GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: EXELON VICTORIA B-2306 DATE: 11/16/07
CLIENT: MACTEC JOB: 7501
AUTHOR: C. CARTER PAGE 6 OF 7

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
60.5	198.49	118		
61.0	200.13	119		
61.5	201.77	120		
62.0	203.41	121		
62.5	205.05	122		
63.0	206.69	123		
63.5	208.33	124		
64.0	209.97	125		
64.5	211.61	126		
65.0	213.25	127		
65.5	214.90	128		
66.0	216.54	129		
66.5	218.18	130		
67.0	219.82	131		
67.5	221.46	132		
68.0	223.10	133		
68.5	224.74	134		
69.0	226.38	135		
69.5	228.02	136		
70.0	229.66	137		
70.5	231.30	138		
71.0	232.94	139		
71.5	234.58	140		
72.0	236.22	141		
72.5	237.86	142		
73.0	239.50	143		
73.5	241.14	144		
74.0	242.78	145		
74.5	244.42	146		
75.0	246.06	147		
75.5	247.70	148		
76.0	249.34	149		
76.5	250.98	150		
77.0	252.62	151		
77.5	254.27	152		
78.0	255.91	153		
78.5	257.55	154		
79.0	259.19	155		
79.5	260.83	156		
80.0	262.47	157		

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: EXELON VICTORIA B-2306
DATE: 11/16/07
CLIENT: MACTEC
JOB: 7501
AUTHOR: C. CARTER
PAGE 7 OF 7

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
80.5	264.11	158		
81.0	265.75	159		
81.5	267.39	160		
82.0	269.03	161		
82.5	270.67	162		
83.0	272.31	163		
83.5	273.95	164		
84.0	275.59	165		
84.5	277.23	166		
85.0	278.87	167		
85.5	280.51	168		
86.0	282.15	169		
86.5	283.79	170		
87.0	285.43	171		
87.5	287.07	172		
88.0	288.71	173		
88.5	290.35	174		
89.0	291.99	175		
89.5	293.64	176		
90.0	295.28	177		
90.5	296.92	178		6:45pm
91.0	298.56			
91.5	300.20			
92.0	301.84			
92.5	303.48			
93.0	305.12			
93.5	306.76			
94.0	308.40			
94.5	310.04			
95.0	311.68			
95.5	313.32			
96.0	314.96			
96.5	316.60			
97.0	318.24			
97.5	319.88			
98.0	321.52			
98.5	323.16			
99.0	324.80			
99.5	326.44			
100.0	328.08			

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B-2306 CALIPER FIELD LOG

SITE: EXELON VICTORIA COUNTY COL DATE: 11/16/07
CLIENT: MACTEC JOB: 7501
AUTHOR: C. CARTER PAGE 1 OF 2

CONTACT: STEVE CRISENZO OFFICE PHONE: 361-972-0198
CELL PHONE: 919-949-1707
CONTACT: ALLAN SHAW CELL PHONE: 301-704-2684
PHONE:
CONTACT: PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
DRILLER: PHONE:
COMPANY: PHONE:

GENERAL SITE CONDITIONS/LOCATION:

BOREHOLE DESIGNATION: B-2306 LOCATION: Perimeter

COUNTY: VICTORIA RANGE: TOWNSHIP: SECTION:
BOREHOLE CONSTRUCTION: CASED UNCASED X
DIAMETERS AND DEPTH RANGES: 5" 0 TO 310 ft ; , TO
BOREHOLE TOTAL DEPTH AS DRILLED: 310 ft
CONDUCTOR CASING?: YES X DEPTH TO BOTTOM OF CASING 2' ; NO
DEPTH TO BEDROCK: NA DEPTH TO WATER TABLE: NA
BOREHOLE FLUID: WATER ; FRESH WATER MUD X ; SALT WATER MUD ;
OTHER:
DEPTH TO BOREHOLE FLUID: ø TIME SINCE LAST CIRCULATION: 3:45 pm

LOGGING CREW: C. CARTER
VEHICLE(S) USED AND MILEAGE: RENTAL
MOBILIZED FROM: VICTORIA, TX DEPARTURE TIME: 2:30 pm
ARRIVED ON SITE: 3:00 pm
STANDBY TIME: CAUSE:
LOGGING STARTED: 7:40 pm LOGGING COMPLETED: 8:11 pm

GEOVision Geophysical Services 1151 Pomona Road, Unit P, Corona, CA 92882 Ph (951) 549-1234 Fx (951) 549-1236

SITE:_EXELON VICTORIA COUNTY COL B2306 DATE: 11/16/07
CLIENT:_MACTEC JOB:_7501
AUTHOR:_C. CARTER PAGE 2 OF 2

WINCH: COMPROBE___ SILVER X OYO___ RG___ OTHER___
MICROLOGGER 5310 X 5772___ OTHER___
CALIPER PROBE 5368 X OTHER___

PROBE OFFSET	2.08M(6.82 FT) 12 IN MAX	
MINUS CASING STICK-UP	1.25	
DEPTH REF. OFFSET AT START	5.57	
DEPTH REF. OFFSET AT END	5.65	
AFTER SURVEY DEPTH ERROR	.08	LESS THAN 0.4%?

LOG NAME	START DEPTH	START TIME	END DEPTH	END TIME
B2306cal test 01		7:20pm		7:21pm
B2306calUP01	306.25'	7:40pm	5.75'	8:11pm
B2306cal test02		8:16pm		8:17pm

CALIBRATION PLATE S/N 201		AS BUILT			PVC FITTING
		1.968 IN	3.937 IN	8.000 IN	4.500 IN
	FILE NAME	(50 MM)	(100 MM)	(203.2 MM)	(114.3 MM)
AS MEAS.	B2306caltest01	2.629	3.993	8.050	4.561
AS MEAS.	B2306caltest02	1.949	3.848	8.036	4.536
AS MEAS.					
AS MEAS.					
AS MEAS.					
AS MEAS.					

cc 11/16/07

MAINTENANCE PERFORMED ON SITE:___

EQUIPMENT PROBLEMS OR FAILURES:___

SUGGESTIONS, ADDITIONS, CHANGES:___

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B-2306 DEVIATION FIELD LOG

SITE: EXELON VICTORIA COUNTY COL
DATE: 11/16/07
CLIENT: MACTEC
JOB: 7501
AUTHOR: C. CARTER
PAGE 1 OF 2

CONTACT: STEVE CRISENZO — OFFICE PHONE: 361-972-0198
CELL PHONE: 919-949-1707
CONTACT: — OFFICE PHONE:
PHONE:
CONTACT: — PHONE:
PHONE:
CONTACT: — PHONE:
PHONE:
DRILLER: — PHONE:
COMPANY: — PHONE:

DIRECTIONS TO SITE:

GENERAL SITE CONDITIONS/LOCATION:

BOREHOLE DESIGNATION: B-2306 LOCATION: Perimeter

COUNTY: VICTORIA RANGE: TOWNSHIP: SECTION:
BOREHOLE CONSTRUCTION: CASED UNCASED X
DIAMETERS AND DEPTH RANGES: 5" 0 TO 310 ft ; , TO
BOREHOLE TOTAL DEPTH AS DRILLED: 310 ft
CONDUCTOR CASING?: YES X DEPTH TO BOTTOM OF CASING 2' ; NO
DEPTH TO BEDROCK: NA DEPTH TO WATER TABLE: NA
BOREHOLE FLUID: WATER ; FRESH WATER MUD X ; SALT WATER MUD ;
OTHER:
DEPTH TO BOREHOLE FLUID: ~20 ft TIME SINCE LAST CIRCULATION: 3:45pm

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SITE: EXELON VICTORIA COUNTY COL B-2306 DATE: 11/16/07
CLIENT: MACTEC JOB: 7501
AUTHOR: C. CARTER PAGE 2 OF 2

LOGGING CREW: C. CARTER
VEHICLE(S) USED AND MILEAGE: RENTAL
MOBILIZED FROM: Victoria, Tx DEPARTURE TIME: 2:30pm
ARRIVED ON SITE: 3pm
STANDBY TIME: CAUSE:
LOGGING STARTED: 8:38pm LOGGING COMPLETED: 8:52

WINCH: COMPROBE___ SILVER X OYO___ RG___ OTHER___
MICROLOGGER 5310 X 5772___ OTHER___
TELEVIEWER 5174 X OTHER___

1 PROBE TILT TEST 85 BRUNTON TILT 86
2 PROBE TILT TEST 14.8 BRUNTON TILT 15
3 PROBE TILT TEST 10.3 BRUNTON TILT 11 After log
1 PROBE AZIMUTH TEST 234.3 BRUNTON AZIMUTH 230
2 PROBE AZIMUTH TEST 144.1 BRUNTON AZIMUTH 145
3 PROBE AZIMUTH TEST 29.7 BRUNTON AZIMUTH 31 After log

PROBE OFFSET	1.44M(4.72FT)	
MINUS CASING STICK-UP	1.25'	
DEPTH REF. OFFSET AT START	3.47	
DEPTH REF. OFFSET AT END	3.47	
AFTER SURVEY DEPTH ERROR	0	LESS THAN 0.4%?

LOG NAME	START DEPTH	START TIME	END DEPTH	END TIME
B2306AUUP01	307.1'	8:38 pm	3.47	8:52 pm

MAINTENANCE PERFORMED ON SITE:

EQUIPMENT PROBLEMS OR FAILURES:

SUGGESTIONS, ADDITIONS, CHANGES:

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B-2307 BORING GEOPHYSICS FIELD LOG SUMMARY

SITE: EXELON-VICTORIA
DATE: 11/18/07
CLIENT: MACTEC
JOB: 7501
AUTHOR: C. CARTER
PAGE 1 OF 1

CONTACT: STEVE CRISENZO
PHONE: 361-972-0198

BOREHOLE CONSTRUCTION: CASED____ UNCASED X
DIAMETERS AND DEPTH RANGES: 5" 0 TO 310 ft ; ____, ____ TO ____
BOREHOLE TOTAL DEPTH AS DRILLED: 310 ft
CONDUCTOR CASING?: YES X DEPTH TO BOTTOM OF CASING 2' ; NO____
DEPTH TO BEDROCK: NA
BOREHOLE FLUID: WATER____; FRESH WATER MUD X ; SALT WATER MUD ____;

LOGGING CREW: C. Carter

LOG TYPE	FILE NAME	DEPTH RANGE	DATE	TIMES
ELOG	B2307ELOGTEST01		11/18/07	11:59 - 12:01 pm
ELOG	B2307ELOGUP01	309.35 - 39.5 ft	11/18/07	12:50 - 1:18 pm
CALIPER	B2307CALTEST01			1:26 - 1:28 pm
CALIPER	B2307CALUP01	304.2 - 5.6 ft	11/18/07	1:44 - 2:13 pm
CALIPER	B2307CALTEST02			2:18 - 2:19 pm
~~Bow~~ P-S velocity	001.org - 178.org	2.0 - 90.5 m	11/18/07	2:49 - 4:31 pm
Deviation	B2307DVUP01	303.2 - 3.5 ft	11/18/07	5:34 - 5:47 pm

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B-2307 ELOG FIELD LOG

SITE: EXELON VICTORIA DATE: 11/18/07
CLIENT: MACTEC JOB: 7501
AUTHOR: C. CARTER PAGE 1 OF 2

CONTACT: STEVE CRISENZO OFFICE PHONE: 361-972-0198
CELL PHONE: 919-949-1707
CONTACT: OFFICE PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
DRILLER: PHONE:
COMPANY: PHONE:

GENERAL SITE CONDITIONS/LOCATION:

BOREHOLE DESIGNATION: B-2307 LOCATION:

COUNTY: VICTORIA RANGE: TOWNSHIP: SECTION:
BOREHOLE CONSTRUCTION: CASED ___ UNCASED X
DIAMETERS AND DEPTH RANGES: 5" 0 TO 310 ft ; ___, ___ TO ___
BOREHOLE TOTAL DEPTH AS DRILLED: 310 ft
CONDUCTOR CASING?: YES X DEPTH TO BOTTOM OF CASING 2'; NO ___
DEPTH TO BEDROCK: NA DEPTH TO WATER TABLE: NA
BOREHOLE FLUID: WATER ___; FRESH WATER MUD X; SALT WATER MUD ___;
OTHER:
DEPTH TO BOREHOLE FLUID: ϕ TIME SINCE LAST CIRCULATION: 11:45 am

LOGGING CREW: C. CARTER
VEHICLE(S) USED AND MILEAGE: RENTAL
MOBILIZED FROM: Victoria DEPARTURE TIME: 10:00 am
ARRIVED ON SITE: 10:30 am
STANDBY TIME: CAUSE:
LOGGING STARTED: 12:50 pm LOGGING COMPLETED: 1:18 pm

SITE:_EXELON VICTORIA B-2307 DATE: 11/18/07
CLIENT:_MACTEC JOB:_7501
AUTHOR:_C. CARTER PAGE 2 OF 2

WINCH: COMPROBE___ SILVER X OYO___ RG___ OTHER___
MICROLOGGER 5310 X 5772___ OTHER___
ELOG PROBE 5490 X OTHER___

PROBE LENGTH	2.50M(8.20 FT)	
PLUS YOKE 10.0M (32.8 FT)	32.8	
MINUS CASING STICK-UP	1.2	
DEPTH REF. OFFSET AT START	39.8	
DEPTH REF. OFFSET AT END	39.75	
AFTER SURVEY DEPTH ERROR	.05	LESS THAN 0.4%?

LOG NAME	START DEPTH	START TIME	END DEPTH	END TIME
B2307ELOGTEST01		11:59am		12:01pm
B2307ELOGUP01	309.35'	12:50pm	39.5'	1:18pm

MAINTENANCE PERFORMED ON SITE:

EQUIPMENT PROBLEMS OR FAILURES:

SUGGESTIONS, ADDITIONS, CHANGES:

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P-S SUSPENSION VELOCITY FIELD LOG

SITE: EXELON VICTORIA B-2307 DATE: 11/18/07
CLIENT: MACTEC JOB: 7501
AUTHOR: C. CARTER PAGE 1 OF 7

CONTACT: STEVE CRISENZO OFFICE PHONE: 361-972-0198
CELL PHONE: 919-949-1707
CONTACT: OFFICE PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
DRILLER: PHONE:
COMPANY: PHONE:

DIRECTIONS TO SITE:

GENERAL SITE CONDITIONS/LOCATION:

EA#:
BOREHOLE DESIGNATION: B-2307 LOCATION: Perimeter

COUNTY: VICTORIA RANGE: TOWNSHIP: SECTION:
BOREHOLE CONSTRUCTION: CASED UNCASED X
DIAMETERS AND DEPTH RANGES: 5" 0 TO 310 ft ; , TO
BOREHOLE TOTAL DEPTH AS DRILLED: 310 ft
CONDUCTOR CASING?: YES X DEPTH TO BOTTOM OF CASING 2' ; NO
DEPTH TO BEDROCK: N/A DEPTH TO WATER TABLE: N/A
BOREHOLE FLUID: WATER ; FRESH WATER MUD X ; SALT WATER MUD ;
OTHER:
DEPTH TO BOREHOLE FLUID: Ø TIME SINCE LAST CIRCULATION: 11:45 am

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SITE:_EXELON VICTORIA B-2307
CLIENT:_MACTEC
AUTHOR:_C. CARTER

DATE: 11/18/07
JOB:_7501
PAGE 2 OF 7

LOGGING CREW:_C. CARTER
VEHICLE(S) USED AND MILEAGE: _RENTAL
MOBILIZED FROM:_Victoria, TX DEPARTURE TIME: 10:00am
ARRIVED ON SITE: 10:30am
STANDBY TIME: CAUSE:
LOGGING STARTED: 2:49 LOGGING COMPLETED: 4:31pm
STANDBY TIME: CAUSE:
LOGGING STARTED: LOGGING COMPLETED:
DEMOBILIZED TO: ARRIVAL TIME:
ADDITIONAL DEMOB TIME: REASON:

BATTERIES CHANGED BEFORE LOGGING: YES___; NO X; STORED WITH NEW___

WINCH		COMPROBE ☐		GREY ☐		OYO ☐		RG ☐		OTH ☐		
INSTRUMENT	OYO 12004 ☐		15014 ☐		19029 ☒			RG 160023 ☐		160024 ☐		
RECEIVER S/N	12008 ☐		20042 ☒		26066 ☐		11001 ☐		23053 ☐		30086 ☐	

MAINTENANCE PERFORMED ON SITE:

EQUIPMENT PROBLEMS OR FAILURES:

SUGGESTIONS, ADDITIONS, CHANGES:

COMMENTS: Top of ~~dat~~ casing = .37m RP = 1.63m
1.61 m @ 4:51

GEOVision Geophysical Services 1151 Pomona Road, Suite P, Corona, CA 92882 Ph (951) 549-1234 Fx (951) 549-1236

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE:_EXELON VICTORIA_B2307 DATE: 11/18/07
CLIENT:__MACTEC JOB:_7501
AUTHOR:_C. CARTER PAGE 3 OF 7

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
0.5	1.64			
1.0	3.28			
1.5	4.92			
2.0	6.56	001		2:49
2.5	8.20	2		
3.0	9.84	3		
3.5	11.48	4		
4.0	13.12	5		
4.5	14.76	6		
5.0	16.40	7		
5.5	18.04	8		
6.0	19.69	9		
6.5	21.33	10		
7.0	22.97	11		
7.5	24.61	12		
8.0	26.25	13		
8.5	27.89	14		
9.0	29.53	15		
9.5	31.17	16		
10.0	32.81	17		new paper
10.5	34.45	18		
11.0	36.09	19		
11.5	37.73	20		
12.0	39.37	21		
12.5	41.01	22		
13.0	42.65	23		
13.5	44.29	24		
14.0	45.93	25		
14.5	47.57	26		
15.0	49.21	27		
15.5	50.85	28		
16.0	52.49	29		
16.5	54.13	30		
17.0	55.77	31		
17.5	57.41	32		
18.0	59.06	33		
18.5	60.70	34		
19.0	62.34	35		
19.5	63.98	36		
20.0	65.62	37		

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE:_EXELON VICTORIA B-2307 DATE: 11/18/07
CLIENT:__MACTEC JOB:_7501
AUTHOR:_C. CARTER PAGE 4 OF 7

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
20.5	67.26	38		
21.0	68.90	39		
21.5	70.54	40		
22.0	72.18	41		
22.5	73.82	42		
23.0	75.46	43		
23.5	77.10	44		
24.0	78.74	45		
24.5	80.38	46		
25.0	82.02	47		
25.5	83.66	48		
26.0	85.30	49		
26.5	86.94	50		
27.0	88.58	51		
27.5	90.22	52		
28.0	91.86	53		
28.5	93.50	54		
29.0	95.14	55		
29.5	96.78	56		
30.0	98.43	57		
30.5	100.07	58		
31.0	101.71	59		
31.5	103.35	60		
32.0	104.99	61		
32.5	106.63	62		
33.0	108.27	63		
33.5	109.91	64		
34.0	111.55	65		
34.5	113.19	66		
35.0	114.83	67		
35.5	116.47	68		
36.0	118.11	69		
36.5	119.75	70		
37.0	121.39	71		
37.5	123.03	72		
38.0	124.67	73		
38.5	126.31	74		
39.0	127.95	75		
39.5	129.59	76		
40.0	131.23	77		

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: EXELON VICTORIA B-2307 DATE: 11/18/07
CLIENT: MACTEC JOB: 7501
AUTHOR: C. CARTER PAGE 5 OF 7

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
40.5	132.87	78		
41.0	134.51	79		
41.5	136.15	80		
42.0	137.80	81		
42.5	139.44	82		
43.0	141.08	83		
43.5	142.72	84		
44.0	144.36	85		
44.5	146.00	86		
45.0	147.64	87		
45.5	149.28	88		
46.0	150.92	89		
46.5	152.56	90		
47.0	154.20	91		
47.5	155.84	92		
48.0	157.48	93		
48.5	159.12	94		
49.0	160.76	95		
49.5	162.40	96		
50.0	164.04	97		
50.5	165.68	98		
51.0	167.32	99		
51.5	168.96	100		Disk change
52.0	170.60	101		
52.5	172.24	102		
53.0	173.88	103		
53.5	175.52	104		
54.0	177.17	105		
54.5	178.81	106		
55.0	180.45	107		
55.5	182.09	108		
56.0	183.73	109		
56.5	185.37	110		
57.0	187.01	111		
57.5	188.65	112		
58.0	190.29	113		
58.5	191.93	114		
59.0	193.57	115		
59.5	195.21	116		
60.0	196.85	117		

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: EXELON VICTORIA B-2307 DATE: 11/18/07
CLIENT: MACTEC JOB: 7501
AUTHOR: C. CARTER PAGE 6 OF 7

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
60.5	198.49	118		
61.0	200.13	119		
61.5	201.77	120		
62.0	203.41	121		
62.5	205.05	122		
63.0	206.69	123		
63.5	208.33	124		
64.0	209.97	125		
64.5	211.61	126		
65.0	213.25	127		
65.5	214.90	128		
66.0	216.54	129		
66.5	218.18	130		
67.0	219.82	131		
67.5	221.46	132		
68.0	223.10	133		
68.5	224.74	134		
69.0	226.38	135		
69.5	228.02	136		
70.0	229.66	137		
70.5	231.30	138		
71.0	232.94	139		
71.5	234.58	140		
72.0	236.22	141		
72.5	237.86	142		
73.0	239.50	143		
73.5	241.14	144		
74.0	242.78	145		
74.5	244.42	146		
75.0	246.06	147		new paper
75.5	247.70	149		
76.0	249.34	150		
76.5	250.98	151		
77.0	252.62	152		
77.5	254.27	153		
78.0	255.91	154		
78.5	257.55	155		
79.0	259.19	156		
79.5	260.83	157		
80.0	262.47	157		

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: EXELON VICTORIA B-2307
DATE: 11/18/07
CLIENT: MACTEC
JOB: 7501
AUTHOR: C. CARTER
PAGE 7 OF 7

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
80.5	264.11	158		
81.0	265.75	159		
81.5	267.39	160		
82.0	269.03	161		
82.5	270.67	162		
83.0	272.31	163		
83.5	273.95	164		
84.0	275.59	165		
84.5	277.23	166		
85.0	278.87	167		
85.5	280.51	168		
86.0	282.15	169		
86.5	283.79	170		
87.0	285.43	171		
87.5	287.07	172		
88.0	288.71	173		
88.5	290.35	174		
89.0	291.99	175		
89.5	293.64	176		
90.0	295.28	177		
90.5	296.92	178		4:31
91.0	298.56			
91.5	300.20			
92.0	301.84			
92.5	303.48			
93.0	305.12			
93.5	306.76			
94.0	308.40			
94.5	310.04			
95.0	311.68			
95.5	313.32			
96.0	314.96			
96.5	316.60			
97.0	318.24			
97.5	319.88			
98.0	321.52			
98.5	323.16			
99.0	324.80			
99.5	326.44			
100.0	328.08			

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B-2307 CALIPER FIELD LOG

SITE: EXELON VICTORIA COUNTY COL DATE: 11/18/07
CLIENT: MACTEC JOB: 7501
AUTHOR: C. CARTER PAGE 1 OF 2

CONTACT: STEVE CRISENZO OFFICE PHONE: 361-972-0198
CELL PHONE: 919-949-1707
CONTACT: ALLAN SHAW CELL PHONE: 301-704-2684
PHONE:
CONTACT: PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
DRILLER: PHONE:
COMPANY: PHONE:

GENERAL SITE CONDITIONS/LOCATION:

BOREHOLE DESIGNATION: B-2307 LOCATION: Perimeter

COUNTY: VICTORIA RANGE: TOWNSHIP: SECTION:
BOREHOLE CONSTRUCTION: CASED UNCASED X
DIAMETERS AND DEPTH RANGES: 5" 0 TO 310 ft ; , TO
BOREHOLE TOTAL DEPTH AS DRILLED: 310 ft
CONDUCTOR CASING?: YES X DEPTH TO BOTTOM OF CASING 2' ; NO
DEPTH TO BEDROCK: NA DEPTH TO WATER TABLE: NA
BOREHOLE FLUID: WATER ; FRESH WATER MUD X ; SALT WATER MUD ;
OTHER:
DEPTH TO BOREHOLE FLUID: ϕ TIME SINCE LAST CIRCULATION: 11:45am

LOGGING CREW: C. CARTER
VEHICLE(S) USED AND MILEAGE: RENTAL
MOBILIZED FROM: VICTORIA, TX DEPARTURE TIME: 10:00 am
ARRIVED ON SITE: 10:30 am
STANDBY TIME: CAUSE:
LOGGING STARTED: 1:44 pm LOGGING COMPLETED: 2:13 pm

GEOVision Geophysical Services *1151 Pomona Road, Unit P, Corona, CA 92882* *Ph (951) 549-1234 Fx (951) 549-1236*

SITE: EXELON VICTORIA COUNTY COL B-2307 DATE: 11/18/07
CLIENT: MACTEC JOB: 7501
AUTHOR: C. CARTER PAGE 2 OF 2

WINCH: COMPROBE____ SILVER X OYO____ RG____ OTHER____
MICROLOGGER 5310 X 5772___ OTHER____
CALIPER PROBE 5368 X OTHER____

PROBE OFFSET	2.08M(6.82 FT) 12 IN MAX	
MINUS CASING STICK-UP	1.2	
DEPTH REF. OFFSET AT START	5.62	
DEPTH REF. OFFSET AT END	5.60	
AFTER SURVEY DEPTH ERROR	.02	LESS THAN 0.4%?

