STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	U-2525C	1	51

PROJECT: 34821 REFERENCE: U-2525C

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY *GUILFORD*

PROJECT DESCRIPTION *GREENSBORO EASTERN LOOP I-85 BYPASS (-L-) FROM US 29 NORTH OF GREENSBORO TO EAST OF LAWNDALE DRIVE*

SITE DESCRIPTION *SITE NO. 5 (STRUCTURE NO. 7) – BRIDGE NO. 1246 ON SR 1001 (NORTH CHURCH STREET) (-Y5-) OVER GREENSBORO EASTERN LOOP, I-85 BYPASS (-L-)*

CONTENTS

CPT & DILATOMETER TESTING

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	SITE PLAN
3-51	CPT & DMT REPORT/DATA

PERSONNEL

C.R. PASTRANA

CONETEC

INVESTIGATED BY *ESP Associates, P.A.*

DRAWN BY *C.R. PASTRANA*

CHECKED BY *P. WEAVER*

SUBMITTED BY *ESP Associates, P.A.*

DATE *OCTOBER 2017*

ESP ASSOCIATES, PA
7011 ALBERT PICK RD
SUITE E
GREENSBORO, NC 27409
FIRM # C-0587
WWW.ESPASSOCIATES.COM

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

NORTH CAROLINA LICENSED SEAL 1500 GEOLOGIST PAUL M. WEAVER

DocuSigned by:
Paul Weaver
01847D3739AD49C...
SIGNATURE

10/3/2017
DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

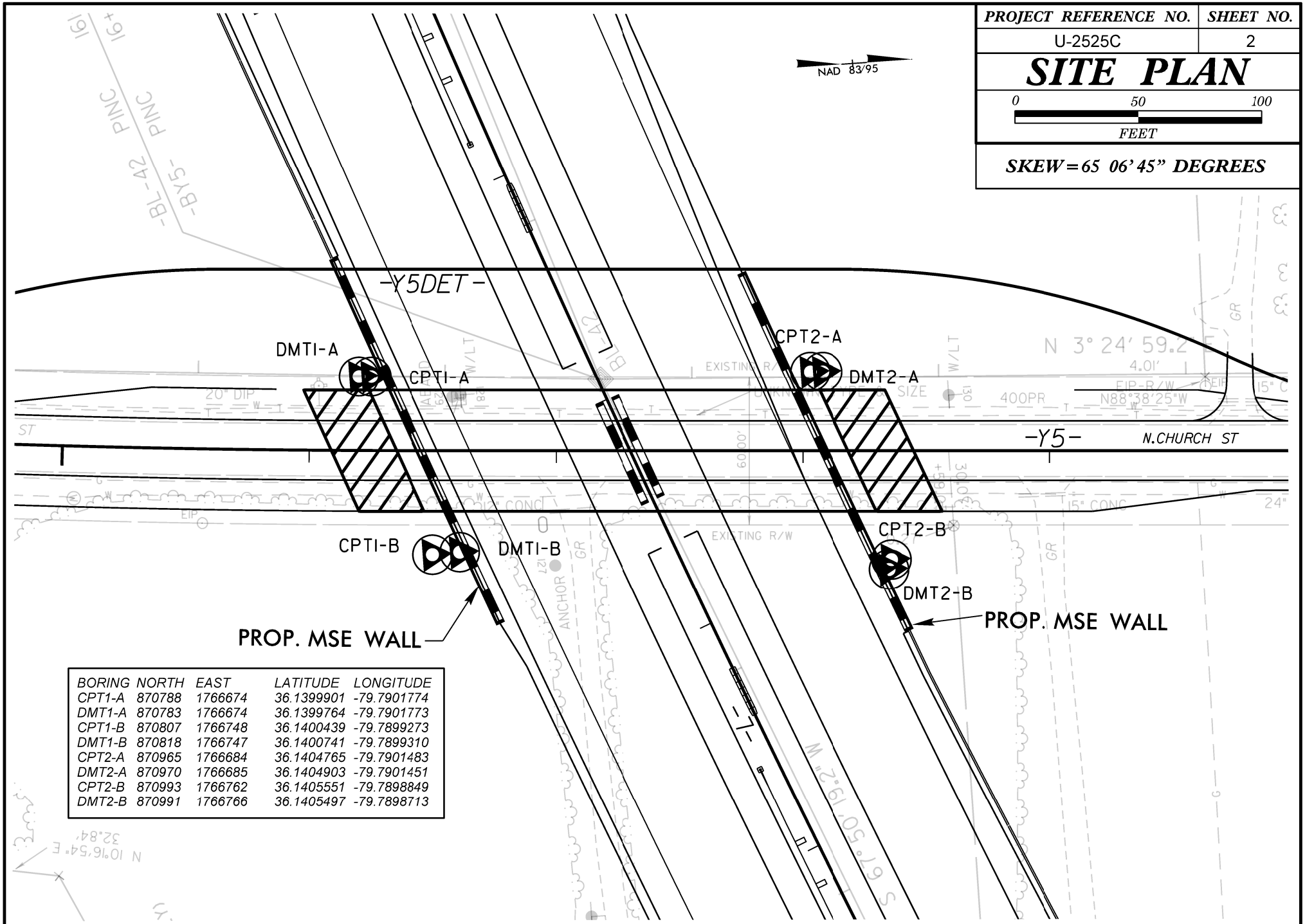
PROJECT REFERENCE NO.	SHEET NO.
U-2525C	2

SITE PLAN

0 50 100

FEET

SKEW = 65 06' 45" DEGREES



BORING	NORTH	EAST	LATITUDE	LONGITUDE
CPT1-A	870788	1766674	36.1399901	-79.7901774
DMT1-A	870783	1766674	36.1399764	-79.7901773
CPT1-B	870807	1766748	36.1400439	-79.7899273
DMT1-B	870818	1766747	36.1400741	-79.7899310
CPT2-A	870965	1766684	36.1404765	-79.7901483
DMT2-A	870970	1766685	36.1404903	-79.7901451
CPT2-B	870993	1766762	36.1405551	-79.7898849
DMT2-B	870991	1766766	36.1405497	-79.7898713

PRESENTATION OF SITE INVESTIGATION RESULTS

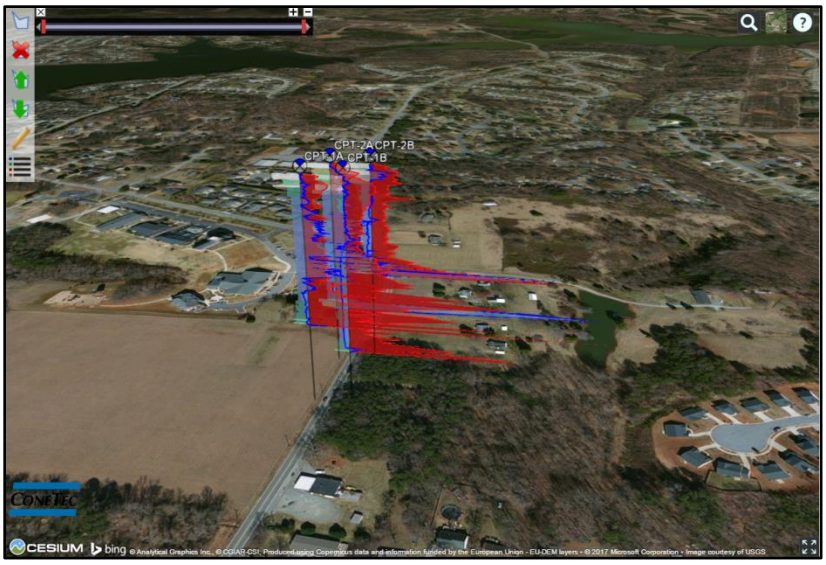
U-2525C

Prepared for:

ESP Associates

ConeTec Job No: 17-54039

Project Start Date: 01-May-2017
Project End Date: 02-May-2017
Report Date: 31-May-2017



Prepared by:

ConeTec Inc.
606-S Roxbury Industrial Center
Charles City, VA 23030

Tel: (804) 966-5696
Fax: (804) 966-5697

Email: virginia@conetec.com
www.conetec.com
www.conetecdataservices.com

Introduction

The enclosed report presents the results of the site investigation program conducted by ConeTec Inc. for ESP Associates in Greenboro, North Carolina. The program consisted of four cone penetration tests (CPTu), and four Flat Plate Dilatometer Tests (DMT). The field work was carried out under the direction of ESP Associates.

Project Information

Project	
Client	ESP Associates
Project	U-2525C
ConeTec project number	17-54039

A map from Cesium including the CPT test locations is presented below.

Rig Description	Deployment System	Test Type
20 Ton Track Rig – TC6	Integrated Ramset	CPT, DMT

Coordinates			
Test Type	Collection Method	EPSG Number	Comments
CPT, DMT	GPS Survey	4326	Coordinates provide by client

Cone Penetration Test (CPT)	
Depth reference	Depths are referenced to the existing ground surface at the time of each test.
Tip and sleeve data offset	0.1 meter This has been accounted for in the CPT data files.

Cone Penetrometers Used for this Project						
Cone Description	Cone Number	Cross Sectional Area (cm^2)	Sleeve Area (cm^2)	Tip Capacity (bar)	Sleeve Capacity (bar)	Pore Pressure Capacity (psi)
AD349:T1500F15U500	AD349	225	15	1500	15	500
Cone 349 was used for all CPT soundings						

Interpretation Tables	
Additional information	The Soil Behaviour Type (SBT) classification chart (Robertson et al., 1986 presented by Lunne, Robertson and Powell, 1997) was used to classify the soil for this project. A detailed set of CPT interpretations were generated and are provided in Excel format files in the release folder. The CPT interpretations are based on values of corrected tip (q_t), sleeve friction (f_s) and pore pressure (u_2). Soils were classified as either drained or undrained based on the Normalized Soil Behaviour Type, SBT Qtn (PKR 2009) classification chart.

Flat Plate Dilatometer Test (DMT)	
Depth reference	Depths are referenced to the existing ground surface at the time of each test.
Phreatic surface determination	Based on adjacent CPT pore pressure dissipation tests
Assumption for equilibrium pore pressure profile	Hydrostatic equilibrium pore pressure profile assumed

Limitations

This report has been prepared for the exclusive use of ESP Associates (Client) for the project titled "U-2525C". The report's contents may not be relied upon by any other party without the express written permission of ConeTec Inc. (ConeTec). ConeTec has provided site investigation services, prepared the factual data reporting, and provided geotechnical parameter calculations consistent with current best practices. No other warranty, expressed or implied, is made.

The information presented in the report document and the accompanying data set pertain to the specific project, site conditions and objectives described to ConeTec by the Client. In order to properly understand the factual data, assumptions and calculations, reference must be made to the documents provided and their accompanying data sets, in their entirety.

The cone penetration tests (CPTu) are conducted using an integrated electronic piezocone penetrometer and data acquisition system manufactured by Adara Systems Ltd. of Richmond, British Columbia, Canada.

ConeTec's piezocone penetrometers are compression type designs in which the tip and friction sleeve load cells are independent and have separate load capacities. The piezocones use strain gauged load cells for tip and sleeve friction and a strain gauged diaphragm type transducer for recording pore pressure. The piezocones also have a platinum resistive temperature device (RTD) for monitoring the temperature of the sensors, an accelerometer type dual axis inclinometer and a geophone sensor for recording seismic signals. All signals are amplified down hole within the cone body and the analog signals are sent to the surface through a shielded cable.

ConeTec penetrometers are manufactured with various tip, friction and pore pressure capacities in both 10 cm^2 and 15 cm^2 tip base area configurations in order to maximize signal resolution for various soil conditions. The specific piezocone used for each test is described in the CPT summary table presented in the first Appendix. The 15 cm^2 penetrometers do not require friction reducers as they have a diameter larger than the deployment rods. The 10 cm^2 piezocones use a friction reducer consisting of a rod adapter extension behind the main cone body with an enlarged cross sectional area (typically 44 mm diameter over a length of 32 mm with tapered leading and trailing edges) located at a distance of 585 mm above the cone tip.

The penetrometers are designed with equal end area friction sleeves, a net end area ratio of 0.8 and cone tips with a 60 degree apex angle.

All ConeTec piezocones can record pore pressure at various locations. Unless otherwise noted, the pore pressure filter is located directly behind the cone tip in the "u_2" position (ASTM Type 2). The filter is 6 mm thick, made of porous plastic (polyethylene) having an average pore size of 125 microns (90-160 microns). The function of the filter is to allow rapid movements of extremely small volumes of water needed to activate the pressure transducer while preventing soil ingress or blockage.

The piezocone penetrometers are manufactured with dimensions, tolerances and sensor characteristics that are in general accordance with the current ASTM D5778 standard. ConeTec's calibration criteria also meet or exceed those of the current ASTM D5778 standard. An illustration of the piezocone penetrometer is presented in Figure CPTu.

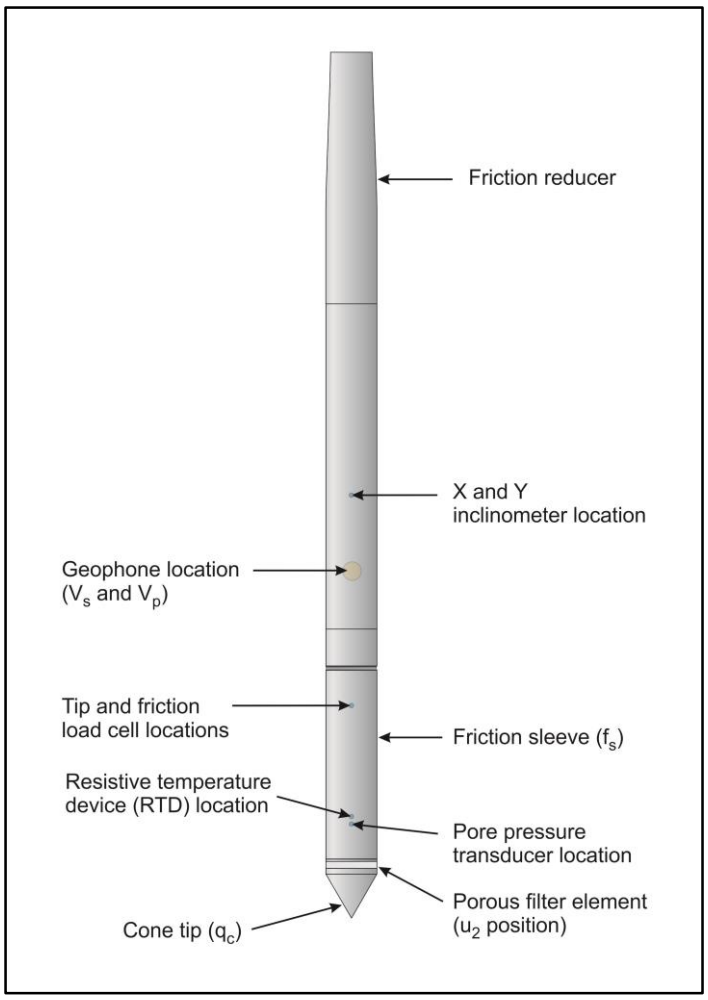


Figure CPTu. Piezocone Penetrometer (15 cm^2)

The ConeTec data acquisition systems consist of a Windows based computer and a signal conditioner and power supply interface box with a 16 bit (or greater) analog to digital (A/D) converter. The data is recorded at fixed depth increments using a depth wheel attached to the push cylinders or by using a spring loaded rubber depth wheel that is held against the cone rods. The typical recording intervals are either 2.5 cm or 5.0 cm depending on project requirements; custom recording intervals are possible. The system displays the CPTu data in real time and records the following parameters to a storage media during penetration:

- Depth
- Uncorrected tip resistance (q_c)
- Sleeve friction (f_s)
- Dynamic pore pressure (u)
- Additional sensors such as resistivity, passive gamma, ultra violet induced fluorescence, if applicable

All testing is performed in accordance to ConeTec's CPT operating procedures which are in general accordance with the current ASTM D5778 standard.

Prior to the start of a CPTu sounding a suitable cone is selected, the cone and data acquisition system are powered on, the pore pressure system is saturated with either glycerin or silicone oil and the baseline readings are recorded with the cone hanging freely in a vertical position.

The CPTu is conducted at a steady rate of 2 cm/s, within acceptable tolerances. Typically one meter length rods with an outer diameter of 1.5 inches are added to advance the cone to the sounding termination depth. After cone retraction final baselines are recorded.

Additional information pertaining to ConeTec's cone penetration testing procedures:

- Each filter is saturated in silicone oil or glycerin under vacuum pressure prior to use
- Recorded baselines are checked with an independent multi-meter
- Baseline readings are compared to previous readings
- Soundings are terminated at the client's target depth or at a depth where an obstruction is encountered, excessive rod flex occurs, excessive inclination occurs, equipment damage is likely to take place, or a dangerous working environment arises
- Differences between initial and final baselines are calculated to ensure zero load offsets have not occurred and to ensure compliance with ASTM standards

The interpretation of piezocone data for this report is based on the corrected tip resistance (q_t), sleeve friction (f_s) and pore water pressure (u). The interpretation of soil type is based on the correlations developed by Robertson (1990) and Robertson (2009). It should be noted that it is not always possible to accurately identify a soil type based on these parameters. In these situations, experience, judgment and an assessment of other parameters may be used to infer soil behavior type.

The recorded tip resistance (q_c) is the total force acting on the piezocone tip divided by its base area. The tip resistance is corrected for pore pressure effects and termed corrected tip resistance (q_t) according to the following expression presented in Robertson et al, 1986:

$$q_t = q_c + (1\text{-}a) \bullet u_2$$

where: q_t is the corrected tip resistance
q_c is the recorded tip resistance
u_2 is the recorded dynamic pore pressure behind the tip (u_2 position)
a is the Net Area Ratio for the piezocone (0.8 for ConeTec probes)

The sleeve friction (f_s) is the frictional force on the sleeve divided by its surface area. As all ConeTec piezocones have equal end area friction sleeves, pore pressure corrections to the sleeve data are not required.

The dynamic pore pressure (u) is a measure of the pore pressures generated during cone penetration. To record equilibrium pore pressure, the penetration must be stopped to allow the dynamic pore pressures to stabilize. The rate at which this occurs is predominantly a function of the permeability of the soil and the diameter of the cone.

The friction ratio (Rf) is a calculated parameter. It is defined as the ratio of sleeve friction to the tip resistance expressed as a percentage. Generally, saturated cohesive soils have low tip resistance, high

friction ratios and generate large excess pore water pressures. Cohesionless soils have higher tip resistances, lower friction ratios and do not generate significant excess pore water pressure.

A summary of the CPTu soundings along with test details and individual plots are provided in the appendices. A set of interpretation files were generated for each sounding based on published correlations and are provided in Excel format in the data release folder. Information regarding the interpretation methods used is also included in the data release folder.

For additional information on CPTu interpretations, refer to Robertson et al. (1986), Lunne et al. (1997), Robertson (2009), Mayne (2013, 2014) and Mayne and Peuchen (2012).

The cone penetration test is halted at specific depths to carry out pore pressure dissipation (PPD) tests, shown in Figure PPD-1. For each dissipation test the cone and rods are decoupled from the rig and the data acquisition system measures and records the variation of the pore pressure (u) with time (t).

