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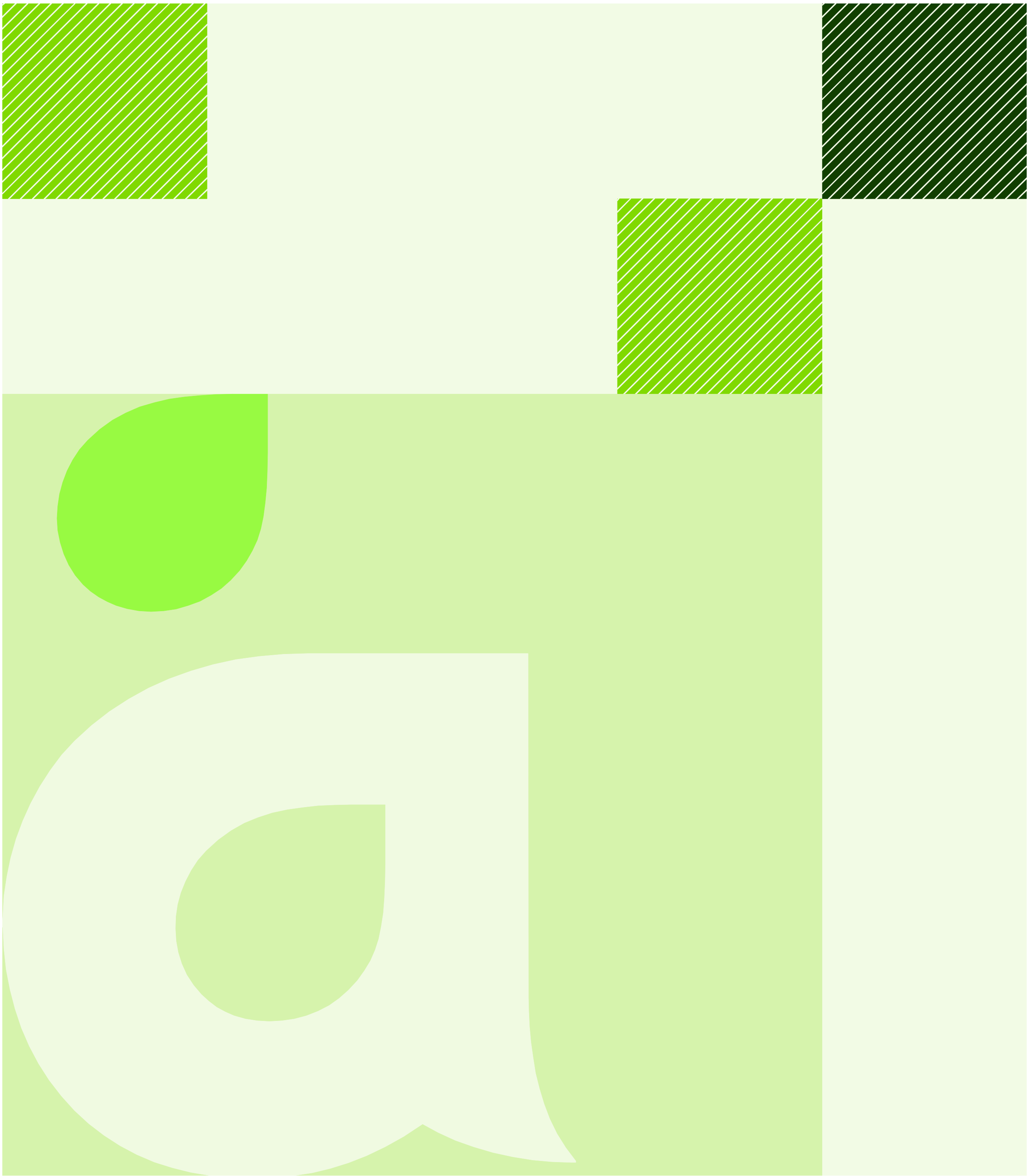

aurecon

Rosemerryn Subdivision, Lincoln

Stages 10 to 18 Geotechnical Investigation Report

Fulton Hogan Land Development Limited

25 September 2015
Revision: 3
Reference: 224464

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Document prepared by:

Aurecon New Zealand Limited
Unit 1, 150 Cavendish Road
Casebrook Christchurch 8051

PO Box 1061
Christchurch 8140
New Zealand

T +64 3 366 0821
F +64 3 379 6955
E christchurch@aurecongroup.com
W aurecongroup.com

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Approval

Author signature		Approver signature	electr. sign
Name	Tim Plunket	Name	Dr Jan Kupec
Title	Geotechnical Engineer	Title	Technical Director – Ground Engineering

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Executive Summary

Introduction

Fulton Hogan Land Development Limited is proposing to subdivide a 26.7ha area of rural land in Lincoln. It will be known as Rosemerryn Stages 10 to 18. The site is located in the central portion of the wider Rosemerryn Subdivision being undertaken by Fulton Hogan Land Development Limited, which when completed Rosemerryn Stages 10 to 18 will comprise 400 residential lots, reserves and associated roading.

Fulton Hogan Land Development Limited has engaged Aurecon to undertake a geotechnical investigation and assessment for the entire Rosemerryn subdivision, including these nine stages. The purpose of the investigation was to assess the suitability of the land for residential development, and in particular to characterise the risk of liquefaction and lateral spreading to the development.

Geotechnical Investigations

Based on the results of our geotechnical investigations the site is underlain by variable geology.

The northern section of the site is typically underlain by:

- 0.1 to 0.7m of topsoil.
- 0.1 to 6.2m of loose to medium dense Sands and Silty Sands interbedded with layers of soft to stiff Sandy Silts and Silts.
- Over 10m of medium dense to very dense Sandy Gravels and Gravels

The southern section of the site is typically underlain by:

- 0.2 to 0.5m of topsoil.
- 2.5 to 7.8m of loose to medium dense Sands and Silty Sands interbedded with layers of soft to stiff Sandy Silts and Silts.
- Over 10m of medium dense to very dense Sandy Gravels and Gravels

Based on groundwater measurements during testing which occurred between 2011 and 2015 and the ECan groundwater model we infer the groundwater level to be approximately between 1m and 3m depth in the northern section and 1m depth in the southern section. Groundwater levels will however vary seasonally or following prolonged rainfall.

Liquefaction Assessment

A liquefaction assessment has been carried out at the site. The assessment indicated the following:

- Based on the O'Rourke et. al. (2012) PGA model the site has been "sufficiently tested" (MBIE Guidelines (2012)) as the median value for the PGA for the 4 September 2010 event exceeded 170% of the SLS PGA (i.e. 1.7 x 0.13g = 0.22g). Therefore, we have considered ground damage observations at the site after the 4 September 2010 earthquake event to help refine our liquefaction assessment.
- GNS Science report on liquefaction in eastern Canterbury (GNS, 2012), review of aerial photography and site observations made by Aurecon and Fulton Hogan staff confirms there was no evidence of liquefaction observed at the site after the 4 September 2010 Darfield earthquake or any subsequent earthquakes part of the 2010 to 2012 Canterbury Earthquake Sequence.

- In all cases the liquefaction assessment calculated that lower levels of vertical settlement and ground damage will occur in a SLS earthquake event than those observed following the 4 September 2010 Darfield Earthquake.
- Due to current topography liquefaction induced lateral spreading is considered to be low.
- Based on our liquefaction assessment and observed damage we infer that minor to moderate land damage from liquefaction is possible in future large earthquakes at parts of the site.

Further information of the liquefaction assessment are outlined in Section 4.4 of this report.

Technical Category Classification

Based on our liquefaction assessment the site in its current form is considered consistent with a mixture of zones of **Technical Category 1 and 2 Classification**. Across Rosemerryn Stages 10 to 18 future land damage from liquefaction is unlikely in the Technical Category 1 area and possible in the Technical Category 2 area in future large earthquakes.

The locations of the various Technical Category zones are shown on Figure 8 in Appendix A.

Due to the potential liquefaction risk at the site, recommendations for the protection of Council vested infrastructure have been made in Section 4.6 of this report.

Soft to Firm Clayey Silty Soils

Soft to firm clayey silty soils may be encountered at relatively shallow depths in most of the southern side of the site and in isolated pockets of the northern side of the site. Based on investigation logs we have split the site into two Zones as follows:

- Zone A – there is potential for soft silt layers being present at 2m depth with thicknesses between 0.3m and 1.0m. There is also another soft layer from 3m with thicknesses up to 2m.
- Zone B – there is potential that soft silt layers will be present in isolated pockets across this part of the site.

The approximate areas of these zones are shown on Figure 9 in Appendix A.

Based on the available investigation logs it is unlikely that shallow bearing for a typical house foundation of 300kPa could be achieved in these areas. Therefore if these soils are encountered *'Good Ground'* as per NZS3604 will not be met and specifically designed foundations will be required based on the building consent investigations.

However, based on our analysis typical TC2 type waffle or beam grid type systems should be suitable as foundation elements. The calculated long term consolidation settlement induced by foundation loading is likely to be within acceptable limits of the NZ Building Code (i.e settlement less than 25mm over 6m). However as this is a subdivision area wide geotechnical report and in line with MBIE guidelines bearing capacities must be confirmed during the detailed house design.

RMA Section 106 Assessment

The site is potentially susceptible to “subsidence” and “inundation” from seismically induced liquefaction. However, using appropriate liquefaction mitigation and remediation measures, as detailed in this report, we believe that the risk imposed by liquefaction will be reduced to an acceptable level. As such, the site will essentially be geotechnically stable land. **Thus in our opinion, the proposed development will generally be free of “erosion,” “falling debris,” “subsidence,” “slippage,” and “inundation” and the proposed development satisfies the intent of RMA Section 106 1(a).**

Provided that appropriate investigation and design inputs are made, as recommended in this report, subsequent use of the land following development is unlikely to accelerate, worsen, or result in material damage to the land, other land, or structures. **In our opinion therefore, the development will comply with the requirements of Clause 106 1(b) RMA.**

The geotechnical investigation was aimed at assessing the site for geotechnical suitability for subdivision into residential lots with associated access roads and rights-of-way. Detailed design of house foundations has not been addressed in the report.

This Revision 3 report updates figures and incorporates Client and Council peer reviewer comment, finalise the site specific Technical Category classification and supersedes all previous revisions.

Our Limitations are attached as Section 7 of this report. This report shall be read as a whole.

1 Introduction

Fulton Hogan Land Development Limited is proposing to subdivide a 26.7ha area of rural land in Lincoln. It will be known as Rosemerryn Stages 10 to 18. The final layout has now been confirmed and will comprise 400 residential lots, reserves and associated roading. The site is located in the central portion of the wider Rosemerryn Subdivision being undertaken by Fulton Hogan Land Development Limited. See Figures 1 and 2 in Appendix A and the Davie Lovell Smith drawing in Appendix B.

Fulton Hogan Land Development Limited has engaged Aurecon to undertake a geotechnical investigation and assessment for the entire Rosemerryn subdivision, including Stages 10 to 18. The purpose of the investigation was to assess the suitability of the land for residential development, and in particular to better characterise the risk of liquefaction and lateral spreading to the development. The scope of the works undertaken was as follows:

- A detailed desk study of readily available geological and geotechnical information available for this site.
- A preliminary site walkover and reconnaissance.
- Review the existing geotechnical work carried out in the area by Aurecon.
- Undertake further geotechnical investigations comprising of three machine drilled boreholes, five cone penetration tests and MASW soundings.
- Undertake an updated and revisited liquefaction hazard assessment based upon the results of the geotechnical data.
- Provide recommendations on potential liquefaction remediation options for the site.
- Provide recommendations for further testing (if required).
- Assess the site against Sections 106 1a) and 1b) of the RMA.
- Prepare this factual and interpretive geotechnical for Rosemerryn Subdivision stages 10 to 18.

This Revision 3 report updates figures and incorporates Client and Council peer reviewer comment, finalise the site specific Technical Category classification and supersedes all previous revisions.

Our limitations are attached as Section 7 of this report. This report shall be read as a whole.

2 Site Conditions

2.1 Site Description

The site is located in the central portion of the wider Rosemerryn subdivision (See Figures 1 and 2 in Appendix A and the Davie Lovell Smith drawing in Appendix B). The main site features are:

- The site has an approximate area of 26.7ha.
- The site is made from two irregularly shaped rectangles, a northern rectangle and a southern rectangle which we have denoted the northern and southern section respectively.
- The site is bound to the north by rural land, to the west by rural land and previous stages of the Rosemerryn subdivision, to the south by previous stages of the Rosemerryn subdivision and Edward Street and to the east by future stages in the Rosemerryn subdivision which is currently used for farming activities.
- There is a small stream which runs through the Rosemerryn subdivision and divides the northern section from the southern section. The stream is approximately 0.5m deep and 2m to 3m wide with no significant bank.
- It is understood that there will be not stormwater basins or stormwater channels built as part of the subdivision.
- The site is currently being used for pastoral and cropping farming activities and is covered in barley and grass.
- Current drainage is inferred to be via direct soakage to the ground or via runoff to the small stream.

2.2 Regional Geology

The regional geology of the site is described in the Institute of Geological and Nuclear Sciences (GNS) QMaps (as shown on the Canterbury Geotechnical Database (CGD, 2015) as *"Modern river floodplain / low-level degradation terrace. Unweathered, variably sorted gravel / sand / silt / clay. Surfaces <2 degree slope (Q1a)".*

2.3 Seismicity

The GNS Science Active Fault System database (GNS, 2011a) indicates that the site is located approximately 12km south-east of the eastern extension of the Greendale Fault. Movement on the Greendale Fault was responsible for the Magnitude M_w7.1 Darfield (Canterbury) Earthquake on 4 September 2010.

The site is also located:

- 16km south-west of the epicentre of the Magnitude M_w6.2 Christchurch Earthquake on 22 February 2011 (GNS, 2011b);
- 21km south-west of the epicentre of the Magnitude M_w6.0 major aftershock on 13 June 2011 (GNS, 2011b); and
- 23km south-west of the epicentre of the Magnitude M_w5.9 major aftershock on 23 December 2011 (GNS, 2011b).

Based on the O'Rourke et. al. (2012) (as shown on the CGD, 2015) peak ground accelerations of approximately 0.34g were experienced at the site during the 4 September 2010 Darfield Earthquake.

2.4 Recorded Earthquake Damage

Based on the GNS Science report “Review of liquefaction hazard information in eastern Canterbury, including Christchurch City and parts of Selwyn, Waimakariri and Hurunui” (GNS, 2012), as shown on Canterbury Maps (2015), there was no observed liquefaction induced damage after the 4 September 2010 or 22 February 2011 earthquakes. But there were minor observed areas within 500m of the site. The locations of observed damage are shown in Figures 3 and 4 in Appendix A.

Following reviews of aerial photography, discussions with Fulton Hogan staff that are familiar with the site, and Aurecon site walk overs in 2011, 2012, 2013 and 2015, no surface expression or manifestation of liquefaction induced ground damage was observed. This confirms the lack of observations noted in the GNS Science report.

2.5 MBIE Land Classification

The current land classification for the site, according to the Ministry of Business Innovation and Employment (MBIE) Technical Categories map (as shown on the CGD, 2015), is “*N/A – Rural & Unmapped*”. But to the east of the site on the eastern side of Elsmere Road it is classified as “*Technical Category 2*” and to the west of the site it is classified as “*Technical Category 1*”. “*N/A – Rural & Unmapped*” means that normal consenting procedures apply in these areas. “*Technical Category 1*” means that future land damage from liquefaction is unlikely, and ground settlements are expected to be within normally accepted tolerances. Standard foundations (NZS 3604) are acceptable subject to shallow geotechnical investigation. “*Technical Category 2*” means that minor to moderate land damage from liquefaction is possible in future large earthquakes. Lightweight construction or enhanced foundations are likely to be required such as enhanced concrete raft foundations (i.e. stiffer floor slabs that tie the structure together).

3 Geotechnical Review and Site Investigations

3.1 General

The objective of the geotechnical review and site investigation was to investigation the ground and groundwater conditions across the site in order to assess the suitability of the site for subdividing into residential sections.

An initial geotechnical assessment investigation was carried out across the wider site between August and September 2011. Additional testing on these stages was undertaken between April 2012 and January 2015 to provide information for detailed liquefaction risk assessment as part of the subdivision consenting and design process.

The geotechnical review and investigation comprised the following:

- A review of publically available geotechnical information from Environment Canterbury and the Geotechnical Database.
- Cone Penetrometer Testing supervised by Engineering Geologists and Geotechnical Engineers from Aurecon.
- Excavation and logging of test pits by Engineering Geologists from Aurecon.
- Borehole drilling and logging by Engineering Geologists and Geotechnical Engineers from Aurecon.
- Undertaking of Multi-channel Analysis of Surface Waves (MASW) profiling to generate shear wave velocity profiles.

This section of the report describes the geotechnical testing undertaken on the site.

3.2 Environment Canterbury GIS Data

A review of the Environment Canterbury GIS Database (ECan, 2015) indicates five Environment Canterbury boreholes with logs on the site. The borehole logs, locations, and depths are summarised in Table 1 below.

Table 1: Summary of ECan borehole logs

Borehole	Location	Depth	Summary of Stratigraphy
M36/8672	In eastern side of southern section	6.0m	• 0 to 0.2m – Topsoil • 0.2 to 6.0m – Silty Sand, Silt Sandy, Clayey Silt and Silty Clay
M36/8673	To the west of the southern section	6.0m	• 0 to 0.2m – Topsoil • 0.2 to 6.0m – Clayey Silt and Silty Clay
M36/8677	In the south-eastern side of the northern section	5.2m	• 0 to 0.2m – Topsoil • 0.2 to 2.8m – Silt and Silty Clay • 2.8 to 5.2m – Gravel
M36/8678	In the western side of the northern section	5.2m	• 0 to 0.2m – Topsoil • 0.2 to 1.0m – Silty Clay • 1.0 to 1.8m – Sandy Gravel and Silty Gravel • 1.8 to 2.8m – Silty Clay with no to some Gravel. • 2.8 to 5.2m – Silty Gravel
M36/8681	In the northern side of the northern section	4.5m	• 0 to 0.2m – Topsoil • 0.2 to 1.8m – Silt and Silty Sand mixed with Gravel • 1.8 to 4.5m – Gravel

The locations of the ECan borehole logs are presented in Figure 5 in Appendix A and the borehole logs are presented in Appendix C.

3.3 Canterbury Geotechnical Database

A review of the Canterbury Geotechnical Database (CGD, 2015) indicates one borehole log near to the site. As the site is in Lincoln there is no other applicable information is available on the Canterbury Geotechnical Database. The borehole log, location, and depth are summarised in Table 2 below.

Table 2: Summary of CGD borehole logs

Borehole	Location	Depth	Summary of Stratigraphy
BH_33771 (Borehole 3)	To the west of the northern section	10.5m	• 0 to 0.5m – Topsoil • 0.5 to 3.1m – Silty Sand • 3.1 to 3.7m – Sand • 3.7 to 10.5m – Sandy Gravel with a sand lens between 5.0 and 5.15m.

The location of CGD log is presented in Figure 5 in Appendix A and the borehole log is presented in Appendix D.

3.4 Cone Penetration Testing

69 Cone Penetration Tests (CPT) were undertaken in the vicinity of Stages 10 to 18 of the Rosemerryn Subdivision to effective refusal (a sustained tip bearing over 30MPa) at depths between 0.7m and 10.2m depth. The locations of the CPTs are shown in Figure 6 in Appendix A and the logs are presented in Appendix E.

The CPT logs indicate:

Northern section of the site

- Surface to 0.4-6.5m – Interbedded layers Sands to Silty Clays
- 0.4-6.5m onwards – Sandy Gravels

Southern section of the site

- Surface to 3.0-8.0m – Interbedded layers Sands to Silty Clays
- 3.0-8.0m onwards – Sandy Gravels

3.5 Test Pit Excavations

45 test pit excavations were undertaken in the vicinity of Stages 10 to 18 of the Rosemerryn Subdivision to a maximum achievable depth of 2.0m and 4.2m due to the test pits collapsing or encountering very dense gravels. The test pits were logged in accordance with the New Zealand Geotechnical Society's field description of soil and rock (NZGS, 2005). The locations of the test pits are shown in Figure 6 in Appendix A and the logs are presented in Appendix F together with an explanatory sheet outlining the terms and symbols on the logs.

The test pits logs indicate:

Northern section of the site

- Surface to 0.2-0.5m – Topsoil
- 0.2-0.5m to 0.4-3.7m – Sand, Silty Sand, Sandy Silt, Silt
- 0.4-3.7m onwards – Gravel and Sandy Gravel

Southern section of the site

- Surface to 0.3-0.4m – Topsoil
- 0.3-0.4m onwards – Sand, Silty Sand, Sandy Silt, Silt

3.6 Boreholes

Five machine boreholes with Standard Penetrometer Testing (SPT) were drilled in the vicinity of Stages 10 to 18 of the Rosemerryn Subdivision. The boreholes were drilled to the target depth between 10.5m and 15.2m and were logged in accordance with the New Zealand Geotechnical Society's field description of soil and rock (NZGS, 2005). The locations of the boreholes are shown in Figure 6 in Appendix A and the Aurecon and McMillan logs are presented in Appendix G.

The test pits logs indicate:

Northern section of the site

- Surface to 0.1-0.7m – Topsoil
- 0.1-0.7m to 0.1-3.8m – Interbedded Sand, Silty Sand, Sandy Silt and Silt
- 0.1-3.8m onwards – Predominately Sandy Gravel and Gravel with minor sand lenses up to 1.5m thick.

Southern section of the site

- Surface to 0.4m – Topsoil
- 0.4 to 6.8m – Silt and Silty Sand
- 6.8m onwards – Sandy Gravel

3.7 MASW Soundings

A series of 12 Multi-channel Analysis of Surface Waves (MASW) profile lines were undertaken by Southern Geophysical Limited. These profile lines total 3.1km in length and comprise individual MASW soundings at approximately 10m centres. From the MASW soundings, shear wave velocity profile sections have been produced for the upper 25m of the soil profile. The MASW soundings were undertaken to obtain information between the physical control points (CPT, borehole and test pits) and in particular it provided information on the start of the gravel layer in both sections and sand lens in the gravel layer though the upper profile in the northern section. The locations of the profile lines are shown in Figure 7 in Appendix A and the velocity profiles are presented in Appendix H.

The shear wave velocity (V_s) profiles when calibrated to the CPT, test pit and borehole logs indicate:

Northern section of the site

- Upper Sands and Silts – V_s < 180m/s
- Gravels (Upper 10m) – 180m/s < V_s < 350 m/s
- Sand Lenses – 200m/s < V_s < 250 m/s
- Gravels (Deeper) – 350m/s < V_s

Southern section of the site

- Upper Sands and Silts – V_s < 180m/s
- Gravels (Upper 10m) – 180m/s < V_s < 250 m/s
- Gravels (Deeper) – 250m/s < V_s

3.8 Ground Water

Groundwater levels have been recorded from the four sources as follows:

- After the CPTs water measurements have been taken, where possible, when the rods have been removed these show water at approximately 1.9m depth in the northern section.
- From the test pit logs groundwater was encountered at depths between 2.0m and 3.6m on the northern section and between 2.0m and 3.8m on the southern section.
- During the drilling of the machine boreholes static ground water was observed between 1.8m and 3.8m on the northern section and 1.2m in the southern section.
- Groundwater level has been recorded in the CGD borehole by the northern section at 2.1m depth.

Groundwater levels are expected to vary seasonally or with periods of high or low precipitation.

4 Engineering Considerations

4.1 General

Fulton Hogan Land Development Limited is proposing to subdivide 26.7ha area of rural land in Lincoln. It will be known as Rosemerryn Stages 10 to 18 and comprises 400 residential lots and reserve areas. To fulfil the Ministry of Business, Innovation and Employment (MBIE, 2012) guidelines on residential development, the liquefaction risk at the site needs to be quantified. Once this liquefaction risk is quantified then appropriate mitigation measures (if required) can be developed as part of the physical site development.

This section of the reports outlines details of our liquefaction assessment, and presents our recommendations for liquefaction mitigation options as part of the site development.

4.2 Geotechnical Ground Model

Based on the results of our geotechnical site investigation we infer a ground profile as presented in Table 3 and 4.

Table 3: Inferred ground profile – northern section of site

Unit	Depth to Start of Layer	Depth to End of Layer	Material
1	Surface	0.1 to 0.7m	Topsoil
2	0.1 to 0.7m	0.4 to 6.5m	Loose to medium dense Sands and Silty Sands interbedded with layers of soft to stiff Sandy Silts and Silts
3	0.4 to 6.5m	15m onwards	Predominately medium dense to very dense Sandy Gravels and Gravel with occasional sand lenses up to 1.5m thick

Table 4: Inferred ground profile – southern section of site

Unit	Depth to Start of Layer	Depth to End of Layer	Material
1	Surface	0.2 to 0.5m	Topsoil
2	0.2 to 0.5m	3.0 to 8.0m	Loose to medium dense Sands and Silty Sands interbedded with layers of soft to stiff Sandy Silts and Silts. With a 0.5m to 2m soft to firm Clayey Silt starting approximately 2m depth.
3	3.0 to 8.0m	15m onwards	Medium dense to very dense Sandy Gravels and Gravels

Based on our ground investigations and the ECan groundwater model we infer groundwater levels to be approximately between 1m and 3m below ground level on the northern section of the site and to be approximately 1m below ground level on the southern section of the site.

Groundwater levels are expected to vary seasonally or with period of high or low precipitation.

4.3 Site Flexibility

We have assessed the site flexibility based on the following:

- Site stratigraphy comprises approximately sands and silts underlain by gravels to at least 15m depth (maximum depth investigated at the site).
- Clause 3.1.3 and Table 3.2 of NZS 1170.5:2004.

We consider that the site subsoil category in terms of NZS 1170.5:2004 Clause 3.1.3 is Class D (Deep soil site).

4.4 Liquefaction Assessment

4.4.1 General

Under cyclic loading (i.e. during an earthquake) loose, non-cohesive materials such as gravels, sands, silty-sands, tend to decrease in volume. This tendency to decrease in volume is much greater in loose than in dense soils. When loose non-cohesive soils are saturated and rapid loading occurs under undrained conditions, the soils densification causes pore water pressure to increase. The increase in pore water pressure results in a loss of soil strength due to a decrease in effective stress and eventually liquefaction occurs when the effective stress drops to zero. Liquefaction can lead to large displacements of foundations, flow failures of slopes and ground surface settlement, sand boils, and post-earthquake stability failures.

This assessment quantifies the risk of future liquefaction in terms of the technical category classification system outlined in the MBIE (2012) guidelines. This classification system is divided into three technical categories that reflect both the liquefaction experience to date and future performance expectations. The categories and corresponding criteria are summarised as follows:

- **Technical Category 1 (TC1)** – Future land damage from liquefaction is unlikely, and ground settlements are expected to be within normally accepted tolerances.
- **Technical Category 2 (TC2)** – Minor to moderate land damage form liquefaction is possible in future large earthquakes.
- **Technical Category 3 (TC3)** – Moderate to significant land damage from liquefaction is possible in future large earthquakes.

MBIE (2012) has indicated the following liquefaction and lateral spreading deformation limits for house foundations as summarised in Table 5 below:

Table 5: Liquefaction deformation limits and house foundation implications

Technical Category	Index Liquefaction Deformation Limits				Likely Implication for House Foundations (subject to individual assessment)
	Vertical		Lateral Spread		
	SLS	ULS	SLS	ULS	
TC1	15mm	25mm	Nil	Nil	Standard NZS3604 type foundations with tied slabs
TC2	50mm	100mm	50mm	100mm	MBIE enhanced foundation solutions
TC3	>50mm	>100mm	>50mm	>100mm	Site specific foundation solution

In determining the liquefaction potential at the site, the main factors to be considered are:

- How has the site performed during the major seismic events of the Canterbury earthquake sequence?
- Which layers have liquefied?
- What is the likelihood of further liquefaction in the future?
- How the potential liquefaction affects the development?

Each of these is considered below.

Observations after Previous Major Earthquake Events

As outlined in Section 2.4 there is no evidence of liquefaction observed at the site after the 4 September 2010 Darfield earthquake or any subsequent earthquakes part of the 2010 to 2012 Canterbury Earthquake Sequence. This suggests that limited potential for soil liquefaction at the site.

Potential for Liquefaction

Three primary factors contribute to liquefaction potential:

- Soil grading and density.
- Groundwater.
- Earthquake intensity and level of ground shaking.

Each of these is discussed below.

Soil Grading and Density

The CPT logs show layers of loose to medium dense sands, silty sands and sandy silts. These layers are considered to be potentially susceptible to liquefaction from a soil grading and density perspective.

Groundwater

We have adopted a groundwater table between 1m and 3m below ground level for the northern section and a groundwater table at 1m below ground level for the southern section. Therefore, soils are potentially liquefiable from a depth of 1m to 3m from a saturation criterion. It should be noted that groundwater levels are subject to seasonal changes.

Earthquake Intensity and Level of Shaking

The level of ground shaking is one of the key factors in determining whether liquefaction will or will not occur. For this study, we have assessed the three design levels of shaking outlined in the MBIE Guidelines plus two peak ground acceleration cases of the 4 September 2010 earthquake event. We have considered the 4 September 2010 Darfield earthquake as there is PGA data available for the site which shows the levels of shaking was larger than an SLS event. Therefore the 4 September 2010 earthquake provides an upper bound indicator of ground damage and settlements likely to occur in an SLS event. The levels of shaking used are as follows:

Table 6: Earthquake events for liquefaction analysis

Earthquake Event	Magnitude	Peak Ground Acceleration
4 September 2010-a	$M_W7.1^{(1)}$	$0.34g^{(1)}$
4 September 2010-b	$M_W7.1^{(1)}$	$0.20g^{(2)}$
ULS	$M_W7.5$	0.35g
SLS-a	$M_W7.5$	0.13g
SLS-b	$M_W6.0$	0.19g

(1) Magnitude and peak ground acceleration from O'Rourke et. al. (2012) (as shown on the CGD 2014)

(2) Approximately 65% (1/170%) of the peak ground acceleration of the O'Rourke et. al. (2012) to account for uncertainty of PGA model

For an Ultimate Limit State (ULS) earthquake buildings are expected to retain their structural integrity and form during a ULS earthquake event and not endanger life. Some plastic deformation of structural elements within the structure is expected to occur but ideally the damage can be repaired and the structure can be returned to service after the event, although repair may be uneconomical.

For a Serviceability Limit State (SLS) earthquake buildings are expected to perform well for the SLS event and be returned to service after limited repair.

4.4.2 Liquefaction Potential Assessment

The ground investigations show that the site is directly underlain by sandy and silty soils which in turn is underlain by predominately gravels with some sand lenses. Based on the geotechnical ground investigations the gravels have been assessed to be non-liquefiable in design level events due to the recorded relative densities and partial size. Therefore to define the liquefaction hazard at the site we need to assess the liquefaction potential of the upper soils as well as the sand lenses within the gravel layers. To assess the liquefaction potential of the upper soils we have used a cone penetration test (CPT) assessment and to assess the liquefaction potential of the sand lenses we have considered the relative density of the sandy layers from the SPT and shear wave velocity data.

As the Bradley and Hughes (2012a, b) ground shaking model does not extend into Lincoln area we have considered the O'Rourke et al (2012) PGA model. Based on this PGA model and the MBIE Guidelines (2012) the site has been 'sufficiently tested' as the median value for the PGA for the 4 September 2010 event exceeded 170% of the SLS PGA (i.e. 1.7 x 0.13g = 0.22g). Therefore, we have also considered ground damage observations at the site after the 4 September 2010 earthquake event to help refine our liquefaction assessment.

Liquefaction in the Deeper Soils

A sand lens was encountered in a borehole BH102 as well as other sand lenses being inferred in the MASW soundings. For this reason in our liquefaction assessment we have considered the liquefaction hazard of these layers.

To assess liquefaction of these sand lenses we have considered an SPT undertaken in this layer and shear wave velocity profile obtained from the MASW sounding and well as the mechanism of liquefaction occurring, the likely damage from it occurring and the previous observed damage or lack thereof.

Using the single SPT (BH102 at 4.56m depth) we have in a sand lens we have assessed the liquefaction potential of this layer based on the Boulanger and Idriss (2014) SPT based liquefaction assessment method assuming a clean sand. The calculated factors of safety are shown in the Table below:

Table 7: Summary of SPT based liquefaction analysis for sand lenses

Earthquake Event	Calculated Factor of Safety Against Liquefaction
4 September 2010-a	0.4
4 September 2010-b	0.7
SLS-a	1.0
SLS-b	0.8
ULS	0.4

From this SPT based liquefaction assessment, sand lens are assessed as being is highly liquefiable even at relatively low levels of shaking with the factor of safety against liquefaction for 4 September 2010 event calculated to have a factor of safety between a SLS and ULS design event.

To supplement this SPT we have also considered the shear wave velocity obtained from the MASW soundings. Based on the method outlined in Idriss and Boulanger (2008) the maximum shear wave velocity for liquefiable soils is 215m/s. Therefore in the initial liquefaction analysis for the site we have considered that all soils with shear wave velocities less than 200m/s are potentially liquefiable in a design level event. This shows that there is limited potential for liquefaction to occur within in these sand lenses.

These two assessments show differing results. For this reason we have considered the mechanism of the liquefaction process. When loose non-cohesive soils are saturated and rapid loading occurs under undrained conditions, the soils densification causes pore water pressure to increase. The increase in pore water pressure results in a loss of soil strength due to a decrease in effective stress and eventually liquefaction occurs when the effective stress drops to zero. However, as these sand lenses as surrounded by gravel drainage effects may occur, limiting and reducing the build-up of excess pore water pressure, thus limiting liquefaction occurring. Therefore the liquefaction hazard of these sand lenses will be reduced.

The effects of these sand lenses liquefying also required to be considered. Borehole BH102 shows 4.5m of medium to very dense gravels overlying the potentially liquefiable sand lens. The MASW profiles suggest that this layer of medium dense to very dense gravels is as thin as 3m in some areas. Therefore based on observations in Christchurch if these sand layers were to liquefy the damage to shallow founded structures will likely be suppressed due to this medium dense to very dense gravel layer.

Lastly no significant differential damage, including settlement, was observed across areas with sand lens and areas without. Which suggests that either theses layers did not liquefy or the upper gravel layer has supressed the liquefaction induced damage in these areas.

For these reasons we consider the liquefaction or liquefaction effects occurring in these deeper sand lenses to be limited concerns to shallow founded domestic structures and therefore we have not considered it further in our assessment. Instead we have only considered liquefaction in the upper soils as the main driving mechanism of the site liquefaction hazard.

Liquefaction in the Upper Soils Methodology

The ability for the subsoils to resist the effect of ground shaking associated with the design level earthquakes has been assessed from the upper subsoil information obtained from the CPTs.

The liquefaction assessment was carried out using the methods outlined in Boulanger and Idriss (2014) in line with the recent amendments to the MBIE Guidelines (2014). The fines content fitting parameter has been set as 0 as no laboratory testing has been undertaken on the soils at the site.

Some of the upper soils were inferred to be clayey silts to organic silts (I_c greater than 2.6). As limited laboratory testing has been carried out to aid in determining a liquefaction cut off on the soils underlying the site, soils have been assumed to be non-liquefiable where the CPT Soil Character Index, I_c, is greater than 2.6.

Upper Liquefaction Effects

Liquefaction can have a number of effects on buildings and land. In this assessment we have considered the following effects:

- Liquefiable layers.
- Liquefaction induced reconsolidation settlement.
- Liquefaction induced ground damage.

These are discussed in the following sections:

Liquefiable Layers

The layers which may liquefy in a design level event are critical in regards to the foundation performance. The Boulanger and Idriss (2014) method has been used in this assessment and it has been assumed that soils are liquefiable when the factor of safety is below one.

Liquefaction Induced Settlement

The method of Zhang et. al. (2004) was used for calculating the potential liquefaction induced reconsolidation settlements in the CPT analysis. Settlements have been calculated over the entire CPT profiles (up to 15m depth), as well as over the upper 10m of the profile (“index settlement” in terms of the MBIE Guidelines).

Liquefaction Induced Ground Damage

We have used two methods to assess the potential for liquefaction induced ground damage as outlined below:

a) Published information (after Ishihara, 1985) can be used to assess the potential for surface expression of liquefaction and hence the likelihood of inducing damage. Ishihara’s method is for a single non-liquefiable layer overlying a single liquefiable layer only. The liquefaction analysis indicates multiple liquefiable layers within the CPT profiles and to account for this we have taken the thickness of the non-liquefied crust as the thickness from the ground surface to the top of the uppermost critical liquefiable layer, and the thickness of the critical liquefied layer as the sum of the thicknesses of all critical liquefiable layers.

   Ishihara’s plots do not explicitly indicate ground damage curves for specific PGAs such as 0.13g which is the SLS level PGA. To simplify the analysis we have used following curves to assess the ground damage:

   - The 0.20g curve when assessing damage under SLS design levels of ground shaking and the lower bound 4 September 2010 Darfield Earthquake.
   - The 0.40g curve when assessing damage under ULS design level of ground shaking and the 4 September 2010 Darfield Earthquake.

b) Tonkin & Taylor (T&T) developed the Liquefaction Severity Number (LSN) (Tonkin & Taylor 2013) based on investigation data and observations made following major earthquake events in Christchurch. The LSN uses the settlements calculated from the Idriss and Boulanger (2008) method with the Robertson and Wride (1998) fines content method and the Zhang et. al. (2004) settlement method to assess the expected ground damage that could be caused by liquefaction in future earthquakes. The level of ground damage associated with LSN numbers is summarised in Table 8 below.

Table 8: LSN descriptions

LSN Range	Predominate Performance
0-10	Little to no expression of liquefaction, minor effects
10-20	Minor expression of liquefaction, some sand boils
20-30	Moderate expression of liquefaction, with sand boils and some structural damage
30-40	Moderate to severe expression of liquefaction, settlement can cause structural damage
40-50	Major expression of liquefaction, undulations and damage to ground surface, severe total and differential settlement of structures
>50	Severe damage, extensive evidence of liquefaction at surface, severe total and differential settlement affecting structures, damage to services

Upper Liquefaction Results

The result of the liquefaction assessment for the 4 September 2010 event are summarised in Table 9 and the results of the design level events are summarised in Table 10. The liquefaction outputs are presented in Appendix I.

Table 9: Summary of liquefaction analysis for the 4 September 2010 Darfield Earthquake

Earthquake Event	Earthquake Effects	Northern Section	Southern Section
4 September 2010 Darfield Earthquake (M_w7.1, 0.34g)	Liquefiable Layers(1)	Unit 2 below the water level	Unit 2 below the water level
	Settlement(2)	0 to 50mm	35 to 145mm
	Ground Damage(3)	Yes over half of the site	Yes
	LSN	0 to 16	21 to 56
	Comments	The analysis indicates minor to moderate damage	The analysis indicates moderate to major damage
4 September 2010 Darfield Earthquake (M_w7.1, 0.20g)	Liquefiable Layers(1)	Some of the sandy layers of Unit 2 below the water table	Unit 2 below the water level
	Settlement(2)	0 to 35mm	15 to 130mm
	Ground Damage(3)	No	Yes over half of the site
	LSN	0 to 14	8 to 50
	Comments	Not assessed	The analysis indicates minor to major damage

(1) Due to the inherent uncertainty in calculating liquefiable layers, the calculated layers are indicative only. Actual positions and thickness of liquefiable layers could vary from those above.

(2) Settlements are calculated over the full CPT profile. Settlements are presented to the nearest 5mm. Due to the inherent uncertainty in calculating liquefaction induced settlements, the calculated settlements are indicative only and actual settlements will vary from those above.

(3) Ground damage based upon published information after Ishihara (1985).

Table 10: Summary of liquefaction analysis for the design level events

Earthquake Event	Earthquake Effects	Northern Section	Southern Section
ULS (1 in 500 year event) (M_w7.5, 0.35g)	Liquefiable Layers(1)	Unit 2 below the water level	Unit 2 below the water level
	Settlement(2)	0 to 50mm	35 to 150mm
	Ground Damage(3)	Yes over half of the site	Yes
	LSN	0 to 16	21 to 56
	Comments	The analysis indicates minor to moderate damage. This is similar to or greater than what is calculated in the 4 September 2010 earthquake.	The analysis indicates moderate to major damage. This is similar to or greater than what is calculated in the 4 September 2010 earthquake.
SLS-a (1 in 25 year event) (M_w7.5, 0.13g)	Liquefiable Layers(1)	Limited layers	Some of the sandy layers of Unit 2 below the water table
	Settlement(2)	0 to 15mm	0 to 105mm
	Ground Damage(3)	No	No
	LSN	0 to 6	2 to 41
	Comments	The analysis indicates minor damage. This is less than that calculated for the 4 September 2010 Earthquake.	The analysis indicates minor to major damage. This is less than that calculated for the 4 September 2010 Earthquake.
SLS-b (1 in 25 year event) (M_w6.0, 0.19g)	Liquefiable Layers(1)	Some of the sandy layers of Unit 2 below the water table	Unit 2 below the water level
	Settlement(2)	0 to 30mm	10 to 125mm
	Ground Damage(3)	Predominately No	Yes over 1/6 of the site
	LSN	0 to 5	2 to 40
	Comments	The analysis indicates minor damage. This is less than that calculated for the 4 September 2010 Earthquake.	The analysis indicates minor to major damage. This is less than that calculated for the 4 September 2010 Earthquake.

(1) Due to the inherent uncertainty in calculating liquefiable layers, the calculated layers are indicative only. Actual positions and thickness of liquefiable layers could vary from those above.

(2) Settlements are calculated over the full CPT profile. Settlements are presented to the nearest 5mm. Due to the inherent uncertainty in calculating liquefaction induced settlements, the calculated settlements are indicative only and actual settlements will vary from those above.

(3) Ground damage based upon published information after Ishihara (1985).

Discussion

The MBIE guidelines divide flat land into three technical categories that reflect both the liquefaction experience to date and future performance expectations. The categories and corresponding criteria are summarised as follows:

- **Technical Category 1 (TC1)** – Future land damage from liquefaction is unlikely, and ground settlements are expected to be within normally accepted tolerances.
- **Technical Category 2 (TC2)** – Minor to moderate land damage form liquefaction is possible in future large earthquakes.
- **Technical Category 3 (TC3)** – Moderate to significant land damage from liquefaction is possible in future large earthquakes.

As the Bradley and Hughes (2012a, b) does not extend into Lincoln we have considered the O'Rourke et. al. (2012) PGA model. Based on the MBIE Guidelines (2012) the site has been 'sufficiently tested' as the median value for the PGA for the 4 September 2010 event exceeded 170% of the SLS PGA (i.e. 1.7 x 0.13g = 0.22g). No damage was observed on the site due to liquefaction after the 4 September 2010 earthquake event. Based upon this actual site response we infer that the liquefaction assessment method over estimates likely settlement under future large earthquakes. Therefore, we have calibrated the liquefaction assessment based on observations from the previous 4 September 2010 Darfield earthquake event.

It is not possible to compare the calculated and actual settlements for the 4 September 2010 Darfield earthquake event at the site because there is no quality information on actual ground settlements. We can however make the following comments based on observations, calculated settlements and ground damage for the three design earthquakes:

- For the northern part of the site the calculated ULS settlements are between 0mm and 50mm and the calculated SLS settlements are between 0mm 30mm which is consistent with MBIE TC1 and TC2 classifications. The analysis indicates that in a ULS event minor to moderate damage and in a SLS event minor damage.
- For the southern part of the site the calculated ULS settlements are between 35mm and 150mm and the calculated SLS settlements are between 0mm 125mm which is consistent with MBIE TC2 and TC3 classifications. The analysis indicates that in a ULS event moderate to major damage which is similar to or greater than what is calculated in the 4 September 2010 event, and in a SLS event minor to major damage which is less than that calculated for the 4 September 2010 Earthquake.
- Based on the GNS Science (2012) report on liquefaction in eastern Canterbury, discussions with a Fulton Hogan staff that are familiar with the site, review of aerial photography and Aurecon site walkovers in 2011, 2012, 2013 and 2015 no liquefaction induced damage was noted on the site.
- The MBIE prescribe liquefaction assessment methodology indicates that in the southern section of the site moderate to major ground damage should have occurred in the 4 September 2010 Darfield earthquake, which is not supported by field observations.
- In the southern section of the site the liquefaction assessment calculated that lower levels of vertical settlement and ground damage will occur in a SLS earthquake event than the 4 September 2010 Darfield Earthquake.

For the southern section of the site the liquefaction assessment overstates the liquefaction risk when compared to actual site performance as only limited to minor damage was observed at and around the site after the 4 September 2010 earthquake event.

Hence, based on our liquefaction assessment and observed damage we infer that minor to moderate land damage from liquefaction is possible in future large earthquakes at parts of the site. Therefore we conclude based on our liquefaction assessment:

- The northern section of Stage 10 to 18 is consistent with the classifications of **Technical Category 1 (TC1) and Technical Category 2 (TC2).**
- The southern section is consistent with the classification of **Technical Category 2 (TC2).**

The areas of TC1 and TC2 are shown in Figure 8 in Appendix A.

4.4.3 Liquefaction Induced Lateral Spreading

Lateral spreading occurs in the surface soils move downslope or towards a free edge, such as a river or basin. Lateral spreading can occur during an earthquake under seismic loading and following the earthquake until the excess pore water pressure caused by ground shaking dissipate and the soil regains strength.

When assessing liquefaction induced lateral spreading we considered the following:

- There is a small stream which runs through the site which is approximately 0.5m deep and 2m to 3m wide with no significant bank.
- No other significant rivers or significant changes in height are in close proximity to the site.
- The site is relatively level and we understand that there will be no significant change in this once the development is undertaken.
- We understand that no stormwater basins or open channels will be built as part of this development.

Based on the site topography we consider that the global lateral and lateral stretch potentials across the site is considered to be low and will not govern the MBIE Technical Category assessment. As such no further assessment of lateral spreading has been undertaken.

4.4.4 Summary of MBIE Technical Category Liquefaction Assessment

The liquefaction analysis indicates the following:

- Based on the O'Rourke et. al. (2012) PGA model the site has been "sufficiently tested" (MBIE Guidelines (2012)) as the median value for the PGA for the 4 September 2010 event exceeded 170% of the SLS PGA (i.e. 1.7 x 0.13g = 0.22g). Therefore, we have also considered the lack of ground damage observations at the site after the 4 September 2010 earthquake event to help refine our liquefaction assessment.
- GNS Science report on liquefaction (GNS, 2012), review of aerial photography and site observations made by Aurecon and Fulton Hogan staff confirms there was no evidence of liquefaction observed at the site after the 4 September 2010 Darfield earthquake or any subsequent earthquakes part of the 2010 to 2012 Canterbury Earthquake Sequence.
- In all cases the liquefaction assessment calculated that lower levels of vertical settlement and ground damage will occur in a SLS earthquake event than the 4 September 2010 Darfield Earthquake.
- Liquefaction induced lateral spreading is considered to be low.
- Based on our liquefaction assessment and observed damage we infer that minor to moderate land damage from liquefaction is possible in future large earthquakes at parts of the site.

- Therefore we conclude based on our liquefaction assessment and accounting for groundwater levels and depth to underlying gravels, the northern section of Stage 10 to 18 is consistent with the classifications of **Technical Category 1 (TC1) and Technical Category 2 (TC2)** and the southern section is consistent with the classification of **Technical Category 2 (TC2).** See Figure 9 in Appendix 9 for further details.

4.5 Liquefaction Mitigation

4.5.1 General

It is considered that the site in its current assessment state is susceptible to varying degrees of seismically induced liquefaction in a future major seismic event.

In terms of liquefaction hazard mitigation there are four basic approaches as follows:

1. **Accept Liquefaction Risk**

   Design a structure with no regards to the liquefaction risk. This approach would only be used where there is effectively no to very little risk from seismically induced liquefaction (i.e. in Technical Category 1 areas).

2. **Building Strengthening**

   Structurally design the building to accommodate the effects of liquefaction. Examples of this include using raft or piled foundations. These methods do not remove the liquefaction hazard but reinforce the structure in such a way that it maintains stability during a liquefaction event.

3. **Ground Improvement**

   Improve the soil at the site so that it is less susceptible to seismically induced liquefaction. This general approach can be divided into three categories:

   1. Densify the soil so that soil grain skeleton will not collapse under earthquake loading. Examples of this include compaction and replacement (refilling with material which will not liquefy).

   2. Soil reinforcement. Examples include stone columns, driven piles to densify and stiffen the soil, deep soil mixing, soil cement columns etc.

   3. Allow dissipation of excess pore water pressure so that liquefaction is reduced. Examples of this include installation of drains, drainage blankets, and or stone columns.

4. **Alternative Land Use**

   Use the site for non-residential housing activities, such as reserve areas, playing fields etc.

The recommended approach for liquefaction mitigation in each Technical Category classification zone is discussed below.

4.5.2 Technical Category 1

As per the MBIE (2012) Guidelines with TC1 sites *"Future land damage from liquefaction is unlikely, and ground settlements from liquefaction effects are expected to be within normal accepted tolerances"*. Therefore, only shallow geotechnical testing is required at the building consent stage of residential development. If *'Good Ground'* test is met, NZS3604 *'Timber Framed Buildings'* type foundations can be used.

For the TC1 area we are effectively using an *'Acceptance of Liquefaction'* solution as the risk is sufficient low to warrant this approach.

4.5.3 Technical Category 2

The sites are consistent with the deformation characteristics of TC2 and do not meet the intent of the definition of *'Good Ground'* as per the New Zealand Standards (NZS3604 *'Timber Framed Buildings'* and NZS4229 *'Concrete Masonry Buildings not requiring Specific Engineering Design'*). These standards are typically used to design the structural components of residential dwellings. Due to a TC2 equivalent classification the generic foundation options presented in these standards cannot generally be used.

The principal objectives of the foundation design at the site should be to provide sufficient stiffness for the house to remain in a near flat plane in a future earthquake, and to be capable of being re-levelled if differential settlement does occur. To achieve these objectives the foundation system will need to go beyond the lightly reinforced slab-on grade floor system permitted by NZS3604 which is too flexible and lacks the strength to resist ground movement without significant damage. The chosen foundation system should be designed to be able to accommodate settlement of ground beneath the house and to be capable of resisting imposed loads and stresses from differential settlement.

The above comments are in line with the guidance advice made by the MBIE (2012). The foundation options in the MBIE guidelines are house specific and will need to be selected and design during two categories: shallow foundations, and deep foundations. Each of these is discussed below. For the TC2 area we are effectively using a '*Building Strengthening'* type approach to liquefaction mitigation where the foundations are strengthened to withstand the effects of liquefaction.

It should be noted that this report provides guidance only on residential foundation design and should not be taken as detailed design. Other foundation solutions are available (i.e ground improvement to achieve TC1 site characteristics etc.). However these options are unlikely to be economic relative to the options below and are not recommended at this stage.

Shallow Foundations

A shallow foundation, such as a raft, is intended to tie the superstructure together and to minimise structural damage if there is any ground movement during or following a future major seismic event. A properly detailed raft foundation is unlikely to prevent settlement of the dwelling but will reduce differential settlement and will also allow the house to be re-levelled if required. Raft foundations are generally suitable for dwellings with concrete floor slab only.

Raft foundations can take several forms, including:

- A gravel raft (either with or without geogrid reinforcement) with a reinforced concrete slab formed on top of the gravel raft.
- A double reinforced concrete raft case onto the in situ ground.
- A reinforced ground beam grid with slab foundation case onto the in situ ground (rib raft).

An alternative shallow foundation option is to use a suspended wooden floor with short piles and ring foundations as given in NZS3604. However, with this option, the site foundation soils must have 300kPa rupture bearing capacity and the building must have lightweight cladding and roofing systems.

Deep Foundations

Deep foundations such as piles will transfer structural loads from the structure to deeper and stronger non-liquefiable soil layers which will minimise any structural damage associated with ground liquefaction and settlement during and after a major seismic event. Piled foundations will minimise both total and differential settlements.

Piled foundations for a residential house typically comprise driven piles and can be either concrete (typically used if a concrete floor system is to be used), or timber (typically used if a timber floor and sub-floor system is to be used). A piled foundation system does not require any special soil preparation, but will require site specific investigation and design. Based upon the results of the ground testing, pile foundations would likely be founded well into the sandy gravel material at typically 4m to 5.5m below the finished ground level.

Discussion and Recommendations

The recommendations above are based on Section 5 of the MBIE (2012) guidelines. Schematics and typical cross sections of these foundation systems are presented in the guideline.

The raft foundation options are likely to be cheaper than the piled foundation options but piled foundations are often recommended for residential housing as piled foundations minimise settlement and damage during a large seismic event.

If piled foundations are adopted, then the floor slab should be well reinforced to provide continuity across the building floor and foundation elements. The objective is to provide additional capacity in the floor slab and enhance its ability to redistribute loads, if necessary, during large seismic events. All pile heads need to be adequately tied into the floor slab. An alternative approach could be to utilise the NZS3604 suspended wooden floor system founded directly onto the deep driven timber piles.

During detailed foundation design particular attention should be given to detailing the connections of buried services (water and sewer pipes, power conduits, etc.) between the house foundation and the in situ ground. The design should allow sufficient movement and ductility to account for seismic shaking and liquefaction induced movement, and to allow for easy reinstatement in the event of future damage.

Due to the depth of gravel layer on the southern section, we do not currently recommend using deep piles in this area.

To provide site specific geotechnical information for use in foundation design in TC2 areas it is recommended that a site specific geotechnical assessment be carried out by suitability qualified chartered engineer with experienced in residential house development in accordance with the MBIE guidelines.

4.6 Soft to Firm Clayey Silty Soils

Soft to firm clayey silty soils may be encountered at relatively shallow depths in most of the southern side of the site and in isolated pockets of the northern side of the site. Based on investigation logs we have split the site into two Zones as follows:

- Zone A – there is potential for soft silt layers being present at 2m depth with thicknesses between 0.3m and 1.0m. There is also another soft layer from 3m with thicknesses up to 2m.
- Zone B – there is potential that soft silt layers will be present in isolated pockets across this part of the site.

The approximate areas of these zones are shown on Figure 9 in Appendix A.

Based on the available investigation logs it is unlikely that shallow bearing for a typical house foundation of 300kPa could be achieved in these areas. Therefore if these soils are encountered *'Good Ground'* as per NZS3604 will not be met and specifically designed foundations will be required based on the building consent investigations.

However, based on our analysis typical TC2 type waffle or beam grid type systems should be suitable as foundation elements. The calculated long term consolidation settlement induced by foundation loading is likely to be within acceptable limits of the NZ Building Code (i.e settlement less than 25mm over 6m). However as this is a subdivision area wide geotechnical report and in line with MBIE guidelines bearing capacities must be confirmed during the detailed house design.

4.7 Council Vested Infrastructure

For the area identified as TC1 no specific liquefaction mitigation measures are required for Council vested infrastructure. The potential effects of liquefaction will need to be considered when designing the Council vested infrastructure in TC2 areas.

This section describes the proposed liquefaction mitigation measures for the infrastructure at Rosemerryn Stages 10 to 18 in the areas classified as TC2 only (see Figure 8). The proposed liquefaction mitigation measures are in line with the Christchurch City Council Capital Programme Group Technical Memorandum *'Earthquake Learnings – Amendments to the IDS and the CSS for Pipes Infrastructure in Christchurch City, to Mitigate Against Future Earthquake Damage'*.

4.7.1 Buried Structures

In order to minimise lifting / floatation all buried services founded below design groundwater level as manhole risers, pump station chamber, etc. should be designed to have neutral buoyancy and to resist the uplift forces associated with liquefied soil, not just groundwater buoyancy forces. Spaces around buried structures should be backfilled with free draining, granular, non-liquefying fill in order to alleviate pore water pressure build up during a large seismic event thereby reducing the potential for liquefaction in the soils immediately surrounding the buried structure.

Manhole inverts and pipe entry and exit levels should be designed to accommodate liquefaction induced differential settlements. The hydraulic design of the pipes entering and exiting the manhole risers should be designed to accommodate up to 50mm on the northern section and 115mm on the southern section of vertical movement both up and down. Manhole risers should have strap rings to hold the manhole riser sections together in order to reduce lateral displacement of the manhole risers. Additionally, manhole connectors with greater than 90mm sealing lengths should be used to minimise the potential for joint pull-out.

It is recommended that the finalised design of each buried service (manhole riser, pump station, etc.) is confirmed on a case by case basis during construction once the site specific ground conditions are identified, in particular if the infrastructure element is being founded directly into gravel.

4.7.2 Pipe and Service Conduits

In line with the Christchurch City Council Capital Programme Group Technical Memorandum, all pipes and service conduits should be made from flexible material (e.g. plastic) where practicable. For gravity reticulated sewer lines, all pipe joints and intersections with manhole risers should be installed with short slip collars to allow greater capacity of joint movement and increase joint resilience. Pressurised sewer lines should be constructed from PE pipe and should have end restraints at pump stations. Well-designed end restraints combined with the PE pipe material itself will improve the resilience of the pressure line and help prevent damage.

As noted above, for hydraulic pipes (sewer, stormwater, and possibly reticulated water), the pipe sizes and gradients should be designed in such a way that they can accommodate post liquefaction differential settlement, both positive and negative. Differential settlements of 50 in the northern section and 115mm in the southern section should be used for design.

All pipes and conduits should be founded into the non-liquefiable crust material where possible. If the founding depth of the pipes and conduits extends down to liquefiable silty sandy material the service trenches should be backfilled with non-liquefiable geotechnically competent fill.

All service trenches located below the water table should be lined with a geosynthetic filter fabric material (i.e. Bidim A19 or similar) to separate potentially liquefiable soils from non-liquefiable granular bedding and backfill material. For shallow service trenches founded above the water table, a filter fabric is not required but is generally recommended.

By providing a filter fabric and filling the service trenches with non-liquefiable geotechnically competent fill the trench backfill is non-liquefiable and will therefore limit liquefaction induced settlement or flotation. Additionally, if a pipe was to rupture, by having a filter fabric encasing the bedding material there is less likelihood of sand material infiltrating into and blocking the pipeline.

4.7.3 Pavements

At this stage it is inferred that the pavement is unlikely to be significantly affected by seismically induced liquefaction. However, to ensure robustness of the pavement following a liquefaction inducing major earthquake it is recommended that the pavement be designed to accommodate the potentially adverse effect of seismically induced liquefaction. The pavement should be designed in such a way that it can bridge any localised voids / settlements that may be caused by seismically induced liquefaction, and prevent liquefiable soil from penetrating into the pavement structure.

If subsoil drains are to be installed as part of the subdivision development for stormwater control, then it is recommended extending the subsoil drainage under the foot print of the roading network. Drainage will increase the thickness of non-liquefied crust below the pavement areas as well as the residential sections, thereby minimising the likelihood of liquefaction induced damage.

A geosynthetic filter fabric (i.e. Bidim A29 or similar) should be placed directly onto the in situ sub-grade material prior to the placement of the granular sub-base fill to limit fines migration from the sub-grade to the sub-base during a liquefaction inducing seismic event and the potential loss of pavement strength.

5 Assessment Against the RMA

Section 106 of the Resource Management Act (RMA) states *inter alia*

> *… "a consent authority may refuse to grant a subdivision consent, or may grant a subdivision consent subject to conditions, if it considers that:*
>
> *a) the land in respect of which a consent is sought, or any structure on the land, is or is likely to be subject to material damage by erosion, falling debris, subsidence, slippage, or inundation from any source; or*
>
> *b) any subsequent use that is likely to be made of the land is likely to accelerate, worsen, or result in material damage to the land, other land, or structure by erosion, falling debris, subsidence, slippage, or inundation from any source; or*
>
> *c) sufficient provision has not been made for legal and physical access to each allotment to be created by the subdivision."*

No erosion was observed on the site. However the silty soils that directly underlie the site are inferred to be potentially susceptible to erosion when left unvegetated. We infer that the site is not susceptible to falling debris or slippage due to the topographical location.

It is noted that issues surround stormwater discharge are being dealt with in the detailed civil engineering design by Davie Lovell-Smith and any potential "inundation" susceptibility due to stormwater is being addressed as part of the detailed subdivision civil engineering design.

Due to the potential for seismically induced liquefaction, we infer that parts of the site are potentially susceptible to varying degrees to subsidence and inundation from liquefaction. However, if the appropriate liquefaction mitigation measures, as outlined in this report, are undertaken, then the risk of subsidence and inundation from liquefaction is significantly reduced to an acceptable (TC1 or TC2) level as defined by the MBIE. Therefore, if appropriate liquefaction mitigation measures are implemented in or opinion the site will be free of "subsidence", or "inundation". The proposed subdivision development therefore generally complies with the intent of Section 106 (a).

The site is underlain by fine grained soils and there is potential for erosion and rilling from run-off or wind if vegetation cover is removed for prolonged periods of time from both stormwater runoff if it is not discharged in a controlled manner, and from the wind. The susceptibility to erosion of the silty soils can be minimised by using appropriate industry standard design measures during construction.

The site has been identified as being susceptible to seismically induced liquefaction and hence has the potential for "subsidence", "and "inundation." Provided that appropriate liquefaction mitigation measures are implemented, as recommended in this report, subsequent use of the land following development is unlikely to accelerate, worsen, or result in material damage to the land, other land, or structures. In our opinion therefore, the development will comply with the intent of section 106 (b).

Section 106 (c) is not directly relevant to a geotechnical appraisal and therefore has not been considered in detail in this report.

6 References

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7 Limitations

We have prepared this report in accordance with the brief as provided. The contents of the report are for the sole use of the Client and no responsibility or liability will be accepted to any third party. Data or opinions contained within the report may not be used in other contexts or for any other purposes without our prior review and agreement.

The recommendations in this report are based on data collected at specific locations and by using appropriate investigation methods with limited site coverage. Only a finite amount of information has been collected to meet the specific financial and technical requirements of the Client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgment and it must be appreciated that actual conditions could vary from the assumed model.

Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

Subsurface conditions, such as groundwater levels, can change over time. This should be borne in mind, particularly if the report is used after a protracted delay.

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Appendix A
Figures

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CLIENT

PRELIMINARY NOT FOR CONSTRUCTION

ALL DIMENSIONS APPROXIMATE ONLY

FIGURE: FIGURE 1

PROJECT: ROSEMERRYN STAGES 10 TO 18

SCALE: NTS

SIZE: A4

BY: T. PLUNKET

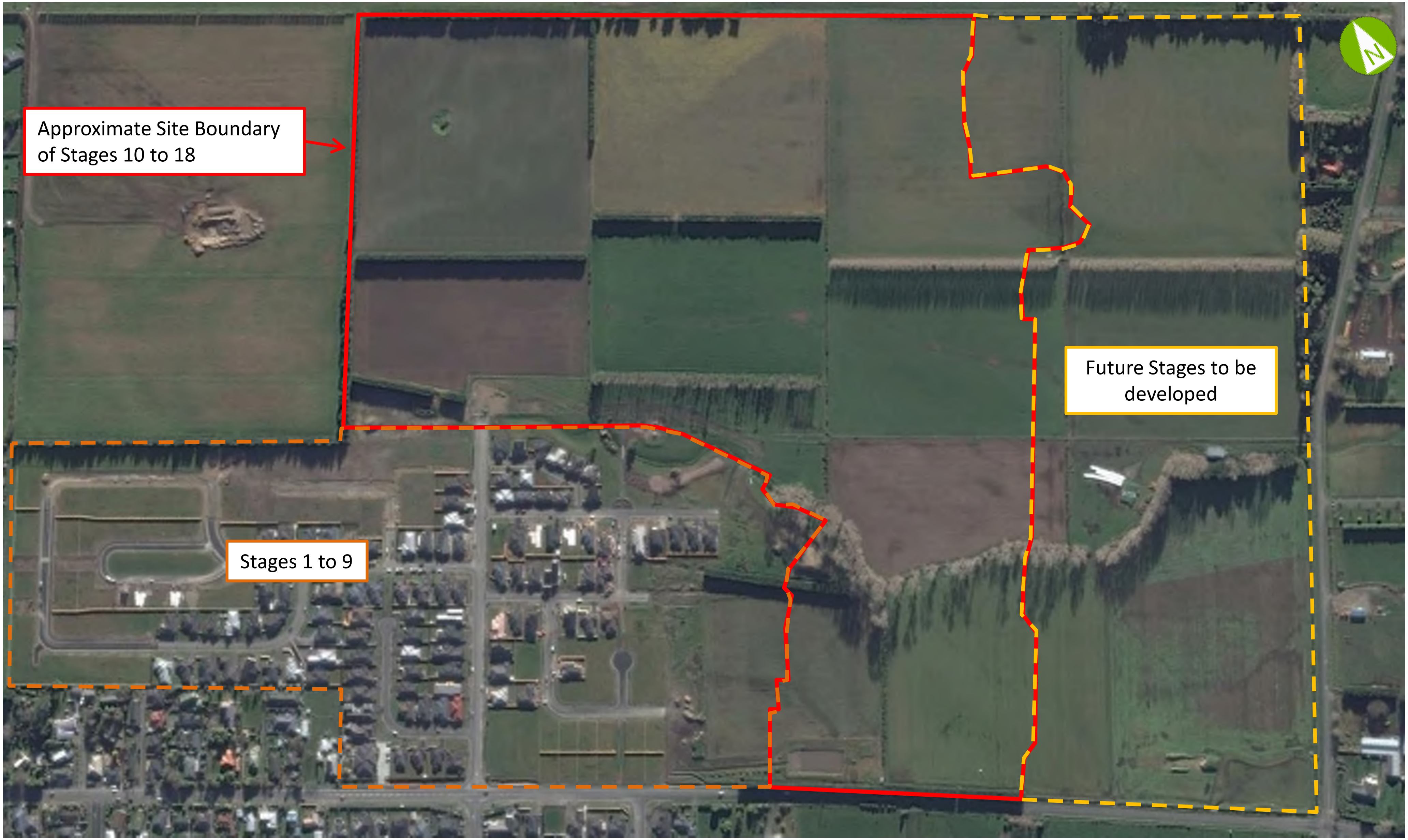
APPROVED: J. KUPEC

DATE: 24 SEPTEMBER 2015

TITLE: REGIONAL LOCATION PLAN

REFERENCE: BACKGROUND SOURCED FROM LINZ CROWN COPYRIGHT RESERVED

FIGURE No.	PROJECT	WBS	TYPE	DISC	NUMBER	REV
	224464	-	FIG	TRA	01	B



CLIENT

PRELIMINARY NOT FOR CONSTRUCTION

ALL DIMENSIONS APPROXIMATE ONLY

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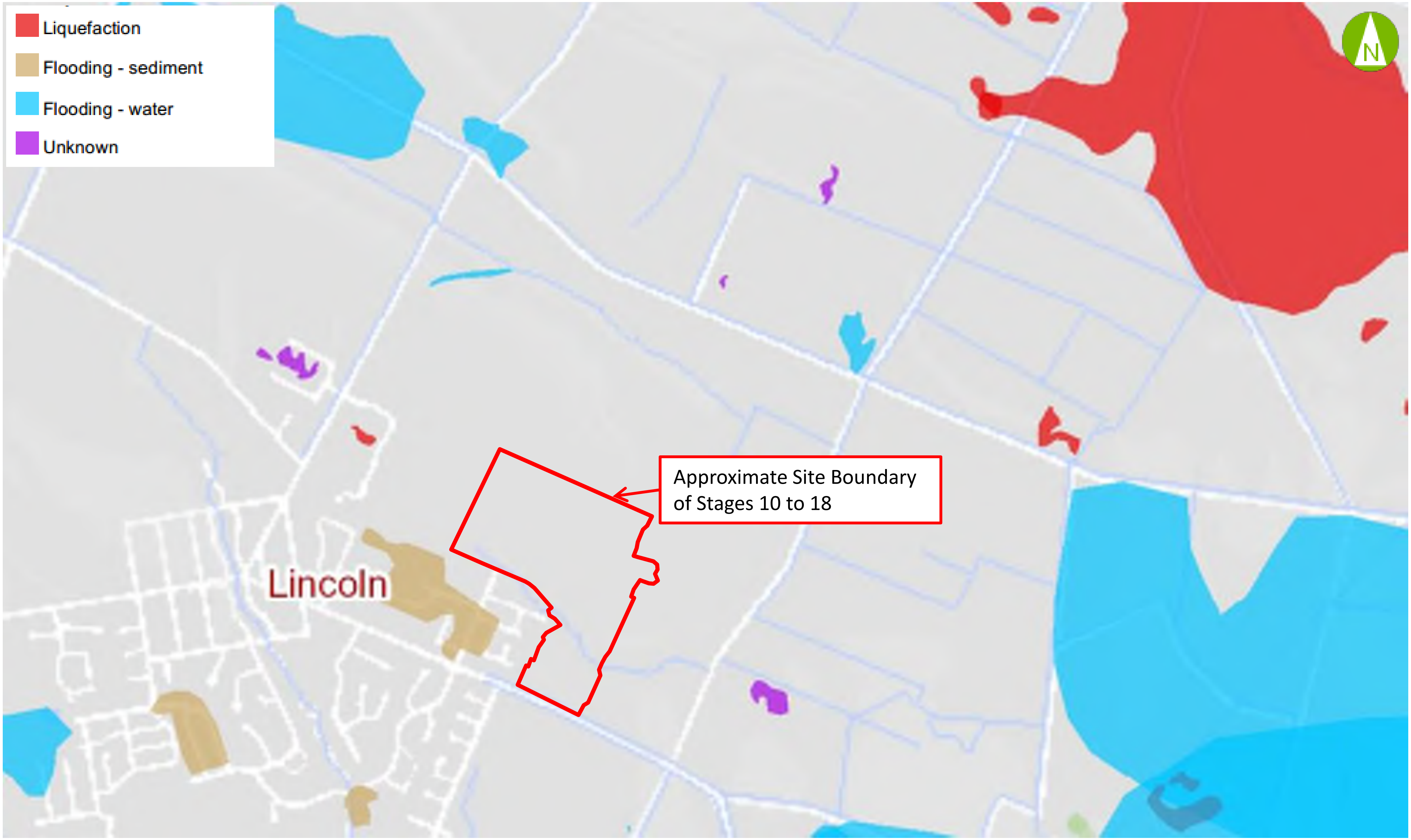
SCALE	NTS
SIZE	A4
BY	T. PLUNKET
APPROVED	J. KUPEC
DATE	24 SEPTEMBER 2015
FIGURE	FIGURE 2
PROJECT	ROSEMERRYN STAGES 10 TO 18
TITLE	SITE OVERVIEW
REFERENCE	BACKGROUND IMAGINE SOURCED FROM CANTERBURY MAPS. COPYRIGHT RESERVED. IMAGE TAKEN ON 23 FEBRUARY 2011.

FIGURE No.

PROJECT	WBS	TYPE	DISC	NUMBER	REV
224464	-	FIG	TRA	02	B



Approximate Site Boundary of Stages 10 to 18

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CLIENT

PRELIMINARY NOT FOR CONSTRUCTION

ALL DIMENSIONS APPROXIMATE ONLY

FIGURE: FIGURE 3

PROJECT: ROSEMERRYN STAGES 10 TO 18

SCALE: NTS

SIZE: A4

BY: T. PLUNKET

APPROVED: J. KUPEC

DATE: 24 SEPTEMBER 2015

TITLE: GNS (2012) RECORDED LIQUEFACTION AFTER THE 4 SEPTEMBER 2010 EARTHQUAKE

REFERENCE: BACKGROUND IMAGINE SOURCED FROM CANTERBURY MAPS. COPYRIGHT RESERVED

FIGURE No.

PROJECT	WBS	TYPE	DISC	NUMBER	REV
224464	-	FIG	TRA	04	B

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PRELIMINARY NOT FOR CONSTRUCTION
ALL DIMENSIONS APPROXIMATE ONLY

FIGURE: FIGURE 4
PROJECT: ROSEMERRYN STAGES 10 TO 18

SCALE	SIZE
NTS	A4

BY: T. PLUNKET
APPROVED: J. KUPEC
DATE: 24 SEPTEMBER 2015

TITLE: GNS (2012) RECORDED LIQUEFACTION AFTER THE 22 FEBRUARY 2011 EARTHQUAKE
REFERENCE: BACKGROUND IMAGINE SOURCED FROM CANTERBURY MAPS. COPYRIGHT RESERVED

FIGURE No.

PROJECT	WBS	TYPE	DISC	NUMBER	REV
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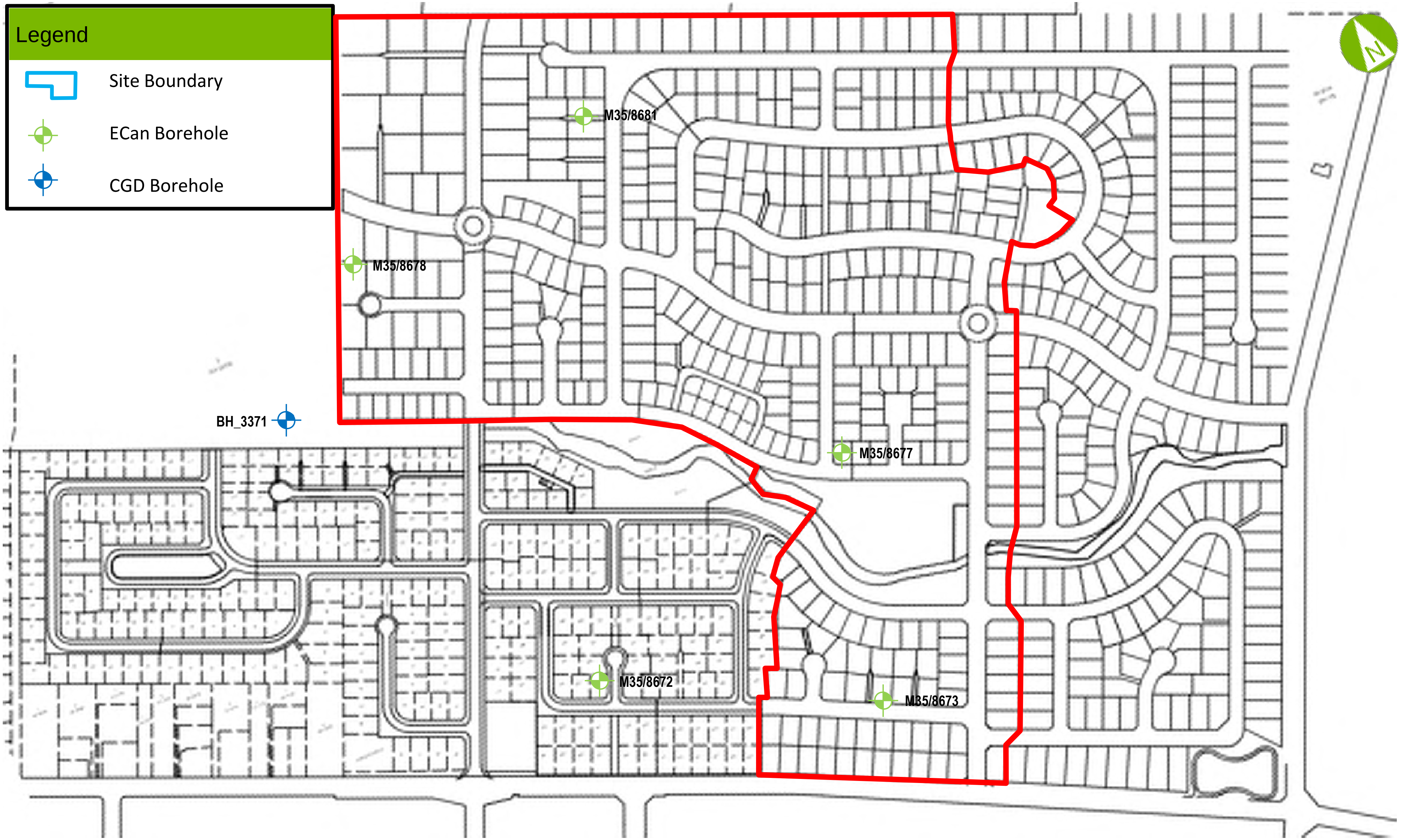

CLIENT

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PRELIMINARY NOT FOR CONSTRUCTION

ALL DIMENSIONS APPROXIMATE ONLY

FIGURE	FIGURE 5
PROJECT	ROSEMERRYN STAGES 10 TO 18

SCALE	SIZE
NTS	A4

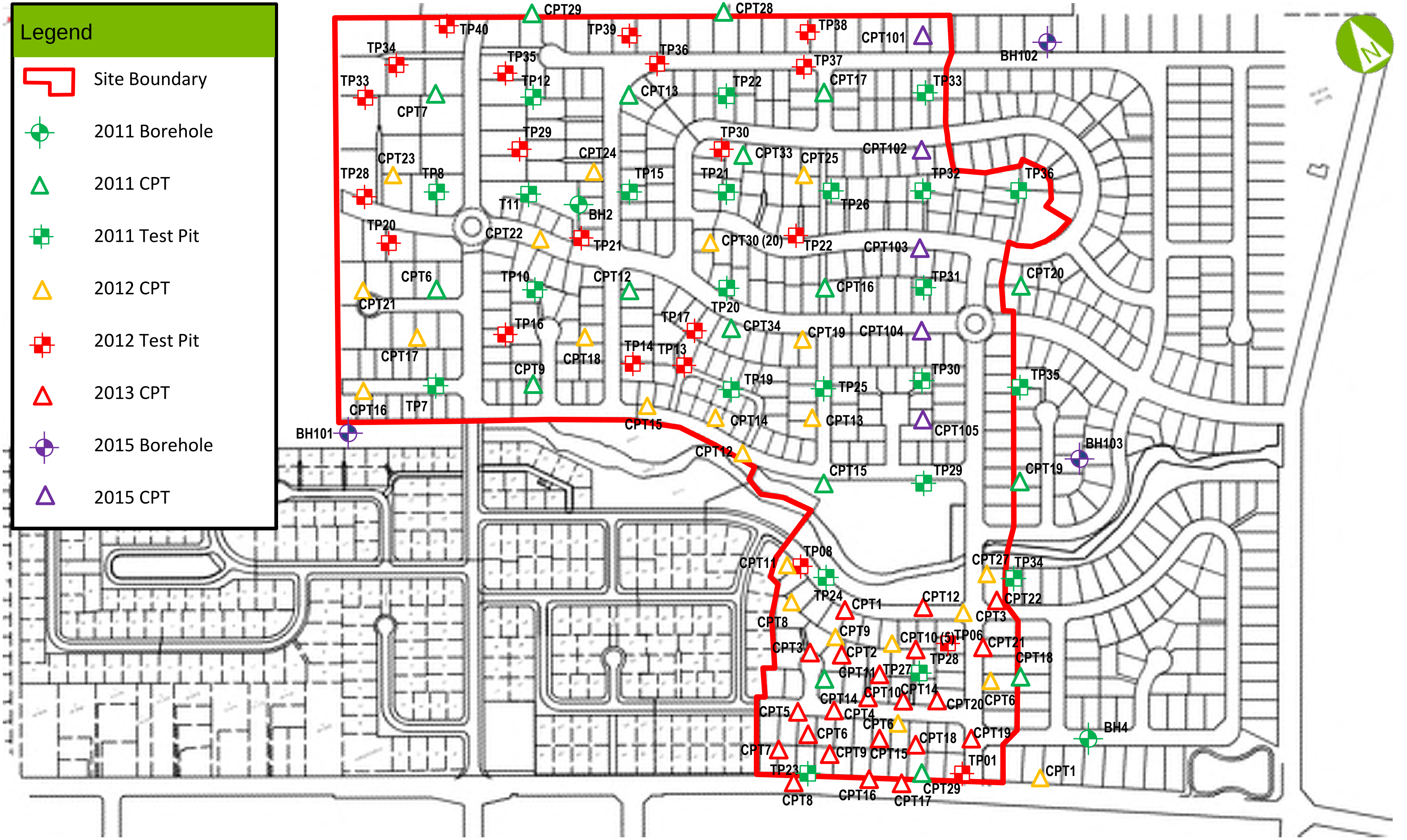
BY
T. PLUNKET

APPROVED
J. KUPEC

DATE
24 SEPTEMBER 2015

TITLE	ECAN AND CGD BOREHOLE LOCATION PLAN
REFERENCE	BACKGROUND IMAGINE PROVIDED BY DAVIE LOVELL-SMITH

FIGURE No.	PROJECT	WBS	TYPE	DISC	NUMBER	REV
	224464	-	FIG	TRA	05	B



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PRELIMINARY NOT FOR CONSTRUCTION
ALL DIMENSIONS APPROXIMATE ONLY

FIGURE
FIGURE 6

PROJECT
ROSEMERRYN STAGES 10 TO 18

SCALE	SIZE
NTS	A4

BY
T. PLUNKET

APPROVED
J. KUPEC

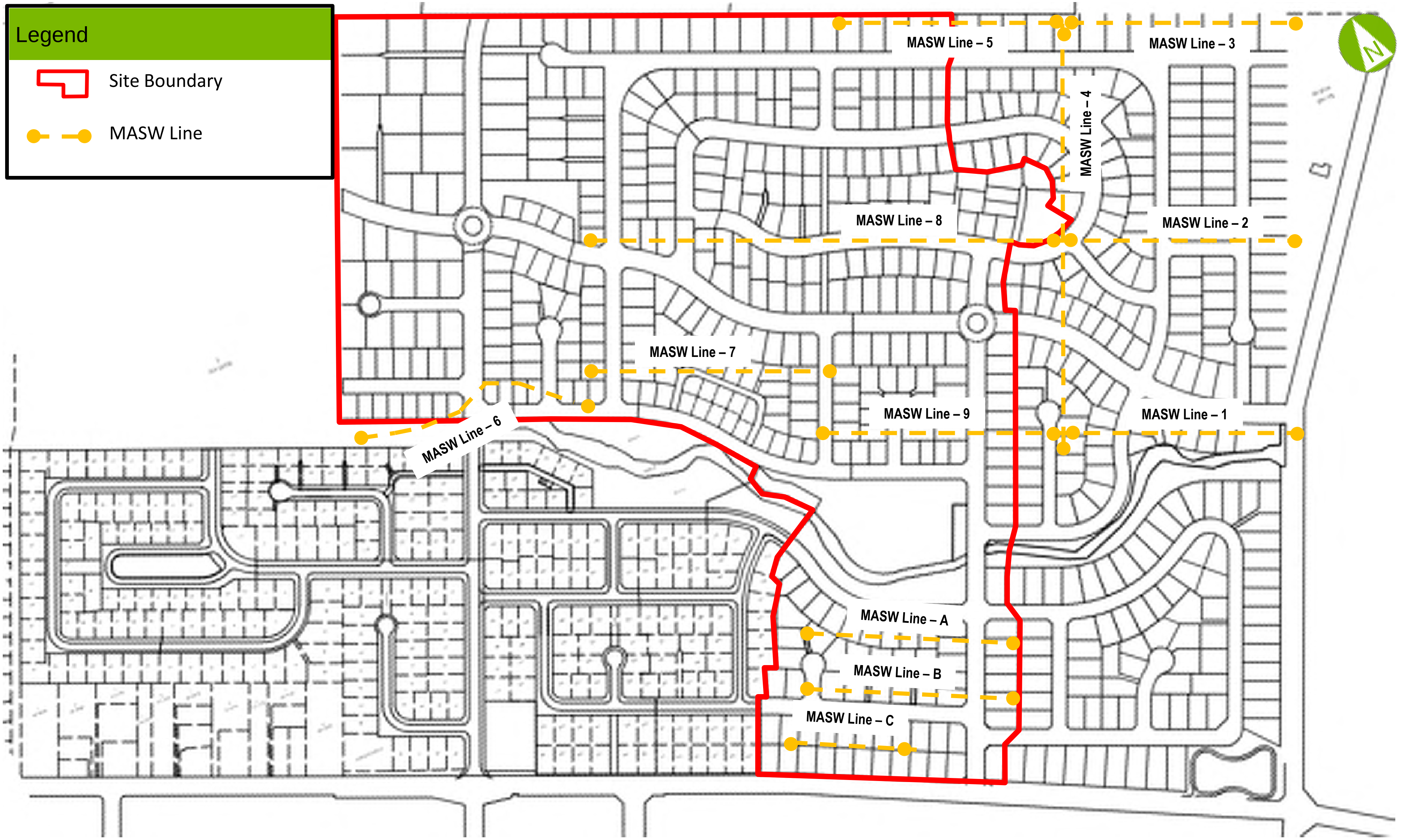
DATE
24 SEPTEMBER 2015

TITLE
AURECON GEOTECHNICAL INVESTIGATION LOCATION PLAN

REFERENCE
BACKGROUND IMAGINE PROVIDED BY DAVIE LOVELL-SMITH

FIGURE No.

PROJECT	WBS	TYPE	DISC	NUMBER	REV
224464	-	FIG	TRA	06	B



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PRELIMINARY NOT FOR CONSTRUCTION

ALL DIMENSIONS APPROXIMATE ONLY

SCALE	SIZE
NTS	A4

BY
T. PLUNKET

APPROVED
J. KUPEC

DATE
24 SEPTEMBER 2015

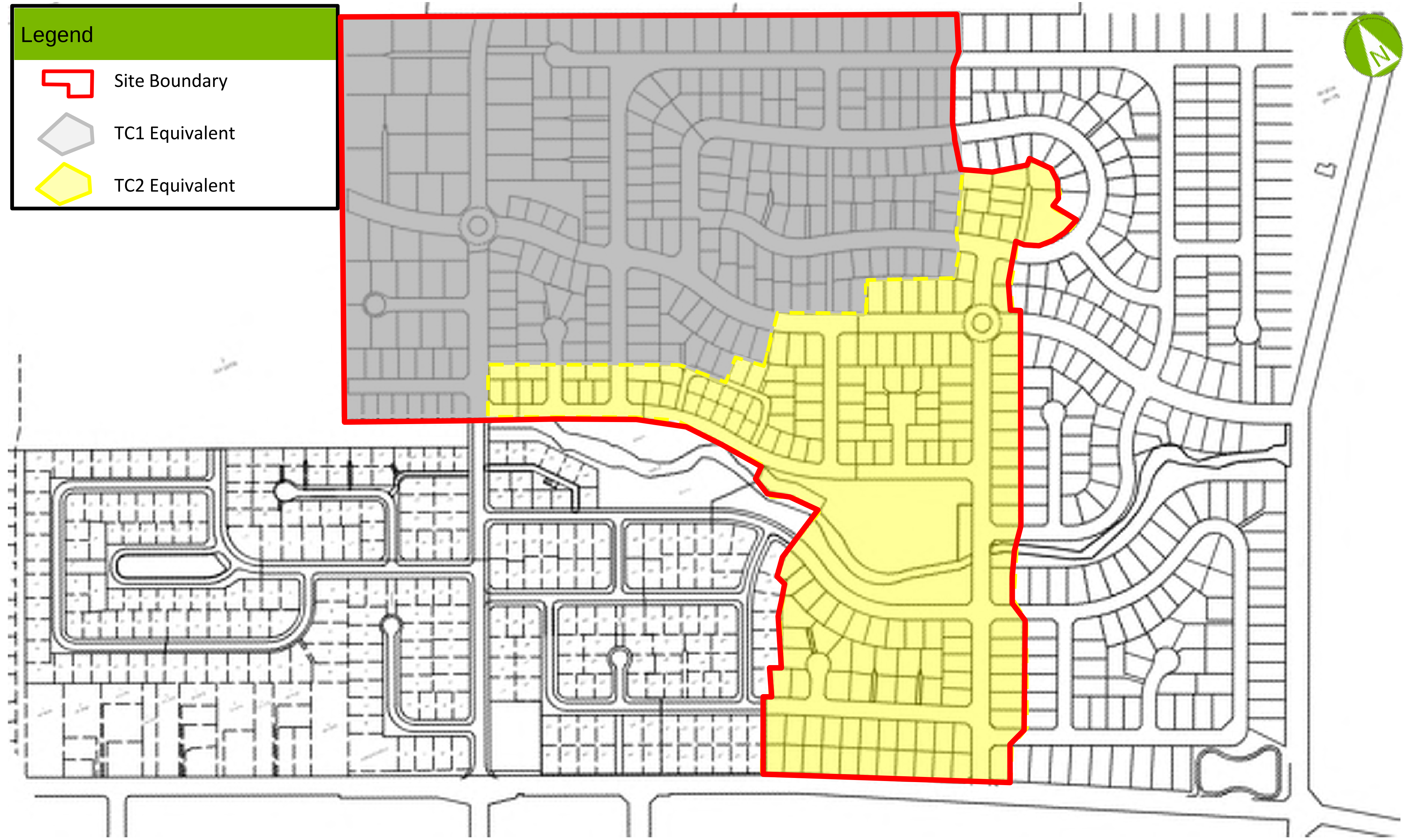
FIGURE: FIGURE 7

PROJECT: ROSEMERRYN STAGES 10 TO 18

TITLE: MASW SECTIONS

REFERENCE: BACKGROUND IMAGINE PROVIDED BY DAVIE LOVELL-SMITH

FIGURE No.	PROJECT	WBS	TYPE	DISC	NUMBER	REV
	224464	-	FIG	TRA	07	B



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ALL DIMENSIONS APPROXIMATE ONLY

FIGURE: FIGURE 8

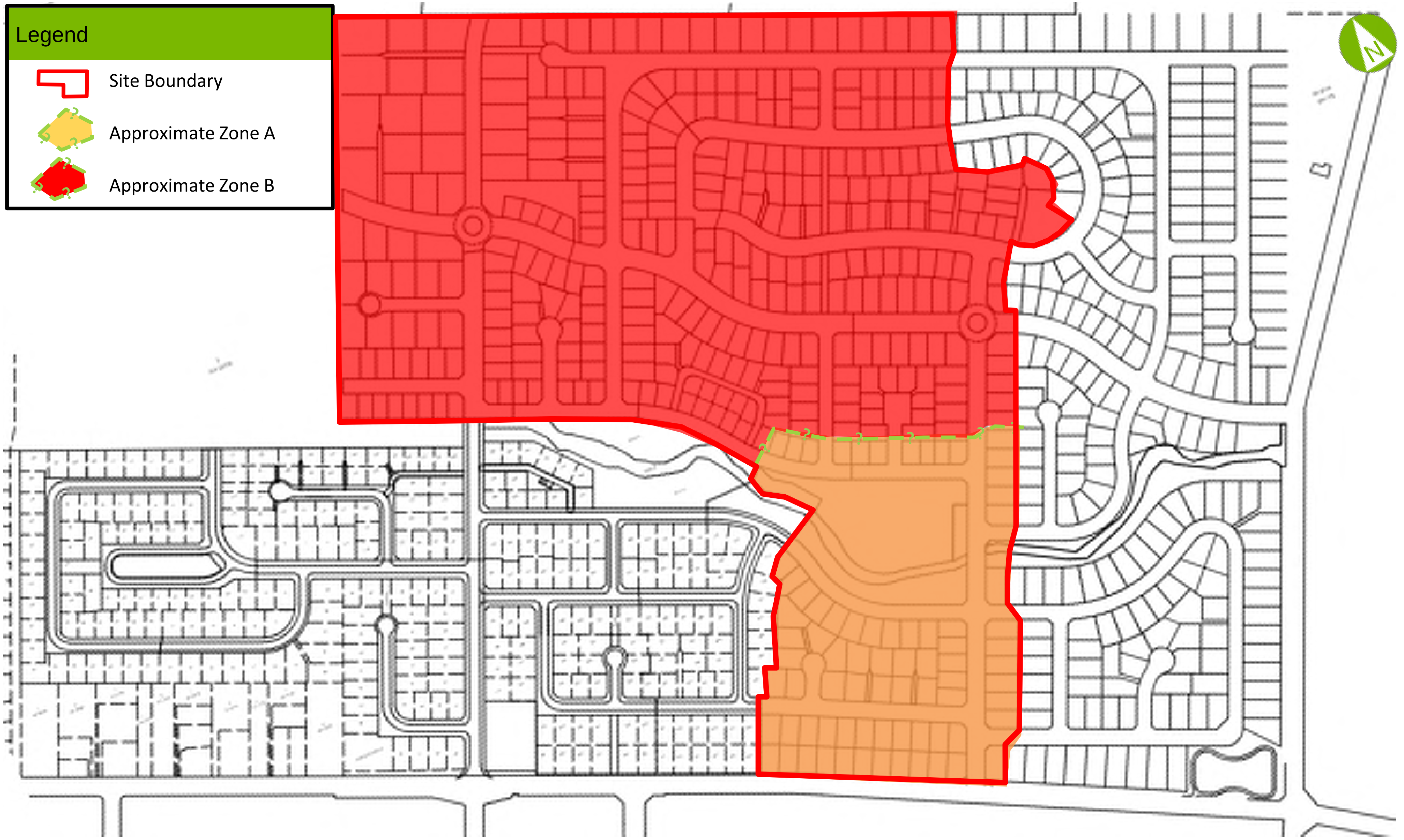
PROJECT: ROSEMERRYN STAGES 10 TO 18

SCALE: NTS
SIZE: A4
BY: T. PLUNKET
APPROVED: J. KUPEC
DATE: 24 SEPTEMBER 2015

TITLE: TECHNICAL CATEGORY CLASSIFICATION ZONES

REFERENCE: BACKGROUND IMAGINE PROVIDED BY DAVIE LOVELL-SMITH

FIGURE No.	PROJECT	WBS	TYPE	DISC	NUMBER	REV
	224464	-	FIG	TRA	03	B



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ALL DIMENSIONS APPROXIMATE ONLY

FIGURE: FIGURE 9

PROJECT: ROSEMERRYN STAGES 10 TO 18

SCALE: NTS

SIZE: A4

BY: T. PLUNKET

APPROVED: J. KUPEC

DATE: 24 SEPTEMBER 2015

TITLE: APPROXIMATE AREAS OF LOW BEARING SOILS

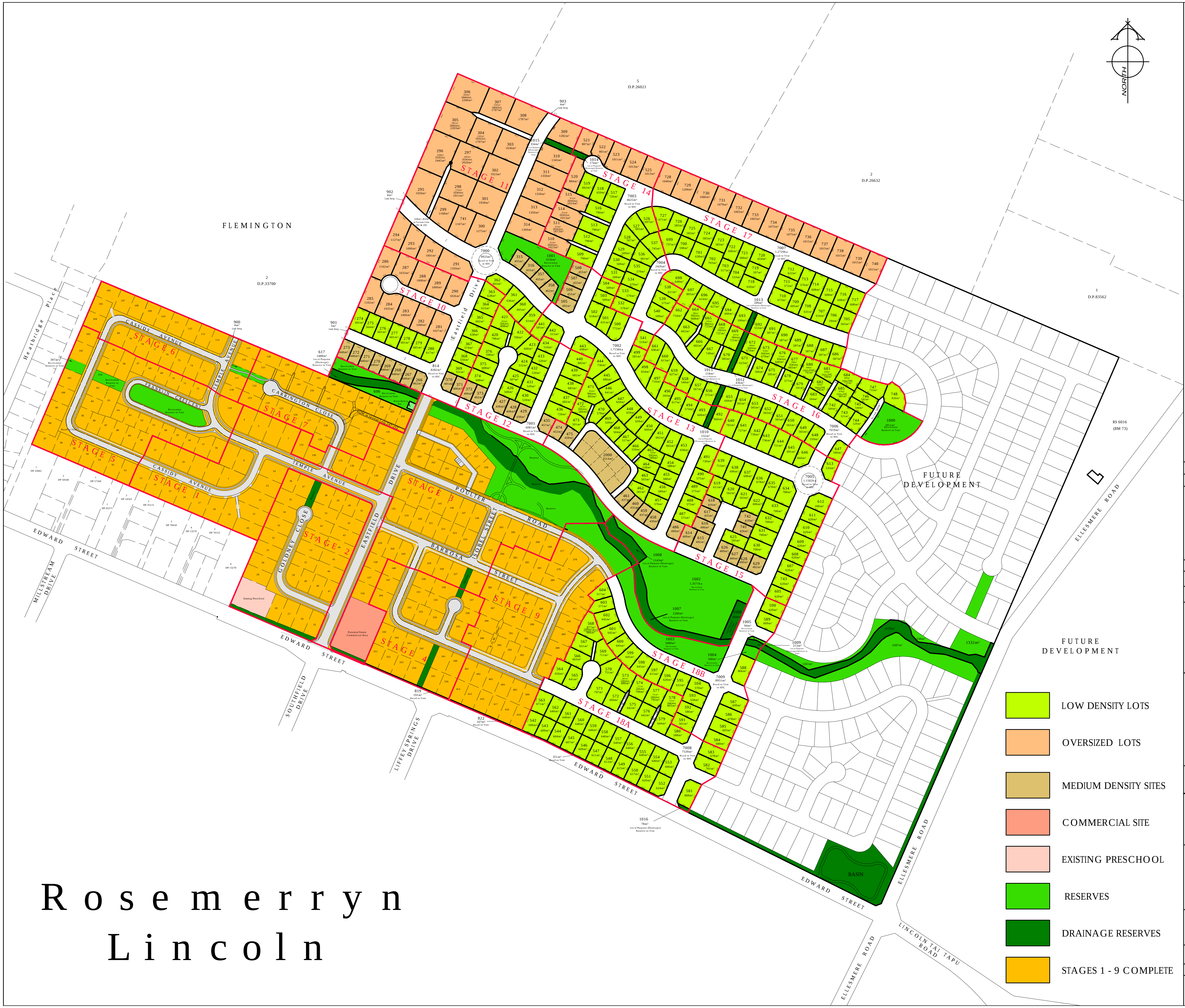
REFERENCE: BACKGROUND IMAGINE PROVIDED BY DAVIE LOVELL-SMITH

FIGURE No.

PROJECT	WBS	TYPE	DISC	NUMBER	REV
224464	-	FIG	TRA	08	B

Appendix B

Provided Davis Lovell Smith Drawings



Rosemerryn
Lincoln

NOTES :

1) Areas and dimensions are subject to final survey and deposit of plans.

2) Service easements to be created as required.

3) This plan has been prepared for subdivision consent purposes only. No liability is accepted if the plan is used for any other purpose.

4) Any measurements taken from information which is not dimensioned on the electronic copy are at the risk of the recipient.

5) This plan is subject to the granting of subdivision and/or resource consents and should be treated as a proposal until such time as the necessary consents have been granted by the relevant authorities.

	No of Lots	Total Area	Average
Large Lot/Oversized	58	7.1630ha	1235m²
Low Density	290	18.1243ha	624.9m²
Medium Density	52	2.2169ha	426.3m²

	STAGES 1-9	STAGES 10-18B	FUTURE DEVELOPMENT
TOTAL AREA	25.9302ha	40.7332ha	25.0592ha
NET AREA	24.5204ha	39.9733ha	23.7586ha
LOTS	267	400	241
LOTS/ha	10.888	10.006	10.143
OVERALL LOTS/ha	10.288 Sites /ha		

STAGES 10-18B SCHEDULE OF AREAS

Description	Area
Residential Lots	27.5042ha
Roading	9.6245ha
Reserve	2.5360ha
Drainage Reserve	6167m²
Right of Way	3589m²
	40.6403ha

Total Area: 91.7226ha

Comprised in: CFR 608420

Fulton Hogan
LAND DEVELOPMENT LTD.

DAVIE LOVELL-SMITH
PLANNING SURVEYING ENGINEERING

116 Wrights Road P O Box 679 Christchurch 8140. New Zealand
Telephone: 03 379-0793 Website: www.dls.co.nz E-mail: office@dls.co.nz

JOB TITLE :
Fulton Hogan Limited
Edward Street, Lincoln

SHEET TITLE :
Proposed Subdivision of
Lot 703 DP 461935

DRAWING STATUS
Density Purposes

SCALE : 1:5000@A3
1:2500@A1

DATE : July 2015

CAD FILE : J:\17001\S17001 STAGING PLAN_R18.dwg

DRAWING No : S.17001

SHEET No :

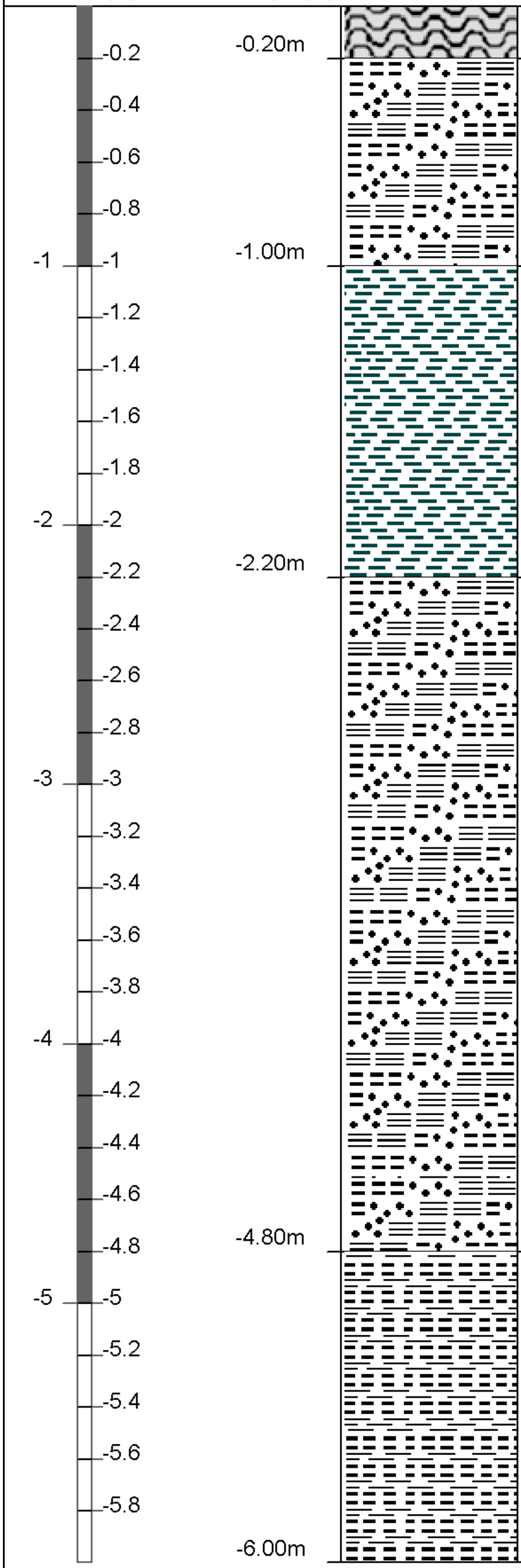
REVISION : R18

Appendix C

ECan Borehole Logs

Borelog for well M36/8672

Gridref: M36:69507-29314 Accuracy : 2 (1=high, 5=low)
Ground Level Altitude : 9.45 +MSD
Driller : not known
Drill Method : Rotary/Percussion
Drill Depth : -6m Drill Date : 9/10/2008

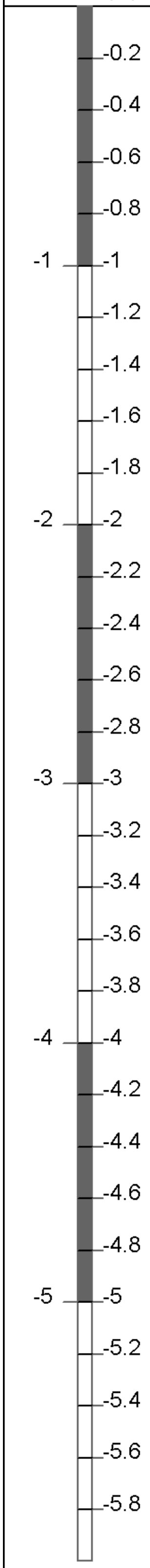


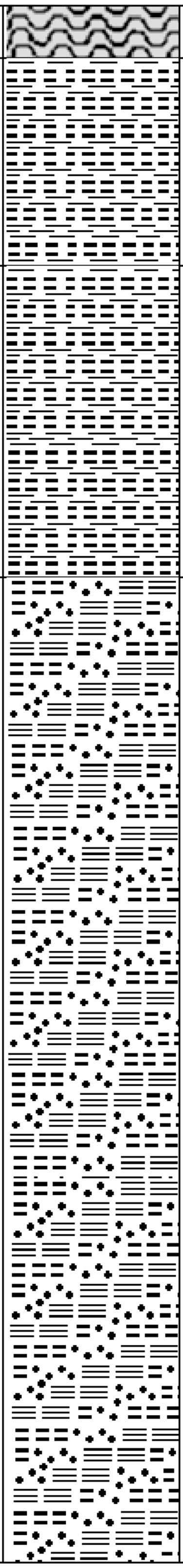
Water Level	Depth(m)	Full Drillers Description	Formation Code
	-0.20m	Dark Grey loamy topsoil	
	-1.00m	Grey mottled with yellow silty clay mixed with grey silty sand	
	-2.20m	Grey puggy silt mottled with orange/yellow rust discoluration	
	-4.80m	Grey sandy silt mixed with grey clayey silt. Clay faction increasing	
	-6.00m	Grey mottled with orange brown clayey silt with pieces of timber <100mm diameter	

Borelog for well M36/8673

Gridref: M36:69764-29180 Accuracy : 2 (1=high, 5=low)
Ground Level Altitude : 8.67 +MSD
Driller : not known
Drill Method : Rotary/Percussion
Drill Depth : -6m Drill Date : 9/10/2008

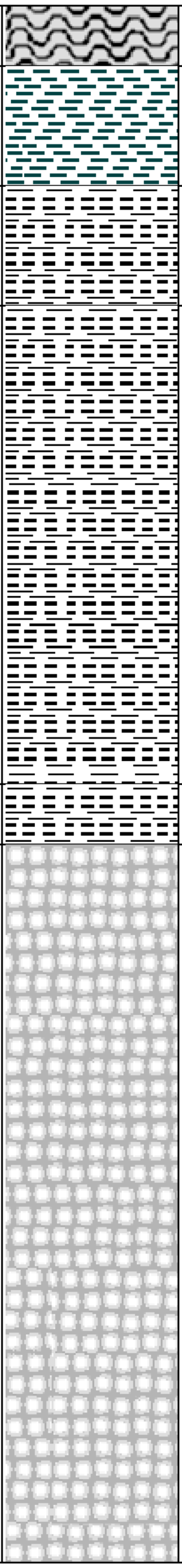
Scale(m)	Water Level	Depth(m)	Full Drillers Description	Formation Code
		-0.20m	Dark grey loamy topsoil	
		-1.00m	Soft light grey, mottled with orange, silty clay	
		-2.20m	Soft light grey silty clay mixed with soft orange silty clay. Clay content more distict, very soft	
		-6.00m	Very soft grey, speckled with orange, silty clay. Mixed with minor patches of orange/brown coarse sand.	