LOG NAME	START DEPTH	START TIME	END DEPTH	END TIME
B2307CALTEST01		1:26 pm		1:28 pm
B2307CALUP01	304.2'	1:44 pm	5.6'	2:13 pm
B2307CALTEST02		2:18 pm		2:19 pm

CALIBRATION PLATE S/N 201		AS BUILT			PVC FITTING
		1.968 IN	3.937 IN	8.000 IN	4.500 IN cc 11/18/07
	FILE NAME	(50 MM)	(100 MM)	(203.2 MM)	(114.3 MM)
AS MEAS.	B2307CALTEST01	2.025	3.948	8.050	4.567
AS MEAS.	B2307CALTEST02	2.02	3.952	8.036	4.567
AS MEAS.					
AS MEAS.					
AS MEAS.					
AS MEAS.					

MAINTENANCE PERFORMED ON SITE:

EQUIPMENT PROBLEMS OR FAILURES:

SUGGESTIONS, ADDITIONS, CHANGES:

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B-2307 DEVIATION FIELD LOG

SITE: EXELON VICTORIA COUNTY COL DATE: 11/18/07
CLIENT: MACTEC JOB: 7501
AUTHOR: C. CARTER PAGE 1 OF 2

CONTACT: STEVE CRISENZO OFFICE PHONE: 361-972-0198
CELL PHONE: 919-949-1707
CONTACT: OFFICE PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
DRILLER: PHONE:
COMPANY: PHONE:

DIRECTIONS TO SITE:

GENERAL SITE CONDITIONS/LOCATION:

BOREHOLE DESIGNATION: B-2307 LOCATION: Perimeter

COUNTY: VICTORIA RANGE: TOWNSHIP: SECTION:
BOREHOLE CONSTRUCTION: CASED UNCASED X
DIAMETERS AND DEPTH RANGES: 5" 0 TO 310 ft ; , TO
BOREHOLE TOTAL DEPTH AS DRILLED: 310 ft
CONDUCTOR CASING?: YES X DEPTH TO BOTTOM OF CASING 2' ; NO
DEPTH TO BEDROCK: NA DEPTH TO WATER TABLE: NA
BOREHOLE FLUID: WATER ; FRESH WATER MUD X ; SALT WATER MUD ;
OTHER:
DEPTH TO BOREHOLE FLUID: ∅ TIME SINCE LAST CIRCULATION: 11:45 am

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geophysical services

SITE: EXELON VICTORIA COUNTY COL B-2307 DATE: 11/18/07
CLIENT: MACTEC JOB: 7501
AUTHOR: C. CARTER PAGE 2 OF 2

LOGGING CREW: C. CARTER
VEHICLE(S) USED AND MILEAGE: RENTAL
MOBILIZED FROM: Victoria, TX DEPARTURE TIME: 10:00 am
ARRIVED ON SITE: 10:30 am
STANDBY TIME: CAUSE:
LOGGING STARTED: 5:34 pm LOGGING COMPLETED: ~~5:…~~ cc 11/18/07 5:47 pm

WINCH: COMPROBE___ SILVER X OYO___ RG___ OTHER___
MICROLOGGER 5310 X 5772___ OTHER___
TELEVIEWER 5174 X OTHER___

1 PROBE TILT TEST 60.1 BRUNTON TILT 30
2 PROBE TILT TEST 96.9 BRUNTON TILT 6
3 PROBE TILT TEST 31.76 BRUNTON TILT 59 After log
1 PROBE AZIMUTH TEST 173.7 BRUNTON AZIMUTH 175
2 PROBE AZIMUTH TEST 242.9 BRUNTON AZIMUTH 239
3 PROBE AZIMUTH TEST 171.6 BRUNTON AZIMUTH 175 After log

PROBE OFFSET	1.44M(4.72FT)	
MINUS CASING STICK-UP	1.2	
DEPTH REF. OFFSET AT START	3.52	
DEPTH REF. OFFSET AT END	3.50	
AFTER SURVEY DEPTH ERROR	.02	LESS THAN 0.4%?

LOG NAME	START DEPTH	START TIME	END DEPTH	END TIME
B23074UUPD1	303.2'	5:34	3.5 ft	5:47

MAINTENANCE PERFORMED ON SITE:

EQUIPMENT PROBLEMS OR FAILURES:

SUGGESTIONS, ADDITIONS, CHANGES:

GEOVision Geophysical Services *1151 Pomona Road, Unit P, Corona, CA 92882* *Ph (951) 549-1234 Fx (951) 549-1236*

APPENDIX E

BORING GEOPHYSICAL LOGGING FIELD MEASUREMENT PROCEDURES

PROCEDURE FOR

OYO P-S SUSPENSION SEISMIC VELOCITY LOGGING

Background

This procedure describes a method for measuring shear and compressional wave velocities in soil and rock. The OYO P-S Suspension Method is applied by generating shear and compressional waves in a borehole using the OYO P-S Suspension Logger borehole tool and measuring the travel time between two receiver geophones or hydrophones located in the same tool.

Objective

The outcome of this procedure is a plot and table of P and S_H wave velocity versus depth for each borehole. Standard analysis is performed on receiver to receiver data. Data is presented in report format, with digital data files transmitted in Excel, Word or ASCII format.

Instrumentation

1. OYO Model 170 Digital Logging Recorder or equivalent
2. OYO P-S Suspension Logger probe or equivalent, including two sets horizontal and vertical geophones, seismic source, and power supply for the source and receivers
3. Winch and winch controller, with logging cable
4. Batteries to operate P-S Logger and winch

The Suspension P-S Logger system, manufactured by OYO Corporation, or the Robertson Digital P-S Suspension Probe with the Robertson Micrologger2 are currently the only commercially available suspension logging systems. As shown in Figure 1, these systems consists of a borehole probe suspended by a cable and a recording/control electronics package on the surface.

The suspension system probe consists of a combined reversible polarity solenoid horizontal shear-wave generator (S_H) and compressional-wave generator (P), joined to two biaxial geophones by a flexible isolation cylinder. The separation of the two geophones is one meter, allowing average wave velocity in the region between the geophones to be determined by inversion of the wave travel time between the two geophones. The total length of the probe is approximately 7 meters; the center point of the geophones is approximately 4 meters above the bottom end of the probe.

The probe receives control signals from, and sends the amplified geophone signals to, the instrumentation package on the surface via an armored 4 or 7 conductor cable. The cable is wound onto the drum of a winch and is used to support the probe. Cable travel is measured by a rotary encoder to provide probe depth data.

The entire probe is suspended by the cable and may be centered in the borehole by nylon "whiskers." Therefore, source motion is not coupled directly to the borehole walls; rather, the source motion creates a horizontally propagating pressure wave in the fluid filling the borehole and surrounding the source. This pressure wave produces a horizontal displacement of the soil forming the wall of the borehole. This displacement propagates up and down the borehole wall, in turn causing a pressure wave to be generated in the fluid surrounding the geophones as the soil displacement wave passes their location.

Environmental Conditions

The OYO P-S Suspension Logging Method can be used in either cased or uncased boreholes. For best results, the uncased borehole must be between 10 and 20 cm in diameter, or 4 to 8 inches. A cased borehole may be as small as 3 inches, if properly grouted (see below) and the grout annulus does not exceed 1 inch.

Uncased boreholes are preferred because the effects of the casing and grouting are removed. It is recommended that the borehole be drilled using the rotary mud method. This method does little damage to the borehole wall, and the drilling fluid coats and seals the borehole wall reducing fluid loss and wall collapse. The borehole fluid is required for the logging, and must be well circulated prior to logging.

If the borehole must be cased, the casing must be PVC and properly installed and grouted. Any voids in the grout will cause problems with the data. Likewise, large grout bulbs used to fill cavities will also cause problems. The grout must be set before testing. This means the grouting must take place at least 48 hours before testing.

For borehole casing, applicable preparation procedures are presented in ASTM Standard D4428/D4428M-91 Section 4.1 (see ASTM website for copy).

Calibration

Calibration of the digital recorder is required. Calibration is limited to the timing accuracy of the recorder. GEOVision's Seismograph Calibration Procedure or equivalent should be used. Calibration must be performed on an annual basis.

Measurement Procedure

The entire probe is lowered into the borehole to a specific measurement depth by the winch. A measurement sequence is then initiated by the operator from the instrumentation package control panel. No further operator intervention is then needed to complete the measurement sequence described below.

The system electronics activates the SH-wave source in one direction and records the output of the two horizontally oriented geophone axes which are situated parallel to the axis of motion of the source. The source is then activated in the opposite direction, and the horizontal output signals are again recorded, producing a SH-wave record of polarity opposite to the previous record. The source is finally actuated in the first direction again, and the responses of the vertical geophone axes to the resultant P-wave are recorded during this sampling.

The data from each geophone during each source activation is recorded as a different channel on the recording system. The seismograph has at least six channels (two simultaneous recording channels), each with at least a 12 bit 1024 sample record. Newer seismographs may have longer record lengths. The recorded data is displayed on a CRT or LCD display and possibly on paper tape output as six channels with a common time scale. Data is stored on digital media for further processing. Up to 8 sampling sequences can be stacked (averaged) to improve the signal to noise ratio of the signals.

Review of the data on the display or paper tape allows the operator to set the gains, filters, delay time, pulse length (energy), sample rate, and stacking number in order to optimize the quality of the data before recording. In the case of the Model 170, printed data is verified by the operator prior to moving the probe. In the case of the Robertson Micrologger2, storage on the hard disk should be verified from time-to-time, certainly before exiting the borehole.

Typical depth spacing for measurements is 1.0 meters, or 3.3 feet. Alternative spacing is 0.5 meter, or 1.6 feet.

Required Field Records

1) Field log for each borehole showing

   a) Borehole identification

   b) Date of test

   c) Tester or data recorder

d) Description of measurement

e) Any deviations from test plan and action taken as a result

f) QA Review

2) Paper output records are no longer required, since the Micrologger2 cannot generate them. However, data must be stored in at least 2 places prior to leaving the site

3) List of record ID numbers (for data on digital media) and corresponding depth

4) Diskettes, CDRom, or USB flash drives with backup copies of data on hard disk, labeled with borehole designation, record ID numbers, date, and tester name.

An example Field Log is attached to this procedure.

Analysis

Following completion of field work, the recorded digital records are processed by computer using the OYO Corporation software program PSLOG and interactively analyzed by an experienced geophysicist to produce plots and tables of P and S_H wave velocity versus depth.

The digital time series records from each depth are transferred to a personal computer for analysis. Figure 2 shows a sample of the data from a single depth. These digital records are analyzed to locate the first minima on the vertical axis records, indicating the arrival of P-wave energy. The difference in travel time between these arrivals is used to calculate the P-wave velocity for that 1-meter interval. When observable, P-wave arrivals on the horizontal axis records are used to verify the velocities determined from the vertical axis data. In addition, the soil velocity calculated from the travel time from source to first receiver is compared to the velocity derived from the travel time between receivers.

The digital records are studied to establish the presence of clear SH-wave pulses, as indicated by the presence of opposite polarity pulses on each pair of horizontal records. Ideally, the SH-wave signals from the 'normal' and 'reverse' source pulses are very nearly inverted images of each other. Digital FFT – IFFT lowpass filtering are used to remove the higher frequency P-wave signal from the SH-wave signal.

The first maxima are picked for the 'normal' signals and the first minima are picked for the 'reverse' signals. The absolute arrival time of the 'normal' and 'reverse' signals may vary by +/- 0.2 milliseconds, due to differences in actuation time of the solenoid source caused by constant mechanical bias in the source or by borehole inclination. This variation does not affect the velocity determinations, as the differential time is measured between arrivals of waves created by the same source actuation. The final velocity value is the average of the values obtained from the 'normal' and 'reverse' source actuations.

In Figure 2, the time difference over the 1-meter interval of 1.70 millisecond is equivalent to a SH-wave velocity of 588 m/sec. Whenever possible, time differences are determined from several phase points on the S_H -wave pulse trains to verify the data obtained from the first arrival of the S_H -wave pulse. In addition, the soil velocity calculated from the travel time from source to first receiver is compared to the velocity derived from the travel time between receivers.

Figure 3 is a sample composite plot of the far normal horizontal geophone records for a range of depths. This plot shows the waveforms at each depth, clearly showing the S-wave arrivals. This display format is used during analysis to observe trends in velocity with changing depth.

Once the proper picks are entered in PSLOG, the picks are transferred to an Excel spreadsheet where Vs and Vp are calculated. The spreadsheet allows output for presentation in charts and tables.

Standard analysis is performed on receiver 1 to receiver 2 data, with separate analysis performed on source to receiver data as a quality assurance procedure.

Registered Geophysicist Antony Martin Date 9/11/06

QA Review ________ Date 9/11/06

References:

1. "In Situ P and S Wave Velocity Measurement", Ohya, S. 1986. Proceedings of In-Situ '86, *Use of In-Situ Tests In Geotechnical Engineering*, an ASCE Specialty Conference sponsored by the Geotechnical Engineering Division of ASCE and co-sponsored by the Civil Engineering Dept of Virginia Tech.

2. Guidelines for Determining Design Basis Ground Motions, Report TR-102293, Electric Power Research Institute, Palo Alto, California, November 1993, Sections 7 and 8.

3. "Standard test Methods for Crosshole Seismic Testing", ASTM Standard D4428/D4428M-91, July 1991, Philadelphia, PA

OYO SUSPENSION P-S VELOCITY LOGGING SETUP

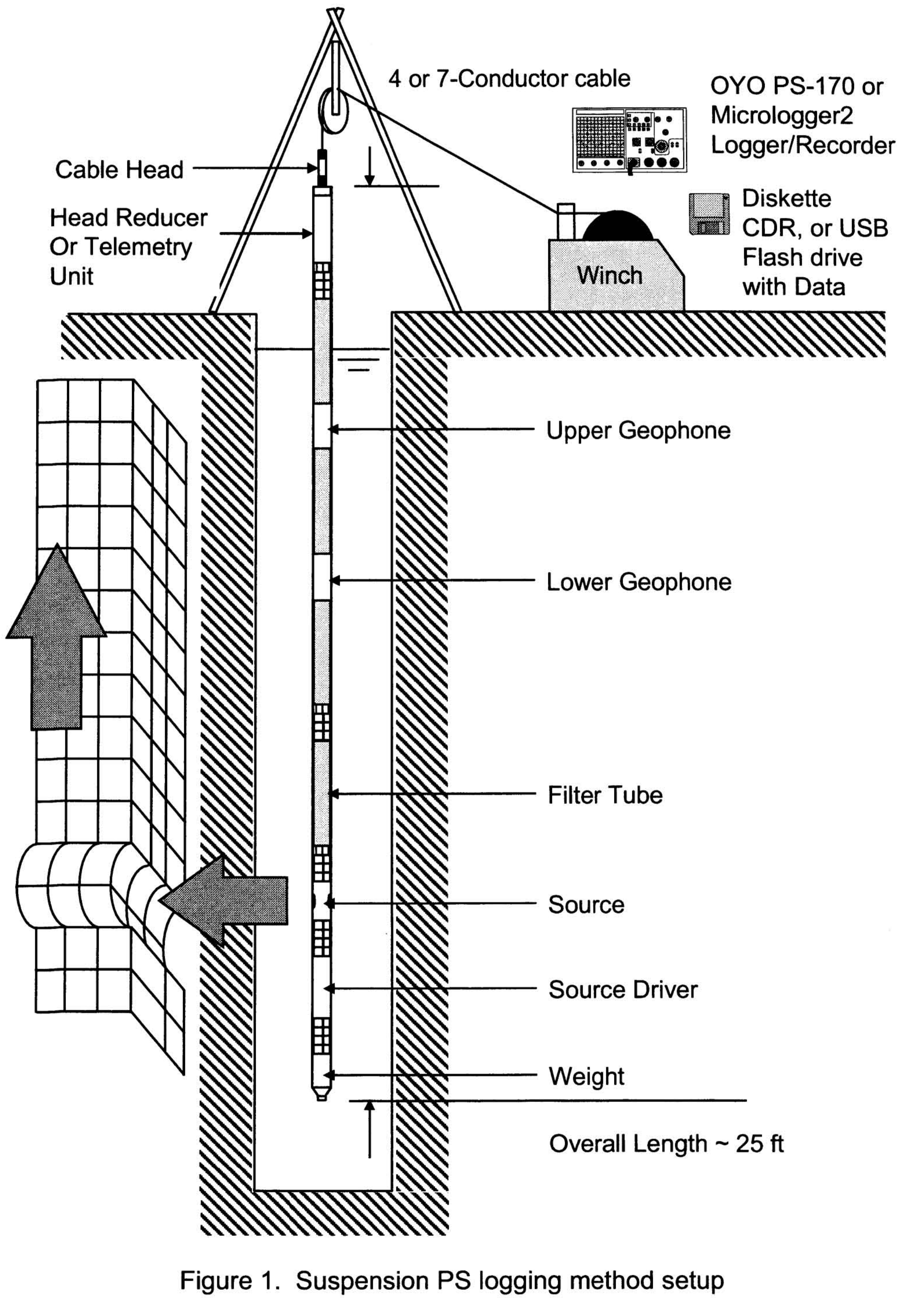

Figure 1. Suspension PS logging method setup

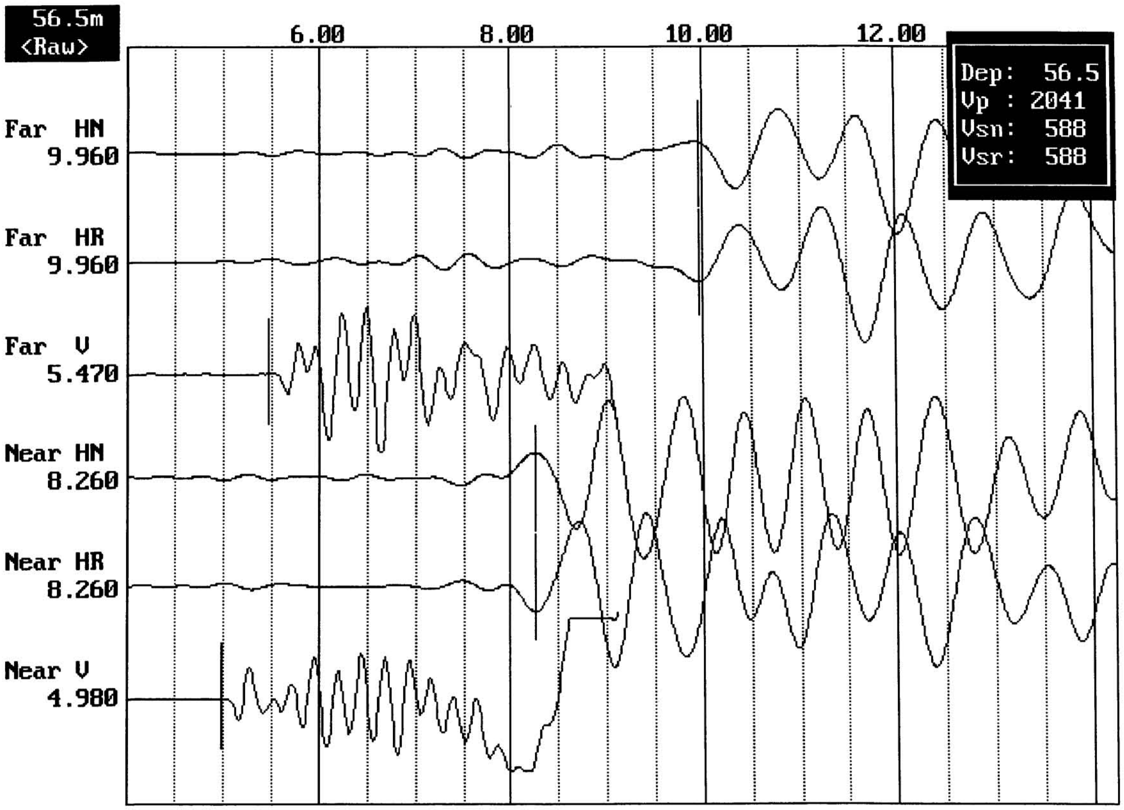

Figure 2. Sample suspension method waveform data showing horizontal normal and reversed (HR and HN), and vertical (V) waveforms received at the near (bottom 3 channels) and far (top 3 channels) geophones. The arrivals in milliseconds for each pick are shown on the left. The box in the upper right corner shows the depth in the borehole and the velocities calculated based on the picks.

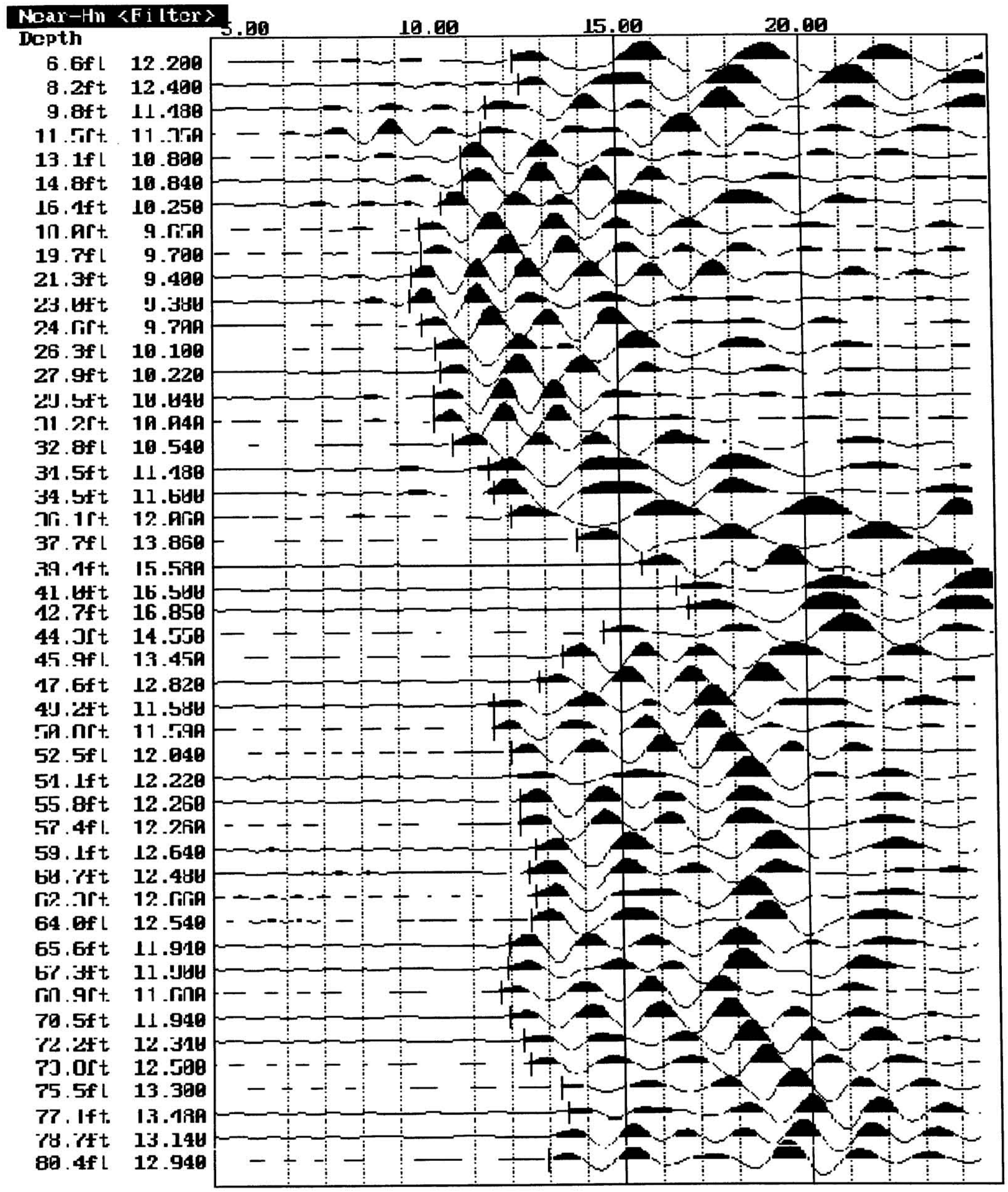

Figure 3. Sample composite waveform plot for normal shear waves received at the near geophone in a single borehole

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P-S SUSPENSION VELOCITY FIELD LOG

SITE:____________________ DATE:____________
CLIENT:____________________ JOB:____________
AUTHOR:____________________ PAGE 1 OF _____

CONTACT:______________ OFFICE PHONE:____________
_________ PHONE:____________
CONTACT:______________ OFFICE PHONE:____________
_________ PHONE:____________
CONTACT:______________ _________ PHONE:____________
_________ PHONE:____________
CONTACT:______________ _________ PHONE:____________
_________ PHONE:____________
DRILLER:______________ _________ PHONE:____________
COMPANY:______________ _________ PHONE:____________

