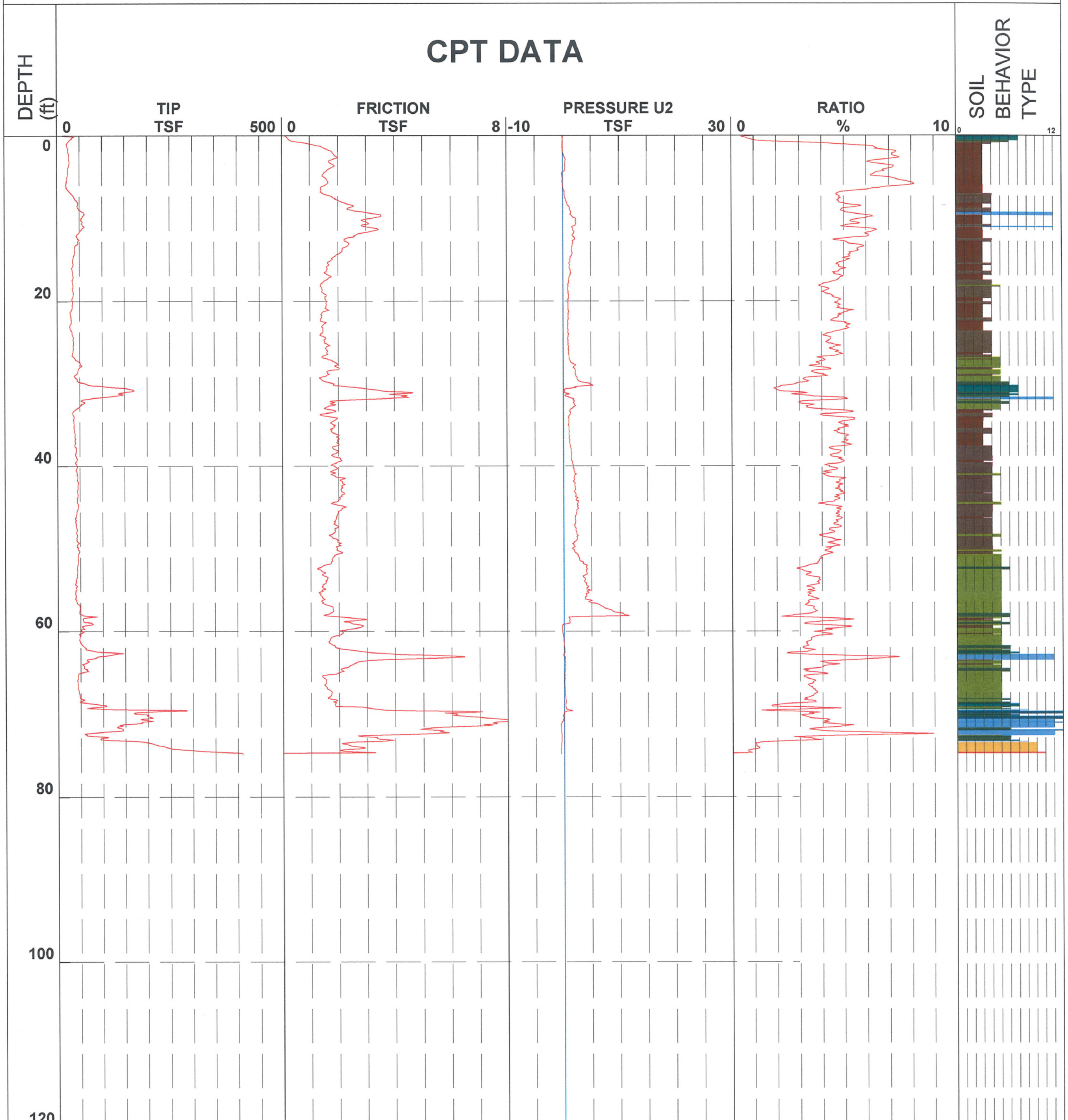
EXELON TEXAS VICTORIA COL

CPT LOGS

CPT Data

FUGRO

Job Number	04.1909-0015	CPT Number	C-3101	Location	Exelon Victoria-TX
Operator	Albert Fonseca	Date and Tin	06-Mar-2009 12:25:30	Cone Numbe	F7.5CKE2HAW21498
Client	MACTEC	Northing	13411985.89	Easting	2599505.85
Elevation	79.87	Review by:	SL	Verify by:	Ry

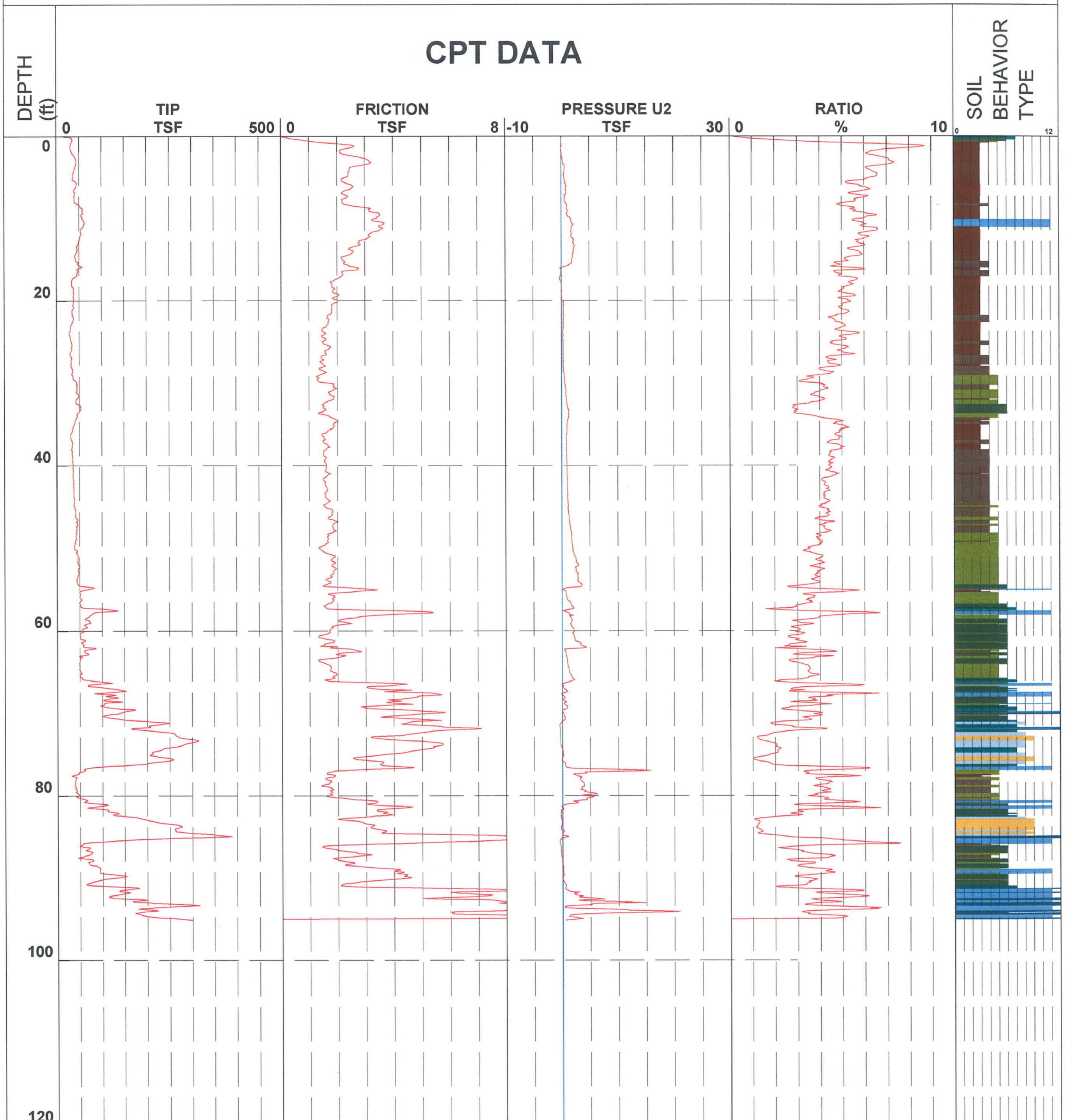


■ 1 - sensitive fine grained
■ 2 - organic material
■ 3 - clay
■ 4 - silty clay to clay
■ 5 - clayey silt to silty clay
■ 6 - sandy silt to clayey silt
■ 7 - silty sand to sandy silt
■ 8 - sand to silty sand
■ 9 - sand
■ 10 - gravelly sand to sand
■ 11 - very stiff fine grained (*)
■ 12 - sand to clayey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

Robertson et al. 1986 * Overconsolidated or Cemented

CPT Data

Job Number	04.1909-0015	CPT Number	C-3102	Location	Exelon Victoria-TX
Operator	Albert Fonseca	Date and Tir	06-Mar-2009 13:44:49	Cone Numbei	F7.5CKE2HAW21498
Client	MACTEC	Northing	13412109.22	Easting	2599642.04
Elevation	80.03	Review by:	SL	Verify by:	Ry

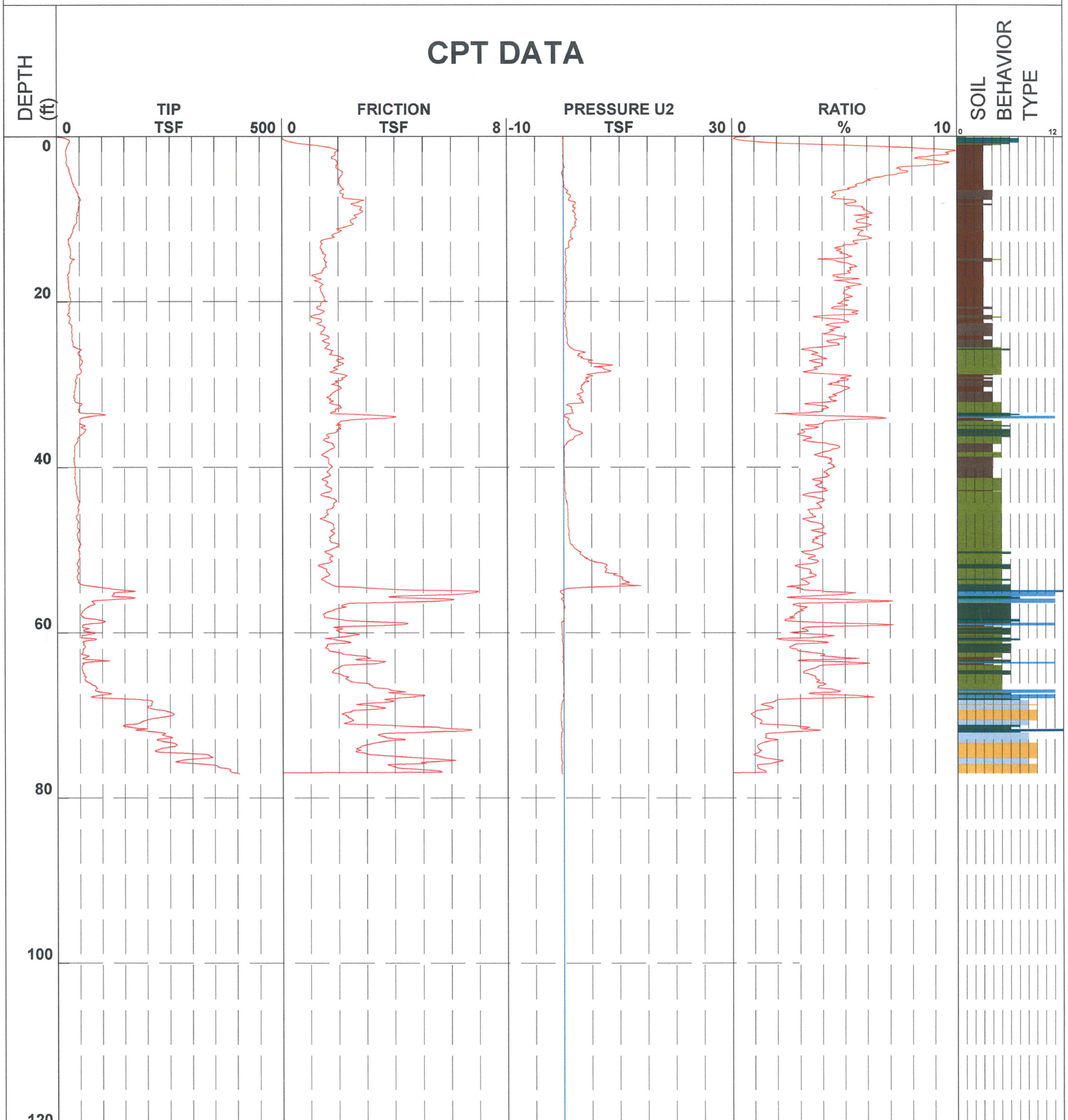


1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Robertson et al. 1986 * Overconsolidated or Cemented

CPT Data

Job Number	04.1909-0015	CPT Number	C-3110	Location	Exelon Victoria-TX
Operator	Albert Fonseca	Date and Tin	06-Mar-2009 10:21:38	Cone Numbei	F7.5CKE2HAW21498
Client	MACTEC	Northing	13411774.14	Easting	2599769.00
Elevation	79.19	Review by:	SL	Verify by:	Ry