Borelog for well M36/8677

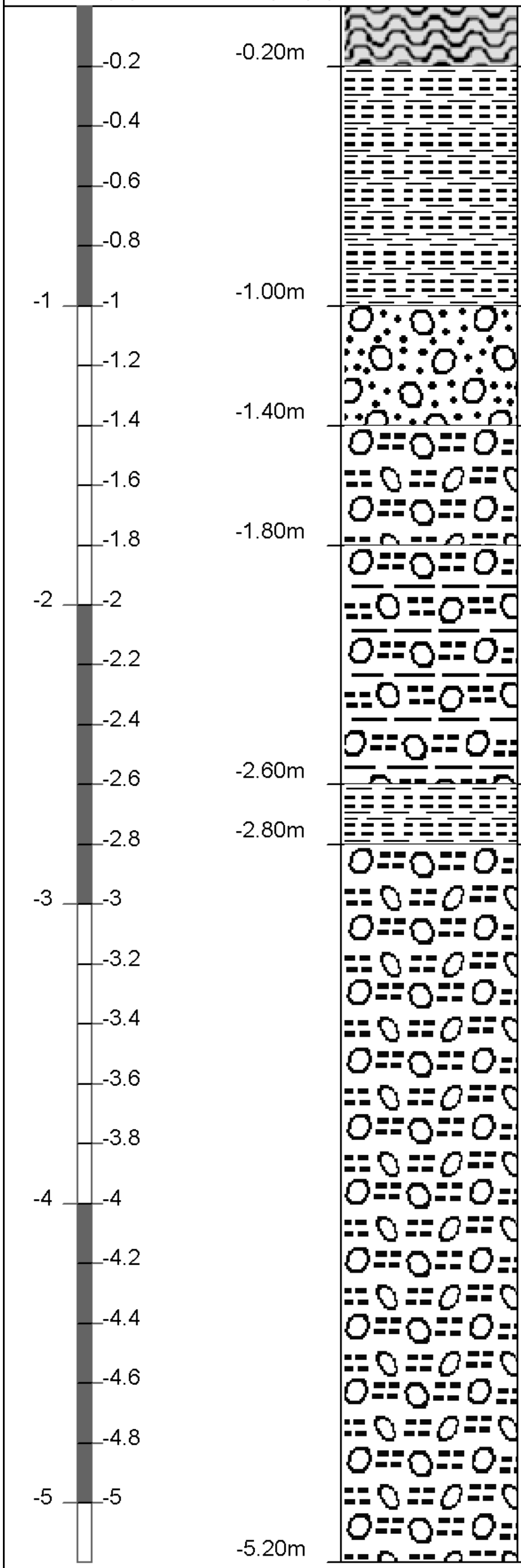
Gridref: M36:69828-29433 Accuracy : 2 (1=high, 5=low)
Ground Level Altitude : 8.67 +MSD
Driller : not known
Drill Method : Rotary/Percussion
Drill Depth : -5.2m Drill Date : 9/10/2008



Scale(m)	Water Level	Depth(m)	Full Drillers Description	Formation Code
		-0.20m	Dark grey loamy topsoil	
		-0.60m	Grey & yellow silt speckled with orange	
-1		-1.00m	Soft grey silty clay speckled with orange	
-2		-2.60m	Soft blue grey silty clay with pieces of timber	
		-2.80m	Soft brown yellow silty clay	
-3 -4 -5		-5.20m	Grey gravel	

Borelog for well M36/8678

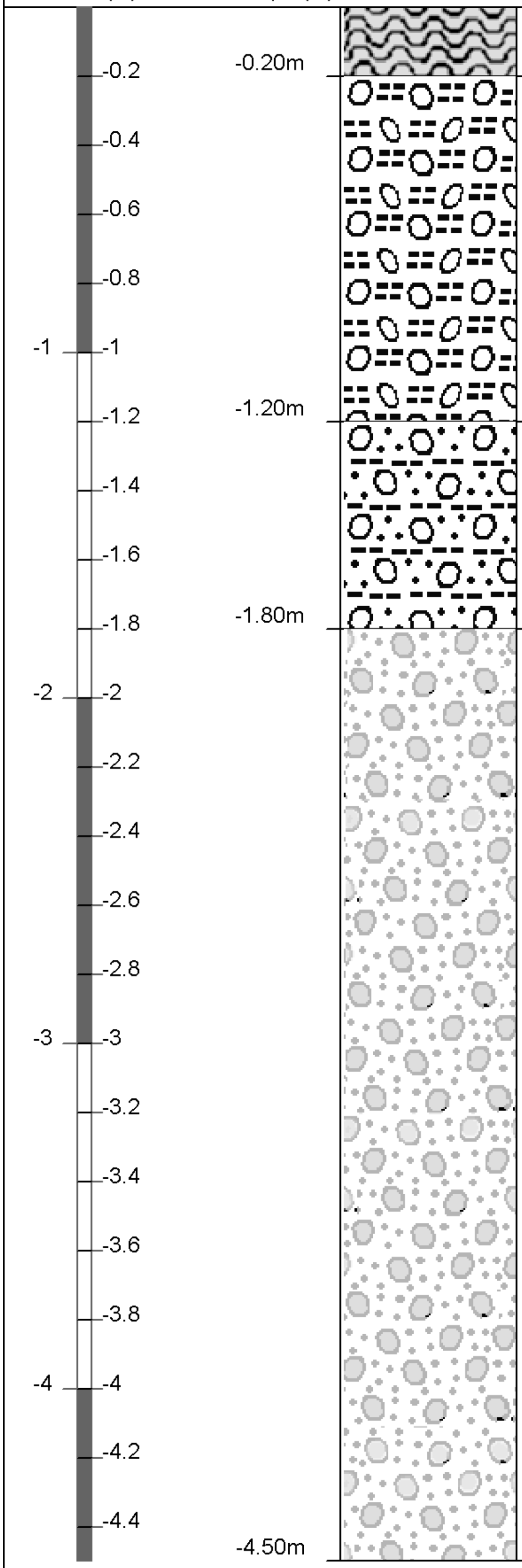
Gridref: M36:69444-29810 Accuracy : 2 (1=high, 5=low)
Ground Level Altitude : 10.14 +MSD
Driller : not known
Drill Method : Rotary/Percussion
Drill Depth : -5.2m Drill Date : 9/10/2008



Water Level	Depth(m)	Full Drillers Description	Formation Code
	-0.20m	Dark grey loamy topsoil	
	-1.00m	Light grey & yellow silty clay	
	-1.40m	Sandy gravel <70mm diameter	
	-1.80m	Silty gravel	
	-2.60m	Yellow & grey silty clay with some gravel	
	-2.80m	Soft brown yellow silty clay	
	-5.20m	Grey silty gravel	

Borelog for well M36/8681

Gridref: M36:69726-29855 Accuracy : 2 (1=high, 5=low)
Ground Level Altitude : 10.14 +MSD
Driller : not known
Drill Method : Rotary/Percussion
Drill Depth : -4.5m Drill Date : 9/10/2008



Depth(m)	Full Drillers Description	Formation Code
-0.20m	Dark grey loamy topsoil	
-1.20m	Grey & brown silt mixed with gravel. Dry. No sand or small gravel particles. Max. Gravel size 80mm	
-1.80m	Grey silty sand mixed with gravel. Dry	
-4.50m	Grey sandy gravel becoming wet	

Appendix D
CGD Borehole Log

Eliot Sinclair
surveyors | engineers | planners

Unit 4, 502 Wairakei Road, Christchurch
PO Box 4597, Christchurch N.Z.
Ph. (03) 379-4014 Fax. (03) 365-2449

Job Number	
359181	
Date Tested	
8-Nov-2012	
Page	1 of 2

SITE INVESTIGATION RECORD

D.P **33700**
Lot **2**

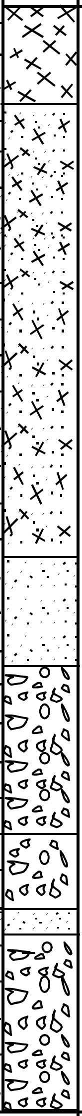
Client ***NZ Plant & Food Research***
Site: ***581 Birches Road, Lincoln***

Borehole 3

DEPTH
[m]
GL

Borehole log

SPT Data
(uncorrected)



Depth [m]	Borehole log	SPT Data (uncorrected)
0.0	Greyish Brown SILT, highly plastic, soft, moist	
0.4		
0.8	Brownish Grey Mottled Orange Silty SAND.	
1.2		
1.6		N=4 (C) 1.5m 1, 1/ 1, 1, 1, 1 75mm
2.0	▽ Water table at 2.1m depth .	
2.4		
2.8		N=3 (C) 3.0m 0, 1/ 0, 1, 0, 2 75mm
3.2	Grey fine-medium SAND, moist-wet.	
3.6		
4.0	Brownish Orange coarse Sandy GRAVEL up to 70mm, some Silt, moist-wet.	
4.4		N=30(C) 4.5m 5, 10/ 8, 7, 8, 7 75mm
4.8	Greyish Brown medium-coarse Sandy Gravel, moist-wet Greyish Brown fine-medium-SAND, moist-wet.	
5.2		
5.6	Brownish Grey medium-coarse Sandy GRAVEL up to 70mm.	
6.0		

Site Plan **See attached test location plan**

Comments

Civil Engineer ***Date:***

Eliot Sinclair
surveyors | engineers | planners

Unit 4, 502 Wairakei Road, Christchurch
PO Box 4597, Christchurch N.Z.
Ph. (03) 379-4014 Fax. (03) 365-2449

Job Number	
359181	
Date Tested	
8-Nov-2012	
Page	***2 of 2***

SITE INVESTIGATION RECORD

D.P ***33700***
Lot **2**

Client ***NZ Plant & Food Research***
Site: ***581 Birches Road, Lincoln***

Project No.
Borehole 3

DEPTH ***[m]*** GL	***Borehole log***	***SPT Data (uncorrected)***
6.0		
6.4		N=42 (C) 6.0m 4, 8/ 8, 7, 8, 7 75mm
6.8		
7.2		
7.6	Brownish Grey medium Sandy GRAVEL up to 80mm.	N=24 (C) 7.5m 4, 6/ 7, 6, 4, 7 75mm
8.0		
8.4		
8.8		
9.2		N=36(C) 9.0m 2, 5/ 9, 8, 10, 9 75mm
9.6		
10.0		
10.4		
10.8	End of Log at 10.5m depth	N=49(C) 10.5m 7, 9/ 11, 12, 14, 12 75mm
11.2		
11.6		
12.0		

Site Plan

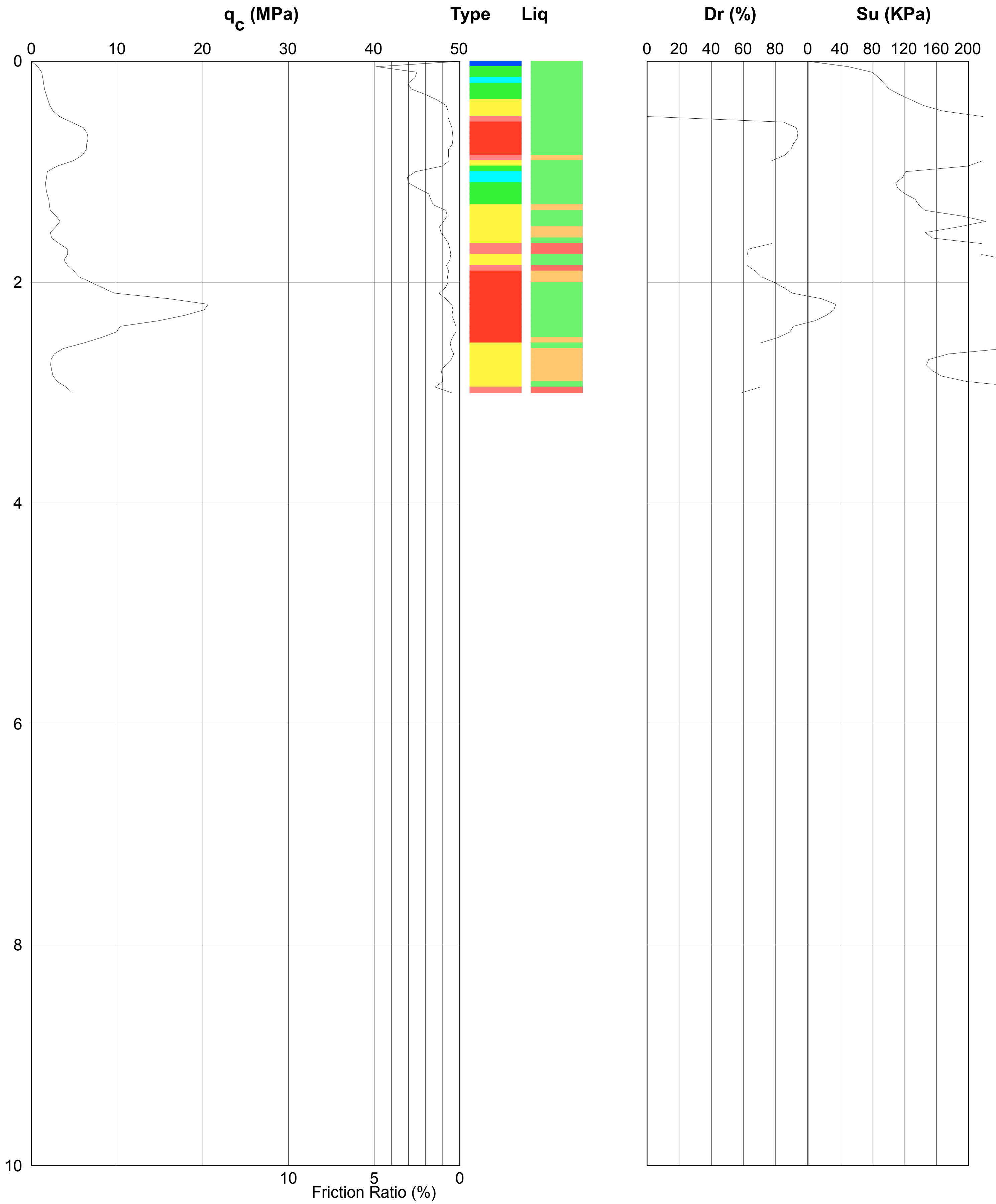
See attached test location plan

Comments

Civil Engineer ***Date:***

Appendix E
CPT Logs

PIEZOCONE PENETROMETER TEST (CPTU) INTERPRETIVE REPORT



Job No: 9402

CPT No: CPTu006

Project: FH C/o Aurecon

Location: Rosemerryn, Edward St, Lincoln

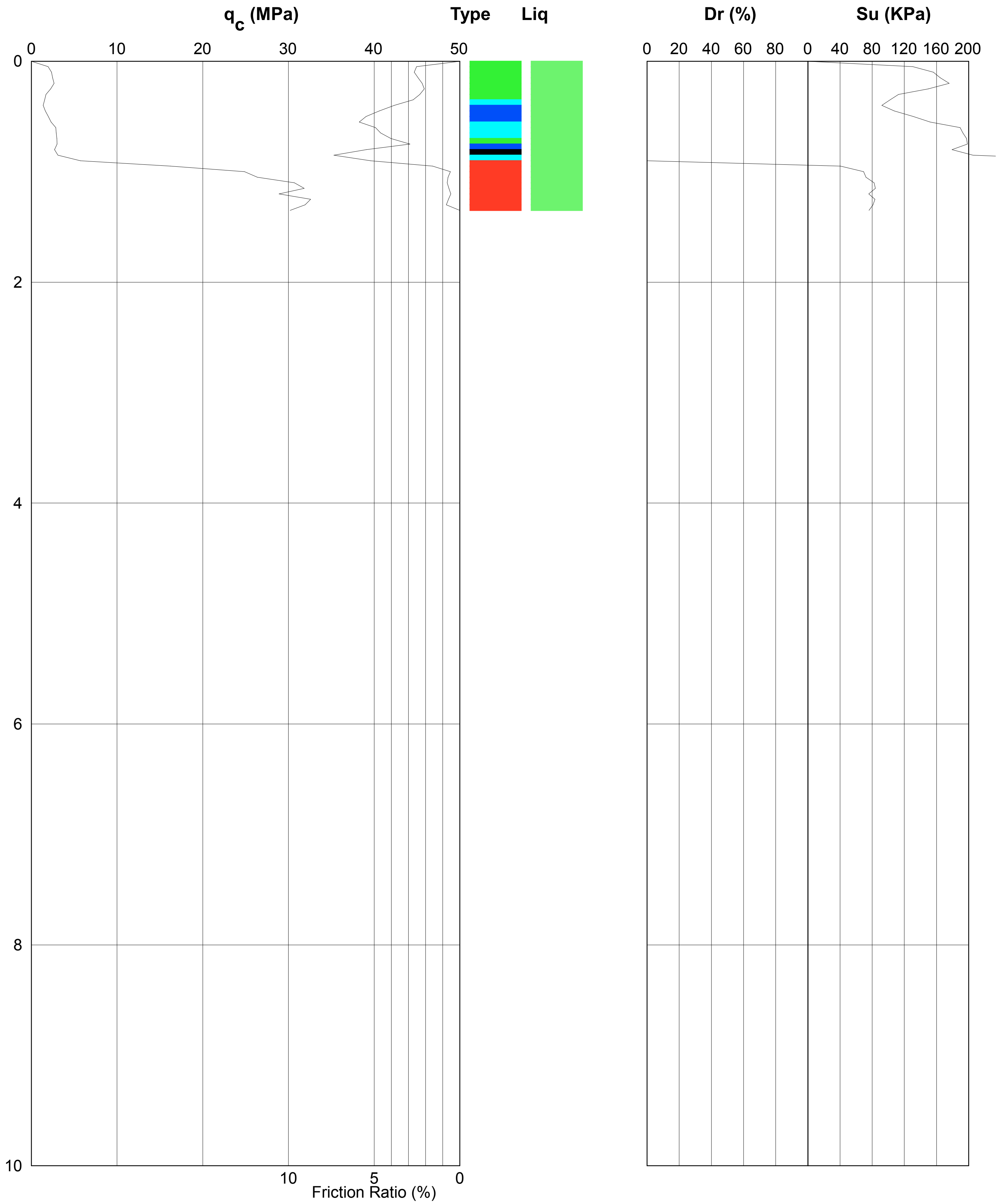
Date: 27/08/11

Operator: J. Kendrick

Remark: Effective Refusal

McMILLAN DRILLING SERVICES

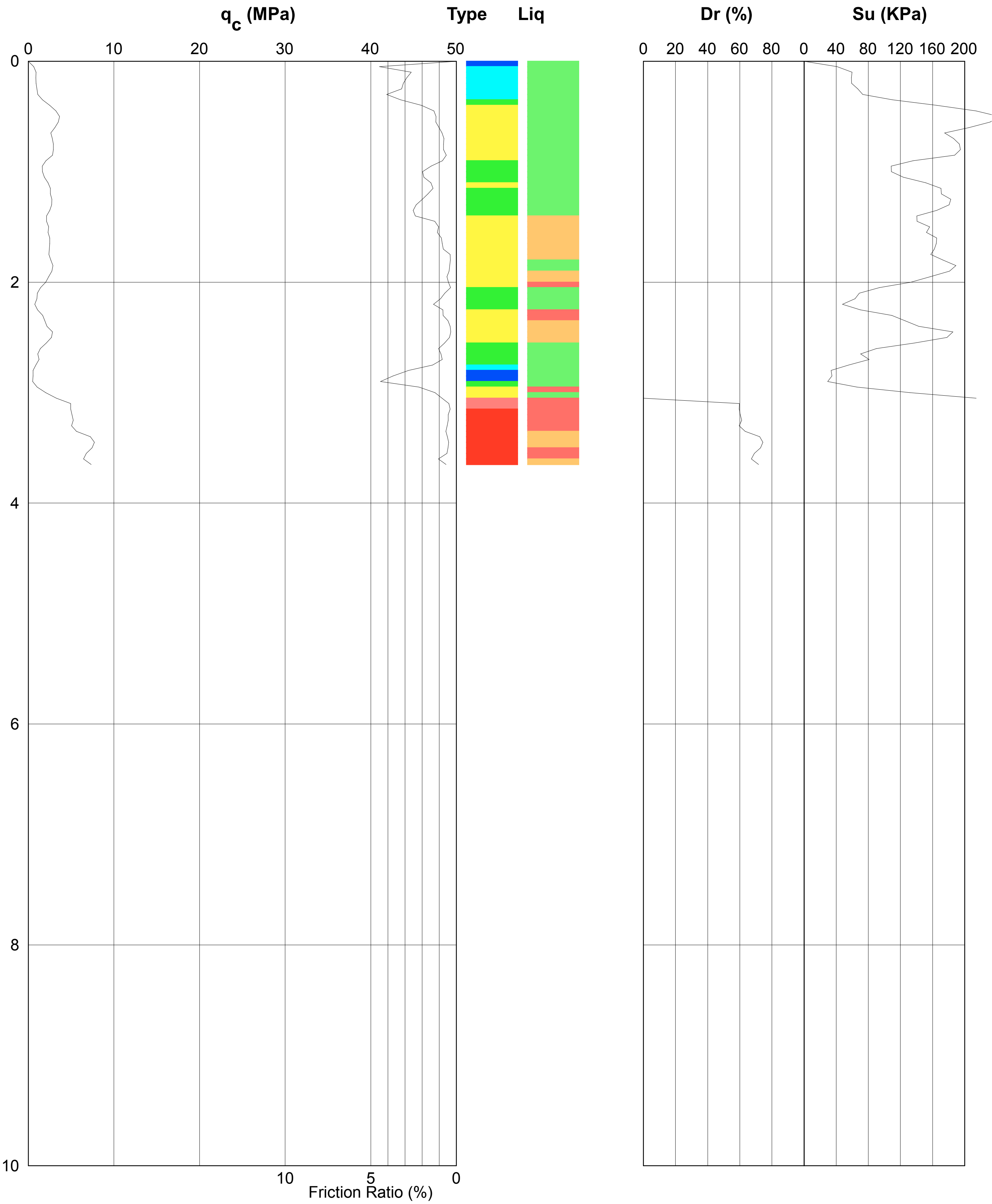
PIEZOCONE PENETROMETER TEST (CPTU) INTERPRETIVE REPORT



Job No:	9402	Date:	27/08/11
CPT No:	CPTu007	Operator:	J. Kendrick
Project:	FH C/o Aurecon	Remark:	Effective Refusal
Location:	Rosemerryn, Edward St, Lincoln		

McMILLAN DRILLING SERVICES

PIEZOCONE PENETROMETER TEST (CPTU) INTERPRETIVE REPORT



Job No: 9402

CPT No: CPTu009

Project: Job No 9402 - Site Investigations

Location: Rosemerryn, Edward St, Lincoln

Date: 27/08/11

Operator: J. Kendrick

Remark: Effective Refusal

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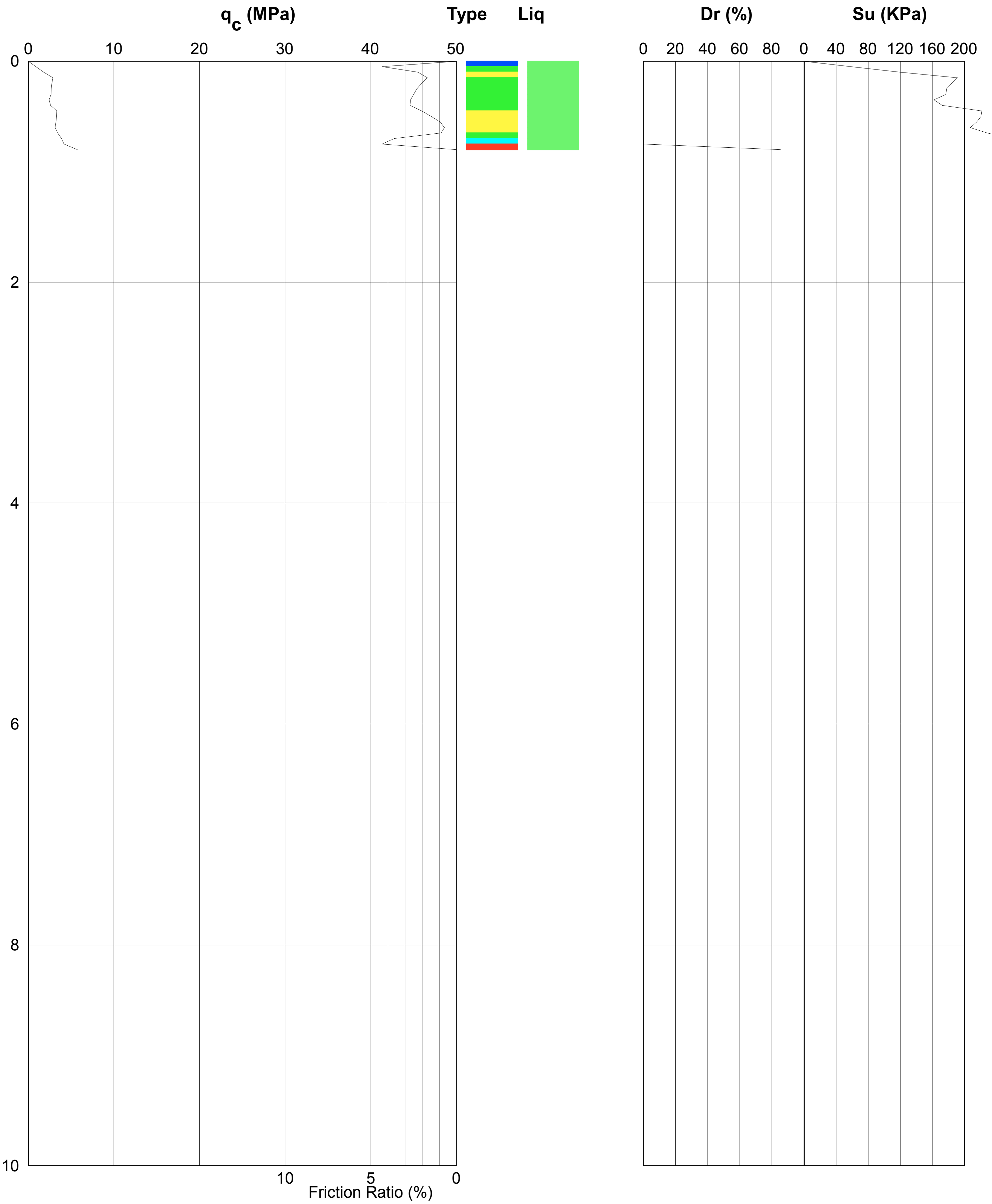
PIEZOCONE PENETROMETER TEST (CPTU) INTERPRETIVE REPORT



Job No: 9402

CPT No: CPTu009a

Project: FH C/o Aurecon

Location: Rosemerryn, Edward St, Lincoln

Date: 27/08/11

Operator: J. Kendrick

Remark: Effective Refusal

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PIEZOCONE PENETROMETER TEST (CPTU) INTERPRETIVE REPORT

Job No:	9402	Date:	27/08/11
CPT No:	CPTu012	Operator:	J. Kendrick
Project:	FH C/o Aurecon	Remark:	Effective Refusal
Location:	Rosemerryn, Edward St, Lincoln		

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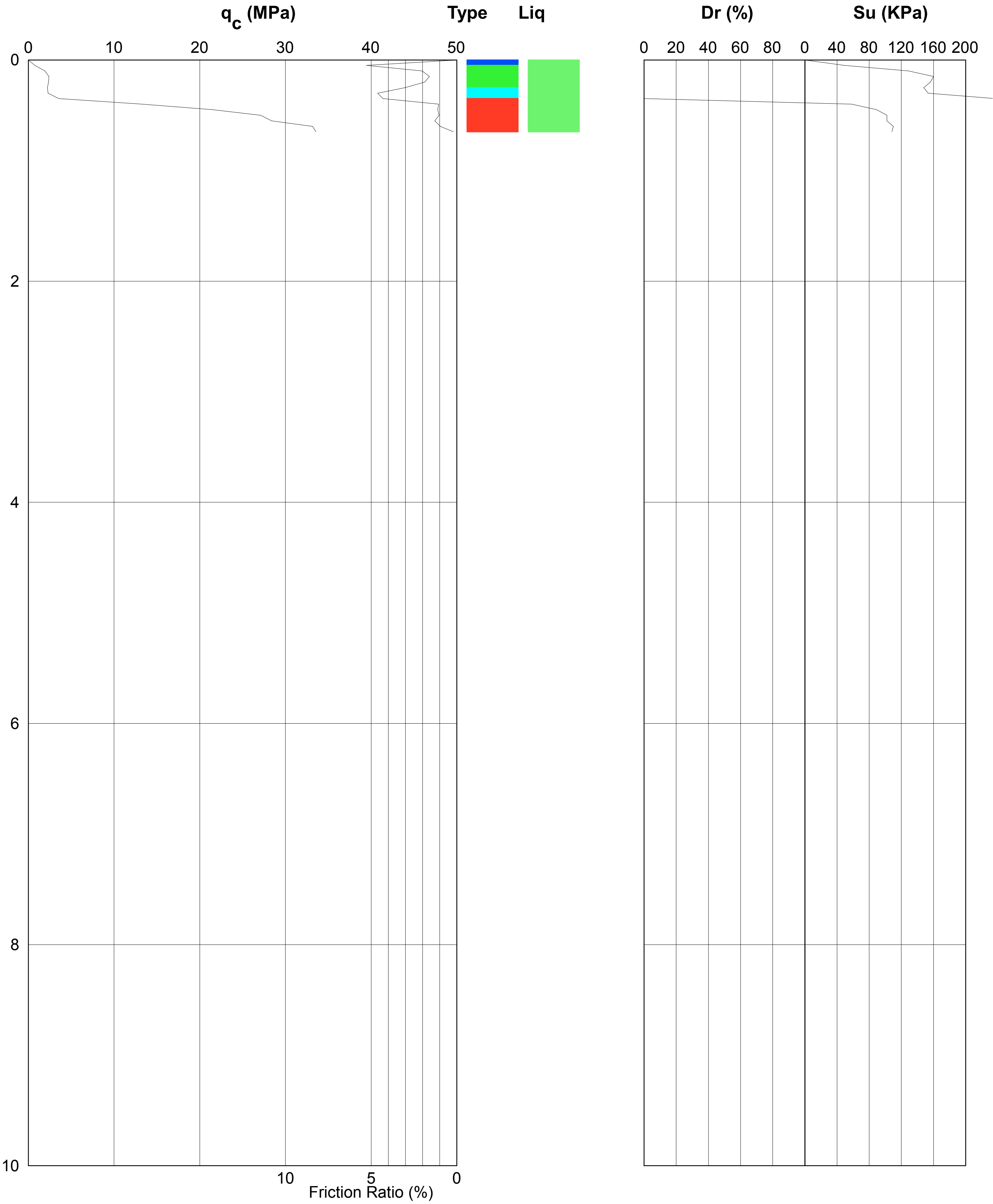
PIEZOCONE PENETROMETER TEST (CPTU) INTERPRETIVE REPORT



Job No:	9402	Date:	27/08/11
CPT No:	CPTu013	Operator:	J. Kendrick
Project:	FH C/o Aurecon	Remark:	Effective Refusal
Location:	Rosemerryn, Edward St, Lincoln		

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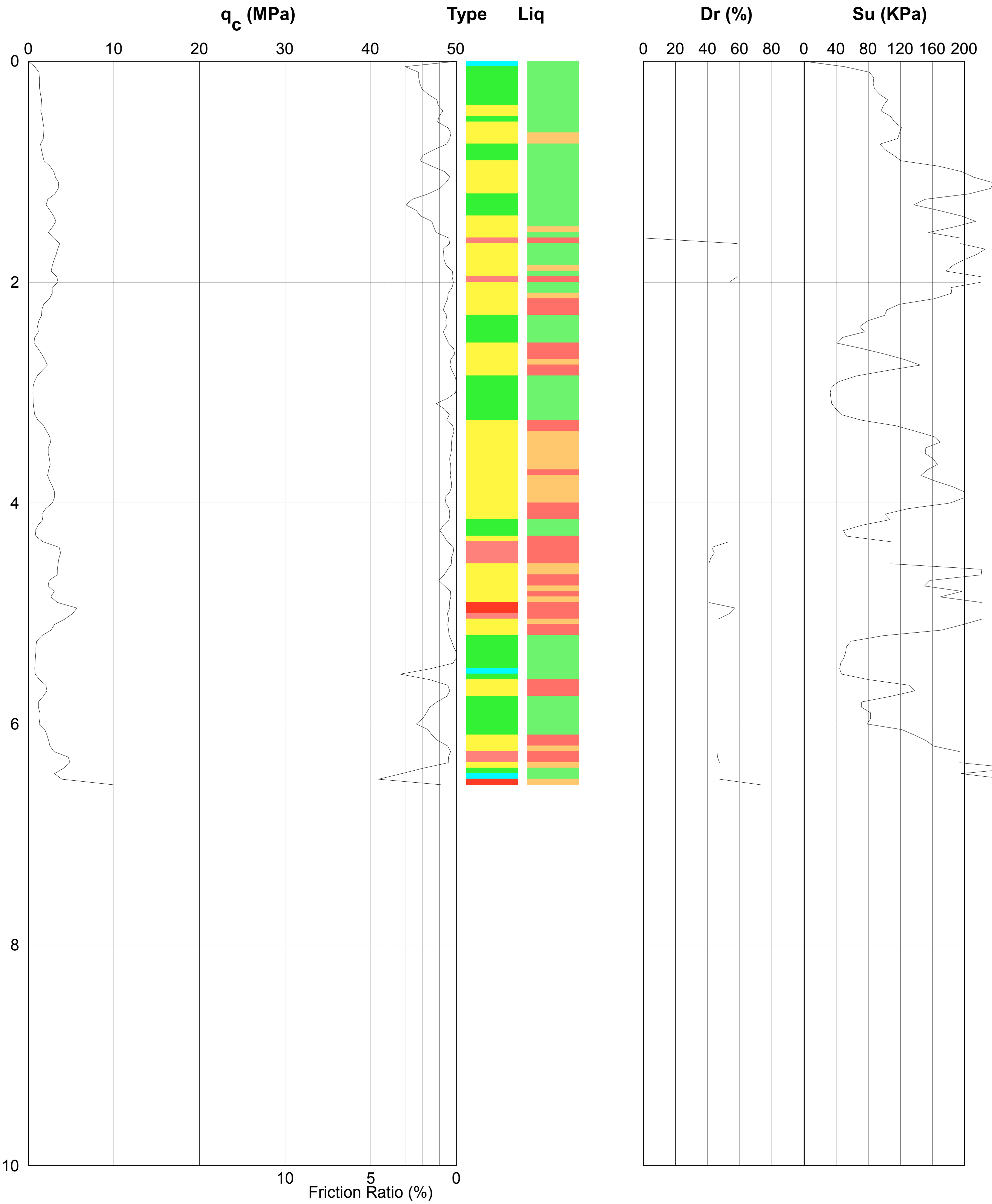
PIEZOCONE PENETROMETER TEST (CPTU) INTERPRETIVE REPORT



Job No: 9402

CPT No: CPTu014

Project: FH C/o Aurecon

Location: Rosemerryn, Edward St, Lincoln

Date: 27/08/11

Operator: J. Kendrick

Remark: Effective Refusal

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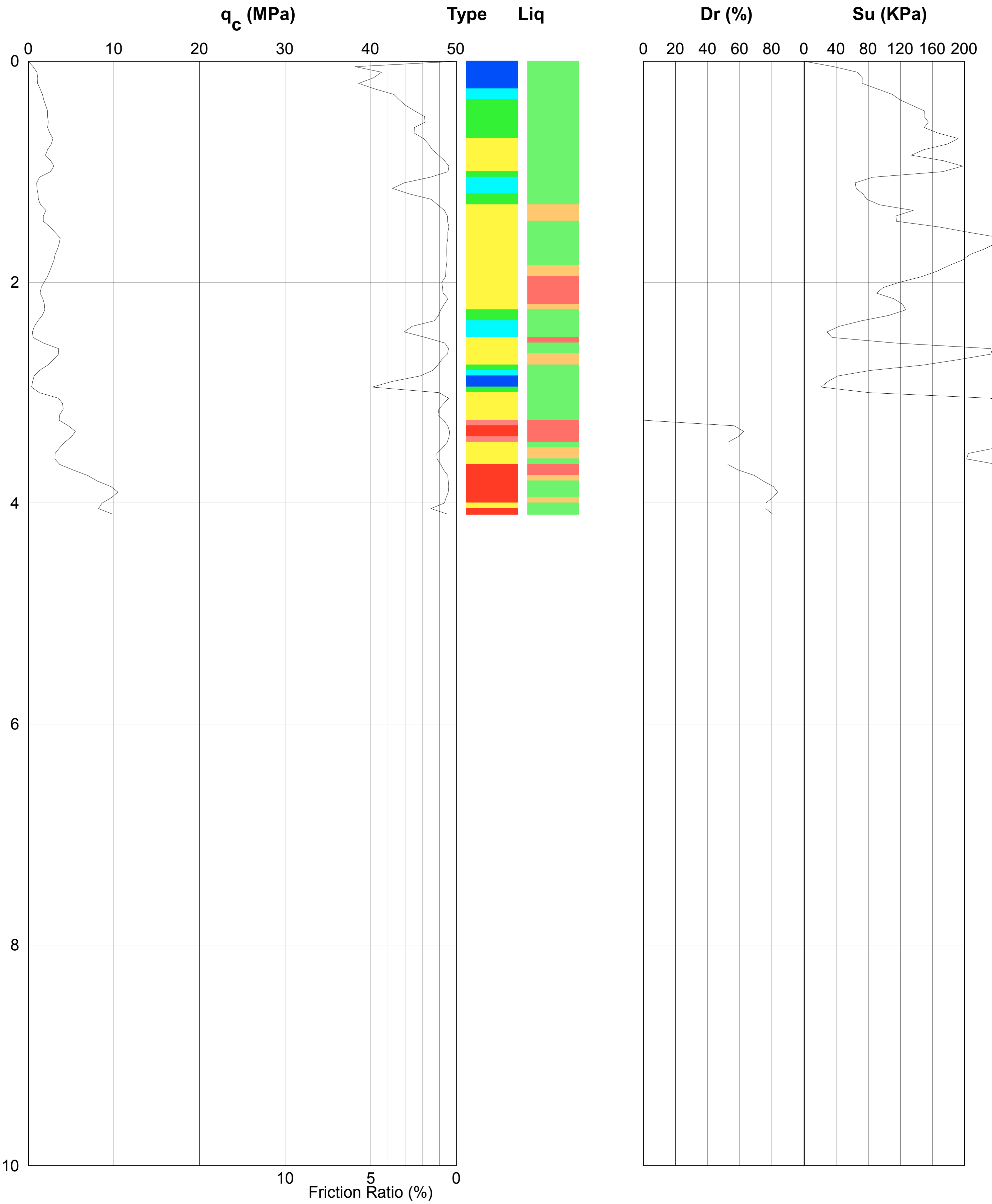
PIEZOCONE PENETROMETER TEST (CPTU) INTERPRETIVE REPORT



Job No: 9402

CPT No: CPTu015

Project: FH C/o Aurecon

Location: Rosemerryn, Edward St, Lincoln

Date: 27/08/11

Operator: J. Kendrick

Remark: Effective Refusal

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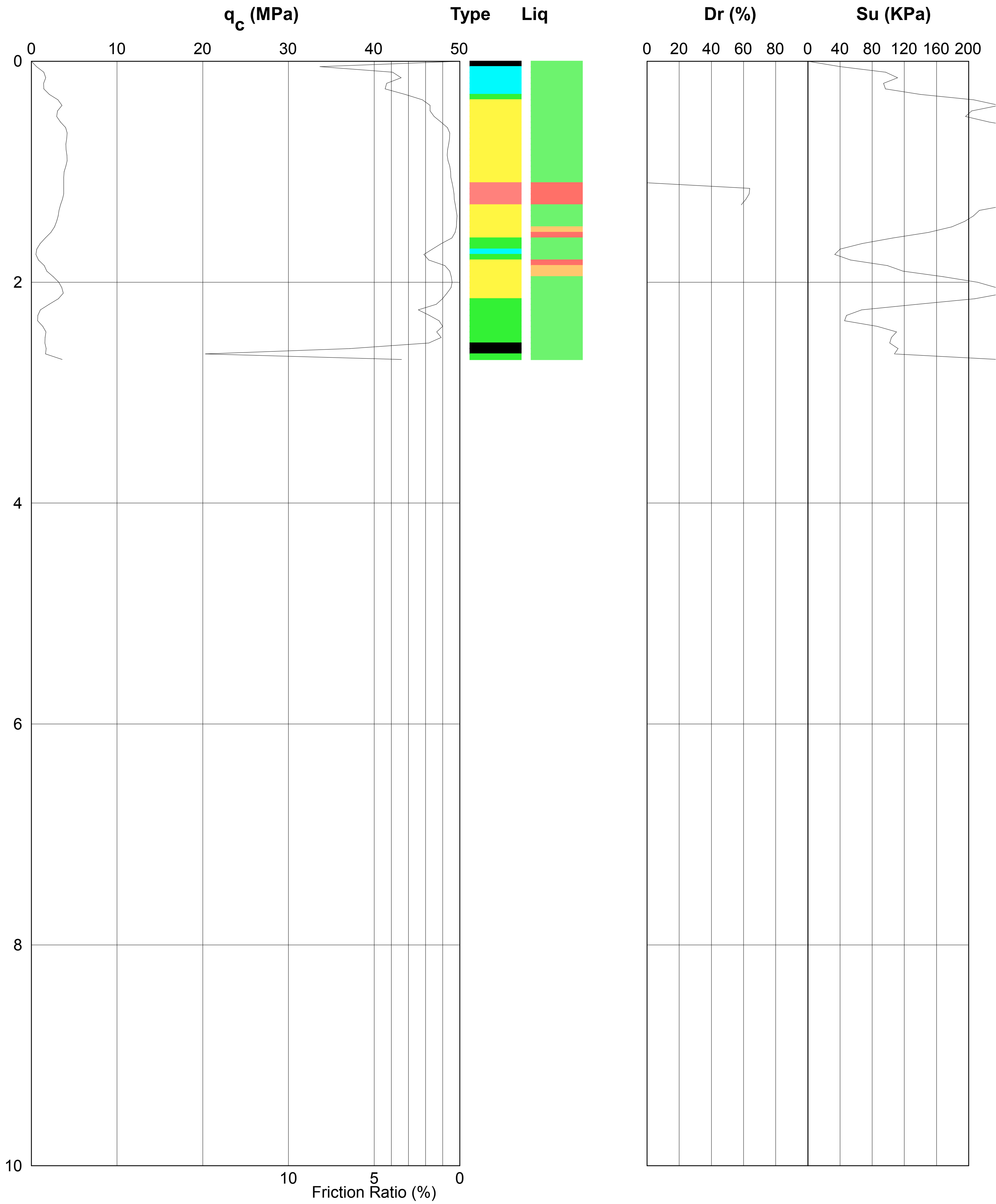
PIEZOCONE PENETROMETER TEST (CPTU) INTERPRETIVE REPORT



Job No:	9402	Date:	27/08/11
CPT No:	CPTu016	Operator:	J. Kendrick
Project:	FH C/o Aurecon	Remark:	Effective Refusal
Location:	Rosemerryn, Edward St, Lincoln		

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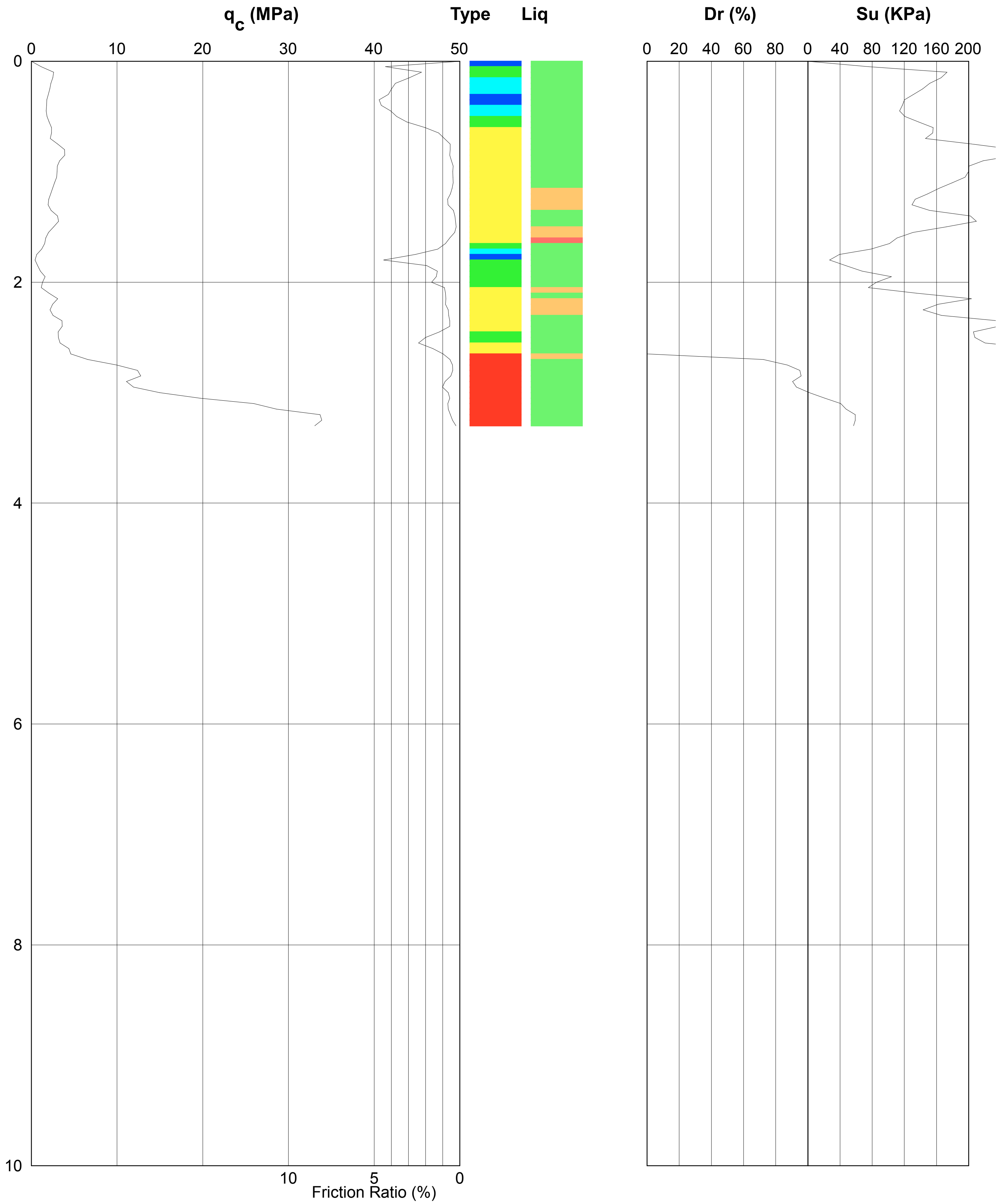
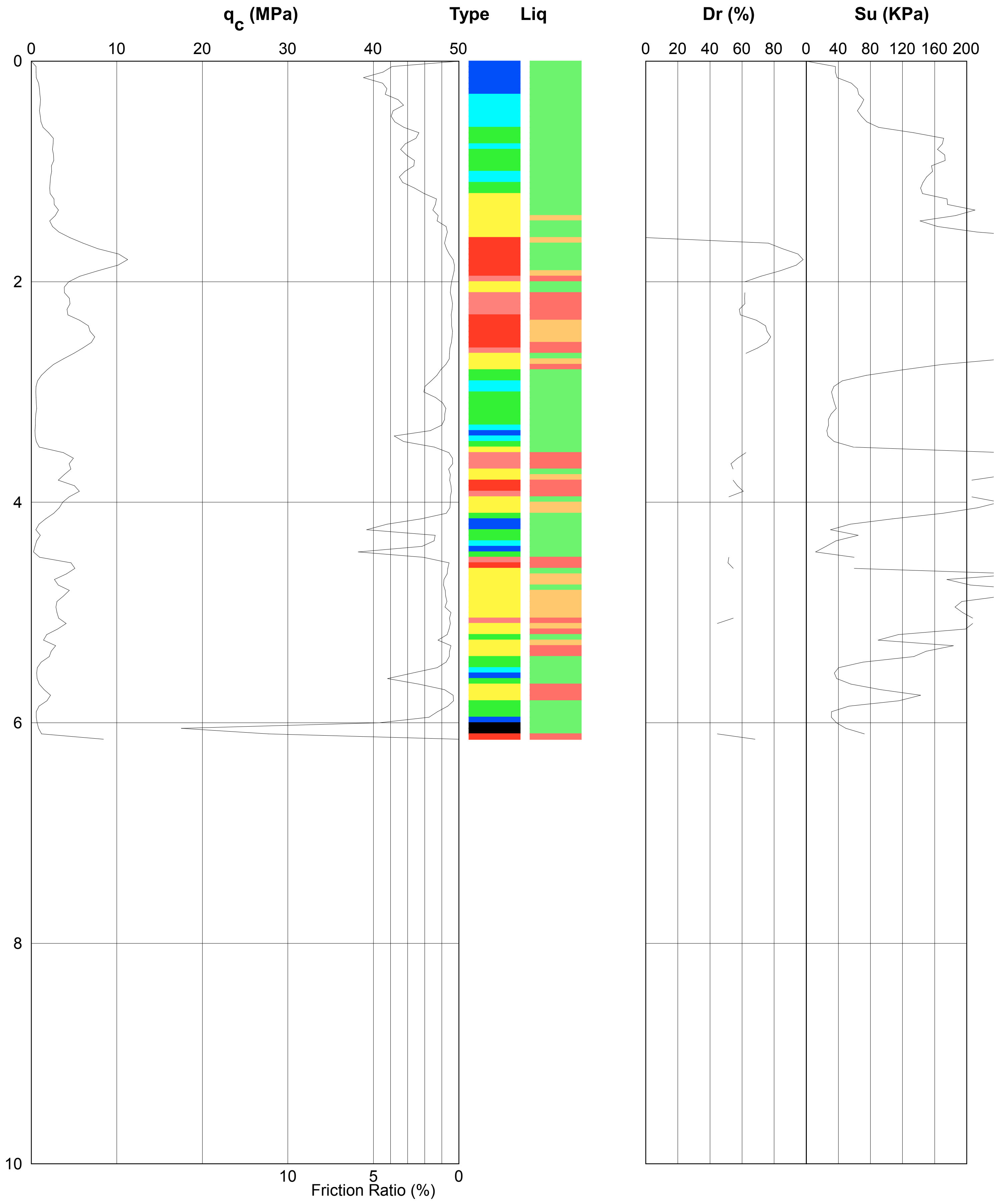
PIEZOCONE PENETROMETER TEST (CPTU) INTERPRETIVE REPORT



Job No:	9402	Date:	27/08/11
CPT No:	CPTu017	Operator:	J. Kendrick
Project:	FH C/o Aurecon	Remark:	Effective Refusal
Location:	Rosemerryn, Edward St, Lincoln		

PIEZOCONE PENETROMETER TEST (CPTU) INTERPRETIVE REPORT



Job No: 9402

CPT No: CPTu018

Project: FH C/o Aurecon

Location: Rosemerryn, Edward St, Lincoln

Date: 27/08/11

Operator: J. Kendrick

Remark: Effective Refusal

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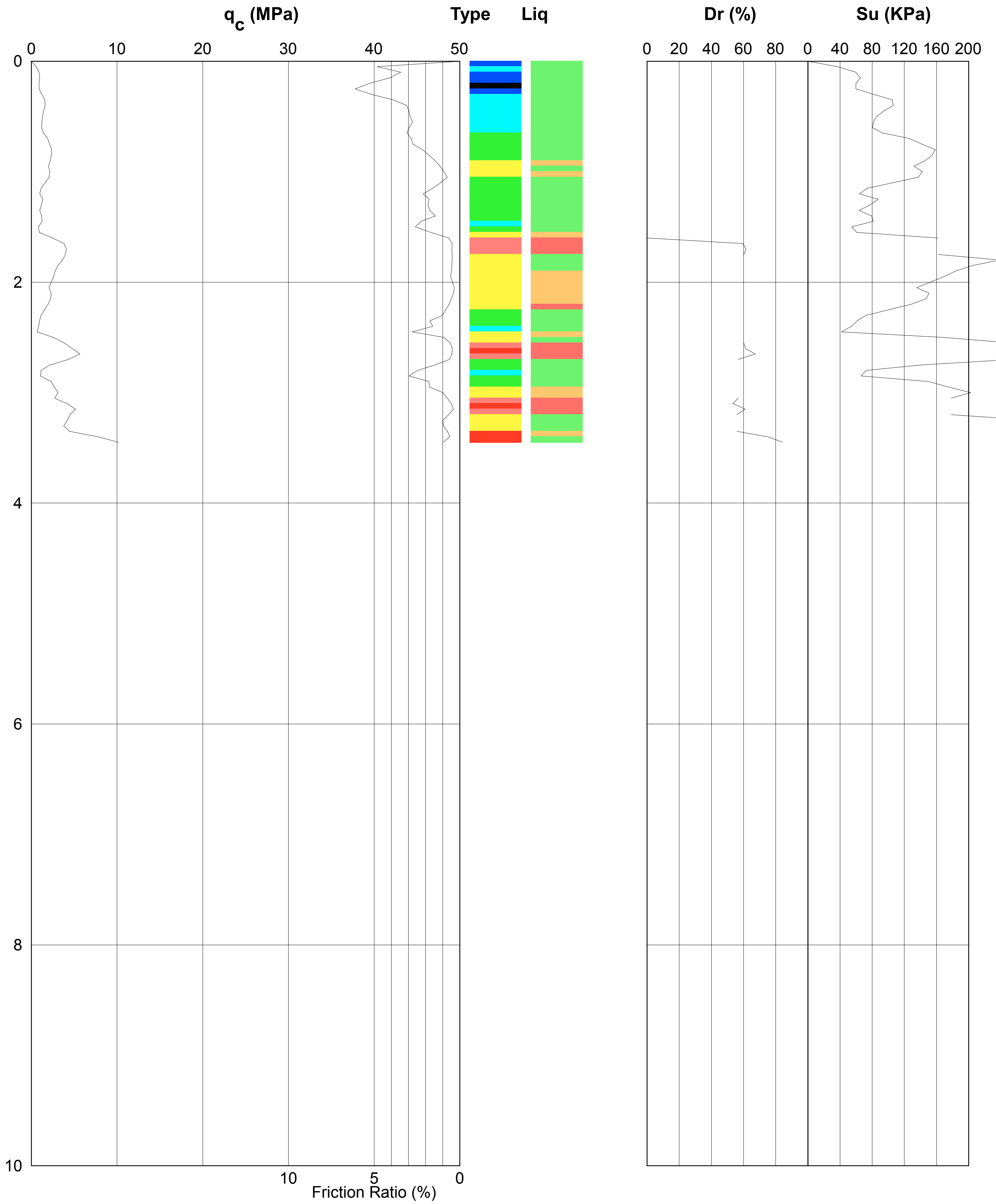
PIEZOCONE PENETROMETER TEST (CPTU) INTERPRETIVE REPORT



Job No:	9402	Date:	27/08/11
CPT No:	CPTu019	Operator:	J. Kendrick
Project:	FH C/o Aurecon	Remark:	Effective Refusal
Location:	Rosemerryn, Edward St, Lincoln		

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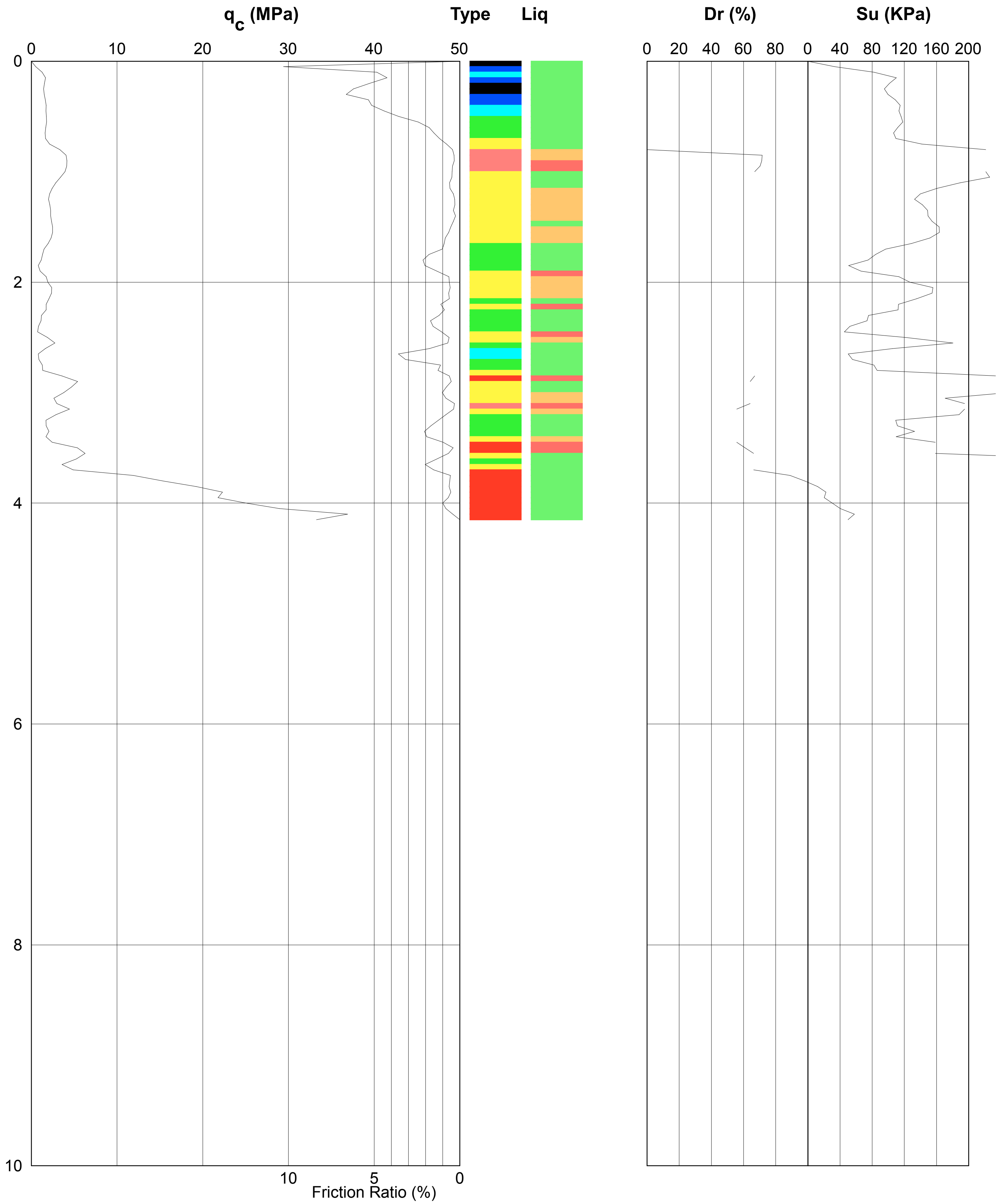
PIEZOCONE PENETROMETER TEST (CPTU) INTERPRETIVE REPORT



Job No: 9402

CPT No: CPTu020

Project: FH C/o Aurecon

Location: Rosemerryn, Edward St, Lincoln

Date: 27/08/11

Operator: J. Kendrick

Remark: Effective Refusal

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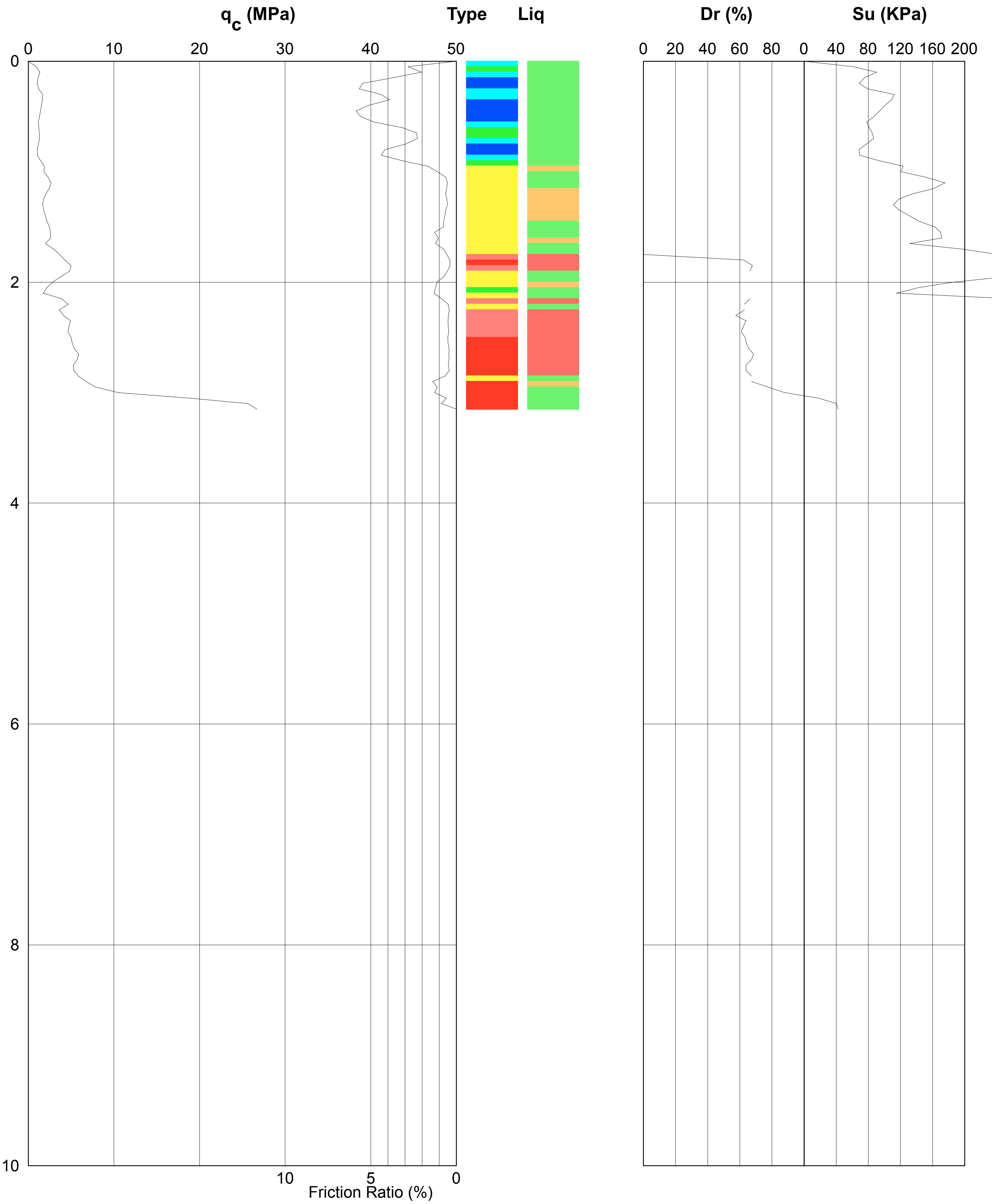
PIEZOCONE PENETROMETER TEST (CPTU) INTERPRETIVE REPORT



Job No:	9402	Date:	27/08/11
CPT No:	CPTu021	Operator:	J. Kendrick
Project:	FH C/o Aurecon	Remark:	Effective Refusal
Location:	Rosemerryn, Edward St, Lincoln		

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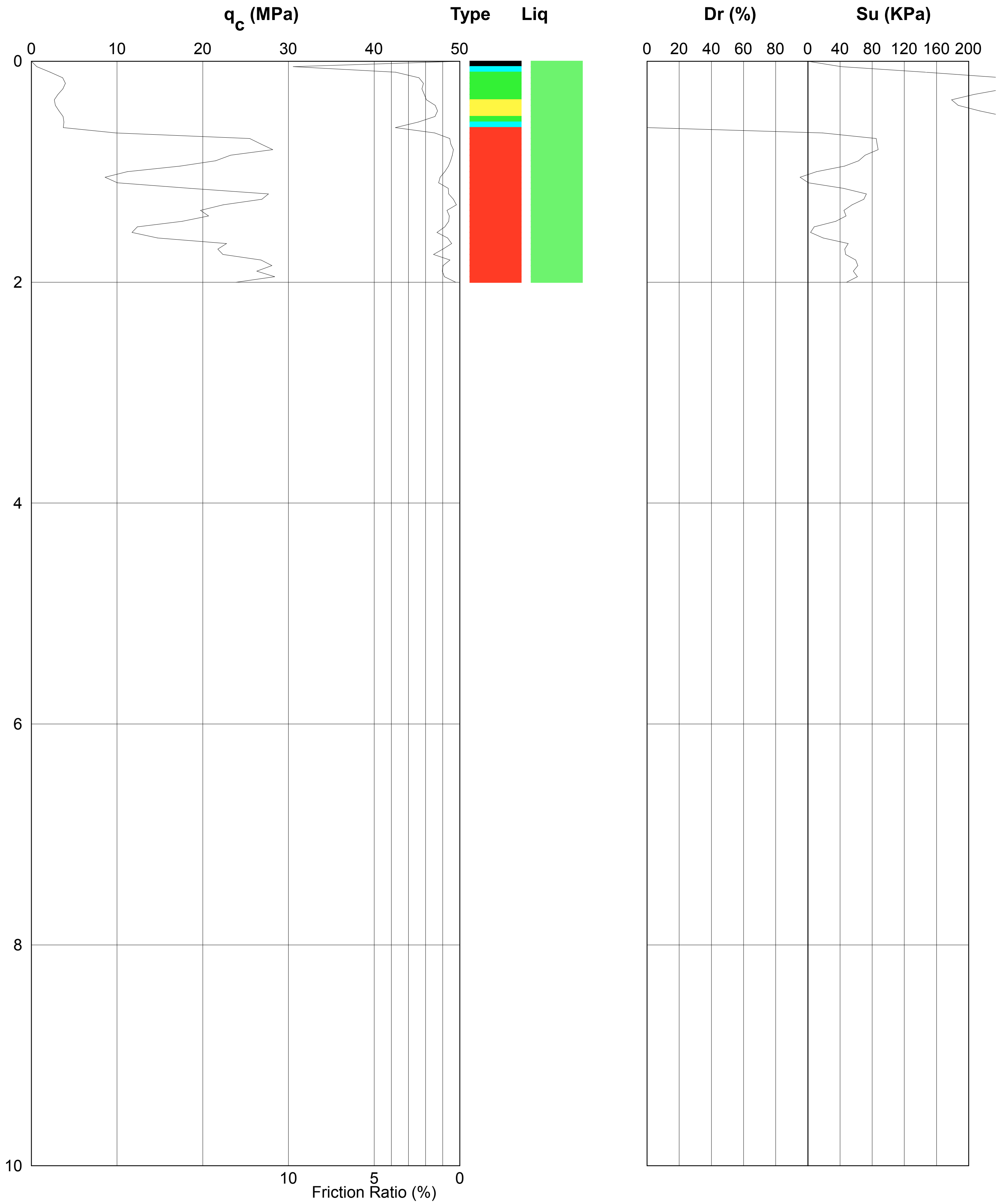
PIEZOCONE PENETROMETER TEST (CPTU) INTERPRETIVE REPORT



Job No:	9402	Date:	27/08/11
CPT No:	CPTu028	Operator:	J. Kendrick
Project:	FH C/o Aurecon	Remark:	Effective Refusal
Location:	Rosemerryn, Edward St, Lincoln		

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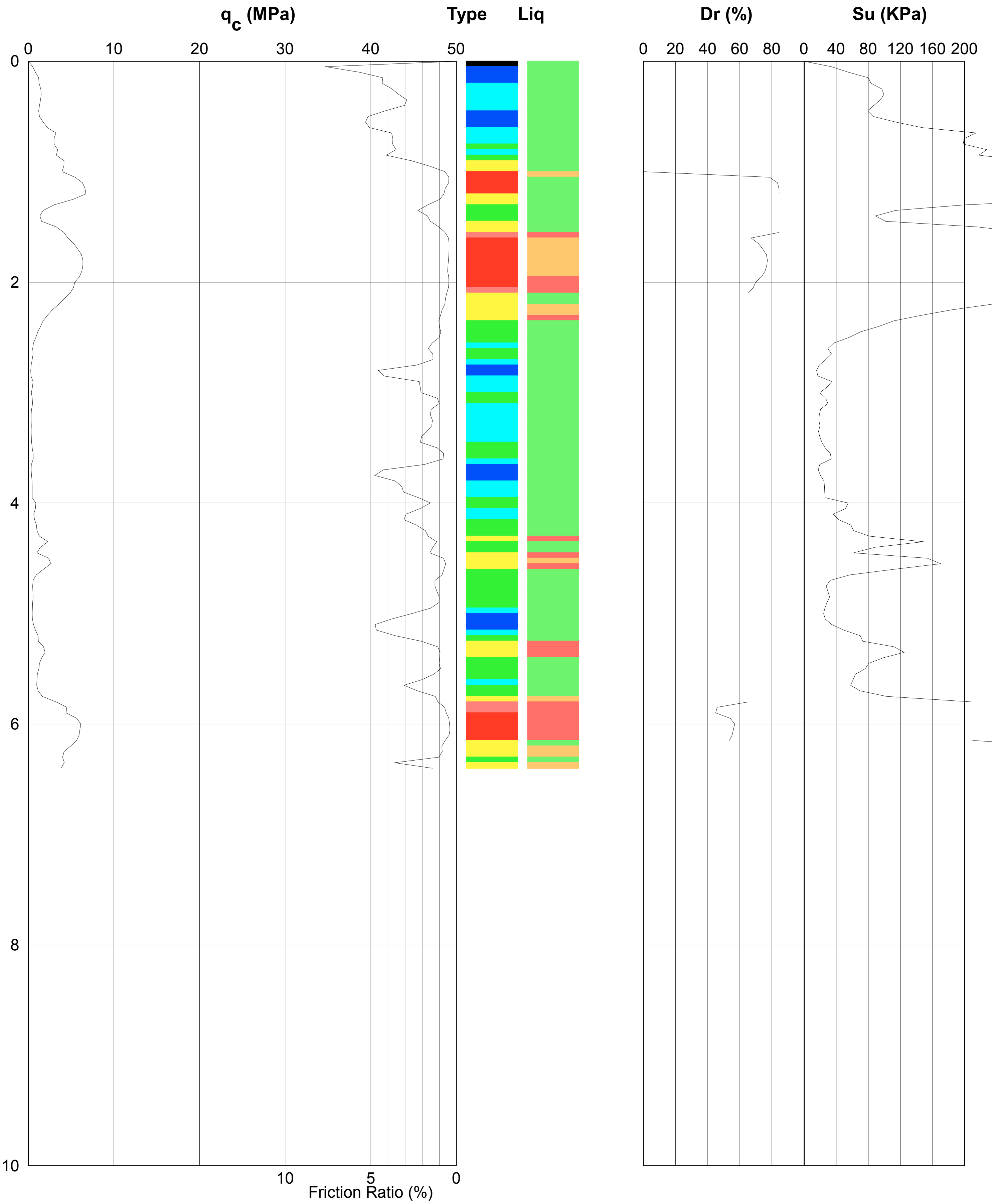
PIEZOCONE PENETROMETER TEST (CPTU) INTERPRETIVE REPORT



Job No:	9402	Date:	27/08/11
CPT No:	CPTu029	Operator:	J. Kendrick
Project:	FH C/o Aurecon	Remark:	Effective Refusal
Location:	Rosemerryn, Edward St, Lincoln		

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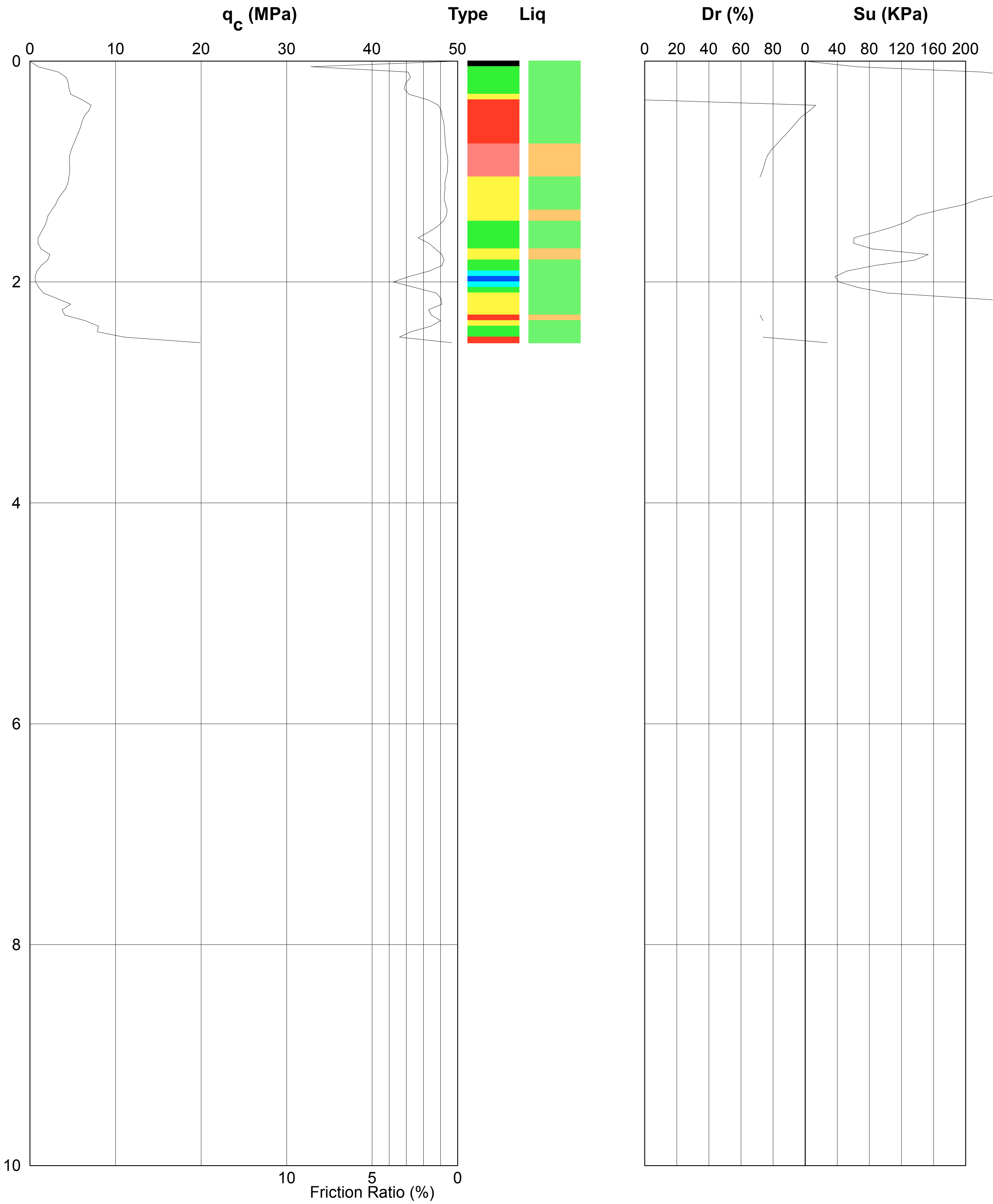
PIEZOCONE PENETROMETER TEST (CPTU) INTERPRETIVE REPORT



Job No:	9402	Date:	20/09/11
CPT No:	CPTu033	Operator:	B. Powell
Project:	FH C/o Aurecon	Remark:	Effective Refusal
Location:	Rosemerryn, Edward St, Lincoln		

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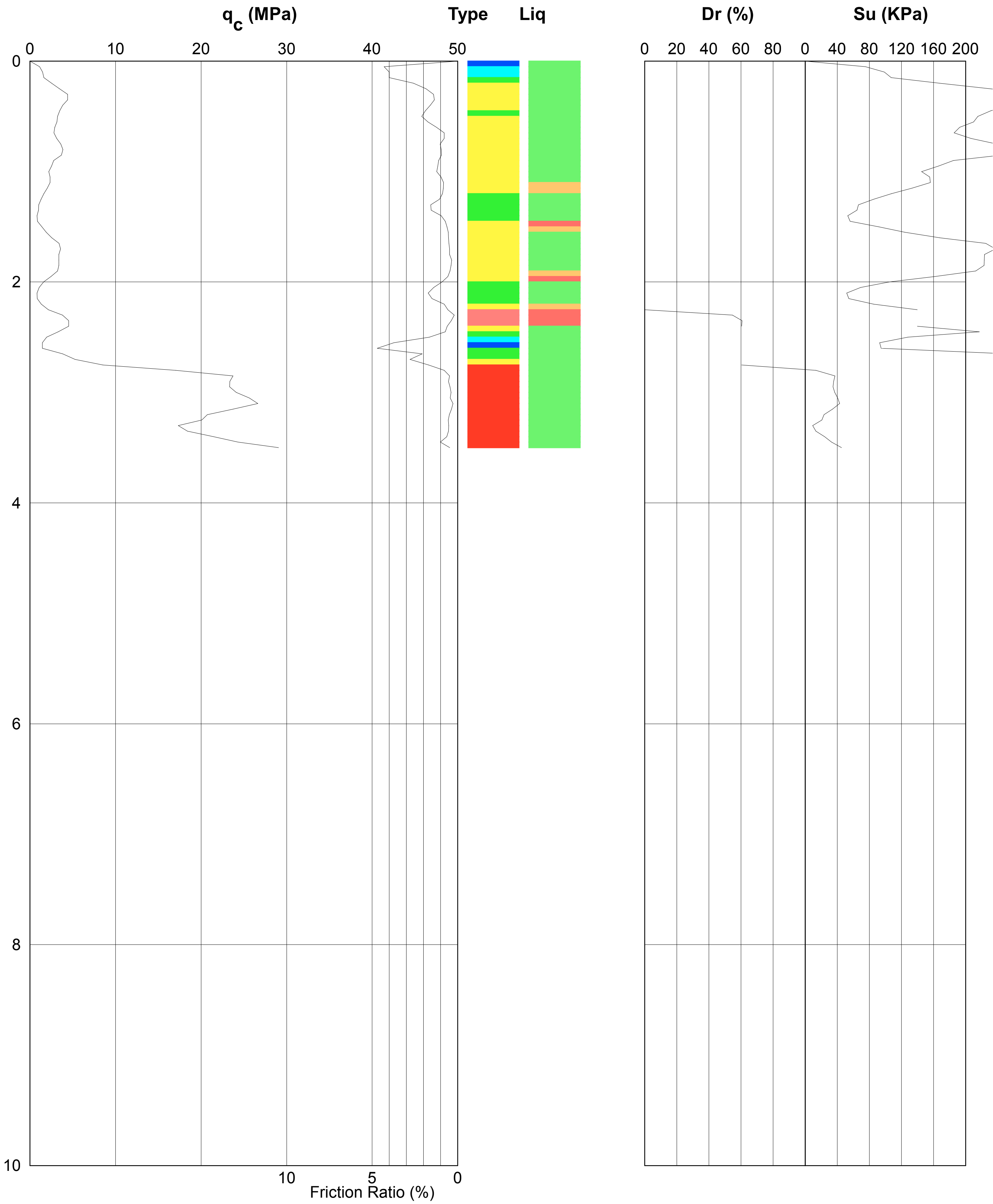
PIEZOCONE PENETROMETER TEST (CPTU) INTERPRETIVE REPORT



Job No:	9402	Date:	20/09/11
CPT No:	CPTu034	Operator:	B. Powell
Project:	FH C/o Aurecon	Remark:	Effective Refusal
Location:	Rosemerryn, Edward St, Lincoln		

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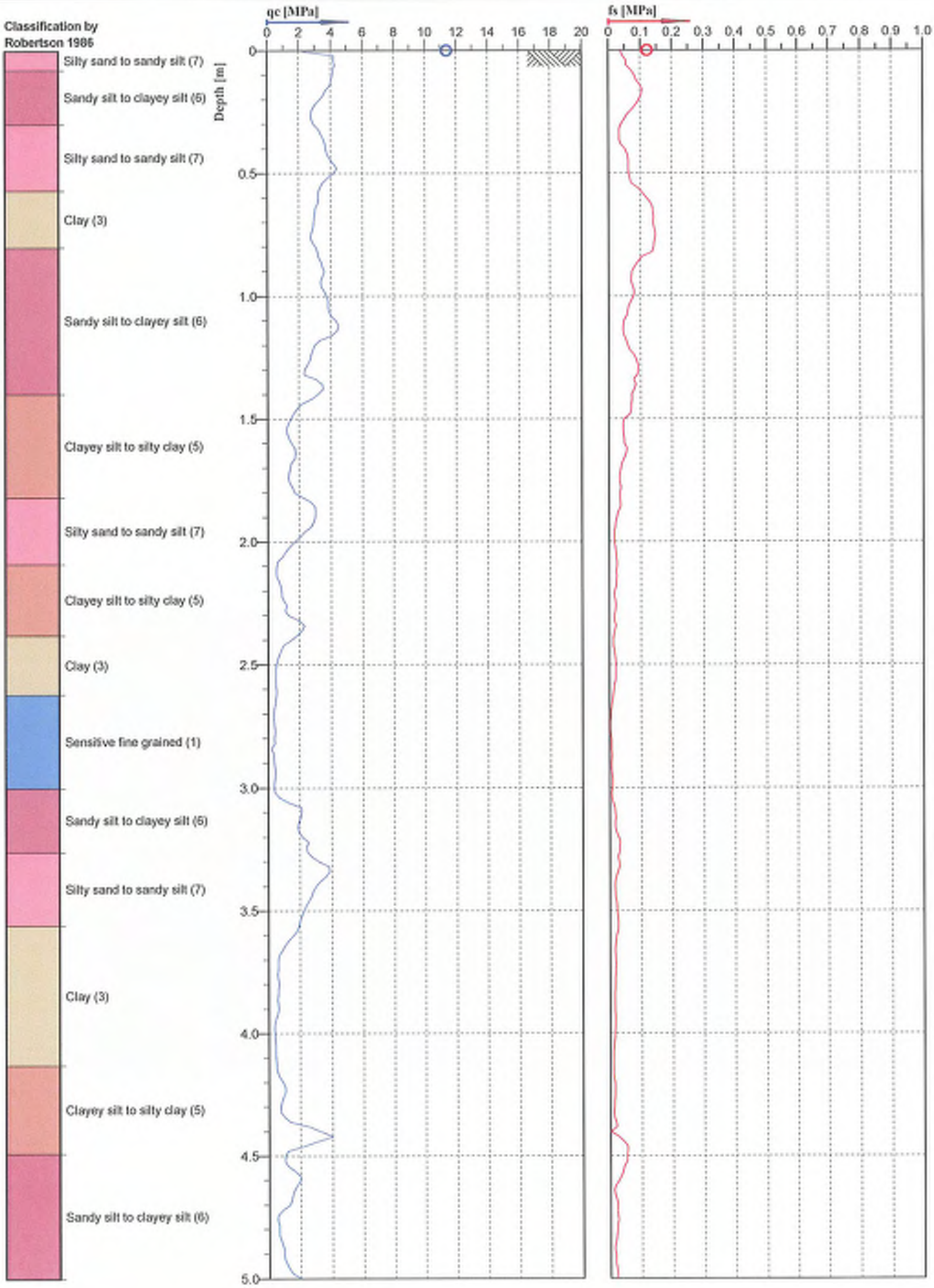
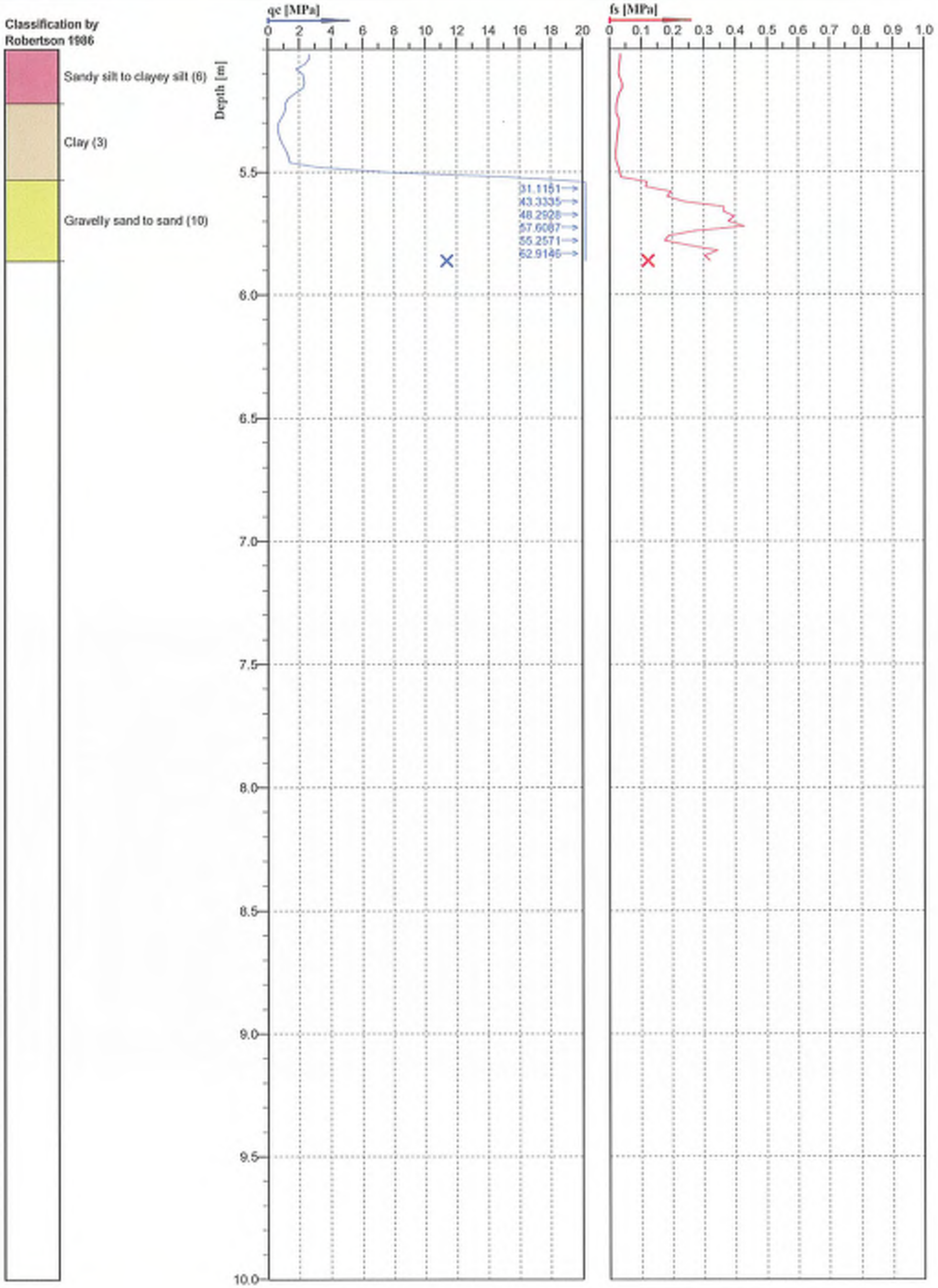


PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637

Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 1
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/2	Fig:
		File: RosemarrynSubdivisionCPT1.cpt	



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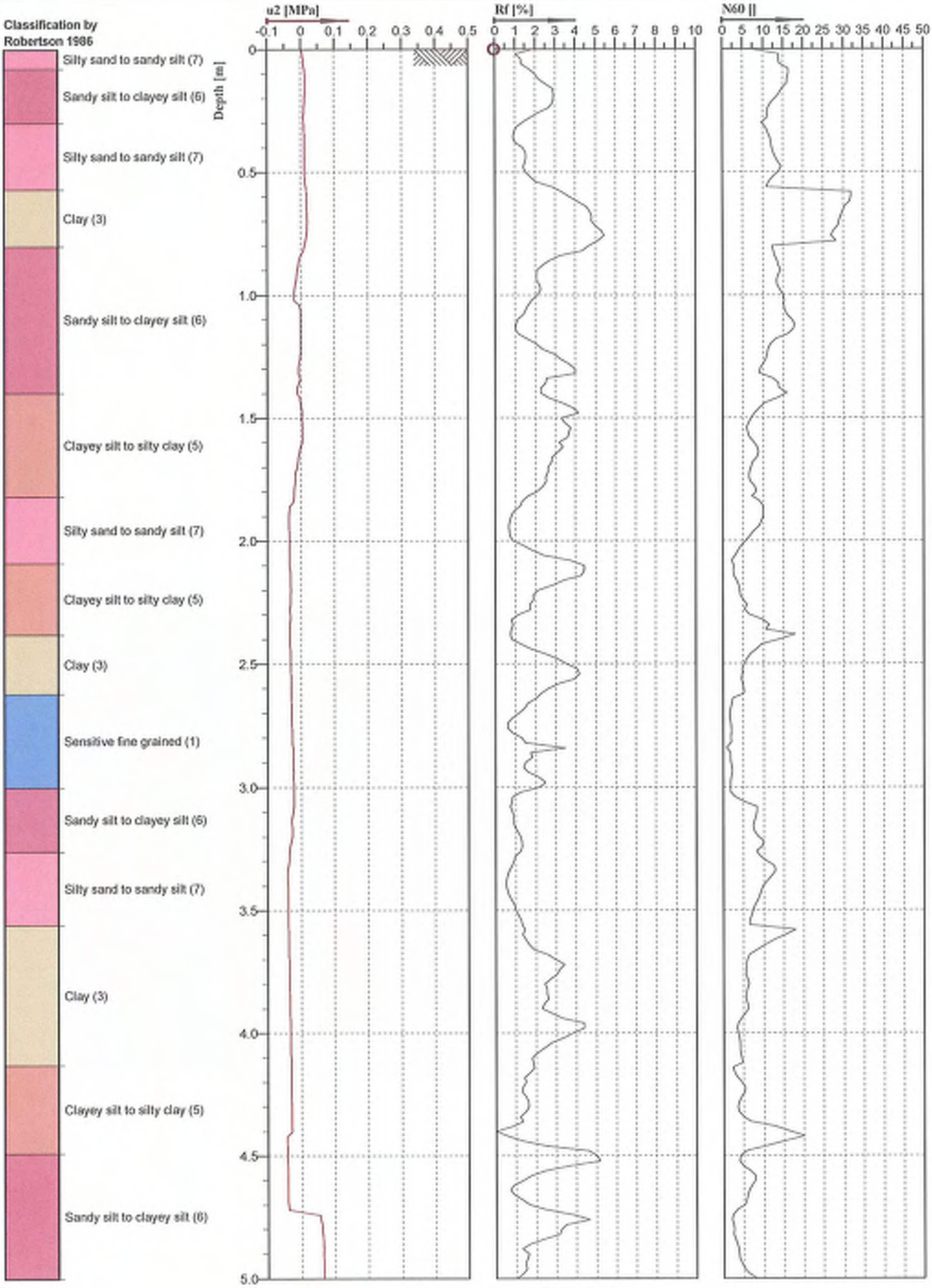
ENGINEERS
0800 477 637

Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

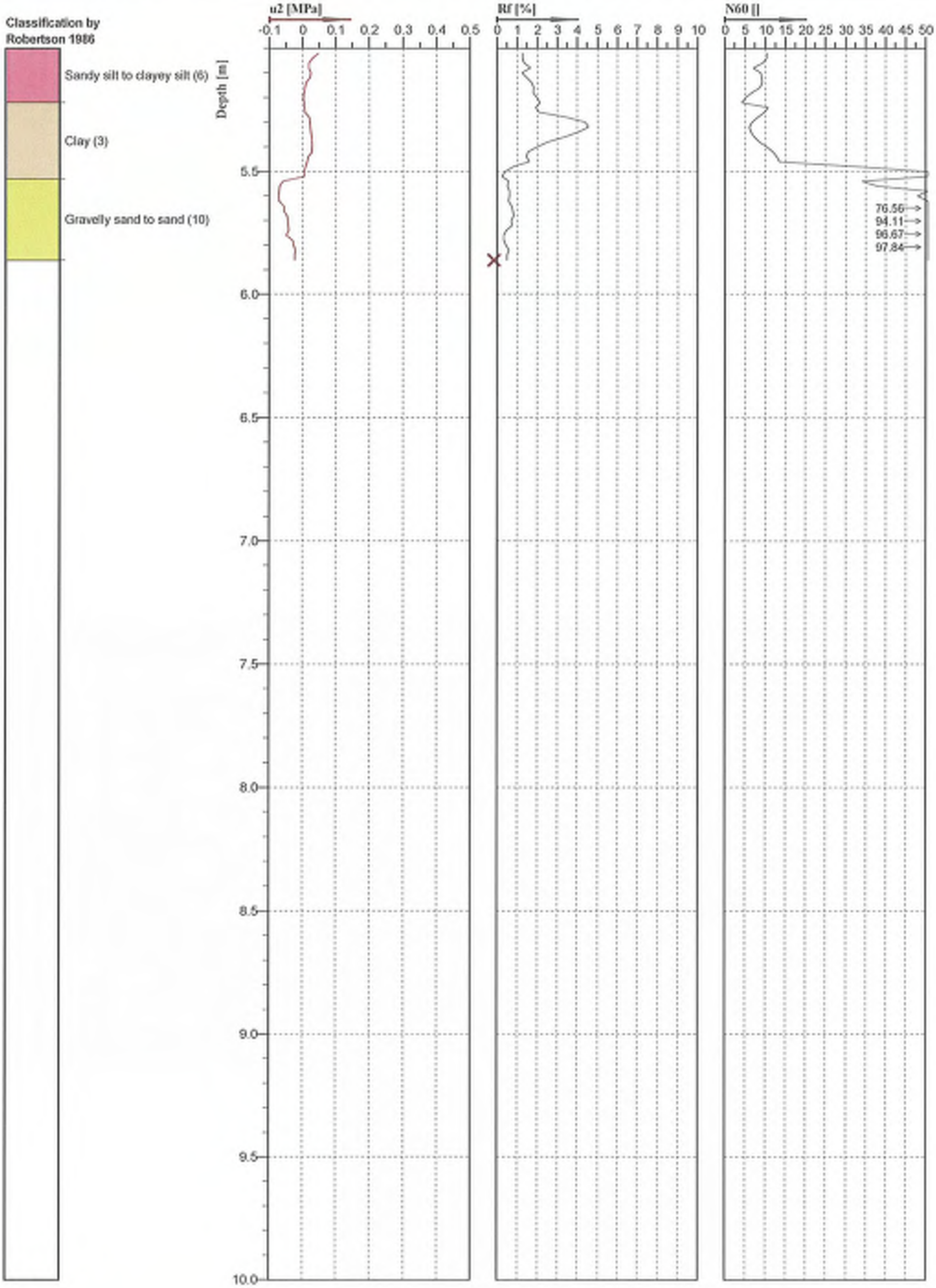
Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 1
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 2/2	Fig:
		File: RosemarrynSubdivisionCPT1.cpt	



PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637

Cone No: 4465
Tip area [cm2]: 10
Sleeve area [cm2]: 150

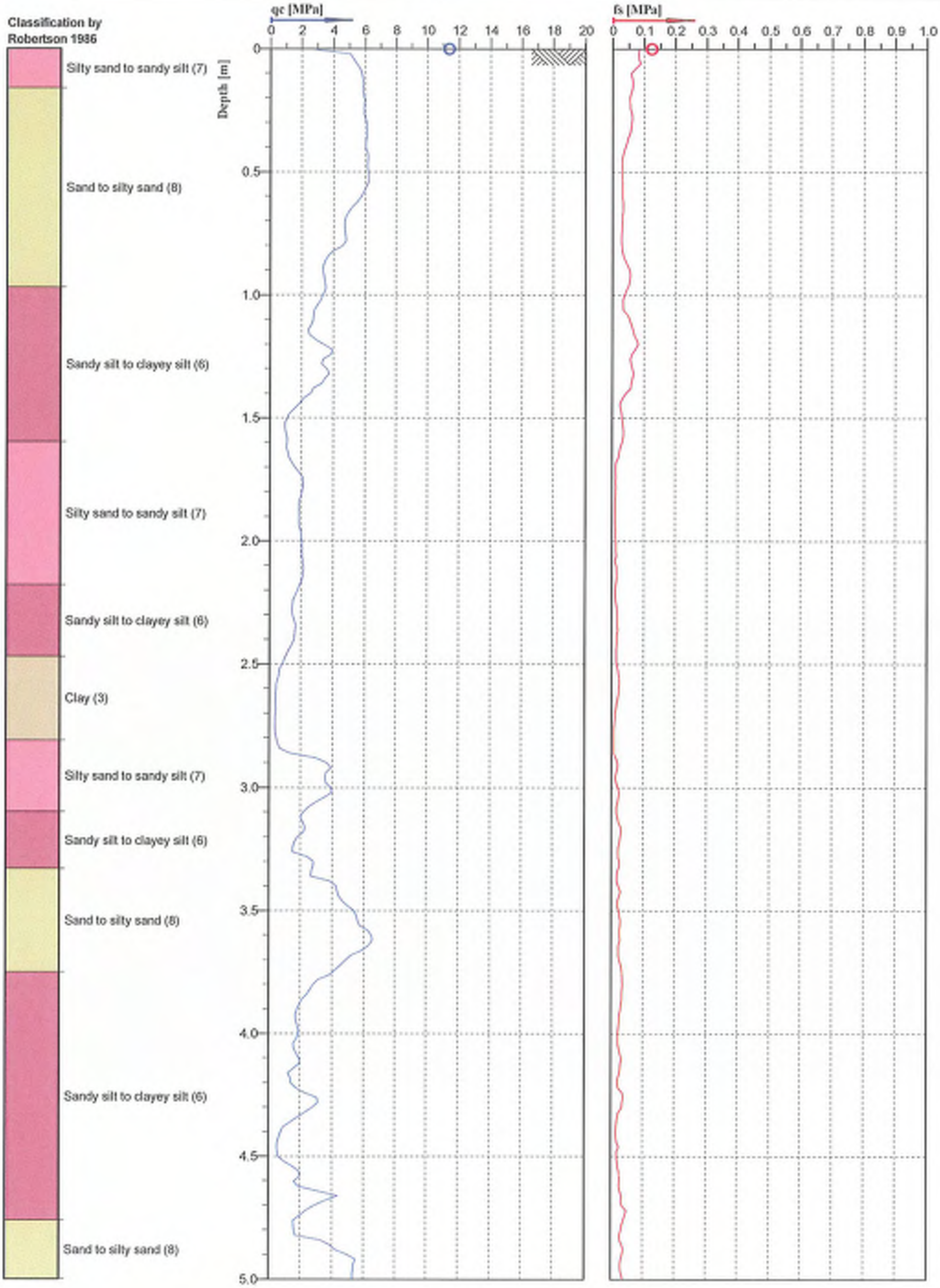
Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 1
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/2	Fig:
		File: RosemarrynSubdivisionCPT1.cpt	



SPECIALIST DRILLING ENGINEERS
0800 477 637

Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 1
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 2/2	Fig:
		File: RosemarrynSubdivisionCPT1.cpt	



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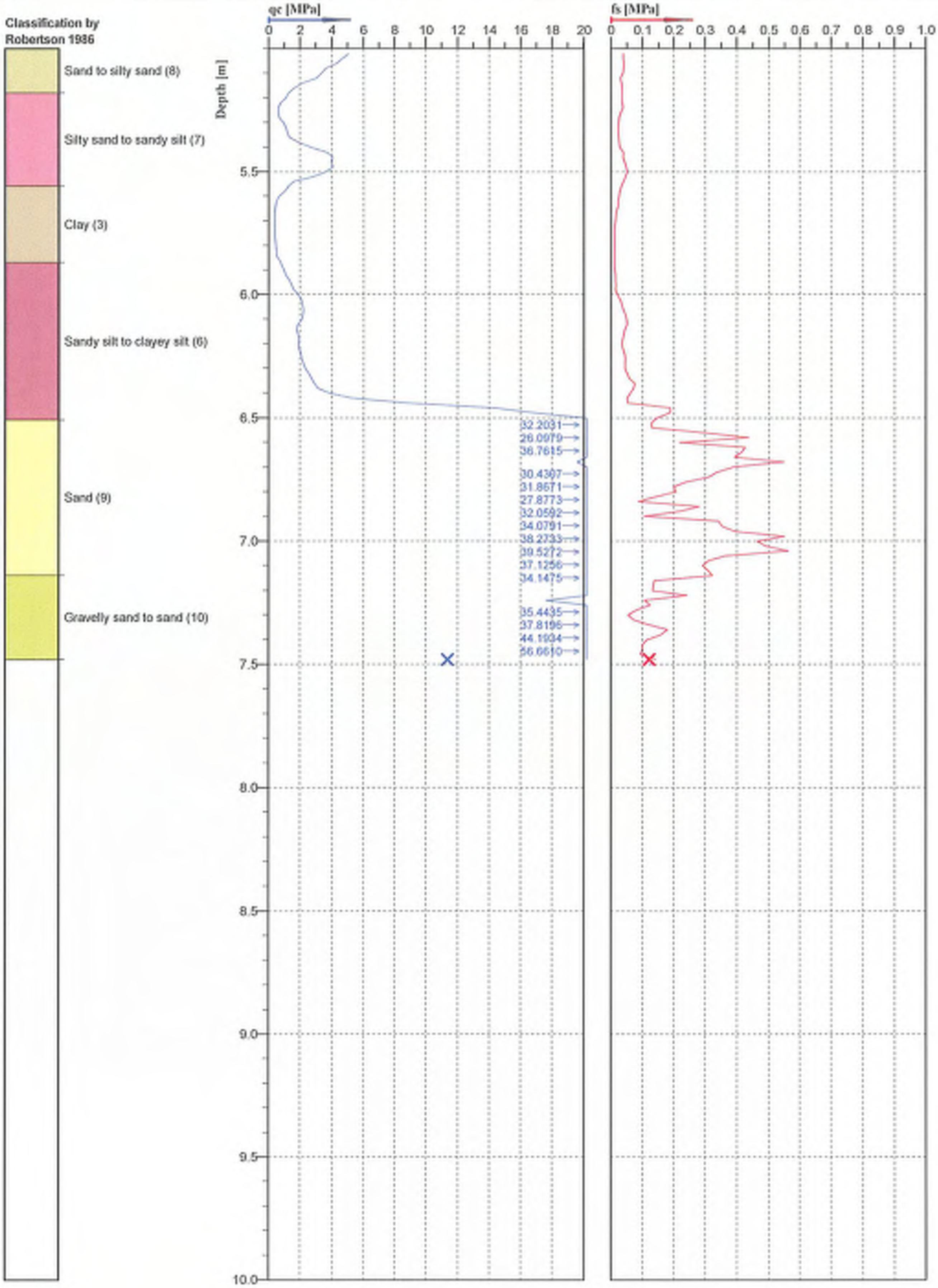
SPECIALIST DRILLING ENGINEERS
0800 477 637

Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

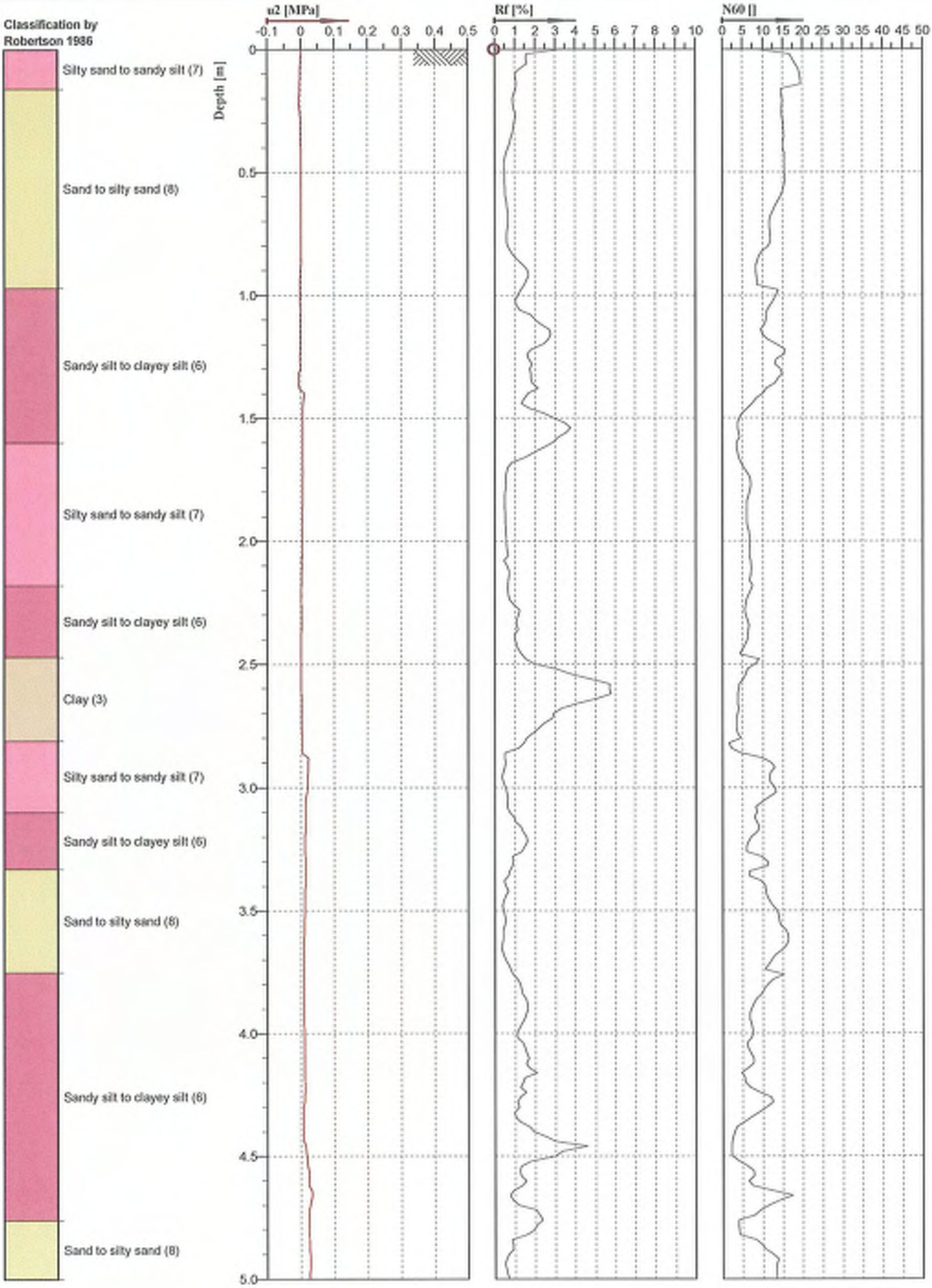
Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 2
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/2	Fig:
		File: RosemarrynSubdivisionCPT2.cpt	



PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637

Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 2
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 2/2	Fig:
		File: RosemarrynSubdivisionCPT2.cpt	



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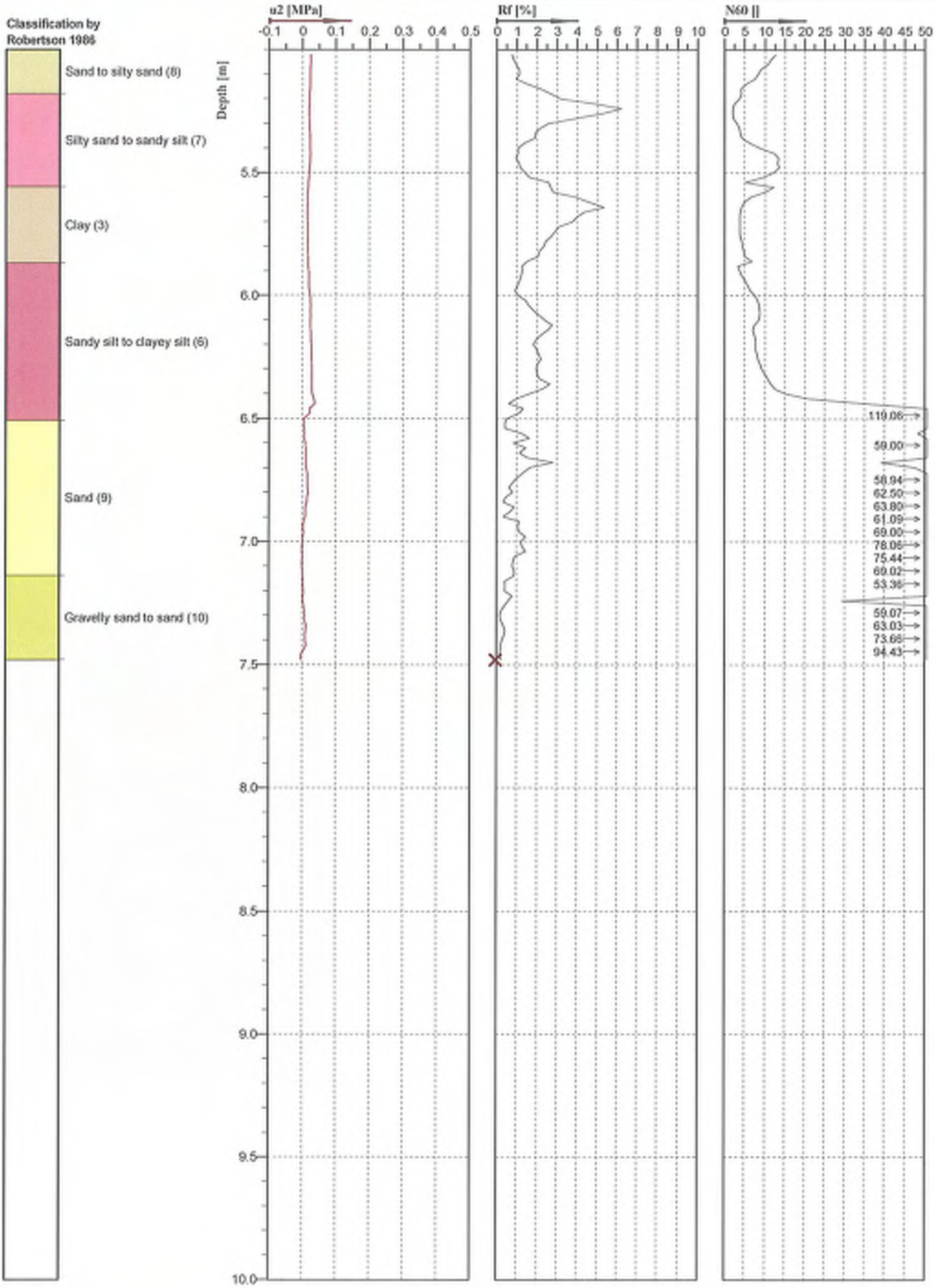
ENGINEERS
0800 477 637

Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

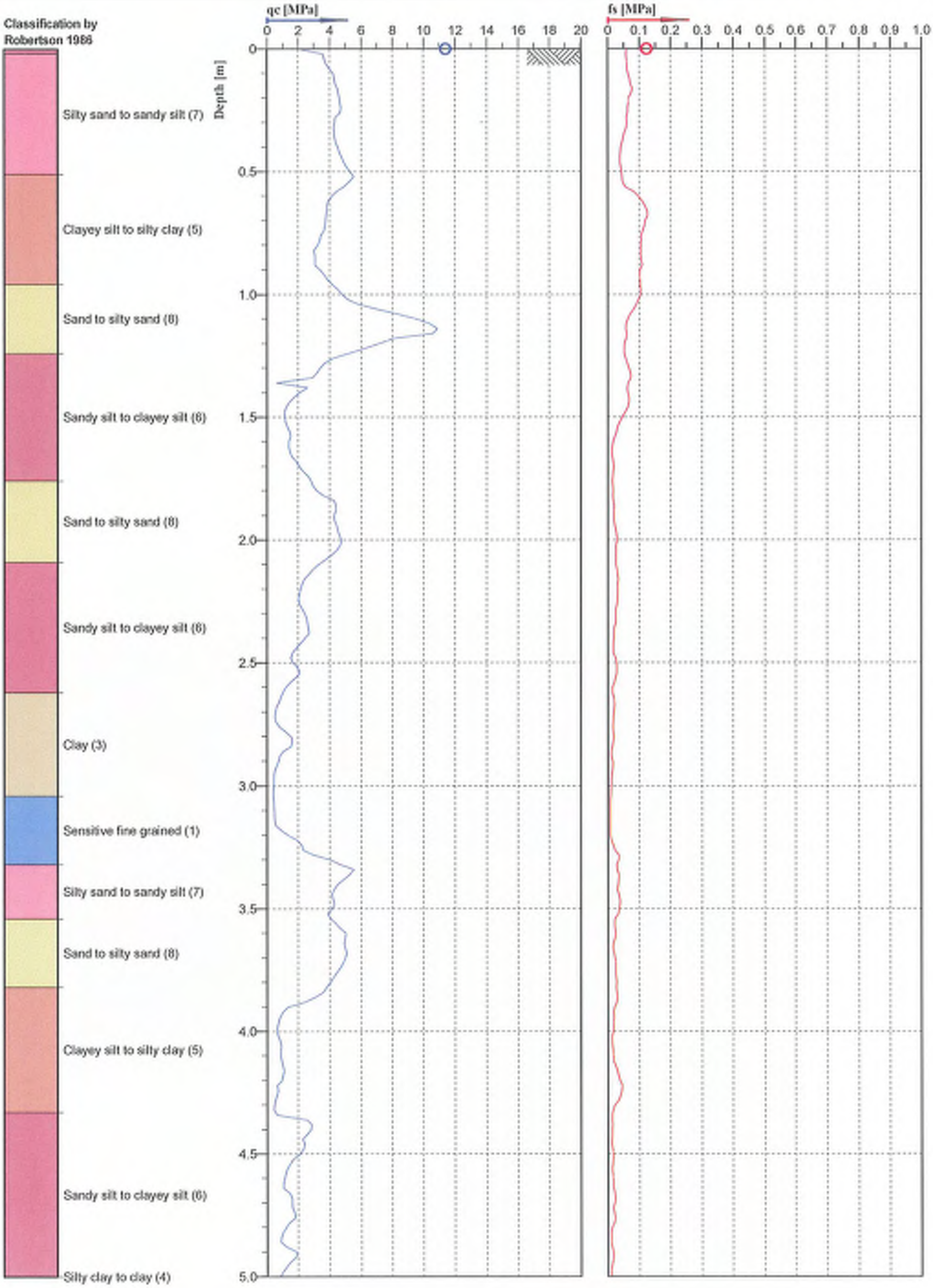
Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 2
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/2	Fig:
		File: RosemarrynSubdivisionCPT2.cpt	



PRO-DRILL
SPECIALIST DRILLING
ENGINEERS
0800 477 637

Cone No: 4465
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 2
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 2/2	Fig:
		File: RosemarrynSubdivisionCPT2.cpt	



PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637

Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 3
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/2	Fig:
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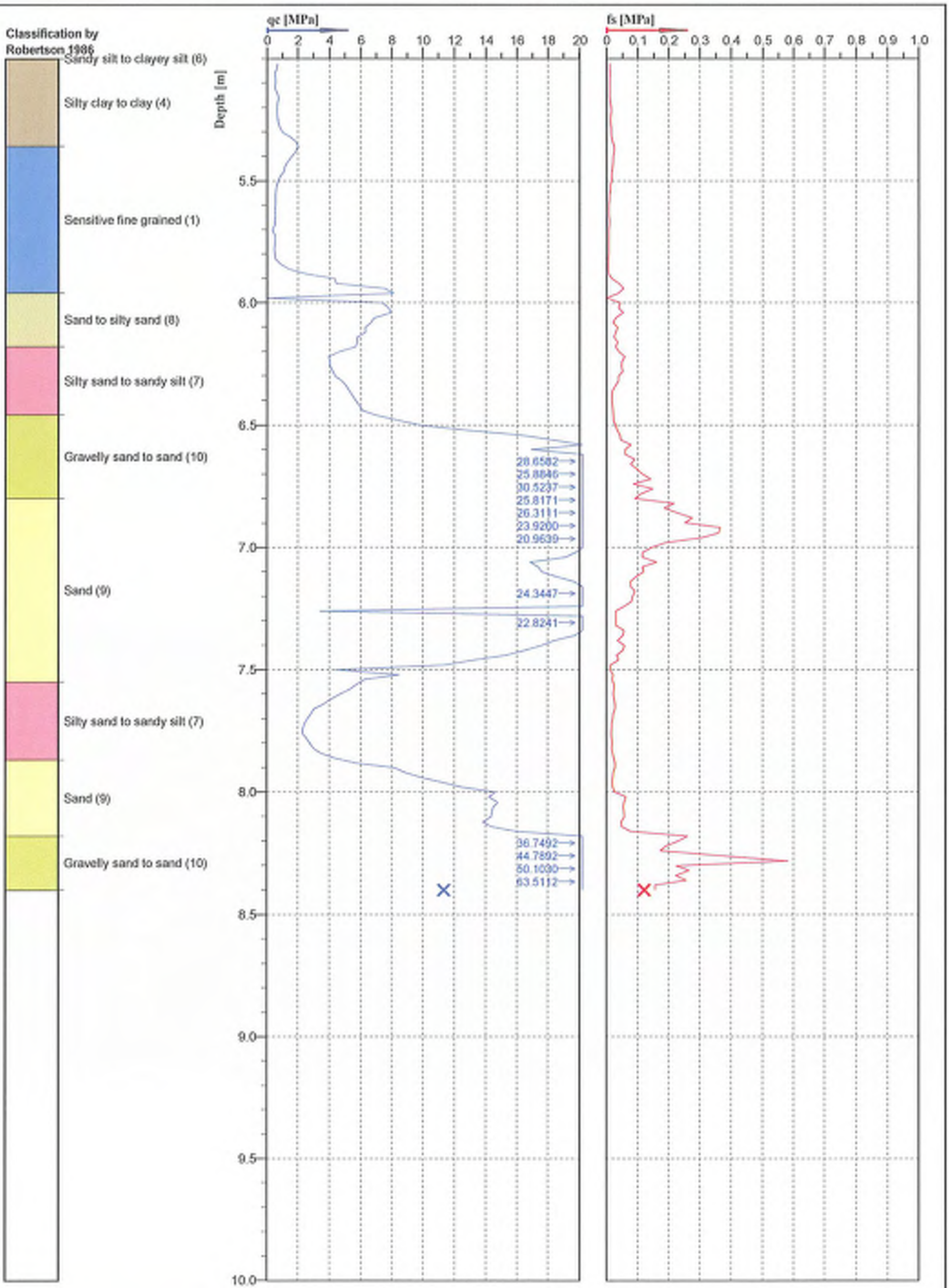
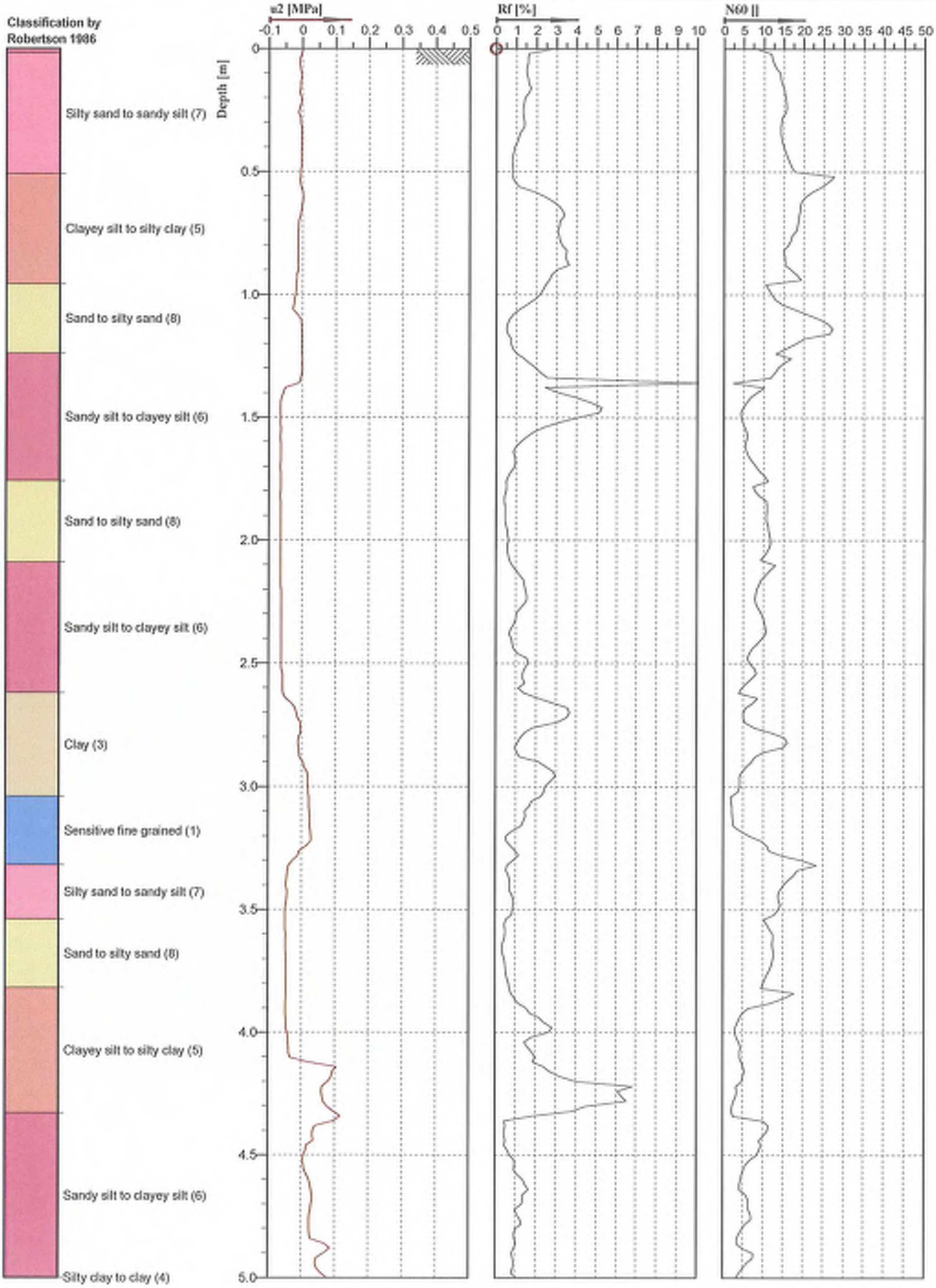


PRO-DRILL
SPECIALIST DRILLING
ENGINEERS
0800 477 637

Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 3
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 2/2	Fig:
		File: RosemarrynSubdivisionCPT3.cpt	



PRO-DRILL
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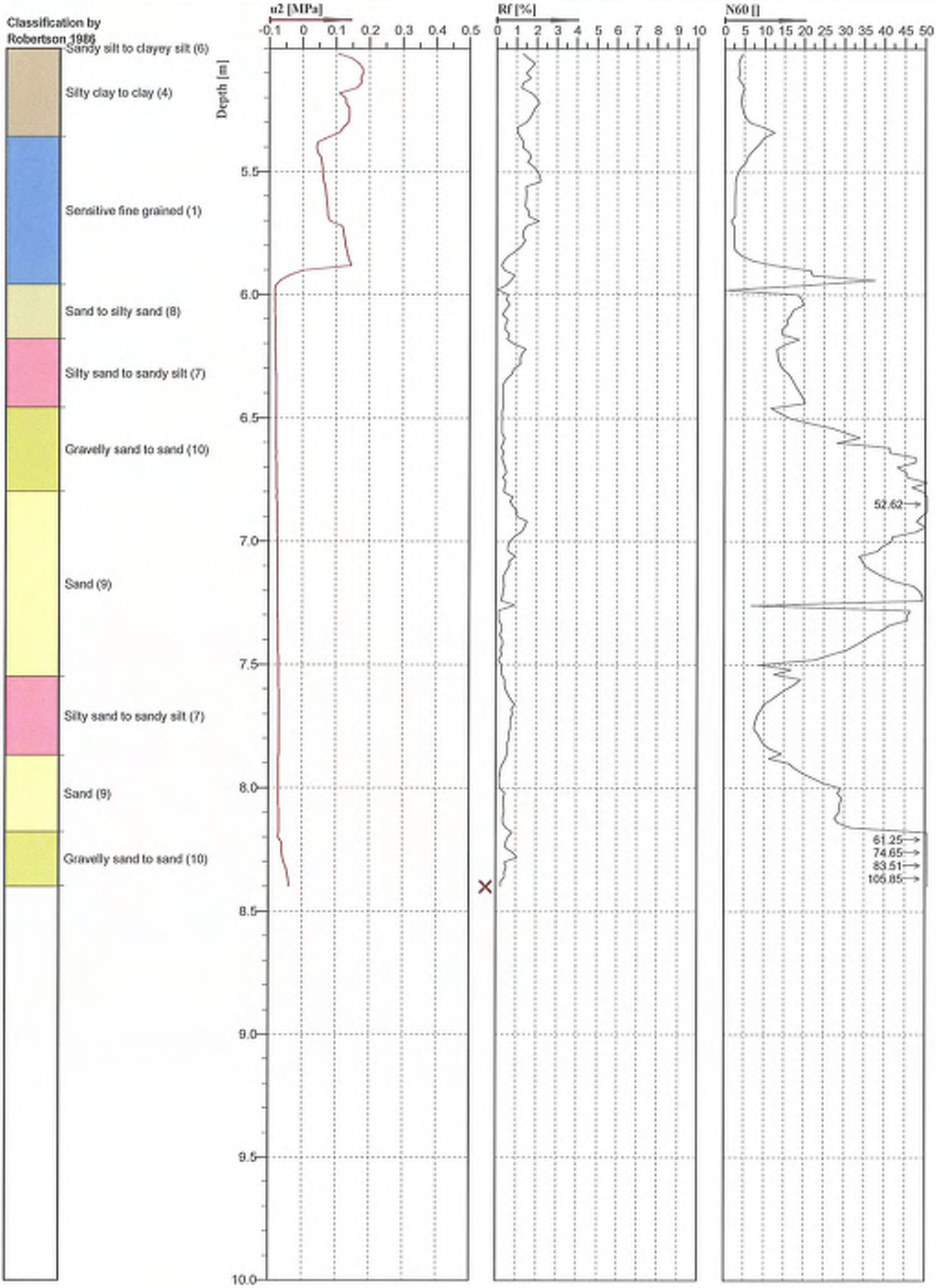
0800 477 637

Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 3
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/2	Fig:
		File: RosemarrynSubdivisionCPT3.cpt	



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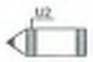
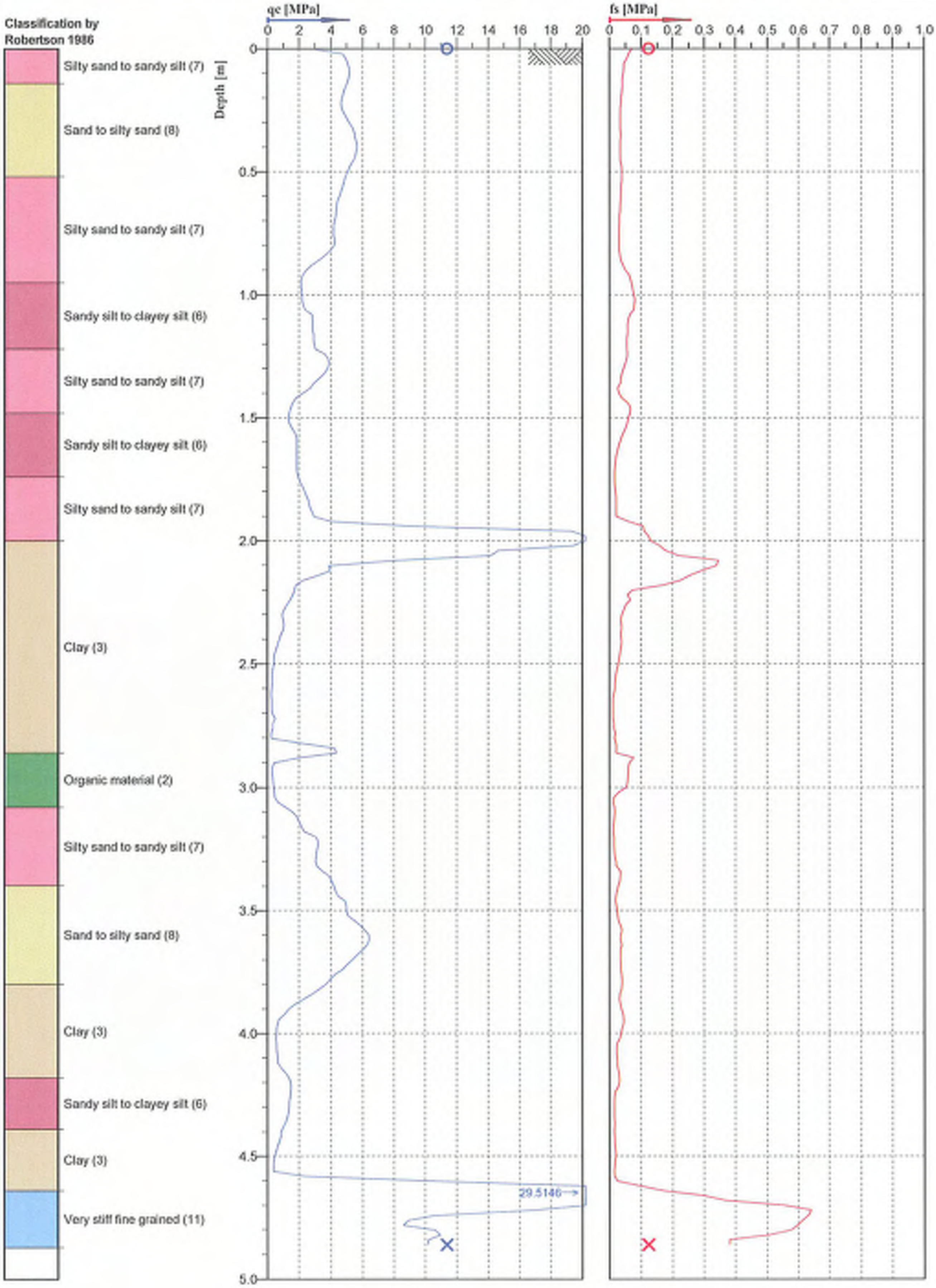


Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 3
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 2/2	Fig:
		File: RosemarrynSubdivisionCPT3.cpt	



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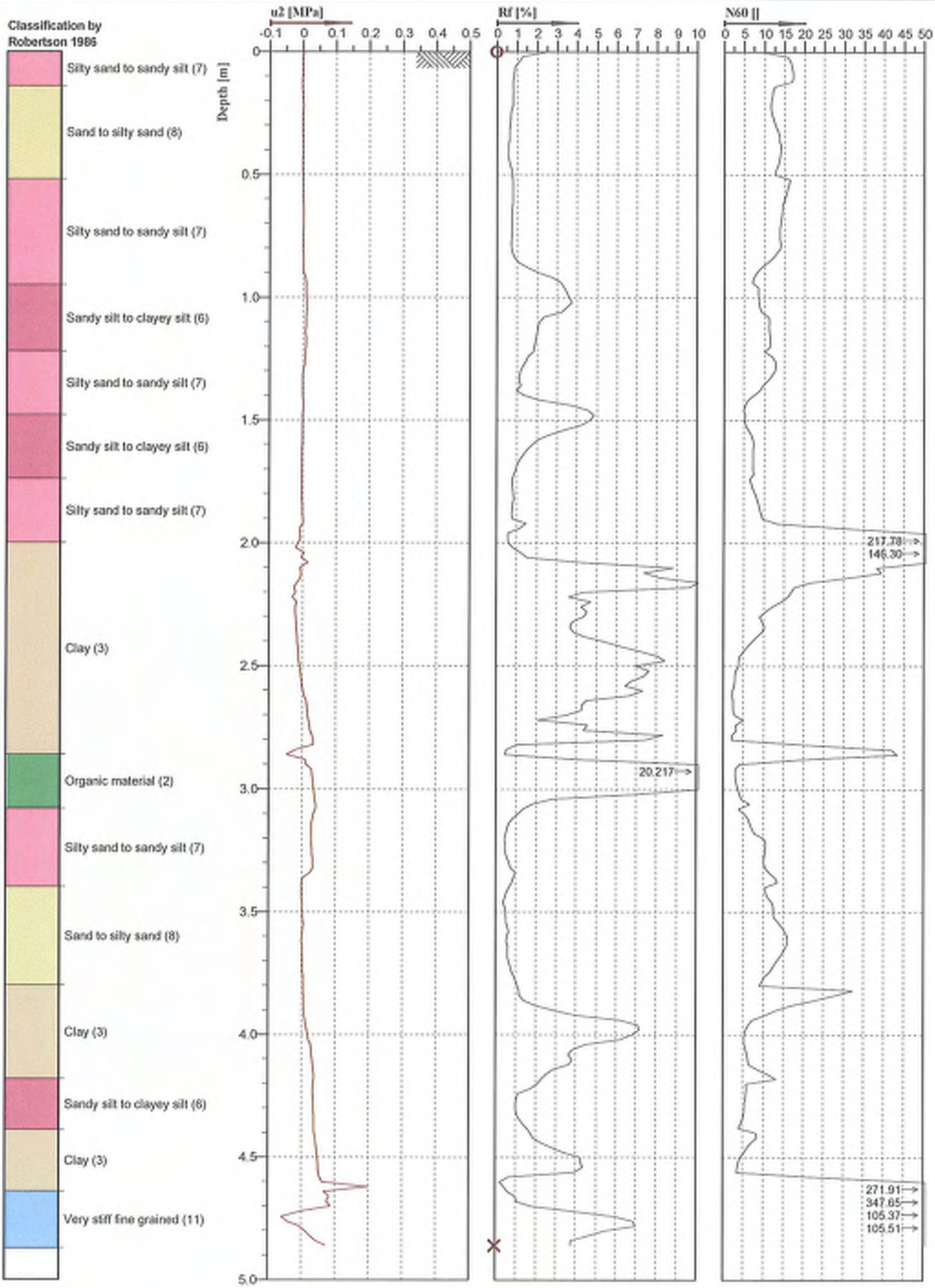
Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 5
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT5.cpt	



PRO-DRILL
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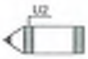
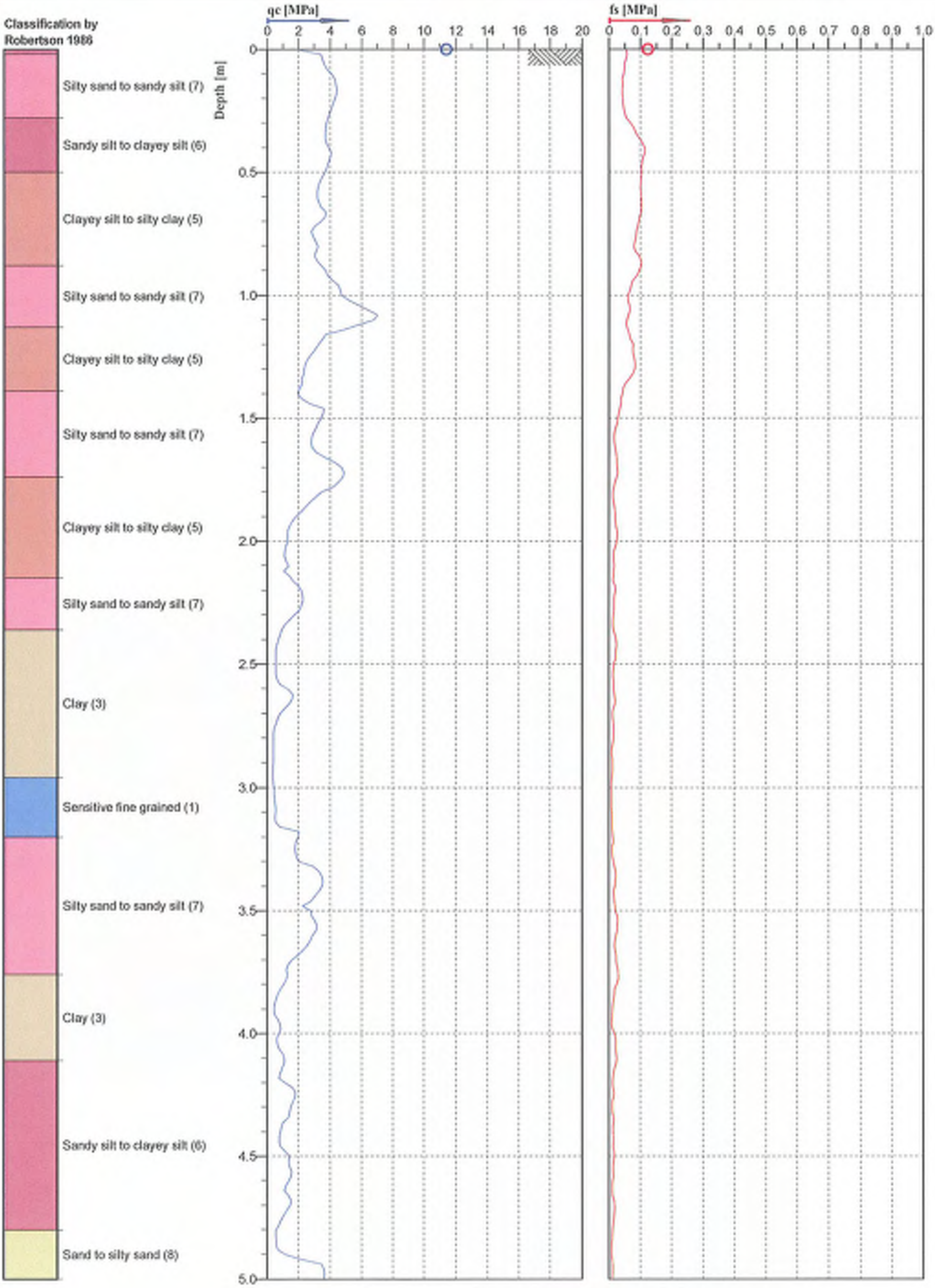


Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 5
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT5.cpt	



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ENGINEERS
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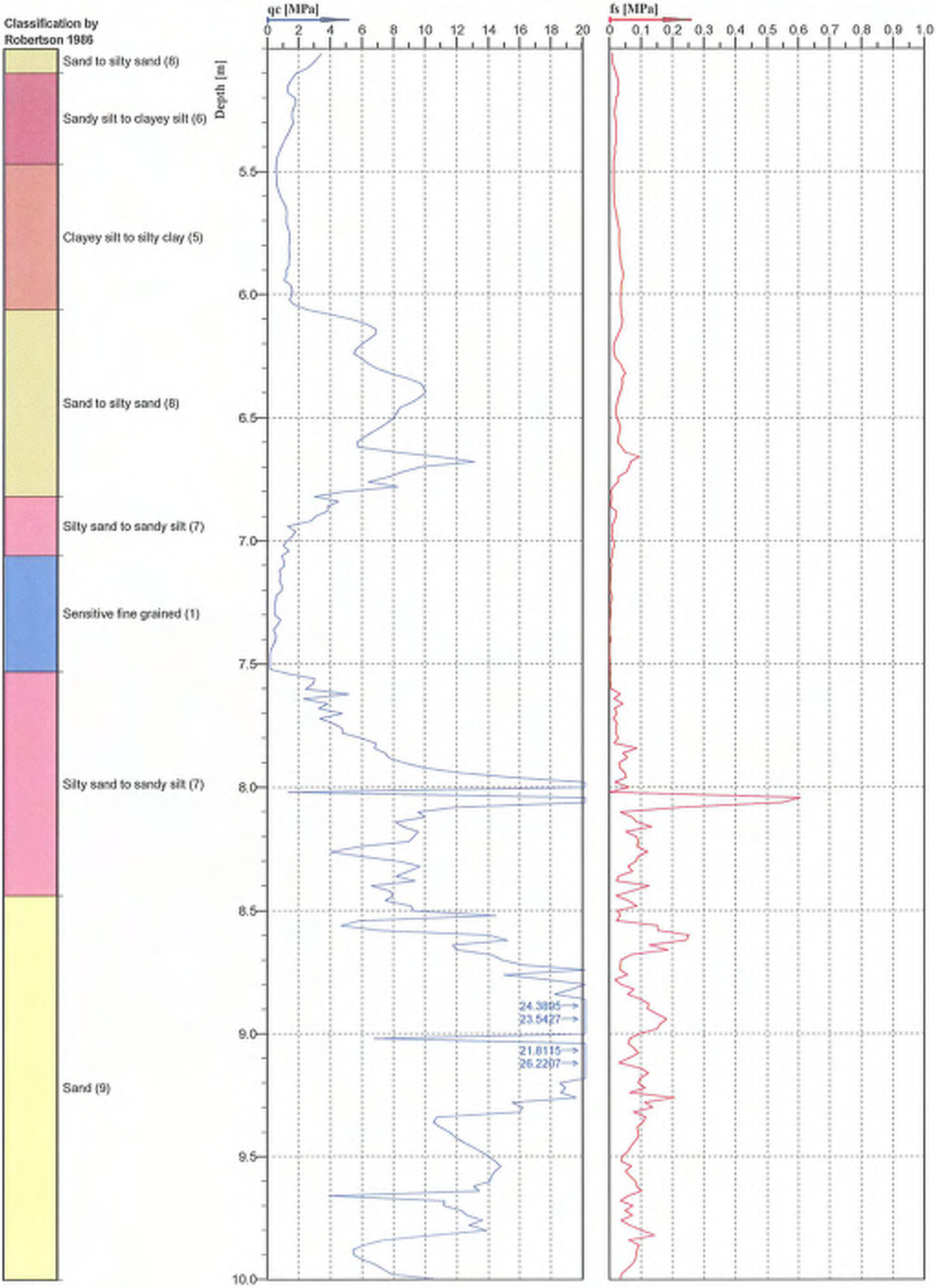
Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 6
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/3	Fig:
		File: RosemarrynSubdivisionCPT6.cpt	



