

**GROUND INVESTIGATION
REPORT
FOR
PARKSIDE, HOYLAND COMMON,
BARNSELY**



REPORT STATUS SHEET

Client:	Newlands Developments
Report Title:	Ground Investigation Report for Parkside, Hoyland Common, Barnsley
Report Type	Ground Investigation Report
Report Number:	HOY-AG-VGT-XX-RP-CE-AG3080D-20-AL24
Report Status:	Revision 0
Date:	November 2020



		Date	Signed for and on behalf of Applied Geology Limited
Report Authors	F Connor BSc (Hons) FGS Project Geologist	13/11/2020	
	A T Perks MGeol (Hons) CGeol FGS Principal Engineering Geologist 	13/11/2020	
Checked & Authorised	S Day BSc (Hons) MSc CGeol FGS SiLC Director 	13/11/2020	

Document Verification Sheet

Revision	Status	Date	Prep By	Auth By
0	Issued	12/11/2020	FC & ATP	SD

CONTENTS

1.0	INTRODUCTION	1
1.1	Scope and Objective of the Report	1
1.2	Description of Project	1
1.3	Geotechnical Category	1
2.0	EXISTING INFORMATION – DESK STUDY REVIEW.....	1
2.1	Location & Topography	2
2.2	Published Geological Information	2
2.3	History and Former Land Use	2
2.4	Mining and Minerals	2
2.5	Hydrology and Flooding	3
2.6	Hydrogeology	3
2.7	Conceptual Site Model	3
3.0	FIELD AND LABORATORY STUDIES.....	4
3.1	Site Description	4
3.2	Intrusive Ground Investigation	5
3.3	Geotechnical Laboratory Testing	7
3.4	Chemical Laboratory Testing	8
4.0	GROUND CONDITIONS.....	8
4.1	General.....	8
4.2	Topsoil/Made Ground & Made Ground	8
4.3	Made Ground	9
4.4	Made Ground – Opencast Backfill	9
4.5	Pennine Middle Coal Measures Formation	10
5.0	GROUND GAS & GROUNDWATER	10
5.1	Ground/Mine Gas	10
5.2	Groundwater	11
5.3	Variable Head Permeability Testing	11
5.4	Trial Pit Soakaway Testing.....	11
6.0	GEOTECHNICAL PROPERTIES.....	11
6.1	Classification/Index Properties	12
6.2	Particle Size Distribution	13
6.3	Bulk Density	14
6.4	Maximum Dry Density/Optimum Moisture Content.....	14
6.5	Particle Density	14
6.6	CBR.....	15
6.7	Franklin Point Load Test Index	15
6.8	Undrained Shear Strength	15
6.9	Shear Box Test	16
6.10	Consolidation Properties	16
6.11	Sulphates	17
7.0	GEOTECHNICAL RISK REGISTER.....	18
8.0	CONTAMINATION ASSESSMENT	18
8.1	Human Health Risk Assessment	19
8.2	Controlled Waters Risk Assessment.....	19
8.3	Conclusions and Recommendations	19
9.0	UPDATED COAL MINING RISK ASSESSMENT	20
9.1	September 2020 Investigation	20
9.2	Risk Assessment of Unrecorded Shallow Mine Workings	21
9.3	Risk Assessment of Recorded Mine Shafts.....	21
9.4	Unrecorded Mine Entries	21
9.5	Mining Geology (faults & fissures)	22
9.6	Surface Mining (Opencast Workings)	22
9.7	Revised Coal Mining Risk Assessment	22
9.8	Conclusions.....	23
GENERAL NOTES		

APPENDICES

APPENDIX A

DRAWINGS & FIGURES

- Site Location Plan, Dwg No. AG3080D-20-01
- Exploratory Hole Location Plan, Dwg No. AG3080D-20-02
- Geological Cross Sections AG3080D-20-03
- Opencast Mining Information Drawing, Dwg No. AG3080D-20-04
- Proposed layout – pHp drawing Ref. 4400-SP002 p4;
- Proposed Levels – RPS drawing ref. HOYLA-RPS-SI-XX-DR-C-1651 rev P01
- Earthworks Volumes – RPS drawing ref. HOYLA-RPS-SI-XX-DR-C-1650 rev P01
- SPT vs Depth Plot
- SPT vs Elevation Plot
- Moisture Content vs Depth Plot
- Plasticity Chart
- Combined Grading Curves by Strata and Material Type

APPENDIX B

EXPLORATORY HOLE RECORDS

- Trial Pit records TP1401-TP1415
- Trial Trench TT2101- TT2107
- Driven Continuous Sampling borehole records DCS6101 - DCS6110
- CPT Report

APPENDIX C

PHOTOGRAPHS

- Trial Pit and Trial Trench photographs

APPENDIX D

GROUNDWATER & GROUND GAS MONITORING AND IN-SITU TEST RESULTS

- Groundwater and gas monitoring results (4 visits)
- Falling Head Permeability Test Results
- Trial Pit Soakaway Test Results

APPENDIX E

GEOTECHNICAL LABORATORY TEST RESULTS

- PSL Report PSL 5161 (compaction studies)
- Geolabs Report GEO-31824 01 (triaxial, oedometer and small shear box)
- i2 Reports 20-35149-1 (sulphates)
- Applied Geology Point Load Test Results

APPENDIX F

CHEMICAL LABORATORY TEST RESULTS AND SUMMARY SHEETS

- Assessment Methodology
- i2 Reports 20-33372-1 (soil)
- Summary of Soil Test Result
- Summary of Leachate Test Results

APPENDIX G

GEOTECHNICAL RISK REGISTER

1.0 INTRODUCTION

1.1 Scope and Objective of the Report

An area of land between Sheffield Road and Stead Lane, to the south of Hoyland Common near Barnsley (the site) is to be developed by Newlands Developments (the Client). The proposals comprise the construction of football pitches and an archery pitch, temporary car parking and a temporary container pod for changing facilities, as well as a possible attenuation pond (dependant on final drainage scheme design). There will be some cut/fill to create level development platforms.

Applied Geology Limited has been appointed by Newlands Developments to undertake a Ground Investigation to provide information to assist in the effective and economical design of the proposed development.

This Ground Investigation Report (GIR) has been prepared in general accordance with guidance set out in British Standard EN 1997-2:2007 Eurocode 7 – Geotechnical Design (BS EN 1997-2, 2007). The report provides full details of the fieldwork and laboratory testing undertaken, presents the factual findings and provides an interpretation of the ground conditions and characteristic material properties of the various strata encountered for use in a Geotechnical Design Report (GDR), which is to be issued under separate cover. The report also includes an assessment of ground contamination, an updated coal mining risk assessment and a geotechnical risk register.

1.2 Description of Project

The proposals comprise the construction of football pitches and an archery pitch, temporary car parking and a temporary container pod for changing facilities, as well as a possible attenuation pond in the southeast of the site (dependant on final drainage scheme design). There will be up to 2.9m of cut and up to 3.6m of fill required to create the proposed levels for the various pitches. The development will be carried out in two phases (Phase 1 and Phase 2). Details of the proposed layout, the proposed levels and the earthworks required are shown on various drawings included in Appendix A.

1.3 Geotechnical Category

The proposed development of sports pitches and associated car parks have been categorised as Geotechnical Category 2 as defined by British Standard EN 1997-1:2007 Eurocode 7 – Geotechnical Design. This is because it involves conventional types of geotechnical earthworks and activities.

2.0 EXISTING INFORMATION – DESK STUDY REVIEW

A Phase 1 Desk Study and Preliminary/Phase 1 Coal Mining Risk Assessment (CMRA) were carried out for the site by Applied Geology in August 2020 (Report Ref. AG3080D-20-AK84) For full details of the identified coal mining issues and geo-environmental setting of the site, reference should be made to the report detailed above. However, a summary of the key findings is provided below

2.1 Location & Topography

The site is located between Sheffield Road (A6135) to the southwest and Stead Lane to the northeast. It is adjacent to the southeast of the village of Hoyland Common and approximately 6.5km south of Barnsley town centre in South Yorkshire. The Ordnance Survey grid reference for the centre of the site is 436069, 399771 as shown on the Site Location Plan (AG3080D-20-01) included in Appendix A.

The site is irregular in plan shape, covering an approximate area of 5.5ha. The site has a generally undulating topography, with an overall downhill slope towards the southeast from approximately 137m AOD in the north-western corner of the site to approximately 124m AOD on the south-eastern corner of the site.

2.2 Published Geological Information

Reference to the published 1:50,000 scale British Geological Survey (BGS) map, Sheet 87 (Barnsley) [Bedrock and Superficial Geology] dated 2008 indicates the site to be underlain by Solid Geology of the Pennine Middle Coal Measures Formation of Carboniferous age. A band of sandstone is present along the north eastern site boundary and in the northern corner of the site, with the remainder of the site comprising interbedded mudstone, siltstone and sandstone with numerous workable coal, ironstone and fireclay seams, which have been historically worked in the area. No natural Superficial Deposits are shown to be present on or in the vicinity of the site. A geological fault runs along the southwestern site boundary, downthrown to the southwest.

The Groundsure Report, which sources information on radon affected areas from the BGS/Public Health England, identifies the western part of the site to be in an area where <1% of properties are above the Action Level and the remainder of the site to be within an area where between 1% and 3% of properties are above the Action Level. Therefore, no precautions against ingress of radon into buildings would be necessary if any new buildings were constructed on site in the future.

2.3 History and Former Land Use

Historical Ordnance Survey maps show the site to have comprised fields since at least 1850, with opencast mining marked southeast of the site during the mid-20th century. Information in later sections of this report confirm that the opencast mining extended onto site, though this is not apparent from available mapping. The opencast pits have since been backfilled and the land restored back to fields. The surrounding area has remained predominantly agricultural, with numerous former ironstone pits southwest of the site and coal mining and brick works some distance east and southeast of the site. Residential development of Hoyland Common has extended up to the north-eastern and north-western site boundaries.

2.4 Mining and Minerals

The Groundsure Report identifies historic opencast mining on site and numerous historic underground workings within 1km of the site, predominantly for ironstone and coal. The site is within a Coal Mining Reporting Area, with much of the site (the area of the former opencast) within a Development High Risk Area.

The Coal Mining Report identifies underground mining of coal seams (Swallow Wood Coal and those below) and the Tankersley Ironstone seam between 1892 and 1956. No shafts are identified on site, with the closest being approximately 70m southwest of the southern extent of the site. There are shown on abandonment plans to be four opencast pits on site, with an unidentified coal seam initially extracted in the northeast and southeast of the site (maximum pit depth of 10.87m bgl), followed by the Dunsil (Harley) Coal across most of the site (maximum pit depth of 18.95m bgl), followed by a thin coal seam in the west and southwest (maximum pit depth of 17.25m bgl) and the Swallow Wood Coal also in the west and southwest (maximum pit depth of 26m bgl).

The Groundsure Report identifies that the site is not located in an area of recorded natural cavity formation, nor is it within area of known brine or gypsum extraction.

2.5 Hydrology and Flooding

The closest watercourse to the site is a stream, identified on the Groundsure Report approximately 7m northeast, on the opposite side of Stead Lane, and noted during the walkover survey east of the site. The stream flows to the southeast. The Surface Water Flooding map within the Groundsure Report suggests that the stream flows across the northern corner of the site, is culverted along part of Stead Lane and then becomes a surface water course again close to the eastern extremity of the site. The historic maps do not show the stream to formerly or currently cross the site.

There are no surface water abstractions or licensed discharge consents to Controlled Waters within 500m of the site.

The site is not within Fluvial Flood Zones 2 or 3. However, surface water flooding associated with the stream crossing the northern corner of the site has a highest flood risk rating of 1 in 30 years.

The opencast mine abandonment plan shows a deep mine drain at the base of the opencast site which flows to the southeast and discharged into a water course further to the southeast.

2.6 Hydrogeology

The Pennine Middle Coal Measures Formation is classified by the Environment Agency as a Secondary A Aquifer.

There are no groundwater abstraction licences within 1km of the site and the site is not located within a groundwater Source Protection Zone.

2.7 Conceptual Site Model

As part of the previous Phase 1 Desk Study a Conceptual Site Model (CSM) has been produced and this is summarised below with the source-pathway-receptor linkages and qualitatively assessed levels of risk:

Source	Pathway	Receptor	Risk*
Backfill material to historic opencast pits (on and off site) and possible spoil from any historic unrecorded workings (on site)	Ingestion, dermal contact, inhalation of dust	End users	Low
	Leaching/migration	Neighbours	Low
		Stream	Low
		Aquifer	Low
	Direct contact	Water supply pipes	Low
Ground gas from backfill material to historic opencast pits (on and off site) and possible spoil from any historic unrecorded workings (on site)	Migration into buildings, service ducts, etc and inhalation	Neighbours	Low
Mine gas from the Pennine Middle Coal Measures strata	Migration into buildings, service ducts, etc and inhalation	Neighbours	Low
Elevated sulphates in backfill material, any spoil and natural soils (on site)	Direct contact	Buried concrete	Medium-High

*** Definition of Risk Categories**

Negligible - Contaminants that might have unacceptable impact on key receptors, are unlikely to be present, or, no pathway is envisaged.

Low Risk: Contaminants may be present but are unlikely to be at levels to have unacceptable impact on key receptors, or pathways are likely to be minimal.

Medium Risk: Contaminants are probably present and might have an unacceptable impact on key receptors. Pathways may also be present therefore remedial measures may be necessary to reduce the risks.

High Risk – Contaminants probably or certainly present and pathways are probably also present. Therefore, contaminants are likely to have an unacceptable impact on key receptors and remedial measures are likely to be necessary to reduce the risks to acceptable levels.

2.8 Unexploded Ordnance (UXO) Risk

The Zetica on-line bomb risk map identifies the site to be within a low risk area of unexploded bombs from WWII.

3.0 FIELD AND LABORATORY STUDIES

3.1 Site Description

At the time of the walkover the site comprised two fields separated by concrete fence posts, with the majority of the former mesh fencing no longer visible. The field in the northwest comprised open pasture land and the field in the southeast comprised agricultural land (cropped) and an electricity pylon. Anecdotal evidence from local residents identified that the north western field was formerly used as playing fields, but due to the undulating ground surface, was no longer useable for this purpose. A public footpath ran along the northern site boundary and was signposted from the NE corner of the site.

The site was bound to the northeast by Stead Lane, with residential properties beyond and a stream and fields beyond at its eastern extent, to the southeast by the remainder of the cropped field present on site, to the southwest by Sheffield Road and to the northwest by residential properties off Parkside Road beyond. Trees were

spread out along all the site boundaries and along the fence line separating the two fields.

Since the time of the site inspection/walkover undertaken on the 6th August 2020 and the fieldwork carried out in September, the cropped field in the southeast had been harvested and was left as stubble. Beyond the site boundary the south eastern field had also undergone cultivation.

3.2 Intrusive Ground Investigation

Fieldwork was generally carried out, in accordance with BS5930 “Code of Practice for Site Investigations”, BS10175 Investigation of Potentially Contaminated Sites, the Association of Geotechnical and Geo-environmental Specialist Guidelines for Good Practice in Site Investigations and supervised by an experienced Engineering Geologist.

The locations of the exploratory holes were selected and set out on site by Applied Geology Limited. The statutory plans did not identify any utility services on site with the exception of the overhead electricity pylons and a run of sewers that crossed the far north eastern corner, where no exploratory holes were proposed. The positions of the exploratory holes were levelled and located on site by specialist contractor (Midland Survey Ltd.). The locations are presented on the Exploratory Hole Location Plan, Drawing No AG3080D-20-02 in Appendix A.

Descriptions and depths of the various strata recovered are presented on the exploratory hole records, reproduced in Appendix B, together with sample depths, the results of in-situ testing, comments on groundwater inflows, pit stability and any other pertinent information. The soils and rocks encountered have been described in accordance with BS5930:1999 + A2:2010 and BS EN ISO 14688-1:2002 and BS EN ISO 14689-1:2003.

The following scope of fieldwork was undertaken:

- 15 No. machine excavated trial pits (TP1401 to TP1415);
- 7 No. trenches to investigate the opencast boundary and coal seam outcrops (TT2101 and TT2107);
- 3 No. soakaway tests in trial pits (TP1404, TP1414 & TP1415);
- 14 No. cone penetration tests (CPT5101 to CPT5109, and CPT5104A, CPT5105A, CPT5105B, CPT5106A and CPT5106B);
- 10 No. driven continuous sampling boreholes (DCS6101 to DCS6110).

Where natural and opencast backfill materials were encountered in a single excavation due to presence of a highwall, an ‘A’ suffix to the exploratory hole location indicates the log of natural soils outside the highwall and a ‘B’ suffix indicates the log of opencast backfill materials within the former opencast pit.

Copies of all the exploratory hole records are presented within Appendix B. Trial Trench sketches and photos are also located in Appendix B, with photographs of trial pits located in Appendix C.

3.2.1 Trial Pits & Soakaway Tests

Fifteen machine dug trial pits were undertaken across the site to provide general spatial coverage of the proposed balancing pond area and these were excavated using a 20 tonne 360 tracked excavator. These provided information on the nature of the backfill material, allowed for sampling for laboratory testing and allowed for observation of ground stability and groundwater seepage/flow.

One of the machine-dug trial pits (TP1412) was also located to attempt to locate the opencast high wall and extended as necessary into a trial trench.

In-situ soakaway testing was carried out in TP1404, TP1414 and TP1415 with the test strata comprising both opencast backfill and natural materials. The tests were carried out in general accordance with BRE DG 365 with three test fills carried out over successive days where the permeability of the ground allowed for multiple fills. The results of the tests are discussed in Section 5.4.

3.2.2 Trial trenches

Seven machine dug trial pits were also undertaken to accurately locate opencast high walls, many of these taking the form of extended trench excavations to locate the high walls. These were excavated using a 20 tonne 360 tracked excavator.

3.2.3 Driven continuous sampling boreholes

Ten driven continuous sample boreholes (with SPTs) were undertaken across the site, with one specifically targeting the route of the proposed road/roundabout. The drilling was carried out with a using a Premier 110 drill rig. This method was selected because deep boreholes were not required as part of the investigation due to the nature of the proposed development. This method was capable of sampling soils to the base of the proposed cut; including in-situ testing and soil samples. This method was also able to prove the base of the soil strength weathered bedrock outside of the opencast area.

In six of the ten boreholes, groundwater monitoring standpipes were installed targeting Made Ground - Opencast Materials.

3.2.4 Cone penetration testing

A series of fourteen cone penetration tests (CPT's) were undertaken to ascertain soil property information for use in settlement analysis and geotechnical modelling, focussed within the opencast backfill. The testing also included repeat tests at locations CPT5104A, CPT5105A, CPT5105B, CPT5106A and CPT5106B which were carried out due to premature / shallow termination at the original test location. The testing was carried out generally in accordance with BS ISO 22476-1:2012 using an 18.5 ton tracked rig with a 15 ton capacity hydraulic ram and utilising a piezocone and the full report is included within Appendix B.

3.2.5 Instrumentation

Standpipes were installed in selected DCS boreholes as follows:

Borehole N°	Depth To Base (m)	Nominal Pipe Diameter (mm)	Response Zone (m bgl)	Response Zone Strata
DCS6101	2.00	50	1.00-2.00	Made Ground - Opencast Backfill & Pennine Middle Coal Measures Formation
DCS6103	4.00	50	1.00-4.00	Made Ground - Opencast Backfill
DCS6104	5.00	50	1.00-5.00	Made Ground - Opencast Backfill
DCS6105	5.00	50	1.00-5.00	Made Ground - Opencast Backfill
DCS6106	5.00	50	1.00-5.00	Made Ground - Opencast Backfill
DCS6109	5.00	50	1.00-5.00	Made Ground - Opencast Backfill

3.2.6 Groundwater and Gas Monitoring

Monitoring visits were undertaken on 4 occasions from 30th September to 23rd October 2020 including during 1 period of falling atmospheric pressure. Each monitoring well was monitored for concentrations of carbon dioxide, methane, oxygen, carbon monoxide, hydrogen sulphide together with flow rate, differential pressure and water level. The monitoring results are included in Appendix D.

3.2.7 Variable Head Testing

Following completion of the monitoring falling head permeability tests were undertaken in standpipes installed within all borehole installations in general accordance with BE EN ISO 2282-2. The results and calculated permeabilities are discussed in Section 5 and the results are presented in Appendix D.

3.3 Geotechnical Laboratory Testing

A programme of geotechnical laboratory testing was scheduled by Applied Geology on samples selected of soil and rock.

The geotechnical testing was carried out generally in accordance with BS 1377:1990 Method of Tests for Soils for Civil Engineering Purposes and was undertaken by specialist laboratories (Professional Soils Ltd and Geolabs Ltd) and comprised:

- 13 No Natural Moisture content tests;
- 13 No Atterberg Limit tests;
- 7 No Particle Size Distribution tests;
- 8 No Compaction tests (6 no. 4.5kg tests & 2 no. 2.5kg tests)
- 6 No Particle density tests;
- 4 No remoulded CBR tests;
- 2 No unconsolidated undrained triaxial tests;
- 2 No shear strength by direct shear (small shear box) tests;
- 2 No One Dimensional Consolidation tests
- 11 No BRE "Special Digest 1" suites;

In addition, 12 No point load tests were undertaken by Applied Geology on samples of rock lumps recovered from trial pits as part of the logging process during the site works.

The geotechnical laboratory test results and 'field' point load test results are presented in Appendix E.

3.4 Chemical Laboratory Testing

A programme of chemical laboratory testing was scheduled on samples selected of soil and groundwater by Applied Geology. The tests were carried out by specialist laboratories i2 Analytical comprised:

- 18 No soil suites comprising heavy metals, PAHs, pH and SOM on a combination of topsoil, soil, weathered rock and Made Ground samples;
- 5 No leachate suites comprising heavy metals, PAHs and pH on a combination of topsoil, topsoil/Made Ground and Made Ground samples;
- 2 No pesticide screening tests on Topsoil samples.

The test results are presented in Appendix F.

4.0 GROUND CONDITIONS

4.1 General

A layer of Topsoil/Made Ground typically less than 0.40m thick was encountered at the surface. The Made Ground - Opencast Backfill typically consisted of reworked natural coal measures material. The in-situ natural coal measures strata consisted of an initial weathered clay horizon where natural materials were present from shallow depth, increasing to rock strength mudstone, siltstone and sandstone with depth. To the east of the opencast the natural materials consisted of near surface rock strength sandstone and locally ironstone.

The mine abandonment plans show four seams to have been worked by opencast on the site, with an unidentified coal seam initially extracted in the northeast and southeast of the site (maximum pit depth of 10.87m bgl), followed by the Dunsil (Harley) Coal across most of the site (maximum pit depth of 18.95m bgl), followed by a thin coal seam in the west and southwest (maximum pit depth of 17.25m bgl) and the Swallow Wood Coal also in the west and southwest (maximum pit depth of 26m bgl). These can be seen on the EHLP, opencast backfill record and section drawings (Drawing No AG3080D-20-02, AG3080D-20-03 and AG3080D-20-04). The boundary of the opencast materials was proven to be broadly concurrent with the abandonment plans. The depth of the opencast backfill materials were not proven by the exploratory holes, as this was not the aim of the investigation, although several of the CPTs may have encountered the base in some locations.

Groundwater was not encountered during the excavation of exploratory holes, nor during the return monitoring visits.

Four geological cross sections have been produced and these have been referenced Section A-A, which is oriented NW-SE, Section B-B that is oriented WNW-ESE, Section C-C, which is oriented NNE-SSW and Section D-D, which is oriented NNE-SSW. All sections are included in Appendix A as drawing AG3080D-20-04.

4.2 Topsoil/Made Ground & Made Ground

A layer of re-worked Topsoil was recorded over the whole site comprising what was likely to have originally been natural Topsoil with rare man-made fragments such as brick and ceramic tile etc. This stratum has been labelled as 'Topsoil/Made Ground'

where such man-made detritus was recorded. The layer was between 0.20m and 0.35m bgl with an average thickness of 0.30m. This stratum generally comprised of firm to stiff friable brown and dark brown slightly gravelly clay with frequent rootlets. Gravel content comprised mudstone, siltstone, occasional ironstone and coal, with locally brick and ceramic tile fragments.

4.3 **Made Ground**

In proximity to the western opencast highwall, there was a thin layer of Made Ground between the Topsoil and the underlying strata, locally extending out into the opencast area. This was present in DCS6110, TT2101, TT2103 (A&B) and TT2104 to a depth of between 0.50m and 0.75m bgl.

The material comprised generally firm to stiff dark grey and dark brown slightly sandy gravelly to very gravelly clay with rare cobbles of mudstone and siltstone. No man-made detritus was identified within these materials and the strata is considered to represent a reworked natural material, derived from the opencast mining activities taking place in the locality.

4.4 **Made Ground – Opencast Backfill**

Made Ground - Opencast Backfill was encountered underlying the Topsoil/Made Ground and locally Made Ground within the general area of opencast as shown on the abandonment plans.

The trial trenches indicated that the highwall was of a gradient close to vertical, with the exception of the north-western corner where the gradient was initially shallow, before steepening to a similar gradient to the rest of the highwalls.

This stratum was proven to a maximum depth of 5.45m bgl. It was not possible to prove the base of the strata in the driven continuous sampling boreholes nor trial pits, with the exception of DCS6101 (1.75m) and TT2104 (1.10m) which were situated on the north western opencast boundary where the gradient of the highwall was initially shallow. The majority of the opencast strata comprised firm through to very stiff often friable brown and dark grey slightly gravelly to gravelly clay with occasional to frequent subangular cobbles of mudstone, siltstone and locally ironstone. Approximately 20% of the strata were described as granular and comprised grey sandy clayey to very clayey gravel with frequent cobbles. Gravel was fine to coarse angular to subangular mudstone, siltstone, coal and ironstone.

TP1414, TT2101, TT2103B, TT2104 and TT2107B were all notable for their boulder content, all with rare siltstone and sandstone boulders within the opencast material with maximum dimensions of between c. 0.60m and 0.90m in length/breadth.

CPTs were also undertaken to provide more information on the Made Ground - Opencast Backfill, particularly in the area where the greatest thickness of fill is to be placed. Several tests refused at depths significantly shallower than the predicted opencast base depth, likely as a result of a boulder within the backfill material. These tests were repeated c.1m away from the original location, all progressing deeper on the second attempt indicating a localised obstruction, not shallow bedrock. The majority of locations did not terminate on what was considered to represent the natural competent bedrock at the base of the opencast; typically terminating on boulders at depth within the opencast material. Those that may have terminated at or

close to the bedrock include CPT5103, CPT5105A, CP5106B, and CPT5108, situated in opencast with a base in line with the worked out Dunsil (Harley) Coal seam.

4.5 Pennine Middle Coal Measures Formation

Strata of the Pennine Middle Coal Measures Formation were encountered around the perimeter of the site, outside the area of previous opencast excavation. The strata were recorded to depths of between 0.9m and 3.0m bgl, with the base not proven.

In the western half of the site (where opencast materials were absent) a weathered upper layer was present to a depth of c. 2m bgl, generally comprising firm to stiff becoming very stiff grey and light brown slightly sandy clay with occasional becoming frequent fine to medium gravel lithorelicts of mudstone, siltstone and locally clarain and vitrain coal fragments. Rock strength horizons was encountered below the weathered clay horizon. These materials generally comprised extremely weak mudstone and siltstone.

In the eastern half of the site (where opencast materials were absent) a cohesive weathered upper horizon was not present. Here, weathered rock comprising medium strong locally very weak slightly fractured orangish brown locally yellowish brown and grey siltstone with locally thin bands of firm clay and cobble sized ironstone nodules was encountered directly below the Topsoil/Made Ground. This material was recovered as slightly sandy gravel and cobbles of subangular tabular siltstone and ironstone. Exploratory holes terminated in this material at a depth of between 1.70m and 2.00mbgl, as the extent of weathering reduced.

The only coal seam encountered on the site was in TP1401, in the north east of the site, at a depth of between 2.30m and 2.70m bgl, described as black vitrain and clarain coal, it is considered to be the Unidentified Seam, which is indicated to outcrop in an northwest/southeast orientation to the west of this location.

5.0 GROUND GAS & GROUNDWATER

5.1 Ground/Mine Gas

Four phases of gas monitoring have been undertaken as part of this investigation, the results of which are included in Appendix D. Installations were predominantly installed in the Made Ground Opencast Backfill.

All installations recorded negligible methane concentrations, all below the level of detection (0.1%). Most installations were measuring some carbon dioxide concentrations with several measuring >5%. Installations within the opencast backfill materials recorded carbon dioxide concentration between 0.1% and 8.9%.

Oxygen concentrations were recorded as between 6.5% (depleted) and 21.8% (atmospheric). All have negligible carbon monoxide concentrations, below the level of detection (less than 1ppm). All hydrogen sulphide concentrations can be considered negligible. Flow rates were generally negligible with a maximum rate of 0.1l/hr recorded.

5.2 Groundwater

Groundwater was not encountered in any of the boreholes during drilling or subsequent monitoring of installations. There was no indication of excess pore water pressures during the CPTs.

It is considered likely that groundwater is at depths greater than penetrated by the DCS boreholes, possibly as a result of the large drainage channel installed at the base of the opencast, prior to its backfill (as shown on the abandonment plan).

5.3 Variable Head Permeability Testing

Variable head permeability tests were undertaken in five installations within the Made Ground - Opencast Backfill materials to give an indication of the permeability of these strata. Up to fifty litres of clean water was used in each test. The results are included in Appendix D and summarised below:

Borehole	Strata	Permeability (m/s)
DCS6101	MG-OC & PMCMF*	1.2×10^{-8}
DCS6103	MG- OC	1.1×10^{-7}
DCS6104	MG-OC	1.2×10^{-8}
DCS6106	MG-OC	1.2×10^{-8}
DCS6109	MG-OC	3.8×10^{-8}

* Last 0.50m of installation within PMCMF.

5.4 Trial Pit Soakaway Testing

Soakaway tests were carried out in three trial pits over a period of several days. In the more permeable Pennine Middle Coal Measures Formation materials (TP1415) up to three fills were carried out. The tests carried out in the Made Ground Opencast Backfill (TPs 1404 & 1414) experienced slower rates of infiltration and thus only one fill was achievable. Infiltration rates were calculated in accordance with BRE 365 methodology. The test results are included in Appendix D and summarised below:

Test Location	Calculated Soil Infiltration Rate (m/s)		
	Fill 1	Fill 2	Fill 3
TP1404	Insufficient drop in water level over three days to calculate infiltration rate.		
TP1414	Insufficient drop in water level over three days to calculate infiltration rate.		
TP1415	2.5×10^{-4}	6.3×10^{-5}	7.5×10^{-5}

6.0 GEOTECHNICAL PROPERTIES

A range of geotechnical properties have been derived for the various strata encountered. These have been drawn from various methods/sources including from laboratory analyses, assessment/engineering judgement and published correlations. Reference has also been made to the in-situ testing (SPTs and CPTs) carried out in very similar soils as part of the ground investigation for the main site located to the west of Parkside.

6.1 Classification/Index Properties

6.1.1 Moisture Contents

Moisture Content tests were undertaken on 8 no. samples from the Made Ground - Opencast material and 5 no samples from the soil and extremely weak rock strength Pennine Middle Coal Measures Formation. A summary of the results of this testing is presented in the table below:

Stratum	Moisture Content (%)		
	Min	Max	Average
Made Ground - Opencast	8.6	22.7	14.4
Pennine Middle Coal Measures Formation	9.0	22.0	15.0

6.1.2 Atterberg Limits

Thirteen Atterberg limit tests were undertaken on soil samples from across the site at a range of depths. The minimum, maximum and average values for Made Ground – Opencast Backfill and Pennine Middle Coal Measures Formation soils are presented below. The results are also presented on a plasticity chart in Appendix A.

Material - Description	w%	% passing 425um	wL	wP	PI	
			<i>uncorrected</i>	<i>uncorrected</i>	<i>uncorrected</i>	<i>corrected</i>
Made Ground - Opencast Backfill (Minimum)	9.0	33.0	42.0	21.0	14.0	6.6
Made Ground - Opencast Backfill (Average)	14.4	63.0	43.6	22.6	21.0	13.9
Made Ground - Opencast Backfill (Maximum)	22.7	97.0	51.0	27.0	31.0	30.1
Pennine Middle Coal Measures (Minimum)	12	24.0	38.0	20.0	21.0	5.5
Pennine Middle Coal Measures (Average)	17.0	79.0	46.8	23.0	23.8	18.9
Pennine Middle Coal Measures (Maximum)	22.0	99.0	55.0	26.0	28.0	27.2

Made Ground - Opencast Backfill

Eight Atterberg tests were carried out on samples of cohesive materials of Made Ground - Opencast Backfill. Of these 7 indicated intermediate/medium plasticity and 1 indicated high plasticity. The results also indicated the material to be of low to medium shrinkability in the samples tested.

Pennine Middle Coal Measures Formation

Five Atterberg tests were carried out on samples of Pennine Middle Coal Measures Formation. Of these 3 indicated intermediate/medium plasticity and 1 indicated high plasticity, and 1 was recorded as being non-plastic. The results also indicated the material to be of low to medium shrinkability in the samples tested.

6.1.3 Organic Content

Soil organic matter testing was carried out as part of the chemical laboratory testing. The results of 7 no. tests on the Topsoil/Made Ground recorded results of 3.0-5.1% (average of 4.2%); one test on natural Topsoil returned a result of 3.5%.

The results of 6 no. tests Made Ground-Opencast Backfill returned results of 0.80-2.2% (average of 1.6%).

Four tests on natural Pennine Middle Coal Measures Formation returned results of 0.20-1.5% (average of 1.0%).

6.2 Particle Size Distribution

Four Particle Size Distribution (PSD) tests were undertaken on samples from the Made Ground - Opencast. The results of this testing and the resultant classification are given in the table below. Combined graphs of the PSD tests per material type are also included in Appendix A.

Location	Depth (m bgl)	Sample Proportion (%)					Classification
		Clay	Silt	Sand	Gravel	Cobbles	
TT2101	0.5	94		4	0	0	Slightly sandy silty CLAY.
TP1414	2.2	79		10	11	0	Slightly gravelly slightly sandy CLAY.
TT2107B	1.0	29		11	60	0	Sandy very clayey GRAVEL.
TT2105B	1.0	13		16	71	0	Sandy clayey GRAVEL

Three Particle Size Distribution tests were undertaken on samples from the Pennine Middle Coal Measures Formation. The results of this testing and the resultant classification are given in the table below:

Location	Depth (m bgl)	Sample Proportion (%)					Classification
		Clay	Silt	Sand	Gravel	Cobbles	
TT2107A	0.5	6		4	60	30	Slightly clayey slightly sandy GRAVEL with frequent cobbles.
TT2103A	1.0	19		14	55	12	Clayey sandy GRAVEL with occasional cobbles.
TT2104	1.1	42	49	7	2	0	Slightly gravelly slightly sandy very clayey SILT.

6.3 Bulk Density

Eleven Bulk Density tests were undertaken on samples from the Made Ground - Opencast (8 no.) and Pennine Middle Coal Measures Formation (3 no.). The results of this testing are given in the table below.

Stratum	Bulk Density (Mg/m ³)
Made Ground - Opencast Backfill	Min: 2.05 Avg:2.16 Max: 2.22
Pennine Middle Coal Measures Formation	Min: 2.03 Avg: 2.04 Max: 2.06

6.4 Maximum Dry Density/Optimum Moisture Content

The maximum dry density results from the 2.5kg rammer are as follows:

Strata	Optimum moisture content (%)			Maximum dry density (Mg/m ³)		
	Min	Max	Ave	Min	Max	Ave
Made Ground – Opencast Backfill	One Test: 17			One Test: 1.80		
Pennine Middle Coal Measures Formation	One Test: 19			One Test: 1.71		

The maximum dry density results from the 4.5kg rammer are as follows:

Strata	Optimum moisture content (%)			Maximum dry density (Mg/m ³)		
	Min	Max	Ave	Min	Max	Ave
Made Ground – Opencast Backfill	7	14	10.2	1.86	2.16	2.03
Pennine Middle Coal Measures Formation	9	16	11.6	1.83	2.06	1.98

For the Made Ground - Opencast Backfill material of the four comparisons undertaken of natural moisture content and optimum moisture content; one was dry of optimum (> +2%), three were within optimum +/- 2% whilst none of the samples were wet of optimum (< -2%).

For the Pennine Middle Coal Measures Formation material of the four comparisons undertaken of natural moisture content and optimum moisture content; one was wet of optimum (> +2%), three were classified as within optimum +/- 2% whilst none of the samples were dry of optimum (< -2%).

6.5 Particle Density

Particle Density tests were undertaken on the samples subjected to compaction testing. A summary of the results of this testing is presented in the table below:

Stratum	Particle Density (Mg/m ³)
	Range
Made Ground – Opencast Backfill	2.65-2.70
Pennine Middle Coal Measures Formation	2.62-2.67

6.6 CBR

CBR tests were undertaken on materials at optimum moisture content/maximum dry density alongside the compaction tests. The tests were undertaken on samples recompacted using 4.5kg compactive effort. The results are summarised below:

Stratum	CBR Value (%)			
	Min		Max	
	Top	Base	Top	Base
Made Ground – Opencast Backfill	54	58	70	72
Pennine Middle Coal Measures Formation	34	35	54	60

Using the results of the plasticity index results for the materials inferred by the correlation outlined in Table 5.1 in the Interim Advice Note 73/06 Rev 1(2009), CBR values are indicated to range between 3.5% and 5.5% dependant on thick or thin pavement construction.

6.7 Franklin Point Load Test Index

Although no rotary coring was carried out during the fieldworks, lumps of rock from the shallow natural Pennine Middle Coal Measures Formation where sandstone/siltstone was found within the trial pits (TT2103A and TP1415) were sampled. Several of these cobble sized lumps have been tested using the Franklin point load test method; in general accordance with ISRM Suggested Methods - Rock Characterization Testing and Monitoring 1974 - 2006. A summary of the results is presented below.

Strata type	Sample Type	Range of Is(50) Results (MPa)	Average Is (50) (MPa)
Sandstone/Siltstone	Irregular lump	0.22-1.78	0.97

6.8 Undrained Shear Strength

Two unconsolidated 'quick' undrained triaxial tests were undertaken on samples of the Made Ground Opencast Backfill from DCS6103 and DCS6110 at depths of 0.55m and 1.0m bgl respectively. The test from 0.55m bgl recorded an undrained shear strength of 68kN/m² (medium strength). The test from 1.0m bgl recorded undrained shear strength of 59kN/m² (medium strength).

Approximate undrained shear strengths derived from SPT N values and f_1 (after Stroud *et al*) assessed from average plasticity index are detailed in the table below. For the coal measures clay strata it has been possible to subdivide this into an upper

and lower unit based on field description / consistency and the SPT Vs Depth profile. When calculating the approximate mass shear strengths the mean plasticity indices were used being 14% for Opencast Backfill, 19% for the upper coal measures clay.

Stratum	Approx. Undrained Shear Strength (kN/m ²) from SPT N and plasticity index		
	Min	Max	Average
Made Ground - Opencast Backfill	25	100	55
Pennine Middle Coal Measures Formation (all 3 np. tests from c. 2.0m bgl)	230	420	N/A

6.9 Shear Box Test

One small shear box test was undertaken on a sample of Made Ground Opencast Backfill material, another test was undertaken on Pennine Middle Coal Measures Formation both on samples from 1.0m bgl. The samples were remoulded at existing moisture content using a 2.5kg rammer and was consolidated for a period of 1 day. The shearing stage for the three remoulded samples lasted a duration of 5 days each. Once the sample had been sheared and peak conditions recorded the apparatus was racked back allowing approximate residual conditions to be estimated. The results of the test are tabulated below.

Location	Peak Condition		Residual Condition	
	Apparent Cohesion (kPa)	Angle of Shearing Resistance (degrees)	Apparent Cohesion (kPa)	Angle of Shearing Resistance (degrees)
DCS6106 (MG-OC)	18	26.0	16	21.5
DCS6102 (PMCMF)	20	18.0	19	8.5

6.10 Consolidation Properties

One dimensional consolidation tests were undertaken on two 'undisturbed' samples of the Made Ground Opencast Backfill. The oedometer m_v values were calculated for various pressure ranges from field curves reconstructed from the laboratory data. The results are presented in the table below.

Borehole	Depth	Pressure Range	m_v
		kPa	m ² /MN
DCS6104	1.00 - 1.45	125-225	0.19*1
DCS6106	1.00 - 1.45	125-225	0.16*1

*1 Based on pressure range equivalent to approximate current overburden pressure +100kN/m² to approximate current overburden pressure +200 kN/m²

The above values of m_v for the pressure range equivalent to existing overburden pressure are relatively consistent in the range 0.16-0.19 m^2/MN . However, it is important to note that these three samples have all been taken from a similar shallow depth and compressibility parameters at different depths in the Opencast Backfill are anticipated to be different and possibly more variable.

The above values of m_v for the pressure range equivalent to existing overburden pressure are reasonably similar. However, it is important to note that these three samples have all been taken from a similar shallow depth and conditions at different depths in the Opencast Backfill are anticipated to be more variable.

Approximate Coefficient of Compressibility (m_v) values have also been calculated for soils strength materials, derived from reference to the SPT N values and plasticity from each material and using the Stroud correlation.

Made Ground – Opencast Backfill

Plasticity in the opencast materials is very variable with values of between 6.6% and 31% and an average of 14%. SPT N is also variable with a range of between 5 and 23 is apparent with a mean average of c. 14 with no obvious trend with depth. This correlates to approximate estimates of m_v of c. 0.10-0.45 m^2/MN with a tentative average value in the order of 0.15 m^2/MN (medium to high compressibility).

Pennine Middle Coal Measures

Plasticity in the Pennine Middle Coal Measures is also very variable with values of between 5.5% and 27.2% and an average of 19%. Due to undisturbed samples being taken in the upper clay (0.5-1.0m bgl) only SPT values from c. 2m bgl have been recorded within the Pennine Middle Coal Measures. SPT N recorded at 2.0m bgl range between 53 (extrapolated from 50 blows for 285mm penetration) and 94 (extrapolated from 50 blows for 160mm penetration). These correlate to approximate estimates of m_v of c. 0.02-0.05 m^2/MN (low compressibility) at a depth of c. 2.0m bgl. Below this depth rock strength materials were encountered.

6.11 Sulphates

Selected samples of soils were submitted for assessment of sulphate, sulphur and pH concentrations in order to assess classifications for the design of buried concrete. The table below provides a summary of the results.

Stratum	Characteristic Water-Soluble Sulphate (mg/l) *1	Characteristic Total Potential Sulphate (TPS) SO ₄ % *2	Characteristic pH	Design Class based on w/s sulphate	Design Class based on TPS
TS	50 (8)	-	6.6 (8)	DS-1	-
OCBF	500 (11)	0.9 (6)	6.4 (11)	DS-2	N/A*3
PMCMF	300 (10)	0.4 (5)	5.4 (10)	DS-1	N/A*3

TS – Topsoil or Topsoil/Made Ground

OCBF – Opencast Backfill

PMCMF – Pennine Middle Coal Measures Formation

Number of test results forming assessment in brackets

*1: Rounded to nearest 100mg/l (where a significant value i.e. >50mg/l)

*2: Rounded to nearest 0.1%

*3: No samples found to be potentially pyritic and hence, use of TPS is not appropriate

Of the samples tested for acid soluble sulphate and total sulphur none were potentially pyritic. Therefore, it can be concluded that it is not appropriate to base the Design Sulphate Class on characteristic Total Potential Sulphate values. However, a design class of DS-2 is still recommended due to the soluble sulphate content of the Opencast Backfill.

Under BRE SD1, it could be argued that the site can be deemed greenfield as it essentially comprised natural soils or fill derived from natural soils and is unlikely to contain chemical residues produced by or associated with industrial production. Should this be the case, an ACEC Class of AC-2 would generally be appropriate, however, a pH value of 5.4 (as assigned to the natural coal measures strata) would indicate AC-3z conditions.

The sulphate results have also been assessed for consideration of suitability of moisture modification by the addition of lime. In respect of Total Potential Sulphate (TPS) a total of 11no. determinations were made with results generally ranging between 0.03% and 0.59% with one result from the Opencast Backfill at greater than 0.25% (1.80%). The total (acid soluble) sulphate concentrations for all materials tested were generally in the range 0.029-0.10%, with an average of 0.053%. However, higher values of 0.553% and 1.59% were recorded in samples from the Coal Measures and Opencast Backfill respectively. Water soluble sulphate in soils all fall well below the limits set by SHW600 (30000mg/l). None of the tests recorded oxidizable sulphides of >0.6% with the highest results being 0.21%. These results generally indicate that the sulphate concentrations of the materials beneath the site would not restrict the use of lime modification and/or stabilisation, if required.

7.0 GEOTECHNICAL RISK REGISTER

The proposed Parkside, Hoyland sports pitches development has been categorised as Geotechnical Category 2 as defined by British Standard EN 1997-1:2007 Eurocode 7 – Geotechnical Design. This is because it involves conventional types of geotechnical earthworks and activities.

A Geotechnical Risk Register has been derived for the proposed development and is presented in Appendix G. The aim of the risk register is to identify the geotechnical hazards and risks associated with the proposed development at the time of reporting. Later, as the project progresses with more detailed information in terms of design and mitigation measures, this should be revised and updated.

8.0 CONTAMINATION ASSESSMENT

One purpose of the ground investigation was to investigate the potential sources identified in the preliminary conceptual site model (principally the opencast backfill materials) and also to prove potential pathways and determine any impact on groundwater quality. The results of the chemical analysis of the soil and groundwater results and the implications on the source-pathway-receptor linkage and assessed risk are discussed below.

8.1 Human Health Risk Assessment

The results of the chemical testing on soils have been assessed as follows:

- Proposed end-use – football pitches and an archery pitch, temporary car parking and a temporary container pod for changing facilities, as well as a possible attenuation pond in the southeast of the site;
- Screening criteria – public open space (parks), assuming 2.5% SOM for all soils;
- Based on the soils encountered on the site and proposed redevelopment plans, the testing has been treated as one data set.

Spreadsheets summarising the laboratory results for each data set and relevant screening values are presented in Appendix F. From these summary spreadsheets, it can be seen that determinants have been found not to exceed their relevant screening values.

Due to the current agricultural land use, a selection of Topsoil//Topsoil Made Ground samples were analysed for a suite of pesticides (SVOC suite with TICs). All of these recorded concentrations below the level of detection.

PAHs were widely tested for across all soil types and all recorded concentrations below relevant screening criteria, many below levels of detection.

Based on the currently proposed commercial/industrial end use it is considered that the site presents a negligible risk to identified human health receptors.

8.2 Controlled Waters Risk Assessment

There was no evidence of Made Ground on the site aside from reworked materials derived from natural soils/bedrock placed as part of the Opencast coal mining activities, therefore a source of any pollutants is not evident.

All concentrations in leachate samples tested were below the conservative screening criteria adopted. It is therefore considered that the site presents a negligible risk to identified controlled water receptors.

8.3 Conclusions and Recommendations

The above risk assessments have established a negligible risk to human health and Controlled Water receptors. It is therefore considered that further assessment or remedial actions are not warranted for this development.

The results of the chemical testing confirm that the Topsoil and Topsoil/Made Ground is chemically suitable for re-use on site or off-site. However, topsoil suitability depends on other factors including the requirements of the sports pitch designer and the landscape architect in respect of any proposed perimeter planting.

As part of the redevelopment, a proportion of the natural and Made Ground Opencast Backfill materials will be excavated, especially from the north and centre of the site, to be re-used as engineered fill placed predominantly in the south of site. The chemical testing undertaken on these soils has indicated that they are chemically suitable for re-use as engineered fill.

Issues regarding the potential impact on buried concrete, water supply pipes and possible lime modification of wet soils is discussed in the Geotechnical Design Report (GDR).

The development is being designed to achieve a cut-fill balance; hence the aim is to re-use all excavated materials on site as engineered fill to create the required development platforms. Should any excavated opencast backfill or natural soils require disposal off site, they should be appropriately tested and classified. On the basis of the test results undertaken as part of the current investigation, it is anticipated that the soils would be classified as inert. However, if the soils could not be recycled, the organic/coal content may preclude disposal of some materials at landfill as inert waste.

Measures will be included in the GDR and/or Earthworks Specification on how to deal with any suspected contamination, should it be uncovered as part of the redevelopment works.

9.0 UPDATED COAL MINING RISK ASSESSMENT

The previously issued Phase 1 report which included a Preliminary Coal Mining Risk Assessment has been updated following the findings of the ground investigation.

The previous report came to a number of conclusions relating to risks based on the information available at that time. These were summarised at the time as follows:

Coal Mining Issue	Yes/No	Risk Assessment
Recorded underground shallow mine workings	Yes	Low risk – mined at 38m or greater depths in 1955/56. Movements should by now have ceased.
Unrecorded underground shallow mine workings	Yes	Low risk: workable shallow seams all recorded as mined but adjacent unrecorded workings could exist
Recorded Mine entries (shafts and adits)	No	Negligible
Unrecorded Mine entries (shafts and adits)	Yes	Very low risk – potentially present just outside opencast area where seams shallowest.
Mining geology (faults and fissures)	Yes	Very low risk – faulting recorded on abandonment plan within opencast mine now backfilled
Record of past mine gas emissions	No	Negligible
Recorded mining surface hazard	No	Negligible
Surface mining (opencast workings)	Yes	Low Risk: Uncontrolled backfill

9.1 September 2020 Investigation

Since the Phase 1 report was issued, a ground investigation has been undertaken across the site area by Applied Geology. The investigation included 10 no. driven continuous sampling boreholes extended up to 5.45m bgl together with 15 no. trial pits, 7 no. trial trenches, 14 no. cone penetration tests and laboratory testing and monitoring. However, this investigation focussed on identifying the lateral extents of the former opencast area and the nature of the near surface materials. The aim of the investigation was not to prove the deeper geology.

