TESORO

Tesoro Environmental Resource Company
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11 March, 2011

Mr. Jerry Wickham
Hazardous Materials Specialist
Alameda County Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Subject: **Membrane Interface Probe Investigation Results and Work Plan for Deep Monitoring Well Installation**
1619 1st Street, Livermore, California
Tesoro No. 67076 (Former Beacon 3604); ACEH Case No. RO0434

Dear Mr. Wickham:

Enclosed please find a copy of the membrane interface probe investigation results and work plan for deep monitoring well installation for the subject site located at 1619 1st Street in Livermore, California. This report is submitted by Arctos Environmental on behalf of Tesoro Environmental Resources Company.

Based on my inquiry of the person or persons directly responsible for gathering the information contained in this report, I believe the information was prepared by qualified personnel who properly gathered and evaluated the information, and that the information submitted is, to the best of my knowledge and belief, true, correct, and complete. Please feel free to call me at 253/896-8700 or Matthew Nelson of Arctos Environmental at 562/988-2755 with questions.

Sincerely,

Jeffrey M. Baker, P.E.
Supervisor, Environmental
Compliance & Remediation
Tesoro Companies, Inc.

Attachments

CC: Arctos – Matthew Nelson

[S:\Tesoro\01LV\LTR\LTR044.doc] 3/10/11

ARCTOS

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11 March 2011
Project No. 01LV

Jerry Wickham
Hazardous Materials Specialist
Alameda County Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-6577

Subject: Membrane Interface Probe Investigation Results and Work Plan for Deep Monitoring Well Installation
1619 1st Street, Livermore, California
Tesoro No. 67076 (Former Beacon 3604); ACEH Case No. RO0000434

Dear Mr. Wickham:

Arctos Environmental (Arctos), on behalf of Tesoro Environmental Resources Company (Tesoro), is submitting the results of a membrane interface probe (MIP) investigation and a work plan for installation of a deep monitoring well at the subject site (Figure 1). The investigation was conducted in accordance with Arctos's work plan dated 19 November 2010 and approved by and Alameda County Environmental Health (ACEH) in a letter dated 30 December 2010.

Executive Summary

Arctos performed a MIP investigation to assess the lateral and vertical extent of free product after it was detected at the site on 25 October 2010 in injection well IP-8. The investigation was conducted on 3 and 4 January and 24 through 26 January 2011. The highest impacts were generally encountered between 55 and 70 feet below grade in the southwest portion of the site near the underground storage tanks (USTs). These impacts are approximately 20 feet below the top of the current water table. Based on the results of the MIP borings, Arctos recommends installation of an offsite deep monitoring well just downgradient of the USTs.

Site Background

Arctos detected free product at the site on 25 October 2010 in injection well IP-8, which is located in the southwest portion of the site adjacent to the USTs (Figure 2). Free

product was measured at an approximate thickness of 1 foot on 25 October 2010 before removal by manual bailing. Since the detection and initial removal of free product in IP-8 there has not been more than 0.02 foot of product detected in the well. Free product was not detected in any other wells in the area. Injection well IP-8 and adjacent injection well IP-9 contain the highest total petroleum hydrocarbons as gasoline (TPHg) and benzene, toluene, ethylbenzene, and total xylenes (BTEX) concentrations at the site.

A complete site description and background are included in Arctos's IRAP dated 21 March 2008 (Arctos, 2008).

MIP Investigation Objective and Scope of Work

The objective of the MIP investigation was to evaluate the vertical and lateral extent of the free product adjacent to the USTs. To meet this objective, Arctos performed the following scope of work:

1. Arctos mobilized for the MIP investigation, which included (1) marking for underground service alert (USA), (2) obtaining a boring permit from Zone 7 Water Agency, (3) obtaining an encroachment permit from the City of Livermore, and (4) preparing a site-specific health and safety plan (HSP).

2. A licensed drilling contractor was retained to drill 10 soil borings, designated as MIP-1 to MIP-10 (Figure 2). A MIP was advanced in each boring to produce continuous chemical and physical logs of the vadose and saturated zones (Appendices A and B, respectively).

3. Borings were backfilled with Portland cement grout and patched to match the existing grade.

4. A licensed surveyor was contracted to survey the boring locations (Appendix C).

MIP Technology and Field Program

The MIP is a direct-push tool that produces continuous chemical and physical logs of the vadose and saturated zones. It measures volatile organic compounds (VOCs) in situ and shows where they occur relative to the geologic and hydrologic units. The MIP is a downhole tool that heats the soils and groundwater adjacent to the probe to 120°C. The heat volatilizes VOCs, which diffuse across a membrane into a closed inert gas loop that carries these vapors to a series of detectors housed at the surface. Typically, an electron capture detector (ECD) is used to detect chlorinated solvents, a photoionization detector (PID) is used to detect petroleum hydrocarbons, and a flame ionization detector (FID) is

used to detect methane. The MIP preferentially detects VOCs that are sorbed to soil particles over those dissolved in groundwater. Continuous chemical logs or profiles are generated from each borehole. Soil lithologic logs are also developed using measurements of cone bearing, sleeve friction, and pore water pressure to be compared to the chemical logs to better understand where the VOCs occur.

On 3 and 4 January and 24 through 26 January 2011, Gregg Drilling & Testing, Inc., of Martinez, California, advanced 10 MIP borings to depths ranging from 59 to 83 feet below grade using a truck-mounted cone penetration testing (CPT) rig. The MIP was operated by a field technician from Vironex, Inc., of Santa Ana, California. Qualitative responses were obtained during the MIP investigation from the gas stream passed through the ECD, PID, and FID. The results were viewed in real time during the field program.

Appendix A contains the MIP results and field quality assurance/quality control (QA/QC) procedures. Appendix B contains the boring logs and Appendix D presents the general field investigation and QA/QC procedures.

MIP Investigation Results

The subsurface soil encountered during drilling generally consisted of silty sands to sands from the ground surface to approximately 60 feet below grade with an approximate 10-foot layer of silts and clays from 20 to 30 feet below grade. Silts, clays, and cemented sands were encountered at a depth of approximately 60 feet below grade. In the two deepest borings (MIP-2 and MIP-7), sands to silty sands were encountered from approximately 80 feet to the total depth of 83 feet below grade.

Depth to groundwater was measured at 32.3 feet below the top of casing on 1 February 2011 at nearby groundwater monitoring well MW-11. Geologic cross sections are shown on Figures 3 and 4.

The FID was the primary detector used to detect petroleum hydrocarbons (Figure 2). The highest FID responses were generally encountered between 55 and 70 feet below grade (approximately 20 feet below the top of the current water table). The highest FID responses on site were reported at MIP-1 and MIP-7, located near injection well IP-9 at the southwest corner of the USTs. Offsite FID responses were observed northwest of these borings at MIP-4 and MIP-5, in the direction of the general groundwater gradient, and further downgradient at MIP-9. MIP-6, MIP-8, and MIP-10 were advanced off site and produced significantly lower or no FID responses, indicating that the contaminant plume is likely delineated off site to the north and south. Additional borings could not be installed northwest of MIP-9 due to access constraints at the intersection of P and 1st Streets.

The borings closest to the USTs, MIP-1 through MIP-3, also had FID responses at approximately 30 feet below grade. The onsite petroleum hydrocarbons impacts from 55 to 70 feet were delineated to the north by MIP-2 and MIP-3, with reduced FID responses. Petroleum hydrocarbons at this deeper interval had previously been delineated to the south at injection well IP-10. Figures 3 and 4 show geologic cross sections with locations of contaminant plumes based on FID responses.

Work Plan for Deep Monitoring Well Installation

Arctos is proposing to install a deep groundwater well (designated as DW-8) to monitor petroleum hydrocarbon impacted-groundwater detected in the MIP investigation. Well DW-8 will be installed in South P Street downgradient of MIP-1 and MIP-7 (Figure 2). To meet this objective, Arctos will perform the following scope of work:

1. Mobilize for well installation including (1) marking for USA, (2) obtaining well permits from Zone 7 Water Agency, (3) obtaining an encroachment permit from the City of Livermore, and (4) preparing a site-specific HSP.

2. Drill a soil boring and collect soil samples 5 feet below grade and at 5-foot intervals for visual logging using the Unified Soil Classification System (USCS) and field headspace measurements using a PID.

3. Install and develop the deep monitoring well DW-8, screened between 55 and 65 feet below grade (Figure 5).

4. Collect groundwater sample from the new well for laboratory analysis.

5. Submit the water sample and selected soil samples to a State-certified laboratory for analysis of TPHg, BTEX, methyl tert-butyl ether, tert-butyl alcohol, other oxygenates, lead scavengers, methanol, and ethanol analyses using EPA Method 8260B.

6. Survey the new well.

7. Evaluate the field analytical data and incorporate the results into the next quarterly status report.

Details of Arctos's field procedures for the proposed field program are described in Appendix E. A well construction diagram for the proposed groundwater monitoring well is shown on Figure 5. Field personnel may adjust the actual well depth and screen

placement as required by the field conditions encountered. Arctos will evaluate the field and analytical data and incorporate the results into the next quarterly status report. The report will include the following:

- ☐ Field activities and sampling procedures (including boring/well construction log, development log, sampling log, and a figure showing the well location)
- ☐ Laboratory analytical results presented in tables.

Schedule

Arctos is requesting approval to conduct the well installation activities in the second quarter 2011.

If you have any questions or comments, please call Mike Purchase at 510/525-2180 or Matthew Nelson at 562/988-2755.

Very truly yours,

ARCTOS ENVIRONMENTAL

Matthew J. Nelson, P.E.
Project Engineer

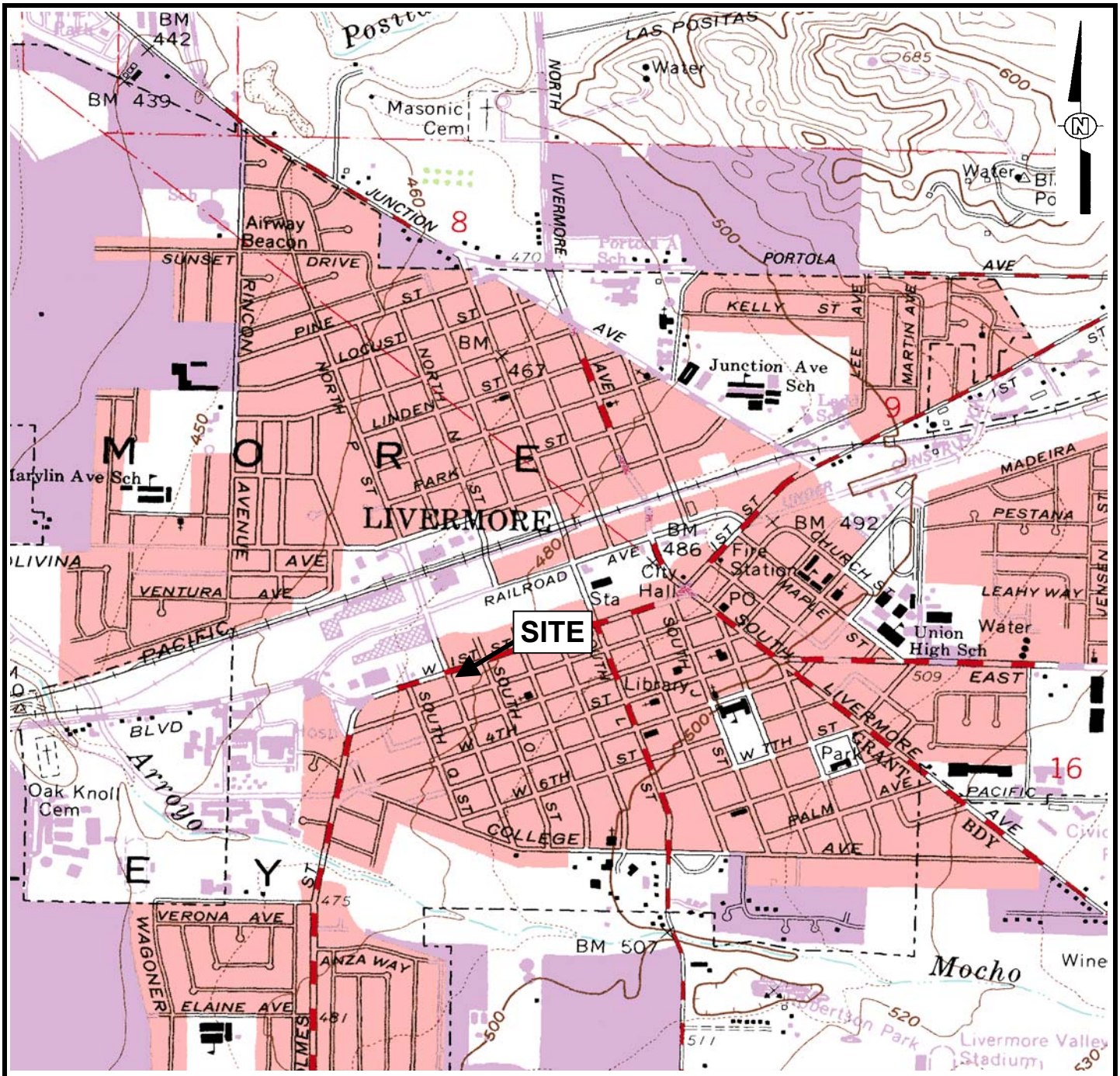
Michael P. Purchase, P.E.
Senior Project Manager

Copy: Jeffrey M. Baker, P.E. – Tesoro Companies, Inc.
Colleen Winey – Zone 7 Water Agency

Attachments: Figure 1 – Site Location Map
Figure 2 – Site Plan with MIP Boring Results
Figure 3 – Geologic Cross Section A-A' with MIP Results
Figure 4 – Geologic Cross Section B-B' with MIP Results
Figure 5 – Deep Monitoring Well Construction Diagram
Appendix A – Vironex MIP Report
Appendix B – Boring Logs
Appendix C – Survey Report
Appendix D – Field Investigation QA/QC Procedures
Appendix E – Well Installation QA/QC Procedures

References

Arctos Environmental, 2008. *Interim Remedial Action Plan for Groundwater, 1619 1st Street, Livermore, California, Tesoro Station No. 67076, Former Beacon Station No. 3604, ACEH Case No. RO0434,* 21 March.



REFERENCE

7.5 MINUTE USGS TOPOGRAPHIC MAP OF
LIVERMORE, CALIFORNIA QUADRANGLE
DATE: 1961, PHOTOREVISED 1980
SCALE = 1:24,000

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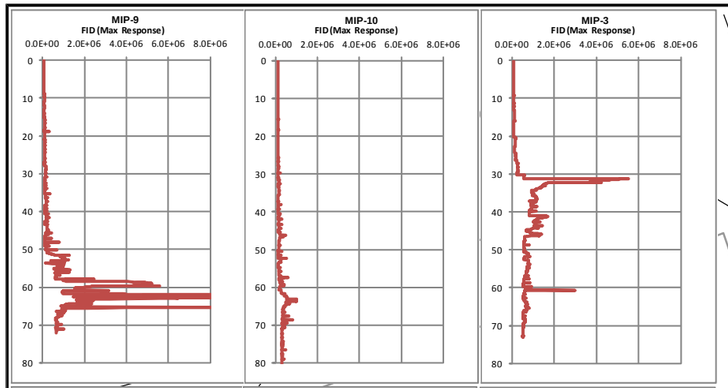
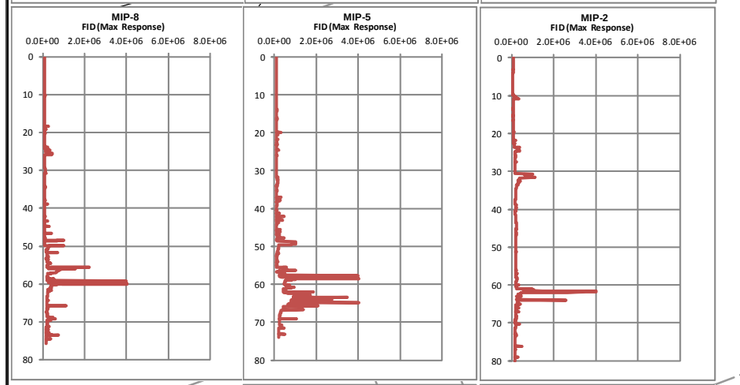
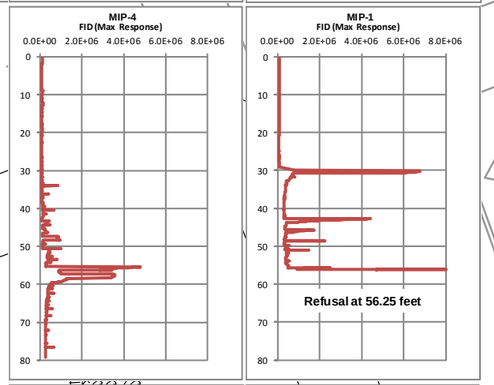
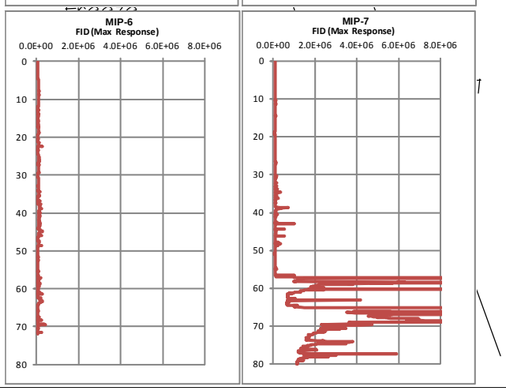
TESORO - LIVERMORE			
SITE LOCATION MAP			
PROJECT NO. 01LV	DRAWN BY MP	CHECKED BY MP	APPROVED BY JG
FILE NO. Site Map.xls		**FIGURE 1**	









Hollywood Video

MW-5

1st Street

Curb

Driveway

Driveway

MW-3

TPHg	190
Benzene	5.4
MTBE	3.4

TPHg	33,000
Benzene	49
MTBE	14

IP-7

IP-5

TPHg	270
Benzene	5.7
MTBE	20

IP-6

TP-2

IP-4

MW-2

DW-1

IP-3

TP-1

TPHg	8,000
Benzene	24
MTBE	0.51

TPHg	430
Benzene	6.4
MTBE	3.9

Canopy

VW-2

Dispenser Islands

IP-2

TPHg	2,700
Benzene	66
MTBE	3.3

Air/Water

B

A

IP-1

TPHg	33,000
Benzene	900
MTBE	ND

MIP-9

MIP-10

MIP-3

USTs

VW-3

South Street

Driveway

MIP-5

DW-8

IP-8

MIP-2

TPHg	83,000
Benzene	3,900
MTBE	ND

MIP-8

MIP-4

MW-11

Station Building

Trash Enclosure

MIP-1

IP-9

MIP-6

TPHg	92,000
Benzene	6,000
MTBE	ND

MIP-7

B'

MW-1

IP-10

A'

Equipment Area

Electrical Panel

TPHg	3,600
Benzene	73
MTBE	ND

Residence

Legend

- MW-1 — Groundwater Monitoring Well
- DW-1 — Deep Groundwater Monitoring Well
- IP-1 — Injection Well With May 2010 Total Petroleum Hydrocarbons as Gasoline (TPHg), Benzene, and Methyl Tert-Butyl Ether (MTBE) Results in Micrograms per Liter (µg/l)
- IP-6 △ — Angled Injection Well Screen Location With May 2010 TPHg, Benzene, and MTBE Results in µg/l
- VW-3 — Vapor Extraction Well (Not Connected to System)
- TP-2 — Monitoring Well/Vapor Extraction Well
- MIP-1 — January 2011 Membrane Interface Probe (MIP) Boring
- DW-8 — Proposed Deep Groundwater Monitoring Well
- A A' — Geologic Cross Section

Note:
Inset graphs display flame ionization detector (FID) responses for each MIP boring. Vertical axis represents depth in feet and horizontal axis reprsents FID response ranging from 0 to 8.0E6.

N

0 10' 20'
SCALE

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SITE PLAN WITH MIP BORING RESULTS

REVISION	NO.	BY	DATE	DESCRIPTION
1	0	MY	11/8/10	Fourth Quarter 2010 Monitoring Report
	1	MY	2/9/11	Site Investigation Report

PROJECT NO.	DRAWN BY	CHECKED BY	APPROVED BY
01LV	MY	MN	JPG

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FIGURE 2

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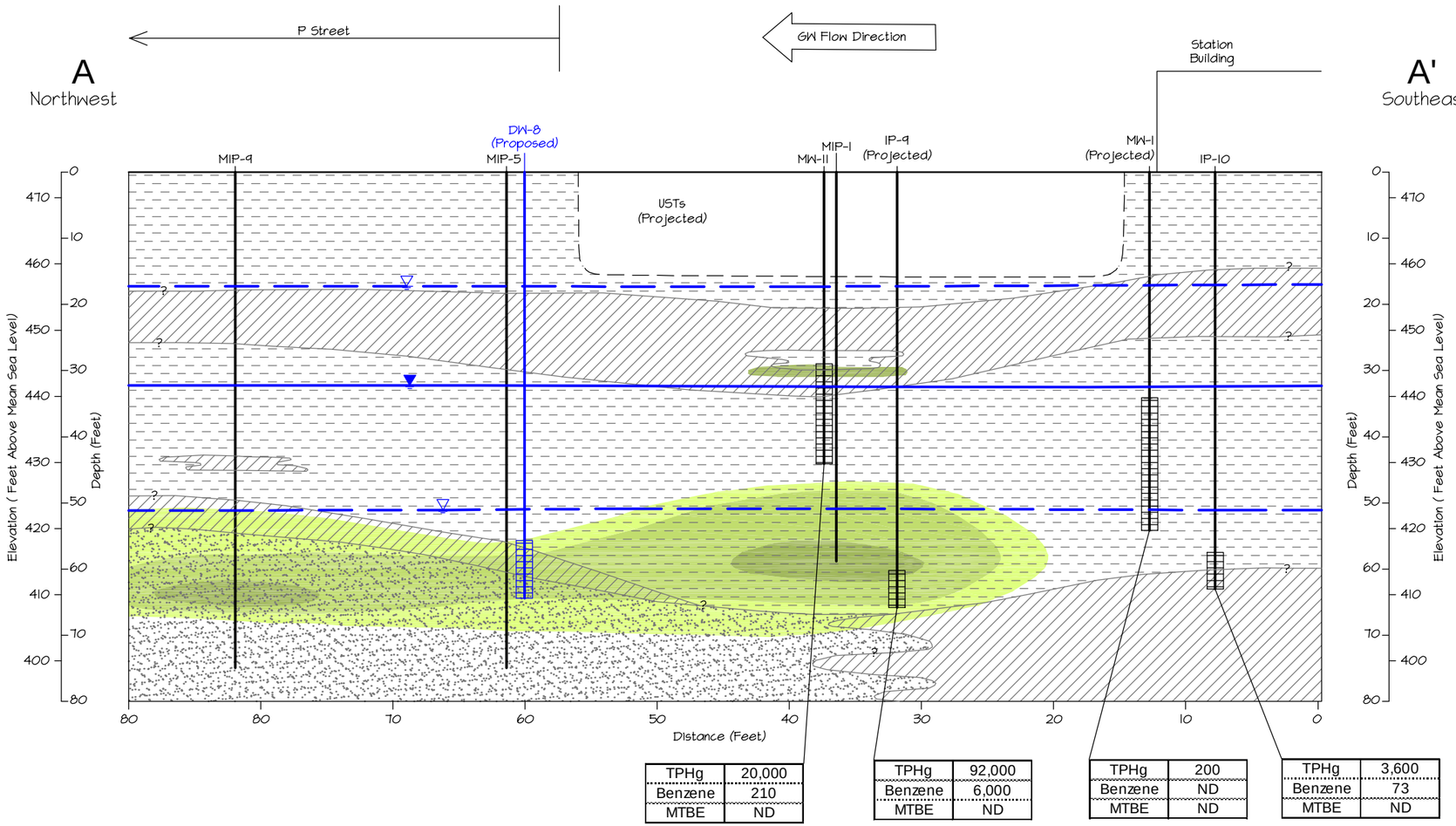

