



K250791-1

26 February 2026

**Geotechnical Engineering Investigation
Proposed Residential Subdivision
6 Wroots Road & 101 Sabys Road
Kennedys Bush
Christchurch**

Prepared For:
Sabys 101 Ltd
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Christchurch

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REPORT ISSUE AUTHORISATION

Geotechnical Engineering Investigation
Proposed Residential Subdivision
6 Wroots Road & 101 Sabys Road
Kennedys Bush
Christchurch

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EXECUTIVE SUMMARY

Geotechnical Engineering Investigation

Proposed Residential Subdivision

6 Wroots Road & 101 Sabys Road

Kennedys Bush

Christchurch

SUB-SOIL CONDITIONS	Lithology	The sub-surface conditions comprise topsoil up to 0.4m depth overlying interbedded sands and silts. Intermediate gravel layer present across the majority of the site with the exception of the northeastern portion. Gravels expected from approximately 15m depth.	
	Soil Classification as per NZS 1170.5:2004	Class 'D' (Deep or soft soil sites)	
	Groundwater Depth	Encountered between 0.6m and 2.5m depth	
SEISMIC ASSESSMENT	Vertical Displacement under Earthquake Ground Motions (Index Value)	SLS	ULS
		5 – 90mm	15 – 110mm
	Liquefaction Potential Index (LPI) Value	SLS	ULS
		0 – 4	3 – 20
	Liquefaction Severity Number (LSN) Index Value	SLS	ULS
		2 – 15	8 – 34
	Horizontal Movement	Lateral Spreading	Lateral Stretch
		Minor	Minor
	Seismic Technical Categorisation	MBIE	N/A – Rural & Unmapped, TC3 & TC2
		Site Specific	Refer KGA DWG 5.
SUBDIVISION ASSESSMENT	Static settlements are expected across the site. Detailed assessment required once detailed cut/fill earthworks plan is available and further investigations completed. Potential for lateral spreading adjacent to Nottingham Stream and Halswell River. Building setback of 20m recommended otherwise detailed assessment will be required. This report is a geotechnical assessment in terms of suitability of land for subdivision. Further investigations and separate report required for subdivision and fast-track application.		
REPORT DISTRIBUTION	A full copy of this report must be provided to all relevant parties involved in the project. This should include, but not be limited to, owner, architectural designers, engineers (civil and structural) and the earthworks/building contractor.		

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Attachments:

KGA DWG 01 – Site Plan
KGA DWG 02 – Depth to Gravels
KGA DWG 03 – Depth of Soft Soils
KGA DWG 04 – Liquefaction Induced Settlement (SLSB/ULS)
KGA DWG 05 – Technical Categorisation Plan

Hand Auger and Scala Penetrometer Logs
Cone Penetrometer Test Logs

Appendix A:	Third Party Documents
Appendix B:	Background Information Documents
Appendix C:	Site Photographs
Appendix D:	Liquefaction Analyses

1. INTRODUCTION

At the instruction of Sabys 101 Ltd, we have undertaken a geotechnical engineering investigation on the property comprising 6 Wroots Road & 101 Sabys Road in Kennedys Bush, Christchurch. The work was carried out in accordance with our Agreement dated 8 December 2025.

As part of our investigation, we have undertaken a detailed site and environs walkover inspection, and referenced available information from the New Zealand Geotechnical Database (NZGD), Environment Canterbury (ECan) Christchurch City Council (CCC) and Selwyn District Council (SDC) websites. We also conducted a subsurface investigation comprising hand auger boreholes with associated Scala penetrometer tests and cone penetrometer testing in order to assess ground conditions and likely behaviour of the ground, as well as confirm preliminary suitability of land for subdivision/development to support a fast-track referral application.

The investigation was carried out with reference to the Ministry of Business, Innovation & Employment (MBIE) Guidance - Version 3, dated December 2012 - "Repairing and rebuilding houses affected by the Canterbury earthquakes" and subsequent updates, as well as the relevant New Zealand Geotechnical Society (NZGS) and MBIE Modules; "Earthquake Geotechnical Engineering Practice".

This report presents our findings and conclusions. It has been prepared in the context of providing geotechnical information for use in assessing the suitability of the site for subdivision. We also understand this report will be used to support a fast-track referral application. For that we are undertaking sufficient investigation and assessment to confirm that the site is generally free of significant geotechnical hazards or that these can be mitigated/managed to a level that confirms that a residential subdivision is suitable at this site. A more detailed geotechnical report and additional geotechnical investigations will be required for subdivision consent/fast-track application.

2. SITE DESCRIPTION

The properties are legally described as Lots 2,3, DP 68573 and PT Lot 1 DP 1537-BAL at 23562-06900. The combined area is approximately 50Ha. The properties are irregularly shaped and located between Sabys and Halswell Road as indicated in Figure 1 below (hereinafter referred to as 'the site'). It is otherwise bounded by rural-residential properties.

The site is located immediately north of Nottingham Stream and the Halswell River meanders in the general west to east direction through the site (highlighted on Figure 1 below). An unnamed drain is also present in the northern portion of the site.

We note that significant undulations were observed across the site (most notably the northeast portion of the site, east of Candys Road), indicating the presence of paleochannel features likely formed during migration of the nearby channels.

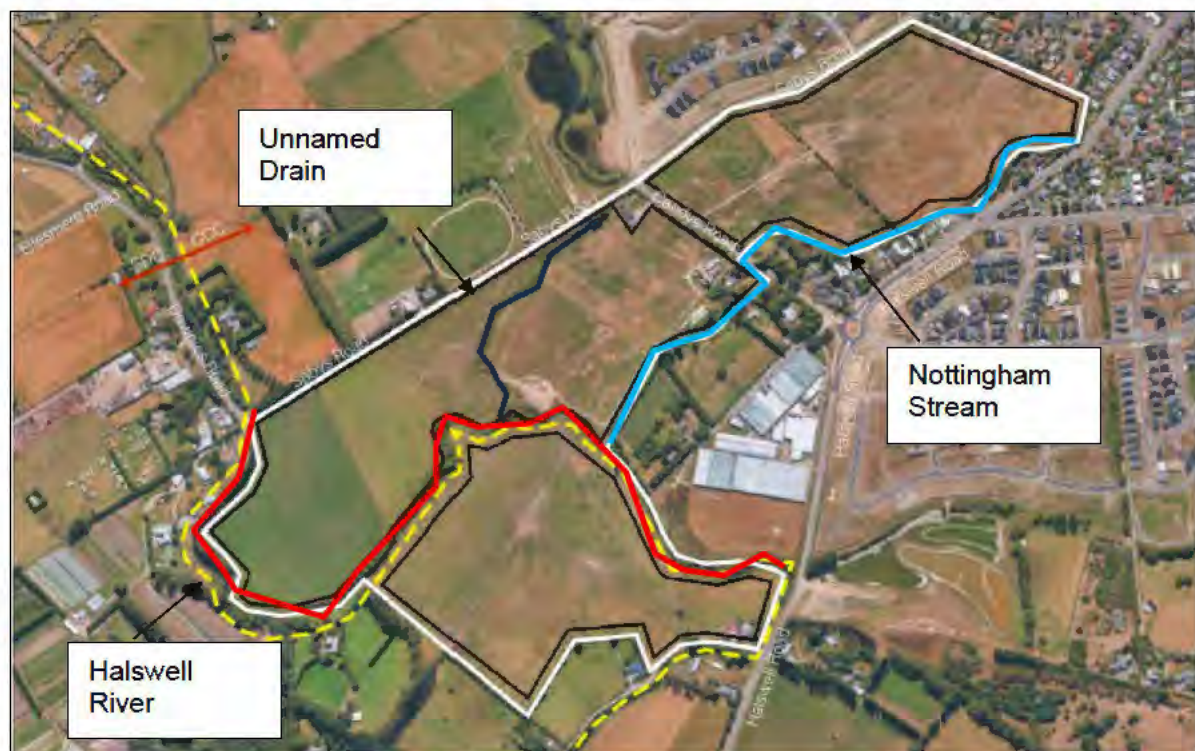


Figure 1: The subject site outlined in white, parcel boundaries in black and the CCC/SDC boundary in yellow dash

The surrounding rural-residential properties to the east are classified as TC2, with a localised strip of TC3 land along Nottingham Stream which extends adjacent to the southern site boundary. The properties to the west of the site are also generally classified as TC2 with localised pockets of TC3 land. The land is also classified as TC3 along the Halswell River.