DIRECTIONS TO SITE:________________________________

GENERAL SITE CONDITIONS/LOCATION:________________________

EA#:____________________
BOREHOLE DESIGNATION:__________LOCATION:____________

COUNTY:________RANGE:______TOWNSHIP:______SECTION:______
BOREHOLE CONSTRUCTION: CASED_____ UNCASED______
DIAMETERS AND DEPTH RANGES: _______ 0 TO ________ ; ______, _______ TO _______
BOREHOLE TOTAL DEPTH AS DRILLED:_______________
CONDUCTOR CASING?: YES____ DEPTH TO BOTTOM OF CASING_______; NO____
DEPTH TO BEDROCK:________ DEPTH TO WATER TABLE:_________
BOREHOLE FLUID: WATER_____; FRESH WATER MUD_____; SALT WATER MUD _____;
OTHER:________________________________
DEPTH TO BOREHOLE FLUID:_________ TIME SINCE LAST CIRCULATION:_________

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SITE:______________________________ DATE:______________________
CLIENT:____________________________ JOB:_______________________
AUTHOR:____________________________ PAGE 2 OF _____

LOGGING CREW:____
VEHICLE(S) USED AND MILEAGE: _____________________________
MOBILIZED FROM:__________________ DEPARTURE TIME:__________________
ARRIVED ON SITE:__________________
STANDBY TIME:____________________ CAUSE:___________________________
LOGGING STARTED:_________________ LOGGING COMPLETED:_______________
STANDBY TIME:____________________ CAUSE:___________________________
LOGGING STARTED:_________________ LOGGING COMPLETED:_______________
DEMOBILIZED TO:__________________ ARRIVAL TIME:____________________
ADDITIONAL DEMOB TIME:___________ REASON:__________________________

BATTERIES CHANGED BEFORE LOGGING: YES_____; NO_____; STORED WITH NEW_____

WINCH	COMPROBE ☐	GREY ☐	OYO ☐	RG ☐	OTH ☐	
INSTRUMENT	OYO 12004 ☐	15014 ☐	19029 ☐	RG 160023 ☐	160024 ☐	
RECEIVER S/N	12008 ☐	20042 ☐	26066 ☐	11001 ☐	23053 ☐	

MAINTENANCE PERFORMED ON SITE:_____________________________________
____
____

EQUIPMENT PROBLEMS OR FAILURES:____________________________________
____
____

SUGGESTIONS, ADDITIONS, CHANGES:___________________________________
____
____

COMMENTS:____
____
____
____
____
____

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GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: ______________________ DATE: ____________

CLIENT: ______________________ JOB: ____________

AUTHOR: ______________________ PAGE ______ OF ______

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
0.5	1.64			
1.0	3.28			
1.5	4.92			
2.0	6.56			
2.5	8.20			
3.0	9.84			
3.5	11.48			
4.0	13.12			
4.5	14.76			
5.0	16.40			
5.5	18.04			
6.0	19.69			
6.5	21.33			
7.0	22.97			
7.5	24.61			
8.0	26.25			
8.5	27.89			
9.0	29.53			
9.5	31.17			
10.0	32.81			
10.5	34.45			
11.0	36.09			
11.5	37.73			
12.0	39.37			
12.5	41.01			
13.0	42.65			
13.5	44.29			
14.0	45.93			
14.5	47.57			
15.0	49.21			
15.5	50.85			
16.0	52.49			
16.5	54.13			
17.0	55.77			
17.5	57.41			
18.0	59.06			

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: ____________________ DATE: ____________

CLIENT: ____________________ JOB: ____________

AUTHOR: ____________________ PAGE ______ OF ______

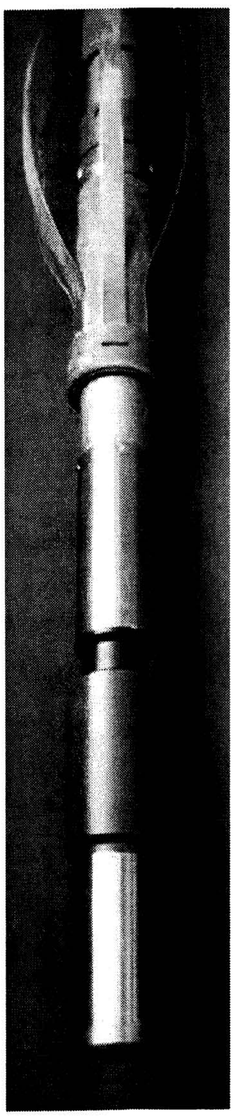
DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
18.5	60.70			
19.0	62.34			
19.5	63.98			
20.0	65.62			
20.5	67.26			
21.0	68.90			
21.5	70.54			
22.0	72.18			
22.5	73.82			
23.0	75.46			
23.5	77.10			
24.0	78.74			
24.5	80.38			
25.0	82.02			
25.5	83.66			
26.0	85.30			
26.5	86.94			
27.0	88.58			
27.5	90.22			
28.0	91.86			
28.5	93.50			
29.0	95.14			
29.5	96.78			
30.0	98.43			
30.5	100.07			
31.0	101.71			
31.5	103.35			
32.0	104.99			
32.5	106.63			
33.0	108.27			
33.5	109.91			
34.0	111.55			
34.5	113.19			
35.0	114.83			
35.5	116.47			
36.0	118.11			

PROCEDURE FOR USING THE ROBERTSON GEOLOGGING HI-RESOLUTION ACOUSTIC TELEVIEWER (HiRAT)

Reviewed 2/13/06

Background

The acoustic televiewer is a device for producing a qualitative image of the wall of a borehole. Because it uses ultrasound rather than visible light it is able to work in dirty or opaque borehole fluids, although heavy drilling mud will cause excessive dispersion of the acoustic beam. The picture below shows the sonde's lower nylon section, and one of the bowspring attachments which are used to centralize the sonde in the borehole.



Pulses of ultrasound (0.5 - 1.5MHz) are generated by a piezo-electric resonator. The pulses are transmitted through the oil in which the resonator is immersed, through the wall of the acoustic housing, then propagate through the borehole fluid and are reflected from the wall of the borehole. The reflected energy is picked up by the same transducer, from which is recorded both the ***amplitude*** of the returned pulse and the ***travel-time*** which have elapsed. Blanking must be applied to prevent the transducer from registering reflections from the inside surface of the acoustic housing. The material of the housing is chosen so that its acoustic properties are similar to the oil which fills it. The housing is not designed to withstand borehole fluid pressures, but has a piston device to allow equalization between inside and outside pressure.

The ***amplitude*** of the returned pulse is a function of the acoustic reflectivity of the borehole wall. If the beam strikes a hard borehole wall normally to the surface the energy will be returned to the transducer and a strong return will be recorded. If the formation is softer, then less energy will be reflected. Also, if the surface of the borehole is rough, or effectively missing because of the presence of a fracture or other structure, then energy will be dispersed and a poor return will be recorded.

The ***travel-time*** is a simple function of the diameter of the borehole and the velocity of sound in the borehole fluid (typically 1.5Km/sec). An A/D converter monitors the output from the transducer once the blanking period has expired and a comparator is used to detect the peak amplitude during the sampling window.

The coaxially-mounted transducer has a planar radiating surface, but the vibration characteristics are such that the acoustic pulse is emitted as a 'pencil' beam. The emitted beam is deflected by a planar mirror so that it leaves the acoustic housing at right angles to the sonde axis. The mirror is rotated to scan the borehole wall. The ultrasound pulses are synchronized with rotation of the mirror so that up to 360 pulses are emitted in every revolution. Because of the time which must elapse for the two-way transit of the borehole fluid, there is an upper limit upon the number of radial samples that may be acquired from a borehole of a particular radius. In larger boreholes, therefore, it may be necessary to reduce the number of radial samples. The sonde is able to operate at 90, 180 or 360 samples per revolution.

An image of the borehole wall is produced by moving the sonde along the borehole axis while it is scanning radially. By the same logic as shown above, it can be seen that any horizontal point will be imaged by more than one sweep of the acoustic beam so long as the axial movement of the sonde during one complete sweep is no greater than the beam diameter. An upper limit is therefore imposed upon the logging speed which will be a function of the rotational speed of the transducer, the radial sampling interval and borehole diameter.

Objective

The objective of this procedure is to provide a pseudo "core" of the borehole, and map the orientation and angles of cracks and voids in rock boreholes.

Instrumentation

This procedure is written specifically for the Robertson Geologging High-Resolution Acoustic Televiewer (HiRAT). The required equipment includes:

1. The Robertson High-Resolution Acoustic Televiewer (HiRAT) sonde with centralizers
2. A 4-conductor wire-line winch with cable at least 30m (100ft) longer than the depth of the borehole (RG Smart Winch or equivalent. GEOVision has adapted all our 4-conductor winches)
3. A sheave with depth encoder with minimum 500 pulse/revolution
4. A Robertson Geologging Micrologger II
5. A laptop with Winlogger installed and the following minimum system requirements:
   - Windows 98SE or above
   - 64M System memory
   - 800x600x24 SVGA Display with DirectX 8.0
   - 500Mhz CPU
   - USB 2.0 connection
6. Battery power supply with cables

Environmental Conditions

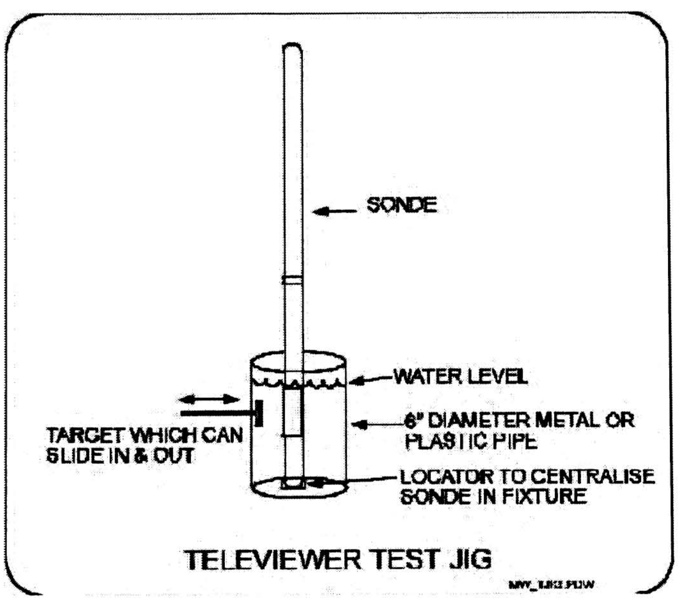
This tool is designed for fluid-filled boreholes between 67 and 150mm (3-6in) in rock. Since fine cracks are usually not visible in the walls of soil borings, the televiewers add very little information from a soil boring than a simple video. Now if the boring has soil AND rock, televiewer visuals in the soil may still be useful.

Calibration

The acoustic televiewer uses the variability in reflectance and the travel time to make an image of the borehole wall, mostly resulting from relative differences of materials and the physical characteristics of the wall. Since these are relative measurements, no field calibration of the sonde is required. However, it is important that the same location in the borehole be checked at the start and finish of the logging to make sure that the response or functionality haven't changed during the measurement.

A test fixture may be used to check function of the acoustic televiewer prior to use. This test fixture should comprise a plastic pipe, with a known internal diameter between 3 and 6 inches. This should be filled with water and the sonde stood upright in the fixture. A target made of metal or metal foil is glued on the inside of the container, or optionally on a seal and shaft so that it can be moved in and out on a line radial to the center-line of the pipe. A representation of this is shown in the figure below.

The purpose of this test fixture is to check the ability of the sonde to differentiate between materials of different acoustic reflectances, and different travel times, and to check the calibration of the caliper function of the sensor using the measured diameter of the pipe. However, if calibrated caliper measurements are required, it is recommended that a mechanical 3-arm caliper tool be used for this purpose because it can be calibrated in the field prior to use. The HiRAT will give very accurate results but this procedure does not cover calibration.

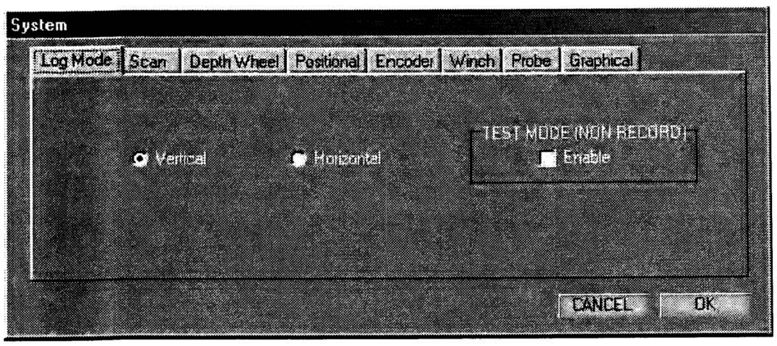


Hi-RAT Field Procedure

Because the logging software is a standalone module, there are a number of settings which must be initialized independently of the WinLogger software. These include the depth measurement subsystem and sonde operating modes. Click on 'System' on the menu bar to show the following dialog boxes:

1.0 Log Mode

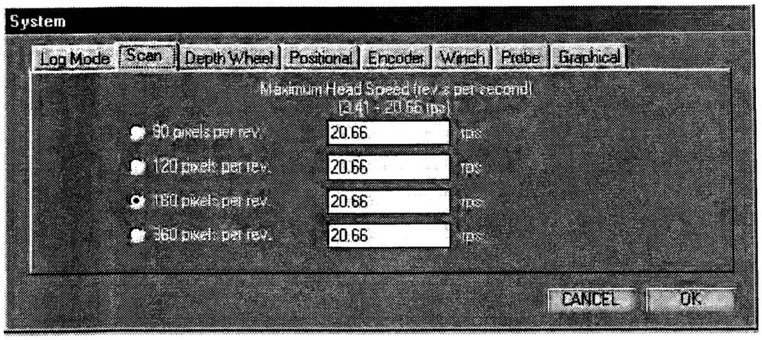
The sonde can operate in three distinct modes:



- Vertical mode is used for boreholes which are drilled from the surface and are deviated at less than 70 degrees from the vertical. Most exploration boreholes will fall into this class. In this mode the image is orientated according to compass directions (magnetic co-ordinates).
- Horizontal mode is used for boreholes which are sub-horizontal so their inclination will probably exceed 70 degrees from the vertical. Boreholes in this class would normally be drilled as part of ground investigations for tunneling and mining, drilling ahead of a drive to determine the nature and extent of fracturing. In this mode the image is orientated according to gravitational coordinates (up/down) since there is no unique point of the image circle which can be orientated to North with any precision.
- Test mode is used to exercise all sonde functions without creating a log. The image will scroll on the screen in the normal fashion, and orientation readouts will be refreshed continuously.

2.0 Scan Parameters

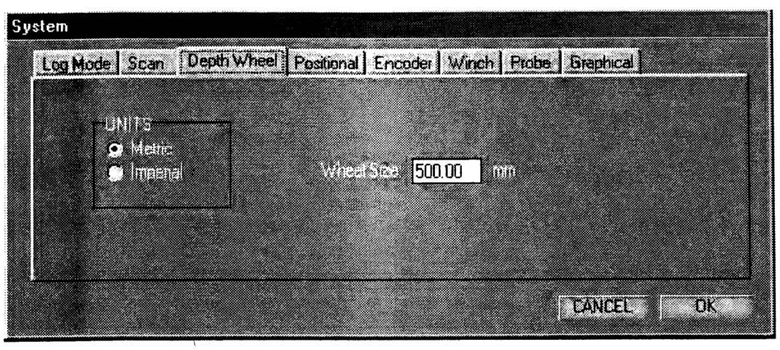
The scan parameters control the radial sampling of the borehole. The values will be retained between logging sessions, so the sonde will be initialized correctly at power-on. There are three parameters in the dialog:



- The radial sampling rate can be set to one of 90, 120, 180, 360 samples per revolution. There is a relationship between the logging speed and the radial sampling rate, since the time taken to send the dataset to the surface depends upon its length. The size of the log file is also determined by the radial sampling rate. The probe will always try to use the maximum head speed entered. If limited by a low Baud rate or a large 'window' setting then the probe will reduce its head speed automatically to compensate - see sonde operation section.

3.0 Depth Wheel Configuration

The depth measurement system is dependent upon the combination of depth measurement wheel with its calibrated groove, and the shaft encoder which translates rotation into pulses which are counted by the logging system controller. Two parameters are therefore required: depth wheel circumference and encoder pulse rate. The encoder parameters are covered in a subsequent topic.

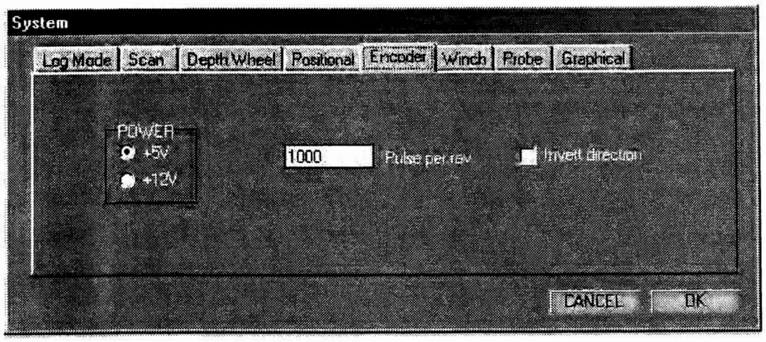


- Select Metric or Imperial depth measurement units from the left-hand pane.

- Type the circumference of the depth measurement wheel into the 'wheel size' box. The standard sizes of GEOVision wheels are 1000mm. If you are measuring in Imperial units (or changing back to metric units), the standard wheel size can be converted automatically by clicking the left mouse button and choosing the appropriate conversion. The size is always specified in units of 1/1000 of the depth unit i.e. millimetres (mm) or millifeet (mft).

4.0 Encoder Configuration

The depth measurement system is dependent upon the combination of depth measurement wheel with its calibrated groove, and the shaft encoder which translates rotation into pulses which are counted by the logging system controller. The depth wheel circumference is covered in a previous topic. In order to accommodate a variety of encoders, their operational characteristics can be configured in the software.



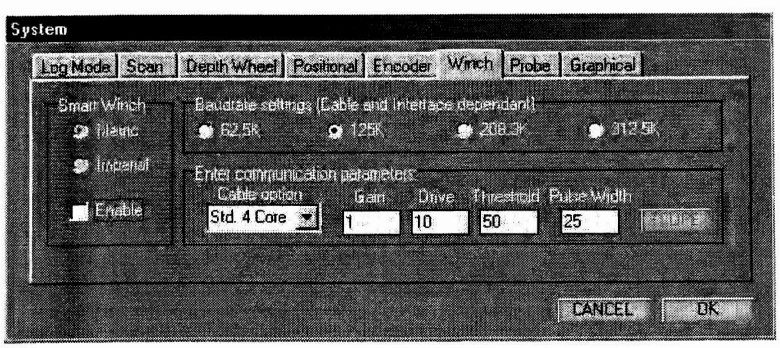
- Select supply voltage from the radio buttons in the left-hand pane. The options are 5 Volt and 12 Volt. GEOVision encoders are always specified for 5 Volt operation.

- Type the number of pulses emitted per revolution into the central box. The standard values for all GEOVision winches are 500 pulses/rev.

- The logical direction of movement can be reversed if required to accommodate the directional characteristics (phase lead or lag) of the different encoder types.

5.0 Winch and Cable Configuration

Support for remote control of the RG Smart Winch is provided, and can be enabled by checking the ***Enable*** control in the left-hand Smart Winch pane. If the Smart Winch control is enabled, it is also necessary to select the measure units in force - select ***Metric*** or ***Imperial*** from the radio buttons on offer.



The Baud settings can be chosen to match the *quality* of the communication channel. The channel will be effected by cable type and length. Typically a Baudrate of 312.5K is used. The remaining controls in the dialog relate to the communications parameters. The operation is entirely compatible with the WinLogger software operation and the values would be expected to be the same as those in force for logging six-channel type sondes with that software. (Certain probe types may be fitted with a digital interface that does not require set-up and in this case the parameter edit boxes will not appear.)

- ***Cable Option*** is used to select the logging cable type which is available on the winch. The options are *Not Connected*, *Std. 4 Core*, *Differential* and *Monocable*. The only cable types used in GEOVision systems is Std. 4 Core. Select the appropriate type from the drop-down menu box. Note this value can only be changed when the probe power is turned off.

- ***Gain*** is related to cable length and uphole signal attenuation. Gain values range from 0-3 and control the amplification applied to the incoming signal. Use the *Scope* dialog to visualize the incoming signals. Gain should be set so that the signal reaches between 70% and 100% of the height of the display, generally obtained with a setting of 0 for GEOVision winches. If the peak height exceeds this level, clipping will result in artifacts which will be detected erroneously. Click *Apply* to set the parameters before proceeding to the *Scope* dialog.

- ***Threshold*** is the level at which the incoming signals are detected. Gain and Threshold are related, and can be visualized using the *Scope* dialog. Set the gain so that the signal reaches between 70% and 100% of the height of the display. Then adjust the threshold so that it is between 50% and 70% of the height of the pulses displayed and clear of any region of 'overshoot' of the positive and negative pulses. This will ensure that peaks are detected and noise is ignored. Generally a setting of 25 is used for GEOVision winches. When the scope dialog is displayed, the position of the mouse is reported as a threshold value to make it simpler to infer the correct setting. The scope option is greyed out when the probe power is turned off.

- ***Drive*** sets the strength of the downhole signal. It is not possible to visualize the downhole signal, but the effect of insufficient drive is to disable downhole communication, which will result in the commands being ignored by the sonde. Values range from 0 -127, and for GEOVision winches will be around 10. Increase the drive for longer cables.

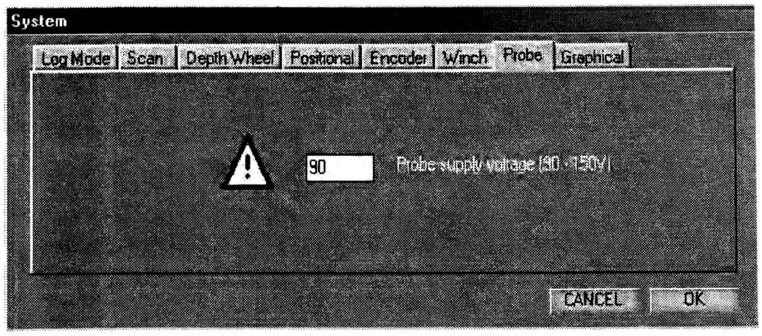
- ***Pulse Width*** This is the width of the transmitted communication pulses in 100nS steps. The default is 25 equivalent to 2.5uS. The range is from 8 to 64. The pulse width can be reduced to prevent signal overshoot on short cables. The default value is used in most cases. Note any changes only come into effect during a log. (Note setting too large a pulse width when using the highest Baud rates will automatically be prevented within the probe and the pulse width reduced.)

IMPORTANT Please note the effects of changing 'Baud' will not appear until the first new log is made. The setting for 'threshold' may be effected by an increase in the 'Baud' rate please recheck 'threshold' if 'Baud' is altered using the 'Scope' function after making a short test log.

The parameters which are entered will be applied automatically if you close the dialog with ***OK***. The above parameters once set correctly will be remembered by the system and should never need to be altered.

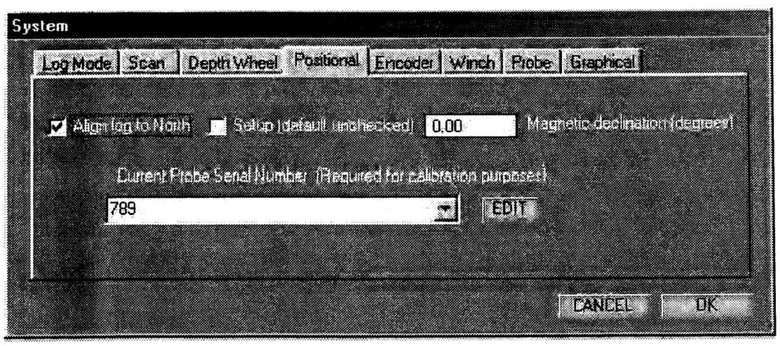
6.0 Probe Configuration

The probe is normally energized at 90 Volts from the surface. However, it may be necessary to compensate for voltage drop on longer cables due to the higher power draw of this sonde. The voltage at the surface may be increased in order to deliver 90 Volts at the sonde. Simply type the value into the text box provided. The voltage should be set at 90V for all GEOVision winches. Values outside the indicated range will be rejected.