PRO-DRILL
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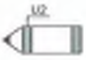
ENGINEERS
0800 477 637



Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 6
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 2/3	Fig:
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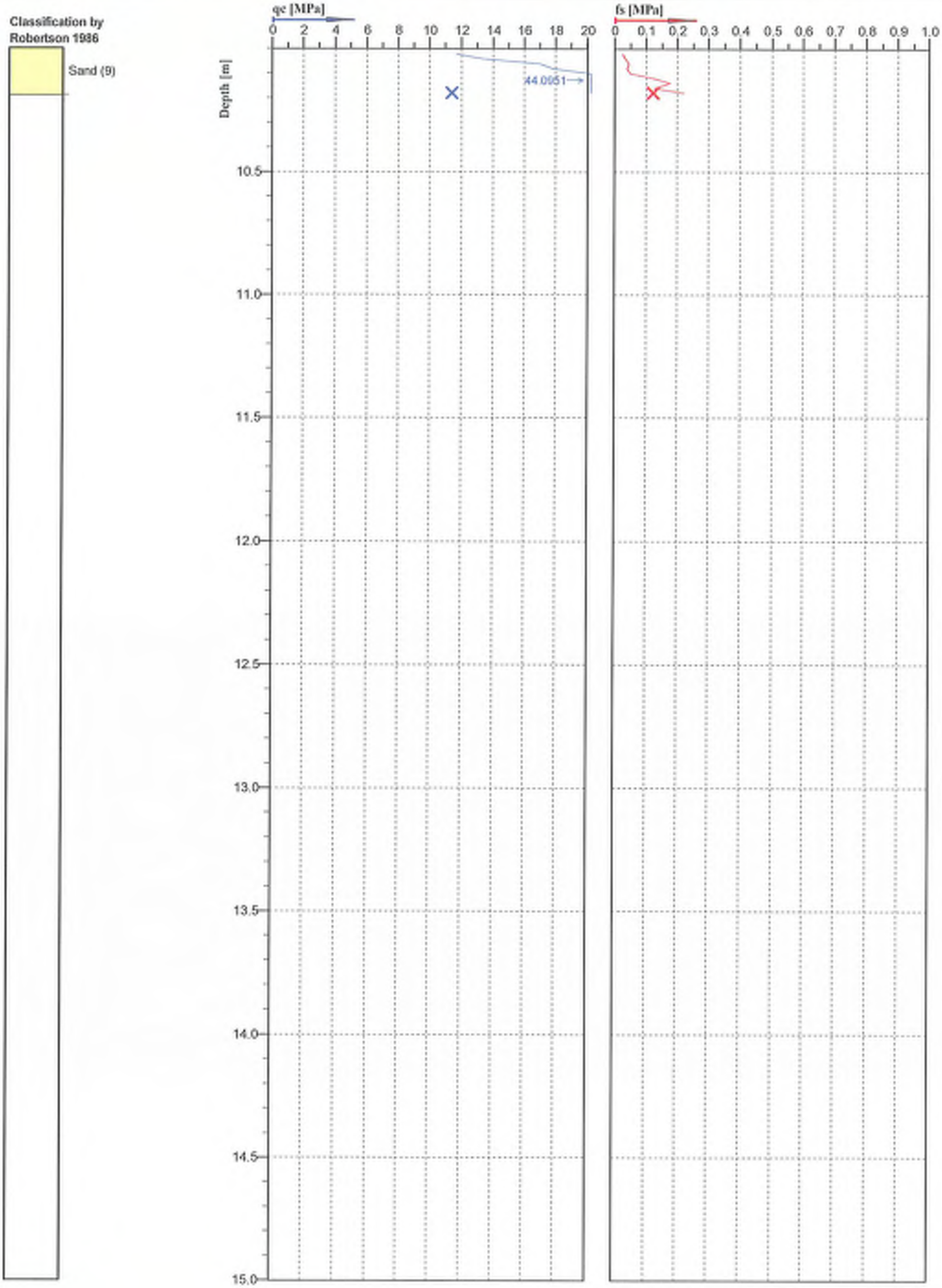

PRO-DRILL
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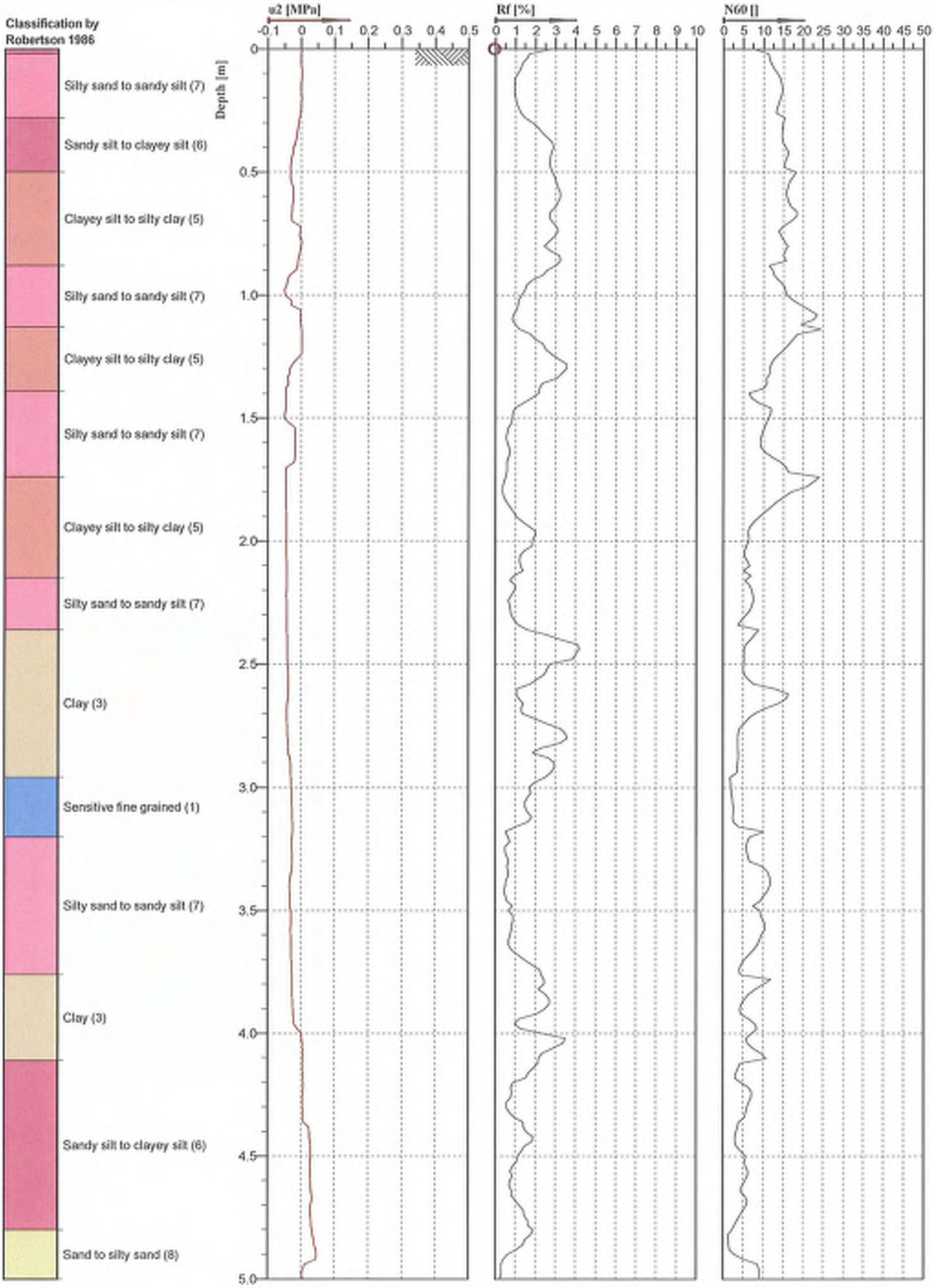
Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 6
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 3/3	Fig:
		File: RosemarrynSubdivisionCPT6.cpt	

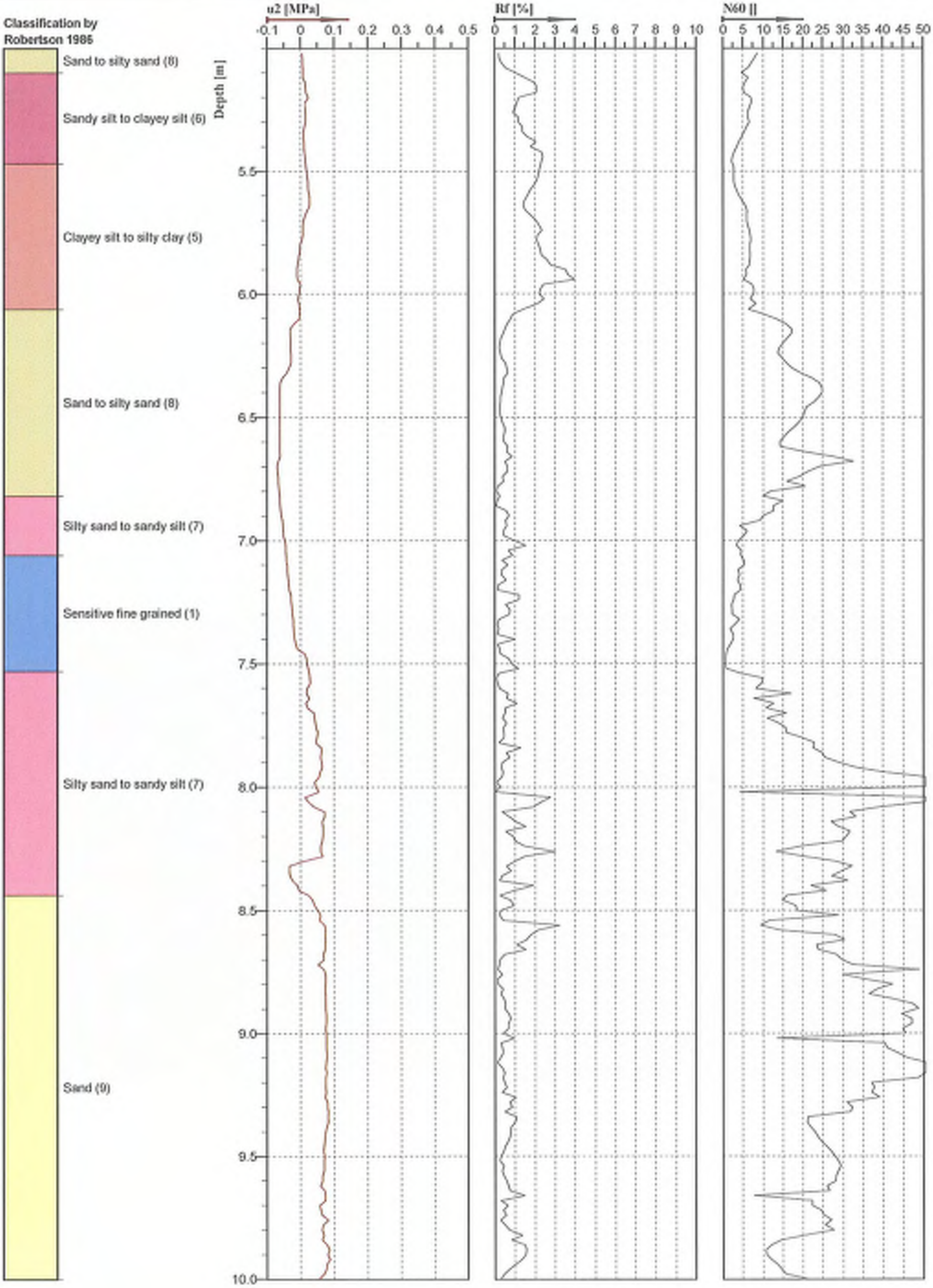


PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637

u2

Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 6
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/3	Fig:
		File: RosemarrynSubdivisionCPT6.cpt	



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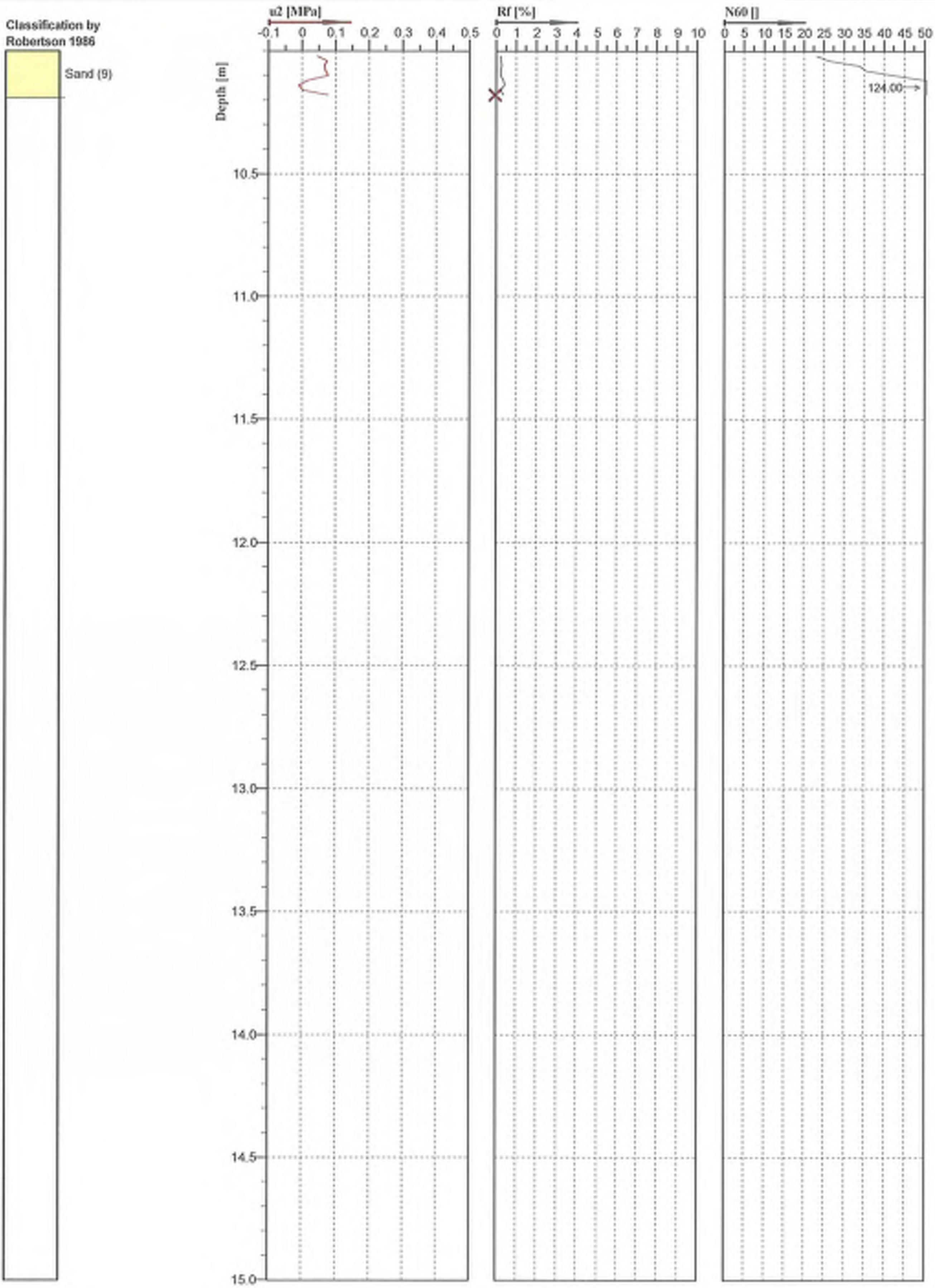
Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 6
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 2/3	Fig:
		File: RosemarrynSubdivisionCPT6.cpt	



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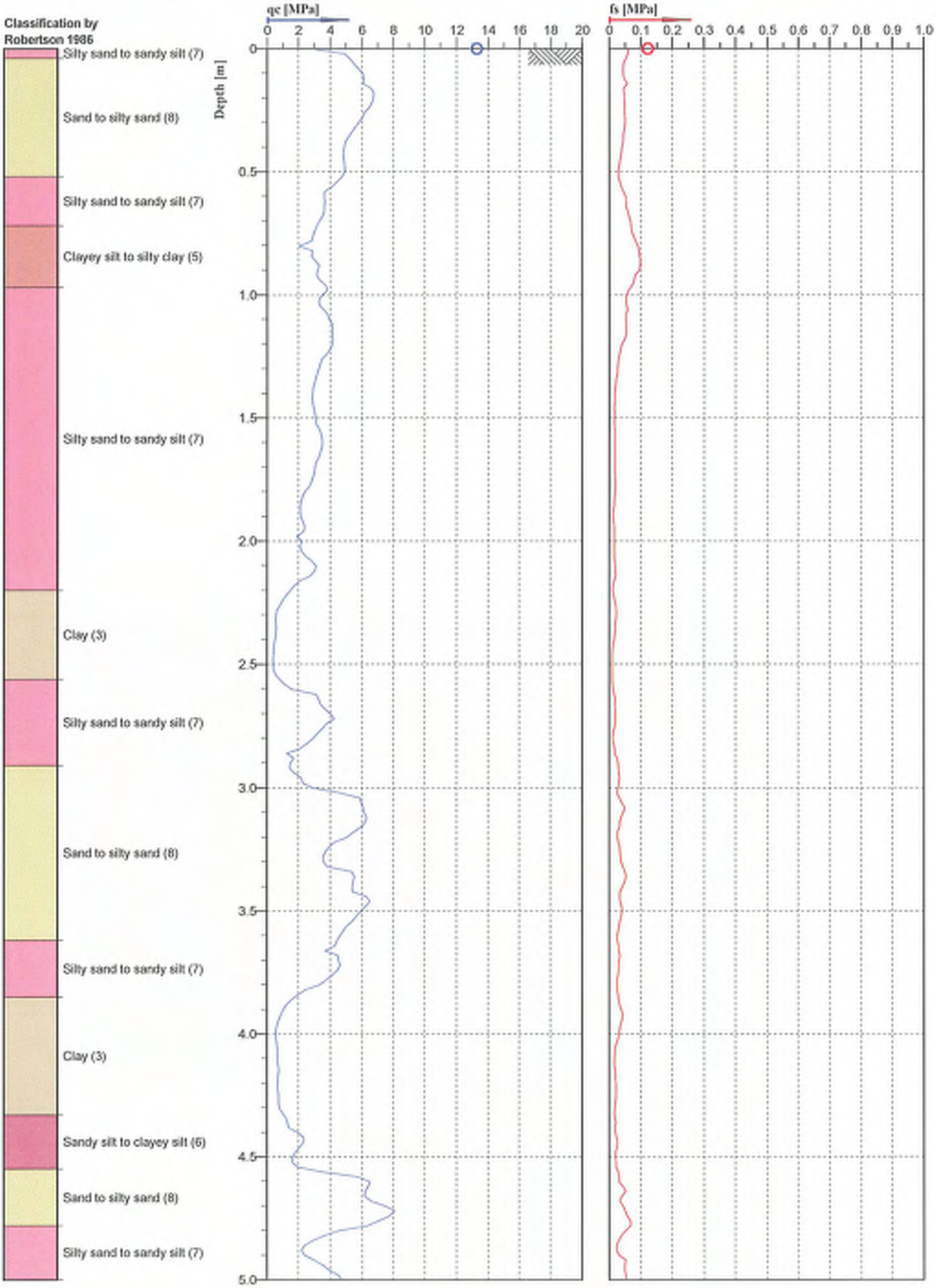
Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 6
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 3/3	Fig:
		File: RosemarrynSubdivisionCPT6.cpt	



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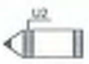
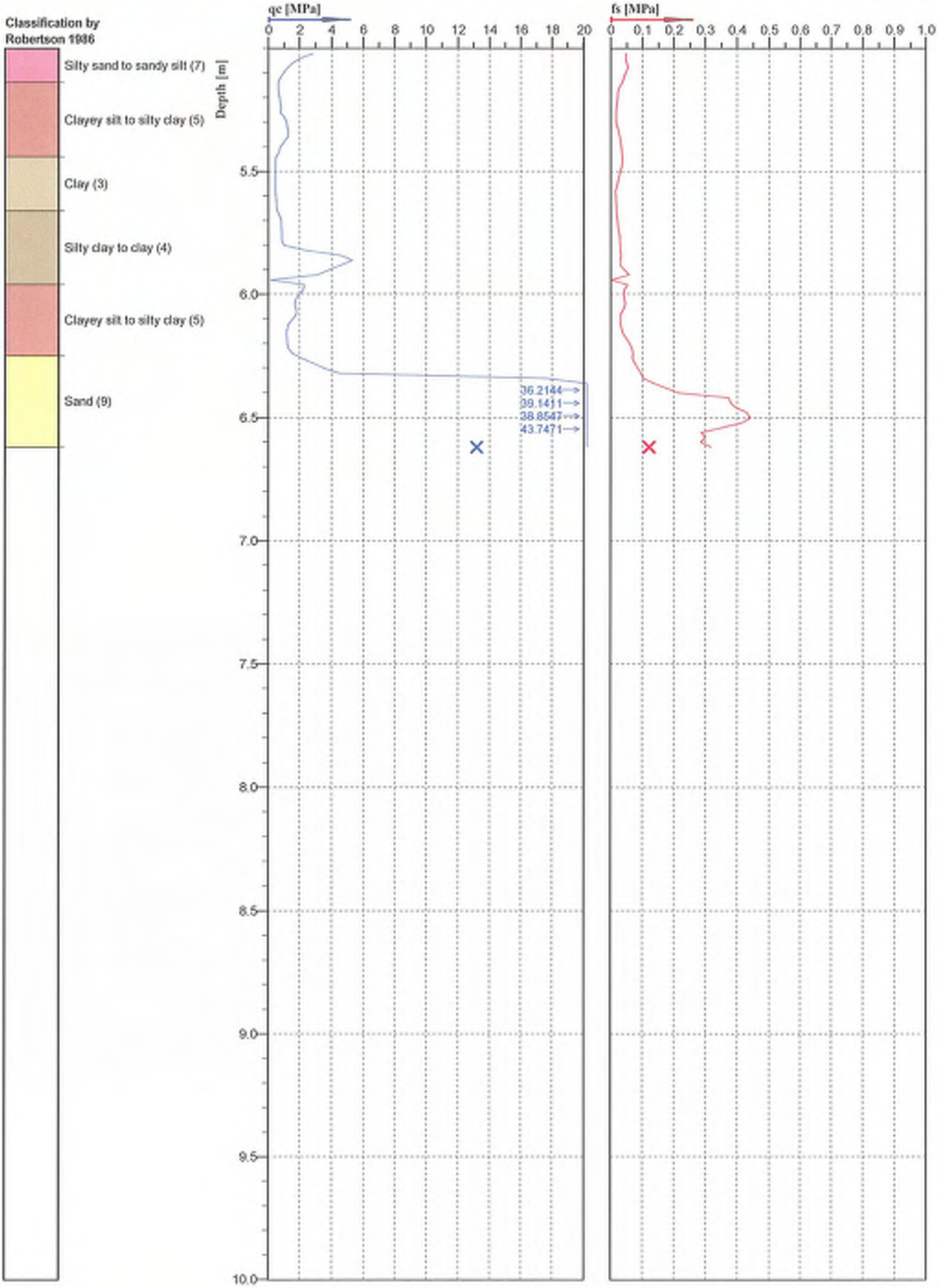


Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 8
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/2	Fig:
		File: RosemarrynSubdivisionCPT8.cpt	



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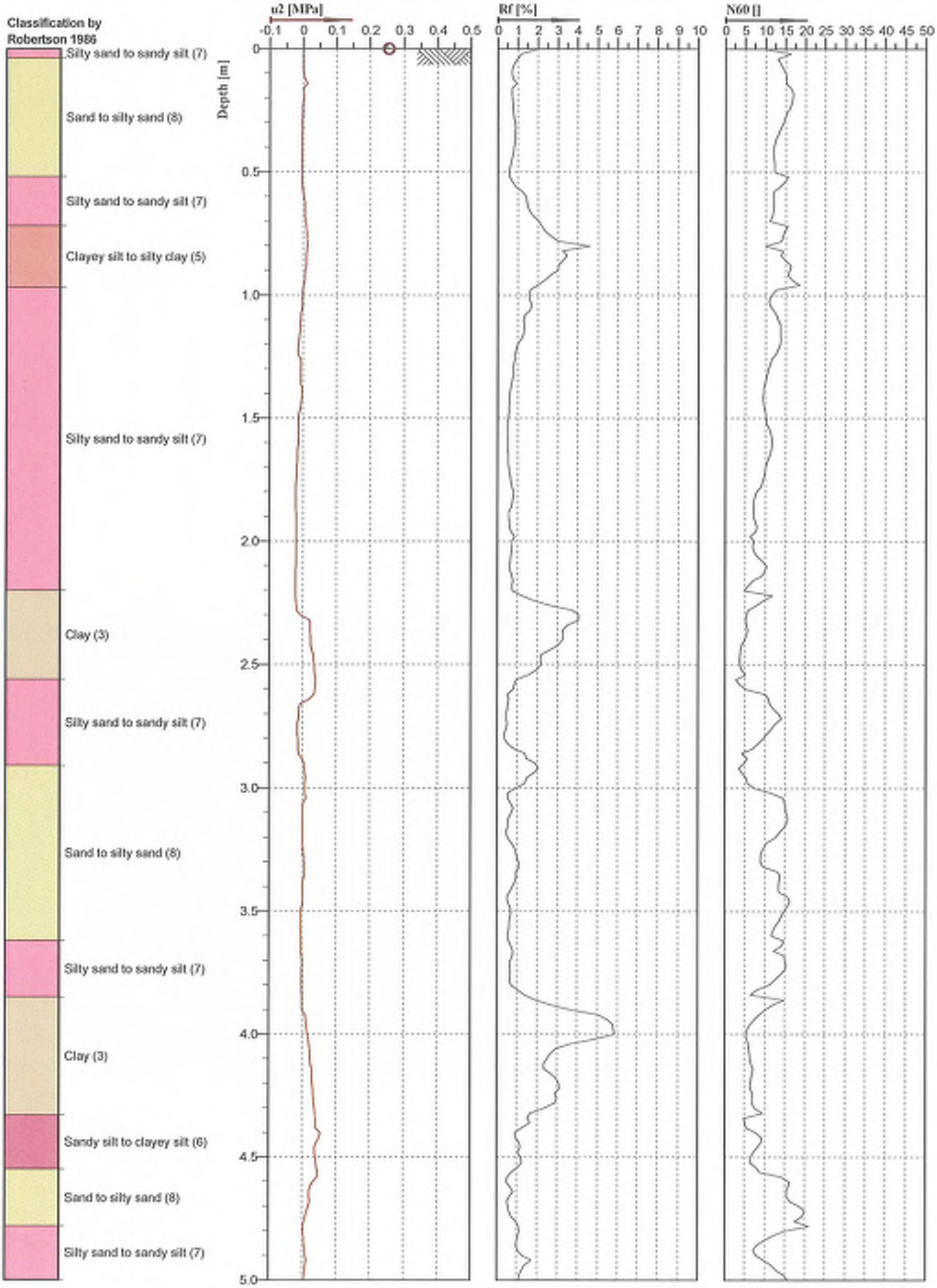
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 8
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 2/2	Fig:
		File: RosemarrynSubdivisionCPT8.cpt	



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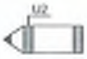
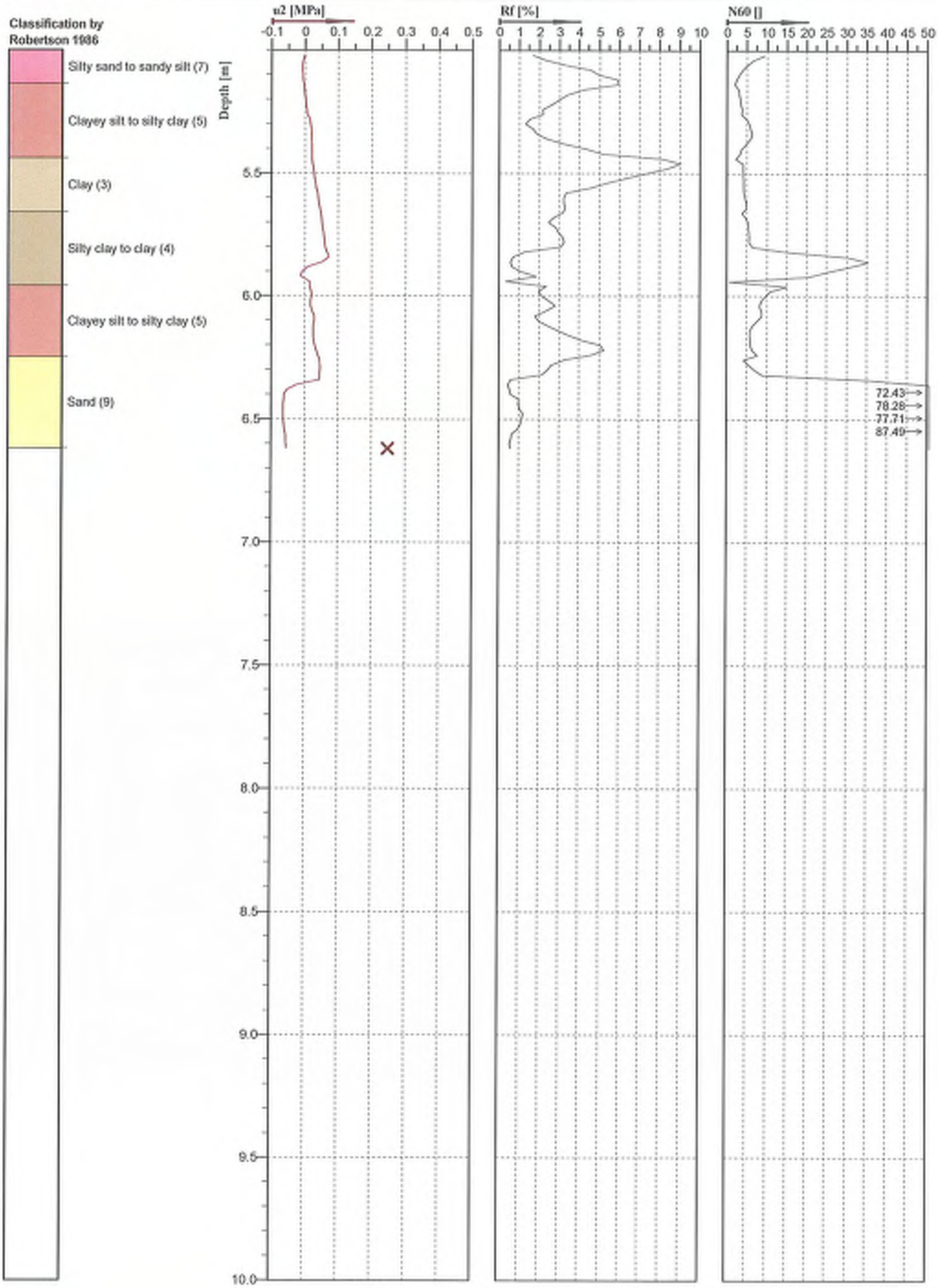


Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 8
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/2	Fig:
		File: RosemarrynSubdivisionCPT8.cpt	



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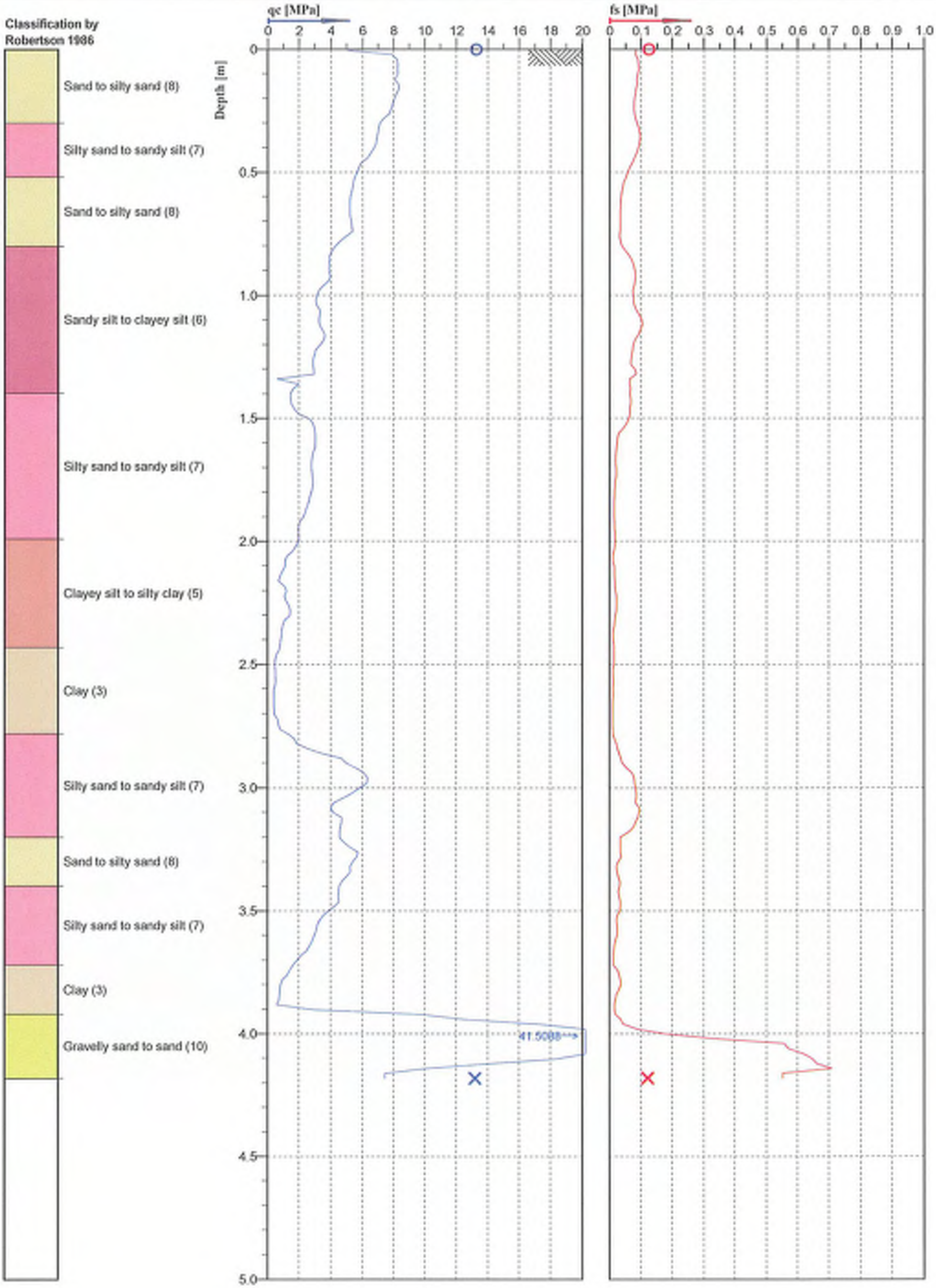
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 8
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 2/2	Fig:
		File: RosemarrynSubdivisionCPT8.cpt	



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U2

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 9
Project ID:	Client: Aurecon	Date: 4/23/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT9.cpt	

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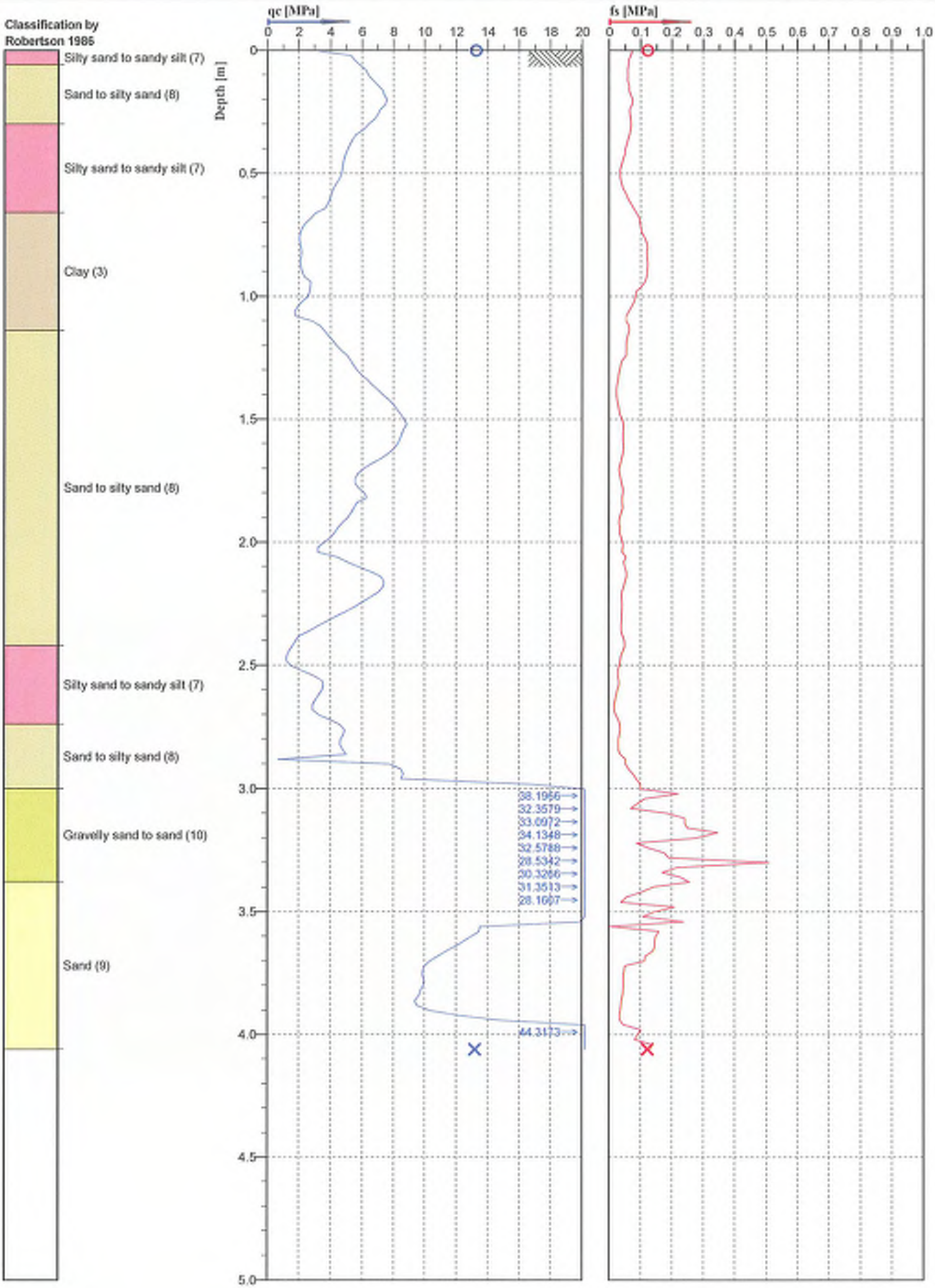
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 9
Project ID:	Client: Aurecon	Date: 4/23/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT9.cpt	



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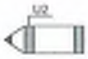
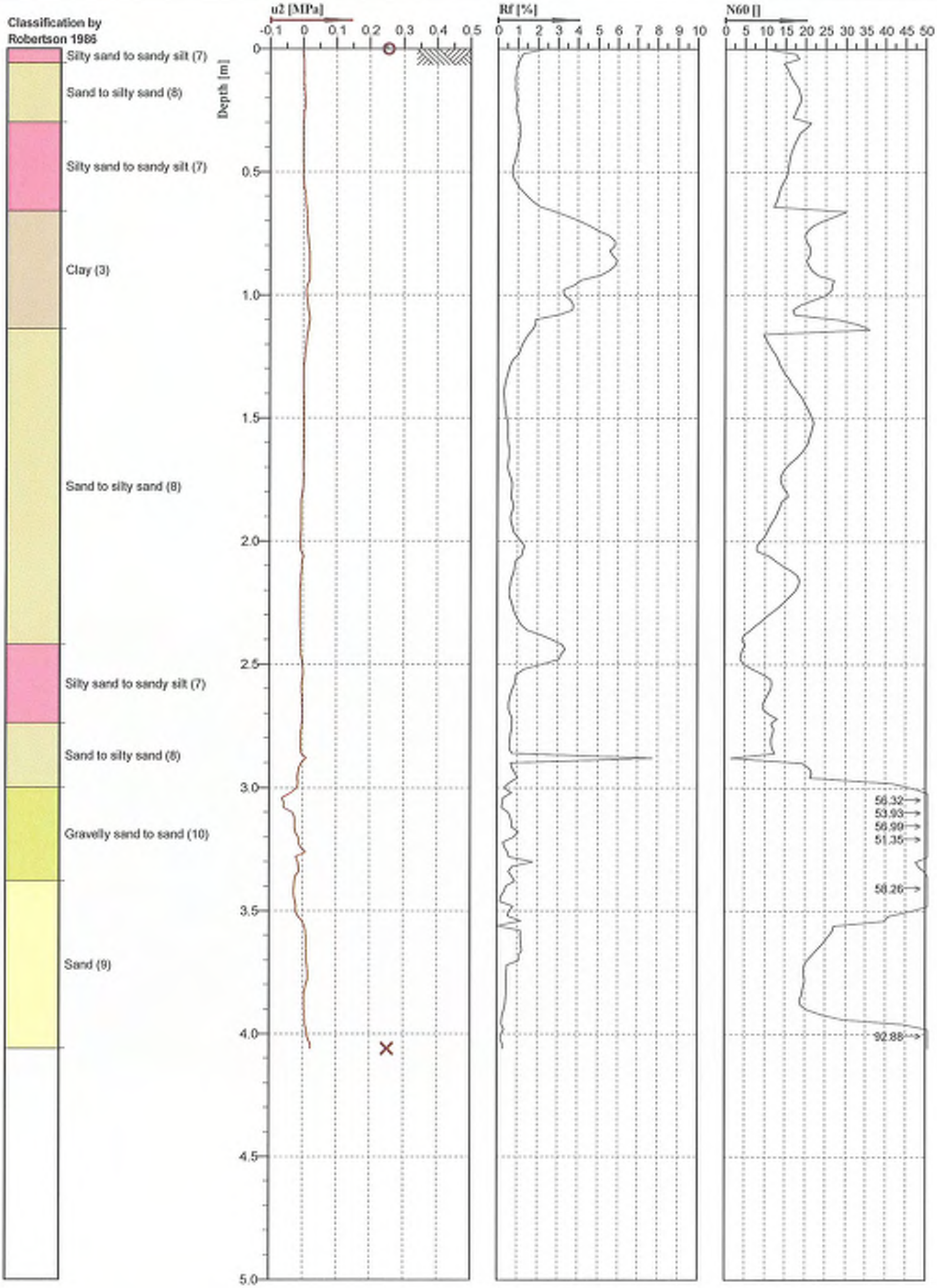


Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 10
Project ID:	Client: Aurecon	Date: 4/21/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT10.cp	



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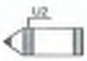
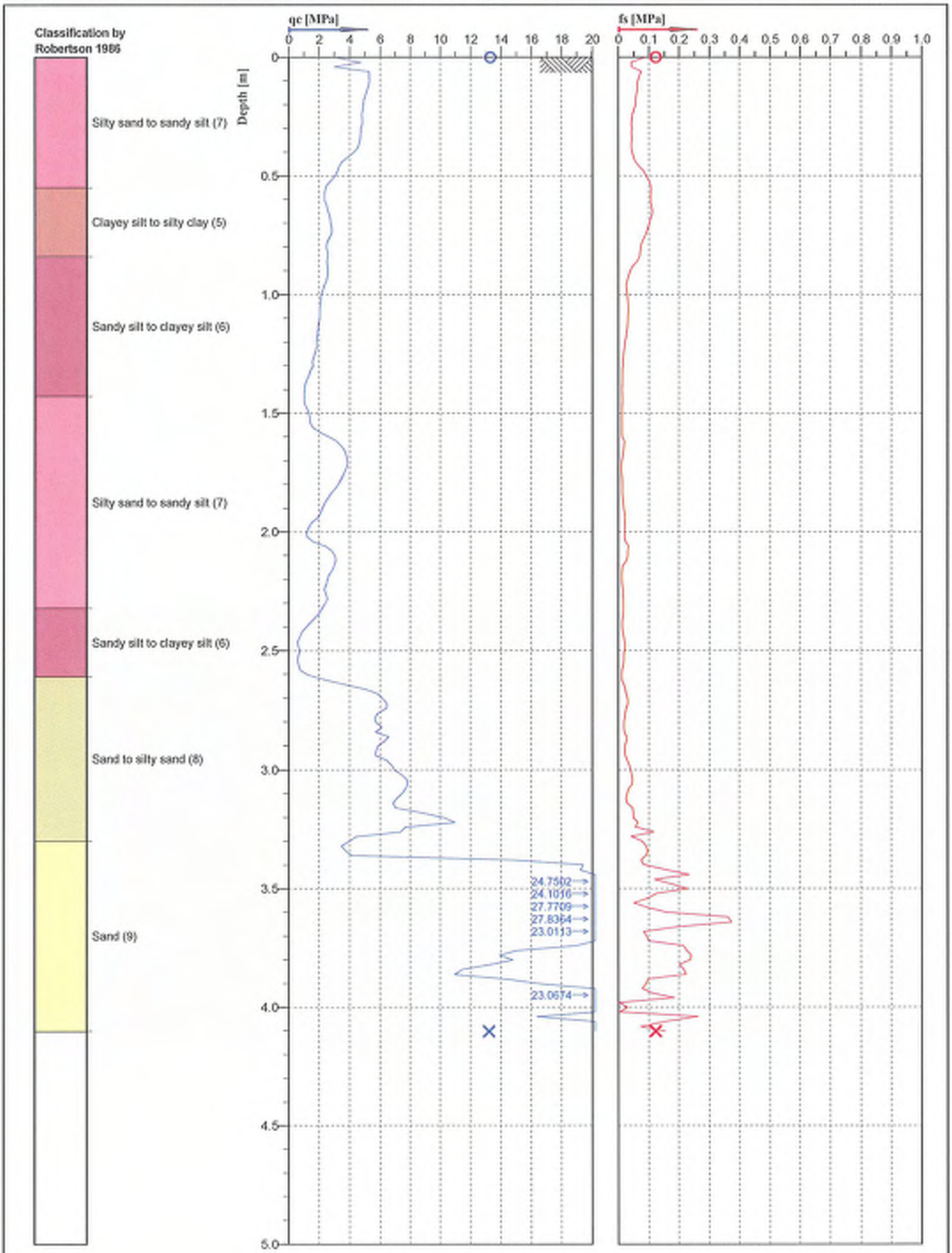


Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 10
Project ID:	Client: Aurecon	Date: 4/21/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT10.cp	



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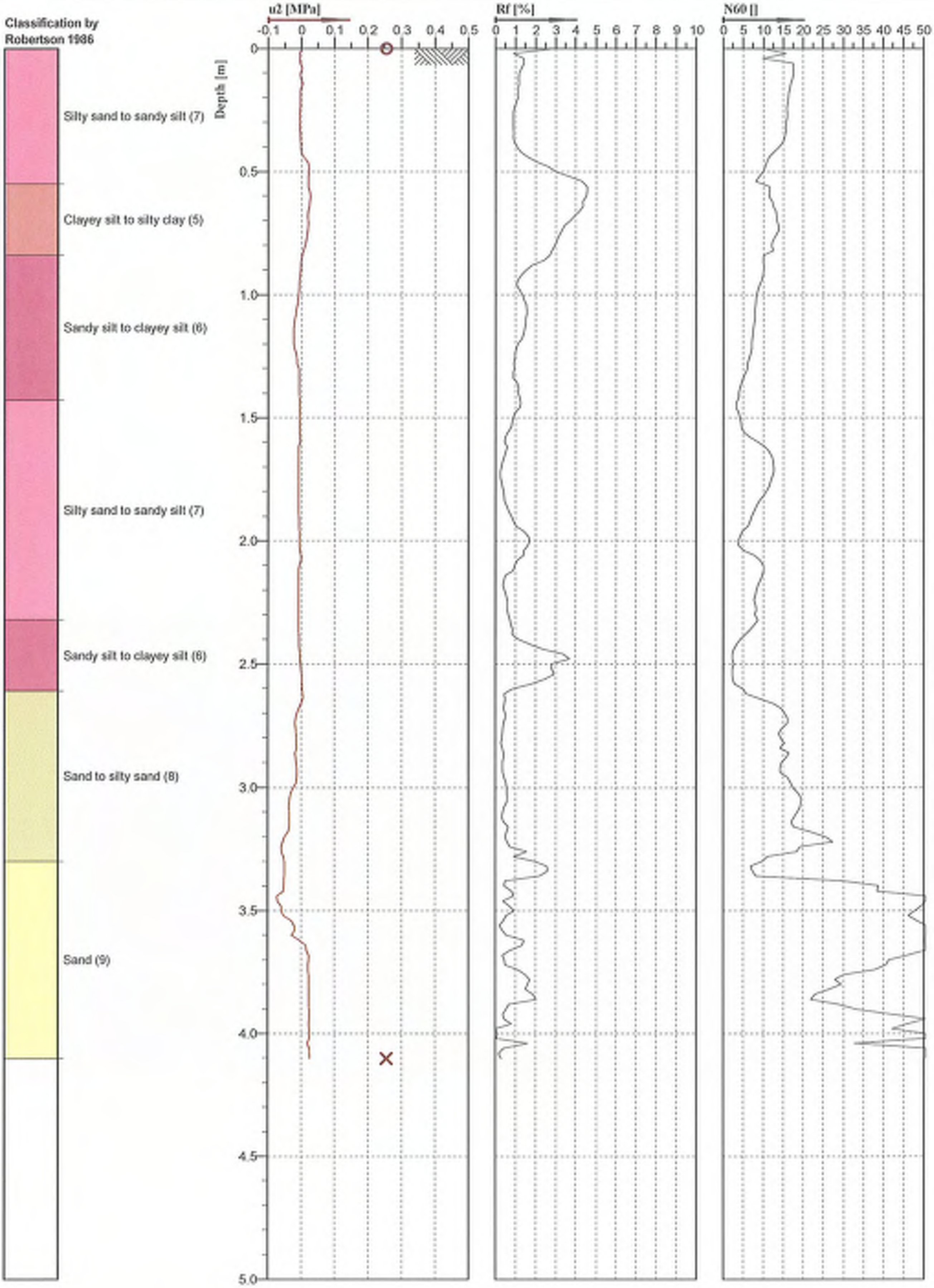
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 11
Project ID:	Client: Aurecon	Date: 4/21/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT11.cp	



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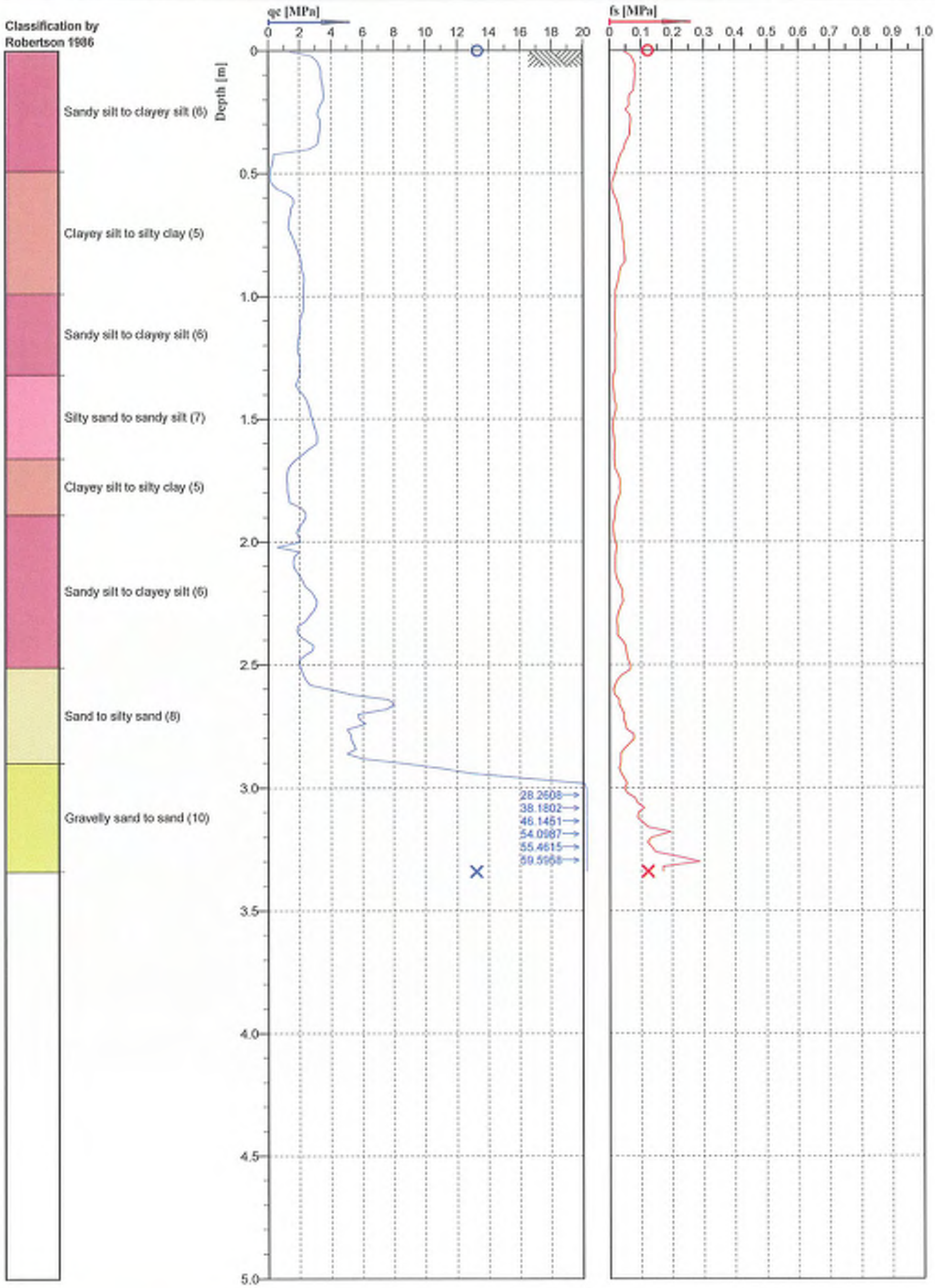
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 11
Project ID:	Client: Aurecon	Date: 4/21/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT11.cp	



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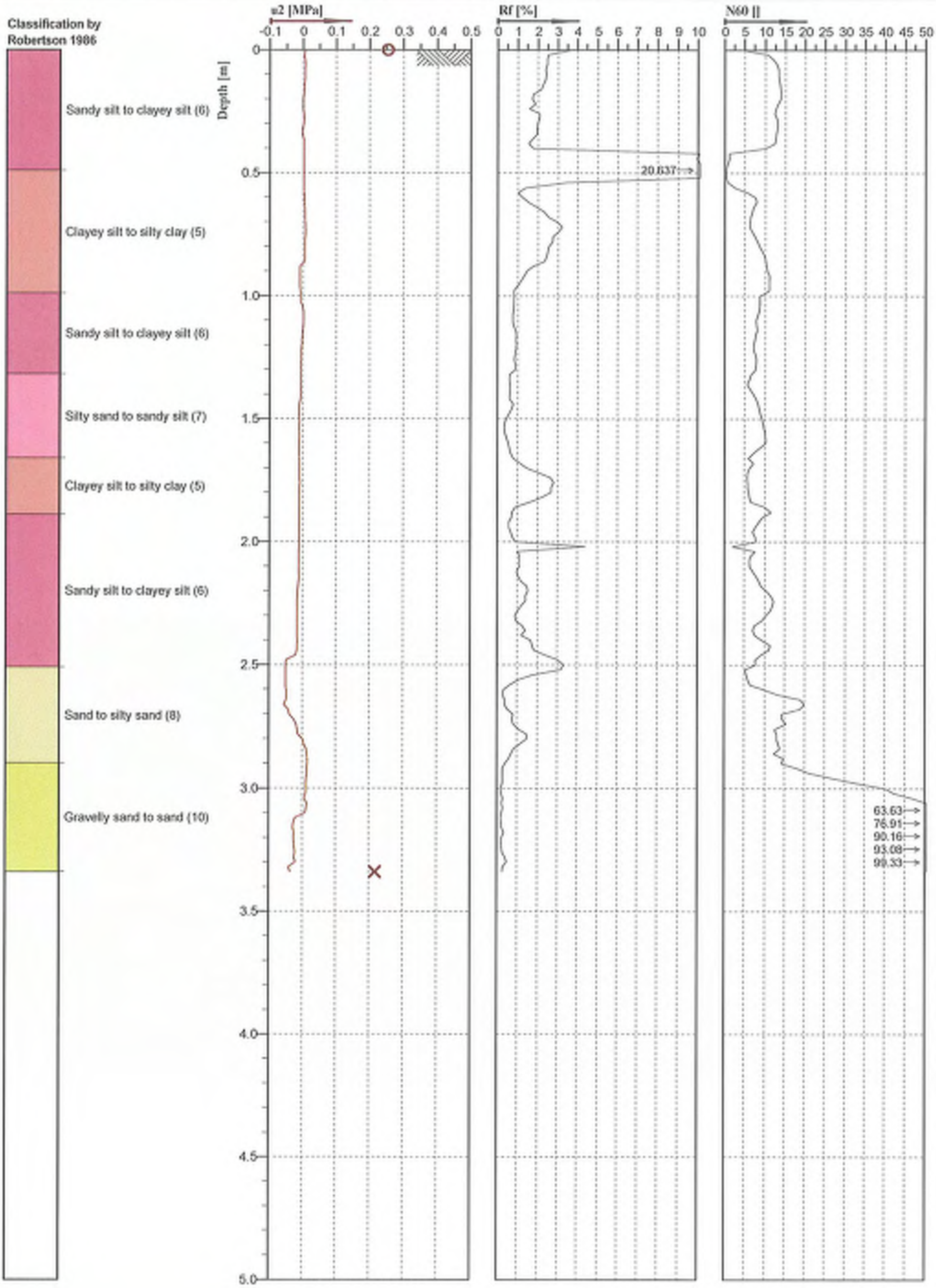
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 12
Project ID:	Client: Aurecon	Date: 4/21/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT12.cp	



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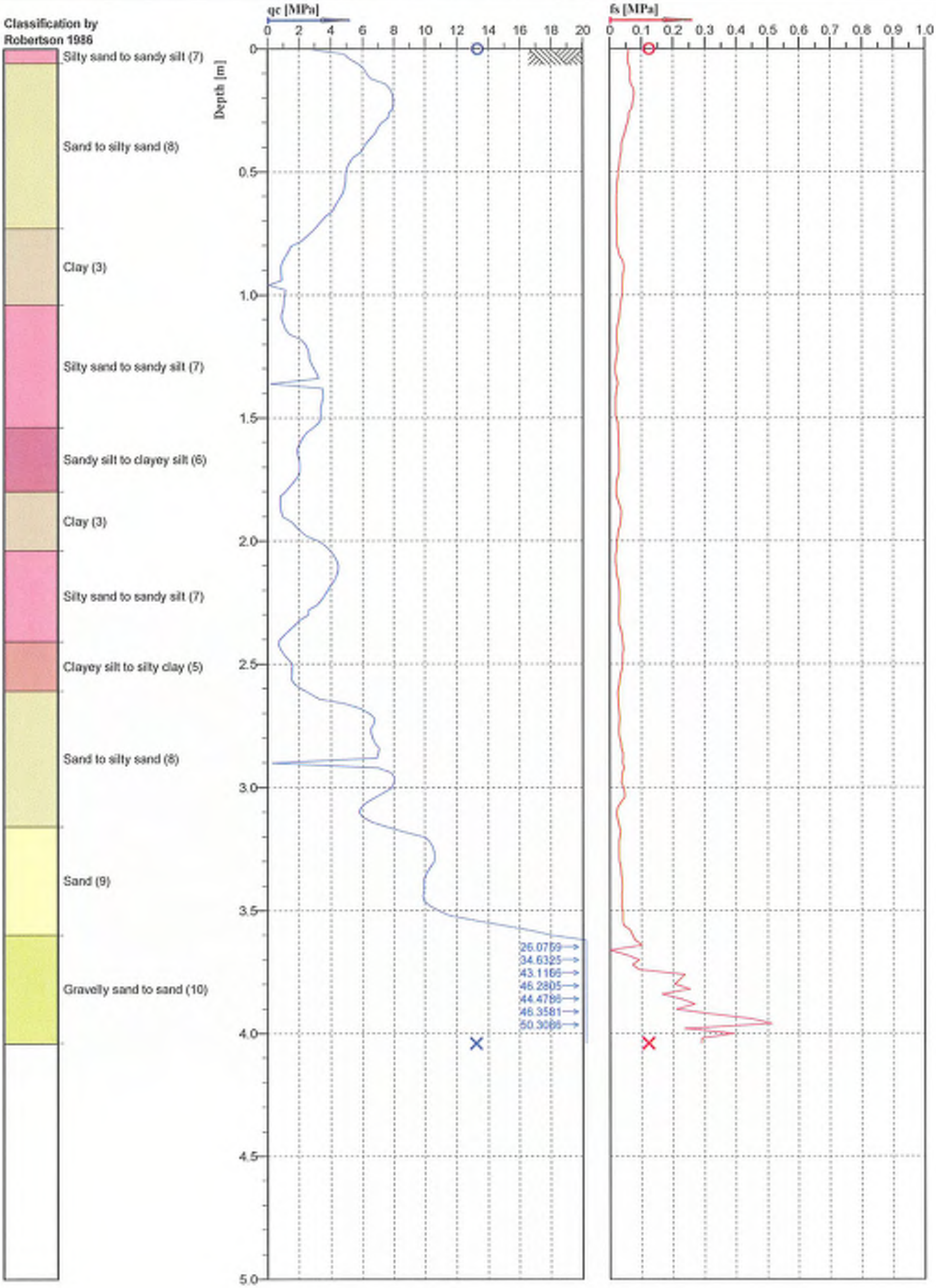
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 12
Project ID:	Client: Aurecon	Date: 4/21/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT12.cp	



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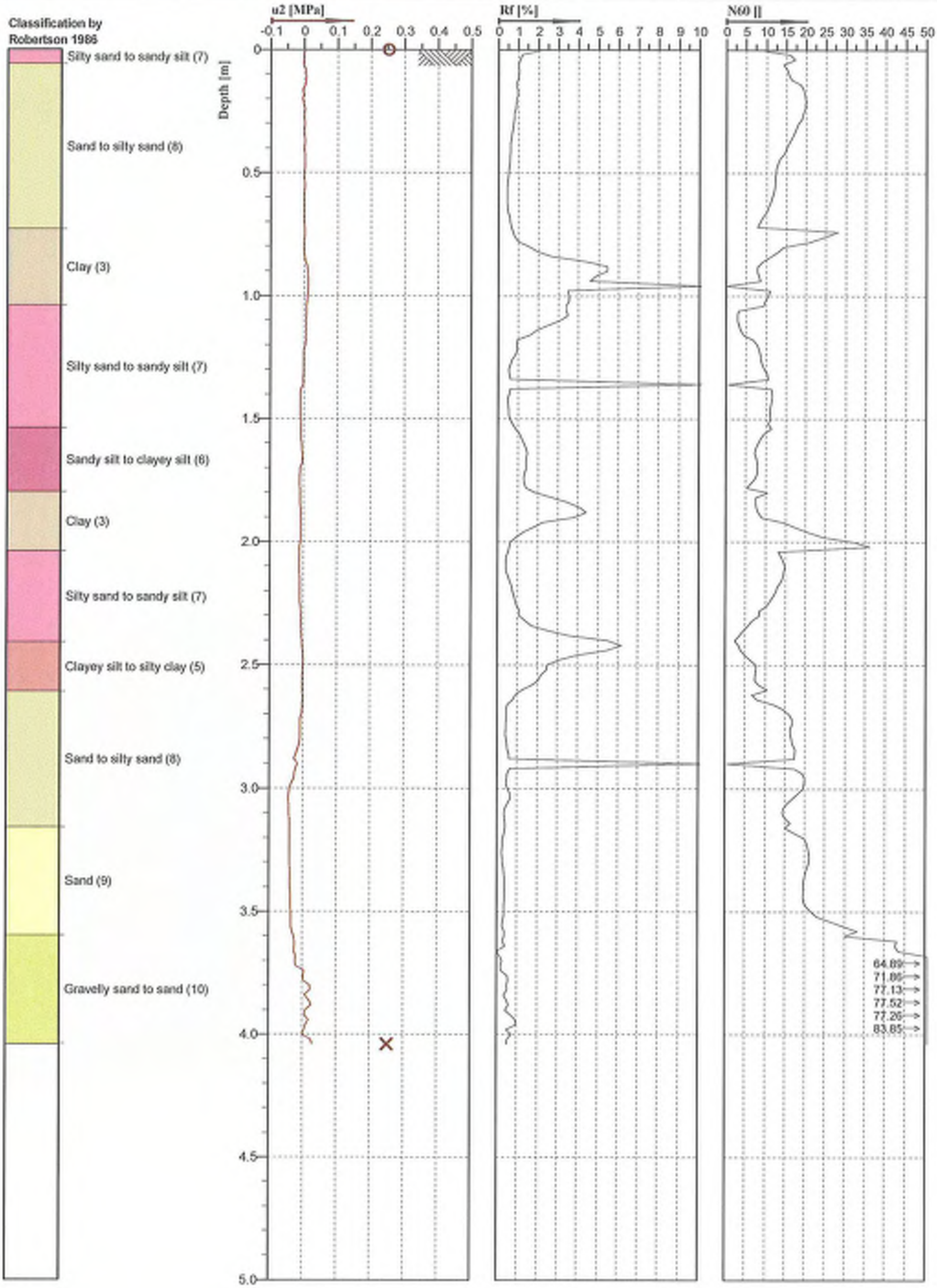
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 13
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT13.cp	



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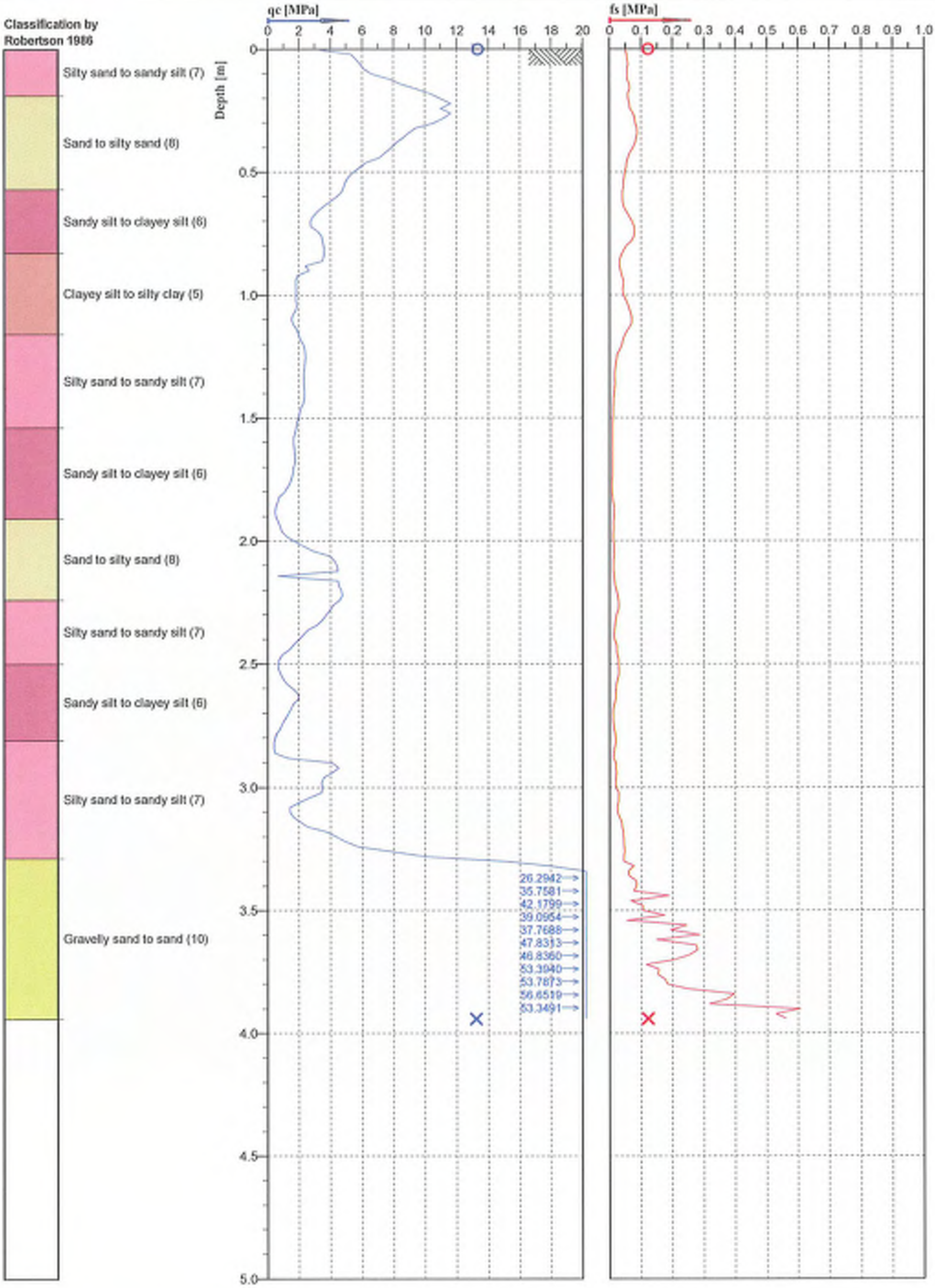
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 13
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT13.cp	



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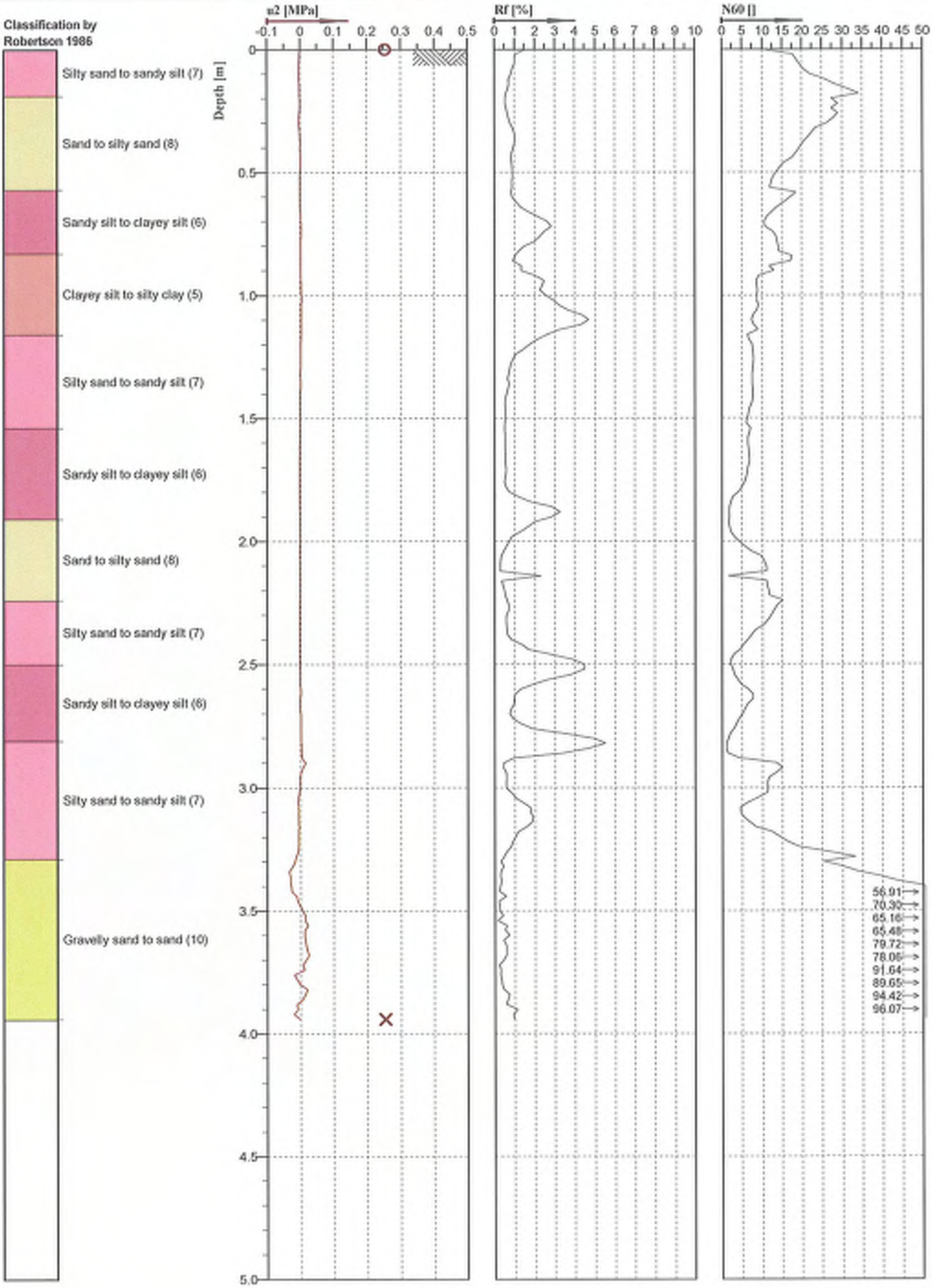
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 14
Project ID:	Client: Aurecon	Date: 4/21/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT14.cp	



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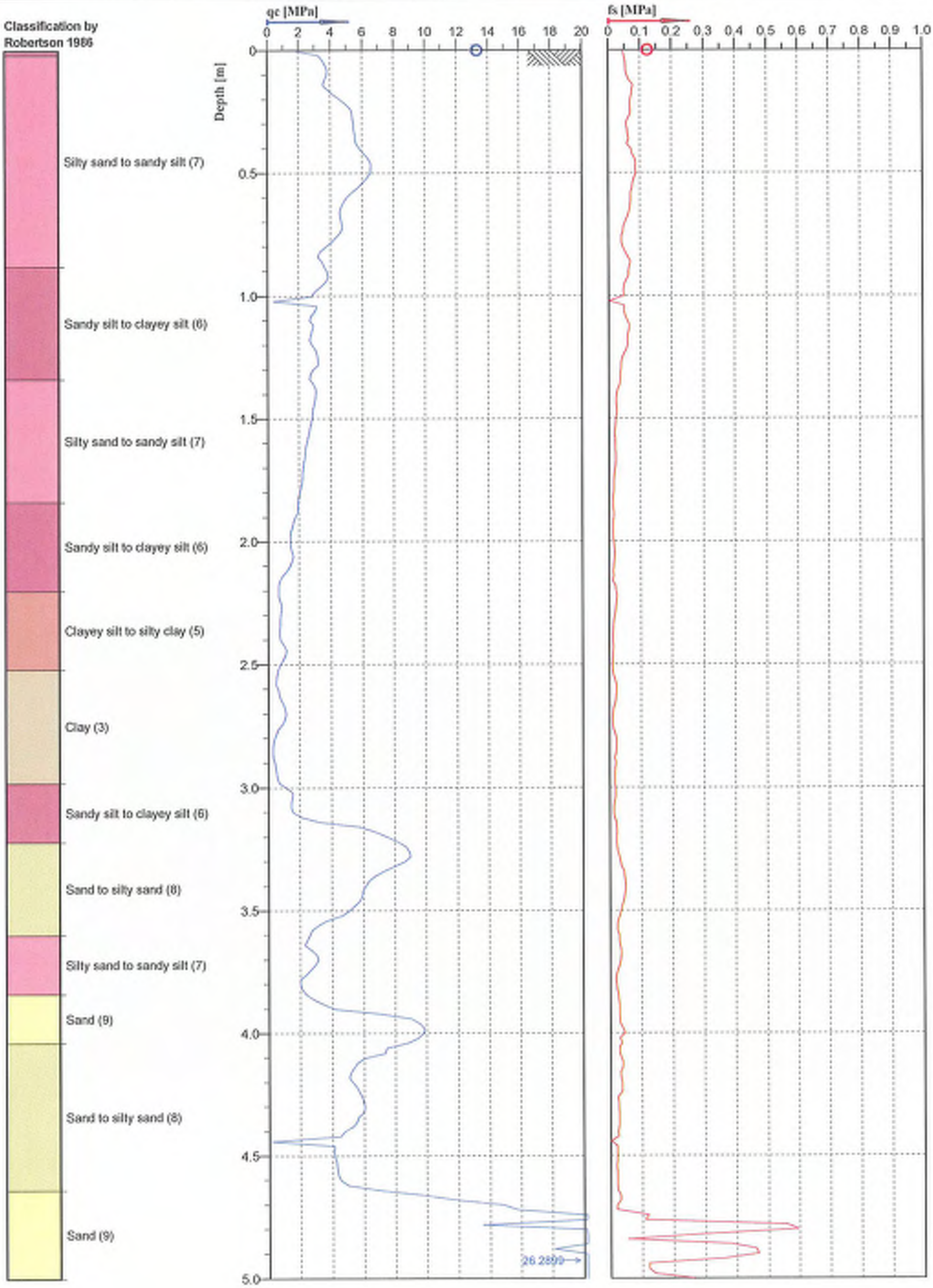
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 14
Project ID:	Client: Aurecon	Date: 4/21/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT14.cp	



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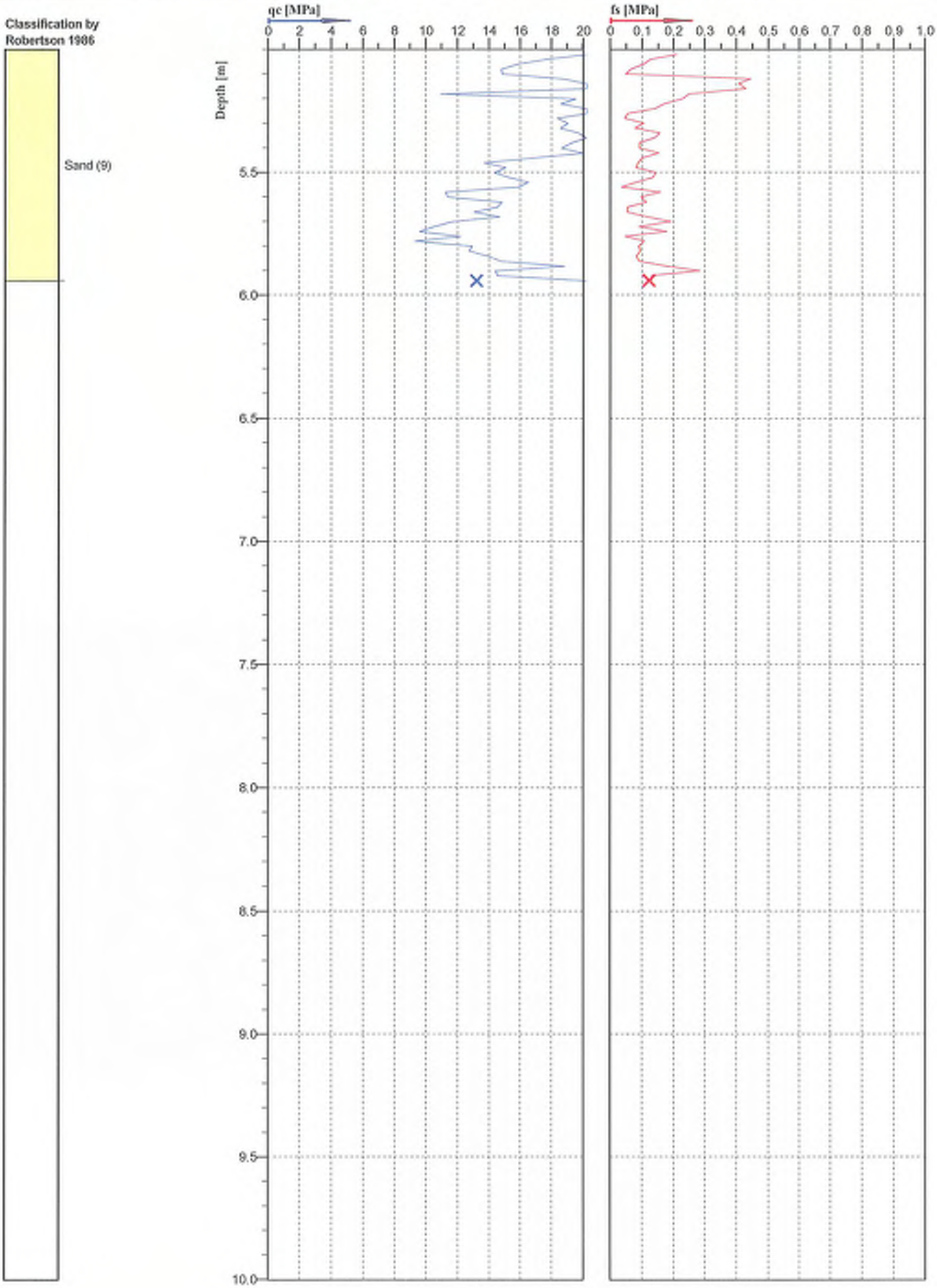
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 15
Project ID:	Client: Aurecon	Date: 4/21/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/2	Fig:
		File: RosemarrynSubdivisionCPT15.cp	



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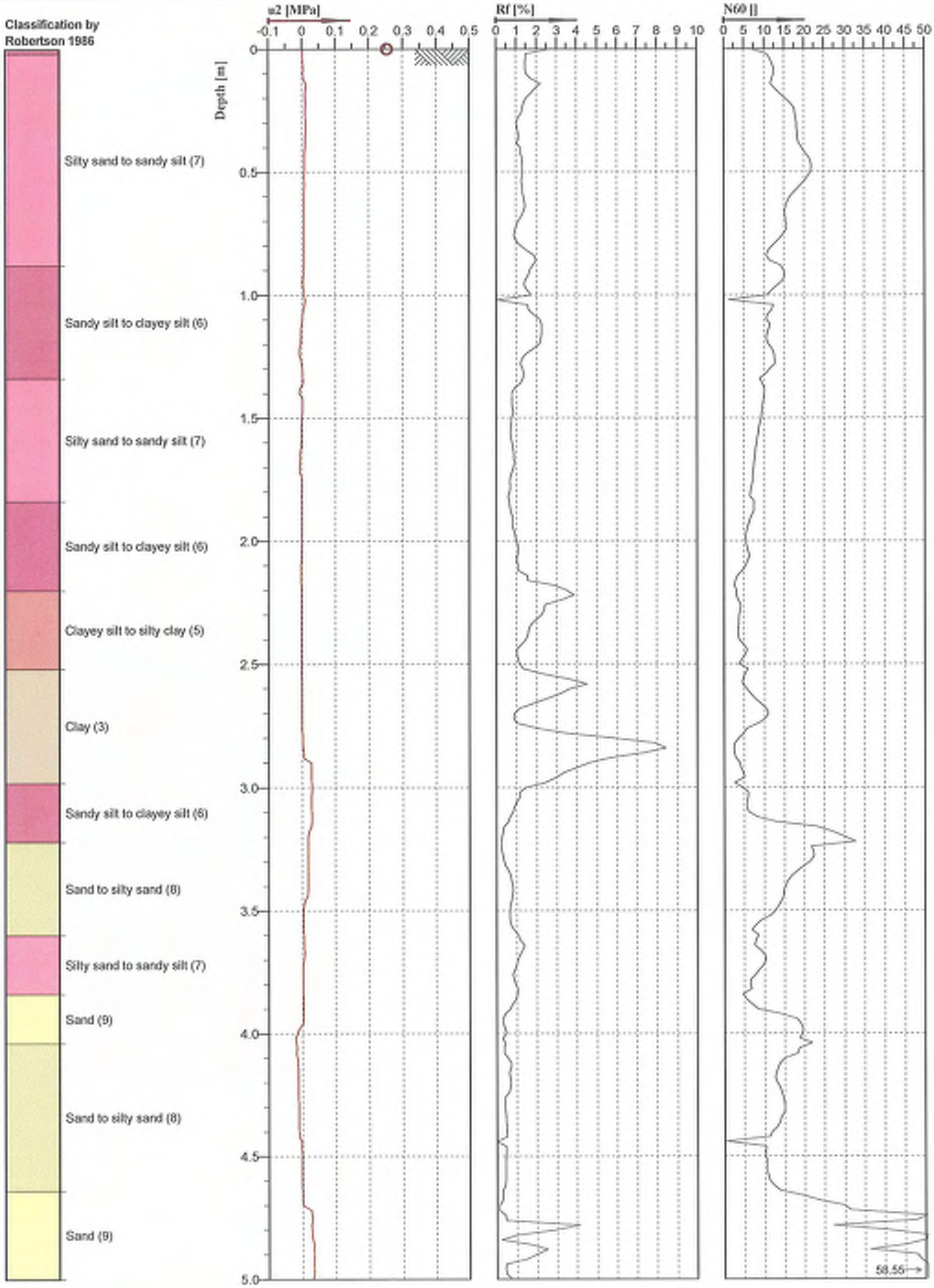
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 15
Project ID:	Client: Aurecon	Date: 4/21/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 2/2	Fig:
		File: RosemarrynSubdivisionCPT15.cp	



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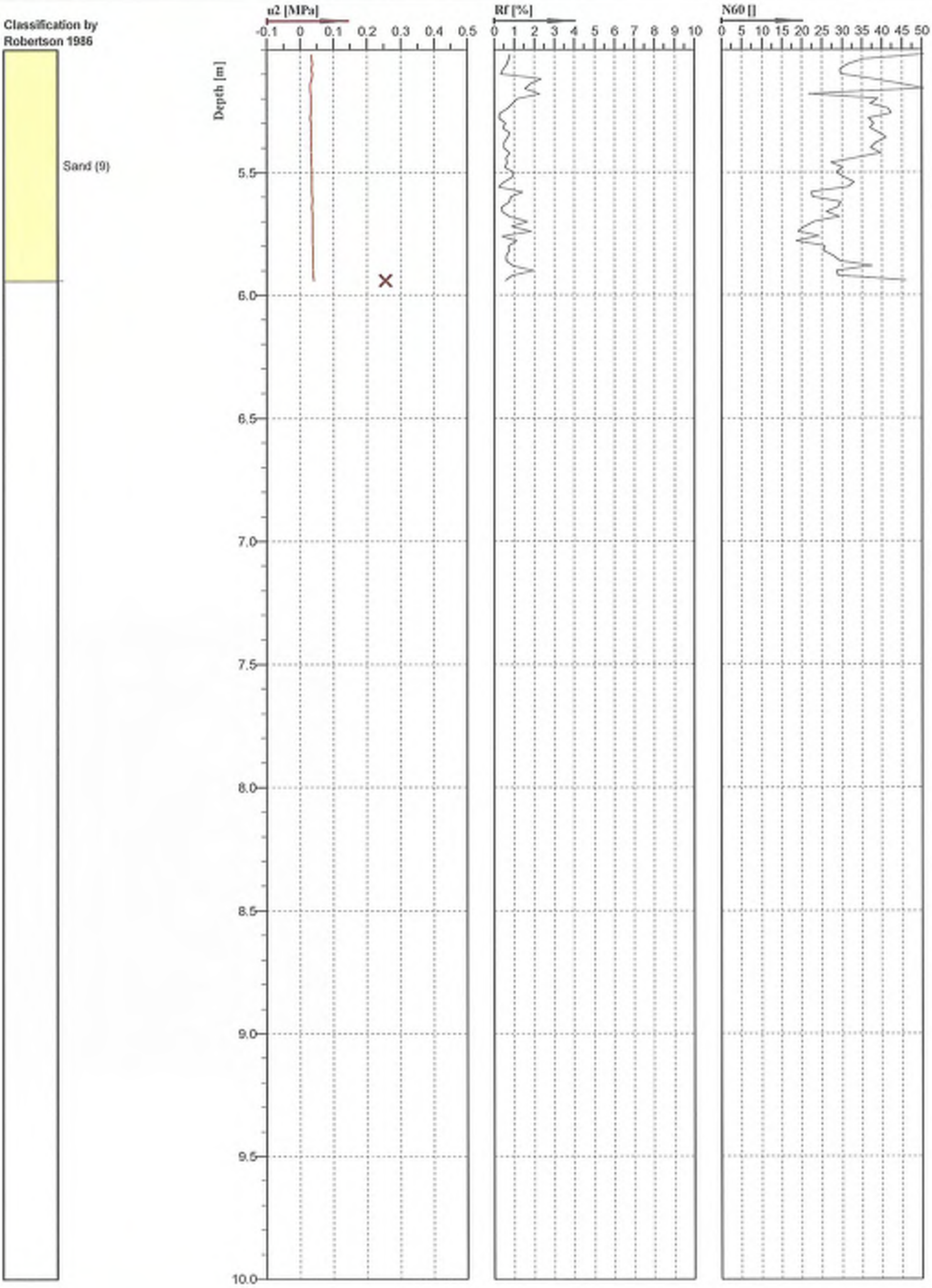
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 15
Project ID:	Client: Aurecon	Date: 4/21/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/2	Fig:
		File: RosemarrynSubdivisionCPT15.cp	



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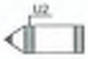

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 15
Project ID:	Client: Aurecon	Date: 4/21/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 2/2	Fig:
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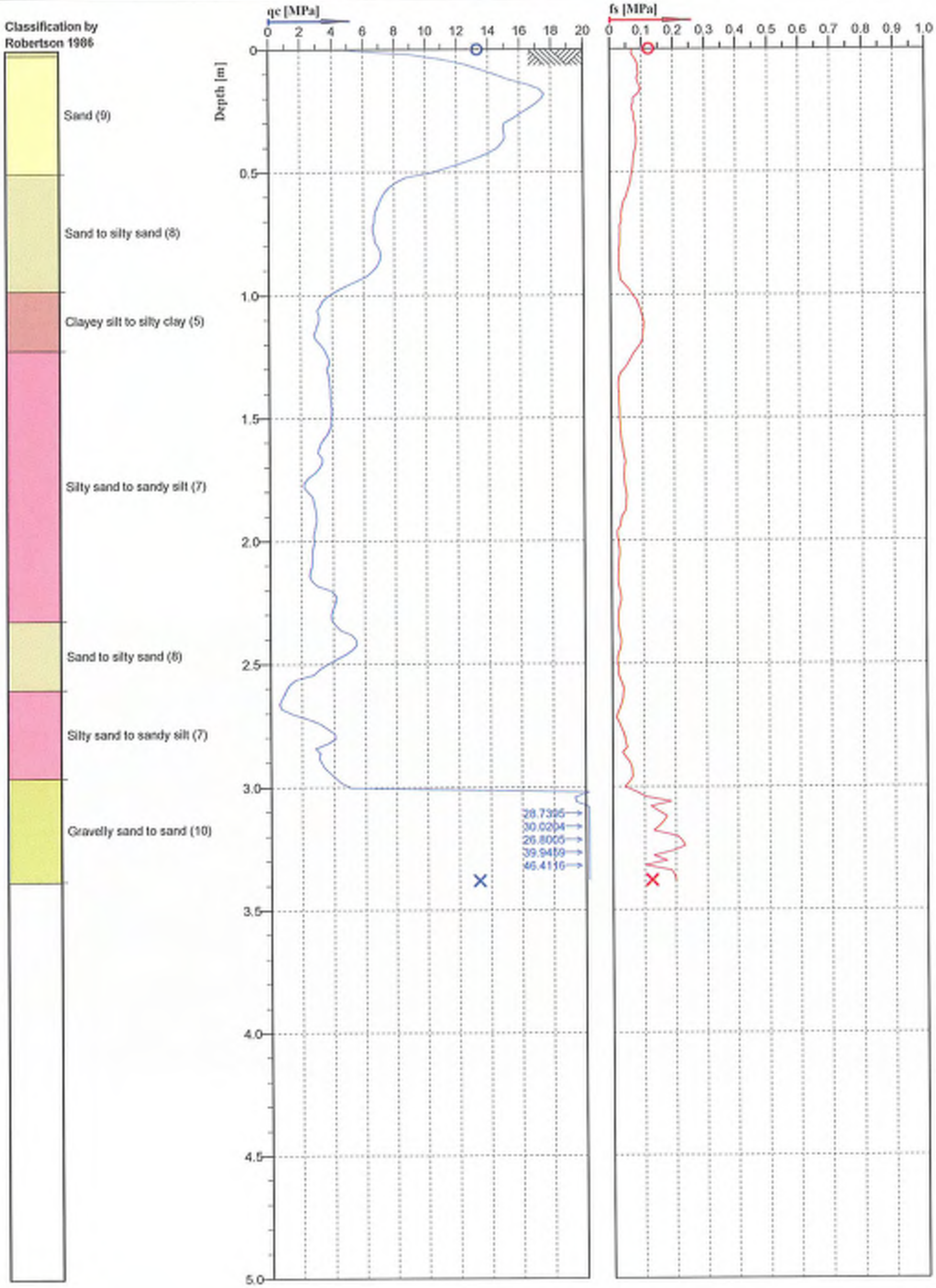

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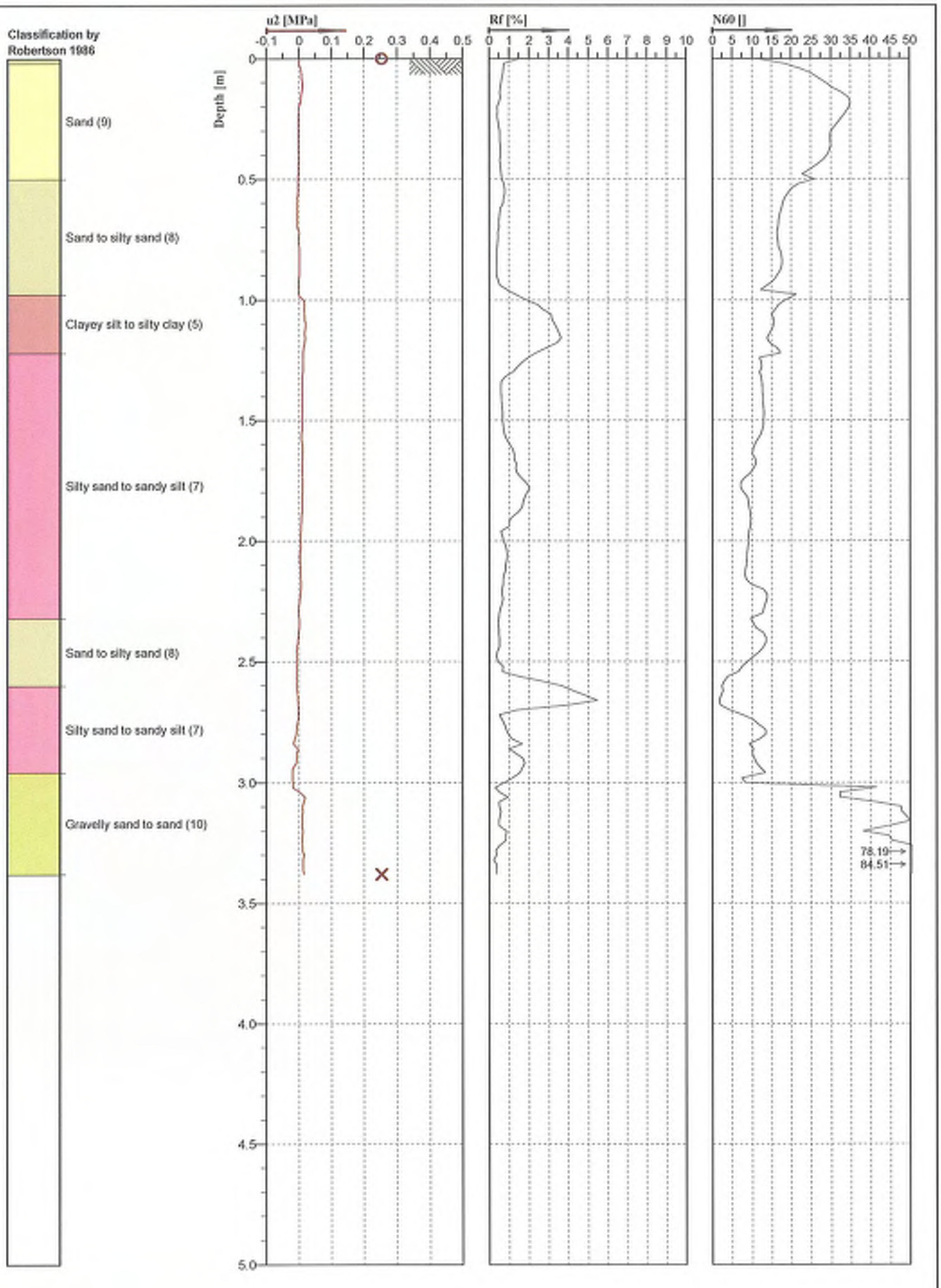
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 16
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT16.cp	



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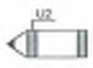
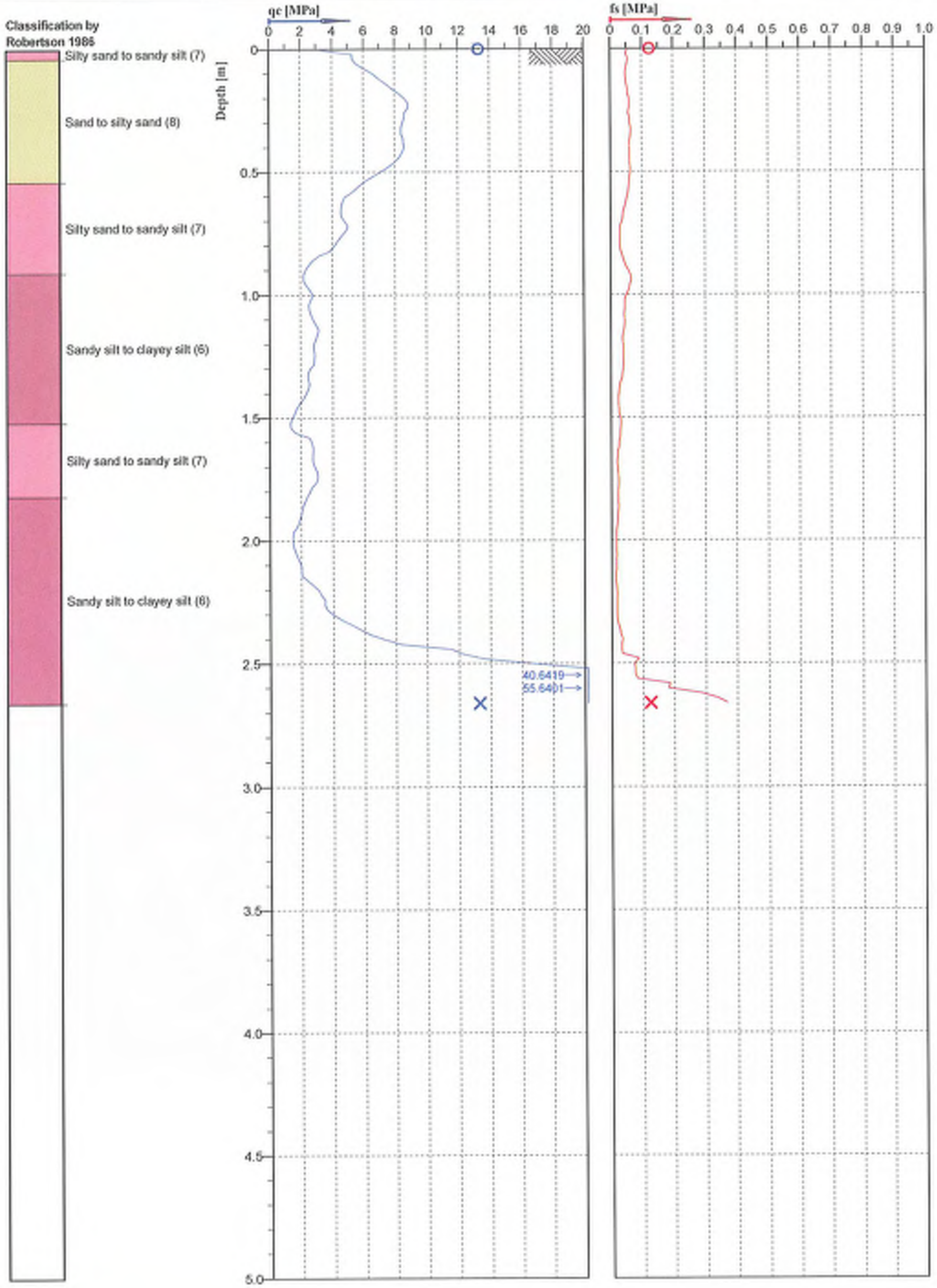


Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision
Position: X: 0.00 m, Y: 0.00 m
Ground level: 0.00
Test no: 16
Project ID:
Client: Aurecon
Date: 4/21/2013
Scale: 1 : 22
Project: ROSEMARRYN
Page: 1/1
Fig:
File: RosemarrynSubdivisionCPT16.cp



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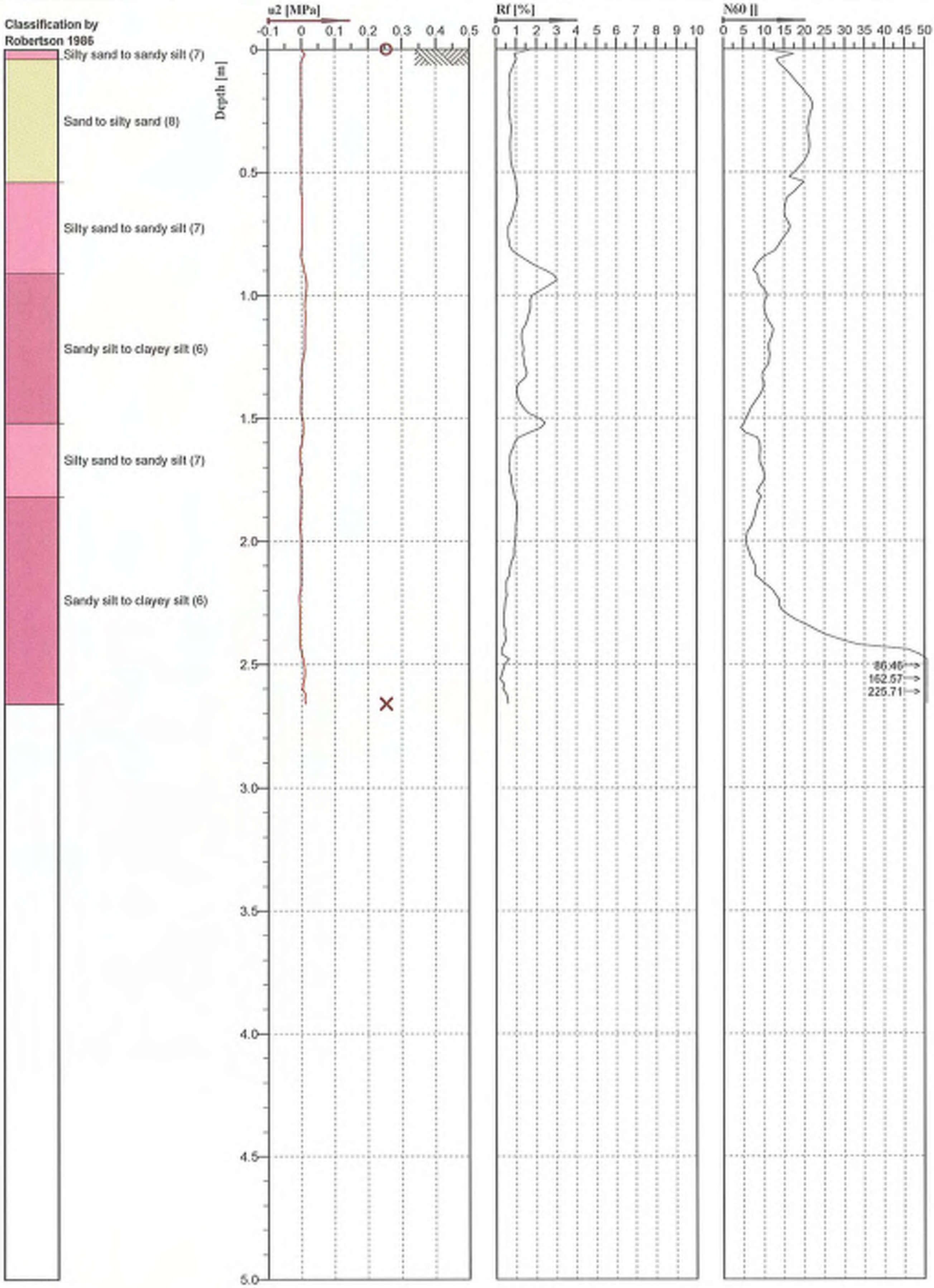
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 17
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT17.cp	



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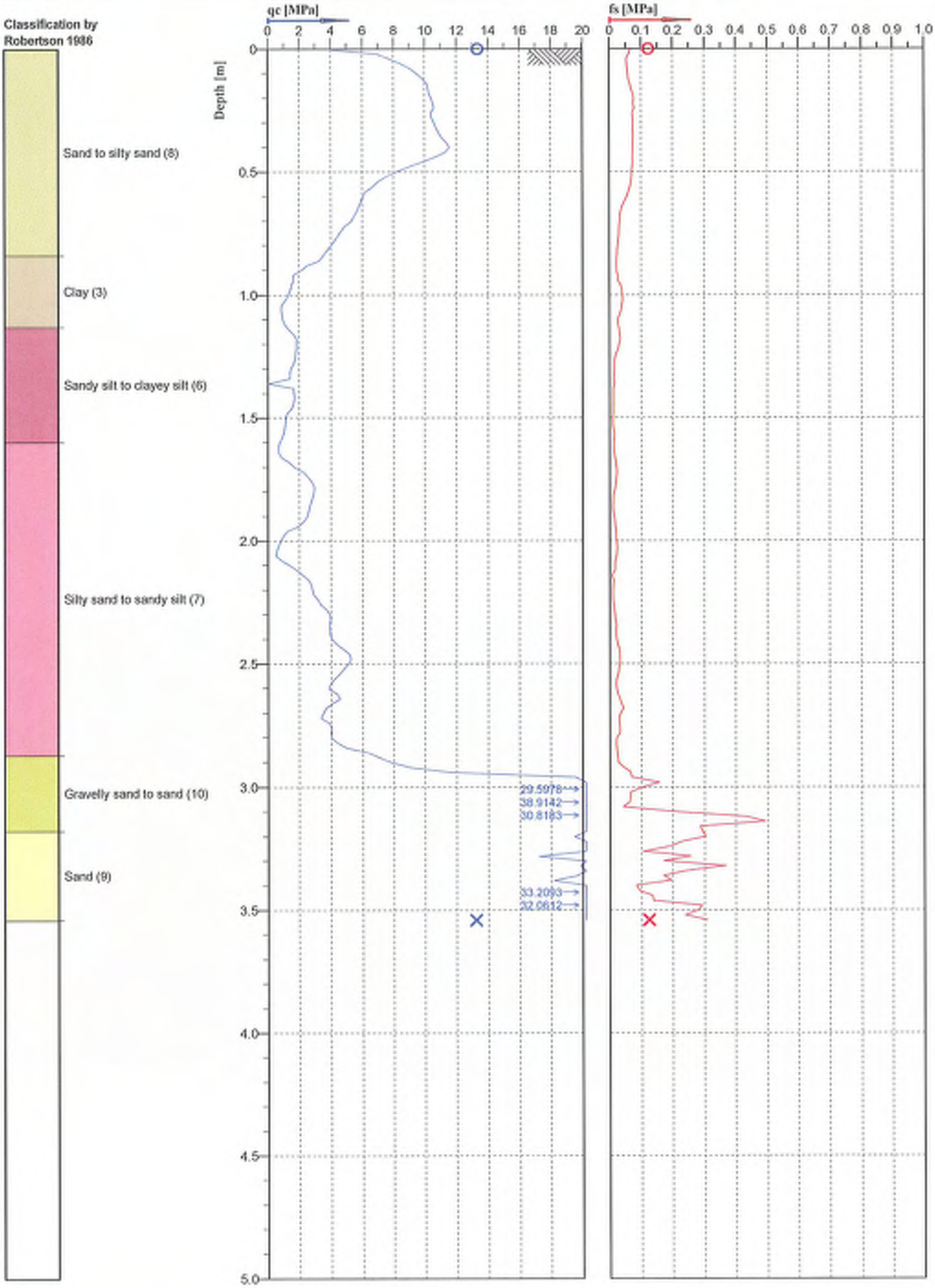
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 17
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT17.cp	



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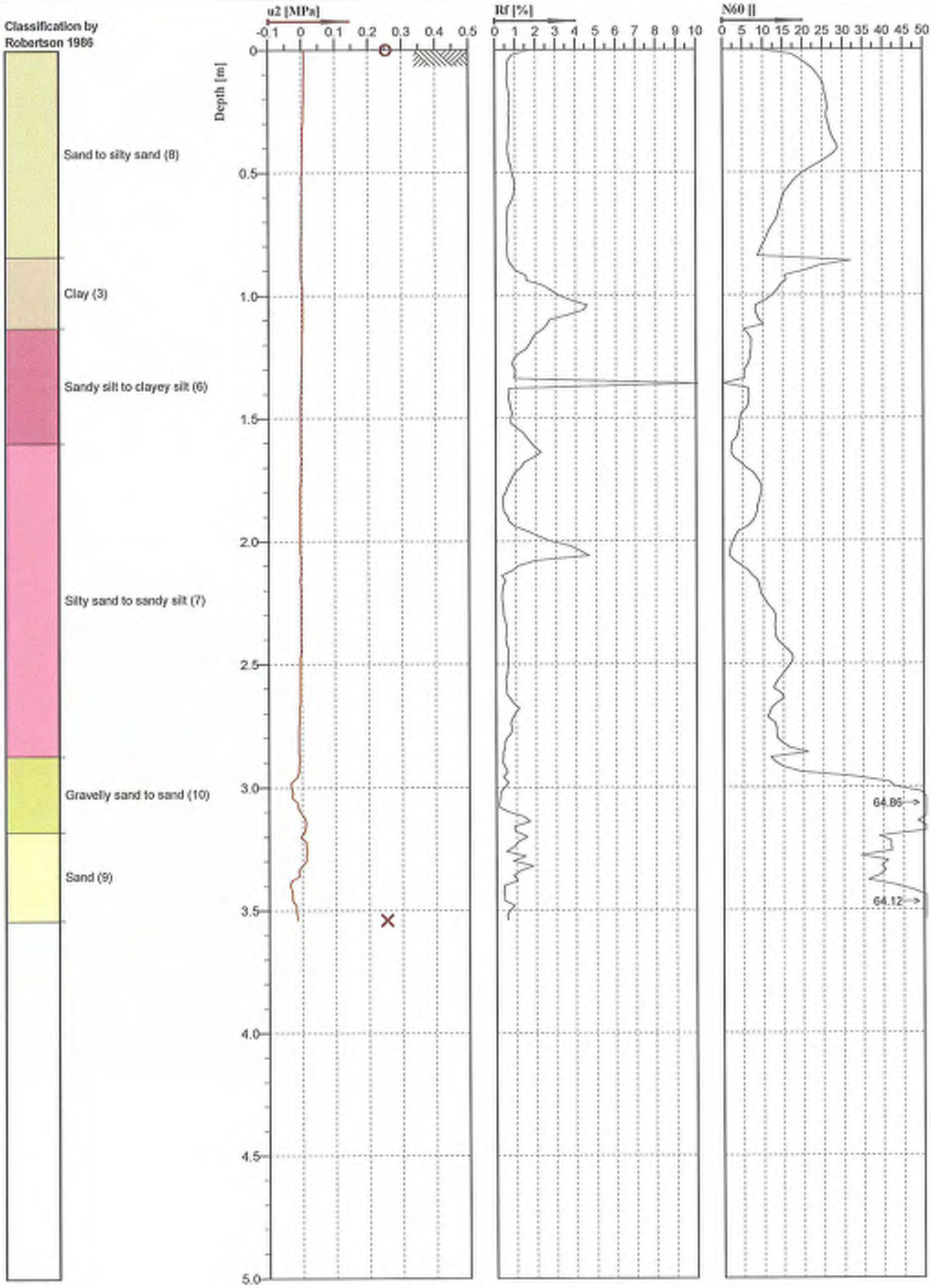
U2

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 18
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT18.cp	



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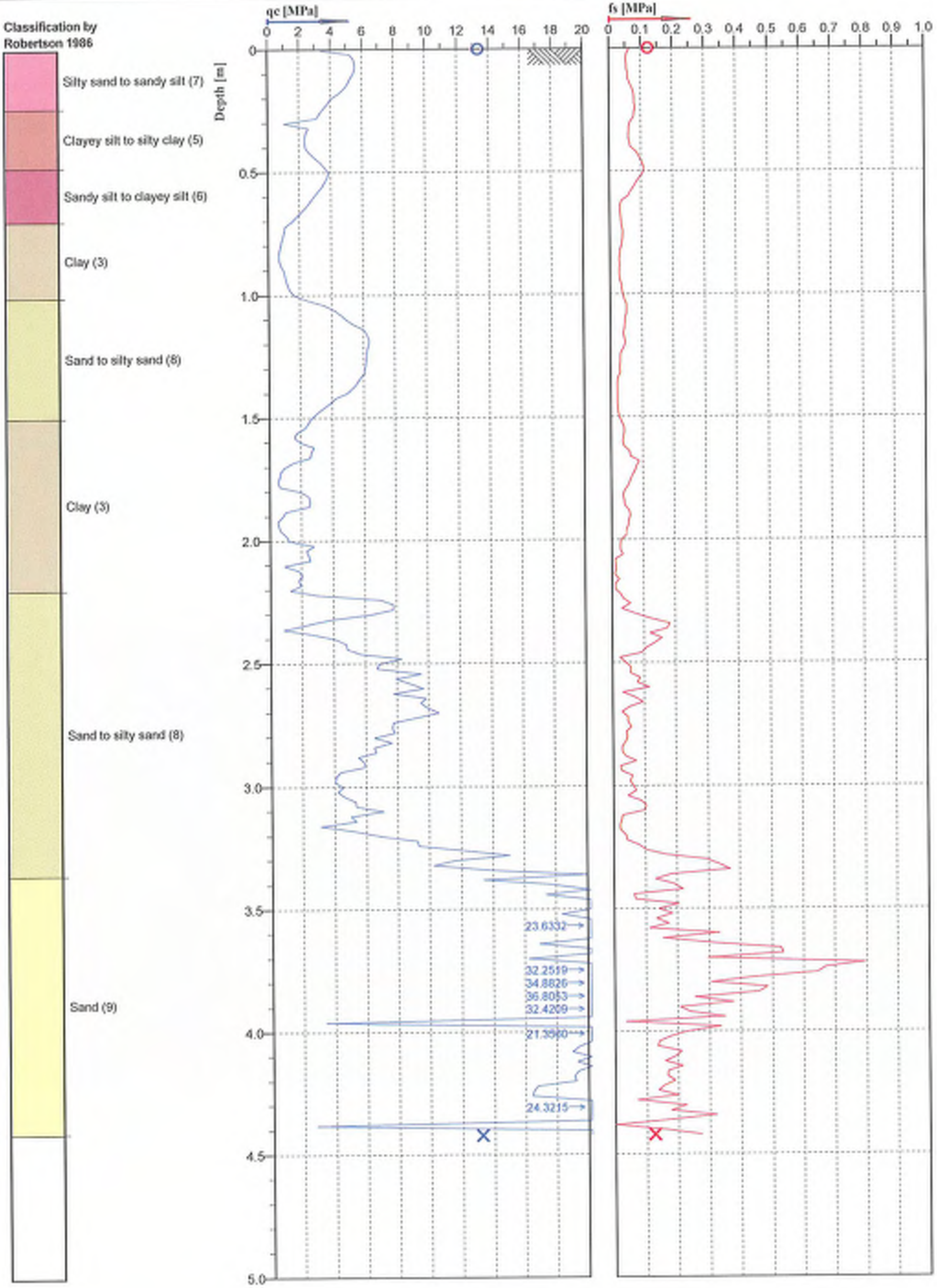
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 18
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT18.cp	

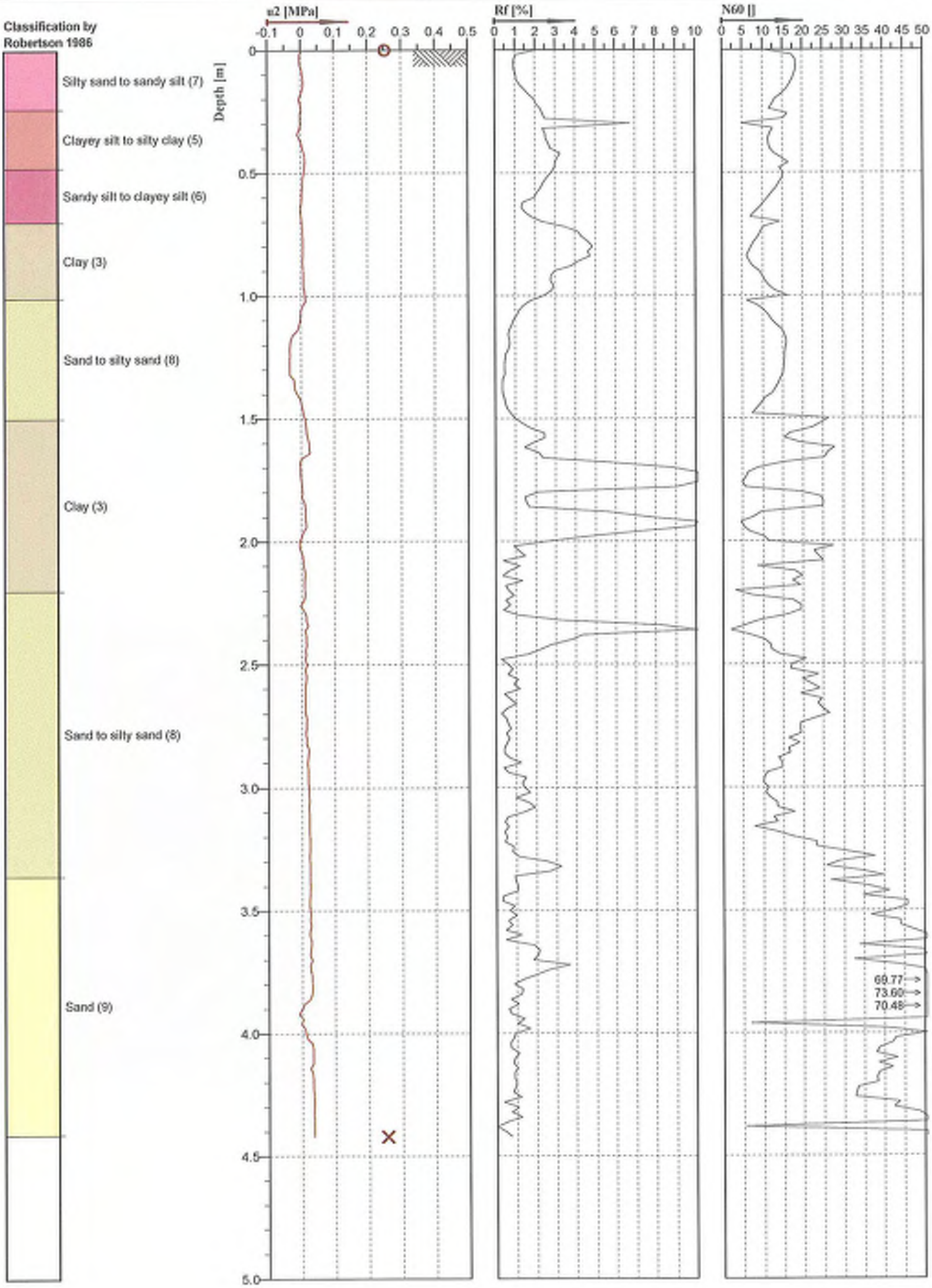


PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637

U2

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 19
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT19.cp	