Legend

Soil Classification

- Silts and Clays
- Sands and Silty Sands
- Cemented Sands or Silts
- IP-9 — Well or Boring Identification
- Screened Interval
- Groundwater Elevation at MW-1 on 1 February 2011
- Historic High Groundwater Elevation at MW-1 (21 March 1996) and Historic Low Groundwater Elevation at MW-1 (4 August 2009)

Groundwater Results From May 2010 (IP-9, IP-10) or February 2011 (MW-1, MW-11)

TPHg	20,000 — Total Petroleum Hydrocarbons as Gasoline (µg/l)
Benzene	210 — Benzene (µg/l)
MTBE	ND — Methyl Tert-Butyl Ether (µg/l)

ND Not Detected at Reporting Limit

Flame Ionization Detector (FID) Response Contours From January 2011 Membrane Interface Probe (MIP) Borings

- 1.0E6 - 3.0E6
- 3.0E6 - 5.0E6
- >5.0E6

0 5 10 Horizontal Scale

0 10 20 Vertical Scale

REVISION	NO.	BY	DATE	DESCRIPTION
0	0	MY	2/10/11	Site Investigation Report

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GEOLOGIC CROSS SECTION A-A' WITH MIP RESULTS

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FIGURE 3

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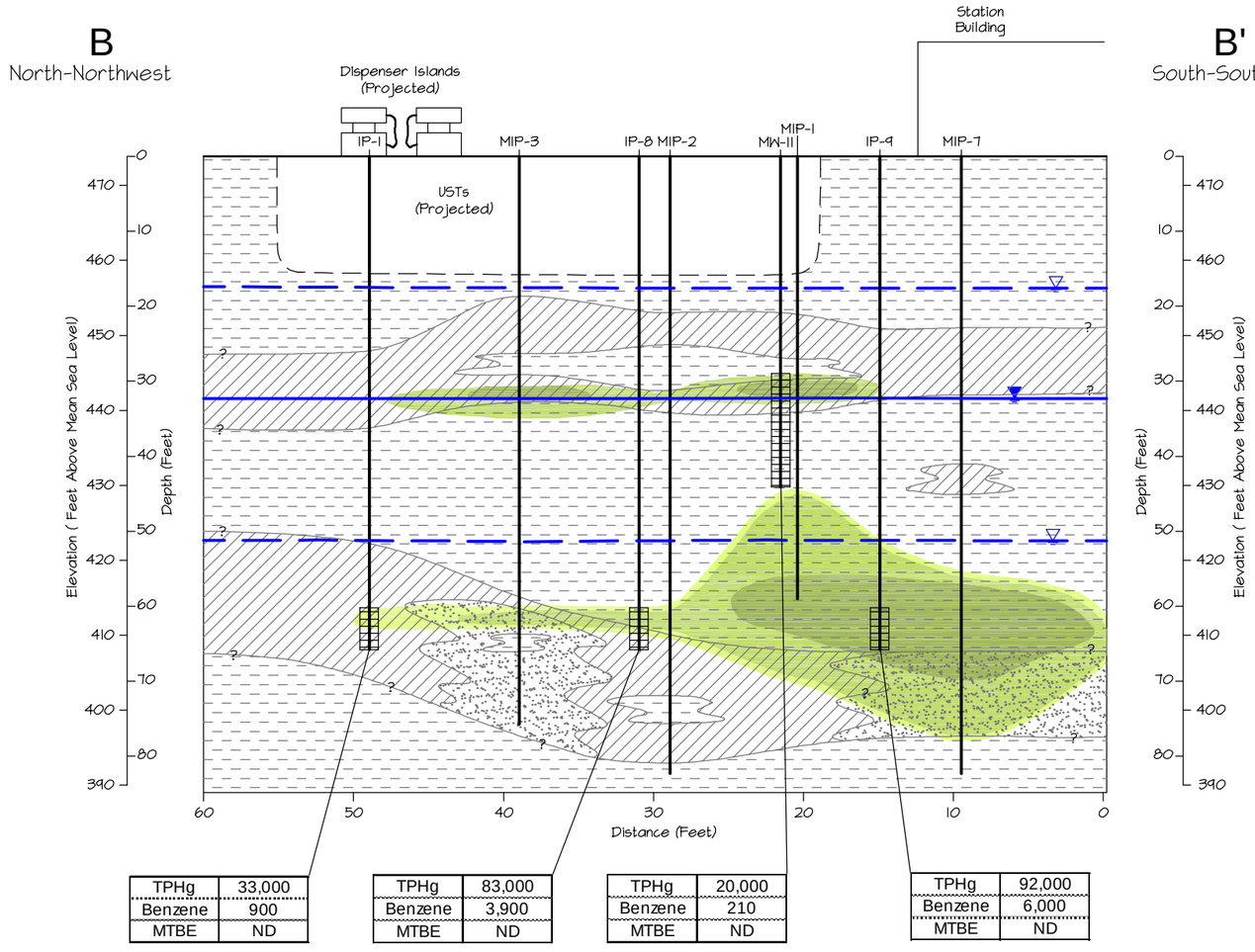

Legend

Soil Classification

- Silts and Clays
- Sands and Silty Sands
- Cemented Sands or Silts
- IP-9 — Well or Boring Identification
- Screened Interval
- Groundwater Elevation at MW-1 on 1 February 2011
- Historic High Groundwater Elevation at MW-1 (21 March 1996) and Historic Low Groundwater Elevation at MW-1 (4 August 2009)

Groundwater Results From May 2010 (IP-1, IP-8, IP-9) or February 2011 (, MW-11)

TPHg	33,000
Benzene	900
MTBE	ND

- TPHg — Total Petroleum Hydrocarbons as Gasoline (µg/l)
- Benzene — Benzene (µg/l)
- MTBE — Methyl Tert-Butyl Ether (µg/l)

ND Not Detected at Reporting Limit

Flame Ionization Detector (FID) Response Contours From January 2011 Membrane Interface Probe (MIP) Borings

- 1.0E6 - 3.0E6
- 3.0E6 - 5.0E6
- >5.0E6

0 5 10 Horizontal Scale

0 10 20 Vertical Scale

REVISION	NO.	BY	DATE	DESCRIPTION
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ARCTOS ENVIRONMENTAL

TESORO - LIVERMORE

GEOLOGIC CROSS SECTION B-B' WITH MIP RESULTS

PROJECT NO.	DRAWN BY	CHECKED BY	APPROVED BY
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FIGURE 4

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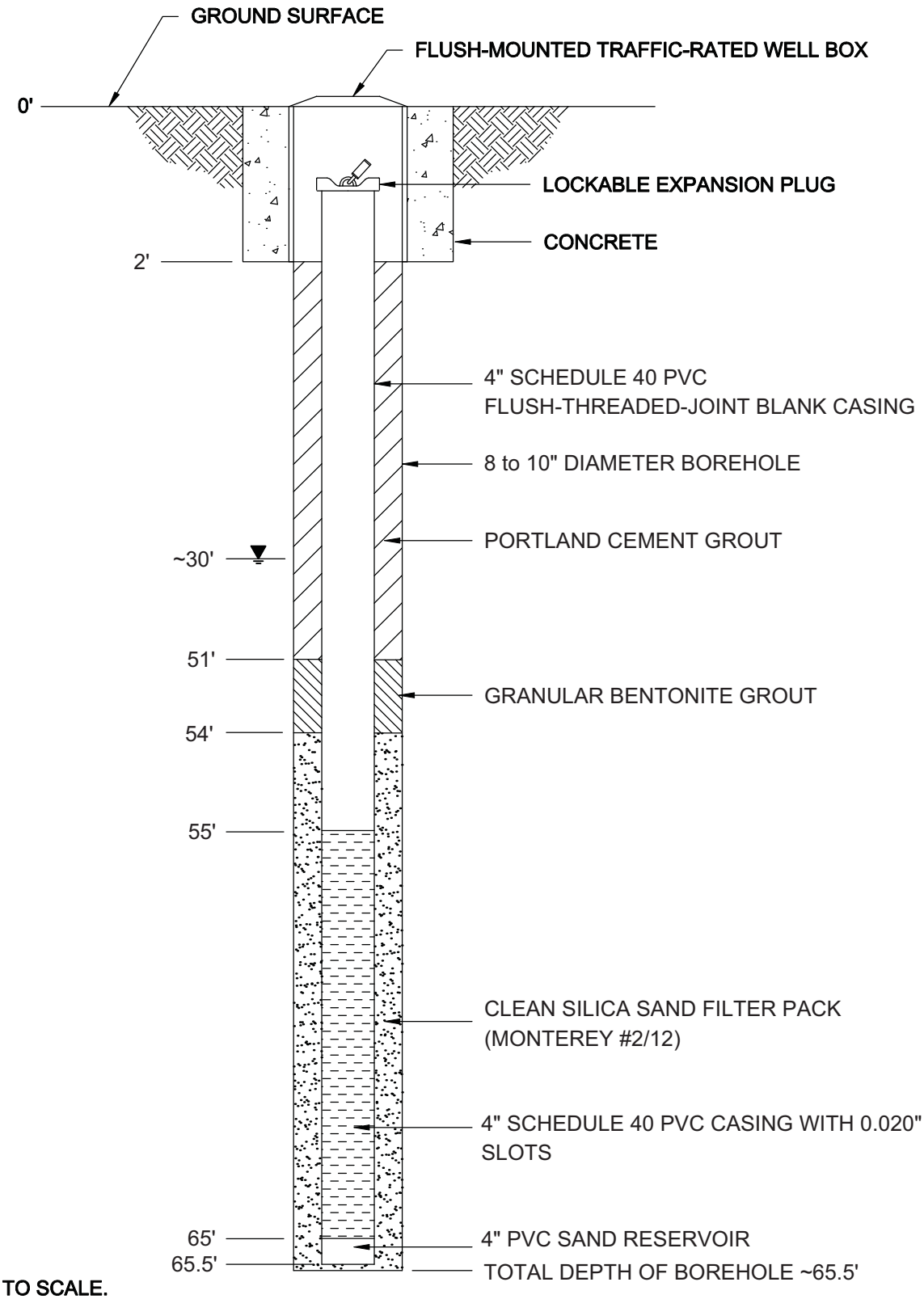

NOTES:

1. DRAWING NOT TO SCALE.
2. ACTUAL WELL CONSTRUCTION MAY VARY BASED ON FIELD INVESTIGATION.

REVISION	REVISIONS			
	NO.	BY	DATE	DESCRIPTION
0	0	MN	3/11/11	MIP report and DW-8 Work Plan

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DEEP MONITORING WELL CONSTRUCTION DIAGRAM

PROJECT NO.	DRAWN BY	CHECKED BY	APPROVED BY
01LV	MY	MP	JPG

FILE NO. DW-8 Well Const.pdf

FIGURE 5

APPENDIX A

VIRONEX MIP REPORT

Report
Membrane Interface Probe Services
Tesoro
1619 1st St
Livermore, CA

Prepared for:
Orion Environmental Inc
Mathew Nelson
mnelson@orionenv.com
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Direct - 562-988-2755
Fax - 562-988-2759
Mobile - 562-787-0384

Prepared by:
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P: 714-647-6290
C: 714-863-0988

Table of Contents

Project Description

Scope of Work Summary

Target Area	~250 - 250'
Number of MIP Locations	10
Target Interval	0' - 80' bgs
Target Interval Lithology	Gravel, Sand, Silt, Cemented Clay
Depth to Groundwater	~30' bgs
Contaminants of Concern	Vocs, tphg
Groundwater mg/l	Unknown
Soil mg/kg	Unknown
DNAPL / Free Product	No

Objectives - Use the MIP for vertical and lateral delineation of petro chemical plume. Previous USTs were used for gasoline.

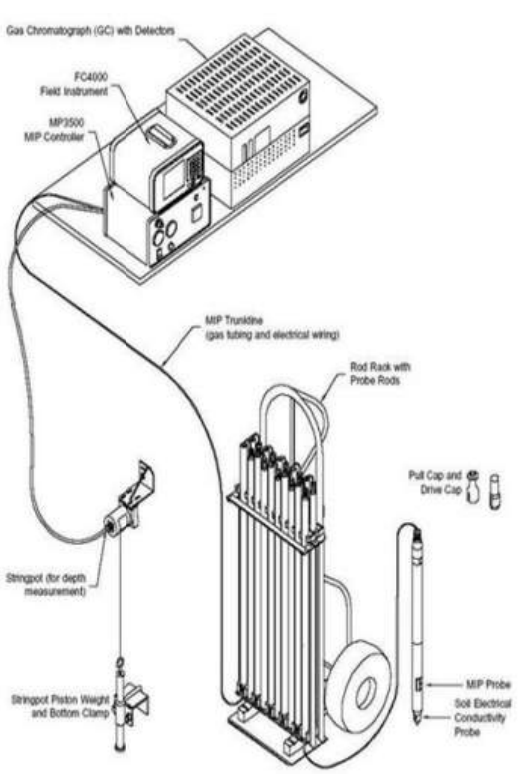
Notes

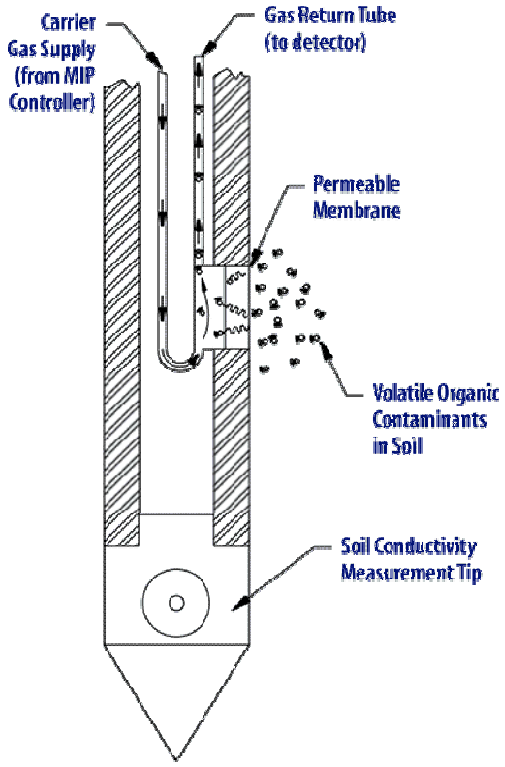
MIP Boring	Date	Notes
MIP-5	01/03/11	Air knife to 5' bgs. Refusal at 51' bgs.
MIP-2	01/03/11	Air knife to 5' bgs.
MIP-1	01/04/11	Air knife to 5' bgs. Refusal at 32' bgs.
MIP-4	01/04/11	Air knife to 5' bgs.
MIP-1-DEEP	01/04/11	Pre punch to 25'. Refusal at 59' bgs.
MIP-3	01/24/11	Air knife to 5' bgs.
MIP-6	01/24/11	Air knife to 5' bgs.
MIP-1-75	01/24/11	Air knife to 5' bgs. Refusal at 57.5' bgs.
MIP-5-DEEP	01/25/11	Air knife to 5' bgs.
MIP-8	01/25/11	Air knife to 5' bgs.
MIP-7	01/25/11	Air knife to 5' bgs.
MIP-10	01/26/11	Air knife to 5' bgs.
MIP-9	01/26/11	Hand auger to 5' bgs.

MIP System Overview

The MIP is a direct push tool that produces continuous chemical and physical logs of the vadose and saturated zones. It locates VOCs in-situ and shows you where they occur relative to the geologic and hydrologic units. Vertical profiles, transects, 3D pictures and maps can all be made from the electronic data generated by the MIP logs. Its unique capability of providing reliable, real-time information allows you to make better and timely decisions while your team is still in the field.

The MIP is a down hole tool that heats the soils and groundwater adjacent to the probe to 120 degrees C. This increases volatility and the vapor phase diffuses across a membrane into a closed, inert gas loop that carries these vapors to a series of detectors housed at the surface. Continuous chemical logs or profiles are generated from each hole. Soil conductivity is also measured and these logs can be compared to the chemical logs to better understand where the VOCs occur. The MIP technology is only appropriate for volatile organic compounds (VOCs). The gas stream can be analyzed with multiple detectors, for example an electron capture detector is used to detect chlorinated solvents, a photo-ionization detector is used to detect petroleum hydrocarbons, and a flame ionization detector is used to detect methane.





Equipment Used:

- CPT Rig
- MIP Controller (Nitrogen Flow and Heater)
- Geoprobe FC 5000 Computer
- HP 5890 Gas Chromatograph
- ECD (Electron Capture Detector)
- PID (Photo Ionization Detector) 10.2 eV Lamp
- FID (Photo Ionization Detector)
- 200' Geoprobe Trunkline
- 1.75" O.D. CPT probe / MIP Heater Block
- 1.75" O.D. Drive Rods

Detector Overview

- ECD – Electron Capture Detector uses a radioactive Beta emitter (electrons) to ionize some of the carrier gas and produce a current between a biased pair of electrodes. When organic molecules contain electronegative functional groups, such as halogens, phosphorous, and nitro groups pass by the detector, they capture some of the electrons and reduce the current measured between the electrodes.

- PID – Photo Ionization Detector sample stream flows through the detector's reaction chamber where it is continuously irradiated with high energy ultraviolet light. When compounds are present that have a lower ionization potential than that of the irradiation energy (10.2 electron volts with standard lamp) they are ionized. The ions formed are collected in an electrical field, producing an ion current that is proportional to compound concentration. The ion current is amplified and output by the gas chromatograph's electrometer.

- FID – Flame Ionization Detector consists of a hydrogen / air flame and a collector plate. The effluent from the GC (trunkline) passes through the flame, which breaks down organic molecules and produces ions. The ions are collected on a biased electrode and produce an electric signal.

MIP Data Collected

- Depth - Data is collected from twenty data points per foot. 0.05', 0.10', 0.15', etc…

- Electrical Conductivity - Electrical Conductivity data is measured/collected in milli-siemens per Meter (ms/M). The conductivity of soils is different for each type of media. Finer grained sediments, such as silts or clays, will have a higher EC signal. While coarser grained sediments, sands and gravel, will have a lower EC signal. The coarser grained sediments will allow the migration of contaminants and the finer grained sediments will trap the contaminant.(NOT COLLECTED)

- Speed / Advancement Rate - Speed data is measured/collected in feet per minute (ft/min). Speed is an indication of the physical advancement rate of the MIP probe. Speed of the MIP

probe can vary due to operator advancement and dense soil types. Speed log can provide soil type information which can be correlated with electrical conductivity. Lower advancement speed, correlated with lower conductivity or larger grained soils would more than likely be associated with dense or compacted sands.

- Temperature - Temperature data is measured/collected in Degrees Celsius. Temperature is an indication of the physical temperature of the MIP block. Minimum and Maximum temperature is collected at each vertical interval. Vironex's temperature protocol indicates that the MIP probe temperature shall maintain a minimum temperature of 75 Degrees Celsius.

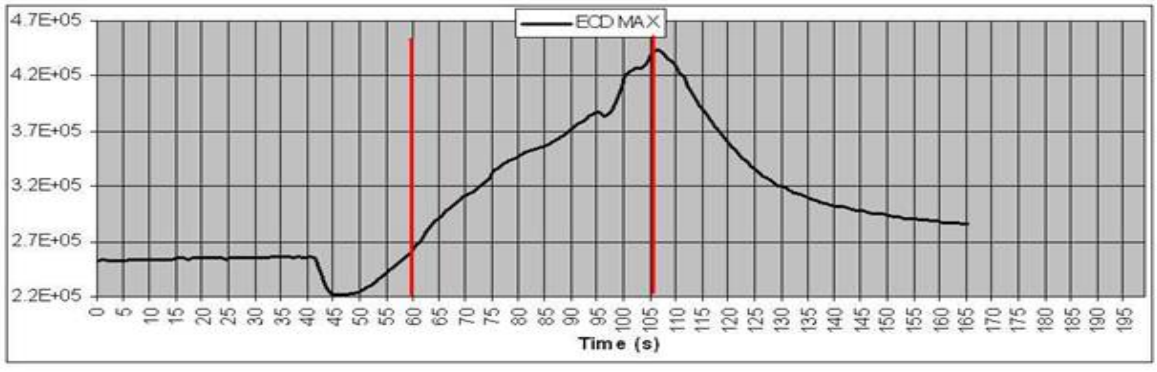
- Pressure - Pressure data is measured/collected in PSI. Pressure is an indication of the internal pressure of the nitrogen lines located within the trunkline and the pressure behind the membrane. Minimum and Maximum temperature is collected at each vertical interval. Geoprobe's pressure protocol indicates that the MIP probe pressure shall not exceed 1.5 PSI difference from baseline.

- Detector (ECD, PID, FID) - Detector responses are measured/collected in micro Volts (uV). Detector responses are an indication of relative contaminant responses. Minimum and Maximum detector responses are collected at each vertical interval.

MIP QA/QC

Vironex adheres to Geoprobe's Standard Operating Procedure, technical Bulletin No. MK3010, prepared: May, 2003. The response testing is a necessary part of the MIP logging process because it ensures that the system is working correctly and also enables the operator to measure the response time. Response time is the time it takes for the contaminant to go from the probe, through the trunk line, and to the detectors. This time is entered into the FC5000 computer for depth calculations. A response test is completed at the beginning of the day, between each boring, and at the end of each day. The response time will vary due to weather temperatures and length of the trunkline.

Per Geoprobe's SOP, a pass response is indicated as double the noise above the baseline.



