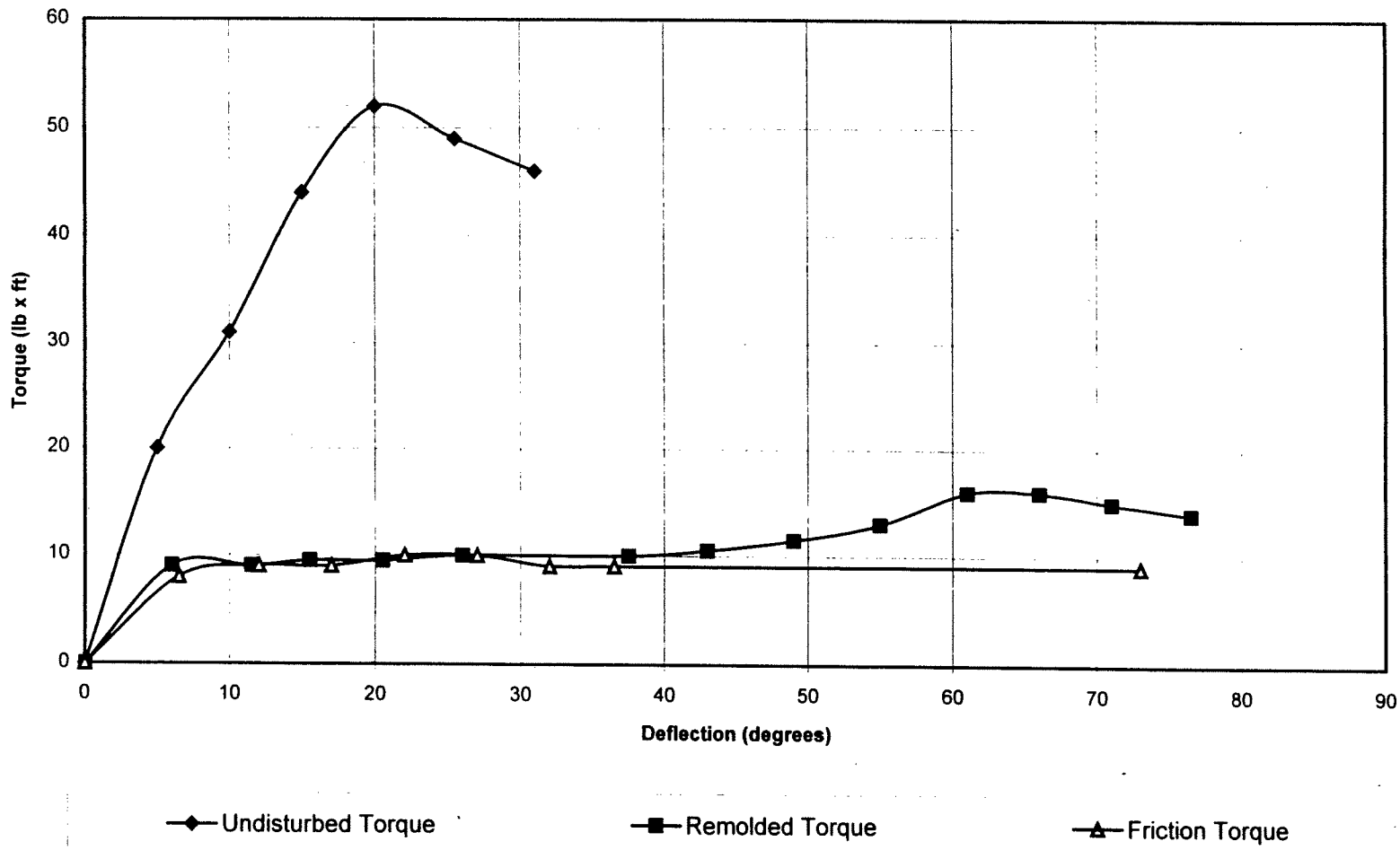
UNDISTURBED TEST:
Undrained Shear Strength: 460 psf

REMOLDED TEST:
Undrained Shear Strength: 70 psf

Drilling Foreman:	Rick Rider
Inspector:	Michael Gill
Supervising Engineer:	Chris Reith


Field Vane Shear Test Data
Pigeon Point, Boring B-9
Depth=24.5 ft
Shear Strength (psf)
500
450
400
350
300
250
200
150
100
50
0
0
10
20
30
40
50
60
70
80
Deflection (degrees)
UNDISTURBED TEST
REMOLDED TEST

Field Vane Shear Test Data
Pigeon Point, Boring B-9
Depth=24.5 ft



Schnabel Engineering

Field Vane Shear Test Log

PROJECT NAME:	PIGEON POINT LANDFILL - DSWA 408
CONTRACT NUMBER:	985176
CONTRACTOR:	HARDIN-HUBER INC.
DATE:	August 17, 1998

BORING NUMBER:	B-9	TEST NUMBER:	VANE #5
GROUND SURFACE EL.:	17	VANE DIAMETER (in):	3.6
DEPTH TO VANE TIP (ft):	28	VANE SHAPE:	TAPERED
DEPTH BELOW AUGERS (ft):	2.5	ROD DIAMETER (in):	0.8

Description of test procedure: 4.25 inch I.D. auger was advanced to 2.5 feet above the desired vane tip depth.
A non-housed vane was pushed to 2.5 feet below the augers.
The torque was applied manually by a hand crank that turned a geared drive.
A force gauge set on a moment arm of known length measured the torque.

Time elapsed between vane insertion and shear testing = 10 minutes.

SOIL STRATUM TESTED: STRATUM B

UNDISTURBED TEST:

Maximum Torque (ft x lb):	70	Time to Failure (min):	5
Ave. Shear Rate (deg/sec):	0.09	Deflect. at Failure (deg):	26

REMOLDED TEST:

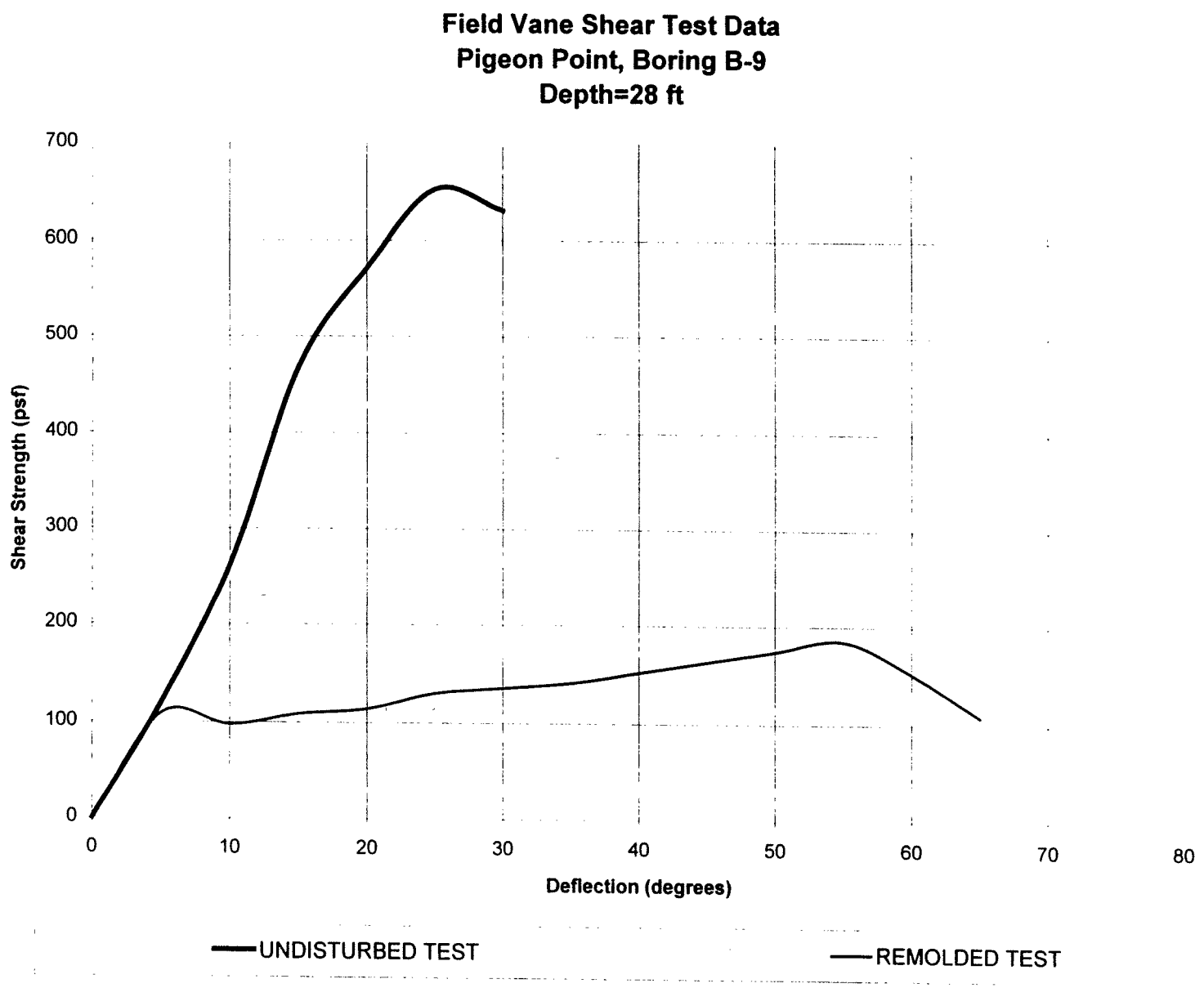
Maximum Torque (ft x lb):	26	Time to Failure (min):	13
Ave. Shear Rate (deg/sec):	0.07	Deflect. at Failure (deg):	58

Friction Correction (ft x lb):	10	from friction test at 21.5 feet

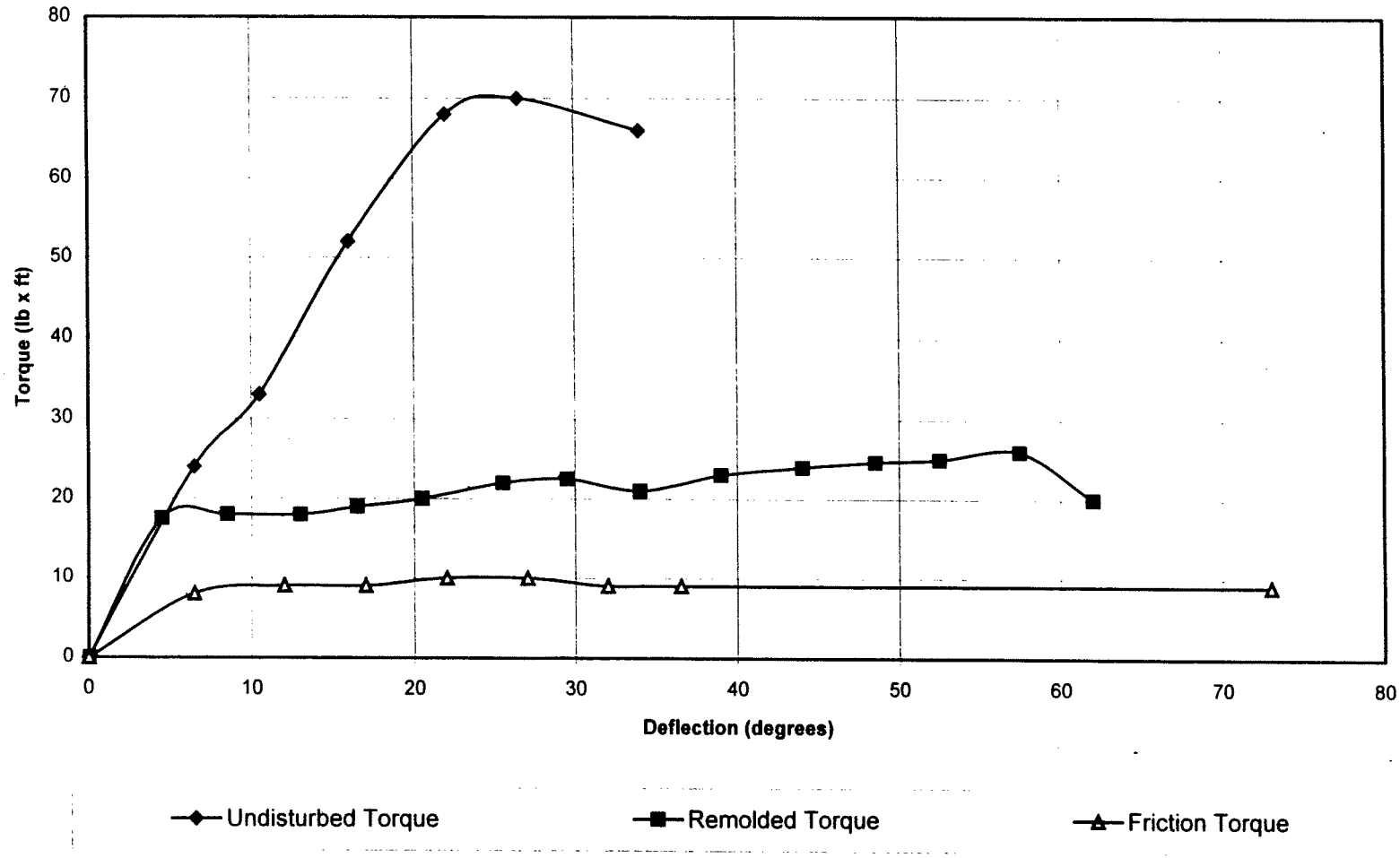
UNDISTURBED TEST:
Undrained Shear Strength: 650 psf

REMOLDED TEST:
Undrained Shear Strength: 170 psf

Drilling Foreman:	Rick Rider
Inspector:	Michael Gill
Supervising Engineer:	Chris Reith


Field Vane Shear Test Data
Pigeon Point, Boring B-9
Depth=28 ft
Shear Strength (psf)
700
600
500
400
300
200
100
0
0
10
20
30
40
50
60
70
80
Deflection (degrees)
UNDISTURBED TEST
REMOLDED TEST

Field Vane Shear Test Data
Pigeon Point, Boring B-9
Depth=28 ft



Schnabel Engineering

Field Vane Shear Test Log

PROJECT NAME:	PIGEON POINT LANDFILL - DSWA 408
CONTRACT NUMBER:	985176
CONTRACTOR:	HARDIN-HUBER INC.
DATE:	August 17, 1998

BORING NUMBER:	B-9	TEST NUMBER:	VANE #6
GROUND SURFACE EL.:	17	VANE DIAMETER (in):	3.63
DEPTH TO VANE TIP (ft):	31	VANE SHAPE:	TAPERED
DEPTH BELOW AUGERS (ft):	2.5	ROD DIAMETER (in):	0.75

Description of test procedure: 4.25 inch I.D. auger was advanced to 2.5 feet above the desired vane tip depth.
A non-housed vane was pushed to 2.5 feet below the augers.
The torque was applied manually by a hand crank that turned a geared drive.
A force gauge set on a moment arm of known length measured the torque.

Time elapsed between vane insertion and shear testing = 10 minutes.

SOIL STRATUM TESTED: STRATUM B

UNDISTURBED TEST:

Maximum Torque (ft x lb):	56	Time to Failure (min):	4
Ave. Shear Rate (deg/sec):	0.08	Deflect. at Failure (deg):	19

REMOLDED TEST:

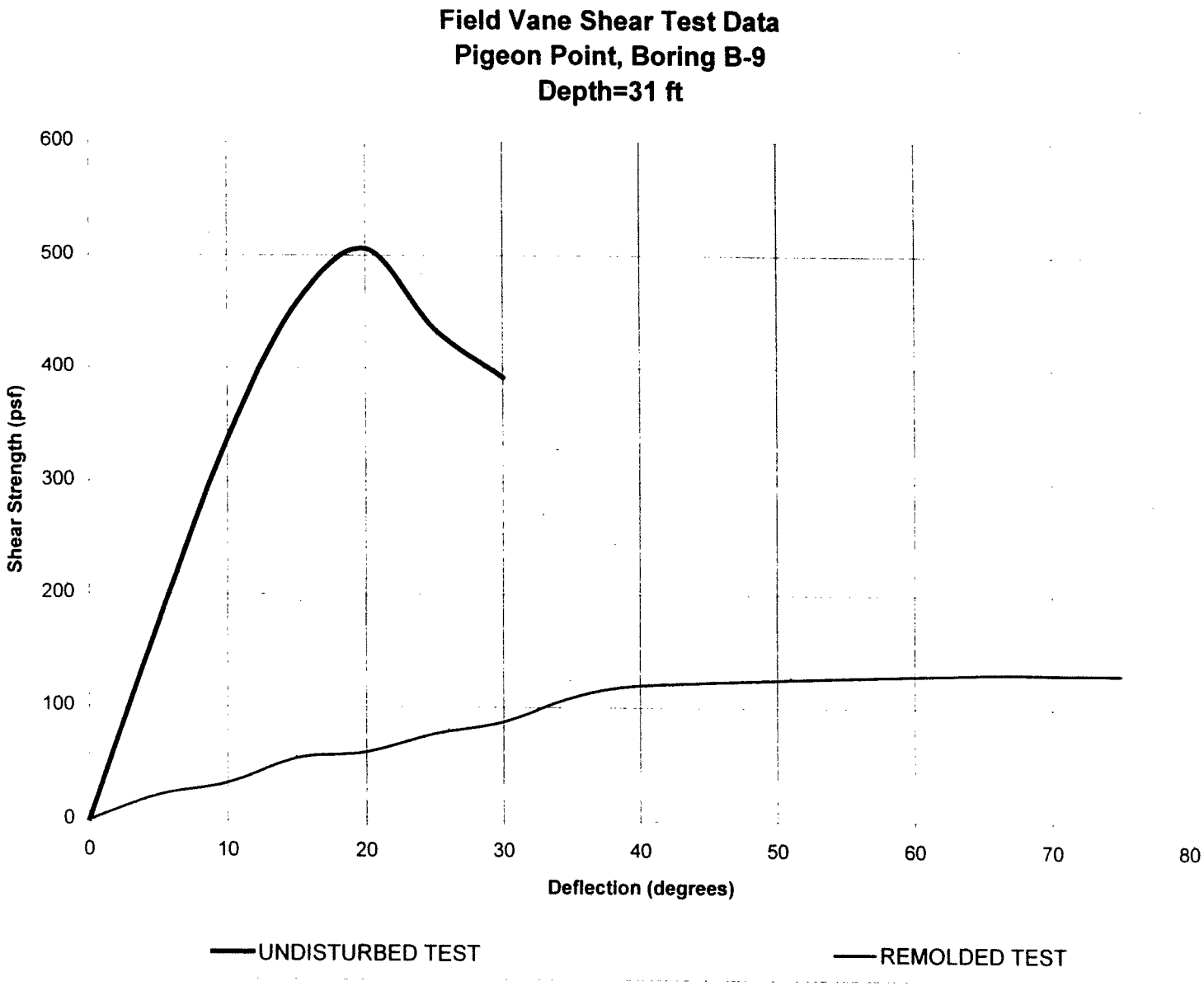
Maximum Torque (ft x lb):	21	Time to Failure (min):	14
Ave. Shear Rate (deg/sec):	0.07	Deflect. at Failure (deg):	59

Friction Correction (ft x lb):	10	from friction test at 21.5 feet

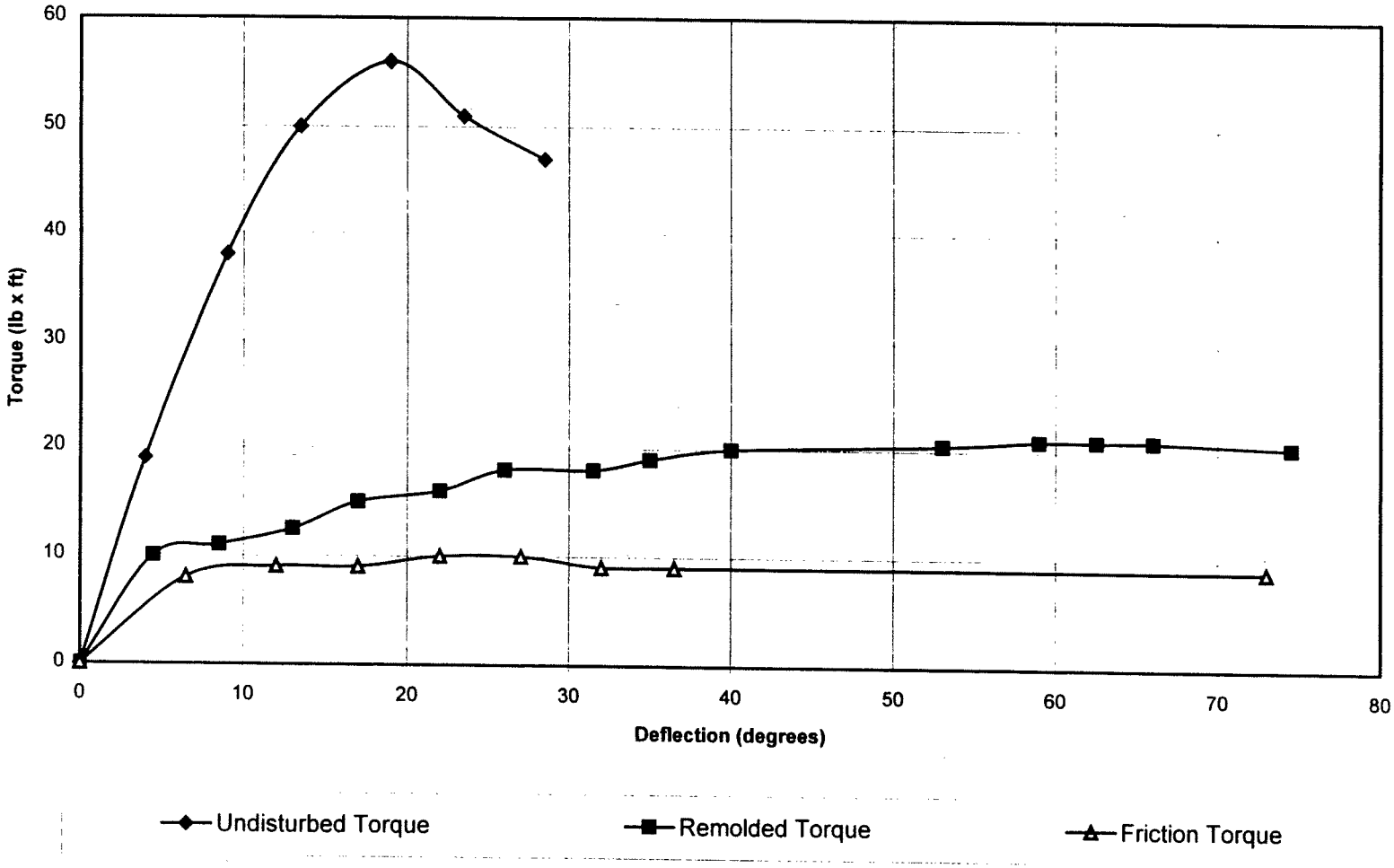
UNDISTURBED TEST:
Undrained Shear Strength: 500 psf

REMOLDED TEST:
Undrained Shear Strength: 120 psf

Drilling Foreman:	Rick Rider
Inspector:	Michael Gill
Supervising Engineer:	Chris Reith


Field Vane Shear Test Data
Pigeon Point, Boring B-9
Depth=31 ft
Shear Strength (psf)
600
500
400
300
200
100
0
0
10
20
30
40
50
60
70
80
Deflection (degrees)
UNDISTURBED TEST
REMOLDED TEST

Field Vane Shear Test Data
Pigeon Point, Boring B-9
Depth=31 ft



Schnabel Engineering

Field Vane Shear Test Log

PROJECT NAME:	PIGEON POINT LANDFILL - DSWA 408
CONTRACT NUMBER:	985176
CONTRACTOR:	HARDIN-HUBER INC.
DATE:	August 17, 1998

BORING NUMBER:	B-9	TEST NUMBER:	VANE #7
GROUND SURFACE EL.:	17	VANE DIAMETER (in):	3.63
DEPTH TO VANE TIP (ft):	37	VANE SHAPE:	TAPERED
DEPTH BELOW AUGERS (ft):	2.5	ROD DIAMETER (in):	0.75

Description of test procedure: 4.25 inch I.D. auger was advanced to 2.5 feet above the desired vane tip depth.
A non-housed vane was pushed to 2.5 feet below the augers.
The torque was applied manually by a hand crank that turned a geared drive.
A force gauge set on a moment arm of known length measured the torque.

Time elapsed between vane insertion and shear testing = 10 minutes.

SOIL STRATUM TESTED: STRATUM B

UNDISTURBED TEST:

Maximum Torque (ft x lb):	84	Time to Failure (min):	4.5
Ave. Shear Rate (deg/sec):	0.08	Deflect. at Failure (deg):	23

REMOLDED TEST:

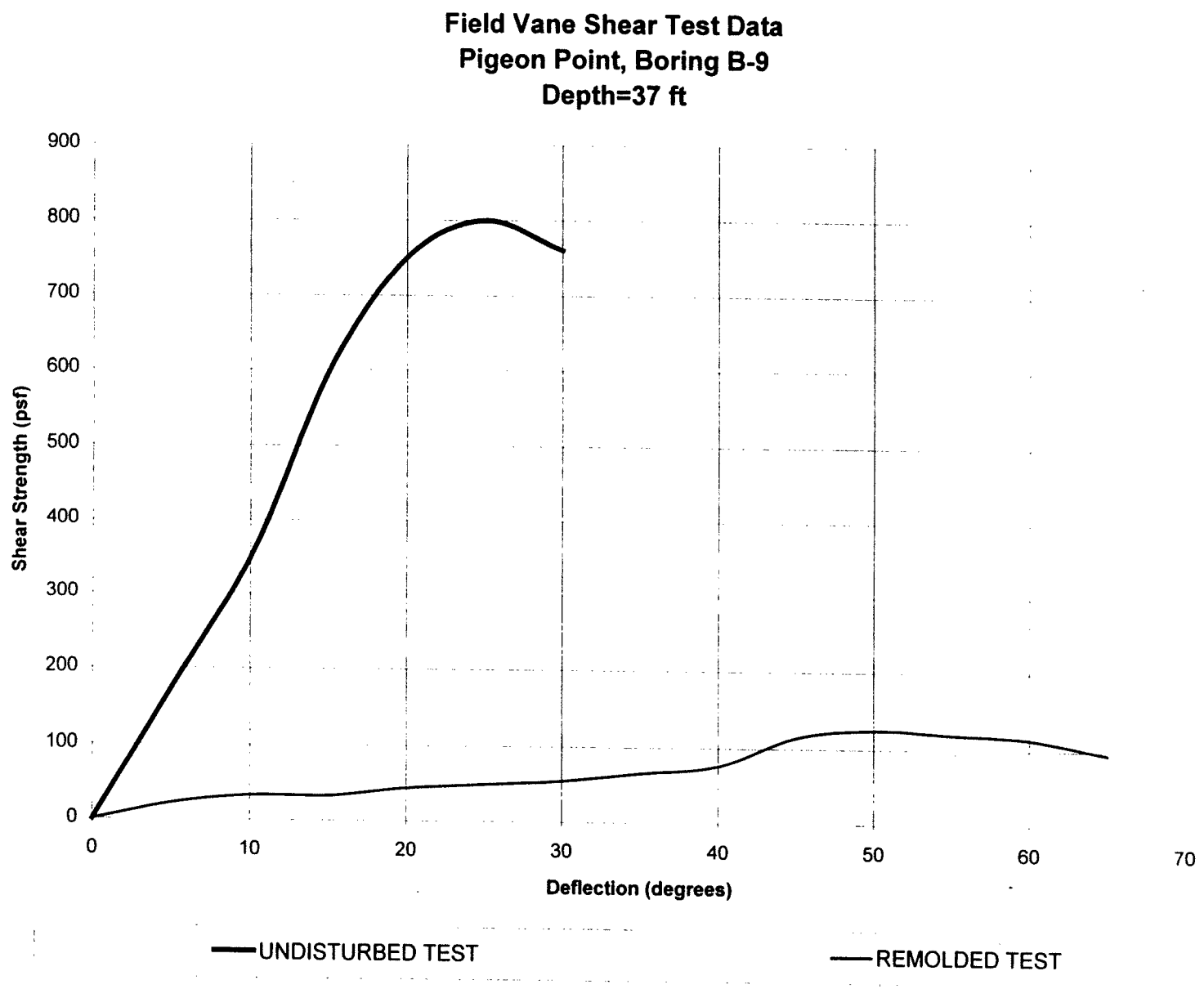
Maximum Torque (ft x lb):	23.5	Time to Failure (min):	10
Ave. Shear Rate (deg/sec):	0.09	Deflect. at Failure (deg):	53

Friction Correction (ft x lb):	12.5	from friction test at 39.5 feet

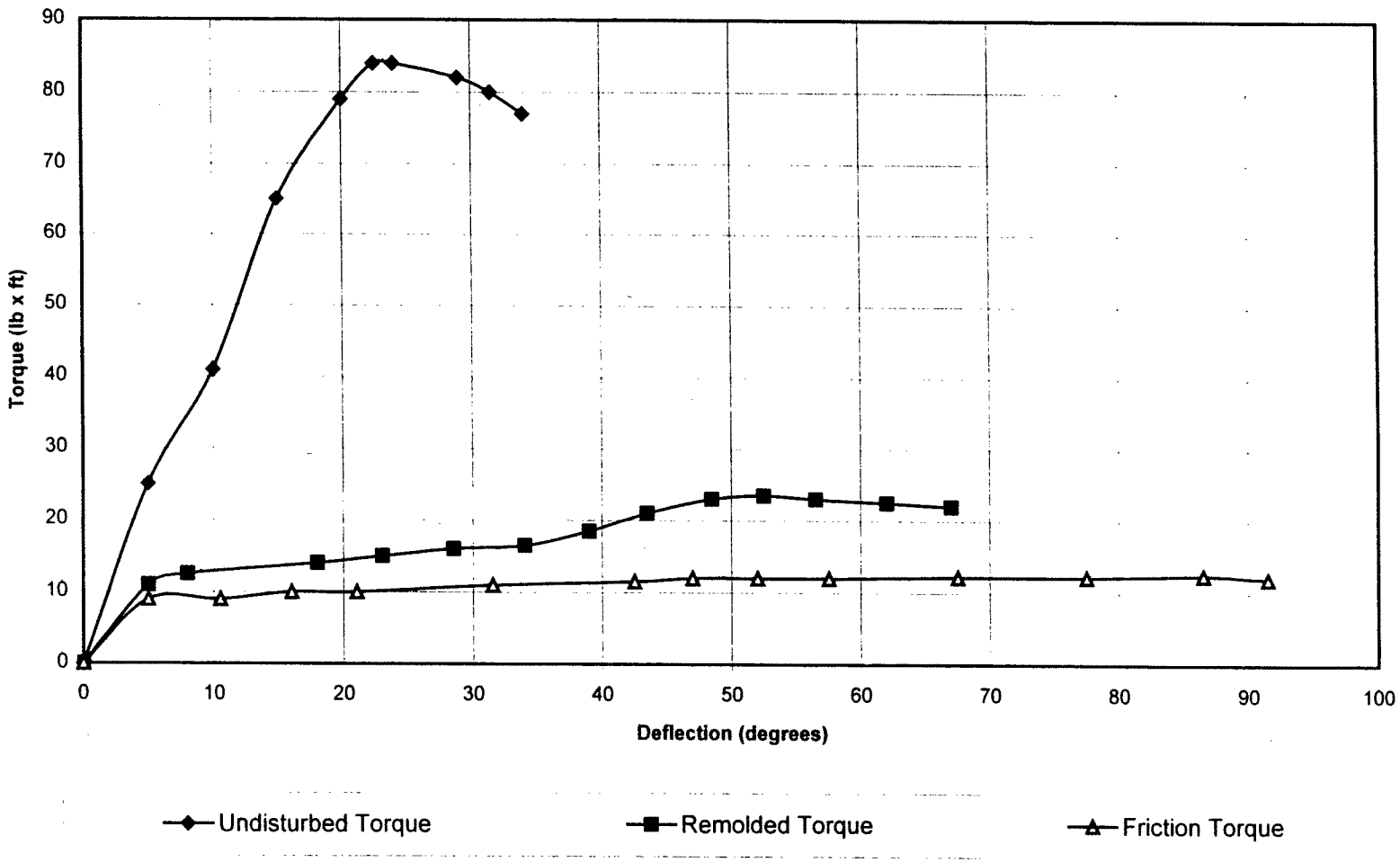
UNDISTURBED TEST:
Undrained Shear Strength: 800 psf

REMOLDED TEST:
Undrained Shear Strength: 120 psf

Drilling Foreman:	Rick Rider
Inspector:	Michael Gill
Supervising Engineer:	Chris Reith


Field Vane Shear Test Data
Pigeon Point, Boring B-9
Depth=37 ft
Shear Strength (psf)
900
800
700
600
500
400
300
200
100
0
0
10
20
30
40
50
60
70
Deflection (degrees)
UNDISTURBED TEST
REMOLDED TEST

Field Vane Shear Test Data
Pigeon Point, Boring B-9
Depth=37 ft



Schnabel Engineering

Field Vane Shear Test Log

PROJECT NAME:	PIGEON POINT LANDFILL - DSWA 408
CONTRACT NUMBER:	985176
CONTRACTOR:	HARDIN-HUBER INC.
DATE:	August 17, 1998

BORING NUMBER:	B-9	TEST NUMBER:	VANE #8
GROUND SURFACE EL.:	17	VANE DIAMETER (in):	3.63
DEPTH TO VANE TIP (ft):	44	VANE SHAPE:	TAPERED
DEPTH BELOW AUGERS (ft):	2.5	ROD DIAMETER (in):	0.75

Description of test procedure: 4.25 inch I.D. auger was advanced to 2.5 feet above the desired vane tip depth.
A non-housed vane was pushed to 2.5 feet below the augers.
The torque was applied manually by a hand crank that turned a geared drive.
A force gauge set on a moment arm of known length measured the torque.

Time elapsed between vane insertion and shear testing = 10 minutes.

