

**WEPA UK Limited**

**BRIDGEND PAPER MILL, MAESTEG**

**Factual Site Investigation Report**

**Areas A, B, C and T**

12495/RB/20/FSI-A,B,C,T

**CLIENT:** WEPA UK Limited

**PROJECT:** Bridgend Paper Mills, Maesteg

**TITLE:** Factual Site Investigation Report Areas A, B, C and T

**JOB NO:** 12495

**DOCUMENT REF:** 12495/RB/20/FSI-A,B,C,T

Revision	Purpose Description	Originated	Reviewed	Authorised	Date
0	Issue	LP/RB	RB	HP	Feb'2020

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## **1.0 INTRODUCTION**

### **1.1 GENERAL**

WEPA UK Limited are proposing the extension of their existing premises in Bridgend for commercial end-use.

Intégral Géotechnique (Wales) Ltd have been appointed as the Geotechnical Engineers to undertake a factual site investigation in general accordance with a scope of works outlined by BHM Ingenieure.

This factual report represents the findings of the intrusive site investigation.

Intégral Géotechnique (Wales) Ltd have previously submitted a 'Site Investigation Report' relating to the site. The findings of this intrusive investigation are presented in Report Reference 12495/GNS/19/SI/RevC, dated January 2020.

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### **1.2 PROPOSED DEVELOPMENT**

The proposed development comprises a number of extensions to the existing site buildings and the layout is presented on Figure 2, which details the areas of the site in which new development is proposed relative to the existing site layout.

The proposed development will consist of the construction of the following:

- Pulp Storage (Department A) and Bale Handling (Department B), located in the southeast part of the site,
- New shipping areas and loading bays located in the southwest part of the site, adjacent to the existing Warehouse A and Converting Hall 3 (Departments D, E and J),
- Paper Machine Building (Department C) comprising multiple levels, located within the southeast part of the site adjacent to the Jupiter M/C House,

## 1.2 PROPOSED DEVELOPMENT (CONTINUED)

- High Bay Warehouse, including Shipping Area (Department F), located in the northern part of the site.

An additional building referred to as Department T is also proposed within the eastern part of the site.

Further several technical bridges (pipe bridge, pallet conveyor bridges), auxiliary building ports (exterior tank foundations, canopies), a new Gatehouse (Department G), new car parking and truck parking area in the north and northwest, and a new access in the southeast are also proposed as part of the project.

The existing paved areas, parking lots and underground services have to be adapted to the defined project. Considering the different terrain levels, appropriate slope protection measures (pile walls, retaining walls etc) must be provided upfront for the new buildings in order to create the platforms for the building foundations.

This report refers specifically to Areas A & B, C and T.

## 1.3 SCOPE OF WORKS

An intrusive ground investigation was undertaken in general accordance with a scope of works outlined by BHM Ingenieure.

The intrusive ground investigation comprised:

- 8No rotary Boreholes (dynamic sampled to rockhead and rotary cored to a maximum depth of 25m);
- 10No electrocone CPT tests with piezo measurement;
- Sampling of made ground for laboratory chemical testing (Area T only);
- Geotechnical testing of the cored rock; and
- Groundwater Monitoring.

## 1.4 LIMITATIONS

It is important to recognise that there may be areas of contamination that have not been found, or that contaminants are present at concentrations above those that have been found. It is also important to recognise that contamination may be localised and that no investigation, however comprehensive, is capable of finding such occurrences other than by chance.

**1.4 LIMITATIONS** (CONTINUED)

It should also be noted that vertical and lateral changes in ground conditions may be present between exploratory hole locations.

Access for the intrusive site investigation was coordinated in detail with WEPA UK and their representatives.

The locations of the boreholes and CPT tests were determined by BHM Ingenieure.

## 2.0 THE SITE

### 2.1 SITE LOCATION AND DESCRIPTION

#### ***General***

The site is located at Bridgend Paper Mills to the northwest of Bridgend at a National Grid Reference of 287780, 187160, see Figure 1.

The site is irregular in shape and occupies an area of approximately 20 hectares. The boundaries of the site are defined by the A4063 road to the south, generally undeveloped fields to the north, and existing access road to the east and the railway line to the northeast, see Figure 2.

The site generally falls to the southeast and east from a maximum elevation of approximately 100m AOD to a minimum elevation of approximately 77m AOD. The Lynfi River flows along the base of the Lynfi Valley beyond the railway line approximately 40m to the northeast.

The site comprises an existing paper mill, and includes a number of warehouse buildings, storage areas, processing plant, paper mill, offices, etc. A number of extensions are proposed to the existing buildings, and a description of each area of the site to be developed is provided below.

This report relates on to Departments/Areas A, B, C and T.

#### ***New PM Building (Department C)***

This proposed building is located within service yard EA3 opposite the existing Jupiter House (MB10). The majority of this area is predominantly laid to concrete and relatively level. The northeast area of this part of the site is at a lower level than the rest of the area. At the time of the fieldworks the southern part of this site area was occupied by stockpiles of unprocessed paper.

#### ***New Bale Handling (Department B) and Pulp Storage (Department A)***

This area of the site, occasionally referred to as 'Soweto', is located within the southeast corner of the site and accessed via a graded soil ramp which extends up from the existing yard area to the west. The area is partly used for the storage of materials and skips and is densely vegetated, particularly in the north and west with immature trees and shrubs.

This area of the site is elevated by some 3m to 4m relative to the surrounding land to the west and north, with this change in level achieved by slopes falling down to the west and north.

## 2.1 SITE LOCATION AND DESCRIPTION (CONTINUED)

Due to the densely vegetated nature of the slopes, it was not possible to undertake a detailed observation of the condition of the existing slopes.

### *New Building (Department T)*

A new building of unconfirmed proposed use, referred to as Department T, is proposed in the eastern part of the site. This area of the site is typically flat and currently covered by concrete hardstanding. There is evidence of former tanks having been present in this area of the site.

## 2.2 AVAILABLE SITE INVESTIGATION DATA

Previous site investigation reports have been completed by this practice and others within the area of the existing factory.

Not all of this information will be relevant to the proposed development areas.

When compiling Site Investigation Report Reference 12495/GNS/19/SI/RevC, dated January 2020 report, reference was made to the following reports: -

- Geotechnical Report reference 7261/C dated November 1997 completed for Quorum Associates Limited and entitled "Proposed New Warehouse, Jamont UK Limited, Llangynwyd, near Bridgend".
- Site Investigation Factual Report reference 7741/C dated December 1999 completed for Fort James UK Limited and entitled "Proposed Expansion of Bridgend Paper Mills, Llangynwyd, Bridgend".
- Geotechnical Report reference 8670/PB/03 dated July 2003 completed for Quorum Associates Limited and entitled "Proposed New Warehouse and Paper Mill, Bridgend Paper Mills".

Additional reports have been completed by other parties, which have also been referenced and include the following:

- Golder Associates (UK) Limited Consulting Engineers report reference 9253009 dated April 1992 completed for James and Nicholas entitled "Ground Investigation at British Tissues, Maesteg".
- Ground Investigation Geotechnical and Contaminated Land Consultants report reference p-w.0960-01.letter.doc dated February 2012 completed for Georgia-Pacific UK Limited entitled "Bridgend Paper Mill".

### **3.0 THE SITE INVESTIGATION**

#### **3.1 FIELDWORKS**

The intrusive ground investigation was undertaken in general accordance with the scope of works outlined by BHM Ingenieure.

The intrusive ground investigation comprised 8 No. rotary boreholes, and 10No electrocone CPT tests was carried out during January/February 2020. The locations of all the exploratory holes are indicated on Figure 2.

The rotary holes were drilled to a maximum depth of 25.80m, with each hole dynamically sampled to rockhead and cored to the base of the borehole. The boreholes were drilled using a Klemm 802 drilling rig, using a mist and water flush. Odex casing was used to advance the borehole through any superficial soils.

The rock cores were sampled for geotechnical testing and the samples logged to provide information for pile design.

Samples of made ground were also taken from RC12 and RC13 from Area T, for laboratory chemical testing and placed in the appropriate sample containers deemed suitable for the analysis required. Strict protocols were adopted during this process to limit the cross contamination of samples.

Groundwater monitoring standpipes were installed within each of the rotary borehole to allow groundwater levels to be monitored. Data loggers have been installed in three boreholes and these will be monitored over a period of three months from completion of the site works.

Electrocone CPT testing was carried out at 10No locations (9No locations within Areas A and B, and 1No location in Area T). The CPT testing was carried out by using an 18.0 tonne track-truck mounted CPT unit equipped with a 17.5 tonne capacity hydraulic ram set. Cone penetration testing was carried out in general accordance with BS ISO 22476-1:2012. Penetrometer measurements included cone tip resistance, friction sleeve resistance and dynamic pore water pressure sample at a 10mm resolution.

The fieldworks were supervised by a qualified Geotechnical Engineer from Intégral Géotechnique (Wales) Limited who also logged the rotary boreholes and prepared their detailed engineering logs in accordance with the requirements of BS5930+A2: 2010. The engineering logs provide descriptions of the materials encountered in accordance with BSEN ISO 14688-1 (2002) and 14689-1 (2003) for soils and rocks respectively.

### 3.1 FIELDWORKS (CONTINUED)

The approximate locations of the rotary boreholes and the CPT tests are shown on Figure 2. The borehole logs and core photographs are presented in Appendix A and the results of the CPT testing are presented in Appendix B.

### 3.2 LABORATORY CHEMICAL TESTING

Representative soil samples were taken from RC12 and RC13 within Area T, stored at the appropriate temperature and dispatched to the UKAS and MCERTS accredited laboratories of i2 Analytical for laboratory chemical testing within 24 hours.

A list of the soil testing carried out is given below:

Beryllium	Cadmium
Total Chromium	Hexavalent Chromium (VI)
Copper	Lead
Mercury	Nickel
Vanadium	Zinc
Arsenic	Boron
Selenium	Elemental Sulphur
Total Cyanide	Total Sulphate
Sulphide	Water Soluble Sulphate
pH	Monohydric Phenol
Polyaromatic Hydrocarbons (PAH)	Petroleum Hydrocarbons (VPH/EPH)
Asbestos	

The results of the soil testing are presented in Appendix C.

### 3.3 LABORATORY GEOTECHNICAL TESTING

Representative samples of the bedrock were taken and tested at the laboratories of Apex Testing Solutions Limited.

The rock samples were tested for either Uniaxial Compressive Strength (UCS), or Point Load Index Testing, subject to the nature of the rock core sample.

Samples of the overlying superficial soils were also tested for Liquid Limit, Plastic Limit and Plasticity Index.

The results of the geotechnical testing are presented in Appendix D.

### **3.4 IN-SITU GROUNDWATER MONITORING**

Data loggers have been installed in three groundwater monitoring wells and will monitor any changes to groundwater levels over a three month period. This report will be updated once the data logger information is available.

During the installation of the data loggers, the groundwater levels within each standpipe were measured.

The results of the groundwater monitoring are presented in Appendix E.

## **APPENDIX A**

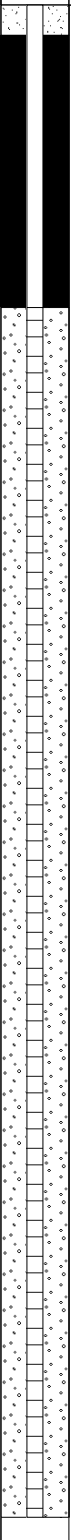
### **ROTARY BOREHOLE LOGS & CORE PHOTOGRAPHS**


	Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com	Project Name: <b>Wepa UK Limited</b>	Project No.: <b>12495</b>	Borehole No.: <b>RC06</b> Sheet 1 of 3
	Location: <b>Bridgend Paper Mill, Bridgend</b>	Client: <b>Wepa UK Limited</b>	Coordinates: 287830.63mE 187040.06mN	Hole Type: <b>RC</b>

Equipment: <b>Klemm 802</b>	Diameter of Casing: <b>115mm</b>	Level: <b>80.87m AOD</b>	Scale: <b>1:50</b>
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Diameter of Boring: <b>115mm</b>	Depth of Casing: <b>9.00m</b>	Dates: <b>28/01/2020 -</b>	Logged By: <b>GNS</b>
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Rotary Coring	Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description
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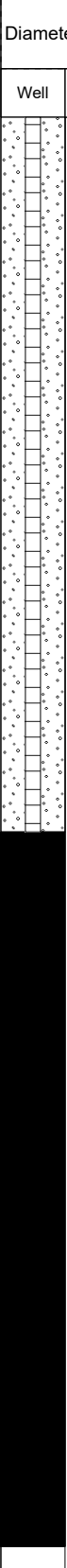
Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description
		Depth (m)	TCR	SCR	RQD	FI					
						0.22	80.65			Dense grey reinforced CONCRETE	
						0.80	80.07			Compact grey slightly sandy angular gravel and cobbles of limestone and concrete (MADE GROUND)	
						2.00	78.87			Open hole drilled through cobble and boulder obstructions	
						8.20	72.67			(Medium dense) brown, orange brown and dark brown, brown and grey clayey slightly silty sandy GRAVEL/gravelly SAND. Gravel is fine to coarse angular to sub angular sandstone and siltstone with ordinate bands of firm to stiff gravelly CLAY	
										(Medium dense) grey slightly clayey GRAVEL. Gravel is fine to coarse angular to tabular mudstone	


<b>Remarks:</b> 1. Dynamic sampled GL to 9.5m depth. Cored 9.5m to 25.0m depth 2. Heavy water seepage at 13.5m depth	<b>Key:</b> D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample SPT - Standard Penetration Test (split spoon) CPT - Standard Penetration Test (solid cone)	W - Water sample U - Undisturbed sample TCR - Total Core Recovery SCR - Solid Core Recovery RQD - Rock Quality Designation	
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	Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com	Project Name: <b>Wepa UK Limited</b>	Project No.: <b>12495</b>	Borehole No.: <b>RC06</b> Sheet 2 of 3
	Location: <b>Bridgend Paper Mill, Bridgend</b>	Client: <b>Wepa UK Limited</b>	Coordinates: 287830.63mE 187040.06mN	Hole Type: RC

Equipment: <b>Klemm 802</b>	Diameter of Casing: <b>115mm</b>	Level: <b>80.87mAOD</b>	Scale: <b>1:50</b>
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Diameter of Boring: <b>115mm</b>	Depth of Casing: <b>9.00m</b>	Dates: <b>28/01/2020 -</b>	Logged By: <b>GNS</b>
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Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description
		Depth (m)	TCR	SCR	RQD	FI					
		9.50 - 10.50	60	0	0		10.50	70.37		Black bright amorphous COAL (recovered as fine to coarse angular gravel)	
		10.50 - 12.00	67	7	0		11.20	69.67		Extremely weak and weak dark grey very thinly bedded fissile highly weathered MUDSTONE -Discontinuities closely spaced sub horizontal to 70 degrees irregular, rough, open	
		12.00 - 13.50	100	73	25						
		13.50 - 15.00	93	37	30		14.00	66.87		Weak to moderately strong grey thinly to medium bedded locally laminated moderately weathered coarse grained SILTSTONE/fine grained SANDSTONE -Discontinuities closely to medium spaced sub horizontal rough, open, planar and locally sub vertical to 65 degrees rough, irregular and stepped	
		15.00 - 16.50	93	73	40					Non intact between 14.10m-14.70m, 15.50m-15.60m, 16.60m-16.70m	
		16.50 - 17.70	100	25	12		17.00	63.87		Moderately strong grey laminated brown very thinly to medium bedded slightly to moderately weathered fine grained to medium grained SANDSTONE -Discontinuities closely to moderately spaced sub horizontal planar and tight (bedding) and locally sub vertical to 65 degrees irregular open, rough and stepped	
		17.70 - 19.20	100	87	47					-Non intact 17.40m-17.70m and non intact recovered as gravel 19.00m-19.50m	
		19.20 - 20.70	100	60	30						

<b>Remarks:</b> 1. Dynamic sampled GL to 9.5m depth. Cored 9.5m to 25.0m depth 2. Heavy water seepage at 13.5m depth	<b>Key:</b> D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample SPT - Standard Penetration Test (split spoon) CPT - Standard Penetration Test (solid cone)	W - Water sample U - Undisturbed sample TCR - Total Core Recovery SCR - Solid Core Recovery RQD - Rock Quality Designation	
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		Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com		Project Name: <b>Wepa UK Limited</b>				Project No.: <b>12495</b>		Borehole No.: <b>RC06</b> Sheet 3 of 3	
		Location: Bridgend Paper Mill, Bridgend				Client: Wepa UK Limited				Coordinates: 287830.63mE 187040.06mN	
Equipment: Klemm 802				Diameter of Casing: 115mm				Level: 80.87mAOD		Scale 1:50	
Diameter of Boring: 115mm				Depth of Casing: 9.00m				Dates 28/01/2020 -		Logged By: GNS	
Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description
		Depth (m)	TCR	SCR	RQD	FI					
		20.70 - 22.20	100	23	23						21
		22.20 - 23.70	100	0	0						22
		23.70 - 25.00	100	27	15						23
											24
						25.00	55.87			End of Borehole at 25.00 m	25
											26
											27
											28
											29
											30

**Remarks:**  
 1. Dynamic sampled GL to 9.5m depth. Cored 9.5m to 25.0m depth  
 2. Heavy water seepage at 13.5m depth

**Key:**  
 D - Small disturbed sample  
 B - Bulk disturbed sample  
 ES - Environmental soil sample  
 SPT - Standard Penetration Test (split spoon)  
 CPT - Standard Penetration Test (solid cone)  
 W - Water sample  
 U - Undisturbed sample  
 TCR - Total Core Recovery  
 SCR - Solid Core Recovery  
 RQD - Rock Quality Designation




	Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com	Project Name: <b>Wepa UK Limited</b>	Project No.: <b>12495</b>	Borehole No.: <b>RC07</b> Sheet 1 of 3
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Location: <b>Bridgend Paper Mill, Bridgend</b>	Client: <b>Wepa UK Limited</b>	Coordinates: 287880.49mE 187020.15mN	Hole Type: RC
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Equipment: <b>Klemm 802</b>	Diameter of Casing: <b>115mm</b>	Level: <b>80.49mAOD</b>	Scale: <b>1:50</b>
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Diameter of Boring: <b>115mm</b>	Depth of Casing: <b>11.50m</b>	Dates: <b>24/01/2020 -</b>	Logged By: <b>GNS</b>
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Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description	
		Depth (m)	TCR	SCR	RQD	FI						
						0.22	80.27			Dense grey reinforced CONCRETE		
						0.35	80.14			Compact grey slightly silty slightly sandy gravel and cobbles of angular and subangular concrete (MADE GROUND) (Loose) red brown and grey slightly clayey slightly silty slightly sandy GRAVEL. Gravel is fine to coarse angular and sub angular burnt brick and shale (MADE GROUND)	1	
						2.20	78.29			(Loose) brown grey and dark grey clayey silty slightly sandy GRAVEL with occasional cobbles of sub angular concrete. Gravel is fine to coarse angular and sub angular sandstone, occasional slag and concrete (MADE GROUND)	2	
						2.90	77.59			(Medium dense) brown silty sandy GRAVEL. Gravel is fine to coarse angular to sub rounded sandstone and siltstone	3	
											4	
						5.50	74.99			Firm to stiff light brown, brown and locally dark brown and grey slightly silty slightly sandy gravelly CLAY. Gravel is fine to coarse angular to sub rounded sandstone. Soft between 8.5m and 8.9m depth	6	
											7	
						9.50	70.99			Stiff dark grey and grey slightly silty very gravelly CLAY. Gravel is fine to coarse tabular mudstone.	9	
						10.00	70.49				10	






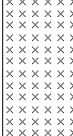


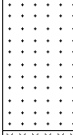
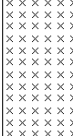


<b>Remarks:</b> 1. Dynamic sampled GL to 10.0m depth. Cored 10.0m to 25.0m depth 2. Borehole wet at 4.5m depth	<b>Key:</b> D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample SPT - Standard Penetration Test (split spoon) CPT - Standard Penetration Test (solid cone)	W - Water sample U - Undisturbed sample TCR - Total Core Recovery SCR - Solid Core Recovery RQD - Rock Quality Designation	
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	Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com	Project Name: <b>Wepa UK Limited</b>	Project No.: <b>12495</b>	Borehole No.: <b>RC07</b> Sheet 2 of 3
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Location: <b>Bridgend Paper Mill, Bridgend</b>	Client: <b>Wepa UK Limited</b>	Coordinates: 287880.49mE 187020.15mN	Hole Type: RC
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Equipment: <b>Klemm 802</b>	Diameter of Casing: <b>115mm</b>	Level: <b>80.49mAOD</b>	Scale: <b>1:50</b>
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Diameter of Boring: <b>115mm</b>	Depth of Casing: <b>11.50m</b>	Dates: <b>24/01/2020 -</b>	Logged By: <b>GNS</b>
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Well	Water Strikes	Rotary Coring				Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description
		Depth (m)	TCR	SCR	RQD					
		10.00 - 11.50	80	9	0	10.90	69.59		Black bright amorphous COAL (recovered as fine to coarse blocky gravel with some disseminated pyrite)	
						11.70	68.79		Extremely weak to weak dark grey thinly bedded fissile highly weathered carbonaceous MUDSTONE -Discontinuities closely spaced sub horizontal tight, planar and smooth	11
		11.50 - 13.00	100	90	49				-Non intact recovered as fine to coarse gravel between 11.50m-11.70m Extremely weak to moderately strong grey laminated light grey thinly to moderately weathered coarse grained SILTSTONE	12
									-Discontinuities closely to medium spaced sub horizontal to 10 degrees stepped, rough, open, irregular and rarely sub vertical to 70 degrees planar, tight, smooth	13
		13.00 - 14.50	100	90	70					14
		14.50 - 16.00	100	93	54	15.90	64.59			15
		16.00 - 17.50	98	89	35	17.00	63.49		Moderately strong grey thinly to medium bedded locally thickly laminated slightly weathered fine to medium grained SANDSTONE with localised disseminated 1-2mm pyrite crystals -Discontinuities closely to medium spaced sub horizontal irregular rough, open and sub vertical, irregular, rough, stepped	16
		17.50 - 19.00	97	88	51				Weak dark grey thinly to medium bedded slightly weathered SILTSTONE -Discontinuities closely to medium spaced sub horizontal tight and incipient, planar and smooth locally sub vertical -Non intact and recovered as fine to coarse tabular and sub angular gravel between 17.50m-17.70m and 19.00m-19.50m	17
		19.00 - 20.50	100	5	0	19.60	60.89		Moderately strong grey thinly to medium bedded slightly weathered fine to medium grained SANDSTONE	18
									19	
									20	

**Remarks:**  
 1. Dynamic sampled GL to 10.0m depth. Cored 10.0m to 25.0m depth  
 2. Borehole wet at 4.5m depth

**Key:**  
 D - Small disturbed sample  
 B - Bulk disturbed sample  
 ES - Environmental soil sample  
 SPT - Standard Penetration Test (split spoon)  
 CPT - Standard Penetration Test (solid cone)  
 W - Water sample  
 U - Undisturbed sample  
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 SCR - Solid Core Recovery  
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 Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com		Project Name: <b>Wepa UK Limited</b>				Project No.: <b>12495</b>		Borehole No.: <b>RC07</b> Sheet 3 of 3				
		Location: Bridgend Paper Mill, Bridgend				Client: Wepa UK Limited		Coordinates: 287880.49mE 187020.15mN		Hole Type: RC		
Equipment: Klemm 802		Diameter of Casing: 115mm				Level: 80.49mAOD		Scale 1:50				
Diameter of Boring: 115mm		Depth of Casing: 11.50m				Dates 24/01/2020 -		Logged By: GNS				
Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description	
		Depth (m)	TCR	SCR	RQD	FI						
		20.50 - 22.00	100	90	50				.....	-Discontinuities sub horizontal, sub vertical to 60 degrees irregular open rough  -Note localised rip up clasts and skerries of thin coal partings	21	
		22.00 - 23.50	100	53	43						22	
		23.50 - 25.00	100	63	60						23	
						25.00	55.49			End of Borehole at 25.00 m	24	
											25	
											26	
											27	
											28	
											29	
											30	


**Remarks:**  
 1. Dynamic sampled GL to 10.0m depth. Cored 10.0m to 25.0m depth  
 2. Borehole wet at 4.5m depth

**Key:**  
 D - Small disturbed sample  
 B - Bulk disturbed sample  
 ES - Environmental soil sample  
 SPT - Standard Penetration Test (split spoon)  
 CPT - Standard Penetration Test (solid cone)  
 W - Water sample  
 U - Undisturbed sample  
 TCR - Total Core Recovery  
 SCR - Solid Core Recovery  
 RQD - Rock Quality Designation



 Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com	Project Name: <b>Wepa UK Limited</b>	Project No.: <b>12495</b>	Borehole No.: <b>RC08</b> Sheet 1 of 3
	Location: Bridgend Paper Mill, Bridgend	Client: Wepa UK Limited	Coordinates: 287918.58mE 187020.75mN
Equipment: Klemm 802	Diameter of Casing: 115mm	Level: 80.66mAOD	Scale 1:50
Diameter of Boring: 115mm	Depth of Casing: 11.00m	Dates 22/01/2020 -	Logged By: GNS

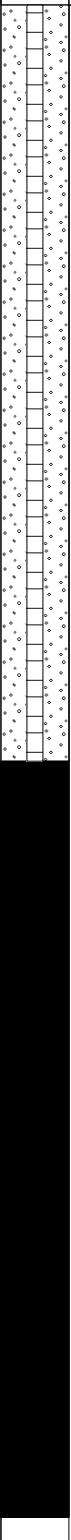
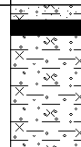
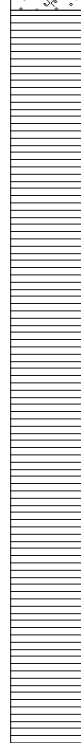
Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description
		Depth (m)	TCR	SCR	RQD	FI					
						0.23	80.43			Dense grey reinforced CONCRETE	1
						2.60	78.06			(Compact) grey slightly silty GRAVEL with occasional small cobbles. Gravel and cobbles fine to coarse angular limestone (MADE GROUND)	2
						5.10	75.56			Firm to stiff becoming stiff brown orange brown and grey slightly silty slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub rounded and sub angular sandstone	3
						8.40	72.26			(Medium dense to dense) brown and grey slightly silty sandy GRAVEL. Gravel is fine to coarse sub angular and angular sandstone and siltstone	4
										Stiff brown, grey and dark grey slightly silty very slightly sandy slightly gravelly CLAY. Gravel is fine to coarse angular and sub angular sandstone and siltstone with some coal	5
											6
											7
											8
											9
											10

<b>Remarks:</b> 1. dynamic sampled GL to 11.0m depth. Cored 11.0m to 25.0m depth.	<b>Key:</b> D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample SPT - Standard Penetration Test (split spoon) CPT - Standard Penetration Test (solid cone)	W - Water sample U - Undisturbed sample TCR - Total Core Recovery SCR - Solid Core Recovery RQD - Rock Quality Designation	
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Location: Bridgend Paper Mill, Bridgend	Client: Wepa UK Limited	Coordinates: 287918.58mE 187020.75mN	Hole Type: RC
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Equipment: Klemm 802	Diameter of Casing: 115mm	Level: 80.66mAOD	Scale: 1:50
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Diameter of Boring: 115mm	Depth of Casing: 11.00m	Dates: 22/01/2020 -	Logged By: GNS
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Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description
		Depth (m)	TCR	SCR	RQD	FI					
						10.10	70.56			Black bright friable COAL	
						10.20	70.46			Soft to firm to firm grey and dark grey slightly silty CLAY with frequent fine to medium tabular and angular gravel sized mudstone lithorelicts	
						11.00	69.66			Extremely weak and weak grey and dark grey very thinly bedded to thinly laminated moderately to highly weathered MUDSTONE	
		11.00 - 12.50	100	40	0					-Discontinuities closely to very closely spaced sub horizontal to 20 degrees stepped, planar, smooth and sub vertical to 65 degrees irregular, stepped, rough, open, tight incipient locally gravel filled	
		12.50 - 14.00	87	27	0					-Non intact between 11.00m-11.80m, 14.00m-15.30m, 15.50m-15.80m and recovered as fine to medium angular mudstone gravel	
		14.00 - 15.50	93	10	0					-Frequent coal traces/bands between 14.00m-15.30m	
		15.50 - 17.00	100	80	51	15.90	64.76			Weak to moderately strong grey thinly to medium bedded to thinly laminated (relict cross bedding) slightly weathered coarse grained SILTSTONE to fine grained SANDSTONE	
	17.00 - 18.50	90	76	35				-Discontinuities medium spaced sub horizontal tight, locally gravel filled and close incipient vertical to 75 degrees planar and tight			
	18.50 - 20.00	97	97	67							

**Remarks:**  
 1. dynamic sampled GL to 11.0m depth. Cored 11.0m to 25.0m depth.

- Key:**
- |   |                                |
|---|--------------------------------|
| D - Small disturbed sample                    | W - Water sample               |
| B - Bulk disturbed sample                     | U - Undisturbed sample         |
| ES - Environmental soil sample                | TCR - Total Core Recovery      |
| SPT - Standard Penetration Test (split spoon) | SCR - Solid Core Recovery      |
| CPT - Standard Penetration Test (solid cone)  | RQD - Rock Quality Designation |



 Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com		Project Name: <b>Wepa UK Limited</b>				Project No.: <b>12495</b>		Borehole No.: <b>RC08</b> Sheet 3 of 3							
		Location: Bridgend Paper Mill, Bridgend				Client: <b>Wepa UK Limited</b>		Coordinates: 287918.58mE 187020.75mN		Hole Type: RC					
Equipment: <b>Klemm 802</b>		Diameter of Casing: <b>115mm</b>				Level: <b>80.66mAOD</b>		Scale: 1:50							
Diameter of Boring: <b>115mm</b>		Depth of Casing: <b>11.00m</b>				Dates: 22/01/2020 -		Logged By: GNS							
Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description				
		Depth (m)	TCR	SCR	RQD	FI									
[REDACTED]	[REDACTED]	20.00 - 21.50	87	77	37		22.40	58.26	[REDACTED]	[REDACTED]	[REDACTED]	21			
		21.50 - 23.00	90	60	27								23		
		23.00 - 24.50	97	80	0									24	
		24.50 - 25.00	100	70	0										25
					25.00	55.66			25						
										End of Borehole at 25.00 m		26			
												27			
												28			
												29			
												30			
<b>Remarks:</b> 1. dynamic sampled GL to 11.0m depth. Cored 11.0m to 25.0m depth.								<b>Key:</b> D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample SPT - Standard Penetration Test (split spoon) CPT - Standard Penetration Test (solid cone)				W - Water sample U - Undisturbed sample TCR - Total Core Recovery SCR - Solid Core Recovery RQD - Rock Quality Designation			
															

Location:  
Bridgend Paper Mill, Bridgend

Client: Wepa UK Limited

Coordinates:  
287893.14mE  
186998.28mN

Hole Type:  
RC

Equipment: Klemm 802

Diameter of Casing: 115mm

Level: 80.18mAOD

Scale  
1:50

Diameter of Boring: 115mm

Depth of Casing: 7.50m

Dates  
21/01/2020 -

Logged By:  
GNS

Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description	
		Depth (m)	TCR	SCR	RQD	FI						
							0.22	79.96			Dense grey reinforced CONCRETE	
							0.40	79.78			(Compact) grey slightly silty slightly sandy GRAVEL of angular concrete and limestone (MADE GROUND)	
											(Medium dense) brown, orange brown, grey locally dark brown slightly silty slightly sandy to sandy GRAVEL. Gravel is fine to coarse angular, sub angular and sub rounded sandstone and siltstone	
								5.50	74.68			Stiff grey brown slightly silty very slightly sandy slightly gravelly to gravelly CLAY. Gravel is fine to coarse angular, sub angular to sub rounded sandstone and siltstone
								5.90	74.28			Dense grey and brown slightly silty blocky and sub angular GRAVEL of sandstone and siltstone
				6.70 - 8.00	77	80	8	6.70	73.48			Weak to moderately strong grey thinly bedded to thinly laminated (relict cross bedding) slightly weathered to moderately weathered coarse grained SILTSTONE and locally fine grained SANDSTONE
				8.00 - 9.50	100	87	22					-Discontinuities closely spaced, sub horizontal to 20 degrees, smooth, open, rough and close incipient tight and rough  -Non intact between 6.70m-7.20m and recovered as fine to medium angular and sub angular siltstone/sandstone gravel. Locally non intact

**Remarks:**  
1. Dynamic sampled GL to 6.7m depth. Cored 6.7m to 13.6m depth  
2. Artisan flow at 6.0m depth

**Key:**  
D - Small disturbed sample  
B - Bulk disturbed sample  
ES - Environmental soil sample  
SPT - Standard Penetration Test (split spoon)  
CPT - Standard Penetration Test (solid cone)  
W - Water sample  
U - Undisturbed sample  
TCR - Total Core Recovery  
SCR - Solid Core Recovery  
RQD - Rock Quality Designation

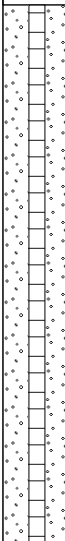
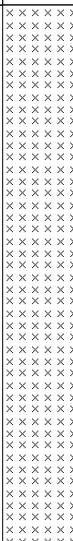



	Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com	Project Name: <b>Wepa UK Limited</b>	Project No.: <b>12495</b>	Borehole No.: <b>RC09</b> Sheet 2 of 2
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Location: <b>Bridgend Paper Mill, Bridgend</b>	Client: <b>Wepa UK Limited</b>	Coordinates: 287893.14mE 186998.28mN	Hole Type: RC
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Equipment: <b>Klemm 802</b>	Diameter of Casing: <b>115mm</b>	Level: <b>80.18mAOD</b>	Scale: <b>1:50</b>
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Diameter of Boring: <b>115mm</b>	Depth of Casing: <b>7.50m</b>	Dates: <b>21/01/2020 -</b>	Logged By: <b>GNS</b>
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Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description
		Depth (m)	TCR	SCR	RQD	FI					
		9.50 - 10.60	100	86	11						
		10.60 - 12.10	93	83	44						
		12.10 - 13.60	100	90	17						
						13.60	66.58			End of Borehole at 13.60 m	

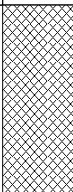
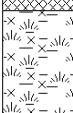

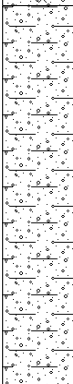
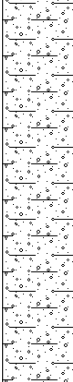




<b>Remarks:</b> 1. Dynamic sampled GL to 6.7m depth. Cored 6.7m to 13.6m depth 2. Artisan flow at 6.0m depth	<b>Key:</b> D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample SPT - Standard Penetration Test (split spoon) CPT - Standard Penetration Test (solid cone)	W - Water sample U - Undisturbed sample TCR - Total Core Recovery SCR - Solid Core Recovery RQD - Rock Quality Designation	
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	Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com	Project Name: <b>Wepa UK Limited</b>	Project No.: <b>12495</b>	Borehole No.: <b>RC10</b> Sheet 1 of 3
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Location: <b>Bridgend Paper Mill, Bridgend</b>	Client: <b>Wepa UK Limited</b>	Coordinates: 288024.65mE 187040.45mN	Hole Type: <b>RC</b>
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Equipment: <b>Klemm 802</b>	Diameter of Casing: <b>115mm</b>	Level: <b>75.90m AOD</b>	Scale: <b>1:50</b>
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Diameter of Boring: <b>115mm</b>	Depth of Casing: <b>14.70m</b>	Dates: <b>15/01/2020 -</b>	Logged By: <b>GNS</b>
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Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description	
		Depth (m)	TCR	SCR	RQD	FI						
						1.30	74.60			Stiff grey brown and dark brown slightly sandy gravelly CLAY with frequent cobbles of subangular sandstone. Gravel is fine to coarse sandstone and rare ash and brick (MADE GROUND)		1
						2.10	73.81			Soft brown silty sandy peaty CLAY/clayey PEAT with frequent rootlets		2
						2.90	73.00			Firm grey brown silty sandy slightly gravelly CLAY. Gravel is fine to coarse angular to sub angular sandstone		3
										(Medium dense to dense) brown, light brown, orange brown and dark grey slightly clayey sandy GRAVEL. Gravel is fine to coarse angular to sub rounded and sub angular sandstone and siltstone		4
												5
												6
												7
						8.00	67.90			Firm grey brown slightly silty slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub rounded and sub angular sandstone and siltstone		8
						9.00	66.90			(Medium dense) brown slightly silty sandy GRAVEL. Gravel is fine to coarse sub rounded and sub angular sandstone		9
						9.40	66.50			Firm to stiff grey brown slightly gravelly CLAY. Gravel is fine to coarse angular and sub angular sandstone and siltstone		10

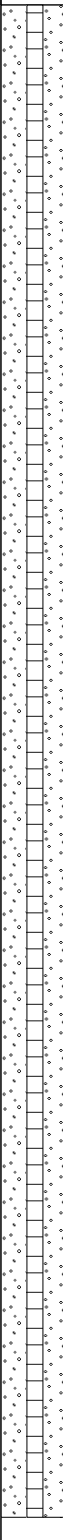
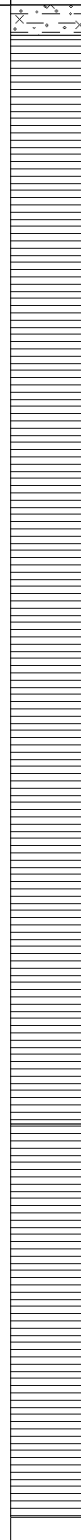
<b>Remarks:</b> 1. Dynamic sampled GL to 10.2m depth. Cored 10.2m to 25.8m depth 2. Borehole artesian at 10.2m depth 3. Borehole collapsing 16m to 10m depth	<b>Key:</b> D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample SPT - Standard Penetration Test (split spoon) CPT - Standard Penetration Test (solid cone)	W - Water sample U - Undisturbed sample TCR - Total Core Recovery SCR - Solid Core Recovery RQD - Rock Quality Designation	
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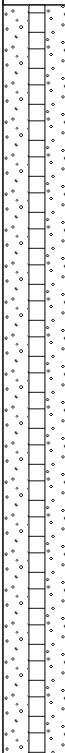

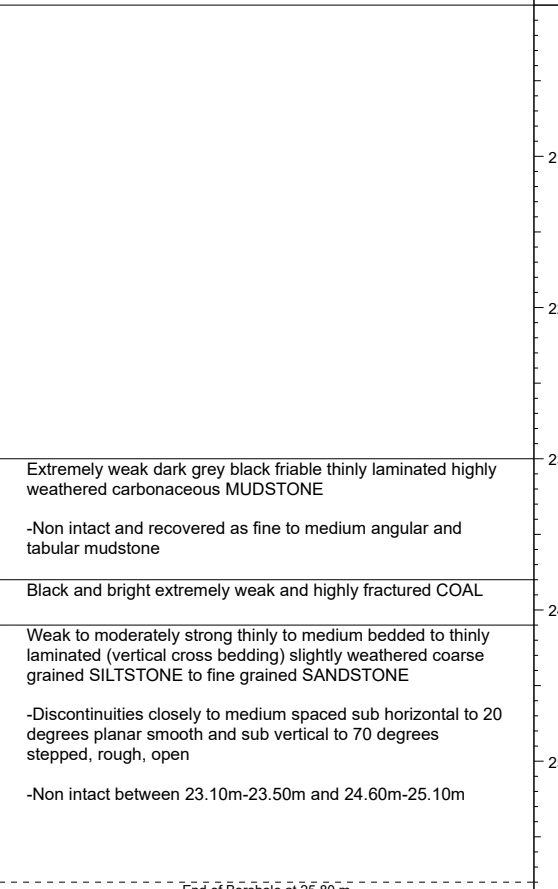
Location: <b>Bridgend Paper Mill, Bridgend</b>	Client: <b>Wepa UK Limited</b>	Coordinates: 288024.65mE 187040.45mN	Hole Type: <b>RC</b>
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Equipment: <b>Klemm 802</b>	Diameter of Casing: <b>115mm</b>	Level: <b>75.90m AOD</b>	Scale: <b>1:50</b>
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Diameter of Boring: <b>115mm</b>	Depth of Casing: <b>14.70m</b>	Dates: <b>15/01/2020 -</b>	Logged By: <b>GNS</b>
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Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description
		Depth (m)	TCR	SCR	RQD	FI					
	10.20					10.20	65.70			<p>Extremely weak and weak grey and dark grey thinly bedded moderately weathered to highly weathered MUDSTONE</p> <p>-Discontinuities closely spaced sub horizontal, planar, tight, open and sub vertical 60-85 degrees planar smooth and stepped</p> <p>-Non intact between 10.20m-14.80m, 13.20m-13.50m, 14.70m-14.80m and 16.10m-16.25m</p>	
	10.20 - 11.70	73	10	0				11			
	11.70 - 13.20	97	13	0				12			
	13.20 - 14.70	100	13	0				13			
	14.70 - 16.10	100	11	0				14			
	16.10 - 17.40	100	46	0				15			
	17.40 - 18.90	100	55	0		17.40	58.50	16			
18.90 - 20.10	100	18	0				17				
										18	
										19	
										20	

<b>Remarks:</b> 1. Dynamic sampled GL to 10.2m depth. Cored 10.2m to 25.8m depth 2. Borehole artesian at 10.2m depth 3. Borehole collapsing 16m to 10m depth	<b>Key:</b> D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample SPT - Standard Penetration Test (split spoon) CPT - Standard Penetration Test (solid cone)	W - Water sample U - Undisturbed sample TCR - Total Core Recovery SCR - Solid Core Recovery RQD - Rock Quality Designation	
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		Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com		Project Name: <b>Wepa UK Limited</b>			Project No.: <b>12495</b>		Borehole No.: <b>RC10</b> Sheet 3 of 3		
Location: Bridgend Paper Mill, Bridgend				Client: Wepa UK Limited			Coordinates: 288024.65mE 187040.45mN		Hole Type: RC		
Equipment: Klemm 802				Diameter of Casing: 115mm			Level: 75.90m AOD		Scale: 1:50		
Diameter of Boring: 115mm				Depth of Casing: 14.70m			Dates: 15/01/2020 -		Logged By: GNS		
Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description
		Depth (m)	TCR	SCR	RQD	FI					
		20.10 - 21.60	100	80	0						
		21.60 - 23.10	47	0	0						
		23.10 - 24.60	87	60	27		23.00 52.90	23.80 52.10			24.10 51.80
		24.60 - 25.80	83	21	13						
							25.80 50.10				
		End of Borehole at 25.80 m									

**Remarks:**  
 1. Dynamic sampled GL to 10.2m depth. Cored 10.2m to 25.8m depth  
 2. Borehole artesian at 10.2m depth  
 3. Borehole collapsing 16m to 10m depth

**Key:**  
 D - Small disturbed sample  
 B - Bulk disturbed sample  
 ES - Environmental soil sample  
 SPT - Standard Penetration Test (split spoon)  
 CPT - Standard Penetration Test (solid cone)  
 W - Water sample  
 U - Undisturbed sample  
 TCR - Total Core Recovery  
 SCR - Solid Core Recovery  
 RQD - Rock Quality Designation



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	Location: Bridgend Paper Mill, Bridgend	Client: Wepa UK Limited	Coordinates: 288008.28mE 186989.47mN	Hole Type: RC

Equipment: Klemm 802	Diameter of Casing: 115mm	Level: 82.66mAOD	Scale 1:50
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Diameter of Boring: 115mm	Depth of Casing: 13.50m	Dates 17/01/2020 -	Logged By: GNS
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Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description	
		Depth (m)	TCR	SCR	RQD	FI						
						0.60	82.06			(Compact) grey brown and light grey slightly clayey slightly silty sandy GRAVEL with frequent cobbles of limestone, clinker, slag, sandstone and brick. Gravel is fine to coarse angular and sub angular concrete, clinker, sandstone and brick (MADE GROUND)		
										Soft to firm locally firm medium brown to dark brown silty sandy gravelly CLAY with frequent cobbles of concrete, brick, sandstone, vesicular slag, sandstone and clinker. Gravel is fine to coarse angular and sub angular sandstone, vesicular slag, clinker, concrete, mudstone, ash and timber. Locally fine to medium gravel sized inclusions of peat/organic rich material (MADE GROUND)	1	
											2	
											3	
											4	
						5.00	77.66			Firm to stiff brown mottled grey slightly silty slightly sandy gravelly CLAY. Gravel is fine to coarse sub angular, angular and sub rounded sandstone and siltstone	5	
						6.00	76.66			(Medium dense) brown locally dark brown slightly silty sandy GRAVEL. Gravel is fine to coarse sub angular and sub rounded sandstone and siltstone	6	
											7	
						8.30	74.36			Stiff brown and grey slightly silty sandy slightly gravelly CLAY. Gravel is fine to coarse sub rounded and sub angular sandstone and siltstone	8	
						9.00	73.66			(Medium dense) brown slightly silty sandy GRAVEL. Gravel is fine to coarse sub angular and sub rounded sandstone and siltstone	9	
						9.80	72.86			Stiff brown and grey slightly silty sandy slightly gravelly to	10	

**Remarks:**

- Dynamic sampled GL to 13.5m depth. Rotary cored 13.5m to 25.0m depth
- Borehole wet at 6.0m depth
- Water seepage at 19.0m depth
- Heavy water seepage at 23.1m depth

**Key:**

D - Small disturbed sample	W - Water sample
B - Bulk disturbed sample	U - Undisturbed sample
ES - Environmental soil sample	TCR - Total Core Recovery
SPT - Standard Penetration Test (split spoon)	SCR - Solid Core Recovery
CPT - Standard Penetration Test (solid cone)	RQD - Rock Quality Designation

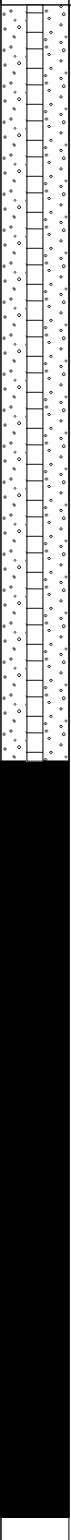




	Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com	Project Name: <b>Wepa UK Limited</b>	Project No.: <b>12495</b>	Borehole No.: <b>RC11</b> Sheet 2 of 3
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Location: <b>Bridgend Paper Mill, Bridgend</b>	Client: <b>Wepa UK Limited</b>	Coordinates: 288008.28mE 186989.47mN	Hole Type: RC
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Equipment: <b>Klemm 802</b>	Diameter of Casing: <b>115mm</b>	Level: <b>82.66m AOD</b>	Scale: <b>1:50</b>
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Diameter of Boring: <b>115mm</b>	Depth of Casing: <b>13.50m</b>	Dates: <b>17/01/2020 -</b>	Logged By: <b>GNS</b>
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Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description
		Depth (m)	TCR	SCR	RQD	FI					
										gravelly CLAY. Gravel is sub rounded to angular sandstone and siltstone	
							12.85	69.81			Black and bright friable COAL recovered as firm to medium angular gravel
							13.20	69.46			Stiff grey slightly silty thinly laminated CLAY with frequent fine to medium gravel sized mudstone lithorelicts
							13.50	69.16			Extremely weak to weak grey and dark grey thinly bedded to thinly laminated moderately weathered fissile MUDSTONE  -Discontinuities closely to very closely spaced sub horizontal to 20 degrees stepped rough and sub vertical to 70 degrees irregular stepped rough open and tight and incipient  -Generally non-intact between 13.50m-14.20m and between 16.60m -18.00m and recovered as fine to coarse angular gravel of sandstone with some clay matrix
		13.50 - 15.00	84	27	0						
		15.00 - 16.50	87	32	0						
		16.50 - 18.00	87	0	0						
		18.00 - 18.40					18.00	64.66			Black bright friable COAL (recovered as fine to medium angular gravel) Non-intact
		18.00 - 18.40					18.40	64.26			Extremely weak to weak grey and dark grey thinly bedded to thinly laminated moderately weathered fissile MUDSTONE
		18.00 - 19.50	80	37	7						
					19.50	63.16				Soft to firm very gravelly CLAY. Gravel is fine to medium angular to sub angular mudstone	
					19.90	62.76					

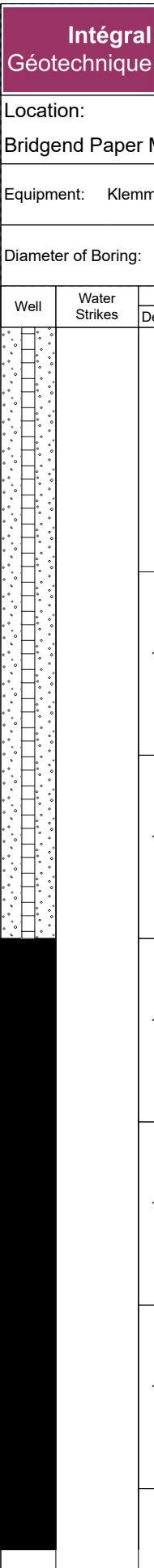
<b>Remarks:</b> 1. Dynamic sampled GL to 13.5m depth. Rotary cored 13.5m to 25.0m depth 1. Borehole wet at 6.0m depth 2. Water seepage at 19.0m depth 2. Heavy water seepage at 23.1m depth	<b>Key:</b> D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample SPT - Standard Penetration Test (split spoon) CPT - Standard Penetration Test (solid cone)	W - Water sample U - Undisturbed sample TCR - Total Core Recovery SCR - Solid Core Recovery RQD - Rock Quality Designation	
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 Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com	Project Name: <b>Wepa UK Limited</b>		Project No.: <b>12495</b>	Borehole No.: <b>RC12</b> Sheet 1 of 3	
	Location: Bridgend Paper Mill, Bridgend		Client: Wepa UK Limited	Coordinates: 287974.53mE 187134.29mN	Hole Type: RC
	Equipment: Klemm 802		Diameter of Casing: 115mm	Level: 75.59m AOD	Scale: 1:50
	Diameter of Boring: 115mm		Depth of Casing: 18.00m	Dates: 03/02/2020 -	Logged By: GNS

Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description	
		Depth (m)	TCR	SCR	RQD	FI						
						0.20	75.39			Dense grey reinforced CONCRETE		
						0.40	75.19			Compact dark grey and black slightly silty gravel of angular limestone, brick and ash (MADE GROUND)		
						0.60	74.99			Dense grey CONCRETE		
						0.90	74.69			Soft dark brown grey and yellow brown silty sandy gravelly CLAY. Gravel is fine to coarse angular and sub angular limestone, concrete and ash (MADE GROUND)		
										Firm orange brown and grey and light brown silty very sandy slightly gravelly CLAY. Gravel is fine to coarse sub angular sandstone	1	
						2.00	73.59			(Medium dense) brown and grey slightly silty sandy GRAVEL. Gravel is fine to coarse angular to sub rounded sandstone	2	
											3	
											4	
											5	
											6	
						6.20	69.39			Stiff dark grey brown very slightly silty very slightly sandy slightly gravelly CLAY with occasional cobbles of sub rounded and sub angular sandstone	7	
											8	
											9	
											10	

<b>Remarks:</b> 1. Dynamic sampled GL to 12.0m depth. Cored 12.0m to 25.0m. 2. Dynamic sample wet at 2.5m depth 3. Borehole wet at 4.5m depth 4. Borehole collapsing 17.0m-18.0m depth	<b>Key:</b> D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample SPT - Standard Penetration Test (split spoon) CPT - Standard Penetration Test (solid cone)	W - Water sample U - Undisturbed sample TCR - Total Core Recovery SCR - Solid Core Recovery RQD - Rock Quality Designation	
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		Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com		Project Name: <b>Wepa UK Limited</b>		Project No.: <b>12495</b>		Borehole No.: <b>RC12</b> Sheet 2 of 3			
		Location: Bridgend Paper Mill, Bridgend		Client: Wepa UK Limited		Coordinates: 287974.53mE 187134.29mN		Hole Type: RC			
Equipment: Klemm 802		Diameter of Casing: 115mm		Level: 75.59m AOD		Scale 1:50					
Diameter of Boring: 115mm		Depth of Casing: 18.00m		Dates 03/02/2020 -		Logged By: GNS					
Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description
		Depth (m)	TCR	SCR	RQD	FI					
		12.00 - 13.50	97	26	7	12.00	63.59			Extremely weak dark grey very thinly bedded to thinly bedded fissile moderately weathered MUDSTONE  -Discontinuities closely spaced sub horizontal, rough, open, stepped and locally sub vertical to 60 degrees tight incipient and irregular  -Non intact 12.00m-12.30m, 12.35m-12.40m and 12.70m-12.75m	
		13.50 - 15.00	77	17	0	13.90	61.69			Weak to moderately strong grey brown thinly bedded to thinly laminated black highly weathered to moderately weathered SANDSTONE with frequent irregular 1-3mm coal partings bands	
		15.00 - 16.50	83	23	0	14.90	60.69			Weak to medium strong light grey and grey thinly bedded to thinly laminated (relict cross bedding) coarse grained SILTSTONE/fine grained SANDSTONE  -Discontinuities closely to medium spaced sub horizontal stepped rough and sub vertical to 45 degrees irregular rough stepped open and locally angular gravel filled	
		16.50 - 18.00	53	7	0	16.80	58.79			Strong grey thinly to medium bedded slightly weathered well cemented SANDSTONE  -Discontinuities sub horizontal planar and smooth, sub vertical, planar, smooth and open  -Non-intact 17.1m-18.00m	
		18.00 - 19.50	13	0	0	18.00	57.59			Firm grey silty sandy gravelly CLAY. Gravel is fine to coarse angular mudstone, siltstone and coal  -Localised thin subordinate bands of coal  -Soft between 21.6m-21.8m	


**Remarks:**

1. Dynamic sampled GL to 12.0m depth. Cored 12.0m to 25.0m.
2. Dynamic sample wet at 2.5m depth
3. Borehole wet at 4.5m depth
4. Borehole collapsing 17.0m-18.0m depth

**Key:**

- |   |                                |
|---|--------------------------------|
| D - Small disturbed sample                    | W - Water sample               |
| B - Bulk disturbed sample                     | U - Undisturbed sample         |
| ES - Environmental soil sample                | TCR - Total Core Recovery      |
| SPT - Standard Penetration Test (split spoon) | SCR - Solid Core Recovery      |
| CPT - Standard Penetration Test (solid cone)  | RQD - Rock Quality Designation |



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		Location: Bridgend Paper Mill, Bridgend				Client: Wepa UK Limited		Coordinates: 287974.53mE 187134.29mN		Hole Type: RC	
Equipment: Klemm 802		Diameter of Casing: 115mm				Level: 75.59mAOD		Scale 1:50			
Diameter of Boring: 115mm		Depth of Casing: 18.00m				Dates 03/02/2020 -		Logged By: GNS			
Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description
		Depth (m)	TCR	SCR	RQD	FI					
		19.50 - 20.50	7	0	0						
		20.50 - 22.00	80	0	0		21.80	53.79			
							22.00	53.59			(Loose) dark brown and black clayey silty organic rich SAND
		22.00 - 23.50	93	10	0		22.30	53.29			Black bright friable COAL recovered as fine to medium blocky and platy gravel of coal
											Extremely weak to weak grey thinly bedded to thinly laminated fissile MUDSTONE
		23.50 - 25.00	87	0	0					-Highly fractured and generally non intact and recovered as fine to coarse gravel and cobbles of angular mudstone	
						25.00	50.59			End of Borehole at 25.00 m	

**Remarks:**  
 1. Dynamic sampled GL to 12.0m depth. Cored 12.0m to 25.0m.  
 2. Dynamic sample wet at 2.5m depth  
 3. Borehole wet at 4.5m depth  
 4. Borehole collapsing 17.0m-18.0m depth

**Key:**  
 D - Small disturbed sample  
 B - Bulk disturbed sample  
 ES - Environmental soil sample  
 SPT - Standard Penetration Test (split spoon)  
 CPT - Standard Penetration Test (solid cone)  
 W - Water sample  
 U - Undisturbed sample  
 TCR - Total Core Recovery  
 SCR - Solid Core Recovery  
 RQD - Rock Quality Designation

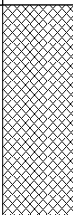
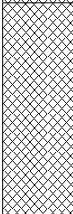
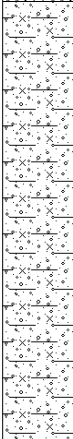





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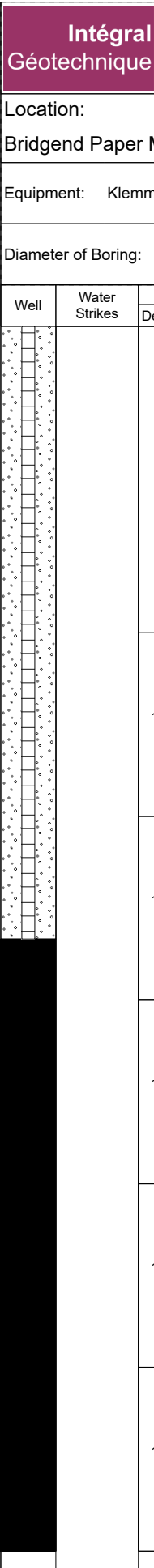
Location: <b>Bridgend Paper Mill, Bridgend</b>	Client: <b>Wepa UK Limited</b>	Coordinates: 287984.11mE 187122.17mN	Hole Type: RC
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Equipment: <b>Klemm 802</b>	Diameter of Casing: <b>115mm</b>	Level: <b>75.34mAOD</b>	Scale: 1:50
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Diameter of Boring: <b>115mm</b>	Depth of Casing: <b>19.50m</b>	Dates: 30/01/2020 -	Logged By: GNS
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Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description
		Depth (m)	TCR	SCR	RQD	FI					
						1.40	73.94			(Compact) grey brown and red brown slightly clayey sandy GRAVEL. Gravel is fine to coarse angular limestone, brick, ash, clinker, slag. poor recovery (MADE GROUND)	1
						2.80	72.54			(Loose) brown discoloured grey and black slightly gravelly SAND. Gravel is fine to coarse angular brick, ash, clinker, sandstone and shell fragments (MADE GROUND)	2
						5.70	69.64			(Medium dense) brown light brown and dark brown slightly clayey slightly silty sandy GRAVEL. Gravel is fine to coarse angular to sub rounded sandstone. Occasional sub angular sandstone cobbles	3
						9.00	66.34			Stiff grey brown slightly silty slightly sandy slightly gravelly to gravelly CLAY. Gravel is fine to coarse angular to sub angular sandstone and siltstone	6
										Firm grey slightly silty gravelly CLAY/clayey GRAVEL. Gravel is fine to coarse angular and platy mudstone	9

<b>Remarks:</b> 1. Dynamic sampled GL to 12.5m depth. Cored 12.5m to 25.0m 2. Borehole wet at 0.4m depth 3. Artesian flow at 14.0m depth 4. Borehole collapsing at 17.3m and 19.0m depth (excessive water)	<b>Key:</b> D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample SPT - Standard Penetration Test (split spoon) CPT - Standard Penetration Test (solid cone)	W - Water sample U - Undisturbed sample TCR - Total Core Recovery SCR - Solid Core Recovery RQD - Rock Quality Designation	
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		Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com		Project Name: <b>Wepa UK Limited</b>		Project No.: <b>12495</b>		Borehole No.: <b>RC13</b> Sheet 2 of 3		
Location: Bridgend Paper Mill, Bridgend		Client: Wepa UK Limited		Coordinates: 287984.11mE 187122.17mN		Hole Type: RC				
Equipment: Klemm 802		Diameter of Casing: 115mm		Level: 75.34mAOD		Scale: 1:50				
Diameter of Boring: 115mm		Depth of Casing: 19.50m		Dates: 30/01/2020 -		Logged By: GNS				
Well	Water Strikes	Rotary Coring				Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description
		Depth (m)	TCR	SCR	RQD					
		12.50 - 14.00	100	33	0	12.50	62.84			Extremely weak grey clayey highly weathered fissile MUDSTONE
						13.50	61.84			Moderately strong dark grey thinly laminated highly weathered SANDSTONE with frequent 2-4mm coal traces
						14.00	61.34			-Banded appearance
						14.20	61.14			-Generally non intact and recovered as fine to coarse blocky gravel
		14.00 - 15.50	73	0	0	14.40	60.94			Soft to firm grey silty slightly sandy CLAY with frequent fine to coarse gravel sized lithorelicts
										Black bright amorphous COAL (recovered as coarse blocky gravel with disseminated pyrite)
										Firm grey slightly silty CLAY with frequent fine to coarse gravel sized mudstone lithorelicts and coal fragments
						15.20	60.14			Black bright amorphous COAL (recovered as coarse blocky gravel with disseminated pyrite)
						15.50	59.84			Soft grey silty CLAY with frequent fine to medium gravel sized angular mudstone lithorelicts (completely weathered mudstone)
		15.50 - 17.00	100	0	0	16.30	59.04			Stiff grey silty CLAY with frequent fine to medium tabular and platy mudstone lithorelicts (completely weathered mudstone)
		17.00 - 18.50	50	0	0					
		18.50 - 20.00	0	0	0					
						20.00	55.34			


**Remarks:**


1. Dynamic sampled GL to 12.5m depth. Cored 12.5m to 25.0m
2. Borehole wet at 0.4m depth
3. Artesian flow at 14.0m depth
4. Borehole collapsing at 17.3m and 19.0m depth (excessive water)

**Key:**

- |   |                                |
|---|--------------------------------|
| D - Small disturbed sample                    | W - Water sample               |
| B - Bulk disturbed sample                     | U - Undisturbed sample         |
| ES - Environmental soil sample                | TCR - Total Core Recovery      |
| SPT - Standard Penetration Test (split spoon) | SCR - Solid Core Recovery      |
| CPT - Standard Penetration Test (solid cone)  | RQD - Rock Quality Designation |



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		Location: Bridgend Paper Mill, Bridgend				Client: Wepa UK Limited		Coordinates: 287984.11mE 187122.17mN		Hole Type: RC		
Equipment: Klemm 802		Diameter of Casing: 115mm				Level: 75.34mAOD		Scale 1:50				
Diameter of Boring: 115mm		Depth of Casing: 19.50m				Dates 30/01/2020 -		Logged By: GNS				
Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description	
		Depth (m)	TCR	SCR	RQD	FI						
		20.00 - 21.50	100	40	23					Extremely weak dark grey thinly laminated fissile highly weathered MUDSTONE with sub ordinate clay bands  -Discontinuities very closely spaced sub horizontal rough, stepped, open, tight, irregular	21	
		21.50 - 23.00	93	43	12						22	
		23.00 - 24.50	80	0	0						23	
						24.50	50.84			NO RECOVERY	24	
						25.00	50.34			End of Borehole at 25.00 m	25	
											26	
											27	
											28	
											29	
											30	

<b>Remarks:</b> 1. Dynamic sampled GL to 12.5m depth. Cored 12.5m to 25.0m 2. Borehole wet at 0.4m depth 3. Artesian flow at 14.0m depth 4. Borehole collapsing at 17.3m and 19.0m depth (excessive water)	<b>Key:</b> D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample SPT - Standard Penetration Test (split spoon) CPT - Standard Penetration Test (solid cone)	W - Water sample U - Undisturbed sample TCR - Total Core Recovery SCR - Solid Core Recovery RQD - Rock Quality Designation	
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RC06 - CORE PHOTOGRAPHS 0m to 6.5m

Wepa UK, Bridgend Paper Mill, Cardiff



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Castlegate Business Park  
Caerphilly  
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RC06 - CORE PHOTOGRAPHS 6.5m to 12.0m

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RC06 - CORE PHOTOGRAPHS 12.0m to 17.7m

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RC06 - CORE PHOTOGRAPHS 20.7m to 23.7m

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RC06 - CORE PHOTOGRAPHS 23.7m to 25.0m

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RC07 - CORE PHOTOGRAPHS 0m to 5.5m

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RC07 - CORE PHOTOGRAPHS 5.5m to 11.5m

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RC07 - CORE PHOTOGRAPHS 11.5m to 17.5m

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RC07 - CORE PHOTOGRAPHS 17.5m to 23.5m

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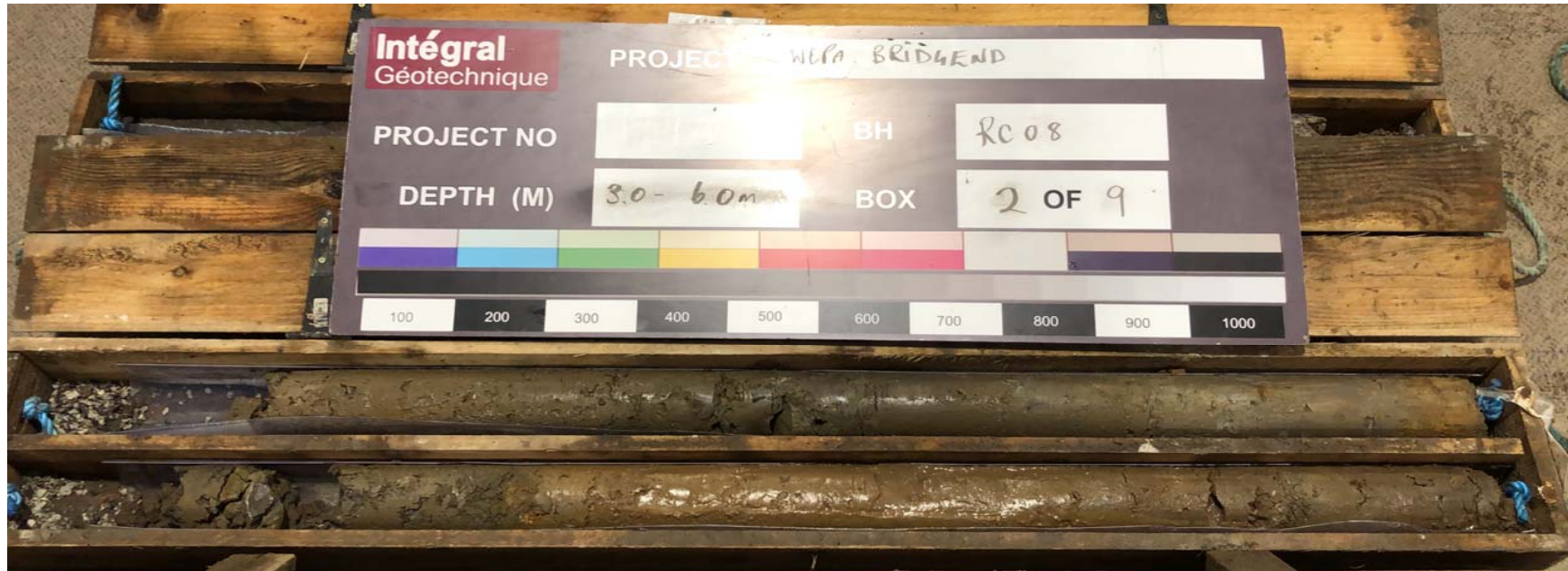


RC07 - CORE PHOTOGRAPHS 23.5m to 25.0m

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RC08 - CORE PHOTOGRAPHS 0m to 6.0m

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RC08 - CORE PHOTOGRAPHS 6.0m to 11.0m

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Caerphilly  
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Fax: 029 2086 2176



RC08 - CORE PHOTOGRAPHS 11.0m to 17.0m

Wepa UK, Bridgend Paper Mill, Cardiff



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Caerphilly  
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Fax: 029 2086 2176



RC08 - CORE PHOTOGRAPHS 17.0m to 23.0m

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Fax: 029 2086 2176



RC08 - CORE PHOTOGRAPHS 23.0m to 25.0m

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Fax: 029 2086 2176

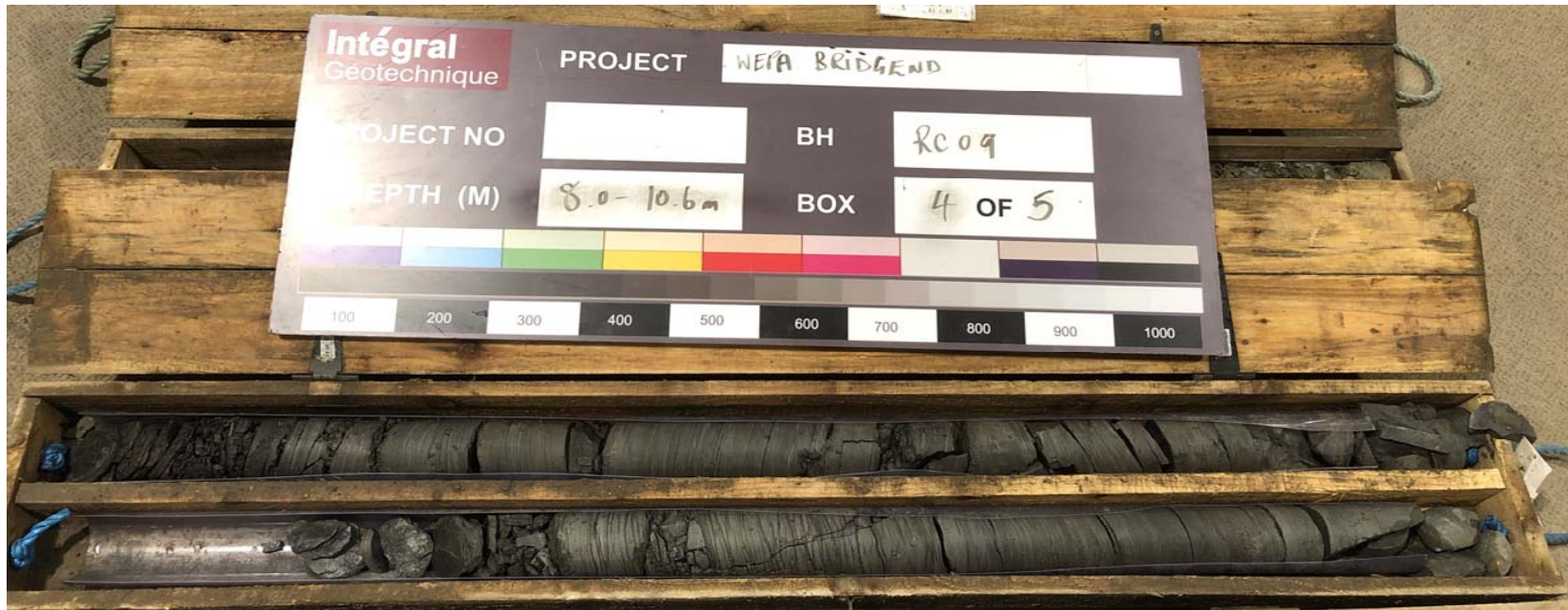


RC09 - CORE PHOTOGRAPHS 0m to 6.0m

Wepa UK, Bridgend Paper Mill, Cardiff



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Castlegate Business Park  
Caerphilly  
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Fax: 029 2086 2176



RC09 - CORE PHOTOGRAPHS 6.0m to 10.6m

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Caerphilly  
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Fax: 029 2086 2176



RC09 - CORE PHOTOGRAPHS 10.6m to 13.6m

Wepa UK, Bridgend Paper Mill, Cardiff



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RC10 - CORE PHOTOGRAPHS 0m to 6.0m

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RC10 - CORE PHOTOGRAPHS 6.0m to 11.7m

Wepa UK, Bridgend Paper Mill, Cardiff



RC10 - CORE PHOTOGRAPHS 11.7m to 17.4m

Wepa UK, Bridgend Paper Mill, Cardiff



RC10 - CORE PHOTOGRAPHS 17.4m to 23.1m

Wepa UK, Bridgend Paper Mill, Cardiff



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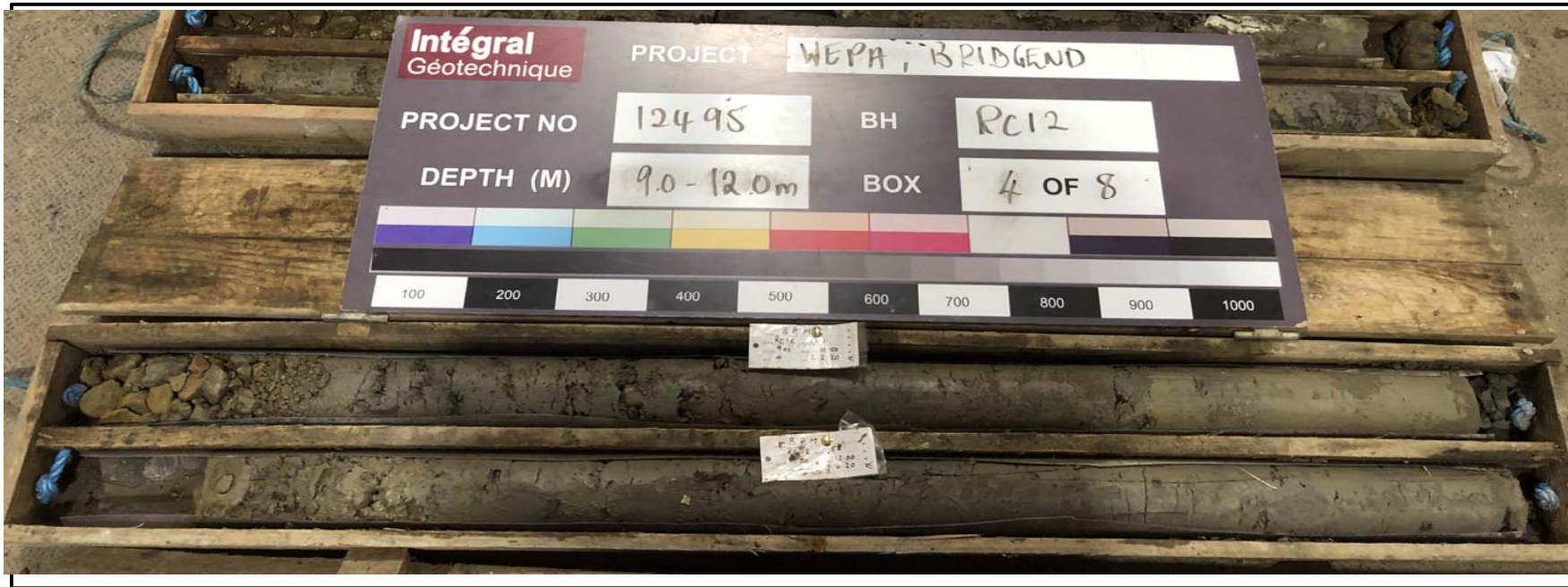


RC12 - CORE PHOTOGRAPHS 0.6m-6.0m

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RC12 - CORE PHOTOGRAPHS 6.0m to 12m

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RC13 - CORE PHOTOGRAPHS 0m to 5.5m

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RC13 - CORE PHOTOGRAPHS 5.5m to 11.5m

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RC13 - CORE PHOTOGRAPHS 11.5m to 17.0m

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RC13 - CORE PHOTOGRAPHS 17.0m to 24.5m

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## **APPENDIX B**

### **ELECTROCONE CPT TEST RESULTS**

# BRIDGEND, SOUTH WALES

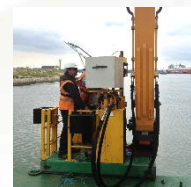
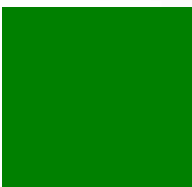
## SOIL INVESTIGATION

### CPT REPORT

Cone penetration test  
Dissipation test  
Geotechnical data interpretation

---

Project ref.: P-107374-1



<b>PROJECT:</b>	Bridgend, South Wales
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<b>CLIENT:</b>	Integral Geotechnique
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### FIELDWORK

CPT rig(s)	18.0-tonne track-truck mounted CPT unit (UK22)
Date fieldwork started	15 <sup>th</sup> January 2020
Date fieldwork completed	16 <sup>th</sup> January 2020
Lankelma's representative	Seain Way
Client's representative	Rob Bathurst

### REPORT

Status	Revision	Action	Date	Name
Final	00	Completed	23/01/20	Chris Player
		Checked	23/01/20	Emma Stickland
		Approved	27/01/20	Joseph Hobbs

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## 1 INTRODUCTION

At the request of Integral Geotechnique, a soils investigation was carried out on project *Bridgend, South Wales*.

Site location (in the general region of):

WEPA UK  
Bridgend Paper Mills  
Llangynwyd, Maesteg  
CF34 9RS

## 2 DISCLAIMER

The investigation information, raw data and interpretations provided in this report are for the sole benefit of the Client identified at the front of the report.

Lankelma has exercised reasonable skill, care and diligence in the fieldwork and preparation of this report. This report has been completed based on information available to Lankelma at the time of preparation. The measurement and interpreted data in this report do not constitute recommendations for design purposes. An appropriately qualified person must review and interpret the data given in this report, together with any assumptions we have made that affect the data, before using the data for design or recommendation.

Lankelma accepts no responsibility for the accuracy or appropriateness of any assumptions, derived soil parameters, soil descriptions or soil unit boundaries contained in this report.

## 3 COMPLETED WORKS

- 13 nr. cone penetration tests (CPTu) with piezo measurement;
- 3 nr. dissipation tests; and
- Factual report plus additional geotechnical data interpretation.

The *Summary Tables* section contains tabulated summaries of the works completed together with analysis results where necessary.

Several non-scheduled short QA/QC dissipation tests were undertaken during the works during testing downtime, to verify drainage conditions or during temperature stabilisation pauses. These have not been included in the dissipation interpretation but do appear in the AGS 4.0 data file provided.

## 4 FIELDWORK GENERAL

Fieldwork was performed with an 18.0-tonne track-truck mounted CPT unit (UK22) equipped with a 17.5-tonne capacity hydraulic ram set.

The Client was responsible for the positioning and re-survey of all investigative locations.

The target depth for the investigation was 15 m below ground level. Table 1 details the final test depths and reasons for test termination (*refusal factor*). Where penetration refusal was encountered the termination depth was advised to, and agreed with, the Client's on-site representative.

The depths of dissipation tests were advised by the Client or their site representative.

## 5 CONE PENETRATION TESTS

Cone penetration testing was carried out in general accordance with BS ISO 22476-1:2012.

Penetrometer measurements included cone tip resistance, friction sleeve resistance and dynamic pore water pressure sampled at a 10 mm resolution.

The penetrometer was calibrated in accordance with BS8422:2003 and ASTM E74-13a. The management of calibration records is in accordance with ISO 10012. Copies of all calibration certificates for the cones used are provided in Appendix B.

The piezometer filter element was in the  $u_2$  position and was vacuum saturated. The pore pressure system was saturated with de-aired 10000 cSt silicone oil.

### 5.1 GLOSSARY OF CPT TERMS AND SYMBOLS

#### SYMBOLS & ABBREVIATIONS

$q_c$ :-	Cone resistance. The total force acting on the cone $Q_c$ , divided by the projected area of the cone, $A_c$ ; ( $q_c=Q_c/A_c$ ).
$q_t$ :-	Corrected cone resistance. The cone resistance $q_c$ corrected for pore water pressure on the cone shoulder.
$f_s$ :-	Friction sleeve resistance. The total frictional force acting on the friction sleeve, $F_s$ , divided by its surface area, $A_s$ . $f_s= F_s/A_s$ .
$u_2$ or $u_1$	Water pressure. Water pressure measured at the shoulder position ( $u_2$ ) or cone face ( $u_1$ ).
$R_f$ :-	Friction ratio The ratio, expressed as a percentage, of the sleeve friction, $f_s$ , to the cone resistance, $q_c$ , both measured at the same depth; [ $R_f= (f_s/q_c) \cdot 100$ ].
$\gamma$	Unit weight of soil.
$\gamma_w$	Unit weight of water.

$\sigma_v$ :-	Total overburden stress
$\sigma'_v$ :-	Effective overburden stress
$\sigma_{atm}$ , or, $P_a$	Reference atmospheric stress = 100kPa
$q_{t-net}$ :-	Net cone resistance = $(q_t - \sigma_v)$ . Where $q_t$ is unavailable $q_c$ is applied.
$Q_t$ :-	Normalised cone resistance (Method 1) = $(q_c - \sigma_v)/\sigma'_v$
$q_{t1}$ :-	Normalised cone resistance (Method 2) = $(q_t)/(\sigma'_v)^{0.5}$
$F_r$ :-	Normalised friction sleeve resistance = $f_s / (q_c - \sigma_v)$
$I_c$ :-	Soil Behaviour Type Index
SBT or SBTn:	Soil behaviour type classification
$B_q$ :-	Pore pressure ratio. The net pore pressure normalized with respect to the net cone resistance. = $(u_2 - u_0)/(q_t - \sigma_v)$

### TERMS

**Cone (or tip):** - The conical tip of the cone penetrometer.

**Friction sleeve:** - The section of the cone penetrometer upon which the sleeve friction is measured, located behind the cone tip.

**Piezocone:** - A cone penetrometer with a pore pressure sensor ( $u_2 / u_1$ )

**Dynamic pore pressure:** - The pore pressure measured during penetration ( $u_2 / u_1$ ).

**Soil behaviour type:** - Soil classification scheme or classified soil type according to Robertson (1990, 2016) often abbreviated to SBT or SBTn.

## 5.2 CPT DATA REDUCTION AND PRESENTATION

The CPT results are presented in Appendix C. The corrected cone resistance ( $q_t$ ), local side friction ( $f_s$ ), dynamic pore water pressure ( $u_2$ ), friction ratio ( $R_f$ ) and inclination are all presented against depth and elevation in accordance BS ISO 22476-1:2012. CPT data and the associated derived geotechnical parameters are included in the AGS 3.1 and 4.0 data files provided.

The cone tip resistance and sleeve force measurements were converted to pressures using the nominal dimensions of the penetrometer.

For piezocone tests the corrected tip resistance was calculated according to the formula:

$$q_t = q_c + u_2 \times (1 - a)$$

Where  $a$  is the 'area ratio' and  $(1 - a)$  is the proportion of cross-sectional area between the cone tip and cone body where pore pressures (positive or negative) can act to add or subtract from the total external axial force on the tip. The difference between measured and corrected values is largest in low strength soils with large excess pore pressures. The percentage adjustment is described by the curves in the following chart for alpha factor of 0.8:

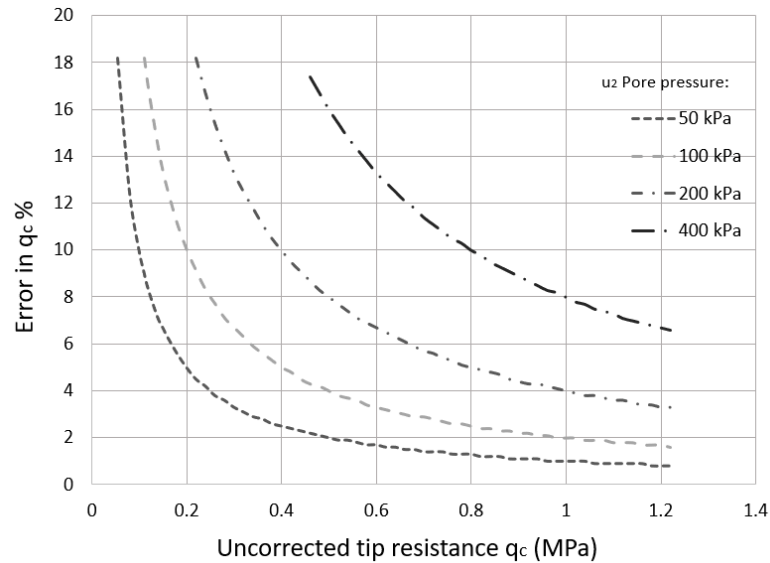


Figure 5-1 Uncorrected tip with measured tip resistance

Penetration length readings were corrected for inclination and sleeve readings were depth corrected for the dimensional offset between cone tip and sleeve during post processing. An additional shift of -80 mm was applied to the sleeve to account for tip failure zone offset (see 'CPT Interpretation Notes'). 'Rod spikes', artefacts of the pause for push rod addition, were filtered from the cone tip and sleeve data.

The raw (or corrected) data are presented in Appendix C. Dissipation data graphs are presented in Appendix G. Results for tests performed at each CPT position are plotted on the same graph.

Geotechnical parameters appropriate for drained and undrained cone penetration conditions were derived for corresponding drained and undrained derived soil behaviour types (SBTs) respectively, however, to account for uncertainty in the SBT correlation with drainage behaviour, all parameters were derived over a range of transitional soils within the range  $2.4 < I_c < 2.7$  (see section 6.3).

In general, the engineering parameters derived are intended for non-cemented predominantly silicate soils.

### 5.3 IN-SITU STRESS CONDITIONS

An estimate of the vertical in-situ stress states is necessary as they are applied in many derived parameters obtained from the CPT and dissipation test.

The total vertical stress with depth was calculated as the sum of the calculated soil unit weight above a given depth. See section 5.4 for information on the empirical estimate of soil unit weight.

The depth of the principal phreatic surface applied in the calculation of effective stress was estimated for each location based on interpretation of piezocone measurements in drained soils and the final pressure of dissipation tests which proceed to equilibrium pressure and were assumed to represent hydrostatic pressure.

The in-situ pore pressure for specific dissipation test interpretation was assumed as above or, where possible, assessed directly from the dissipation plot.

**Note:** The term phreatic surface is used here, however when it is based on piezocone measurements it is assumed that the piezometric level (under hydrostatic conditions) and groundwater table coincide. The phreatic or piezometric surface reported is intended to provide information about the assumed pore pressure distribution for calculation of relevant derived parameters from the CPT and may not represent the true position of the groundwater table or perched water bodies. Complex groundwater pressure distributions, if they are observed from the measurements, will be applied to relevant derived parameters.

#### 5.4 SOIL UNIT WEIGHT

The soil unit weight was estimated using the following method proposed by Robertson (2010).

$$\frac{\gamma}{\gamma_w} = 0.27 \text{Log}(R_f) + 0.36 (\text{Log}(q_t/R_f)) + 1.236$$

Throughout pre-drilled zones (inspection pits or drill-out) the soil unit weight was assumed as 18 kN/m<sup>3</sup>.

For depths where the friction sleeve measurement falls below zero, the friction sleeve was substituted with an artificial nominal 1.0 kPa resistance for the purpose of obtaining an approximate soil unit weight necessary for estimation of total vertical stress over the entire profile.

#### 5.5 SOIL BEHAVIOUR TYPE

The soil behaviour type (SBT) was interpreted using the Robertson (1990) classification system based on the normalised cone resistance ( $Q_t$ ) and normalised friction sleeve resistance ( $F_r$ ) for silicate soils.

While the classification based on normalised parameters is considered more accurate, particularly at depths exceeding 15-20 m, the classification is often significantly in error (artificially granular/drained) at very shallow depth (< 1-3 m). The error at shallow depth is associated with the potentially large difference between the estimated vertical effective stress (applied in normalisation) and the unknown horizontal stress influencing penetration resistance.

Robertson (2010) proposed a non-normalised version of the 1990 chart which uses dimensionless cone resistance ( $q_c/\text{Pa}$ ) and friction ratio,  $R_f$ . The classification according to this chart can be more reliable at shallow depth and has been plotted as an approximate SBT index (discussed below) for comparison to the normalised classification.

The SBT chart is provided in Appendix B - *General Information*, titled 'CPT Soil Behaviour Type Chart'.

It should be noted that the SBT classification provides the general soil 'type' which typically provides a similar CPT measurement range of  $q_c$  and  $f_s$ . Correspondingly, it will also show biased

towards the soil fraction that dominates the mechanical behaviour. While the repeatability and behavioural bias of the SBT is usually beneficial, the classification is not always an appropriate substitute for classification based on grain-size distribution.

Where dissipation tests have been performed the derived permeability may be used to assess the derived SBT as an indicator of drainage characteristics. To assist with this, the equivalent SBT classification based on permeability has been plotted for comparison, as discussed in section 6.12.

The results are presented on the plots of Appendix D.

## 5.6 SOIL BEHAVIOUR TYPE INDEX - $I_c$

The main trend in soil behaviour type (SBT) variation can be expressed a continuous index,  $I_c$ , proposed by Robertson and Wride (1998) based on a similar index proposed by Jefferies and Davies (1993). The index provides a continuous profile of SBT variation with depth for end-user analysis of soil units and variation within units.

The equivalent non-normalised version, as proposed by Robertson (2010), is provided for comparison.

The basis of  $I_c$  and its approximation of the original chart classification zones may be seen from Appendix B figure 'CPT Soil Behaviour Type Chart'. The method does not identify zones 1 (*sensitive fine grained*) and zones 8 & 9 (*overconsolidated or cemented*).

Normalised SBT index  $I_c$  (Robertson and Wride, 1998):

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

Non-normalised SBT index  $I_c$  (Robertson, 2010):

$$I_c = \left[ \left( 3.47 - \log \left( \frac{q_c}{\sigma_{atm}} \right) \right)^2 + (\log R_f + 1.22)^2 \right]^{0.5}$$

The results are presented on the plots of Appendix D.

## 5.7 RELATIVE DENSITY

The relative density of sands was calculated based on an empirical relationship proposed by Jamiolkowski *et al.* (2001) based on a large database of undisturbed frozen samples and calibration chamber tests. The expected accuracy may be evaluated from the figures presented below.

$$D_r = 100 \left[ 0.268 \cdot \ln \left( \frac{q_t / \sigma_{atm}}{\sqrt{\sigma_{vo}' / \sigma_{atm}}} \right) - k \right]$$

$k$  = Compressibility dependant constant can be taken as -0.675 for medium compressibility (applied value in our interpretation),  $\leq 1$  for high compressibility and  $\geq 2$  for compressible sands.

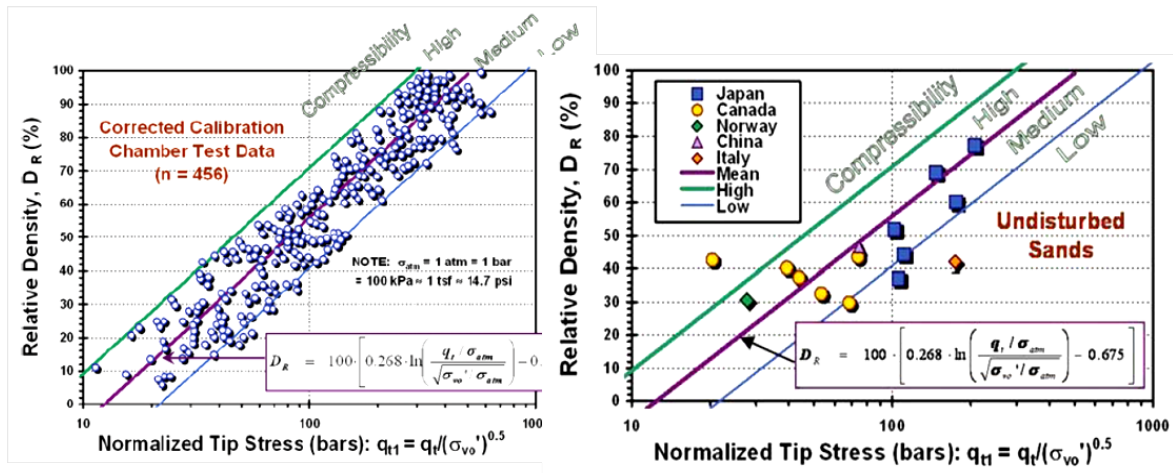


Figure 5-2 Relative density with normalised tip stress and sand compressibility from calibration chamber tests (left) and undisturbed frozen samples (right). Jamiolkowski *et al.* (2001). Reproduced from Mayne (2007).

The results are presented on the plots of Appendix E- *Standard interpretation results (set 2)*.

### 5.8 UNDRAINED SHEAR STRENGTH

The undrained shear strength  $s_u$  is usually estimated as a factor of net cone tip resistance (Lunne *et al*, 1981):

$$s_u = \frac{q_c - \sigma_{v0}}{N_k}$$

where  $N_k$  is an empirical cone factor which varies with soil type, stress history, structure/fabric, plasticity and the mode of shearing.

Mayne and Peuchen (2018) performed an evaluation of 407 high-quality triaxial compression tests against net tip resistance and proposed  $N_{kt}$  factors with regression analysis details for five categories of clays shown in Table 1.

Table 1 Summary of CAUC  $s_u$  versus  $q_{net}$  for clays. Reproduced from Mayne and Peuchen (2018).

Clay Group	Number of sites	No. Data	Correlation Coefficient $r_2$	Factor $N_{kt}$	Mean Pore Pressure Parameter $B_q$
Offshore NC-LOC	17	115	0.98	12.32	0.51
Onshore NC-LOC	30	191	0.867	12	0.53
Sensitive NC-LOC	5	43	0.507	10.33	0.84
OC Intact	5	36	0.862	13.57	0.49
OC Fissured	5	22	0.393	22.47	-0.01
All clays	62	407	0.923	13.33	0.55

Alternatively, a variable  $N_{kt}$  factor can be estimated for the profile as a function of the pore pressure parameter  $B_q$ , applicable for  $B_q$  values of  $> -0.01$ . The following equation proposed by Mayne and Peuchen is based on the same database evaluation:

$$N_{kt} = 10.5 - 4.6 \cdot \ln(B_q + 0.1)$$

Where the pore pressure parameter  $B_q$  is the ratio of excess pore pressure to net tip resistance:

$$B_q = \frac{u_2 - u_0}{q_t - \sigma_{v0}}$$

The  $N_{kt}$  estimate has a standard error of 2.4  $N_k$  and correlation coefficient of 0.645.

The estimate based on  $B_q$  is presented as 's<sub>u5</sub>' on the parameter plots and is only suitable for tests that have a high-quality pore pressure data, often indicated by a positive, repeatable and dynamic response. For tests that have a reliable pore pressure response throughout, the evaluation on a point by point basis is warranted. For projects with variable response quality and with possible piezo desaturation (for example in the unsaturated zone or by dilation/cavitation) it is preferable to identify zones with reliable pore pressure response for representative soils and select a characteristic value of  $B_q$  for evaluation of  $N_{kt}$ . Lankelma are not always in view of the effort that has been made in preparation of the test location to maintain saturation of the piezo sensor.

**Note:**  $N_{kt}$  (with subscript 't') indicates a  $N_k$  factor that has been established using the corrected tip resistance  $q_t$ .  $N_{kt}$  can be applied to the uncorrected tip resistance  $q_c$  (non-piezcone tests) but results in a slightly lower estimate of  $s_u$  depending on the correction magnitude ( $q_c - q_t$ ) in lower strength soils.

Undrained shear strengths corresponding to selected values of  $N_k$  are presented on the plots of Appendix D. 's<sub>u3</sub>' on the logs ( $N_k = 15$ ) has been included as a reference for comparison to traditional arbitrary  $N_k$  values of 15 and 20.

### 5.9 OVERCONSOLIDATION RATIO

The preconsolidation stress  $\sigma'_p$  was calculated based on the method proposed by Mayne et al (2009):

$$\sigma'_p = k \cdot (q_t - \sigma_{v0})^{m'}$$

$$OCR = \sigma'_p / \sigma'_{v0}$$

Mayne *et al* found that the trend with mean grain size followed a power law through the addition of exponent  $m'$  and that its value can be estimated by relation to soil behaviour type index  $I_c$ :

$$m' = 1 - \frac{0.28}{1 + \frac{I_c}{2.65}}^{25}$$

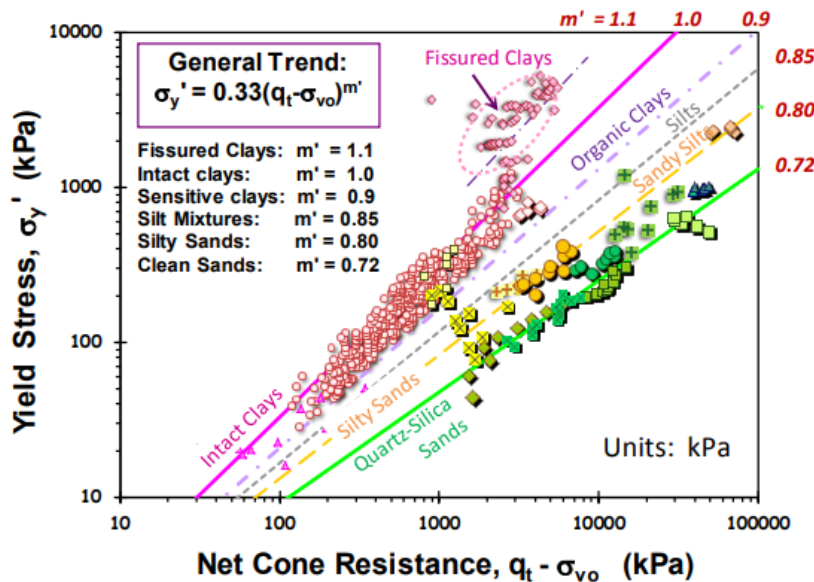


Figure 5-3 Preconsolidation stress with net cone resistance power law, reproduced from Mayne (2014).

An additional  $\sigma'_p$  and OCR was calculated for  $m' = 1.1$  to reflect the upper trend for over consolidated fissured clays not captured by the soil behaviour type index  $I_c$

### 5.10 SPT N60 VALUES

Equivalent SPT N60 values, defined as the non-normalised SPT blow count over a 30 cm interval, were derived for two correlations and are presented together in the results section for comparison.

Method 1 - Lunne *et al.* (1997)

$$N_{60} = \frac{q_t}{8.5 \cdot \sigma_{atm} \cdot \left(1 - \frac{I_c}{4.6}\right)}$$

Method 2 - Robertson (2012)

$$\frac{\left(\frac{q_t}{p_a}\right)}{N_{60}} = 10^{(1.268 - 0.2817I_c)}$$

The correlations are intended for clays, silts and sands and not for carbonates or cemented geo-materials.

The results are presented in Appendix D.

## 5.11 FRICTION ANGLE

### Sands

The peak friction angle of granular materials was calculated using the Kulhawy and Mayne (1990) method and is an empirical relationship as a function of stress normalised cone tip resistance. The relationship is based on a calibration chamber database from 24 sands of varying mineralogy. The relationship has the form:

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

Where:

$\phi'$  = Peak friction angle (degrees)

$q_{t1}$  = stress normalised cone resistance =

$$\left(\frac{q_t}{\sigma_{atm}}\right) / \left(\frac{\sigma_{v0'}}{\sigma_{atm}}\right)^{0.5}$$

The presence of compressible minerals tends to reduce tip resistance resulting in lower estimate of friction angle, while very coarse (sand) or larger grain size tends to increase tip resistance resulting in higher estimate.