The ground investigation was able to confirm many of the ground conditions and features predicted to be present on site by the Phase 1 CMRA. In particular, the opencast highwalls were identified in the trial trenches broadly in line with where they were indicated on the abandonment plans. The cone penetration testing was able, in some locations, possibly also to prove the base of the opencast.

Four geological cross sections have been produced for the site (Drawing AG3080D-20-04), taking information from the ground investigation and abandonment plans. These show the general profile of the opencast pits and presence of shallow sandstone strata within the natural Pennine Middle Coal Measures around the eastern extremity of the opencast. The Dunsil (Harley) Seam was identified in one location in the central north of the site close to where it is likely to outcrop at a depth of 2.40m bgl, and a thickness of 0.30m.

9.2 Risk Assessment of Unrecorded Shallow Mine Workings

Shallow underground mine workings of the Swallow Wood Coal seam are recorded on mine abandonment plan NE820 which shows underground workings from 1955 and 1956 below the eastern part of the site. The CA Report states the shallowest depth of workings being 38m bgl. There is estimated to be between 15 and 20m of solid strata between the underground workings of the Swallow Wood seam and base of opencast mine above. Given this and the nature of the proposed development, these underground workings are unlikely to affect the construction. It was therefore considered further investigation into the presence of these seams below the opencast by means of rotary boreholes or rotary probing was outside the requirements of this investigation.

Underground mine workings of the Lidgett Coal seam are shown on mine abandonment plan 5843 Part A beneath most parts of the site. However, the depth of working is thought to be more than 90m beneath the site. It is considered that there is sufficient thickness of solid strata between the workings and the ground surface to mitigate against the risk of void migration and any general aerial settlement as a result of former workings should now be complete. No further mitigation is required. Recorded workings in coal and ironstone seams below the Lidgett are therefore also considered to present a negligible risk to surface instability.

9.3 Risk Assessment of Recorded Mine Shafts

Given the date, depth and extent of the opencast mine in this area, there are not anticipated to be any unrecorded underground shallow coal mine working present at the site. However, the Dunsil (Harley) Seam is shown to outcrop in the north-western corner of the site just outside the opencast boundary and therefore potential old shallow workings (probably via bell pits) could theoretically exist here. Several trial pits were undertaken in this area as part of the ground investigation works no evidence of shallow workings or shafts was identified. A watching brief is recommended during the earthworks exercise and site preparation works within this area.

9.4 Unrecorded Mine Entries

The proposed development site's coal mining context is such that there will always be a low risk of unrecorded mine entries being present. The same comments and recommendations made in section 9.3 above also relate to the risk of unrecorded

mine entries. Any anomalous features that may indicate historic mine entries should be investigated and recorded by a competent person.

9.5 Mining Geology (faults & fissures)

Minor faulting was noted in the opencast mine (also shown on the underground mine plan) and another fault is mapped immediately west of the site, however, these are not considered likely to affect the proposed development.

9.6 Surface Mining (Opencast Workings)

The proposed development area has been subject to historic opencast mining to various depths across the majority of the site. Variations in backfilling compaction can result in variable and unpredictable settlement when new loads are applied and also as a result of self-weight settlement and changes in groundwater levels. This is particularly the case at highwalls, where sudden variations in thickness of Made Ground can occur.

Even so, the plans for this site are not particularly sensitive to differential settlements and so the risk is deemed to be low. The highwall locations have been investigated where they coincide with the proposed development, with focus on areas of fill which will add loads to the ground and induce settlement in the loosely compacted opencast backfill material. The trial trenches confirmed that the opencast boundaries were broadly located as the abandonment plans indicated. The outline of the highwall taken from plans as well as identified by the ground investigation can be seen on the Exploratory Hole Location Plan (drawing no. AG3080D-20-02).

9.7 Revised Coal Mining Risk Assessment

Base on the results of the recent site investigation, the CMRA findings can be revised as shown below.

Coal Mining Issue	Yes/No	Risk Assessment
Recorded underground shallow mine workings	Yes	Low risk – mined at 38m or greater depths in 1955/56. Movements should by now have ceased.
Unrecorded underground shallow mine workings	Yes	Low risk: workable shallow seams all recorded as mined but adjacent unrecorded workings could exist. None identified during ground investigation.
Recorded Mine entries (shafts and adits)	No	Negligible
Unrecorded Mine entries (shafts and adits)	Yes	Very low risk – potentially present just outside opencast area where seams shallowest. None identified during ground investigation.
Mining geology (faults and fissures)	Yes	Very low risk – faulting recorded on abandonment plan within opencast mine now backfilled
Record of past mine gas emissions	No	Negligible
Recorded mining surface hazard	No	Negligible
Surface mining (opencast workings)	Yes	Low Risk: Uncontrolled backfill. Extent of opencast backfill confirmed by trial trenching exercise, as well as the nature and composition of the backfill materials.

9.8 Conclusions

In summary, it is concluded that there is a low to negligible risk of coal mining related issues affecting the development with the exception of the subsidence risk from the opencast backfill materials. The stability of the opencast backfill materials is also an outstanding risk where such materials form part of cut slopes when the pond is formed. However, sufficient information on ground conditions and materials properties has been gathered by the ground investigation to enable these risks to be mitigated by appropriate design.

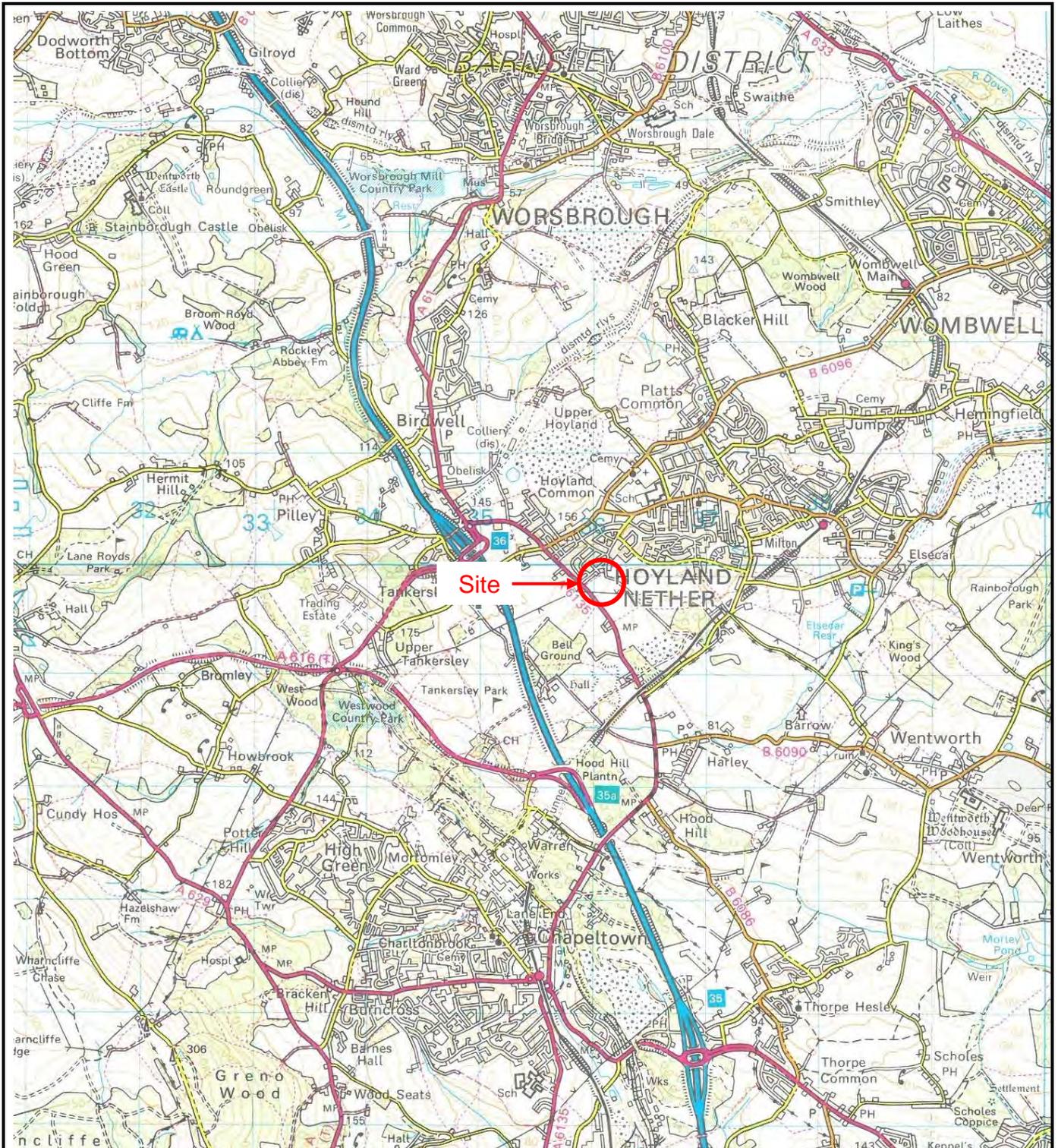
**Applied Geology Limited
Unit 23
Abbey Park
Stareton
Kenilworth
Warwickshire
CV8 2LY**

Tel: 02476 511822

GENERAL NOTES

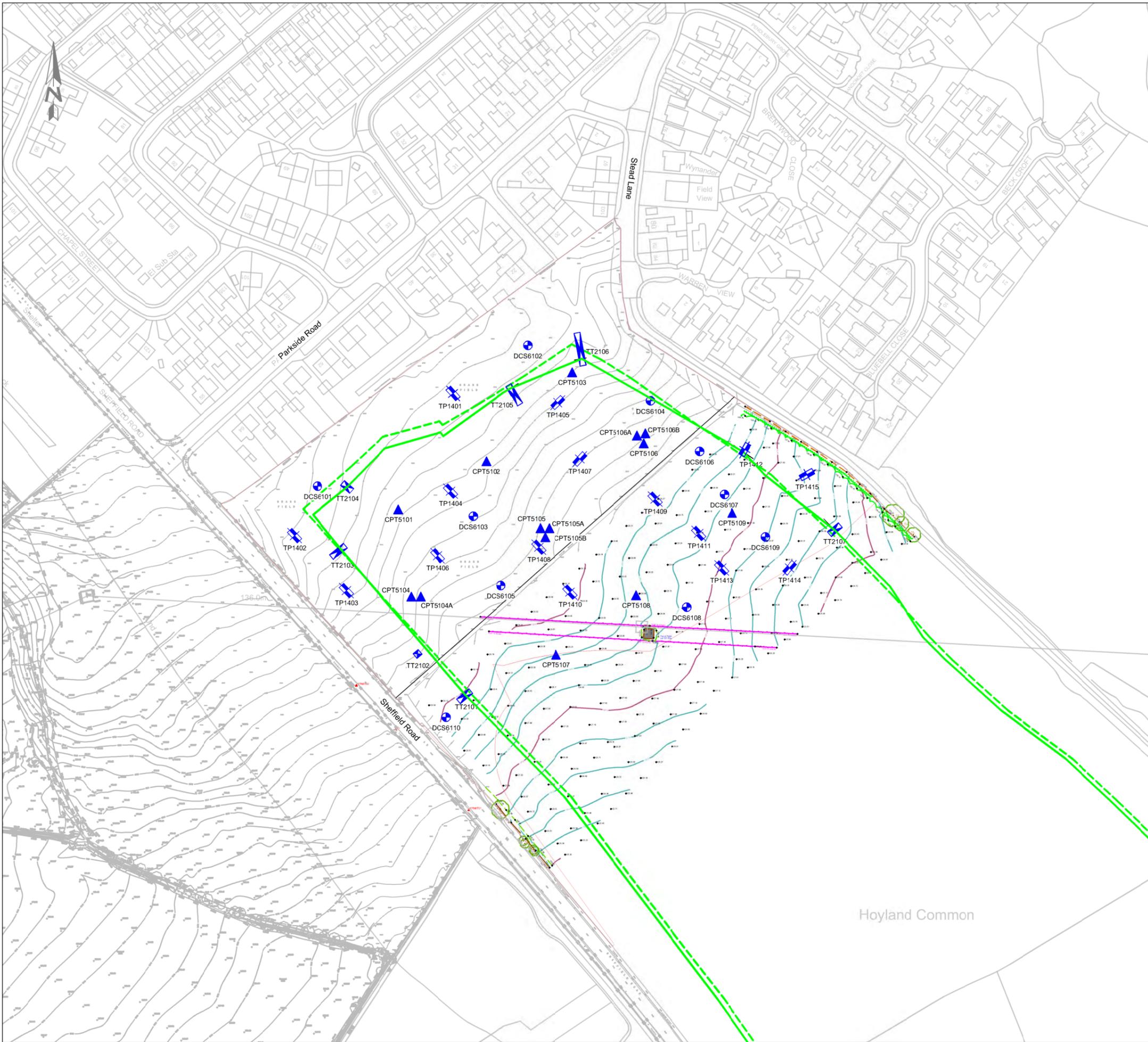
- A) The assessment made in this report is based on the site terrain and ground conditions revealed by the various field investigations undertaken and also any other relevant data for the site including previous site investigation reports (if available) and desk study data. There may be special conditions appertaining to the site, however, which have not been revealed by the investigation and which have not, therefore, been taken into account in the report. The assessment may be subject to amendment in the light of additional information becoming available. It must be recognised that many of the Environmental Searches obtained during the course of the desk study are often lengthy. Applied Geology have, where appropriate and in the interests of simplicity, only reproduced the summary of the searches within the report. A full copy of all the search data is held at the Applied Geology office and is available for inspection if required.
- B) The services provided are defined within our proposal and are carried out in line with the terms of appointment between Applied Geology and the Client.
- C) Where any data supplied by the Client or other external source, including that from previous site investigations, has been used it has been assumed that the information is correct. No responsibility can be accepted by Applied Geology for inaccuracies within this data.
- D) Whilst the report may express an opinion on possible configurations of strata between or beyond the exploratory locations, or on the possible presence of features based on either visual, verbal or published evidence this is for guidance only and no liability can be accepted for the accuracy.
- E) Comments on groundwater (and landfill gas) conditions are based on observations made during the course of the present and past investigations or with reference to published data unless otherwise stated. It should be noted, however, that groundwater (and landfill gas) levels vary due to seasonal (or atmospheric conditions) or other effects.
- F) The copyright of this report and other plans (and documents prepared by Applied Geology) is owned by Applied Geology and no such report, plan or document may be reproduced, published or adapted without the written consent of Applied Geology. Complete copies of the report may, however, be made and distributed by the Client as an expedient in dealing with matters related to its submission.
- G) This report is prepared and written in the context of the proposals stated in the introduction to the report and should not be used in a differing context. Furthermore, new information, improved practices and legislation may necessitate an alteration to the report in whole or in part after its submission. Therefore with any change in circumstances or after the expiry of one year from the date of the report, the report should be referred to Applied Geology for re-assessment and if necessary, re-appraisal.
- H) The survey was conducted and this report was prepared for the sole internal use and reliance of the Client. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Applied Geology. If an unauthorised third party comes into possession of this report they rely on it at their peril and Applied Geology owes them no duty of care and skill.
- I) Ground conditions should be monitored during the construction of the works and the recommendations of the report re-evaluated in the light of this data by the supervising geotechnical or geo-environmental engineers.
- J) Unless specifically stated, the investigation has not taken into account the possible effects of mineral extraction.
- K) The works performed are not a comprehensive site characterisation and should not be construed as being such.
- L) The findings of the geo-environmental risk assessment are based on information obtained from a variety of sources which Applied Geology believe to be correct. Applied Geology cannot and does not guarantee the authenticity or reliability of the information it has relied upon.
- M) The report represents the findings and opinions of experienced geo-environmental consultants. Applied Geology does not provide legal advice and the advice of lawyers may be required.
- N) Conditions at the site are subject to change from the time of the site inspection.
- O) It is possible that researches carried out by Applied Geology, whilst fully appropriate for a phase 1 desk study, failed to indicate the existence of important information sources. Assuming such indicators actually exist, their information could not have been considered in the formulation of Applied Geology findings and opinions.
- P) The economic viability of the proposals referred to in the report, or of the solutions put forward to any problems encountered, depends on very many factors in addition to geotechnical considerations and hence its evaluation is outside the scope of this report.
- Q) Applied Geology operates as a Consultancy and does not operate its own laboratory for soil testing, this work being sub contracted to known and respected, generally UKAS accredited, laboratories. Applied Geology can therefore not be held responsible for the testing carried out.

APPENDIX A



Reproduced from the Ordnance Survey Map with permission of the Controller of Her Majesty's Stationery Office, Crown Copyright* LICENCE No: 100055022

APPLIED GEOLOGY Unit 23 Abbey Park Stareton Kenilworth CV8 2LY Tel: 02476 511822 email: admin@appliedgeology.co.uk			Client: 
			Project: PARKSIDE, HOYLAND COMMON, BARNESLEY
Drawn By: FD	Checked By: SD	Paper Size: A4	Title: SITE LOCATION PLAN
Scale: NTS	Date: 10.08.2020	NGR: 436069 99771	
Drawing No: AG3080D-20-01		Revision: 0	



KEY:

-  Trial Pit
- TP1401
-  Trial Trench
- TT2101
-  Driven Continuous Sampling Borehole
- DCS6101
-  Cone Penetration Test
- CPT5101
-  Extent of Opencast Workings- taken from Abandonment Plan ref. NE419_99 9999 2 of 5
-  Interpreted Extent of Opencast Workings Based on Trial Trench Findings and Coal Authority Abandonment Plans

Drawing based on Stafsuv, drawing No: 11143a dated 18/08/2020.

APPLIED GEOLOGY

Unit 23
Abbey Park
Stareton
Kenilworth
CV8 2LY

Tel: 02476 511822
email: admin@appliedgeology.co.uk

Client:



Project:

PARKSIDE, HOYLAND COMMON, BARNSELY

Title:

EXPLORATORY HOLE LOCATION PLAN

Drawn By:

FD

Checked By:

SD

Paper Size:

A3

Scale:

1:2000

Date:

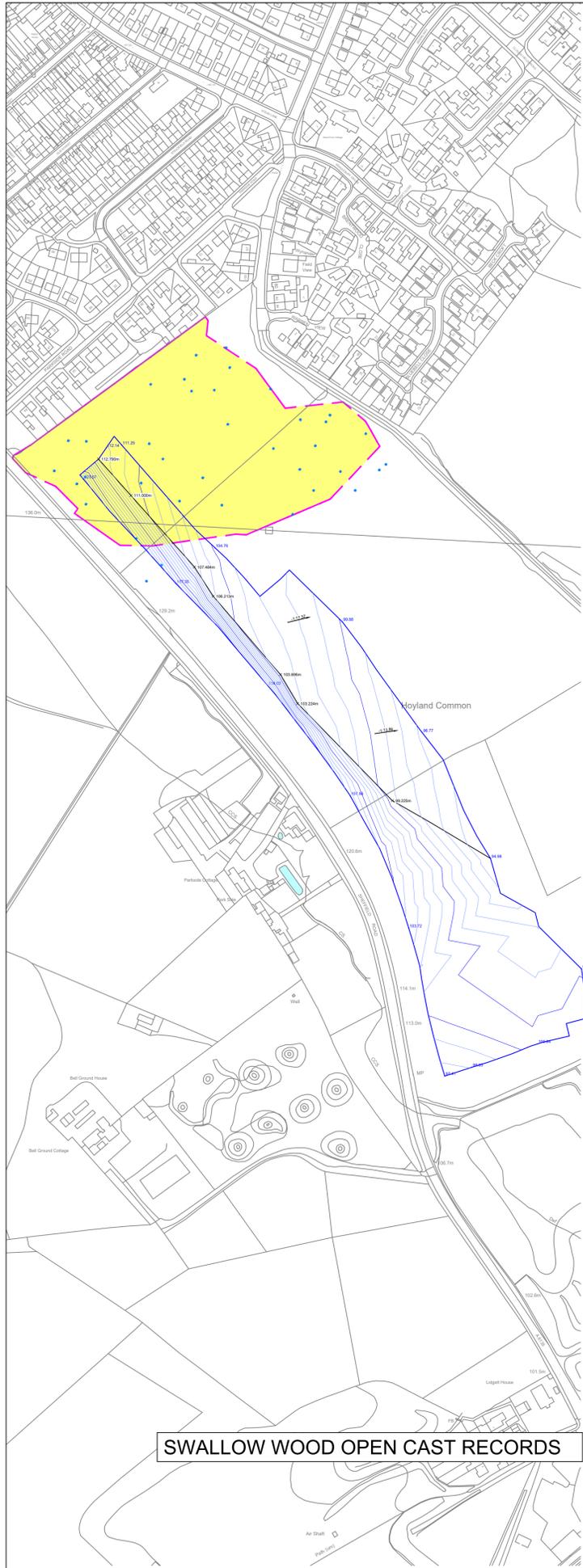
28.09.2020

Drawing No:

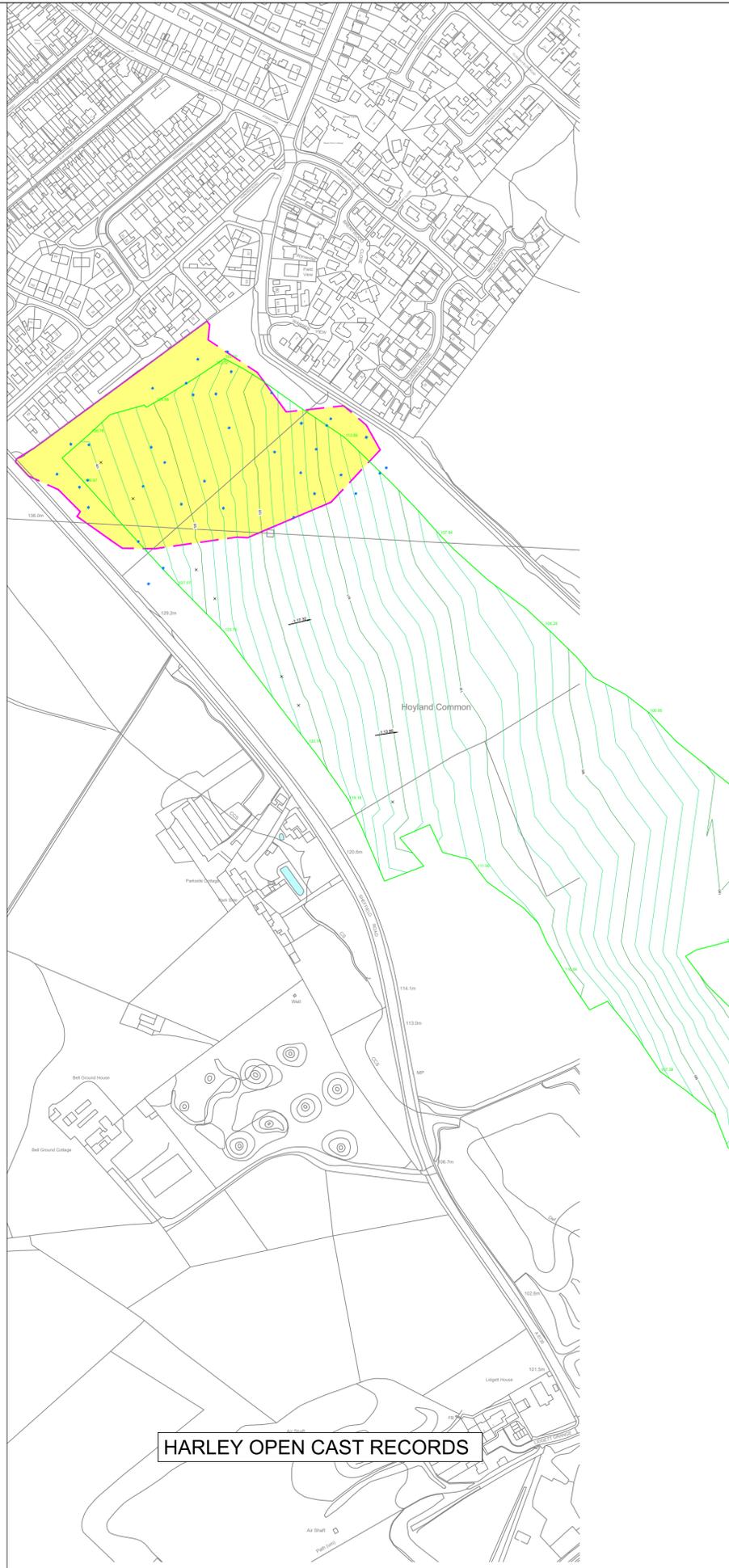
AG3080D-20-02

Revision:

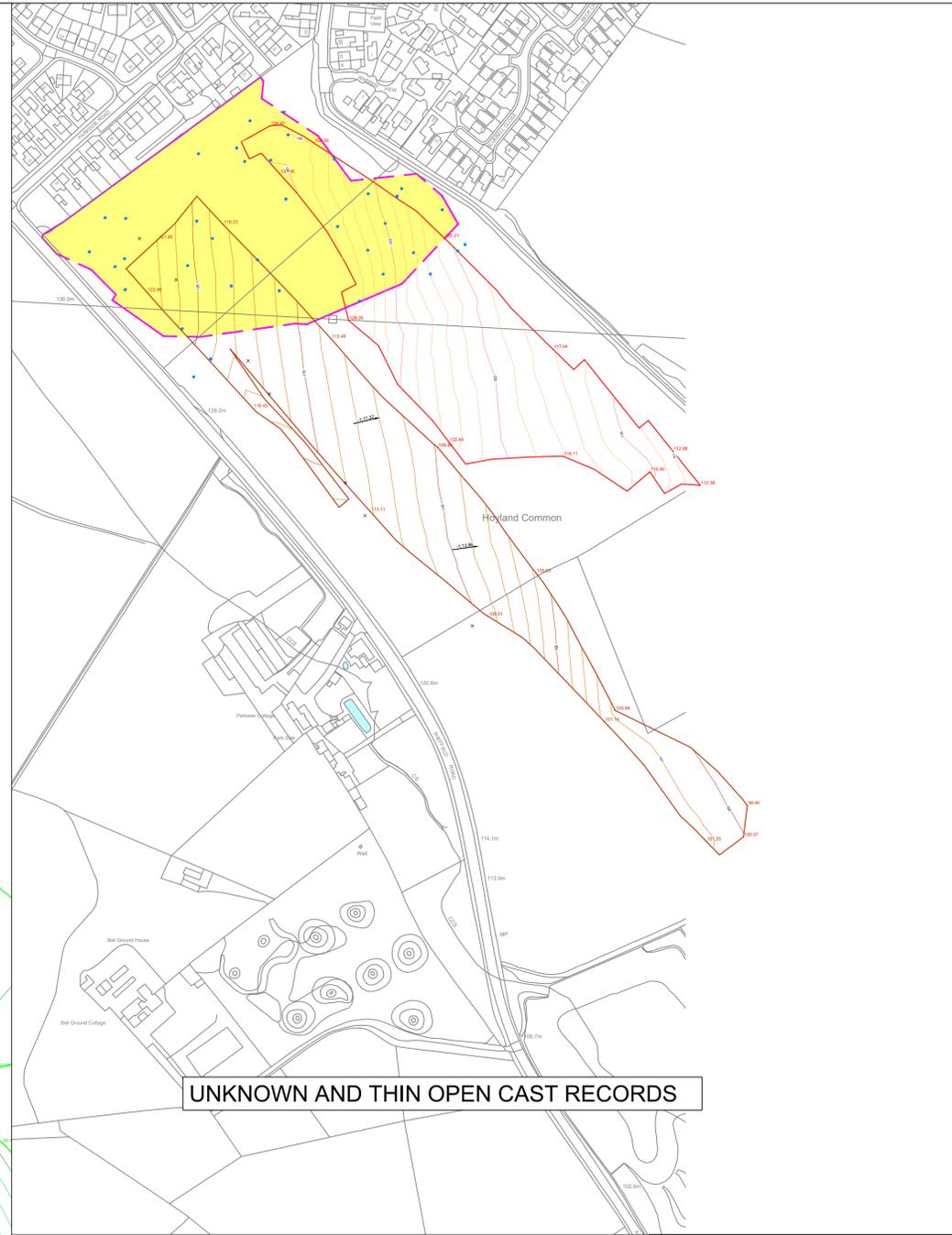
0



SWALLOW WOOD OPEN CAST RECORDS



HARLEY OPEN CAST RECORDS



UNKNOWN AND THIN OPEN CAST RECORDS

LOCATION
 1:2500 SCALE ORDNANCE SHEET REFERENCE 282 18 + 12
 DATE OF ORDNANCE SHEET 1931
 NAME OF SITE STEAD LANE
 LOCATION OF SITE 6 MILES S.E. of BARNSELY
 COUNTY YORKSHIRE
 PARISH HOYLAND NATHER

QUANTITIES WORKED
 TOTAL AREA REQUISITIONED 78.811 ACRES SHEWN
 TOTAL AREA WORKED EXCLUDING BATTERS 46.21 ACRES
 TOTAL COAL RECOVERED FROM ABOVE 168,769 TONS

NAMES OF SEAMS WORKED FOR ABOVE TONNAGE (SEAMS NAMED FROM LEFT TO RIGHT IN GEOLOGICAL DESCENDING ORDER)
 AREA OF COAL SEAM WORKED COLOUR EGGED (SEAMS COLOURED FROM LEFT TO RIGHT IN GEOLOGICAL DESCENDING ORDER)
 TOTAL OLD WORKING VOIDS IN COAL SEAM IN CUBIC YDS.
 AREA OF SEAM WHERE OLD WORKING VOIDS WERE LOCATED

UNIDENTIFIED	THICK	THIN	SHALLOW
█	█	█	█

DIP AND DIRECTION OF EACH SEAM SHEWN

REDUCED LEVELS TO ORDNANCE DATUM SHEWN (GROUND LEVEL BOTTOM OF COAL)
 (RELATIVE TO NEWLYM) 61.445 D 61.447 I 61.448 B 61.444 S
 61.433 B 61.433 S 61.400 I 61.367 D

FAULTS SHEWN WITH THROW IN FEET ON DOWNTROW SIDE

 INDICATES SPORTS FIELD DEVELOPMENT EXTENTS

APPLIED GEOLOGY
 Unit 23
 Abbey Park
 Stareton
 Kenilworth
 CV8 2LY
 Tel: 02476 511822
 Fax: 02476 697682
 email: admin@appliedgeology.co.uk

Client: **newlands developments**

Project: PARKSIDE, HOYLAND COMMON, BARNSELY

Title: COAL AUTHORITY OPENCAST RECORDS CONVERTED TO METERS ABOVE ORDNANCE DATUM (AOD)

Drawn By: SB Checked By: FC Paper Size: A1
 Scale: NTS Date: 10.11.2020
 Drawing No: AG3080D-20-04 Revision: 0



2.4m high Paladin (weldmesh) Fencing Dark Green RAL.6005, to boundary

Notes;

To enable the archery club to have a continuous use it is proposed to undertake the works as indicated in two phases.

Phase 1 will comprise;

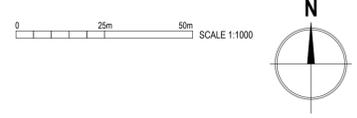
- Undertake site clearance to form new entrance off Sheffield Road;
- Provide a temporary surfaced access way and car park area;
- Undertake earthworks and re-modelling to create plateaus for new archery zone area and sports pitches.
- Subject to the timing of the land exchange the archery area is proposed to be part turfed (to the archery runs) and part grass seeded to the remainder.
- The provision of new archery zone will be located on the lower plateau.
- Provide container storage.

Phase 2 will comprise;

- Finalise clearance and earthworks re-modelling to create required level plateau for sports pitches
- playing areas to be left with a topsoil surface ready to receive seeding/turf as part of BMBC phase of works;
- Form new permanent entrance off Sheffield Road together with underground electricity and surface and foul water supplies to serve the future community building;



Revision:		
P1	first issue	12aug2020 PL
P2	boundary fence type noted	18aug2020 PL
P3	updated as required	19aug2020 PL
P4	rps contours indicated	04nov2020 PL



Hoyland Common
Barnsley M1, J36



php Architects
www.peter-haddon.com
Land for Sports Facilities
Proposed Phase 1 and Phase 2 works
Drawing Status: Preliminary
CAD Reference: 4400-001
Drawn: PL
Date: feb2020
Scale @A1: 1/1000
Project No: 4400
Drawing No: SP002
Rev: P4

This drawing, the works and concepts depicted are copyright of the consultant and may not be reproduced or made use of, either directly or indirectly without express written consent. All heights, levels, sizes and dimensions to be checked on-site before any work is put to hand.

- Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
 2. If received electronically it is the recipient's responsibility to print to correct scale. Only written dimensions should be used.
 3. This drawing should be read in conjunction with all other relevant drawings and specifications.

- Key:
- + 130.500 : Proposed Level
 - 1.6 : Proposed Gradient
 - Major Contour 0.5m Intervals
 - Minor Contour 0.1m Intervals



P01	First Issue	ST	AE	20.08.20
Rev	Description	By	Ckd	Date



Sherwood House, Sherwood Avenue,
Newark, Nottinghamshire, NG24 1QQ
T:01636 605 700 E: rpsnewark@rpsgroup.com



Client **Hoyland**

Title **Sports Facility
Proposed Levels**

RPS Project Number	Scale @ A1	Date Created
NK020040	1:500	20.08.2020
Task Team Manager	Information Author	Task Information Manager
SG	ST	AE

Status **S2 (Suitable for Information)**

Document Number	Revision
HOYLA-RPS-SI-XX-DR-C-1651	P01

Project Code - Originator - Zone - Level - Type - Role - Drawing Number
rpsgroup.com

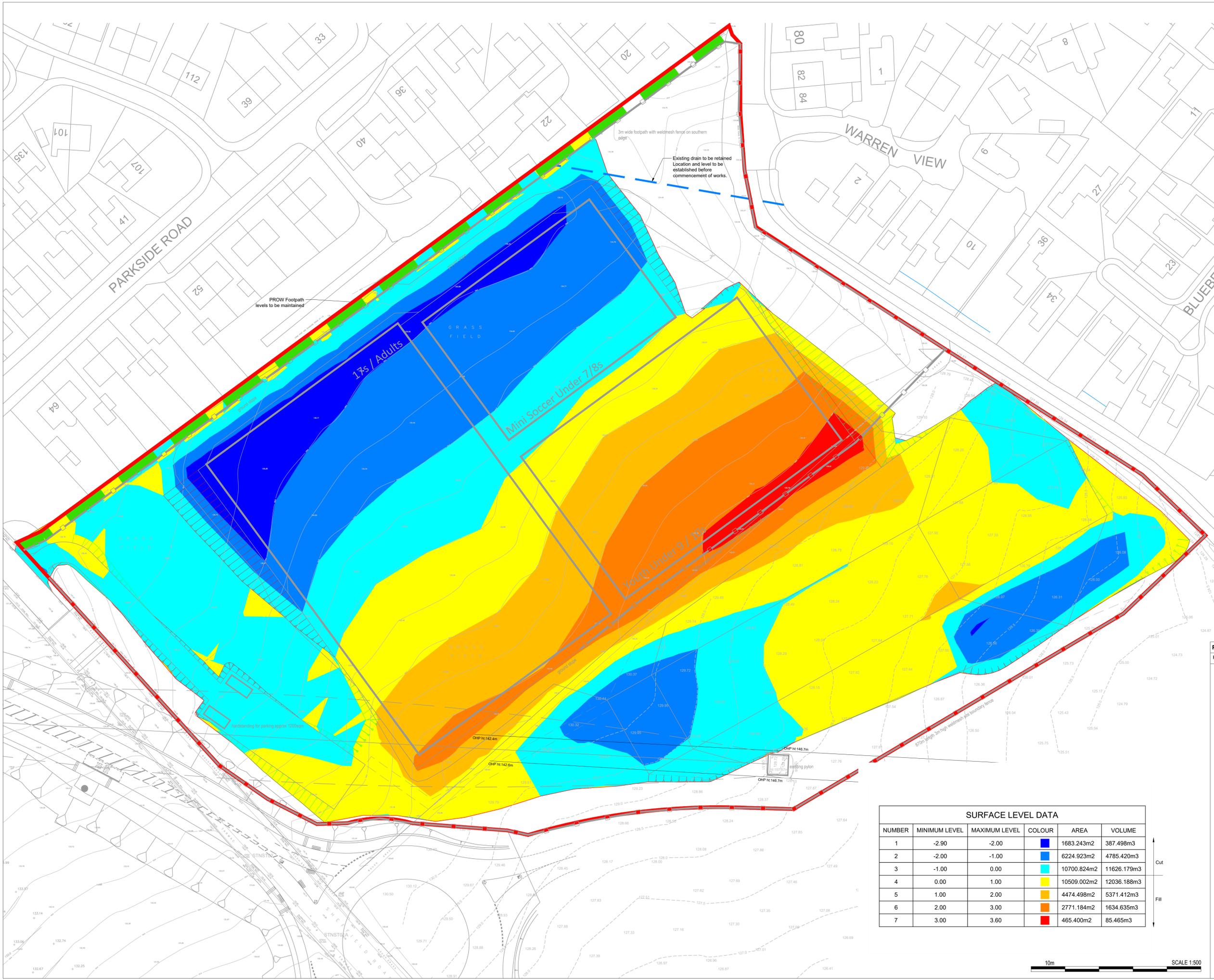
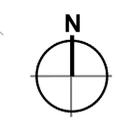


- Notes
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
 2. If received electronically it is the recipient's responsibility to print to correct scale. Only written dimensions should be used.
 3. This drawing should be read in conjunction with all other relevant drawings and specifications.

Design Assumptions

1. This drawing is based on Greenhatch Survey Z001_30326_T_REV0 Topo
2. The Cut and Fill analysis on this drawing is based on the Proposed Finished Floor Levels indicated on RPS drawing HOYLA-RPS-SI-XX-DR-C-1651.
3. The Cut and Fill analysis is based on a general construction depth of 450mm for car park and access road.
4. No allowance has been made for a site strip.
5. No bulking factors have been applied to the figures below.
6. No allowance has been made for drainage or foundation arisings
7. Cut & Fill volumes:

Total cut	= 16,799m³
Total Fill	= 19,128m³
Net (Deficit)	= 2,329m³



NUMBER	MINIMUM LEVEL	MAXIMUM LEVEL	COLOUR	AREA	VOLUME
1	-2.90	-2.00	Blue	1683.243m2	387.498m3
2	-2.00	-1.00	Light Blue	6224.923m2	4785.420m3
3	-1.00	0.00	Cyan	10700.824m2	11626.179m3
4	0.00	1.00	Yellow	10509.002m2	12036.188m3
5	1.00	2.00	Orange	4474.498m2	5371.412m3
6	2.00	3.00	Dark Orange	2771.184m2	1634.635m3
7	3.00	3.60	Red	465.400m2	85.465m3

Cut
Fill



P01	First Issue	ST	AE	20.08.20
Rev	Description	By	Ckd	Date



Sherwood House, Sherwood Avenue,
Newark, Nottinghamshire, NG24 1QQ
T:01636 605 700 E: rpsnewark@rpsgroup.com



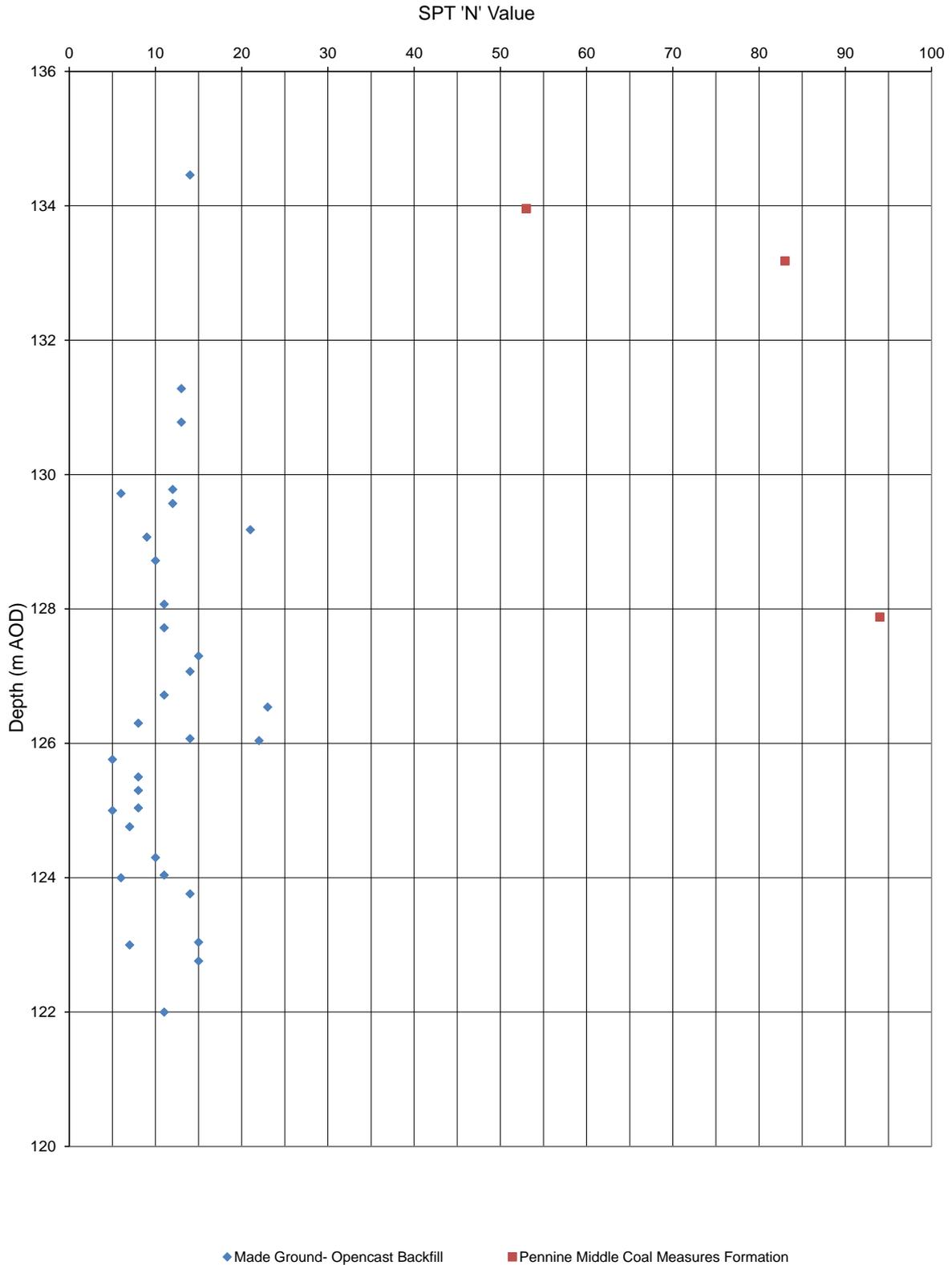
Project **Hoyland**

Title **Sports Facility Earthwork Volumes**

RPS Project Number **NK020040** Scale @ A1 **1:500** Date Created **20.08.2020**
Task Team Manager **SG** Information Author **ST** Task Information Manager **AE**

Status **S2 (Suitable for Information)**
Document Number **HOYLA-RPS-SI-XX-DR-C-1650** Revision **P01**
Project Code - Originator - Zone - Level - Type - Role - Drawing Number
rpsgroup.com

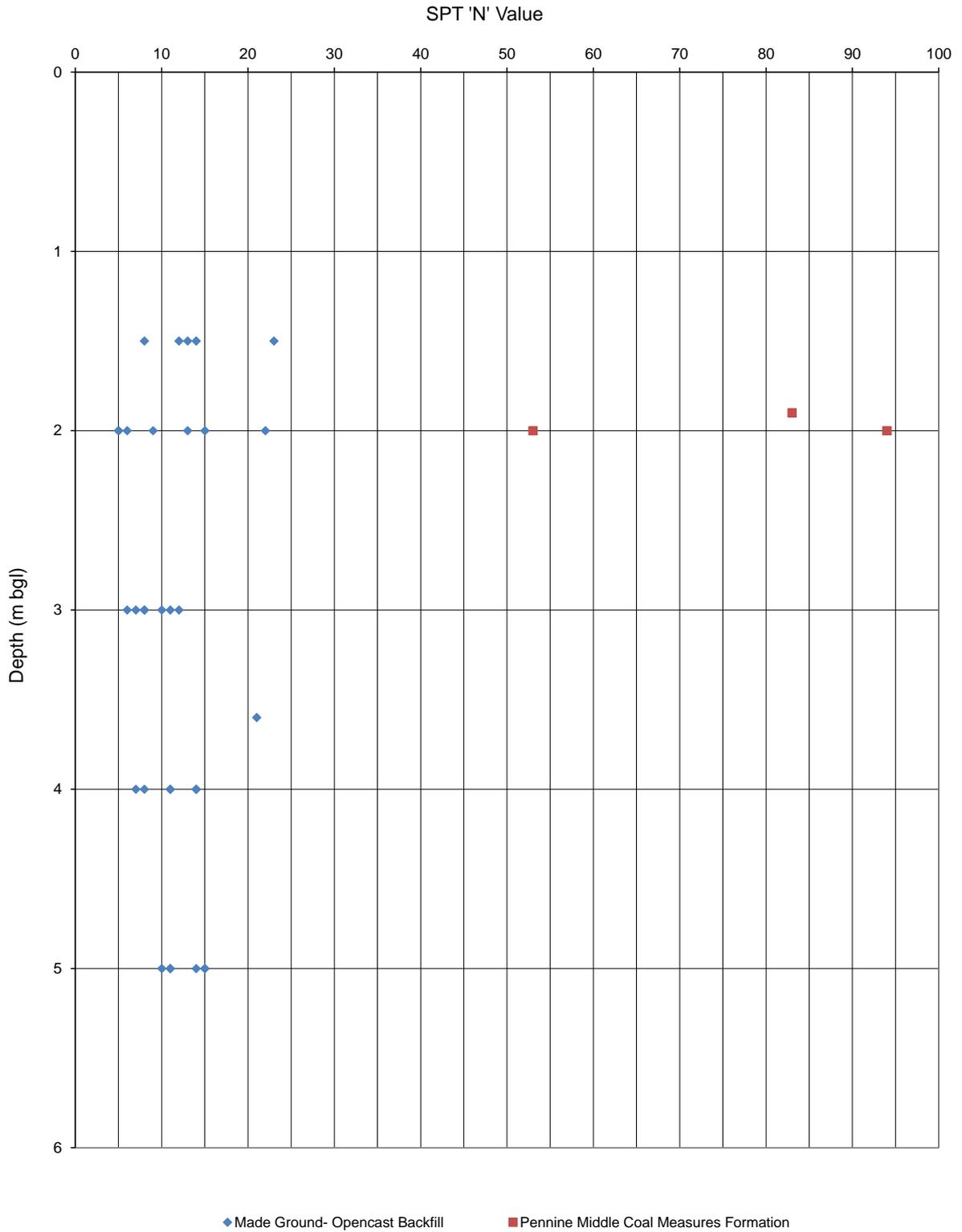
Uncorrected SPT 'N' Value versus depth (m AOD)



Notes: 1. Values >50 have been extrapolated.