SOIL STRATUM TESTED: STRATUM B

UNDISTURBED TEST:

Maximum Torque (ft x lb):	139	Time to Failure (min):	14.5
Ave. Shear Rate (deg/sec):	0.08	Deflect. at Failure (deg):	73

REMOLDED TEST:

Maximum Torque (ft x lb):	43	Time to Failure (min):	12
Ave. Shear Rate (deg/sec):	0.08	Deflect. at Failure (deg):	66

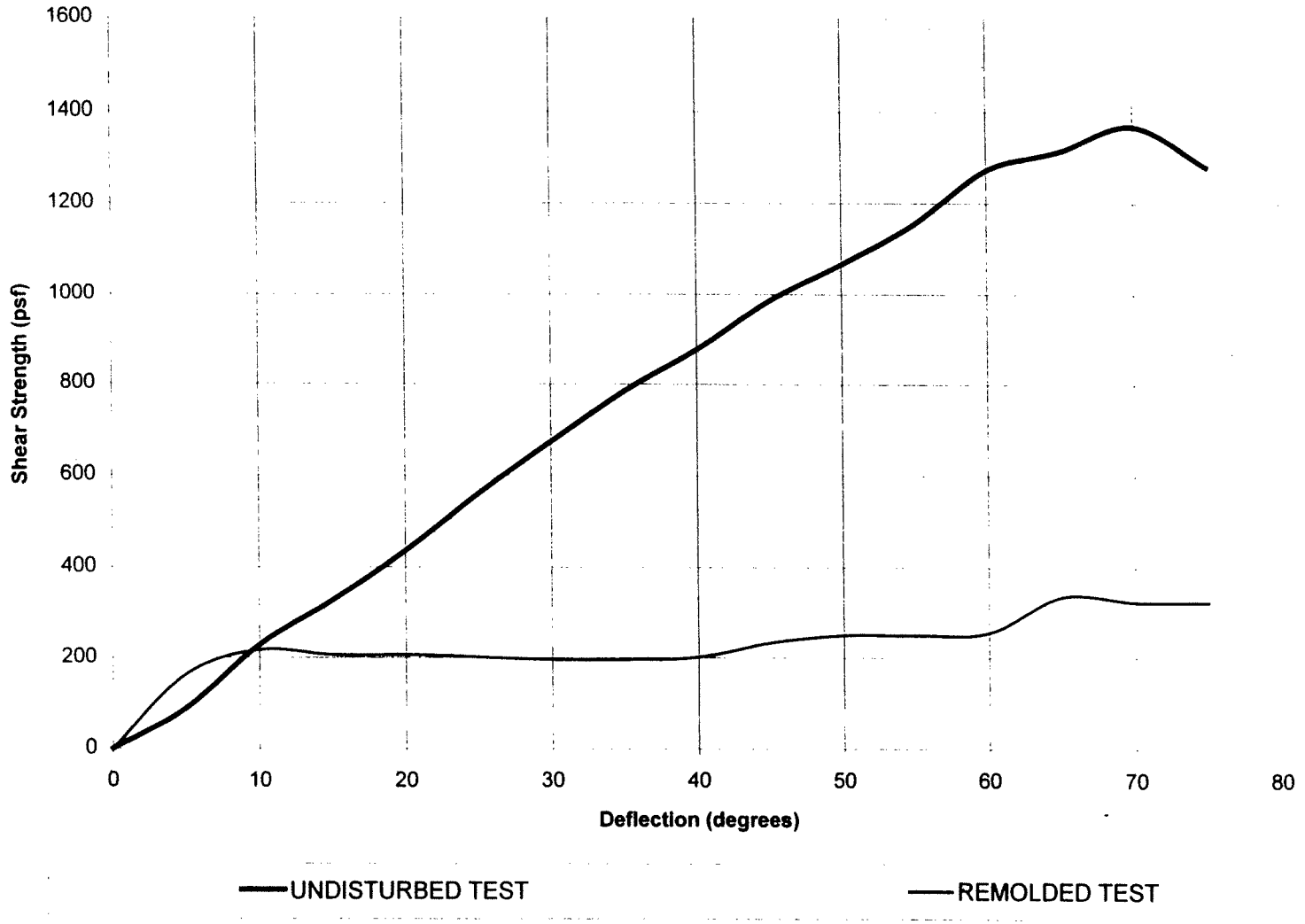
Friction Correction (ft x lb):	12.5	from friction test at 39.5 feet

UNDISTURBED TEST:
Undrained Shear Strength: 1380 psf

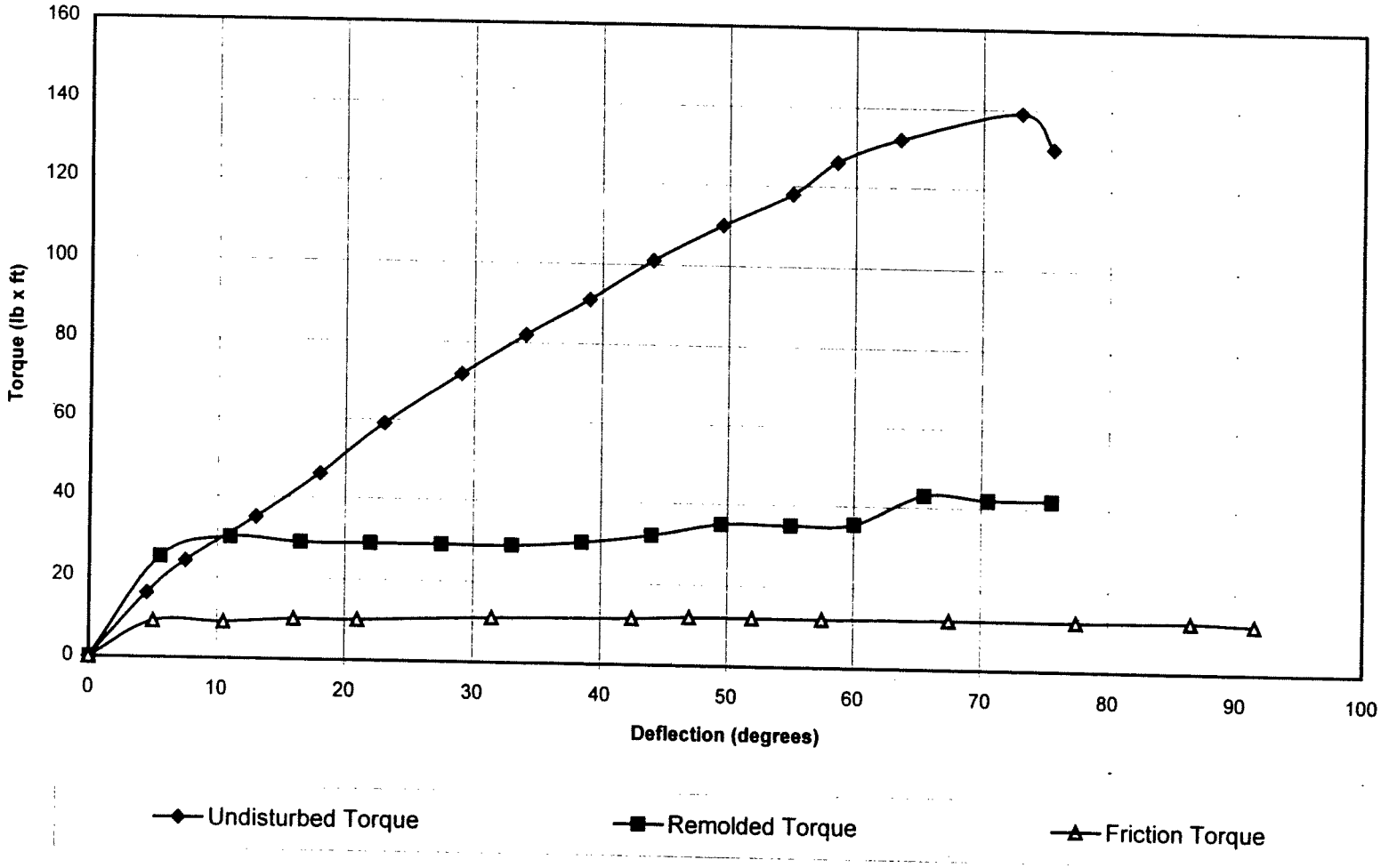
REMOLDED TEST:
Undrained Shear Strength: 330 psf

Drilling Foreman:	Rick Rider
Inspector:	Michael Gill
Supervising Engineer:	Chris Reith

Field Vane Shear Test Data
Pigeon Point, Boring B-9
Depth=44 ft



Field Vane Shear Test Data
Pigeon Point, Boring B-9
Depth=44 ft



Schnabel Engineering

Field Vane Shear Test Log

PROJECT NAME:	PIGEON POINT LANDFILL - DSWA 408
CONTRACT NUMBER:	985176
CONTRACTOR:	HARDIN-HUBER INC.
DATE:	August 19, 1998

BORING NUMBER:	B-13	TEST NUMBER:	VANE #1
GROUND SURFACE EL.:	17	VANE DIAMETER (in):	3.625
DEPTH TO VANE TIP (ft):	8	VANE SHAPE:	TAPERED
DEPTH BELOW AUGERS (ft):	2.5	ROD DIAMETER (in):	0.75

Description of test procedure: 4.25 inch I.D. auger was advanced to 2.5 feet above the desired vane tip depth.
A non-housed vane was pushed to 2.5 feet below the augers.
The torque was applied manually by a hand crank that turned a geared drive.
A force gauge set on a moment arm of known length measured the torque.

Time elapsed between vane insertion and shear testing = 10 minutes.

SOIL STRATUM TESTED: STRATUM B

UNDISTURBED TEST:

Maximum Torque (ft x lb):	54.5	Time to Failure (min):	4
Ave. Shear Rate (deg/sec):	0.08	Deflect. at Failure (deg):	19

REMOLDED TEST:

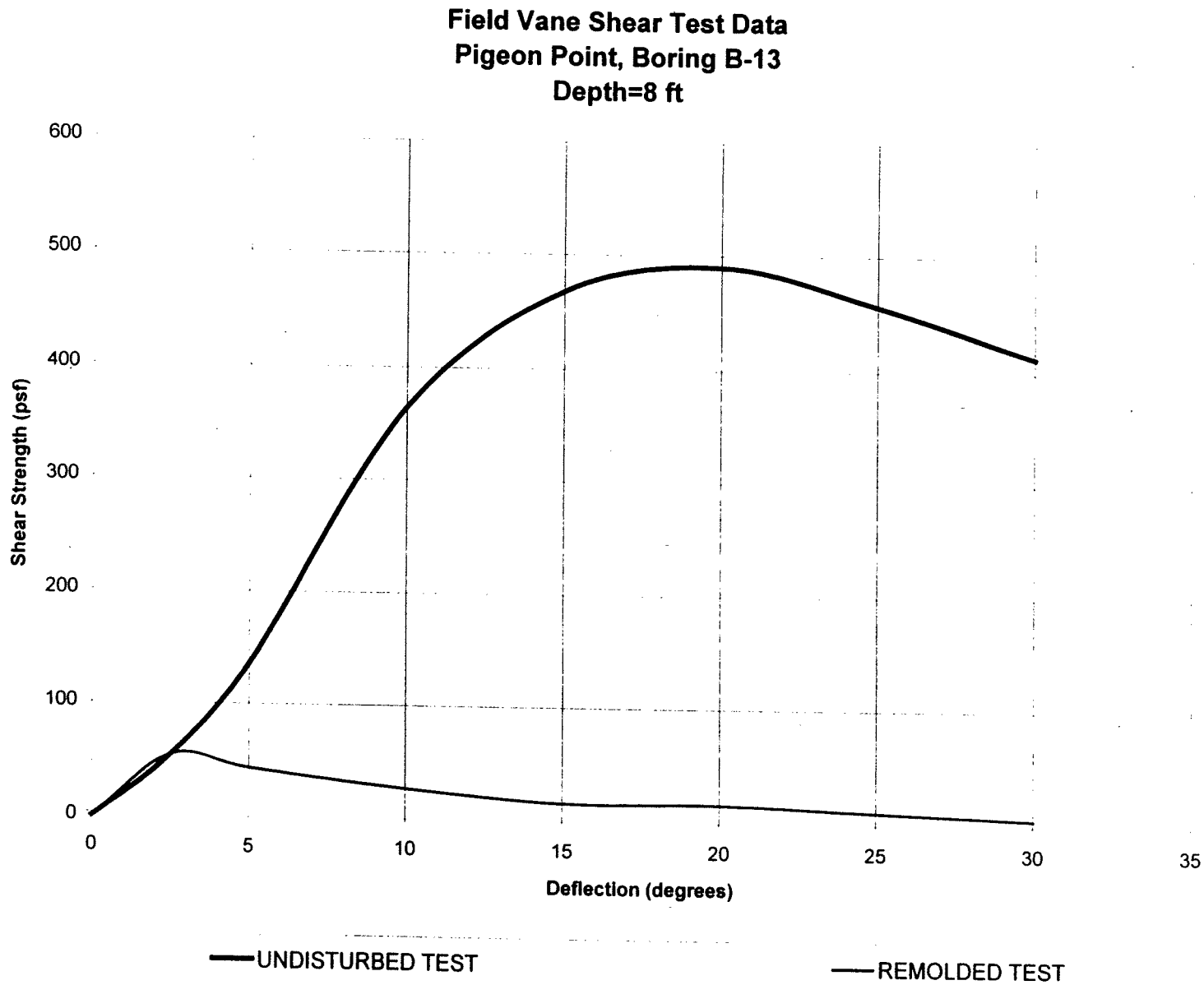
Maximum Torque (ft x lb):	11	Time to Failure (min):	6
Ave. Shear Rate (deg/sec):	0.07	Deflect. at Failure (deg):	27

Friction Correction (ft x lb):	10	from friction test at 12 feet

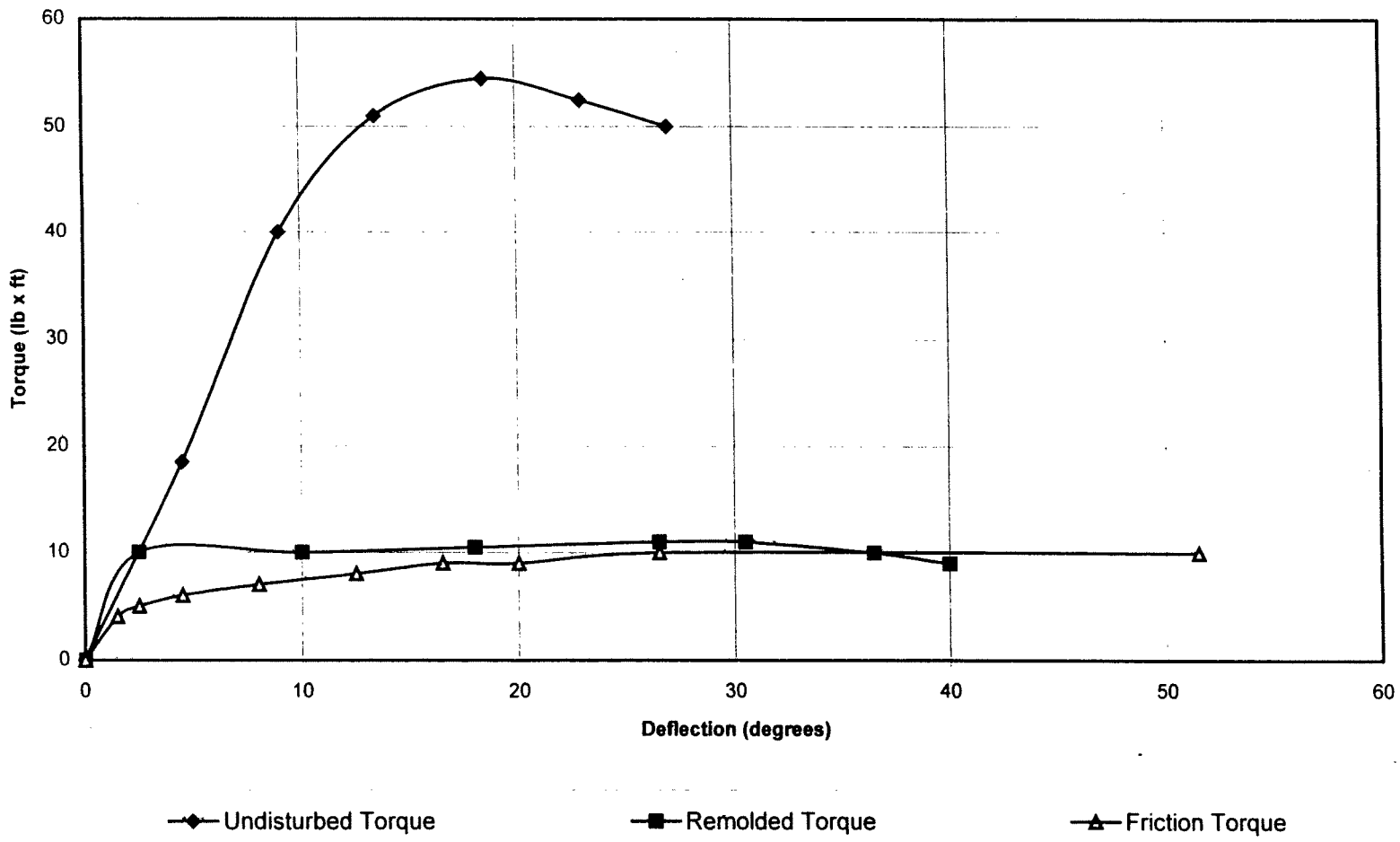
UNDISTURBED TEST:
Undrained Shear Strength: 480 psf

REMOLDED TEST:
Undrained Shear Strength: 50 psf

Drilling Foreman:	Rick Rider
Inspector:	Michael Gill
Supervising Engineer:	Chris Reith


Field Vane Shear Test Data
Pigeon Point, Boring B-13
Depth=8 ft
Shear Strength (psf)
600
500
400
300
200
100
0
0
5
10
15
20
25
30
35
Deflection (degrees)
UNDISTURBED TEST
REMOLDED TEST

Field Vane Shear Test Data
Pigeon Point, Boring B-13
Depth=8 ft



Schnabel Engineering

Field Vane Shear Test Log

PROJECT NAME:	PIGEON POINT LANDFILL - DSWA 408
CONTRACT NUMBER:	985176
CONTRACTOR:	HARDIN-HUBER INC.
DATE:	August 20, 1998

BORING NUMBER:	B-13	TEST NUMBER:	VANE #2
GROUND SURFACE EL.:	17	VANE DIAMETER (in):	3.625
DEPTH TO VANE TIP (ft):	16	VANE SHAPE:	TAPERED
DEPTH BELOW AUGERS (ft):	2.5	ROD DIAMETER (in):	0.75

Description of test procedure: 4.25 inch I.D. auger was advanced to 2.5 feet above the desired vane tip depth.
A non-housed vane was pushed to 2.5 feet below the augers.
The torque was applied manually by a hand crank that turned a geared drive.
A force gauge set on a moment arm of known length measured the torque.

Time elapsed between vane insertion and shear testing = 10 minutes.

SOIL STRATUM TESTED: STRATUM B

UNDISTURBED TEST:

Maximum Torque (ft x lb):	68	Time to Failure (min):	4.5
Ave. Shear Rate (deg/sec):	0.08	Deflect. at Failure (deg):	24

REMOLDED TEST:

Maximum Torque (ft x lb):	17	Time to Failure (min):	17
Ave. Shear Rate (deg/sec):	0.08	Deflect. at Failure (deg):	87

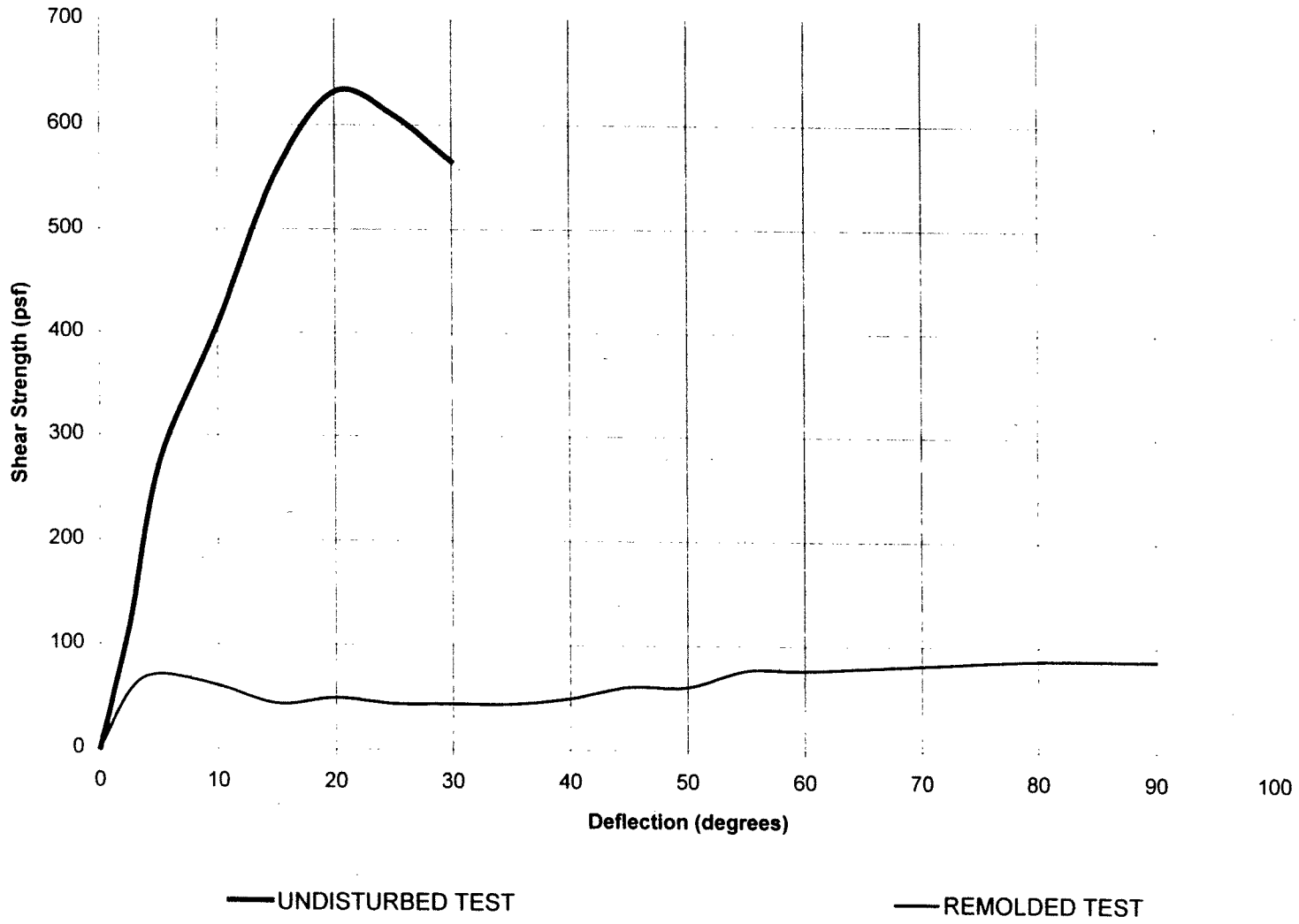
Friction Correction (ft x lb):	10	from friction test at 12 feet

UNDISTURBED TEST:
Undrained Shear Strength: 630 psf

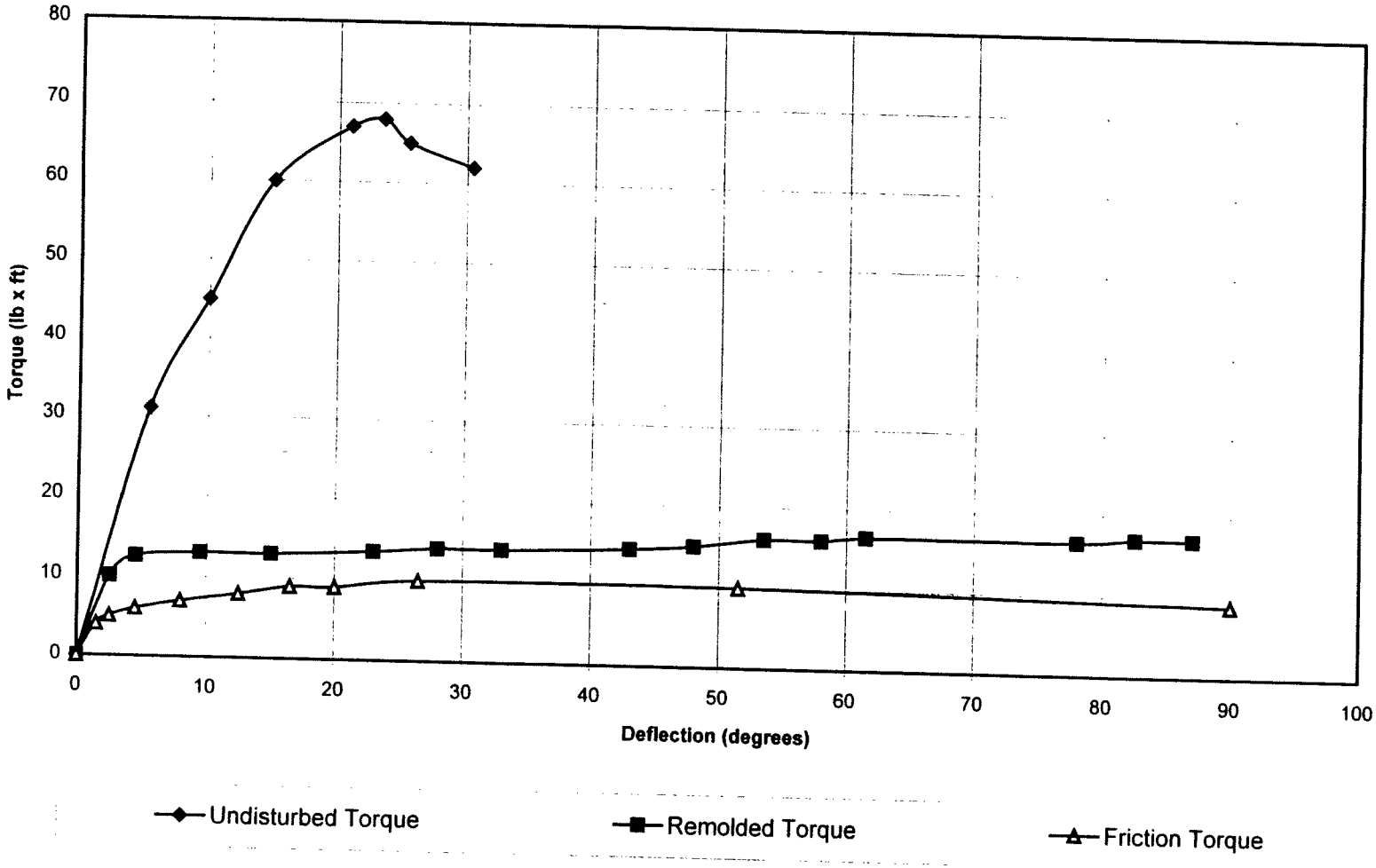
REMOLDED TEST:
Undrained Shear Strength: 90 psf

Drilling Foreman:	Rick Rider
Inspector:	Michael Gill
Supervising Engineer:	Chris Reith

Field Vane Shear Test Data
Pigeon Point, Boring B-13
Depth=16 ft



Field Vane Shear Test Data
Pigeon Point, Boring B-13
Depth=16 ft



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Field Vane Shear Test Log

PROJECT NAME:	PIGEON POINT LANDFILL - DSWA 408
CONTRACT NUMBER:	985176
CONTRACTOR:	HARDIN-HUBER INC.
DATE:	August 17, 1998

BORING NUMBER:	B-9	TEST NUMBER:	VANE #1
GROUND SURFACE EL.:	17	VANE DIAMETER (in):	2
DEPTH TO VANE TIP (ft):	8	VANE SHAPE:	TAPERED
DEPTH BELOW AUGERS (ft):	2.5	ROD DIAMETER (in):	0.75

Description of test procedure: 4.25 inch I.D. auger was advanced to 2.5 feet above the desired vane tip depth.
A non-housed vane was pushed to 2.5 feet below the augers.
The torque was applied manually by a hand crank that turned a geared drive.
A force gauge set on a moment arm of known length measured the torque.

Time elapsed between vane insertion and shear testing = 10 minutes.

SOIL STRATUM TESTED: STRATUM B

UNDISTURBED TEST:

Maximum Torque (ft x lb):	9.7	Time to Failure (min):	1.5
Ave. Shear Rate (deg/sec):		Deflect. at Failure (deg):	

REMOLDED TEST:

Maximum Torque (ft x lb):	4	Time to Failure (min):	2.5
Ave. Shear Rate (deg/sec):		Deflect. at Failure (deg):	

Friction Correction (ft x lb):	0	no friction test conducted on the 1/2" rod

UNDISTURBED TEST:
Undrained Shear Strength: 600 psf *

REMOLDED TEST:
Undrained Shear Strength: 250 psf *

* no friction correction

Drilling Foreman:	Rick Rider
Inspector:	Michael Gill
Supervising Engineer:	Chris Reith

Schnabel Engineering

Field Vane Shear Test Log

PROJECT NAME:	PIGEON POINT LANDFILL - DSWA 408
CONTRACT NUMBER:	985176
CONTRACTOR:	HARDIN-HUBER INC.
DATE:	August 17, 1998

BORING NUMBER:	B-9	TEST NUMBER:	VANE #2
GROUND SURFACE EL.:	17	VANE DIAMETER (in):	3.63
DEPTH TO VANE TIP (ft):	13	VANE SHAPE:	TAPERED
DEPTH BELOW AUGERS (ft):	2.5	ROD DIAMETER (in):	0.75

Description of test procedure: 4.25 inch I.D. auger was advanced to 2.5 feet above the desired vane tip depth.
A non-housed vane was pushed to 2.5 feet below the augers.
The torque was applied manually by a hand crank that turned a geared drive.
A force gauge set on a moment arm of known length measured the torque.

Time elapsed between vane insertion and shear testing = 10 minutes.

SOIL STRATUM TESTED: STRATUM B

UNDISTURBED TEST:

Maximum Torque (ft x lb):	84	Time to Failure (min):	9.5
Ave. Shear Rate (deg/sec):	0.06	Deflect. at Failure (deg):	33

REMOLDED TEST:

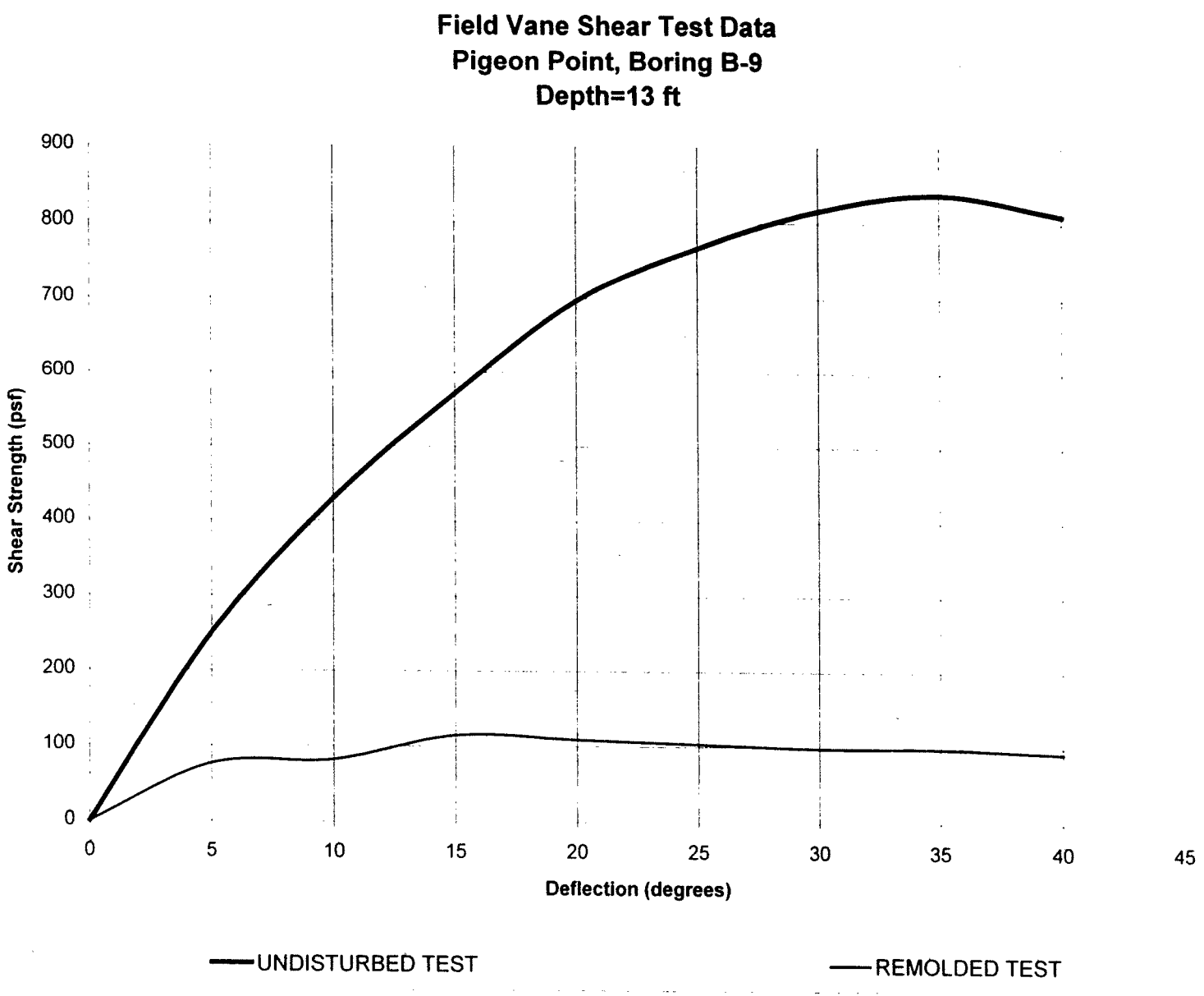
Maximum Torque (ft x lb):	19	Time to Failure (min):	9
Ave. Shear Rate (deg/sec):	0.09	Deflect. at Failure (deg):	49

Friction Correction (ft x lb):	8	from friction test at 15.5 feet

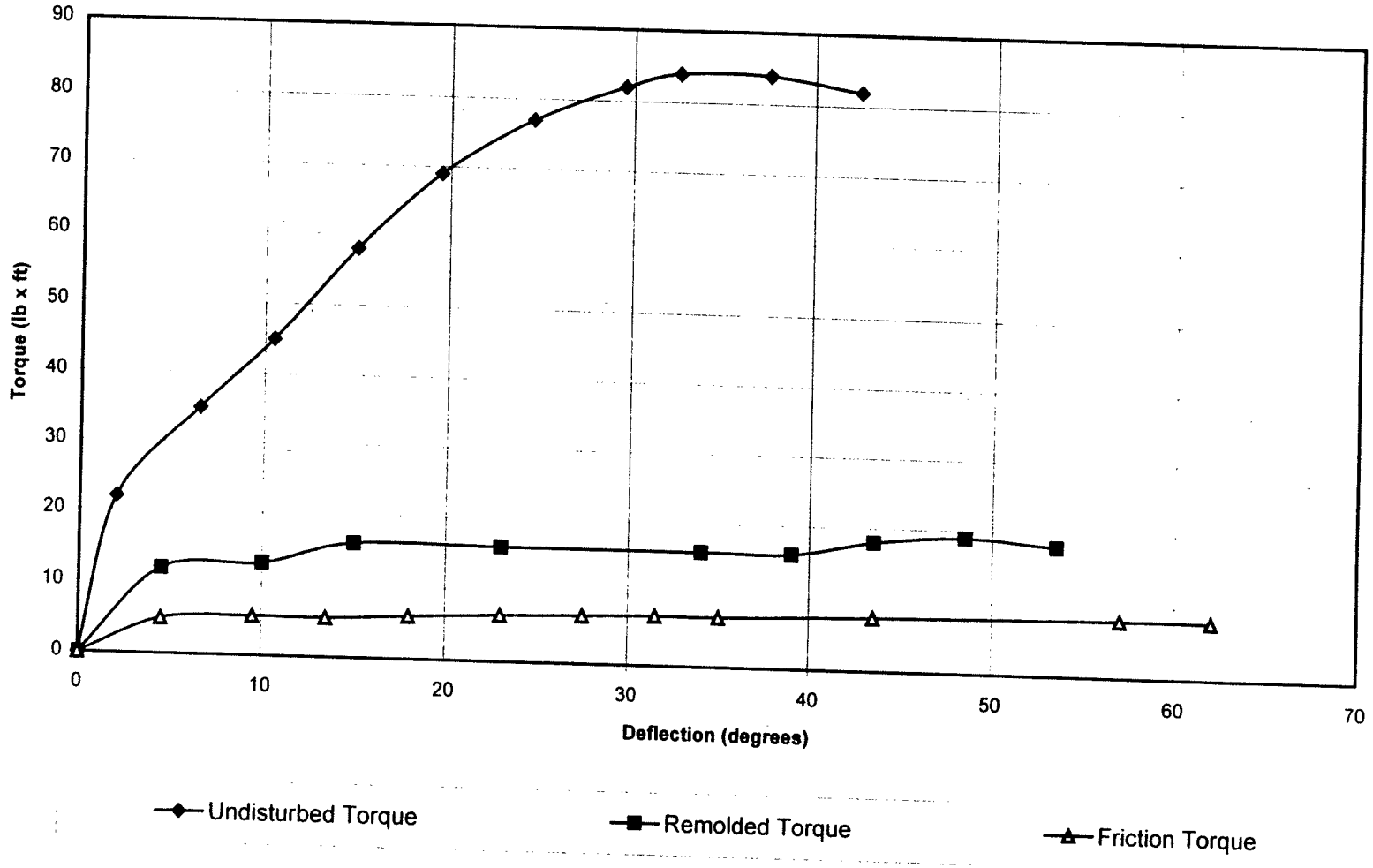
UNDISTURBED TEST:
Undrained Shear Strength: 830 psf

REMOLDED TEST:
Undrained Shear Strength: 120 psf

Drilling Foreman:	Rick Rider
Inspector:	Michael Gill
Supervising Engineer:	Chris Reith


Field Vane Shear Test Data
Pigeon Point, Boring B-9
Depth=13 ft
Shear Strength (psf)
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
35
40
45
Deflection (degrees)
UNDISTURBED TEST
REMOLDED TEST

Field Vane Shear Test Data
Pigeon Point, Boring B-9
Depth=13 ft



Schnabel Engineering

Field Vane Shear Test Log

PROJECT NAME:	PIGEON POINT LANDFILL - DSWA 408
CONTRACT NUMBER:	985176
CONTRACTOR:	HARDIN-HUBER INC.
DATE:	August 17, 1998

BORING NUMBER:	B-9	TEST NUMBER:	VANE #3
GROUND SURFACE EL.:	17	VANE DIAMETER (in):	3.63
DEPTH TO VANE TIP (ft):	19	VANE SHAPE:	TAPERED
DEPTH BELOW AUGERS (ft):	2.5	ROD DIAMETER (in):	0.75

Description of test procedure: 4.25 inch I.D. auger was advanced to 2.5 feet above the desired vane tip depth.
A non-housed vane was pushed to 2.5 feet below the augers.
The torque was applied manually by a hand crank that turned a geared drive.
A force gauge set on a moment arm of known length measured the torque.

