

IN SITU

SITE INVESTIGATION

STATIC CONE PENETRATION TEST

FACTUAL REPORT

CLIENT: Brownfield Solutions

**PROJECT: C5049 – Manchester City
Centre College**



Project	C5049-Manchester City Centre College
Project No.	1230169
Client	Brownfield Solution
Address	William Smith House, 173-183 Witton Street, Northwich, Cheshire, CW9 5LP

Attention: Mr Tim Mayall

Dear Mr Mayall,

We have pleasure in providing a digital copy of our report and data in AGS format for the above project.

We hope that you are satisfied with the performance of our staff, equipment and reporting on this project. If you should have any queries about any aspect of the works carried out, please do not hesitate to contact us. We look forward to being of service to you in the future.

Yours faithfully,

In Situ Site Investigation Limited



Darren Ward

Director

Report Issue

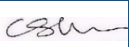
Issue	Date	Prepared	Sign	Checked	Sign	Approved	Sign
01	27/02/2023	Chloe Donovan		Luisa Dhimitri		Darren Ward	

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1.0 INTRODUCTION

In Situ Site Investigation Limited (In Situ) was engaged in a geotechnical site investigation at Manchester City Centre College at the request of Brownfield Solutions. The site investigation consisted of completing 12 Static Piezocone Penetration Tests (CPTU), and 12 Magnetometer Tests to provide information on the soil conditions and derived geotechnical parameters at:

Manchester City Centre College
Great Ducie Street,
Cheetham Hill,
Manchester
M3 1RR

All test locations were provided by the client. A site map is included in the end of Appendix A of this report (if provided by the client). The tests were stopped when they reached the target depth as per the client's technical specifications or for other technical reasons, as detailed in the *Project Summary Table* in *Appendix A.1* and on each CPTU log included in Appendix B of this report.

The fieldwork was carried out on 23rd February 2023 as per the client's request.

The work on site and the final factual reporting have been undertaken in accordance with the international technical standard *ISO 22476-1:2021(E)*.

2.0 FIELDWORK

2.1 CONE PENETRATION TESTS

The fieldwork activity is summarised in Table 2.1.

Table 2.1 Fieldwork Summary	
CPT Operator/s	Rasim Karibov & Pete Dougherty
Date Started	23 rd February 2023
Date Finished	23 rd February 2023
In Situ S.I. Project Manager	Darren Ward
Main Contractor's Site Manager	Coral McShane

2.1.1 Rig Information

Details of CPTU rig used in this project are shown in Table 2.2. Full data sheet for the rig is presented in *Appendix A.2*.

Table 2.2 Rig Summary	
Rig Name	Rig Description
CPT011	11 Tonne Wheel Mounted CPT Rig

2.1.2 CPTU Cone

Details of electric CPTU cone (Type TE2) used in this project conforming to the requirements of Application Class 2 of *ISO 22476-1:2021*, are shown in Table 2.3.

Table 2.3 Cone Summary		
Number	Cross-section area	Filter position
S15-CFIPM.2088	15cm ²	U ₂

A full datasheet of the cone used is shown in *Appendix A.3*.

The cone's measured parameters are shown in Table 2.4.

Table 2.4 Completed Fieldwork Summary

12 CPTU to a maximum depth of 5.05m. Each test measured Cone Resistance, q_c , Sleeve Friction, f_s , Porewater Pressure in the shoulder position, u_2 , Inclination in X and Y axes.

12 MAG tests to a maximum depth of 5.05m. Each MAG test measured Magnetic Field X (nT), Magnetic Field Y (nT) and Magnetic Field Z (nT).

Provision of factual report with estimated soil type, derived geotechnical parameters & AGS data file.

2.1.3 CPTU Cone Calibration

The cone resistance and sleeve friction are recorded by calibrated load cells in the cone. The CPTU load cells and pressure transducers are regularly calibrated in line with *ISO 22476-1:2021(E)* standard by the cone manufacturer. The cone calibration certificate for the cone used at this site are presented in *Appendix A.4*.

2.1.4 CPTU Cone Saturation

The pore water pressure is recorded using a calibrated pressure transducer located in the piezocone. To ensure pore water pressure measurements are not affected by the presence of air in the measuring transducer, a de-airing procedure is carried out prior to each test. The cone and filter are saturated using a glycerine fluid with a viscosity of 10,000 CST.

2.1.5 Test Procedure

The tests are carried out in accordance with the *International Standard for Electrical Cone and Piezocone Penetration Test ISO 22476-1:2021(E)*.

The final depths of the tests were determined by either completion to the specified test depth or when the maximal safe capacity of the equipment was reached. A schedule of the tests performed is shown in *Appendix A.1*, which has been compiled from the operators' daily progress reports.

The data is transmitted from the digital CPTU through an umbilical cable that runs through the push rods to the data acquisition system. Results are displayed instantaneously on the computer logging screen. The results are recorded on the computer hard disc.

The rate of penetration is kept constant at 20 mm/s $\pm$ 5 mm/s except when penetrating very dense or hard strata. Before each test is carried out zero values are taken of the cone to check if it is within calibration. At the end of each test, zero values are taken again to see if there has been any drift during the test. These values are inspected during the post processing stage. This is a quality check on the data and the testing procedure. Individual test zero values are shown on their corresponding test results in *Appendix B*.

2.1.6 *In Situ Pore Pressure (u_0)*

The in situ or hydrostatic pore pressure is required for the calculation of several derived parameters included in this report. For this report, the groundwater level is assumed at 0.5m below ground surface, for calculation purposes. The in situ pore pressure, u_0 values are presented on the pore pressure plot, on *CPT Log 01*, which is included in *Appendix B*.

2.2 POSITIONING

Positioning and surveying of all investigated locations was the responsibility of the client.

3.0 CONE PENETRATION MEASURED PARAMETERS

All measured parameters of tests carried with the CPTU cone are shown in *Appendix B* and all the information about data processing and results are given in sections 3.1, 3.2 and 3.3.

3.1 DATA PROCESSING

The measured parameters, cone end resistance, q_c , sleeve friction, f_s , porewater pressure measurements with filter in shoulder position, u_2 and inclination for x and y axis, I_x , I_y , were recorded for every 10 mm of penetration keeping a constant speed of 20 mm/s $\pm$ 5 mm/s, which may slightly change when the cone is penetrating hard strata.

The measured data from the site works is processed and presented using specialised CPT software. The interpretations on the CPTU results were carried out following the recommendations of *ISO 22476-1:2021(E)*, *Lunne et al. (1997)* and *Robertson (2015)*. Measured parameters, mentioned in *Sections 3.2* and *3.3*, were used to derive all the geotechnical parameters, which are presented in *Chapter 4.0*. The soil behaviour type method used on this report is *Robertson et al. (1986)*, shown in *Figure 3.2*.

3.1.1 Zero Measurements

Before and after each CPTU test, zero measurements are recorded for each channel of the cone. The zero measurements are presented on the logs in *Appendix B*. This is a routine quality check carried out on site.

3.2 MEASURED PARAMETERS

3.2.1 Cone Resistance (q_c)

Cone resistance, q_c , is measured as the total force acting on the cone, divided by the projected area of the cone. The results are presented in MPa, on *CPT Log 01*, in *Appendix B*, scale 0-20 MPa with a minor scale printing on the same graph at 0-4 MPa.

3.2.2 Sleeve Friction (f_s)

Sleeve friction, f_s , is measured as the total frictional force acting on the friction sleeve divided by its surface area. The results are presented in kPa, on *CPT Log 01*, in *Appendix B*, using a scale of 0-500 kPa.

3.2.3 Porewater pressure (u_2)

The pore pressure, u_2 , is measured during the test. If the material is free draining and saturation is maintained it will normally measure hydrostatic pore pressure. In materials that are not free draining, it will record the total pore pressure (hydrostatic plus any excess pore pressures generated) created by the cone penetration through this material.

The filter element can be mounted in one of three positions. For all tests carried out in this project the filter was mounted in the u_2 position (see *Figure 3.1*).

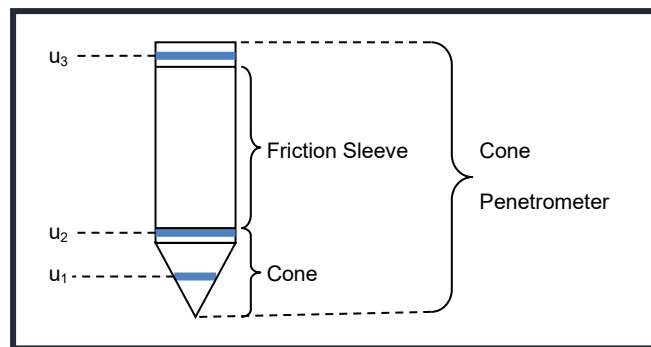


Figure 3.1: Diagram showing pore pressure filter locations (after Lunne et al., 1997)

3.2.4 Inclination (I_x , I_y)

The CPT rig was set up to obtain a thrust direction as near as possible to vertical. The CPTU cones have inclinometers incorporated to measure the non-verticality of the test. For test depths less than 15 m, significant non-verticality is unusual, provided the initial thrust direction is vertical.

3.3 ESTIMATED SOIL BEHAVIOUR TYPE

3.3.1 Friction Ratio (R_f)

The friction ratio, R_f is the ratio between the sleeve friction and the cone resistance (Lunne et al., 1997).

$$\text{Friction Ratio } (R_f) = \left(\frac{\text{Sleeve Friction } (f_s)}{\text{Cone Resistance } (q_c)} \right) \times 100$$

3.3.2 Estimated Soil Behaviour Type (SBT)

The estimation of soil behaviour type, *SBT*, using measurements of cone resistance and sleeve friction is based upon the variations of the friction ratio and cone resistance. The friction

ratio varies depending upon whether the soil is cohesive or granular. The cone resistance varies depending on the strength and densities of the soil.

The interpretation used in this report is *Robertson et al. (1986)*, which is shown in Figure 3.2. The results are presented on *CPT Log 01*, in *Appendix B*.

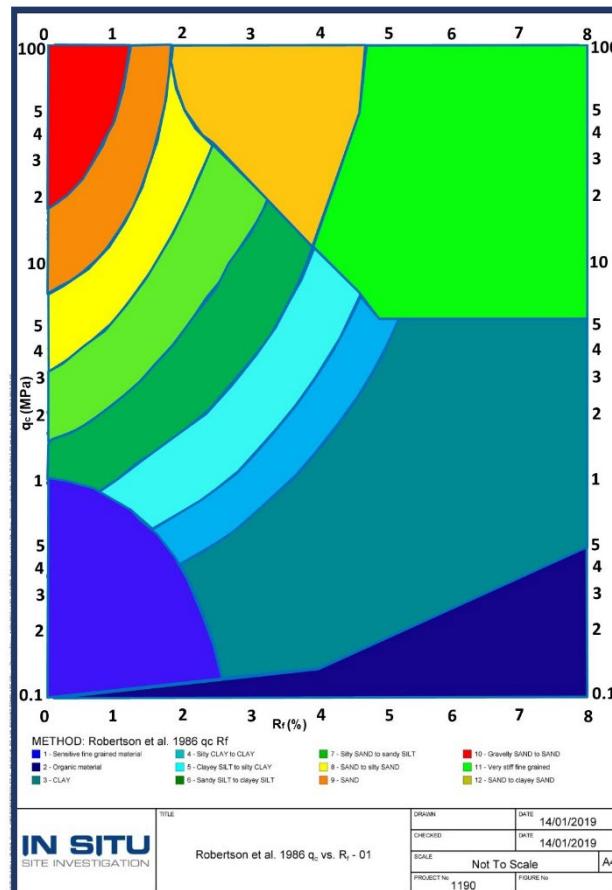


Figure 3.2: *Robertson et al., 1986 soil behaviour type chart.*

3.3.3 Pore Pressure Ratio (B_q)

Pore pressure ratio, B_q is the ratio between the measured pore pressure generated during penetration and the corrected cone resistance minus the total overburden stress.

Pore pressure ratio as defined by *Senneset and Janbu (1985)* is defined as:

$$B_q = \frac{u_2 - u_0}{q_t - \sigma_{vo}}$$

where

- u_2 is pore pressure measured between the cone and the friction sleeve
- u_0 is equilibrium pore pressure
- σ_{vo} is total overburden stress
- q_t is cone resistance corrected for unequal end area effects

3.4 APPLIED CORRECTIONS

3.4.1 Corrected Cone Resistance (q_t)

For each penetration test, the measured cone resistance, q_c , can be corrected for the “unequal area effect” due to the influence of the ambient pore water pressure acting on the cone.

The correction has been applied using the following equation by Lunne et al., 1997:

$$q_t = q_c + [u_2 \cdot (1 - \alpha)]$$

where

α is the cone area ratio

The cone area ratio used for this project is stated on both the cone calibration certificate and the data footer. This value is geometrically measured.

3.4.2 Depth Correction

All tests in the report have been corrected for depth difference caused by inclination. This has been calculated using the method described in *ISO 22476-1:2021*.

To calculate the corrected depth the following formula is used:

$$z = \int_0^l C_{inc} \cdot dl$$

where

z is penetration depth, in m

l is penetration length, in m

C_{inc} is correction factor for the effect of the inclination of the CPTU relative to the vertical axis.

The equation for calculating the correction factor for the influence of the inclination for a bi-axial inclinometer is:

$$C_{inc} = \frac{1}{\sqrt{(1 + \tan^2 \beta_1 + \tan^2 \beta_2)}}$$

where

β_1 is the angle between the vertical axis and the projection of the axis of the CPTU on a vertical plane, in degrees

β_2 is the angle between the vertical axis and the projection of the axis of the CPTU on a vertical plane that is perpendicular to the plane of angle β_1 , in degrees

4.0 GEOTECHNICAL DERIVED PARAMETERS

A number of empirical correlations can be used to derive geotechnical parameters from CPTU data. This report includes only the parameters which are described in this chapter. The results of all correlations used to obtain the geotechnical derived parameters are presented on *CPT Log 02* and *CPT Log 03* in *Appendix B*.

Please, note that each empirical correlation is derived for a certain type of soil, and may not be appropriate for all the soil types encountered on this project.

4.1 SOIL BEHAVIOUR TYPE INDEX (I_c)

The soil behaviour type index, I_c , was derived by *Jefferies and Davies (1991)*, and was created to simplify the application of CPTU SBT chart shown in *Chapter 3, Figure 3.2*. This approach has been modified for use with the *Robertson (1990)* normalised CPT soil classification chart, *Figure 4.1*. The normalised cone parameters Q_t and F_r (for definitions see *Appendix A5 Symbol List*) can be combined into one Soil Behaviour Type Index, I_c , (*Lunne et al., 1997*).

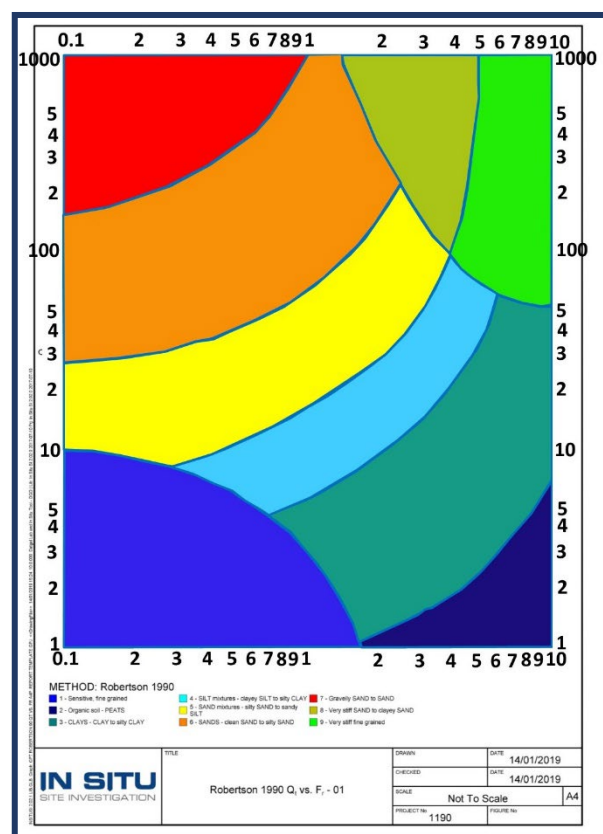


Figure 4.1: Robertson 1990 soil behaviour type chart.

The soil behaviour type index, I_c , can then be defined using *Robertson (2010)* formula, given below:

$$I_c = ((3.47 - \log Q_t)^2 + (\log F_r + 1.22)^2)^{0.5}$$

where

Q_t is the normalized cone resistance which represents the simple normalization with a stress exponent (n) of 1.0, which applies well to clay-like soils

F_R is the normalized friction ratio, in %

The boundaries of soil behaviour type are then given in terms of the index, I_c , presented in *Table 4.1* below.

The soils behaviour type index does not apply to zones 1, 8 and 9. The profiles of I_c provide a simple guide to the continuous variation of soil behaviour type in a given soil profile based on CPTU results, with a reliability greater than 80% compared with soil samples (*Robertson, 2015*).

Zone	Soil Behaviour Type	I_c
1	Sensitive fine grained	N/A
2	Organic Soils – clay	>3.6
3	Clays – silty clay to clay	2.95 – 3.6
4	Silt mixtures – clayey silt to silty clay	2.60 – 2.95
5	Sand mixtures – silty sand to sandy silt	2.05 – 2.6
6	Sands – clean sand to silty sand	1.31 – 2.05
7	Gravelly sand to dense sand	<1.31
8	Very stiff sand to clayey sand*	N/A
9	Very stiff fine grained *	N/A

* Heavily over consolidated or cemented

Table 4.1: Normalized CPTU Soil Behaviour Type (SBT_n) Index values, I_c . (*Robertson, 2010*)

4.2 N VALUE OF STANDARD PENETRATION TEST (SPT) (N_{60})

The derived N value of SPT, N_{60} , is strongly and directly related to the cone resistance, q_c .

In this report the N_{60} value is derived using the following correlations, developed by *Robertson and Wride (1998)*, *Jefferies and Davies (1998)* and *Robertson (2012)*:

1) *Robertson & Wride (1998)*

$$N_{60} = \frac{q_c}{8.5 \cdot p_a \left(1 - \frac{I_c}{4.6}\right)}$$

2) *Jefferies and Davies (1993)*

$$N_{60} = \frac{q_c}{0.85 \cdot \left(1 - \frac{I_c}{4.75}\right)}$$

3) *Robertson (2012)*

$$N_{60} = \frac{\frac{q_c}{p_a}}{10^{1.1268 - 0.2817 I_c}}$$

where

- q_c is the cone resistance
- p_a is the atmospheric pressure equal to *100 kPa*
- I_c is the soil behaviour type index calculated as given in *section 4.1*

It is suggested that these methods provide a better estimation of the N_{60} value than the actual measured N , due to the poor repeatability of SPT test. However, in fine grained soil with high sensitivity these methods may overestimate N_{60} (*Jefferies and Davies, 1991*). The third method suggested by *Robertson (2012)* provides improved estimates of N_{60} for insensitive clays.

4.3 RELATIVE DENSITY (D_r)

Relative density, D_r , is an intermediate parameter for coarse grained soils, widely used to describe sand deposits. All the research on deriving the relative density from CPTU tests results are carried out for **clean predominantly quartz sands**. The studies have shown that CPTU resistance in granular soils is controlled by sand relative density, in situ effective stresses and compressibility. The more compressible sands tend to give lower penetration resistance for a given relative density than less compressible sands.

In this report relative density is calculated using the methods suggested by *Baldi et al., (1986)*, *Jamolkowski et al., (2001)* and *Kulhawy and Mayne (1990)* as shown in the equations below:

1) Baldi et al., (1986)

$$D_r = \frac{1}{C_2} \cdot \ln \left(\frac{q_c \cdot Wehr}{C_1 \cdot (\sigma'_{v0})^{0.55}} \right) \cdot 100$$

where

C_1 is a consolidation coefficient which is 157 for normally consolidated soils and 181 for over consolidated soils

C_2 is a consolidation coefficient which is 2.41 for normally consolidated soils and 2.46 for over consolidated soils

Wehr is a correction coefficient for calcareous soils

2) Jamiolkowski et al., (2001)

$$D_r = 100 \cdot \left[0.268 \cdot \ln \left(\frac{q_t / \sigma_{atm}}{\sqrt{\sigma'_{v0} / \sigma_{atm}}} \right) + C_1 \right]$$

where

C_1 is a compressibility coefficient which is -0.675 for average compressible soils, ≤ 1.0 for high compressible soils and carbonate or calcareous sands and ≥ -2.0 for low compressible soils

q_t is corrected cone resistance

σ_{atm} is the atmospheric pressure

3) Kulhawy and Mayne, (1990)

$$D_r = \left[\frac{q_{c1}}{305 \cdot C_1 \cdot OCR^{0.18} \cdot (1.2 + 0.05 \cdot \log(t/100))} \right]^{0.5} \cdot 100$$

where

q_{c1} is the cone resistance corrected for initial vertical effective stress and atmospheric pressure, calculated by the following formula

$$q_{c1} = \frac{q_c}{\sqrt{\sigma'_{v0} \cdot \sigma_{atm}}}$$

where

q_c is the cone resistance in kPa

σ'_{v0} is the initial vertical effective stress in kPa

C_1 is a compressibility coefficient which is -0.91 for low compressible sands, 1.0 for medium compressible sands and 1.09 for high compressible sands

t is time in years

4.4 FRICTION ANGLE (ϕ')

Friction angle, ϕ' , is used to express the shear strength of uncemented, coarse grained soils. In this report friction angle is derived by the correlations of *Mayne and Campanella (2005)*, *Robertson and Campanella (1983)* and *Kulhawy and Mayne (1990)*.

- 1) Mayne and Campanella, (2005)

$$\phi' = 29.5^0 \cdot B_q^{0.121} \cdot [0.256 + 0.336 \cdot B_q + \log Q_t]$$

where

B_q is the pore pressure ratio, calculated as in Session 3.3

Q_t is the normalized cone resistance

- 2) Robertson and Campanella, (1983)

$$\phi' = \tan^{-1} \left(0.1 + 0.38 \cdot \log \left(\frac{q_t}{\sigma'_{v0}} \right) \right)$$

where

q_c is the cone resistance in *kPa*

σ'_{v0} is the initial vertical effective stress in *kPa*

- 3) Kulhawy and Mayne, (1990)

$$\phi' = 17.6^0 + 11.0^0 \cdot \log(q_{t1})$$

where

q_{t1} is the corrected cone resistance corrected for initial vertical effective stress and atmospheric pressure, calculated by the following formula

$$q_{t1} = \frac{q_t}{\sqrt{\sigma'_{v0} \cdot \sigma_{atm}}}$$

The method suggested by *Mayne and Campanella (2005)* will not provide reliable results for heavily over consolidated soils, fissured geomaterials and highly cemented or structures clays. This approach gives reliable results when pore pressure is positive and varies $0.1 < B_q < 1.0$. The correlation suggested by *Robertson and Campanella (1983)* estimates the peak friction angle for uncemented, unaged, moderately compressible, predominately quartz sands. For sands of higher compressibility, the method will tend to predict low friction angles. The method suggested by *Kulhawy and Mayne (1990)* is an alternate relationship for clean, rounded, uncemented, quartz sands.

4.5 FINES CONTENT (FC)

The fines content, FC , in this report is estimated using two different methods, one from *Robertson and Wride (1998)* and the other, *Suzuki et al. (1998)* as presented below:

- 1) Robertson and Wride (1998)

$$I_c < 1.26: FC = 0$$

$$1.26 \leq I_c \leq 3.5: FC(\%) = 1.75I_c^{3.25} - 3.7$$

$$3.5 < I_c: FC = 100\%$$

- 2) Suzuki et al. (1998)

$$FC(\%) = 2.8I_c^{2.6}$$

where

I_c is the soil behaviour type index, calculated as in section 4.1

4.6 UNDRAINED SHEAR STRENGTH (s_u)

Estimation of undrained shear strength, s_u , from CPTU tests using corrected cone resistance is carried out using the following correlation from *Lunne et al. (1981)*:

$$S_u = \frac{(q_t - \sigma_{v0})}{N_{kt}}$$

where

N_{kt} is the empirical cone factor, which varies from 10 (6 for very soft sensitive fine grained soils) to 20. In this report 3 values are considered: 15, 17.5 and 20. N_{kt} tends to increase with increasing plasticity and decrease with increasing soil sensitivity. It decreases as B_q increases. (*Lunne et al., 1997*)

σ_{v0} = total overburden stress.

This report only presents the undrained shear strength data on soils with soil behaviour type index, I_c values greater than 2.60.

The value of undrained shear strength, s_u to be used in analysis depends on the design problem. In general, the simple shear in the direction of loading often represents the average undrained strength. For larger, moderate to high risk projects, where high quality field and laboratory data may be available, site specific correlations should be developed based on appropriate and reliable values of s_u .

4.7 SENSITIVITY (S_t)

The sensitivity, S_t of clays is defined as the ratio of undisturbed peak undrained shear strength to totally remoulded undrained shear strength.

In this report S_t is calculated using two correlations developed by *Schmertmann (1978)* and *Mayne (2007)*.

1) Schmertmann (1978)

$$S_t = \frac{s_u}{s_{u(rem)}} = \frac{q_t - \sigma_v}{N_{kt}} \left(\frac{1}{f_s} \right)$$

where

$s_{u(rem)}$ is the remoulded undrained shear strength. It can be assumed equal to the sleeve resistance, f_s .

2) Mayne (2007)

$$S_t = \frac{0.073 \cdot (q_t - \sigma_{v0})}{f_s}$$

For relatively sensitive clays, $S_t > 10$, the value of f_s can be very low and not very accurate, hence the estimate of sensitivity should be used as a guide only.

4.8 SOIL UNIT WEIGHT (γ)

Soil unit weight, γ in this report is calculated by using one method for sands, considered under dry conditions and two methods for clays, considered under saturated conditions. These relationships are developed by *Mayne (2007)* and the equations are presented below:

Dry unit weight for sands:

$$\gamma_{dry} = 1.89 \cdot \log(q_{t1}) + 11.82$$

Saturated unit weight for clays method 1

$$\gamma_{sat} = 8.32 \cdot \log(V_s) - 1.61 \cdot \log(z)$$

Saturated unit for clays method 2

$$\gamma_{sat} = 2.60 \cdot \log(f_s) + 15 \cdot G_s - 26.5$$

where

q_{t1} is the corrected cone resistance corrected for initial vertical effective stress and atmospheric pressure, calculated by the following formula:

$$q_{t1} = \frac{q_t}{\sqrt{\sigma'_{v0} \cdot \sigma_{atm}}}$$

z is the depth

V_s is the shear wave velocity, calculated as $V_s = 118.8 \cdot \log(f_s) + 18.5$

G_s is the specific gravity of solids, typically between 2.40 and 2.90

5.0 MAGNETOMETER TESTS MEASUREMENTS

All measured parameters of MAG tests carried with the combined CPTU and MAG cone are shown in *Appendix B*.

5.1 DATA PROCESSING

The measured parameters, Magnetic Field X (nT), Magnetic Field Y (nT) and Magnetic Field Z (nT) were recorded for every 10 mm of penetration.

The measured magnetometer data from the site works is processed and presented using specialised CPT software. During processing the three measured components are combined to give the total magnetic field strength.

5.1.1 Zero Measurements and Data quality

Before and after each MAG test, zero measurements are recorded for each magnetic channel of the cone. The zero measurements are presented on the logs in *Appendix B*. This is a routine quality check carried out on site.

The quality of the data was typically good. The summary of MAG tests is presented in *Appendix A.1*

5.2 MEASURED AND DERIVED PARAMETERS

5.2.1 Magnetic Field X, Magnetic Field Y and Magnetic Field Z

The measured parameters, Magnetic Field X, Magnetic Field Y and Magnetic Field Z are measured on site. The results are presented in nT, on MAG Log, in *Appendix B*, scale -100000 to 100000 nT.

5.2.2 Total Magnetic Field

Total Magnetic Field is calculated based on each measured Magnetic Field, using the formula below:

$$\text{Magnetic Field Total} = \sqrt{\text{MAGX}^2 + \text{MAGY}^2 + \text{MAGZ}^2}$$

where

MAGX	is the Magnetic Field measured in X direction
MAGY	is the Magnetic Field measured in Y direction
MAGZ	is the Magnetic Field measured in Z direction

The results are presented in *nT*, on *MAG Log*, in *Appendix B*, using a scale of *0-100000 nT*.

5.2.3 Magnetic Field Gradient

Magnetic Field Gradient is calculated as the difference between two consecutive values of Total Magnetic Field.

The results are presented in *nT/cm*, on *MAG Log*, in *Appendix B*, using a scale of *-500 to 500 nT/cm*.

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APPENDIX A

APPENDIX A1 – Project Summary Sheet

Piezcone Tests Summary Sheet

HOLE ID	Final Depth (m)	Date of Test	Cone Used	Test Remarks
CPT01	5.00	23/02/2023	S15-CFIPM.2088	Test completed at target depth.
CPT02	1.80	23/02/2023	S15-CFIPM.2088	Test refused on total pressure.
CPT03	5.01	23/02/2023	S15-CFIPM.2088	Test completed at target depth.
CPT04	1.16	23/02/2023	S15-CFIPM.2088	Test refused on total pressure.
CPT05	5.00	23/02/2023	S15-CFIPM.2088	Test completed at target depth.
CPT06	0.70	23/02/2023	S15-CFIPM.2088	Test refused on total pressure.
CPT07	1.06	23/02/2023	S15-CFIPM.2088	Test refused on total pressure.
CPT08	4.89	23/02/2023	S15-CFIPM.2088	Test refused on total pressure.
CPT09	4.99	23/02/2023	S15-CFIPM.2088	Test completed at target depth.
CPT10	0.46	23/02/2023	S15-CFIPM.2088	Test refused on total pressure.
CPT10a	5.05	23/02/2023	S15-CFIPM.2088	Test completed at target depth.
CPT11	1.14	23/02/2023	S15-CFIPM.2088	Test refused on total pressure.

MAG Tests Summary Sheet

HOLE ID	Final Depth (m)	Date of Test	MAG Status	Test Remarks
CPT01	5.00	23/02/2023		Test completed at target depth.
CPT02	1.80	23/02/2023		Test refused on total pressure.
CPT03	5.01	23/02/2023	Low Risk 2.6m	Test completed at target depth.
CPT04	1.16	23/02/2023		Test refused on total pressure.
CPT05	5.00	23/02/2023		Test completed at target depth.
CPT06	0.70	23/02/2023		Test refused on total pressure.
CPT07	1.06	23/02/2023		Test refused on total pressure.
CPT08	4.89	23/02/2023	Clear 4.0m onwards	Test refused on total pressure.
CPT09	4.99	23/02/2023	Low Risk 2.4m	Test completed at target depth.
CPT10	0.46	23/02/2023		Test refused on total pressure.
CPT10a	5.05	23/02/2023	Clear 1.8m onwards	Test completed at target depth.
CPT11	1.14	23/02/2023		Test refused on total pressure.

KEY for MAG Status	
Clear	Clear of UXO.
Clear 1.0m onwards	Disturbance of magnetic field to depth shown due to artificial ground but otherwise clear.
Obstruction	Buried obstruction or refused test due to geology. Change location, then re-test.
Low risk 2.3m	Low risk anomaly at depth shown. Unlikely to be UXB, and clear below.
Suspected existing pile	Disturbance of magnetic field at depth of 0-7.0m, clear below.
Anomaly x metres	Significant magnetic anomaly at depth shown.

APPENDIX A2 – CPT Rig Datasheet

RIGS

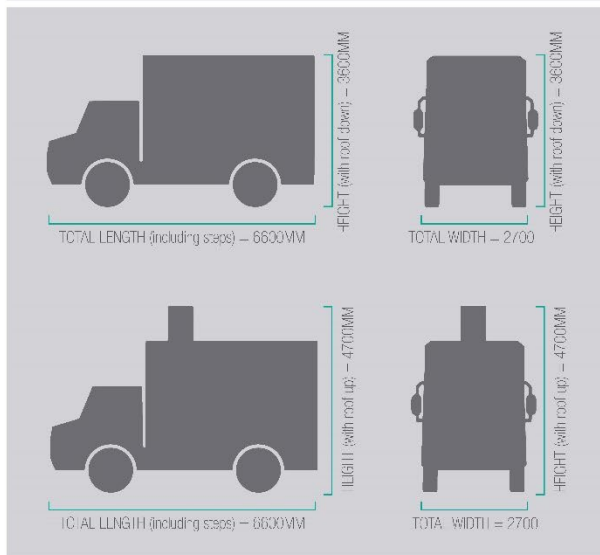
11 TONNE UNIMOG WHEELED RIG (CPT011)

This versatile 4 wheel drive truck (Unimog) is ideal for hardstanding and non hardstanding sites of medium to soft ground. It is capable of pushing a CPT to 25-30 metres, depending on the ground conditions. This rig contains a camera in the cab, useful for lining up over the test positions. Furthermore, the unimog is a short wheel base vehicle so it can access small positions with accuracy. In addition, this is a quiet rig, making it ideal for use in public areas.

CPT RIG DETAILS

DRIVE SYSTEM	4 WHEEL DRIVE
TOTAL WEIGHT	11 TONNES
GROUND BEARING PRESSURE	75KPA
CPT RAM THRUST CAPACITY	15 TONNES
MAXIMUM PENETRATION	25-30M DEPENDING ON THE GROUND CONDITIONS.
PERFORMANCE RATES	100-150M OF TESTING A DAY, DEPENDING ON ACCESS TO POSITIONS.
TYPICAL SITES FOR THIS RIG	HARDSTANDING SITES E.G. ROADS, CAR PARKS, DRY NON HARDSTANDING SITES, MEDIUM/SOFT GROUND.

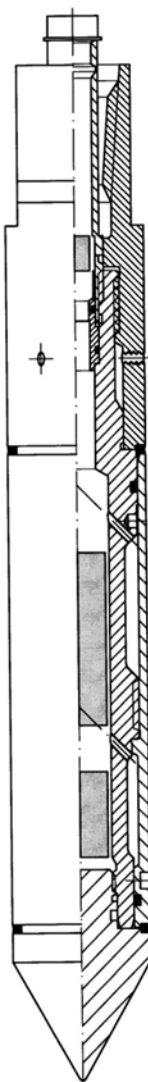
CPT RIG DIMENSIONS



APPENDIX A3 – Cone Datasheet



Rijksstraatweg 22F
 2171 AL Sassenheim
 Tel. : +31 71 301 92 51
 Fax : +31 71 301 92 52
 E-mail : info@geopoint.nl
 ING bank : 68.23.01.396
 Postbank : 5226758
 BTW nr. : NL806331677801



SPECIFICATIONS

S15 SERIES

ELECTRICAL CONES

The electronic subtraction cones have been developed to address the durability problems inherent in other cone designs. The unit consists of a single element temperature compensated strain gauge transducer for measuring both cone resistance and local sleeve friction. This design is therefore more robust than a compression type cone. The cone support electronics package is located directly behind the transducer. The precision strain gauge amplifiers and power supply eliminate the effects of cable resistance on the measurements. A standard subtraction cone is capable of measuring simultaneously the following channels: Tip, Local friction, Pore pressure, Temperature and Inclination.

GENERAL SPECIFICATIONS

Cone Tip Section Area	1,500 mm ²
Friction Sleeve Surface	22,500 mm ²
Total Length	325 mm
Weight	4200 g
Power Supply	± 15 VDC, 100 mA.
Output	0 – 10 VDC*
Working Temperature	0 - 60°C
Storage Temperature	- 40 to + 85°C
Connector	Lemo 10 pins (others on request)

TIP RESISTANCE

Range	100/150* kN
Accuracy	0.25 % FS
Maximum Load	150 % of range
Cone Area Ratio	0.75

LOCAL SLEEVE FRICTION

Range	100/150* kN
Accuracy	0.50 % FS
Maximum Load	150 %
Sleeve Area Ratio	1.0 (EA)

PORE PRESSURE

Range	1/2/5/10* MPa
Accuracy	0.5 % FS
Maximum Load	150 % of range

INCLINATION

Range	25 ° (biaxial)
Accuracy	< 2 °

All our equipment complies with the ISSMGE, ASTM, DIN and NEN Standards.

**Other output and voltage ranges available on request. Loadcells may be calibrated for lower ranges.*

APPENDIX A4 – Cone Calibration Certificate



 Rijksweg 22F
 2171 AL Sassenheim
 The Netherlands

 T +31 71 301 9251
 E info@eijkelkamp-geopoint.com
 I eijkelkamp-geopoint.com

Cone Calibration Certificate

Certificate: **GS-2088-003**
 Instrument Type: Magnetometer 250 μ T(analog)
 Model: S15-CFIIPM
 Serial number: 2088
 Calibration date: 22-11-2022
 Client: In Situ
 Calibrated by: W. Volgering
Calibration instruments
 Manufacturer: Hottinger Baldwin Messtechnik GmbH
 NMI certificate: 2461165.00501
Calibration conditions
 Ambient temperature: 20.3 °C
 Atmospheric pressure: 992 mBar
Cone specifications
 Cone base area: 1500 mm²
 Load tip resistance (nom.): 50 kN
 Friction sleeve area: 22500 mm²
 Load tip + local friction (nom.): 50 kN
 Load friction sleeve (nom.): 22.5 kN
 Load pore pressure (nom.): 2 MPa
 Inclination (nom.): +/- 20 °
 Temperature compensation (all channels): 0...+40 °C
 Maximum overload capacity (all channels): 50 %
 Cone area ratio (a): 0.79
 Max. Inaccuracy, relative to measurement value: 1.0 %

	Tip:		Sleeve:		Pore Pressure:		Inclinometer:		
	qc in kN	mV	fs in kN	mV	MPa	mV	Degrees	X (mV)	Y (mV)
Zero points:		0249		0244		0271			
	0	0	0	0	0	0	0	2514	2471
	5	0286	5	0299	0.4	1503	-20	0541	0469
	10	0577	10	0599	0.8	3001	20	4533	4444
	15	0867	15	0898	1.2	4496			
	20	1159	20	1200	1.6	5993			
	25	1449	25	1499	2.0	7471			
	30	1739	30	1799					
	35	2027	35	2098					
	40	2316	40	2397					
	45	2606	45	2696					
	50	2896	50	2996					

Max. error, abs. qc: 35 kPa
 Max. error, abs. fs: 2 kPa
 Max. error, abs. u2: 10 kPa
 Max. error, abs. i: 1 °

This calibration is compliant with Eijkelkamp GeoPoint SoilSolutions internal quality system, internal calibration procedures and meets the requirements of
 NEN2549, NEN-EN-ISO 22476-1, NORSOK G-001, ISSNFE and ASTM using calibration equipment traceable to (inter-)National Standards.