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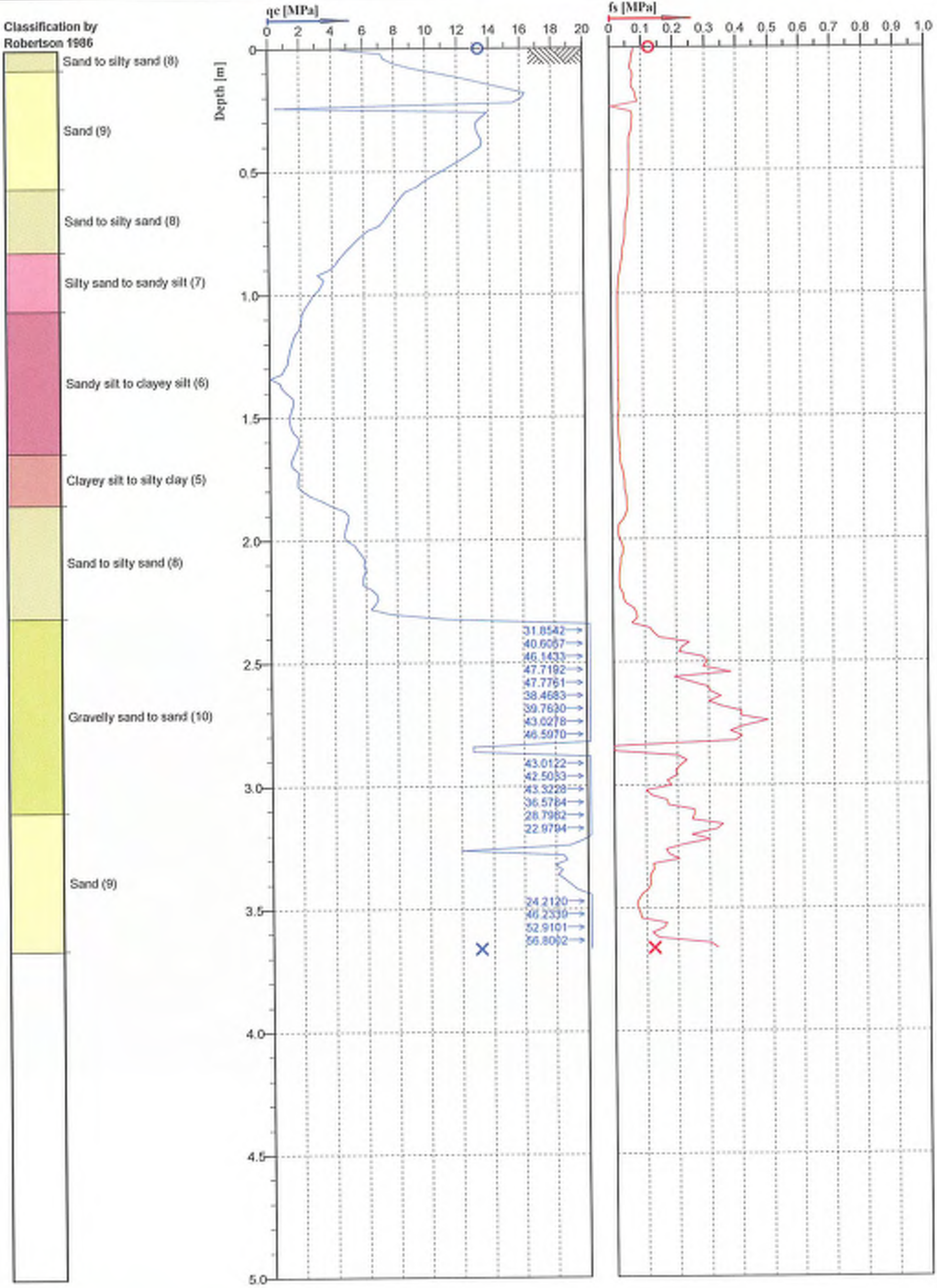
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 19
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT19.cp	



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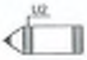
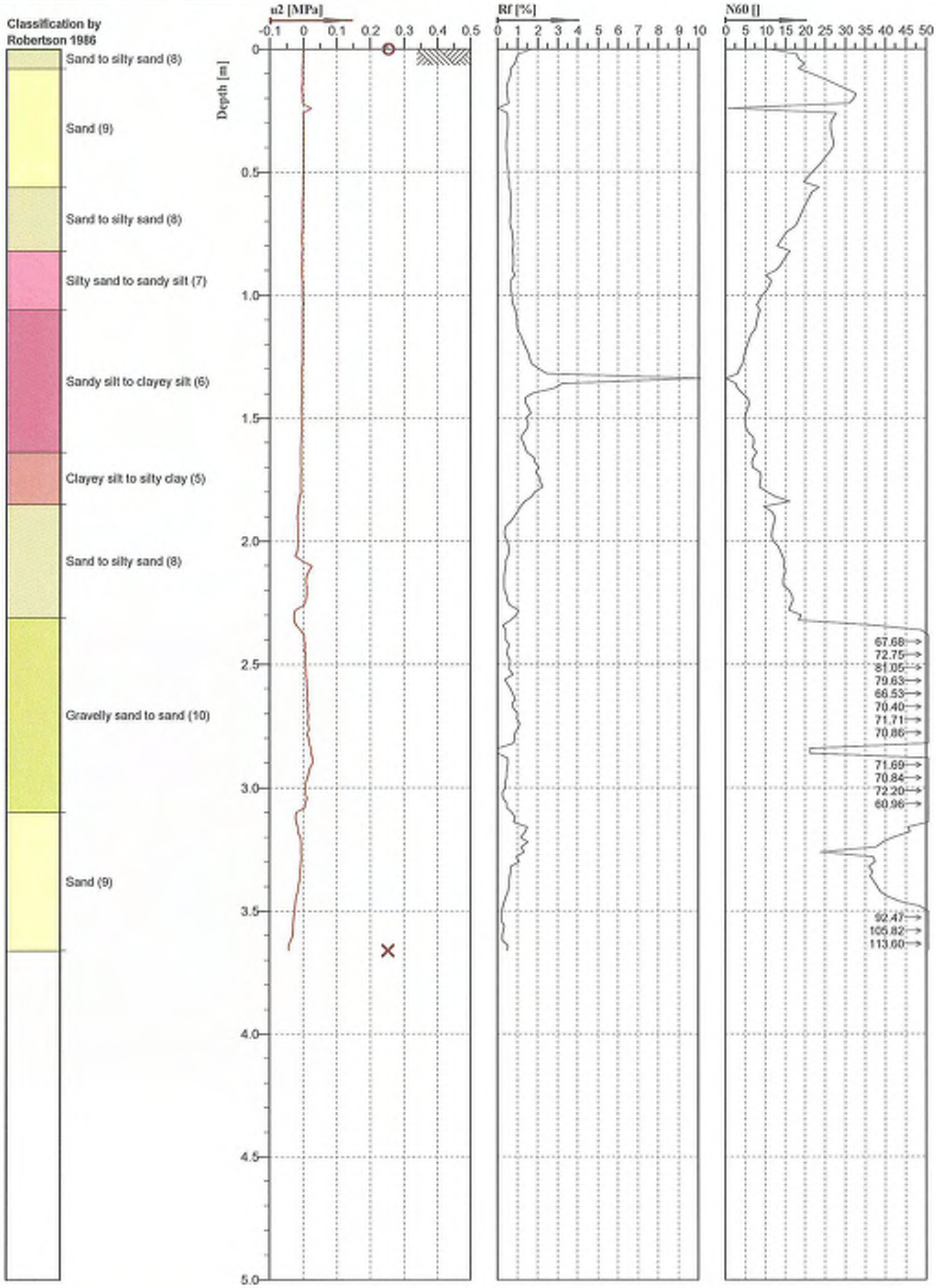


Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 20
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT20.cp	



PRO-DRILL
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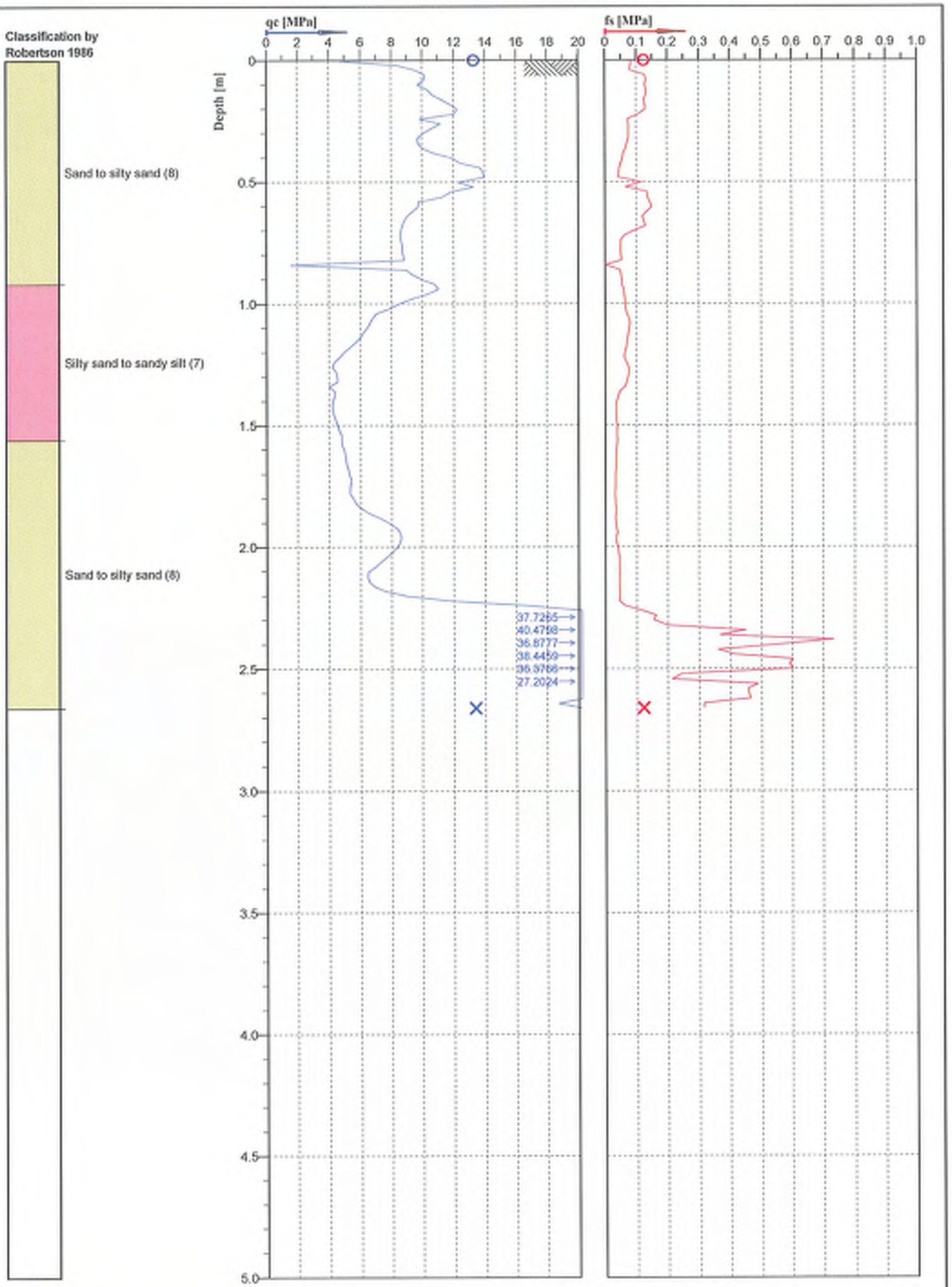
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 20
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT20.cp	

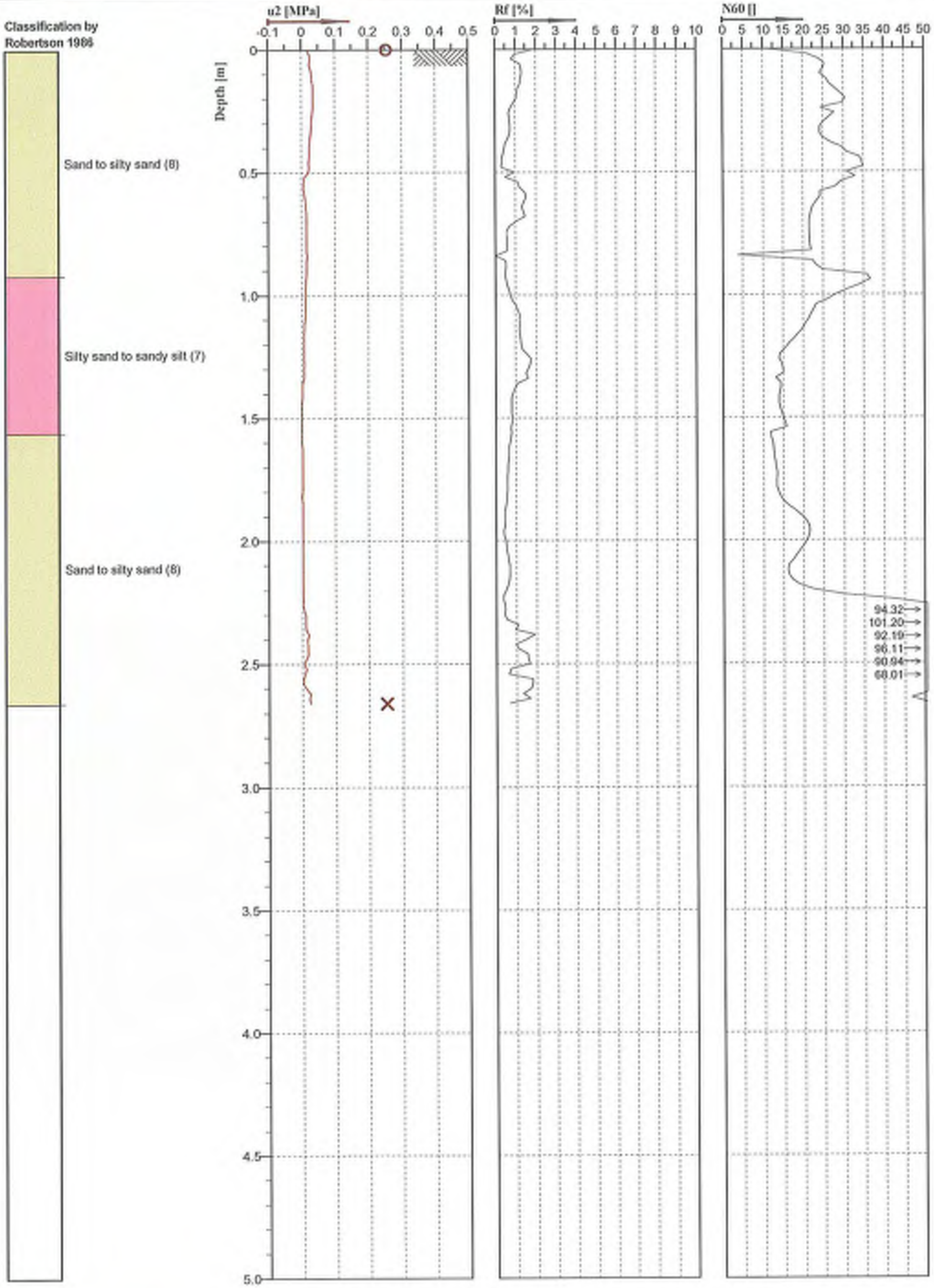


PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637

U2

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 21
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT21.cp	



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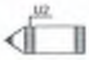
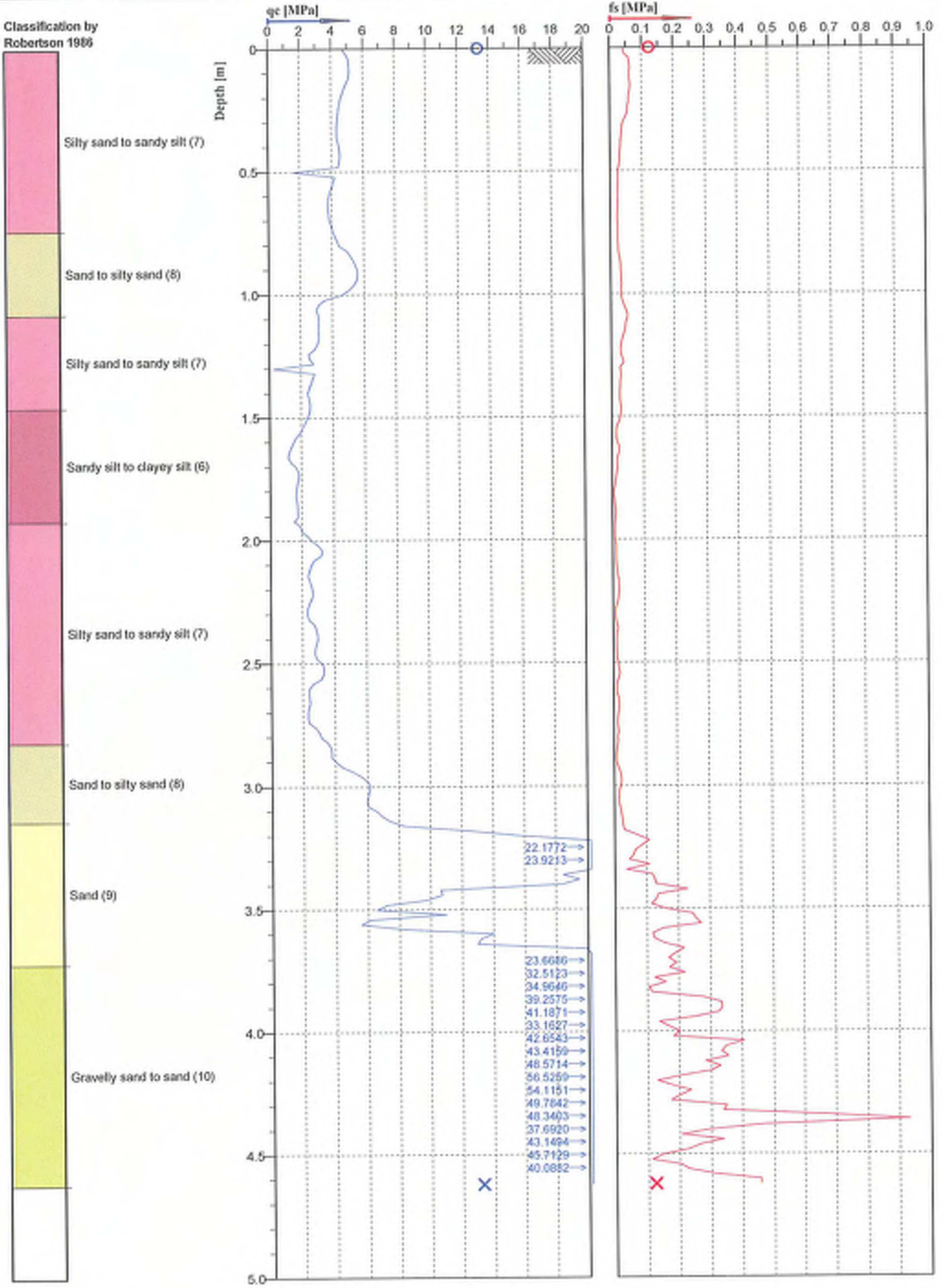


Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 21
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT21.cp	



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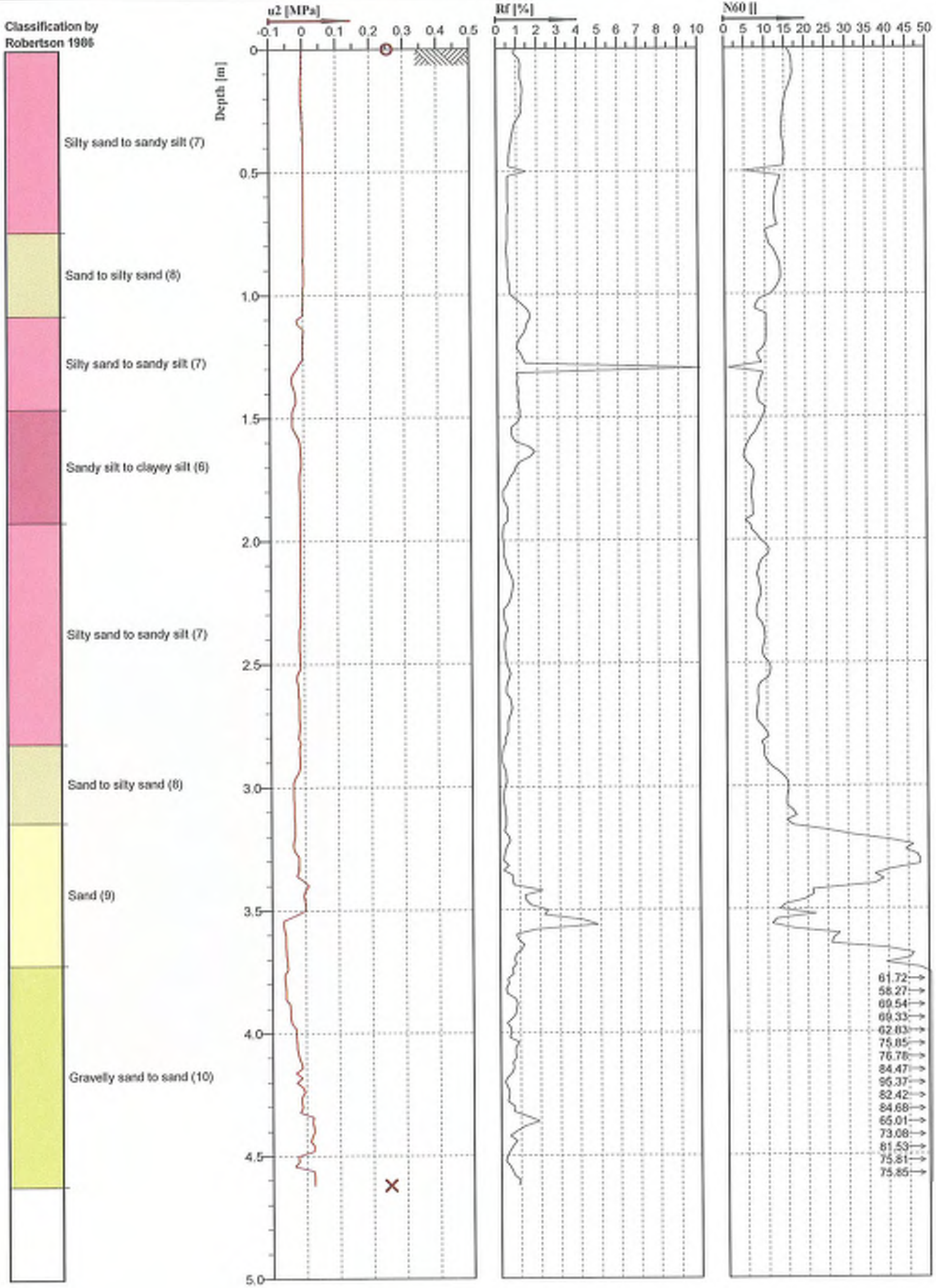
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 22
Project ID:	Client: Aurecon	Date: 4/23/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT22.cp	



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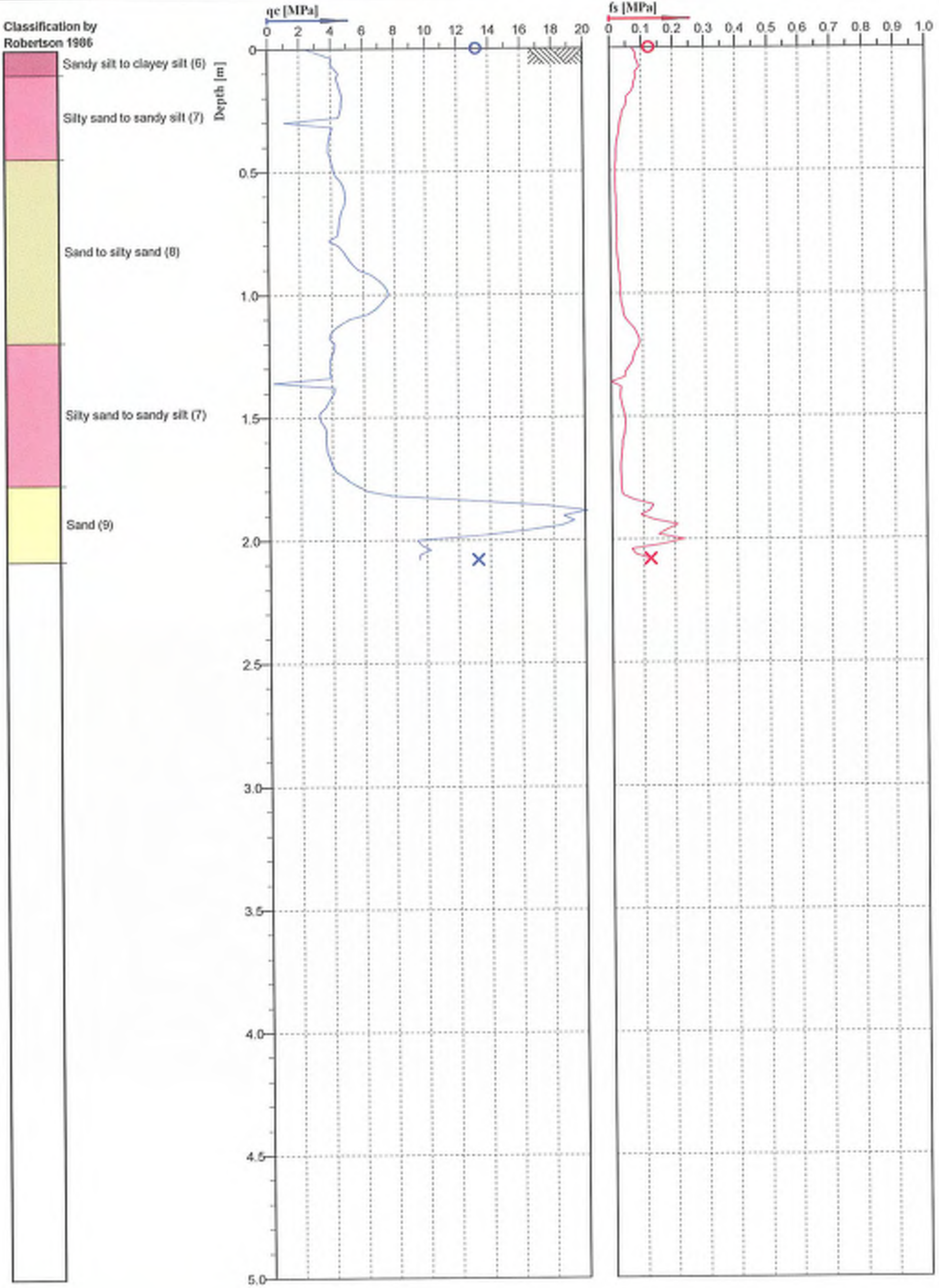
ENGINEERS
0800 477 637

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 22
Project ID:	Client: Aurecon	Date: 4/23/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT22.cp	



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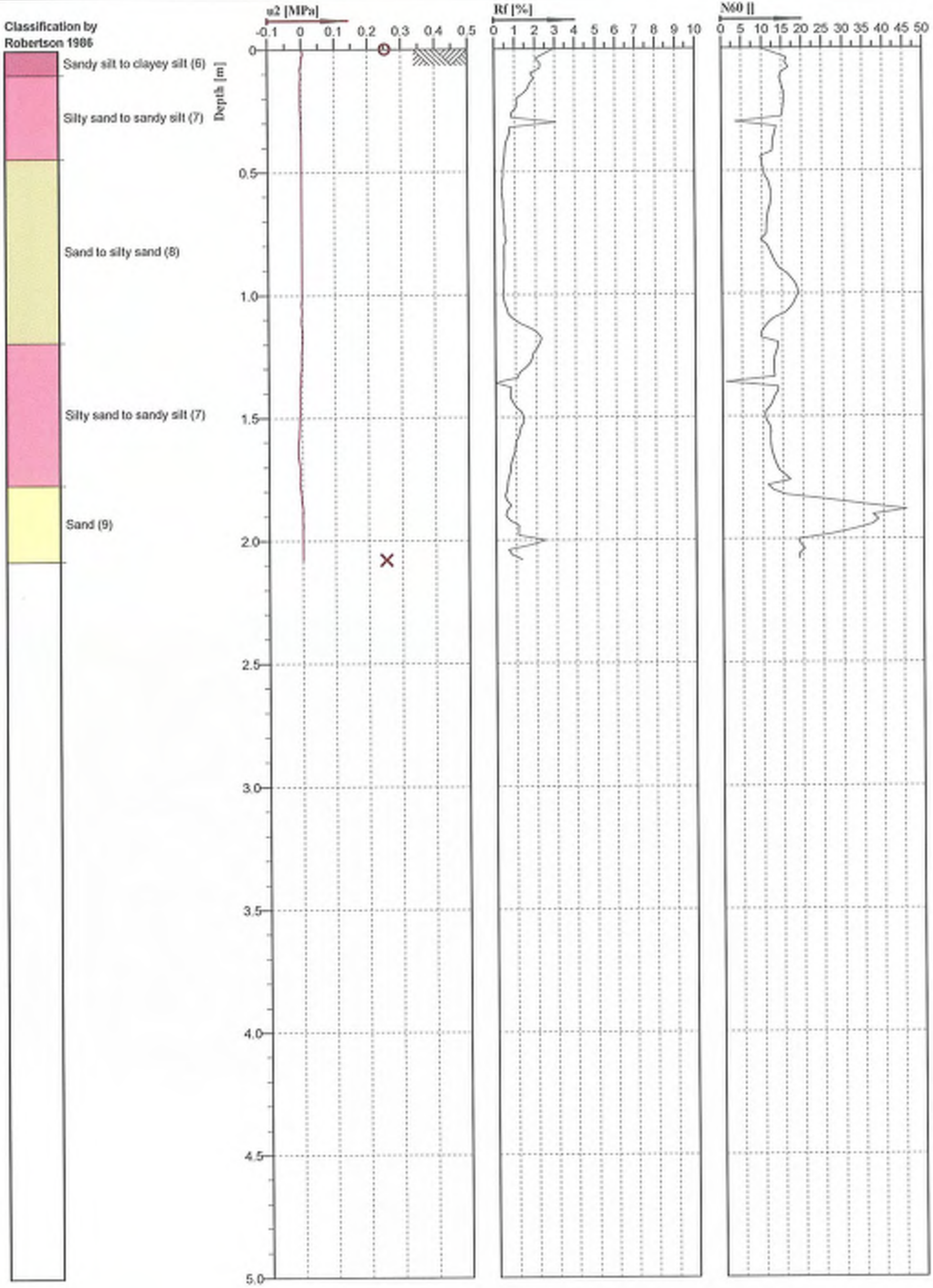
0800 477 637

U2
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision
Position: X: 0.00 m, Y: 0.00 m
Ground level: 0.00
Test no: 23
Project ID:
Client: Aurecon
Date: 4/23/2012
Scale: 1 : 22
Project: ROSEMARRYN
Page: 1/1
Fig:
File: RosemarrynSubdivisionCPT23.cp



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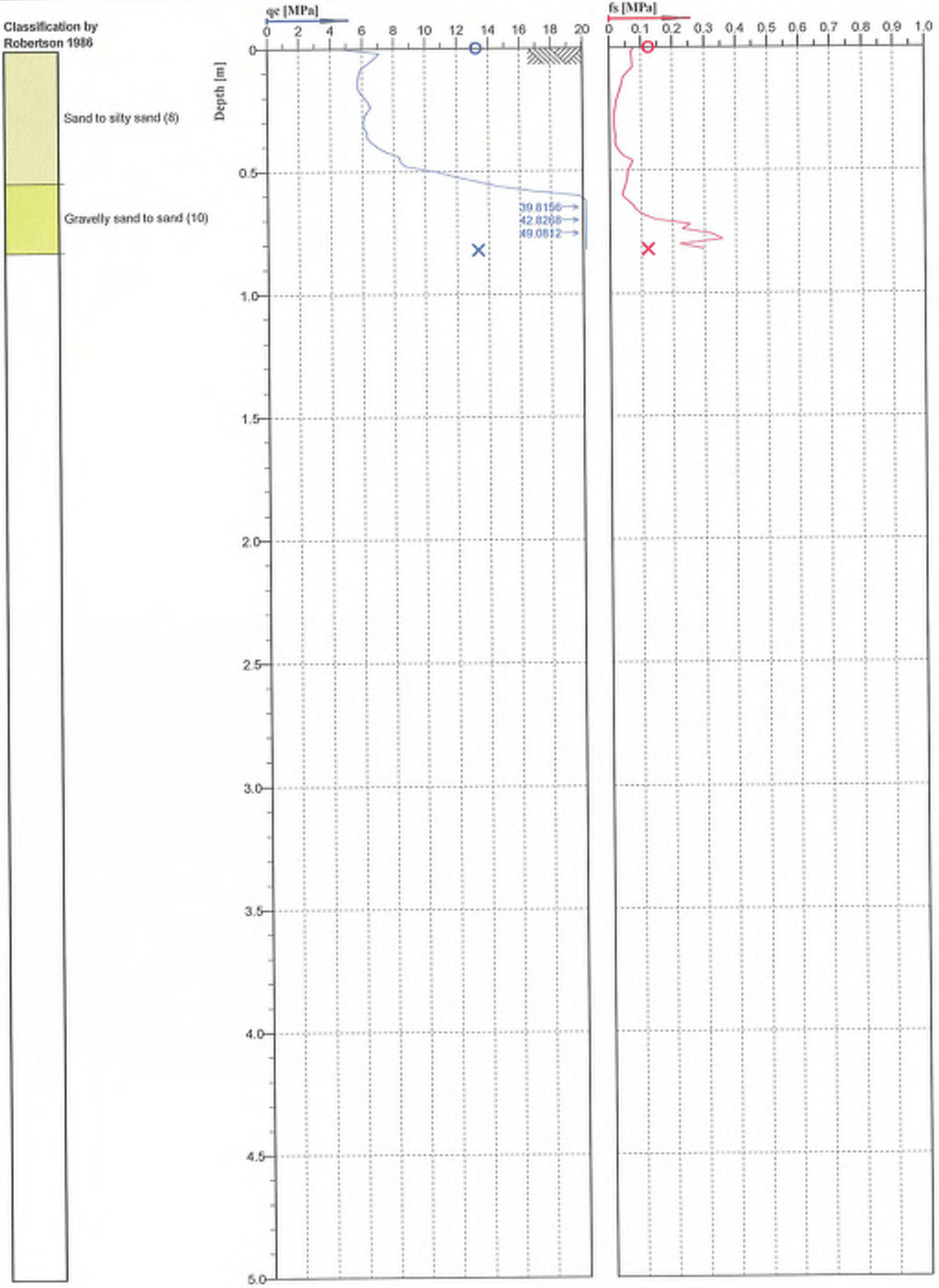
ENGINEERS
0800 477 637

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 23
Project ID:	Client: Aurecon	Date: 4/23/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT23.cp	



PRO-DRILL
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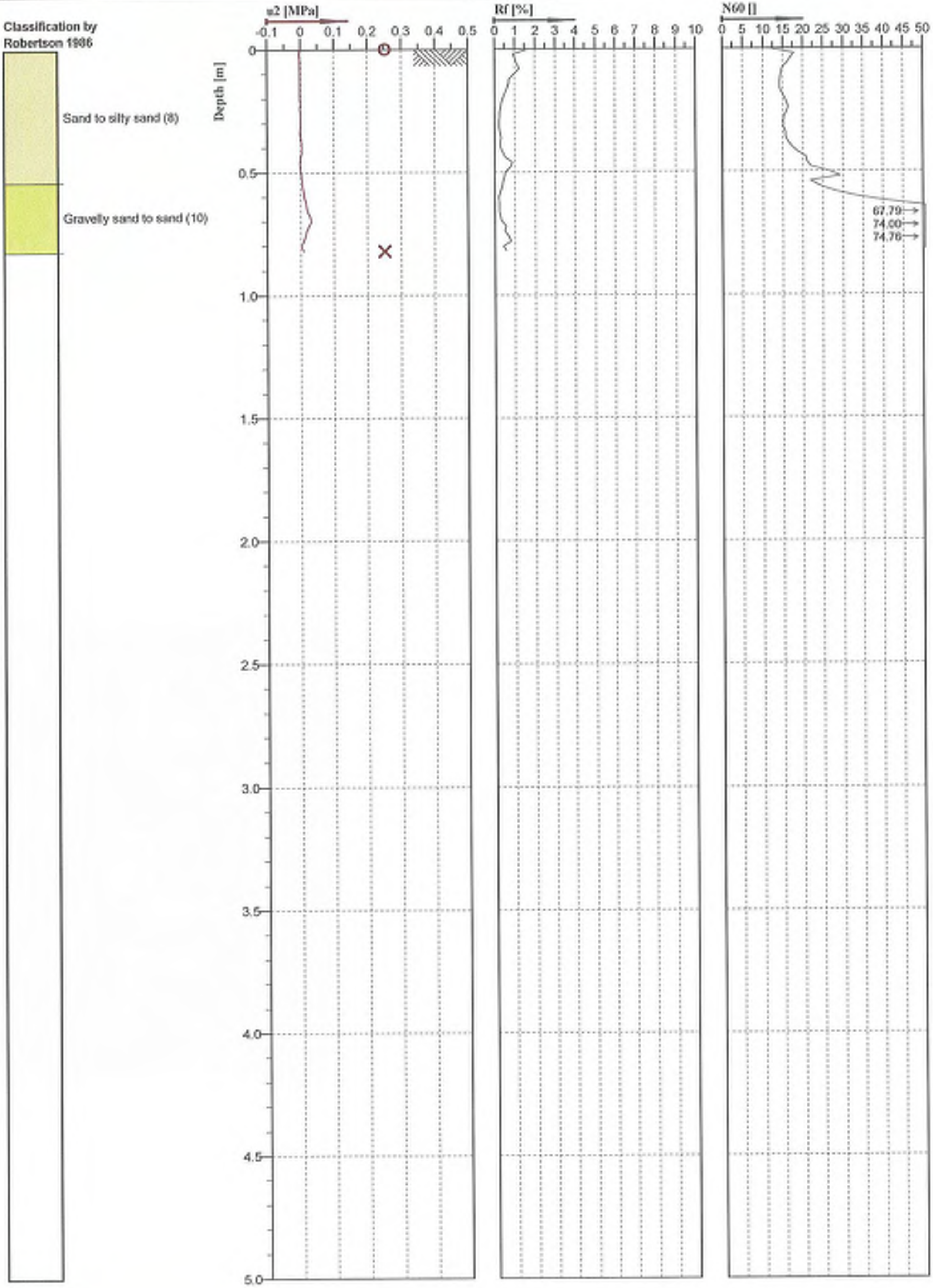
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: CPT24
Project ID:	Client: Aurecon	Date: 4/23/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT24.cp	



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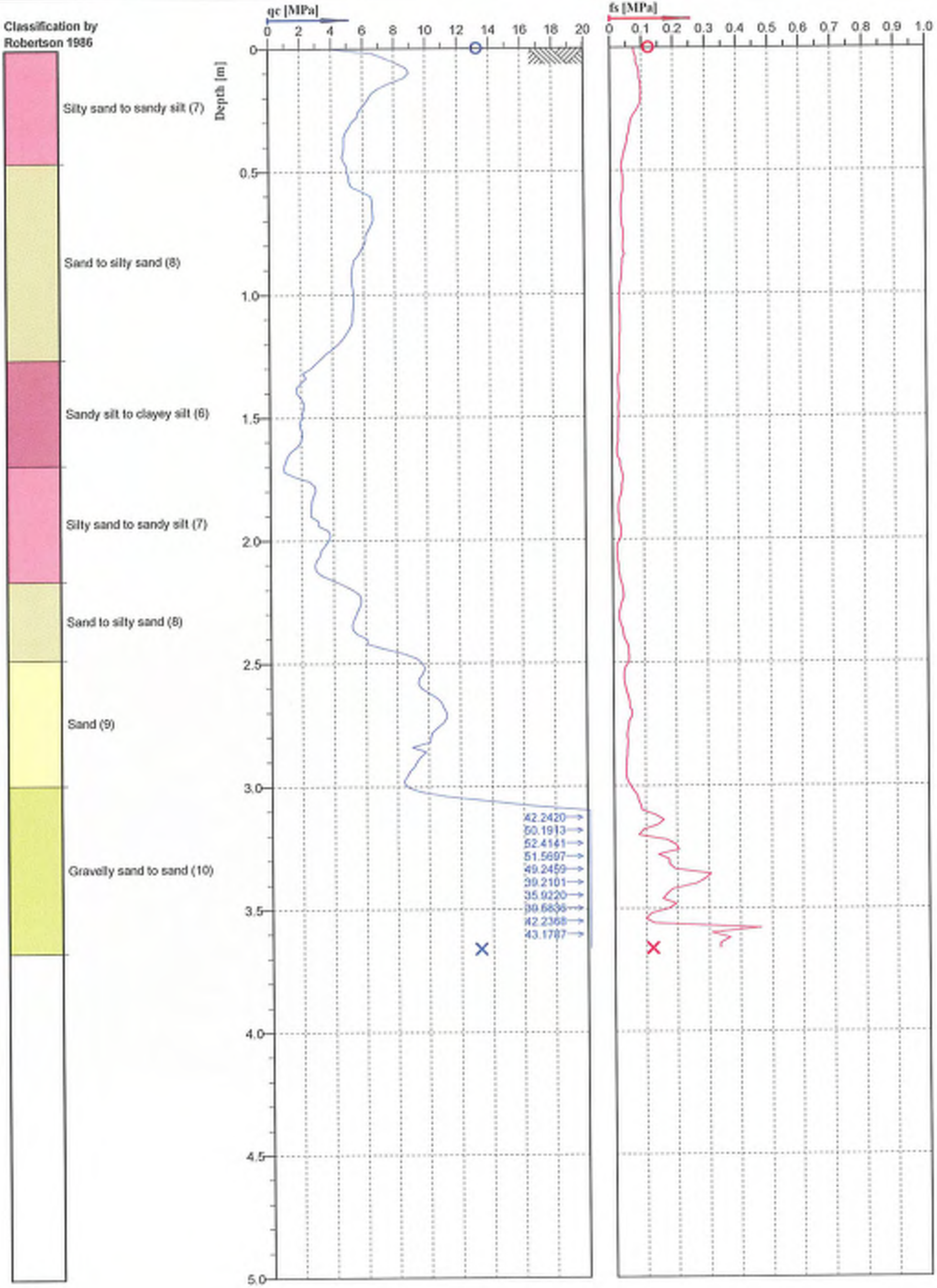
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: CPT24
Project ID:	Client: Aurecon	Date: 4/23/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT24.cp	



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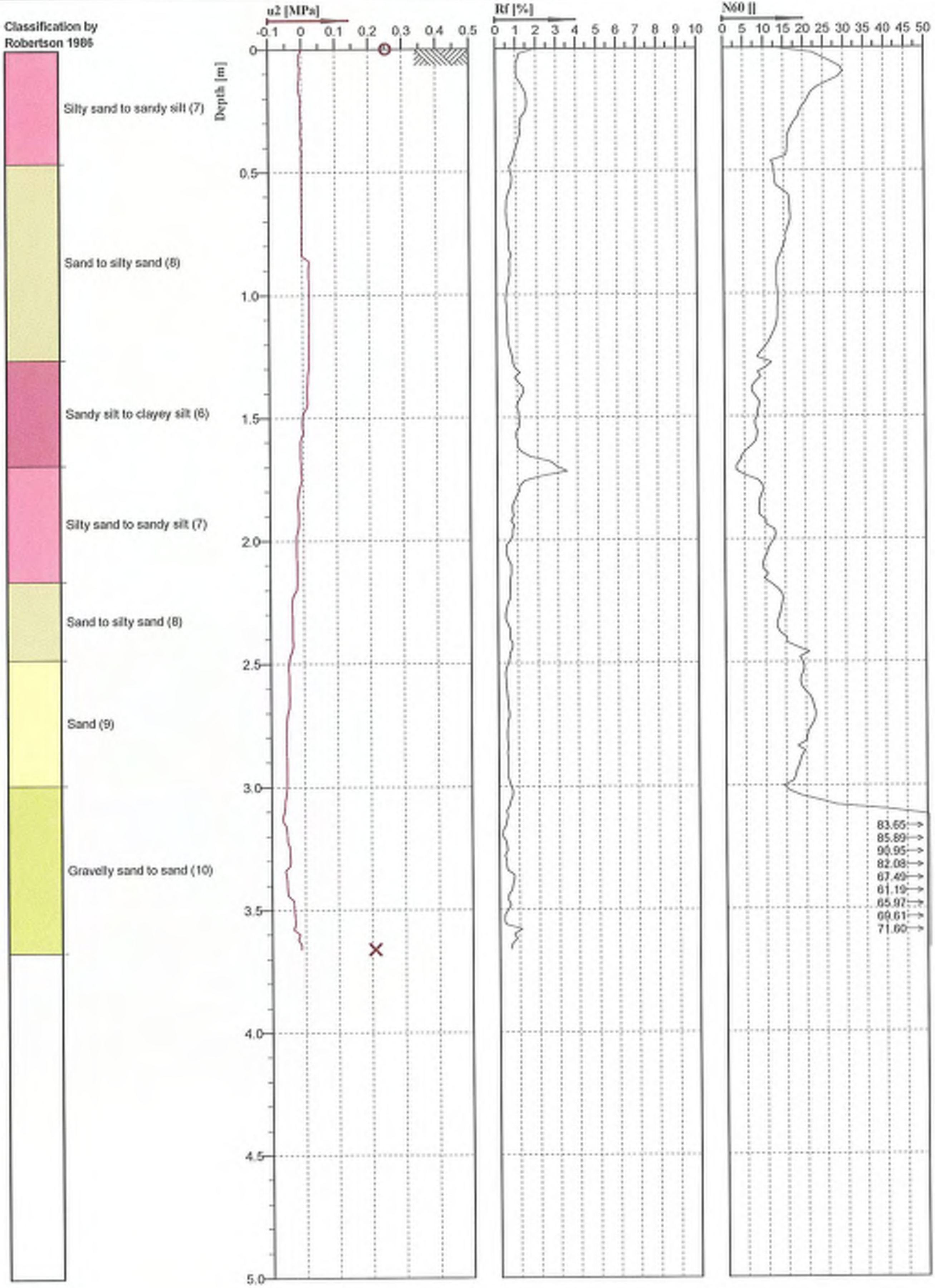
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: CPT25
Project ID:	Client: Aurecon	Date: 4/23/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT25.cp	



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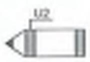
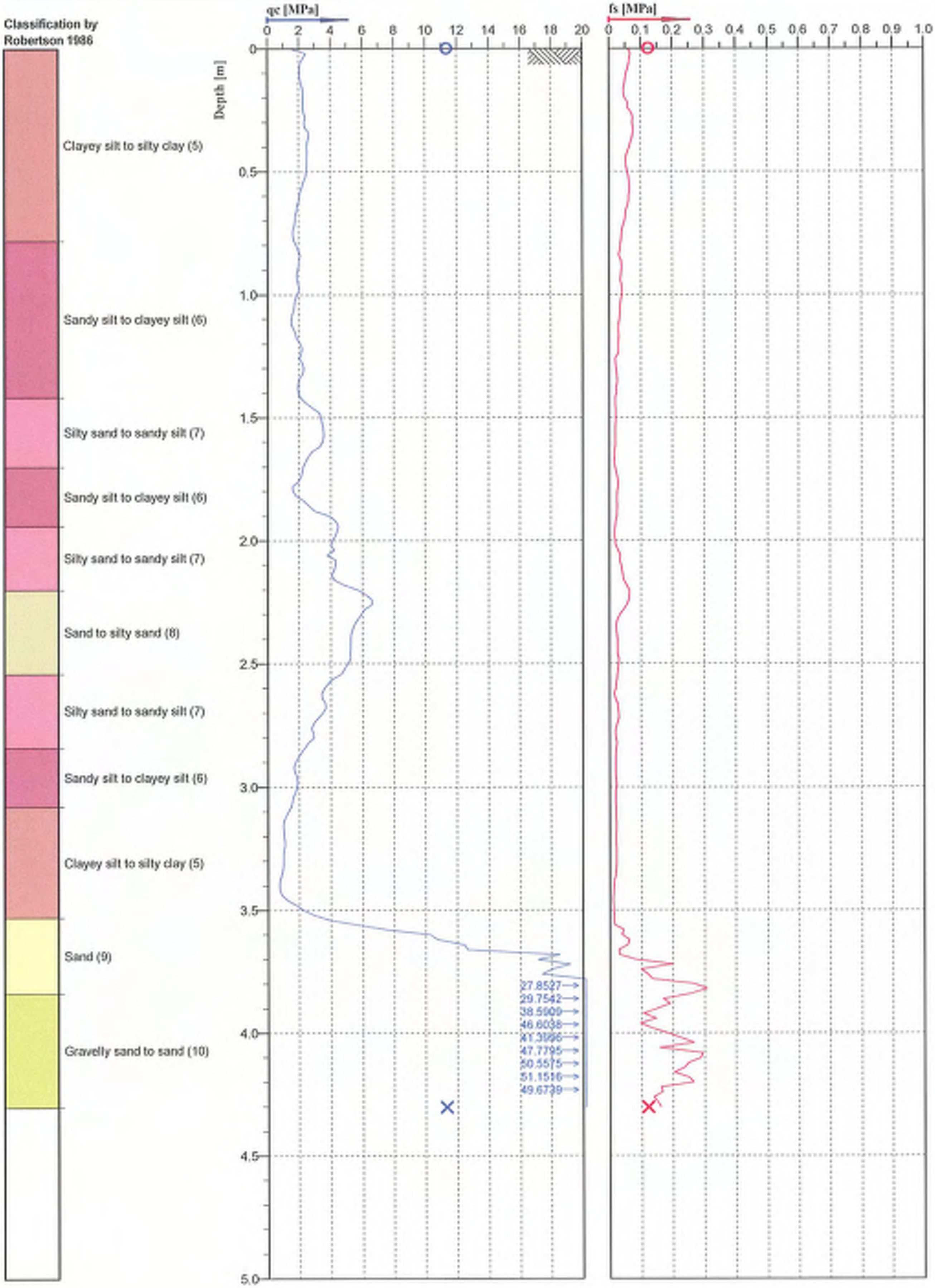


Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: CPT25
Project ID:	Client: Aurecon	Date: 4/23/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT25.cp	



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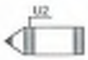
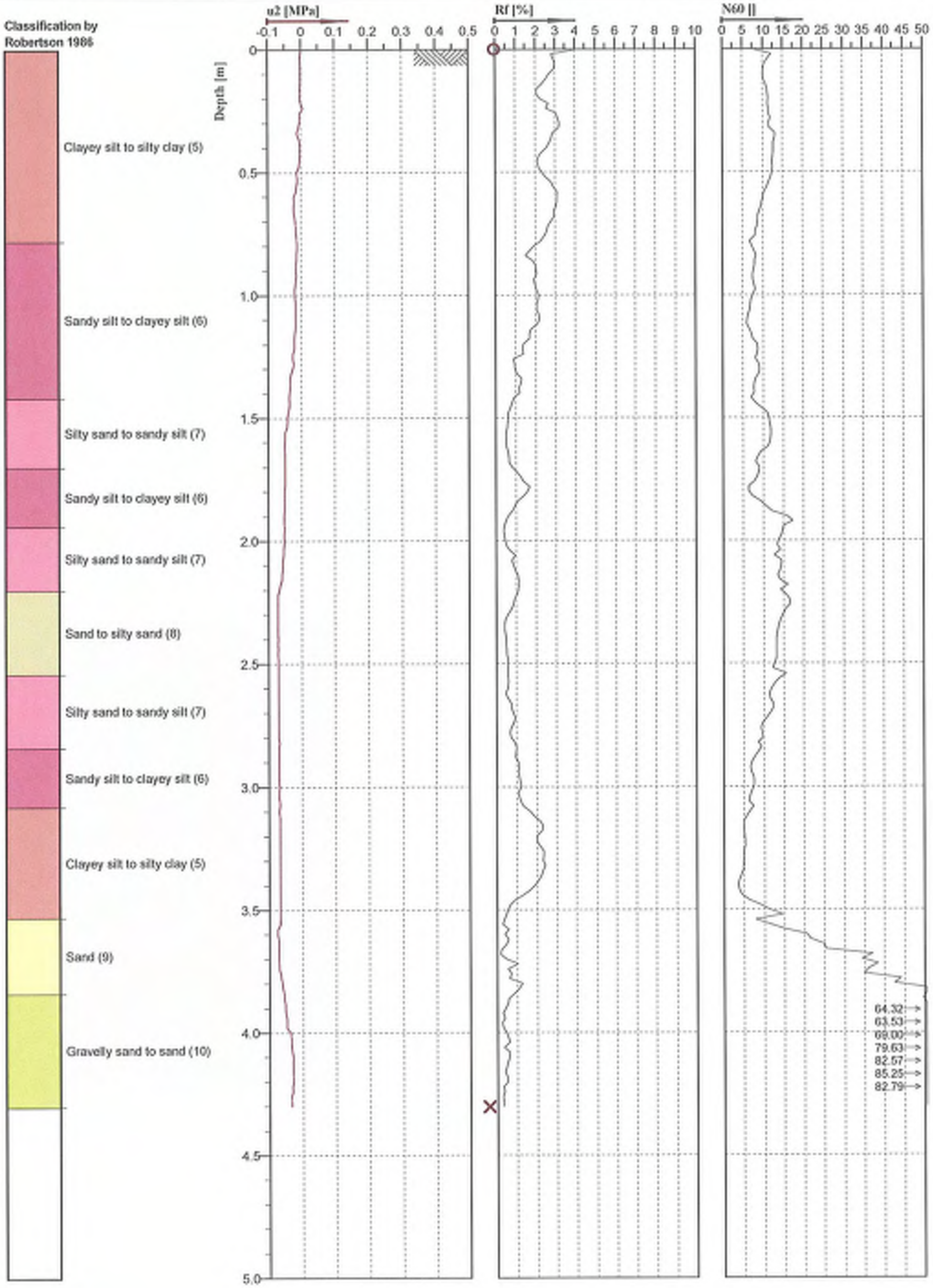


Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 27
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT27.cp	



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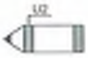
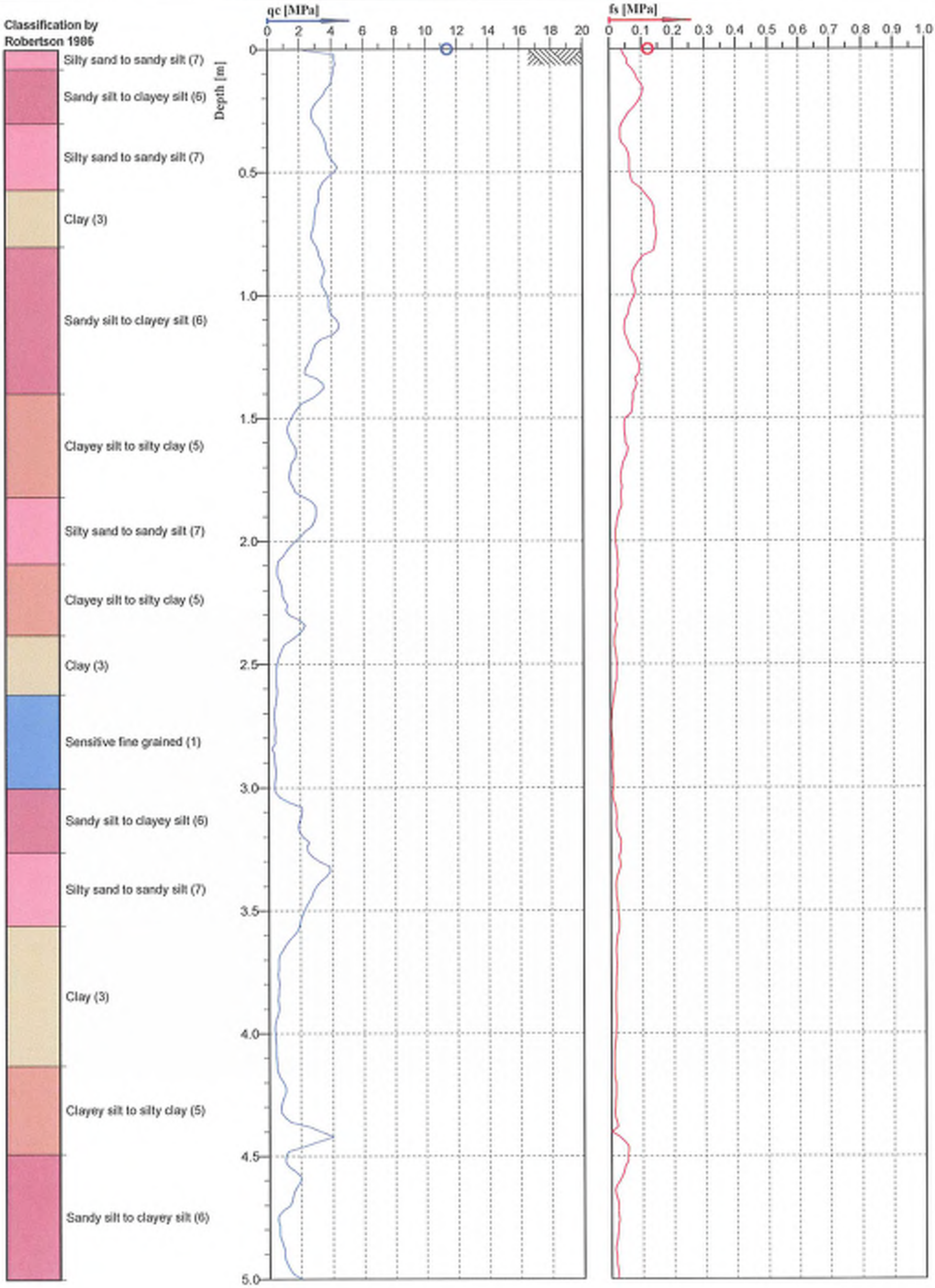


Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 27
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT27.cp	



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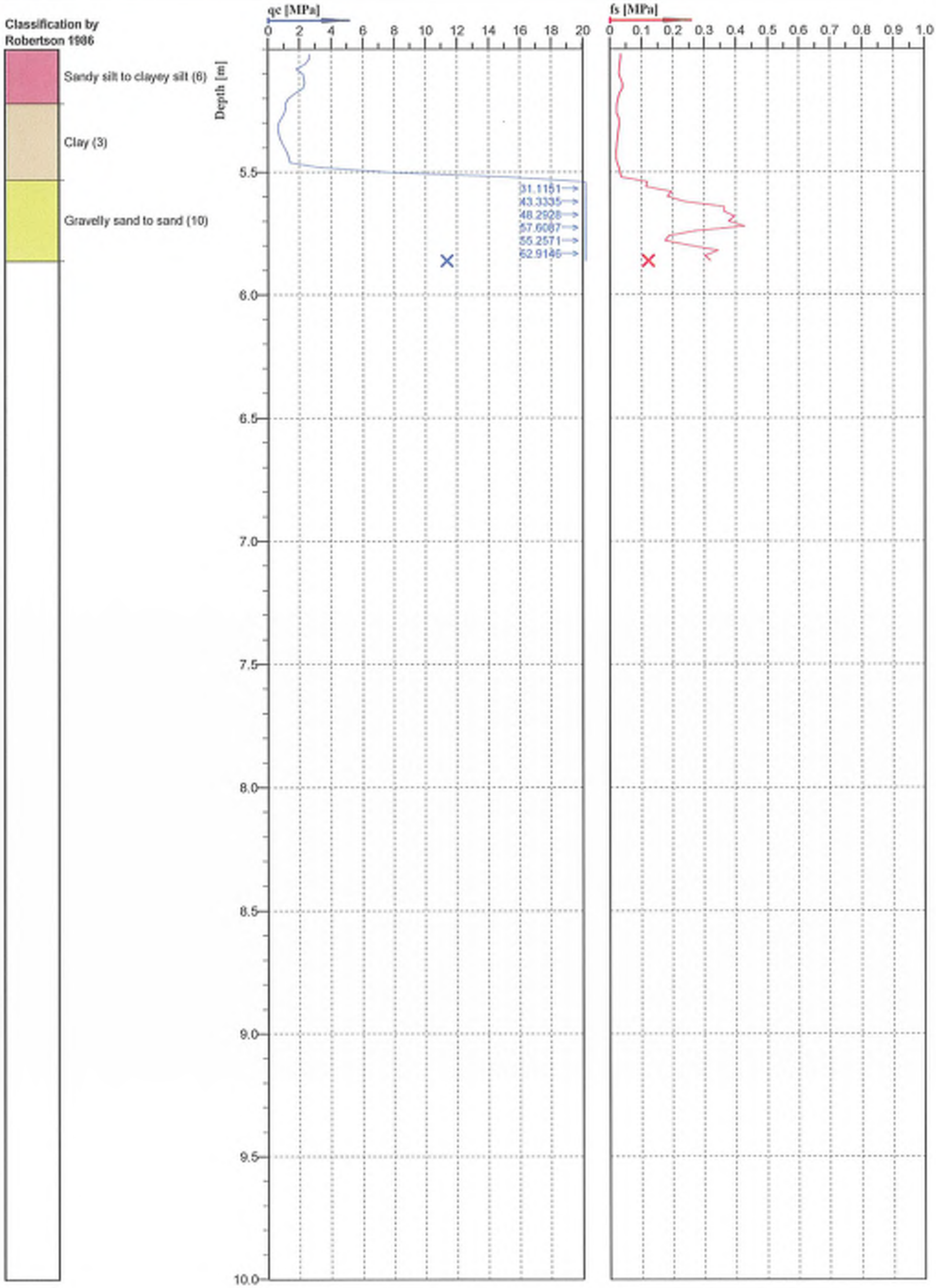
Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 1
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/2	Fig:
		File: RosemarrynSubdivisionCPT1.cpt	



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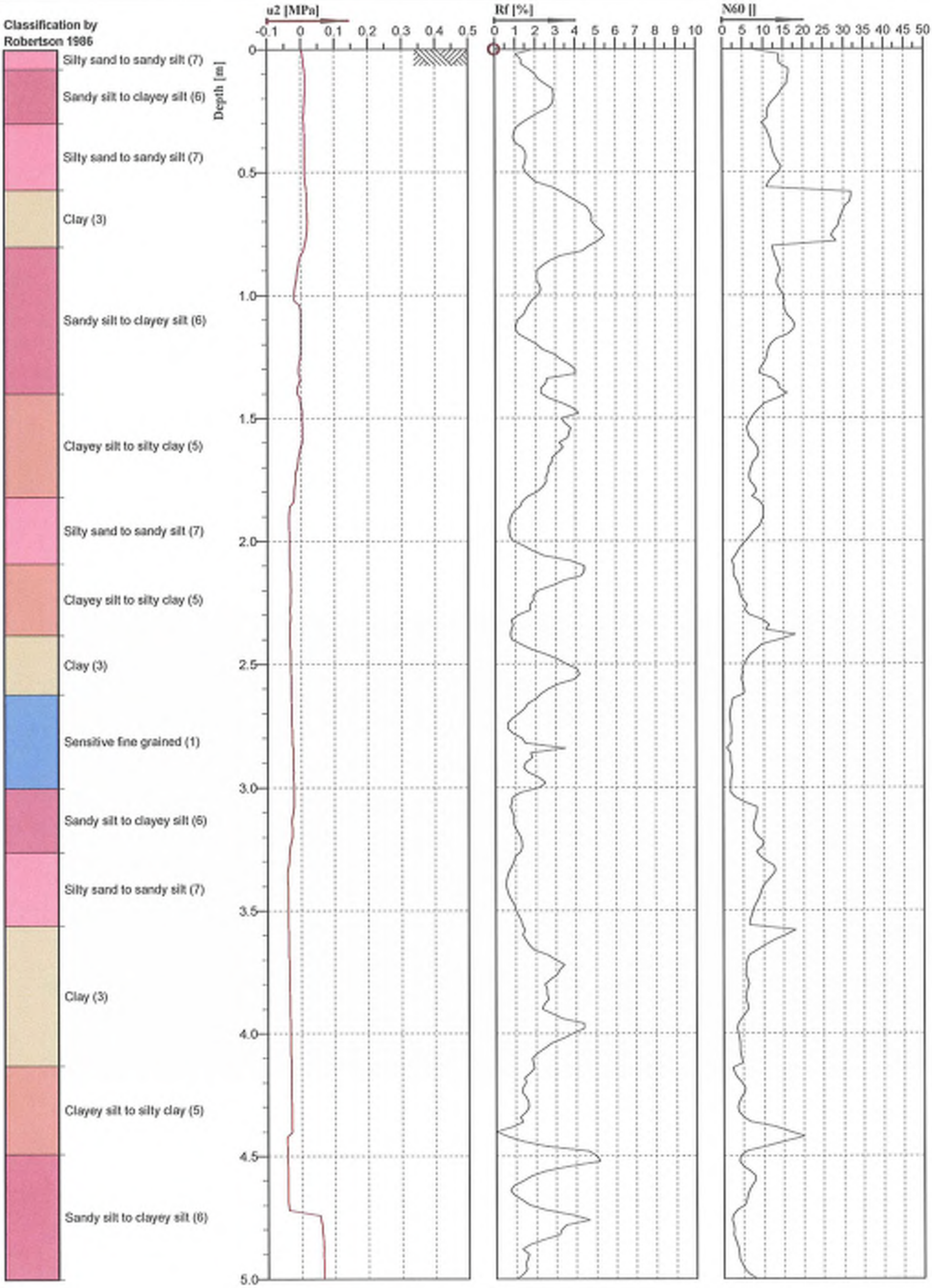
Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 1
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 2/2	Fig:
		File: RosemarrynSubdivisionCPT1.cpt	



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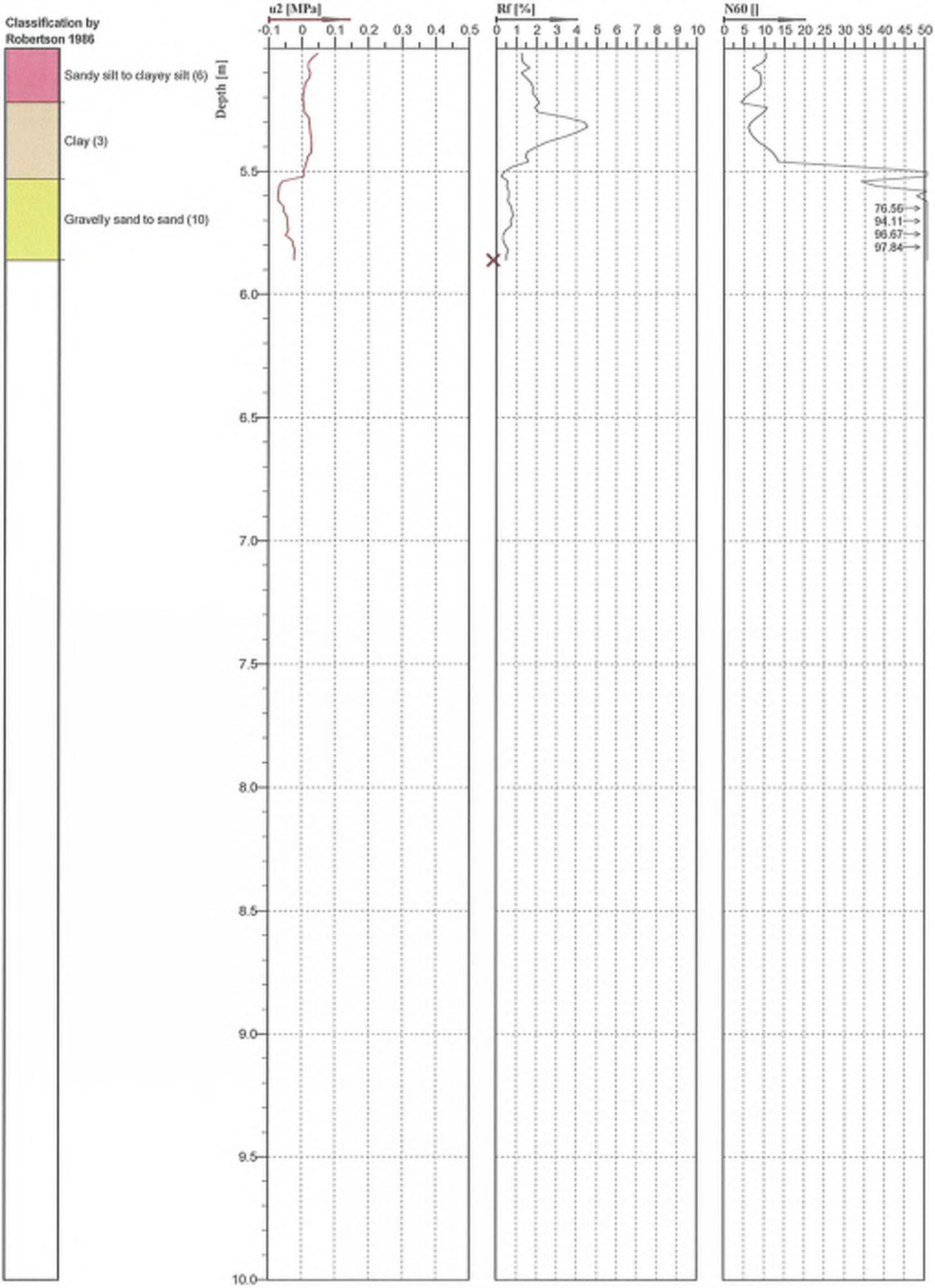
Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 1
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/2	Fig:
		File: RosemarrynSubdivisionCPT1.cpt	



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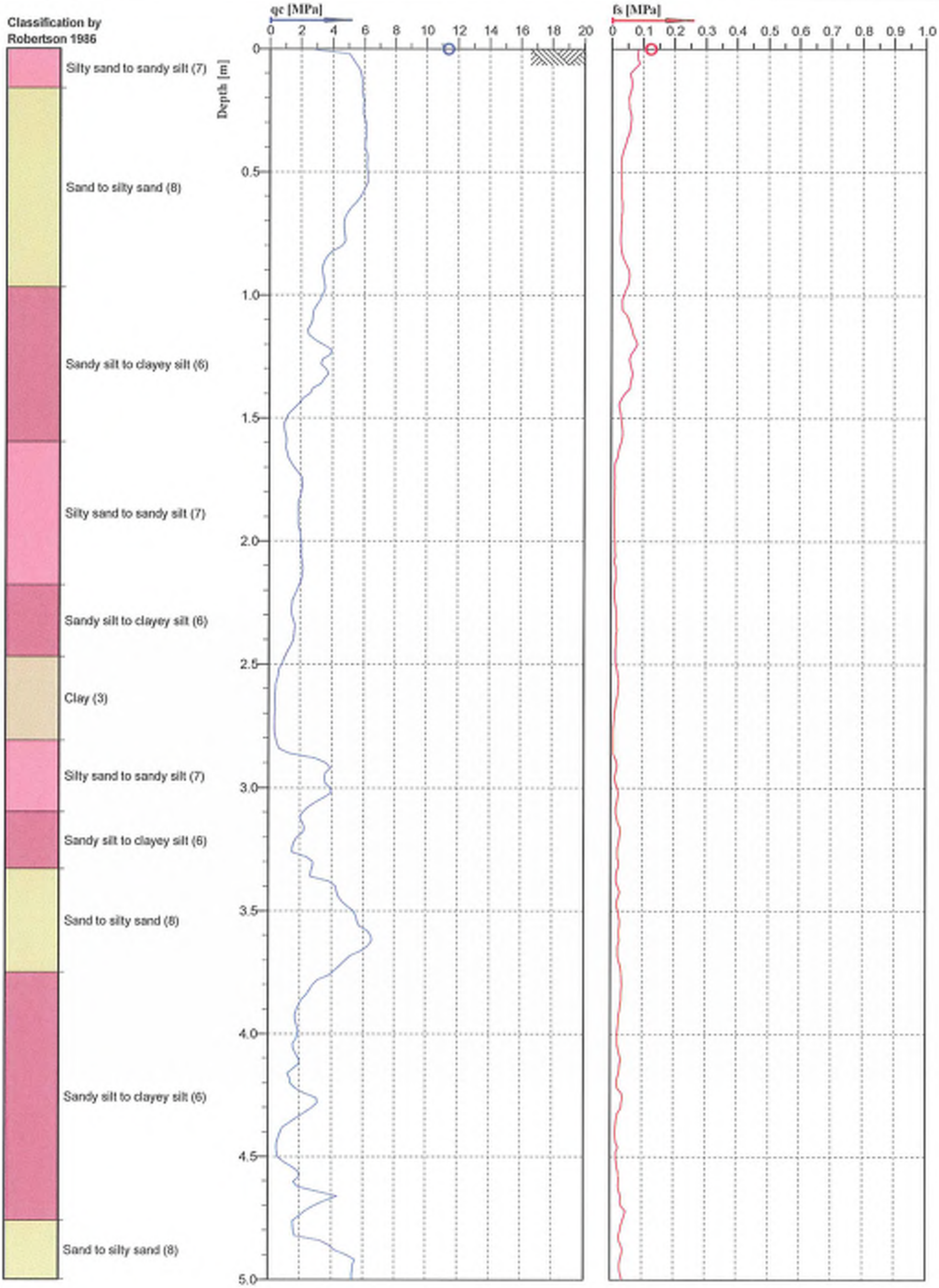
Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 1
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 2/2	Fig:
		File: RosemarrynSubdivisionCPT1.cpt	



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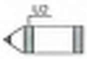
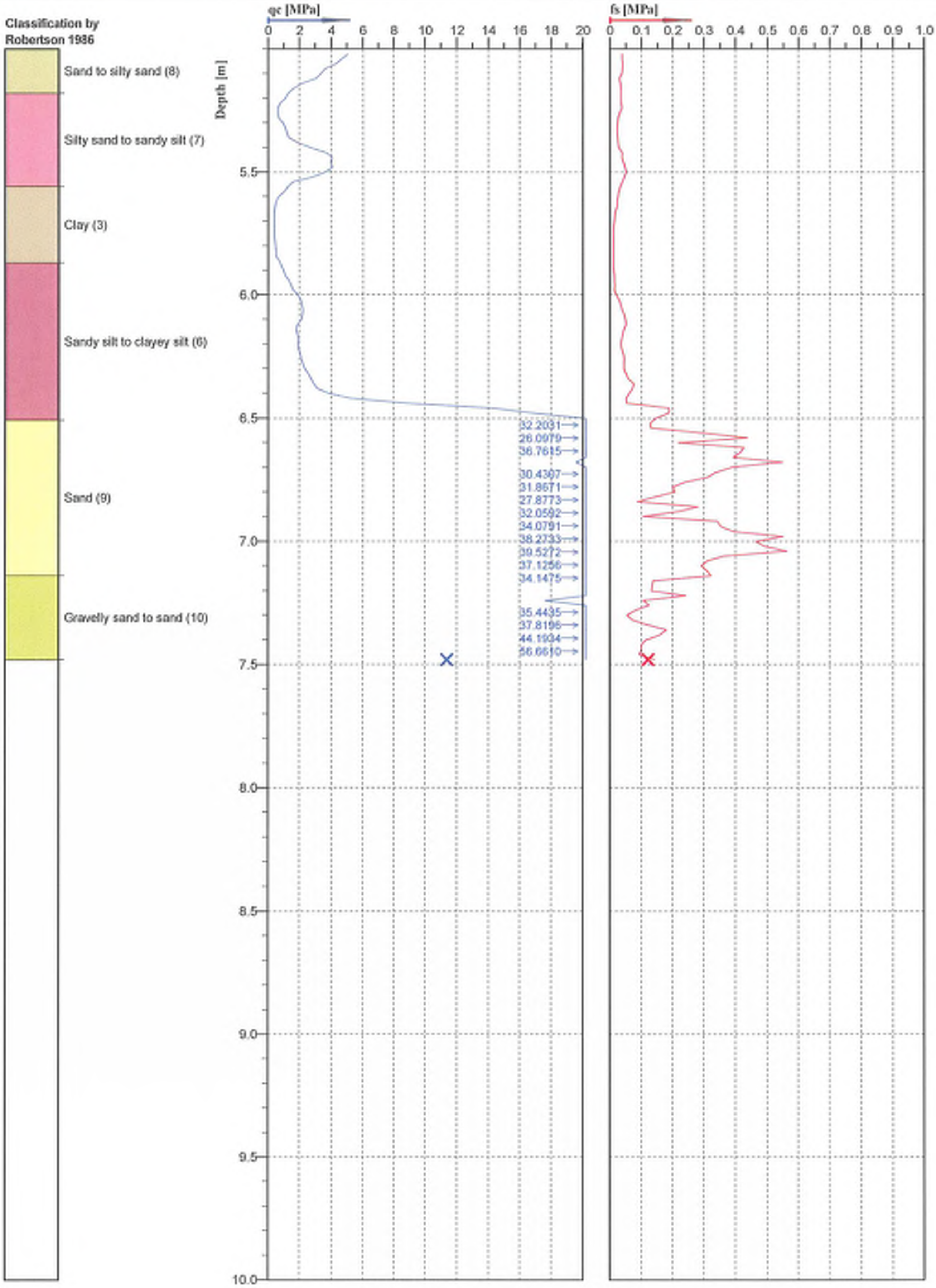


Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 2
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/2	Fig:
		File: RosemarrynSubdivisionCPT2.cpt	



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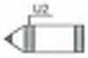
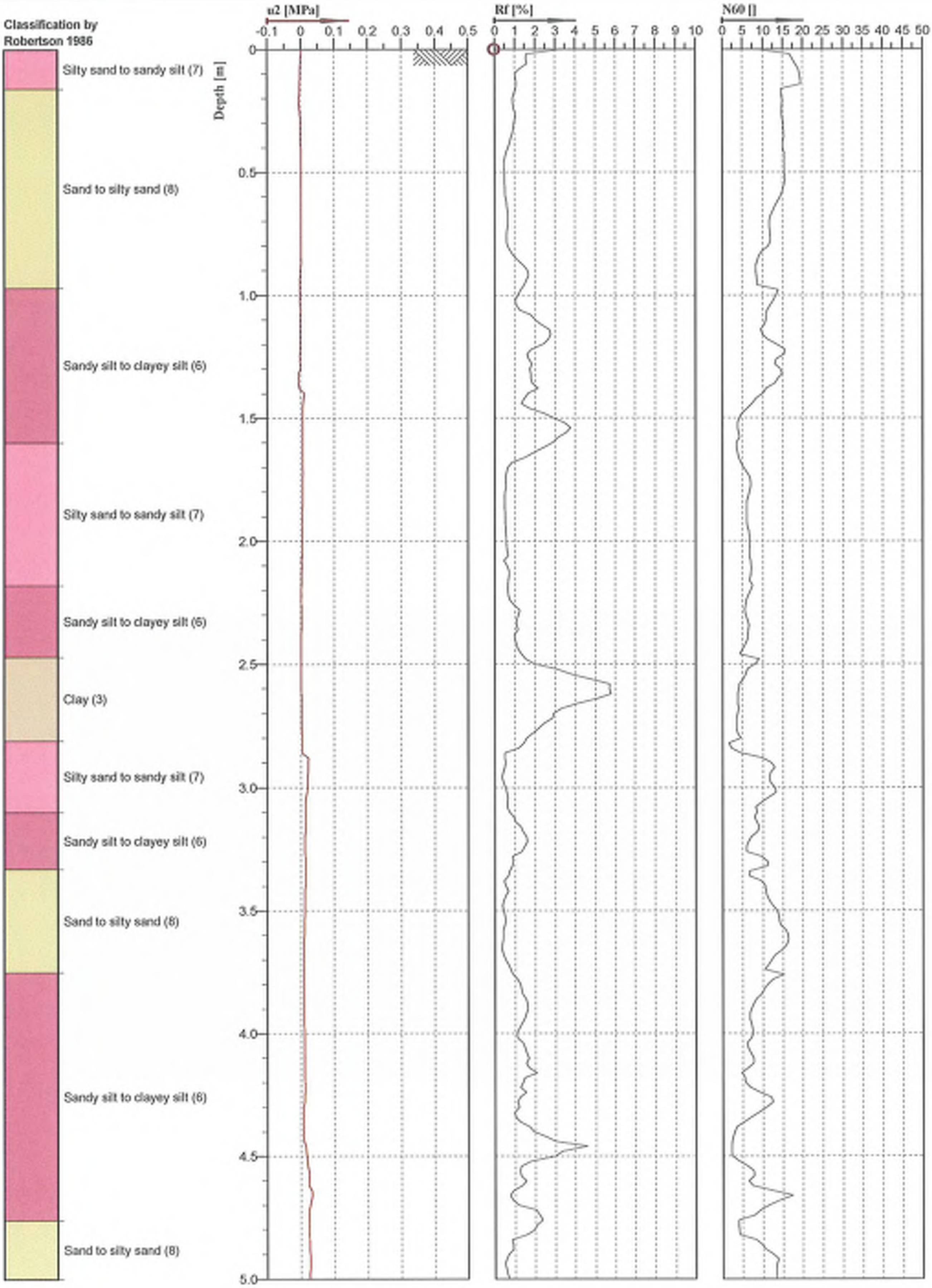


Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 2
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 2/2	Fig:
		File: RosemarrynSubdivisionCPT2.cpt	



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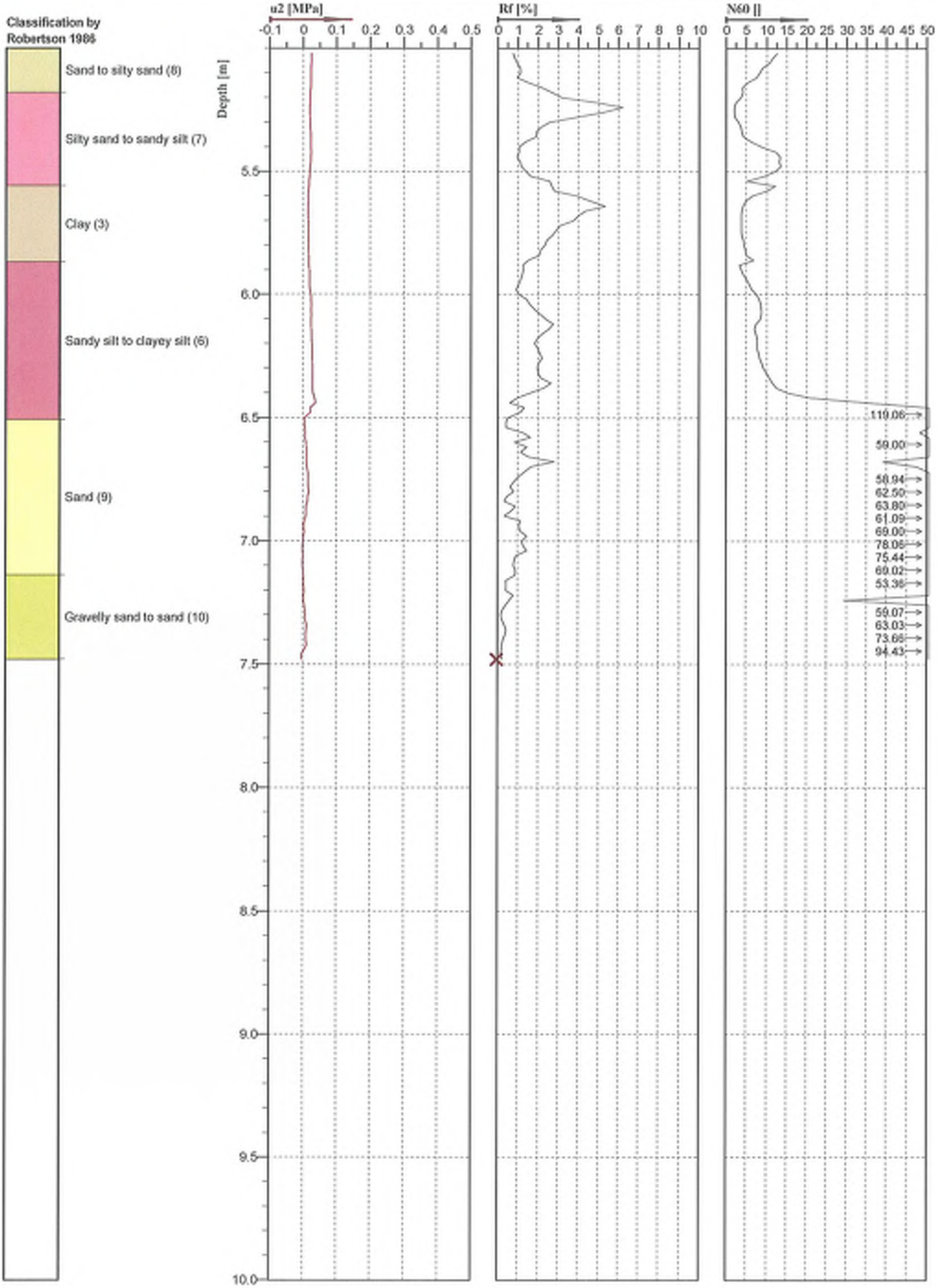
Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 2
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/2	Fig:
		File: RosemarrynSubdivisionCPT2.cpt	



PRO-DRILL
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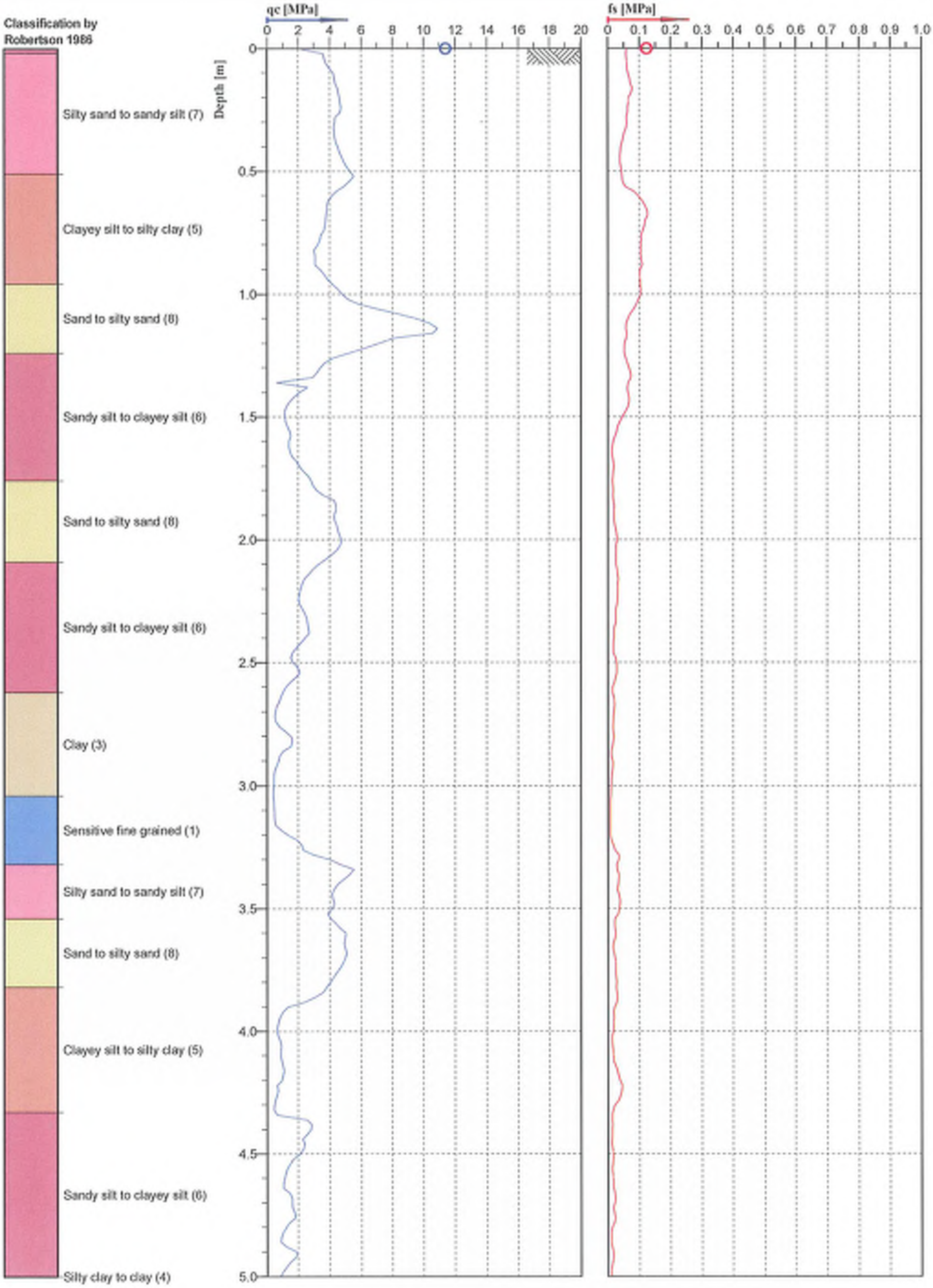
Cone No: 4465
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 2
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 2/2	Fig:
		File: RosemarrynSubdivisionCPT2.cpt	



PRO-DRILL
SPECIALIST DRILLING ENGINEERS
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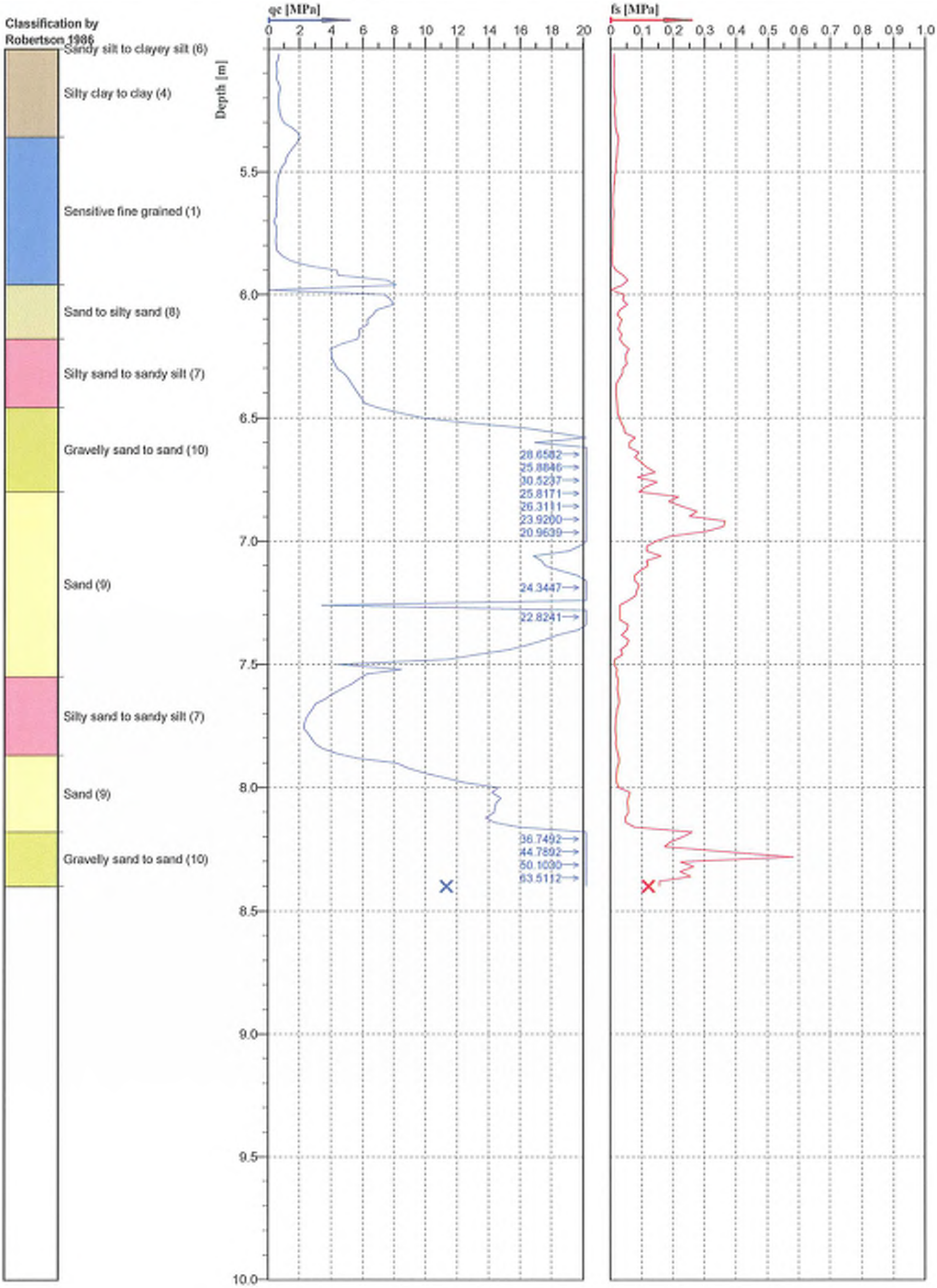
Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 3
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/2	Fig:
		File: RosemarrynSubdivisionCPT3.cpt	



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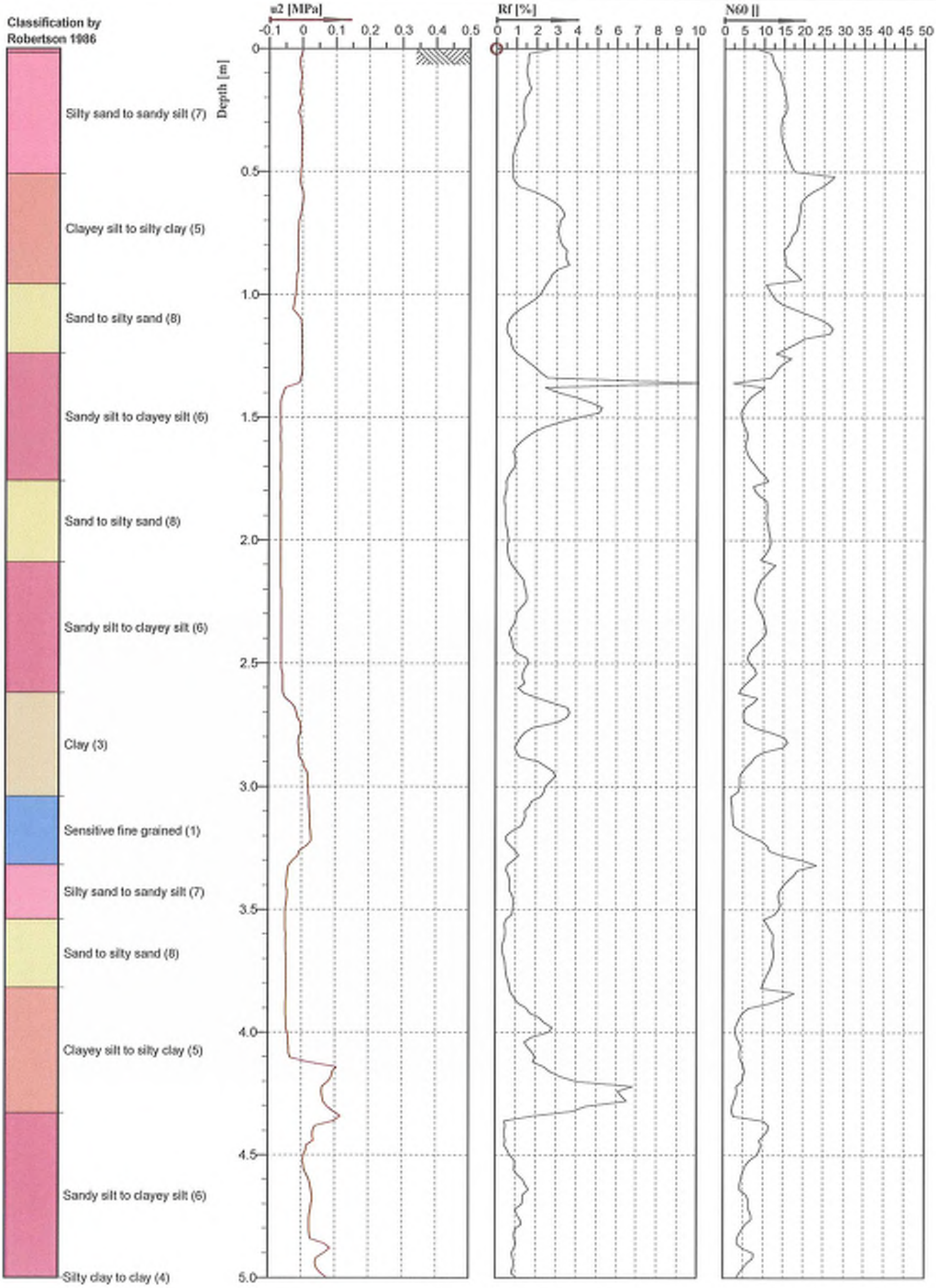
Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 3
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 2/2	Fig:
		File: RosemarrynSubdivisionCPT3.cpt	



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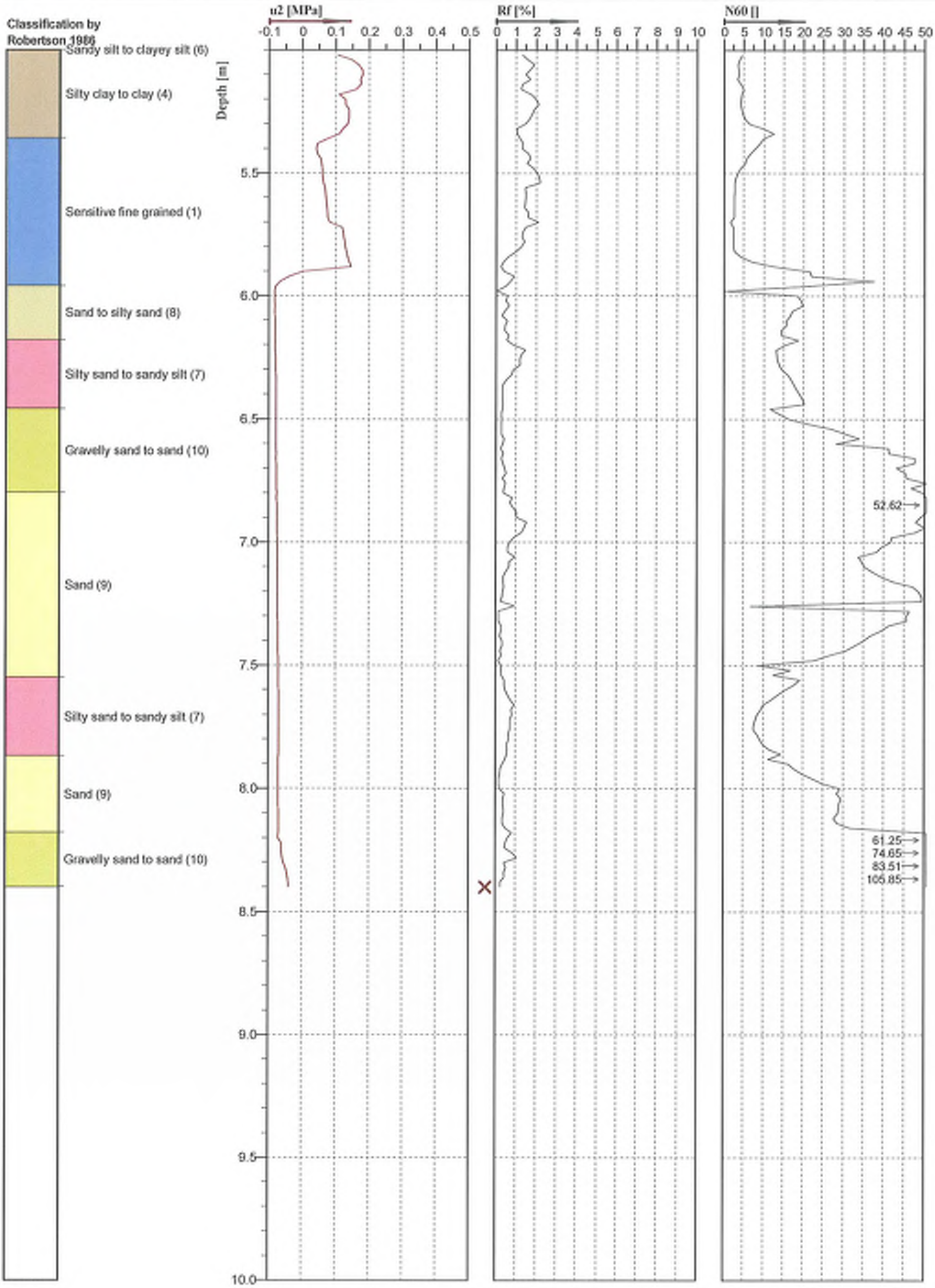
Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 3
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/2	Fig:
		File: RosemarrynSubdivisionCPT3.cpt	



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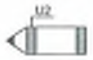
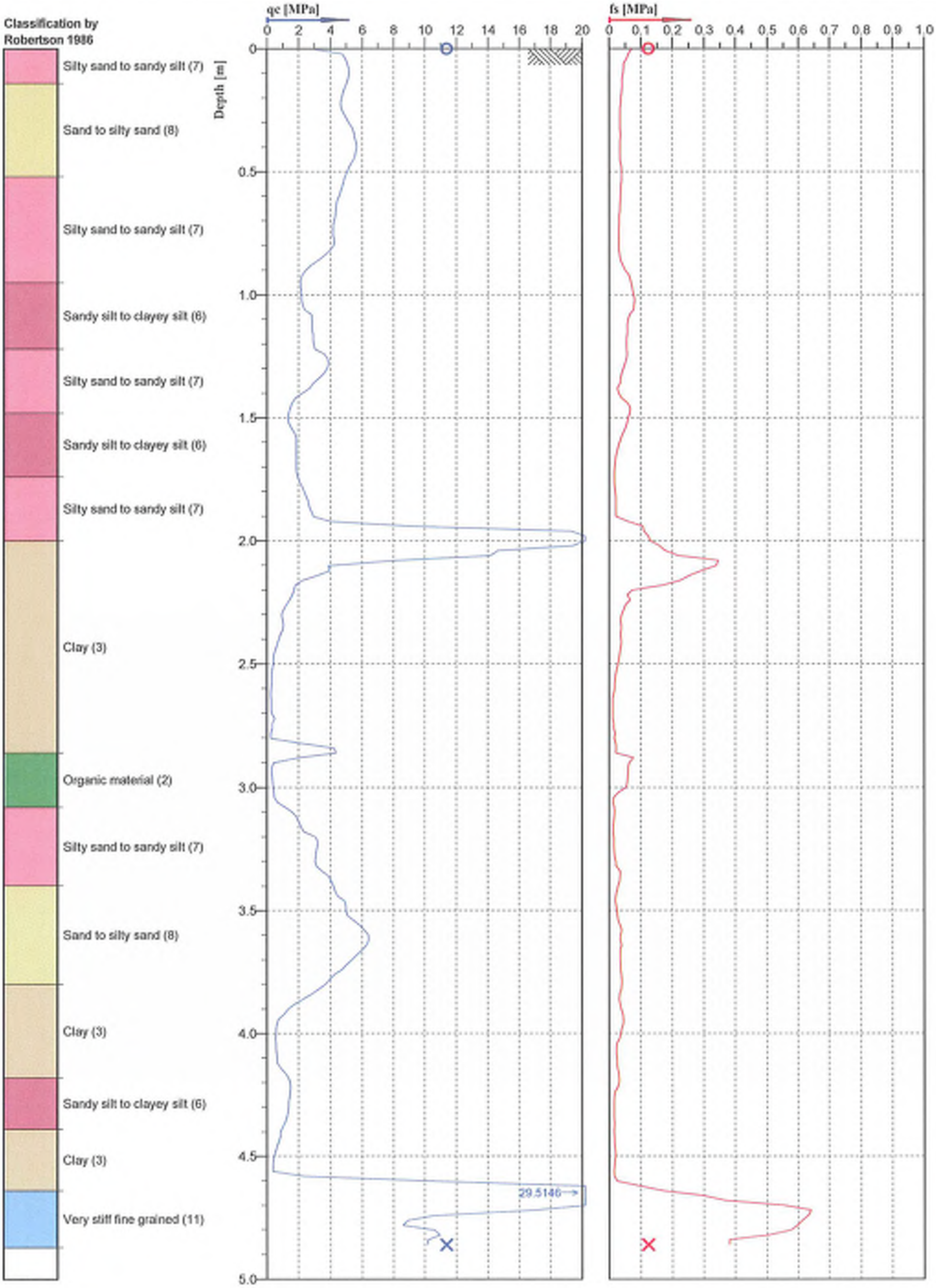


Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 3
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 2/2	Fig:
		File: RosemarrynSubdivisionCPT3.cpt	



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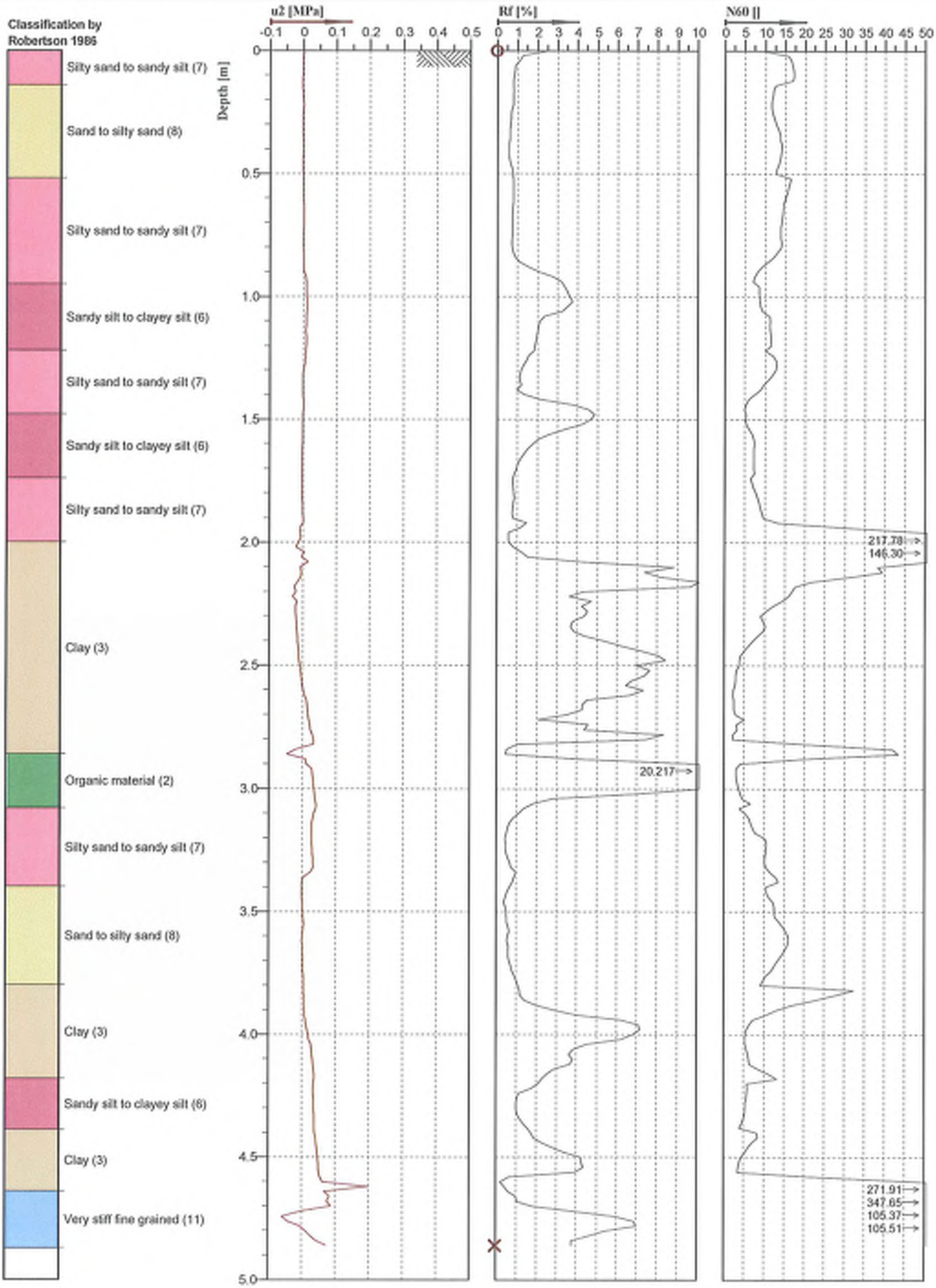
Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 5
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT5.cpt	



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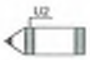
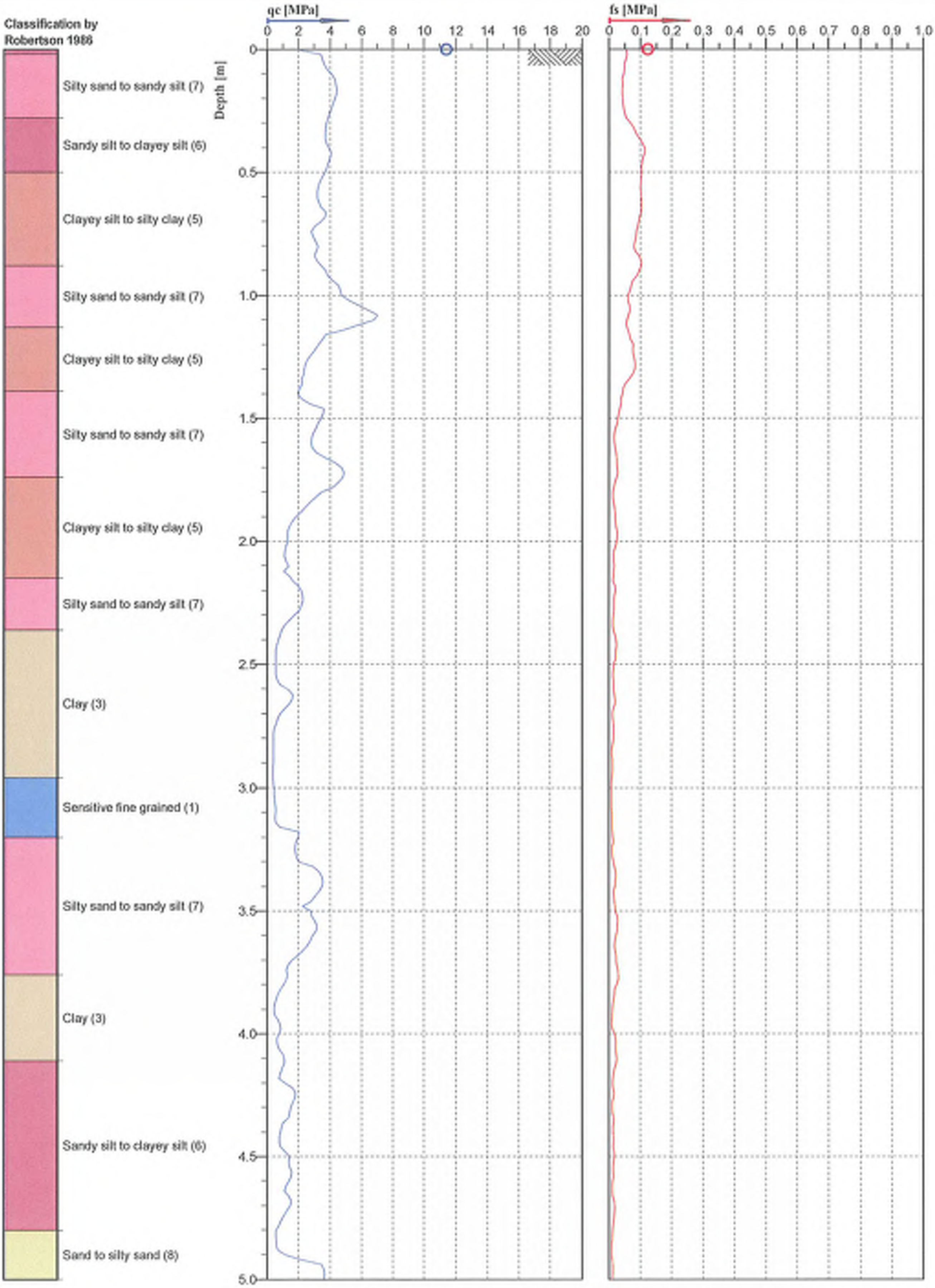


Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 5
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT5.cpt	



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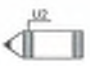
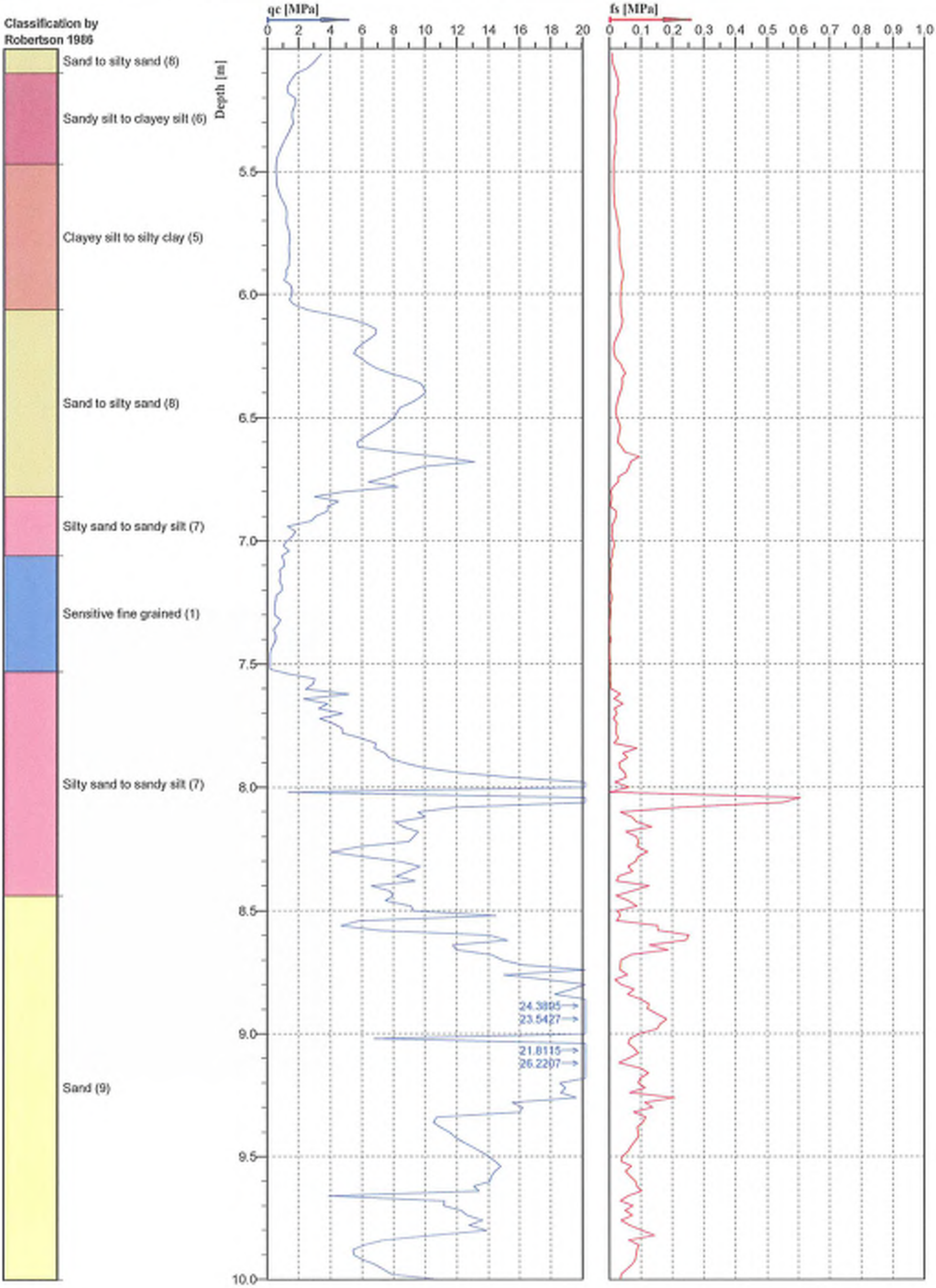


Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 6
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/3	Fig:
		File: RosemarrynSubdivisionCPT6.cpt	



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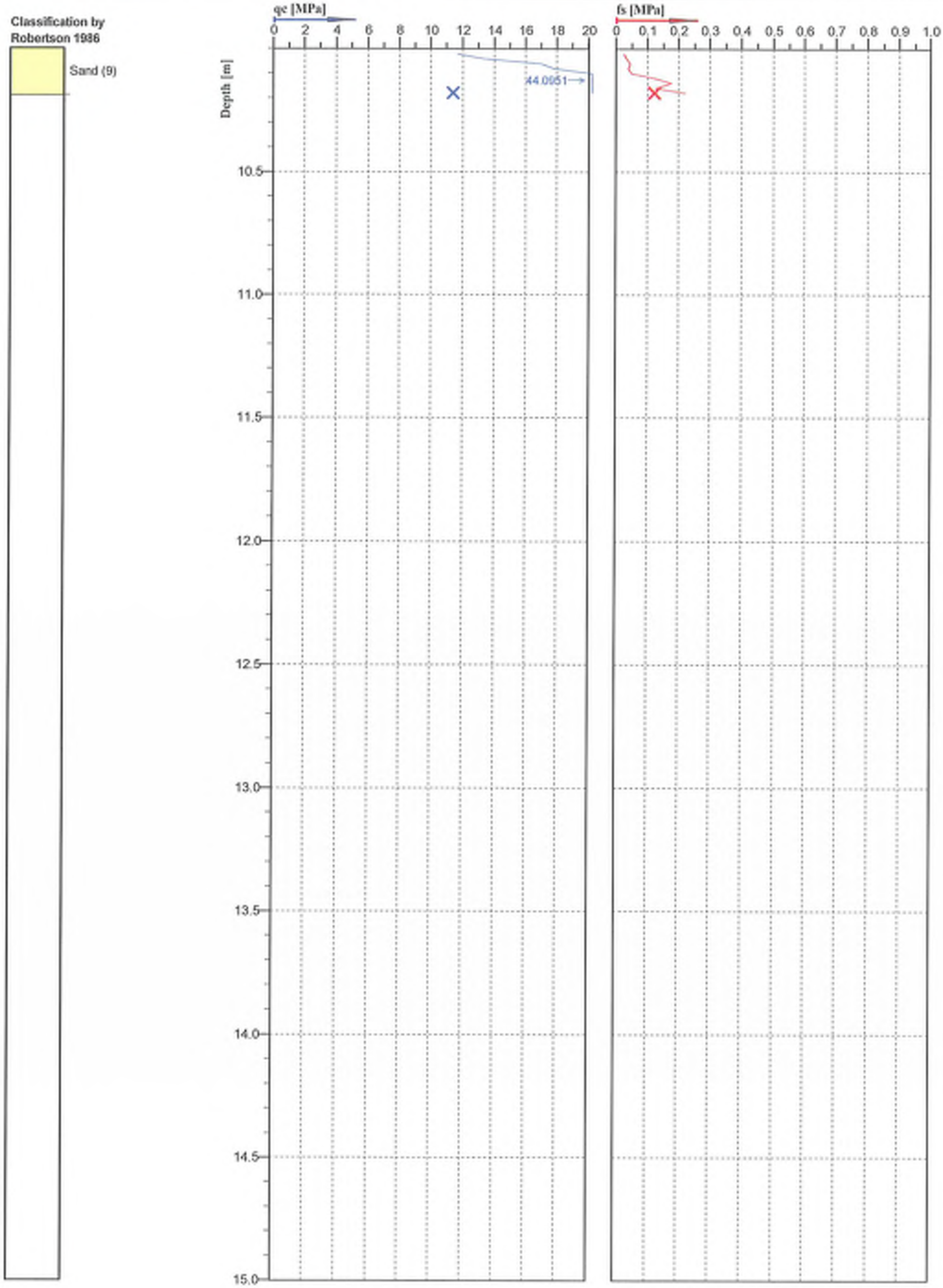
U2

Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 6
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 2/3	Fig:
		File: RosemarrynSubdivisionCPT6.cpt	



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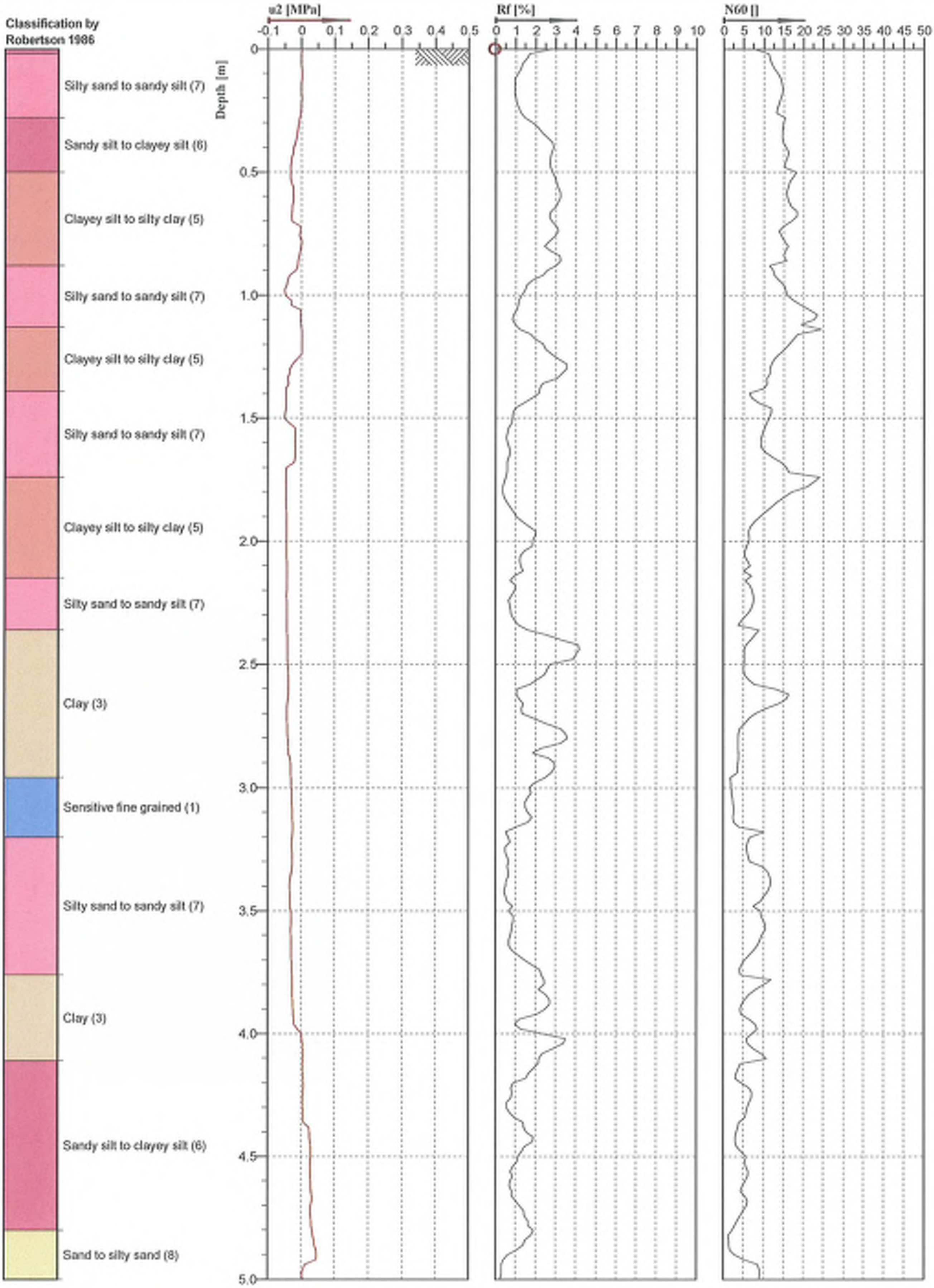
Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 6
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 3/3	Fig:
		File: RosemarrynSubdivisionCPT6.cpt	