Time elapsed between vane insertion and shear testing = 10 minutes.

SOIL STRATUM TESTED: STRATUM B

UNDISTURBED TEST:

Maximum Torque (ft x lb):	60	Time to Failure (min):	4
Ave. Shear Rate (deg/sec):	0.08	Deflect. at Failure (deg):	20

REMOLDED TEST:

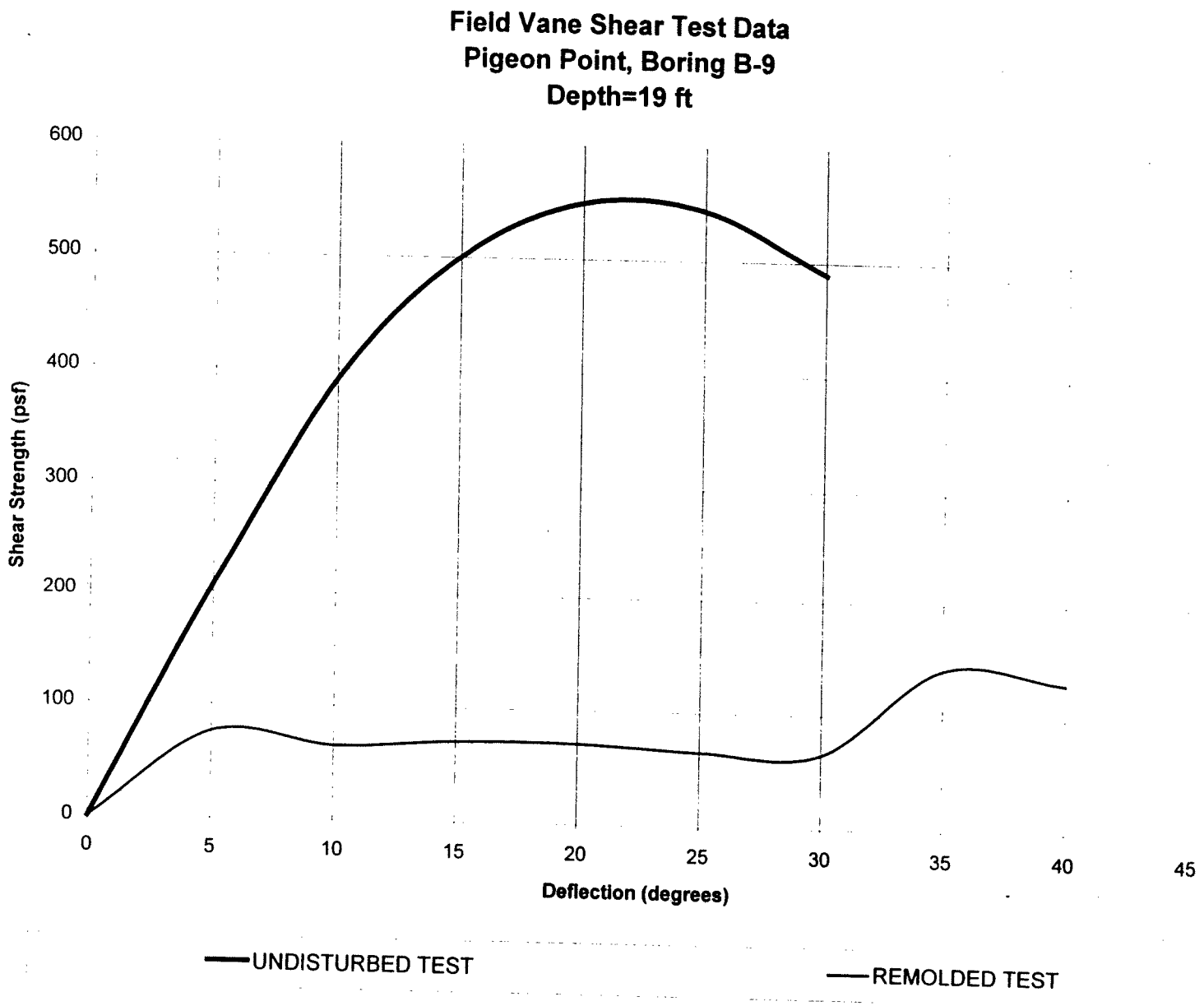
Maximum Torque (ft x lb):	22	Time to Failure (min):	7
Ave. Shear Rate (deg/sec):	0.09	Deflect. at Failure (deg):	35

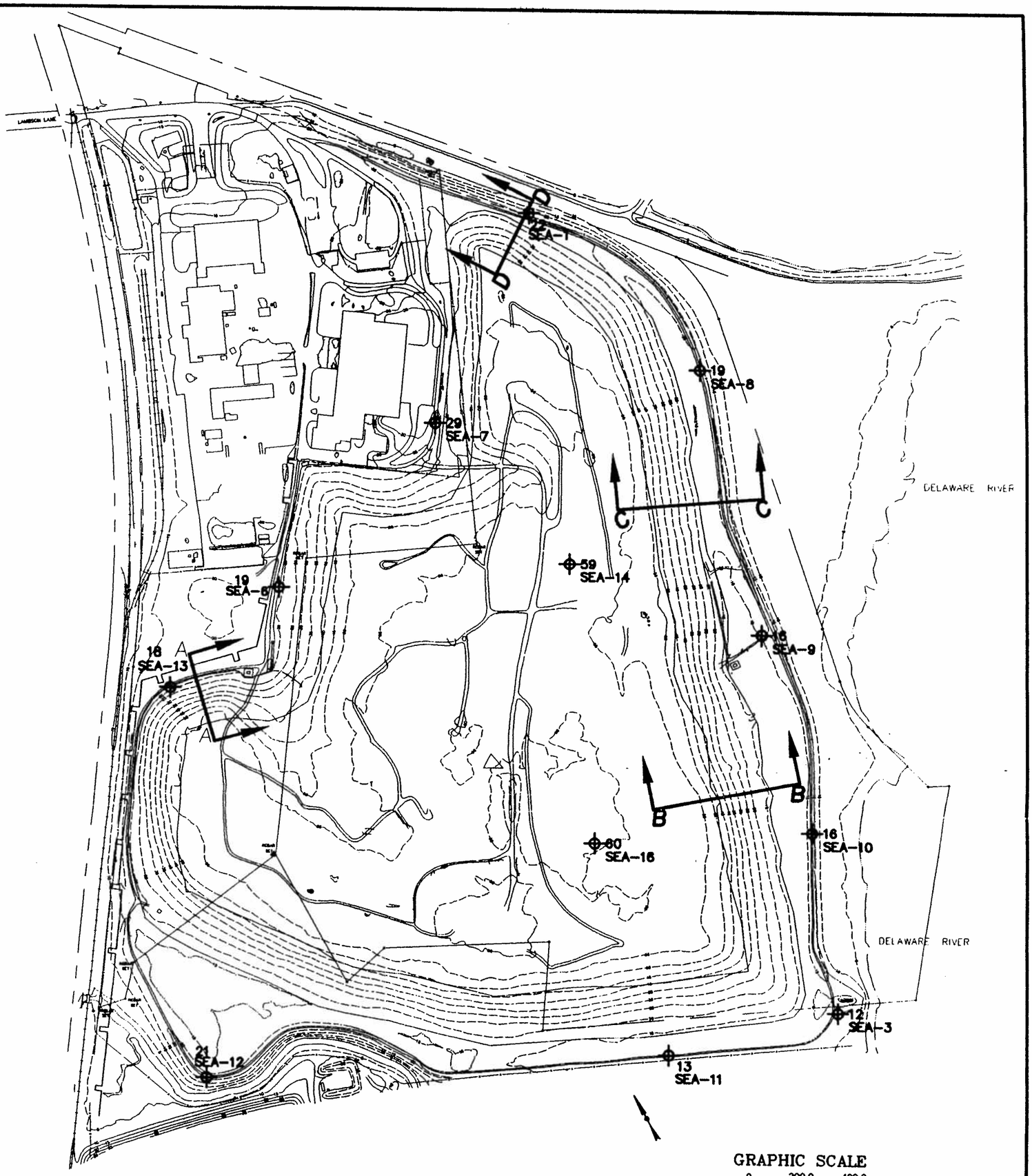
Friction Correction (ft x lb):	10	from friction test at 21.5 feet

UNDISTURBED TEST:
Undrained Shear Strength: 540 psf

REMOLDED TEST:
Undrained Shear Strength: 130 psf

Drilling Foreman:	Rick Rider
Inspector:	Michael Gill
Supervising Engineer:	Chris Reith


Field Vane Shear Test Data
Pigeon Point, Boring B-9
Depth=19 ft
Shear Strength (psf)
600
500
400
300
200
100
0
0
5
10
15
20
25
30
35
40
45
Deflection (degrees)
UNDISTURBED TEST
REMOLDED TEST



GRAPHIC SCALE

0 200.0 400.0

1 inch = 400 ft.

SAMPLE	TEST	NORTHING	EASTING
SEA-1	SPT	620040.67	624809.22
SEA-3	SPT	616789.35	624344.66
SEA-6	SPT	619247.72	623277.29
SEA-7	CPT	619514.68	624103.67
SEA-8	CPT	619210.08	625088.57
SEA-9	SCPT DMT FVST	618210.94	624800.79
SEA-10	CPT	617445.88	624596.98
SEA-11	CPT	616955.54	623699.26
SEA-12	SCPT	617721.51	622113.59
SEA-13	FVST DMT SCPT	619109.53	622729.91
SEA-14	CPT	618800.30	624289.94
SEA-16	CPT	617805.52	623848.27

CPT = CONE PENETRATION TEST
SCPT = SEISMIC CONE PENETRATION TEST
DMT = DILATOMETER TEST
FVST = FIELD VANE SHEAR TEST
SPT = STANDARD PENETRATION TEST

LEGEND

⊕ APPROXIMATE LOCATION OF SUBSURFACE EXPLORATION AND G.S. ELEVATION

APPROXIMATE LOCATION OF SUBSURFACE SECTION

SLOPE STABILITY ANALYSIS, PIGEON POINT DISPOSAL AREA, NEW CASTLE, DELAWARE
LOCATION PLAN

SCHNABEL ENGINEERING ASSOCIATES INCORPORATED [redacted]
ENGINEERING CONSULTANTS

DESIGNED	REVISIONS		FIGURE
---			A-1
DRAWN NSF			
CHECKED MGG	DATE	JOB NO. 985176.06	

APPENDIX B

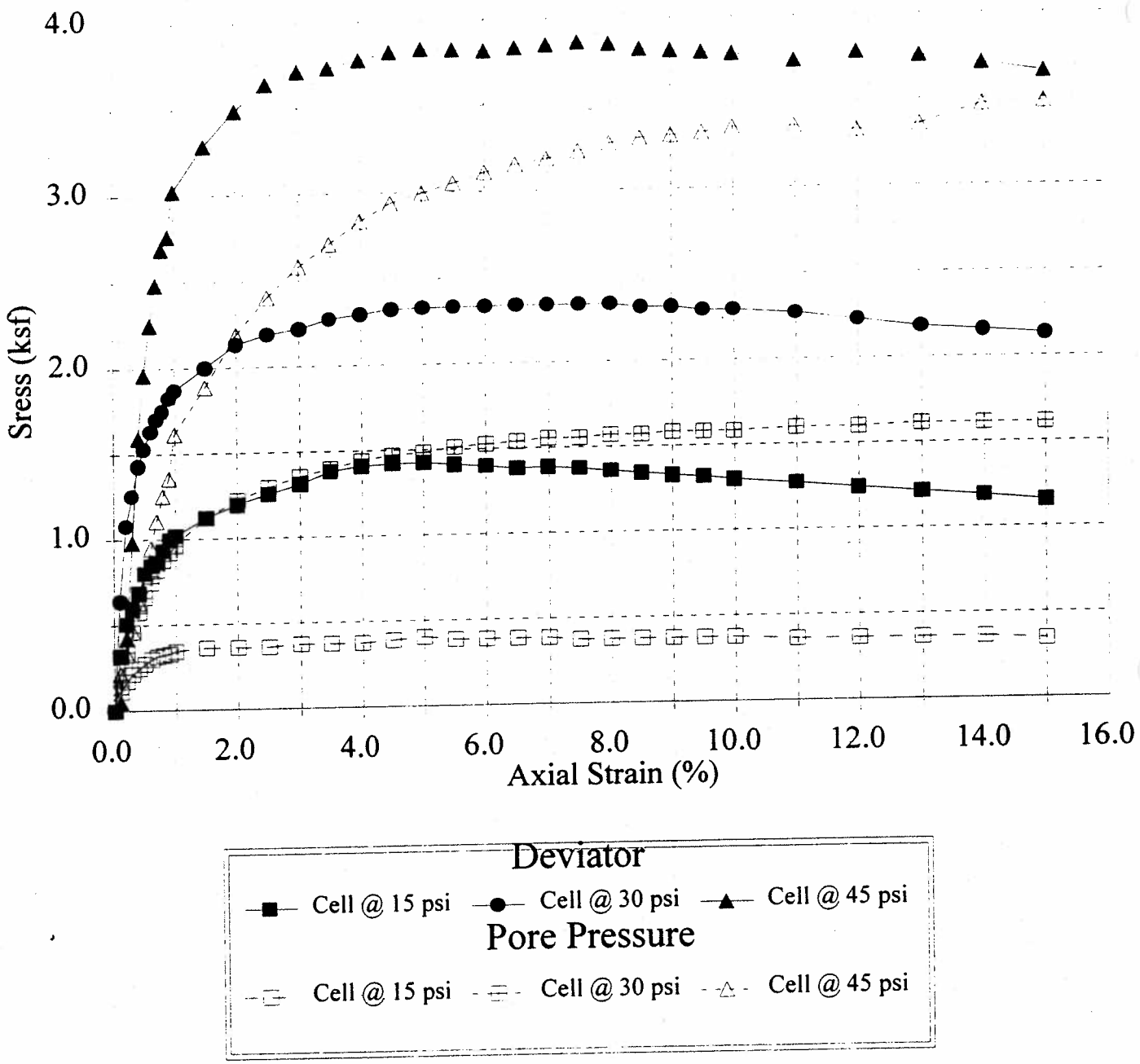
Laboratory Data

Appendix B
Contract 985176.03

SUMMARY OF SOIL LABORATORY TESTS

Boring No.	Sample Depth / Elev.	Sample Type	Description of Soil Specimen	Stratum	Natural Density (pcf)		Atterberg Limits			Natural Moisture (%)	% Passing No. 200 Sieve	Remarks
					Wet	Dry	LL	PL	PI			
SEA-9	7.0-9.0' / 9.0-7.0	TUBE	ELASTIC SILT, trace sand, contains organic matter – dark gray (MH)	B	93.1	53.2	--	--	--	75.0	97	
SEA-9	12.0-14.0' / 4.0-2.0	TUBE	ELASTIC SILT, trace sand, contains organic matter – dark gray (MH)	B	94.4	55.7	61	36	25	69.5	96	
SEA-9	24.0-26.0' / -8.0 to -10.0	TUBE	ELASTIC SILT, trace sand, contains organic matter – dark gray (MH)	B	96.4	55.4	--	--	--	74.0	99	
SEA-9	36.0-38.0' / -20.0 to -22.0	TUBE	ELASTIC SILT, trace sand, contains organic matter – dark gray (MH)	B	98.0	57.9	49	26	23	69.2	96	

Notes:
1. Soil tests in accordance with applicable ASTM Standards
2. Soil classifications in accordance with ASTM D2487
3. Key to abbreviations: LL = Liquid Limit; PL = Plastic Limit; PI = Plasticity Index; NP = Non-Plastic
4. Soil tests were conducted by: SJ, KD, CC & CR



Sample Description:

ELASTIC SILT (MH), dark gray

SCHNABEL ENGINEERING ASSOCIATES, INC.

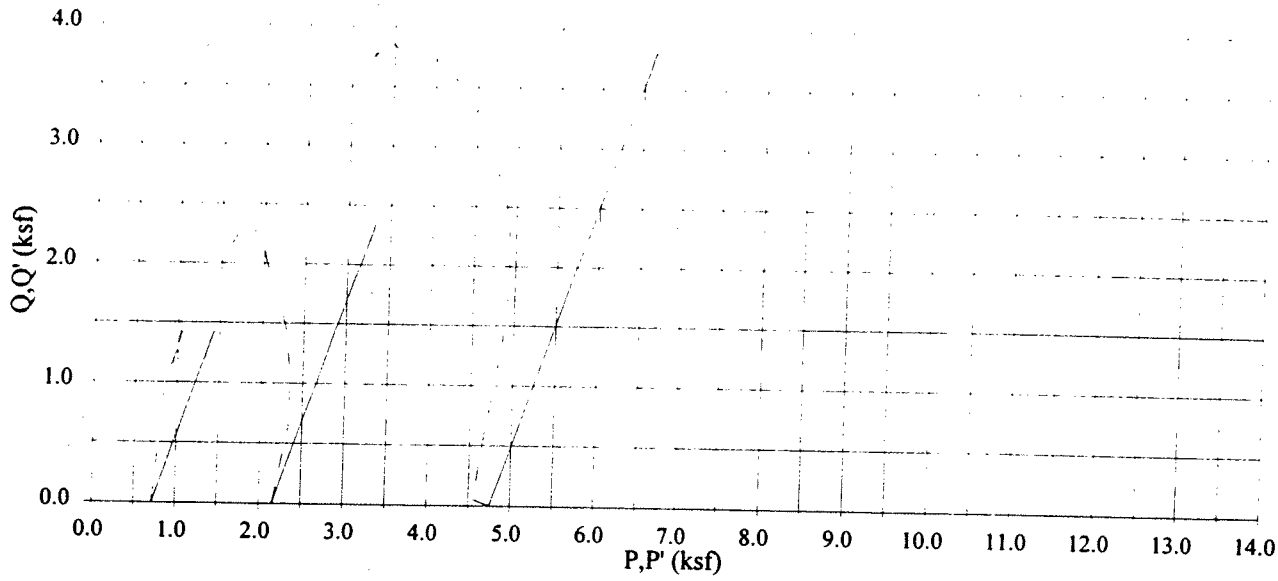
Boring No.	Depth (ft.)	Cell Pressure (ksf)	Moisture Content (percent)		Sample Density (pcf)	
			Initial	Final	Wet	Dry
B-9	7.0-9.0	0.72	74.7	73.2	94.1	53.6
B-9	7.0-9.0	2.16	74.7	59.5	92.4	52.9
B-9	7.0-9.0	4.75	74.7	52.8	92.9	53.2

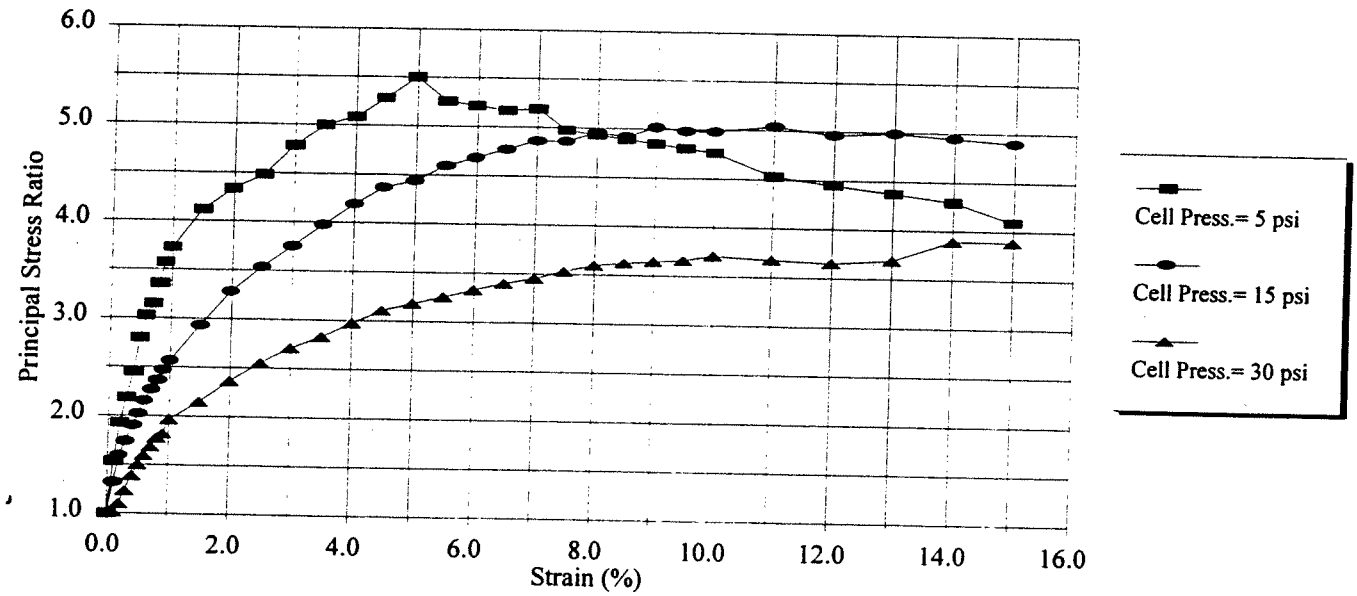
TRIAXIAL COMPRESSION TEST

Test Type: CU Shear Rate: 0.08%/min

Project: Geotechnical Study
Pigeon Point Disposal Area
Wilmington, Delaware

Contract No.: 985176 Date:





Sample Description:

ELASTIC SILT (MH), dark gray

SCHNABEL ENGINEERING ASSOCIATES, INC.

Boring No.	Depth (ft.)	Cell Pressure (ksf)	Moisture Content (percent)		Sample Density (pcf)	
			Initial	Final	Wet	Dry
B-9	7.0-9.0	0.72	74.7	73.2	94.1	53.6
B-9	7.0-9.0	2.16	74.7	59.5	92.4	52.9
B-9	7.0-9.0	4.75	74.7	52.8	92.9	53.2

TRIAXIAL COMPRESSION TEST

Test Type: CU Shear Rate: 0.08%/min

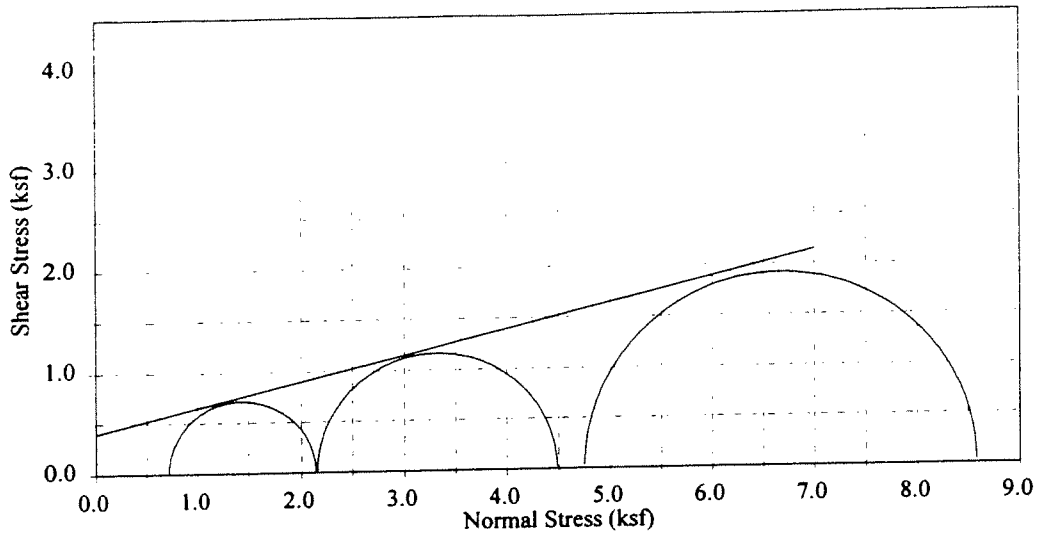
Project: Geotechnical Study
Pigeon Point Disposal Area
Wilmington, Delaware

Contract No.: 985176 Date:

Failure Sketches

TOTAL STRESS

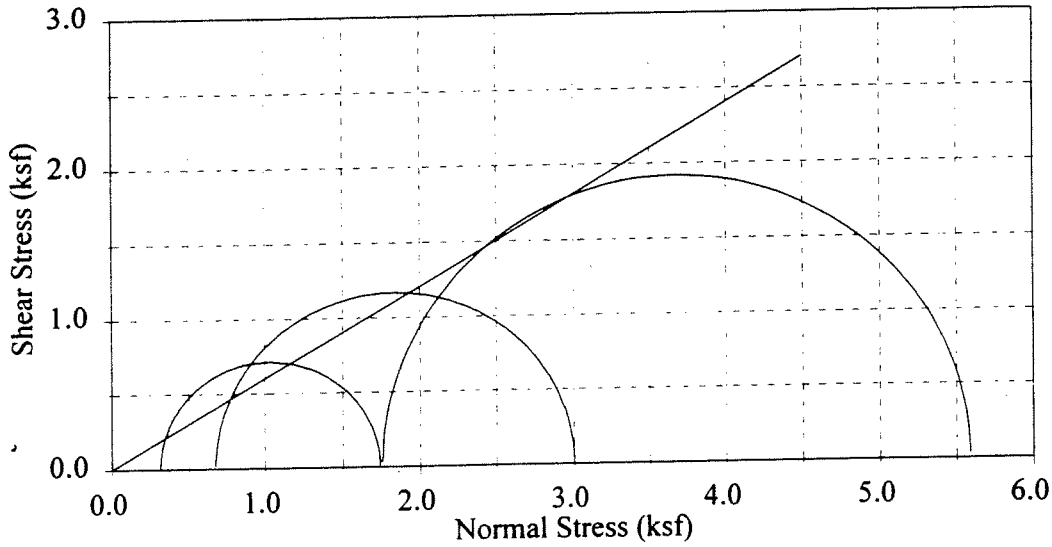
Frict. Ang.= 14 Cohesion= 0.4 ksf



0.72 ksf

EFFECTIVE STRESS

Friction Angle = 31 Cohesion = 0 ksf



2.16 ksf

4.75 ksf

Sample Description:

ELASTIC SILT (MH), dark gray

SCHNABEL ENGINEERING ASSOCIATES, INC.

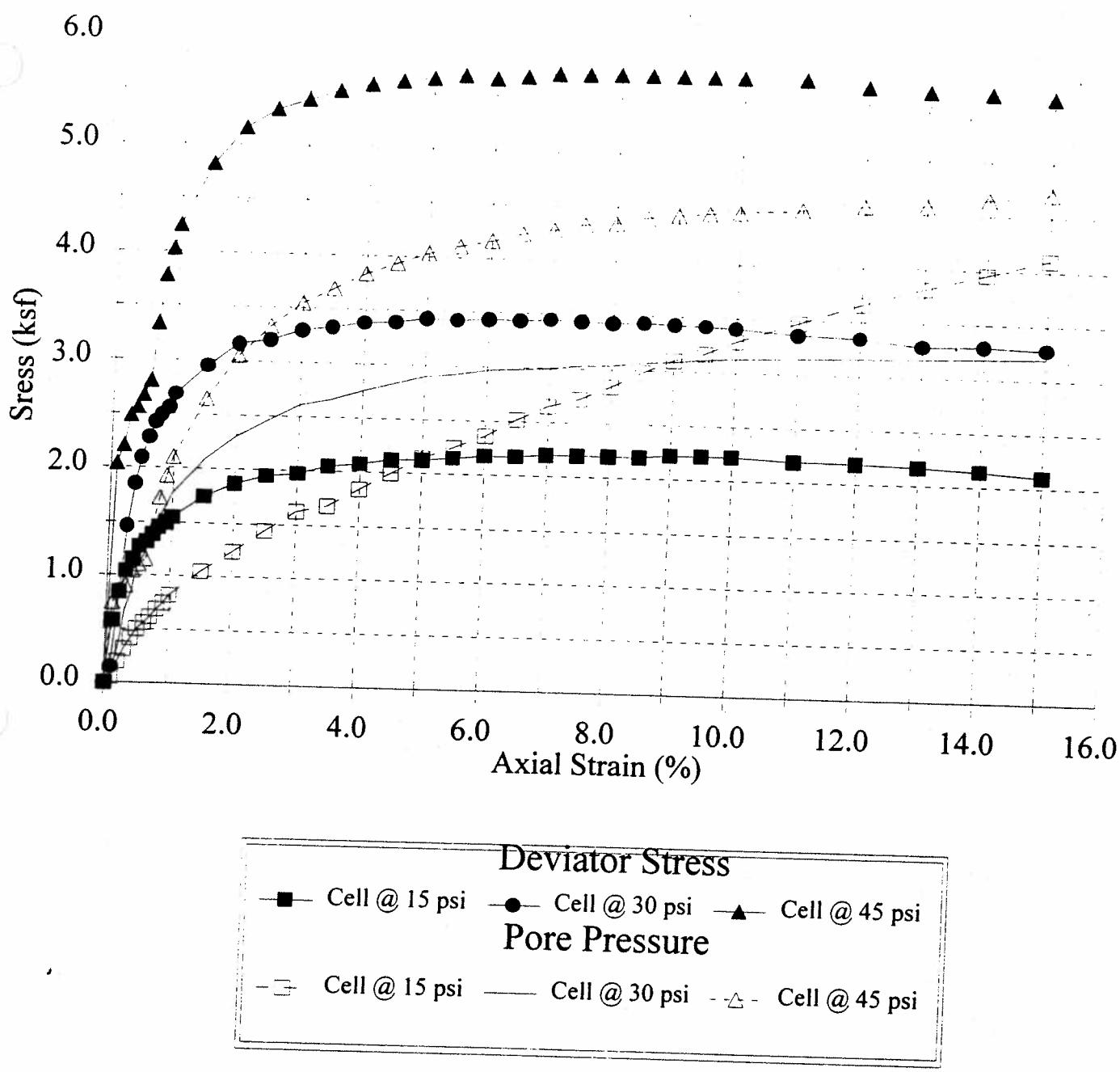
Boring No.	Depth (ft.)	Cell Pressure (ksf)	Moisture Content (percent)		Sample Density (pcf)	
			Initial	Final	Wet	Dry
B-9	7.0-9.0	0.72	74.7	73.2	94.1	53.6
B-9	7.0-9.0	2.16	74.7	59.5	92.4	52.9
B-9	7.0-9.0	4.75	74.7	52.8	92.9	53.2

TRIAXIAL COMPRESSION TEST

Test Type: CU Shear Rate: 0.08%/min

Project: Geotechnical Study
Pigeon Point Disposal Area
Wilmington, Delaware

Contract No.: 985176 Date:



Sample Description:

ELASTIC SILT (MH), dark gray

SCHNABEL ENGINEERING ASSOCIATES, INC.

