



INITIA

GEOTECHNICAL SPECIALISTS

GREENSTONE LAND DEVELOPMENTS LIMITED

STAGE 12, LYNDHURST SUBDIVISION,
HASTINGS

GEOTECHNICAL COMPLETION REPORT

INITIA REF P-000828 REV A

SEPTEMBER 2020

Contents

1. Introduction.....	3
2. Background	4
2.1 General	4
2.2 Resource Consent	4
2.3 Previous Geotechnical Reporting.....	4
2.4 Recent Investigations	4
3. Earthworks	5
3.1 Fill	5
3.2 Compaction Testing.....	5
4. Geotechnical Considerations.....	6
4.1 General	6
4.2 Overall Site Stability.....	6
4.3 Site seismicity and subsoil class.....	6
4.4 Liquefaction susceptibility	6
4.5 Geotechnical Considerations	7
4.5.1 Gravel Raft	7
4.5.2 Foundations.....	7
5. Recommendations	8
6. Statement of Professional Opinion as to the suitability of land for building development.....	9
6.1 Statement.....	9
6.2 Unexpected Ground Conditions.....	9
7. Applicability.....	10
Appendix A: Earthworks Plan – As Built	12
Appendix B: Geotechnical Investigation Plan	13
Appendix C: Initia CPT Logs	14
Appendix D: Initia Hand Auger Borehole Logs	15
Appendix E: Liquefaction Summary	16
Appendix F: Earthworks Contractor's PS3	17



1. Introduction

Initia Limited (Initia) was engaged by Greenstone Land Developments Limited (Greenstone) to provide geotechnical consultancy services in relation to the Stage 12 of proposed Lyndhurst Subdivision at 574 Lyndhurst Road, Frimley, Hastings¹. The legal description of the site is LOT 400 DP 541537.

As shown on the Zorn Surveying fill depth plan² attached in Appendix A, earthworks including the placement of engineered fill up to 1.5 m depth has been completed for most of the site. Initia has recently carried out a geotechnical site investigation for the Stage 12 area (refer the investigation plan attached in Appendix B).

This report summarises and collates the results of all the investigations and testing associated with the bulk earthworks that have been undertaken to prepare the Stage 12 site for the residential subdivision.

The scope of this report is limited to the following:

- Bulk earthworks for the Stage 12 Lots (Lots 118 – 141), and
- Geotechnical investigations, assessment, and recommendations for future building design.

This geotechnical completion report has been prepared to accompany a “Statement of Professional Opinion on Suitability of Land for Construction” This is provided in Section 6.

¹ Initia Ltd (28 May 2020). *Proposal for Geotechnical Consultancy Services – Stage 11 & 12, Lyndhurst Subdivision, Hastings*. Ref P-000829.

² Zorn Surveying (25 March 2020). *Engineered Fill Survey Depths*. Ref J001255.



2. Background

2.1 General

The site at Lyndhurst has previously been used for as agricultural land with the Hawkes Bay expressway present to the north of Stage 12.

2.2 Resource Consent

A Resource Consent for the subdivision has been granted. All the previous geotechnical work carried out at the site was undertaken by Resource Development Consultants Limited (RDCL).

RDCL are no longer involved with the project and Initia were engaged by Greenstone to provide on-going geotechnical support and certification for the Stages 11 and 12.

2.3 Previous Geotechnical Reporting

Geotechnical Investigations (5 No. Cone Penetration Tests – CPTs) within the Stage 11 and 12 areas have been previously undertaken by RDCL³. Particularly, three of the CPTs were undertaken within the Stage 12 area.

The existing investigation data indicates that the site is typically underlain by interbedded alluvial deposits comprising clays, silts and sands. A shallow dense gravel layer has been identified in certain location across the Lyndhurst subdivision. The CPTs have been unable to penetrate this layer.

2.4 Recent Investigations

On 30 and 31 July 2020, Initia carried out 11 No. CPTs and 10 No. hand auger boreholes (shown in red colour on the investigation plan attached in Appendix B) within the Stage 12 area to provide Greenstone with a geotechnical completion report for subdivision. This document will provide potential purchasers of each lot with the required geotechnical information to enable a Building Consent Application to be submitted to Hastings District Council.

5 No. of the Initia CPTs were pushed down to the target depth of 15 m below ground level and the other 6 No. CPTs reached refusal due to high cone resistance q_c (greater than 20 MPa) at variable depths of 5.4 to 14.4 m below ground level.

At the time of the recent investigation, the area of Lots 137 – 139 was occupied by stockpiles and was not tested by Initia. Based on the site observation and results of compaction testing by others (discussed in Section 3.2 below), the condition of fill placed in this area is inferred to be consistent with the adjacent lots.

The Initia investigation logs are attached in Appendix C and D. This data combined with the original RDCL investigations forms the basis of this report.

During the recent investigation, the groundwater levels were measured in the CPTs and were generally at 2.7 to 3.2 m below the surface. We have adopted a design groundwater level of 2.5 m for the purpose of liquefaction analysis.

³ Resource Development Consultants Limited (12 December 2019). Report on: *Stage 10, Lyndhurst Road Subdivision, Frimley, Hastings – Lots 163 to 178 (Excluding Lot 171)*. Project: *Geotechnical Assessment*. Ref R_183970602C_01.



3. Earthworks

The earthworks were undertaken by Santo Drainage & Contracting Ltd and compaction testing was carried out by WSP OPUS (WSP).

3.1 Fill

We understand that the fill materials placed in Stage 12 were dominantly SILT from the Te Aute Road Havelock North Rymans development site. The hand auger boreholes at these lots generally encountered stiff to very stiff SILT or sandy SILT beneath a thin layer of topsoil. The maximum depth of these hand auger boreholes was 1.3 m below ground level.

The Initia CPTs within these lots generally recorded an average q_c of approximately 2 to 4 MPa between depths of 0.3 to 1.5 m below ground level, indicating a good level of compaction.

We have been informed from the client that granular materials ("red metal") were used for filling in an area including Lots 118, 119 and part of Lot 120 within Stage 12. However, we have not been provided with a detailed construction record of filling and the relevant tests (CPT 10 and 11) show limited thickness (less than 0.5 m) of higher strength layer.

3.2 Compaction Testing

A copy of the compaction test results was provided to Initia for review. We note that WSP did not provide oven dried moisture content for the Nuclear Densometer (NDM) testing. They have relied on the NDM alone. In addition, we have only been provided with a single point compaction result. Accordingly, it is difficult to fully assess the compaction of the engineered fill at the site. However, it is noted that the CPTs did record appropriate soil strength data for this material.



4. Geotechnical Considerations

4.1 General

Recommendations and opinions contained in this report are based on the data provided by numerous sources including RDCL and Initia, using a variety of investigation techniques including:

- CPTs
- Hand auger boreholes

All the tests were undertaken at discrete point locations. Inferences about the nature and continuity of the subsoils away from the test locations are made however it must be appreciated that actual conditions could vary from the assumed model. It is important that Initia be informed immediately if differing ground conditions are encountered during the construction process.

4.2 Overall Site Stability

Due to the generally flat topography of the Stage 12 site, the overall stability of the site is not considered to be an issue. Seismic stability of the ground is addressed in the relevant sections below.

4.3 Site seismicity and subsoil class

Based on the previous and recent geotechnical investigations at the site and in the adjacent Stage 11 area, we consider that the site subsoil class should be classified as Class D – Deep or Soft Soil Site, in accordance with NZS1170.5 (2004)⁴.

For determination of the design Peak Ground Acceleration (PGA), we have assumed an Importance Level 2 and a 50-year design life for the future developments. These assumptions should be confirmed by the specific project Structural Engineer.

Based on the above assumptions and in accordance with NZS1170.0 (2002)⁵, the annual probabilities of exceedance for design earthquakes are 1/500 (500 years return period) and 1/25 (25 years return period) for Ultimate Limit States (ULS) and Serviceability Limit States (SLS) respectively.

Based on the assessment by GNS Science⁶, the PGAs and average magnitude of an earthquake contributing to PGA for ULS and SLS design are presented in Table 3-1 below.

Table 4-1 Design PGA and average magnitude of an earthquake contributing to PGA

Limit States	Return Period	PGA	Average Magnitude
ULS	500 years	0.42g	6.5
SLS	25 years	0.14g	6.2

Note: The design PGAs have been based on an Importance Level 2 structure and a 50-year design life.

4.4 Liquefaction susceptibility

The liquefaction susceptibility of the underlying material at the Stage 12 site has been assessed using the results of the Initia 2020 Investigations as well as considering the results and conclusions in RDCL 2019 report.

⁴ New Zealand Standard NZ 1170.5:2004 Structural Design Actions: Part 5: Earthquake actions – New Zealand.

⁵ New Zealand Standard NZ 1170.0:2002 Structural Design Actions: Part 0: General Principles.

⁶ GNS Science (October 2017), Consultancy Report 2015/186: *Assessment of liquefaction risk in the Hawke's Bay*.



A CPT-based liquefaction analysis has been carried out using the computer programme CLiq v.2.3⁷ on the recent Initia CPTs. The adopted analysis method is based on the study by Boulanger and Idriss (2014).

The analysis indicates that the liquefaction susceptibility during the SLS design event is low across the site. For the ULS design event, the liquefaction susceptibility is estimated to be moderate to high across the site. When the liquefaction does occur in a ULS design earthquake event, the analysis indicates that the liquefaction induced settlement may be up to 160 mm. However, the 2.5 m crust of material above the groundwater level will likely form a 'cap' to reduce the effects of liquefaction observed at the surface.

The main output from the ULS liquefaction analysis is attached in Appendix E.

4.5 Geotechnical Considerations

4.5.1 Gravel Raft

To reduce the risk of liquefaction induced damage, we recommend that the existing ground be undercut by 600 mm and backfilled with imported hardfill and compacted to form a gravel raft beneath the building platform. The horizontal extent of gravel raft should be at least 1 m outside perimeter of the building.

The imported hardfill should be placed and compacted in maximum 200mm layers using a smooth drum roller. The supplier of the hardfill should provide a NZ Heavy Compaction curve for the material which indicates the Maximum Dry Density (MDD). The following testing should be carried out to ensure adequate compaction is being achieved:

- 95 % of MDD
- Clegg Impact values (CIV) greater than 20

Testing should be carried on a 5m grid on every 2nd lift and on the final surface.

Two layers of geogrid should be placed at the base of the excavation and at the mid-height of the gravel raft.

4.5.2 Foundations

Shallow pad/strip footings may be adopted on the completed gravel raft for single level lightweight residential developments within Stage 12.

The shallow pad/strip footings on gravel raft should be designed with the following bearing capacities, for a maximum foundation size of 1 m width:

- Geotechnical ultimate bearing capacity 300kPa
- ULS factored bearing capacity 150kPa
- Allowable bearing capacity 100kPa

Given the high liquefaction risk at this site, in the event of a ULS earthquake event, we recommend that all foundations (strips and pads) are tied together to limit differential settlements. This also prevents the building from 'pulling apart' in a large earthquake.

Alternatively, a structural raft foundation such as "rib raft" foundation or other propriety system may also be utilised within Stage 12. We understand that raft foundations have been used extensively in the Lyndhurst Subdivision.

⁷ Geologismiki (2018). CPT liquefaction software.



5. Recommendations

The geotechnical investigations have established that the Stage 12 of Lyndhurst is suitable for residential development in accordance with the conclusions and recommendations outlined in this geotechnical completion report.

We recommend that the Hastings District Council adopt these recommendations in relation to ground improvement and foundation options when assessing individual Building Consent Applications for the site.



6. Statement of Professional Opinion as to the suitability of land for building development

6.1 Statement

I, Andy Pomfret of Initia Limited, 13/114 St Georges Bay Rd, Parnell, Auckland hereby confirm that:

I am a Professional Engineer experienced in the field of geotechnical engineering and was engaged by the developer, Greenstone Land Developments Limited as the Geotechnical Engineer on the "Stage 12 of Lyndhurst Subdivision, Hastings" project located on Lyndhurst Road, Frimley, Hastings. Refer to the plans contained within Appendix A and Appendix B for the extent of the works covered under this statement.

On the basis of our observations and inspections together with the information provided by others, it is my professional opinion, not to be construed as a guarantee that:

- The earth fill shown on the attached Zorn Surveying Plan (Ref J001255-EFDS12) have been generally placed in compliance with the project specifications.
- The completed earthworks give due regard to land slope stability and foundation consideration providing the recommendations outlined in this Geotechnical Completion Report are followed.

6.2 Unexpected Ground Conditions

Our assessment is based on interpolation between site observations and periodic earthwork control visits by others. Local variations in ground conditions may occur leading to unfavourable ground conditions. It is important that we are contacted in this eventuality, or if any variation of subsoil conditions from those described in this report are found. Design assistance is available as required to accommodate any unforeseen ground conditions present.



7. Applicability

This report has been prepared for the exclusive use of our client, Greenstone Land Developments Limited and Hastings District Council, with respect to the brief provided to us and it may not be relied upon in any other contexts or for any other purpose, or by any person other than our client, without prior written agreement.

We note that only a representative sample of earthworks were reviewed by Initia and therefore we are relying on the contractor's PS3 for compliance with design. No liability is accepted for any omissions represented by those documents. The contractor's PS3 is presented in Appendix F. The advice and recommendations presented in this report should not be applied to any other project or used in any other context without prior written approval from Initia Limited.

Report prepared by:



Andy Pomfret
Senior Geotechnical Engineer

Report reviewed by:



Matt Wansbone
Senior Geotechnical Engineer

Document control record

Report Title		Stage 12, Lyndhurst Subdivision, Hastings Geotechnical Completion Report			
Initia Project Reference		P-000828			
Client		Greenstone Land Developments Limited			
Revision	Date	Revision detail	Author	Reviewer	Approved by
A	30/09/20	1 st issue.	A. Pomfret	M. Wansbone	A. Pomfret
Current Revision		A			



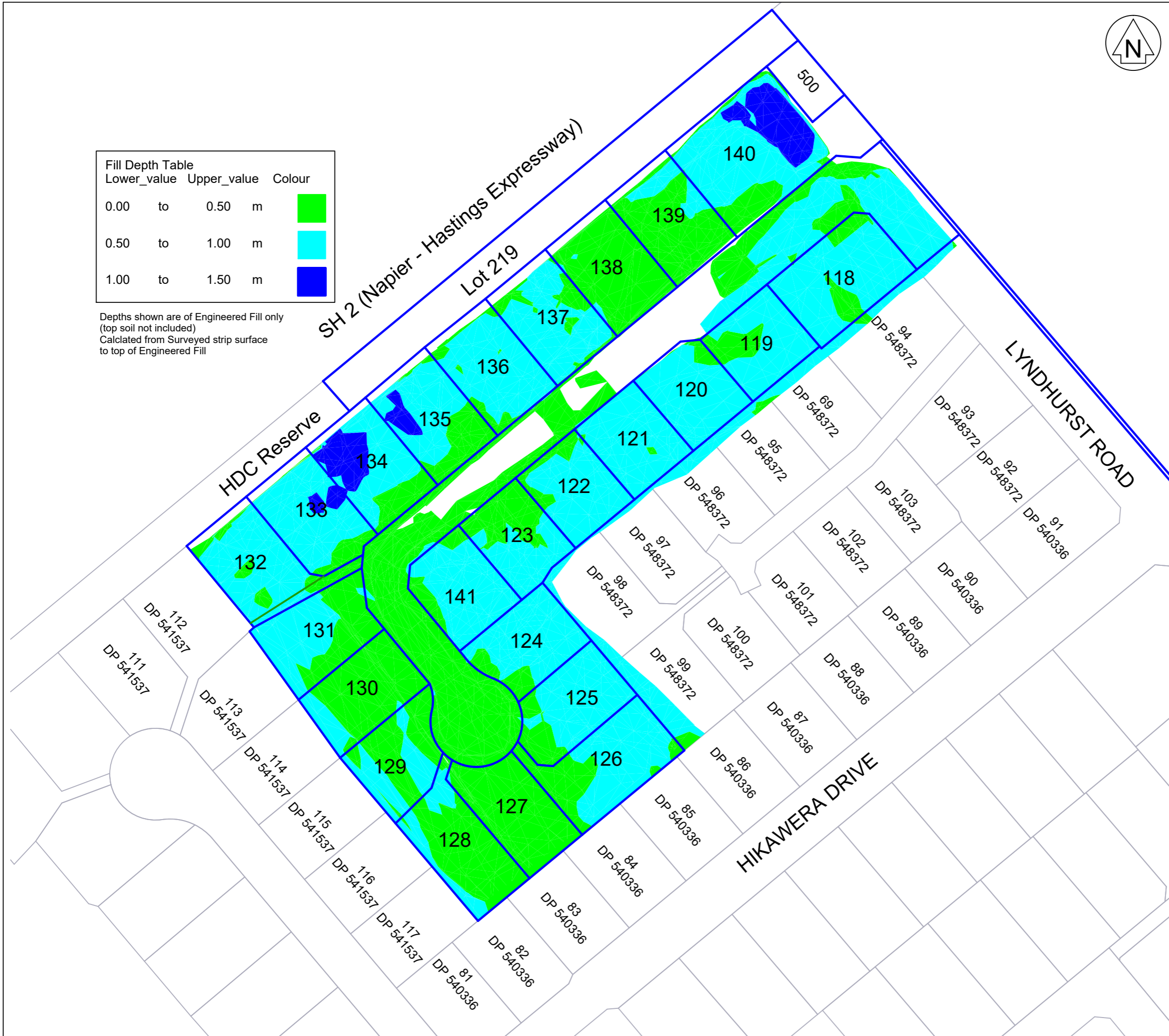
Appendix A: Earthworks Plan – As Built





Fill Depth Table			
Lower_value	Upper_value	Colour	
0.00	to 0.50	m	
0.50	to 1.00	m	
1.00	to 1.50	m	

Depths shown are of Engineered Fill only
(top soil not included)
Calculated from Surveyed strip surface
to top of Engineered Fill



SANTO CONSTRUCTION
C/O GLDL
ENGINEERED FILL
SURVEYED DEPTHS

DATE : Varies over 2020
SCALE : 1:1000 @ A3
DRAWN BY : R.Mac
JOB NO. : J001255
PLAN NO. : EFDS12






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Appendix B: Geotechnical Investigation Plan






LEGEND

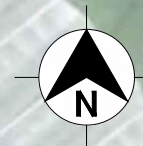
INITIA INVESTIGATIONS

-  CONE PENETROMETER TEST
CPT108 (JULY 2020)
-  HAND AUGER
HA111 (JULY 2020)
-  CONE PENETROMETER TEST
CPT17 (JUNE 2020)

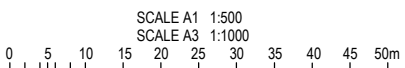
HISTORICAL INVESTIGATION

-  CONE PENETROMETER TEST
CPT108 (RDCL - MAY 2019)

-  SITE BOUNDARY
-  EXISTING LIDAR CONTOUR
(0.5m INTEVAL)



- NOTES**
1. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
 2. COORDINATE DATUM: NZTM
 3. AERIAL IMAGE AND PROPERTY BOUNDARY TAKEN FROM LINZ DATA, DATE 2017.
 4. PROPOSED SUBDIVISION MASTER PLAN, SUPPLIED BY ZORN SURVEYING, DATED APRIL 2019, REFERENCE "190429 FRIMLEY OVERALL PLAN.PDF"



FOR INFORMATION

NOT FOR CONSTRUCTION			
THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION UNLESS SIGNED AS APPROVED			
			APPROVED:
B	ADDITIONAL INVESTIGATIONS (JULY 2020)	BS	JG
A	FIRST ISSUE (22/06/2020)	AP	JG
Rev	Revision Description	Designed	Drawn
		Checked	Scale
			AS SHOWN
			Original Size
			A3



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**GREENSTONE
LAND DEVELOPMENTS
LIMITED**

STAGE 11 & 12, LYNDHURST SUBDIVISION, HASTINGS	
GEOTECHNICAL INVESTIGATION LOCATION PLAN	Initial Project ref: P000828
828-001	Revision B

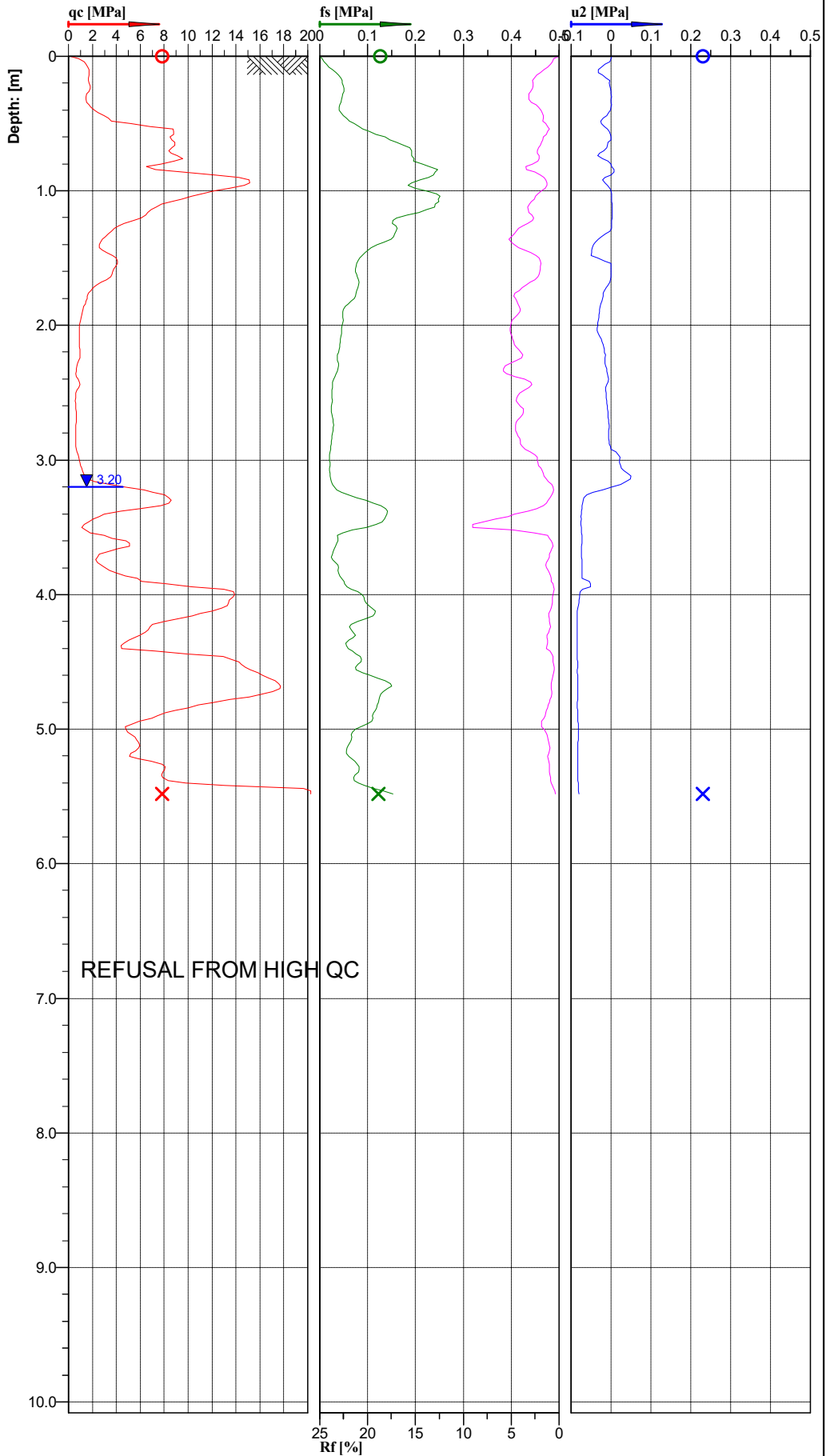
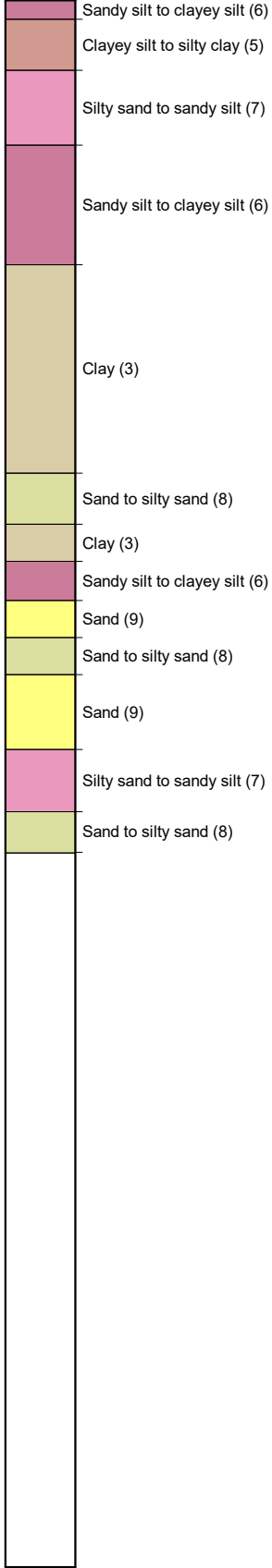
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Appendix C: Initia CPT Logs



**Classification by
Robertson 1986**



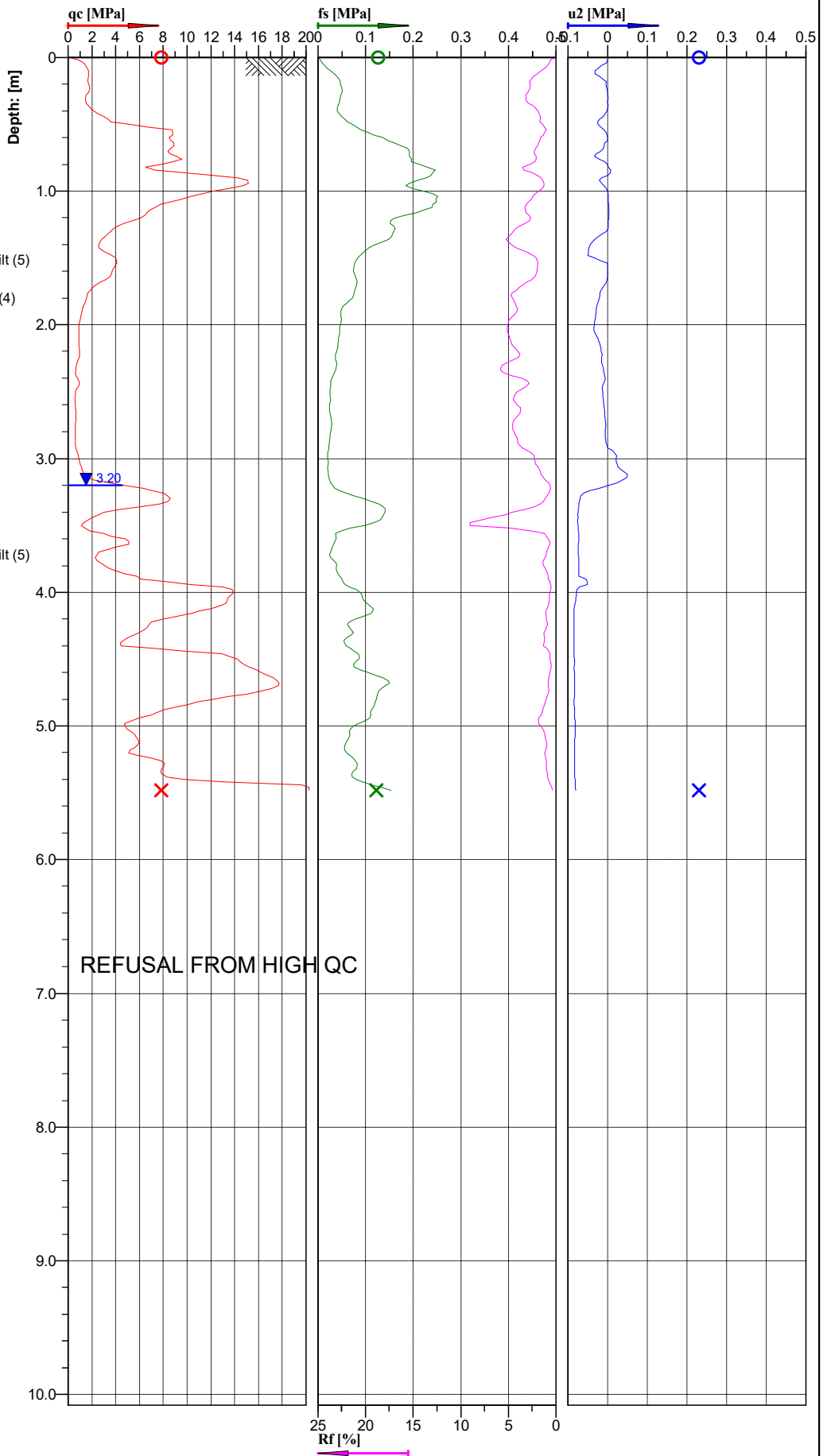
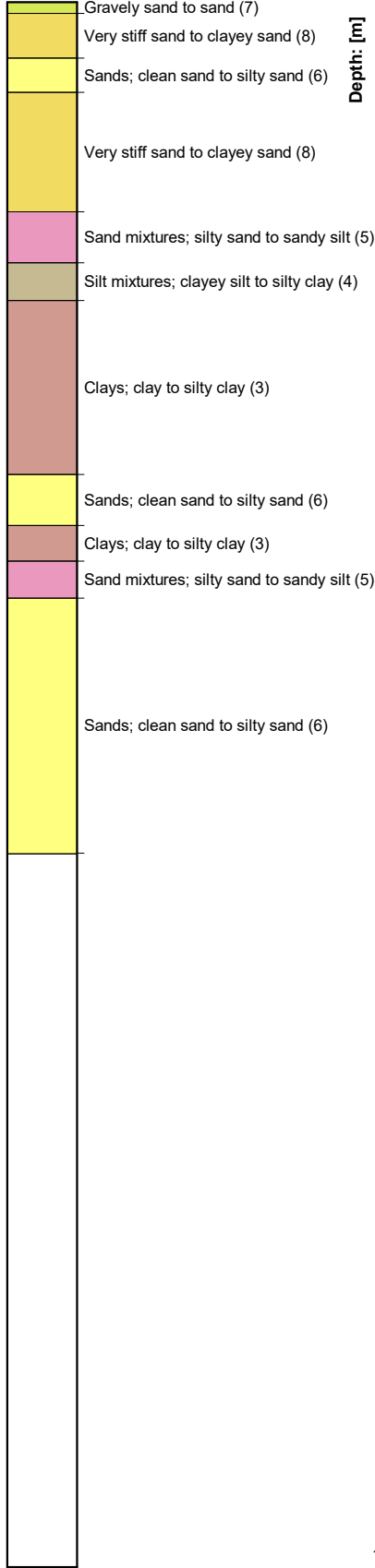
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Project:	LYNDHURST ROAD			Page:	1/1	Fig.:	
S 39.61432, E 176.82654				File:	CPT01.cpt		



Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



**Classification by
Robertson 1990**



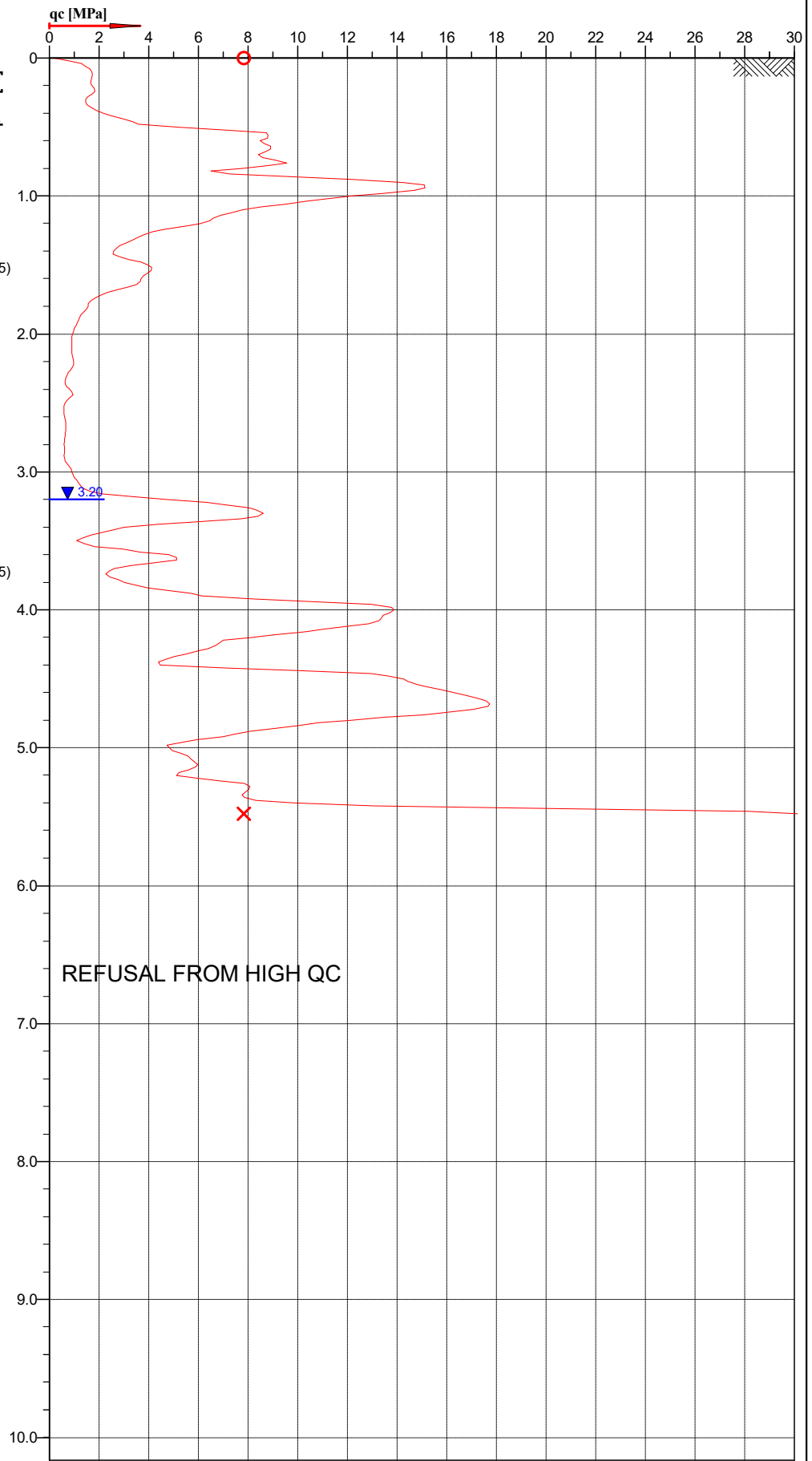
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 Sleeve area [cm²]: 150



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
**Classification by
Robertson 1990**

- Gravely sand to sand (7)
- Very stiff sand to clayey sand (8)
- Sands; clean sand to silty sand (6)
- Very stiff sand to clayey sand (8)
- Sand mixtures; silty sand to sandy silt (5)
- Silt mixtures; clayey silt to silty clay (4)
- Clays; clay to silty clay (3)
- Sands; clean sand to silty sand (6)
- Clays; clay to silty clay (3)
- Sand mixtures; silty sand to sandy silt (5)
- Sands; clean sand to silty sand (6)



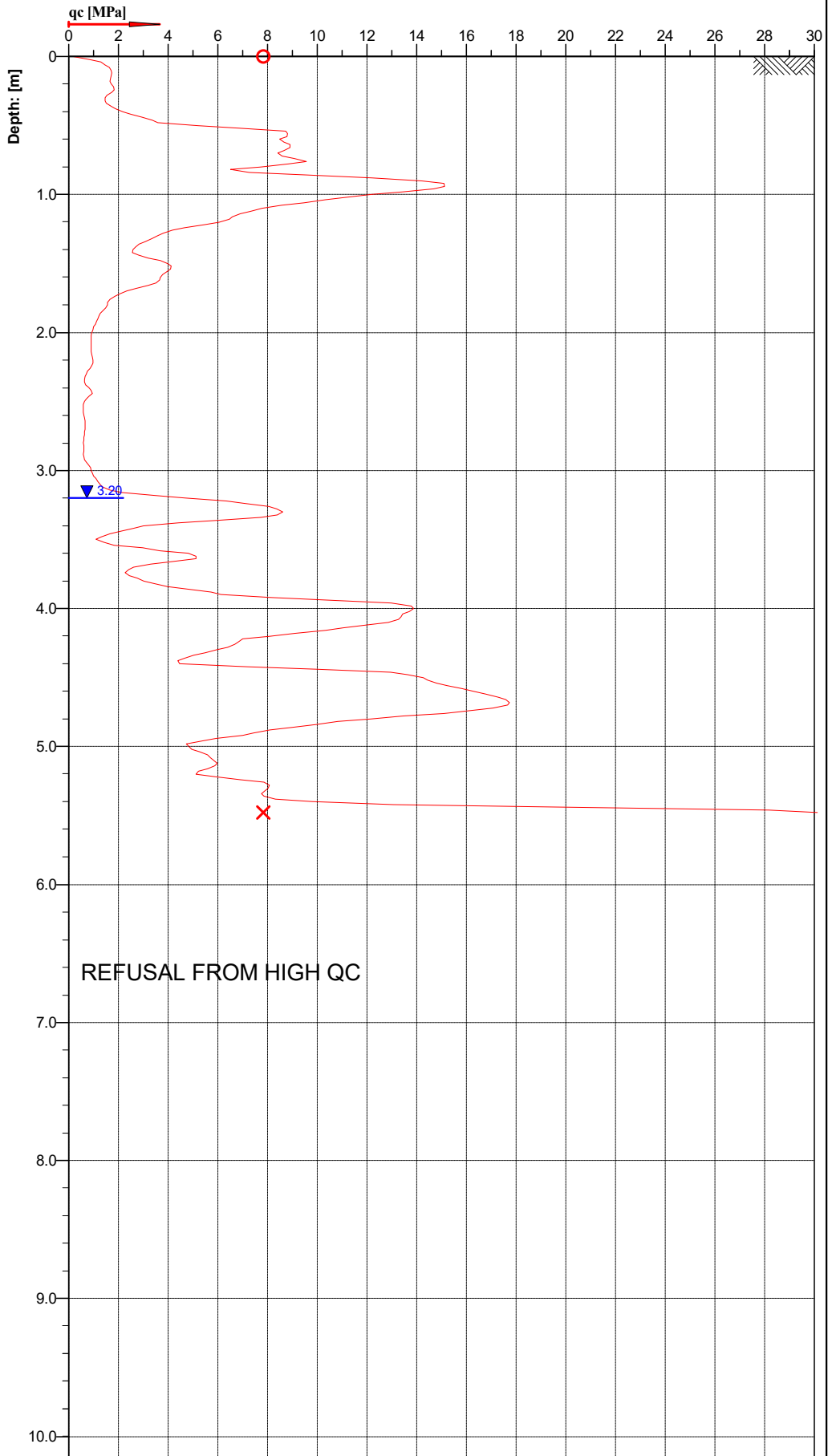
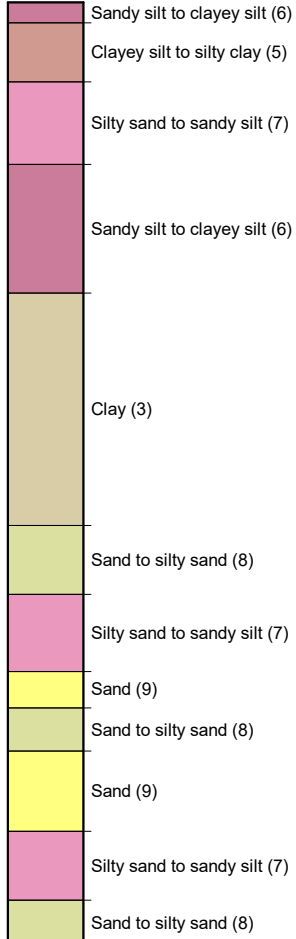
REFUSAL FROM HIGH QC




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Classification by Robertson 1986