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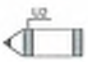
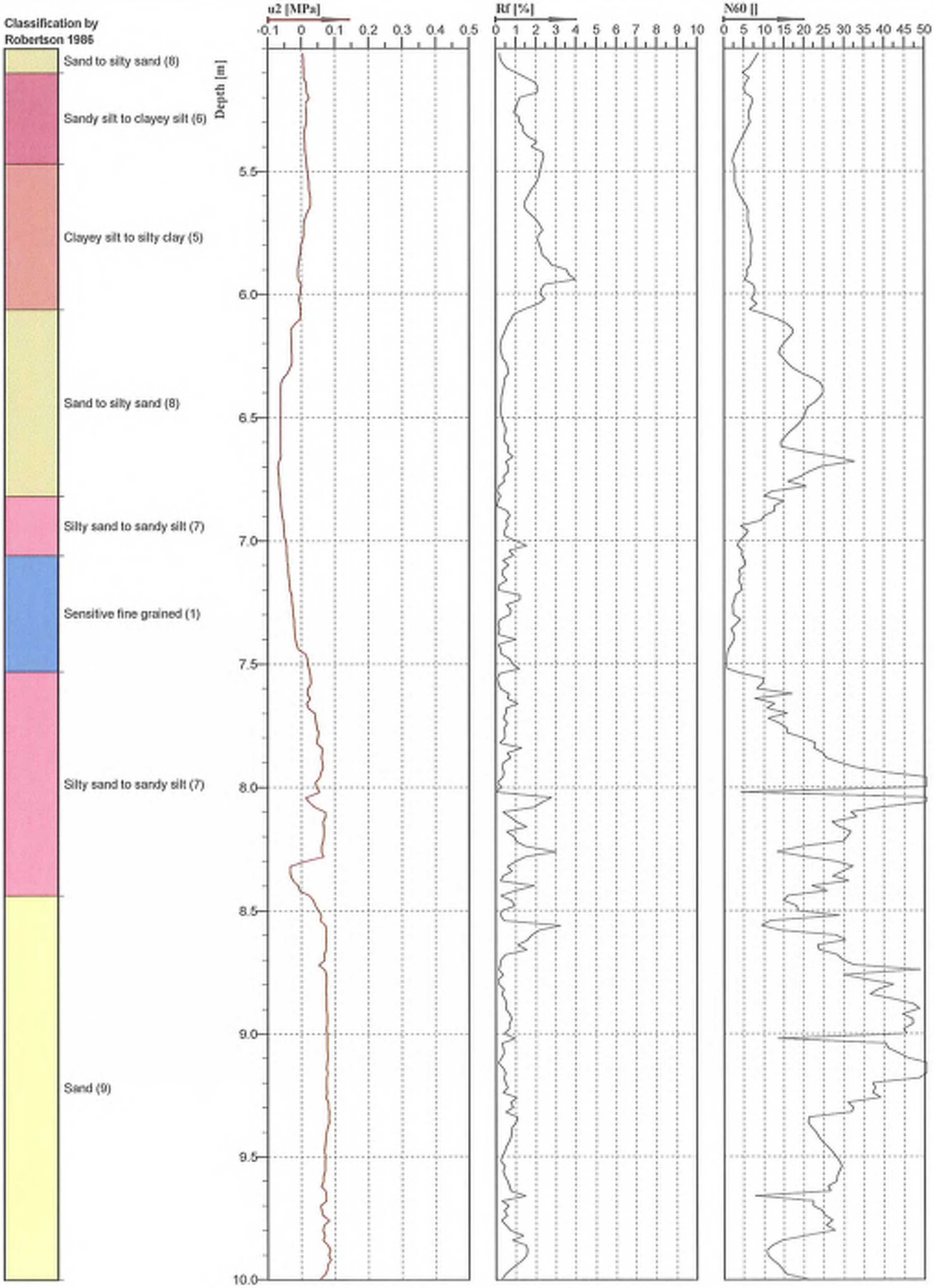


Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 6
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/3	Fig:
		File: RosemarrynSubdivisionCPT6.cpt	



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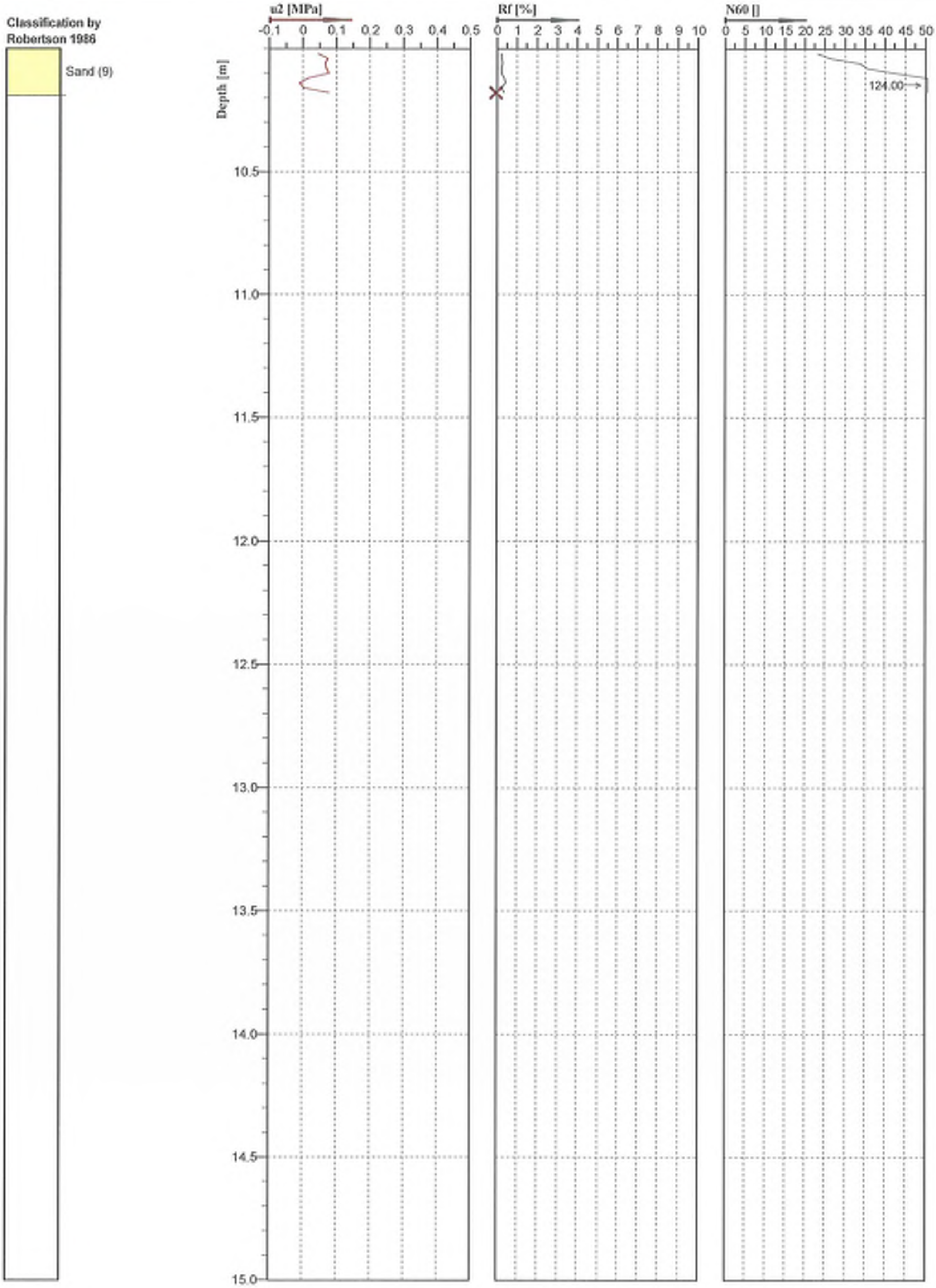
Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 6
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 2/3	Fig:
		File: RosemarrynSubdivisionCPT6.cpt	



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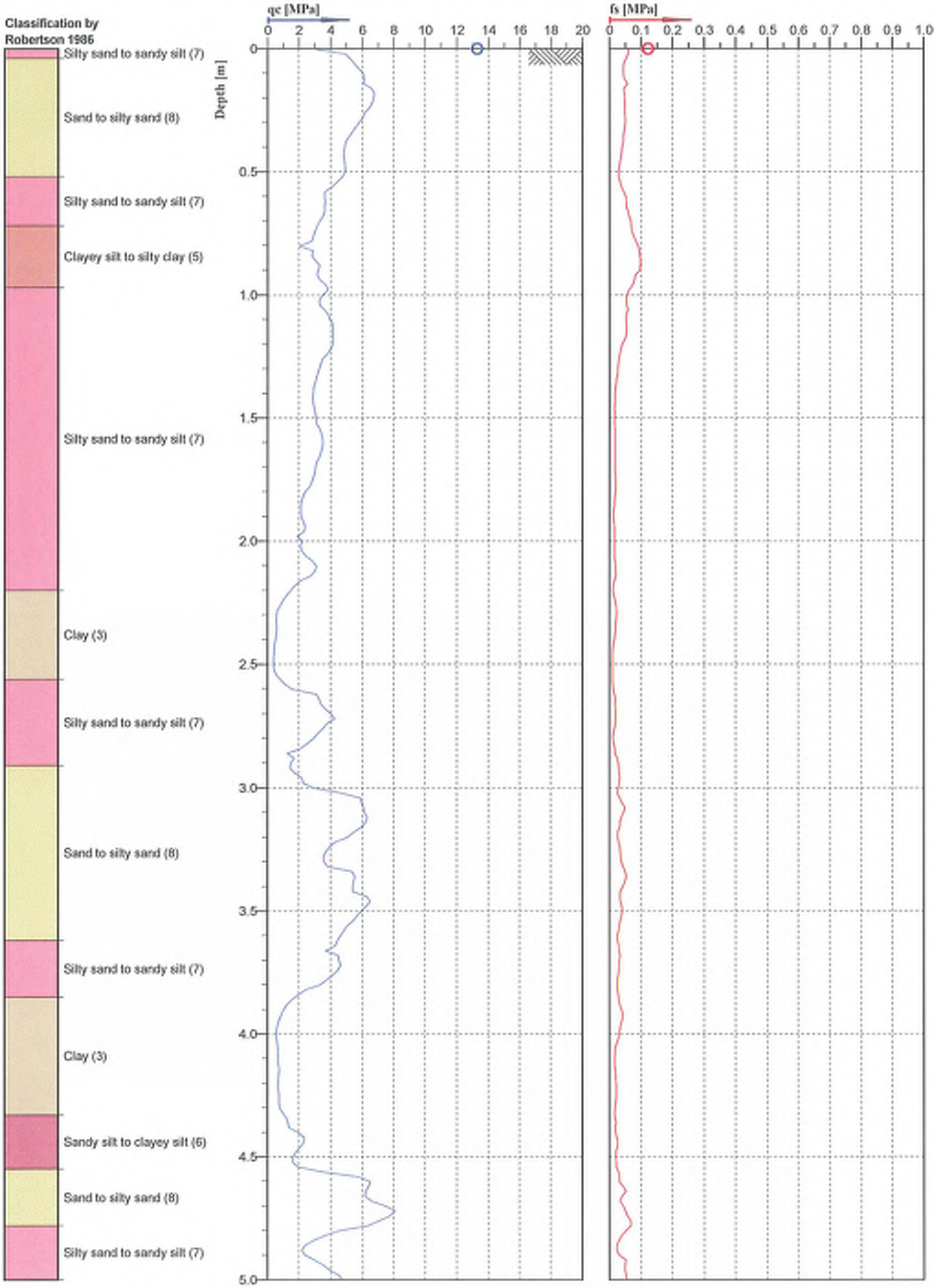
Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 6
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 3/3	Fig:
		File: RosemarrynSubdivisionCPT6.cpt	



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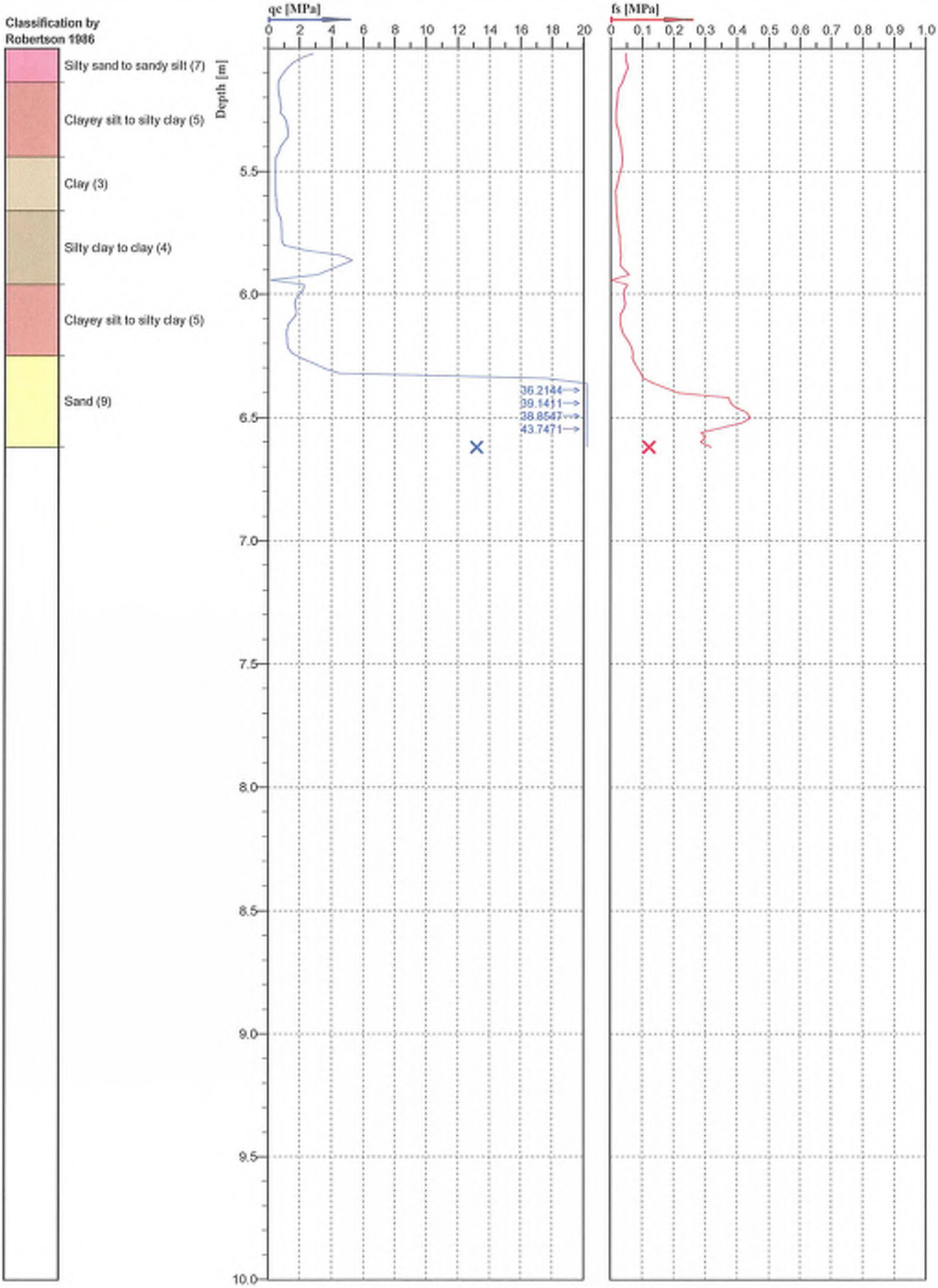
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 8
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/2	Fig:
		File: RosemarrynSubdivisionCPT8.cpt	



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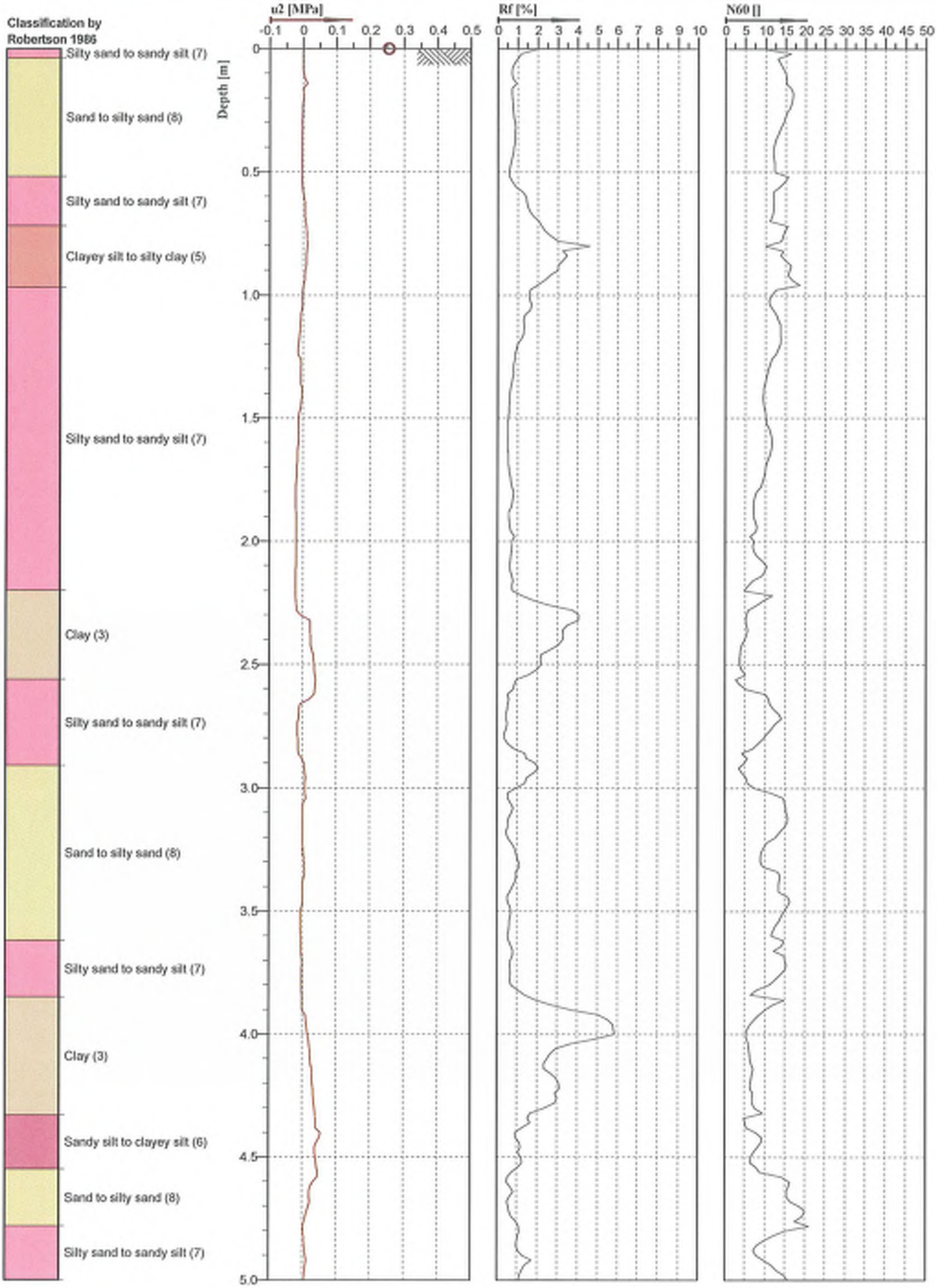
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 8
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 2/2	Fig:
		File: RosemarrynSubdivisionCPT8.cpt	



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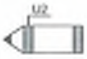
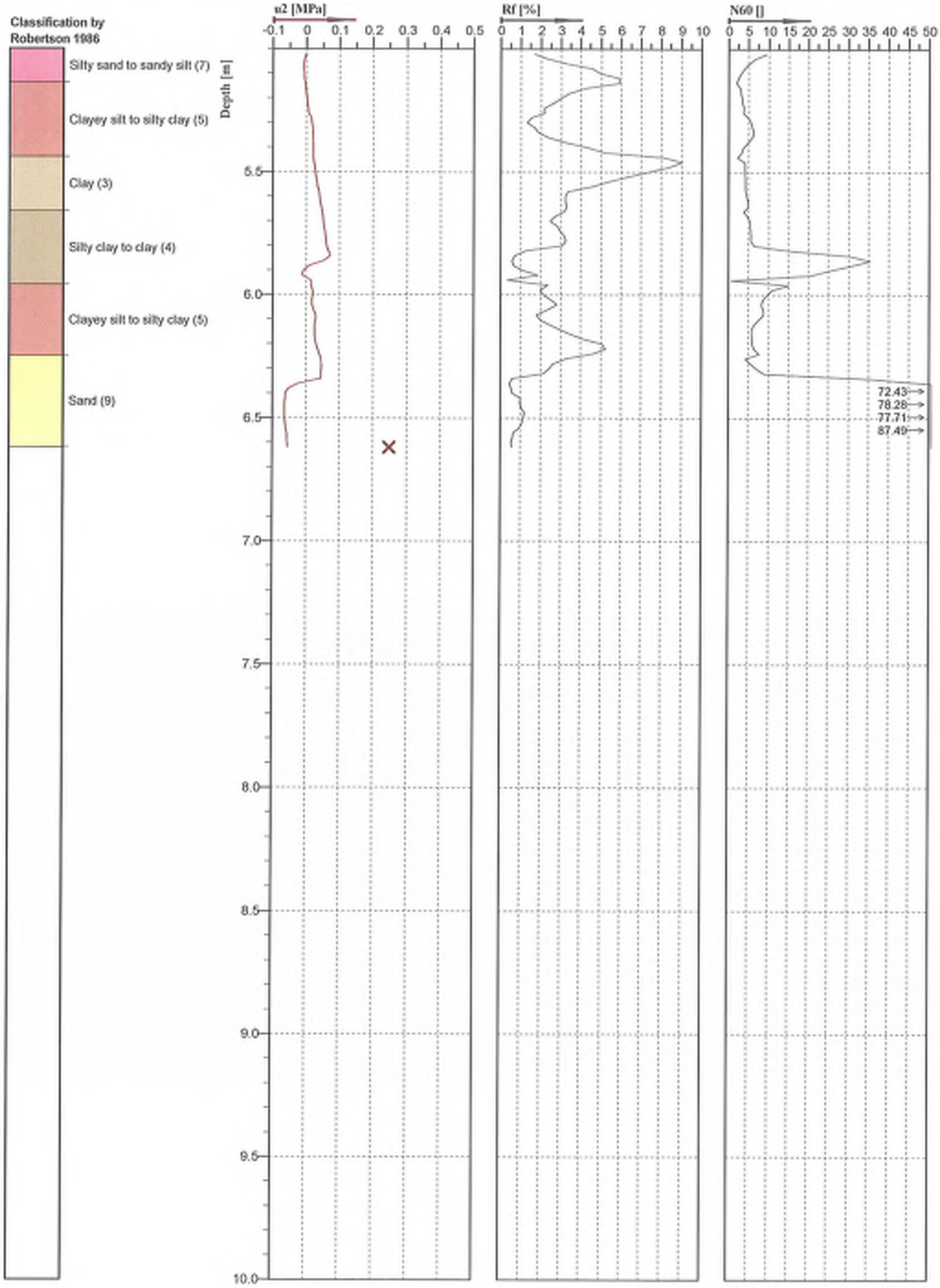


Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 8
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/2	Fig:
		File: RosemarrynSubdivisionCPT8.cpt	



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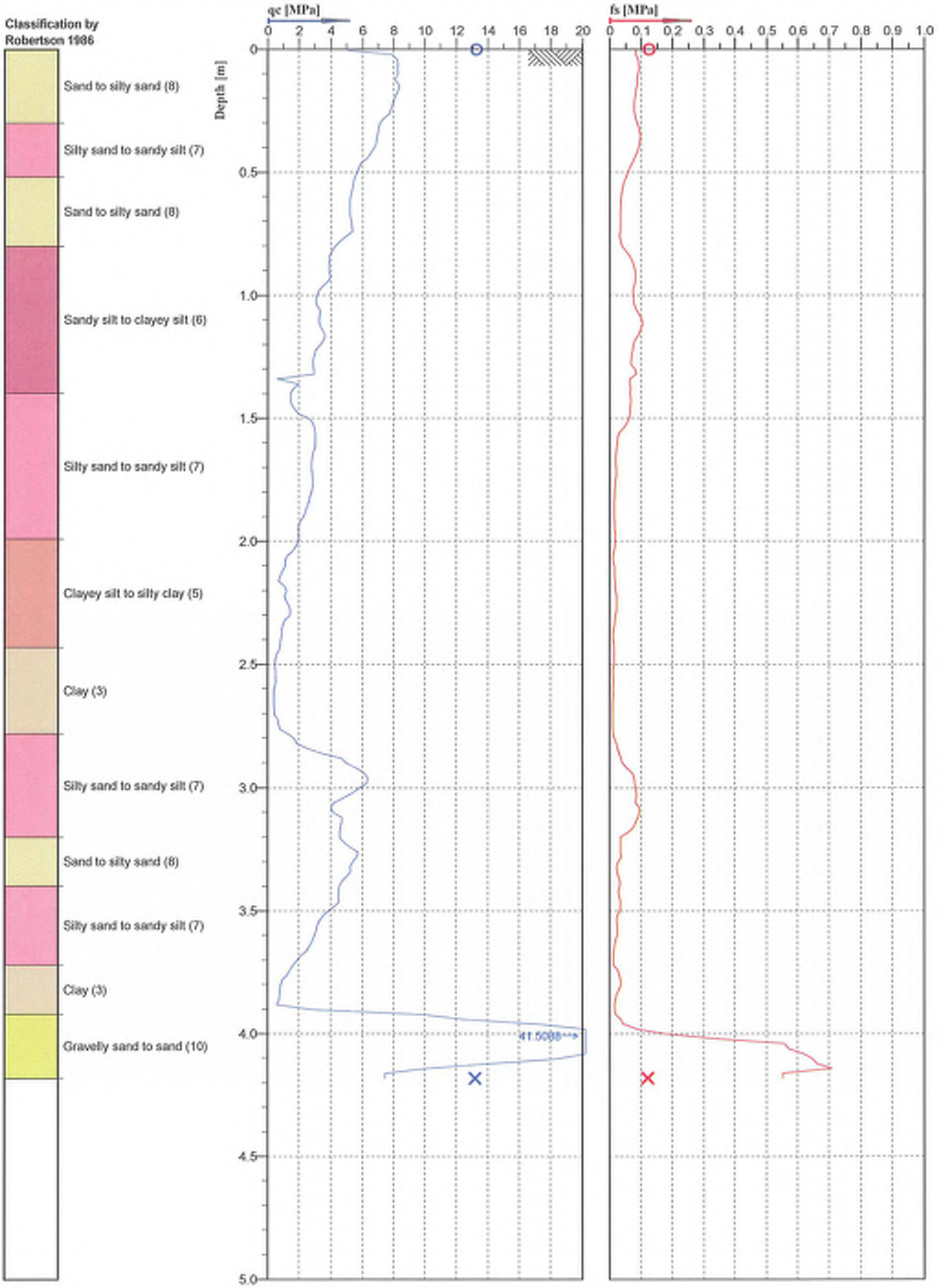
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 8
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 2/2	Fig:
		File: RosemarrynSubdivisionCPT8.cpt	



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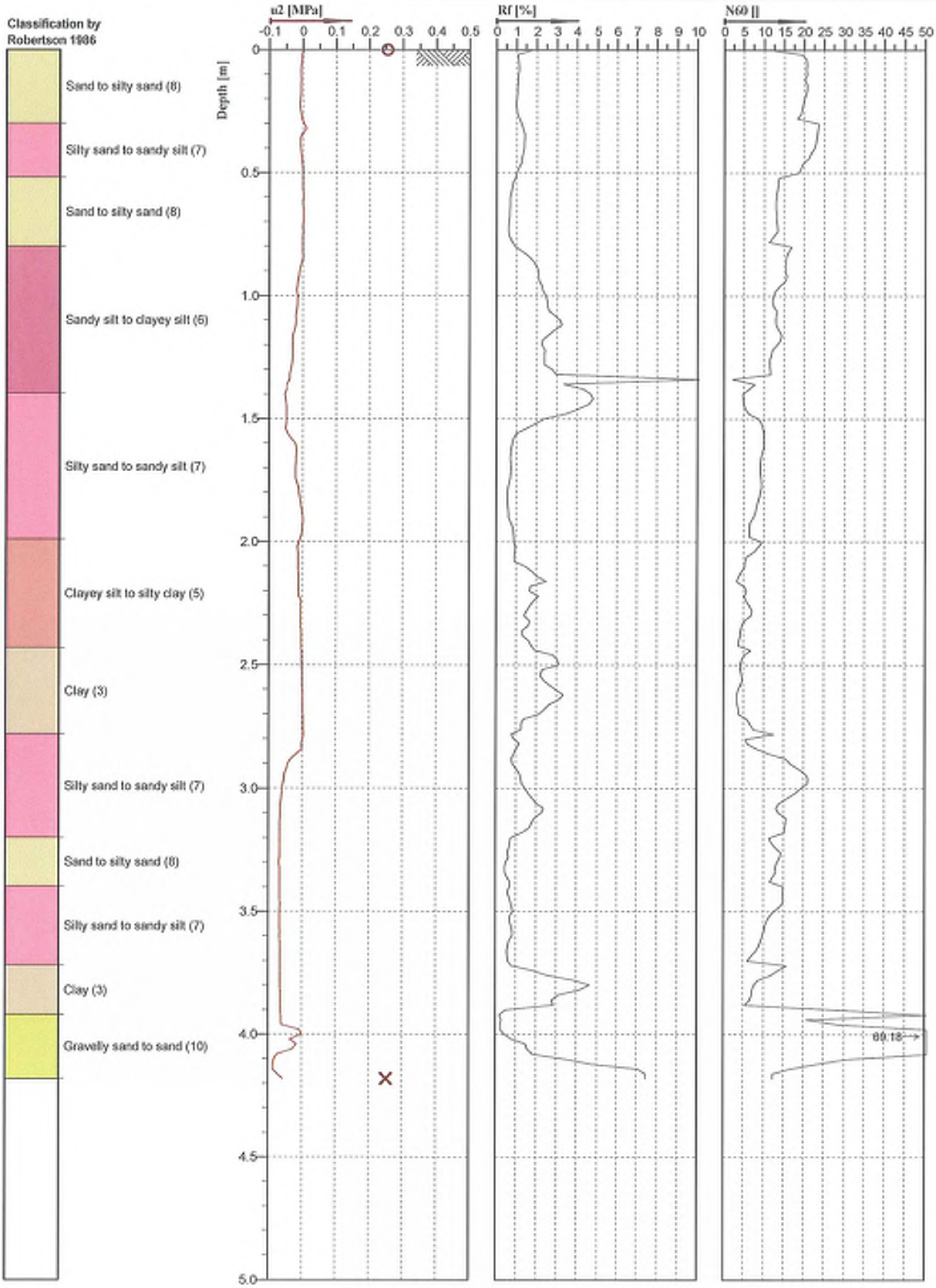
U2

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 9
Project ID:	Client: Aurecon	Date: 4/23/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT9.cpt	



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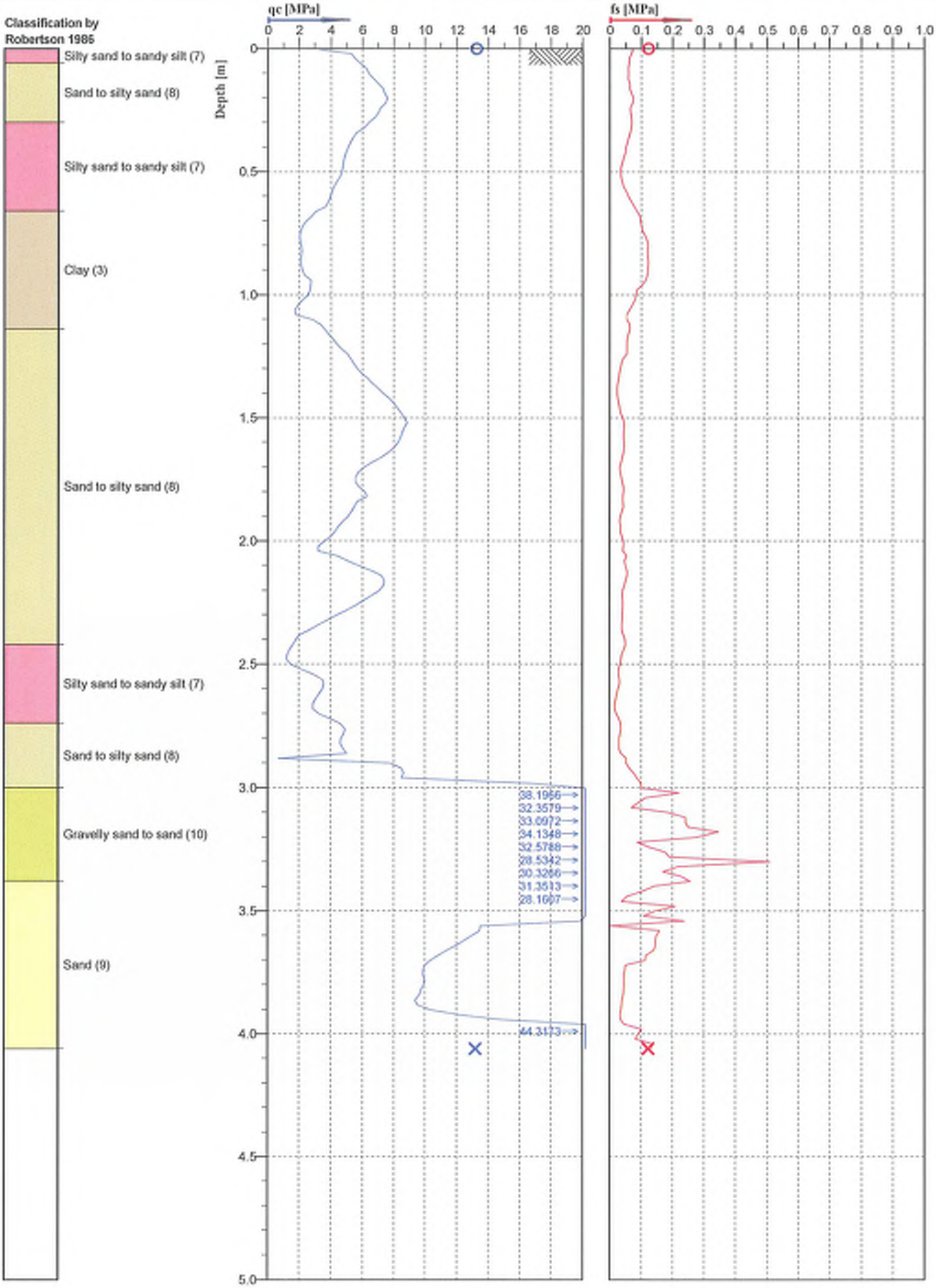
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 9
Project ID:	Client: Aurecon	Date: 4/23/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT9.cpt	



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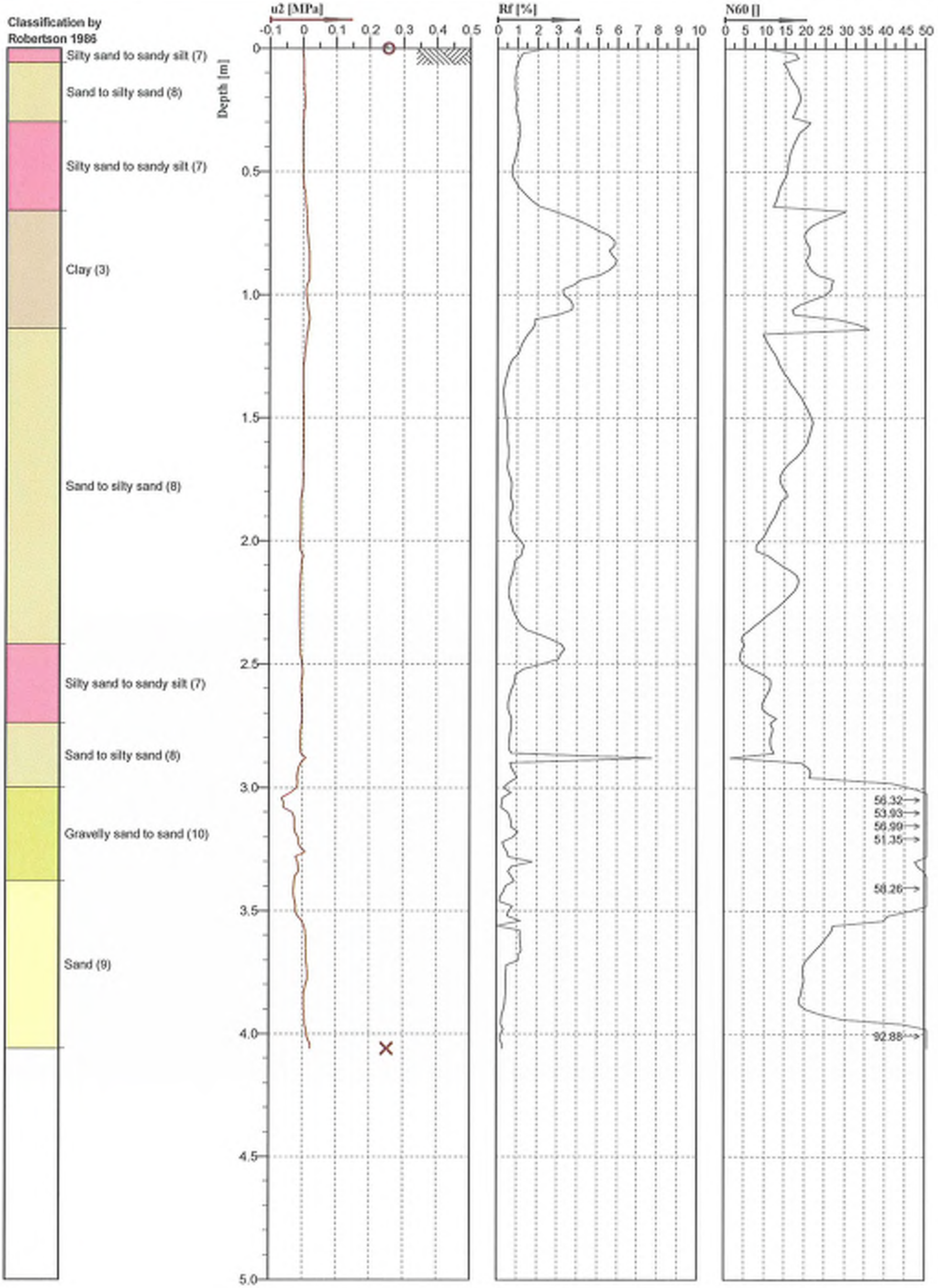
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 10
Project ID:	Client: Aurecon	Date: 4/21/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT10.cp	



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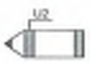

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 10
Project ID:	Client: Aurecon	Date: 4/21/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
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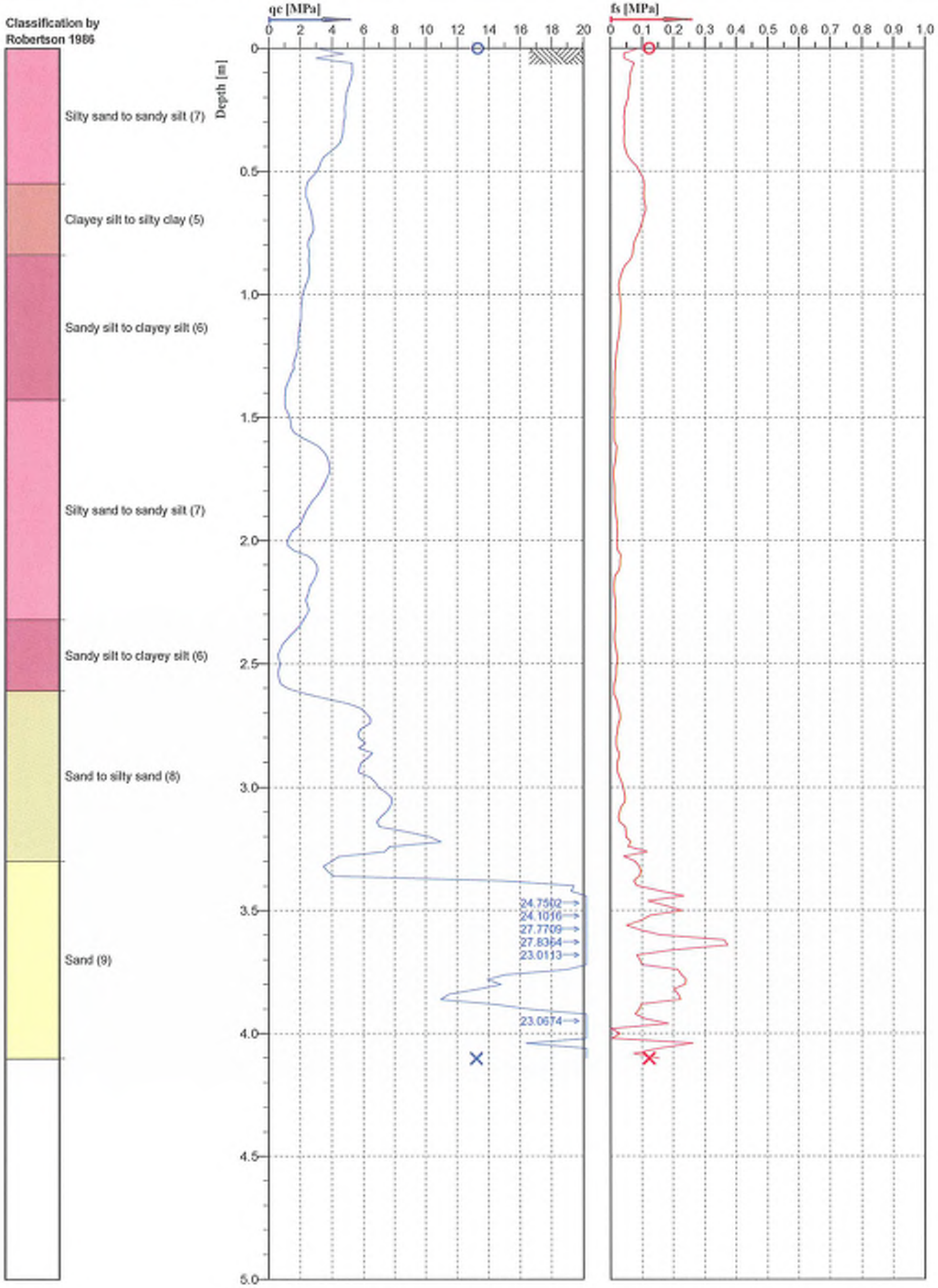

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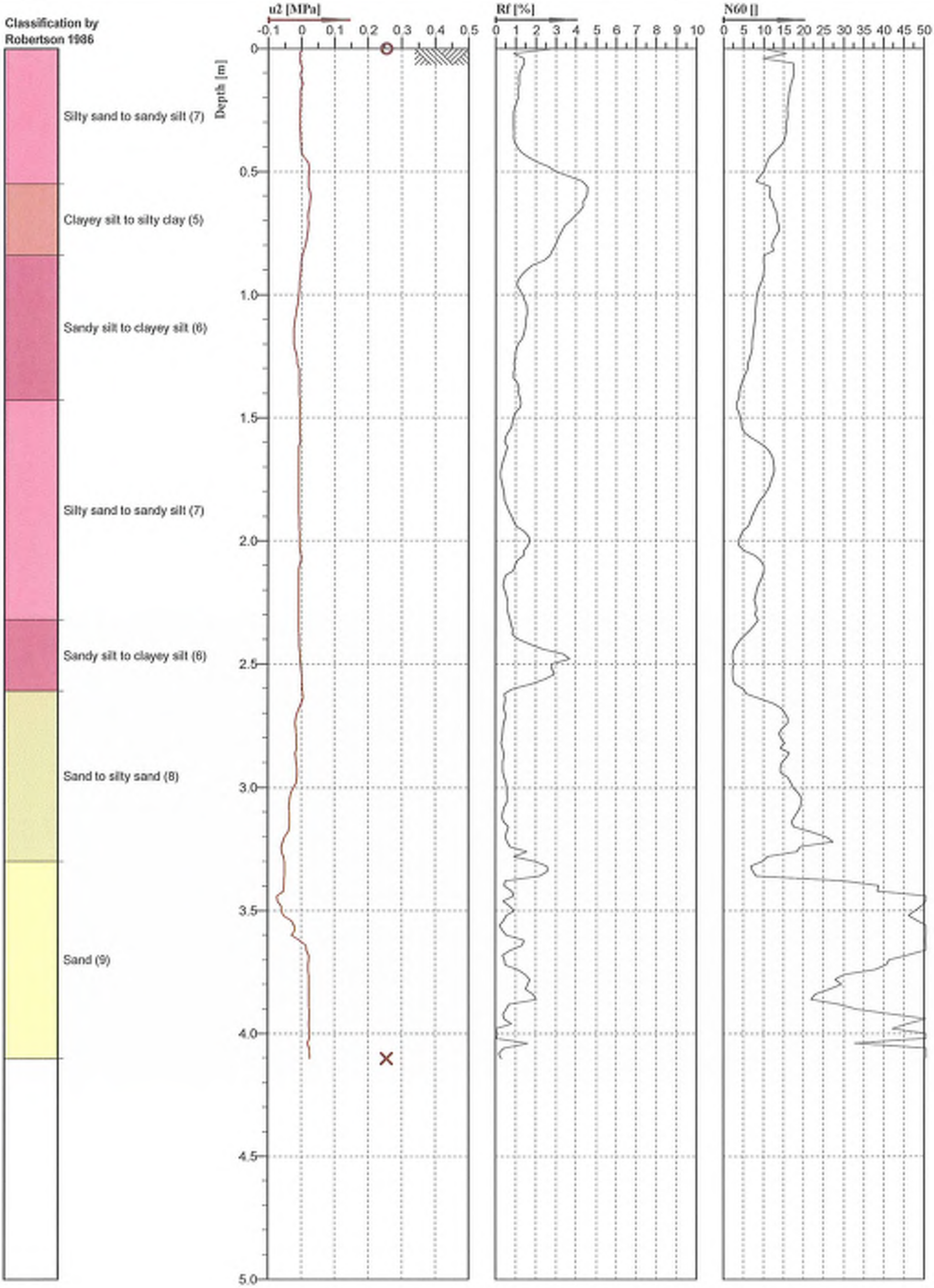
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 11
Project ID:	Client: Aurecon	Date: 4/21/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT11.cp	



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Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 11
Project ID:	Client: Aurecon	Date: 4/21/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
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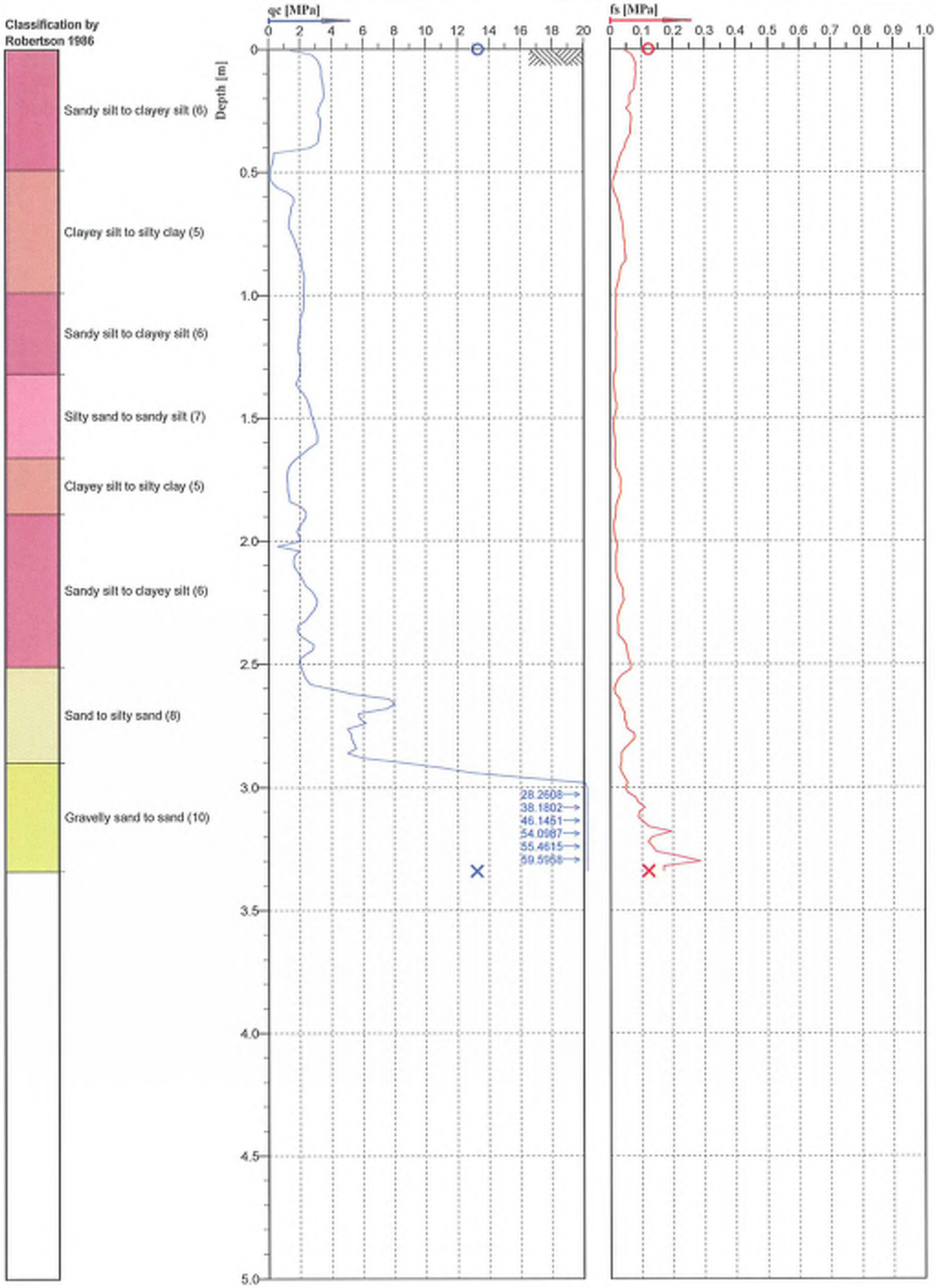

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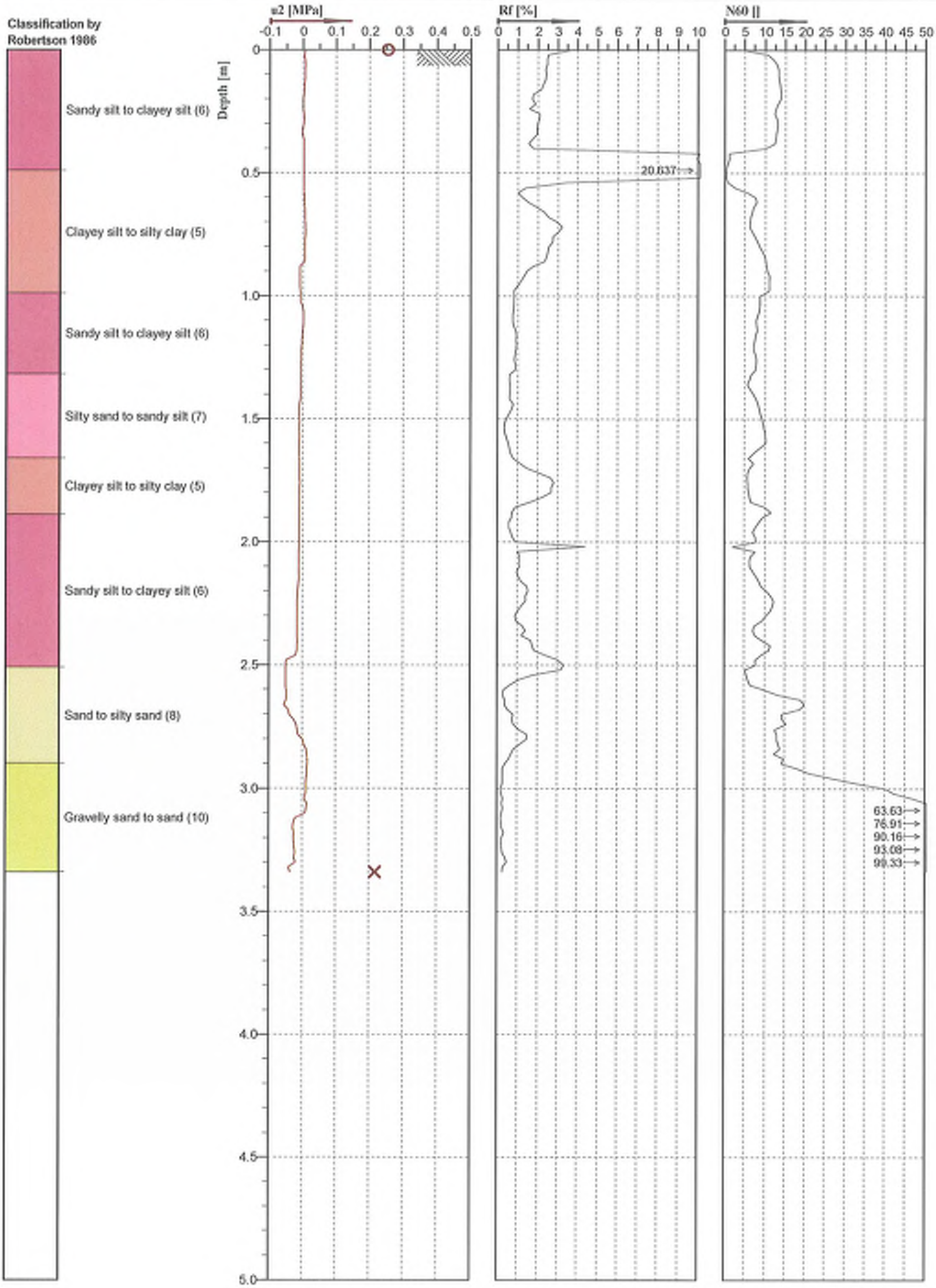
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 12
Project ID:	Client: Aurecon	Date: 4/21/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT12.cp	



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u2

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 12
Project ID:	Client: Aurecon	Date: 4/21/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
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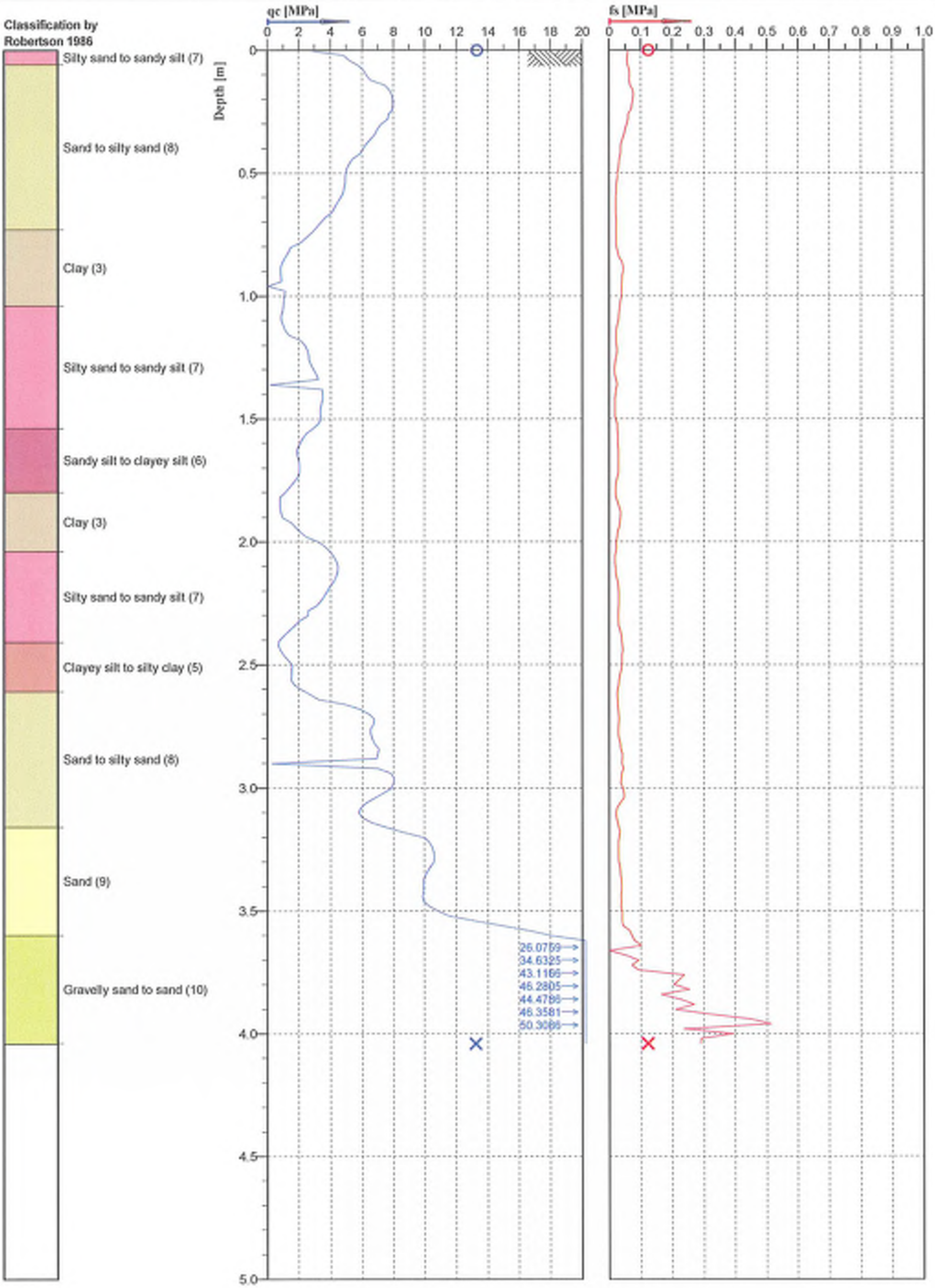

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Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 13
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
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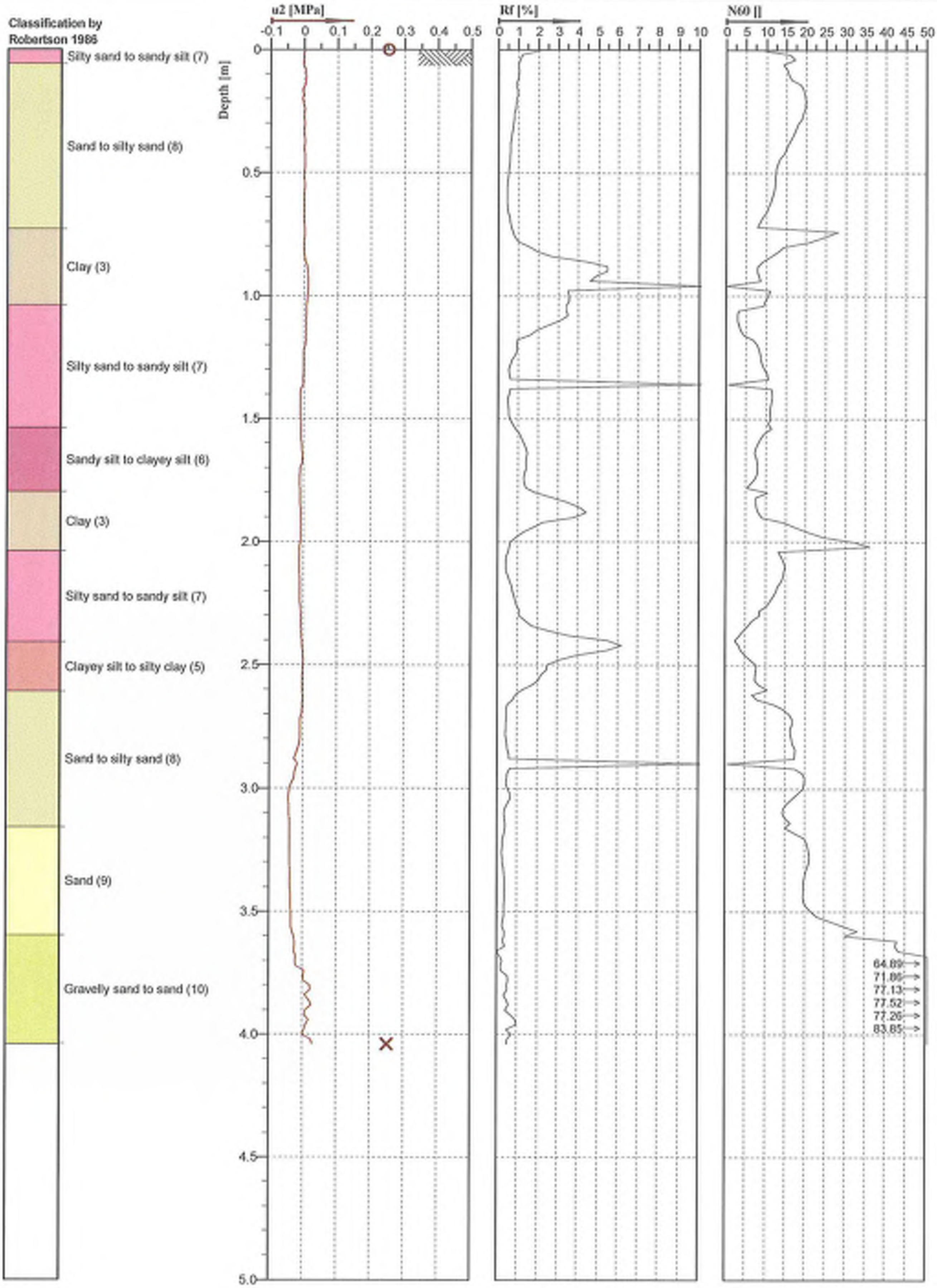

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Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 13
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
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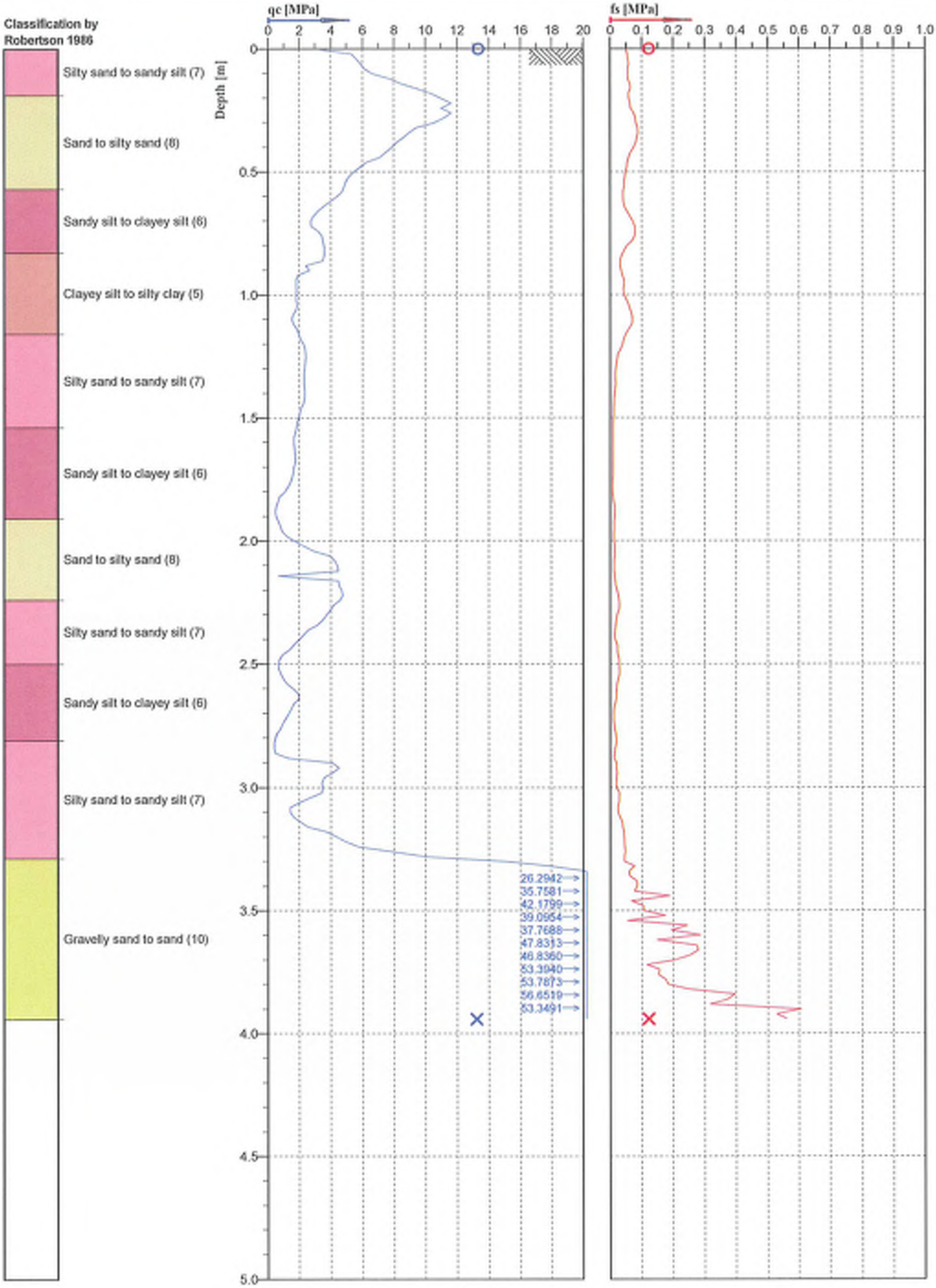

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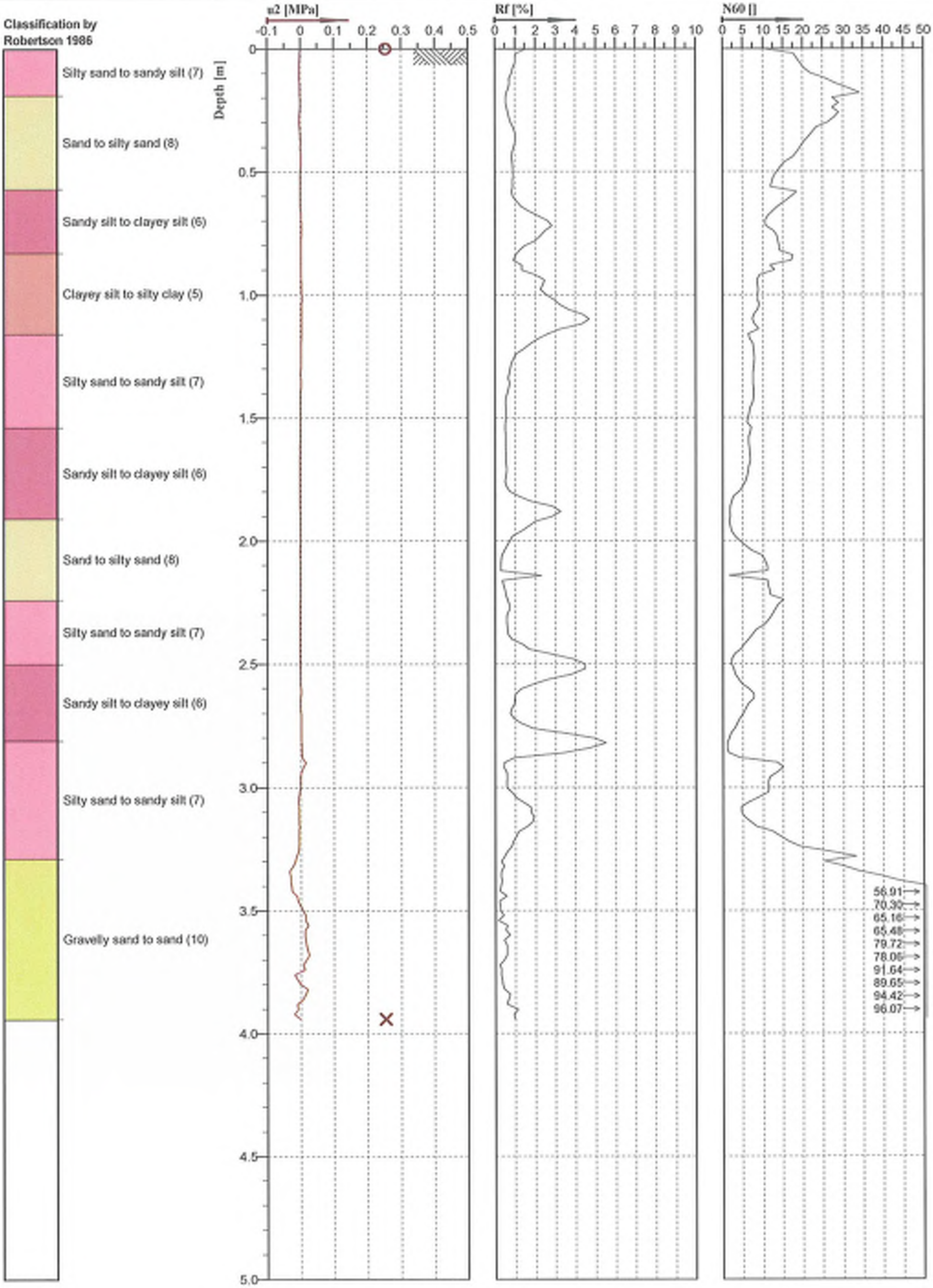
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 14
Project ID:	Client: Aurecon	Date: 4/21/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT14.cp	



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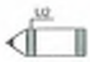
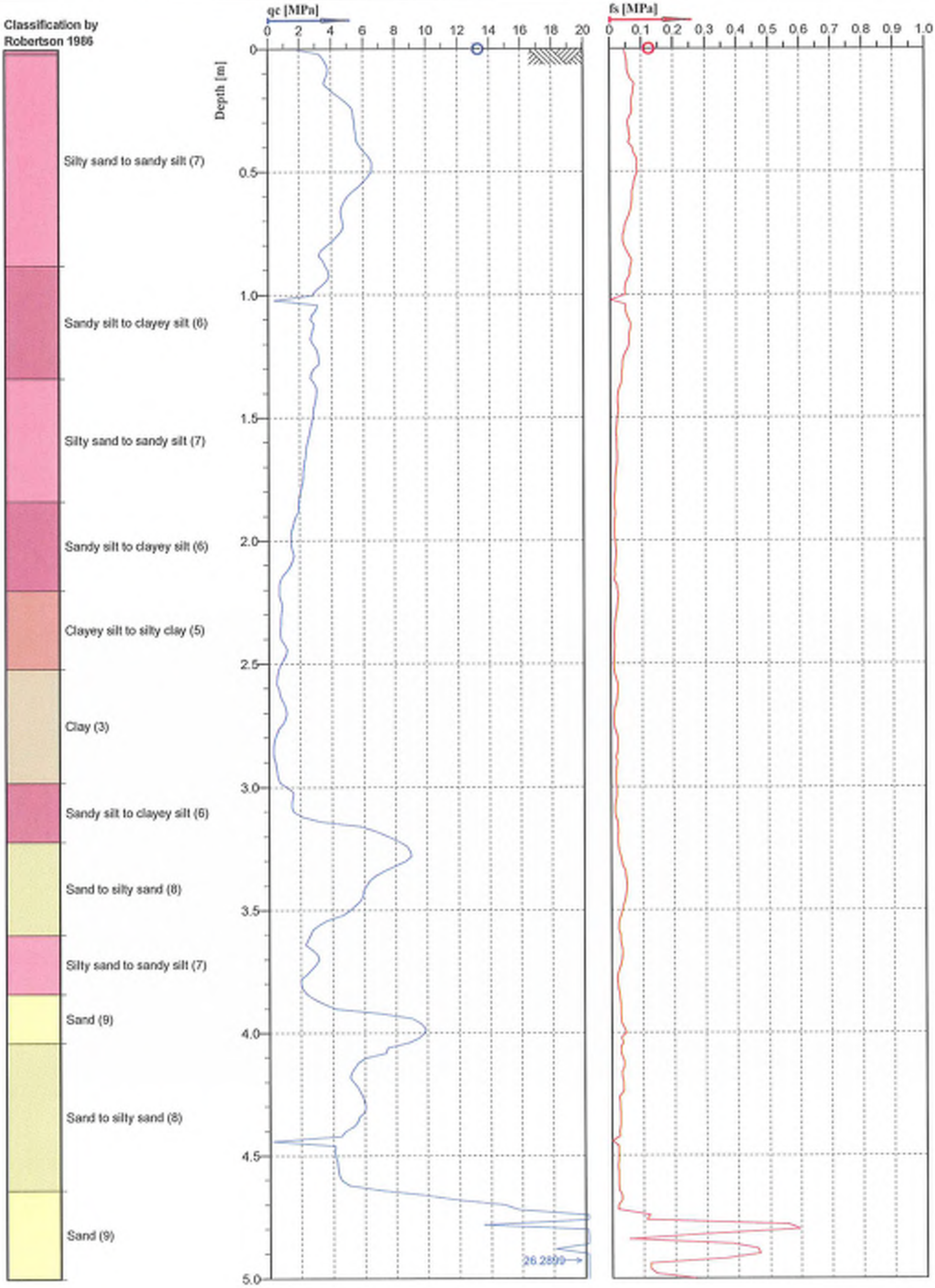


Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 14
Project ID:	Client: Aurecon	Date: 4/21/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT14.cp	



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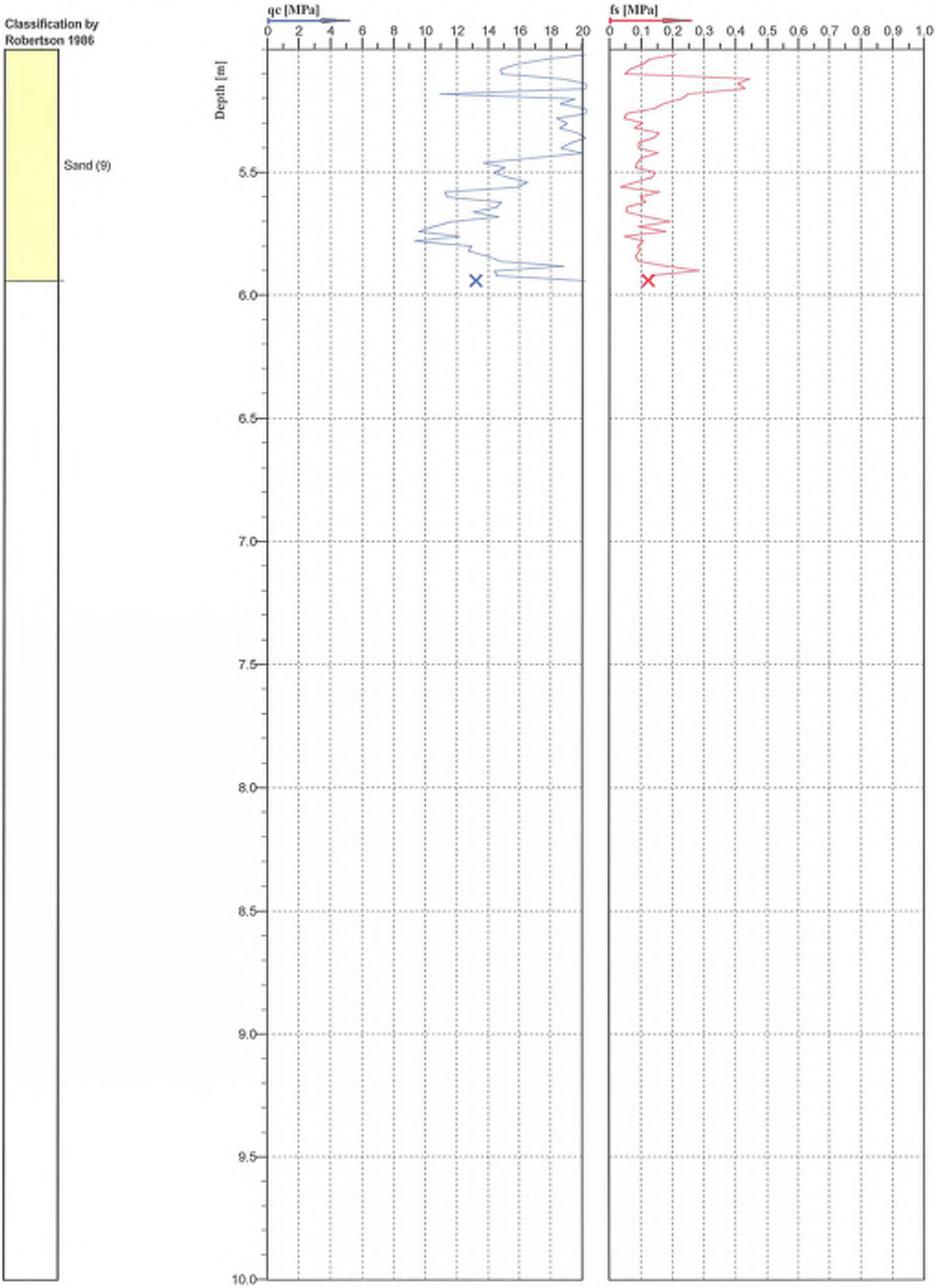
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision
Position: X: 0.00 m, Y: 0.00 m
Ground level: 0.00
Test no: 15
Project ID:
Client: Aurecon
Date: 4/21/2012
Scale: 1 : 22
Project: ROSEMARRYN
Page: 1/2
Fig:
File: RosemarrynSubdivisionCPT15.cp



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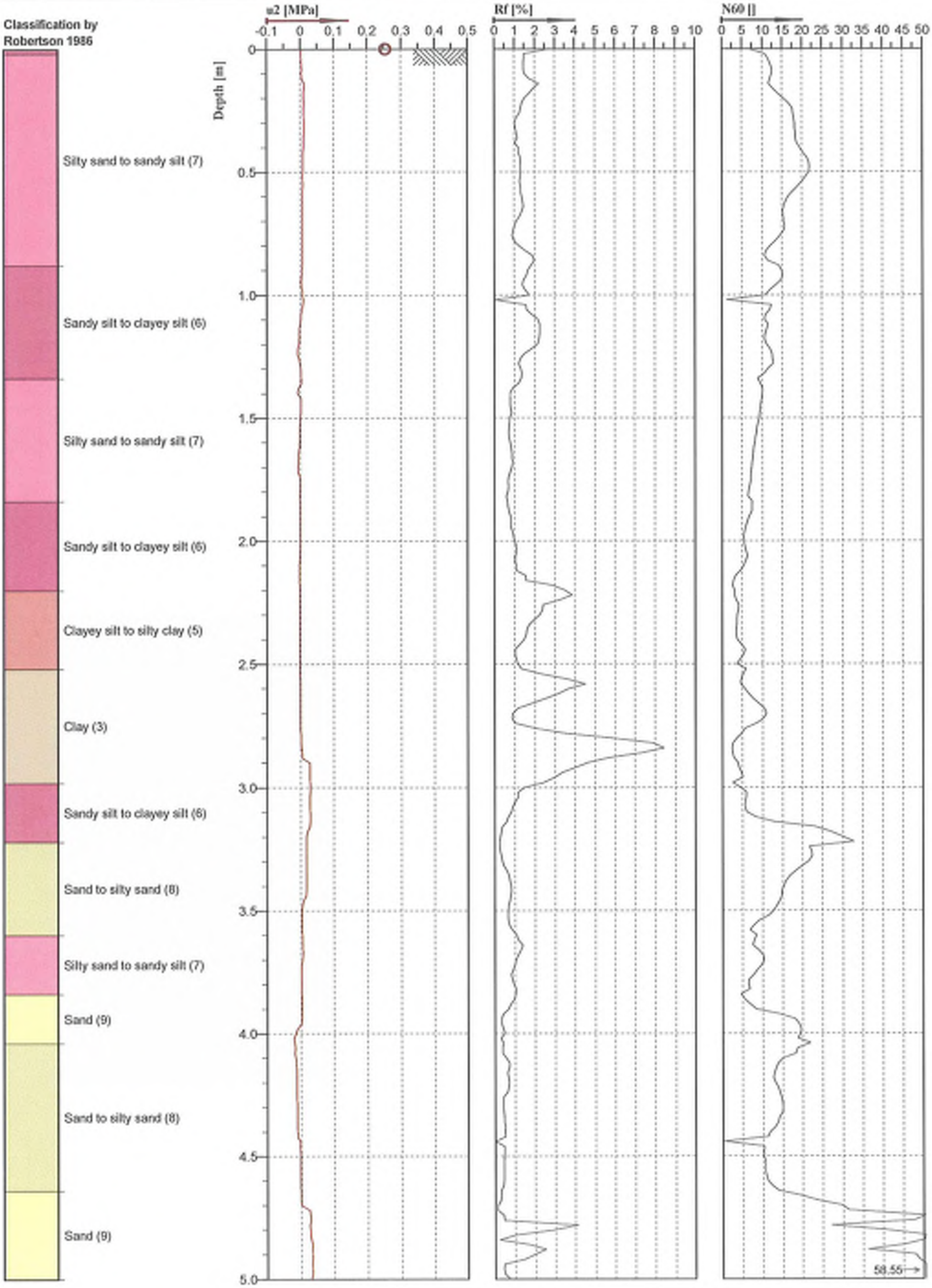
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 15
Project ID:	Client: Aurecon	Date: 4/21/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 2/2	Fig:
		File: RosemarrynSubdivisionCPT15.cp	



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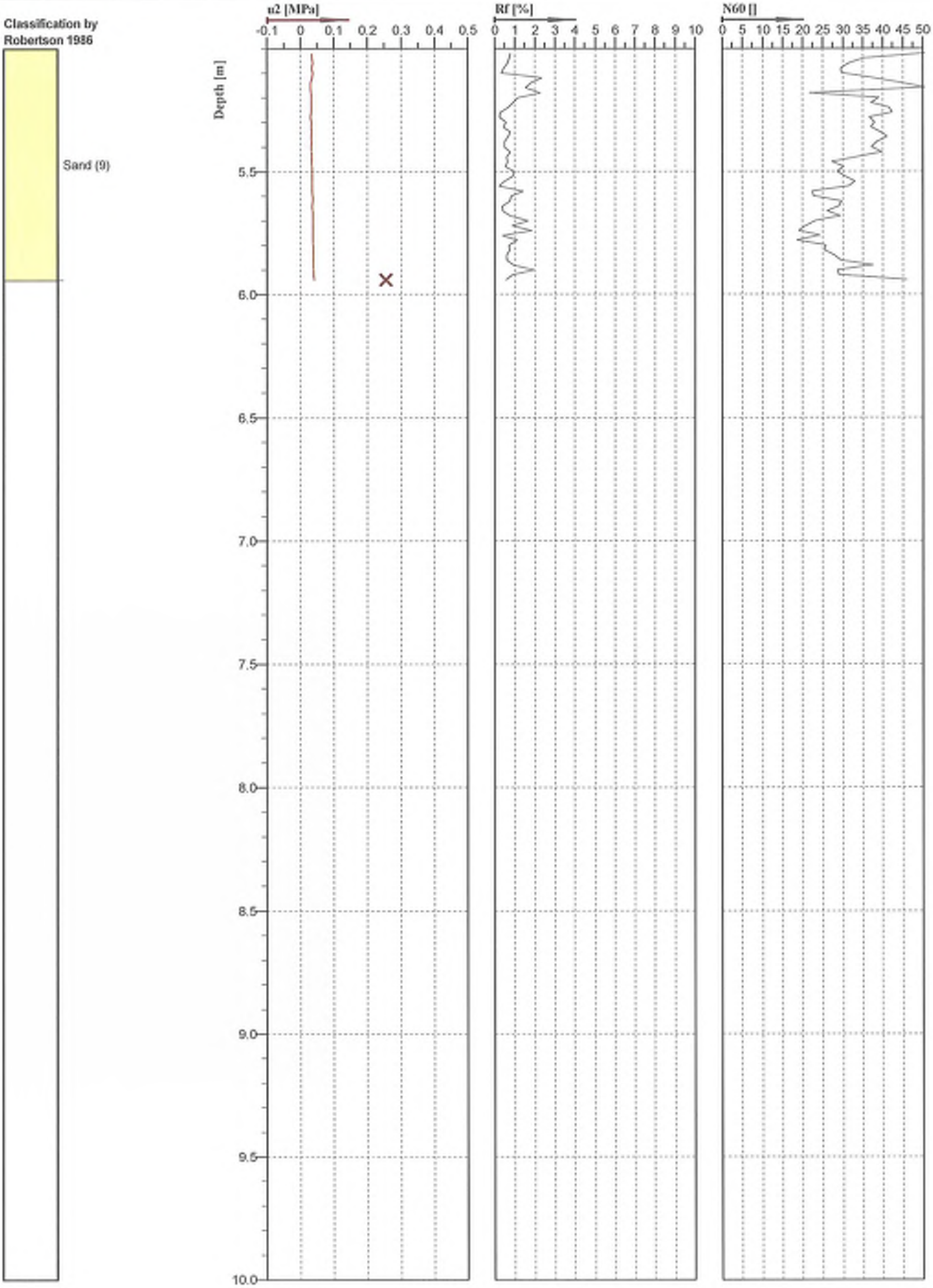
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 15
Project ID:	Client: Aurecon	Date: 4/21/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/2	Fig:
		File: RosemarrynSubdivisionCPT15.cp	



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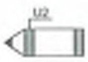
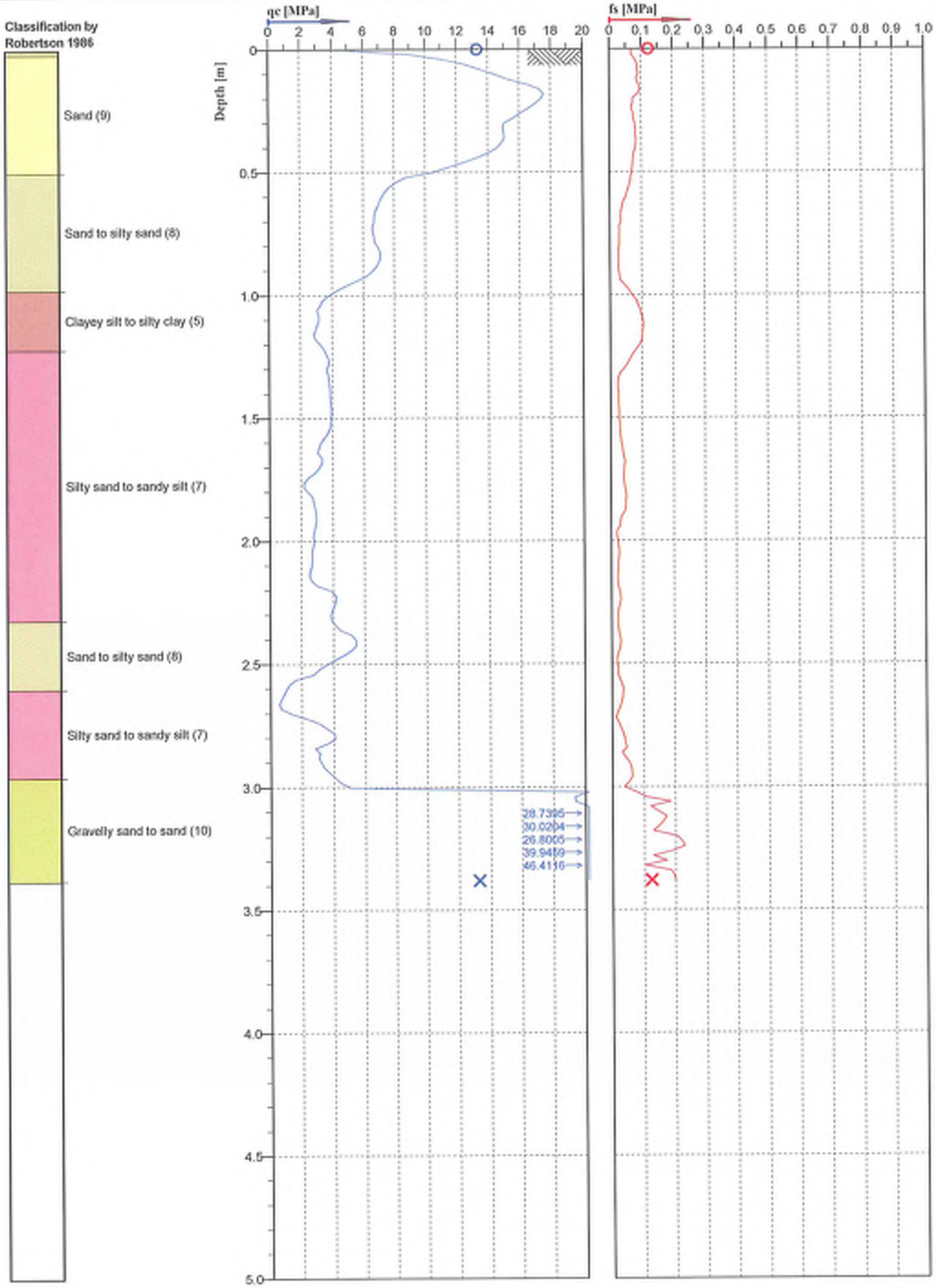


Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 15
Project ID:	Client: Aurecon	Date: 4/21/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 2/2	Fig:
		File: RosemarrynSubdivisionCPT15.cp	



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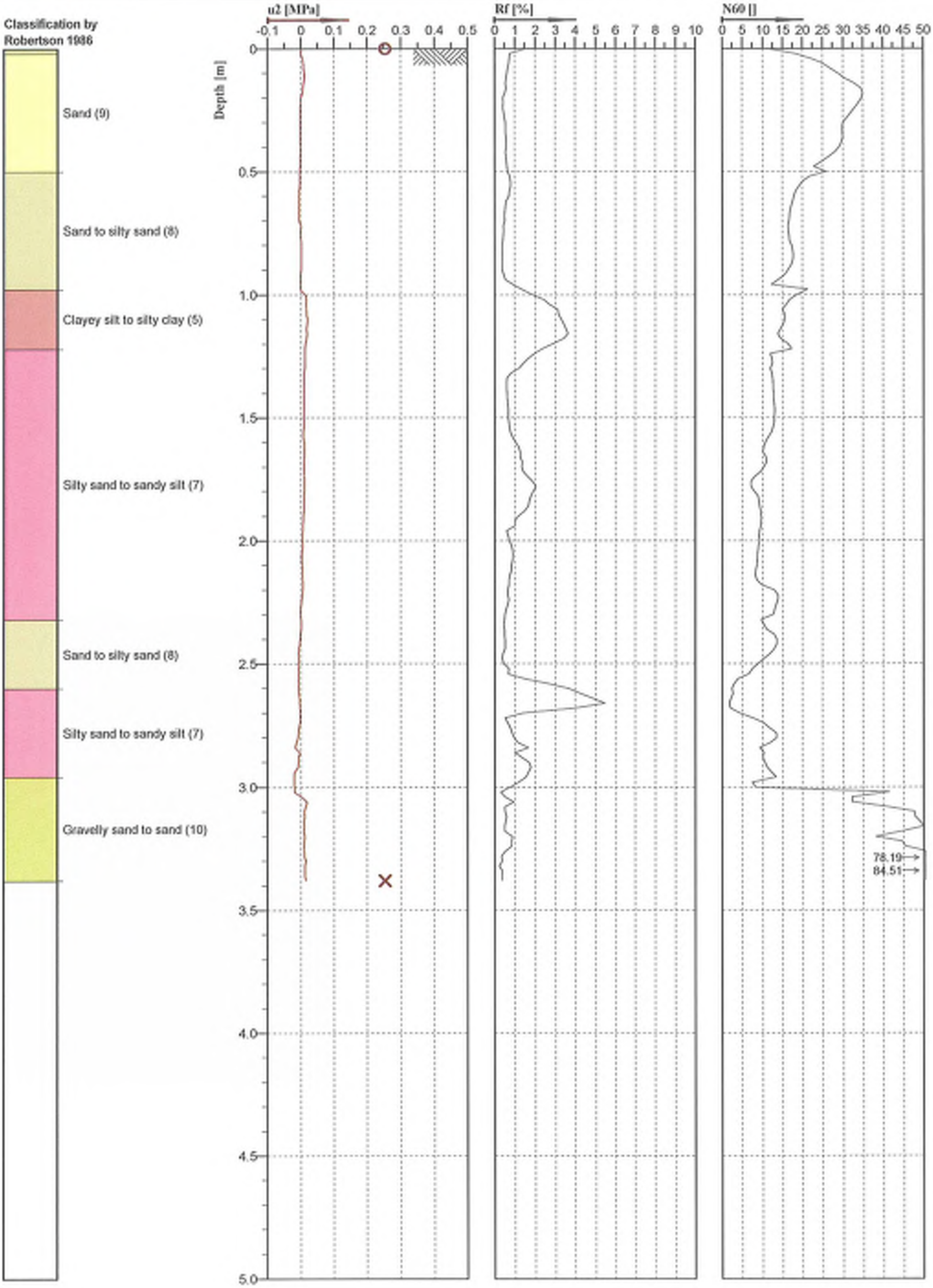
0800 477 637

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

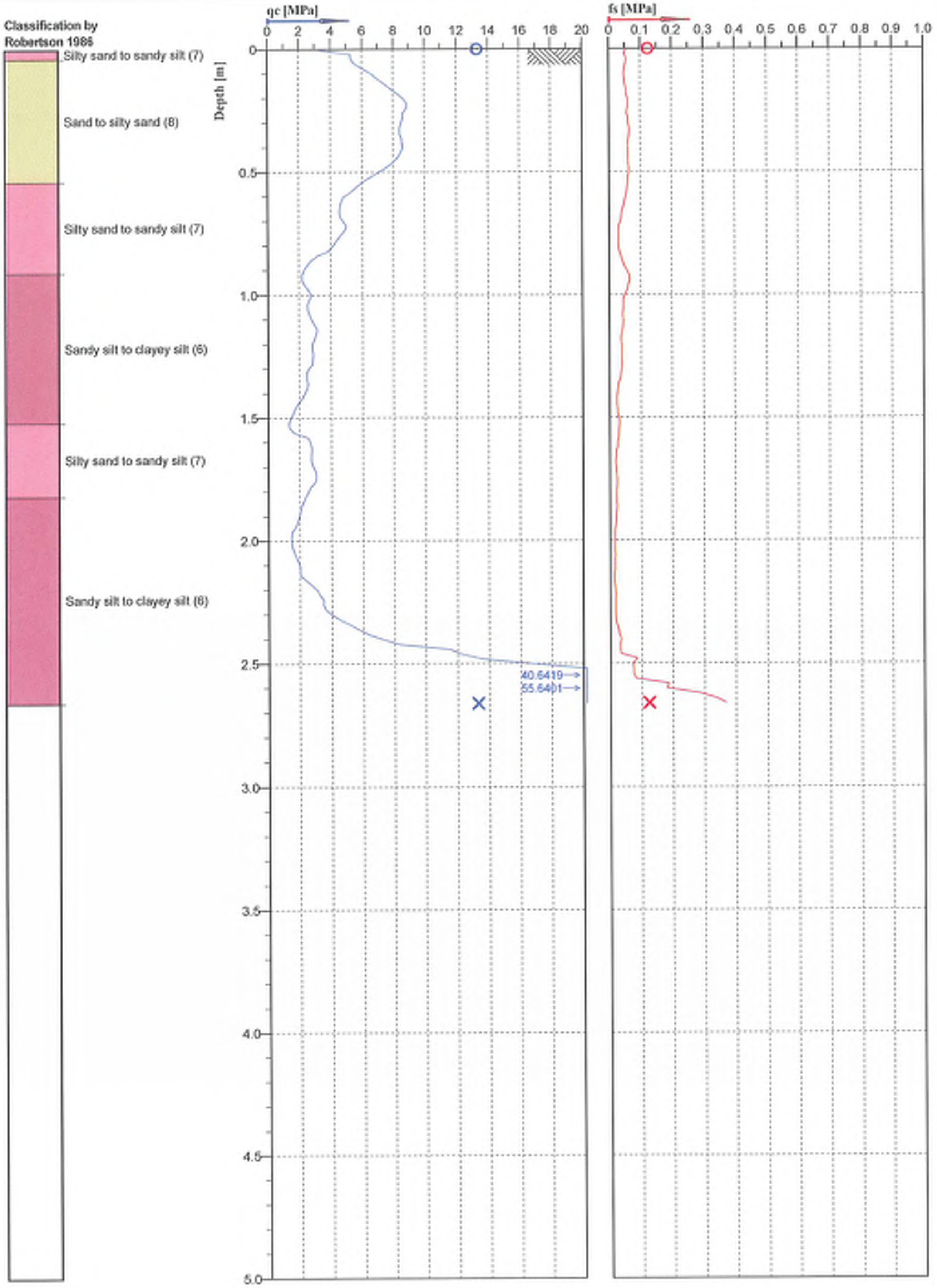
Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 16
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT16.cp	



PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

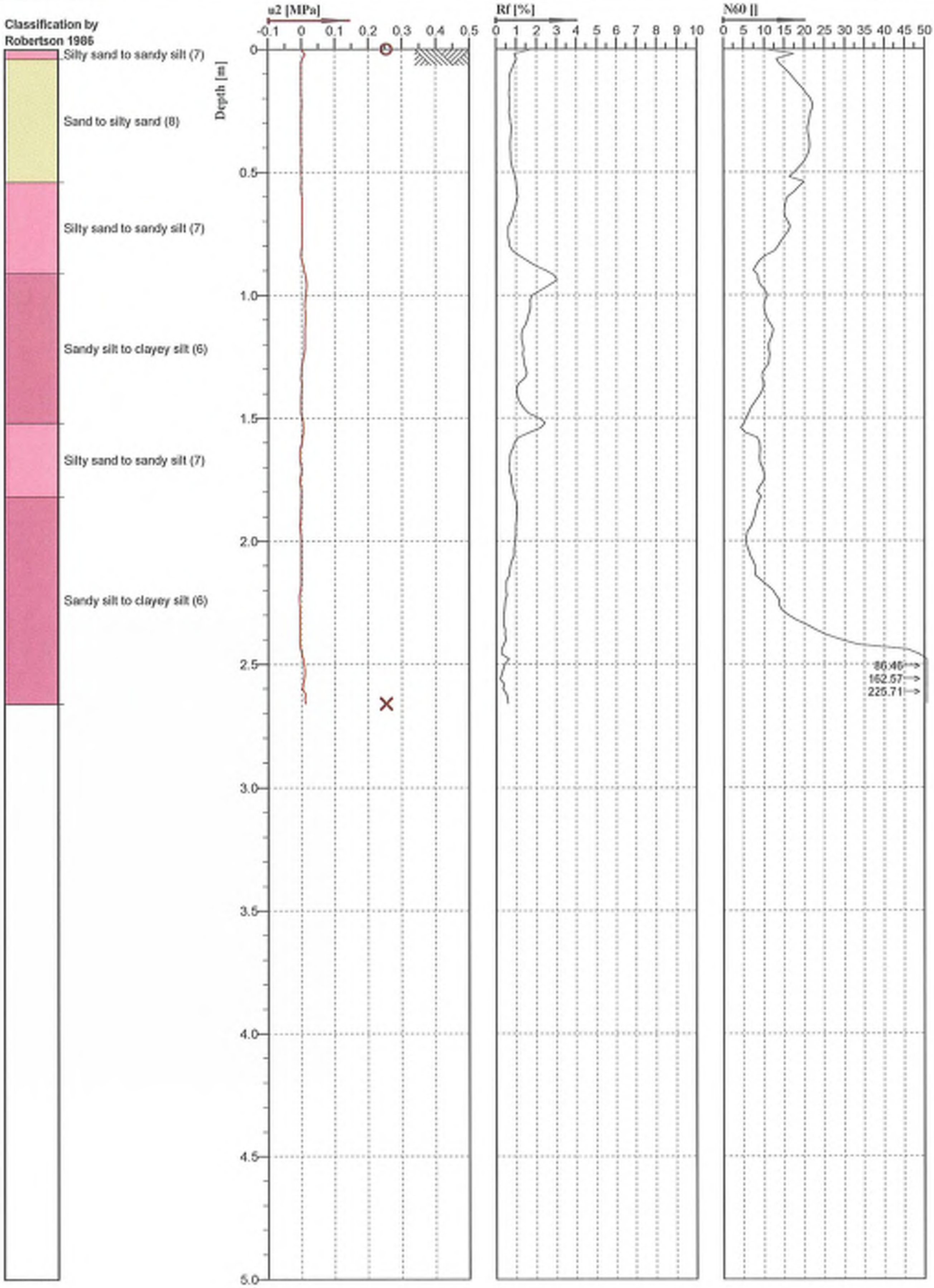
Location: Rosemarryn Subdivision
Position: X: 0.00 m, Y: 0.00 m
Ground level: 0.00
Test no: 16
Project ID:
Client: Aurecon
Date: 4/21/2013
Scale: 1 : 22
Project: ROSEMARRYN
Page: 1/1
Fig:
File: RosemarrynSubdivisionCPT16.cp



PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

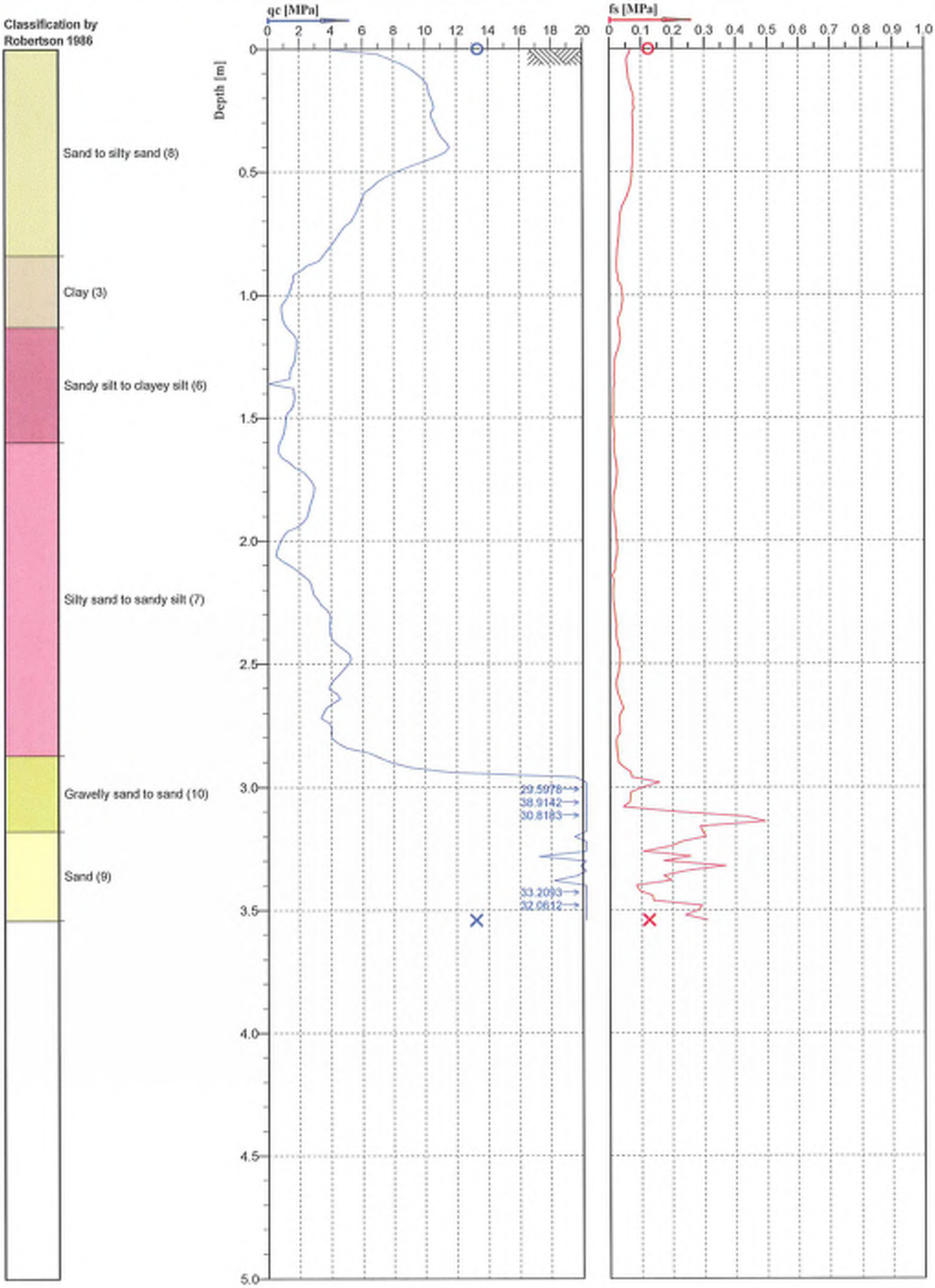
Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 17
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT17.cp	



PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

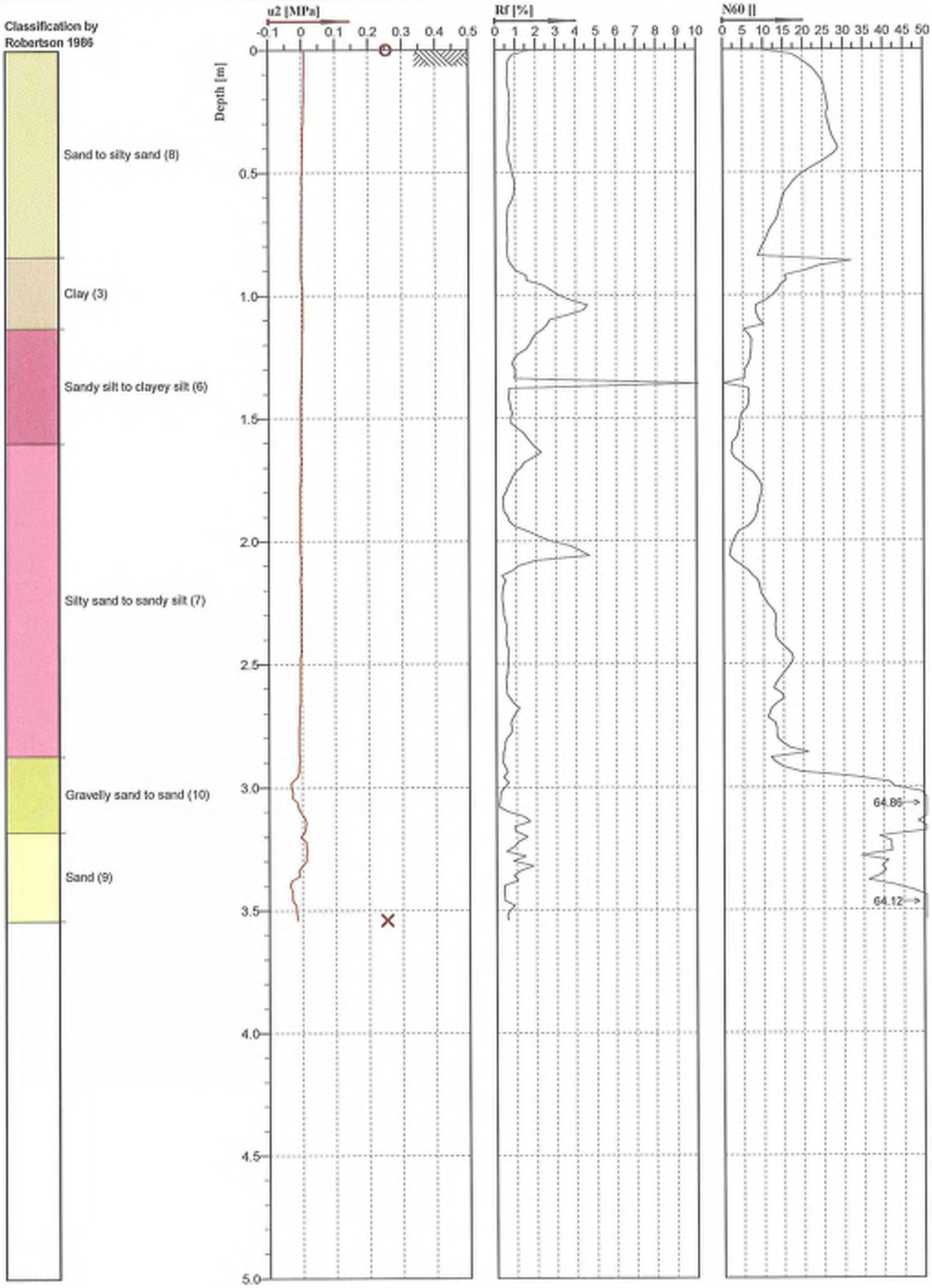
Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 17
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT17.cp	



PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

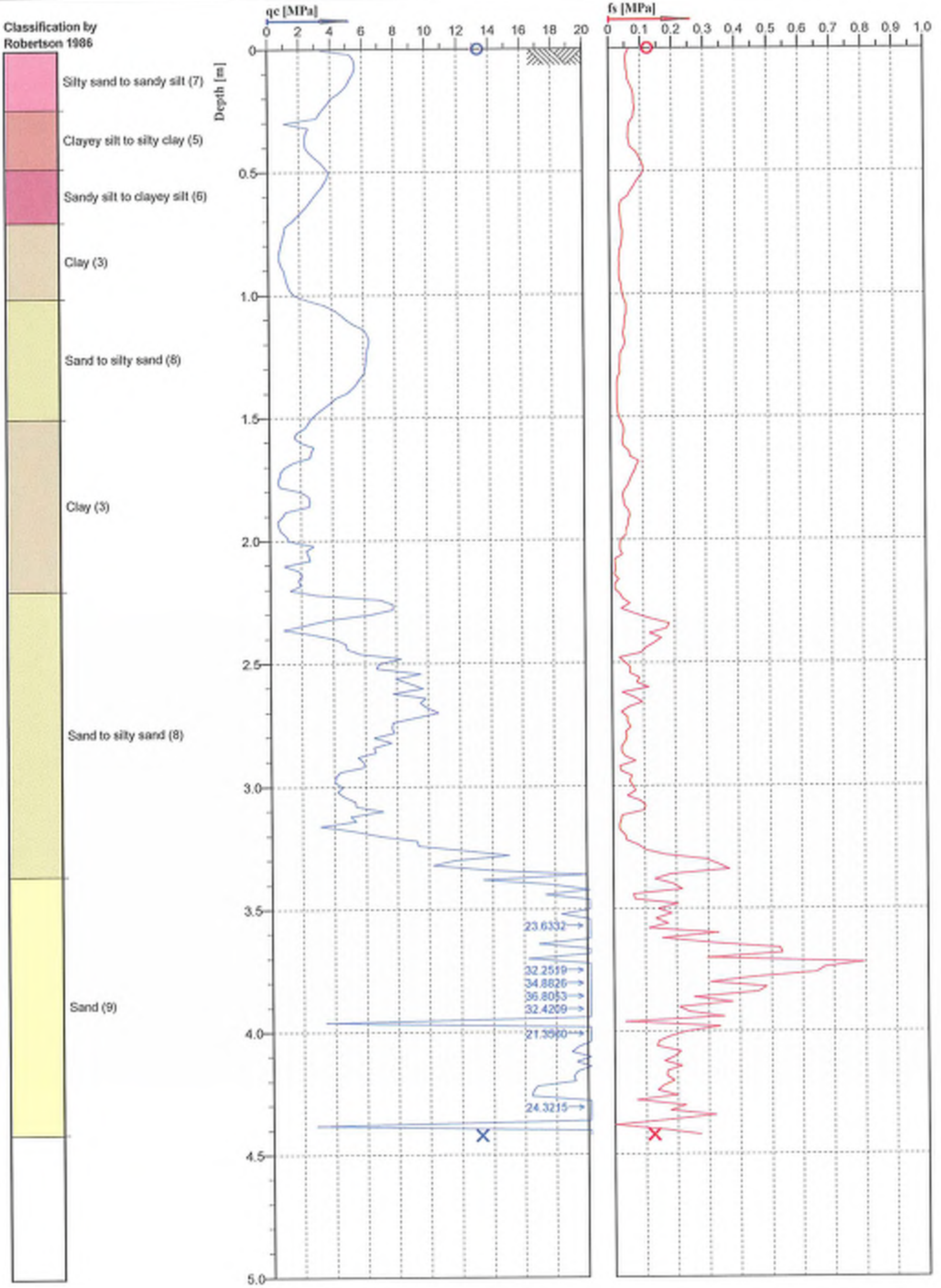
Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 18
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT18.cp	



PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

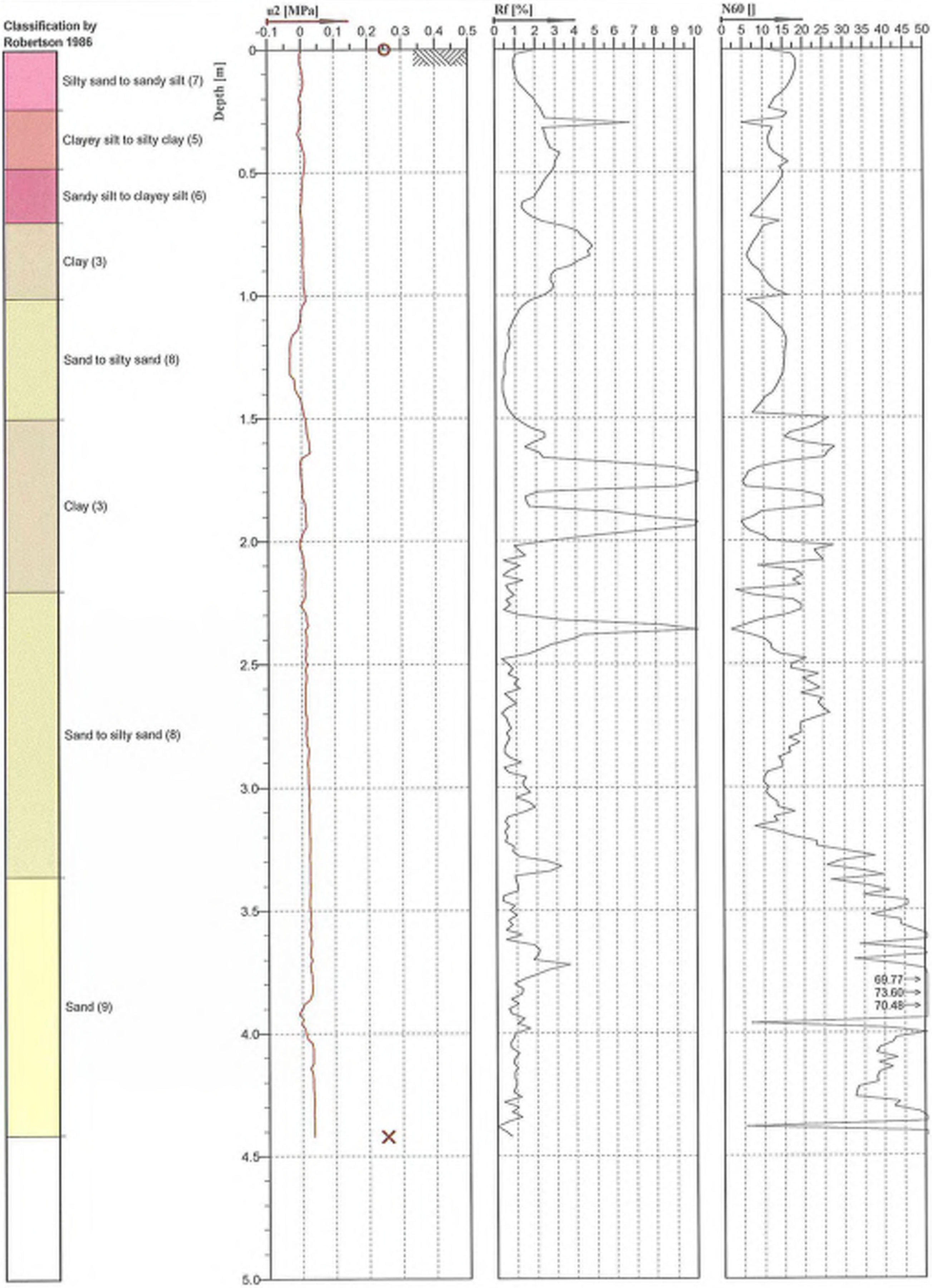
Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 18
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT18.cp	



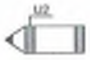
PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637

U2
Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 19
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT19.cp	

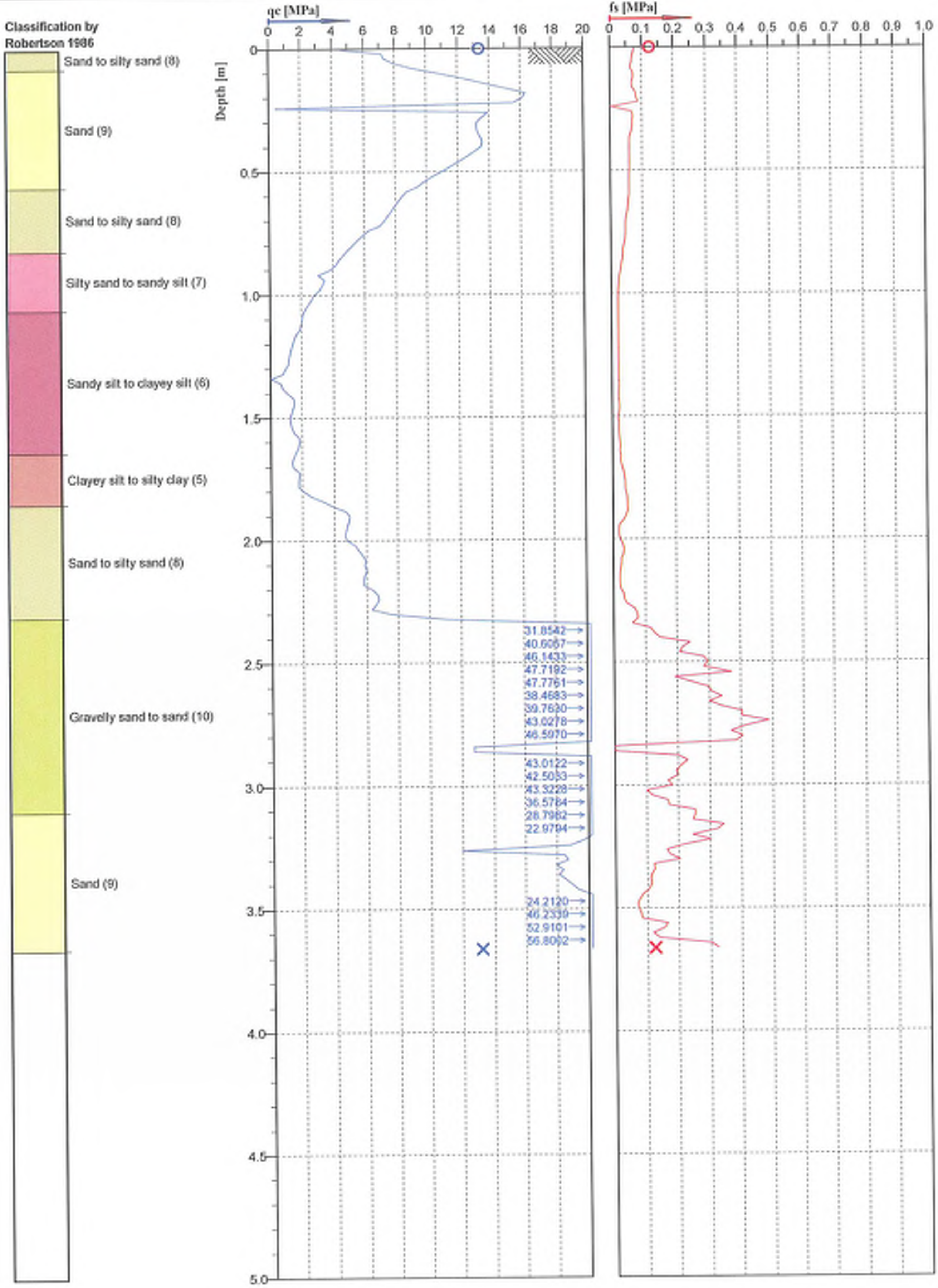


PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637



Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

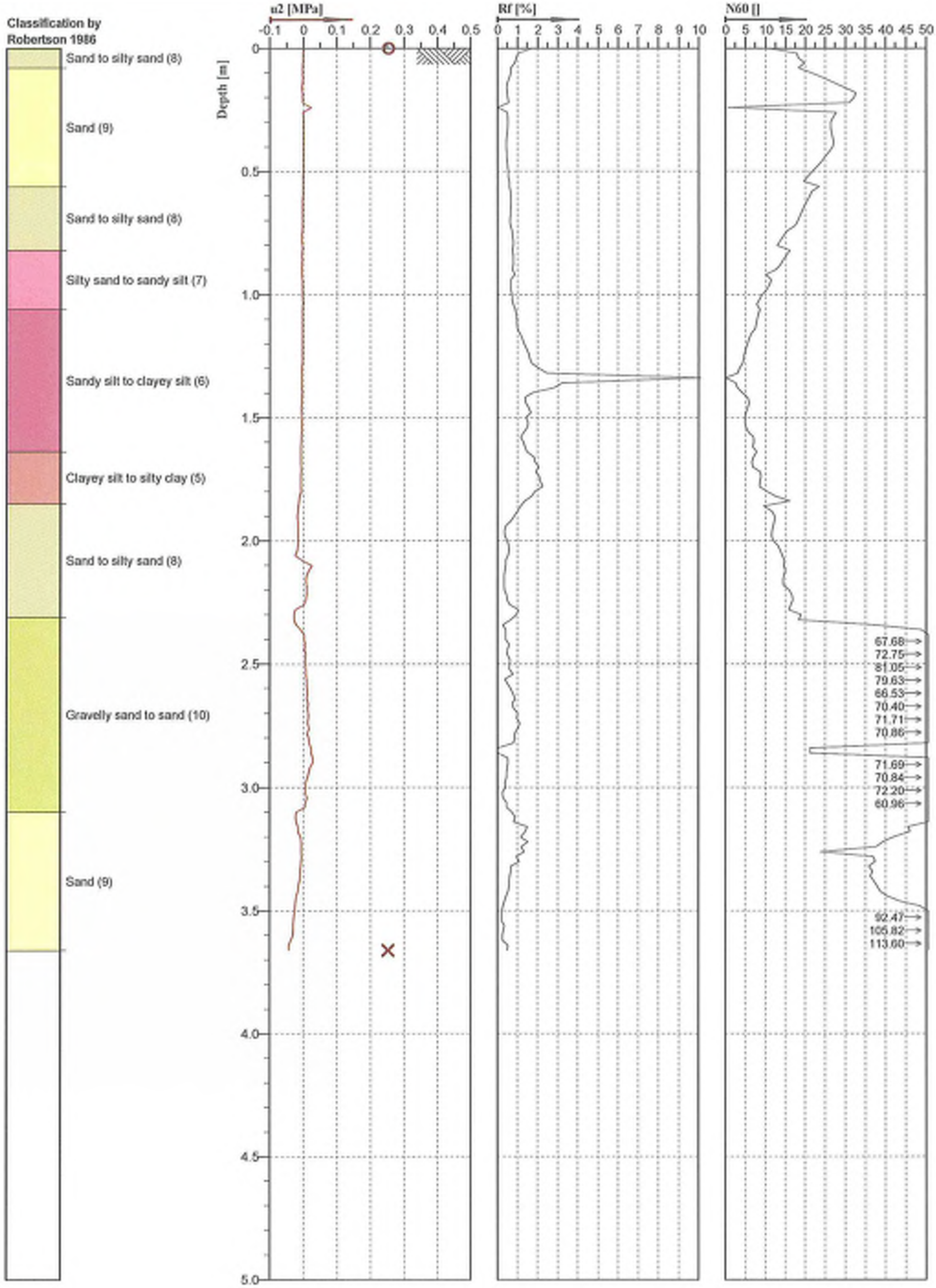
Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 19
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT19.cp	



PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

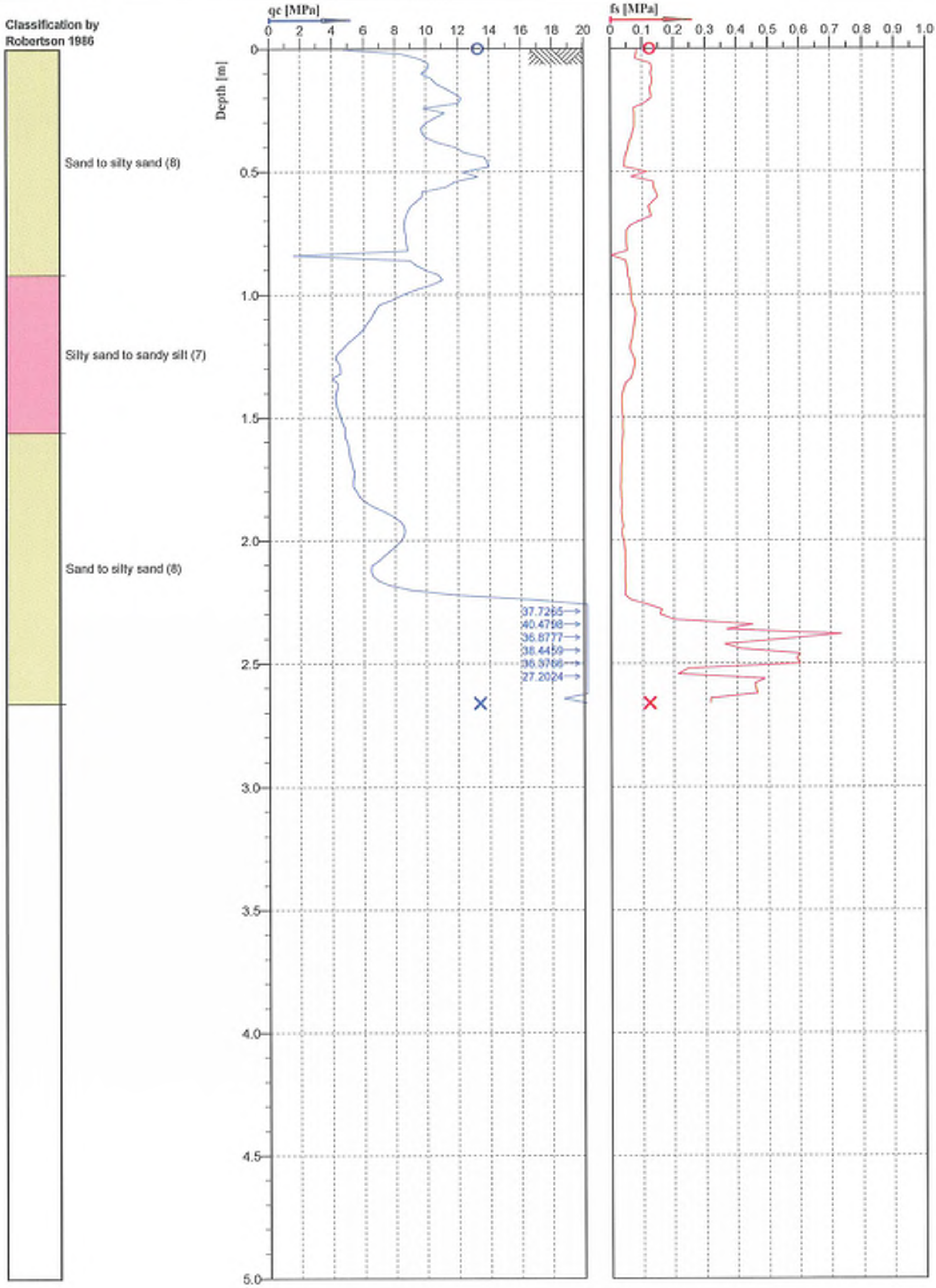
Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 20
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT20.cp	



PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 20
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT20.cp	

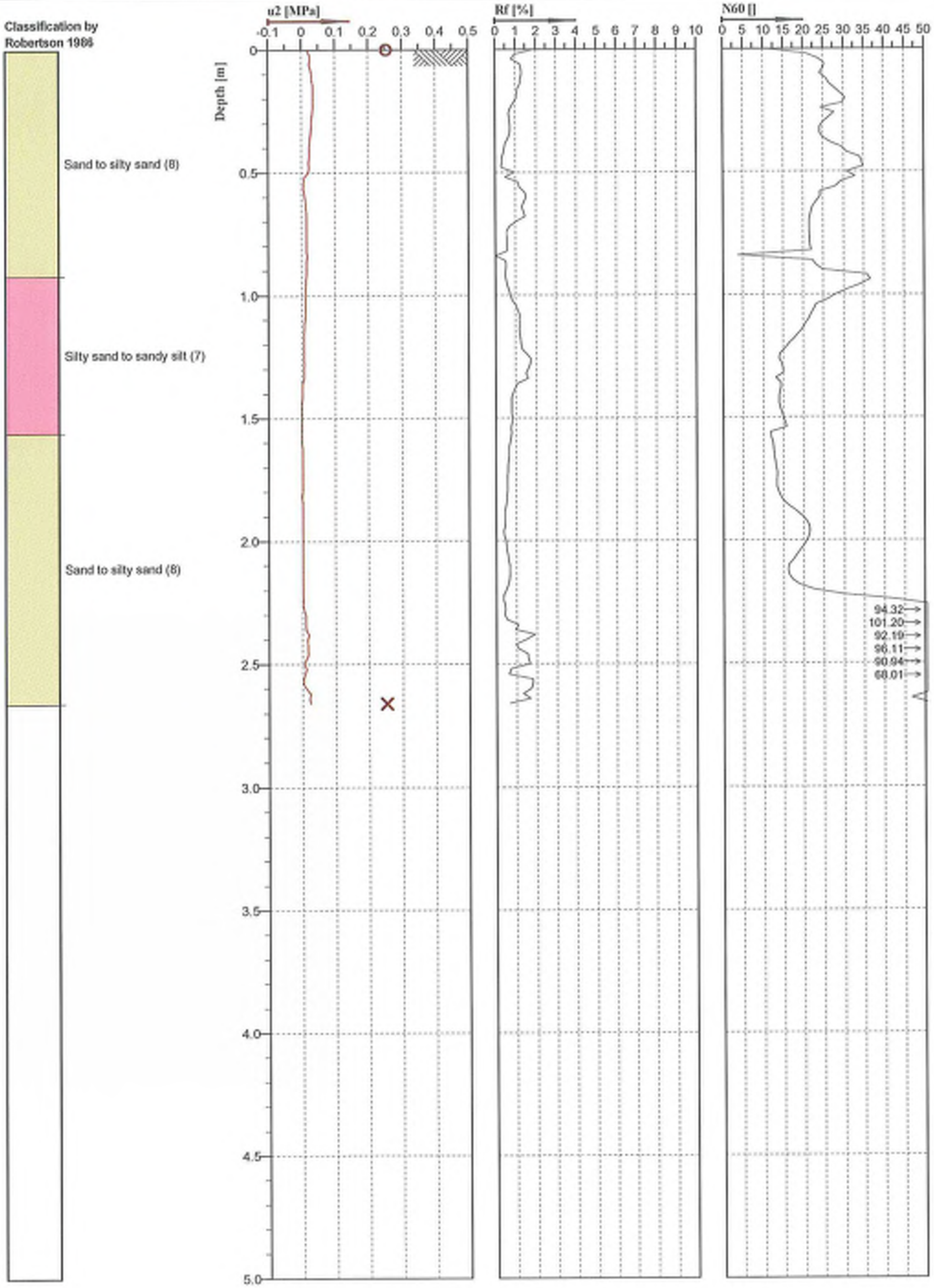


PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637

U2

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

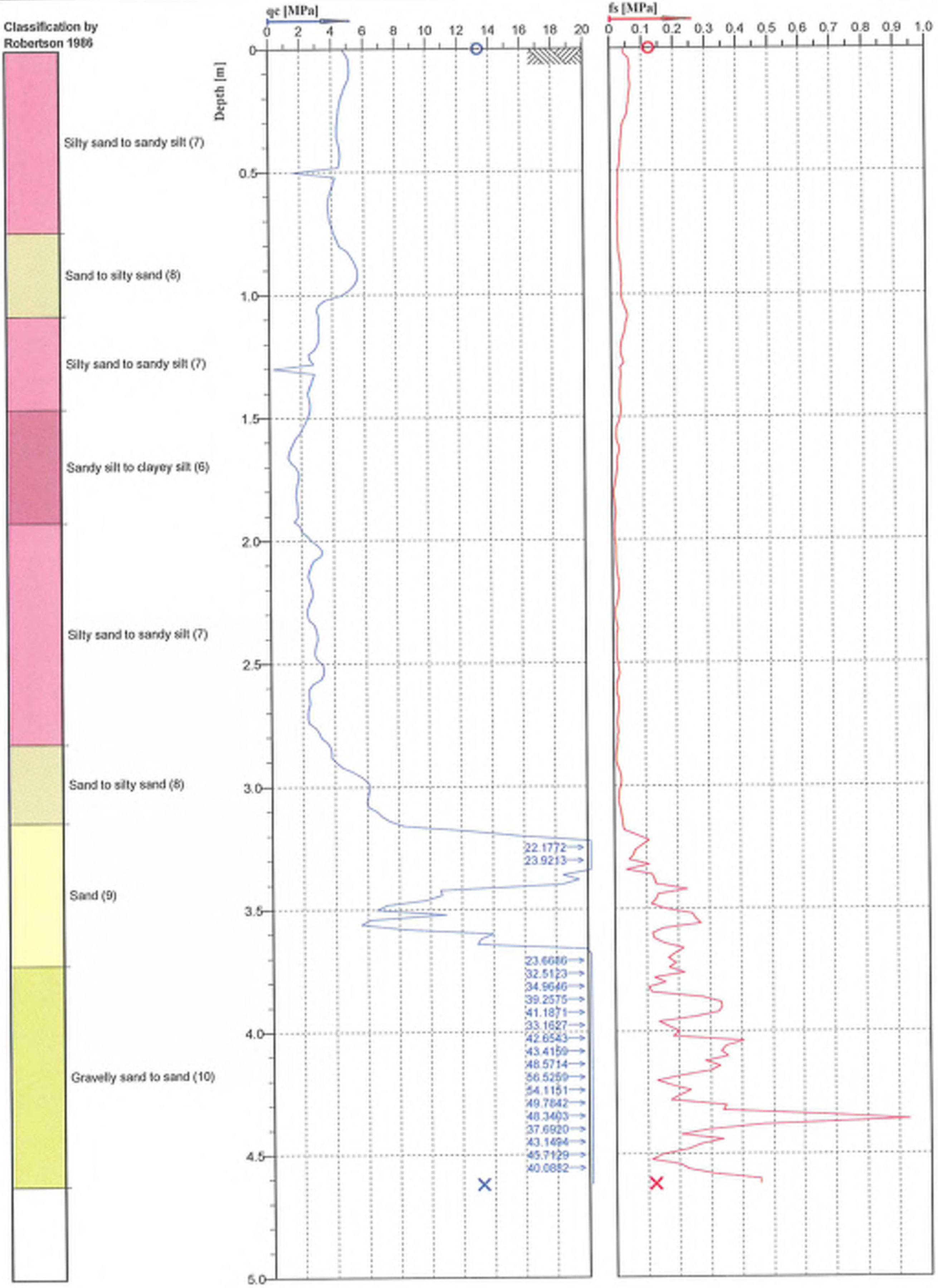
Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 21
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT21.cp	



PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

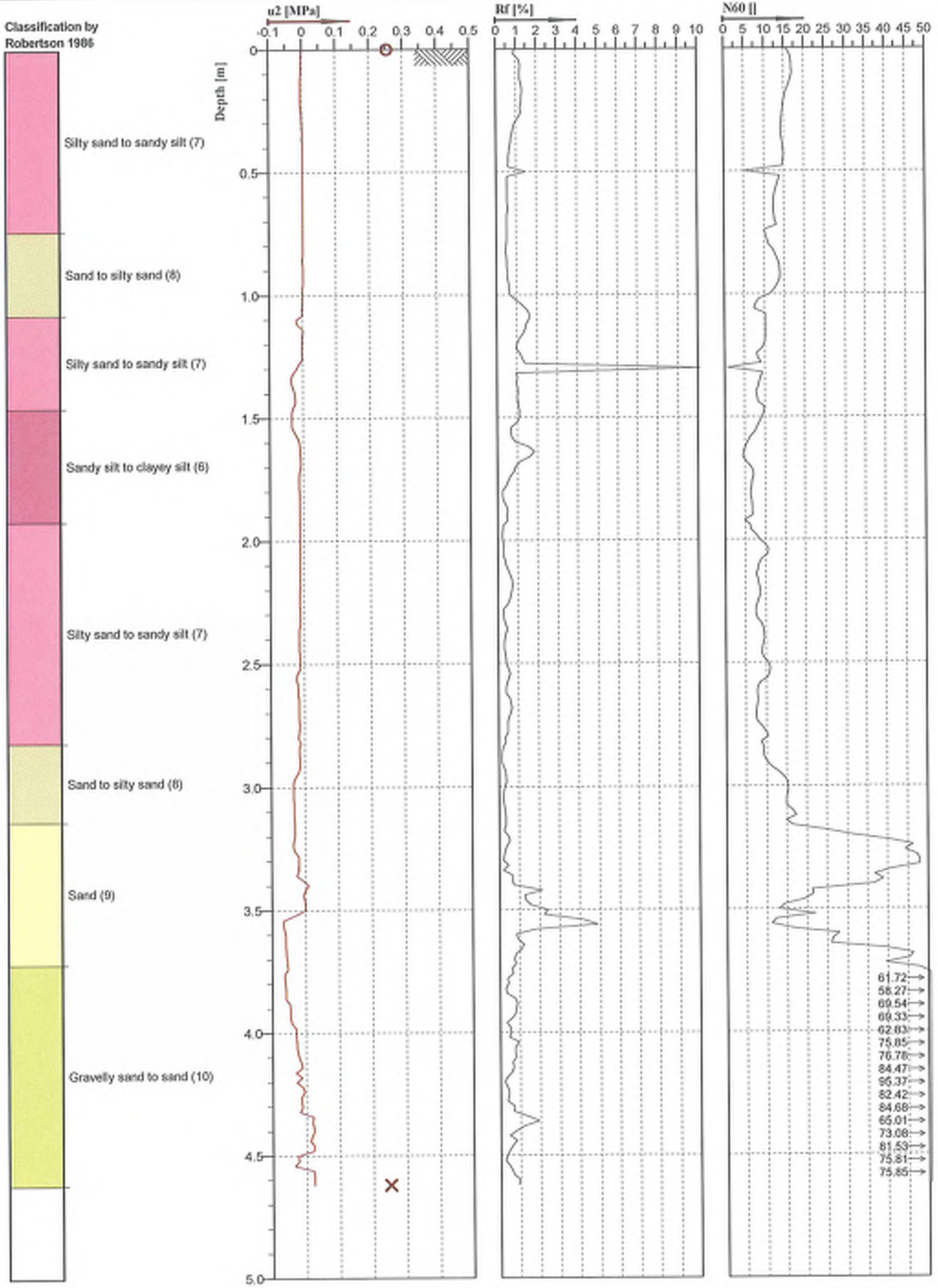
Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 21
Project ID:	Client: Aurecon	Date: 4/21/2013	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT21.cp	



PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

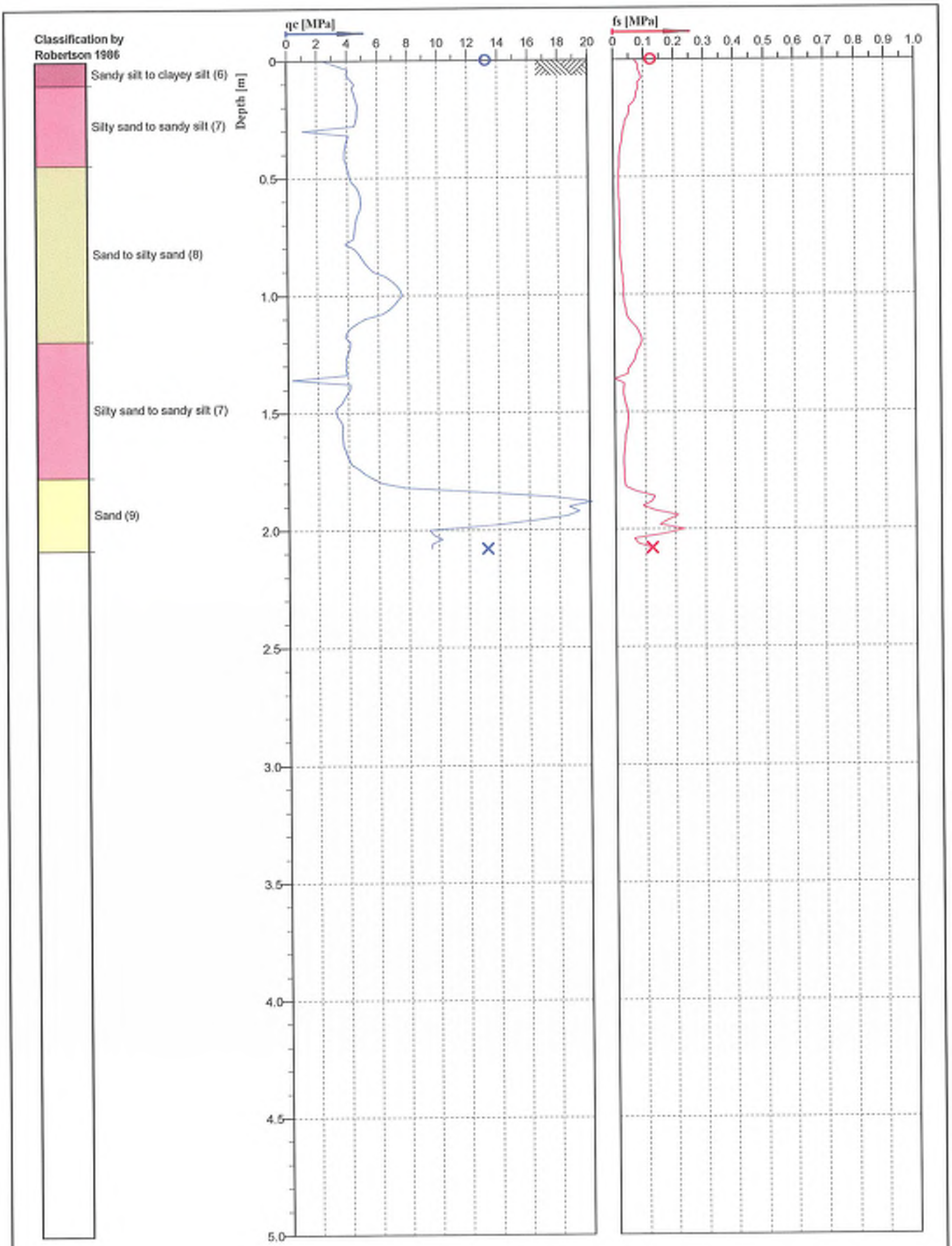
Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 22
Project ID:	Client: Aurecon	Date: 4/23/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT22.cp	



PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 22
Project ID:	Client: Aurecon	Date: 4/23/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT22.cp	

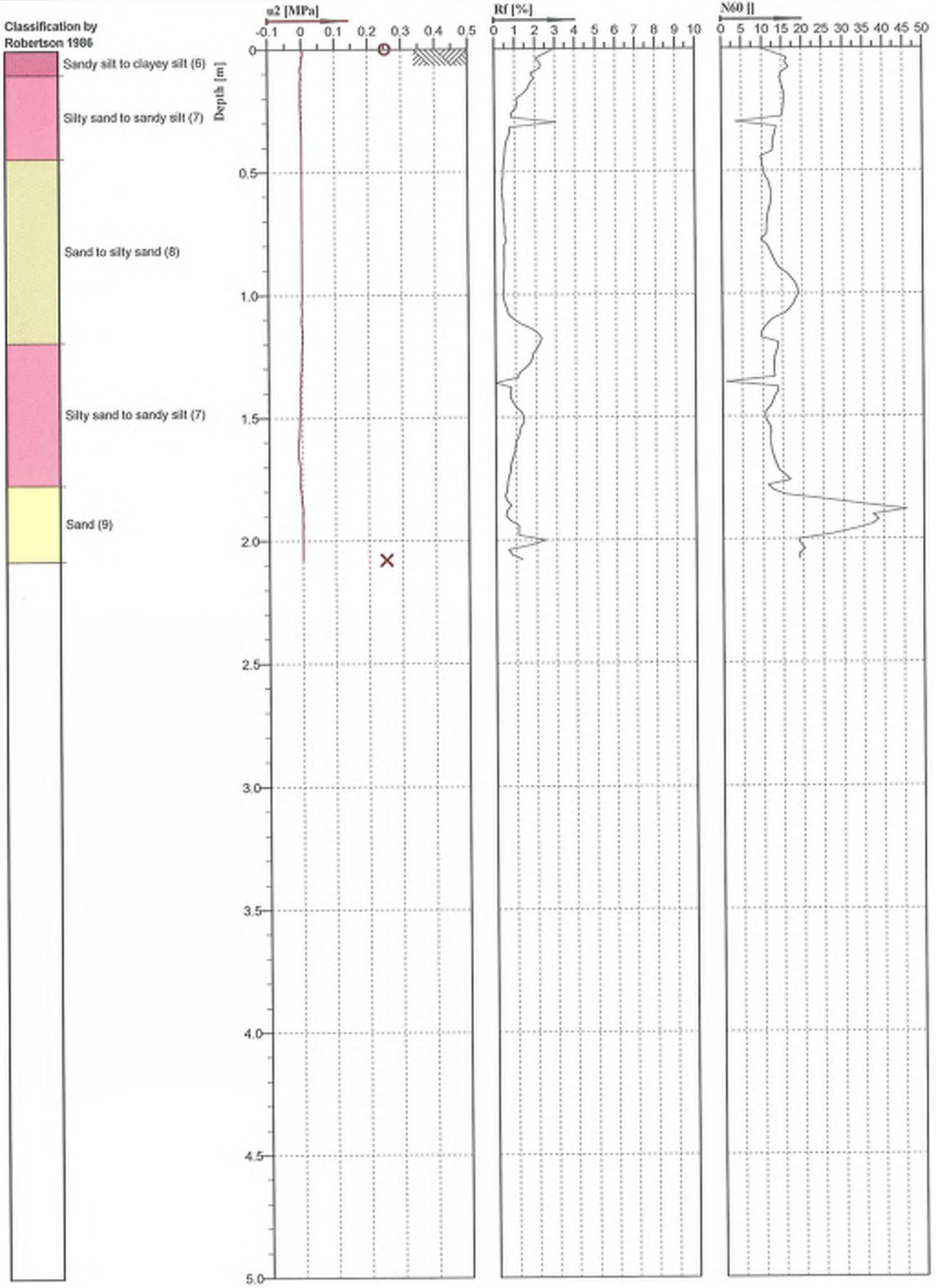


PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637

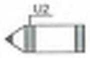
U2

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 23
Project ID:	Client: Aurecon	Date: 4/23/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT23.cp	

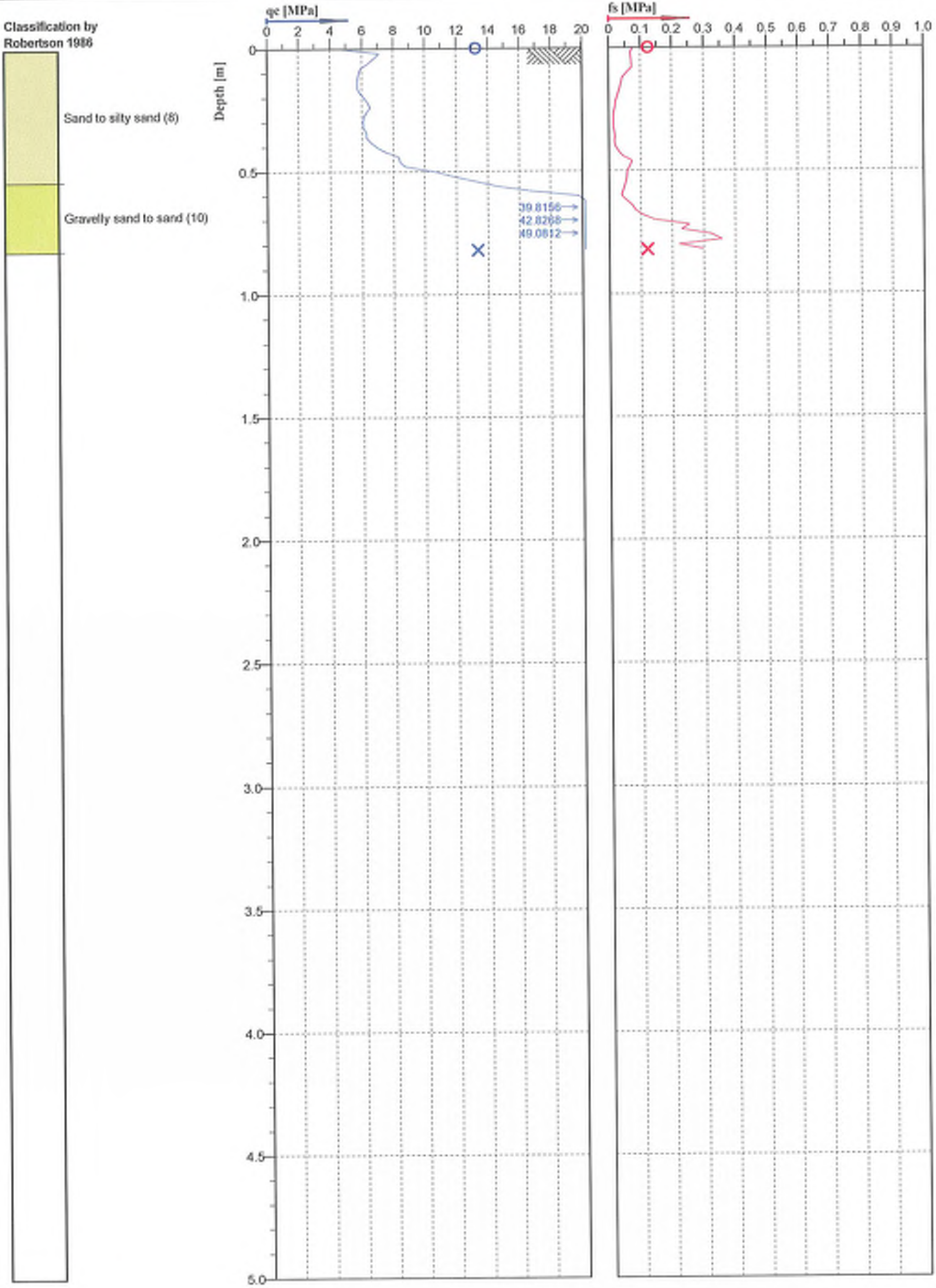


PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637



Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 23
Project ID:	Client: Aurecon	Date: 4/23/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT23.cp	

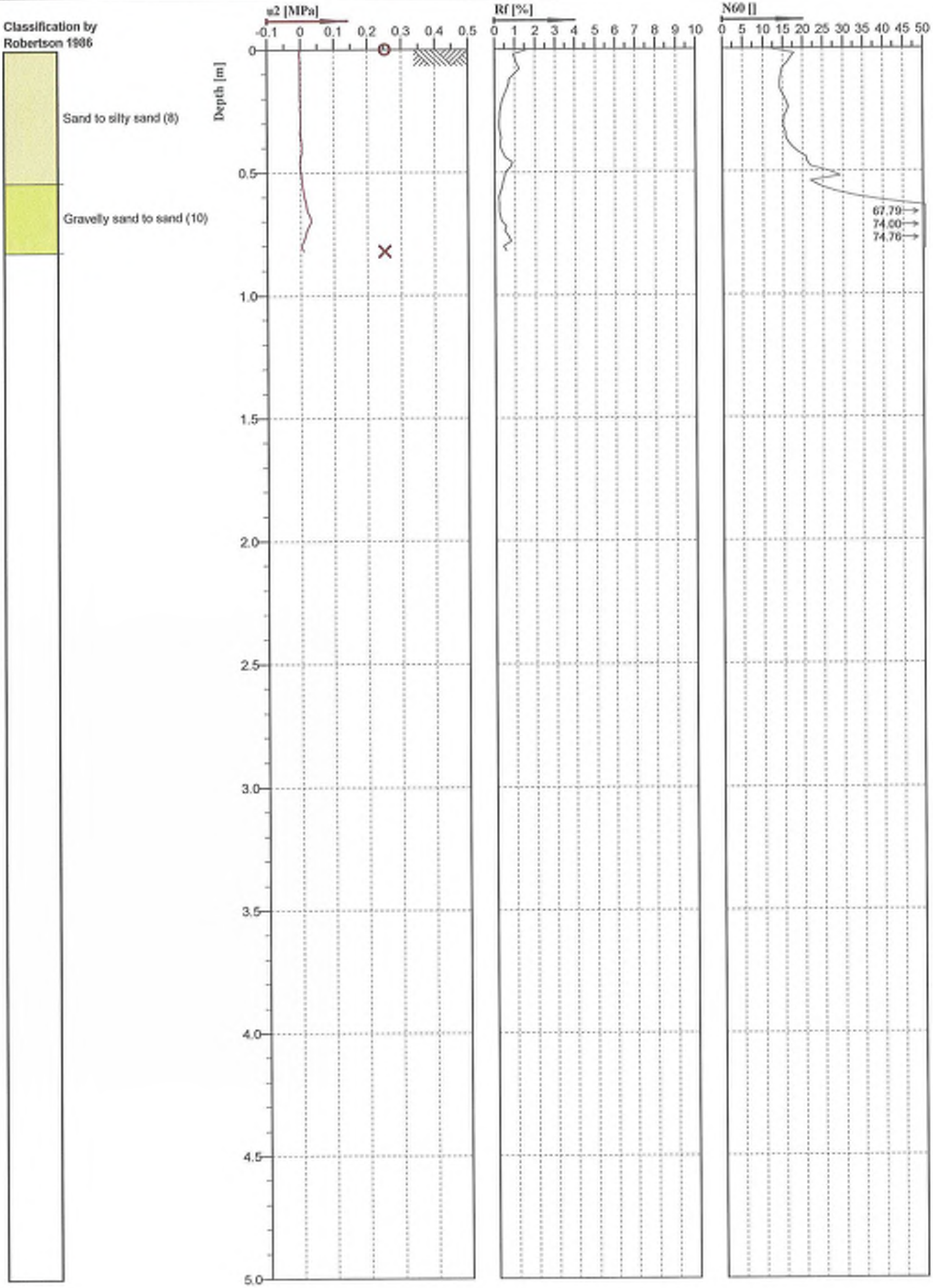


PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637

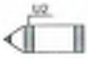
U2

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: CPT24
Project ID:	Client: Aurecon	Date: 4/23/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT24.cp	

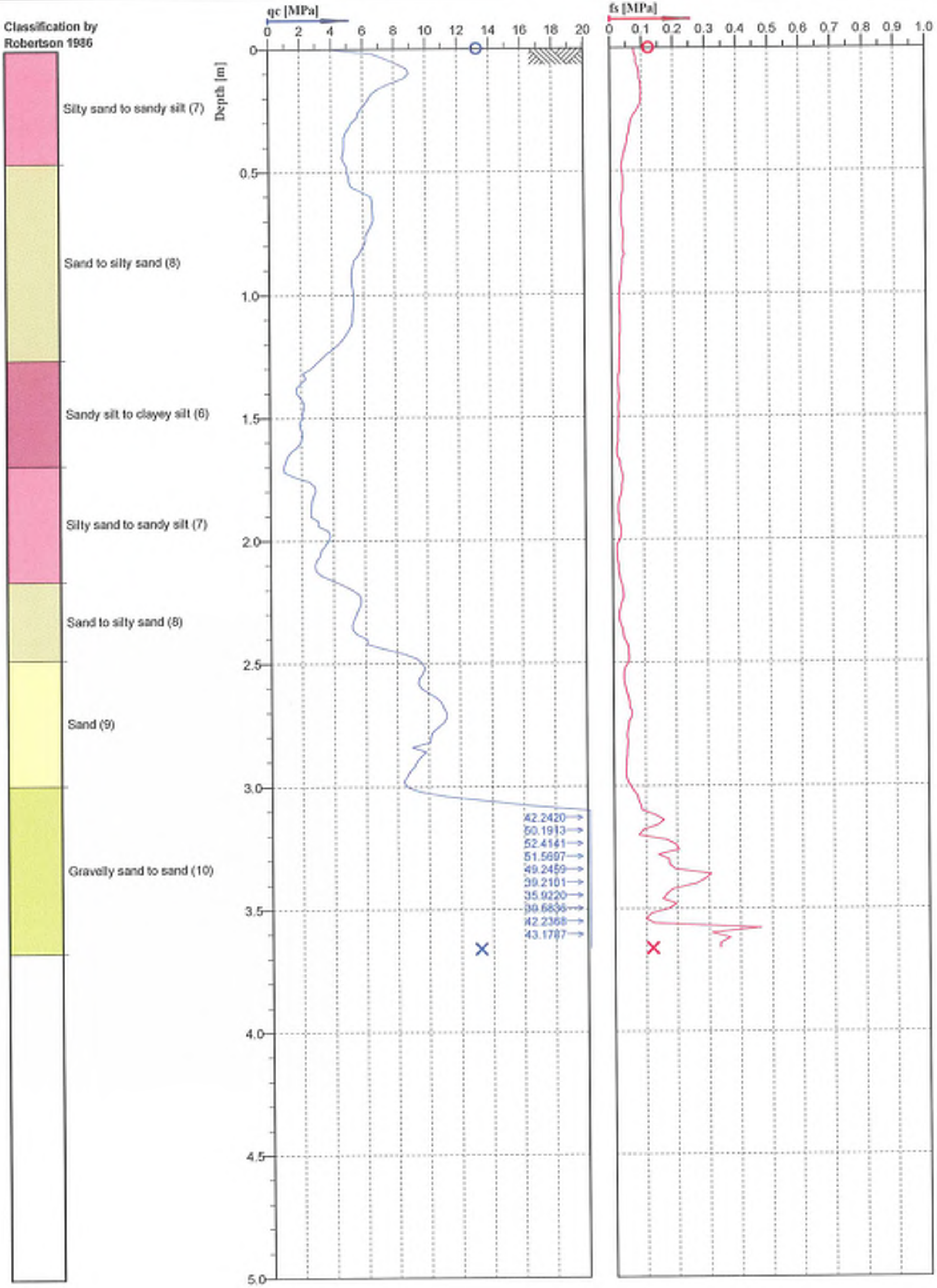


PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637



Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

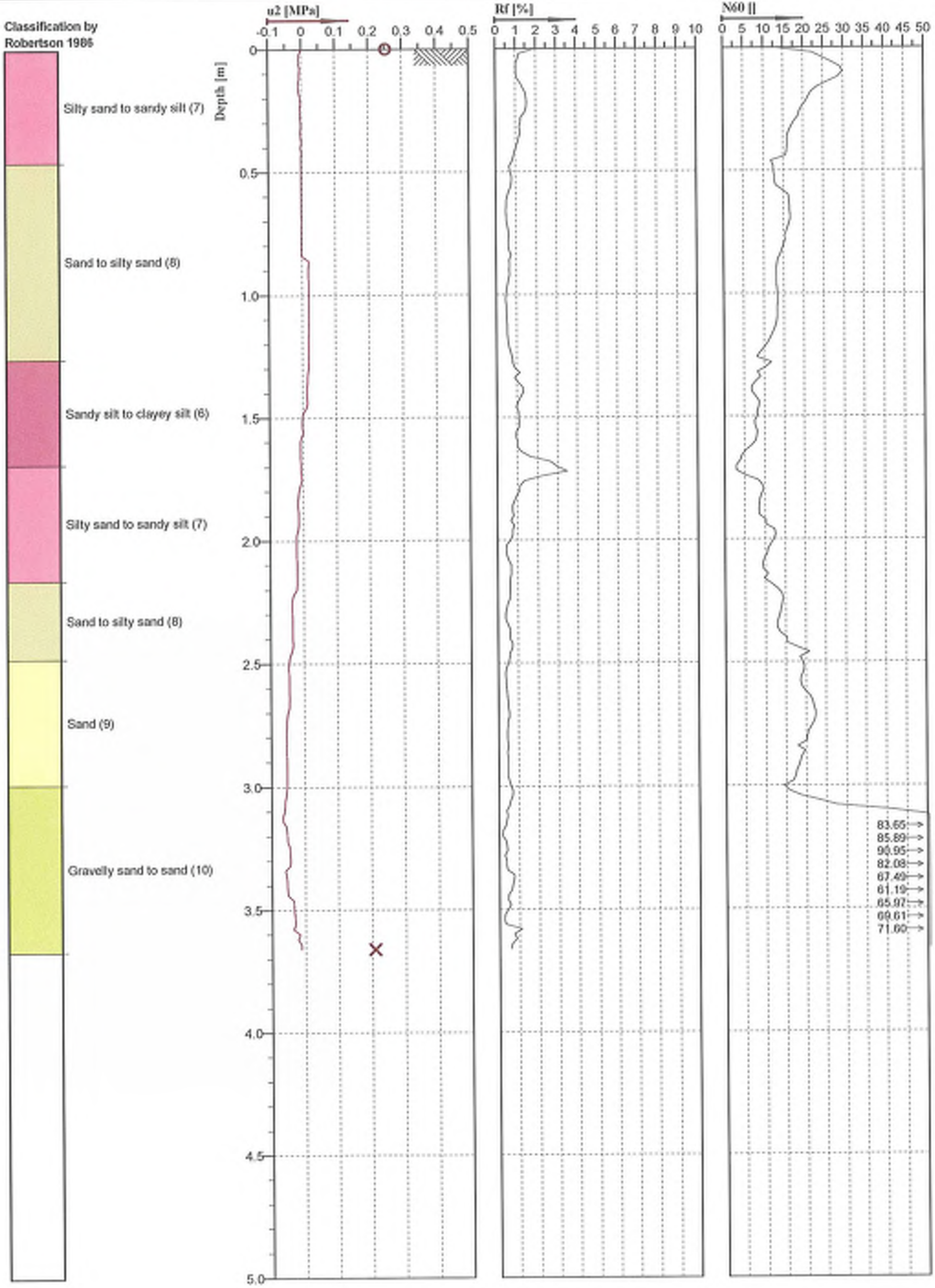
Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: CPT24
Project ID:	Client: Aurecon	Date: 4/23/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT24.cp	



PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

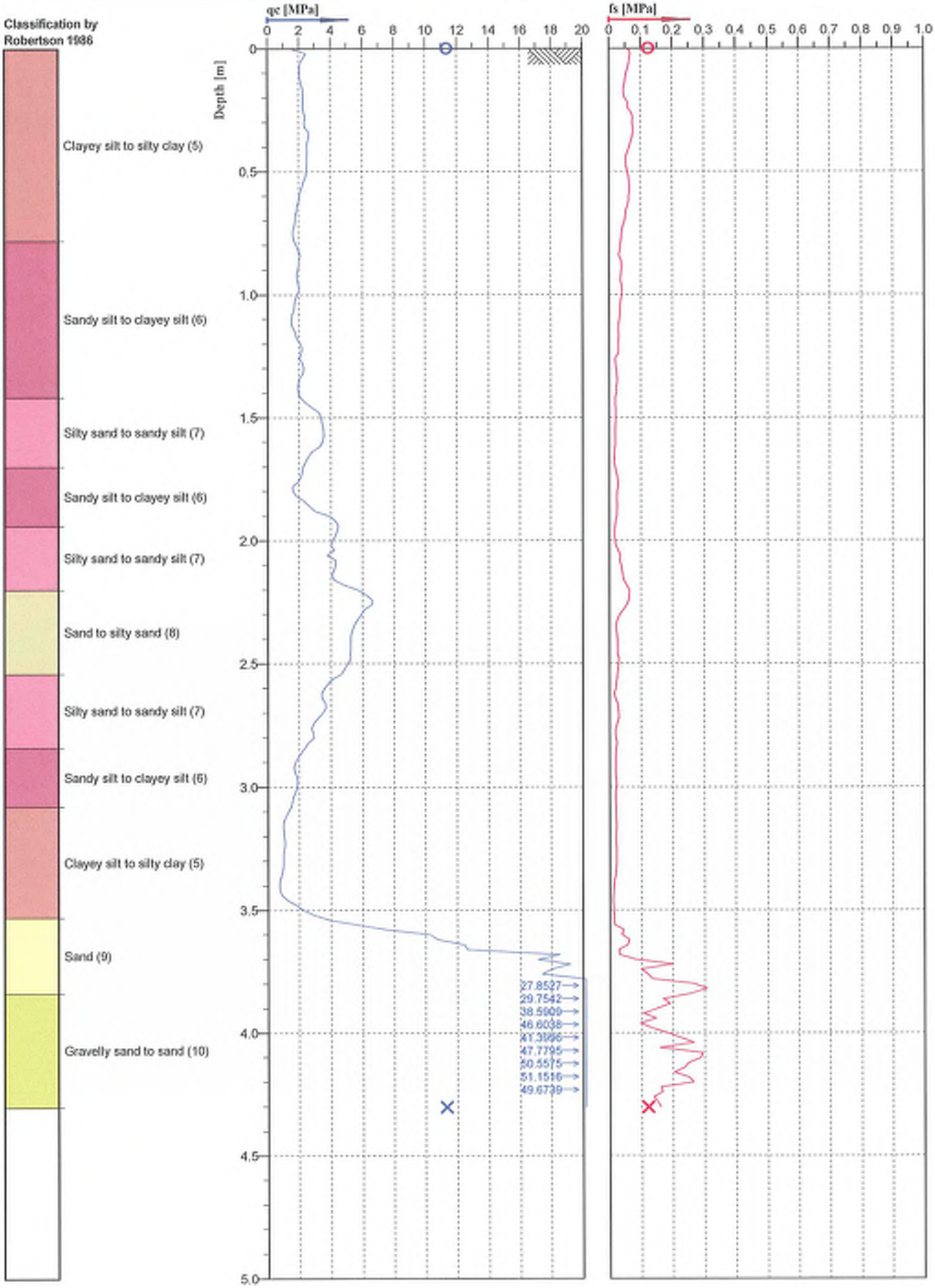
Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: CPT25
Project ID:	Client: Aurecon	Date: 4/23/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT25.cp	



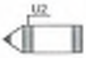
PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637

Cone No: 4439
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: CPT25
Project ID:	Client: Aurecon	Date: 4/23/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT25.cp	

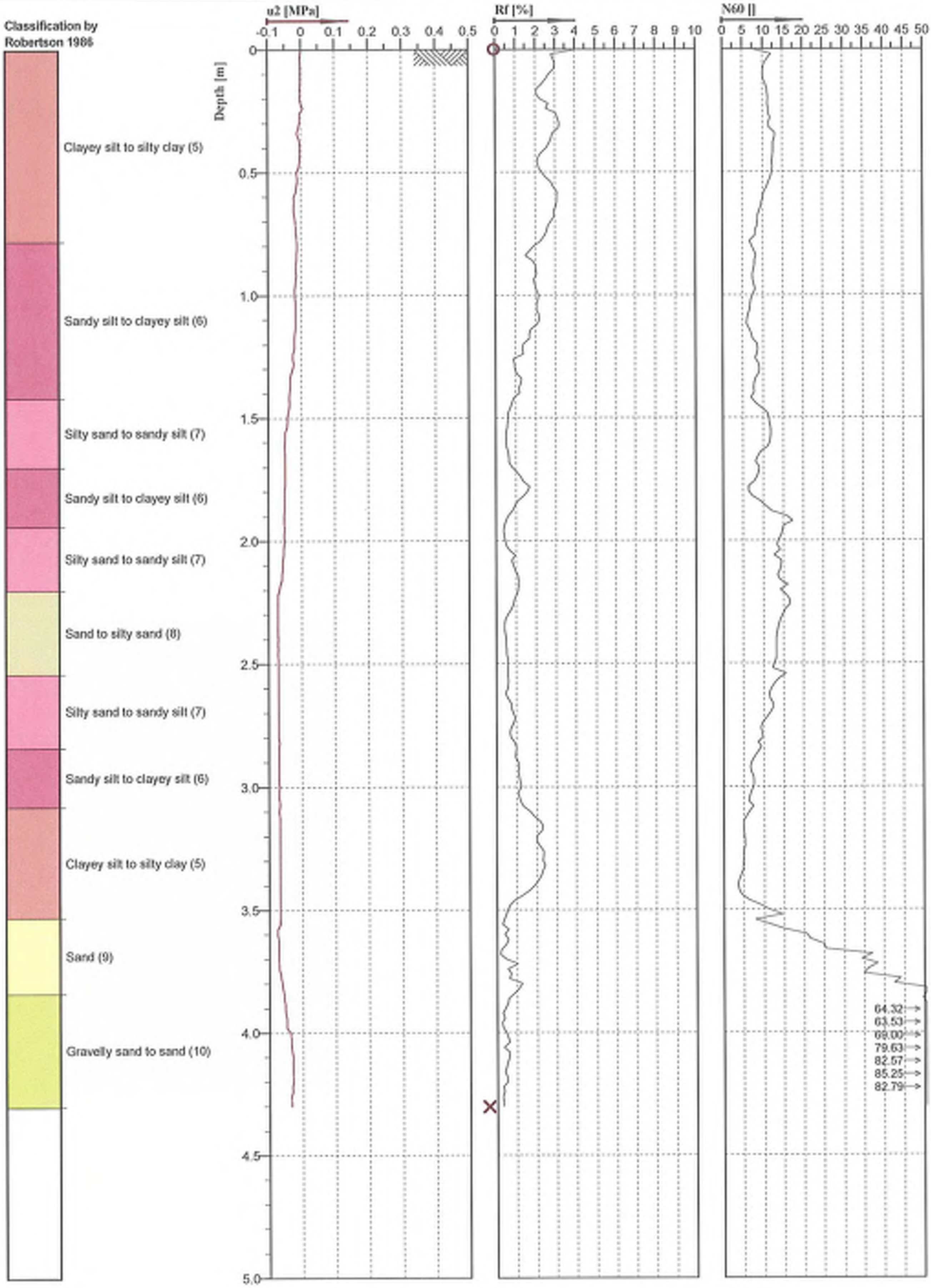


PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637



Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

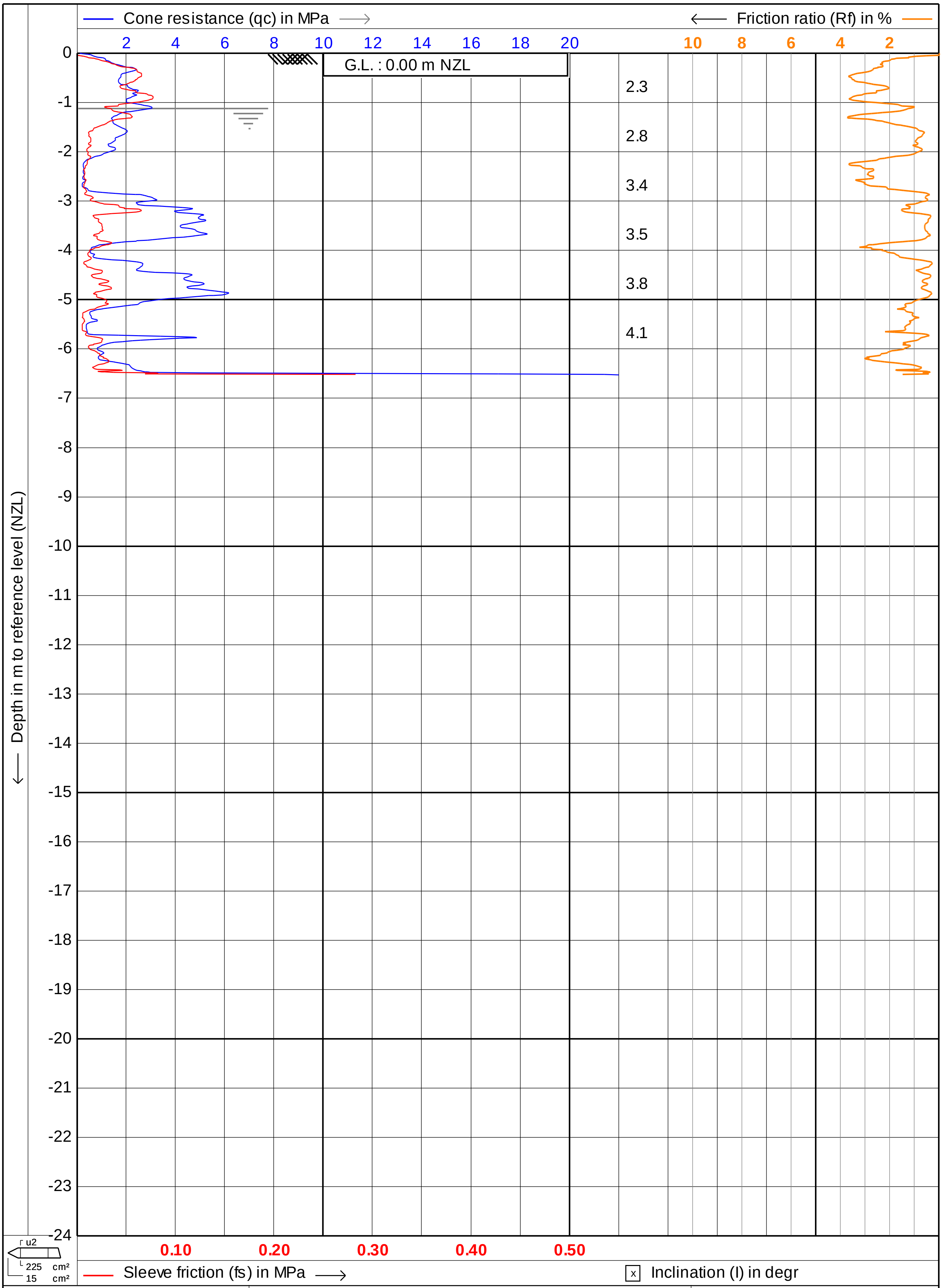
Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 27
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT27.cp	



PRO-DRILL
SPECIALIST DRILLING ENGINEERS
0800 477 637

Cone No: 4485
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Rosemarryn Subdivision	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 27
Project ID:	Client: Aurecon	Date: 4/20/2012	Scale: 1 : 22
Project: ROSEMARRYN		Page: 1/1	Fig:
		File: RosemarrynSubdivisionCPT27.cp	



DCN DRILLING LTD
0274 735 011

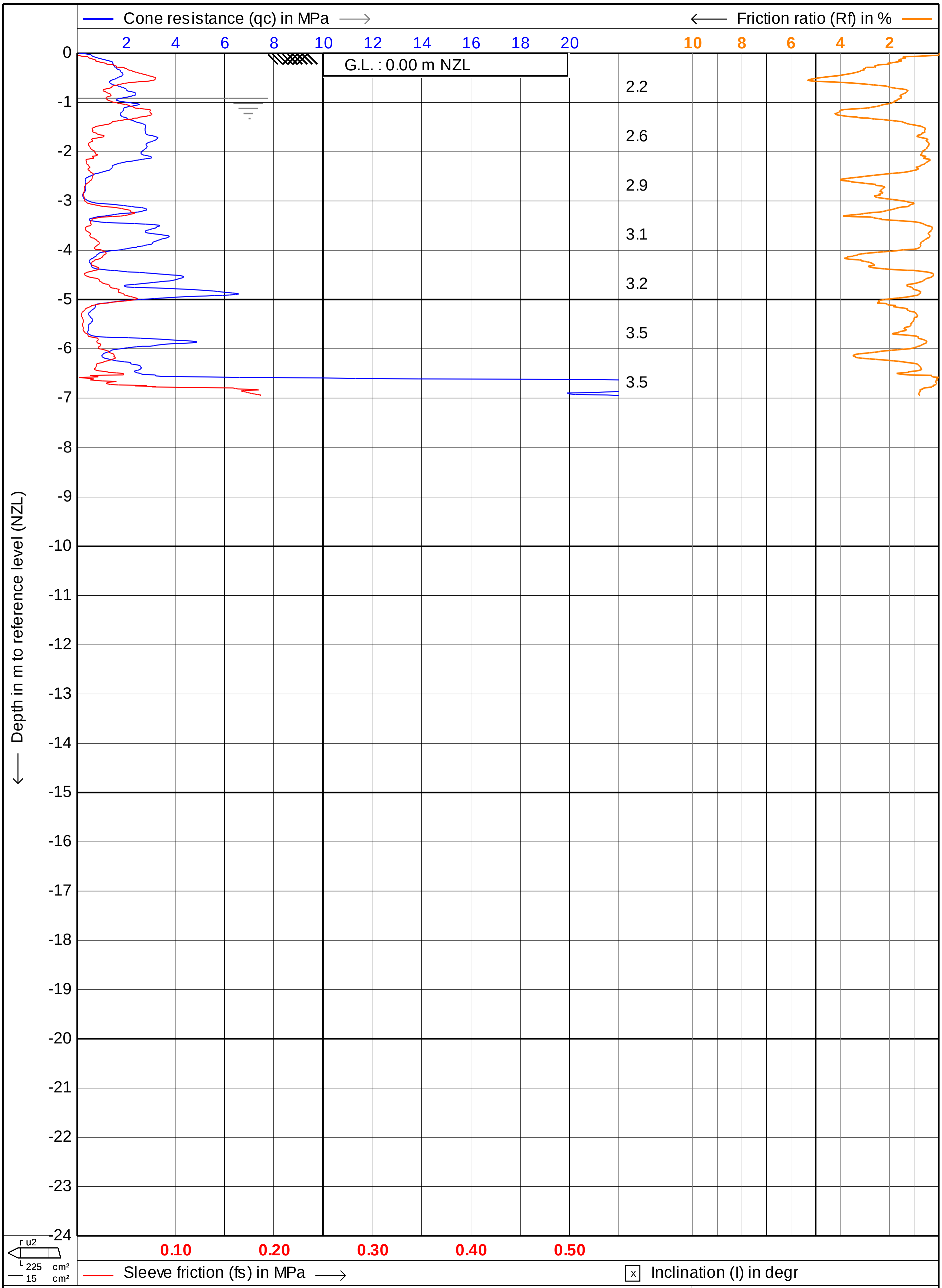
Test according ASTM Standard D 5778-07

Project : **Rosemerryn Subdivision**

Location: **Lincoln**

Date : **30-9-2013**
Cone no. : **S15CFIIP.S12008**
Project no. : **224464**
CPT no. : **cpt1** **1/15**

1.40



DCN DRILLING LTD
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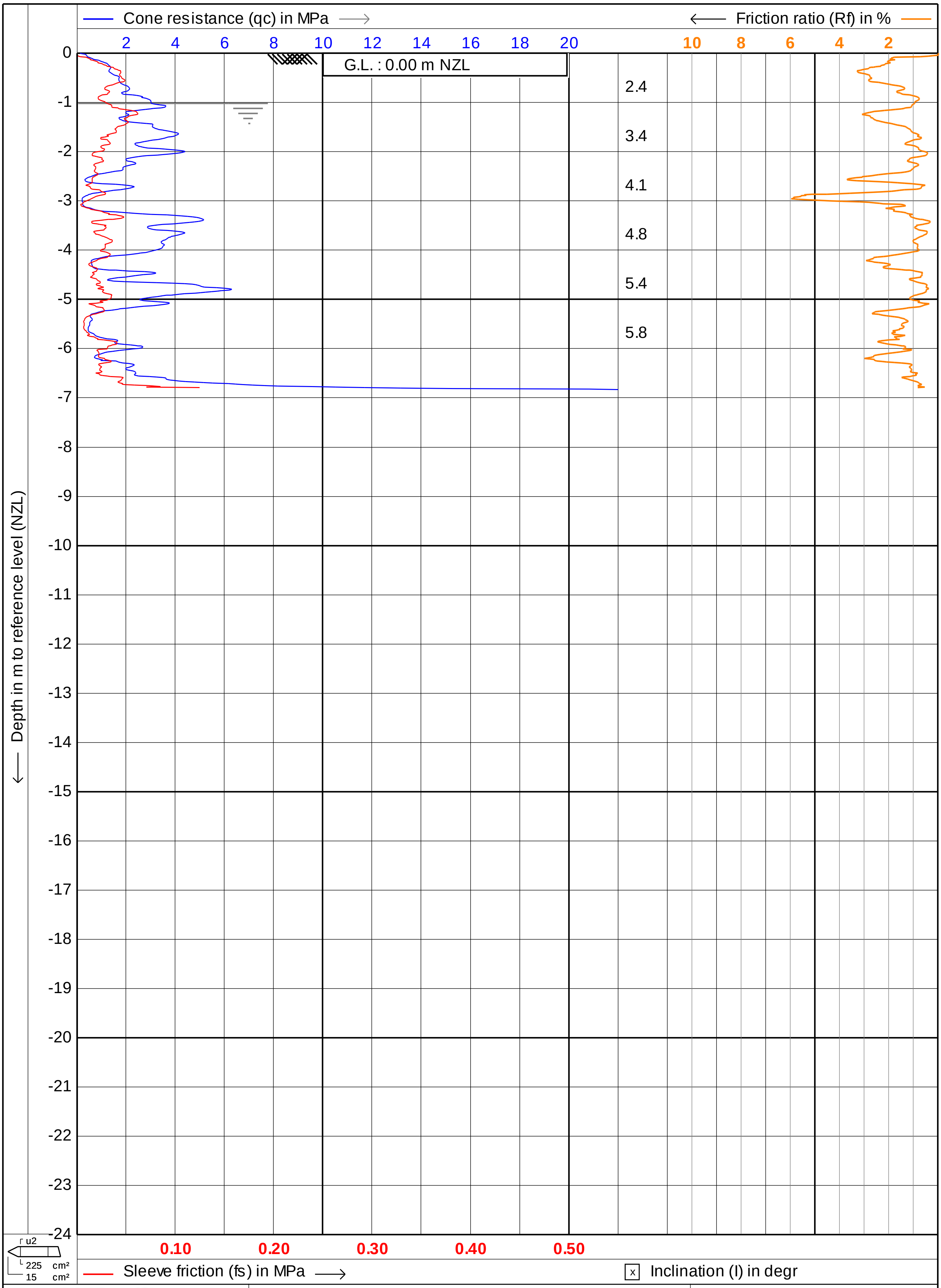
Test according ASTM Standard D 5778-07

Project : **Rosemerryn Subdivision**

Location: **Lincoln**

Date : **1-10-2013**
Cone no. : **S15CFIIP.S12008**
Project no. : **224464**
CPT no. : **cpt2** **1/15**

1.40



DCN DRILLING LTD
0274 735 011

Test according ASTM Standard D 5778-07

Project : **Rosemerryn Subdivision**

Location: **Lincoln**

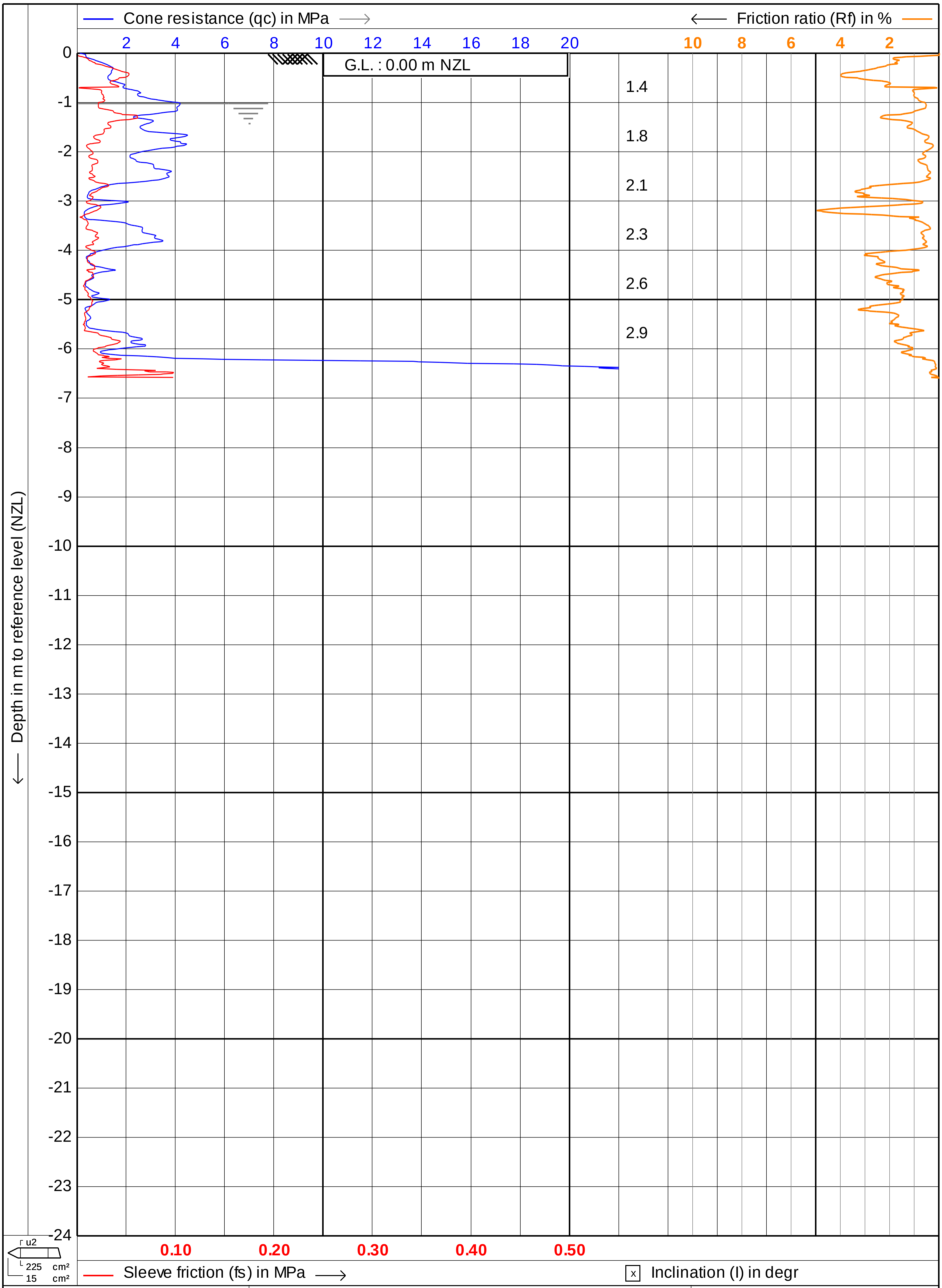
Date : **30-9-2013**

Cone no. : **S15CFIIP.S12008**

Project no. : **224464**

CPT no. : **cpt3** **1/15**

1.40



DCN DRILLING LTD
0274 735 011

Test according ASTM Standard D 5778-07

Project : **Rosemerryn Subdivision**

Location: **Lincoln**

Date : **1-10-2013**

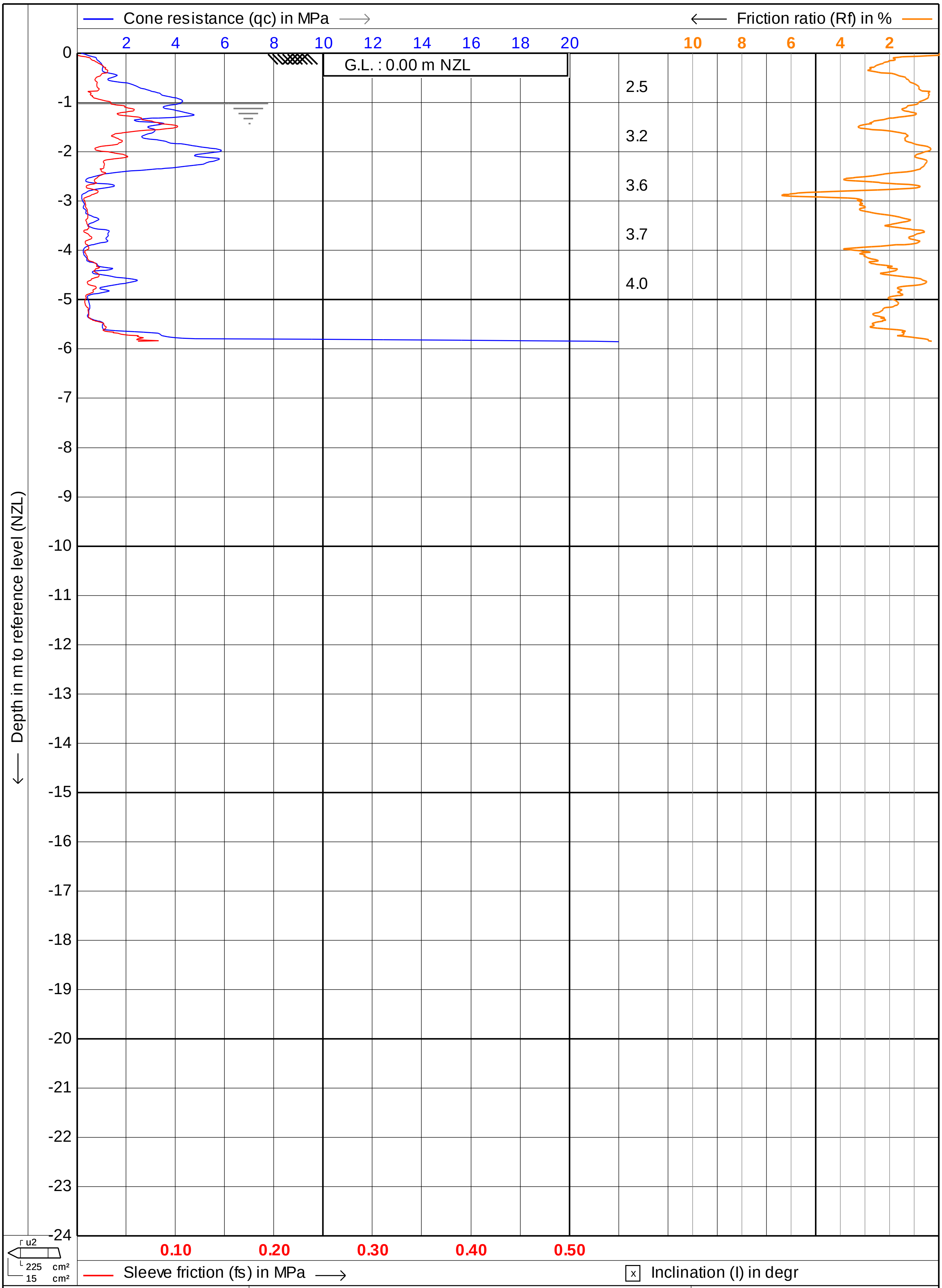
Cone no. : **S15CFIIP.S12008**

Project no. : **224464**

CPT no. : **cpt4**

1/15

1.40



DCN DRILLING LTD
0274 735 011

Test according ASTM Standard D 5778-07

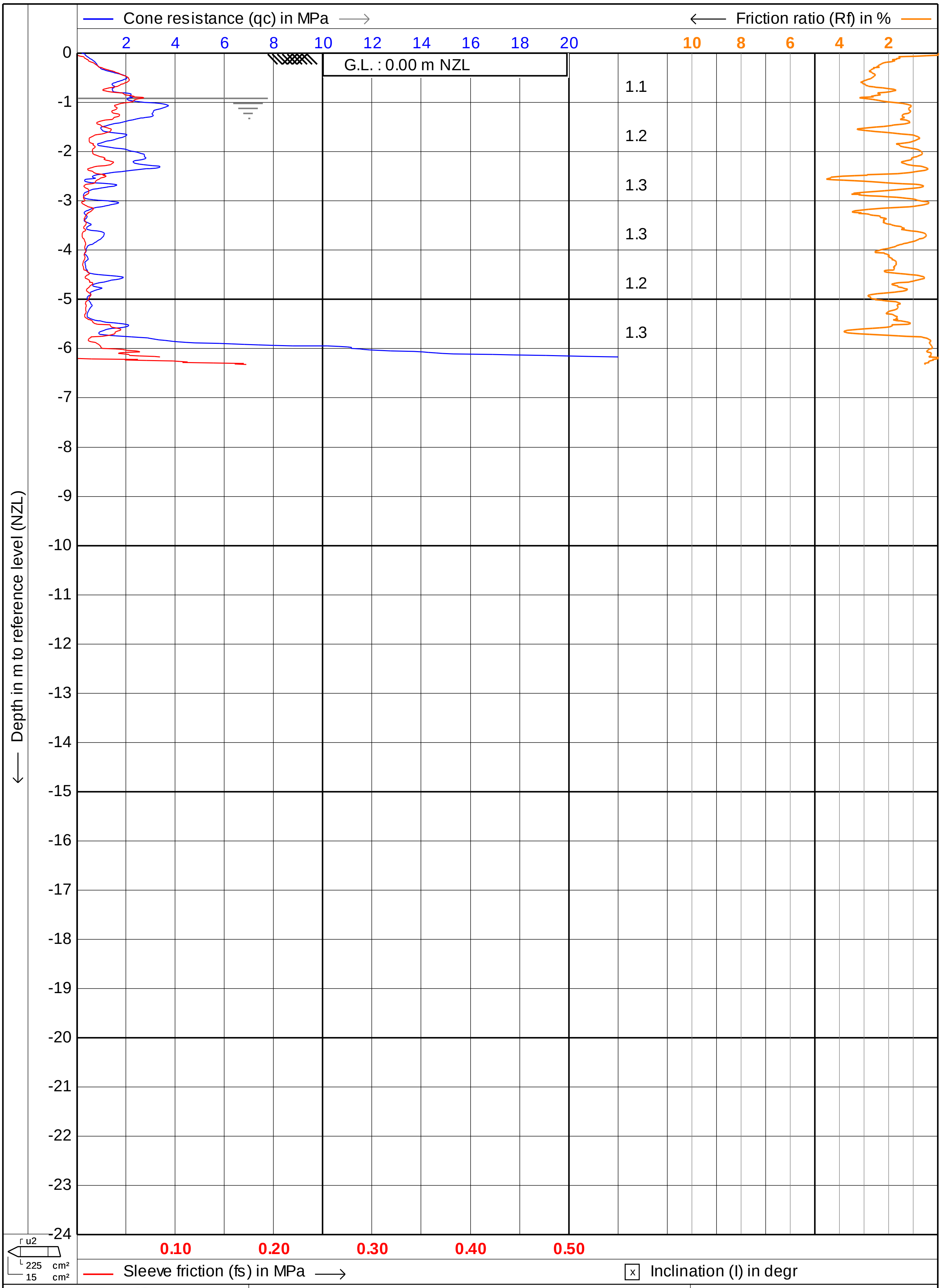
Project : **Rosemerryn Subdivision**

Location: **Lincoln**

Date : **30-9-2013**
Cone no. : **S15CFIIP.S12008**
Project no. : **224464**
CPT no. : **cpt5**

1/15

1.40



DCN DRILLING LTD
0274 735 011

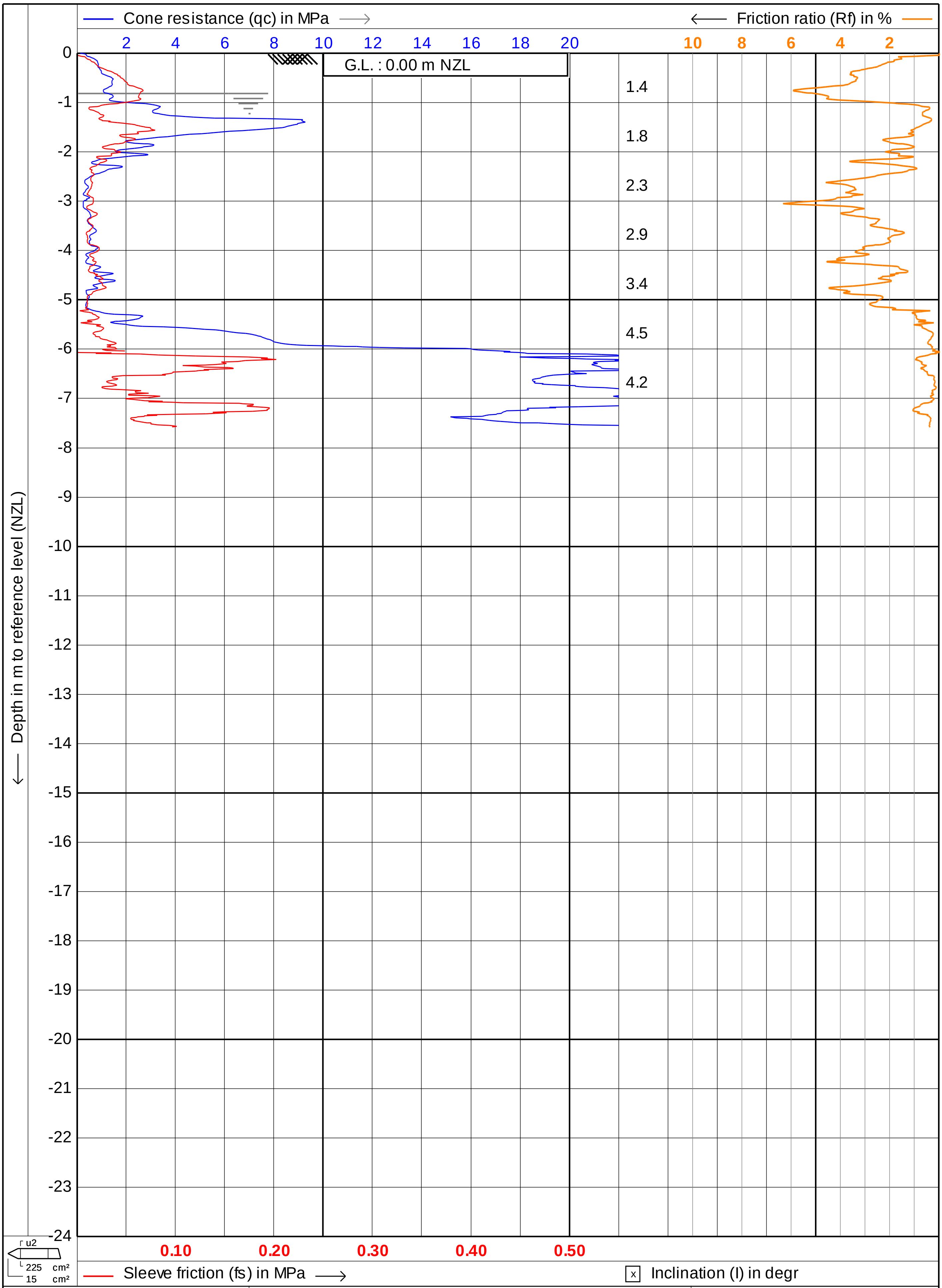
Test according ASTM Standard D 5778-07

Project : **Rosemerryn Subdivision**

Location: **Lincoln**

Date : **1-10-2013**
Cone no. : **S15CFIIP.S12008**
Project no. : **224464**
CPT no. : **cpt6**
1/15

1.40



DCN DRILLING LTD
0274 735 011

Test according ASTM Standard D 5778-07

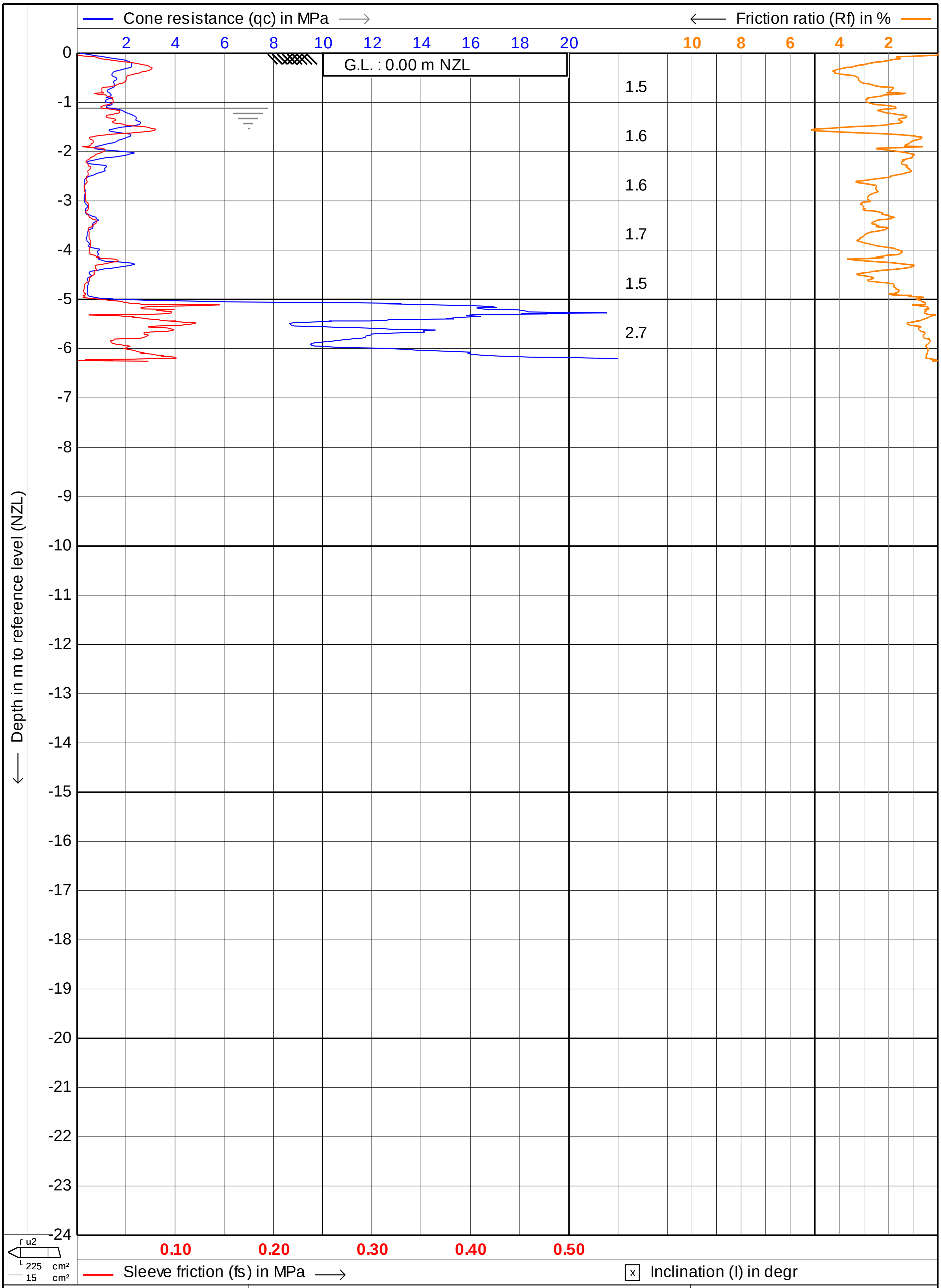
Project : **Rosemerryn Subdivision**

Location: **Lincoln**

Date : **30-9-2013**
Cone no. : **S15CFIIP.S12008**
Project no. : **224464**
CPT no. : **cpt7**

1/15

1.40



DCN DRILLING LTD
0274 735 011

Test according ASTM Standard D 5778-07

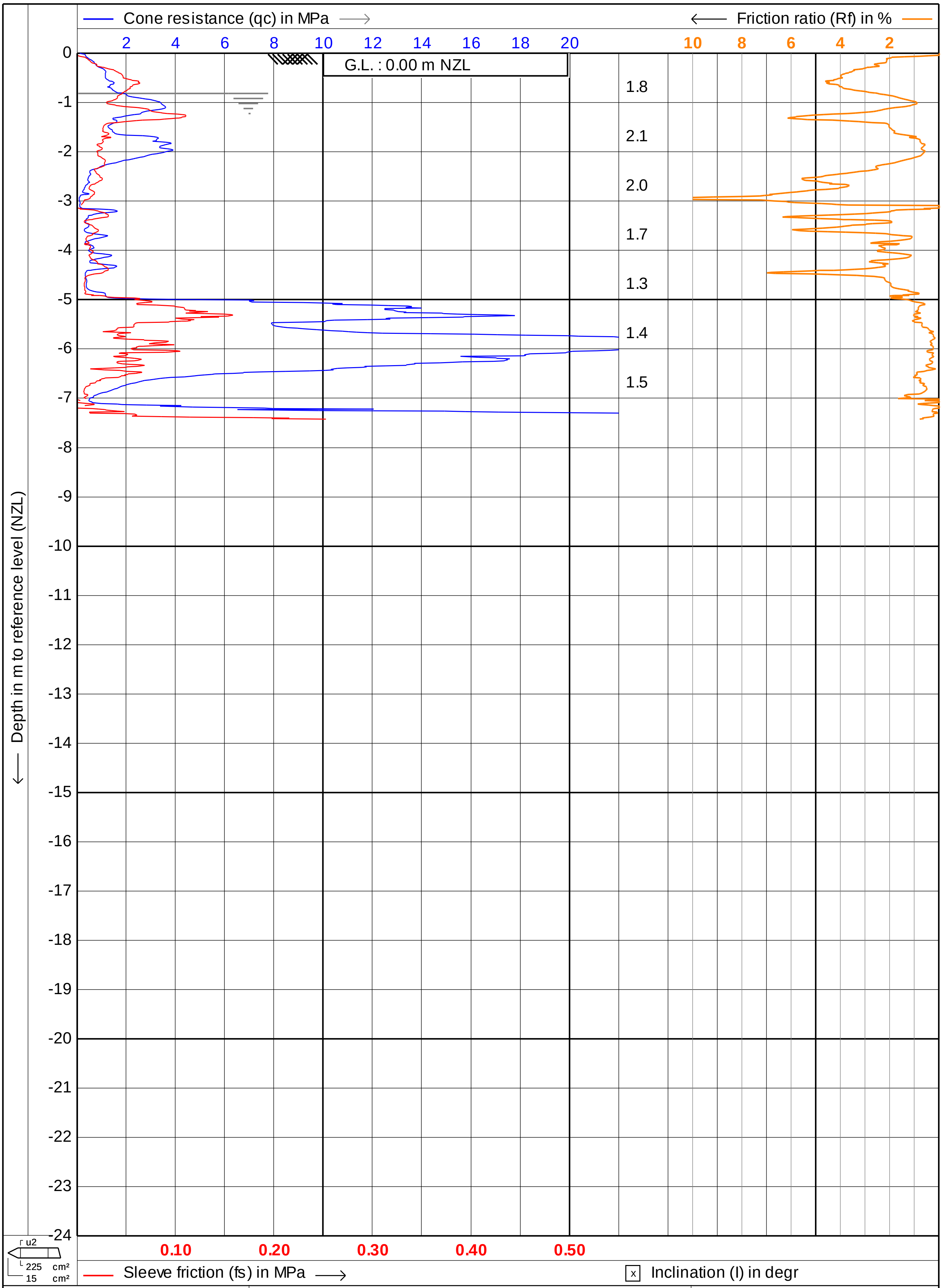
Project : **Rosemerryn Subdivision**

Location: **Lincoln**

Date : **30-9-2013**
Cone no. : **S15CFIIP.S12008**
Project no. : **224464**
CPT no. : **cpt8**

1/15

1.40



DCN DRILLING LTD
0274 735 011

Test according ASTM Standard D 5778-07

Project : **Rosemerryn Subdivision**

Location: **Lincoln**

Date : **1-10-2013**

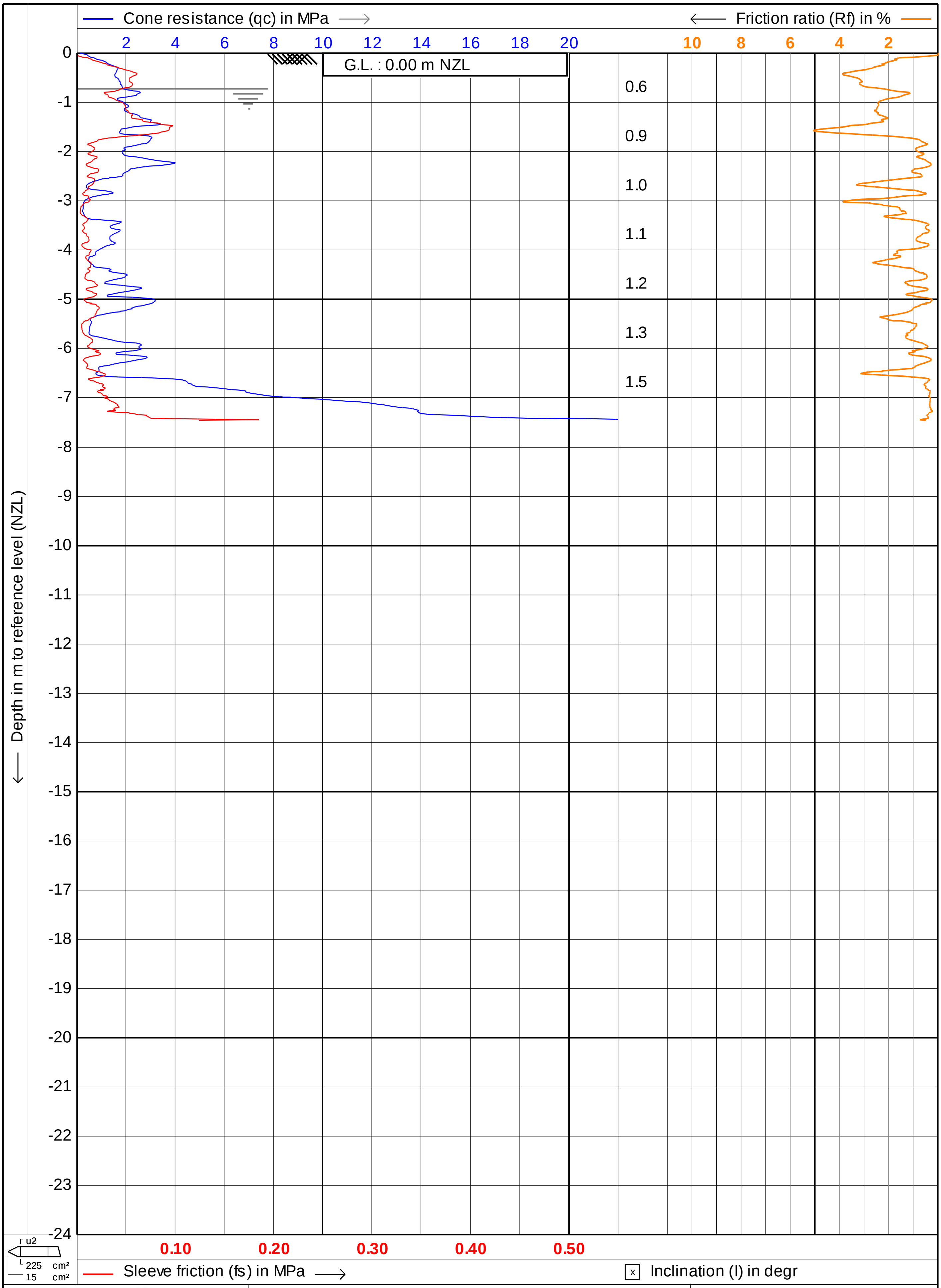
Cone no. : **S15CFIIP.S12008**

Project no. : **224464**

CPT no. : **cpt9**

1/15

1.40



1.40

DCN DRILLING LTD
0274 735 011

Test according ASTM Standard D 5778-07

Project : **Rosemerryn Subdivision**

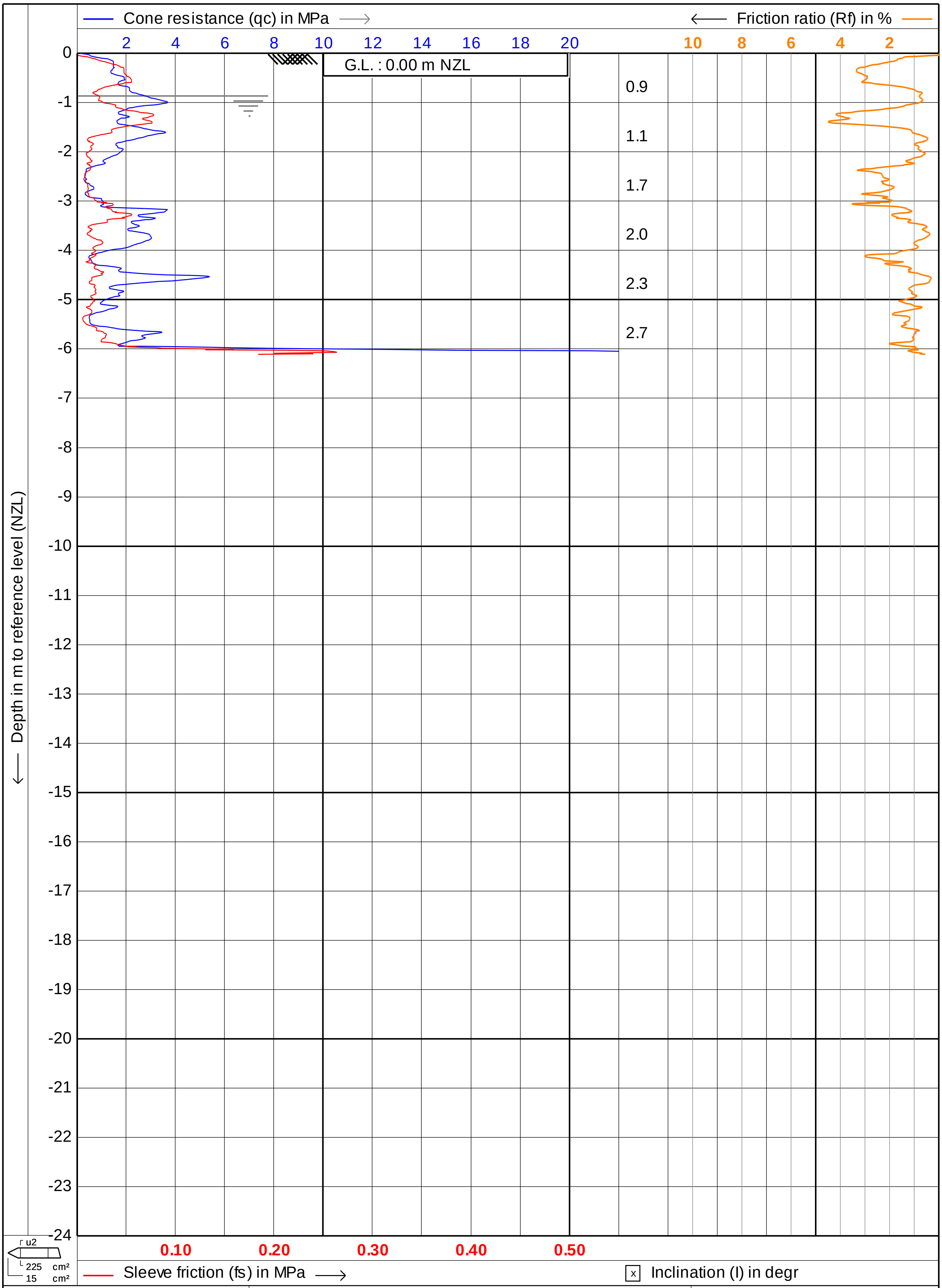
Location: **Lincoln**

Date : **1-10-2013**

Cone no. : **S15CFIIP.S12008**

Project no. : **224464**

CPT no. : **cpt10** **1/15**



DCN DRILLING LTD
0274 735 011

Test according ASTM Standard D 5778-07

Project : **Rosemerryn Subdivision**

Location: **Lincoln**

Date : **1-10-2013**

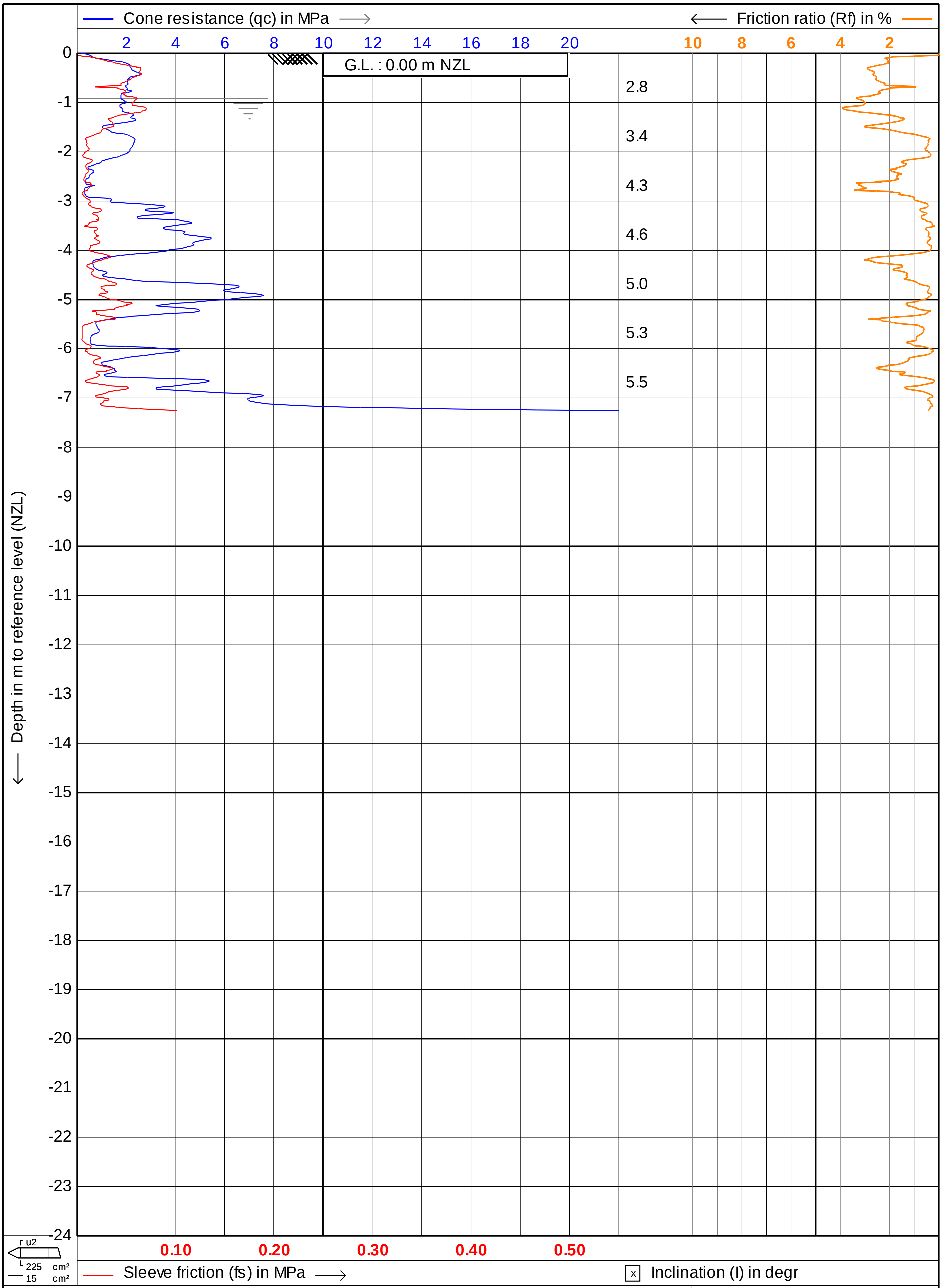
Cone no. : **S15CFIIP.S12008**

Project no. : **224464**

CPT no. : **cpt11**

1/15

1.40



DCN DRILLING LTD
0274 735 011

Test according ASTM Standard D 5778-07

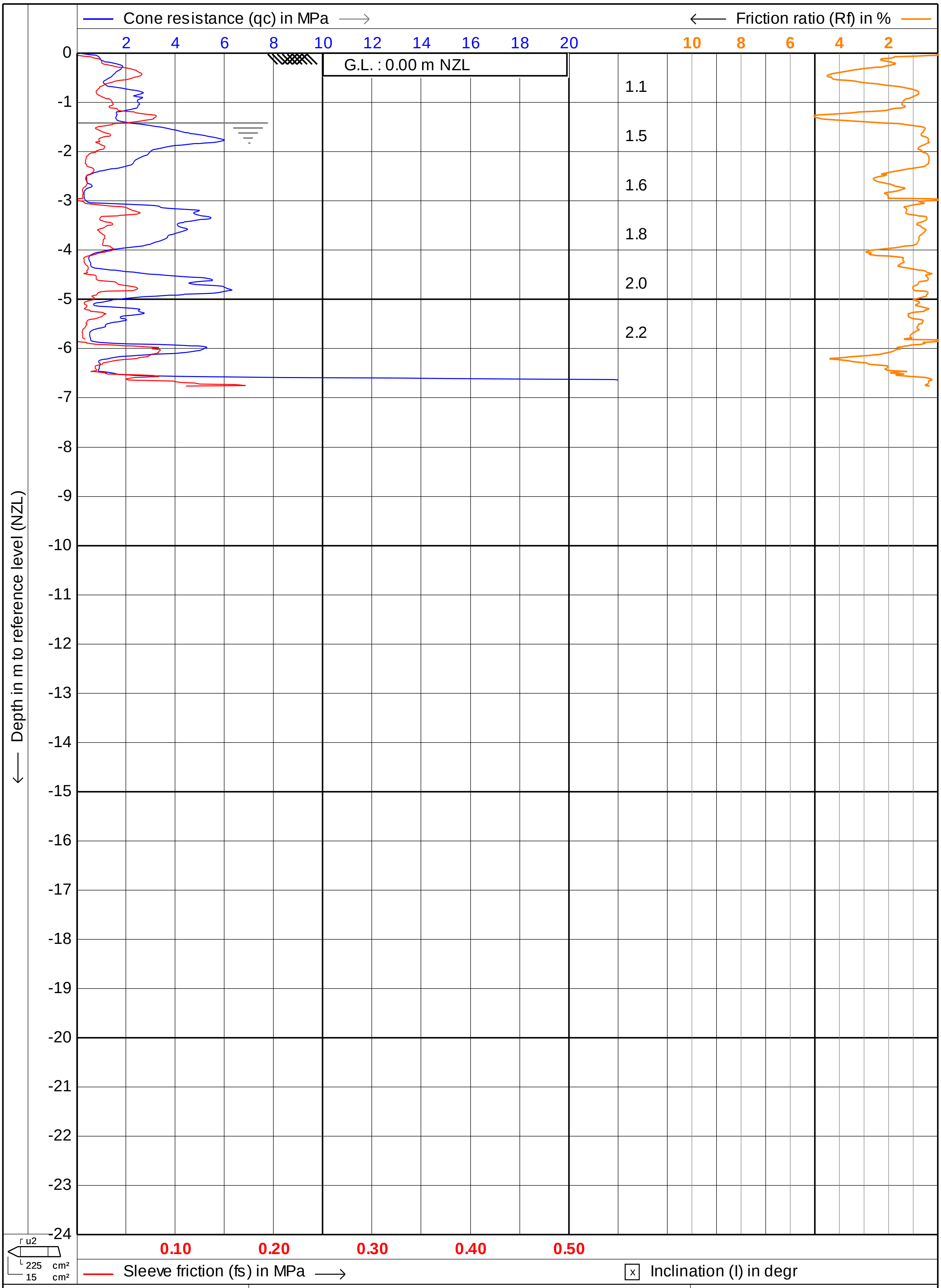
Project : **Rosemerryn Subdivision**

Location: **Lincoln**

Date : **30-9-2013**
Cone no. : **S15CFIIP.S12008**
Project no. : **224464**
CPT no. : **cpt12**

1/15

1.40



DCN DRILLING LTD
0274 735 011

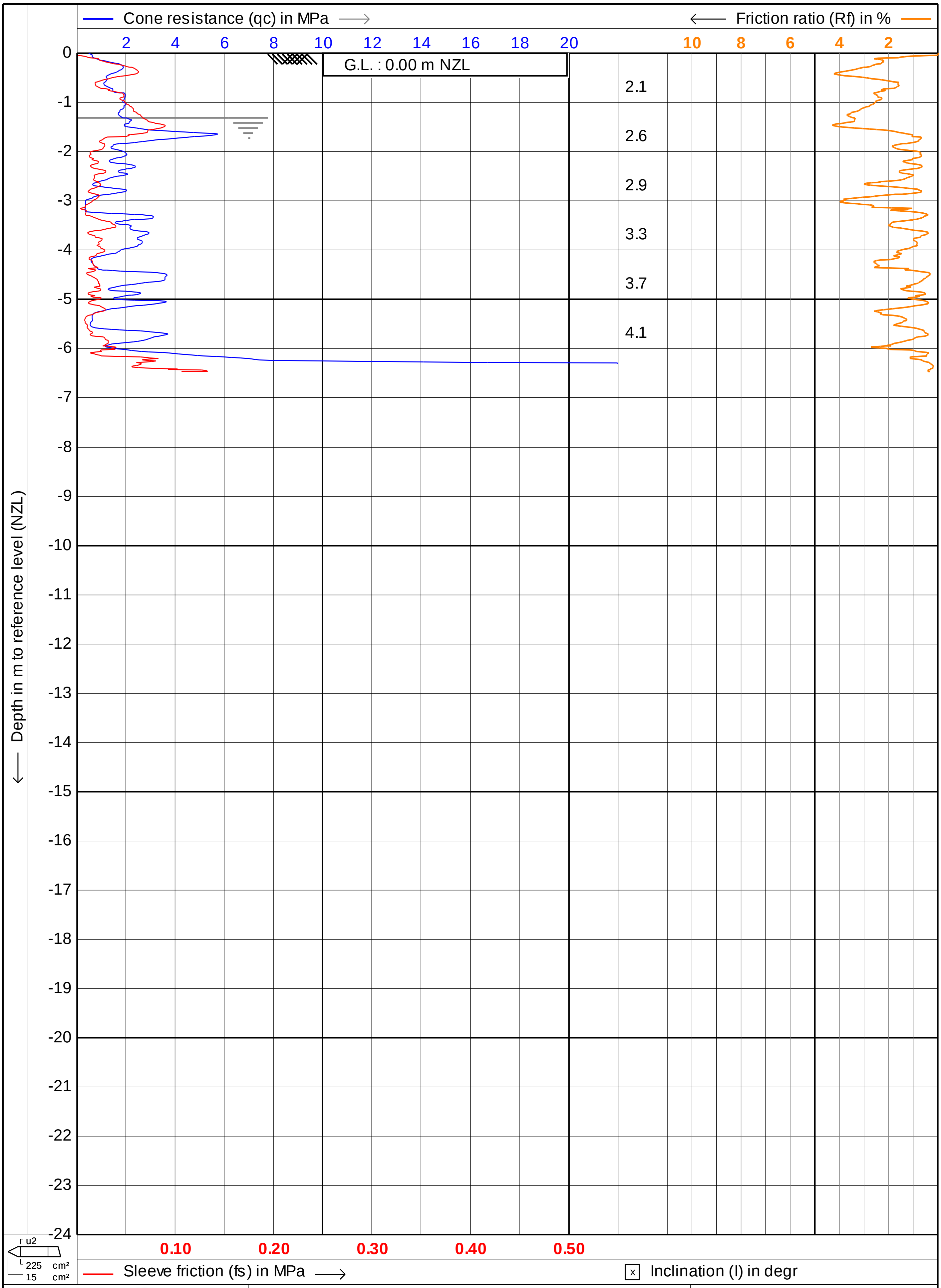
Test according ASTM Standard D 5778-07

Project : **Rosemerryn Subdivision**

Location: **Lincoln**

Date : **30-9-2013**
Cone no. : **S15CFIIP.S12008**
Project no. : **224464**
CPT no. : **cpt13** **1/15**

1.40



DCN DRILLING LTD
0274 735 011

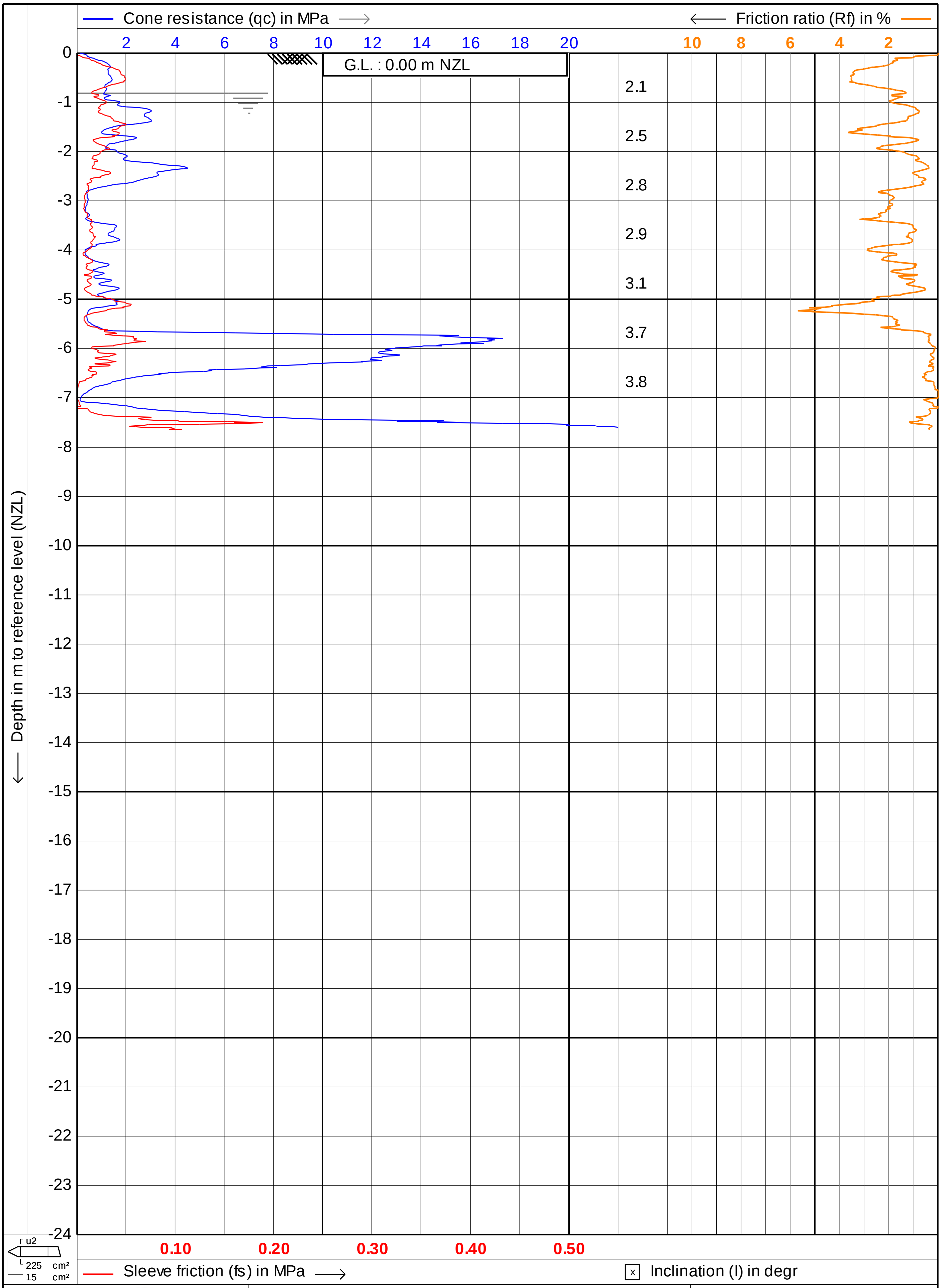
Test according ASTM Standard D 5778-07

Project : **Rosemerryn Subdivision**

Location: **Lincoln**

Date : **30-9-2013**
Cone no. : **S15CFIIP.S12008**
Project no. : **224464**
CPT no. : **cpt14** **1/15**

1.40



DCN DRILLING LTD
0274 735 011

1.40

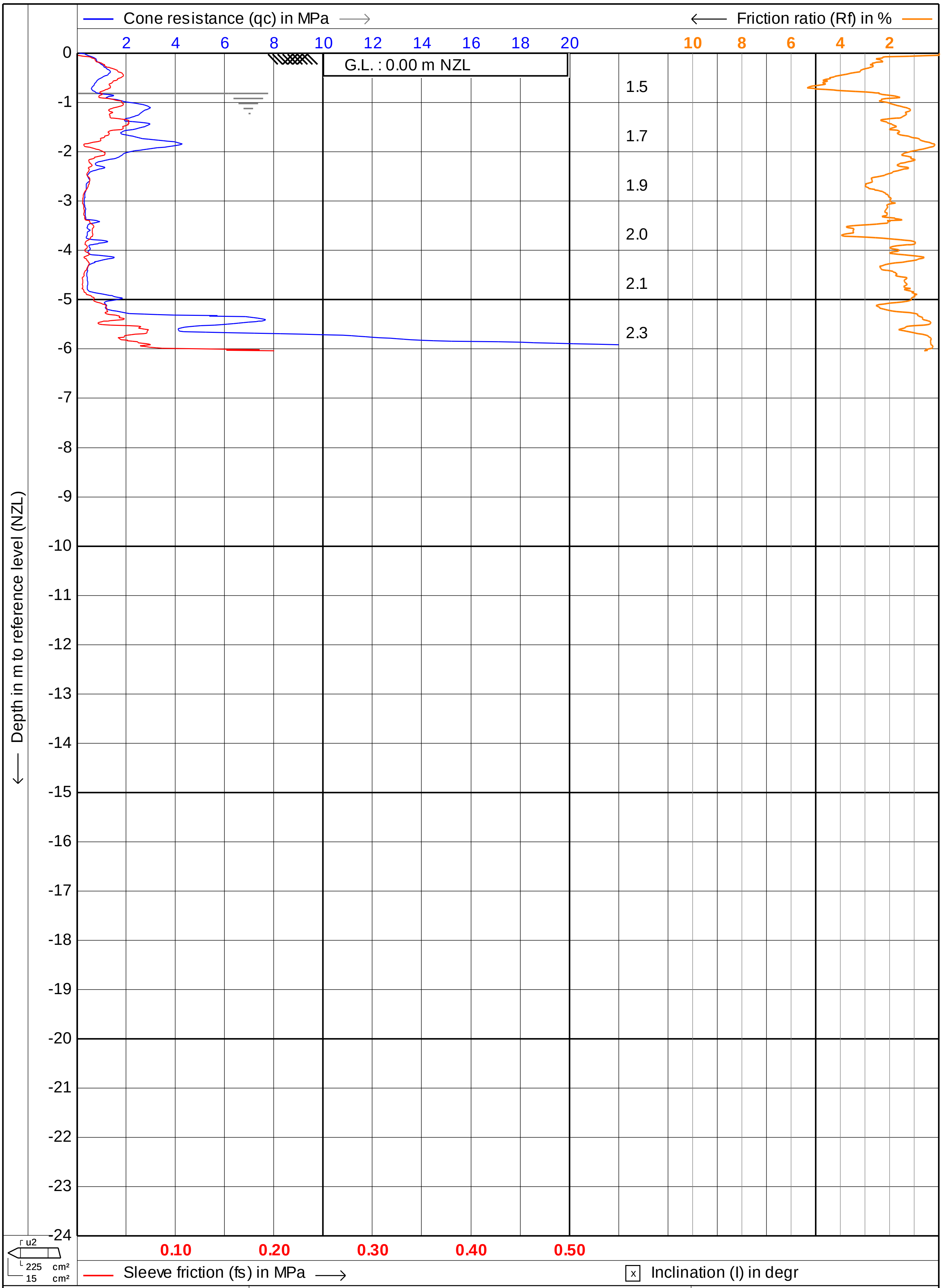
Test according ASTM Standard D 5778-07

Project : **Rosemerryn Subdivision**

Location: **Lincoln**

Date	:	**1-10-2013**
Cone no.	:	**S15CFIIP.S12008**
Project no.	:	**224464**
CPT no.	:	**cpt15**

1/15



DCN DRILLING LTD
0274 735 011

Test according ASTM Standard D 5778-07

Project : **Rosemerryn Subdivision**

Location: **Lincoln**

Date : **1-10-2013**

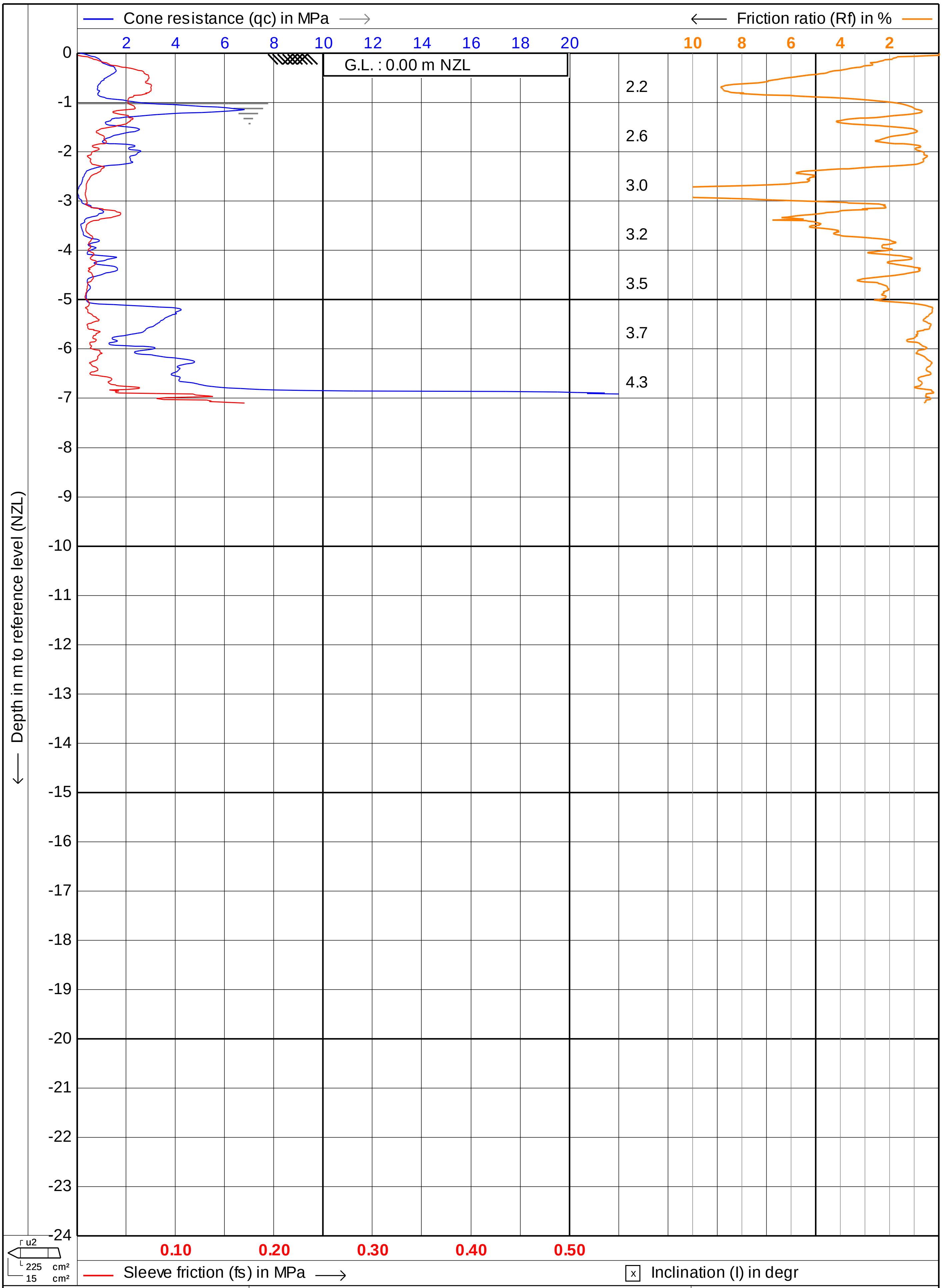
Cone no. : **S15CFIIP.S12008**

Project no. : **224464**

CPT no. : **cpt16**

1/15

1.40



DCN DRILLING LTD
0274 735 011

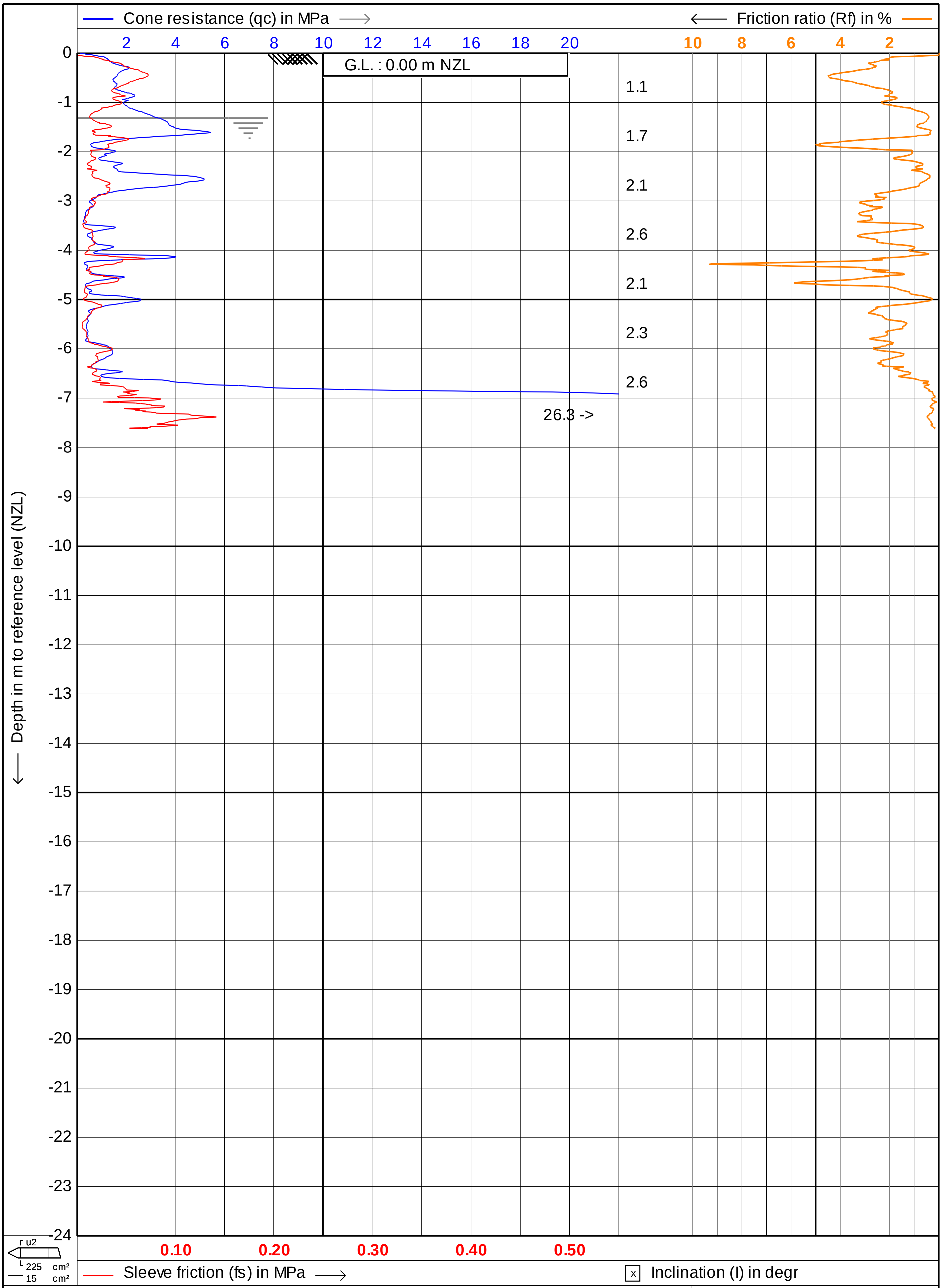
Test according ASTM Standard D 5778-07

Project : **Rosemerryn Subdivision**

Location: **Lincoln**

Date : **30-9-2013**
Cone no. : **S15CFIIP.S12008**
Project no. : **224464**
CPT no. : **cpt17** **1/15**

1.40



DCN DRILLING LTD
0274 735 011

Test according ASTM Standard D 5778-07

Project : **Rosemerryn Subdivision**

Location: **Lincoln**

Date : **30-9-2013**

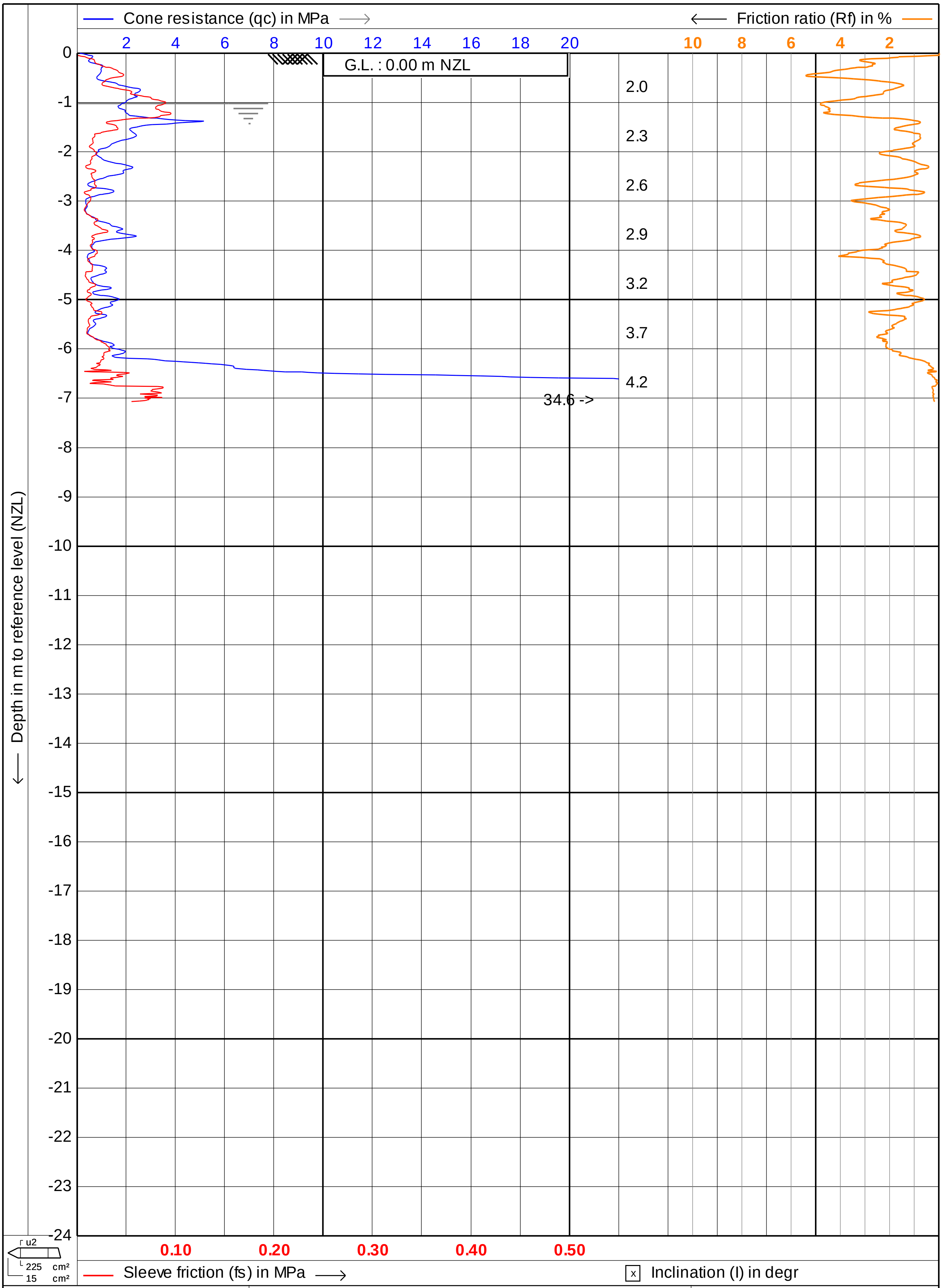
Cone no. : **S15CFIIP.S12008**

Project no. : **224464**

CPT no. : **cpt18**

1/15

1.40



DCN DRILLING LTD
0274 735 011

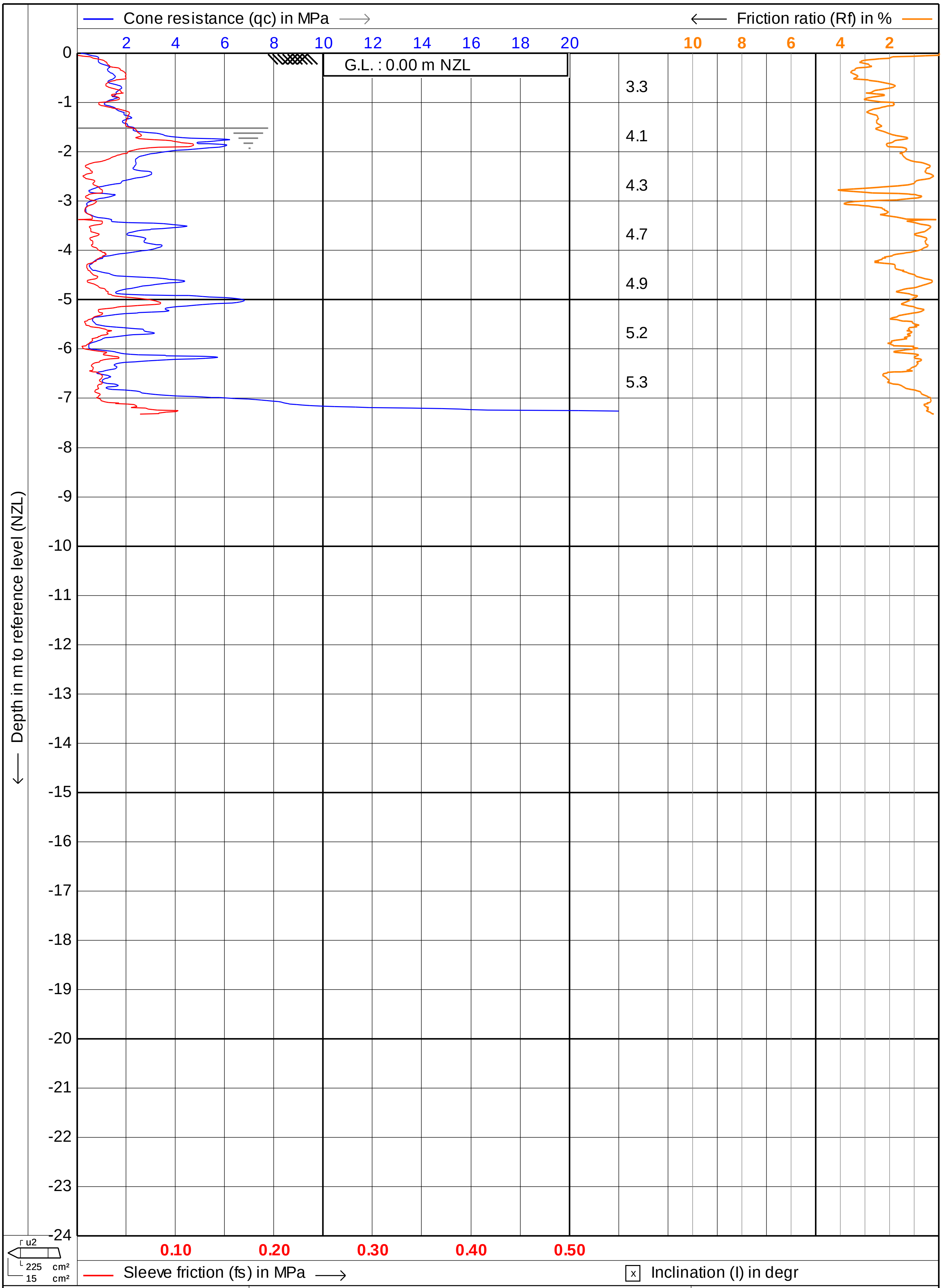
Test according ASTM Standard D 5778-07

Project : **Rosemerryn Subdivision**

Location: **Lincoln**

Date	: **30-9-2013**
Cone no.	: **S15CFIIP.S12008**
Project no. :	**224464**
CPT no.	: **cpt19** **1/15**

1.40



DCN DRILLING LTD
0274 735 011

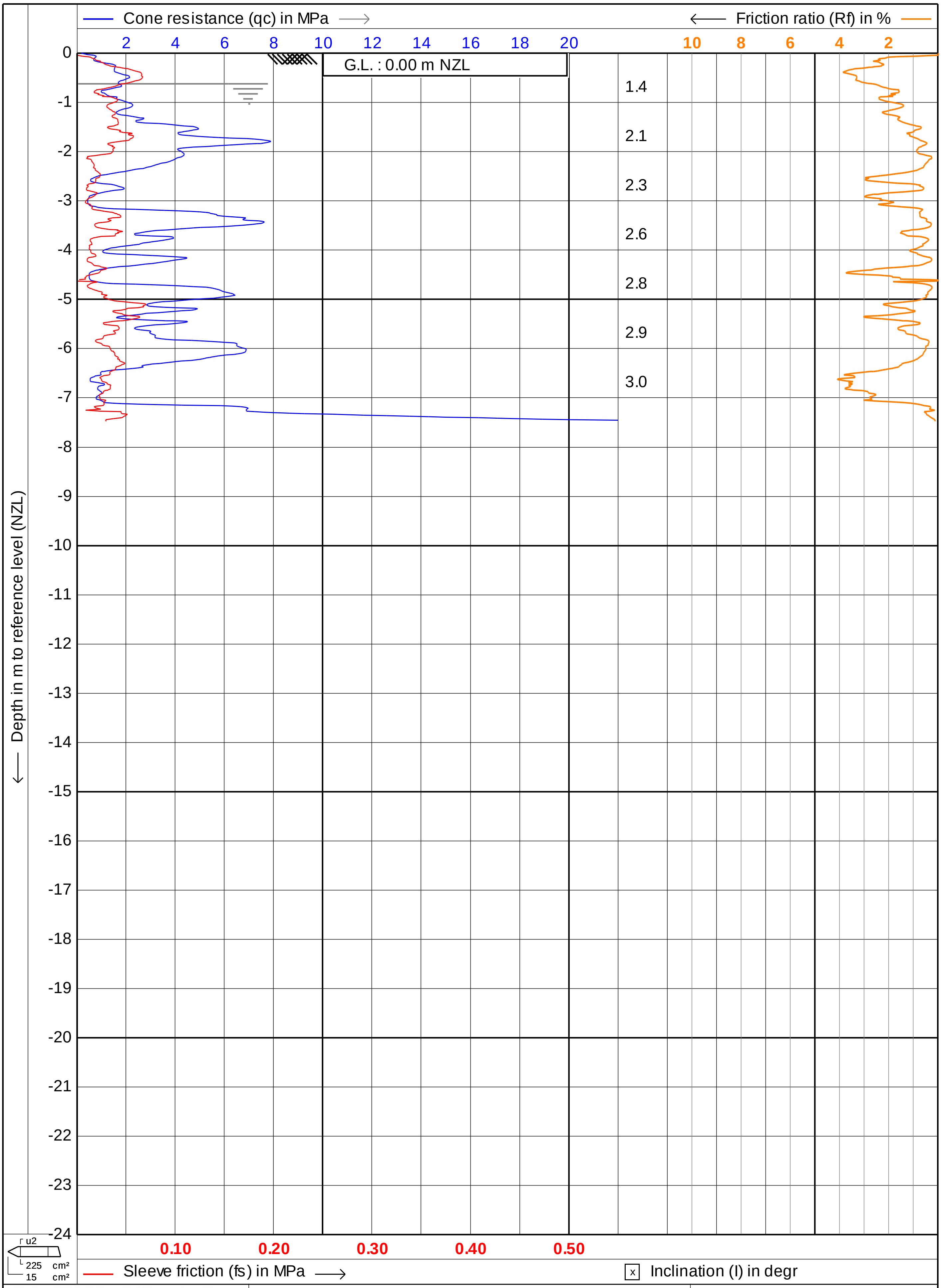
Test according ASTM Standard D 5778-07

Project : **Rosemerryn Subdivision**

Location: **Lincoln**

Date : **30-9-2013**
Cone no. : **S15CFIIP.S12008**
Project no. : **224464**
CPT no. : **cpt20**
1/15

1.40



DCN DRILLING LTD
0274 735 011

Test according ASTM Standard D 5778-07

Project : **Rosemerryn Subdivision**

Location: **Lincoln**

Date : **30-9-2013**

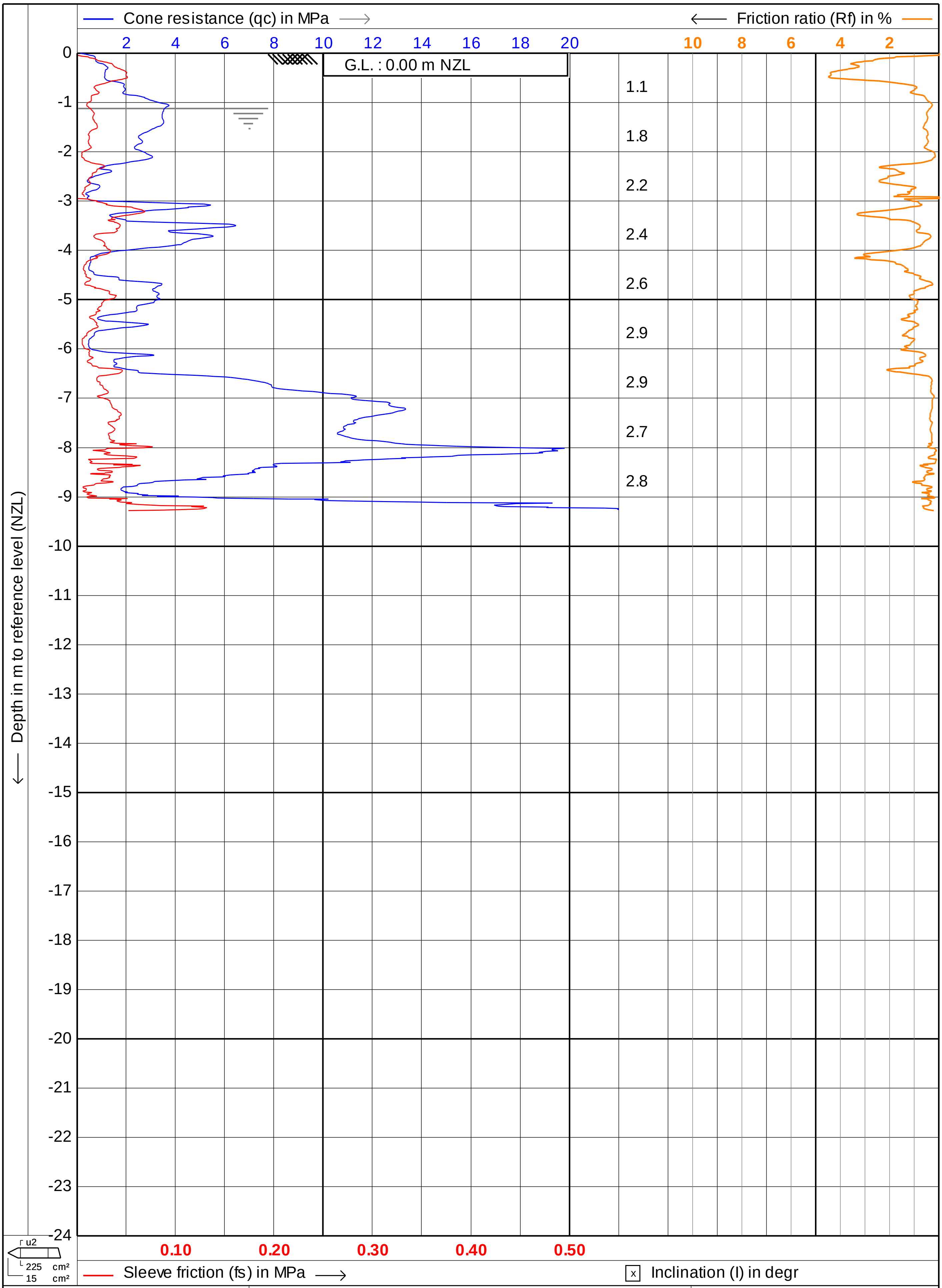
Cone no. : **S15CFIIP.S12008**

Project no. : **224464**

CPT no. : **cpt21**

1/15

1.40



DCN DRILLING LTD
0274 735 011

Test according ASTM Standard D 5778-07

Project : **Rosemerryn Subdivision**

Location: **Lincoln**

Date : **30-9-2013**
Cone no. : **S15CFIIP.S12008**
Project no. : **224464**
CPT no. : **cpt22**
1/15

1.40

Appendix F
Test Pits Logs

aurecon

Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN FARM SUBDIVISION**
Location: **SEE PLAN**
Project Reference: **224464**

TP07

Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 30t Excavator
Test Pit Dimensions:
Contractor: Fulton Hogan

CO-ORDINATES NZTM
Easting: 1559471 m
Northing: 5168052 m
Ground Level: N/A

Date Started: 6/09/2011
Date Completed: 6/09/2011

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Depth (m)	Sample	Water Level (m)	Graphic Log	Shear Vane Tests	Pocket Penetrometer Tests	Soil Description	Elevation (m)
0.00–0.25						TOPSOIL SILT with trace sand and rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained.	
0.25–1.00						SAND; Brown. Loose. Moist. Sand fine grained.	
1.00–2.20				Shear vane at 1m: 59/30kPa Shear vane at 1.5m: 41/30kPa		SILT; Grey with orange brown mottling. Very stiff. Moist. Non plastic.	
2.20–3.00						SAND with minor silt; Light blue grey. Medium dense. Saturated. Sand fine grained.	
3.00–3.30						SILT with minor peat inclusions. Light blue grey. Wet. Low plasticity.	
3.30–3.50		▼ 3.5				SILT; Light blue grey. Stiff. Wet. Low plasticity.	
3.50						End of Test Pit at 3.5m (GW Reached)	

Remarks:

Groundwater reached @ 3.5m

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Sheet **1** of **1**

Last Generated: 27/10/2011 5:55:40 p.m.