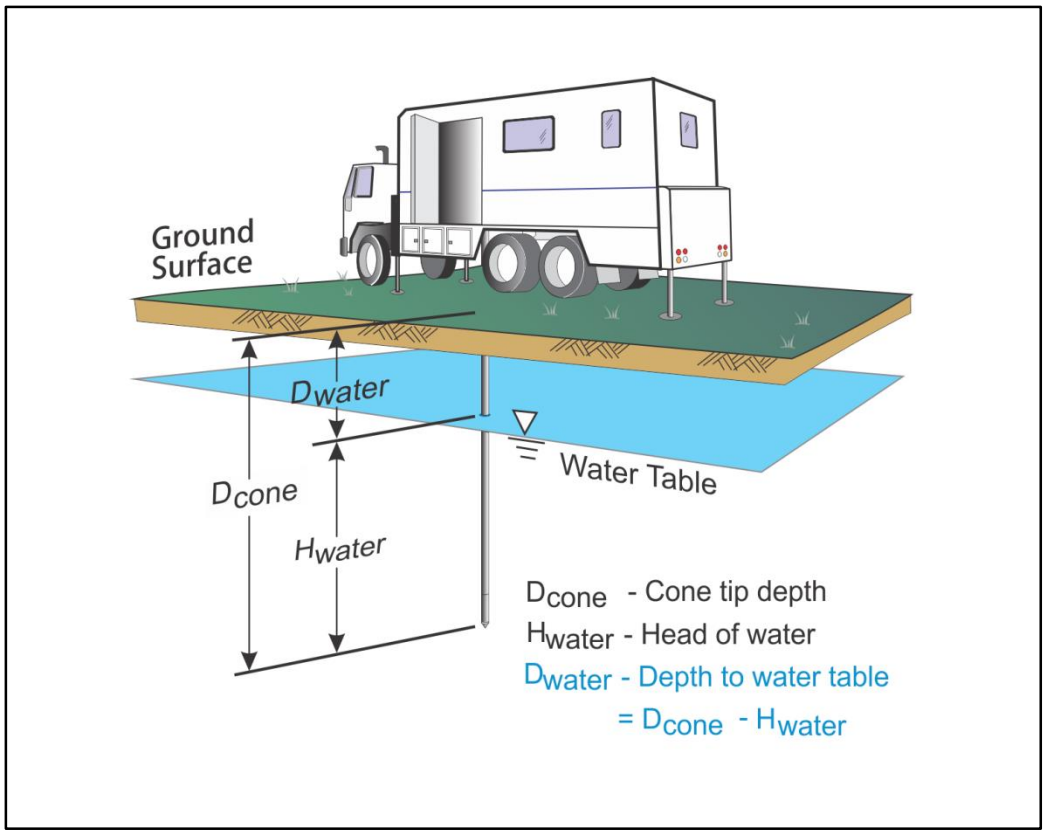


Figure PPD-1. Pore pressure dissipation test setup

Pore pressure dissipation data can be interpreted to provide estimates of ground water conditions, permeability, consolidation characteristics and soil behavior.

The typical shapes of dissipation curves shown in Figure PPD-2 are very useful in assessing soil type, drainage, in situ pore pressure and soil properties. A flat curve that stabilizes quickly is typical of a freely draining sand. Undrained soils such as clays will typically show positive excess pore pressure and have long dissipation times. Dilative soils will often exhibit dynamic pore pressures below equilibrium that then rise over time. Overconsolidated fine-grained soils will often exhibit an initial dilatory response where there is an initial rise in pore pressure before reaching a peak and dissipating.

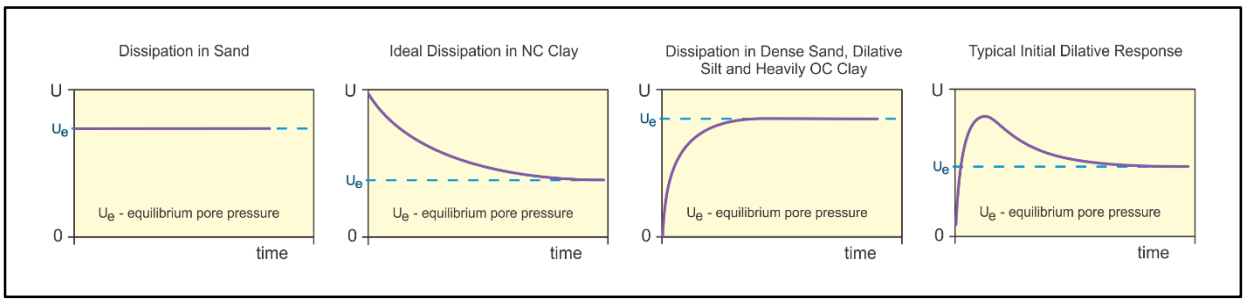


Figure PPD-2. Pore pressure dissipation curve examples

In order to interpret the equilibrium pore pressure (u_{eq}) and the apparent phreatic surface, the pore pressure should be monitored until such time as there is no variation in pore pressure with time as shown for each curve of Figure PPD-2.

In fine grained deposits the point at which 100% of the excess pore pressure has dissipated is known as t_{100}. In some cases this can take an excessive amount of time and it may be impractical to take the dissipation to t_{100}. A theoretical analysis of pore pressure dissipations by Teh and Houlsby (1991) showed that a single curve relating degree of dissipation versus theoretical time factor (T*) may be used to calculate the coefficient of consolidation (c_h) at various degrees of dissipation resulting in the expression for c_h shown below.

$$c_h = \frac{T^* \cdot a^2 \cdot \sqrt{I_r}}{t}$$

Where:

T* is the dimensionless time factor (Table Time Factor)
a is the radius of the cone
I_r is the rigidity index
t is the time at the degree of consolidation

Table Time Factor. T* versus degree of dissipation (Teh and Houlsby, 1991)

Degree of Dissipation (%)	20	30	40	50	60	70	80
T* (u_2)	0.038	0.078	0.142	0.245	0.439	0.804	1.60

The coefficient of consolidation is typically analyzed using the time (t_{50}) corresponding to a degree of dissipation of 50% (u_{50}). In order to determine t_{50}, dissipation tests must be taken to a pressure less than u_{50}. The u_{50} value is half way between the initial maximum pore pressure and the equilibrium pore pressure value, known as u_{100}. To estimate u_{50}, both the initial maximum pore pressure and u_{100} must be known or estimated. Other degrees of dissipations may be considered, particularly for extremely long dissipations.

At any specific degree of dissipation the equilibrium pore pressure (u at t_{100}) must be estimated at the depth of interest. The equilibrium value may be determined from one or more sources such as measuring the value directly (u_{100}), estimating it from other dissipations in the same profile, estimating the phreatic surface and assuming hydrostatic conditions, from nearby soundings, from client provided information, from site observations and/or past experience, or from other site instrumentation.

For calculations of c_h (Teh and Houlsby, 1991), t_{50} values are estimated from the corresponding pore pressure dissipation curve and a rigidity index (I_r) is assumed. For curves having an initial dilatory response in which an initial rise in pore pressure occurs before reaching a peak, the relative time from the peak value is used in determining t_{50}. In cases where the time to peak is excessive, t_{50} values are not calculated.

Due to possible inherent uncertainties in estimating I_r, the equilibrium pore pressure and the effect of an initial dilatory response on calculating t_{50}, other methods should be applied to confirm the results for c_h.

Additional published methods for estimating the coefficient of consolidation from a piezocone test are described in Burns and Mayne (1998, 2002), Jones and Van Zyl (1981), Robertson et al. (1992) and Sully et al. (1999).

A summary of the pore pressure dissipation tests and dissipation plots are presented in the relevant appendix.

ASTM D5778-12, 2012, "Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils", ASTM, West Conshohocken, US.

Burns, S.E. and Mayne, P.W., 1998, "Monotonic and dilatory pore pressure decay during piezocone tests", Canadian Geotechnical Journal 26 (4): 1063-1073.

Burns, S.E. and Mayne, P.W., 2002, "Analytical cavity expansion-critical state model cone dissipation in fine-grained soils", Soils & Foundations, Vol. 42(2): 131-137.

Jones, G.A. and Van Zyl, D.J.A., 1981, "The piezometer probe: a useful investigation tool", Proceedings, 10th International Conference on Soil Mechanics and Foundation Engineering, Vol. 3, Stockholm: 489-495.

Lunne, T., Robertson, P.K. and Powell, J. J. M., 1997, "Cone Penetration Testing in Geotechnical Practice", Blackie Academic and Professional.

Mayne, P.W., 2013, "Evaluating yield stress of soils from laboratory consolidation and in-situ cone penetration tests", Sound Geotechnical Research to Practice (Holtz Volume) GSP 230, ASCE, Reston/VA: 406-420.

Mayne, P.W., 2014, "Interpretation of geotechnical parameters from seismic piezocone tests", CPT'14 Keynote Address, Las Vegas, NV, May 2014.

Mayne, P.W. and Peuchen, J., 2012, "Unit weight trends with cone resistance in soft to firm clays", Geotechnical and Geophysical Site Characterization *4,* Vol. 1 (Proc. ISC-4, Pernambuco), CRC Press, London: 903-910.

Robertson, P.K., 1990, "Soil Classification Using the Cone Penetration Test", Canadian Geotechnical Journal, Volume 27: 151-158.

Robertson, P.K., 2009, "Interpretation of cone penetration tests – a unified approach", Canadian Geotechnical Journal, Volume 46: 1337-1355.

Robertson, P.K., Campanella, R.G., Gillespie, D. and Greig, J., 1986, "Use of Piezometer Cone Data", Proceedings of InSitu 86, ASCE Specialty Conference, Blacksburg, Virginia.

Robertson, P.K., Sully, J.P., Woeller, D.J., Lunne, T., Powell, J.J.M. and Gillespie, D.G., 1992, "Estimating coefficient of consolidation from piezocone tests", Canadian Geotechnical Journal, 29(4): 551-557.

Sully, J.P., Robertson, P.K., Campanella, R.G. and Woeller, D.J., 1999, "An approach to evaluation of field CPTU dissipation data in overconsolidated fine-grained soils", Canadian Geotechnical Journal, 36(2): 369-381.

Teh, C.I., and Houlsby, G.T., 1991, "An analytical study of the cone penetration test in clay", Geotechnique, 41(1): 17-34.

Flat plate dilatometer tests (DMT) are conducted using a flat steel blade with a thin, expandable, circular membrane mounted on one surface, a control unit and a compressed gas (typically nitrogen) supply. A photo of the system is presented in Figure DMT-1.

The dilatometer blade is connected to the up-hole control box by a pneumatic tube with an inner conductor wire. The tube is threaded through a set of steel push rods. The control unit has pressure gauges, an audio-visual signal, a gas flow control and vent valve. A syringe is used to quantify the stiffness of the blade membrane.

Figure DMT-1. Flat plate dilatometer system
(Marchetti, http://www.marchetti-dmt.it/pagespictures/blade&case.htm)

Prior to conducting a DMT profile, the blade membrane stiffness is recorded according to the current ASTM D6635 specifications and the system is assembled and tested for any leaks.

The dilatometer blade is pushed into the ground to the desired depth from surface or through a cased hole using a CPT rig or a drill rig. The blade is inflated using compressed gas and up to three pressure readings are recorded, the A reading at zero deflection (lift-off) and the B reading when a deflection of 1.1 mm has been achieved. An optional C reading representing the closing pressure can be recorded by slowly deflating the membrane soon after B is reached. The blade is advanced to subsequent depths

and the test procedures are repeated at each test depth, up to the sounding termination depth. After the blade is retracted membrane stiffness values are recorded.

The dilatometer operating procedures are performed in general accordance with the current ASTM D6635 standard.

The interpretation of the dilatometer data is based on the pressure related parameters p_o and p_1 that are derived from the recorded A and B pressure values corrected for membrane stiffness and the gauge zero offset. Figure DMT-2 shows p_o and p_1.

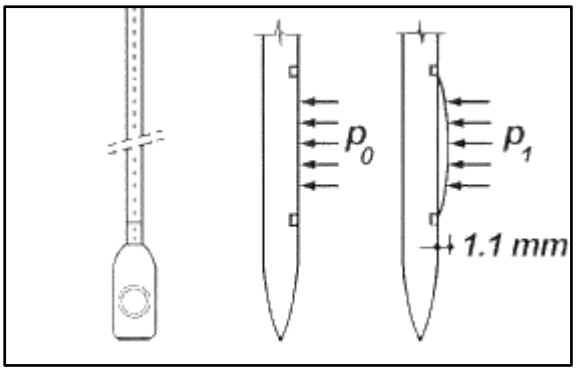


Figure DMT-2. Flat plate dilatometer p_0 and p_1
(Marchetti, http://www.marchetti-dmt.it/)

The A reading is the pressure required to lift-off the membrane while the B reading is the pressure required to move the center of the membrane by 1.1 mm. The C pressure measurement is the pressure at which the membrane returns to the A position and is used to estimate equilibrium pore pressures in sand. The A and B pressure readings are corrected by the membrane stiffness values at the respective membrane deflections that are recorded before and after each test location.

The empirical correlations use the parameters p_0, p_1 and p_2 derived from the A, B and C readings accounting for membrane stiffness and gauge offset. These parameters provide the basic values needed in the empirical correlations developed by Marchetti et al. (2001). The equations for these parameters are presented in the relevant appendix.

The p_o, p_1 and p_2 parameters are used to calculate the DMT indices, material index (I_D), horizontal stress index (K_D), and dilatometer modulus (E_D). Soil type is inferred from the material index. Clays generally have a material index of less than 0.6. The material index for silts is generally between 0.6 and 1.8, while sands generally exhibit a material index greater than 1.8. While K_D and E_D have limited direct use in geotechnical design, they are critical for determining parameters that are required for most design calculations such as earth pressure coefficient (K_o), undrained shear strength (S_u), and over consolidation ratio (OCR).

A summary of the tests including coordinates and estimated phreatic surface, along with plots and tabular results are provided in the relevant appendices. The calculated geotechnical parameters presented are based on published empirical correlations and are provided only as a first approximation. No warranty, expressed or implied, is made to the accuracy of these estimated geotechnical parameters.

References

ASTM D6635-01, Reapproved 2007, "Standard Test Method for Performing the Flat Plate Dilatometer ", ASTM, West Conshohocken, US.

Foti, D., Lancellotta, R., Marchetti, D., Monaco, P., and Totani, P., 2006, “Interpretation of SDMT tests in a transversely isotropic medium”, Proceedings from the Second International Conference on the Flat Dilatometer, Washington, DC., April 2-5.

Marchetti, S., Monaco P., Totani G. and Calabrese M., 2001, “The Flat Dilatometer Test (DMT) in soil investigations”, A Report by the ISSMEGE Committee TC16. Proc. IN SITU 2001, Intnl. Conf. On In Situ Measurement of Soil Properties, Bali, Indonesia, May 2001, 41 pp.

Marchetti, S., n.d, [Photographs of DMT and SDMT system], Retrieved from http://www.marchetti-dmt.it/pagespictures/blade&case.htm.

Marchetti, S., n.d, [Illustration of DMT blade, po and p1], http://www.marchetti-dmt.it/.

The appendices listed below are included in the report:

- Cone Penetration Test Summary and Standard Cone Penetration Test Plots
- Pore Pressure Dissipation Summary and Pore Pressure Dissipation Plots
- Flat Plate Dilatometer Test Summary, Plots and Tabular Results

Cone Penetration Test Summary and Standard Cone Penetration Test Plots

Job No:	17-54039
Client:	ESP Associates
Project:	U-2525C
Start Date:	01-May-2017
End Date:	02-May-2017

CONE PENETRATION TEST SUMMARY

Sounding ID	File Name	Date	Cone	Assumed Phreatic Surface[1] (ft)	Final Depth (ft)	Latitude[2] (Degrees)	Longitude[2] (Degrees)	Elevation[3] (ft)
CPT-1A	17-54039_CP CPT-1A	01-May-2017	AD349	24	55.3	36.13999	-79.79018	856.8
CPT-1B	17-54039_CP CPT-1B	02-May-2017	AD349	26	66.1	36.14004	-79.78993	855.8
CPT-2A	17-54039_CP CPT-2A	01-May-2017	AD349	18	59.1	36.14048	-79.79015	852.0
CPT-2B	17-54039_CP CPT-2B	02-May-2017	AD349	18	45.3	36.14056	-79.78988	851.1
Totals	4 soundings				225.718			

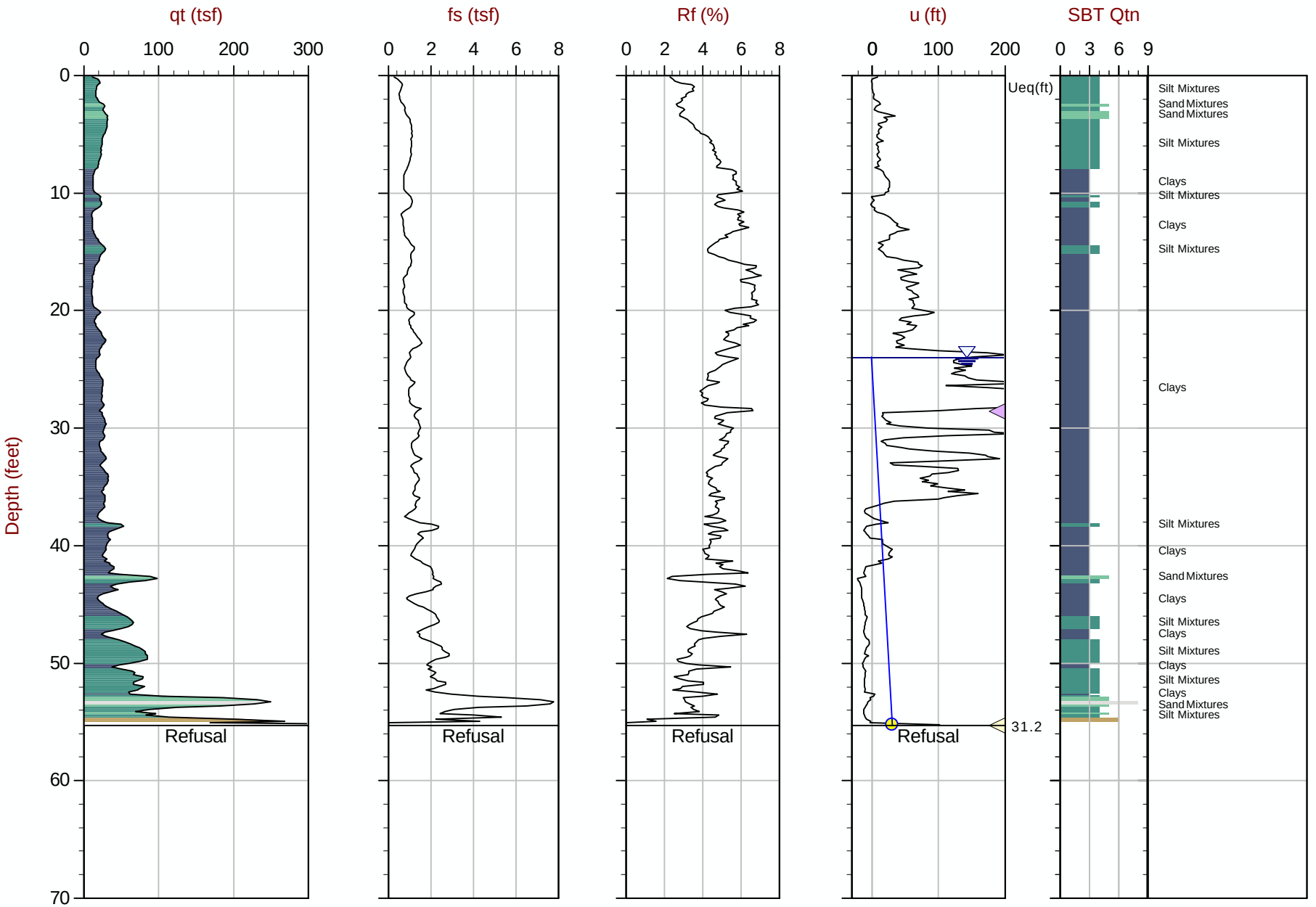
1. Phreatic surface based on pore pressure dissipation test unless otherwise noted. Hydrostatic profile applied to interpretation tables
2. Coordinates were provided by client - WGS 84
3. Elevations are referenced to the exisiting ground surface at the time of testing.