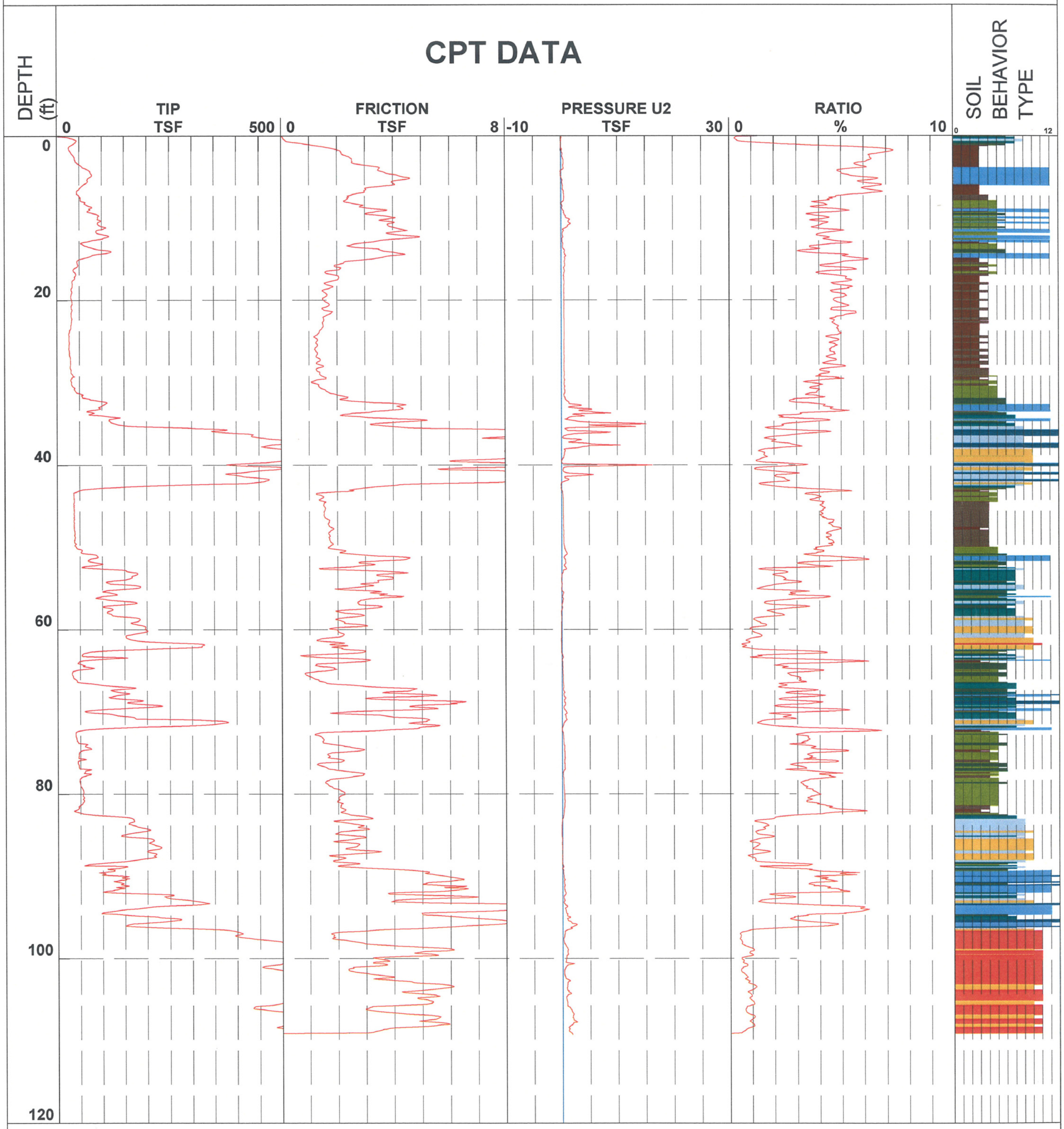


1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Robertson et al. 1986 * Overconsolidated or Cemented

CPT Data

Job Number	04.1909-0015	CPT Number	C-3201	Location	Exelon Victoria-TX
Operator	Albert Fonseca	Date and Tin	05-Mar-2009 10:17:49	Cone Number	F7.5CKE2HAW21498
Client	MACTEC	Northing	13413646.69	Easting	2600904.17
Elevation	79.87	Review by:	SL	Verify by:	Ry



■ 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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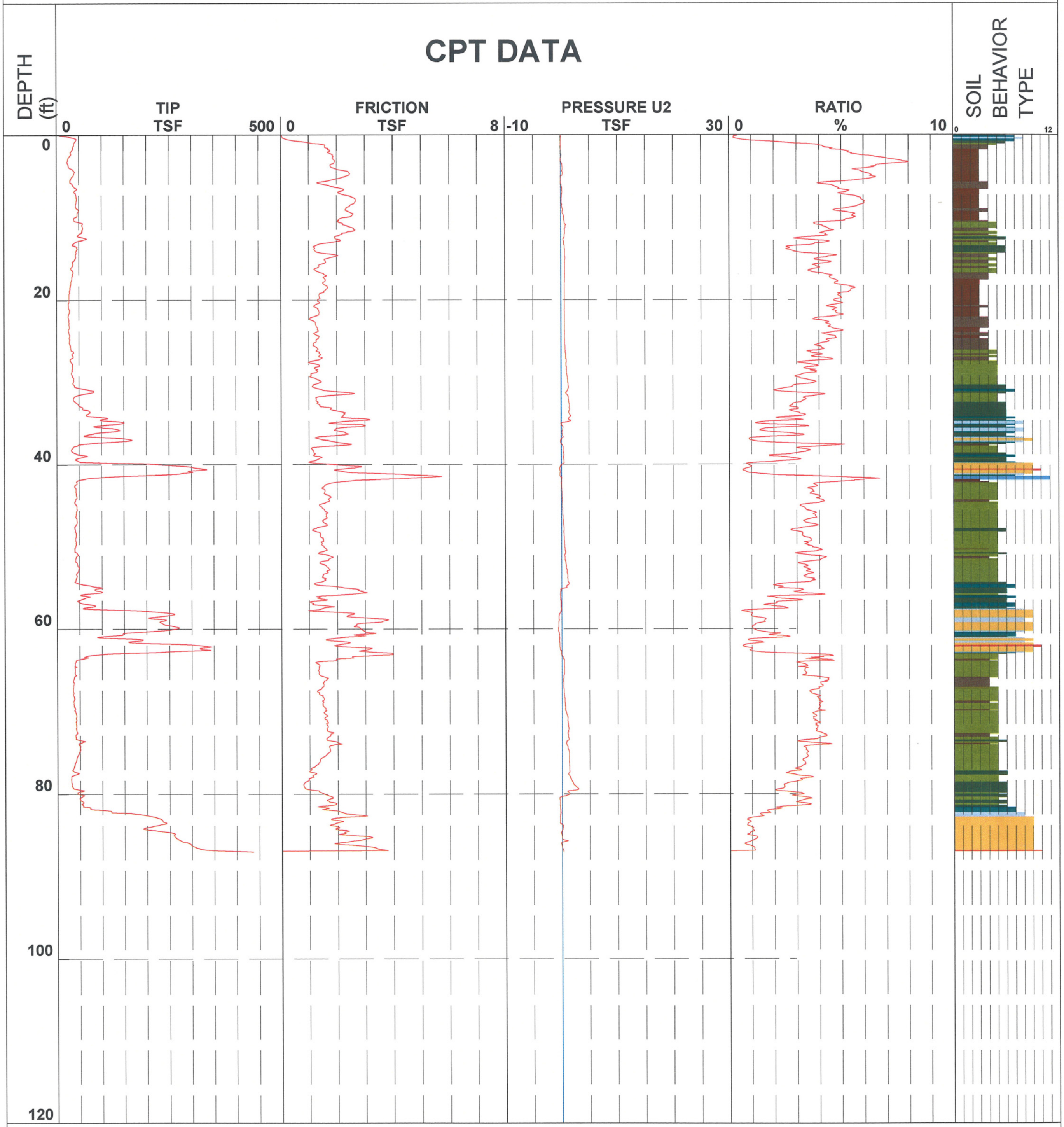
CPT Data

Job Number	04.1909-0015	CPT Number	C-3204	Location	Exelon Victoria-TX
Operator	Albert Fonseca	Date and Tin	04-Mar-2009 15:49:04	Cone Numbei	F7.5CKE2HAW21498
Client	MACTEC	Northing	13413340.70	Easting	2600979.03
Elevation	79.99	Review by:	SL	Verify by:	fy



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 (*)

Robertson et al. 1986 * Overconsolidated or Cemented

CPT Data

Job Number	04.1909-0015	CPT Number	C-3205	Location	Exelon Victoria-TX
Operator	Albert Fonseca	Date and Tin	05-Mar-2009 08:29:08	Cone Numbei	F7.5CKE2HAW21498
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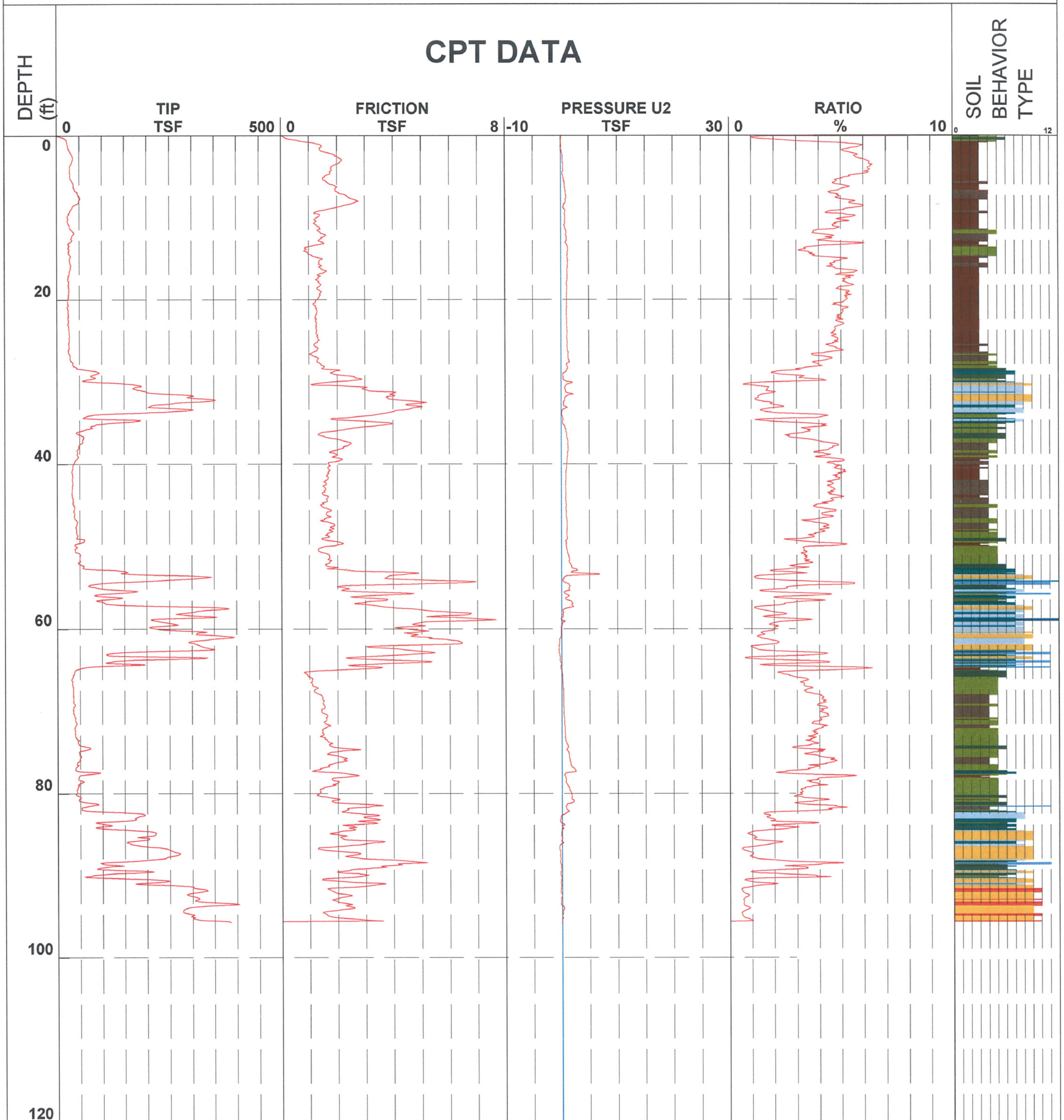
Elevation	80.12	Review by:	Sh	Verify by:	Ry