3. EXISTING STRUCTURES AND PROPOSED DEVELOPMENT

3.1 Existing Structures

There are several structures located on the site, these include:

- A dwelling and garages/shed structures in the southeastern corner of the site access via Haslwell Road.
- Silos, dwelling and farm outbuildings located close to the western Candys Road entrance.

The remainder of the property comprises grassed paddocks with mature trees and fences.

A review of the historical aerial photographs between 1925 to present, as obtained from the ECan database, indicate that the site has been primarily used for horticultural activities, and does not appear to have been previously occupied by historical structures. Nottingham Stream and the Halswell Rover appear to have been constrained to a similar flow path as present prior to 1925. We note a historic drainage or irrigation channel extended through the centre of the site, with distinctive paleochannels across the western portions.

3.2 Proposed Development

We have been provided with conceptual plans from Davie Lovell-Smith (DLS) dated December 2025 which, we understand, indicate a subdivision with approximately 500 lots. A stormwater reserve is located across the southern portion of the site with a 20m strip of landscape/esplanade located adjacent to the Halswell river and Nottingham stream. It is unclear if the unnamed drain is to remain or be filled in. No setbacks are shown.

We have included these plans in Appendix A.

4. BACKGROUND INFORMATION

4.1 Sources Consulted

The following third-party information sources were consulted and referred to in this report:

- KGA Existing Subdivision Report for 101 Sabys Road
- New Zealand Geotechnical Database (NZGD)
- Environment Canterbury (ECan)
- Christchurch City Council (CCC)

A summary of our understanding of the third-party information is presented below. We note that the below summary of information is limited to that considered relevant to the geotechnical assessment of the property, and is intended to present facts and opinions as contained in third-party sources and does not constitute interpretation or endorsement by KGA.

4.2 KGA Existing Subdivision Report for 101 Sabys Road

KGA has previously completed a report for the portion of the site to the east of Candys Road, titled “Geotechnical Engineering Investigation, Proposed Subdivision, 101 Sabys Road, Halswell, Christchurch” (Ref: K210506-2, dated 25 June 2025).

This report (2026) supersedes the original report (2025); however, the testing undertaken in 2021 and the associated analyses remain relevant. These are summarised below.

- Ten hand auger boreholes were completed across the site. The majority of tests achieved the target depth of 3.0m with the exception of two tests which refused between 1.1m and 2.0m depth.
- Twenty CPTs were undertaken to between 6.7m and 15.1m depth. Six tests within the western portion of the site terminated in gravels at approximately 5m to 8m depth.
- Subsoil conditions across the site are variable but generally comprise:
 - o Topsoil up to 0.4m depth.
 - o Interbedded silty and sand soils with variable densities typically between 1.8m and 3.5m depth.

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4.3 New Zealand Geotechnical Database (NZGD) & Environment Canterbury (ECan)

The NZGD and ECan websites were searched for geotechnical information in the form of relevant well/borehole logs and Cone Penetrometer Test (CPT) data. Significant data is present in the area. Seven boreholes and 13 CPTs were considered the most relevant. A location plan and the investigation logs are reproduced in Appendix C, and referenced further in Section 7.1 of this report.

The ECan website indicates that the site is overlaying a “Coastal Confined Gravel Aquifer System”.

Aerial imagery taken following the 22 February 2011 earthquake event indicates minor to moderate surface expression of liquefaction across the site, with greater quantities typically localised within historic paleochannel areas as shown in Figure 3 to 6.

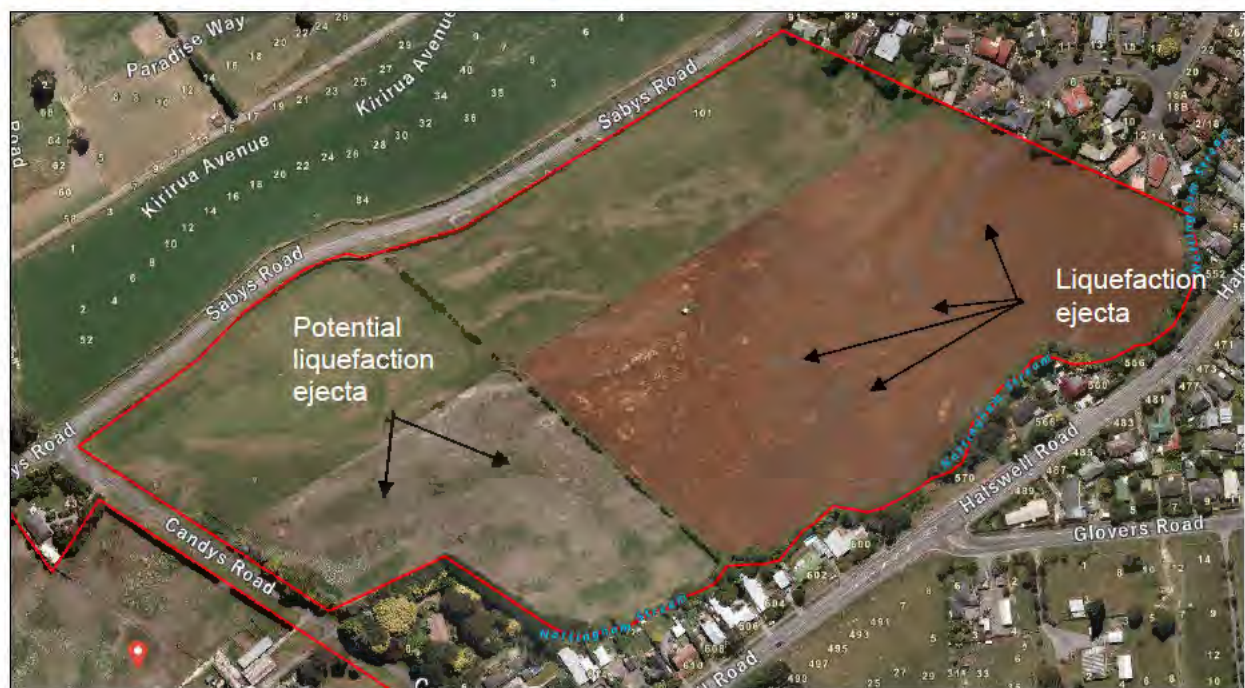


Figure 3: Aerial Imagery from 22 February 2011 (Northeast Corner, 101 Sabys Rd)



Figure 4: Aerial Imagery from 22 February 2011 (Central)