 Approved by:
 Date:

 B. Kop
 22-11-2022

 Eijkelkamp GeoPoint SoilSolutions
 V.A.T. NO. NL 8584.21.422.B01
 Trade Reg. Arnhem no. 70686149

 IBAN NL43 RABO 0326 7904 38
 BIC: RABONL2U

APPENDIX A5 – Symbol List

English

a	is area ratio of the cone ($= A_n/A_c$)
A	is area
A _c	is projected area of the cone
A _n	is cross sectional area of load cell or shaft
A _s	is area of friction sleeve
A _{sb}	is bottom end area of friction sleeve
A _{st}	is top end area of friction sleeve
B _q	is pore pressure parameter ($= (u_2 - u_0)/(q_t - \sigma_{v0})$)
C _h	is horizontal coefficient of consolidation
C _v	is vertical coefficient of consolidation
D	is diameter
D _r	is relative density ($= \frac{e_{max}-e}{e_{max}-e_{min}} \times 100\%$)
e	is void ratio
e _{max}	is maximum void ratio
e _{min}	is minimum void ratio
E	is Young's modulus
f _s	is unit sleeve friction resistance
f _t	is sleeve friction corrected for pore pressure effects
F _s	is total force acting on friction sleeve
F _R	is normalized friction ratio ($= f_s/(q_t - \sigma_{v0})$)
FoS	is factor of safety
FC	is fines content
g	is acceleration due to gravity
G ₀	is initial or maximum shear modulus, shear stiffness
I _c	is soil behavior type index
I _r	is rigidity index ($= G/s_u$)
I _p	is plasticity index
k	is coefficient of permeability
k _h	is coefficient of permeability in horizontal direction
k _v	is coefficient of permeability in vertical direction
K ₀	is coefficient of earth pressure at rest ($= \sigma'_{h0}/\sigma'_{v0}$)
L	is length
m _v	is coefficient of volume change
M	is constrained deformation modulus
M7.5	is earthquake magnitude of 7.5 Richter scale
N	is number of blows of SPT
N ₆₀	is SPT energy ratio
N _k	is cone factor
N _{ke}	is cone factor
N _{kt}	is cone factor
N _{Δu}	is cone factor
p _a	is reference stress ($= 100 \text{ kPa}$)
q _c	is measured cone resistance
q _e	is effective cone resistance ($= q_t - u_2$)
q _n	is net cone resistance ($= q_t - \sigma_{v0}$)
q _t	is corrected cone resistance ($= q_c - (1 - a)u_2$)
Q _c	is total force acting on the cone
Q _t	is normalized cone resistance ($= q_t - \sigma_{v0}/\sigma'_{v0}$)

R_f	is friction ratio ($= (f_t/q_t) \times 100\%$ or alternatively $= (f_t/q_t) \times 100\%$)
s_u	is undrained shear strength
s_{ur}	is remoulded undrained shear strength
S_t	is sensitivity
t	is time
t_{50}	is time for 50% dissipation of excess pore water pressure
T_{50}	is time factor at $U = 50\%$
u	is pore water pressure
u_0	is in situ pore pressure
u_1	is pore pressure measured on the cone
u_2	is pore pressure measured behind the cone
u_3	is pore pressure measured behind sleeve friction
Δu	is excess pore water pressure
U	is normalized excess pore pressure
V_s	is shear wave velocity
z	is depth

Greek

α	is constant
α	is cone roughness
β	is constant
β_1	is the angle between the vertical axis and the projection of the axis of the CPTU on a vertical plane, in degrees
β_2	is the angle between the vertical axis and the projection of the axis of the CPTU on a vertical plane that is perpendicular to the plane of angle β_1 , in degrees
γ	is unit weight of soil
γ_w	unit weight of water
Δ	is change
Δu	is excess pore pressure ($= u - u_0$)
μ	is Poisson's ratio
ρ	is density
ψ	is state parameter
σ, σ'	is normal stress (total, effective)
σ_h, σ'_h	is horizontal stress (total, effective)
σ_v, σ'_v	is horizontal stress (total, effective)
$\sigma_{v0}, \sigma'_{v0}$	is overburden stress (total, effective)
T_{av}	is average cyclic shear stress
T_{cy}	is cyclic shear stress
ϕ'	is effective friction angle

APPENDIX A6 – Abbreviations

ASTM	American Society for Testing and Materials
CPTU	Cone Penetration Test with Pore Pressure Measurement (Piezocone Test)
CRR	Cyclic Resistance Ratio
CSR	Cyclic Stress Ratio
GWT	Ground Water Table
NC	Normally Consolidated
OC	Over consolidated
OCR	Over consolidation Ratio
PL	Limit Pressure
SCPT	Seismic Cone Penetration
SDMT	Seismic Dilatometer Marchetti
SPT	Standard Penetration Test
TC	Technical Committee

APPENDIX A7 – Glossary

CPT

Cone Penetration Test.

Cone

The part of the cone penetrometer on which the end bearing is developed.

Cone Penetrometer

The assembly containing the *cone*, *friction sleeve*, any other sensors and measuring systems, as well as the connections to the *push-rods*.

Cone resistance, q_c

The total force acting on the cone, Q_c , divided by the projected area of the cone, A_c . $q_c = Q_c / A_c$

Corrected cone resistance, q_t

The *cone resistance*, q_c corrected for pore water pressure effects.

Corrected sleeve friction, f_t

The *sleeve friction* corrected for pore water pressure effects on the ends of the *friction sleeve*.

Data acquisition system

The system used to measure and record the measurements made by the *cone penetrometer*.

Dissipation Test

A test when the decay of the pore water pressure is monitored during a pause in penetration.

Filter element

The porous element inserted into the cone penetrometer to allow transmission of the pore water pressure to the pore pressure sensor, while maintaining the correct profile of the *cone penetrometer*.

Friction ratio, R_f

The ratio, expressed as a percentage of the *sleeve friction*, f_s , to the *cone resistance*, q_c , both measured at the same depth.

Friction reducer

A local enlargement on the push-rod surface, placed at a distance above the cone penetrometer, and provided to reduce the friction on the *push-rods*.

Friction sleeve

The section of the *cone penetrometer* upon which the *sleeve friction* is measured.

Normalized cone resistance, Q_c or Q_t

The *cone resistance* expressed in a non-dimensional form and taking account of stress changes *in situ*, $Q_c = (q_c - \sigma_{v0}) / \sigma'_{v0}$, or when the *corrected cone resistance* is used $Q_t = (q_t - \sigma_{v0}) / \sigma'_{v0}$. Where σ_{v0} and σ'_{v0} are the total and effective vertical stress respectively.

Net cone resistance, q_n

The *corrected cone resistance* minus the vertical total stress. $q_n = q_t - \sigma_{v0}$

Normalized friction ratio, F_r

The *sleeve friction* normalized by the *net cone resistance*.

Piezocone

A *cone penetrometer* containing a pore pressure sensor.

Pore pressure, u

The pore pressure generated during penetration and measured by a pore pressure sensor, u_1 when measured on the cone, u_2 when measured just behind the cone and u_3 when measured just behind the friction sleeve.

Pore pressure ratio, B_q

The *net pore pressure* normalized with respect to the *net cone resistance*.

Push-rods

The thick-walled tubes or rods used for advancing the cone penetrometer.

Rig machine

The equipment which pushes the cone penetrometer and rods into the ground.

Sleeve friction, f_s

The total frictional force acting on the *friction sleeve*, F_s , divided by its *surface area*, A_s . $f_s = F_s / A_s$

APPENDIX A8 – Soils Description Tables

GRANULAR SOILS (Sands and Gravels)

Description	Relative Density D_r (%)	SPT N value, N_{SPT}
Very Loose	0 – 15	0 - 4
Loose	15 – 35	4 - 10
Medium Dense	35 – 65	10 - 30
Dense	65 – 85	30 - 50
Very Dense	>85	>50

COHESIVE SOILS (Clays and Silts)

Term based on measurement	Undrained Shear Strength Classification, s_u (kPa)
Extremely low	<10
Very low	10 - 20
Low	20 - 40
Medium	40 - 75
High	75 - 150
Very high	150 - 300
Extremely high	>300

APPENDIX B

Cone Penetration Measured Parameters and Geotechnical Derived Parameters



PointID

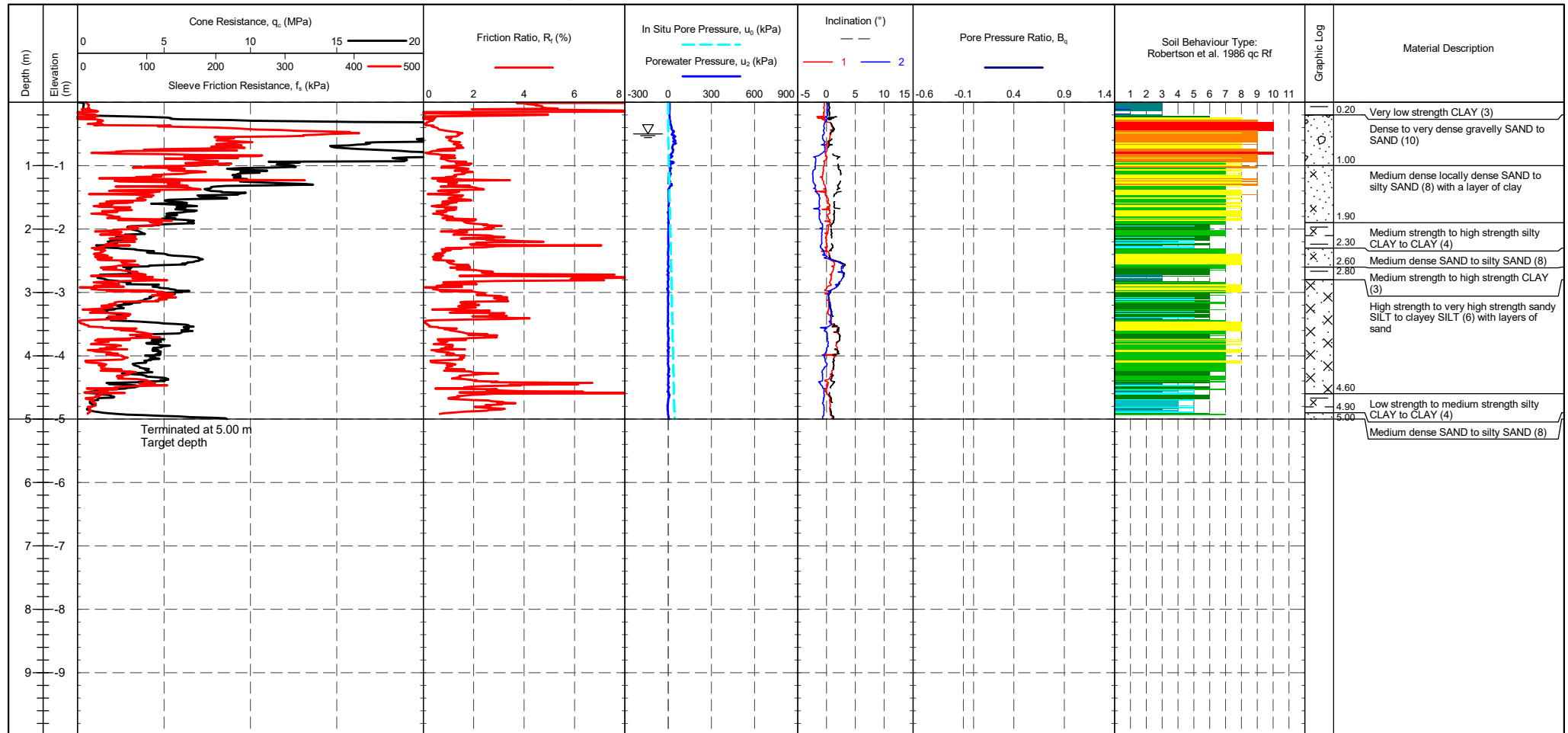
CPT01

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CALIBRATION DATE : 22/11/2022
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold
GROUNDWATER DEPTH : Assumed for calculation purposes

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip	268 mV	267 mV	-0.012 MPa
Sleeve	265 mV	266 mV	0.001 kPa
Pore Pressure 2	280 mV	282 mV	0.001 kPa
X-Y Inclinator	2481 mV	2483 mV	

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material	5 - Clayey SILT to silty CLAY	9 - SAND
2 - Organic material	6 - Sandy SILT to clayey SILT	10 - Gravelly SAND to SAND
3 - CLAY	7 - Silty SAND to sandy SILT	11 - Very stiff fine grained
4 - Silty CLAY to CLAY	8 - SAND to silty SAND	12 - SAND to clayey SAND

Groundwater
Level

Dissipation Test



PointID

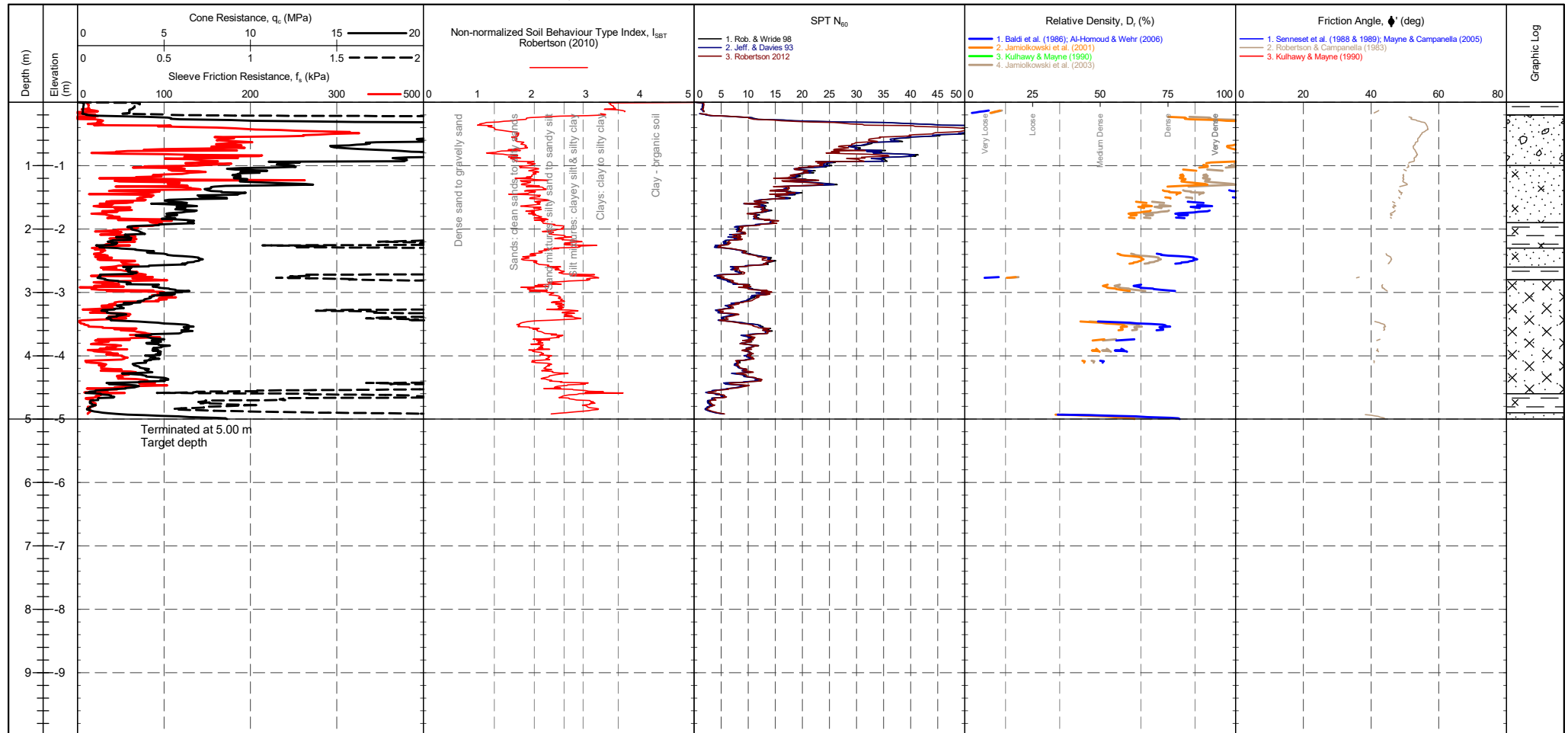
CPT01

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold

Transducer :
Tip :
Sleeve :
Pore Pressure 2 :
X-Y Inclinator :
CPTU ZERO VALUES
Pre :
Post :
Difference :
268 mV : 267 mV : -0.012 MPa
265 mV : 266 mV : 0.001 kPa
280 mV : 282 mV : 0.001 kPa
2481 mV : 2483 mV

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12

Description	SBT Index, I_c	Description	SPT N value, NSPT	Description	Relative Density D_r (%)
Clays	2.95-3.60	Very Loose	0 - 4	Very Loose	0 - 15
Silt mixtures	2.60-2.95	Loose	4 - 10	Loose	15 - 35
Sand mixtures	2.05-2.60	Medium Dense	10 - 30	Medium Dense	35 - 65
Sands	1.31-2.05	Dense	30 - 50	Dense	65 - 85
Gravelly sand	<1.31	Very Dense	>50	Very Dense	>85

Groundwater Level
Dissipation Test



PointID

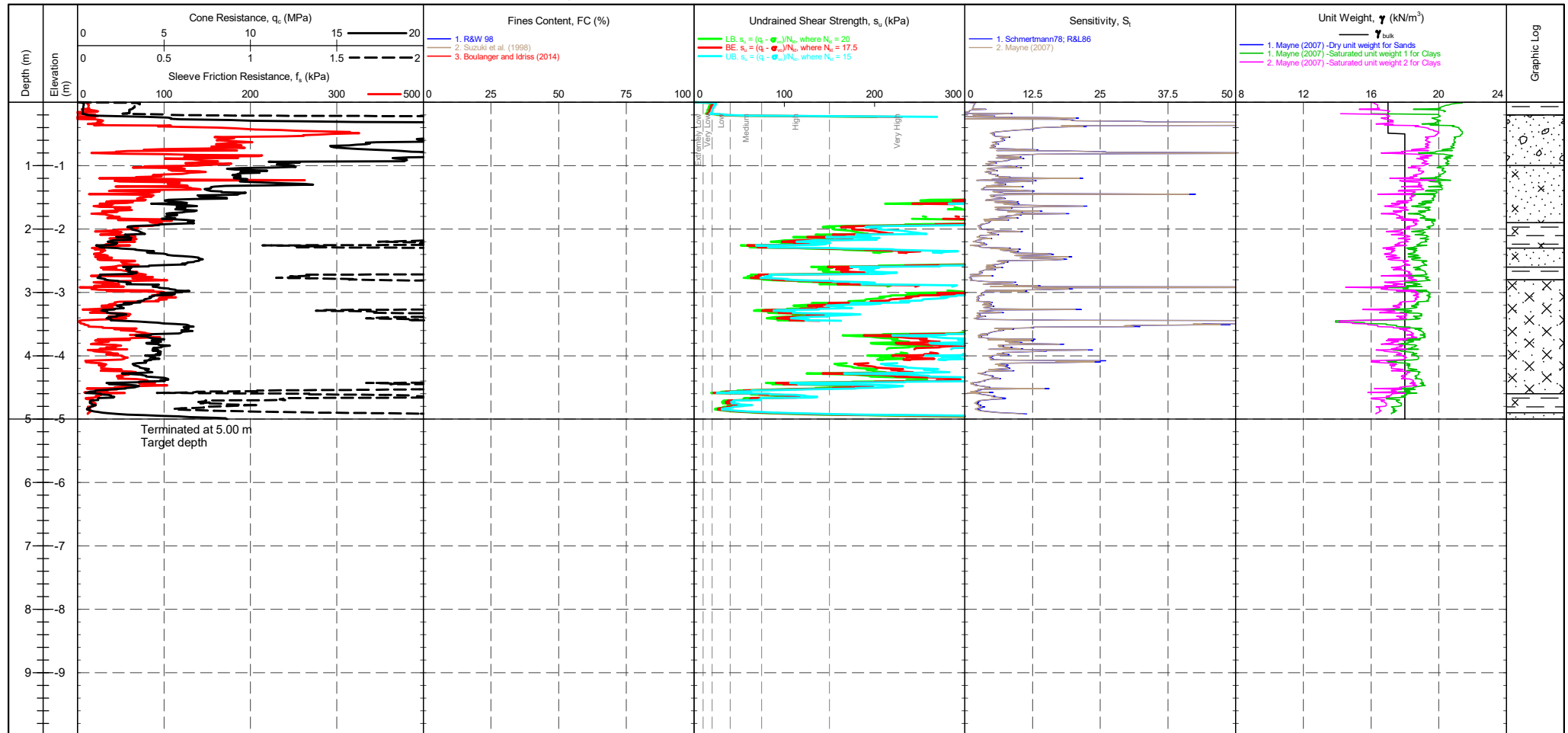
CPT01

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold

Transducer
Tip
Sleeve
Pore Pressure 2
X-Y Inclinator

Pre	Post	Difference
268 mV	267 mV	-0.012 MPa
265 mV	266 mV	0.001 kPa
280 mV	282 mV	0.001 kPa
2481 mV	2483 mV	

CPTU ZERO VALUES

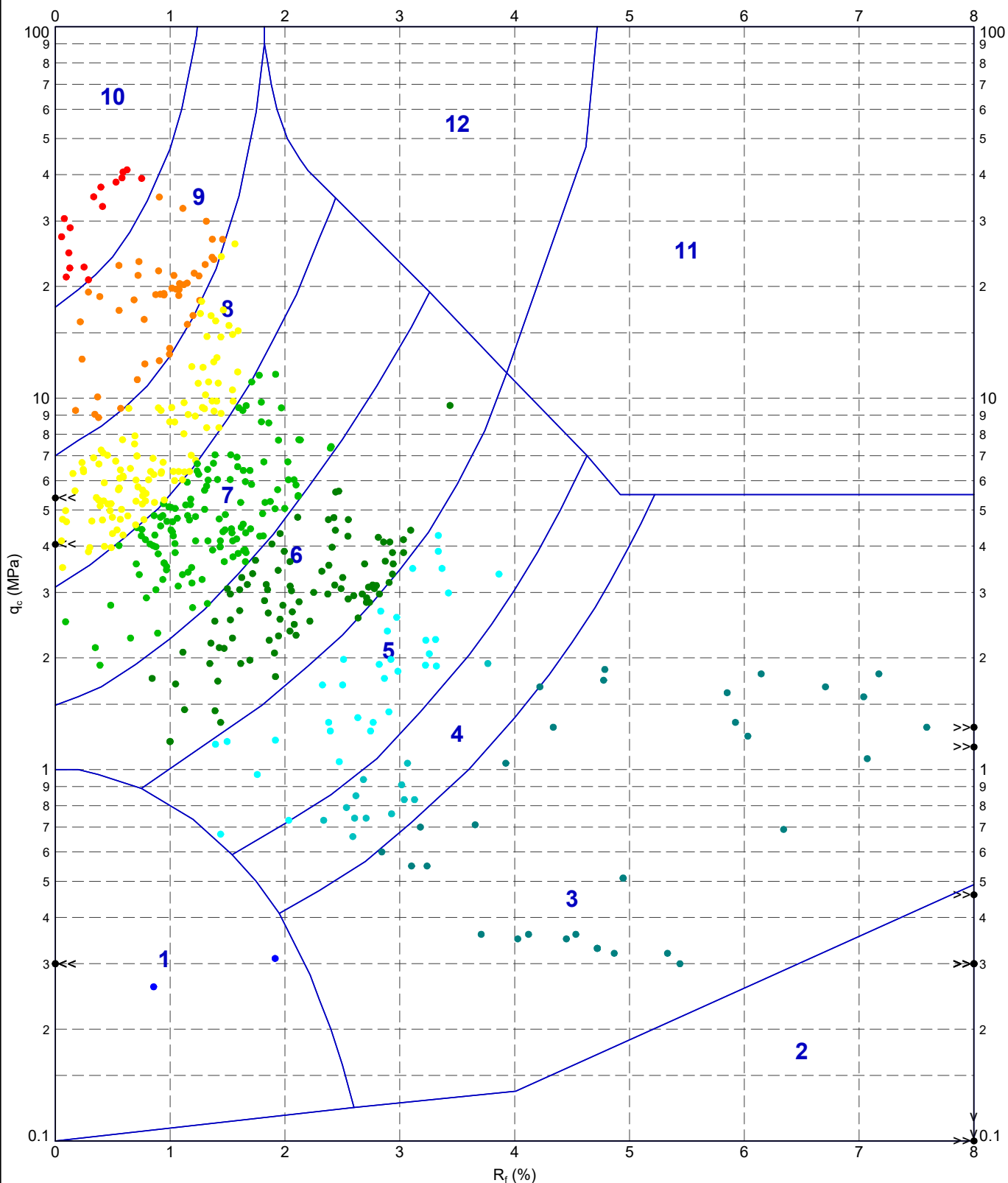
COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	s_u (kPa)	Term based on measurement	s_u (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater
Level

Dissipation Test

220629-ADVANCED REPORT INSTITUSI 202.1 LUB - CHLOE GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF AP 1230169 MANCHESTER CITY CENTRE COLLEGE BROWNFIELD SOLUTIONS.GPJ <<DrawingFile>> 27/02/2023 13:23 10.03.00.09 Dalgel Lab and In Situ Tool - DGD [Lib: In Situ SI 2.02.0 2017-07-10 Proj: In Situ SI 2.02.0 2017-07-10



METHOD: Robertson et al. 1986 q_c R_f

- | | | | |
|-------------------------------------|-------------------------------|------------------------------|------------------------------|
| 1 - Sensitive fine grained material | 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 |

IN SITU
SITE INVESTIGATION

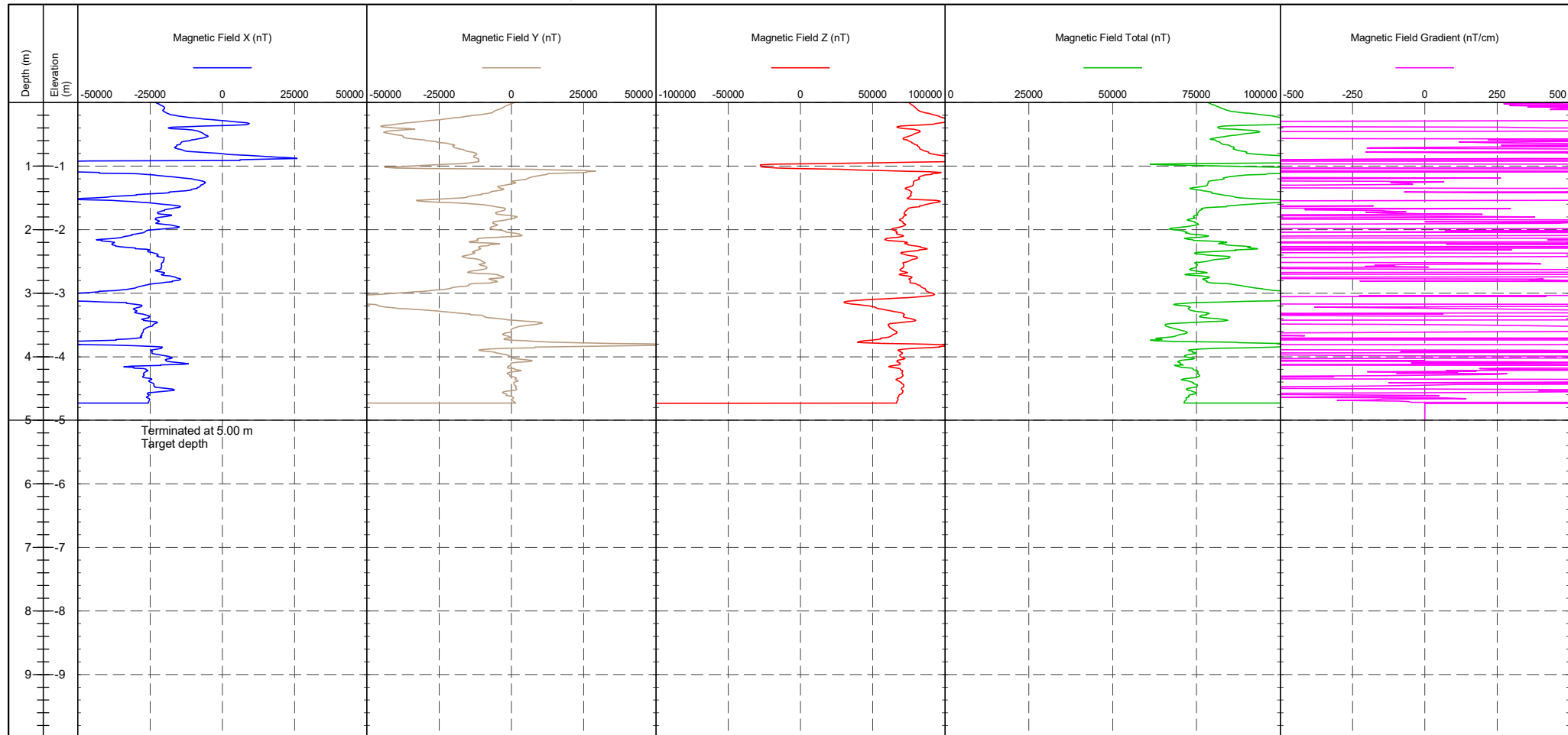
Brownfield Solutions
Manchester
Manchester City Centre College
Robertson et al. 1986 q_c vs. R_f - CPT01

DRAWN	DATE	27/02/2023
CHECKED	DATE	27/02/2023
SCALE	Not To Scale	
PROJECT No	FIGURE No	A4
1230169		



PointID	CPT01
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CLIENT : Brownfield Solutions PROJECT : Manchester City Centre College LOCATION : Manchester PROJECT No. : 1230169	EASTING : 0.000 m NORTHING : 0.000 m ELEVATION : 0.000 m OD CHECKED BY : LD TERMINATION REASON : Target depth	Remark: Test completed at target depth.	SHEET : 1 OF 1 STATUS : Final TEST DATE : 23/02/2023 PLOT DATE : 27/02/2023 METHOD : ISO 22476-1:2012
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CONE ID	: S15-CFIPM.2088	RIG	: CPT 011 - Unimog	CPTU ZERO VALUES			
CONE MODEL	: Subtraction	OPERATOR	: RK & PD	Transducer	Pre	Post	Difference
				Tip	268 mV	267 mV	-0.012 MPa
				Sleeve	265 mV	266 mV	0.001 kPa
				Pore Pressure 2	280 mV	282 mV	0.001 kPa
				X-Y Inclinator	2481 mV	2483 mV	



PointID

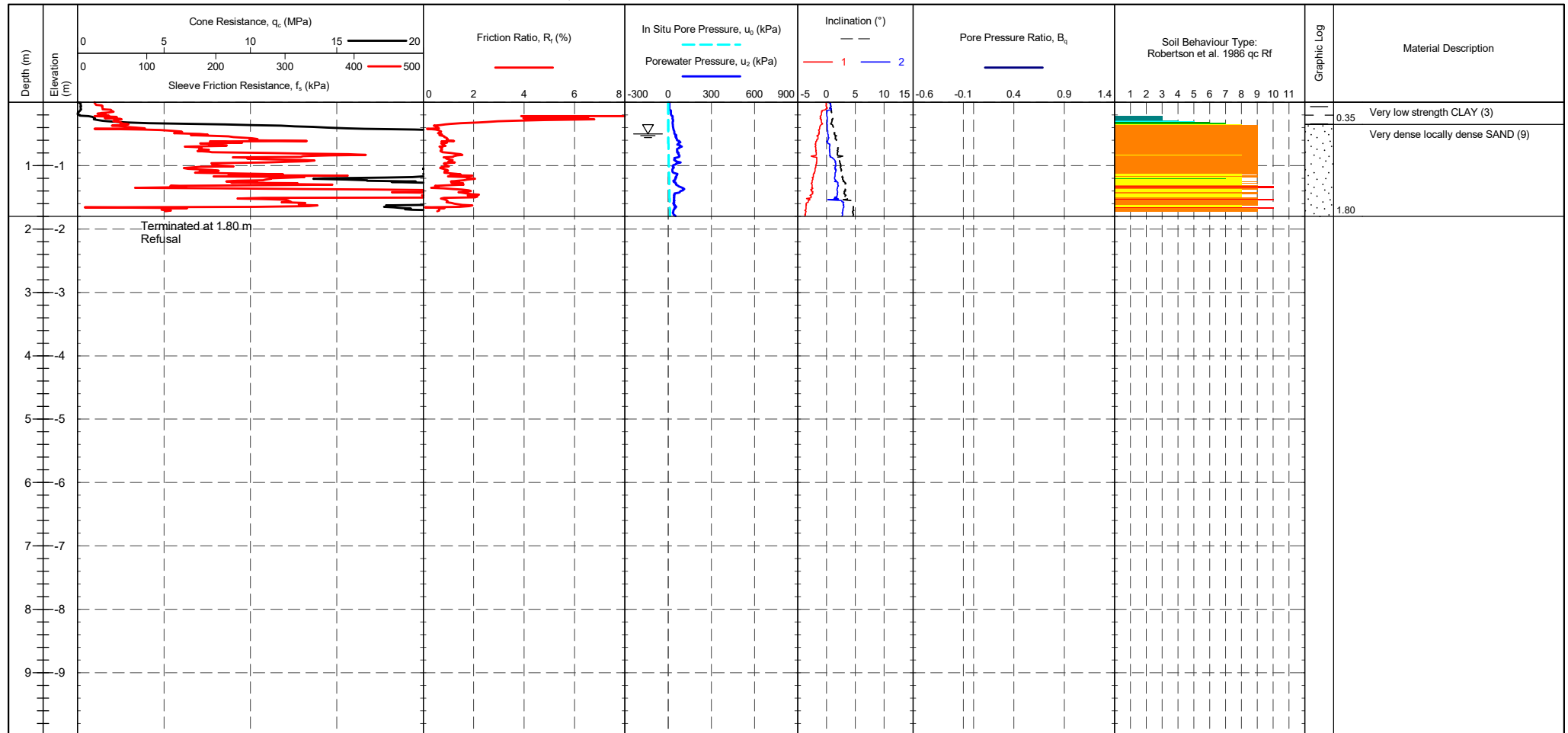
CPT02

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CALIBRATION DATE : 22/11/2022
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE
TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold
GROUNDWATER DEPTH : Assumed for calculation purposes

CPTU ZERO VALUES
Transducer Pre Post Difference
Tip 268 mV 270 mV 0.023 MPa
Sleeve 263 mV 265 mV 0.001 kPa
Pore Pressure 2 287 mV 344 mV 0.015 kPa
X-Y Inclinator 2560 mV 2430 mV

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material
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

Groundwater
Level

Dissipation Test



PointID

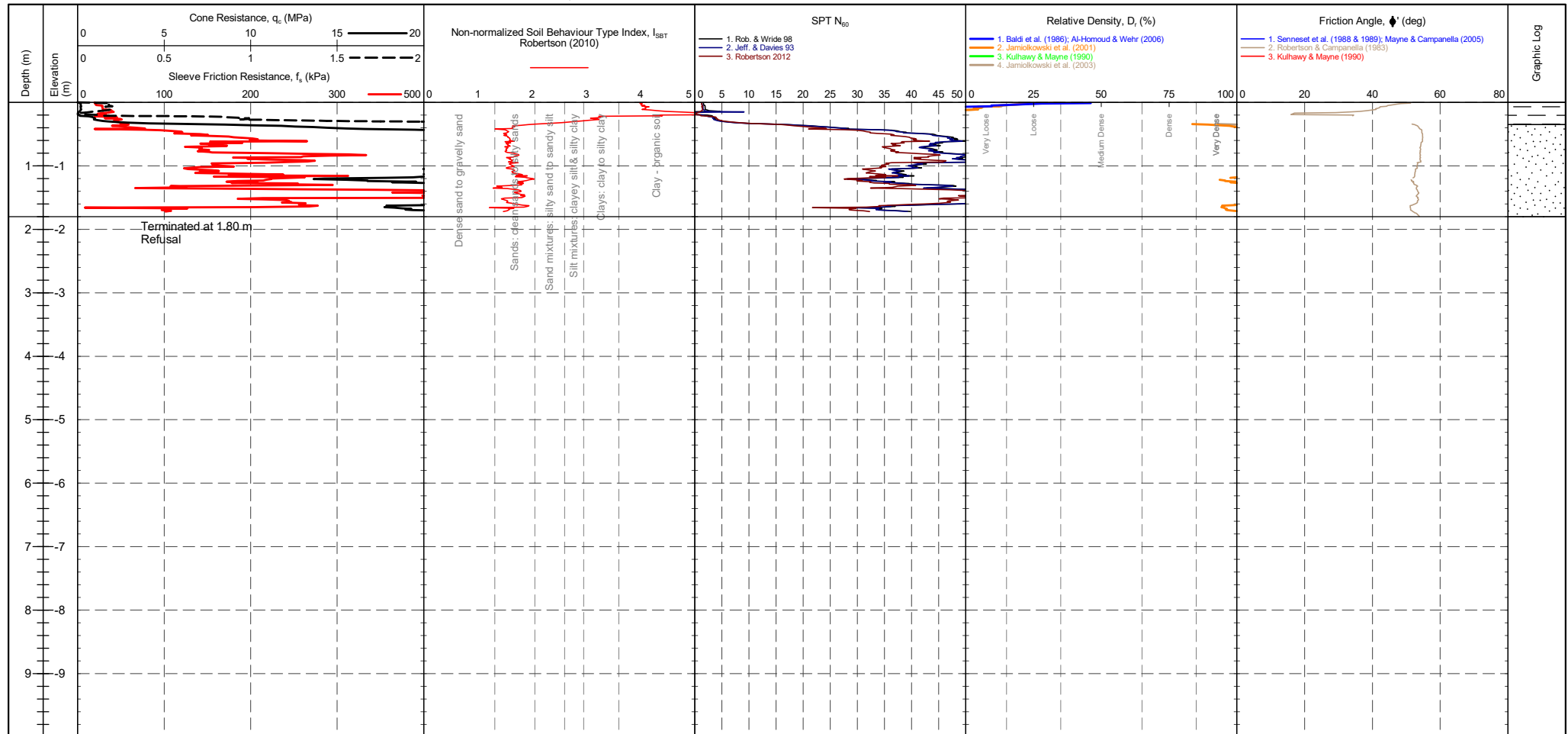
CPT02

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip	268 mV	270 mV	0.023 MPa
Sleeve	263 mV	265 mV	0.001 kPa
Pore Pressure 2	287 mV	344 mV	0.015 kPa
X-Y Inclinator	2560 mV	2430 mV	

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12

Description	SBT Index, I_c	Description	SPT N value, NSPT	Description	Relative Density D_r (%)
Clays	2.95-3.60	Very Loose	0 - 4	Very Loose	0 - 15
Silt mixtures	2.60-2.95	Loose	4 - 10	Loose	15 - 35
Sand mixtures	2.05-2.60	Medium Dense	10 - 30	Medium Dense	35 - 65
Sands	1.31-2.05	Dense	30 - 50	Dense	65 - 85
Gravelly sand	<1.31	Very Dense	>50	Very Dense	>85