Client:	Newlands Developments	APPLIED GEOLOGY
Project:	Parkside, Hoyland Common, Barnsley	
Project No.:	AG3080D-20	

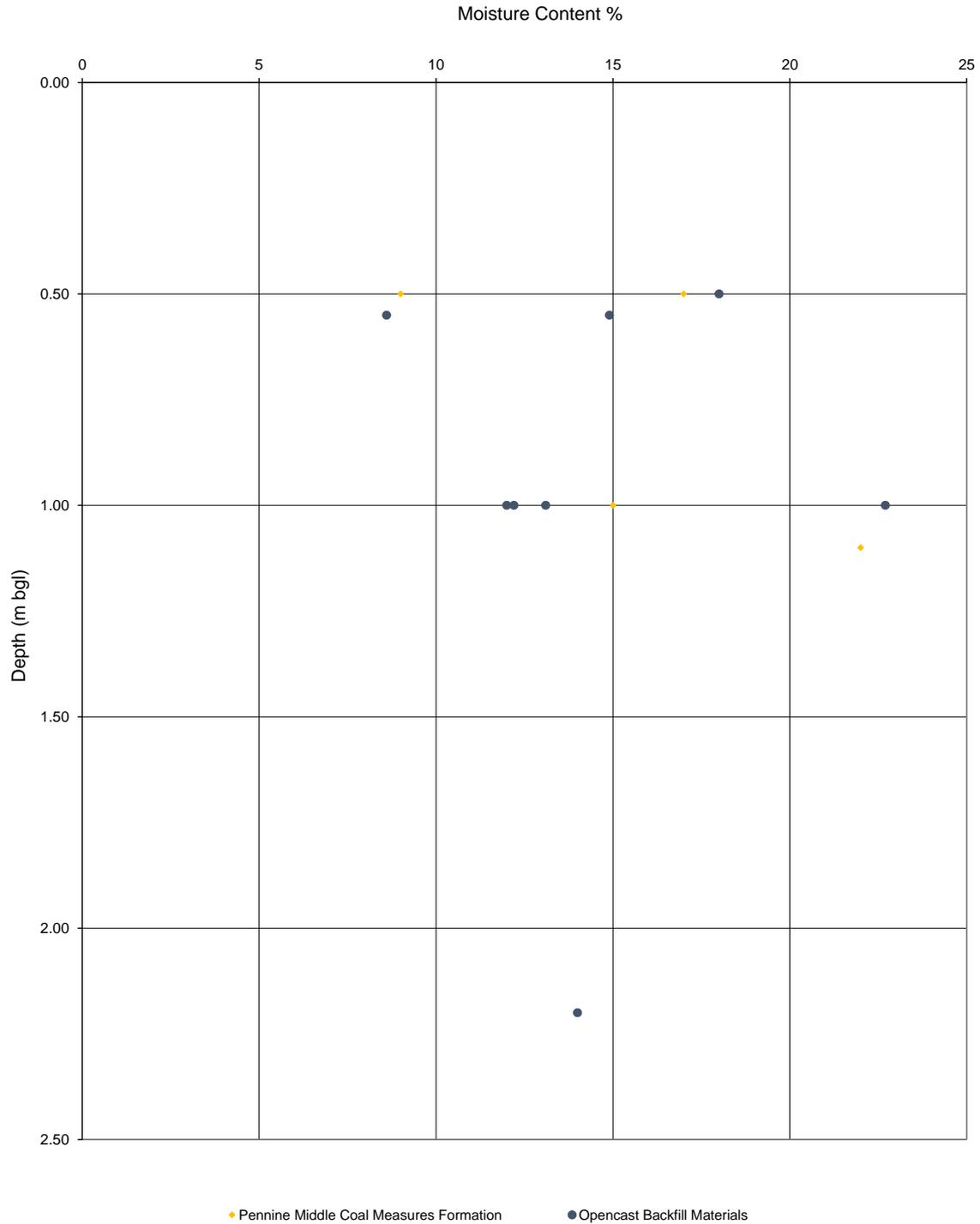
Uncorrected SPT 'N' Value versus depth (m bgl)



Notes: 1. Values >50 have been extrapolated.

Client:	Newlands Developments	APPLIED GEOLOGY
Project:	Parkside, Hoyland Common, Barnsley	
Project No.:	AG3080D-20	

Moisture Content Versus Depth Plot (m bgl)

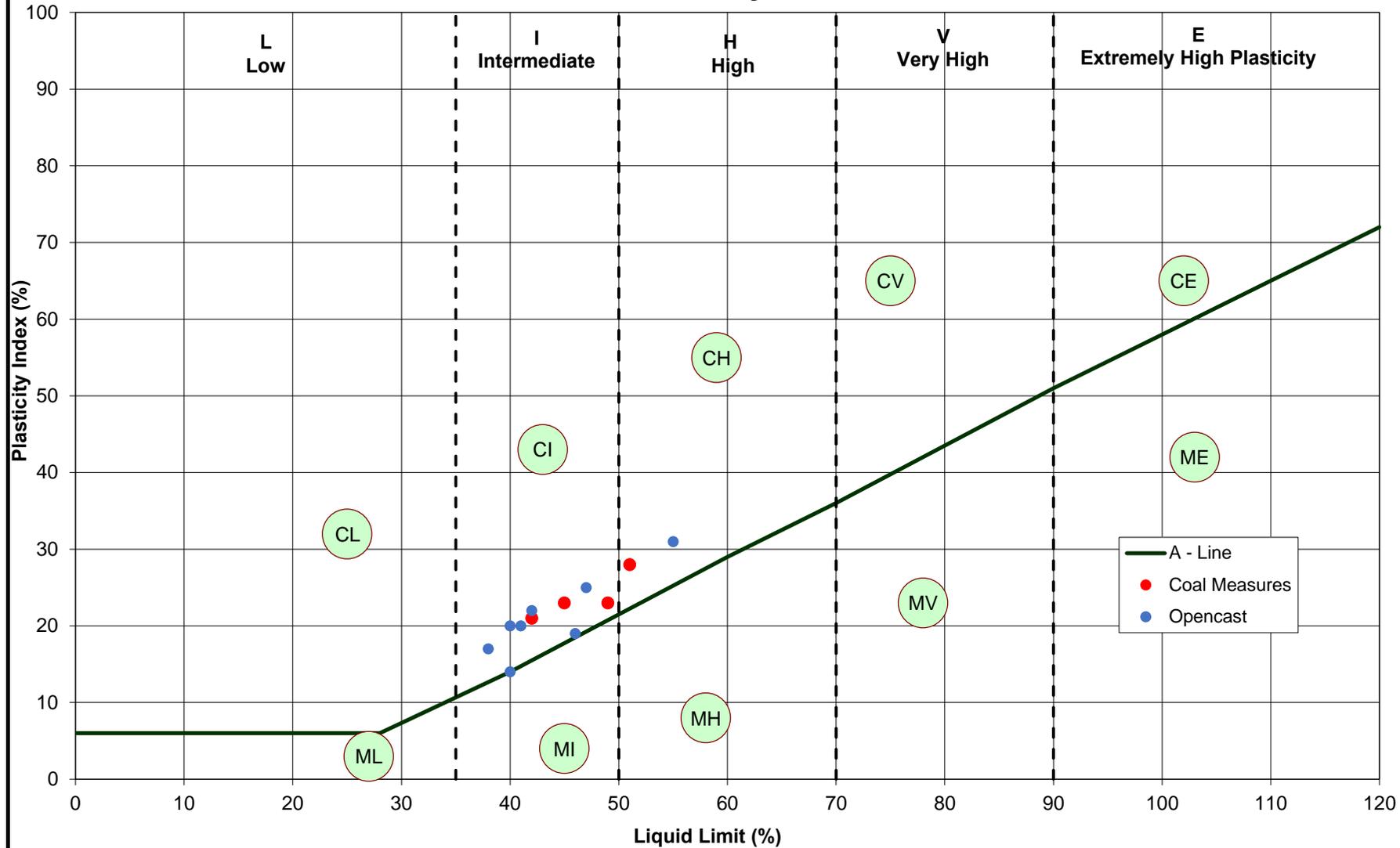


Notes:

Client:	Newlands Developments
Project:	Parkside, Hoyland Common, Barnsley
Project No.:	AG3080D-20

APPLIED GEOLOGY

Plasticity Chart

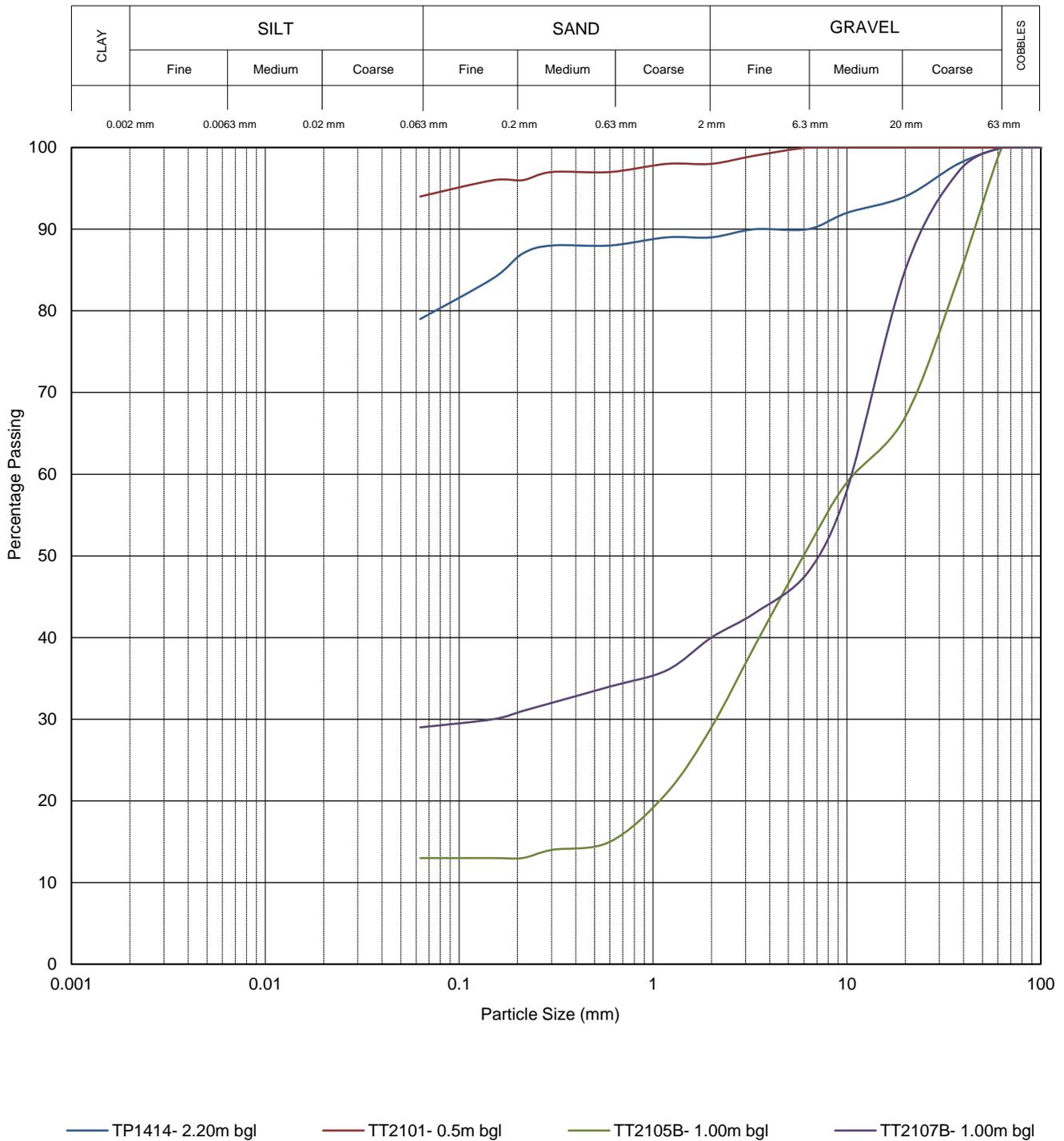


Client:	Newlands Developments
Project:	Parkside, Hoyland Common, Barnsley
Project No.:	AG3080D-20

APPLIED GEOLOGY

Determination of Particle Size Distribution- Made Ground Opencast Backfill

BS1377 : Part 2 : Clause 9.2 : 1990 Wet Sieving Method
 BS1377 : Part 2 : Clause 9.3 : 1990 Pipette Sedimentation

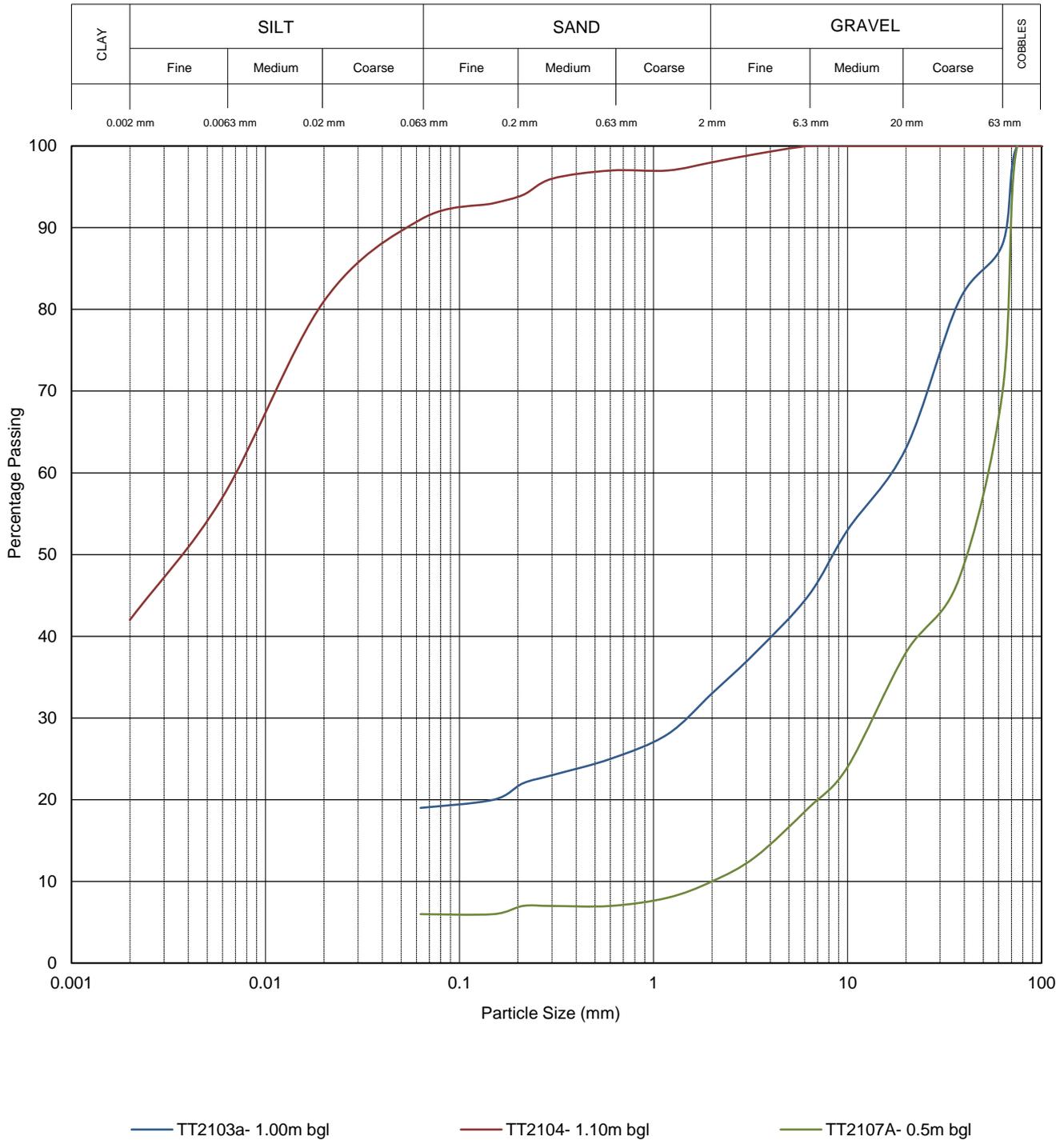


Client:	Newlands Developments
Project:	Parkside, Hoyland Common, Barnsley
Project No.:	AG3080D-20

APPLIED GEOLOGY

Determination of Particle Size Distribution- Pennine Middle Coal Measures Formation

BS1377 : Part 2 : Clause 9.2 : 1990 Wet Sieving Method
 BS1377 : Part 2 : Clause 9.3 : 1990 Pipette Sedimentation



Client:	Newlands Developments
Project:	Parkside, Hoyland Common, Barnsley
Project No.:	AG3080D-20

APPLIED GEOLOGY

APPENDIX B

TRIAL PIT LOG

TP1401

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Date 23/09/2020

Scale

1:25

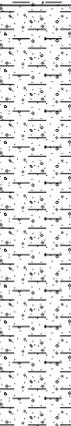
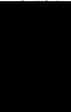
Ground Level 134.98m AOD

Coordinates

E 436012.61 N 399847.32

Total Depth

3.00m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
D ES	0.50 0.50		134.68	(0.30) 0.30		Firm brown slightly gravelly sandy CLAY with frequent rootlets. Gravel is fine to medium subangular to subrounded mudstone, siltstone and coal. (TOPSOIL)		
				(0.60)		Stiff greyish brown slightly gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. (PENNINE MIDDLE COAL MEASURES FORMATION)		
B D ES	1.50 1.50 1.50		134.08	0.90		Stiff to very stiff light brown and grey slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone, ironstone and coal. (PENNINE MIDDLE COAL MEASURES FORMATION)		
				(1.40)				
D	2.50		132.68	2.30		Black GRAVEL of fine to coarse angular to subangular clarin-vitrain coal. (PENNINE MIDDLE COAL MEASURES FORMATION)		
				(0.40)				
D ES	3.00 3.00		132.28	2.70		Very stiff light brown and grey slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. (PENNINE MIDDLE COAL MEASURES FORMATION)		
				(0.30)				
			131.98	3.00		End of Trial Pit at 3.00m		

Method: 21T Tracked Excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion.

Length:	2.50m
Width:	0.80m
Logged:	JW
Checked:	

TRIAL PIT LOG

TP1402

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Date 24/09/2020

Scale

1:25

Ground Level 136.04m AOD

Coordinates

E 435928.26 N 399771.72

Total Depth

2.70m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(0.30)		Firm brown slightly gravelly sandy CLAY with frequent rootlets. Gravel is fine to medium subangular to subrounded mudstone and siltstone. (TOPSOIL)		
			135.74	0.30				
D ES	0.60 0.60			(0.70)		Stiff light grey and light brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. (PENNINE MIDDLE COAL MEASURES FORMATION)		
			135.04	1.00				
B D ES	1.30 1.30 1.30			(1.00)		Stiff light grey and light brown sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. (PENNINE MIDDLE COAL MEASURES FORMATION)		
			134.04	2.00				
D	2.30			(0.70)		Extremely weak locally medium strong closely to medium spaced fractured grey and dark brown SILTSTONE with thin bands of firm to stiff clay. Recovered as gravel with frequent tabular cobbles of siltstone. Gravel is fine to coarse angular to subrounded mudstone and siltstone. (PENNINE MIDDLE COAL MEASURES FORMATION)		
			133.34	2.70		End of Trial Pit at 2.70m		

Method: 21t Tracked excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion.

Length:	2.50m
Width:	0.70m
Logged:	JW
Checked:	

TRIAL PIT LOG

TP1403

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Date 24/09/2020

Scale

1:25

Ground Level 134.49m AOD

Coordinates

E 435955.92 N 399742.49

Total Depth

3.00m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(0.35)		Firm brown slightly gravelly sandy CLAY with frequent rootlets. Gravel is fine to coarse subangular to subrounded mudstone, siltstone and coal. (TOPSOIL)		
B	0.60		134.14	0.35		Stiff light grey and light brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. (PENNINE MIDDLE COAL MEASURES FORMATION)		
D ES	1.20 1.20			(1.15)				
			132.99	1.50		Stiff light grey and brown sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. (PENNINE MIDDLE COAL MEASURES FORMATION)		
B	2.00			(0.70)				
			132.29	2.20		Extremely weak locally medium strong closely to medium spaced fractured grey and dark brown SILTSTONE with thin bands of firm to stiff clay. Recovered as gravel with frequent tabular cobbles of siltstone. Gravel is fine to coarse angular to subrounded mudstone and siltstone. (PENNINE MIDDLE COAL MEASURES FORMATION)		
D	3.00		131.49	3.00				
						End of Trial Pit at 3.00m		

Method: 21T Tracked excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion.

Length:	2.50m
Width:	0.80m
Logged:	JW
Checked:	

TRIAL PIT LOG

TP1404

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Date 22/09/2020

Scale

1:25

Ground Level 133.42m AOD

Coordinates

E 436011.30 N 399795.36

Total Depth

1.80m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
ES	0.40		133.17	(0.25)		Firm friable dark brown slightly gravelly sandy silty CLAY with frequent rootlets. Gravel is fine to coarse angular to subangular siltstone and rare coal. (TOPSOIL/MADE GROUND)		
				0.25		Firm to stiff locally friable dark grey, greyish brown and grey slightly sandy gravelly to very gravelly silty CLAY with occasional to frequent cobbles. Gravel is fine to coarse subangular siltstone, mudstone and rare sandstone/ironstone. Cobbles are subangular of siltstone. (MADE GROUND - OPENCAST BACKFILL)		
D	0.70							
ES	1.20			(1.55)				
B	1.50							
D	1.50							
			131.62	1.80		End of Trial Pit at 1.80m		

Method: Tracked Excavator

Groundwater: Groundwater not encountered.

Stability: Good.

Remarks: Trial pit used for soakaway test and backfilled with arisings on completion.

Length:	2.80m
Width:	0.60m
Logged:	FC
Checked:	

TRIAL PIT LOG

TP1405

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Date 23/09/2020

Scale

1:25

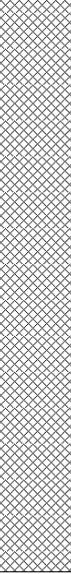
Ground Level 133.15m AOD

Coordinates

E 436068.40 N 399842.41

Total Depth

3.40m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(0.30)		Firm brown slightly gravelly sandy CLAY with frequent rootlets. Gravel is fine to medium subangular to subrounded mudstone and siltstone. (TOPSOIL)		
			132.85	0.30		Stiff grey and light brown slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. Occasional angular to subrounded cobbles of mudstone. (MADE GROUND - OPENCAST BACKFILL)		
D ES	0.70 0.70			(1.20)				
D	1.30							
			131.65	1.50		Stiff grey and light brown sandy very gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone, coal and ironstone. (MADE GROUND - OPENCAST BACKFILL)		
B	2.00							
				(1.90)				
B	3.00							
			129.75	3.40		End of Trial Pit at 3.40m		

Method: 21T Tracked excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion.

Length:	2.50m
Width:	0.80m
Logged:	JW
Checked:	

TRIAL PIT LOG

TP1406

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Date 24/09/2020

Scale

1:25

Ground Level 132.51m AOD

Coordinates

E 436004.31 N 399761.04

Total Depth

3.60m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
D	0.50		132.26	(0.25)		Firm brown slightly gravelly sandy CLAY with frequent rootlets. Gravel is fine to medium subangular to subrounded mudstone and coal. (TOPSOIL)		
				0.25		Stiff brown and grey slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone, coal and ironstone. (MADE GROUND - OPENCAST BACKFILL)		
B	1.50		131.91	(0.35)		Stiff brown and grey slightly sandy very gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. Frequent cobbles of angular to subrounded mudstone. (MADE GROUND - OPENCAST BACKFILL)		
				0.60				
D	2.50			(1.10)				
			130.81	1.70		Grey sandy very clayey GRAVEL with frequent cobbles. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. Cobbles are angular to subrounded mudstone and siltstone. (MADE GROUND - OPENCAST BACKFILL)		
B	3.50		128.91	(1.90)				
				3.60		End of Trial Pit at 3.60m		

Method: 21T Tracked excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion.

Length:	2.50m
Width:	0.80m
Logged:	JW
Checked:	

TRIAL PIT LOG

TP1407

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Date 23/09/2020

Scale

1:25

Ground Level 131.25m AOD

Coordinates

E 436080.15 N 399812.44

Total Depth

4.00m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
D	0.20			(0.30)		Firm brown slightly gravelly sandy CLAY with frequent rootlets. Gravel is fine to medium subangular to subrounded mudstone and siltstone. (TOPSOIL)		
ES	0.20		130.95	0.30				
D	1.00			(1.40)		Stiff grey and light brown slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. Occasional cobbles of angular to subrounded mudstone. (MADE GROUND - OPENCAST BACKFILL)		
B	1.50		129.55	1.70				
D	2.50			(2.30)		Stiff grey and light brown sandy very gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone, ironstone and coal. Frequent cobbles of angular to subrounded mudstone. (MADE GROUND - OPENCAST BACKFILL)		
B	3.50		127.25	4.00				
						End of Trial Pit at 4.00m		

Method: 21T Tracked excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion.

Length:	2.50m
Width:	0.80m
Logged:	JW
Checked:	

TRIAL PIT LOG

TP1408

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Date 23/09/2020

Scale

1:25

Ground Level 130.92m AOD

Coordinates

E 436058.27 N 399765.54

Total Depth

3.70m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
D ES	0.20 0.20		130.57	(0.35)		Firm brown slightly gravelly sandy CLAY with frequent rootlets. Gravel is fine to medium subangular to subrounded mudstone, brick and coal. (TOPSOIL/MADE GROUND)		
D	0.60		130.12	(0.45)		Stiff brown and grey sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. (MADE GROUND - OPENCASST BACKFILL)		
B	1.50			(2.90)		Stiff brown and grey slightly sandy very gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, ironstone and coal. Frequent cobbles of angular to subrounded mudstone. (MADE GROUND - OPENCASST BACKFILL)		
B	2.50		127.22	3.70		End of Trial Pit at 3.70m		

Method: 21T Tracked excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion.

Length:	2.50m
Width:	0.80m
Logged:	JW
Checked:	

TRIAL PIT LOG

TP1409

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Date 24/09/2020

Scale

1:25

Ground Level 129.34m AOD

Coordinates

E 436120.13 N 399791.12

Total Depth

4.60m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(0.25)		Firm brown slightly gravelly sandy CLAY with frequent rootlets. Gravel is fine to medium subangular to subrounded mudstone, coal and brick. (TOPSOIL/MADE GROUND)		
			129.10	0.25				
D	0.40			(0.35)		Stiff brown and grey slightly sandy slightly gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, coal and ironstone. (MADE GROUND - OPENCAST BACKFILL)		
ES	0.40							
D	0.50		128.74	0.60		Stiff brown and grey slightly sandy very gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. Frequent cobbles of angular to subrounded mudstone and siltstone. (MADE GROUND - OPENCAST BACKFILL)		
B	1.50							
D	2.50			(4.00)				
D	3.50							
			124.74	4.60		End of Trial Pit at 4.60m		

Method: 21T Tracked excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion.

Length:	2.50m
Width:	0.80m
Logged:	JW
Checked:	

TRIAL PIT LOG

TP1410

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Date 24/09/2020

Scale

1:25

Ground Level 130.16m AOD

Coordinates

E 436074.98 N 399741.67

Total Depth

3.70m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
D ES	0.20		129.92	(0.25)		Firm brown slightly gravelly sandy CLAY with frequent rootlets. Gravel is fine to medium subangular to subrounded mudstone, brick, siltstone and coal. (TOPSOIL/MADE GROUND)		
	0.20			0.25		Stiff brown and grey slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. (MADE GROUND - OPENCAST BACKFILL)		
D ES	0.80			(1.35)				
	0.80							
B	1.80		128.56	1.60		Stiff grey slightly sandy very gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone, ironstone and coal. Frequent cobbles of angular to subrounded siltstone. (MADE GROUND - OPENCAST BACKFILL)		
				(1.00)				
D ES	2.80		127.56	2.60		Grey sandy very clayey GRAVEL of fine to coarse angular to subrounded mudstone, siltstone and coal. Frequent cobbles of angular to subrounded mudstone. (MADE GROUND - OPENCAST BACKFILL)		
	2.80			(1.10)				
B	3.50							
			126.46	3.70		End of Trial Pit at 3.70m		

Method: 21T Tracked excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion.

Length:	2.50m
Width:	0.80m
Logged:	JW
Checked:	

TRIAL PIT LOG

TP1411

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Date 24/09/2020

Scale

1:25

Ground Level 128.20m AOD

Coordinates

E 436143.30 N 399772.86

Total Depth

4.00m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(0.30)		Firm brown slightly gravelly sandy CLAY with frequent rootlets. Gravel is fine to coarse subangular to subrounded mudstone. (TOPSOIL)		
D	0.50		127.90	0.30		Firm becoming stiff brown and grey gravelly sandy CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone, coal and ironstone. (MADE GROUND - OPENCAST BACKFILL)		
ES	0.50			(0.80)				
B	1.00		127.10	1.10		Stiff grey slightly sandy very gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. Frequent cobbles of angular to subrounded mudstone and siltstone. (MADE GROUND - OPENCAST BACKFILL)		
D	2.00			(2.90)				
B	3.00							
			124.20	4.00		End of Trial Pit at 4.00m		

Method: 21T Tracked excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion.

Length:	2.50m
Width:	0.80m
Logged:	JW
Checked:	

TRIAL PIT LOG

TP1412A

Project Parkside, Hoyland Common, Barnsley

Project No. AG3080D-20

Client Newlands Developments

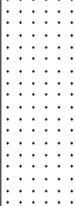
Sheet 1 of 1

Date 22/09/2020

Scale 1:25

Ground Level 128.50m AOD **Coordinates** E 436169.70 N 399820.48

Total Depth 1.00m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(0.30)		Stiff friable dark brown slightly sandy to sandy silty CLAY with frequent rootlets. (TOPSOIL)		
D	0.50		128.20	0.30		Weak to medium strong orangish brown mottled yellowish brown and grey SANDSTONE and SILTSTONE with thin bands of silty clay. Recovered as slightly clayey slightly sandy gravelly tabular cobbles. (PENNINE MIDDLE COAL MEASURES FORMATION)		
D	0.80			(0.70)				
			127.50	1.00		End of Trial Pit at 1.00m		

Method: Tracked Excavator

Groundwater: Groundwater not encountered.

Stability: Good

Remarks: Trial pit backfilled with arisings on completion. See also log for TP1412B.

Length:	7.00m
Width:	0.60m
Logged:	FC
Checked:	

TRIAL PIT LOG

TP1412B

Project Parkside, Hoyland Common, Barnsley

Project No. AG3080D-20

Client Newlands Developments

Sheet 1 of 1

Date 22/09/2020

Scale 1:25

Ground Level 128.50m AOD **Coordinates** E 436166.20 N 399814.53

Total Depth 1.45m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(0.30)		Stiff friable dark brown slightly sandy to sandy silty CLAY with frequent rootlets. (TOPSOIL/MADE GROUND)		
LB	0.50		128.20	0.30		Stiff dark greyish brown and dark grey gravelly silty CLAY with frequent cobbles. Gravel is fine to coarse subangular siltstone, mudstone and rare coal and slate. (MADE GROUND - OPENCAST BACKFILL)		
D	0.60							
				(1.15)				
D	1.10							
			127.05	1.45		End of Trial Pit at 1.45m		

Method: Tracked Excavator

Groundwater: Groundwater not encountered.

Stability: Good

Remarks: Trial pit backfilled with arisings on completion. See also log for TP1412A.

Length:	7.00m
Width:	0.60m
Logged:	FC
Checked:	

TRIAL PIT LOG

TP1413

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Date 24/09/2020

Scale

1:25

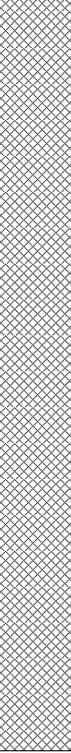
Ground Level 127.44m AOD

Coordinates

E 436155.41 N 399754.48

Total Depth

3.40m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
			127.14	(0.30)		Firm brown slightly gravelly sandy CLAY with frequent rootlets. Gravel is fine to medium subangular to subrounded mudstone, brick and coal. (TOPSOIL/MADE GROUND)		
			126.54	(0.60)		Firm becoming stiff grey and brown slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone, ironstone and coal. (MADE GROUND - OPENCAST BACKFILL)		
B	1.00		126.54	0.90		Stiff grey and brown slightly sandy very gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. Occasional cobbles of angular to subrounded mudstone and siltstone. (MADE GROUND - OPENCAST BACKFILL)		
D	2.00			(2.50)				
B	3.00		124.04	3.40		End of Trial Pit at 3.40m		

Method: 21T Tracked excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion.

Length:	2.50m
Width:	0.70m
Logged:	JW
Checked:	

TRIAL PIT LOG

TP1414

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Date 21/09/2020

Scale

1:25

Ground Level 126.14m AOD

Coordinates

E 436191.80 N 399754.56

Total Depth

2.50m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
D	0.40		125.84	(0.30)	E	Firm to stiff friable dark brown slightly gravelly slightly sandy silty CLAY with occasional rootlets. Gravel is fine to coarse subangular siltstone, mudstone and rare brick. (TOPSOIL/MADE GROUND)		
				0.30	E	Firm to stiff grey locally dark grey and greyish brown slightly sandy gravelly CLAY with frequent cobbles and occasional boulders. Gravel is fine to coarse subangular sandstone, siltstone and mudstone. Cobbles are subangular sandstone and siltstone. Boulders are subangular of siltstone. (MADE GROUND - OPENCAST BACKFILL)		
ES	0.90							
				(2.20)				
LB D	2.20				M/H			
	2.30							
			123.64	2.50		End of Trial Pit at 2.50m		

Method: Tracked Excavator

Groundwater: Groundwater not encountered.

Stability: Good.

Remarks: Trial pit used for soakaway test and backfilled with arisings on completion.

Length:	3.00m
Width:	0.60m
Logged:	FC
Checked:	

TRIAL PIT LOG

TP1415

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Date 21/09/2020

Scale

1:25

Ground Level 126.94m AOD

Coordinates

E 436201.08 N 399804.15

Total Depth

2.00m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
ES	0.10		126.64	(0.30) 0.30	E	Firm locally soft locally friable dark brown slightly gravelly slightly sandy silty CLAY with occasional rootlets. Gravel is subangular siltstone and sandstone. (TOPSOIL)		
B	1.00		124.94	(1.70) 2.00	M/H	Medium strong locally very weak slightly fractured orangish brown locally yellowish brown and grey SILTSTONE with cobble sized ironstone nodules. Recovered as slightly sandy gravel and cobbles of subangular tabular siltstone and ironstone. (PENNINE MIDDLE COAL MEASURES FORMATION)		
						End of Trial Pit at 2.00m		

Method: Tracked Excavator

Groundwater: Groundwater not encountered.

Stability: Good

Remarks: Trial pit used for soakaway test and backfilled with arisings on completion.

Length:	3.60m
Width:	0.60m
Logged:	FC
Checked:	

TRIAL PIT LOG

TT2101

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Date 21/09/2020

Scale

1:25

Ground Level 129.86m AOD

Coordinates

E 436021.96 N 399689.04

Total Depth

2.30m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
ES	0.10			(0.30)	E	Stiff friable dark brown slightly gravelly slightly sandy silty CLAY with occasional rootlets. Gravel is fine to coarse subangular brick and rare coal. (TOPSOIL/MADE GROUND)		
D	0.40		129.56	0.30	E	Firm to stiff friable dark brown and dark grey slightly sandy gravelly silty CLAY. Gravel is fine to coarse subangular mudstone, siltstone, sandstone and rare coal.		
LB	0.50		129.36	0.50	E	(MADE GROUND)		
D	0.60				E	Firm locally stiff friable grey and dark grey silty gravelly CLAY with frequent cobbles and rare to occasional boulders. Gravel is fine to coarse angular to subangular mudstone, siltstone, sandstone and rare coal. Cobbles are subangular siltstone and occasional mudstone and sandstone. Boulders are subangular sandstone and siltstone (maximum dimensions of 0.50m x 0.70m x 0.20m). (MADE GROUND - OPENCAST BACKFILL)		
				(1.80)	M			
D	1.50							
LB	1.50							
D	2.00							
			127.56	2.30		Between 2.00m and 2.30m bgl: boulder sized pockets of slightly clayey gravel with frequent cobbles.		
						End of Trial Pit at 2.30m		

Method: Tracked Excavator

Groundwater: Groundwater not encountered.

Stability: Good

Remarks: Trench backfilled with arisings on completion.

Length:	8.50m
Width:	0.60m
Logged:	FC
Checked:	

TRIAL PIT LOG

TT2102

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Date 21/09/2020

Scale

1:25

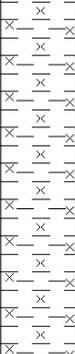
Ground Level 131.74m AOD

Coordinates

E 436000.00 N 399712.36

Total Depth

1.50m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
ES	0.20		131.44	(0.30)	E	Firm to stiff friable dark brown slightly gravelly sandy silty CLAY with occasional to frequent rootlets. (TOPSOIL)		
D	0.50			0.30	E	Firm to stiff yellowish brown and light grey silty CLAY with closely to medium spaced fissures. (PENNINE MIDDLE COAL MEASURES FORMATION) <i>Between 0.30m and 0.50m bgl: occasional rootlets.</i>		
				(1.20)		<i>Below 1.00m bgl: stiff and light grey.</i>		
D	1.50		130.24	1.50	M	End of Trial Pit at 1.50m		

Method: Tracked Excavator

Groundwater: Groundwater not encountered.

Stability: Good

Remarks: Trench backfilled with arisings on completion.

Length:	3.50m
Width:	0.60m
Logged:	FC
Checked:	

TRIAL PIT LOG

TT2103A

Project Parkside, Hoyland Common, Barnsley

Project No. AG3080D-20

Client Newlands Developments

Sheet 1 of 1

Date 22/09/2020

Scale 1:25

Ground Level 135.24m AOD **Coordinates** E 435948.05 N 399760.27

Total Depth 1.30m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
ES	0.20		134.94	(0.30)	E	Firm to stiff friable dark brown slightly gravelly slightly sandy silty CLAY with occasional to frequent rootlets. Gravel is fine to medium subangular siltstone and sandstone. (TOPSOIL/MADE GROUND)		
D	0.50		134.69	(0.25) (0.55)	E	Firm dark grey and brownish grey slightly sandy gravelly to very gravelly CLAY with rare cobbles. Gravel is fine to coarse subangular sandstone, mudstone and siltstone. Cobbles are subangular sandstone. (MADE GROUND)		
B	1.00			(0.75)	M	Medium strong locally very weak closely to moderately fractured yellowish and orangish brown locally light grey SILTSTONE with thin bands of firm clay. Recovered as slightly clayey slightly gravelly subangular tabular cobbles. Gravel is fine to coarse subangular siltstone. (PENNINE MIDDLE COAL MEASURES FORMATION)		
D	1.10		133.94	1.30	M/H	<i>Below 1.00m bgl: no clay bands</i>		
						End of Trial Pit at 1.30m		

Method: Tracked Excavator

Groundwater: Groundwater not encountered.

Stability: Good

Remarks: Trench backfilled with arisings on completion. See also log for TP2103B.

Length:	9.50m
Width:	0.60m
Logged:	FC
Checked:	

TRIAL PIT LOG

TT2103B

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Date 22/09/2020

Scale

1:25

Ground Level 135.24m AOD

Coordinates

E 435955.34 N 399766.37

Total Depth

2.10m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(0.30)	E	Firm to stiff friable dark brown slightly gravelly slightly sandy silty CLAY with occasional to frequent rootlets. Gravel is fine to medium subangular siltstone and sandstone. (TOPSOIL/MADE GROUND)		
ES	0.40		134.94	0.30				
B	0.50			(0.25)	E	Firm dark grey and brownish grey slightly sandy gravelly to very gravelly CLAY with rare cobbles. Gravel is fine to coarse subangular sandstone, mudstone and siltstone. Cobbles are subangular sandstone.		
D	0.60		134.69	0.55		(MADE GROUND)		
					E	Firm locally stiff friable grey and dark grey slightly sandy gravelly to very gravelly CLAY with frequent cobbles and occasional to frequent boulders. Gravel is fine to coarse subangular mudstone, siltstone and mudstone. Cobbles are subangular mudstone and siltstone. Boulders are subangular siltstone and sandstone (average dimensions 0.70m x 0.50m x 0.20m and maximum dimensions 0.90m x 0.90m x 0.30m). (MADE GROUND - OPENCAST BACKFILL) <i>Between 0.80m and 1.35m bgl: locally cobble sized pockets of soft slightly gravelly clay.</i>		
D	1.20			(1.55)	M			
					E	End of Trial Pit at 2.10m		
D	2.00		133.14	2.10				

Method: Tracked Excavator

Groundwater: Groundwater not encountered.

Stability: Good

Remarks: Trench backfilled on completion. See also log for TP2103A.

Length:	9.50m
Width:	0.60m
Logged:	FC
Checked:	

TRIAL PIT LOG

TT2104

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Date 22/09/2020

Scale

1:25

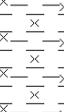
Ground Level 135.57m AOD

Coordinates

E 435956.30 N 399797.50

Total Depth

1.50m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(0.30)		Stiff sark brown slightly gravelly very sandy silty CLAY with frequent rootlets. Gravel is fine to medium subangular to subrounded siltstone, rare quartzite and brick fragments.		
			135.27	0.30		(TOPSOIL/MADE GROUND)		
				(0.20)		Firm dark brown and dark grey slightly sandy gravelly to very gravelly CLAY. Gravel is fine to coarse subangular siltstone, mudstone, ironstone and rare brick.		
			135.07	0.50		(MADE GROUND)		
				(0.60)		Dark grey slightly sandy clayey GRAVEL with occasional cobbles and boulders. Gravel is fine to coarse angular to subangular mudstone, siltstone and rare coal. Cobbles are subangular mudstone and siltstone. Boulders are subangular siltstone (maximum dimensions of 0.80m x 0.40m x 0.20m).		
ES	0.90					(MADE GROUND - OPENCAST BACKFILL)		
D	1.00							
LB	1.10		134.47	1.10		Stiff yellowish brown and light grey silty CLAY with rare fine to medium siltstone lithorelicts.		
D	1.20			(0.40)		(PENNINE MIDDLE COAL MEASURES FORMATION)		
			134.07	1.50		<i>Below 1.45m bgl: becoming increasingly grey</i> End of Trial Pit at 1.50m		

Method: Tracked Excavator

Groundwater: Groundwater not encountered.

Stability: Good

Remarks: Trench backfilled with arisings on completion.

Length:	6.50m
Width:	0.60m
Logged:	FC
Checked:	

TRIAL PIT LOG

TT2105A

Project Parkside, Hoyland Common, Barnsley

Project No. AG3080D-20

Client Newlands Developments

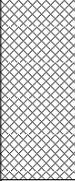
Sheet 1 of 1

Date 22/09/2020

Scale 1:25

Ground Level 134.58m AOD **Coordinates** E 436042.17 N 399851.78

Total Depth 1.10m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
			134.38	(0.20)	E	Stiff dark brown friable sandy silty CLAY with frequent rootlets. (TOPSOIL/MADE GROUND)		
			134.08	(0.30)	E	Dark grey and brown slightly sandy gravelly CLAY with rare cobbles. Gravel is fine to coarse angular to subangular siltstone, mudstone and rare coal. (MADE GROUND - OPENCAST BACKFILL)		
D	0.70			(0.50)		Firm becoming stiff light grey mottled light yellowish brown silty CLAY with locally fine to medium subangular mudstone lithorelicts. (PENNINE MIDDLE COAL MEASURES FORMATION)		
D	0.70			(0.60)	E			
D	1.07		133.48	1.10	E/M	Between 1.00m and 1.05m bgl: black carbonaceous material Between 1.05m and 1.10m bgl: grey End of Trial Pit at 1.10m		

Method: Tracked Excavator

Groundwater: Groundwater not encountered.

Stability: Good

Remarks: Trench backfilled with arisings on completion. See also log for TP2105B.

Length:	12.00m
Width:	0.60m
Logged:	FC
Checked:	

TRIAL PIT LOG

TT2105B

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Date 22/09/2020

Scale

1:25

Ground Level 134.58m AOD

Coordinates

E 436048.37 N 399841.50

Total Depth

1.60m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(0.25)	E	Stiff dark brown friable sandy silty CLAY with frequent rootlets. (TOPSOIL/MADE GROUND)		
ES	0.50		134.33	0.25	E	Dark grey and brown slightly sandy gravelly CLAY with rare cobbles. Gravel is fine to coarse angular to subangular siltstone, mudstone and rare coal. (MADE GROUND - OPENCAST BACKFILL)		
			134.13	(0.20)	E			
D	0.80			0.45	E	Dark grey and grey slightly sandy clayey silty GRAVEL ith occasional to frequent cobbles. Gravel is fine to coarse subangular mudstone, siltstone, occasional sandstone and rare coal. Cobbles are subangular siltstone. (MADE GROUND - OPENCAST BACKFILL)		
B	1.00			(1.15)	E			
					E/M	End of Trial Pit at 1.60m		
			132.98	1.60				

Method: Tracked Excavator

Groundwater: Groundwater not encountered.

Stability: Good

Remarks: Trench backfilled with arisings on completion. See also log for TP2105A.

Length:	12.00m
Width:	0.60m
Logged:	FC
Checked:	

TRIAL PIT LOG

TT2106A

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Date 23/09/2020

Scale

1:25

Ground Level 134.02m AOD

Coordinates

E 436078.66 N 399879.53

Total Depth

1.00m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(0.30)	E	Dark brown friable silty sandy CLAY with frequent rootlets. (TOPSOIL)		
D	0.50		133.72	0.30		Firm to stiff light grey mottled yellowish brown slightly fine sandy silty CLAY with rare rootlets and occasional thin to medium bands of medium strong siltstone recovered as tabular cobbles. (PENNINE MIDDLE COAL MEASURES FORMATION)		
LB	0.50			(0.70)	E			
					M			
D	1.00		133.02	1.00		End of Trial Pit at 1.00m		

Method: Tracked Excavator

Groundwater: Groundwater not encountered.

Stability: Good

Remarks: Trench backfilled with arisings on completion. See also log for TP2106B.

Length:	18.80m
Width:	0.60m
Logged:	FC
Checked:	

TRIAL PIT LOG

TT2106B

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Date 23/09/2020

Scale

1:25

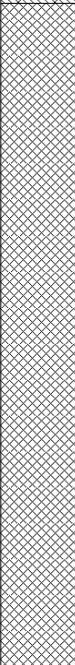
Ground Level 134.02m AOD

Coordinates

E 436081.91 N 399862.03

Total Depth

2.50m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(0.30)	E	Dark brown friable silty sandy CLAY with frequent rootlets. (TOPSOIL)		
D	0.40		133.72	0.30		Dark grey and grey clayey GRAVEL with occasional cobbles. Gravel is fine to coarse angular to subangular siltstone, mudstone and rare sandstone. Cobbles are subangular siltstone. (MADE GROUND - OPENCAST BACKFILL)		
LB	0.80				E	<i>Below 1.00m bgl: occasional boulder sized pockets of soft to firm gravelly clay</i>		
D	1.50			(2.20)	E			
					E			
			131.52	2.50	E	End of Trial Pit at 2.50m		

Method: Tracked Excavator

Groundwater: Groundwater not encountered.

Stability: Good

Remarks: Trench backfilled with arisings on completion. See also log for TP2106A.

Length:	18.80m
Width:	0.60m
Logged:	FC
Checked:	

TRIAL PIT LOG

TT2107A

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Date 21/09/2020

Scale

1:25

Ground Level 125.84m AOD

Coordinates E 436218.68 N 399777.28

Total Depth

0.90m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
D LB	0.50 0.50		125.64	(0.20) 0.20	E	Stiff friable dark brown slightly gravelly slightly sandy silty CLAY with occasional rootlets. Gravel is subangular siltstone and mudstone. (TOPSOIL)		
				(0.70)	M/H	Medium strong locally very weak closely fractured orangish brown locally light grey SILTSTONE with occasional ironstone staining along fracture surfaces. Recovered as slightly silty gravelly subangular tabular cobbles. (PENNINE MIDDLE COAL MEASURES FORMATION)		
			124.94	0.90		End of Trial Pit at 0.90m		

Method: Tracked Excavator

Groundwater: Groundwater not encountered.

Stability: Good

Remarks: Trench backfilled with arisings on completion. See also log for TP2107B.

Length:	7.50m
Width:	0.60m
Logged:	FC
Checked:	

TRIAL PIT LOG

TT2107B

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Date 21/09/2020

Scale

1:25

Ground Level 125.84m AOD

Coordinates

E 436212.92 N 399772.47

Total Depth

1.70m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
ES	0.10		125.64	(0.20) 0.20	E	Stiff friable dark brown slightly gravelly slightly silty CLAY with occasional rootlets. Gravel is fine to medium subangular ceramic tile and mudstone. (TOPSOIL/MADE GROUND)		
D	0.50					Firm to stiff grey and dark grey gravelly to very gravelly silty CLAY with frequent cobbles and occasional boulders. Gravel is fine to coarse subangular mudstone, siltstone, sandstone and rare coal. Cobbles are subangular mudstone and siltstone. Boulders are subangular sandstone, (maximum dimensions of 0.25m x 0.68m x 0.43m). (MADE GROUND - OPENCAST BACKFILL)		
LB	1.00			(1.50)	E			
ES	1.70		124.14	1.70		End of Trial Pit at 1.70m		

Method: Tracked Excavator

Groundwater: Groundwater not encountered.

Stability: Good

Remarks: Trench backfilled with arisings on completion. See also log for TP2107A.

Length: 7.50m

Width: 0.60m

Logged: FC

Checked:

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS6101

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Start 22/09/2020

Coordinates E 435940.49 N 399798.04

Scale

1:25

End 22/09/2020

Ground Level 135.96m AOD

Total Depth

2.44m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
D ES	0.15 0.15			135.76	(0.20) 0.20	Firm brown slightly sandy gravelly CLAY with frequent rootlets. Gravel is fine to medium subangular to subrounded mudstone, coal and brick. (TOPSOIL/MADE GROUND)			
UT	0.55				(1.30)	Stiff becoming very stiff light brown and grey sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. (MADE GROUND - OPENCAST BACKFILL)			
S D ES	1.50 1.60 1.60	N = 14		134.46	1.50 (0.25)	Grey very clayey sandy GRAVEL. Gravel is fine to coarse subangular to rounded mudstone, siltstone and coal. (MADE GROUND - OPENCAST BACKFILL)			
S D ES	2.00 2.20 2.20	N >50		134.21	1.75 (0.69)	Very stiff light brown and grey CLAY with occasional fine to medium gravel sized mudstone and siltstone lithorelicts. (PENNINE MIDDLE COAL MEASURES FORMATION)			
				133.52	2.44	End of Borehole at 2.44m			

Installation: 50mm diameter standpipe installed to 2.00m bgl.

Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Groundwater Strikes					Drilled: DH
Depth Strike	Rose to	Remarks	Cased	Sealed	
					Logged: JW
					Checked:

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS6102

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Start 22/09/2020

Coordinates E 436052.45 N 399872.88

Scale

1:25

End 22/09/2020

Ground Level 135.08m AOD

Total Depth

1.93m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
D ES	0.15 0.15			134.88	(0.20) 0.20	Firm brown sandy gravelly CLAY with frequent rootlets. Gravel is fine to coarse subangular to subrounded mudstone and siltstone. (TOPSOIL)			
D ES	0.70 0.70					Stiff becoming very stiff light brown and grey silty CLAY with occasional becoming frequent fine to medium gravel sized mudstone and siltstone lithorelicts. (PENNINE MIDDLE COAL MEASURES FORMATION)			
UT UT	1.00 1.00				(1.73)				
D ES S	1.90 1.90 1.90	N >50		133.16	1.93	End of Borehole at 1.93m			

Installation:

Remarks: Hand dug service inspection pit excavated to 1.20m bgl. No install.

Groundwater Strikes					Drilled: DH
Depth Strike	Rose to	Remarks	Cased	Sealed	
					Logged: JW
					Checked:

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS6103

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Start 22/09/2020

Coordinates E 436023.30 N 399782.02

Scale

1:25

End 22/09/2020

Ground Level 132.78m AOD

Total Depth

4.00m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
D ES	0.20 0.20			132.52	(0.25) 0.25	Firm brown slightly gravelly sandy CLAY with frequent rootlets. Gravel is fine to medium subangular to subrounded mudstone and coal. (TOPSOIL)			
UT UT	0.55 0.55				(0.65)	Stiff grey and brown sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. (MADE GROUND - OPENCAST BACKFILL)			
				131.88	0.90	Stiff greyish brown slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. (MADE GROUND - OPENCAST BACKFILL)			
D S	1.50 1.50	N = 13							
D S	2.00 2.00	N = 13			(2.50)				
D	2.50								
D S	3.00 3.00	N = 12							
D S	3.50 3.60	N = 21		129.38	3.40 (0.60)	Brownish grey clayey sandy GRAVEL. Gravel is fine to coarse angular to subrounded mudstone and siltstone. (MADE GROUND - OPENCAST BACKFILL)			
D	4.00			128.78	4.00	End of Borehole at 4.00m			

Installation: 50mm diameter standpipe installed to 4.00m bgl.

Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Groundwater Strikes					Drilled: DH
Depth Strike	Rose to	Remarks	Cased	Sealed	
					Logged: JW
					Checked:

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS6104

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 2

Start 22/09/2020

Coordinates E 436117.62 N 399843.37

Scale

1:25

End 22/09/2020

Ground Level 131.72m AOD

Total Depth

5.45m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
D	0.20				(0.30)	Brown clayey gravelly SAND with frequent rootlets. Gravel is fine to coarse subangular to subrounded mudstone, siltstone and brick. (TOPSOIL/MADE GROUND)			
ES	0.20			131.42	0.30	Stiff brownish grey sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. (MADE GROUND - OPENCAST BACKFILL)			
D	0.70				(1.20)				
UT	1.00								
UT	1.00								
				130.22	1.50	Brown and grey clayey sandy GRAVEL. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. (MADE GROUND - OPENCAST BACKFILL)			
D	1.80				(0.35)				
S	2.00	N = 6		129.87	1.85	Stiff brown and grey sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. (MADE GROUND - OPENCAST BACKFILL) <i>From below 2.10m: locally light brown, slightly sandy.</i>			
D	2.30								
D	2.80								
S	3.00	N = 10			(2.25)				
D	3.30								
D	3.80								
S	4.00	N = 11		127.62	4.10	Grey clayey sandy GRAVEL. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. (MADE GROUND - OPENCAST BACKFILL)			
D	4.30				(0.40)				
				127.22	4.50	Stiff greyish brown sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. (MADE GROUND - OPENCAST BACKFILL)			
D	4.80								
S	5.00	N = 11			(0.95)				

Continued next sheet

Installation: 50mm diameter standpipe installed to 5.00m bgl.

Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Groundwater Strikes					Drilled: DH
Depth Strike	Rose to	Remarks	Cased	Sealed	
					Logged: JW
					Checked:

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS6104

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

2 of 2

Start 22/09/2020

Coordinates E 436117.62 N 399843.37

Scale

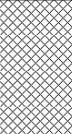
1:25

End 22/09/2020

Ground Level 131.72m AOD

Total Depth

5.45m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
				126.27	5.45	Stiff greyish brown sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. (MADE GROUND - OPENCAST BACKFILL)			
						End of Borehole at 5.45m			

Installation: 50mm diameter standpipe installed to 5.00m bgl.

Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Groundwater Strikes					Drilled: DH
Depth Strike	Rose to	Remarks	Cased	Sealed	
					Logged: JW
					Checked:

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS6105

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 2

Start 22/09/2020

Coordinates E 436037.94 N 399745.21

Scale

1:25

End 22/09/2020

Ground Level 131.07m AOD

Total Depth

5.45m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
D ES	0.20			130.82	(0.25)	Firm brown slightly gravelly sandy CLAY with frequent rootlets. Gravel is fine to medium subangular to subrounded mudstone, brick and coal. (TOPSOIL/MADE GROUND)			
	0.20				0.25	Stiff grey and light brown slightly gravelly sandy CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. (MADE GROUND - OPENCAST BACKFILL)			
UT UT	0.55			130.27	(0.55)				
	0.55				0.80				
S	1.50	N = 12		129.47	1.60	Stiff to very stiff sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. (MADE GROUND - OPENCAST BACKFILL) <i>From between 1.60m and 2.00m:: stiff, brown and grey.</i>			
D	1.80								
S	2.00	N = 9							
D	2.50								
D	3.00	N = 11							
S	3.00								
D	3.50				(3.85)				
D	4.00								
S	4.00	N = 14				<i>From between 4.10m and 4.25m: grey gravelly sand. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal.</i>			
D	4.50					<i>From between 4.60m and 4.80m: grey and brown sandy clayey gravel. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal.</i>			
S	5.00	N = 14				Continued next sheet			

Installation: 50mm diameter standpipe installed to 5.00m bgl.

Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Groundwater Strikes					Drilled: DH
Depth Strike	Rose to	Remarks	Cased	Sealed	
					Logged: JW
					Checked:

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS6105

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

2 of 2

Start 22/09/2020

Coordinates E 436037.94 N 399745.21

Scale

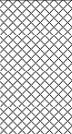
1:25

End 22/09/2020

Ground Level 131.07m AOD

Total Depth

5.45m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
				125.62	5.45	Stiff to very stiff sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. (MADE GROUND - OPENCAST BACKFILL)			
						End of Borehole at 5.45m			

Installation: 50mm diameter standpipe installed to 5.00m bgl.

Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Groundwater Strikes					Drilled: DH
Depth Strike	Rose to	Remarks	Cased	Sealed	
					Logged: JW
					Checked:

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS6106

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 2

Start 21/09/2020

Coordinates E 436143.78 N 399816.49

Scale

1:25

End 21/09/2020

Ground Level 129.30m AOD

Total Depth

5.45m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
D ES B	0.20 0.20 0.35			128.95	(0.35) 0.35	Firm brown slightly sandy gravelly CLAY with frequent rootlets. Gravel is fine to coarse subangular to subrounded mudstone and brick. (TOPSOIL/MADE GROUND)			
D ES	0.70 0.70			128.10	(0.85)	Stiff brown and grey very gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, coal and siltstone. (MADE GROUND - OPENCAST BACKFILL) <i>Between 0.55m and 0.60m bgl: land drain present</i>			
UT UT	1.00 1.00			128.10	1.20	Firm greyish brown slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, coal and siltstone. (MADE GROUND - OPENCAST BACKFILL)			
B	1.45				(1.05)				
S	2.00	N = 15							
B	2.25			127.05	2.25	Brown and grey clayey sandy GRAVEL. Gravel is fine to coarse angular to subrounded mudstone, coal and siltstone. (MADE GROUND - OPENCAST BACKFILL)			
					(0.60)				
B S	2.85 3.00	N = 8		126.45	2.85	Stiff brown and grey slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, coal and sandstone. (MADE GROUND - OPENCAST BACKFILL)			
					(2.60)				
B S	4.00 4.00	N = 8							
S	5.00	N = 10							

Continued next sheet

Installation: 50mm diameter standpipe installed to 5.00m bgl.

Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Groundwater Strikes					Drilled: DH
Depth Strike	Rose to	Remarks	Cased	Sealed	
					Logged: JW
					Checked:

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS6106

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

2 of 2

Start 21/09/2020

Coordinates E 436143.78 N 399816.49

Scale

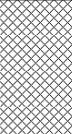
1:25

End 21/09/2020

Ground Level 129.30m AOD

Total Depth

5.45m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
				123.85	5.45	Stiff brown and grey slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, coal and sandstone. (MADE GROUND - OPENCAST BACKFILL)			
						End of Borehole at 5.45m			

Installation: 50mm diameter standpipe installed to 5.00m bgl.

Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Groundwater Strikes					Drilled: DH
Depth Strike	Rose to	Remarks	Cased	Sealed	
					Logged: JW
					Checked:

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS6107

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 2

Start 21/09/2020

Coordinates E 436156.93 N 399793.61

Scale

1:25

End 21/09/2020

Ground Level 128.04m AOD

Total Depth

5.45m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
D	0.20				(0.25)	Firm brown slightly sandy gravelly CLAY with frequent rootlets. Gravel is fine to coarse subangular to subrounded mudstone, brick and coal. (TOPSOIL/MADE GROUND)			
ES	0.20			127.79	0.25	Stiff brown and grey slightly sandy gravelly CLAY. Gravel is fine to coarse subangular to subrounded mudstone, siltstone and coal. (MADE GROUND - OPENCAST BACKFILL)			
UT	0.55				(0.95)				
D	1.30			126.84	1.20	Firm to stiff brownish grey sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. (MADE GROUND - OPENCAST BACKFILL)			
S	1.50	N = 23			(0.80)				
D	1.80								
S	2.00	N = 22		126.04	2.00	Grey clayey sandy GRAVEL. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal. (MADE GROUND - OPENCAST BACKFILL)			
D	2.30			125.74	2.30	Stiff brownish grey slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, coal and siltstone. (MADE GROUND - OPENCAST BACKFILL)			
D	2.80								
S	3.00	N = 8			(1.60)				
D	3.50								
S	4.00	N = 11		124.14	3.90	Stiff greyish brown and light brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded mudstone, coal and siltstone. (MADE GROUND - OPENCAST BACKFILL)			
D	4.30								
D	4.80				(1.55)				
S	5.00	N = 15							

Continued next sheet

Installation:

Remarks: Hand dug service inspection pit excavated to 1.20m bgl. No install.

Groundwater Strikes					Drilled: DH
Depth Strike	Rose to	Remarks	Cased	Sealed	
					Logged: JW
					Checked:

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS6107

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

2 of 2

Start 21/09/2020

Coordinates E 436156.93 N 399793.61

Scale

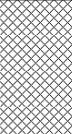
1:25

End 21/09/2020

Ground Level 128.04m AOD

Total Depth

5.45m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
				122.59	5.45	Stiff greyish brown and light brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded mudstone, coal and siltstone. (MADE GROUND - OPENCAST BACKFILL)			
						End of Borehole at 5.45m			

Installation:

Remarks: Hand dug service inspection pit excavated to 1.20m bgl. No install.

Groundwater Strikes					Drilled: DH
Depth Strike	Rose to	Remarks	Cased	Sealed	
					Logged: JW
					Checked:

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS6108

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 2

Start 21/09/2020

Coordinates E 436137.07 N 399733.65

Scale

1:25

End 21/09/2020

Ground Level 127.76m AOD

Total Depth

5.45m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
D	0.20				(0.25)	Firm brown sandy gravelly CLAY with frequent rootlets. Gravel is fine to coarse subangular to subrounded mudstone and coal.			
ES	0.20			127.50	0.25	(TOPSOIL)			
D	0.60				(0.50)	Stiff grey and brown slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, coal and siltstone.			
				127.00	0.75	(MADE GROUND - OPENCAST BACKFILL)			
D	1.50				(1.05)	Grey clayey sandy GRAVEL. Gravel is fine to coarse angular to subrounded mudstone, coal and siltstone.			
				125.96	1.80	(MADE GROUND - OPENCAST BACKFILL)			
D	2.00	N = 5				Stiff brown and grey sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, coal and siltstone.			
S	2.00					(MADE GROUND - OPENCAST BACKFILL)			
D	2.50								
D	3.00	N = 7							
S	3.00								
D	3.50				(3.65)				
S	4.00	N = 14				Between 3.80m and 4.00m bgl: gravel is fine to coarse angular to subrounded mudstone.			
D	4.25								
D	4.90	N = 15							
S	5.00								

Continued next sheet

Installation:

Remarks: Hand dug service inspection pit excavated to 1.20m bgl. No install.

Groundwater Strikes					Drilled: DH
Depth Strike	Rose to	Remarks	Cased	Sealed	
					Logged: JW
					Checked:

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS6108

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

2 of 2

Start 21/09/2020

Coordinates E 436137.07 N 399733.65

Scale

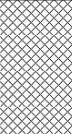
1:25

End 21/09/2020

Ground Level 127.76m AOD

Total Depth

5.45m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
				122.30	5.45	Stiff brown and grey sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, coal and siltstone. (MADE GROUND - OPENCAST BACKFILL)			
						End of Borehole at 5.45m			

Installation:

Remarks: Hand dug service inspection pit excavated to 1.20m bgl. No install.

Groundwater Strikes					Drilled: DH
Depth Strike	Rose to	Remarks	Cased	Sealed	
					Logged: JW
					Checked:

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS6109

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 2

Start 21/09/2020

Coordinates E 436178.86 N 399771.02

Scale

1:25

End 21/09/2020

Ground Level 127.00m AOD

Total Depth

5.45m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
D ES	0.20 0.20			126.75	(0.25) 0.25	Firm brown slightly sandy gravelly CLAY with frequent rootlets. Gravel is fine to coarse subangular to subrounded mudstone and coal. (TOPSOIL)			
UT	0.55					Stiff grey and brown slightly sandy gravelly CLAY. Gravel is fine to coarse subangular to subrounded mudstone, coal and siltstone. (MADE GROUND - OPENCAST BACKFILL)			
						<i>Between 1.0m and 1.70m bgl: sandy gravelly clay.</i>			
D ES	1.20 1.20				(1.85)				
S	1.50	N = 8							
D ES	1.80 1.80								
S	2.00	N = 5		124.90	2.10	Brown and grey very clayey sandy GRAVEL. Gravel is fine to coarse angular to subrounded mudstone, coal and siltstone. (MADE GROUND - OPENCAST BACKFILL)			
D	2.50				(0.80)				
S	3.00	N = 6		124.10	2.90	Stiff grey and brown sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, coal and siltstone. (MADE GROUND - OPENCAST BACKFILL)			
D	3.30				(1.10)				
D	3.80								
S	4.00	N = 7		123.00	4.00	Grey clayey sandy GRAVEL. Gravel is fine to coarse angular to subrounded mudstone, coal and siltstone. (MADE GROUND - OPENCAST BACKFILL)			
D	4.30				(0.60)				
D	4.80								
S	5.00	N = 11		122.40	4.60	Stiff grey and brown slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, coal and sandstone. (MADE GROUND - OPENCAST BACKFILL)			

Continued next sheet

Installation: 50mm diameter standpipe installed to 5.00m bgl.

Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Groundwater Strikes					Drilled: DH
Depth Strike	Rose to	Remarks	Cased	Sealed	
					Logged: JW
					Checked:

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS6109

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

2 of 2

Start 21/09/2020

Coordinates E 436178.86 N 399771.02

Scale

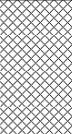
1:25

End 21/09/2020

Ground Level 127.00m AOD

Total Depth

5.45m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
					(0.85)	Stiff grey and brown slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, coal and sandstone. (MADE GROUND - OPENCAST BACKFILL)			
				121.55	5.45				
						End of Borehole at 5.45m			

Installation: 50mm diameter standpipe installed to 5.00m bgl.

Remarks: Hand dug service inspection pit excavated to 1.20m bgl.

Groundwater Strikes					Drilled: DH
Depth Strike	Rose to	Remarks	Cased	Sealed	
					Logged: JW
					Checked:

BOREHOLE LOG - DRIVEN CONTINUOUS SAMPLING

DCS6110

Project Parkside, Hoyland Common, Barnsley

Project No.

AG3080D-20

Client Newlands Developments

Sheet

1 of 1

Start 21/09/2020

Coordinates E 436008.92 N 399675.15

Scale

1:25

End 21/09/2020

Ground Level 129.88m AOD

Total Depth

2.31m

Sample / Test Type	Depth (m)	Result	Dia./ Rec.	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
D ES	0.20			129.62	(0.25)	Firm brown sandy gravelly CLAY with frequent rootlets. Gravel is fine to coarse subangular to subrounded mudstone and sandstone. (TOPSOIL)			
	0.20				0.25	Stiff brown and grey slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded mudstone and coal. (MADE GROUND)			
D ES	0.70			129.12	(0.50)				
	0.70				0.75				
UT UT	1.00 1.00								
D	1.50				(1.56)	<i>Below 1.50m bgl: increase in lithorelicts.</i>			
S	2.00	N >50							
D	2.30			127.56	2.31	End of Borehole at 2.31m			

Installation:

Remarks: Hand dug service inspection pit excavated to 1.20m bgl. No install.

Groundwater Strikes					Drilled: DH
Depth Strike	Rose to	Remarks	Cased	Sealed	
					Logged: JW
					Checked:

SPT SUMMARY SHEET

Project: Parkside, Hoyland Common, Barnsley
Client: Newlands Developments
Project No: AG3080D-20

Borehole No.	Borehole depth (m)	Bottom depth (m)	Casing depth (m)	Water Level (m)	Equipment ref.	Seating Drive				Test Drive					Test Type	N Value				
						Blows	Pen (mm)	Blows	Pen (mm)	Total Pen (mm)										
DCS6101	1.50	1.95			110.119	4	3	75	75	3	4	4	3	75	75	75	75	300	S	14
DCS6101	2.00	2.44			110.119	4	5	75	75	6	8	10	26	75	75	75	60	285	S	>50
DCS6102	1.90	2.23			110.119	6	12	75	75	13	20	17		75	75	30		180	S	>50
DCS6103	1.50	1.95			110.119	2	3	75	75	3	3	4	3	75	75	75	75	300	S	13
DCS6103	2.00	2.45			110.119	2	3	75	75	2	3	3	5	75	75	75	75	300	S	13
DCS6103	3.00	3.45			110.119	4	2	75	75	3	3	3	3	75	75	75	75	300	S	12
DCS6103	3.60	4.05			110.119	8	4	75	75	4	5	6	6	75	75	75	75	300	S	21
DCS6104	2.00	2.45			110.119	1	1	75	75	1	1	2	2	75	75	75	75	300	S	6
DCS6104	3.00	3.45			110.119	1	1	75	75	2	3	2	3	75	75	75	75	300	S	10
DCS6104	4.00	4.45			110.119	2	2	75	75	2	3	3	3	75	75	75	75	300	S	11
DCS6104	5.00	5.45			110.119	2	3	75	75	3	2	3	3	75	75	75	75	300	S	11
DCS6105	1.50	1.95			110.119	2	3	75	75	3	3	3	3	75	75	75	75	300	S	12
DCS6105	2.00	2.45			110.119	2	2	75	75	2	2	3	2	75	75	75	75	300	S	9
DCS6105	3.00	3.45			110.119	2	2	75	75	3	2	3	3	75	75	75	75	300	S	11
DCS6105	4.00	4.45			110.119	7	4	75	75	3	4	4	3	75	75	75	75	300	S	14
DCS6105	5.00	5.45			110.119	4	4	75	75	3	3	4	4	75	75	75	75	300	S	14
DCS6106	2.00	2.45			110.119	4	3	75	75	4	3	4	4	75	75	75	75	300	S	15
DCS6106	3.00	3.45			110.119	1	2	75	75	2	2	2	2	75	75	75	75	300	S	8
DCS6106	4.00	4.45			110.119	2	2	75	75	2	2	2	2	75	75	75	75	300	S	8
DCS6106	5.00	5.45			110.119	2	3	75	75	3	2	3	2	75	75	75	75	300	S	10
DCS6107	1.50	1.95			110.119	4	5	75	75	5	6	6	6	75	75	75	75	300	S	23
DCS6107	2.00	2.45			110.119	5	7	75	75	6	4	6	6	75	75	75	75	300	S	22
DCS6107	3.00	3.45			110.119	1	2	75	75	2	2	2	2	75	75	75	75	300	S	8
DCS6107	4.00	4.45			110.119	3	3	75	75	2	3	3	3	75	75	75	75	300	S	11
DCS6107	5.00	5.45			110.119	3	4	75	75	4	3	4	4	75	75	75	75	300	S	15
DCS6108	2.00	2.45			110.119	1	1	75	75	1	1	2	1	75	75	75	75	300	S	5
DCS6108	3.00	3.45			110.119	1	1	75	75	1	2	2	2	75	75	75	75	300	S	7
DCS6108	4.00	4.45			110.119	2	2	75	75	3	3	4	4	75	75	75	75	300	S	14
DCS6108	5.00	5.45			110.119	2	3	75	75	3	4	4	4	75	75	75	75	300	S	15
DCS6109	1.50	1.95			110.119	1	2	75	75	2	2	2	2	75	75	75	75	300	S	8
DCS6109	2.00	2.45			110.119	1	1	75	75	1	2	1	1	75	75	75	75	300	S	5
DCS6109	3.00	3.45			110.119	4	2	75	75	2	1	2	1	75	75	75	75	300	S	6
DCS6109	4.00	4.45			110.119	1	3	75	75	1	2	2	2	75	75	75	75	300	S	7
DCS6109	5.00	5.45			110.119	2	3	75	75	3	3	2	3	75	75	75	75	300	S	11

Notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005
2. N values have not been subjected to any correction.
3. Test carried out using split spoon S, or solid cone C.

SPT SUMMARY SHEET

Project: Parkside, Hoyland Common, Barnsley
Client: Newlands Developments
Project No: AG3080D-20

Borehole No.	Borehole depth (m)	Bottom depth (m)	Casing depth (m)	Water Level (m)	Equipment ref.	Seating Drive		Test Drive			Test Type	N Value						
						Blows	Pen (mm)	Blows	Pen (mm)	Total Pen (mm)								
DCS6110	2.00	2.31			110.119	4	8	75	75	12	20	18	75	75	10	160	S	>50

Notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005
2. N values have not been subjected to any correction.
3. Test carried out using split spoon S, or solid cone C.



SPT Calibration Report

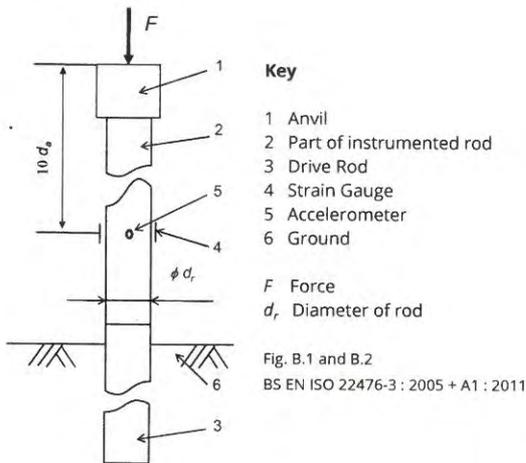
Hammer Energy Measurement Report

Type of Hammer PREMIER COMPACT
 Test No EQU2556
 Client APPLIED GEOLOGY

Test Depth (m) 9.20
 Mass of hammer $m = 63.5\text{kg}$
 Falling height $h = 0.76\text{m}$
 $E_{\text{theor}} = m \times g \times h = 473\text{J}$

Characteristics of the instrumented rod

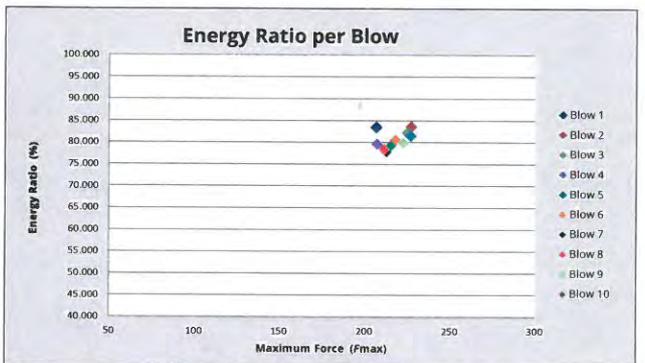
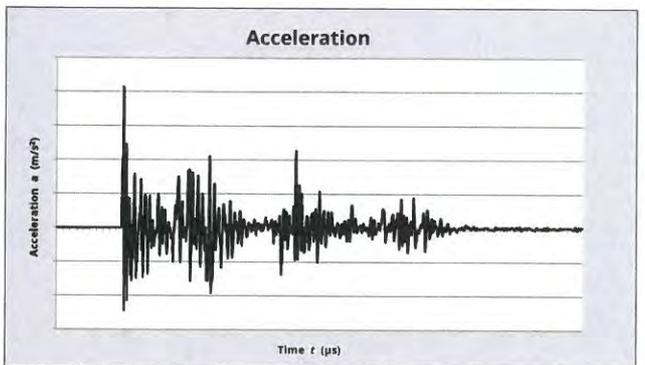
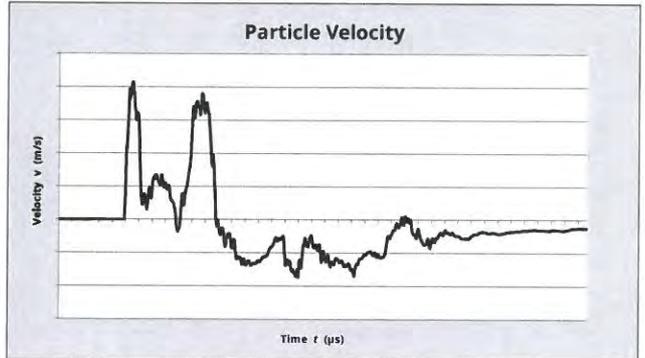
Diameter $d_r = 0.052\text{ m}$
 Length of instrumented rod 0.558 m
 Area $A = 11.61\text{ cm}^2$
 Modulus $E_o = 206843\text{ MPa}$



DATE OF TEST	VALID UNTIL	HAMMER ID
30/03/2020	30/03/2021	PREMIER 110/119

$E_{\text{meas}} = 0.381\text{ kN-m}$
 $E_{\text{theor}} = 0.473\text{ kN-m}$

Comments



Energy Ratio (Er) = $\frac{E_{\text{meas}}}{E_{\text{theor}}}$ **80.64%**

EQUIPE GROUP
 ©COPYRIGHT 2020

Equipe SPT Analyzer Operator KS	Certificate prepared by 	Certificate checked by 	Certificate date 17/04/2020
---	-----------------------------	----------------------------	---------------------------------------

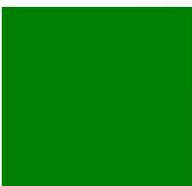
HOYLAND COMMON, BARNESLEY

SOIL INVESTIGATION

CPT REPORT

Cone penetration testing
Parameter interpretation

Project ref.: P-107408-1



PROJECT:	Hoyland Common, Barnsley
-----------------	--------------------------

CLIENT:	Applied Geology
----------------	-----------------

FIELDWORK

CPT rig(s)	18.5-tonne rubber-tracked CPT unit (UK8)
Date fieldwork started	23 rd September 2020
Date fieldwork completed	23 rd September 2020
Lankelma's representative	Paul Dimelow
Client's representative	Adam Perks

REPORT

Status	Revision	Action	Date	Name
02 Revised	00	Completed	05/10/20	Chris Player
		Checked	05/10/20	Emma Stickland
		Approved	05/10/20	Joseph Hobbs
02 Revised	01	Completed	07/10/20	Chris Player
		Checked	07/10/20	Emma Stickland
		Approved	07/10/20	Joseph Hobbs
02 Final	02	Completed	07/10/20	Chris Player
		Checked	07/10/20	Emma Stickland
		Approved	07/10/20	Joseph Hobbs

CONTENTS

1	INTRODUCTION	1
2	DISCLAIMER	1
3	COMPLETED WORKS	1
4	FIELDWORK GENERAL	1
5	CONE PENETRATION TESTS	2
5.1	<i>Glossary of CPT Terms and Symbols</i>	2
5.2	<i>CPT Data Reduction and Presentation</i>	4
5.3	<i>In-situ Stress Conditions</i>	5
5.4	<i>Soil Unit Weight</i>	5
5.5	<i>Soil Behaviour Type</i>	6
5.6	<i>Soil Behaviour Type Index – I_c</i>	7
5.7	<i>Undrained Shear Strength</i>	7
5.8	<i>Overconsolidation Ratio</i>	9
5.9	<i>SPT N₆₀ Values</i>	9
5.10	<i>Coefficient of Volume Change</i>	10
6	CPT INTERPRETATION NOTES	11
7	REFERENCES	14
APPENDIX A	SUMMARY TABLES	
APPENDIX B	GENERAL INFORMATION	
APPENDIX C	CONE PENETRATION TEST RESULTS	
APPENDIX D	INTERPRETATION RESULTS - SET 1	
APPENDIX E	INTERPRETATION RESULTS - SET 2	
APPENDIX F	SITE LOCATION PLAN	

1 INTRODUCTION

At the request of Applied Geology, a soils investigation was carried out on project *Hoyland Common, Barnsley*.

Site location:

(In the general region of)

Sheffield Road
Hoyland Common
Barnsley
S74 0DP

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 and care 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 suitability of any assumptions, derived soil parameters, soil classification descriptions or soil layer boundaries contained in this report.

3 COMPLETED WORKS

- 14 nr. cone penetration tests with pore pressure measurement (CPTu)
- Factual report including point data interpretation of selected parameters

Appendix A *Summary Tables* contains tabulated details of the works completed together with analysis results where applicable.

4 FIELDWORK GENERAL

Fieldwork was performed with an 18.5-tonne rubber-tracked CPT unit (UK8) equipped with a 15-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 between 10 m and 25 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.

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.

Penetrometers without load cell temperature sensors were calibrated in accordance with BS8422:2003 and ASTM E74-13a, and penetrometers with down-hole digitisation and incorporating load cell temperature sensors were calibrated in accordance with ISO 376:2011. The BS8422:2003 calibration provides a single calibration uncertainty value as a percentage of full scale output (FSO), while ISO 376:2011 calibrations provide an uncertainty value for each calibration force or pressure and extends to the very low range (tip pressure ≥ 0.06 MPa) required to quantify uncertainty in low strength soils. 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 1000 cSt glycerine oil.

5.1 GLOSSARY OF CPT TERMS AND SYMBOLS

SYMBOLS & ABBREVIATIONS

B_q	Pore pressure ratio. The net pore pressure normalized with respect to the net cone resistance: $B_q = (u_2 - u_0) / (q_t - \sigma_v)$
F_r	Normalised friction sleeve resistance: $F_r = f_s / (q_c - \sigma_v)$
f_s	Friction sleeve resistance. The total frictional force acting on the friction sleeve, F_s , divided by its surface area A_s : $f_s = F_s / A_s$.
G	Shear modulus
g	Gravitational constant: $g = 9.81 \text{ m/s}^2$
G_0	Small strain shear modulus
G_s	Specific gravity of solids
HOC	Heavily overconsolidated
I_c	Soil Behaviour Type Index
LOC	Lightly overconsolidated
NC	Normally consolidated
OC	Overconsolidated

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	Normalised cone resistance (Method 1): $Q_t = (q_c - \sigma_v)/\sigma'_v$
q_t	Corrected tip resistance. The cone tip resistance q_c corrected for pore water pressure effects on the cone shoulder.
q_{t-net}	Net cone resistance: $q_{t-net} = q_t - \sigma_v$. Where q_t is unavailable q_c is applied.
q_{t1}	Normalised cone resistance (Method 2): $q_{t1} = (q_t)/(\sigma'_v)^{0.5}$
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: $R_f = (f_s/q_c) \cdot 100$
SBT or SBTn	Soil behaviour type classification
u_0	Equilibrium pore pressure
u_2	Pore pressure. Dynamic pore pressure measured at the shoulder position (u_2) during penetration dissipation tests. $u_2 = \Delta u_2 + u_0$
Δu_2	Excess pore pressure. $\Delta u_2 = u_2 - u_0$
V_s, V_p	Shear wave velocity, V_s, and pressure wave velocity, V_p. Measured with use of a seismic receiver.
z	Depth below ground level. Depth below ground level as penetration length without correction for inclination, or true depth after correction for inclination.
<u>Greek</u>	
γ	Unit weight of soil
γ_w	Unit weight of water
ρ	Volumetric mass density (or specific mass) of soil
σ_v	Total overburden stress
σ'_v	Effective overburden stress
σ_{atm} , or, P_a	Reference atmospheric stress: $\sigma_{atm} = 101.3$ kPa

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)

Seismic cone: A cone penetrometer with a seismic receiver incorporated inside or behind.

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

Soil behaviour type, or 'SBT': Soil classification scheme or classified soil type according to Robertson (1990, 2016) often abbreviated to SBT or according to normalised cone parameters SBTn.

Rod string: The series of hollow tube push rods that transmit force to the penetrometer.

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 and sleeve force measurements were converted to pressure 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 $a = 0.8$:

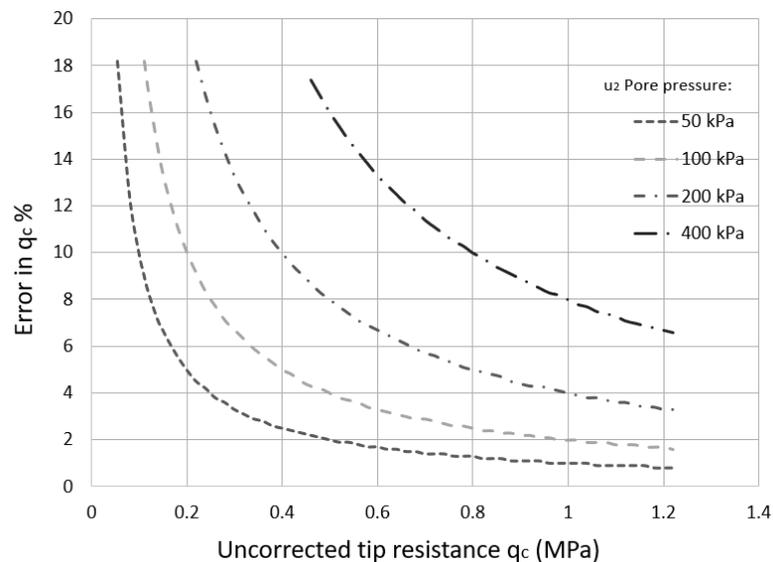


Figure 5-1 Uncorrected tip with measured tip resistance

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. Rod spikes (artefacts of the pause for push rod addition) were filtered from the cone tip and sleeve data. The data was re-sampled from 10 mm resolution to 20 mm to reduce the size of the data set to a more manageable size for end users. A 20 mm resolution is well within the intrinsic influence zone of the cone tip measurement and the loss of meaningful resolution is negligible.

The raw data are presented in Appendix C. For piezocone tests q_t is reported on all logs, and q_c only appears in the digital AGS data.

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 for fine grain soils (undrained) are suitable for soils of both silicate and carbonate composition, whereas parameters derived for coarse soils are intended for non-cemented predominantly silicate composition.

5.3 IN-SITU STRESS CONDITIONS

An estimate of the equilibrium pore pressure and total and effective vertical stress states is required for derivation of many 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 taken as equal to the groundwater level(s) provided by the Client. In this instance, below the final depth of all tests.

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 phreatic surface coincide. The phreatic or piezometric surface reported is intended to provide information about the assumed pore pressure distribution and may not represent the true position of the groundwater table or perched water bodies. Complex groundwater pressure distributions will be applied if they are observed from the measurements and are sufficiently well defined.

5.4 SOIL UNIT WEIGHT

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

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

Throughout pre-drilled zones (inspection pits or drill-out) the soil unit weight was assumed as 17 kN/m³.

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 for NC soils exceeding a depth of 15 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/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 and plasticity.

The layer boundaries are manually interpreted based on broad changes in SBT classification or variance with depth. Once layer boundaries are defined, the SBT zones classified within each layer are listed together with the corresponding percentage of data points within the layer. The modal classification is reported in full, with abbreviated short descriptions for all secondary zones, for example - '*Clays - clay to silty clay [74%]; *Silt mixtures [20%]*', where the asterisk represents an abbreviation of the full description '*Silt mixtures - clayey silt to silty clay*'. It is important to consider that the classification zone boundaries do not exist in reality and small shifts in the cone response can lead multiple classifications within layers of relatively uniform behaviour; especially were the layer data plot close to a triple junction and/or has spurious spikes or very thin layers. Therefore, some system to limit the number of classified zones is usually necessary for clarity in the plot. The logic used by Lankelma for each layer is:

For $LT \geq 1$, $C = 85$

For $0.5 \leq LT < 1$, $C = 75$

For $0 < LT < 0.5$, $C = 65$

Where

C = Minimum % SBT zone classification coverage within the layer

LT = Layer thickness (m)

For layers having a thickness of less than 1 m then 10% of data at the top and bottom of the layer are excluded to limit the effect of transition zone data (mobilised resistance influenced by overlying or underlying strata) being included in the classification.

The continuous SBT index I_c should be used to assess the classification distribution and variation not accounted for by the layer description.

An alternative to this system is to classify each data point using coloured bars. However, the zones where the classification is known to be incorrect (e.g. very thin layers, transition zones) are left included and may be misinterpreted.

The results are presented in Appendix D.

5.6 SOIL BEHAVIOUR TYPE INDEX - I_c

The main trend in soil behaviour type (SBT) variation can be expressed by 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*) or zones 8 & 9 (*overconsolidated or cemented*).

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

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

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 normalised version of I_c is generally more accurate, while the non-normalised version is intended for compatibility with the non-normalised Robertson's (2010) SBT chart and may be more accurate at shallow depths in overconsolidated soils.

The results are presented in Appendix D.

5.7 UNDRAINED SHEAR STRENGTH

The undrained shear strength s_u is usually estimated as a factor of net 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 shear.

Mayne and Peuchen (2018) performed an evaluation of 407 high-quality triaxial compression tests with net tip resistance to 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_{u5}' 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.

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_{u3}' on the logs ($N_k = 15$) has been included as a reference for comparison to traditionally reported N_k values of 15 and 20.

5.8 OVERCONSOLIDATION RATIO

The preconsolidation stress σ'_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 :

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

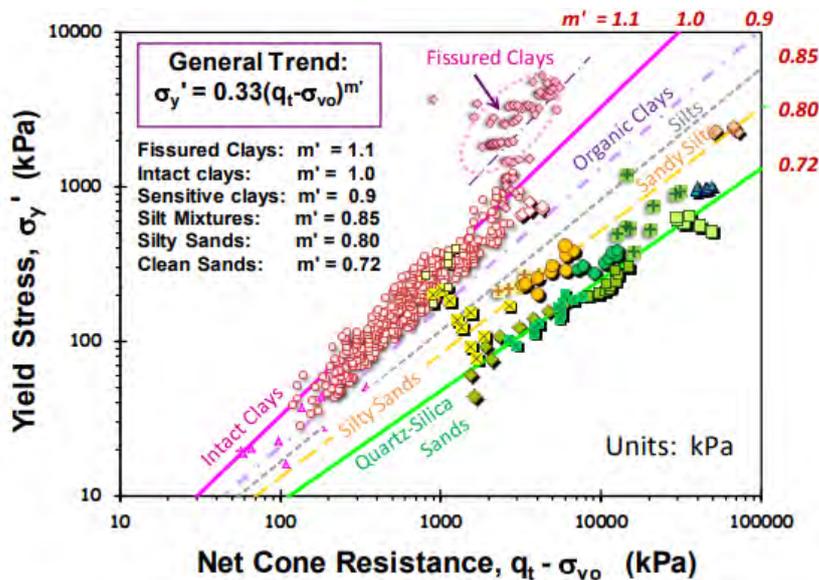


Figure 5-2 Preconsolidation stress with net cone resistance power law, reproduced from Mayne (2014).

An additional σ'_p and OCR was calculated for $m' = 1.1$ to reflect the upper trend for over consolidated fissured clays not captured by the correlation with I_c .

5.9 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.

Method 1 - Jefferies and Davies (1993) cited in 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.

5.10 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.

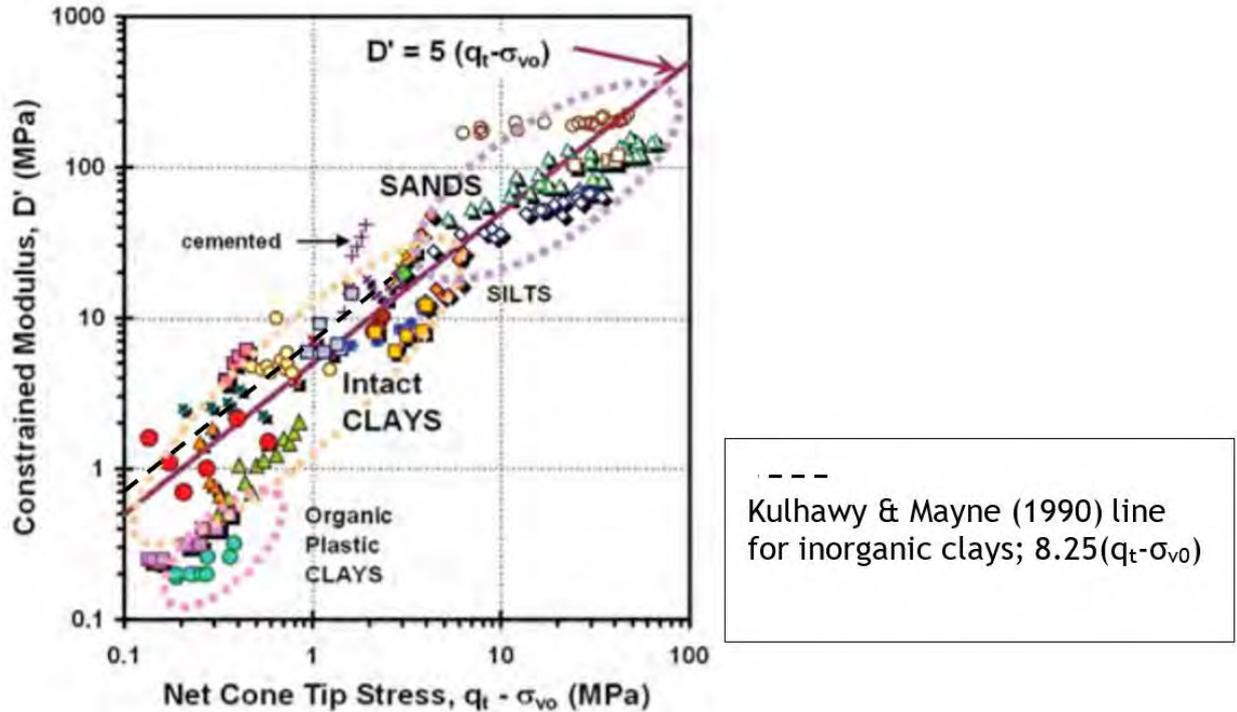


Figure 5-3 Constrained modulus of Mayne (2006). Annotated/redrawn from NCHRP Synthesis 368 (2007).

The results are presented in Appendix D.

6 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.

Piezocone 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 u_2 (CPT u)

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 pressure 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 re-saturate at higher excess pressures later in the test as gas dissolves under pressure. The pore pressure response in saturated contractive soils should 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 (up to 20%, typically ~10%) than the equivalent corrected tip resistance depending on the magnitude of excess pore pressure generated during penetration.

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. The last ~8 cm of data is also not included in the SBT material description as no friction sleeve measurements are recorded.

FRICION SLEEVE DATA

There are two common causes of friction sleeve measurement issues; 1) unequal pore pressure acting on the sleeve end areas as the sleeve passes through materials of different permeability and hence excess pore pressure Δu_2 , often resulting in a negative/positive spike, and 2) Accuracy limitations and temperature effects in very low strength or sensitive soils. 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 cm² projected cone tip area and 150 cm² friction sleeve area, however it is common to use a larger 15 cm² cone with a 225 cm² friction sleeve area for improved sensitivity, temperature stability, damage prevention and penetration depth potential due to the higher bending strength. Use of a 15 cm² cone does however require higher penetration force (reaction force) for a given penetration pressure and produces more pronounced transition zones and thin layer effects (larger 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 short sharp reductions in pore water readings due to dilation effects. Frequent gravels in soft or loose soils may generate localised erroneous friction ratio values.

7 REFERENCES

- ASTM E74-13a (2013), Standard Practice of Calibration of Force-Measuring Instruments for Verifying the Force Indication of Testing Machines, ASTM International, West Conshohocken, PA.
- British Standards Institution (2003) BS 8422:2003, Force measurement - Strain gauge load cell systems - Calibration method. London: British Standards Institution.
- Houlsby, G.T. and Teh, C.I. (1988). Analysis of the Piezocone in Clay. Proceedings of the International Symposium on Penetration Testing (ISOPT-1), Orlando, Vol. 2, pp. 777-783. Balkema Pub., Rotterdam.
- ISO 376:201. Metallic materials – Calibration of force-proving instruments used for the verification of uniaxial testing machines (2011).
- ISO 10012:2003 Measurement management systems - Requirements for measurement processes and measuring equipment. New Delhi: Bureau of Indian Standards (2003).
- ISO 22476-1:2012 Geotechnical investigation and testing - Field testing - Part 1: Electrical cone and piezocone penetration test. New Delhi: Bureau of Indian Standards (2012).
- ISSMGE, 1999. International reference test procedure for the cone penetrometer test CPT and the cone penetration test CPTU, Report of ISSMGE TC16 on Ground Property Characterisation for in situ Testing, In Proceedings of the 12th European conference on Soil Mechanics and Geotechnical Engineering 3:2195-222 (1999).
- Idriss, I. M., and Boulanger, R. W. (2008) "Soil liquefaction during earthquakes". Monograph MNO-12, Earthquake Engineering Research Institute, Oakland, CA, pp. 261.
- Jamiolkowski, M., LoPresti, D.C.F., and Manassero, M. (2001) "Evaluation of Relative Density and Shear Strength of Sands from Cone Penetration Test and Flat Dilatometer Test". Soil Behaviour and Soft Ground Construction (GSP119), American Society of Civil Engineers, pp. 201-238. Reston, Va. 2001
- Jefferies, M.G. and Davies M.P. (1993), "Use of CPTu to estimate equivalent SPT N60", Geotechnical Testing Journal, 16(4), pp. 458-467.
- Kim, K., Prezzi, M., Salgado, R., and Lee, W. (2008) "Effect of Penetration Rate on Cone Penetration Resistance in Saturated Clayey Soils", Journal of Geotech. Geoenviron. Eng., Vol. 134(8), pp. 1142-1153.
- Kulhawy, F.H. and Mayne, P.W. (1990) "Manual on Estimating Soil Properties for Foundation Design". Report EPRI EL-6800 Research Project 1493-6, Electric Power Research Institute, Palo Alto, CA, pp. 306.
- Ladd, C.C. and DeGroot, D.J. (2003) "Recommended Practice for Soft Ground Site Characterization: Arthur Casagrande Lecture". Soil & Rock America 2003 (Proceedings. 12th Pan American Conference on Soil Mechanics and Geotechnical Engineering, Boston, MA). Verlag Glückauf, Essen, Germany. pp. 3-57.
- Lunne, T., Robertson, P.K. and Powell, J.J.M. (1997) "Cone Penetration Testing in Geotechnical Practice" Blackie Academic, New York 1997. (Robertson, 2009)
- Lunne, T. and Kleven, A. (1981) "Role of CPT in North Sea Foundation Engineering". Session at the ASCE National Convention: Cone Penetration Testing and Materials. pp. 76-107. American Society of Engineers (ASCE).
- Mayne, P.W. and Campanella, R.G. (2005) "Versatile Site Characterisation by Seismic Piezocone". Proceedings of the 16th International Conference on Soil Mechanics and Geotechnical Engineering, Vol. 2. Millpress, Rotterdam, The Netherlands 2005. pp 721-724.
- Mayne, P.W. and Peuchen J. (2018), "Evaluation of CPTU Nkt cone factor for undrained strength of clays". Proceedings of the 4th International Symposium on Cone Penetration Testing (CPT'18), 21-22 June 2018, Delft, The Netherlands. CRC Press. pp. 423-429.
- Mayne, P.W. (2007) "Cone Penetration Testing - A Synthesis of Highway Practice". NCHRP Synthesis 368, Transportation Research Board, Washington, D.C.
- Mayne, P.W. (2014). KN2: "Interpretation of geotechnical parameters from seismic piezocone tests". Proceedings of the 3rd International Symposium on Cone Penetration Testing (CPT'14), June 2014, ISSMGE Technical Committee TC 102, Edited by P.K. Robertson and K.I. Cabal: pp. 47-73.
- Parez, L. and Fauriel, R. (1988). "Le piézocône. Améliorations apportées à la reconnaissance de sols". Revue Française de Géotech, Vol. 33, pp. 13-27.
- Robertson, P.K. (2009). Cited in "Guide to Cone Penetration Testing - 6th edition (2015)", pp. 36, pp. 58, Gregg Drilling & Testing, Inc.