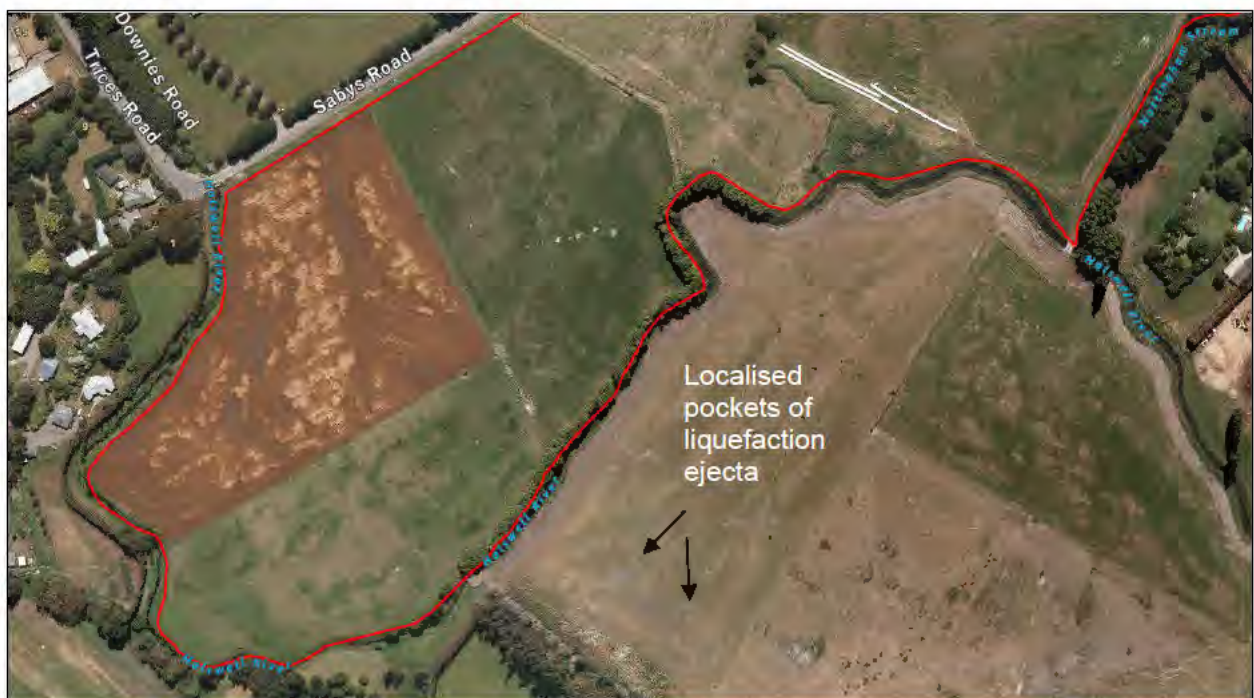


Figure 5: Aerial Imagery from 22 February 2011 (Northwest Corner)



Figure 6: Aerial Imagery from 22 February 2011 (Southern Portion)

Google imagery undertaken following the September 2010 earthquake event indicates what appears to be extensive flooding across the entire site and the properties south of the site as per Figure 7 below. The NZGD does not contain any aerial photographs taken during the other major events of the CES other than February 2011 described above.

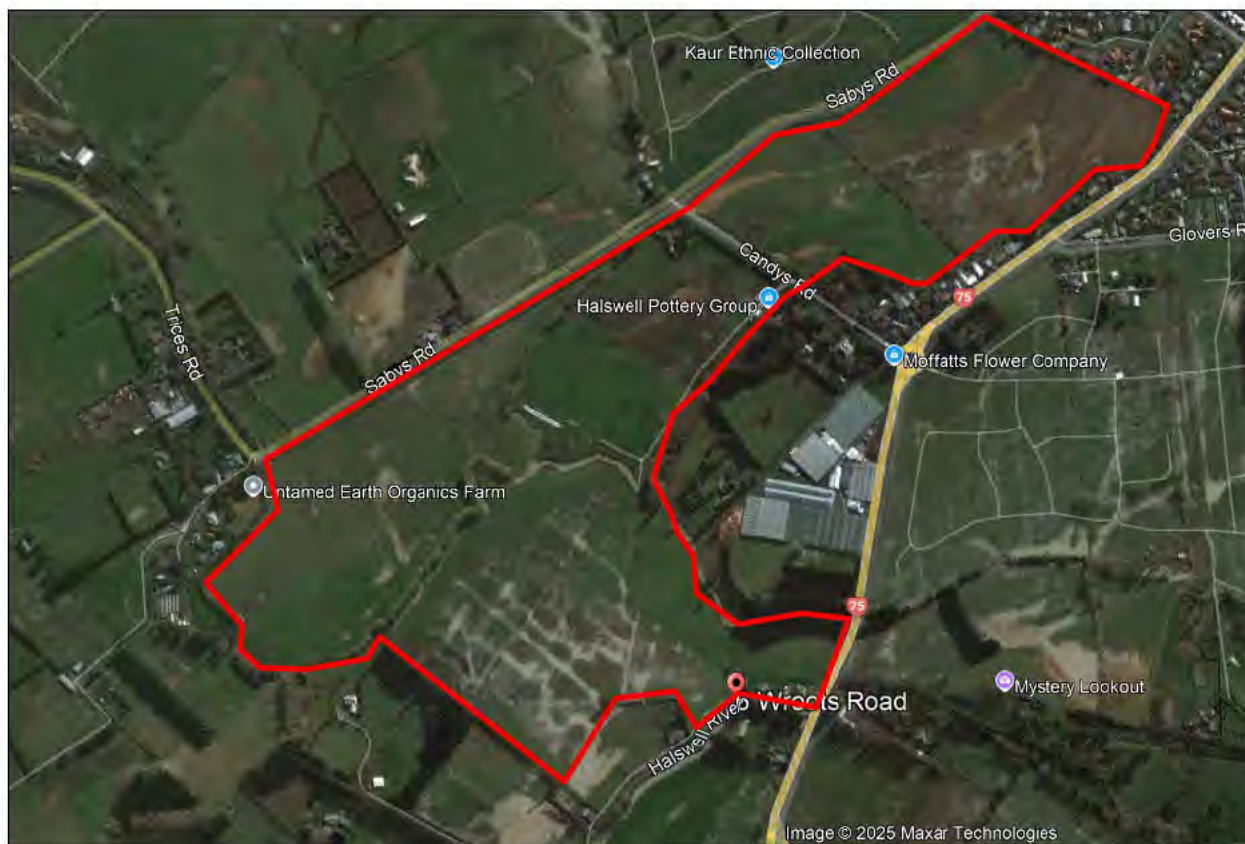


Figure 7: Google Aerial Imagery from 4 September 2010

A summary of aerial photography and field observations, as well as the Peak Ground Acceleration (PGA) experienced on the site during the major earthquake events of the Canterbury Earthquake Sequence (CES) is given in Table 1. We have also scaled the PGA to a magnitude 7.5 event to be able to compare the recorded PGA to the ULS and SLS values recommended in the MBIE Guidance ($PGA_{7.5}(ULS)=0.35g$, $PGA_{7.5}(SLS)=0.13g$).

For the magnitude scaling factor assessment, it is important to note that the 13 June and 23 December 2011 aftershocks each comprised two separate earthquakes. In both cases, the second of the two earthquakes was the more damaging, but the first earthquake is inferred to have caused elevated pore water pressure and increased the susceptibility for liquefaction to occur. To take the two earthquakes into consideration for modelling purposes, the Tonkin & Taylor Liquefaction Vulnerability Study considers the second earthquake with an increased magnitude to include the effects of the first one. The design earthquake magnitude for each event is presented in Table 1, and a copy of the Property Summary Report is included in Appendix C.

Table 1: Summary Desk Study Information

	September 2010 (M 7.1)	February 2011 (M 6.2)	June 2011 (M 6.0)	December 2011 (M 5.9)
Mapped Ground Cracks	No mapped ground cracks observed on majority of the site except three (50mm to 100mm cracks) parallel to Nottingham Stream. A series of cracks (10mm up to 100mm) mapped near the residential sites to the east of Nottingham Stream. See map below.			
PGA (g)	0.30	0.35	0.14	0.13
Scaled PGA_{7.5} (g)¹	0.27	0.25	0.09	0.09

¹ Scaled to M7.5 using Idriss and Boulanger recommendations (2008)



Figure 8: Crack Map

4.4 Christchurch City Council (CCC) & Selwyn District Council (SDC) – Flooding Risk

According to the flood data provided by the CCC and SDC, we note the following:

- The site is within a CCC District Plan Flood Management Area.
- Floor levels up to 1m depth are expected across the site, generally within the low lying areas as per Figure 9 below.



Figure 9: SDC Flood Map

CCC and SDC should be contacted directly to comment on the floor level requirement, as a full flood risk assessment is outside the scope of this report. However, we expect that the site will generally be required to be raised by the use of fill.

4.5 Environment Canterbury (ECan) – Listed Land Use Register

ECan has identified sites where Hazardous Activities and Industries List (HAIL) activities have been located throughout Canterbury and maintains the Listed Land Use Register (LLUR) database which alerts about potential contamination before site works commence. After consultation of the database regarding these sites, the following information was obtained: “The Listed Land Use Register does not currently have any information about a Hazardous Activities and Industries List site on your selected land parcel”. Relevant extracts from the LLUR are presented in Appendix B.

Due to the limited extent of our investigation, we cannot guarantee that contamination is not present.