APPENDIX A

Physical Properties Chart

Compound	Formula	Density	Flashpoint* (°C)	Molecular Weight	Melting Point (°C)	Boiling Point (°C)	Water Solubility**	ECD	PID	FID
1,1,1,2-Tetrachloroethane	$C_2H_2Cl_4$	1.5532	6	167.8498	-70.2	130.5	<0.1 g/100 mL at 20.5 C	●		
1,1,1-Trichloroethane	$C_2H_3Cl_3$	1.3376	N/A	133.4047	-32.6	74.1	Slightly soluble. 0.1495 g/100 mL	●		
1,1,2,2-Tetrachloroethane	$C_2H_2Cl_4$	1.595	N/A	167.8498	-43	146.3	Soluble. 0.2962 g/100 mL	●		
1,1,2-Trichloroethane	$C_2H_3Cl_3$	1.4411	N/A	133.4047	-36.5	113.8	Insoluble. 0.442 g/100 mL	●		
1,1-Dichloroethane	$C_2H_4Cl_2$	1.176	-5	98.9596	-97.4	57.3	Slightly soluble. 0.506 g/100 mL	●		
1,1-Dichloroethene	$C_2H_2Cl_2$	1.213	-28	96.9438	-122.1	31.7	Insoluble. 0.225 g/100 mL	●	●	
2,3-Dichloropropene	$C_3H_4Cl_2$	1.204	10	110.9706	10	94	<0.1 g/100 mL at 22 C	●	●	
1,2,3-Trichlorobenzene	$C_6H_3Cl_3$	1.69	126	181.4487	52.6	219	Insoluble	●	●	
1,2,3-Trichloropropane	$C_3H_5Cl_3$	1.389	82	147.4315	-14.7	156	insoluble. 0.18 g/100 mL	●		
1,2,4-Trichlorobenzene	$C_6H_3Cl_3$	1.4634	110	181.4487	16.95	214.4	Insoluble. 0.0049 g/100 mL	●	●	
1,2-Dichlorobenzene	$C_6H_4Cl_2$	1.306	67	147.0036	-15	180.5	slightly soluble. 0.008396 g/100 mL	●	●	
1,2-Dichloroethane	$C_2H_4Cl_2$	1.253	13	98.9596	-35.3	83.5	Slightly soluble. 0.8608 g/100 mL	●		
1,2-Dichloropropane	$C_3H_6Cl_2$	1.1558	15	112.9864	-100.4	96.8	Slightly soluble. 0.27 g/100 mL	●		
1,3-Dichlorobenzene	$C_6H_4Cl_2$	1.288	67	147.0036	-24.76	173	insoluble. 0.0125 g/100 mL	●	●	
1,4-Dichlorobenzene	$C_6H_4Cl_2$	1.2417	67	147.0036	53.1	173.4	Insoluble. 0.00813 g/100 mL	●	●	
1,2-Dichloropropane	$C_3H_6Cl_2$	1.1558	15	112.9864	-100.4	96.8	Slightly soluble. 0.27 g/100 mL	●		
2-Chloropropane	C_3H_7Cl	0.862	-32	78.5413	-117.18	35.74	0.31 g/100 mL at 20 C	●		
2-Chlorotoluene	C_7H_7Cl	1.082	47	126.5853	-35.1	158.97	Slightly soluble	●	●	
3-Chloropropene	C_3H_5Cl	0.938	-29	76.5255	-134.5	44 - 46	Slightly soluble. 0.337 g/100 mL	●	●	
4-Chlorotoluene	C_7H_7Cl	1.07	49	126.5853	7.5	161.9	<0.1 g/100 mL at 20 C	●	●	
Carbon tetrachloride	CCl_4	1.594	N/A	153.823	-22.9	76.7	Slightly sol. 0.08048 g/100 mL	●		
Chlorobenzene	C_6H_5Cl	1.1066	29	112.5585	-45.6	130	Slightly soluble. 0.0497 g/100 mL	●	●	
Chloroethane	C_2H_5Cl	0.92	-50	64.5145	-136.4	12.3	Soluble. 0.574 g/100 mL at 20 C	●		
Chloroform	$CHCl_3$	1.49845	N/A	119.3779	-63.7	61.7	Slightly sol. 0.795 g/100 mL	●		
Chloromethane	CH_3Cl	0.991	N/A	50.4877	-97.1	-24.2	insoluble. 0.5325 g/100 mL	●		
cis-1,2-Dichloroethene	$C_2H_2Cl_2$	1.284	6	96.9438	-80.5	60	0.08 g/100 mL	●	●	
cis-1,3-Dichloropropene	$C_3H_4Cl_2$	1.22	N/A	110.9706	-50	104.3	<0.1 g/100 mL at 20.5 C	●	●	
cis-1,4-Dichloro-2-butene	$C_4H_6Cl_2$	1.188	56	124.9974	-48	152	0.058 g/100 mL	●	●	
Methylene Chloride	CH_2Cl_2	1.3255	N/A	84.9328	-96.7	39.8	Slightly sol. 1.32 g/100 mL	●		
Tetrachloroethene	C_2Cl_4	1.623	N/A	165.834	-22.3	121.1	Almost insoluble 0.015 g/100 mL	●	●	
Trans-1,2-Dichloroethene	$C_2H_2Cl_2$	1.257	6	96.9438	-50	47.5	Slightly. 0.63 g/100 mL	●	●	

Compound	Formula	Density	Flashpoint* (°C)	Molecular Weight	Melting Point (°C)	Boiling Point (°C)	Water Solubility**	ECD	PID	FID
trans-1,3-Dichloropropene	$C_3H_4Cl_2$	1.217	27	110.9706	N/A	112	<0.1 g/100 mL at 20.5 C	●	●	
trans-1,4-Dichloro-2-butene	$C_4H_6Cl_2$	1.183	N/A	124.9974	2	155.5	0.085 g/100 mL at 25 C	●	●	
Trichloroethene	C_2HCl_3	1.462	N/A	131.3889	-86	86.7	Slightly soluble. 0.11 g/100 mL	●	●	
Vinyl Chloride	C_2H_3Cl	0.9106	42	62.4987	-153.7	-13.9	Slightly soluble 0.11 g/100 mL	●	●	
Benzene	C_6H_6	0.8786	-11	78.1134	5.5	80.1	Slightly sol. 0.18 g/100 mL		●	●
Hexane	C_6H_{14}	0.6548	-22	86.1766	-95	69	Slightly sol. .000947 g/100 mL		●	●
n-Butylbenzene	$C_{10}H_{14}$	0.86	59	134.2206	-88	183	insoluble		●	●
1,2,4-Trimethylbenzene	C_9H_{12}	0.876	48	120.1938	-43.8	169	Slightly soluble		●	●
1,3,5-Trimethylbenzene	C_9H_{12}	0.865	44	120.1938	-44.7	165	insoluble		●	●
Ethyl Benzene	C_8H_{10}	0.867	15	106.167	-94.9	136.2	0.0206 g/100 mL		●	●
m,p-Xylene	C_8H_{10}	0.862	25	106.167	-50	140	Insoluble. 0.0175 g/100 mL		●	●
Naphthalene	$C_{10}H_8$	0.997	78	128.1732	80.6	218	Slightly soluble. 0.0031 g/100 mL		●	●
o-Xylene	C_8H_{10}	0.897	32	106.167	-25.2	144	0.00 g/100 mL. Insoluble		●	●
n-Propylbenzene	C_9H_{12}	0.862	47	120.1938	-101.6	159	insoluble		●	●
Toluene	C_7H_8	0.867	4	92.1402	-93	110.6	Slightly sol. 0.0526 g/100 mL		●	●
1,2-Dibromo-3-chloropropane	$C_3H_5Br_2Cl$	2.05	N/A	236.3335	6	195	0.123 g/100 mL	●		
1,2-Dibromoethane	$C_2H_4Br_2$	2.17	1	187.8616	9.97	131.7	Slightly sol. 0.4152 g/100 mL	●		
1,3-Dichloropropane	$C_3H_6Cl_2$	1.188	20	112.9864	-99	120.4	insoluble	●		
Acrylonitrile	C_3H_3N	0.8075	-5	53.0634	-83.55	77.3	Soluble. 7.45 g/100 mL		●	
Bromobenzene	C_6H_5Br	1.495	51	157.0095	-30.8	155	insoluble. <0.1 g/100 mL at 20.5 C	●	●	
Bromochloromethane	CH_2BrCl	1.991	N/A	129.3838	-88	67.8	Slightly soluble. 0.1-0.5 g/100 mL at 20 C	●		
Bromodichloromethane	$CHBrCl_2$	1.971	N/A	163.8289	-57.1	90.1	Slightly soluble. 0.6735 g/100 mL	●		
Bromoform	$CHBr_3$	2.894	N/A	252.7309	8.3	149.5	Slightly soluble. 0.301 g/100 mL	●		
Bromomethane	CH_3Br	1.732	N/A	94.9387	-93.7	3.56	Very slightly soluble. 1.522 g/100 mL	●		
Carbon disulfide	CS_2	1.2632	-30	76.131	-110	46.2	Slightly sol. 0.1185 g/100 mL		●	
Cumene	C_9H_{12}	0.862	31	120.1938	-96	151	insoluble. 0.00499 g/100 mL		●	
Dibromochloromethane	$CHBr_2Cl$	2.451	N/A	208.2799	-22	120	0.4 g/100 mL	●		
Dibromomethane	CH_2Br_2	2.497	N/A	173.8348	-53	97	Soluble. 1.193 g/100 mL	●		
Freon 11	CCl_3F	1.494	N/A	137.3684	-111	23.8	insoluble. 0.124 g/100 mL	●		
Freon 113	$C_2Cl_3F_3$	1.575	N/A	187.3762	-36.4	47.6	0.02 g/100 mL. Slightly soluble. Insoluble	●		

Compound	Formula	Density	Flashpoint* (°C)	Molecular Weight	Melting Point (°C)	Boiling Point (°C)	Water Solubility**	ECD	PID	FID
Hexachlorobutadiene	C_4Cl_6	1.68	N/A	260.762	-21	210	Insoluble. 0.00032 g/100 mL	●	●	
p-Cymene	$C_{10}H_{14}$	0.86	47	134.2206	-67	176 - 178	insoluble		●	
sec-Butylbenzene	$C_{10}H_{14}$	0.862	45	134.2206	-75	173	0.00176 g/100mL		●	
Styrene	C_8H_8	0.9045	32	104.1512	-30.6	145.2	0.032 g/100 mL		●	●
tert-Butylbenzene	$C_{10}H_{14}$	0.867	44	134.2206	-58	169	0.00295 g/100 mL		●	

* Compound with no flashpoint are not ignitable.

** If temperature is not otherwise noted, assume 25° C.

● indicates a possible response on specific detector

Associated Parent Compound
Chlorinated
Gasoline
Diesel
Gasoline and Diesel
Not typical of primary compounds

APPENDIX B

MIP BORINGS

VIRONEX
1641 Challenge Drive
Concord, CA 94520
P: 925-849-6970
F: 925-849-6973
www.vironex.com

Boring Name : MIP-1-75

Total Depth (ft): 54.55

Notes: Air knife to 5 feet bgs. 3rd attempt at this location. Pushed CPT MIP to 50 feet then started 1 foot per min. CPT MIP encountered refusal at 57.5.

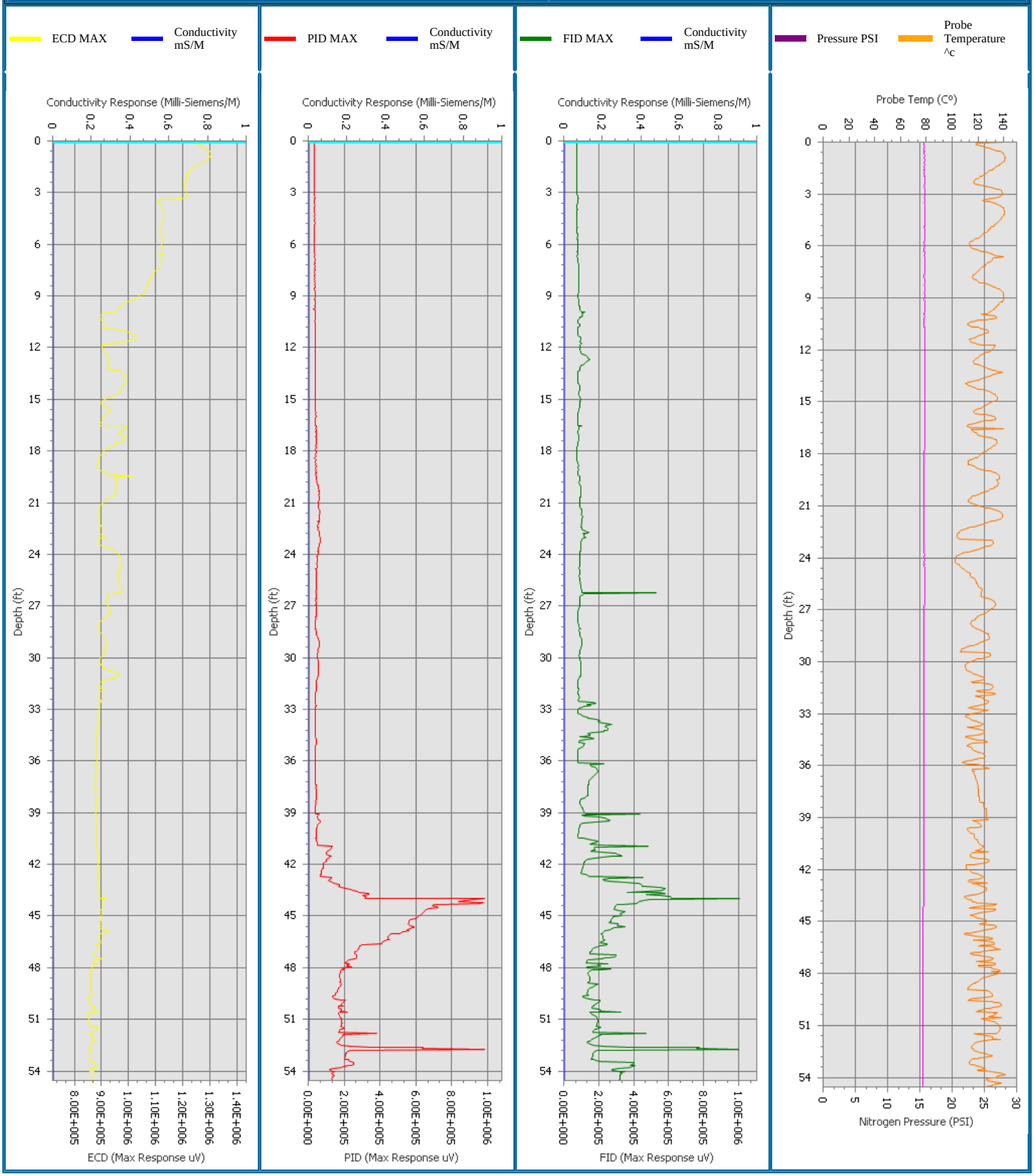
GW Depth (Ft) 0
Depth of GW Provided by Client

Job Information

Client Company :	ORION Environmental Inc.
Project Name :	Tesoro – Livermore Site
Site Address :	1619 1st St, Livermore, CA

MIP Sampling Information

Trunkline length :	200	Start Boring Time :	Mon Jan 24 2011 15:32:10
Probe Type :	6520/Heater Block	End Boring Time :	Mon Jan 24 2011 16:19:50
Rig Type :	CPT/Heater Block	MIP Specialist :	Jeff Paul



VIRONEX
1641 Challenge Drive
Concord, CA 94520
P: 925-849-6970
F: 925-849-6973
www.vironex.com

Boring Name : MIP-1

Total Depth (ft): 29.05

Notes: **Air knife to 5 feet bgs. CPT MIP encountered refusal at 32 feet bgs.**

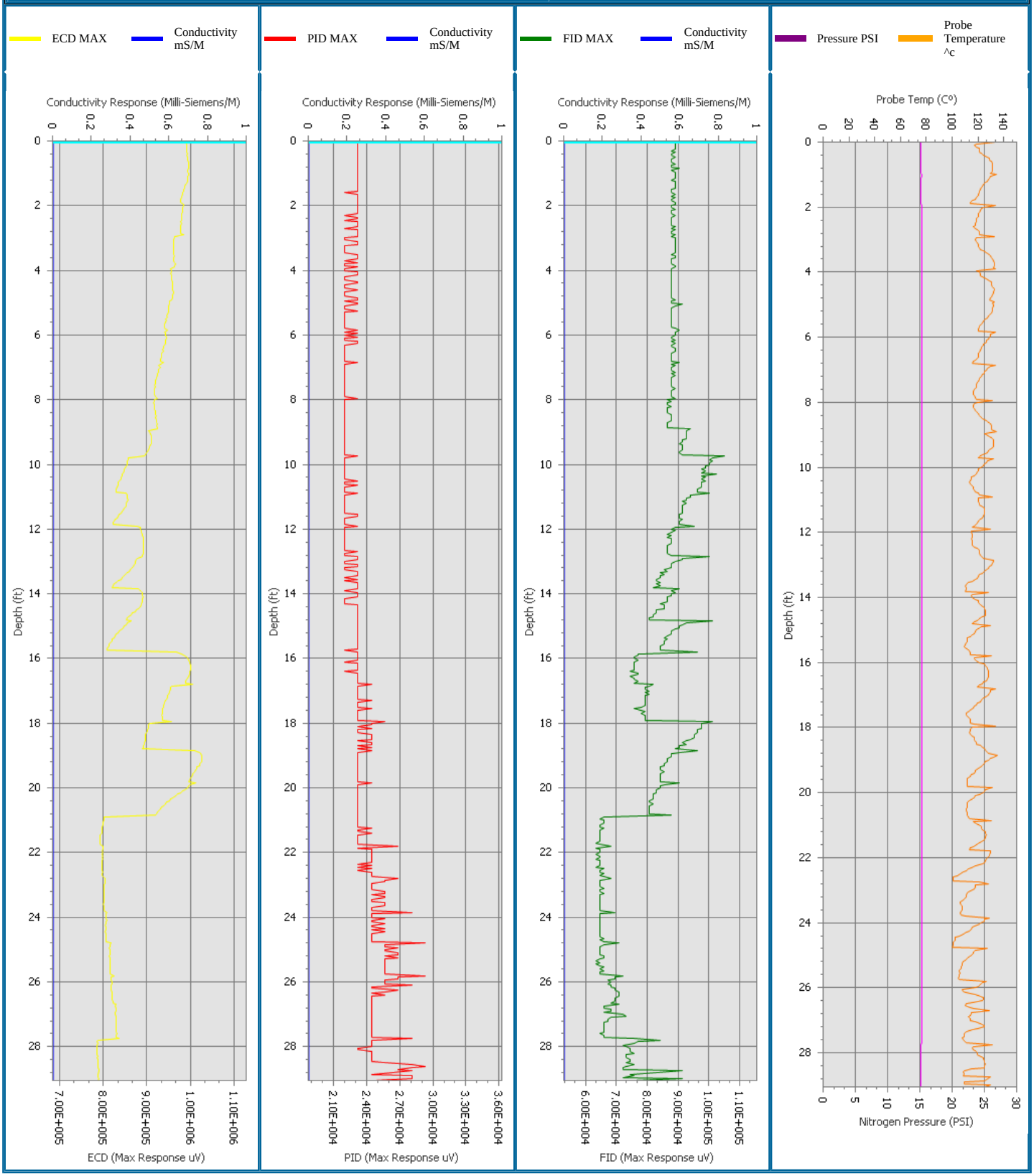
GW Depth (Ft) 0
Depth of GW Provided by Client

Job Information

Client Company :	ORION Environmental Inc.
Project Name :	Tesoro – Livermore Site
Site Address :	1619 1st St, Livermore, CA

MIP Sampling Information

Trunkline length :	200	Start Boring Time :	Tue Jan 04 2011 08:06:47
Probe Type :	6520/Heater Block	End Boring Time :	Tue Jan 04 2011 08:54:43
Rig Type :	CPT/Heater Block	MIP Specialist :	Jeff Paul



VIRONEX
1641 Challenge Drive
Concord, CA 94520
P: 925-849-6970
F: 925-849-6973
www.vironex.com

Boring Name : MIP-1-DEEP

Total Depth (ft): 56.25

Notes: Air knife to 5 feet bgs. Pre punch to 25 feet bgs. Gas data is not valid 0 to 25 feet bg

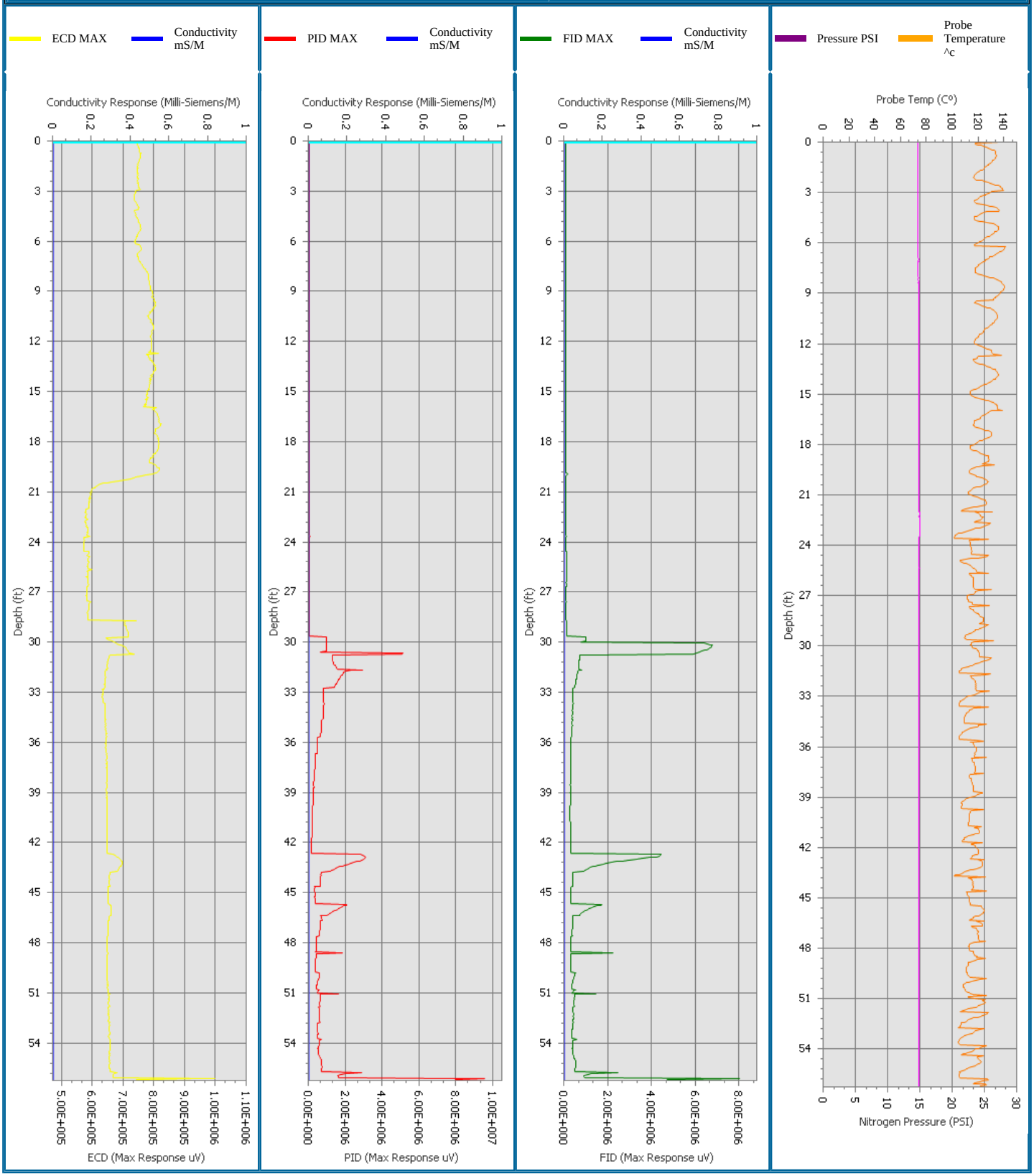
GW Depth (Ft) 0
Depth of GW Provided by Client

Job Information

Client Company :	ORION Environmental Inc.
Project Name :	Tesoro – Livermore Site
Site Address :	1619 1st St, Livermore, CA

MIP Sampling Information

Trunkline length :	200	Start Boring Time :	Tue Jan 04 2011 15:27:36
Probe Type :	6520/Heater Block	End Boring Time :	Tue Jan 04 2011 16:28:13
Rig Type :	CPT/Heater Block	MIP Specialist :	Jeff Paul



VIRONEX
1641 Challenge Drive
Concord, CA 94520
P: 925-849-6970
F: 925-849-6973
www.vironex.com

Boring Name : MIP-2

Total Depth (ft): 80.05

Air knife to 5 feet bgs.