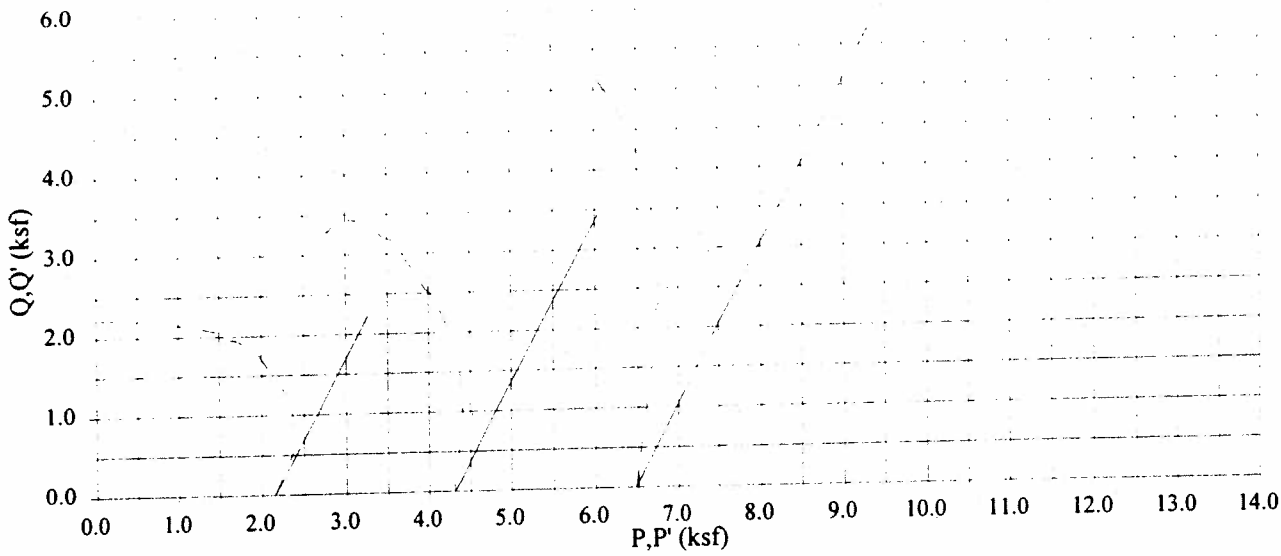
Boring No.	Depth (ft.)	Cell Pressure (ksf)	Moisture Content (percent)		Sample Density (pcf)	
			Initial	Final	Wet	Dry
B-9	24.0-26.0	2.16	74.3	58.0	97.0	55.7
9	24.0-26.0	4.32	78.3	59.5	97.7	54.8
B-9	24.0-26.0	6.48	76.0	50.7	94.6	55.8

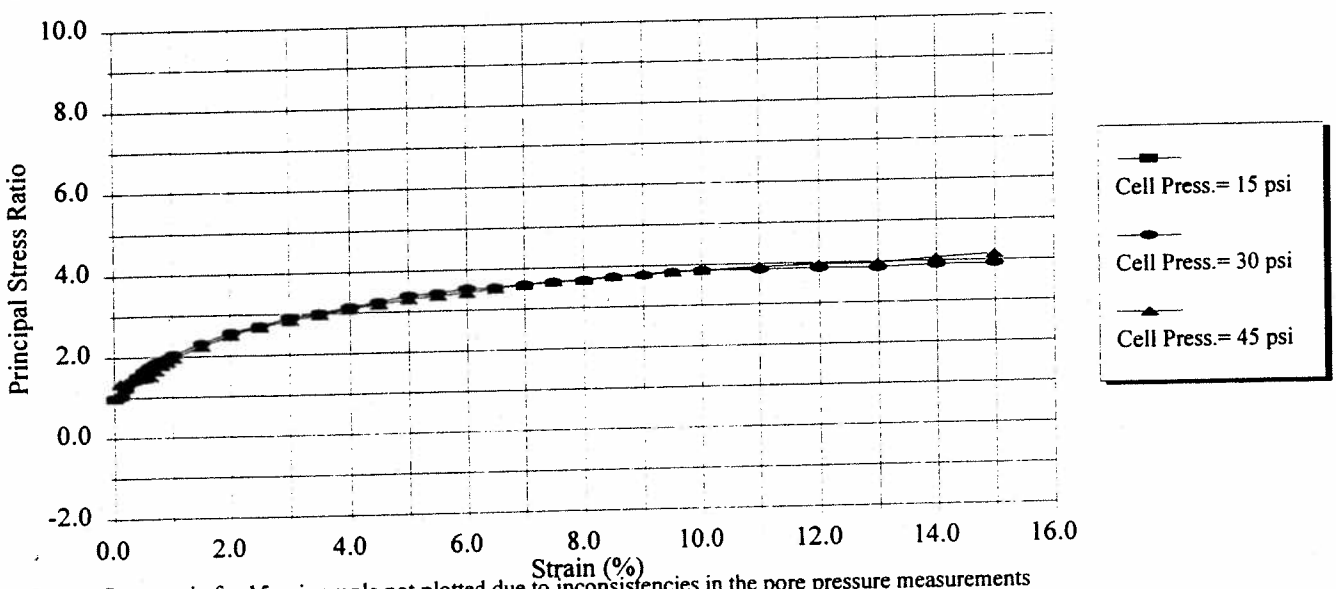
TRIAXIAL COMPRESSION TEST

Test Type: CU Shear Rate: 0.07%/min

Project: Geotechnical Study
Pigeon Point Disposal Area
Wilmington, Delaware

Contract No.: 985176 Date:





Note: Stress ratio for 15 psi sample not plotted due to inconsistencies in the pore pressure measurements

Sample Description:

ELASTIC SILT (MH), dark gray

SCHNABEL ENGINEERING ASSOCIATES, INC.

Boring No.	Depth (ft.)	Cell Pressure (ksf)	Moisture Content (percent)		Sample Density (pcf)	
			Initial	Final	Wet	Dry
B-9	24.0-26.0	2.16	74.3	58.0	97.0	55.7
B-9	24.0-26.0	4.32	78.3	59.5	97.7	54.8
B-9	24.0-26.0	6.48	76.0	50.7	94.6	55.8

TRIAXIAL COMPRESSION TEST

Test Type: CU Shear Rate: 0.07%/min

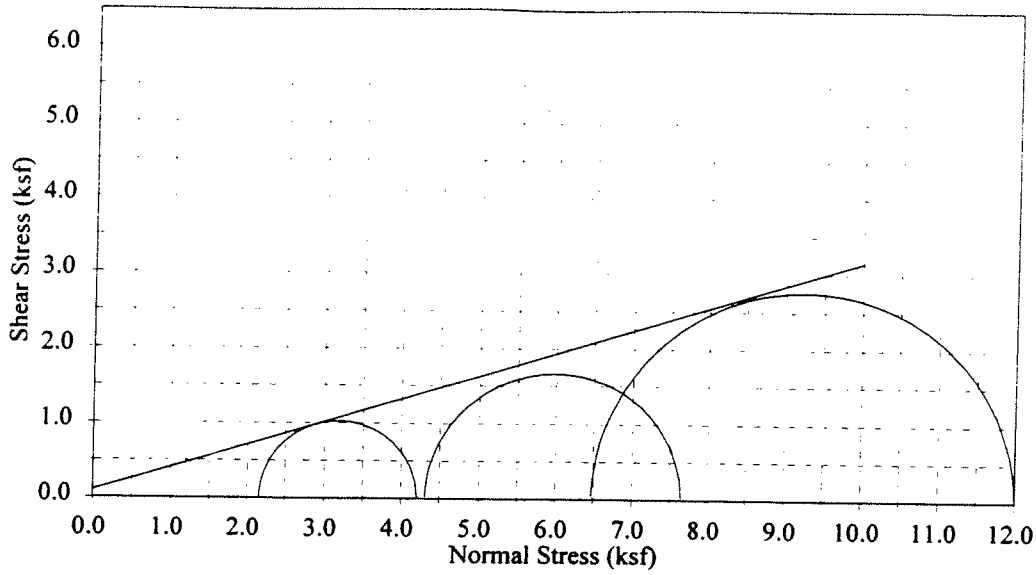
Project: Geotechnical Study
Pigeon Point Disposal Area
Wilmington, Delaware

Contract No.: 985176 Date:

Failure Sketches

TOTAL STRESS

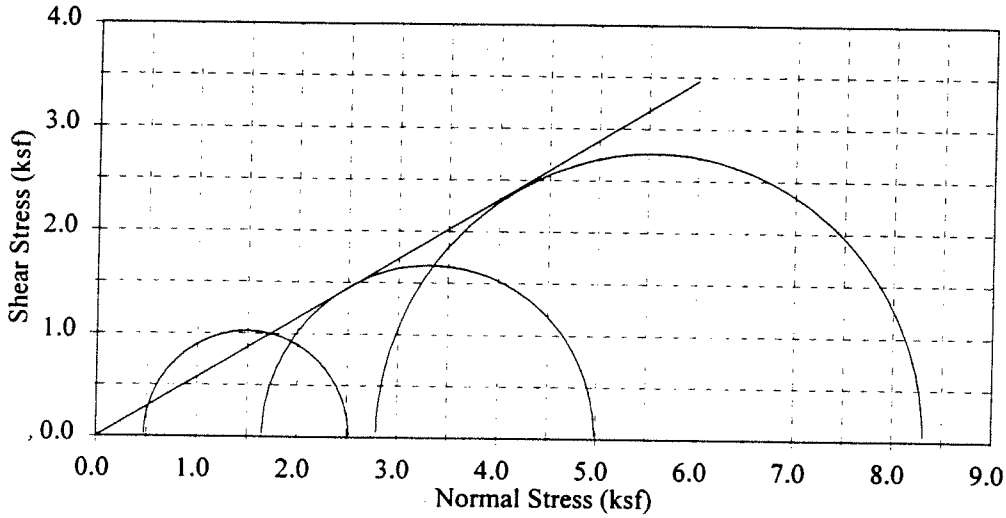
Frict. Ang.= 15 Cohesion= 0.1 ksf



2.16 ksf

EFFECTIVE STRESS

Friction Angle= 30 Cohesion=0.0 ksf



4.32 ksf

6.48 ksf

Sample Description:

ELASTIC SILT (MH), dark gray

SCHNABEL ENGINEERING ASSOCIATES, INC.

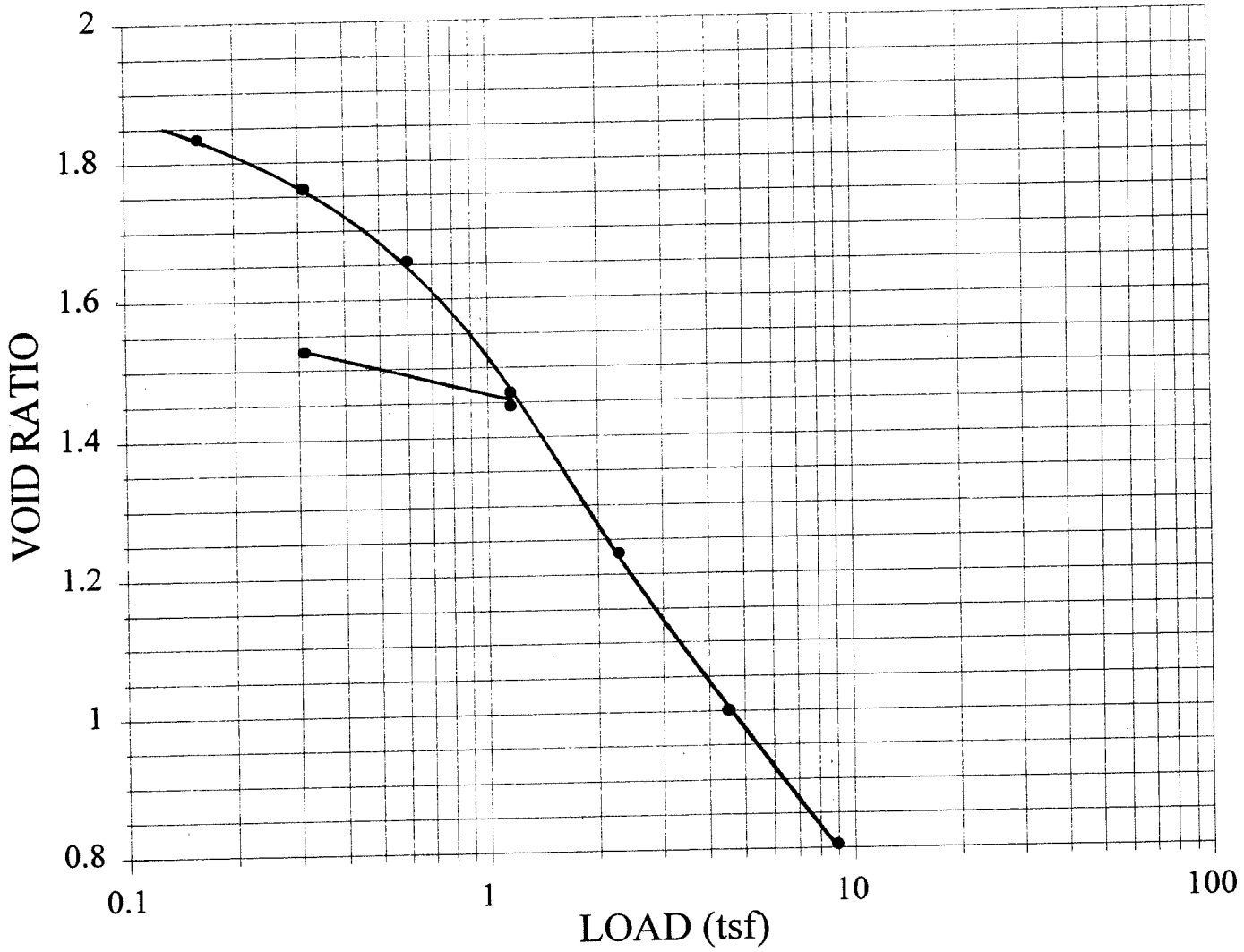
Boring No.	Depth (ft.)	Cell Pressure (ksf)	Moisture Content (percent)		Sample Density (pcf)	
			Initial	Final	Wet	Dry
B-9	24.0-26.0	2.16	74.3	58.0	97.0	55.7
B-9	24.0-26.0	4.32	78.3	59.5	97.7	54.8
B-9	24.0-26.0	6.48	76.0	50.7	94.6	55.8

TRIAXIAL COMPRESSION TEST

Test Type: CU Shear Rate: 0.07%/min

Project: Geotechnical Study
Pigeon Point Disposal Area
Wilmington, Delaware

Contract No.: 985176 Date:



Sample Description:
ELASTIC SILT, trace sand, contains organic matter - dark gray

Classification: MH LL: 61 PI: 25

Boring No.:	B-9	Initial Moisture (%):	69.5
Depth (feet):	13.5 ft	Initial Saturation (%):	—
Sample Dia. (in):	2.5	Initial Void Ratio:	2.03
Initial Height (in):	1.00	Final Moisture (%):	48.0
Specific Gravity:	2.6	Final Saturation (%):	—
Dry Density (pcf):	55.7	Final Void Ratio:	0.88

Estimated Preconsolidation Pressure (Pc) (tsf):	0.6
Approximate Overburden Stress (Po) (tsf):	0.6
Compression Index (Cc) (from 1 to 4 tsf):	0.79
Recompression Index (Cr) (from 0.3 to 1 tsf):	0.13

SCHNABEL ENGINEERING ASSOCIATES, INC.

CONSOLIDATION TESTING

Specification: ASTM D 2435

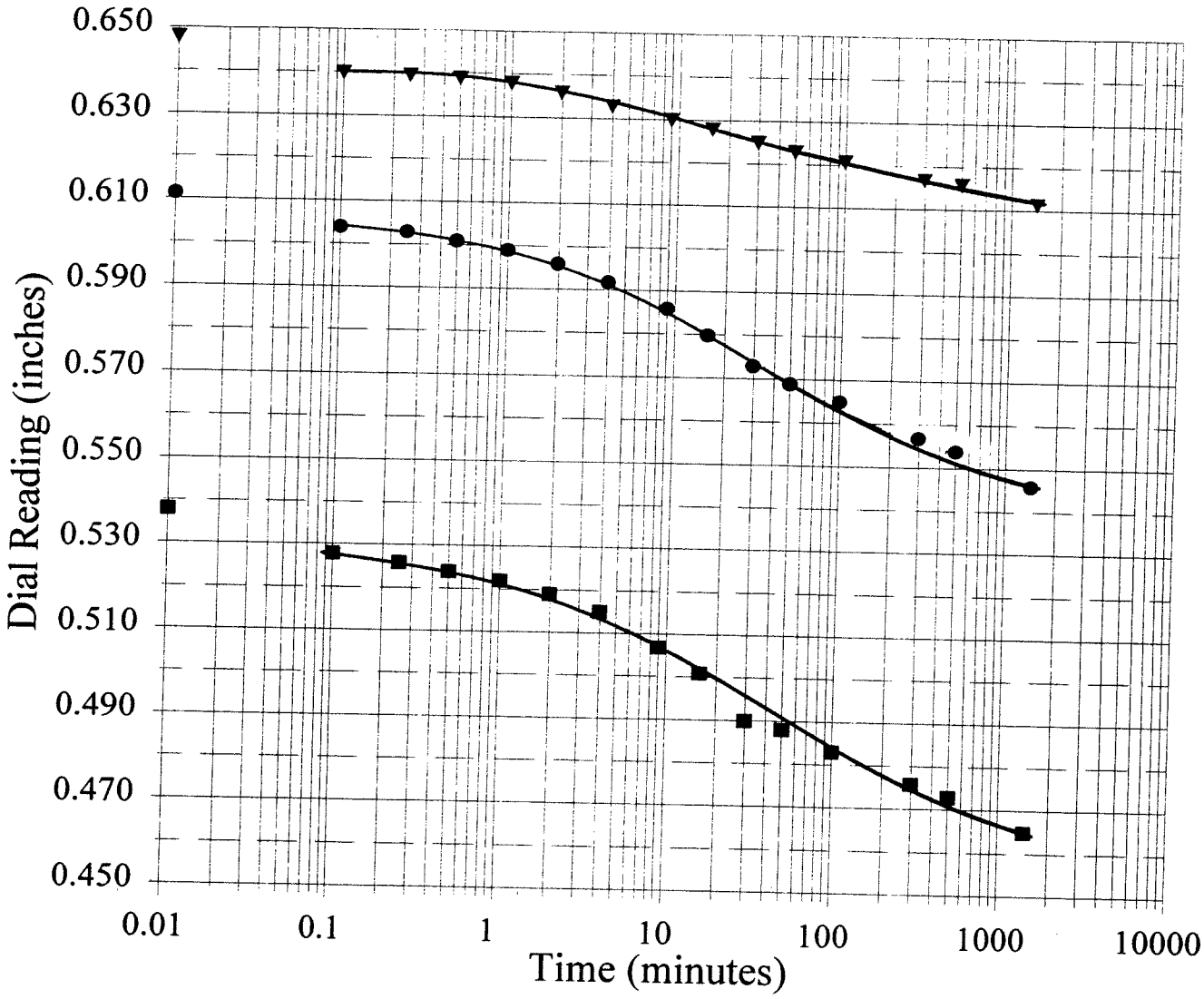
Project:

Pigeon Point Disposal Area

Wilmington, Delaware

Contract No.: 985176

G:\985176\Lab\985176 B-9 Consolidation 13ft.WB2



Sample Description:
ELASTIC SILT, trace sand, contains organic matter - dark gray

Classification: MH

SCHNABEL ENGINEERING ASSOCIATES, INC.

ONE-DIMENSIONAL CONSOLIDATION TIME vs. COMPRESSION CURVES

BORING NO: B-9 DEPTH: 13.5 ft

KEY	LOAD (tsf)	Cv (square inches/minute)
	0.50	0.0102
	1.00	0.0059
	2.00	0.0041

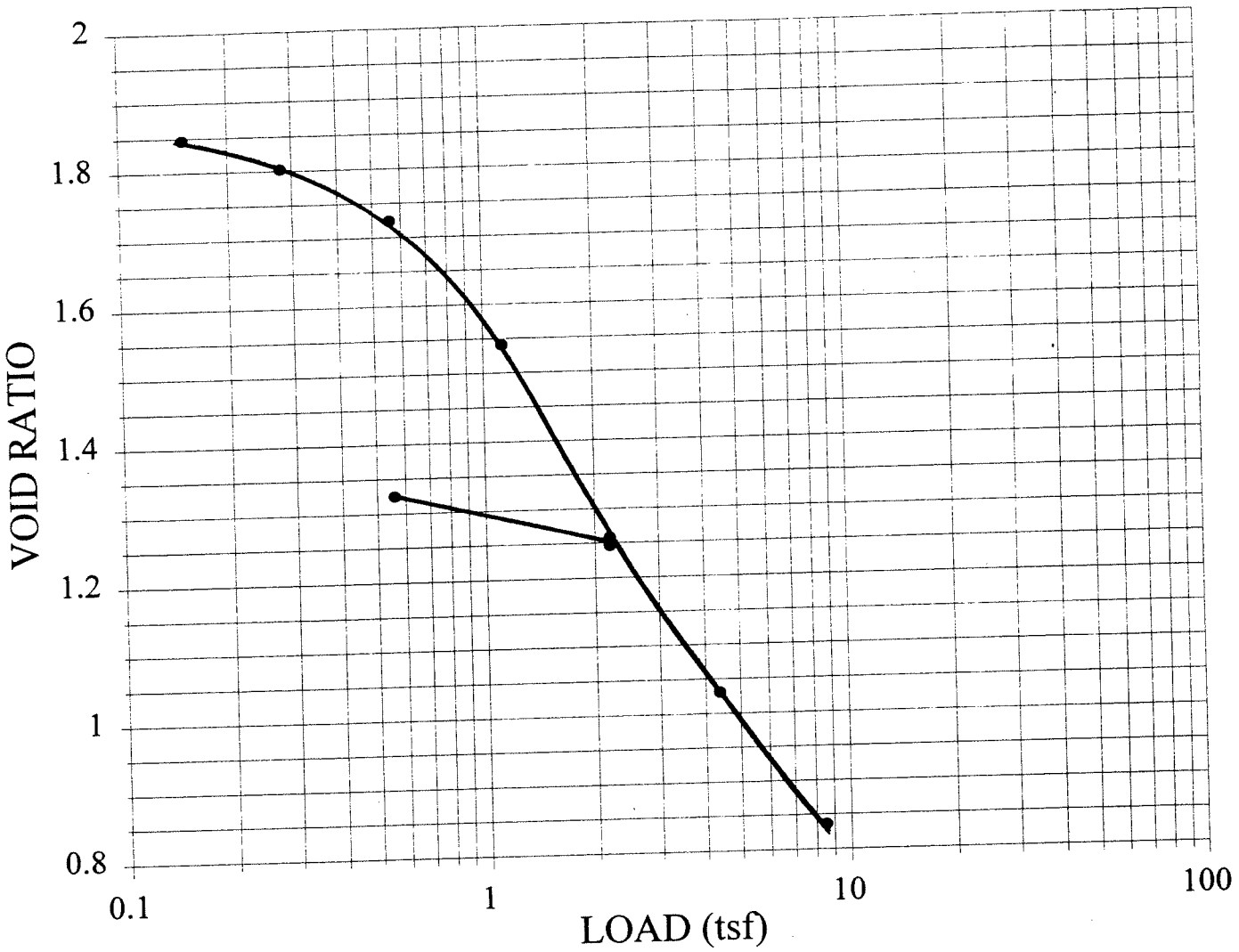
Project:

Pigeon Point Disposal Area

Wilmington, Delaware

Contract No.: 985176

G:\985176\Lab\985176 time rate curves.WB2



Sample Description: ELASTIC SILT, trace sand, contains organic matter - dark gray					
Classification:	ML	LL:	49	PI:	23
Boring No.:		B-9	Initial Moisture (%):		69.2
Depth (feet):		37.5 ft	Initial Saturation (%):		—
Sample Dia. (in):		2.5	Initial Void Ratio:		1.91
Initial Height (in):		1.00	Final Moisture (%):		36.4
Specific Gravity:		2.7	Final Saturation (%):		—
Dry Density (pcf):		57.9	Final Void Ratio:		0.84
Estimated Preconsolidation Pressure (Pc) (tsf):				1.2	
Approximate Overburden Stress (Po) (tsf):				1.7	
Compression Index (Cc) (from 2 to 4 tsf):				0.87	
Recompression Index (Cr) (from 0.5to 2 tsf):				0.12	

SCHNABEL ENGINEERING ASSOCIATES, INC.

CONSOLIDATION TESTING

Specification: ASTM D 2435

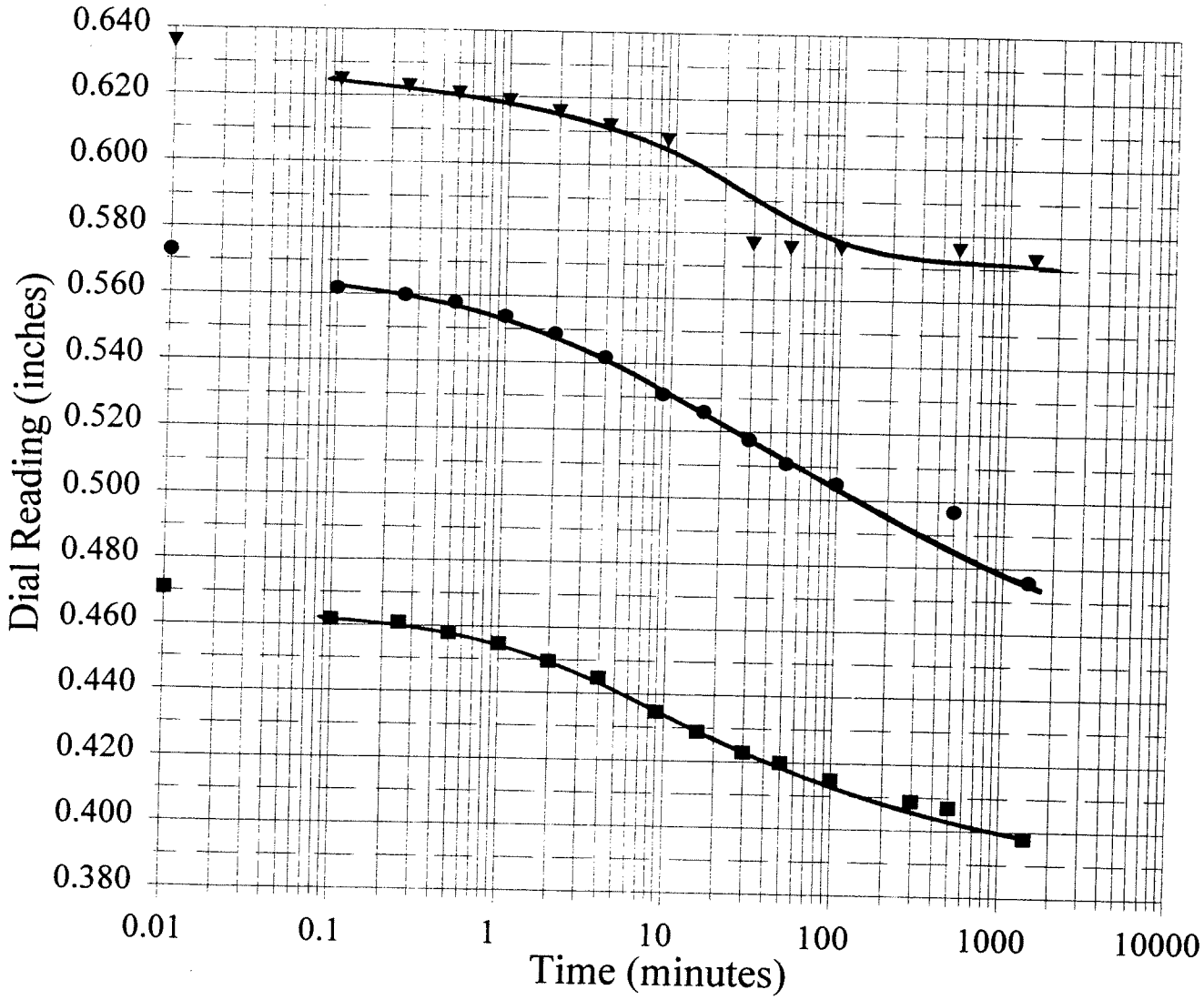
Project:

Pigeon Point Disposal Area

Wilmington, Delaware

Contract No.: 985176

G:\985176\Lab\985176 B-9 Consolidation 37ft.WB2



Sample Description:
ELASTIC SILT, trace sand, contains organic matter - dark gray

Classification: ML

SCHNABEL ENGINEERING ASSOCIATES, INC.

ONE-DIMENSIONAL CONSOLIDATION TIME vs. COMPRESSION CURVES

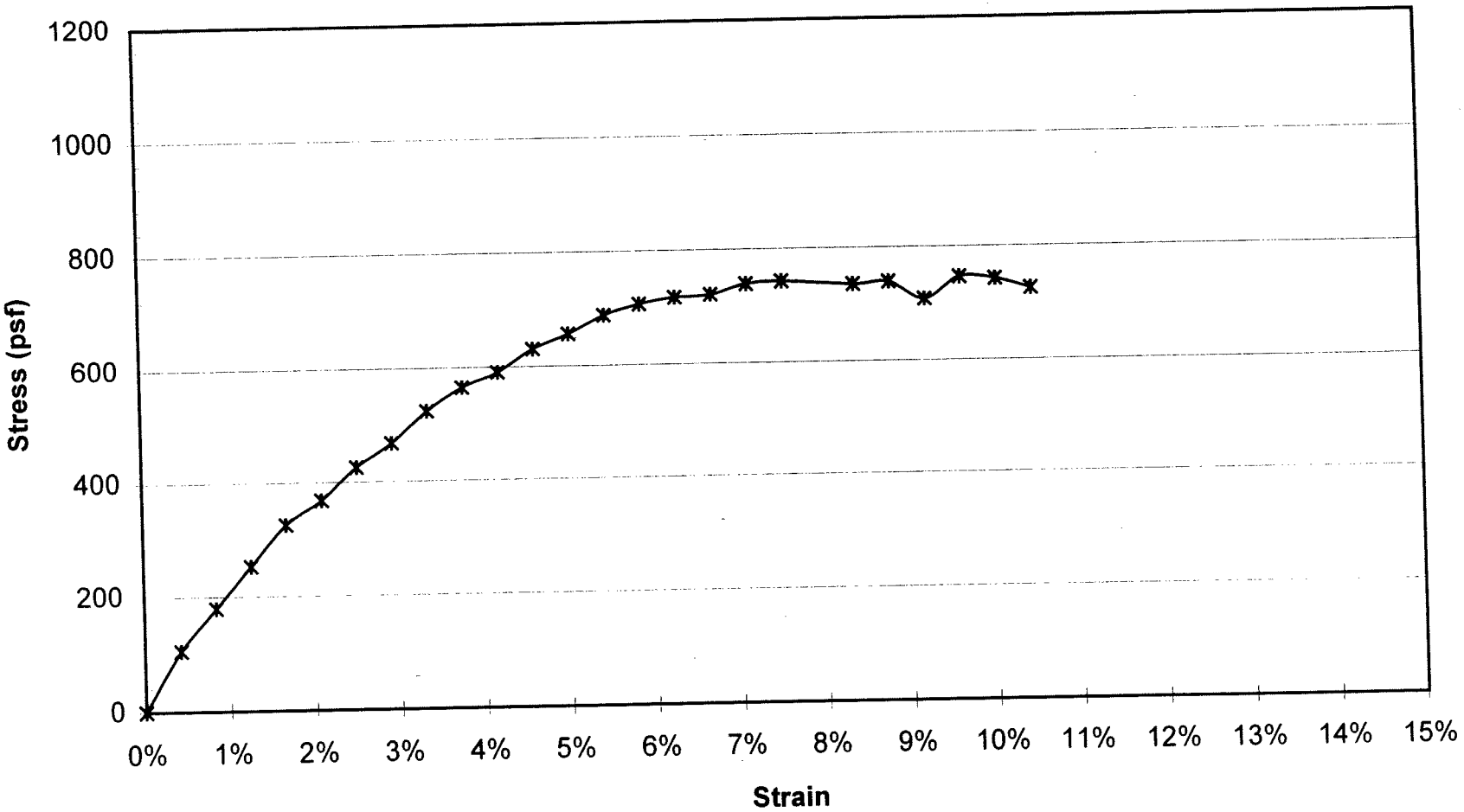
BORING NO: B-9 | DEPTH: 37.5 ft

Project: Pigeon Point Disposal Area, Wilmington, Delaware

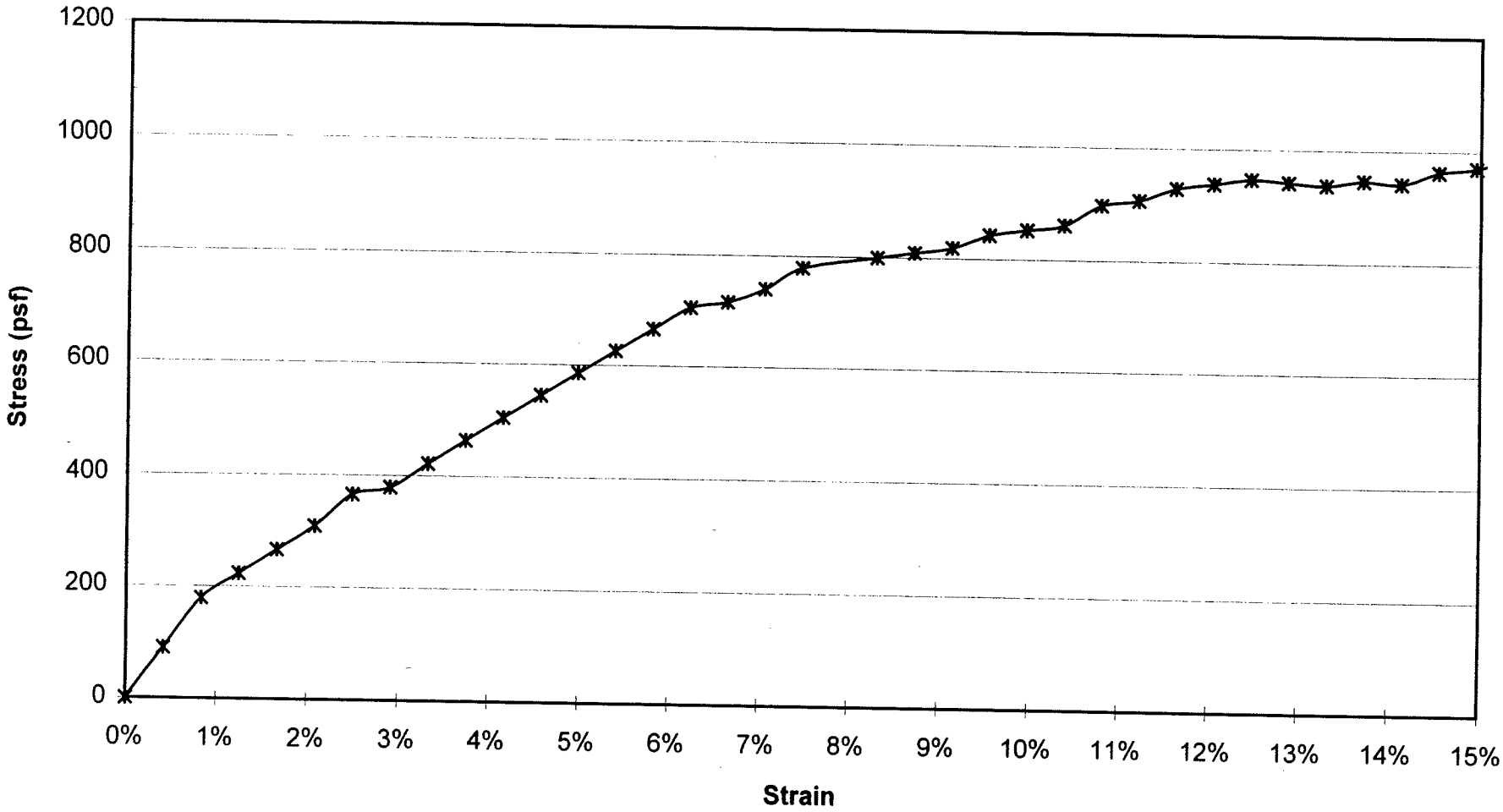
KEY	LOAD (tsf)	Cv (square inches/minute)
	1.00	0.0047
	2.00	0.0074
	4.00	0.0060