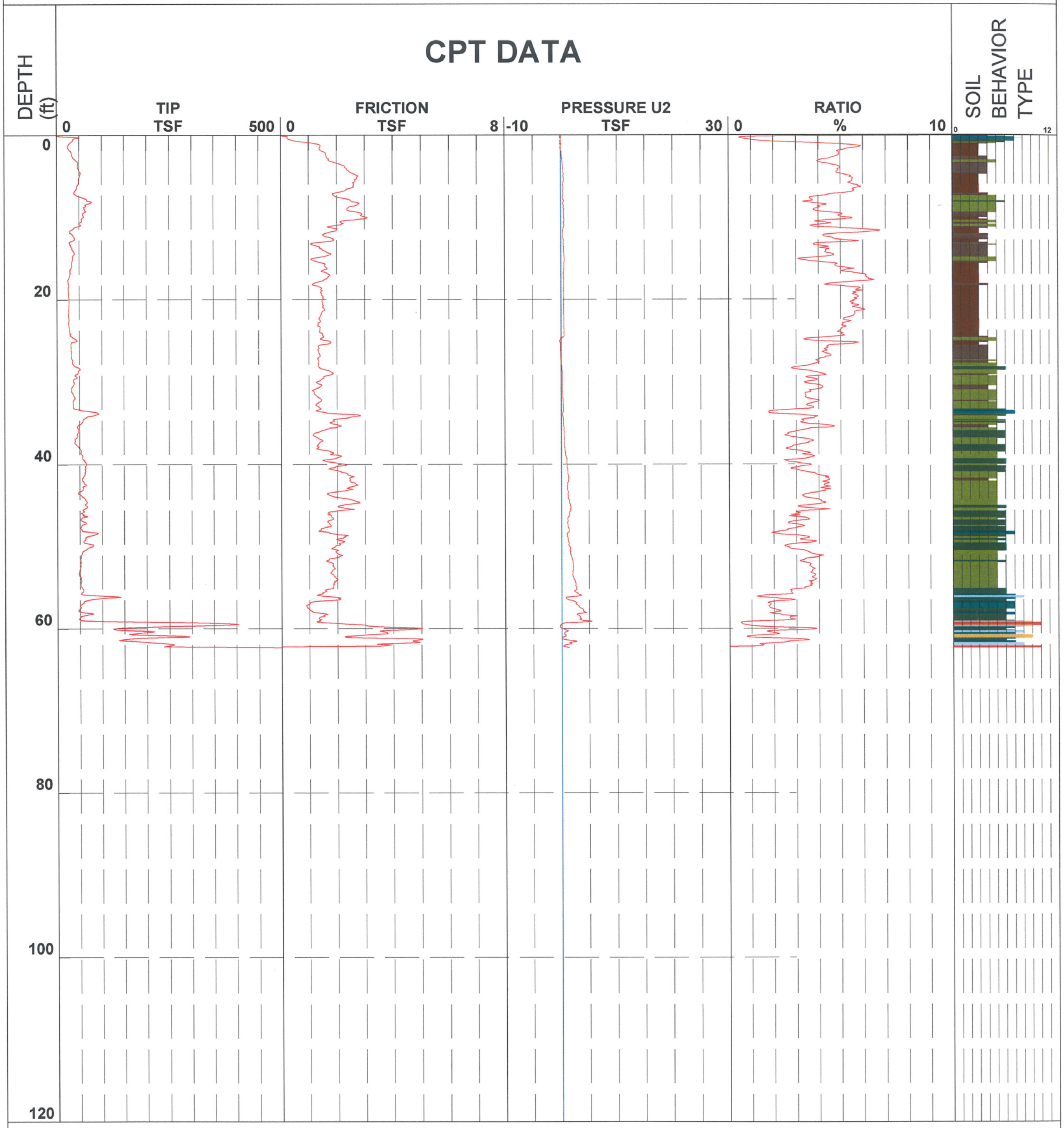


1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Robertson et al. 1986 * Overconsolidated or Cemented

CPT Data

Job Number	04.1909-0015	CPT Number	C-3206	Location	Exelon Victoria-TX
Operator	Albert Fonseca	Date and Tir	04-Mar-2009 11:49:07	Cone Number	F7.5CKE2HAW21498
Client	MACTEC	Northing	13413096.81	Easting	2600879.63
Elevation	80.31	Review by:	SL	Verify by:	Ry



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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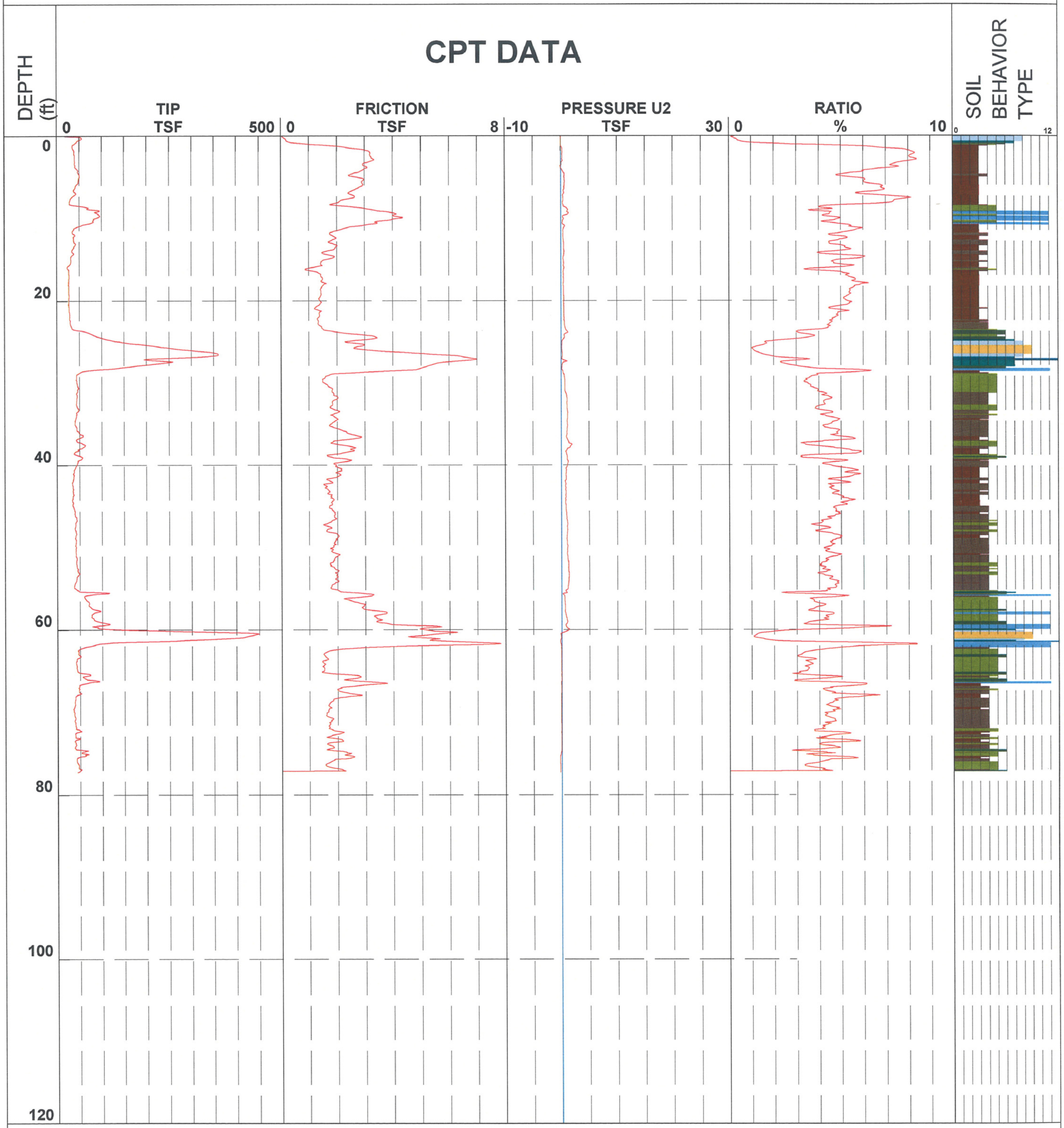
CPT Data

Job Number	04.1909-0015	CPT Number	C-3207	Location	Exelon Victoria-TX
Operator	Albert Fonseca	Date and Tin	06-Mar-2009 08:26:57	Cone Numbei	F7.5CKE2HAW21498
Client	MACTEC	Northing	13412840.47	Easting	2600672.65
Elevation	79.99	Review by:	SL	Verify by:	Ry

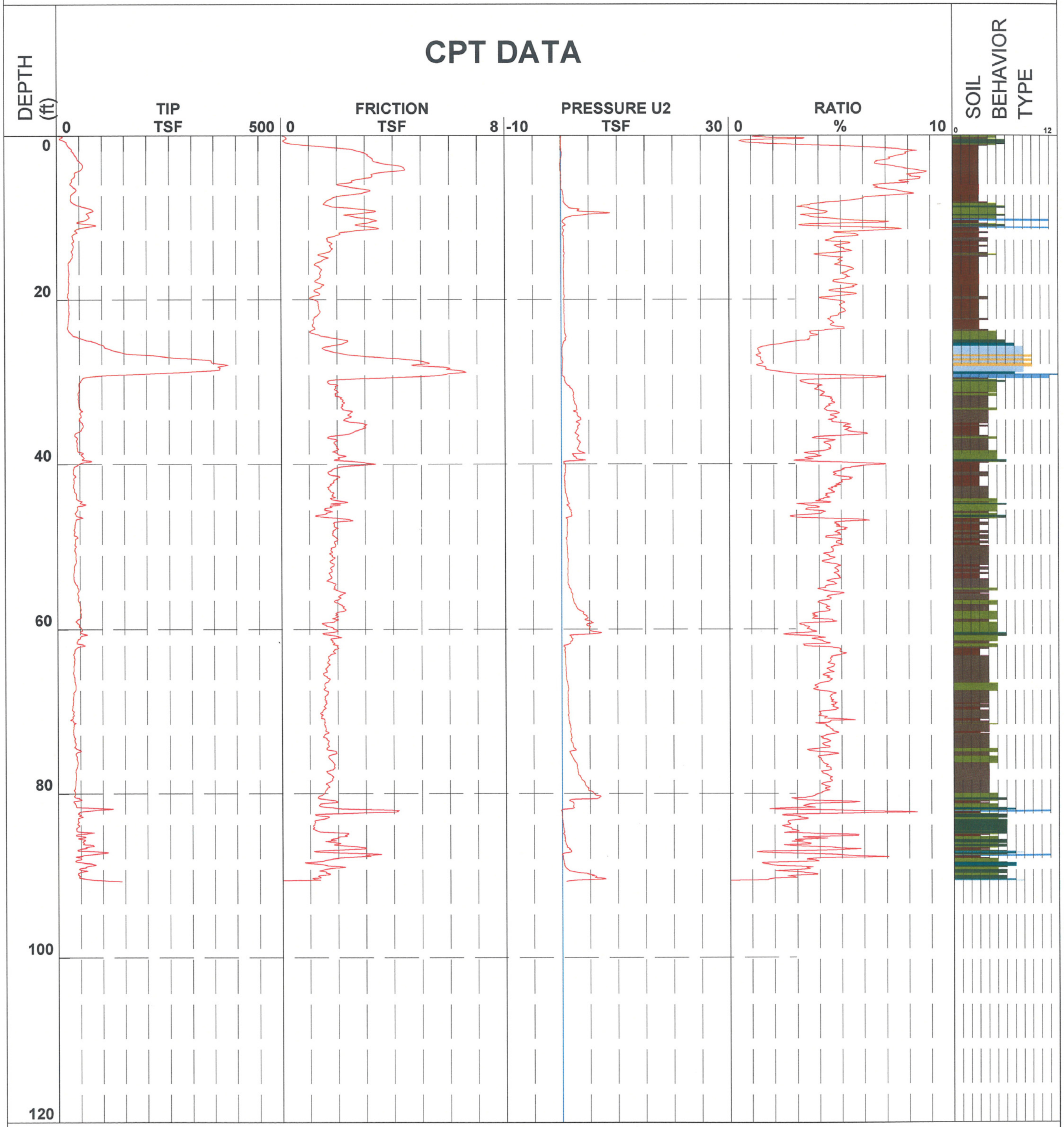


1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Robertson et al. 1986 * Overconsolidated or Cemented

CPT Data

Job Number	04.1909-0015	CPT Number	C-3208	Location	Exelon Victoria-TX
Operator	Albert Fonseca	Date and Tin	05-Mar-2009 12:38:29	Cone Number	F7.5CKE2HAW21498
Client	MACTEC	Northing	13412902.67	Easting	2600610.62
Elevation	80.08	Review by:	SL	Verify by:	Ry



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 (*)

Robertson et al. 1986 * Overconsolidated or Cemented

CPT Data

FUGRO

Job Number	04.1909-0015	CPT Number	C-3209	Location	Exelon Victoria-TX
Operator	Albert Fonseca	Date and Tin	04-Mar-2009 14:11:43	Cone Numbei	F7.5CKE2HAW21498
Client	MACTEC	Northing	13413406.91	Easting	2601142.50
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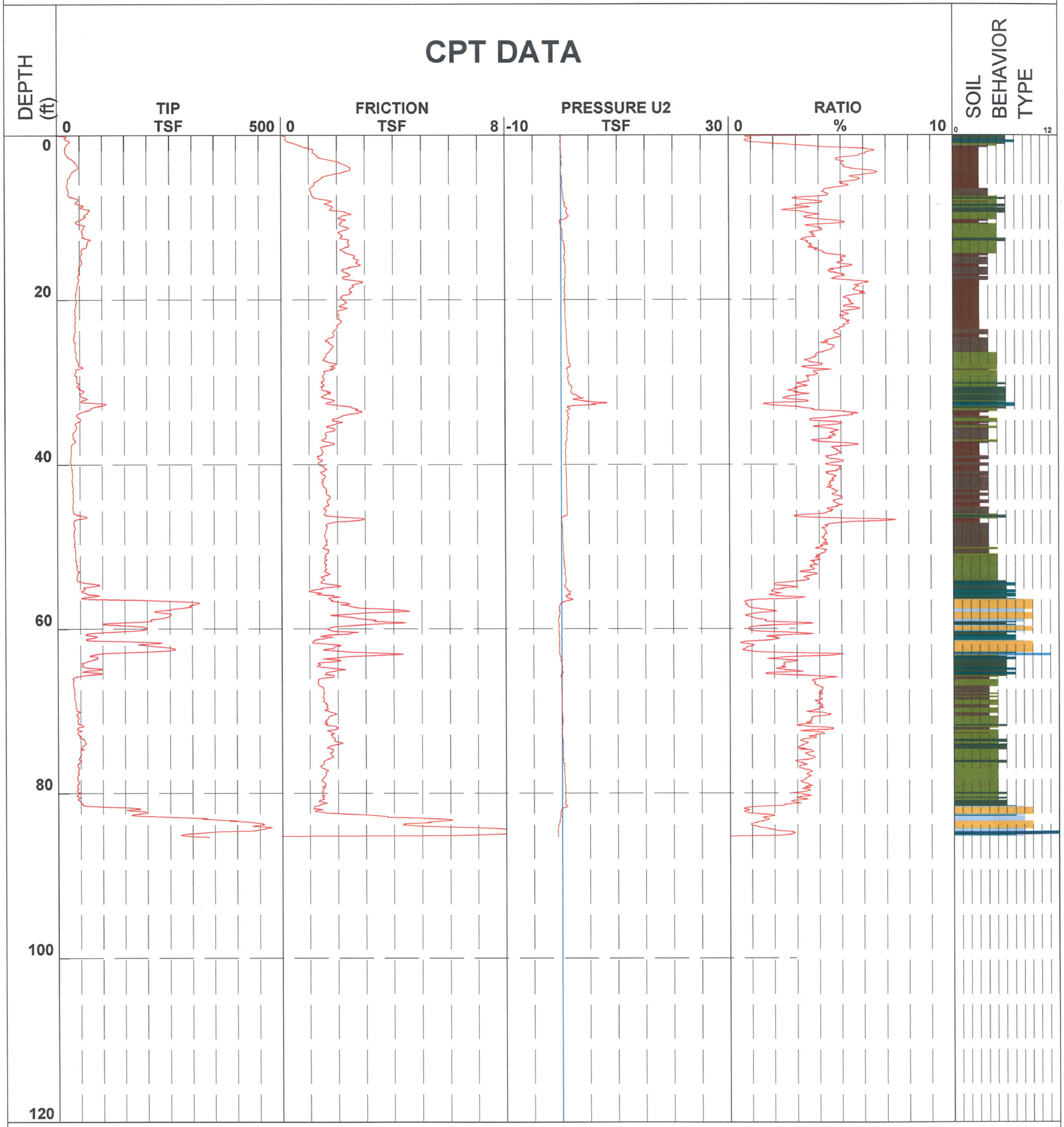