Groundwater Level

Dissipation Test



PointID

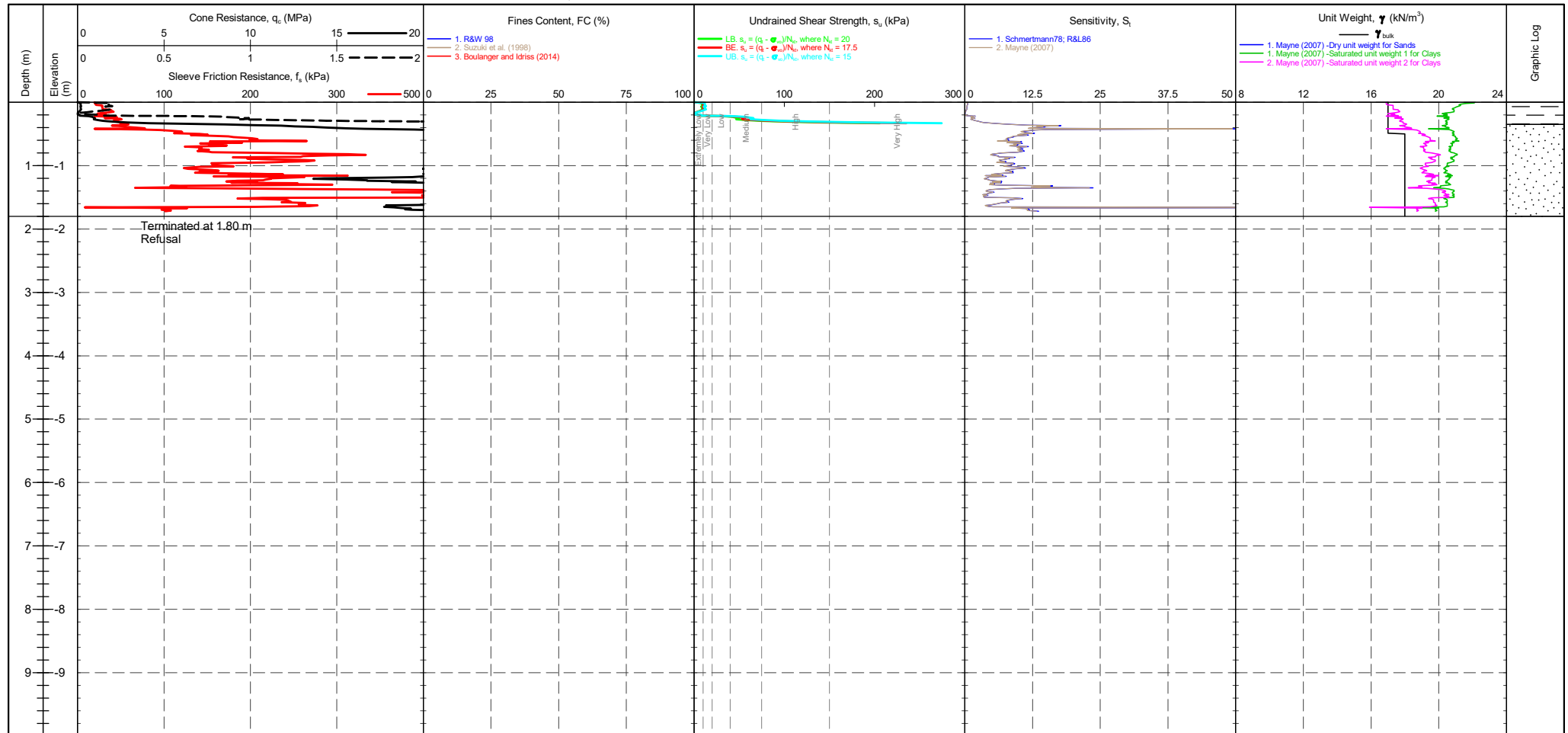
CPT02

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold

CPTU ZERO VALUES

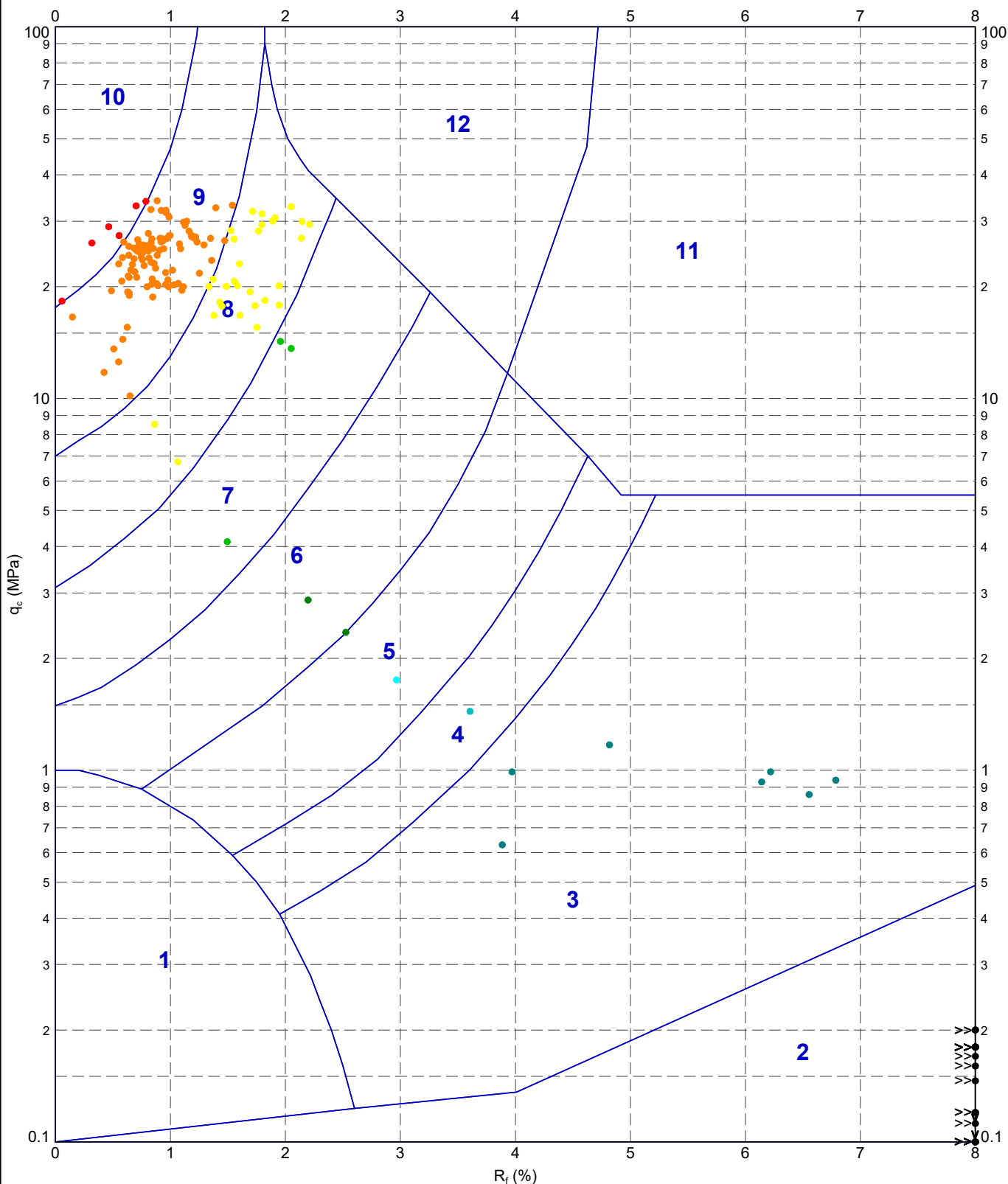
Transducer	Pre	Post	Difference
Tip	268 mV	270 mV	0.023 MPa
Sleeve	263 mV	265 mV	0.001 kPa
Pore Pressure 2	287 mV	344 mV	0.015 kPa
X-Y Inclinator	2560 mV	2430 mV	

COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	s_u (kPa)	Term based on measurement	s_u (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater Level
Dissipation Test

220629-ADVANCED REPORT INSTITUSI 202.1 LUB - CHLOE GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF APF 1230169 MANCHESTER CITY CENTRE COLLEGE BROWNFIELD SOLUTIONS.GPJ <DrawingFile>> 27/02/2023 13:24 10.03.00.09 Dalgel Lab and In Situ Tool - DGD [Lib: In Situ SI 2.02.0 2017-07-10 Proj: In Situ SI 2.02.0 2017-07-10



METHOD: Robertson et al. 1986 q_c R_f

- | | | | |
|-------------------------------------|-------------------------------|------------------------------|------------------------------|
| 1 - Sensitive fine grained material | 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 |

IN SITU
SITE INVESTIGATION

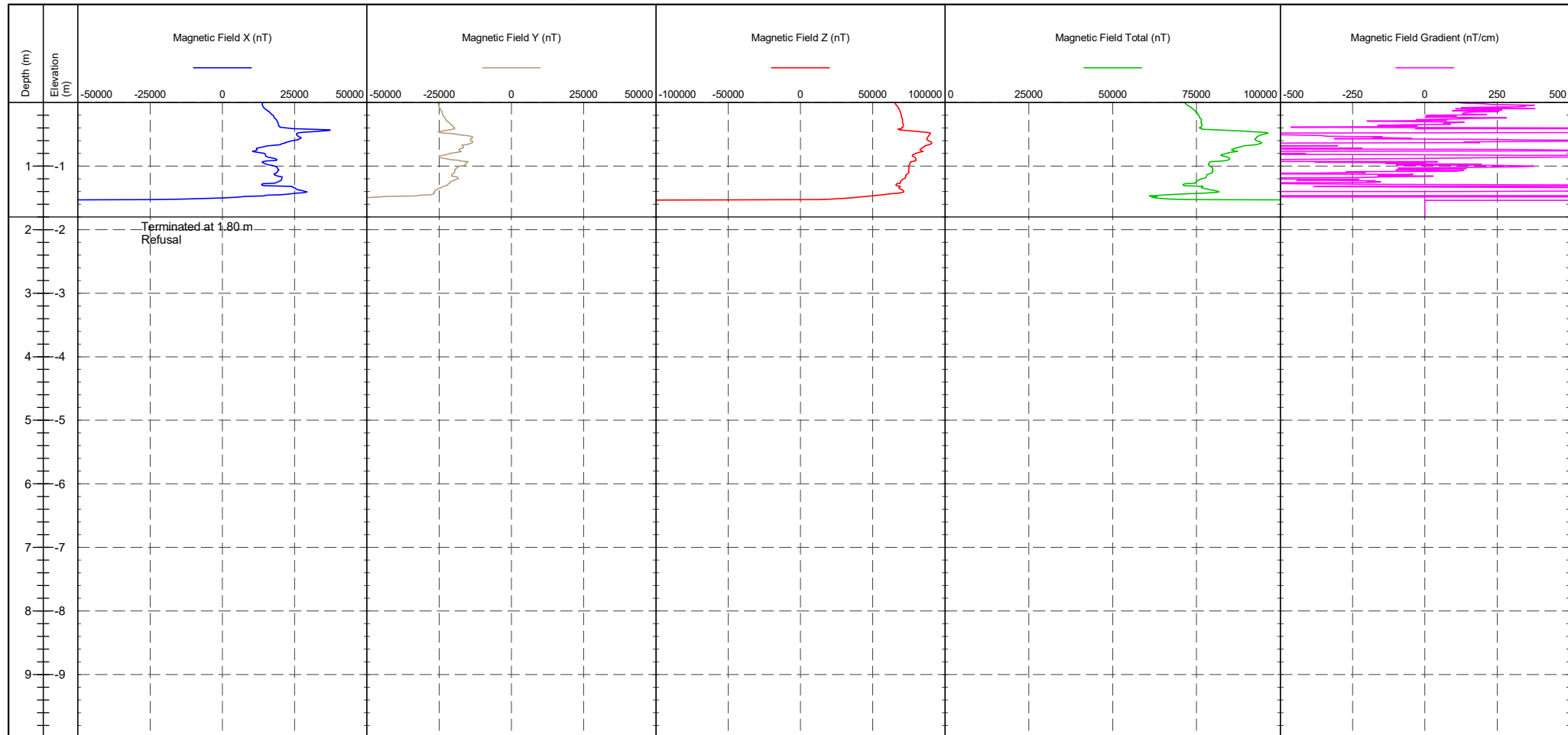
Brownfield Solutions
Manchester
Manchester City Centre College
Robertson et al. 1986 q_c vs. R_f - CPT02

DRAWN	DATE	27/02/2023
CHECKED	DATE	27/02/2023
SCALE	Not To Scale	
PROJECT No	FIGURE No	A4
1230169		



PointID	CPT02
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CLIENT : Brownfield Solutions PROJECT : Manchester City Centre College LOCATION : Manchester PROJECT No. : 1230169	EASTING : 0.000 m NORTHING : 0.000 m ELEVATION : 0.000 m OD CHECKED BY : LD TERMINATION REASON : Refusal	Remark: Test refused on total pressure.	SHEET : 1 OF 1 STATUS : Final TEST DATE : 23/02/2023 PLOT DATE : 27/02/2023 METHOD : ISO 22476-1:2012
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CONE ID	: S15-CFIPM.2088	RIG	: CPT 011 - Unimog	CPTU ZERO VALUES			
CONE MODEL	: Subtraction	OPERATOR	: RK & PD	Transducer	Pre	Post	Difference
				Tip	268 mV	270 mV	0.023 MPa
				Sleeve	263 mV	265 mV	0.001 kPa
				Pore Pressure 2	287 mV	344 mV	0.015 kPa
				X-Y Inclinator	2560 mV	2430 mV	



PointID

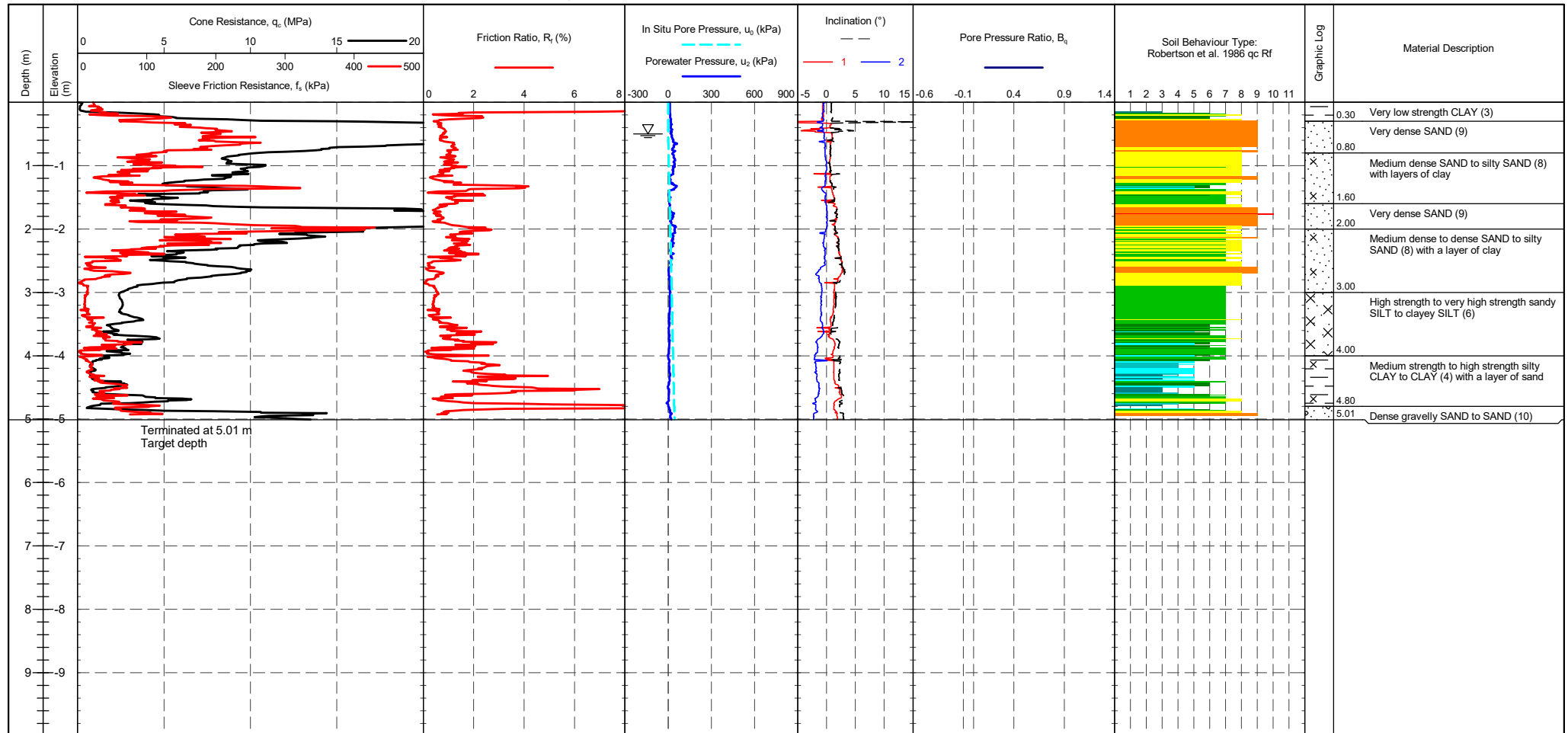
CPT03

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CALIBRATION DATE : 22/11/2022
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE
TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold
GROUNDWATER DEPTH : Assumed for calculation purposes

CPTU ZERO VALUES
Transducer Pre Post Difference
Tip 269 mV 266 mV -0.035 MPa
Sleeve 265 mV 265 mV 0 kPa
Pore Pressure 2 282 mV 305 mV 0.006 kPa
X-Y Inclinator 2452 mV 2483 mV

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material
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

Groundwater
Level
Dissipation Test



PointID

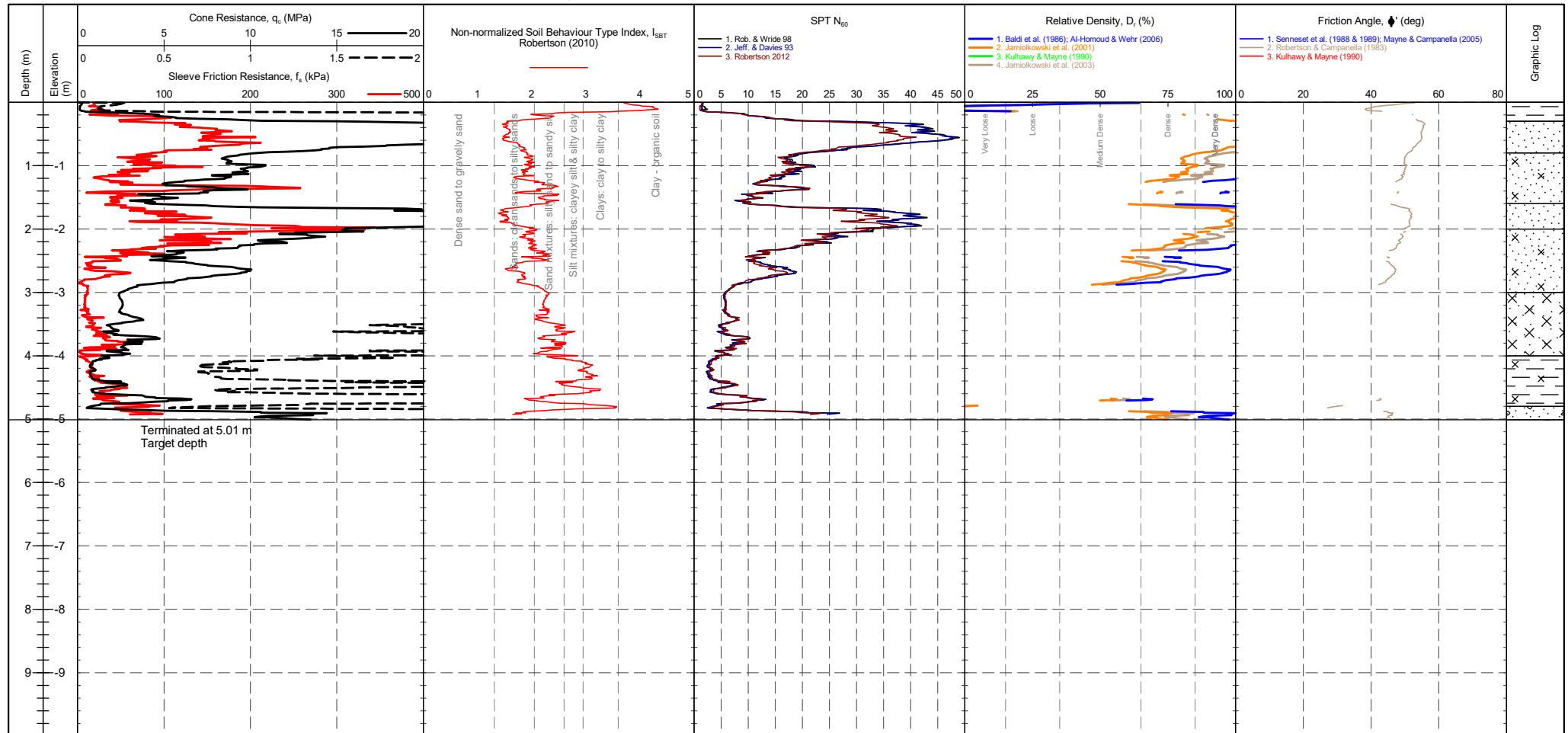
CPT03

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold

Transducer :
Tip :
Sleeve :
Pore Pressure 2 :
X-Y Inclinator :
CPTU ZERO VALUES
Pre :
Post :
Difference :
269 mV : 266 mV : -0.035 MPa
265 mV : 265 mV : 0 kPa
282 mV : 305 mV : 0.006 kPa
2452 mV : 2483 mV

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12			
Description	SBT Index, I _c	Description	SPT N value, NSPT
Clays	2.95-3.60	Very Loose	0 - 4
Silt mixtures	2.60-2.95	Loose	4 - 10
Sand mixtures	2.05-2.60	Medium Dense	10 - 30
Sands	1.31-2.05	Dense	30 - 50
Gravelly sand	<1.31	Very Dense	>50

Description	Relative Density Dr (%)
Very Loose	0 - 15
Loose	15 - 35
Medium Dense	35 - 65
Dense	65 - 85
Very Dense	>85

Groundwater
Level

Dissipation Test



PointID

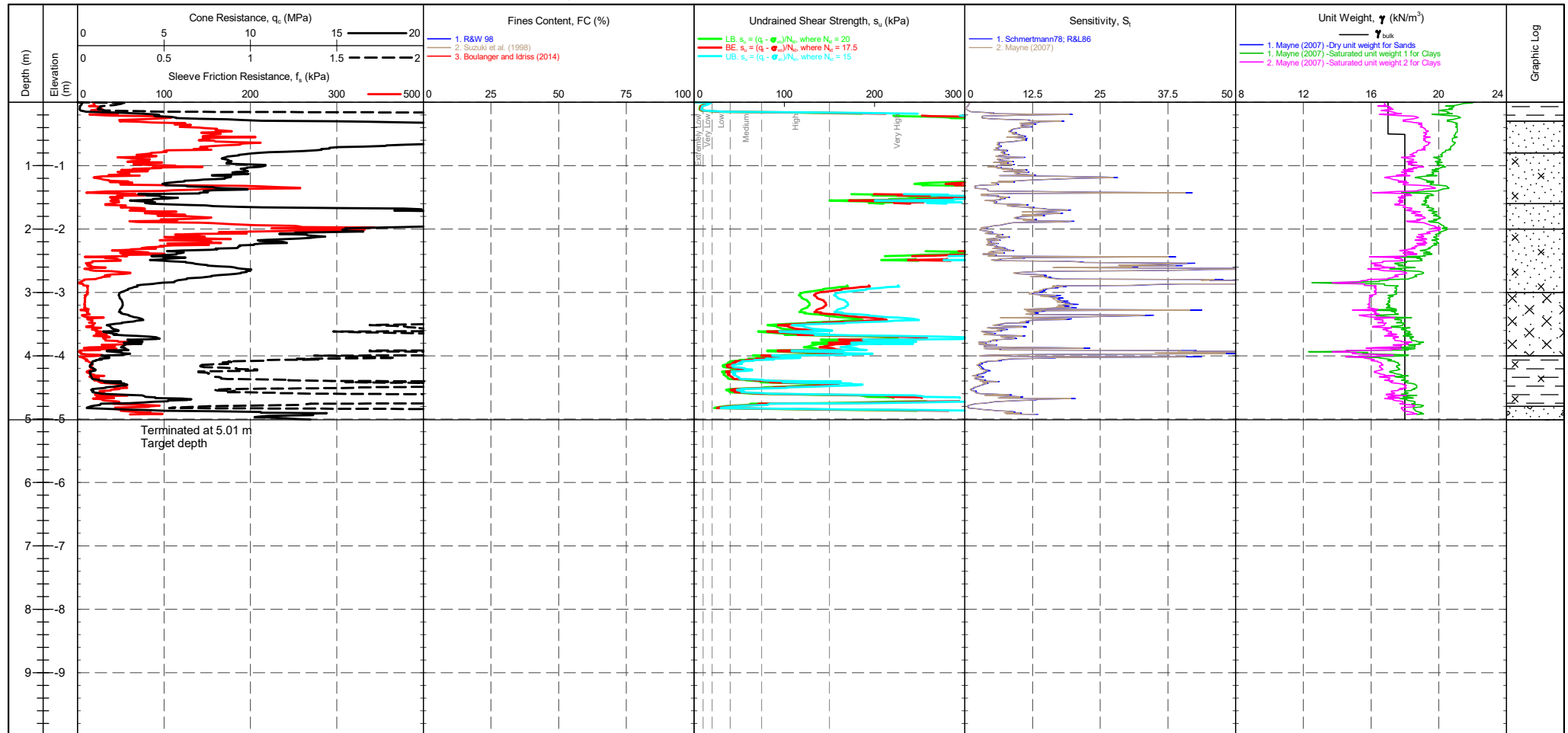
CPT03

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold

Transducer
Tip
Sleeve
Pore Pressure 2
X-Y Inclinator

CPTU ZERO VALUES

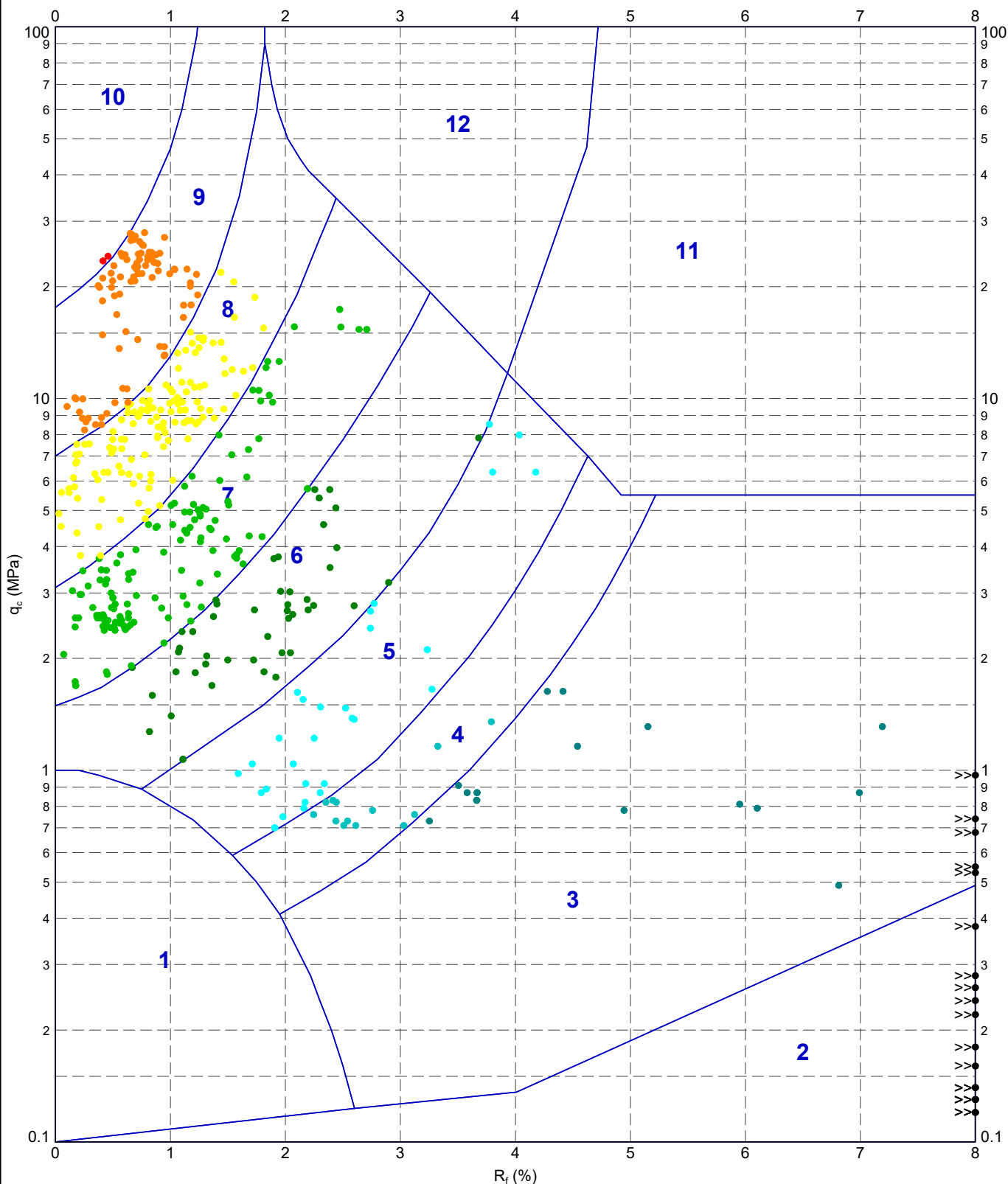
Pre	Post	Difference
269 mV	266 mV	-0.035 MPa
265 mV	265 mV	0 kPa
282 mV	305 mV	0.006 kPa
2452 mV	2483 mV	

COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	s_u (kPa)	Term based on measurement	s_u (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater Level
Dissipation Test

220629-ADVANCED REPORT INSTITUSI 202.1 LIB - CHLOE GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF APF 1230169 MANCHESTER CITY CENTRE COLLEGE BROWNFIELD SOLUTIONS.GPJ <<DrawingFile>> 27/02/2023 13:25: 10.03.00.09 Dalgel Lab and In Situ Tool - DGD [Lib: In Situ SI 2.02.0 2017-07-10 Proj: In Situ SI 2.02.0 2017-07-10



METHOD: Robertson et al. 1986 qc Rf

- | | | | |
|-------------------------------------|-------------------------------|------------------------------|------------------------------|
| 1 - Sensitive fine grained material | 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 |

IN SITU
SITE INVESTIGATION

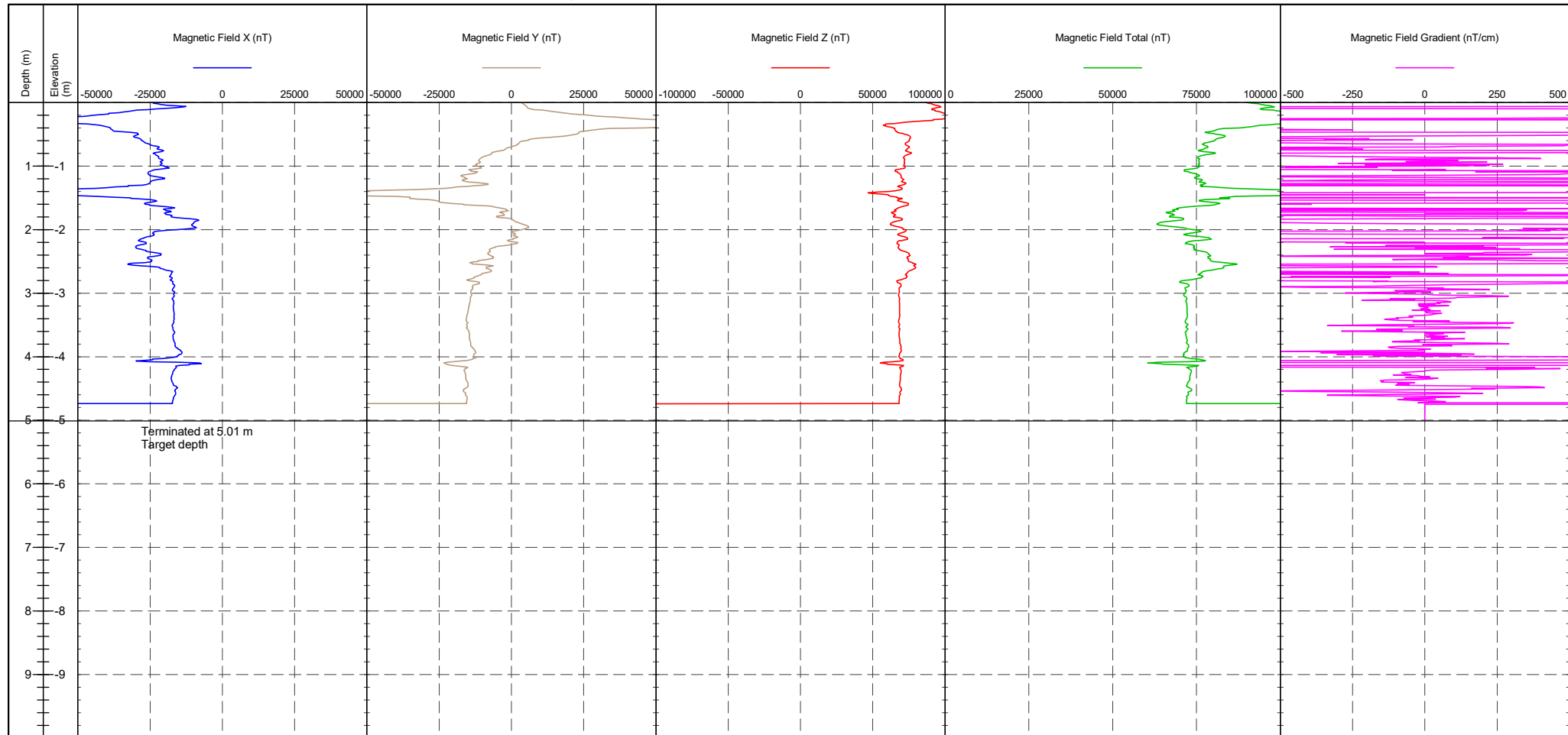
Brownfield Solutions
Manchester
Manchester City Centre College
Robertson et al. 1986 qc vs. Rf - CPT03

DRAWN	DATE	27/02/2023
CHECKED	DATE	27/02/2023
SCALE	Not To Scale	
PROJECT No	FIGURE No	A4
1230169		



PointID	CPT03
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CLIENT : Brownfield Solutions PROJECT : Manchester City Centre College LOCATION : Manchester PROJECT No. : 1230169	EASTING : 0.000 m NORTHING : 0.000 m ELEVATION : 0.000 m OD CHECKED BY : LD TERMINATION REASON : Target depth	Remark: Test completed at target depth.	SHEET : 1 OF 1 STATUS : Final TEST DATE : 23/02/2023 PLOT DATE : 27/02/2023 METHOD : ISO 22476-1:2012
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CONE ID : S15-CFIPM.2088	RIG : CPT 011 - Unimog	CPTU ZERO VALUES				
CONE MODEL : Subtraction	OPERATOR : RK & PD	Transducer	Pre	Post	Difference	
		Tip	269 mV	266 mV	-0.035 MPa	
		Sleeve	265 mV	265 mV	0 kPa	
		Pore Pressure 2	282 mV	305 mV	0.006 kPa	
		X-Y Inclinator	2452 mV	2483 mV		



PointID

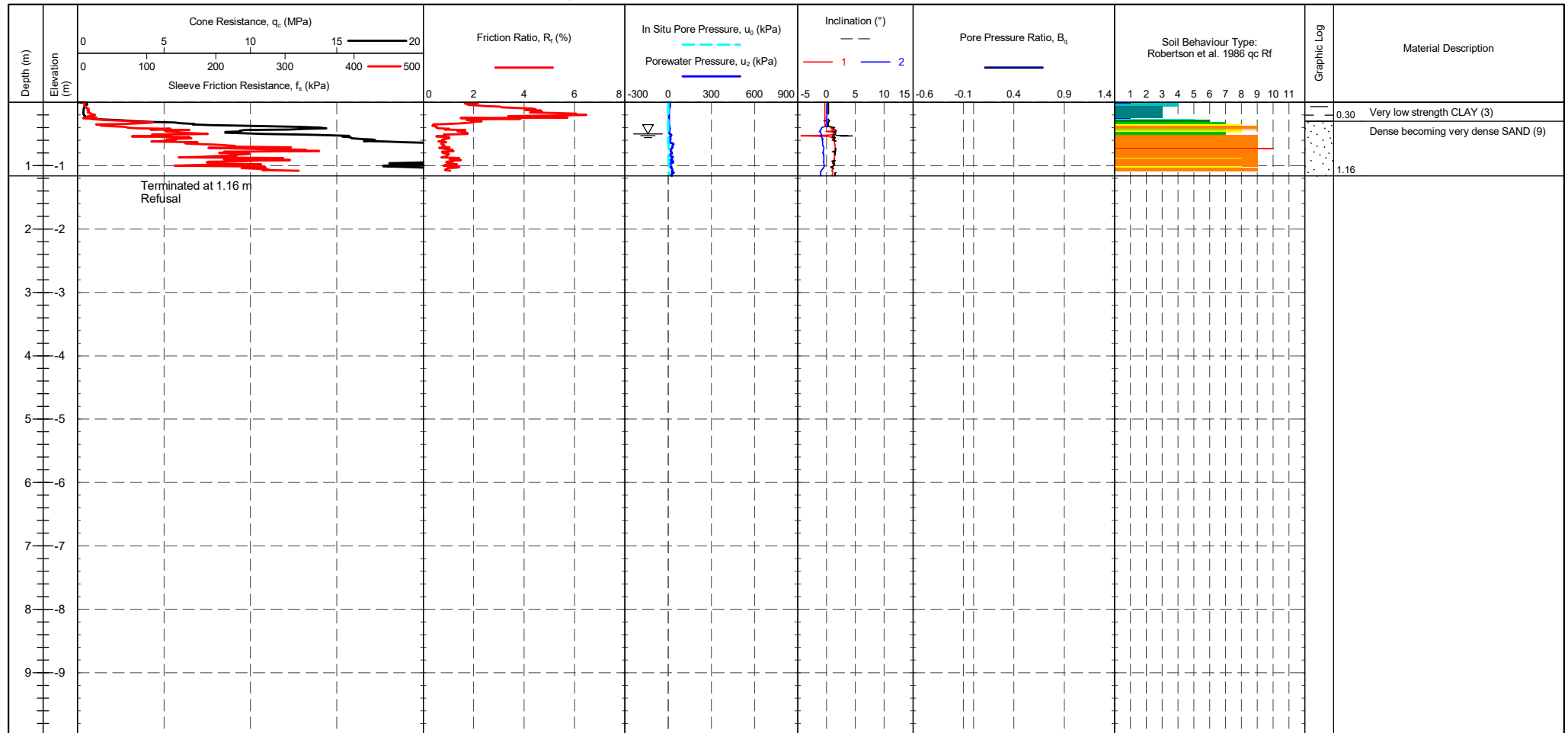
CPT04

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CALIBRATION DATE : 22/11/2022
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold
GROUNDWATER DEPTH : Assumed for calculation purposes

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip	269 mV	271 mV	0.023 MPa
Sleeve	266 mV	268 mV	0.001 kPa
Pore Pressure 2	290 mV	282 mV	-0.002 kPa
X-Y Inclinator	2482 mV	2484 mV	

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material	5 - Clayey SILT to silty CLAY	9 - SAND
2 - Organic material	6 - Sandy SILT to clayey SILT	10 - Gravelly SAND to SAND
3 - CLAY	7 - Silty SAND to sandy SILT	11 - Very stiff fine grained
4 - Silty CLAY to CLAY	8 - SAND to silty SAND	12 - SAND to clayey SAND