Contract No.: 985176

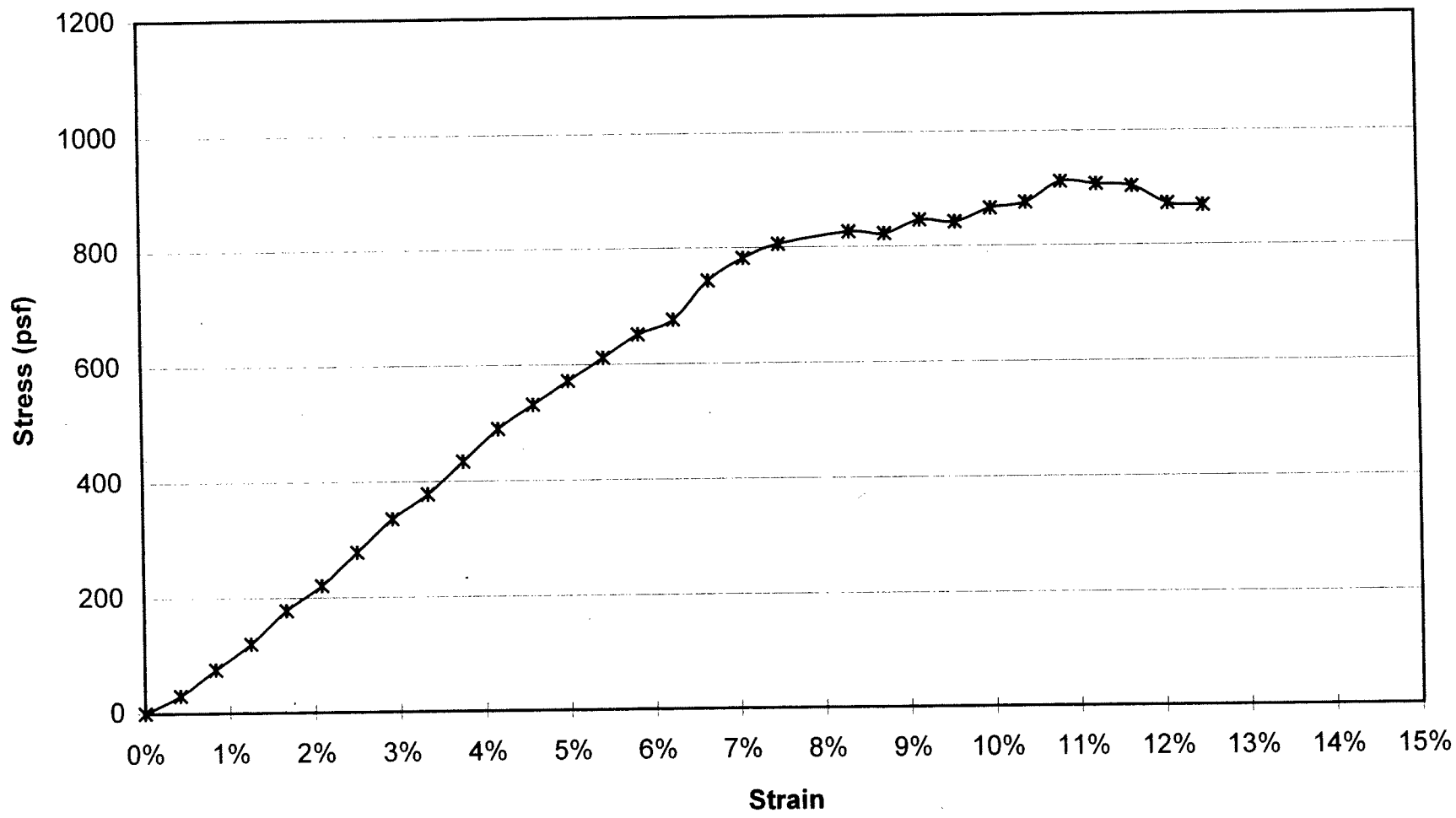
G:\985176\Lab\985176 time rate curves b-9 37ft.WB2



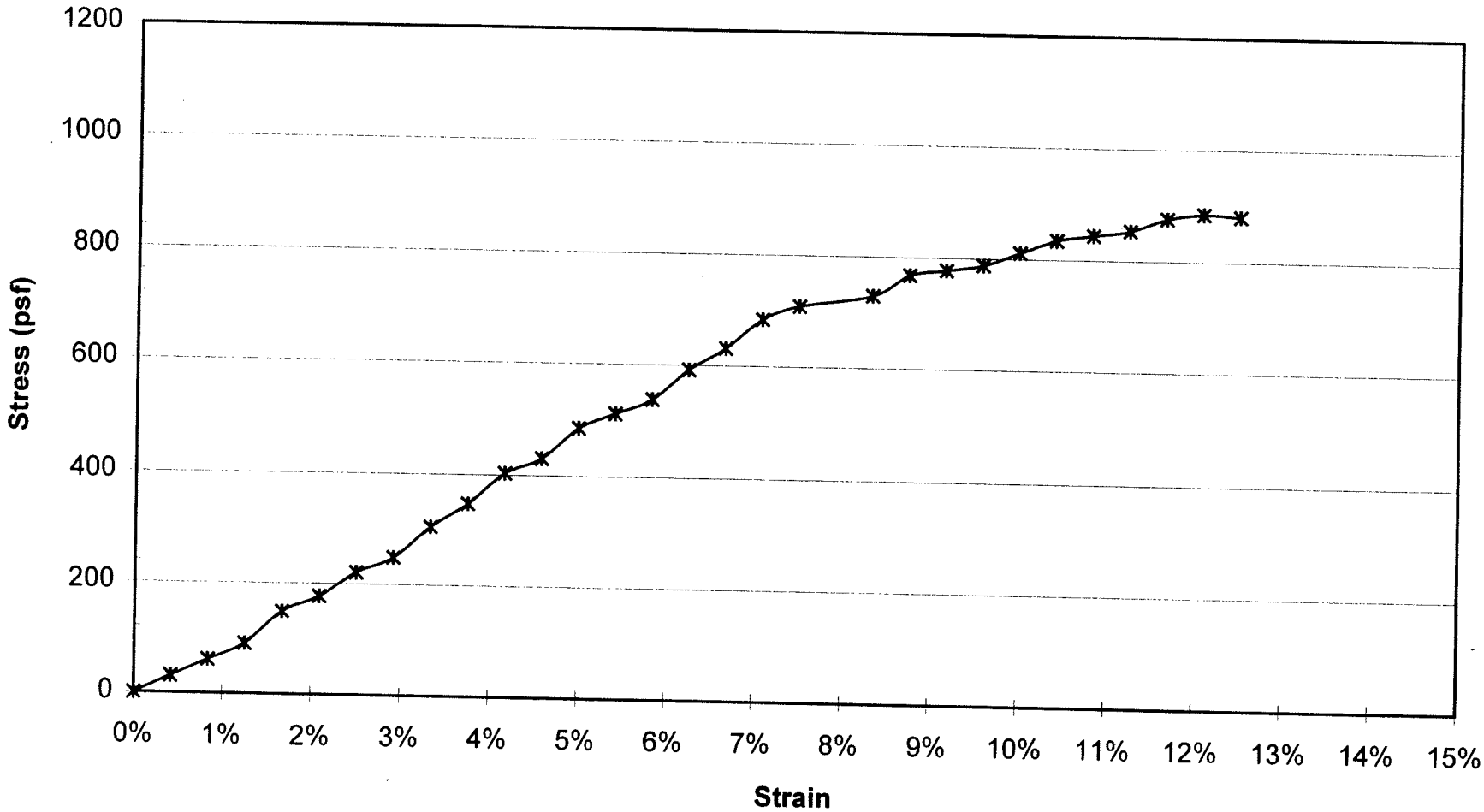
SCHNABEL ENGINEERING ASSOCIATES	
Unconfined Compression Plot Boring SEA-9, 12-14 Ft	
Pigeon Point Disposal Area Wilmington, Delaware	
CONTRACT NO. 985176	DATE



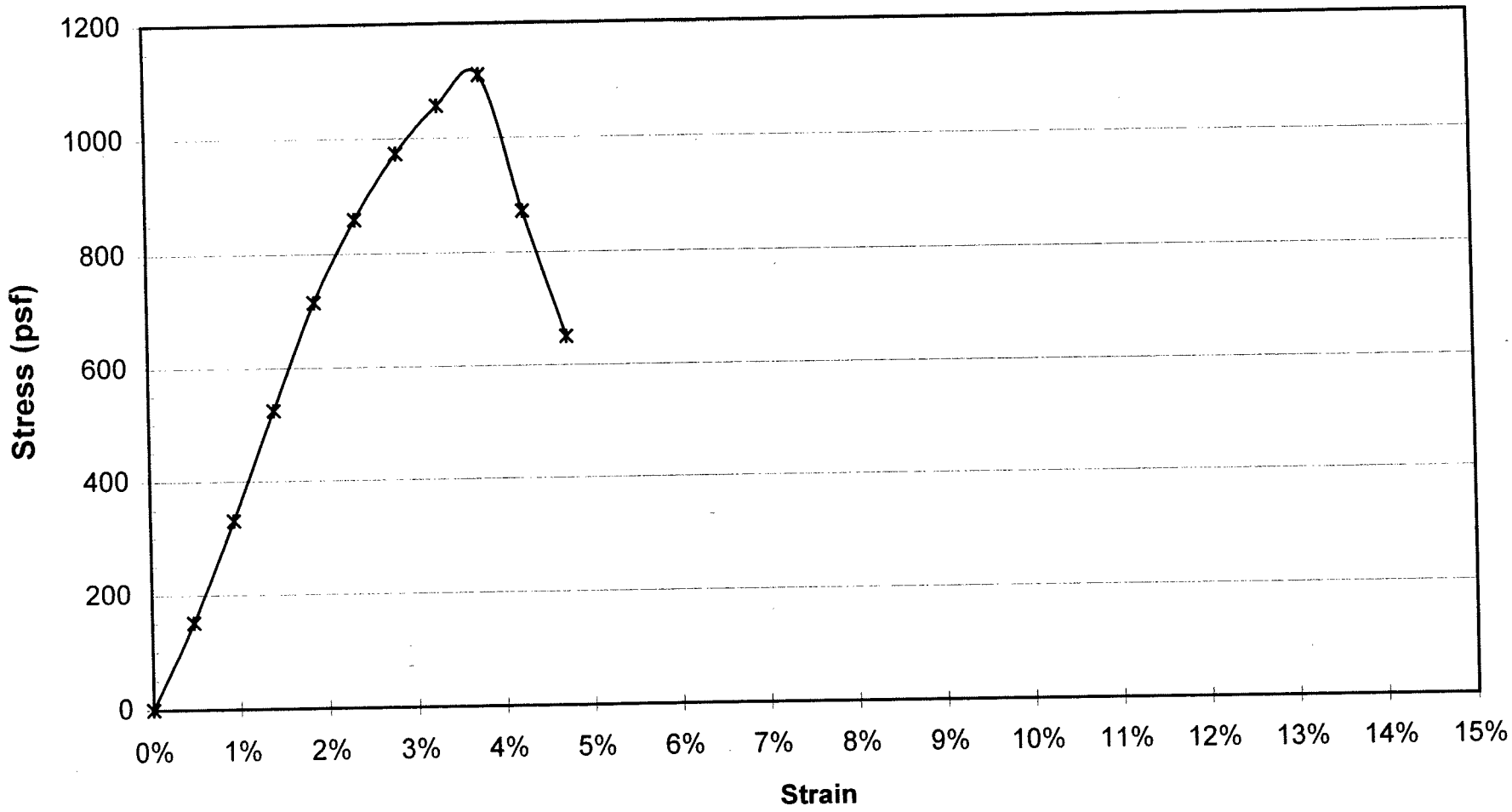
SCHNABEL ENGINEERING ASSOCIATES	
Unconfined Compression Plot Boring SEA-9, 18-20 Ft	
Pigeon Point Disposal Area Wilmington, Delaware	
CONTRACT NO. 985176	DATE



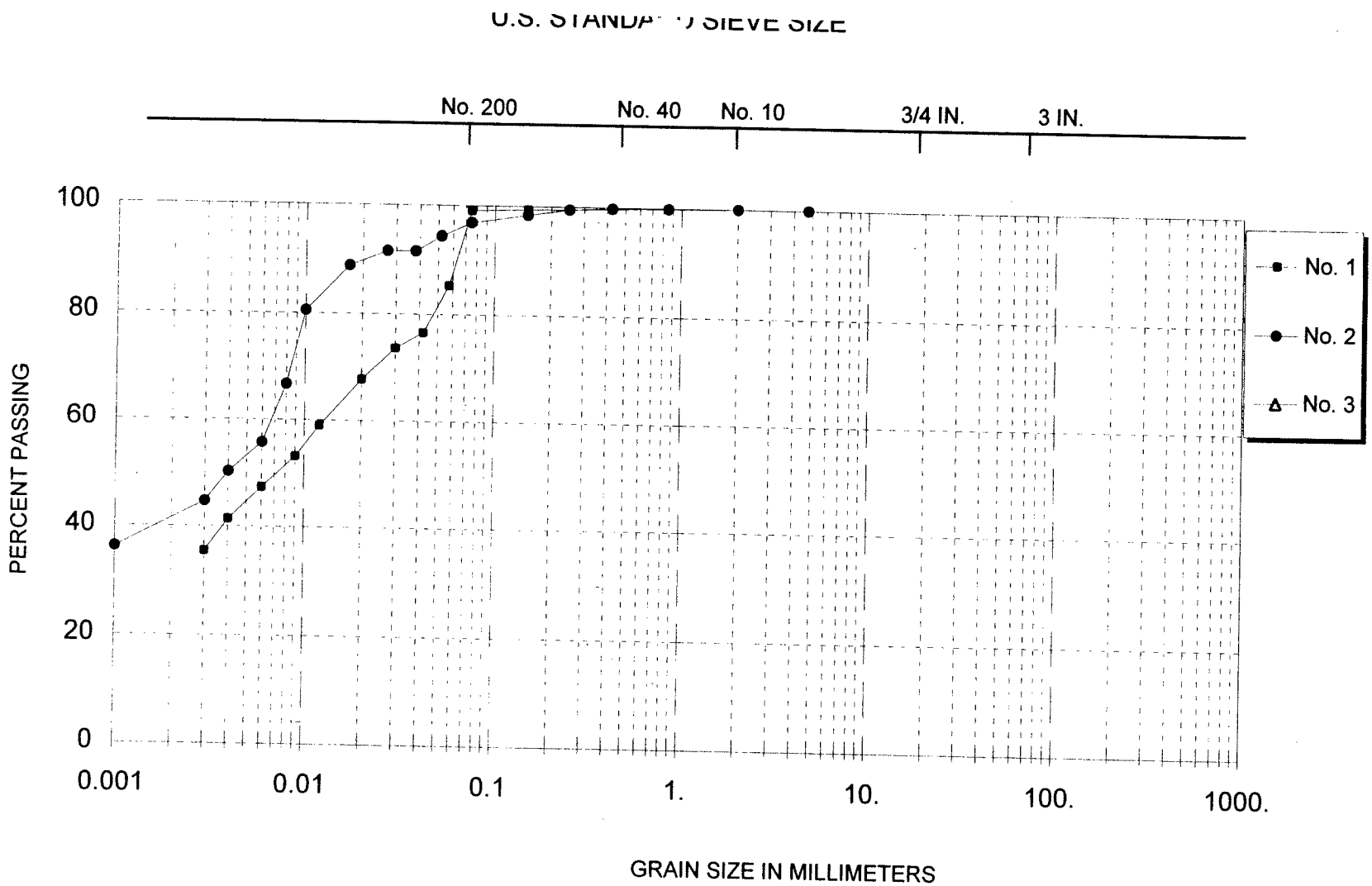
SCHNABEL ENGINEERING ASSOCIATES	
Unconfined Compression Plot Boring SEA-9, 30-31 Ft	
Pigeon Point Disposal Area Wilmington, Delaware	
CONTRACT NO. 985176	DATE



SCHNABEL ENGINEERING ASSOCIATES	
Unconfined Compression Plot Boring SEA-9, 31-32 Ft	
Pigeon Point Disposal Area Wilmington, Delaware	
CONTRACT NO. 985176	DATE



SCHNABEL ENGINEERING ASSOCIATES	
Unconfined Compression Plot Boring SEA-9, 36-38 Ft	
Pigeon Point Disposal Area Wilmington, Delaware	
CONTRACT NO. 985176	DATE



SILT OR CLAY	SAND			GRAVEL		COBBLES
	Fine	Medium	Coarse	Fine	Coarse	

KEY	NO.	DEPTH	DESCRIPTION OF SOIL SAMPLE TESTED	CLASS.
No. 1	B-9	24.0-28.0	FAT CLAY, dark gray LL=120 PI=77	CH
No. 2	B-9	7.0-9.0	FAT CLAY, dark gray LL=96 PI=59	CH
No. 3				

SCHNABEL ENGINEERING ASSOCIATES

GRADATION CURVES

Pigeon Point Disposal Area

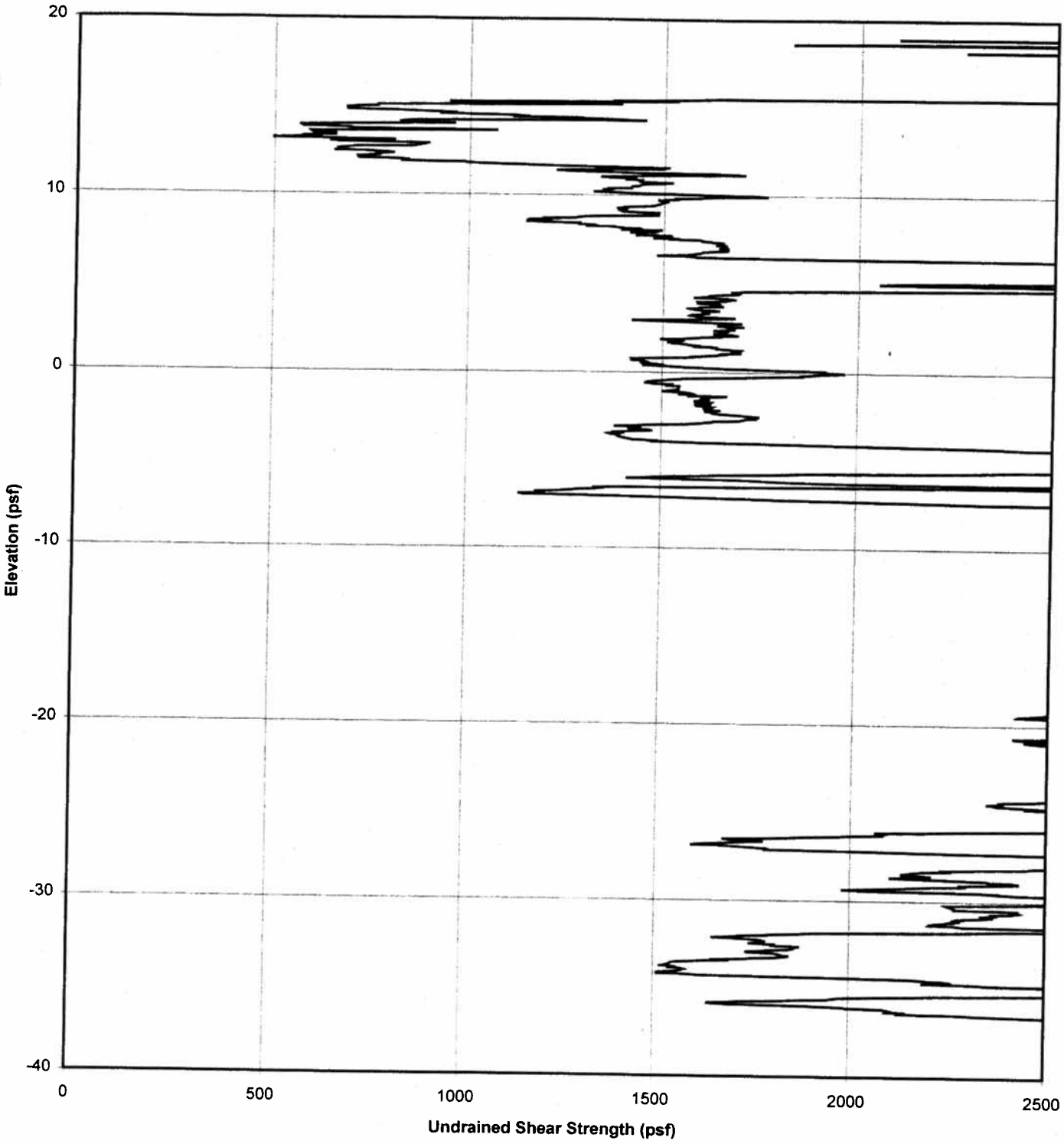
Wilmington, Delaware

CONTRACT NO. 985176

DATE

APPENDIX C

Geotechnical Data



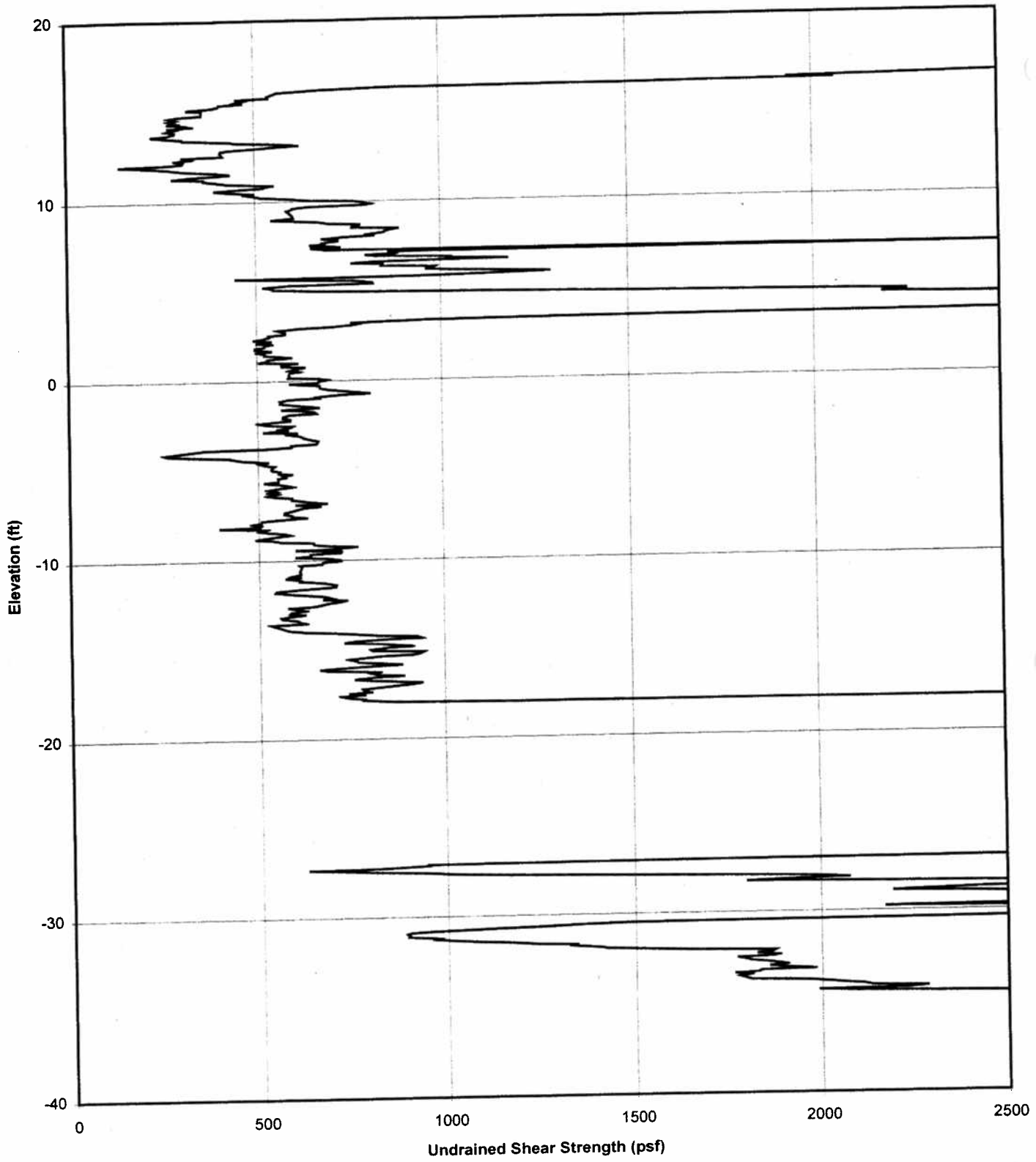
Undrained Shear Strength vs.Elevation for SEA-7
Pigeon Point

SCHNABEL ENGINEERING ASSOCIATES, INC.

Pigeon Point Disposal Area
Wilmington, Delaware

DATE:

CONTRACT NO.: 985176



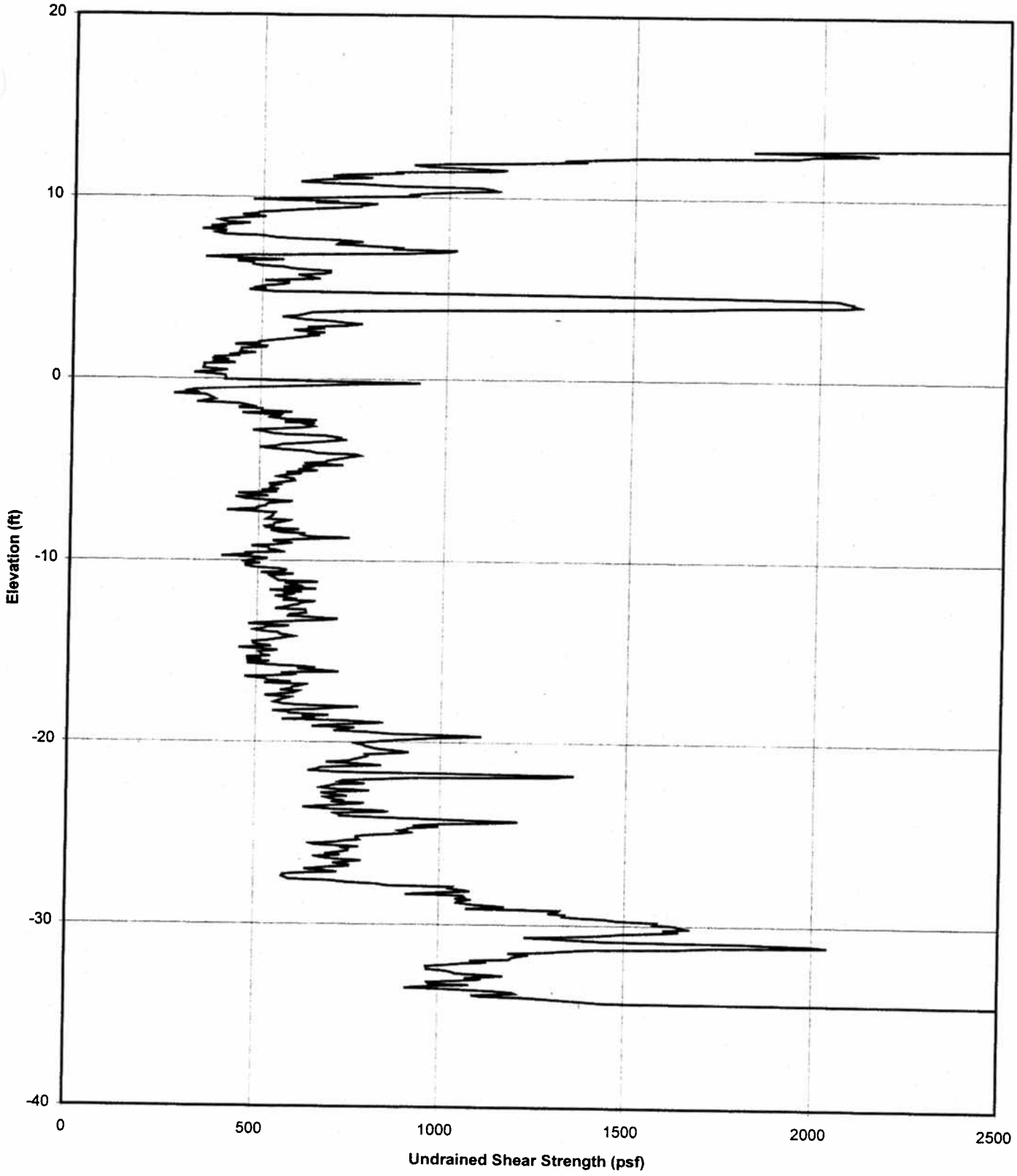
Undrained Shear Strength vs. Elevation for SEA-8
Pigeon Point

SCHNABEL ENGINEERING ASSOCIATES, INC.

Pigeon Point Disposal Area
Wilmington, Delaware

DATE:

CONTRACT NO.: 985176



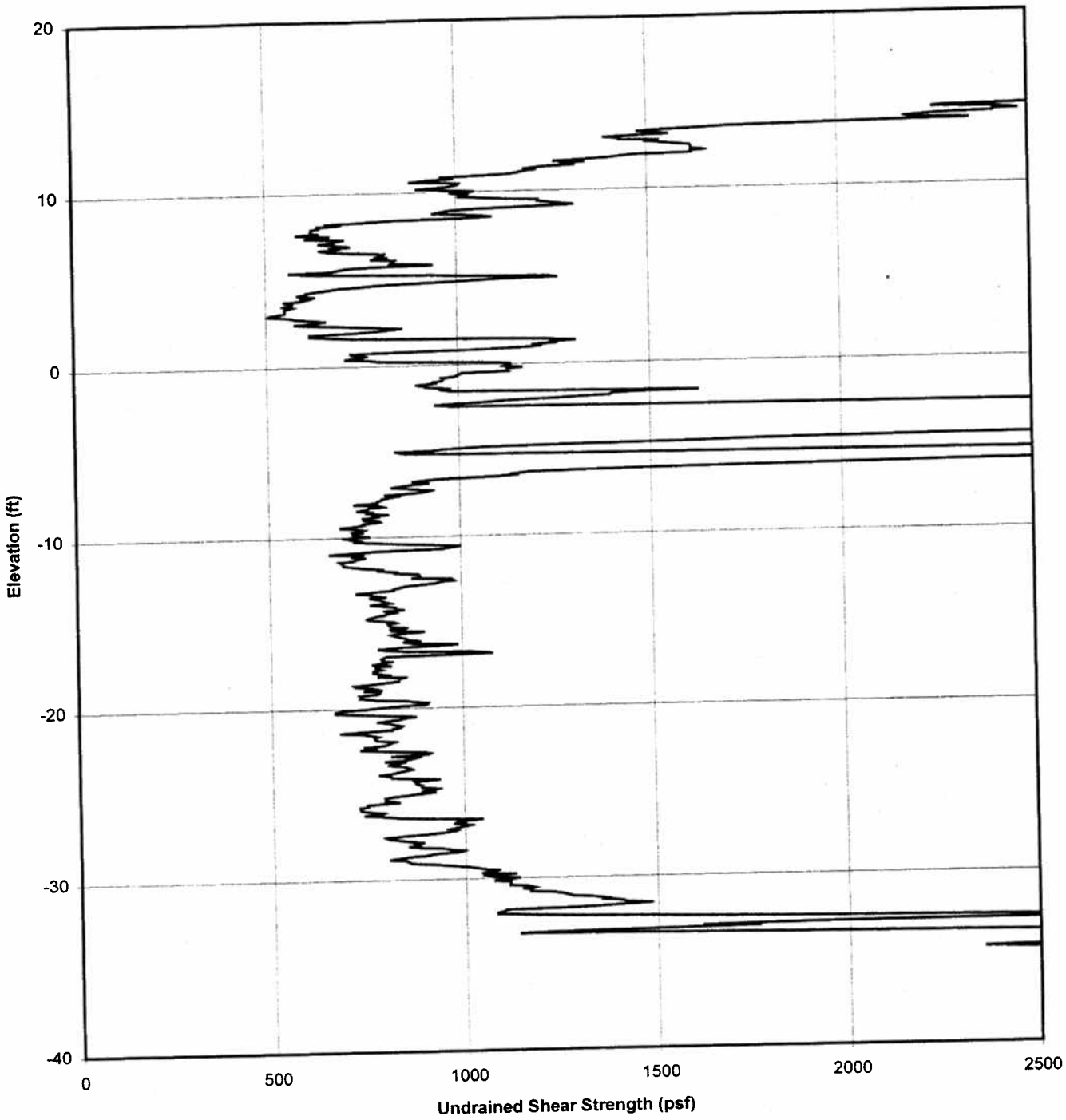
Undrained Shear Strength vs. Elevation for SEA-9
Pigeon Point

SCHNABEL ENGINEERING ASSOCIATES, INC.