7.0 Positional Configuration

The probe includes a 3-axis orientation package, and is capable of producing a borehole image aligned to geographic North. This is achieved by determining and applying two image rotation parameters:



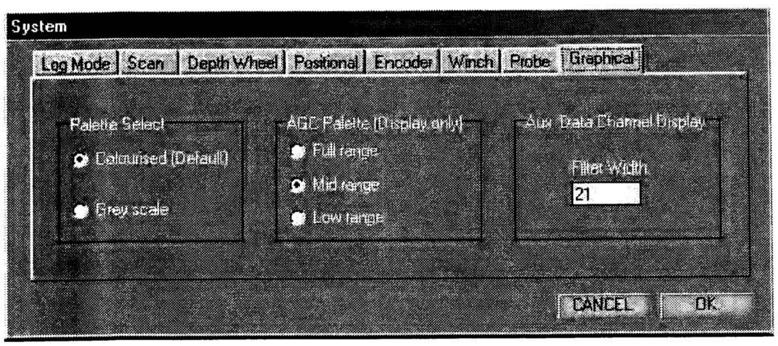
- ***Magnetic Declination*** is used to correct for the difference between Magnetic North and True North. The value varies from place to place, so the local value must be inserted here if you wish to perform this correction during data collection. This correction may also be made during processing. If the value is zero, the log will be referred to Magnetic North.
- ***Align to North*** is a check-box used to select image rotation to start at Magnetic North. If in addition a value is set for Magnetic Declination (see above) the image will be rotated to start at True North. If the box is not checked, the image will not be oriented to geographic co-ordinates, but will use the local co-ordinate frame of the sonde (X, Y, Z axis of the orientation module). This mode may be used to inspect the inside of magnetic casing, where an orientated image would be subjected to random effects caused by the metalwork.
- Set-up mode is selected by checking the ***Setup*** box, and is used to determine the required image rotation offset to correct for the angle between the axis of the orientation package and the index mark of the rotating transducer section. In set-up mode the normal sonde azimuth display is modified, and will instead show the 'relative bearing' which is measured between the high side of the borehole and the orientation sensor index. Check ***Setup***, then OK to close the dialog. The icon adjacent to the sonde azimuth readout at the top of the screen is modified with the legend CAL when the system is in set-up mode. The sonde must now be placed in a stand or jig so that it

is inclined at about 20 degrees to the vertical, and adjacent to a target fixed to the jig so that it is directly above the transducer in the vertical plane. Lower the sonde with its attachment into a large bucket of water so that the transducer and target are fully immersed. Start the radial amplitude display, when it will be possible to see the strong signal returning from the target. Rotate the sonde so that the image of the target moves to the top of the display. When the two are coincident, the 'relative bearing' reads out the image rotation offset. This value is fixed for the sonde unless it is disassembled and rebuilt, at which point the procedure MUST be repeated. Please see the additional topic on the Radial Amplitude Display for further details.

- The ***Serial Number*** list box is used to select the sonde which is in use. When the appropriate sonde is selected, the image rotation offset determined by the above procedure is selected. To edit the image offset click the '***Edit***' and enter the new offset. Several serial numbers and associated offsets can be stored and selected as required.

8.0 Graphical

The palette can be changed between a colored and grey scale setting. The changes affect the log screen palette display and are also applied when replaying a log. Selecting Full range in the 'AGC Palette' will cause the software to spread the palette over the full 16bit signal. 'Mid range' will spread the palette over the first quarter of the 16bit range and 'Low range' will spread the palette over the first eighth of the 16 bit range. In most cases the 'Low range' selection is used. Note these settings do not affect the stored log data in any way. The 'Filter Width' is applied to the Natural Gamma trace data and is a simply running average filter. The range of the filter width is from 1 to 50 (x 10 millidepth units ie. mm or mft).

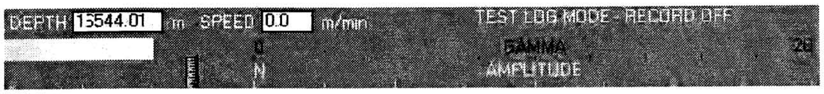


9.0 Sonde Operation

When the operations specified above have been reviewed and the correct settings have been selected, the system is ready for use. The main screen area is divided into 3 horizontal elements. At the top is the depth and orientation readout, together with the scale headings for the scrolling display of unwrapped borehole image.

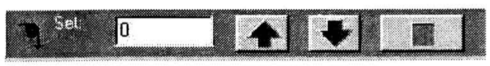
On the left side of the depth track is the travel time display, with text boxes for sonde inclination, azimuth and head temperature.

On the right side is the display of amplitude and indication of current operating mode. Located in the center above the depth track are the text boxes for depth and cable speed (computed at the surface). The ranges for the 'Natural Gamma' channel overlay (optional) are shown above the Amplitude.



The central area is utilized for the scrolling display of unwrapped borehole data. The display is orientated with the left edge corresponding to North point of the aligned image data (if orientation is selected) according to the outputs of the sonde's orientation package.

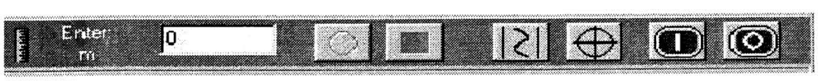
The lower area has controls for the winch (applicable to RG Smart Winch only), depth initialization and sonde control.



The winch control area is only displayed when RG SmartWinch operation is enabled - see section 5 - and has four controls. Set Target Speed by typing the required speed into the window and pressing Enter.

Cable movement is initiated by clicking on either the UP or DOWN arrow control.

Cable movement is halted by clicking on the square STOP control.



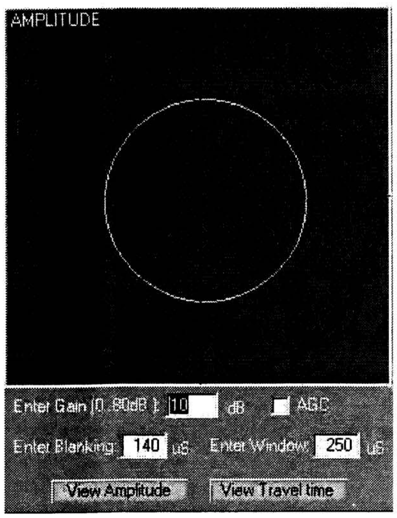
Depth is initialized by typing the required value into the entry box and pressing Enter. The entry box is not available at times when the system is in logging mode and the depth should not be changed by user entry.

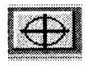
Sonde power is applied by clicking on the green-colored 1 button. Power is turned off by clicking on the red-colored 0 button. There is no indicator for the state of the power supply on the desktop, so the external indicators should be observed for this purpose.

To make a log ensure that the Test Mode is disabled - see section 1, Log Mode setting. Click File|New Log and select a filename. Old logs may be overwritten if necessary -TAKE CARE. The header editor will be started automatically. A previous set of header data may be loaded by clicking LOAD and choosing a template.

To start logging, click on the red Record (circle) control. The log data will start to scroll down the screen after a brief pause for synchronization. The messages "DSP2: Detecting data stream" and "Updating probe settings" will be observed at the bottom of the screen during this process. Note that the screen scrolling direction is not affected by the actual direction of movement of the sonde. To cease logging, click on the black STOP control (square). The data should be immediately backed up to a USB drive, CD, or other data storage prior to beginning another log.

If the data display from a probe which is properly connected appears to occupy only half of the track area, with the remainder filled with random colors such as green which are not part of the regular palette, then it is most likely that the downhole data communication is not functioning properly. This symptom is due to the fact that the probe settings cannot be communicated properly, and it is operating in its default power-up mode. If this is the case, the Drive setting of the System|Winch dialog should be increased or decreased accordingly. See section 5 for full details.





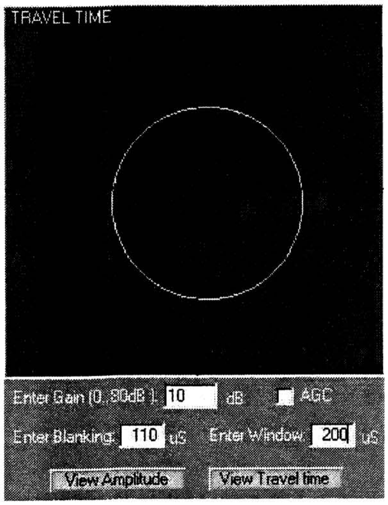
To adjust the sonde gain it is necessary to use the Radial Amplitude plot, which is enabled by clicking on the circle with cross-hairs symbol. When the dialog is active a new window will open on top of the unwrapped data display. In this display, the data is presented as a 'polar' plot. Press the 'View Amplitude' button to display the amplitude plot. This plot shows amplitude increasing towards the outside of the circle and the compass direction following the sweep of the transducer. The line indicating the data is drawn in the regular palette, so that high amplitudes are drawn in white and low amplitudes in black/brown. The picture here shows the image of the inside of a cylinder.

If the data is concentrated in a small circle at the center, the gain is too low and should be increased. If the data is obviously clipped at the outside of the circle, then the gain should be reduced. Type the new gain value into the entry box and press Enter. The ideal would be to set a gain value which allows the peak values to be displayed without clipping, with the majority of the data around the half-way level. It may also be necessary to adjust the blanking to ensure that internal reflections from the acoustic housing are not detected at the new gain value. This will be apparent in the unwrapped data display as pronounced patterning unrelated to the true target. The AGC option causes the probe to set gain automatically thus preventing signal saturation in most cases. (The gain is varied in 6dB steps

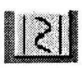
Blanking Period and window length can be set independently. Blanking is set to avoid reflections from the housing of the acoustic transducer or random reflections from a rugose borehole, and window length is set to accommodate the range of borehole radius that might be expected. An error will be indicated if the sum of the blanking period and window length would be greater than 409 microseconds, which is the maximum range of the timer. The default value for the blanking period is 145 microseconds, which is the minimum required for the two-way transit from the transceiver to the outer surface of the acoustic housing. It is not advisable to reduce this value beyond the default setting, although it may be increased for larger boreholes at the rate of 1.5mm of one-way travel per microsecond.

Window Length (sample time) defines the period during which the arrival gate remains open to detect the returned acoustic pulse. The acoustic pulse will travel in water at a speed of approximately 1.5mm per microsecond. The default window length is 150 microseconds, which is equivalent to 225 mm of (two-way) travel in the borehole fluid, or approximately 110mm of borehole diameter. If this is added to the default blanking period, which is equivalent to the outside diameter of the acoustic housing, it can be seen that the default set-up will be correct for boreholes up to 150mm. An error will be indicated if the sum of the blanking period and window length would be greater than 409 microseconds, which is the maximum range of the timer. Choose your window setting to best match the borehole diameter.

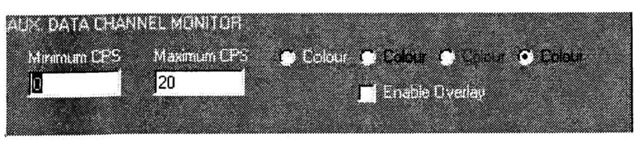
Pressing the 'View Travel time' button changes the display to that shown below:



The unhatched ring between the two cross hatched zones represents the sample window. The width of this ring will vary with window length value. The profile of a cylinder is represented here appearing as a circle in the sample window.



Pressing this button displays the following dialog box:



This box allows you to enable the Natural Gamma option by checking the 'Enable Overlay' check box. The Overlay appears as a trace upon the Amplitude plot. The trace range and color can also be set by this dialog. The level of filtering can also be altered (see section 8) (note that any displayed trace data is automatically aligned with the acoustic scan data but only when logging up. The Natural Gamma sensor occupies a higher position in the probe so sufficient data has to be prebuffered so that the acoustic data can depth aligned with gamma. The prebuffering results in a delay at the start of a log before correct gamma data appears this is normal.)

Data Analysis and Interpretation

RG-DIP, the manufacturer's image interpretation package, offers manual and automatic feature recognition options. Feature orientations (dip/strike and azimuth) are automatically calculated. Display options include stereographic projections of zone axes, orientation frequency plots and 'synthetic cores' for comparison with real core data. The last option is invaluable for orientating core samples, particularly in the case of incomplete recovery.

Reporting

The final report will include the objective and scope of the survey, location of the boreholes, discussion of instrumentation and procedures in the field and lab. For each borehole there will be a plot showing the dip/strike and azimuth of features. The next page shows an example.

Assumptions and limitations of the results will be discussed. Supporting references will be listed as necessary

Required Field Records

Field log for each borehole showing

a) Location and description of the borehole

b) Date of test

c) Field personnel

d) Instrumentation

e) Any deviations from test plan and action taken as a result

This procedure has been reviewed and approved by the undersigned:

Professional Geophysicist Antony Martin Date Feb 13. 2006

QA Review ____________ Date Feb 13. 2006

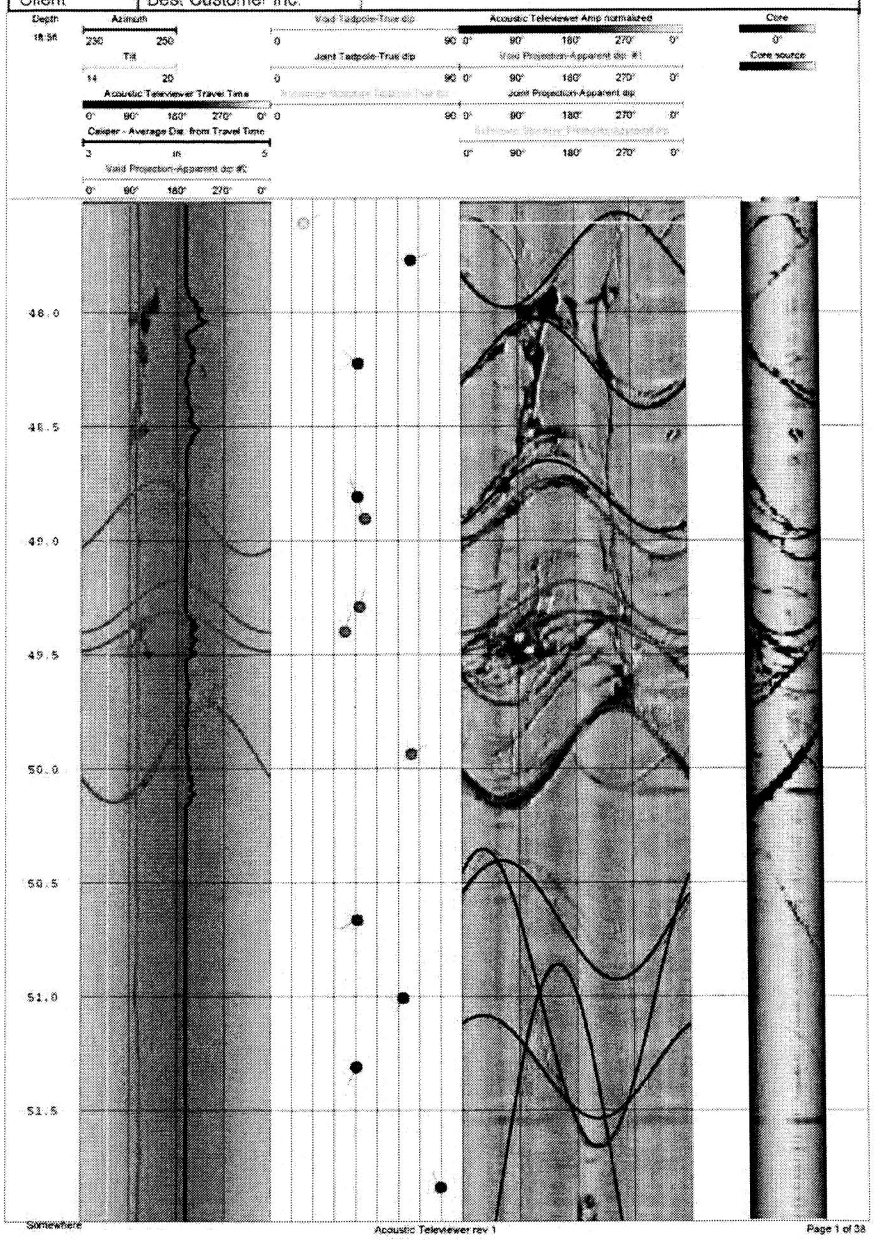
B-XXX	Company	Geovision Geophysical Services
	Location	Somewhere Dam

BH	B-XXX Acoustic Televiewer		
Date	7/8/05	BH Fluid	Air/Water
Casing	4" Steel to 15 ft		
File Name	BXXXdown1		
Depth Drilled	300 feet		
Depth Logged	299.3 feet		
Logged by	Rob Steller		
Client	Best Customer Inc.		

Notes:

1) All orientations referenced to True North

2) Tadpole tails indicate dip direction with True North as up.



FINAL DATA REPORT Rev 0
GEOTECHNICAL EXPLORATION AND TESTING

EXELON TEXAS COL PROJECT
VICTORIA COUNTY, TEXAS
POWER BLOCK

July 10, 2008

VOLUME 2

Prepared By:

MACTEC Engineering and Consulting, Inc.
Raleigh, North Carolina

MACTEC Project No. 6468-07-1777

Prepared For:

Bechtel Power Corporation
Subcontract No. 25352-102-HC4-CY00-00001

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VOLUME 2
Appendix C – Cone Penetrometer Test Results

Prepared By:

MACTEC Engineering and Consulting, Inc.
Raleigh, North Carolina

MACTEC Project No. 6468-07-1777

Prepared For:

Bechtel Power Corporation
Subcontract No. 25352-102-HC4-CY00-00001

FUGRO CONSULTANTS, INC.

6105 Rookin Road
Houston, Texas 77074
Tel: 713-346-4000
Fax: 713-346-4002

March 14, 2008
Report Number 1907-0075

Mr. Scott Auger, P.E., PMP
Mactec Engineering and Consulting, Inc.
3301 Atlantic Avenue
Raleigh, North Carolina 27604

REPORT FOR
SEISMIC PIEZOCONE PENETRATION TESTING
AND RELATED SERVICES
EXELON TEXAS COL UNITS 1 AND 2
VICTORIA, TEXAS
MACTEC PROJECT # 6468071777

Dear Mr. Auger:

Fugro is pleased to enclose the data report for Cone Penetration Testing (CPT) at the Exelon Texas Col Units 1 and 2 sites at Victoria, Texas. Cone Penetration Tests were carried out according to ASTM 5778-2000, "Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils" standard test method.

For your information, the soil stratigraphy was identified using Campanella and Robertson's Simplified Soil Behavior Chart. Please note that because of the empirical nature of the soil behavior chart, the soil identification should be verified locally. Some soils, such as glacial till, cemented soils and calcareous soils are outside the scope of these soil behavior charts."

Cone Penetration Test data was collected utilizing Fugro's digital cone penetrometer systems that were mounted on a purpose-built 25-ton capacity truck-mounted unit or a 15-ton capacity ATV track-mounted Cone Penetration unit.

The Fugro Organization has been developing and deploying Cone Penetration Testing (CPT) systems since the early 1940's. We currently own and operate over 600 onshore and offshore cone deployment systems worldwide. Fugro developed the first commercial cone penetrometer in the 1960's and has manufactured and utilized the industry standard in electronic cone penetrometers since that time.

The following sections summarize the CPT test method and our site investigation activities:

1.0 Summary of CPT Test Method

A penetrometer assembly with a conical point having a 60° apex angle and a cone base area of 15 cm^2 is advanced through the soil at a constant rate of 2 centimeters per second. The force on the conical point (cone) required to penetrate the soil is measured by strain gages at a minimum of every 2 centimeters of penetration. Stress is calculated by dividing the measured force (total cone force) by the cone base area to obtain cone resistance, q_c.

A friction sleeve is present on the penetrometer immediately behind the cone tip, and the force exerted on the friction sleeve is measured by strain gages attached to load cells at the top and bottom of the sleeve assembly, at a minimum of every 2 cm of penetration. Stress is calculated by dividing the measured force by the surface area (200 cm^2) of the friction sleeve to determine friction sleeve resistance, f_s.

Many penetrometers are capable of measuring dynamic pore pressure induced during advancement of the penetrometer tip using an internal pressure transducer. These penetrometers are called "piezocones." The piezocone is advanced at a rate of 2 centimeters per second, and readings are taken at a minimum of every 2 centimeters of penetration. The dissipation of excess pore pressure can be monitored by stopping penetration, unloading the push rod, and recording pore pressure as a function of time. When pore pressure becomes constant, it is measuring the equilibrium value or piezometric head at that depth.

Penetrometers are also available with geophones mounted above the friction sleeve for measuring shear wave velocity. These penetrometers are called "seismic cones." The seismic cone is advanced at a rate of 2 centimeters per second, and readings taken at a minimum of every 2 centimeters of penetration. Advancement of the seismic cone is stopped at predetermined intervals (usually 5 or 10 feet). At these intervals shear wave velocity measurements are recorded using a seismograph. Placing a metal beam on the ground and striking the ends of the beam with a hammer generate the shear waves.

2.0 Significance and Use

Tests performed using CPT methods provide a detailed record of penetrometer results, which are used for the evaluation of site stratigraphy, homogeneity and depth to firm layers, voids or cavities, other discontinuities, and correlations with geotechnical and hydrogeological properties of soils. When properly performed at suitable sites, the test provides a rapid means for determining subsurface conditions.

CPT methods provide data used for estimating engineering properties of soil intended to help with the design and construction of earthworks, foundations for structures, and the behavior of soils under static and dynamic loads.

CPT methods test the soil in situ and soil samples are not obtained. The interpretation of the results from the test methods provides estimates of the types of soil penetrated. Engineers may obtain soil samples from parallel borings for correlation purposes since the results of these tests are empirical in nature and yield results regarded as behavior type, but not actual grain size.

3.0 Limitations of Use

Refusal, deflection, or damage to the penetrometer assembly may occur in coarse-grained soil deposits with maximum particle sizes that approach or exceed the diameter of the cone. Partially lithified and/or cemented deposits may cause refusal, deflection, or damage to the penetrometer assembly.

Standard push rods can be damaged or broken under extreme load conditions. The amount of force that push rods are able to sustain is a function of the unrestrained length of the push rods and the weak links in the push rod-penetrometer tip string, such as push rod joints and push rod-penetrometer assembly connections. The force at which rods may break is a function of the equipment configuration and ground conditions during penetration. Excessive rod deflection is the most common cause for rod breakage during deep pushes in dense material with soft overlying soil.

4.0 Equipment

Equipment utilized in conducting Cone Penetrometer Testing include:

1. Digital Standard Cone (CPT) to measure tip and sleeve resistances and probe inclination.
2. Digital Piezocone (CPTu) to measure tip and sleeve resistances, probe inclination and dynamic pore pressure.
3. Digital Seismic Cone (SCPTu) to measure tip and sleeve resistances, probe inclination, dynamic pore pressure, and shear wave velocity.
4. Cone rods with pre strung electrical cone cable.
5. Digital Data Acquisition System including the Digital Connection Box (PCUM), a data logging laptop computer and laser printer.
6. A self-contained CPT rig that contains the hydraulic pushing system, a power supply unit and other tools, equipment and materials necessary.

Digital Piezocone (CPTu) and Digital Seismic Cone (SCPTu) testing was done during this investigation.

4.1 Electric Cone Penetrometers

Fugro utilizes electric cone penetrometers, available in either a $10cm^2$ or $15cm^2$ cone base area that exceed the standards set forth by ASTM-D5778-2000, ISO 9001 and ISSMGE Technical Committee 16. Technical details and specifications of Fugro's Cone Penetrometers are given in Appendix A.

4.2 Cone Rods

Fugro's CPT cone rods are manufactured from high tensile strength steel and have a cross sectional area adequate to sustain, without buckling, the thrust required to advance the penetrometer tip. Prior to testing, an electrical cone cable is prestrung through the cone rods and is connected by a crossover cable to the Data Acquisition System.

Push rods are supplied in 1 meter lengths and must be secured together to bear against each other at the joints to form a rigid-jointed string. The deviation of push rod alignment from a straight axis should be held to a minimum, especially in the push rods near the penetrometer tip, to avoid excessive directional penetrometer drift.

Generally, when a 1-m long push rod is subjected to a permanent circular bending resulting in 1 to 2 millimeter (mm) of center axis rod shortening, the push rod should be discarded. This corresponds to a horizontal deflection of 2 to 3 mm at the center of bending. The locations of push rods in the string should be varied periodically to avoid permanent curvature.

Standard 20-metric ton high tensile strength steel push rods with 36-mm OD, 16-mm ID, and a mass per unit length of 6.65 kg/m are used.

4.3 Data Acquisition System

The. digital data acquisition system utilized by Fugro in conducting CPT Testing consists of a PCUM, a portable laptop computer, and a printer.

The digital data acquisition system collects the cone penetrometer's digital signal, which is monitored, recorded and presented in near-real time on the laptop computer.

Information collected during a push is stored digitally as binary data on computer's hard disk and transferred to compact disks. Windows-based programs ~~that~~ read the data and convert them to text files. The data files include project description and location, operator, data format information and other pertinent information about the sounding. KAW 4/29/08

Following each push, data collected with a standard CPT cone are presented in a graphical format. The log includes:

1. Cone resistance plot in tons/ft^2 (TSF)
2. Friction sleeve resistance plot in tons/ft.^{2} (TSF)
3. Friction ratio plot in %

Versus depth below ground surface in feet.

For data collected with a piezocone, the log includes, in addition to the above, an additional plot of pore pressure in tons/ft^2 (TSF), versus depth in feet.

A variety of plotting parameters are available for uniform presentation of data. As stipulated in the ASTM standard, the vertical axis is designated for the depth while the horizontal axis displays the magnitude of the test values recorded. Final plotting scales are determined after all the tests are completed, and takes into consideration test values and depths recorded for the project.

4.4 CPT Rig

A primary component of any CPT system is the CPT rig. Fugro Consultants, Inc. currently owns and operates ten (10) truck mounted CPT units, four (4) ATV-mounted units, and two (2) skid mounted units in the United States. The CPT rigs have self contained electrical, hydraulic, and climate control systems and range in weight from 15 to 30 tons. Except for the skid-mounted units, the rigs have hydraulic jacking systems to lift and level the pushing platform. The "dead weight" of the rigs provides the reaction weight necessary for advancing the CPT tools, eliminating the need for time-consuming earth anchoring. Fugro's typical purpose build CPT rigs are shown in Appendix B.

5.0 Calibration

Fugro's cone penetrometer manufacturing and calibration procedures include ISO 9001, ASTM D-5778-2000, and European cone penetration standards. The calibration tests include load testing over the full range of output for each cone. Cones are tested and calibrated for the following:

- Mechanical Calibration
- Cross-talk Check
- Dimension Check
- Seal / O-Ring Check

- Electronic Calibration
- Temperature Effect
- Pre and Post Test Voltage Readings (zeros)
- Full Scale Output Load Reading
- Pore Pressure effect on tip and friction readings
- Pore Pressure Transducer calibration

Fugro's cone penetrometer calibration zeros are checked and verified before and after each sounding. Periodic full-scale calibration is likewise conducted according to the Quality Assurance and Quality Control procedures as specified in ASTM D-5778-2000.