Groundwater
Level

Dissipation Test



PointID

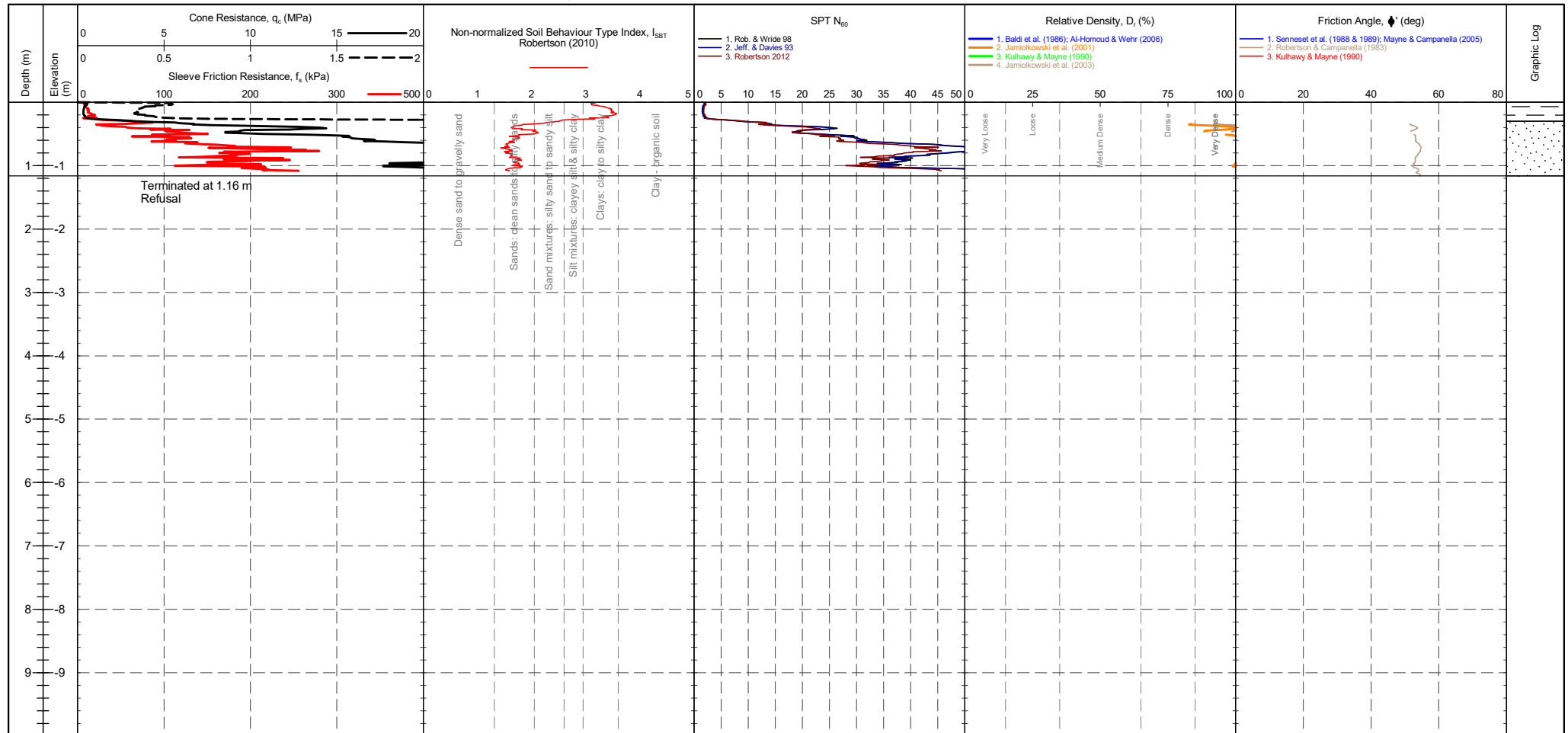
CPT04

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold

Transducer :
Tip :
Sleeve :
Pore Pressure 2 :
X-Y Inclinator :
CPTU ZERO VALUES
Pre : 269 mV
Post : 271 mV
Difference : 0.023 MPa
Pre : 266 mV
Post : 268 mV
Difference : 0.001 kPa
Pre : 290 mV
Post : 282 mV
Difference : -0.002 kPa
Pre : 2482 mV
Post : 2484 mV

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12			
Description	SBT Index, I _c	Description	SPT N value, NSPT
Clays	2.95-3.60	Very Loose	0 - 4
Silt mixtures	2.60-2.95	Loose	4 - 10
Sand mixtures	2.05-2.60	Medium Dense	10 - 30
Sands	1.31-2.05	Dense	30 - 50
Gravelly sand	<1.31	Very Dense	>50

Description	Relative Density D _r (%)
Very Loose	0 - 15
Loose	15 - 35
Medium Dense	35 - 65
Dense	65 - 85
Very Dense	>85

Groundwater
Level

Dissipation Test



PointID

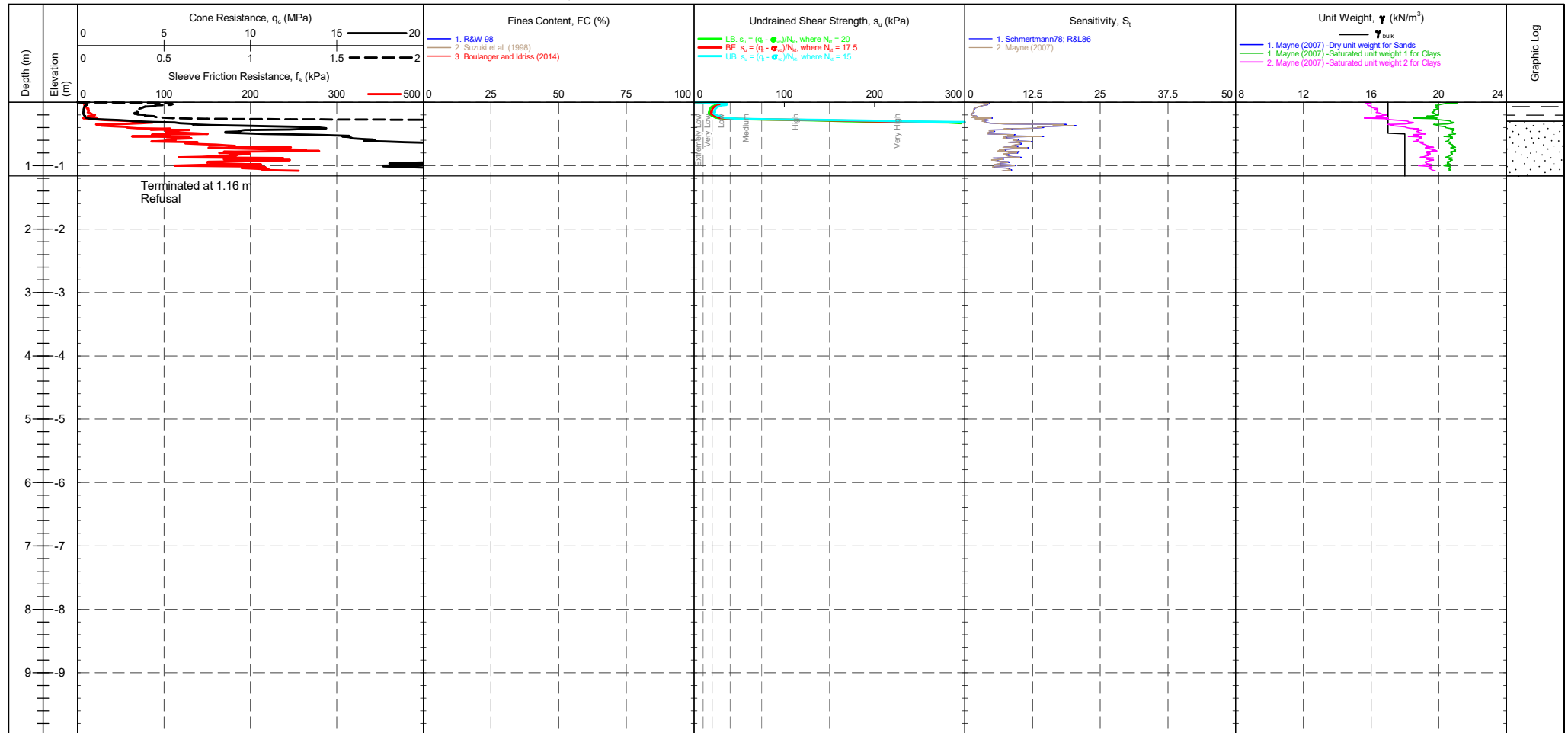
CPT04

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold

CPTU ZERO VALUES

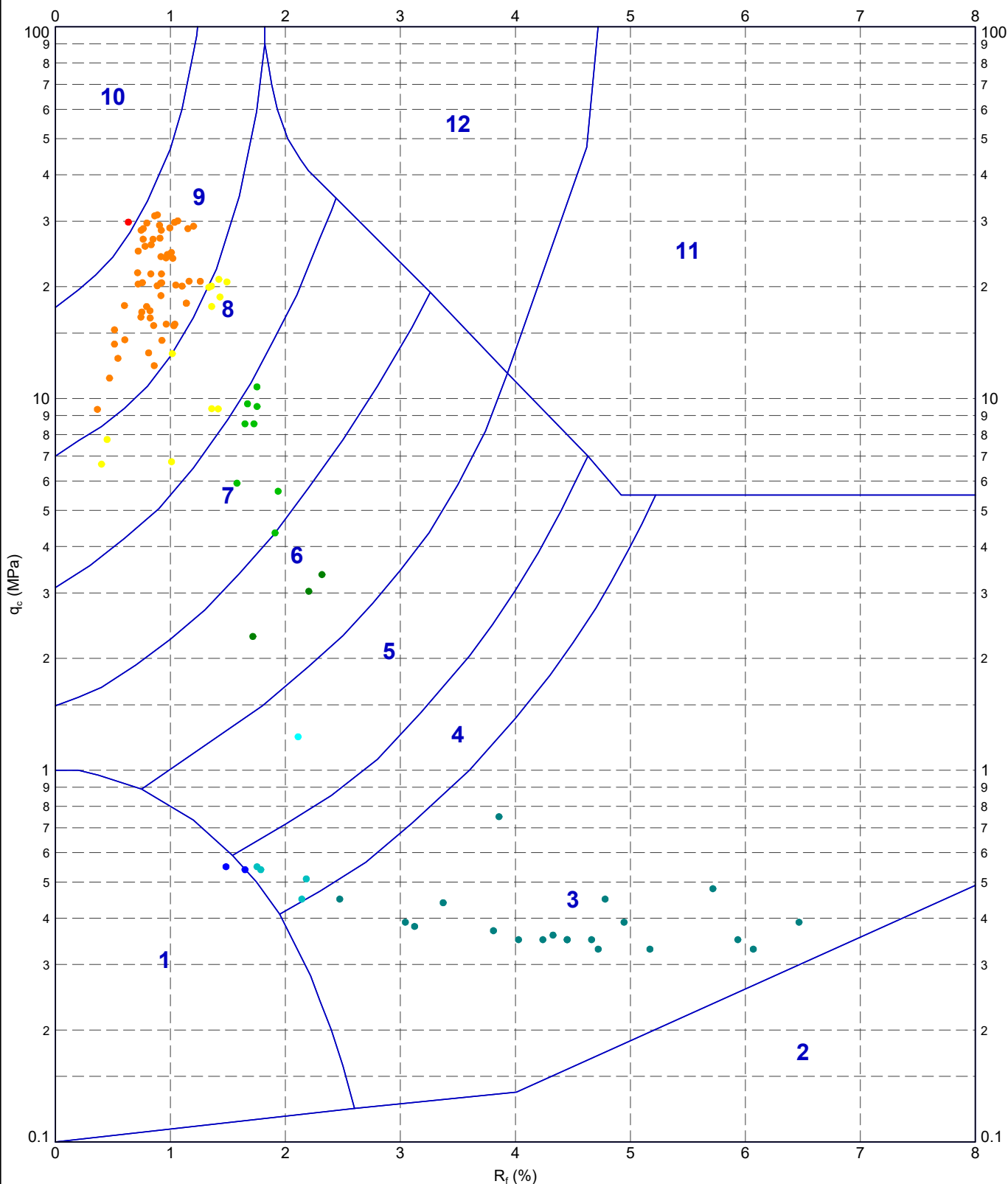
Transducer	Pre	Post	Difference
Tip	269 mV	271 mV	0.023 MPa
Sleeve	266 mV	268 mV	0.001 kPa
Pore Pressure 2	290 mV	282 mV	-0.002 kPa
X-Y Inclinator	2482 mV	2484 mV	

COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	s_u (kPa)	Term based on measurement	s_u (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater Level
Dissipation Test

22069-ADVANCED REPORT INSTITUTION 202.1 LIB - CHLOE GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF MAP 1230169 MANCHESTER CITY CENTRE COLLEGE BROWNFIELD SOLUTIONS.GPJ <<DrawingFile>> 27/02/2023 13:26 10.03.00.09 Dalziel Lab and In Situ Tool - DGD [Lib: In Situ SI 2.02.0 2017-07-10 Proj: In Situ SI 2.02.0 2017-07-10



METHOD: Robertson et al. 1986 qc R_f

- | | | | |
|-------------------------------------|-------------------------------|------------------------------|------------------------------|
| 1 - Sensitive fine grained material | 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 |

IN SITU
SITE INVESTIGATION

TITLE

Brownfield Solutions
Manchester
Manchester City Centre College
Robertson et al. 1986 q_c vs. R_f - CPT04

DRAWN

DATE

27/02/2023

CHECKED

DATE

27/02/2023

SCALE

Not To Scale

A4

PROJECT No

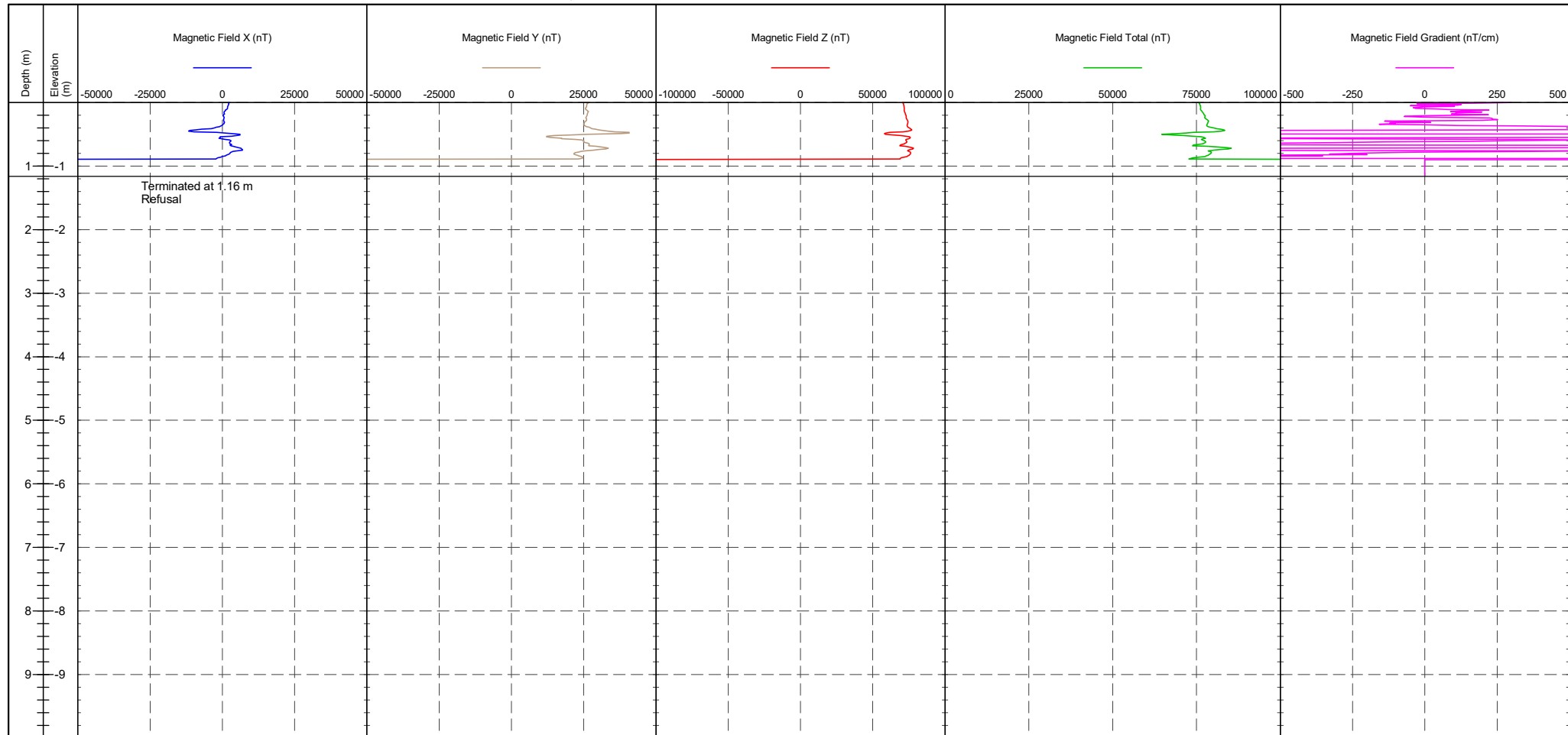
1230169

FIGURE No



PointID	CPT04
---------	--------------

CLIENT : Brownfield Solutions PROJECT : Manchester City Centre College LOCATION : Manchester PROJECT No. : 1230169	EASTING : 0.000 m NORTHING : 0.000 m ELEVATION : 0.000 m OD CHECKED BY : LD TERMINATION REASON : Refusal	Remark: Test refused on total pressure.	SHEET : 1 OF 1 STATUS : Final TEST DATE : 23/02/2023 PLOT DATE : 27/02/2023 METHOD : ISO 22476-1:2012
---	---	---	--



CONE ID	: S15-CFIPM.2088	RIG	: CPT 011 - Unimog	CPTU ZERO VALUES			
CONE MODEL	: Subtraction	OPERATOR	: RK & PD	Transducer	Pre	Post	Difference
				Tip	269 mV	271 mV	0.023 MPa
				Sleeve	266 mV	268 mV	0.001 kPa
				Pore Pressure 2	290 mV	282 mV	-0.002 kPa
				X-Y Inclinator	2482 mV	2484 mV	



PointID

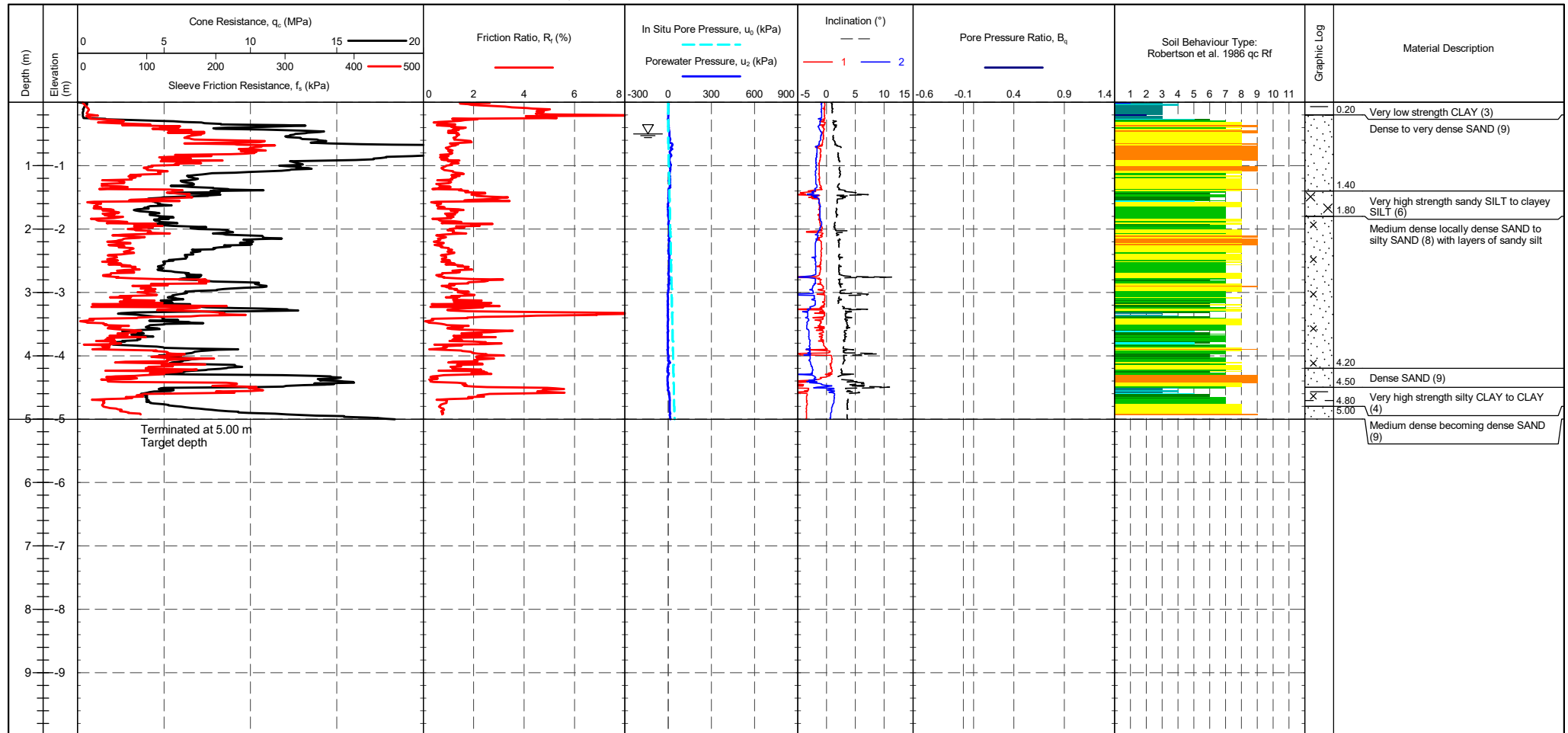
CPT05

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CALIBRATION DATE : 22/11/2022
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold
GROUNDWATER DEPTH : Assumed for calculation purposes

CPTU ZERO VALUES
Transducer Pre Post Difference
Tip 267 mV 266 mV -0.012 MPa
Sleeve 264 mV 265 mV 0.001 kPa
Pore Pressure 2 293 mV 282 mV -0.003 kPa
X-Y Inclinator 2485 mV 2499 mV

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material
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

Groundwater
Level

Dissipation Test



PointID

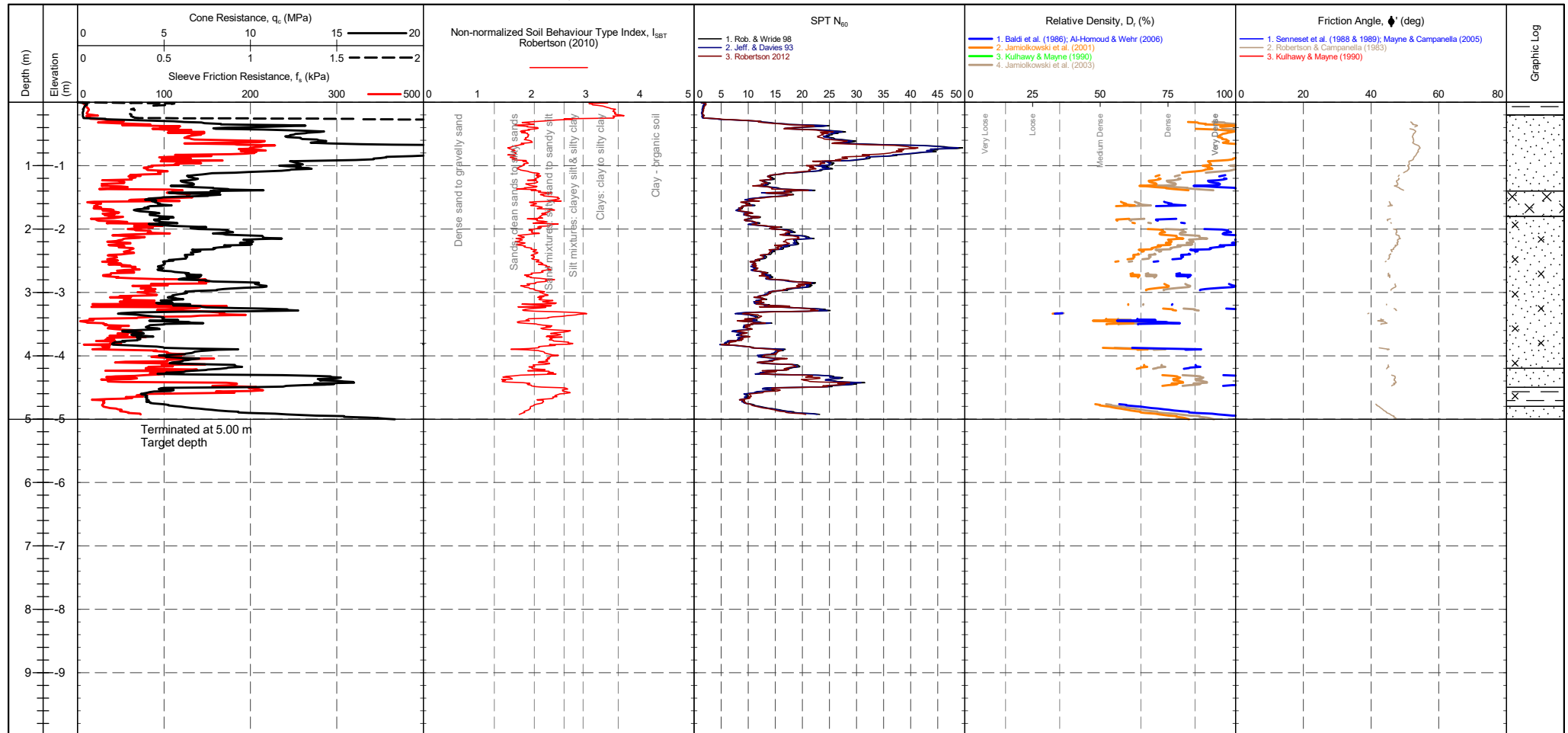
CPT05

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold

Transducer :
Tip :
Sleeve :
Pore Pressure 2 :
X-Y Inclinator :
CPTU ZERO VALUES
Pre :
Post :
Difference :
267 mV : 266 mV : -0.012 MPa
264 mV : 265 mV : 0.001 kPa
293 mV : 282 mV : -0.003 kPa
2485 mV : 2499 mV

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12

Description	SBT Index, I_c	Description	SPT N value, NSPT	Description	Relative Density D_r (%)
Clays	2.95-3.60	Very Loose	0 - 4	Very Loose	0 - 15
Silt mixtures	2.60-2.95	Loose	4 - 10	Loose	15 - 35
Sand mixtures	2.05-2.60	Medium Dense	10 - 30	Medium Dense	35 - 65
Sands	1.31-2.05	Dense	30 - 50	Dense	65 - 85
Gravelly sand	<1.31	Very Dense	>50	Very Dense	>85

Groundwater Level
Dissipation Test



PointID

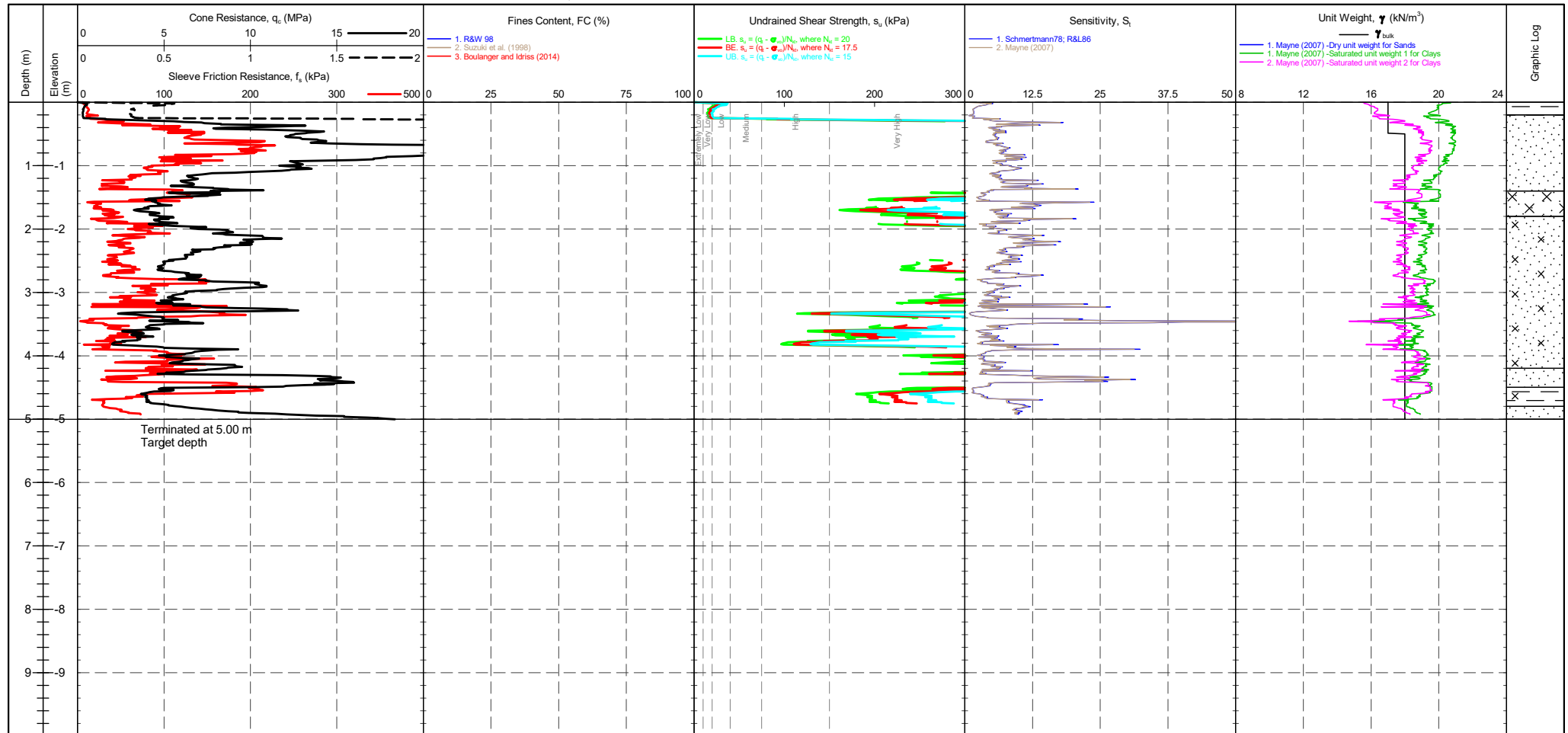
CPT05

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold

Transducer
Tip
Sleeve
Pore Pressure 2
X-Y Inclinator

CPTU ZERO VALUES

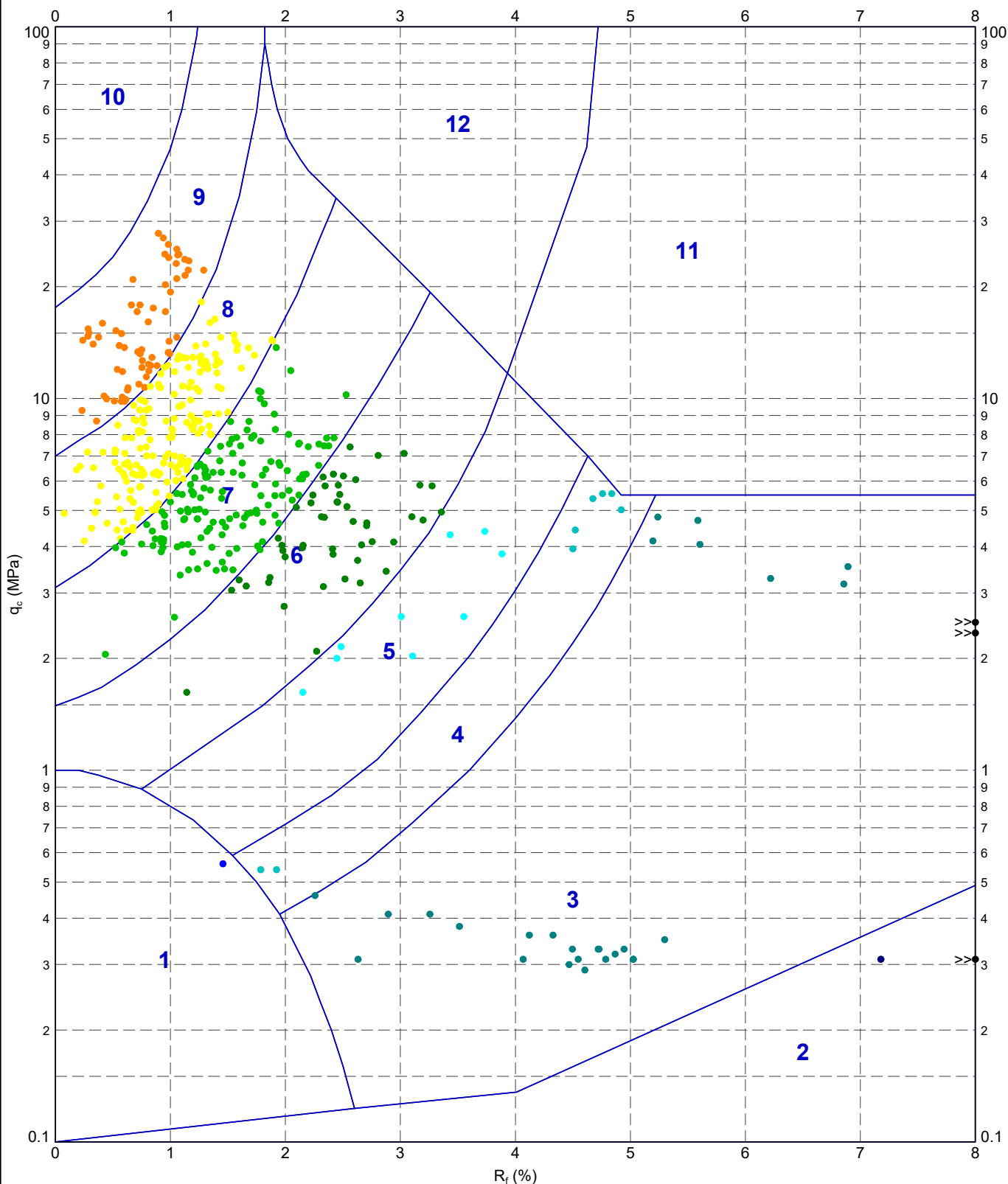
Pre	Post	Difference
267 mV	266 mV	-0.012 MPa
264 mV	265 mV	0.001 kPa
293 mV	282 mV	-0.003 kPa
2485 mV	2499 mV	

COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	s_u (kPa)	Term based on measurement	s_u (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater Level
Dissipation Test

220629-ADVANCED REPORT INSTITUSI 202.1 LUB - CHLOE GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF AP 1230169 MANCHESTER CITY CENTRE COLLEGE BROWNFIELD SOLUTIONS.GPJ <<DrawingFile>> 27/02/2023 13:27 10.03.00.09 Dalgel Lab and In Situ Tool - DGO [Lib: In Situ SI 2.02.0 2017-07-10 Proj: In Situ SI 2.02.0 2017-07-10



METHOD: Robertson et al. 1986 q_c vs R_f

- | | | | |
|-------------------------------------|-------------------------------|------------------------------|------------------------------|
| 1 - Sensitive fine grained material | 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 |

IN SITU
SITE INVESTIGATION

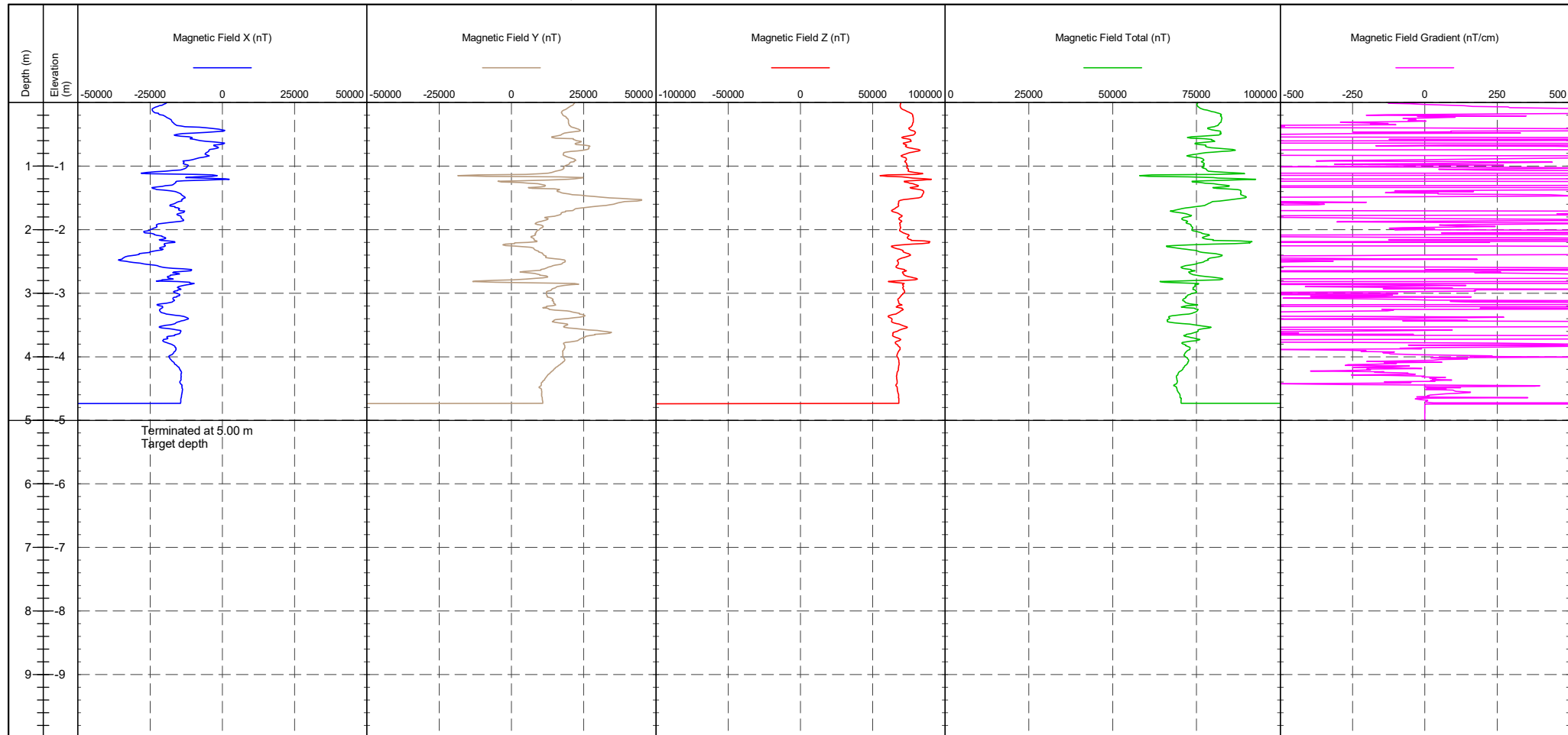
Brownfield Solutions
Manchester
Manchester City Centre College
Robertson et al. 1986 q_c vs. R_f - CPT05