Pigeon Point Disposal Area
Wilmington, Delaware

DATE:

CONTRACT NO.: 985176



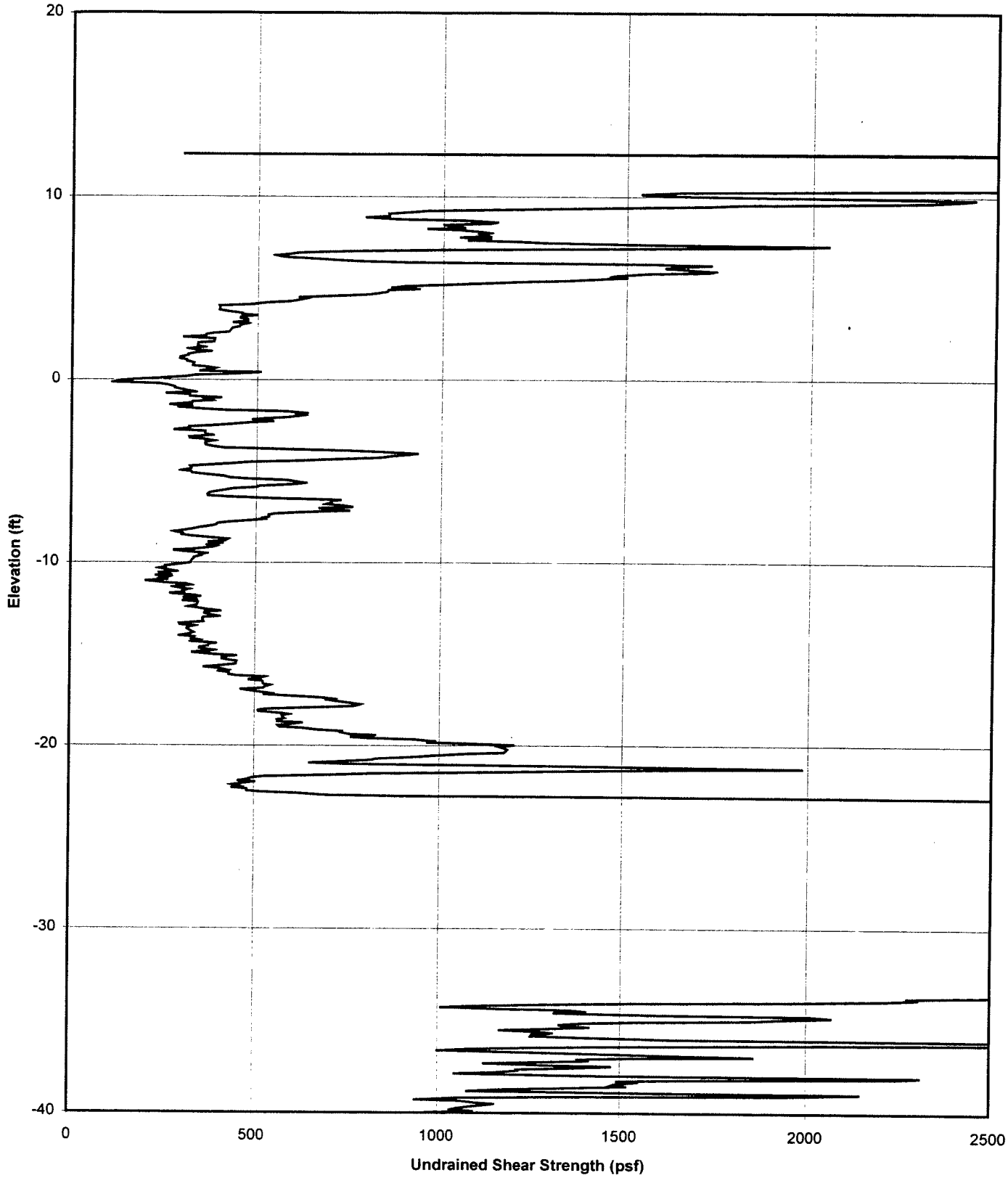
Undrained Shear Strength vs.Elevation for SEA-10
Pigeon Point

SCHNABEL ENGINEERING ASSOCIATES, INC.

Pigeon Point Disposal Area
Wilmington, Delaware

DATE:

CONTRACT NO.: 985176



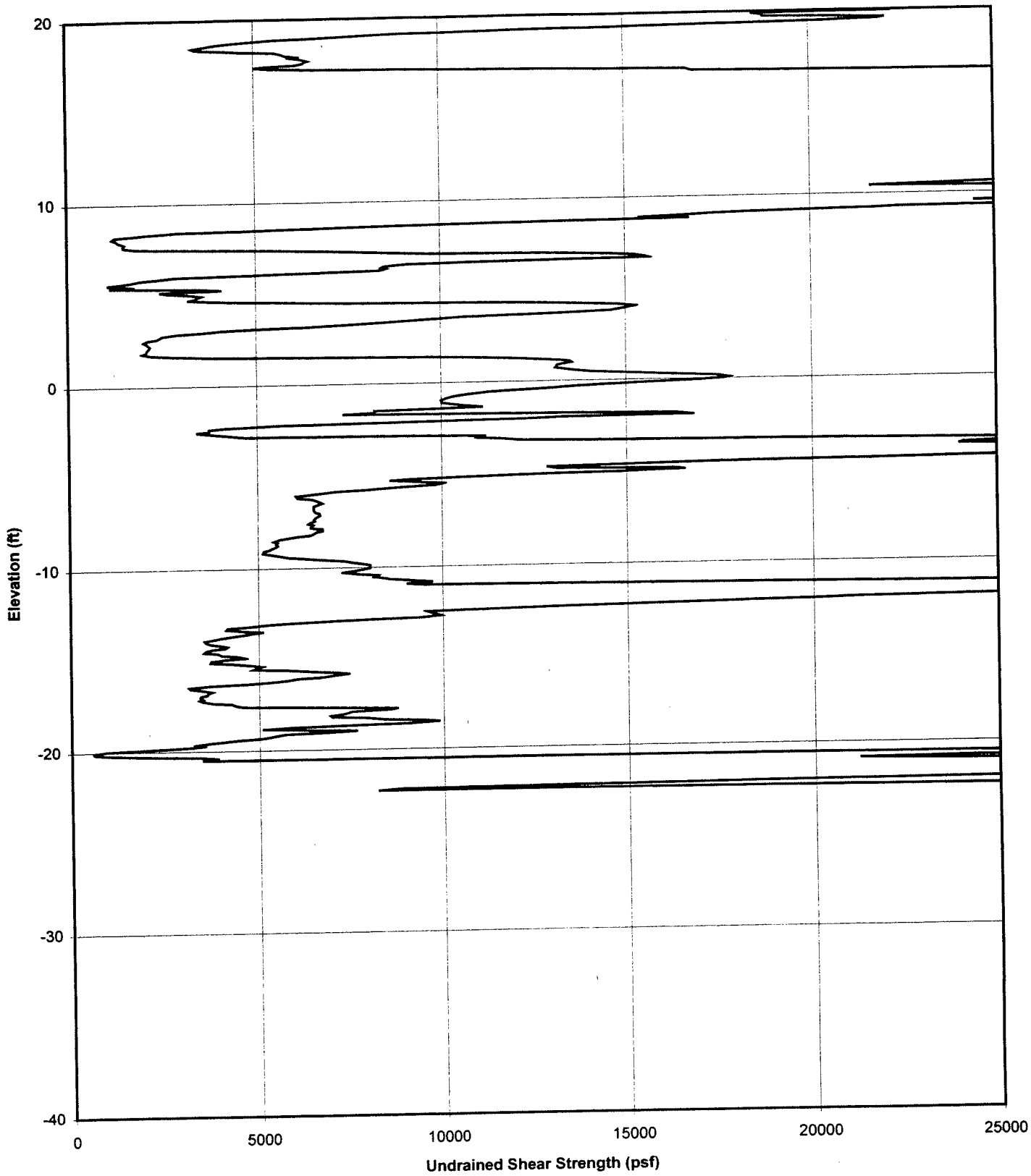
Undrained Shear Strength vs. Elevation for SEA-11
Pigeon Point

SCHNABEL ENGINEERING ASSOCIATES, INC.

Pigeon Point Disposal Area
Wilmington, Delaware

DATE:

CONTRACT NO.: 985176



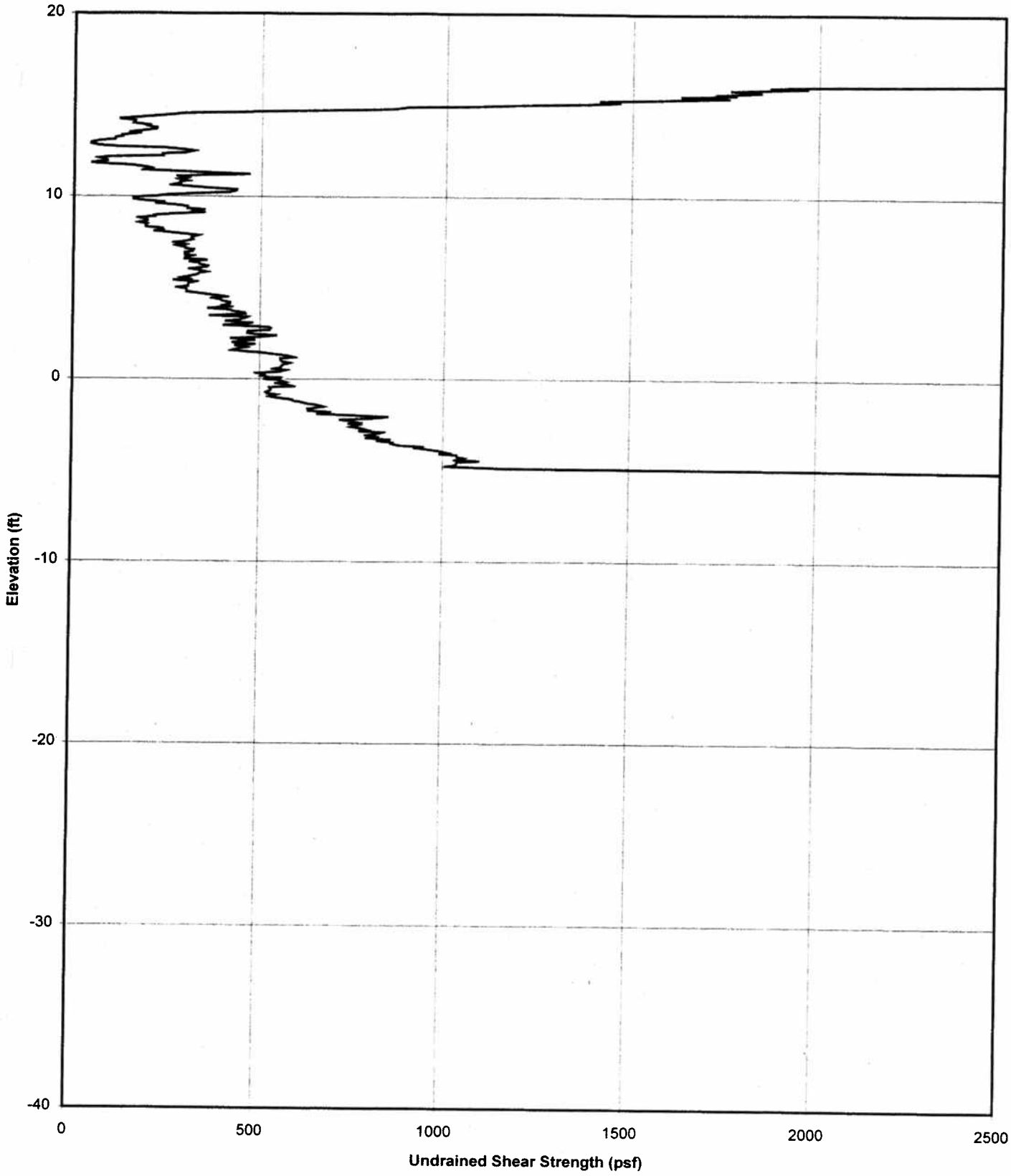
Undrained Shear Strength vs. Elevation for SEA-12
Pigeon Point

SCHNABEL ENGINEERING ASSOCIATES, INC.

Pigeon Point Disposal Area
Wilmington, Delaware

DATE:

CONTRACT NO.: 985176



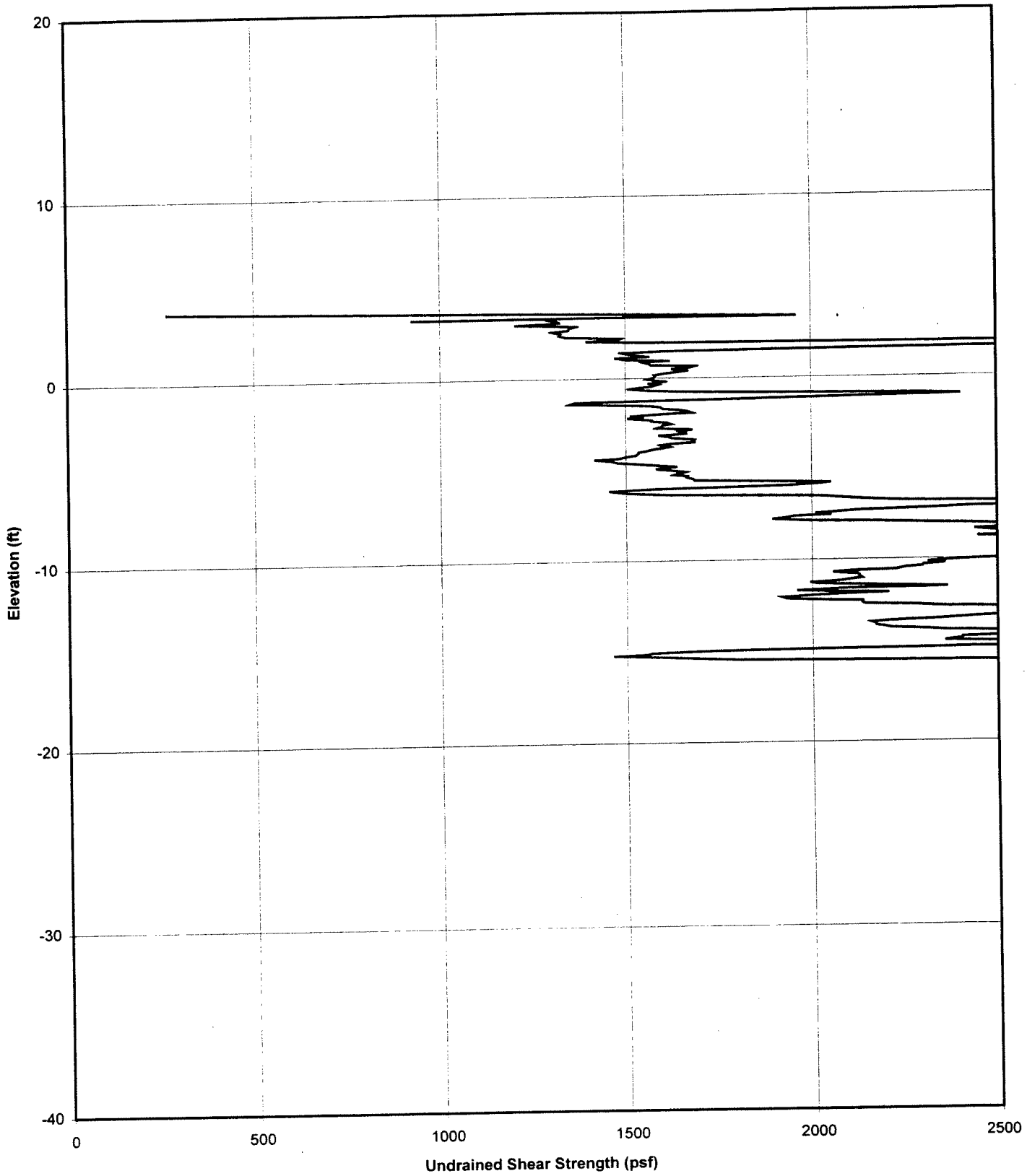
Undrained Shear Strength vs. Elevation for SEA-13
Pigeon Point

SCHNABEL ENGINEERING ASSOCIATES, INC.

Pigeon Point Disposal Area
Wilmington, Delaware

DATE:

CONTRACT NO.: 985176



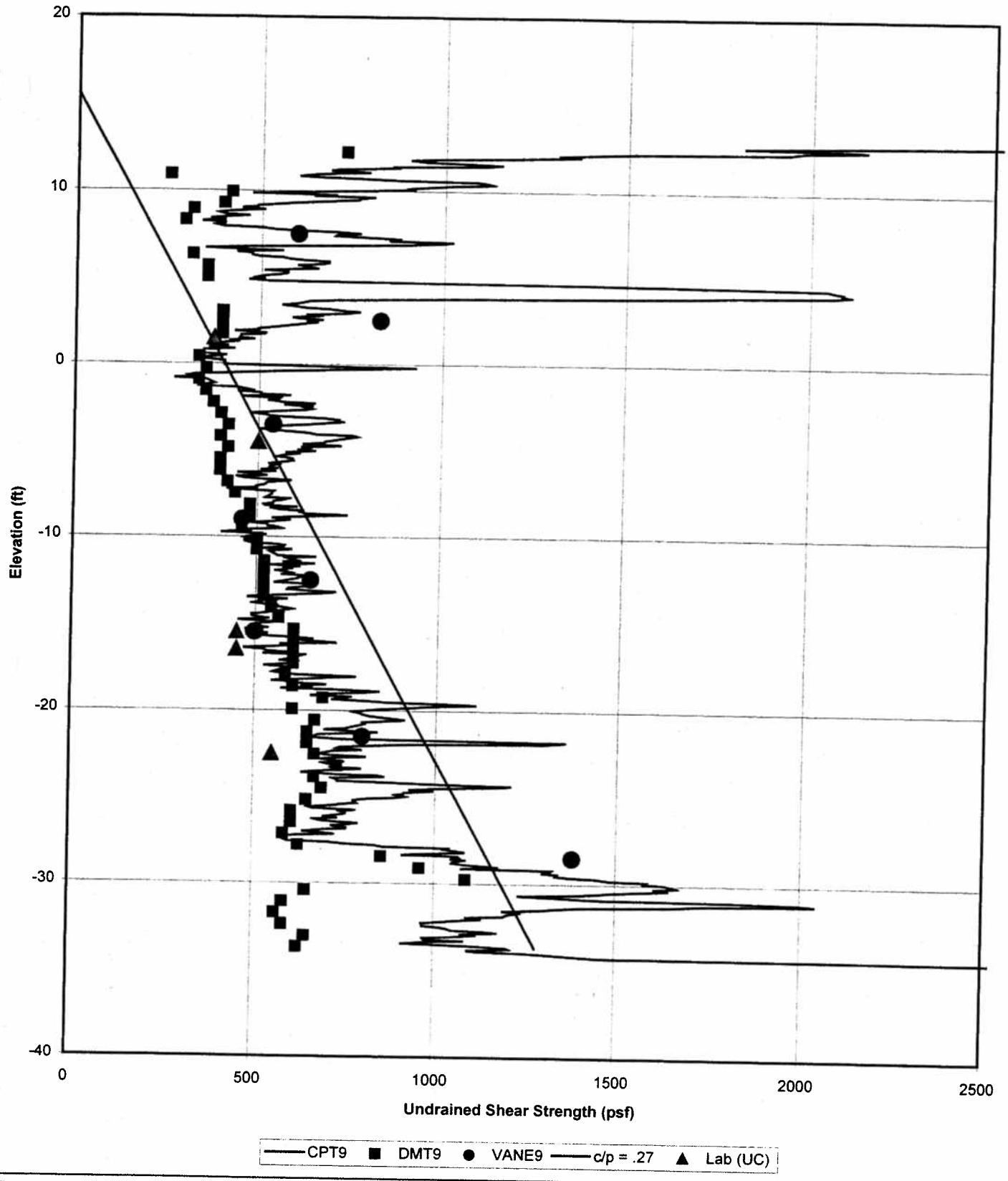
Undrained Shear Strength vs. Elevation for SEA-14
Pigeon Point

SCHNABEL ENGINEERING ASSOCIATES, INC.

Pigeon Point Disposal Area
Wilmington, Delaware

DATE:

CONTRACT NO.: 985176



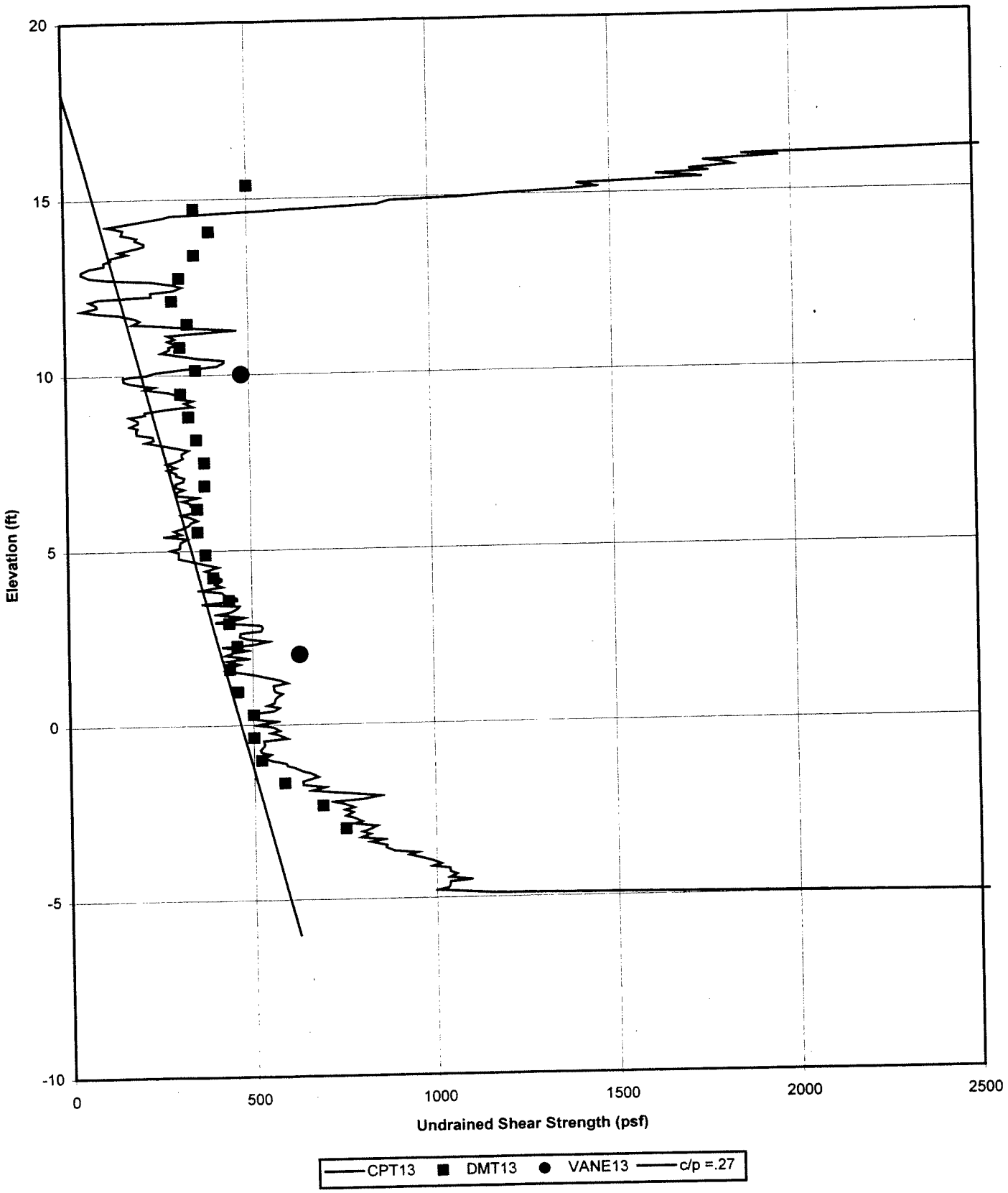
Undrained Shear Strength vs. Elevation for SEA-9
Pigeon Point

SCHNABEL ENGINEERING ASSOCIATES, INC.

Pigeon Point Disposal Area
Wilmington, Delaware

DATE:

CONTRACT NO 985176



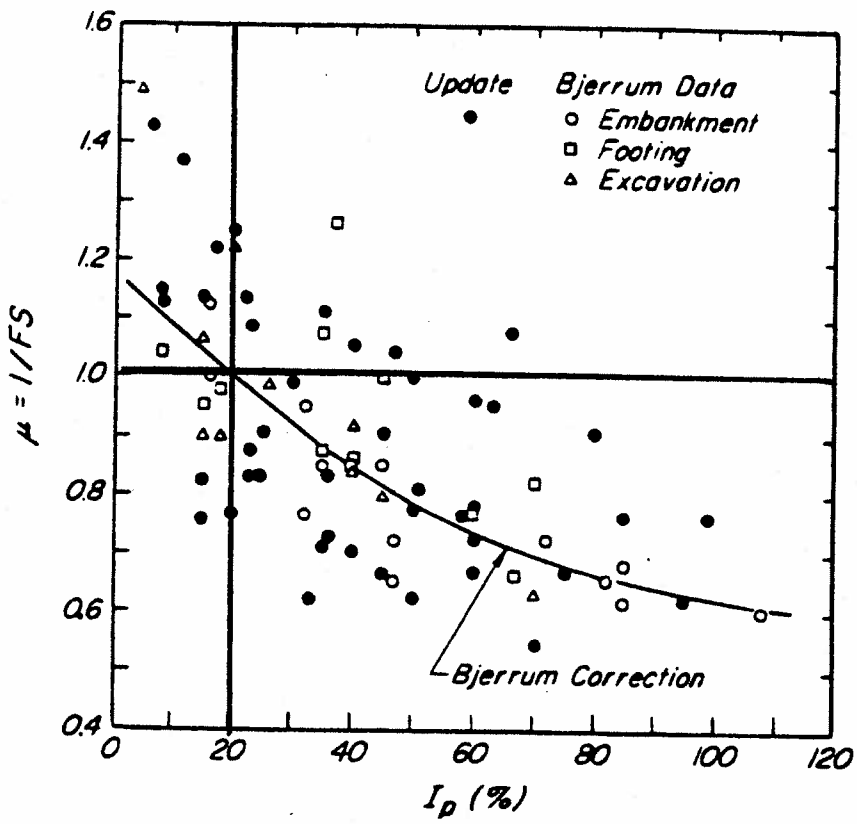
Undrained Shear Strength vs. Elevation for SEA-13
Pigeon Point

SCHNABEL ENGINEERING ASSOCIATES, INC.

Pigeon Point Disposal Area
Wilmington, Delaware

DATE:

CONTRACT NO.: 985176



Bjerrum's field vane correction factor.

FIGURE C-1
Undrained Shear Strength Correction
for the Field Vane Shear Test (Bjerrum, 1973)

985176

Schnabel Engineering

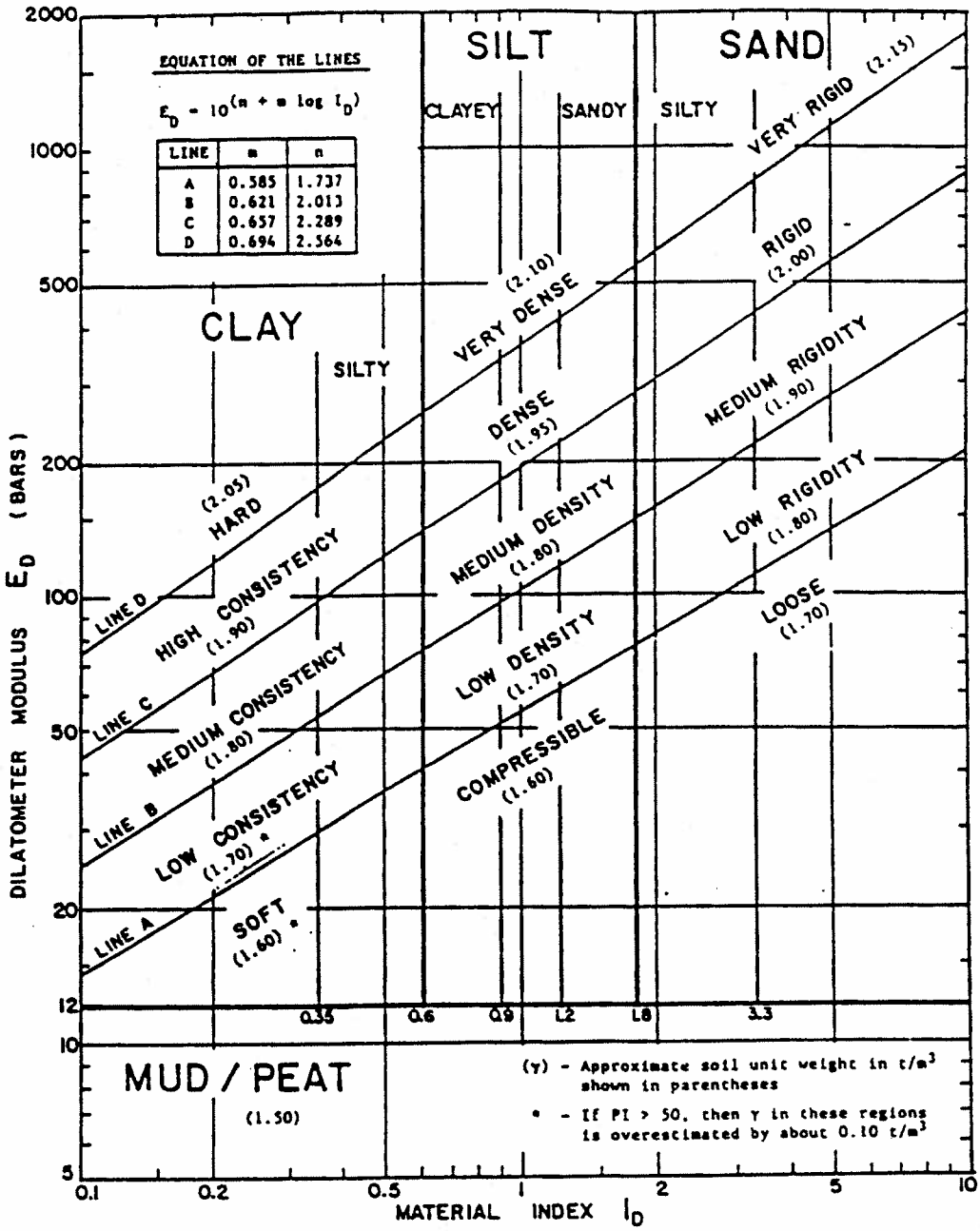


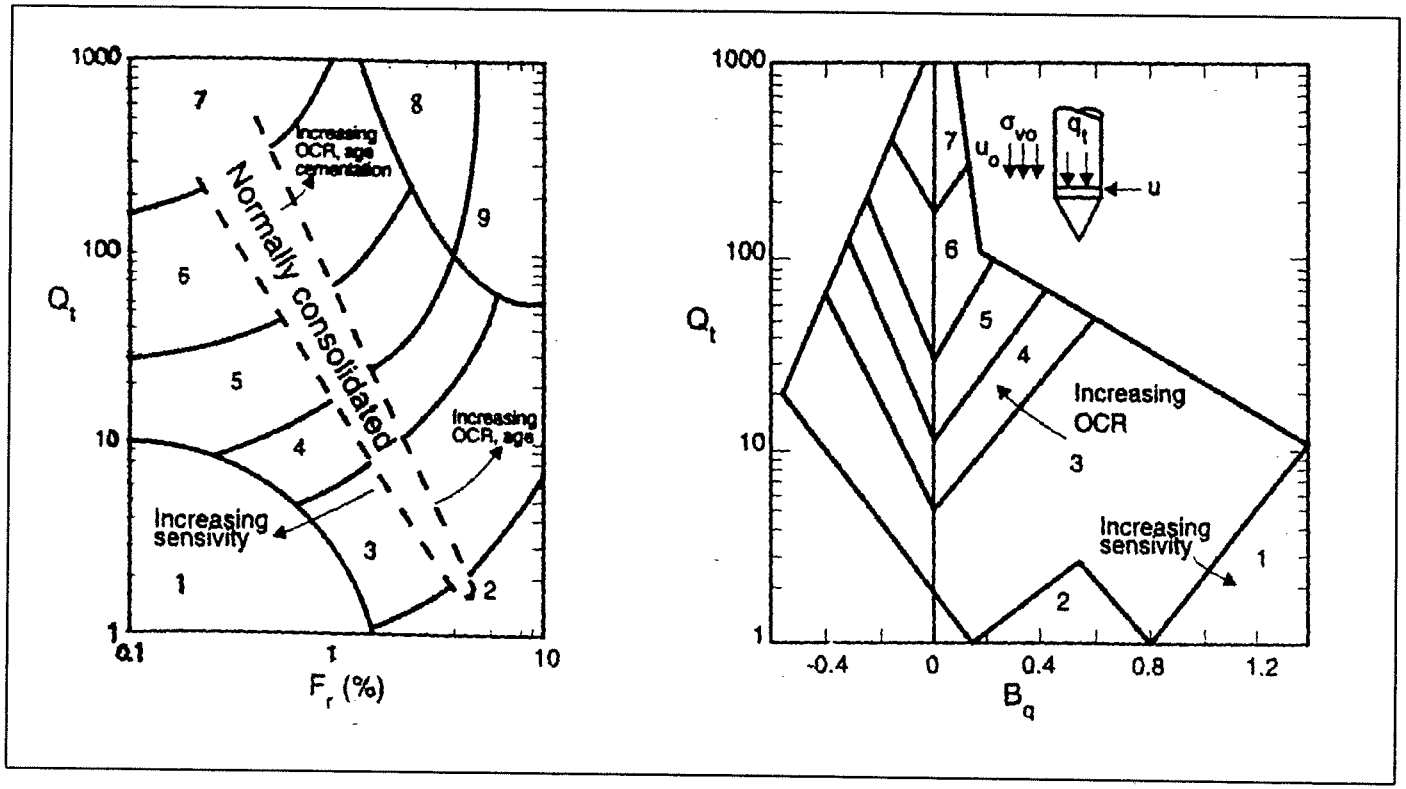
Chart for Determination of Soil Description and Unit Weight (From Marchetti and Crapps 1981)

FIGURE C-2

Soil Classification and Unit Weight Chart Based on Material Index and Dilatometer Modulus (Marchetti and Crapps, 1981)

985176

Schnabel Engineering



Zone	Soil Behavior	Zone	Soil Behavior	Zone	Soil Behavior
1	Sensitive, fine grained	4	Clayey silt to silty clay	7	Gravelly sand to sand
2	Organic soils, peats	5	Silty sand to sandy silt	8	Very dense sand to clayey sand
3	Clays: Clay to silty clay	6	Clean sands to silty sands	9	Very stiff fine grained

FIGURE C-3
Soil Classification for Cone Penetration Test
(Robertson, 1990)

985176

Schnabel Engineering

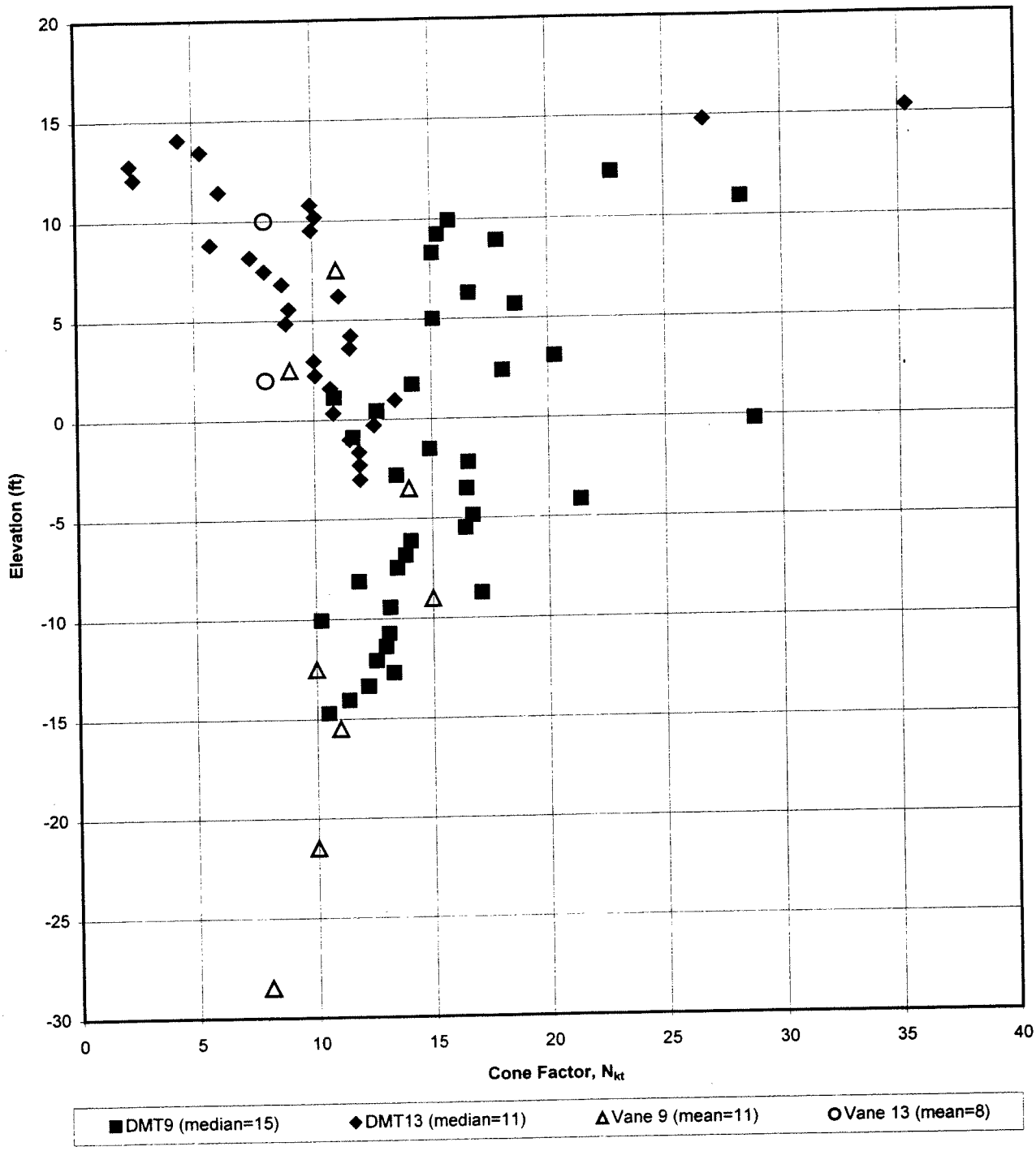


Figure C-4
Cone Factor, N_{kt}, vs. Elevation for DMT9 and DMT13
Pigeon Point
N_{kt} = 11

SCHNABEL ENGINEERING ASSOCIATES, INC.