CONETEC

ESP Associates

Job No: 17-54039
Date: 05:01:17 15:53
Site: U-2525C

Sounding: CPT-1A
Cone: 349:T1500F15U500



Max Depth: 16.850 m / 55.28 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 17-54039_CPCPT-1A.COR
Unit Wt: SBT Zones

SBT: Robertson, 2009 and 2010
Coords: N: 36.140 E: -79.790 Elev: 856.8ft

△ Dissipation with estimated Ueq value △ Dissipation, equilibrium not achieved ○ Equilibrium Pore Pressure (Ueq)

The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

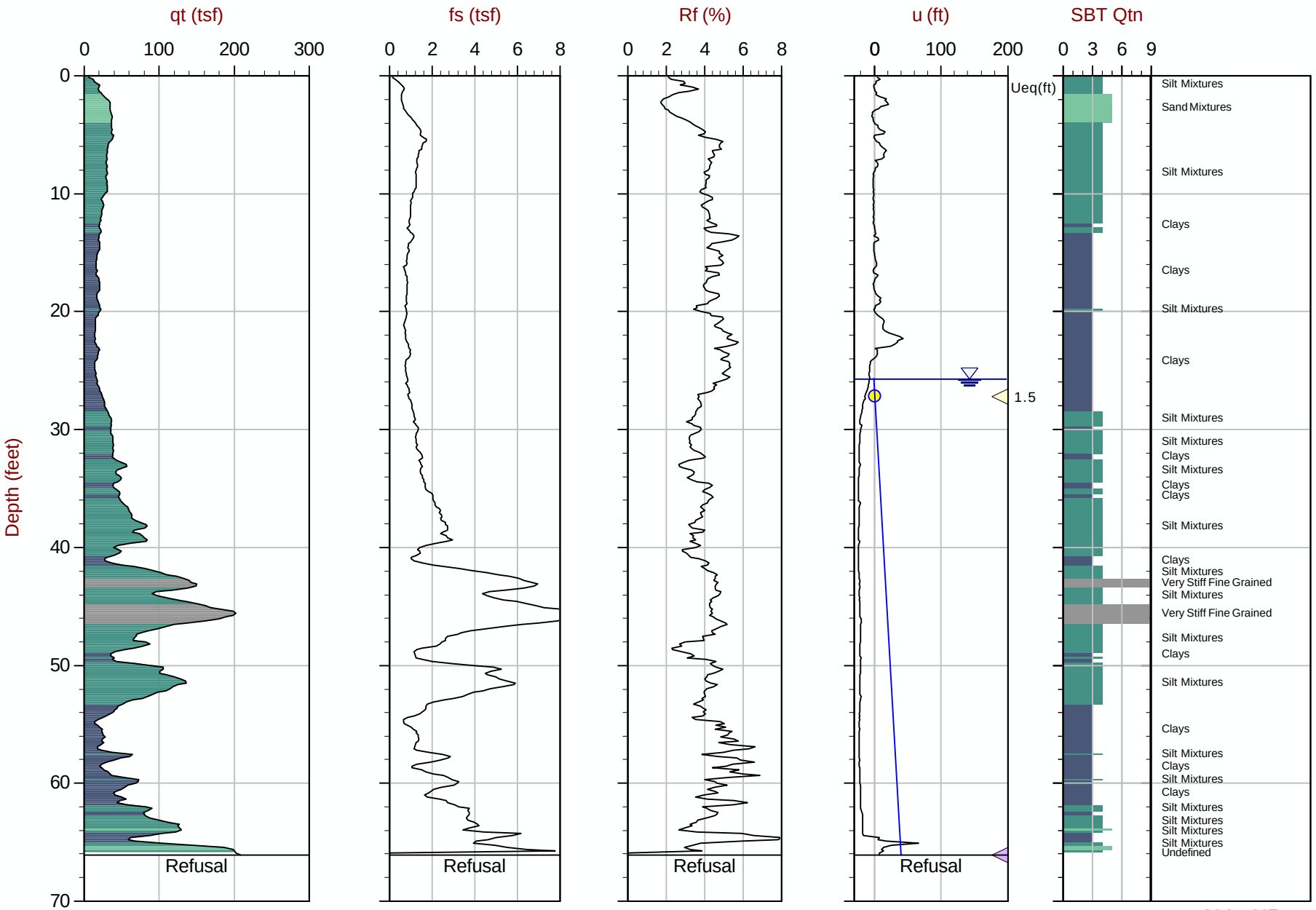
ALI: -Y5-
STN: 21+25
OFFSET: 30'LT
N: 870788
E: 1766674

CONETEC

ESP Associates

Job No: 17-54039
Date: 05:02:17 09:07
Site: U-2525C

Sounding: CPT-1B
Cone: 349:T1500F15U500



Max Depth: 20.150 m / 66.11 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 17-54039_CPCPT-1B.COR
Unit Wt: SBT Zones

SBT: Robertson, 2009 and 2010
Coords: N: 36.140 E: -79.790 Elev: 855.8ft

△ Dissipation with estimated Ueq value △ Dissipation, equilibrium not achieved ○ Equilibrium Pore Pressure (Ueq)

The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

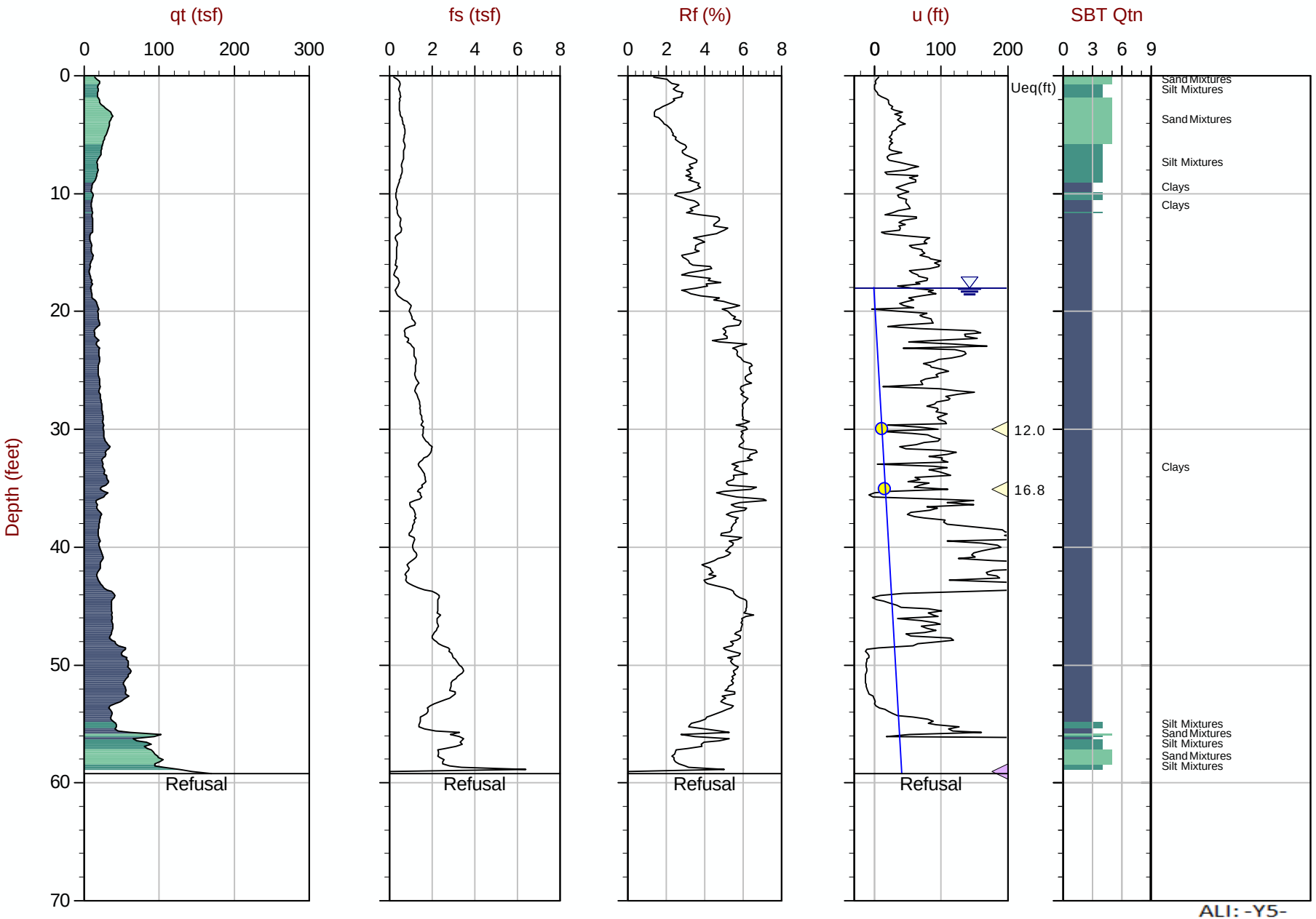
ALI: -Y5-
STN: 21+50
OFFSET: 42'RT
N: 870807
E: 1766748

CONETEC

ESP Associates

Job No: 17-54039
Date: 05:01:17 12:52
Site: U-2525C

Sounding: CPT-2A
Cone: 349:T1500F15U500



Max Depth: 18.050 m / 59.22 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 17-54039_CPCPT-2A.COR
Unit Wt: SBT Zones

SBT: Robertson, 2009 and 2010
Coords: N: 36.140 E: -79.790 Elev: 852.0ft

△ Dissipation with estimated Ueq value △ Dissipation, equilibrium not achieved ○ Equilibrium Pore Pressure (Ueq)

The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

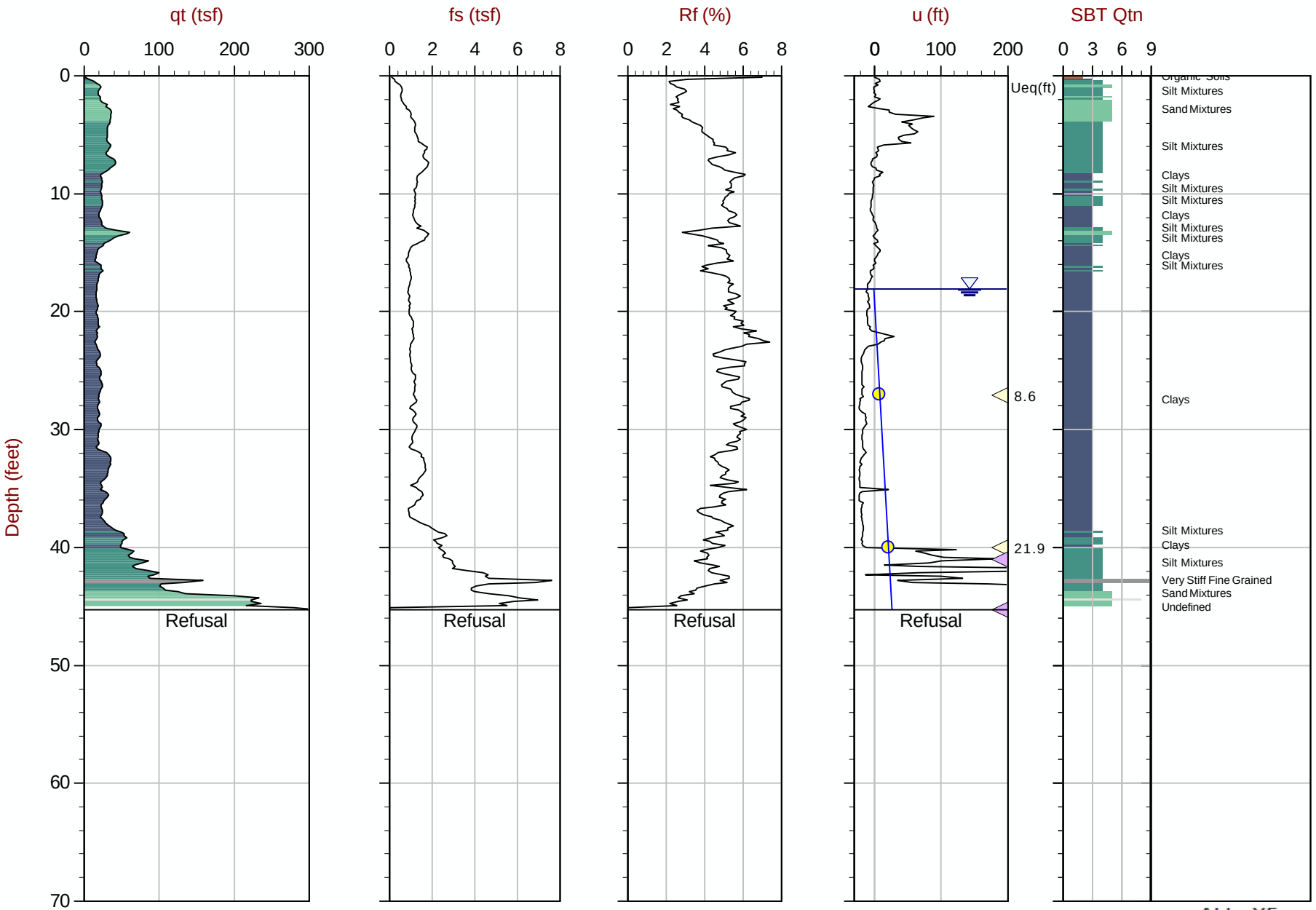
ALI: -Y5-
STN: 23+03
OFFSET: 32'LT
N: 870965
E: 1766684

CONETEC

ESP Associates

Job No: 17-54039
Date: 05:02:17 13:54
Site: U-2525C

Sounding: CPT-2B
Cone: 349:T1500F15U500



Max Depth: 13.800 m / 45.28 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 17-54039_CP CPT-2B.COR
Unit Wt: SBT Zones

SBT: Robertson, 2009 and 2010
Coords: N: 36.141 E: -79.790 Elev: 851.1ft

△ Dissipation with estimated Ueq value △ Dissipation, equilibrium not achieved ○ Equilibrium Pore Pressure (Ueq)

The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ALI: -Y5-
STN: 23+36
OFFSET: 44'RT
N: 870993
E: 1766762

Pore Pressure Dissipation Summary and

Pore Pressure Dissipation Plots

CONETEC

Job No:	17-54039
Client:	ESP Associates
Project:	U-2525C
Start Date:	01-May-17
End Date:	02-May-17

CPTu PORE PRESSURE DISSIPATION SUMMARY

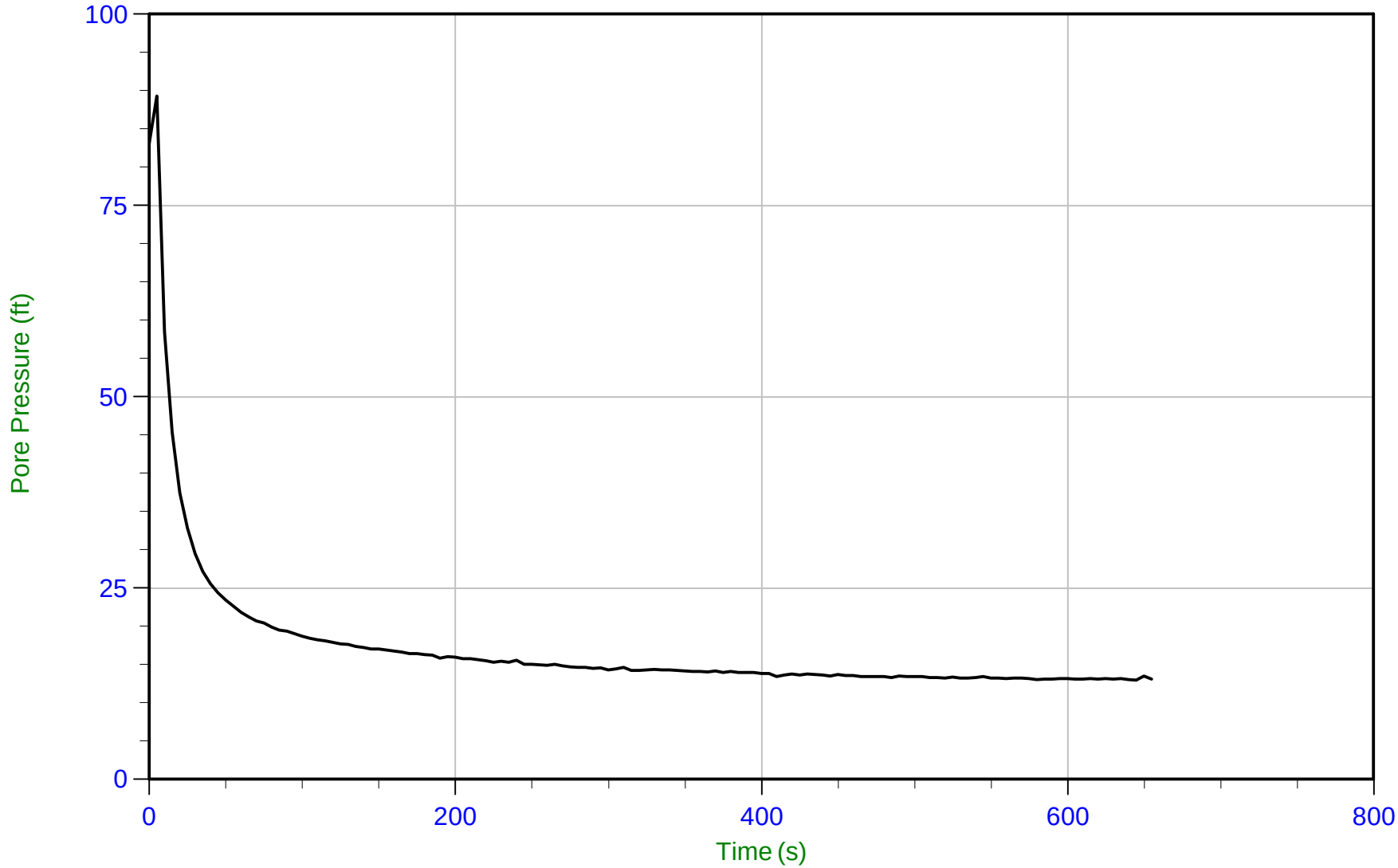
Sounding ID	File Name	Cone Area (cm^2)	Duration (s)	Test Depth (ft)	Estimated Equilibrium Pore Pressure U_{eq} (ft)	Calculated Phreatic Surface (ft)
CPT-1A	17-54039_CP CPT-1A	15.0	655	28.5		
CPT-1A	17-54039_CP CPT-1A	15.0	795	55.3	31	24
CPT-1B	17-54039_CP CPT-1B	15.0	400	27.2	2	26
CPT-1B	17-54039_CP CPT-1B	15.0	190	66.1		
CPT-2A	17-54039_CP CPT-2A	15.0	315	30.0	12	18
CPT-2A	17-54039_CP CPT-2A	15.0	420	35.1	17	18
CPT-2A	17-54039_CP CPT-2A	15.0	210	59.1		
CPT-2B	17-54039_CP CPT-2B	15.0	665	27.1	9	18
CPT-2B	17-54039_CP CPT-2B	15.0	1200	40.0	22	18
CPT-2B	17-54039_CP CPT-2B	15.0	200	41.0		
CPT-2B	17-54039_CP CPT-2B	15.0	145	45.3		
Totals	11		86.6 min			

CONETEC

ESP Associates

Job No: 17-54039
Date: 05/01/2017 15:53
Site: U-2525C

Sounding: CPT-1A
Cone: 349:T1500F15U500
Cone Area: 15 sq cm



Trace Summary:

Filename: 17-54039_CP CPT-1A.PPD
Depth: 8.700 m / 28.543 ft
Duration: 655.0 s

U Min: 13.0 ft
U Max: 89.3 ft

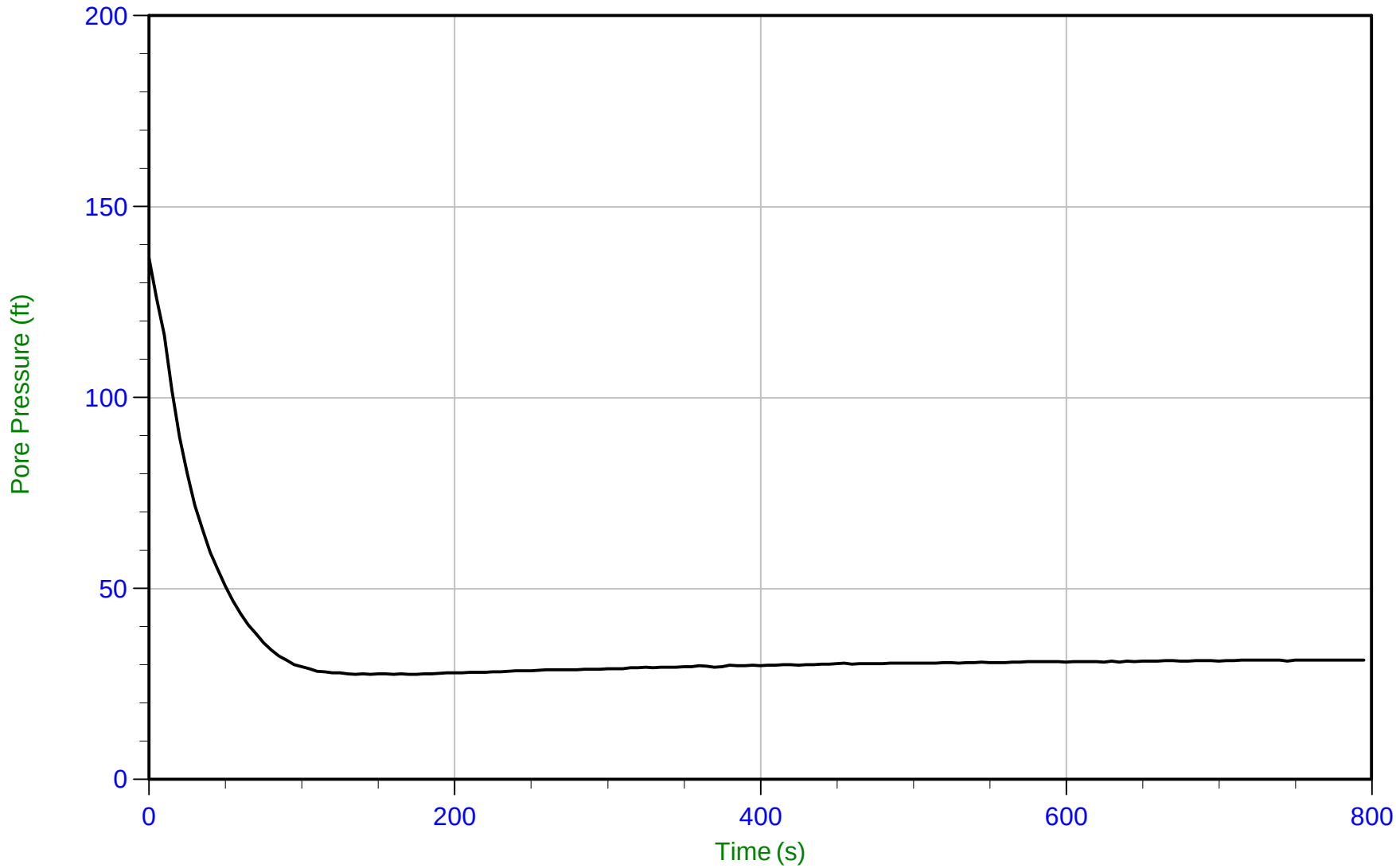
ALI: -Y5-
STN: 21+25
OFFSET: 30'LT
N: 870788
E: 1766674

CONETEC

ESP Associates

Job No: 17-54039
Date: 05/01/2017 15:53
Site: U-2525C

Sounding: CPT-1A
Cone: 349:T1500F15U500
Cone Area: 15 sq cm



Trace Summary:

Filename: 17-54039_CP CPT-1A.PPD
Depth: 16.850 m / 55.281 ft
Duration: 795.0 s

U Min: 27.5 ft
U Max: 136.5 ft

WT: 7.326 m / 24.035 ft
Ueq: 31.2 ft

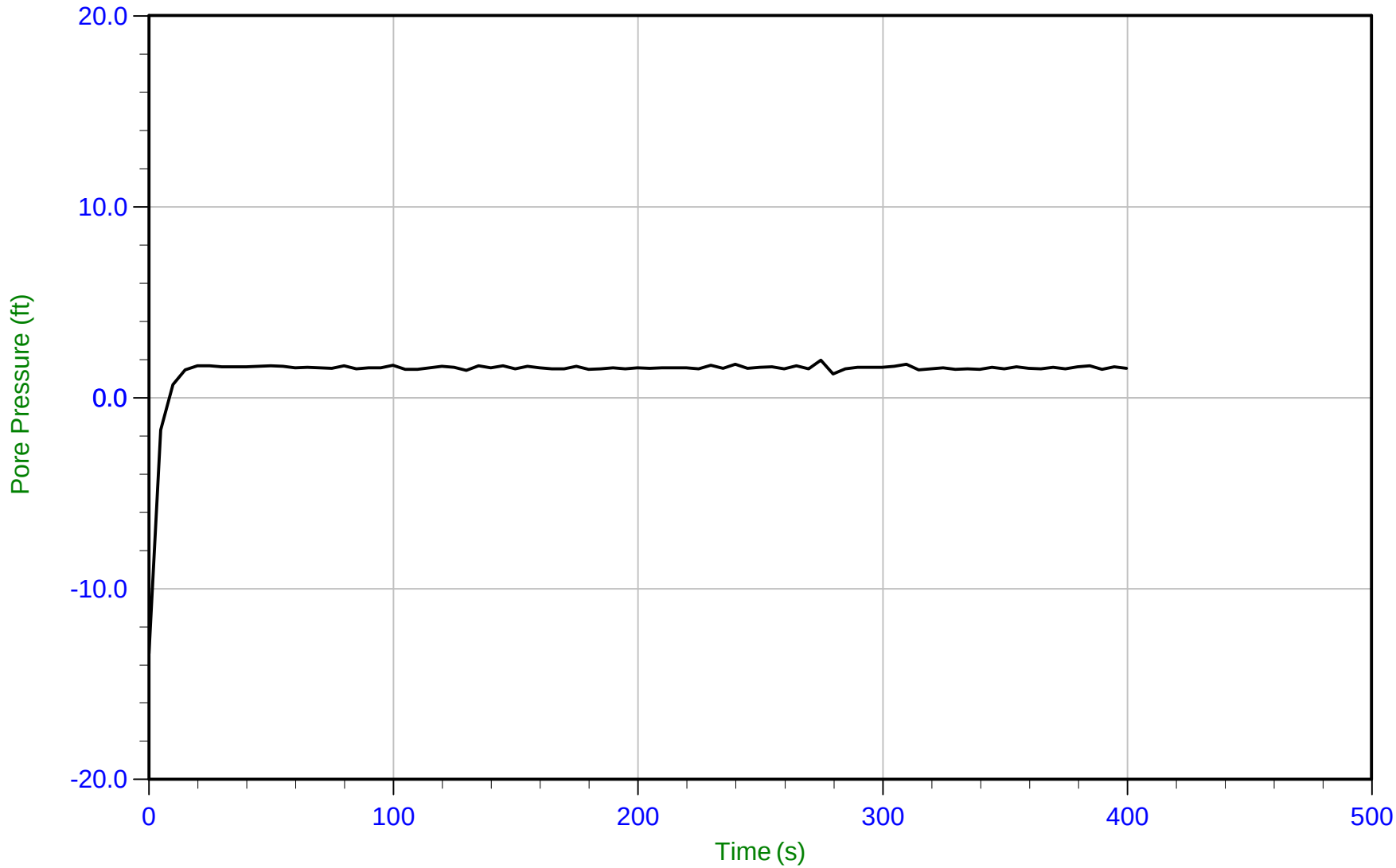
ALI: -Y5-
STN: 21+25
OFFSET: 30'LT
N: 870788
E: 1766674

CONETEC

ESP Associates

Job No: 17-54039
Date: 05/02/2017 09:07
Site: U-2525C

Sounding: CPT-1B
Cone: 349:T1500F15U500
Cone Area: 15 sq cm



Trace Summary:

Filename: 17-54039_CP CPT-1B.PPD
Depth: 8.300 m / 27.231 ft
Duration: 400.0 s

U Min: -13.4 ft
U Max: 2.0 ft

WT: 7.830 m / 25.689 ft
Ueq: 1.5 ft

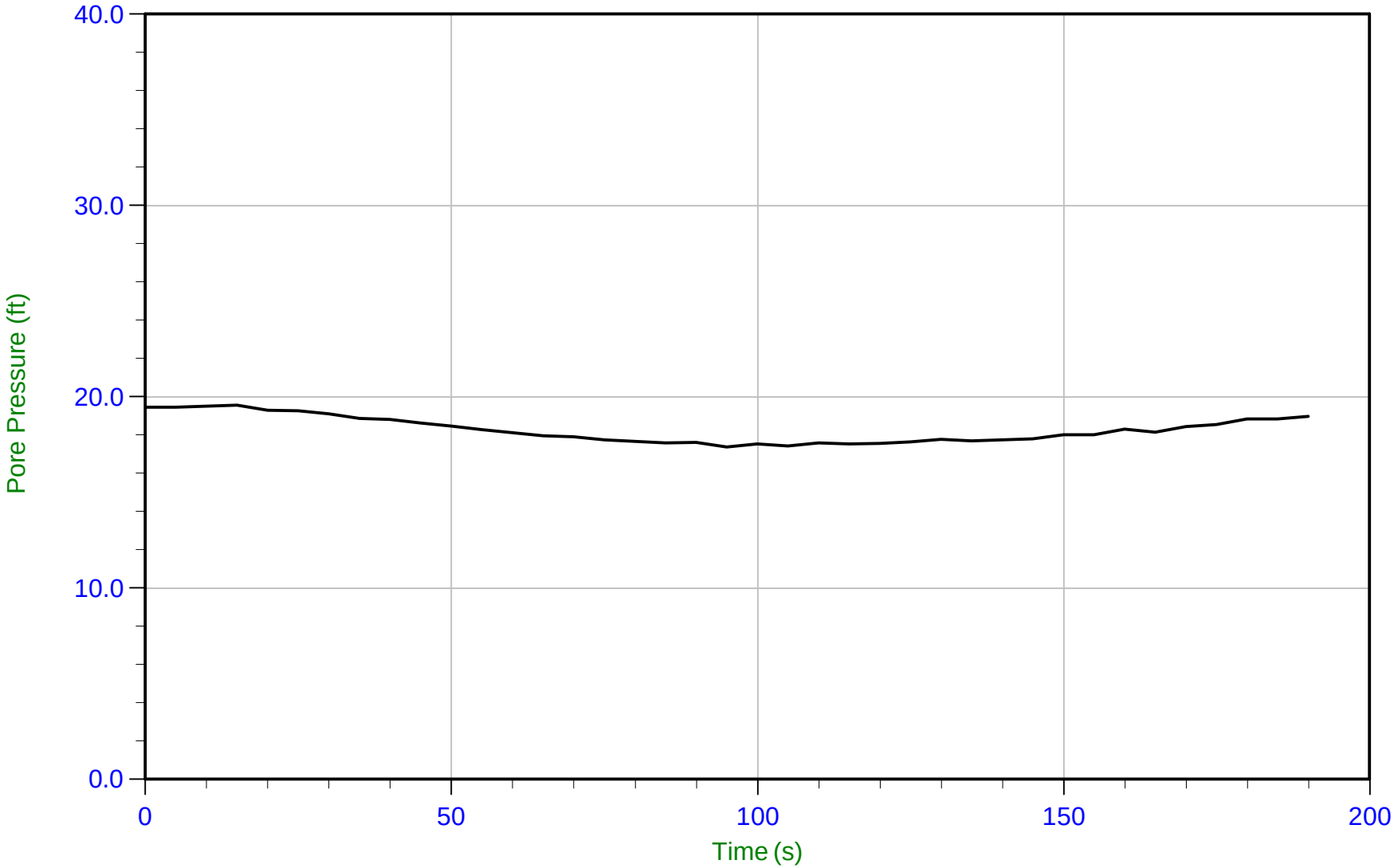
ALI: -Y5-
STN: 21+50
OFFSET: 42'RT
N: 870807
E: 1766748

CONETEC

ESP Associates

Job No: 17-54039
Date: 05/02/2017 09:07
Site: U-2525C

Sounding: CPT-1B
Cone: 349:T1500F15U500
Cone Area: 15 sq cm



Trace Summary:

Filename: 17-54039_CP CPT-1B.PPD
Depth: 20.150 m / 66.108 ft
Duration: 190.0 s

U Min: 17.4 ft
U Max: 19.5 ft

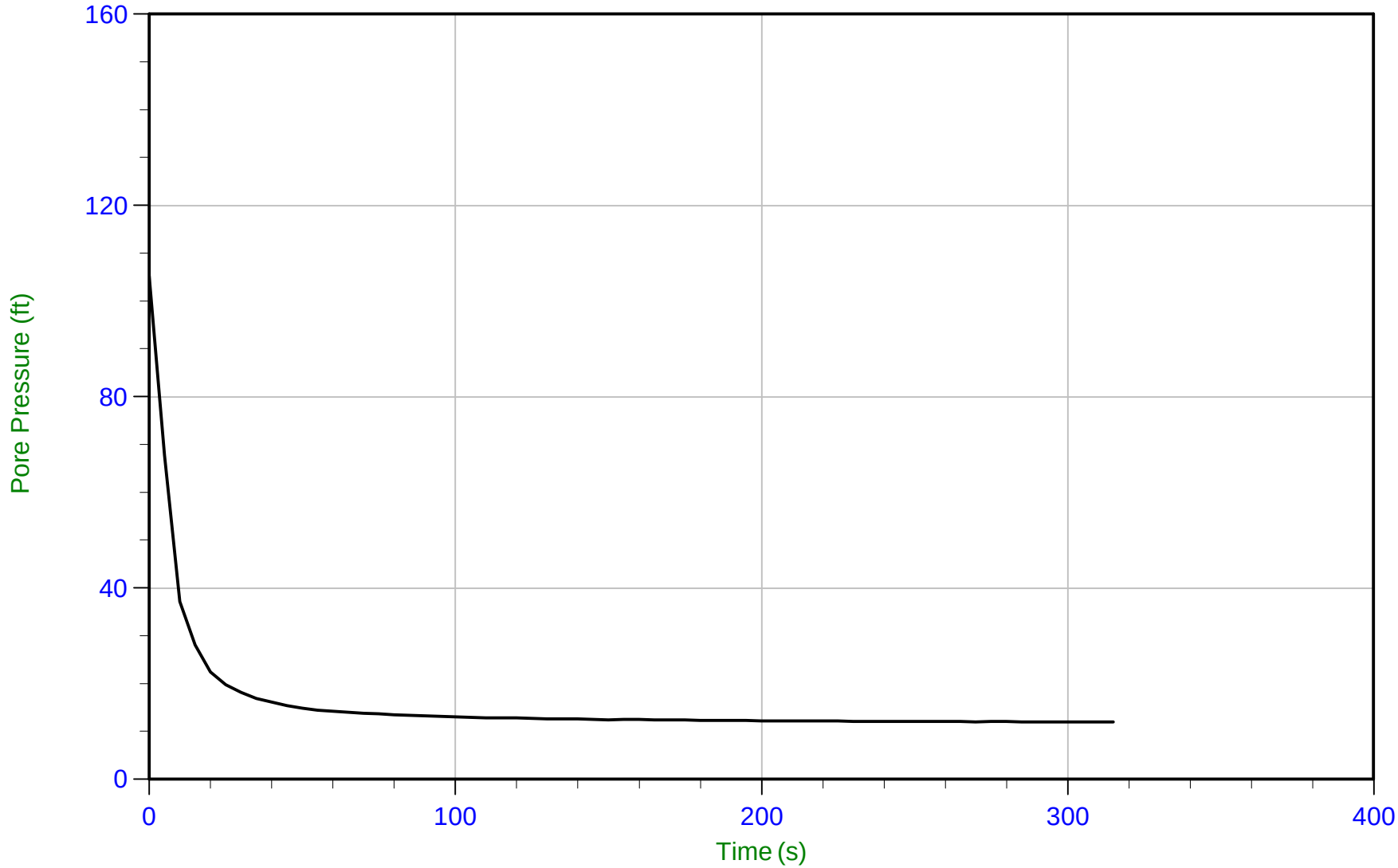
ALI: -Y5-
STN: 21+50
OFFSET: 42'RT
N: 870807
E: 1766748

CONETEC

ESP Associates

Job No: 17-54039
Date: 05/01/2017 12:52
Site: U-2525C

Sounding: CPT-2A
Cone: 349:T1500F15U500
Cone Area: 15 sq cm



Trace Summary:

Filename: 17-54039_CP CPT-2A.PPD
Depth: 9.150 m / 30.019 ft
Duration: 315.0 s

U Min: 12.0 ft
U Max: 105.2 ft

WT: 5.487 m / 18.001 ft
Ueq: 12.0 ft

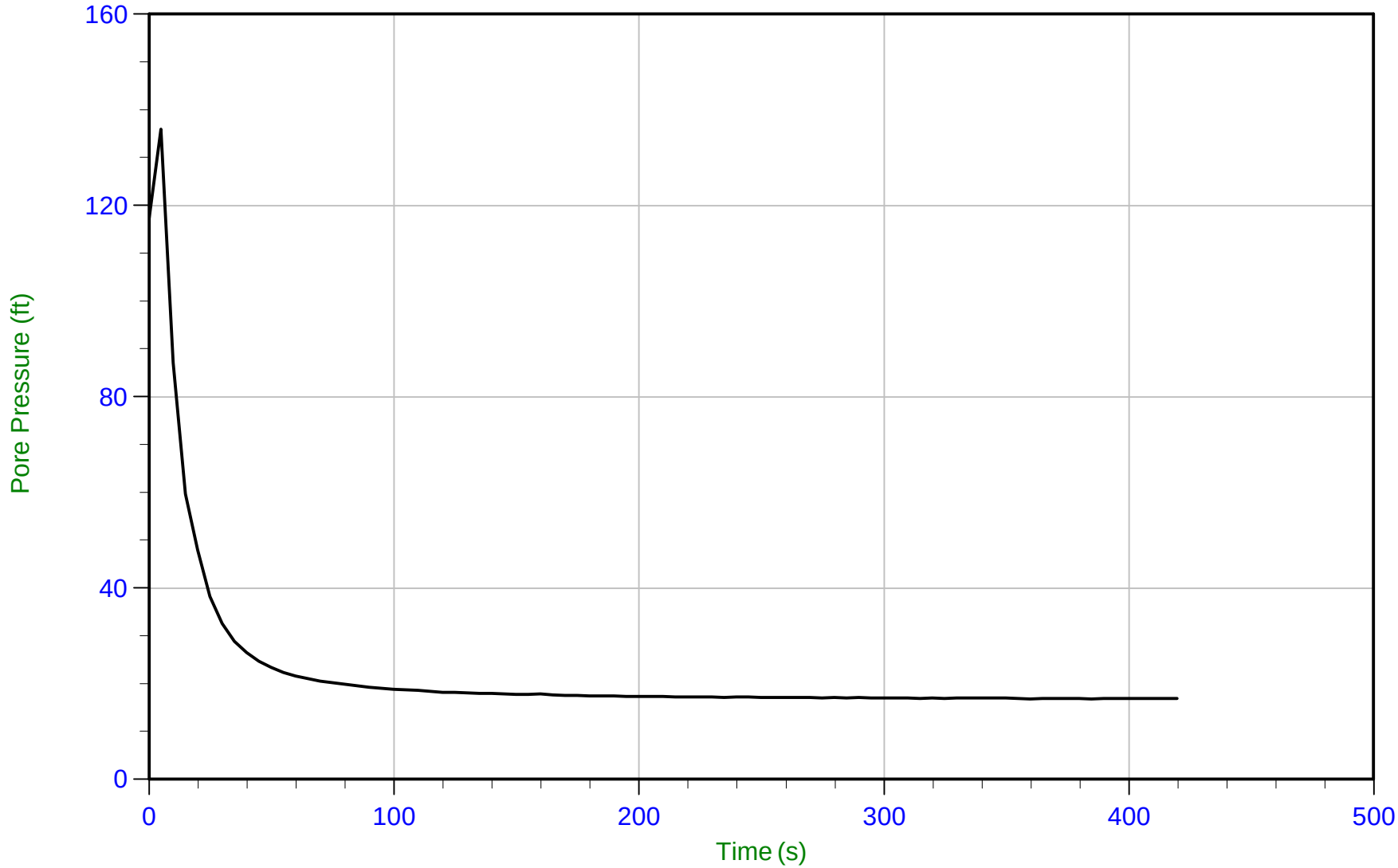
ALI: -Y5-
STN: 23+03
OFFSET: 32'LT
N: 870965
E: 1766684

CONETEC

ESP Associates

Job No: 17-54039
Date: 05/01/2017 12:52
Site: U-2525C

Sounding: CPT-2A
Cone: 349:T1500F15U500
Cone Area: 15 sq cm



Trace Summary:

Filename: 17-54039_CP CPT-2A.PPD
Depth: 10.700 m / 35.105 ft
Duration: 420.0 s

U Min: 16.8 ft
U Max: 136.0 ft

WT: 5.565 m / 18.257 ft
Ueq: 16.8 ft

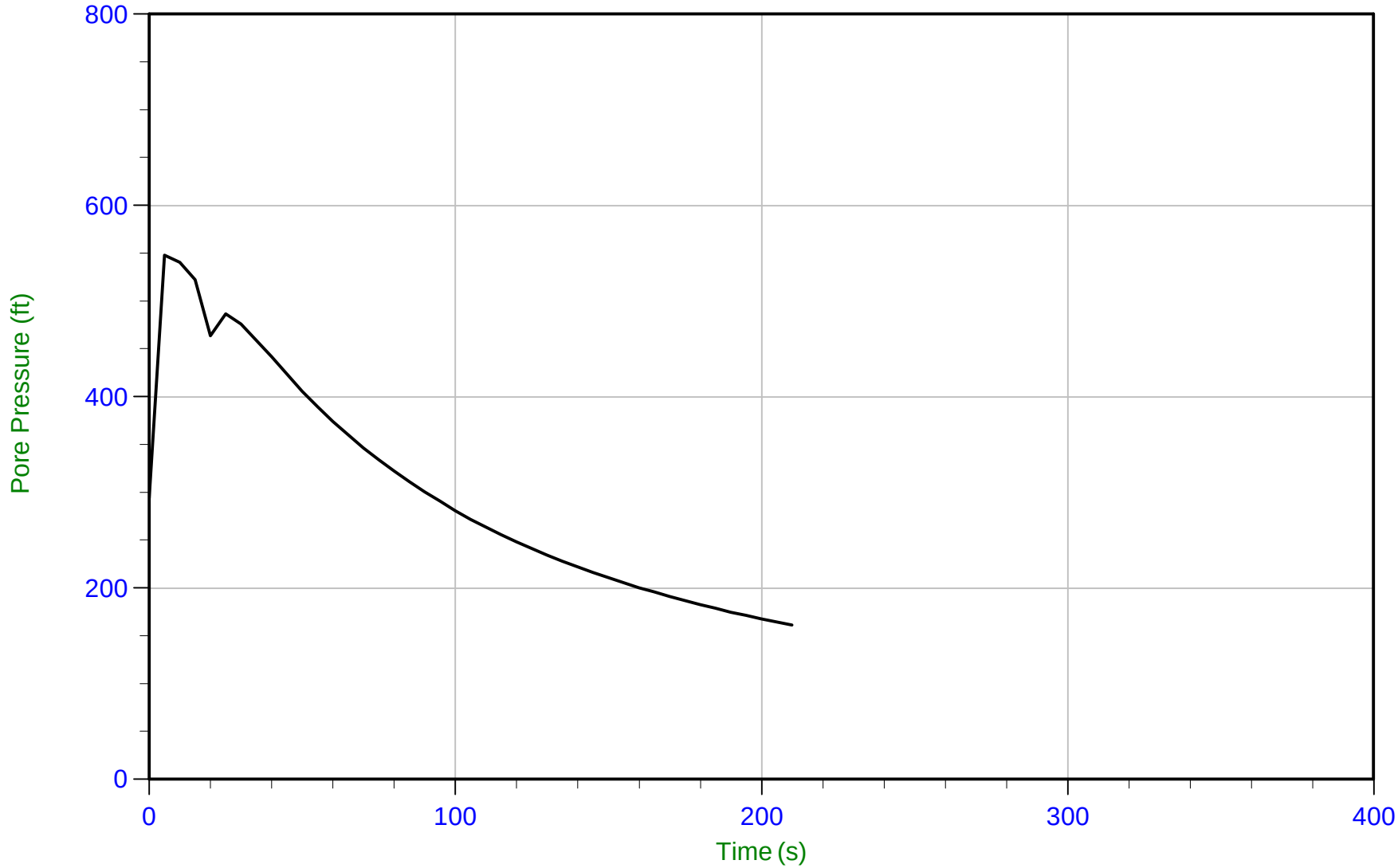
ALI: -Y5-
STN: 23+03
OFFSET: 32'LT
N: 870965
E: 1766684

CONETEC

ESP Associates

Job No: 17-54039
Date: 05/01/2017 12:52
Site: U-2525C

Sounding: CPT-2A
Cone: 349:T1500F15U500
Cone Area: 15 sq cm



Trace Summary:

Filename: 17-54039_CP CPT-2A.PPD
Depth: 18.000 m / 59.054 ft
Duration: 210.0 s

U Min: 161.2 ft
U Max: 547.8 ft

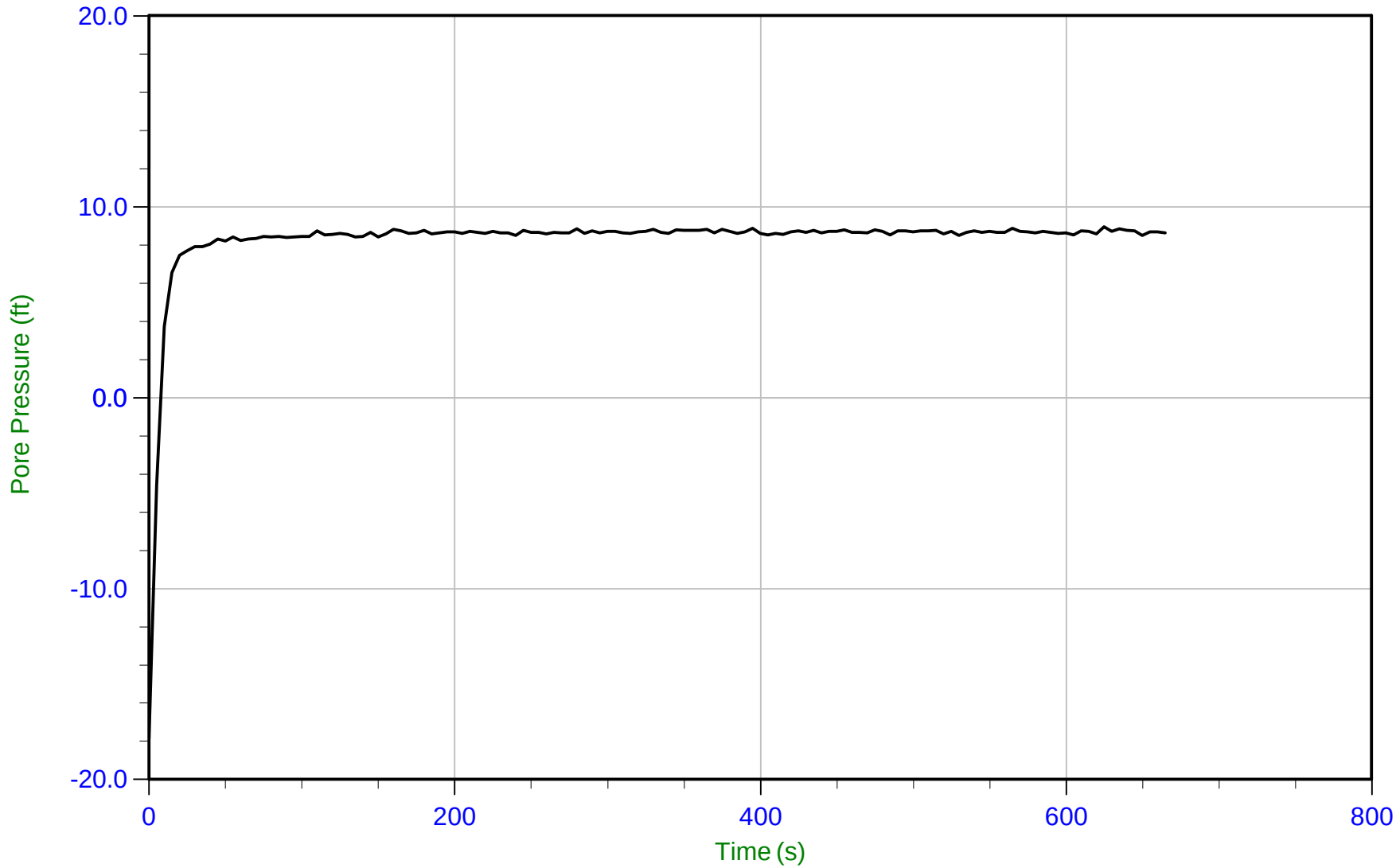
ALI: -Y5-
STN: 23+03
OFFSET: 32'LT
N: 870965
E: 1766684

CONETEC

ESP Associates

Job No: 17-54039
Date: 05/02/2017 13:54
Site: U-2525C

Sounding: CPT-2B
Cone: 349:T1500F15U500
Cone Area: 15 sq cm



Trace Summary:

Filename: 17-54039_CP CPT-2B.PPD
Depth: 8.250 m / 27.067 ft
Duration: 665.0 s

U Min: -17.9 ft
U Max: 8.9 ft

WT: 5.617 m / 18.427 ft
Ueq: 8.6 ft

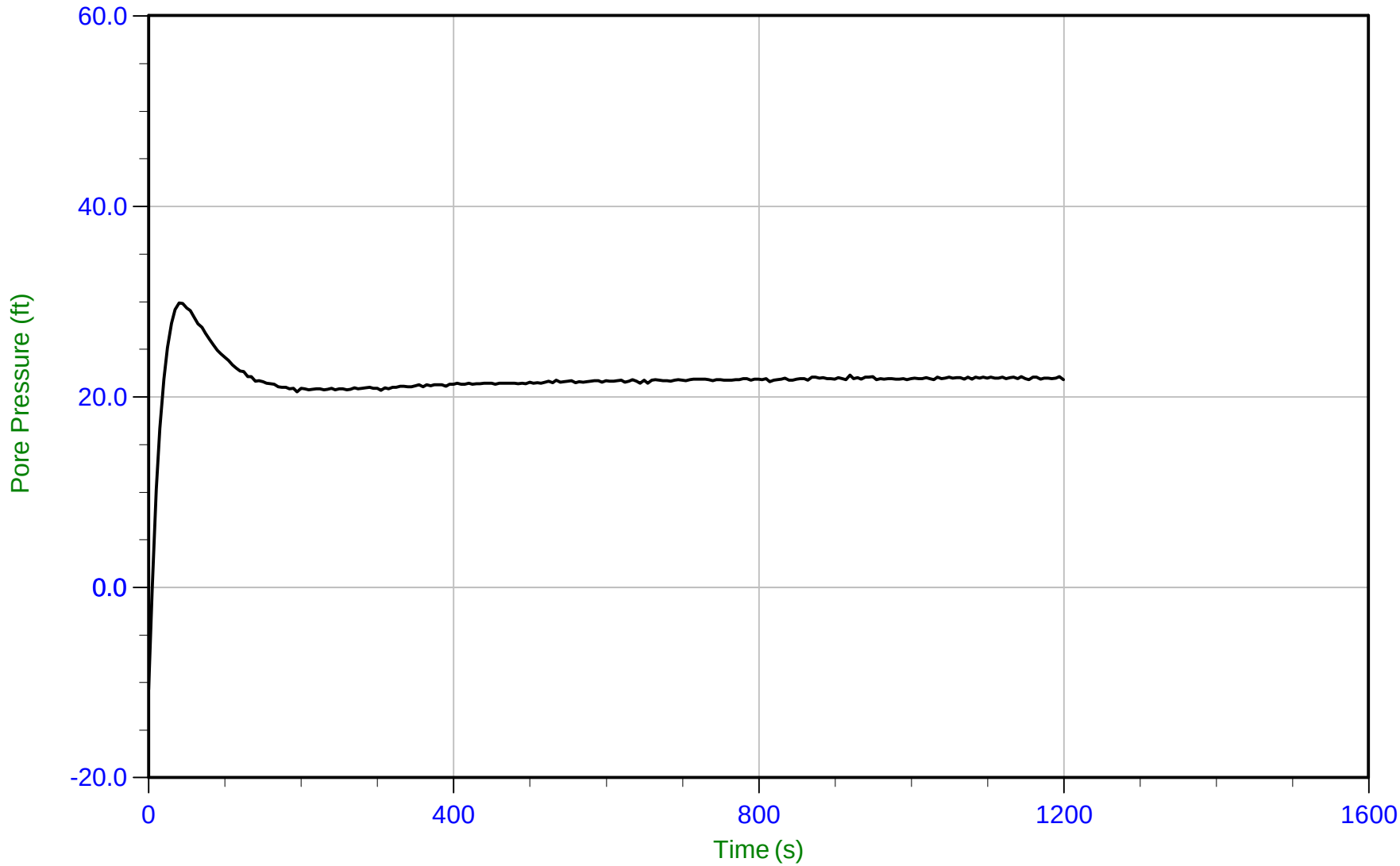
ALI: -Y5-
STN: 23+36
OFFSET: 44'RT
N: 870993
E: 1766762

CONETEC

ESP Associates

Job No: 17-54039
Date: 05/02/2017 13:54
Site: U-2525C

Sounding: CPT-2B
Cone: 349:T1500F15U500
Cone Area: 15 sq cm



Trace Summary:

Filename: 17-54039_CP CPT-2B.PPD
Depth: 12.200 m / 40.026 ft
Duration: 1200.0 s

U Min: -10.8 ft
U Max: 29.8 ft

WT: 5.513 m / 18.087 ft
Ueq: 21.9 ft

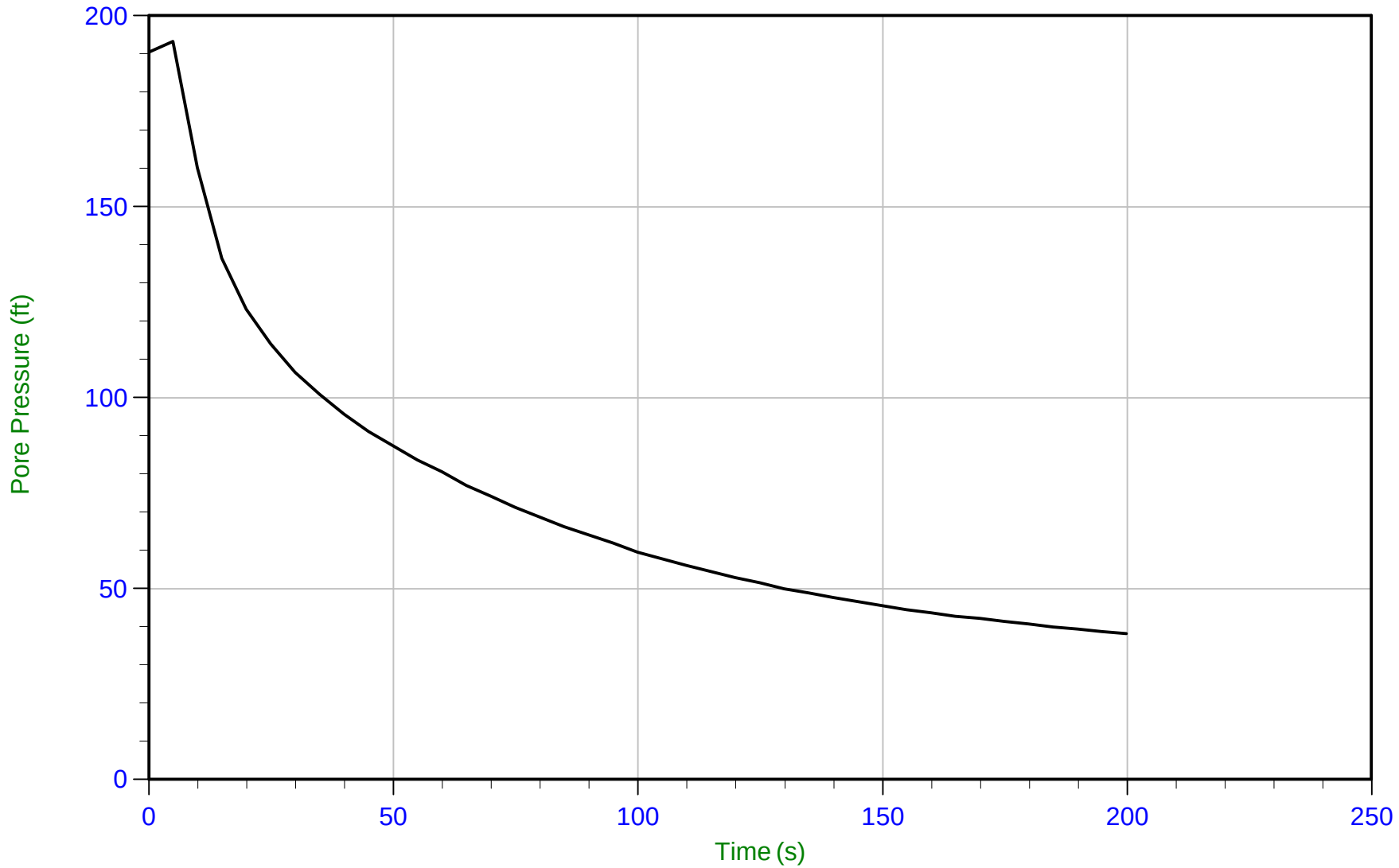
ALI: -Y5-
STN: 23+36
OFFSET: 44'RT
N: 870993
E: 1766762

CONETEC

ESP Associates

Job No: 17-54039
Date: 05/02/2017 13:54
Site: U-2525C

Sounding: CPT-2B
Cone: 349:T1500F15U500
Cone Area: 15 sq cm



Trace Summary:

Filename: 17-54039_CP CPT-2B.PPD
Depth: 12.500 m / 41.010 ft
Duration: 200.0 s

U Min: 38.3 ft
U Max: 193.3 ft

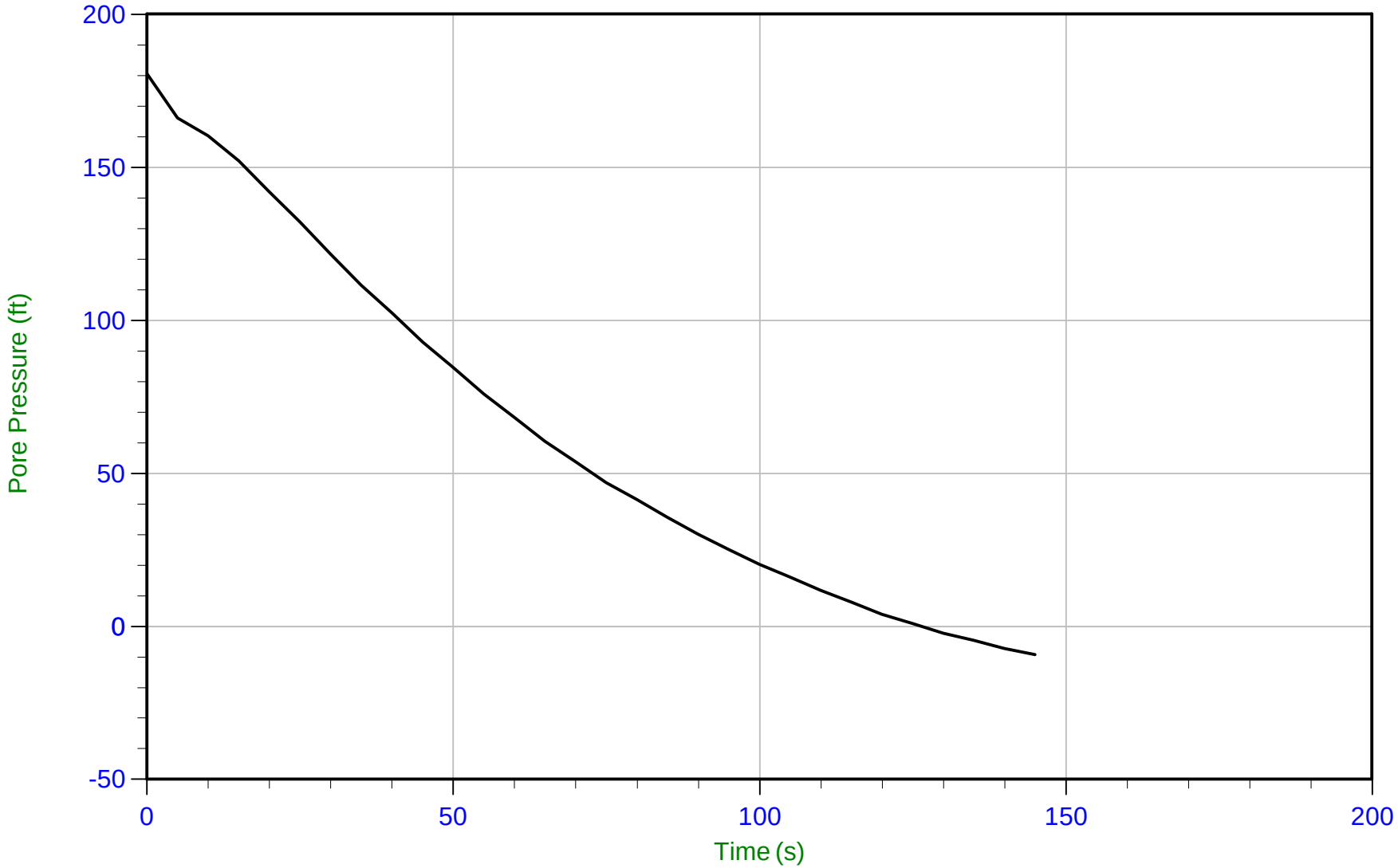
ALI: -Y5-
STN: 23+36
OFFSET: 44'RT
N: 870993
E: 1766762