Robertson, P.K. (2009). Interpretation of cone penetration tests - a unified approach. Canadian Geotechnical Journal, 46, pp. 1337-1355.

Robertson, P.K. (2010) "Soil Behaviour Type from the CPT: an update". 2nd International Symposium on Cone Penetration Testing. Huntington Beach, CA, USA.

Robertson, P.K. (2012). Interpretation of in-situ tests - some insights, Proc. 4th Int. Conf. on Geotechnical & Geophysical Site Characterization, ISC'4, Brazil, 1.

Robertson, P.K (2014) "Estimating in-situ soil permeability from CPT & CPTu". Proceedings of the 3rd International Symposium on Cone Penetration Testing (CPT'14), June, 2014, ISSMGE Technical Committee TC 102.

Senneset, K., R. Sandven, and N. Janbu (1989), "Evaluation of Soil Parameters from Piezocone Tests," Transportation Research Record 1235, Transportation Research Board, National Research Council, Washington D.C, pp. 24-37.

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

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)	Casing depth (m)	Refusal factor	Dissipations	Seismic cone	Samples	Easting	Northing	Elevation (m)	Date of test	Remarks
CPT5101	6.42	S15-CFIP.1526	UK8			Tip load				435983.46	399785.62	133.98	23/09/2020	
CPT5102	5.04	S15-CFIP.1526	UK8			Tip load				436030.23	399811.23	133.67	23/09/2020	
CPT5103	10.14	S15-CFIP.1526	UK8			Target depth				436076.11	399858.50	133.52	23/09/2020	
CPT5104	4.12	S15-CFIP.1526	UK8			Inclination				435990.39	399739.26	132.43	23/09/2020	
CPT5104A	2.90	S15-CFIP.1526	UK8			Tip load				435990.39	399739.26	132.43	23/09/2020	
CPT5105	3.64	S15-CFIP.1526	UK8			Tip load				436059.15	399775.64	131.12	23/09/2020	
CPT5105A	9.86	S15-CFIP.1526	UK8			Tip load				436059.15	399775.64	131.12	23/09/2020	
CPT5105B	1.00	S15-CFIP.1526	UK8			Tip load				436059.15	399775.64	131.12	23/09/2020	
CPT5106	3.14	S15-CFIP.1526	UK8			Inclination				436161.04	399783.79	127.79	23/09/2020	
CPT5106A	10.66	S15-CFIP.1526	UK8			Tip load				436114.09	399820.78	130.57	23/09/2020	
CPT5106B	11.68	S15-CFIP.1526	UK8			Tip load				436114.09	399820.78	130.57	23/09/2020	
CPT5107	1.58	S15-CFIP.1526	UK8			Tip load				436114.09	399820.78	130.57	23/09/2020	
CPT5108	10.16	S15-CFIP.1526	UK8			Target depth				436067.45	399708.39	129.05	23/09/2020	
CPT5109	10.20	S15-CFIP.1526	UK8			Target depth				436110.03	399739.98	128.72	23/09/2020	

CPT test plots are presented in Appendix C.

APPENDIX B GENERAL INFORMATION

LIST OF FIGURES

Cone calibration certificate: S15-CFIIP.1526

Data sheet: 18.5-tonne rubber-tracked CPT unit (UK8)

CPT soil behaviour type chart

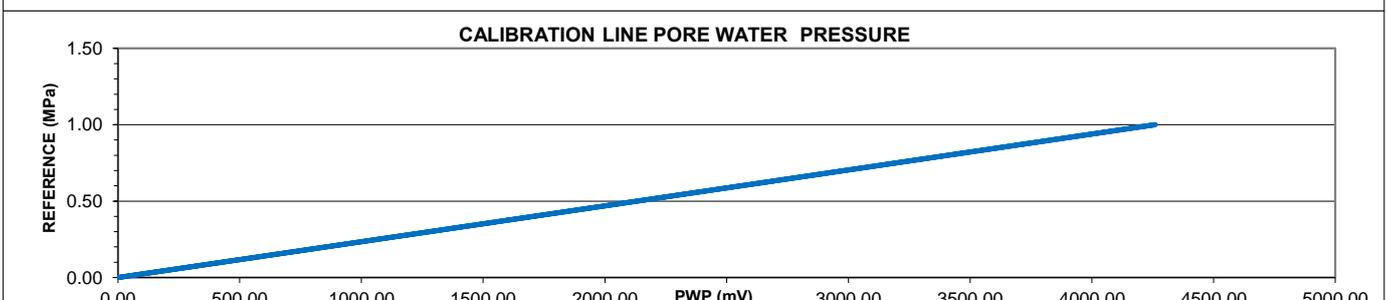
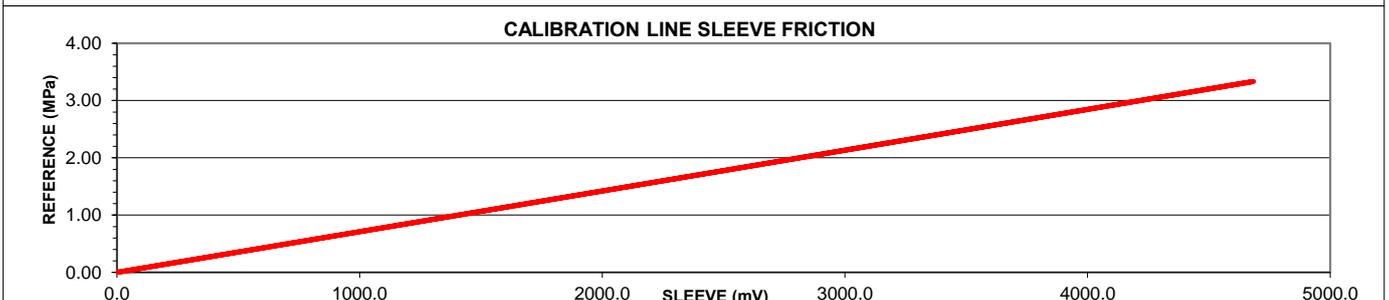
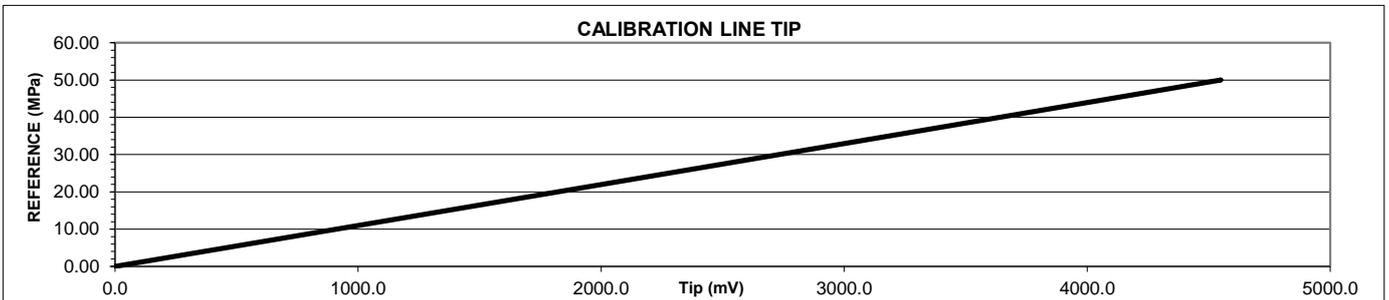


CALIBRATION CERTIFICATE

Geopoint-S15-150kN-2MPa

Cone Serial Number:
S15-CFIIP.1526

REFERENCE INSTRUMENTS:	CONE END RESISTANCE	SLEEVE FRICTION	PORE WATER PRESSURE
ID	51998	51998	502273
TYPE	AM DSCC-100kN	AM DSCC-100kN	Omega MMG750V1
UNCERTAINTY (±%)	0.01	0.01	0.01
Nominal pressure (MPa,MPa,MPa)	50.00	3.33	1.00
Maximum pressure (MPa,MPa,MPa)	100.00	6.67	2.00
Area (cm²)	15	225	N/A
Sensitivity (mV/MPa)	91.01	1405.07	4259.49
Calibration file scaling factor:			
Nominal cal force (kN, kN, BAR)	75	75	10
Calibration number (mV)	4551	4684	4259
Zero point (mV)	250	326	739
Sensitivity (mV/kN, mV/kN, mV/BAR)	60.675	62.447	425.949
Inclination factors (mV)	X -20°= 611, 0°= 2500, 20°= 4538 / Y -20°= 682, 0°= 2472, 20°= 4679		
Measured alpha factor:	0.80		
Uncertainty (%):			
Reproducibility	0.02	0.02	0.05
Linearity	0.06	0.05	0.20
Hysteresis	0.06	0.09	0.12
Combined expanded (k=2)	0.13	0.32	0.42
Application class	1	1	1



Instrument:	S15-150kN	Location:	Lankelma Calibration Laboratory
Serial Number:	S15-CFIIP.1526	Temperature(° C)	19.3
Manufacturer:	Geopoint	Calibration Engineer	Ed Forder
Date of calibration:	19/06/2020	Calibration Expiry	18/10/2020
Calibration signed and dated by:		Calibration checked and dated by:	
<i>Ed Forder</i>		<i>A Harman</i>	



UK8

Tracked crawler



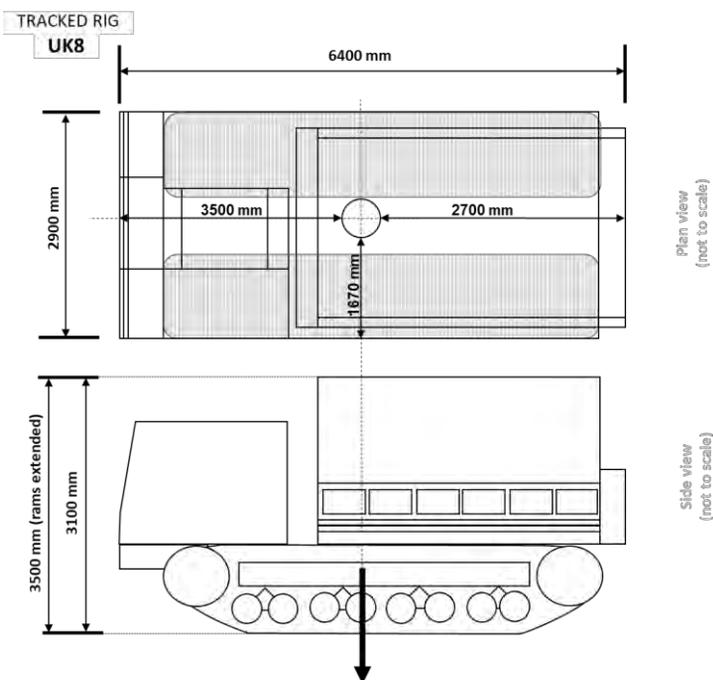
Rig weight	16.5 T
Max. operating ram capacity	15 T
Max. travelling speed	15 km/h
Track material	Rubber
Track length	3.40 m
Track width	0.75 m
Max. ground clearance on jacks	0.21 m
Max. ground bearing pressure	Tracking/pushing – 35 kPa Pulling – 63 kPa
Max. testing gradient	Flat – no self levelling
Max. traversing gradient	35 degrees (operator assessed)
Noise output at 2 m	Testing – 74 dBA Driving – 95 dBA
Clamp arrangement	36/55 push-pull clamp
Ram stroke	0.70 m
Max. casing size	55 mm
Fuel type	Biodegradable diesel
Typical production	100m+ of standard CPTu testing per day (depending on site conditions and access)

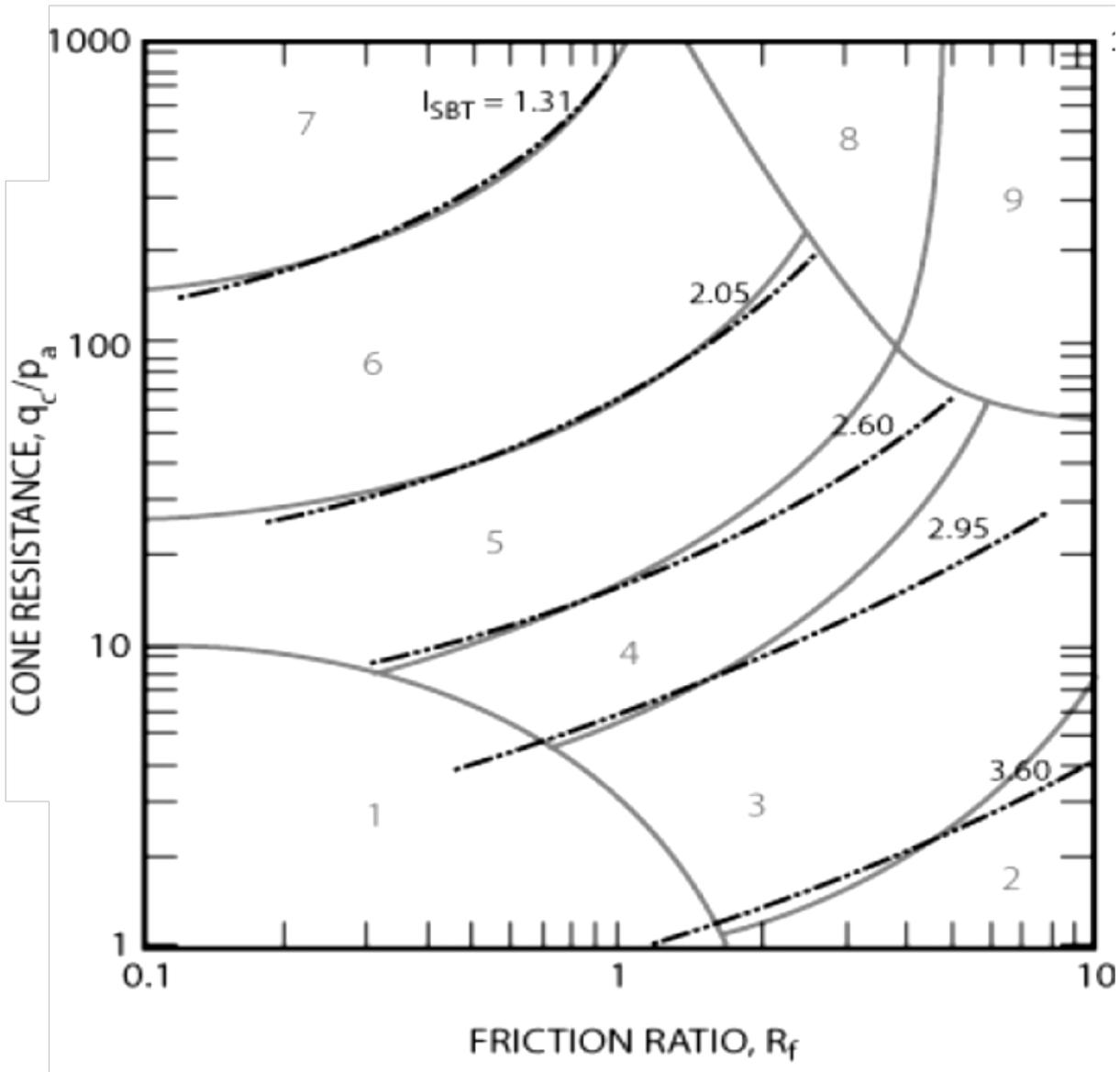
The low ground bearing pressures, large footprint and high ground clearance of our 'bogskipper' tracked crawler makes it perfect for working on sites with boggy or very soft ground conditions.

This unique rig has experience working on intertidal projects, peat bogs and weight-sensitive sites.

The rubber tracks minimize the potential for any damage to delicate infrastructure, such as a sea wall.

Biodegradable diesel and hydraulic oil for working on environmentally sensitive sites.



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 SBT index I_{SBT} (denoted I_c on the test plots). The chart is also applicable to normalised tip and 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		*Heavily overconsolidated or cemented

Note zones 8 and 9 appear as 'Stiff sand to clayey sand – HOC or cemented' and 'Stiff fine grained – HOC or cemented' within the soil unit descriptions of plots in Appendix D.

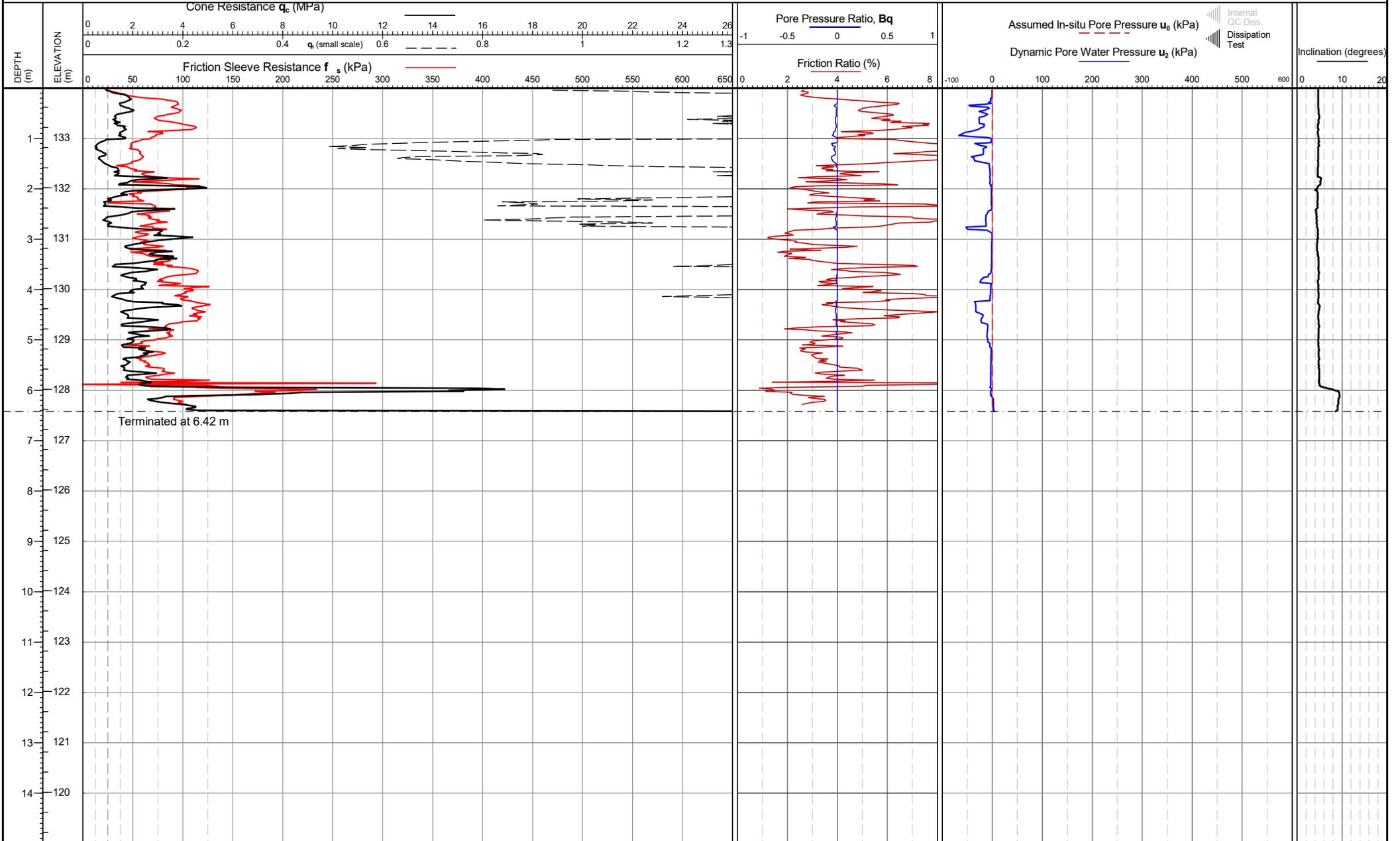
APPENDIX C CONE PENETRATION TEST RESULTS**RAW DATA PLOTS**

Plots are provided for all locations



Project: HOYLAND COMMON, BARNSELEY

Client: APPLIED GEOLOGY



Cone area (mm²): 1500
 Cone ID: S15-CFIP.1526
 Operator: Martyn Waters
 Rig Used: UK8
 Date of test: 23/09/2020 13:00:00

Zero drift (Pre/post test)
 qc (kPa): -22.0
 fs (kPa): 1.5 (fs,drm - qc,drm)
 U₂ (kPa): -1.4

Location: South Yorkshire, UK
 Coordinates: 435983.46, 399785.62
 Elevation: 133.98
 Coordinate system:

Remarks:
 *Phreatic surface origin: Client estimate
 Termination Remark: Tip load

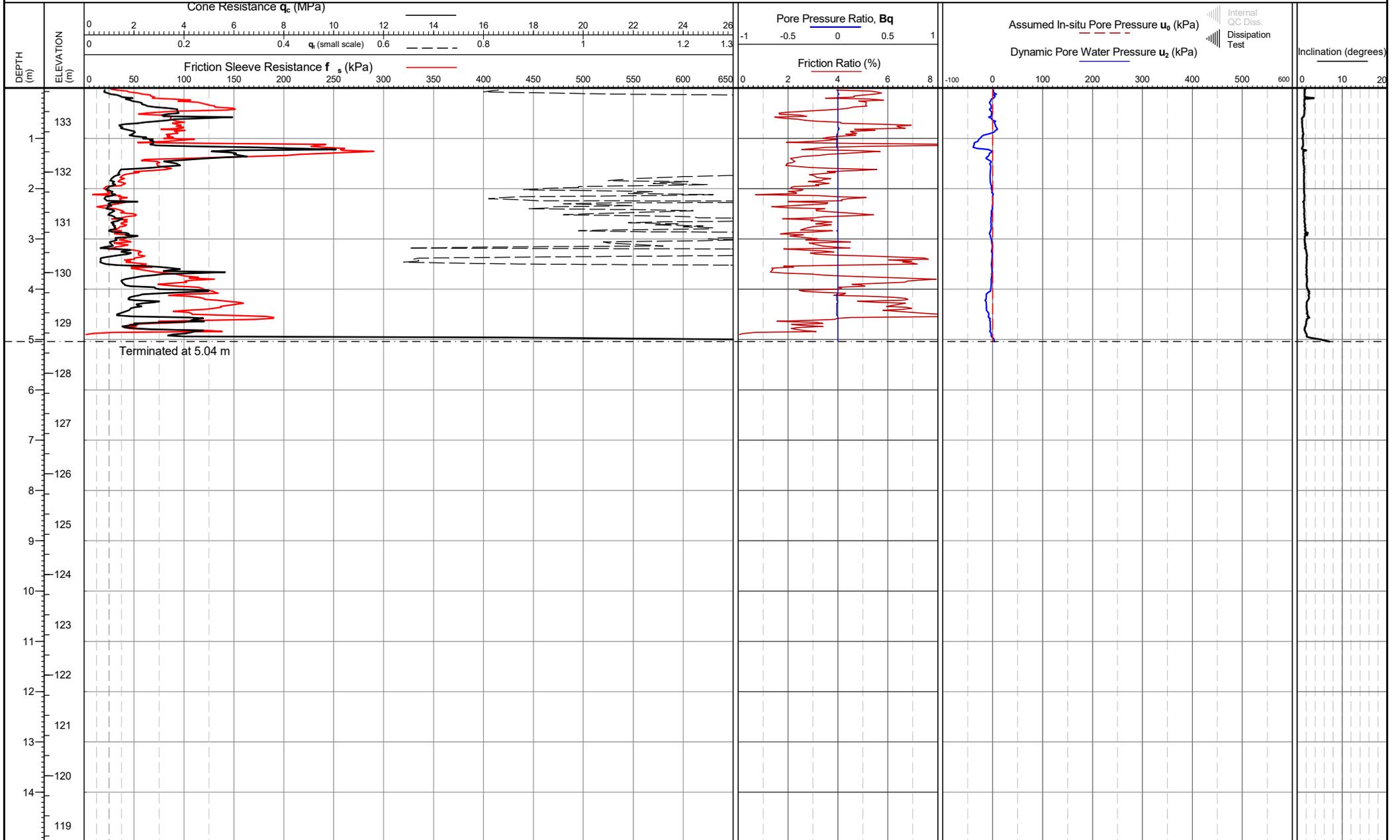
Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1
 Checked by: Chris Player

TEST ID: CPT5101
 Page 1 of 1



Project: HOYLAND COMMON, BARNSELEY

Client: APPLIED GEOLOGY



Cone area (mm²): 1500
 Cone ID: S15-CFIP.1526
 Operator: Martyn Waters
 Rig Used: UK8
 Date of test: 23/09/2020 13:18:00

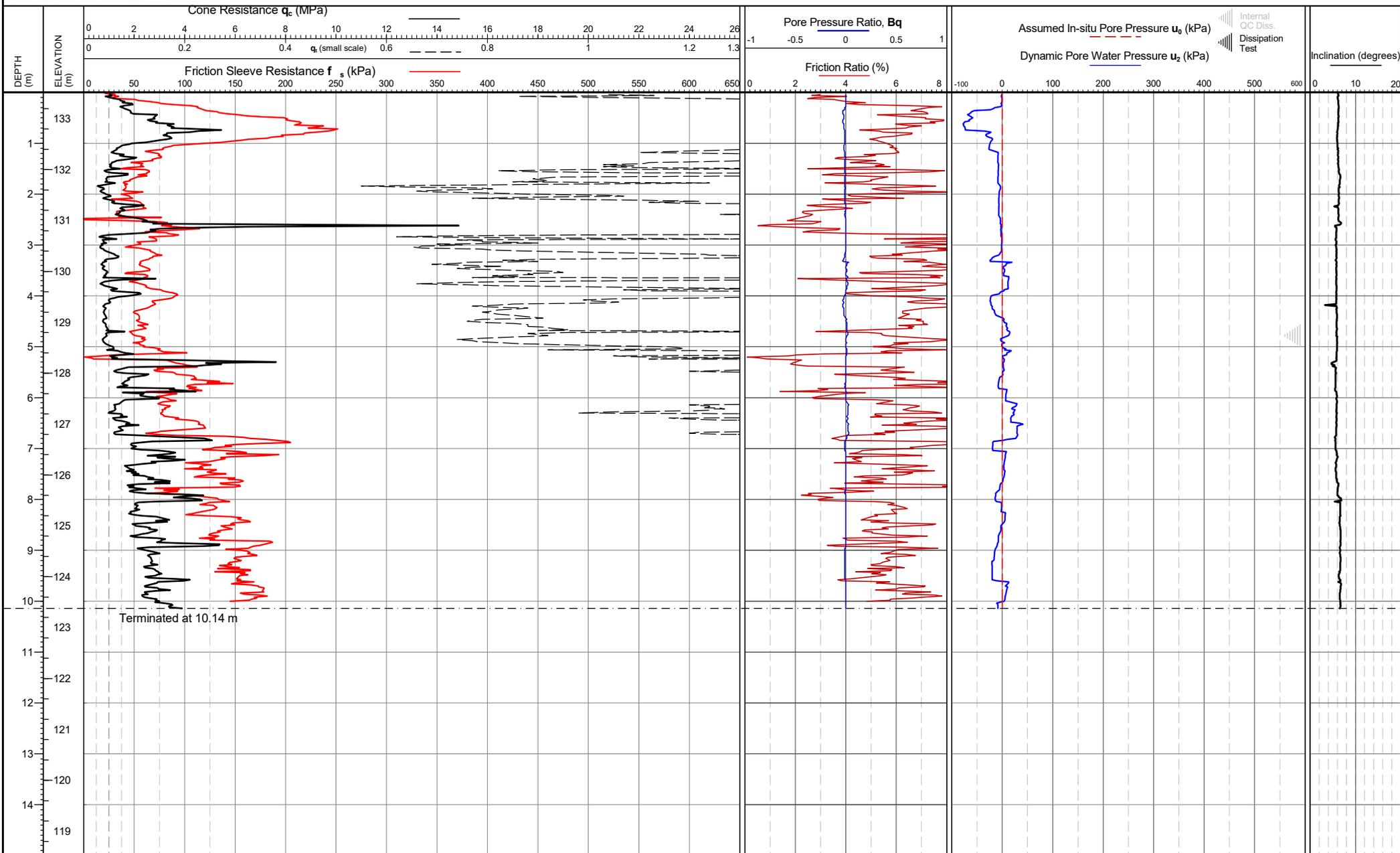
Zero drift (Pre/post test)
 qc (kPa): 11.0
 fs (kPa): -2.1 (fs drift - qc drift)
 U₂ (kPa): 2.1

Location: South Yorkshire, UK
 Coordinates: 436030.23, 399811.23
 Elevation: 133.67
 Coordinate system:

Remarks:
 *Phreatic surface origin: Client estimate
 Termination Remark: Tip load

Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1
 Checked by: Chris Player

TEST ID: CPT5102
 Page 1 of 1

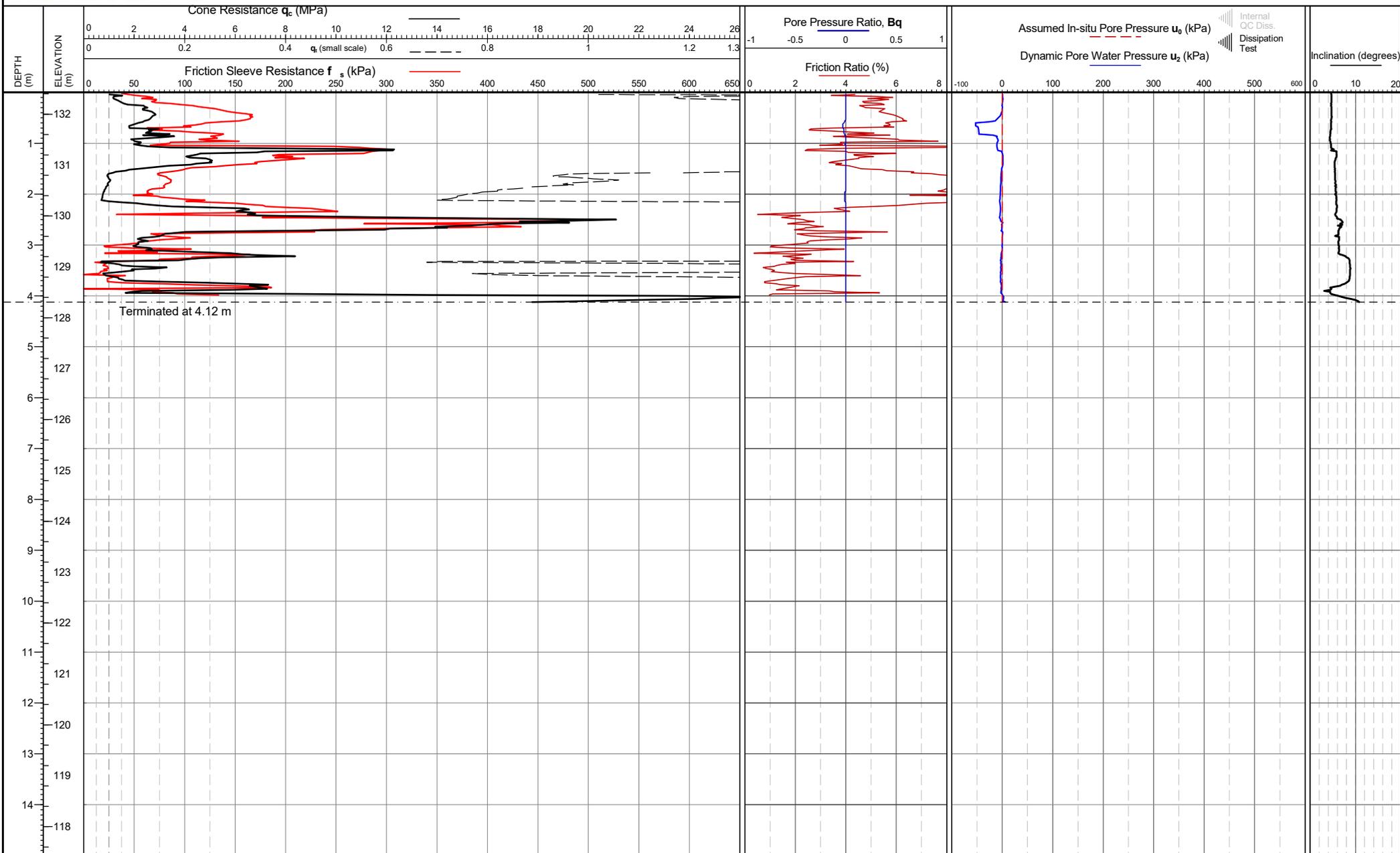


<p>Cone area (mm²): 1500 Cone ID: S15-CFIP.1526 Operator: Martyn Waters Rig Used: UK8 Date of test: 23/09/2020 11:27:00</p>	<p>Zero drift (Pre/post test) q_c (kPa): 11.0 f_s (kPa): 0.7 ($f_{s, drift} - q_{c, drift}$) u_2 (kPa): 0.5</p>	<p>Location: South Yorkshire, UK Coordinates: 436076.11, 399858.5 Elevation: 133.52 Coordinate system:</p>	<p>Remarks: *Phreatic surface origin: Client estimate Termination Remark: Target depth</p>	<p>Date of plot: 07-10-20 Lankelma Project Ref: P-107408-1 Checked by: Chris Player</p>	<p>TEST ID: CPT5103 Page 1 of 1</p>
--	--	---	--	---	---



Project: HOYLAND COMMON, BARNSELEY

Client: APPLIED GEOLOGY



Cone area (mm²): 1500
 Cone ID: S15-CFIP.1526
 Operator: Martyn Waters
 Rig Used: UK8
 Date of test: 23/09/2020 13:35:00

Zero drift (Pre/post test)
 q_c (kPa): -11.0
 f_s (kPa): 0.0 ($f_{s, drift} - q_{c, drift}$)
 u_2 (kPa): -7.3

Location: South Yorkshire, UK
 Coordinates: 435990.39, 399739.26
 Elevation: 132.43
 Coordinate system:

Remarks:
 *Phreatic surface origin: Client estimate
 Termination Remark: Inclination

Date of plot:
 07-10-20

Lankelma Project Ref:
 P-107408-1

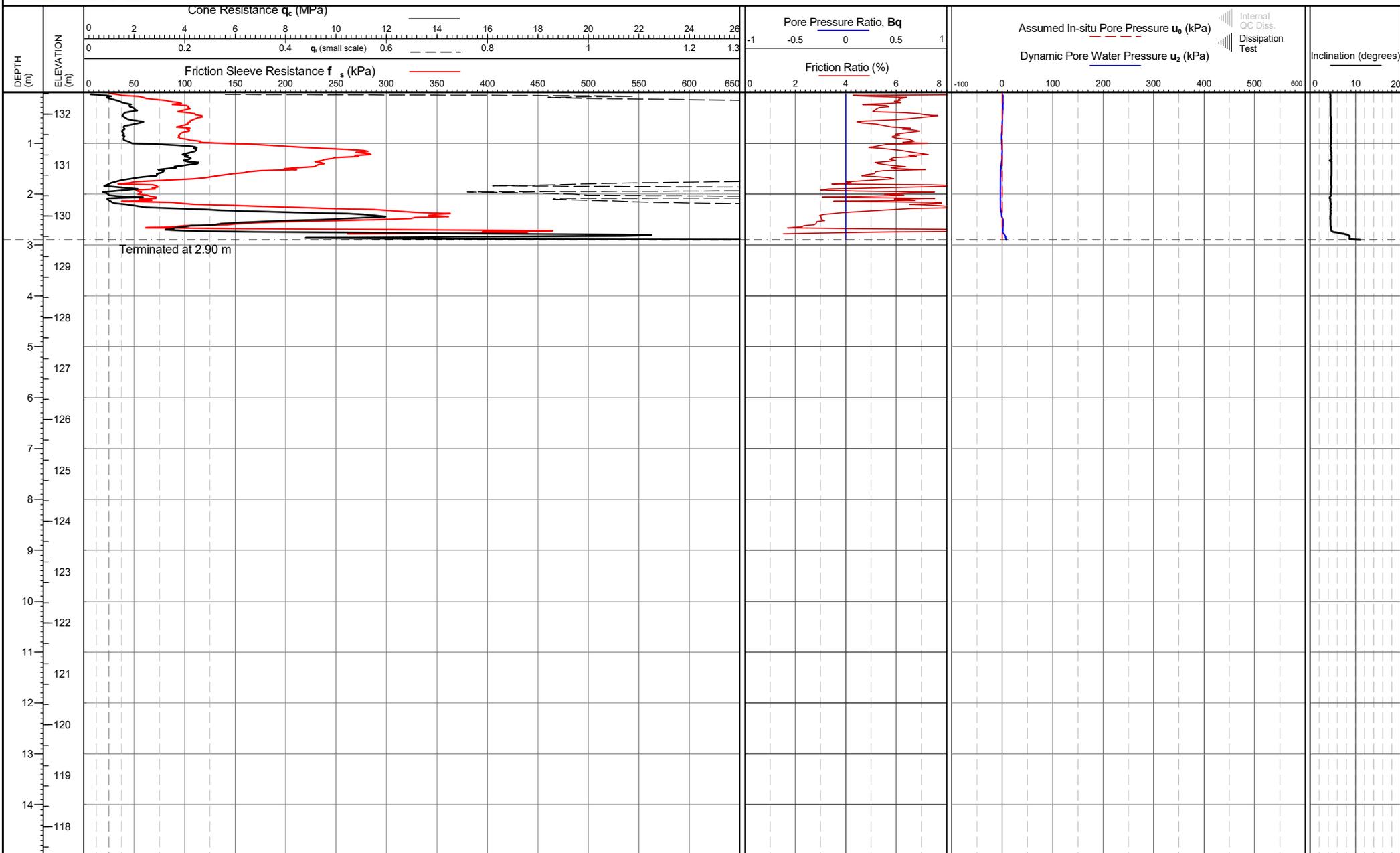
Checked by:
 Chris Player

TEST ID: CPT5104



Project: HOYLAND COMMON, BARNSELEY

Client: APPLIED GEOLOGY



Cone area (mm²): 1500
 Cone ID: S15-CFIP.1526
 Operator: Martyn Waters
 Rig Used: UK8
 Date of test: 23/09/2020 13:49:00

Zero drift (Pre/post test)
 qc (kPa): 0.0
 fs (kPa): -15.7 (fs_drift - qc_drift)
 U₂ (kPa): 3.5

Location: South Yorkshire, UK
 Coordinates: 435990.39, 399739.26
 Elevation: 132.43
 Coordinate system:

Remarks:
 *Phreatic surface origin: Client estimate
 Termination Remark: Tip load

Date of plot:
 07-10-20

Lankelma Project Ref:
 P-107408-1

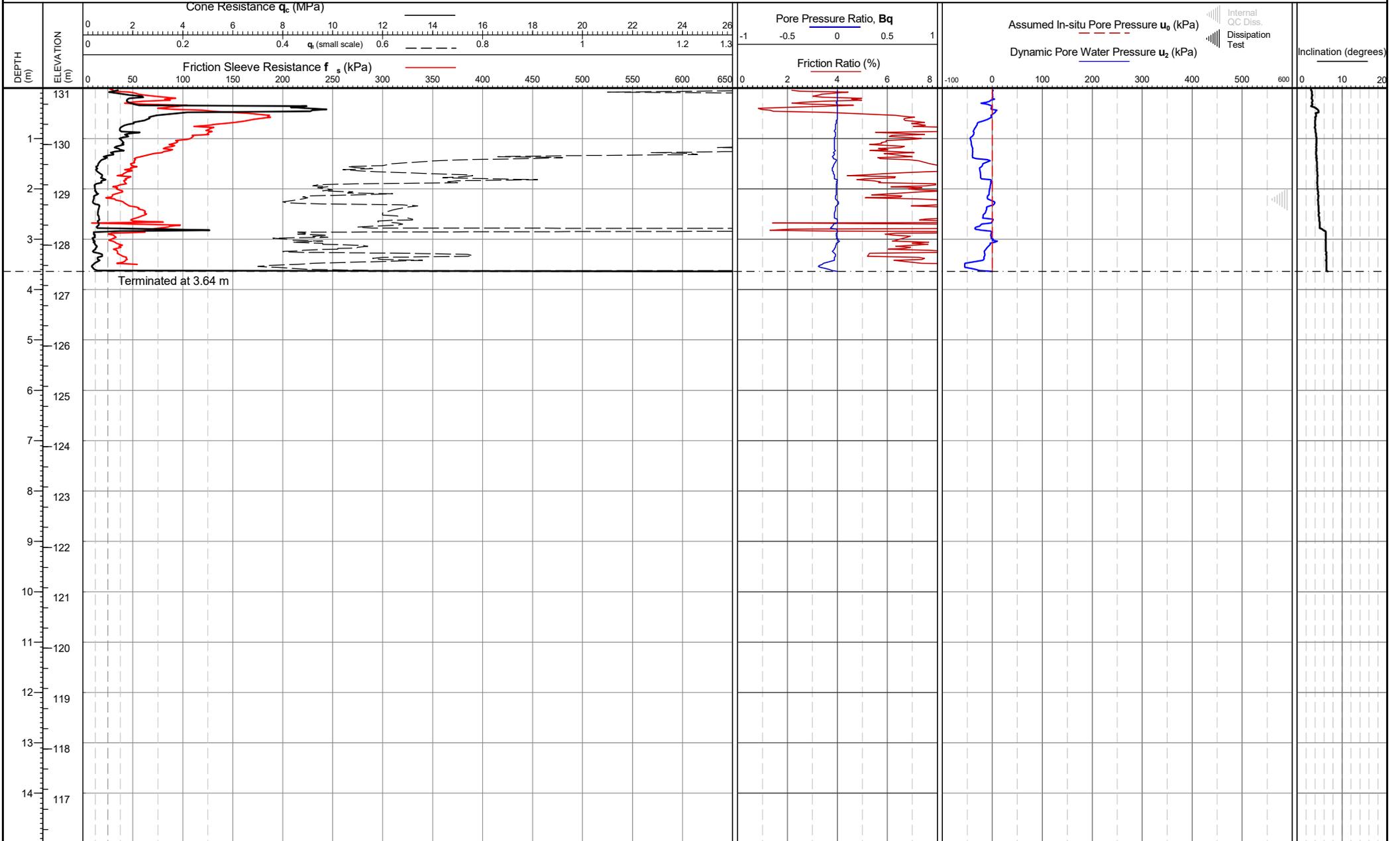
Checked by:
 Chris Player

TEST ID: CPT5104A



Project: HOYLAND COMMON, BARNSELY

Client: APPLIED GEOLOGY



Cone area (mm²): 1500
 Cone ID: S15-CFIP.1526
 Operator: Martyn Waters
 Rig Used: UK8
 Date of test: 23/09/2020 12:08:00

Zero drift (Pre/post test)
 q_c (kPa): 22.0
 f_s (kPa): -0.8 ($f_{s, drift} - q_{c, drift}$)
 u_2 (kPa): -4.0

Location: South Yorkshire, UK
 Coordinates: 436059.15, 399775.64
 Elevation: 131.12
 Coordinate system:

Remarks:
 *Phreatic surface origin: Client estimate
 Termination Remark: Tip load

Date of plot:
 07-10-20

Lankelma Project Ref:
 P-107408-1

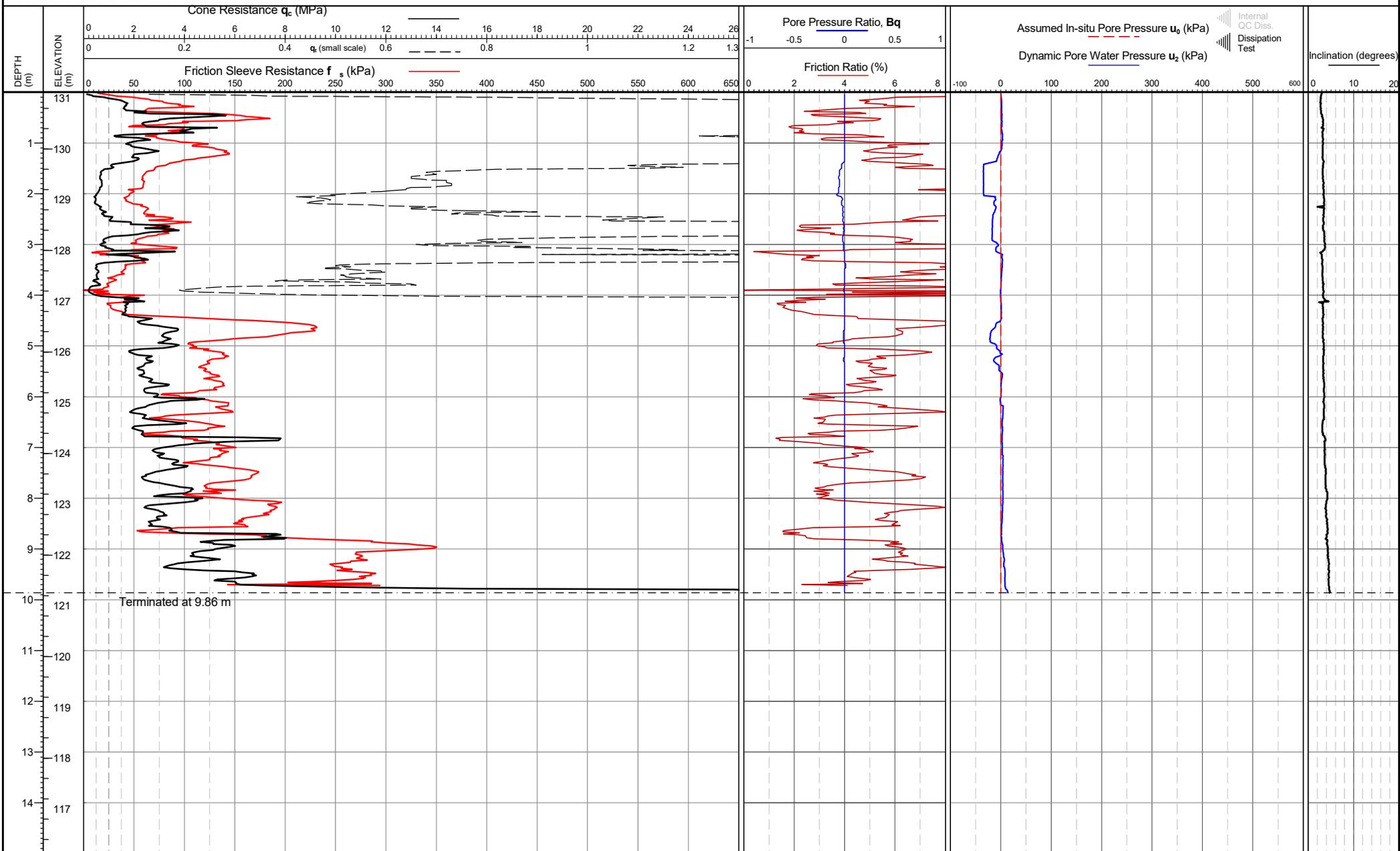
Checked by:
 Chris Player

TEST ID: CPT5105



Project: HOYLAND COMMON, BARNSELEY

Client: APPLIED GEOLOGY



Cone area (mm²): 1500
 Cone ID: S15-CFIP.1526
 Operator: Martyn Waters
 Rig Used: UK8
 Date of test: 23/09/2020 12:33:00

Zero drift (Pre/post test)
 q_c (kPa): -11.0
 f_s (kPa): 0.7 ($f_{s, drift} - q_{c, drift}$)
 u_2 (kPa): -13.1

Location: South Yorkshire, UK
 Coordinates: 436059.15, 399775.64
 Elevation: 131.12
 Coordinate system:

Remarks:
 *Phreatic surface origin: Client estimate
 Termination Remark: Tip load