Pigeon Point Disposal Area
Wilmington, Delaware

DATE:

CONTRACT NO.: 985176

Soil Classification Based on I_D (From Marchetti 1980)

Soil Type	Material Index
Peat / Sensitive Clays	< 0.10
Clay	0.10 - 0.35
Silty Clay	0.35 - 0.60
Clayey Silt	0.60 - 0.90
Silt	0.90 - 1.20
Sandy Silt	1.20 - 1.80
Silty Sand	1.80 - 3.30
Sand	> 3.30

TABLE C-1
Soil Classification Based on Material Index
from Dilatometer Test (Marchetti, 1980)

985176

Schnabel Engineering

LANDFILL SETTLEMENT CALCULATIONS

SCHNABEL ENGINEERING ASSOCIATES

BY CR DATE 7/27/99
CHKD. BY A DATE
SUBJECT PIGEON POINT - SUBGRADE SETTLEMENT

SHEET NO. 1 OF 5
JOB NO. 985176.06

CONSOLIDATION SETTLEMENT ESTIMATE

ASSUME BASE GRADE = EL 10
UNIT WEIGHT = 70 PCF FOR WASTE
88 PCF FOR SLUDGE/ASH

PRESSURE AT CENTER = (50)(70) + 15(88) = 4820 PSF

PRESSURE AT EDGE = 45(70) + 5(88) = 3590 PSF

	C	C_c	e_0	DEPTH	γ_d	γ_s
B-8	0.22	0.65	1.95	12	55	93
B-9	0.20	0.47	1.35	37	68.9	103
B-15	0.18	0.53	1.89	20	56.2	96
B-17	0.23	0.61	1.70	27	60.2	98
B-18	0.17	0.55	2.22	27	50.4	89
SEA-9	0.26	0.79	2.03	14	55.7	94
SEA-9	0.30	0.87	1.91	38	57.9	98
AVERAGES:	0.2	0.56	1.82			

ASSUME BASE GRADE = EL 10

UNIT WEIGHT OF WASTE = 70 PCF

UNIT WEIGHT OF SLUDGE/IRON FILL = 90 PCF

AVERAGE $C_c = 0.6$

$e_o = 1.9$

LAYER THICKNESS - VARIES USE ISOPACH BY DUFFIELD

- SETTLEMENT ALONG MH F-2 TO EAST PUMP STATION

MAXIMUM AT CENTER 20 FT OF NEW WASTE 50 FT OF COMPRESSIBLE MATERIAL

EXISTING LOAD = 50 FT · 70 PCF = 3500 PSF

$$\delta = \frac{C_c H_o}{1+e_o} \log \frac{\bar{\sigma}_o + \Delta\bar{\sigma}}{\bar{\sigma}_o}$$

$H_o = 50$ FT

$\bar{\sigma}_o = (100)(10) + (115)(40) = 1600$ PSF

$$= \frac{(0.6)(50)(12)}{1+1.9} \log \frac{1600+3500}{1600} = 62.5'' = 5.2 \text{ FT}$$

TOTAL NEW LOAD

$= 3500 + (20)(90) = 5{,}300$ PSF

$$\delta = \frac{(0.6)(50)(12)}{1+1.9} \log \frac{1600+5300}{1600} = 78.5'' = 6.6 \text{ FT}$$

— AT MH D-1

35 FT COMPRESSIBLE SOILS
40 FT OF WASTE
0 NEW WASTE

$\bar{\sigma}_0 = 10(10) + 12.5(40) = 1400$ PSF
$\Delta\sigma = 2800$

$$\delta = \frac{(0.6)(12)(35)}{1+1.9} \log \frac{1400+2800}{1400} = 41.5'' = 3.5 \text{ FT}$$

— AT MH D-2

45 FT COMP. SOILS
43 FT OF WASTE
12 FT OF NEW WASTE

$\bar{\sigma}_0 = 10(5) + 12.5(40) = 1500$ PSF
$\Delta\sigma = 3010$
$\Delta\sigma_1 = 4090$

$$\delta = \frac{(0.6)(12)(45)}{1+1.9} \log \frac{1500+3010}{1500} = 53.4'' = 4.5 \text{ FT}$$

$$= \frac{(0.6)(12)(45)}{2.9} \log \frac{1500+4090}{1500} = 63.8'' = 5.3 \text{ FT}$$

— AT MH D-3

45 FT OF COMP. SOIL
50 FT OF WASTE
25 FT OF NEW WASTE

$\bar{\sigma}_0 = 1500$ PSF
$\Delta\sigma = 3500$
$\Delta\sigma_1 = 5750$

$$\delta = \frac{(0.6)(12)(45)}{2.9} \log \frac{1500+3500}{1500} = 58.4'' = 4.9 \text{ FT}$$

$$= \log \frac{1500+5750}{1500} = 76.4'' = 6.4 \text{ FT}$$

AT MH D-4

50 FT OF COMP. SOILS
50 FT OF WASTE
25 FT OF NEW WASTE

$\bar{\sigma}_0$ = [illegible] PSF
$\Delta\sigma = 3500$
$\Delta\sigma_1 = 5750$

$$\delta = \frac{(0.6)(12)(50)}{2.9} \log \frac{1500+3500}{1500} = 62.5'' = 5.2 \text{ FT}$$

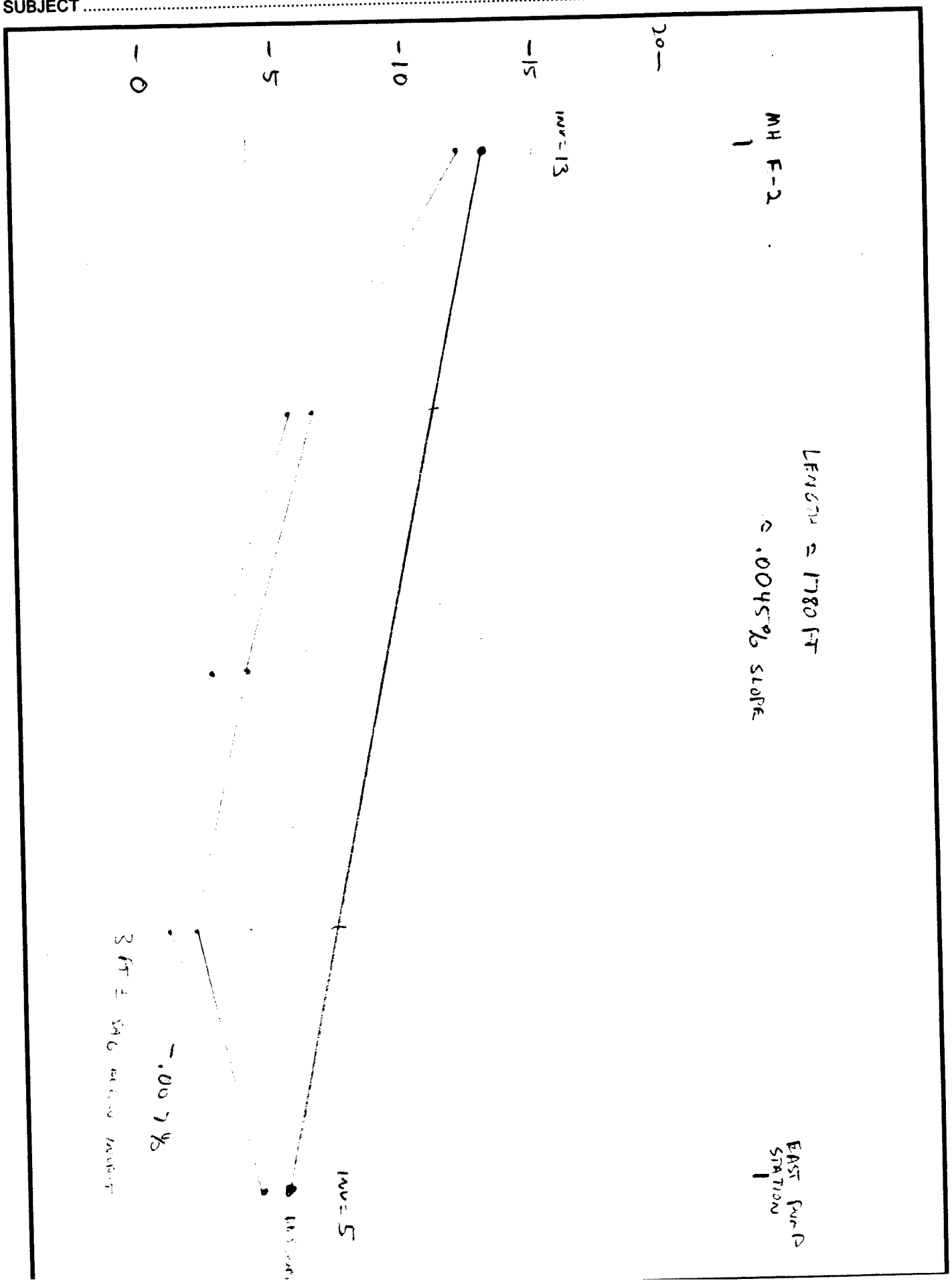
$$= [illegible]'' = 6.9 \text{ FT}$$

SCHNABEL ENGINEERING ASSOCIATES

BY CR DATE 7/22/99 SHEET NO. 4 OF 5

CHKD. BY DATE JOB NO.

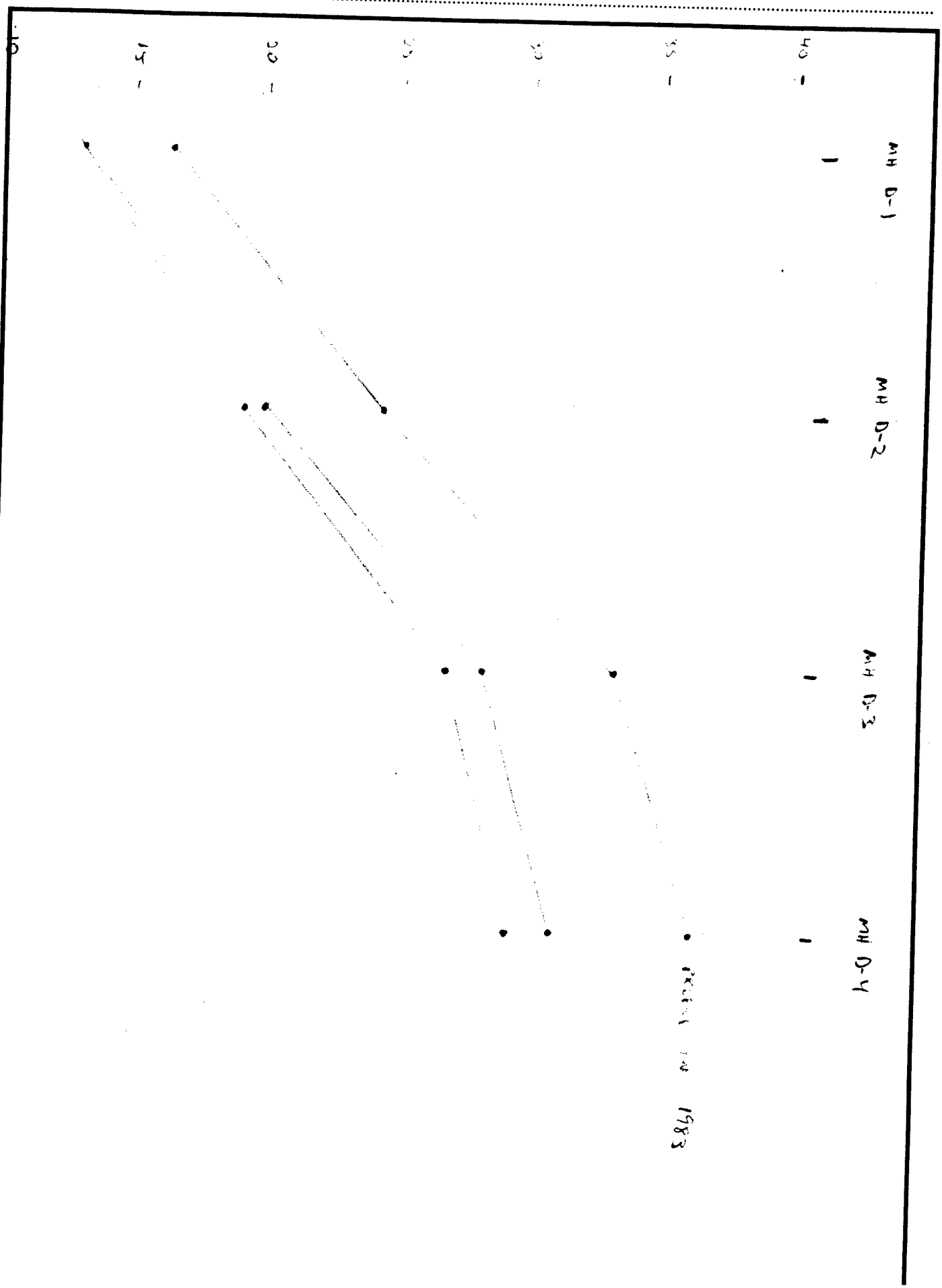
SUBJECT



SCHNABEL ENGINEERING ASSOCIATES

BY CR DATE 7/22/09
CHKD. BY DATE
SUBJECT

SHEET NO. 5 OF 5
JOB NO.



ESTIMATION OF WASTE SETTLEMENT

ADDING 5 TO 30 FT OF NEW MATERIAL AT 90 PCF

450 ~ 2,700 PSF

ASSUME 40 FT OF WASTE

SOWERS METHOD

PRIMARY:

$$S = H \frac{C_c}{1+e_0} \log \frac{P_0 + dP}{P_0}$$

$P_0 = 20(70) = 1400$ PSF $\quad dP = 450$ TO 2700

$H = 40$ FT

$$\frac{C_c}{1+e_0} \simeq 0.1 \sim 0.4 \quad \text{SAY } 0.2$$

$$S = (40)(0.2) \log \frac{1400 + dP}{1400}$$

$= 1$ FT TO 3.7 FT IN 1 TO 5 YRS

SECONDARY:

$$S_s = H \frac{C_\alpha}{1+e_0} \log \frac{t_2}{t_1}$$

$C_\alpha = 0.025$

$H = 40$ FT

$1+e_0 = 2.5$

$t_1 = 1$ YR

$t_2 = 10$ YRS

$$S_s = (40)(\log 10) \frac{0.025}{2.5} = 0.4 \text{ FT}$$

SMALL, DON'T CONSIDER THIS FOR ADDITIONAL VOLUME NOW

$3.7 + 0.4 \simeq 4$ FT

GIBSON & LO MODEL

$$S(t) = H \Delta\sigma \{a + b[1 + \exp(-\tau/\mu t)]\}$$

$t = 5$ YRS $= 1825$ DAYS

$H = 40$ FT

$\Delta\sigma = 450$ TO 2700 PSF $= 21.5 \sim 129.3$ kPa

$a = 1 \times 10^{-5}$ (3×10^{-3})

$b = .001$ $(.005$

$\tau/\mu = .0005$

$$S(t) = (40)(129.3)\left\{1 \times 10^{-5} + .001\left[1 + e^{\left(-\frac{.0005}{1825}\right)}\right]\right\} = \boxed{10.4 \text{ FT}}$$

POWER CREEP LAW

$$S(t) = H \Delta\sigma m \left(\frac{t}{t_n}\right)^m$$

$m = 3.4 \times 10^{-5}$

$n = 0.37$ 5 YRS

$H = 40$ FT

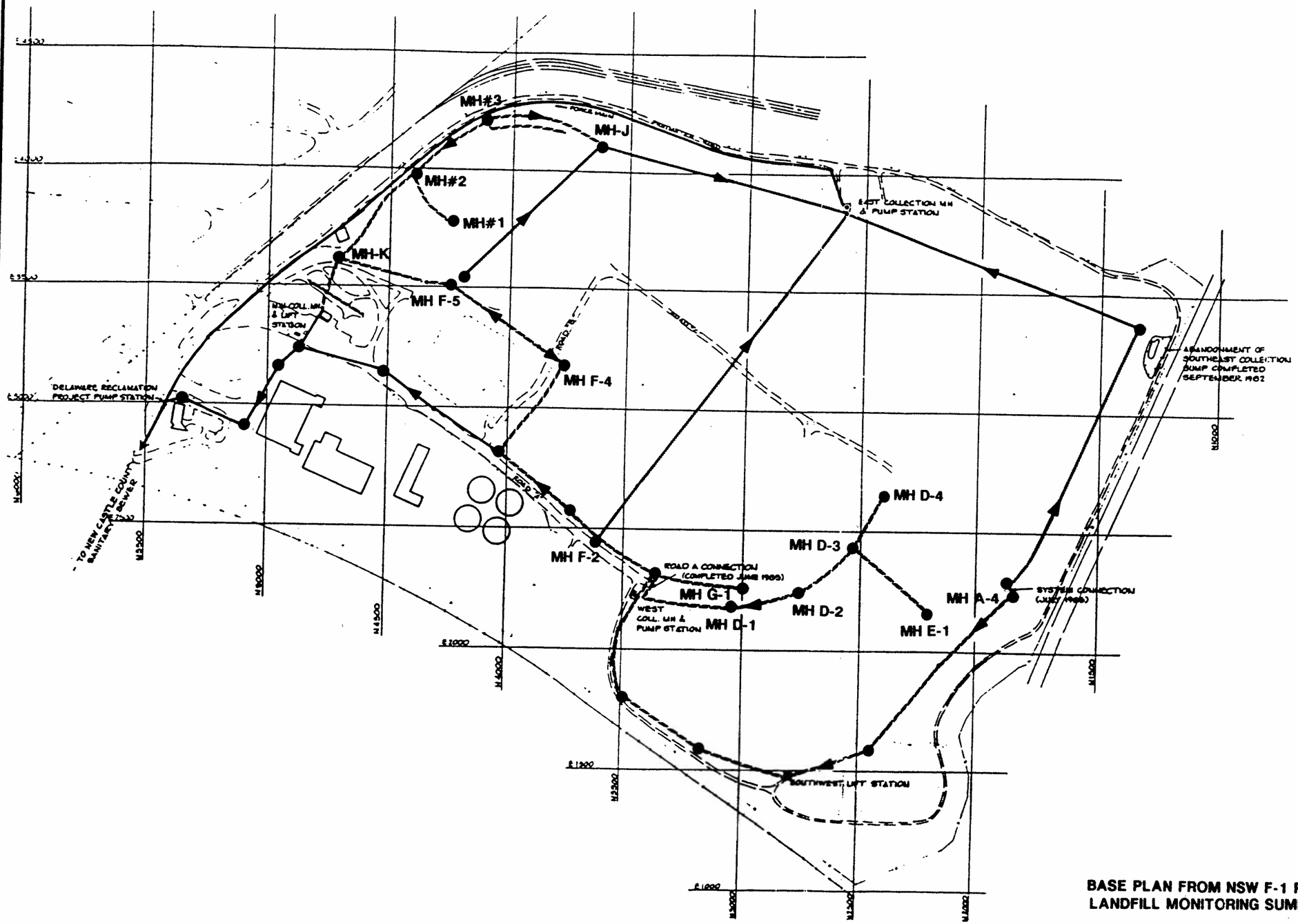
$$S(t) = (40)(129.3)\, 3.4 \times 10^{-5} (5)^{0.37} = \boxed{0.32 \text{ FT}}$$

0.52 FT

FIGURE C-5

NORTHERN SOLID WASTE MANAGEMENT CENTER-1
PIGEON POINT DISPOSAL AREA
WILMINGTON, DELAWARE
985176.06

LEACHATE COLLECTION SYSTEM SCHEMATIC PLAN



LEGEND

● MANHOLE LOCATION

BASE PLAN FROM NSW F-1 PIGEON POINT LANDFILL MONITORING SUMMARY 4-2-87

Schnabel Engineering

APPENDIX D

PCSTABL Slope Stability Analysis Plots

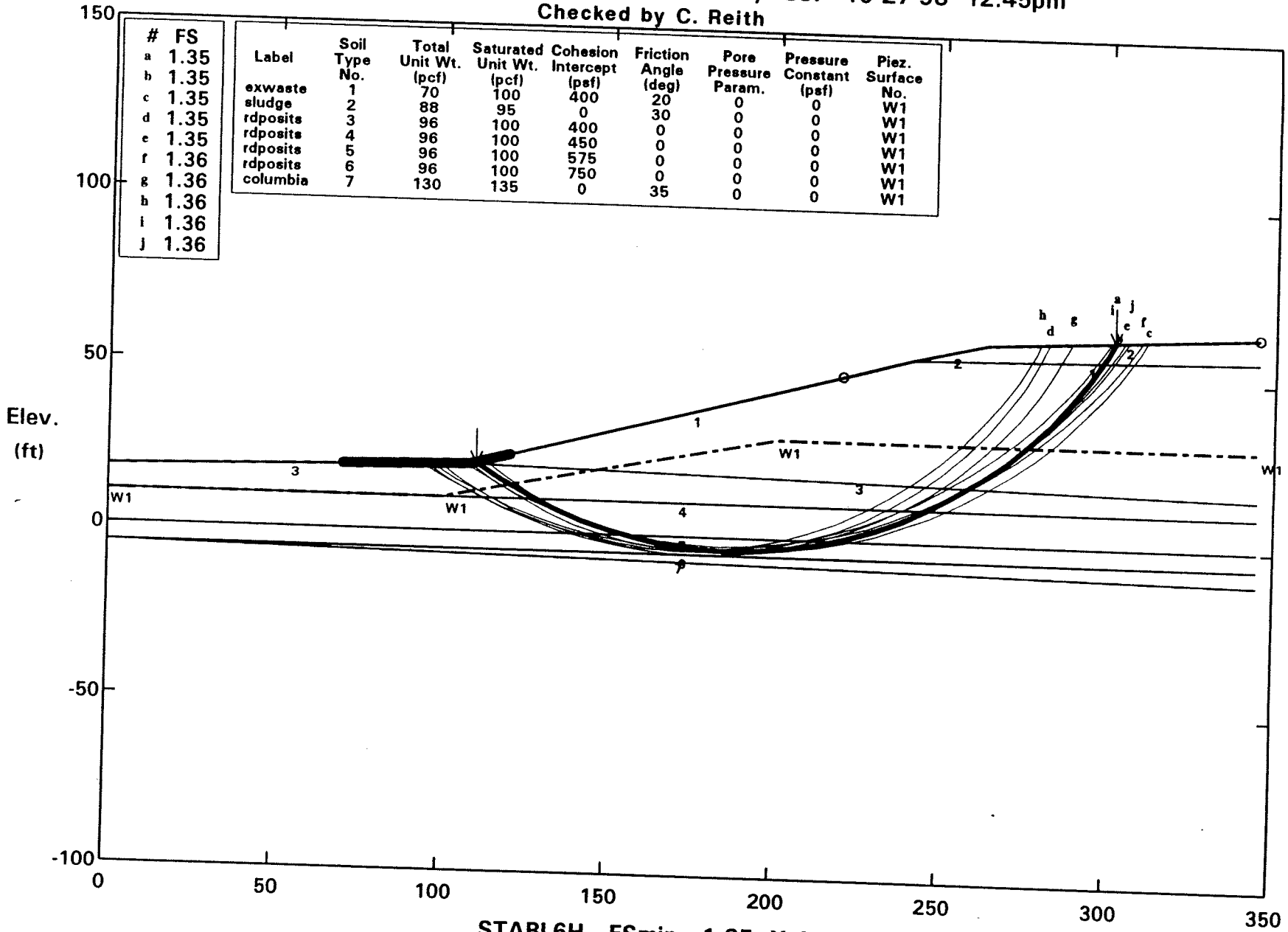
DSWA - Pigeon Point (985176.06) -- Section A - Total Stress Analysis

Ten Most Critical. C:SECTA-1.PLT By: GSP 10-27-98 12:45pm

Checked by C. Reith

#	FS
a	1.35
b	1.35
c	1.35
d	1.35
e	1.35
f	1.36
g	1.36
h	1.36
i	1.36
j	1.36

Label	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
exwaste	1	70	100	400	20	0	0	W1
sludge	2	88	95	0	30	0	0	W1
rdposits	3	96	100	400	0	0	0	W1
rdposits	4	96	100	450	0	0	0	W1
rdposits	5	96	100	575	0	0	0	W1
rdposits	6	96	100	750	0	0	0	W1
columbia	7	130	135	0	35	0	0	W1



STABL6H FSmin = 1.35 X-Axis (ft)

Factors Of Safety Calculated By The Modified Bishop Method

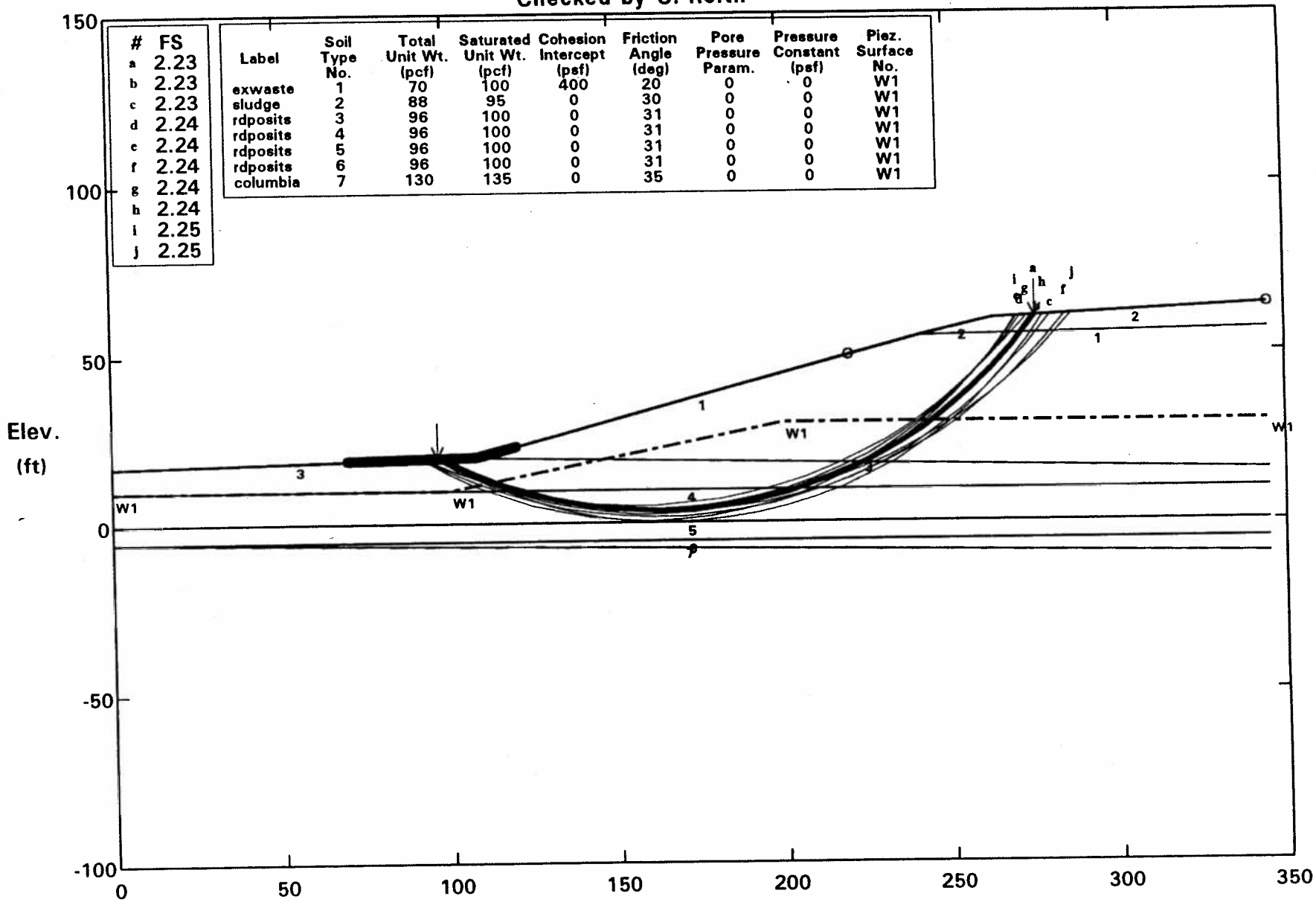
DSWA - Pigeon Point (985176.06) -- Section A - Effective Stress Analysis

Ten Most Critical. C:SECTA-2.PLT By: GSP 10-27-98 12:46pm

Checked by C. Reith

#	FS
a	2.23
b	2.23
c	2.23
d	2.24
e	2.24
f	2.24
g	2.24
h	2.24
i	2.25
j	2.25

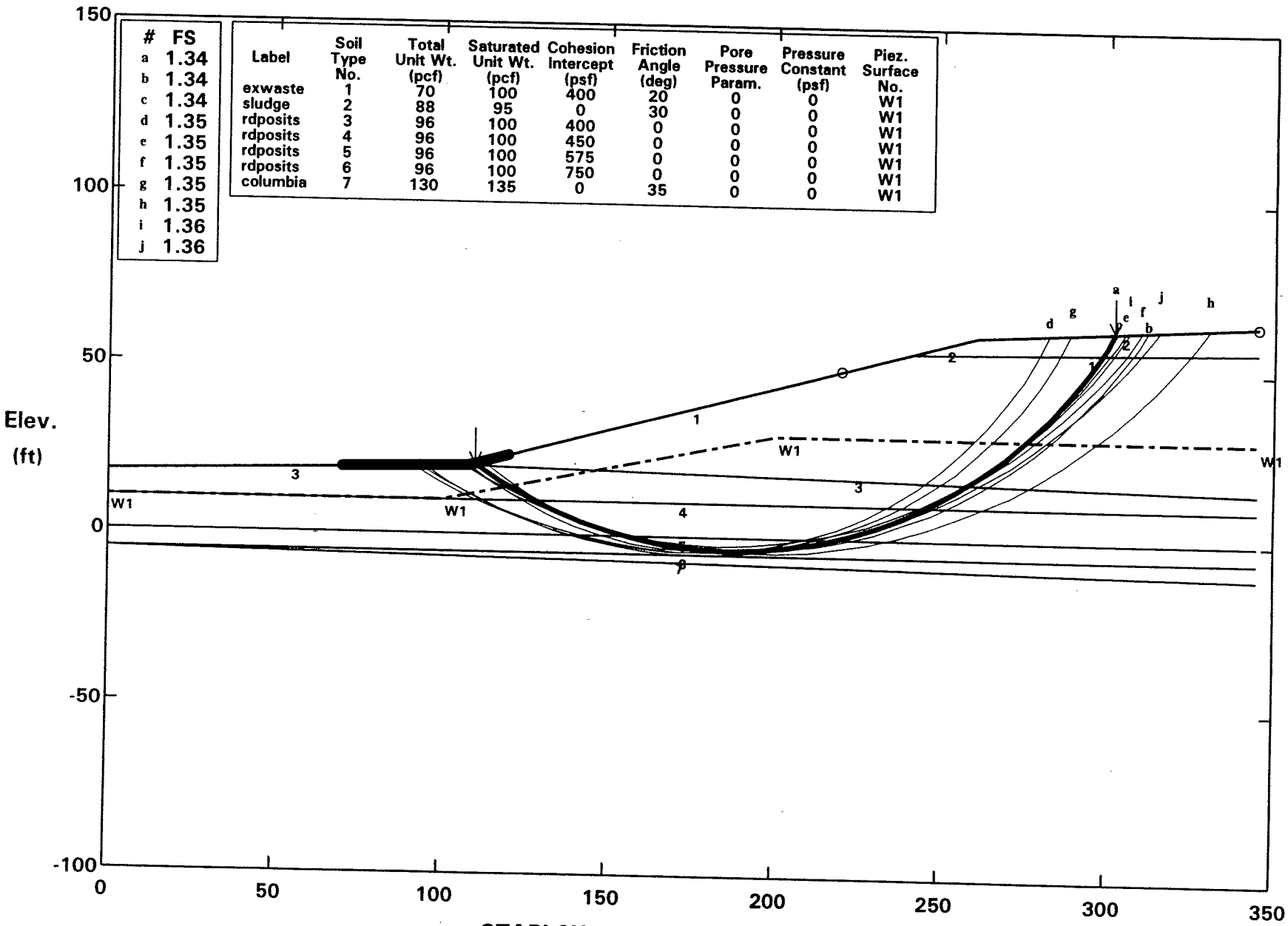
Label	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
exwaste	1	70	100	400	20	0	0	W1
sludge	2	88	95	0	30	0	0	W1
rdposits	3	96	100	0	31	0	0	W1
rdposits	4	96	100	0	31	0	0	W1
rdposits	5	96	100	0	31	0	0	W1
rdposits	6	96	100	0	31	0	0	W1
columbia	7	130	135	0	35	0	0	W1