5. SITE OBSERVATIONS

The following observations were noted during our site walkover on 13 January 2026 (relevant site photographs are included within Appendix C):

- Nottingham stream and the unnamed drain are up to 2.5m wide approximately.
- Halswell River is up to 6.0m wide approximately.
- Water in the channels appears to be up to 1.0m deep.
- The river and stream are up to 3m below the surrounding ground level approximately with highly vegetated slopes.
- Timber retaining walls observed supporting embankments immediately below residential dwellings along Nottingham stream (east of Candys Road). The retaining walls appear to be tilting forward or bulging in places. Fence posts appear uniformly level across the site with minor, irregular tilt type displacement (i.e. toward and away from the stream).

6. GEOLOGY

The published geology of the Christchurch urban area shows the site is underlain by the Yaldhurst Member of the Springston Formation. The Springston Formation was deposited during the Holocene epoch ($\leq 10,000$ years old) and has accumulated the inland margin of the Christchurch Formation. The Springston Formation contains postglacial fluvial channel and overbank sediments resulting in the deposition of well-sorted gravels, sands and silts sourced from the Southern Alps. Due to the movement of the Waimakariri River channels, the deposits appear as fan shaped wedges or localised lenses, creating extensive layers with varying thicknesses.

The Yaldhurst Member is the most recent deposit of the Springston Formation and was deposited just above the present Waimakariri River flood level during the last 3000 years. It contains three distinct lithological units; alluvial sand and silt overbank deposits; historic river flood channels containing silts, sands and alluvial gravel; and peat deposits.

We have also referred to the published Geomorphological Map of Eastern Canterbury (2015) which indicates that the site is underlain by river plain or channel deposits, river channels and troughs, and swamp basin (see Figure 10).

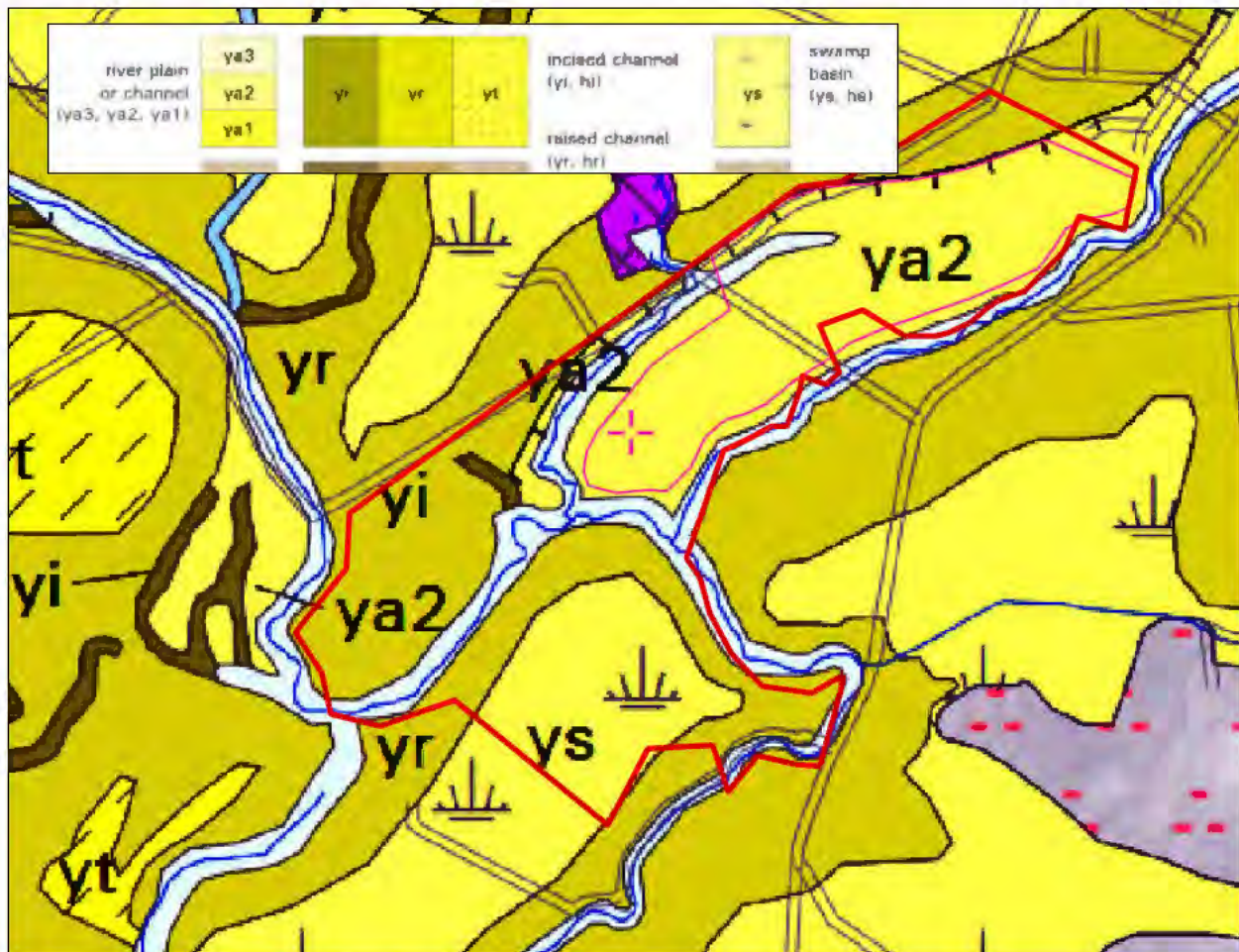


Figure 10: GNS Geomorphological Map of the Christchurch Region

We have also looked to the historic black maps for the site which indicates the southern portion of the site was waterbody/wetland/swamp consistent with the location of swamp basin as indicated on Figure 9.

7. GROUND INVESTIGATION

7.1 Existing Ground Information

A search of the ECan and NZGD websites identified significant data in the local area with seven machine boreholes and 13 CPTs considered the most relevant. The investigation logs are reproduced in Appendix C, and the data referenced in more detail in Table 2.

We note that the 2021 KGA investigations are available on the NZGD; however, these are not included in Table 2 below. These tests are described in Section 7.2 below.

Table 2: NZGD Data

NZGD Test Reference	Source	Source Reference	Probe Depth (m)	Approx. Distance From Site (m)
BH_18076	Tonkin + Taylor	HAL-POD01-BHCPT006	19.8	60 (south)
BH_40392	Coffey	BH1	17.0	10 (north)
BH_50567	Golder Associates	GA_18503	17.5	75 (southwest)
BH_110260	Beca	BH02	15.5	Onsite
BH_33271	Elliot Sinclair	BH01	16.7	100 (south)
BH_28196	Golder Associates	GA_15883	16.5	60 (south)
BH_76343	Riley Consultants	BH1	17.2	165 (northwest)
CPT_16241	McMillan	CPTu001	15.0	25 (northeast)
CPT_44048	GeoCivil	CPT003	15.7	15 (southeast)
CPT_73085	Landtest	CPTU001	15.0	15 (southeast)
CPT_128298	Prodrill	CPT16	15.0	Onsite
CPT_128299	Prodrill	CPT15	15.0	Onsite
CPT_143394	Ground Investigation	CPT-15	14.8	40 (northwest)
CPT_143395	Ground Investigation	CPT-16	14.8	40 (northwest)
CPT_143396	Ground Investigation	CPT-17	15.1	45 (northwest)
CPT_143397	Ground Investigation	CPT-18	15.1	30 (northwest)
CPT_143398	Ground Investigation	CPT-19	15.0	45 (northwest)
CPT_37556	Geoscience Consulting	CPTu001	6.3	20 (west)
CPT_38526	Cook Costello	CPT3	4.1	5 (west)
CPT_33270	Eliot Sinclair	CPTu003	4.9	80 (south)

7.2 KGA Historic Investigation

As mentioned above, KGA has completed extensive testing across the portion of the site to the east of Candys Road. An overview of the ground investigations is presented in Table 3.