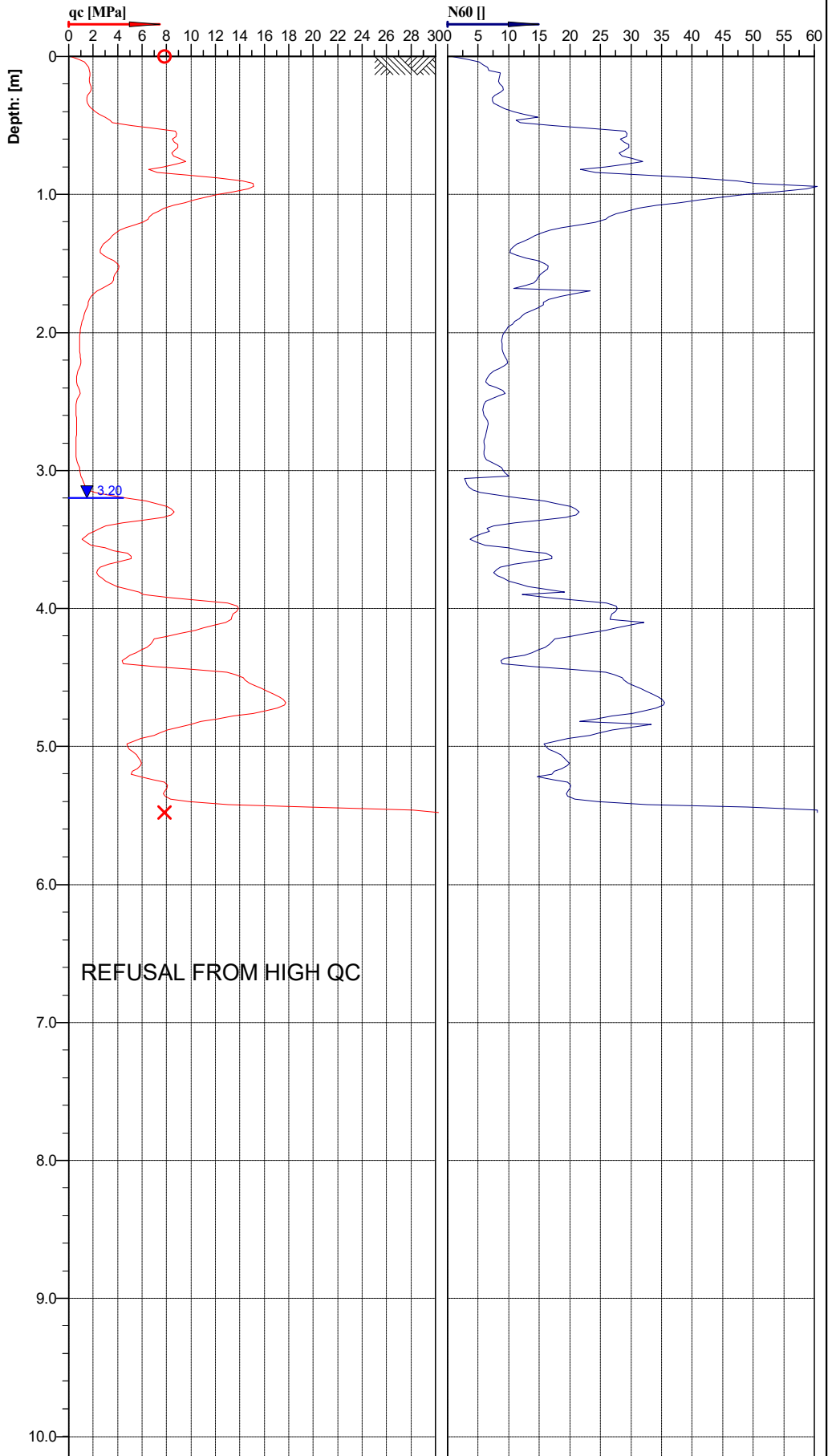
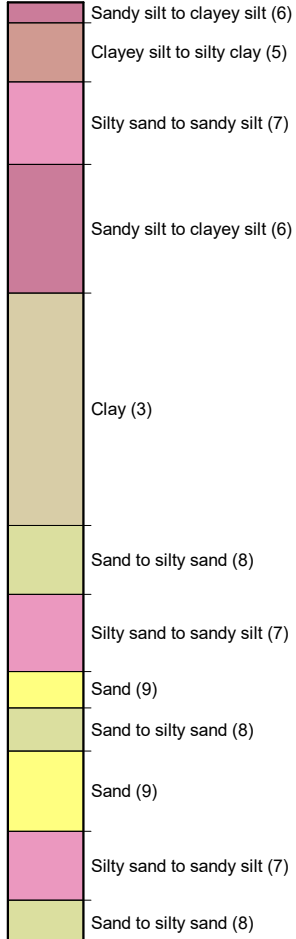


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
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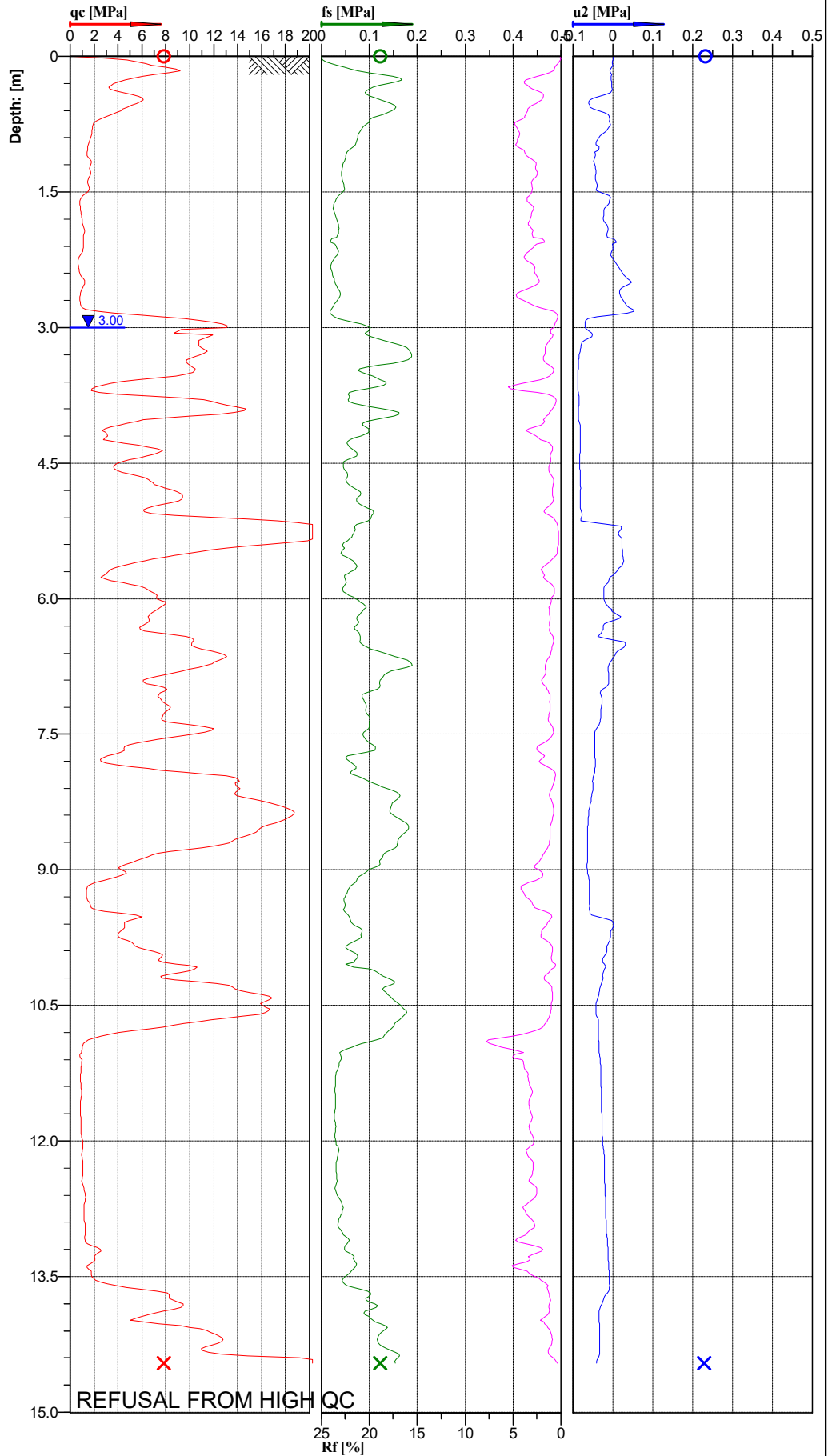
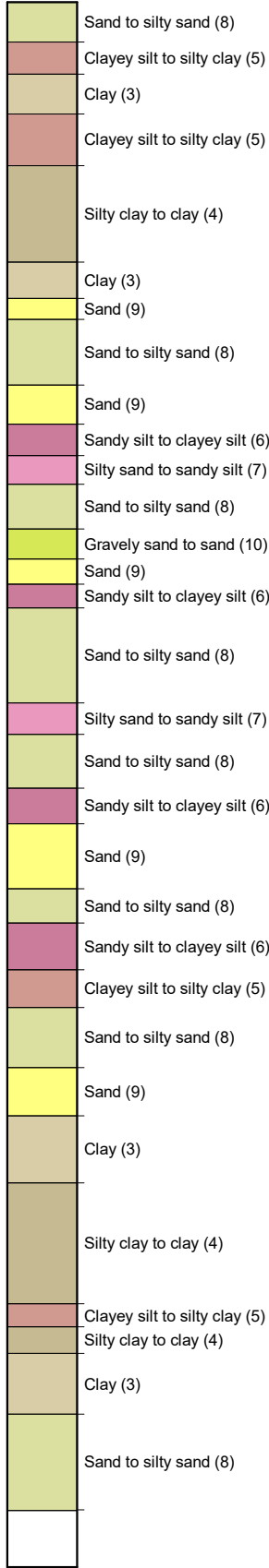


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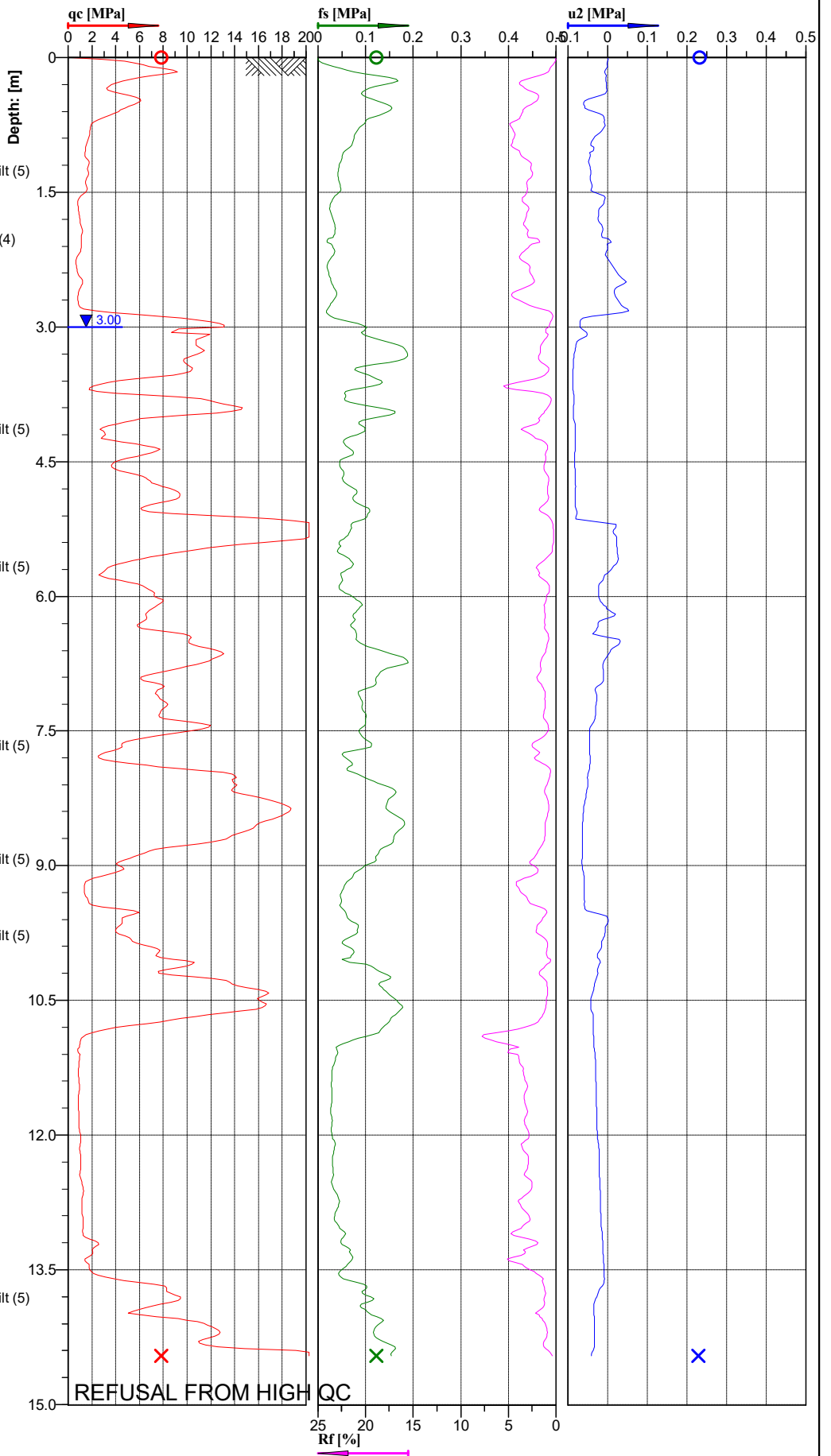


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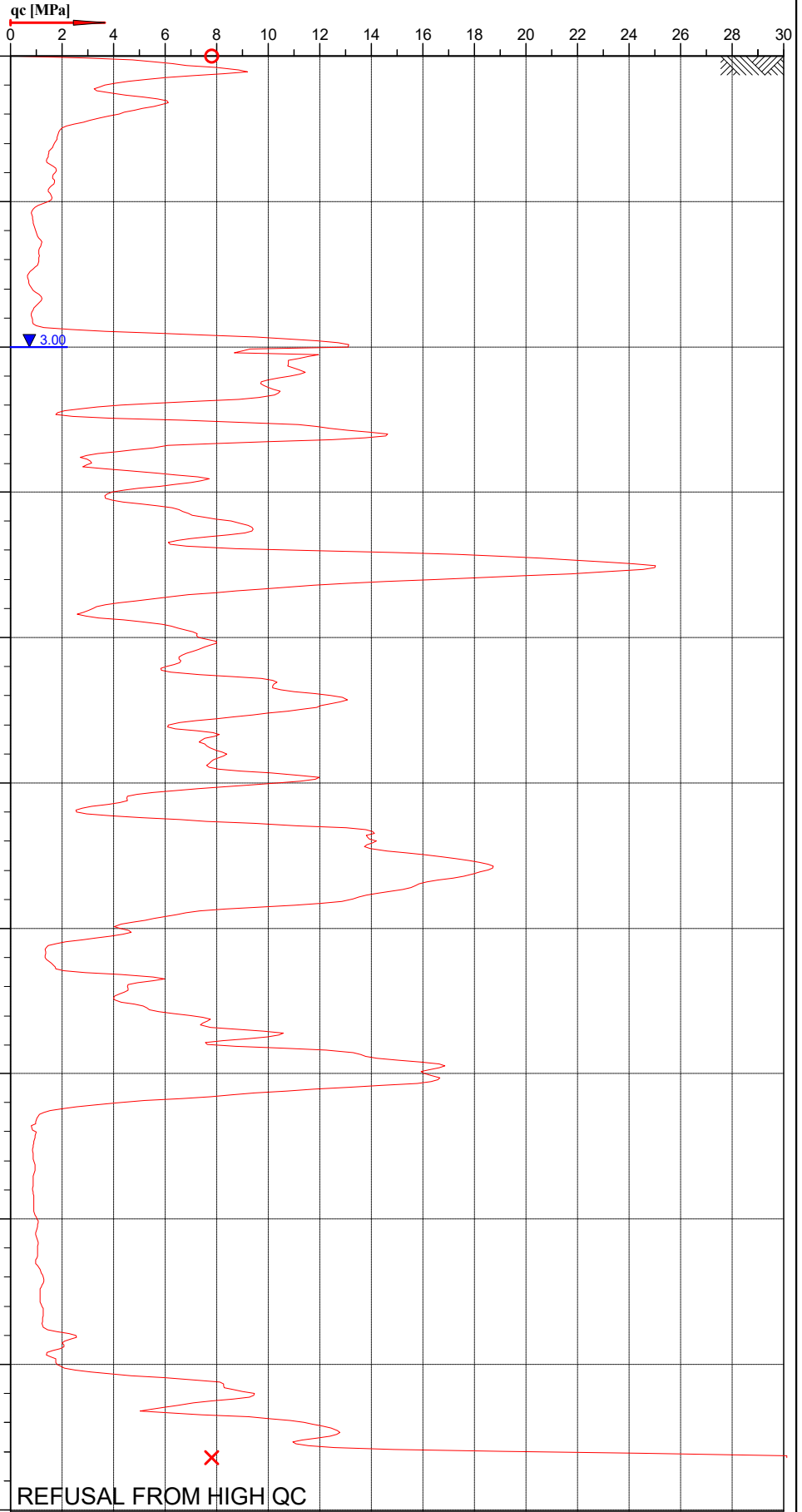
Classification by Robertson 1990



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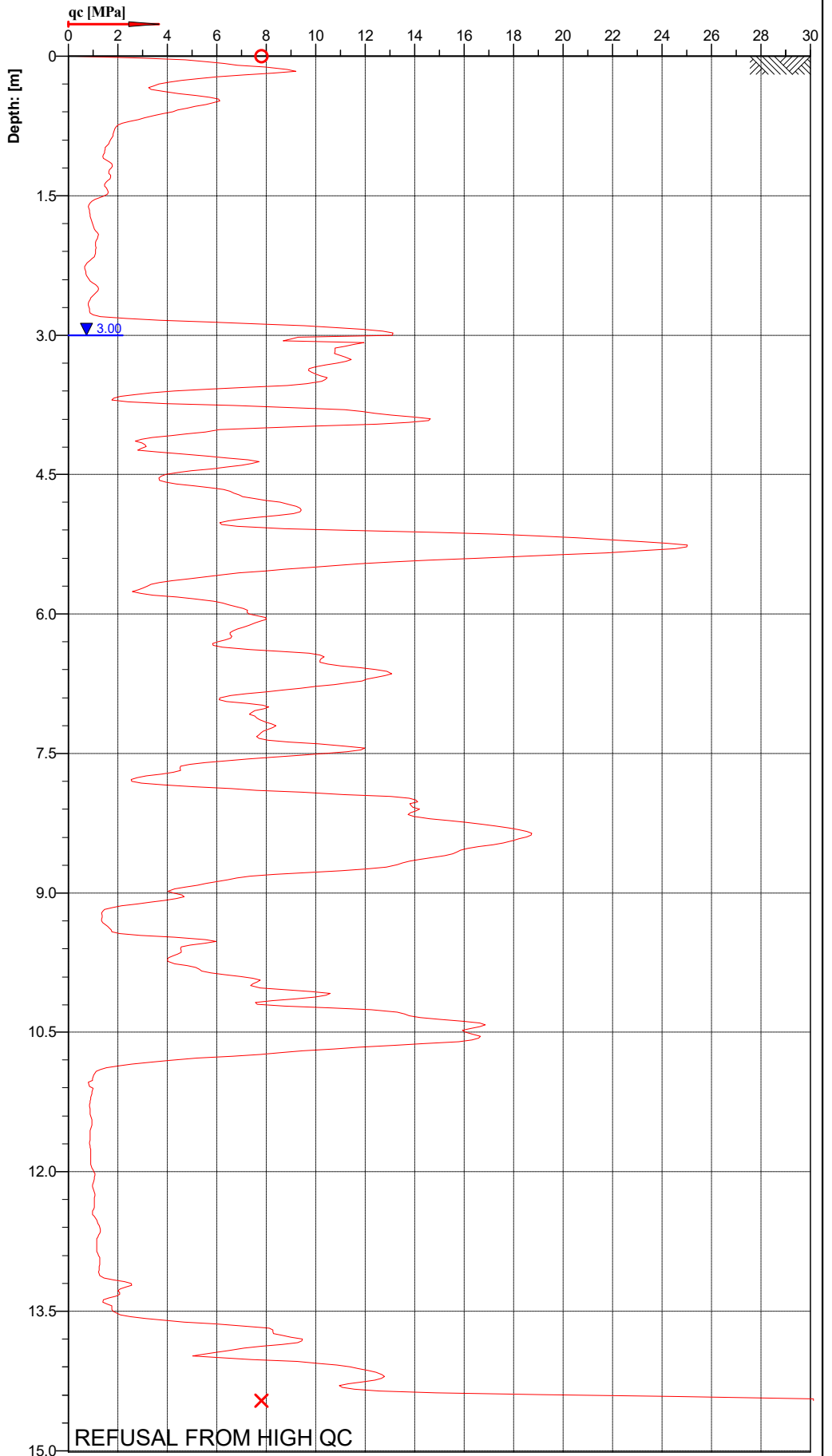
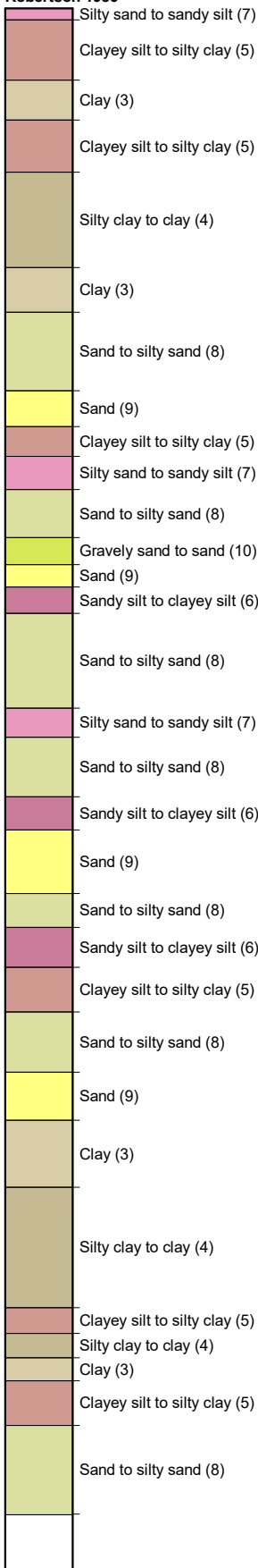
**Classification by
Robertson 1990**



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**Classification by
Robertson 1986**

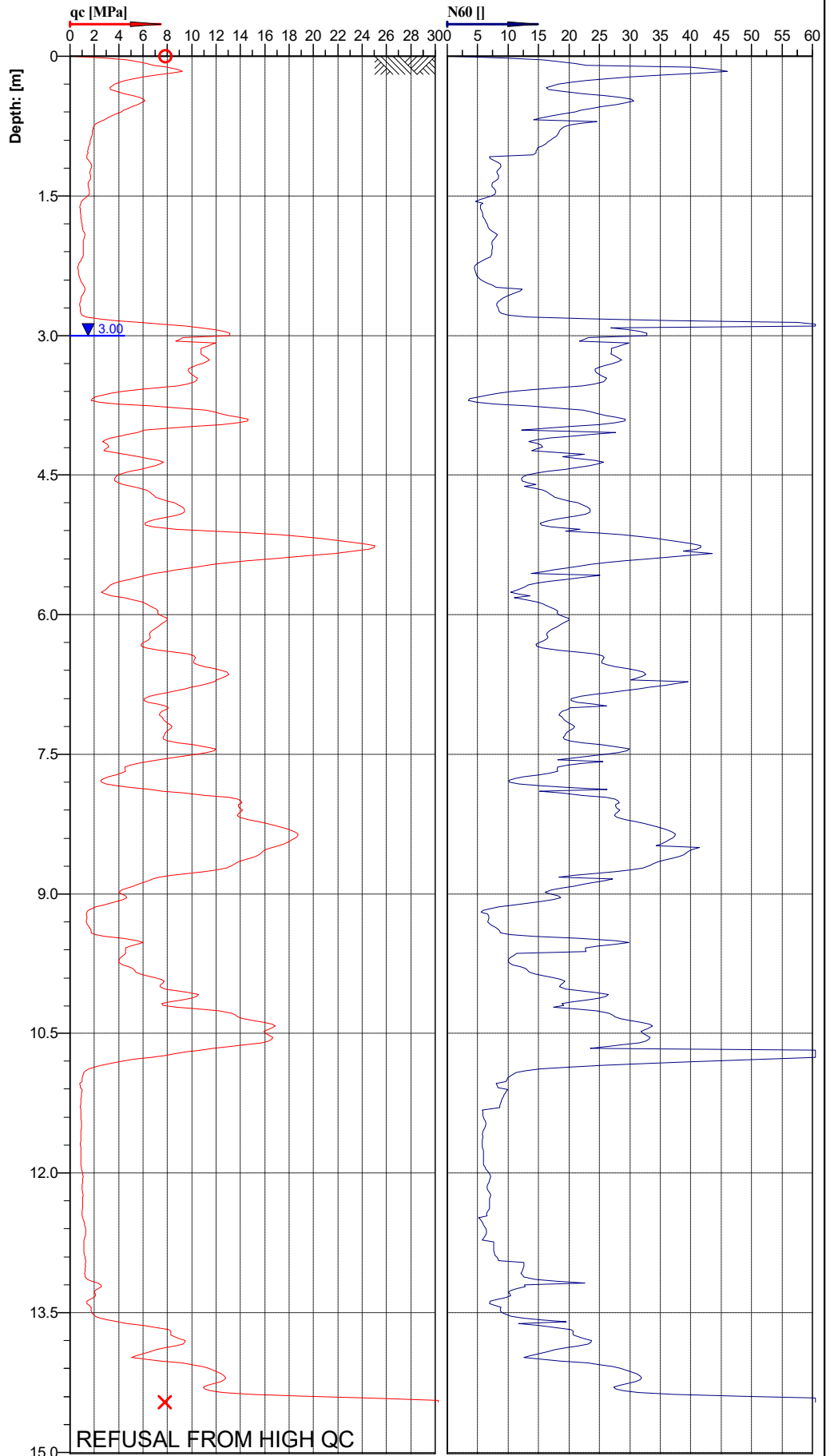
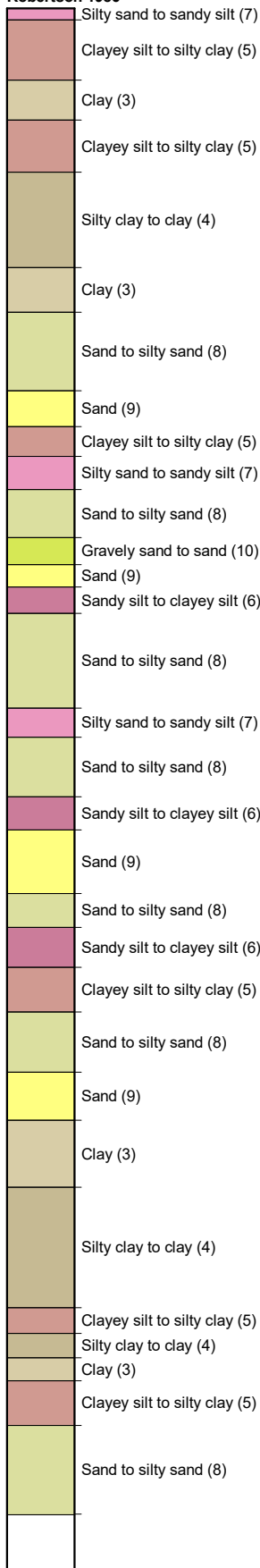


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**Classification by
Robertson 1986**

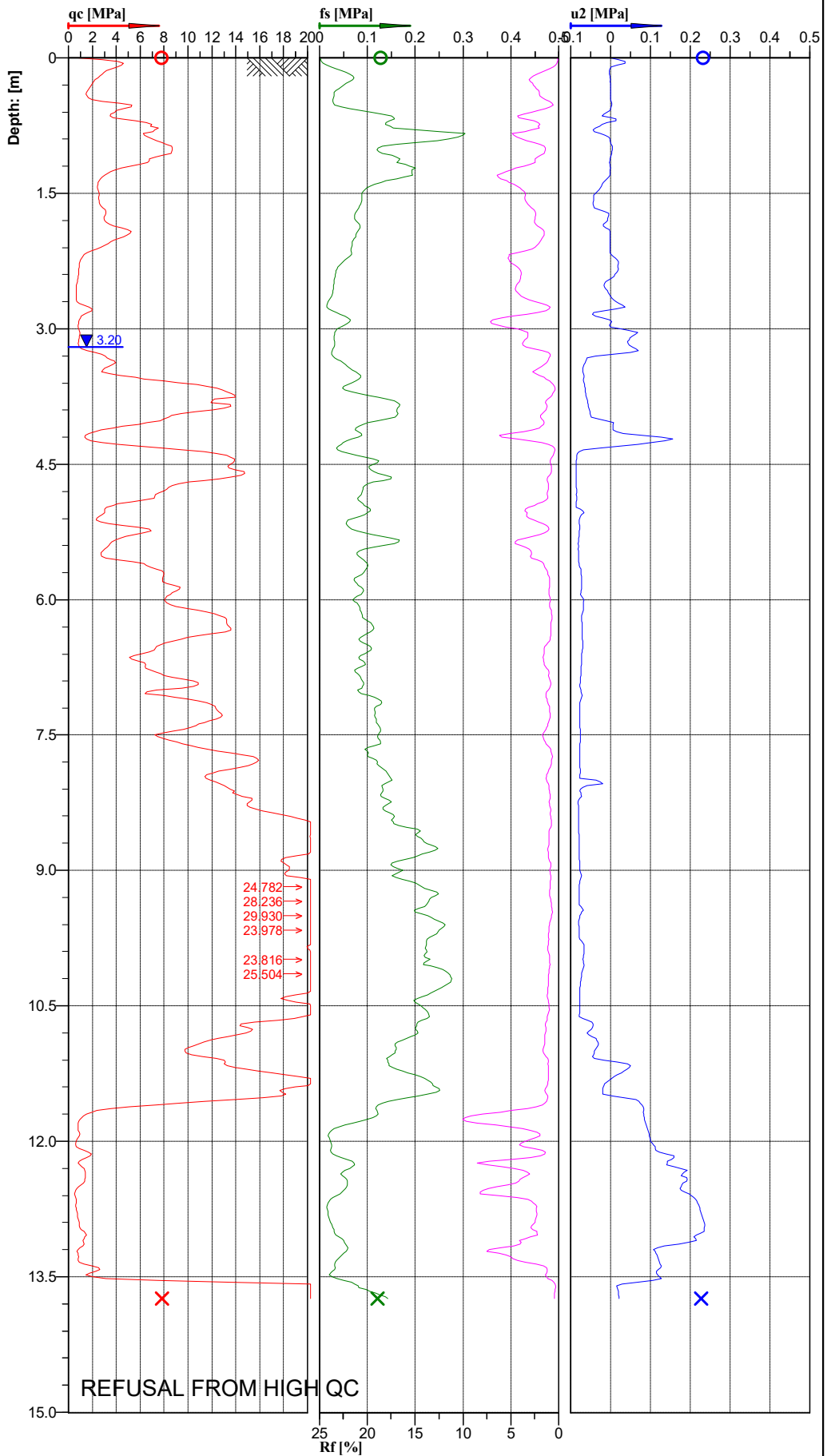
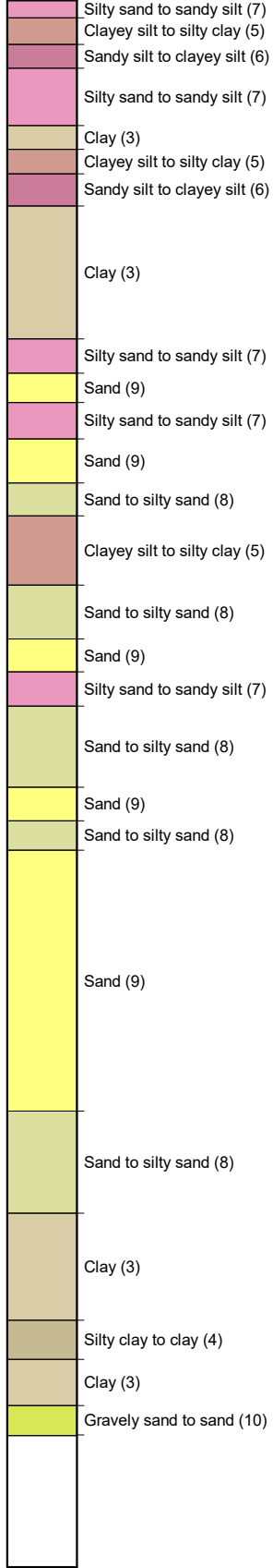


Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT02
Project ID:	P000828	Client:	INITIA	Date:	30/07/2020	Scale:	1 : 65
Project:	LYNDHURST ROAD			Page:	1/1	Fig.:	
	S 39.61483, E 176.82547			File:	CPT02.cpt		

Classification by Robertson 1986

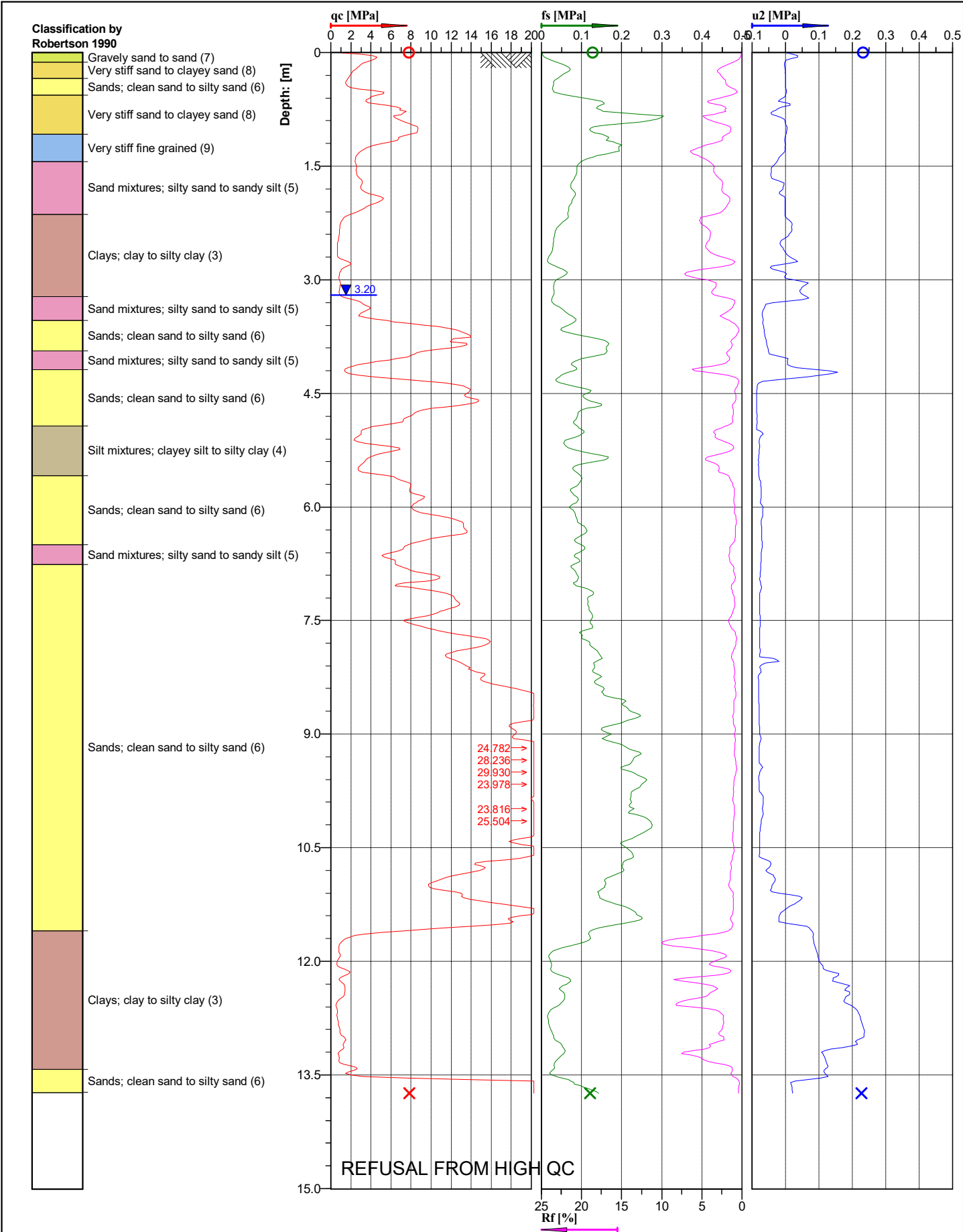


REFUSAL FROM HIGH QC



Cone No: 5332
 Tip area [cm²]: 10
 Sleeve area [cm²]: 150

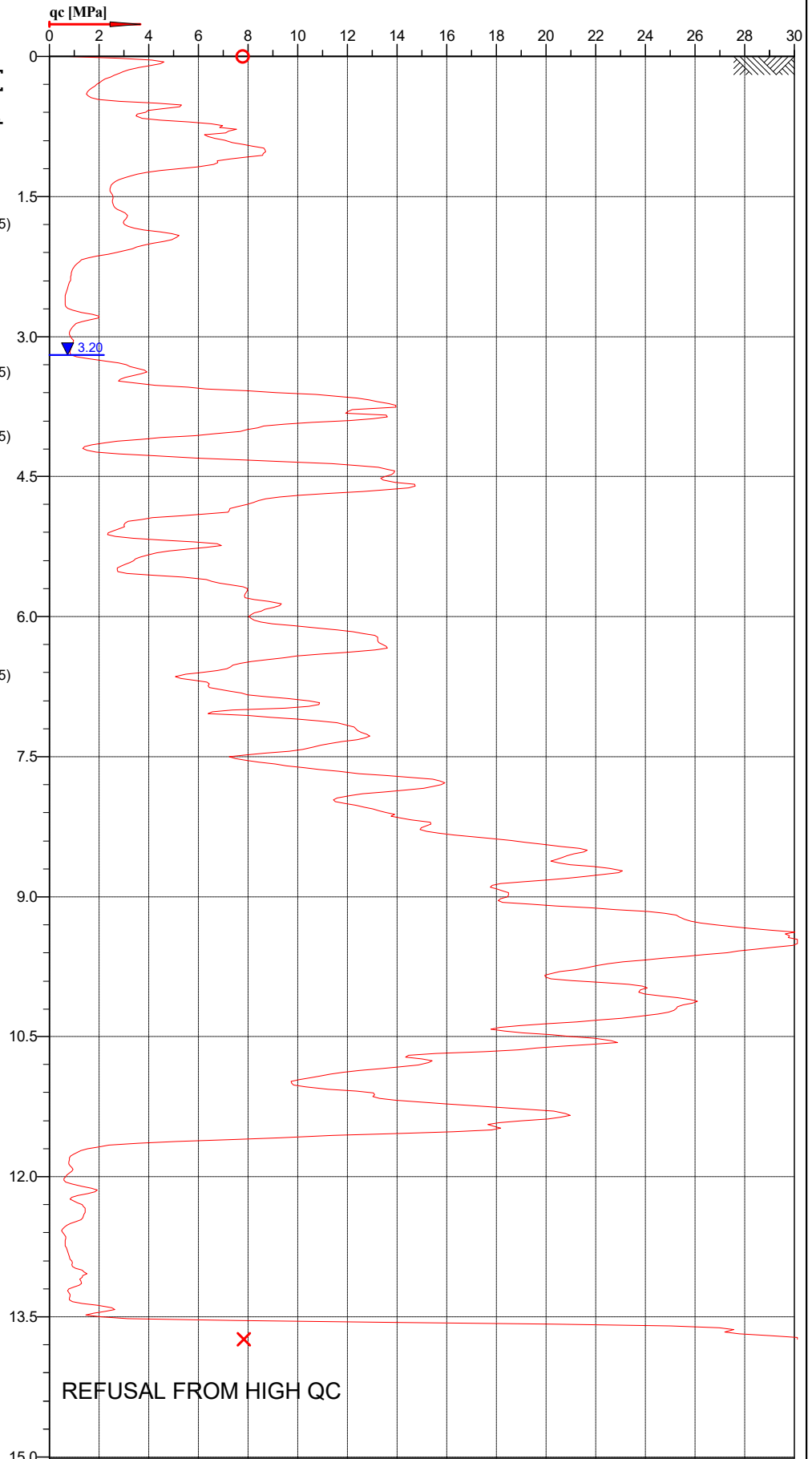
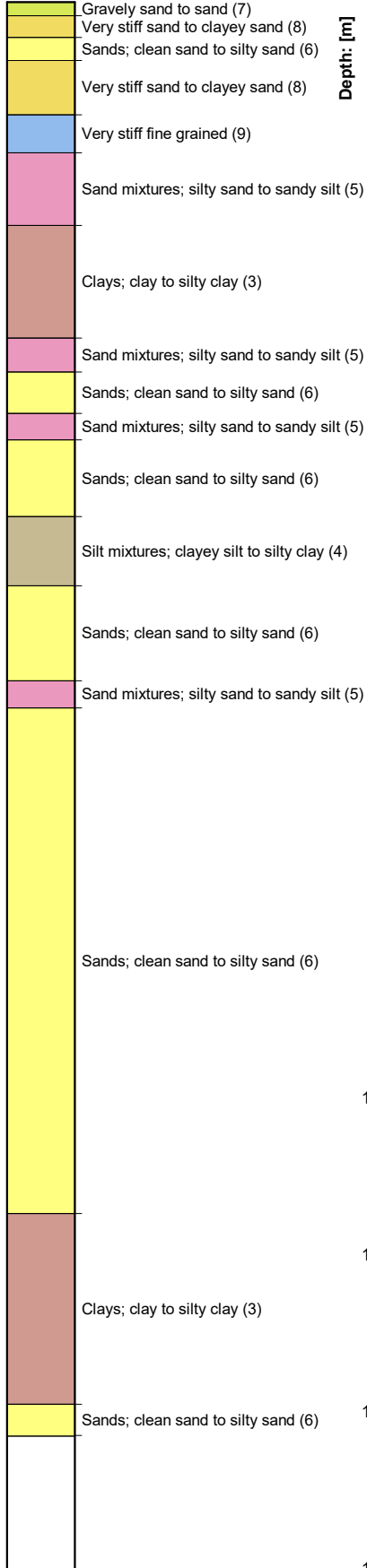
Location: HASTINGS	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT03
Project ID: P000828	Client: INITIA	Date: 30/07/2020	Scale: 1 : 67
Project: LYNTHURST ROAD		Page: 1/1	Fig.:
S 39.61511, E 176.82513		File: CPT03.cpt	



Cone No: 5332
 Tip area [cm²]: 10
 Sleeve area [cm²]: 150

Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT03
Project ID:	P000828	Client:	INITIA	Date:	30/07/2020	Scale:	1 : 67
Project:	LYNDHURST ROAD			Page:	1/1	Fig.:	
S 39.61511, E 176.82513				File:	CPT03.cpt		