DRAWN	DATE	27/02/2023
CHECKED	DATE	27/02/2023
SCALE	Not To Scale	
PROJECT No	FIGURE No	A4
1230169		



PointID	CPT05
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CLIENT : Brownfield Solutions PROJECT : Manchester City Centre College LOCATION : Manchester PROJECT No. : 1230169	EASTING : 0.000 m NORTHING : 0.000 m ELEVATION : 0.000 m OD CHECKED BY : LD TERMINATION REASON : Target depth	Remark: Test completed at target depth.	SHEET : 1 OF 1 STATUS : Final TEST DATE : 23/02/2023 PLOT DATE : 27/02/2023 METHOD : ISO 22476-1:2012
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CONE ID : S15-CFIPM.2088 CONE MODEL : Subtraction	RIG OPERATOR : CPT 011 - Unimog : RK & PD	CPTU ZERO VALUES <table> <tr> <th>Transducer</th><th>Pre</th><th>Post</th><th>Difference</th></tr> <tr> <td>Tip</td><td>267 mV</td><td>266 mV</td><td>-0.012 MPa</td></tr> <tr> <td>Sleeve</td><td>264 mV</td><td>265 mV</td><td>0.001 kPa</td></tr> <tr> <td>Pore Pressure 2</td><td>293 mV</td><td>282 mV</td><td>-0.003 kPa</td></tr> <tr> <td>X-Y Inclinator</td><td>2485 mV</td><td>2499 mV</td><td></td></tr> </table>	Transducer	Pre	Post	Difference	Tip	267 mV	266 mV	-0.012 MPa	Sleeve	264 mV	265 mV	0.001 kPa	Pore Pressure 2	293 mV	282 mV	-0.003 kPa	X-Y Inclinator	2485 mV	2499 mV		
Transducer	Pre	Post	Difference																				
Tip	267 mV	266 mV	-0.012 MPa																				
Sleeve	264 mV	265 mV	0.001 kPa																				
Pore Pressure 2	293 mV	282 mV	-0.003 kPa																				
X-Y Inclinator	2485 mV	2499 mV																					



PointID

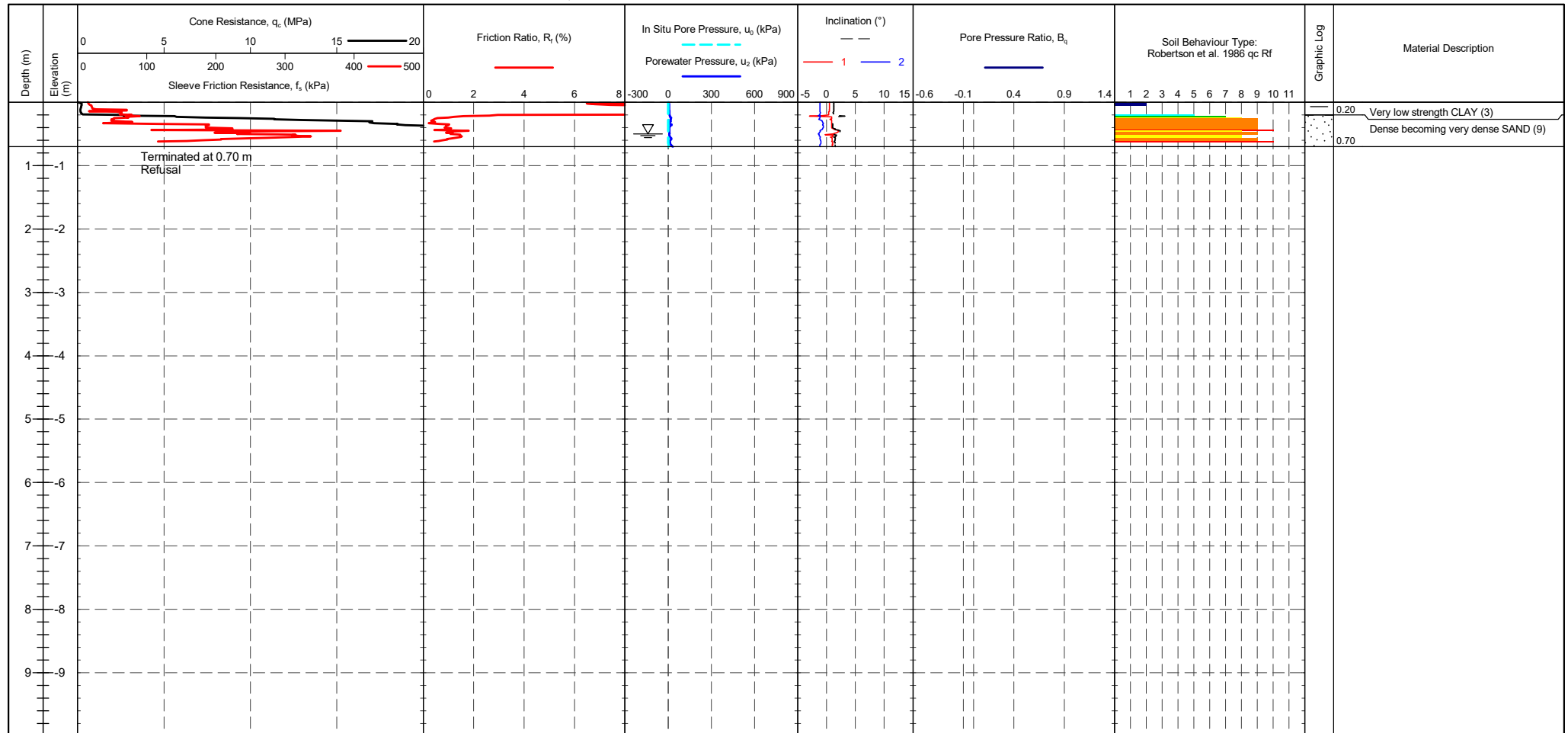
CPT06

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CALIBRATION DATE : 22/11/2022
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold
GROUNDWATER DEPTH : Assumed for calculation purposes

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip	266 mV	270 mV	0.046 MPa
Sleeve	263 mV	265 mV	0.001 kPa
Pore Pressure 2	287 mV	288 mV	0 kPa
X-Y Inclinator	2570 mV	2730 mV	

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material	5 - Clayey SILT to silty CLAY	9 - SAND
2 - Organic material	6 - Sandy SILT to clayey SILT	10 - Gravelly SAND to SAND
3 - CLAY	7 - Silty SAND to sandy SILT	11 - Very stiff fine grained
4 - Silty CLAY to CLAY	8 - SAND to silty SAND	12 - SAND to clayey SAND

Groundwater
Level

Dissipation Test



PointID

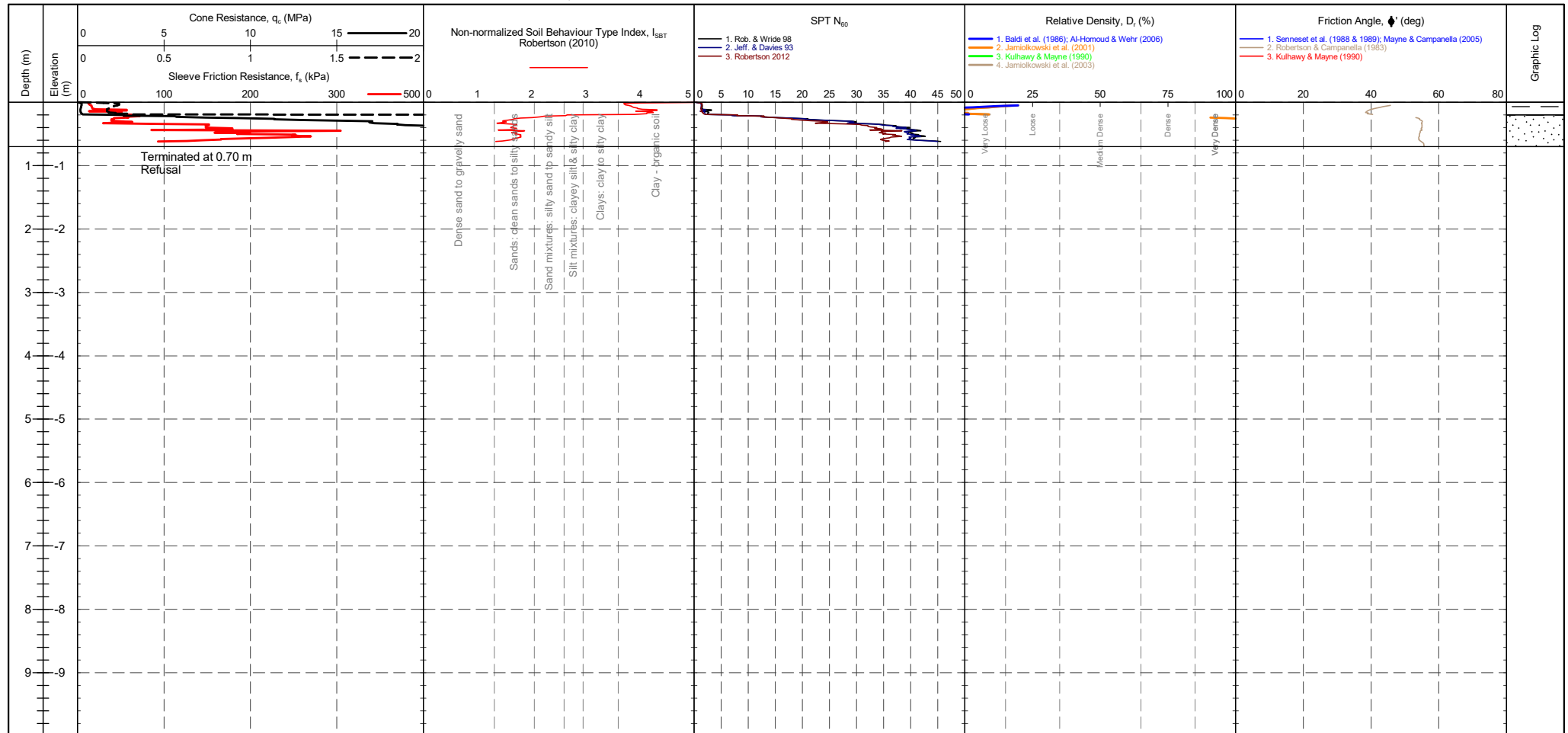
CPT06

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold

Transducer :
Tip :
Sleeve :
Pore Pressure 2 :
X-Y Inclinator :
CPTU ZERO VALUES
Pre :
Post :
Difference :
266 mV : 270 mV : 0.046 MPa
263 mV : 265 mV : 0.001 kPa
287 mV : 288 mV : 0 kPa
2570 mV : 2730 mV

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12

Description	SBT Index, I _c	Description	SPT N value, NSPT	Description	Relative Density D _r (%)
Clays	2.95-3.60	Very Loose	0 - 4	Very Loose	0 - 15
Silt mixtures	2.60-2.95	Loose	4 - 10	Loose	15 - 35
Sand mixtures	2.05-2.60	Medium Dense	10 - 30	Medium Dense	35 - 65
Sands	1.31-2.05	Dense	30 - 50	Dense	65 - 85
Gravelly sand	<1.31	Very Dense	>50	Very Dense	>85

Groundwater Level
Dissipation Test



PointID

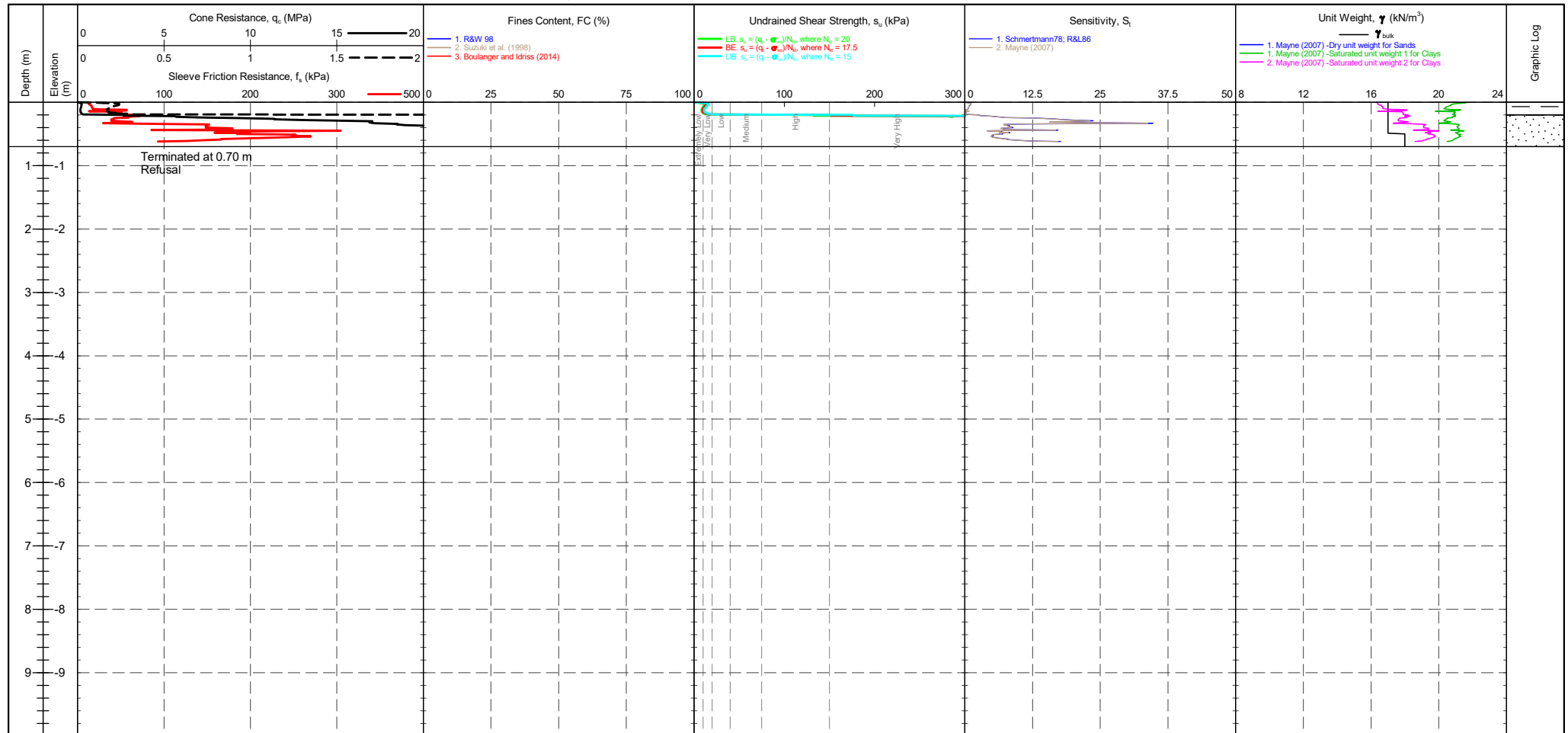
CPT06

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold

CPTU ZERO VALUES

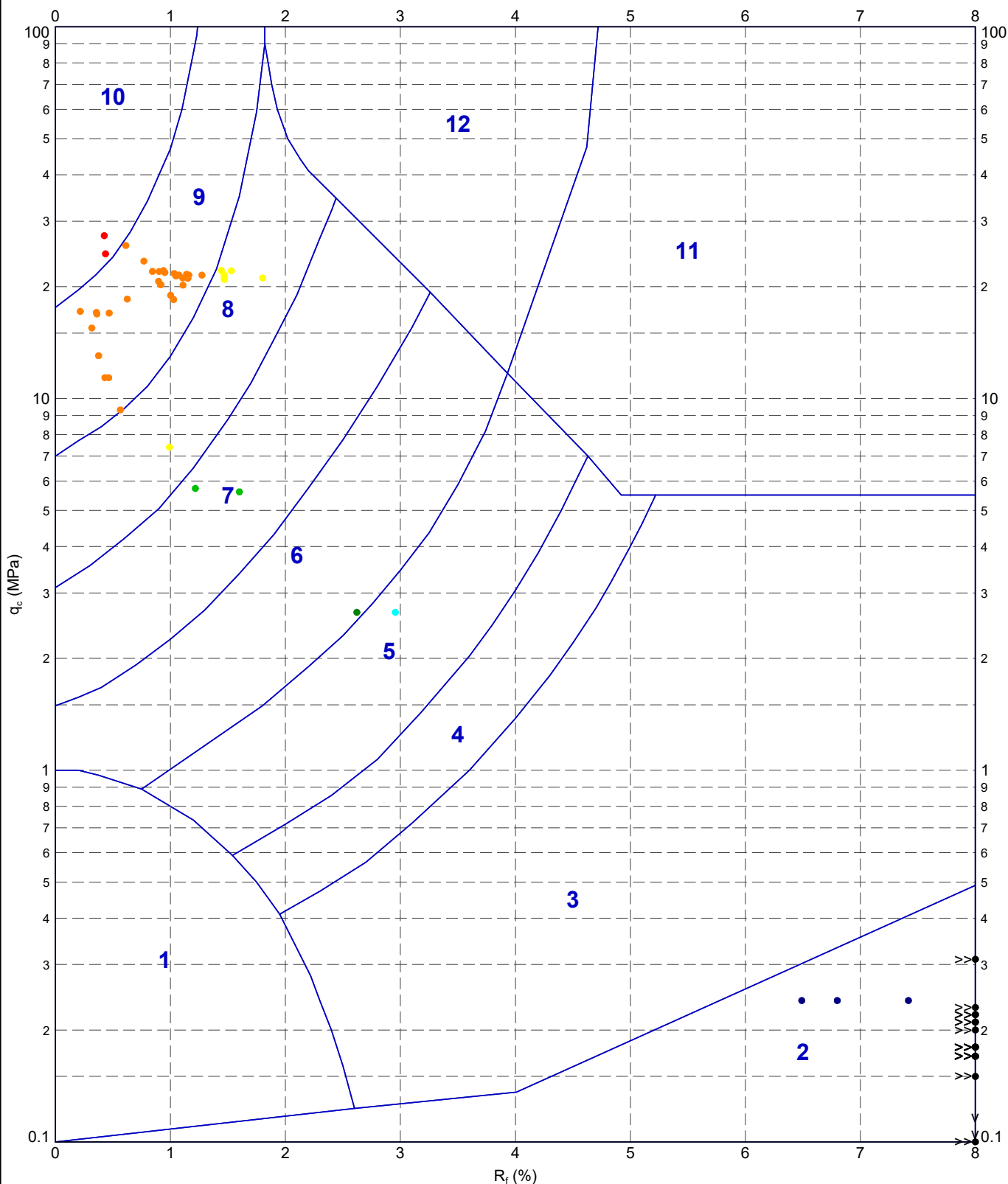
Transducer	Pre	Post	Difference
Tip	266 mV	270 mV	0.046 MPa
Sleeve	263 mV	265 mV	0.001 kPa
Pore Pressure 2	287 mV	288 mV	0 kPa
X-Y Inclinator	2570 mV	2730 mV	

COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	s_u (kPa)	Term based on measurement	s_u (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater Level
Dissipation Test

220629-ADVANCED REPORT INSTITUSI 2.02.1 LUB - CHLOE GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF APF 1230169 MANCHESTER CITY CENTRE COLLEGE BROWNFIELD SOLUTIONS.GPJ <<DrawingFile>> 27/02/2023 13:29 10.03.00.09 Dalgel Lab and In Situ Tool - DGD [Lib: In Situ SI 2.02.0 2017-07-10 Proj: In Situ SI 2.02.0 2017-07-10



METHOD: Robertson et al. 1986 qc R_f

1 - Sensitive fine grained material

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

IN SITU
SITE INVESTIGATION

TITLE

Brownfield Solutions
Manchester
Manchester City Centre College
Robertson et al. 1986 q_c vs. R_f - CPT06

DRAWN

DATE

27/02/2023

CHECKED

DATE

27/02/2023

SCALE

Not To Scale

A4

PROJECT No

1230169

FIGURE No



PointID

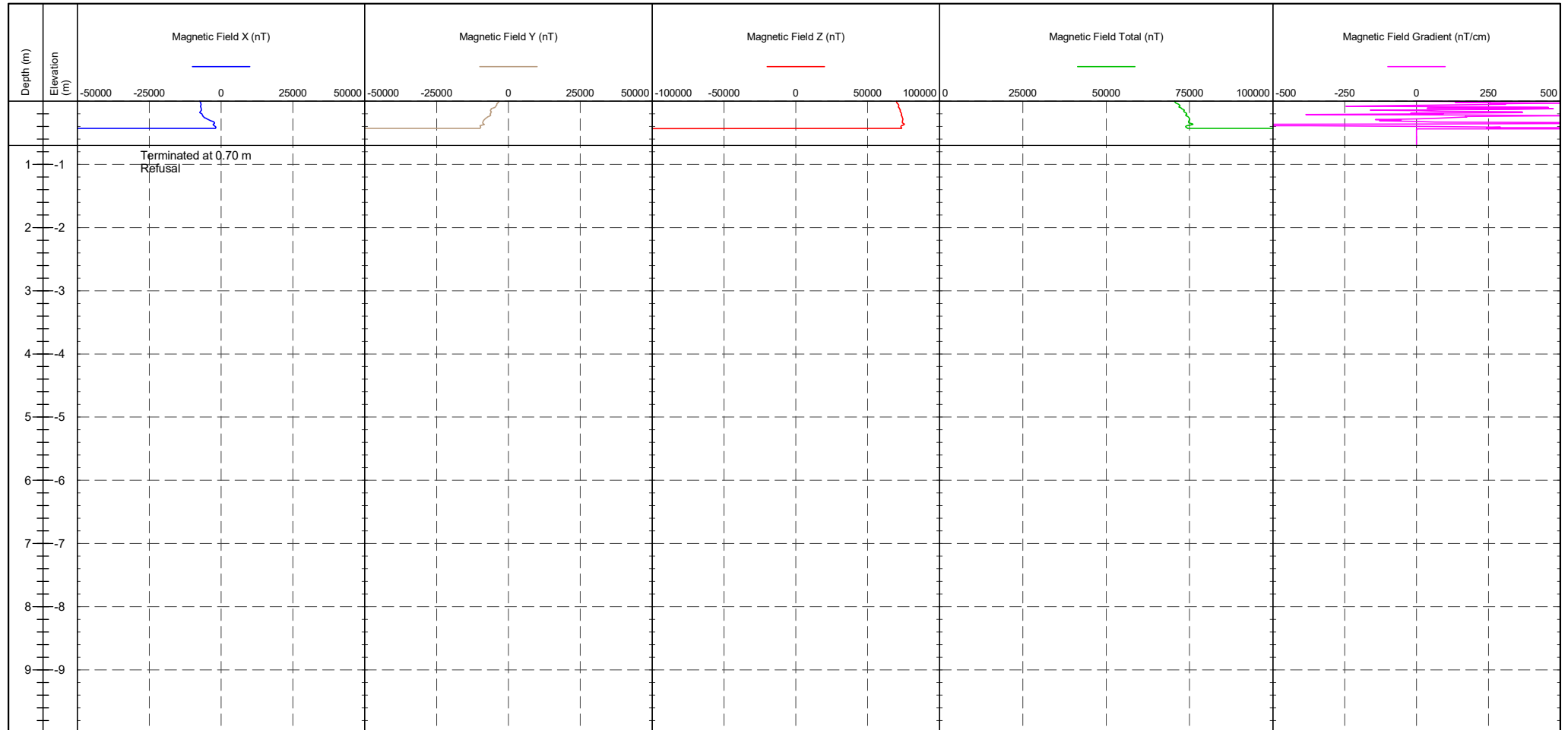
CPT06

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction

RIG : CPT 011 - Unimog
OPERATOR : RK & PD

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip	266 mV	270 mV	0.046 MPa
Sleeve	263 mV	265 mV	0.001 kPa
Pore Pressure 2	287 mV	288 mV	0 kPa
X-Y Inclinator	2570 mV	2730 mV	



PointID

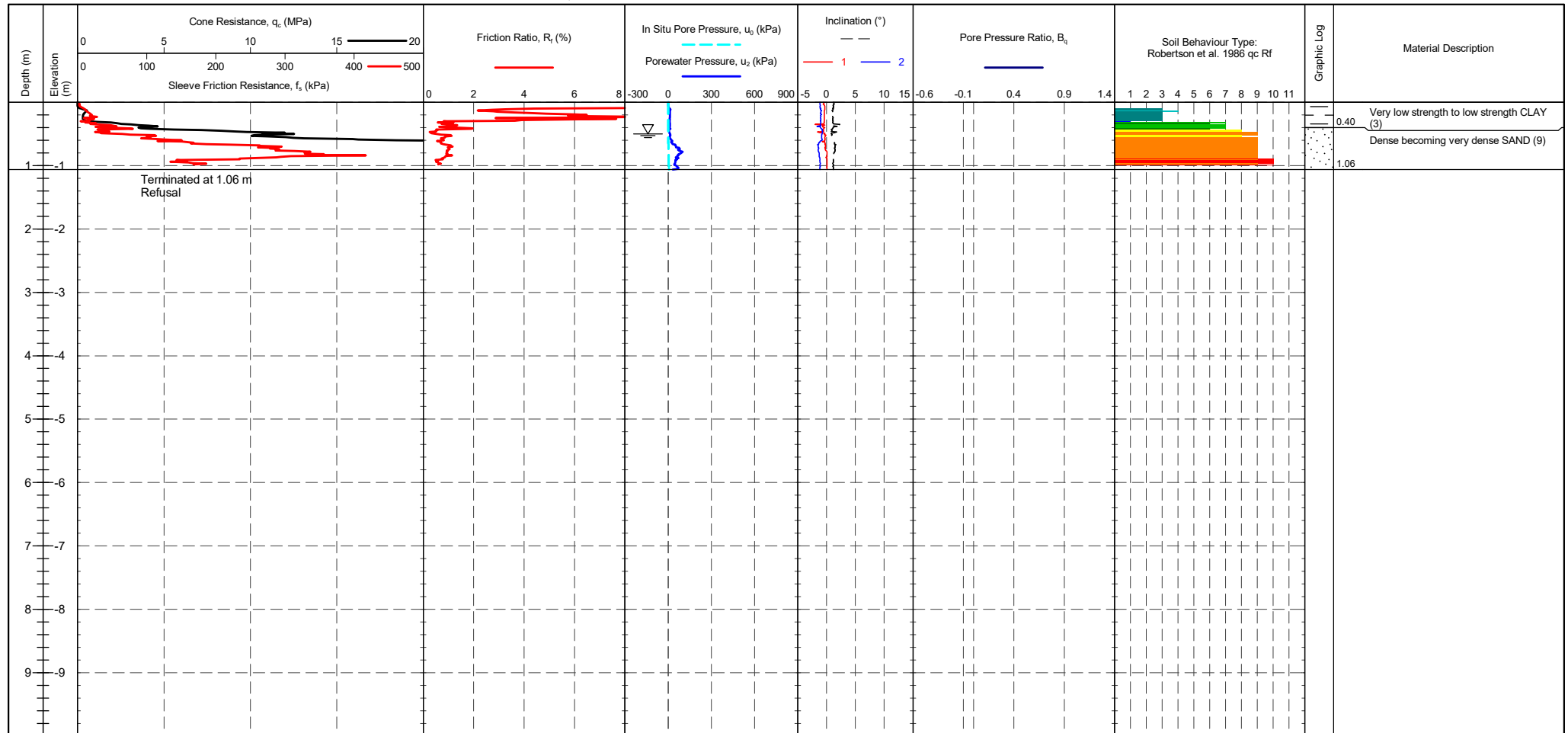
CPT07

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CALIBRATION DATE : 22/11/2022
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold
GROUNDWATER DEPTH : Assumed for calculation purposes

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip	267 mV	267 mV	0 MPa
Sleeve	264 mV	266 mV	0.001 kPa
Pore Pressure 2	286 mV	279 mV	-0.002 kPa
X-Y Inclinator	2476 mV	2483 mV	

METHOD: Robertson et al. 1986 $q_c R_f$

1 - Sensitive fine grained material	5 - Clayey SILT to silty CLAY	9 - SAND
2 - Organic material	6 - Sandy SILT to clayey SILT	10 - Gravelly SAND to SAND
3 - CLAY	7 - Silty SAND to sandy SILT	11 - Very stiff fine grained
4 - Silty CLAY to CLAY	8 - SAND to silty SAND	12 - SAND to clayey SAND

Groundwater
Level

Dissipation Test



PointID

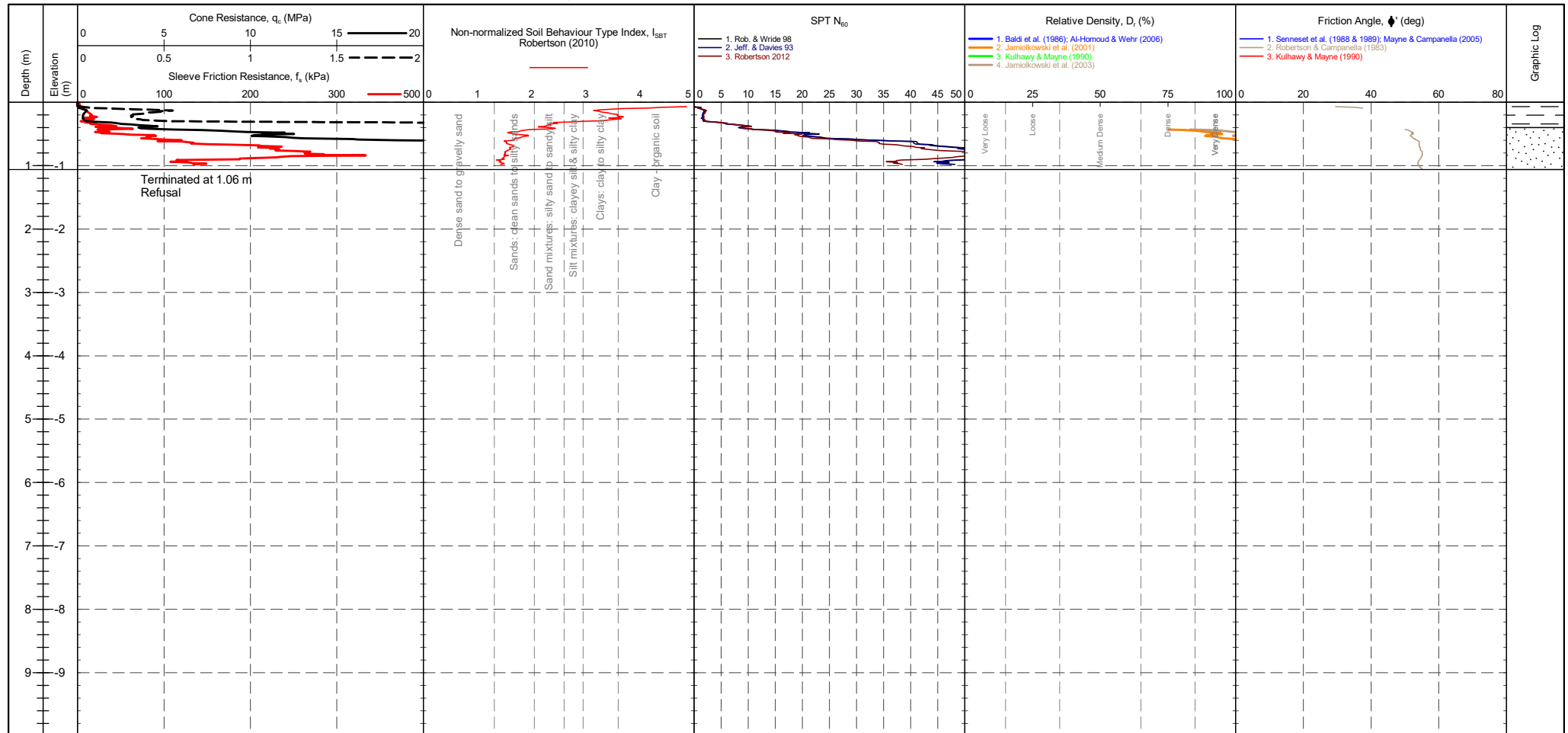
CPT07

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold

Transducer :
Tip :
Sleeve :
Pore Pressure 2 :
X-Y Inclinator :
CPTU ZERO VALUES
Pre :
Post :
Difference :
267 mV : 267 mV : 0 MPa
264 mV : 266 mV : 0.001 kPa
286 mV : 279 mV : -0.002 kPa
2476 mV : 2483 mV

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12			
Description	SBT Index, I _c	Description	SPT N value, NSPT
Clays	2.95-3.60	Very Loose	0 - 4
Silt mixtures	2.60-2.95	Loose	4 - 10
Sand mixtures	2.05-2.60	Medium Dense	10 - 30
Sands	1.31-2.05	Dense	30 - 50
Gravelly sand	<1.31	Very Dense	>50

Description	Relative Density D _r (%)
Very Loose	0 - 15
Loose	15 - 35
Medium Dense	35 - 65
Dense	65 - 85
Very Dense	>85

Groundwater
Level

Dissipation Test



PointID

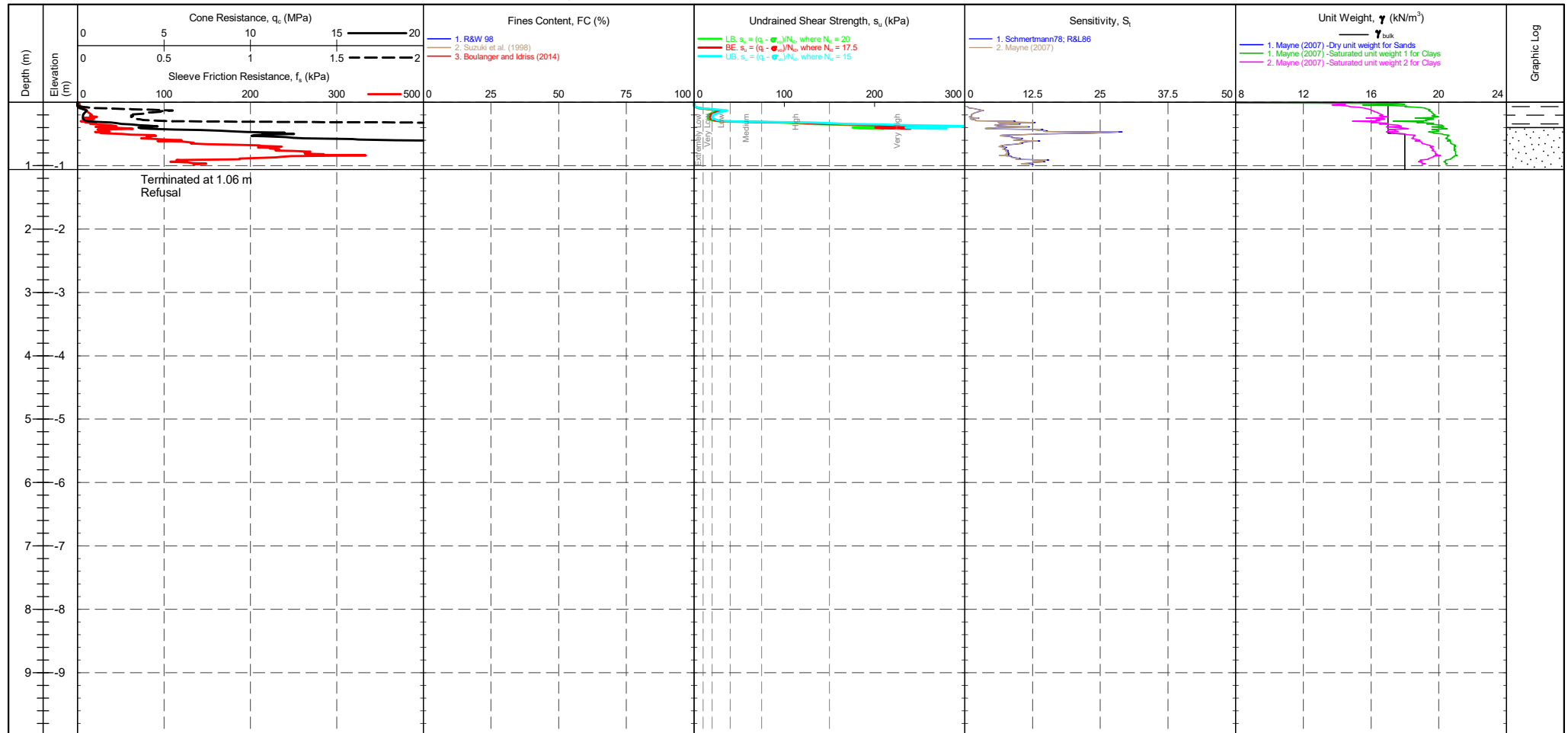
CPT07

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip	267 mV	267 mV	0 MPa
Sleeve	264 mV	266 mV	0.001 kPa
Pore Pressure 2	286 mV	279 mV	-0.002 kPa
X-Y Inclinator	2476 mV	2483 mV	

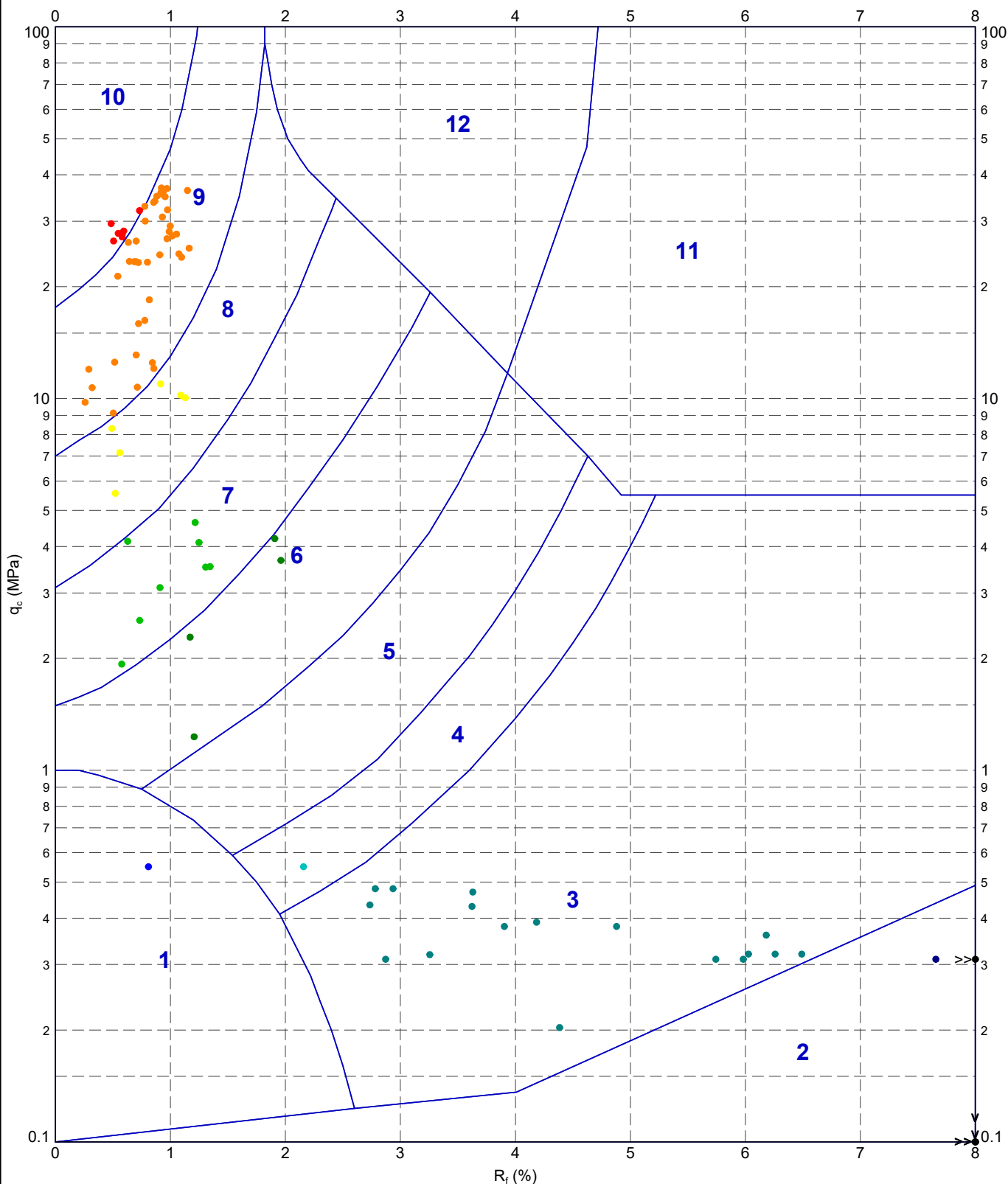
COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	su (kPa)	Term based on measurement	su (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater
Level