STABL6H FSmin = 2.23 X-Axis (ft)

Factors Of Safety Calculated By The Modified Bishop Method

DSWA - Pigeon Point (985176.06) -- Sect , A - Total Stress Analysis 4H:1V Slope
Ten Most Critical. G:SECTA-1A.PLT By: CMR 12-13-99 3:24pm
Checked by A. Cadden



#	FS
a	1.34
b	1.34
c	1.34
d	1.35
e	1.35
f	1.35
g	1.35
h	1.35
i	1.36
j	1.36

Label	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
exwaste	1	70	100	400	20	0	0	W1
sludge	2	88	95	0	30	0	0	W1
rdposits	3	96	100	400	0	0	0	W1
rdposits	4	96	100	450	0	0	0	W1
rdposits	5	96	100	575	0	0	0	W1
rdposits	6	96	100	750	0	0	0	W1
columbia	7	130	135	0	35	0	0	W1

STABL6H FSmin = 1.34 X-Axis (ft)
Factors Of Safety Calculated By The Modified Bishop Method

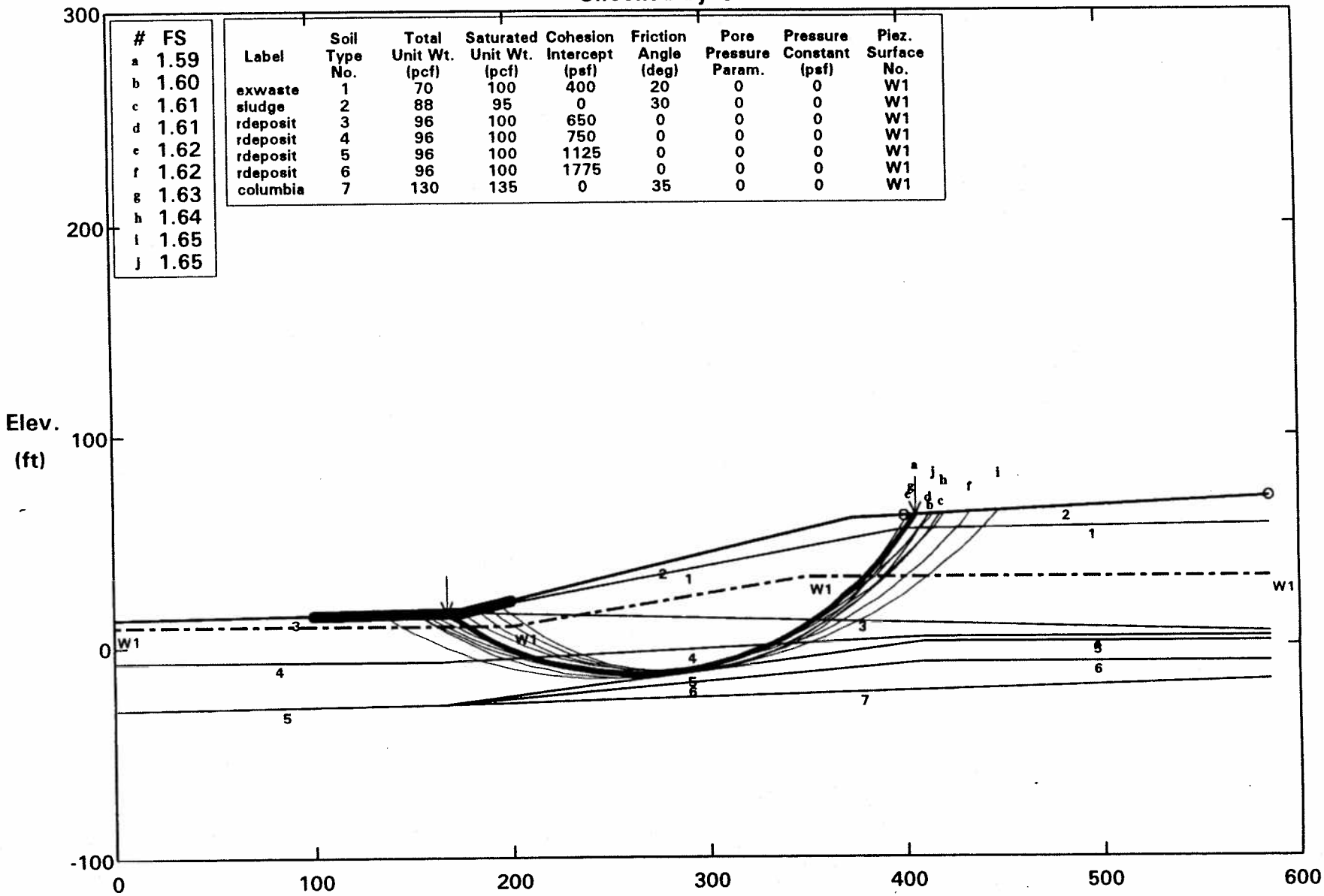
DSWA - Pigeon Point (985176.06) -- Section B - Total Stress Analysis

Ten Most Critical. C:SECTB-1.PLT By: GSP 10-27-98 12:48pm

Checked by C. Reith

#	FS
a	1.59
b	1.60
c	1.61
d	1.61
e	1.62
f	1.62
g	1.63
h	1.64
i	1.65
j	1.65

Label	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
exwaste	1	70	100	400	20	0	0	W1
sludge	2	88	95	0	30	0	0	W1
rdeposit	3	96	100	650	0	0	0	W1
rdeposit	4	96	100	750	0	0	0	W1
rdeposit	5	96	100	1125	0	0	0	W1
rdeposit	6	96	100	1775	0	0	0	W1
columbia	7	130	135	0	35	0	0	W1



STABL6H FSmin = 1.59 X-Axis (ft)

Factors Of Safety Calculated By The Modified Bishop Method

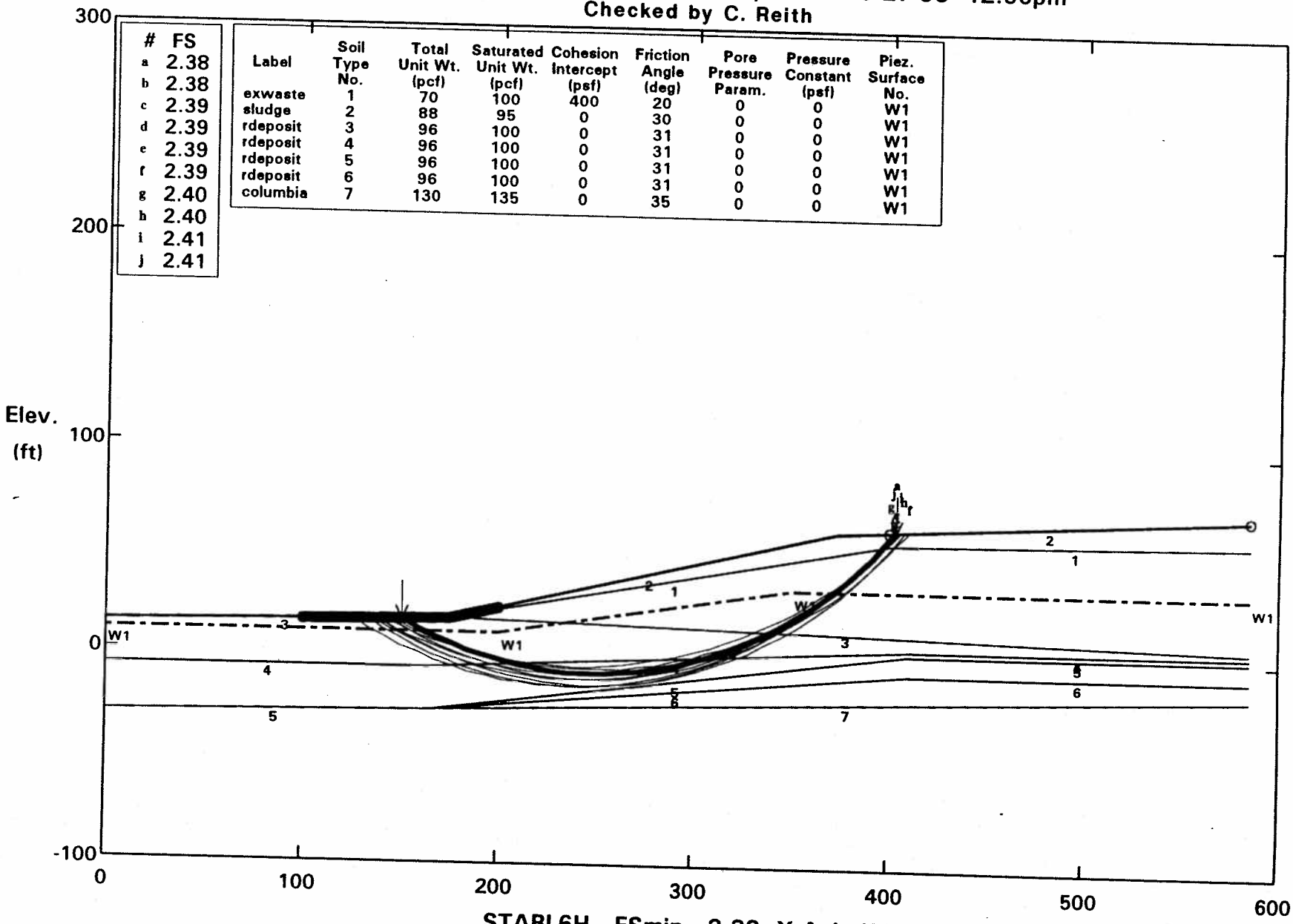
DSWA - Pigeon Point (985176.06) -- Section B - Effective Stress Analysis

Ten Most Critical. C:SECTB-2.PLT By: GSP 10-27-98 12:50pm

Checked by C. Reith

#	FS
a	2.38
b	2.38
c	2.39
d	2.39
e	2.39
f	2.39
g	2.40
h	2.40
i	2.41
j	2.41

Label	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
exwaste	1	70	100	400	20	0	0	W1
sludge	2	88	95	0	30	0	0	W1
rdeposit	3	96	100	0	31	0	0	W1
rdeposit	4	96	100	0	31	0	0	W1
rdeposit	5	96	100	0	31	0	0	W1
rdeposit	6	96	100	0	31	0	0	W1
columbia	7	130	135	0	35	0	0	W1



STABL6H FSmin = 2.38 X-Axis (ft)

Factors Of Safety Calculated By The Modified Bishop Method

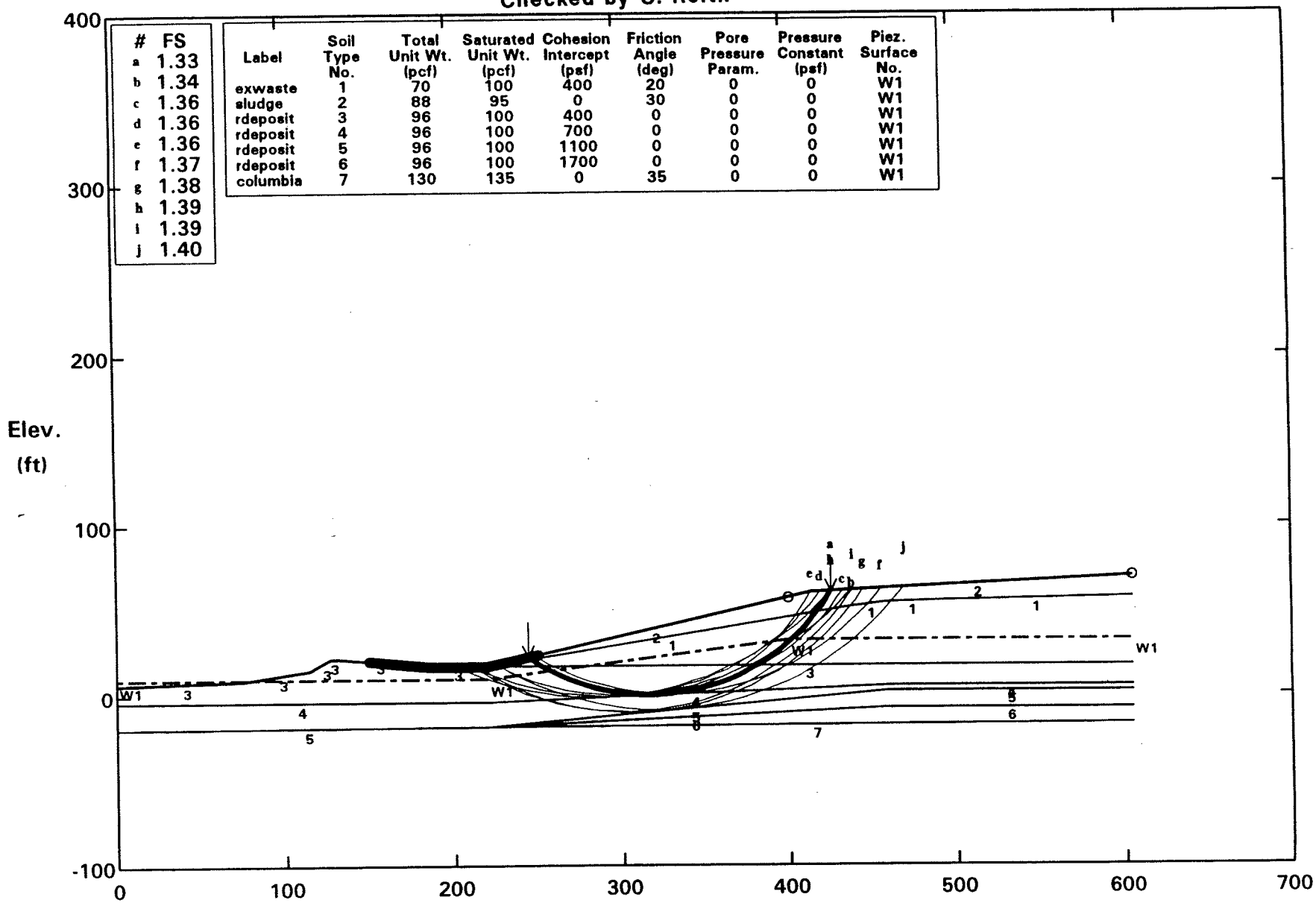
DSWA - Pigeon Point (985176.06) -- Section C - Total Stress Analysis

Ten Most Critical. C:SECTC-1.PLT By: GSP 10-27-98 12:52pm

Checked by C. Reith

#	FS
a	1.33
b	1.34
c	1.36
d	1.36
e	1.36
f	1.37
g	1.38
h	1.39
i	1.39
j	1.40

Label	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
exwaste	1	70	100	400	20	0	0	W1
sludge	2	88	95	0	30	0	0	W1
rdeposit	3	96	100	400	0	0	0	W1
rdeposit	4	96	100	700	0	0	0	W1
rdeposit	5	96	100	1100	0	0	0	W1
rdeposit	6	96	100	1700	0	0	0	W1
columbia	7	130	135	0	35	0	0	W1



STABL6H FSmin = 1.33 X-Axis (ft)

Factors Of Safety Calculated By The Modified Bishop Method

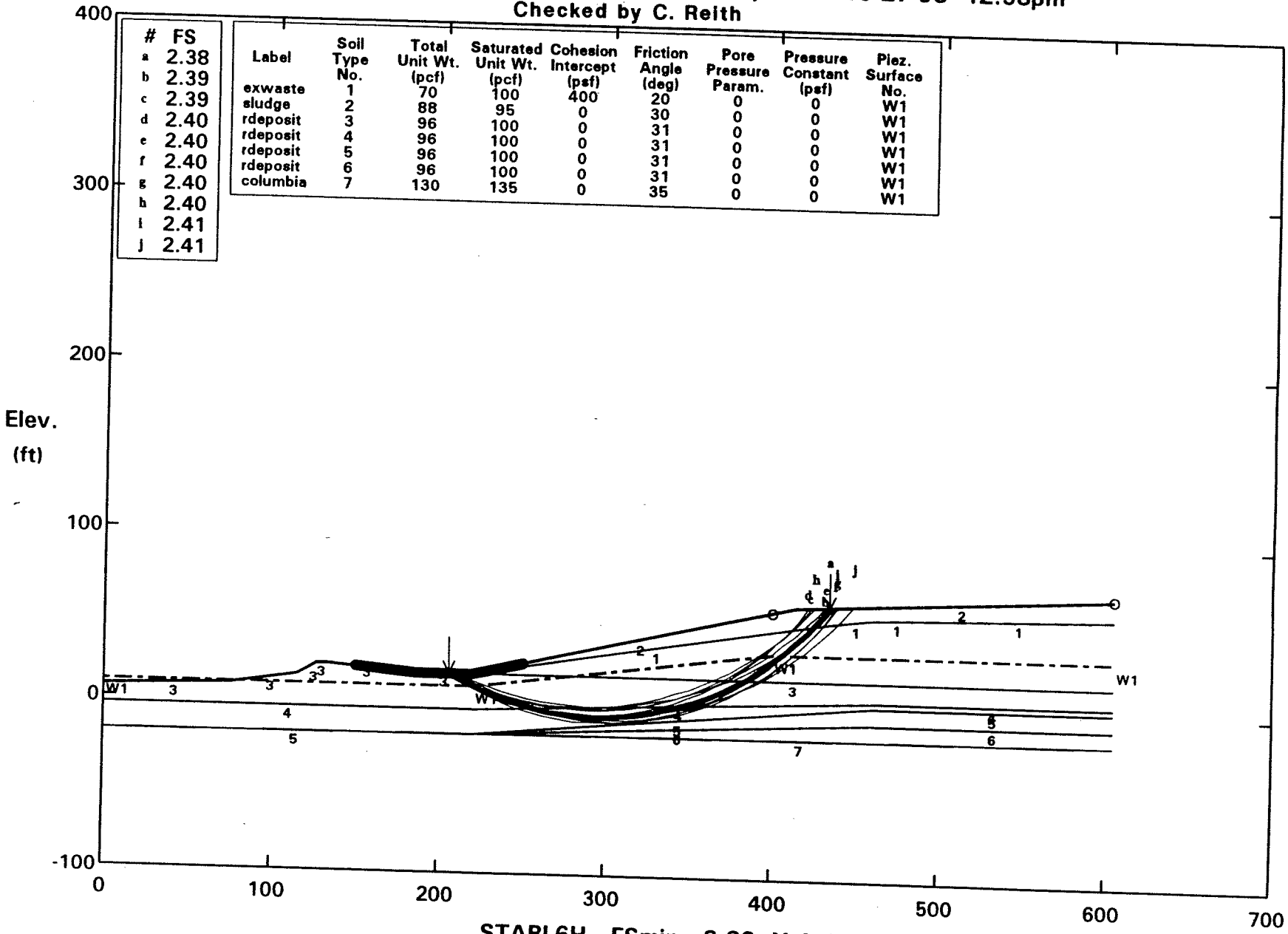
DSWA - Pigeon Point (985176.06) -- Section C - Effective Stress Analysis

Ten Most Critical. C:SECTC-2.PLT By: GSP 10-27-98 12:58pm

Checked by C. Reith

#	FS
a	2.38
b	2.39
c	2.39
d	2.40
e	2.40
f	2.40
g	2.40
h	2.40
i	2.41
j	2.41

Label	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
exwaste	1	70	100	400	20	0	0	W1
sludge	2	88	95	0	30	0	0	W1
rdeposit	3	96	100	0	31	0	0	W1
rdeposit	4	96	100	0	31	0	0	W1
rdeposit	5	96	100	0	31	0	0	W1
rdeposit	6	96	100	0	31	0	0	W1
columbia	7	130	135	0	35	0	0	W1



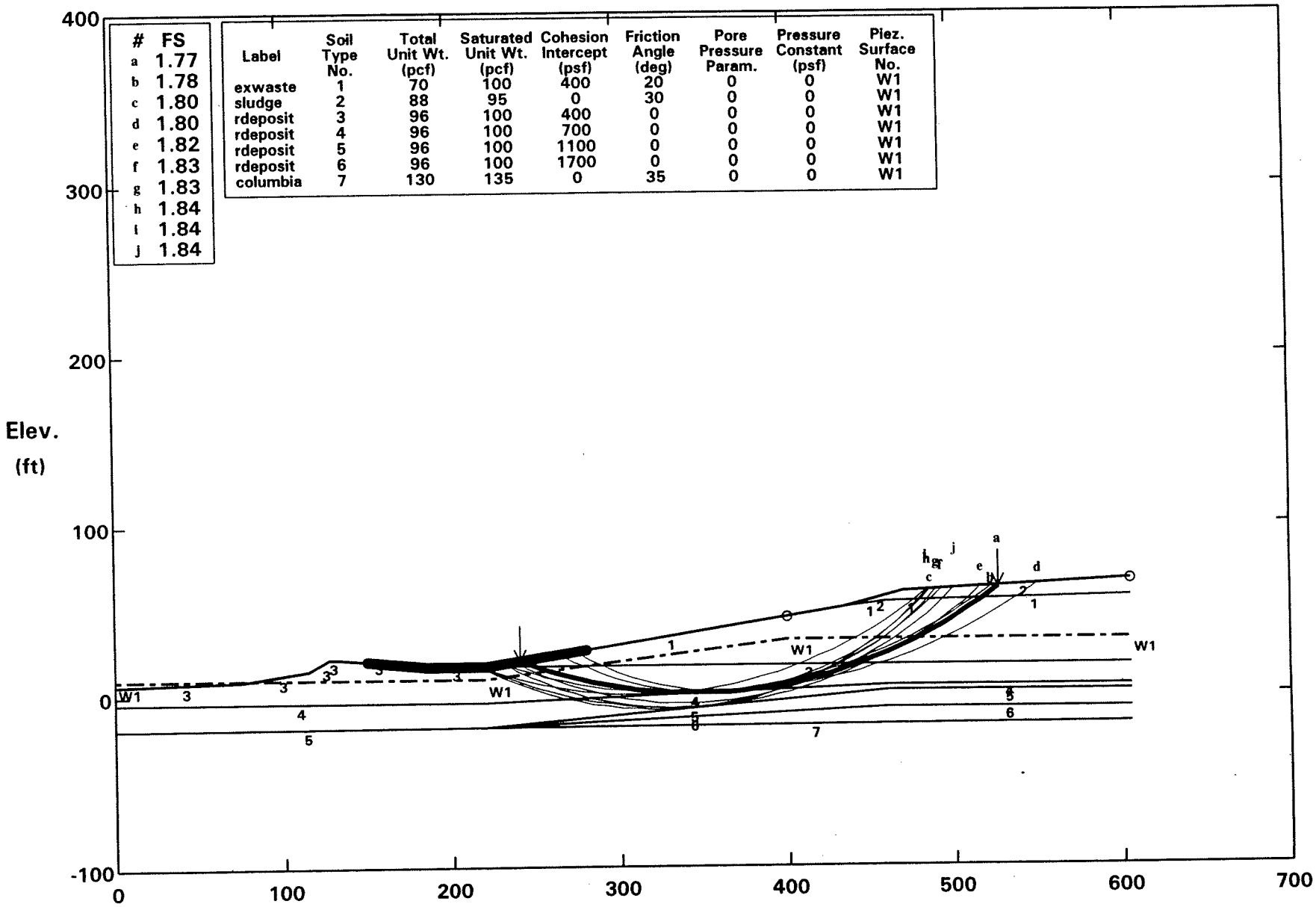
STABL6H FSmin = 2.38 X-Axis (ft)

Factors Of Safety Calculated By The Modified Bishop Method

DSWA - Pigeon Point (985176.06) -- Section C - Total Stress Analysis 4H:1V Slope
Ten Most Critical. G:SECTC-1A.PLT By: CMR 12-13-99 3:38pm
Checked by A. Cadden

#	FS
a	1.77
b	1.78
c	1.80
d	1.80
e	1.82
f	1.83
g	1.83
h	1.84
i	1.84
j	1.84

Label	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
exwaste	1	70	100	400	20	0	0	W1
sludge	2	88	95	0	30	0	0	W1
rdeposit	3	96	100	400	0	0	0	W1
rdeposit	4	96	100	700	0	0	0	W1
rdeposit	5	96	100	1100	0	0	0	W1
rdeposit	6	96	100	1700	0	0	0	W1
columbia	7	130	135	0	35	0	0	W1



STABL6H FSmin = 1.77 X-Axis (ft)
Factors Of Safety Calculated By The Modified Bishop Method

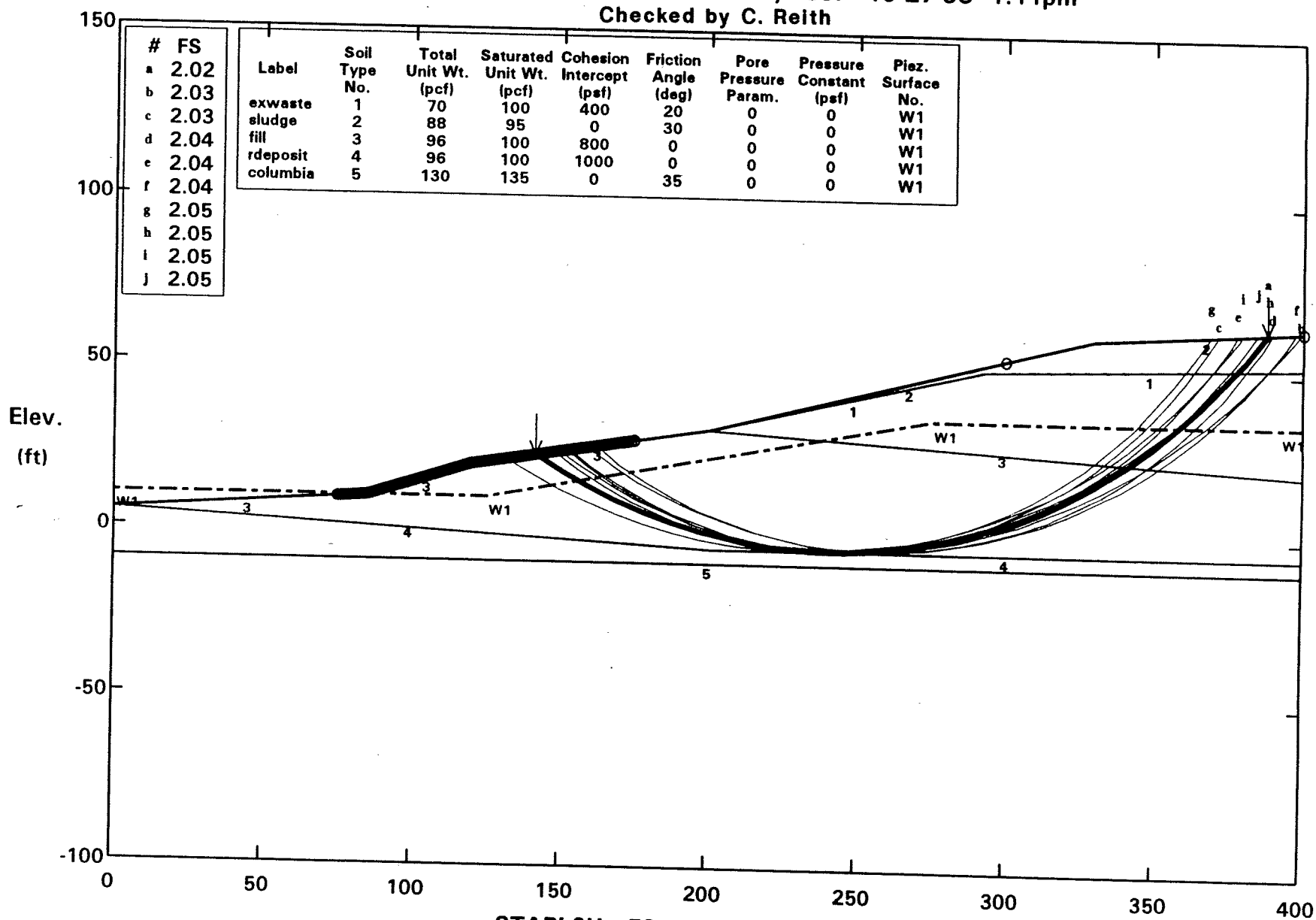
DSWA - Pigeon Point (985176.06) -- Section D - Total Stress Analysis

Ten Most Critical. C:SECTD-1.PLT By: GSP 10-27-98 1:11pm

Checked by C. Reith

#	FS
a	2.02
b	2.03
c	2.03
d	2.04
e	2.04
f	2.04
g	2.05
h	2.05
i	2.05
j	2.05

Label	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
exwaste	1	70	100	400	20	0	0	W1
sludge	2	88	95	0	30	0	0	W1
fill	3	96	100	800	0	0	0	W1
rdeposit	4	96	100	1000	0	0	0	W1
columbia	5	130	135	0	35	0	0	W1



STABL6H FSmin = 2.02 X-Axis (ft)

Factors Of Safety Calculated By The Modified Bishop Method

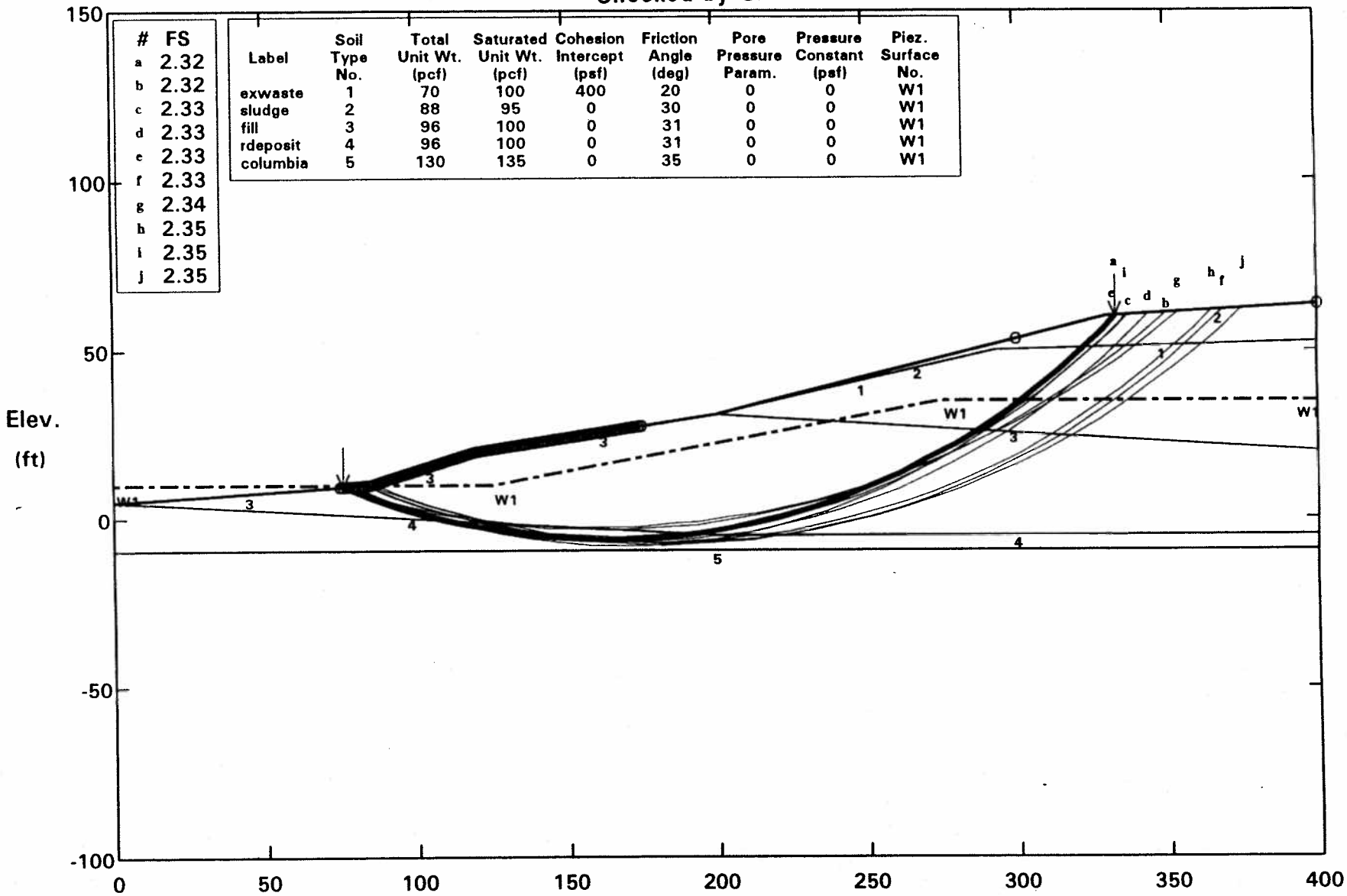
DSWA - Pigeon Point (985176.06) -- Section D - Effective Stress Analysis

Ten Most Critical. C:SECTD-2.PLT By: GSP 10-27-98 1:13pm

Checked by C. Reith

#	FS
a	2.32
b	2.32
c	2.33
d	2.33
e	2.33
f	2.33
g	2.34
h	2.35
i	2.35
j	2.35

Label	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
exwaste	1	70	100	400	20	0	0	W1
sludge	2	88	95	0	30	0	0	W1
fill	3	96	100	0	31	0	0	W1
rdeposit	4	96	100	0	31	0	0	W1
columbia	5	130	135	0	35	0	0	W1



STABL6H FSmin = 2.32 X-Axis (ft)

Factors Of Safety Calculated By The Modified Bishop Method

APPENDIX E

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