CONETEC

ESP Associates

Job No: 17-54039
Date: 05/02/2017 13:54
Site: U-2525C

Sounding: CPT-2B
Cone: 349:T1500F15U500
Cone Area: 15 sq cm



Trace Summary:

Filename: 17-54039_CP CPT-2B.PPD
Depth: 13.800 m / 45.275 ft
Duration: 145.0 s

U Min: -9.3 ft
U Max: 180.7 ft

ALI: -Y5-
STN: 23+36
OFFSET: 44'RT
N: 870993
E: 1766762

Flat Plate Dilatometer Test Summary, Plots and Tabular Results

CONETEC

Job No:	17-54039
Client:	ESP Associates
Project:	U-2525C
Start Date:	01-May-2017
End Date:	02-May-2017

FLAT PLATE DILATOMETER TEST SUMMARY

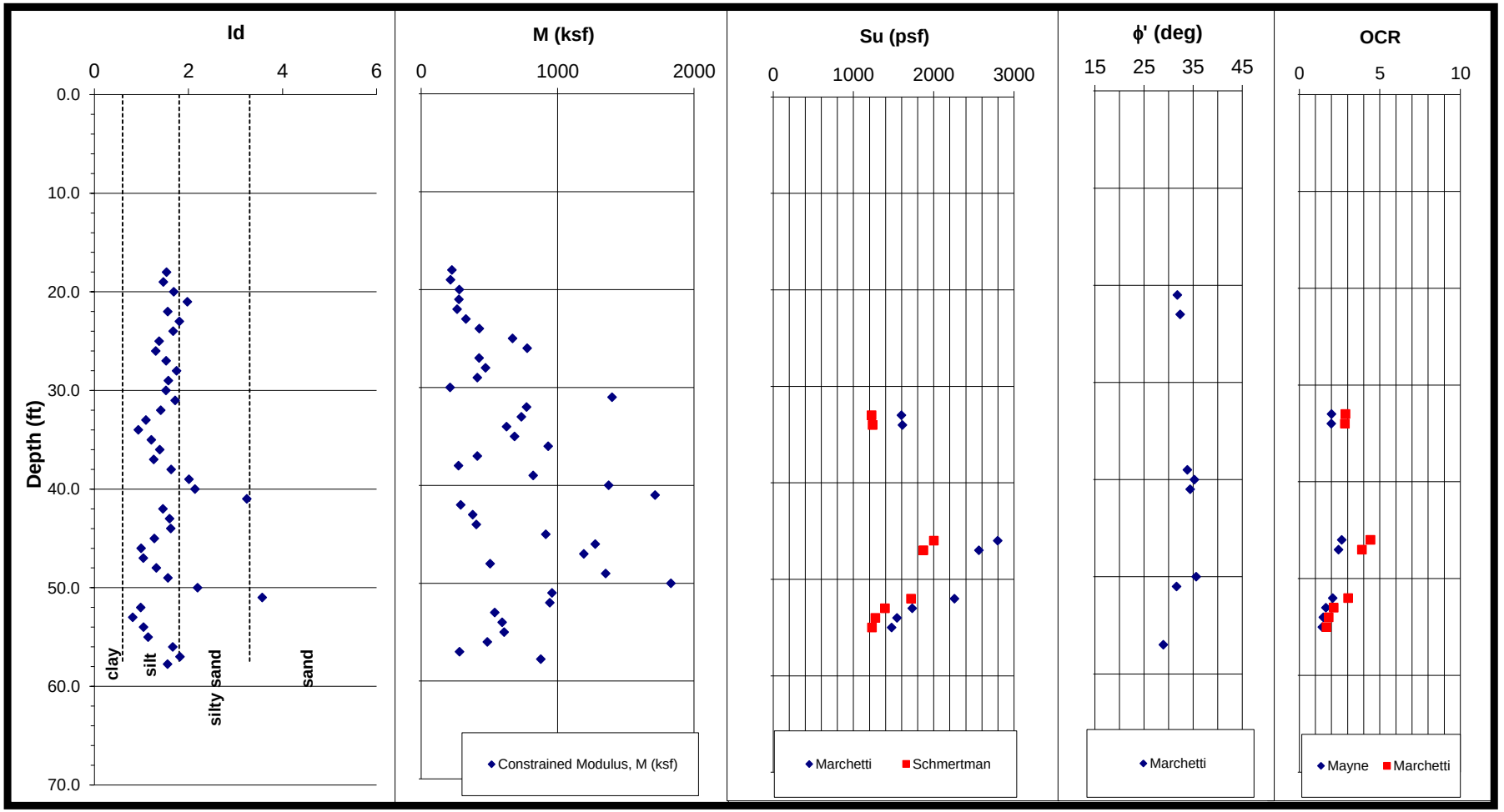
Sounding ID	File Name	Date	Depth From (ft)	Depth To (ft)	Assumed Phreatic Surface (ft)	Latitude[2] (deg)	Longitude[2] (deg)	Elevation[3] (ft)
DMT-1A	17-54039_DMT-1A	01-May-17	18.00	57.75	24.00	36.139976	-79.790177	856.8
DMT-1B	17-54039_DMT-1B	02-May-17	18.00	62.50	26.00	36.140074	-79.789931	855.9
DMT-2A	17-54039_DMT-2A	01-May-17	17.00	53.50	18.00	36.140490	-79.790145	851.9
DMT-2B	17-54039_DMT-2B	02-May-17	14.00	41.00	18.00	36.140550	-79.789871	851.1

1. Assumed phreatic surface based on adjacent CPT dissipation tests
2. Coordinates were provided by client - WGS 84 UTM
3. Elevations are referenced to the exisiting ground surface at the time of testing.

DILATOMETER TEST RESULTS

Test ID: DMT-1A
Site: U-2525C
Location: Greensboro, North Carolina
Project No.: 17-54039

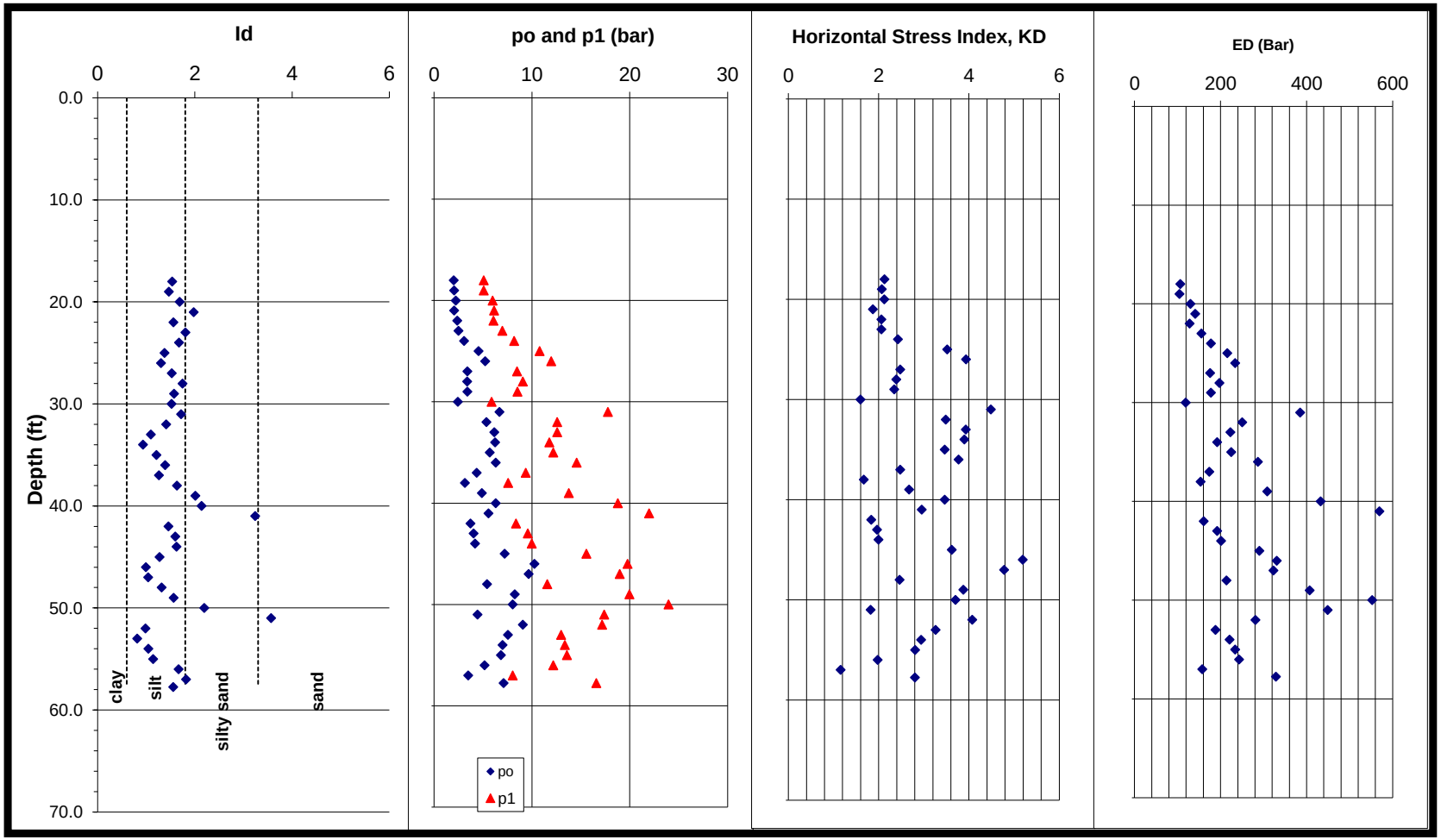
Alignment -Y5-
Station 21+20
Offset 30'LT
Northing 870783
Easting 1766674



DILATOMETER TEST RESULTS

Test ID: DMT-1A
Site: U-2525C
Location: Greensboro, North Carolina
Project No.: 17-54039

Alignment -Y5-
Station 21+20
Offset 30'LT
Northing 870783
Easting 1766674



Job No: 17-54039
Job Name: U-2525C
Job Location: Greensboro, North Carolina
Date: 5-1-17
Sounding No: DMT-1A
Ground Water Depth (ft): 24

	Membrane 1	Membrane 2	Membrane 3
ΔA =	0.15	0	0
ΔB =	0.575	0	0
Zm=	0.05	bar	

Latitude: 36.13998
Longitude: -79.79018

Alignment -Y5-
Station 21+20
Offset 30'LT
Northing 870783
Easting 1766674

[1] Depth Below Existing Ground Surface
[2] Mayne, 1995
[3] Marchetti,2001
[4] Schmertman, 1991
[5] Mayne, 2002

CONETEC

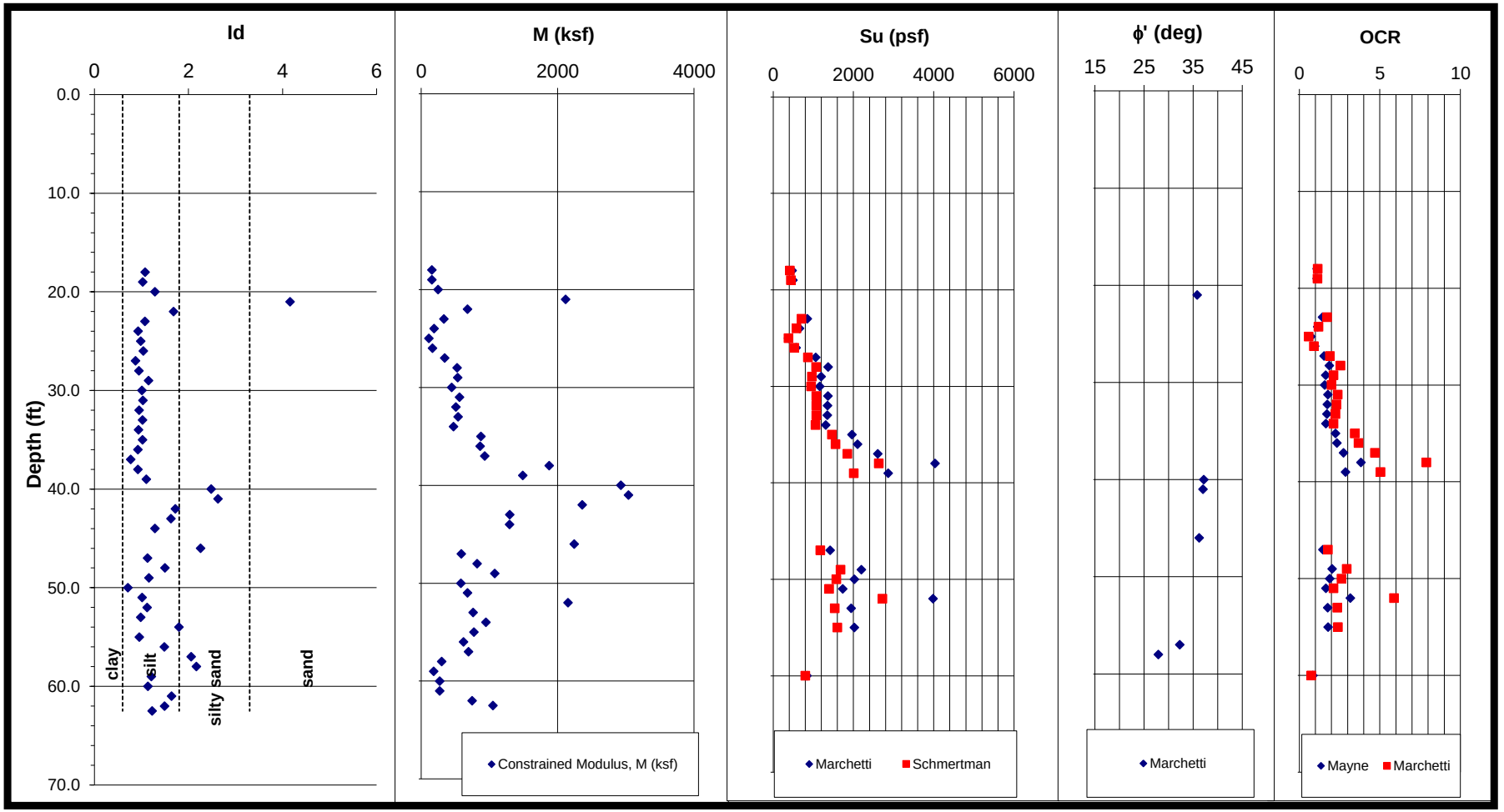
DILATOMETER TEST RESULTS

Depth[1] (ft)	A (bar)	B (bar)	C (bar)	po (bar)	p1 (bar)	p2 (bar)	u_o (psf)	γ_T[5] (pcf)	σ_{vo} (psf)	σ_{vo}' (psf)	Id	K_D	E_D (bar)	K_o	OCR[2]	OCR[3]	ϕ'[3] (deg)	R_M	E_D (ksf)	s_u[3] (psf)	s_u[4] (psf)	M (ksf)
18.0	2.05	5.7		2.0	5.075		0	109	1962	1962	1.53	2.1	107					1.01	223			225
19.0	2.1	5.7		2.1	5.075		0	109	2071	2071	1.47	2.1	105					0.98	219			214
20.0	2.3	6.6	0	2.2	5.975		0	111	2181	2181	1.69	2.1	130					1.02	272			278
21.0	2.15	6.75		2.1	6.125		0	111	2292	2292	1.98	1.9	141				31.8	0.93	295			275
22.0	2.45	6.7		2.4	6.075		0	111	2403	2403	1.56	2.1	128					0.98	268			263
23.0	2.6	7.6		2.5	6.975		0	112	2515	2515	1.81	2.1	156				32.4	1.01	325			328
24.0	3.2	8.8		3.1	8.175		0	114	2629	2629	1.67	2.4	178					1.15	371			426
25.0	4.75	11.4	0	4.6	10.775		62	118	2747	2684	1.38	3.5	216					1.48	451			668
26.0	5.45	12.6		5.2	11.975		125	119	2866	2741	1.31	3.9	234					1.59	489			776
27.0	3.55	9.1		3.4	8.475		187	115	2980	2793	1.53	2.5	176					1.16	367			424
28.0	3.55	9.7		3.4	9.075		250	115	3095	2846	1.75	2.4	198					1.14	413			471
29.0	3.55	9.15		3.4	8.525		312	115	3210	2898	1.57	2.3	178					1.11	371			410
30.0	2.5	6.5	0	2.4	5.875		374	110	3320	2946	1.52	1.6	119					0.85	249			212
31.0	7.1	18.4		6.7	17.775		437	123	3443	3007	1.72	4.5	385					1.74	805			1398
32.0	5.6	13.2		5.4	12.575		499	119	3563	3063	1.41	3.5	250					1.48	523			772
33.0	6.35	13.2		6.1	12.575		562	119	3682	3120	1.09	3.9	223	1.0	2.0	2.9		1.57	466	1598	1227	733
34.0	6.4	12.4		6.2	11.775		624	119	3801	3177	0.93	3.9	192	1.0	2.0	2.8		1.56	401	1612	1240	625
35.0	5.9	12.8	0.1	5.7	12.175	0.20	686	119	3919	3233	1.21	3.5	225					1.46	470			684
36.0	6.6	15.2		6.3	14.575		749	121	4040	3291	1.39	3.8	287					1.55	599			930
37.0	4.5	10		4.4	9.375		811	116	4156	3345	1.26	2.5	174					1.13	363			411
38.0	3.25	8.2		3.1	7.575		874	113	4269	3395	1.63	1.7	154					0.85	322			273
39.0	5.2	14.4		4.9	13.775		936	120	4388	3452	2.01	2.7	309				33.9	1.27	645			820
40.0	6.8	19.4	0.5	6.3	18.775	0.60	998	123	4511	3513	2.14	3.5	433				35.3	1.52	904			1374
41.0	6.25	22.6		5.6	21.975		1061	124	4636	3575	3.24	3.0	569				34.4	1.44	1189			1714
42.0	3.85	9		3.7	8.375		1123	114	4749	3626	1.46	1.8	161					0.86	337			289
43.0	4.2	10.2		4.0	9.575		1186	115	4865	3679	1.60	2.0	192					0.94	401			377
44.0	4.35	10.6		4.2	9.975		1248	116	4981	3733	1.62	2.0	201					0.96	420			403
45.0	7.5	16.2	0	7.2	15.575		1310	122	5102	3792	1.27	3.6	291					1.50	607			912
46.0	10.6	20.4		10.2	19.775		1373	125	5227	3854	0.99	5.2	331	1.2	2.6	4.4		1.85	691	2797	2003	1275
47.0	10	19.6		9.7	18.975		1435	124	5351	3916	1.04	4.8	323	1.1	2.4	3.9		1.77	675	2563	1873	1192
48.0	5.6	12.2		5.4	11.575		1498	118	5469	3971	1.32	2.5	214					1.13	447			505
49.0	8.7	20.6		8.2	19.975		1560	124	5593	4033	1.57	3.9	407					1.59	850			1352
50.0	8.7	24.6	0	8.0	23.975		1622	126	5719	4097	2.19	3.7	553				35.6	1.58	1155			1830
51.0	4.95	18		4.4	17.375		1685	121	5840	4155	3.57	1.8	449				31.7	1.02	938			958
52.0	9.35	17.8		9.1	17.175		1747	123	5963	4216	0.99	4.1	281	1.0	2.1	3.0		1.60	588	2258	1718	942
53.0	7.7	13.6		7.5	12.975		1810	119	6082	4272	0.81	3.3	189	0.8	1.7	2.1		1.37	394	1733	1394	539
54.0	7.2	14		7.0	13.375		1872	120	6201	4329	1.05	2.9	221	0.8	1.5	1.8		1.28	462	1543	1274	593
55.0	7.05	14.2	0.2	6.8	13.575	0.30	1934	120	6321	4387	1.14	2.8	234	0.7	1.4	1.7		1.24	489	1476	1233	608
56.0	5.4	12.8		5.2	12.175		1997	118	6439	4442	1.66	2.0	243					0.95	508			484
57.0	3.6	8.65		3.5	8.025		2059	112	6551	4492	1.82	1.2	158				28.9	0.85	329			280
57.8	7.45	17.2	1.15	7.1	16.575	1.25	2106	122	6643	4537	1.56	2.8	329					1.28	687			876