Database File: TEST PITS.GPJ, Library: COPY OF CHCH LIBRARY MARCH 2011.GLB, Data template: CHCH DATA TEMPLATE NOV 2010.GDT, Last Generated: 27/10/2011.

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN**
Location: **SEE PLAN**
Project Reference: **224464**

TP08

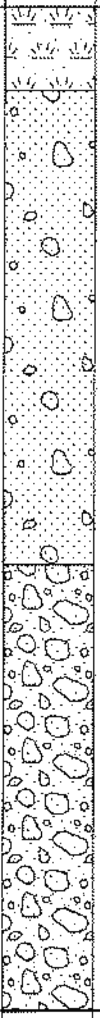
Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 30t Excavator
Test Pit Dimensions:
Contractor: Fulton Hogan

CO-ORDINATES N/A
Easting: 1559549 m
Northing: 5168236 m
Ground Level: N/A

Date Started: 6/09/2011
Date Completed: 6/09/2011

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK



Depth (m)	Sample	Water Level (m)	Graphic Log	Shear Vane Tests	Pocket Penetrometer Tests	Soil Description	Elevation (m)
						TOPSOIL silt with trace sand and occaisional rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained.	
0.30						Gravelly SAND; Brown. Loose. Moist. Gravel fine to medium grained, sub rounded. Sand medium grained.	
2.00						Sandy GRAVEL; Brown. Loose. Moist. Gravel fine to medium grained, sub rounded. Sand medium grained.	
3.60		▼				End of Test Pit at 3.6m (GW Reached)	

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Remarks:

Groundwater reached @ 3.6m

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Sheet 1 of 1

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
Telephone +64 3 366 0821
Facsimile +64 3 379 6955
w www.aurecongroup.com
Email christchurch@aurecongroup.com

Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN**
Location: **SEE PLAN**
Project Reference: **224464**

TP10

Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 30t Excavator
Test Pit Dimensions:
Contractor: Fulton Hogan

CO-ORDINATES N/A
Easting: 1559602 m
Northing: 5166105 m
Ground Level: N/A

Date Started: 6/09/2011
Date Completed: 6/09/2011

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Depth (m)	Sample	Water Level (m)	Graphic Log	Shear Vane Tests	Pocket Penetrometer Tests	Soil Description	Elevation (m)
						TOPSOIL SILT with trace sand and occaisional rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained.	
0.5				Shear vane at 0.5m: 10/12kPa		0.50 SILT; Grey with orangle brown mottling. Very stiff. Moist. Non plastic.	
1.0						1.00 SAND; Brown. Loose to medium dense. Moist. Medium grained.	
						1.20 SILT; Light grey. Soft. Moist. Low plasticity.	
1.5				Shear vane at 1.5m: [illegible]kPa			
2.0				Shear vane at 2m: 60/15kPa		2.00 SAND with minor silt; Blue grey. Medium dense. Saturated. Fine grained. Low plasticity.	
2.5						2.30 PEAT silty with some roots. Light blue grey. Wet. Low plasticity.	
3.0						3.00 GRAVEL sandy with trace silts; Grey. Loose. Wet. Fine to medium grained. Non plastic. Well graded.	
						3.10 GRAVEL sandy with trace silts; Light brown orange. Loose. Wet. Fine to medium grained. Non plastic. Well graded.	
						3.30 End of Test Pit at 3.3m (GW Reached)	
3.5							
4.0							
4.5							

Remarks:

No groundwater encountered

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Sheet 1 of 1

Last Generated: 6/10/2011 11:16:33 a.m.

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aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone +64 3 366 0821
Facsimile +64 3 379 6955

Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN**
Location: **SEE PLAN**
Project Reference: **224464**

TP11

Sheet 1 of 1

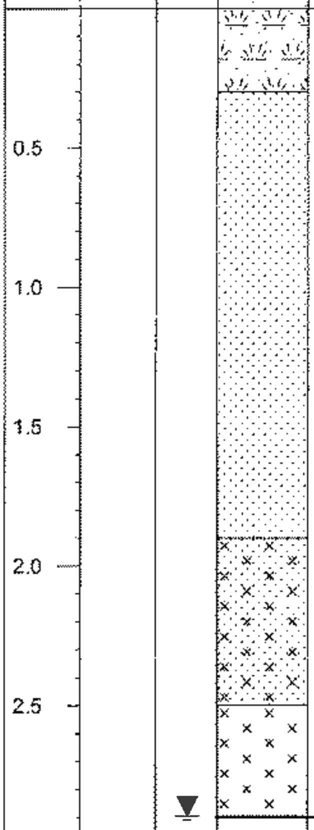
TEST PIT INFORMATION
Excavator Type: 30t Excavator
Test Pit Dimensions:
Contractor: Fulton Hogan

CO-ORDINATES N/A
Easting: 1559641 m
Northing: 5168197 m
Ground Level: N/A

Date Started: 7/09/2011
Date Completed: 7/09/2011

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Depth (m)	Sample	Water Level (m)	Graphic Log	Shear Vane Tests	Pocket Penetrometer Tests	Soil Description	Elevation (m)
0.00–0.30						TOPSOIL SILT with trace sand and occaisional rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained.	
0.30–1.90						SAND; Brown with orange mottling. Loose. Moist. Sand fine grained.	
1.90–2.50						Silty SAND; Dark grey. Loose. Moist. Sand fine grained.	
2.50–2.90		▼				SILT; Dark grey blue. Soft. Wet. Low plasticity.	
2.90						End of Test Pit at 2.9m (GW Reached)	



Remarks:
Groundwater reached @ 2.9m

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Sheet 1 of 1

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aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN**
Location: **SEE PLAN**
Project Reference: **224464**

TP12

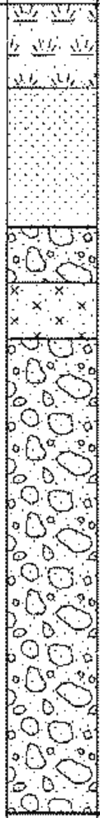
Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 30t Excavator
Test Pit Dimensions:
Contractor: Fulton Hogan

CO-ORDINATES N/A
Easting: 1559680 m
Northing: 5168289 m
Ground Level: N/A

Date Started: 6/09/2011
Date Completed: 6/09/2011

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Depth (m)	Sample	Water Level (m)	Graphic Log	Shear Vane Tests	Pocket Penetrometer Tests	Soil Description	Elevation (m)
						TOPSOIL SILT with trace sand and occaisional rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained.	
0.30						SAND with some silt; Brown. Loose to medium dense. Moist. Sand fine grained.	
0.80						Sandy GRAVEL; Light grey. Loose to medium dense. Moist. Gravel fine to medium grained, sub rounded. Sand medium grained.	
1.00						Sandy SILT; Light brown. Firm. Wet. Low plasticity. Sand fine grained.	
1.20		▼				Sandy GRAVEL; Light grey. Loose to medium dense. Moist. Gravel fine to medium grained, sub rounded. Sand medium grained.	
2.90						End of Test Pit at 2.9m (GW Reached)	

0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5

Remarks:

Groundwater reached 2.9m

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Sheet **1** of **1**

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile +64 3 379 6955
Email: christchurch@ap.aurecongroup.com

Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN**
Location: **SEE PLAN**
Project Reference: **224464**

TP15

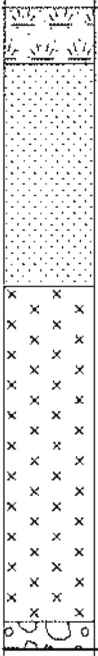
Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 30t Excavator
Test Pit Dimensions:
Contractor: Fulton Hogan

CO-ORDINATES N/A
Easting: 1559733 m
Northing: 5168158 m
Ground Level: N/A

Date Started: 7/09/2011
Date Completed: 7/09/2011

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK



Depth (m)	Sample	Water Level (m)	Graphic Log	Shear Vane Tests	Pocket Penetrometer Tests	Soil Description	Elevation (m)
0.20						TOPSOIL SILT with trace sand and occaisional rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained.	
1.00						SAND; Grey with orange brown mottling. Loose. Moist. Sand fine grained.	
2.20		▼				SILT; Dark grey. Soft. Moist. Low plasticity.	
2.30						GRAVEL with some sand; Grey and dark orange brown. Dense. Wet to saturated. Gravel fine grained, rounded to sub-rounded. Sand fine grained.	
						End of Test Pit at 2.3m (GW Reached)	

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Remarks:

Tree roots @ 1.5m
Groundwater reached 2.3m

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Sheet 1 of 1

Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN FARM SUBDIVISION**
Location: **SEE PLAN**
Project Reference: **224464**

TP19

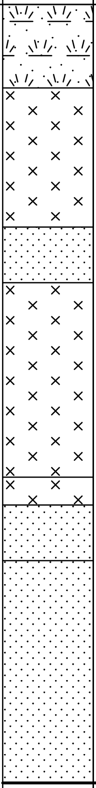
Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 30t Excavator
Test Pit Dimensions:
Contractor: Fulton Hogan

CO-ORDINATES NZTM
Easting: 1559747 m
Northing: 5167935 m
Ground Level: N/A

Date Started: 6/09/2011
Date Completed: 6/09/2011

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK



Depth (m)	Sample	Water Level (m)	Graphic Log	Shear Vane Tests	Pocket Penetrometer Tests	Soil Description	Elevation (m)
0.00–0.30						TOPSOIL SILT with trace sand and rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained.	
0.30–0.80						SILT; Light brown. Soft. Moist. Low plasticity.	
0.80–1.00						SAND with minor silt; Light brown. Loose to medium dense. Moist. Sand fine grained.	
1.00–1.70						SILT with minor sand; Grey with brown mottling. Stiff. Moist. Low plasticity. Sand fine to medium grained.	
1.70–1.80						SILT with some peat inclusions; Light blue grey. Wet. Low plasticity.	
1.80–2.00						SAND; Blue. Loose to medium dense. Wet. Fine grained.	
2.00–2.80		▼ 2.80				SAND; Brown. Loose to medium dense. Wet. Fine grained.	
2.80						End of Test Pit at 2.8m (GW Reached)	

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Remarks:

Tree branch @ 1.8m
Groundwater seepage @ 1.7m
Tree root @ 2.5m
Groundwater table reached at 2.8m

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Sheet **1** of **1**

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@nz.aurecongroup.com
Telephone +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN**
Location: **SEE PLAN**
Project Reference: **224464**

TP20

Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 30t Excavator
Test Pit Dimensions:
Contractor: Fulton Hogan

CO-ORDINATES N/A
Easting: 1559786 m
Northing: 5168027 m
Ground Level: N/A

Date Started: 6/09/2011
Date Completed: 6/09/2011

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Depth (m)	Sample	Water Level (m)	Graphic Log	Shear Vane Tests	Pocket Penetrometer Tests	Soil Description	Elevation (m)
						TOPSOIL SILT with trace sand and occaisional rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained.	
						0.30 SAND with minor silt; Brown. Loose to medium dense. Moist. Sand fine grained.	
0.5						0.50 Silty SAND; Grey with orange brown moltling. Loose to medium dense. Moist. Sand fine grained.	
1.0							
1.5							
2.0						2.00 SILT with tree roots; Grey with brown mottling. Soft. Wet. Low plasticity.	
2.5							
						2.80 Gravelly SAND; Grey. Loose. Wet. Sand fine to medium grained. Gravel medium to coarse grained and sub rounded.	
3.0		▼				3.00 End of Test Pit at 3m (GW Reached)	
3.5							
4.0							
4.5							

Remarks:

Groundwater table reached at 3.0m

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Sheet **1** of **1**

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone +64 3 366 0821
Facsimile +64 3 379 6955

Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN**
Location: **SEE PLAN**
Project Reference: **224464**

TP21

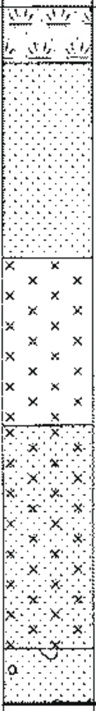
Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 30t Excavator
Test Pit Dimensions:
Contractor: Fulton Hogan

CO-ORDINATES N/A
Easting: 1559825 m
Northing: 5168119 m
Ground Level: N/A

Date Started: 9/09/2011
Date Completed: 9/09/2011

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK



Depth (m)	Sample	Water Level (m)	Graphic Log	Shear Vane Tests	Pocket Penetrometer Tests	Soil Description	Elevation (m)
						TOPSOIL SILT with trace sand and occaisional rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained. 0.10	
0.5						SAND; Grey with orange brown mottling. Loose. Moist. Sand fine grained. 0.90	
1.0						SILT; Dark grey. Soft. Moist. Low plasticity. 1.50	
1.5 2.0		▼				Silty SAND; Dark blue grey. Loose to medium dense. Moist. Sand fine grained. 2.30	
						Gravelly SAND; Grey and dark orange brown. Dense. Wet to saturated. Gravel fine grained, rounded to sub-rounded. Sand fine grained. 2.50	
2.5 3.0 3.5 4.0 4.5						End of Test Pit at 2.5m (GW Reached)	

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Sheet 1 of 1

Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1051
Christchurch 8140
New Zealand
www.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955
Email: christchurch@ap.aurecongroup.com

Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN**
Location: **SEE PLAN**
Project Reference: **224464**

TP22

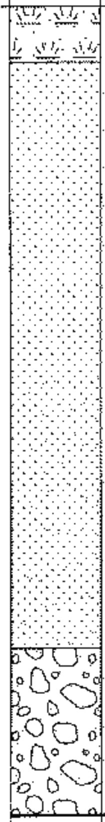
Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 30t Excavator
Test Pit Dimensions:
Contractor: Fulton Hogan

CO-ORDINATES N/A
Easting: 1559864 m
Northing: 5168211 m
Ground Level: N/A

Date Started: 9/09/2011
Date Completed: 9/09/2011

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK



Depth (m)	Sample	Water Level (m)	Graphic Log	Shear Vane Tests	Pocket Penetrometer Tests	Soil Description	Elevation (m)
						TOPSOIL SILT with trace sand and occaisional rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained.	
0.20						SAND; Grey with orange brown mottling. Loose. Moist. Sand fine grained.	
0.5							
1.0							
1.5							
2.0							
2.30						GRAVEL with some sand; Grey with brown sand. Dense. Wet to saturated. Gravel fine to medium grained, rounded to sub-rounded. Sand fine grained.	
2.5							
2.90		▼				End of Test Pit at 2.9m (GW Reached)	
3.0							
3.5							
4.0							
4.5							

Remarks:

No groundwater encountered

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Sheet **1** of **1**

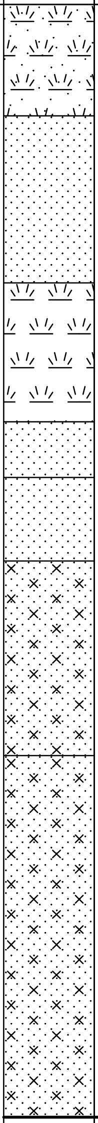
aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN FARM SUBDIVISION**
Location: **SEE PLAN**
Project Reference: **224464**

TP23

Sheet **1** of **1**

TEST PIT INFORMATION	**CO-ORDINATES NZTM**		
Excavator Type: 30t Excavator	Easting: 1559684 m	Date Started: 9/09/2011	Logged by: LFS
Test Pit Dimensions:	Northing: 5167528 m	Date Completed: 9/09/2011	Input by: LFS
Contractor: Fulton Hogan	Ground Level: N/A		Checked by: JSM
			Verified by: JK



Depth (m)	Sample	Water Level (m)	Graphic Log	Shear Vane Tests	Pocket Penetrometer Tests	Soil Description	Elevation (m)
						TOPSOIL SILT with trace sand and rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained.	
0.5						0.40 SAND; Dark grey. Loose to medium dense. Moist. Sand fine grained.	
1.0						1.00 Silt with some peat inclusions. Light blue grey. Soft. Wet. Low plasticity.	
1.5						1.50 SAND; Brown. Loose to medium dense. Moist. Sand medium grained.	
						1.70 SAND; Grey. Loose to medium dense. Wet. Sand medium grained.	
2.0						2.00 Silty SAND; Grey. Loose to medium dense. Wet. Sand medium grained.	
2.5						2.70 Silty SAND with tree roots; Light blue grey. Medium dense. Wet. Sand fine grained.	
3.0							
3.5							
4.0						4.00 End of Test Pit at 4m (Pit Collapse)	
4.5							

Remarks:

Tree roots @ 1.0m
Tree roots @ 3.0m
No groundwater encountered

Logged by:	LFS
Input by:	LFS
Checked by:	JSM
Verified by:	JK

Sheet **1** of **1**

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN FARM SUBDIVISION**
Location: **SEE PLAN**
Project Reference: **224464**

TP24

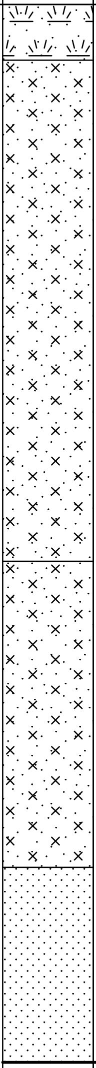
Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 30t Excavator
Test Pit Dimensions:
Contractor: Fulton Hogan

CO-ORDINATES NZTM
Easting: 1559762 m
Northing: 5167712 m
Ground Level: N/A

Date Started: 9/09/2011
Date Completed: 9/09/2011

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK



Depth (m)	Sample	Water Level (m)	Graphic Log	Shear Vane Tests	Pocket Penetrometer Tests	Soil Description	Elevation (m)
0.20						TOPSOIL SILT with trace sand and rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained.	
0.5				Shear vane at 0.5m: 104/18kPa			
1.0				Shear vane at 1m: 44/27kPa			
1.5				Shear vane at 1.5m: 30/27kPa			
2.00						Sandy SILT; Grey with orange brown mottling. Stiff. Moist. Low plasticity. Sand fine grained.	
2.5							
3.0							
3.10						Sandy SILT with tree roots; Dark blue grey. Stiff. Saturated. Low plasticity. Sand fine grained.	
3.5							
3.80		▼				SAND; Brown. Loose to medium dense. Saturated. Sand medium grained.	
						End of Test Pit at 3.8m (GW Reached)	
4.0							
4.5							

Remarks:

Groundwater encountered @ 3.8m

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

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Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN FARM SUBDIVISION**
Location: **SEE PLAN**
Project Reference: **224464**

TP25

Sheet **1** of **1**

TEST PIT INFORMATION Excavator Type: 30t Excavator Test Pit Dimensions: Contractor: Fulton Hogan	**CO-ORDINATES NZTM** Easting: 1559840 m Northing: 5167896 m Ground Level: N/A	Date Started: 6/09/2011 Date Completed: 6/09/2011	Logged by: LFS Input by: LFS Checked by: JSM Verified by: JK

Depth (m)	Sample	Water Level (m)	Graphic Log	Shear Vane Tests	Pocket Penetrometer Tests	Soil Description	Elevation (m)
0.00						TOPSOIL with some rootlets and minor silt; Dark brown. Moist. Low plasticity.	
0.30						SILT; Light brown. Firm. Moist. Low plasticity.	
0.80						SAND with minor silt; Light brown. Loose to medium dense. Moist. Fine grained.	
1.50						SAND with some silt; Grey with orange brown mottling. Loose to medium dense. Wet. Fine grained.	
2.00						SILT; Light blue grey. Soft. Wet. Low plasticity.	
2.50						SAND; Reddish brown. Loose. Wet. Sand medium grained.	
2.80		▼				End of Test Pit at 2.8m (GW Reached)	

Depth scale (m): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Remarks:

Groundwater seepage @ 2.2

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

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aurecon
Aurecon (New Zealand) Limited
Unit 1, 100 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN**
Location: **SEE PLAN**
Project Reference: **224464**

TP26

Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 30I Excavator
Test Pit Dimensions:
Contractor: Fulton Hogan

CO-ORDINATES N/A
Easting: 1559917 m
Northing: 5168080 m
Ground Level: N/A

Date Started: 9/09/2011
Date Completed: 9/09/2011

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Depth (m)	Sample	Water Level (m)	Graphic Log	Shear Vane Tests	Pocket Penetrometer Tests	Soil Description	Elevation (m)
0.20						TOPSOIL SILT with trace sand and occaisional rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained.	
0.5 0.80				Shear vane at 3.5m: 64/21kPa		Sandy SILT; Brown. Firm. Moist. Low plasticity. Sand fine grained.	
1.0 1.5 1.80						SAND; Brown with orange mottling. Loose to medium dense. Moist. Sand fine grained.	
2.0 2.00						SAND with some silt; Dark blue grey. Loose to medium dense. Wet. Sand fine grained.	
2.50						SILT with some tree roots; Dark blue grey. Soft. Wet. Low plasticity.	
2.5 2.80		▼				Gravelly SAND; Grey and dark orange brown. Dense. Wet to saturated. Gravel fine grained, rounded to sub-rounded. Sand fine grained.	
3.0 3.5 4.0 4.5						End of Test Pit at 2.8m (GW Reached)	

Remarks:
No groundwater encountered

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN**
Location: **SEE PLAN**
Project Reference: **224464**

TP27

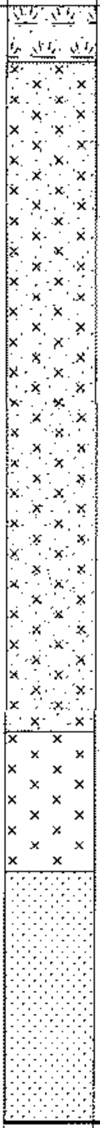
Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 30t Excavator
Test Pit Dimensions:
Contractor: Fulton Hogan

CO-ORDINATES N/A
Easting: 1559815 m
Northing: 5167561 m
Ground Level: N/A

Date Started: 9/09/2011
Date Completed: 9/09/2011

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK



Depth (m)	Sample	Water Level (m)	Graphic Log	Shear Vane Tests	Pocket Penetrometer Tests	Soil Description	Elevation (m)
						TOPSOIL SILT with trace sand and occaisional rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained.	
0.20						Sandy SILT; Grey with orange brown mottling. Stiff. Moist. Low plasticity. Sand fine grained.	
0.5							
1.0							
1.5							
2.0							
2.5							
2.60						SILT with tree roots; Dark blue grey. Soft. Saturated. Low plasticity.	
3.0							
3.10						SAND; Dark blue grey. Loose to medium dense. Saturated. Sand fine grained.	
3.5							
4.0						End of Test Pit at 4m (Pit Collapse)	
4.5							

Remarks:

Groundwater seepage @ 3.0m

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Sheet 1 of 1

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **FULTON HOGAN LANO OEVELOPMENT**
Project Name: **ROSEMERRYN**
Location: **SEE PLAN**
Project Reference: **224464**

TP28

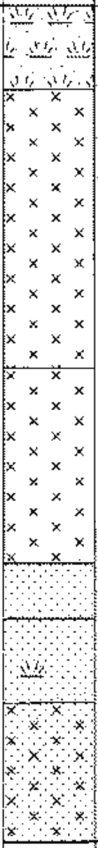
Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 30t Excavator
Test Pit Dimensions:
Contractor: Fulton Hogan

CO-ORDINATES N/A
Easting: 1559854 m
Northing: 5167673 m
Ground Level: N/A

Date Started: 9/09/2011
Date Completed: 9/09/2011

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK



Depth (m)	Sample	Water Level (m)	Graphic Log	Shear Vane Tests	Pocket Penetrometer Tests	Soil Description	Elevation (m)
						TOPSOIL SILT with trace sand and occaisional rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained.	
0.31						SILT; Grey with orange brown mottling. Stiff. Moist. Low plasticity.	
1.30						SILT; Grey. Soft. Wet. Low plasticity.	
2.00						SAND; Light grey. Loose. Wet. Sand fine grained.	
2.20						SAND with tree roots; Light grey. Medium dense. Moist. Sand medium grained.	
2.50						Silty SAND; Brown. Medium dense. Moist. Sand fine grained.	
3.00		▼				End of Test Pit at 3m (GW Reached)	

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Remarks:

Groundwater @ 3.0m

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Sheet **1** of **1**

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 5955

Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN**
Location: **SEE PLAN**
Project Reference: **224464**

TP29

Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 30t Excavator
Test Pit Dimensions:
Contractor: Fulton Hogan

CO-ORDINATES N/A
Easting: 1559893 m
Northing: 5167765 m
Ground Level: N/A

Date Started: 9/09/2011
Date Completed: 9/09/2011

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Depth (m)	Sample	Water Level (m)	Graphic Log	Shear Vane Tests	Pocket Penetrometer Tests	Soil Description	Elevation (m)
						TOPSOIL SILT with trace sand and occaisional rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained. 0.23	
0.5				Shear vane at 0.5m: 92/39kPa		Sandy SILT; Grey with orange brown mottling. Stiff. Moist. Low plasticity. Sand fine grained. 0.90	
1.0				Shear vane at 1m: 88/[illegible]kPa		Silty SAND; Grey with orange brown mottling. Loose. Moist. Sand fine grained. 1.50	
1.5				Shear vane at 1.5m: 30/[illegible]kPa		SILT with tree roots; Dark blue grey. Soft. Wet. Low plasticity. 1.70	
						SAND; Light grey. Loose. Moist. Sand medium grained. 1.90	
2.0						SILT with tree roots; Dark blue grey. Soft. Wet. Low plasticity. 2.10	
2.5						SAND; Light grey. Loose. Moist. Sand medium grained. 2.80	
3.0		▼				Sandy GRAVEL; Brown. Dense. Saturated. Gravel fine to coarse grained, sub-rounded. Sand medium grained. 3.00	
						End of Test Pit at 3m (GW Reached)	
3.5							
4.0							
4.5							

Remarks:

Tree roots @ 1.9m
Groundwater @ 3.0m

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 5955
Email: christchurch@ap.aurecongroup.com

Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN**
Location: **SEE PLAN**
Project Reference: **224464**

TP30

Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 30t Excavator
Test Pit Dimensions:
Contractor: Fulton Hogan

CO-ORDINATES N/A
Easting: 1559932 m
Northing: 5167857 m
Ground Level: N/A

Date Started: 9/09/2011
Date Completed: 9/09/2011

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Depth (m)	Sample	Water Level (m)	Graphic Log	Shear Vane Tests	Pocket Penetrometer Tests	Soil Description	Elevation (m)
						TOPSOIL SILT with trace sand and occaisional rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained.	
0.5						0.30 SAND with trace silts; Grey with orange mottling. Loose. Moist. Sand fine to medium grained.	
1.0							
1.5						1.20 SAND; Dark grey. Loose to medium dense. Wet. Sand fine to medium grained.	
2.0						1.80 SILT with some tree roots; Dark blue grey. Soft. Wet. Low plasticity.	
2.5						2.50 SAND; Dark brown. Loose. Moist. Sand fine to medium grained.	
3.0		▼				3.00 End of Test Pit at 3m (GW Reached)	
3.5							
4.0							
4.5							

Remarks:

Tree roots @ 1.5m
Groundwater @ 3.0 m

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Sheet 1 of 1

Last Generated: 29/09/2011 10:02:22 a.m.

Database File: TEST PITS.GPJ. Library: COPY OF CHCH LIBRARY MARCH 2011.GLB. Data template: CHCH DATA TEMPLATE NOV 2010.GDT. Last Generated: 29/09/2011.

aurecon

Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955
Email: christchurch@ap.aurecongroup.com

Client: **FULTDN HOGAN LAND DEVELDPMENT**
Project Name: **ROSEMERRYN**
Location: **SEE PLAN**
Project Reference: **224464**

TP31

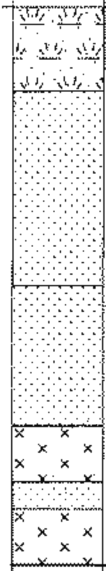
Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 30l Excavator
Test Pit Dimensions:
Contractor: Fulton Hogan

CO-ORDINATES N/A
Easting: 1559971 m
Northing: 5167949 m
Ground Level: N/A

Date Started: 9/09/2011
Date Completed: 9/09/2011

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK



Depth (m)	Sample	Water Level (m)	Graphic Log	Shear Vane Tests	Pocket Penetrometer Tests	Soil Description	Elevation (m)
						TOPSOIL SILT with trace sand and occaisional rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained.	
0.30						SAND with trace silts; Grey with orange mottling. Loose. Moist. Sand fine to medium grained.	
0.5							
1.00						SAND; Dark brown. Loose. Moist. Sand fine to medium grained.	
1.50						SILT with some tree roots; Dark blue grey. Soft. Wet. Low plasticity.	
1.70						SAND; Dark grey. Loose to medium dense. Wet. Sand fine to medium grained.	
1.80						SILT with some tree roots; Dark blue grey. Soft. Wet. Low plasticity.	
2.00						End of Test Pit at 2m (GW Reached)	
2.5							
3.0							
3.5							
4.0							
4.5							

Remarks:

Groundwater @ 2.0m

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Sheet **1** of **1**

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN**
Location: **SEE PLAN**
Project Reference: **224464**

TP32

Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 30t Excavator
Test Pit Dimensions:
Contractor: Fulton Hogan

CO-ORDINATES N/A
Easting: 1560010 m
Northing: 5168041 m
Ground Level: N/A

Date Started: 9/09/2011
Date Completed: 9/09/2011

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Depth (m)	Sample	Water Level (m)	Graphic Log	Shear Vane Tests	Pocket Penetrometer Tests	Soil Description	Elevation (m)
						TOPSOIL SILT with trace sand and occaisional rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained. 0.30	
0.5				Shear vane at 0.5m: 133/30kPa		SILT; Grey with brown mottling. Firm. Wet. Low plasticity. 1.00	
1.0						SAND; Dark brown. Loose. Moist. Sand fine to medium grained. 1.50	
1.5						SILT with some tree roots; Dark blue grey. Soft. Wet. Low plasticity. 2.00	
2.0						SAND with some tree roots; Dark grey. Loose. Wet. Sand fine to medium grained. 2.40	
2.5		▼				SAND; Dark brown. Loose. Moist. Sand fine to medium grained. 2.80	
3.0 3.5 4.0 4.5						End of Test Pit at 2.8m (GW Reached)	

Remarks:

Tree roots @ 1.5m
Groundwater @ 2.8m

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Sheet 1 of 1

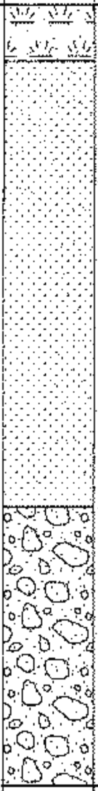
aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN**
Location: **SEE PLAN**
Project Reference: **224464**

TP33

Sheet 1 of 1

TEST PIT INFORMATION Excavator Type: 30t Excavator Test Pit Dimensions: Contractor: Fulton Hogan	**CO-ORDINATES N/A** Easting: 1560049 m Northing: 5168133 m Ground Level: N/A	Date Started: 9/09/2011 Date Completed: 9/09/2011	Logged by: LFS Input by: LFS Checked by: JSM Verified by: JK

Depth (m)	Sample	Water Level (m)	Graphic Log	Shear Vane Tests	Pocket Penetrometer Tests	Soil Description	Elevation (m)
						TOPSOIL SILT with trace sand and occaisional rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained.	
						0.20 SAND; Grey with orange brown mottling. Loose. Moist. Sand fine grained.	
0.5							
1.0							
1.5							
						1.80 Sandy GRAVEL; Grey with brown sand. Dense. Wet to saturated. Gravel fine to medium grained, rounded to sub-rounded. Sand fine grained.	
2.0							
2.5							
		▼				2.80 End of Test Pit at 2.8m (GW Reached)	
3.0							
3.5							
4.0							
4.5							

Remarks:

Groundwater @ 2.8m

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Sheet 1 of 1

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 6140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN**
Location: **SEE PLAN**
Project Reference: **224464**

TP34

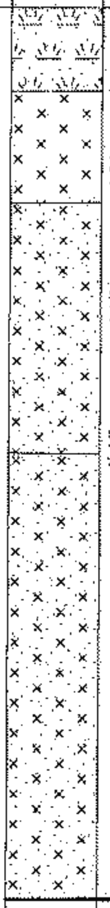
Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 30t Excavator
Test Pit Dimensions:
Contractor: Fulton Hogan

CO-ORDINATES N/A
Easting: 1559946 m
Northing: 5167634 m
Ground Level: N/A

Date Started: 9/09/2011
Date Completed: 9/09/2011

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK



Depth (m)	Sample	Water Level (m)	Graphic Log	Shear Vane Tests	Pocket Penetrometer Tests	Soil Description	Elevation (m)
0.00–0.30						TOPSOIL SILT with trace sand and occaisional rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained.	
0.30–0.70				Shear vane at 0.5m: 44/24kPa		SILT; Grey with orange brown moltling. Stiff. Moist. Low plasticity.	
0.70–1.60				Shear vane at 1m: 107/18kPa Shear vane at 1.5m: 27/12kPa		Sandy SILT; Grey with orange brown mottling. Stiff. Moist. Low plasticity. Sand fine grained.	
1.60–3.20						Sandy SILT; Blue grey. Soft. Saturated. Low plasticity. Sand fine grained.	
3.20						End of Test Pit at 3.2m (Pit Collapse)	

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Remarks:

Groundwater seepage @ 1.6m
Tree roots @ 1.8m

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Sheet **1** of **1**

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955
Email christchurch@ap.aurecongroup.com

Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN**
Location: **SEE PLAN**
Project Reference: **224464**

TP35

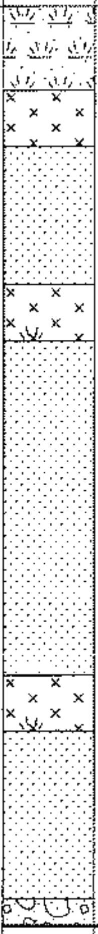
Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 30t Excavator
Test Pit Dimensions:
Contractor: Fulton Hogan

CO-ORDINATES N/A
Easting: 1560024 m
Northing: 5167818 m
Ground Level: N/A

Date Started: 9/09/2011
Date Completed: 9/09/2011

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK



Depth (m)	Sample	Water Level (m)	Graphic Log	Shear Vane Tests	Pocket Penetrometer Tests	Soil Description	Elevation (m)
						TOPSOIL SILT with trace sand and occaisional rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained.	
0.30						SILT with minor sand. Grey with orange brown mottling. Firm. Moist. Low plasticity. Sand fine grained. Friable.	
0.50						SAND with minor silt. Grey with orange brown mottling. Loose. Moist. Sand fine grained.	
1.00						SILT with minor sand and tree roots. Grey with orange brown mottling. Firm. Wet. Low plasticity. Sand fine grained.	
1.20						SAND. Grey. Loose to medium dense. Wet. Sand fine grained.	
2.40						SILT with minor sand and tree roots. Grey with orange brown mottling. Firm. Wet. Low plasticity. Sand fine grained.	
2.60						SAND; Brown. Loose to medium dense. Moist. Sand fine grained.	
3.10		▼				Sandy GRAVEL; Brown. Dense. Wet. Gravel medium to coarse grained, rounded. Sand medium grained.	
3.20						End of Test Pit at 3.3m (GW Reached)	

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Remarks:

Groundwater seepage @ 1.0m

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Sheet **1** of **1**

Last Generated: 29/09/2011 10:02:33 a.m.

Database File: TEST PITS.GPJ. Library: COPY OF CHCH LIBRARY MARCH 2011.GLB. Date template: CHCH DATA TEMPLATE NOV 2010.GDT. Last Generated: 29/09/2011

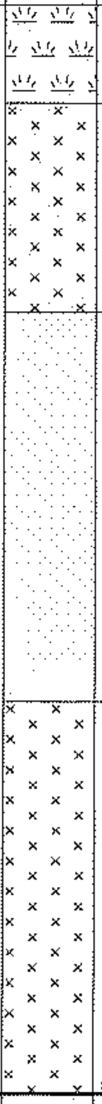
aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP01

Sheet **1** of **1**

TEST PIT INFORMATION Excavator Type: 8 Tonne Excavator Test Pit Dimensions: 1.5m x 3m Contractor: Skellys Limited	**CO-ORDINATES N/A** Easting: 1557263 m Northing: 5166808 m Ground Level: 18 m	Date Started: 27/04/2012 Date Completed: 27/04/2012	Logged by: RS Input by: MJF Checked by: RS Verified by: WD



Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.35	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL)	
0.5						**Sandy SILT**; light brown. Stiff, moist, low plasticity. Sand is fine grained and poorly graded (ALLUVIAL DEPOSITS).	
1.0					1.10	0.95m Becomes brown mottled grey.	17
1.5						**SAND** with minor silt; brown mottled grey. Loosely packed, moist; sand is fine grained and poorly graded.	
2.0						2.0m Becomes dark grey mottled orange brown.	16
					2.50	2.2m Becomes with some silt.	
2.5 3.0 3.5		▼			3.90	**SILT** with some sand; dark grey. Moist, moderate plasticity; sand is fine grained.	15
4.0 4.5						End of Test Pit at 3.9m (Maximum Extention of Excavator.)	14

Remarks:

Groundwater at 2.7m

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Aurecon (New Zealand) Limited
Unit 5, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
Telephone: +64 3 366 0821
www.aurecongroup.com
Facsimile: +64 3 379 6955
Email: christchurch@ap.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP03

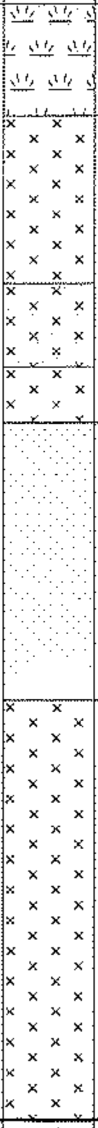
Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559600 m
Northing: 5167558 m
Ground Level: N/A

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD



Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
						SILT, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
					0.40	**SILT** with some sand; light brown mottled orange brown. Stiff, moist, moderate plasticity; sand is fine to medium grained (ALLUVIAL DEPOSITS).	
0.5							
1.0						1.0m Becomes **sandy**.	
						1.3m Becomes with trace sand; grey mottled light brown.	
1.5					1.50	**SAND** with some silt; dark grey. Loosely packed moist; sand is fine to medium grained.	
2.0		▼					
						2.3m Becomes with fibrous organic inclusions (branches and roots up to 30mm in diameter).	
2.5					2.50	**SILT** with minor sand; dark grey. Stiff, moist, moderate plasticity.	
3.0							
						3.4m Becomes with fibrous organic inclusions (up to 80mm in diameter).	
3.5							
4.0					4.00	End of Test Pit at 4m (Target Depth Achieved.)	
4.5							

Remarks:

Groundwater at 2.0m

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com

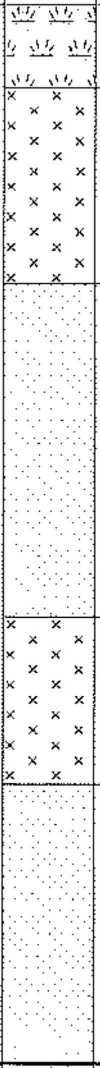
Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP06

Sheet **1** of **1**

TEST PIT INFORMATION Excavator Type: 8 Tonne Excavator Test Pit Dimensions: 1.5m x 3m Contractor: Skellys Limited	**CO-ORDINATES N/A** Easting: 1559835 m Northing: 5167650 m Ground Level: 18 m	Date Started: 27/04/2012 Date Completed: 27/04/2012	Logged by: RS Input by: MJF Checked by: RS Verified by: WD

Columns: Depth (m) | Sample | Water Level (m) | Pocket Penetrometer Tests | Shear Vane Tests | Graphic Log | Soil Description | Elevation (m)



Depth (m)	Soil Description	Elevation (m)
0.00–0.30	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.30–1.00	**SILT** with some sand; light brown. Stiff, moist, low plasticity. Sand is fine grained and poorly graded (ALLUVIAL DEPOSITS).	
1.00–2.20	**SAND** with some silt; light brown grey. Loosely packed, moist; sand is fine grained. 1.5m Becomes mottled reddish brown. 1.9m Becomes dark grey.	17 (1.0) 16 (2.0)
2.20–2.80	**SILT** with some sand; light brown. Stiff, moist, moderate plasticity. Sand is fine grained and poorly graded.	
2.80–3.80	**SAND** with some silt; dark grey. Loosely packed, moist; sand is fine grained. 3.0m Becomes with fibrous organic inclusions (roots) 20mm in diameter.	15 (3.0)
3.80	End of Test Pit at 3.8m (Target Depth Achieved.)	14 (4.0)

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Remarks:

Groundwater not encountered.

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP08

Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559761 m
Northing: 5167731 m
Ground Level: 16 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD

Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
						SILT, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
					0.30	**SILT** with some sand; light brown. Stiff, moist, low plasticity; sand is fine to medium grained (ALLUVIAL DEPOSITS).	
0.5							
1.0							15
						1.1m Becomes brownish grey mottled orange.	
1.5							
					1.70	**SAND** with minor silt; greyish brown mottled orange brown. Loosely packed, moist; sand is fine to medium grained.	
2.0						2.0m Becomes dark grey.	14
		▼				2.1m Becomes with fibrous organic inclusions (up to 20mm in diameter).	
2.5							
3.0							13
3.5							
					3.70	End of Test Pit at 3.7m (Target Depth Achieved.)	
4.0							12
4.5							

Remarks:

Groundwater at 2.1m

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955
Email: christchurch@ap.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP13

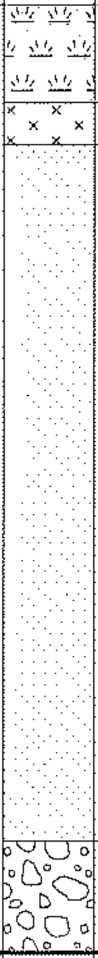
Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavetor
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559745 m
Northing: 5167953 m
Ground Level: 16 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD



Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.35	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.5					0.50	**SILT** with some sand; light brown mottled orange brown. Very stiff, dry to wet, low plasticity; sand is fine grained (ALLUVIAL DEPOSITS).	
1.0 1.5 2.0 2.5					3.00	**SAND** with minor silt; light brown mottled orange brown. Loosely packed, moist; sand is fine to medium grained. 1.2m Becomes dark grey with some silt. 2.3m Becomes with occasional fibrous organic inclusions (rootlets).	15 14
3.0		▼			3.40	**GRAVEL** with some sand; brownish grey. Loosely packed; moist to wet; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	13
3.5 4.0 4.5						End of Test Pit at 3.4m (Target Depth Achieved.)	12

Remarks:

Groundwater 3.2m

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: Fulton Hogan Land Development Limited
Project Name: Rosemerryn Farm Subdivision
Location: Stage 7 to 15
Project Reference: 224464

TP14

Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 30t Excavator
Test Pit Dimensions:
Contractor: Fulton Hogan

CO-ORDINATES NZTM
Easting: 1559655 m
Northing: 5167974 m
Ground Level: N/A

Date Started: 6/09/2011
Date Completed: 6/09/2011

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.25	TOPSOIL SILT with trace sand and rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained.	
0.5					1.00	SAND; Brown. Medium dense. Moist. Fine grained.	
1.0				Shear vane at 1m: 101/24kPa	1.50	SILT; Light brown. Soft. Moist. Low plasticity.	
1.5					2.00	SAND; Brown orange. Loose. Wet. Sand fine grained.	
2.0 2.5					2.60	SAND; Grey. Loose. Wet. Sand fine grained.	
3.0 3.5		▼			3.70	Sandy SILT; Blue grey. Firm. Wet. Low plasticity. Sand is fine grained.	
4.0 4.5						End of Test Pit at 3.7m (GW Reached)	

Remarks:

Tree roots @ 2.4m
Groundwater reached 3.7m

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP16

Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559549 m
Northing: 5168050 m
Ground Level: 16 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD

Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
						SILT, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.5					0.30	**Silty SAND**; light brown mottled orange. Loosely packed, moist; sand is fine to medium grained (ALLUVIAL DEPOSITS).	
1.0							15
1.5					1.20	**SAND** with some silt; light brown mottled orange brown. Loosely packed, mosit; sand is fine to medium grained.	
2.0						2.0m Becomes dark grey. 2.1m Log encountered (250mm in diameter).	14
2.5							
3.0					3.00	End of Test Pit at 3m (Target Depth Achieved.)	13
3.5							
4.0							12
4.5							

Remarks:

Groundwater Not Encountered

Last Generated: 3/07/2012 11:26:27 a.m.

Database File: STAGE 7 TO 15 UPDATED TEST PIT LOGS.GPJ, Library: AURECON CHRISTCHURCH.GLB, Data template: CHCH DATA TEMPLATE NOV 2010.GDT

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
Telephone: +64 3 366 0821
www.aurecongroup.com
Facsimile: +64 3 379 6955
Email: christchurch@ap.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP17

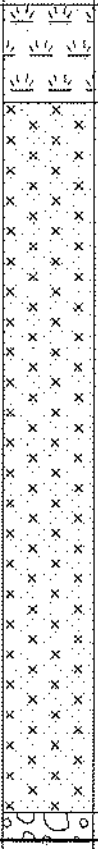
Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559708 m
Northing: 5168009 m
Ground Level: 13 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD



Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.35	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.5						**Silty SAND**; light brown mottled orange. Loosely packed, moist; sand is fine to medium grained (ALLUVIAL DEPOSITS).	
1.0							12
1.5						1.4m Becomes with some silt, grey mottled orange brown. 1.5m Becomes with occasional fibrous organic inclusions (rootlets).	
2.0						2.0m Becomes dark grey.	11
2.5							
		▼			2.90	**GRAVEL** with some sand; brownish grey. Loosely packed; saturated; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	
3.0					3.00	End of Test Pit at 3m (Too dense to excavate.)	10
3.5							
4.0							9
4.5							

Remarks:

Groundwater at 2.9m

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP20

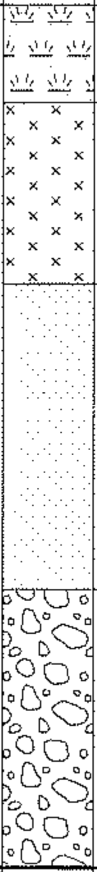
Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559485 m
Northing: 5168200 m
Ground Level: 18 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD



Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.35	**SILT**, minor sand, dark brown. Stiff, moisf, low plasticity, sand is fine grained (TOPSOIL).	
0.5					1.00	**SILT**, some sand, light brown mottled orange brown. Very stiff, dry, low plasticity, Sand is fine grained (ALLUVIAL DEPOSITS).	
1.0						**SAND** with some silt; light brown mottled orange brown; sand is fine to medium grained.	17
1.5							
2.0					2.10		16
						Sandy GRAVEL brownish grey. Loosely packed; moist to wet; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	
2.5							
3.0					3.10		15
						End of Test Pit at 3.1m (Target Depth Achieved.)	
3.5							
4.0							14
4.5							

Remarks:

Groundwater not encountered.

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955
Email: christchurch@ap.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP21

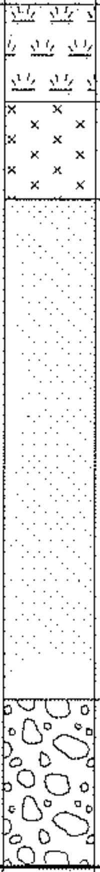
Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559683 m
Northing: 5168142 m
Ground Level: 17 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD



Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.35	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.5					0.70	**SILT**, some sand; light brown mottled orange brown. Very stiff, dry to moist, low plasticity; sand is fine grained (ALLUVIAL DEPOSITS).	
1.0						**SAND** with some silt; light brown mottled orange brown; sand is fine to medium grained.	16
1.5						1.5m Becomes dark grey.	
2.0							15
2.5		▼			2.50	**GRAVEL** with some sand; brownish grey. Loosely packed; moist to wet; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	
3.0					3.10		14
						End of Test Pit at 3.1m (Test Pit Sides Collapsing)	
3.5							
4.0							13
4.5							

Remarks:

Groundwater at 2.4m

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP22

Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559859 m
Northing: 5168076 m
Ground Level: 17 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD

Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.30	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.5					0.70	**SILT** with some sand; light brown mottled orange brown. Dry to moist, low plasticity; sand is fine grained (ALLUVIAL DEPOSITS).	
						SAND with some silt; light brown mottled orange brown. Loosely packed, mosit; sand is fine to medium grained.	
1.0							16
						1.2m Becomes grey.	
1.5							
2.0						2.0m Becomes dark grey. 2.1m Becomes with fibrous organic inclusions (Branches and roots up to 60mm in diameter).	15
2.5							
		▼			2.90		
3.0					3.20	**GRAVEL** with some sand; brownish grey. Loosely packed; moist to wet; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	14
						End of Test Pit at 3.2m (Test Pit Sides Collapsing)	
3.5							
4.0							13
4.5							

Remarks:

Groundwater at 2.8m

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Telephone. +64 3 368 0821
Facsimile: +64 3 379 6955
Email: christchurch@ap.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP28

Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559471 m
Northing: 5168269 m
Ground Level: 14 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD

Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.35	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
					0.45	**Sandy SILT**, light brown mottled orange brown. Very stiff, dry, low plasticity, sand is fine grained (ALLUVIAL DEPOSITS).	
0.5						**Sandy GRAVEL**; brownish grey. Loosely packed; moist to wet; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	
1.0							13
1.5							
2.0							12
2.5							
3.0					3.00	End of Test Pit at 3m (Target Depth Achieved.)	11
3.5							
4.0							10
4.5							

Remarks:

Groundwater not encountered.

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Aurecon (New Zealand) Limited
Unit 1, 160 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955
Email: christchurch@ap.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP29

Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: N/A
Northing: N/A
Ground Level: N/A

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD

Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.30	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.5					0.80	**SILT**, some sand, light brown mottled orange brown. Very stiff, dry, low plasticity, Sand is fine grained (ALLUVIAL DEPOSITS).	
1.0						**SAND** with some silt; light brown mottled orange brown; sand is fine to medium grained.	
						1.2m Becomes dark grey.	
1.5						1.6m Becomes fibrous organic inclusions (branches up to 100mm diameter).	
2.0						2.0m Tree stump 0.5m diameter.	
2.5					2.60		
						GRAVEL with some sand; brownish grey. Loosely packed; moist to wet; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	
3.0		▼			3.00	End of Test Pit at 3m (Target Depth Achieved.)	
3.5							
4.0							
4.5							

Remarks:

Groundwater at 3.0m

Last Generated: 3/07/2012 11:26:33 a.m.

Database File: STAGE 7 TO 15 UPDATED TEST PIT LOGS.GPJ, Library: AURECON CHRISTCHURCH.GLB, Data template: CHCH DATA TEMPLATE NOV 2010.GDT

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1001
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP30

Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559847 m
Northing: 5168197 m
Ground Level: 13 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD

Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.30	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.5					0.70	**SILT**, with some sand; light brown mottled orange brown. Very stiff, dry, low plasticity; Sand is fine grained (ALLUVIAL DEPOSITS).	
						SAND with some silt; light brown mottled orange brown; sand is fine to medium grained.	
1.0							12
						1.2m Becomes dark grey.	
1.5							
						1.6m Becomes with fibrous organic inclusions (branches up to 100mm diameter).	
2.0						2.0m Tree stump 0.5m diameter.	11
2.5							
3.0		▼			3.20	**GRAVEL** with some sand; brownish grey. Loosely packed; moist to wet; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	10
						End of Test Pit at 3.2m (Target Depth Achieved.)	
3.5							
4.0							9
4.5							

Remarks:

Groundwater at 3.0m

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone. +64 3 366 0821
Facsimile. +64 3 379 6955

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP33

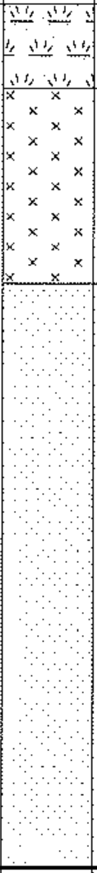
Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559526 m
Northing: 5168388 m
Ground Level: 16 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD



Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
						SILT, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
					0.30	**SILT** with some sand; brown. Stiff, wet, low to moderate plasticity. Sand is fine to medium grained (ALLUVIAL DEPOSITS).	
0.5							
1.0					1.00	**SAND** with minor silt; light brown mottled orange brown. Loosely packed, moist; sand is fine to medium grained.	15
1.5							
						1.8m Becomes light grey mottled orange brown.	
2.0							14
						2.3m Becomes dark grey.	
2.5							
3.0							13
					3.10	End of Test Pit at 3.1m (Target Depth Achieved.)	
3.5							
4.0							12
4.5							

Remarks:

Groundwater not encountered.

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955
Email: christchurch@ap.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP34

Sheet 1 of 1

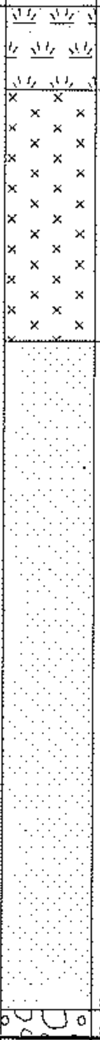
TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559565 m
Northing: 5168402 m
Ground Level: 11 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD

Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.30	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.5					1.20	**SILT**, minor to some sand, brown. Stiff, moist, low to moderate plasticity, sand is fine to medium grained (ALLUVIAL DEPOSITS).	
1.0							10
1.5					3.60	**SAND** with minor silt; brown and grey. Loosely packed; moist; poorly graded; sand is fine to medium grained.	
2.0						2.0m Becomes with some silt.	9
						2.3m Becomes dark grey.	
2.5						2.5m Becomes with organic inclusions (branches and large roots).	
3.0							8
3.5		▼			3.70	**GRAVEL** with some sand; brownish grey. Loosely packed; moist to wet; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	
						End of Test Pit at 3.7m (Target Depth Achieved.)	
4.0							7
4.5							



Remarks:

Groundwater at 3.5m

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP35

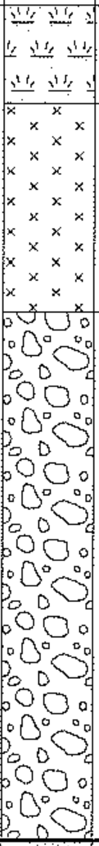
Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559649 m
Northing: 5168358 m
Ground Level: 14 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD



Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
0.00–0.35					0.35	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.35–1.10 (0.5, 1.0)					1.10	**SILT** , minor sand; brown. Stiff, moist, low plasticity; sand is fine to medium grained (ALLUVIAL DEPOSITS).	13
1.10–3.00 (1.5, 2.0, 2.5, 3.0)					3.00	**GRAVEL** with some sand; brownish grey. Loosely packed; moist to wet; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained. 1.3m Becomes with some sand.	12, 11
3.0						End of Test Pit at 3m (Target Depth Achieved.)	11
3.5							
4.0							10
4.5							

Remarks:

Groundwater not encountered.

Last Generated: 3/07/2012 11:26:37 a.m.

Database File: STAGE 7 TO 15 UPDATED TEST PIT LOGS.GPJ, Library: AURECON CHRISTCHURCH.GLB, Data template: CHCH DATA TEMPLATE NOV 2010.GDT

aurecon
Aurecon (New Zealand) Limited
Unit 5, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Telephone +64 3 366 0821
Facsimile +64 3 379 6955
Email: christchurch@ap.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP36

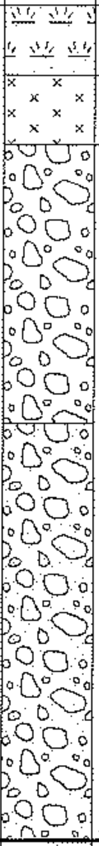
Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559878 m
Northing: 5168255 m
Ground Level: 16 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD



Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.25	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.5					0.50	**SILT**, some sand; light brown mottled orange brown. Very stiff, dry, low plasticity; sand is fine grained (ALLUVIAL DEPOSITS).	
						GRAVEL with some sand; brownish grey. Loosely packed; dry; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	
1.0							15
1.5						1.5m Becomes **sandy** and moist.	
2.0							14
2.5							
3.0					3.00	End of Test Pit at 3m (Target Depth Achieved.)	13
3.5							
4.0							12
4.5							

Remarks:

Groundwater not encountered.

Last Generated: 3/07/2012 11:26:38 a.m.

Database File: STAGE 7 TO 15 UPDATED TEST PIT LOGS.GPJ. Library: AURECON CHRISTCHURCH.GLB. Data template: CHCH DATA TEMPLATE NOV 2010.GDT

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP37

Sheet 1 of **1**

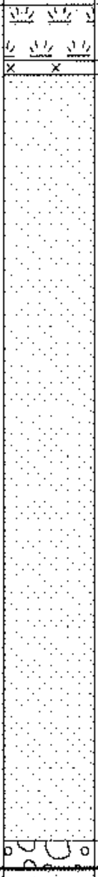
TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559935 m
Northing: 5168238 m
Ground Level: 15 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD

Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.20	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
					0.25	**SILT**, some sand; light brown mottled orange brown. Stiff, moist, low plasticity; sand is fine grained (ALLUVIAL DEPOSITS).	
0.5						**SAND** with minor silt; light brown motttled orange brown. Loosely packed, moist; sand is fine to medium grained.	
						0.8m Becomes grey mottled orange brown.	
1.0							14
						1.3m Becomes dark grey.	
1.5							
2.0							13
2.5							
		▼					
3.0					3.00	**GRAVEL** with some sand; brownish grey. Loosely packed; dry; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	12
					3.10	End of Test Pit at 3.1m (Target Depth Achieved.)	
3.5							
4.0							11
4.5							



Remarks:

Groundwater at 2.9m

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 0955
Email: christchurch@ap.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP38

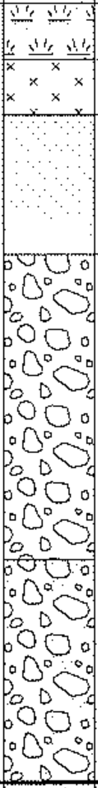
Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559993 m
Northing: 5168257 m
Ground Level: 16 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD



Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.20	**SILT**, minor sand, dark brown. Stiff, dry, low plasticity, sand is fine grained (TOPSOIL).	
					0.40	**SILT** with some sand; light brown mottled orange brown. Very stiff, dry, low plasticity; Sand is fine grained (ALLUVIAL DEPOSITS).	
0.5					0.90	**SAND** with minor to some silt; light brown mottled orange brown. Loosely packed; sand is fine to medium grained.	
1.0						**GRAVEL** with some sand; brownish grey. Loosely packed; dry; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	15
1.5						1.4m Becomes moist.	
2.0						2m Becomes sandy.	14
2.5		▼			2.80		
						End of Test Pit at 2.8m (Target Depth Achieved.)	
3.0							13
3.5							
4.0							12
4.5							

Remarks:

Groundwater at 2.7m

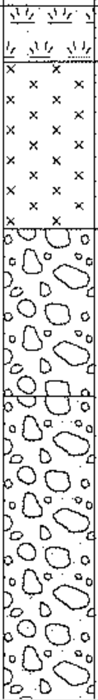
aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Telephone +64 3 366 0821
Facsimile: +64 3 379 0955
Email: christchurch@ap.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP39

Sheet 1 of 1

TEST PIT INFORMATION Excavator Type: 8 Tonne Excavator Test Pit Dimensions: 1.5m x 3m Contractor: Skellys Limited	**CO-ORDINATES N/A** Easting: 1559837 m Northing: 5168324 m Ground Level: 16 m	Date Started: 27/04/2012 Date Completed: 27/04/2012	Logged by: RS Input by: MJF Checked by: RS Verified by: WD



Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.20	**SILT**, minor sand, dark brown. Stiff, dry, low plasticity, sand is fine grained (TOPSOIL).	
					0.80	**SILT** with some sand; light brown mottled orange brown. Very stiff, dry, low plasticity; sand is fine grained (ALLUVIAL DEPOSITS).	
0.5							
						GRAVEL with some sand; brownish grey. Loosely packed; dry; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	
1.0							15
						1.4m Becomes sandy.	
1.5							
						1.9m Becomes moist.	
2.0							14
2.5					2.50	End of Test Pit at 2,5m (Target Depth Achieved.)	
3.0							13
3.5							
4.0							12
4.5							

Remarks:

Groundwater not encountered.

Last Generated: 3/07/2012 11:26:41 a.m.

Database File: STAGE 7 TO 15 UPDATED TEST PIT LOGS.GPJ, Library: AURECON CHRISTCHURCH.GLB, Data template: CHCH DATA TEMPLATE NOV 2010.GDT

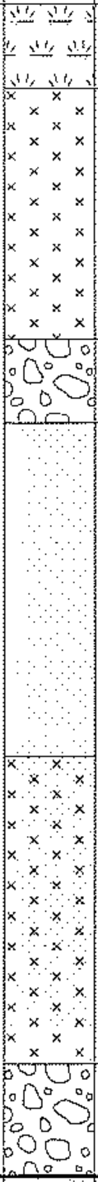
aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
Telephone +64 3 366 0821
www.aurecongroup.com
Facsimile +64 3 379 6955
Email: christchurch@nz.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP40

Sheet **1** of **1**

TEST PIT INFORMATION	CO-ORDINATES N/A		
Excavator Type: 6 Tonne Excavator	Easting: 1559627 m	Date Started: 27/04/2012	Logged by: RS
Test Pit Dimensions: 1.5m x 3m	Northing: 5168409 m	Date Completed: 27/04/2012	Input by: MJF
Contractor: Skellys Limited	Ground Level: 17 m		Checked by: RS
			Verified by: WD

Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					 0.30	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.5 1.0					1.20	**SILT** , some sand; brown. Stiff, moist, low to moderate plasticity; sand is fine to medium grained (ALLUVIAL DEPOSITS).	16
					1.50	**GRAVEL** with some sand; brown and grey. Loosely packed; moist to wet; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to medium grained.	
1.5 2.0 2.5 3.0 3.5					3.80	**SAND** with minor silt; brown mottled grey. Loosely packed; moist; poorly graded; sand is fine to medium grained. 2.5m Becomes dark grey. 2.7m Becomes **silty**.	15 14
4.0					4.20	**GRAVEL** with some sand; brownish grey. Loosely packed; moist to wet; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	13
4.5						End of Test Pit at 4.2m (Target Depth Achieved.)	

Remarks:

Groundwater not encountered.

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
Telephone: +64 3 366 0821
www.aurecongroup.com
Facsimile: +64 3 379 6955
Email: christchurch@ap.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP01

Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1557263 m
Northing: 5166808 m
Ground Level: 18 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD

Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.35	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL)	
0.5						**Sandy SILT**; light brown. Stiff, moist, low plasticity. Sand is fine grained and poorly graded (ALLUVIAL DEPOSITS).	
1.0						0.95m Becomes brown mottled grey.	17
					1.10	**SAND** with minor silt; brown mottled grey. Loosely packed, moist; sand is fine grained and poorly graded.	
1.5							
2.0						2.0m Becomes dark grey mottled orange brown.	16
						2.2m Becomes with some silt.	
2.5					2.50	**SILT** with some sand; dark grey. Moist, moderate plasticity; sand is fine grained.	
		▼					
3.0							15
3.5							
					3.90	End of Test Pit at 3.9m (Maximum Extention of Excavator.)	
4.0							14
4.5							

Remarks:

Groundwater at 2.7m

Last Generated: 3/07/2012 11:26:21 a.m.

Database File: STAGE 7 TO 15 UPDATED TEST PIT LOGS.GPJ, Library: AURECON CHRISTCHURCH.GLB, Data template: CHCH DATA TEMPLATE NOV 2010.GDT

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955
www.aurecongroup.com
Email: christchurch@sp.aurecongroup.com

Client: Fulton Hogan Land Development Limited
Project Name: Rosemerryn Farm Subdivision
Location: Stage 7 to 15
Project Reference: 224464

TP03

Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559600 m
Northing: 5167558 m
Ground Level: N/A

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD

Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.40	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.5						**SILT** with some sand; light brown mottled orange brown. Stiff, moist, moderate plasticity; sand is fine to medium grained (ALLUVIAL DEPOSITS).	
1.0						1.0m Becomes sandy.	
					1.50	1.3m Becomes with trace sand; grey mottled light brown.	
1.5						**SAND** with some silt; dark grey. Loosely packed moist; sand is fine to medium grained.	
2.0		▼					
					2.50	2.3m Becomes with fibrous organic inclusions (branches and roots up to 30mm in diameter).	
2.5						**SILT** with minor sand; dark grey. Stiff, moist, moderate plasticity.	
3.0							
3.5					4.00	3.4m Becomes with fibrous organic inclusions (up to 80mm in diameter).	
4.0						End of Test Pit at 4m (Target Depth Achieved.)	
4.5							

Remarks:

Groundwater at 2.0m

Last Generated: 3/07/2012 11:26:23 a.m.

Database File: STAGE 7 TO 15 UPDATED TEST PIT LOGS.GPJ, Library: AURECON CHRISTCHURCH.GLB, Data template: CHCH DATA TEMPLATE NOV 2010.GDT

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1081
Christchurch 8140
New Zealand
www.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955
Email: christchurch@ap.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP06

Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559835 m
Northing: 5167650 m
Ground Level: 18 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD

Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.30	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.5					1.00	**SILT** with some sand; light brown. Stiff, moist, low plasticity. Sand is fine grained and poorly graded (ALLUVIAL DEPOSITS).	
1.0						**SAND** with some silt; light brown grey. Loosely packed, moist; sand is fine grained.	17
1.5						1.5m Becomes mottled reddish brown.	
2.0					2.20	1.9m Becomes dark grey.	16
2.5					2.80	**SILT** with some sand; light brown. Stiff, moist, moderate plasticity. Sand is fine grained and poorly graded.	
3.0						**SAND** with some silt; dark grey. Loosely packed, moist; sand is fine grained. 3.0m Becomes with fibrous organic inclusions (roots) 20mm in diameter.	15
3.5					3.80		
						End of Test Pit at 3.8m (Target Depth Achieved.)	
4.0							14
4.5							

Remarks:

Groundwater not encountered.

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP08

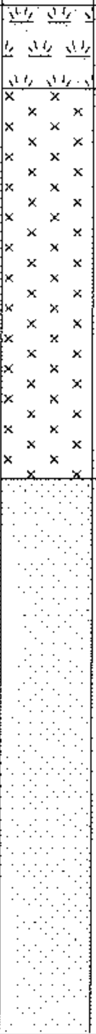
Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559761 m
Northing: 5167731 m
Ground Level: 16 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD



Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.30	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.5						**SILT** with some sand; light brown. Stiff, moist, low plasticity; sand is fine to medium grained (ALLUVIAL DEPOSITS).	
1.0						1.1m Becomes brownish grey mottled orange.	15
1.5					1.70		
						SAND with minor silt; greyish brown mottled orange brown. Loosely packed, moist; sand is fine to medium grained.	
2.0		▼				2.0m Becomes dark grey. 2.1m Becomes with fibrous organic inclusions (up to 20mm in diameter).	14
2.5							
3.0							13
3.5					3.70		
						End of Test Pit at 3.7m (Target Depth Achieved.)	
4.0							12
4.5							

Remarks:

Groundwater at 2.1m

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955
Email: christchurch@ap.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP13

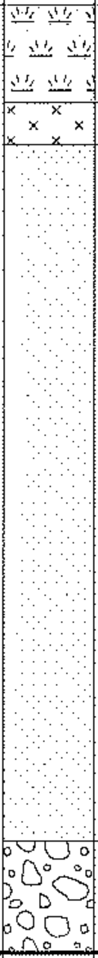
Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559745 m
Northing: 5167953 m
Ground Level: 16 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD



Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.35	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.5					0.50	**SILT** with some sand; light brown mottled orange brown. Very stiff, dry to wet, low plasticity; sand is fine grained (ALLUVIAL DEPOSITS).	
						SAND with minor silt; light brown mottled orange brown. Loosely packed, moist; sand is fine to medium grained.	
1.0							15
						1.2m Becomes dark grey with some silt.	
1.5							
2.0							14
						2.3m Becomes with occasional fibrous organic inclusions (rootlets).	
2.5							
3.0					3.00	**GRAVEL** with some sand; brownish grey. Loosely packed; moist to wet; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	13
		▼			3.40		
3.5						End of Test Pit at 3.4m (Target Depth Achieved.)	
4.0							12
4.5							

Remarks:

Groundwater 3.2m

Last Generated: 3/07/2012 11:26:26 a.m.

Database File: STAGE 7 TO 15 UPDATED TEST PIT LOGS.GPJ, Library: AURECON CHRISTCHURCH.GLB, Data template: CHCH DATA TEMPLATE NOV 2010.GDT

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955
Email: christchurch@ap.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP14

Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 30t Excavator
Test Pit Dimensions:
Contractor: Fulton Hogan

CO-ORDINATES NZTM
Easting: 1559655 m
Northing: 5167974 m
Ground Level: N/A

Date Started: 6/09/2011
Date Completed: 6/09/2011

Logged by: LFS
Input by: LFS
Checked by: JSM
Verified by: JK

Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.25	TOPSOIL SILT with trace sand and rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained.	
0.5					1.00	SAND; Brown. Medium dense. Moist. Fine grained.	
1.0				Shear vane at 1m: 101/24kPa	1.50	SILT; Light brown. Soft. Moist. Low plasticity.	
1.5					2.00	SAND; Brown orange. Loose. Wet. Sand fine grained.	
2.0 2.5					2.60	SAND; Grey. Loose. Wet. Sand fine grained.	
3.0 3.5		▼			3.70	Sandy SILT; Blue grey. Firm. Wet. Low plasticity. Sand is fine grained.	
4.0 4.5						End of Test Pit at 3.7m (GW Reached)	

Remarks:

Tree roots @ 2.4m
Groundwater reached 3.7m

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP16

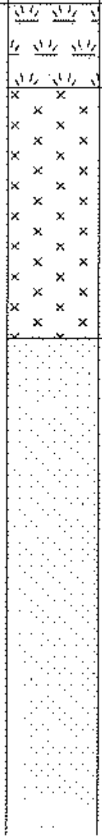
Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559549 m
Northing: 5168050 m
Ground Level: 16 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD



Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
						SILT, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
					0.30	**Silty SAND**; light brown mottled orange. Loosely packed, moist; sand is fine to medium grained (ALLUVIAL DEPOSITS).	
0.5							
1.0							15
					1.20	**SAND** with some silt; light brown mottled orange brown. Loosely packed, mosit; sand is fine to medium grained.	
1.5							
2.0						2.0m Becomes dark grey. 2.1m Log encountered (250mm in diameter).	14
2.5							
3.0					3.00	End of Test Pit at 3m (Target Depth Achieved.)	13
3.5							
4.0							12
4.5							

Remarks:

Groundwater Not Encountered

Last Generated: 3/07/2012 11:26:27 a.m.

Database File: STAGE 7 TO 15 UPDATED TEST PIT LOGS.GPJ, Library: AURECON CHRISTCHURCH.GLB, Data template: CHCH DATA TEMPLATE NOV 2010.GDT

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP17

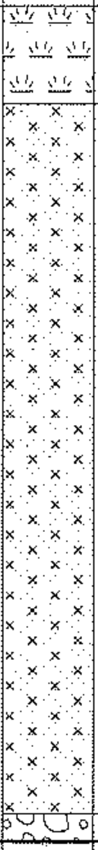
Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559708 m
Northing: 5168009 m
Ground Level: 13 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD



Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.35	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.5						**Silty SAND**; light brown mottled orange. Loosely packed, moist; sand is fine to medium grained (ALLUVIAL DEPOSITS).	
1.0							12
1.5						1.4m Becomes with some silt, grey mottled orange brown. 1.5m Becomes with occasional fibrous organic inclusions (rootlets).	
2.0						2.0m Becomes dark grey.	11
2.5							
		▼			2.90		
3.0					3.00	**GRAVEL** with some sand; brownish grey. Loosely packed; saturated; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained. End of Test Pit at 3m (Too dense to excavate.)	10
3.5							
4.0							9
4.5							

Remarks:

Groundwater at 2.9m

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
Telephone: +64 3 366 0821
www.aurecongroup.com
Facsimile +64 3 379 6955
Email: christchurch@ap.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP20

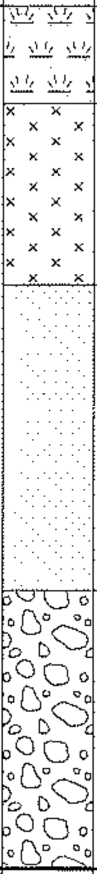
Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559485 m
Northing: 5168200 m
Ground Level: 18 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD



Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.35	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.5					1.00	**SILT**, some sand, light brown mottled orange brown. Very stiff, dry, low plasticity, Sand is fine grained (ALLUVIAL DEPOSITS).	
1.0 1.5 2.0					2.10	**SAND** with some silt; light brown mottled orange brown; sand is fine to medium grained.	17 16
2.5 3.0					3.10	**Sandy GRAVEL** brownish grey. Loosely packed; moist to wet; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	15
3.5 4.0 4.5						End of Test Pit at 3.1m (Target Depth Achieved.)	14

Remarks:

Groundwater not encountered.

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
Telephone: +64 3 366 0821
www.aurecongroup.com
Facsimile: +64 3 379 6955
Email: christchurch@ap.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP21

Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559683 m
Northing: 5168142 m
Ground Level: 17 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD

Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.35	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.5					0.70	**SILT**, some sand; light brown mottled orange brown. Very stiff, dry to moist, low plasticity; sand is fine grained (ALLUVIAL DEPOSITS).	
1.0						**SAND** with some silt; light brown mottled orange brown; sand is fine to medium grained.	16
1.5						1.5m Becomes dark grey.	
2.0							15
2.5		▼			2.50	**GRAVEL** with some sand; brownish grey. Loosely packed; moist to wet; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	
3.0					3.10		14
						End of Test Pit at 3.1m (Test Pit Sides Collapsing)	
3.5							
4.0							13
4.5							

Remarks:

Groundwater at 2.4m

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955
Email: christchurch@ap.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP22

Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559859 m
Northing: 5168076 m
Ground Level: 17 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD

Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.30	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.5					0.70	**SILT** with some sand; light brown mottled orange brown. Dry to moist, low plasticity; sand is fine grained (ALLUVIAL DEPOSITS).	
1.0						**SAND** with some silt; light brown mottled orange brown. Loosely packed, mosit; sand is fine to medium grained.	16
						1.2m Becomes grey.	
1.5							
2.0						2.0m Becomes dark grey. 2.1m Becomes with fibrous organic inclusions (Branches and roots up to 60mm in diameter).	15
2.5							
		▼			2.90		
3.0					3.20	**GRAVEL** with some sand; brownish grey. Loosely packed; moist to wet; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	14
						End of Test Pit at 3.2m (Test Pit Sides Collapsing)	
3.5							
4.0							13
4.5							

Remarks:

Groundwater at 2.8m

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Telephone. +64 3 366 0821
Facsimile: +64 3 379 6955
Email: christchurch@ap.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP28

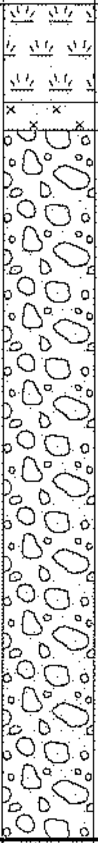
Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559471 m
Northing: 5168269 m
Ground Level: 14 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD



Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
						SILT, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
					0.35	**Sandy SILT**, light brown mottled orange brown. Very stiff, dry, low plasticity, sand is fine grained (ALLUVIAL DEPOSITS).	
0.5					0.45	**Sandy GRAVEL**; brownish grey. Loosely packed; moist to wet; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	
1.0							13
1.5							
2.0							12
2.5							
3.0					3.00	End of Test Pit at 3m (Target Depth Achieved.)	11
3.5							
4.0							10
4.5							

Remarks:

Groundwater not encountered.

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955
Email: christchurch@ap.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP29

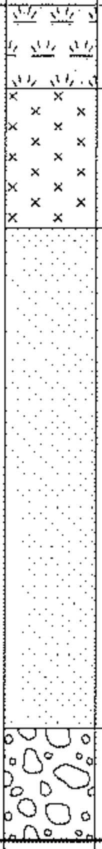
Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: N/A
Northing: N/A
Ground Level: N/A

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD



Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.30	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.5					0.80	**SILT**, some sand, light brown mottled orange brown. Very stiff, dry, low plasticity, Sand is fine grained (ALLUVIAL DEPOSITS).	
1.0 1.5 2.0 2.5					2.60	**SAND** with some silt; light brown mottled orange brown; sand is fine to medium grained. 1.2m Becomes dark grey. 1.6m Becomes fibrous organic inclusions (branches up to 100mm diameter). 2.0m Tree stump 0.5m diameter.	
3.0		▼			3.00	**GRAVEL** with some sand; brownish grey. Loosely packed; moist to wet; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	
3.5 4.0 4.5						End of Test Pit at 3m (Target Depth Achieved.)	

Remarks:

Groundwater at 3.0m

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP30

Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559847 m
Northing: 5168197 m
Ground Level: 13 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD

Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.30	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.5					0.70	**SILT**, with some sand; light brown mottled orange brown. Very stiff, dry, low plasticity; Sand is fine grained (ALLUVIAL DEPOSITS).	
						SAND with some silt; light brown mottled orange brown; sand is fine to medium grained.	
1.0							12
						1.2m Becomes dark grey.	
1.5							
						1.6m Becomes with fibrous organic inclusions (branches up to 100mm diameter).	
2.0						2.0m Tree stump 0.5m diameter.	11
2.5							
3.0		▼					10
					3.20	**GRAVEL** with some sand; brownish grey. Loosely packed; moist to wet; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	
						End of Test Pit at 3.2m (Target Depth Achieved.)	
3.5							
4.0							9
4.5							

Remarks:

Groundwater at 3.0m

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Telephone. +64 3 366 0821
Facsimile. +64 3 379 6955
Email: christchurch@ap.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP33

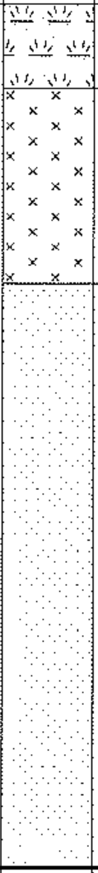
Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559526 m
Northing: 5168388 m
Ground Level: 16 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD



Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.30	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.5					1.00	**SILT** with some sand; brown. Stiff, wet, low to moderate plasticity. Sand is fine to medium grained (ALLUVIAL DEPOSITS).	
1.0						**SAND** with minor silt; light brown mottled orange brown. Loosely packed, moist; sand is fine to medium grained.	15
1.5							
						1.8m Becomes light grey mottled orange brown.	
2.0							14
						2.3m Becomes dark grey.	
2.5							
3.0					3.10		13
						End of Test Pit at 3.1m (Target Depth Achieved.)	
3.5							
4.0							12
4.5							

Remarks:

Groundwater not encountered.

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email. christchurch@ap.aurecongroup.com
Telephone. +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP34

Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559565 m
Northing: 5168402 m
Ground Level: 11 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD

Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.30	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.5						**SILT**, minor to some sand, brown. Stiff, moist, low to moderate plasticity, sand is fine to medium grained (ALLUVIAL DEPOSITS).	
1.0					1.20		10
1.5						**SAND** with minor silt; brown and grey. Loosely packed; moist; poorly graded; sand is fine to medium grained.	
2.0						2.0m Becomes with some silt.	9
						2.3m Becomes dark grey.	
2.5						2.5m Becomes with organic inclusions (branches and large roots).	
3.0							8
3.5		▽			3.60		
					3.70	**GRAVEL** with some sand; brownish grey. Loosely packed; moist to wet; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	
						End of Test Pit at 3.7m (Target Depth Achieved.)	
4.0							7
4.5							

Remarks:

Groundwater at 3.5m

Last Generated: 3/07/2012 11:26:36 a.m.

Database File: STAGE 7 TO 15 UPDATED TEST PIT LOGS.GPJ, Library: AURECON CHRISTCHURCH.GLB, Data template: CHCH DATA TEMPLATE NOV 2010.GDT

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP35

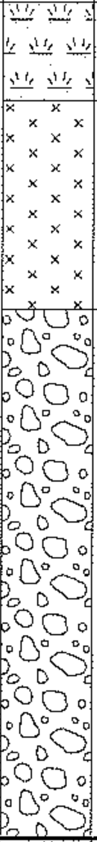
Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559649 m
Northing: 5168358 m
Ground Level: 14 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD

Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					 0.35	**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
0.5 1.0					1.10	**SILT** , minor sand; brown. Stiff, moist, low plasticity; sand is fine to medium grained (ALLUVIAL DEPOSITS).	13
1.5 2.0 2.5					3.00	**GRAVEL** with some sand; brownish grey. Loosely packed; moist to wet; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained. 1.3m Becomes with some sand.	12
3.0 3.5 4.0 4.5						End of Test Pit at 3m (Target Depth Achieved.)	11 10

Remarks:

Groundwater not encountered.

Last Generated: 3/07/2012 11:26:37 a.m.

Database File: STAGE 7 TO 15 UPDATED TEST PIT LOGS.GPJ, Library: AURECON CHRISTCHURCH.GLB, Data template: CHCH DATA TEMPLATE NOV 2010.GDT

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP36

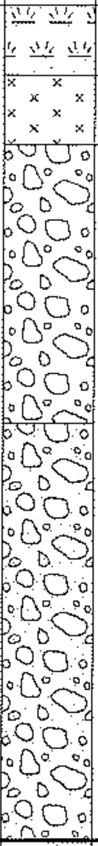
Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559878 m
Northing: 5168255 m
Ground Level: 16 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD

Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
						**SILT**, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
					0.25	**SILT**, some sand; light brown mottled orange brown. Very stiff, dry, low plasticity; sand is fine grained (ALLUVIAL DEPOSITS).	
0.5					0.50	**GRAVEL** with some sand; brownish grey. Loosely packed; dry; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	
1.0							15
1.5						1.5m Becomes **sandy** and moist.	
2.0							14
2.5							
3.0					3.00	End of Test Pit at 3m (Target Depth Achieved.)	13
3.5							
4.0							12
4.5							

Remarks:

Groundwater not encountered.

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955
Email: christchurch@ap.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP37

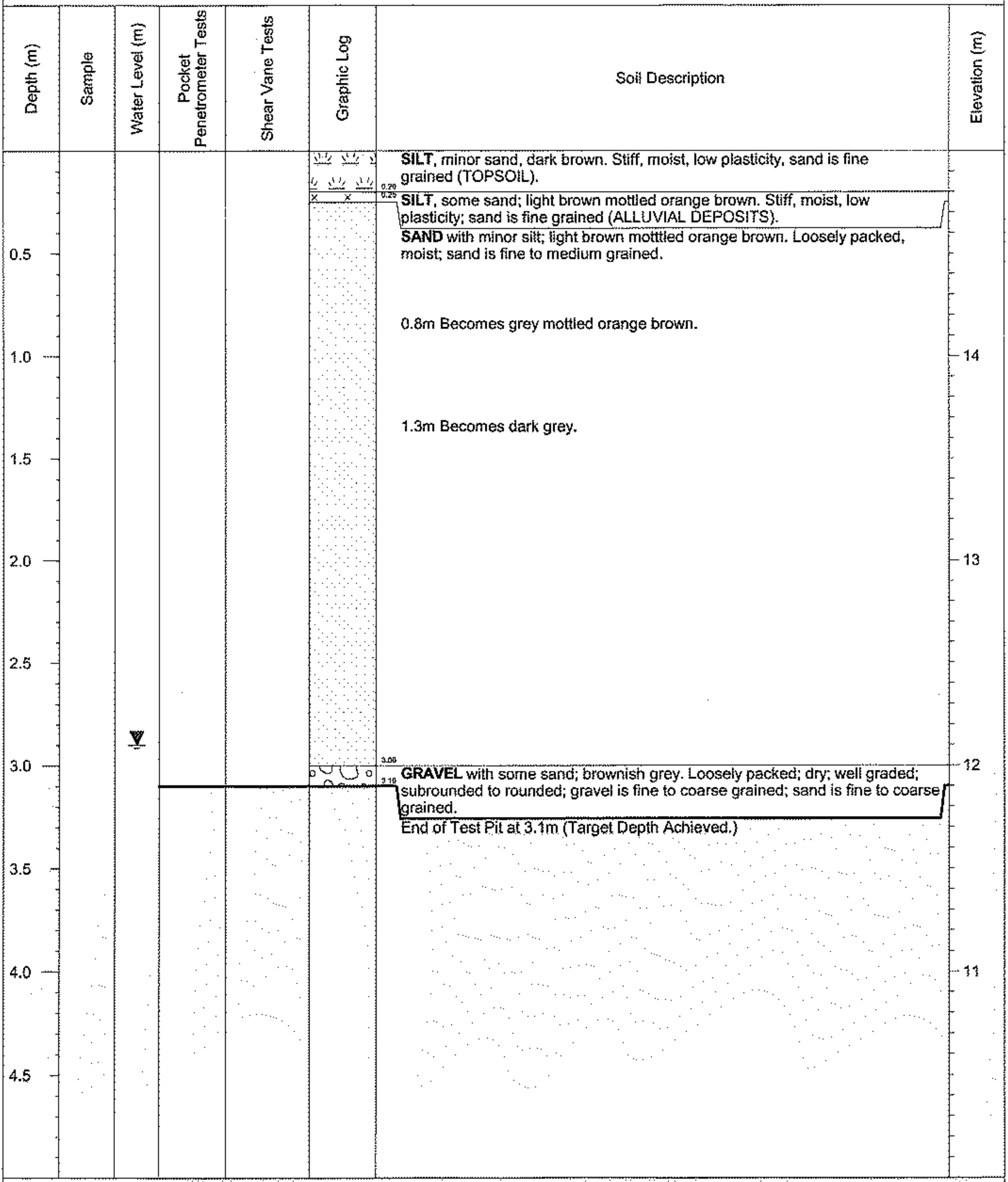
Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559935 m
Northing: 5168238 m
Ground Level: 15 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD



SILT, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).

SILT, some sand; light brown mottled orange brown. Stiff, moist, low plasticity; sand is fine grained (ALLUVIAL DEPOSITS).

SAND with minor silt; light brown motttled orange brown. Loosely packed, moist; sand is fine to medium grained.

0.8m Becomes grey mottled orange brown.

1.3m Becomes dark grey.

GRAVEL with some sand; brownish grey. Loosely packed; dry; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.

End of Test Pit at 3.1m (Target Depth Achieved.)

Remarks:

Groundwater at 2.9m

Last Generated: 3/07/2012 11:26:39 a.m.

Database File: STAGE 7 TO 15 UPDATED TEST PIT LOGS.GPJ, Library: AURECON CHRISTCHURCH.GLB, Data template: CHCH DATA TEMPLATE NOV 2010.GDT

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955
Email: christchurch@ap.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP38

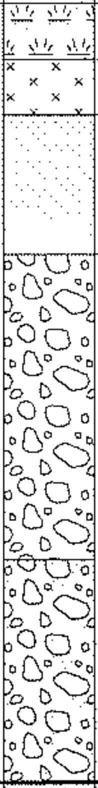
Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559993 m
Northing: 5168257 m
Ground Level: 16 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD



Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
					0.20	**SILT**, minor sand, dark brown. Stiff, dry, low plasticity, sand is fine grained (TOPSOIL).	
					0.40	**SILT** with some sand; light brown mottled orange brown. Very stiff, dry, low plasticity; Sand is fine grained (ALLUVIAL DEPOSITS).	
0.5					0.90	**SAND** with minor to some silt; light brown mottled orange brown. Loosely packed; sand is fine to medium grained.	
1.0						**GRAVEL** with some sand; brownish grey. Loosely packed; dry; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	15
1.5						1.4m Becomes moist.	
2.0						2m Becomes sandy.	14
2.5		▼			2.80		
3.0						End of Test Pit at 2.8m (Target Depth Achieved.)	13
3.5							
4.0							12
4.5							

Remarks:

Groundwater at 2.7m

Last Generated: 3/07/2012 11:26:40 a.m.

Database File: STAGE 7 TO 15 UPDATED TEST PIT LOGS.GPJ, Library: AURECON CHRISTCHURCH.GLB, Data template: CHCH DATA TEMPLATE NOV 2010.GDT

aurecon

Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
Telephone +64 3 366 0821
Facsimile +64 3 379 6955
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP39

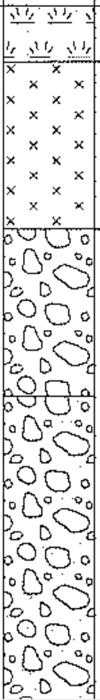
Sheet 1 of 1

TEST PIT INFORMATION
Excavator Type: 8 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559837 m
Northing: 5168324 m
Ground Level: 16 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD



Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
0.00–0.20						**SILT**, minor sand, dark brown. Stiff, dry, low plasticity, sand is fine grained (TOPSOIL).	
0.20–0.80						**SILT** with some sand; light brown mottled orange brown. Very stiff, dry, low plasticity; sand is fine grained (ALLUVIAL DEPOSITS).	
0.5							
0.80–2.50						**GRAVEL** with some sand; brownish grey. Loosely packed; dry; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	
1.0							15
1.4						1.4m Becomes sandy.	
1.5							
1.9						1.9m Becomes moist.	
2.0							14
2.5						End of Test Pit at 2.5m (Target Depth Achieved.)	
3.0							13
3.5							
4.0							12
4.5							

Remarks:

Groundwater not encountered.

Last Generated: 3/07/2012 11:26:41 a.m.

Database File: STAGE 7 TO 15 UPDATED TEST PIT LOGS.GPJ, Library: AURECON CHRISTCHURCH.GLB, Data template: CHCH DATA TEMPLATE NOV 2010.GDT

aurecon
Aurecon (New Zealand) Limited
Unit 1, 150 Cavendish Rd
PO BOX 1061
Christchurch 8140
New Zealand
Telephone +64 3 366 0821
Facsimile +64 3 379 6955
www.aurecongroup.com
Email: christchurch@nz.aurecongroup.com

Client: **Fulton Hogan Land Development Limited**
Project Name: **Rosemerryn Farm Subdivision**
Location: **Stage 7 to 15**
Project Reference: **224464**

TP40

Sheet **1** of **1**

TEST PIT INFORMATION
Excavator Type: 6 Tonne Excavator
Test Pit Dimensions: 1.5m x 3m
Contractor: Skellys Limited

CO-ORDINATES N/A
Easting: 1559627 m
Northing: 5168409 m
Ground Level: 17 m

Date Started: 27/04/2012
Date Completed: 27/04/2012

Logged by: RS
Input by: MJF
Checked by: RS
Verified by: WD

Depth (m)	Sample	Water Level (m)	Pocket Penetrometer Tests	Shear Vane Tests	Graphic Log	Soil Description	Elevation (m)
						SILT, minor sand, dark brown. Stiff, moist, low plasticity, sand is fine grained (TOPSOIL).	
					0.30	**SILT** , some sand; brown. Stiff, moist, low to moderate plasticity; sand is fine to medium grained (ALLUVIAL DEPOSITS).	
0.5							
1.0							16
					1.20	**GRAVEL** with some sand; brown and grey. Loosely packed; moist to wet; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to medium grained.	
1.5					1.50	**SAND** with minor silt; brown mottled grey. Loosely packed; moist; poorly graded; sand is fine to medium grained.	
2.0							15
2.5						2.5m Becomes dark grey.	
						2.7m Becomes **silty**.	
3.0							14
3.5							
					3.80	**GRAVEL** with some sand; brownish grey. Loosely packed; moist to wet; well graded; subrounded to rounded; gravel is fine to coarse grained; sand is fine to coarse grained.	
4.0							13
					4.20	End of Test Pit at 4.2m (Target Depth Achieved.)	
4.5							

Remarks:

Groundwater not encountered.

Last Generated: 3/07/2012 11:26:41 a.m.

Database File: STAGE 7 TO 15 UPDATED TEST PIT LOGS.GPJ, Library: AURECON CHRISTCHURCH.GLB, Data template: CHCH DATA TEMPLATE NOV 2010.GDT

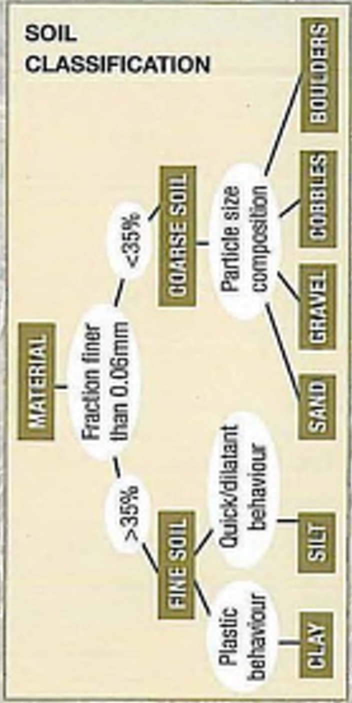
SOIL > field guide sheet

FIELD DESCRIPTION OF SOIL

SEQUENCE OF TERMS – fraction – colour – structure – strength – moisture – bedding – plasticity – sensitivity – additional

GRAIN SIZE CRITERIA

TYPE	COARSE								FINE		ORGANIC
	Boulders	Cobbles	Gravel			Sand			Silt	Clay	Organic Soil
			coarse	medium	fine	coarse	medium	fine			
Size Range (mm)	200	60	20	6	2	0.6	0.2	0.06	0.002		
Graphic Symbol	●	● ●	○○○	○○○	○○○	· · · ·	· · · ·	· · · ·	× × ×	– – –	ѱ ѱ ѱ



SOIL CLASSIFICATION

PROPORTIONAL TERMS DEFINITION (COARSE SOILS)

Fraction	Term	% of Soil Mass	Example
Major	(....) [UPPER CASE]	≥ 50 [major constituent]	GRAVEL
Subordinate	(....) y [lower case]	20 – 50	Sandy
Minor	with some ... with minor ...	12 – 20 5 – 12	with some sand with minor sand
	with trace of (or slightly)...	< 5	with trace of sand (slightly sandy)

DENSITY INDEX (RELATIVE DENSITY) TERMS

Descriptive Term	Density Index (R_D)	SPT "N" value (blows / 300 mm)	Dynamic Cone (blows / 100 mm)
Very dense	> 85	> 50	> 17
Dense	65 – 85	30 – 50	7 – 17
Medium dense	35 – 65	10 – 30	3 – 7
Loose	15 – 35	4 – 10	1 – 3
Very loose	< 15	< 4	0 – 2

Note: • No correlation is implied between Standard Penetration Test (SPT) and Dynamic Cone Test values.
• SPT "N" values are uncorrected. • Dynamic Cone Penetrometer (Scala)

CONSISTENCY TERMS FOR COHESIVE SOILS

Descriptive Term	Undrained Shear Strength (kPa)	Diagnostic Features
Very soft	< 12	Easily exudes between fingers when squeezed
Soft	12 – 25	Easily indented by fingers
Firm	25 – 50	Indented by strong finger pressure and can be indented by thumb pressure
Stiff	50 – 100	Cannot be indented by thumb pressure
Very stiff	100 – 200	Can be indented by thumb nail
Hard	200 – 500	Difficult to indent by thumb nail

ORGANIC SOILS/ DESCRIPTORS

Term	Description
Topsoil	Surficial organic soil layer that may contain living matter. However topsoil may occur at greater depth, having been buried by geological processes or man-made fill, and should then be termed a buried topsoil.
Organic clay, silt or sand	Contains finely divided organic matter; may have distinctive smell; may stain; may oxidise rapidly. Describe as for inorganic soils.
Peat	Consists predominantly of plant remains. *Firm*: Fibres already compressed together *Spongy*: Very compressible and open stucture *Plastic*: Can be moulded in hand and smears in fingers *Fibrous*: Plant remains recognisable and retain some strength *Amorphous*: No recognisable plant remains
Rootlets	Fine, partly decomposed roots, normally found in the upper part of a soil profile or in a redeposited soil (e.g. colluvium or fill)
Carbonaceous	Discrete particles of hardened (carbonised) plant material.

MOISTURE CONDITION

Condition	Description	Granular Soils	Cohesive Soils
Dry	Looks and feels dry	Run freely through hands	Hard, powdery or friable
Moist	Feels cool, darkened in colour	Tend to cohere	Weakened by moisture, but no free water on hands when remoulding
Wet			Weakened by moisture, free water forms on hands when handling
Saturated	Feels cool, darkened in colour and free water is present on the sample		

PLASTICITY (CLAYS & SILTS)

Term	Description
High plasticity	Can be moulded or deformed over a wide range of moisture contents without cracking or showing any tendency to volume change
Low plasticity	When moulded can be crumbled in the fingers; may show quick or dilatant behaviour

GRADING (GRAVELS & SANDS)

Term	Description	
Well graded	Good representation of all particle sizes from largest to smallest	
Poorly graded	Limited representation of grain sizes - further divided into:	
	Uniformly graded	Most particles about the same size
	Gap graded	Absence of one or more intermediate sizes

compiled by KATE WILLIAMS design KARRYN MUSCHAMP

NZ GEOTECHNICAL SOCIETY INC

This field sheet has been taken from and should be used and read with reference to the document FIELD DESCRIPTION OF SOIL AND ROCK. Guideline For the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005. **www.nzgeotechsoc.org.nz**

Appendix G

Borehole Logs

aurecon
Aurecon (New Zealand) Limited
Unit 1, 160 Cavendish Road
PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN FARM SUBDIVISION**
Location: **SEE PLAN**
Project Reference: **224464**

BH02

Sheet 1 of 2

BOREHOLE INFORMATION
Drilling Method: CAT 312 Track Rig
Diameter Core: 100mm
Contractor: McMillan Drilling

CO-ORDINATES N/A
Easting: N/A
Northing: N/A
Ground Level: N/A

Date Started: 16/09/2011
Date Completed: 19/09/2011
Inclination: 90
Orientation:

Logged by: JSM
Input by: JSM
Checked by: JSM
Verified by: JK

Method/Casing	Core Recovery (%)	Water Loss (%)	Groundwater Level (m)	R.L. (m)	Depth (m)	Graphic Log	Material Description	USC Description	Consistency/Density	Moisture	Sample	In-Situ Testing	Laboratory Testing	Notes	Backfill	Geological Unit
WASH					0.40		TOPSOIL SILT with trace sand and occasional rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained.	OL					NO LABORATORY TESTING			
					1.00		SAND; Grey brown with orange brown motties. Loose. Moist. Sand fine grained.	SP								
			▼		1 2 3.10		SILT; Dark blue grey. Low plasticity. Stiff. Moist.	ML			B					
					4 5 6 7 8 9		Sandy GRAVEL; Dark grey with orange brown mottling. Dense. Wet to saturated. Gravel fine to coarse grained and rounded. Sand fine to medium grained.	GW				SPT at 3m N = 35 6, 9/9, 9, 9, 8 450mm (BC)				

Method

CC	concrete core
OB	open barrel
SSA	solid stem auger
HSA	hollow stem auger
WASH	wash drill
PQ3	PQ Triple Tube
HQ3	HQ Triple Tube
NQ3	NQ Triple Tube
NMLC	NMLC Triple Tube
DP	Direct Push
DT	Dual Tube (70mm)
░	Casing

USC Classification

CH	Inorganic CLAYS high plasticity
CI	Inorganic CLAYS medium plasticity
CL	Inorganic CLAYS low plasticity
GC	Clayey GRAVEL
GM	Silty GRAVEL
GP	Poorly Graded GRAVEL
GW	Well Graded GRAVEL
MH	Inorganic SILT high plasticity
ML	Inorganic SILT low plasticity
OH	ORGANIC CLAY medium to high plasticity
OL	ORGANIC SILT low plasticity
PT	PEAT and highly organic soils
SC	Clayey SAND
SM	Silty SAND
SP	Poorly graded SAND
SW	Well graded SAND

Consistency

VS	very soft
S	soft
F	firm
S	stiff
VS	very stiff
H	hard

Density

VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Soil Samples

B	bulk
U	undisturbed
D	disturbed

Water

▼	at end of excavation
▼	at time of excavation
▼	at time of closure

In Situ Testing

PP	pen penetrometer
VS	vane shear
SPT	std. pen. test
SS	split spoon
SC	solid cone
HB	hammer bouncing
SH	sinks under own weight

Moisture

D	dry
M	moist
W	wet
S	saturated

Graphic Log
Topsoil
SAND
SILT
Sandy GRAVEL

Backfill
Cement Seal: 1 pipe group, 1 pipe
Bentonite Seal: 1 pipe group, 1 pipe
Slough Backfill: 1 pipe group, 1 pipe
Slotted Pipe: 1 pipe group, 1 pipe

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PO BOX 1061
Christchurch 8140
New Zealand
www.aurecongroup.com
Email: christchurch@ap.aurecongroup.com
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Facsimile: +64 3 379 6955

Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN FARM SUBDIVISION**
Location: **SEE PLAN**
Project Reference: **224464**

BH02

Sheet **2** of **2**

BOREHOLE INFORMATION
Drilling Method: CAT 312 Track Rig
Diameter Core: 100mm
Contractor: McMillan Drilling

CO-ORDINATES N/A
Easting: N/A
Northing: N/A
Ground Level: N/A

Date Started: 16/09/2011
Date Completed: 19/09/2011
Inclination: 90
Orientation:

Logged by: JSM
Input by: JSM
Checked by: JSM
Verified by: JK

Method/Casing	Core Recovery (%)	Water Loss (%)	Groundwater Level (m)	R.L. (m)	Depth (m)	Graphic Log	Material Description	USC Description	Consistency/Density	Moisture	Sample	In-Situ Testing	Laboratory Testing	Notes	Backfill	Geological Unit
WASH					11 12 13 14		Sandy GRAVEL: Dark grey with orange brown mottling. Dense. Wet to saturated. Graval fine to coarse grained and rounded. Sand fine to medium grained. *(Layer Continued from previous page)*	GW				SPT at 10m N = 50 5, 7/12, 14, 13, 11 460mm (SC)	NO LABORATORY TESTING			
					15 16 17 18 19		Borehole Terminated at 15m (Target Depth)									

Method
- CC concrete core
- OB open barrel
- SSA solid stem auger
- HSA hollow stem auger
- WASH wash drill
- PQ3 PQ Triple Tube
- HQ3 HQ Triple Tube
- NQ3 NQ Triple Tube
- NMLC NMLC Triple Tube
- DP Direct Push
- DT Dual Tube (70mm)
- Casing

USC Classification
- CH Inorganic CLAYS high plasticity
- CI Inorganic CLAYS medium plasticity
- CL Inorganic CLAYS low plasticity
- GC Clayey GRAVEL
- GM Silty GRAVEL
- GP Poorly Graded GRAVEL
- GW Well Graded GRAVEL
- MH Inorganic SILT high plasticity
- ML Inorganic SILT low plasticity
- OH ORGANIC CLAY medium to high plasticity
- OL ORGANIC SILT low plasticity
- PT PEAT and highly organic soils
- SC Clayey SAND
- SM Silty SAND
- SP Poorly graded SAND
- SW Well graded SAND

Consistency
- VS very soft
- S soft
- F firm
- S stiff
- VS very stiff
- H hard

Density
- VL very loose
- L loose
- MD medium dense
- D dense
- VD very dense

Soil Samples
- B bulk
- U undisturbed
- D disturbed

Water
- ▽ at end of excavation
- ▼ at time of excavation
- ▼ at time of closure

In Situ Testing
- PP pen penetrometer
- VS vane shear
- SPT std. pen. test
- SS split spoon
- SC solid cone
- HB hammer bouncing
- SH sinks under own weight

Moisture
- D dry
- M moist
- W wet
- S saturated

Graphic Log
- Topsoil
- SAND
- SILT
- Sandy GRAVEL

Backfill
- ▨ Cement Seal: 1 pipe group, 1 pipe
- ■ Bentonite Seal: 1 pipe group, 1 pipe
- ▦ Slough Backfill: 1 pipe group, 1 pipe
- ▤ Slotted Pipe: 1 pipe group, 1 pipe

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Facsimile: +64 3 379 6955

Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN FARM SUBDIVISION**
Location: **SEE PLAN**
Project Reference: **224464**

BH04

Sheet 1 of 2

BOREHOLE INFORMATION
Drilling Method: CAT 312 Track Rig
Diameter Core: 100mm
Contractor: McMillan Drilling

CO-ORDINATES N/A
Easting: N/A
Northing: N/A
Ground Level: N/A

Date Started: 15/09/2011
Date Completed: 15/09/2011
Inclination: 90
Orientation:

Logged by: JSM
Input by: JSM
Checked by: JSM
Verified by: JK

Method/Casing	Core Recovery (%)	Water Loss (%)	Groundwater Level (m)	R.L. (m)	Depth (m)	Graphic Log	Material Description	USC Description	Consistency/Density	Moisture	Sample	In-Situ Testing	Laboratory Testing	Notes	Backfill	Geological Unit
WASH					0.40		TOPSOIL SILT with trace sand and occaisional rootlets; Dark brown. Firm. Moist. Low plasticity. Sand fine grained.	OL					NO LABORATORY TESTING			
			▼		1 1.40		SILT with minor sand; Yellow brown. Low plasticity. Firm. Moist. Sand fine to medium grained.	ML								
					2 3 4 4.20		Silty SAND; Dark blue grey. Loose to medium dense. Moist to wet. Sand fine to medium grained.	SM				SPT at 3m N = 12 2, 2/3, 3, 3, 3 450mm (SC)				
					5 6 6.60		SILT: Dark blue grey. Low plasticity. Firm to stiff. Moist.	ML								
					7 8 9		Sandy GRAVEL: Dark grey with orange brown mottling. Dense. Wet to saturated. Gravel fine to coarse grained and rounded. Sand fine to medium grained.	GW								

Method
CC concrete core
OB open barrel
SSA solid stem auger
HSA hollow stem auger
WASH wash drill
PQ3 PQ Triple Tube
HQ3 HQ Triple Tube
NQ3 NQ Triple Tube
NMLC NMLC Triple Tube
DP Direct Push
DT Dual Tube (70mm)
▒ Casing

USC Classification
CH Inorganic CLAYS high plasticity
CI Inorganic CLAYS medium plasticity
CL Inorganic CLAYS low plasticity
GC Clayey GRAVEL
GM Silty GRAVEL
GP Poorly Graded GRAVEL
GW Well Graded GRAVEL
MH Inorganic SILT high plasticity
ML Inorganic SILT low plasticity
OH ORGANIC CLAY medium to high plasticity
OL ORGANIC SILT low plasticity
PT PEAT and highly organic soils
SC Clayey SAND
SM Silty SAND
SP Poorly graded SAND
SW Well graded SAND

Consistency
VS very soft
S soft
F firm
S stiff
VS very stiff
H hard

Density
VL very loose
L loose
MD medium dense
D dense
VD very dense

Soil Samples
B bulk
U undisturbed
D disturbed

Water
▼ at end of excavation
▼ at time of excavation
▼ at time of closure

In Situ Testing
PP pen penetrometer
VS vane shear
SPT std. pen. test
SS split spoon
SC solid cone
HB hammer bouncing
SH sinks under own weight

Moisture
D dry
M moist
W wet
S saturated

Graphic Log
▨ Topsoil
☒ SILT
▨ Silty SAND
▨ Sandy GRAVEL

Backfill
▨ Cement Seal: 1 pipe group, 1 pipe
■ Bentonite Seal: 1 pipe group, 1 pipe
▨ Slough Backfill: 1 pipe group, 1 pipe
▨ Slotted Pipe: 1 pipe group, 1 pipe

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Client: **FULTON HOGAN LAND DEVELOPMENT**
Project Name: **ROSEMERRYN FARM SUBDIVISION**
Location: **SEE PLAN**
Project Reference: **224464**

BH04

Sheet **2** of **2**

BOREHOLE INFORMATION
Drilling Method: CAT 312 Track Rig
Diameter Core: 100mm
Contractor: McMillan Drilling

CO-ORDINATES N/A
Easting: N/A
Northing: N/A
Ground Level: N/A

Date Started: 15/09/2011
Date Completed: 15/09/2011
Inclination: 90
Orientation:

Logged by: JSM
Input by: JSM
Checked by: JSM
Verified by: JK

Method/Casing	Core Recovery (%)	Water Loss (%)	Groundwater Level (m)	R.L. (m)	Depth (m)	Graphic Log	Material Description	USC Description	Consistency/Density	Moisture	Sample	In-Situ Testing	Laboratory Testing	Notes	Backfill	Geological Unit
WASH							Sandy GRAVEL: Dark grey with orange brown mottling. Dense. Wat to saturated. Gravel fine to coarse grained and rounded. Sand fine to medium grained. *(Layer Continued from previous page)*	GW				SPT at 10m N = 49 3, 6/10, 18, 9, 18 450mm (SC)	NO LABORATORY TESTING			
					11											
					12											
					13											
					14											
					15	15.00	Borehole Terminated at 15m (Targat Depth)									
					16											
					17											
					18											
					19											

Method

CC	concrete core
OB	open barrel
SSA	solid stem auger
HSA	hollow stem auger
WASH	wash drill
PQ3	PQ Triple Tube
HQ3	HQ Triple Tube
NQ3	NQ Triple Tube
NMLC	NMLC Triple Tube
DP	Direct Push
DT	Dual Tube (70mm)
░	Casing

USC Classification

CH	Inorganic CLAYS high plasticity
CI	Inorganic CLAYS medium plasticity
CL	Inorganic CLAYS low plasticity
GC	Clayey GRAVEL
GM	Silty GRAVEL
GP	Poorly Graded GRAVEL
GW	Well Graded GRAVEL
MH	Inorganic SILT high plasticity
ML	Inorganic SILT low plasticity
OH	ORGANIC CLAY medium to high plasticity
OL	ORGANIC SILT low plasticity
PT	PEAT and highly organic soils
SC	Clayey SAND
SM	Silty SAND
SP	Poorly graded SAND
SW	Well graded SAND

Consistency

VS	very soft
S	soft
F	firm
S	stiff
VS	very stiff
H	hard

Density

VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Soil Samples

B	bulk
U	undisturbed
D	disturbed

Water

▽ at end of excavation
▼ at time of excavation
▼ at time of closure

In Situ Testing

PP	pen penetrometer
VS	vane shear
SPT	std. pen. test
SS	split spoon
SC	solid cone
HB	hammer bouncing
SH	sinks under own weight

Moisture

D	dry
M	moist
W	wet
S	saturated

Graphic Log

Topsoil
SILT
Silty SAND
Sandy GRAVEL

Backfill

Cement Seal: 1 pipe group, 1 pipe
Bentonite Seal: 1 pipe group, 1 pipe
Slough Backfill: 1 pipe group, 1 pipe
Slotted Pipe: 1 pipe group, 1 pipe

Bore Log

DRILLING SERVICES

Client: Aurecon NZ Ltd

Project: Edward Street, Lincoln

Bore No.: BH001

Job No.: 9402

Site Location: Between TP9 and TP13

Grid Reference: Refer to Aurecon NZ site plan

Rig Operator: P. Smith

Rig Model and Mounting: CAT 312 - Track, 100mm (AFR)

Date Commenced: 19/09/2011

Date Completed: 19/09/2011

Consent:

Datum: Ground

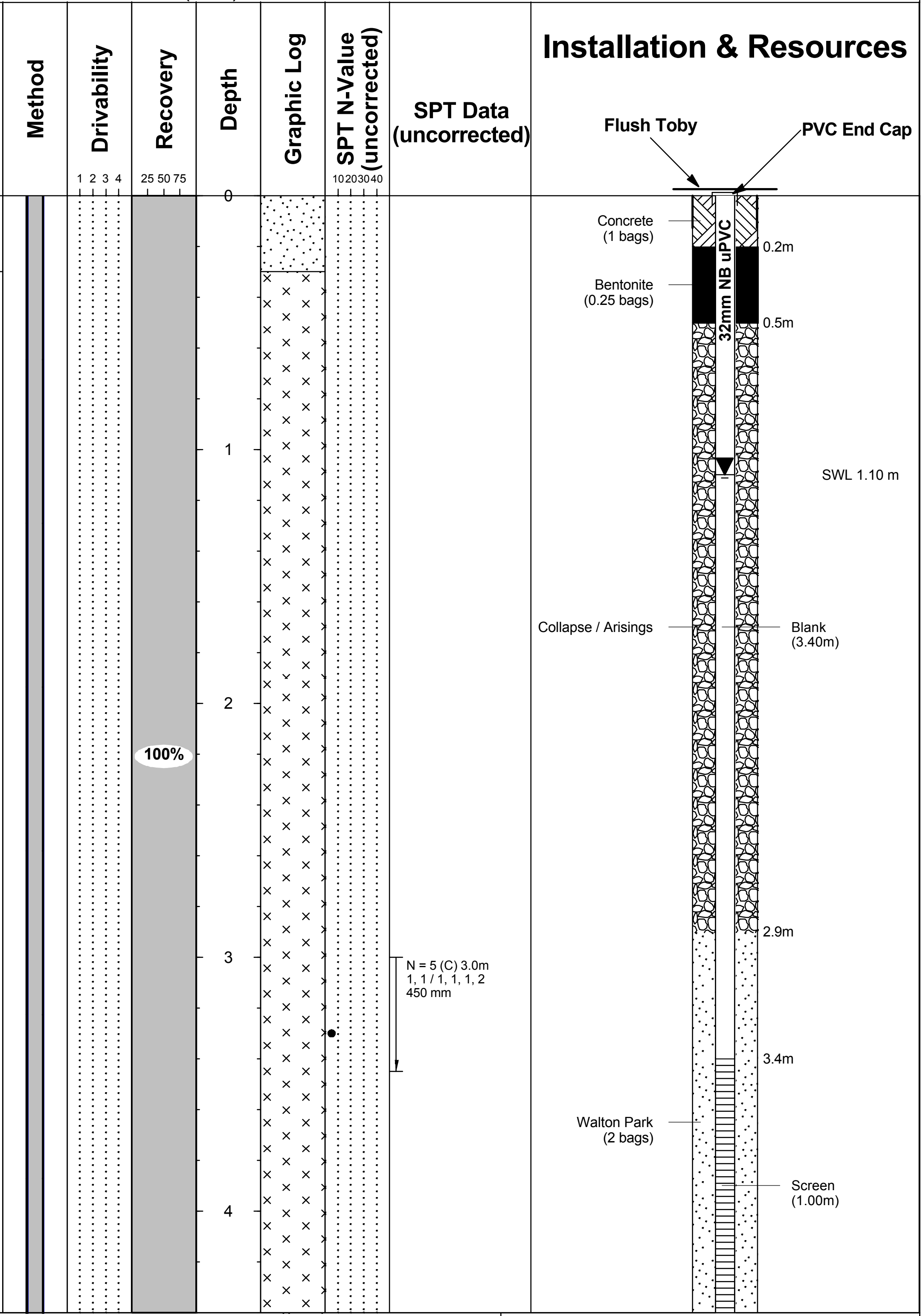
Description

TOPSOIL.