Dissipation Test

220629-ADVANCED REPORT INSTITUSI 202.1 LUB - CHLOE GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF AP 1230169 MANCHESTER CITY CENTRE COLLEGE BROWNFIELD SOLUTIONS.GPJ <<DrawingFile>> 27/02/2023 13:30 10.03.00.09 Dalgel Lab and In Situ Tool - DGD (Lib: In Situ SI 2.02.0 2017-07-10 Proj: In Situ SI 2.02.0 2017-07-10



METHOD: Robertson et al. 1986 qc Rf

- | | | | |
|-------------------------------------|-------------------------------|------------------------------|------------------------------|
| 1 - Sensitive fine grained material | 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 |

IN SITU
SITE INVESTIGATION

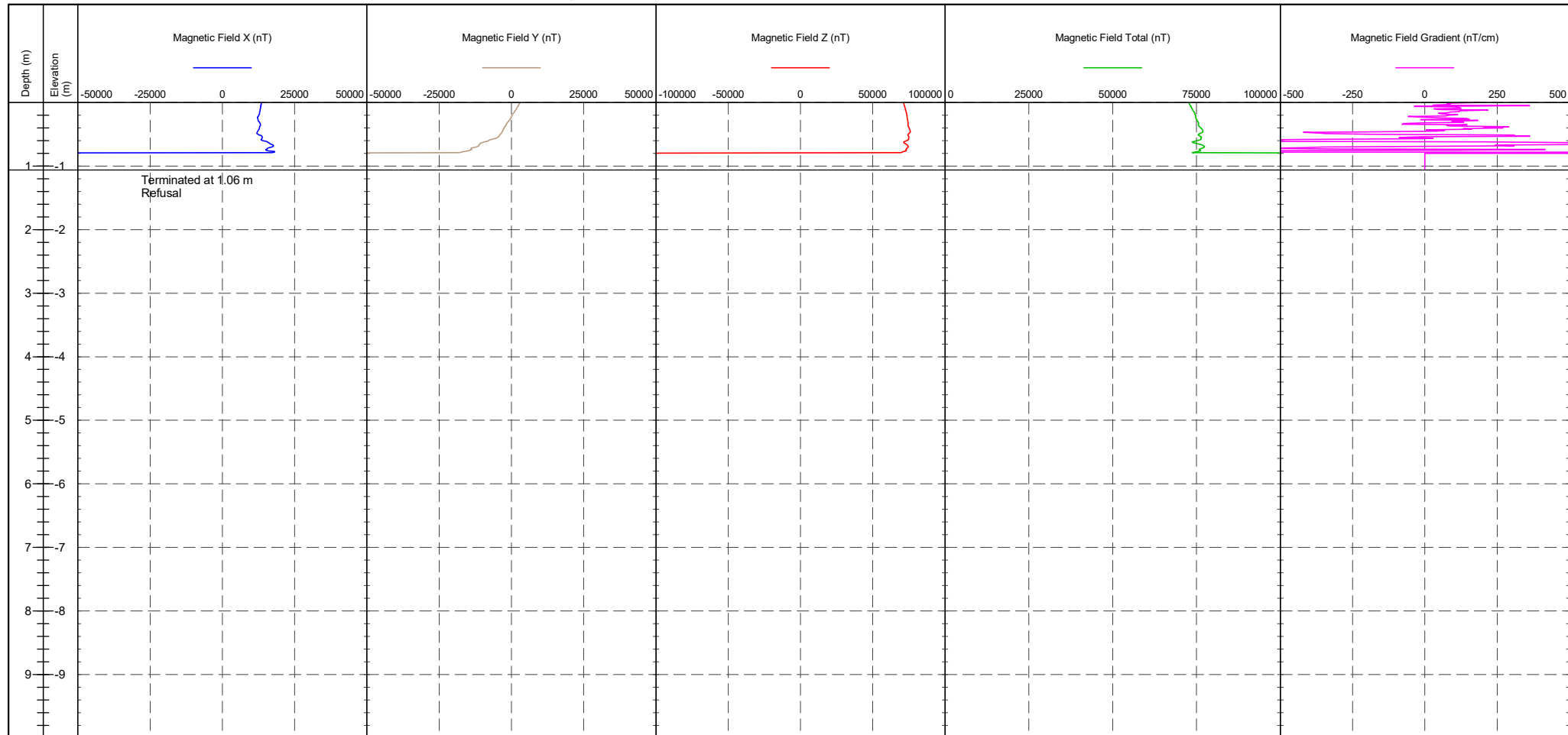
Brownfield Solutions
Manchester
Manchester City Centre College
Robertson et al. 1986 q_c vs. R_f - CPT07

DRAWN	DATE	27/02/2023
CHECKED	DATE	27/02/2023
SCALE	Not To Scale	
PROJECT No	FIGURE No	A4
1230169		



PointID	CPT07
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CLIENT : Brownfield Solutions PROJECT : Manchester City Centre College LOCATION : Manchester PROJECT No. : 1230169	EASTING : 0.000 m NORTHING : 0.000 m ELEVATION : 0.000 m OD CHECKED BY : LD TERMINATION REASON : Refusal	Remark: Test refused on total pressure.	SHEET : 1 OF 1 STATUS : Final TEST DATE : 23/02/2023 PLOT DATE : 27/02/2023 METHOD : ISO 22476-1:2012
---	---	---	--



CONE ID : S15-CFIPM.2088	RIG : CPT 011 - Unimog	CPTU ZERO VALUES			
CONE MODEL : Subtraction	OPERATOR : RK & PD	Transducer	Pre	Post	Difference
		Tip	267 mV	267 mV	0 MPa
		Sleeve	264 mV	266 mV	0.001 kPa
		Pore Pressure 2	286 mV	279 mV	-0.002 kPa
		X-Y Inclinator	2476 mV	2483 mV	



PointID

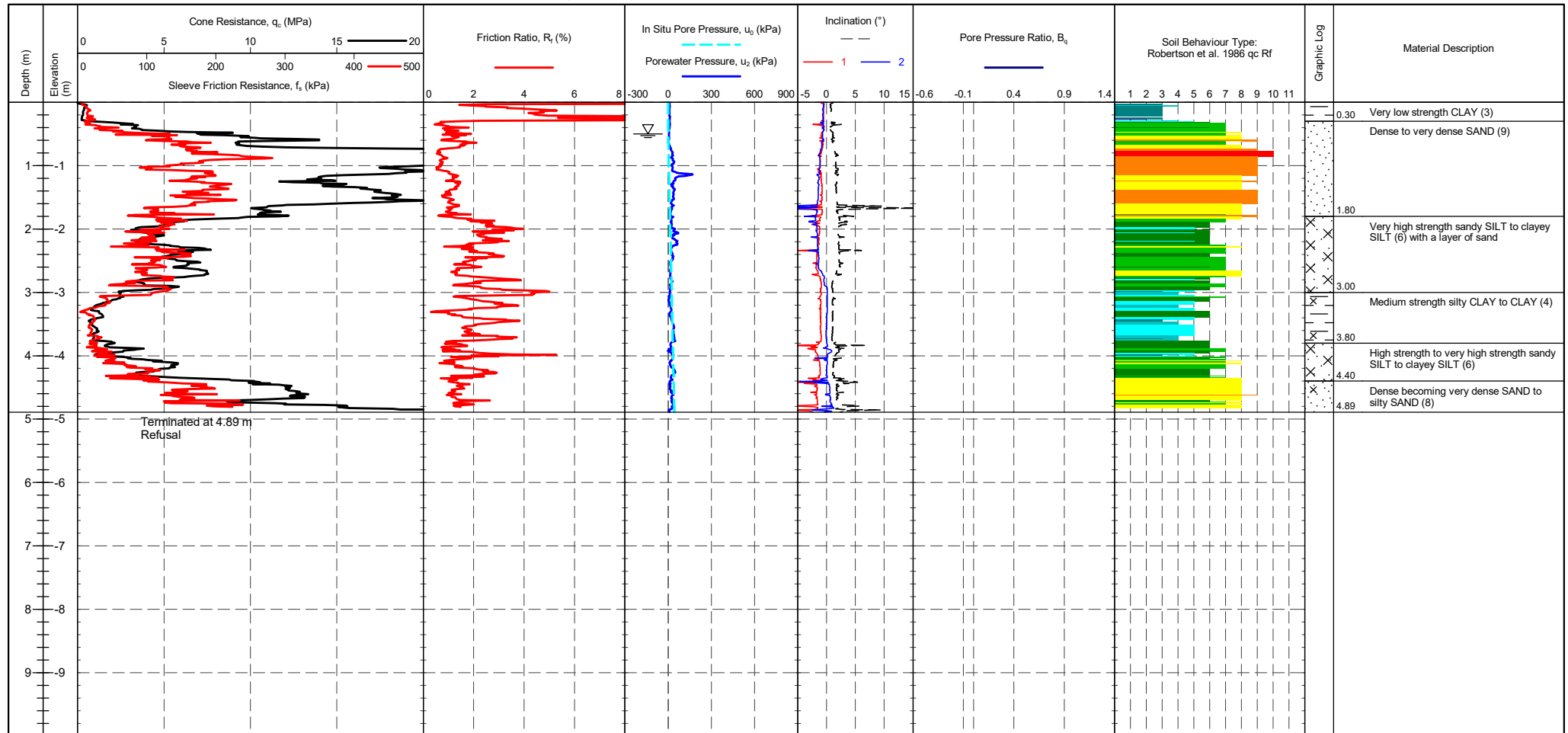
CPT08

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CALIBRATION DATE : 22/11/2022
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold
GROUNDWATER DEPTH : Assumed for calculation purposes

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip	268 mV	268 mV	0 MPa
Sleeve	262 mV	266 mV	0.003 kPa
Pore Pressure 2	299 mV	294 mV	-0.001 kPa
X-Y Inclinator	2437 mV	2479 mV	

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material	5 - Clayey SILT to silty CLAY	9 - SAND
2 - Organic material	6 - Sandy SILT to clayey SILT	10 - Gravelly SAND to SAND
3 - CLAY	7 - Silty SAND to sandy SILT	11 - Very stiff fine grained
4 - Silty CLAY to CLAY	8 - SAND to silty SAND	12 - SAND to clayey SAND

Groundwater
Level

Dissipation Test



PointID

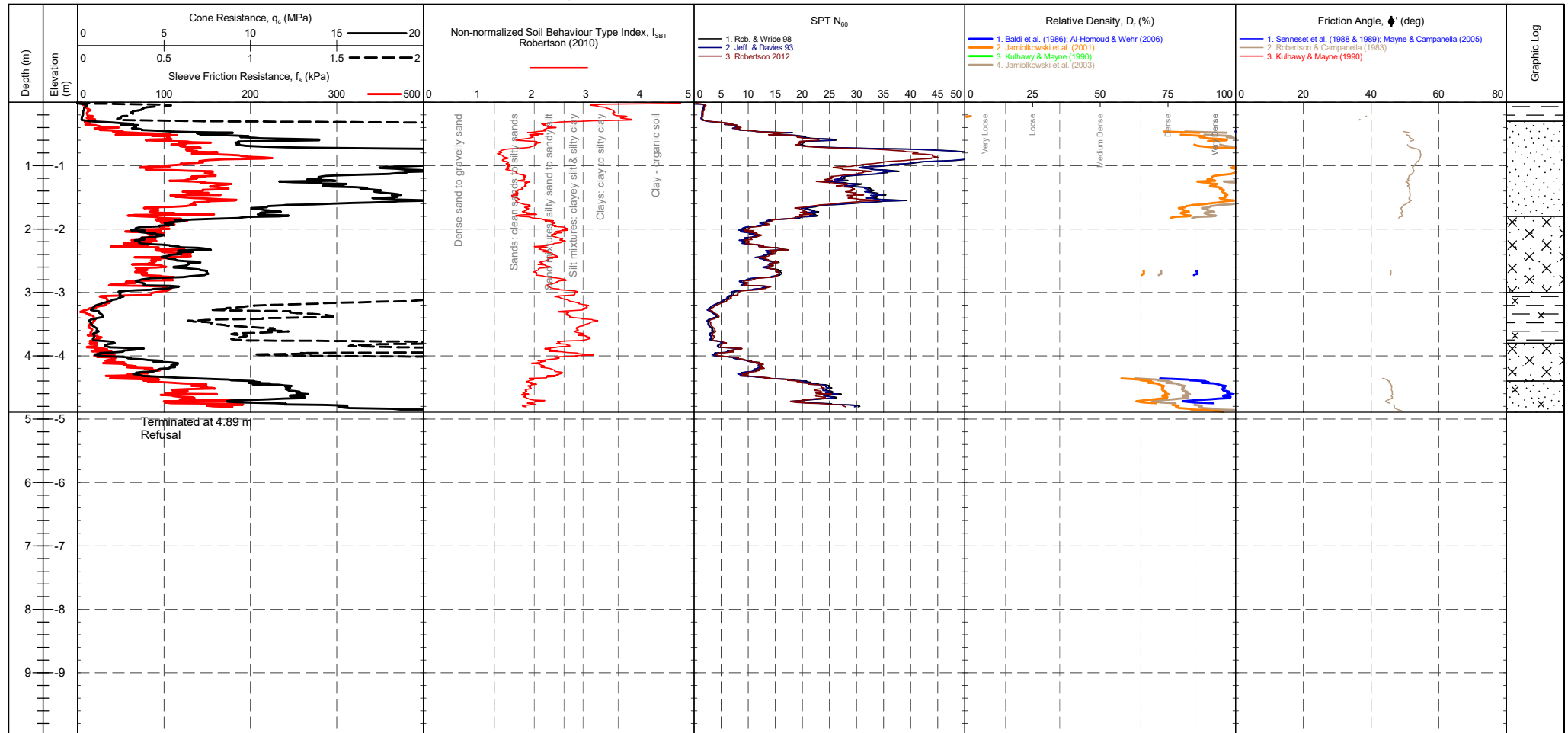
CPT08

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold

Transducer :
Tip :
Sleeve :
Pore Pressure 2 :
X-Y Inclinator :
CPTU ZERO VALUES
Pre :
Post :
Difference :
268 mV : 268 mV : 0 MPa
262 mV : 266 mV : 0.003 kPa
299 mV : 294 mV : -0.001 kPa
2437 mV : 2479 mV

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12				
Description	SBT Index, I_c	Description	SPT N value, NSPT	Description
Clays	2.95-3.60	Very Loose	0 - 4	Very Loose
Silt mixtures	2.60-2.95	Loose	4 - 10	Loose
Sand mixtures	2.05-2.60	Medium Dense	10 - 30	Medium Dense
Sands	1.31-2.05	Dense	30 - 50	Dense
Gravelly sand	<1.31	Very Dense	>50	Very Dense

Groundwater Level
Dissipation Test



PointID

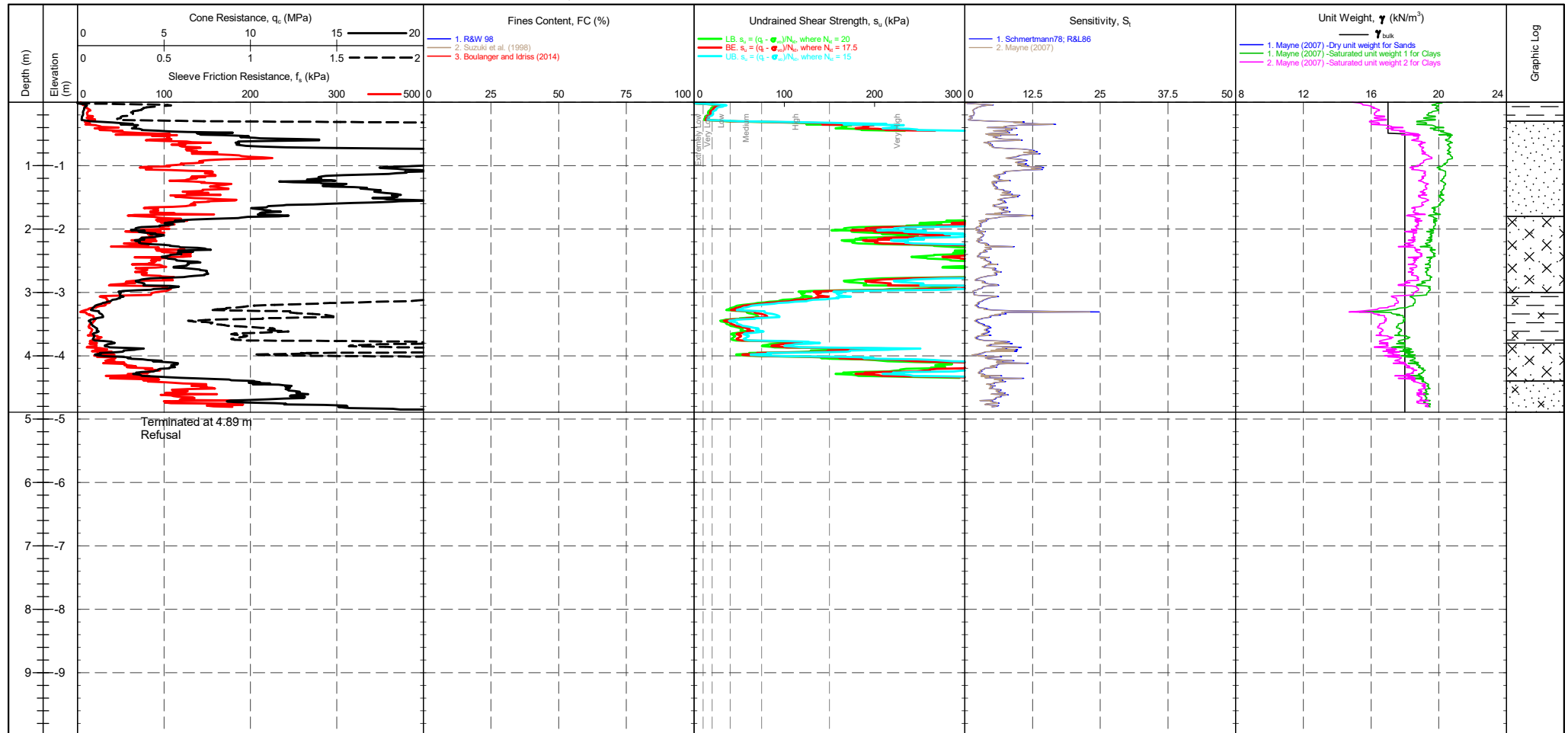
CPT08

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip	268 mV	268 mV	0 MPa
Sleeve	262 mV	266 mV	0.003 kPa
Pore Pressure 2	299 mV	294 mV	-0.001 kPa
X-Y Inclinator	2437 mV	2479 mV	

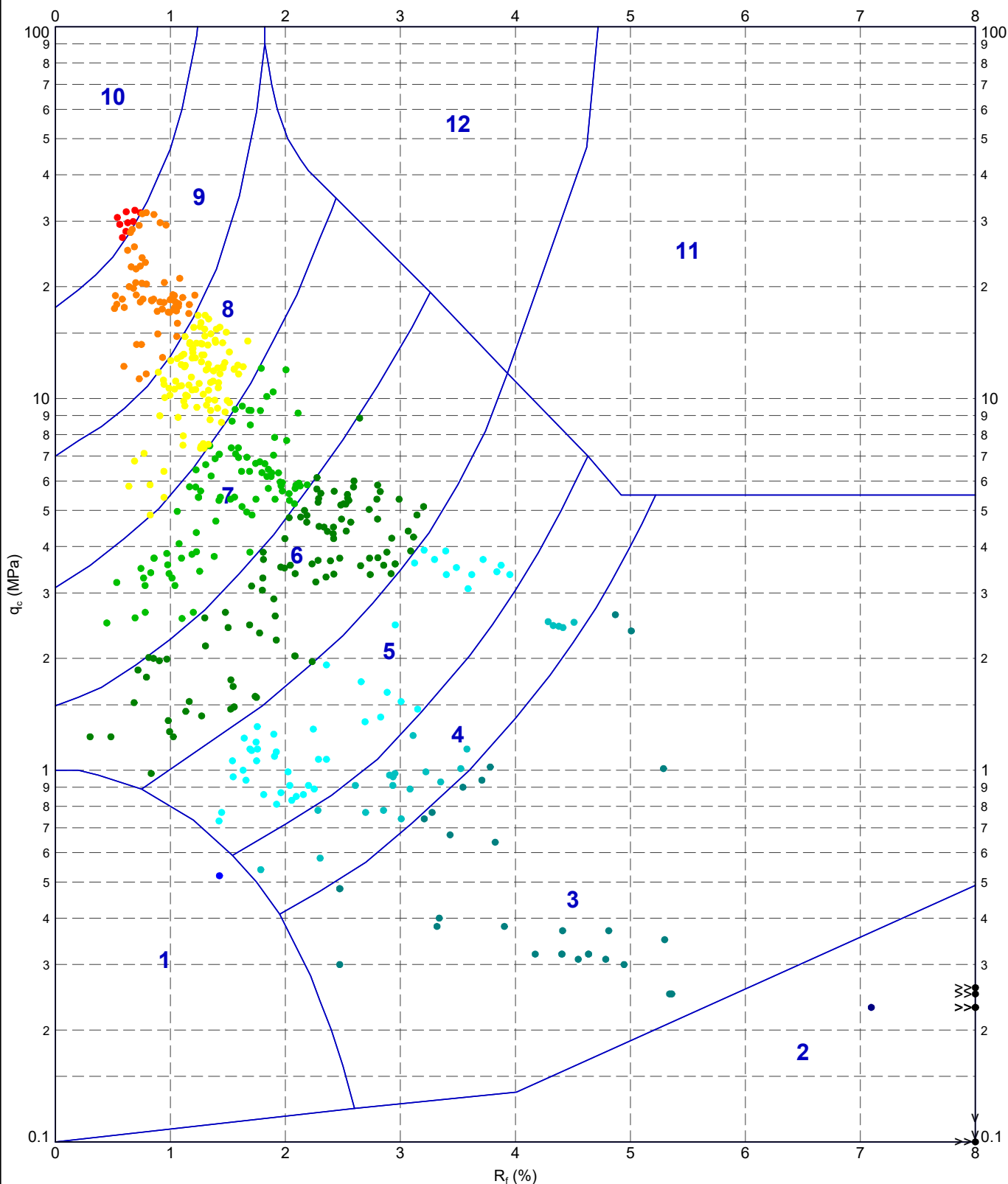
COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	s_u (kPa)	Term based on measurement	s_u (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater Level

Dissipation Test

220629-ADVANCED REPORT INSTITUTION 202.1 LUB - CHLOE GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF MAP 1230169 MANCHESTER CITY CENTRE COLLEGE BROWNFIELD SOLUTIONS.GPJ <<DrawingFile>> 27/02/2023 13:31 10.03.00.09 Dalglish Lab and In Situ Tool - DGD [Lib: In Situ SI 2.02.0 2017-07-10 Proj: In Situ SI 2.02.0 2017-07-10



METHOD: Robertson et al. 1986 qc Rf

- | | | | |
|-------------------------------------|-------------------------------|------------------------------|------------------------------|
| 1 - Sensitive fine grained material | 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 |

IN SITU
SITE INVESTIGATION

Brownfield Solutions
Manchester
Manchester City Centre College
Robertson et al. 1986 q_c vs. R_f - CPT08

DRAWN	DATE	27/02/2023
CHECKED	DATE	27/02/2023
SCALE	Not To Scale	
PROJECT No	FIGURE No	A4
1230169		



PointID

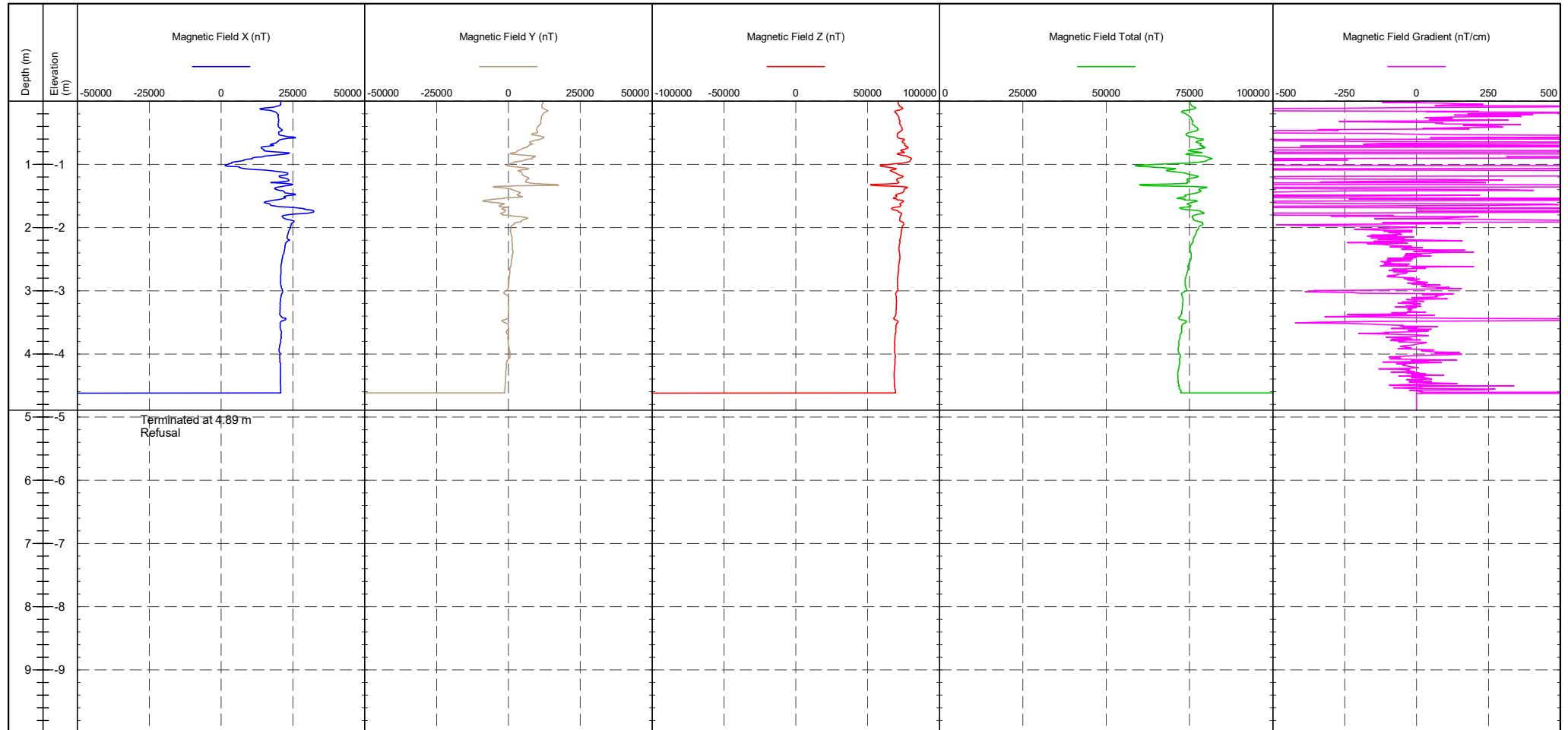
CPT08

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction

RIG OPERATOR : CPT 011 - Unimog
: RK & PD

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip	268 mV	268 mV	0 MPa
Sleeve	262 mV	266 mV	0.003 kPa
Pore Pressure 2	299 mV	294 mV	-0.001 kPa
X-Y Inclinator	2437 mV	2479 mV	



PointID

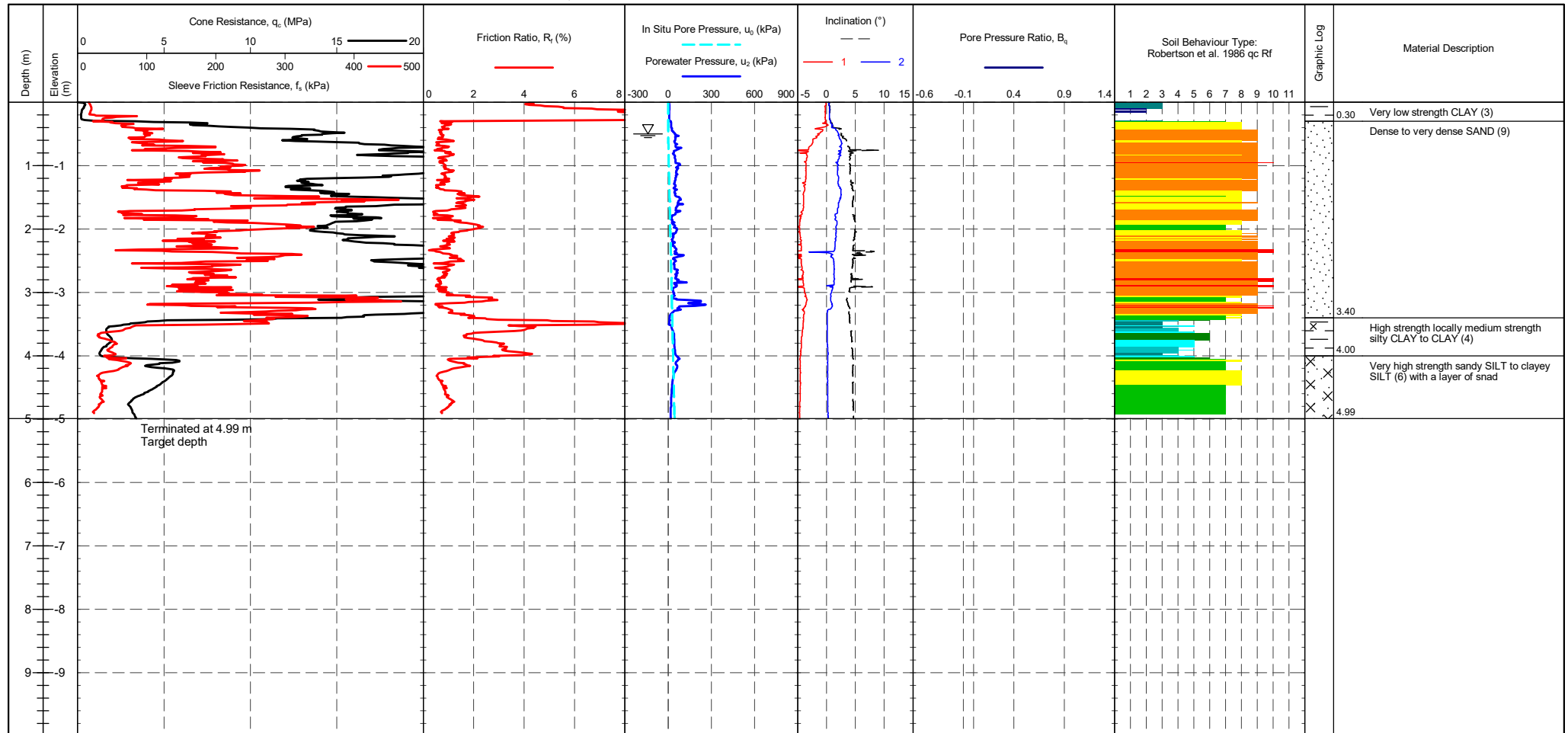
CPT09

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CALIBRATION DATE : 22/11/2022
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold
GROUNDWATER DEPTH : Assumed for calculation purposes

CPTU ZERO VALUES
Transducer Pre Post Difference
Tip 267 mV 262 mV -0.058 MPa
Sleeve 259 mV 261 mV 0.001 kPa
Pore Pressure 2 349 mV 378 mV 0.008 kPa
X-Y Inclinator 2488 mV 2487 mV

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material
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

Groundwater
Level

Dissipation Test



PointID

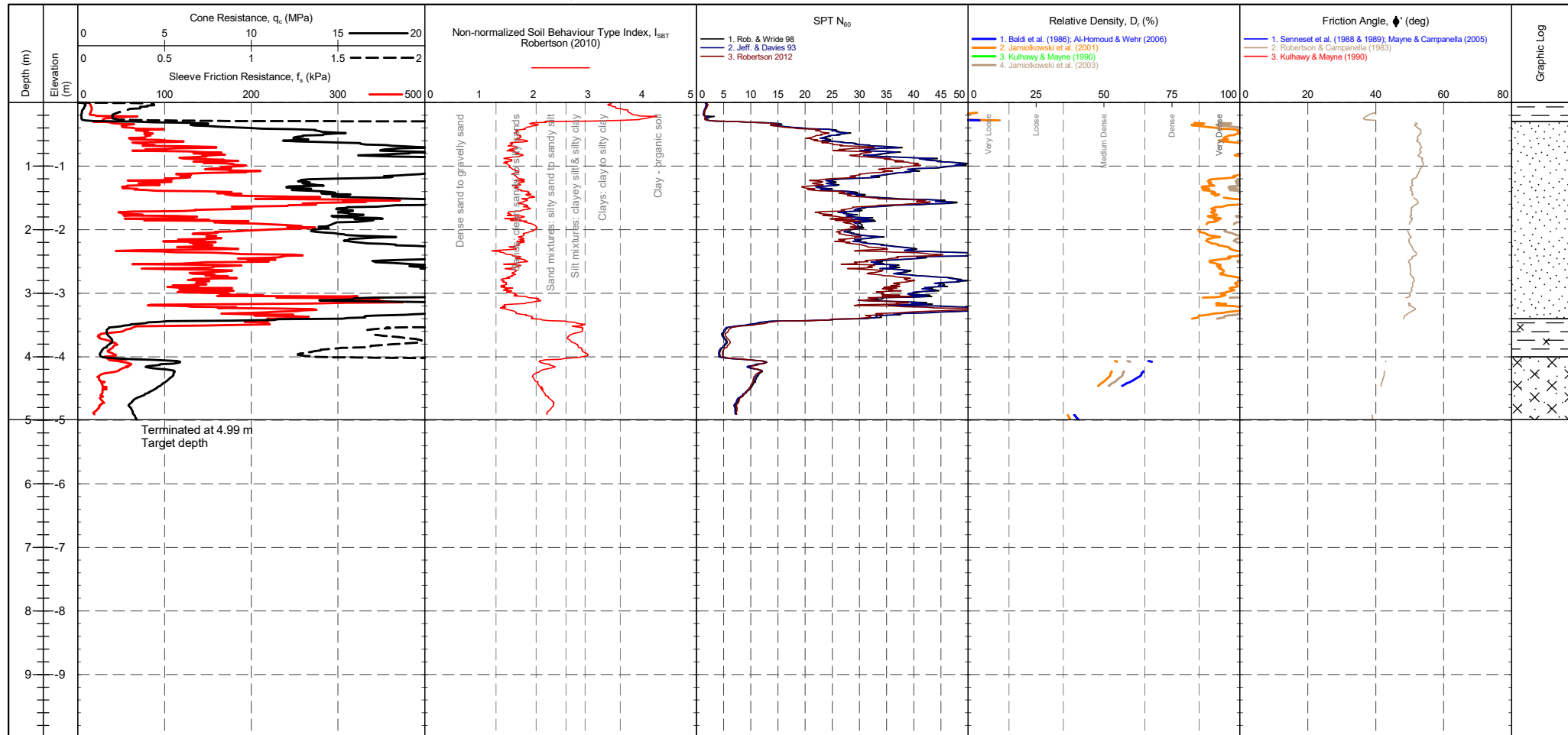
CPT09

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold

Transducer
Tip
Sleeve
Pore Pressure 2
X-Y Inclinator

CPTU ZERO VALUES

Pre	Post	Difference
267 mV	262 mV	-0.058 MPa
259 mV	261 mV	0.001 kPa
349 mV	378 mV	0.008 kPa
2488 mV	2487 mV	

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12

Description	SBT Index, I_c	Description	SPT N value, NSPT	Description	Relative Density D_r (%)
Clays	2.95-3.60	Very Loose	0 - 4	Very Loose	0 - 15
Silt mixtures	2.60-2.95	Loose	4 - 10	Loose	15 - 35
Sand mixtures	2.05-2.60	Medium Dense	10 - 30	Medium Dense	35 - 65
Sands	1.31-2.05	Dense	30 - 50	Dense	65 - 85
Gravelly sand	<1.31	Very Dense	>50	Very Dense	>85