During this investigation, utilized cone penetrometers, were load range checked and calibration verified before and after the project. Calibration Verification is documented in our report dated January 24, 2008.

6.0 Test Procedure

Prior to beginning a sounding, a site survey is performed to ensure hazards such as underground utilities will not be encountered. The rig is positioned over the location of the sounding and the leveling jacks are lowered to raise the machine mass off the rig's suspension system. The hydraulic rams of the penetrometer thrust system are set to as near vertical as possible by adjusting the leveling jacks. Once the rig is set level, the data acquisition system is powered up and standard Fugro CPT checklist procedures are followed.

During this investigation, for each CPT test initial and final zero readings were recorded and are included in Appendix C. In addition to standard cone penetrometer checklist during Piezocone penetration testing the following procedures are followed:

1. Assemble the piezo elements with all fluid chambers submerged in the de-aired medium (silicon oil) used to prepare the elements. Flush all confined areas with fluid to remove air bubbles, tighten the cone tip to effectively seal the flat surfaces and apply vacuum pressure to piezo tip section.

2. If unsaturated soil is first penetrated and it is desired to obtain accurate dynamic pore pressure response once below the groundwater, it may be necessary to prebore or sound a pilot hole to the water table. In many cases the piezocone fluid system may be cavitated during penetration through unsaturated soil or in dilating sand layers below the water table, which can adversely affect dynamic response. CPTs C-2106 and C2206 were done using the prebore technique.

The CPT rig was placed over the location and leveled with leveling jacks. After insuring the cone was cleaned and the seals were in place, the cone was prepared as in step 1 above. The cone was then suspended over the location and lowered until the tip was above the ground surface, but not in contact with it.

Labels were entered into the computer to identify the CPT sounding and location. The test was then started on the computer. After starting the test software the operator waits for 30 seconds to allow the system to collect zero readings before lowering the cone to the ground surface and advancing the penetrometer into the soil.

The penetrometer is pushed into the soil at a rate of 2 cm per second. A shaft encoder that is connected to the cone rod using a slip ring plate measures depth. A steel cable is attached to slip ring plate. The cable is then routed over a pulley then attached to a spring-loaded wheel on the shaft encoder. As the cone rod penetrates the soil the cable turns the wheel on the encoder and counts the depth.

The readings from the penetrometer and encoder are sent to the computer, which displays the data graphically, and numerically on screen in real time. The raw data is also stored on the computer hard drive. After the desired depth or refusal is reached, the penetrometer and cone rod are pulled from the ground. When the penetrometer is hanging free above the ground, post test zero readings are recorded and the data stored.

CPT soundings may encounter refusal prior to reaching the desired depth for several reasons. These reasons include:

- The CPT rig cannot generate enough downward force to continue penetration.
- The CPT rig is lifting off the ground while pushing.
- The slope of the penetrometer exceeds angle limits.
- There is not enough lateral support from the soil to prevent the cone rod from bowing and breaking as it is advanced. Casing can help in this situation, however it is not always possible to advance casing to the depth required.

If refusal is due to slope the operator will terminate the sounding and determine the cause. The test will also be terminated if there is a problem with the data observed during the test. After correcting the problem the operator will move over and re-push the test.

Pore Pressure Dissipation Testing was performed during some CPT soundings. Penetration is temporarily stopped at the location of interest, and the force is released from the cone rods. Pore pressure versus time is recorded during the dissipation test. Pressures are monitored until equilibrium pore pressure is reached or 50% of the initial pore pressure is dissipated. In fine grained soils of very low conductivity, very long times may be required to reach the 50% dissipation. Some dissipation tests were terminated prior to reaching 50% pressure at the direction of the client.

During this investigation there were two soundings, C-2106 and C-2206, done in multiple stages to depths of 300 feet below ground surface. An initial CPT was pushed from the surface to refusal. The CPT rig was removed from the location and a rotary wash drill rig was set up on the location. A boring was advanced to the depth where the CPT encountered refusal. Leaving the pipe in place the drill rig was removed from the location. The CPT rig set up over the location again. A sounding was then advanced through the drill pipe to the undisturbed soil and pushed to refusal. This process was repeated until data had been collected to a depth of 300 feet.

The data from the multiple CPT soundings at the location were combined into a single file and then plotted.

7.0 Quality Assurance and Quality Control

As part of Fugro's QA procedures, when a digital data acquisition system is activated, the serial number, calibration values for each channel, calibration date and calibration due dates will automatically be recorded in each CPT test file along with the initial and final zero readings of the cone penetrometer.

Upon completion of a project, the field data is transmitted electronically or by overnight mail to the main office in Houston, Texas, where it is processed, reviewed and finalized. The original, unprocessed data is stored in a large capacity, limited access storage medium where it is kept indefinitely for future reference as a confidential records.

The integrity of the measurements are checked and verified to ensure that the logs generated are as accurate as possible. Rod spikes, which are generated naturally when the pushing is stopped to add rods while advancing the sounding, are identified and edited out.

Prior to the release of the Final Report, the entire set of data is reviewed by a Senior Staff member. In this process, the reviewer conducts a thorough assessment of the data set checking its consistency and accuracy. Should any deviation beyond Fugro's accepted standards occur, the data is rejected and test is redone at Fugro's expense.

8.0 Summary of Testing performed on this project

The table below is a summary of testing done for this project. All CPT testing was done using Fugro's Digital Cone Penetrometer system. All cones used were 15 cm^2 cones piezocones or seismic cones with the piezo transducer mounted in the U2 position (between the tip and sleeve).

CPT	Date	Depth (feet)	Dissipations (1) (feet)		Comments
C-2101	11/12/2007	94.6			Refusal (dense sand) (9)
C-2102S	11/13/2007	91.9			Refusal (dense sand) (9)
C-2103	11/13/2007	93.4			Refusal (dense sand) (9)
C-2104S	11/14/2007	71.5	20	35.2	Refusal (dense sand) (9)
C-2105	11/13/2007	88			Refusal (dense sand) (9)
C-2106S	11/15/2007	79.3			Refusal (dense sand) (9)
C-2106	12/2/2007	81.2	75.3		(2) (10)
C-2106	12/2/2007	125	116.2		Drilled to 105 (2) (10)
C-2106	12/3/2007	0			Drilled to 210, terminate. (2) (3) (10)
C-2106	12/3/2007	220			Drilled to 210 (2) (10)
C-2106	12/4/2007	239.7	239.7		Drilled to 225 (2) (10)
C-2106	12/5/2007	300	296.4		Drilled to 285 (2) (10)
C-2107	11/29/2007	95.3			Refusal (dense sand) (9)
C-2108	11/30/2007	93.3			Refusal (dense sand) (9)
C-2109S	11/14/2007	90			Refusal (dense sand) (9)
C-2110	11/30/2007	92.9			Refusal (slope) (9)
C-2111	11/29/2007	16.7			Refusal (slope) (4) (9)
C-2111A	11/29/2007	33.9			Refusal (slope) (4) (9)
C-2111B	11/30/2007	38.4			Refusal (slope) (4) (9)
C-2111C	11/30/2007	85.8			Refusal (slope) (4) (9)
C-2111D	11/30/2007	95.5			(9)
C-2112	11/29/2007	99.7			(9)
C-2113	11/29/2007	96.8			(9)
C-2201	12/4/2007	98.7			(10)
C-2202S	11/15/2007	93			Refusal (9)
C-2203	11/28/2007	100	60.7	77.1	(9)
C-2204S	11/16/2007	55			Geophone malfunction (5) (9)
C-2204SA	11/17/2007	91	60	76.9	Refusal (dense sand) (5) (9)
C-2204SB	1/10/2008	90			Refusal (dense sand) (9)
C-2205	11/28/2007	95			Refusal (dense sand) (9)
C-2206S	11/17/2007	93.8			Refusal (dense sand) (9)
C-2206	12/12/2007	83.9	75.3		Drilled to 55 (6) 10)

C-2206	12/12/2007	130.7			Drilled to 113 (6) (10)
C-2206	12/13/2007	160.3			Drilled to 144 (6) (10)
C-2206	12/13/2007	183.4			Drilled to 181.5 (6) (10)
C-2206	12/14/2007	223.3			Drilled to 219 (6) (10)
C-2206	12/14/2007	247.2	247.2		Drilled to 241 (6) (10)
C-2206	12/15/2007				Drilled to 277 (7) (10)
C-2207	11/27/2007	90.6	68.9	84.4	(9)
C-2208	11/18/2007	96			Refusal (dense sand) (9)
C-2209S	11/16/2007	90			Refusal (lift track) (9)
C-2210	11/18/2007	33			Refusal slope (8) (9)
C-2210A	11/18/2007	99.6			Refusal (dense sand) (9)
C-2211	11/18/2007	93			Refusal (dense sand) (9)
C-2212	11/18/2007	83			Refusal (dense sand) (9)
C-2213	11/27/2007	97.3	78.5	83.5	(9)
C-2214	11/29/2007	93.6			(9)
C-2215	11/28/2007	92.6			(9)
C-2216	12/4/2007	96.7			(10)

Notes:

1. Initially dissipation test were planned to be conducted at predetermined depths. Following a review with the client, this procedure was changed to the selection of dissipation test depths by the client's engineer, with the client's engineer observing the test data as the test progressed.
2. CPT C-2106 was performed by pushing to refusal then drilling out and pushing through the drill pipe. These CPTs were combined into one file for data presentation.
3. This test was terminated due to computer problems and re-pushed. No data was collected.
4. These CPT attempts were terminated due to excessive slope. Test was repeated. Disregard.
5. CPT C-2204S and C-2204SA. First attempt geophones not working. Second attempt seismic data was not good data. Repeated test on January 10, 2008. Disregard first two attempts.
6. CPT C-2206 was performed by pushing to refusal then drilling out and pushing through the drill pipe. These CPTs were combined into one file for data presentation.
7. The cone rod slipped and ~~were~~ was KAW 4/28/08 dropped when the cone was at 242.7 feet. The rods and cone fell approximately 33 feet. While recovering the rods and cone the cone became wedged in the drill pipe by a piece of metal which broke off the air jaws and fell down the drill pipe. During recovery the cone was damaged when the tip was pulled off the cone and the seals failed causing drill mud to enter the cone. Due to the damage the cone was not operable and post project calibration checks were not possible.
8. CPT C-2210 refused due to excessive slope. Repeat test. Disregard.
9. Track Rig 5000
10. Truck Rig 5040

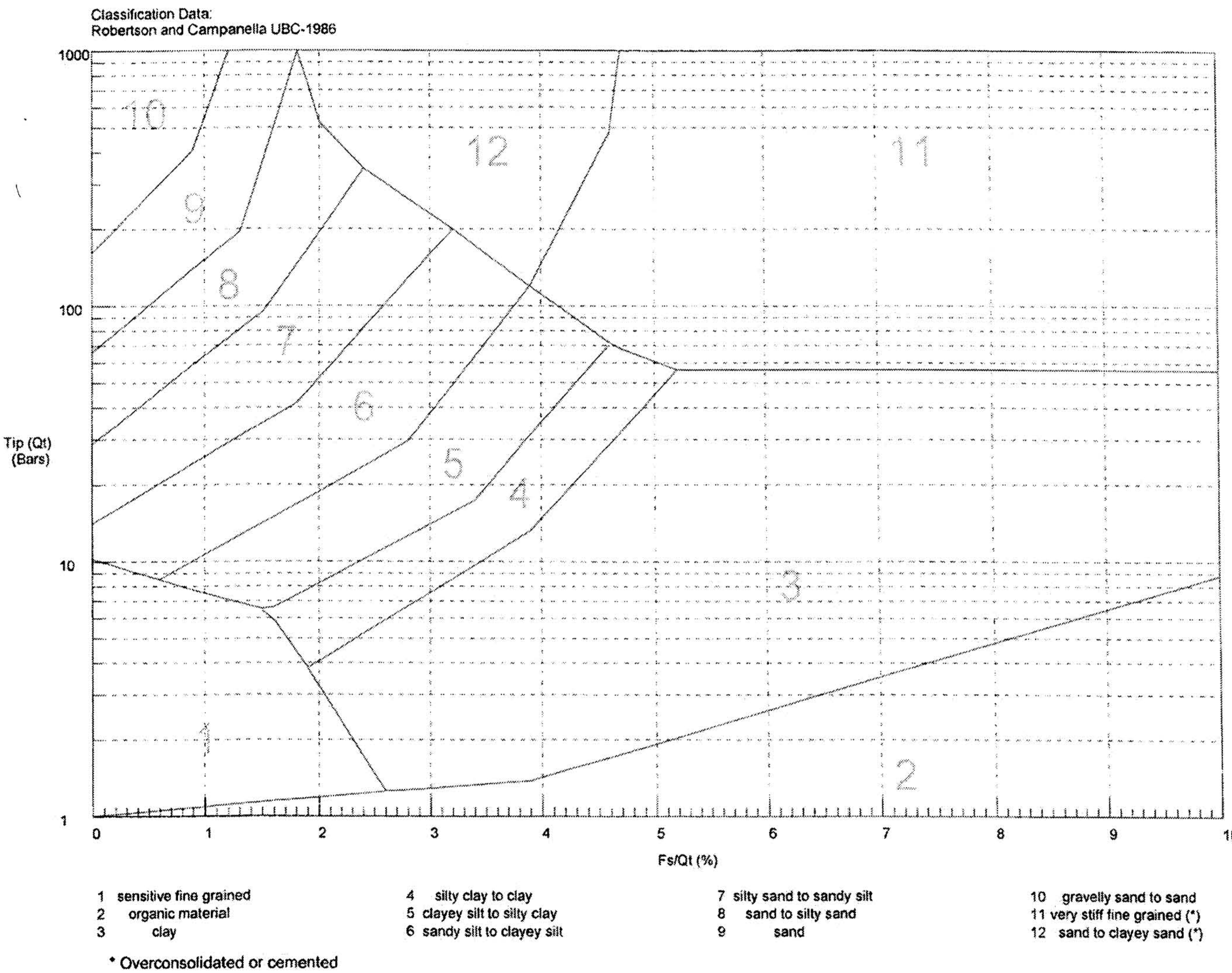
Fugro appreciates the opportunity to be of service to Mactec Engineering and Consulting, Inc. If you have any questions, please feel free to contact me at 713-346-4000.

Very truly yours,
FUGRO CONSULTANTS, INC.

Recep Yilmaz
Senior Vice President

FUGRO

12 Zone Soil Behavior Chart

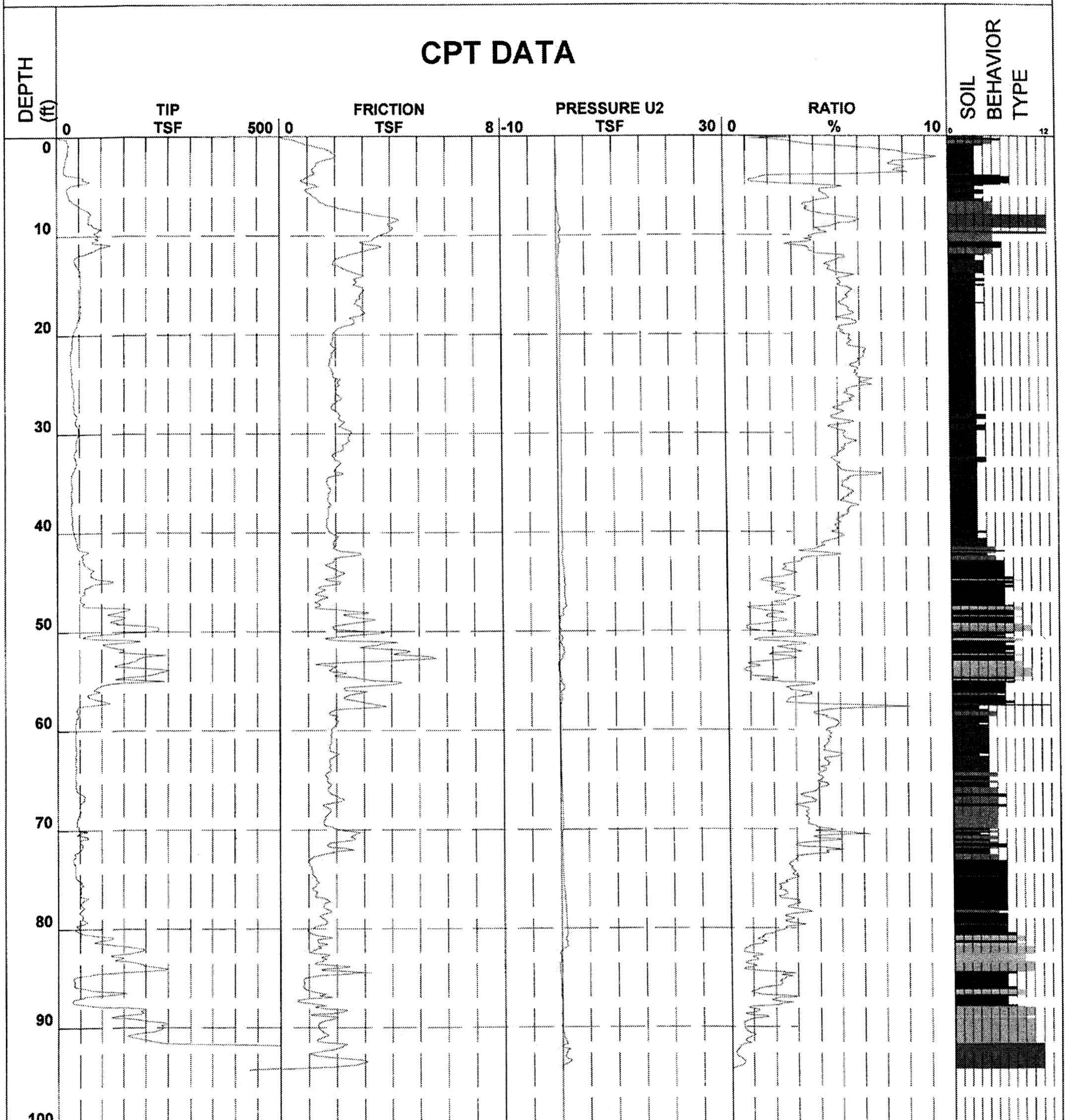


CPT LOGS

CPT Data

FUGRO

Job Number	1907-0075	CPT Number	C-2101	Location	Exelon Victoria, TX
Operator	Albert Fonseca	Date and Tin	12-Nov-2007 14:28:13	Cone Number	F7.5CKEW2/B 1832
Client	MACTEC	Elevation	80.12	Water Table	ND
Coord. North	13412774.10	Coord. East	2599705.86	Check: MS	Verify: SG



1 - sensitive fine grained | 4 - silty clay to clay | 7 - silty sand to sandy silt | 10 - gravelly sand to sand

2 - organic material | 5 - clayey silt to silty clay | 8 - sand to silty sand | 11 - very stiff fine grained (*)

3 - clay | 6 - sandy silt to clayey silt | 9 - sand | 12 - sand to clayey sand (*)

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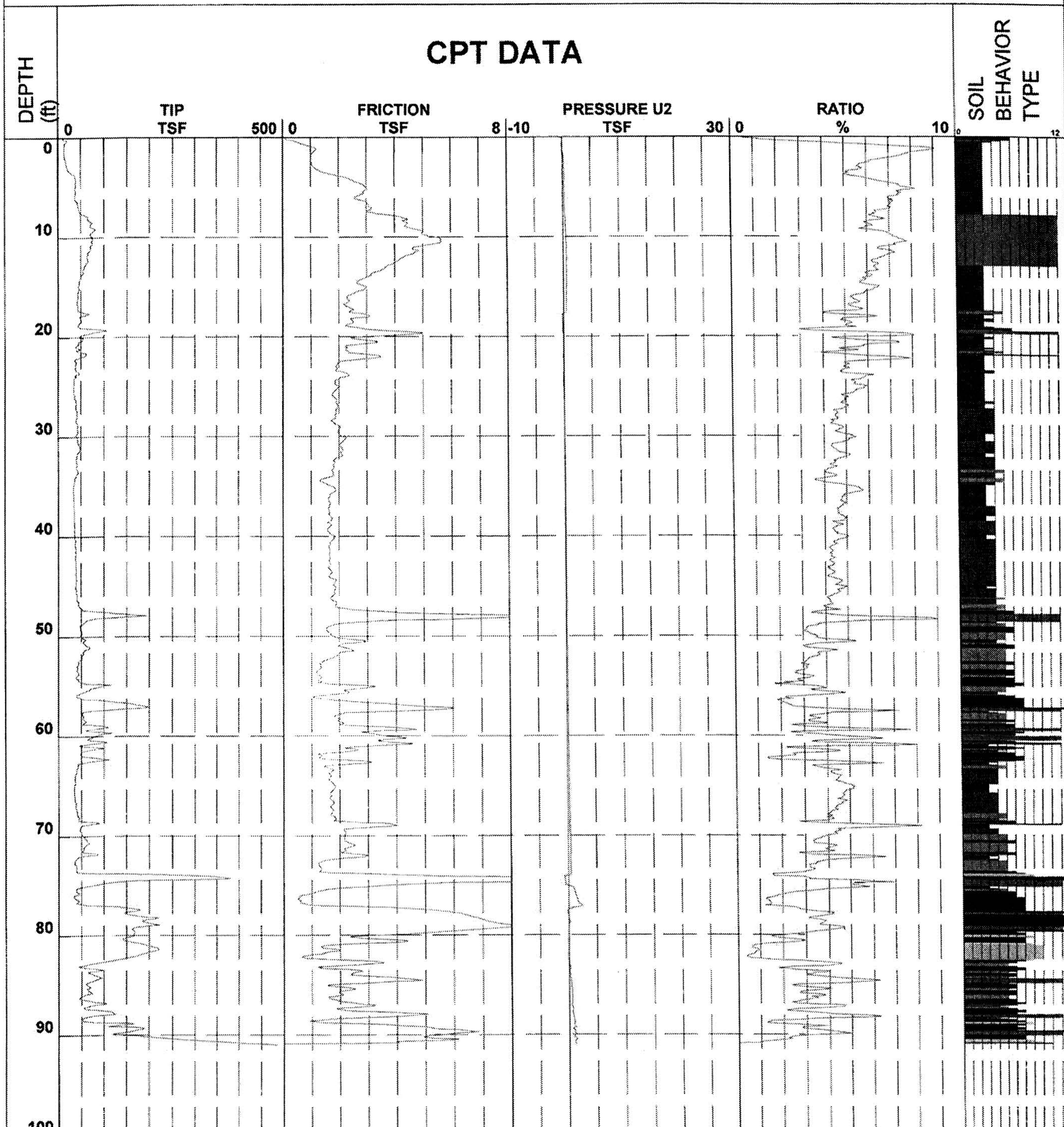
Plate 1 of 1

CPT Data

Job Number	1907-0075	CPT Number	C-2102S	Location	Exelon Victoria, TX
Operator	Albert Fonseca	Date and Tir	13-Nov-2007 08:11:02	Cone Number	A15F2.5CKE3S1788
Client	MACTEC	Elevation	80.17	Water Table	ND
Coord. North	13412550.23	Coord. East	2599702.26	Check: DS	Verify: [illegible]



■ 1 - sensitive fine grained
■ 2 - organic material
■ 3 - clay
■ 4 - silty clay to clay
■ 5 - clayey silt to silty clay
■ 6 - sandy silt to clayey silt
■ 7 - silty sand to sandy silt
■ 8 - sand to silty sand
■ 9 - sand
■ 10 - gravelly sand to sand
■ 11 - very stiff fine grained (*)
■ 12 - sand to clayey sand (*)