Notes:

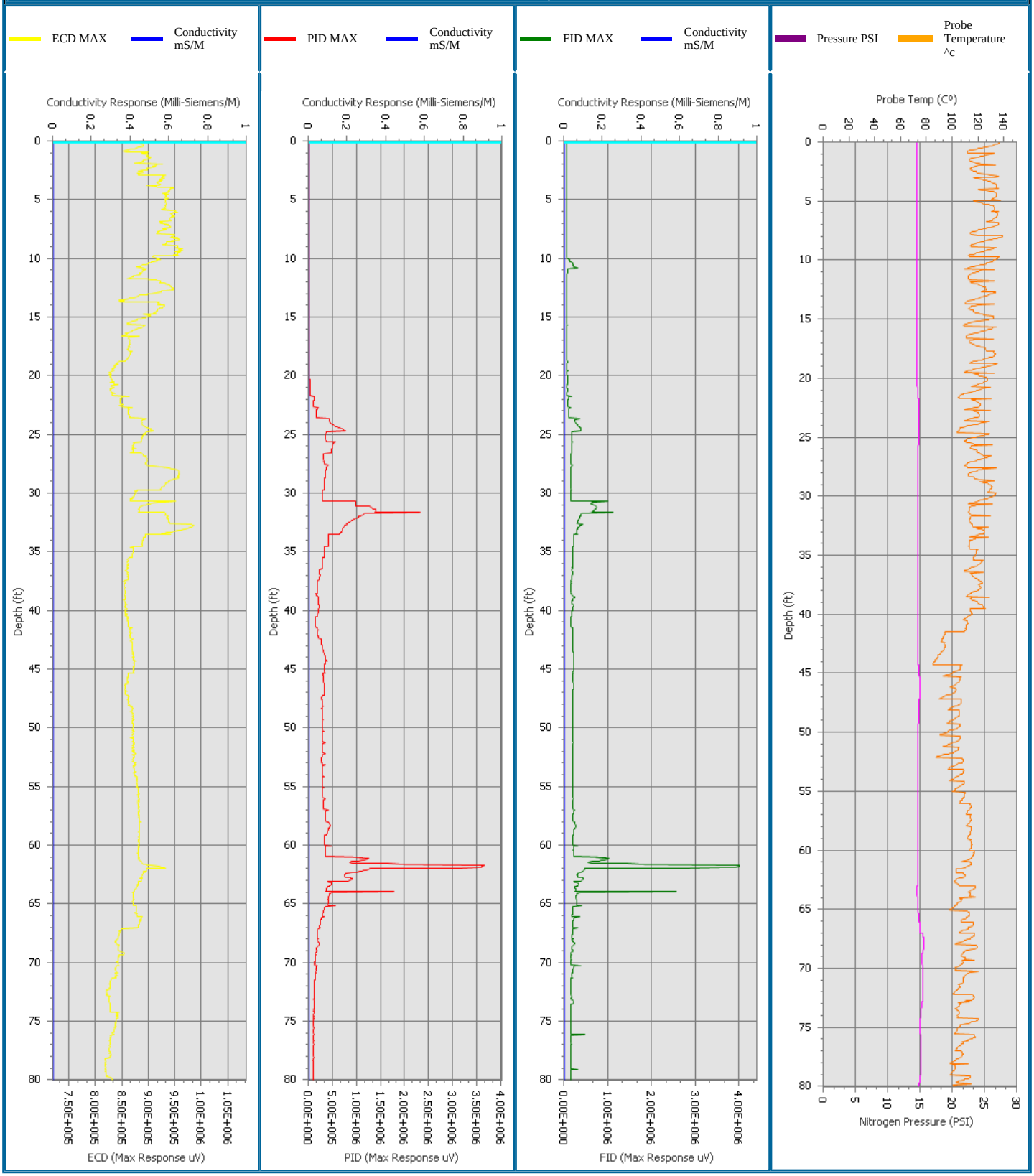
GW Depth (Ft) 0
Depth of GW Provided by Client

Job Information

Client Company :	ORION Environmental Inc.
Project Name :	Tesoro – Livermore Site
Site Address :	1619 1st St, Livermore, CA

MIP Sampling Information

Trunkline length :	200	Start Boring Time :	Mon Jan 03 2011 14:51:02
Probe Type :	6520/Heater Block	End Boring Time :	Mon Jan 03 2011 16:19:54
Rig Type :	CPT/Heater Block	MIP Specialist :	Jeff Paul



VIRONEX
1641 Challenge Drive
Concord, CA 94520
P: 925-849-6970
F: 925-849-6973
www.vironex.com

Boring Name : MIP-3

Total Depth (ft): 73.1

Air knife to 5 feet bgs.

Notes:

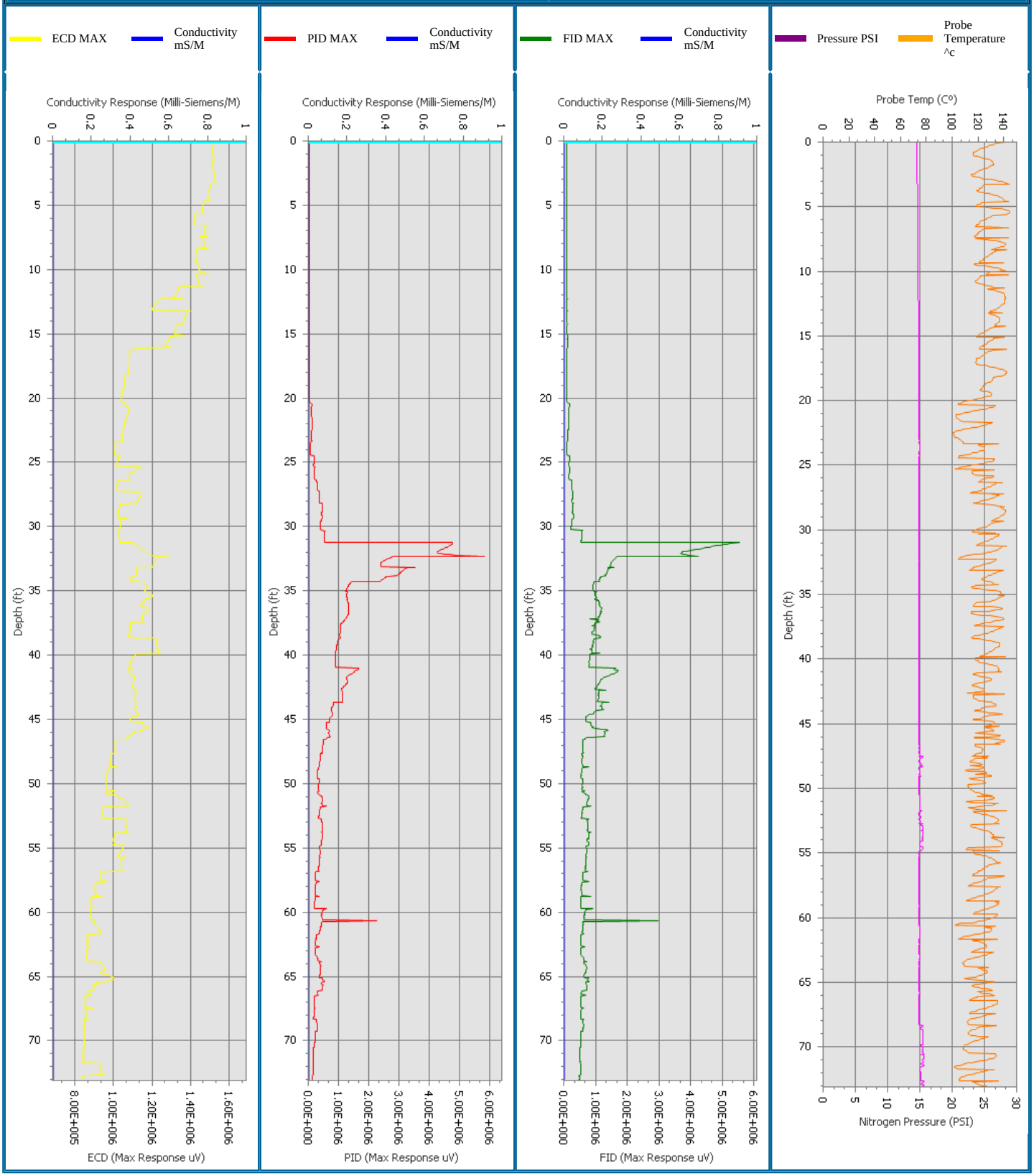
GW Depth (Ft) 0
Depth of GW Provided by Client

Job Information

Client Company :	ORION Environmental Inc.
Project Name :	Tesoro – Livermore Site
Site Address :	1619 1st St, Livermore, CA

MIP Sampling Information

Trunkline length :	200	Start Boring Time :	Mon Jan 24 2011 08:28:20
Probe Type :	6520/Heater Block	End Boring Time :	Mon Jan 24 2011 09:55:57
Rig Type :	CPT/Heater Block	MIP Specialist :	Jeff Paul



VIRONEX
1641 Challenge Drive
Concord, CA 94520
P: 925-849-6970
F: 925-849-6973
www.vironex.com

Boring Name : MIP-4

Total Depth (ft): 79.2

Hand auger to 5 feet bgs.

Notes:

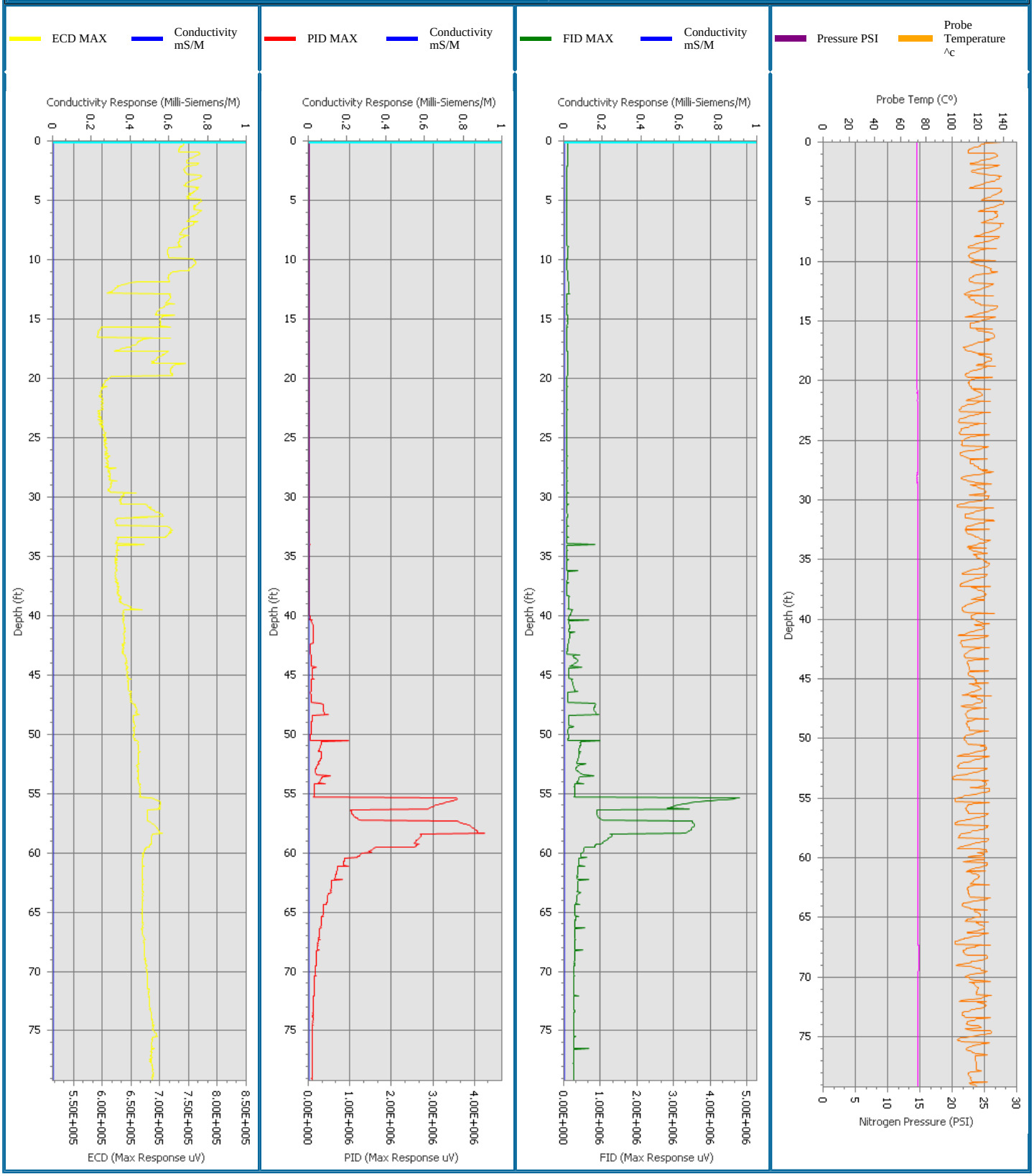
GW Depth (Ft) 0
Depth of GW Provided by Client

Job Information

Client Company :	ORION Environmental Inc.
Project Name :	Tesoro – Livermore Site
Site Address :	1619 1st St, Livermore, CA

MIP Sampling Information

Trunkline length :	200	Start Boring Time :	Tue Jan 04 2011 11:36:20
Probe Type :	6520/Heater Block	End Boring Time :	Tue Jan 04 2011 13:15:07
Rig Type :	CPT/Heater Block	MIP Specialist :	Jeff Paul



VIRONEX
1641 Challenge Drive
Concord, CA 94520
P: 925-849-6970
F: 925-849-6973
www.vironex.com

Boring Name : MIP-5

Total Depth (ft): 48.2

Notes: **Air knife to 5 feet bgs. CPT MIP encountered refusal at 51 feet bgs.**

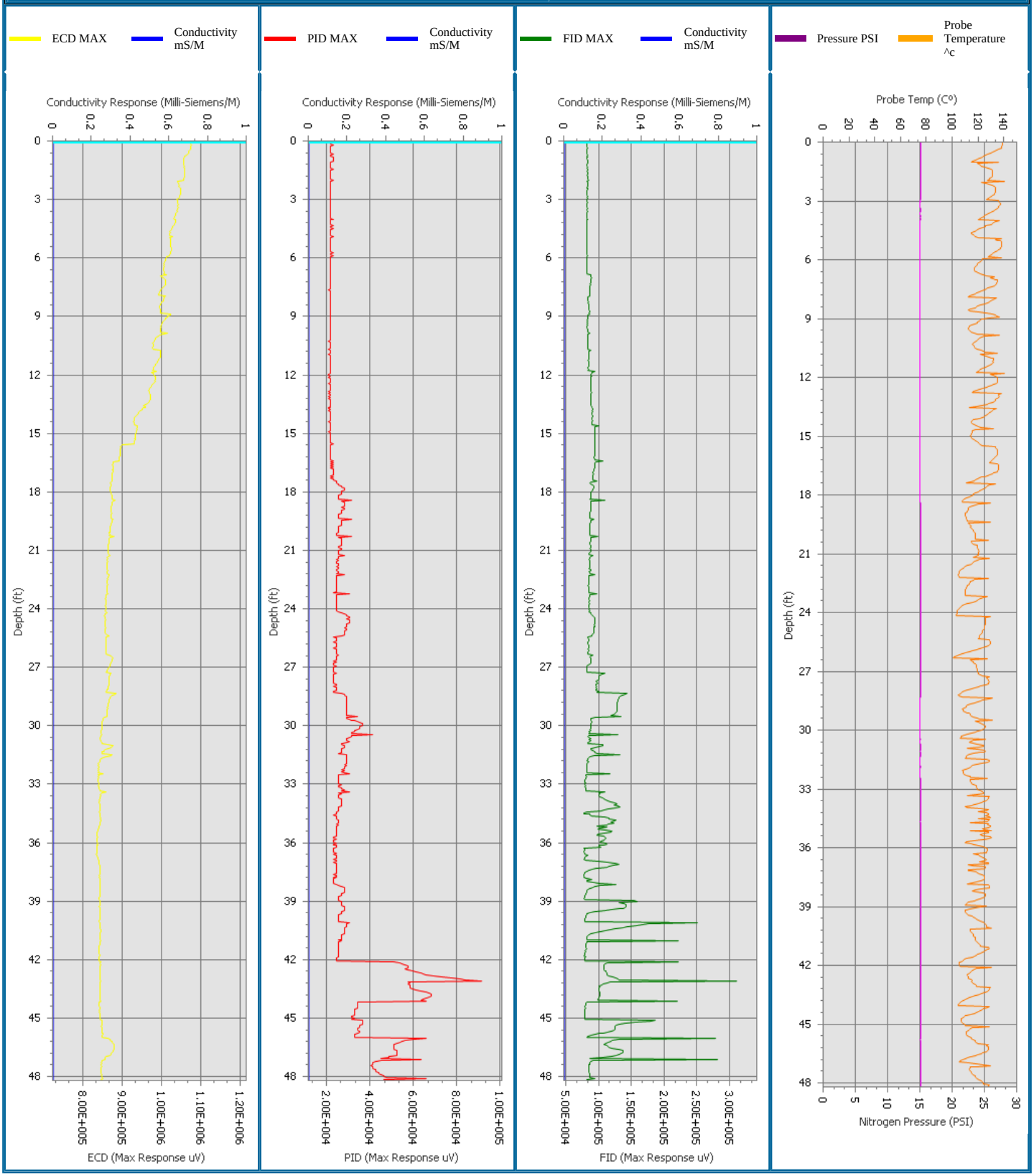
GW Depth (Ft) 0
Depth of GW Provided by Client

Job Information

Client Company :	ORION Environmental Inc.
Project Name :	Tesoro – Livermore Site
Site Address :	1619 1st St, Livermore, CA

MIP Sampling Information

Trunkline length :	200	Start Boring Time :	Mon Jan 03 2011 12:22:29
Probe Type :	6520/Heater Block	End Boring Time :	Mon Jan 03 2011 13:28:16
Rig Type :	CPT/Heater Block	MIP Specialist :	Jeff Paul



VIRONEX
1641 Challenge Drive
Concord, CA 94520
P: 925-849-6970
F: 925-849-6973
www.vironex.com

Boring Name : MIP-5-DEEP

Total Depth (ft): 74

Notes: Air knife to 5 feet bgs. Pushed CPT MIP to 40 feet bgs then started 1 foot per min.

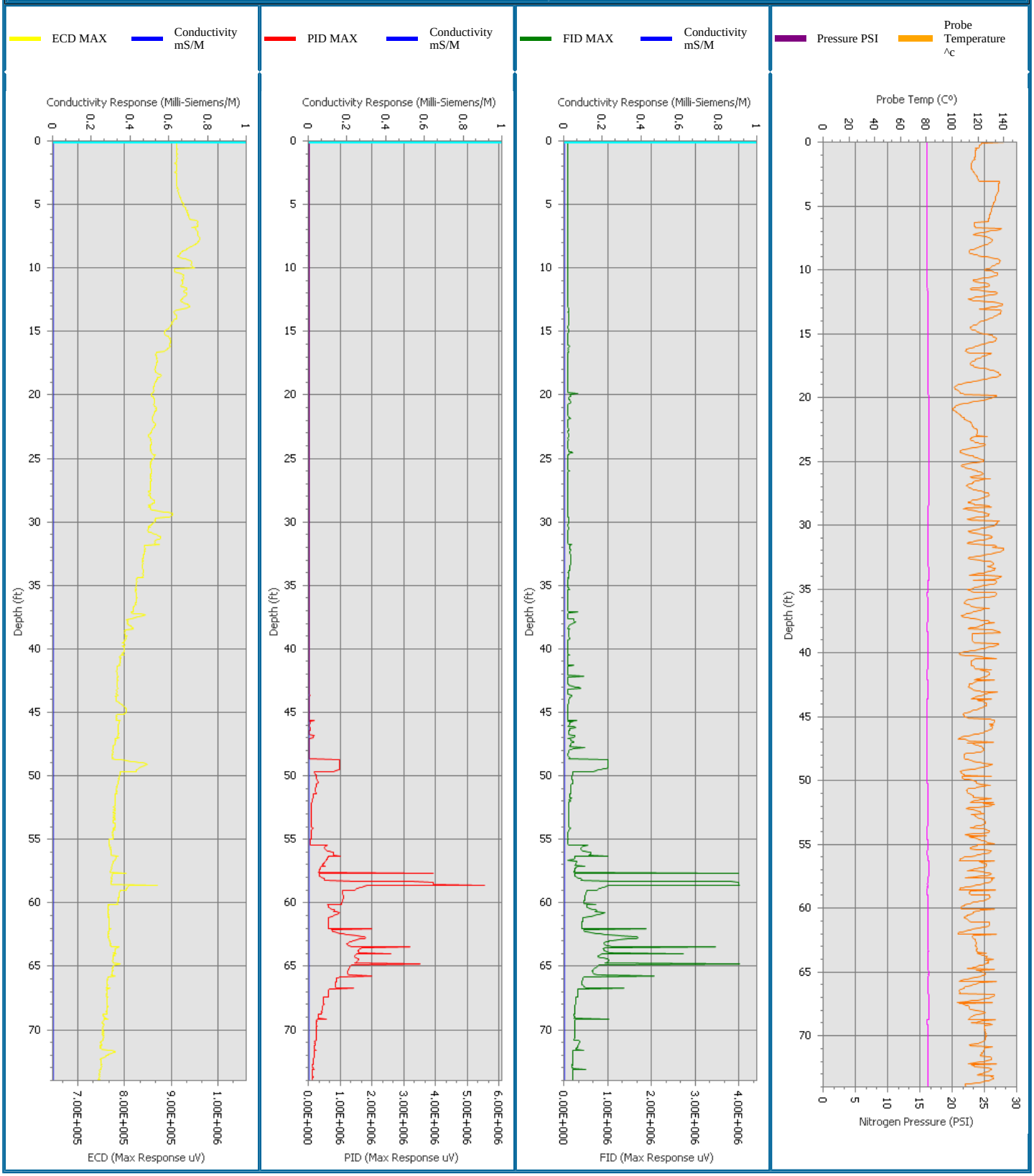
GW Depth (Ft) 0
Depth of GW Provided by Client

Job Information

Client Company :	ORION Environmental Inc.
Project Name :	Tesoro – Livermore Site
Site Address :	1619 1st St, Livermore, CA

MIP Sampling Information

Trunkline length :	200	Start Boring Time :	Tue Jan 25 2011 09:16:58
Probe Type :	6520/Heater Block	End Boring Time :	Tue Jan 25 2011 10:19:01
Rig Type :	CPT/Heater Block	MIP Specialist :	Jeff Paul



VIRONEX
1641 Challenge Drive
Concord, CA 94520
P: 925-849-6970
F: 925-849-6973
www.vironex.com

Boring Name : MIP-6

Total Depth (ft): 72

Air knife to 5 feet bgs.