Table 3: Historic KGA Tests

Test Type	Test Ref.	Depth (m)	Reason for Termination	Date of Test
Hand Auger & Scala Penetrometer	HA01/SP01	3.0/3.0	Target depth	25/06/2021
	HA02/SP02			
	HA03/SP03	2.0/3.0	Hole collapse/target depth	
	HA04/SP04	3.0/3.0	Target depth	
	HA05/SP05			
	HA06/SP06	1.1/3.0	Inferred gravels/Target depth	
	HA07/SP07	3.0/3.0	Target depth	
	HA08/SP08			
	HA09/SP09			
	HA10/SP10			
CPT	CPT-01	7.3	Refusal, inferred gravels Refusal, inferred gravels	24/06/2021
	CPT-02	6.9		
	CPT-03	14.6	Target depth	23/06/2021
	CPT-04	15.1		
	CPT-05	15.1		
	CPT-06	7.3	Refusal, inferred gravels	21/06/2021
	CPT-07	14.9	Target depth	22/06/2021
	CPT-08	8.8	Refusal, inferred gravels	
	CPT-09	15.0	Target depth	
	CPT-10	15.1		
	CPT-11	15.2		
	CPT-12	6.7	Refusal, inferred gravels	21/06/2021
	CPT-13	15.1	Target depth	
	CPT-14	15.1		22/06/2021

Test Type	Test Ref.	Depth (m)	Reason for Termination	Date of Test
	CPT-15	15.4		
	CPT-16	7.8	Refusal, inferred gravels	21/06/2021
	CPT-17	14.8	Target depth	22 June 2021
	CPT-18	15.1		
	CPT-19	15.1		
	CPT-20	15.1		23/06/2021

7.3 Current Ground Investigation

To supplement the existing onsite and nearby ground information, a project specific deep and shallow ground investigation for subsoil identification and bearing capacity purposes was undertaken. The subsurface conditions on site were explored by drilling three hand auger boreholes (HA01 to HA03), performing three Scala penetrometer tests (SP01 to SP03) within the borehole locations, and completing 11 CPT (CPT-01 to CPT-11).

The shallow ground investigation services were provided by KGA on 13 January 2026, with the CPTs undertaken by Ground Investigation Ltd on the same date. An overview of the ground investigations is presented in Table 4, and a description of the testing is given in the following sections.

Table 4: Schedule of Exploratory Ground Investigation

Test Type	Test Ref.	Depth (m)	Reason for Termination	Date of Test
Hand Auger & Scala Penetrometer	HA01/SP01	3.0	Target depth	13/01/2026
	HA02/SP02			
	HA03/SP03			
CPT	CPT-01	6.4	Limit of reaction force	13/01/2026
	CPT-02	5.6	High cone end resistance	
	CPT-03	7.5	Limit of reaction force	
	CPT-04	7.3		
	CPT-05	7.8	Danger of buckling rods	
	CPT-06	7.0	High cone end resistance	
	CPT-07	13.1	Danger of buckling rods	
	CPT-08	13.2	High cone end resistance	
	CPT-09	4.0	Limit of reaction force	
	CPT-10	7.4		
	CPT-11	4.3	High cone end resistance	

The exploratory test locations were selected to provide representative indications of the subsurface ground conditions within the area being assessed. The test locations are shown on our site plan.

7.4 Hand Auger Boreholes and Scala Penetrometer Tests

Hand auger boreholes were drilled in conjunction with the Scala penetrometer testing using a 50mm diameter hand auger and a soil description log in accordance with the NZGS Guidelines “Field description of soil and rock” is presented for each borehole. Scala Penetrometer testing was carried out at nominal 1.0m depth intervals with hand auger boreholes drilled over the Scala test points to the same depth to reduce the friction on the rod for subsequent testing.

The Scala penetrometer probe consists of a hand operated dynamic cone penetrometer and is used to evaluate the penetration resistance of a soil. A 9kg hammer weight is dropped over a height of 510mm driving a 20mm diameter cone into the ground. The number of hammer blows is recorded for each 50mm of penetration. Testing is in accordance with NZS 4402 Test 6.5.2:1988.

The hand auger boreholes and Scala penetrometer tests were intended to be taken to 3.0m depth or to a depth where effective refusal was reached, whichever was shallower.

7.5 Subsurface Conditions

The subsurface ground conditions encountered are briefly described and summarised below. For more detailed descriptions, reference should be made to the attached investigation logs. To prepare a subsurface model of the site, the subsurface conditions encountered have been inferred between our boreholes. It must be accepted that the conditions are likely to vary between each borehole location, particularly when the distances between test locations are large.

- Topsoil encountered up to 0.4m depth overlying interbedded sands and silts.
- An intermediate gravelly sand and/or sandy gravel was generally encountered between 4.0m to 6.0m depth to the west of Candys Road, becoming shallower to the south (towards Haswell Road). To the east of Candys Road, the intermediate gravelly layer was generally encountered between 5.5m and 8.0m depth and is absent below the eastern portion as shown on KGA Drawing 02. Layer is generally between 2.5m and 4.0m thick.
- Soft silts (cone resistance, $q_c < 1\text{MPa}$) are present across the site as indicated on KGA Drawing 3 (where greater than 0.5m thick). These areas are more clustered around the northeastern portion of the site and along the western boundary.
- Inferred dense sand and gravels generally below 15m depth.

7.6 Groundwater

Groundwater was only encountered in one of the 2026 hand augers (west of Candys Road) at 2.8m depth with the CPTs measuring the groundwater between 0.6m and 2.5m depth. The shallowest groundwater levels (shallower than 1m depth) were measured in the southern paddock where lower ground levels are present, and is historically mapped as swamp/wetland.

The 2021 tests undertaken in June (east of Candys Road) measured groundwater between 0.8m and 2.5m depth, with the majority falling between 1.5m and 2.5m depth.

Groundwater levels can and will vary with changes in weather patterns, particularly following periods of prolonged wet or dry weather.

8. FUTURE LAND PERFORMANCE & DESIGN CONSIDERATIONS

8.1 Liquefaction Analysis – General

Liquefaction analyses were completed for both SLS and ULS design criteria, using the CPT data referenced in Table 4. Calculations were performed over the full investigation depth and the MBIE 'Index' depth of 10.0m, using the input parameters described in Table 5.

We consider the 2021 KGA liquefaction assessment for the CPT east of Candys Road to remain relevant and hence we have not reassessed these CPTs however the results are summarised in Table 6A for completeness. Relevant attachments are included in Appendix D.

Table 5: Input Parameters to NZS1170.5:2004 & NZGS/MBIE Module 1

Input Parameters	Design Event		
	SLS (A)	SLS (B)	ULS
Building Importance Level	IL2		
Soil Class	Class D		
Annual Exceedance Probability	1/25	1/25	1/500
Magnitude (M_w)	7.5	6.0	7.5
Peak Ground Acceleration (g)	0.13	0.19	0.35

This section presents two parameters commonly used to predict the liquefaction vulnerability; the liquefaction induced settlements, and the characteristics of liquefaction and the resulting ground deformation.

The in situ groundwater level was considered to exist at 1.5m bgl, and the groundwater level during earthquake used for the calculation was conservatively assumed at 1.0m bgl, similar to our previous assessment.

8.2 Liquefaction Analysis – Estimated Future Settlements

We have analysed the CPT data using the current software 'CLiq' and a copy of the output from the analyses has been included within Appendix D. The software includes for normalisation of the data for overburden pressure and is considered to provide improved indications of liquefaction potential. The seismic design requirements adopted for use in the analyses are defined in Part C of the MBIE Guidelines "Repairing and rebuilding houses affected by the Canterbury earthquakes" with the recent update regarding Boulanger & Idriss (2014) liquefaction analysis methodology. These are:

- Boulanger and Idriss (2014) methodology for liquefaction triggering.
- Zhang et al. (2002) volumetric densification calculation.

We also adopted a fines content coefficient (C_{FC}) of 0.2 based on recent research of soil properties in the Christchurch area and applied transitional layer due to the interbedded nature of the soil profile.

The results of our original liquefaction analysis for 101 Sabys Road to the east of Candys Road are presented in Table 6A. The results of the liquefaction analysis to the west of Candys Road are presented in Table 6B.