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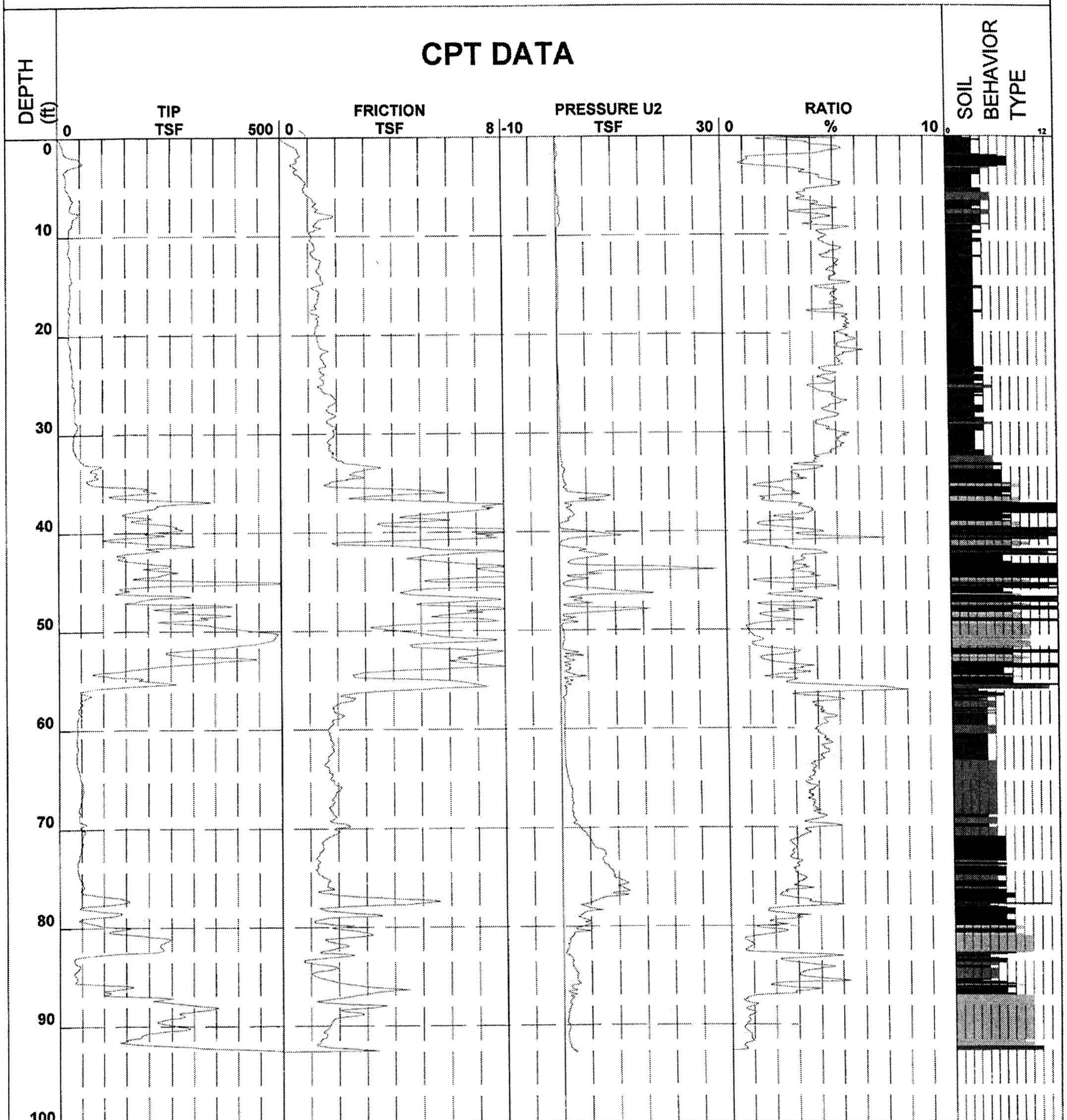
Plate 1 of 1

CPT Data

Job Number	1907-0075	CPT Number	C-2103	Location	Exelon Victoria, TX
Operator	Albert Fonseca	Date and Tin	13-Nov-2007 14:02:27	Cone Number	F7.5CKEW2/B 1832
Client	MACTEC	Elevation	77.68	Water Table	ND
Coord. North	13412715.32	Coord. East	2599852.09	Check: DV Verify:	



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

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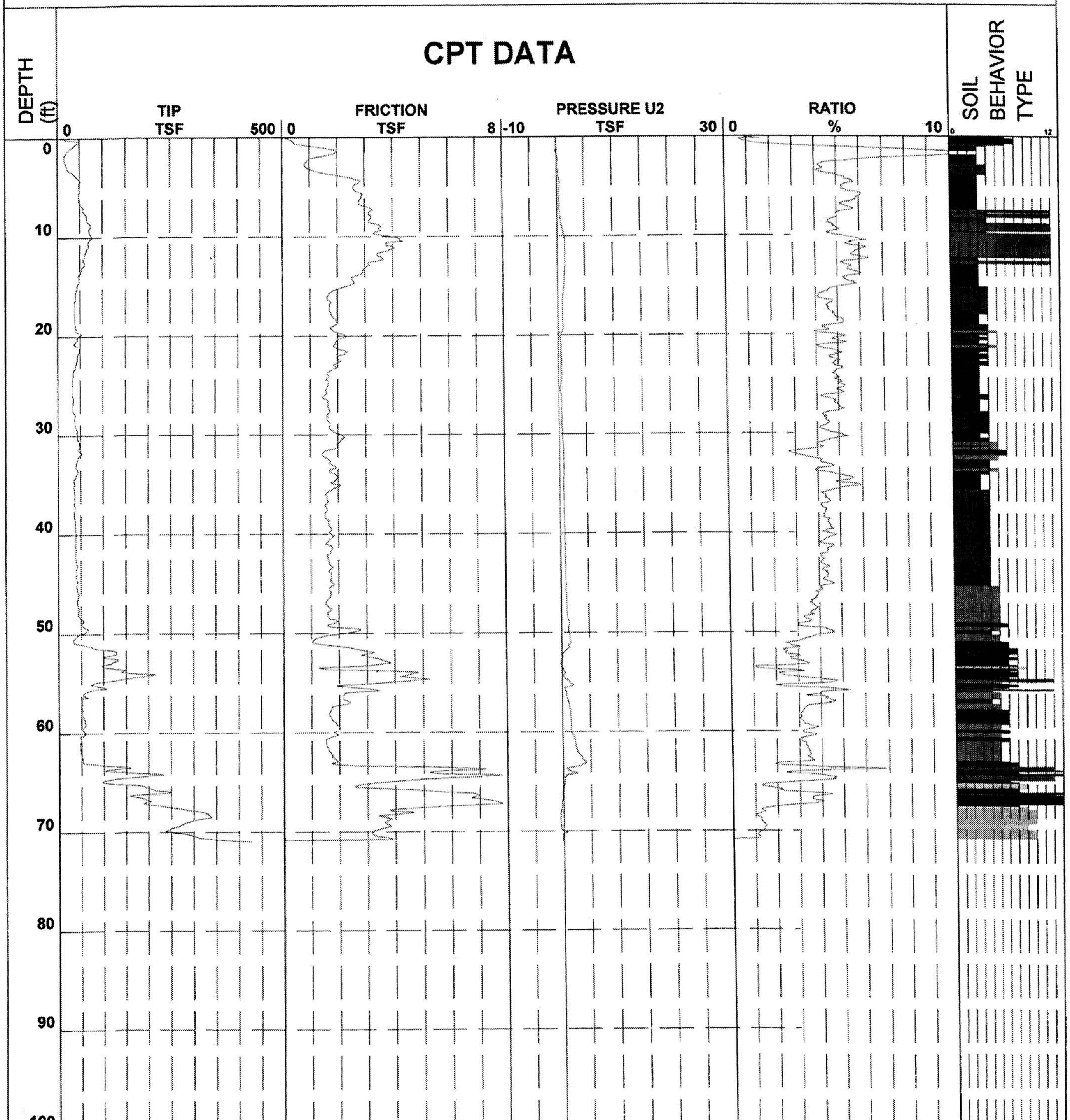
CPT Data

Job Number	1907-0075	CPT Number	C-2104S	Location	Exelon Victoria, TX
Operator	Albert Fonseca	Date and Tin	14-Nov-2007 08:34:33	Cone Number	A15F2.5CKE3S1788
Client	MACTEC	Elevation	80.10	Water Table	ND
Coord. North	13412187.52	Coord. East	2599704.22	Check: DW	Verify: Sly



■ 1 - sensitive fine grained
■ 2 - organic material
■ 3 - clay
■ 4 - silty clay to clay
■ 5 - clayey silt to silty clay
■ 6 - sandy silt to clayey silt
■ 7 - silty sand to sandy silt
■ 8 - sand to silty sand
■ 9 - sand
■ 10 - gravelly sand to sand
■ 11 - very stiff fine grained (*)
■ 12 - sand to clayey sand (*)

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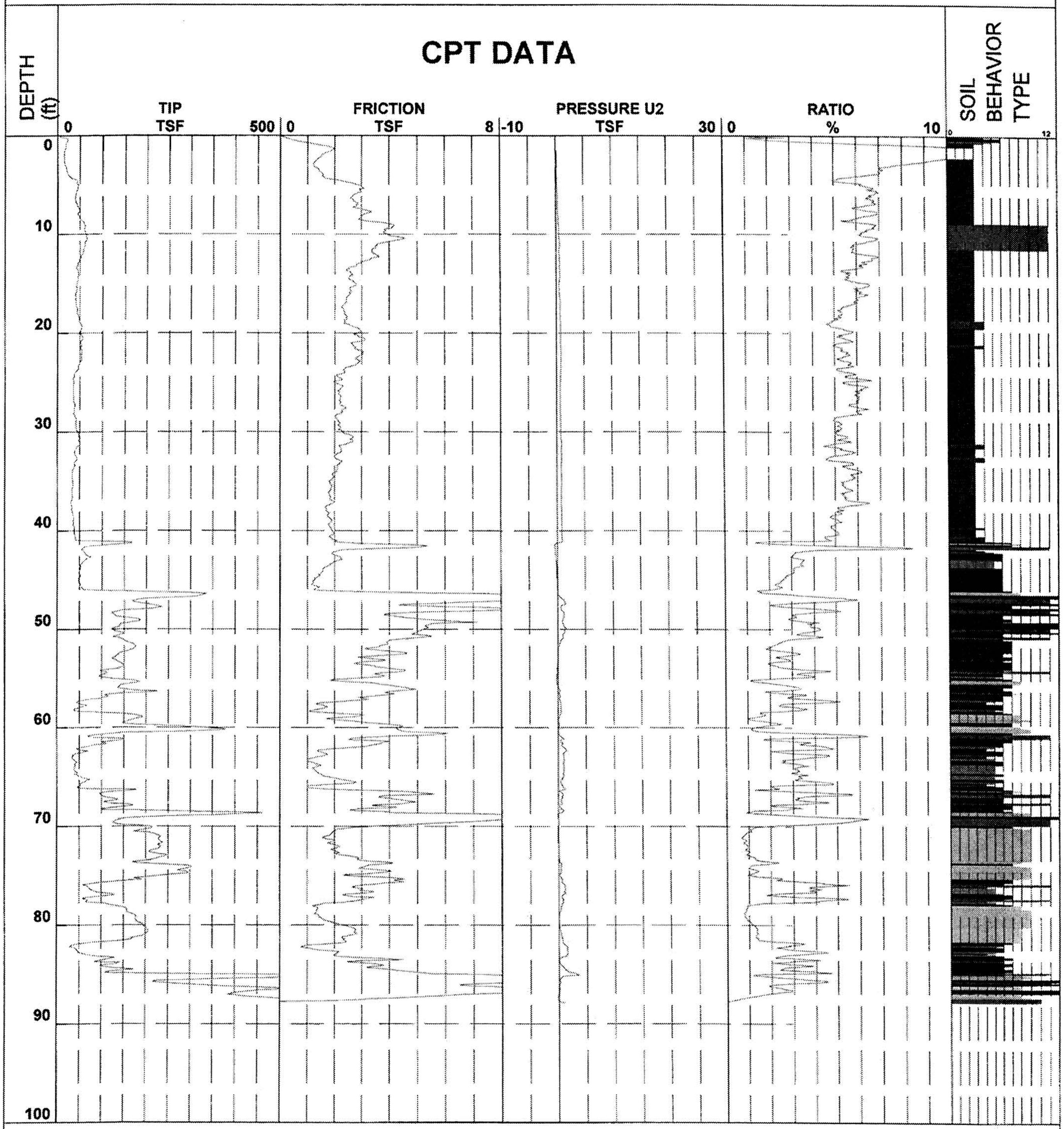
CPT Data

Job Number	1907-0075	CPT Number	C-2105	Location	Exelon Victoria, TX
Operator	Albert Fonseca	Date and Tir	13-Nov-2007 16:15:48	Cone Number	F7.5CKEW2/B 1832
Client	MACTEC	Elevation	80.19	Water Table	ND
Coord. North	13412269.09	Coord. East	2599774.92	Check:	Verify:



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

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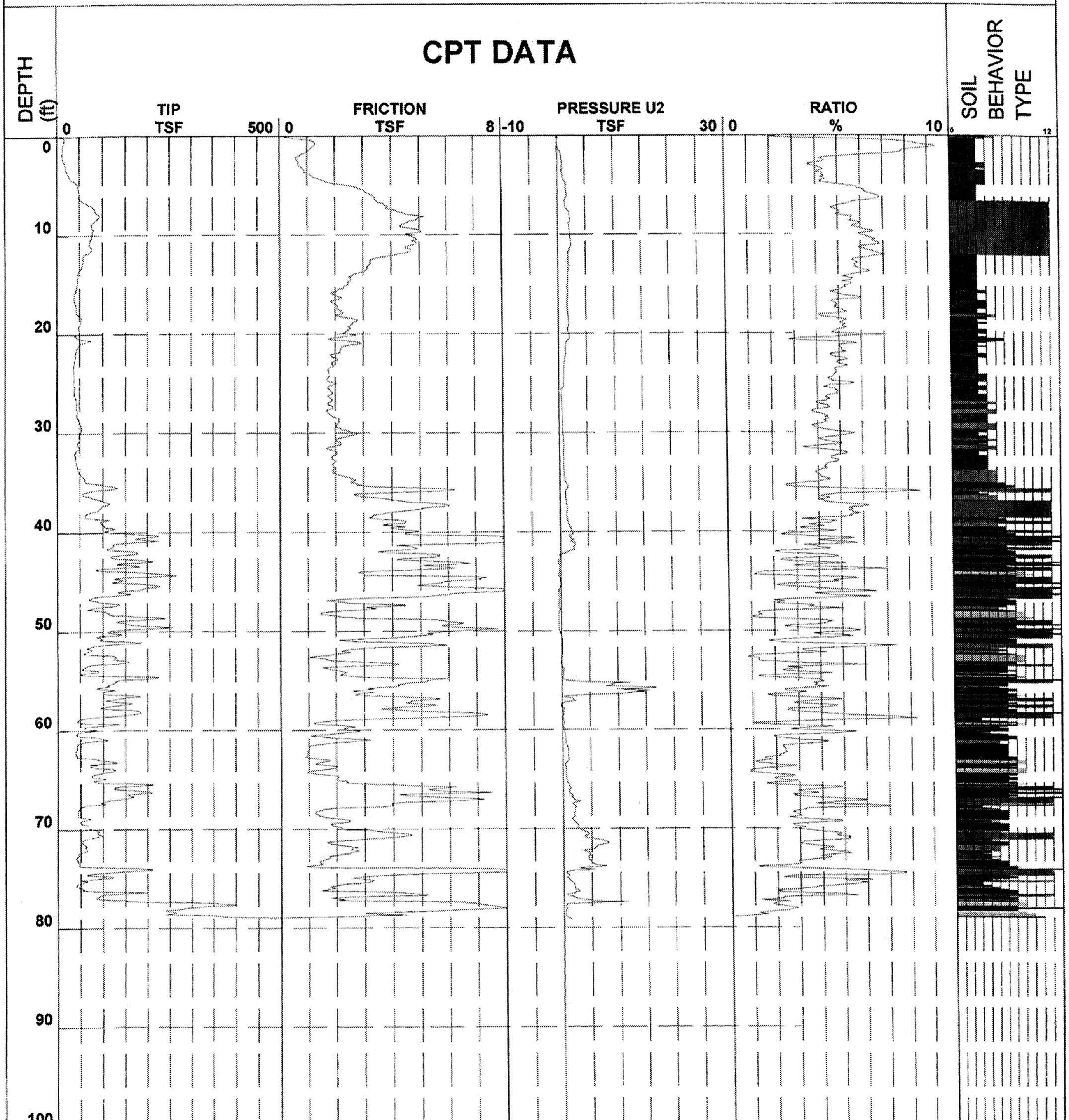
Plate 1 of 1

CPT Data

Job Number	1907-0075	CPT Number	C-2106s	Location	Exelon Victoria, TX
Operator	Albert Fonseca	Date and Tir	15-Nov-2007 08:09:26	Cone Number	A15F2.5CKE3S1788
Client	MACTEC	Elevation	79.51	Water Table	ND
Coord. North	13412296.36	Coord. East	2599958.27	Check: DS	Verify:



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

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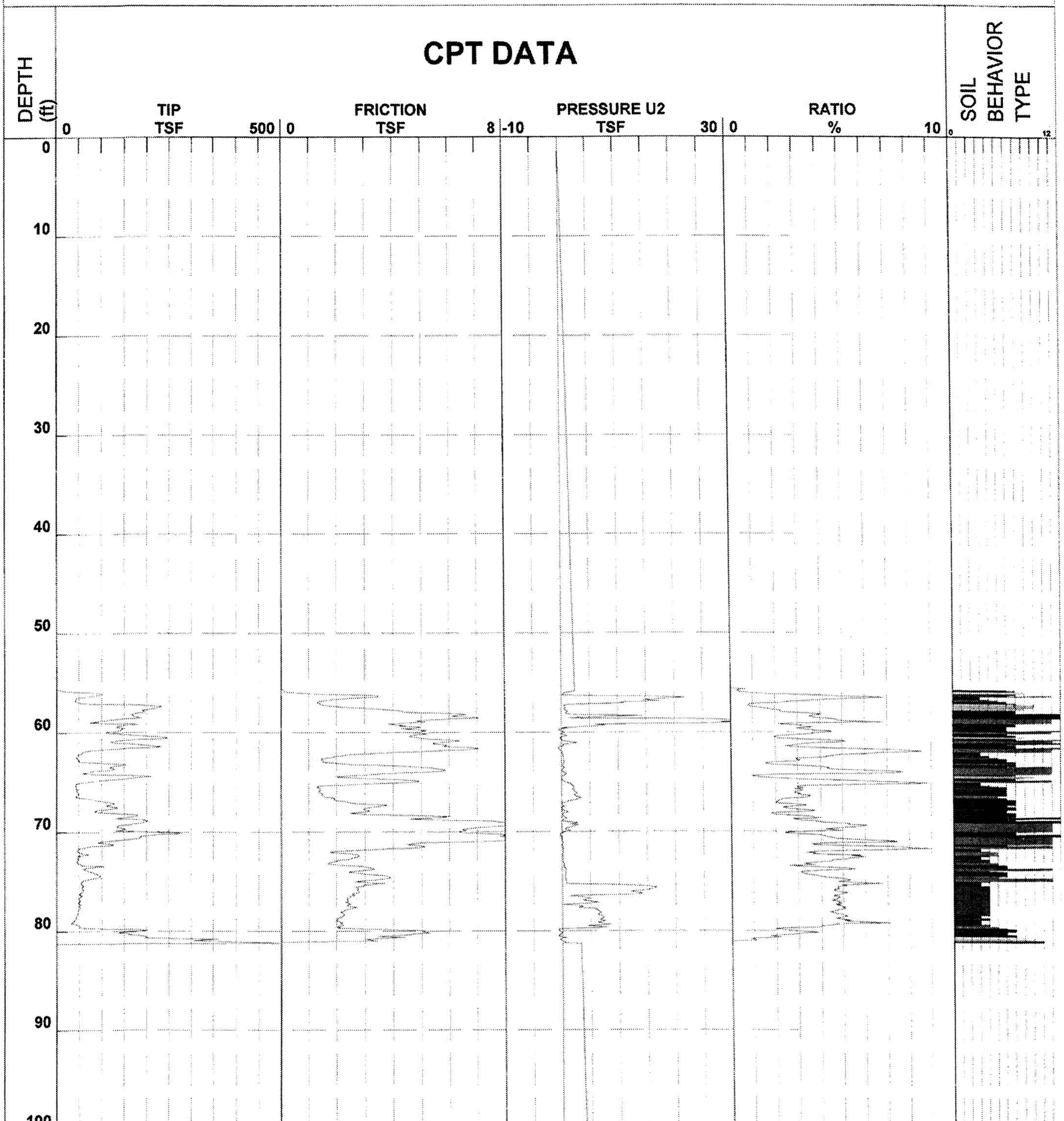
Plate 1 of 1

CPT Data

FUGRO

Job Number	1907-0075	CPT Number	C-2106	Location	Exelon Victoria, TX
Operator	Albert Fonseca	Date and Tin	02-Dec-2007 08:50:26	Cone Number	F7.5CKEW2/B 1831
Client	MACTEC	Elevation	79.59	Water Table	ND
Coord. North	13412291.55	Coord. East	2~~2~~99955.62 5 ZHU 4/29/08	Check:	Verify:



1 - sensitive fine grained
4 - silty clay to clay
7 - silty sand to sandy silt
10 - gravelly sand to sand
2 - organic material
5 - clayey silt to silty clay
8 - sand to silty sand
11 - very stiff fine grained (*)
3 - clay
6 - sandy silt to clayey silt
9 - sand
12 - sand to clayey sand (*)

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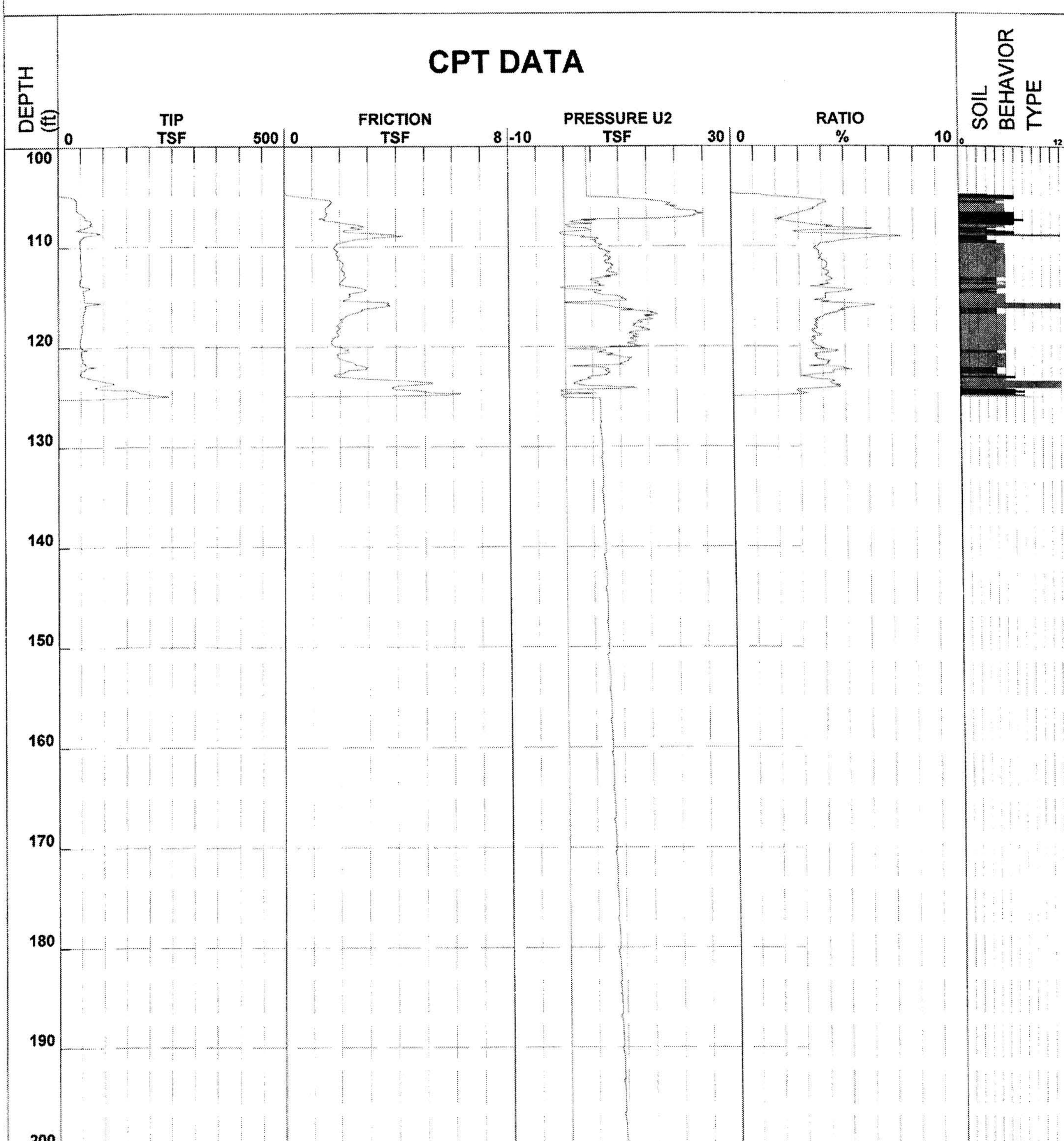
Plate 1 of 3

CPT Data

Job Number	1907-0075	CPT Number	C-2106	Location	Exelon Victoria, TX
Operator	Albert Fonseca	Date and Tin	02-Dec-2007 08:50:26	Cone Number	F7.5CKEW2/B 1831
Client	MACTEC	Elevation	79.59	Water Table	ND
Coord. North	13412291.55	Coord. East	2599955.62		Check: Verify:



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

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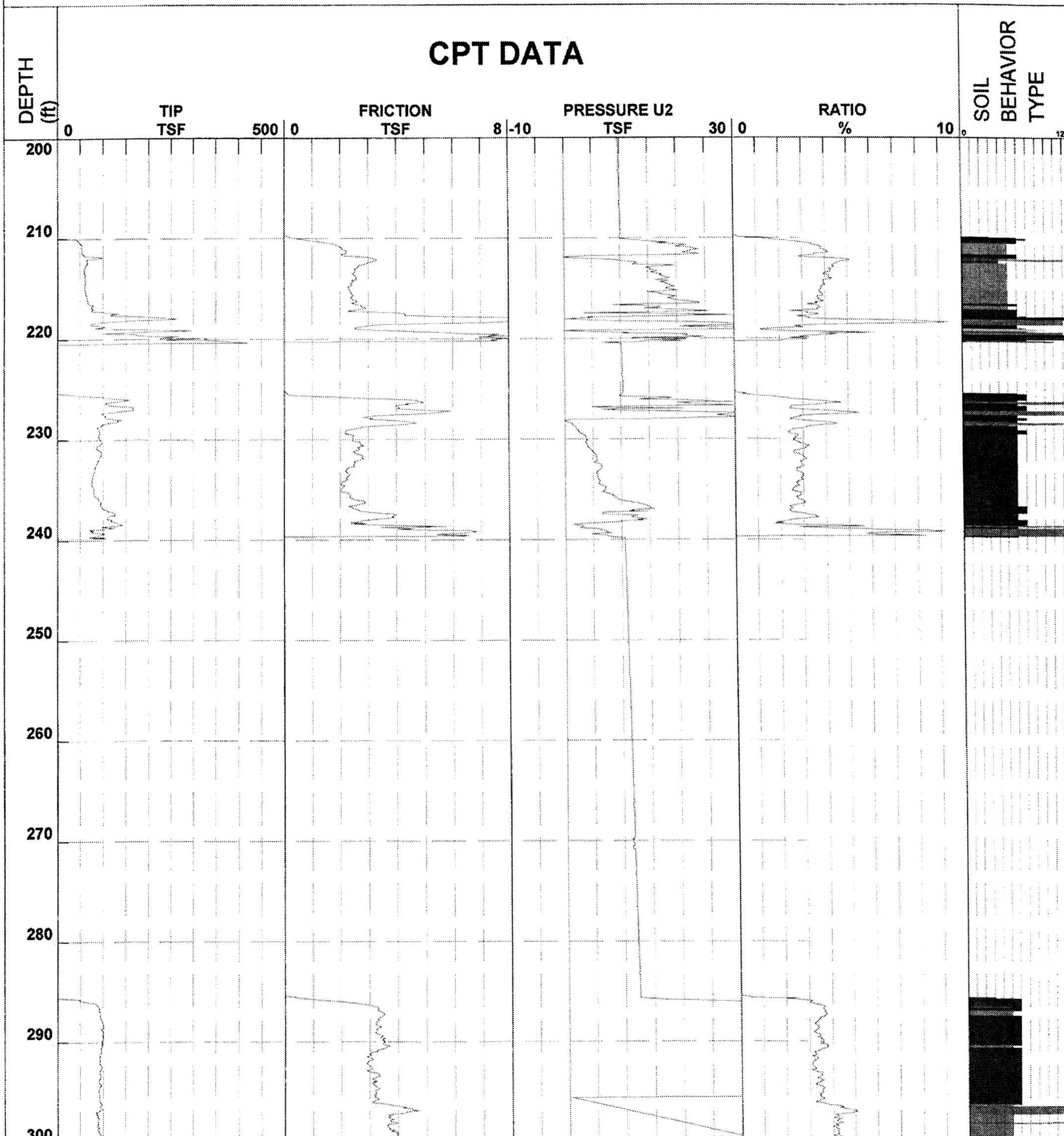
Plate 2 of 3

CPT Data

FUGRO

Job Number	1907-0075	CPT Number	C-2106	Location	Exelon Victoria, TX
Operator	Albert Fonseca	Date and Tin	02-Dec-2007 08:50:26	Cone Number	F7.5CKEW2/B 1831
Client	MACTEC	Elevation	79.59	Water Table	ND
Coord. North	13412291.55	Coord. East	2599955.62	Check:	Verify:



1 - sensitive fine grained
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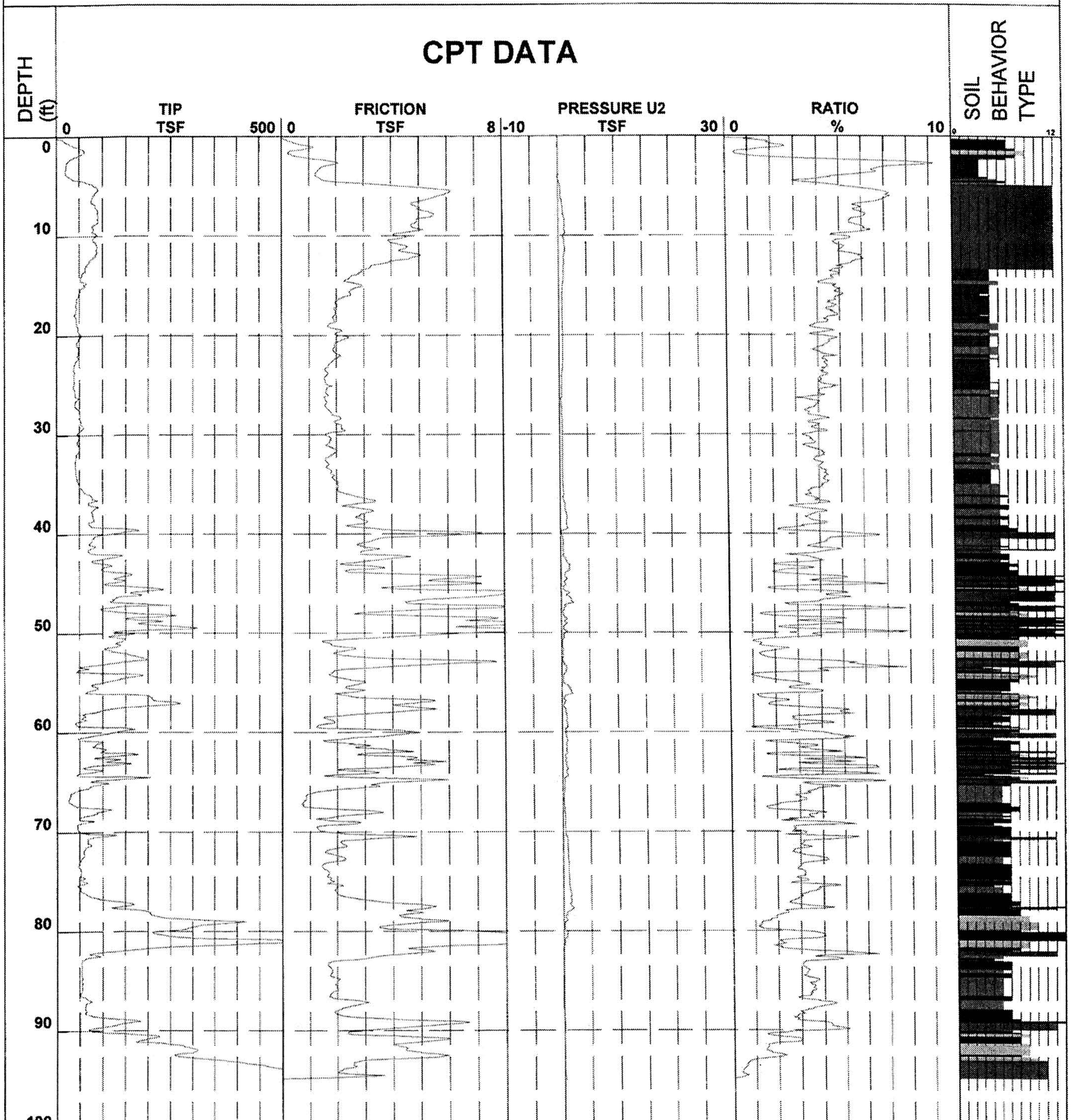
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Robertson et al. 1986 * Overconsolidated or Cemented

Plate 3 of 3

CPT Data

Job Number	1907-0075	CPT Number	C-2107	Location	Exelon Victoria, TX
Operator	Albert Fonseca	Date and Tin	29-Nov-2007 11:24:26	Cone Number	F7.5CKEW2/B 1832
Client	MACTEC	Elevation	79.96	Water Table	ND
Coord. North	13412304.73	Coord. East	2600042.26	Check: DB	Verify:



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

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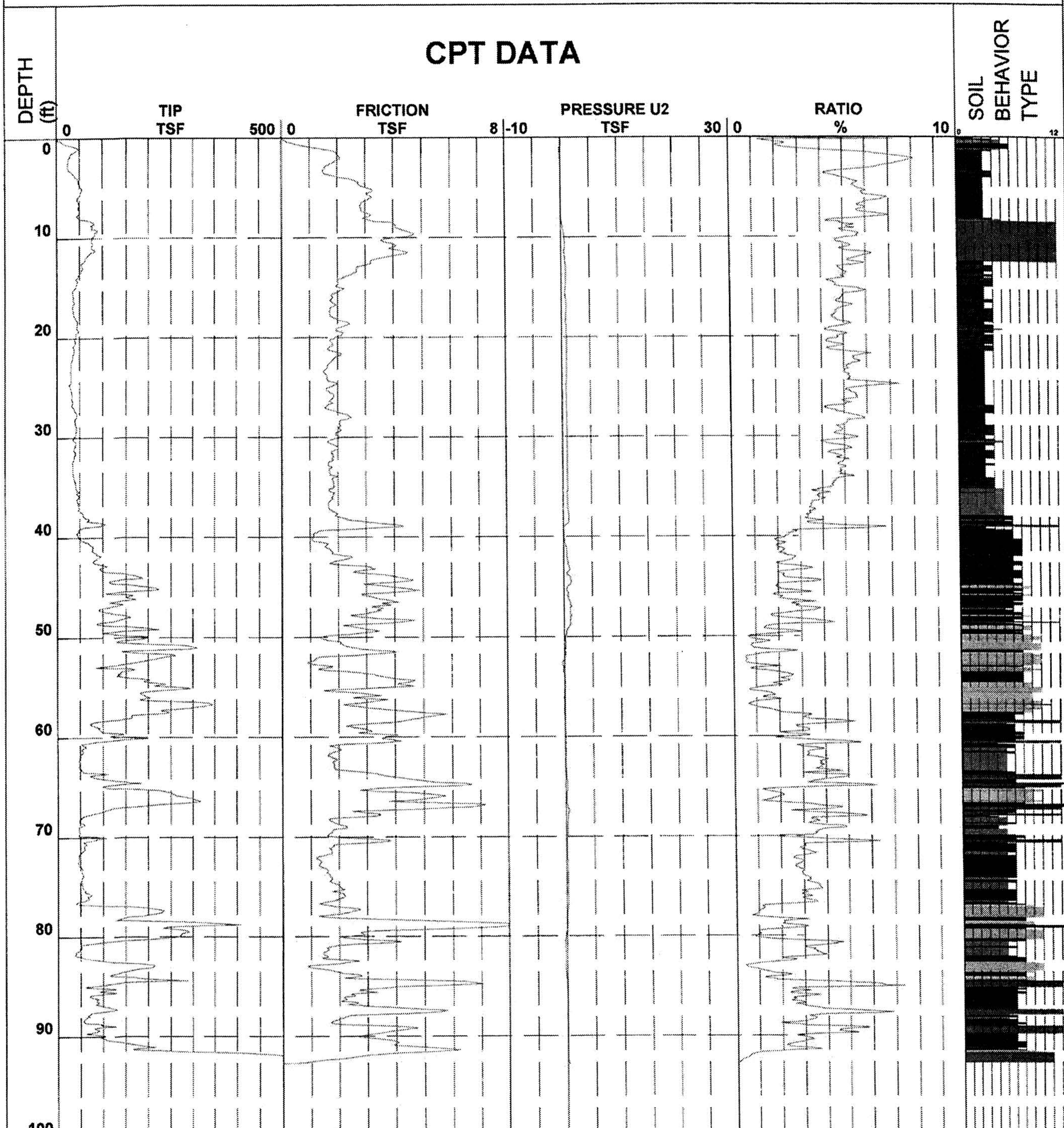
CPT Data

FUGRO

Job Number	1907-0075	CPT Number	C-2108	Location	Exelon Victoria, TX
Operator	Albert Fonseca	Date and Tir	30-Nov-2007 08:17:35	Cone Number	F7.5CKEW2/B 1831
Client	MACTEC	Elevation	79.78	Water Table	ND
Coord. North	13412425.89	Coord. East	2600105.91	Check: DB	Verify:



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

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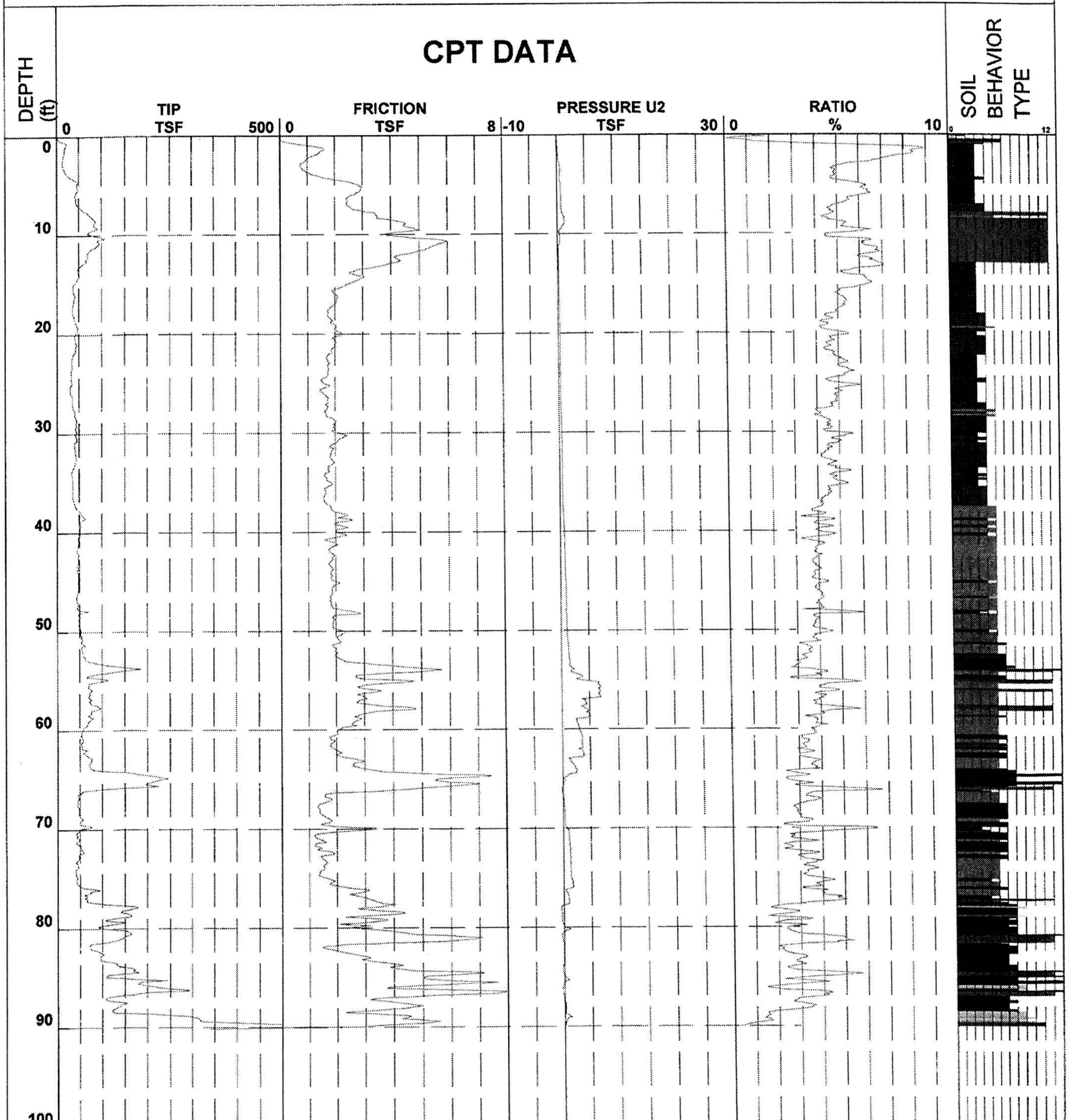
CPT Data

FUGRO

Job Number	1907-0075	CPT Number	C-2109S	Location	Exelon Victoria, TX
Operator	Albert Fonseca	Date and Tir	14-Nov-2007 13:07:39	Cone Number	A15F2.5CKE3S1788
Client	MACTEC	Elevation	79.93	Water Table	ND
Coord. North	13412545.94	Coord. East	2600138.83	Check: DB	Verify:



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

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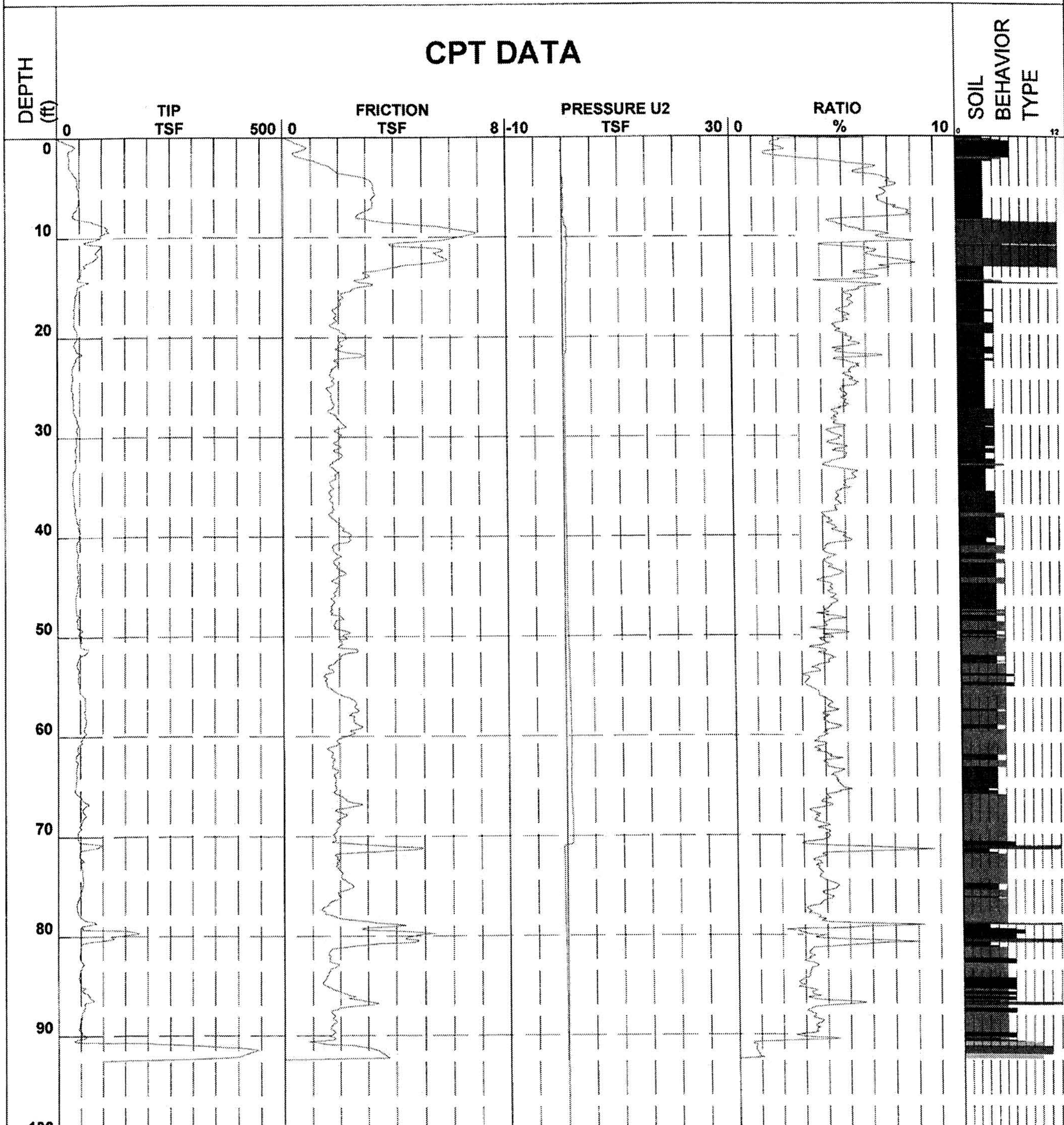
CPT Data

FUGRO

Job Number	1907-0075	CPT Number	C-2110	Location	Exelon Victoria, TX
Operator	Albert Fonseca	Date and Tin	30-Nov-2007 10:10:21	Cone Number	F7.5CKEW2/B 1831
Client	MACTEC	Elevation	80.0	Water Table	ND
Coord. North	13412478.15	Coord. East	2600217.10	Check: PB	Verify:



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

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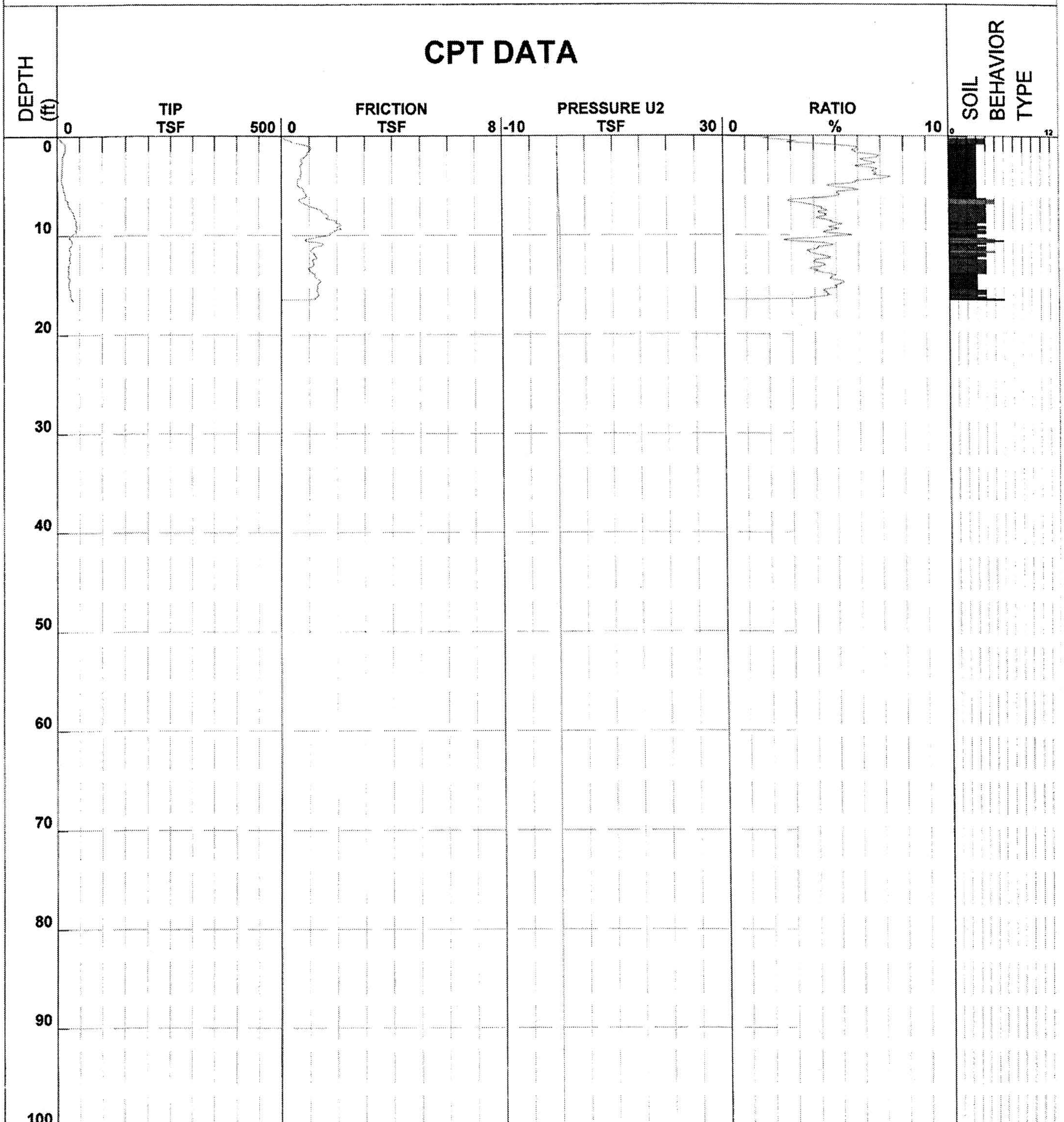
CPT Data - DISREGARD

Job Number	1907-0075	CPT Number	C-2111	Location	Exelon Victoria-TX
Operator	Albert Fonseca	Date and T	29-Nov-2007 14:04:35	Cone Number	F7.5CKEW2/B 1832
Client	MACTEC	Elevation	78.04	Water Table	ND
Coord. North	13412225.65	Coord. East	2600089.78	Check:NA	Verify:NA