**Classification by
Robertson 1990**



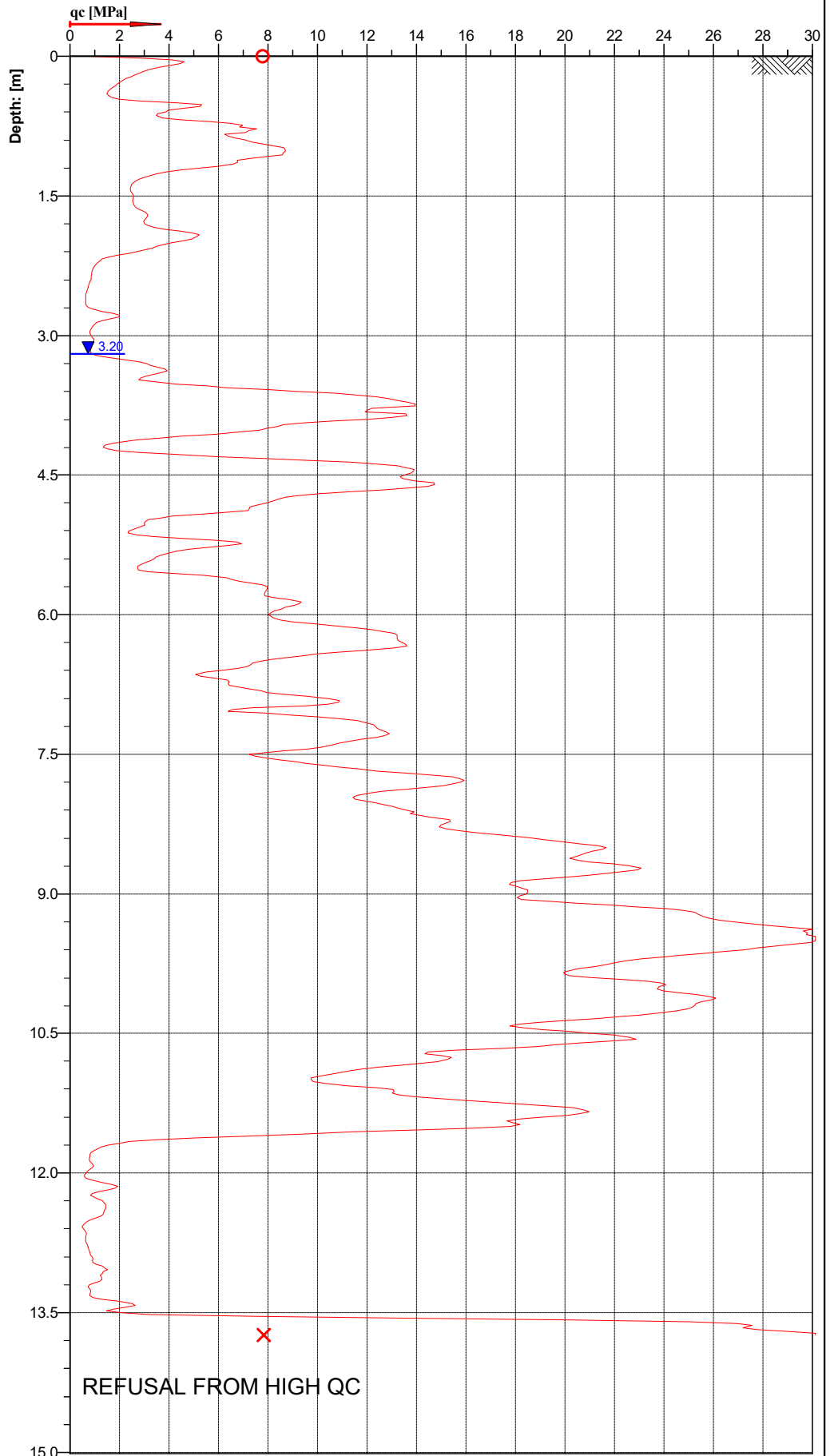
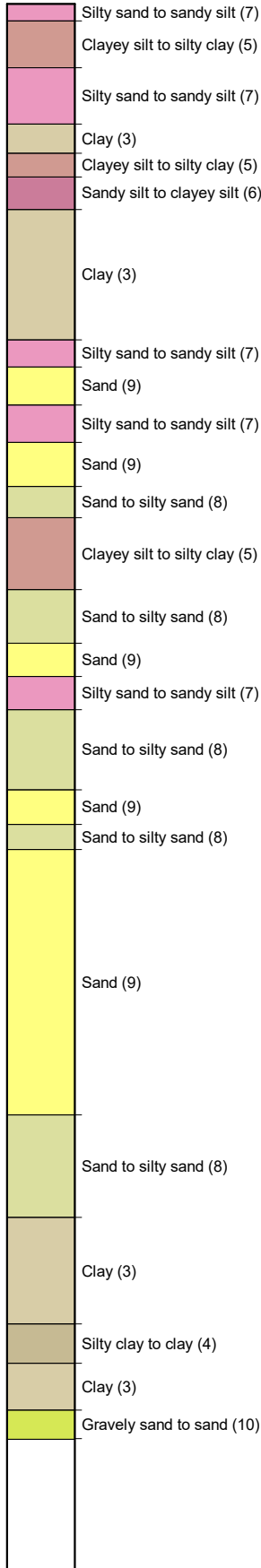
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Project ID:	P000828	Client:	INITIA	Date:	30/07/2020	Scale:	1 : 65
Project:	LYNDHURST ROAD			Page:	1/1	Fig.:	
S 39.61511, E 176.82513				File:	CPT03.cpt		



Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



**Classification by
Robertson 1986**

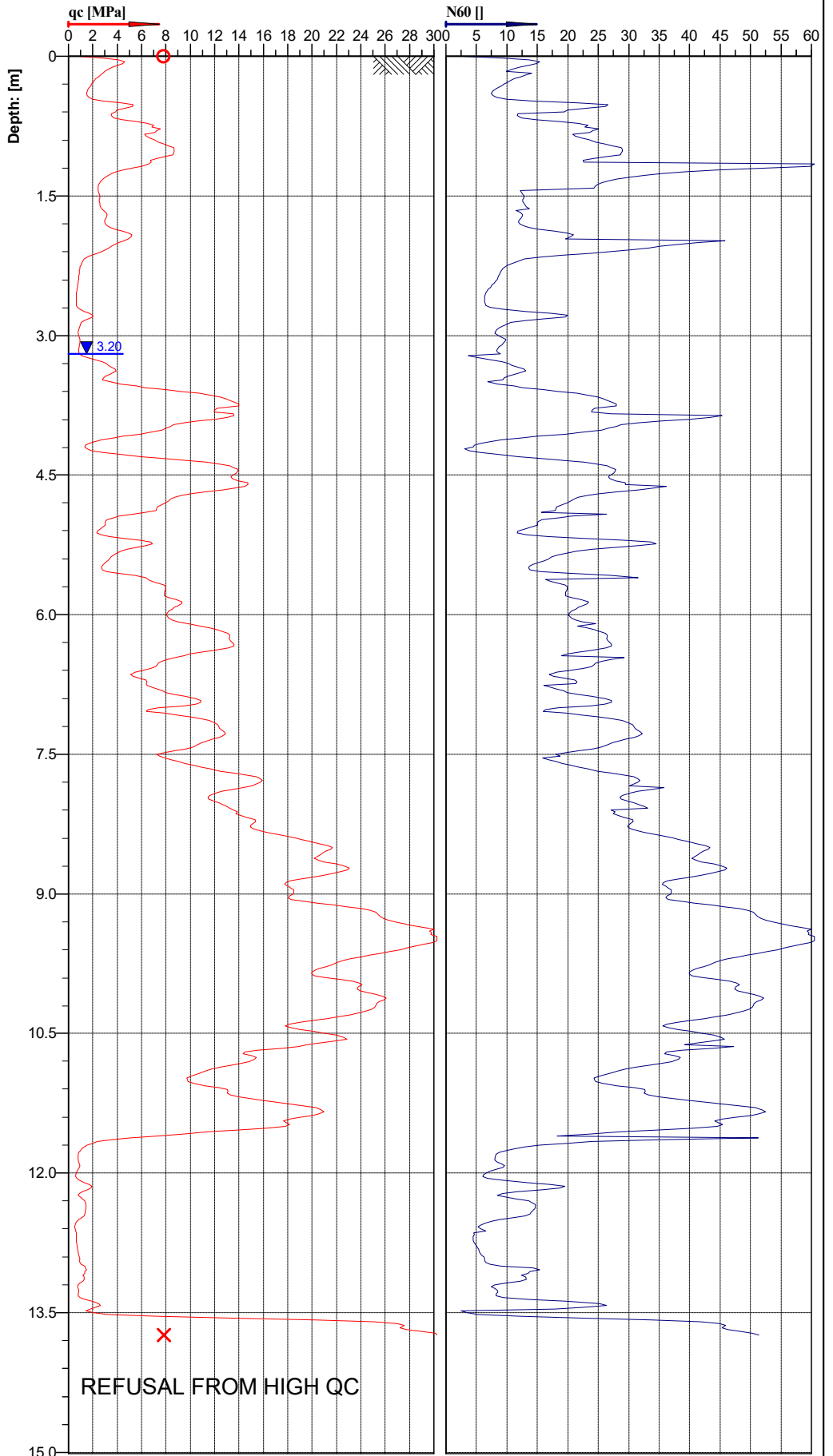
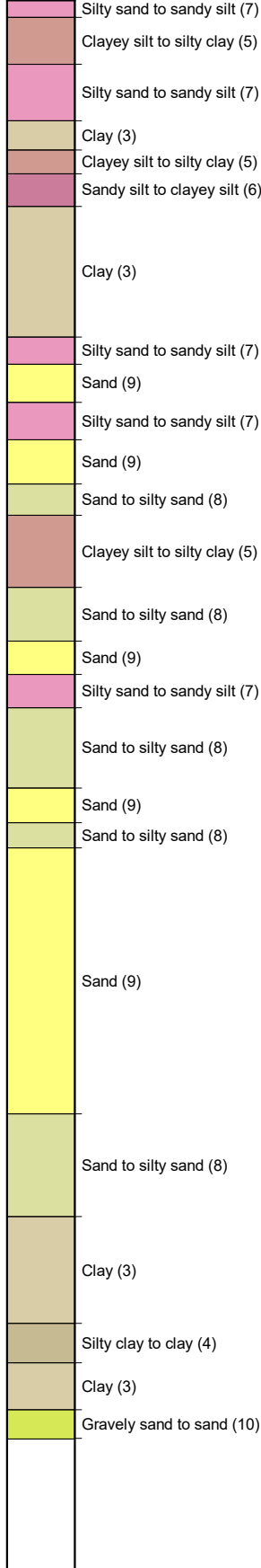


Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT03
Project ID:	P000828	Client:	INITIA	Date:	30/07/2020	Scale:	1 : 65
Project:	LYNDHURST ROAD			Page:	1/1	Fig.:	
	S 39.61511, E 176.82513			File:	CPT03.cpt		



Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150

**Classification by
Robertson 1986**

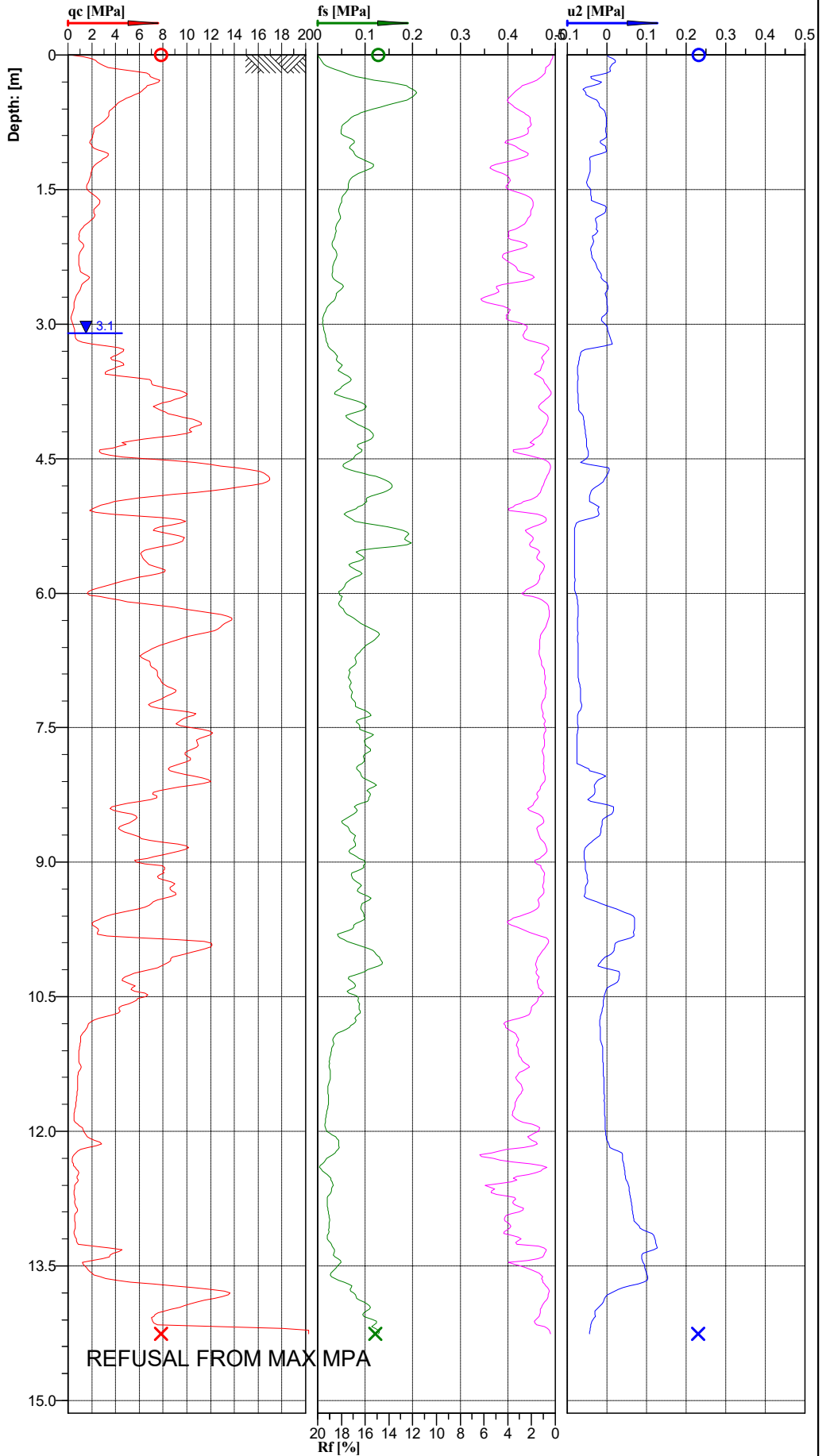
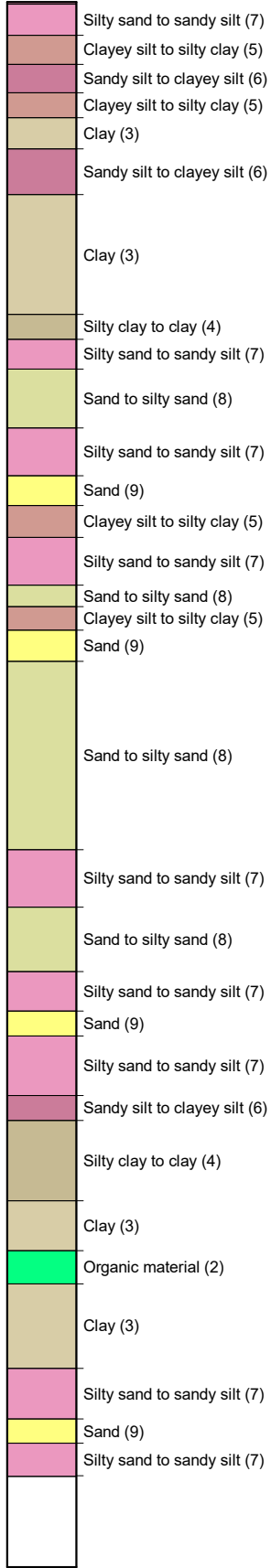


Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m
Project ID:	P000828	Client:	INITIA
Project:	LYNDHURST ROAD		Ground level:
	S 39.61511, E 176.82513		0.00
		Test No.:	CPT03
		Date:	30/07/2020
		Page:	1/1
		Scale:	1 : 65
		Fig.:	
		File:	CPT03.cpt

**Classification by
Robertson 1986**

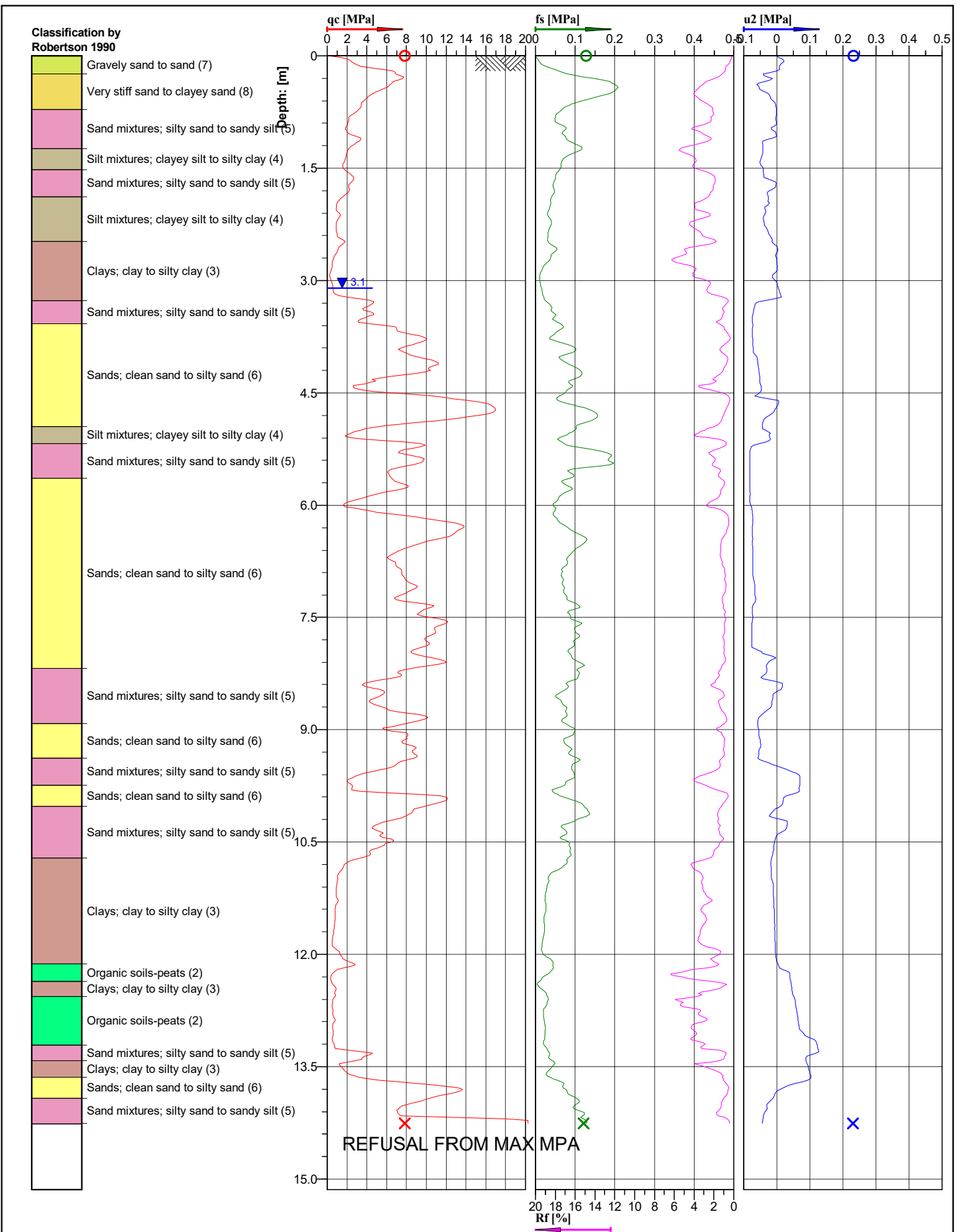


REFUSAL FROM MAX MPA



Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150

Location: HASTINGS	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT04
Project ID: P000828	Client: INITIA	Date: 30/07/2020	Scale: 1 : 67
Project: LYNDHURST RD		Page: 1/1	Fig.:
S 39.61530 E 176.82484		File: CPT04.cpt	

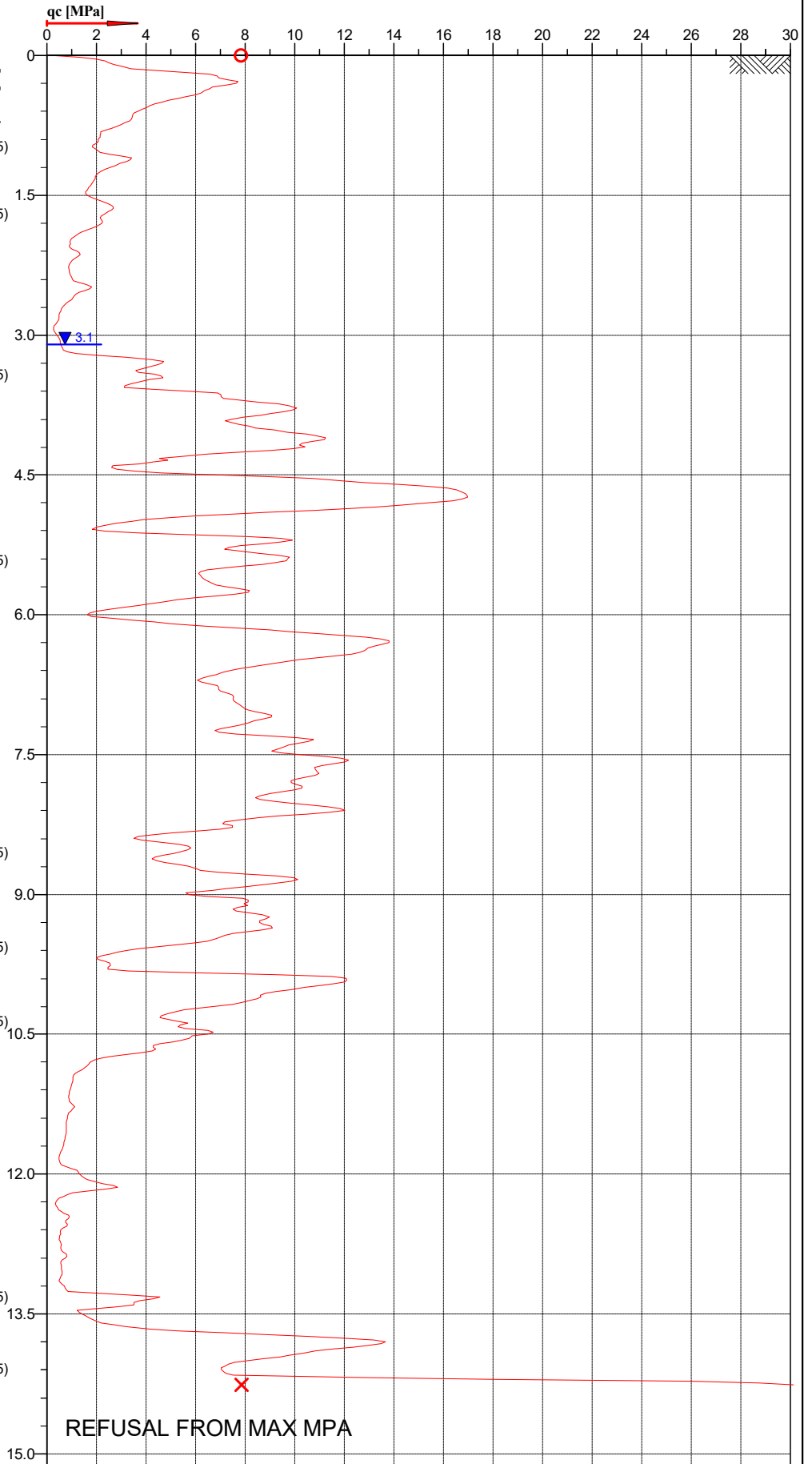
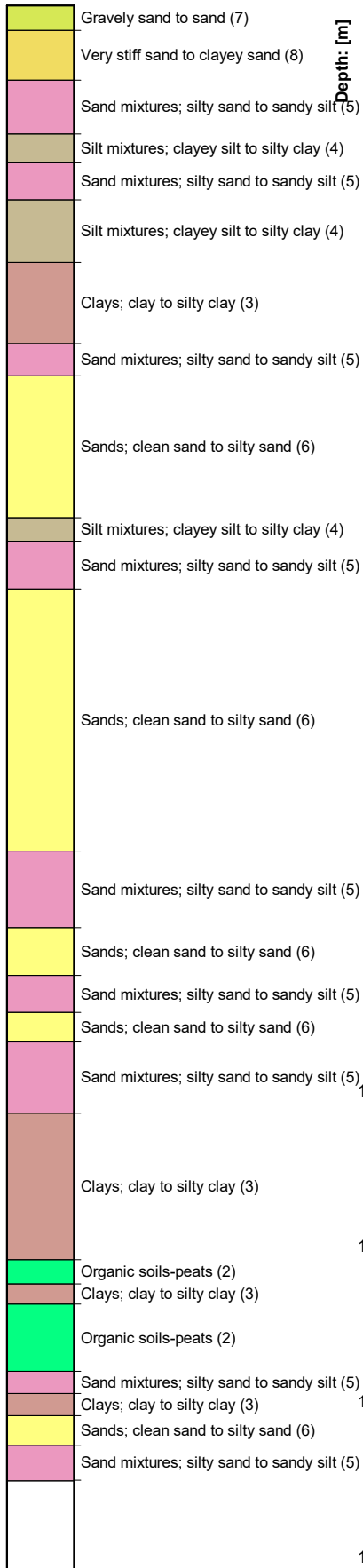


Cone No: 5332
 Tip area [cm²]: 10
 Sleeve area [cm²]: 150



Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT04
Project ID:	P000828	Client:	INITIA	Date:	30/07/2020	Scale:	1 : 67
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
	S 39.61530 E 176.82484			File:	CPT04.cpt		

**Classification by
Robertson 1990**

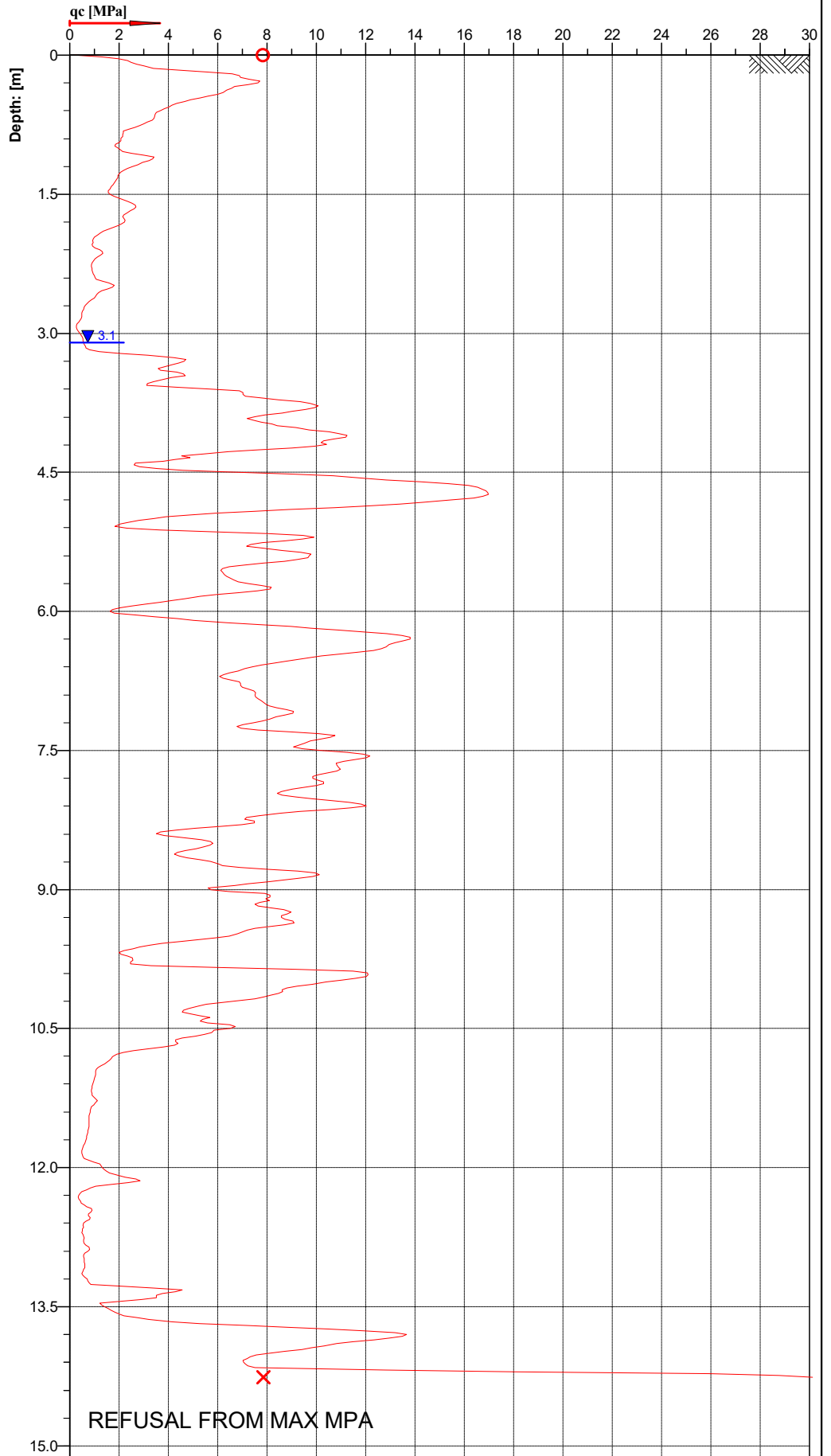
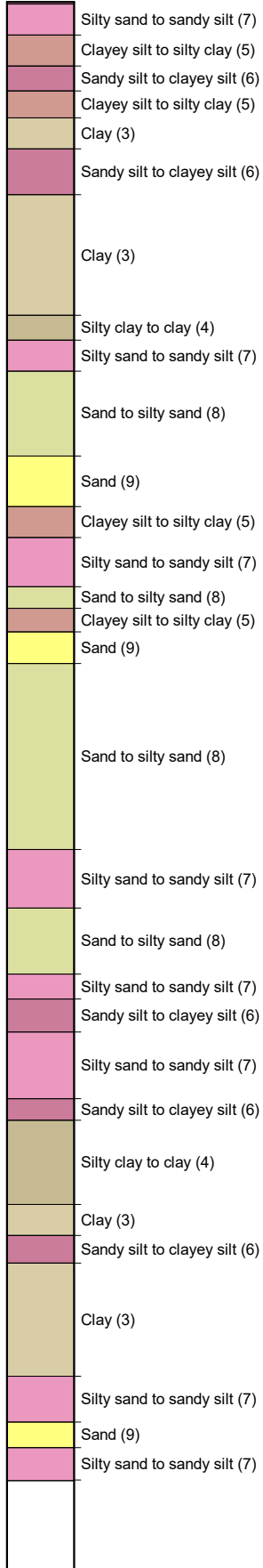


Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT04
Project ID:	P000828	Client:	INITIA	Date:	30/07/2020	Scale:	1 : 65
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
	S 39.61530 E 176.82484			File:	CPT04.cpt		

**Classification by
Robertson 1986**

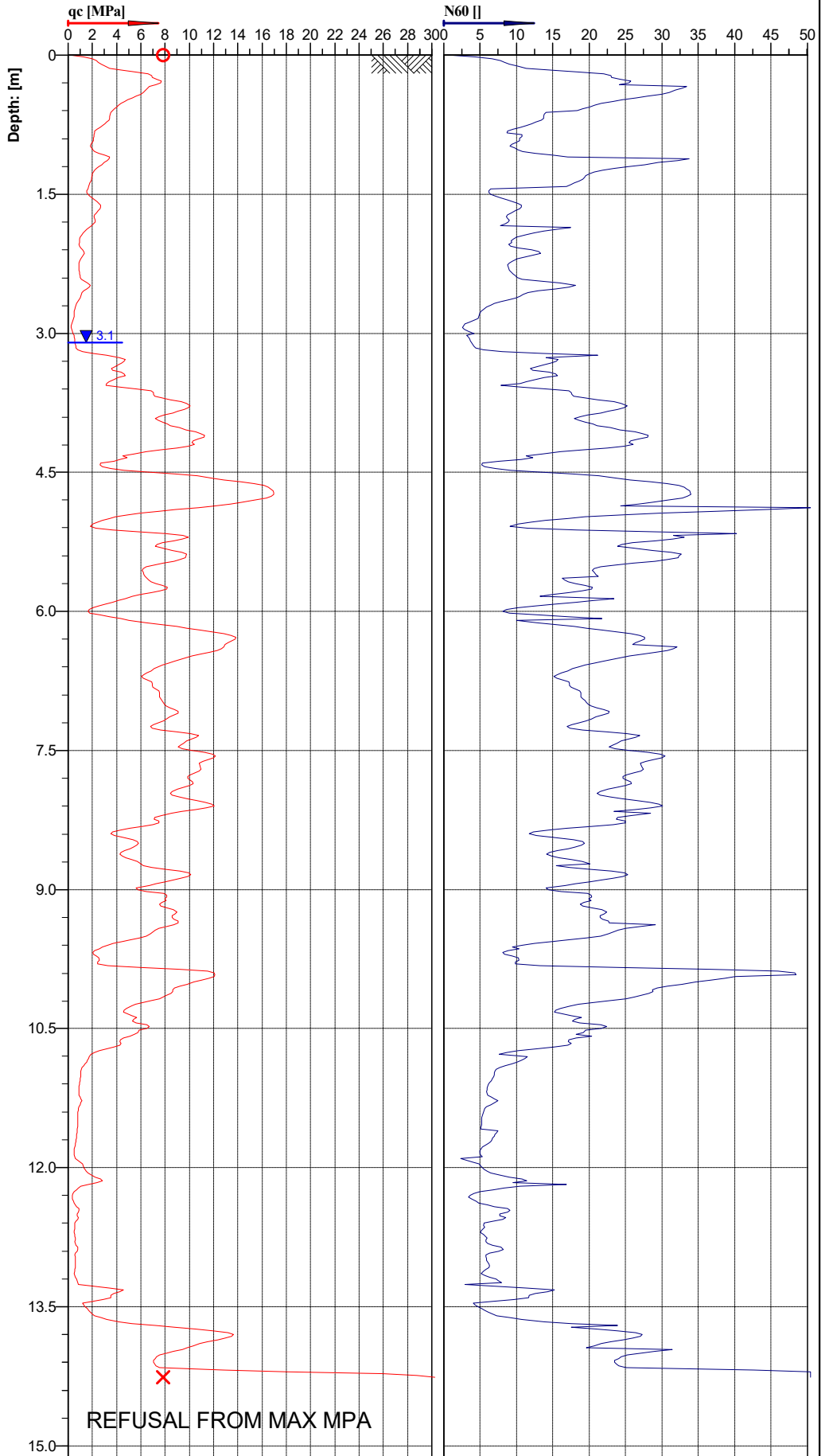
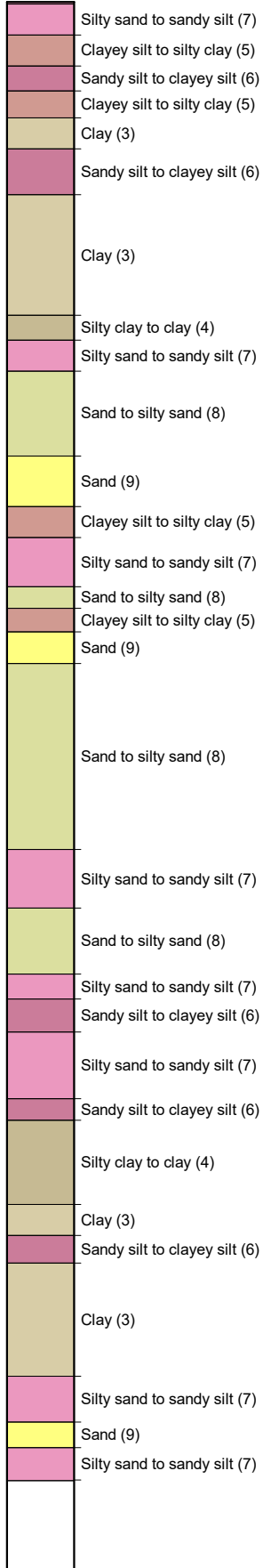


Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT04
Project ID:	P000828	Client:	INITIA	Date:	30/07/2020	Scale:	1 : 65
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
	S 39.61530 E 176.82484			File:	CPT04.cpt		

**Classification by
Robertson 1986**

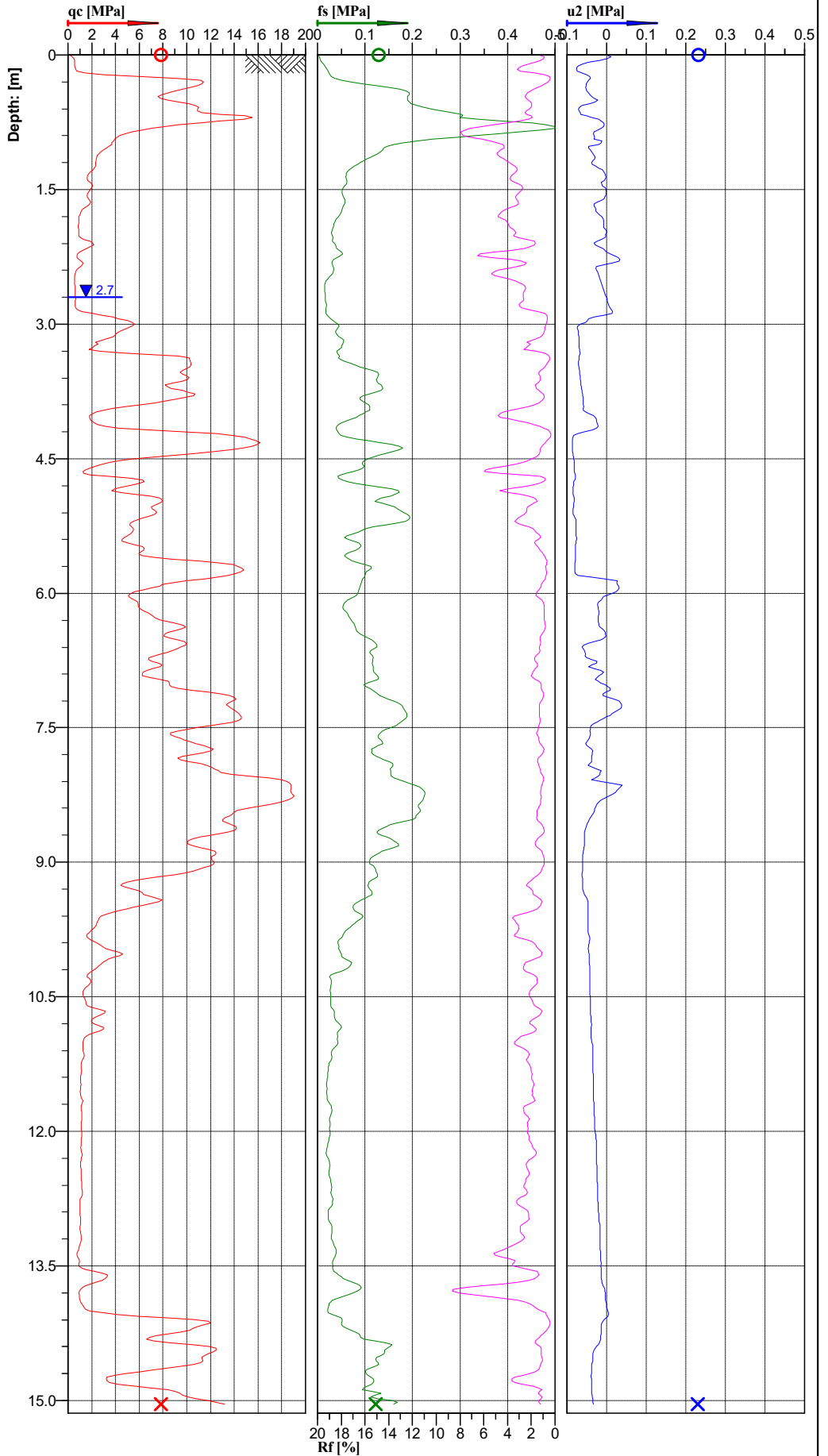
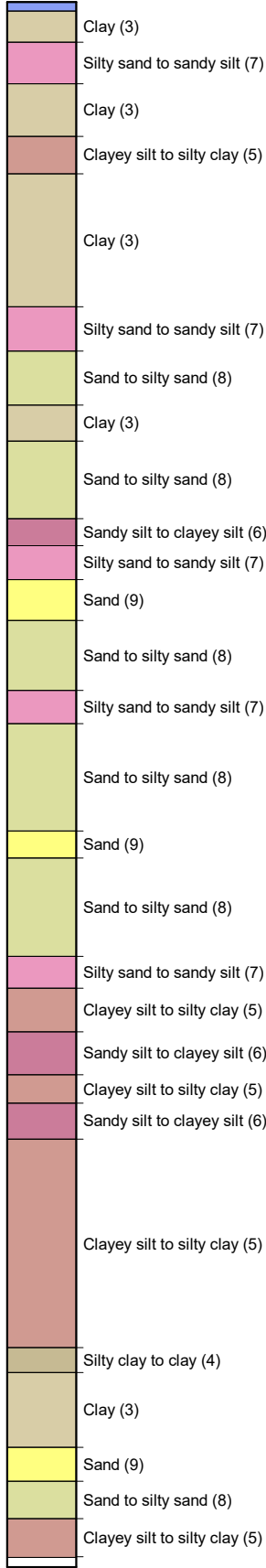


Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT04
Project ID:	P000828	Client:	INITIA	Date:	30/07/2020	Scale:	1 : 65
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
	S 39.61530 E 176.82484			File:	CPT04.cpt		