Table 6A: Liquefaction Analysis Results – 2021 Investigations

Test	Calculation Limit Depth (m)	Calculated Vertical Settlement (mm)		
		SLS (A)	SLS (B)	ULS
CPT-01	MBIE Index (10.0)	5	15	40
CPT-02	MBIE Index (10.0)	5	5	20
CPT-03	MBIE Index (10.0)	10	15	30
CPT-04	MBIE Index (10.0)	20	40	105 (TC3)
CPT-05	MBIE Index (10.0)	15	30	95
CPT-06	MBIE Index (10.0)	15	30	45
CPT-07	MBIE Index (10.0)	10	20	40
CPT-08	MBIE Index (10.0)	10	20	65
CPT-09	MBIE Index (10.0)	20	40	95
CPT-10	MBIE Index (10.0)	20	30	65
CPT-11	MBIE Index (10.0)	35	50	80
CPT-12	MBIE Index (10.0)	5	15	30
CPT-13	MBIE Index (10.0)	25	45	90
CPT-14	MBIE Index (10.0)	25	40	100

Test	Calculation Limit Depth (m)	Calculated Vertical Settlement (mm)		
		SLS (A)	SLS (B)	ULS
CPT-15	MBIE Index (10.0)	30	45	90
CPT-16	MBIE Index (10.0)	15	30	65
CPT-17	MBIE Index (10.0)	25	40	100
CPT-18	MBIE Index (10.0)	30	45	110 (TC3)
CPT-19	MBIE Index (10.0)	25	40	95
CPT-20	MBIE Index (10.0)	50	90 (TC3)	110 (TC3)

Table 6B: Liquefaction Analysis Results – 2026 Investigations

Test	Calculation Limit Depth (m)	Calculated Vertical Settlement (mm)		
		SLS (A)	SLS (B)	ULS
CPT-01	Full depth (6.4)	10	20	50
CPT-02	Full depth (5.6)	5	10	35
CPT-03	Full depth (7.5)	20	35	50
CPT-04	Full depth (7.3)	<5	10	25
CPT-05	Full depth (7.8)	5	15	40
CPT-06	Full depth (7.0)	<5	15	30
CPT-07	MBIE Index (10.0)	5	15	45
	Full depth (13.1)	10	20	60
CPT-08	MBIE Index (10.0)	10	20	40
	Full depth (13.2)	25	30	60
CPT-09	Full depth (4.0)	<5	10	15
CPT-10	Full depth (7.4)	<5	10	15
CPT-11	Full depth (4.3)	<5	10	30

The above calculated settlements generally fall within a TC2 categorisation as defined by the MBIE Guidance. The 2021 CPTs to the east of Candys Road generally indicate a mix of TC2 and TC2/TC3.

A summary of the liquefaction induced SLSB and ULS settlements are highlighted on KGA Drawing 04.

At SLS levels of shaking, significant liquefaction is generally not expected above the intermediate gravelly layer except locally at CPT-03 (2026) which indicates liquefaction from 1.5m to 2.8m depth. At ULS, liquefiable layers greater than 0.5m thick are expected to occur in the upper 3m depth.

Post-earthquake general observations show that the empirical calculation of the settlement is uncertain with perhaps a $\pm 50\%$ margin to the numbers given in Tables 6A and 6B. We therefore recommend that engineering judgment is applied when interpreting the computed settlements.

We point out that the settlements presented in Tables 6A and 6B describe the settlements of the ground not occupied by a building, but occurring due to dissipation of excess pore water pressure generated during earthquake shaking. Additional settlements may also occur due to yield of the liquefied soils under foundation loading, soil loss of volume (liquefaction ejecta) and lateral spreading, but these components are very difficult to predict. Subsurface conditions may vary across the site, making accurate prediction of future settlements even more difficult.

8.3 Liquefaction Induced Ground Deformation

Guidance on expected levels of liquefaction-induced ground deformation is provided within Section 5.4 of Module 3 of the Earthquake Geotechnical Engineering Practice documents issued by MBIE and NZGS. This provides a summary of expected performance levels for liquefied soil deposits, based on the liquefaction triggering factor, LPI and LSN. The LPI and LSN are indices that quantify liquefaction-induced damage by taking into consideration the severity, thickness and depth of the liquefiable layers within the soil profile. The expected level of ground performance is summarised in Table 5.1 of Module 3, defined as six performance levels as a consequence of liquefaction (L0 – ‘Insignificant’ to L5 – ‘Very severe’). We have analysed the CPT data using CLiq and the calculated LPI and LSN values are presented in Table 7A and 7B for our original analysis and the 2026 analysis, respectively.

It should be noted that LPI and LSN indices are typically applied to area-wide screening and are considered to have reasonable predictive capacity when applied this way; however, they may misrepresent performance in approximately 20% to 30% of cases. Therefore, the expected performance levels provided in Tables 7A and 7B below are only intended as general guidance, and the uncertainties and/or non-uniformities of ground deformation should be considered in any subsequent design.

Table 7A: General Performance Levels – 2021 Tests

Test	SLS (B)		Effect from Liquefaction	ULS		Effect from Liquefaction
	LPI	LSN		LPI	LSN	
CPT-01	1	4	Insignificant	7	15	Mild / Moderate
CPT-02	0	2	Insignificant	4	11	Mild / Moderate
CPT-03	0	4	Insignificant	6	9	Mild / Moderate
CPT-04	2	8	Mild	18	28	High
CPT-05	1	8	Mild	16	30	High / severe
CPT-06	2	7	Mild	9	13	Mild / Moderate
CPT-07	1	9	Mild	8	15	Moderate / High
CPT-08	1	7	Mild	11	25	Moderate / High
CPT-09	2	9	Mild	16	22	Moderate / High
CPT-10	2	8	Mild	11	19	Moderate / High
CPT-11	3	8	Mild	15	18	Moderate / High
CPT-12	1	8	Mild	5	17	Moderate / High
CPT-13	3	9	Mild	16	29	High
CPT-14	3	11	Mild / Moderate	18	32	High / Severe
CPT-15	3	9	Mild	16	26	High
CPT-16	1	10	Mild / Moderate	12	26	High
CPT-17	2	10	Mild / Moderate	17	27	High
CPT-18	2	9	Mild	19	34	High / Severe
CPT-19	2	8	Mild	16	28	High
CPT-20	4	13	Mild / Moderate	20	29	High

Table 7B: General Performance Levels – 2026 Tests

Test	SLS (B)		Effect from Liquefaction	ULS		Effect from Liquefaction
	LPI	LSN		LPI	LSN	
CPT-01	1	9	Insignificant	10	25	Moderate / high
CPT-02	1	3	Insignificant	6	18	Moderate / high
CPT-03	3	15	Mild / moderate	9	18	Moderate / high
CPT-04	1	6	Insignificant	5	14	Mild / moderate
CPT-05	0	5	Insignificant	7	16	Moderate / high
CPT-06	1	7	Insignificant	6	17	Moderate / high
CPT-07	0	6	Insignificant	7	14	Mild / moderate
CPT-08	1	3	Insignificant	7	11	Mild / moderate

Test	SLS (B)		Effect from Liquefaction	ULS		Effect from Liquefaction
	LPI	LSN		LPI	LSN	
CPT-09	1	5	Insignificant	3	8	Insignificant
CPT-10	0	6	Insignificant	3	9	Insignificant
CPT-11	0	4	Insignificant	6	17	Moderate / high

The LPI and LSN values in Table 6 indicate a performance level of L0 to L3 ('insignificant' to 'moderate' effect from excess pore water pressure and liquefaction) for the SLS case and generally L2 to L3 ('moderate' to 'high') for the ULS case. Reference should be made to Table 5.1 of Module 3 for a full description of the expected characteristics and consequences of liquefaction.

8.4 Cyclic Softening Potential

There is a tendency for very soft to soft or sensitive clays and silts to undergo cyclic softening (loss of shear strength and stiffness) as a result of strong shaking. According to the onsite CPT profile, the soft soils could be prone to cyclic softening during a strong seismic event. We have therefore undertaken a cyclic softening potential assessment, based on Idriss and Boulanger (2008) methodology as implemented in CLiq software, to gain more insight into the cyclic softening potential of the soils at the site.