1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

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CPT Data

Job Number	04.1909-0015	CPT Number	C-3211	Location	Exelon Victoria-TX
Operator	Albert Fonseca	Date and Tir	04-Mar-2009 09:49:23	Cone Numbei	F7.5CKE2HAW21498
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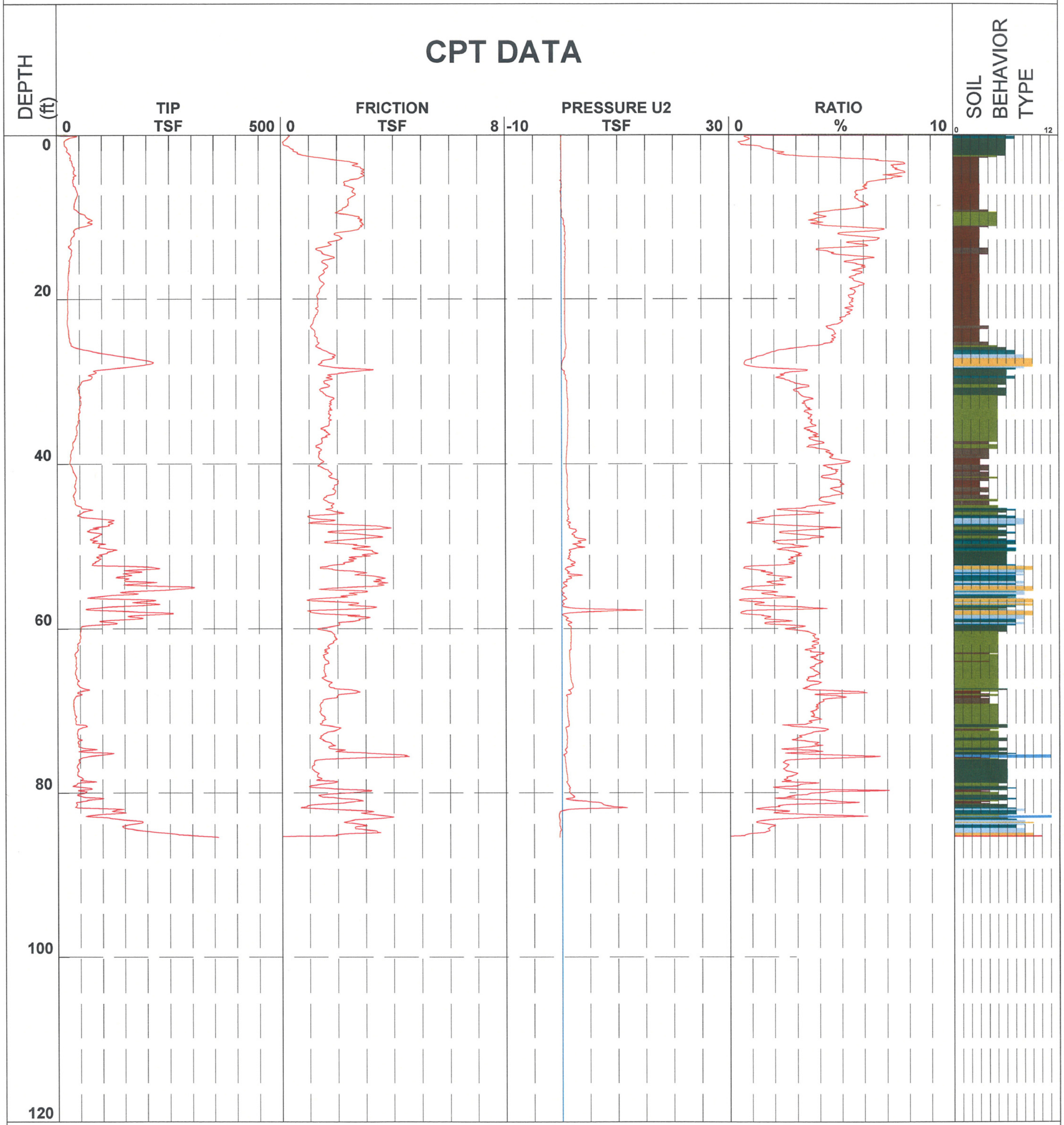

1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Robertson et al. 1986 * Overconsolidated or Cemented

CPT Data

FUGRO

Job Number	04.1909-0015	CPT Number	C-3212	Location	Exelon Victoria-TX
Operator	Albert Fonseca	Date and Tir	05-Mar-2009 15:28:31	Cone Numbe	F7.5CKE2HAW21498
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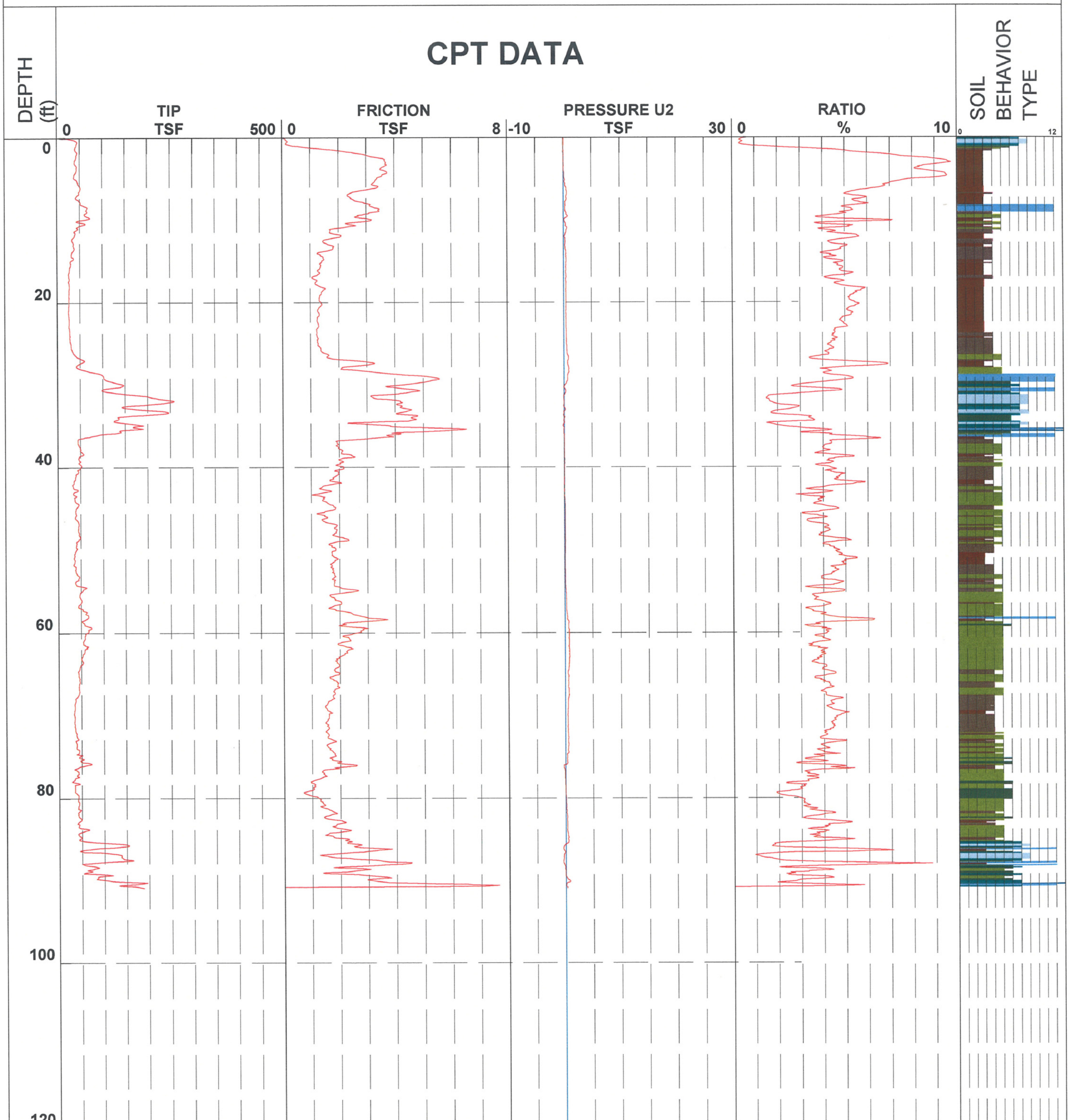

1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Robertson et al. 1986 * Overconsolidated or Cemented

FINAL DATA REPORT REVISION 0
GEOTECHNICAL EXPLORATION AND TESTING

EXELON TEXAS COL PROJECT
VICTORIA COUNTY, TEXAS
SUPPLEMENTAL INVESTIGATION INCLUDING UHS

August 11, 2009

VOLUME 2
Appendix D - Geophysical Test Data

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

MACTEC

DOCUMENTATION OF TECHNICAL REVIEW
SUBCONTRACTOR WORK PRODUCT

Project Name: Exelon Texas COL Project – Supplemental Investigation, Including UHS

Project Number: 6468-07-1777

Project Manager: Scott Auger

Project Principal: Kathryn White

The report described below has been prepared by the named subcontractor retained in accordance with the MACTEC QAPD. The work and report have been reviewed by a MACTEC technically qualified person. Comments on the work or report, if any, have been satisfactorily addressed by the subcontractor. The attached report is approved in accordance with section QS-7 of MACTEC's QAPD.

The information and data contained in the attached report are hereby released by MACTEC for project use.

REPORT :

Boring Geophysical Logging, Report No. 9054-01, rev. 1; Dated July 17, 2009

SUBCONTRACTOR:

GeoVision

DATE OF ACCEPTANCE : 8·11·09

TECHNICAL REVIEWER: Kathryn White

PROJECT PRINCIPAL: Kathryn A White

FINAL REPORT

BORING GEOPHYSICAL LOGGING
BORINGS B-3170AO, B-3185AO, B-3270AO AND B-3285AO

EXELON COL - VICTORIA COUNTY SITE

Report 9054 -01 rev 1

July 17, 2009

FINAL REPORT

BORING GEOPHYSICAL LOGGING
BORINGS B-3170AO, B-3185AO, B-3270AO
AND B-3285AO

EXELON COL - VICTORIA COUNTY SITE

Report 9054 -01 rev 1

July 17, 2009

Prepared for:

MACTEC Engineering and Consulting, Inc.
3301 Atlantic Avenue
Raleigh, N. C. 27604
919-831-8000
MACTEC Job number 6468-07-1777

Prepared by

GEOVision Geophysical Services
1124 Olympic Drive
Corona, California 92881
(951) 549-1234

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APPENDICES

CERTIFICATION

All geophysical data, analysis, interpretations, and results in this document have been reviewed by a **GEO*Vision*** California Registered Professional Engineer.

Reviewed and Approved by

July 17, 2009

John G. Diehl Date
California Professional Engineer 30362
GEO*Vision* Geophysical Services

* This geophysical investigation has been reviewed and approved by a California Registered Professional Engineer based on industry standard methods and equipment. A high degree of professionalism was maintained during all aspects of the project from the field investigation and data acquisition, through data processing interpretation and reporting. All original field data files, field notes and observations, and other pertinent information are maintained in the project files and are available for the client to review for a period of at least one year.

A professional engineer's certification of review comprises a declaration of his/her professional judgment. It does not constitute a warranty or guarantee, expressed or implied, nor does it relieve any other party of its responsibility to abide by contract documents, applicable codes, standards, regulations or ordinances.

INTRODUCTION

Boring geophysical measurements were collected in four uncased borings located at the Exelon Combined Operating License (COL) Application Project, located in Victoria County, Texas. Geophysical data acquisition was performed between February 18 and 21, 2009 by Charles Carter of **GEO***Vision*. Data analysis and report preparation was performed by Robert Steller and reviewed by John Diehl of **GEO***Vision*. The work was performed under subcontract with MACTEC Engineering and Consulting, Inc., (MACTEC) with Stephen Criscenzo serving as the point of contact for MACTEC.

This report describes the field measurements, data analysis, and results of this work.

SCOPE OF WORK

This report presents the results of boring geophysical measurements collected between February 18 and 21, 2009, in four borings, as detailed in Table 1. The purpose of these studies was to supplement stratigraphic information obtained during MACTEC's soil sampling program and to acquire shear wave velocities and compressional wave velocities as a function of depth, as a component of the Exelon COL Project, located in Victoria County, Texas.

The OYO/Robertson Suspension PS Logging System (Suspension System) was used to obtain in-situ horizontal shear (S_H) and compressional (P) wave velocity measurements in all four borings at 1.6-foot intervals. The acquired data was analyzed and a profile of velocity versus depth was produced for both compressional and horizontally polarized shear waves.