Notes:

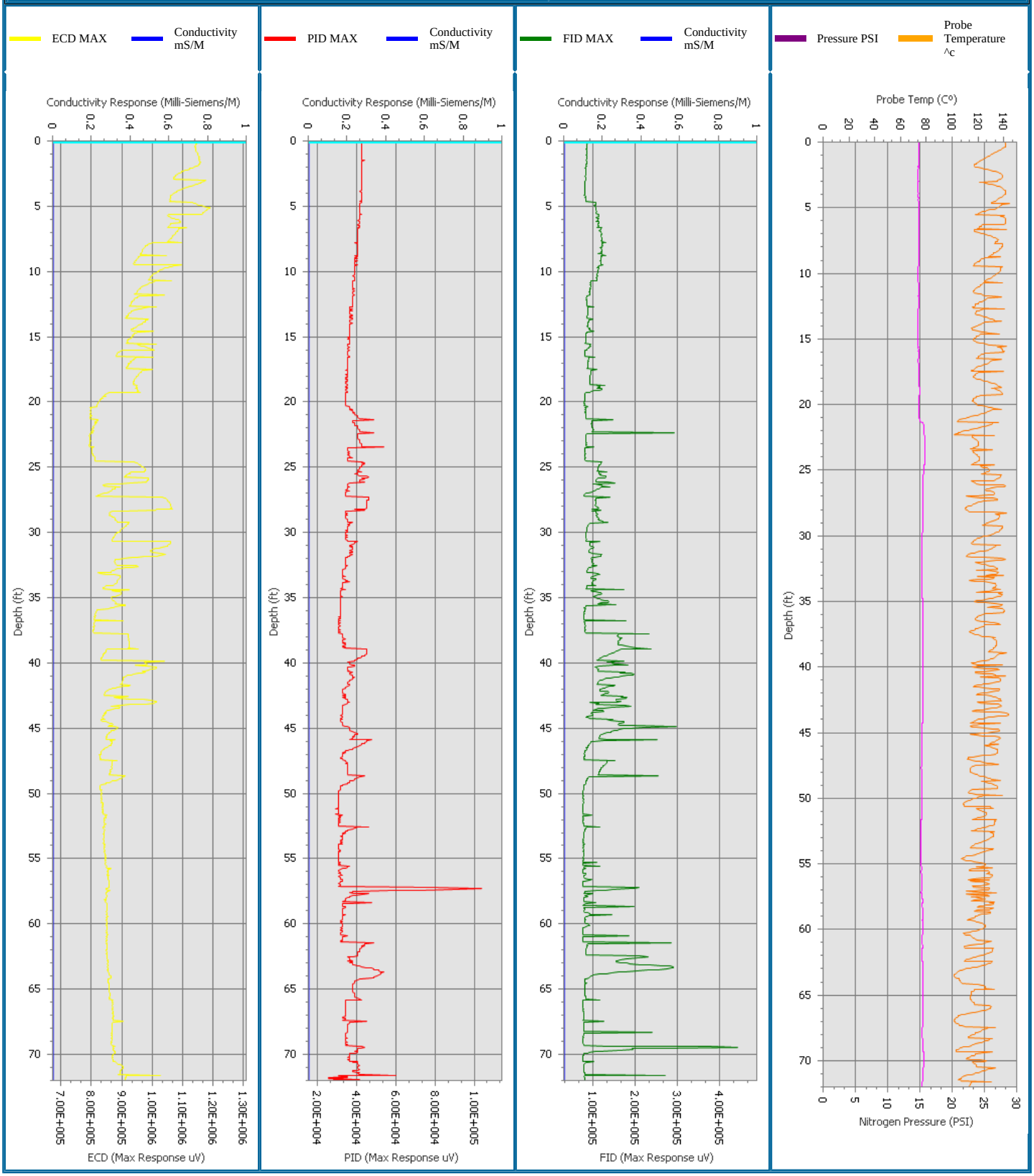
GW Depth (Ft) 0
Depth of GW Provided by Client

Job Information

Client Company :	ORION Environmental Inc.
Project Name :	Tesoro – Livermore Site
Site Address :	1619 1st St, Livermore, CA

MIP Sampling Information

Trunkline length :	200	Start Boring Time :	Mon Jan 24 2011 11:39:00
Probe Type :	6520/Heater Block	End Boring Time :	Mon Jan 24 2011 13:13:02
Rig Type :	CPT/Heater Block	MIP Specialist :	Jeff Paul



VIRONEX
1641 Challenge Drive
Concord, CA 94520
P: 925-849-6970
F: 925-849-6973
www.vironex.com

Boring Name : MIP-7

Total Depth (ft): 80

Air knife to 5 feet bgs.

Notes:

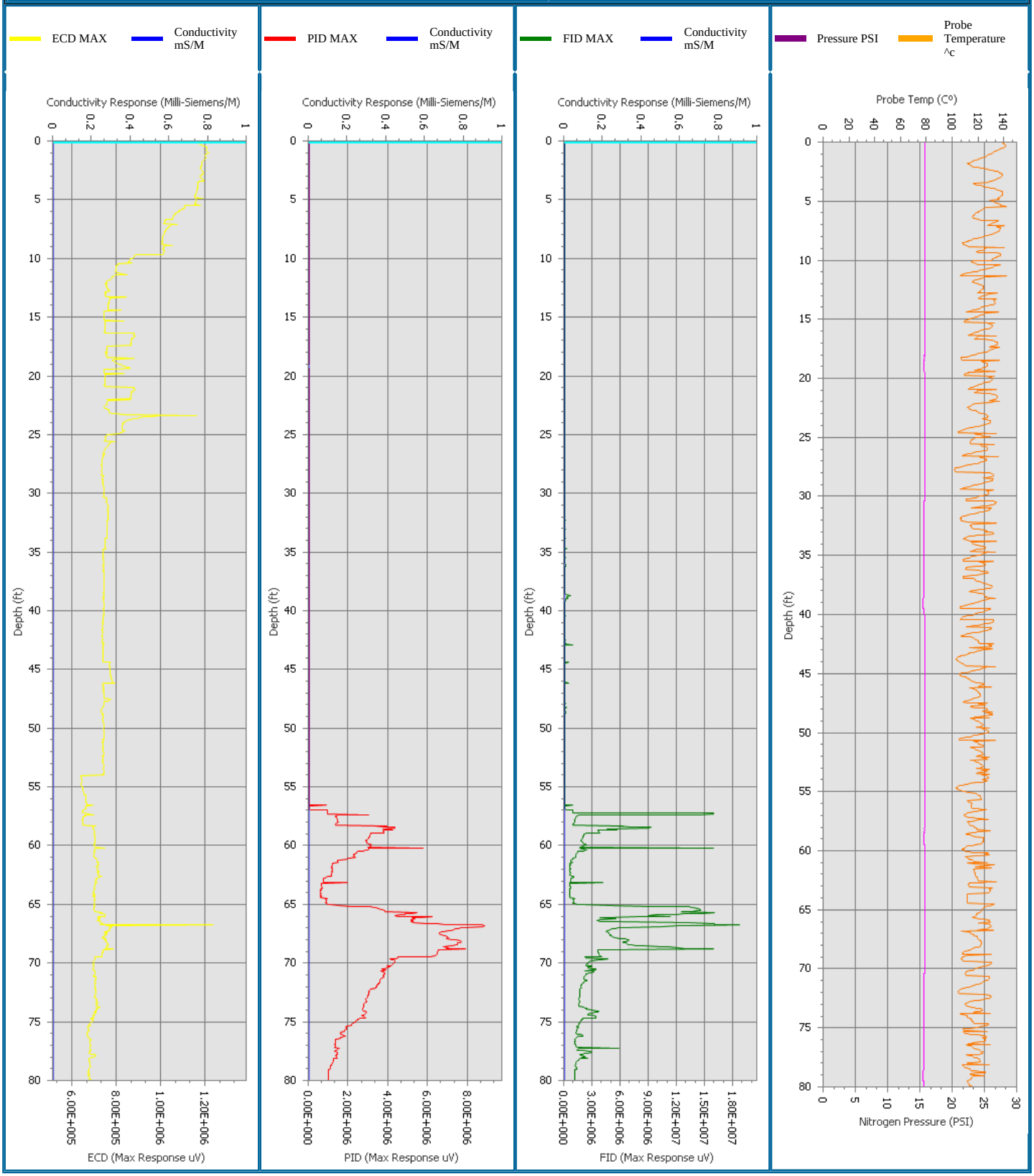
GW Depth (Ft) 0
Depth of GW Provided by Client

Job Information

Client Company :	ORION Environmental Inc.
Project Name :	Tesoro – Livermore Site
Site Address :	1619 1st St, Livermore, CA

MIP Sampling Information

Trunkline length :	200	Start Boring Time :	Tue Jan 25 2011 15:28:15
Probe Type :	6520/Heater Block	End Boring Time :	Tue Jan 25 2011 18:12:58
Rig Type :	CPT/Heater Block	MIP Specialist :	Jeff Paul



VIRONEX
1641 Challenge Drive
Concord, CA 94520
P: 925-849-6970
F: 925-849-6973
www.vironex.com

Boring Name : MIP-8

Total Depth (ft): 75.75

Air knife to 5 feet bgs.

Notes:

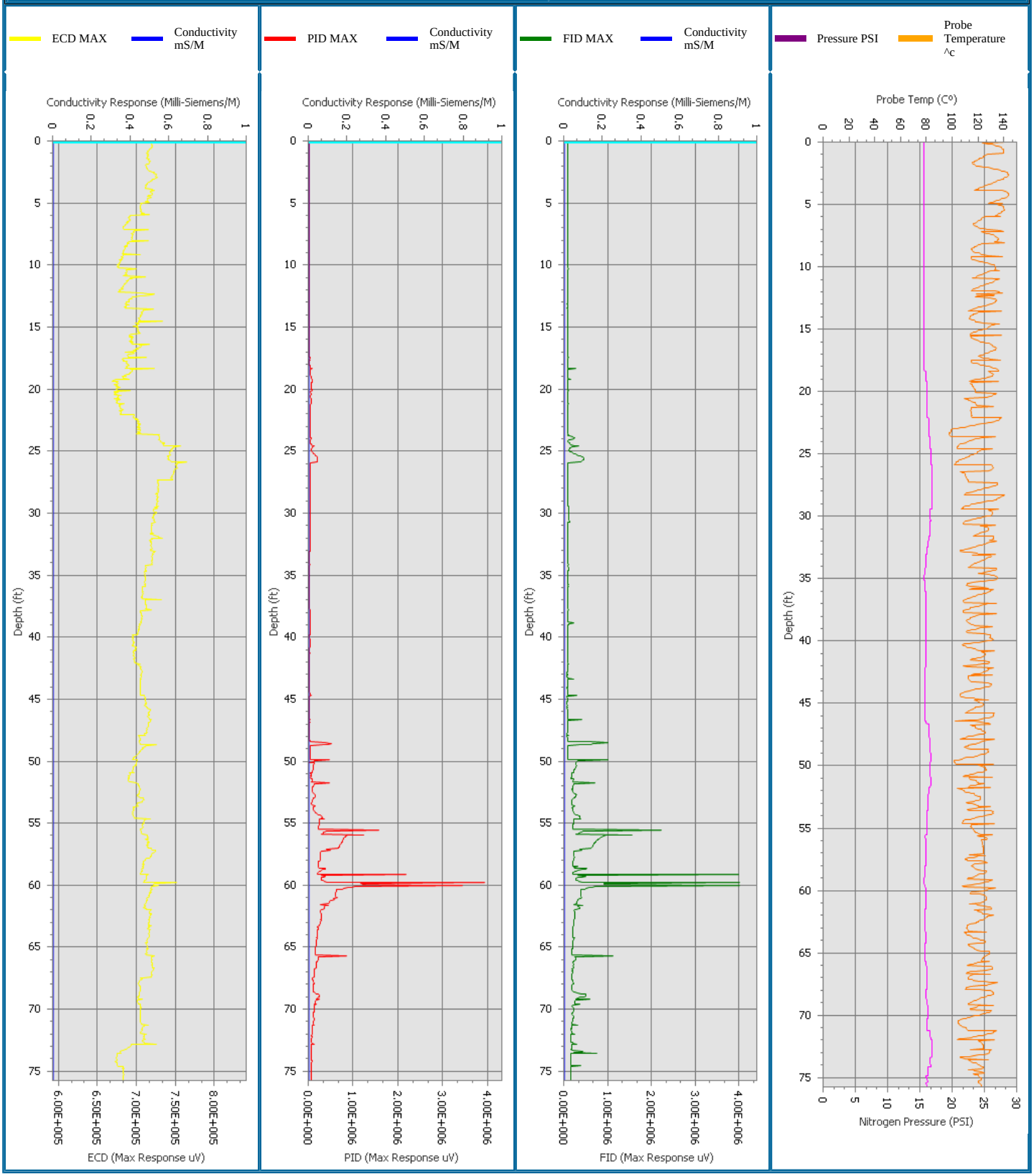
GW Depth (Ft) 0
Depth of GW Provided by Client

Job Information

Client Company :	ORION Environmental Inc.
Project Name :	Tesoro – Livermore Site
Site Address :	1619 1st St, Livermore, CA

MIP Sampling Information

Trunkline length :	200	Start Boring Time :	Tue Jan 25 2011 11:51:43
Probe Type :	6520/Heater Block	End Boring Time :	Tue Jan 25 2011 13:13:16
Rig Type :	CPT/Heater Block	MIP Specialist :	Jeff Paul



VIRONEX
1641 Challenge Drive
Concord, CA 94520
P: 925-849-6970
F: 925-849-6973
www.vironex.com

Boring Name : MIP-9

Total Depth (ft): 72

Hand auger to 5 feet bgs.

Notes:

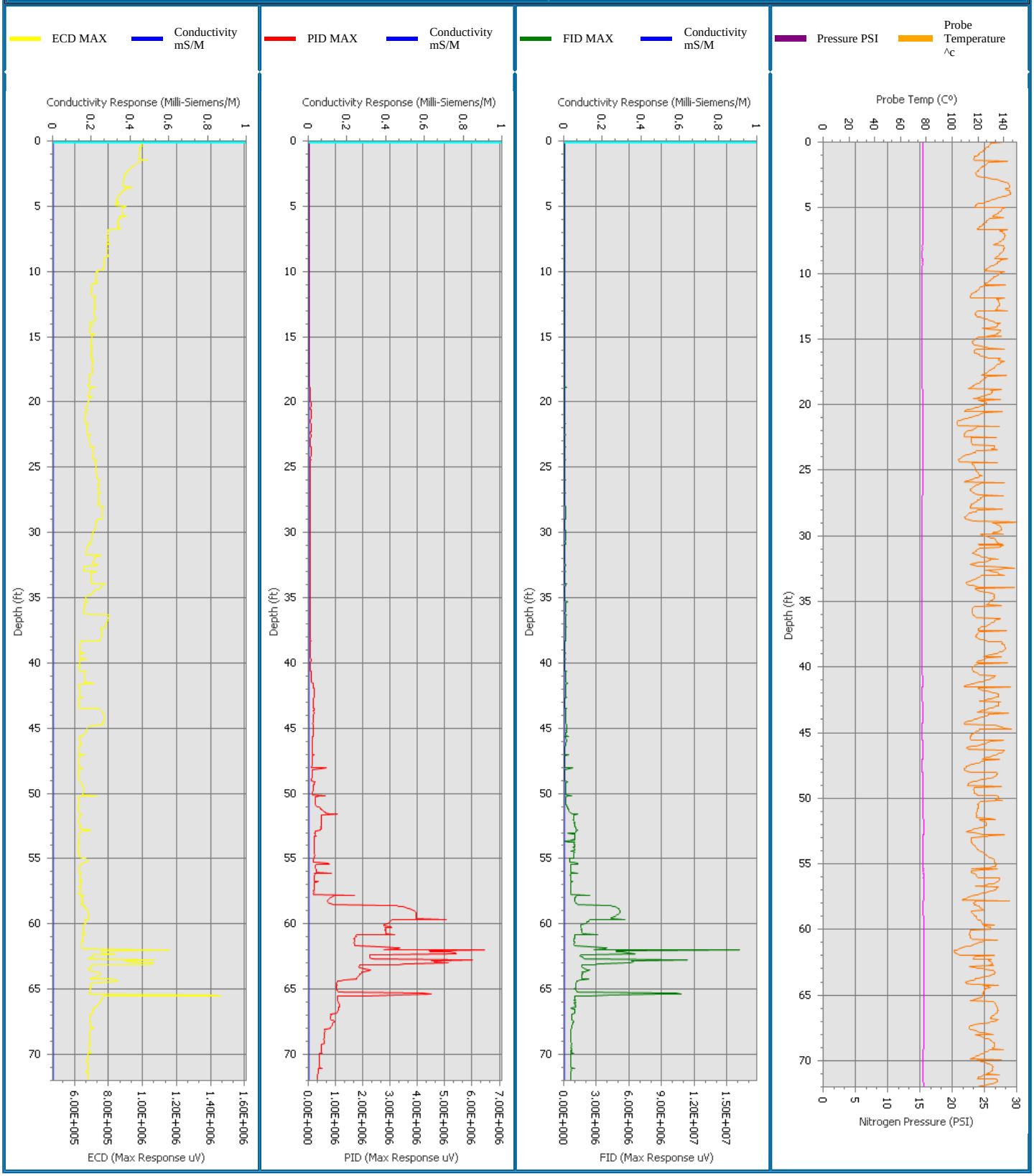
GW Depth (Ft) 0
Depth of GW Provided by Client

Job Information

Client Company :	ORION Environmental Inc.
Project Name :	Tesoro – Livermore Site
Site Address :	1619 1st St, Livermore, CA

MIP Sampling Information

Trunkline length :	200	Start Boring Time :	Wed Jan 26 2011 13:51:01
Probe Type :	6520/Heater Block	End Boring Time :	Wed Jan 26 2011 15:22:09
Rig Type :	CPT/Heater Block	MIP Specialist :	Jeff Paul



VIRONEX
1641 Challenge Drive
Concord, CA 94520
P: 925-849-6970
F: 925-849-6973
www.vironex.com

Boring Name : MIP-10

Total Depth (ft): 81.1

Hand auger to 5 feet bgs.

Notes:

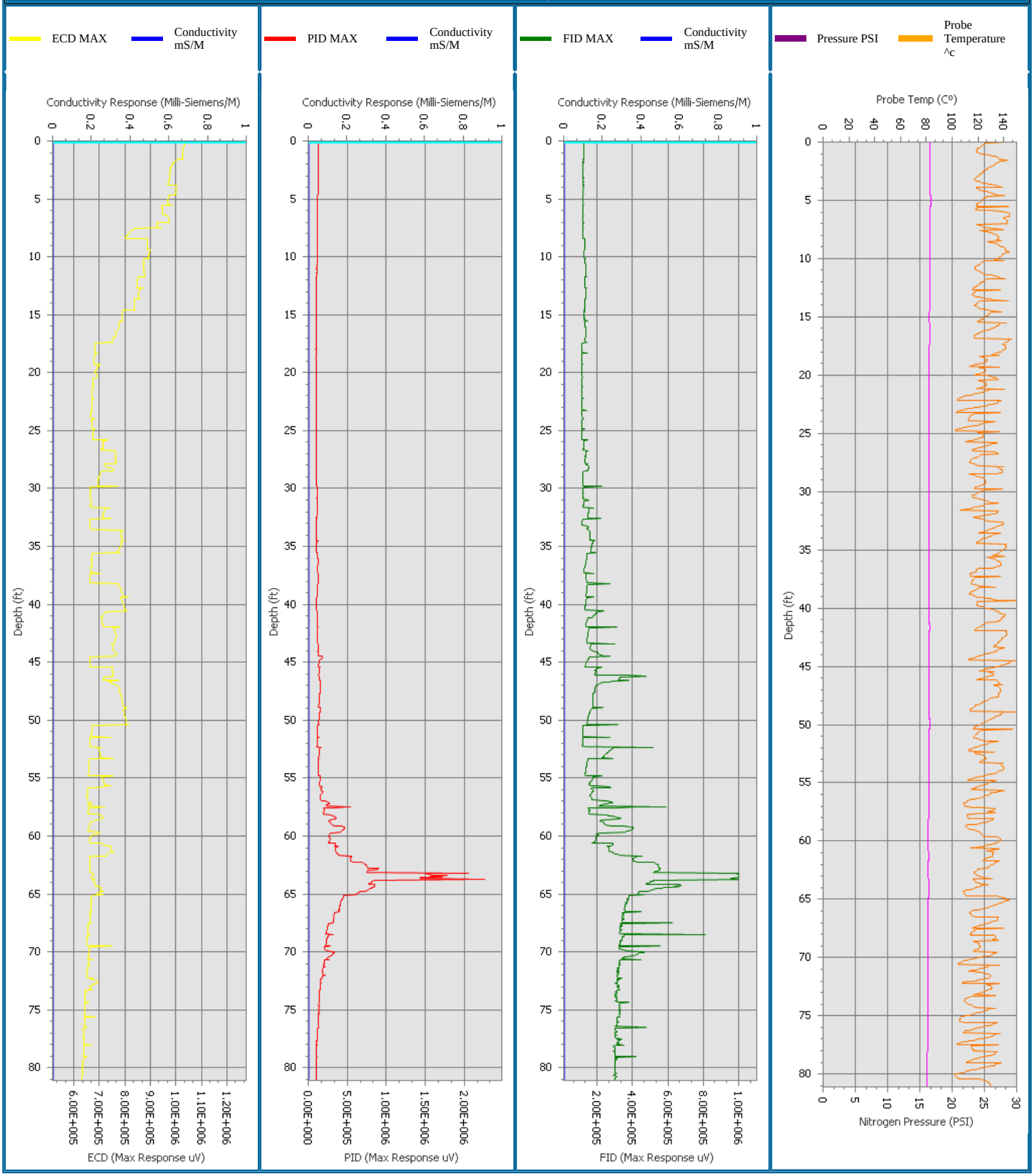
GW Depth (Ft) 0
Depth of GW Provided by Client

Job Information

Client Company :	ORION Environmental Inc.
Project Name :	Tesoro – Livermore Site
Site Address :	1619 1st St, Livermore, CA

MIP Sampling Information

Trunkline length :	200	Start Boring Time :	Wed Jan 26 2011 09:40:43
Probe Type :	6520/Heater Block	End Boring Time :	Wed Jan 26 2011 11:22:25
Rig Type :	CPT/Heater Block	MIP Specialist :	Jeff Paul