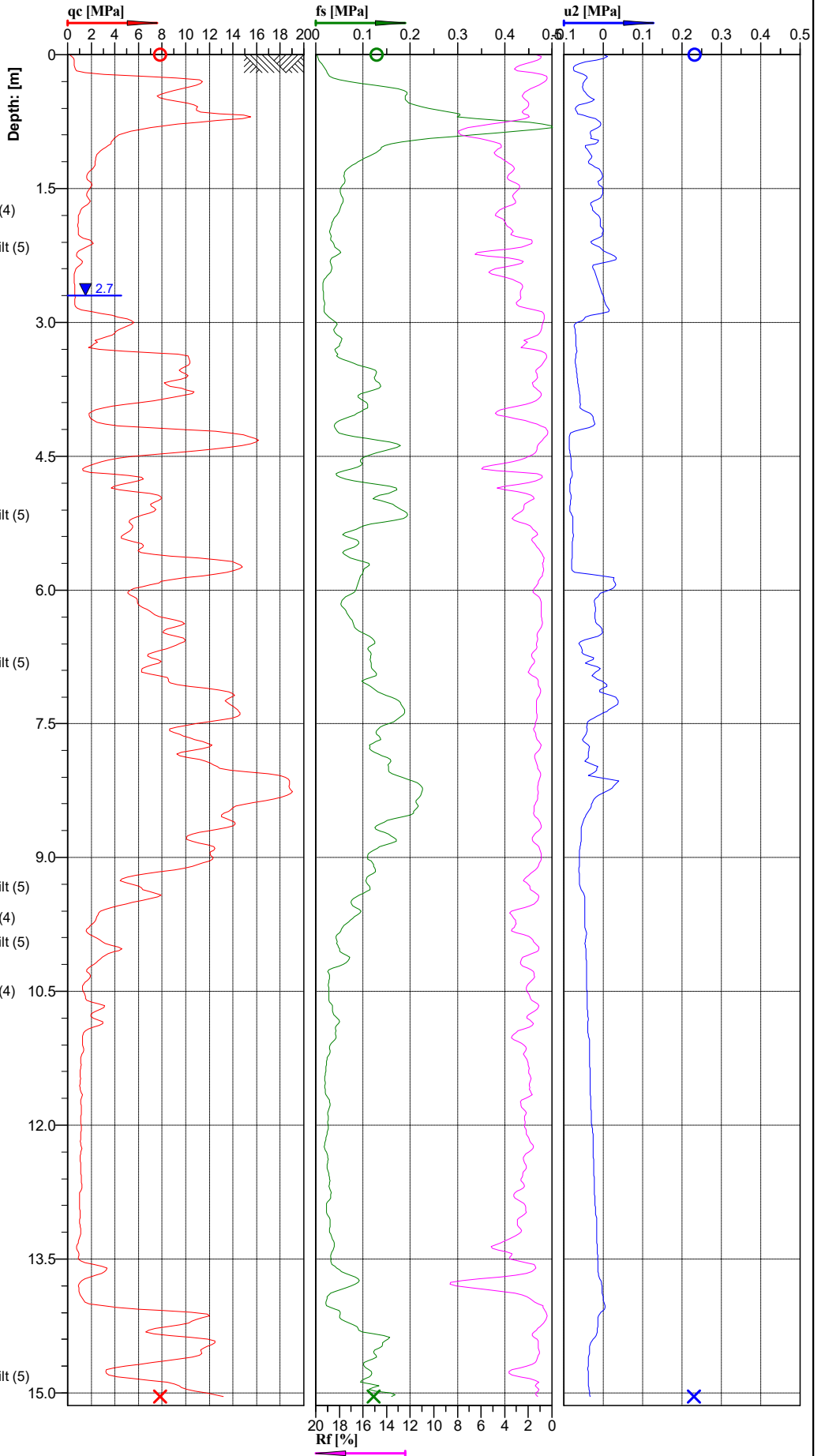
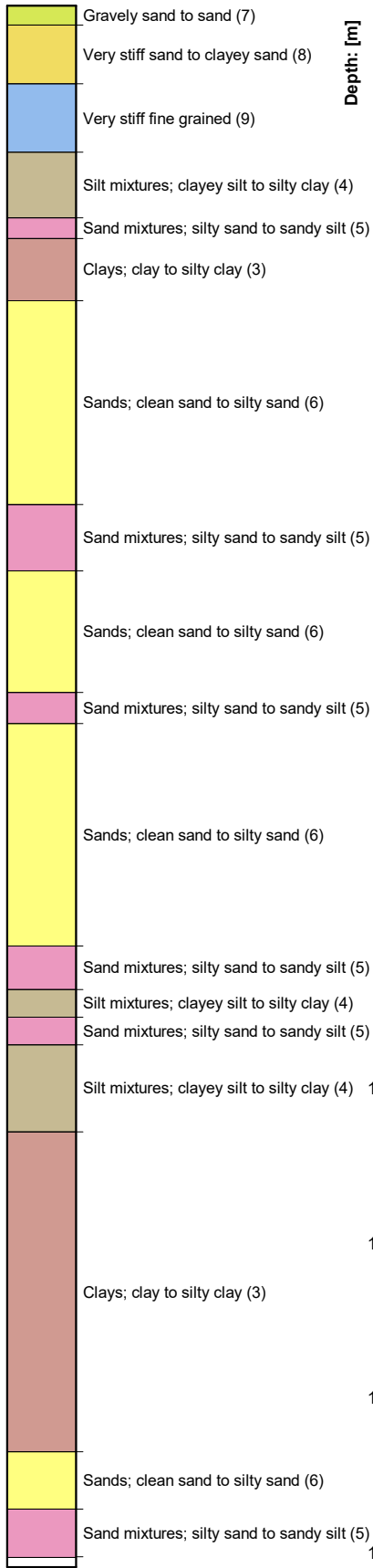
**Classification by
Robertson 1986**



Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150

Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT05
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 67
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
S 39.61560 E 176.82523				File:	CPT05.cpt		

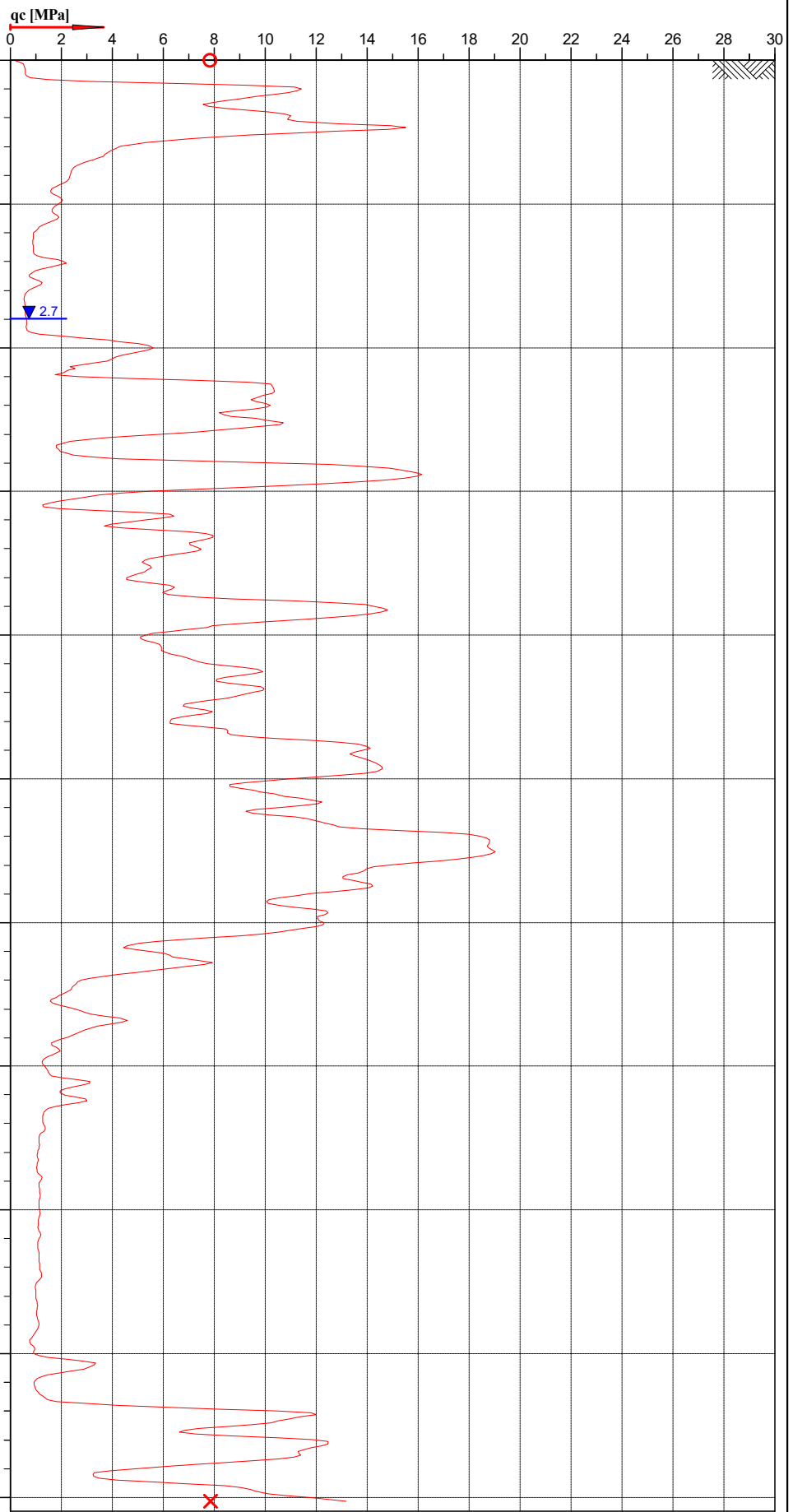
**Classification by
Robertson 1990**




Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150

Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT05
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 67
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
S 39.61560 E 176.82523				File:	CPT05.cpt		

**Classification by
Robertson 1990**

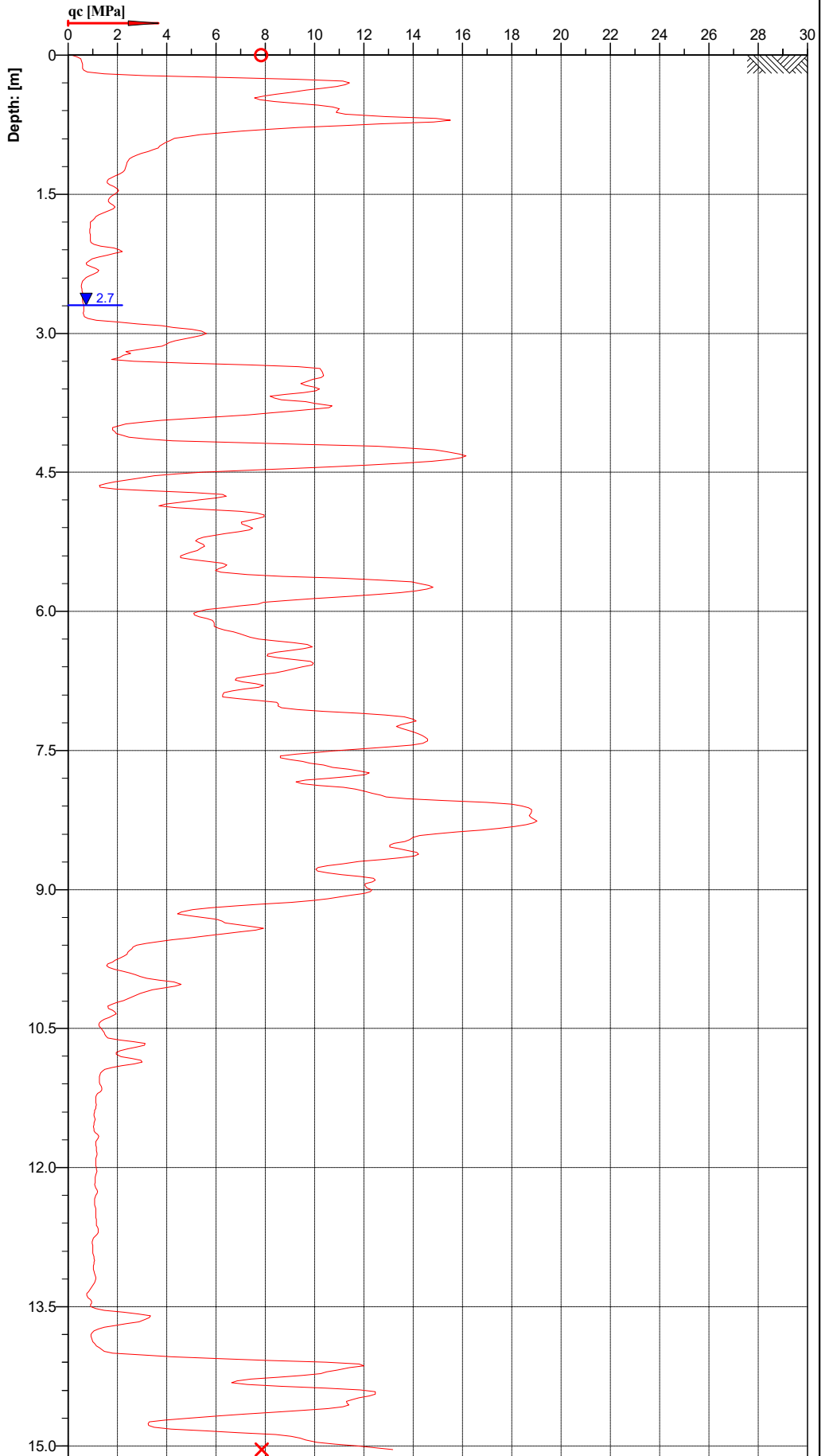
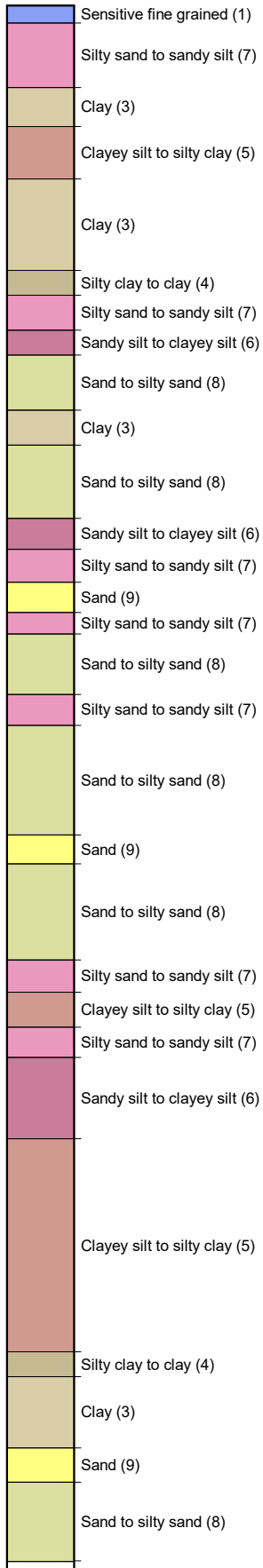



 Cone No: 5332
 Tip area [cm²]: 10
 Sleeve area [cm²]: 150

Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT05
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 65
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
				File:	CPT05.cpt		

S 39.61560 E 176.82523

**Classification by
Robertson 1986**

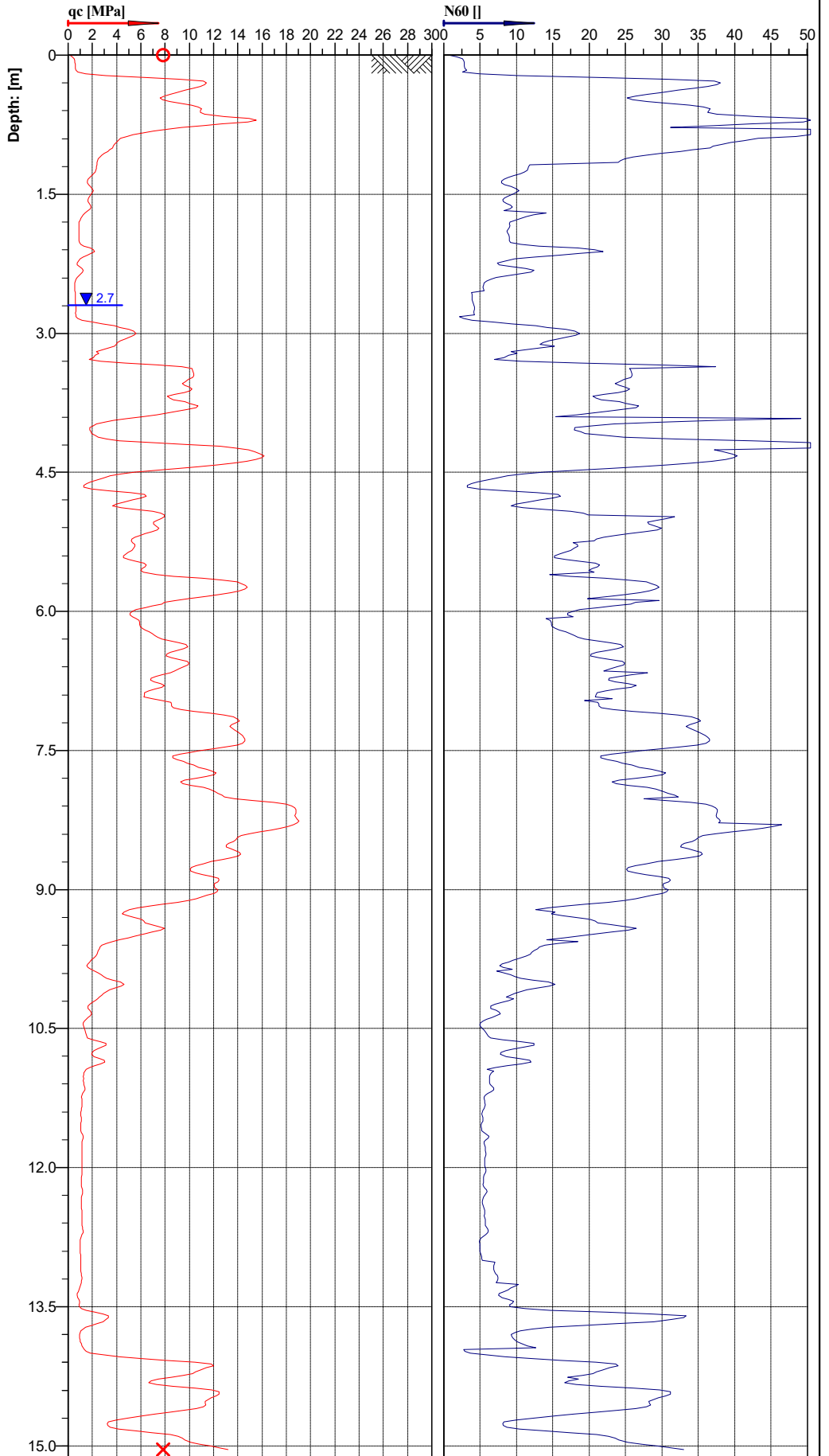
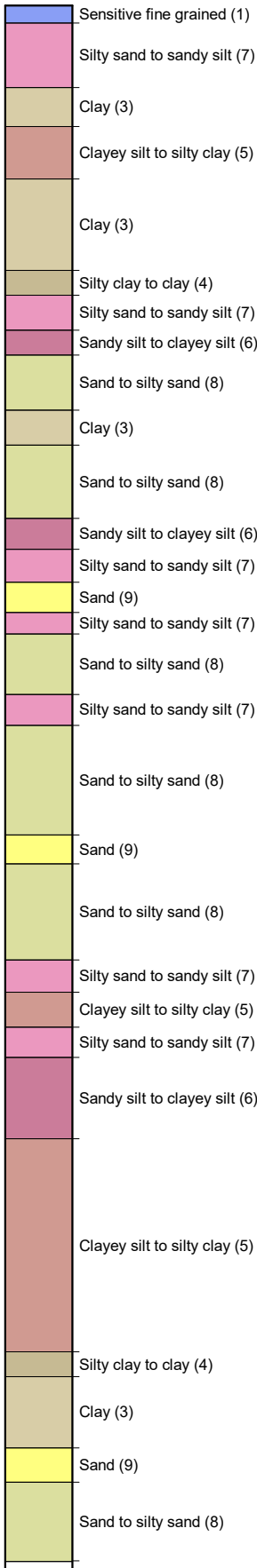


Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT05
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 65
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
S 39.61560 E 176.82523				File:	CPT05.cpt		

**Classification by
Robertson 1986**

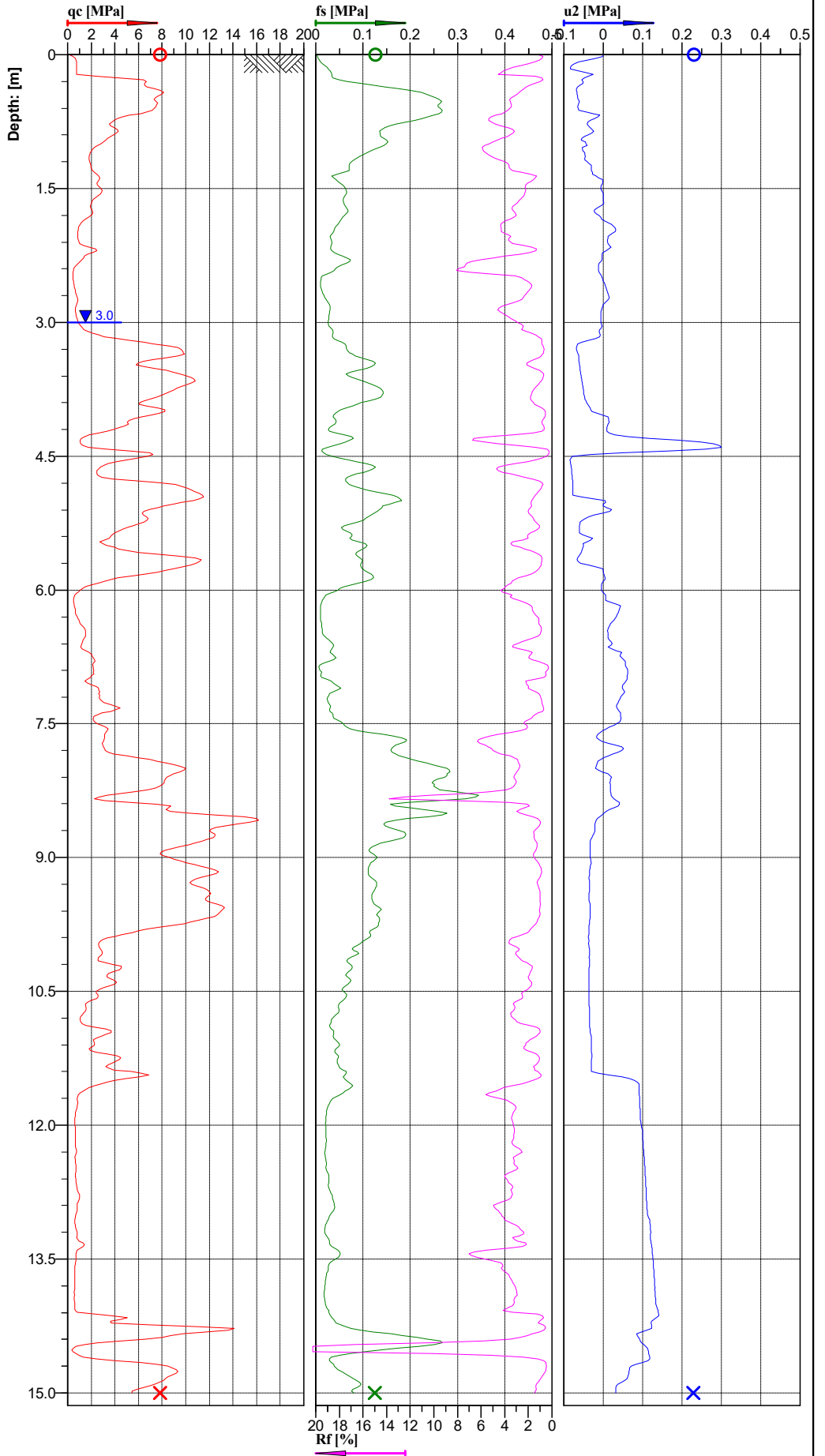
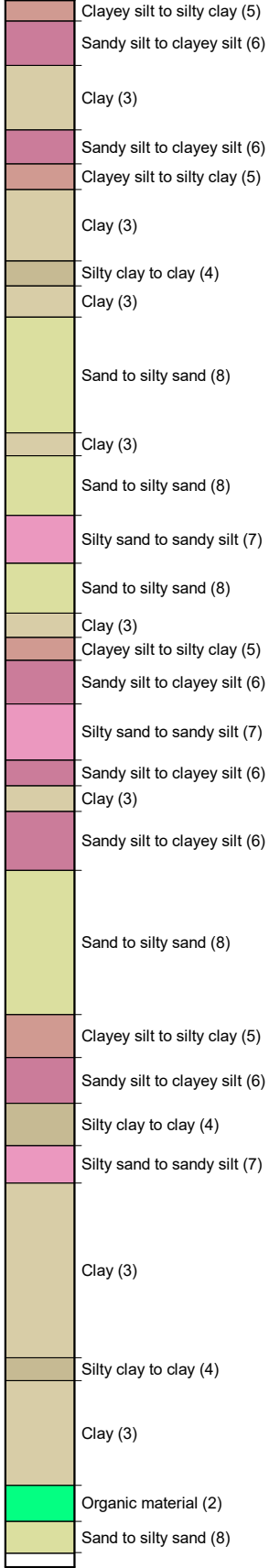


Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT05
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 65
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
S 39.61560 E 176.82523				File:	CPT05.cpt		

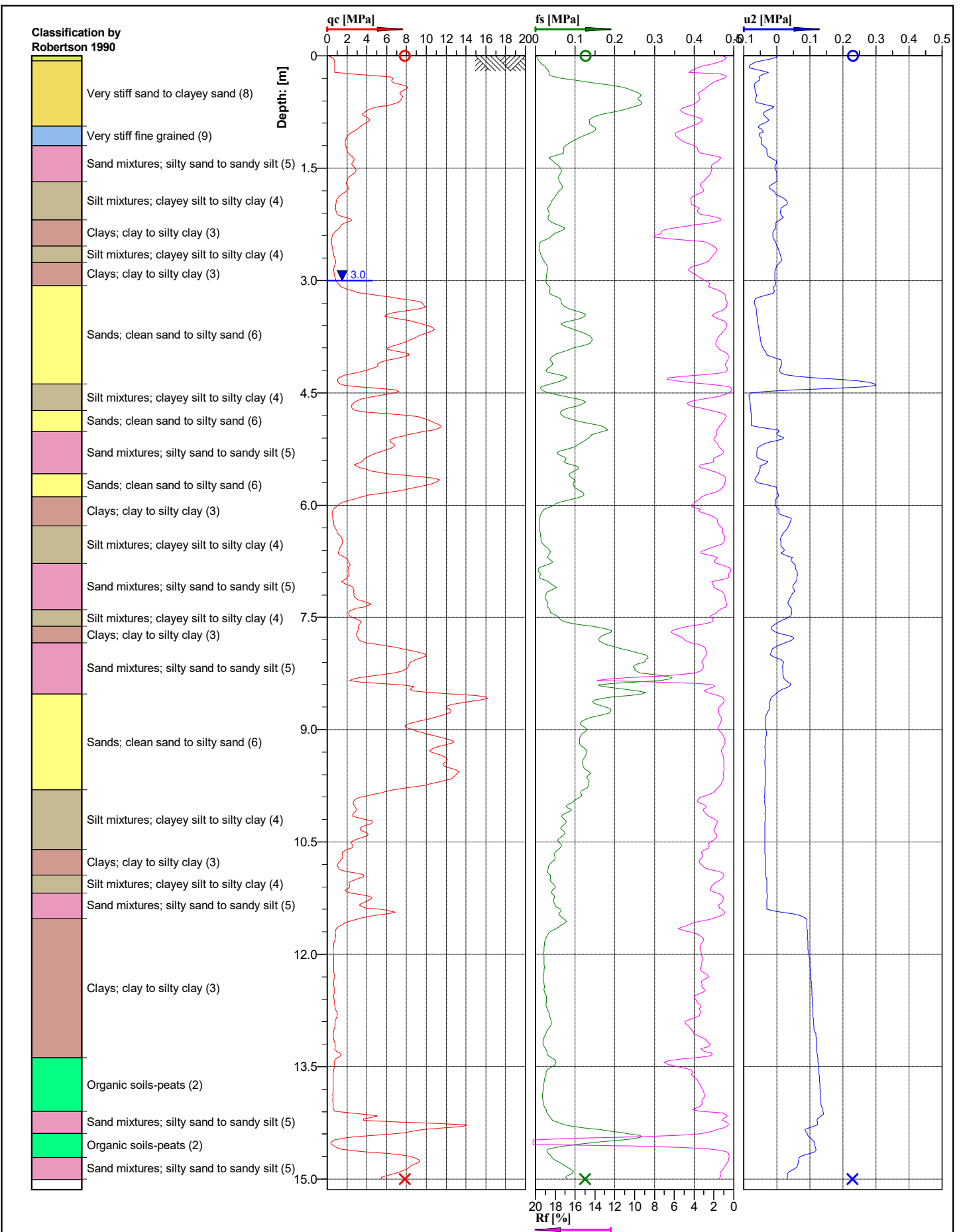
**Classification by
Robertson 1986**



Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



Location: HASTINGS	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT06
Project ID: P000828	Client: INITIA	Date: 31/07/2020	Scale: 1 : 67
Project: LYNDHURST RD		Page: 1/1	Fig.:
S 39.61590 E 176.82542		File: CPT06.cpt	

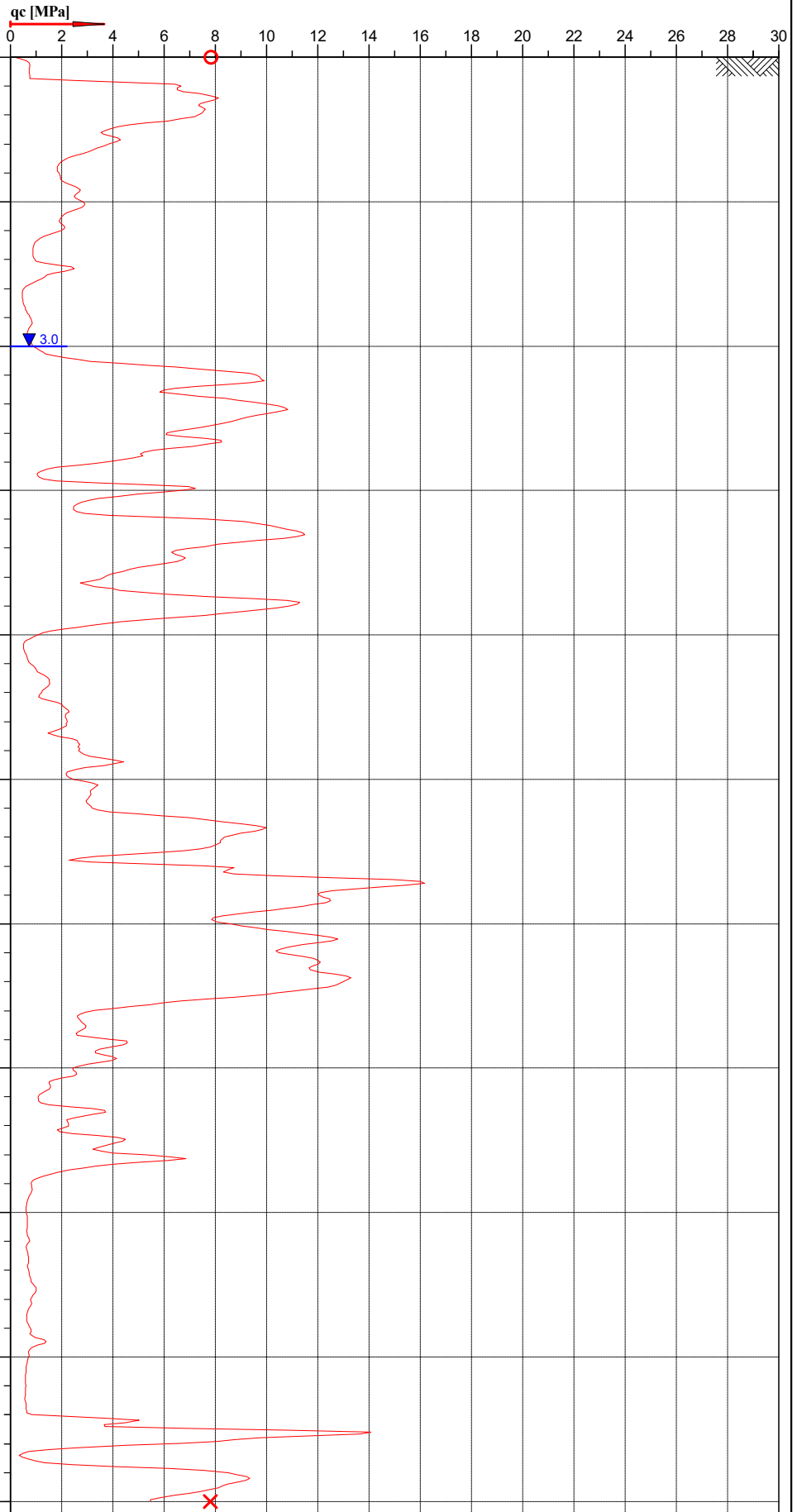
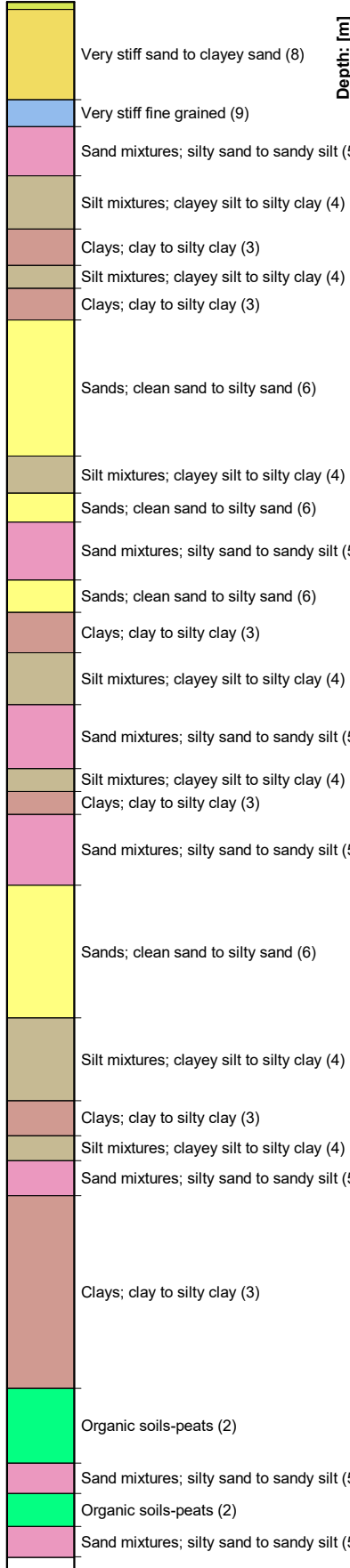


Cone No: 5332
 Tip area [cm2]: 10
 Sleeve area [cm2]: 150



Location: HASTINGS	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT06
Project ID: P000828	Client: INITIA	Date: 31/07/2020	Scale: 1 : 67
Project: LYNDHURST RD		Page: 1/1	Fig.:
S 39.61590 E 176.82542			File: CPT06.cpt

**Classification by
Robertson 1990**



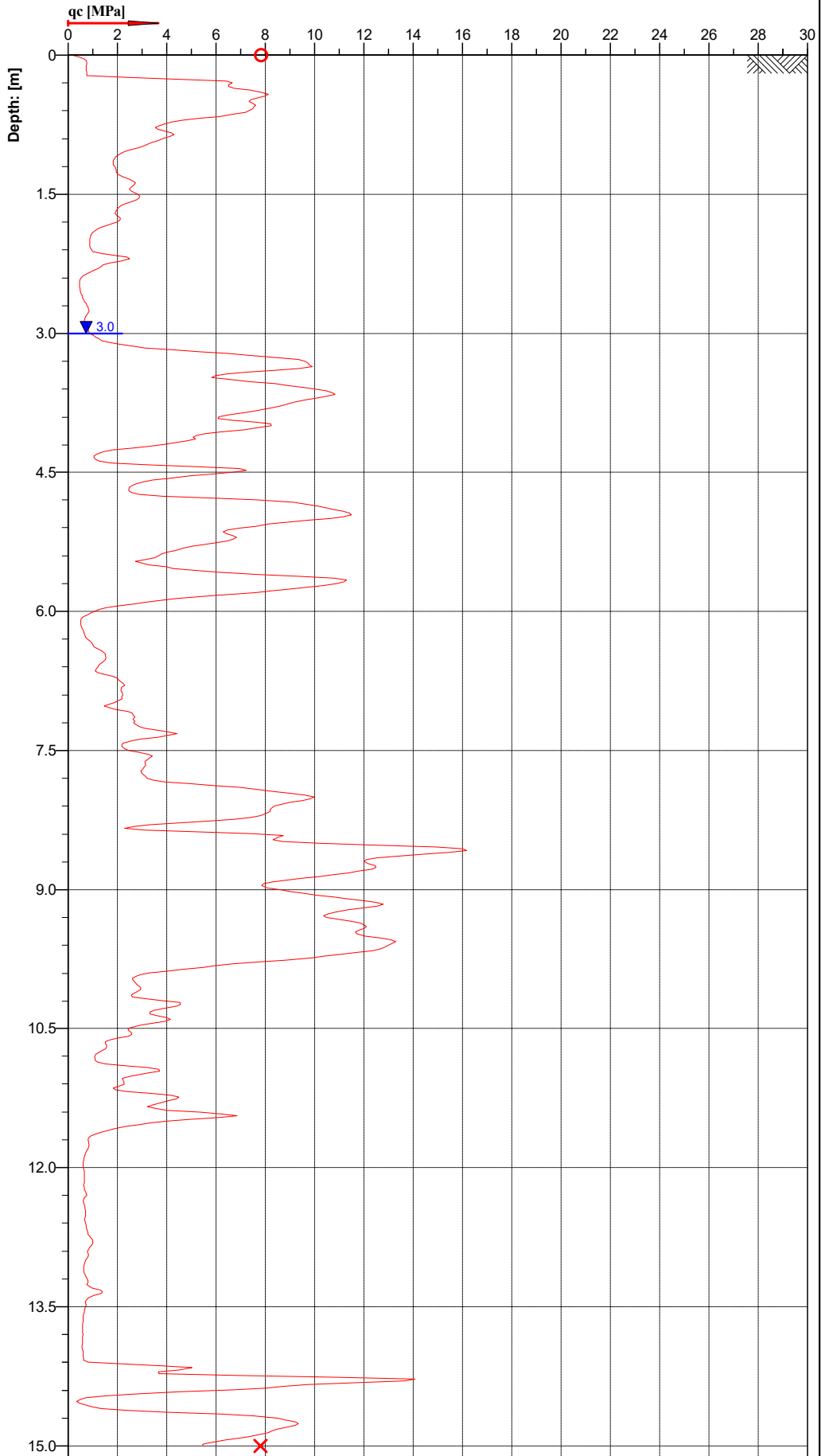
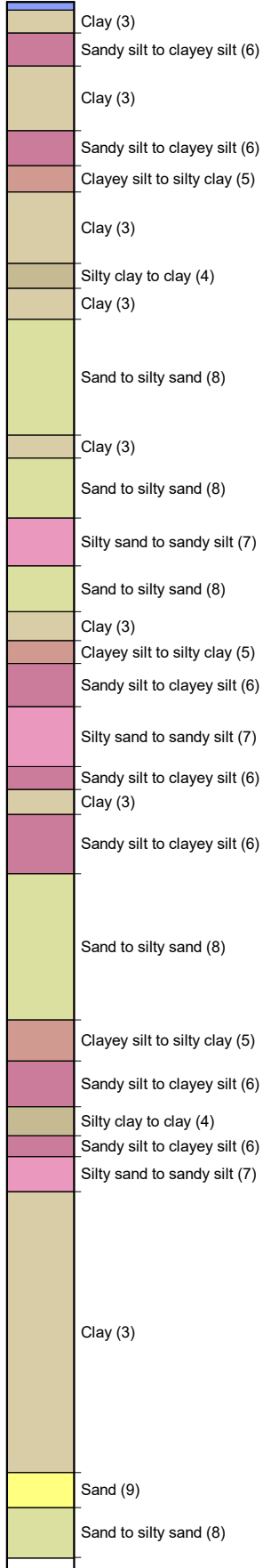
Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT06
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 65
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
				File:	CPT06.cpt		