DILATOMETER TEST RESULTS

Test ID: DMT-1B
Site: U-2525C
Location: Greensboro, North Carolina
Project No.: 17-54039

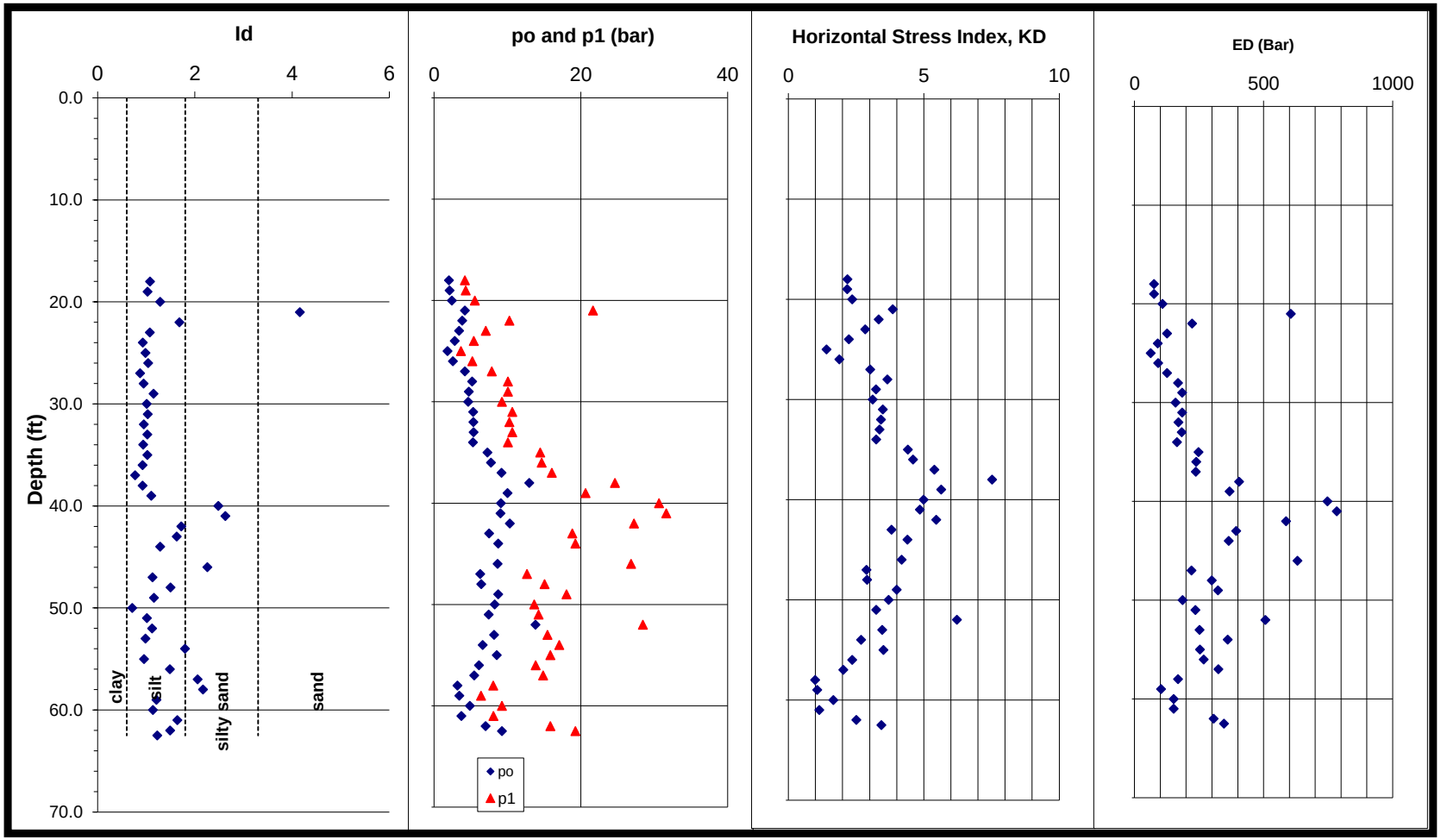
Alignment -Y5-
Station 21+61
Offset 41'RT
Northing 870818
Easting 1766747



DILATOMETER TEST RESULTS

Test ID: DMT-1B
Site: U-2525C
Location: Greensboro, North Carolina
Project No.: 17-54039

Alignment -Y5-
Station 21+61
Offset 41'RT
Northing 870818
Easting 1766747



Job No: 17-54039
Job Name: U-2525C
Job Location: Greensboro, North Carolina
Date: 5-2-17
Sounding No: DMT-1B
Ground Water Depth (ft): 26

	Membrane 1	Membrane 2	Membrane 3
ΔA =	0.175	0	0
ΔB =	0.5	0	0
Zm=	0.05	bar	

Latitude: 36.14007
Longitude: -79.78993

Alignment -Y5-
Station 21+61
Offset 41'RT
Northing 870818
Easting 1766747

[1] Depth Below Existing Ground Surface
[2] Mayne, 1995
[3] Marchetti,2001
[4] Schmertman, 1991
[5] Mayne, 2002

CONETEC

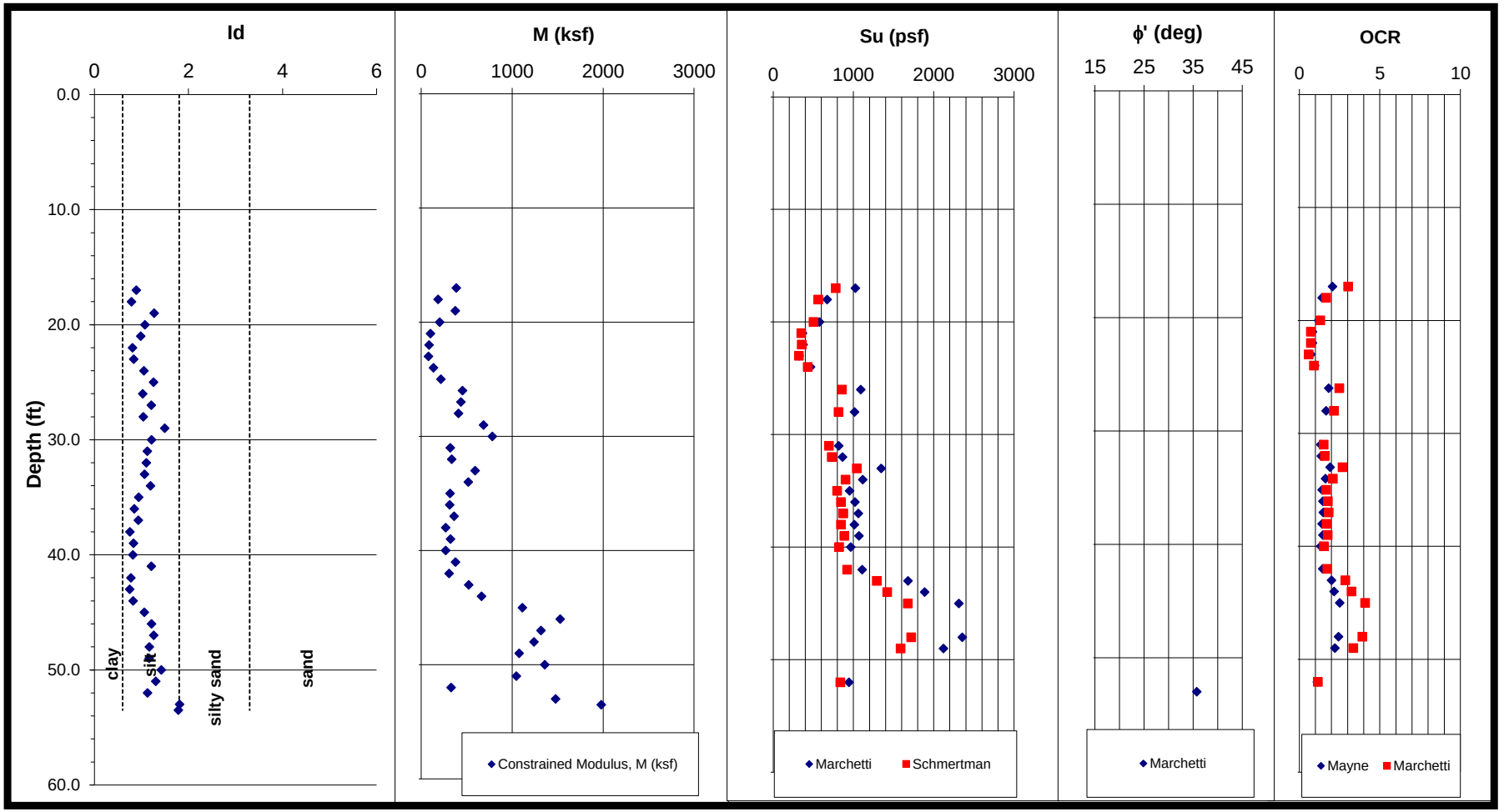
DILATOMETER TEST RESULTS

Depth[1] (ft)	A (bar)	B (bar)	C (bar)	po (bar)	p1 (bar)	p2 (bar)	u_o (psf)	γ_T[5] (pcf)	σ_{vo} (psf)	σ_{vo}' (psf)	Id	K_D	E_D (bar)	K_o	OCR[2]	OCR[3]	ϕ'[3] (deg)	R_M	E_D (ksf)	s_u[3] (psf)	s_u[4] (psf)	M (ksf)
18.0	2	4.75		2.0	4.2		0	107	1929	1929	1.08	2.2	76	0.6	1.1	1.2		0.99	158	475	422	156
19.0	2.1	4.85		2.1	4.3		0	107	2036	2036	1.03	2.2	76	0.6	1.1	1.1		0.98	158	498	443	155
20.0	2.45	6.1	0	2.4	5.55		0	110	2147	2147	1.29	2.4	108					1.09	226			246
21.0	4.9	22.2		4.2	21.65		0	123	2270	2270	4.16	3.9	606				35.8	1.67	1265			2116
22.0	4	10.8		3.8	10.25		0	117	2387	2387	1.68	3.3	223					1.45	466			678
23.0	3.45	7.6		3.4	7.05		0	113	2500	2500	1.07	2.8	127	0.8	1.4	1.7		1.25	264	853	710	330
24.0	2.8	5.95		2.8	5.4		0	110	2609	2609	0.93	2.2	90	0.6	1.1	1.2		1.00	188	662	585	188
25.0	1.8	4.2	0	1.8	3.65		0	106	2715	2715	0.99	1.4	63	0.4	0.7	0.6		0.85	131	387	384	112
26.0	2.55	5.75		2.5	5.2		0	109	2825	2825	1.04	1.9	92	0.5	1.0	0.9		0.85	192	577	532	163
27.0	4.25	8.4		4.2	7.85		62	114	2939	2876	0.87	3.0	127	0.8	1.5	1.9		1.30	264	1063	871	343
28.0	5.3	10.6		5.2	10.05		125	117	3056	2931	0.95	3.7	169	0.9	1.9	2.6		1.49	352	1372	1072	525
29.0	4.85	10.6		4.7	10.05		187	117	3172	2985	1.15	3.2	185	0.8	1.6	2.1		1.39	386	1201	967	535
30.0	4.75	9.8	0	4.7	9.25		250	116	3288	3039	1.01	3.1	159	0.8	1.6	2.0		1.34	333	1165	948	445
31.0	5.45	11.2		5.3	10.65		312	117	3406	3094	1.03	3.5	185	0.9	1.8	2.4		1.45	386	1366	1080	560
32.0	5.45	10.8		5.3	10.25		374	117	3523	3148	0.95	3.4	170	0.9	1.7	2.3		1.43	356	1357	1078	507
33.0	5.5	11.2		5.4	10.65		437	117	3640	3203	1.02	3.4	183	0.9	1.7	2.3		1.41	382	1352	1079	541
34.0	5.4	10.6		5.3	10.05		499	117	3757	3257	0.94	3.2	165	0.8	1.7	2.1		1.37	344	1312	1057	472
35.0	7.5	15	0	7.3	14.45		562	121	3878	3316	1.02	4.4	249	1.1	2.2	3.4		1.69	519	1965	1465	875
36.0	7.95	15.2		7.7	14.65		624	121	3999	3375	0.93	4.6	240	1.1	2.3	3.7		1.72	500	2108	1555	862
37.0	9.4	16.6		9.2	16.05		686	122	4121	3435	0.77	5.4	238	1.2	2.7	4.7		1.87	497	2611	1853	931
38.0	13.4	25.2		13.0	24.65		749	128	4249	3500	0.93	7.5	405	1.5	3.8	7.9		2.21	847	4035	2634	1875
39.0	10.4	21.2		10.0	20.65		811	125	4374	3563	1.10	5.6	369	1.3	2.9	5.0		1.93	770	2868	2011	1489
40.0	10	31.2	0.5	9.1	30.65	0.63	874	129	4503	3630	2.48	5.0	748				37.2	1.87	1562			2926
41.0	10	32.2		9.0	31.65		936	130	4633	3697	2.63	4.9	784				37.0	1.86	1638			3039
42.0	11	27.8		10.3	27.25		998	129	4762	3763	1.72	5.5	588					1.92	1227			2361
43.0	7.9	19.4		7.5	18.85		1061	124	4885	3825	1.63	3.8	394					1.58	824			1298
44.0	9.1	19.8		8.7	19.25		1123	124	5010	3886	1.29	4.4	365					1.70	763			1293
45.0	19.6	60+					1186	130	5140	3954												
46.0	9.4	27.4	0	8.7	26.85		1248	128	5267	4019	2.26	4.2	631				36.3	1.70	1318			2244
47.0	6.45	13.2		6.3	12.65		1310	119	5386	4076	1.13	2.9	221	0.8	1.5	1.8		1.27	462	1422	1179	588
48.0	6.7	15.6		6.4	15.05		1373	121	5507	4135	1.50	2.9	300					1.31	626			818
49.0	9.05	18.6		8.7	18.05		1435	123	5631	4196	1.16	4.0	323	1.0	2.0	3.0		1.60	675	2198	1680	1077
50.0	8.4	14.2	1.95	8.3	13.65	2.08	1498	120	5751	4253	0.71	3.7	187	0.9	1.9	2.6		1.49	390	2025	1577	581
51.0	7.65	14.8		7.5	14.25		1560	120	5871	4311	1.01	3.2	236	0.8	1.7	2.1		1.38	493	1739	1400	679
52.0	14.4	29		13.8	28.45		1622	129	6000	4378	1.12	6.2	507	1.4	3.2	5.9		2.03	1060	3983	2726	2152
53.0	8.4	16		8.2	15.45		1685	121	6122	4437	0.99	3.5	252	0.9	1.8	2.4		1.44	527	1944	1540	760
54.0	7	17.6		6.6	17.05		1747	122	6244	4497	1.80	2.7	362					1.26	755			949
55.0	8.75	16.4	0.75	8.5	15.85	0.88	1810	122	6366	4556	0.96	3.5	254	0.9	1.8	2.4		1.45	531	2026	1600	770
56.0	6.35	14.4		6.1	13.85		1872	120	6486	4614	1.49	2.4	269					1.10	561			619
57.0	5.8	15.4		5.5	14.85		1934	120	6606	4671	2.06	2.0	325				32.3	1.02	679			693
58.0	3.3	8.6		3.2	8.05		1997	112	6718	4721	2.17	1.0	169				27.9	0.85	352			299
59.0	3.45	6.95		3.4	6.4		2059	110	6828	4768	1.21	1.1	103					0.85	215			183
60.0	4.95	9.8	0	4.9	9.25		2122	115	6942	4821	1.14	1.7	152	0.5	0.8	0.8		0.85	318	845	804	270
61.0	3.8	8.65		3.7	8.1		2184	113	7055	4871	1.64	1.1	152					0.85	318			270
62.0	7.3	16.4		7.0	15.85		2246	121	7176	4930	1.49	2.5	307					1.16	641			746
62.5	9.6	19.8	0.95	9.2	19.25	1.08	2278	124	7238	4960	1.23	3.4	347					1.45	725			1050

DILATOMETER TEST RESULTS

Test ID: DMT-2A
Site: U-2525C
Location: Greensboro, North Carolina
Project No.: 17-54039

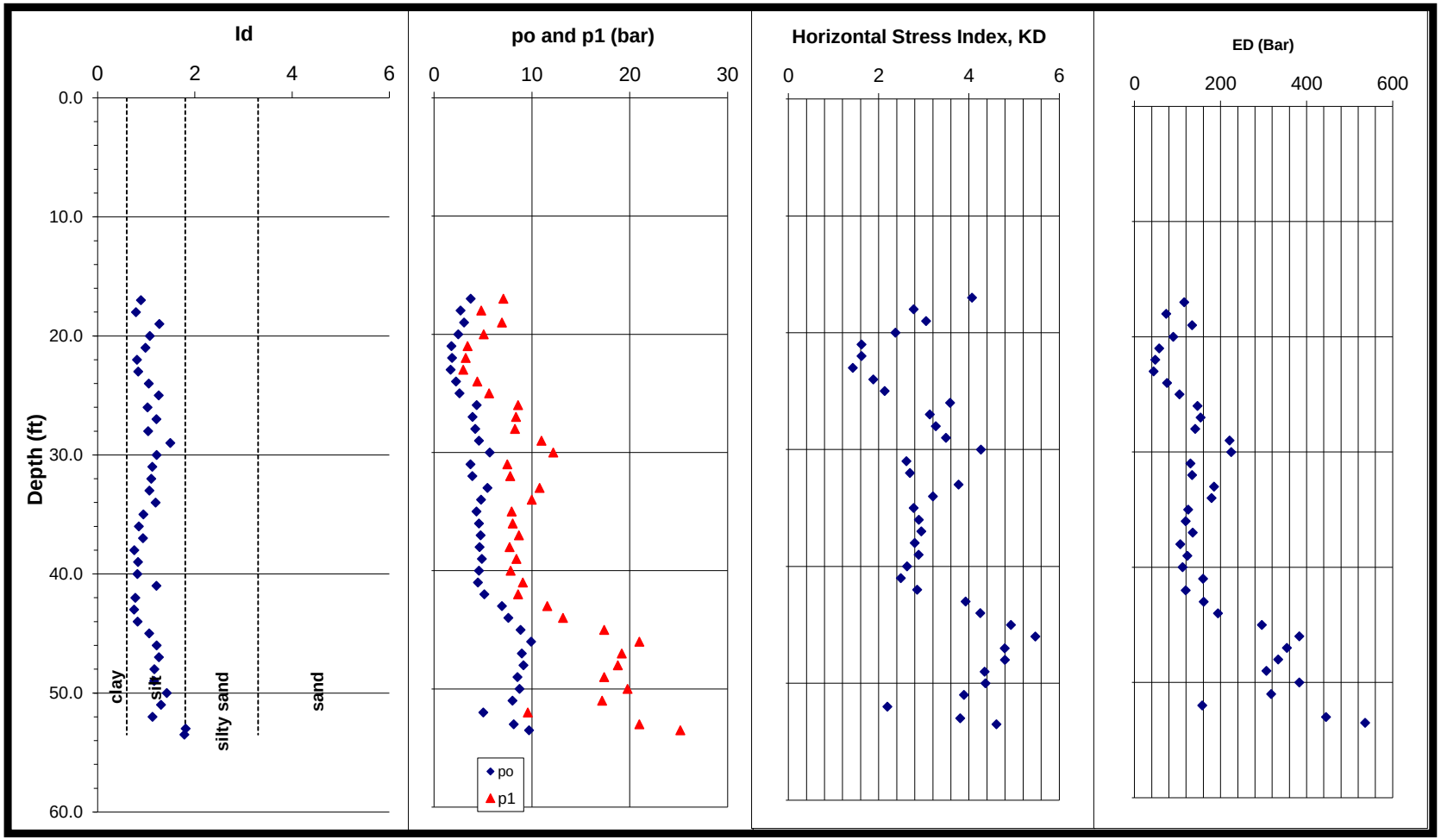
Alignment -Y5-
Station 23+08
Offset 32'LT
Northing 870970
Easting 1766685