Groundwater Level
Dissipation Test



PointID

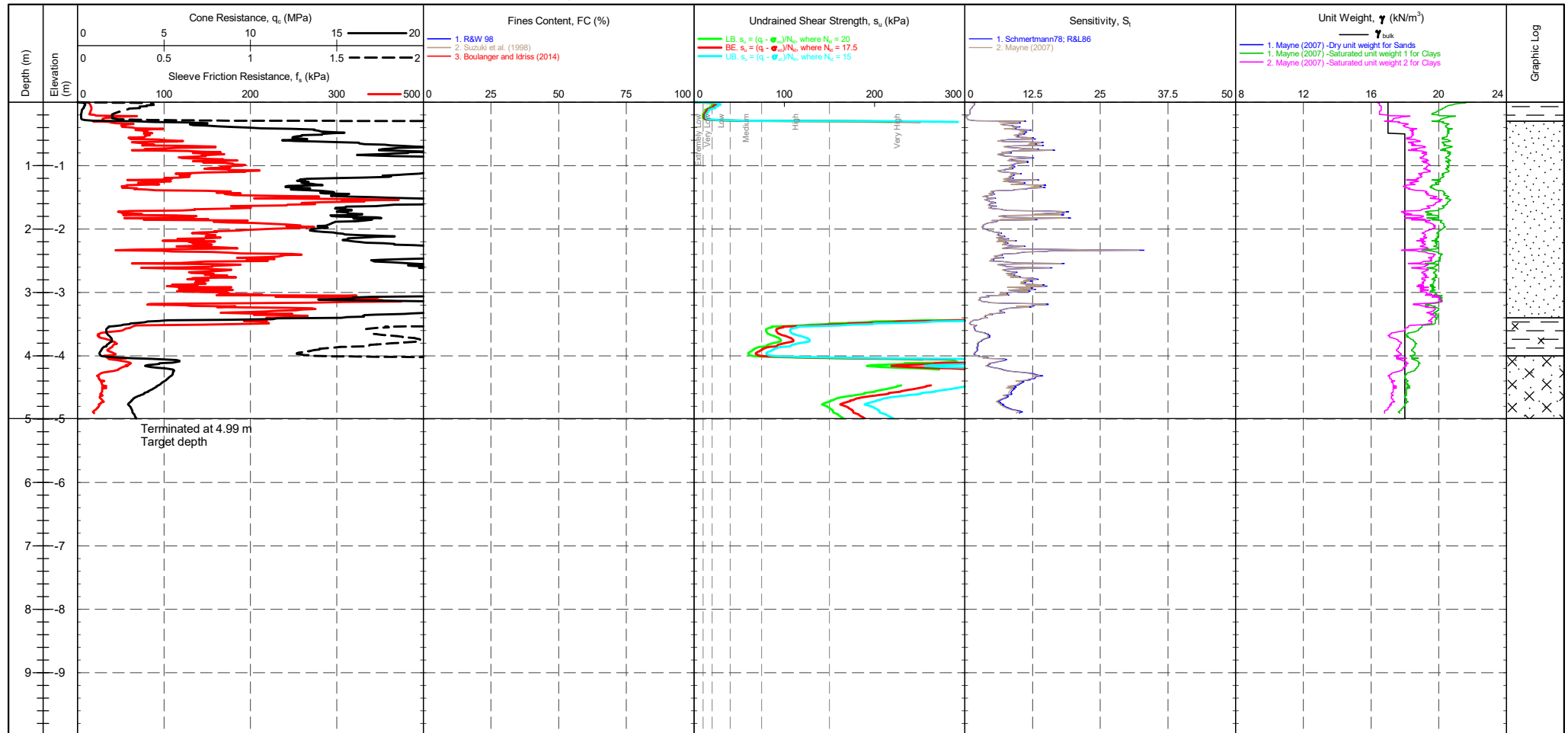
CPT09

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold

Transducer
Tip
Sleeve
Pore Pressure 2
X-Y Inclinator

CPTU ZERO VALUES

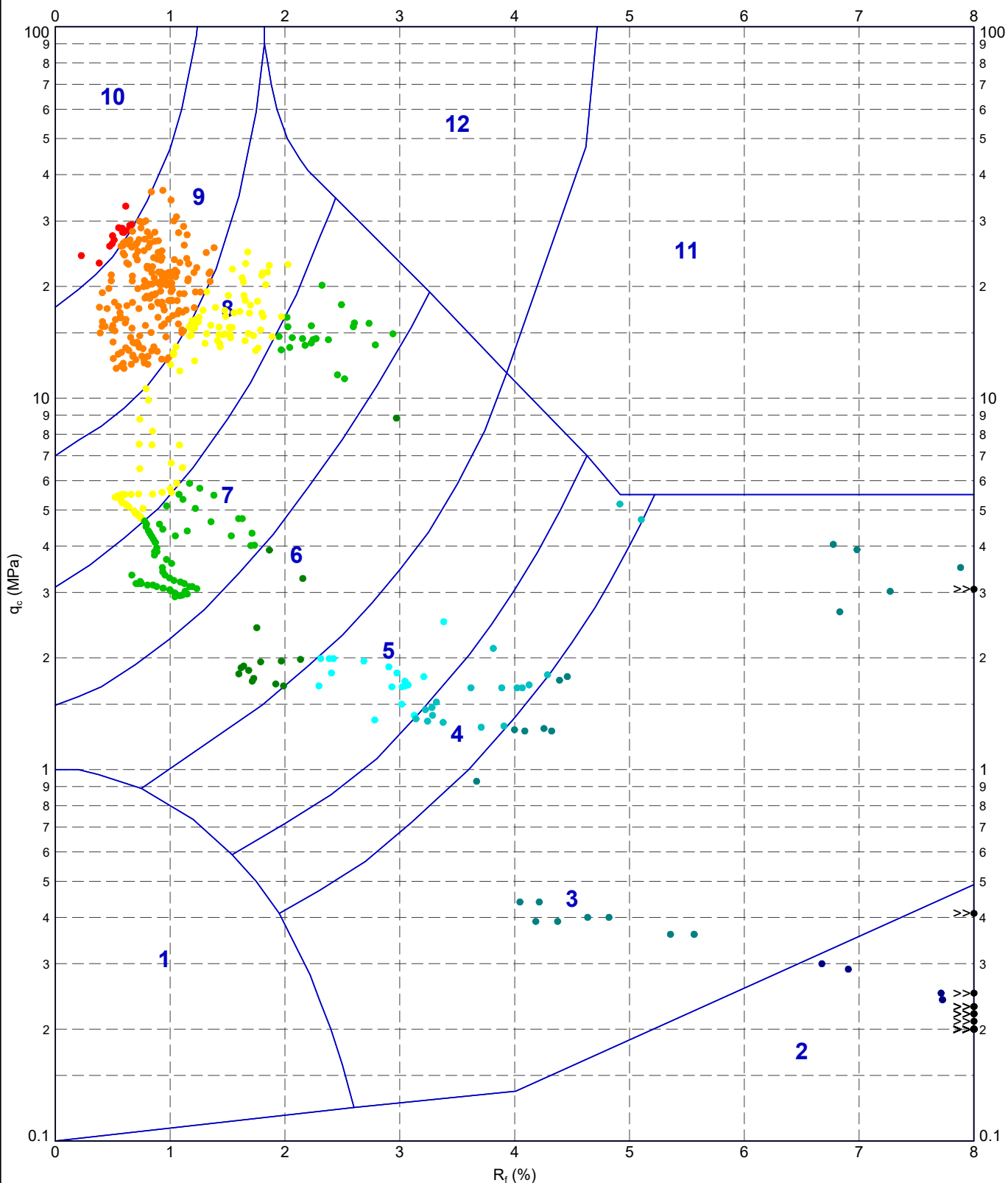
Pre	Post	Difference
267 mV	262 mV	-0.058 MPa
259 mV	261 mV	0.001 kPa
349 mV	378 mV	0.008 kPa
2488 mV	2487 mV	

COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	s_u (kPa)	Term based on measurement	s_u (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater Level
Dissipation Test

22069-ADVANCED REPORT INSTITUSI 202.1 LUB - CHLOE GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF AP 1230169 MANCHESTER CITY CENTRE COLLEGE BROWNFIELD SOLUTIONS.GPJ <<DrawingFile>> 27/02/2023 13:32: 10.03.00.09 Dalgel Lab and In Situ Tool - DGD [Lib: In Situ SI 2.02.0 2017-07-10 Proj: In Situ SI 2.02.0 2017-07-10



METHOD: Robertson et al. 1986 qc Rf

- | | | | |
|-------------------------------------|-------------------------------|------------------------------|------------------------------|
| 1 - Sensitive fine grained material | 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 |

IN SITU
SITE INVESTIGATION

Brownfield Solutions
Manchester
Manchester City Centre College
Robertson et al. 1986 qc vs. Rf - CPT09

DRAWN	DATE	27/02/2023
CHECKED	DATE	27/02/2023
SCALE	Not To Scale	
PROJECT No	FIGURE No	A4
1230169		



PointID

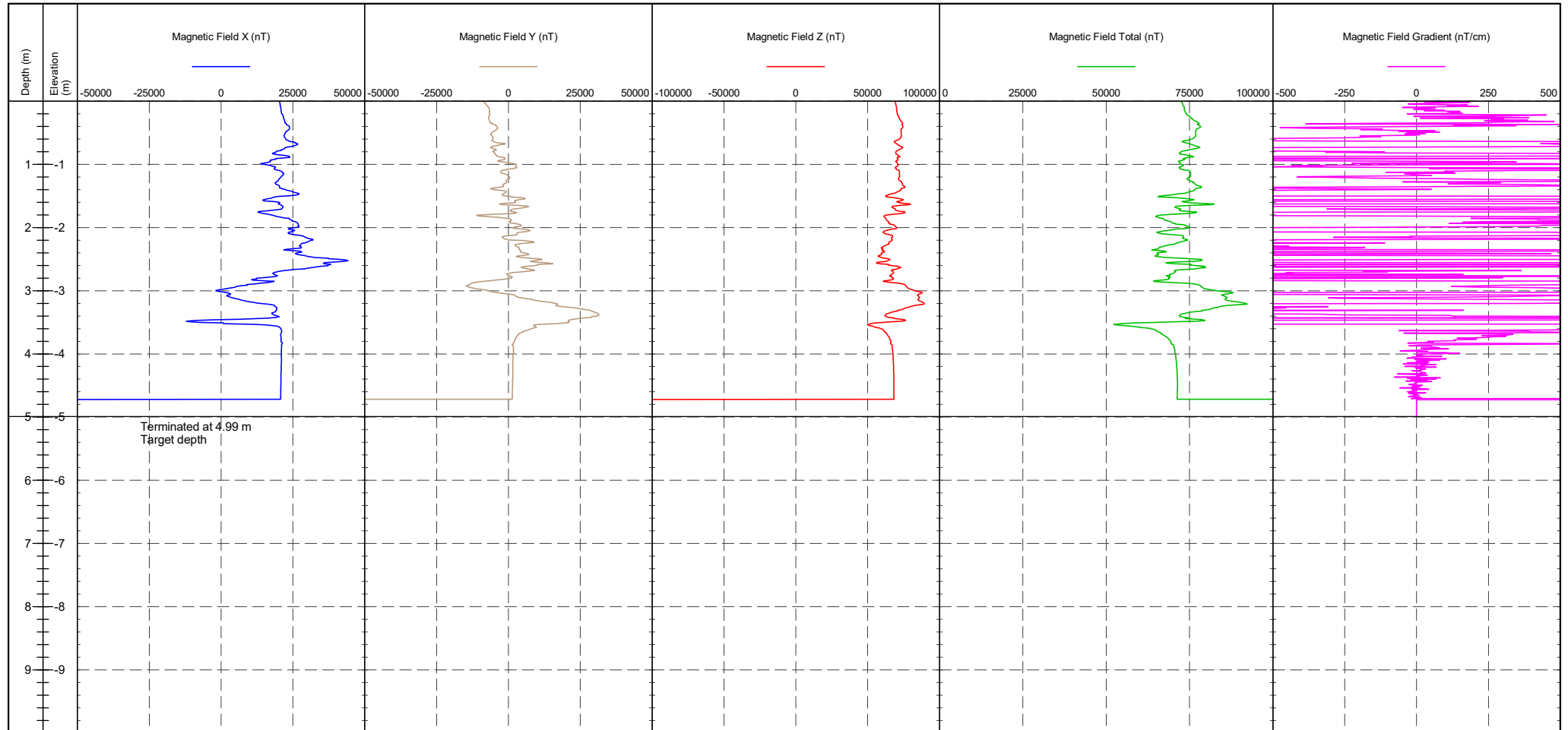
CPT09

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction

RIG OPERATOR : CPT 011 - Unimog
: RK & PD

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip	267 mV	262 mV	-0.058 MPa
Sleeve	259 mV	261 mV	0.001 kPa
Pore Pressure 2	349 mV	378 mV	0.008 kPa
X-Y Inclinator	2488 mV	2487 mV	



PointID

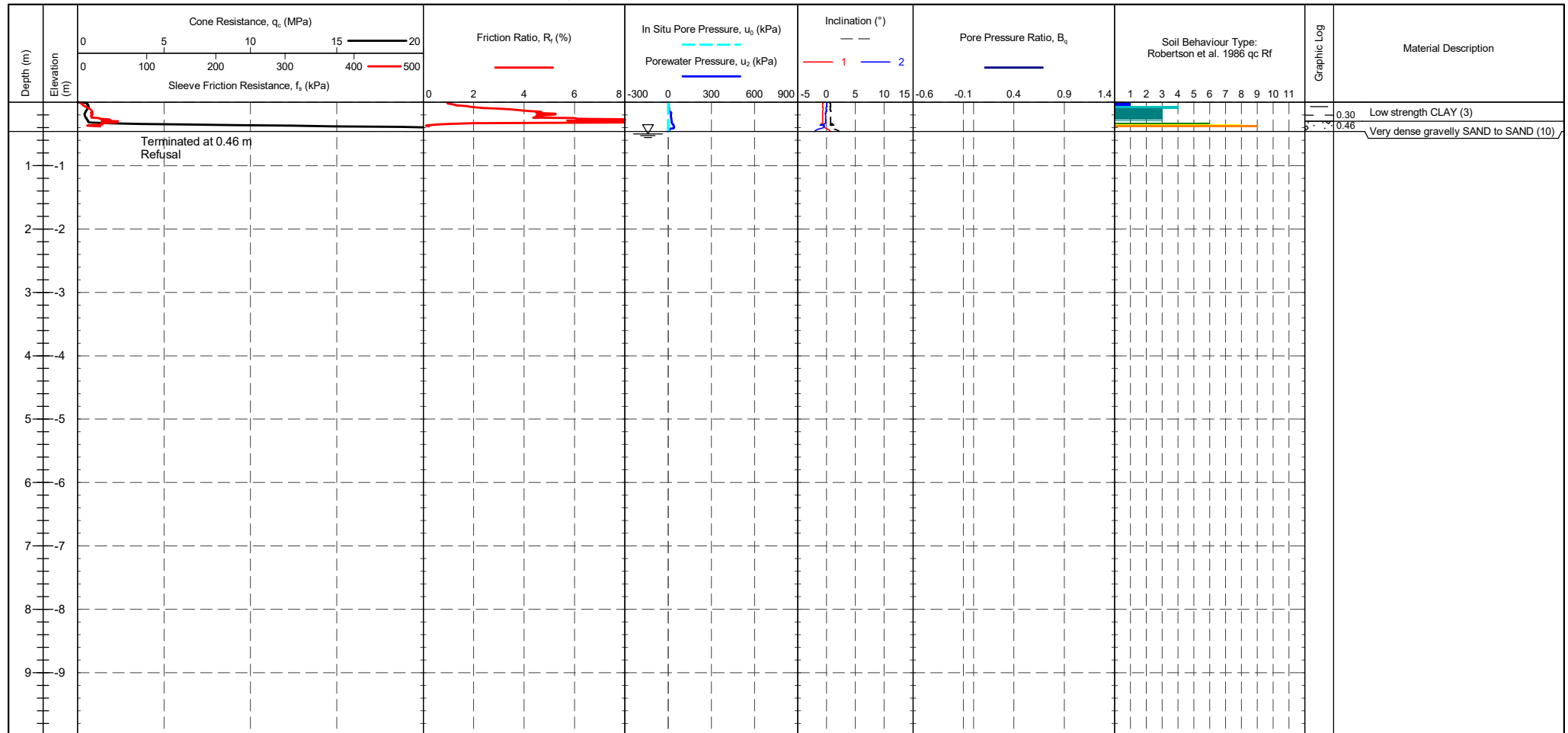
CPT10

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CALIBRATION DATE : 22/11/2022
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE
TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold
GROUNDWATER DEPTH : Assumed for calculation purposes

CPTU ZERO VALUES
Transducer : Pre Post Difference
Tip : 266 mV 267 mV 0.012 MPa
Sleeve : 259 mV 262 mV 0.002 kPa
Pore Pressure 2 : 324 mV 312 mV -0.003 kPa
X-Y Inclinator : 2476 mV 2446 mV

METHOD: Robertson et al. 1986 qc Rf
1 - Sensitive fine grained material
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

Groundwater Level
Dissipation Test



PointID

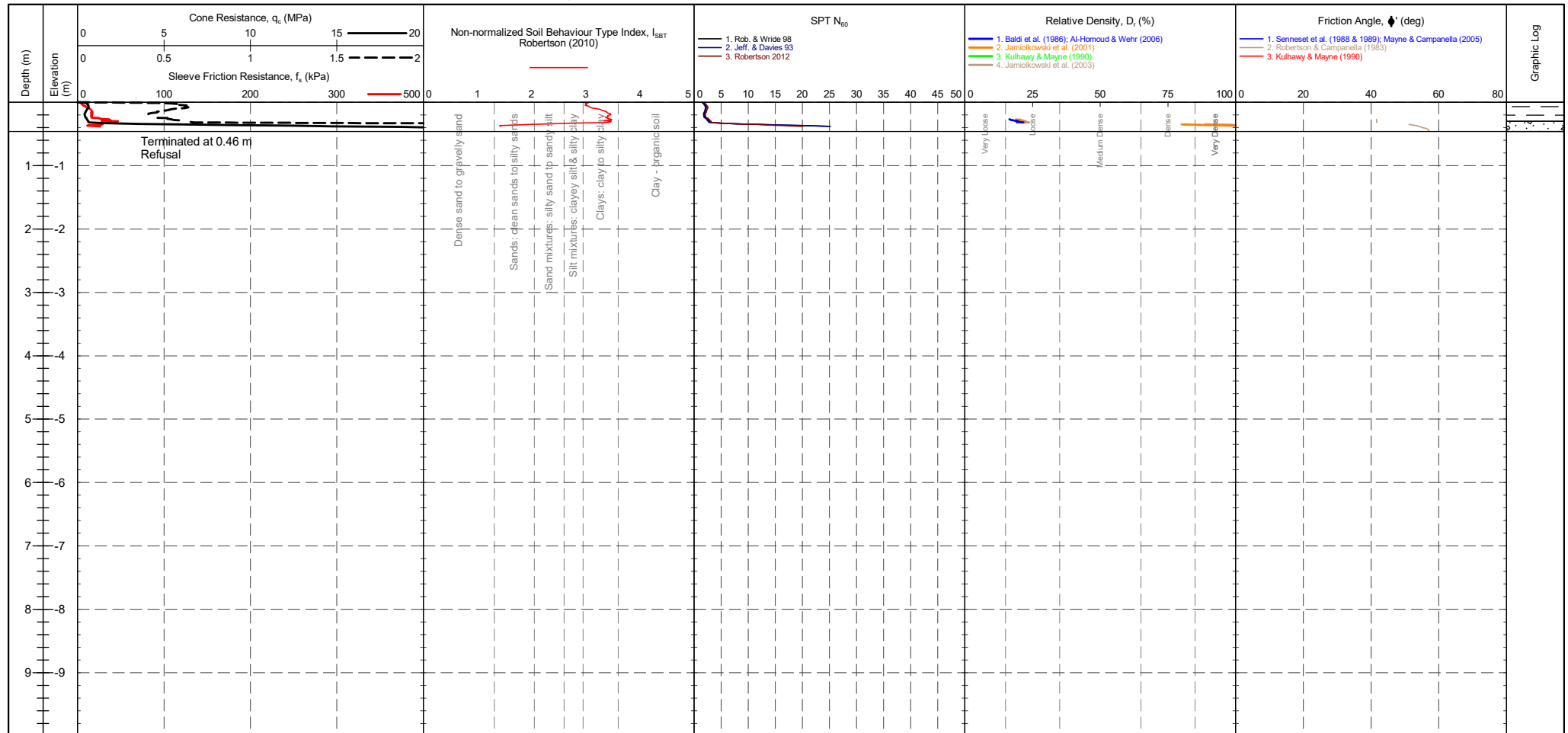
CPT10

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold

Transducer :
Tip :
Sleeve :
Pore Pressure 2 :
X-Y Inclinator :
CPTU ZERO VALUES
Pre :
Post :
Difference :
266 mV :
267 mV :
0.012 MPa :
259 mV :
262 mV :
0.002 kPa :
324 mV :
312 mV :
-0.003 kPa :
2476 mV :
2446 mV :

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12

Description	SBT Index, I_c	Description	SPT N value, NSPT	Description	Relative Density D_r (%)
Clays	2.95-3.60	Very Loose	0 - 4	Very Loose	0 - 15
Silt mixtures	2.60-2.95	Loose	4 - 10	Loose	15 - 35
Sand mixtures	2.05-2.60	Medium Dense	10 - 30	Medium Dense	35 - 65
Sands	1.31-2.05	Dense	30 - 50	Dense	65 - 85
Gravelly sand	<1.31	Very Dense	>50	Very Dense	>85

Groundwater Level
Dissipation Test



PointID

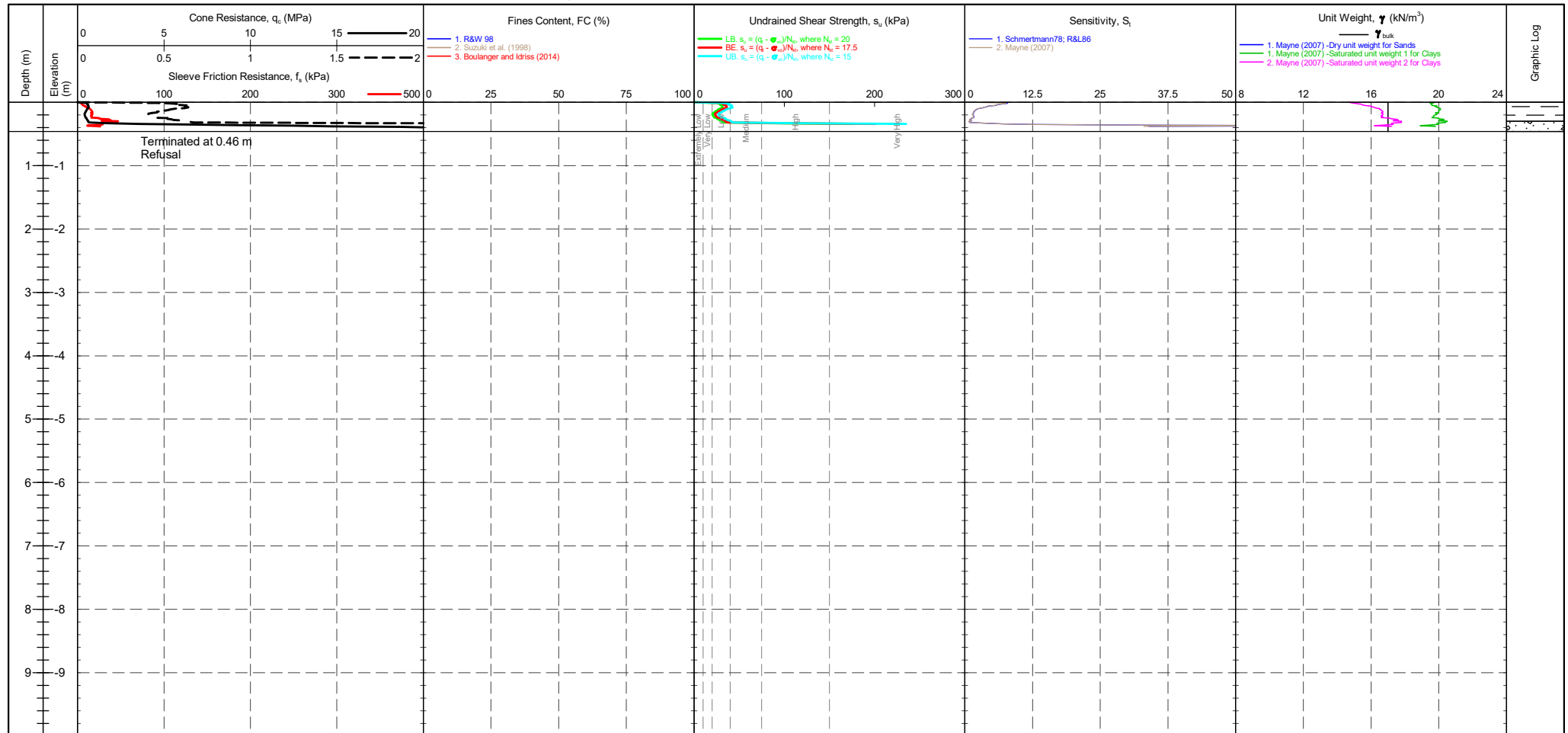
CPT10

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold

CPTU ZERO VALUES

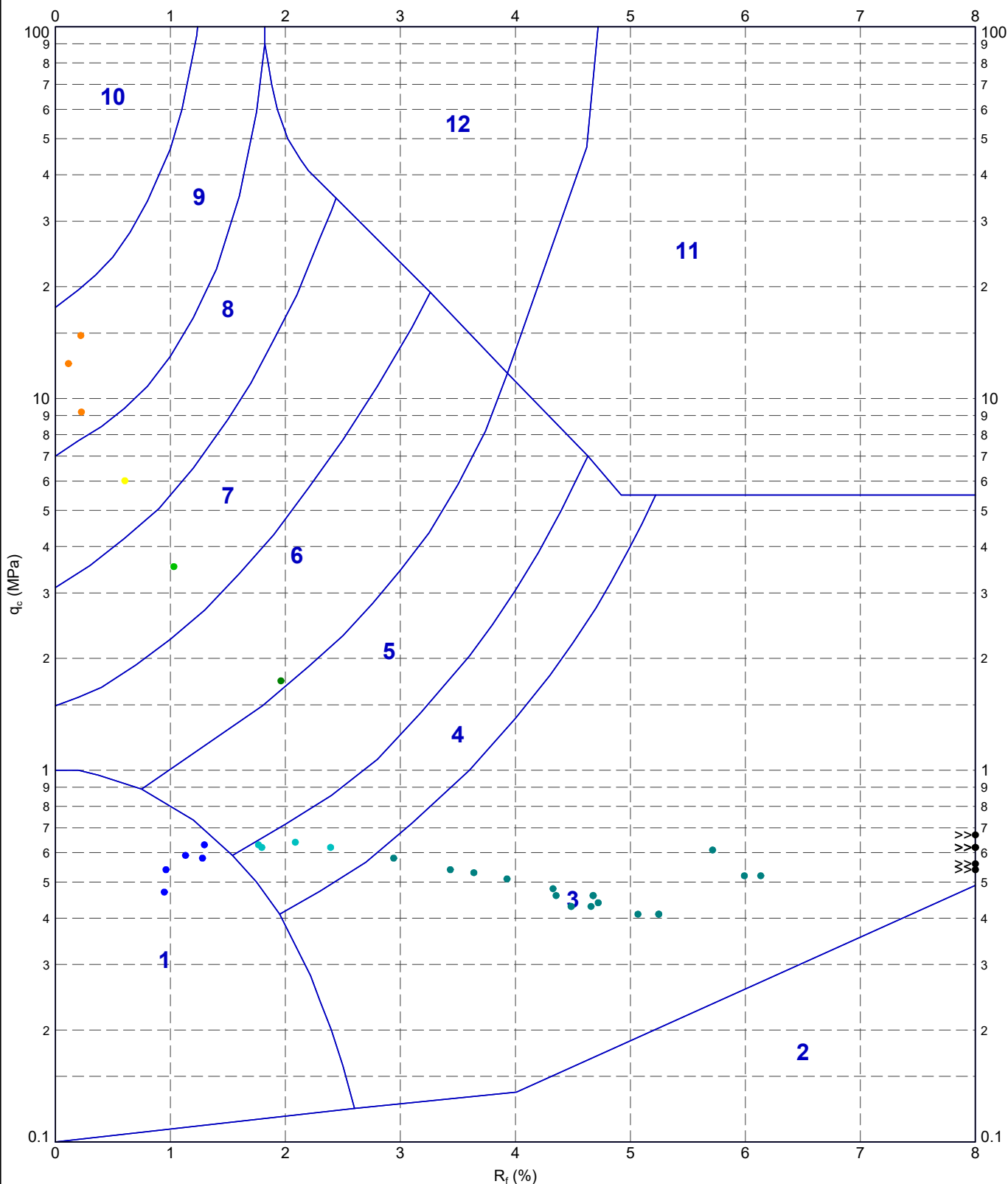
Transducer	Pre	Post	Difference
Tip	266 mV	267 mV	0.012 MPa
Sleeve	259 mV	262 mV	0.002 kPa
Pore Pressure 2	324 mV	312 mV	-0.003 kPa
X-Y Inclinator	2476 mV	2446 mV	

COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	s_u (kPa)	Term based on measurement	s_u (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater Level
Dissipation Test

220629-ADVANCED REPORT INSTITUTION 202.1 LIB - CHLOE GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF - APF 1230169 MANCHESTER CITY CENTRE COLLEGE BROWNFIELD SOLUTIONS.GPJ <<DrawingFile>> 27/02/2023 13:34 10.03.00.09 Dalglish Lab and In Situ Tool - DGD [Lib: In Situ SI 2.02.0 2017-07-10 Proj: In Situ SI 2.02.0 2017-07-10



METHOD: Robertson et al. 1986 qc Rf

- | | | | |
|-------------------------------------|-------------------------------|------------------------------|------------------------------|
| 1 - Sensitive fine grained material | 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 |

IN SITU
SITE INVESTIGATION

TITLE

Brownfield Solutions
Manchester
Manchester City Centre College
Robertson et al. 1986 qc vs. Rf - CPT10

DRAWN

DATE

27/02/2023

CHECKED

DATE

27/02/2023

SCALE

Not To Scale

A4

PROJECT No

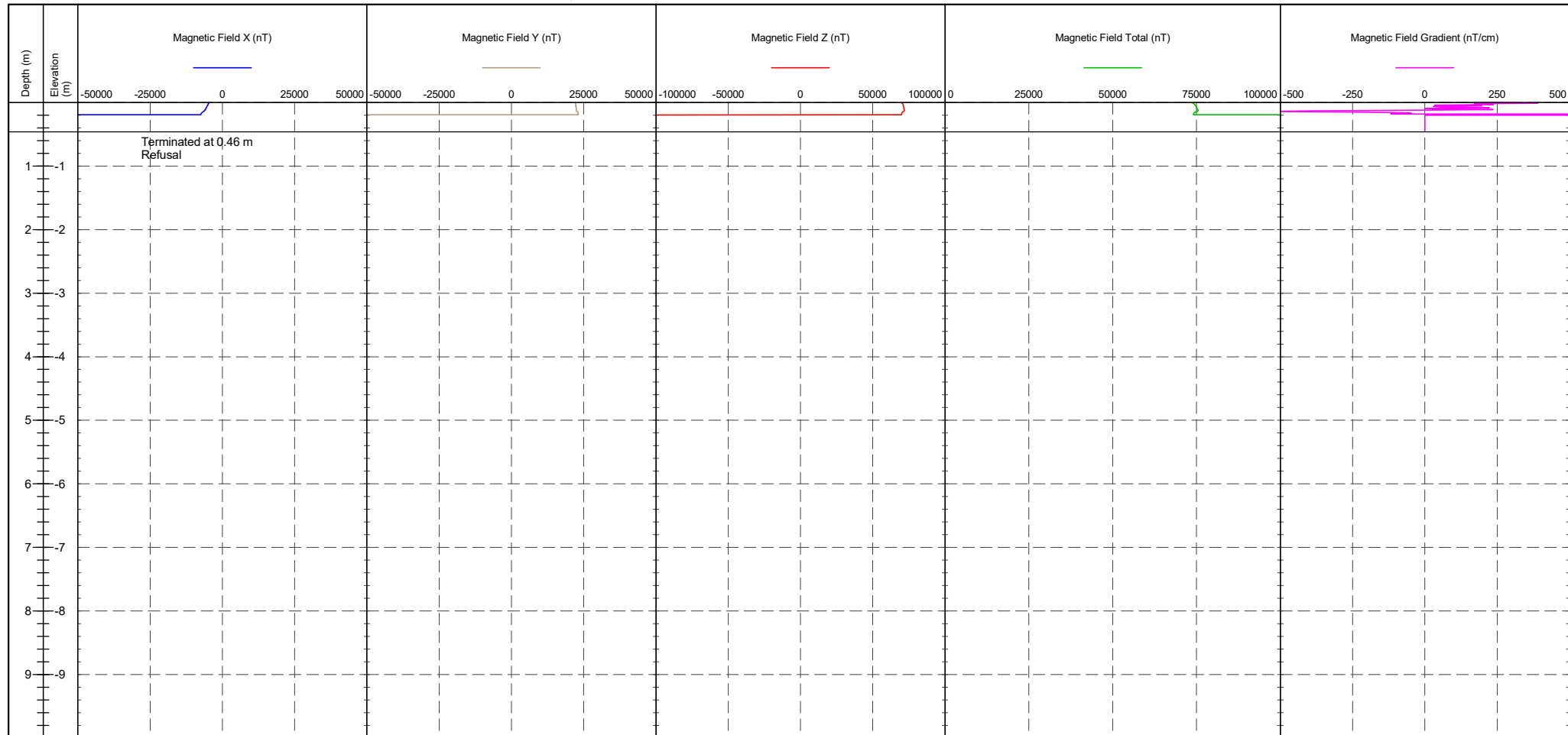
1230169

FIGURE No



PointID	CPT10
---------	--------------

CLIENT : Brownfield Solutions PROJECT : Manchester City Centre College LOCATION : Manchester PROJECT No. : 1230169	EASTING : 0.000 m NORTHING : 0.000 m ELEVATION : 0.000 m OD CHECKED BY : LD TERMINATION REASON : Refusal	Remark: Test refused on total pressure.	SHEET : 1 OF 1 STATUS : Final TEST DATE : 23/02/2023 PLOT DATE : 27/02/2023 METHOD : ISO 22476-1:2012
---	---	---	--



CONE ID	: S15-CFIPM.2088	RIG	: CPT 011 - Unimog	CPTU ZERO VALUES			
CONE MODEL	: Subtraction	OPERATOR	: RK & PD	Transducer	Pre	Post	Difference
				Tip	266 mV	267 mV	0.012 MPa
				Sleeve	259 mV	262 mV	0.002 kPa
				Pore Pressure 2	324 mV	312 mV	-0.003 kPa
				X-Y Inclinator	2476 mV	2446 mV	



PointID

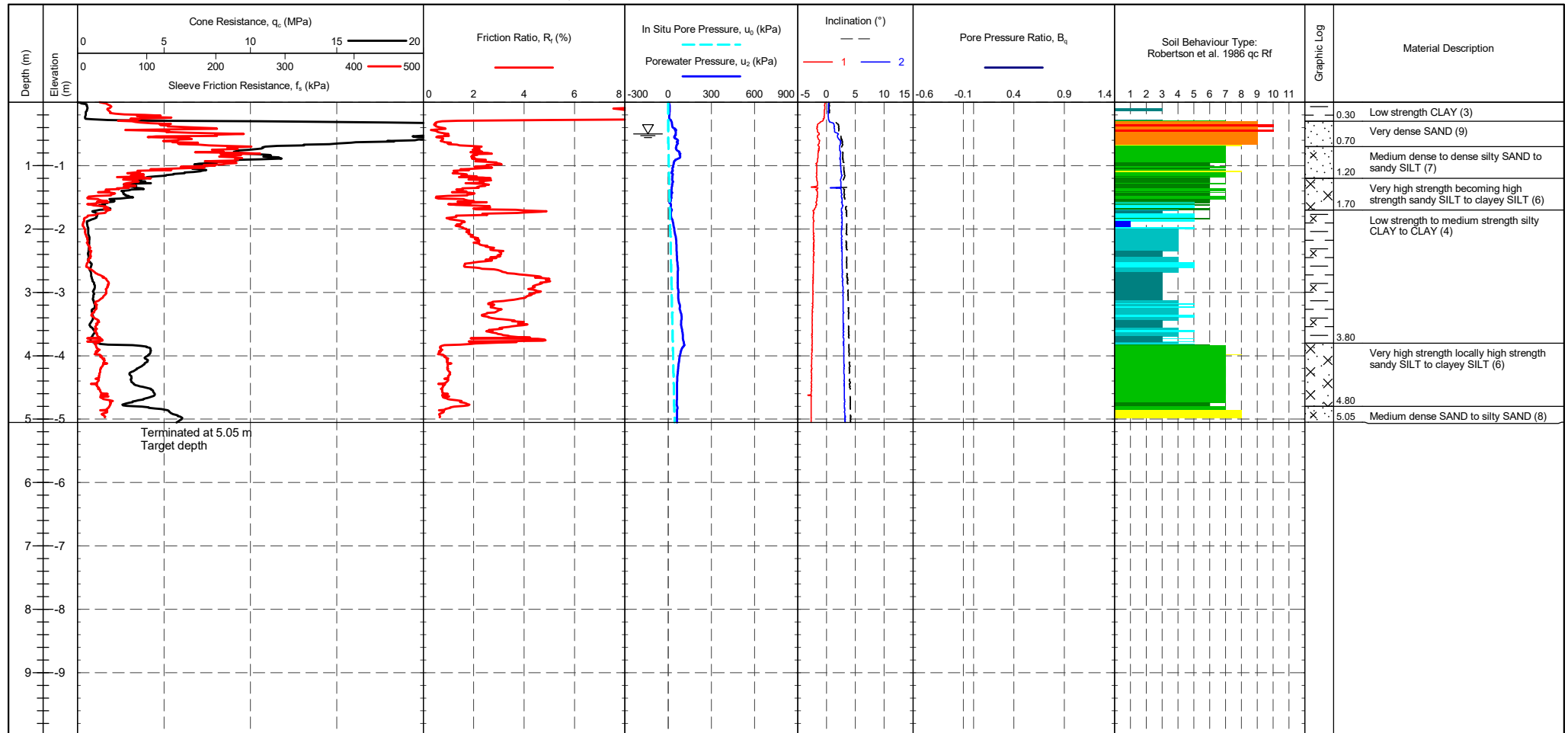
CPT10a

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CALIBRATION DATE : 22/11/2022
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold
GROUNDWATER DEPTH : Assumed for calculation purposes

CPTU ZERO VALUES
Transducer Pre Post Difference
Tip 267 mV 265 mV -0.023 MPa
Sleeve 259 mV 258 mV -0.001 kPa
Pore Pressure 2 294 mV 371 mV 0.021 kPa
X-Y Inclinator 2506 mV 2488 mV

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material
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

Groundwater
Level

Dissipation Test



PointID

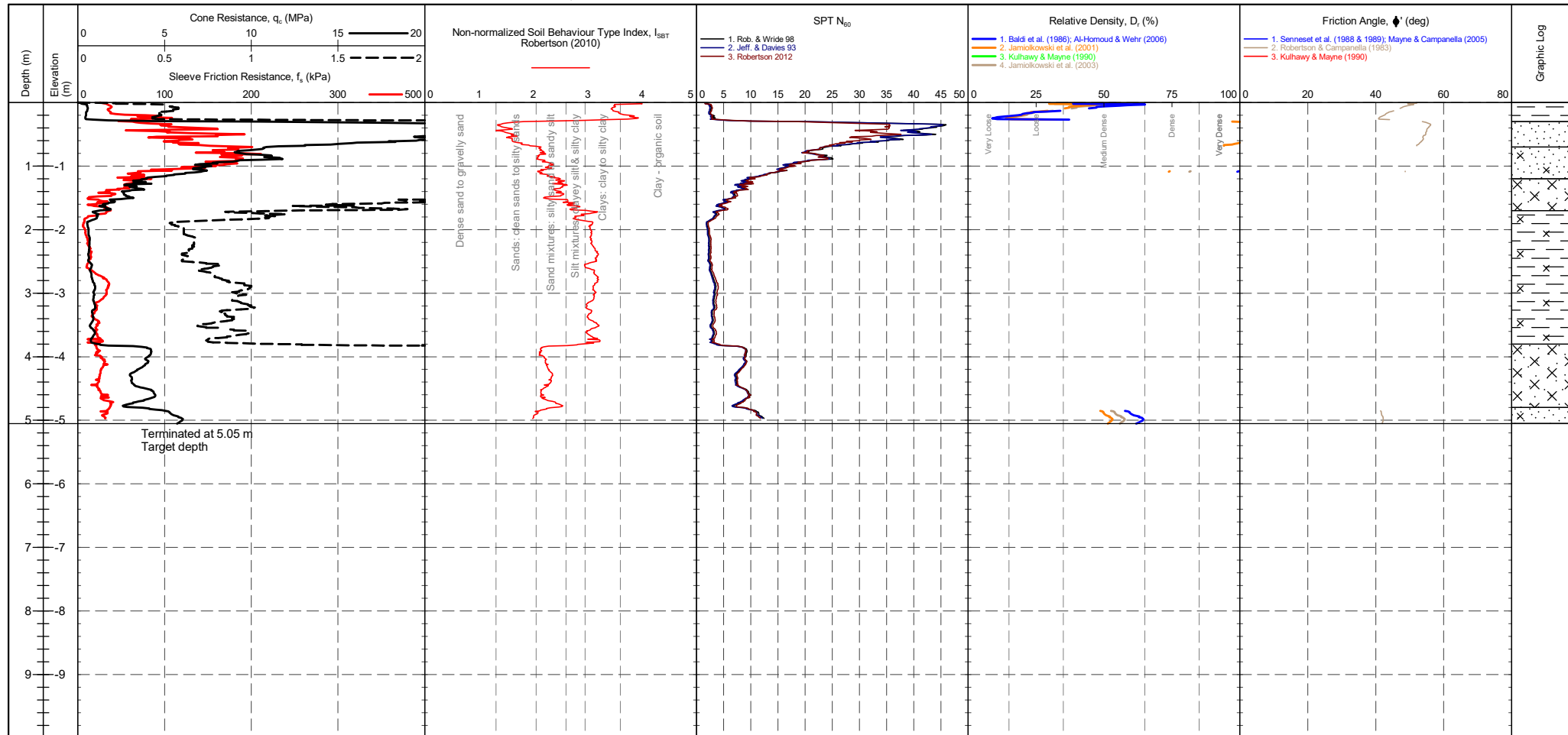
CPT10a

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold

Transducer
Tip
Sleeve
Pore Pressure 2
X-Y Inclinator

CPTU ZERO VALUES

Pre	Post	Difference
267 mV	265 mV	-0.023 MPa
259 mV	258 mV	-0.001 kPa
294 mV	371 mV	0.021 kPa
2506 mV	2488 mV	