The Robertson 3ACS probe was used to collect natural gamma (CNGA) and 3 arm mechanical caliper (CALP) data at 0.05-foot intervals in all four borings to aid in identification of stratagraphic transitions.

The Robertson ELGX probe was used to collect long normal resistivity (LON) and short normal resistivity (SHN), single point resistance (SPR), Spontaneous Potential (SP) and natural gamma (NGAM) data at 0.05-foot intervals in all four borings to aid in identification of stratagraphic transitions.

The Robertson High Resolution Acoustic Televiewer (HiRAT) was used to collect deviation data at 0.04-foot intervals in all four borings.

A detailed reference for the velocity measurement techniques used in this study is:

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

INSTRUMENTATION

Suspension Instrumentation

Suspension soil velocity measurements were performed using the suspension PS logging system, manufactured by OYO Corporation, and their subsidiary, Robertson Geologging. Components used in these measurements are listed in Table 1. This system directly determines the average velocity of a 3.3-foot high segment of the soil column surrounding the boring of interest by measuring the elapsed time between arrivals of a wave propagating upward through the soil column. The receivers that detect the wave, and the source that generates the wave, are moved as a unit in the boring producing relatively constant amplitude signals at all depths.

The suspension system probe consists of a combined reversible polarity solenoid horizontal shear-wave source (S_H) and compressional-wave source (P), joined to two biaxial receivers by a flexible isolation cylinder, as shown in Figure 1. The separation of the two receivers is 3.3 feet (1.0 meter), allowing average wave velocity in the region between the receivers to be determined by inversion of the wave travel time between the two receivers. The total length of the probe as used in these surveys is 19 feet, with the center point of the receiver pair 12.1 feet above the bottom end of the probe.

The probe receives control signals from, and sends the digitized receiver signals to, instrumentation on the surface via an armored 4-conductor cable. The cable is wound onto the drum of a winch and is used to support the probe. Cable travel is measured to provide probe depth data, using a 3.28-foot circumference sheave fitted with a digital rotary encoder.

The entire probe is suspended in the boring by the cable, therefore, source motion is not coupled directly to the boring walls; rather, the source motion creates a horizontally propagating impulsive pressure wave in the fluid filling the boring and surrounding the source. This pressure wave is converted to P and S_H-waves in the surrounding soil and rock as it passes through the casing and grout annulus and impinges upon the wall of the boring. These waves propagate through the soil and rock surrounding the boring, in turn causing a pressure wave to be generated in the fluid surrounding the receivers as the soil waves pass their location. Separation of the P and S_H-waves at the receivers is performed using the following steps:

1. Orientation of the horizontal receivers is maintained parallel to the axis of the source, maximizing the amplitude of the recorded S_H -wave signals.
2. At each depth, S_H-wave signals are recorded with the source actuated in opposite directions, producing S_H-wave signals of opposite polarity, providing a characteristic S_H-wave signature distinct from the P-wave signal.
3. The 6.3-foot separation of source and receiver 1 permits the P-wave signal to pass and damp significantly before the slower S_H-wave signal arrives at the receiver. In faster soils or rock, the isolation cylinder is extended to allow greater separation of the P- and S_H-wave signals.
4. In saturated soils, the received P-wave signal is typically of much higher frequency than the received S_H-wave signal, permitting additional separation of the two signals by low pass filtering.
5. Direct arrival of the original pressure pulse in the fluid is not detected at the receivers because the wavelength of the pressure pulse in fluid is significantly greater than the dimension of the fluid annulus surrounding the probe (foot versus inch scale), preventing significant energy transmission through the fluid medium.

In operation, a distinct, repeatable pattern of impulses is generated at each depth as follows:

1. The source is fired in one direction producing dominantly horizontal shear with some vertical compression, and the signals from the horizontal receivers situated parallel to the axis of motion of the source are recorded.
2. The source is fired again in the opposite direction and the horizontal receiver signals are recorded.
3. The source is fired again and the vertical receiver signals are recorded. The repeated source pattern facilitates the picking of the P and S_H-wave arrivals; reversal of the source changes the polarity of the S_H-wave pattern but not the P-wave pattern.

The data from each receiver during each source activation is recorded as a different channel on the recording system. The Suspension PS system has six channels (two simultaneous recording channels), each with a 1024 sample record. The recorded data are displayed as six channels with a common time scale. Data are stored on disk for further processing. Up to 8 sampling sequences can be summed to improve the signal to noise ratio of the signals.

Review of the displayed data on the recorder or computer screen allows the operator to set the gains, filters, delay time, pulse length (energy), sample rate, and summing number to optimize the quality of the data before recording. Verification of the calibration of the Suspension PS digital recorder is performed every twelve months using a NIST traceable frequency source and counter, as outlined in Appendix C.

Caliper / Natural Gamma Instrumentation

Caliper and natural gamma data were collected using a Model 3ACS 3-leg caliper probe, serial number 5368, manufactured by Robertson Geologging, Ltd. With the short arm configuration used in these surveys, the probe permitted measurement of boring diameters between 1.6 and 16 inches. With this tool, caliper measurements were collected concurrent with measurement of natural gamma emission from the boring walls. The probe is 6.82 feet long, and 1.5 inches in diameter.

This probe is useful in the following studies:

- Measurement of boring diameter and volume
- Location of hard and soft formations
- Location of fissures, caving, pinching and casing damage
- Bed boundary identification
- Strata correlation between borings

The probe receives control signals from, and sends the digitized measurement values to, a Robertson Micrologger II on the surface via an armored 4-conductor cable. The cable is wound onto the drum of a winch and is used to support the probe. Cable travel is measured to provide probe depth data, using a 3.28-foot circumference sheave fitted with a digital rotary encoder. The probe and depth data are transmitted by USB link from the Micrologger unit to a laptop computer where it is displayed and stored on hard disk.

The caliper consists of three arms, each with a toothed quadrant at their base, pivoted in the lower probe body. A toothed rack engages with each quadrant, thus constraining the arms to move together. Linear movement of the rack is converted to opening and closing of the arms. Springs hold the arms open in the operating position. A motor drive is provided to retract the arms, allowing the probe to be lowered into the boring. The rack is coupled to a potentiometer which converts movement into a voltage sensed by the probe's microprocessor.

Natural gamma measurements rely upon small quantities of radioactive material contained in all soil and rocks to emit gamma radiation as they decay. Trace amounts of Uranium and Thorium are present in a few minerals, where potassium-bearing minerals such as feldspar, mica and clays will include traces of a radioactive isotope of Potassium. These emit gamma radiation as they decay with an extremely long half-life. This radiation is detected by scintillation - the production of a tiny flash of light when gamma rays strike a crystal of sodium iodide. The light is converted into an electrical pulse by a photomultiplier tube. Pulses above a threshold value of 60 thousand electron Volts (KeV) are counted by the probe's microprocessor. The measurement is useful because the radioactive elements are concentrated in certain soil and rock types e.g. clay or shale, and depleted in others e.g. sandstone or coal.

Resistivity / Spontaneous Potential / Natural Gamma Instrumentation

Resistivity, spontaneous potential and natural gamma data were collected using a Model ELXG electric log probe, S/N 5490, manufactured by Robertson Geologging, Ltd. This probe measures Single Point Resistance (SPR), short normal (16 inch) resistivity (SHN), long normal (64 inch) resistivity (LON), Spontaneous Potential (SP) and natural gamma (NGAM). The probe is 8.20 feet long, and 1.73 inches in diameter.

This probe is useful in the following studies:

- Bed boundary identification
- Strata correlation between borings
- Strata geometry and type (shale indication)

The probe receives control signals from, and sends the digitized measurement values to, a Robertson Micrologger II on the surface via an armored 4-conductor cable. The cable is wound onto the drum of a winch and is used to support the probe. Cable travel is measured to provide probe depth data, using a 3.28-foot circumference sheave fitted with a digital rotary encoder. The probe and depth data are transmitted by USB link from the Micrologger unit to a laptop computer where it is displayed and stored on hard disk.

The resistivity section of the probe operates by driving an alternating current into the formation from the central SPR/DRIVE electrode. The current returns via the logging cable armor. To ensure adequate penetration of the formation the logging cable is insulated for approximately 30 feet from the cablehead. Voltages are measured between the 16 inch and 64 inch electrodes and the remote earth connection at surface, as noted below:

- Single Point Resistance (SPR): The current flowing to the cable armor is measured along with the voltage at the SPR electrode. The voltage divided by current gives resistance.

- Spontaneous Potential (SP): This is the DC bias of the 16 inch electrode with respect to the voltage return at the surface (ground stake).

Data quality depends upon good grounding at the surface. This is achieved with a metal stake driven into the mud-pit.

Boring Deviation Instrumentation

Boring deviation data were collected using a High Resolution Acoustic Televiewer probe (HiRAT), serial number 5174, manufactured by Robertson Geologging, Ltd.

In this application, this probe is useful in the following studies:

- Measurement of boring inclination and deviation from vertical
- Determination of need to correct soil and geophysical log depths to true vertical depths

The probe receives control signals from, and sends the digitized measurement values to a Robertson Micrologger II on the surface via an armored 4-conductor cable. The cable is wound onto the drum of a winch and is used to support the probe. Cable travel is measured to provide probe depth data, using a 3.28-foot circumference sheave fitted with a digital rotary encoder. The probe and depth data are transmitted by USB link from the Micrologger unit to a laptop computer where it is displayed and stored on hard disk.

The probe contains a fluxgate magnetometer to monitor magnetic north, and all raw televiewer data are referenced to magnetic north. A three-axis accelerometer is enclosed in the probe, providing boring dip data that, when processed with the orientation data, allows boring deviation data to be obtained.

The data are presented on a computer screen for operator review during the logging run, and stored on hard disk for later processing.

MEASUREMENT PROCEDURES

Suspension Measurement Procedures

All four borings were logged uncased, filled with bentonite or polymer based drilling mud. Measurements followed the **GEO***Vision* Procedure for P-S Suspension Seismic Velocity Logging, revision 1.31, as presented in Appendix E. This procedure was supplied and approved by MACTEC in advance of the work. In each boring, the probe was positioned with the top of the probe at the top of the surface casing, and the electronic depth counter was set to the distance between the mid-point of the receiver and the top of the probe, minus the height of the surface casing above grade, as verified with a tape measure, and recorded on the field logs. The probe was lowered to the bottom of the boring, stopping at 1.6-foot intervals to collect data, as summarized in Table 3.

At each measurement depth the measurement sequence of two opposite horizontal records and one vertical record was performed, and the gains were adjusted as required. The data from each depth were viewed on the computer display, checked, and recorded on disk before moving to the next depth.

Upon completion of the measurements, the probe zero depth indication at the depth reference point was verified prior to removal from the boring, and the after survey depth error (ASDE) was calculated, as summarized in Table 4.

Caliper / Natural Gamma Measurement Procedures

All four borings were logged uncased, filled with bentonite or polymer based drilling mud. Measurements followed ASTM D6167-97 (Reapproved 2004) Conducting Borehole Geophysical Logging – Mechanical Caliper.

Prior to and following each logging run, the caliper tool was verified, using the manufacturer's supplied three point calibration jig, and a PVC coupling provided by MACTEC with an inside diameter traceable to NIST. The three point jig is a circular plate with a series of holes in the top surface into which the tips of the caliper arms fit. This has circles of diameters from 2 to 12 inches. The calibration jig is placed over a bucket with the probe standing upright with its nose section passing through the jig's central hole. The caliper probe arms are opened under program control, and a log is recorded as the tips of the arms are placed in the holes on the calibration jig and inside the PVC coupling. The measured dimensions, as displayed on the recording computer screen was recorded on the field log sheet, as well as in the digital files, and compared with the calibration jig dimensions. These files are presented in LAS 2.0 format in the boring specific sub-directories of the data directory on the data disk (CD-R) labeled Report 9054-02 that accompanies this report. If the verification records did not fall within +/- 0.05 inches of the calibration jig values, the caliper tool was re-calibrated, using the three point calibration jig, and the log repeated. As with the verification, the tips of the caliper arms are placed in the holes marked with the required diameter. During calibration, the value of the current calibration point, as stamped on the jig, is entered via the control computer. The system counts for 15 seconds to make an average of the response. The procedure is repeated for the second and third required openings.

The computation and generation of the calibration coefficient file is entirely automatic. The calibration file is simply the set of coefficients of a quadratic curve which fits the three data points. Figure 2 shows the response of a caliper probe using data gathered during calibration.

Natural gamma was not calibrated in the field, as it is a qualitative measurement, not a quantitative value, and is used only to assist in picking transitions between stratigraphic units, as described in ASTM D6274-98 (Reapproved 2004), Conducting Borehole Geophysical Logging - Gamma.

In each boring, the probe was positioned with the top of the probe at the top of the surface casing, and the electronic depth counter was set to the specified length of the probe, minus the height of the surface casing above grade, as verified with a tape measure, and recorded on the field logs. The probe was lowered to the bottom of the boring, where the caliper legs were opened, and data collection begun. The probe was then returned to the surface at 10 feet/minute, collecting data continuously at 0.05-foot spacing, as summarized in Table 3.

Upon completion of the measurements, the probe zero depth indication at the depth reference point was verified prior to removal from the boring, and the after survey depth error (ASDE) was calculated, as summarized in Table 4.

Resistivity / Spontaneous Potential / Natural Gamma Procedures

All four borings were logged uncased, filled with bentonite or polymer based drilling mud. The probe was connected to the logging cable using a 32.8-foot long insulating cable section or “yoke”. The probe head was insulated by wrapping all exposed metal of the cablehead and probe with self-amalgamating insulation tape. The 32.8-foot insulating yoke was checked for any damage, and repaired with self-amalgamating insulation tape as needed.

The reference ground stake was driven firmly into the mud pit, and connected to the ground socket on the winch switch box.