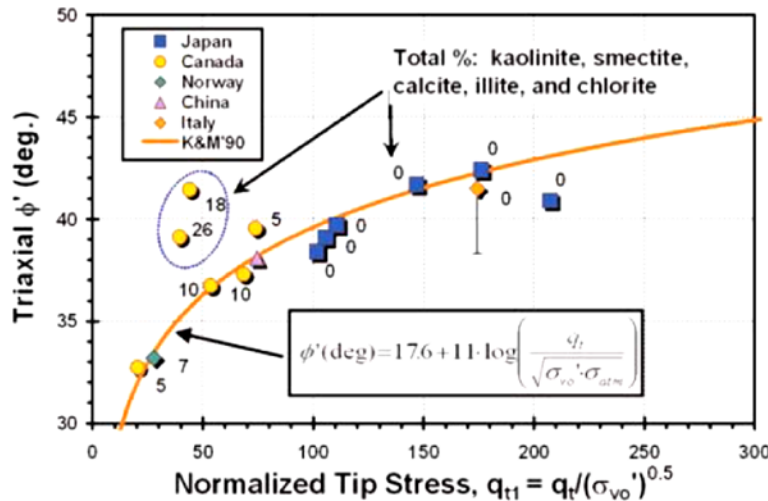


Figure 5-4 Peak triaxial friction angle from undisturbed sands with normalised cone resistance.

### Fine grained soils

The effective friction angle for fine grained soils was calculated based on the Senneset *et al.* (1988, 1989) method by applying the approximate closed form solution by Mayne & Campanella (2005) as a direct function of the pore pressure parameter  $B_q$  and normalised tip resistance  $Q$ . The method is applicable where  $0.1 < B_q < 1.0$  and  $20^\circ < \phi' < 45^\circ$  and generally appropriate for non-cemented NC-LOC soils.

$$\phi' = 29.5^\circ B_q^{0.121} [0.256 + 0.336 B_q + \log Q]$$

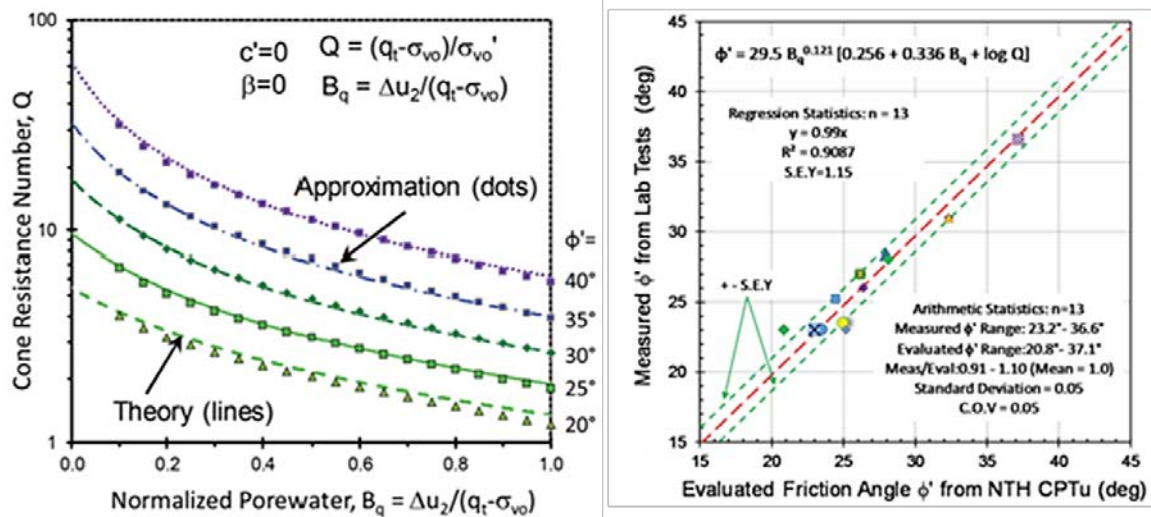


Figure 5-5 [Left] Theoretical curves with function approximation (dots) overlay [Right] calibration data from geotechnical centrifuge tests for a variety of soils. Redrawn from Ouyang & Mayne (2018).

The results are presented in Appendix E.

## 5.12 COEFFICIENT OF VOLUME CHANGE

Coefficient of volume change ( $m_v$ ) defined as the inverse of the constrained modulus ( $M$ ), is evaluated for all soil types using the constrained modulus method proposed by Mayne (2006) cited in Mayne (2007) applicable to the present state of vertical effective stress up to the pre-consolidation stress.

$$m_v = \frac{1}{M}$$

Where:

$$M = \alpha \cdot (q_t - \sigma_v)$$

$$\alpha = 5$$

An alpha factor of 8.25 reported by Kulhawy & Mayne (1990) for fine grained soils appears to provide a better fit through the data for intact non-organic clays, reducing to around 1 to 2 for organic plastic clays.

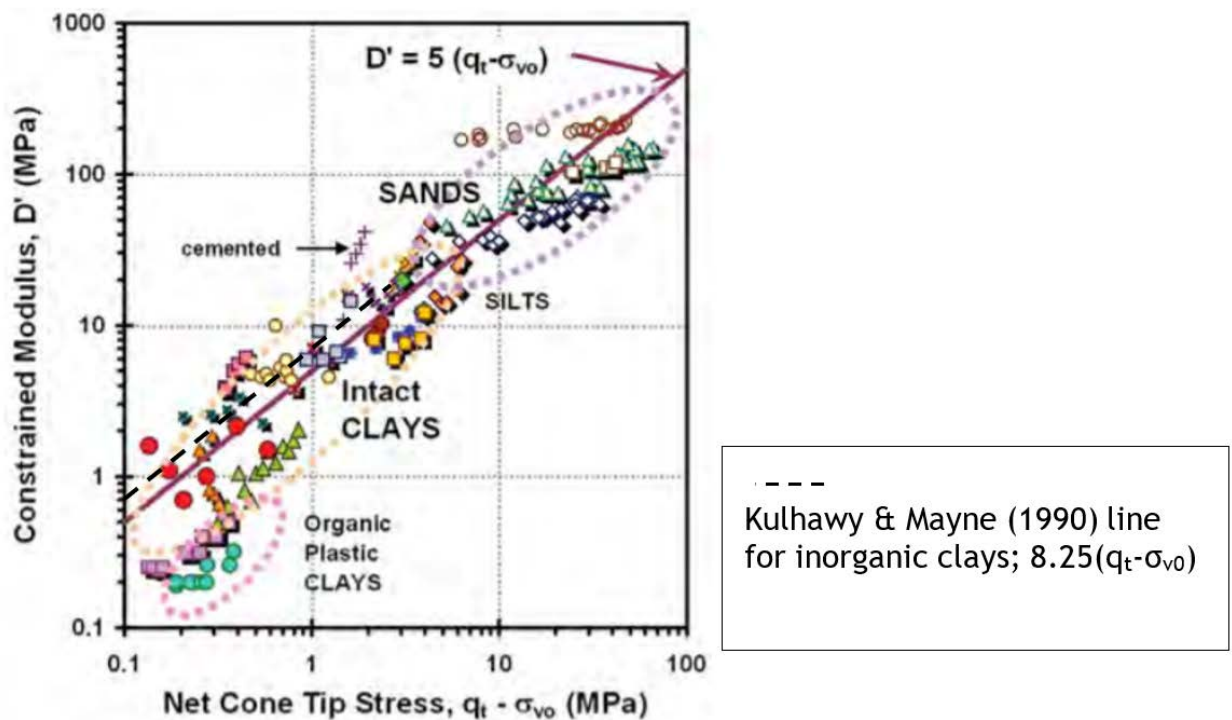


Figure 5-6 Constrained modulus of Mayne (2006). Annotated/redrawn from NCHRP Synthesis 368 (2007).

The results are presented on the plots of Appendix D.

## 5.13 YOUNG'S MODULUS

The Young's modulus at 25% mobilised shear strength (FOS = 4) was calculated according to the method proposed by Robertson (2009):

$$E' = \alpha(q_t - \sigma_v)$$

Where:

$$\alpha = 0.015(10^{0.55Ic+1.68})$$

The method described by Robertson may be adapted to estimate E' for loading at different percentages of yield stress.

The results are presented in Appendix E.

## 6 DISSIPATION TESTS

Dissipation tests were performed during the CPT at depths specified by the Client's representative on site.

The hydraulic clamp was on and maintained pressure for the duration of the test.

Pore pressures were sampled at 1 second resolution up to 300 seconds followed by a 10 second resolution thereafter.

### 6.1 COEFFICIENT OF CONSOLIDATION

The interpretation of the dissipation test applies the method of Houlsby and Teh (1988). Modified dimensionless time factors  $T^*$  have been determined from which values of  $c_{vh}$  can be derived using the following relationship:

$$T^* = \frac{c_{vh} \cdot t}{r^2 \cdot \sqrt{Ir}}$$

Where  $r^2$  = Radius of the cone,  $Ir$  = Rigidity Index (Assumed = 100),  $T^*$  = Time factor for a given degree of pore water dissipation (see table below for values),  $t$  = Measured time to a given degree of pore water pressure dissipation.

Rigidity index:

$$Ir = \frac{G_u}{s_u}$$

Where;

$G_u$  = Shear modulus of the soil  $s_u$  = Undrained shear strength of the soil

A value of  $Ir$  of 100 has been assumed in the analysis. The initial peak pressure has been corrected for soil dilatancy (initial rise in pressure) using the Sully *et al* (1999) method by backwards extrapolation of the initial decay curve plotted in root time.

The saturated porous filter was in the shoulder ( $u_2$ ) position in all cases. The results of the dissipation tests are presented in Appendix F.

Table 2 Modified time factors  $T^*$  from consolidation analysis (Houlsby and Teh, 1988)

Degree of dissipation (%)	$u_1$ measuring position	$u_2$ measuring position
0	0.014	0.038
30	0.032	0.078
40	0.063	0.142
50	0.118	0.245

Where a test is of insufficient duration to perform the above analysis an upper-bound value of  $c_{vh}$  will be calculated taking the time of the final value as equal to  $t_{50}$ . This should be treated with caution but is usually a safe assumption given that the peak measured pore pressure is very rarely less than 65% of the corrected initial pressure estimated by the Sully *et al.* method described above.

## 6.2 PERMEABILITY

**Method 1:** Perez and Fauriel (1988) method based on  $t_{50}$ :

$$k = \left( \frac{1}{251 \cdot t_{50}} \right)^{1.25}$$

Where  $t_{50}$  is the time to 50% dissipation of excess pore pressure, and  $k$  is permeability (m/s).

This method is based on monotonic dissipation results and should be cautiously applied to dissipations that exhibit dilative behaviour (showing initial rise to peak pressure) where  $t_{50}$  is calculated using a corrected initial pore pressure. Permeability values are multiplied by a factor of 1.5 for 15 cm<sup>2</sup> cones.

**Method 2:** Robertson (2014) theoretical method which considers the effect of soil stiffness of the soil using the relationship:

$$k = \frac{c_{vh} \cdot \gamma_w}{M}$$

Where  $c_{vh}$  is the coefficient of consolidation;  $\gamma_w$  is the specific weight of water and  $M$  is the constrained modulus. The derivations of  $c_{vh}$  and  $M$  are described separately within this report.

Robertson (2014) proposed an approximate relationship between permeability ( $k$ ) and the soil behaviour type index ( $I_c$ ) as follows:

$$\text{For } 1.0 < I_c \leq 3.27 \quad k = 10^{(0.952 - 3.04 I_c)}$$

$$\text{For } 3.27 < I_c < 4.0 \quad k = 10^{(-4.52 - 1.37 I_c)}$$

The values have been derived and are presented in the Appendix F.

Where dissipation tests have been performed, it is possible to reverse calculate the 'equivalent' index  $I_c$  from the calculated permeability. These values have been derived and plotted in the  $I_c$  log as K1 and K2 corresponding to permeability method 1 and 2 above.

This equivalent  $I_c$  values are not intended as a correction nor a more accurate version of the index; the index value evaluated from the CPT is a parameter describing the soil type which typically has mechanical properties consistent with the CPT measurements, and often represents the soil constituent controlling mechanical behaviour. The equivalent value based on permeability simply provides comparative insight into the soil type in terms of drainage characteristics.

## 7 CPT INTERPRETATION NOTES

Provided below is a non-exhaustive set of notes on interpretation of the acquired CPT data with reference to examples within the dataset where appropriate.

### ***DRAINED AND UNDRAINED SOIL BEHAVIOUR***

Geotechnical parameters appropriate for drained and undrained cone penetration conditions are derived for drained and undrained soil behaviour types (SBTs) respectively, however, to help mitigate the uncertainty in the SBT correlation with drainage behaviour, all parameters are derived over the Soil Behaviour Type range  $2.4 < I_c < 2.7$ . For partially drained conditions, error will be introduced within derived parameters.

Piezocene dynamic pore pressure and dissipation tests may be used to identify drainage conditions. Dissipation  $t_{50}$  values exceeding 50 seconds indicate undrained penetration behaviour based on the findings of Kim *et al.* (2008).

In partially drained materials the friction sleeve resistance may rise significantly immediately following a pause in penetration due to consolidation and increased effective stress on the friction sleeve.

### ***DYNAMIC PORE PRESSURE (CPT<sub>u</sub>)***

While the piezo system is saturated before use, testing through unsaturated soils may result in some degree of desaturation leading to a less accurate and more 'sluggish' pore pressure response. Desaturation can also occur during penetration due to suction during dilative shear at the cone shoulder. Dissipation tests that are undertaken following desaturation are likely to have a more pronounced initial rise and some degree of error will be present in the analysis.

If the system becomes desaturated it may or may not re-saturate at higher excess pressures later in the test. The pore pressure response in saturated contractive soils normally have a dynamic 'peaky' appearance.

The tip resistance in lower strength contractive soils without pore pressure measurement in the  $u_2$  position is likely to be significantly lower than the equivalent corrected tip resistance depending on the magnitude of pore pressure acting in the gap between cone tip and cone body.

### ***CONE TIP AND SLEEVE OFFSET***

The accuracy of the SBT over thin layers and at layer boundaries is sensitive to offset error in the friction ratio often resulting in sharp peaks or troughs at boundaries. The friction ratio is often inaccurate in heavily disturbed soils with a 'blocky' macro fabric.

For this investigation a friction sleeve depth shift of -80mm was applied together with a 2-point (40 mm) moving average on the friction ratio to minimise the influence of this effect.

### ***FRICION SLEEVE DATA***

There are two common causes of artificially low or negative friction sleeve measurement; 1) Sudden unequal pore pressure effects at strata boundaries often resulting in a negative spike and 2) very sensitive soils where the measured resistance falls to zero or lower due to instrument limitations or temperature effects. The latter can often be mitigated by temperature stabilisation during the test and at the time of zero output measurement.

### ***CONE TYPE***

The reference cone type has a 10 cm<sup>2</sup> projected cone tip area and 150 cm<sup>2</sup> friction sleeve area, however it is common to use the larger 15 cm<sup>2</sup> cone with 225 cm<sup>2</sup> friction sleeve area for improved sensitivity and penetration depth potential. Use of the 15 cm<sup>2</sup> cone will produce more pronounced transition zones and thin layer effects (larger zone of influence and failure zone).

### ***TRANSITION ZONES AND THIN LAYER EFFECTS***

During penetration at the boundary between soils of contrasting stiffness, a transition zone is often evident prior to mobilisation of the true soil stiffness. These should be cautiously ignored in assessment of soil behaviour type and parameter evaluation. Where the stiff layer is thin (<~0.75 m) mobilised resistance may be significantly less than that of an equivalent thick layer. The effect for thin low stiffness layers is less significant. Procedures for thin-layer effect correction are provided by Robertson and Wride (1998).

### ***GRAVELS***

The presence of gravel or larger clasts in a soil is often characterised by short peaks in the CPT tip and sleeve readings, possibly with associate inclinometer 'shake' and/or sharp reductions in pore water readings due to dilation effects. Frequent gravels in soft or loose soils may generate localised erroneous friction ratio values.

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## APPENDICES

## APPENDIX A SUMMARY TABLES

Table 1 CPT summary

Test ID	Final depth (mBGL)	Cone ID {C=Cone tip; F=Friction Sleeve; I=Inclination; P = Piezo; S=Subtraction cone; 15/10 = cone projected area (cm2) }	CPT rig	Pre-drilled / inspection pit (m)	Refusal factor	Dissipations	Seismic cone	Easting	Northing	Elevation (m)	Date of test	Remarks
CPT01	0.24	S15-CFIPT.1769	UK22		Lateral support						15/01/2020	
CPT01A	0.18	S15-CFIPT.1769	UK22		Lateral support						15/01/2020	
CPT01B	10.06	S15-CFIPT.1769	UK22		Lateral support						16/01/2020	
CPT02	13.80	S15-CFIPT.1769	UK22		Lateral support						15/01/2020	
CPT03	11.80	S15-CFIPT.1769	UK22		Lateral support						15/01/2020	
CPT04	9.44	S15-CFIPT.1769	UK22		Lateral support						15/01/2020	
CPT05	5.74	S15-CFIPT.1769	UK22		Lateral support						15/01/2020	
CPT06	18.30	S15-CFIPT.1769	UK22		Target depth	1					15/01/2020	
CPT07	15.40	S15-CFIPT.1769	UK22		Target depth	1					16/01/2020	
CPT08	5.62	S15-CFIPT.1769	UK22		Lateral support	1					16/01/2020	
CPT09	7.62	S15-CFIPT.1769	UK22		Lateral support						16/01/2020	
CPT10	0.06	S15-CFIPT.1769	UK22		Lateral support						15/01/2020	
CPT10A	0.94	S15-CFIPT.1769	UK22	0.70	Lateral support						16/01/2020	

CPT test plots are presented in Appendix C.

Table 2 Dissipation test interpretation summary

Location ID	Depth (mBGL)	G.W.L (mBGL)	In-situ pore pressure $u_0$ (kPa)	G.W.L. Origin	Coefficient of consolidation $C_{vh}$ (m <sup>2</sup> /yr)	Upper bound $C_{vh}$ - final time as $t_{50}$ (m <sup>2</sup> /yr)	Constrained modulus (MPa)	Permeability $k_1$ (m/s)	Permeability $k_2$ (m/s)	Upper bound $k_2$ (m/s) based on UB $C_{vh}$	Remarks
CPT06	5.82	1.74	40.00	$u_0$ (t100) measurement at this location	292.00		4.3	3.44E-08	2.11E-08		
CPT07	7.10	4.25	28.00	$u_0$ (t100) measurement at this location	862.80		0.6	1.33E-07	4.47E-07		
CPT08	1.89	3.00	0.00	$u_0$ pressure (t100) measured at another location	79.10		3.4	6.71E-09	7.24E-09		

\*Abbreviations:

- NEP: No excess pore pressures generated - excess pore pressures are required for interpretation of  $C_{vh}$ .
- ID: Insufficient test duration - insufficient or no decay of excess pore pressure.
- UR: Uncharacteristic response - uncharacteristic pore pressure dissipation response precludes interpretation.
- DR: Drained or partially drained response - calculation of  $C_{vh}$  is appropriate for undrained cone penetration response only,  $t_{50}$  time limit of 30 s is applied.
- A: Estimated/measured in-situ pore pressure corresponds to artesian conditions.
- PUS: Potentially unsaturated soil.
- MD: Monotonic decay.
- IEP: Insufficient excess pressure generated.
- LBI: Lower bound interpretation.
- DT: Disrupted test.
- NI: No interpretation.

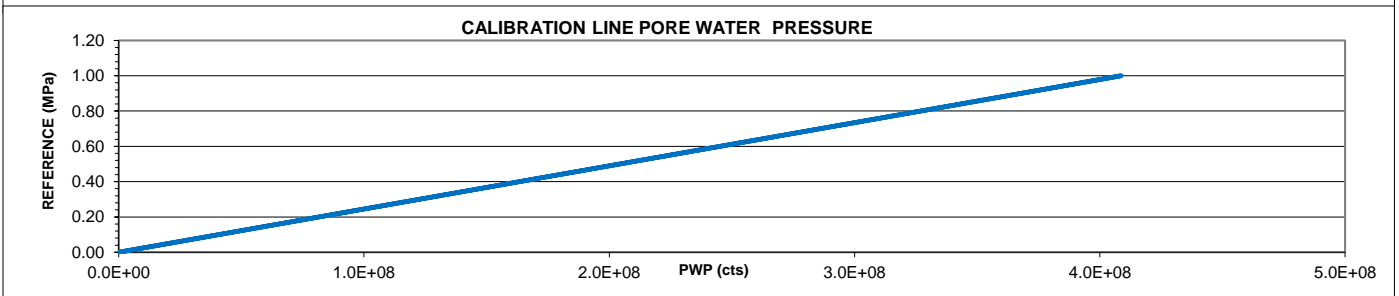
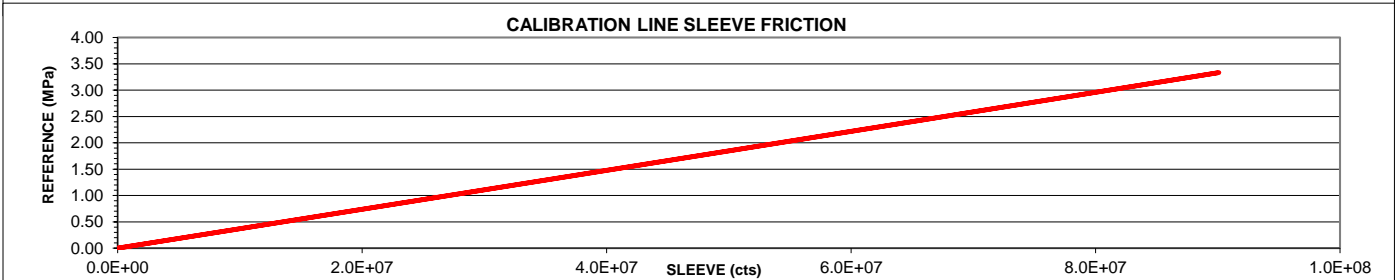
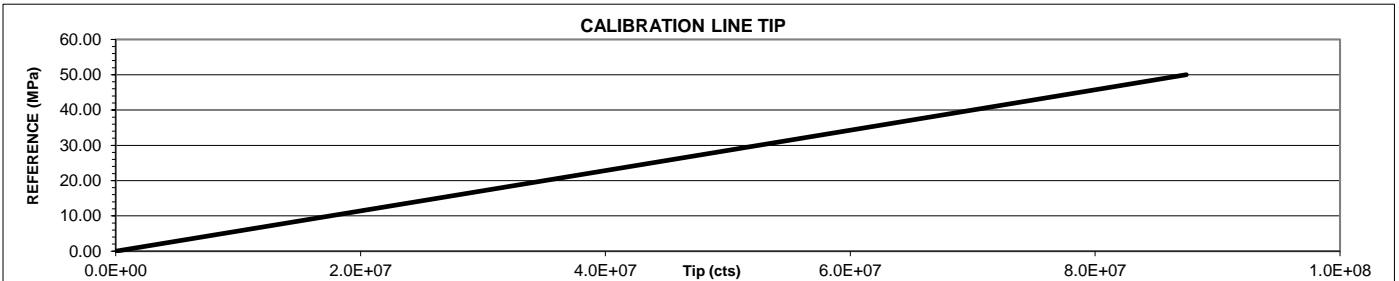
Dissipation test plots are presented in Appendix G

## APPENDIX B GENERAL INFORMATION

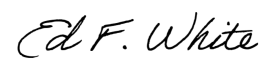

### LIST OF FIGURES

<b>Description</b>	<b>Pages included</b>
Cone calibration certificate: DS15-CFIIPT.1769	1
Data sheet: 18.0-tonne track-truck mounted CPT unit (UK22)	1
CPT soil behaviour type chart	1

REFERENCE INSTRUMENTS:	CONE END RESISTANCE	SLEEVE FRICTION	PORE WATER PRESSURE
ID	51998	51998	4009509
TYPE	AM DSCC-100kN	AM DSCC-100kN	Druck DPI 104
UNCERTAINTY (±%)	0.01	0.01	0.05
Nominal pressure (MPa,MPa,MPa)	50.00	3.33	1.00
Maximum pressure (MPa,MPa,MPa)	100.00	6.67	2.00
Area (cm <sup>2</sup> )	15	225	N/A
Sensitivity (cts/kPa)	1749.152	27029.36	408674.1
<b>Calibration scaling factors:</b>			
Nominal cal force (kN, kN, kPa)	75	75	1000
Nominal output (cts, cts, cts)	87,457,586	90,097,876	408,674,064
Zero point (cts)	2,564,088	1,648,371	-15,201,816
Resolution (N, N, Pa)	0.1	0.1	0.1
Cal Factor (0.1N, 0.1N, 0.1Pa)	0.008576	0.008324	0.024469
Sensitivity (cts/N, cts/N, cts/Pa)	1166.101	1201.305	408.674
Inclination calibration (cts)	X -20°= -27252, 0°= 57, 20°= 27509		Y -20°= -25849, 0°= -228, 20°= 26230
Inclination cal factor (0.0001°)	9.130565		9.599972
Temperature calibration (cts):	0°C = -297,912,562	10°C = -170,675,875	15°C = -107,057,532
Temperature cal factor (0.0001°C)	0.000786		20°C = -43,439,188
Measured alpha factor:	0.81		30°C = 83,797,499
<b>Uncertainty (%):</b>			
Reproducibility	0.08	0.20	0.06
Linearity	0.08	0.09	0.14
Hysteresis	0.13	0.12	0.08
Combined expanded (k=2)	0.31	0.79	0.34
Application class	1	1	1
Temperature uncertainty (+/- °C)	0.05		



Instrument:	S15-150kN	Location:	Lankelma Calibration Laboratory
Serial number:	DS15-CFIIPT.1769	Temperature(° C)	18.1
Manufacturer:	Geopoint	Temperature Change(° C)	0.30
Date of calibration:	22/11/2019	Calibration Engineer	ed f. white
Calibration standard:	Conforms to BS8422, ASTM E74, ISO 22476-1	Calibration Expiry	21/02/2020

<b>Calibration signed and dated by:</b>  	<b>Calibration checked and dated by:</b>  
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# UK22 Track-truck



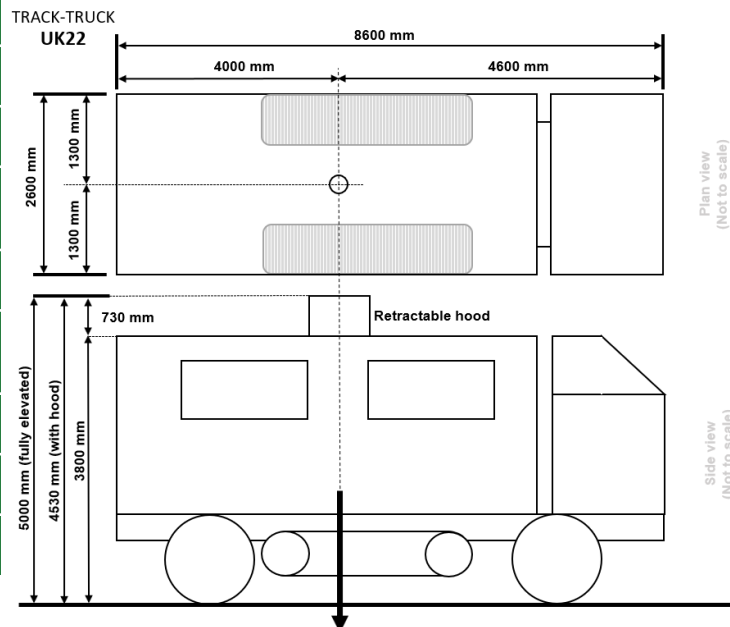
Rig weight	18 T
Max. operating ram capacity	200 kN
Max. travelling speed	4 km/h (tracking)
Track material	Composite
Track length	2800 mm
Track width	650 mm
Jack plate dimensions	Tracks act as jacks
Jack arrangements	1nr. on each side
Max. ground bearing pressure	76 kPa
Max. testing gradient	10 degrees
Max. traversing gradient	30 degrees (operator assessed)
Clamp arrangement	Automatic hydraulic
Ram stroke	1250 mm
Max. casing size	55 mm

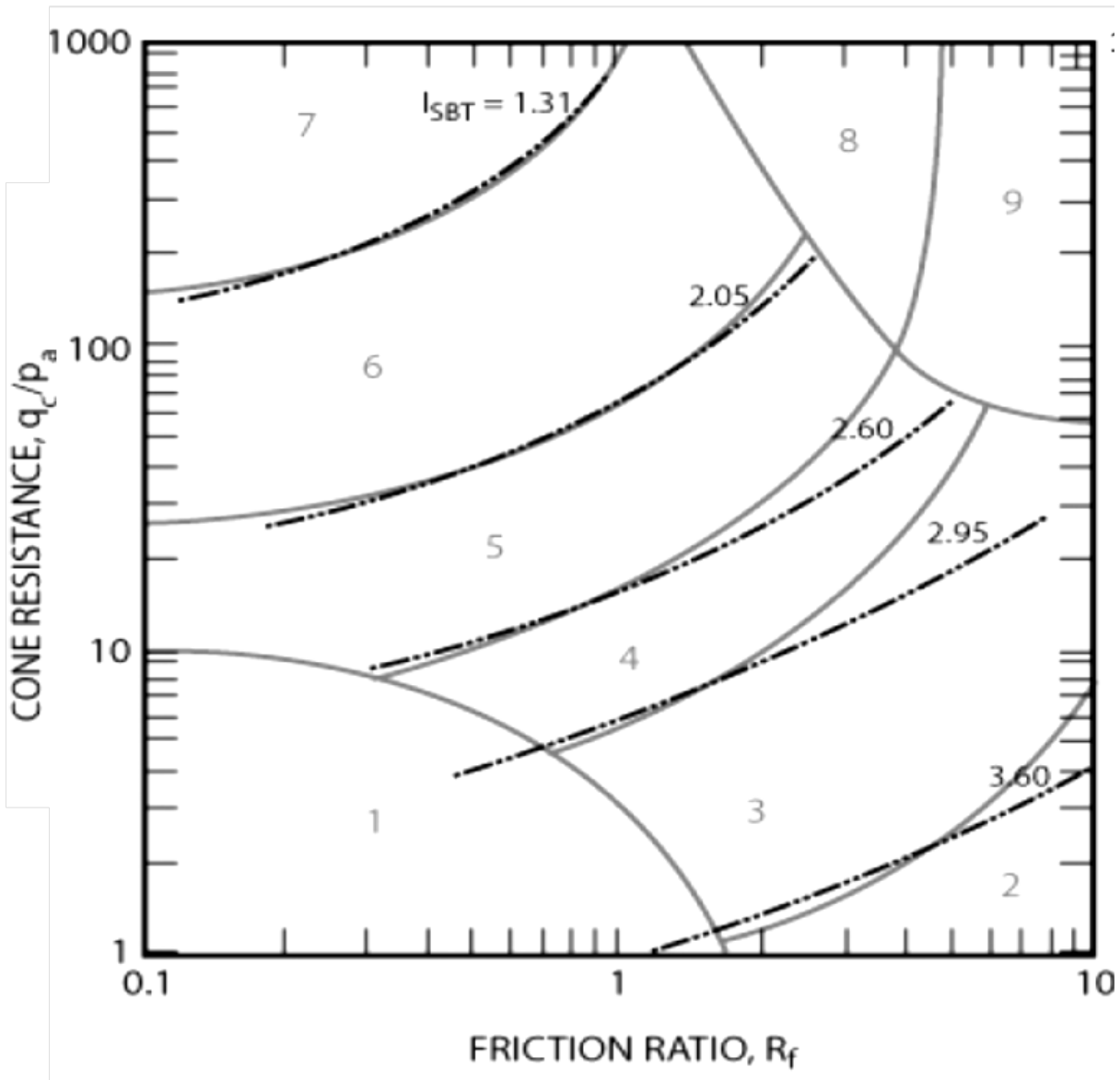
Lankelma's versatile track-truck is suitable for most geotechnical sites. The rig is driven to site as a self-contained HGV with tracks that can be deployed to cope with soft or uneven terrain.

UK22 complies with Euro 6 emission standards for use in London's low emissions zones (LEZ).

### Production

An expected 100m+ of standard CPTu testing can be executed in a day (depending on conditions and access).



**CPT SOIL BEHAVIOUR TYPE CHART**


Non-normalised SBT chart by Robertson *et al.* (2010) based on dimensionless cone resistance ( $q_c/P_a$ ) and friction ratio,  $R_f$ , showing contours of  $I_{c}$  index. The chart is also applicable to normalised tip/sleeve values  $Q_t$  and  $F_r$ .

Zone	Soil Behaviour Type (SBT)		
1	Sensitive fine-grained	6	Sands: clean sand to sandy silt
2	Clay – organic soil	7	Dense sand to gravelly sand
3	Clays: Clay to silty clay	8	Stiff sand to clayey sand*
4	Silt mixtures: clayey silt to silty clay	9	Stiff fine grained*
5	Sand mixtures: Silty sand to sandy silt		*Overconsolidated or cemented

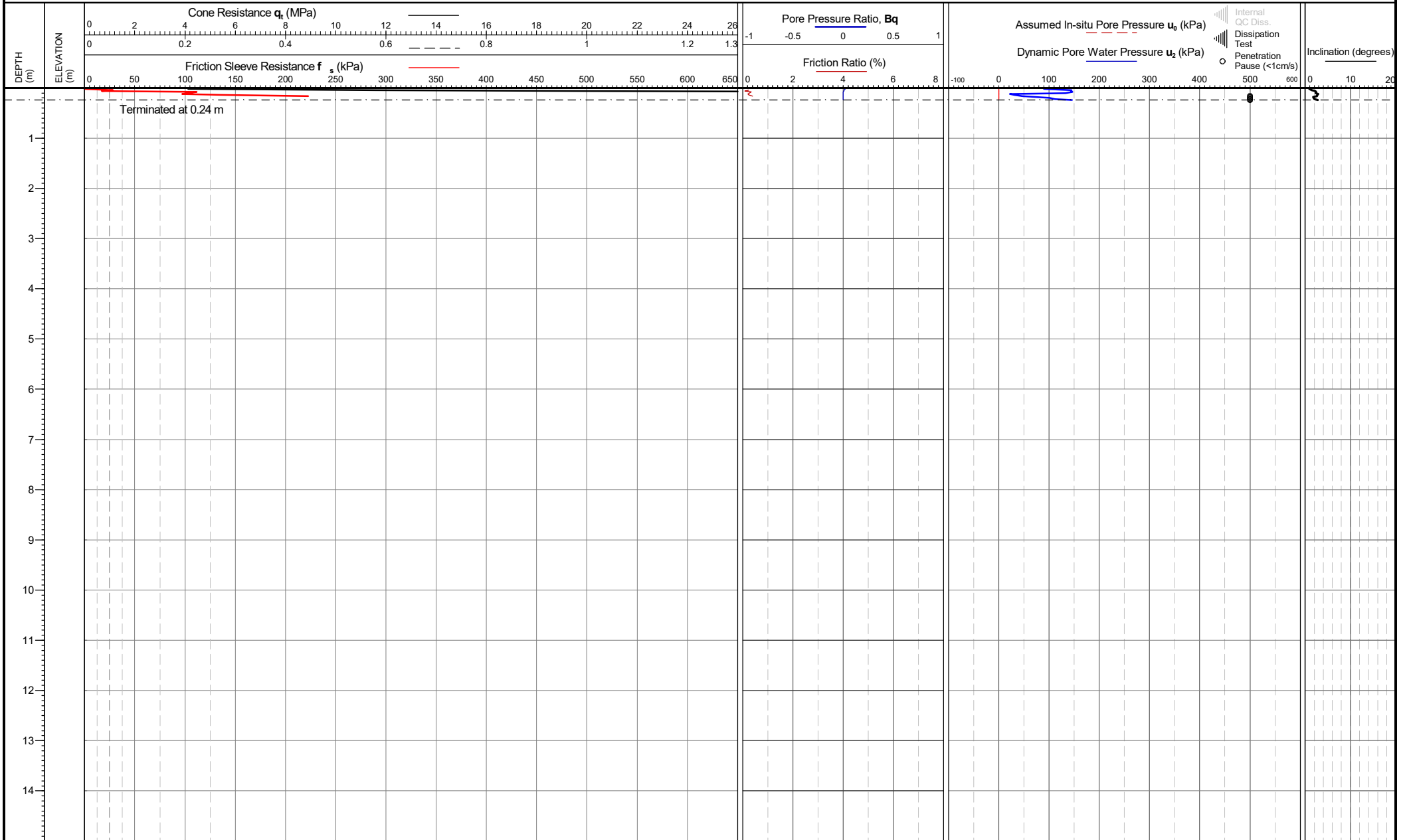
**APPENDIX C CONE PENETRATION TEST RESULTS****RAW DATA PLOTS****LIST OF FIGURES:**

<b>Location ID</b>	<b>Pages included</b>
CPT01	1
CPT01A	1
CPT01B	1
CPT02	1
CPT03	1
CPT04	1
CPT05	1
CPT06	2
CPT07	2
CPT08	1
CPT09	1
CPT10	1
CPT10A	1



Project: BRIGEND, SOUTH WALES

Client: INTEGRAL GEOTECHNIQUE



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Rig Used: UK22  
 Date of test: 15/01/2020 10:45:00

Zero drift (Pre/post test)  
 q<sub>c</sub> (kPa): -5.4  
 f<sub>s</sub> (kPa): -2.2 (f<sub>s</sub> + q<sub>c</sub> error)  
 U<sub>2</sub> (kPa): -3.7

Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Remarks:  
 \*Phreatic surface origin: u<sub>0</sub> pressure (t100) measured at another location  
 Termination Remark: Lateral support

Date of plot:  
 16-01-20

Lankelma Project Ref:  
 P-107374-1

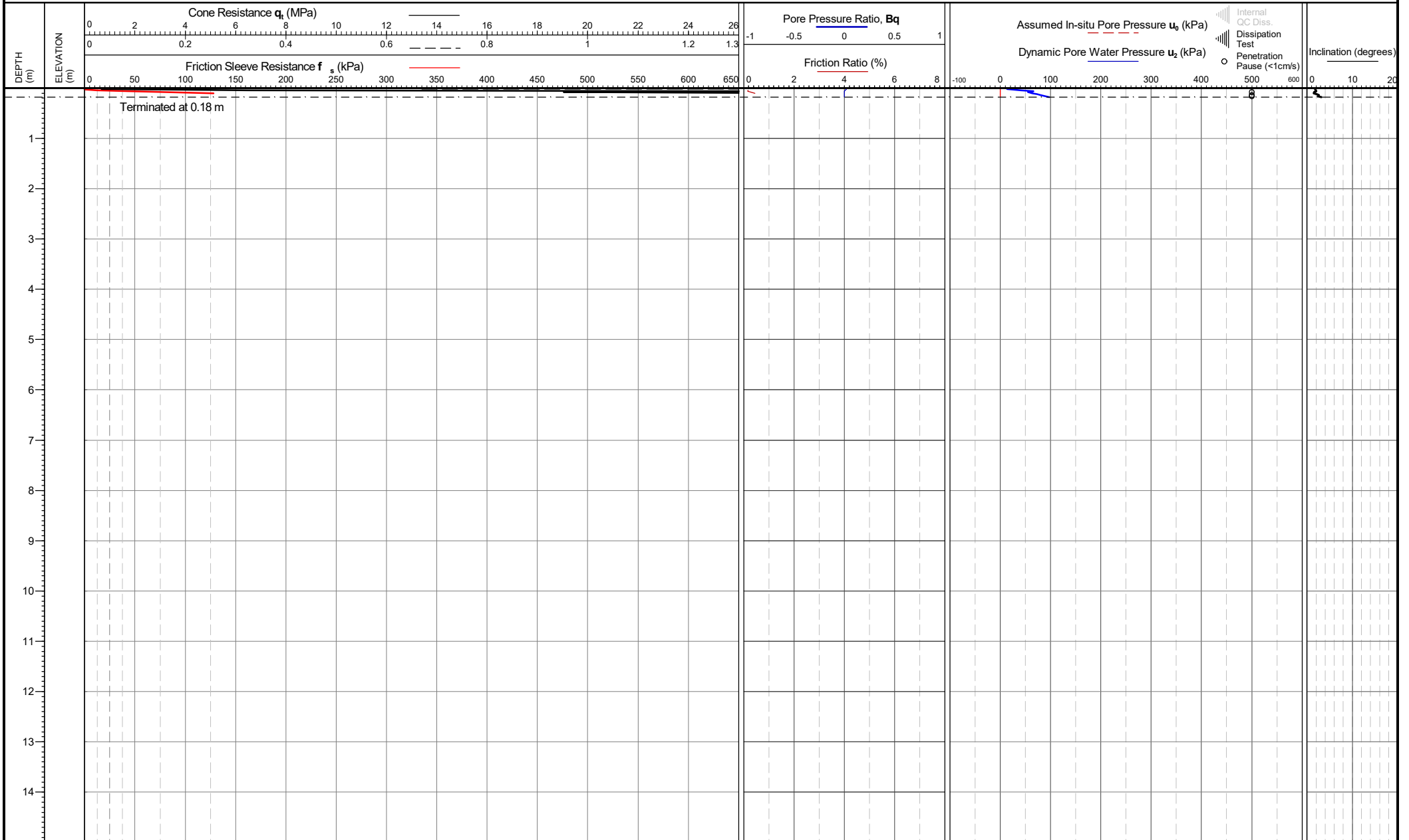
Checked by:  
 Chris Player

**TEST ID: CPT01**



Project: BRIDGEND, SOUTH WALES

Client: INTEGRAL GEOTECHNIQUE



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Rig Used: UK22  
 Date of test: 15/01/2020 10:57:00

Zero drift (Pre/post test)  
 $q_c$  (kPa): 58.4  
 $f_s$  (kPa): -3.3 ( $f_s + q_c$  error)  
 $U_2$  (kPa): -0.2

Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

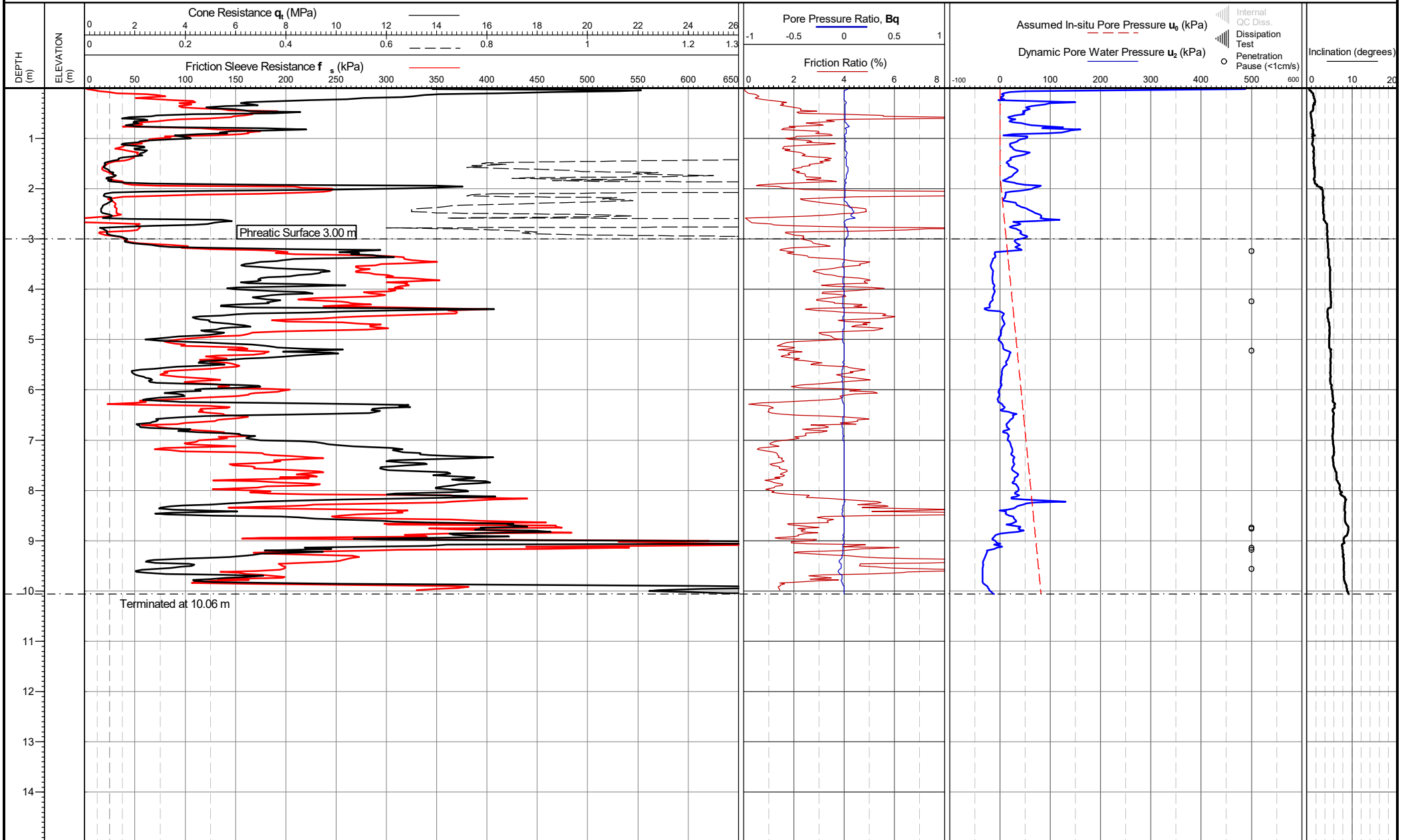
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 \*Phreatic surface origin:  $u_0$  pressure (t100) measured at another location  
 Termination Remark: Lateral support

Date of plot:  
 16-01-20

Checked by:  
 Chris Player

Lankelma Project Ref:  
 P-107374-1

**TEST ID: CPT01A**



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Rig Used: UK22  
 Date of test: 16/01/2020 09:23:00

Zero drift (Pre/post test)  
 $q_c$  (kPa): -7.2  
 $f_s$  (kPa): 0.0 ( $f_s + q_c$  error)  
 $U_2$  (kPa): 1.1

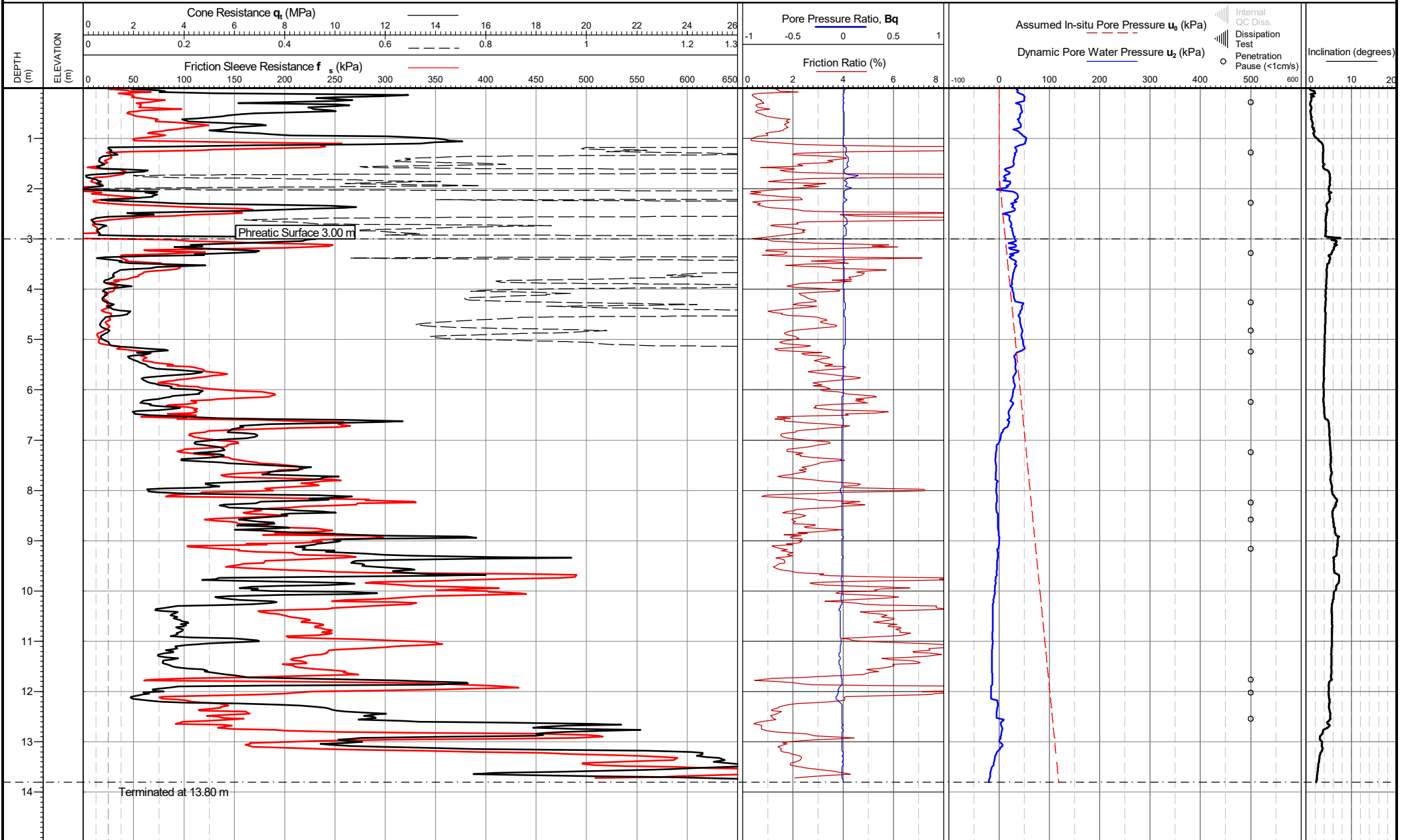
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 Coordinates: ,  
 Elevation:  
 Coordinate system:

Remarks:  
 \*Phreatic surface origin:  $u_0$  pressure (t100) measured at another location  
 Termination Remark: Lateral support

Date of plot:  
 16-01-20  
 Checked by:  
 Chris Player

Lankelma Project Ref:  
 P-107374-1

**TEST ID: CPT01B**



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Rig Used: UK22  
 Date of test: 15/01/2020 11:09:00

Zero drift (Pre/post test)  
 $q_c$  (kPa): -78.2  
 $f_s$  (kPa): -0.8 ( $f_s + q_c$  error)  
 $U_2$  (kPa): 46.8

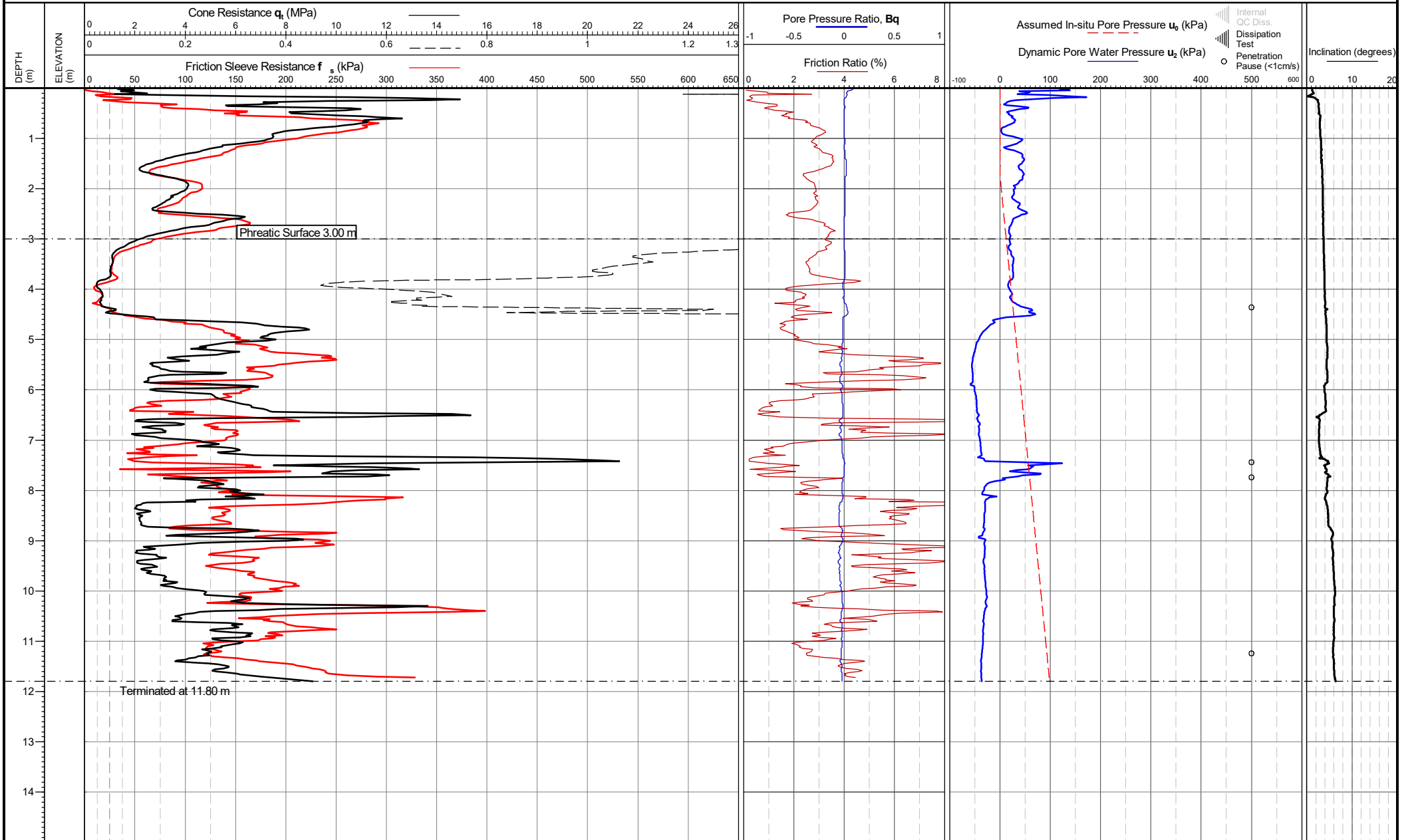
Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Remarks:  
 \*Phreatic surface origin:  $u_0$  pressure (t100) measured at another location  
 Termination Remark: Lateral support

Date of plot:  
 16-01-20  
 Checked by:  
 Chris Player

Lankelma Project Ref:  
 P-107374-1

**TEST ID: CPT02**



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Rig Used: UK22  
 Date of test: 15/01/2020 11:47:00

Zero drift (Pre/post test)  
 $q_c$  (kPa): 53.2  
 $f_s$  (kPa): -3.4 ( $f_s + q_c$  error)  
 $U_2$  (kPa): -5.9

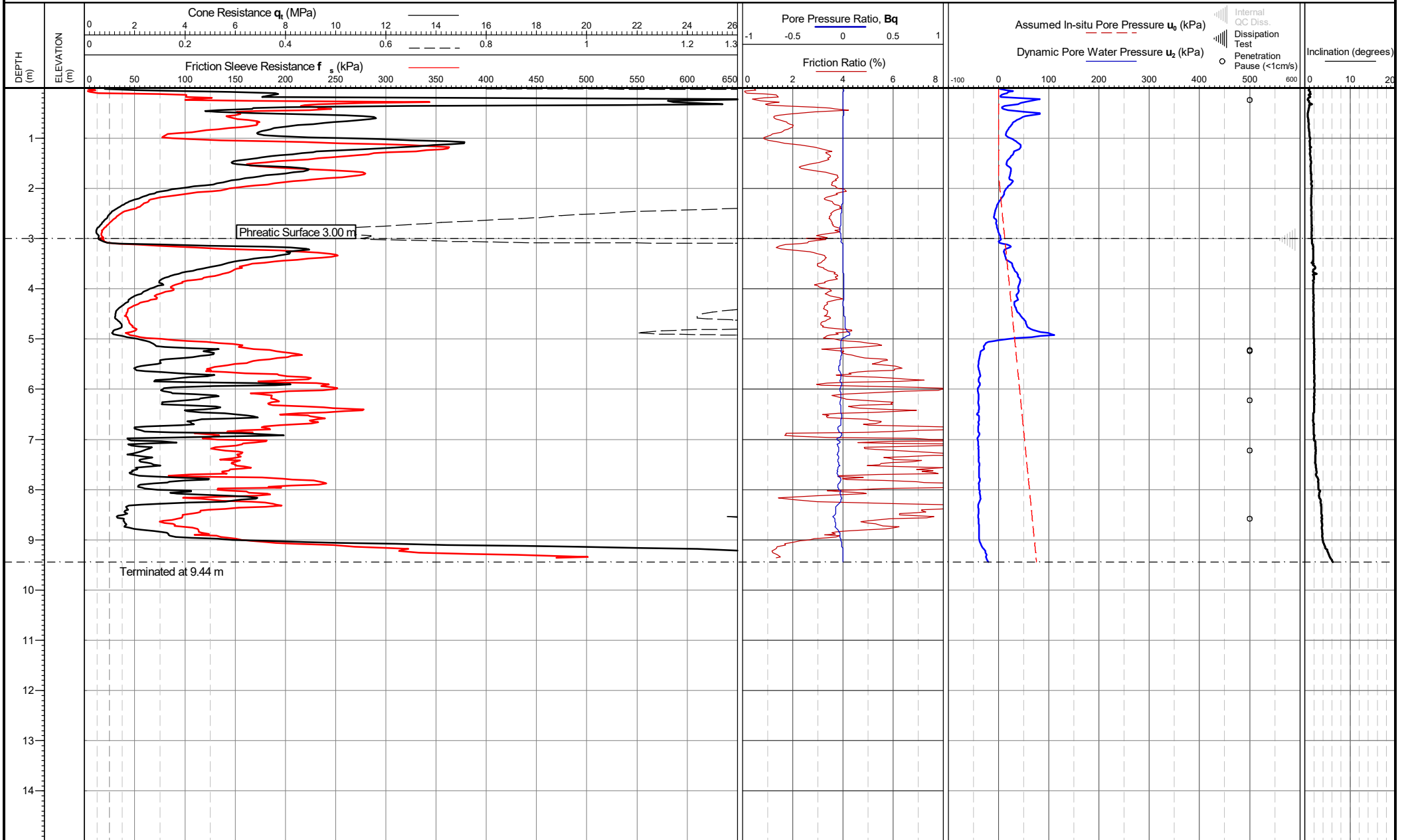
Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Remarks:  
 \*Phreatic surface origin:  $u_0$  pressure (t100) measured at another location  
 Termination Remark: Lateral support

Date of plot:  
 16-01-20  
 Checked by:  
 Chris Player

Lankelma Project Ref:  
 P-107374-1

**TEST ID: CPT03**



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Rig Used: UK22  
 Date of test: 15/01/2020 12:29:00

Zero drift (Pre/post test)  
 $q_c$  (kPa): 1.0  
 $f_s$  (kPa): -1.4 ( $f_s + q_c$  error)  
 $U_2$  (kPa): -5.1

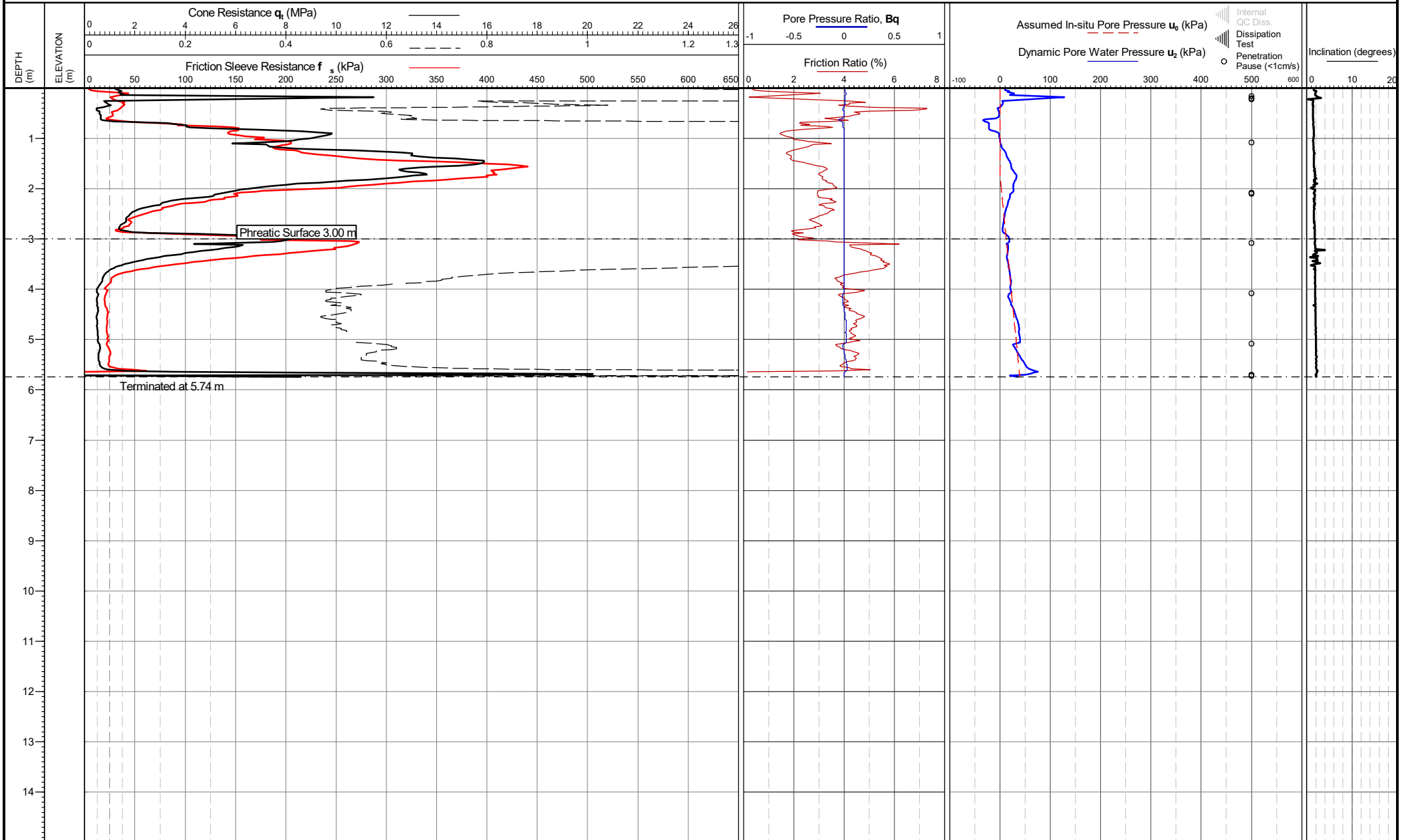
Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Remarks:  
 \*Phreatic surface origin:  $u_0$  pressure (t100) measured at another location  
 Termination Remark: Lateral support

Date of plot:  
 16-01-20  
 Checked by:  
 Chris Player

Lankelma Project Ref:  
 P-107374-1

**TEST ID: CPT04**



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Rig Used: UK22  
 Date of test: 15/01/2020 13:14:00

Zero drift (Pre/post test)  
 $q_c$  (kPa): 10.2  
 $f_s$  (kPa): 1.5 ( $f_s + q_c$  error)  
 $U_2$  (kPa): 2.6

Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

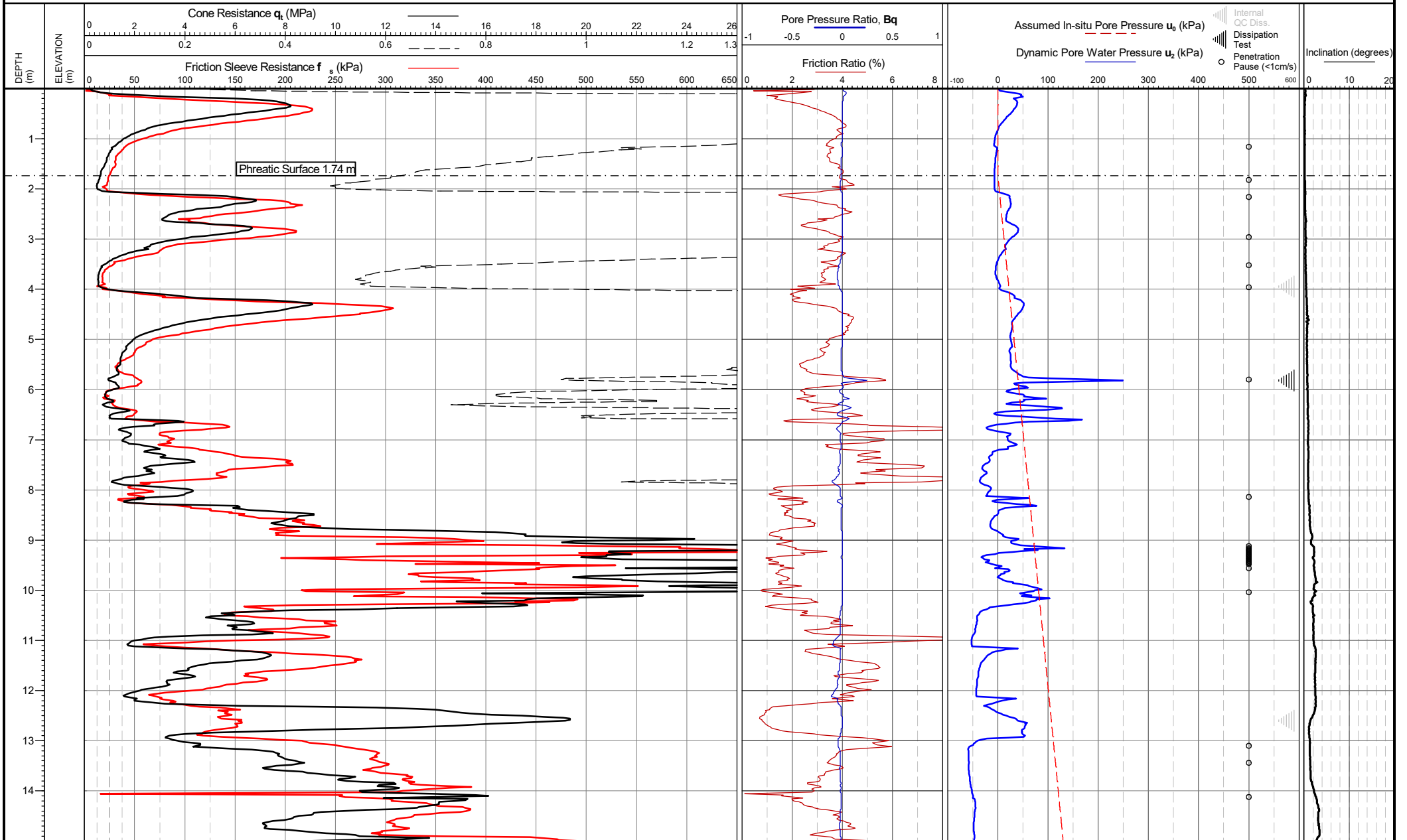
Remarks:  
 \*Phreatic surface origin:  $u_0$  pressure (t100) measured at another location  
 Termination Remark: Lateral support

Date of plot:  
 16-01-20

Lankelma Project Ref:  
 P-107374-1

Checked by:  
 Chris Player

**TEST ID: CPT05**



Cone area (mm<sup>2</sup>):1500  
Cone ID: S15-CFIPT.1769  
Operator: Gary Connor  
Rig Used: UK22  
Date of test: 15/01/2020 13:53:00

Zero drift (Pre/post test)  
 $q_c$  (kPa): -6.6  
 $f_s$  (kPa): -2.1 ( $f_s + q_c$  error)  
 $U_2$  (kPa): 1.4

Location: Bridgend, UK  
Coordinates: ,  
Elevation:  
Coordinate system:

Remarks:  
\*Phreatic surface origin:  $u_0$  (t100) measurement at this location

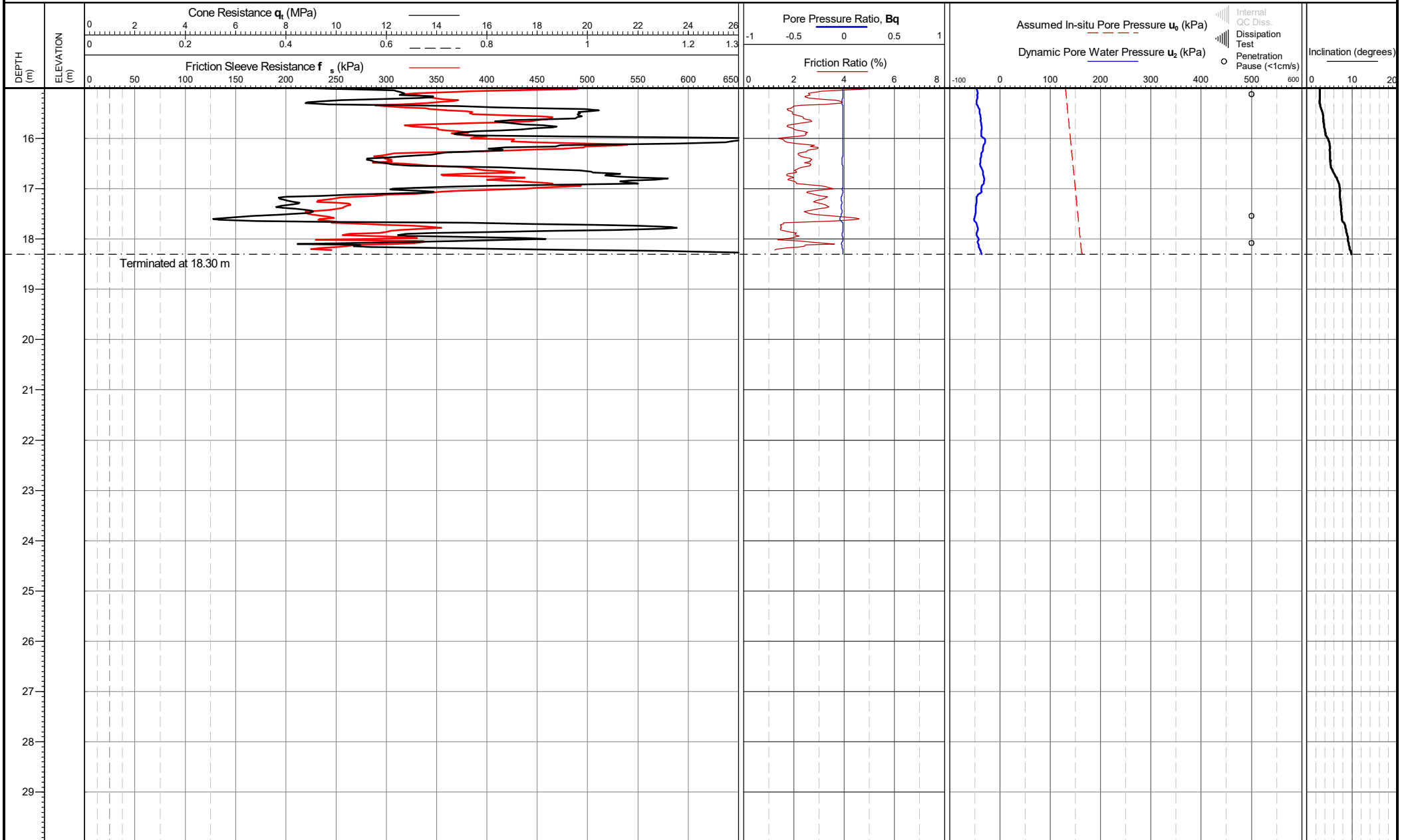
Termination Remark: Target depth

Date of plot:  
16-01-20

Checked by:  
Chris Player

Lankelma Project Ref:  
P-107374-1

**TEST ID: CPT06**



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Rig Used: UK22  
 Date of test: 15/01/2020 13:53:00

Zero drift (Pre/post test)  
 $q_c$  (kPa): -6.6  
 $f_s$  (kPa): -2.1 ( $f_s + q_c$  error)  
 $U_2$  (kPa): 1.4

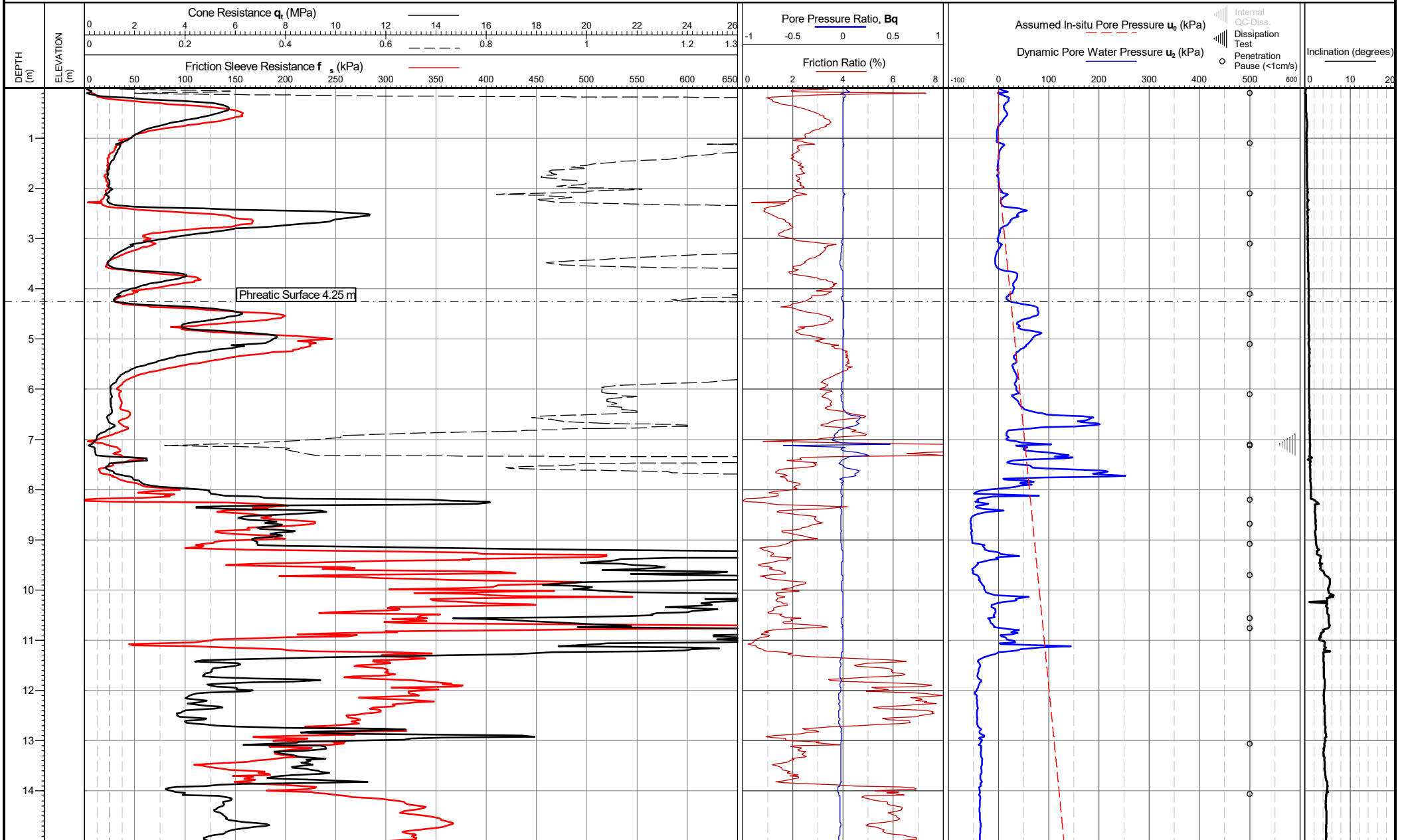
Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Remarks:  
 \*Phreatic surface origin:  $u_0$  (t100) measurement at this location  
 Termination Remark: Target depth

Date of plot:  
 16-01-20  
 Checked by:  
 Chris Player

Lankelma Project Ref:  
 P-107374-1

**TEST ID: CPT06**



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Rig Used: UK22  
 Date of test: 16/01/2020 08:38:00

Zero drift (Pre/post test)  
 $q_c$  (kPa): 17.8  
 $f_s$  (kPa): -2.8 ( $f_s + q_c$  error)  
 $U_2$  (kPa): -3.5

Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Remarks:  
 \*Phreatic surface origin:  $u_0$  (t100) measurement at this location

Termination Remark: Target depth

Date of plot:  
 16-01-20

Checked by:  
 Chris Player

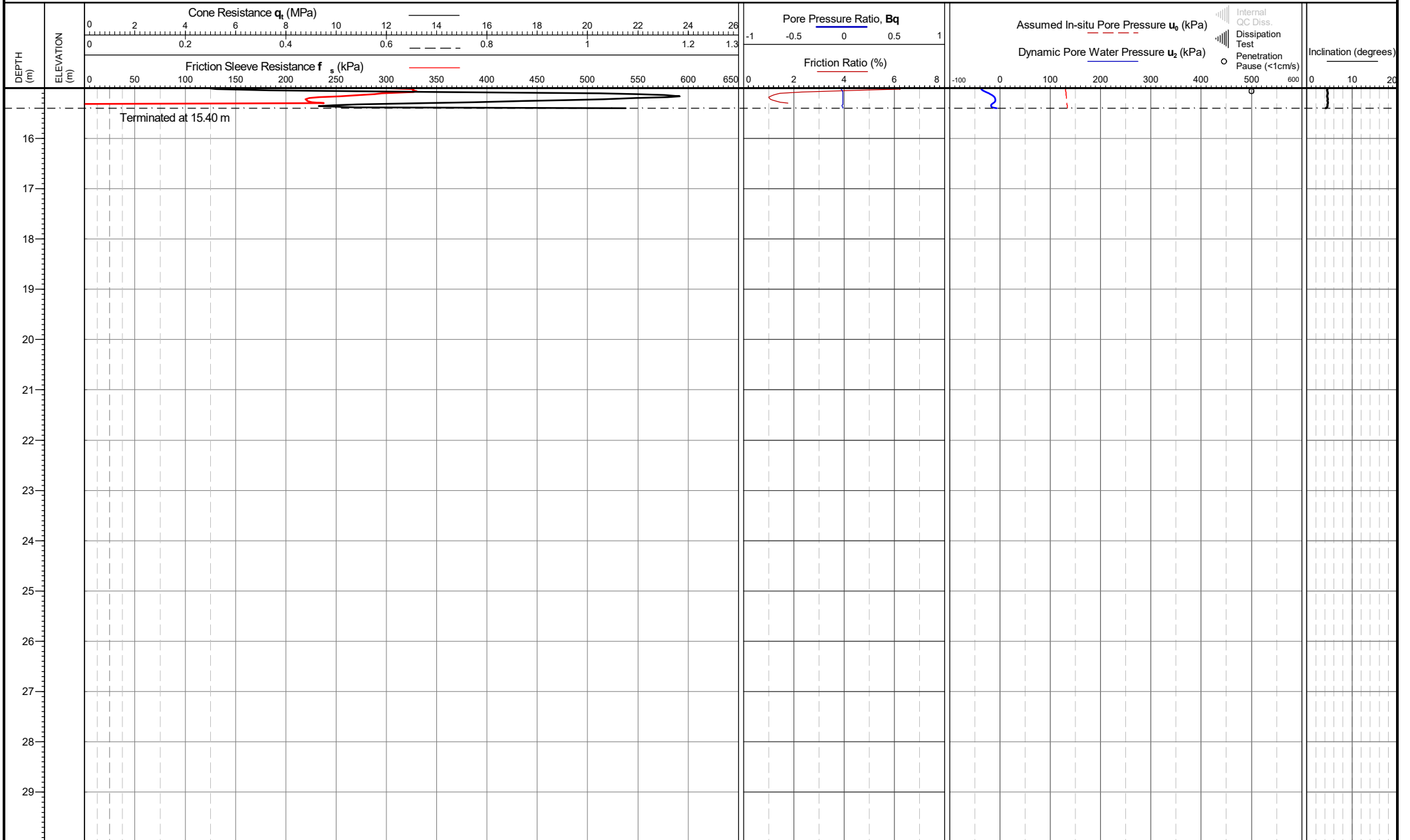
Lankelma Project Ref:  
 P-107374-1

**TEST ID: CPT07**



Project: BRIDGEND, SOUTH WALES

Client: INTEGRAL GEOTECHNIQUE



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Rig Used: UK22  
 Date of test: 16/01/2020 08:38:00

Zero drift (Pre/post test)  
 q<sub>c</sub> (kPa): 17.8  
 f<sub>s</sub> (kPa): -2.8 (f<sub>s</sub> + q<sub>c</sub> error)  
 U<sub>2</sub> (kPa): -3.5

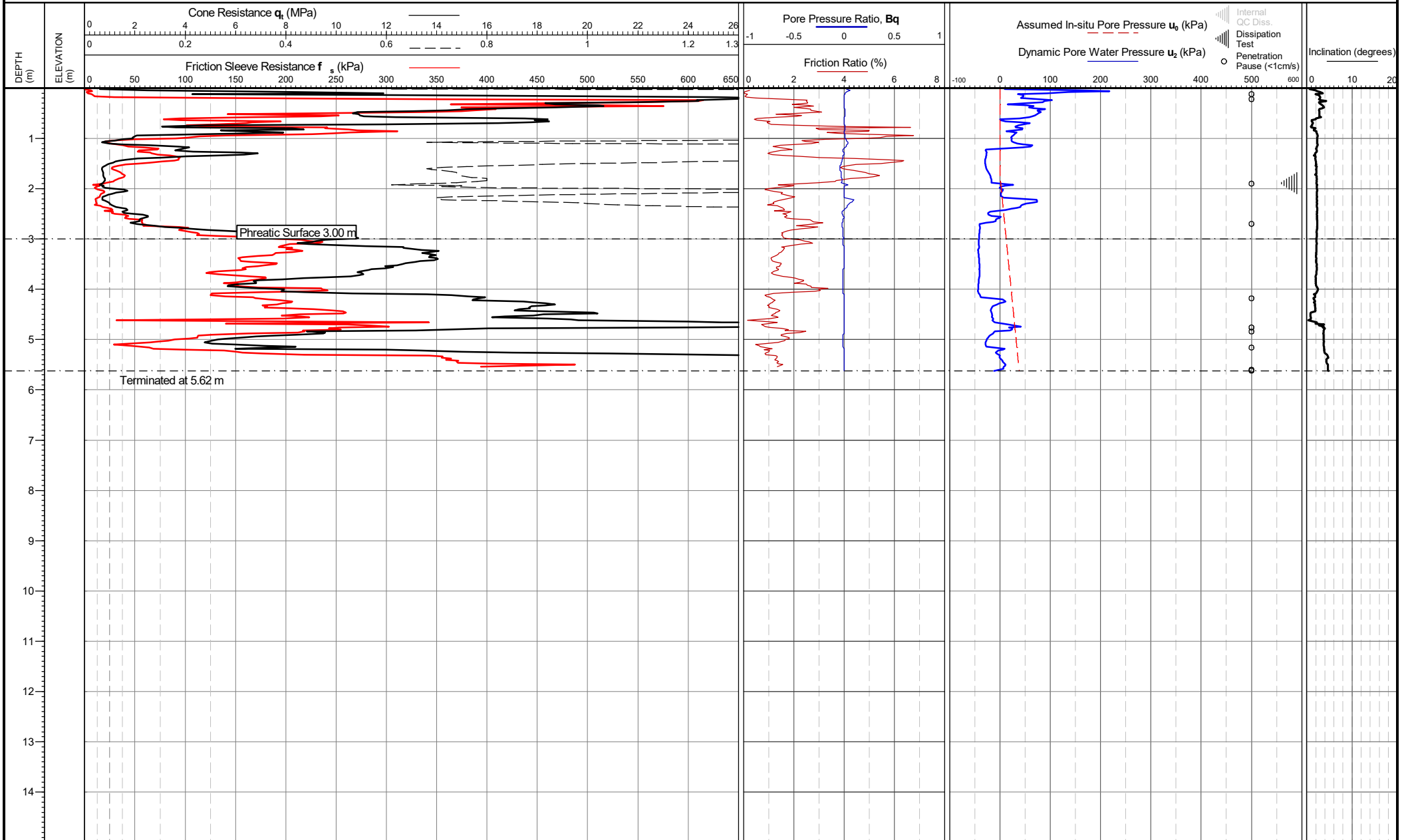
Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Remarks:  
 \*Phreatic surface origin: u<sub>0</sub> (t100) measurement at this location  
 Termination Remark: Target depth

Date of plot:  
 16-01-20  
 Checked by:  
 Chris Player

Lankelma Project Ref:  
 P-107374-1

**TEST ID: CPT07**



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Rig Used: UK22  
 Date of test: 16/01/2020 10:54:00

Zero drift (Pre/post test)  
 $q_c$  (kPa): 17.2  
 $f_s$  (kPa): 0.5 ( $f_s + q_c$  error)  
 $U_2$  (kPa): -1.2

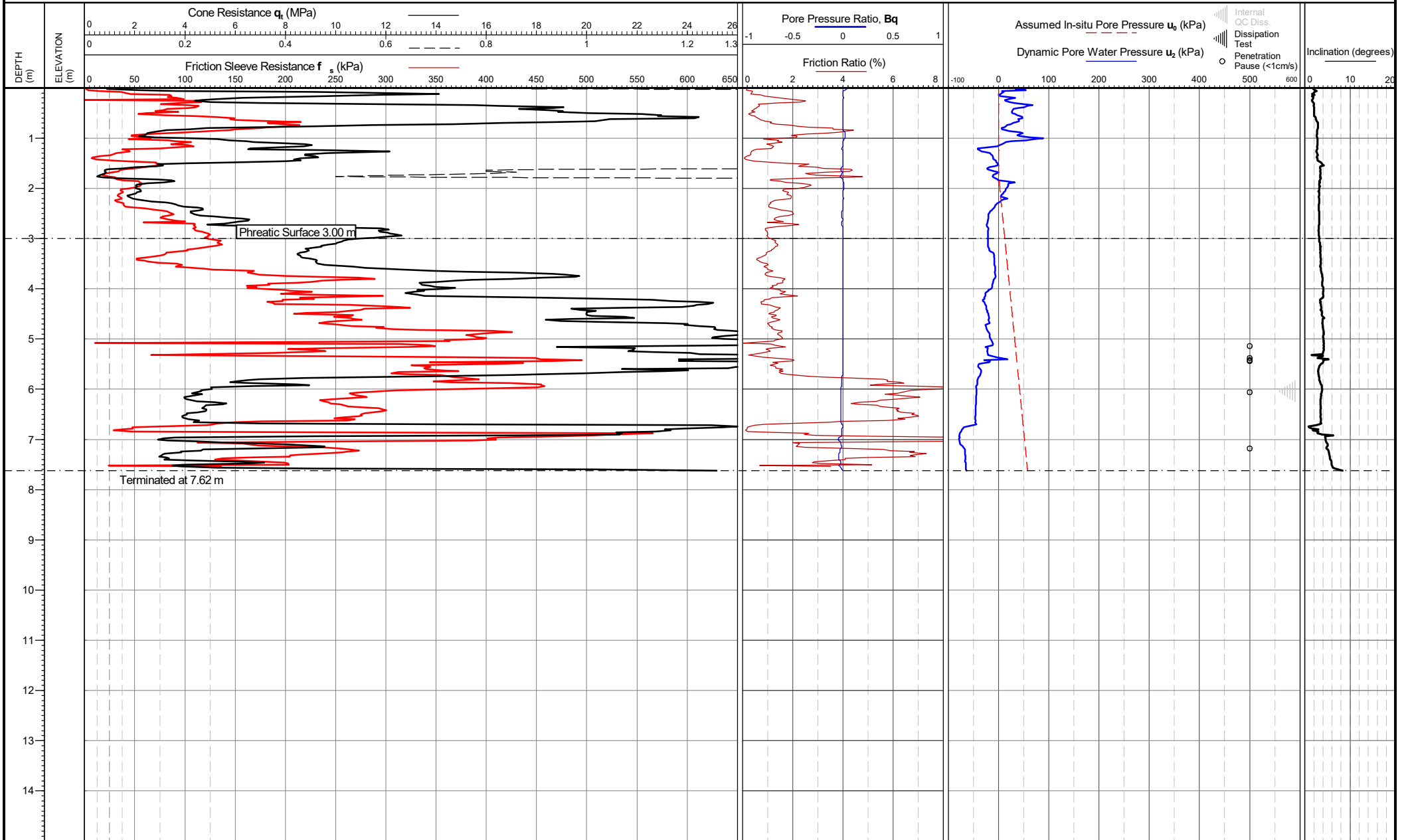
Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Remarks:  
 \*Phreatic surface origin:  $u_0$  pressure (t100) measured at another location  
 Termination Remark: Lateral support

Date of plot:  
 16-01-20  
 Checked by:  
 Chris Player

Lankelma Project Ref:  
 P-107374-1

**TEST ID: CPT08**



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Rig Used: UK22  
 Date of test: 16/01/2020 10:12:00

Zero drift (Pre/post test)  
 $q_c$  (kPa): -20.2  
 $f_s$  (kPa): -0.7 ( $f_s + q_c$  error)  
 $U_2$  (kPa): -0.6

Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Remarks:  
 \*Phreatic surface origin:  $u_0$  pressure (t100) measured at another location  
 Termination Remark: Lateral support

Date of plot:  
 16-01-20  
 Checked by:  
 Chris Player

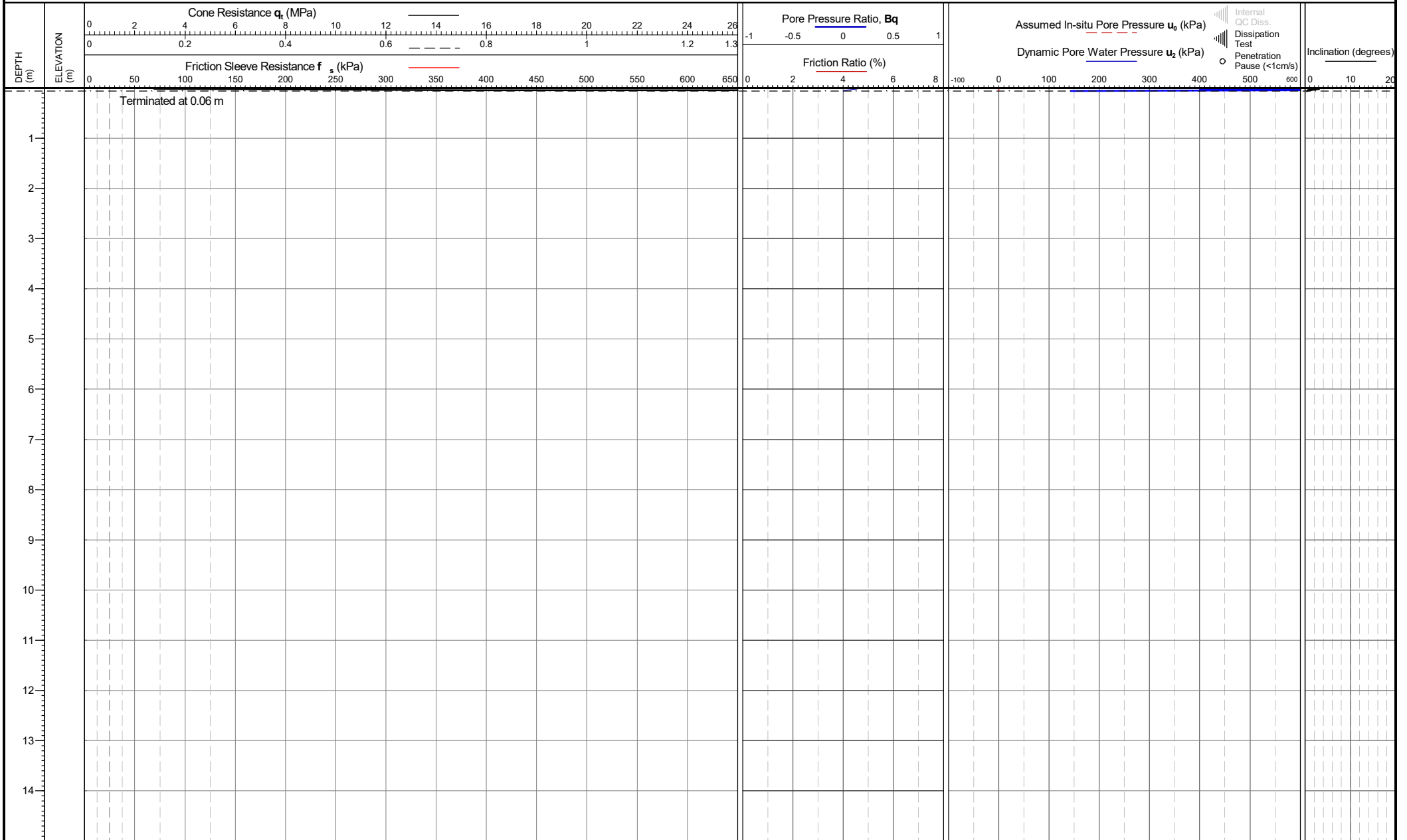
Lankelma Project Ref:  
 P-107374-1

**TEST ID: CPT09**



Project: BRIGEND, SOUTH WALES

Client: INTEGRAL GEOTECHNIQUE



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Rig Used: UK22  
 Date of test: 15/01/2020 10:24:00

Zero drift (Pre/post test)  
 q<sub>c</sub> (kPa): 5.4  
 f<sub>s</sub> (kPa): 0.3 (f<sub>s</sub> + q<sub>c</sub> error)  
 U<sub>2</sub> (kPa): -1.4

Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

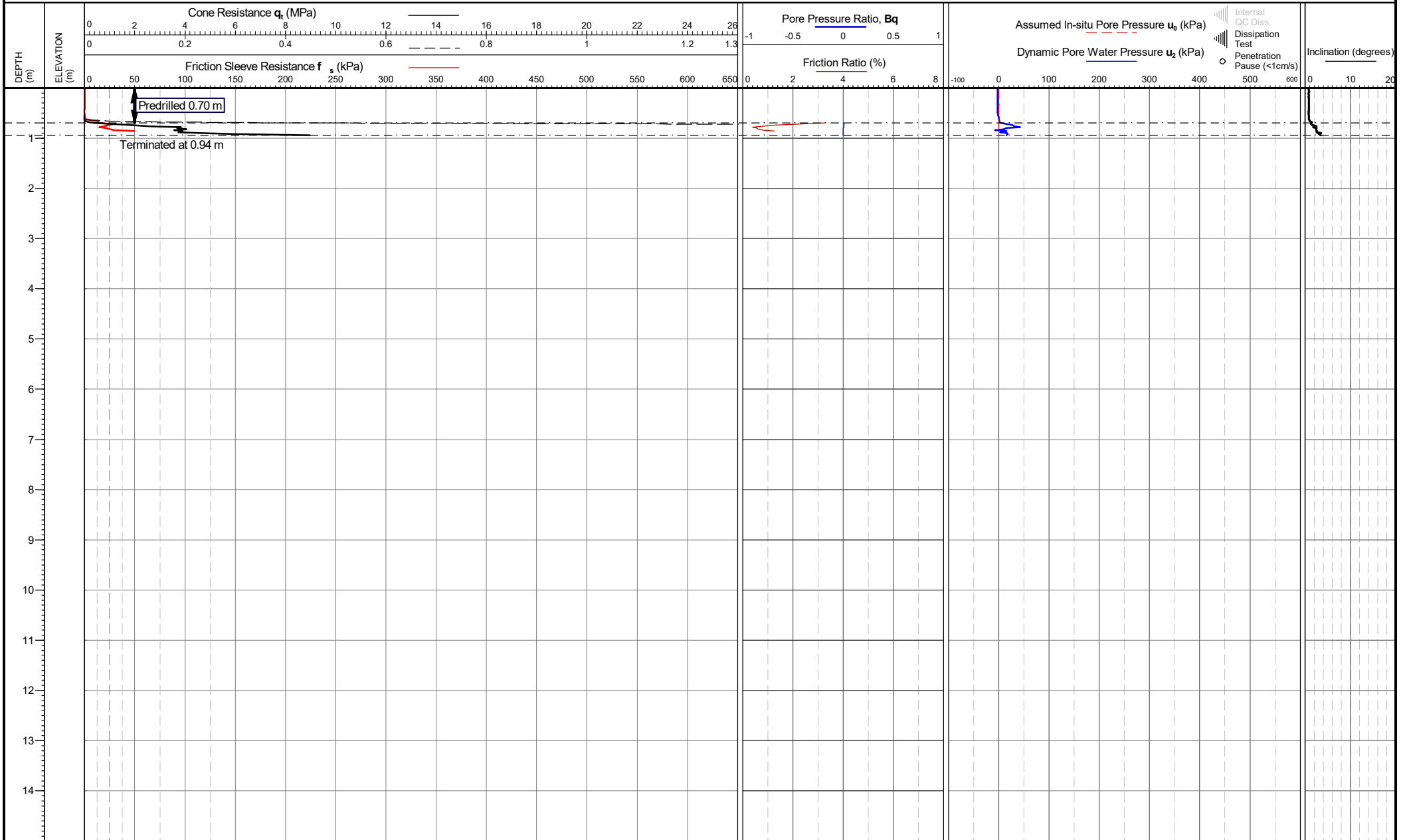
Remarks:  
 \*Phreatic surface origin: u0 pressure (t100) measured at another location  
 Termination Remark: Lateral support

Date of plot:  
 16-01-20

Lankelma Project Ref:  
 P-107374-1

Checked by:  
 Chris Player

**TEST ID: CPT10**



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Rig Used: UK22  
 Date of test: 16/01/2020 12:19:00

Zero drift (Pre/post test)  
 $q_c$  (kPa): -39.6  
 $f_s$  (kPa): 2.1 ( $f_s + q_c$  error)  
 $U_2$  (kPa): 1.5

Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Remarks:  
 \*Phreatic surface origin:  $u_0$  pressure (t100) measured at another location  
 Termination Remark: Lateral support