S 39.61590 E 176.82542

**Classification by
Robertson 1986**

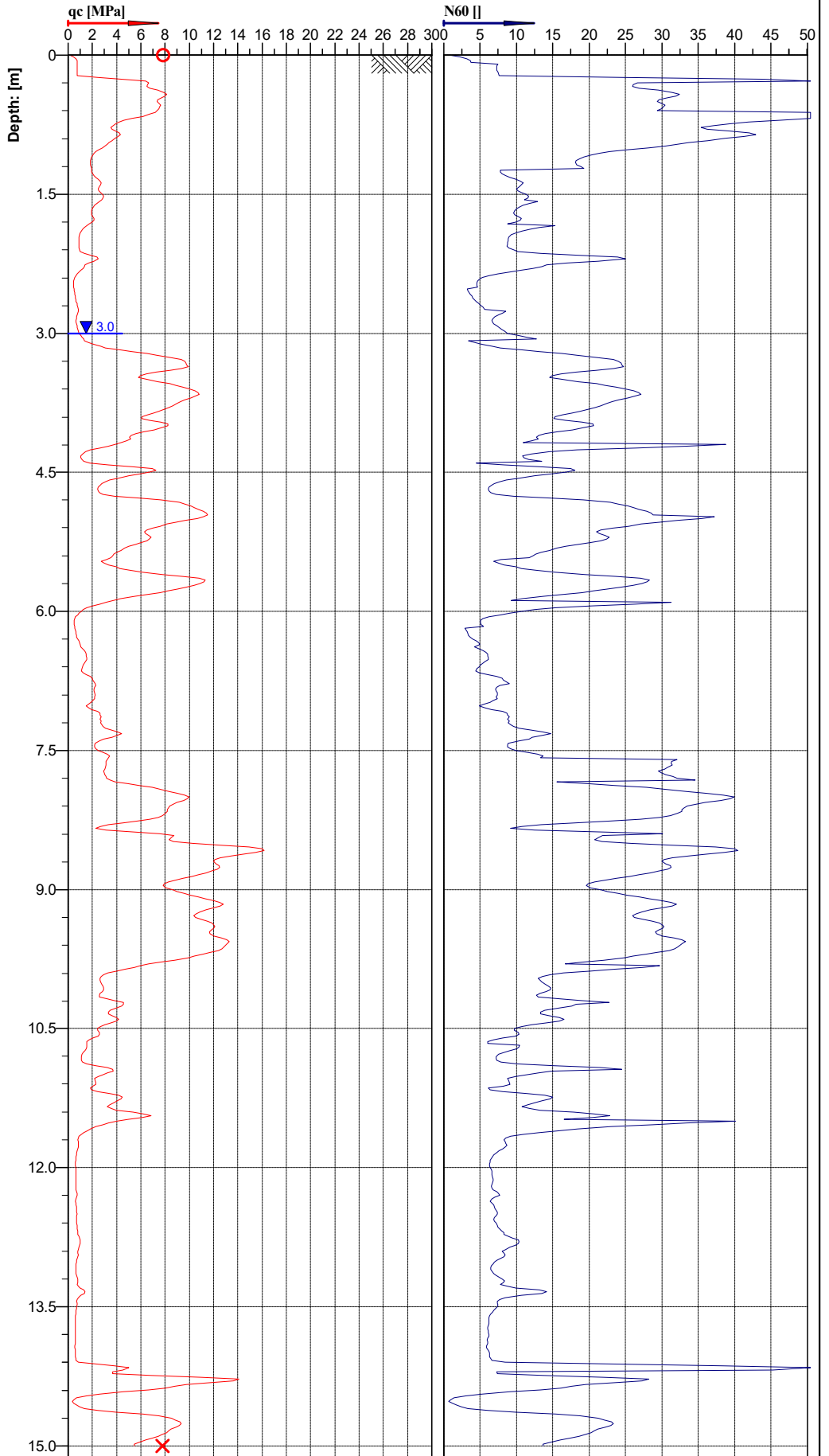
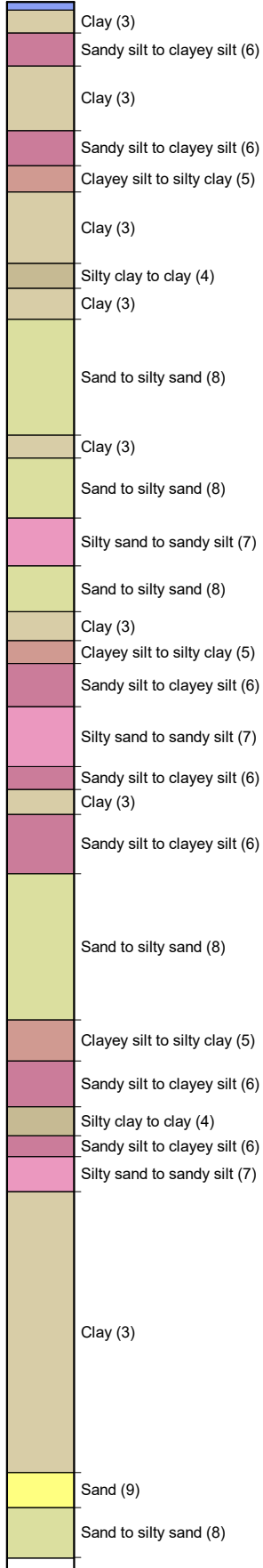


Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT06
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 65
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
S 39.61590 E 176.82542				File:	CPT06.cpt		

**Classification by
Robertson 1986**

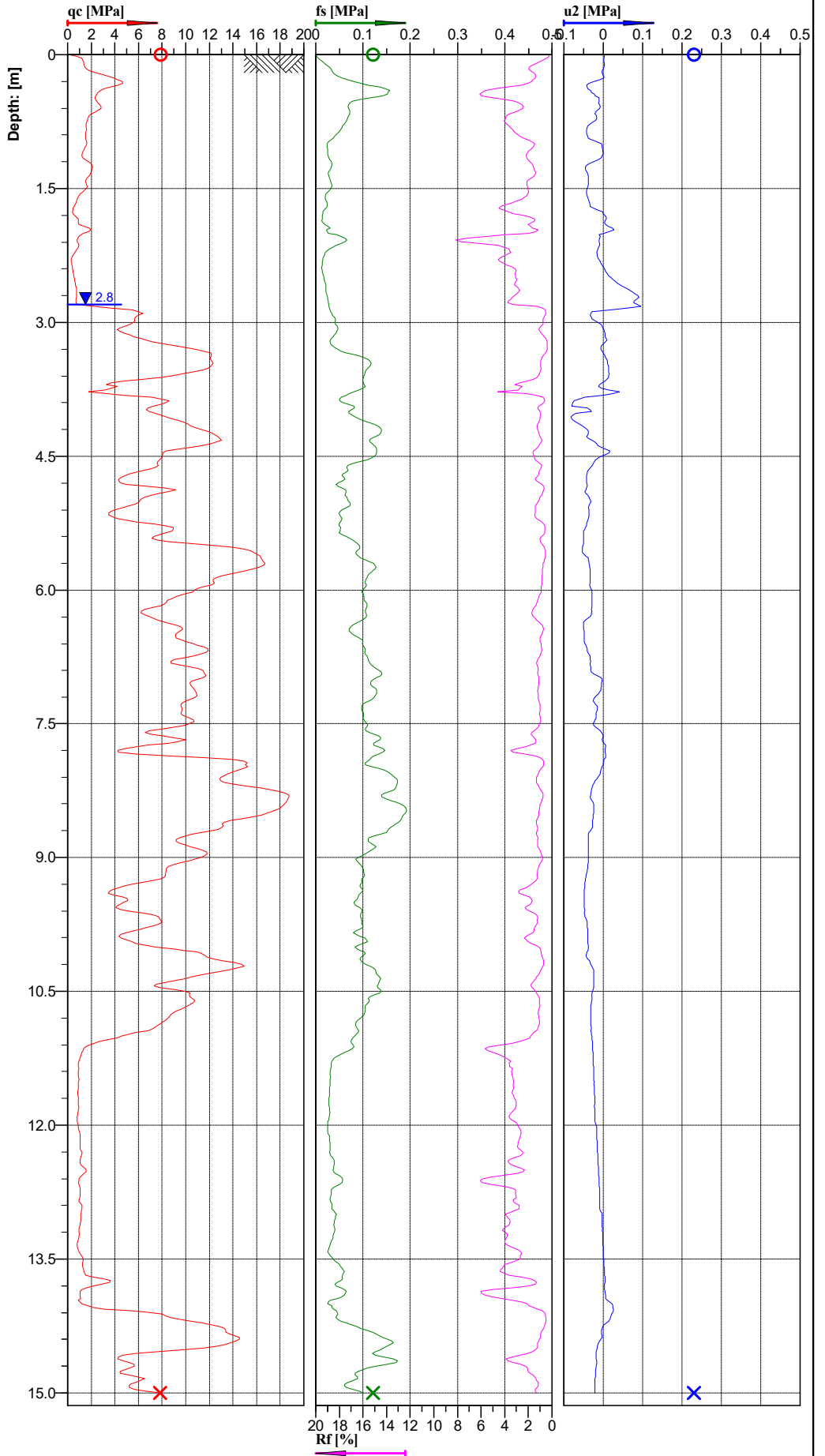
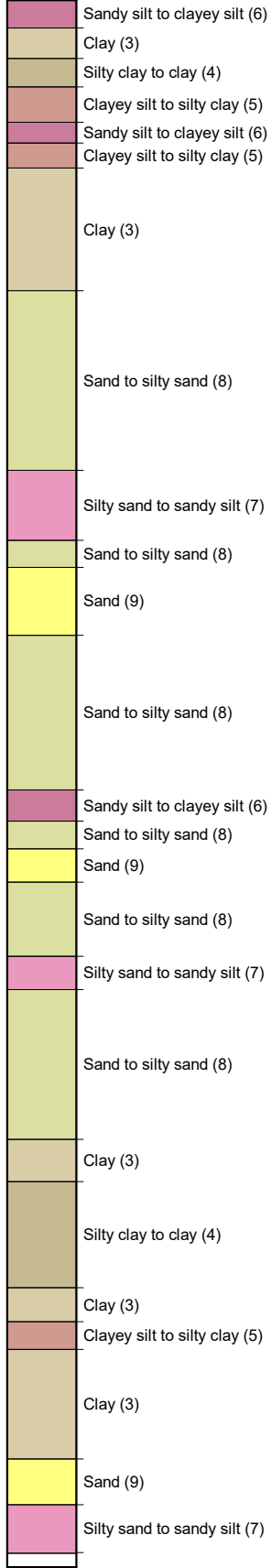


Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



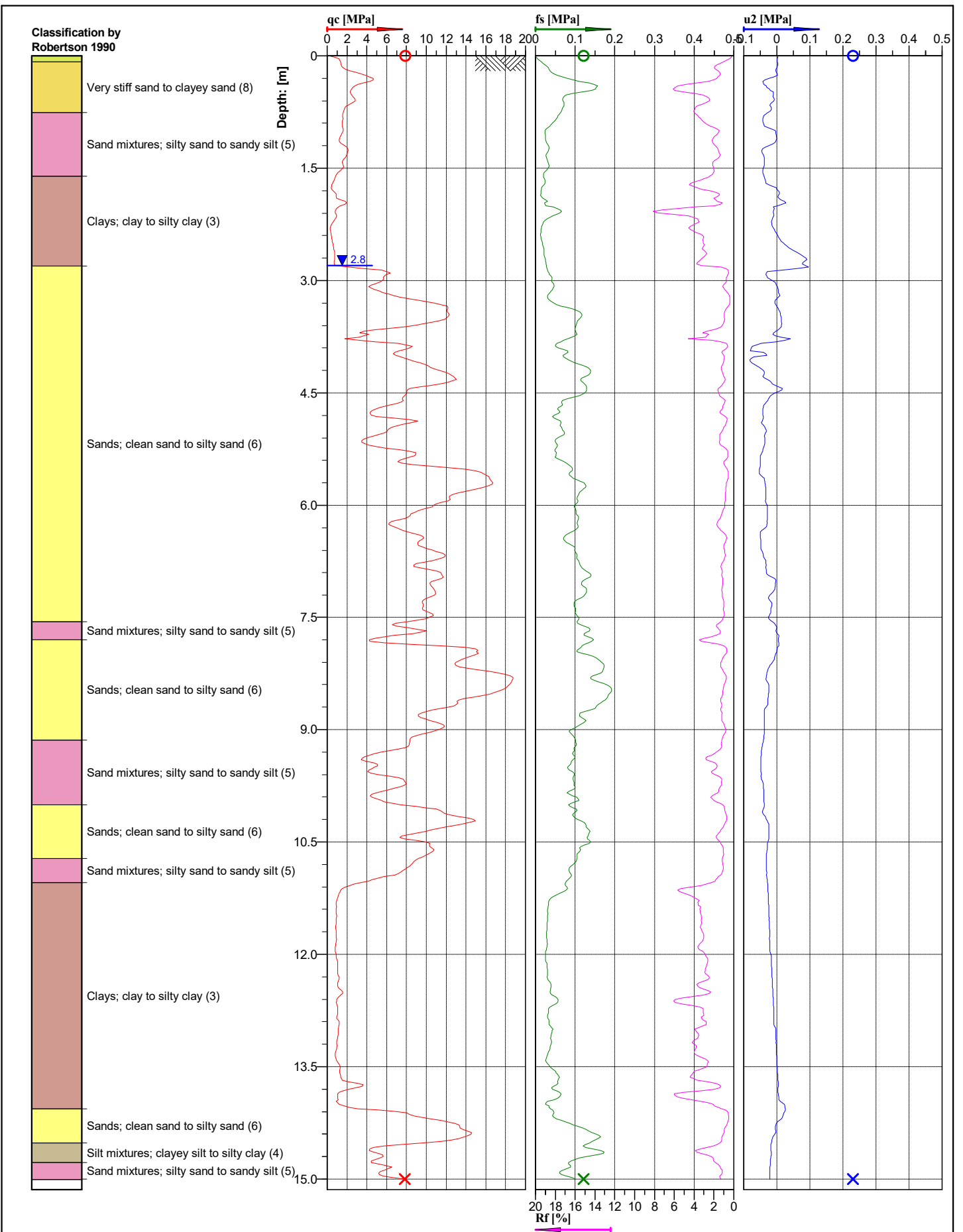
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Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 65
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
				File:	CPT06.cpt		
				S 39.61590 E 176.82542			


Classification by Robertson 1986



Cone No: 5332
 Tip area [cm²]: 10
 Sleeve area [cm²]: 150

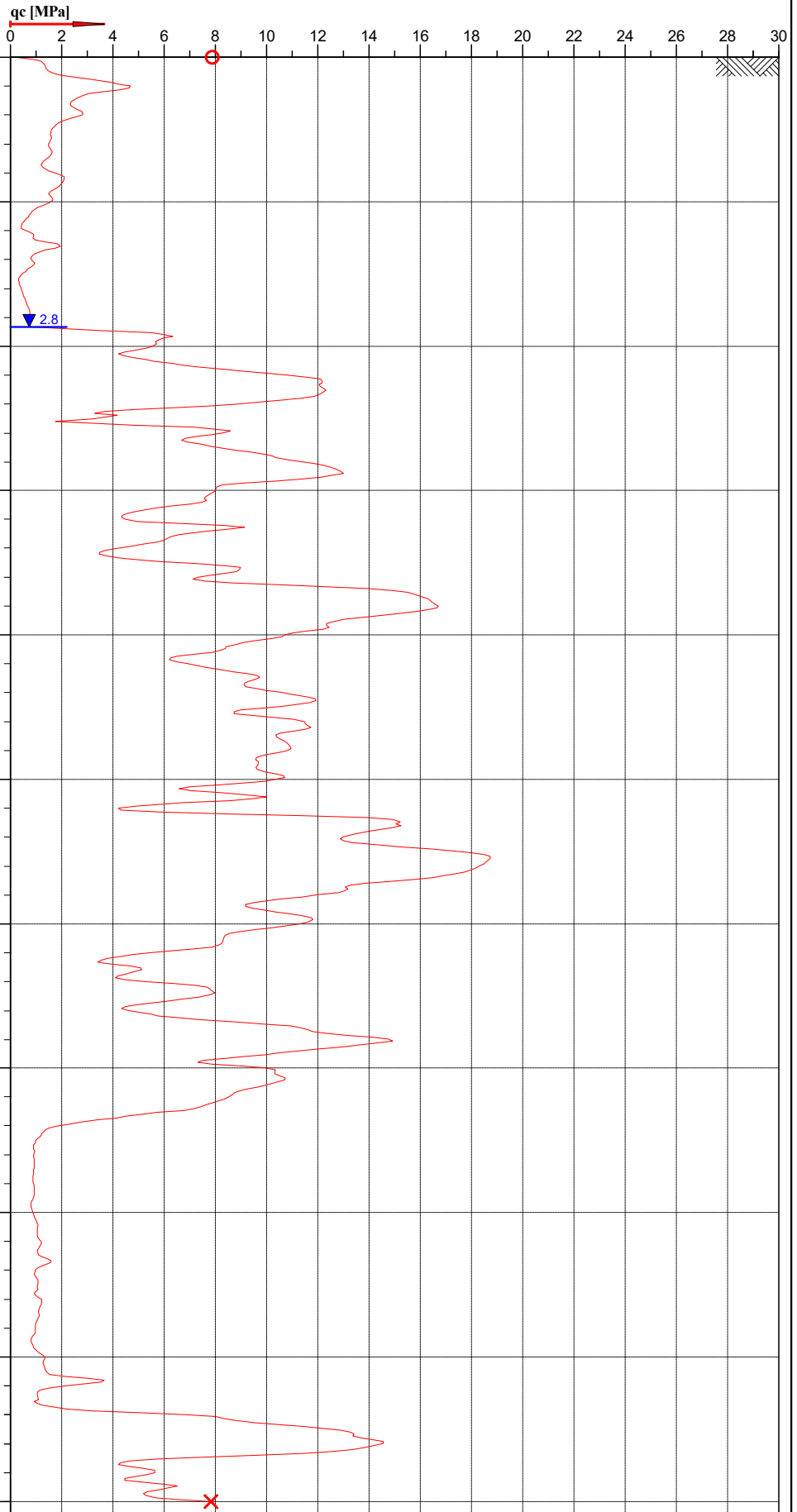
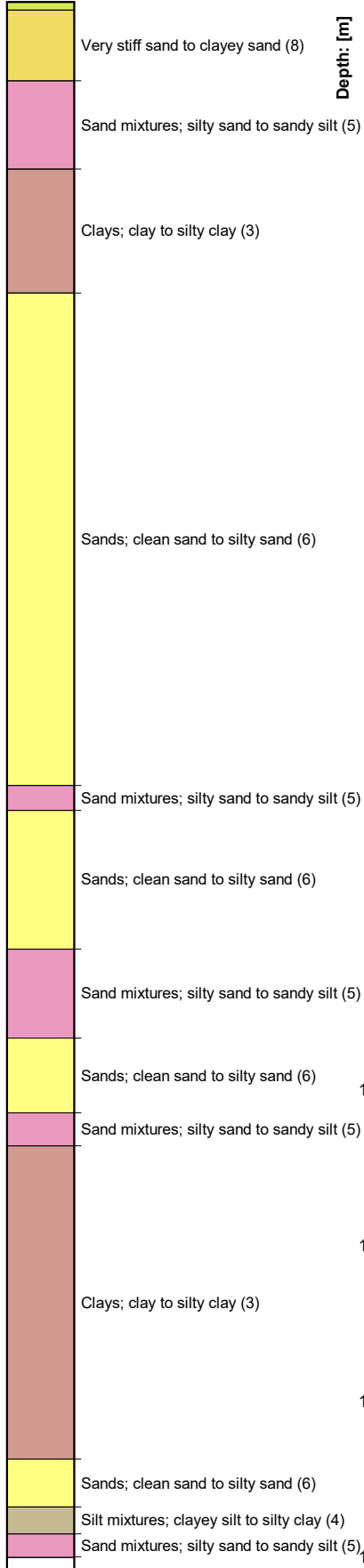
Location: HASTINGS	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT07
Project ID: P000828	Client: INITIA	Date: 31/07/2020	Scale: 1 : 67
Project: LYNDHURST RD		Page: 1/1	Fig.:
S 39.61585 E 176.82603		File: CPT07.cpt	





 Cone No: 5332
 Tip area [cm²]: 10
 Sleeve area [cm²]: 150

Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT07
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 67
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
	S 39.61585 E 176.82603			File:	CPT07.cpt		

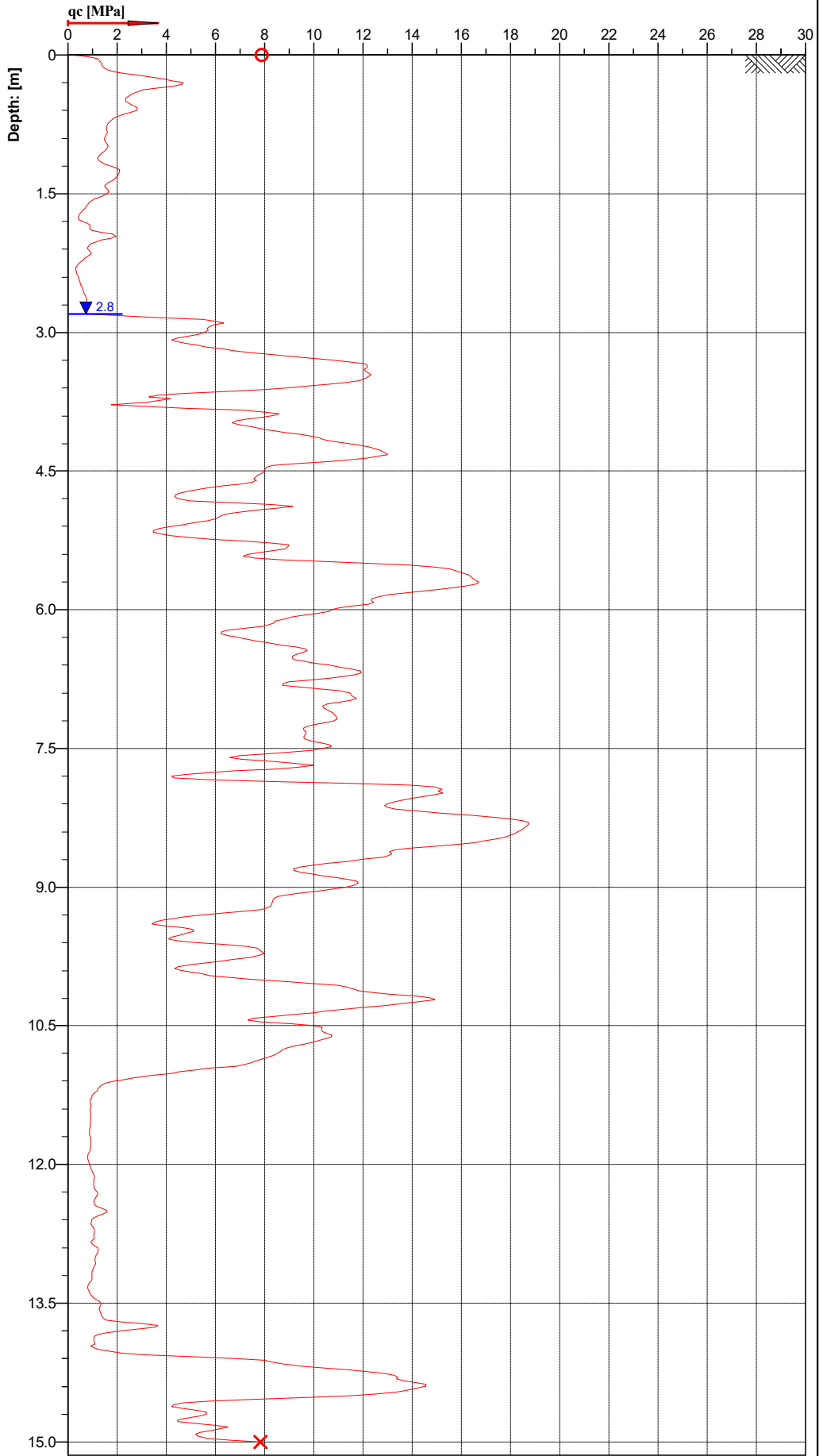
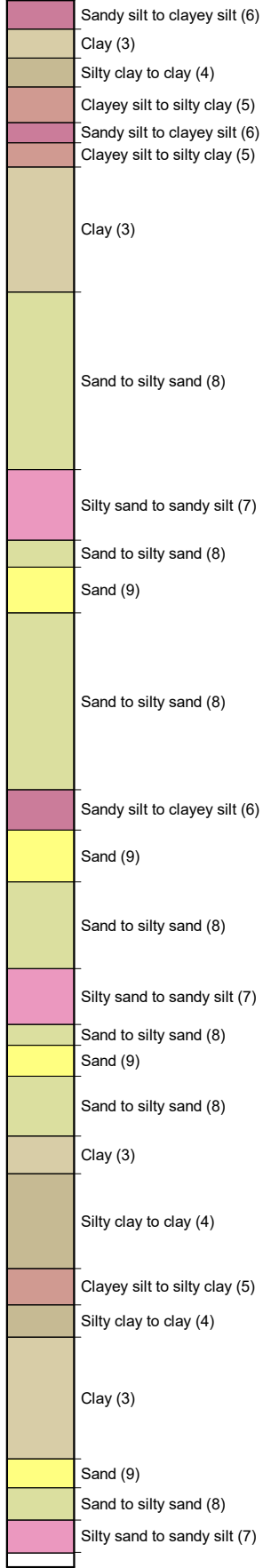
**Classification by
Robertson 1990**




 Cone No: 5332
 Tip area [cm²]: 10
 Sleeve area [cm²]: 150

Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT07
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 65
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
	S 39.61585 E 176.82603			File:	CPT07.cpt		

**Classification by
Robertson 1986**

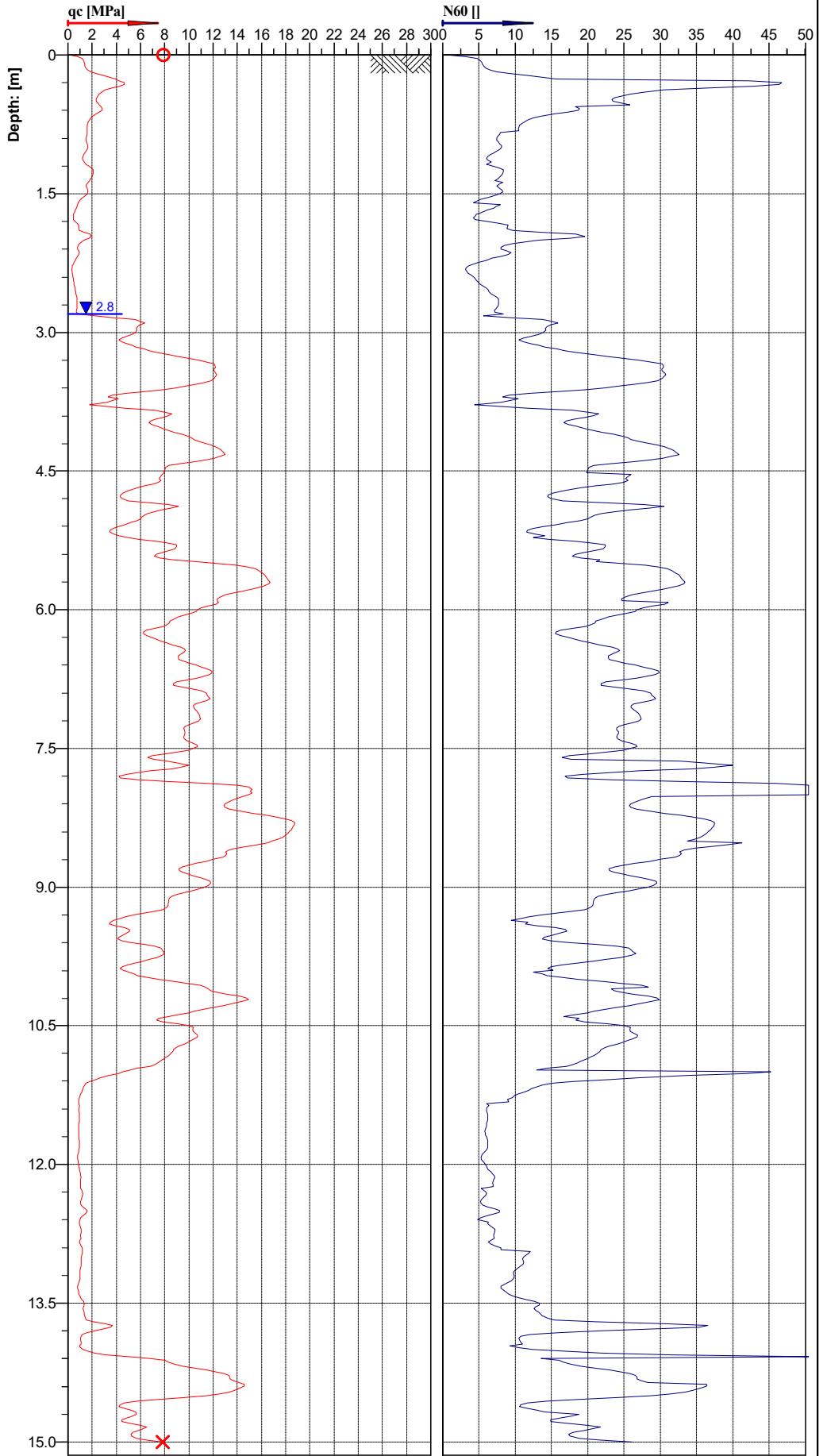
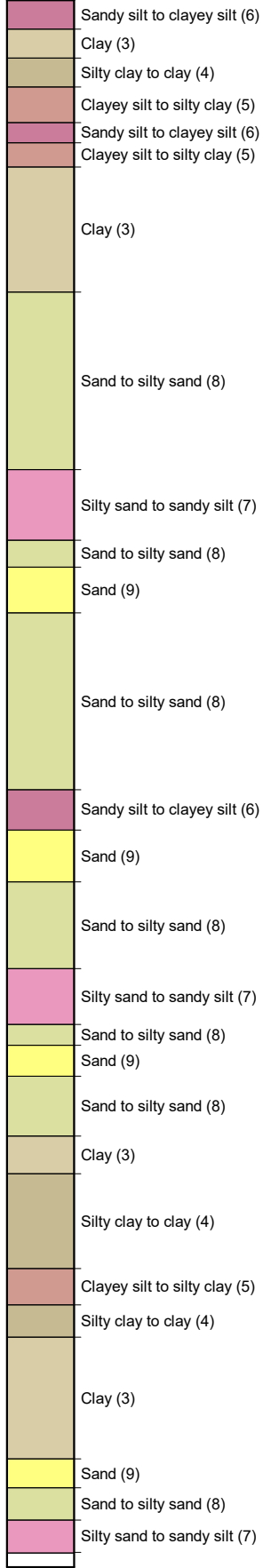


Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT07
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 65
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
	S 39.61585 E 176.82603			File:	CPT07.cpt		

**Classification by
Robertson 1986**

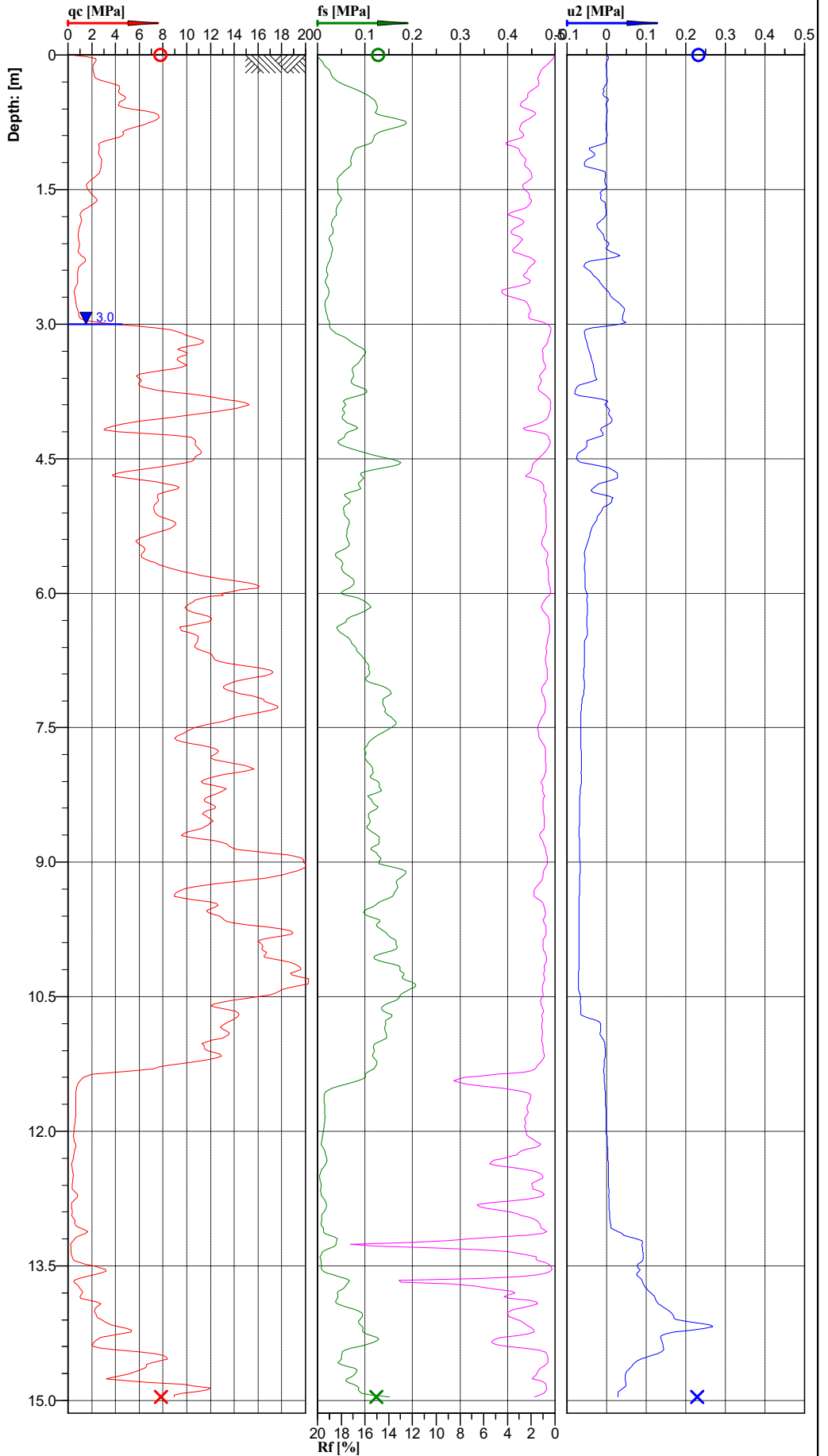
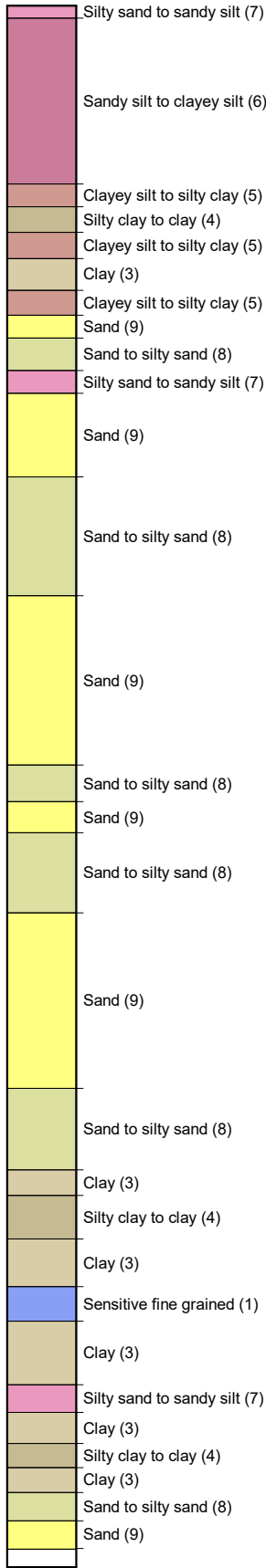


Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT07
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 65
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
	S 39.61585 E 176.82603			File:	CPT07.cpt		

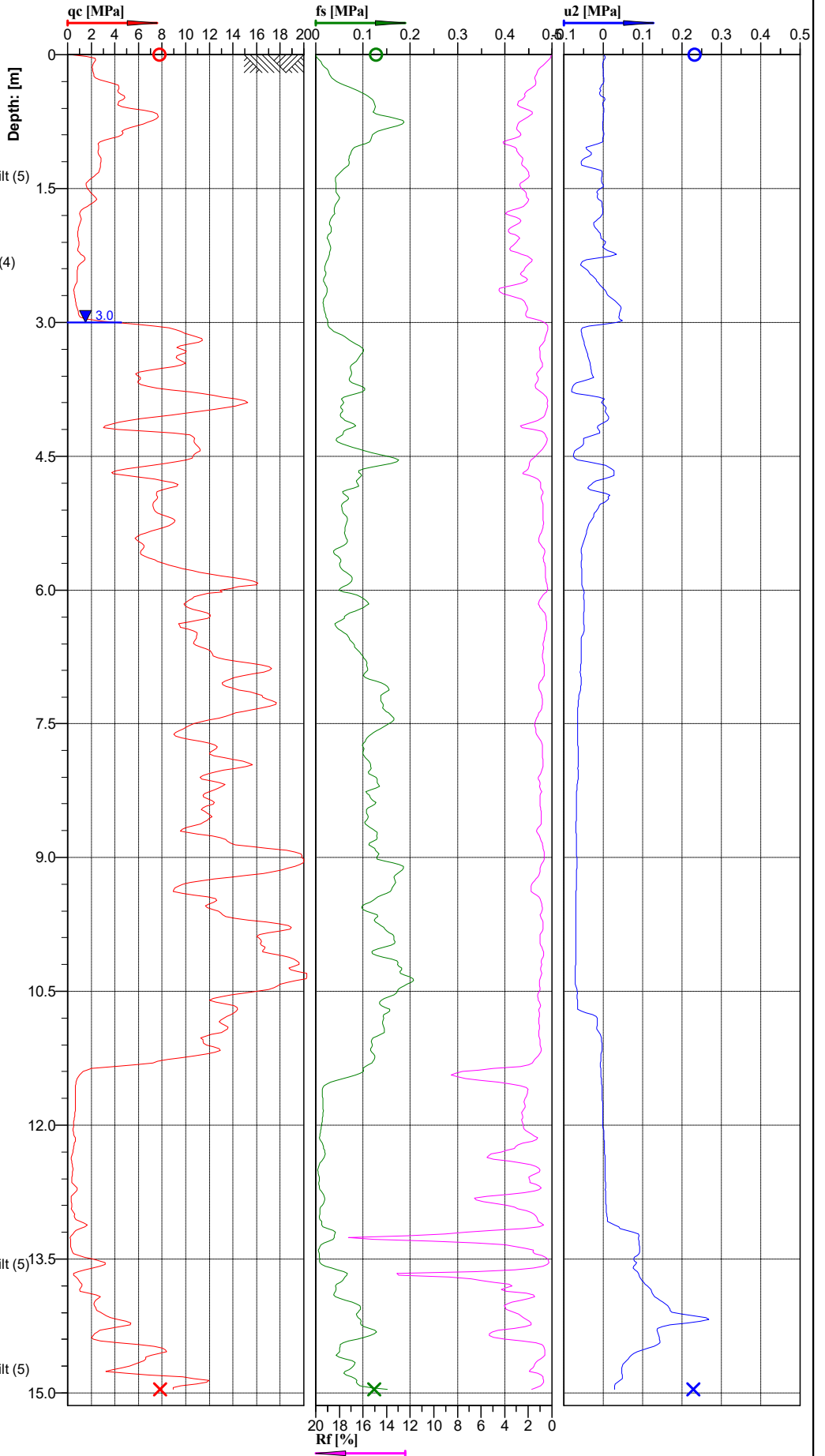
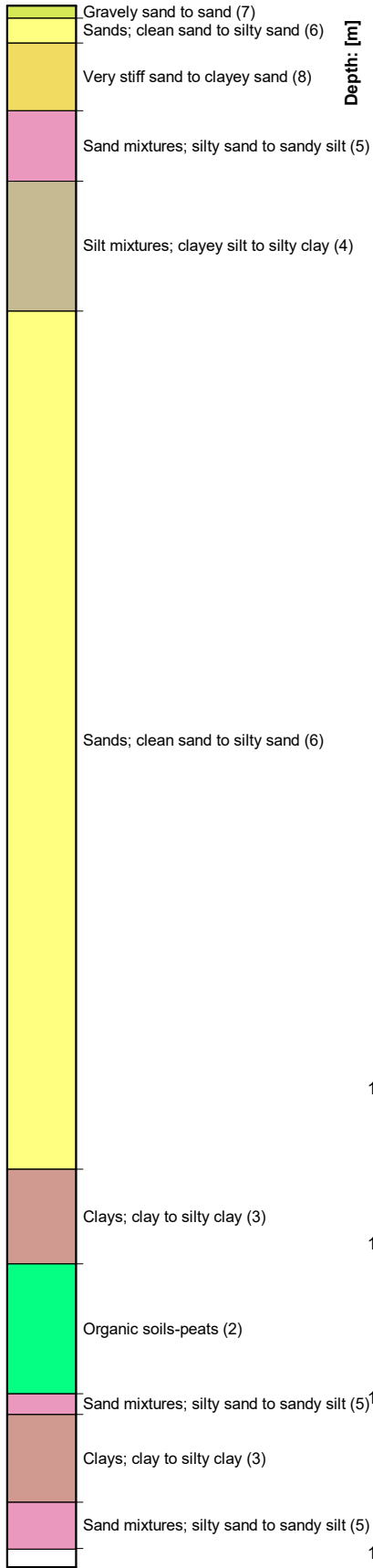
Classification by Robertson 1986



Cone No: 5332
 Tip area [cm²]: 10
 Sleeve area [cm²]: 150

Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT08
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 67
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
	S 39.61557 E 176.82593			File:	CPT08.cpt		