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12

Description	SBT Index, I_c	Description	SPT N value, NSPT	Description	Relative Density D_r (%)
Clays	2.95-3.60	Very Loose	0 - 4	Very Loose	0 - 15
Silt mixtures	2.60-2.95	Loose	4 - 10	Loose	15 - 35
Sand mixtures	2.05-2.60	Medium Dense	10 - 30	Medium Dense	35 - 65
Sands	1.31-2.05	Dense	30 - 50	Dense	65 - 85
Gravelly sand	<1.31	Very Dense	>50	Very Dense	>85

Groundwater Level
Dissipation Test



PointID

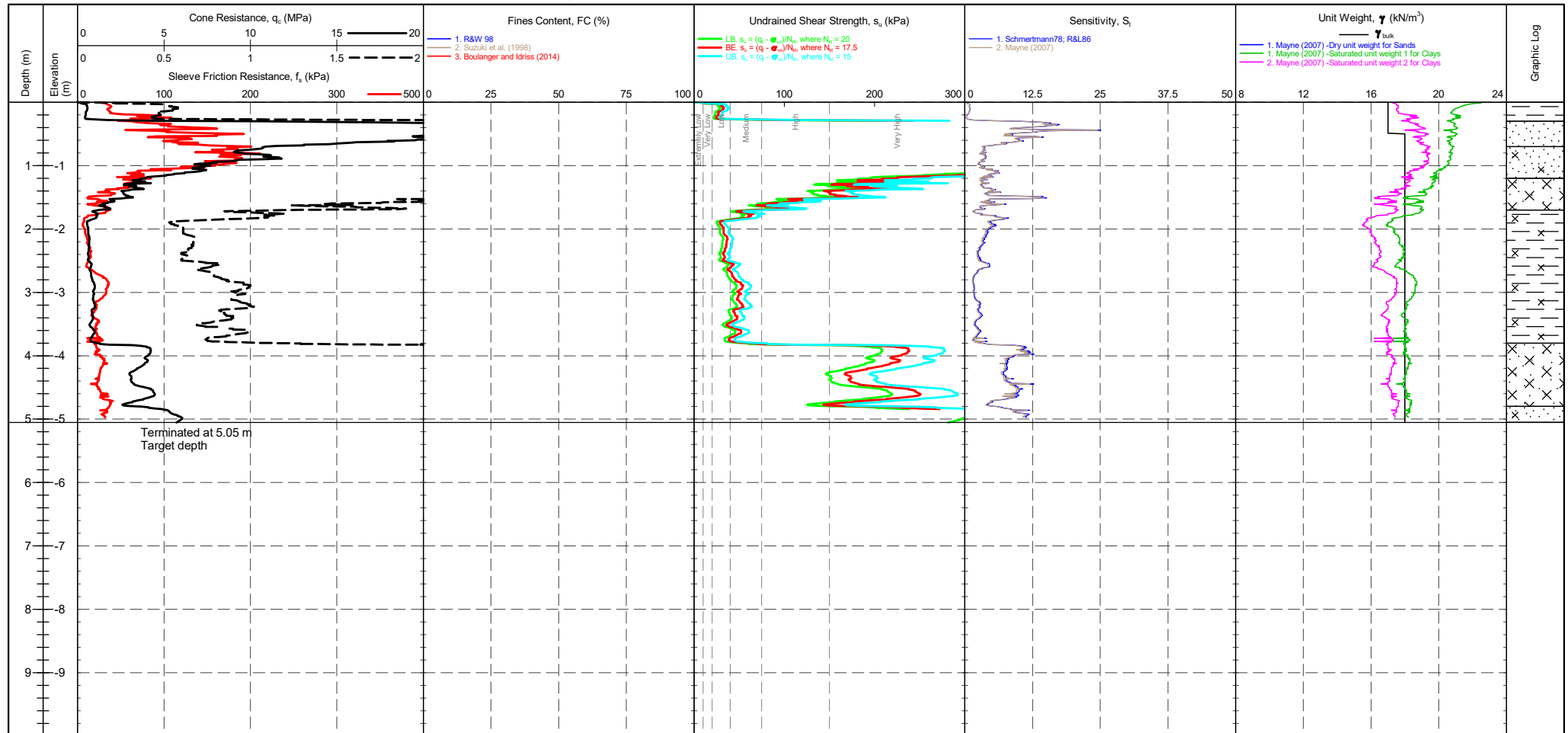
CPT10a

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip	267 mV	265 mV	-0.023 MPa
Sleeve	259 mV	258 mV	-0.001 kPa
Pore Pressure 2	294 mV	371 mV	0.021 kPa
X-Y Inclinator	2506 mV	2488 mV	

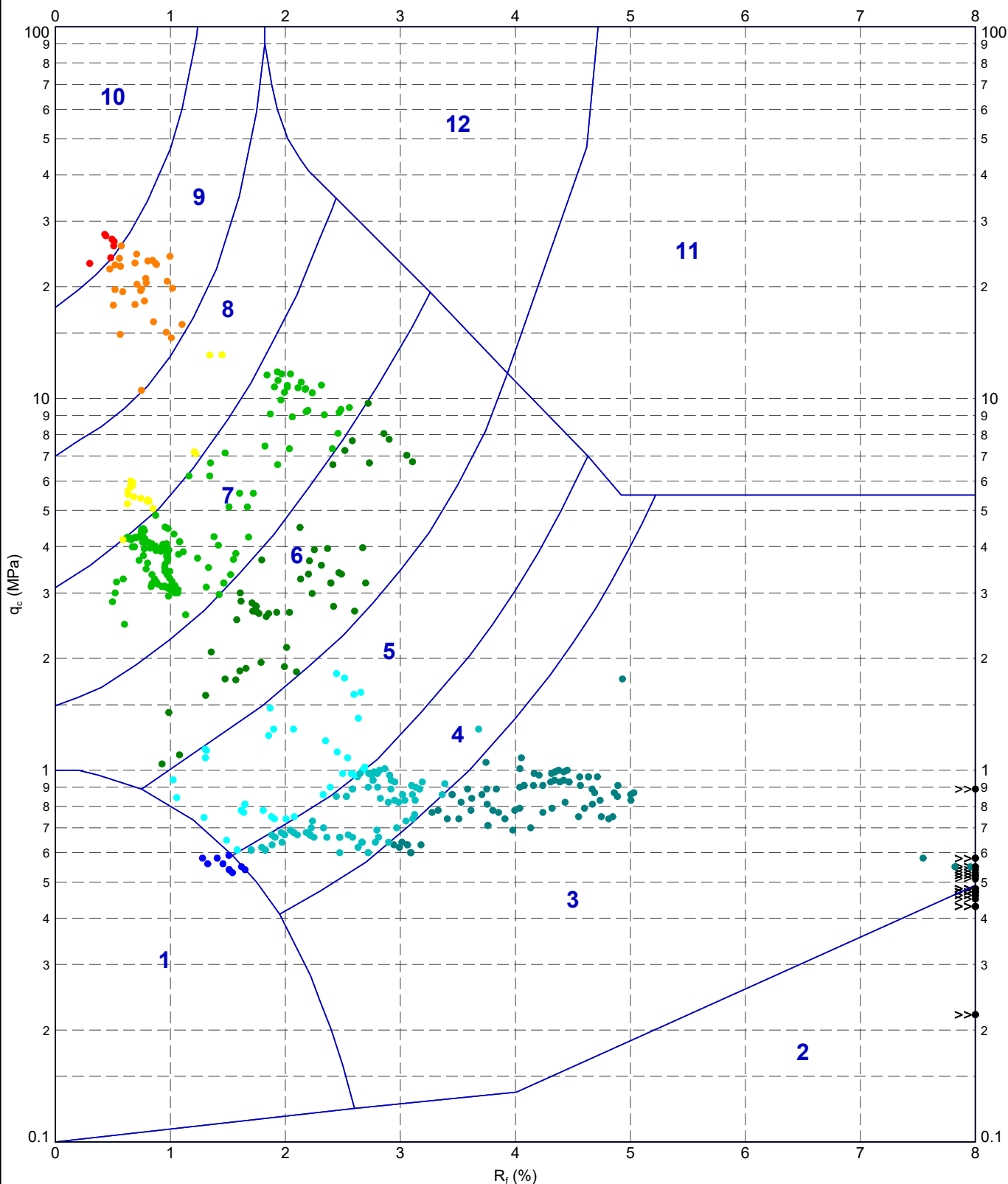
COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	s_u (kPa)	Term based on measurement	s_u (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater Level

Dissipation Test

220629-ADVANCED REPORT INSTITUSI 202.1 LIB - CHLOE GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF AP 1230169 MANCHESTER CITY CENTRE COLLEGE BROWNFIELD SOLUTIONS.GPJ <DrawingFile>> 27/02/2023 13:35: 10.03.00.09 Dalgel Lab and In Situ Tool - DGO [Lib: In Situ SI 2.02.0 2017-07-10 Proj: In Situ SI 2.02.0 2017-07-10



METHOD: Robertson et al. 1986 q_c R_f

- | | | | |
|-------------------------------------|-------------------------------|------------------------------|------------------------------|
| 1 - Sensitive fine grained material | 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 |

IN SITU
SITE INVESTIGATION

TITLE

Brownfield Solutions
Manchester
Manchester City Centre College
Robertson et al. 1986 q_c vs. R_f - CPT10a

DRAWN

DATE

27/02/2023

CHECKED

DATE

27/02/2023

SCALE

Not To Scale

A4

PROJECT No

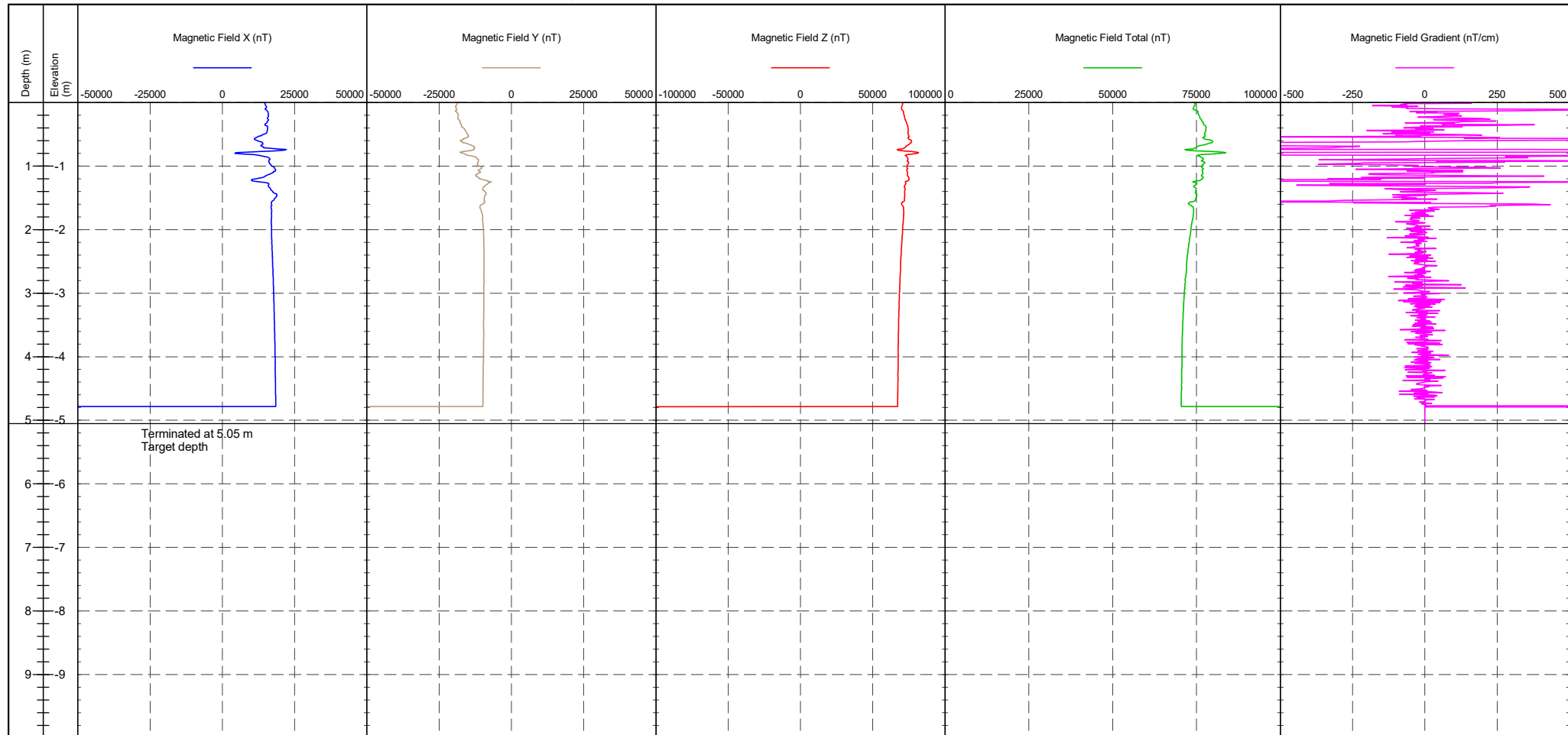
1230169

FIGURE No



PointID	CPT10a
---------	--------

CLIENT : Brownfield Solutions PROJECT : Manchester City Centre College LOCATION : Manchester PROJECT No. : 1230169	EASTING : 0.000 m NORTHING : 0.000 m ELEVATION : 0.000 m OD CHECKED BY : LD TERMINATION REASON : Target depth	Remark: Test completed at target depth.	SHEET : 1 OF 1 STATUS : Final TEST DATE : 23/02/2023 PLOT DATE : 27/02/2023 METHOD : ISO 22476-1:2012
---	--	---	--



CONE ID	: S15-CFIPM.2088	RIG	: CPT 011 - Unimog	CPTU ZERO VALUES			
CONE MODEL	: Subtraction	OPERATOR	: RK & PD	Transducer	Pre	Post	Difference
				Tip	267 mV	265 mV	-0.023 MPa
				Sleeve	259 mV	258 mV	-0.001 kPa
				Pore Pressure 2	294 mV	371 mV	0.021 kPa
				X-Y Inclinator	2506 mV	2488 mV	



PointID

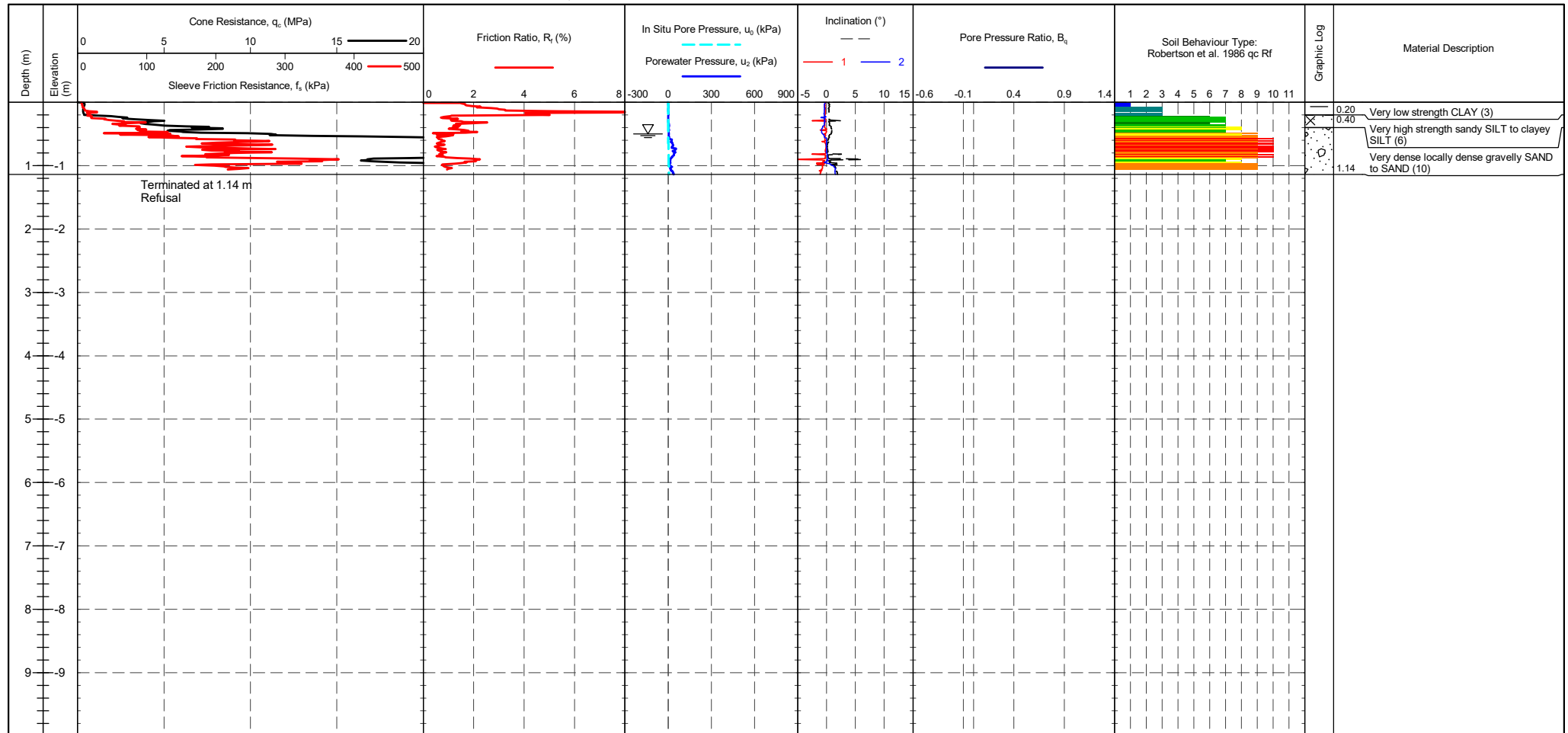
CPT11

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CALIBRATION DATE : 22/11/2022
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold
GROUNDWATER DEPTH : Assumed for calculation purposes

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip	269 mV	266 mV	-0.035 MPa
Sleeve	266 mV	264 mV	-0.001 kPa
Pore Pressure 2	283 mV	277 mV	-0.002 kPa
X-Y Inclinator	2490 mV	2489 mV	

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material	5 - Clayey SILT to silty CLAY	9 - SAND
2 - Organic material	6 - Sandy SILT to clayey SILT	10 - Gravelly SAND to SAND
3 - CLAY	7 - Silty SAND to sandy SILT	11 - Very stiff fine grained
4 - Silty CLAY to CLAY	8 - SAND to silty SAND	12 - SAND to clayey SAND

Groundwater
Level

Dissipation Test

PointID

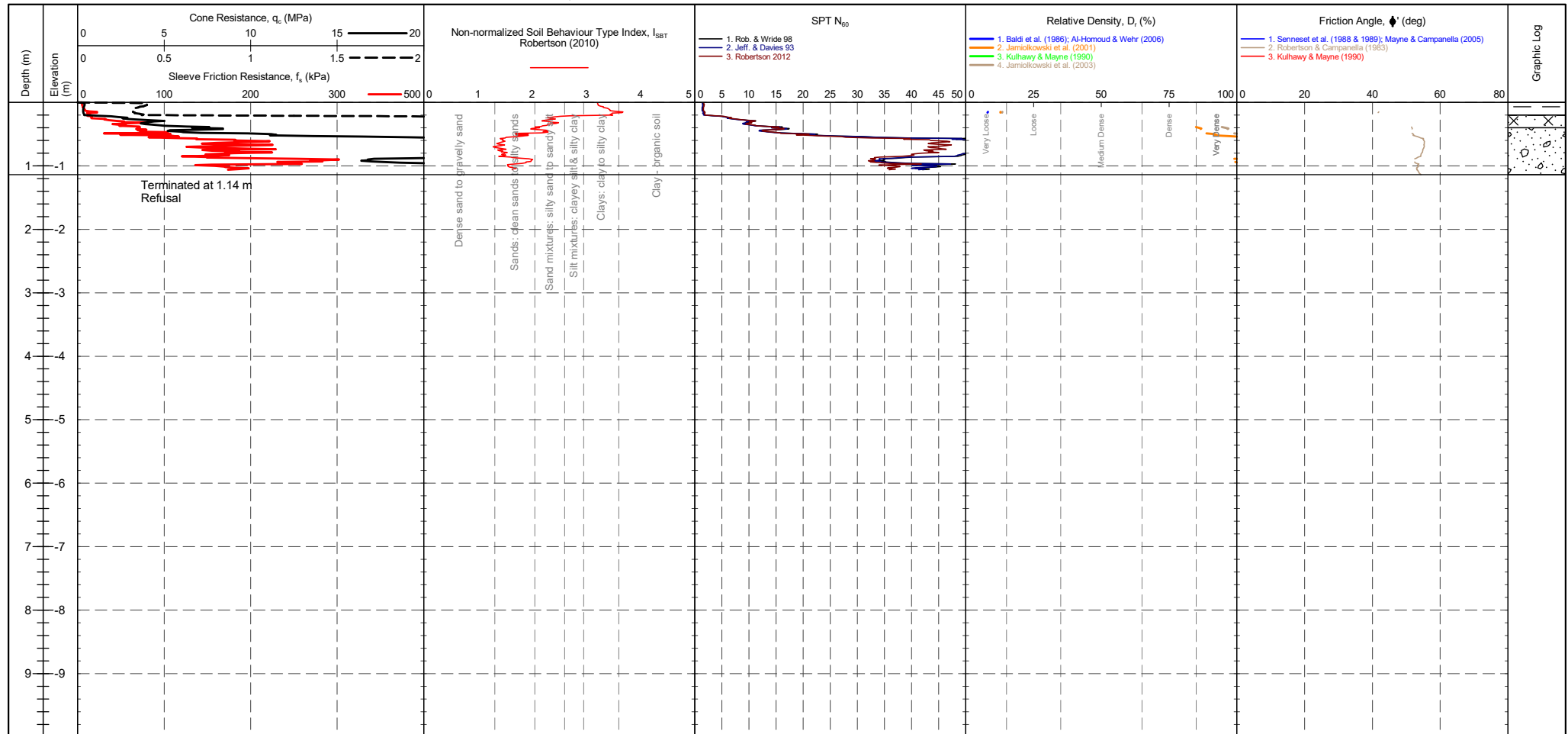
CPT11

CLIENT : Brownfield Solutions
PROJECT: Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID	: S15-CFIPM.2088
CONE MODEL	: Subtraction
CONE AREA	: 15cm ²
CONE AREA RATIO	: 0.79
FILTER POSITION	: u2
FILTER TYPE	: HDPE

TEST TYPE	: TE2
APPLICATION CLASS	: 2
RIG	: CPT 011 - Unimog
OPERATOR	: RK & PD
FRICTION REDUCER	: None
WEATHER	: Sunny & Cold

CPTU ZERO VALUES			
Transducer	Pre	Post	Difference
Tip	269 mV	266 mV	-0.035 MPa
Sleeve	266 mV	264 mV	-0.001 kPa
Pore Pressure 2	283 mV	277 mV	-0.002 kPa
X-Y Inclinator	2490 mV	2489 mV	

Description	SBT Index, Ic	Description	SPPT N value, NSPT	Description	Relative Density Dr (%)
Clays	2.95-3.60	Very Loose	0 - 4	Very Loose	0 - 15
Silt mixtures	2.60-2.95	Loose	4 - 10	Loose	15 - 35
Sand mixtures	2.05-2.60	Medium Dense	10 - 30	Medium Dense	35 - 65
Sands	1.31-2.05	Dense	30 - 50	Dense	65 - 85
Gravelly sand	<1.31	Very Dense	>50	Very Dense	>85

Groundwater Level

Dissipation Test



PointID

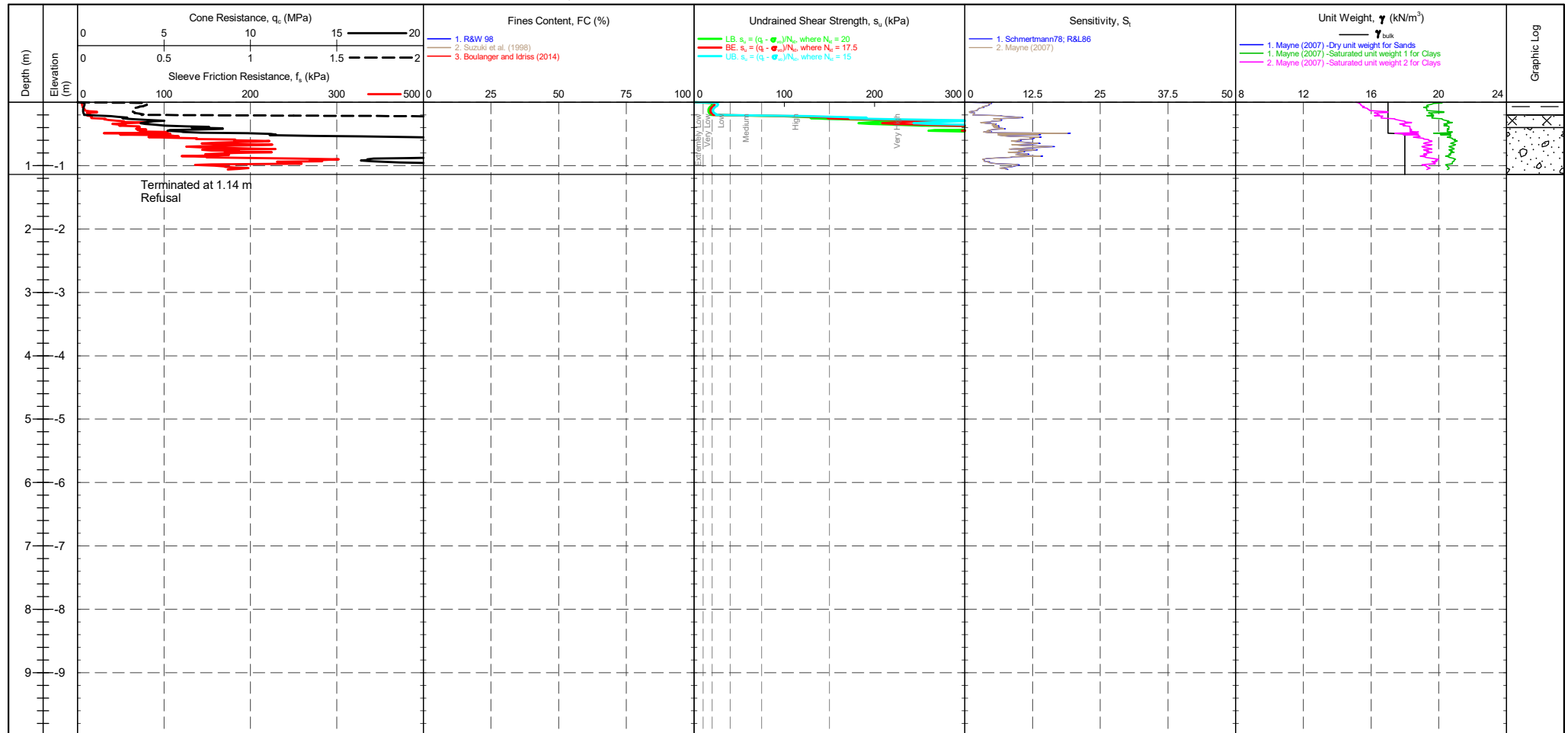
CPT11

CLIENT : Brownfield Solutions
PROJECT : Manchester City Centre College
LOCATION : Manchester
PROJECT No. : 1230169

EASTING : 0.000 m
NORTHING : 0.000 m
ELEVATION : 0.000 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 23/02/2023
PLOT DATE : 27/02/2023
METHOD : ISO 22476-1:2012



CONE ID : S15-CFIPM.2088
CONE MODEL : Subtraction
CONE AREA : 15cm²
CONE AREA RATIO : 0.79
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 011 - Unimog
OPERATOR : RK & PD
FRICTION REDUCER : None
WEATHER : Sunny & Cold

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip	269 mV	266 mV	-0.035 MPa
Sleeve	266 mV	264 mV	-0.001 kPa
Pore Pressure 2	283 mV	277 mV	-0.002 kPa
X-Y Inclinator	2490 mV	2489 mV	

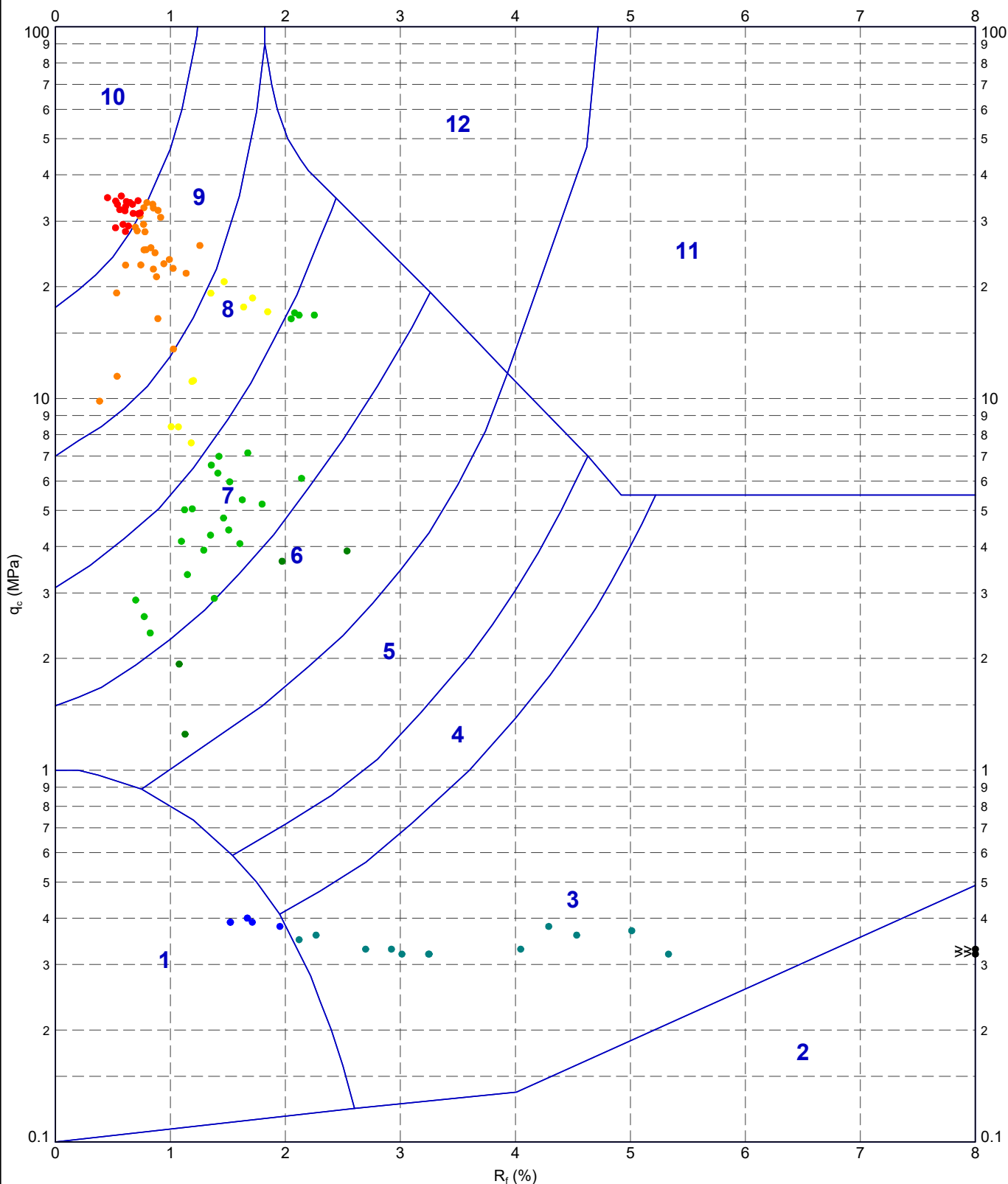
COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	s_u (kPa)	Term based on measurement	s_u (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater Level

Dissipation Test

220629-ADVANCED REPORT INSTITUSI 202.1 LIB - CHLOE GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF AP 1230169 MANCHESTER CITY CENTRE COLLEGE BROWNFIELD SOLUTIONS.GPJ <<DrawingFile>> 27/02/2023 13:38 10.03.00.09 Dalgel Lab and In Situ Tool - DGD [Lib: In Situ SI 2.02.0 2017-07-10 Pdf: In Situ SI 2.02.0 2017-07-10



METHOD: Robertson et al. 1986 qc Rf

- | | | | |
|-------------------------------------|-------------------------------|------------------------------|------------------------------|
| 1 - Sensitive fine grained material | 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 |

IN SITU
SITE INVESTIGATION

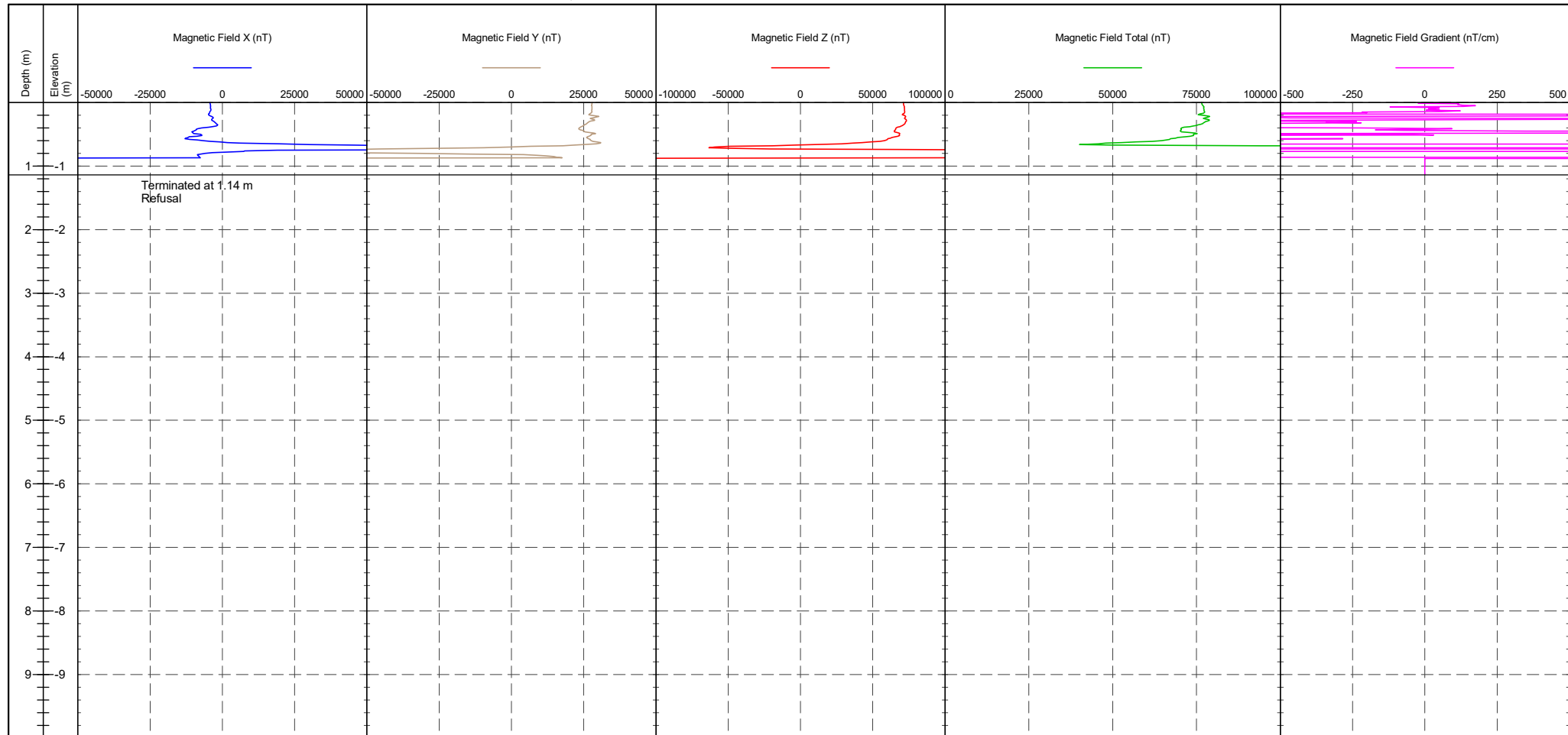
Brownfield Solutions
Manchester
Manchester City Centre College
Robertson et al. 1986 qc vs. Rf - CPT11

DRAWN	DATE	27/02/2023
CHECKED	DATE	27/02/2023
SCALE	Not To Scale	
PROJECT No	FIGURE No	A4
1230169		



PointID	CPT11
---------	--------------

CLIENT : Brownfield Solutions PROJECT : Manchester City Centre College LOCATION : Manchester PROJECT No. : 1230169	EASTING : 0.000 m NORTHING : 0.000 m ELEVATION : 0.000 m OD CHECKED BY : LD TERMINATION REASON : Refusal	Remark: Test refused on total pressure.	SHEET : 1 OF 1 STATUS : Final TEST DATE : 23/02/2023 PLOT DATE : 27/02/2023 METHOD : ISO 22476-1:2012
---	---	---	--



CONE ID	: S15-CFIPM.2088	RIG	: CPT 011 - Unimog	CPTU ZERO VALUES			
CONE MODEL	: Subtraction	OPERATOR	: RK & PD	Transducer	Pre	Post	Difference
				Tip	269 mV	266 mV	-0.035 MPa
				Sleeve	266 mV	264 mV	-0.001 kPa
				Pore Pressure 2	283 mV	277 mV	-0.002 kPa
				X-Y Inclinator	2490 mV	2489 mV	



IN SITU SITE INVESTIGATION

Unit 23 Hastings Innovation
Centre,
Highfield Drive
St. Leonards on Sea, East Sussex,
TN38 9UH, U.K.

Company No.: 6339499
VAT No.: 922 3561 41