For the 2021 CPTs (east of Candys Road), our cyclic softening assessment indicates that the soft soils between 3.5m to 5.0m depth are predicted to undergo softening under ULS seismicity, with interbedded susceptible layers predicted at greater depths than 9.5m to 14.1m, although these are not continuous. We also note that the frequency and distribution of susceptible layer in the upper 5m is variable between investigations. Additional settlements could therefore occur in these layers i.e. site settlements are expected to be greater than those presented in Table 5 above. Cyclic softening is not predicted at SLS levels of shaking.

The 2026 CPTs (west of Candys Road) indicate that softening is predicted to occur between 3m and 6m in the northeast corner (CPT-01 to CPT-03) and below 7m depth at CPT-08 in the southwest corner of the site. Additional settlements could therefore occur in these layers i.e. site settlements are expected to be greater than those presented in Table 5 above. Cyclic softening is not predicted at SLS levels of shaking.

8.5 Potential for Lateral Spreading

Ground cracking does not appear to have affected the site following the major events of the CES except locally near the edge of Nottingham stream, where some 50mm to 100mm wide cracks were mapped. This is consistent with a strip of land classified as TC3. We also acknowledge that the wider cracking (greater than 50mm) was generally limited to within 20m of the stream edges, although minor cracking extended up to within 50m of the stream.

As we do not have detailed plans at this time for the channels, we have not completed a lateral spreading assessment; however, we recommend that a no build zone of 20m adjacent to streams/rivers is adopted or adopt a TC3 classification within that strip. Ground improvement techniques may be used to mitigate the lateral spreading potential to TC2 levels as per the rest of the site. We also acknowledge that a 20m reserve is already considered in the plans, meaning that no building platforms are being considered in the high-risk lateral spreading area.

Provided that all new dwellings are at least 20m from the edge of existing channels, we consider that the potential for up to 50mm of lateral movement under SLS levels of shaking and up to 100mm of lateral movement under ULS levels of shaking across proposed lots. We note that the lateral movement within the 20m build zone could be greater, but this is not expected to affect proposed lots at least 20m away from the stream crest.

We also assume that the unnamed drain will be infilled and therefore will not be a risk to lateral spreading, provided it is filled to an engineered standard under the supervision of a geoprofessional.

8.6 Long-Term Settlements in Soft Soils

Near surface soft to firm soils were inferred within the CPT profiles across the site. These could undergo long term static settlement when loaded either from buildings or engineered fill which could be required to raise site levels to achieve minimum floor levels.

To gain further insight into the likely magnitude of predicted static settlements, we have used CPeT-IT software to estimate the predicted static settlements within the underlying soft silts. We have conservatively assumed a uniform pressure of 30kPa, applied over an area of 100m by 100m as an initial assessment. This is likely a very conservative assumption as this would require approximately 1.5m thickness of fill to impose such a load.

The results indicate that static settlements less than 25mm are generally achieved in the 2026 CPTs (west of Candys Road), with localised exceptions at CPT-08. However, we note that the majority of static settlements occur in the silty soils below 7m depth. In addition to this, CPT-08 is located at a proposed stormwater reserve where no residential lots are planned.

The 2021 CPTs (east of Candys Road) generally exceed 25mm of static settlement with settlements generally between 35mm and 50mm, locally up to 120mm estimated. We note that most of the higher estimated static settlements occur in the soft soils at depth (not in the upper 3m).

Based on our assessment, there is potential for static settlement at the site; however, this can be mitigated through preloading or surcharging, if required. Previous jobs in the nearby areas indicate that static settlement under pre-load tend to occur in a relatively short period of time (less than 3 months), so it can be managed during subdivision formation works. The appropriate solution for managing static settlements will be confirmed once additional testing has been completed and further development details are available. Overall, the site remains suitable for subdivision and development, and the potential for static settlement is not expected to adversely affect subdivision or land development.

8.7 Shrink-Swell Characteristics

Based on the near-surface non-plastic, silt and sand based alluvium soils, as noted in our boreholes, and our experience of similar soils elsewhere, the shallow soils are considered to be susceptible to minor swelling and shrinking movements under seasonal variations of water content.

9. SITE DESIGNATION & TECHNICAL CATEGORY

We have assessed the site subsoil class as Class “D” – (Deep or soft soil) for structural design purposes in accordance with Clause 3.1.3 of the New Zealand design standard NZS 1170.5:2004. This assumption is based on the following:

- Our ground investigation did not encounter very soft or very loose soils for a thickness greater than 10.0m below this site. We therefore consider that Class “E” soil conditions are not present.
- Based on our knowledge of the local geology and the GNS geological map data, we infer that dense to very dense sand and gravel type soils extend to depths of greater than 100m below this site.

The site experienced M_w 7.5 scaled peak ground accelerations (PGAs) of 0.09g to 0.27g, as per Table 1. Therefore, the site may be classified as ‘sufficiently tested’ for an SLS event according to Section 13.5 of the MBIE Guidance document. We note that the site has not experienced ground shaking equivalent to ULS shaking.

Several Technical Category areas are mapped across the site as per the available MBIE mapping on the NZGD. These are:

- N/A – Rural & Unmapped across the eastern portion.
- TC3 band around the Halswell River.
- Small pocket of TC2 in the southwestern corner of the site.

Based on our liquefaction analyses, the land across the site and at least 20m from the stream is expected to behave similar to an MBIE TC2 site or Hybrid TC2/TC3 as shown on KGA Drawing 5. We note that the land within the 20m setback adjacent to Nottingham Stream and Halswell River is considered to behave similar to equivalent TC3 land due to lateral spreading potential.

10. SUITABILITY OF SITE FOR SUBDIVISION

Section 106 of the Resource Management Act (RMA) states that a consent authority may refuse to grant subdivision consent, or may grant conditional subdivision consent, if it considers that:

- There is a significant risk from natural hazards.
- Sufficient provision has not been made for legal and physical access to each allotment to be created by the subdivision.

Our assessment of the site against the requirements of Section 106 is presented in Table 8.

Table 8: Assessment of the site against the RMA requirements

Hazard	Potential Susceptibility	
	Current (Section 106, 1A)	Post Development (Section 106, 1Ac)
Erosion	No evidence of erosion across site.	Provided stormwater is discharged in a controlled manner and appropriate engineering design is implemented, erosion is unlikely to worsen due to development or have significant adverse effects on the development.
Falling Debris	The site is flat and located away from any hills, with no risk of falling debris.	--
Slippage / lateral movement	The site at 20m away from the stream presents minor potential for global horizontal movement and lateral stretch. A 20m no build zone is recommended adjacent to the Nottingham Stream and Halswell River.	The development will not have any effect that could worsen the existing potential for horizontal movement on site provided no free faces are created on the site or within close proximity of the site. If at any point the 20m no build zone adjacent to Nottingham Stream/Halswell River is to be developed, further lateral spreading assessment will be required.
Subsidence	Potential liquefaction hazard, cyclic softening, and static settlement is present on site.	Significant damage is unlikely to occur to the proposed development provided dwelling specific investigations are undertaken and building foundations are appropriately designed following site-specific testing recommendations.
Inundation	The site is within a flood management area as per the CCC District Plan. The CCC & SDC should be contacted to comment on floor level requirements.	Provided stormwater discharge is appropriately managed, any CCC/SDC finished floor level requirements are respected and/or advice is sought from an experienced civil engineer, we consider that the risk of inundation will not be exacerbated by developing the land and may be appropriately managed.

A Statement of Professional Opinion (SoPO) on the Suitability of Land for Subdivision is not presented at this stage as there is very little information regarding the proposed subdivision development. Further geotechnical investigation and assessment will be required for subdivision/fast-track application, and a Statement of Professional Opinion (SoPO) will be incorporated into the detailed subdivision report. However, we have done sufficient geotechnical investigation and assessment to confirm on reasonable grounds that the site is suitable for the proposed subdivision in terms of geotechnical constraints.