Classification by Robertson 1990

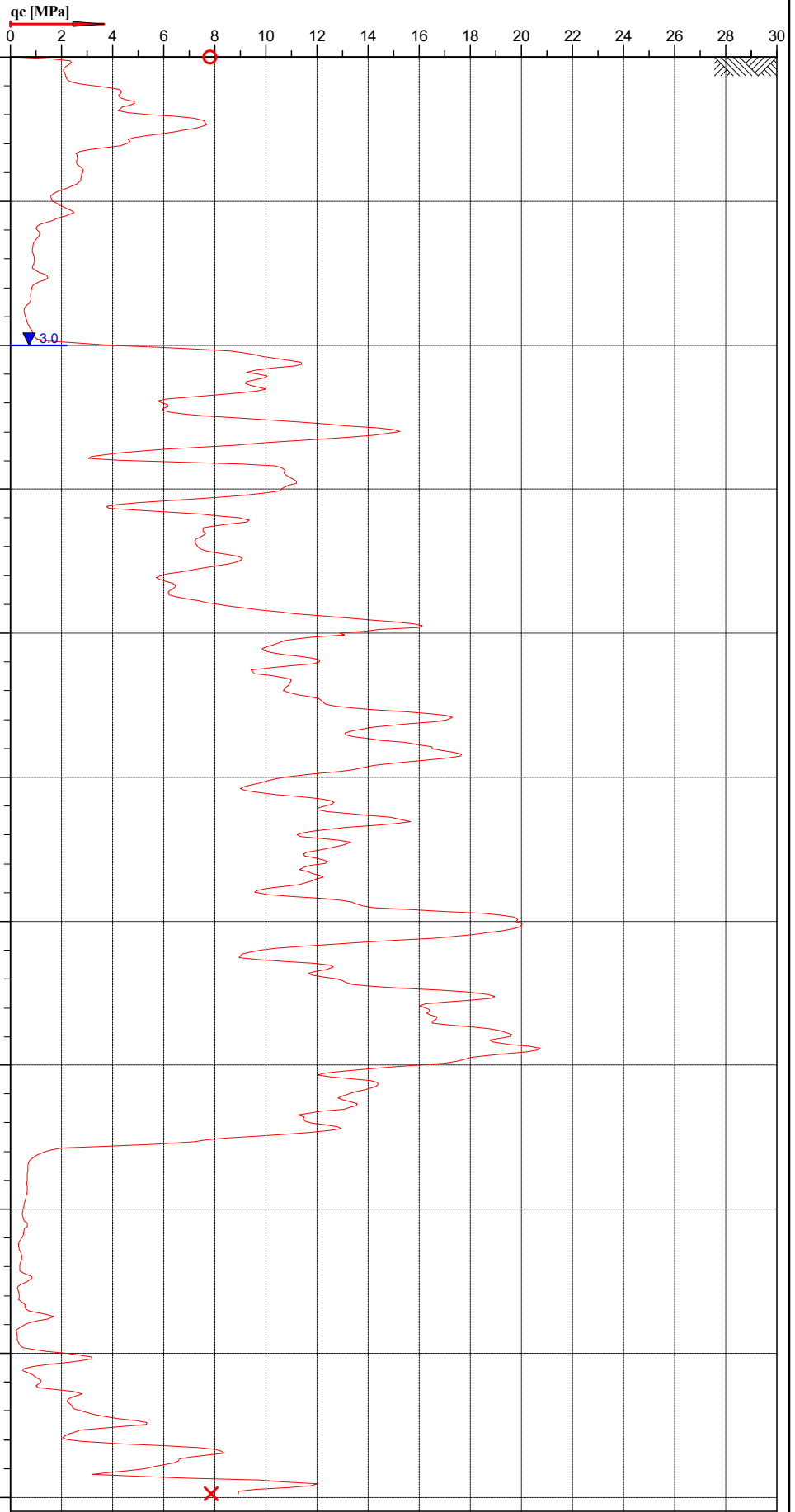
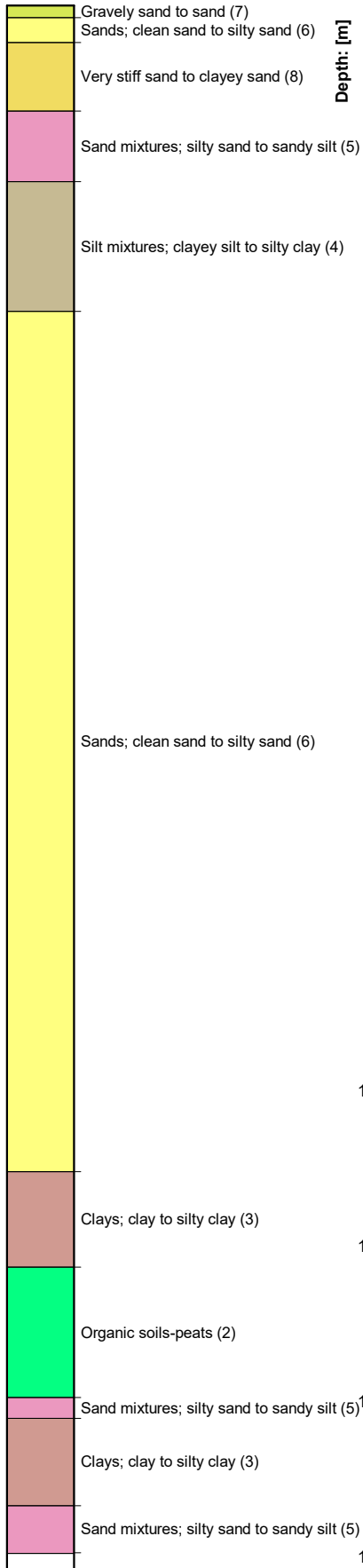


Cone No: 5332
 Tip area [cm2]: 10
 Sleeve area [cm2]: 150

Location: HASTINGS	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT08
Project ID: P000828	Client: INITIA	Date: 31/07/2020	Scale: 1 : 67
Project: LYNDHURST RD		Page: 1/1	Fig.:
S 39.61557 E 176.82593			File: CPT08.cpt



**Classification by
Robertson 1990**

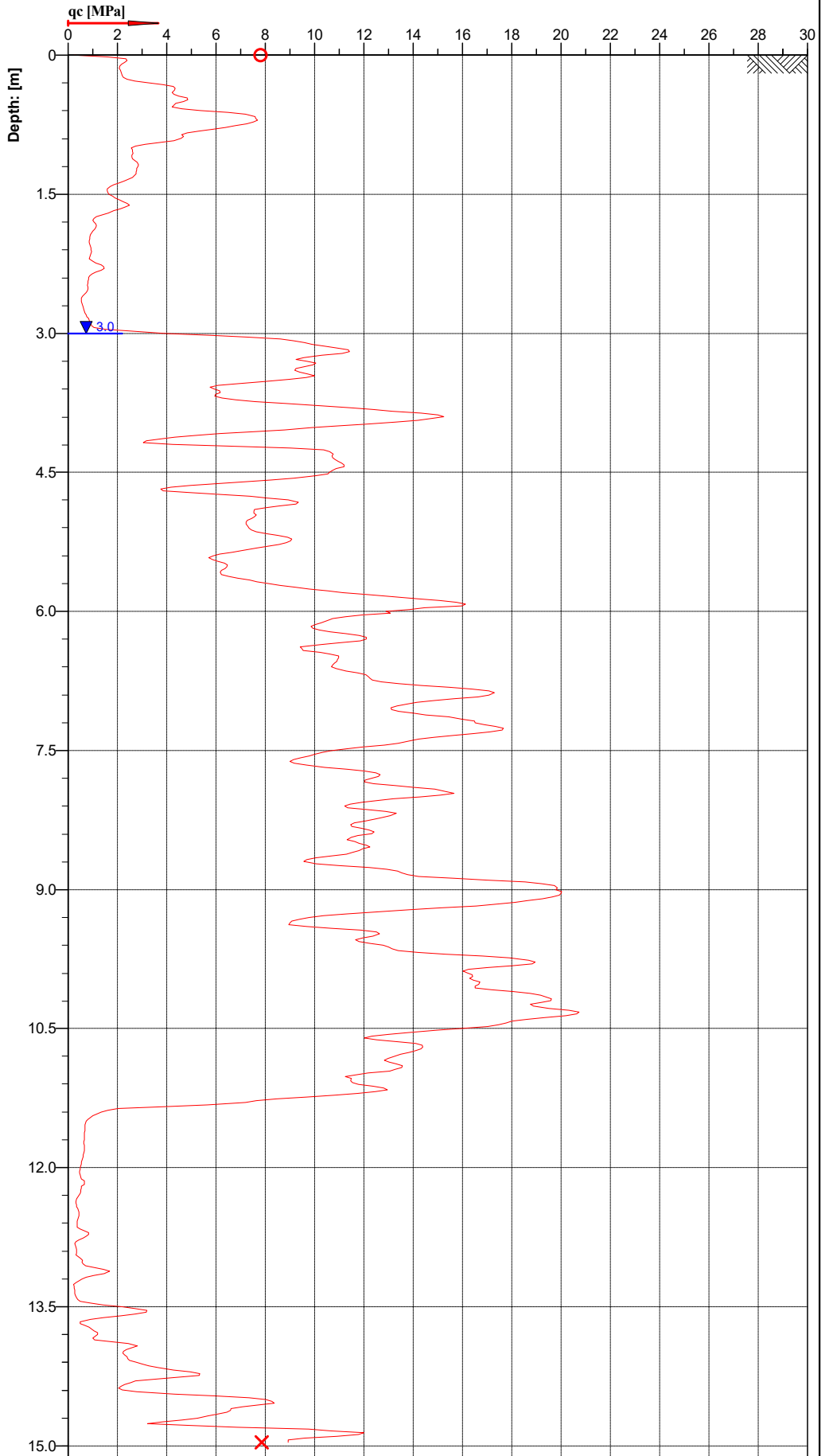
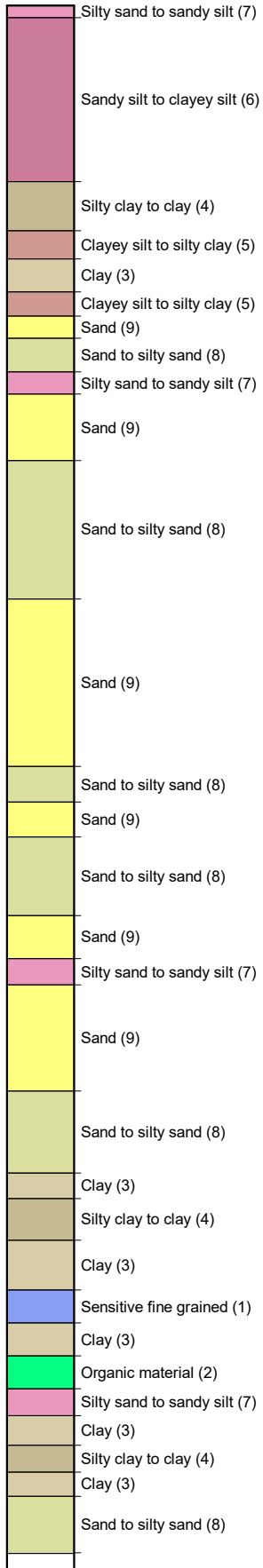


Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT08
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 65
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
	S 39.61557 E 176.82593			File:	CPT08.cpt		

**Classification by
Robertson 1986**

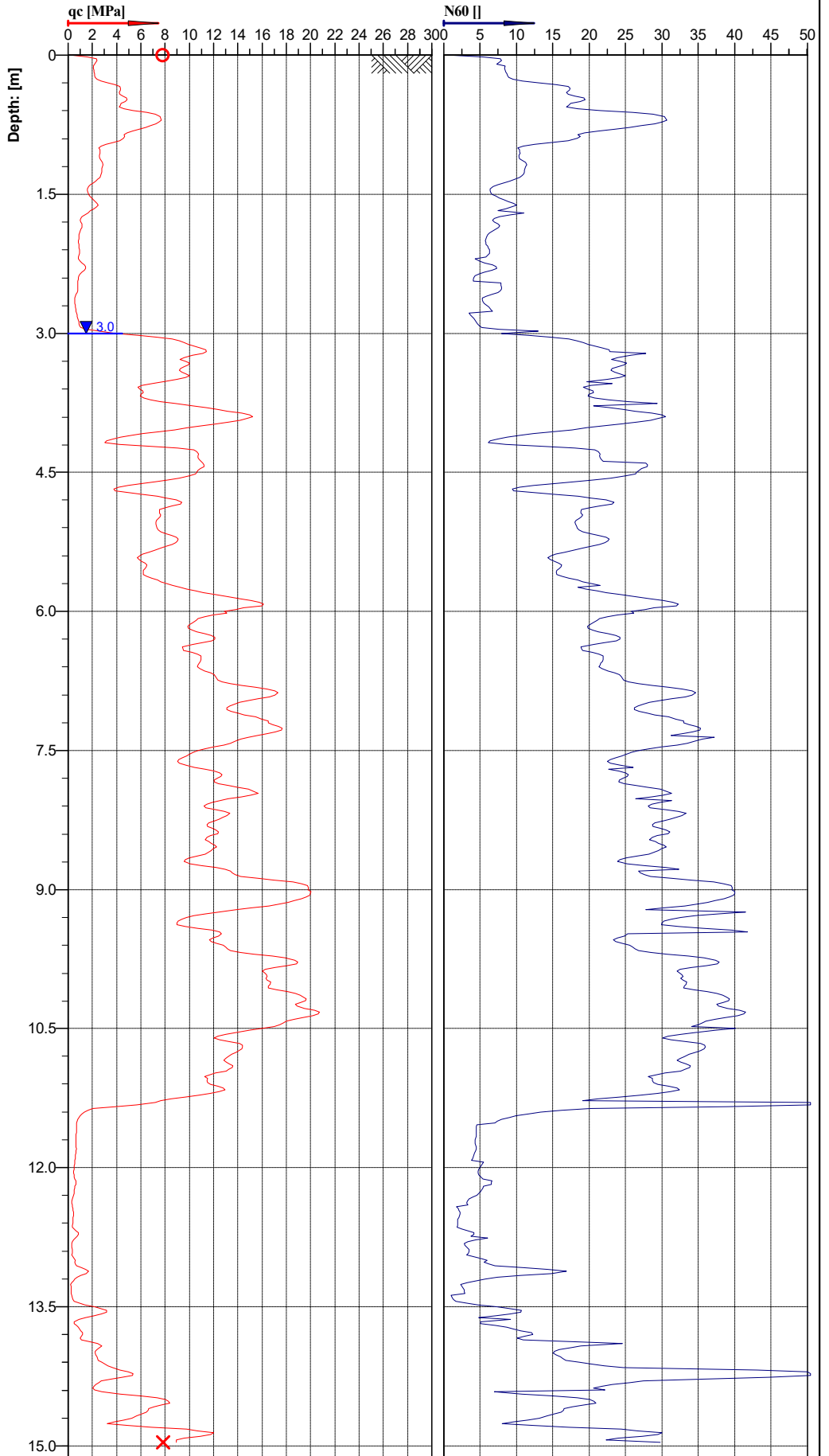
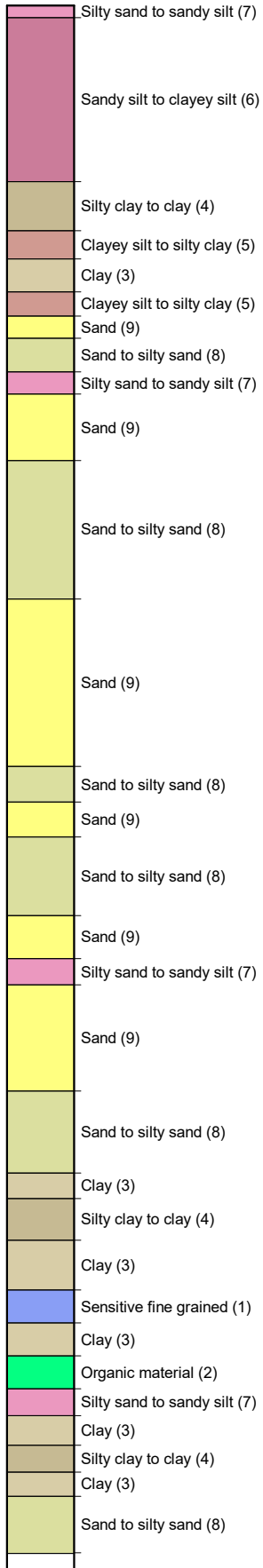


Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT08
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 65
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
	S 39.61557 E 176.82593			File:	CPT08.cpt		

**Classification by
Robertson 1986**

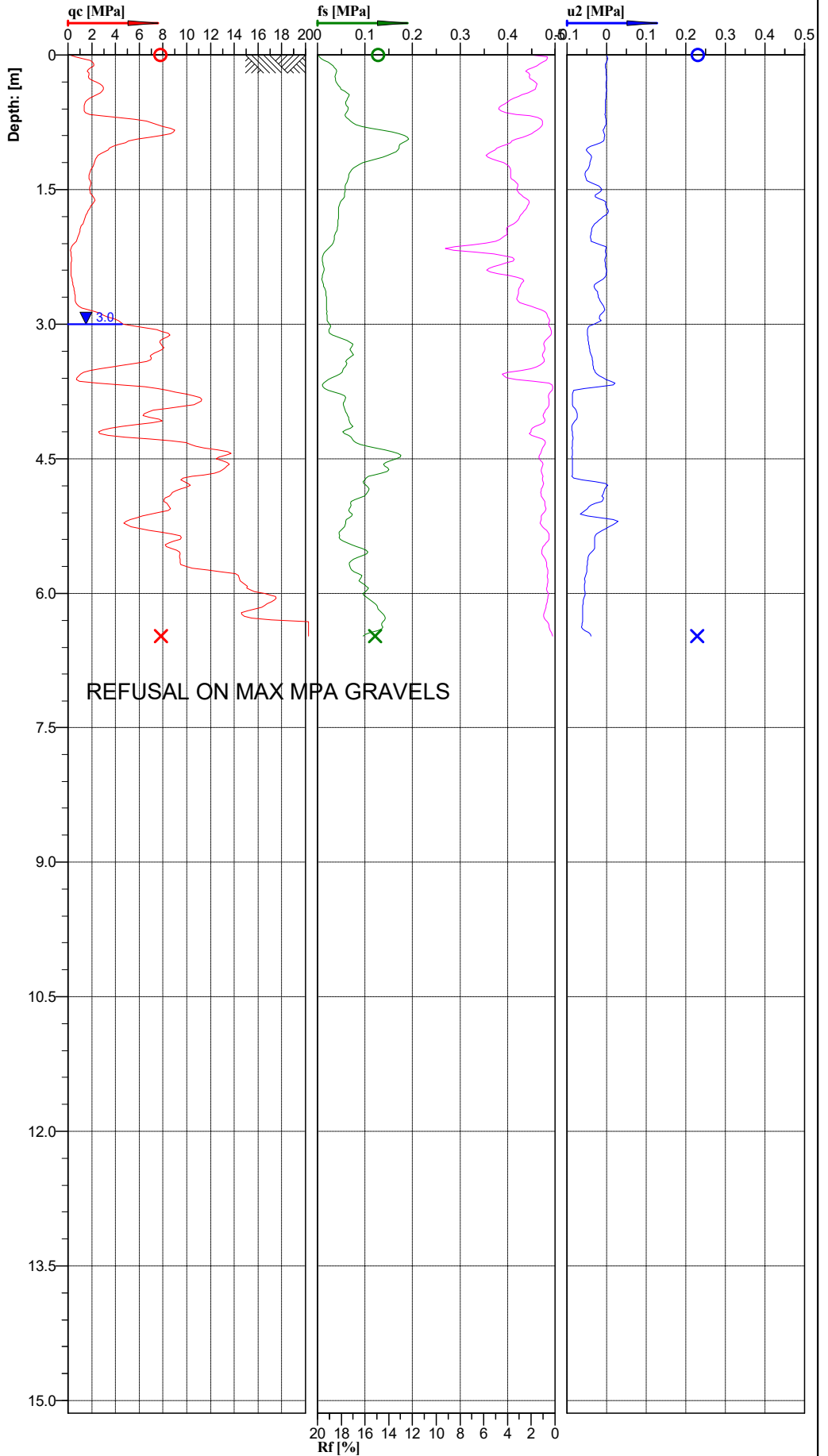
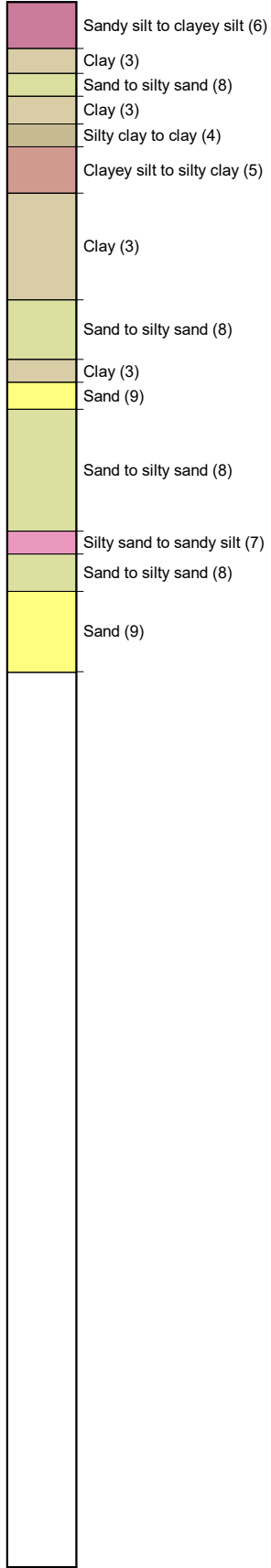


Cone No: 5332
Tip area [cm2]: 10
Sleeve area [cm2]: 150



Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT08
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 65
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
	S 39.61557 E 176.82593			File:	CPT08.cpt		

**Classification by
Robertson 1986**



REFUSAL ON MAX MPA GRAVELS

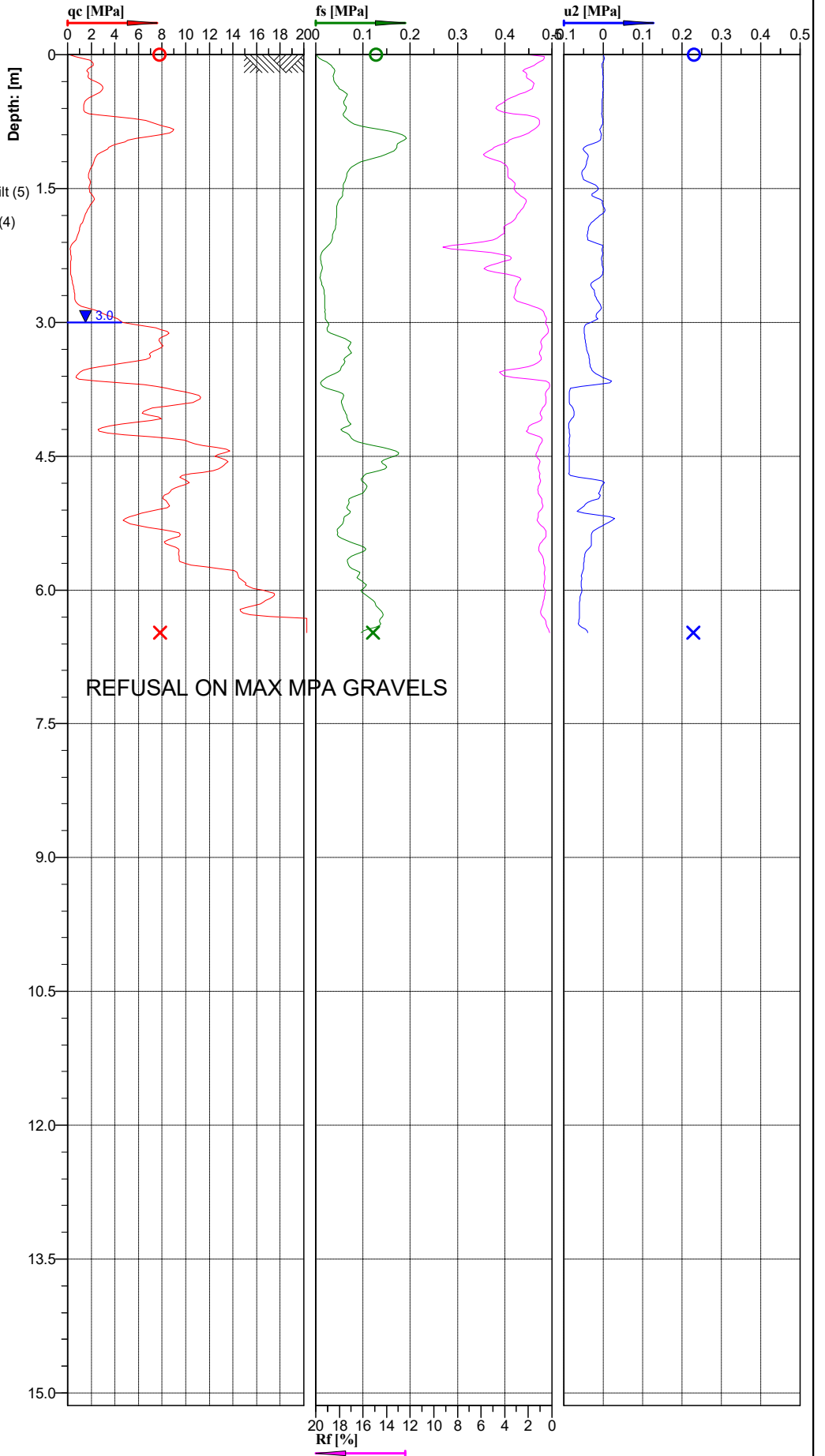
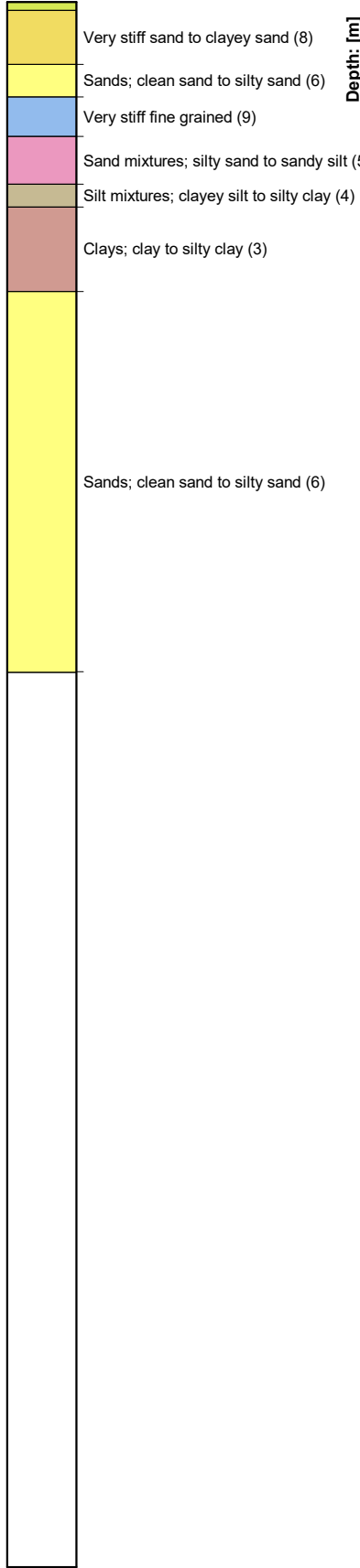


Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT09
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 67
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
S 39.61536 E 176.82573				File:	CPT09.cpt		

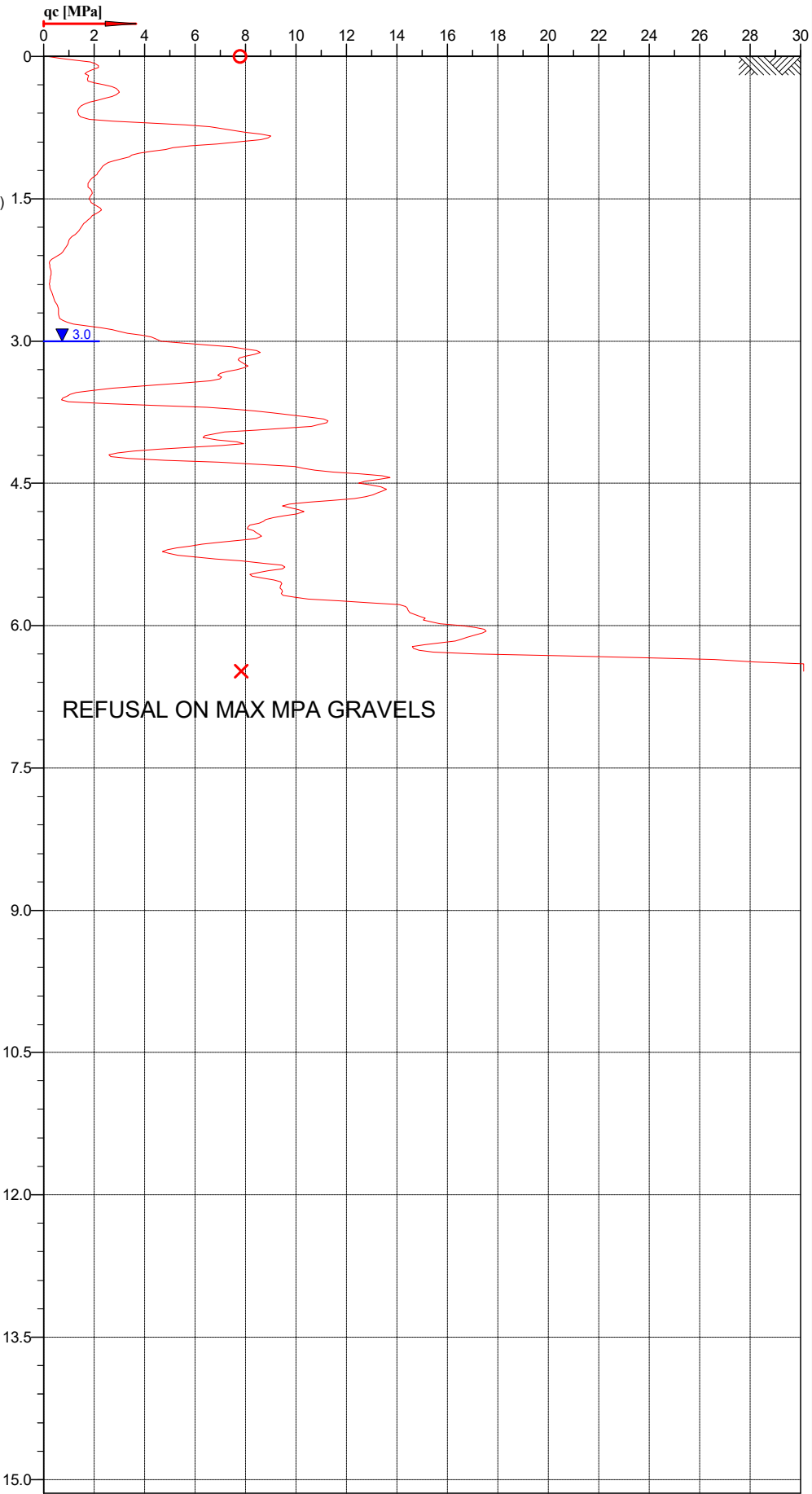
**Classification by
Robertson 1990**




Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150

Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT09
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 67
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
S 39.61536 E 176.82573				File:	CPT09.cpt		

**Classification by
Robertson 1990**

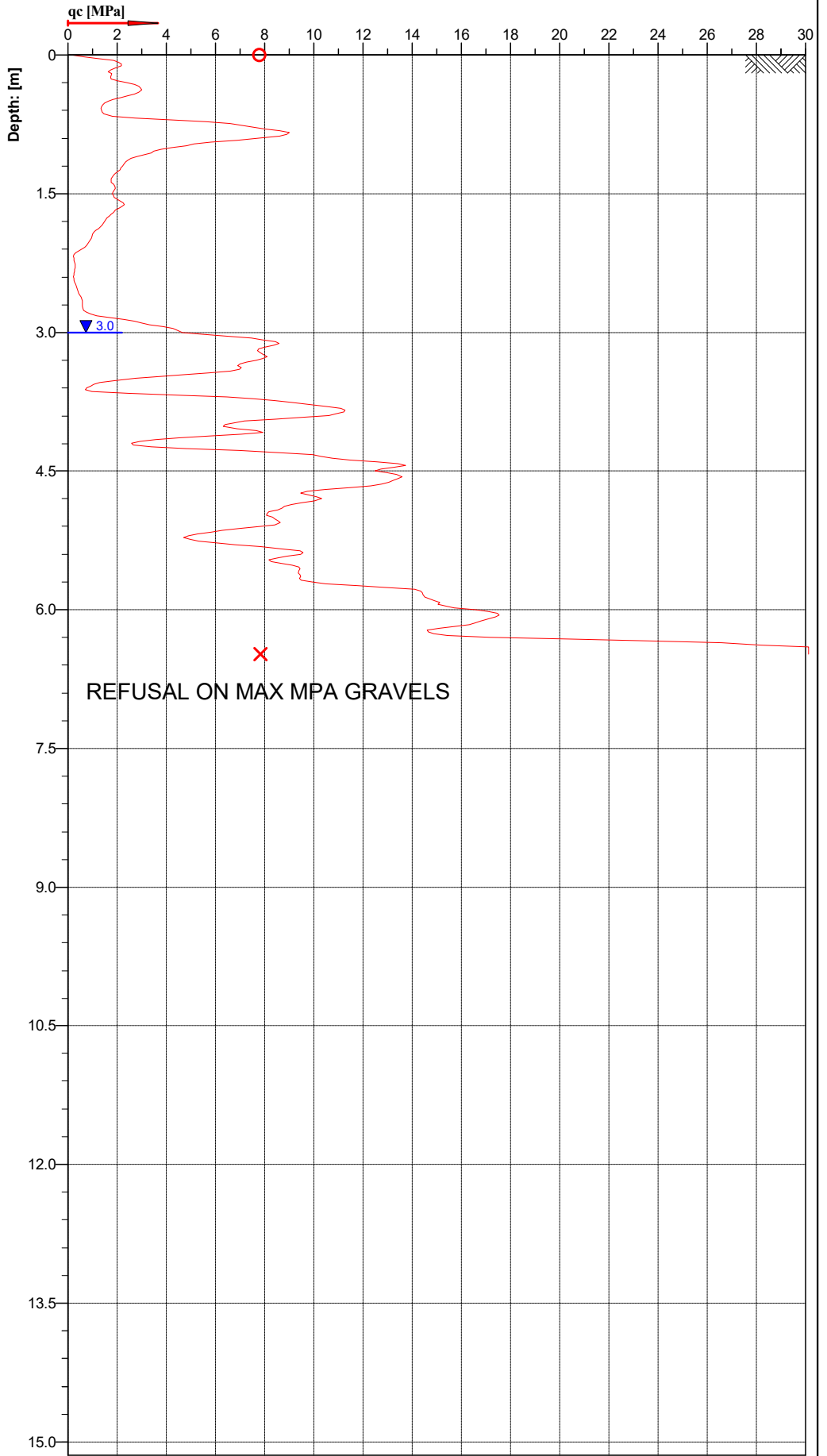
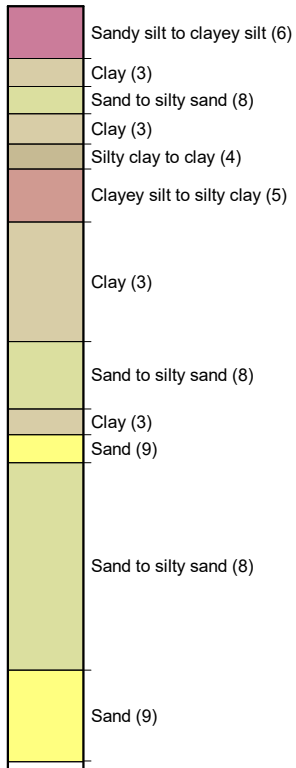





 Cone No: 5332
 Tip area [cm²]: 10
 Sleeve area [cm²]: 150

Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT09
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 65
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
	S 39.61536 E 176.82573			File:	CPT09.cpt		

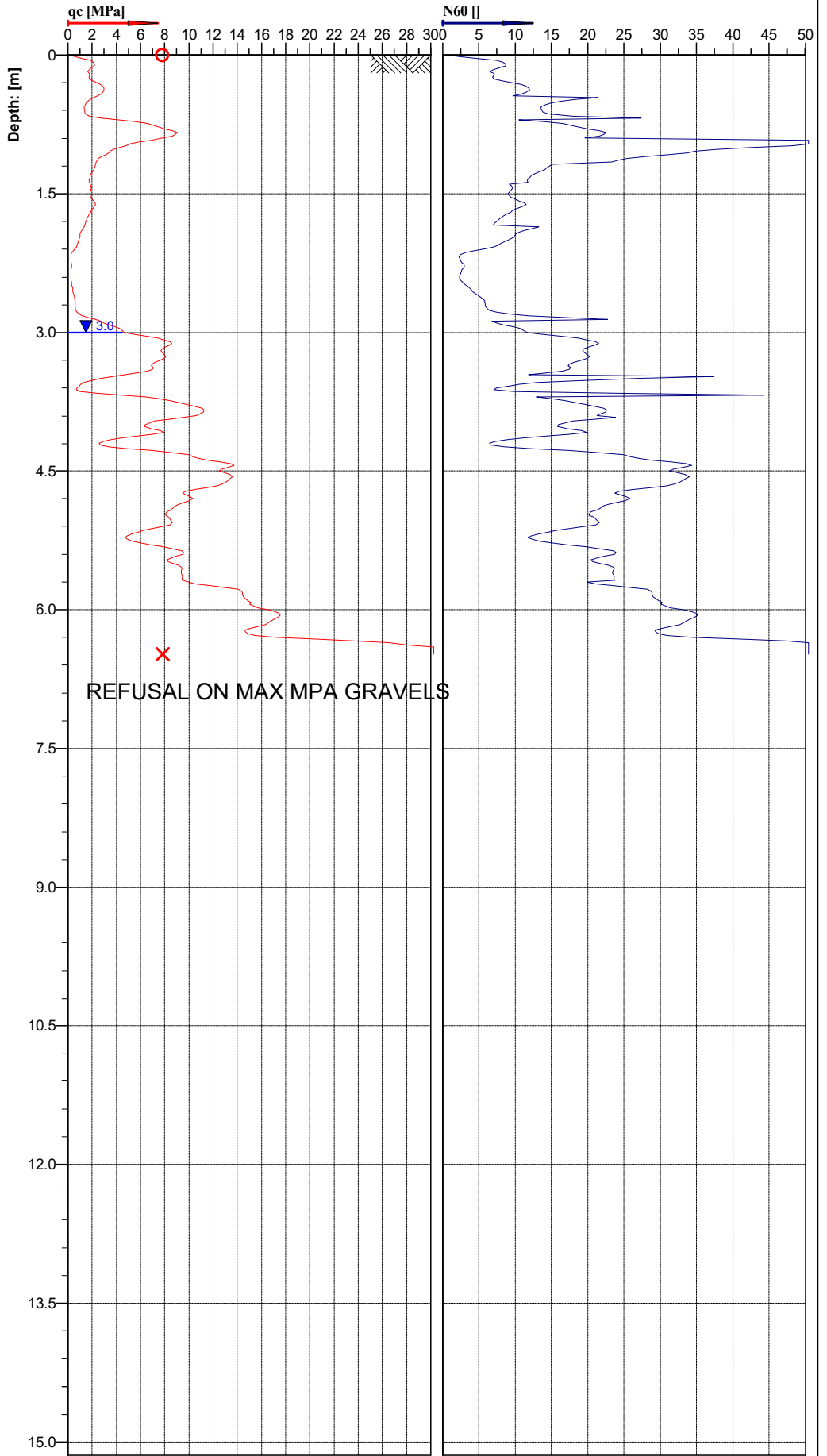
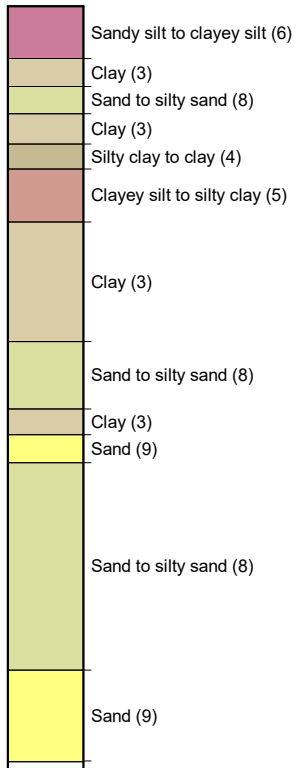
**Classification by
Robertson 1986**




 Cone No: 5332
 Tip area [cm²]: 10
 Sleeve area [cm²]: 150

Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT09
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 65
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
	S 39.61536 E 176.82573			File:	CPT09.cpt		

**Classification by
Robertson 1986**

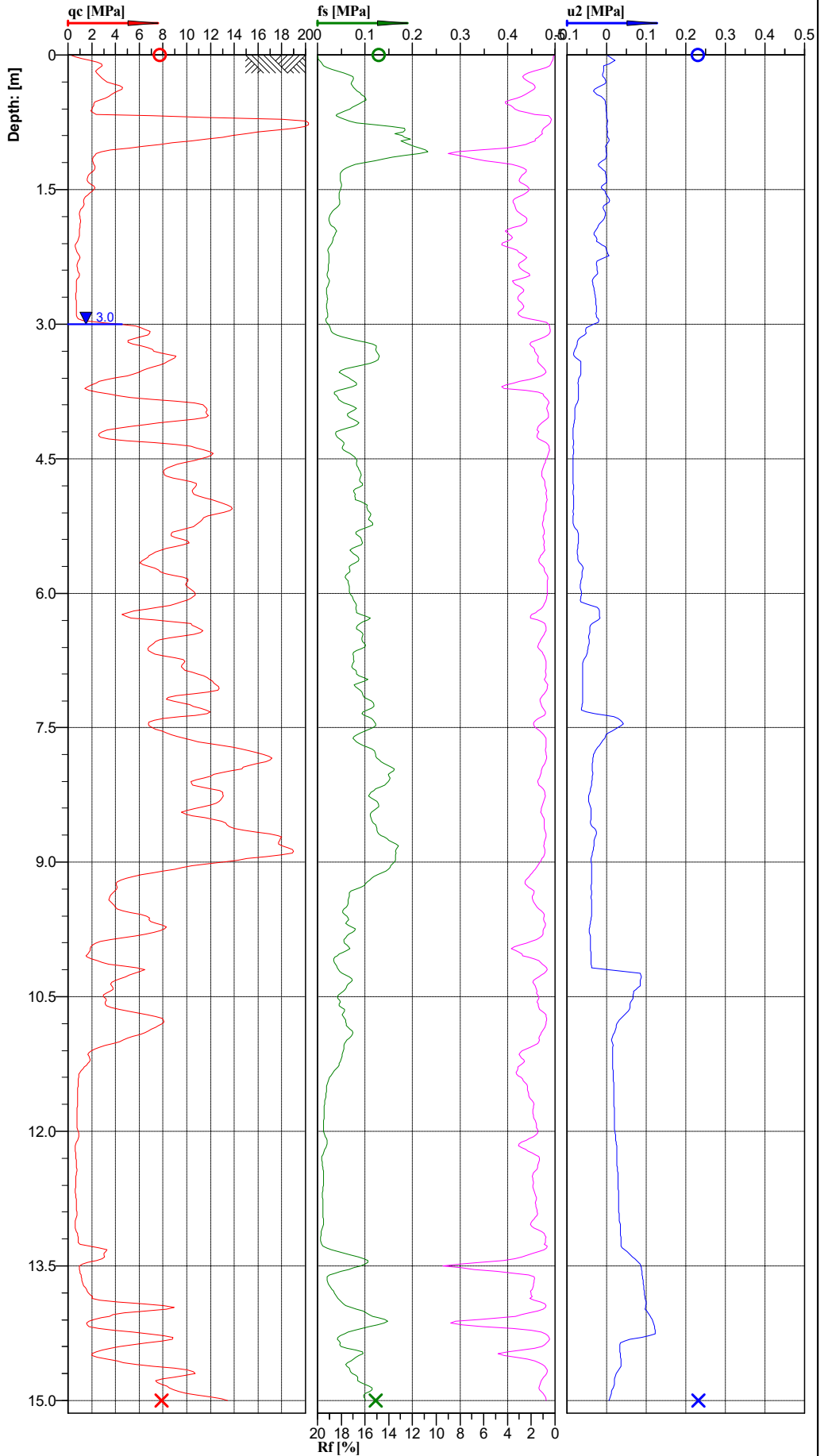
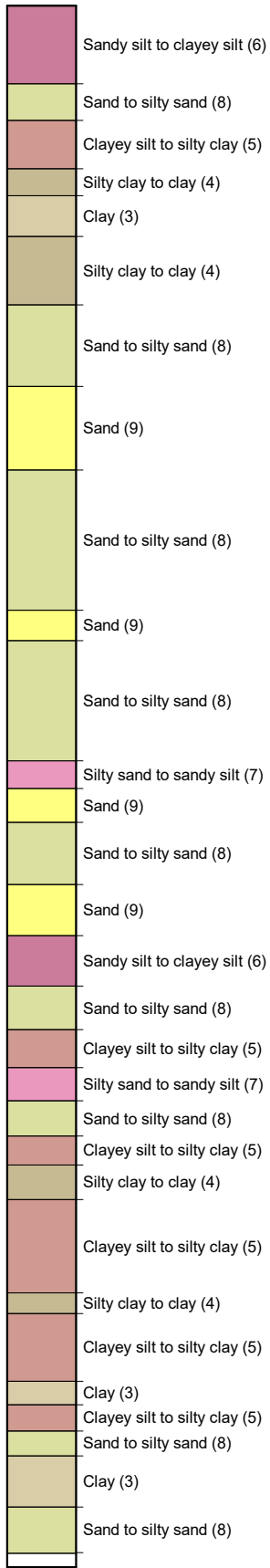


Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT09
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 65
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
				S 39.61536 E 176.82573	File:	CPT09.cpt	

**Classification by
Robertson 1986**

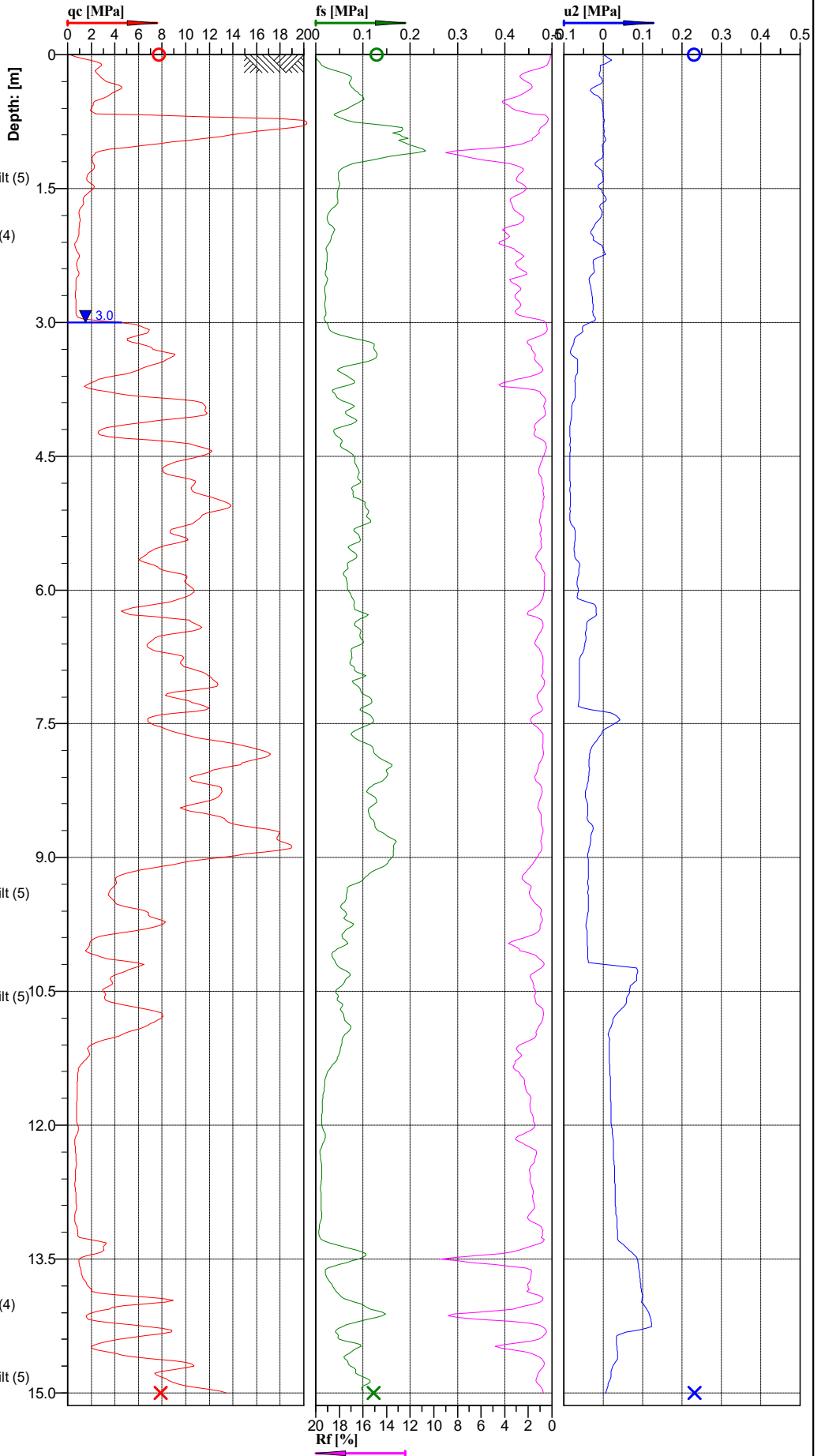
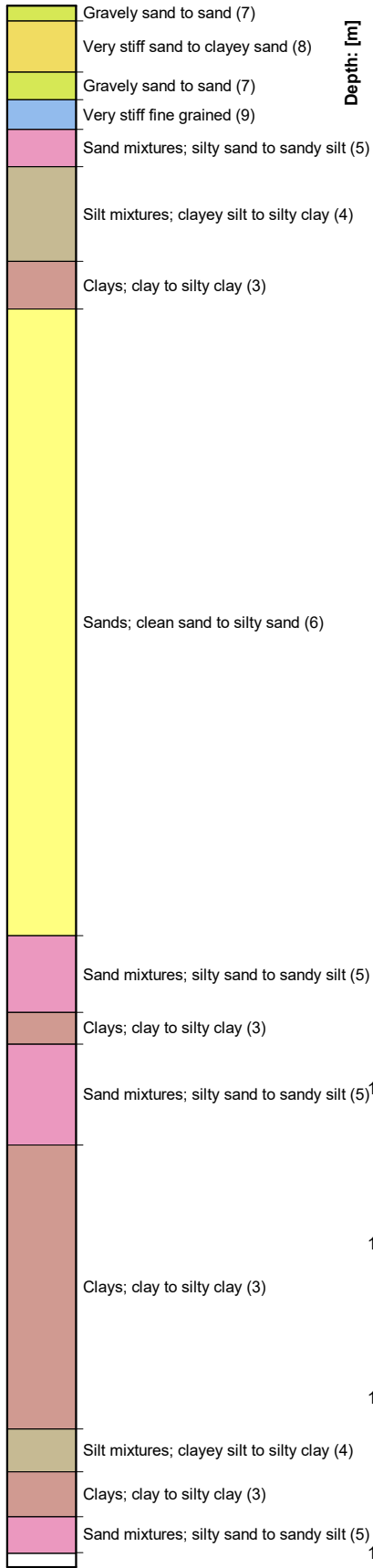


Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT10
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 67
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
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**Classification by
Robertson 1990**

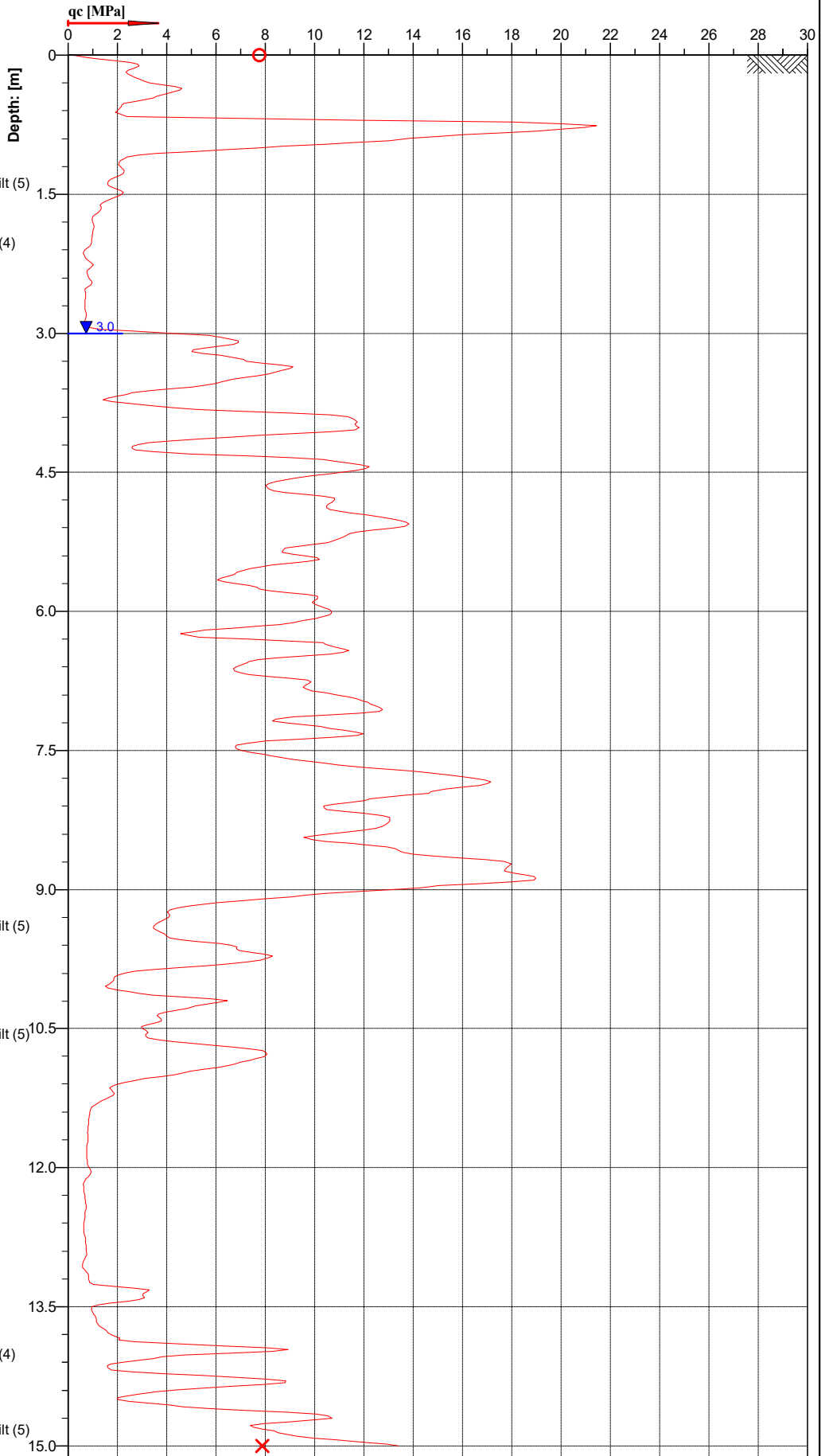
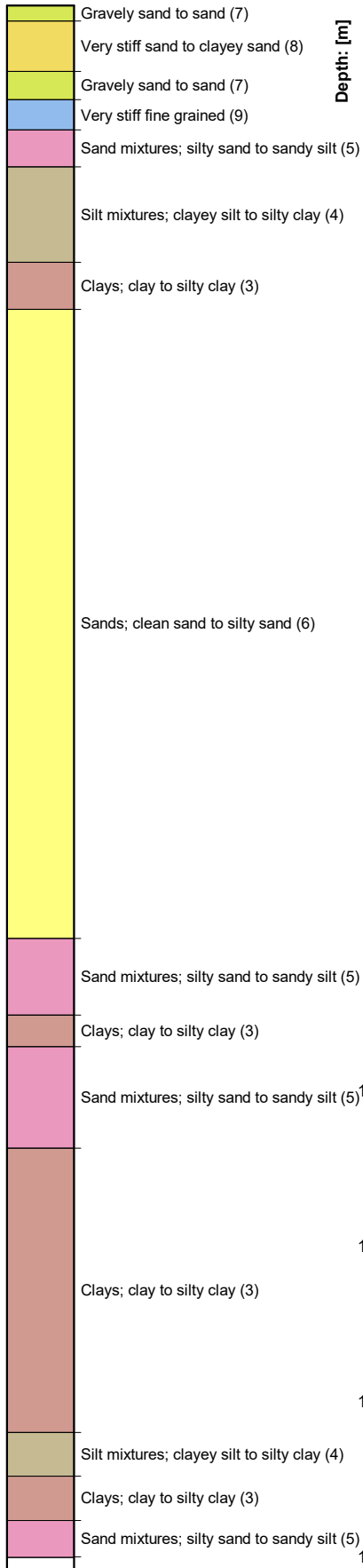


Cone No: 5332
Tip area [cm2]: 10
Sleeve area [cm2]: 150



Location: HASTINGS	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT10
Project ID: P000828	Client: INITIA	Date: 31/07/2020	Scale: 1 : 67
Project: LYNDHURST RD		Page: 1/1	Fig.:
S 39.61491 E 176.82634			File: CPT10.cpt

**Classification by
Robertson 1990**

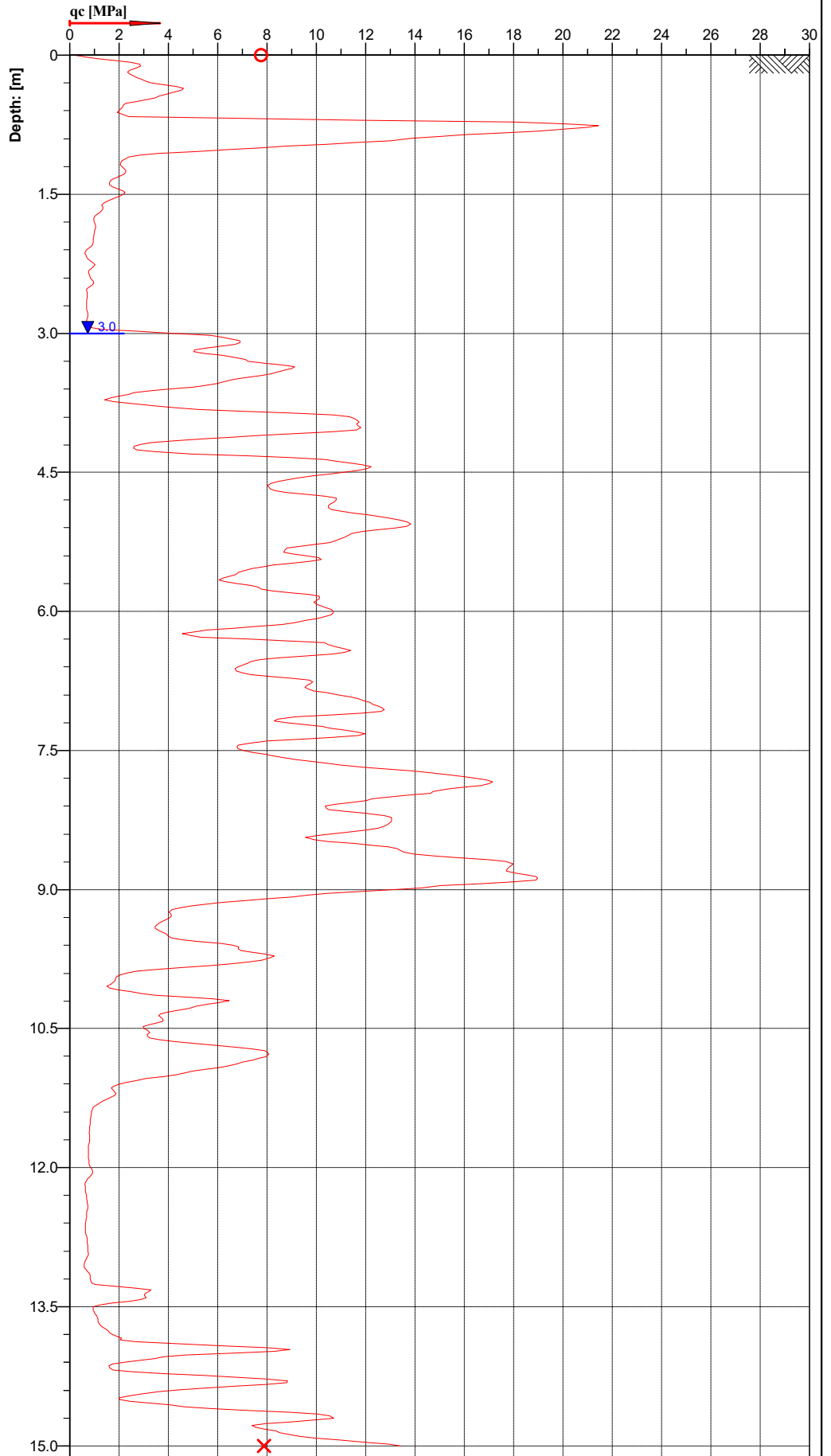
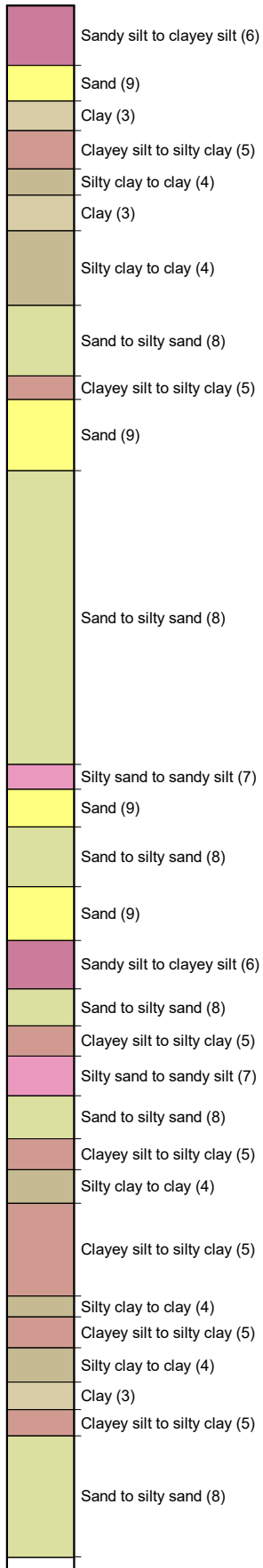


Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT10
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 65
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
S 39.61491 E 176.82634				File:	CPT10.cpt		

**Classification by
Robertson 1986**

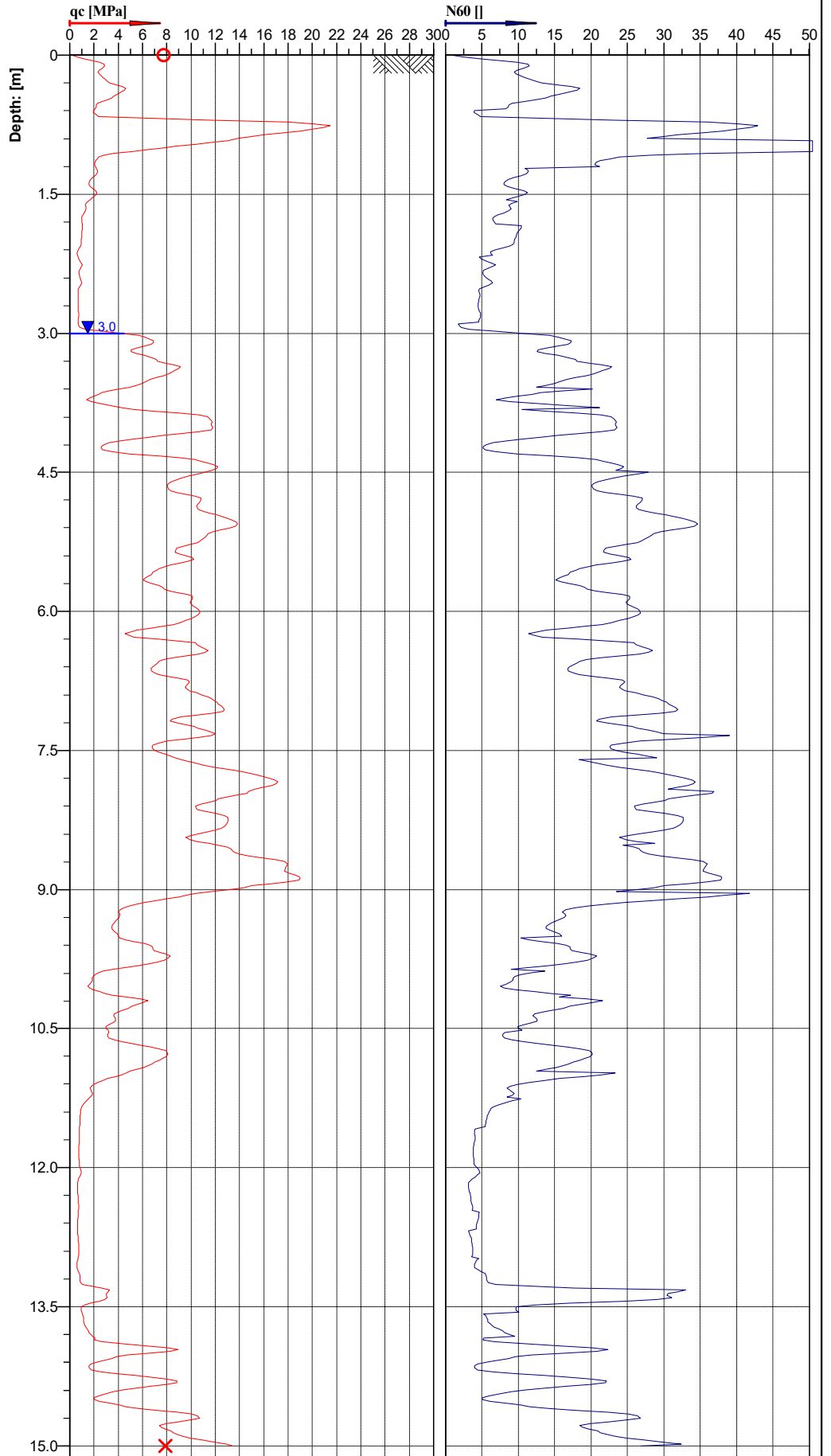
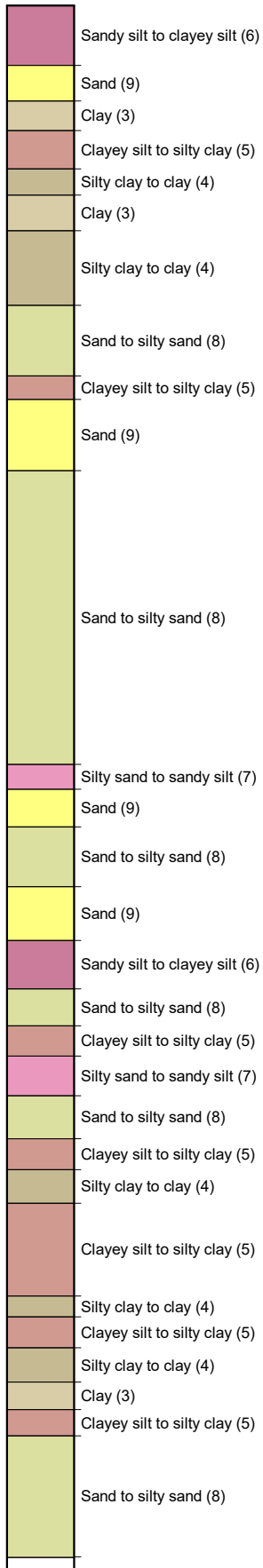


Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT10
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 65
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
	S 39.61491 E 176.82634			File:	CPT10.cpt		

**Classification by
Robertson 1986**



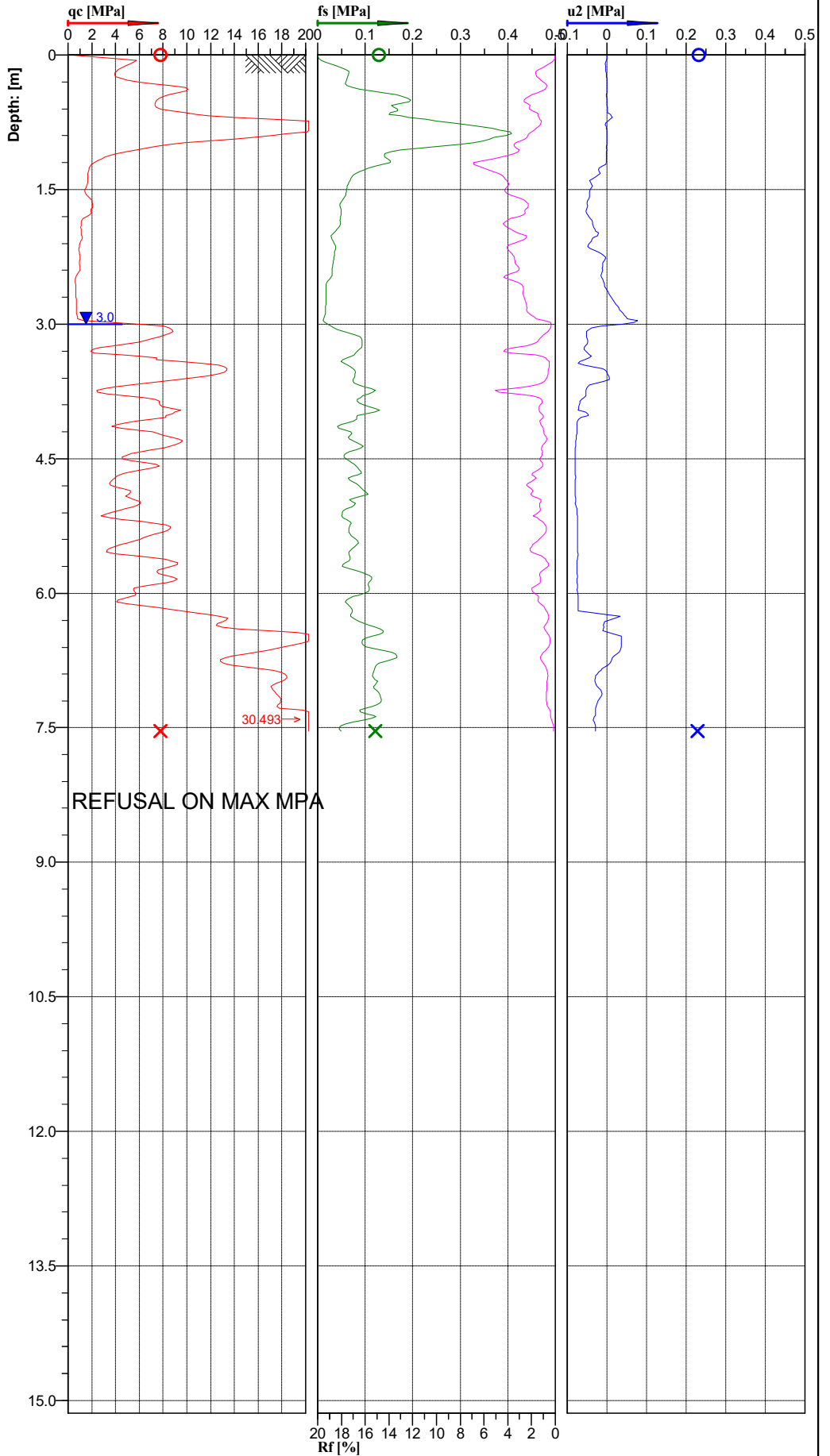
Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT10
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 65
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
	S 39.61491 E 176.82634			File:	CPT10.cpt		

**Classification by
Robertson 1986**

- Silty sand to sandy silt (7)
- Sandy silt to clayey silt (6)
- Sand to silty sand (8)
- Sandy silt to clayey silt (6)
- Clay (3)
- Clayey silt to silty clay (5)
- Clay (3)
- Silty clay to clay (4)
- Silty sand to sandy silt (7)
- Sand to silty sand (8)
- Sandy silt to clayey silt (6)
- Silty sand to sandy silt (7)
- Sand to silty sand (8)
- Silty sand to sandy silt (7)
- Sand (9)
- Gravely sand to sand (10)

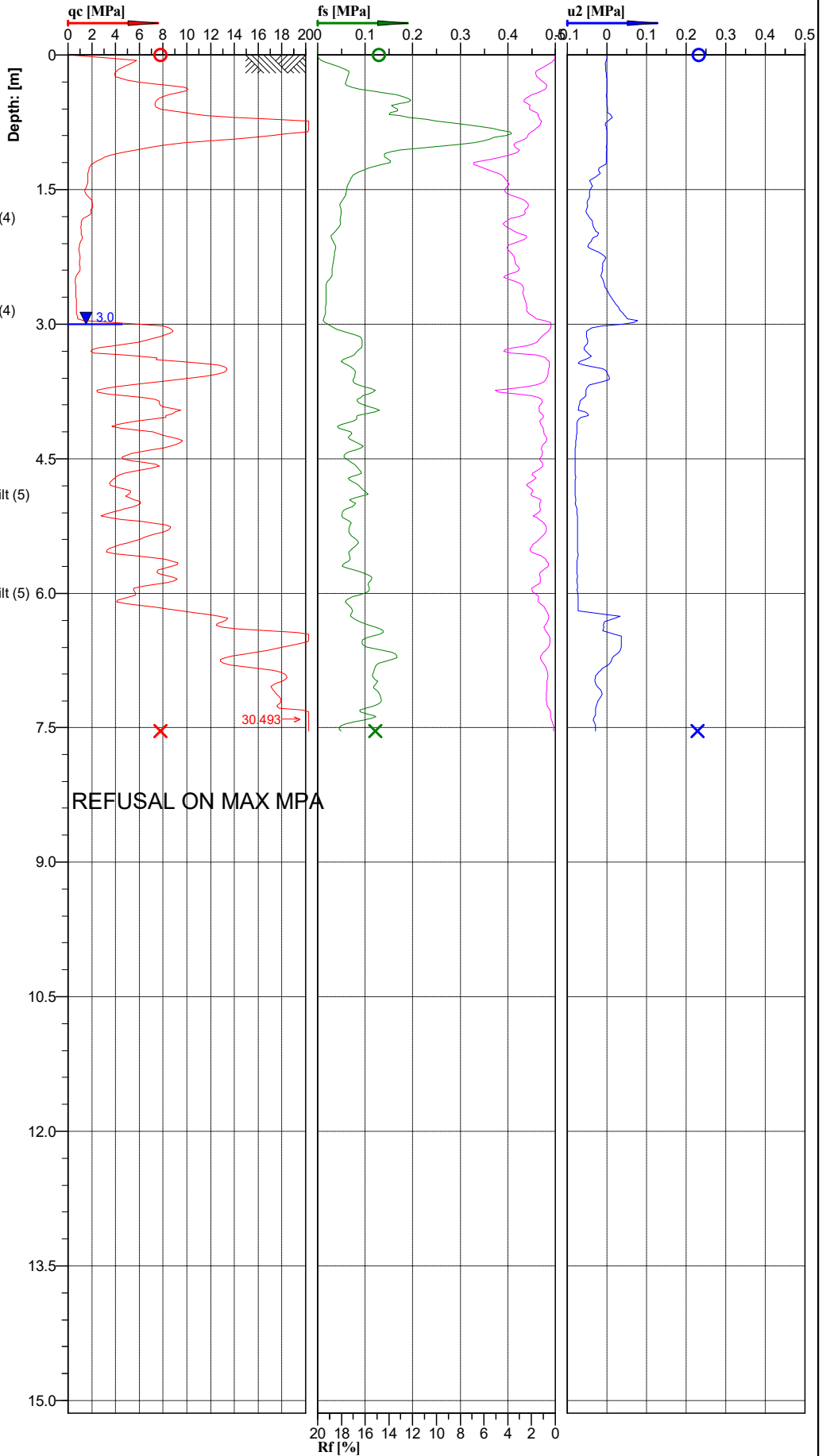
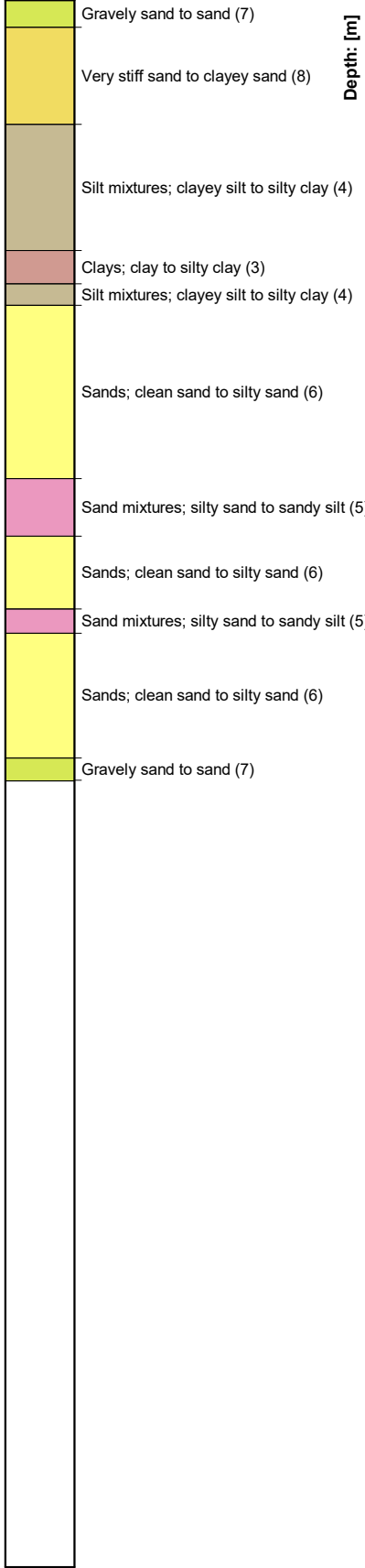


Cone No: 5332
Tip area [cm2]: 10
Sleeve area [cm2]: 150



Location: HASTINGS	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT11
Project ID: P000828	Client: INITIA	Date: 31/07/2020	Scale: 1 : 67
Project: LYNDHURST RD		Page: 1/1	Fig.:
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Classification by Robertson 1990



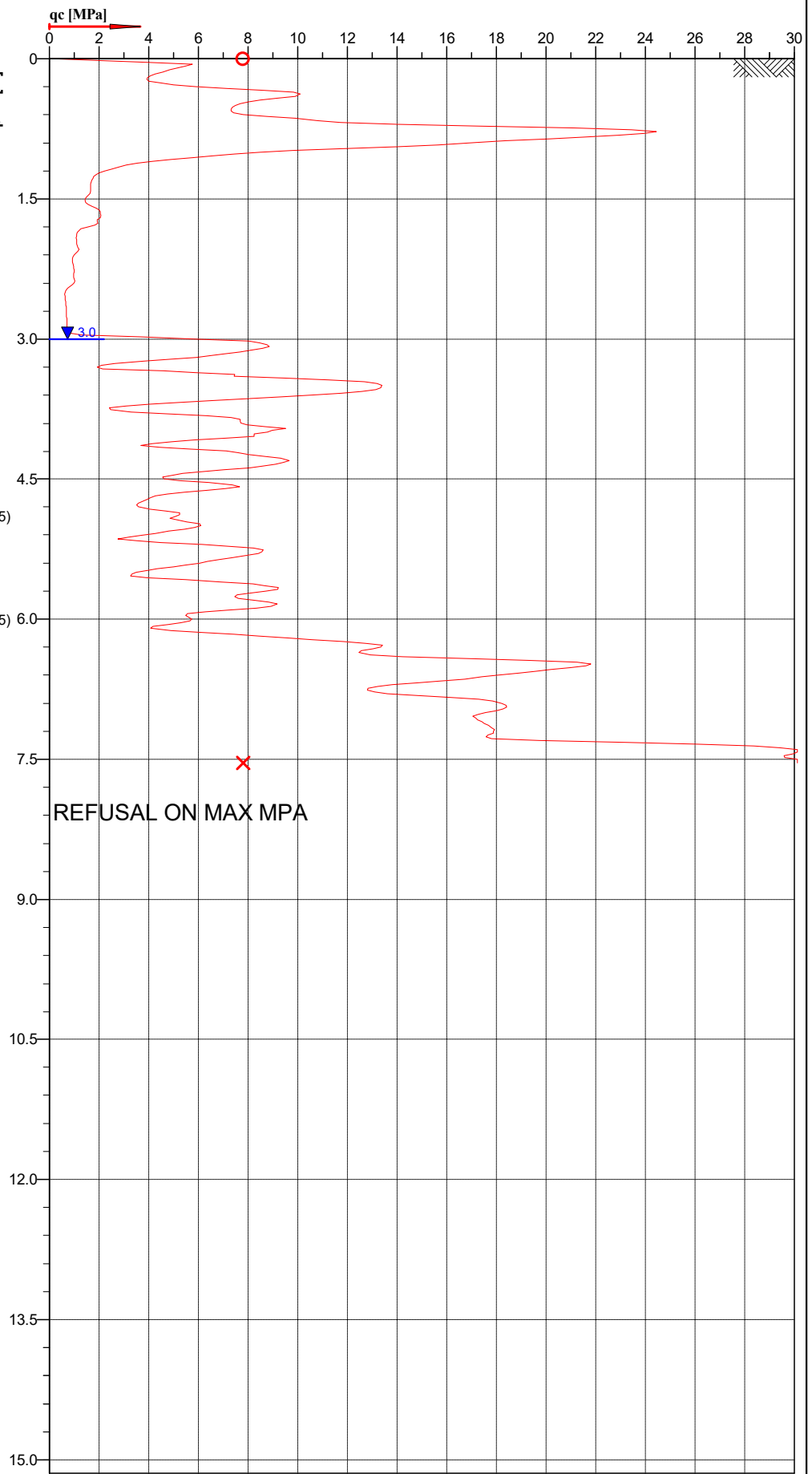
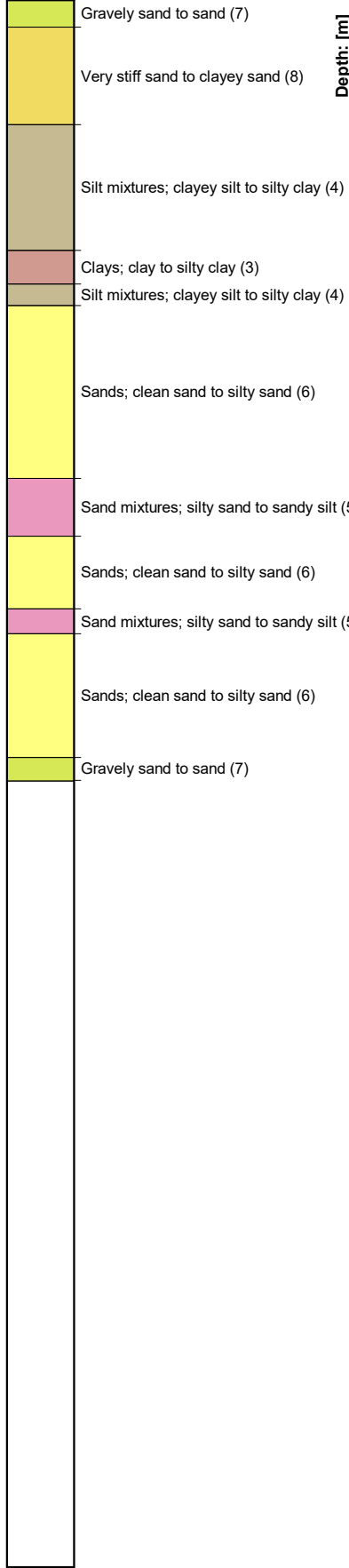
REFUSAL ON MAX MPA




Cone No: 5332
 Tip area [cm²]: 10
 Sleeve area [cm²]: 150

Location: HASTINGS	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test No.: CPT11
Project ID: P000828	Client: INITIA	Date: 31/07/2020	Scale: 1 : 67
Project: LYNDHURST RD		Page: 1/1	Fig.:
S 39.61470 E 176.82657			File: CPT11.cpt