This sonde was not calibrated in the field, as it is used to provide qualitative measurements, not quantitative values, and is used only to assist in picking transitions between stratigraphic units, as described in ASTM D5753-05, Planning and Conducting Borehole Geophysical Surveys. A functional test is performed prior to each logging run by applying fixed resistance values across the probe electrodes, as well as a 100 millivolt signal across the SP electrodes, and recording the resultant output of the system. These functional checks are presented in LAS 2.0 format in the boring specific sub-directories of the data directory on the data disk (CD-R) labeled Report 9054-02 that accompanies this report.

Natural gamma was not calibrated in the field, as it is a qualitative measurement, not a quantitative value, and is used only to assist in picking transitions between stratigraphic units, as described in ASTM D6274-98 (Reapproved 2004), Conducting Borehole Geophysical Logging - Gamma.

In each boring, the probe was positioned with the top of the probe at the top of the surface casing, and the electronic depth counter was set to the specified length of the probe, minus the height of the surface casing above grade, as verified with a tape measure. When logging on smaller drill rigs, the depth was zeroed to the top of the yoke, and 32.8 feet was added to the zero depth, as recorded in the field logs. The probe was lowered to the bottom of the boring, where data collection was begun. The probe was then returned to the surface at 10 feet/minute, collecting data continuously at 0.05-foot spacing, as summarized in Table 3. The natural gamma data collected in these logs is redundant with the data collected in the caliper / natural gamma logs, and the caliper / natural data may be used to verify the natural gamma data collected in these logs.

Normally, when the un-insulated section of the logging cable leaves the boring fluid, the log is terminated, as the electrical measurements do not function under these conditions. However, in these surveys, the log was continued, in order to collect as much natural gamma data as possible before the yoke connector reached the measuring wheel.

Upon completion of the measurements, the probe zero depth indication at the depth reference point was verified prior to removal from the boring, and the after survey depth error (ASDE) was calculated, as summarized in Table 4.

Boring Deviation Measurement Procedures

All four borings were logged for deviation as uncased borings, filled with bentonite or polymer based drilling mud. Although the televiewer is intended for use in cored hard rock borings where it is used to image jointing and bedding planes, and it cannot produce a useful image in the soils at this site, the logs were run in order to provide a deviation log for the borings. Measurements followed the **GEO***Vision* Hi-RAT Field Procedure Rev 1.0, as presented in Appendix E. This procedure was supplied and approved by MACTEC in advance of the work.

Prior to use, the televiewer probe tiltmeter and compass functions were checked by comparison with a Brunton surveyors' compass.

In each boring, the televiewer probe was positioned with the top of the probe at the top of the surface casing, and the electronic depth counter was set to the specified length of the probe, minus the height of the surface casing above grade, as verified with a tape measure, and recorded on the field logs. The probe was lowered to the bottom of the boring, and data collection begun. The probe was then returned to the surface at 10.0 feet/minute, collecting data continuously at 0.04-foot intervals, as summarized in Table 3.

Upon completion of the measurements, the probe zero depth indication at grade was verified prior to removal from the boring and the after survey depth error (ASDE) was calculated, as summarized in Table 4.

DATA ANALYSIS

Suspension Analysis

Using the proprietary OYO program PSLOG.EXE version 1.0, included in the data disk (CD-R) labeled Report 9054-02 that accompanies this report, the recorded digital waveforms were analyzed to locate the most prominent first minima, first maxima, or first break on the vertical axis records, indicating the arrival of P-wave energy. The difference in travel time between receiver 1 and receiver 2 (R1-R2) arrivals was used to calculate the P-wave velocity for that 3.3-foot segment of the soil column. When observable, P-wave arrivals on the horizontal axis records were used to verify the velocities determined from the vertical axis data. The time picks were then transferred into an EXCEL template (EXCEL version 2003 SP2) to complete the velocity calculations based upon the arrival time picks made in PSLOG. The PSLOG pick files and the EXCEL analysis files are included in the boring specific directories on the data disk (CD-R) labeled Report 9054-02 that accompanies this report.

The P-wave velocity over the 6.3-foot interval from source to receiver 1 (S-R1) was also picked using PSLOG, and calculated and plotted in EXCEL, for quality assurance of the velocity derived from the travel time between receivers. In this analysis, the depth values as recorded were increased by 4.8 feet to correspond to the mid-point of the 6.3-foot S-R1 interval. Travel times were obtained by picking the first break of the P-wave signal at receiver 1 and subtracting 0.3 milliseconds, the calculated and experimentally verified delay from source trigger pulse (beginning of record) to source impact. This delay corresponds to the duration of acceleration of the solenoid before impact.

As with the P-wave records, the recorded digital waveforms were analyzed to locate clear S_H-wave pulses, as indicated by the presence of opposite polarity pulses on each pair of horizontal records. Ideally, the S_H-wave signals from the 'normal' and 'reverse' source pulses are very nearly inverted images of each other. Digital Fast Fourier Transform – Inverse Fast Fourier Transform (FFT – IFFT) lowpass filtering was used to remove the higher frequency P-wave signal from the S_H-wave signal. Different filter cutoffs were used to separate P- and S_H-waves at different depths, ranging from 600 Hz in the slowest zones to 2000 Hz in the regions of highest velocity. At each depth, the filter frequency was selected to be at least twice the fundamental frequency of the S_H-wave signal being filtered.

Generally, the first maxima were picked for the 'normal' signals and the first minima for the 'reverse' signals, although other points on the waveform were used if the first pulse was distorted. The absolute arrival time of the 'normal' and 'reverse' signals may vary by +/- 0.2 milliseconds, due to differences in the actuation time of the solenoid source caused by constant mechanical bias in the source or by boring inclination. This variation does not affect the R1-R2 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.

As with the P-wave data, S_H-wave velocity calculated from the travel time over the 6.3-foot interval from source to receiver 1 was calculated and plotted for verification of the velocity derived from the travel time between receivers. In this analysis, the depth values were increased by 4.8 feet to correspond to the mid-point of the 6.3-foot S-R1 interval. Travel times were obtained by picking the first break of the S_H-wave signal at the near receiver and subtracting 0.3 milliseconds, the calculated and experimentally verified delay from the beginning of the record at the source trigger pulse to source impact.

These data and analysis were reviewed by John Diehl as a component of **GEO***Vision*'s in-house data validation.

Figure 3 shows an example of R1 - R2 measurements on a sample filtered suspension record. In Figure 3, the time difference over the 3.3-foot interval of 1.88 milliseconds for the horizontal signals is equivalent to an S_H-wave velocity of 1745 feet/second. Whenever possible, time differences were determined from several phase points on the S_H-waveform records to verify the data obtained from the first arrival of the S_H-wave pulse. Figure 4 displays the same record before filtering of the S_H-waveform record with a 1400 Hz FFT - IFFT digital lowpass filter, illustrating the presence of higher frequency P-wave energy at the beginning of the record, and distortion of the lower frequency S_H-wave by residual P-wave signal.

Caliper / Natural Gamma Analysis

No analysis is required with the caliper or natural gamma data; however depths to identifiable boring features were compared to verify compatible depth readings on all logs. Using Robertson Geologging Winlogger software version 1.5, build 401J, these data were combined with the resistivity, ELOG based natural gamma and spontaneous potential (SP) logs, and converted to LAS 2.0 and PDF formats for transmittal to the client.

Resistivity / Spontaneous Potential / Natural Gamma Analysis

No analysis is required with the resistivity, natural gamma or spontaneous potential data; however depths to identifiable boring features were compared to verify compatible depth readings on all logs. Using Robertson Geologging Winlogger software version 1.5, build 401J, these data were combined with the caliper and caliper-based natural gamma logs, and converted to LAS 2.0 and PDF formats for transmittal to the client.

Boring Deviation Analysis

The collected Acoustic Televiewer data were processed with Robertson Geologging's RGLDIP program, version 6.2, to extract the deviation data and produce an ASCII file and plots of deviation data as presented in the boring specific sub-directories in the data directory on the data disk (CD-R) labeled Report 9054-02 that accompanies this report, and summarized in Table 5.

RESULTS

Suspension Results

Suspension R1-R2 P- and S_H-wave velocities are plotted in Figures 5, 8, 11 and 14. The suspension velocity data presented in these figures are presented in Tables 6 – 9. The PSLOG and EXCEL analysis files for each boring are included in the boring specific directories on the data disk (CD-R) labeled Report 9054-02 that accompanies this report, along with the raw and filtered waveforms.

P- and S_H-wave velocity data from R1-R2 analysis and quality assurance analysis of S-R1 data are plotted together in Figures A-1 through A-4 to aid in visual comparison. It should be noted that R1-R2 data are an average velocity over a 3.3-foot segment of the soil column; S-R1 data are an average over 6.3 feet, creating a significant smoothing relative to the R1-R2 plots. S-R1 data are presented in Tables A-1 through A-4, and included in the EXCEL analysis files for each boring on the data disk (CD-R) labeled Report 9054-02 that accompanies this report.

Calibration procedures and records for the suspension PS measurement system are presented in Appendix C, and **GEO***Vision* standard field log sheets for all borings are reproduced in Appendix D.

The **GEO***Vision* standard field procedures are reproduced in Appendix E.

Caliper/ Natural Gamma Results

Caliper and natural gamma data are presented in combined log plots with resistivity and spontaneous potential as single page logs in Figures 6, 9, 12 and 15, as well as multi-page logs in Appendix B. On these plots, the following acronyms are used:

- NGAM: Natural gamma data collected with the ELOG probe.
- SP: Spontaneous (self) potential.

- CGAM: Natural gamma data collected with the caliper probe.
- CALP: Caliper (borehole diameter)
- SHN: Short normal resistivity (16 inch resistivity)
- LON: Long normal resistivity (64 inch resistivity)
- SPR: Single point resistance

LAS 2.0 data and Acrobat files of the plots for each boring are included in the boring specific sub-directories in the data directory on the data disk (CD-R) labeled Report 9054-02 that accompanies this report.

Resistivity / Spontaneous Potential / Natural Gamma Results

Resistivity and spontaneous potential data are presented in combined log plots with caliper and natural gamma data as single page logs in Figures 6, 9, 12 and 15, as well as multi-page logs in Appendix B. LAS 2.0 data and Acrobat files for each boring are included in the boring specific sub-directories in the data directory on the data disk (CD-R) labeled Report 9054-02 that accompanies this report.

Boring Deviation Results

Boring deviation data are presented graphically in Figures 7, 10, 13 and 16, and summarized in Table 5. Deviation data plots in Acrobat format and deviation data at 1.0-foot stations are presented in ASCII format in the boring specific sub-directories of the data directory on the data disk (CD-R) labeled Report 9054-02 that accompanies this report.

SUMMARY

Discussion of Suspension Results

Suspension PS velocity data are ideally collected in an uncased fluid filled boring, drilled with rotary mud (rotary wash) methods. The borings at this site were ideal for collection of suspension PS velocity data, as they were drilled specifically for geophysical logging immediately before the logs were performed. This approach provided clean borings with a minimum of slough, squeezing and washouts.

Suspension PS velocity data quality is judged based upon 5 criteria:

1. Consistent data between receiver to receiver (R1 – R2) and source to receiver (S – R1) data.
2. Consistent relationship between P-wave and S_H -wave (excluding transition to saturated soils)
3. Consistency between data from adjacent depth intervals.
4. Clarity of P-wave and S_H-wave onset, as well as damping of later oscillations.
5. Consistency of profile between adjacent borings, if available.

All of these data show excellent correlation between R1 – R2 and S – R1 data, as well as excellent correlation between P-wave and S_H-wave velocities. P-wave and S_H-wave onsets are very clear, and later oscillations are well damped. There is local variation between the profiles from all these borings, but the generally velocity trends are similar.

Discussion of Caliper / Natural Gamma Results

Caliper and natural gamma data were collected for the entire depth of each boring. The caliper logs for these borings generally show diameter of less than 7 inches, with the exception of B-3185AO, which was eroded out to about 8 inches at a depth of 80 feet. Natural gamma data were collected with this tool in all the borings, as well as with the ELOG probe, and the comparison between the two data sets provides an almost exact match, verifying the performance of the natural gamma measuring systems.

Discussion of Resistivity / Spontaneous Potential / Natural Gamma Results

These electrical methods provide fair demarcation of different lithologic units at this site, though there appears to be some influence of salt water intrusion. All four resistivity logs show similar structure, and match closely with the structure indicated by the natural gamma logs. The electrical data are not valid above 40 feet, as the upper yoke electrode moves out of the boring fluid at this depth. This natural gamma data agrees well with the natural gamma data collected with the caliper probe. The comparison between the two data sets provides an almost exact match, verifying the performance of the natural gamma measuring systems.

Discussion of Boring Deviation Results

All four borings in which deviation data was collected were inclined at 2.0 degrees or less from vertical, and the maximum error in depth value was 0.2 feet in 261 ft, or 0.08 percent, as presented in Table 5. This depth error is less than the 0.4% after survey depth error considered acceptable in ASTM D6167-97 (Reapproved 2004) Conducting Borehole Geophysical Logging – Mechanical Caliper, section 9.15.4, so no adjustment of log depth is indicated.

Quality Assurance

These boring geophysical measurements were performed using industry-standard or better methods for measurements and analyses. All work was performed under **GEO***Vision* procedures, which include:

- Use of NIST-traceable calibrations, where applicable, for field and laboratory instrumentation
- Use of standard field data logs
- Use of independent verification of velocity data by comparison of receiver-to-receiver and source-to-receiver velocities
- Independent review of calculations and results by a registered professional engineer, geologist, or geophysicist.

Suspension Data Reliability

P- and S_H-wave velocity measurement using the Suspension Method gives average velocities over a 3.3-foot interval of depth. This high resolution results in the scatter of values shown in the graphs. Individual measurements are very reliable with estimated precision of +/- 5%. Standardized field procedures and quality assurance checks contribute to the reliability of these data.