DILATOMETER TEST RESULTS

Test ID: DMT-2A
Site: U-2525C
Location: Greensboro, North Carolina
Project No.: 17-54039

Alignment -Y5-
Station 23+08
Offset 32'LT
Northing 870970
Easting 1766685



Job No: 17-54039
Job Name: U-2525C
Job Location: Greensboro, North Carolina
Date: 5-1-17
Sounding No: DMT-2A
Ground Water Depth (ft): 18

	Membrane 1	Membrane 2	Membrane 3
ΔA =	0.1	0	0
ΔB =	0.575	0	0
Zm=	0.05	bar	

Latitude: 36.14049
Longitude: -79.79015

Alignment -Y5-
Station 23+08
Offset 32'LT
Northing 870970
Easting 1766685

[1] Depth Below Existing Ground Surface
[2] Mayne, 1995
[3] Marchetti,2001
[4] Schmertman, 1991
[5] Mayne, 2002

CONETEC

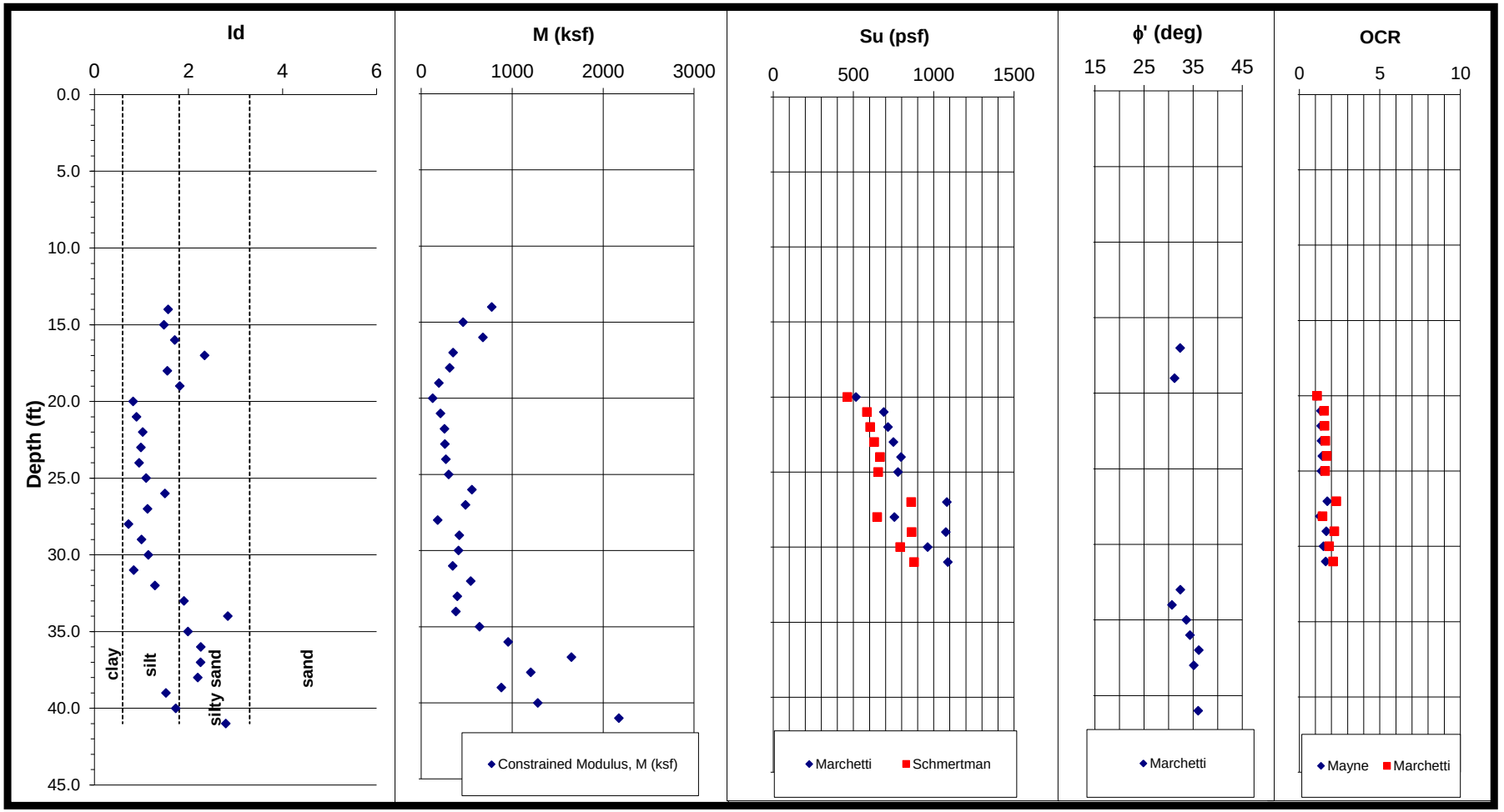
DILATOMETER TEST RESULTS

Depth[1] (ft)	A (bar)	B (bar)	C (bar)	po (bar)	p1 (bar)	p2 (bar)	u_o (psf)	γ_T[5] (pcf)	σ_{vo} (psf)	σ_{vo}' (psf)	Id	K_D	E_D (bar)	K_o	OCR[2]	OCR[3]	ϕ'[3] (deg)	R_M	E_D (ksf)	s_u[3] (psf)	s_u[4] (psf)	M (ksf)
17.0	3.85	7.7		3.7	7.075		0	113	1919	1919	0.89	4.1	116	1.0	2.1	3.0		1.60	242	1027	781	386
18.0	2.75	5.45	0	2.7	4.825		0	109	2028	2028	0.79	2.8	74	0.7	1.4	1.7		1.20	154	673	564	185
19.0	3.2	7.55		3.1	6.925		62	113	2140	2078	1.27	3.1	134					1.34	280			373
20.0	2.55	5.7		2.5	5.075		125	109	2249	2125	1.08	2.4	90	0.6	1.2	1.3		1.07	188	580	505	202
21.0	1.8	4.05		1.8	3.425		187	105	2354	2167	0.98	1.6	57	0.4	0.8	0.7		0.85	120	367	351	102
22.0	1.85	3.85		1.8	3.225		250	104	2458	2208	0.81	1.6	48	0.4	0.8	0.7		0.85	101	374	358	86
23.0	1.7	3.6		1.7	2.975		312	103	2561	2249	0.84	1.4	45	0.4	0.7	0.6		0.85	93	325	322	79
24.0	2.3	5.05	0	2.2	4.425		374	107	2668	2294	1.05	1.9	76	0.5	1.0	0.9		0.85	158	468	432	134
25.0	2.7	6.25		2.6	5.625		437	110	2778	2341	1.26	2.1	105					0.99	219			216
26.0	4.5	9.2		4.3	8.575		499	115	2893	2394	1.03	3.6	147	0.9	1.8	2.5		1.48	306	1093	858	453
27.0	4.1	9		3.9	8.375		562	114	3007	2446	1.21	3.1	154					1.36	322			436
28.0	4.35	8.9		4.2	8.275		624	114	3122	2498	1.04	3.3	141	0.8	1.7	2.2		1.39	295	1015	816	409
29.0	4.85	11.6		4.6	10.975		686	117	3239	2553	1.49	3.5	221					1.48	462			686
30.0	5.95	12.8	0	5.7	12.175		749	119	3358	2609	1.22	4.3	225					1.66	470			781
31.0	3.85	8.1		3.7	7.475		811	113	3471	2660	1.13	2.6	130	0.7	1.3	1.5		1.17	272	819	696	319
32.0	4.05	8.4		3.9	7.775		874	113	3584	2711	1.10	2.7	134	0.7	1.4	1.6		1.20	280	866	731	335
33.0	5.65	11.4		5.4	10.775		936	117	3701	2765	1.07	3.8	185	0.9	1.9	2.7		1.53	386	1346	1044	591
34.0	5	10.6		4.8	9.975		998	116	3818	2819	1.20	3.2	179	0.8	1.6	2.1		1.38	375	1118	903	516
35.0	4.45	8.55		4.3	7.925		1061	113	3931	2870	0.94	2.8	125	0.7	1.4	1.7		1.22	261	953	798	317
36.0	4.7	8.65	0.25	4.6	8.025	0.30	1123	114	4045	2921	0.85	2.9	119	0.8	1.5	1.8		1.25	249	1020	846	311
37.0	4.9	9.3		4.8	8.675		1186	114	4159	2973	0.93	2.9	136	0.8	1.5	1.8		1.27	283	1062	876	361
38.0	4.75	8.35		4.7	7.725		1248	113	4272	3024	0.76	2.8	107	0.7	1.4	1.7		1.21	223	1014	847	269
39.0	5	9.05		4.9	8.425		1310	114	4386	3075	0.83	2.9	123	0.8	1.5	1.8		1.25	257	1071	888	320
40.0	4.7	8.45		4.6	7.825		1373	113	4499	3126	0.82	2.6	112	0.7	1.3	1.5		1.15	234	969	823	269
41.0	4.65	9.7		4.5	9.075		1435	115	4614	3178	1.21	2.5	159					1.13	333			377
42.0	5.25	9.2	0	5.1	8.575		1498	114	4728	3230	0.78	2.9	119	0.8	1.5	1.7		1.23	249	1110	923	307
43.0	7.1	12.2		6.9	11.575		1560	118	4845	3285	0.75	3.9	161	1.0	2.0	2.9		1.55	337	1681	1291	523
44.0	7.8	13.8		7.6	13.175		1622	119	4965	3342	0.82	4.3	194	1.0	2.2	3.2		1.64	405	1888	1422	663
45.0	9.2	18		8.8	17.375		1685	123	5088	3403	1.06	4.9	296	1.1	2.5	4.1		1.80	618	2314	1679	1111
46.0	10.4	21.6		9.9	20.975		1747	125	5213	3466	1.22	5.5	383					1.91	801			1527
47.0	9.4	19.8		9.0	19.175		1810	124	5337	3528	1.26	4.8	354					1.78	740			1316
48.0	9.55	19.4	0.05	9.1	18.775	0.10	1872	124	5461	3589	1.17	4.8	334	1.1	2.4	3.9		1.77	698	2357	1722	1239
49.0	8.9	18		8.5	17.375		1934	123	5584	3649	1.16	4.4	307	1.0	2.2	3.4		1.68	641	2121	1588	1076
50.0	9.2	20.4		8.7	19.775		1997	124	5708	3711	1.42	4.4	383					1.70	801			1358
51.0	8.4	17.8		8.0	17.175		2059	123	5831	3771	1.30	3.9	318					1.58	664			1046
52.0	5.2	10.2		5.0	9.575		2122	115	5946	3824	1.13	2.2	158	0.6	1.1	1.2		1.00	329	945	839	328
53.0	8.7	21.6		8.1	20.975		2184	125	6070	3886	1.81	3.8	445				35.8	1.59	930			1477
53.5	10.4	25.8		9.7	25.175		2215	127	6134	3919	1.79	4.6	537					1.77	1121			1979

DILATOMETER TEST RESULTS

Test ID: DMT-2B
Site: U-2525C
Location: Greensboro, North Carolina
Project No.: 17-54039

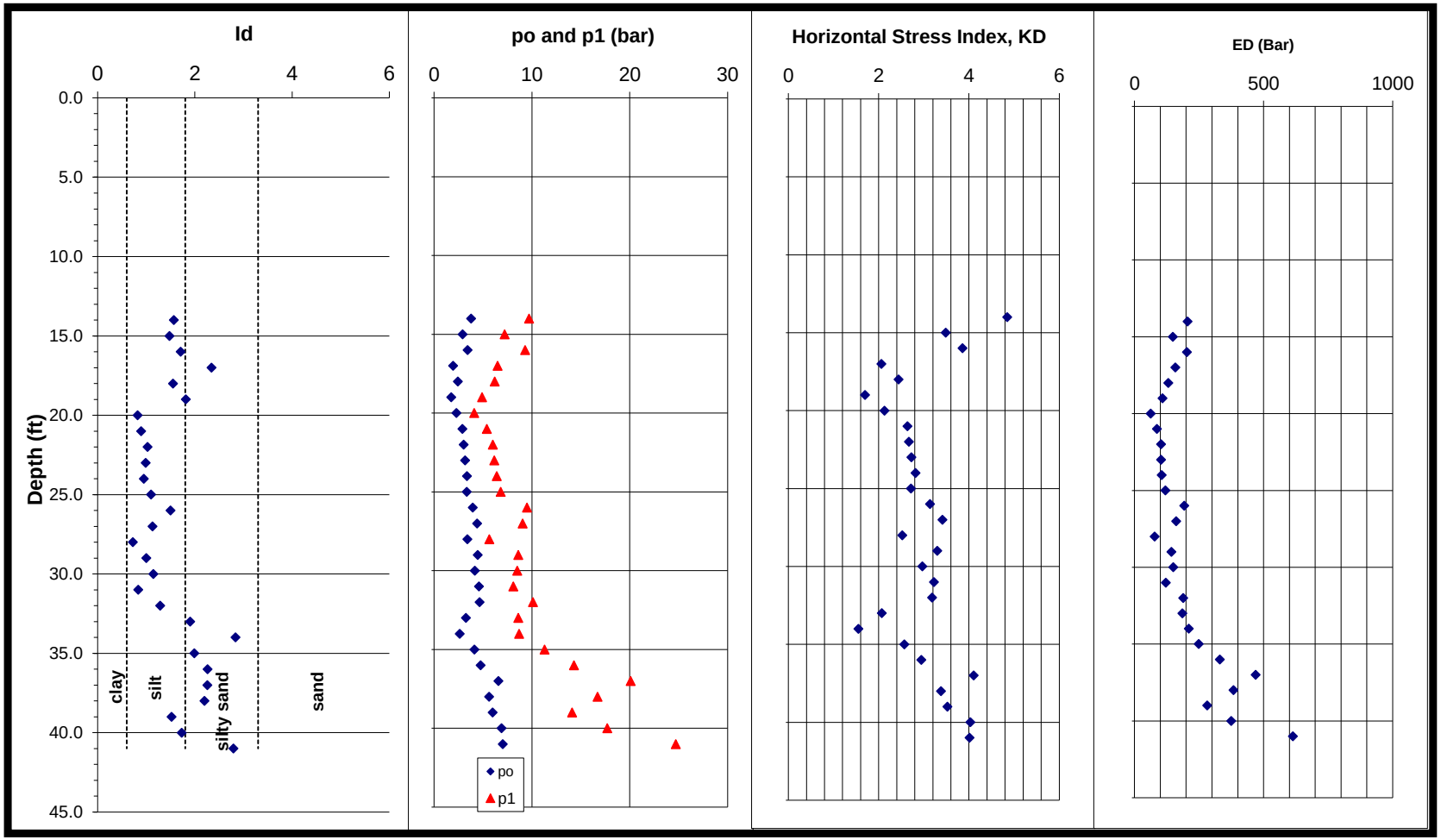
Alignment -Y5-
Station 23+35
Offset 48'RT
Northing 870991
Easting 1766766



DILATOMETER TEST RESULTS

Test ID: DMT-2B
Site: U-2525C
Location: Greensboro, North Carolina
Project No.: 17-54039

Alignment -Y5-
Station 23+35
Offset 48'RT
Northing 870991
Easting 1766766



Job No: 17-54039
Job Name: U-2525C
Job Location: Greensboro, North Carolina
Date: 5-2-17
Sounding No: DMT-2B
Ground Water Depth (ft): 18

	Membrane 1	Membrane 2	Membrane 3
ΔA =	0.11	0	0
ΔB =	0.45	0	0
Zm=	0.05	bar	

Latitude: 36.14055
Longitude: -79.78987

Alignment -Y5-
Station 23+35
Offset 48'RT
Northing 870991
Easting 1766766

[1] Depth Below Existing Ground Surface
[2] Mayne, 1995
[3] Marchetti,2001
[4] Schmertman, 1991
[5] Mayne, 2002

DILATOMETER TEST RESULTS

Depth[1] (ft)	A (bar)	B (bar)	C (bar)	po (bar)	p1 (bar)	p2 (bar)	u_o (psf)	γ_T[5] (pcf)	σ_{vo} (psf)	σ_{vo}' (psf)	Id	K_D	E_D (bar)	K_o	OCR[2]	OCR[3]	ϕ'[3] (deg)	R_M	E_D (ksf)	s_u[3] (psf)	s_u[4] (psf)	M (ksf)
14.0	4	10.2		3.8	9.7		0	116	1627	1627	1.57	4.8	205					1.80	429			774
15.0	3.05	7.7	0	2.9	7.2		0	113	1740	1740	1.48	3.5	149					1.48	311			461
16.0	3.65	9.8		3.4	9.3		0	116	1856	1856	1.71	3.9	204					1.59	425			678
17.0	2.1	7		1.9	6.5		0	111	1967	1967	2.35	2.1	158				32.4	1.06	330			351
18.0	2.55	6.7		2.4	6.2		0	111	2078	2078	1.55	2.4	131					1.14	273			312
19.0	1.85	5.4		1.8	4.9		62	108	2186	2124	1.81	1.7	109				31.3	0.85	228			193
20.0	2.3	4.6	0	2.3	4.1		125	107	2293	2168	0.83	2.1	63	0.6	1.1	1.1		0.94	132	517	462	124
21.0	2.95	5.9		2.9	5.4		187	110	2403	2216	0.90	2.6	87	0.7	1.3	1.5		1.16	182	690	585	211
22.0	3.1	6.5		3.0	6		250	111	2514	2264	1.03	2.7	103	0.7	1.4	1.6		1.18	216	716	605	256
23.0	3.25	6.65		3.2	6.15		312	111	2625	2313	0.99	2.7	103	0.7	1.4	1.6		1.20	216	749	630	259
24.0	3.45	6.9		3.4	6.4		374	111	2736	2362	0.95	2.8	105	0.7	1.4	1.7		1.23	220	797	665	271
25.0	3.45	7.3	0.3	3.3	6.8	0.36	437	112	2848	2411	1.10	2.7	120	0.7	1.4	1.6		1.21	250	778	655	302
26.0	4.15	10		3.9	9.5		499	116	2964	2465	1.50	3.1	193					1.38	403			556
27.0	4.55	9.55		4.4	9.05		562	115	3079	2518	1.13	3.4	162	0.9	1.7	2.3		1.44	338	1082	860	485
28.0	3.45	6.15		3.4	5.65		624	110	3189	2565	0.72	2.5	78	0.7	1.3	1.4		1.10	163	756	648	179
29.0	4.6	9.1		4.5	8.6		686	115	3304	2617	1.00	3.3	144	0.8	1.7	2.2		1.39	300	1076	863	417
30.0	4.3	9	0	4.2	8.5		749	114	3418	2669	1.15	3.0	151	0.8	1.5	1.9		1.30	315	962	792	409
31.0	4.7	8.6		4.6	8.1		811	114	3532	2721	0.83	3.2	122	0.8	1.6	2.1		1.36	254	1089	878	345
32.0	4.85	10.6		4.7	10.1		874	116	3648	2775	1.29	3.2	189					1.38	395			545
33.0	3.45	9.1		3.3	8.6		936	114	3762	2826	1.90	2.1	185				32.4	1.02	387			396
34.0	2.85	9.2		2.6	8.7		998	113	3876	2877	2.84	1.6	211				30.7	0.86	441			381
35.0	4.4	11.8		4.1	11.3		1061	117	3993	2932	1.99	2.6	249				33.6	1.23	520			641
36.0	5.15	14.8	0.9	4.8	14.3	0.96	1123	120	4112	2989	2.26	2.9	331				34.4	1.38	692			955
37.0	7.15	20.6		6.6	20.1		1186	124	4236	3051	2.26	4.1	470				36.2	1.68	981			1652
38.0	6.1	17.2		5.6	16.7		1248	122	4358	3110	2.20	3.4	384				35.1	1.50	802			1204
39.0	6.3	14.6		6.0	14.1		1310	120	4478	3168	1.52	3.5	282					1.49	589			880
40.0	7.35	18.2	1.1	6.9	17.7	1.16	1373	123	4601	3228	1.73	4.0	375					1.64	783			1282
41.0	7.8	25.2	1.5	7.0	24.7	1.56	1435	126	4727	3292	2.79	4.0	614				36.1	1.70	1281			2173