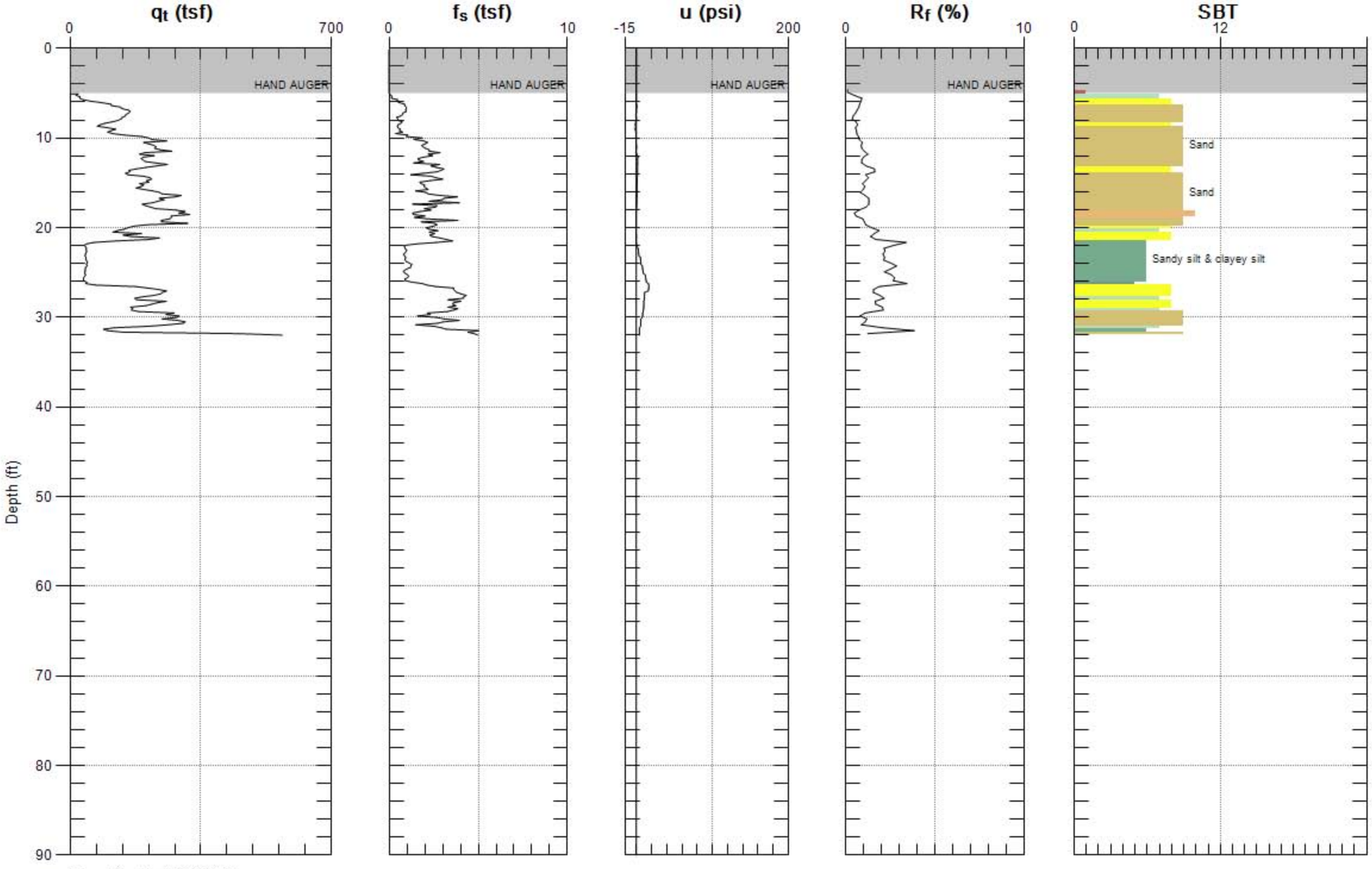
APPENDIX B

BORING LOGS

ARCTOS ENVIRONMENTAL

Site: 1619 1ST ST.
Sounding: MIP-1

Engineer: M.NELSON
Date: 1/4/2011 07:39

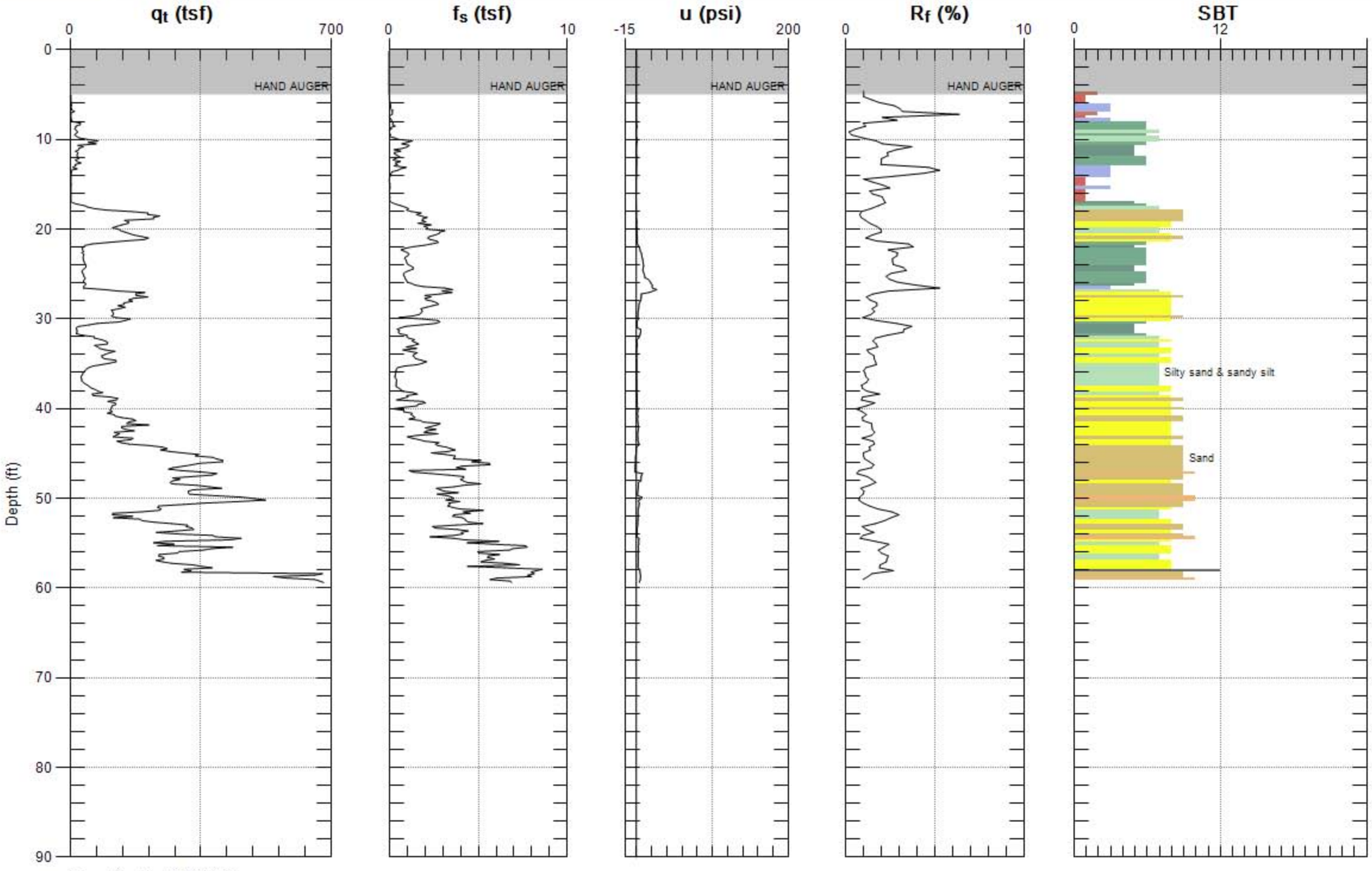


Max. Depth: 31.988 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ARCTOS ENVIRONMENTAL

Site: 1619 1ST ST.
Sounding: MIP-1-DEEP
Engineer: M.NELSON
Date: 1/4/2011 03:10



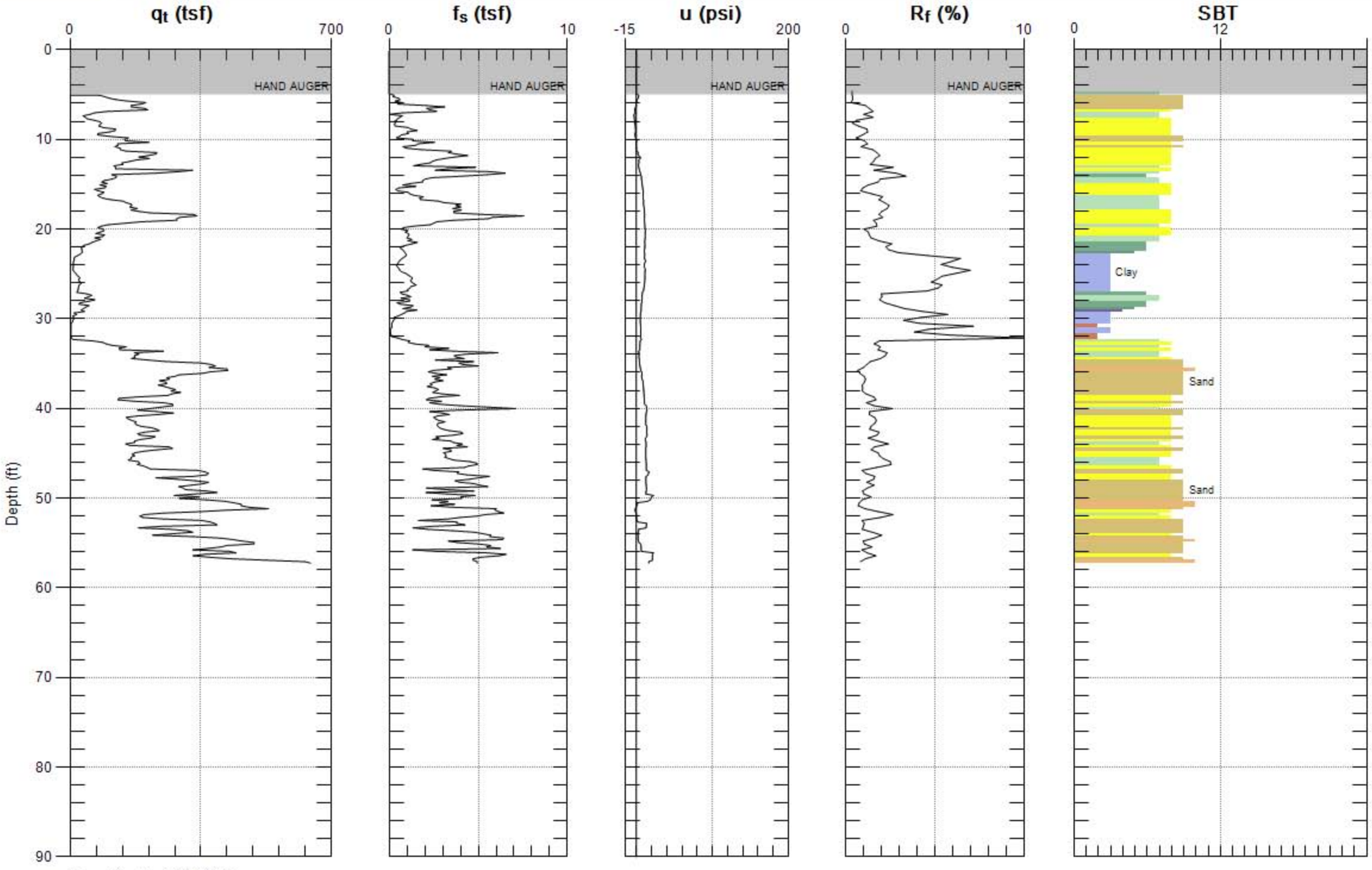
Max. Depth: 59.383 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ARCTOS ENVIRONMENTAL

Site: 1619 1ST ST.
Sounding: MIP-1-75

Engineer: M.NELSON
Date: 1/24/2011 03:18



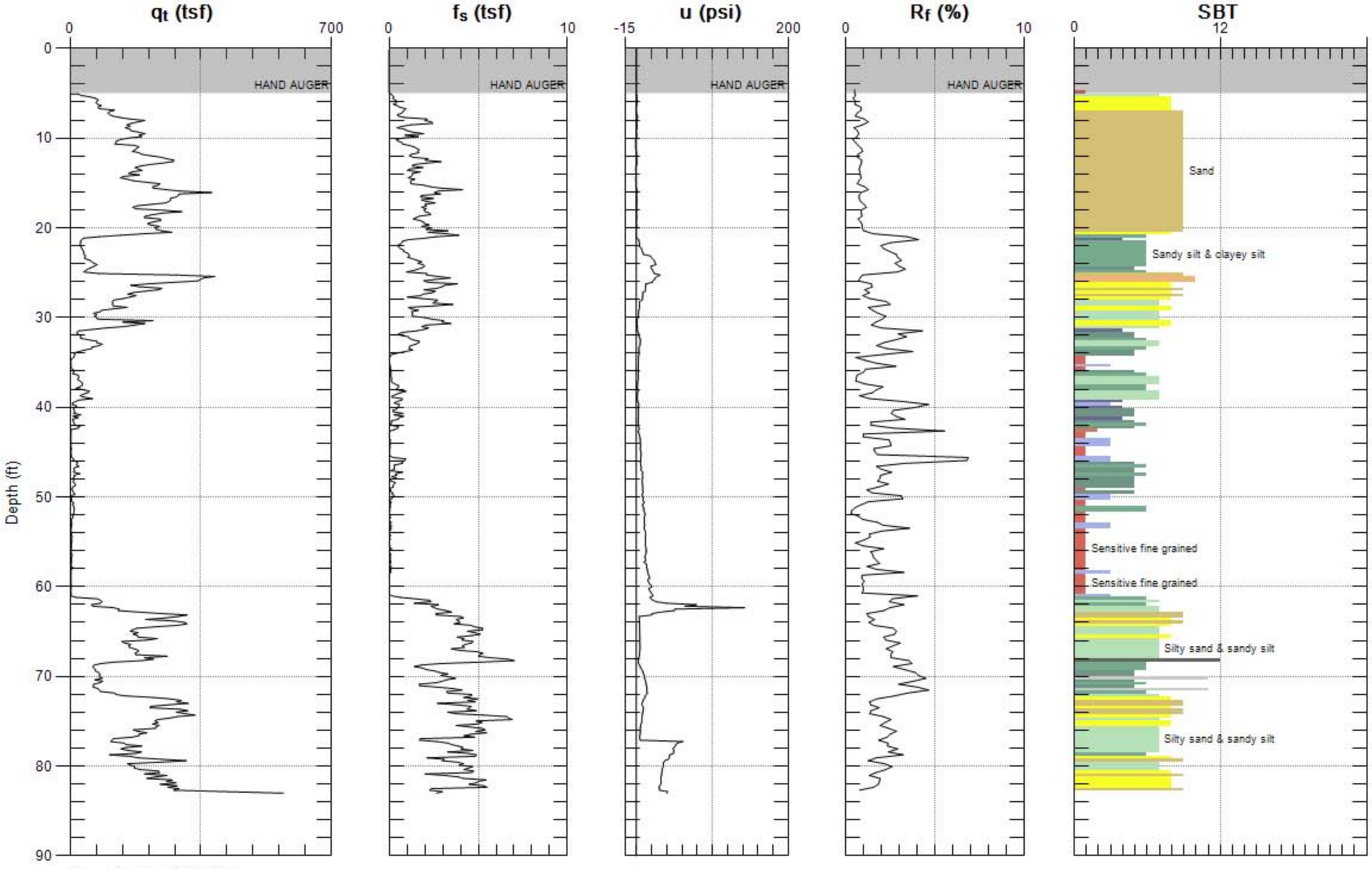
Max. Depth: 57.251 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ARCTOS ENVIRONMENTAL

Site: 1619 1ST ST.
Sounding: MIP-2

Engineer: M.NELSON
Date: 1/3/2011 02:32



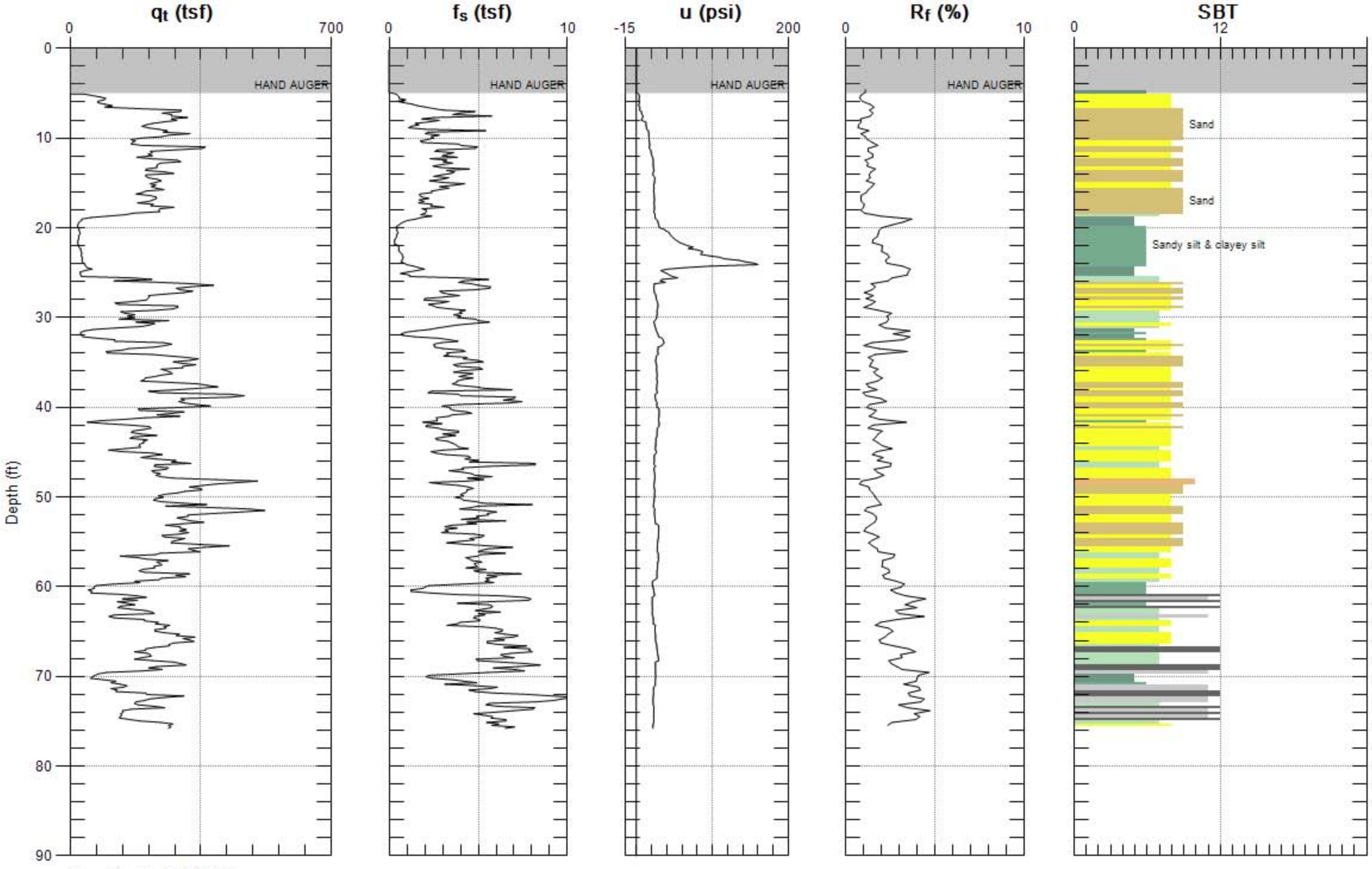
Max. Depth: 83.005 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ARCTOS ENVIRONMENTAL

Site: 1619 1ST ST.
Sounding: MIP-3

Engineer: M.NELSON
Date: 1/24/2011 07:34



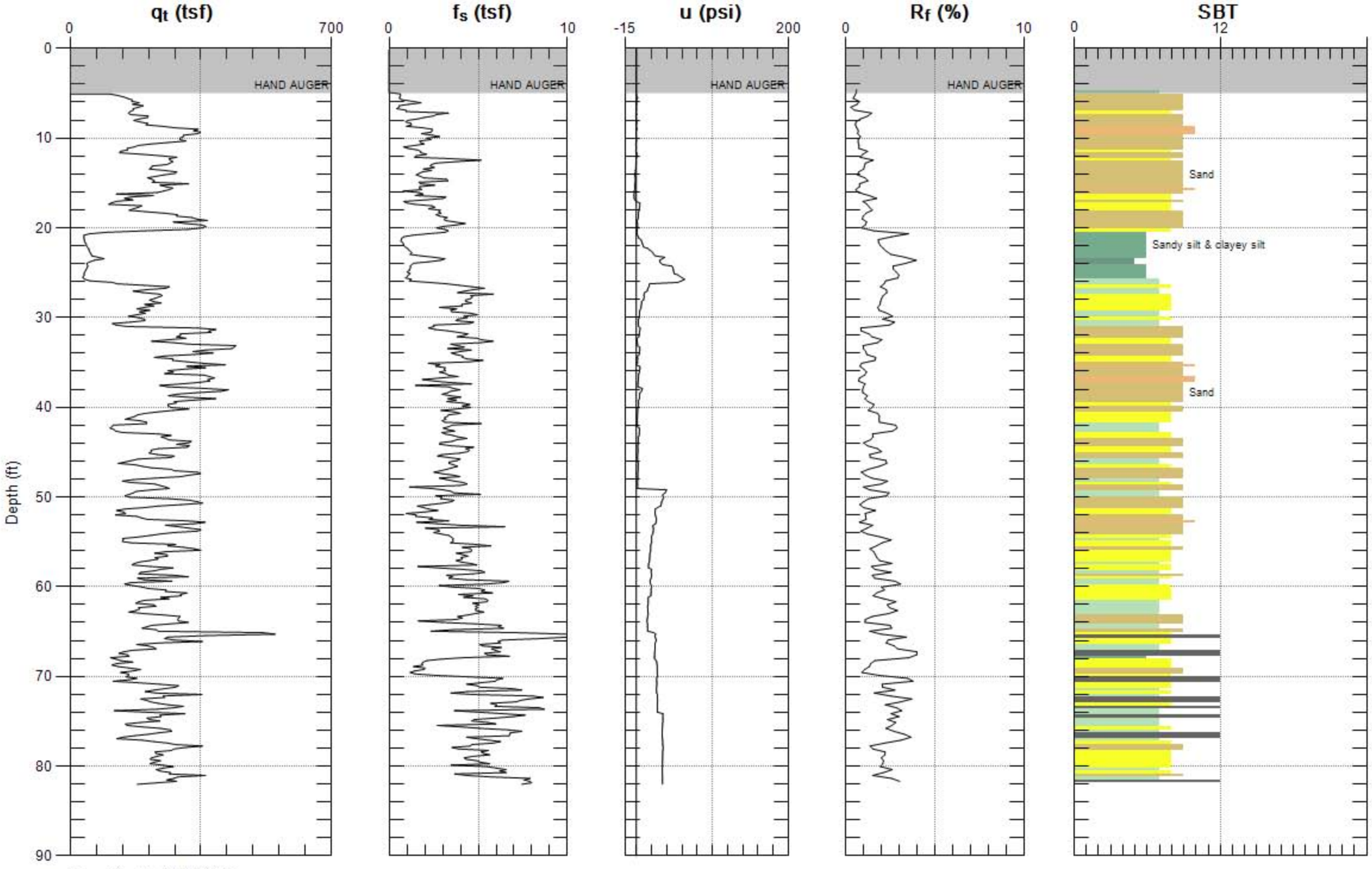
Max. Depth: 75.787 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ARCTOS ENVIRONMENTAL

Site: 1619 1ST ST.
Sounding: MIP-4

Engineer: M.NELSON
Date: 1/4/2011 11:17



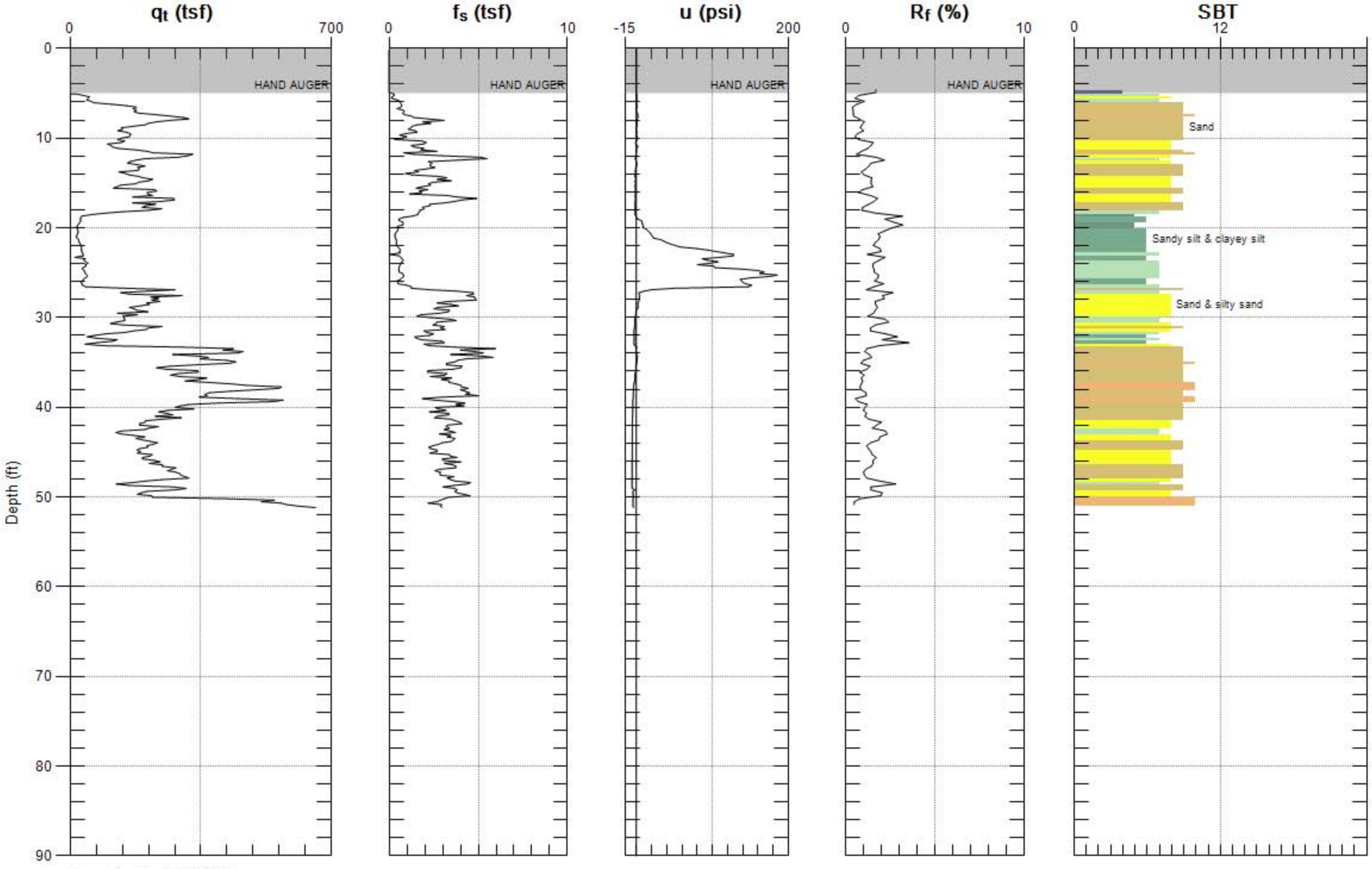
Max. Depth: 82.021 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ARCTOS ENVIRONMENTAL