BORING DESIGNATION	DATES LOGGED	COORDINATES (FEET) [1]		ELEVATION [1] (FEET)
		NORTHING	EASTING	
B-3170AO	2/21/2009	13411915.24	2599287.68	80.12
B-3185AO	2/18/2009	13411826.65	2599726.94	79.58
B-3270AO	2/19/2009	13413799.21	2600956.76	80.15
B-3285AO	2/20/2009	13413451.41	2601067.99	80.14

(1) Survey data and elevation provided by MACTEC, coordinates NAD83 Texas State Plane-South Central Zone (4204) Elevation NAVD88

Table 1. Boring locations and logging dates

Winch GEOVision 4-conductor
Sheave - Measuring wheel GEOVision S/N 103
Robertson Suspension PS telemetry unit M/N 3403 S/N 160024
Robertson Micrologger II S/N 5310
OYO Suspension PS Logger Borehole Probe, includes:
Receiver/Sensor M/N 3385A S/N 30086
Isolation tube, 1m M/N 3387B S/N 300083
OYO PS 170 Source M/N 3304
Driver M/N 3386A
Weight M/N 3302W

Table 2. Suspension PS Logging Equipment

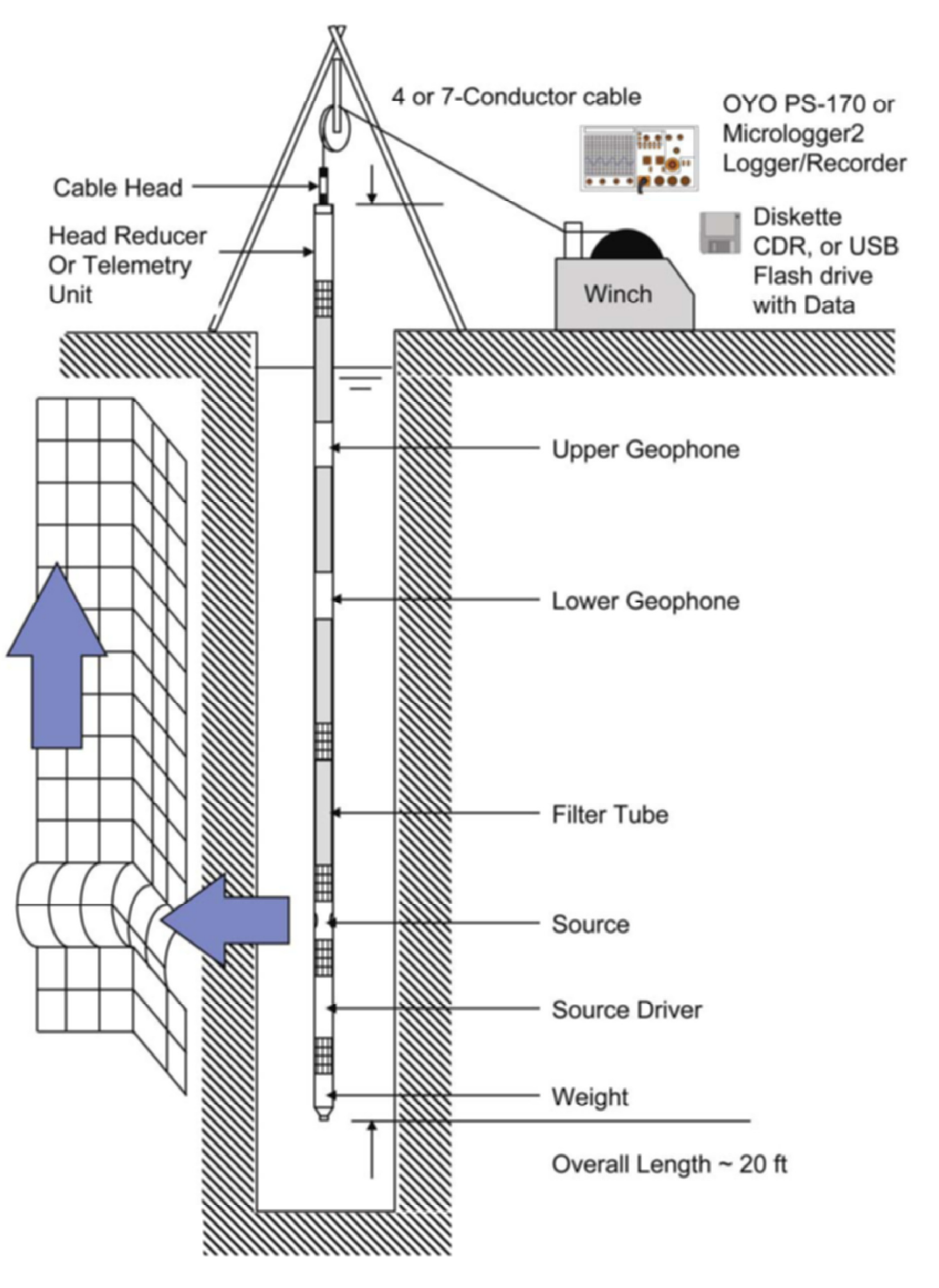

Figure 1: Concept illustration of P-S logging system

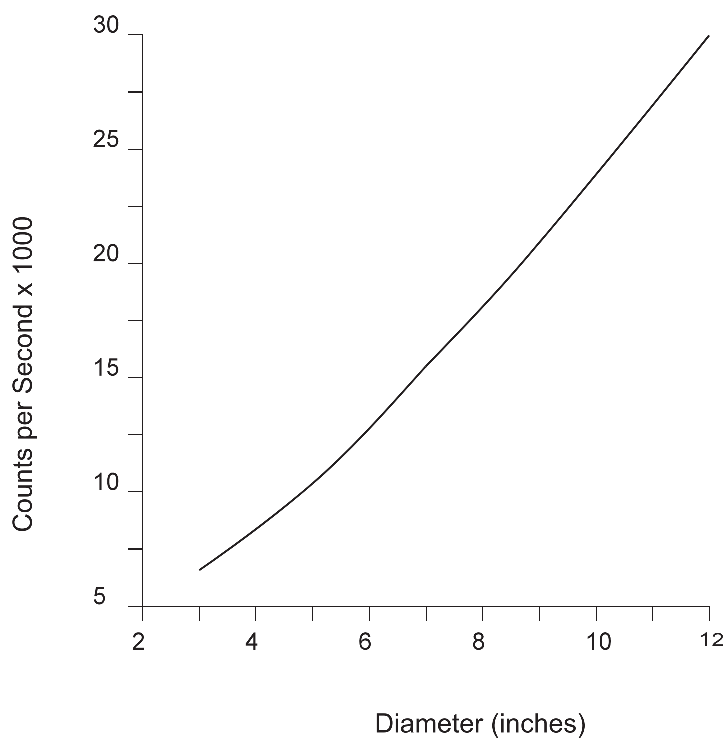

Figure 2. Example Calibration Curve for Caliper Probe

BORING NUMBER	TOOL AND RUN NUMBER	DEPTH RANGE (FEET)	OPEN HOLE (FEET)	DEPTH TO BOTTOM OF CASING (FEET)	SAMPLE INTERVAL (FEET)	DATE LOGGED
B-3170AO	ELOG/GAMMA 1	315.3 – 39.1	315.3	3	0.05	2/21/2009
B-3170AO	SUSPENSION PS 1	6.6 – 301.8	-	3	1.6	2/21/2009
B-3170AO	CALIPER/GAMMA 1	310.5 – 5.0	-	3	0.05	2/21/2009
B-3170AO	DEVIATION 1	314.1 - 2.8	-	3	0.04	2/21/2009
B-3185AO	ELOG/GAMMA 1	265.7 – 84.9	265.7	3.5	0.05	2/18/2009
B-3185AO	ELOG/GAMMA 3	122.5 – 38.2	-	3.5	0.05	2/18/2009
B-3185AO	SUSPENSION PS 1	8.2 – 251.0	-	3.5	1.6	2/18/2009
B-3185AO	CALIPER/GAMMA 1	258.3 – 1.9	-	3.5	0.05	2/18/2009
B-3185AO	DEVIATION 1	254.7 – 2.1	-	3.5	0.04	2/18/2009
B-3270AO	ELOG/GAMMA 1	315.7 – 39.5	315.7	NONE	0.05	2/20/2009
B-3270AO	SUSPENSION PS 1	6.9 – 301.8	-	NONE	1.6	2/20/2009
B-3270AO	CALIPER/GAMMA 1	312.3 – 4.9	-	NONE	0.05	2/20/2009
B-3270AO	DEVIATION 1	311.3 – 3.3	-	NONE	0.04	2/20/2009
B-3285AO	ELOG/GAMMA 1	266.3 – 39.5	266.3	NONE	0.05	2/19/2009
B-3285AO	SUSPENSION PS 1	8.2 – 251.0	-	NONE	1.6	2/19/2009
B-3285AO	CALIPER/GAMMA 1	260.7 – 4.4	-	NONE	0.05	2/19/2009
B-3285AO	DEVIATION 1	261.2 – 2.7	-	NONE	0.04	2/19/2009

\- PROBE DID NOT TOUCH BOTTOM OF BORING

Table 3. Logging dates and depth ranges

BORING NUMBER	TOOL AND RUN NUMBER	TOOL HIT BOTTOM DEPTH (FEET)	DRILLER DEPTH (FEET)	STARTING DEPTH REF. (FEET)	ENDING DEPTH REF. (FEET)	ASDE (FEET)
B-3170AO	ELOG/GAMMA 1	315.3	315	39.4	39.2	-0.2
B-3170AO	SUSPENSION PS 1	-		6.6	6.4	-0.2
B-3170AO	CALIPER/GAMMA 1	-		5.2	5.2	0
B-3170AO	DEVIATION 1	-		3.1	2.8	-0.3
B-3185AO	ELOG/GAMMA 1	265.7	265	37.9	37.9	0
B-3185AO	ELOG/GAMMA 3	-		37.9	37.9	0
B-3185AO	SUSPENSION PS 1	-		5.1	4.9	-0.2
B-3185AO	CALIPER/GAMMA 1	-		3.7	3.8	0.1
B-3185AO	DEVIATION 1	-		1.6	1.6	0
B-3270AO	ELOG/GAMMA 1	315.7	315	39.7	39.6	-0.1
B-3270AO	SUSPENSION PS 1	-		6.8	6.8	0
B-3270AO	CALIPER/GAMMA 1	-		5.5	5.6	0.1
B-3270AO	DEVIATION 1	-		3.4	3.4	0
B-3285AO	ELOG/GAMMA 1	266.3	265	39.9	39.8	-0.1
B-3285AO	SUSPENSION PS 1	-		7.1	7.1	0
B-3285AO	CALIPER/GAMMA 1	-		5.7	5.6	-0.1
B-3285AO	DEVIATION 1	-		3.6	3.6	0

- PROBE DID NOT TOUCH BOTTOM OF BORING

Table 4. Boring Bottom Depths and After Survey Depth Error (ASDE)

BORING NUMBER	MEAN DEVIATION AND AZIMUTH (DEGREES TN)	SURVEY DEPTH (FEET)	VERTICAL DEPTH (FEET)	DEPTH ERROR (FEET)	HORIZONTAL OFFSET (FEET)
B-3170AO	0.6 – N120	313.9	313.8	0.1	3.0
B-3185AO	1.6 – N11	254.6	254.5	0.1	7.1
B-3270AO	0.6 – N214	311.2	311.1	0.1	3.5
B-3285AO	2.0 – N153	261.1	260.9	0.2	9.1