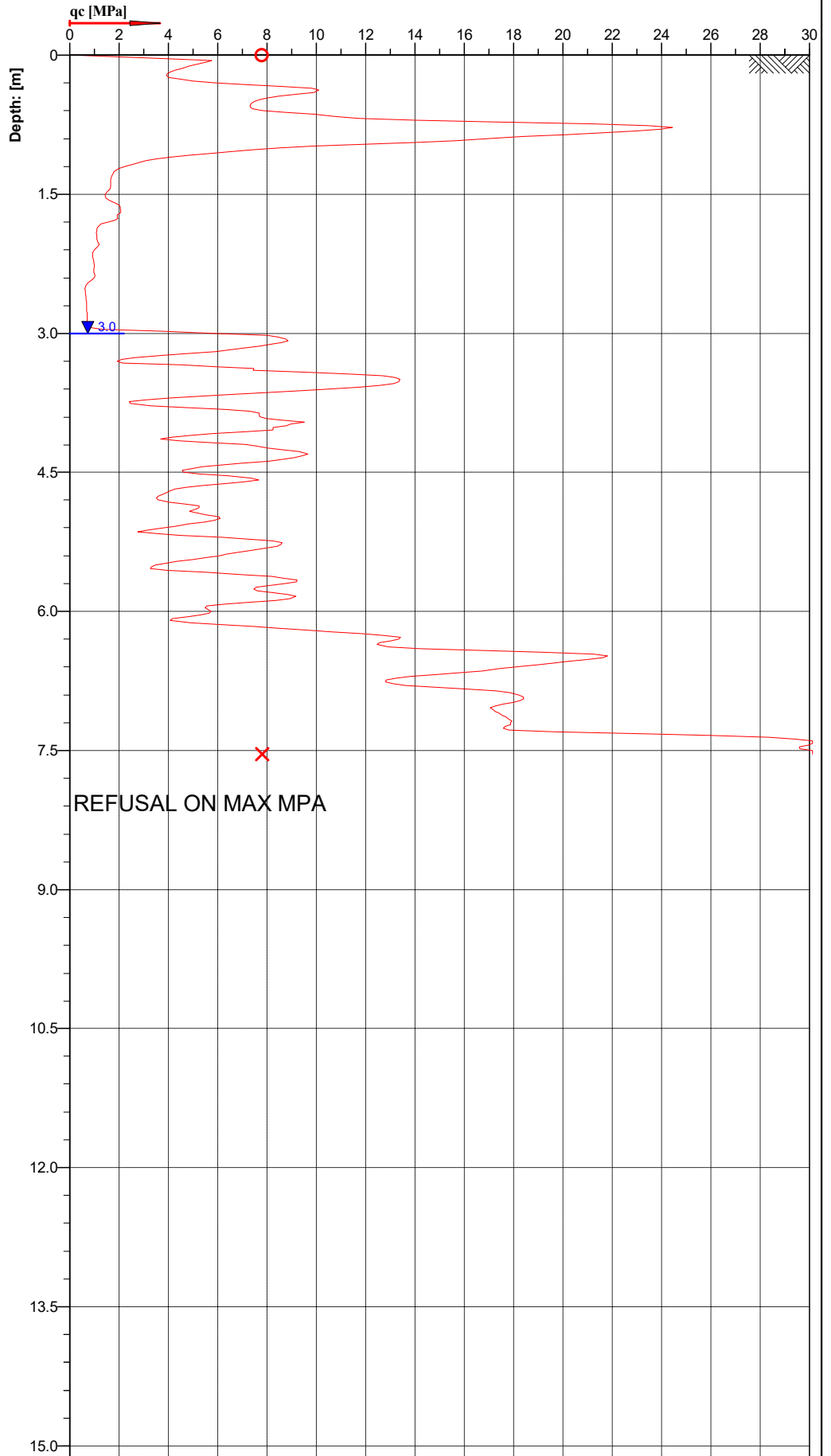
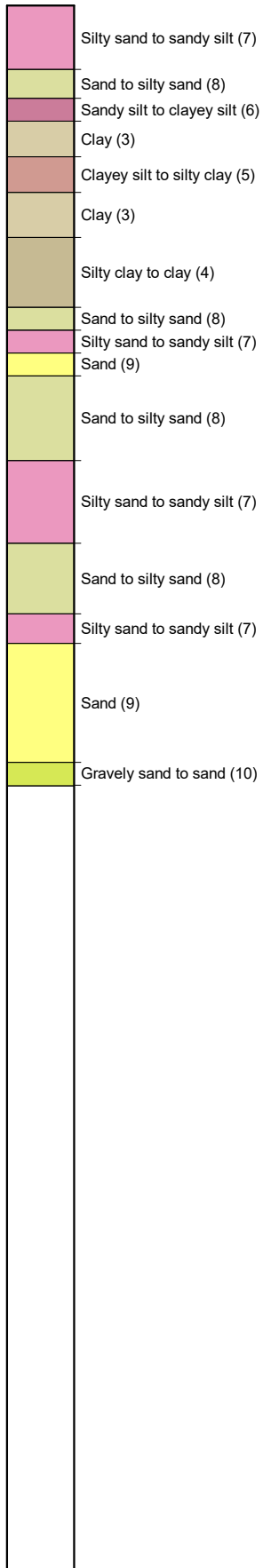
**Classification by
Robertson 1990**




 Cone No: 5332
 Tip area [cm²]: 10
 Sleeve area [cm²]: 150

Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT11
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 65
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
	S 39.61470 E 176.82657			File:	CPT11.cpt		

**Classification by
Robertson 1986**

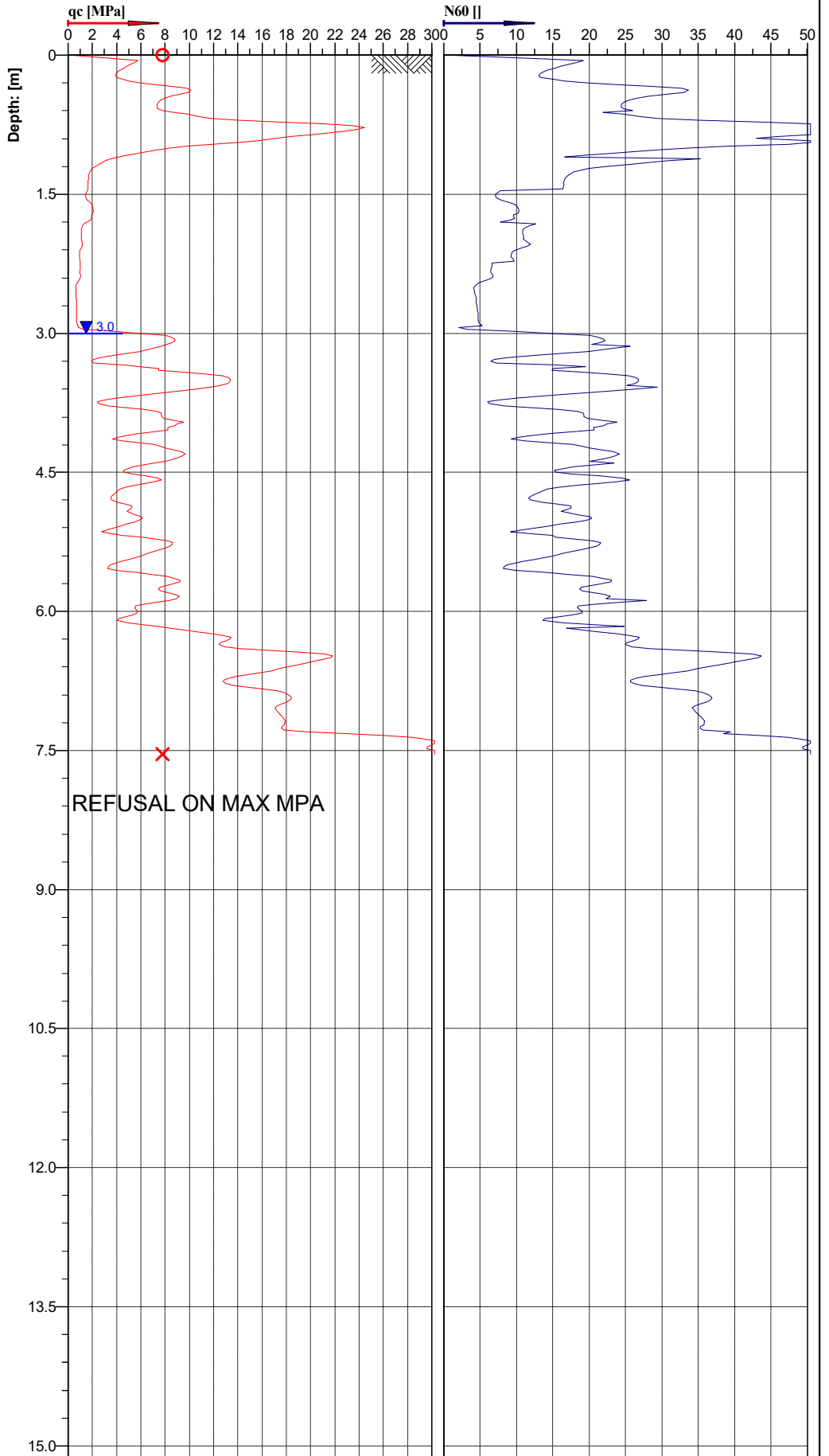
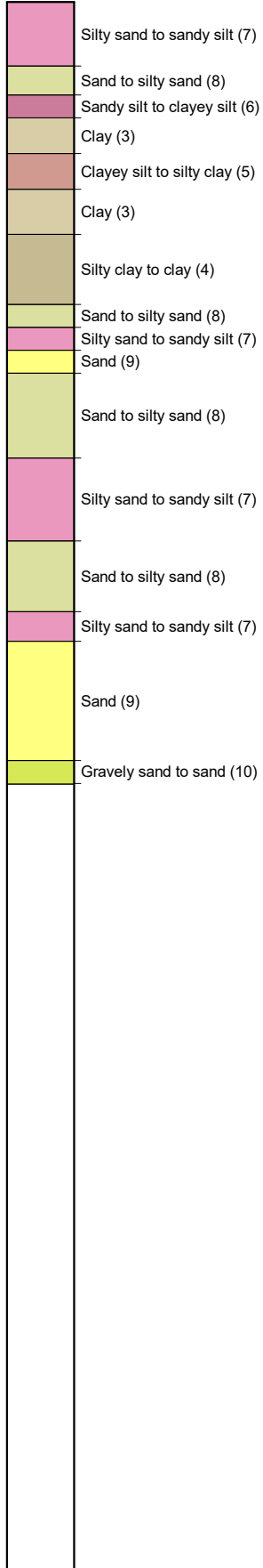


Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT11
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 65
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
	S 39.61470 E 176.82657			File:	CPT11.cpt		

**Classification by
Robertson 1986**



Cone No: 5332
Tip area [cm²]: 10
Sleeve area [cm²]: 150



Location:	HASTINGS	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT11
Project ID:	P000828	Client:	INITIA	Date:	31/07/2020	Scale:	1 : 65
Project:	LYNDHURST RD			Page:	1/1	Fig.:	
	S 39.61470 E 176.82657			File:	CPT11.cpt		

Appendix D: Initia Hand Auger Borehole Logs



HAND AUGER LOG

HOLE NO.:
HA-101

Project Ref.:
P-000828

START DATE: 30/07/2020
END DATE: 30/07/2020
LOGGED BY: BSS
CHECKED BY: RZ

CLIENT: Greenstone Land Developments Ltd **SITE LOCATION:** Lyndhurst Rd, Frimley, Hastings

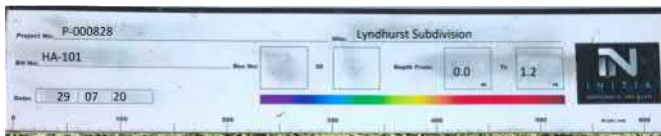
PROJECT: Lyndhurst Subdivision

CO-ORDINATES: 1928425mE, 5607856mN **ELEVATION:** 9m
Co-ordinate system: NZTM **Datum:** NAPIHT1962
Location method: GIS **Level method:** GIS

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm)	VANE SHEAR STRENGTH (kPa) Vane: 2503	WATER
					2 4 6 8 10 12 14 16 18	50 100 150 200 Values	
	SILT, with some clay, with trace sand; brownish grey with dark grey speckles. Very stiff; low plasticity; moist; sand, fine.		0.2	[Cyan cross-hatch pattern]		146	Groundwater Not Encountered
			0.4			44	
	Sandy SILT; light brownish grey. Very stiff; low plasticity; moist; sand, fine.		0.6			149	
			0.8			38	
	0.9m: grades to hard.		1.0			UTP	
			1.2			UTP	
	Sandy SILT with trace gravels; light brownish grey. Hard; low plasticity; moist; sand, fine. End of augering at 1.2m - Gravelly/crunchy sounds at the bottom. EOH: 1.20m		1.4				
			1.6				
			1.8				
			2.0				
			2.2				
			2.4				
			2.6				
			2.8				

REMARKS

1. Test undertaken in Lot 128;
2. Coordinates taken using a hand held GPS. Estimate accuracy of +/- 4m.



- WATER**
- ▼ Standing Water Level
 - ↖ Out flow
 - ↗ In flow
- INVESTIGATION TYPE**
- Hand Auger
 - Test Pit

Ver 2: Generated with CORE-GS by Ceroc - Hand Auger_Initia - 11/08/2020 3:09:25 PM



INITIA
GEOTECHNICAL SPECIALISTS

HAND AUGER LOG

HOLE NO.:
HA-102

CLIENT: Greenstone Land Developments Ltd SITE LOCATION: Lyndhurst Rd, Frimley, Hastings
PROJECT: Lyndhurst Subdivision

Project Ref.:
P-000828

CO-ORDINATES: 1928392mE, 5607904mN ELEVATION: 9m
Co-ordinate system: NZTM Datum: NAPIHT1962
Location method: GIS Level method: GIS

START DATE: 30/07/2020
END DATE: 30/07/2020
LOGGED BY: BSS
CHECKED BY: RZ

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm)	VANE SHEAR STRENGTH (kPa) Vane: 2503	WATER
					2 4 6 8 10 12 14 16 18	50 100 150 200 Values	
	Sandy SILT, with trace clay; light brownish grey with dark grey speckles. Very stiff; low plasticity; moist.		0.2			146	Groundwater Not Encountered
			0.4			47	
	Sandy SILT, with trace clay; light brownish grey with dark grey speckles. Very stiff; low plasticity; moist. End of augering at 0.5m due gravelly layer. EOH: 0.50m		0.6			UTP	
			0.8				
			1.0				
			1.2				
			1.4				
			1.6				
			1.8				
			2.0				
			2.2				
			2.4				
			2.6				
			2.8				

REMARKS

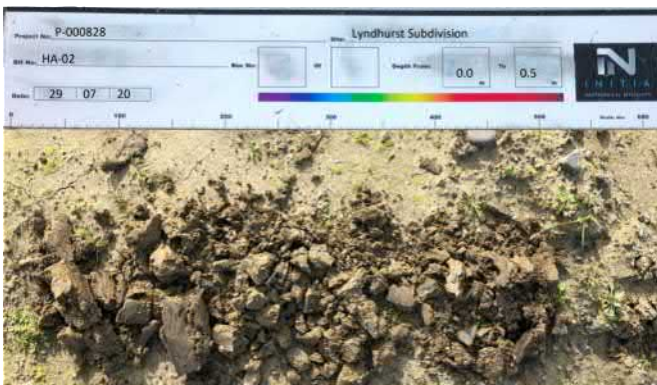
1. Test undertaken in Lot 130;
2. Coordinates taken using a hand held GPS. Estimate accuracy of +/- 4m.

WATER

- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE

- Hand Auger
- Test Pit



HAND AUGER LOG

HOLE NO.:
HA-103

Project Ref.:
P-000828

START DATE: 30/07/2020
END DATE: 30/07/2020
LOGGED BY: BSS
CHECKED BY: RZ

CLIENT: Greenstone Land Developments Ltd **SITE LOCATION:** Lyndhurst Rd, Frimley, Hastings

PROJECT: Lyndhurst Subdivision

CO-ORDINATES: 1928368mE, 5607940mN **ELEVATION:** 9m
Co-ordinate system: NZTM **Datum:** NAPIHT1962
Location method: GIS **Level method:** GIS

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm)	VANE SHEAR STRENGTH (kPa) Vane: 2503	WATER
					2 4 6 8 10 12 14 16 18	50 100 150 200 Values	
	SILT, with some clay, with trace organics and sand; grey with dark grey speckles. Very stiff; moist; sand, fine.		0.2	[Cyan cross-hatch pattern]		126	Groundwater Not Encountered
			0.4			35	
			0.6			131	
	Sandy SILT, with trace clay; yellowish grey. Very stiff; low plasticity; moist; sand, fine.		0.8			32	
			1.0			205+	
	0.9m: grades to hard.		1.2			UTP	
	Sandy SILT, with trace clay and gravels; yellowish grey. Hard; low plasticity; moist; sand, fine. End of augering at 1.2m due gravelly layer. EOH: 1.20m		1.4			-	
			1.6				
			1.8				
			2.0				
			2.2				
			2.4				
			2.6				
			2.8				

REMARKS

1. Test undertaken in Lot 132;
2. Coordinates taken using a hand held GPS. Estimate accuracy of +/- 4m.

WATER

- ▼ Standing Water Level
- ↖ Out flow
- ↗ In flow

INVESTIGATION TYPE

- Hand Auger
- Test Pit



HAND AUGER LOG

HOLE NO.:
HA-104

CLIENT: Greenstone Land Developments Ltd SITE LOCATION: Lyndhurst Rd, Frimley, Hastings
PROJECT: Lyndhurst Subdivision

Project Ref.:
P-000828

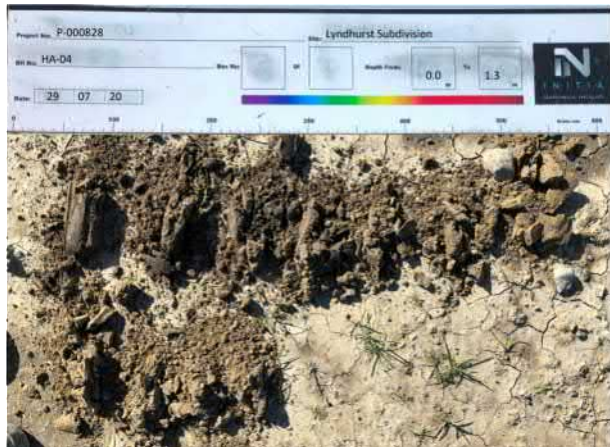
CO-ORDINATES: 1928425mE, 5607931mN ELEVATION: 9m
Co-ordinate system: NZTM Datum: NAPIHT1962
Location method: GIS Level method: GIS

START DATE: 30/07/2020
END DATE: 30/07/2020
LOGGED BY: BSS
CHECKED BY: RZ

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm)					VANE SHEAR STRENGTH (kPa) Vane: 2503				WATER					
					2	4	6	8	10	12	14	16	18		50	100	150	200	Values
	Organic SILT, with trace clay and sand; dark grey. Very stiff, low plasticity; moist.		0.2	[Symbol: Blue cross-hatch pattern]															
			0.4																
	SILT, with minor sand, with trace clay; light brown. Very stiff, non-plastic; moist; sand, fine; End of augering at 1.3m due gravelly layer.		0.6																
			0.8																
	0.9m: grades to hard.		1.0																
	EOH: 1.30m		1.2																
	1.2m - 1.3m: With trace gravel; grey. Gravel, fine.		1.2																
			1.4																
			1.6																
			1.8																
			2.0																
			2.2																
			2.4																
			2.6																
			2.8																

REMARKS

1. Test undertaken in Lot 141;
2. Coordinates taken using a hand held GPS. Estimate accuracy of +/- 4m.



WATER

- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE

- Hand Auger
- Test Pit

HAND AUGER LOG

HOLE NO.:
HA-105

CLIENT: Greenstone Land Developments Ltd **SITE LOCATION:** Lyndhurst Rd, Frimley, Hastings
PROJECT: Lyndhurst Subdivision

Project Ref.:
P-000828

CO-ORDINATES: 1928400mE, 5607969mN **ELEVATION:** 9m
Co-ordinate system: NZTM **Datum:** NAPIHT1962
Location method: GIS **Level method:** GIS

START DATE: 30/07/2020
END DATE: 30/07/2020
LOGGED BY: BSS
CHECKED BY: RZ

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm)	VANE SHEAR STRENGTH (kPa) Vane: 2503	WATER
					2 4 6 8 10 12 14 16 18	50 100 150 200	
	Organic SILT, with trace clay; black. Hard; moist.		0.2	x		205+	205+
	SILT, with trace sand and gravel; brownish grey with black speckles. Hard; non-plastic; moist; sand, fine, gravel, fine; End of augering at 0.5m due gravelly layer. EOH: 0.50m		0.4	x		UTP	UTP
			0.6				-
			0.8				-
			1.0				-
			1.2				-
			1.4				-
			1.6				-
			1.8				-
			2.0				-
			2.2				-
			2.4				-
			2.6				-
			2.8				-

Groundwater Not Encountered

REMARKS

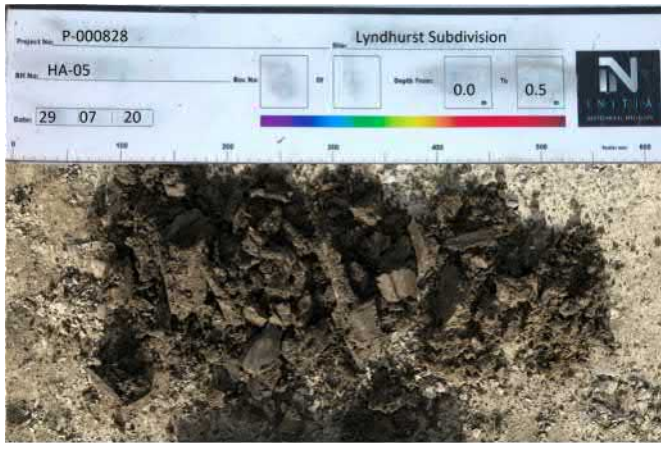
1. Test undertaken in Lot 134;
2. Coordinates taken using a hand held GPS. Estimate accuracy of +/- 4m.

WATER

- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE

- Hand Auger
- Test Pit



HAND AUGER LOG


HOLE NO.:
HA-106

CLIENT: Greenstone Land Developments Ltd **SITE LOCATION:** Lyndhurst Rd, Frimley, Hastings
PROJECT: Lyndhurst Subdivision

Project Ref.:
P-000828

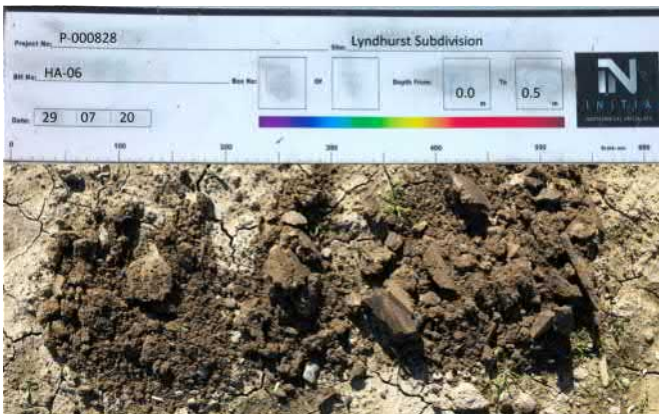
CO-ORDINATES: 1928455mE, 5607955mN **ELEVATION:** 9m
Co-ordinate system: NZTM **Datum:** NAPIHT1962
Location method: GIS **Level method:** GIS

START DATE: 30/07/2020
END DATE: 30/07/2020
LOGGED BY: BSS
CHECKED BY: RZ

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm)	VANE SHEAR STRENGTH (kPa) Vane: 2503	WATER
					2 4 6 8 10 12 14 16 18	50 100 150 200	
	SILT, with trace clay and sand; brown with black speckles. Hard; moist; sand, fine; End of augering at 0.5 due gravelly layer. EOH: 0.50m		0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8			205+ - UTP -	Groundwater Not Encountered

REMARKS

- Test undertaken in Lot 122;
- Coordinates taken using a hand held GPS. Estimate accuracy of +/- 4m.



WATER

- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE

- Hand Auger
- Test Pit

HAND AUGER LOG

HOLE NO.:
HA-107

Project Ref.:
P-000828

START DATE: 31/07/2020
END DATE: 31/07/2020
LOGGED BY: BSS
CHECKED BY: RZ

CLIENT: Greenstone Land Developments Ltd **SITE LOCATION:** Lyndhurst Rd, Frimley, Hastings

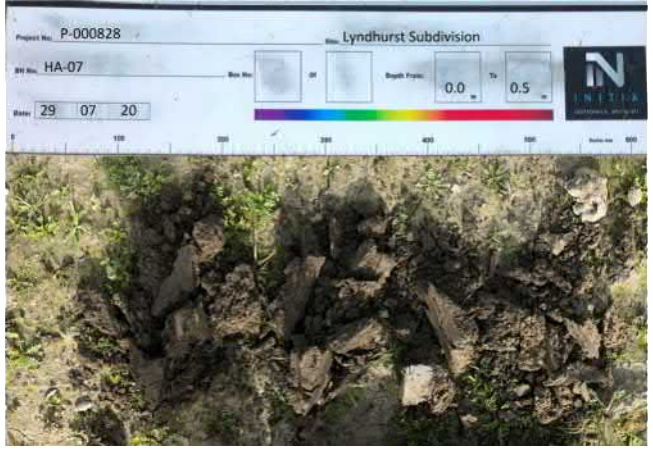
PROJECT: Lyndhurst Subdivision

CO-ORDINATES: 1928434mE, 5607991mN **ELEVATION:** 9m
Co-ordinate system: NZTM **Datum:** NAPIHT1962
Location method: GIS **Level method:** GIS

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm)	VANE SHEAR STRENGTH (kPa) Vane: 2503	WATER
					2 4 6 8 10 12 14 16 18	50 100 150 200 Values	
	SILT, with trace clay and sand; dark grey. Very stiff; low plasticity; moist; sand, fine; End of augering at 0.5m due gravelly layer.		0.2	[Symbol: Blue background with 'x' marks]		146	Groundwater Not Encountered
	EOH: 0.50m 0.5m - 0.5m: With trace gravel. Gravel, fine.		0.4			47	
			0.6			UTP	
			0.8				
			1.0				
			1.2				
			1.4				
			1.6				
			1.8				
			2.0				
			2.2				
			2.4				
			2.6				
			2.8				

REMARKS

1. Test undertaken in Lot 136;
2. Coordinates taken using a hand held GPS. Estimate accuracy of +/- 4m.



- WATER**
- Standing Water Level
 - Out flow
 - In flow
- INVESTIGATION TYPE**
- Hand Auger
 - Test Pit



INITIA
GEOTECHNICAL SPECIALISTS

HAND AUGER LOG

HOLE NO.:
HA-108

CLIENT: Greenstone Land Developments Ltd SITE LOCATION: Lyndhurst Rd, Frimley, Hastings
PROJECT: Lyndhurst Subdivision

Project Ref.:
P-000828

CO-ORDINATES: 1928487mE, 5607982mN ELEVATION: 9m

START DATE: 31/07/2020

Co-ordinate system: NZTM

Datum: NAPIHT1962

END DATE: 31/07/2020

Location method: GIS

Level method: GIS

LOGGED BY: BSS

CHECKED BY: RZ

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm)	VANE SHEAR STRENGTH (kPa) Vane: 2503	WATER
					2 4 6 8 10 12 14 16 18	50 100 150 200 Values	
	SILT, with minor clay, with trace organics and sand; brown with black speckles. Hard; low plasticity; moist; End of augering at 0.5m due gravelly layer. EOH: 0.50m 0.5m - 0.5m: With trace gravel. Gravel, fine.		0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8			UTP - UTP -	Groundwater Not Encountered

REMARKS

1. Test undertaken in Lot 120;
2. Coordinates taken using a hand held GPS. Estimate accuracy of +/- 4m.

WATER

- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE

- Hand Auger
- Test Pit





INITIA

GEOTECHNICAL SPECIALISTS

HAND AUGER LOG

HOLE NO.:
HA-110

CLIENT: Greenstone Land Developments Ltd SITE LOCATION: Lyndhurst Rd, Frimley, Hastings
PROJECT: Lyndhurst Subdivision

Project Ref.:
P-000828

CO-ORDINATES: 1928533mE, 5608014mN ELEVATION: 9m
Co-ordinate system: NZTM Datum: NAPIHT1962
Location method: GIS Level method: GIS

START DATE: 31/07/2020
END DATE: 31/07/2020
LOGGED BY: BSS
CHECKED BY: RZ

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm)	VANE SHEAR STRENGTH (kPa) Vane:				WATER	
					2 4 6 8 10 12 14 16 18	50	100	150	200		Values
	Organics SILT; dark grey. Very stiff, low plasticity; moist.		0.2							UTP	Groundwater Not Encountered
	SILT, with minor clay, with trace organics and sand; orange brown with dark grey speckles. Hard; low plasticity; moist; sand, fine; End of augering at 0.5m due gravelly layer. EOH: 0.50m 0.5m - 0.5m: With trace gravel. Gravel, fine.		0.4							UTP	
			0.6								
			0.8								
			1.0								
			1.2								
			1.4								
			1.6								
			1.8								
			2.0								
			2.2								
			2.4								
			2.6								
			2.8								

REMARKS

1. Test undertaken in Lot 118;
2. Coordinates taken using a hand held GPS. Estimate accuracy of +/- 4m.



WATER

- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE

- Hand Auger
- Test Pit

HAND AUGER LOG

HOLE NO.:
HA-111

Project Ref.:
P-000828

START DATE: 31/07/2020
END DATE: 31/07/2020
LOGGED BY: BSS
CHECKED BY: RZ

CLIENT: Greenstone Land Developments Ltd **SITE LOCATION:** Lyndhurst Rd, Frimley, Hastings

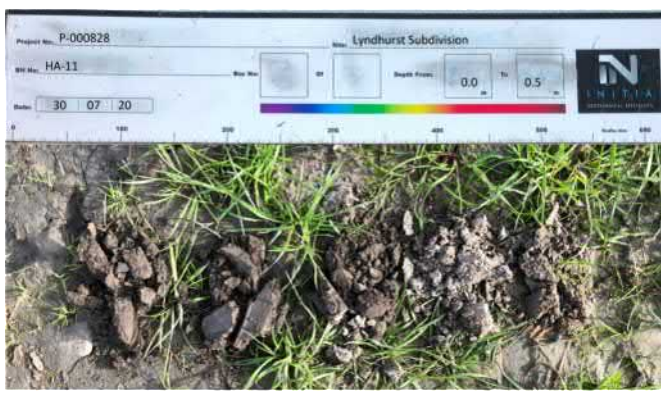
PROJECT: Lyndhurst Subdivision

CO-ORDINATES: 1928500mE, 5608042mN **ELEVATION:** 9m
Co-ordinate system: NZTM **Datum:** NAPIHT1962
Location method: GIS **Level method:** GIS

UNIT	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm)	VANE SHEAR STRENGTH (kPa) Vane: 2503	WATER
					2 4 6 8 10 12 14 16 18	50 100 150 200 Values	
	SILT, with minor clay; black . Firm; low plasticity; moist.		0.0 - 0.2	[Pattern]			
	SILT, with minor clay; light grey. Very stiff; low plasticity; moist.		0.2 - 0.4	[Pattern]		149	Groundwater Not Encountered
	SILT, with some gravel, with minor clay; light grey. Hard; low plasticity; moist; gravel, fine to medium; End of augering at 0.7m due gravelly layer.		0.4 - 0.6	[Pattern]		38	
	EOH: 0.70m		0.6 - 2.8			UTP	

REMARKS

1. Test undertaken in Lot 140;
2. Coordinates taken using a hand held GPS. Estimate accuracy of +/- 4m.



- WATER**
- Standing Water Level
 - Out flow
 - In flow
- INVESTIGATION TYPE**
- Hand Auger
 - Test Pit

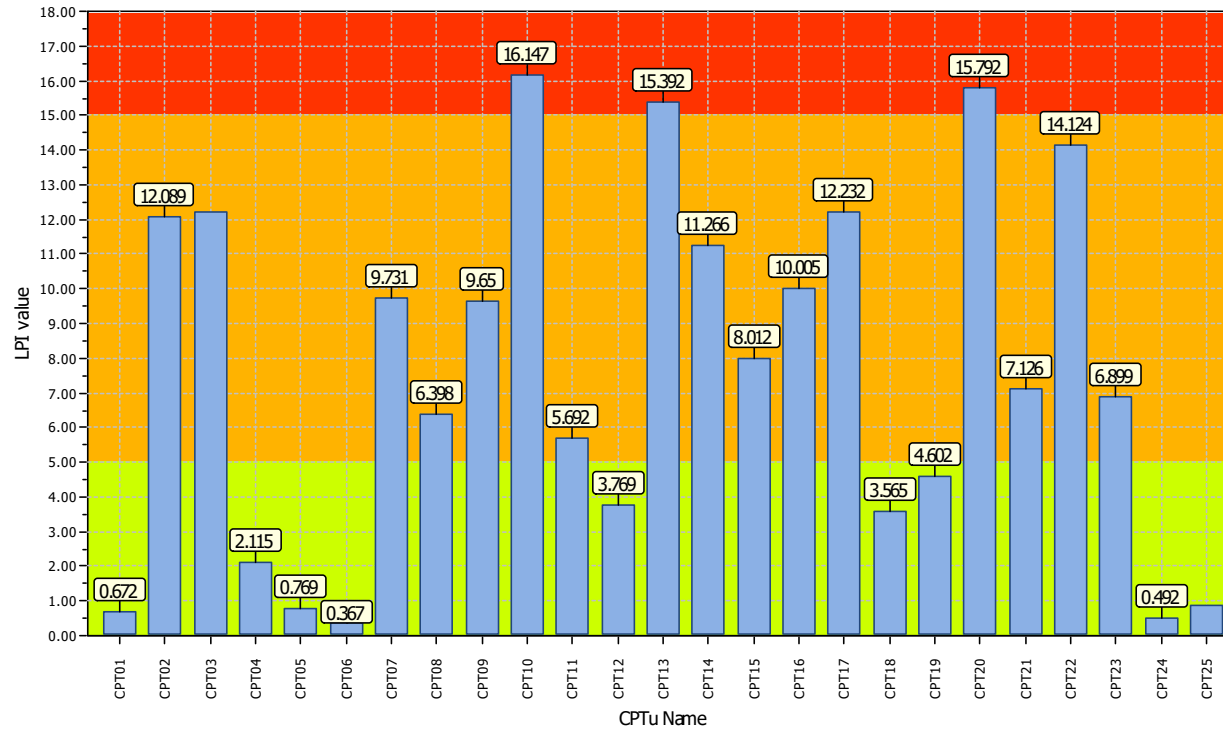
Appendix E: Liquefaction Summary



Project title : P-000828 Lyndhurst, Hastings

Location : Lyndhurst Road, Frimley, Hastings 4120

Overall Liquefaction Potential Index report



LPI color scheme

- Very high risk
- High risk
- Low risk

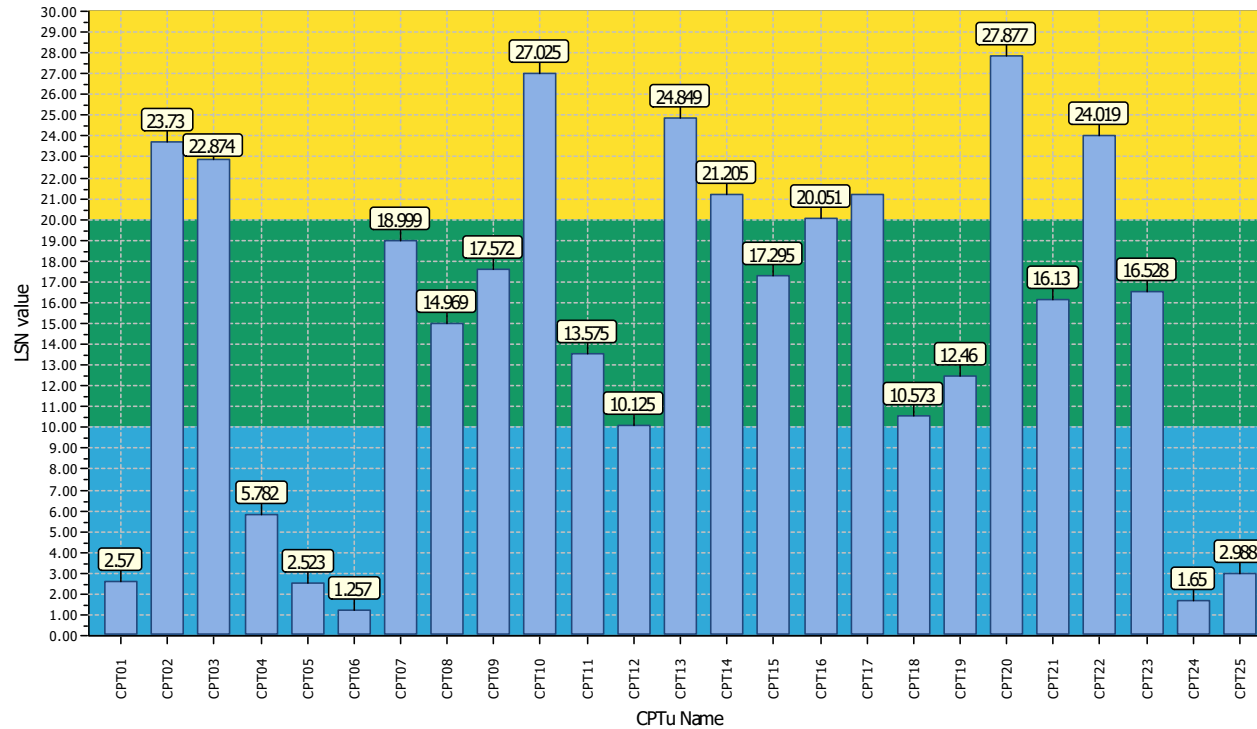
Basic statistics

Total CPT number: 25
 36% low risk
 52% high risk
 12% very high risk

Project title : P-000828 Lyndhurst, Hastings

Location : Lyndhurst Road, Frimley, Hastings 4120

Overall Liquefaction Severity Number report



LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

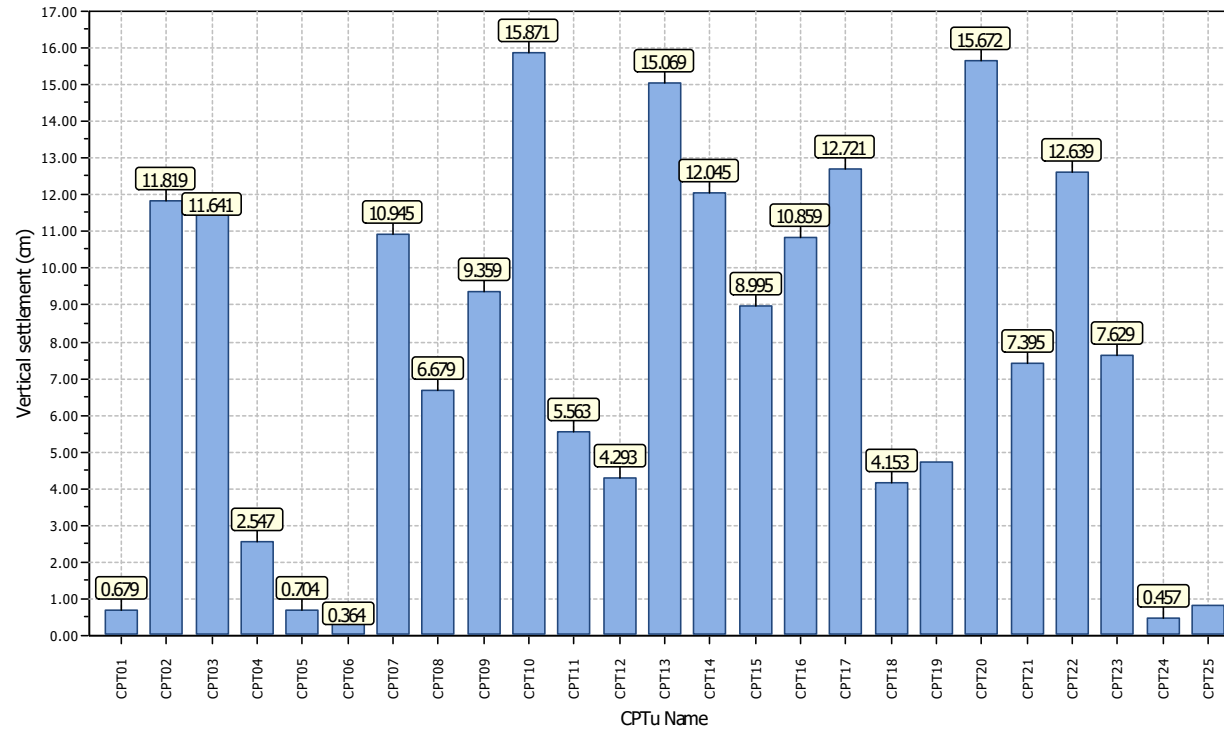
Basic statistics

- Total CPT number: 25
- 24% little liquefaction
- 40% minor liquefaction
- 36% moderate liquefaction
- 0% moderate to major liquefaction
- 0% major liquefaction
- 0% severe liquefaction

Project title : P-000828 Lyndhurst, Hastings

Location : Lyndhurst Road, Frimley, Hastings 4120

Overall vertical settlements report



Appendix F: Earthworks Contractor's PS3



PRODUCER STATEMENT - CONSTRUCTION - 6TH SCHEDULE

CONTRACT: GLDL Stage 12

GREENSTONE RESIDENTIAL DEVELOPMENT

Certification of Construction and Completion of Engineering Works

Issued By: Santo Drainage & Excavation Ltd

(Contractor)

To: Greenstone Land Developments Ltd

(Principal/Developer/Owner/Consultant)

To be Supplied to: HASTINGS DISTRICT COUNCIL _____

(Territorial Authority)

In Respect of: Subdivision Civil Works

(Description of Contract Works)

At: Lyndhurst Road, Frimley, Hastings

(Location and Address)

I Terry Santo a duly authorised representative of

(Full Name of Duty Authorised Agent)

Santo Drainage & Contracting Ltd believe on reasonable grounds that

(Contractor)

_____ has carried out and completed

(Contractor)

All works in accordance with the drawings, specifications and authorised instructions and

variations of contract number _____ except the following _____

Part only as specified in the attached particulars of the works in accordance with the CONTRACT

This certification is furnished to the HDC

Date

8.9.20

(Signature of Authorised Agent on behalf of)



(Contractor)

Santo Drainage & Contracting Ltd

P O Box 123

Waipukurau

(Address)