Site: 1619 1ST ST.
Sounding: MIP-5

Engineer: M.NELSON
Date: 1/3/2011 09:57



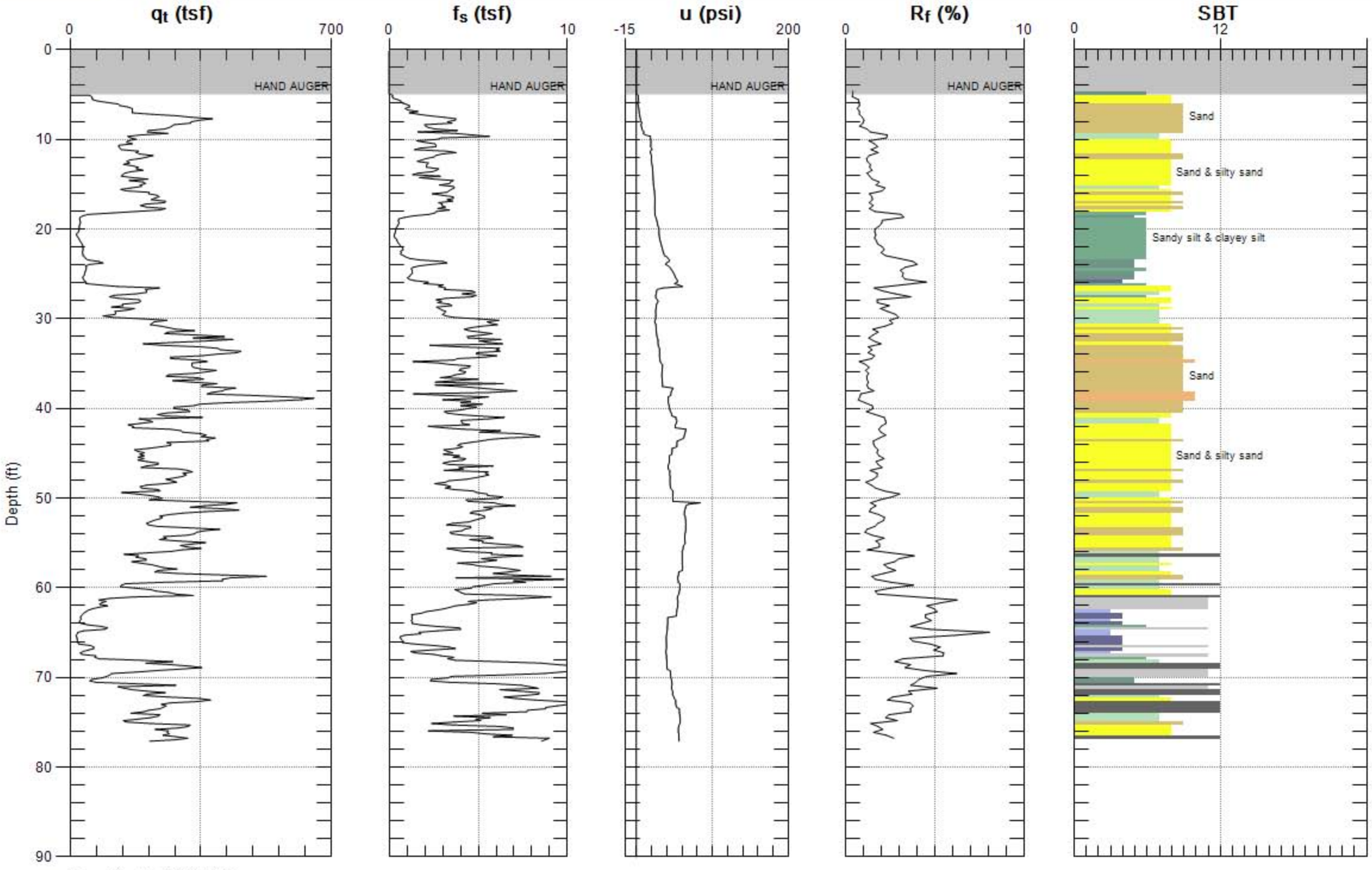
Max. Depth: 51.181 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ARCTOS ENVIRONMENTAL

Site: 1619 1ST ST.
Sounding: MIP-5-DEEP

Engineer: M.NELSON
Date: 1/25/2011 08:52



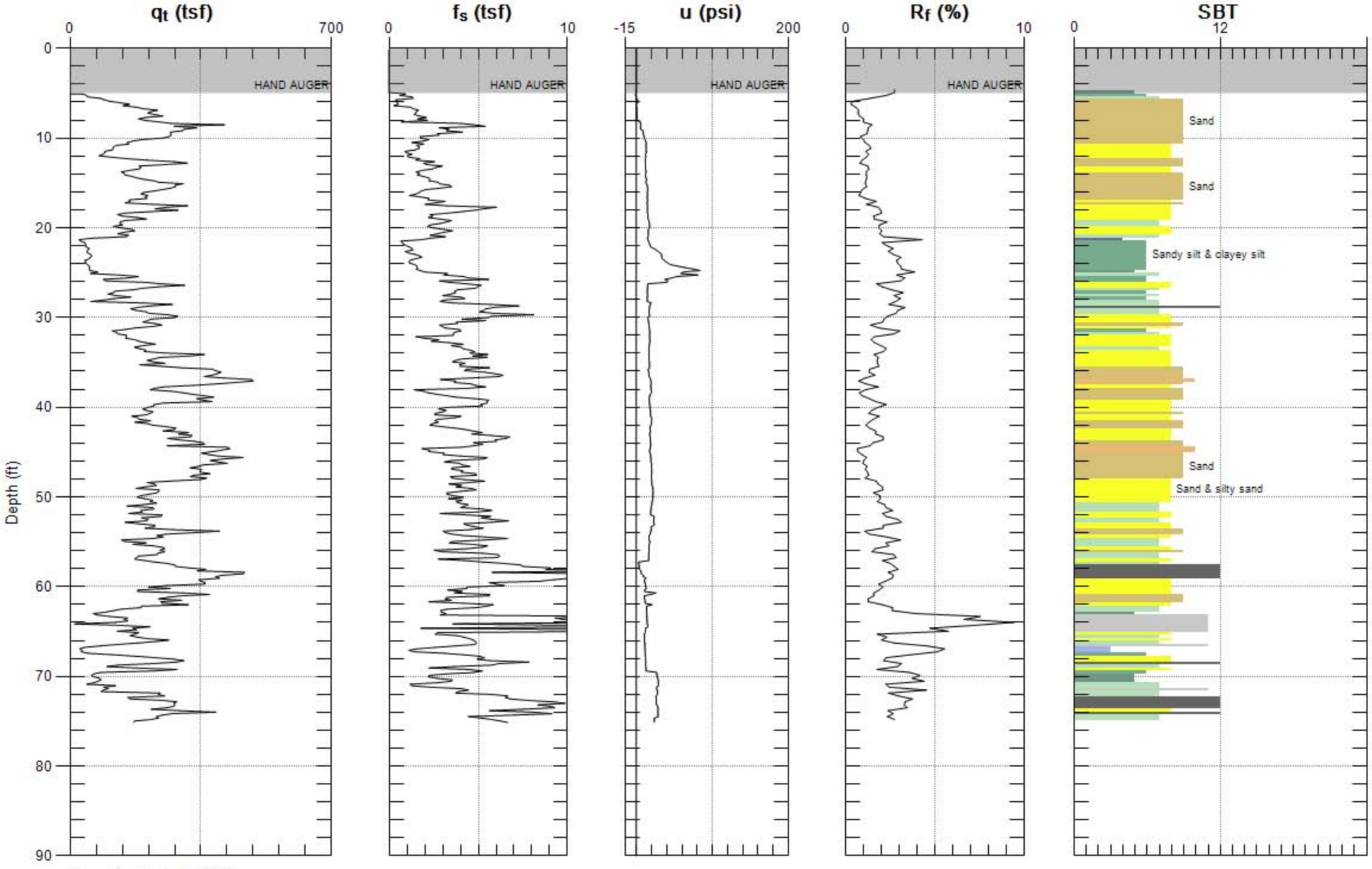
Max. Depth: 77.100 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ARCTOS ENVIRONMENTAL

Site: 1619 1ST ST.
Sounding: MIP-6

Engineer: M.NELSON
Date: 1/24/2011 11:29



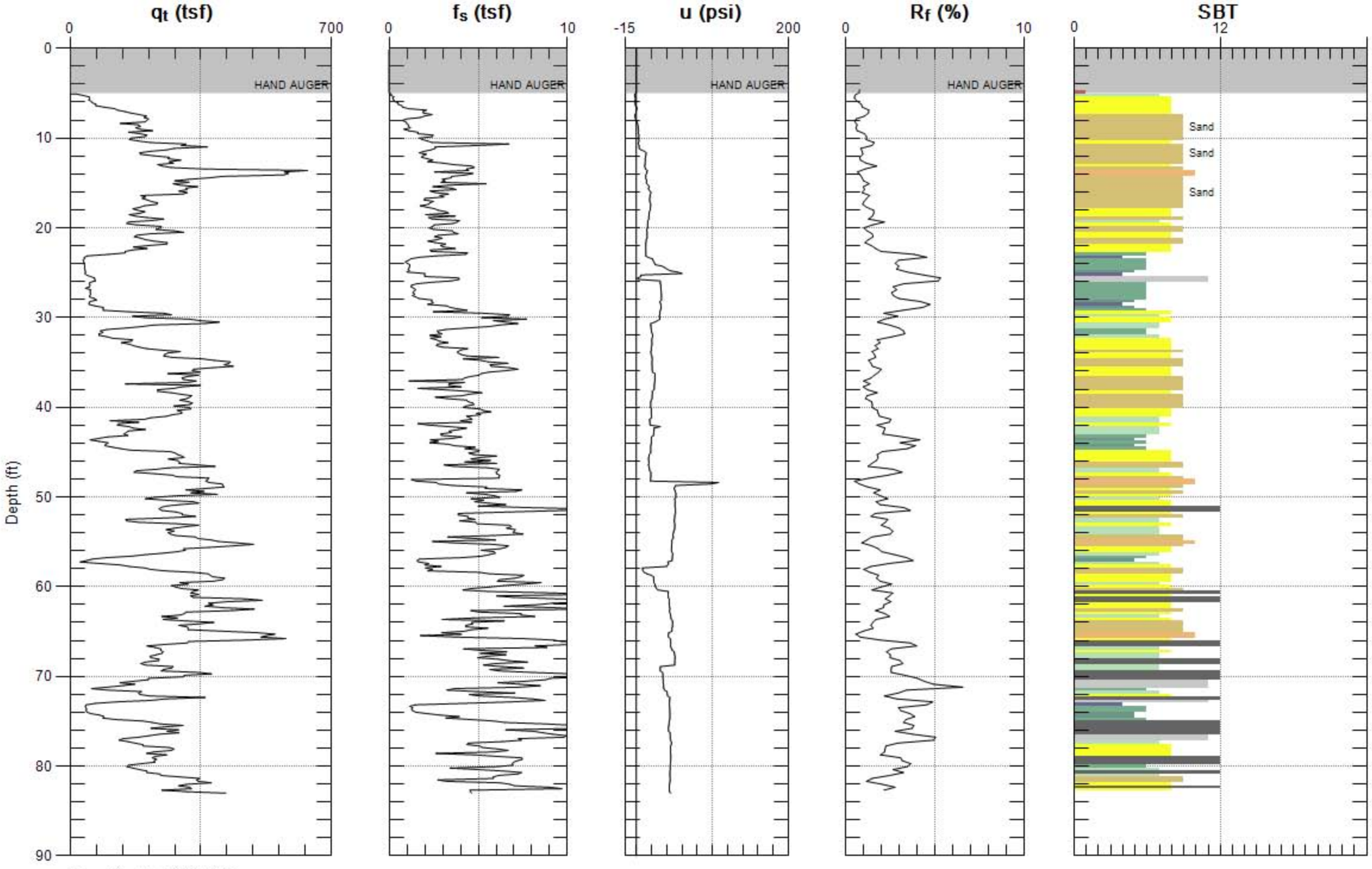
Max. Depth: 75.131 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ARCTOS ENVIRONMENTAL

Site: 1619 1ST ST.
Sounding: MIP-7

Engineer: M.NELSON
Date: 1/25/2011 03:12



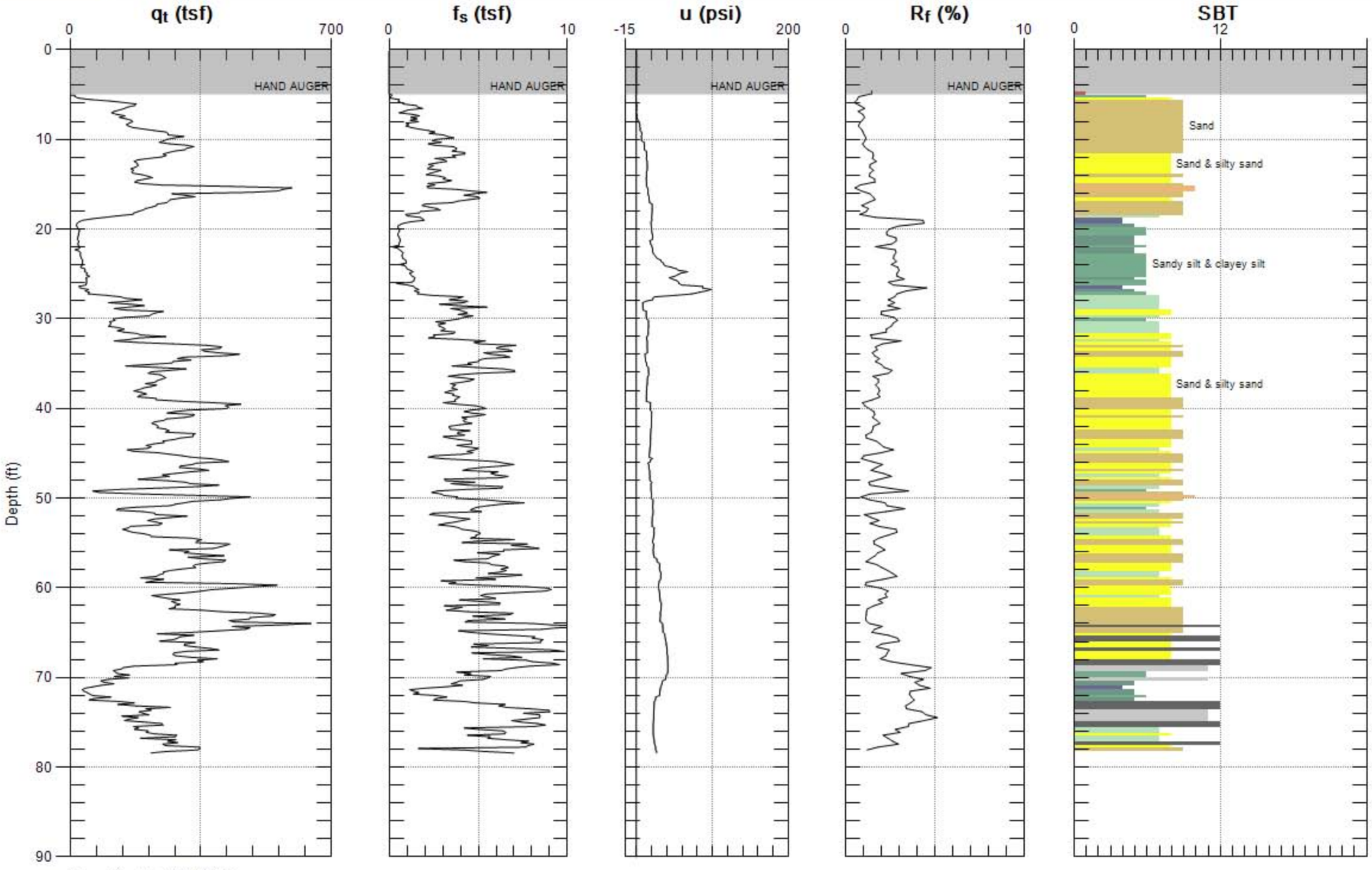
Max. Depth: 83.005 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ARCTOS ENVIRONMENTAL

Site: 1619 1ST ST.
Sounding: MIP-8

Engineer: M.NELSON
Date: 1/25/2011 11:37



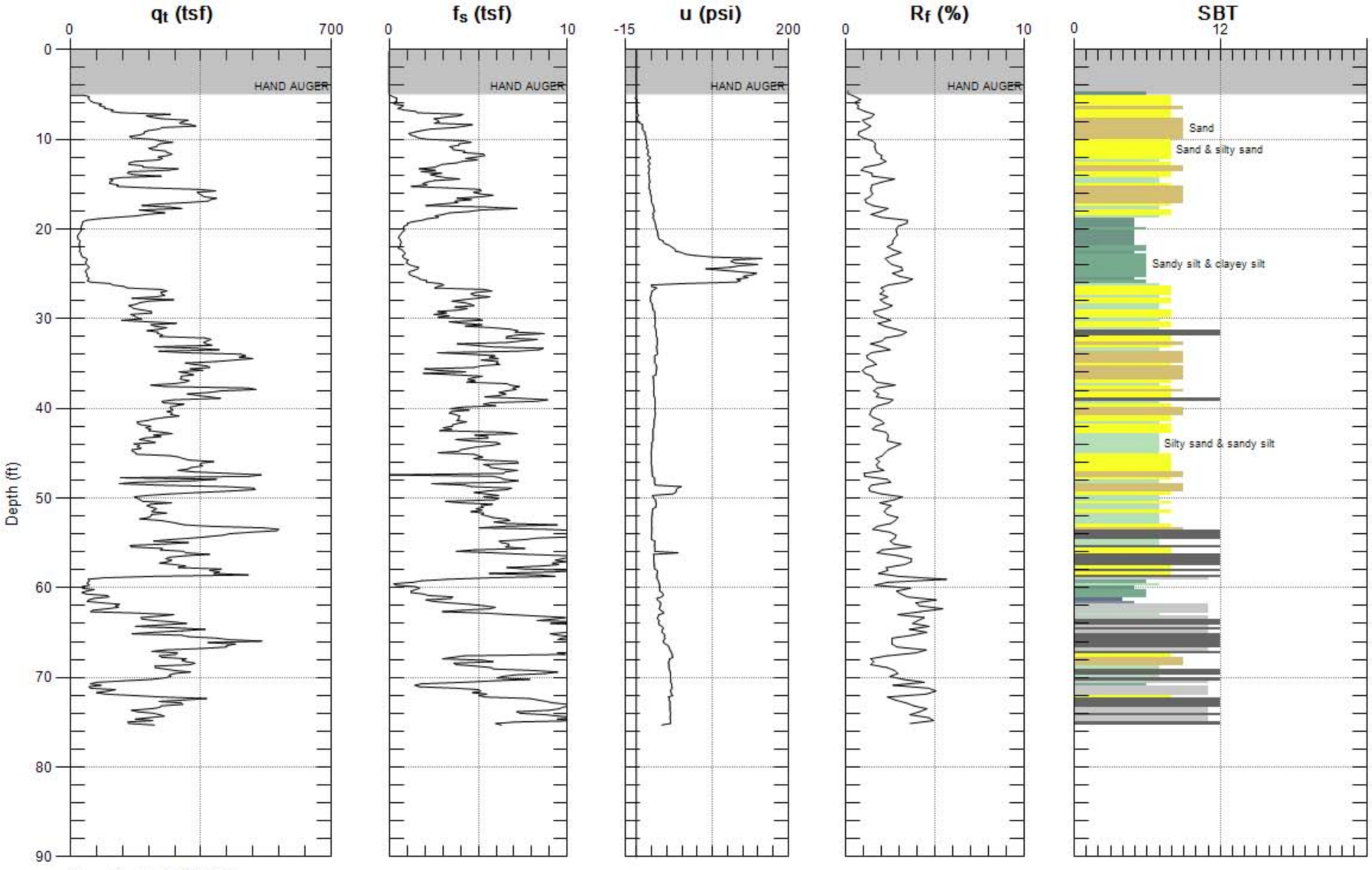
Max. Depth: 78.412 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ARCTOS ENVIRONMENTAL

Site: 1619 1ST ST.
Sounding: MIP-9

Engineer: M.NELSON
Date: 1/26/2011 01:35



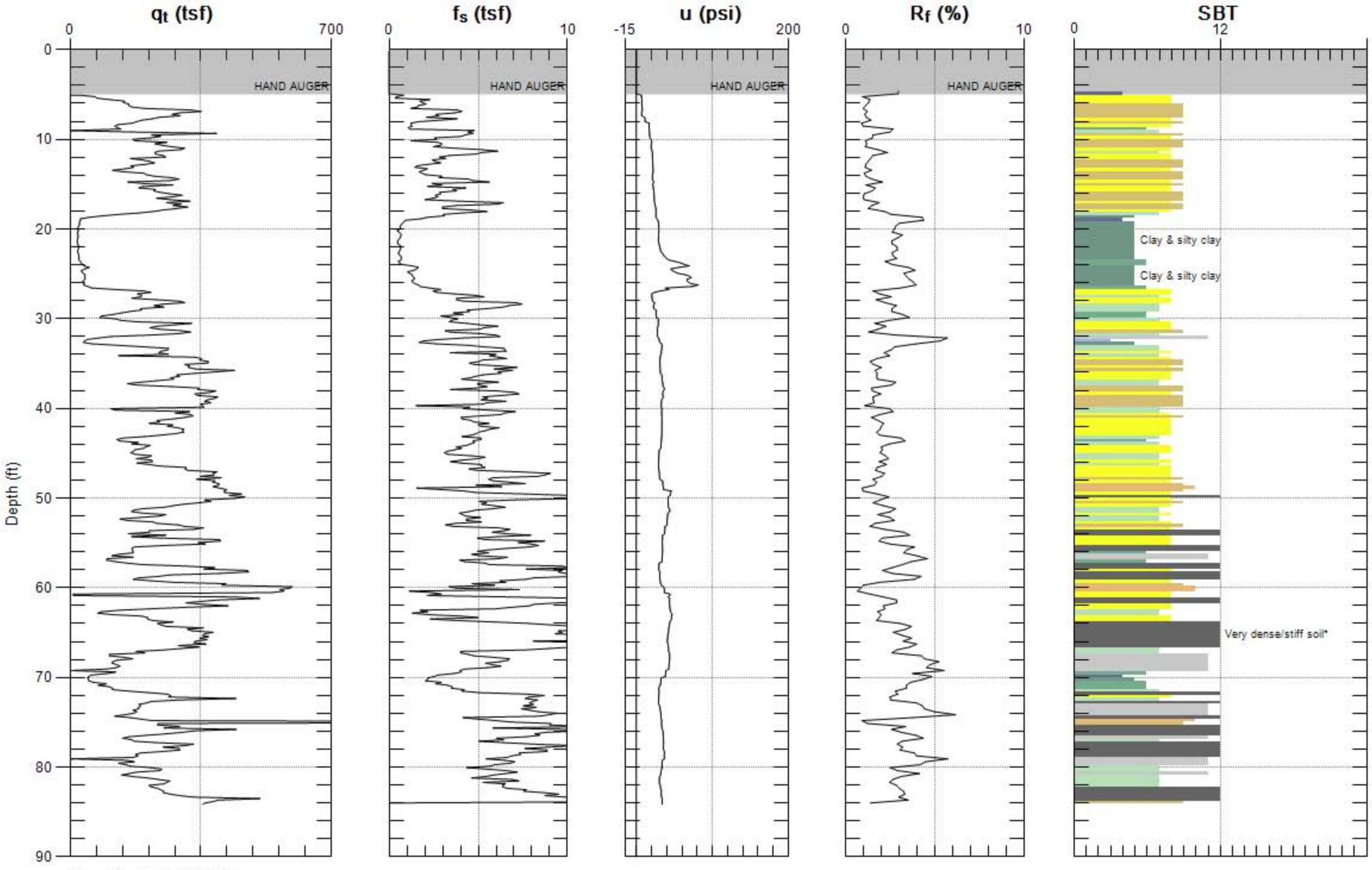
Max. Depth: 75.295 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ARCTOS ENVIRONMENTAL

Site: 1619 1ST ST.
Sounding: MIP-10

Engineer: M.NELSON
Date: 1/26/2011 09:03



Max. Depth: 84.154 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

APPENDIX C

SURVEY REPORT

CROSS LAND SURVEYING, INC.
Consulting Land Surveyors • GPS Control Surveys
KRISTINA D. COMERER, PLS 6766
2210 Mt. Pleasant Road
San Jose, CA 95148
(408) 274-7994
FAX (408) 270-8670

MONITORING WELL REPORT
TESORO SITE
1619 WEST FIRST STREET
LIVERMORE, CALIFORNIA
FEBRUARY 4, 2011

WELL NO.	LATITUDE	LONGITUDE	BORING ELEV.
MIP-1	37.6791890 N	121.7758908 W	473.71
MIP-2	37.6792114 N	121.7759009 W	473.61
MIP-3	37.6792381 N	121.7759121 W	473.55
MIP-4	37.6791955 N	121.7759559 W	473.03
MIP-5	37.6792186 N	121.7759670 W	472.97
MIP-6	37.6791726 N	121.7759432 W	473.06
MIP-7	37.6791618 N	121.7758745 W	474.27
MIP-8	37.6792086 N	121.7760069 W	473.32
MIP-9	37.6792503 N	121.7760295 W	473.16
MIP-10	37.6792452 N	121.7759833 W	472.98

Horizontal datum is NAD83 derived from a GPS Fast-Static survey holding California High Precision Geodetic Network Densification (HPGN-D) points CA 04-FK and CA 04-FL fixed horizontally, as published for epoch 1991.35, from the NGS Data Sheet, in a least squares adjustment of the GPS data.