Table 5. Boring Deviation Data Summary

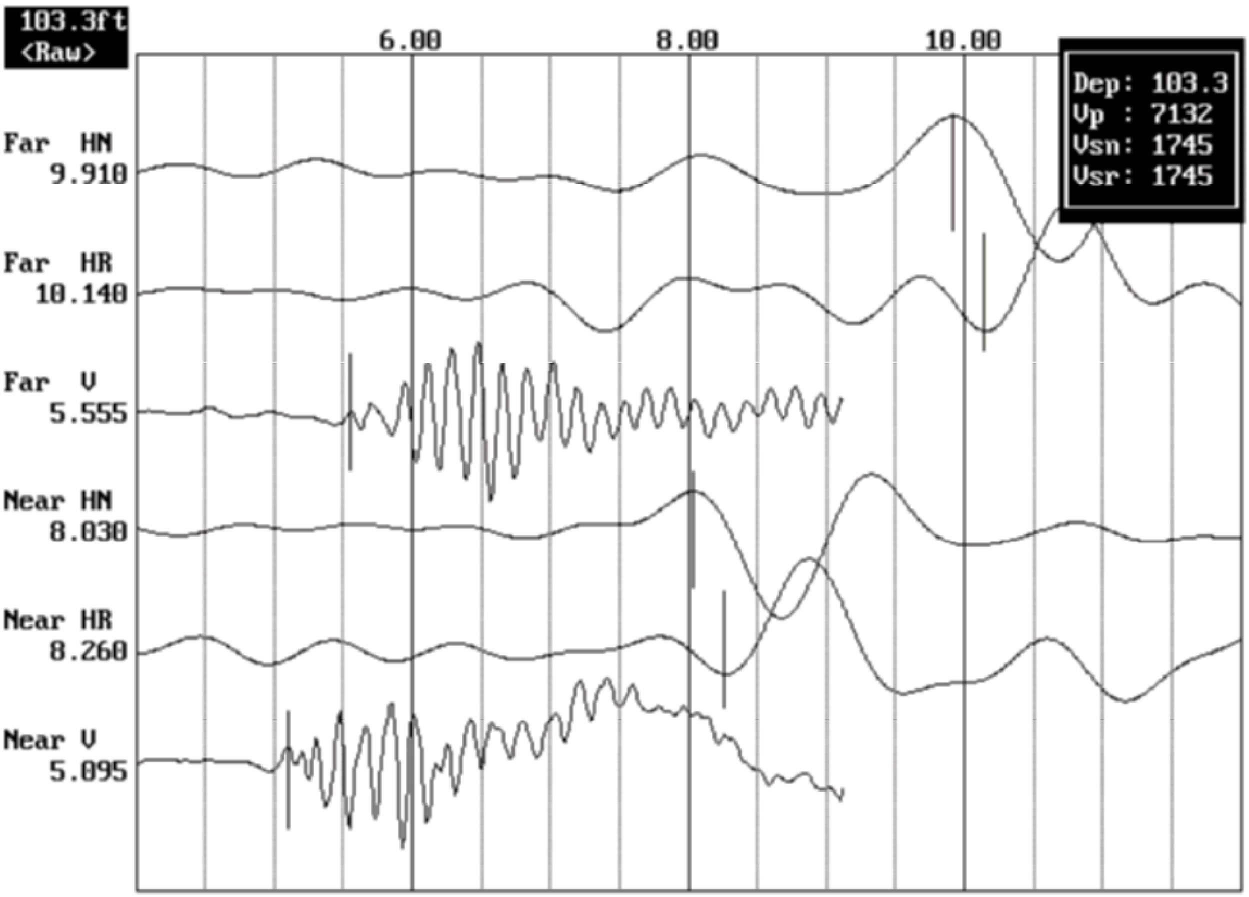

Figure 3: Example of filtered (1400 Hz lowpass) record

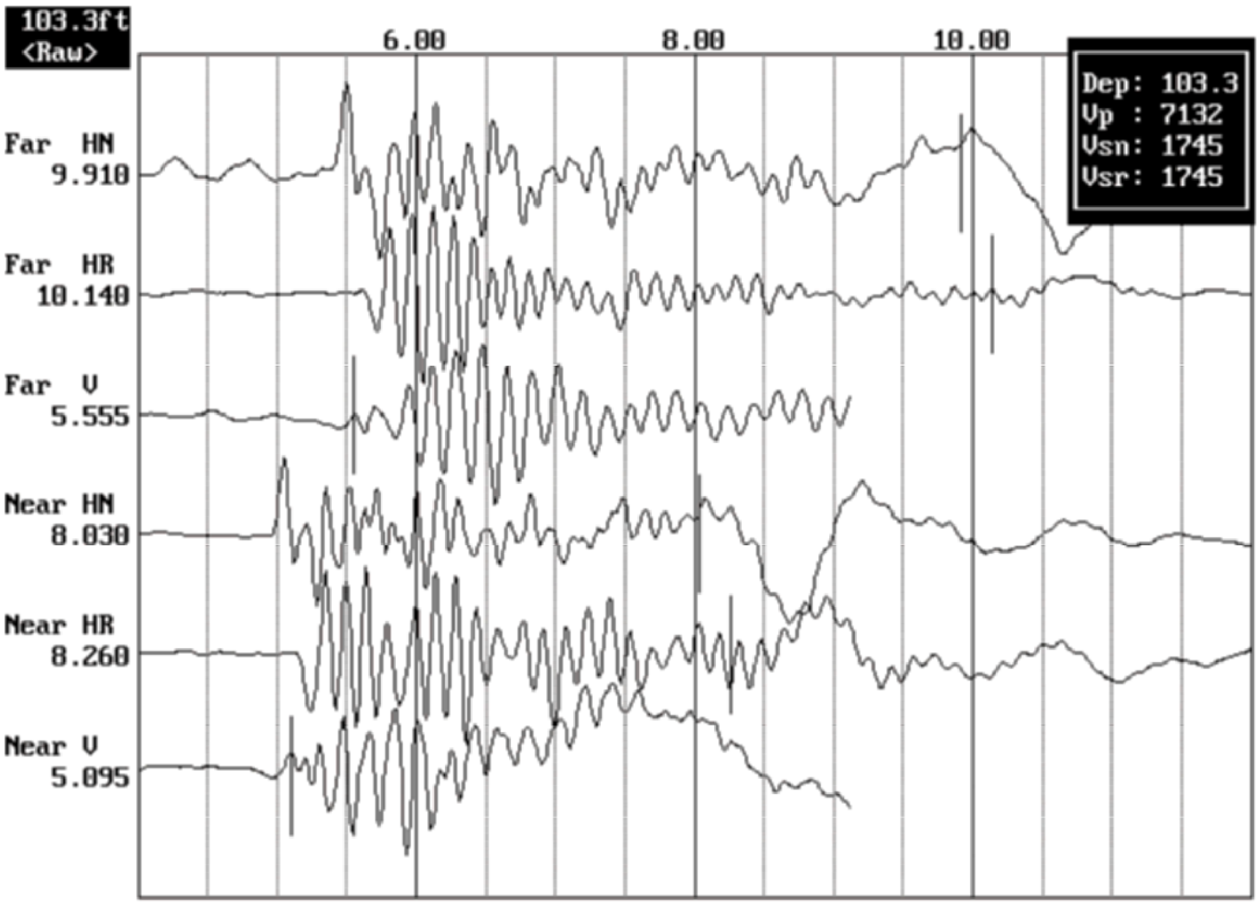

Figure 4. Example of unfiltered record

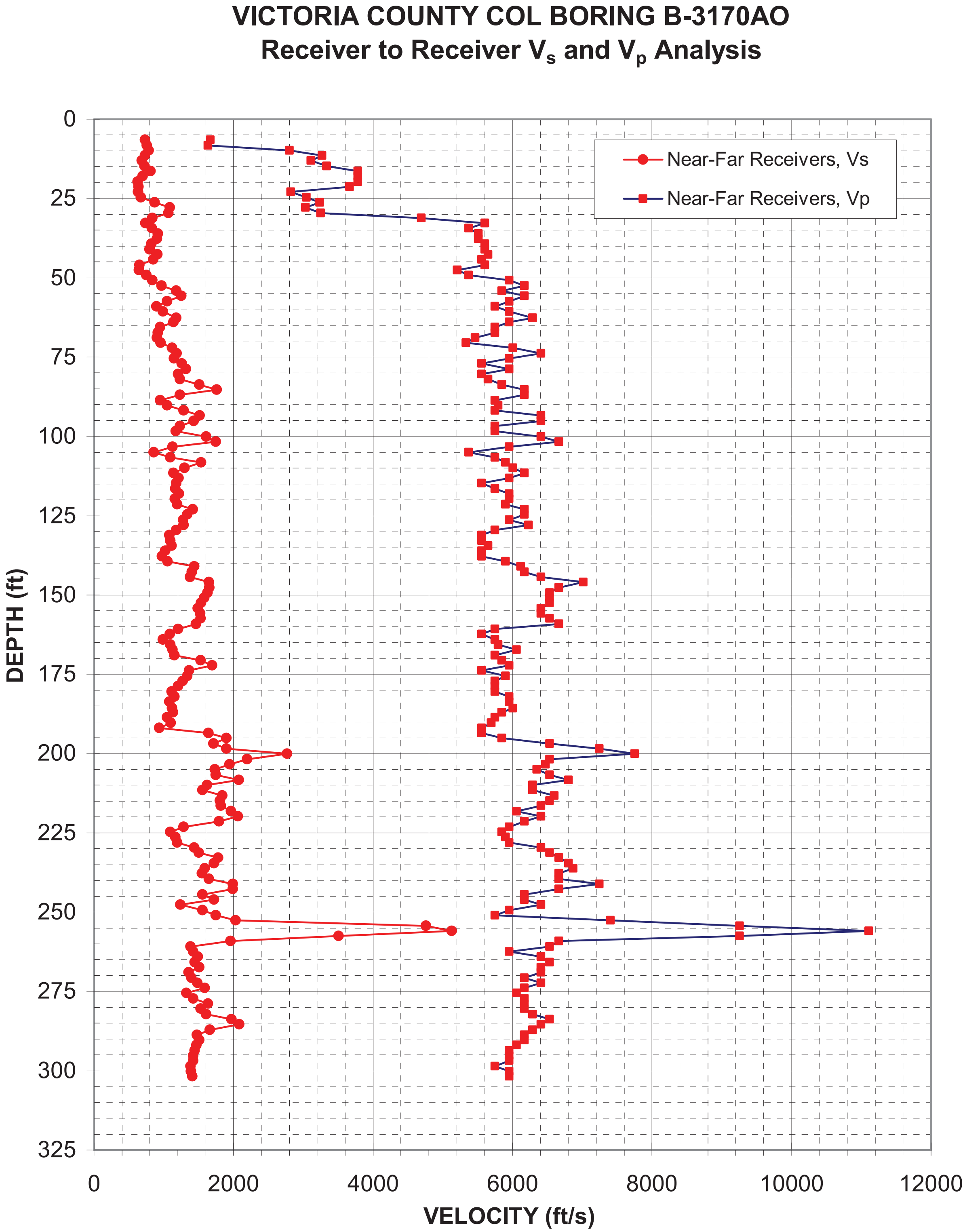

Figure 5: Boring B-3170AO, Suspension R1-R2 P- and S_H-wave velocities

Depth (feet)	V_s (feet/sec)	V_p (feet/sec)	Depth (feet)	V_s (feet/sec)	V_p (feet/sec)	Depth (feet)	V_s (feet/sec)	V_p (feet/sec)
6.6	730	1670	88.6	950	5750	170.6	1530	5850
8.2	760	1630	90.2	1050	5800	172.2	1690	5950
9.8	780	2800	91.9	1290	5750	173.9	1370	5560
11.5	730	3270	93.5	1520	6410	175.5	1340	5900
13.1	690	3120	95.1	1430	6410	177.2	1270	5750
14.8	730	3330	96.8	1230	5750	178.8	1210	5750
16.4	810	3790	98.4	1170	5750	180.5	1110	5750
18.0	700	3790	100.1	1610	6410	182.1	1150	5950
19.7	630	3790	101.7	1750	6670	183.7	1080	5950
21.3	640	3660	103.4	1130	5950	185.7	1120	6010
23.0	630	2820	105.0	850	5380	187.0	1130	5850
24.6	670	3040	106.6	1090	5750	188.7	1050	5750
26.3	870	3240	108.3	1540	5900	190.3	1100	5700
27.9	1090	3030	109.9	1300	6010	191.9	940	5560
29.5	1060	3250	111.6	1140	6170	193.6	1640	5560
31.2	840	4690	113.2	1210	5950	195.2	1900	5850
32.8	740	5600	114.8	1180	5560	196.9	1710	6540
34.5	830	5380	116.5	1170	5750	198.5	1900	7250
36.1	920	5510	118.1	1220	5950	200.1	2770	7750
37.7	900	5510	119.8	1160	5950	201.8	2190	6540
39.4	820	5600	121.4	1190	5900	203.4	1940	6470
41.0	800	5600	123.0	1420	6170	205.1	1730	6350
42.7	910	5650	124.7	1340	6170	206.7	1750	6540
44.3	850	5560	126.3	1280	5950	208.3	2080	6800
45.9	650	5600	128.0	1290	6230	210.0	1620	6290
47.6	640	5210	129.6	1180	5750	211.6	1550	6290
49.2	750	5380	131.2	1080	5560	213.3	1840	6600
50.9	840	5950	132.9	1100	5560	214.9	1810	6540
52.5	970	6170	134.5	1110	5650	216.5	1820	6410
54.1	1180	5850	136.2	1020	5560	218.2	1970	6060
55.8	1250	6170	137.8	980	5560	219.8	2060	6410
57.4	1050	5950	139.4	1050	5900	221.5	1790	6170
59.1	890	5750	141.1	1440	6120	223.1	1290	5950
60.7	990	5950	142.7	1410	6170	224.7	1100	5850
62.7	1180	6290	144.4	1380	6410	226.4	1170	5900
64.0	1140	5950	146.0	1650	7020	228.0	1190	5950
65.6	950	5750	147.6	1650	6670	229.7	1440	6410
67.3	920	5750	149.3	1630	6540	231.3	1500	6540
68.9	900	5460	150.9	1580	6540	232.9	1780	6670
70.5	960	5330	152.6	1540	6540	234.6	1720	6800
72.2	1120	6010	154.2	1490	6410	236.2	1590	6870
73.8	1190	6410	155.8	1520	6410	237.9	1550	6670
75.5	1150	5950	157.5	1530	6540	239.5	1650	6670
77.1	1260	5560	159.1	1460	6670	241.1	1990	7250
78.7	1320	5950	160.8	1200	5750	242.8	1990	6670
80.4	1210	5560	162.4	1090	5560	244.4	1560	6170
82.0	1230	5650	164.0	990	5750	246.1	1720	6170
83.7	1510	5850	165.7	1090	5800	247.7	1240	6410
85.3	1760	6170	167.3	1130	6060	249.3	1560	5950
86.9	1230	6170	169.0	1150	5750	251.0	1750	5750

Table 6. Boring B-3170AO, Suspension R1-R2 depths and P- and S_H-wave velocities

Depth (feet)	V_s (feet/sec)	V_p (feet/sec)
252.6	2030	7410
254.3	4760	9260
255.9	5130	11110
257.6	3510	9260
259.2	1960	6670
260.8	1390	6540
262.5	1420	5950
264.1	1490	6410
265.8	1440	6540
267.4	1510	6410
269.0	1360	6410
270.7	1400	6170
272.3	1480	6410
274.0	1590	6170
275.6	1330	6060
277.2	1420	6170
278.9	1640	6170
280.5	1530	6170
282.2	1610	6290
283.8	1970	6540
285.4	2080	6410
287.1	1660	6290
288.7	1470	6170
290.4	1510	6170
292.0	1470	6060
293.6	1440	5950
295.3	1420	5950
296.9	1420	5950
298.6	1380	5750
300.2	1390	5950
301.8	1410	5950

Table 6, continued. Boring B-3170AO, Suspension R1-R2 depths and P- and S_H-wave velocities