Date of plot:
 07-10-20

Lankelma Project Ref:
 P-107408-1

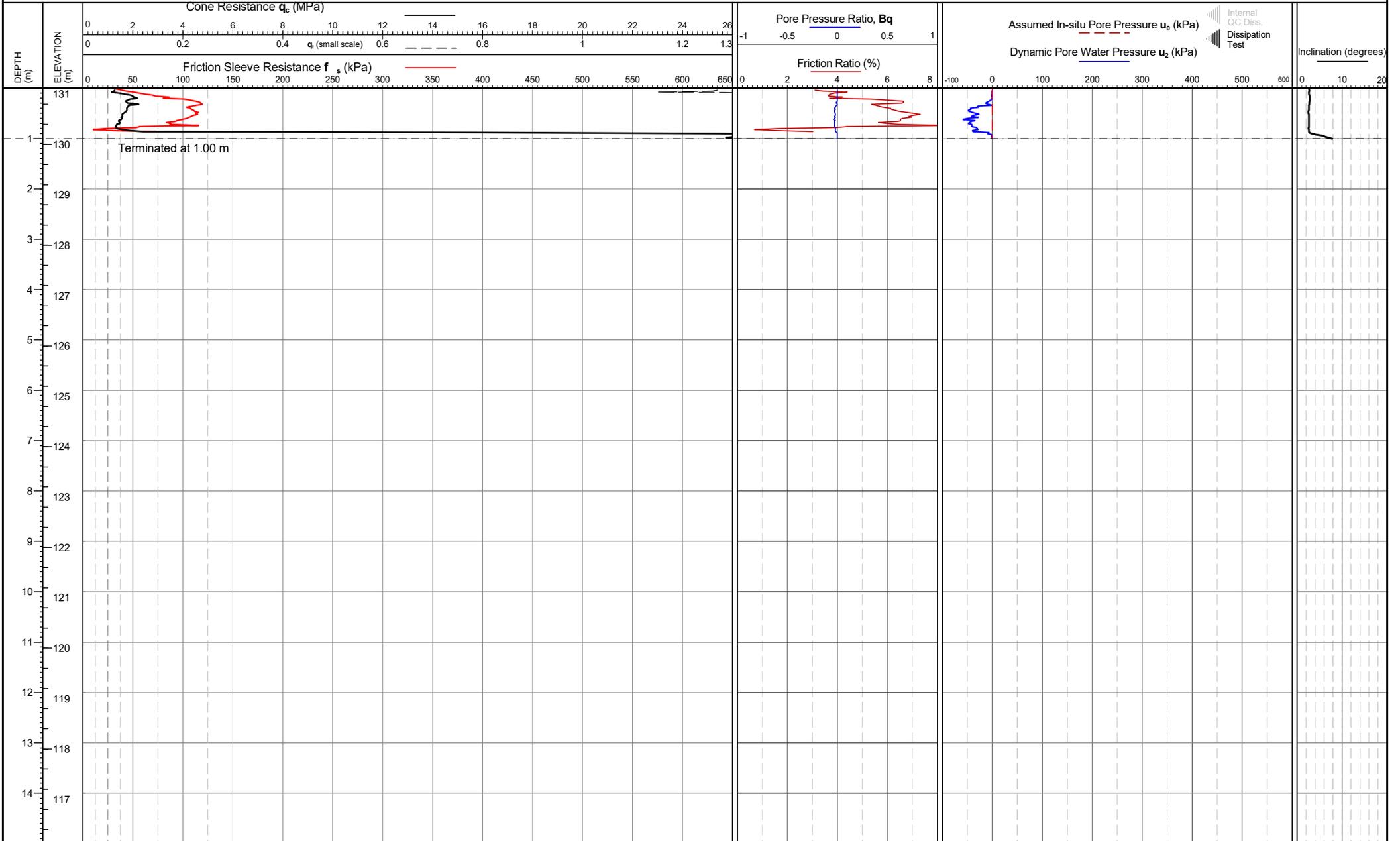
Checked by:
 Chris Player

TEST ID: CPT5105A



Project: HOYLAND COMMON, BARNSELEY

Client: APPLIED GEOLOGY



Cone area (mm²): 1500
 Cone ID: S15-CFIP.1526
 Operator: Martyn Waters
 Rig Used: UK8
 Date of test: 23/09/2020 14:03:00

Zero drift (Pre/post test)
 q_c (kPa): -11.0
 f_s (kPa): 2.8 ($f_{s, drift} - q_{c, drift}$)
 u_2 (kPa): 0.9

Location: South Yorkshire, UK
 Coordinates: 436059.15, 399775.64
 Elevation: 131.12
 Coordinate system:

Remarks:
 *Phreatic surface origin: Client estimate
 Termination Remark: Tip load

Date of plot:
 07-10-20

Lankelma Project Ref:
 P-107408-1

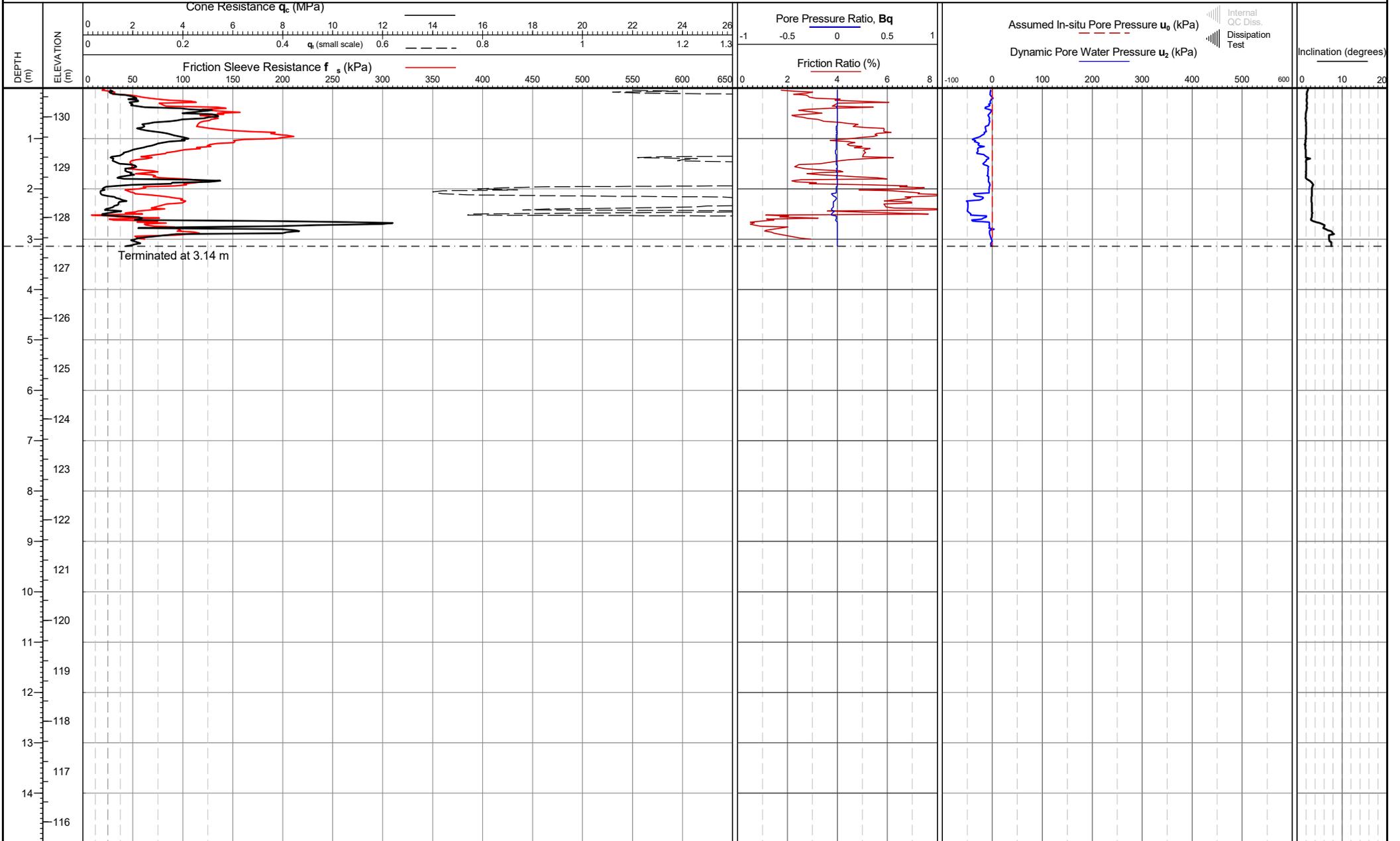
Checked by:
 Chris Player

TEST ID: CPT5105B



Project: HOYLAND COMMON, BARNSELY

Client: APPLIED GEOLOGY

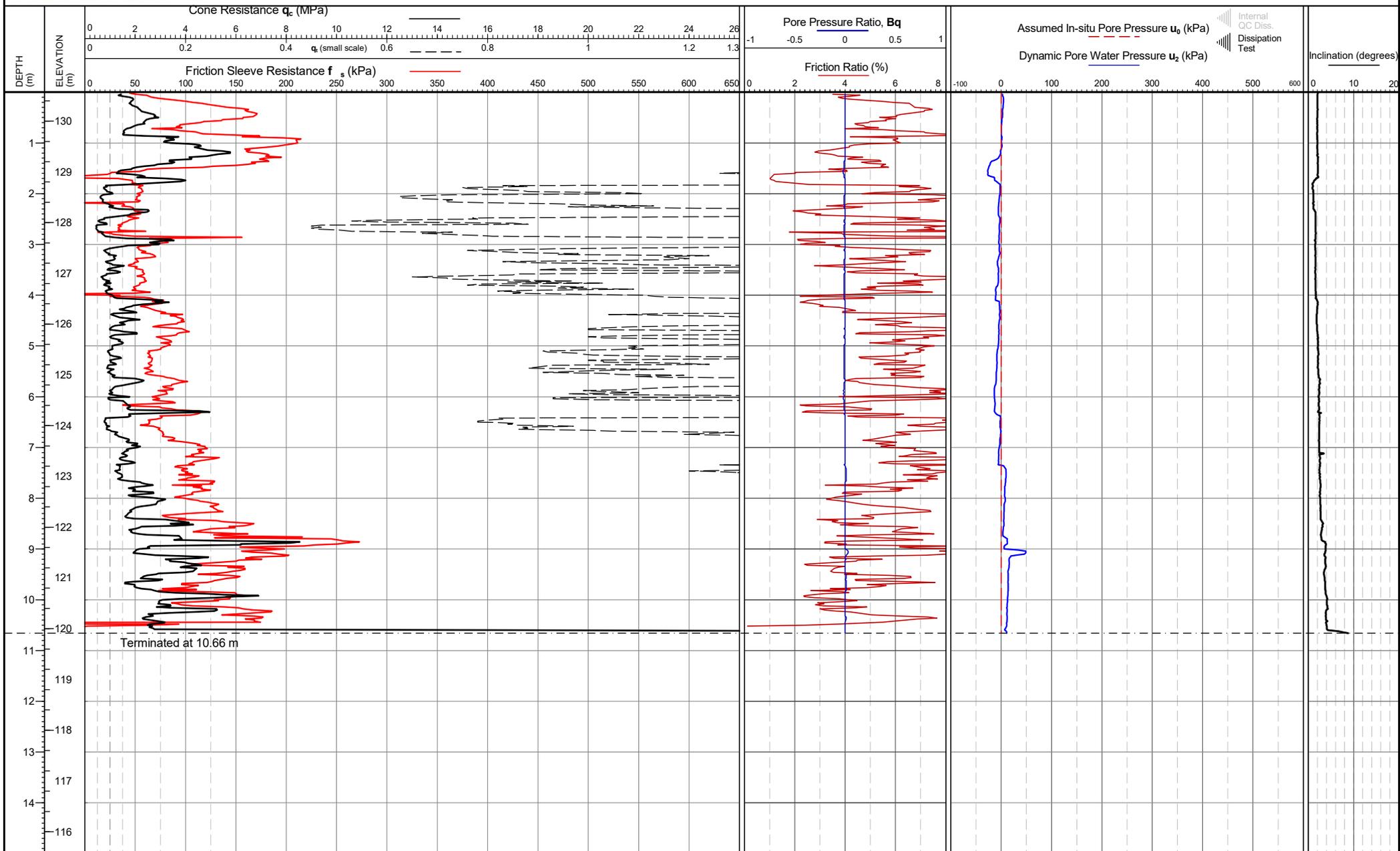


<p>Cone area (mm²): 1500 Cone ID: S15-CFIP.1526 Operator: Martyn Waters Rig Used: UK8 Date of test: 23/09/2020 10:30:00</p>	<p>Zero drift (Pre/post test) q_c (kPa): 11.0 f_s (kPa): -0.7 ($f_{s,drift} - q_{c,drift}$) u_2 (kPa): -3.5</p>	<p>Location: South Yorkshire, UK Coordinates: 436114.09, 399820.78 Elevation: 130.57 Coordinate system:</p>	<p>Remarks: *Phreatic surface origin: Client estimate Termination Remark: Inclination</p>	<p>Date of plot: 07-10-20 Lankelma Project Ref: P-107408-1 Checked by: Chris Player</p>	<p>TEST ID: CPT5106 Page 1 of 1</p>
--	--	--	--	--	--

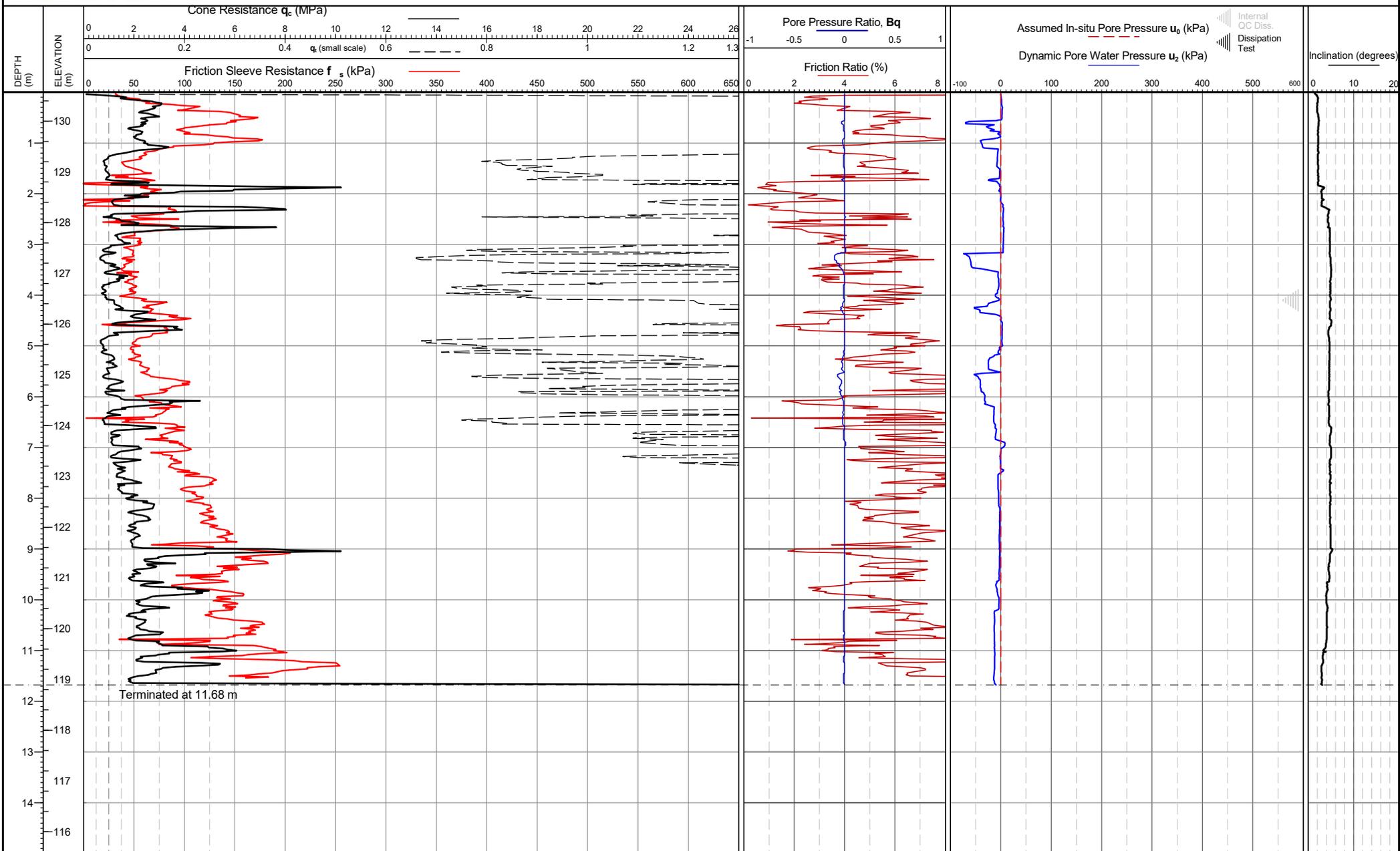


Project: HOYLAND COMMON, BARNSELEY

Client: APPLIED GEOLOGY



<p>Cone area (mm²): 1500 Cone ID: S15-CFIP.1526 Operator: Martyn Waters Rig Used: UK8 Date of test: 23/09/2020 10:59:00</p>	<p>Zero drift (Pre/post test) q_c (kPa): -11.0 f_s (kPa): 0.7 ($f_{s, drift} - q_{c, drift}$) u_2 (kPa): 2.1</p>	<p>Location: South Yorkshire, UK Coordinates: 436114.09, 399820.78 Elevation: 130.57 Coordinate system:</p>	<p>Remarks: *Phreatic surface origin: Client estimate Termination Remark: Tip load</p>	<p>Date of plot: 07-10-20 Lankelma Project Ref: P-107408-1 Checked by: Chris Player</p>	<p>TEST ID: CPT5106A Page 1 of 1</p>
--	---	--	--	---	--

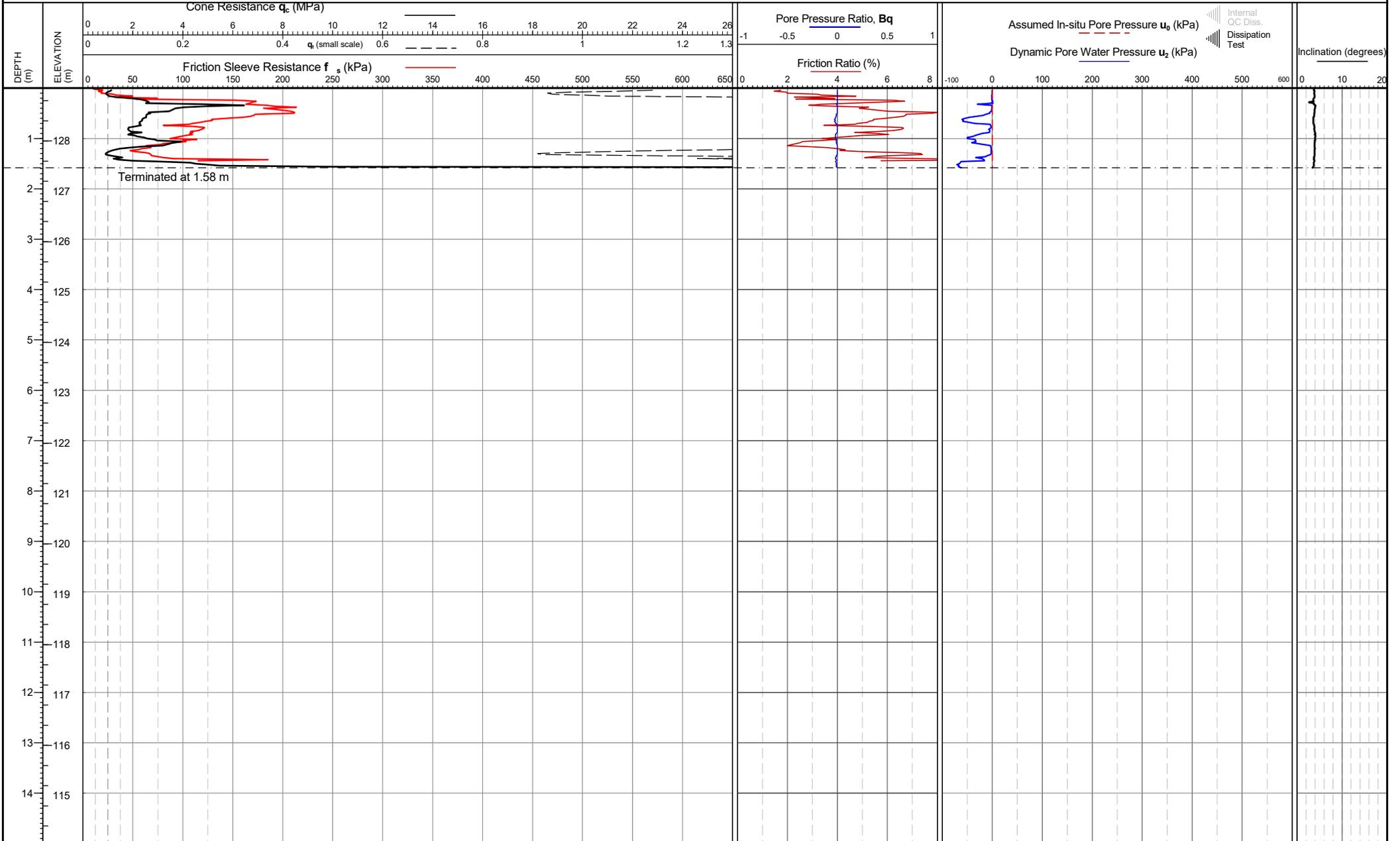


<p>Cone area (mm²): 1500 Cone ID: S15-CFIP.1526 Operator: Martyn Waters Rig Used: UK8 Date of test: 23/09/2020 14:15:00</p>	<p>Zero drift (Pre/post test) q_c (kPa): -11.0 f_s (kPa): 2.1 ($f_{s,drift} - q_{c,drift}$) u_2 (kPa): -2.1</p>	<p>Location: South Yorkshire, UK Coordinates: 436114.09, 399820.78 Elevation: 130.57 Coordinate system:</p>	<p>Remarks: *Phreatic surface origin: Client estimate Termination Remark: Tip load</p>	<p>Date of plot: 07-10-20 Lankelma Project Ref: P-107408-1 Checked by: Chris Player</p>	<p>TEST ID: CPT5106B Page 1 of 1</p>
--	--	--	--	---	--

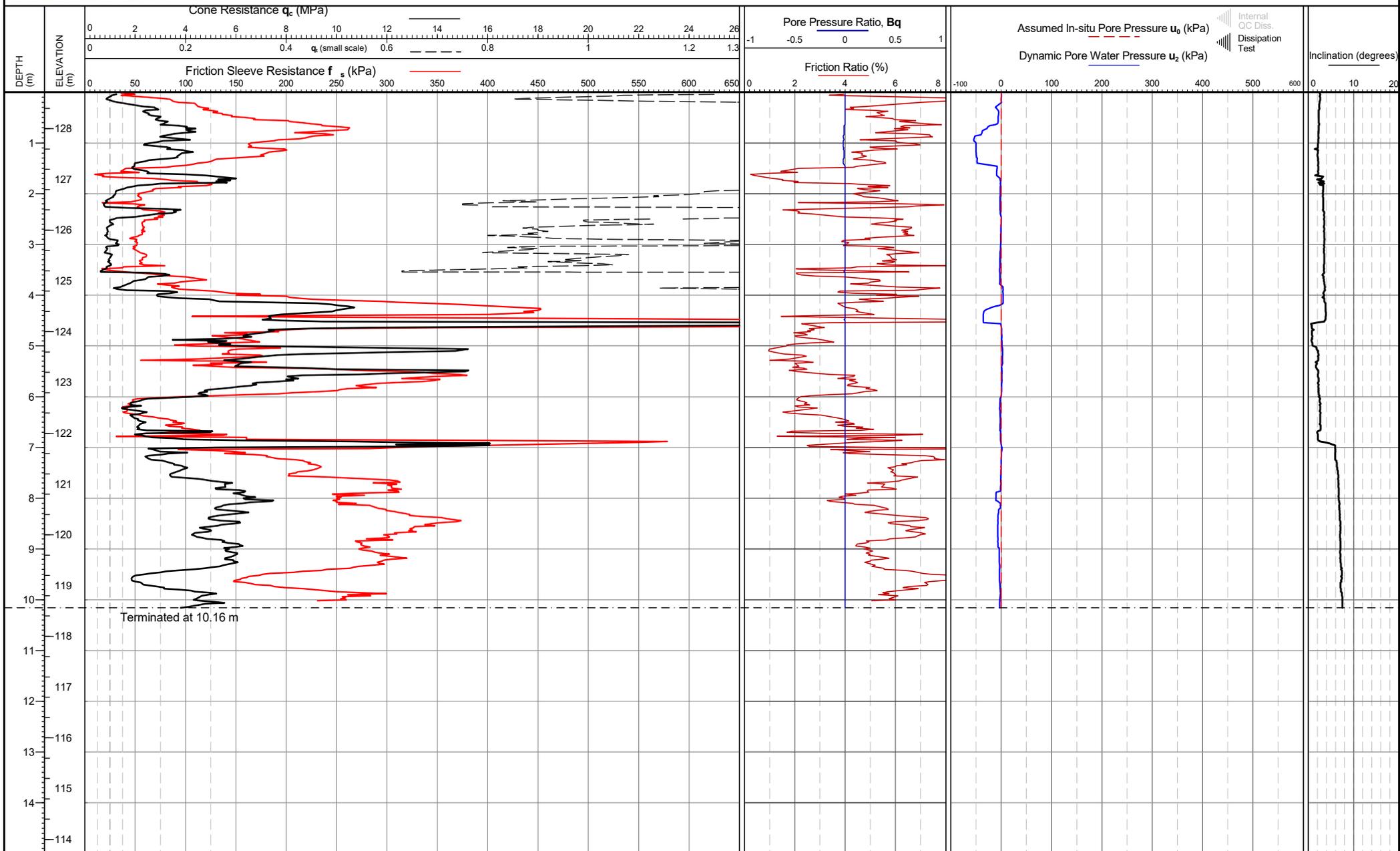


Project: HOYLAND COMMON, BARNSELEY

Client: APPLIED GEOLOGY



<p>Cone area (mm²): 1500 Cone ID: S15-CFIP.1526 Operator: Martyn Waters Rig Used: UK8 Date of test: 23/09/2020 08:46:00</p>	<p>Zero drift (Pre/post test) qc (kPa): 0.0 fs (kPa): 0.0 (fs_{drift} - qc_{drift}) U₂ (kPa): -2.3</p>	<p>Location: South Yorkshire, UK Coordinates: 436067.45, 399708.39 Elevation: 129.05 Coordinate system:</p>	<p>Remarks: *Phreatic surface origin: Client estimate Termination Remark: Tip load</p>	<p>Date of plot: 07-10-20 Lankelma Project Ref: P-107408-1 Checked by: Chris Player</p>	<p>TEST ID: CPT5107 Page 1 of 1</p>
--	--	--	--	---	---

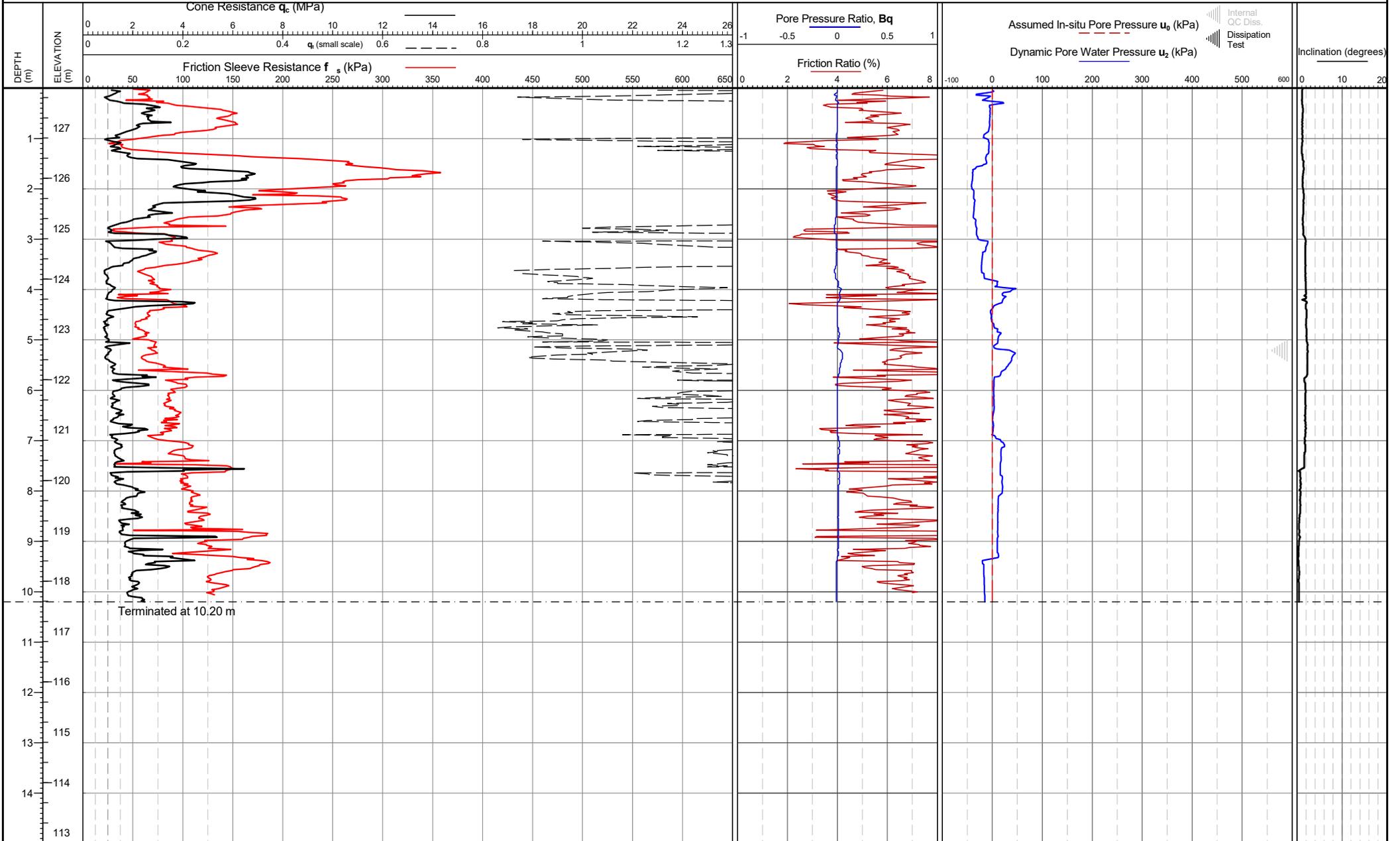


<p>Cone area (mm²): 1500 Cone ID: S15-CFIP.1526 Operator: Martyn Waters Rig Used: UK8 Date of test: 23/09/2020 09:07:00</p>	<p>Zero drift (Pre/post test) q_c (kPa): -22.0 f_s (kPa): -2.1 ($f_{s, drift} - q_{c, drift}$) u_2 (kPa): 0.0</p>	<p>Location: South Yorkshire, UK Coordinates: 436110.03, 399739.98 Elevation: 128.72 Coordinate system:</p>	<p>Remarks: *Phreatic surface origin: Client estimate Termination Remark: Target depth</p>	<p>Date of plot: 07-10-20 Lankelma Project Ref: P-107408-1 Checked by: Chris Player</p>	<p>TEST ID: CPT5108 Page 1 of 1</p>
--	--	--	--	---	---



Project: HOYLAND COMMON, BARNSELEY

Client: APPLIED GEOLOGY



Terminated at 10.20 m

Cone area (mm²): 1500
 Cone ID: S15-CFIP.1526
 Operator: Martyn Waters
 Rig Used: UK8
 Date of test: 23/09/2020 09:39:00

Zero drift (Pre/post test)
 qc (kPa): 11.0
 fs (kPa): -1.4 (fs drift - qc drift)
 U₂ (kPa): 4.0

Location: South Yorkshire, UK
 Coordinates: 436161.04, 399783.79
 Elevation: 127.79
 Coordinate system:

Remarks:
 *Phreatic surface origin: Client estimate
 Termination Remark: Target depth

Date of plot:
 07-10-20

Lankelma Project Ref:
 P-107408-1

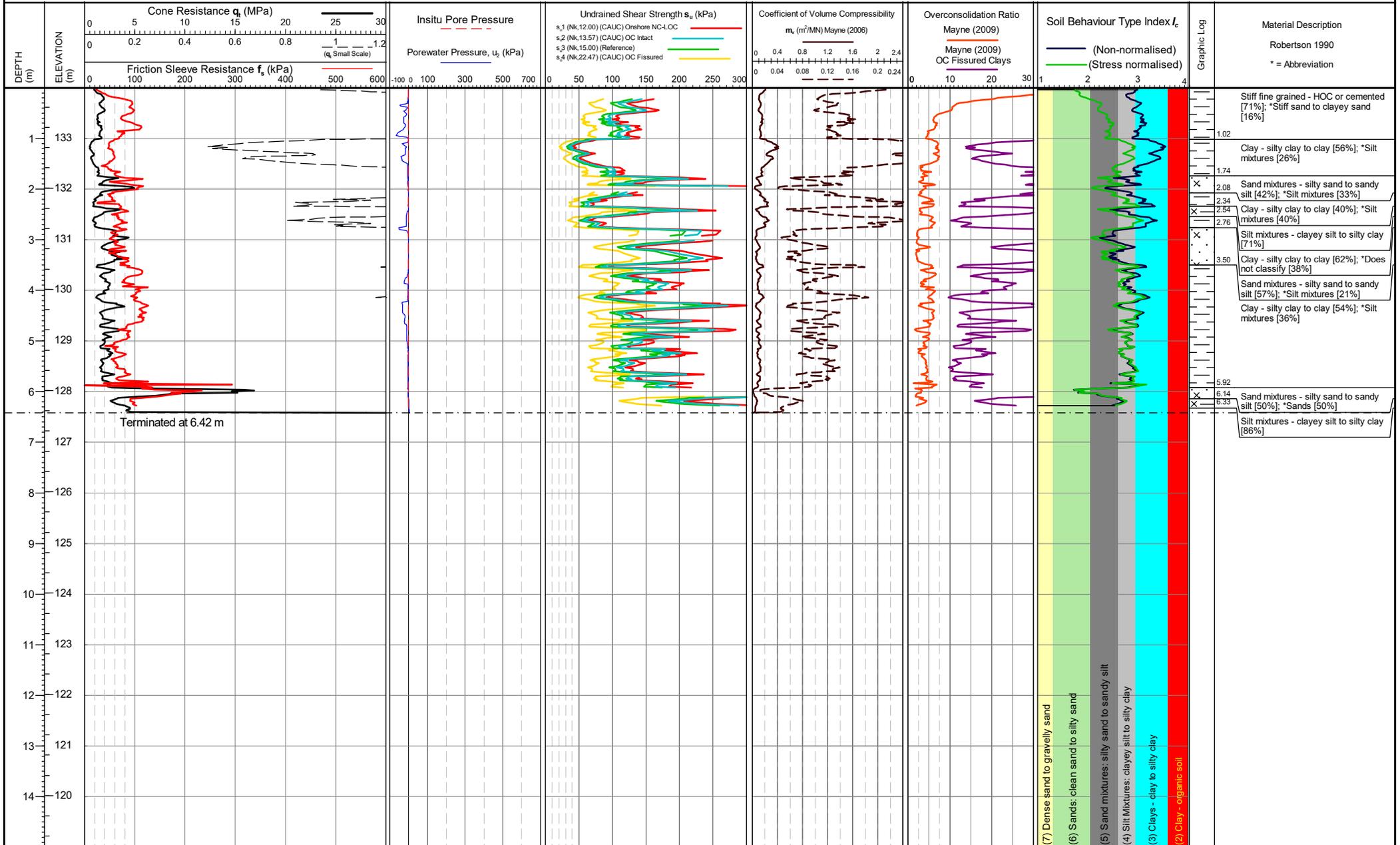
Checked by:
 Chris Player

TEST ID: CPT5109

APPENDIX D INTERPRETATION RESULTS - SET 1

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

Plots are provided for all locations



Cone area (mm²):1500
 ConeID: S15-CFIP.1526
 Operator: Martyn Waters
 Rig Used: UK8
 Date of test: 23/09/2020 13:00:00

Location: South Yorkshire, UK
 Coordinates: 435983.46, 399785.62
 Elevation: 133.98
 Coordinate system:

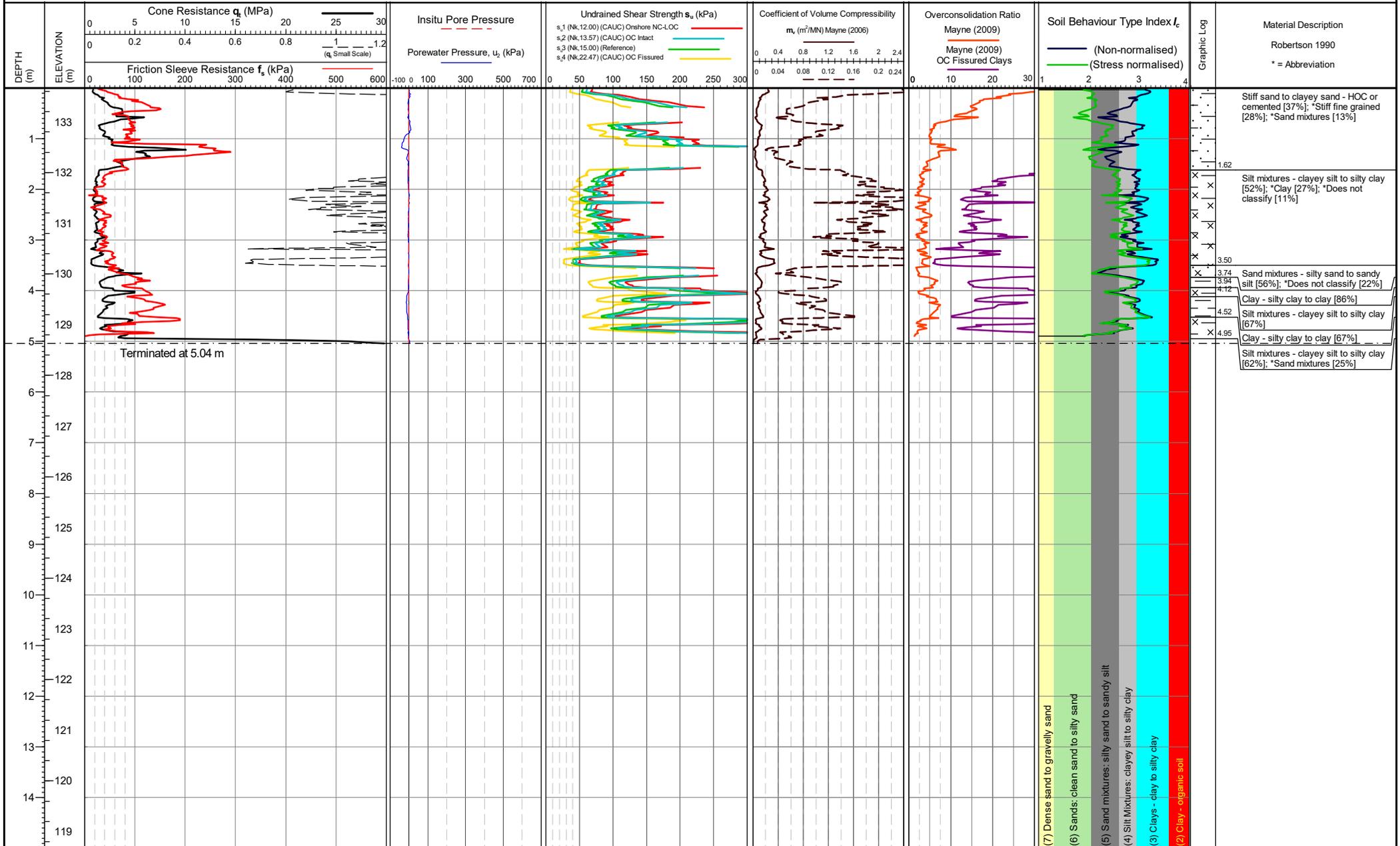
Remarks: *Phreatic surface origin: Client estimate
 Termination Remark: Tip load

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 text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1
 Checked by: Chris Player

TEST ID: CPT5101
 Page 1 of 1



Cone area (mm²):1500
ConeID: S15-CFIP.1526
Operator: Martyn Waters
Rig Used: UK8
Date of test: 23/09/2020 13:18:00

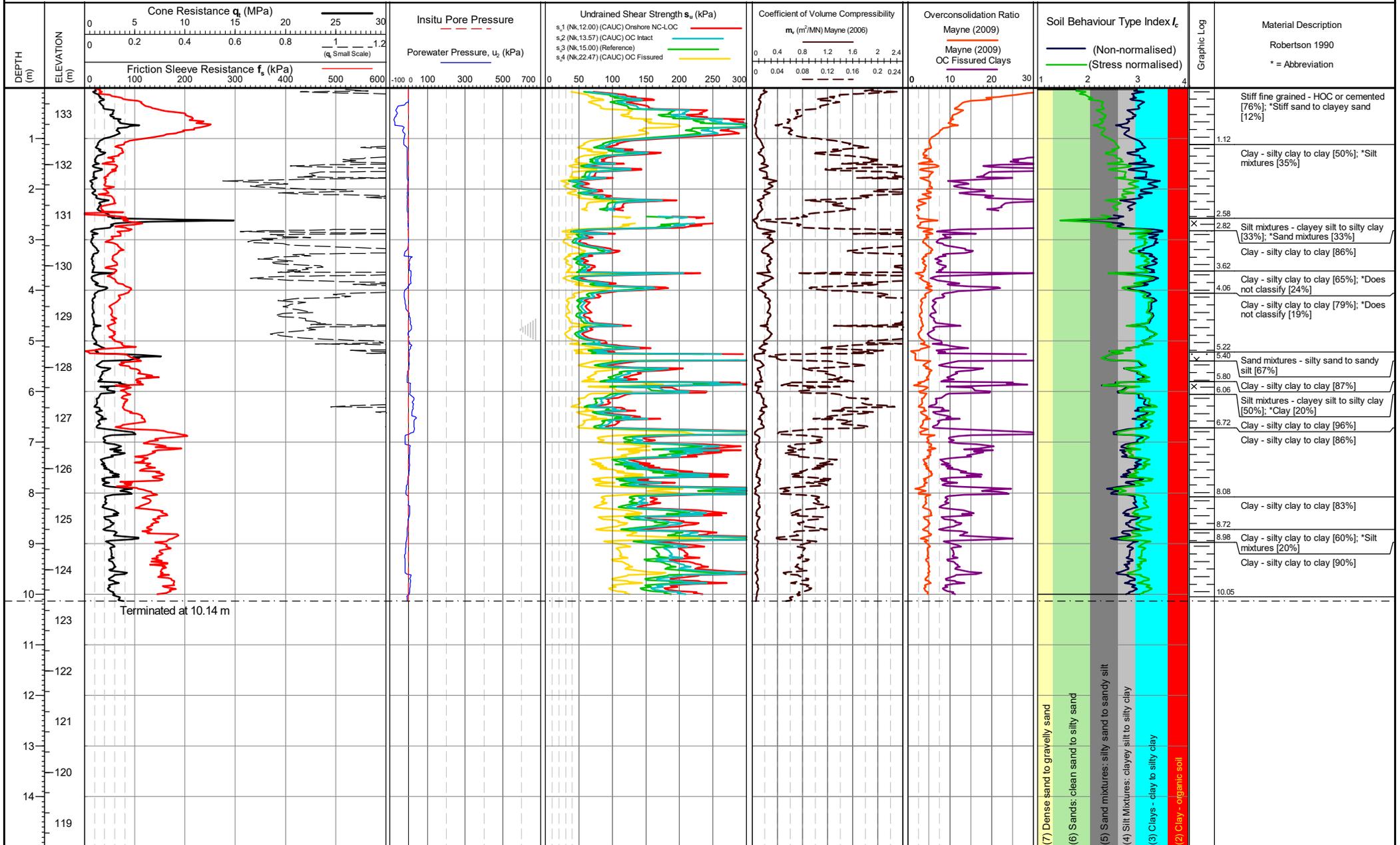
Location: South Yorkshire, UK
Coordinates: 436030.23, 399811.23
Elevation: 133.67
Coordinate system:

Remarks: *Phreatic surface origin: Client estimate
Termination Remark: Tip load

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 text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20
Lankelma Project Ref: P-107408-1
Checked by: Chris Player

TEST ID: CPT5102
Page 1 of 1



Cone area (mm²):1500
 ConeID: S15-CFIP.1526
 Operator: Martyn Waters
 Rig Used: UK8
 Date of test: 23/09/2020 11:27:00

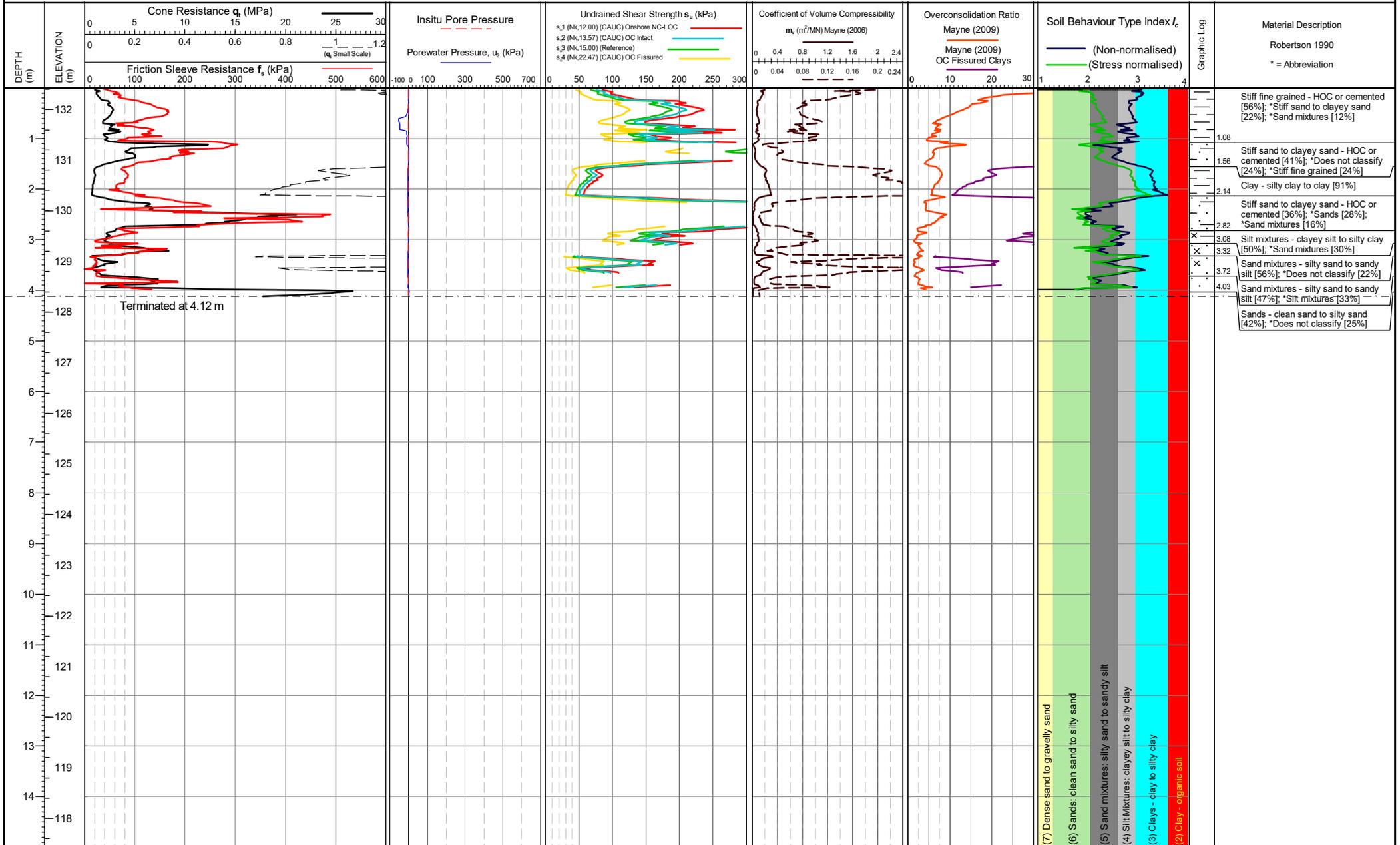
Location: South Yorkshire, UK
 Coordinates: 436076.11, 399858.5
 Elevation: 133.52
 Coordinate system:

Remarks: *Phreatic surface origin: Client estimate
 Termination Remark: Target depth

Internal QA Disc.
 Dissipation Test
 Penetration
 Pause (<1cm/s)
 Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1
 Checked by: Chris Player

TEST ID: CPT5103
 Page 1 of 1



Cone area (mm²):1500
 ConeID: S15-CFIP.1526
 Operator: Martyn Waters
 Rig Used: UK8
 Date of test: 23/09/2020 13:35:00

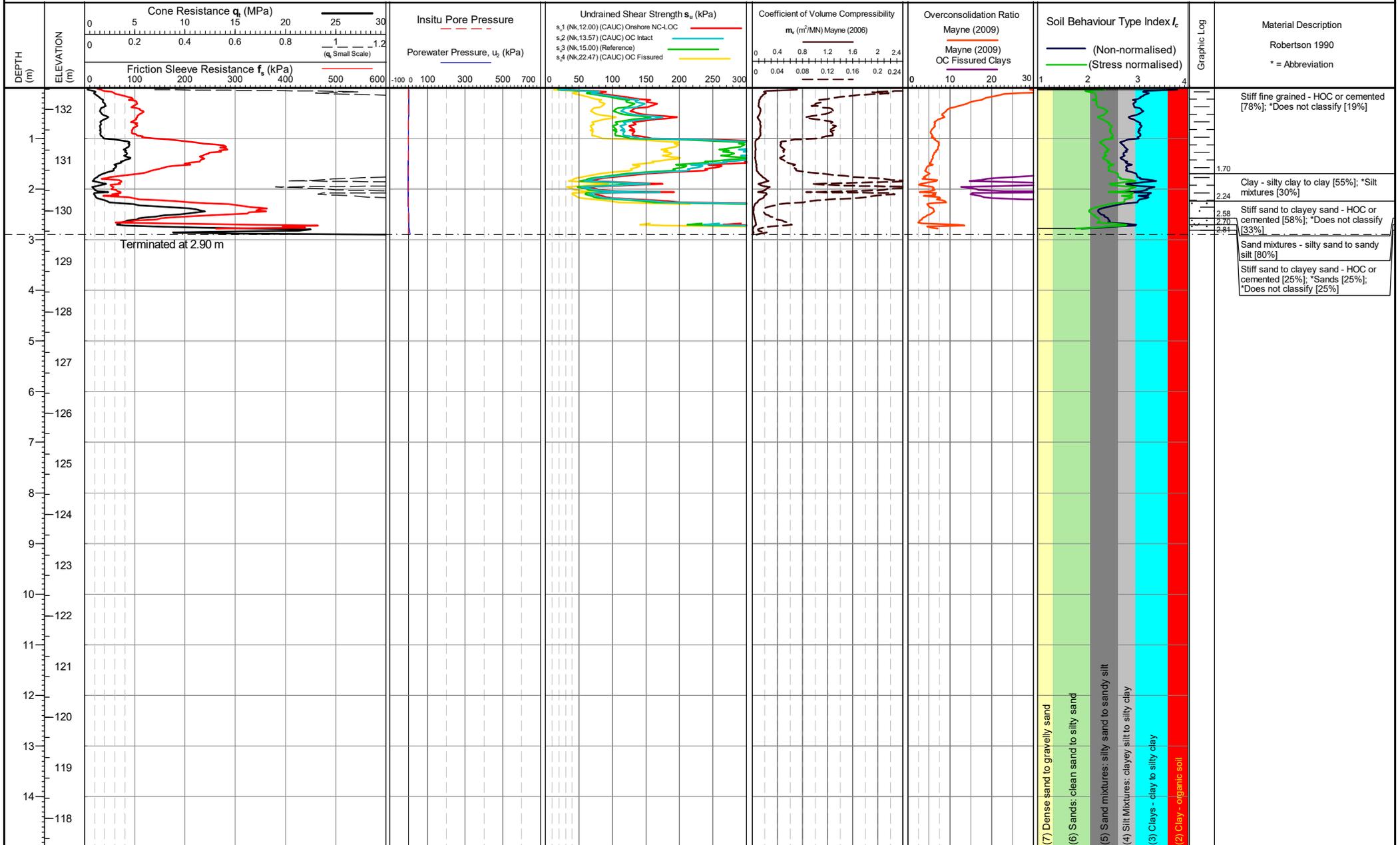
Location: South Yorkshire, UK
 Coordinates: 435990.39, 399739.26
 Elevation: 132.43
 Coordinate system:

Remarks: *Phreatic surface origin: Client estimate
 Termination Remark: Inclination

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 text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1
 Checked by: Chris Player

TEST ID: CPT5104
 Page 1 of 1



Cone area (mm²):1500
 ConeID: S15-CFIP.1526
 Operator: Martyn Waters
 Rig Used: UK8
 Date of test: 23/09/2020 13:49:00

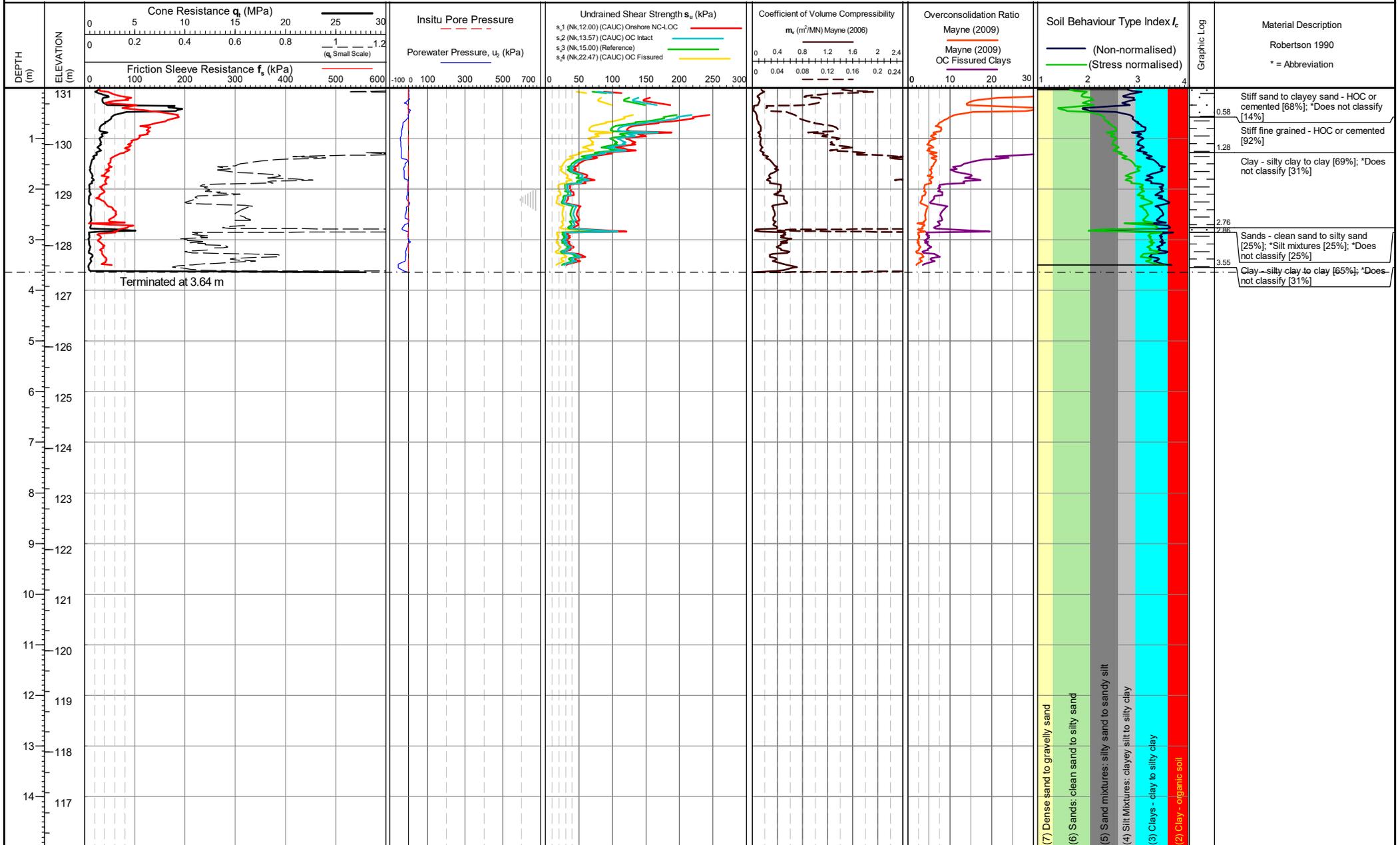
Location: South Yorkshire, UK
 Coordinates: 435990.39, 399739.26
 Elevation: 132.43
 Coordinate system:

Remarks: *Phreatic surface origin: Client estimate
 Termination Remark:
 Tip load

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 text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1
 Checked by: Chris Player

TEST ID: CPT5104A
 Page 1 of 1



Cone area (mm²):1500
 ConeID: S15-CFIP.1526
 Operator: Martyn Waters
 Rig Used: UK8
 Date of test: 23/09/2020 12:08:00

Location: South Yorkshire, UK
 Coordinates: 436059.15, 399775.64
 Elevation: 131.12
 Coordinate system:

Remarks: *Phreatic surface origin: Client estimate

Termination Remark:
 Tip load

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

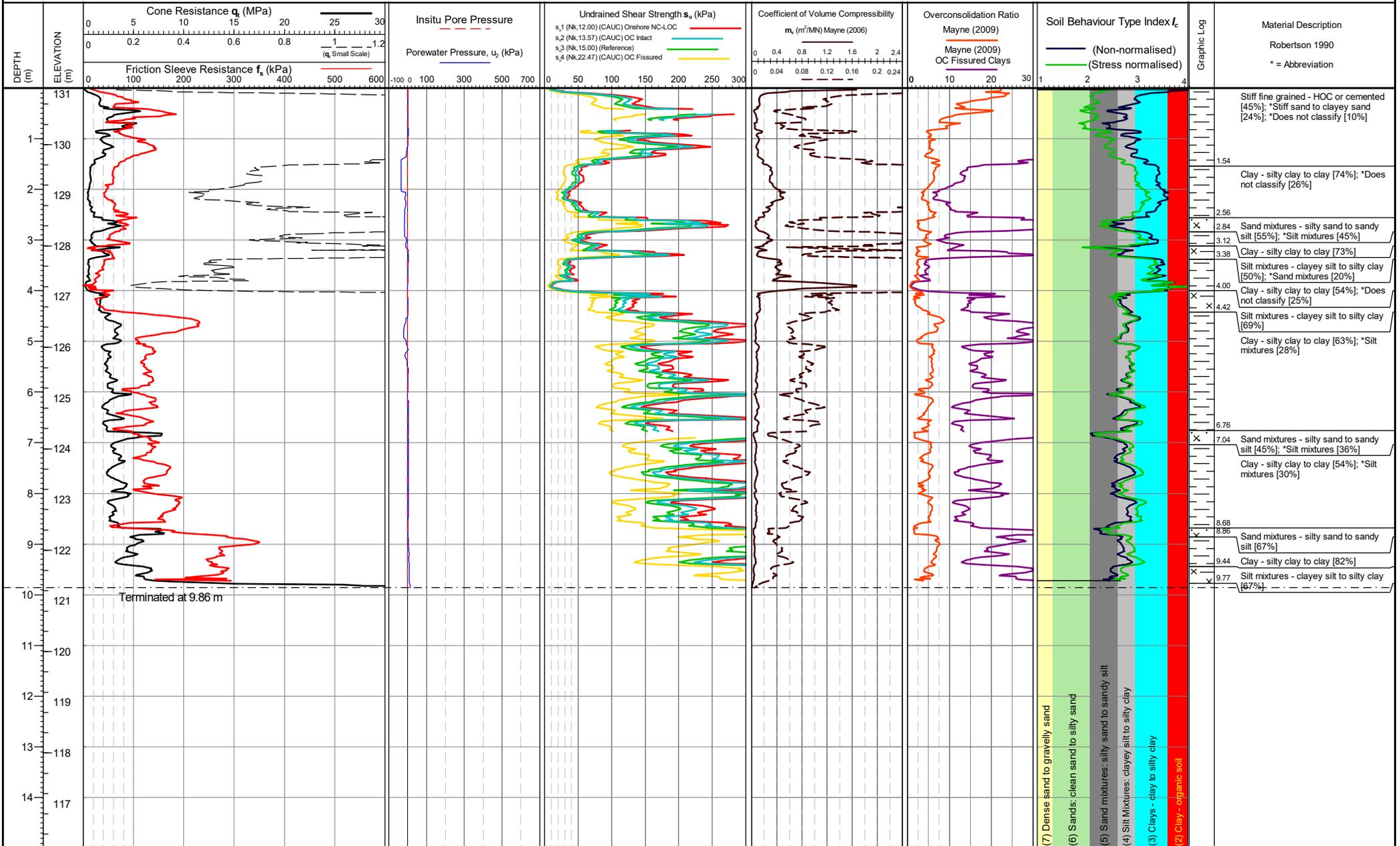
Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot:
 07-10-20

Checked by:
 Chris Player

Lankelma Project Ref:
 P-107408-1

TEST ID: CPT5105



Cone area (mm²):1500
 ConeID: S15-CFIP.1526
 Operator: Martyn Waters
 Rig Used: UK8
 Date of test: 23/09/2020 12:33:00

Location: South Yorkshire, UK
 Coordinates: 436059.15, 399775.64
 Elevation: 131.12
 Coordinate system:

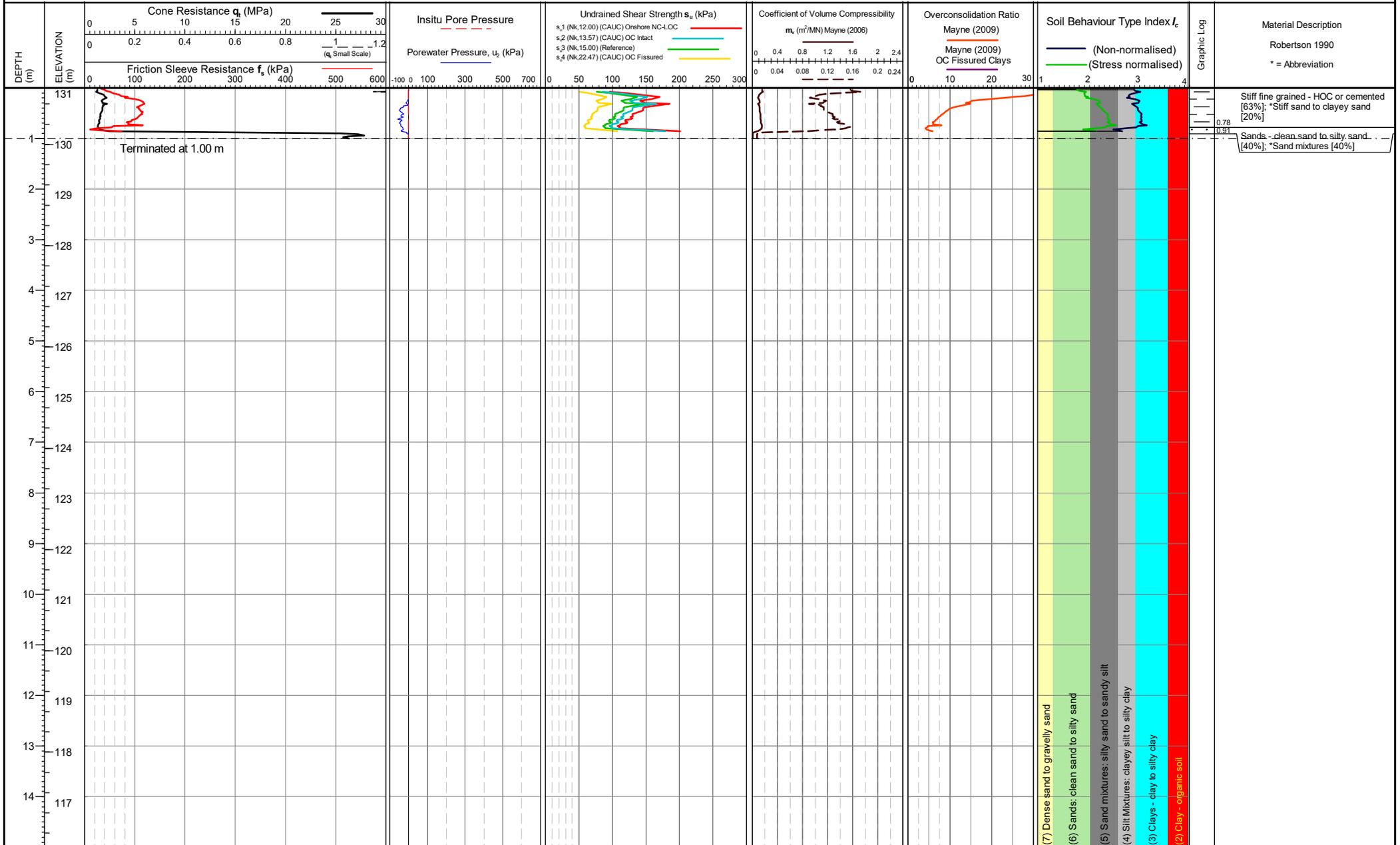
Remarks: *Phreatic surface origin: Client estimate
 Termination Remark: Tip load

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 text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1
 Checked by: Chris Player

TEST ID: CPT5105A
 Page 1 of 1



Cone area (mm²):1500
 ConeID: S15-CFIP.1526
 Operator: Martyn Waters
 Rig Used: UK8
 Date of test: 23/09/2020 14:03:00

Location: South Yorkshire, UK
 Coordinates: 436059.15, 399775.64
 Elevation: 131.12
 Coordinate system:

Remarks: *Phreatic surface origin: Client estimate

Termination Remark:
 Tip load

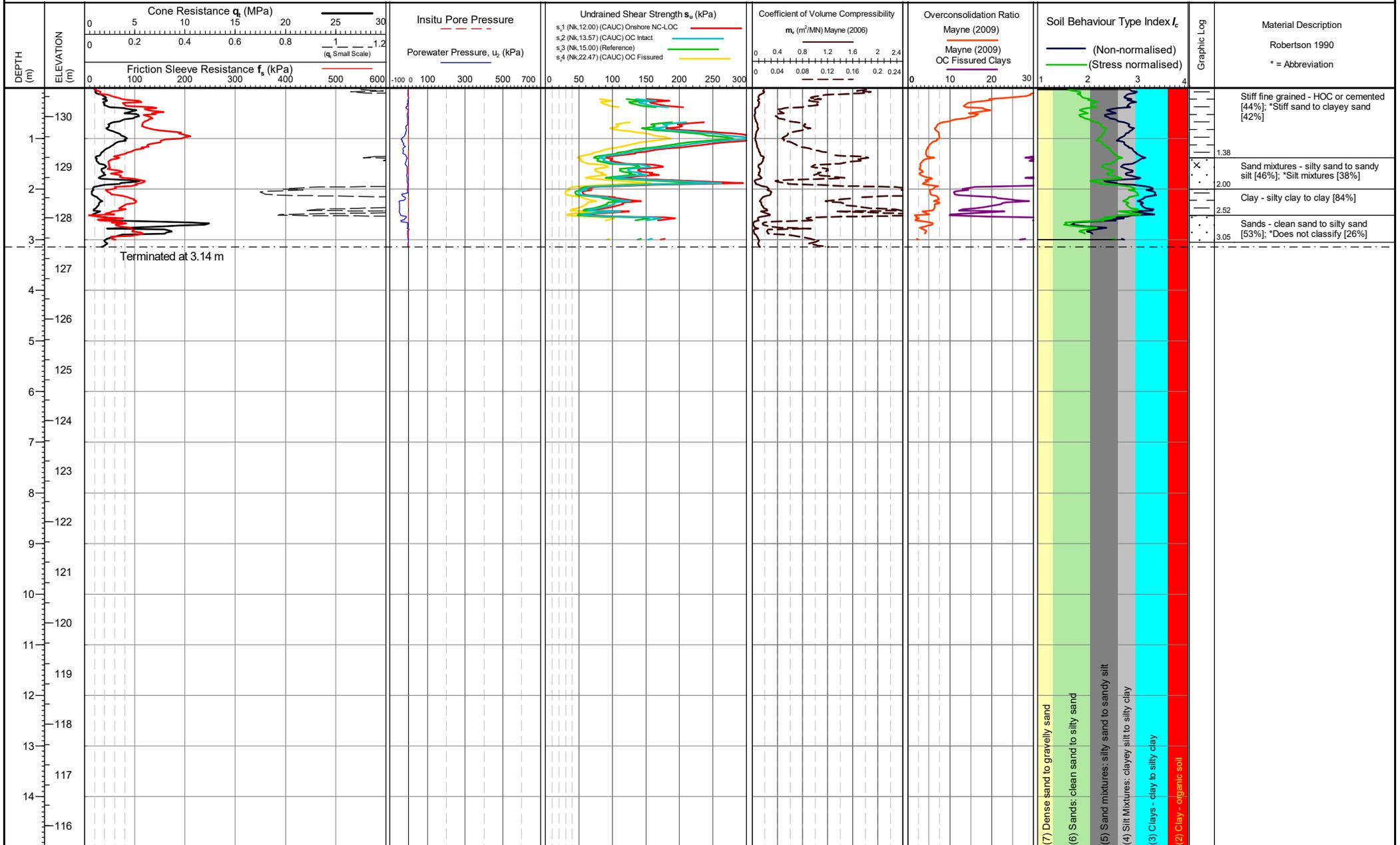
Internal QA Diss.
 Dissipation Test
 Penetration
 Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1
 Checked by: Chris Player

TEST ID: CPT5105B

Page 1 of 1



Cone area (mm²):1500
 ConeID: S15-CFIP.1526
 Operator: Martyn Waters
 Rig Used: UK8
 Date of test: 23/09/2020 10:30:00

Location: South Yorkshire, UK
 Coordinates: 436114.09, 399820.78
 Elevation: 130.57
 Coordinate system:

Remarks: *Phreatic surface origin: Client estimate
 Termination Remark:
 Inclination

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

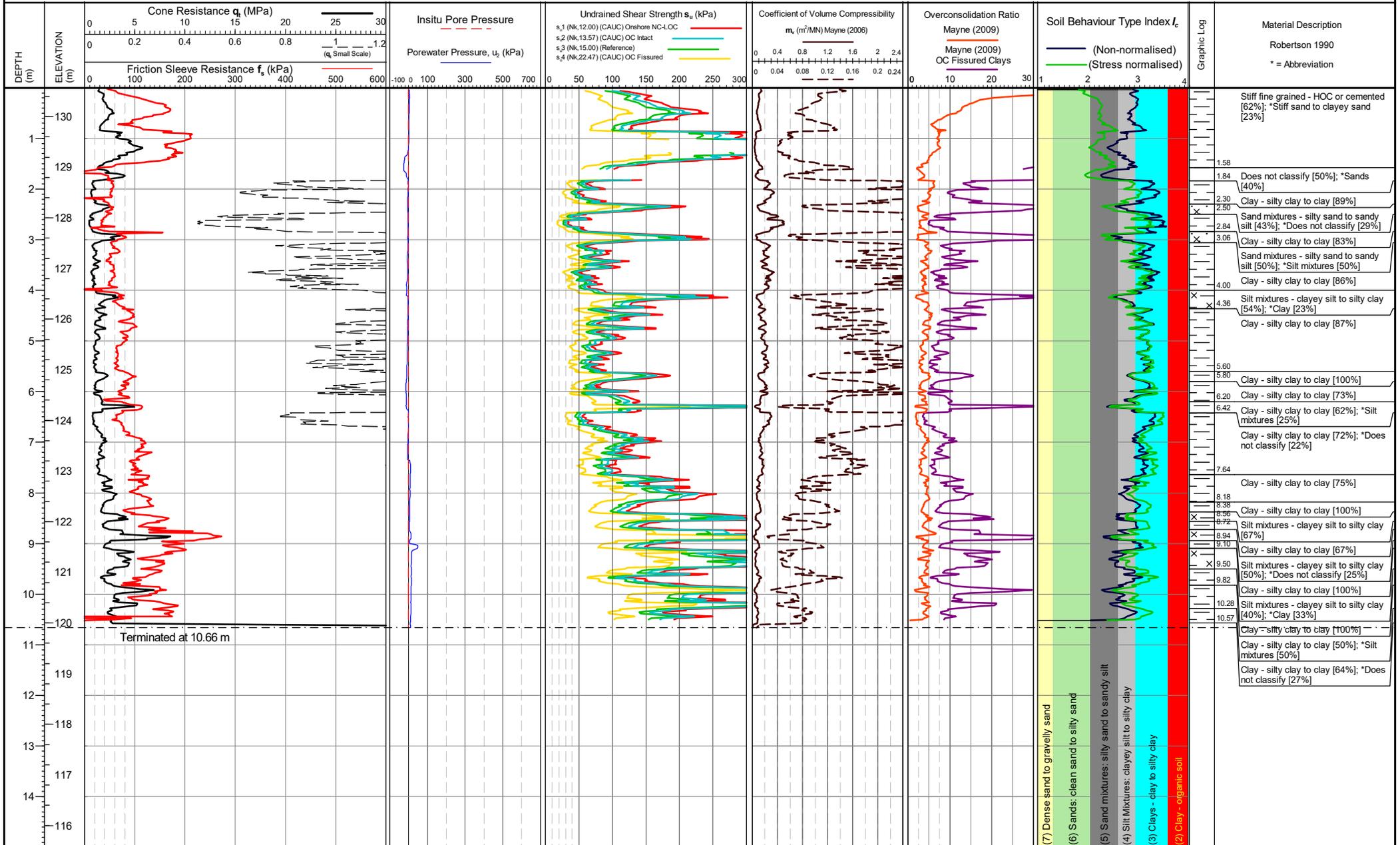
Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20

Checked by: Chris Player

Lankelma Project Ref: P-107408-1

TEST ID: CPT5106



Cone area (mm²):1500
 ConeID: S15-CFIP.1526
 Operator: Martyn Waters
 Rig Used: UK8
 Date of test: 23/09/2020 10:59:00

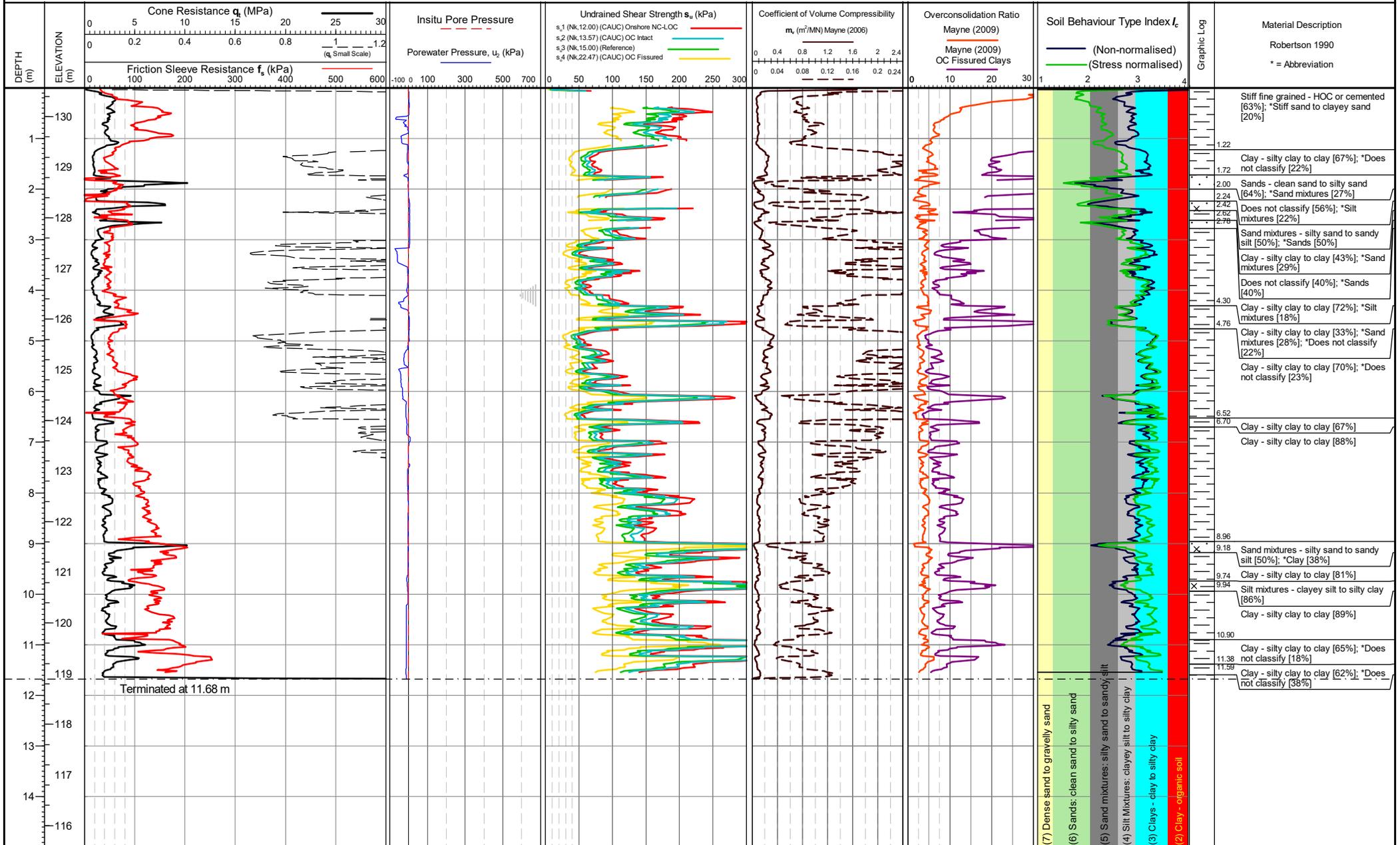
Location: South Yorkshire, UK
 Coordinates: 436114.09, 399820.78
 Elevation: 130.57
 Coordinate system:

Remarks: *Phreatic surface origin: Client estimate
 Termination Remark:
 Tip load

Internal QA Disc.
 Dissipation Test
 Penetration
 Pause (<1cm/s)
 Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1
 Checked by: Chris Player

TEST ID: CPT5106A
 Page 1 of 1



Cone area (mm²):1500
 ConeID: S15-CFIP.1526
 Operator: Martyn Waters
 Rig Used: UK8
 Date of test: 23/09/2020 14:15:00

Location: South Yorkshire, UK
 Coordinates: 436114.09, 399820.78
 Elevation: 130.57
 Coordinate system:

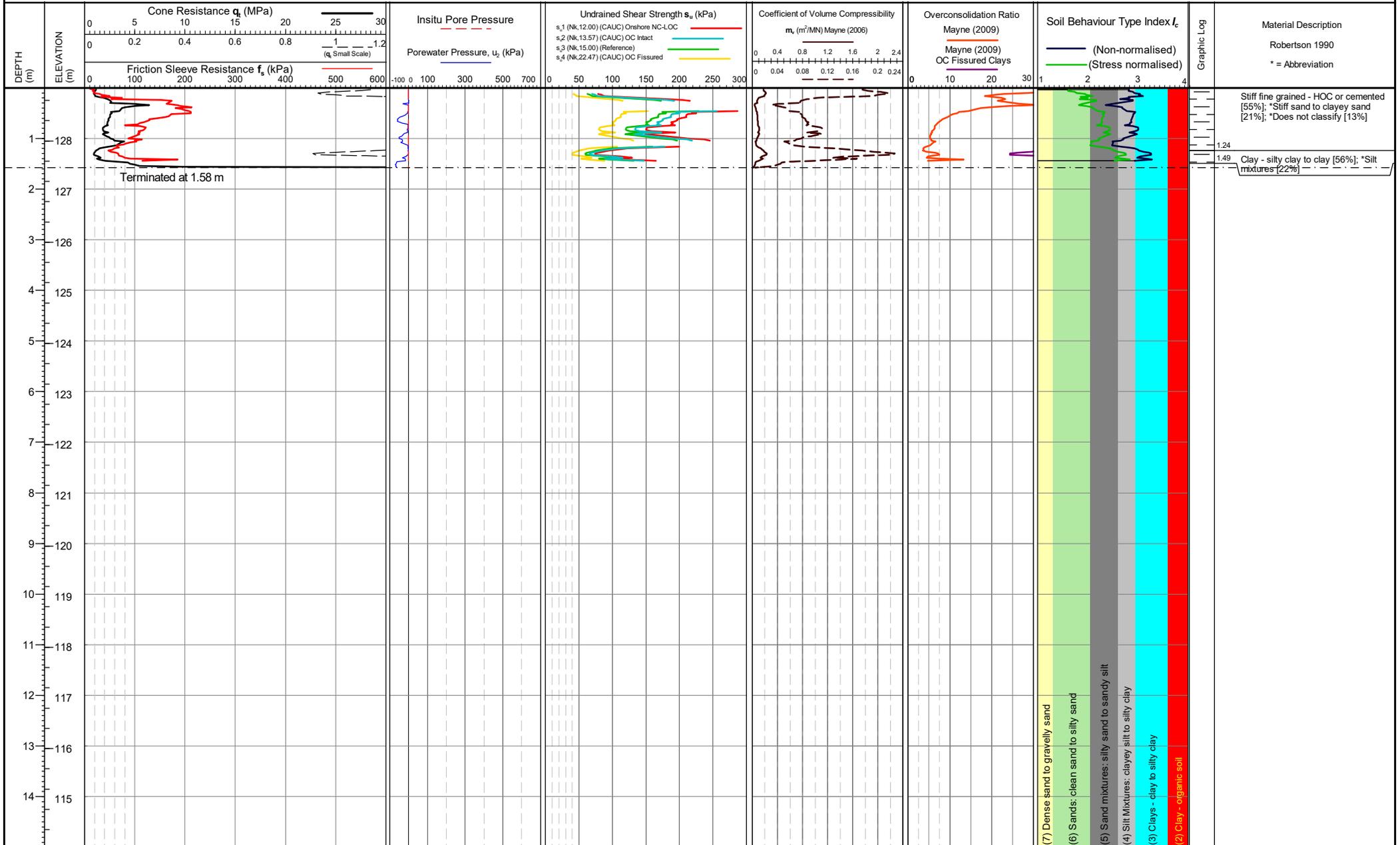
Remarks: *Phreatic surface origin: Client estimate
 Termination Remark:
 Tip load

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 text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1
 Checked by: Chris Player

TEST ID: CPT5106B
 Page 1 of 1



Material Description
 Robertson 1990
 * = Abbreviation

Stiff fine grained - HOC or cemented [55%]; *Stiff sand to clayey sand [21%]; *Does not classify [13%]

Clay - silty clay to clay [56%]; *Silt mixtures [22%]

Cone area (mm²):1500
 ConeID: S15-CFIP.1526
 Operator: Martyn Waters
 Rig Used: UK8
 Date of test: 23/09/2020 08:46:00

Location: South Yorkshire, UK
 Coordinates: 436067.45, 399708.39
 Elevation: 129.05
 Coordinate system:

Remarks: *Phreatic surface origin: Client estimate

Termination Remark:
 Tip load

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

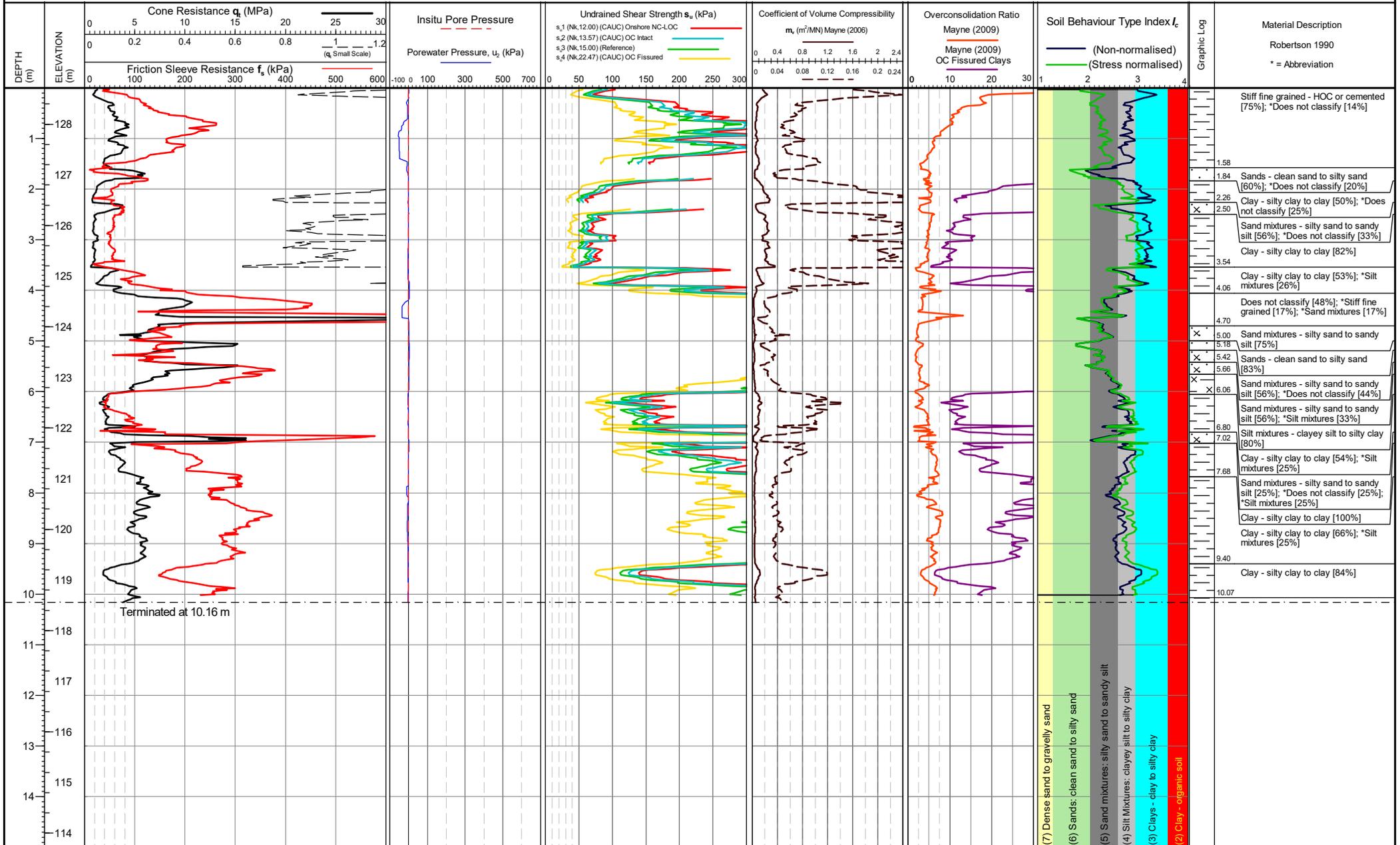
Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1

Checked by: Chris Player

TEST ID: CPT5107

Page 1 of 1



Cone area (mm²):1500
 ConeID: S15-CFIP.1526
 Operator: Martyn Waters
 Rig Used: UK8
 Date of test: 23/09/2020 09:07:00

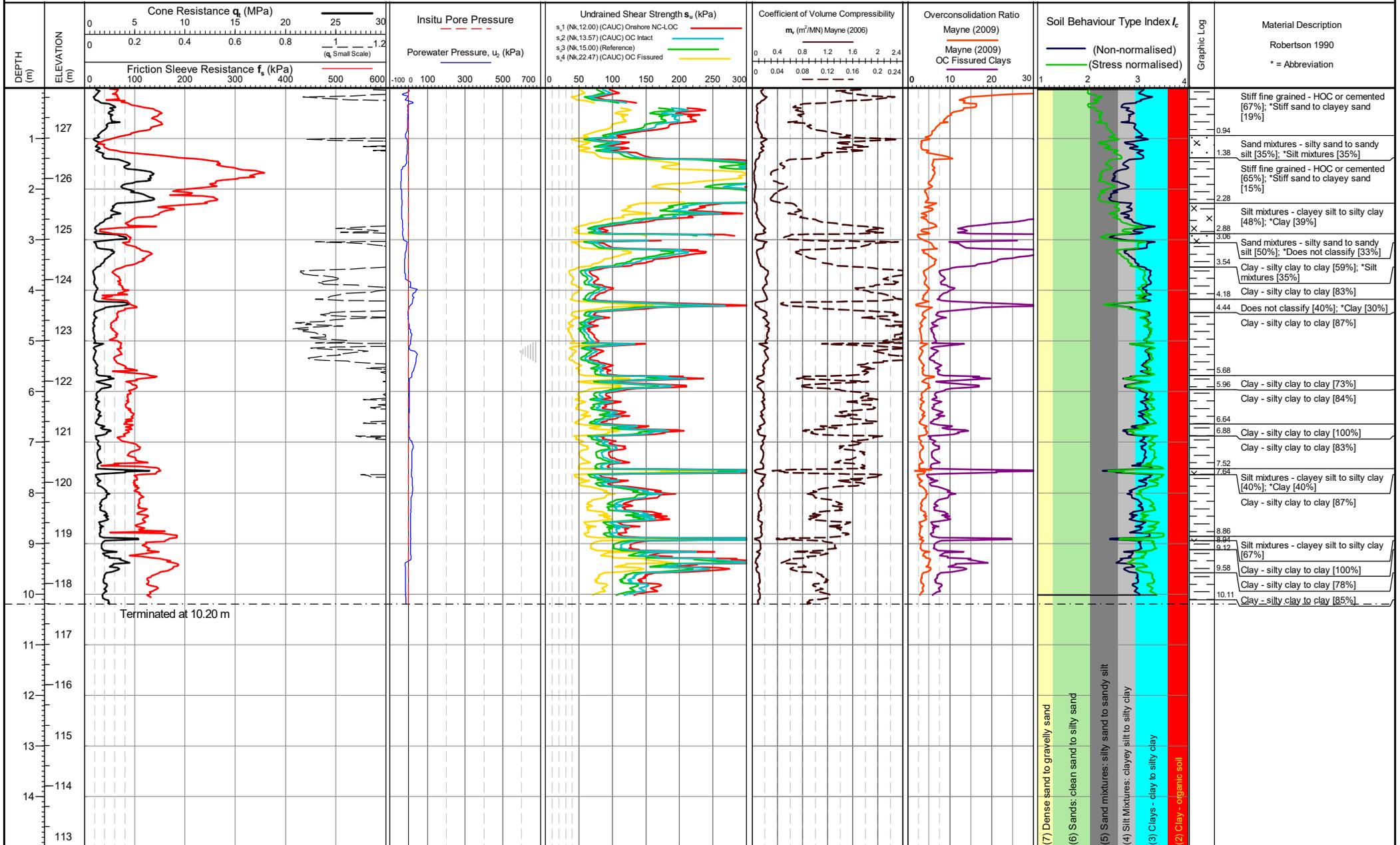
Location: South Yorkshire, UK
 Coordinates: 436110.03, 399739.98
 Elevation: 128.72
 Coordinate system:

Remarks: *Phreatic surface origin: Client estimate
 Termination Remark: Target depth

Internal QA Disc.
 Dissipation Test
 Penetration
 Pause (<1cm/s)
 Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1
 Checked by: Chris Player

TEST ID: CPT5108
 Page 1 of 1



Cone area (mm²):1500
 ConeID: S15-CFIP.1526
 Operator: Martyn Waters
 Rig Used: UK8
 Date of test: 23/09/2020 09:39:00

Location: South Yorkshire, UK
 Coordinates: 436161.04, 399783.79
 Elevation: 127.79
 Coordinate system:

Remarks: *Phreatic surface origin: Client estimate
 Termination Remark: Target depth

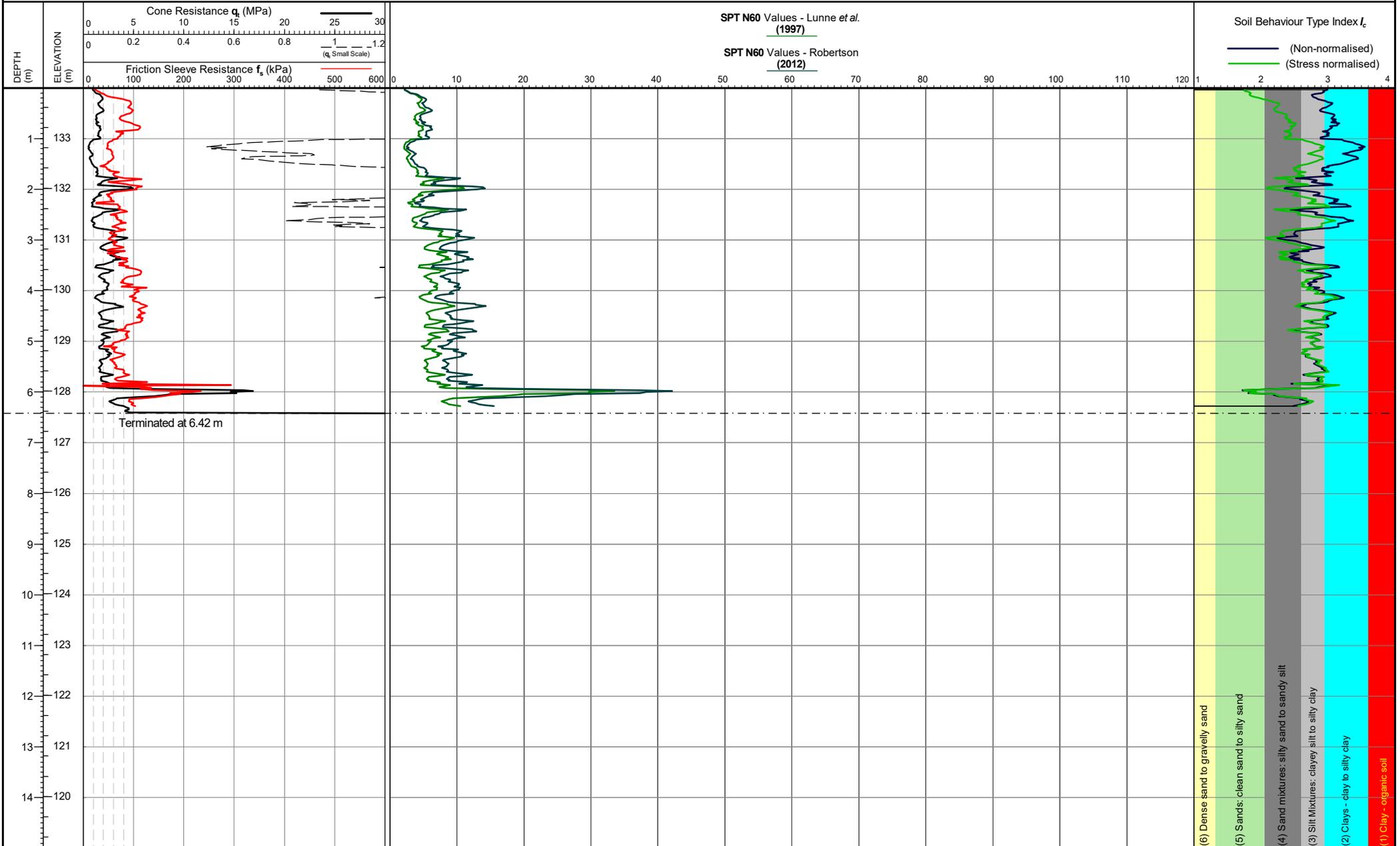
Internal QA Diss. Dissipation Test Penetration Pause (<1cm/s)
 Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1
 Checked by: Chris Player

TEST ID: CPT5109
 Page 1 of 1

APPENDIX E INTERPRETATION RESULTS - SET 2**EQUIVALENT SPT N60**

Plots are provided for all locations



Cone area (mm²):1500
 Cone ID: S15-CFIP.1526
 Operator: Martyn Waters
 Date of test: 23/09/2020 13:00:00

Location: South Yorkshire, UK
 Coordinates: 435983.46, 399785.62
 Elevation: 133.98
 Coordinate system:

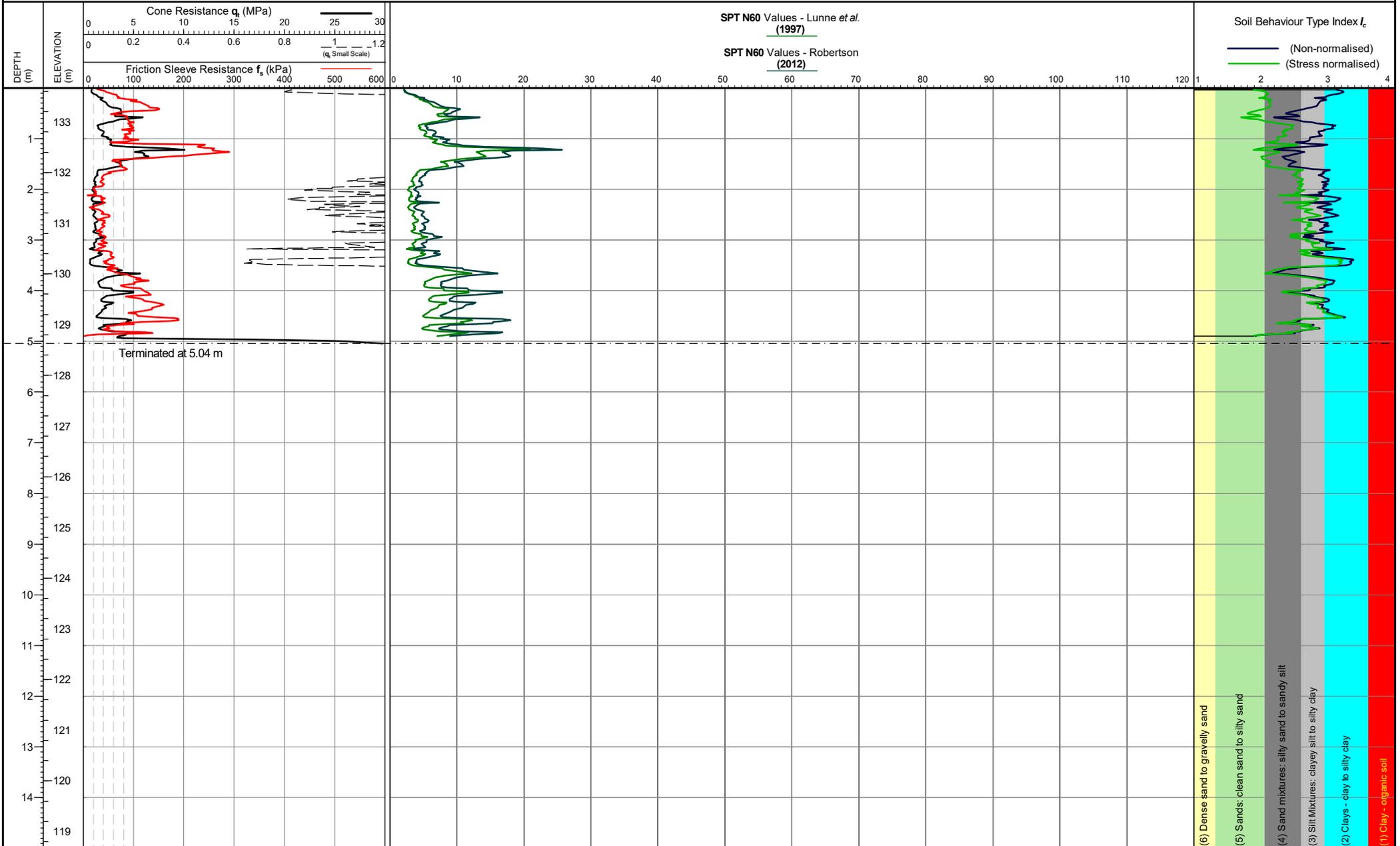
Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20