Vertical datum is NGVD29. Found City of Livermore Bench Mark K2-741 being a brass pin in concrete, dn. 0.4' in easterly monument well at the intersection of S. "P" Street and Railroad Avenue. Published elevation for K2-741 is 467.835 feet, NGVD29, on file with the City of Livermore.

All boring elevations are to the center of the boring.

Kristina D. Comerer

Kristina D. Comerer, PLS 6766

Date: Feb. 4, 2011

MONITORING WELL SURVEY
TESORO SITE
1619 WEST FIRST STREET
LIVERMORE, CALIFORNIA
AUGUST 31, 2005
(REVISED JANUARY 9, 2007)
(REVISED OCTOBER 16, 2008)
(REVISED DECEMBER 18, 2008)
(REVISED DECEMBER 2, 2009)
(REVISED OCTOBER 19, 2010)
(REVISED FEBRUARY 4, 2011)
SCALE: 1" = 60'

TABLE OF BORING COORDINATE VALUES
HORIZONTAL DATUM–NAD83/VERTICAL DATUM–NGVD29

BORING	LATITUDE	LONGITUDE	BORING ELEV.
SG–1	37.6791912	121.7758364	474.41
SG–2	37.6792881	121.7757928	474.22
SG–3	37.6792864	121.7756919	474.46
SG–4	37.6793119	121.7758894	473.56
SG–5	37.6793315	121.7757811	474.12
SG–6	37.6793570	121.7756889	474.09
SG–7	37.6793620	121.7758664	473.86
SG–8	37.6793991	121.7757558	473.78
SG–9	37.6792596	121.7756289	474.80
DB–1	37.6793203	121.7759196	473.42
DB–2	37.6793686	121.7759036	473.27
DB–3	37.6793803	121.7758508	473.47
DB–4	37.6794084	121.7757639	473.61
DB–5	37.6795087	121.7765196	472.01
DB–6	37.6796013	121.7772700	469.35
DB–7	37.6796982	121.7778144	468.80
MIP–1	37.6791890	121.7758908	473.71
MIP–2	37.6792114	121.7759009	473.61
MIP–3	37.6792381	121.7759121	473.55
MIP–4	37.6791955	121.7759559	473.03
MIP–5	37.6792186	121.7759670	472.97
MIP–6	37.6791726	121.7759432	473.06
MIP–7	37.6791618	121.7758745	474.27
MIP–8	37.6792086	121.7760069	473.32
MIP–9	37.6792503	121.7760295	473.16
MIP–10	37.6792452	121.7759833	472.98

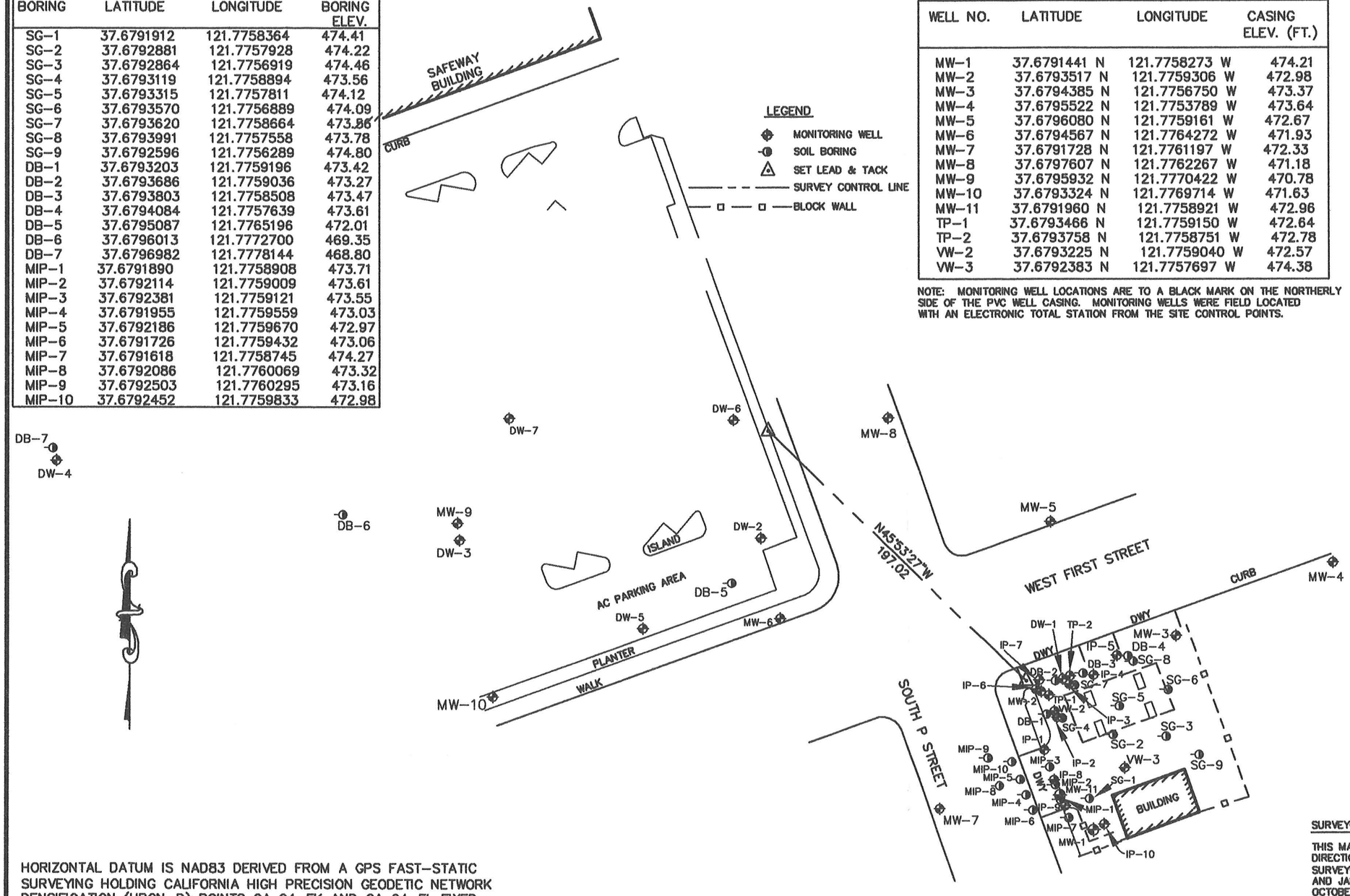


TABLE OF WELL COORDINATE VALUES
HORIZONTAL DATUM–NAD83/VERTICAL DATUM–NGVD29

WELL NO.	LATITUDE	LONGITUDE	CASING ELEV. (FT.)
MW–1	37.6791441 N	121.7758273 W	474.21
MW–2	37.6793517 N	121.7759306 W	472.98
MW–3	37.6794385 N	121.7756750 W	473.37
MW–4	37.6795522 N	121.7753789 W	473.64
MW–5	37.6796080 N	121.7759161 W	472.67
MW–6	37.6794567 N	121.7764272 W	471.93
MW–7	37.6791728 N	121.7761197 W	472.33
MW–8	37.6797607 N	121.7762267 W	471.18
MW–9	37.6795932 N	121.7770422 W	470.78
MW–10	37.6793324 N	121.7769714 W	471.63
MW–11	37.6791960 N	121.7758921 W	472.96
TP–1	37.6793466 N	121.7759150 W	472.64
TP–2	37.6793758 N	121.7758751 W	472.78
VW–2	37.6793225 N	121.7759040 W	472.57
VW–3	37.6792383 N	121.7757697 W	474.38

NOTE: MONITORING WELL LOCATIONS ARE TO A BLACK MARK ON THE NORTHERLY SIDE OF THE PVC WELL CASING. MONITORING WELLS WERE FIELD LOCATED WITH AN ELECTRONIC TOTAL STATION FROM THE SITE CONTROL POINTS.

TABLE OF WELL COORDINATE VALUES
HORIZONTAL DATUM–NAD83/VERTICAL DATUM–NGVD29

WELL NO.	LATITUDE	LONGITUDE	CASING ELEV. (FT.)
IP–1	37.6792638 N	121.7759226 W	473.06
IP–2	37.6793131 N	121.7758990 W	473.06
IP–3	37.6793634 N	121.7758759 W	473.05
IP–4	37.6793779 N	121.7758302 W	473.10
IP–5	37.6794078 N	121.7757863 W	473.05
IP–6	37.6793551 N	121.7759395 W	472.43
IP–7	37.6793691 N	121.7759336 W	472.43
IP–8	37.6792187 N	121.7759034 W	473.22
IP–9	37.6791801 N	121.7758820 W	473.35
IP–10	37.6791530 N	121.7758069 W	473.88
DW–1	37.6793712 N	121.7758889 W	472.85
DW–2	37.6795773 N	121.7764647 W	471.61
DW–3	37.6795678 N	121.7770369 W	470.33
DW–4	37.6796795 N	121.7778064 W	468.48
DW–5	37.6794386 N	121.7766868 W	471.86
DW–6	37.6797544 N	121.7765190 W	471.77
DW–7	37.6797523 N	121.7769456 W	470.07

HORIZONTAL DATUM IS NAD83 DERIVED FROM A GPS FAST–STATIC SURVEYING HOLDING CALIFORNIA HIGH PRECISION GEODETIC NETWORK DENSIFICATION (HPGN–D) POINTS CA 04–FK AND CA 04–FL FIXED HORIZONTALLY, AS PUBLISHED FOR EPOCH 1991.35, FROM THE NGS DATA SHEET, IN A LEAST SQUARES ADJUSTMENT OF THE GPS DATA.

VERTICAL DATUM IS NGVD29. FOUND CITY OF LIVERMORE BENCH MARK K2–741 BEING A BRASS PIN IN CONCRETE, DN. 0.4' IN EASTERLY MONUMENT WELL AT THE INTERSECTION OF S. "P" STREET AND RAILROAD AVENUE. PUBLISHED ELEVATION FOR K2–741 IS 467.835 FEET, NGVD29, ON FILE WITH THE CITY OF LIVERMORE.

LICENSED LAND SURVEYOR
KRISTINA D. COMERER
LS 6766
Exp. 9/30/12
STATE OF CALIFORNIA

SURVEYOR'S STATEMENT

THIS MAP CORRECTLY REPRESENTS A SURVEY MADE BY ME OR UNDER MY DIRECTION IN CONFORMANCE WITH THE REQUIREMENTS OF THE PROFESSIONAL LAND SURVEYORS' ACT AT THE REQUEST OF MIKE PURCHASE, AUGUST 2005, MARCH 2006 AND JANUARY 2007 AND MATTHEW NELSON IN SEPTEMBER 2008, DECEMBER 2009, OCTOBER 2010, AND FEBRUARY 4, 2011.

Kristina D. Comerer
KRISTINA D. COMERER, PLS 6766
DATE: Feb. 4, 2011

CROSS LAND SURVEYING, INC.
2210 MT. PLEASANT ROAD
SAN JOSE, CA 95148
(408) 274–7994
PROJECT NO. 05–32

APPENDIX D

FIELD INVESTIGATION QA/QC PROCEDURES

APPENDIX D
FIELD INVESTIGATION QA/QC PROCEDURES

Health and Safety

Before beginning work at the site, a site safety meeting was conducted. Field personnel reviewed the site-specific health and safety plan (HSP) and signed the accompanying acknowledgment form. Field personnel were required to comply with the HSP throughout performance of site assessment activities.

Based on the site history and potential chemicals of concern, field activities were initiated in Level D personal protective equipment (PPE). During field activities, the breathing zone of field personnel was monitored using a field photoionization detector (PID). If breathing zone PID readings indicated elevated levels of organic vapors, PPE was upgraded accordingly. Breathing zone readings were recorded on the boring logs.

Drilling Methods

Cone penetration testing (CPT) borings were advanced using a 20-ton capacity integrated electronic cone system advanced by direct-push using the weight of the rig. The cone took measurements of cone bearing (qc), sleeve friction (fs), and dynamic pore water pressure (u2) at 5-centimeter intervals during penetration to provide a nearly continuous geologic log. Soil behavior type and stratigraphic interpretation were provided by Gregg Drilling & Testing, Inc., of Martinez, California, and were based on relationships between cone bearing, sleeve friction, and dynamic pore water pressure. The boring and well logs are in Appendix B.

Equipment Decontamination Procedures

Soil boring equipment was decontaminated between borings using the following procedures:

1. Rinse with water using a brush to remove soil and mud.
2. Wash with non-phosphate detergent and water using a brush.
3. Rinse with deionized water.
4. Rinse again with deionized water.
5. Air dry.

Management of Drill Cuttings and Wastewater

The drill cuttings and wastewater were placed in 55-gallon drums and stored on site. Each drum was labeled with the date, drum contents, and corresponding depths (for drill

cuttings). The project manager will determine the appropriate disposal method for the soil and wastewater drums.

Documentation Procedures

Arctos personnel followed documentation procedures developed for site investigation work. The procedures serve to provide a record of the activities performed in the field.

Arctos field personnel were on site to observe the progress of the investigation and to monitor each boring. The membrane interface probe (MIP) results were provided to Arctos field personnel and to the project team in real time during the field program. Based on the real time data, field decisions were made to add additional borings to complete the delineation. The results for each boring are provided in Appendix A.

APPENDIX E

WELL INSTALLATION QA/QC PROCEDURES

APPENDIX E
WELL INSTALLATION QA/QC PROCEDURES

Health and Safety

Arctos will modify the site-specific Health and Safety Plan (HSP) for the field program outlined in this work plan. The HSP presents procedures for personnel and equipment safety, medical surveillance, personal protection, air-quality monitoring, exposure control, emergency response procedures, and general work practices.

Before beginning work at the site, a site safety meeting will be conducted. Field personnel will review the HSP and sign the accompanying acknowledgment form. Field personnel will be required to comply with the HSP throughout performance of site assessment activities.

Based on the site history and potential chemicals of concern, field activities will be initiated in Level D personal protective equipment (PPE). During field activities, the breathing zone of field personnel will be monitored using a field photoionization detector (PID). If breathing zone PID readings indicate elevated levels of organic vapors, PPE will be upgraded accordingly. Breathing zone readings will be recorded on the boring log.

The following sections provide a description of Arctos's proposed drilling, soil sampling, and well installation program.

Drilling and Soil Sampling Procedures

Before initiating drilling activities, Arctos will mark the well locations and contact Underground Service Alert (USA) to clear the area of subsurface lines and utilities. Arctos will also obtain boring and well permits from Zone 7 Water Agency and an encroachment permit from the City of Livermore.

The soil boring for the installation of the monitoring well will be drilled with 10-inch-diameter hollow-stem continuous-flight augers. Soil samples will be collected with a split-spoon sampler containing three brass tubes, each 2 inches in diameter and 6 inches in length. The sampler will be driven to the sampling depth by dropping a 140-pound hammer approximately 36 inches. Samples will be collected at 5 feet below grade and 5-foot intervals thereafter.

Immediately after the sampler is retrieved from the auger, it will be placed on a portable field stand near the boring and the brass tubes removed. The ends of one of the tubes will be covered with Teflon liners and capped with polyvinyl chloride (PVC) end caps. The sealed tubes will be labeled or marked, placed in a resealable plastic, and placed on ice in a cooler until delivery to the analytical laboratory. The information on the label or marked on the brass tube will include project identification, sample number, sample depth, date, time, and initials of the person preparing the samples.

A portion of the soil from one of the tubes will be extruded and placed in a sealable plastic bag, which will then be closed and allowed to equilibrate for approximately 10 minutes. The organic vapor levels in the headspace will be measured using a field PID. The same sample will be visually examined and the results of the visual observation and headspace reading will be recorded on the boring or well construction log. The soil type will be classified using the Unified Soil Classification System (USCS) as described in American Society for Testing and Materials (ASTM) Standards D2487 and D2488.

Monitoring Well Installation

An Arctos registered geologist or registered civil engineer will supervise or direct well construction and installation. The monitoring well will be installed with a casing with total depth of approximately 65.5 feet below grade and screened from 55 to 65 feet below grade as shown on the well construction diagram (Figure 5). Field personnel may adjust actual well depth and screen placement as required by the field conditions encountered.

The well will be constructed using new 4-inch-diameter, flush-threaded, Schedule 40 PVC casings. As indicated by site lithology and previous well constructions, a 0.020-inch slot size and 2/12 Lonestar sand filter pack will be used in the new well. The annular space around the well will be filled with filter pack to about 2 feet above the top of the screen. A drawing showing the as-built well construction will be included on the boring/well installation log.

An approximately 3-foot-thick layer of bentonite will be placed above the filter pack to provide an annular seal. The wells will be surged before placing the annular seal to allow for filter pack settlement. After placement, the seal will be hydrated with potable water. The remainder of the annulus to near ground surface will be filled with cement. A locking cap and traffic-rated cover will be installed at the surface.

The well will be developed at least 72 hours after installation by surging and bailing to remove fines from the filter pack and well screen to reduce sediment in the groundwater. Development will be considered complete when at least 5 to 10 casing volumes are removed or until the pH, temperature, and specific conductivity measurements of the evacuated groundwater stabilize to within 10 percent of the previous readings.

Groundwater Sampling Procedures

Groundwater samples will be collected from the new well at least 48 hours after development. The depth to groundwater will be measured to the nearest 1/100 foot before sampling using an electric water-level sounder. Approximately 3 casing volumes will be purged from the well before sampling. Throughout purging and just before sampling the well, the pH, specific conductivity, and temperature of the purged groundwater will be measured and recorded. These measurements will be made to confirm that the well is purged sufficiently. Groundwater samples will be collected after the measurements stabilize to within 10 percent of the previous readings.

Sampling will be performed using a 1-inch-diameter disposable polyethylene bailer suspended from a nylon line. The bailer will be equipped with a bottom-release device. Samples will be collected from just below the water surface after the water level has recovered to at least 80 percent of the pre-purge level.

Water samples will be transferred from the bailer to new 40-milliliter glass bottles with Teflon-lined caps provided by the analytical laboratory. The bottles will be filled so that no air bubbles (i.e., headspace) will be present in the vial. A field (equipment) blank will be collected after decontamination of the sampling equipment. A field blank will not be collected if the well is sampled using disposable bailers.

Monitoring Well Surveying

A licensed surveyor will survey the elevation and location of the new well following the requirements of State Assembly Bill 2886. The location will be measured to the nearest 1/10 foot and the elevations to the nearest 1/100 foot relative to mean sea level.

General Field Quality Assurance/Control (QA/QC) Procedures

Chain-of-Custody Records
Chain-of-custody records will be completed before samples are packaged for shipment. One copy of these records will be placed in the project file. A second copy will accompany samples during transportation to the laboratory. An individual in the analytical laboratory will accept responsibility for samples by signing and dating the chain-of-custody record.

Equipment Decontamination Procedures
Field equipment will be decontaminated between sampling events using the following procedures:

1. Rinse with water using a brush to remove soil and mud.
2. Wash with non-phosphate detergent and water using a brush.
3. Rinse with deionized or distilled water.
4. Rinse again with deionized or distilled water.
5. Air dry.

Personal Decontamination Procedures
At a minimum, field personnel will follow the following decontamination procedures:

1. Wear appropriate gloves.
2. Wash hands thoroughly with soap and water.

3. Avoid unnecessary contact with groundwater.

The site health and safety plan will be reviewed for site-specific personal decontamination procedures.

Wastewater and Solid Waste Storage and Disposal
Small volumes of used wash and rinse solutions will be collected during field work and transported to a central decontamination area. This wastewater will be stored in a holding tank. The Project Manager will determine the appropriate disposal method for this wastewater. Waste manifests for this quarter are in Attachment G.

Solid wastes such as used personal protective equipment, paper towels, trash bags, and any other solid debris will be collected for disposal. If the sampled groundwater is not a hazardous waste, the solid wastes will be disposed with the onsite trash.

Field Investigation Documentation Procedures
Field personnel will follow documentation procedures developed for site investigation work. The procedures serve to (1) provide a record of the activities performed in the field and (2) permit identification of samples and tracking of their status in the field, during shipment, and at the laboratory. All documentation will be recorded with waterproof ink. Groundwater sampling activities will be documented on daily field reports and on well purge and sample logs.

Health and Safety
Arctos will use a site-specific health and safety plan (HSP) with procedures that will be followed by field personnel for equipment safety, medical surveillance, personal protection, air quality monitoring, exposure control, emergency response, and general work practices during field activities. Before beginning work at the site, a site safety meeting will be conducted. Field personnel will review the HSP and sign the accompanying acknowledgment form before initiating field activities. Field personnel are required to comply with the HSP throughout performance of site assessment activities.

Analytical QA/QC Procedures
Laboratory analytical QA/QC procedures include (1) preparing and analyzing laboratory samples to assess the performance of the analytical laboratory and (2) conducting data validation in accordance with the protocols described below. QC samples prepared by the laboratory include method blanks, matrix spike and matrix spike duplicates, and laboratory control samples.

The laboratory results will be reviewed in general accordance with EPA guidelines for data validation. The data validation process includes reviewing laboratory results for the following parameters:

- ☐ Completeness of the data package
- ☐ Compliance with EPA-required holding times

- ☐ Agreement of dilution factors with reported detection limits
- ☐ Presence or absence of analytes in the method blanks
- ☐ Agreement of duplicate samples
- ☐ Percent recovery and relative percent difference results for matrix spike and matrix spike duplicate analyses
- ☐ Percent recovery results for laboratory control samples.