Date of plot:  
 16-01-20

Lankelma Project Ref:  
 P-107374-1

Checked by:  
 Chris Player

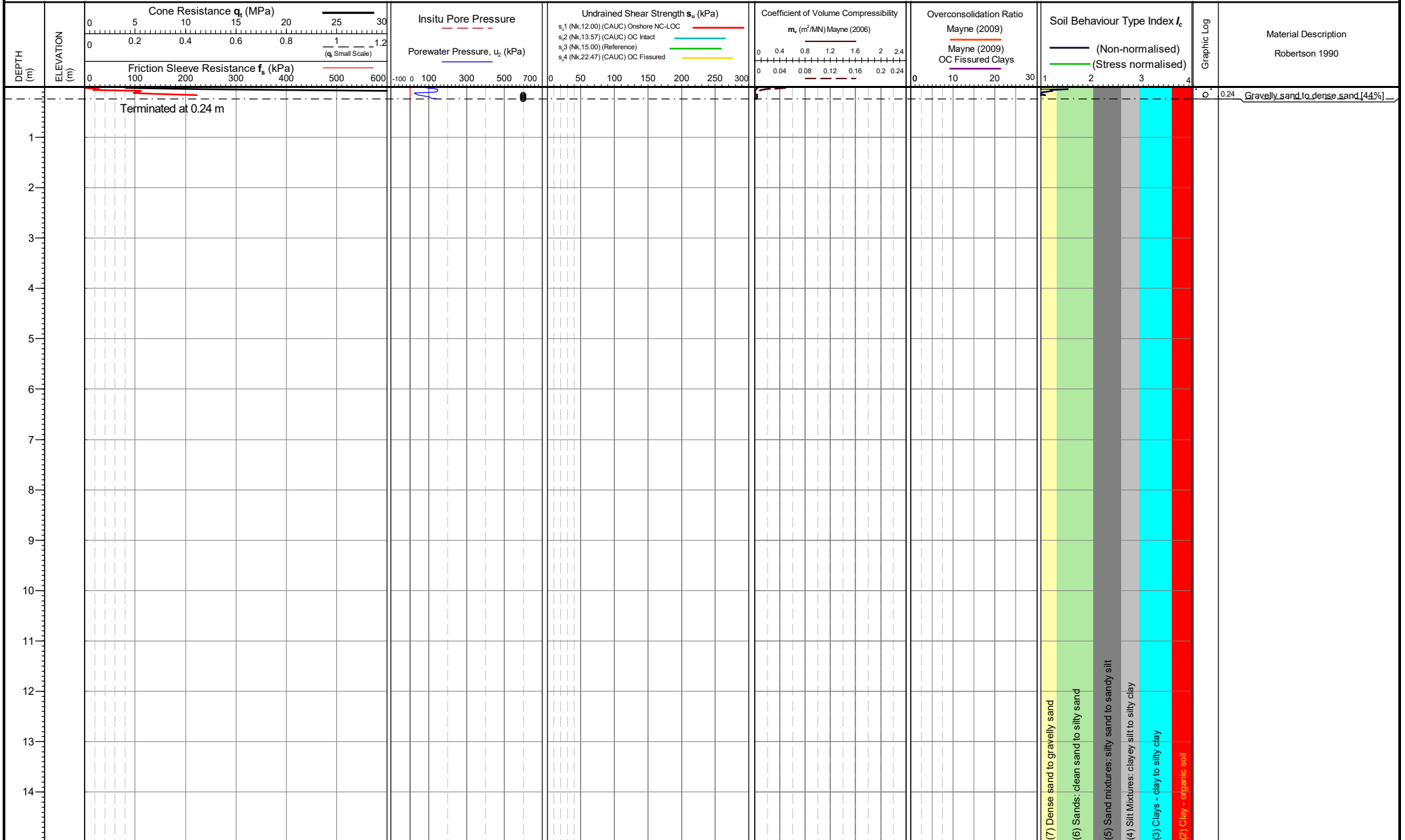
**TEST ID: CPT10A**

**APPENDIX D STANDARD INTERPRETATION RESULTS - SET 1**

UNDRAINED SHEAR STRENGTH  
COEFFICIENT OF VOLUME CHANGE  
OVERCONSOLIDATION RATIO  
SOIL BEHAVIOUR TYPE (SBT) DESCRIPTIONS

**LIST OF FIGURES:**

Location ID	Pages included
CPT01	1
CPT01A	1
CPT01B	1
CPT02	1
CPT03	1
CPT04	1
CPT05	1
CPT06	2
CPT07	2
CPT08	1
CPT09	1
CPT10	1
CPT10A	1



Cone area (mm<sup>2</sup>):1500  
 ConeID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Rig Used: UK22  
 Date of test: 15/01/2020 10:45:00

Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Remarks: \*Phreatic surface origin:  $u_0$  pressure (t100) measured at another location  
 Termination Remark:  
 Lateral support

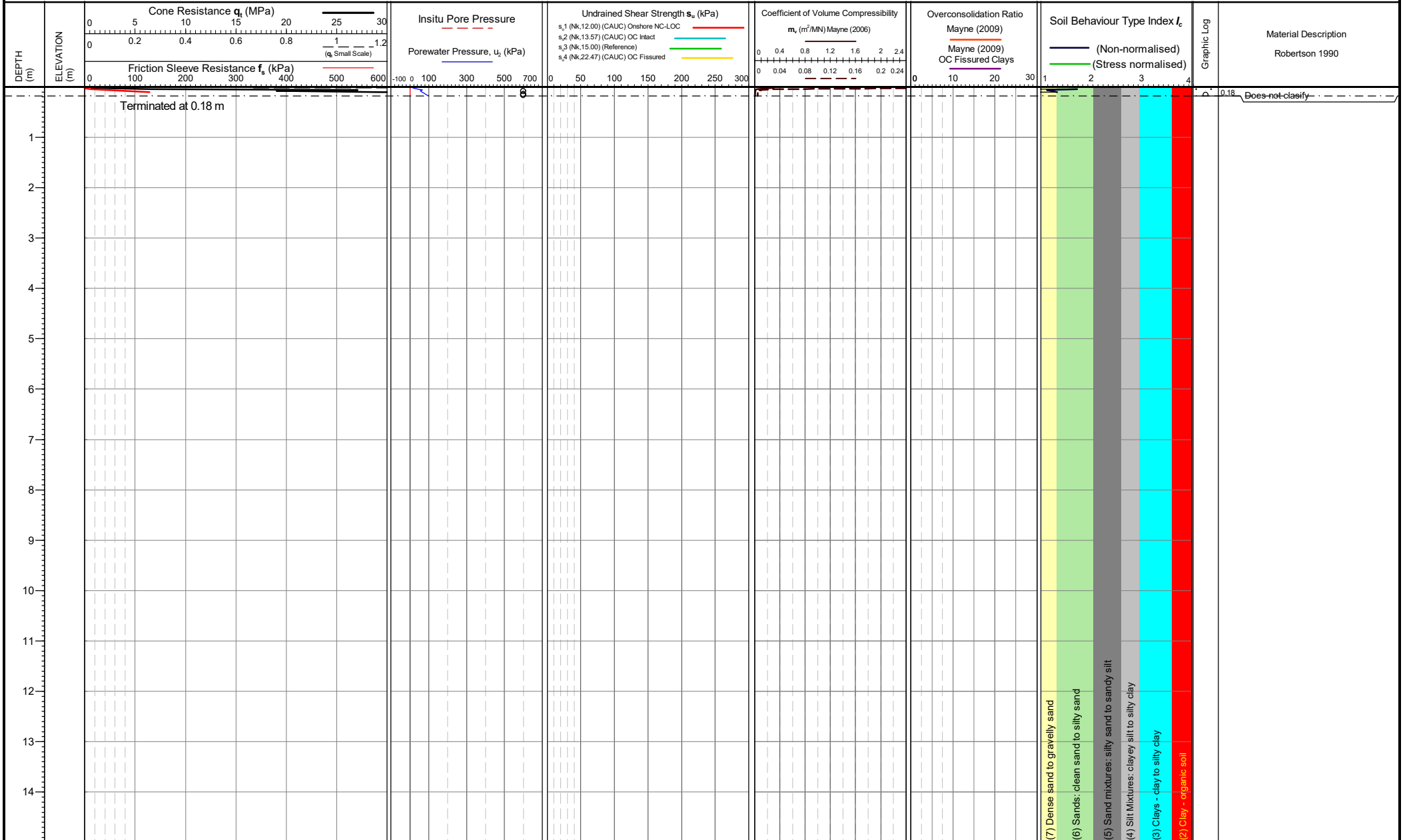
Internal QA Diss.  
 Dissipation Test  
 Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs =  $I_c$  2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
 See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
 Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT01**



Cone area (mm<sup>2</sup>):1500  
 ConeID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Rig Used: UK22  
 Date of test: 15/01/2020 10:57:00

Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Remarks: \*Phreatic surface origin: u0 pressure (t100) measured at another location  
 Termination Remark: Lateral support

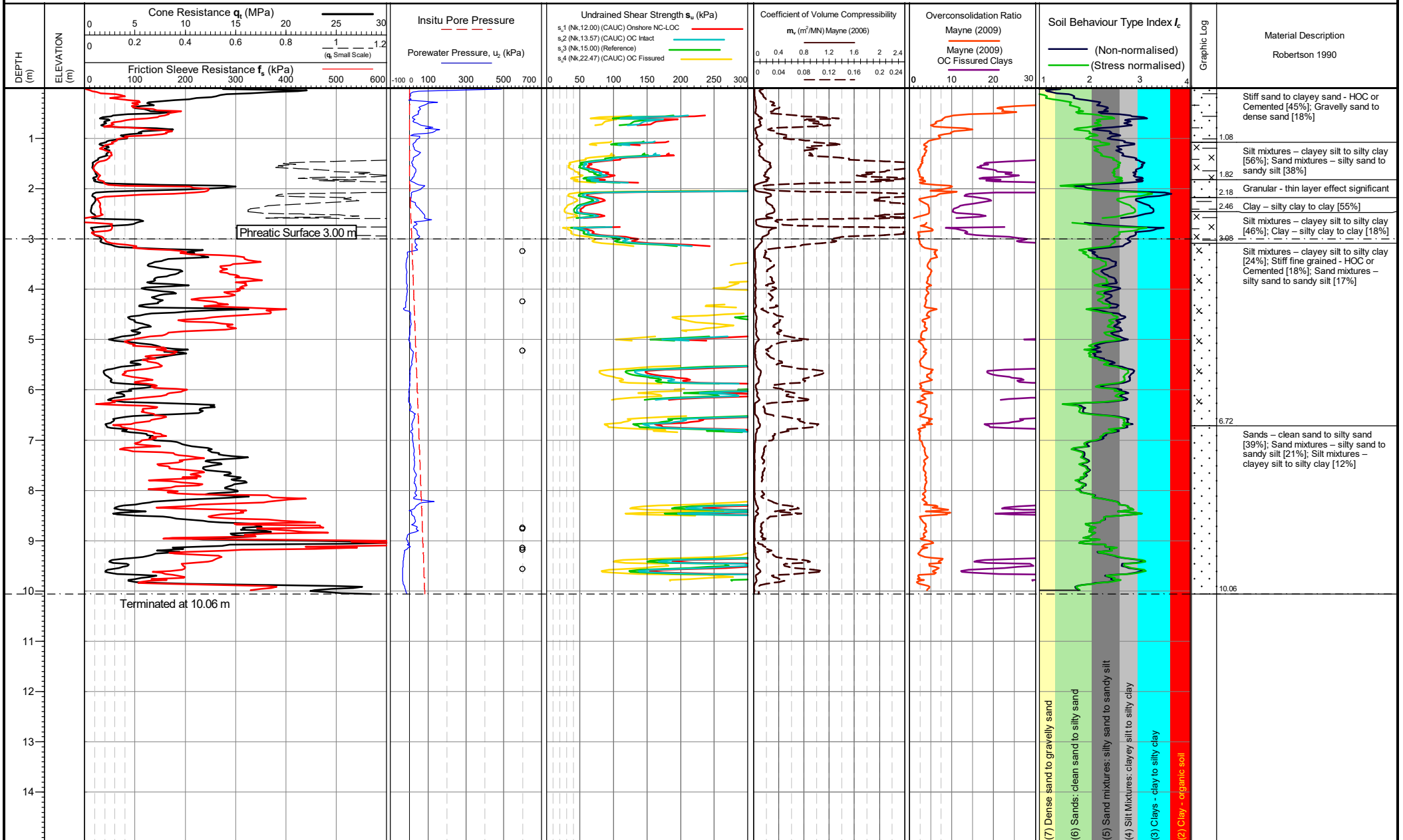
Internal QA Diss. Test  
 Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = I<sub>c</sub> 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
 See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
 Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT01A**



Cone area (mm<sup>2</sup>):1500  
 ConeID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Rig Used: UK22  
 Date of test: 16/01/2020 09:23:00

Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Remarks: \*Phreatic surface origin: u0 pressure (t100) measured at another location  
 Termination Remark: Lateral support

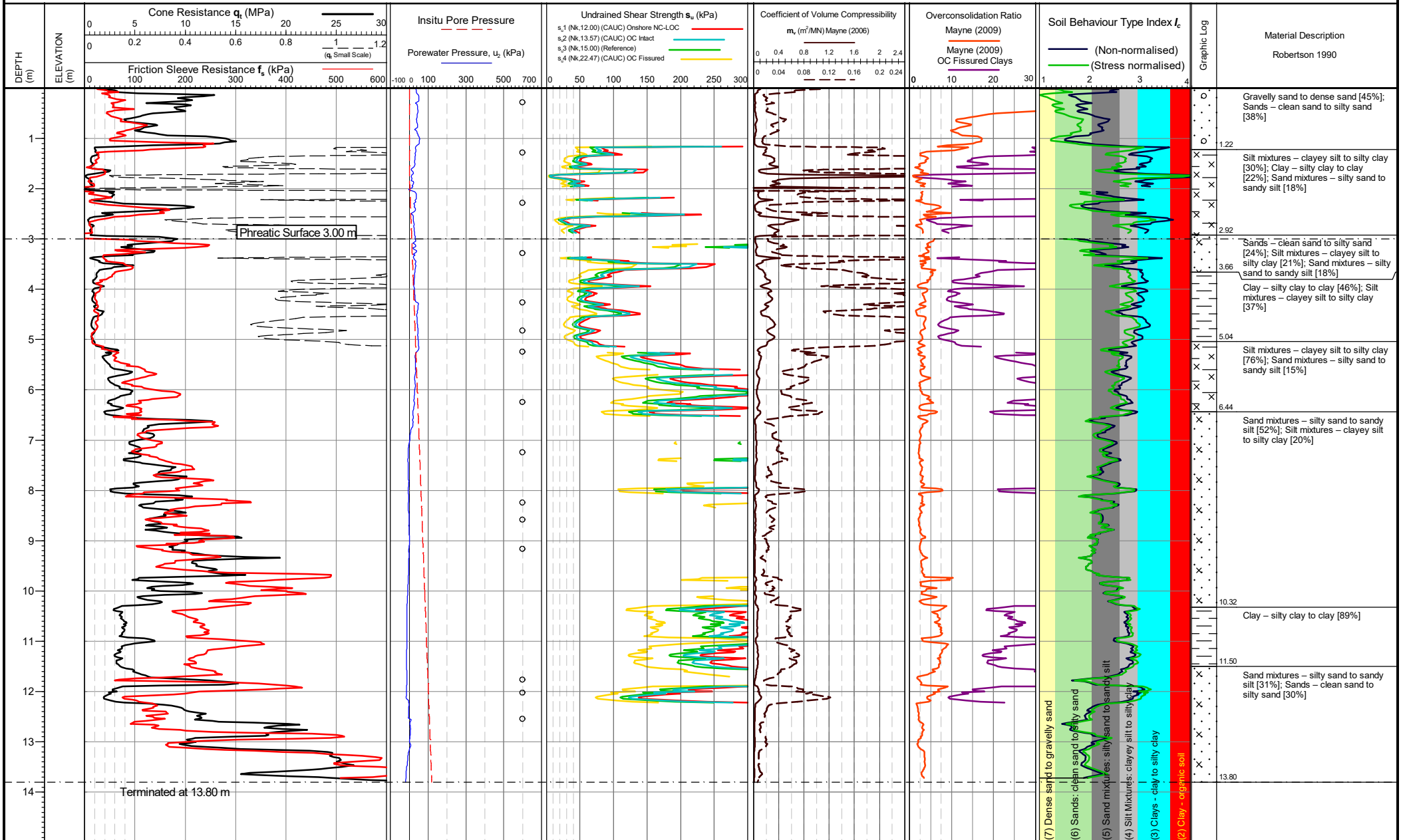
Internal QA Diss. Test  
 Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = I<sub>c</sub> 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
 See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
 Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT01B**



Cone area (mm<sup>2</sup>):1500  
 ConeID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Rig Used: UK22  
 Date of test: 15/01/2020 11:09:00

Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Remarks: \*Phreatic surface origin: u0 pressure (100) measured at another location

Termination Remark:  
 Lateral support

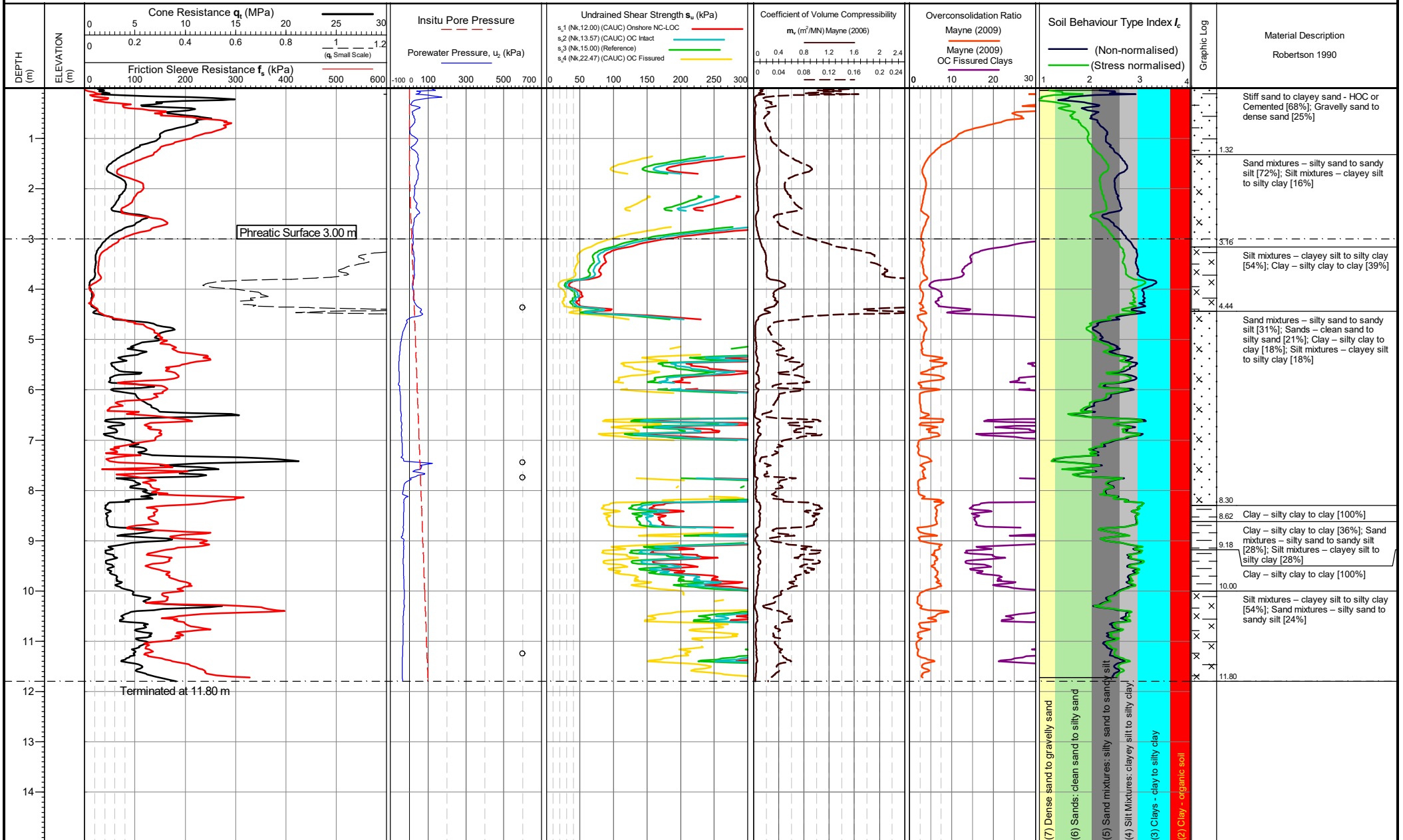
Internal QA Diss.  
 Dissipation Test  
 Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
 See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
 Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT02**



Cone area (mm<sup>2</sup>):1500  
 ConeID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Rig Used: UK22  
 Date of test: 15/01/2020 11:47:00

Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Remarks: \*Phreatic surface origin: u0 pressure (t100) measured at another location

Termination Remark:  
 Lateral support

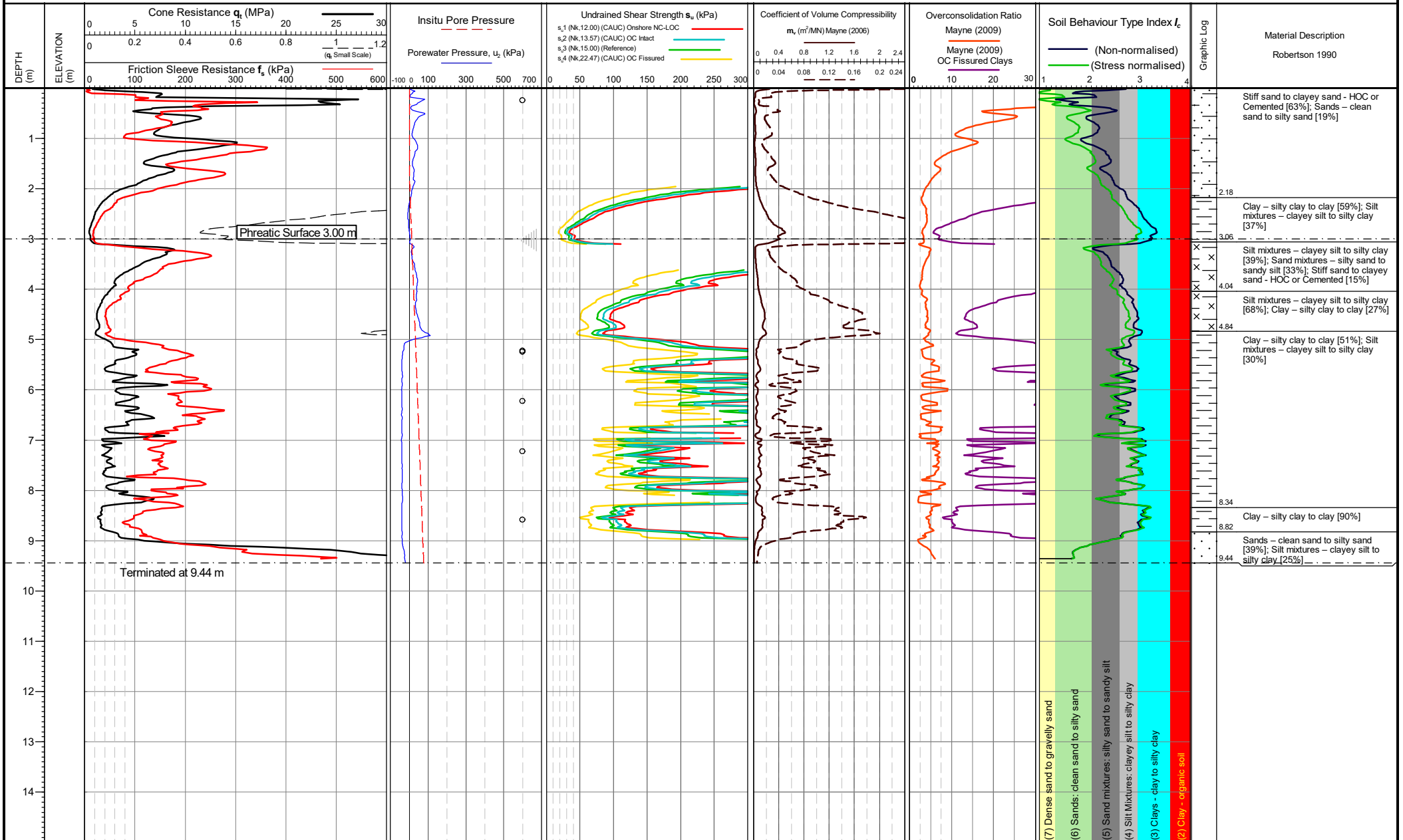
Internal QA Diss.  
 Dissipation Test  
 Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
 See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
 Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT03**



Cone area (mm<sup>2</sup>):1500  
ConeID: S15-CFIPT.1769  
Operator: Gary Connor  
Rig Used: UK22  
Date of test: 15/01/2020 12:29:00

Location: Bridgend, UK  
Coordinates: ,  
Elevation:  
Coordinate system:

Remarks: \*Phreatic surface origin: u0 pressure (t100) measured at another location  
Termination Remark: Lateral support

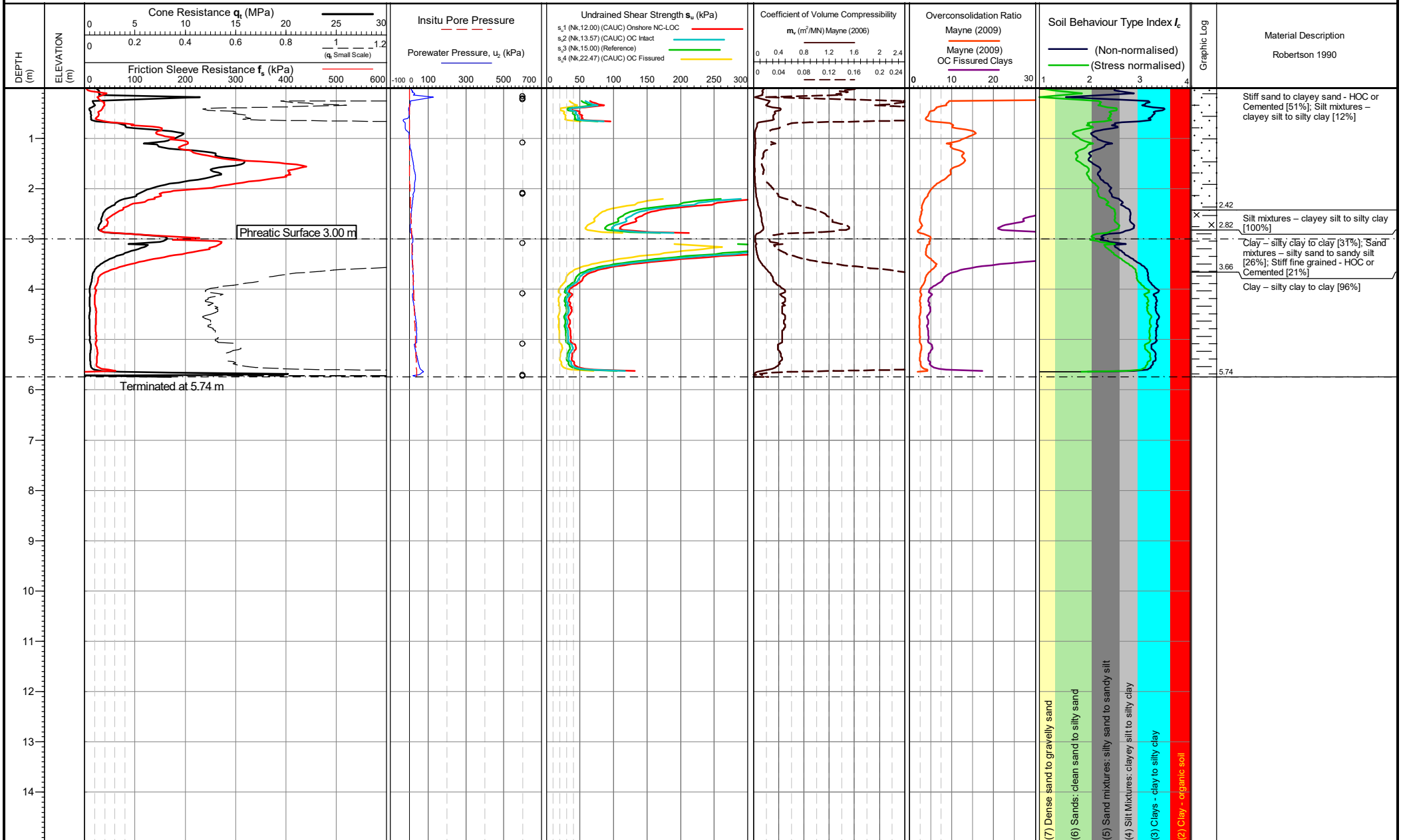
Internal QA Diss. Test  
Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT04**



Cone area (mm<sup>2</sup>):1500  
ConeID: S15-CFIPT.1769  
Operator: Gary Connor  
Rig Used: UK22  
Date of test: 15/01/2020 13:14:00

Location: Bridgend, UK  
Coordinates: ,  
Elevation:  
Coordinate system:

Remarks: \*Phreatic surface origin: u0 pressure (t100) measured at another location

Termination Remark:  
Lateral support

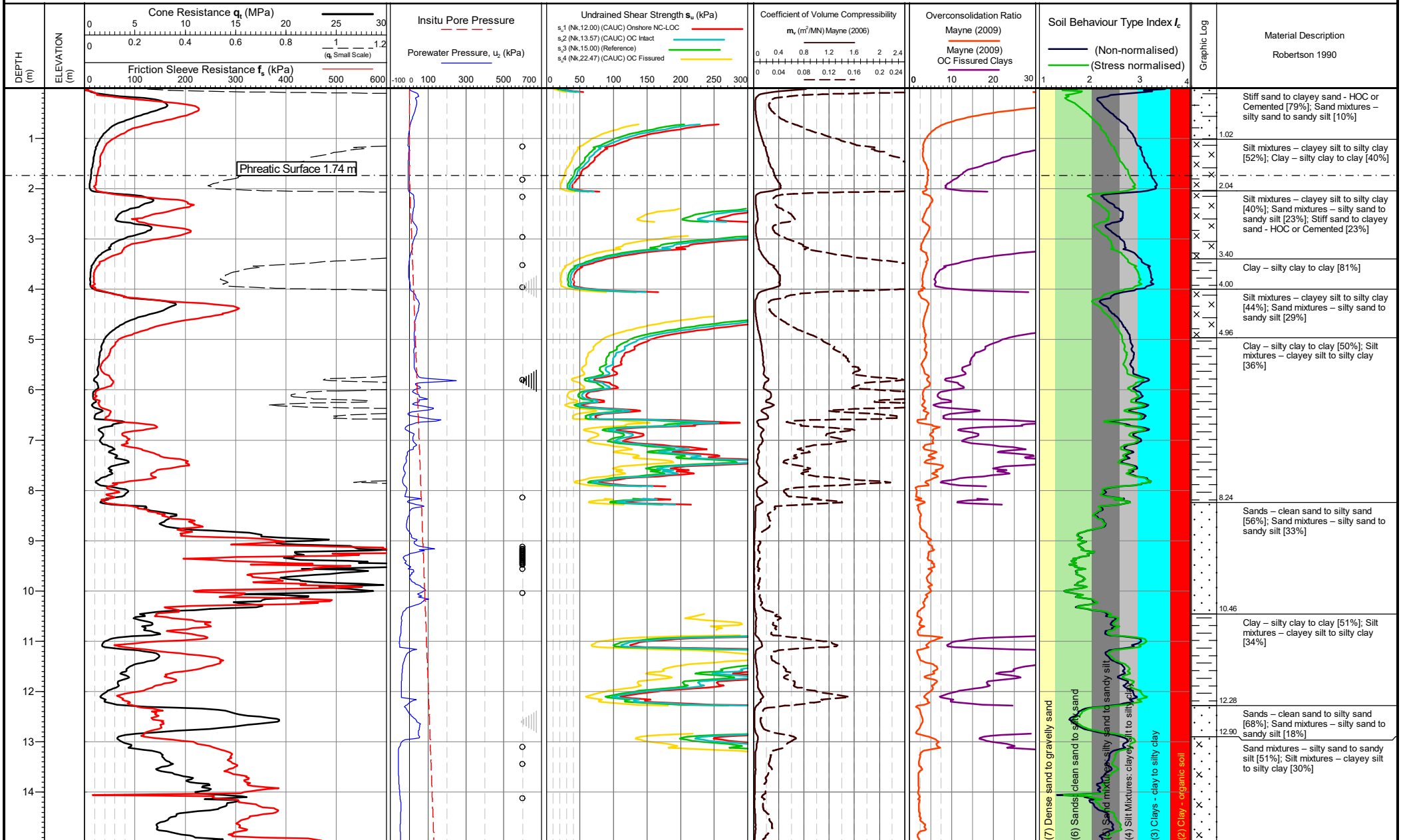
Internal QA Diss.  
Dissipation Test  
Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT05**



Cone area (mm<sup>2</sup>):1500  
ConeID: S15-CFIPT.1769  
Operator: Gary Connor  
Rig Used: UK22  
Date of test: 15/01/2020 13:53:00

Location: Bridgend, UK  
Coordinates: ,  
Elevation:  
Coordinate system:

Remarks: \*Phreatic surface origin: u0 (t100) measurement at this location  
Termination Remark:  
Target depth

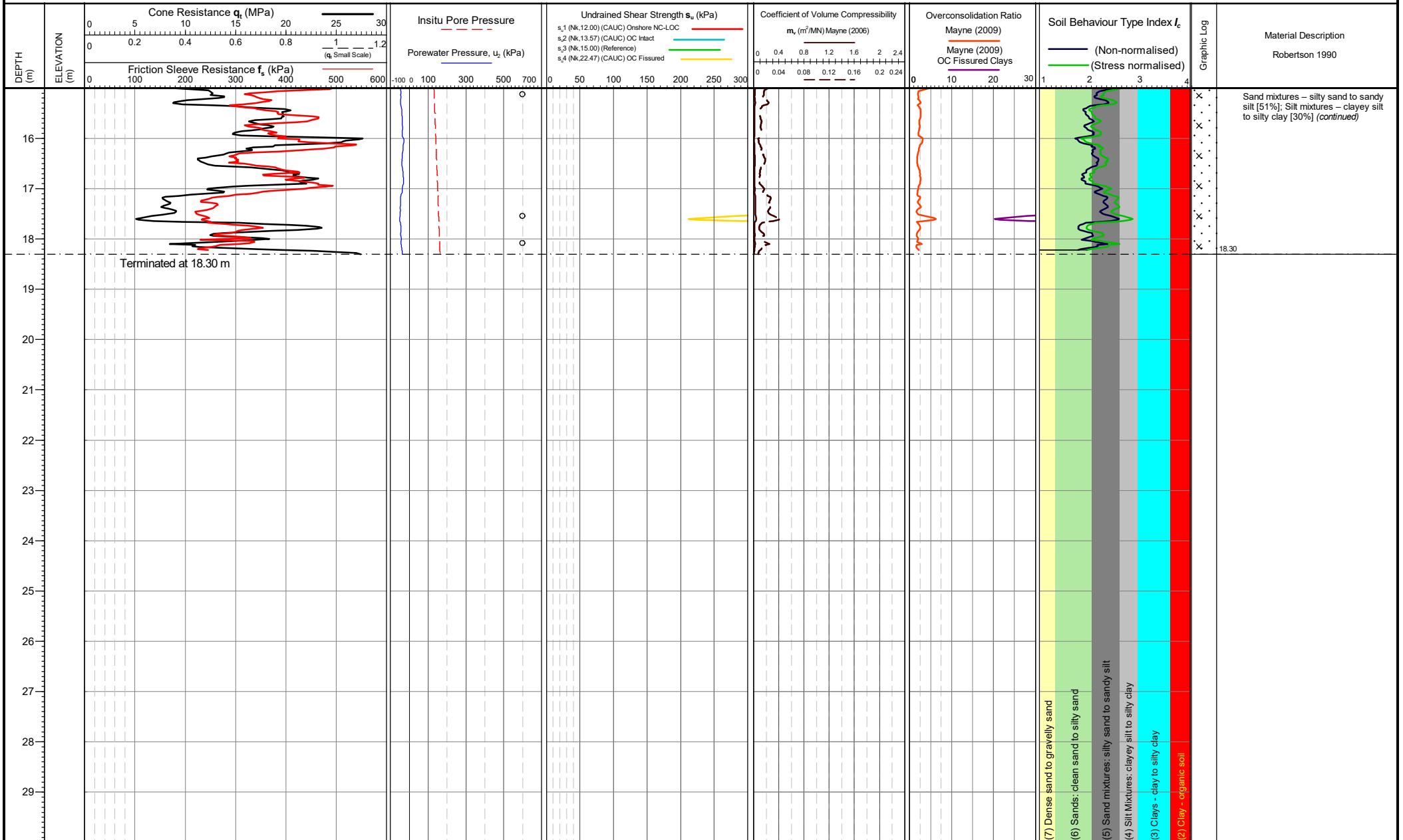
Internal QA Diss. Test  
Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT06**



Cone area (mm<sup>2</sup>):1500  
ConeID: S15-CFIPT.1769  
Operator: Gary Connor  
Rig Used: UK22  
Date of test: 15/01/2020 13:53:00

Location: Bridgend, UK  
Coordinates: ,  
Elevation:  
Coordinate system:

Remarks: \*Phreatic surface origin: u0 (t100) measurement at this location  
Termination Remark: Target depth

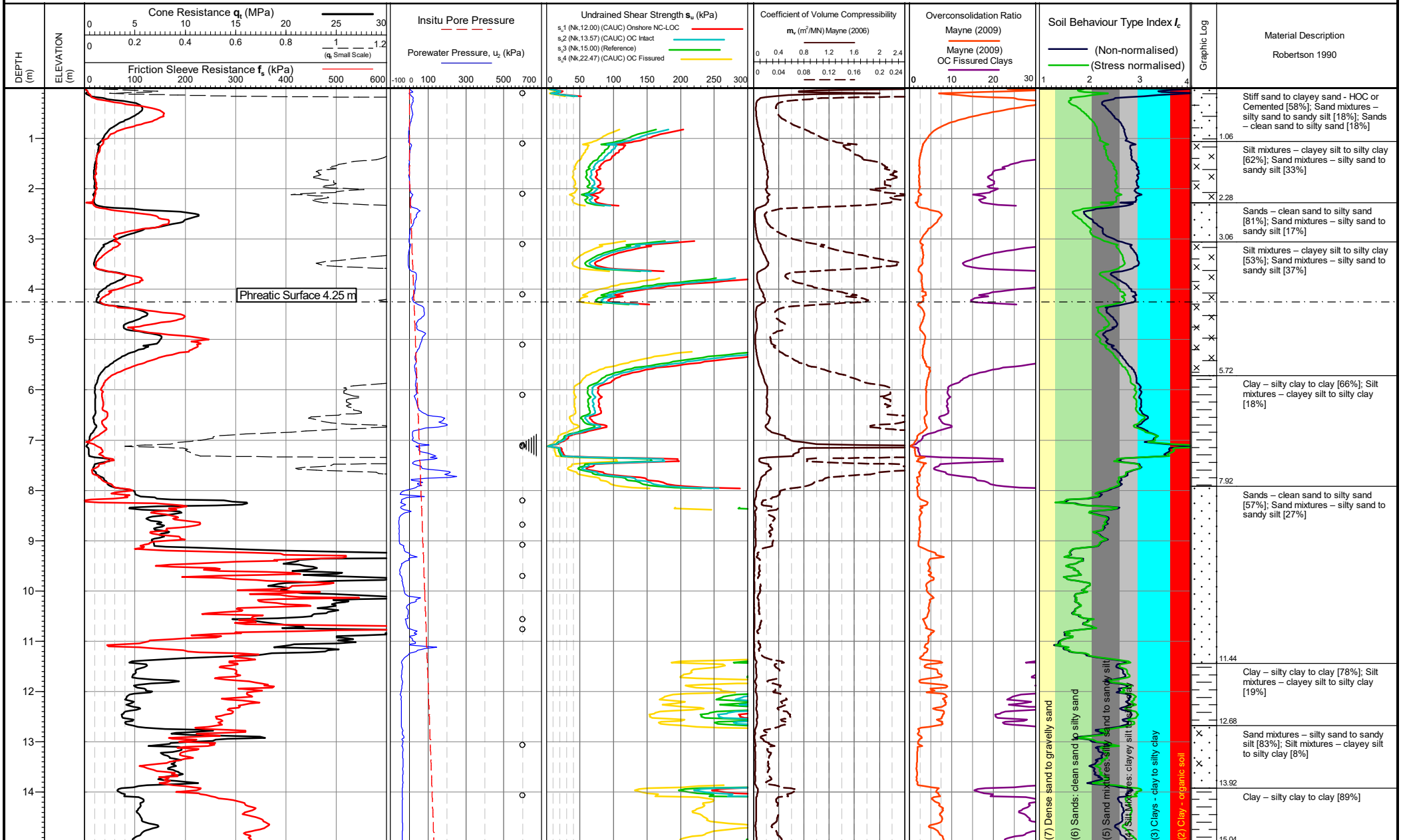
Internal QA Diss. Test  
Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT06**



Cone area (mm<sup>2</sup>):1500  
 ConeID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Rig Used: UK22  
 Date of test: 16/01/2020 08:38:00

Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Remarks: \*Phreatic surface origin: u0 (t100) measurement at this location  
 Termination Remark: Target depth

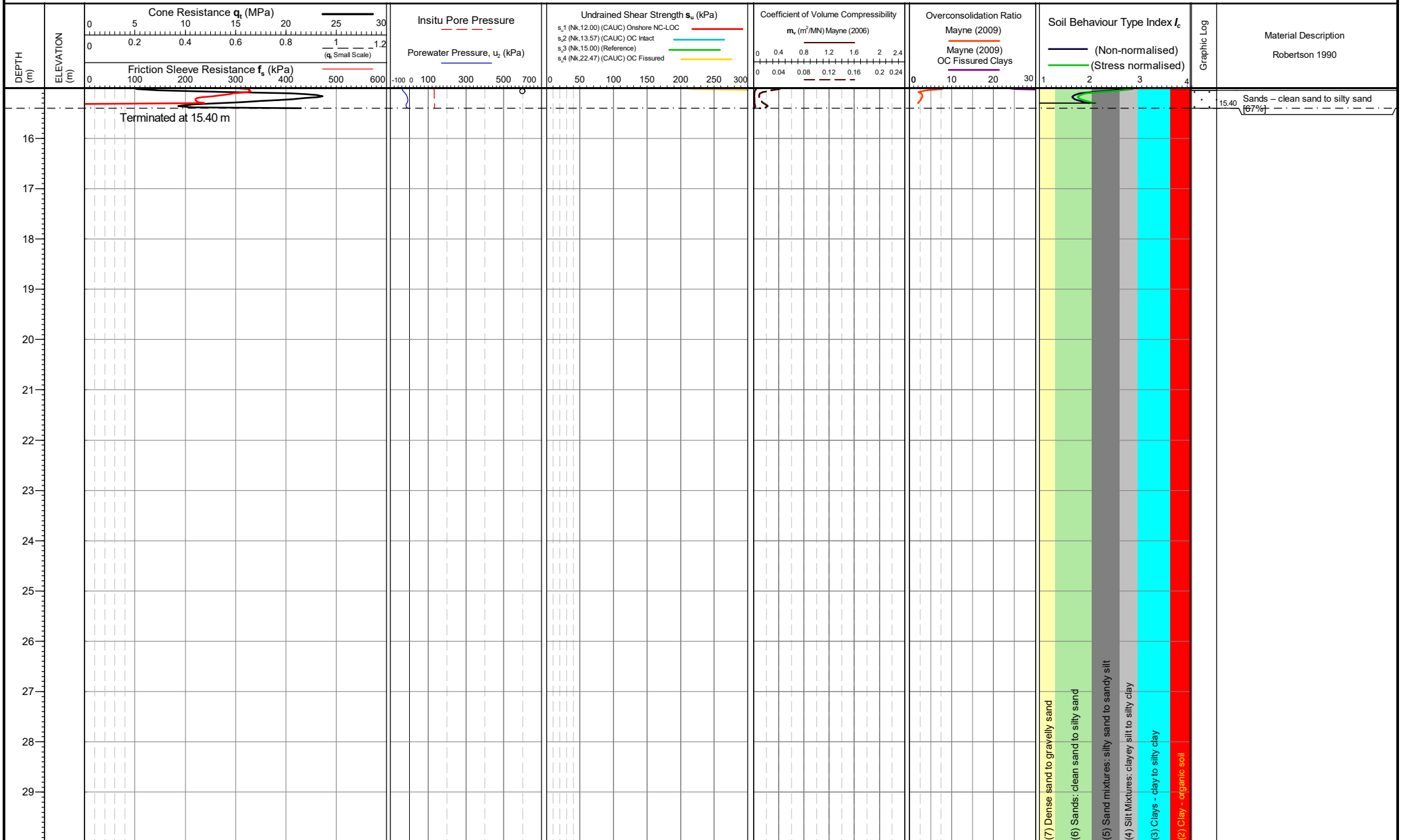
Internal QA Diss. Test  
 Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = lc 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
 See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
 Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT07**



Cone area (mm<sup>2</sup>):1500  
 ConeID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Rig Used: UK22  
 Date of test: 16/01/2020 08:38:00

Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Remarks: \*Phreatic surface origin: u<sub>0</sub> (t100) measurement at this location  
 Termination Remark:  
 Target depth

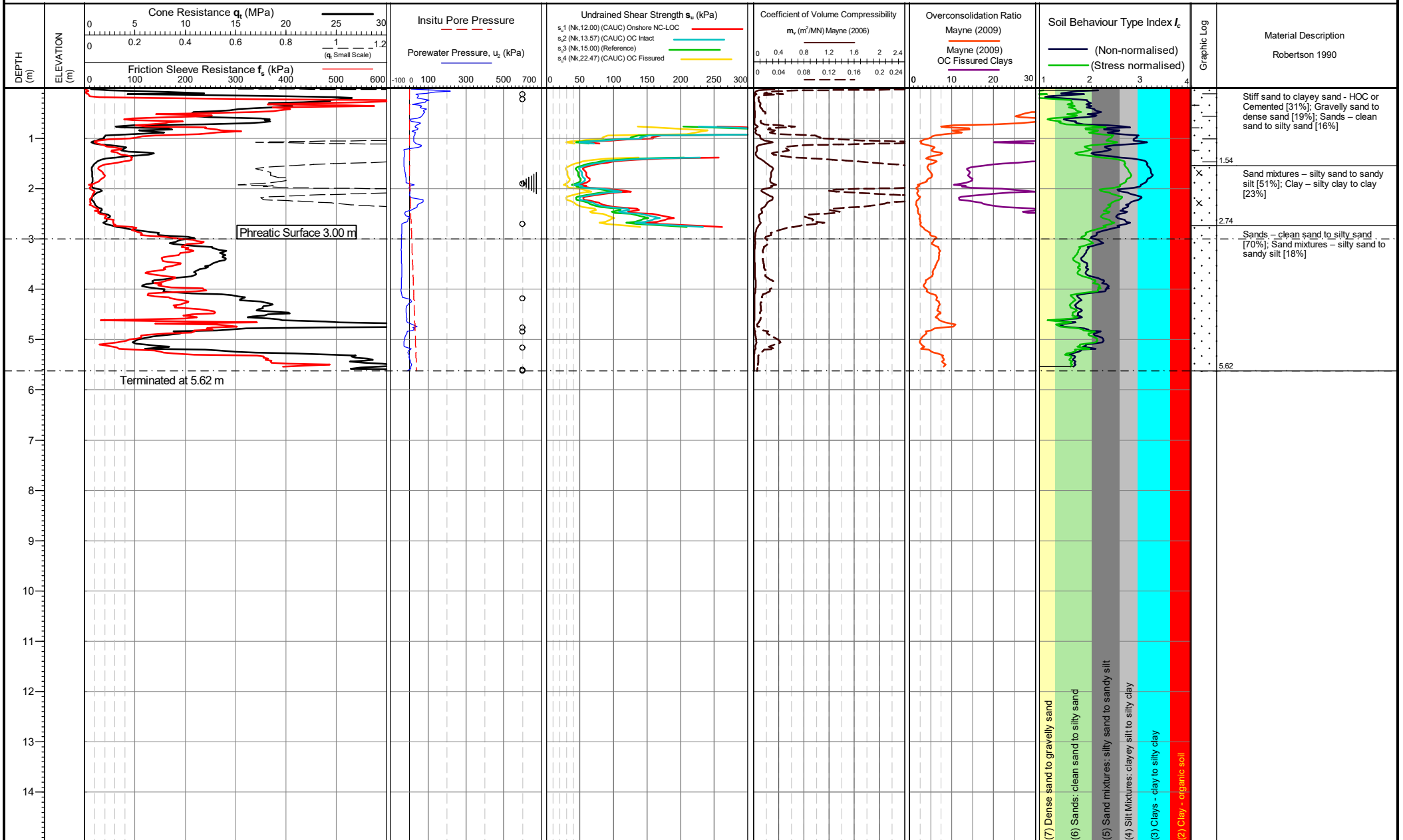
Internal QA Diss.  
 Dissipation Test  
 Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = I<sub>c</sub> 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
 See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
 Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT07**



Cone area (mm<sup>2</sup>):1500  
 ConeID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Rig Used: UK22  
 Date of test: 16/01/2020 10:54:00

Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Remarks: \*Phreatic surface origin: u0 pressure (t100) measured at another location  
 Termination Remark: Lateral support