Lankelma Project Ref: P-107408-1

Checked by: Chris Player

TEST ID: CPT5101



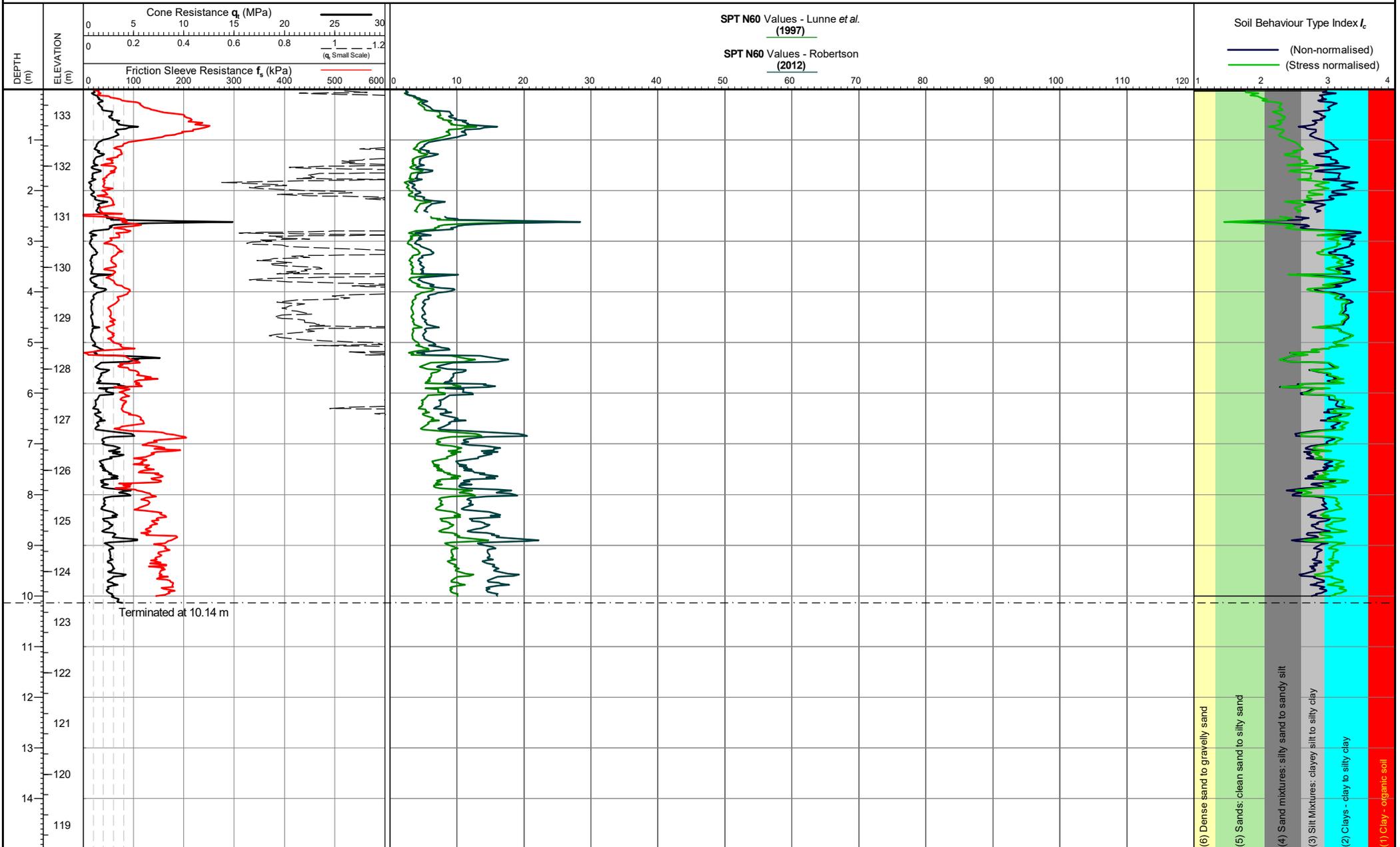
Cone area (mm²):1500
 Cone ID: S15-CFIP.1526
 Operator: Martyn Waters
 Date of test: 23/09/2020 13:18:00

Location: South Yorkshire, UK
 Coordinates: 436030.23, 399811.23
 Elevation: 133.67
 Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1
 Checked by: Chris Player

TEST ID: CPT5102



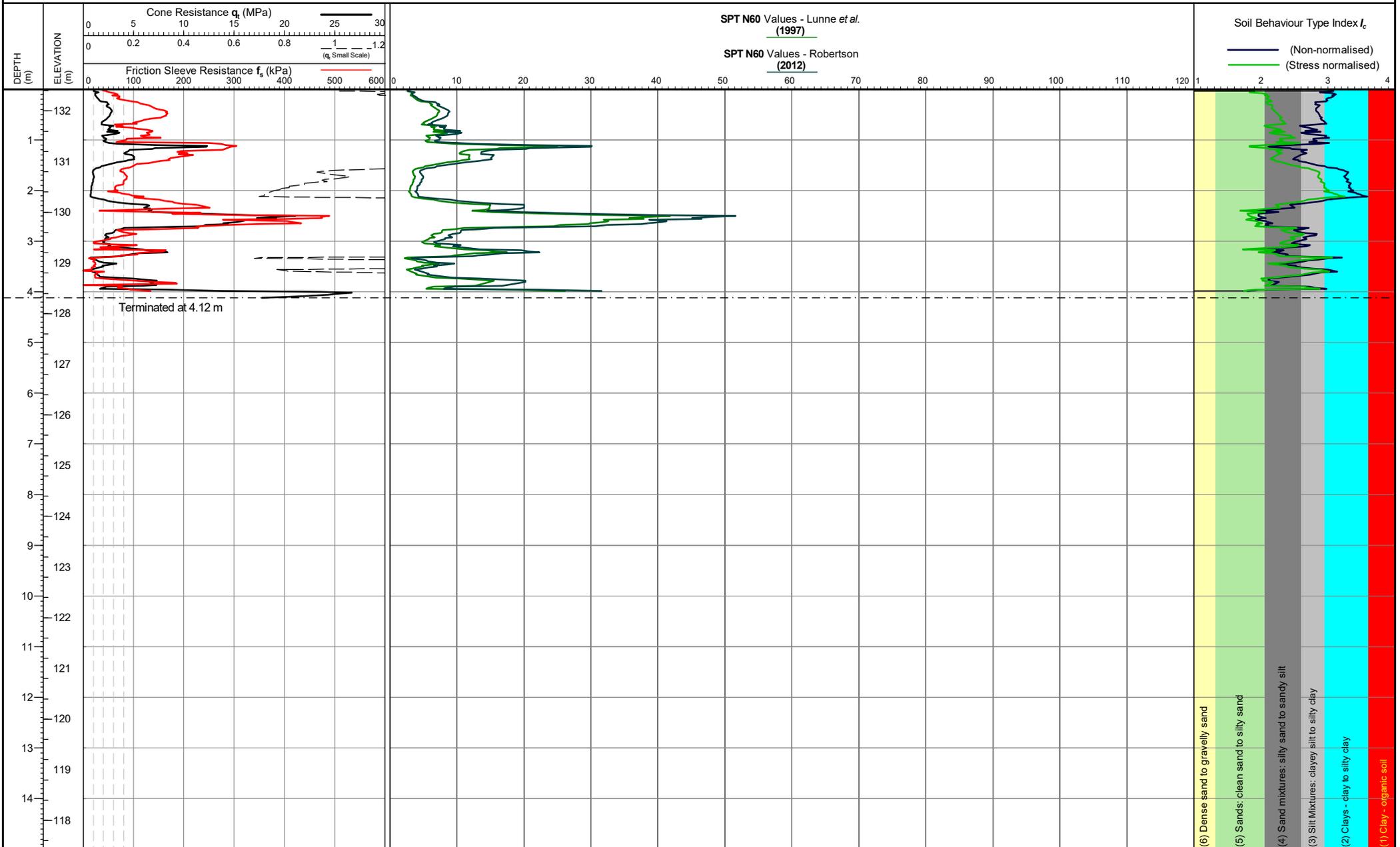
Cone area (mm²):1500
 Cone ID: S15-CFIP.1526
 Operator: Martyn Waters
 Date of test: 23/09/2020 11:27:00

Location: South Yorkshire, UK
 Coordinates: 436076.11, 399858.5
 Elevation: 133.52
 Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1
 Checked by: Chris Player

TEST ID: CPT5103



Cone area (mm²):1500
 Cone ID: S15-CFIP.1526
 Operator: Martyn Waters
 Date of test: 23/09/2020 13:35:00

Location: South Yorkshire, UK
 Coordinates: 435990.39, 399739.26
 Elevation: 132.43
 Coordinate system:

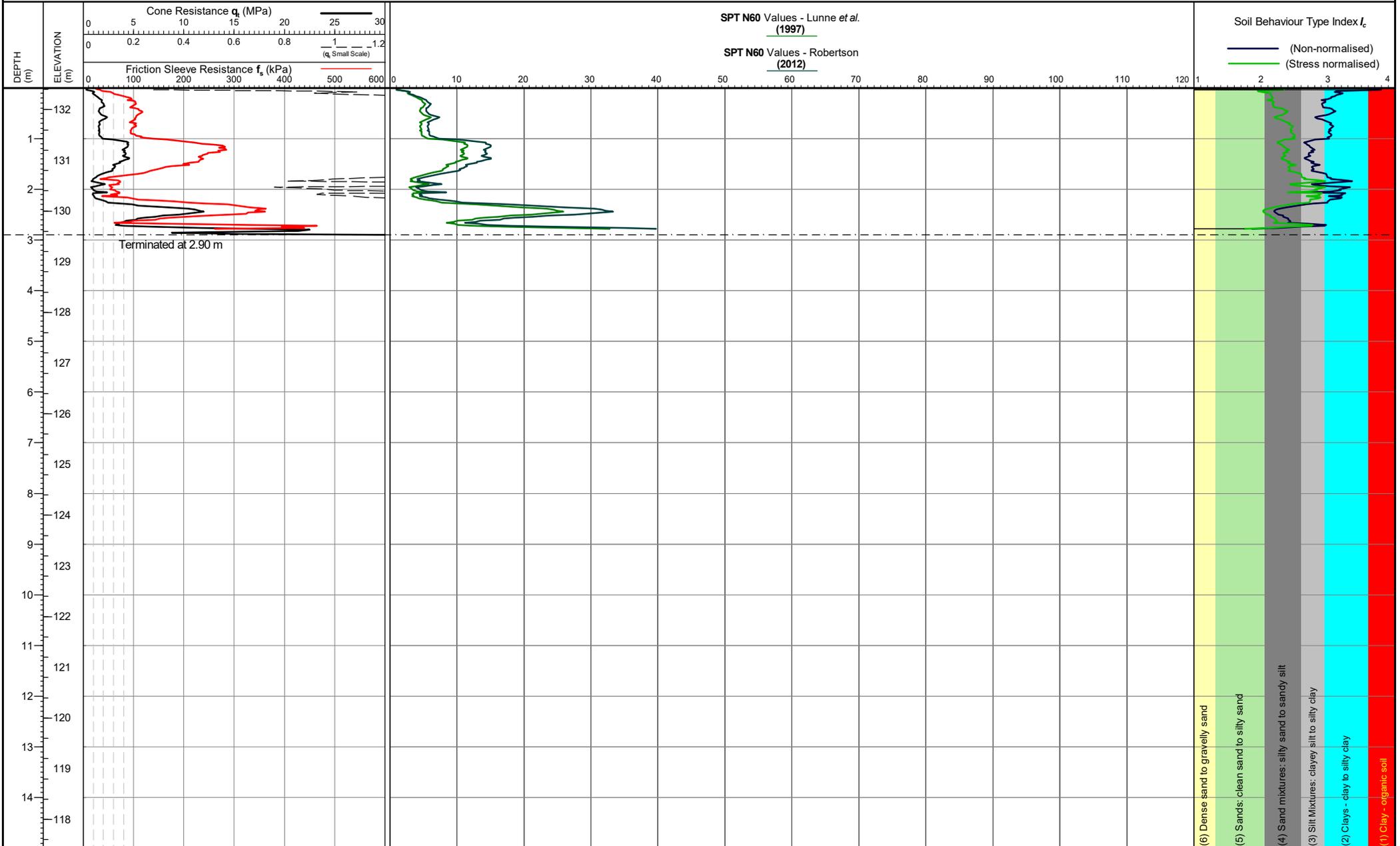
Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20

Lankelma Project Ref: P-107408-1

Checked by: Chris Player

TEST ID: CPT5104



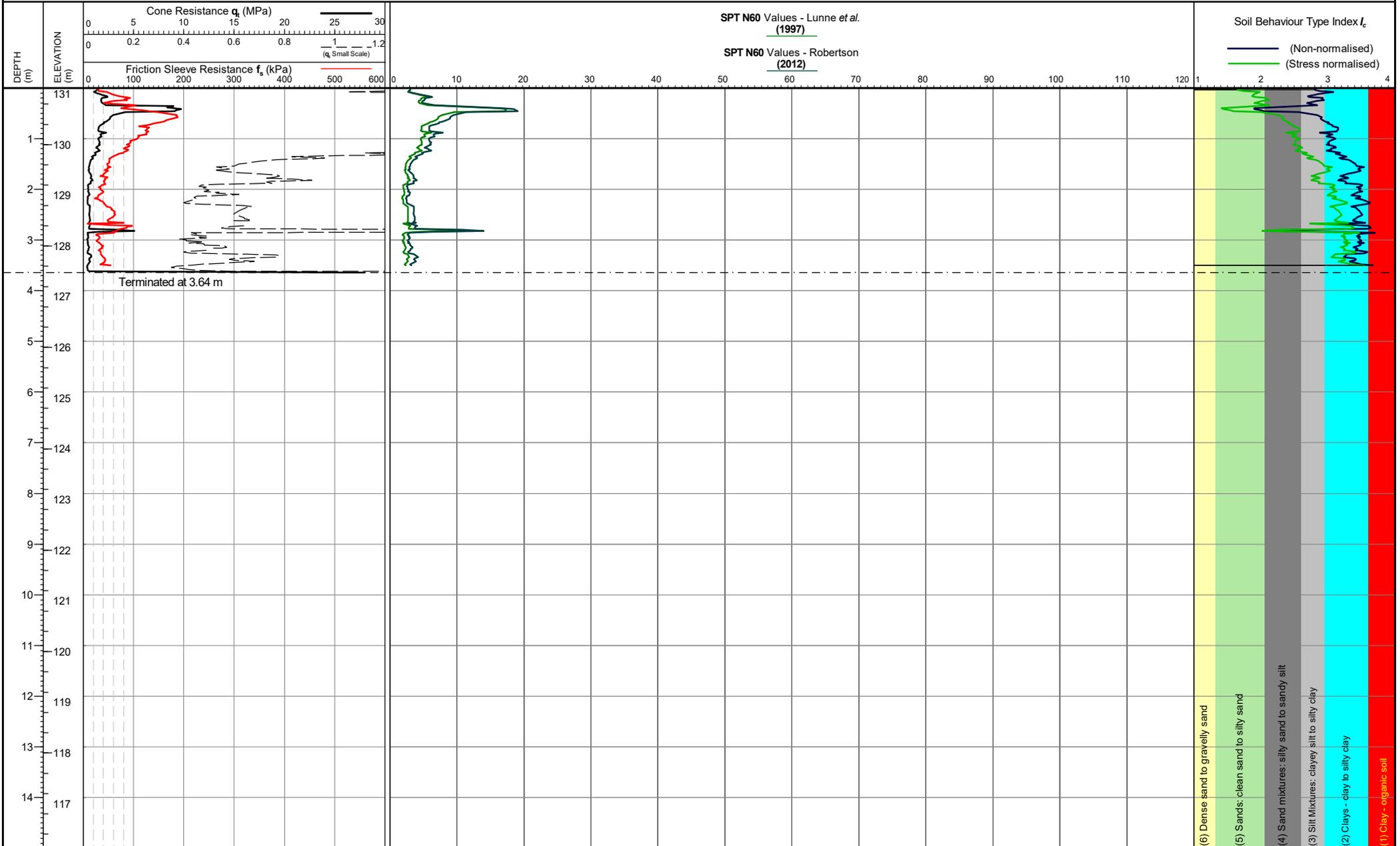
Cone area (mm²):1500
 Cone ID: S15-CFIP.1526
 Operator: Martyn Waters
 Date of test: 23/09/2020 13:49:00

Location: South Yorkshire, UK
 Coordinates: 435990.39, 399739.26
 Elevation: 132.43
 Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1
 Checked by: Chris Player

TEST ID: CPT5104A



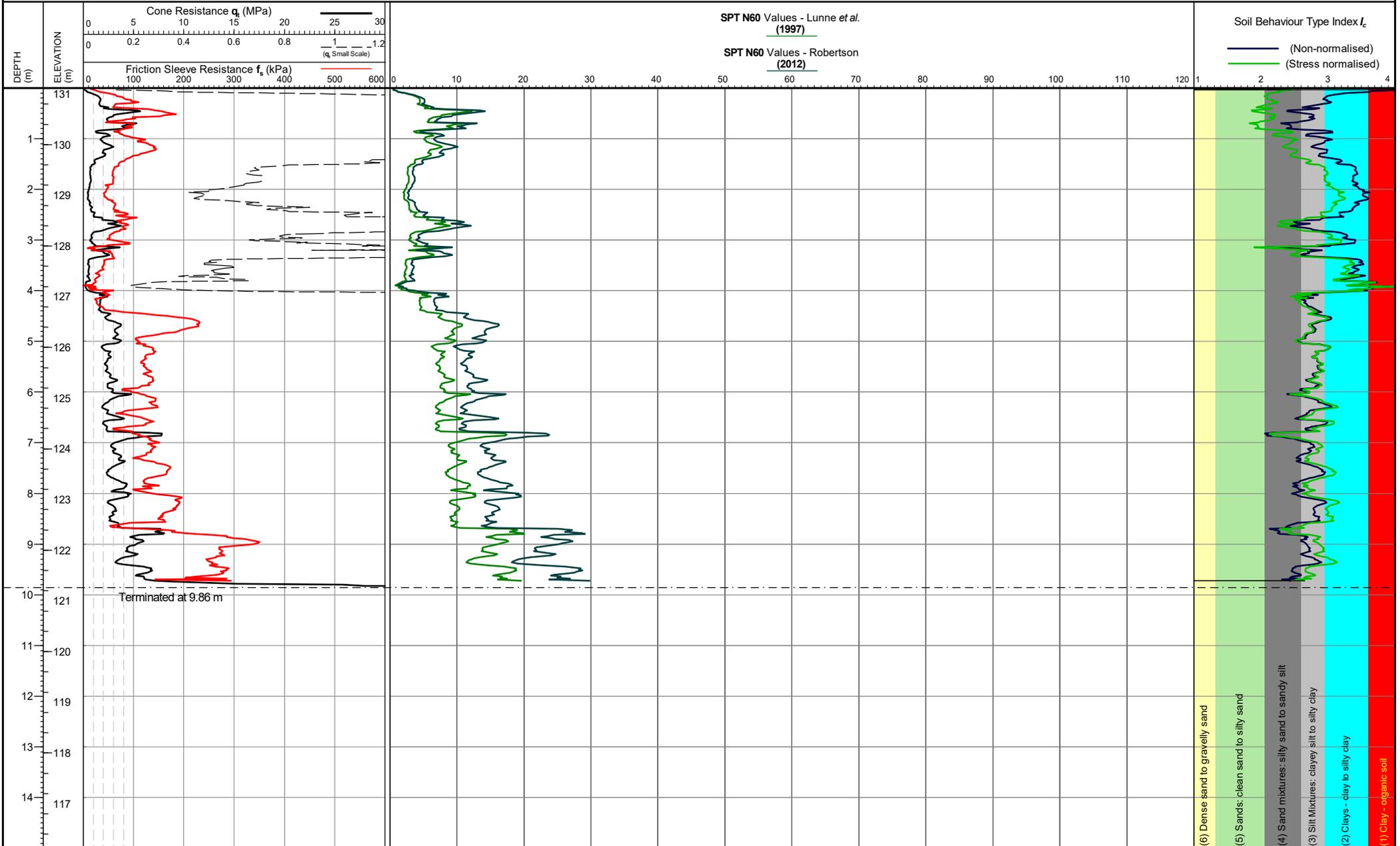
Cone area (mm²):1500
 Cone ID: S15-CFIP.1526
 Operator: Martyn Waters
 Date of test: 23/09/2020 12:08:00

Location: South Yorkshire, UK
 Coordinates: 436059.15, 399775.64
 Elevation: 131.12
 Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1
 Checked by: Chris Player

TEST ID: CPT5105



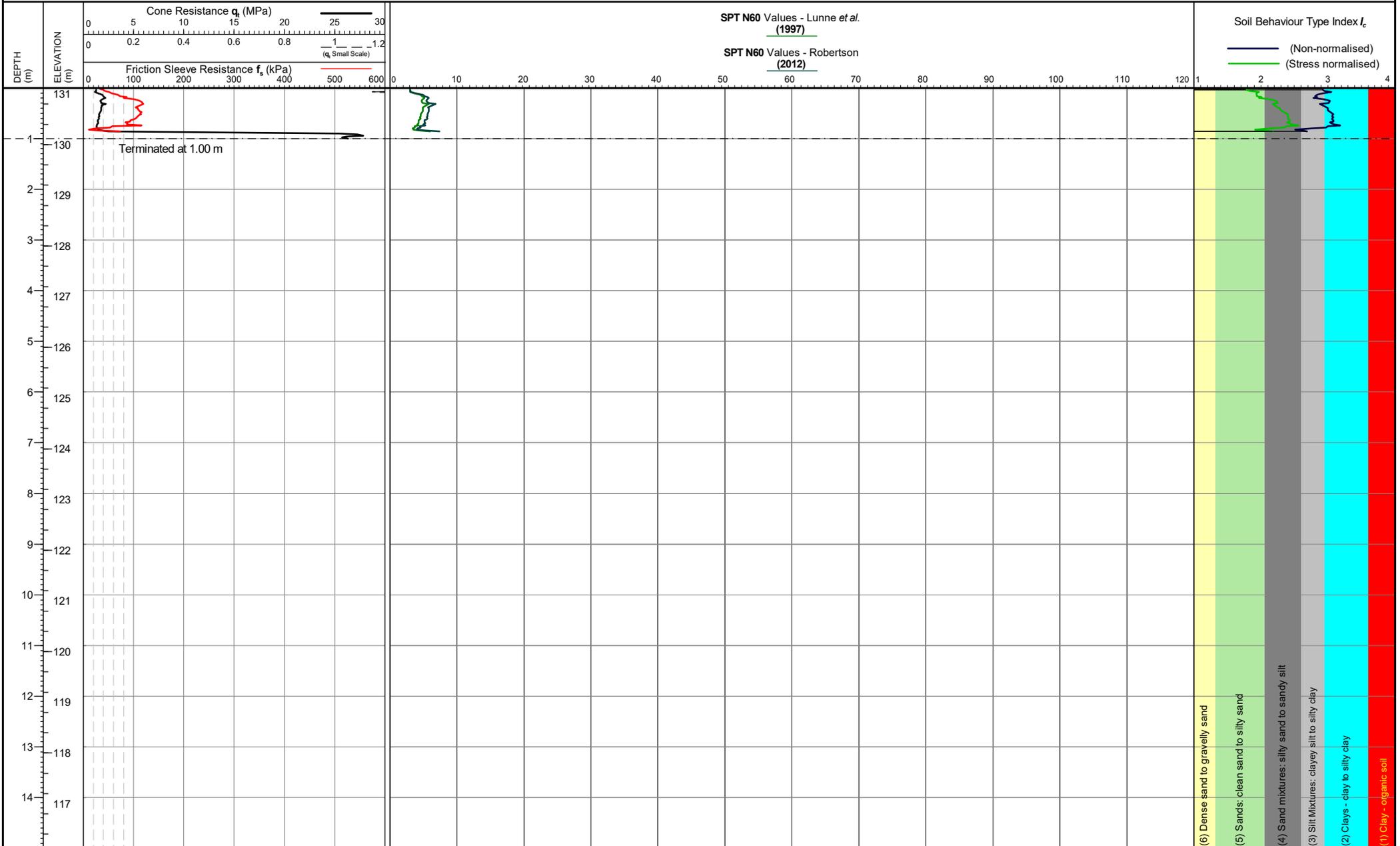
Cone area (mm²):1500
 Cone ID: S15-CFIP.1526
 Operator: Martyn Waters
 Date of test: 23/09/2020 12:33:00

Location: South Yorkshire, UK
 Coordinates: 436059.15, 399775.64
 Elevation: 131.12
 Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1
 Checked by: Chris Player

TEST ID: CPT5105A



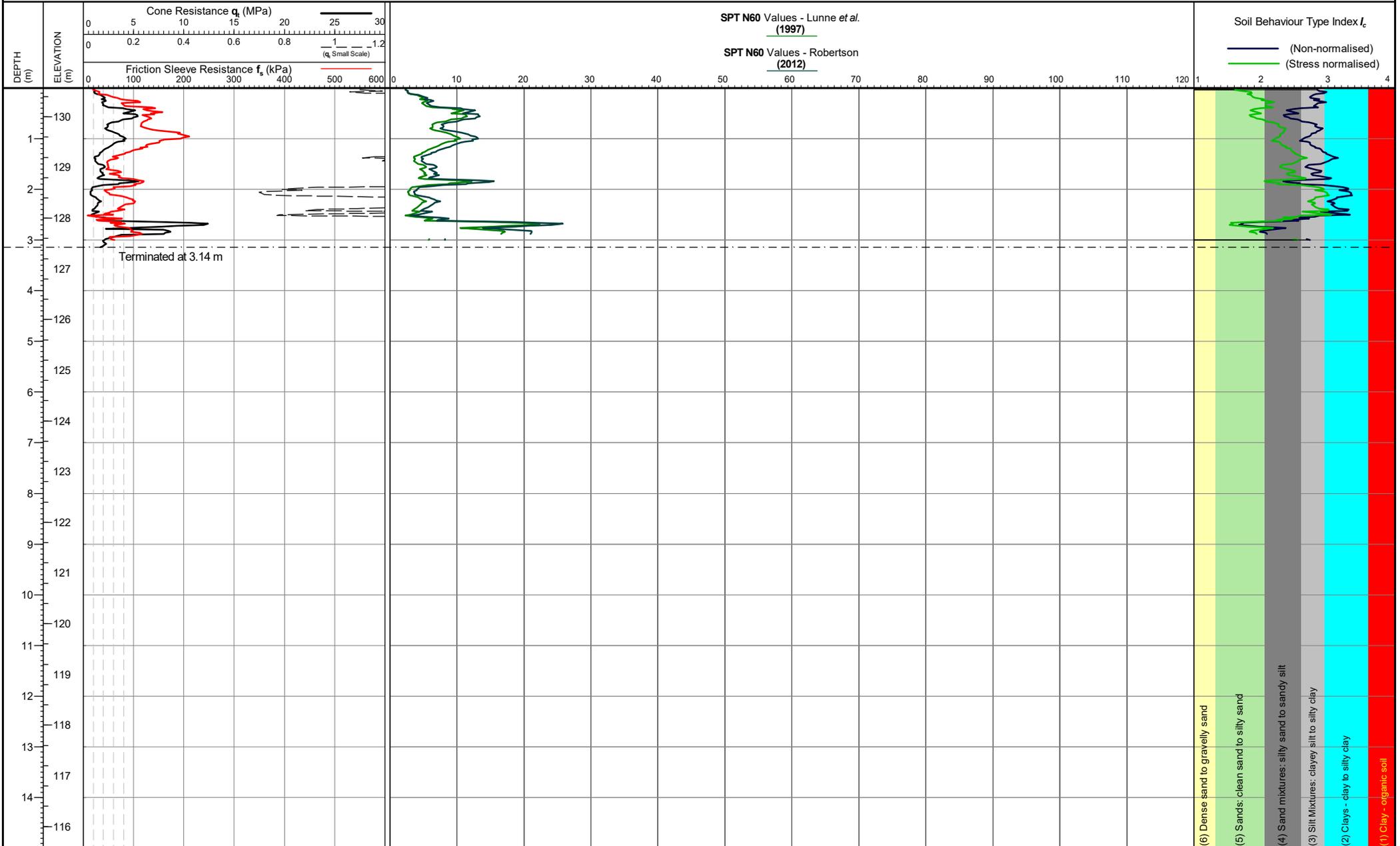
Cone area (mm²):1500
 Cone ID: S15-CFIP.1526
 Operator: Martyn Waters
 Date of test: 23/09/2020 14:03:00

Location: South Yorkshire, UK
 Coordinates: 436059.15, 399775.64
 Elevation: 131.12
 Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1
 Checked by: Chris Player

TEST ID: CPT5105B



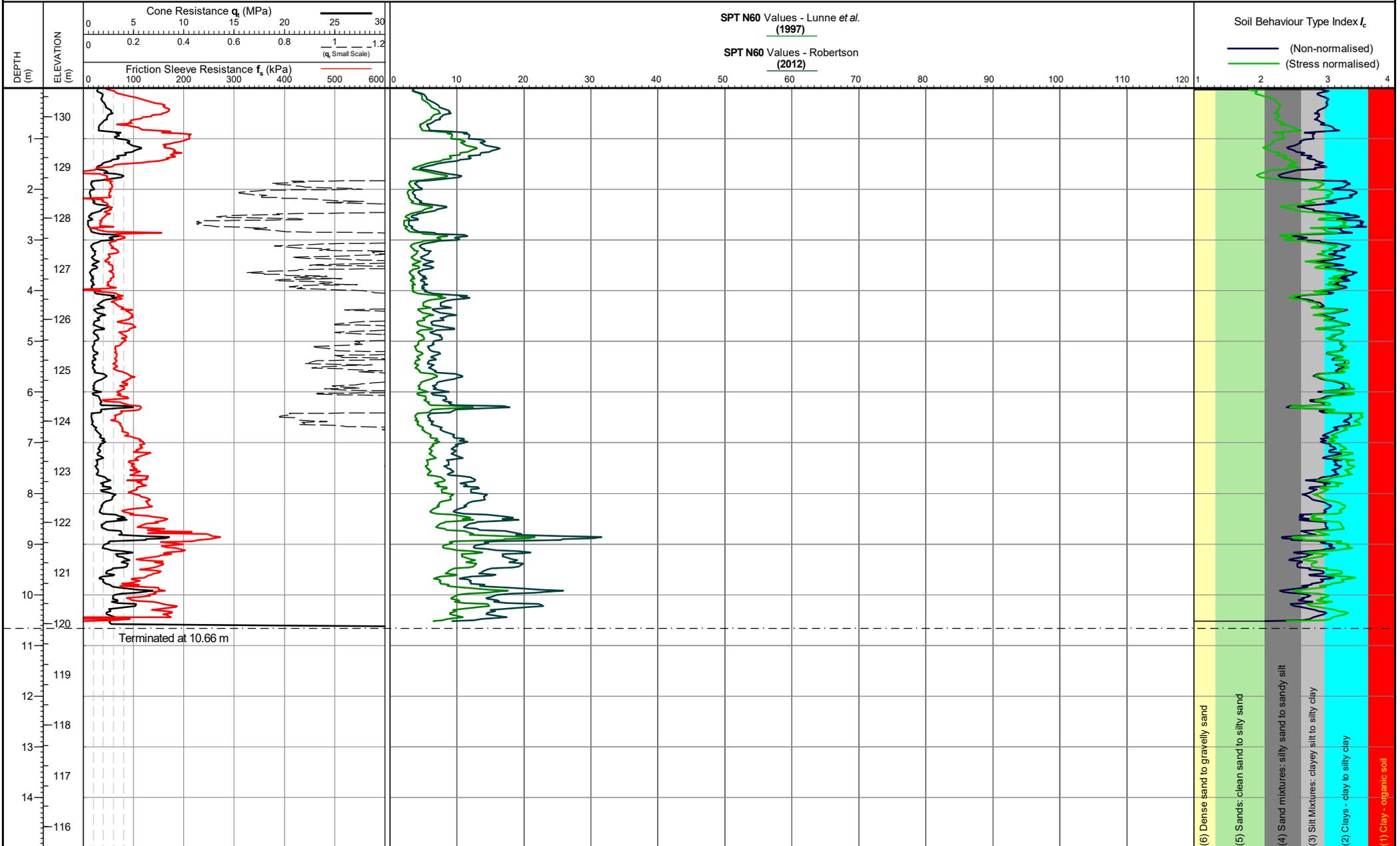
Cone area (mm²):1500
 Cone ID: S15-CFIP.1526
 Operator: Martyn Waters
 Date of test: 23/09/2020 10:30:00

Location: South Yorkshire, UK
 Coordinates: 436114.09, 399820.78
 Elevation: 130.57
 Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1
 Checked by: Chris Player

TEST ID: CPT5106



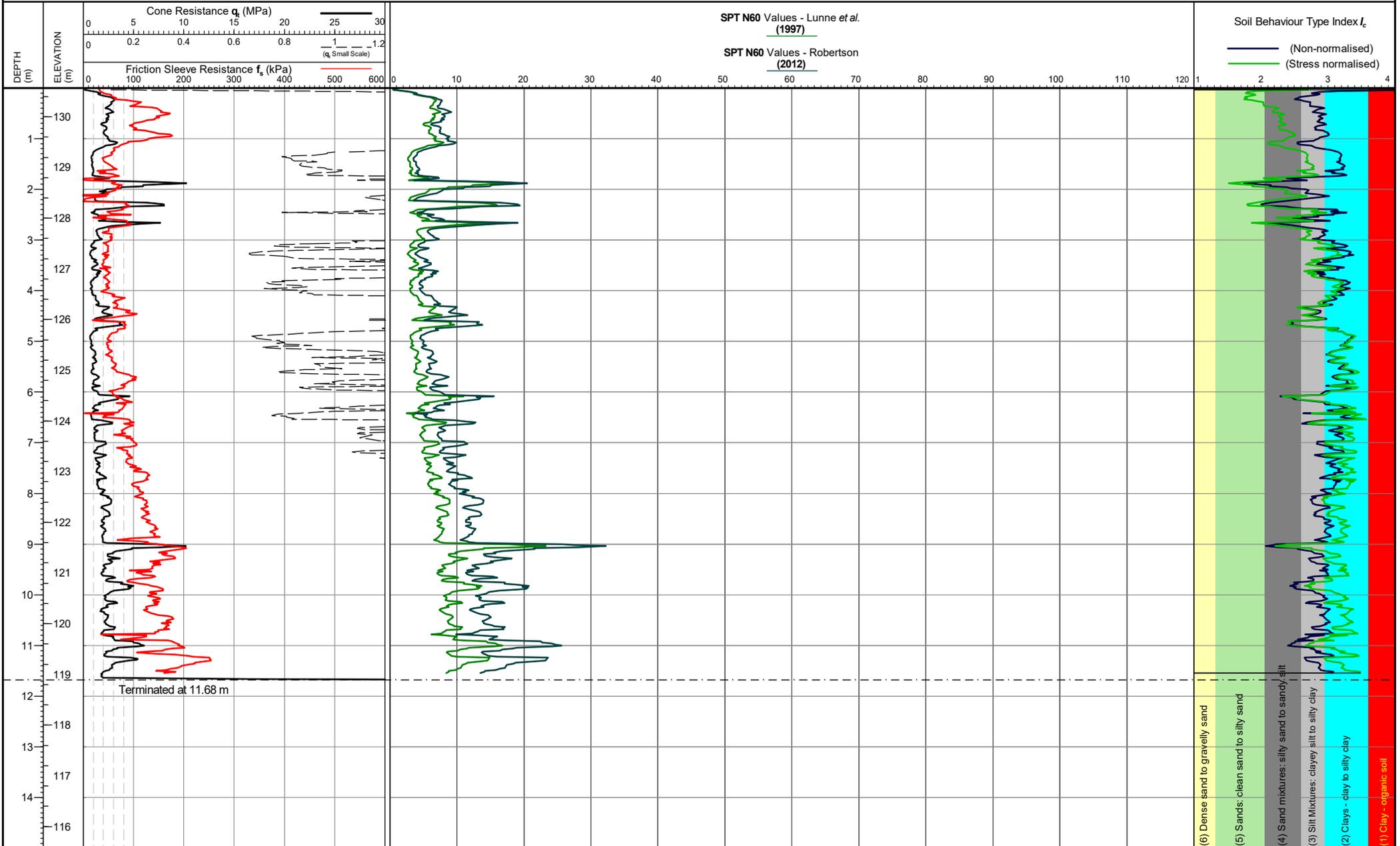
Cone area (mm²):1500
 Cone ID: S15-CFIP.1526
 Operator: Martyn Waters
 Date of test: 23/09/2020 10:59:00

Location: South Yorkshire, UK
 Coordinates: 436114.09, 399820.78
 Elevation: 130.57
 Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1
 Checked by: Chris Player

TEST ID: CPT5106A



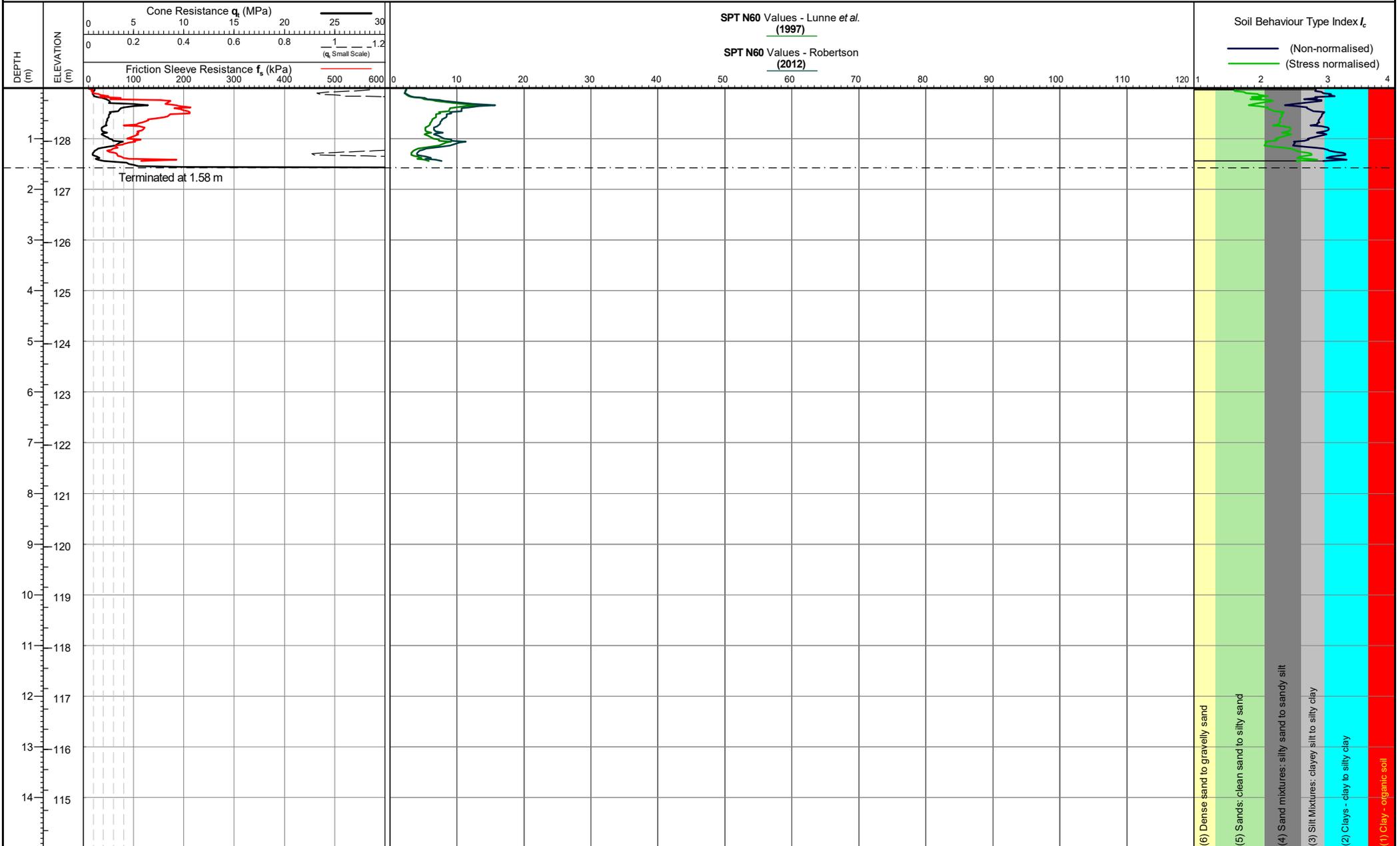
Cone area (mm²):1500
 Cone ID: S15-CFIP.1526
 Operator: Martyn Waters
 Date of test: 23/09/2020 14:15:00

Location: South Yorkshire, UK
 Coordinates: 436114.09, 399820.78
 Elevation: 130.57
 Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1
 Checked by: Chris Player

TEST ID: CPT5106B



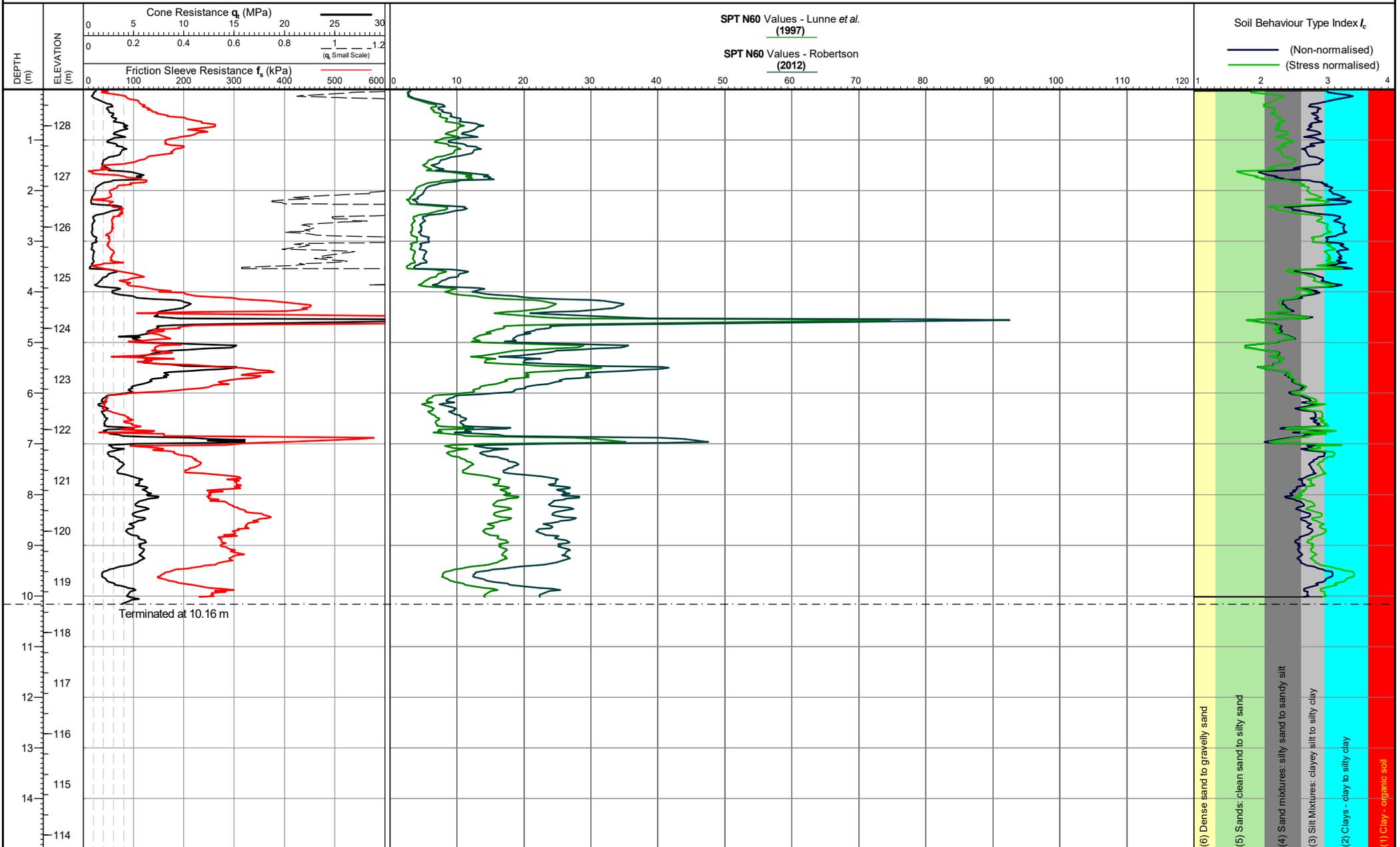
Cone area (mm²):1500
 Cone ID: S15-CFIP.1526
 Operator: Martyn Waters
 Date of test: 23/09/2020 08:46:00

Location: South Yorkshire, UK
 Coordinates: 436067.45, 399708.39
 Elevation: 129.05
 Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1
 Checked by: Chris Player

TEST ID: CPT5107



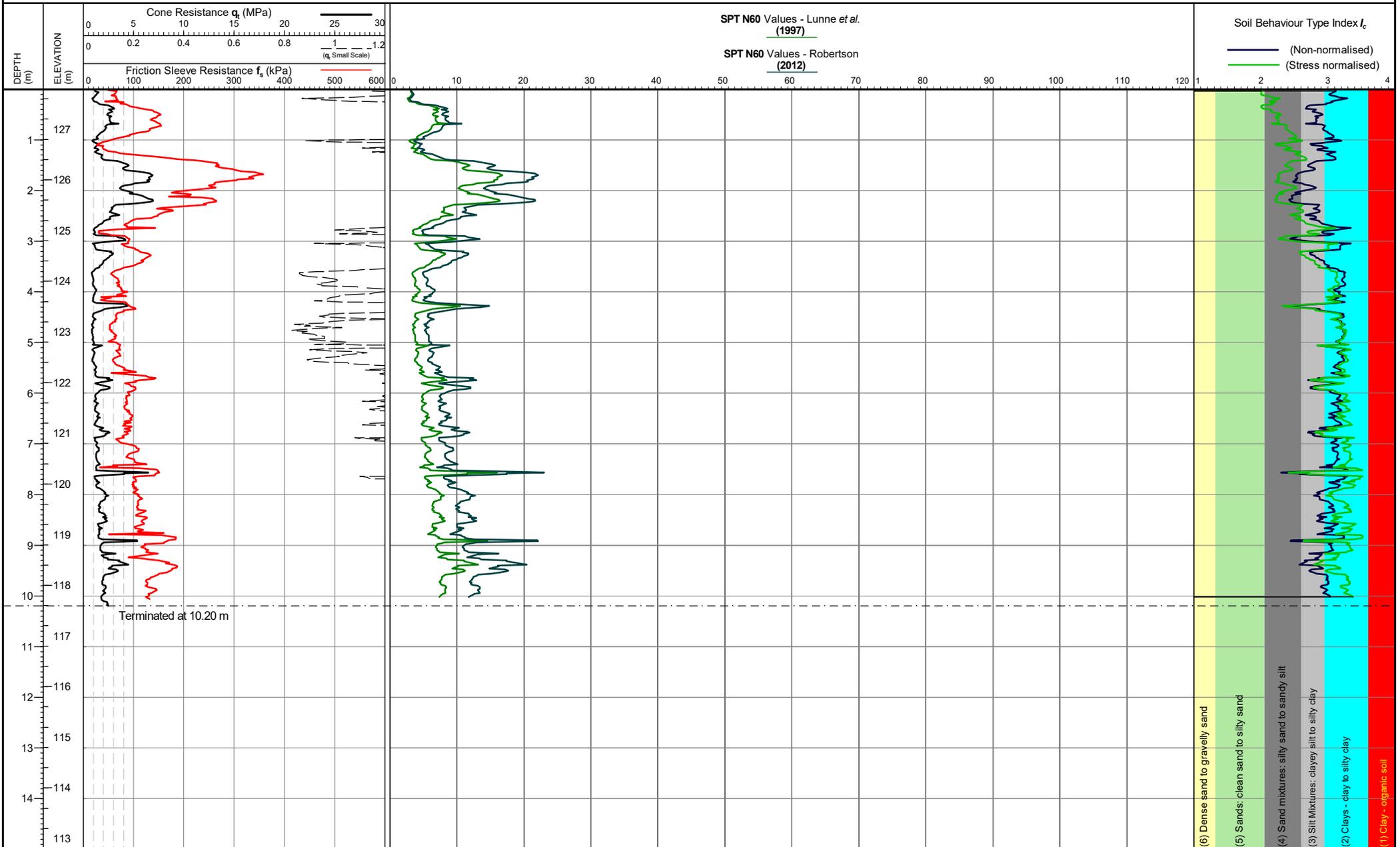
Cone area (mm²):1500
 Cone ID: S15-CFIP.1526
 Operator: Martyn Waters
 Date of test: 23/09/2020 09:07:00

Location: South Yorkshire, UK
 Coordinates: 436110.03, 399739.98
 Elevation: 128.72
 Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1
 Checked by: Chris Player

TEST ID: CPT5108



Cone area (mm²):1500
 Cone ID: S15-CFIP.1526
 Operator: Martyn Waters
 Date of test: 23/09/2020 09:39:00

Location: South Yorkshire, UK
 Coordinates: 436161.04, 399783.79
 Elevation: 127.79
 Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 07-10-20
 Lankelma Project Ref: P-107408-1
 Checked by: Chris Player

TEST ID: CPT5109

APPENDIX F SITE LOCATION PLAN

Not as built