Yellow brown plastic SILT.

Blue grey SILT, some grey sand.

E.O.H 4.4m



Remarks:

Installation of Ground water monitoring well BH001.

SPT @ 3.0m

SPT: "Doughnut" trip SPT Hammer #001 used (energy ratio 52.0%)

Drivability
1 Easy Push - No Hammer \ Fast Penetration
2 Relatively Easy Push - Light Hammer \ Relatively Fast
3 Medium Push - Consistent Hammer \ Medium
4 Hard Push - Full Hammer \ Somewhat Slow
5 Very Hard Push - Very Slow, Full Hammer \ Very Slow

Additional Resources:

Plastic Liner	m	☐
Flush Mounted Toby Box		
- Standard	ea	☒
- Environmental	ea	☐
Above Ground Protective Surround	ea	☐
Geotextile Sock	m	☐
Handclear Location	ea	☐
Decontaminate Equipment	ea	☐

Bore Log

McMILLAN
DRILLING SERVICES

Client: Aurecon NZ Ltd

Project: Edward Street, Lincoln

Bore No.: BH002

Job No.: 9402

Site Location: Between TP11 and TP15
Grid Reference: Refer to Aurecon NZ site plan
Rig Operator: P. Smith
Rig Model and Mounting: CAT 312 - Track, 100mm (AFR)

Date Commenced: 16/09/2011
Date Completed: 19/09/2011
Consent:
Datum: Ground

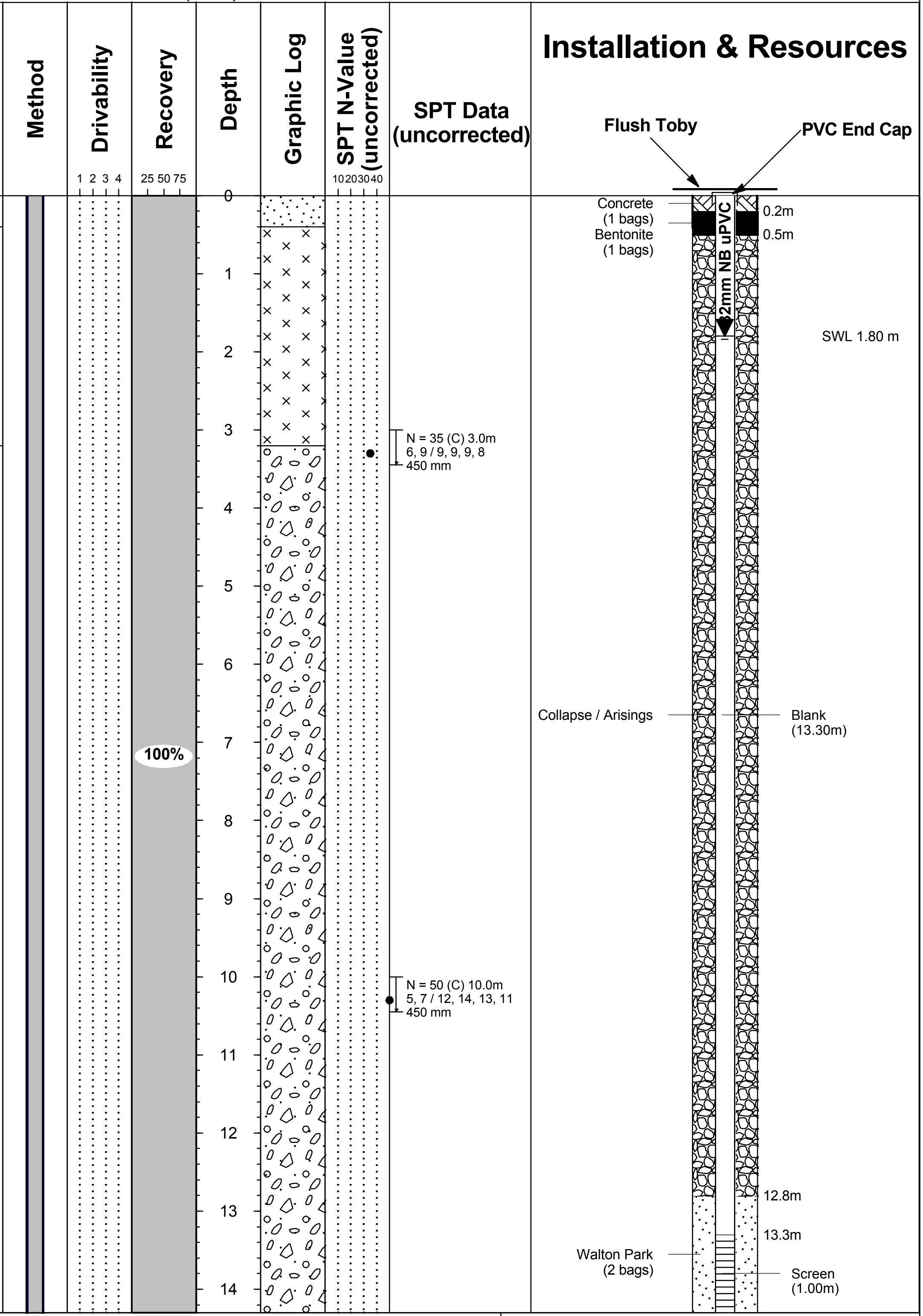
Description

TOPSOIL.

Blue SILT some GRAVEL with depth.

Fine to coarse Sandy fine to coarse GRAVEL, minor to some silt.

E.O.H 14.3m



Remarks:

Installation of Ground water monitoring well BH002.

SPT @ 3.0m and 10.0m

SPT: "Doughnut" trip SPT Hammer #001 used (energy ratio 52.0%)

Drivability
1 Easy Push - No Hammer \ Fast Penetration
2 Relatively Easy Push - Light Hammer \ Relatively Fast
3 Medium Push - Consistent Hammer \ Medium
4 Hard Push - Full Hammer \ Somewhat Slow
5 Very Hard Push - Very Slow, Full Hammer \ Very Slow

Additional Resources:

Plastic Liner	m	☐
Flush Mounted Toby Box		
- Standard	ea	☒
- Environmental	ea	☐
Above Ground Protective Surround	ea	☐
Geotextile Sock	m	☐
Handclear Location	ea	☐
Decontaminate Equipment	ea	☐

Report Created: 28/09/2011 4:16:02 p.m.

Bore Log

McMILLAN
DRILLING SERVICES

Client: Aurecon NZ Ltd

Project: Edward Street, Lincoln

Bore No.: BH003

Job No.: 9402

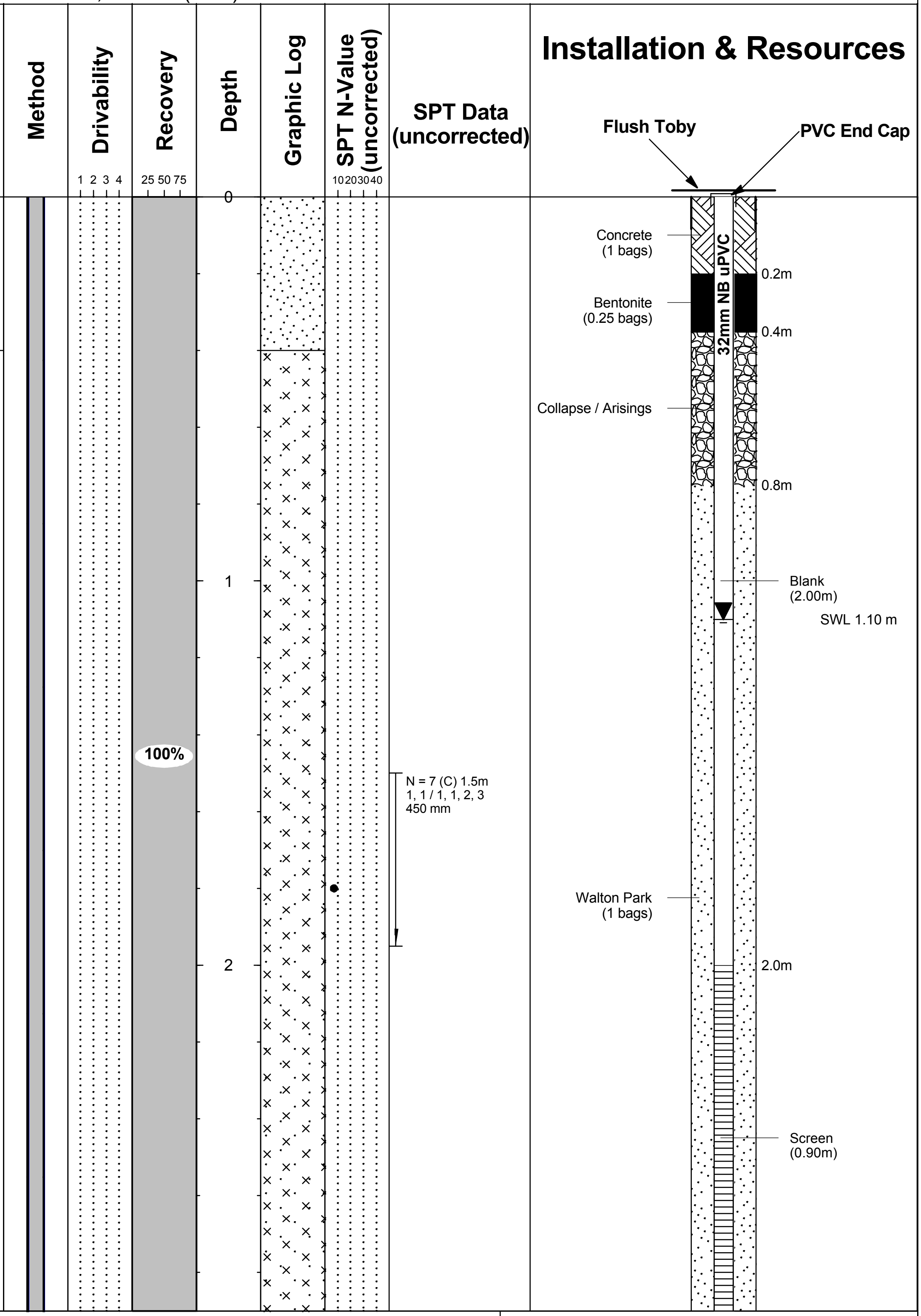
Site Location: Between CPT20 and TP41
Grid Reference: Refer to Aurecon NZ site plan
Rig Operator: P. Smith
Rig Model and Mounting: CAT 312 - Track, 100mm (AFR)

Date Commenced: 16/09/2011
Date Completed: 16/09/2011
Consent:
Datum: Ground

Description

TOPSOIL.

Grey Sandy SILT.



E.O.H 2.9m

Remarks:

Installation of Ground water monitoring well BH003.

SPT Testing @ 1.5m

SPT: "Doughnut" trip SPT Hammer #001 used (energy ratio 52.0%)

Drivability
1 Easy Push - No Hammer \ Fast Penetration
2 Relatively Easy Push - Light Hammer \ Relatively Fast
3 Medium Push - Consistent Hammer \ Medium
4 Hard Push - Full Hammer \ Somewhat Slow
5 Very Hard Push - Very Slow, Full Hammer \ Very Slow

Additional Resources:

Plastic Liner	m	☐
Flush Mounted Toby Box		
- Standard	ea	☒
- Environmental	ea	☐
Above Ground Protective Surround	ea	☐
Geotextile Sock	m	☐
Handclear Location	ea	☐
Decontaminate Equipment	ea	☐

Report Created: 28/09/2011 4:16:02 p.m.

Bore Log

McMILLAN DRILLING SERVICES

Client: Aurecon NZ Ltd

Project: Edward Street, Lincoln

Bore No.: BH004

Job No.: 9402

Site Location: Between CPT22 and TP37
Grid Reference: Refer to Aurecon NZ site plan
Rig Operator: P. Smith
Rig Model and Mounting: CAT 312 - Track, 100mm (AFR)

Date Commenced: 15/09/2011
Date Completed: 15/09/2011
Consent:
Datum: Ground

Description

TOPSOIL.

Yellow brown plastic SILT.

Fine to coarse Sandy fine to coarse GRAVEL, minor to some silt.

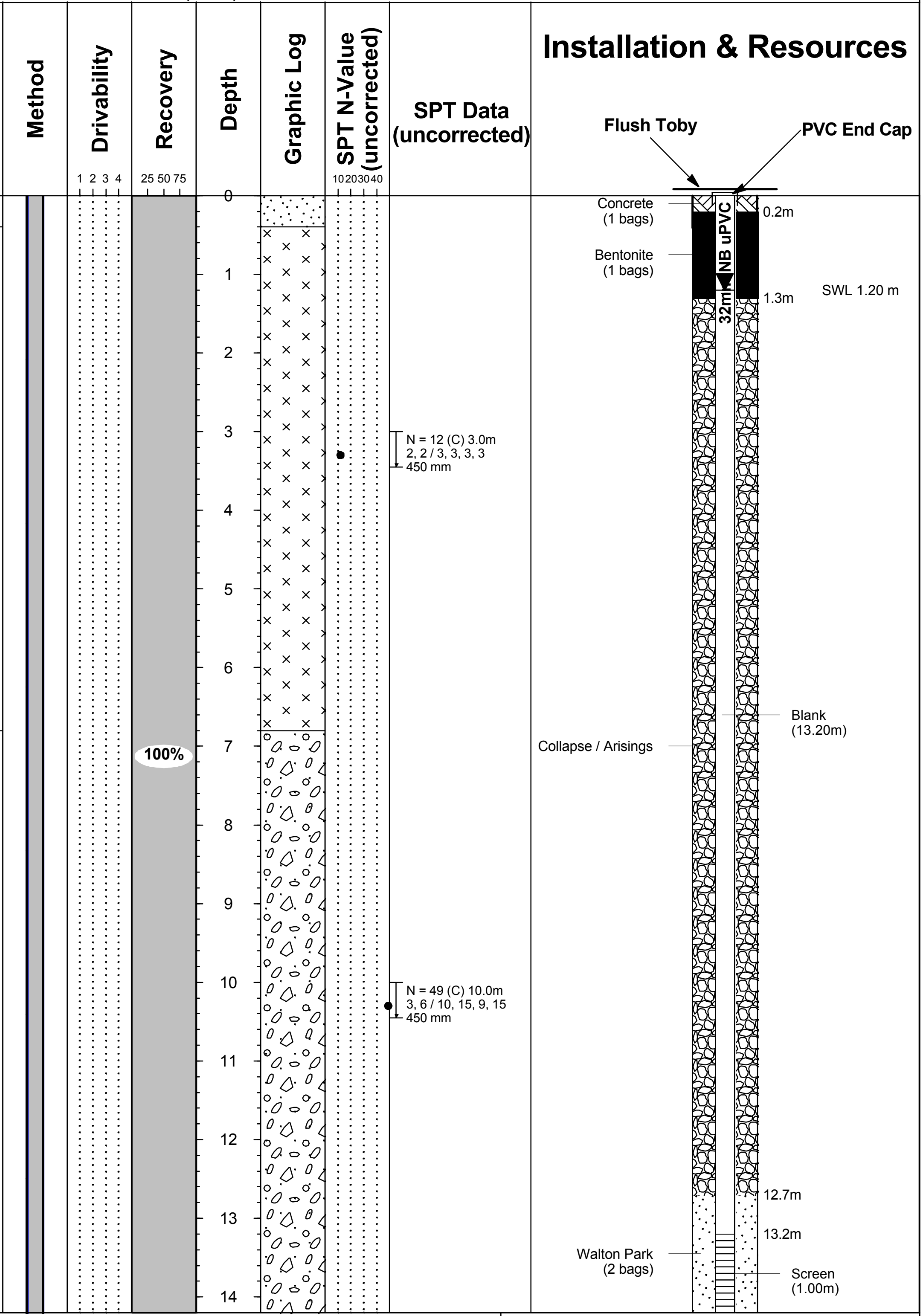
E.O.H 14.2m

SPT Data (uncorrected)

N = 12 (C) 3.0m
2, 2 / 3, 3, 3, 3
450 mm

N = 49 (C) 10.0m
3, 6 / 10, 15, 9, 15
450 mm

Installation & Resources



Remarks:
Installation of Ground water monitoring well BH004.

SPT @ 3.0m and 10.0m

SPT: "Doughnut" trip SPT Hammer #001 used (energy ratio 52.0%)

Drivability
1 Easy Push - No Hammer \ Fast Penetration
2 Relatively Easy Push - Light Hammer \ Relatively Fast
3 Medium Push - Consistent Hammer \ Medium
4 Hard Push - Full Hammer \ Somewhat Slow
5 Very Hard Push - Very Slow, Full Hammer \ Very Slow

Additional Resources:

Plastic Liner	m	☐
Flush Mounted Toby Box		
- Standard	ea	☒
- Environmental	ea	☐
Above Ground Protective Surround	ea	☐
Geotextile Sock	m	☐
Handclear Location	ea	☐
Decontaminate Equipment	ea	☐

Report Created: 28/09/2011 4:16:02 p.m.

aurecon www.aurecongroup.com	**BOREHOLE RECORD**	HOLE NO. **BH101** PROJECT NO. **224464**

PROJECT **Rosemerryn Subdivision**
Lincoln

METHOD **DP**	CO-ORDINATES (NZTM) **E 1559383** **N 5168089**	SHEET **1** of **2**
MACHINE & NO. **VTR 9700-D Truck**		DATE from **21/01/2015** to **22/01/2015**
FLUSHING MEDIUM **Water**	ORIENTATION **VERTICAL**	GROUND-LEVEL **+10.00** m RL

Drilling Progress: 21/01/2015 (0.00 m)

Water level: ▼ at approx. 3.8 m

Depth (m)	Total core Recovery %	Tests	Samples Type	Samples Depth
0.00	90		DT	0.00
1.52	70	(2, 1, 2, 1, 2, 2) N = 7	DT	1.52
3.04	85	(1, 3, 2, 1, 1, 5) N = 9	DT	3.04
4.56	60	(12, 16, 18, 20, 19, 3) N = 60/240 mm	DT	4.56
6.08	70	(5, 8, 7, 8, 9, 9) N = 33	DT	6.08
7.60	35	(3, 4, 4, 3, 3, 5) N = 15	DT	7.60
9.12	40	(6, 7, 10, 9, 11, 10) N = 40	DT	9.12

STRATA DESCRIPTION

SUBORDINATE FRACTION, MAJOR FRACTION, MINOR FRACTION, COLOUR, STRUCTURE, STRENGTH, MOISTURE CONDITION GRADING, BEDDING, PLASTICITY, ETC....
(NZ GEOTECHNICAL SOCIETY - FIELD DESCRIPTION OF SOIL AND ROCK)

Reduced Level	Depth (m)	Strata Description
	0.00	SILT with minor sand and trace rootlets; dark brown. Dry, low plasticity; sand, fine. (TOPSOIL)
+9.50	0.50	SILT with minor sand; light brown mottled orange. Dry, low plasticity; sand, fine.
+9.20	0.80	Fine SAND with some silt; light brown. Dry. 1.00m becomes fine to medium SAND with some silt.
+8.90	1.10	1.10m becomes silty fine SAND.
+8.80	1.20	1.20m becomes sandy SILT; light brown mottled orange. Moist, low plasticity.
+8.40	1.60	Medium to coarse SAND with minor silt; reddish brown.
+8.35	1.65	Silty fine to coarse SAND; brownish grey. Moist.
+8.00	2.00	SILT with some sand and trace organics; dark grey. Moist, low plasticity; sand, fine to coarse.
+7.80	2.20	Medium to coarse SAND; grey. Moist.
+7.75	2.25	SILT with minor sand; grey. Moist, low plasticity.
+7.60	2.40	Fine to coarse SAND with minor silt; grey. Moist.
+6.96	3.04	Sandy SILT; grey. Dry, low plasticity; sand, fine.
+6.45	3.55	3.55m becoming silty fine to medium SAND. Moist.
+6.30	3.70	Sandy fine to coarse GRAVEL; brownish grey. Dry, low plasticity, rounded to subangular; sand, fine to coarse.
+5.44	4.56	Medium to coarse GRAVEL; grey. Dry, subrounded.
+5.25	4.75	Coarse SAND; dark greyish brown. Moist.
+5.05	4.95	Fine to coarse GRAVEL with some sand and minor silt; brownish grey. Dry, subrounded to subangular; sand, fine to coarse. 6.08m - 6.30m coarse GRAVEL with no sand or silt. Grey.
+2.40	7.60	7.60m becomes Sandy fine to coarse GRAVEL with minor silt.
+2.00	8.00	8.00m becomes fine to coarse GRAVEL with some sand and some silt.
+0.88	9.12	Gravelly medium to coarse SAND; dark greyish brown. Dry; gravel, fine to coarse.
+0.65	9.35	Fine to coarse GRAVEL with minor sand; grey. Dry; sand, fine to coarse.

●	**Small Disturbed Sample**	▼	**Water Level**
↕	**Large Disturbed Sample**		**Impression Packer Test**
▨	**SPT Liner Sample**	↓	**Standard Penetration Test**
▮▮	**Thin Wall Undisturbed Sample**		**Permeability Test**
■	**U100 Undisturbed Sample**		**Piezometer / Standpipe Tip**
▷▷	**Pocket Penetrometer Test**		**Packer Test**
PS	**Piston Sample**	∨	**In-situ Vane Shear Test**

LOGGED **T. PLUNKET**
DATE **29/01/2015**
CHECKED **B. SUCKLING**
DATE **05/02/2015**

REMARKS

Coorindates and ground level based on hand held GPS, likely accurate to +/- 5m.

Groundwater level recorded at 3.8m.

SPT hammer energy ratio 79%.

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BOREHOLE RECORD

HOLE NO.	**BH101**
PROJECT NO.	**224464**

PROJECT **Rosemerryn Subdivision**
Lincoln

METHOD **DP**	CO-ORDINATES (NZTM) **E 1559383** **N 5168089**	SHEET **2** of **2**
MACHINE & NO. **VTR 9700-D Truck**		DATE from **21/01/2015** to **22/01/2015**
FLUSHING MEDIUM **Water**	ORIENTATION **VERTICAL**	GROUND-LEVEL **+10.00** m RL

Drilling Progress	Casing depth/size	Water level (m) shift start/ end	Water Recovery %	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples Type	Ref	Depth	Reduced Level	Depth (m) 10.00	Legend	STRATA DESCRIPTION SUBORDINATE FRACTION, MAJOR FRACTION, MINOR FRACTION, COLOUR, STRUCTURE, STRENGTH, MOISTURE CONDITION GRADING, BEDDING, PLASTICITY, ETC.... *(NZ GEOTECHNICAL SOCIETY - FIELD DESCRIPTION OF SOIL AND ROCK)*
				40					DT		10.64				
				25				(0, 1, 0, 1, 0, 0) N = 1	DT		12.16				10.64m becomes medium to coarse GRAVEL. Rounded to subrounded.
				60				(3, 4, 4, 6, 9, 13) N = 32	DT		13.68	-3.16	13.16		Sandy fine to coarse GRAVEL with some silt; brownish grey. Dry, rounded to subangular; sand, fine to coarse. 13.68m - 14.00m sandy fine to medium GRAVEL; dark brownish grey.
				60				(10, 16, 19, 12, 13, 13) N = 57	DT		15.20				
22/01/2015								(14, 25, 20, 21, 24) N = 65/225 mm				-5.20	15.20		End of Dynamic probe sampling at 15.20m, on 22/01/2015 *Termination Reason:* Target depth reached.

●	**Small Disturbed Sample**	▼	**Water Level**
↕	**Large Disturbed Sample**		**Impression Packer Test**
▨	**SPT Liner Sample**	↓	**Standard Penetration Test**
‖	**Thin Wall Undisturbed Sample**	↕	**Permeability Test**
■	**U100 Undisturbed Sample**	▲ △	**Piezometer / Standpipe Tip**
▷▷	**Pocket Penetrometer Test**		**Packer Test**
P/S	**Piston Sample**	∨	**In-situ Vane Shear Test**

LOGGED **T. PLUNKET**
DATE **29/01/2015**
CHECKED **B. SUCKLING**
DATE **05/02/2015**

REMARKS

Coorindates and ground level based on hand held GPS, likely accurate to +/- 5m.

Groundwater level recorded at 3.8m.

SPT hammer energy ratio 79%.

aurecon www.aurecongroup.com	# BOREHOLE RECORD	HOLE NO.	**BH102**
		PROJECT NO.	**224464**

PROJECT	**Rosemerryn Subdivision** **Lincoln**

METHOD **DP**	CO-ORDINATES (NZTM) **E 1560211** **N 5168161**	SHEET **1** of **2**
MACHINE & NO. **VTR 9700-D Truck**		DATE from **22/01/2015** to **22/01/2015**
FLUSHING MEDIUM **Water**	ORIENTATION **VERTICAL**	GROUND-LEVEL **+9.00** m RL

Drilling Progress	Casing depth/size	Water level (m) shift start/ end	Water Recovery %	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples Type	Samples Ref	Samples Depth	Reduced Level	Depth (m) 0.00	Legend	STRATA DESCRIPTION SUBORDINATE FRACTION, MAJOR FRACTION, MINOR FRACTION, COLOUR, STRUCTURE, STRENGTH, MOISTURE CONDITION GRADING, BEDDING, PLASTICITY, ETC.... *(NZ GEOTECHNICAL SOCIETY - FIELD DESCRIPTION OF SOIL AND ROCK)*
22/01/2015				20					DT		0.00				Sandy fine to coarse GRAVEL with some silt and trace rootlets; greyish brown. Dry to moist, subrounded to angular; sand, fine to coarse. (Logged from sample bag)
				20				(26, 25, 24, 23, 15, 7) N = 69/262 mm	DT		1.52	+7.48	1.52		Sandy fine to coarse GRAVEL; brownish grey. Dry, subrounded to angular, gap graded; sand, fine to coarse. (Logged from sample bag)
				40				(3, 5, 5, 5, 6, 6) N = 22	DT		3.04	+5.96	3.04		Gravelly fine to coarse SAND; greyish brown. Moist; gravel, fine to medium, rounded to subangular.
												+5.76	3.24		3.24m becomes sandy fine to medium GRAVEL.
												+5.25	3.75		3.75m becomes fine to coarse GRAVEL with minor sand.
				15				(1, 1, 1, 1, 2, 2) N = 6	DT		4.56	+4.44	4.56		SAND; brown. Wet. (Logged from sample bag)
				90				(2, 4, 5, 4, 4, 7) N = 20	DT		6.08	+2.92	6.08		Sandy fine to coarse GRAVEL; grey. Dry, rounded to subangular; sand, fine to coarse.
												+2.80	6.20		6.20m becomes fine to coarse GRAVEL with some silt and minor sand; reddish brown. Dry.
				40				(4, 7, 7, 5, 5, 4) N = 21	DT		7.60	+1.40	7.60		Fine to coarse GRAVEL with minor sand; grey. Dry, rounded to subangular; sand, fine to coarse.
												+1.10	7.90		Silty fine to coarse GRAVEL with some sand; greyish brown. Dry, subrounded to angular; sand, fine to coarse.
				100				(5, 8, 8, 7, 12, 12) N = 39	DT		9.12	-0.12	9.12		Fine to coarse GRAVEL with minor sand; grey and reddish grey. Dry, rounded to angular; sand, medium to coarse.

•	**Small Disturbed Sample**	▼	**Water Level**
↕	**Large Disturbed Sample**		**Impression Packer Test**
▨	**SPT Liner Sample**	↓	**Standard Penetration Test**
▌▌	**Thin Wall Undisturbed Sample**	⫯	**Permeability Test**
█	**U100 Undisturbed Sample**	▲ △	**Piezometer / Standpipe Tip**
▷▷	**Pocket Penetrometer Test**		**Packer Test**
PS	**Piston Sample**	∨	**In-situ Vane Shear Test**

LOGGED **T. PLUNKET**

DATE **29/01/2015**

CHECKED **B. SUCKLING**

DATE **05/02/2015**

REMARKS

Coorindates and ground level based on hand held GPS, likely accurate to +/- 5m.

Groundwater level not recorded.

SPT hammer energy ratio 79%.

aurecon www.aurecongroup.com	**BOREHOLE RECORD**	HOLE NO. **BH102** PROJECT NO. **224464**

PROJECT	**Rosemerryn Subdivision** **Lincoln**

METHOD **DP**	CO-ORDINATES (NZTM) **E 1560211** **N 5168161**	SHEET **2** of **2**
MACHINE & NO. **VTR 9700-D Truck**		DATE from **22/01/2015** to **22/01/2015**
FLUSHING MEDIUM **Water**	ORIENTATION **VERTICAL**	GROUND-LEVEL **+9.00** m RL

Drilling Progress	Casing depth/size	Water level (m) shift start/ end	Water Recovery %	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples Type Ref Depth	Reduced Level	Depth (m) 10.00	Legend	STRATA DESCRIPTION SUBORDINATE FRACTION, MAJOR FRACTION, MINOR FRACTION, COLOUR, STRUCTURE, STRENGTH, MOISTURE CONDITION GRADING, BEDDING, PLASTICITY, ETC.... *(NZ GEOTECHNICAL SOCIETY - FIELD DESCRIPTION OF SOIL AND ROCK)*
22/01/2015				100					DT 10.64	-1.64	10.64		
								(3, 3, 6, 5, 4, 4) N = 19					End of Dynamic probe sampling at 10.64m, on 22/01/2015 *Termination Reason:* Target depth reached.

- ● **Small Disturbed Sample**
- ↕ **Large Disturbed Sample**
- ▨ **SPT Liner Sample**
- ▮▮ **Thin Wall Undisturbed Sample**
- ■ **U100 Undisturbed Sample**
- ▷▷ **Pocket Penetrometer Test**
- P/S **Piston Sample**
- ▼ **Water Level**
- **Impression Packer Test**
- ↓ **Standard Penetration Test**
- **Permeability Test**
- **Piezometer / Standpipe Tip**
- **Packer Test**
- ∨ **In-situ Vane Shear Test**

LOGGED **T. PLUNKET**

DATE **29/01/2015**

CHECKED **B. SUCKLING**

DATE **05/02/2015**

REMARKS

Coorindates and ground level based on hand held GPS, likely accurate to +/- 5m.

Groundwater level not recorded.

SPT hammer energy ratio 79%.

BOREHOLE RECORD

HOLE NO.	**BH103**	PROJECT NO.	**224464**

PROJECT **Rosemerryn Subdivision**
Lincoln

METHOD **DP**	CO-ORDINATES (NZTM) **E 1560056** **N 5167722**	SHEET **1** of **2**
MACHINE & NO. **VTR 9700-D Truck**		DATE from **28/01/2015** to **28/01/2015**
FLUSHING MEDIUM **Water**	ORIENTATION **VERTICAL**	GROUND-LEVEL **+9.00** m RL

Drilling Progress	Casing depth/size	Water level (m) shift start/ end	Water Recovery %	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples Type	Ref	Depth	Reduced Level	Depth (m) 0.00	Legend	STRATA DESCRIPTION SUBORDINATE FRACTION, MAJOR FRACTION, MINOR FRACTION, COLOUR, STRUCTURE, STRENGTH, MOISTURE CONDITION GRADING, BEDDING, PLASTICITY, ETC.... *(NZ GEOTECHNICAL SOCIETY - FIELD DESCRIPTION OF SOIL AND ROCK)*
28/01/2015				15					DT		0.00				Mix of SILT with minor sand and trace rootlets; dark brown. Dry, low plasticity; sand, fine to medium. (TOPSOIL) and; SILT with some sand; light brown mottled orange. Dry, low plasticity; sand, fine to medium. (Logged from sample bag)
				90				(1, 1, 2, 2, 1, 2) N = 7	DT		1.52	+7.48	1.52		Sandy SILT; greyish brown. Stiff, wet, low plasticity; sand, fine to medium.
												+7.40	1.60		1.60m becomes silty fine to medium SAND; grey. Wet.
		▼										+7.00	2.00		PEAT; dark brown. Fibrous, saturated.
												+6.95	2.05		Peaty SILT; greyish brown. Firm, saturated, low plasticity; peat, fibrous.
												+6.90	2.10		SILT with some sand and trace organics; grey. Firm to stiff, wet, low plasticity; organics are fibrous.
												+6.30	2.70		Silty fine to medium SAND; brown. Wet.
				65				(4, 8, 7, 7, 6, 6) N = 26	DT		3.04	+5.96	3.04		Gravelly fine to coarse SAND; greyish brown. Wet; gravel, fine to coarse, subrounded to subangular.
												+5.75	3.25		3.25m becomes Sandy fine to coarse GRAVEL.
				60				(4, 7, 12, 11, 9, 8) N = 40	DT		4.56	+4.44	4.56		Fine to coarse SAND with minor gravel; brown. Wet; gravel, fine to medium, subrounded to angular.
												+4.20	4.80		Sandy fine to coarse GRAVEL; greyish brown. Wet, subrounded to angular; sand, fine to coarse. 4.95m - 5.15m reddish brown.
				60				(8, 13, 10, 7, 6, 5) N = 28	DT		6.08	+2.92	6.08		Fine to coarse SAND; brown. Wet.
												+2.75	6.25		Sandy fine to medium GRAVEL; greyish brown. Wet, subrounded to angular; sand, fine to coarse.
												+2.60	6.40		Fine to coarse GRAVEL; grey. Wet, rounded to subangular.
												+2.45	6.55		Sandy fine to coarse GRAVEL; greyish brown. Wet, subrounded to angular; sand, fine to coarse.
				100				(8, 12, 13, 12, 12, 14) N = 51	DT		7.60	+1.40	7.60		Fine to coarse SAND; brown. Wet.
												+1.10	7.90		7.90m becomes gravelly fine to coarse SAND. Gravel, fine to medium, rounded to subangular.
												+0.90	8.10		Fine to coarse GRAVEL with minor sand; grey. Wet, subrounded to subangular; sand, fine to coarse.
												+0.70	8.30		No sample recieved.
												+0.50	8.50		Sandy fine to coarse GRAVEL; greyish brown. Wet, subrounded to angular; sand, fine to coarse.
				45				(3, 11, 13, 13, 12, 10) N = 48	DT		9.12				
															9.50m - 9.55m white.

• **Small Disturbed Sample**
Large Disturbed Sample
SPT Liner Sample
Thin Wall Undisturbed Sample
U100 Undisturbed Sample
Pocket Penetrometer Test
Piston Sample

▼ Water Level
Impression Packer Test
Standard Penetration Test
Permeability Test
Piezometer / Standpipe Tip
Packer Test
In-situ Vane Shear Test

LOGGED **T. PLUNKET**
DATE **29/01/2015**
CHECKED **B. SUCKLING**
DATE **05/02/2015**

REMARKS

Coorindates and ground level based on hand held GPS, likely accurate to +/- 5m.

Groundwater level recorded at 2.0m.

SPT hammer energy ratio 79%.

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BOREHOLE RECORD

HOLE NO.	**BH103**
PROJECT NO.	**224464**

PROJECT **Rosemerryn Subdivision**
Lincoln

METHOD **DP**	CO-ORDINATES (NZTM) **E 1560056** **N 5167722**	SHEET **2** of **2**
MACHINE & NO. **VTR 9700-D Truck**		DATE from **28/01/2015** to **28/01/2015**
FLUSHING MEDIUM **Water**	ORIENTATION **VERTICAL**	GROUND-LEVEL **+9.00** m RL

Drilling Progress	Casing depth/size	Water level (m) shift start/ end	Water Recovery %	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples Type	Samples Ref	Samples Depth	Reduced Level	Depth (m) 10.00	Legend	STRATA DESCRIPTION SUBORDINATE FRACTION, MAJOR FRACTION, MINOR FRACTION, COLOUR, STRUCTURE, STRENGTH, MOISTURE CONDITION GRADING, BEDDING, PLASTICITY, ETC.... *(NZ GEOTECHNICAL SOCIETY - FIELD DESCRIPTION OF SOIL AND ROCK)*
28/01/2015				45					DT		10.64	-1.64	10.64		
								(9, 12, 13, 11, 10, 6) N = 40							End of Dynamic probe sampling at 10.64m, on 28/01/2015 *Termination Reason:* Target depth reached.

•	**Small Disturbed Sample**	▼	**Water Level**
↓	**Large Disturbed Sample**		**Impression Packer Test**
▨	**SPT Liner Sample**	↓	**Standard Penetration Test**
‖	**Thin Wall Undisturbed Sample**	⏚	**Permeability Test**
■	**U100 Undisturbed Sample**		**Piezometer / Standpipe Tip**
▷▷	**Pocket Penetrometer Test**		**Packer Test**
PS	**Piston Sample**	∨	**In-situ Vane Shear Test**

LOGGED **T. PLUNKET**
DATE **29/01/2015**
CHECKED **B. SUCKLING**
DATE **05/02/2015**

REMARKS

Coorindates and ground level based on hand held GPS, likely accurate to +/- 5m.

Groundwater level recorded at 2.0m.

SPT hammer energy ratio 79%.

Bore Log

Bore No.: BH101

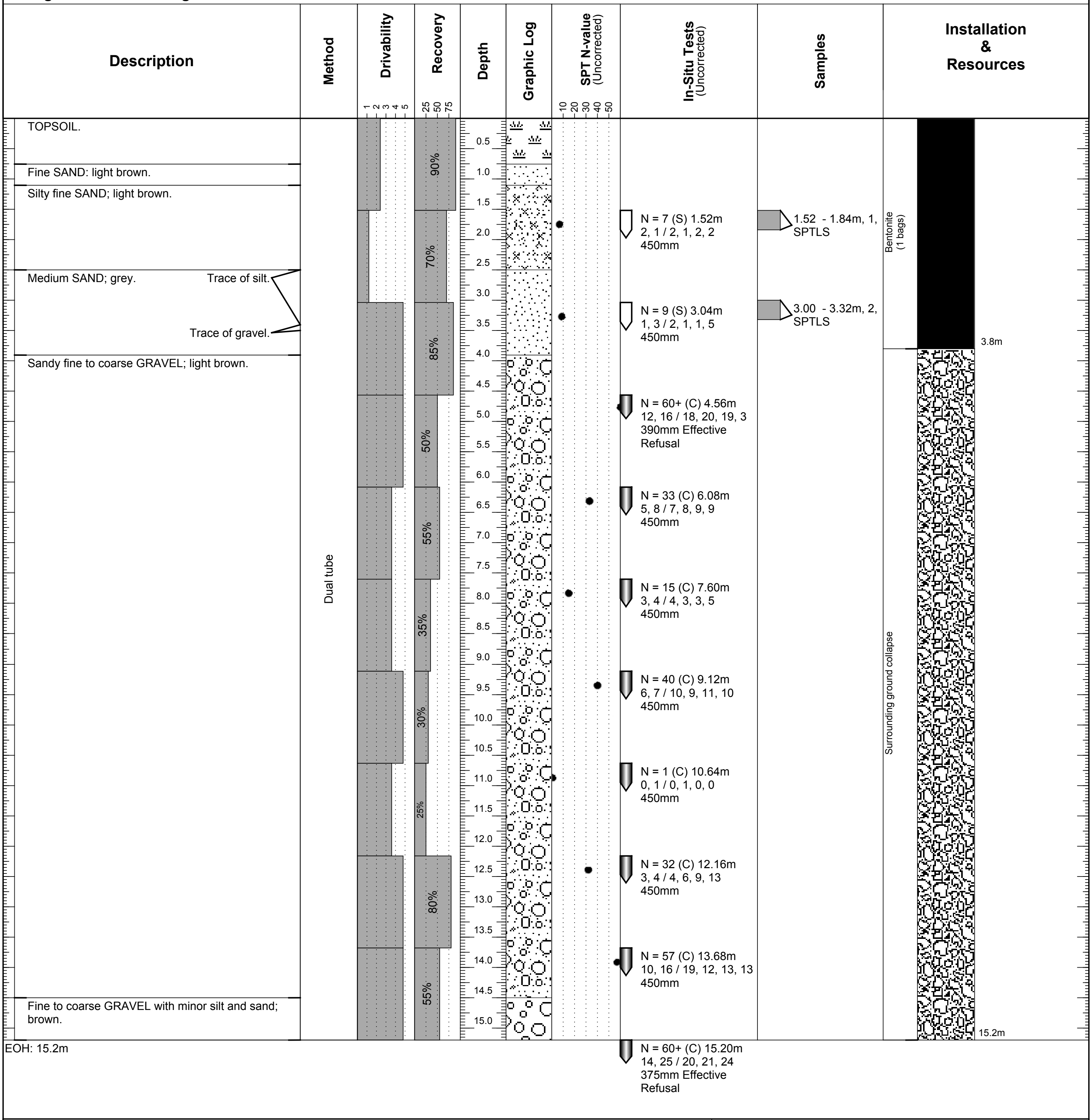
Job No.: 14216

Client: Aurecon NZ Ltd

Project: Rosemerryn Farm development

Site Location: Ellesmere Road, Lincoln (Rosemerryn Farm development)
Grid Reference: 1559383.26mE, 5168089.14mN (NZTM)
Rig Operator: C. Nee
Rig Model & Mounting: VTR 9700-D Truck

Date Commenced: 21/01/2015
Date Completed: 22/01/2015
Consent: -
Datum: Ground



TOPSOIL.

Fine SAND: light brown.

Silty fine SAND; light brown.

Medium SAND; grey. Trace of silt. Trace of gravel.

Sandy fine to coarse GRAVEL; light brown.

Fine to coarse GRAVEL with minor silt and sand; brown.

EOH: 15.2m

In-Situ Tests	Samples
N = 7 (S) 1.52m 2, 1 / 2, 1, 2, 2 450mm	1.52 - 1.84m, 1, SPTLS
N = 9 (S) 3.04m 1, 3 / 2, 1, 1, 5 450mm	3.00 - 3.32m, 2, SPTLS
N = 60+ (C) 4.56m 12, 16 / 18, 20, 19, 3 390mm Effective Refusal	
N = 33 (C) 6.08m 5, 8 / 7, 8, 9, 9 450mm	
N = 15 (C) 7.60m 3, 4 / 4, 3, 3, 5 450mm	
N = 40 (C) 9.12m 6, 7 / 10, 9, 11, 10 450mm	
N = 1 (C) 10.64m 0, 1 / 0, 1, 0, 0 450mm	
N = 32 (C) 12.16m 3, 4 / 4, 6, 9, 13 450mm	
N = 57 (C) 13.68m 10, 16 / 19, 12, 13, 13 450mm	
N = 60+ (C) 15.20m 14, 25 / 20, 21, 24 375mm Effective Refusal	

Remarks

Geotechnical Investigation Borehole BH101 with SPT Testing

Static Water Levels:
-3.8m @ Casing depth of 13.5m; 22/1/2015

500 Liters Water Added

Safety Auto Trip Hammer #398 used (energy ratio 79%)

Drivability

1 Easy Push - No Hammer \ Fast Penetration
2 Relatively Easy Push - Light Hammer \ Relatively Fast
3 Medium Push - Consistent Hammer \ Medium
4 Hard Push - Full Hammer \ Somewhat Slow
5 Very Hard Push - Full Hammer \ Very Slow

Additional Resources:

Plastic Liner	**m**	10
Flush Mounted Toby Box		
- Standard	**ea**	
- Environmental	**ea**	
Above Ground Protective Surround	**ea**	
Geotextile Sock	**m**	-
Hand Clear Location	**ea**	
Decontaminate Equipment	**ea**	

Hole Depth: 15.2m

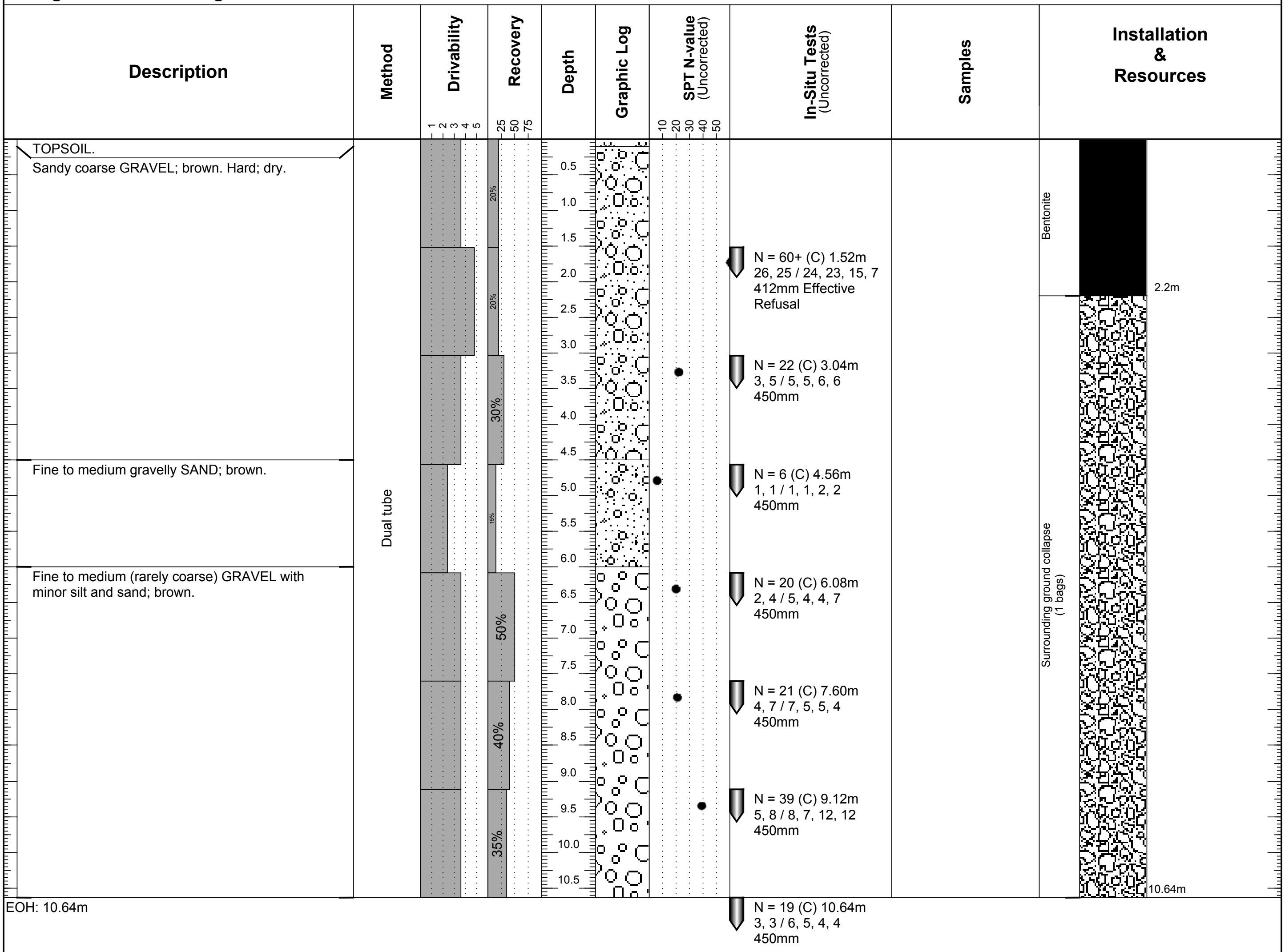
McMILLAN Drilling GROUP

Bore Log

Client: Aurecon NZ Ltd	**Bore No.:**	**BH102**
Project: Rosemerryn Farm development	**Job No.:**	**14216**

Site Location: Ellesmere Road, Lincoln (Rosemerryn Farm development)
Grid Reference: 1560211.07mE, 5168161.33mN (NZTM)
Rig Operator: C. Nee
Rig Model & Mounting: VTR 9700-D Truck

Date Commenced: 22/01/2015
Date Completed: 22/01/2015
Consent: -
Datum: Ground



TOPSOIL.

Sandy coarse GRAVEL; brown. Hard; dry.

Fine to medium gravelly SAND; brown.

Fine to medium (rarely coarse) GRAVEL with minor silt and sand; brown.

EOH: 10.64m

N = 60+ (C) 1.52m
26, 25 / 24, 23, 15, 7
412mm Effective Refusal

N = 22 (C) 3.04m
3, 5 / 5, 5, 6, 6
450mm

N = 6 (C) 4.56m
1, 1 / 1, 1, 2, 2
450mm

N = 20 (C) 6.08m
2, 4 / 5, 4, 4, 7
450mm

N = 21 (C) 7.60m
4, 7 / 7, 5, 5, 4
450mm

N = 39 (C) 9.12m
5, 8 / 8, 7, 12, 12
450mm

N = 19 (C) 10.64m
3, 3 / 6, 5, 4, 4
450mm

Remarks

Geotechnical Investigation Borehole BH102 with SPT Testing

No Static Water Levels recorded

200 Liters Water Added

Safety Auto Trip Hammer #398 used (energy ratio 79%)

Drivability

1 Easy Push - No Hammer \ Fast Penetration
2 Relatively Easy Push - Light Hammer \ Relatively Fast
3 Medium Push - Consistent Hammer \ Medium
4 Hard Push - Full Hammer \ Somewhat Slow
5 Very Hard Push - Full Hammer \ Very Slow

Additional Resources:

Plastic Liner	**m**	6
Flush Mounted Toby Box		
- Standard	**ea**	
- Environmental	**ea**	
Above Ground Protective Surround	**ea**	
Geotextile Sock	**m**	-
Hand Clear Location	**ea**	
Decontaminate Equipment	**ea**	

Generated by GEROC Core-GS

Hole Depth: 10.64m

Created: 2/02/2015 3:06:47 p.m.

Bore Log

McMILLAN Drilling GROUP

Client: Aurecon NZ Ltd

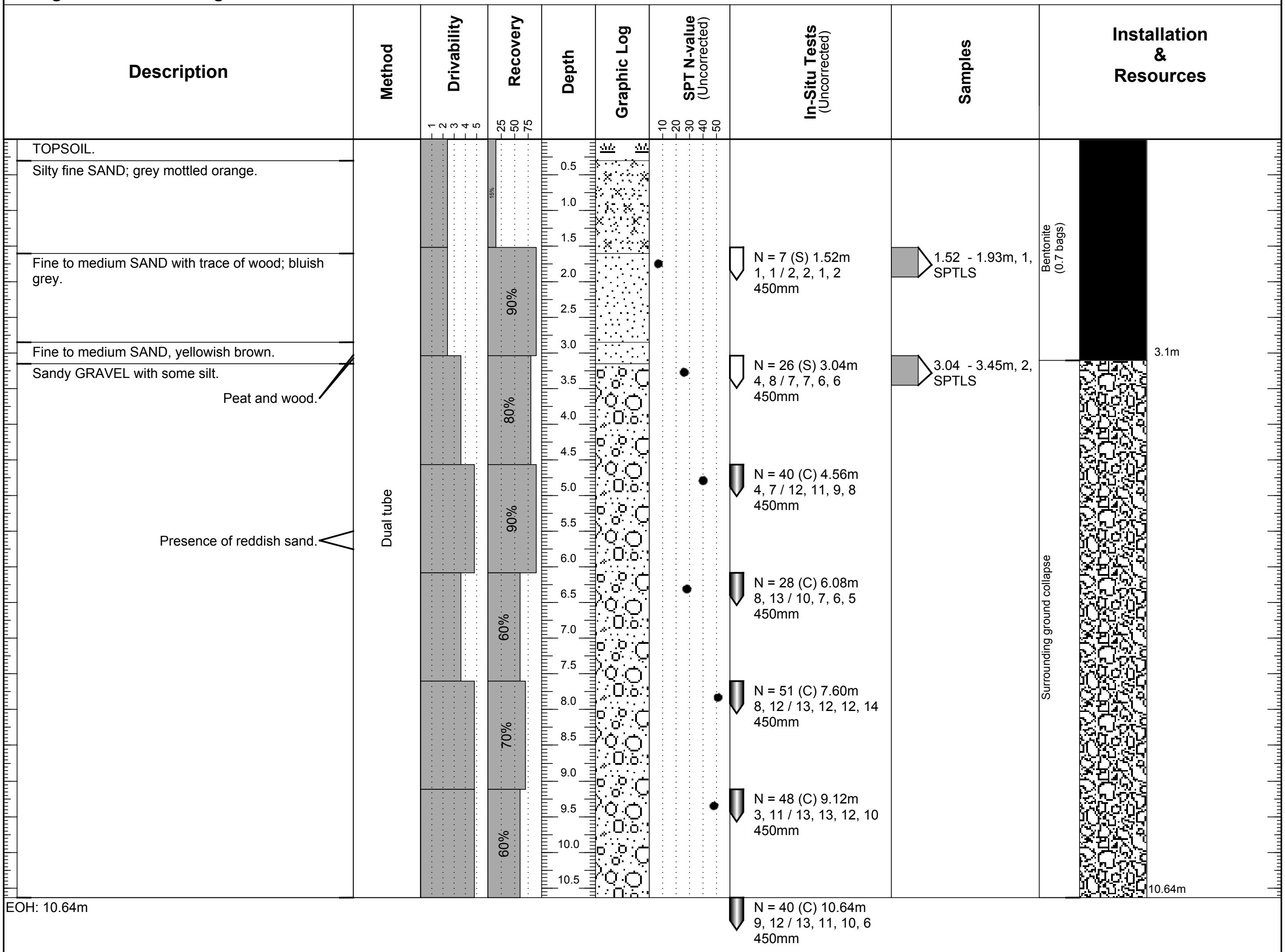
Project: Rosemerryn Farm development

Bore No.: BH103

Job No.: 14216

Site Location: Ellesmere Road, Lincoln (Rosemerryn Farm development)
Grid Reference: 1560056.48mE, 5167721.87mN (NZTM)
Rig Operator: C. Nee
Rig Model & Mounting: VTR 9700-D Truck

Date Commenced: 28/01/2015
Date Completed: 28/01/2015
Consent: -
Datum: Ground



TOPSOIL.

Silty fine SAND; grey mottled orange.

Fine to medium SAND with trace of wood; bluish grey.

Fine to medium SAND, yellowish brown.

Sandy GRAVEL with some silt.

Peat and wood.

Presence of reddish sand.

EOH: 10.64m

N = 7 (S) 1.52m
1, 1 / 2, 2, 1, 2
450mm

N = 26 (S) 3.04m
4, 8 / 7, 7, 6, 6
450mm

N = 40 (C) 4.56m
4, 7 / 12, 11, 9, 8
450mm

N = 28 (C) 6.08m
8, 13 / 10, 7, 6, 5
450mm

N = 51 (C) 7.60m
8, 12 / 13, 12, 12, 14
450mm

N = 48 (C) 9.12m
3, 11 / 13, 13, 12, 10
450mm

N = 40 (C) 10.64m
9, 12 / 13, 11, 10, 6
450mm

1.52 - 1.93m, 1, SPTLS

3.04 - 3.45m, 2, SPTLS

Remarks

Geotechnical Investigation Borehole BH103 with SPT Testing

Static Water Levels:
-2.03m @ Casing depth of 7.5m; 28/1/2015, 11:00 am

300 Liters Water Added

Safety Auto Trip Hammer #398 used (energy ratio 79%)

Drivability

1 Easy Push - No Hammer \ Fast Penetration
2 Relatively Easy Push - Light Hammer \ Relatively Fast
3 Medium Push - Consistent Hammer \ Medium
4 Hard Push - Full Hammer \ Somewhat Slow
5 Very Hard Push - Full Hammer \ Very Slow

Additional Resources:

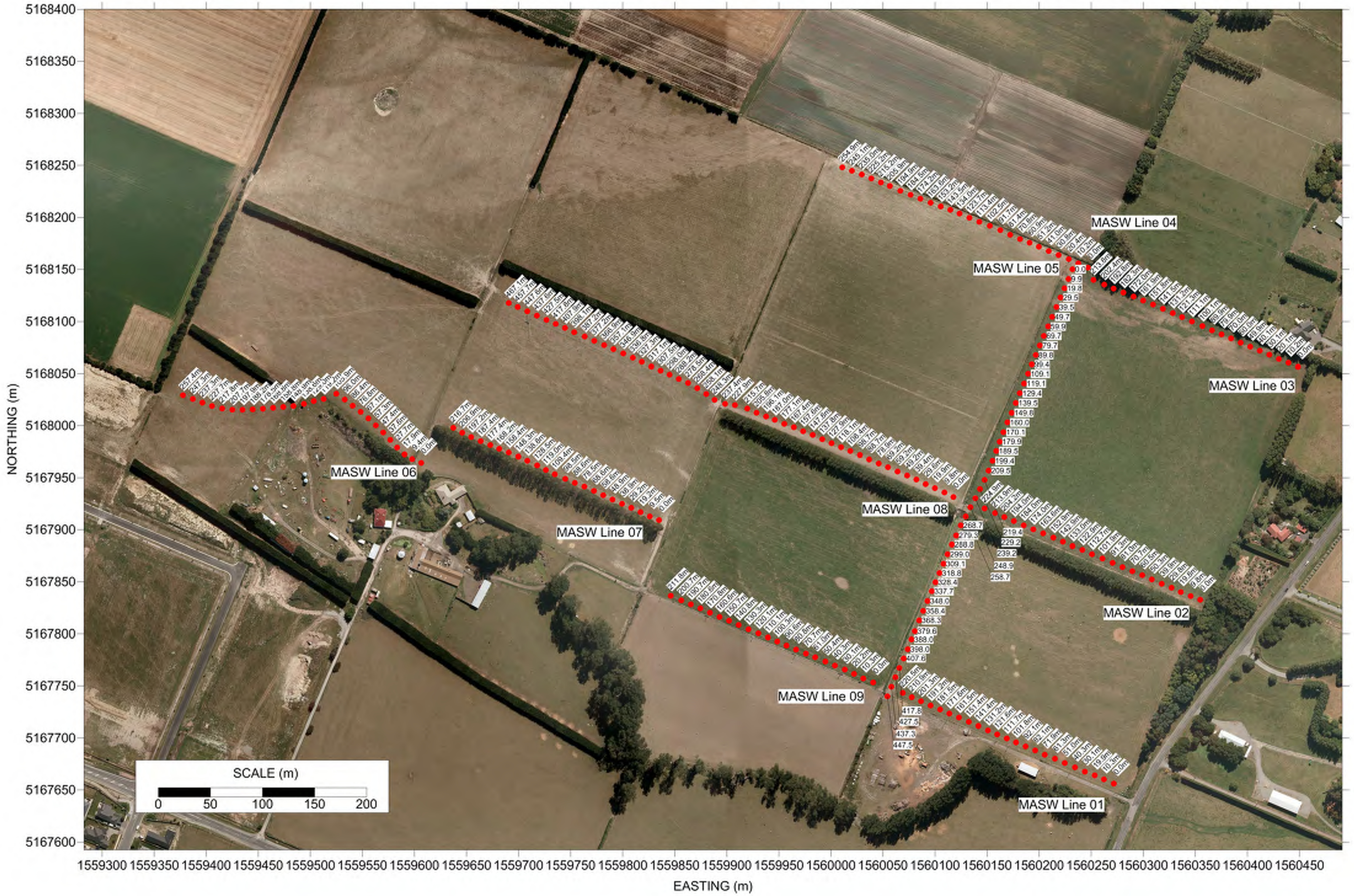
Plastic Liner	**m**	7
Flush Mounted Toby Box		
- Standard	**ea**	
- Environmental	**ea**	
Above Ground Protective Surround	**ea**	
Geotextile Sock	**m**	-
Hand Clear Location	**ea**	
Decontaminate Equipment	**ea**	

Generated by GEROC Core-GS

Hole Depth: 10.64m

Created: 2/02/2015 3:06:47 p.m.

Appendix H
MASW Soundings



TITLE- **Figure 1: MASW Location Plan**

LOCATION- **Rosemerryn Farm, Lincoln**

NOTES-

Coordinates NZ2000 TM Grid.
Aerial photograph post February 2011, sourced from LINZ.
MASW
Line labels show the chainage along the line.
Points are the midpoint of a 23 m 24 channel MASW array with 1 m receiver spacing and 10 m shot offset.

N

A3

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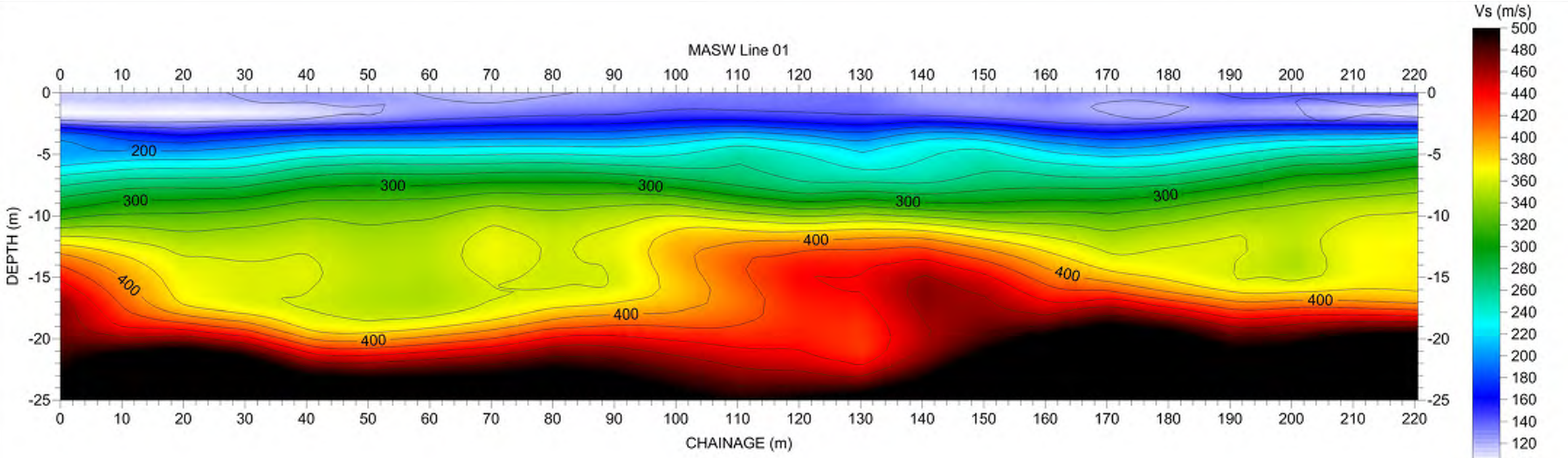

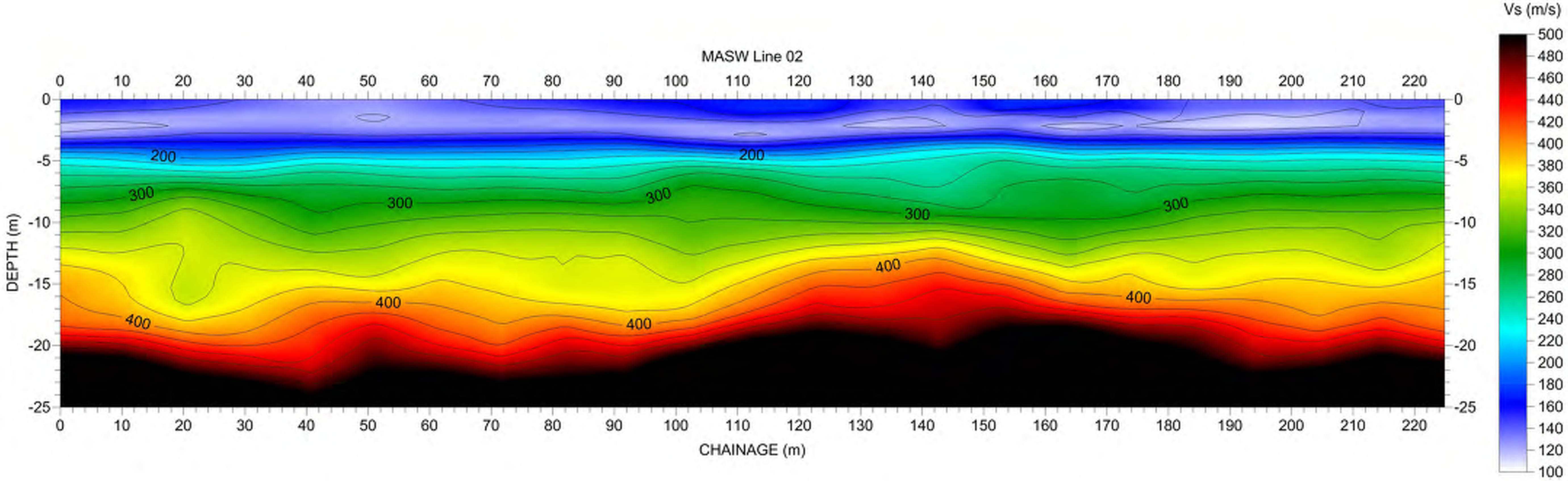

LINE- **Figure 2: MASW Lines 01 and 02**

LOCATION- **Rosemerryn Farm, Lincoln**

NOTES Contour intervals of 20 m/s (Vs).
See site map for location of points.

SCALE: 2:1

A3

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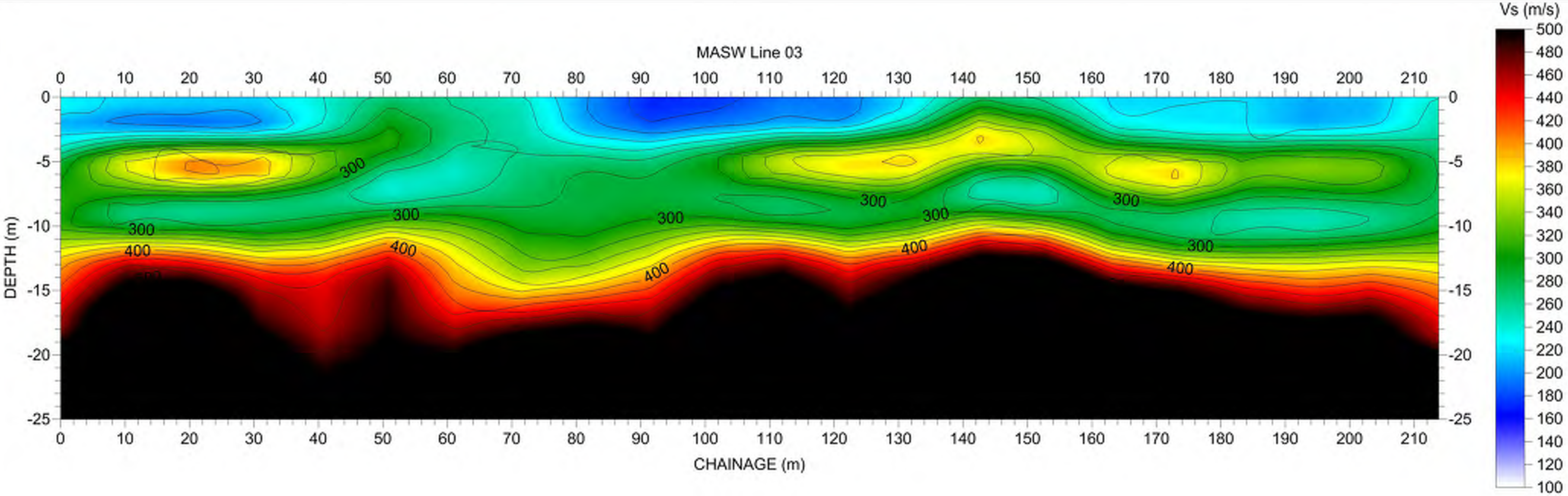

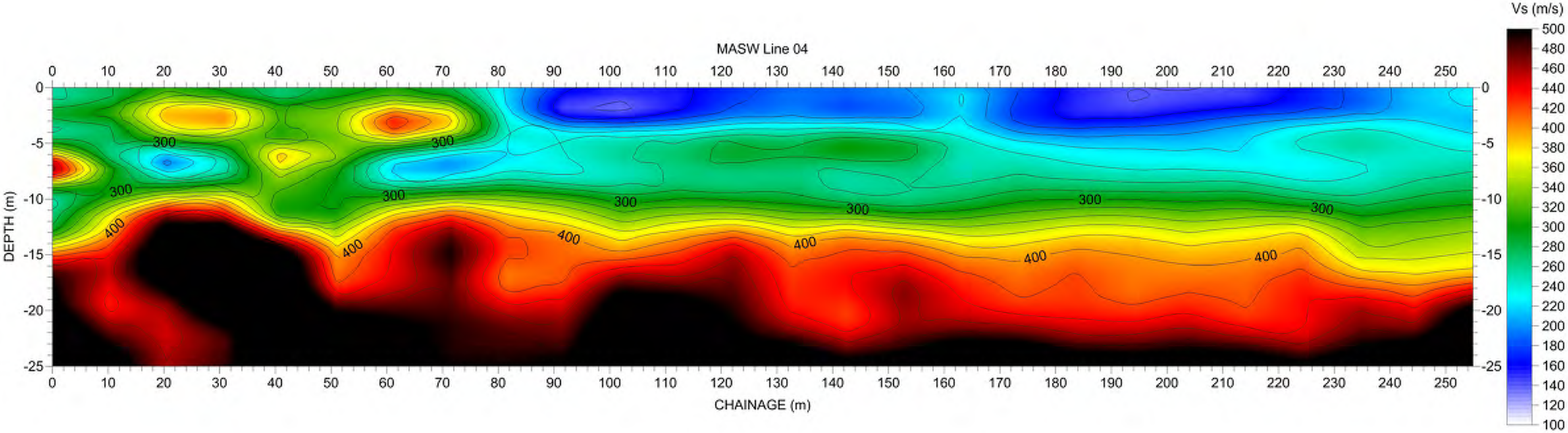

LINE- **Figure 3: MASW Lines 03 and 04**

LOCATION- **Rosemerryn Farm, Lincoln**

NOTES Contour intervals of 20 m/s (Vs).
See site map for location of points.

SCALE: 2:1

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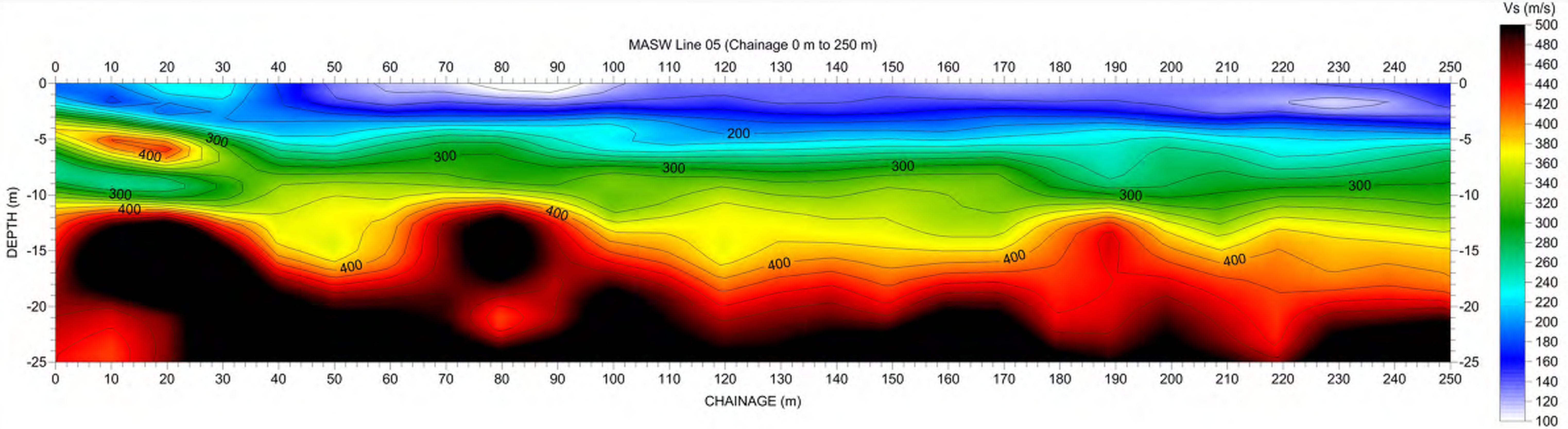
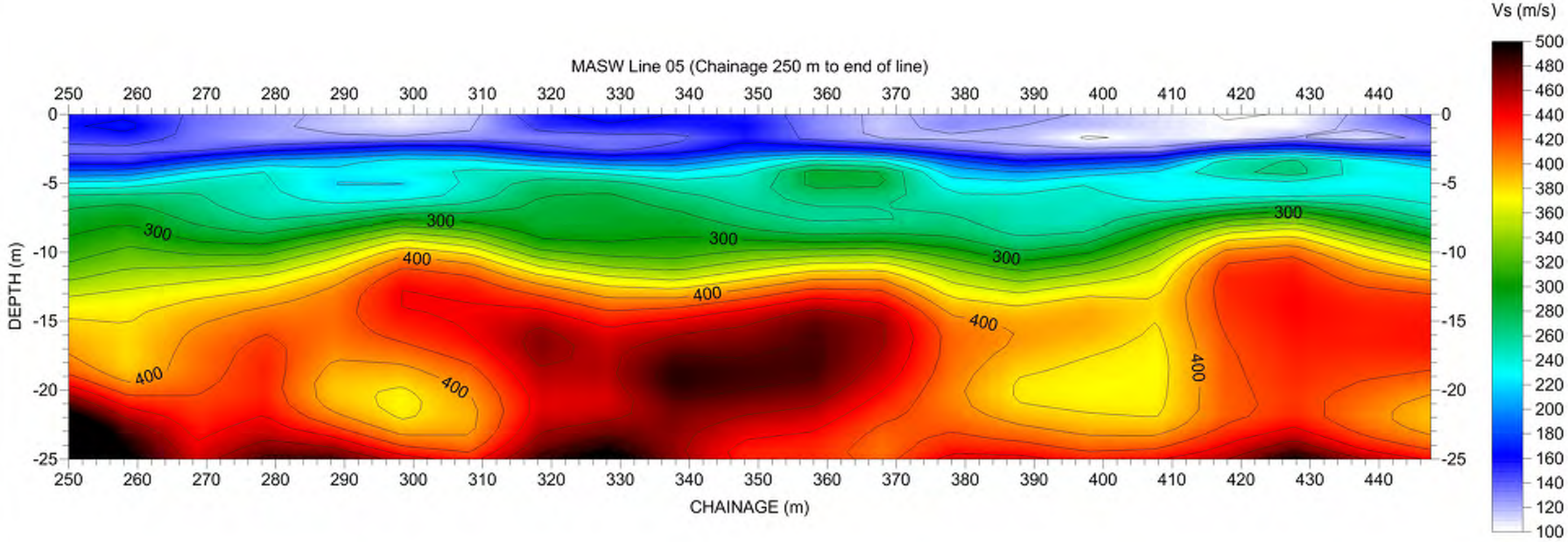
MASW Line 05 (Chainage 0 m to 250 m)



MASW Line 05 (Chainage 250 m to end of line)



LINE- **Figure 4: MASW Line 05**

LOCATION- **Rosemerryn Farm, Lincoln**

NOTES Contour intervals of 20 m/s (Vs).
See site map for location of points.

SCALE: 2:1

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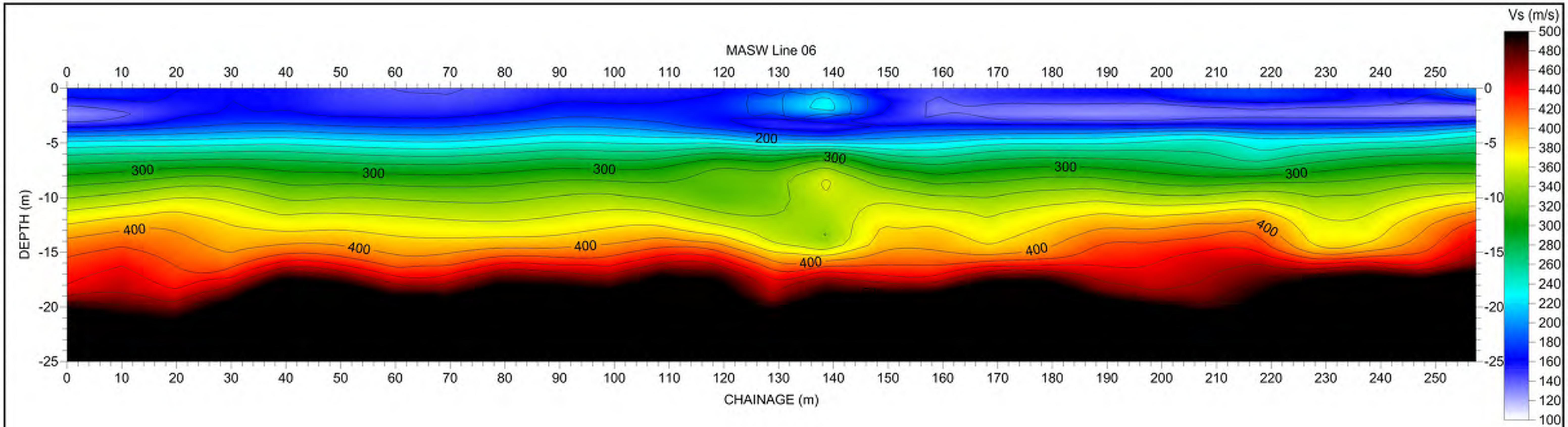

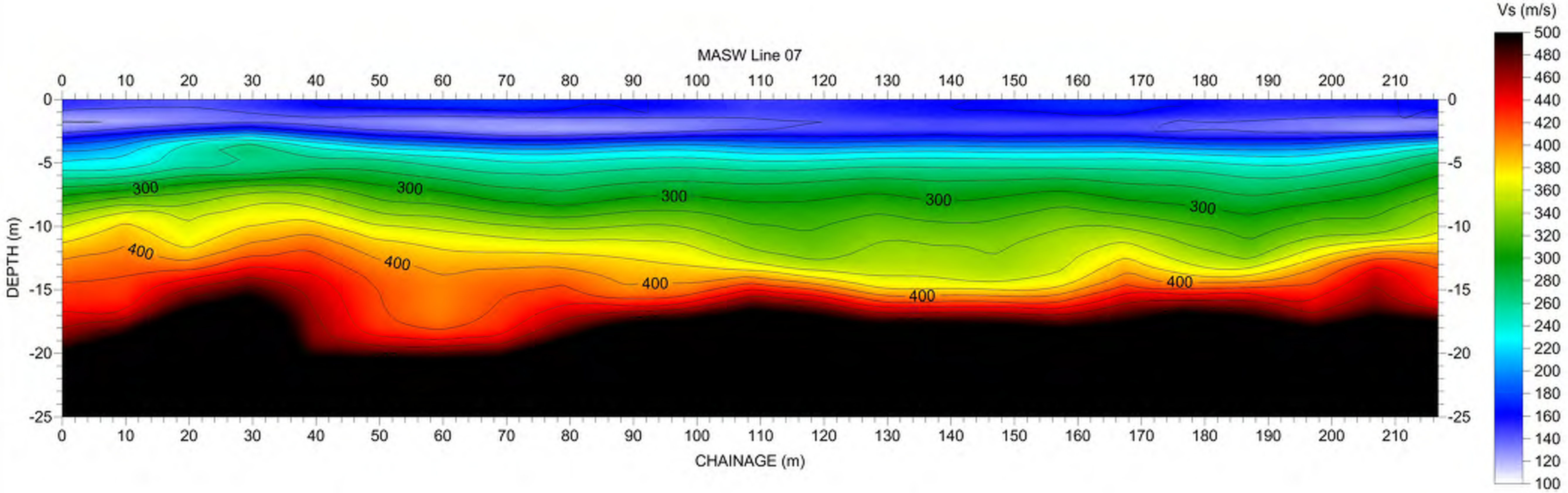

LINE- **Figure 5: MASW Lines 06 and 07**

LOCATION- **Rosemerryn Farm, Lincoln**

NOTES Contour intervals of 20 m/s (Vs).
See site map for location of points.

SCALE: 2:1

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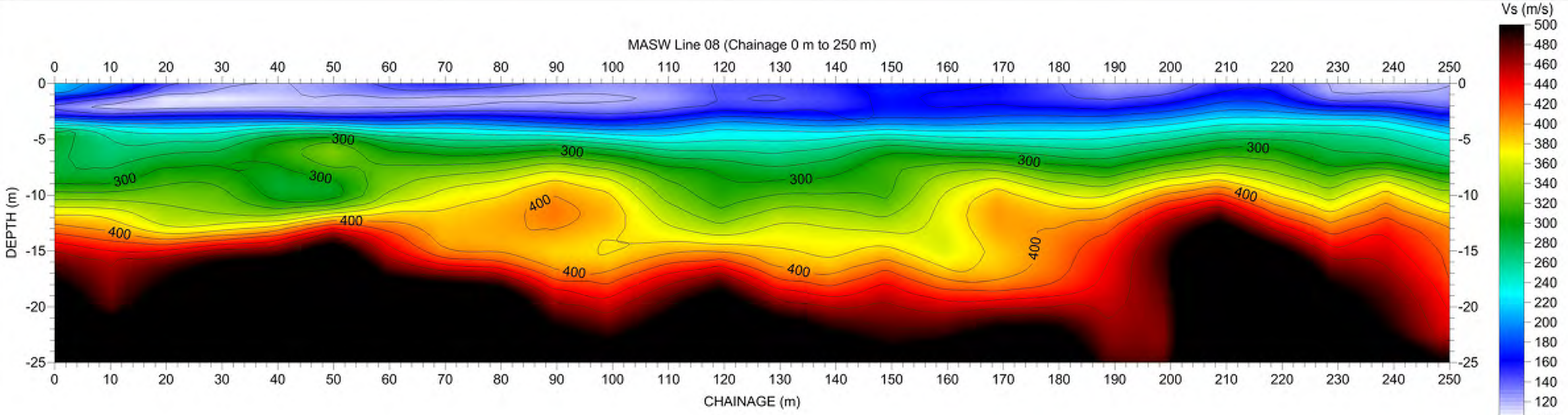
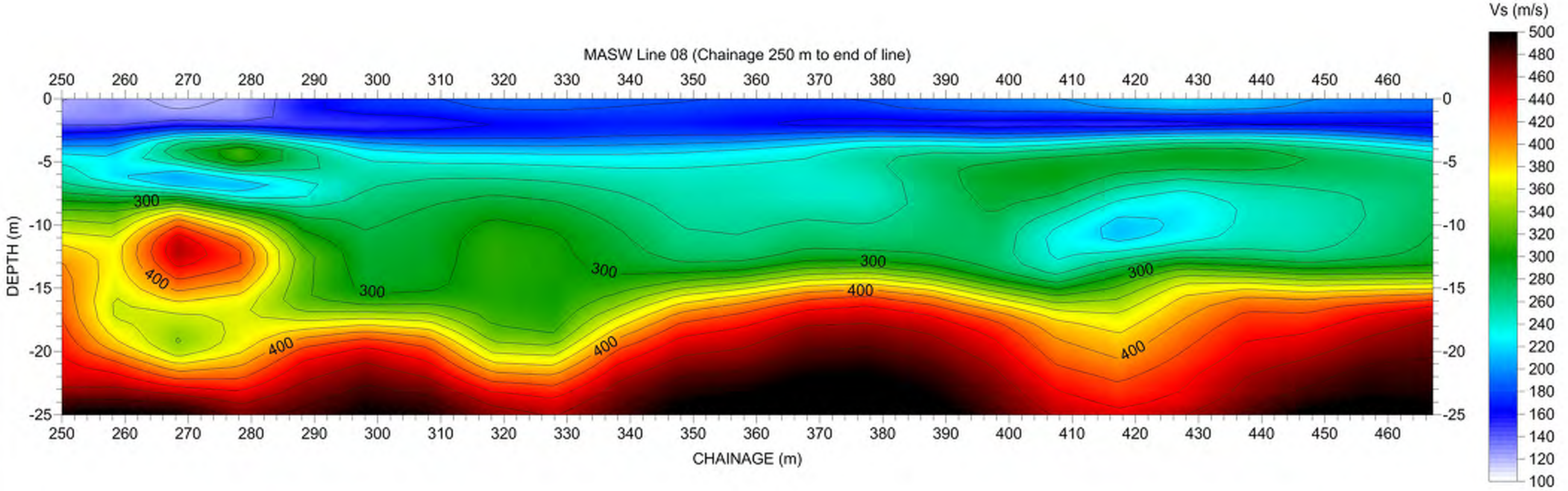
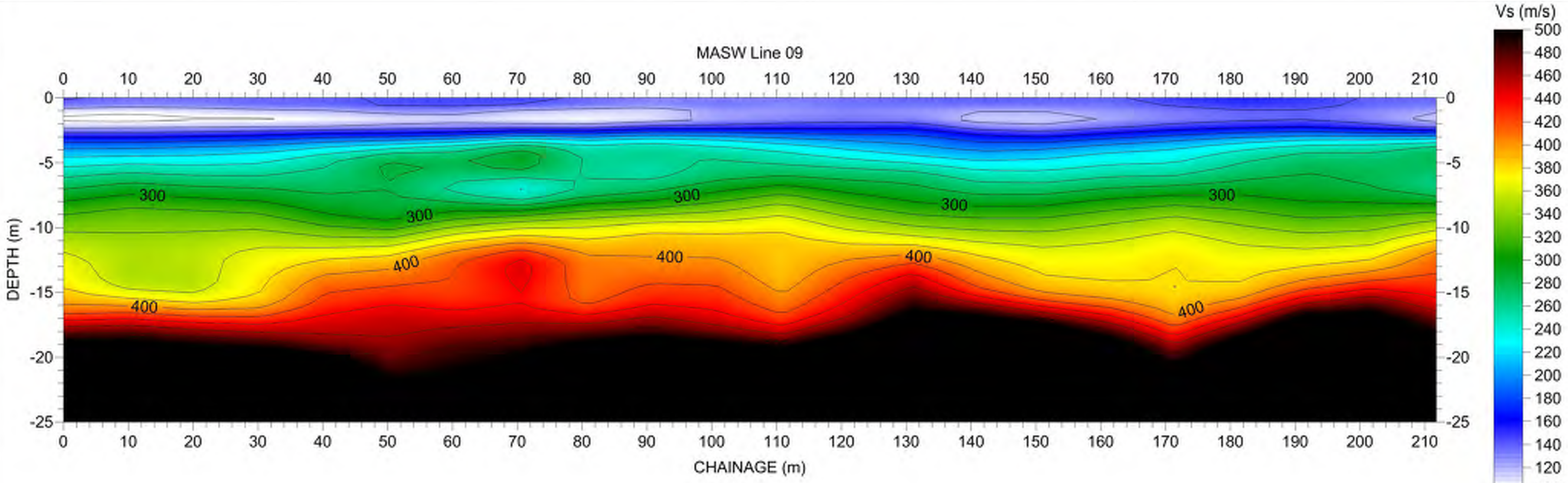
MASW Line 08 (Chainage 0 m to 250 m)



MASW Line 08 (Chainage 250 m to end of line)



LINE- **Figure 6: MASW Line 08**	NOTES Contour intervals of 20 m/s (Vs). See site map for location of points.	SCALE: 2:1	**Southern Geophysical Ltd** www.southerngeophysical.com
LOCATION- **Rosemerryn Farm, Lincoln**		A3	



LINE- **Figure 7: MASW Line 09**

LOCATION- **Rosemerryn Farm, Lincoln**

NOTES Contour intervals of 20 m/s (Vs).
See site map for location of points.

SCALE: 2:1

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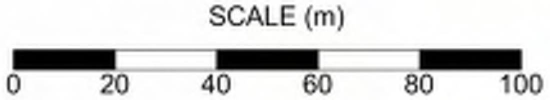

PROJECT-	**MASW Investigation**
LOCATION-	**Rosemerryn Farm Subdivision** **Lincoln, Canterbury**

NOTES-

Coordinates NZ2000 TM Grid.
Aerial photograph post February 2011.
Markers are the midpoint of the 24 channel MASW array at each chainage point. Survey conducted with 1 m receiver spacing and 10 m shot offset, optimized for maximum depth penetration.

N

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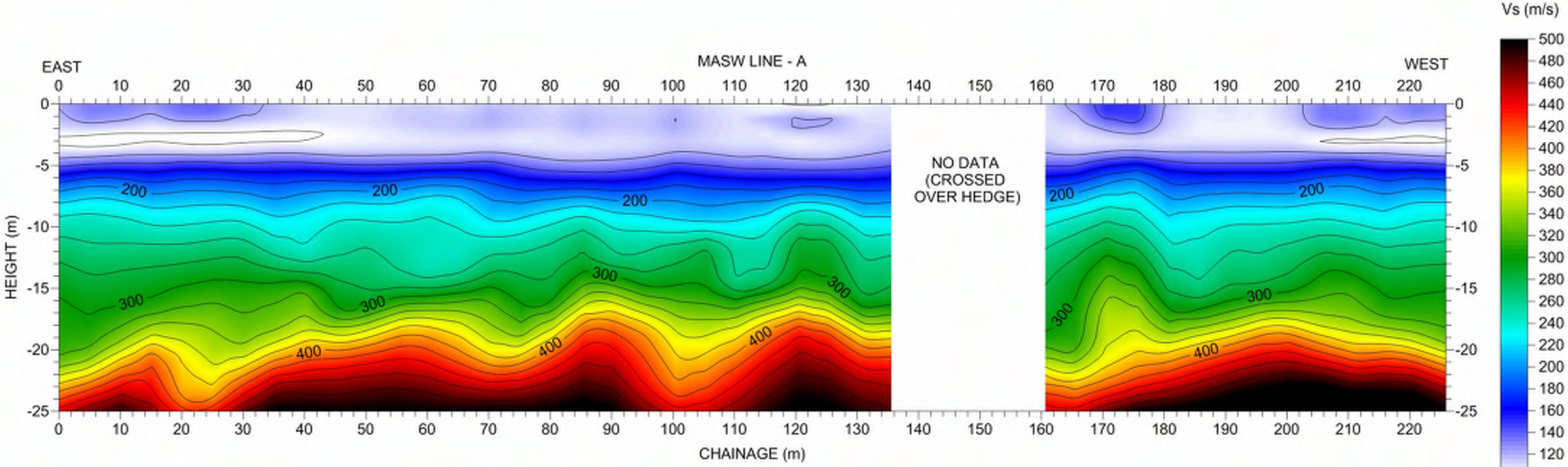

LINE- **LINE - A**

LOCATION- **Rosemerryn Farm Subdivision, Lincoln**

NOTES Contour intervals of 20 m/s (Vs).
See site map for location of points.

SCALE: 1:2

A3

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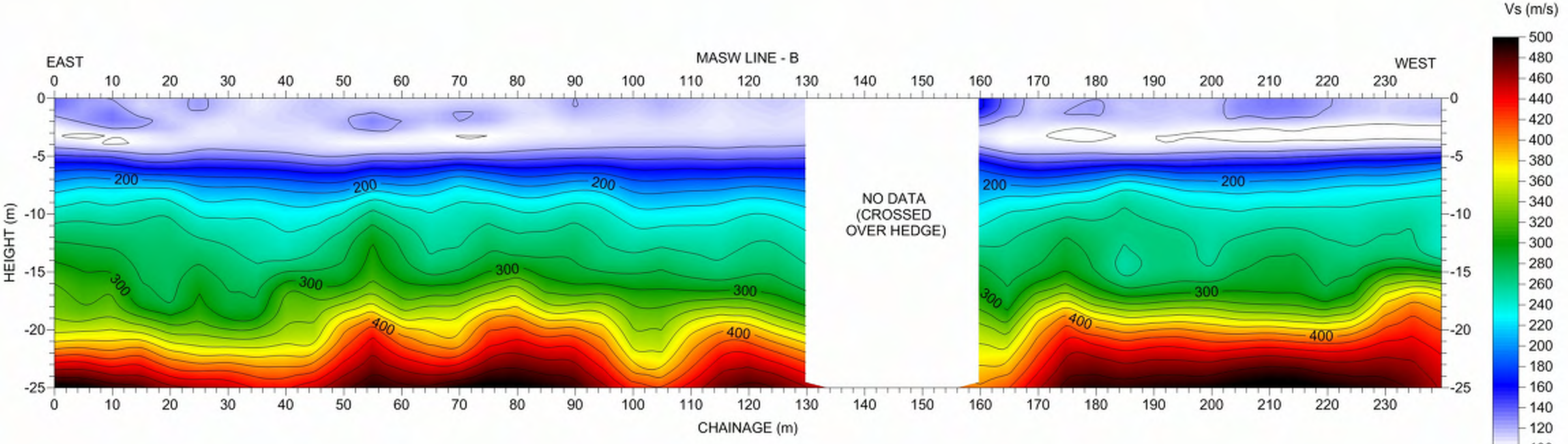

LINE-	**LINE - B**
LOCATION-	**Rosemerryn Farm Subdivision, Lincoln**

NOTES
Contour intervals of 20 m/s (Vs).
See site map for location of points.

SCALE: 1:2

A3

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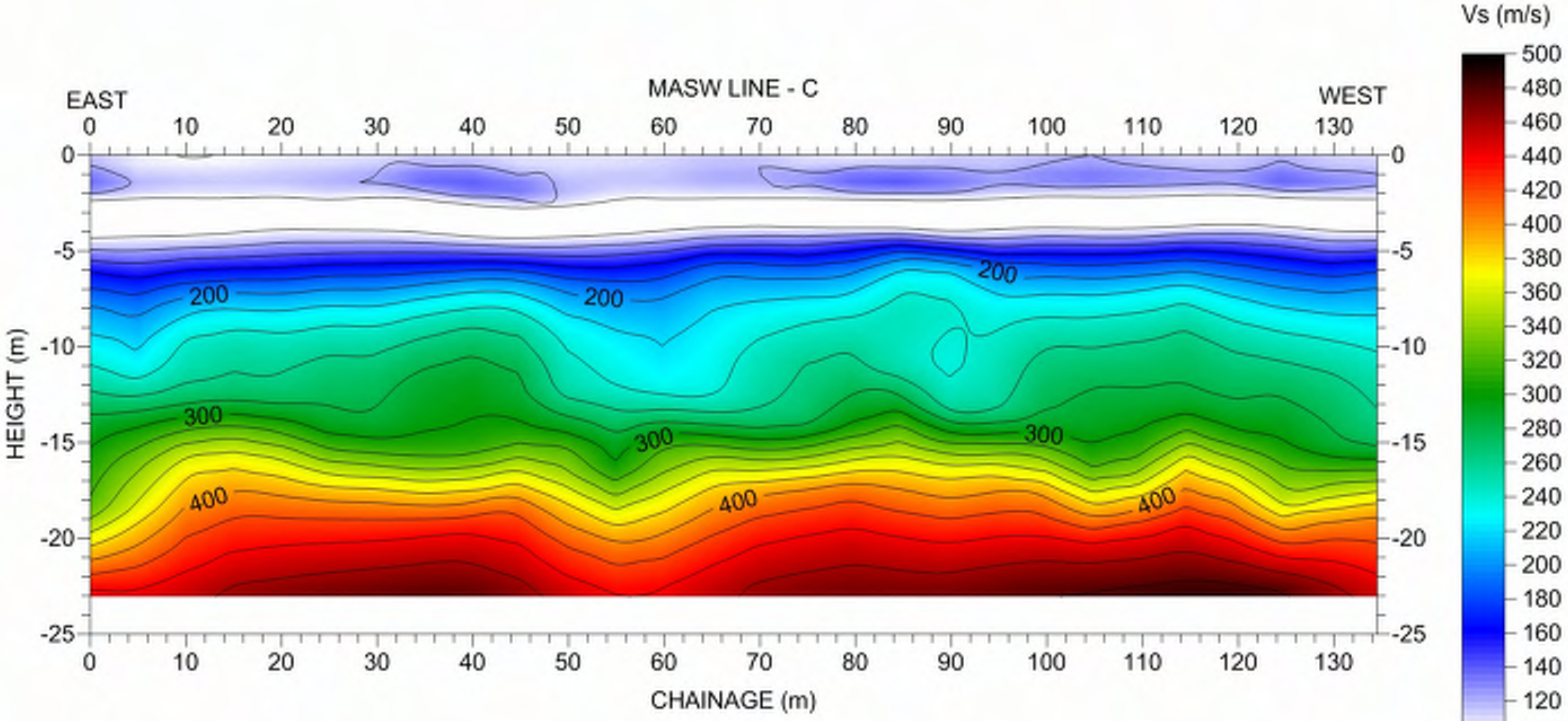

LINE-	**LINE - C**
LOCATION-	**Rosemerryn Farm Subdivision, Lincoln**

NOTES
Contour intervals of 20 m/s (Vs).
See site map for location of points.

SCALE: 1:2

A3

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Appendix I

Summary of Liquefaction Results

Client: Fulton Hogan Land Development
Project: Rosemerryn Subdivsion
Subject: Boulanger and Idriss (2014) assessment

Date: Feb 2014
Job Number: 224464
By: T. Plunket

Southern Section

Year	CPT	Depth (m)	GWL (m bgl)	SLS-a (0.13g, Mw7.5)						SLS-b (0.19g, Mw6.0)						ULS (0.35g, Mw7.5)						Sept 2010 (0.34g, Mw7.1)						Sept 2010 (0.20g, Mw7.1)					
				Total Settlement (mm)	Index Settlement (mm)	LSN	Liquefiable Layers		Ishihara	Total Settlement (mm)	Index Settlement (mm)	LSN	Liquefiable Layers		Ishihara	Total Settlement (mm)	Index Settlement (mm)	LSN	Liquefiable Layers		Ishihara	Total Settlement (mm)	Index Settlement (mm)	LSN	Liquefiable Layers		Ishihara	Total Settlement (mm)	Index Settlement (mm)	LSN	Liquefiable Layers		Ishihara
2011	14	6.6	1	105	N/A	41	1.9	6.5	Yes	125	N/A	40	1.6	6.5	Yes	145	N/A	56	1	6.5	Yes	145	N/A	56	1	6.5	Yes	130	N/A	50	1.1	6.5	Yes
2011	18	6.2	1	40	N/A	15	2.1 3.5	2.3 5.4	No	65	N/A	13	1.9 3.5	2.8 5.4	Yes	85	N/A	35	1 3.5	2.8 5.4	Yes	85	N/A	34	1 3.5	2.8 5.4	Yes	70	N/A	25	1.9 3.5	2.8 5.4	Yes
2011	29	6.5	1	30	N/A	10	4.3 5.3	4.6 6.4	No	40	N/A	9	1.9 4.3 5.3	2.4 4.6 6.4	No	60	N/A	26	1 4.3 5.3	2.4 4.6 6.4	Yes	60	N/A	25	1 4.3 5.3	2.4 4.6 6.4	Yes	50	N/A	16	1.4 4.3 5.3	2.4 4.6 6.4	No
2012	1	5.9	1	20	N/A	11	3.1 4.4 5	3.6 4.7 5.2	No	35	N/A	11	3.1 4.4 5	3.6 4.7 5.2	No	45	N/A	22	1 1.8 3.1 4.4 5	1.4 2 3.6 4.7 5.2	No	45	N/A	22	1 1.8 3.1 4.4 5	1.4 2 3.6 4.7 5.2	No	40	N/A	16	3.1 4.4 5	3.6 4.7 5.2	No
2012	2	7.5	1	45	N/A	29	2.8 5.9	5.5 6.4	No	85	N/A	27	1.6 5.9	5.5 6.4	Yes	105	N/A	43	1	6.5	Yes	105	N/A	43	1	6.5	Yes	95	N/A	36	1.6 5.9	5.5 6.4	Yes
2012	3	8.4	1	55	N/A	22	3.2 4.4 5.9 7.5	3.9 5 6.5 7.9		85	N/A	20	1.5 5.9 7.5	5 6.5 8	Yes	105	N/A	37	1.2 7.5	6.5 8.2	Yes	105	N/A	36	1.2 7.5	6.5 8.2	Yes	95	N/A	33	1.5 5.9 7.5	5 6.5 8	Yes
2012	5	4.9	1	15	N/A	8	3.1	3.9	No	30	N/A	7	1.6 3.1	1.9 3.9	No	45	N/A	23	1.1 3.1	1.9 3.9	Yes	45	N/A	23	1.1 3.1	1.9 3.9	Yes	35	N/A	17	1.6 3.1	1.9 3.9	No
2012	6	10.2	1	70	70	25	3.2 4.2 6.1	3.7 5.4 7.8	No	95	95	23	1.6 3.2 4.2 6.1	2.4 3.7 5.4 8.5	Yes	135	135	43	1 3.2 4.2 6.1	2.4 3.7 5.4 10	Yes	130	130	42	1 3.2 4.2 6.1	2.4 3.7 5.4 10	Yes	115	115	35	1.3 3.2 4.2 6	2.4 3.7 5.4 8.5	No
2012	8	6.6	1	25	N/A	17	3.5 4.4	3.9 5	No	55	N/A	15	1.5 2.6 4.4	2.2 3.8 5.1	No	85	N/A	40	1 4.4 5.8	3.9 5.1 6	Yes	85	N/A	39	1 4.4 5.8	3.9 5.1 6	Yes	70	N/A	33	1.3 4.4 5.8	3.9 5.1 6	Yes
2012	9	4.2	1	10	N/A	9	Limited		No	25	N/A	7	1.7 3.2	2.1 3.7	No	45	N/A	26	1 2.8	2.1 3.7	Yes	45	N/A	25	1 2.8	2.1 3.7	Yes	30	N/A	18	1.5 2.8	2.1 3.7	No
2012	10	4.1	1	0	N/A	2	Limited		No	10	N/A	2	2.5	2.9	No	40	N/A	21	1.1 3.7	3 3.9	Yes	40	N/A	21	1.1 3.7	3 3.9	Yes	15	N/A	8	1.7	2.9	No
2012	11	4.1	1	10	N/A	15	Limited		No	30	N/A	14	1.5	3	No	50	N/A	33	1	3.4	Yes	50	N/A	33	1	3.4	Yes	40	N/A	29	1.1	3.4	Yes
2012	27	4.3	1	10	N/A	12	2.9	3.1	No	30	N/A	10	1.5 2.3	2 3.1	No	55	N/A	35	1	3.1	Yes	55	N/A	35	1	3.1	Yes	45	N/A	31	1.1	3.1	Yes
2013	1	6.5	1	45	N/A	23	2.8	5.2	No	75	N/A	22	1.5 2.8	2.1 5.2	No	85	N/A	36	1 2.8	2.1 5.2	Yes	85	N/A	36	1 2.8	2.1 5.2	Yes	80	N/A	32	1.4 2.8	2.1 5.2	Yes
2013	2	6.9	1	45	N/A	22	3.4 4.4 5.8	4 5 6.6	No	70	N/A	20	1.7 3.1 4.4 5.8	2.4 4 5 6.6	No	85	N/A	35	1 3.1 5.8	2.4 5 6.6	Yes	85	N/A	35	1 3.1 5.8	2.4 5 6.6	Yes	75	N/A	33	1.3 3.1 5.8	2.4 5 6.6	No
2013	3	6.8	1	45	N/A	21	3.4 4.4 5.8	4.1 5.2 6.8	No	75	N/A	18	1.8 3.2 5.8	2.4 5.2 6.8	No	100	N/A	40	1 5.8	5.2 6.8	Yes	100	N/A	40	1 5.8	5.2 6.8	Yes	85	N/A	34	1.2 3.2 5.8	2.4 5.2 6.8	Yes
2013	4	6.6	1	35	N/A	20	3.4 5.6	4 6.2	No	60	N/A	19	1.6 3.4 5.6	2.7 4 6.2	No	80	N/A	38	1 3.4 5.6	2.7 4 6.3	Yes	80	N/A	38	1 3.4 5.6	2.7 4 6.3	Yes	70	N/A	31	1.4 3.4 5.6	2.7 4 6.2	No
2013	5	5.8	1	20	N/A	9	4.4	4.8	No	30	N/A	8	1.9 4.4	2.4 4.8	No	55	N/A	30	1 4.4	2.4 4.8	Yes	55	N/A	29	1 4.4	2.4 4.8	Yes	40	N/A	17	1.6 4.4	2.4 4.8	No
2013	6	6.3	1	25	N/A	16	Limited		No	40	N/A	15	1.6	2.5	No	55	N/A	29	1 5.5	2.5 6.1	Yes	55	N/A	29	1 5.5	2.5 6.1	Yes	45	N/A	23	1.3 5.5	2.5 6	No
2013	7	7.6	1	15	N/A	8	5.3	5.8	No	25	N/A	7	5.3	5.9	No	45	N/A	23	1 5.3	2.4 6	Yes	45	N/A	22	1 5.3	2.4 6	Yes	35	N/A	16	1.7 5.3	2.4 5.9	No
2013	8	6.3	1	10	N/A	10	Limited		No	20	N/A	9	1.6	2.4	No	35	N/A	21	1.1 5.4	2.4 6.1	Yes	35	N/A	21	1.1 5.4	2.4 6.1	Yes	25	N/A	18	1.1	2.4	Yes
2013	9	7.4	1	25	N/A	10	6.5	6.9	No	35	N/A	9	1.8 6.4	2.2 6.9	No	55	N/A	24	1 4.9 6.3	2.2 5.7 7.3	Yes	55	N/A	23	1 4.9 6.3	2.2 5.7 7.3	Yes	45	N/A	18	1.6 6.4	2.2 7.2	No
2013	10	7.5	1	75	N/A	29	3.4 4.4 5.8	4 5.3 7	No	90	N/A	27	1.7 3.4 4.4 5.8	2.6 4 5.3 7	No	110	N/A	43	1 3.4 4.4 5.8	2.9 4 5.3 7.3	Yes	110	N/A	43	1 3.4 4.4 5.8	2.9 4 5.3 7.3	Yes	100	N/A	37	1.7 3.4 4.4 5.8	2.6 4 5.3 7.1	No
2013	11	6.1	1	45	N/A	23	3.4 4.3 5.6	4 5.2 5.9	No	65	N/A	22	1.7 3.1 5.6	2.3 5.2 5.9	No	80	N/A	33	1 3.1 5.6	2.3 5.2 6	Yes	80	N/A	33	1 3.1 5.6	2.3 5.2 6	Yes	70	N/A	29	1.5 3.1 5.6	2.3 5.2 6	Yes
2013	12	7.3	1	65	N/A	27	2.9	7.2	No	95	N/A	26	1.6 2.9	2.2 7.2	No	105	N/A	37	1.2 2.9	2.2 7.2	Yes	105	N/A	37	1.2 2.9	2.2 7.2	Yes	100	N/A	35	1.6 2.9	2.2 7.2	Yes
2013	13	6.8	1	40	N/A	18	3.1 4.4	4 5.6	No	65	N/A	17	1.8 3.3 4.4	2.4 4 6.2	No	90	N/A	35	1 3.1	2.4 6.2	Yes	90	N/A	35	1 3.1	2.4 6.2	Yes	80	N/A	29	1.4 3.1	2.4 6.2	No
2013	14	6.5	1	50	N/A	27	3.2 4.2 5.6	4.1 5.2 6.2	No	75	N/A	26	1.8 4.2 4.4 5.6	2.9 4.1 5.2 6.2	No	90	N/A	37	1	6.3	Yes	90	N/A	37	1	6.3	Yes	80	N/A	33	1.7	6.1	Yes
2013	15	7.7	1	50	N/A	21	3.5 4.2 6.3	3.9 4.9 7.4	No	65	N/A	19	1.7 3.5 4.2 6.3	2.7 3.9 4.9 7.4	No	85	N/A	36	1 3.5 4.2 6	2.7 3.9 4.9 7.5	Yes	85	N/A	36	1 3.5 4.2 6	2.7 3.9 4.9 7.5	Yes	75	N/A	31	1.7 3.5 4.2 6.3	2.7 3.9 4.9 7.4	No
2013	16	6	1	20	N/A	11	5.2	5.6	No	30	N/A	10	1.8 5.2	2.2 5.7	No	50	N/A	28	1.8 4.9	2.3 5.8	No	50	N/A	28	1.8 4.9	2.3 5.8	No	40	N/A	22	1.3 4.9	2.2 5.7	No
2013	17	7.1	1	55	N/A	17	5.1	6.8	No	65	N/A	17	1.8 5.1	2.3 6.9	No	80	N/A	28	1 5.1	2.3 6.9	Yes	80	N/A	28	1 5.1	2.3 6.9	Yes	70	N/A	23	1.5 5.1	2.3 6.9	No
2013	18	7.6	1	30	N/A	16	6.4	6.8	No	45	N/A	15	2 6.4	2.8 6.8	No	65	N/A	32	1 6.4	2.8 6.8	Yes	65	N/A	32	1 6.4	2.8 6.8	Yes	55	N/A	28	1.2 6.4	2.8 6.8	Yes
2013	19	7.1	1	40	N/A	20	2.2 3.5 6	2.9 3.8 6.5	No	55	N/A	19	1.9 3.5 6	2.9 3.8 6.5	No	65	N/A	28	1.3 3.5 6	2.9 3.8 6.5	Yes	65	N/A	28	1.3 3.5 6	2.9 3.8 6.5	Yes	60	N/A	25	1.4 3.5 6	2.9 3.8 6.5	Yes
2013	20	7.3	1	60	N/A	25	3.4	7.1	No	85	N/A	24	2.1	7.2	Yes	105	N/A	40	1.2	7.2	Yes	105	N/A	40	1.2	7.2	Yes	95	N/A	35	1.2	7.2	Yes
2013	21	7.5	1	55	N/A	22	3.6	6.4	No	85	N/A	19	2 3.2	2.8 6.4	No	115	N/A	44	1	6.4	Yes	115	N/A	44	1	6.4	Yes	100	N/A	34	1.9	6.4	Yes
2013	22	9.3	1	75	N/A	29	3.3 4.5 6 8.3	4 5.6 6.9 9.1	No	105	N/A	26	1.5 3 4.5 6 8.3	2.3 4 5.6 6.9 9.1	No	150	N/A	50	1	9.1	Yes	145	N/A	49	1	9.1	Yes	130	N/A	45	1 8.2	6.9 9.1	Yes

Client: Fulton Hogan Land Development
Project: Rosemerryn Subdivsion
Subject: Boulanger and Idriss (2014) assessment

Date: Feb 2014
Job Number: 224464
By: T. Plunket

Northern Section

Year	CPT	Depth (m)	GWL (m bgl)	SLS-a (0.13g, Mw7.5)					SLS-b (0.19g, Mw6.0)					ULS (0.35g, Mw7.5)					Sept 2010 (0.34g, Mw7.1)					Sept 2010 (0.20g, Mw7.1)				
				Total Settlement (mm)	Index Settlement (mm)	LSN	Liquefiable Layers	Ishihara	Total Settlement (mm)	Index Settlement (mm)	LSN	Liquefiable Layers	Ishihara	Total Settlement (mm)	Index Settlement (mm)	LSN	Liquefiable Layers	Ishihara	Total Settlement (mm)	Index Settlement (mm)	LSN	Liquefiable Layers	Ishihara	Total Settlement (mm)	Index Settlement (mm)	LSN	Liquefiable Layers	Ishihara
2011	6	3.1	2	0	N/A	1	Limited	No	5	N/A	1	Limited	No	15	N/A	6	2.4 3.1	Yes	15	N/A	6	2.4 3.1	Yes	10	N/A	4	2.6 3	No
2011	7	1.4	2	0	N/A	0	Limited	No	0	N/A	0	Limited	No	0	N/A	0	Limited	No	0	N/A	0	Limited	No	0	N/A	0	Limited	No
2011	9	3.7	2	5	N/A	5	Limited	No	15	N/A	4	2.4 2.7 2.9 3.4	No	35	N/A	16	2 3.7	Yes	35	N/A	16	2 3.7	Yes	30	N/A	13	2 3.7	No
2011	12	3.8	2	0	N/A	1	Limited	No	0	N/A	1	Limited	No	15	N/A	8	2 2.7	No	15	N/A	8	2 2.7	No	5	N/A	5	2.1 2.5	No
2011	13	0.7	2	0	N/A	0	Limited	No	0	N/A	0	Limited	No	0	N/A	0	Limited	No	0	N/A	0	Limited	No	0	N/A	0	Limited	No
2011	15	4.2	2	5	N/A	3	Limited	No	15	N/A	3	3 3.7	No	45	N/A	16	2 4.1	Yes	40	N/A	16	2 4.1	Yes	30	N/A	14	2 3.8	No
2011	16	2.7	2	0	N/A	2	Limited	No	4	N/A	1	Limited	No	15	N/A	7	2 2.7	No	15	N/A	7	2 2.7	No	10	N/A	6	2.4 2.7	No
2011	17	3.4	2	0	N/A	1	Limited	No	5	N/A	1	Limited	No	15	N/A	8	2.1 2.7	No	15	N/A	8	2.1 2.7	No	6	N/A	5	2.1 2.5	No
2011	19	3.5	2	0	N/A	3	Limited	No	10	N/A	2	Limited	No	30	N/A	14	2 3.4	Yes	30	N/A	14	2 3.4	Yes	20	N/A	11	2 3.4	No
2011	20	4.2	2	5	N/A	5	Limited	No	15	N/A	4	3.1 3.6	No	35	N/A	15	2 3.7	Yes	35	N/A	15	2 3.7	Yes	30	N/A	14	2 3.7	No
2011	21	3.2	2	0	N/A	0	Limited	No	5	N/A	0	Limited	No	25	N/A	10	2 3	Yes	25	N/A	10	2 3	Yes	15	N/A	4	2.3 2.9	No
2011	28	2.1	2	0	N/A	0	Limited	No	0	N/A	0	Limited	No	0	N/A	0	Limited	No	0	N/A	0	Limited	No	0	N/A	0	Limited	No
2011	29	6.5	2	15	N/A	6	4.3 4.6 5.7 6.4	No	30	N/A	5	4.3 4.6 5.3 6.4	No	40	N/A	12	2 2.4 4.3 4.6 5.3 6.4	No	40	N/A	12	2 2.4 4.3 4.6 5.3 6.4	No	35	N/A	9	4.3 4.6 5.3 6.4	No
2011	33	2.6	2	0	N/A	0	Limited	No	0	N/A	0	Limited	No	10	N/A	4	2 2.5	No	10	N/A	4	2 2.5	No	0	N/A	2	Limited	No
2011	34	3.6	2	0	N/A	1	Limited	No	5	N/A	1	Limited	No	15	N/A	7	2.2 2.7	No	15	N/A	7	2.2 2.7	No	10	N/A	6	2.2 2.6	No
2012	12	3.3	2	0	N/A	1	Limited	No	5	N/A	1	Limited	No	20	N/A	10	2 2.9	Yes	20	N/A	9	2 2.9	Yes	5	N/A	5	Limited	No
2012	13	4	2	0	N/A	1	Limited	No	5	N/A	0	Limited	No	25	N/A	11	2 3.5	Yes	25	N/A	10	2 3.5	Yes	10	N/A	4	Limited	No
2012	14	3.9	2	0	N/A	3	Limited	No	10	N/A	3	2.9 3.2	No	25	N/A	12	2 3.3	Yes	25	N/A	12	2 3.3	Yes	20	N/A	9	2 3.2	No
2012	15	5.9	2	5	N/A	6	Limited	No	25	N/A	5	3.5 4.7	No	50	N/A	16	3 4.7	Yes	50	N/A	16	3 4.7	Yes	35	N/A	13	3 4.7	No
2012	16	3.4	2	0	N/A	1	Limited	No	5	N/A	1	Limited	No	25	N/A	10	2 3	Yes	25	N/A	10	2 3	Yes	10	N/A	5	2.3 2.9	No
2012	17	2.7	2	0	N/A	1	Limited	No	0	N/A	1	Limited	No	10	N/A	6	2 2.4	No	10	N/A	6	2 2.4	No	5	N/A	5	2 2.3	No
2012	18	3.5	2	0	N/A	1	Limited	No	5	N/A	1	Limited	No	20	N/A	10	2.1 2.9	No	20	N/A	10	2.1 2.9	No	15	N/A	7	2.1 2.9	No
2012	19	4.4	2	0	N/A	1	Limited	No	5	N/A	1	Limited	No	20	N/A	10	2 3.2	Yes	20	N/A	9	2 3.2	Yes	7	N/A	4	Limited	No
2012	20	3.7	2	0	N/A	0	Limited	No	0	N/A	0	Limited	No	5	N/A	3	2 2.3	No	5	N/A	3	2 2.3	No	1	N/A	0	Limited	No
2012	21	2.7	2	0	N/A	0	Limited	No	0	N/A	0	Limited	No	5	N/A	2	Limited	No	5	N/A	1	Limited	No	0	N/A	0	Limited	No
2012	22	4.6	2	5	N/A	3	Limited	No	15	N/A	5	2.3 3	No	35	N/A	15	2 3.2	No	35	N/A	15	2 3.2	No	25	N/A	13	2 3.1	No
2012	23	2.1	2	0	N/A	0	Limited	No	0	N/A	0	Limited	No	0	N/A	0	Limited	No	0	N/A	0	Limited	No	0	N/A	0	Limited	No
2012	24	0.8	2	0	N/A	0	Limited	No	0	N/A	0	Limited	No	0	N/A	0	Limited	No	0	N/A	0	Limited	No	0	N/A	0	Limited	No
2012	25	3.7	2	0	N/A	0	Limited	No	0	N/A	0	Limited	No	15	N/A	7	2 3	Yes	15	N/A	7	2 3	Yes	5	N/A	2	Limited	No
2015	101	2.1	2	0	N/A	0	Limited	No	0	N/A	0	Limited	No	0	N/A	0	Limited	No	0	N/A	0	Limited	No	0	N/A	0	Limited	No
2015	102	4.4	2	0	N/A	1	Limited	No	5	N/A	1	Limited	No	25	N/A	10	2 3	Yes	25	N/A	10	2 3	Yes	10	N/A	5	2.2 2.7	No
2015	103	4	2	5	N/A	5	Limited	No	15	N/A	5	2.4 3.1	No	20	N/A	10	2 3.1	Yes	20	N/A	10	2 3.1	Yes	20	N/A	9	2.1 3.1	No
2015	104	6.3	2	0	N/A	3	Limited	No	10	N/A	2	Limited	No	35	N/A	14	2 4 4.4 4.9	Yes	35	N/A	13	2 4 4.4 4.9	Yes	15	N/A	7	2.4 3	No
2015	105	3	2	0	N/A	1	Limited	No	3	N/A	0	Limited	No	20	N/A	9	2 2.9	Yes	20	N/A	8	2 2.9	Yes	10	N/A	5	2 2.7	No

Aurecon New Zealand Limited
Unit 1, 150 Cavendish Road
Casebrook Christchurch 8051

PO Box 1061
Christchurch 8140
New Zealand

T +64 3 366 0821
F +64 3 379 6955
E christchurch@aurecongroup.com
W aurecongroup.com