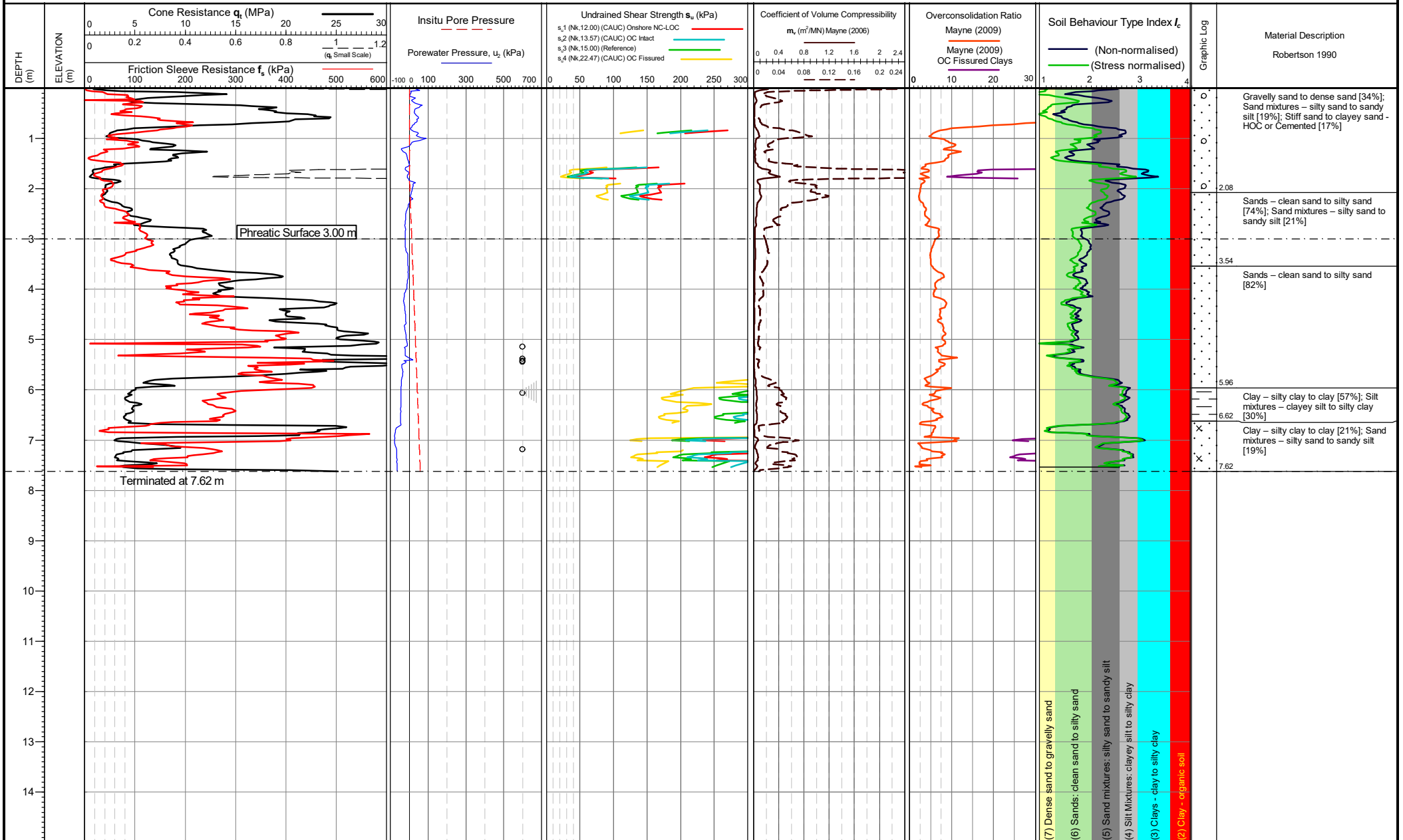
Internal QA Diss. Test  
 Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
 See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
 Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT08**



Cone area (mm<sup>2</sup>):1500  
 ConeID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Rig Used: UK22  
 Date of test: 16/01/2020 10:12:00

Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Remarks: \*Phreatic surface origin: u0 pressure (t100) measured at another location

Termination Remark:  
 Lateral support

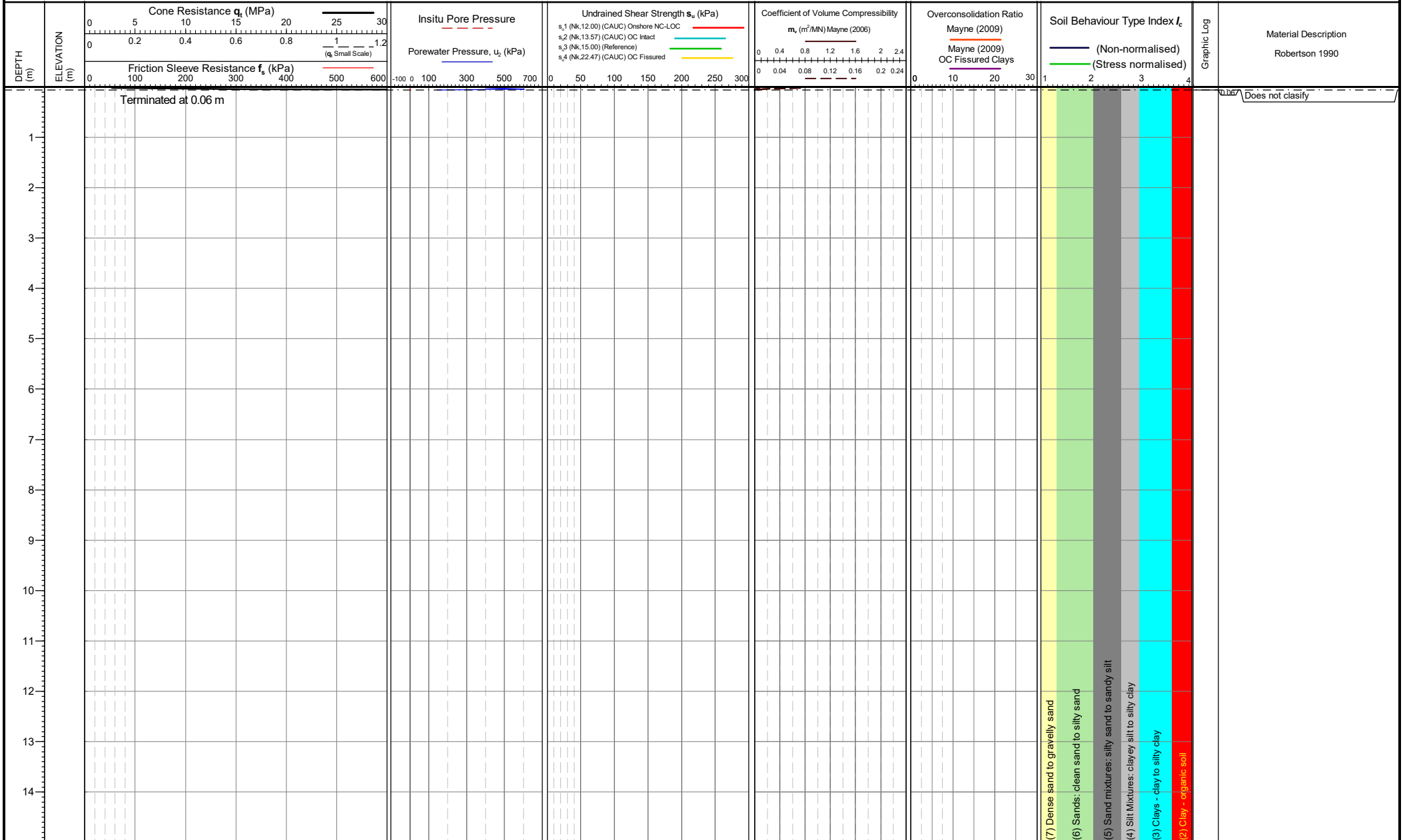
Internal QA Diss. Test  
 Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
 See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
 Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT09**



Cone area (mm<sup>2</sup>):1500  
ConeID: S15-CFIPT.1769  
Operator: Gary Connor  
Rig Used: UK22  
Date of test: 15/01/2020 10:24:00

Location: Bridgend, UK  
Coordinates: ,  
Elevation:  
Coordinate system:

Remarks: \*Phreatic surface origin: u0 pressure (t100) measured at another location  
  
Termination Remark:  
Lateral support

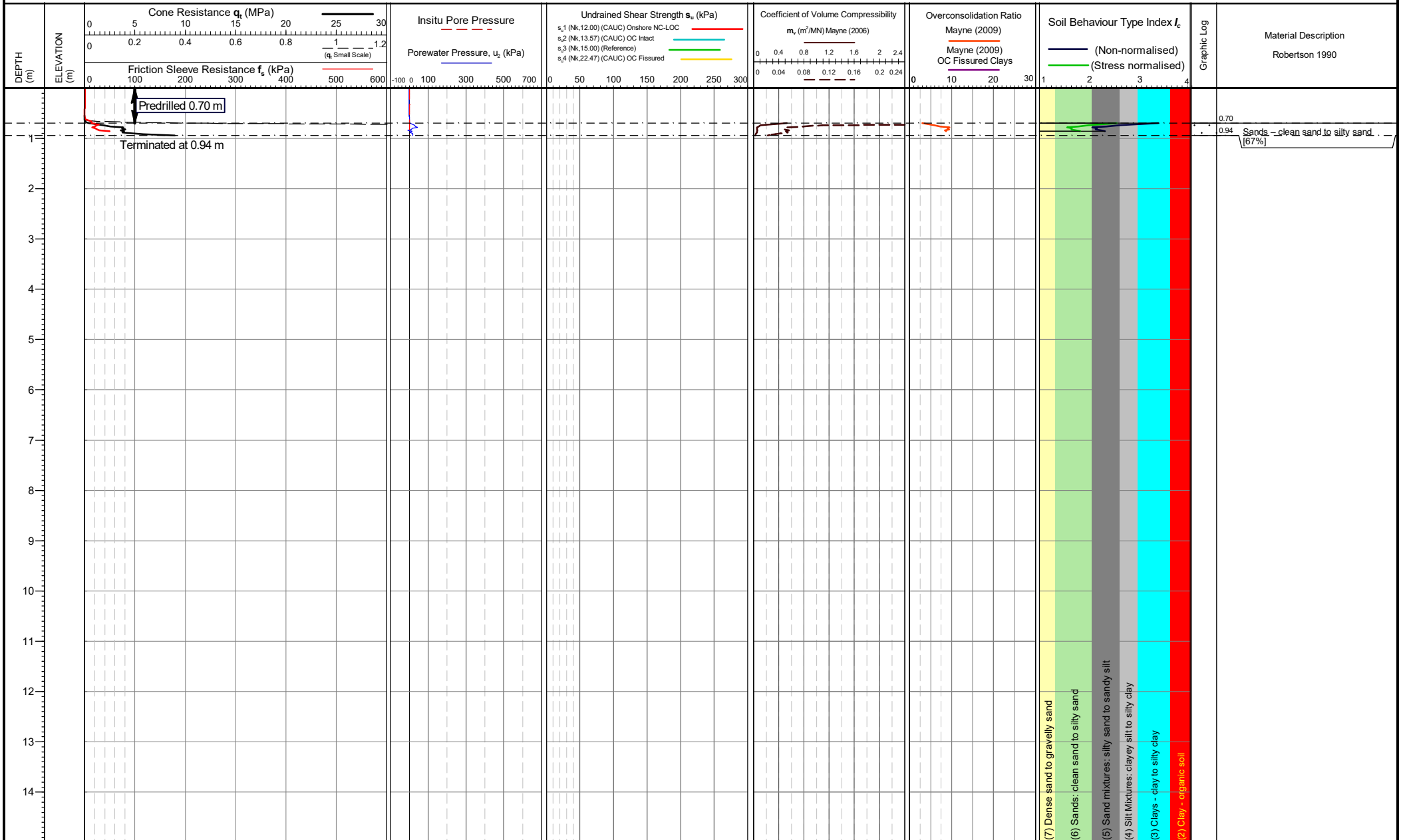
Internal QA Diss.  
Dissipation Test  
Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = I<sub>c</sub> 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT10**



Cone area (mm<sup>2</sup>):1500  
 ConeID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Rig Used: UK22  
 Date of test: 16/01/2020 12:19:00

Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Remarks: \*Phreatic surface origin:  $u_0$  pressure (t100) measured at another location  
 Termination Remark: Lateral support

Internal QA Diss.  
 Dissipation Test  
 Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs =  $I_c$  2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
 See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
 Checked by: Chris Player

Lankelma Project Ref: P-107374-1

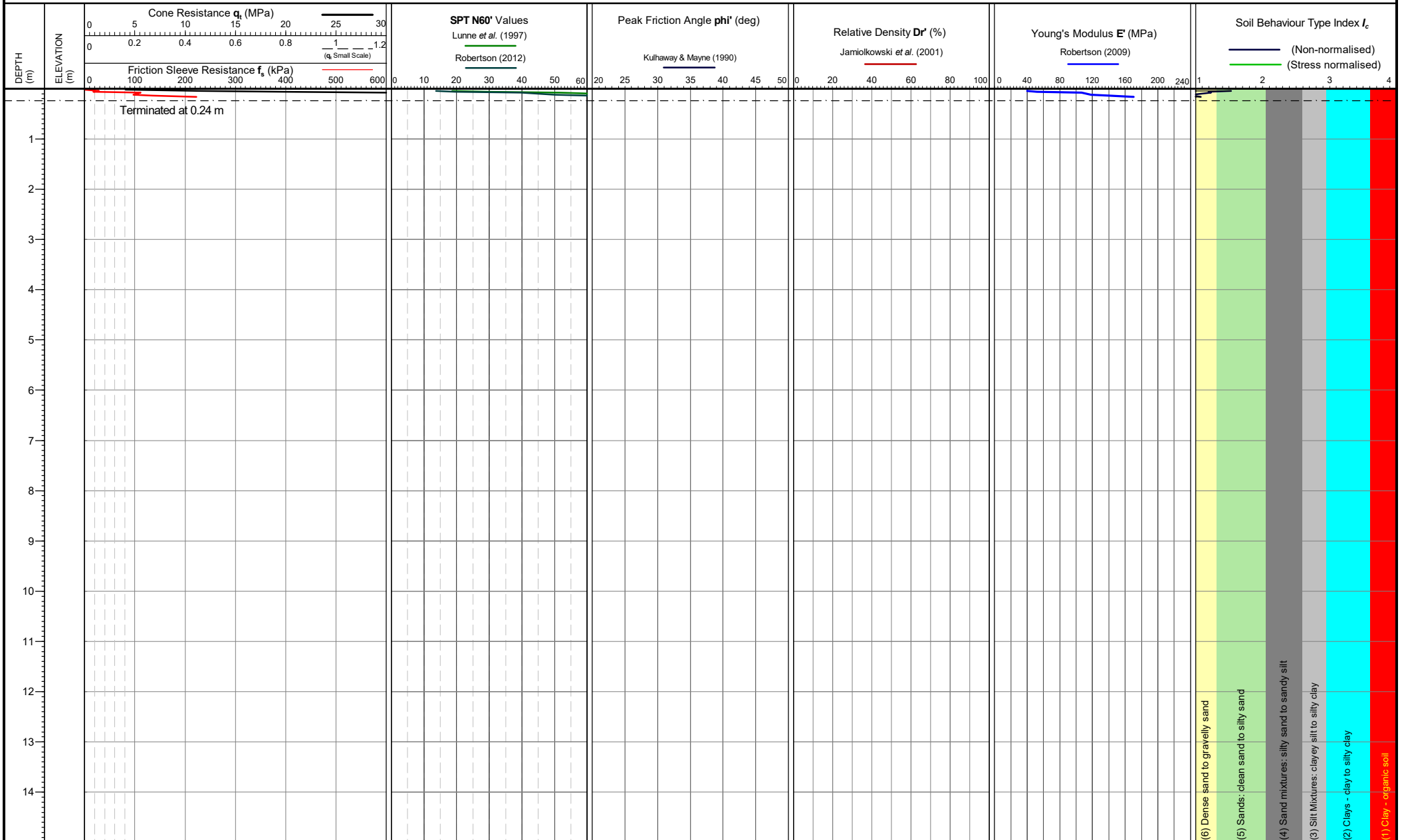
**TEST ID: CPT10A**

**APPENDIX E STANDARD INTERPRETATION RESULTS - SET 2**

EQUIVALENT SPT N60  
PEAK FRICTION ANGLE  
RELATIVE DENSITY  
YOUNG'S MODULUS

**LIST OF FIGURES:**

Location ID	Pages included
CPT01	1
CPT01A	1
CPT01B	1
CPT02	1
CPT03	1
CPT04	1
CPT05	1
CPT06	2
CPT07	2
CPT08	1
CPT09	1
CPT10	1
CPT10A	1



Cone area (mm<sup>2</sup>):1500  
Cone ID: S15-CFIPT.1769  
Operator: Gary Connor  
Date of test: 15/01/2020 10:45:00

Location: Bridgend, UK  
Coordinates: ,  
Elevation:  
Coordinate system:

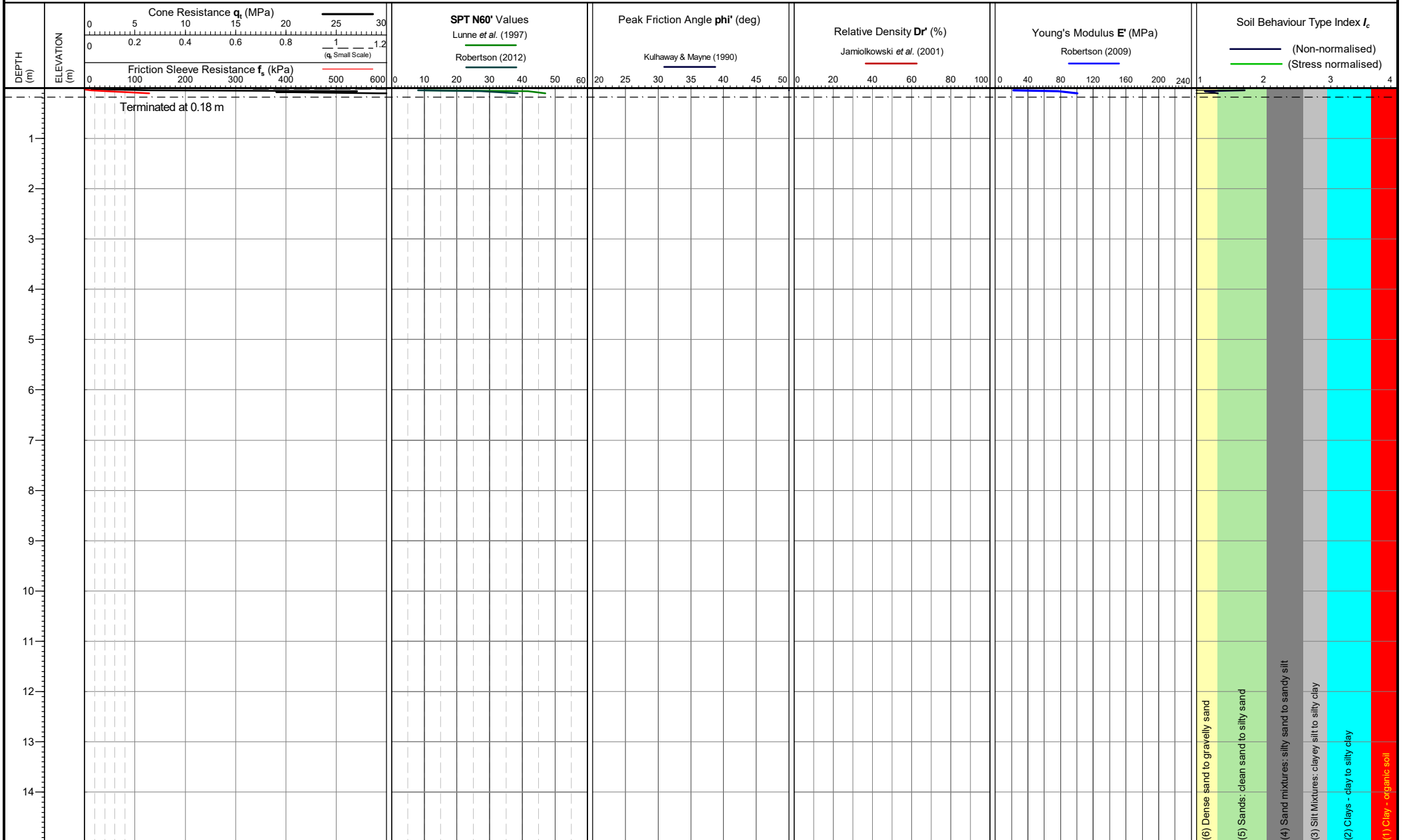
Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT01**

- (6) Dense sand to gravelly sand
- (5) Sands: clean sand to silty sand
- (4) Sand mixtures: silty sand to sandy silt
- (3) Silt Mixtures: clayey silt to silty clay
- (2) Clays - clay to silty clay
- (1) Clay - organic soil



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Date of test: 15/01/2020 10:57:00

Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

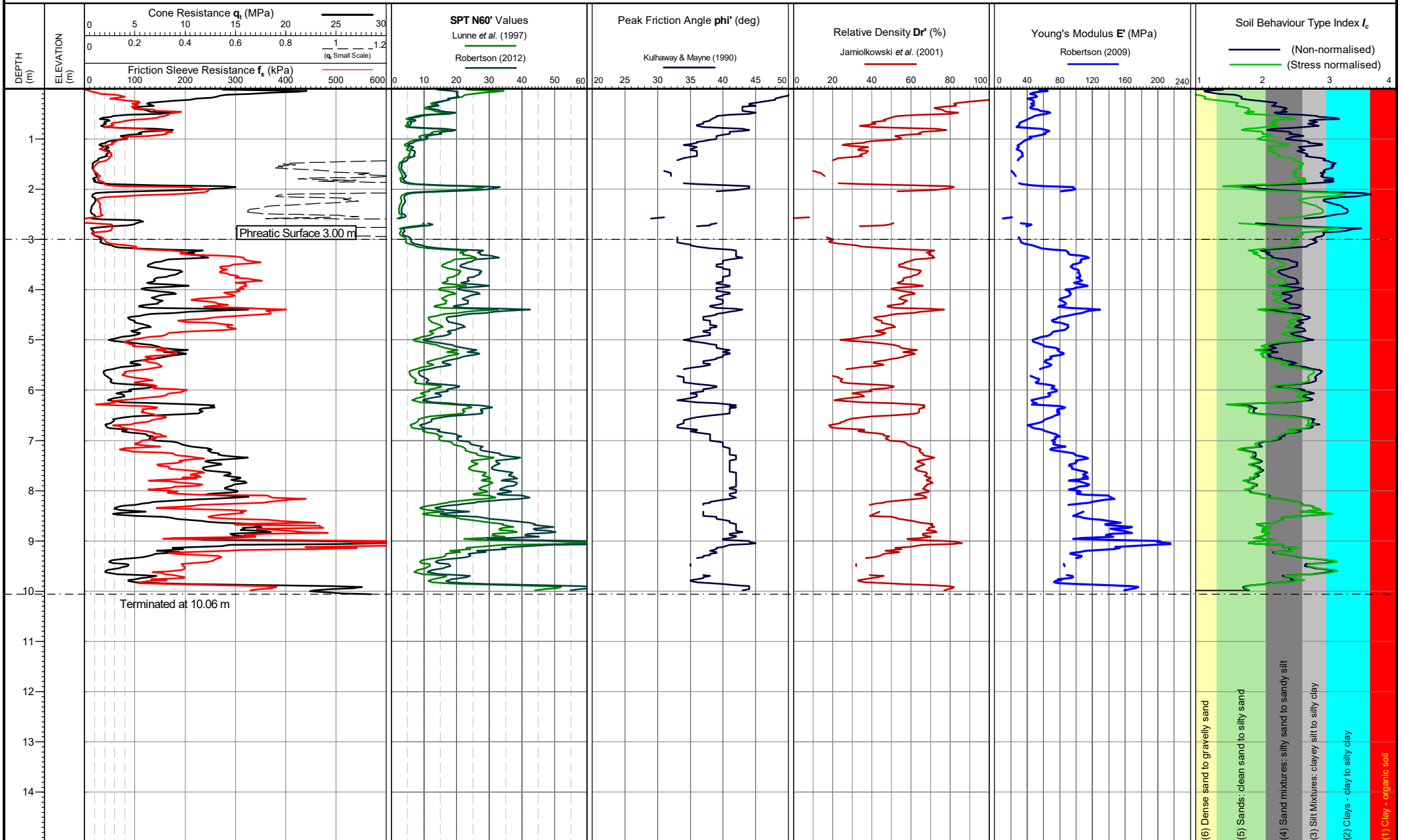
Both drained and undrained parameters are calculated for mixed SBTs =  $I_c$  2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
 See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
 Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT01A**

- (6) Dense sand to gravelly sand
- (5) Sands: clean sand to silty sand
- (4) Sand mixtures: silty sand to sandy silt
- (3) Silt Mixtures: clayey silt to silty clay
- (2) Clays - clay to silty clay
- (1) Clay - organic soil



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Date of test: 16/01/2020 09:23:00

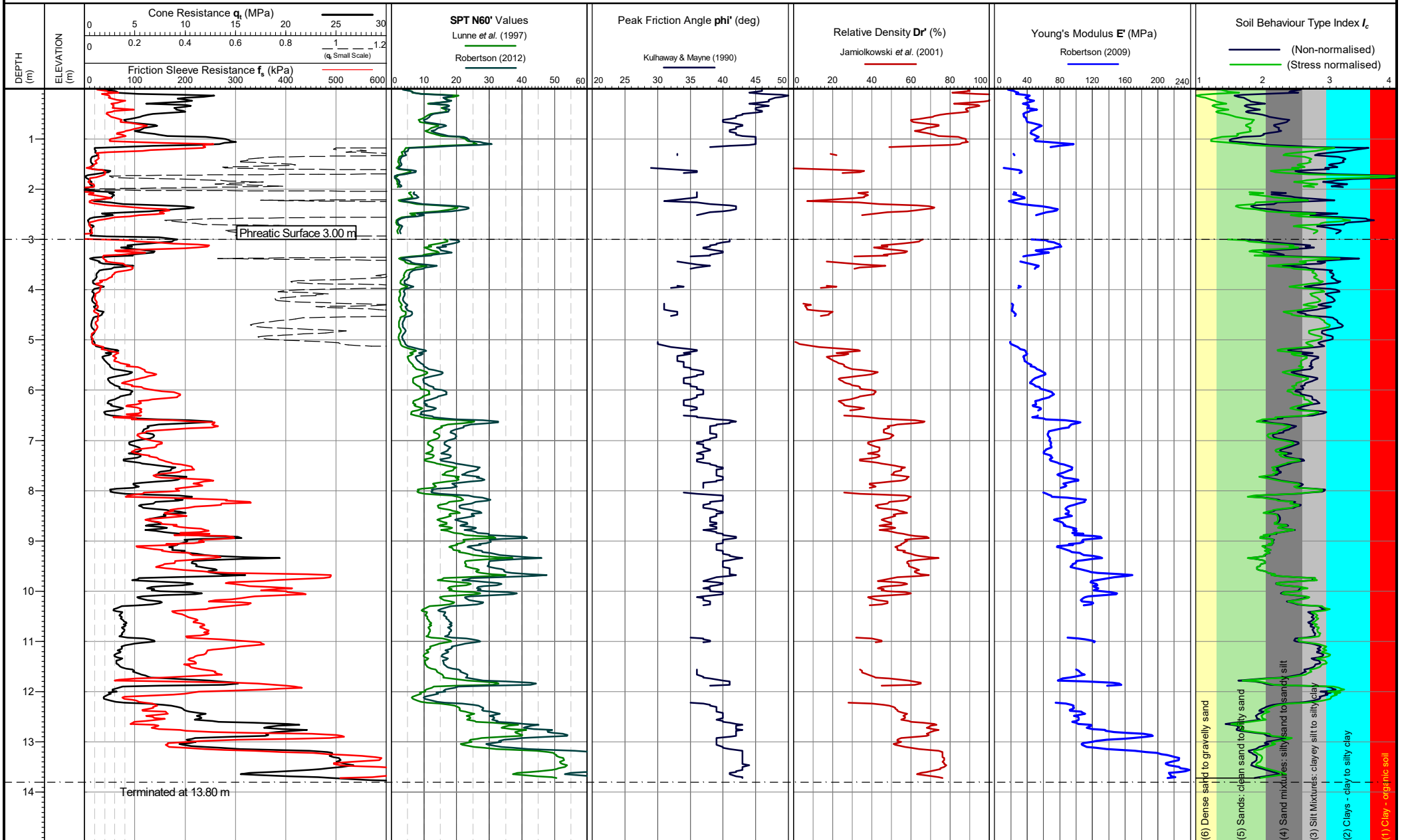
Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
 See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
 Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT01B**



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Date of test: 15/01/2020 11:09:00

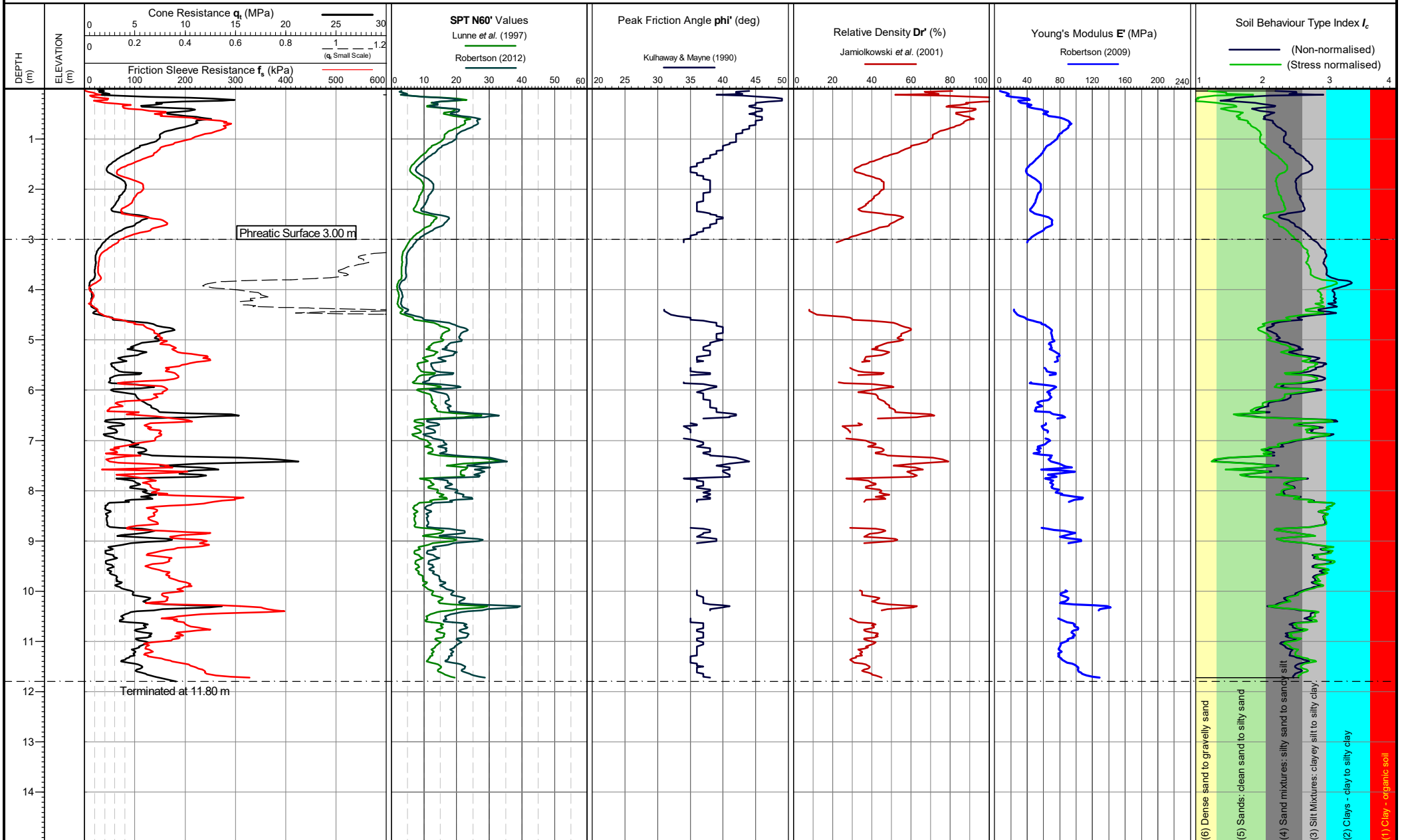
Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
 See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
 Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT02**



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Date of test: 15/01/2020 11:47:00

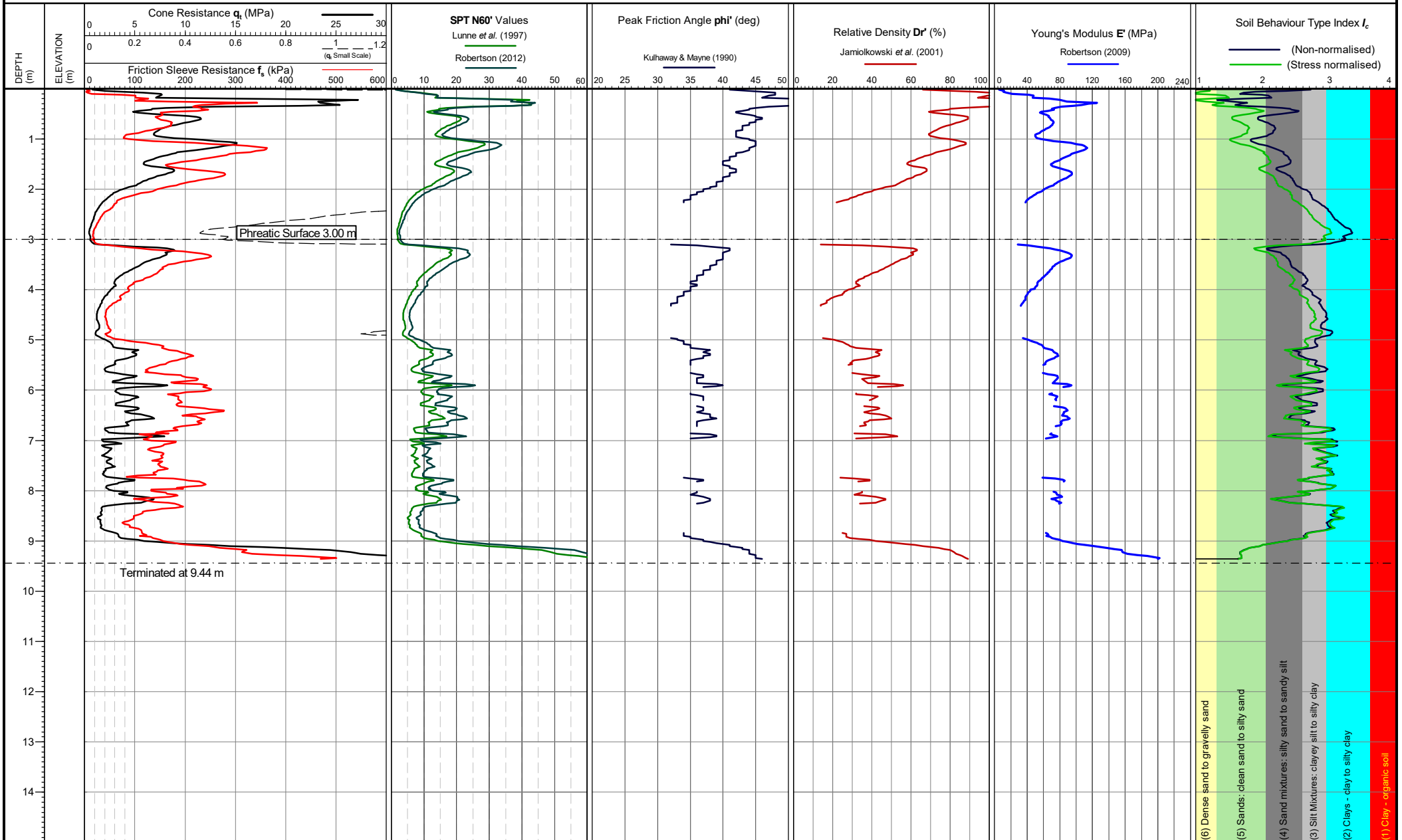
Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs =  $I_c$  2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
 See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
 Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT03**



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Date of test: 15/01/2020 12:29:00

Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

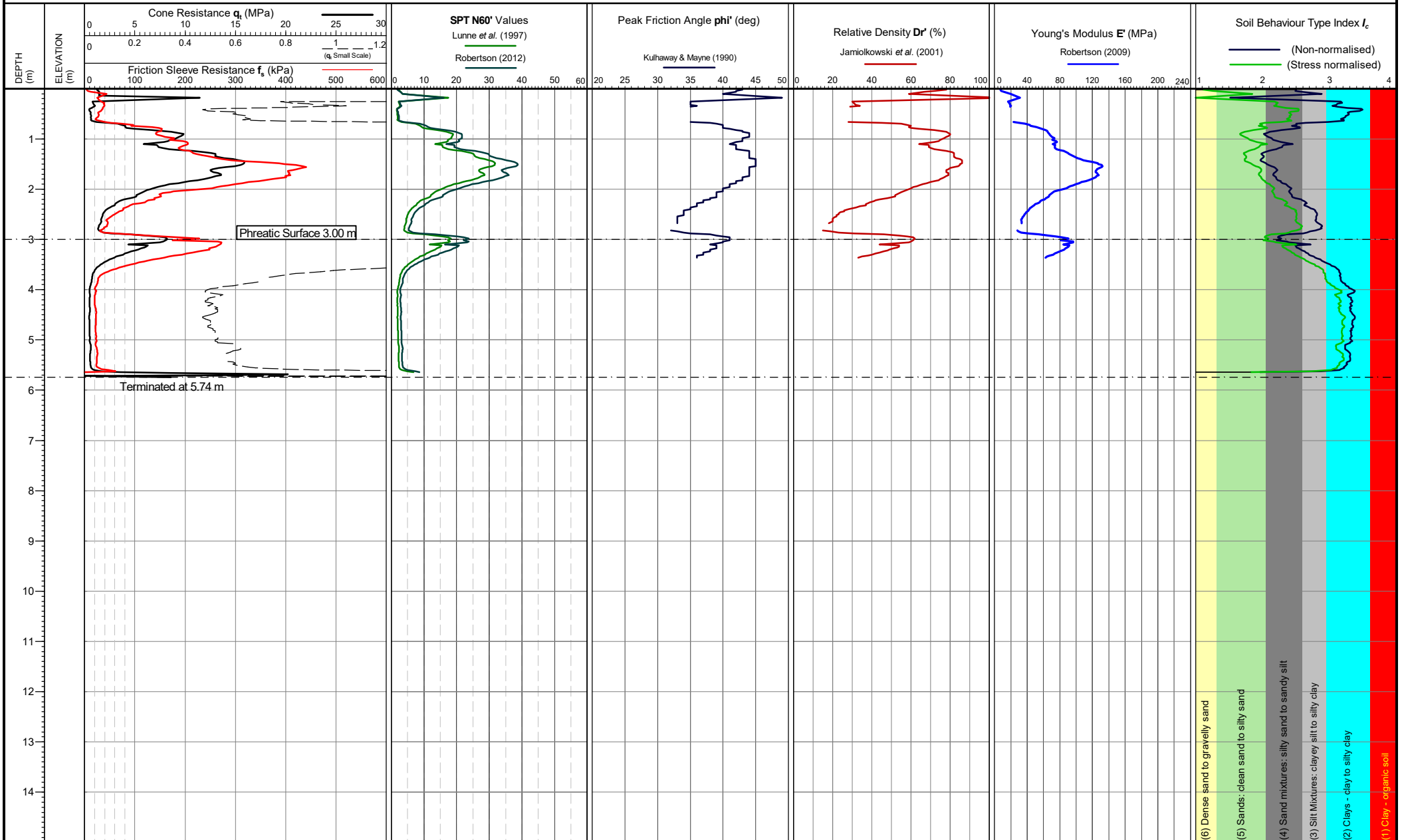
Both drained and undrained parameters are calculated for mixed SBTs =  $I_c$  2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
 See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20

Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT04**



- (6) Dense sand to gravelly sand
- (5) Sands: clean sand to silty sand
- (4) Sand mixtures: silty sand to sandy silt
- (3) Silt Mixtures: clayey silt to silty clay
- (2) Clays - clay to silty clay
- (1) Clay - organic soil

Cone area (mm<sup>2</sup>):1500  
Cone ID: S15-CFIPT.1769  
Operator: Gary Connor  
Date of test: 15/01/2020 13:14:00

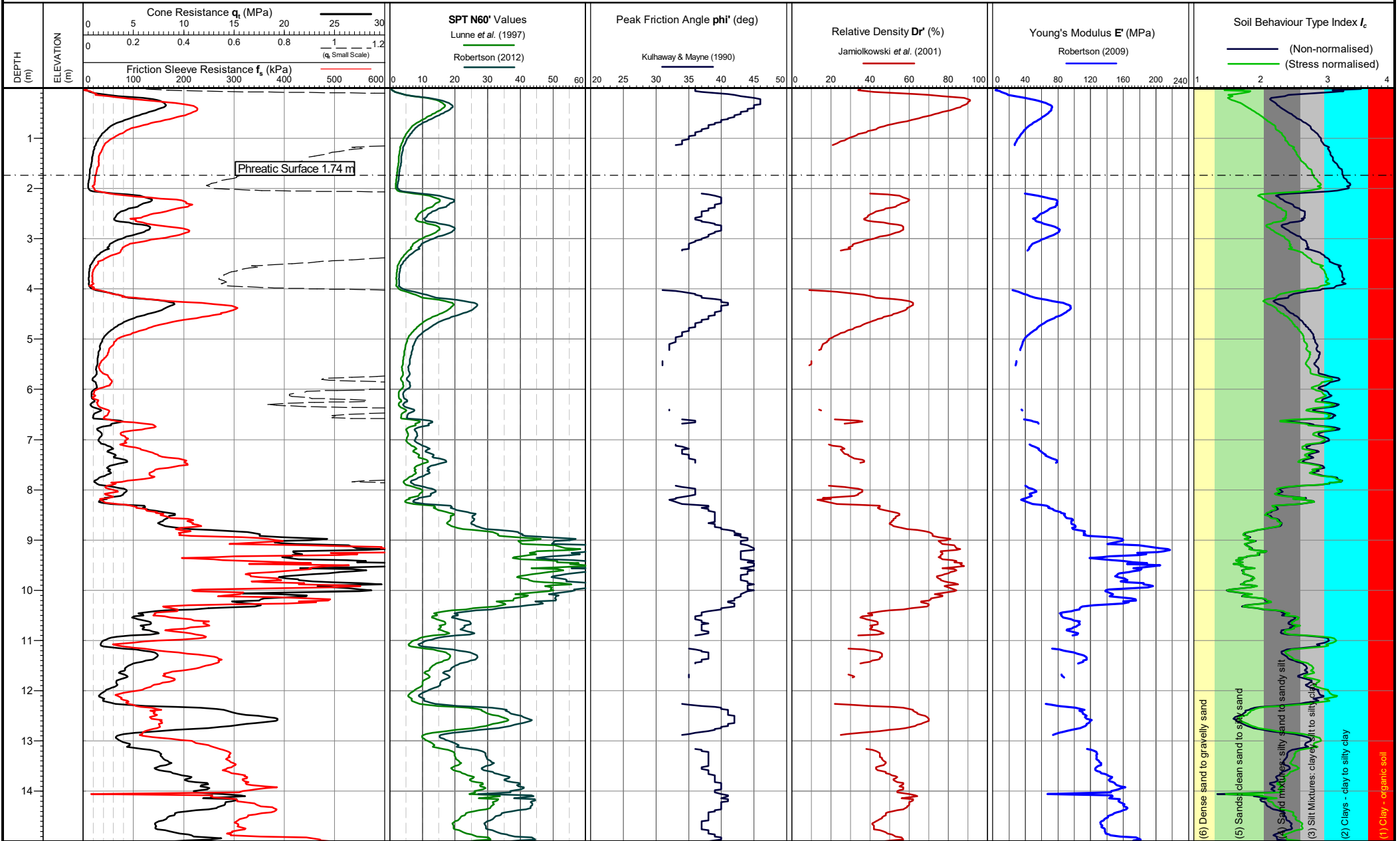
Location: Bridgend, UK  
Coordinates: ,  
Elevation:  
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs =  $I_c$  2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT05**



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Date of test: 15/01/2020 13:53:00

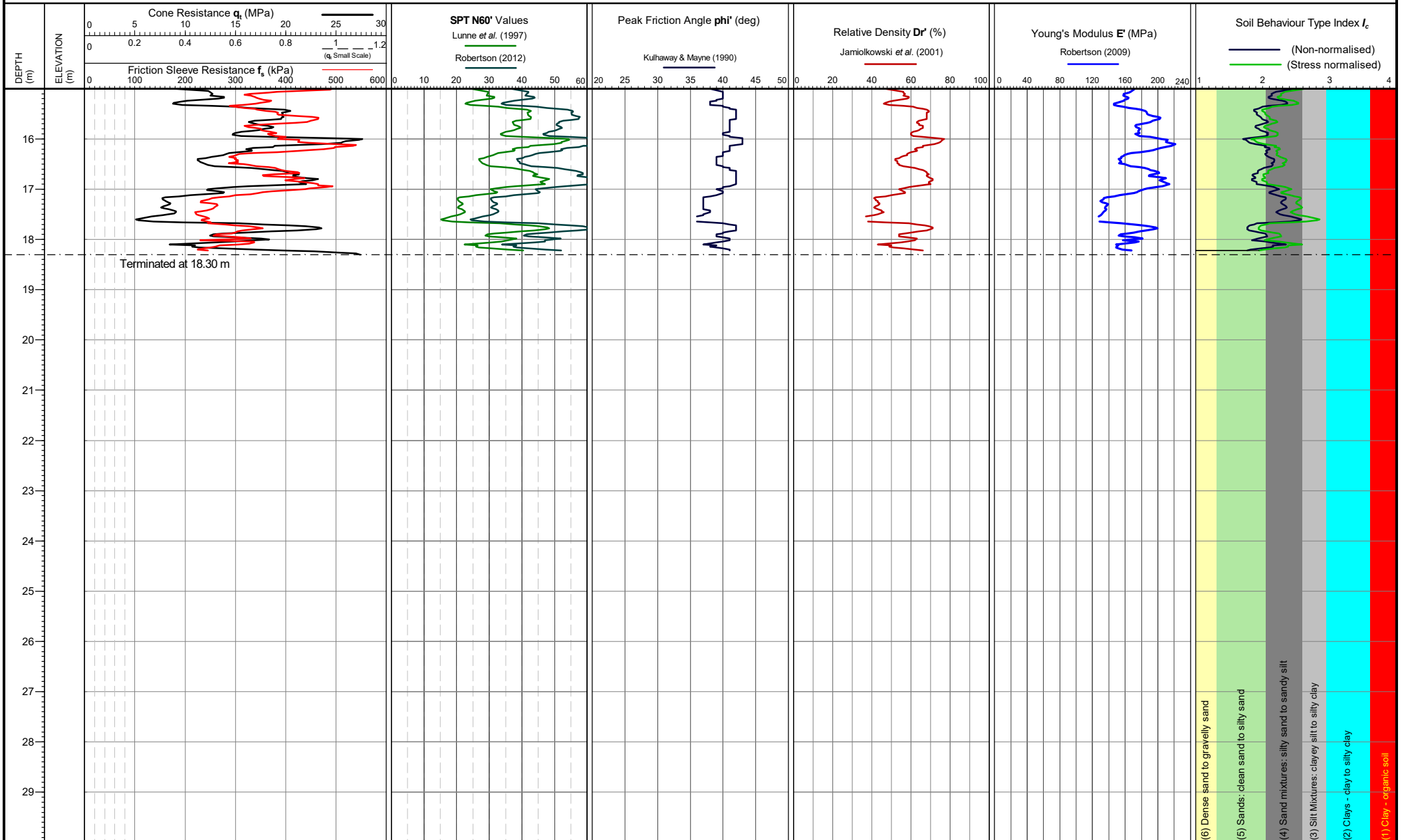
Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
 See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
 Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT06**



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Date of test: 15/01/2020 13:53:00