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

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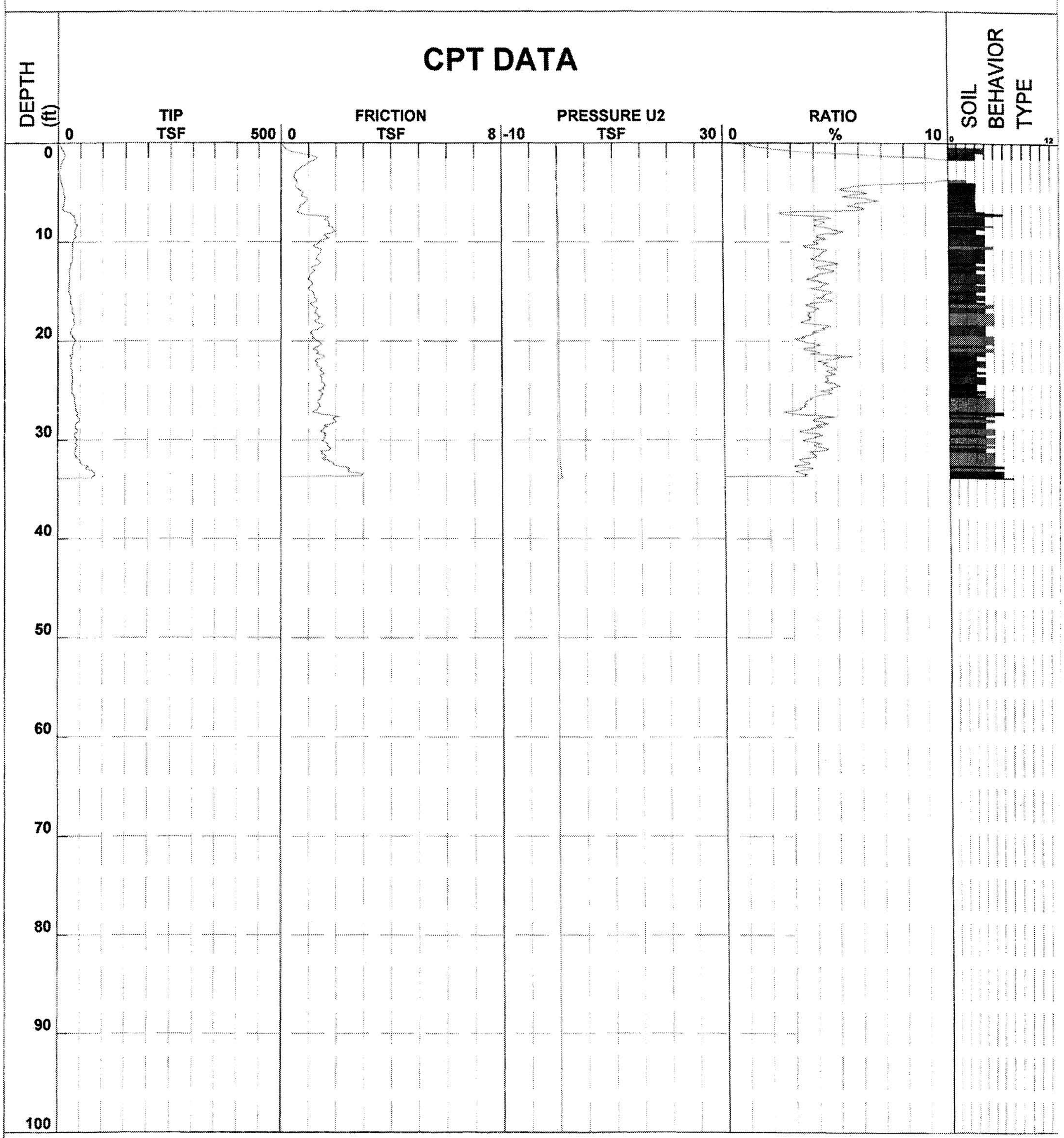
CPT Data - DISREGARD

Job Number	1907-0075	CPT Number	C-2111A	Location	Exelon Victoria-TX
Operator	Albert Fonseca	Date and T	29-Nov-2007 14:29:53	Cone Number	F7.5CKEW2/B 1832
Client	MACTEC	Elevation	78.14	Water Table	ND
Coord. North	13412224.80	Coord. East	2600089.84	Check:NA	Verify:NA



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

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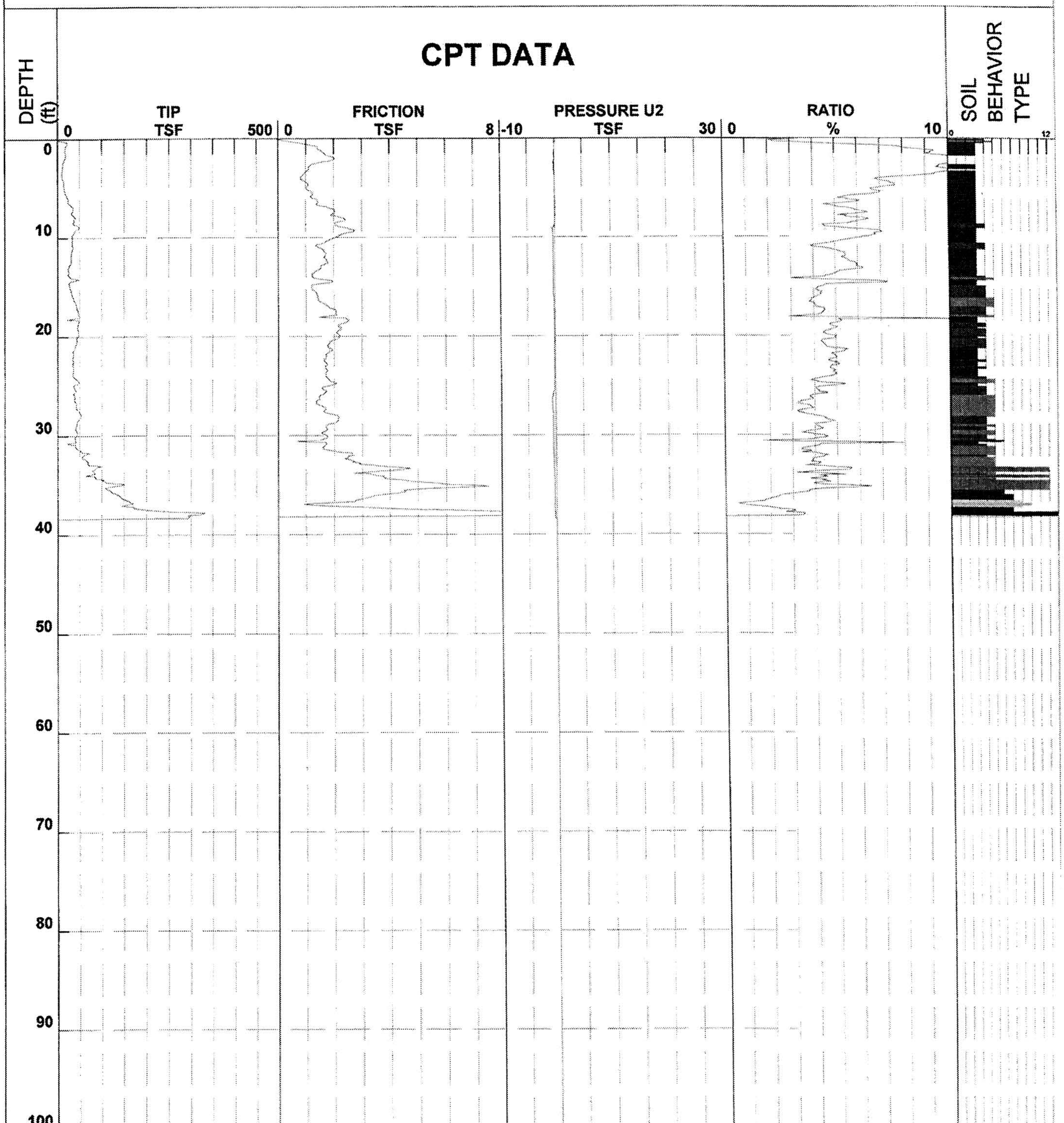
CPT Data - DISREGARD

FUGRO

Job Number	1907-0075	CPT Number	C-2111B	Location	Exelon Victoria-TX
Operator	Albert Fonseca	Date and T	30-Nov-2007 11:38:57	Cone Number	F7.5CKEW2/B 1831
Client	MACTEC	Elevation	78.28	Water Table	ND
Coord. North	13412225.10	Coord. East	2600087.29	Check:NA	Verify:NA

CPT DATA



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

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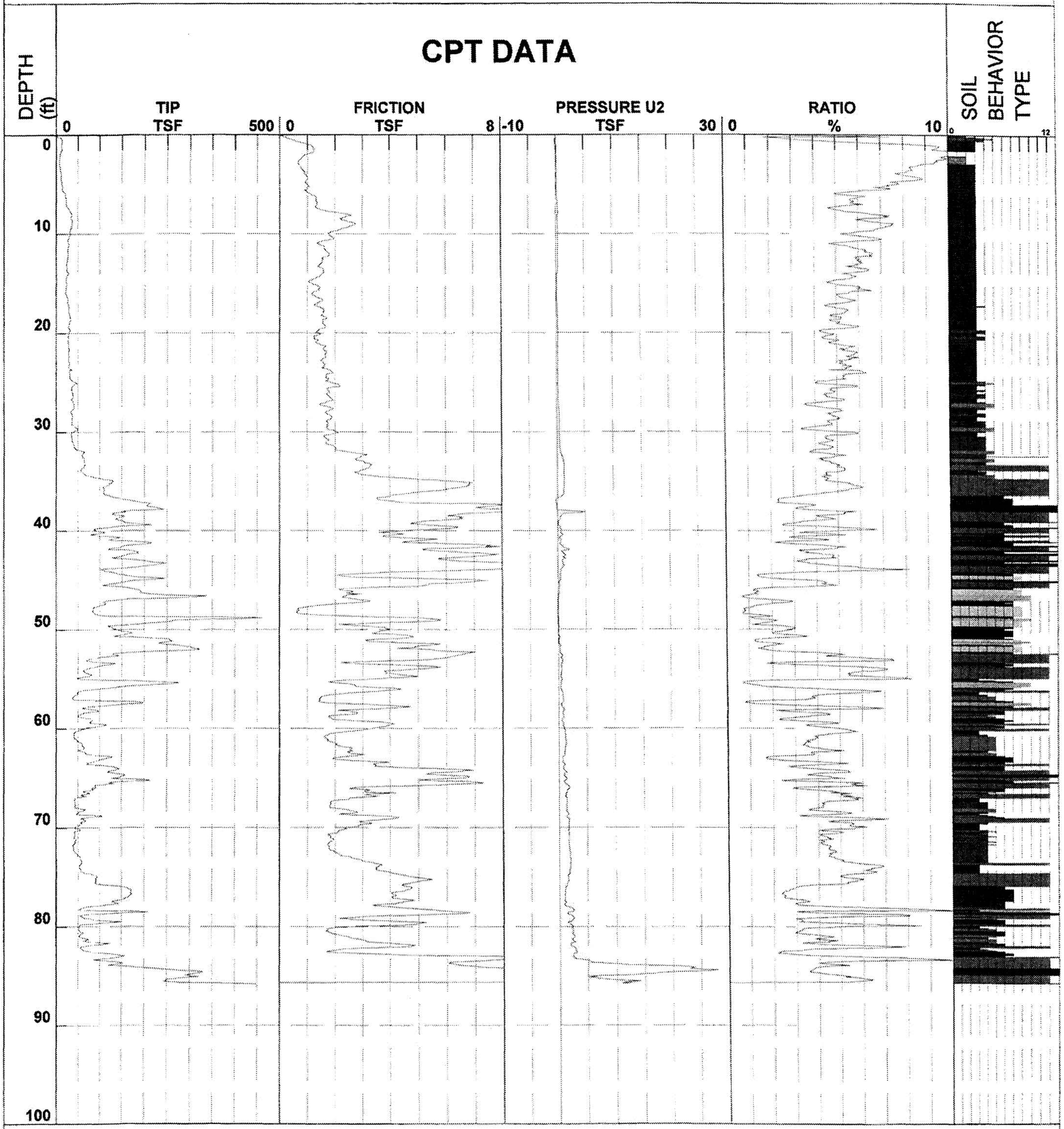
CPT Data - DISREGARD

FUGRO

Job Number	1907-0075	CPT Number	C-2111C	Location	Exelon Victoria-TX
Operator	Albert Fonseca	Date and T	30-Nov-2007 13:29:55	Cone Number	F7.5CKEW2/B 1831
Client	MACTEC	Elevation	78.04	Water Table	ND
Coord. North	13412238.89	Coord. East	2600087.16	Check:NA	Verify:NA



1 - sensitive fine grained
4 - silty clay to clay
7 - silty sand to sandy silt
10 - gravelly sand to sand
2 - organic material
5 - clayey silt to silty clay
8 - sand to silty sand
11 - very stiff fine grained (*)
3 - clay
6 - sandy silt to clayey silt
9 - sand
12 - sand to clayey sand (*)

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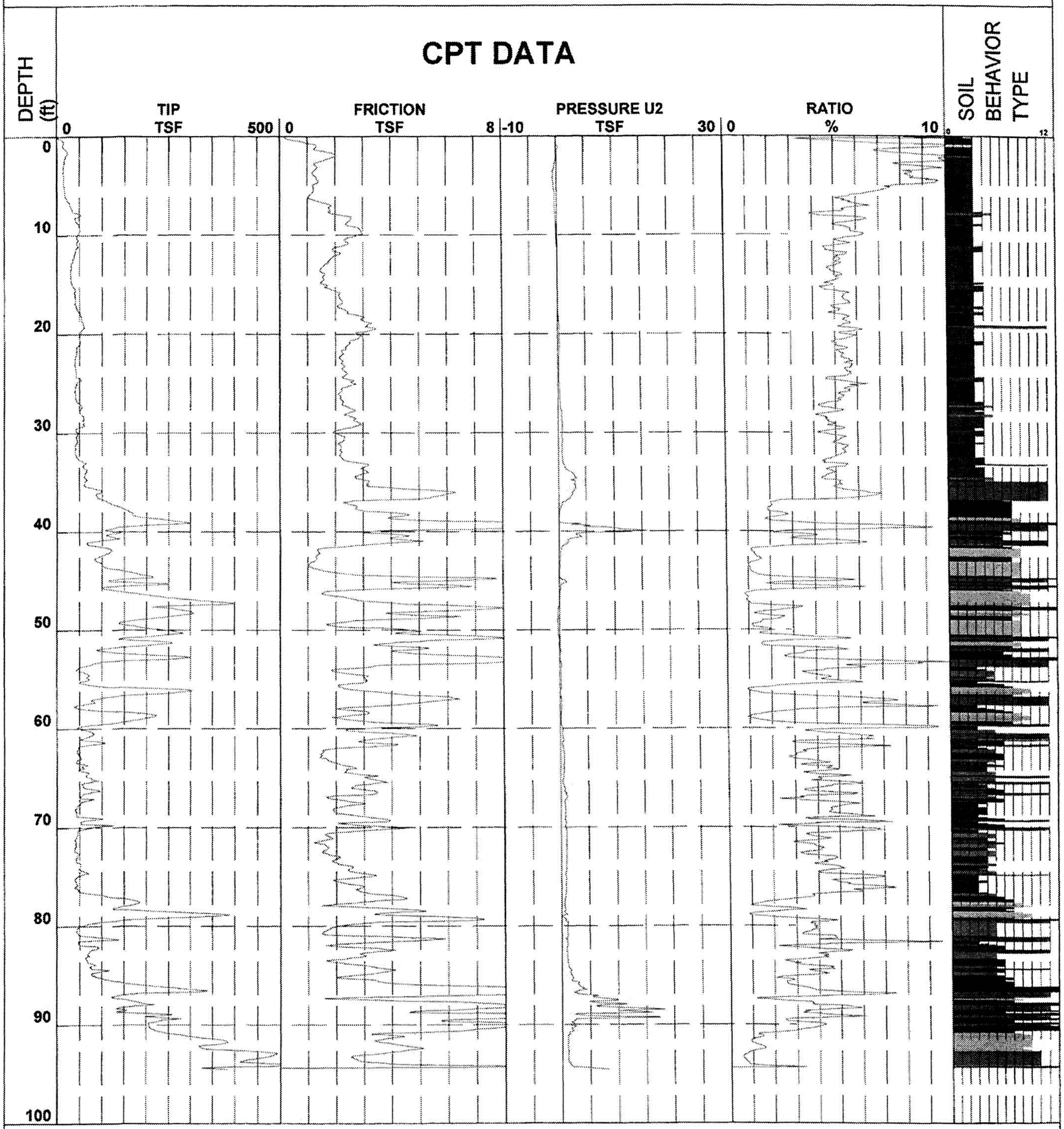
CPT Data

Job Number	1907-0075	CPT Number	C-2111D	Location	Exelon Victoria, TX
Operator	Albert Fonseca	Date and Tin	30-Nov-2007 14:54:45	Cone Number	F7.5CKEW2/B 1831
Client	MACTEC	Elevation	79.22	Water Table	ND
Coord. North	13412212.18	Coord. East	2600086.06	Check:	Verify:



1 - sensitive fine grained | 4 - silty clay to clay | 7 - silty sand to sandy silt | 10 - gravelly sand to sand
2 - organic material | 5 - clayey silt to silty clay | 8 - sand to silty sand | 11 - very stiff fine grained (*)
3 - clay | 6 - sandy silt to clayey silt | 9 - sand | 12 - sand to clayey sand (*)

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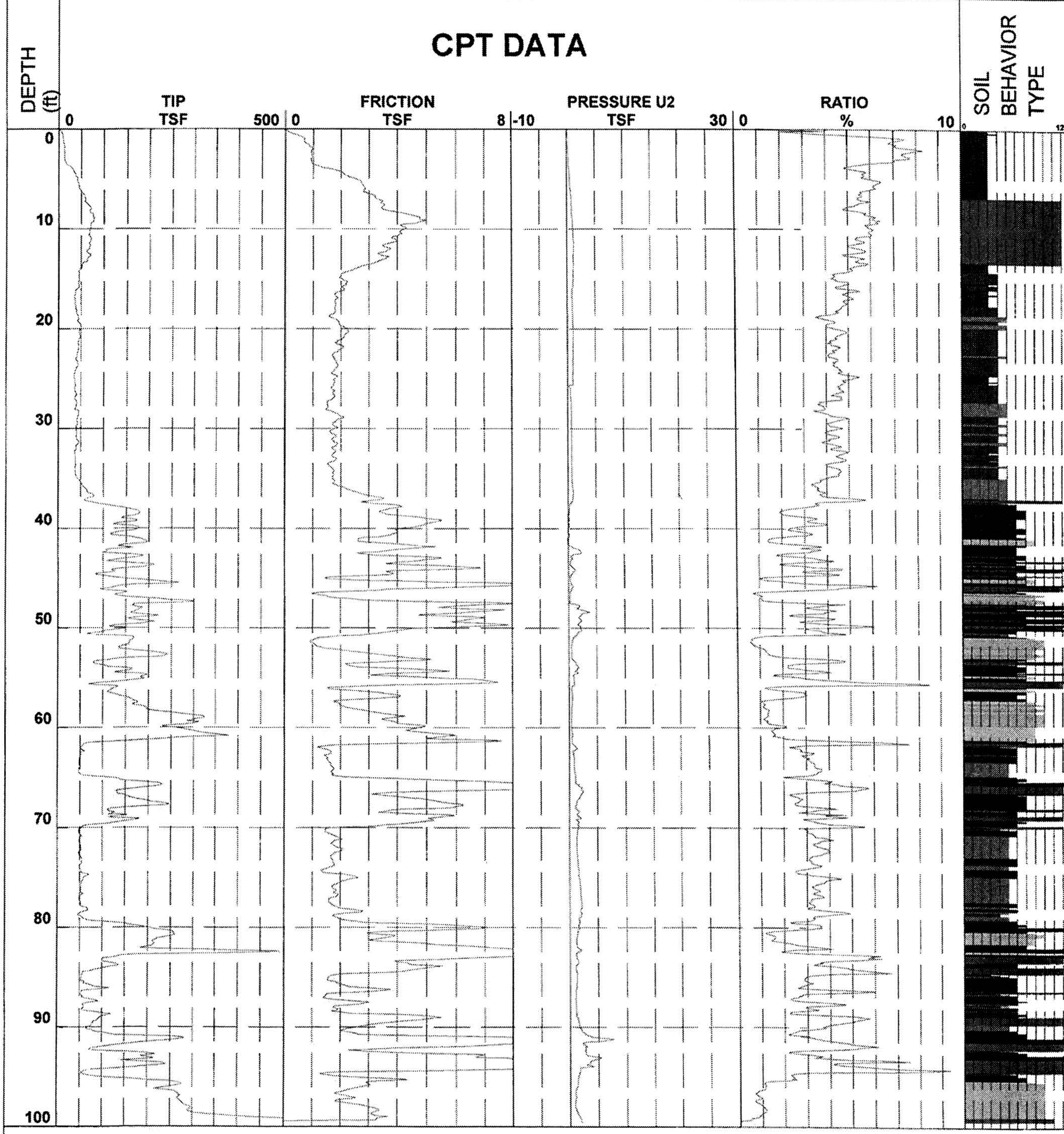
CPT Data

Job Number	1907-0075	CPT Number	C-2112	Location	Exelon Victoria, TX
Operator	Albert Fonseca	Date and Tir	29-Nov-2007 15:38:28	Cone Number	F7.5CKEW2/B 1832
Client	MACTEC	Elevation	79.55	Water Table	ND
Coord. North	13412358.60	Coord. East	2600185.71	Check: DRS	Verify:

CPT DATA



- 1 - sensitive fine grained
- 2 - organic material
- 3 - clay
- 4 - silty clay to clay
- 5 - clayey silt to silty clay
- 6 - sandy silt to clayey silt
- 7 - silty sand to sandy silt
- 8 - sand to silty sand
- 9 - sand
- 10 - gravelly sand to sand
- 11 - very stiff fine grained (*)
- 12 - sand to clayey sand (*)

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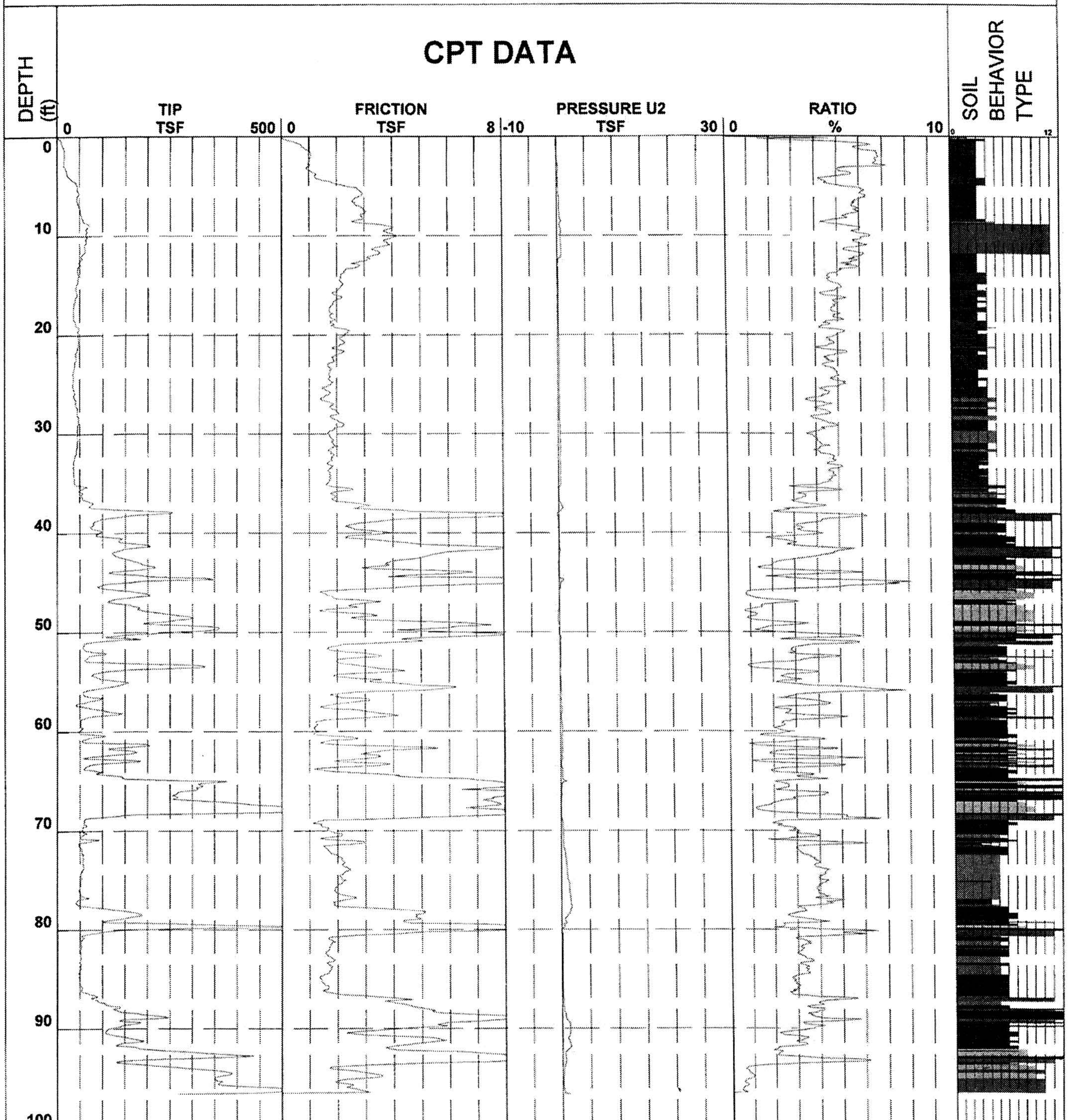
CPT Data

FUGRO

Job Number	1907-0075	CPT Number	C-2113	Location	Exelon Victoria, TX
Operator	Albert Fonseca	Date and Tin	29-Nov-2007 09:18:51	Cone Number	F7.5CKEW2/B 1832
Client	MACTEC	Elevation	79.31	Water Table	ND
Coord. North	13412251.45	Coord. East	2600231.11	Check: DB	Verify:



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

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