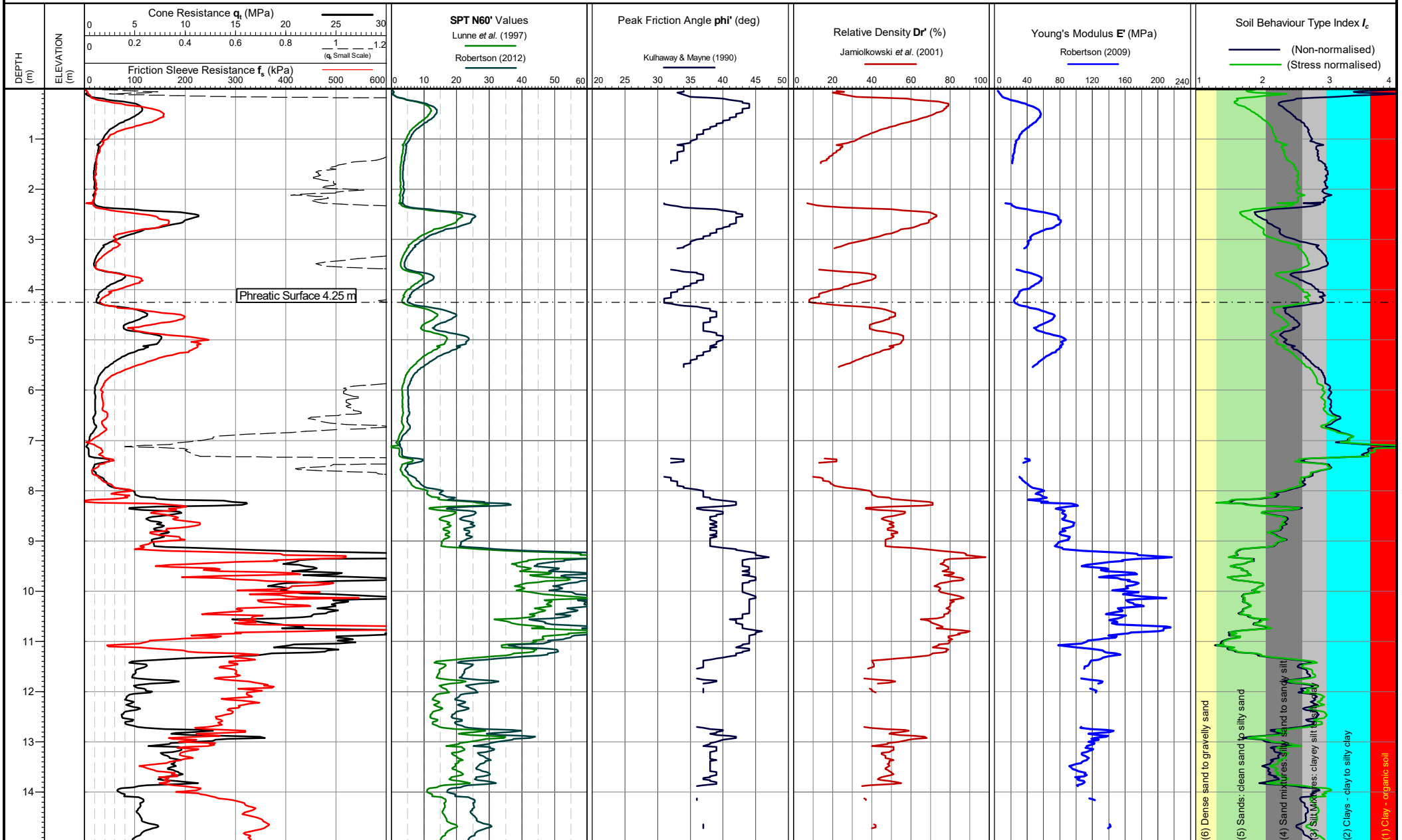
Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
 See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
 Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT06**



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Date of test: 16/01/2020 08:38:00

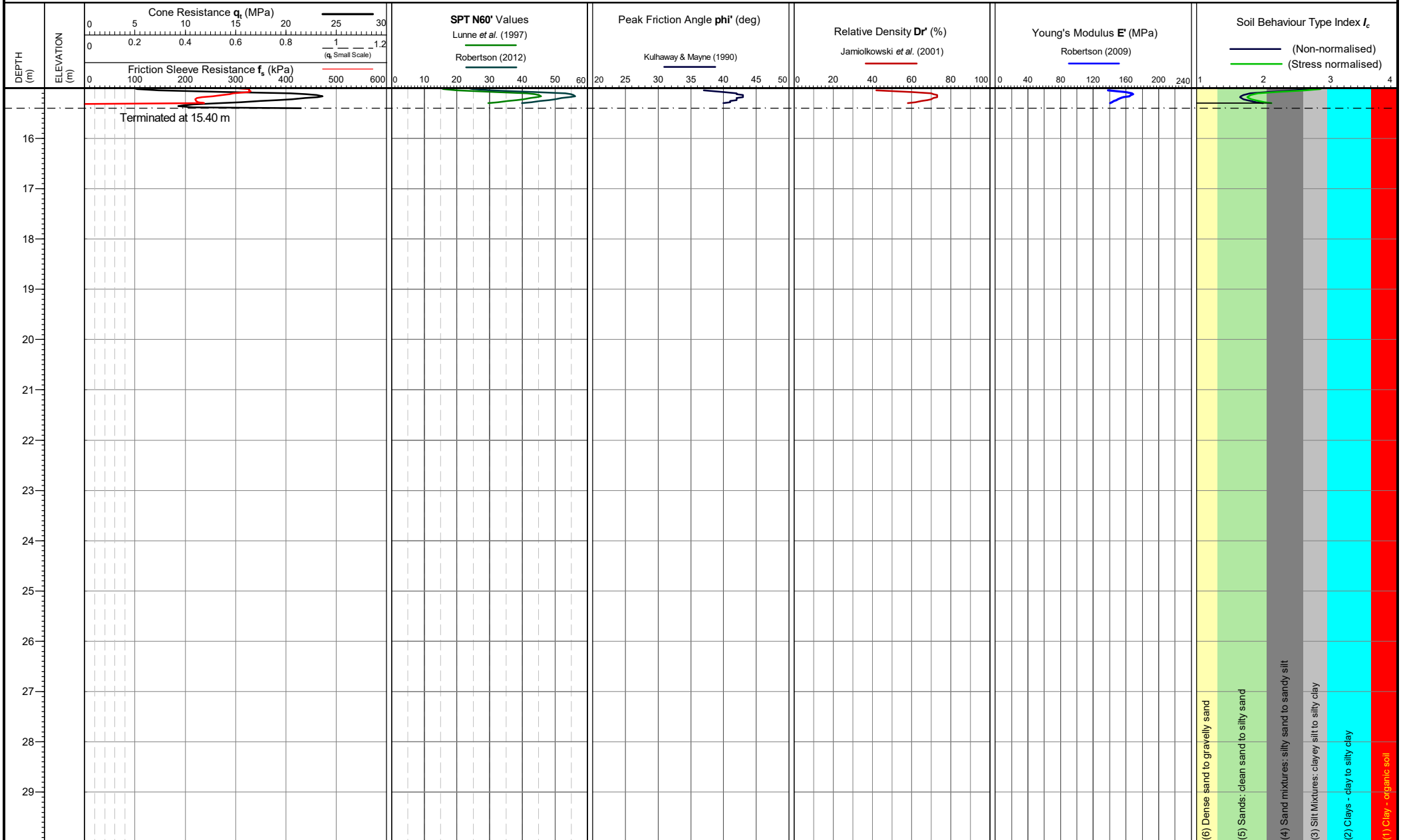
Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
 See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
 Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT07**



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Date of test: 16/01/2020 08:38:00

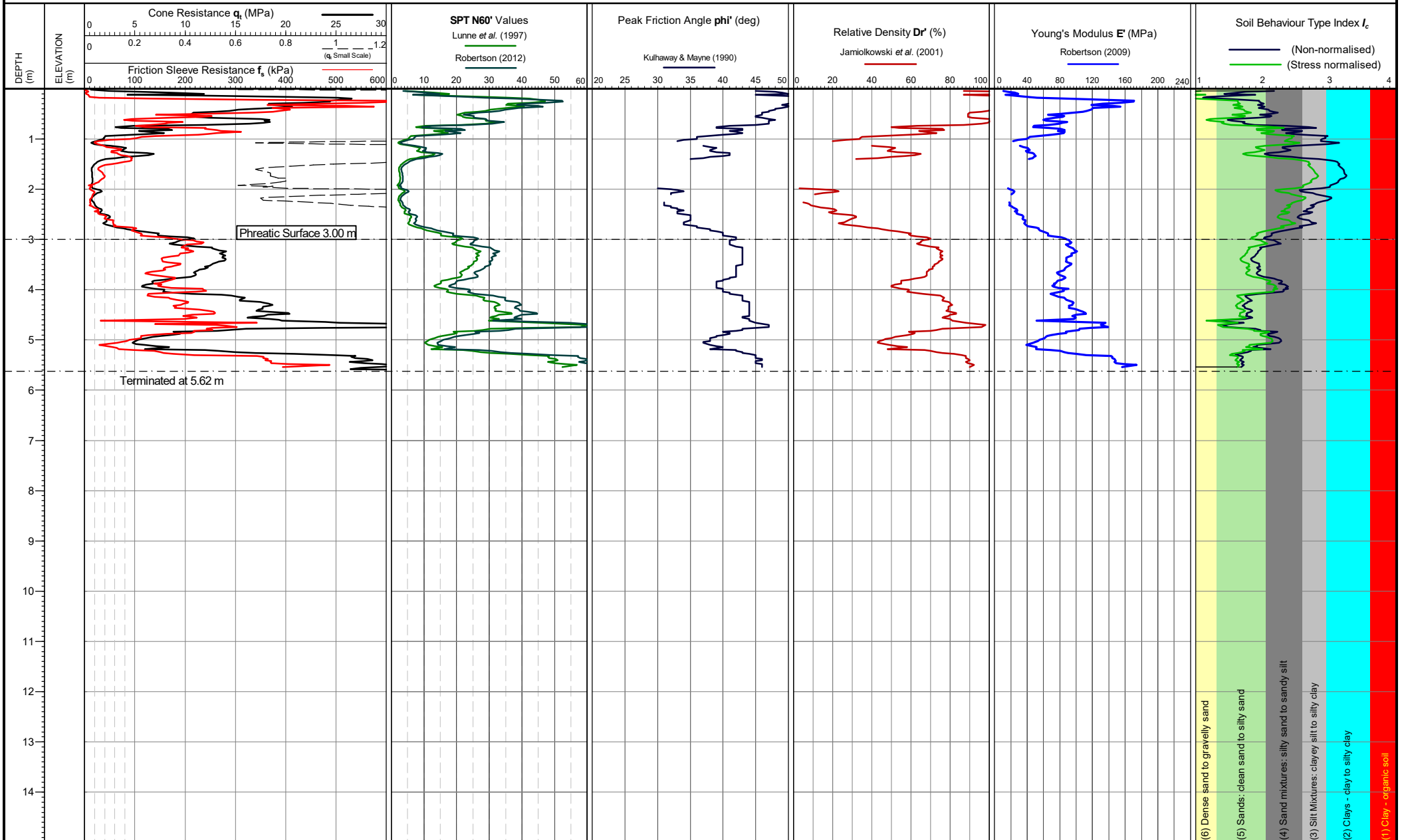
Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
 See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
 Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT07**



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Date of test: 16/01/2020 10:54:00

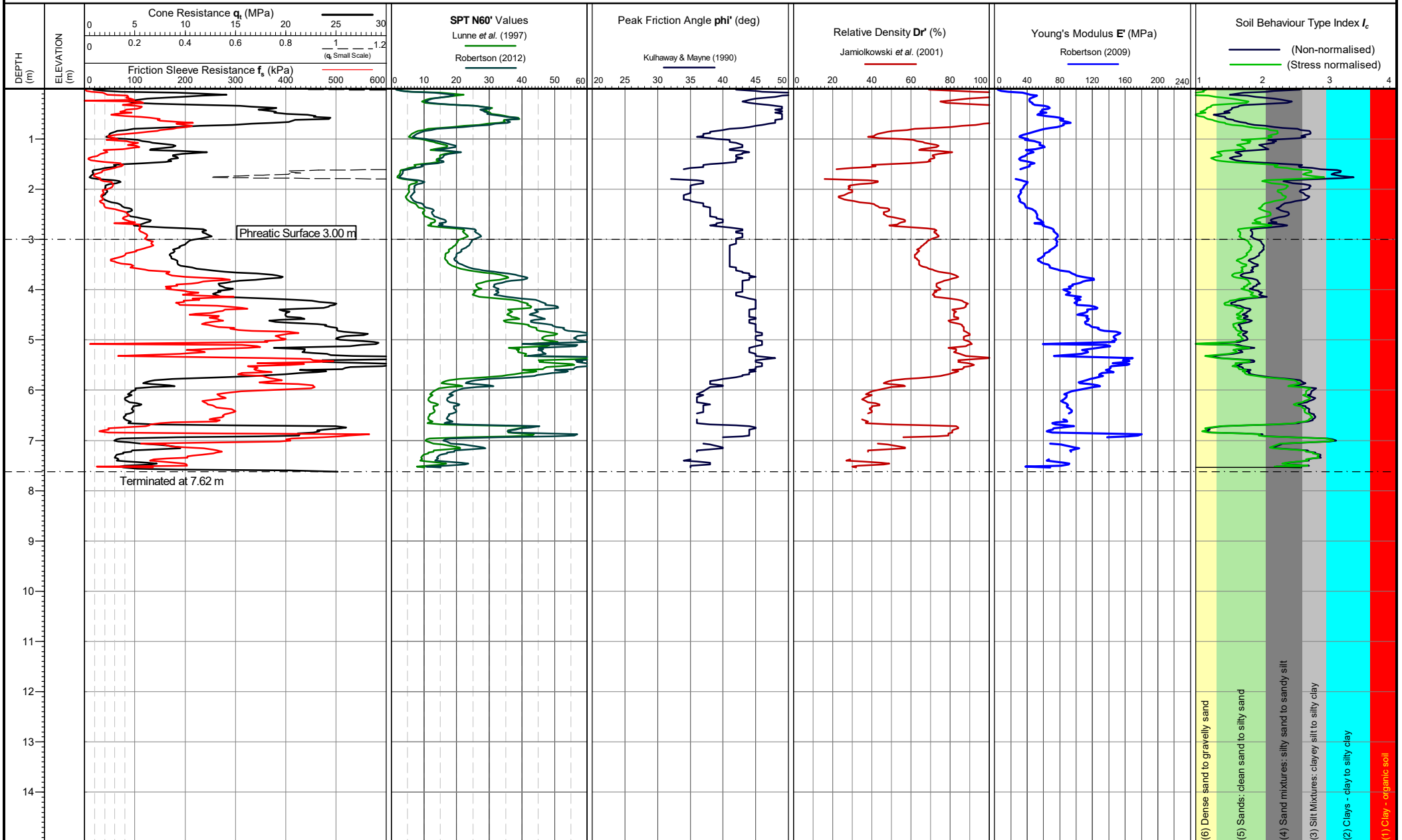
Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
 See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
 Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT08**



Cone area (mm<sup>2</sup>):1500  
Cone ID: S15-CFIPT.1769  
Operator: Gary Connor  
Date of test: 16/01/2020 10:12:00

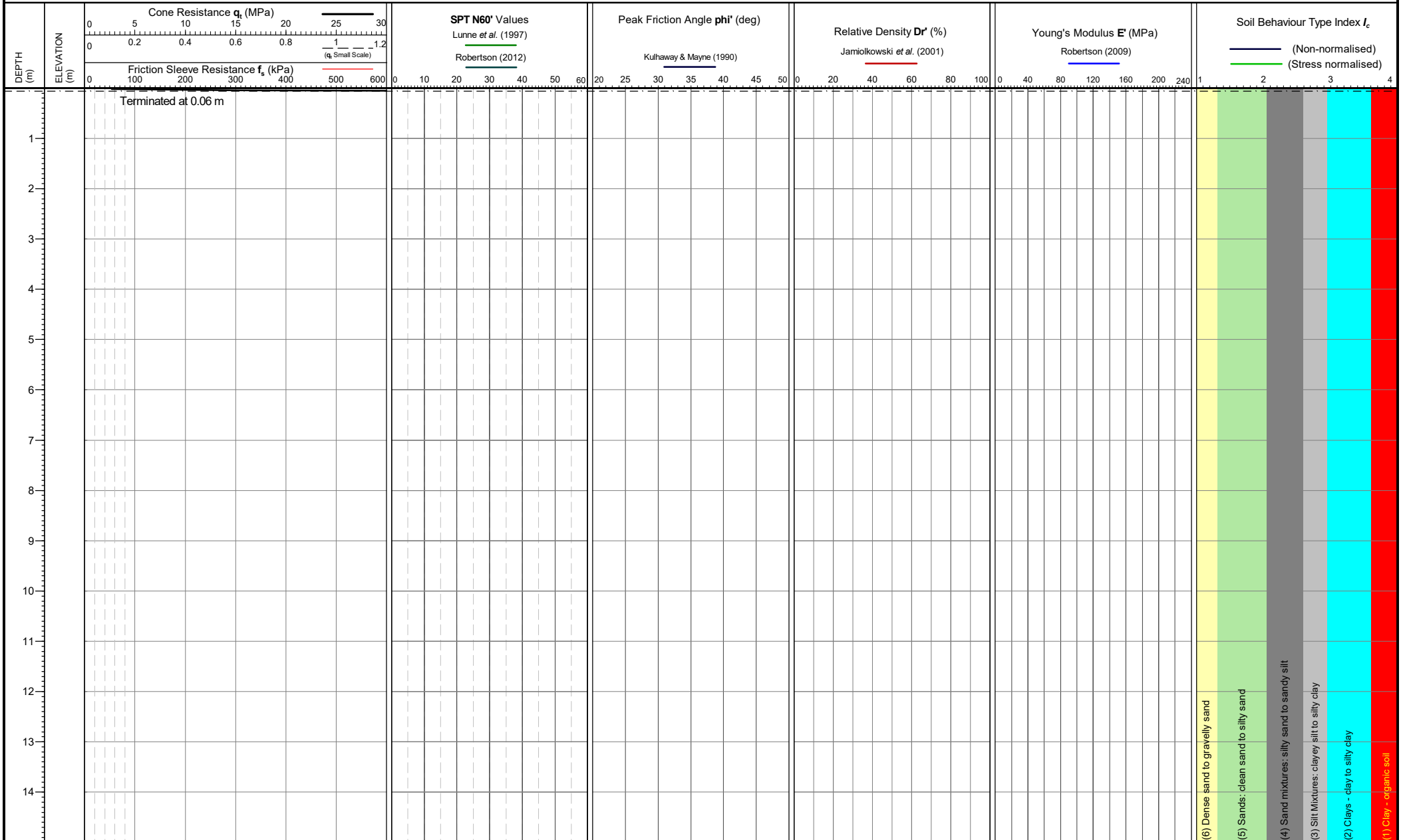
Location: Bridgend, UK  
Coordinates: ,  
Elevation:  
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT09**



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Date of test: 15/01/2020 10:24:00

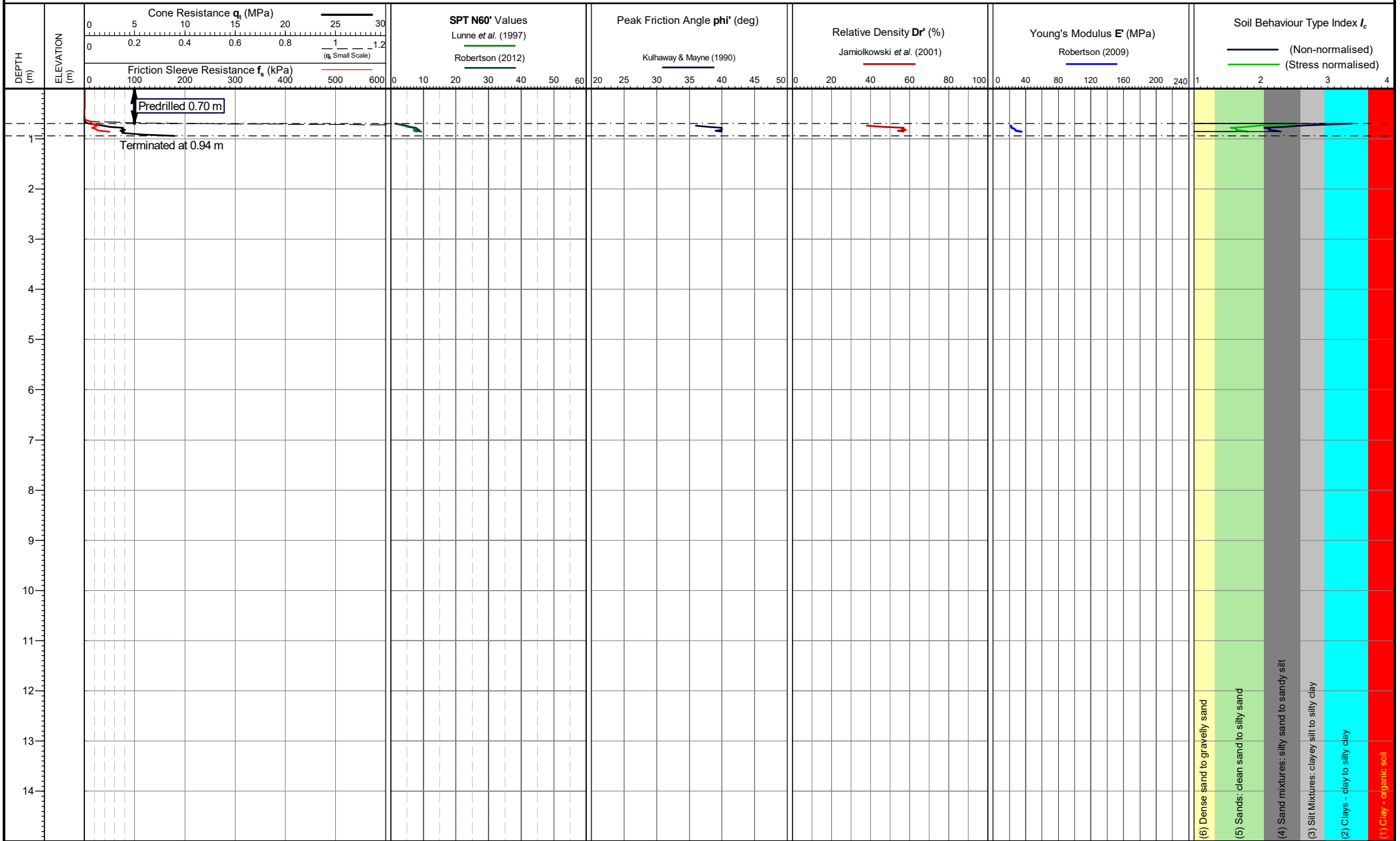
Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
 See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
 Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT10**



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Date of test: 16/01/2020 12:19:00

Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.  
 See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 16-01-20  
 Checked by: Chris Player

Lankelma Project Ref: P-107374-1

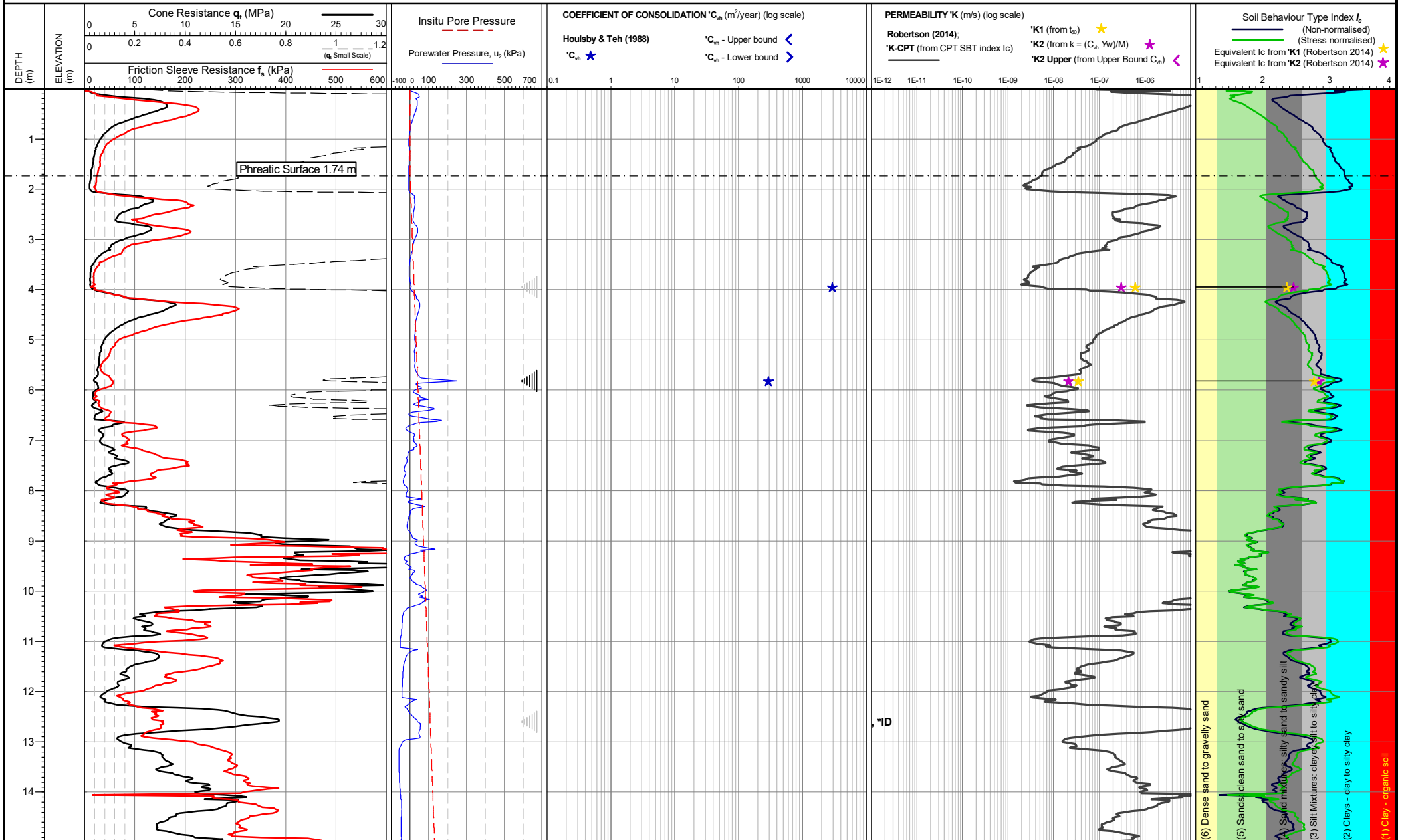
**TEST ID: CPT10A**

**APPENDIX F INTERPRETED DISSIPATION TEST RESULTS**

PERMEABILITY  
COEFFICIENT OF CONSOLIDATION  
EQUIVALENT SBT INDEX ( $I_c$ ) FROM PERMEABILITY

**LIST OF FIGURES:**

Location ID	Pages included
CPT06	2
CPT07	2
CPT08	1



Cone area (mm<sup>2</sup>):1500  
Cone ID: S15-CFIPT.1769  
Operator: Gary Connor  
Date of test: 15/01/2020 13:53:00

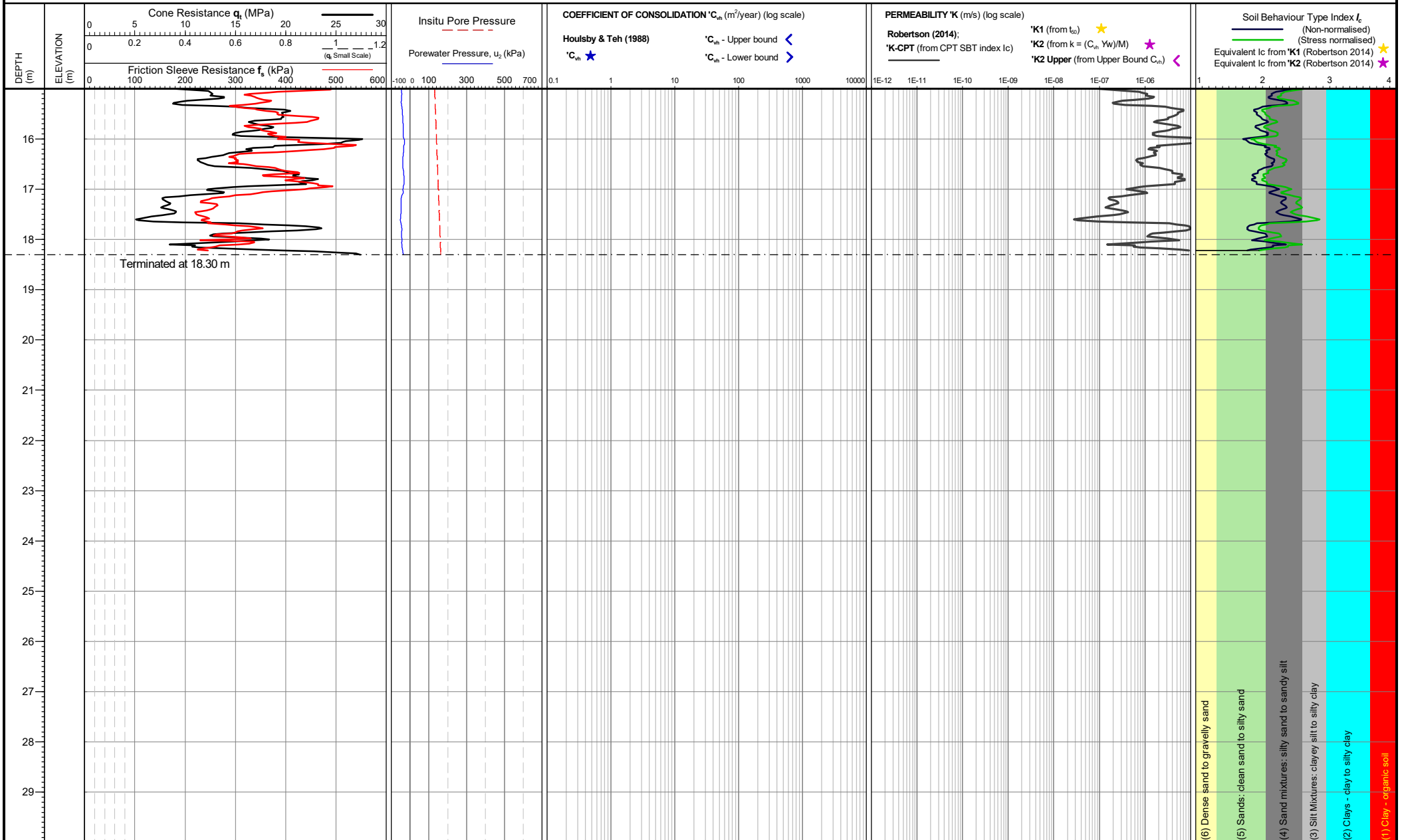
Location: Bridgend, UK  
Coordinates: ,  
Elevation:  
Coordinate system:

\*Abbreviations:  
 NEP: No excess pore pressures generated  
 ID: Insufficient test duration  
 UR: Uncharacteristic response  
 DR: Drained or partially drained response  
 A: Estimated/measured in-situ pore pressure corresponds to artesian conditions.  
 PUS: Potentially unsaturated soil.  
 MD: Monotonic decay.  
 IEP: Insufficient excess pressure generated.  
 LBi: Lower bound interpretation.  
 DT: Disrupted test.  
 NI: No interpretation.

Date of plot: 16-01-20  
Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT06**



Cone area (mm<sup>2</sup>):1500  
Cone ID: S15-CFIPT.1769  
Operator: Gary Connor  
Date of test: 15/01/2020 13:53:00

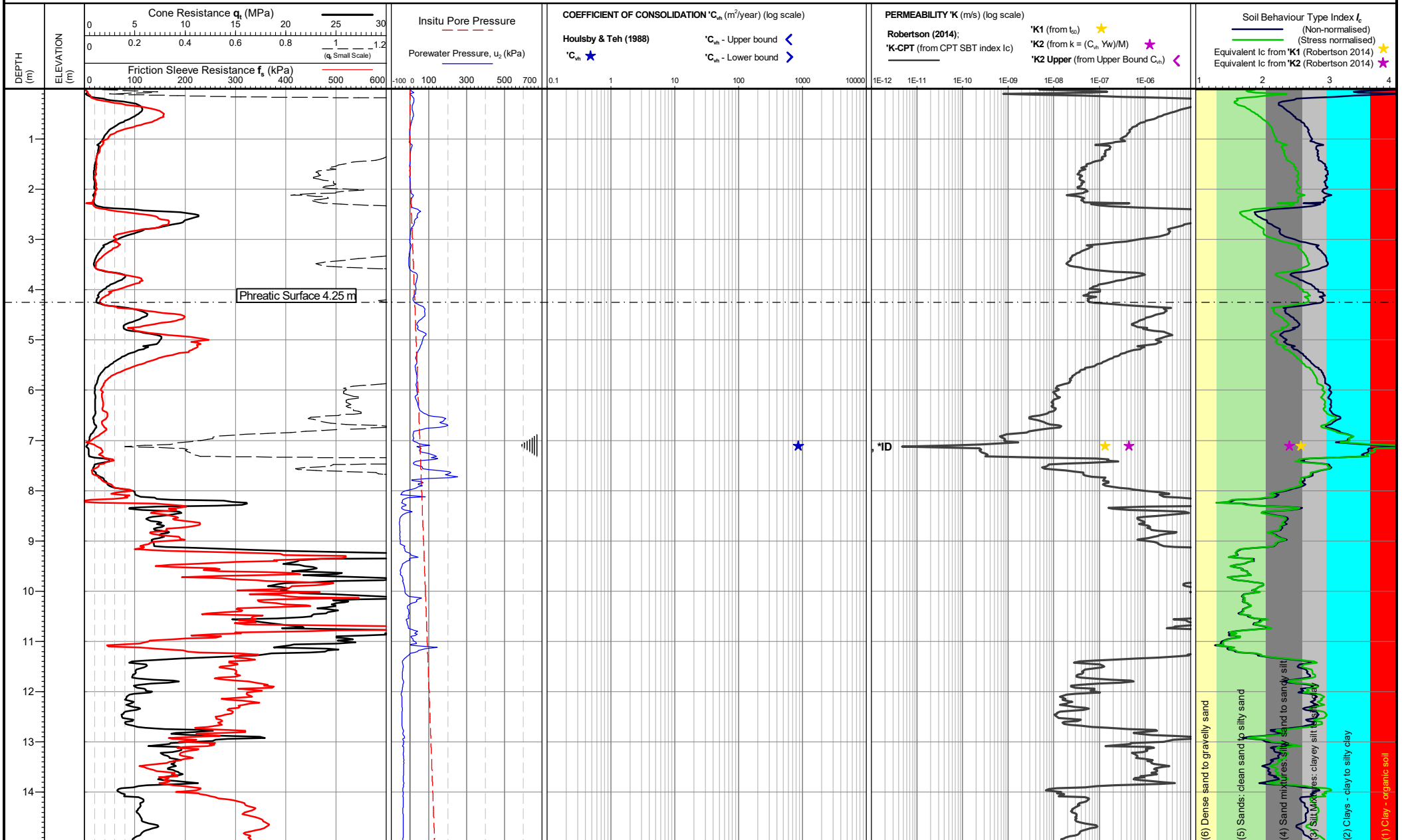
Location: Bridgend, UK  
Coordinates: ,  
Elevation:  
Coordinate system:

\*Abbreviations:  
NEP: No excess pore pressures generated  
ID: Insufficient test duration  
UR: Uncharacteristic response  
DR: Drained or partially drained response  
A: Estimated/measured in-situ pore pressure corresponds to artesian conditions.  
PUS: Potentially unsaturated soil.  
MD: Monotonic decay.  
IEP: Insufficient excess pressure generated.  
LBi: Lower bound interpretation.  
DT: Disrupted test.  
NI: No interpretation.

Date of plot:  
16-01-20  
Checked by:  
Chris Player

Lankelma Project Ref:  
P-107374-1

**TEST ID: CPT06**



Cone area (mm<sup>2</sup>):1500  
 Cone ID: S15-CFIPT.1769  
 Operator: Gary Connor  
 Date of test: 16/01/2020 08:38:00

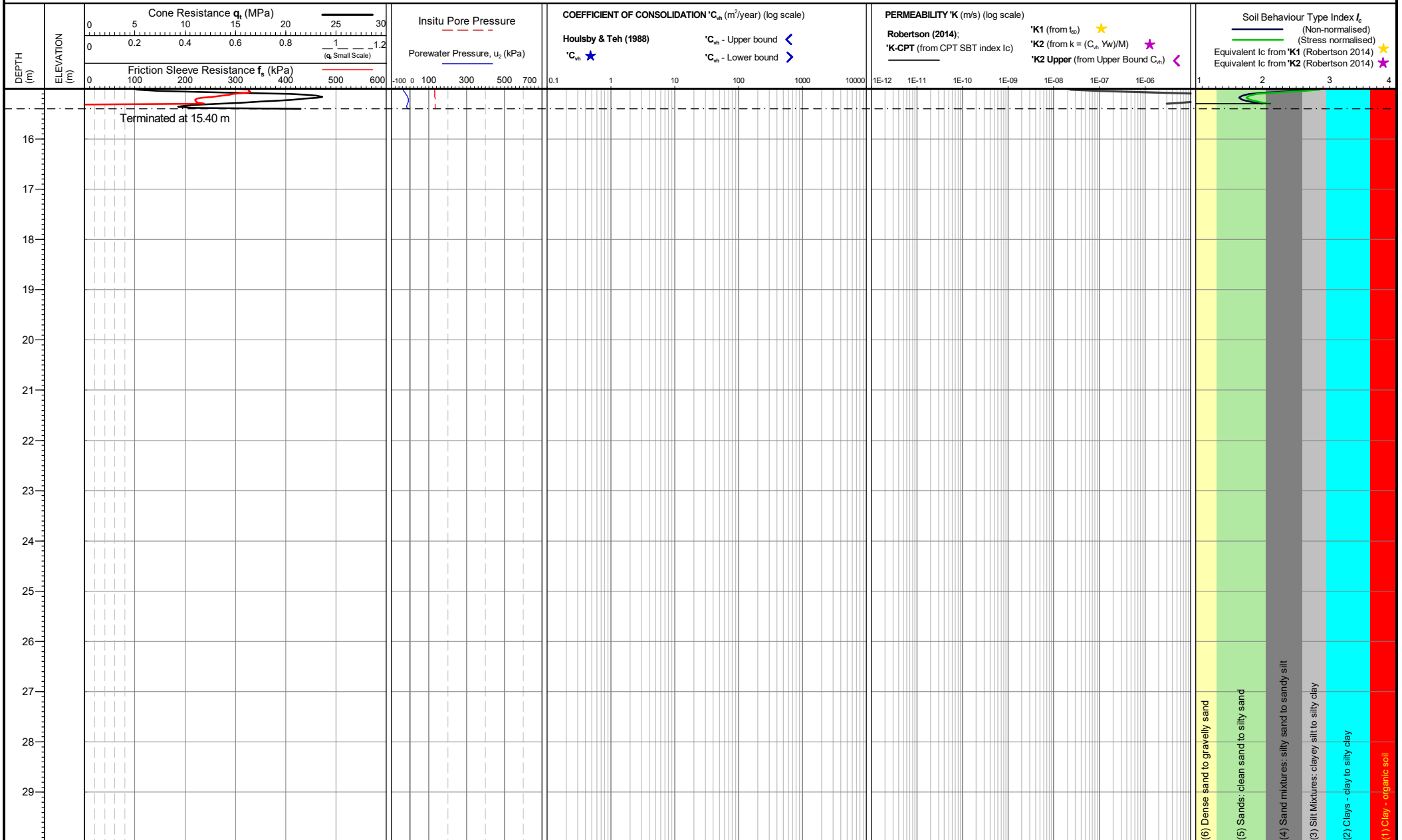
Location: Bridgend, UK  
 Coordinates: ,  
 Elevation:  
 Coordinate system:

\*Abbreviations:  
 NEP: No excess pore pressures generated  
 ID: Insufficient test duration  
 UR: Uncharacteristic response  
 DR: Drained or partially drained response  
 A: Estimated/measured in-situ pore pressure corresponds to artesian conditions.  
 PUS: Potentially unsaturated soil.  
 MD: Monotonic decay.  
 IEP: Insufficient excess pressure generated.  
 LB: Lower bound interpretation.  
 DT: Disrupted test.  
 NI: No interpretation.

Date of plot: 16-01-20  
 Checked by: Chris Player

Lankelma Project Ref: P-107374-1

**TEST ID: CPT07**



Cone area (mm<sup>2</sup>):1500  
Cone ID: S15-CFIPT.1769  
Operator: Gary Connor  
Date of test: 16/01/2020 08:38:00

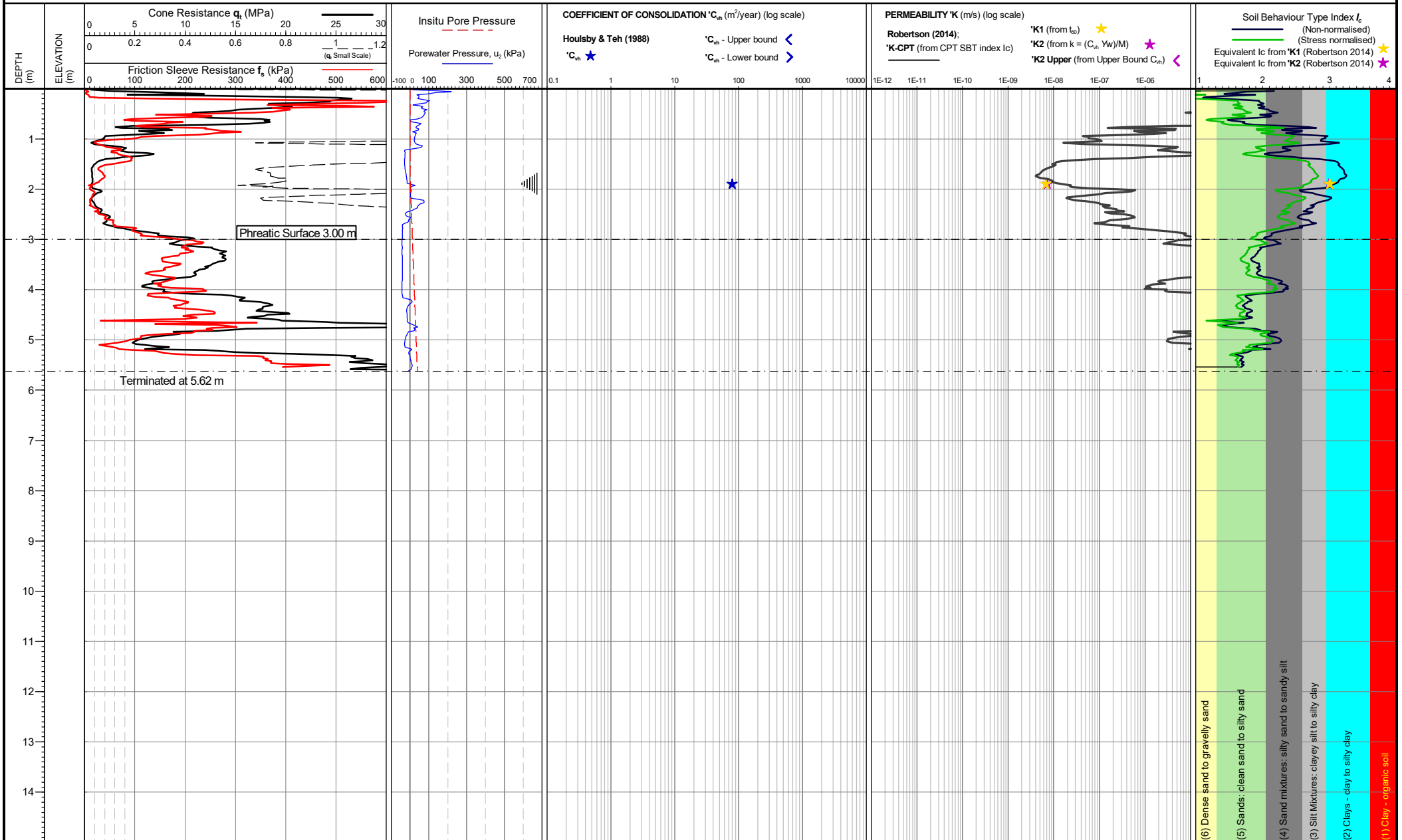
Location: Bridgend, UK  
Coordinates: ,  
Elevation:  
Coordinate system:

\*Abbreviations:  
NEP: No excess pore pressures generated  
ID: Insufficient test duration  
UR: Uncharacteristic response  
DR: Drained or partially drained response  
A: Estimated/measured in-situ pore pressure corresponds to artesian conditions.  
PUS: Potentially unsaturated soil.  
MD: Monotonic decay.  
IEP: Insufficient excess pressure generated.  
LBi: Lower bound interpretation.  
DT: Disrupted test.  
NI: No interpretation.

Date of plot:  
16-01-20  
Checked by:  
Chris Player

Lankelma Project Ref:  
P-107374-1

**TEST ID: CPT07**



Cone area (mm<sup>2</sup>):1500  
Cone ID: S15-CFIPT.1769  
Operator: Gary Connor  
Date of test: 16/01/2020 10:54:00

Location: Bridgend, UK  
Coordinates: ,  
Elevation:  
Coordinate system:

\*Abbreviations:  
NEP: No excess pore pressures generated  
ID: Insufficient test duration  
UR: Uncharacteristic response  
DR: Drained or partially drained response  
A: Estimated/measured in-situ pore pressure corresponds to artesian conditions.  
PUS: Potentially unsaturated soil.  
MD: Monotonic decay.  
IEP: Insufficient excess pressure generated.  
LBi: Lower bound interpretation.  
DT: Disrupted test.  
NI: No interpretation.

Date of plot:  
16-01-20  
Checked by:  
Chris Player

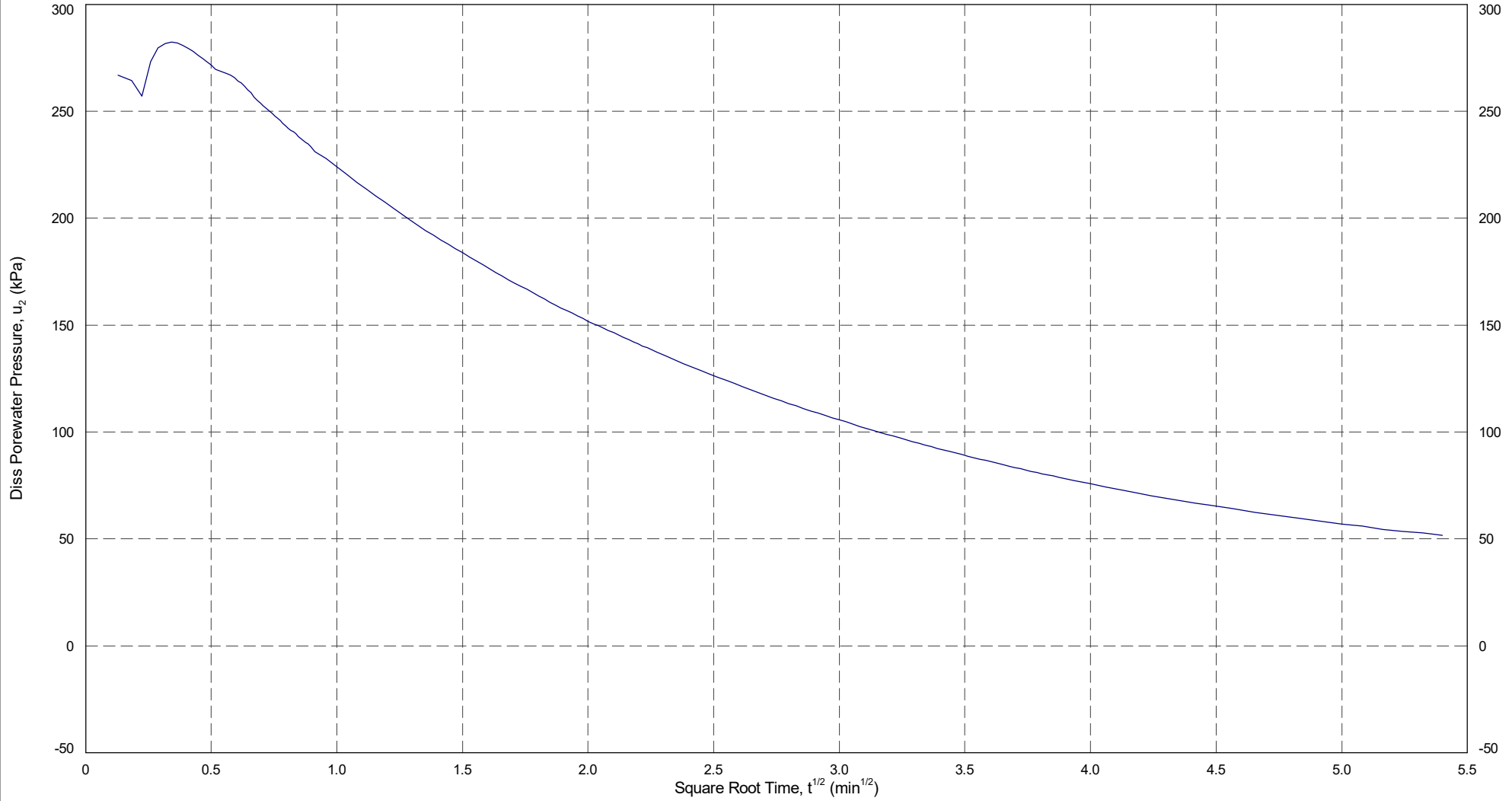
Lankelma Project Ref:  
P-107374-1

**TEST ID: CPT08**

**APPENDIX G RAW DISSIPATION TEST RESULTS****LIST OF FIGURES:**

Location ID	Depth (m BGL)
CPT06	5.82
CPT07	7.10
CPT08	1.89

Dissipation curves are presented grouped by CPT location



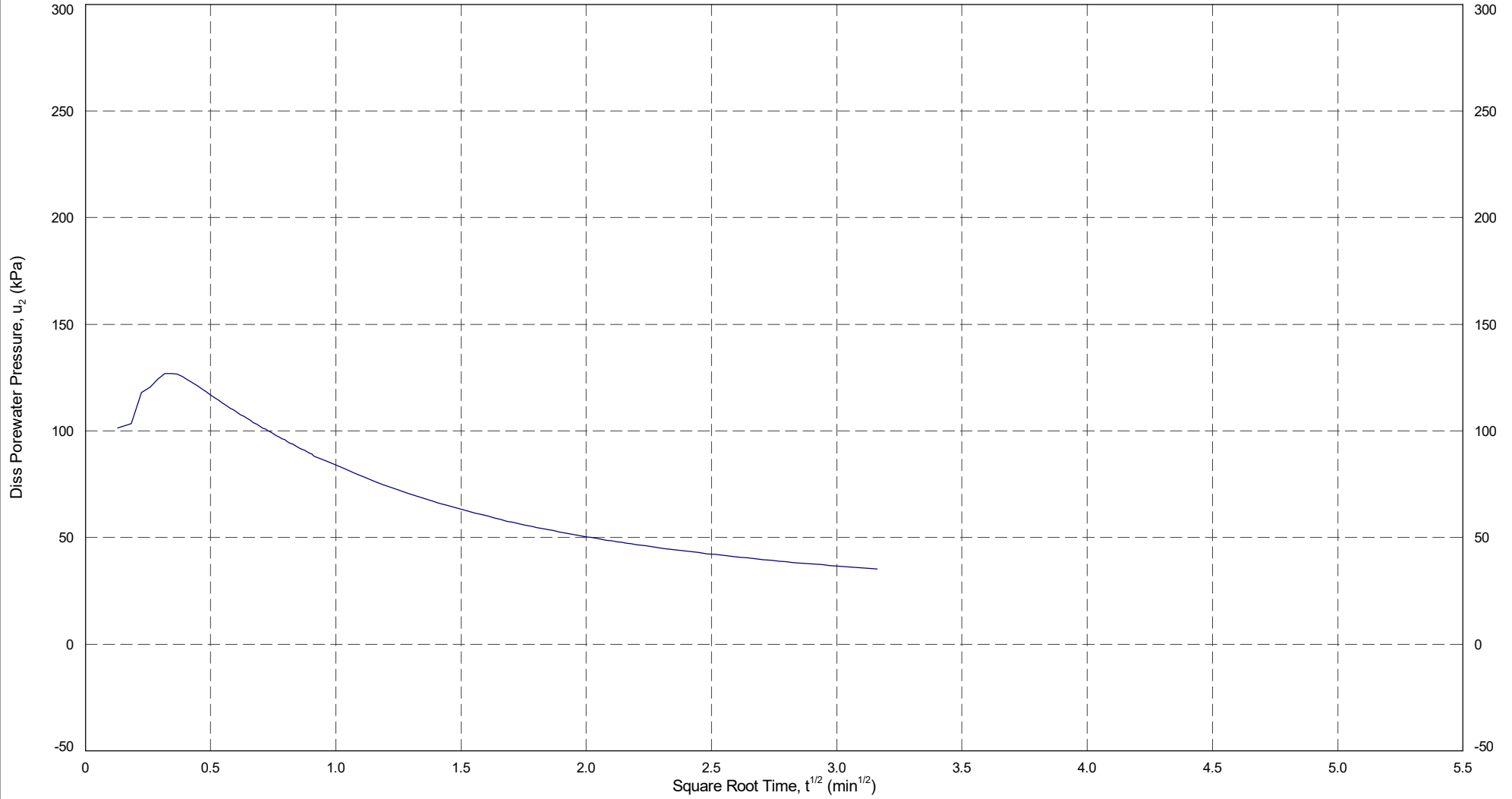
— 5.82 m



TITLE

INTEGRAL GEOTECHNIQUE  
 Bridgend, UK  
 BRIDGEND, SOUTH WALES  
 Dissipation Test - CPT06

DRAWN Christopher Player	DATE 16/01/2020
CHECKED Joseph Hobbs	DATE 16/01/2020
SCALE	A4
PROJECT No P-107374-1	FIGURE No



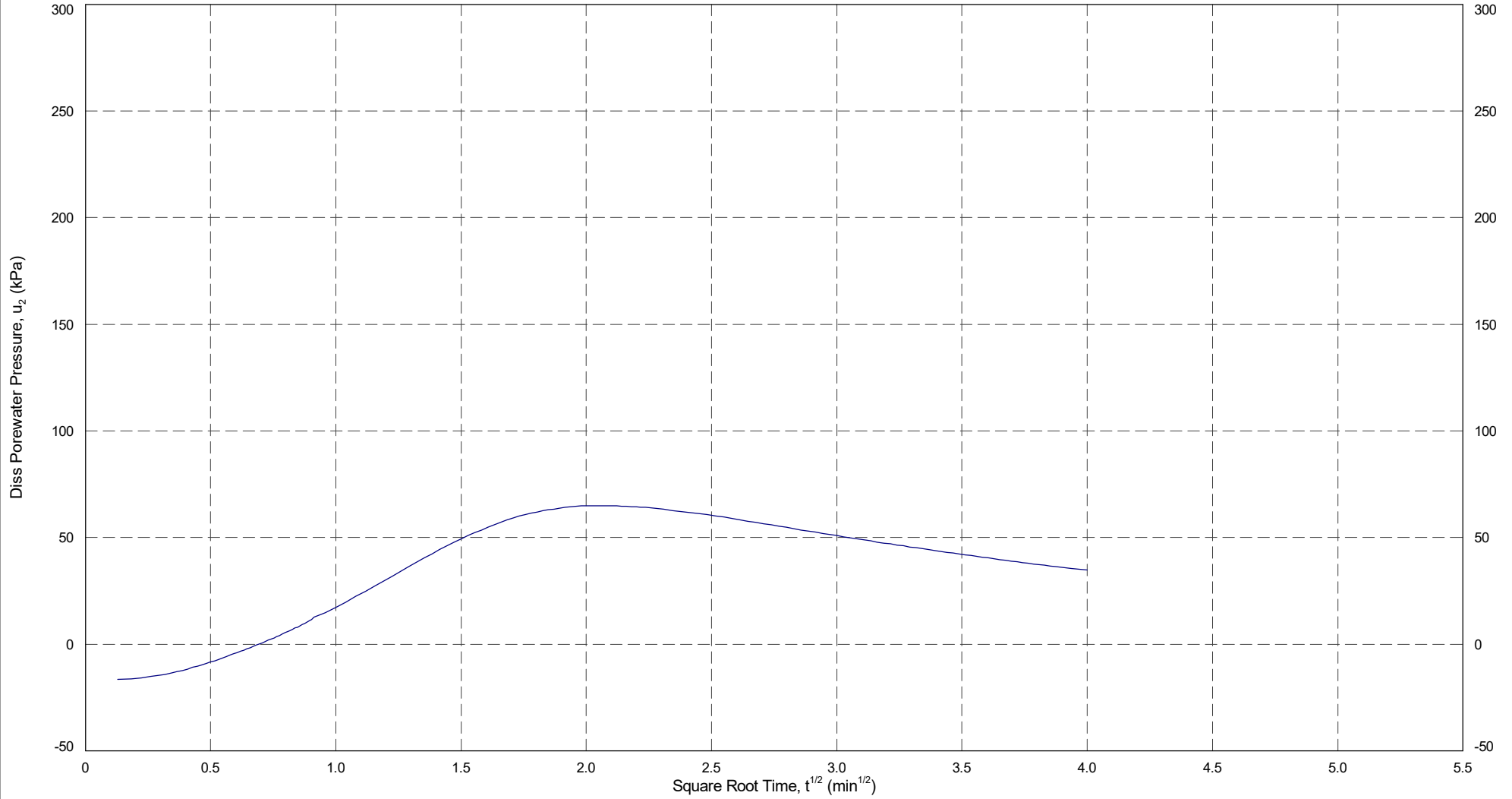
— 7.10 m



TITLE

INTEGRAL GEOTECHNIQUE  
 Bridgend, UK  
 BRIDGEND, SOUTH WALES  
 Dissipation Test - CPT07

DRAWN Christopher Player	DATE 16/01/2020
CHECKED Joseph Hobbs	DATE 16/01/2020
SCALE	A4
PROJECT No P-107374-1	FIGURE No



— 1.89 m



TITLE

INTEGRAL GEOTECHNIQUE  
 Bridgend, UK  
 BRIDGEND, SOUTH WALES  
 Dissipation Test - CPT08

DRAWN Christopher Player	DATE 16/01/2020
CHECKED Joseph Hobbs	DATE 16/01/2020
SCALE	A4
PROJECT No P-107374-1	FIGURE No

## **APPENDIX C**

### **LABORATORY CHEMICAL TEST RESULTS**



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## **Analytical Report Number : 20-85713**

<b>Project / Site name:</b>	Wepa, Bridgend	<b>Samples received on:</b>	10/02/2020
<b>Your job number:</b>	12495	<b>Samples instructed on:</b>	10/02/2020
<b>Your order number:</b>	12495/GNS	<b>Analysis completed by:</b>	18/02/2020
<b>Report Issue Number:</b>	1	<b>Report issued on:</b>	18/02/2020
<b>Samples Analysed:</b>	3 soil samples		

**Signed:** 

Katarzyna Lewicka  
Head of Reporting Section

**For & on behalf of i2 Analytical Ltd.**

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.

Iss No 20-85713-1 Wepa, Bridgend, 12495

This certificate should not be reproduced, except in full, without the express permission of the laboratory.

The results included within the report are representative of the samples submitted for analysis.

Page 1 of 6

Analytical Report Number: 20-85713  
 Project / Site name: Wepa, Bridgend  
 Your Order No: 12495/GNS

Lab Sample Number	1436398			1436399			1436400		
Sample Reference	RC12			RC13			RC13		
Sample Number	None Supplied			None Supplied			None Supplied		
Depth (m)	0.70			0.40			1.60		
Date Sampled	07/02/2020			07/02/2020			07/02/2020		
Time Taken	None Supplied			None Supplied			None Supplied		
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status						
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1			
Moisture Content	%	N/A	NONE	27	9.5	15			
Total mass of sample received	kg	0.001	NONE	0.60	0.60	0.50			

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	-			
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#### General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.2	9.9	-			
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	-			
Total Sulphate as SO <sub>4</sub>	mg/kg	50	MCERTS	540	2300	-			
Water Soluble SO <sub>4</sub> 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.042	0.94	-			
Sulphide	mg/kg	1	MCERTS	8.2	22	-			
Total Sulphur	mg/kg	50	MCERTS	370	1300	-			
Total Organic Carbon (TOC)	%	0.1	MCERTS	2.6	1.8	-			
Loss on Ignition @ 450°C	%	0.2	MCERTS	4.8	2.6	-			

#### Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	-			
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#### Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-			
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-			
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-			
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-			
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-			
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-			
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-			
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-			
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-			
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-			
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-			
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-			
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-			
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-			
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-			
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-			

#### Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80	-			
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#### Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	8.5	4.7	-			
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.63	0.28	-			
Boron (water soluble)	mg/kg	0.2	MCERTS	0.6	0.6	-			
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.2	0.3	-			
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	-			
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	12	11	-			
Copper (aqua regia extractable)	mg/kg	1	MCERTS	11	19	-			
Lead (aqua regia extractable)	mg/kg	1	MCERTS	13	19	-			
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	-			
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	13	8.8	-			
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	-			
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	16	16	-			
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	44	89	-			

Analytical Report Number: 20-85713  
 Project / Site name: Wepa, Bridgend  
 Your Order No: 12495/GNS

Lab Sample Number	1436398	1436399	1436400		
Sample Reference	RC12	RC13	RC13		
Sample Number	None Supplied	None Supplied	None Supplied		
Depth (m)	0.70	0.40	1.60		
Date Sampled	07/02/2020	07/02/2020	07/02/2020		
Time Taken	None Supplied	None Supplied	None Supplied		
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

#### Monoaromatics & Oxygenates

Compound	Units	Limit of detection	Accreditation Status	1436398	1436399	1436400
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0

#### Petroleum Hydrocarbons

TPH-CWG - Aliphatic > EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic > EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic > EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic > EC10 - EC12	mg/kg	1	MCERTS	< 1.0	27	< 1.0
TPH-CWG - Aliphatic > EC12 - EC16	mg/kg	2	MCERTS	< 2.0	180	< 2.0
TPH-CWG - Aliphatic > EC16 - EC21	mg/kg	8	MCERTS	< 8.0	500	< 8.0
TPH-CWG - Aliphatic > EC21 - EC35	mg/kg	8	MCERTS	< 8.0	1800	34
TPH-CWG - Aliphatic > EC16 - EC35	mg/kg	10	MCERTS	< 10	2300	34
TPH-CWG - Aliphatic > EC35 - EC44	mg/kg	8.4	NONE	< 8.4	1000	22
<b>TPH-CWG - Aliphatic (EC5 - EC35)</b>	mg/kg	10	MCERTS	< 10	2500	39
<b>TPH-CWG - Aliphatic (EC5 - EC44)</b>	mg/kg	10	NONE	< 10	3600	61

TPH-CWG - Aromatic > EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic > EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic > EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic > EC10 - EC12	mg/kg	1	MCERTS	< 1.0	11	< 1.0
TPH-CWG - Aromatic > EC12 - EC16	mg/kg	2	MCERTS	< 2.0	69	< 2.0
TPH-CWG - Aromatic > EC16 - EC21	mg/kg	10	MCERTS	< 10	440	< 10
TPH-CWG - Aromatic > EC21 - EC35	mg/kg	10	MCERTS	< 10	2200	< 10
TPH-CWG - Aromatic > EC35 - EC40	mg/kg	10	NONE	< 10	600	< 10
TPH-CWG - Aromatic > EC35 - EC44	mg/kg	8.4	NONE	< 8.4	1000	< 8.4
<b>TPH-CWG - Aromatic (EC5 - EC35)</b>	mg/kg	10	MCERTS	< 10	2700	< 10
<b>TPH-CWG - Aromatic (EC5 - EC44)</b>	mg/kg	10	NONE	< 10	3700	< 10

<b>TPH Total C5 - C44</b>	mg/kg	10	NONE	< 10	7300	61
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Environmental Science

**Analytical Report Number : 20-85713**

**Project / Site name: Wepa, Bridgend**

\* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1436398	RC12	None Supplied	0.70	Brown loam and clay.
1436399	RC13	None Supplied	0.40	Brown clay and sand with gravel.
1436400	RC13	None Supplied	1.60	Brown clay and sand with gravel.

**Analytical Report Number : 20-85713**

**Project / Site name: Wepa, Bridgend**

**Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)**

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L0738-PL	W	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Loss on ignition of soil @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace.	In house method.	L047-PL	D	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In house method.	L038-PL	D	MCERTS



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**Analytical Report Number : 20-85713****Project / Site name: Wepa, Bridgend****Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)**

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	NONE
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/cleanup.	L088/76-PL	W	MCERTS

**For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.****For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.****Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.**

## **APPENDIX D**

### **LABORATORY GEOTECHNICAL TEST RESULTS**

**TEST REPORT**  
**LIQUID LIMIT, PLASTIC LIMIT & PLASTICITY INDEX**  
**BS EN ISO 17892-12:2018 Clauses 5.3/5.5/6.5**

<b>Project No:</b>	D20043	<b>Client:</b>	Integral Geotechnique
<b>Project Name:</b>	WEPA UK	<b>Email:</b>	7 Beddau way Caerphilly CF83 2AX
<b>ATS Sample No:</b>	19675		

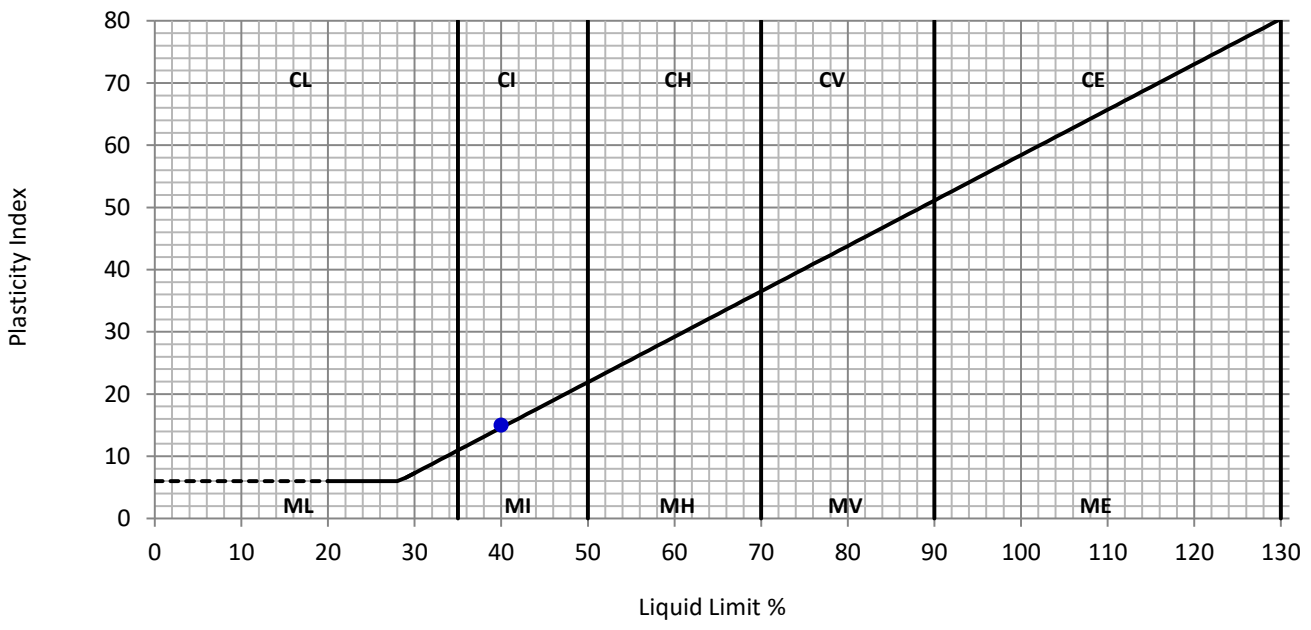
  

<b>Site Ref / Hole ID:</b>	RC10	<b>Depth (m):</b>	1.00
<b>Sample No:</b>		<b>Sample Type:</b>	Disturbed
<b>Sampling Certificate Received:</b>	No	<b>Material Description:</b>	Dark brownish grey slightly gravelly CLAY
<b>Location in Works:</b>		<b>Material Source:</b>	
<b>Date Sampled:</b>	12.11.2019	<b>Material Supplier:</b>	
<b>Sampled By:</b>	Client	<b>Specification:</b>	
<b>Date Received:</b>	05 February 2020	<b>Date Tested:</b>	10 February 2020

**Test Results**

Liquid Limit	40	%
Plastic Limit	25	%
Plasticity Index	15	%

Preparation:	4.2.4 Sieved Specimen
Proportion retained on 425µm sieve:	37 %



**Remarks:**

**TEST REPORT**  
**LIQUID LIMIT, PLASTIC LIMIT & PLASTICITY INDEX**

**BS EN ISO 17892-12:2018    Clauses 5.3/5.5/6.5**

<b>Project No:</b> D20043	<b>Client:</b> Integral Geotechnique
<b>Project Name:</b> WEPA UK	<b>Email:</b> 7 Beddau way Caerphilly CF83 2AX
<b>ATS Sample No:</b> 19676	

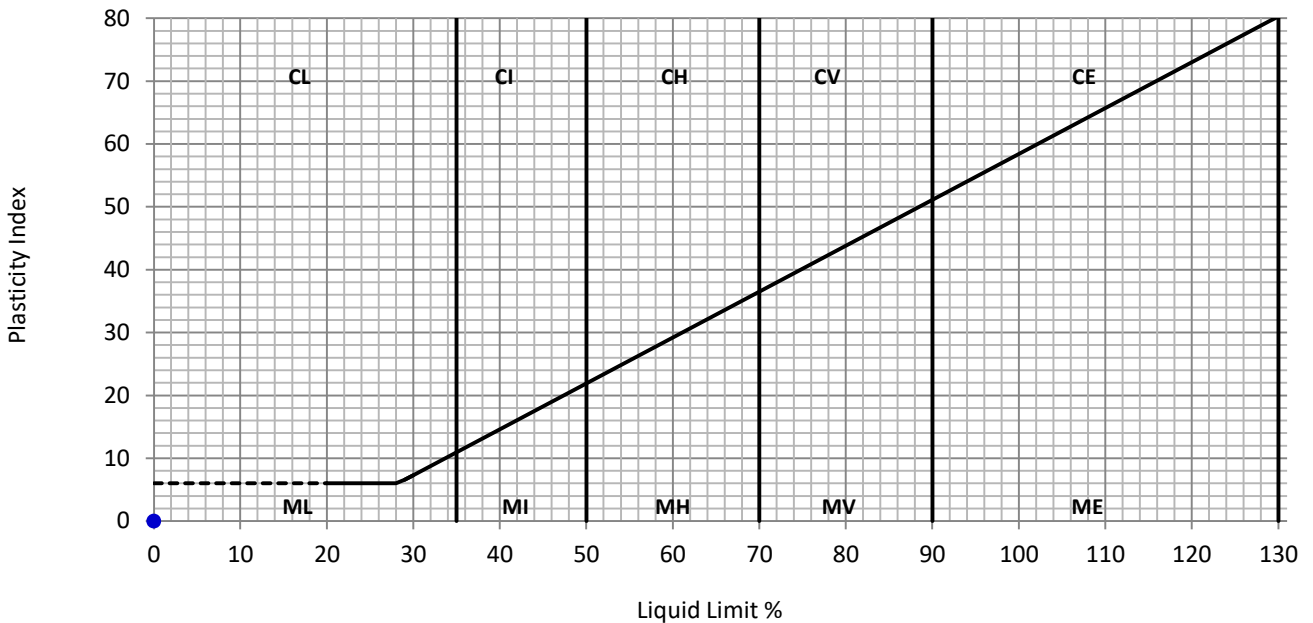
  

<b>Site Ref / Hole ID:</b> RC10	<b>Depth (m):</b> 2.45
<b>Sample No:</b>	<b>Sample Type:</b> Disturbed
<b>Sampling Certificate Received:</b> No	<b>Material Description:</b> Grey very gravelly fine sand
<b>Location in Works:</b>	<b>Material Source:</b>
<b>Date Sampled:</b> 07 February 2020	<b>Material Supplier:</b>
<b>Sampled By:</b>	<b>Specification:</b>
<b>Date Received:</b> 05 February 2020	<b>Date Tested:</b> 10 February 2020

**Test Results**

Liquid Limit	0	%
Plastic Limit		%
Plasticity Index	#VALUE!	%

Preparation:	4.2.4 Sieved Specimen
Proportion retained on 425µm sieve:	34 %



**Remarks:** Sample is non-plastic

**TEST REPORT**  
**LIQUID LIMIT, PLASTIC LIMIT & PLASTICITY INDEX**  
**BS EN ISO 17892-12:2018 Clauses 5.3/5.5/6.5**

<b>Project No:</b>	D20043	<b>Client:</b>	Integral Geotechnique
<b>Project Name:</b>	WEPA UK	<b>Email:</b>	7 Beddau way Caerphilly CF83 2AX
<b>ATS Sample No:</b>	19682		

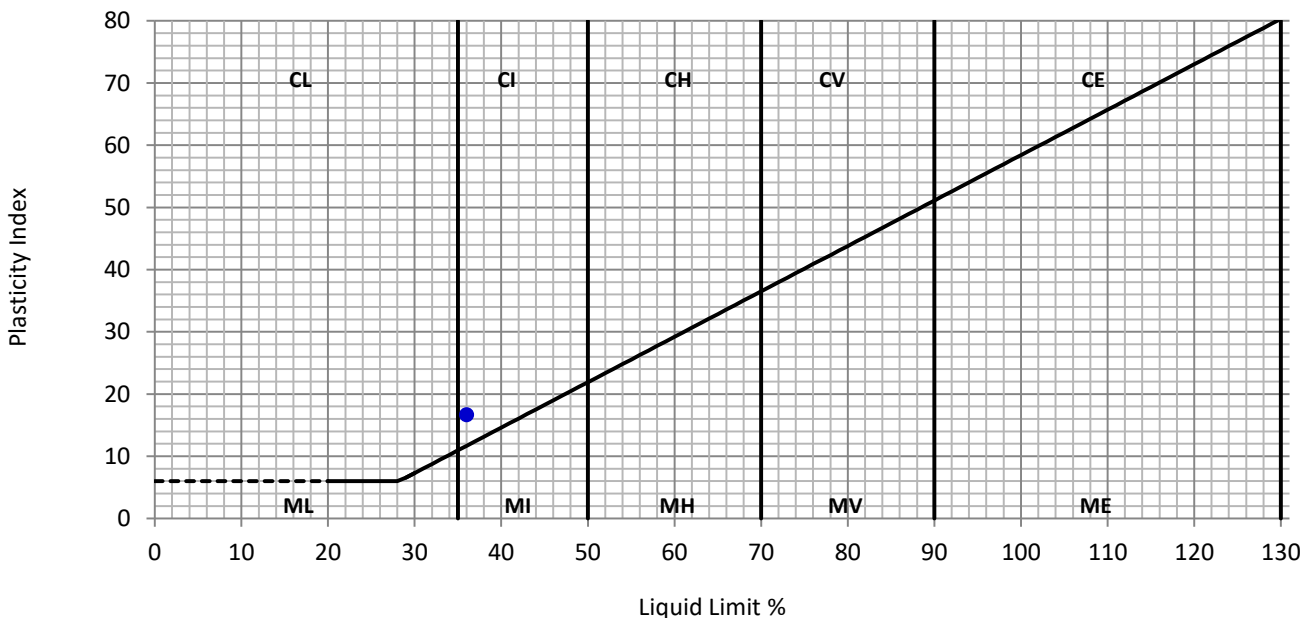
  

<b>Site Ref / Hole ID:</b>	RC11	<b>Depth (m):</b>	1.00
<b>Sample No:</b>		<b>Sample Type:</b>	Disturbed
<b>Sampling Certificate Received:</b>	No	<b>Material Description:</b>	Dark grey gravelly CLAY
<b>Location in Works:</b>		<b>Material Source:</b>	
<b>Date Sampled:</b>		<b>Material Supplier:</b>	
<b>Sampled By:</b>		<b>Specification:</b>	
<b>Date Received:</b>	05 February 2020	<b>Date Tested:</b>	10 February 2020

**Test Results**

Liquid Limit	36	%
Plastic Limit	19	%
Plasticity Index	17	%

Preparation:	4.2.4 Sieved Specimen
Proportion retained on 425µm sieve:	56 %



**Remarks:**

**TEST REPORT**  
**LIQUID LIMIT, PLASTIC LIMIT & PLASTICITY INDEX**  
**BS EN ISO 17892-12:2018 Clauses 5.3/5.5/6.5**

<b>Project No:</b>	D20043	<b>Client:</b>	Integral Geotechnique
<b>Project Name:</b>	WEPA UK	<b>Email:</b>	7 Beddau way Caerphilly CF83 2AX
<b>ATS Sample No:</b>	19683		

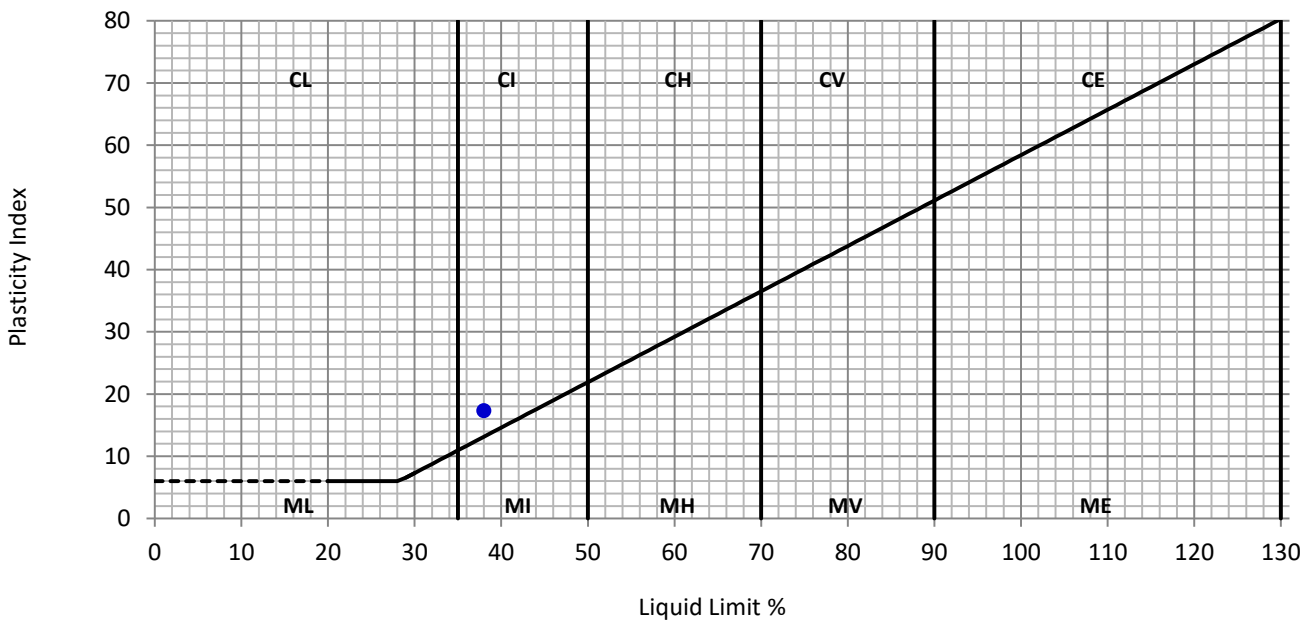
  

<b>Site Ref / Hole ID:</b>	RC11	<b>Depth (m):</b>	2.50
<b>Sample No:</b>		<b>Sample Type:</b>	Disturbed
<b>Sampling Certificate Received:</b>	No	<b>Material Description:</b>	Light brownish grey gravelly CLAY
<b>Location in Works:</b>		<b>Material Source:</b>	
<b>Date Sampled:</b>		<b>Material Supplier:</b>	
<b>Sampled By:</b>		<b>Specification:</b>	
<b>Date Received:</b>	05 February 2020	<b>Date Tested:</b>	10 February 2020

**Test Results**

Liquid Limit	38	%
Plastic Limit	21	%
Plasticity Index	17	%

Preparation:	4.2.4 Sieved Specimen
Proportion retained on 425µm sieve:	54 %



**Remarks:**

# POINT LOAD INDEX TEST

## ISRM: 1985

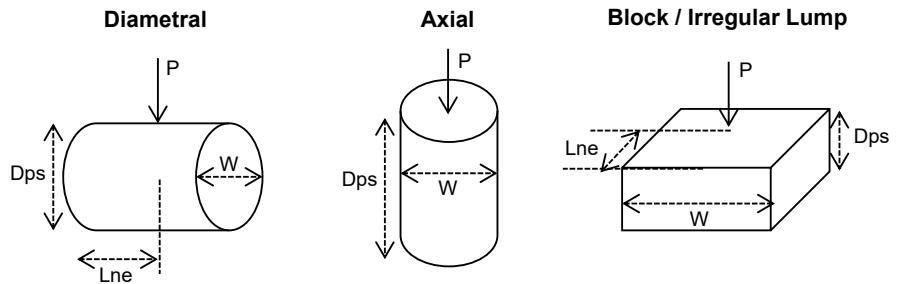
Project Number: D20043						Project Name: WEPA UK											
Borehole	Depth m	Sample Ref	Sample Type	Specimen Ref	Specimen Depth	Rock Type	Test Type see ISRM Fig 5 and 8		Failure Valid (Y/N)	Dimensions			LOAD P kN	De equivalent diameter, mm	Point Load Index Mpa $F=(De/50)^{0.45}$		Remarks
							Type (D, A, I, B)	Direction (L, P or U)		Lne mm	Dps' mm	W mm			I <sub>s</sub>	I <sub>s(50)</sub>	
RC06	14.2		C		14	Siltstone	D	P	Y	63	72	72	2.49	72	0.48	0.57	
RC06	14.2		C		14	Siltstone	A	L	Y		58	72	2.36	72.918	0.44	0.53	
RC06	12.7		C		13	Shale	D	P	Y	35	72	72	0.14	72	0.03	0.03	
RC06	12.7		C		13	Shale	A	L	Y		38	72	1.37	59.022	0.39	0.42	
RC06	12.8		C		13	Shale	D	P	Y	24	72	72	1.49	72	0.29	0.34	
RC06	12.8		C		13	Shale	A	L	Y		25	72	1.01	47.873	0.44	0.43	
RC06	13.3		C		13	Siltstone	D	P	Y	70	72	72	1.08	72	0.21	0.25	
RC06	13.3		C		13	Siltstone	A	L	Y		60	72	4.46	74.165	0.81	0.97	
RC07	11.9		C		12	Shale	D	P	Y	30	72	72	4.09	72	0.79	0.93	
RC07	11.9		C		12	Shale	A	L	Y		62	72	3.51	75.391	0.62	0.74	
RC07	11.3		C		11	Sandstone / Siltstone	D	P	Y	65	72	72	0.40	72	0.08	0.09	
RC07	11.3		C		11	Sandstone / Siltstone	A	L	Y		45	72	8.02	64.228	1.94	2.18	
RC07	13.2		C		13	Sandstone / Siltstone	D	P	Y	48	72	72	1.01	72	0.20	0.23	
RC07	13.2		C		13	Sandstone / Siltstone	A	L	Y		50	72	2.95	67.703	0.64	0.74	
RC07	14.5		C		15	Sandstone / Siltstone	D	P	Y	80	72	72	0.69	72	0.13	0.16	
RC07	14.5		C		15	Sandstone / Siltstone	A	L	Y		55	72	6.56	71.007	1.30	1.52	

All specimens tested as received water content unless shown otherwise

**Test Type**  
D - Diametral, A - Axial, I - Irregular Lump, B - Block

**Direction**  
U - Unknown or Random  
L - Parallel to planes of weakness  
P - Perpendicular to planes of weakness

**Dimensions**  
Dps' - Distance between platens at failure  
Lne - Length from platens to nearest free end  
W - Width of shortest dimension perpendicular to load, P



<b>QA Ref.</b> ISRM Rev 1.0	<p><b>Apex Testing Solutions</b> Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096</p>	<b>Approver</b>  A Grogan  A Grogan, Laboratory Manager	<b>Date</b>  11/02/2020	<b>Fig.</b>
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# POINT LOAD INDEX TEST

## ISRM: 1985

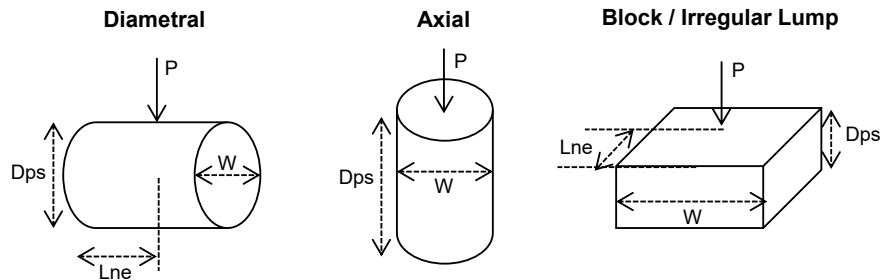
Project Number: D20043		Project Name: WEPA UK															
Borehole	Depth m	Sample Ref	Sample Type	Specimen Ref	Specimen Depth	Rock Type	Test Type see ISRM Fig 5 and 8		Failure Valid (Y/N)	Dimensions			LOAD P kN	De equivalent diameter, mm	Point Load Index Mpa $F=(De/50)^{0.45}$		Remarks
							Type (D, A, I, B)	Direction (L, P or U)		Lne mm	Dps' mm	W mm			I <sub>s</sub>	I <sub>s(50)</sub>	
RC08	12.0		C		12.0	Shale	D	P	Y	27	75	75	0.66	75	0.12	0.14	
RC08	12.0		C		12.0	Shale	A	L	Y		28	75	1.45	51.709	0.54	0.55	
RC08	12.2		C		12.2	Shale	D	P	Y	25	75	75	0.15	75	0.03	0.03	
RC08	12.2		C		12.2	Shale	A	L	Y		45	75	1.59	65.553	0.37	0.42	
RC08	13		C		13.0	Shale	D	P	Y	22	75	75	0.85	75	0.15	0.18	
RC08	13		C		13.0	Shale	A	L	Y		21	75	0.49	44.781	0.24	0.23	
RC08	11.7		C		11.7	Shale	I	L	Y	35	34	72	0.68	55.829	0.22	0.23	
RC08	11.7		C		11.7	Shale	I	L	Y	35	30	72	0.62	52.442	0.23	0.23	
RC09	7.2		C		7.2	Siltstone/ Sandstone	D	P	Y	55	72	72	1.21	72	0.23	0.28	
RC09	7.2		C		7.2	Siltstone/ Sandstone	A	L	Y		74	72	9.48	82.364	1.40	1.75	
RC09	10.4		C		10.4	Siltstone/ Sandstone	D	P	Y	35	72	72	0.92	72	0.18	0.21	
RC09	10.4		C		10.4	Siltstone/ Sandstone	A	L	Y		56	72	6.68	71.65	1.30	1.53	
RC09	6.7		C		6.7	Siltstone/ Sandstone	D	P	Y	36	72	72	0.05	72	0.01	0.01	
RC09	6.7		C		6.7	Siltstone/ Sandstone	A	L	Y		36	72	4.51	57.448	1.37	1.45	
RC09	8.5		C		8.5	Siltstone/ Sandstone	D	P	Y	45	72	72	0.01	72	0.00	0.00	
RC09	8.5		C		8.5	Siltstone/ Sandstone	A	L	Y		54	72	6.44	70.359	1.30	1.52	

All specimens tested as received water content unless shown otherwise

Test Type  
D - Diametral, A - Axial, I - Irregular Lump, B - Block

Direction  
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L - Parallel to planes of weakness  
P - Perpendicular to planes of weakness

Dimensions  
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W - Width of shortest dimension perpendicular to load, P



QA Ref. ISRM Rev 1.0	<p><b>Apex Testing Solutions</b> Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096</p>	Approver  A Grogan	Date  11/02/2020	Fig.
		A Grogan, Laboratory Manager		

# POINT LOAD INDEX TEST

## ISRM: 1985

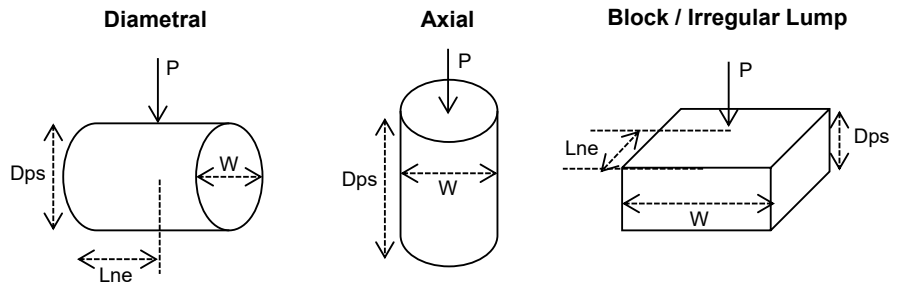
Project Number: <b>D20043</b>						Project Name: <b>WEPA UK</b>											
Borehole	Depth m	Sample Ref	Sample Type	Specimen Ref	Specimen Depth	Rock Type	Test Type see ISRM Fig 5 and 8			Dimensions			LOAD P kN	De equivalent diameter, mm	Point Load Index Mpa $F=(De/50)^{0.45}$		Remarks
							Type (D, A, I, B)	Direction (L, P or U)	Failure Valid (Y/N)	Lne mm	Dps' mm	W mm			I <sub>s</sub>	I <sub>s(50)</sub>	
RC10	18.05		C		18	Shale	D	P	Y	35	72	72	0.51	72	0.10	0.12	
RC10	18.05		C		18	Shale	A	L	Y		40	72	1.08	60.555	0.30	0.32	
RC10	18.25		C		18	Shale	D	P	Y	34	72	72	0.07	72	0.01	0.02	
RC10	18.25		C		18	Shale	A	L	Y		33	72	0.43	55.002	0.14	0.15	
RC10	16.9		C		17	Shale	D	P	Y	22	72	72	0.79	72	0.15	0.18	
RC10	16.9		C		17	Shale	A	L	Y		57	72	1.19	72.287	0.23	0.27	
RC10	17.1		C		17	Shale	D	P	Y	60	72	72	0.37	72	0.07	0.09	
RC10	17.1		C		17	Shale	A	L	Y		45	72	0.62	64.228	0.15	0.17	
RC11	19		C		19	Shale	D	P	Y	42	72	72	0.90	72	0.17	0.20	
RC11	19		C		19	Shale	A	L	Y		41	72	0.48	61.307	0.13	0.14	
RC11	16.5		C		17	Shale / Coal	D	P	Y	28	72	72	0.28	72	0.05	0.06	
RC11	16.5		C		17	Shale / Coal	A	L	Y		48	72	0.17	66.335	0.04	0.04	
RC11	15.4		C		15	Shale	D	P	Y	17	72	72	0.06	72	0.01	0.01	
RC11	15.4		C		15	Shale	A	L	Y		25	72	1.06	47.873	0.46	0.45	
RC11	20.4		C		20	Shale	D	P	Y	50	72	72	0.34	72	0.07	0.08	
RC11	20.4		C		20	Shale	A	L	Y		56	72	3.25	71.65	0.63	0.74	

All specimens tested as received water content unless shown otherwise

**Test Type**  
D - Diametral, A - Axial, I - Irregular Lump, B - Block

**Direction**  
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<b>QA Ref.</b> ISRM Rev 1.0		<b>Apex Testing Solutions</b> Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096	<b>Approver</b>  A Grogan  A Grogan , Laboratory Manager	<b>Date</b>  11/02/2020	<b>Fig.</b>
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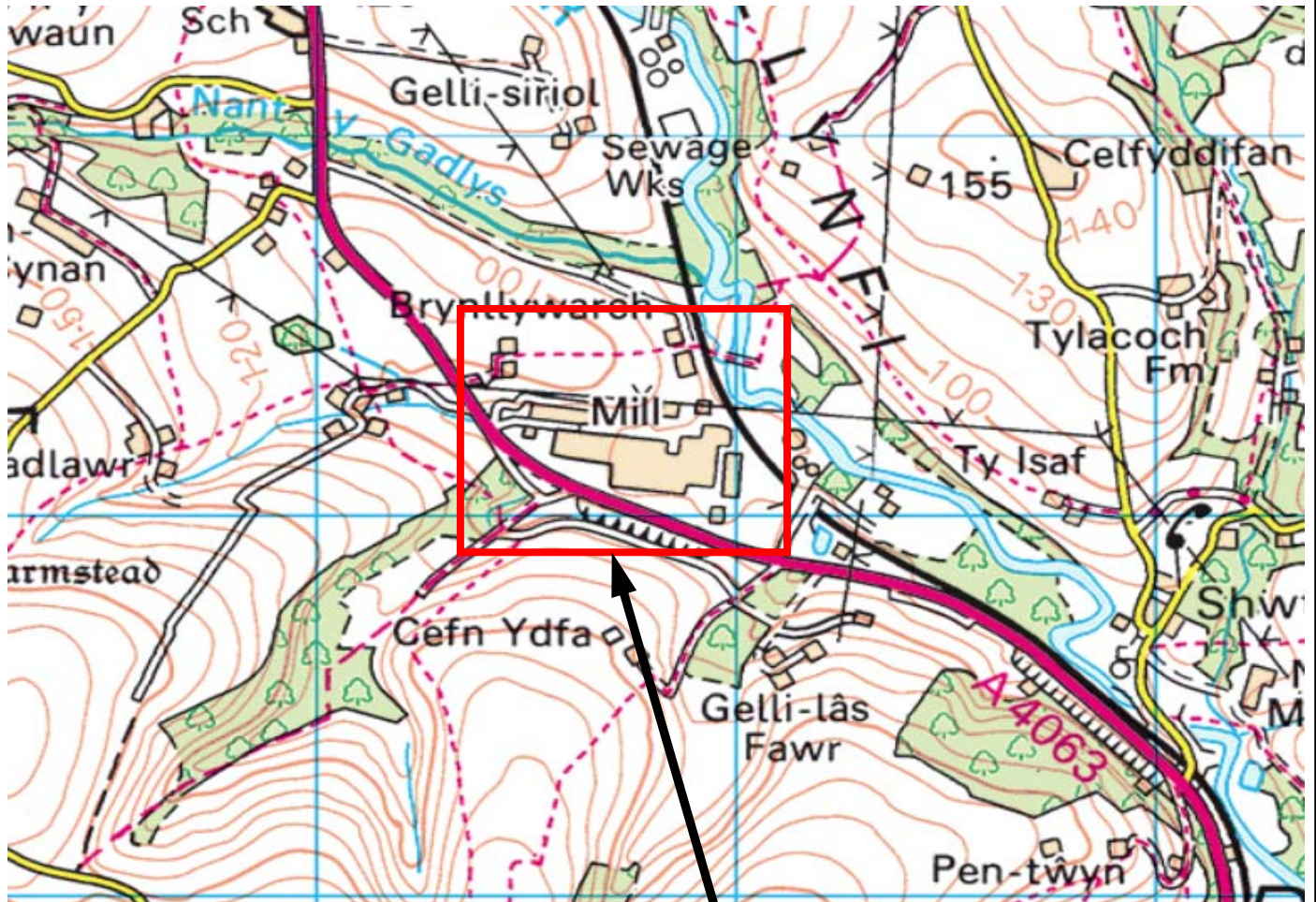
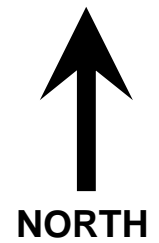


## **APPENDIX E**

### **GROUNDWATER MONITORING RESULTS**



## FIGURES



The Site

FIGURE 1 - Site Location Plan

WEPA UK, Bridgend Paper Mill

**Intégral**  
Géotechnique

Intégral House  
7 Beddau Way  
Castlegate Business Park  
Caerphilly  
CF83 2AX  
Tel: 029 2080 7991  
Fax: 029 2086 2176

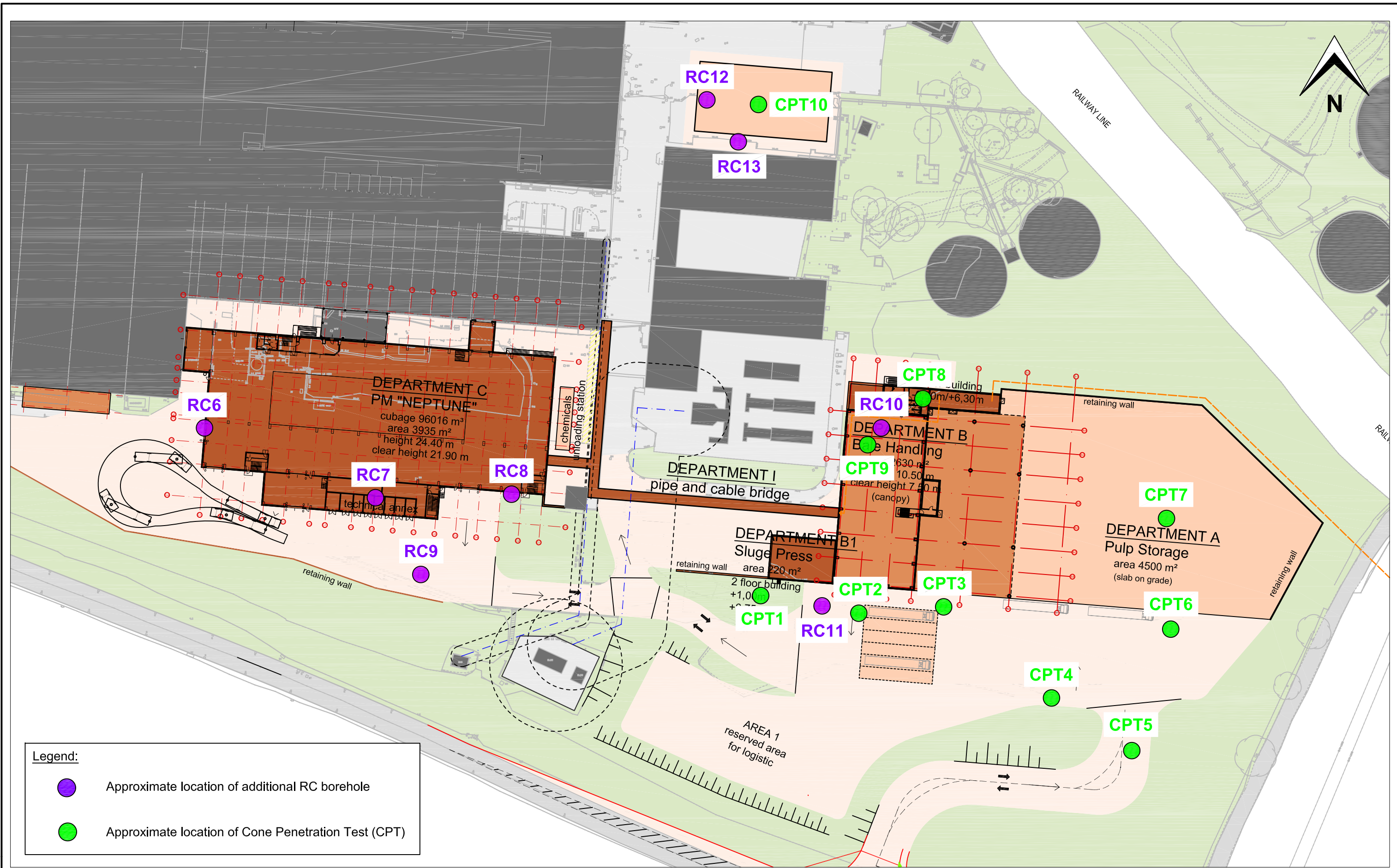


Figure 2: Additional RC and CPT Locations

Project: WEPA UK, Bridgend Paper Mill

Client: WEPA UK

Job No.: 12495

Scale: 1:1,000 at A3

**Intégral**  
Géotechnique

Integral House,  
7 Beddau Way,  
Castlegate Business Park,  
Caerphilly,  
CF83 2AX.  
Tel: 029 2080 7991