11. GEOTECHNICAL CONSIDERATIONS FOR LAND SUBDIVISION

11.1 Preliminary Geotechnical Considerations

Based on our investigation results and observations, the following geotechnical information should be considered for the proposed subdivision:

- The site is underlain by interbedded silts, sandy silts and silty sands overlying intermediate gravels and/or gravels. The soils in the upper 15.0m are expected to be variable across the site.
- There is potential for ongoing static settlements at the site due to the presence of soft soils; however, potential for settlement is not expected to adversely affect subdivision or land development. The appropriate solution for managing static settlements will be confirmed once additional testing has been completed and further development details are available. This is on the basis of relevant experience on nearby sites with similar ground conditions.
- The local groundwater level was encountered at depths of 0.6m to 2.5m within our onsite investigations (shallow and deep).
- Liquefaction ejecta was observed across the site during the February 2011 earthquake event.
- There is potential for lateral spreading within the vicinity of Nottingham Stream and the Halswell River. We recommend a 20m no build zone which is consistent with the current indicating a 20m reserve band. If residential developments are proposed for the 20m setback distance from the stream, further lateral spreading assessment will be required following confirmation of the proposed development details which may result in lateral spreading mitigation improvement measures.
- Further investigations will be undertaken for the substantive application.

- Site-specific shallow investigations will be required to confirm foundation design for the development of each new Lot.

The design of the foundation system should be undertaken in accordance with the recommendations and guidance provided within NZGS/MBIE Earthquake Geotechnical Engineering Practice Module 4.

12. INFRASTRUCTURE DESIGN

12.1 Services

Underground service pipes and connections should be designed in accordance with the relevant recommendations contained in the MBIE Guidance (particularly Section 5.7), CCC Infrastructure Design Standards (IDS), and the CCC Construction Standard Specification (CSS).

12.2 Landscaping

Where trees are proposed for landscaping, these should be planted a minimum distance of the radius of the expected canopy or half the height of the mature tree (whichever is greater) from any proposed foundations. This will prevent any adverse effects on the foundations caused by tree roots.

13. SAFETY IN DESIGN

The main purpose of our report is to assess the feasibility of the proposed land development from a geotechnical perspective, and so we have not included a project-specific safety in design risk register in this report. Nevertheless, general safe work practises must be adopted and clearly conveyed to all relevant parties prior to and during completion of subdivision earthworks.

14. FURTHER WORKS

This report is a preliminary geotechnical assessment in terms of suitability of the land for subdivision. Additional investigations and a separate subdivision report will be required to provide recommendations regarding the proposed development once a more developed plan is available. Lot specific investigations will also be required to confirm foundation design for each Lot.

15. LIMITATIONS

Our report was prepared in line with the current MBIE Guidance. To satisfy the requirements of the Building Code and the New Zealand Standard “NZS 1170 - Structural Design Actions”, foundations must be designed so that the building must remain functional under SLS level loads; minor damage is acceptable provided the damage is readily repairable, and the building does not collapse under ULS level loads, but could suffer moderate to significant structural damage.

Desk study data was obtained from several investigation and modelling study sources made available to the public and engineering industry post the Canterbury Earthquake Sequence. Acknowledgment is given regarding the free use of the New Zealand Geotechnical Database, Christchurch City Council and Environment Canterbury websites. The data is used in good faith and no responsibility can be taken for the accuracy or completeness of the data.

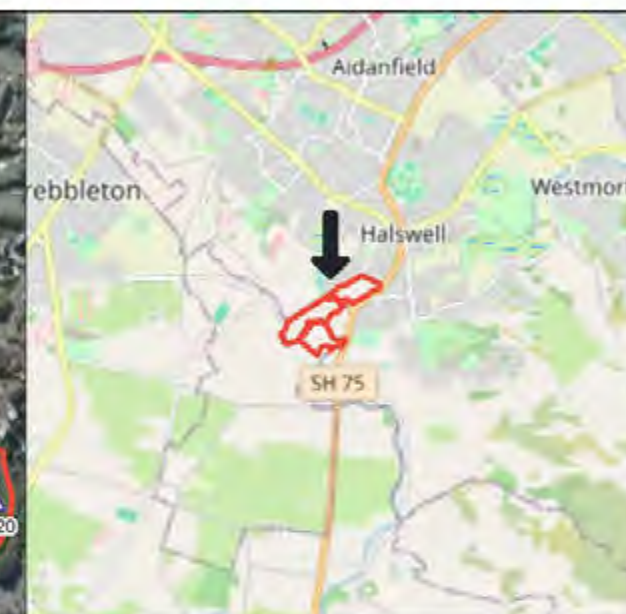
This report was prepared in the context defined in Section 1 above and must not be relied upon by any other party other than our Client, for whom it was prepared, and the relevant Territorial Authority. It has been compiled with respect to the brief given to us, and must not be relied upon in any other context, recreated for any other purpose, or used by any person who is not our Client without first obtaining our written permission.

We point out that our conclusions are based on desk study material, a visual surface inspection of the site, third party investigation data from nearby sites and discrete exploratory hole positions. Ground conditions may vary between investigation points. The recommendations given in this report are provided as an overall strategy to minimise risks from geotechnical hazards. It should be noted that they are unlikely to remain effective if they are adopted in a piecemeal manner.

REFERENCES

- Barrell, D.J.A. (2015). Geomorphological map of eastern Canterbury. GNS Science geological map 3, 1:50,000. Lower Hutt, New Zealand: GNS Science.
- Boulanger, R. W., Idriss, I. M. (2014). CPT and SPT Based Liquefaction Triggering Procedures. Center for Geotechnical Modelling, Department of Civil & Environmental Engineering, College of Engineering, University of California at Davis, April 2014. Report No. UCD/CGM-14/01.
- Brown, L. J., & Weeber, J. H. (1992). Geology of the Christchurch Urban Area. Institute of Geological and Nuclear Sciences 1:25 000 map 1. Lower Hutt, New Zealand: Institute of Geological & Nuclear Sciences Limited.
- Canterbury Maps. (2014). Canterbury Maps Viewer. Retrieved from <https://mapviewer.canterburymaps.govt.nz/?webmap=0c3ca2ccfe1145c5849dc39864590d0b>
- Christchurch City Council. (2014). Floor Level Map. Retrieved from <https://www.ccc.govt.nz/services/stormwater-and-drainage/flooding/floorlevelmap/>
- Day, R.W. (2001). Geotechnical Earthquake Engineering Handbook: London, United Kingdom: McGraw-Hill.
- Forsyth, P.J., Barrell, D.J.A. & Jongens, R. (2008). Geology of the Christchurch area. Institute of Geological and Nuclear Sciences 1:250 000 map 16. Lower Hutt, New Zealand: Institute of Geological & Nuclear Sciences Limited.
- Leeves, J., van Ballegooy, S., Lees, J. & Wentz, F. (2015). Effect of Fines Content Correlations and Liquefaction Susceptibility Thresholds on Liquefaction Consequence. 6th International Conference of Earthquake Geotechnical Engineering.
- Ministry of Business, Innovation & Employment. (2012). Repairing and rebuilding houses affected by the Canterbury earthquakes (Version 3). Wellington, New Zealand.
- New Zealand Geotechnical Database. (2024). NZGD. Retrieved from <http://www.nzgd.org.nz>
- New Zealand Geotechnical Society. (2005). Field description of soil and rock - Guideline for the field classification and description of soil and rock for engineering purposes.
- New Zealand Geotechnical Society and Ministry of Business, Innovation & Employment. (2021). Earthquake Geotechnical Engineering Practice, Modules 1-6. Wellington, New Zealand.
- Standards New Zealand. (1988). Part 4: Determination of the minimum and maximum dry densities and relative density of a cohesionless soil (NZS 4402:1988). Wellington, NZ: Standards New Zealand.
- Standards New Zealand. (1988). Part 6: Determination of the penetration resistance of a soil (NZS 4402:1988). Wellington, NZ: Standards New Zealand.
- Standards New Zealand. (2011). Timber Framed Buildings (NZS 3604:2011). Wellington, NZ: Standards New Zealand.
- Tonkin & Taylor Ltd. (2013). Liquefaction Vulnerability Study. Retrieved from: http://www.eqc.govt.nz/sites/public_files/documents/liquefaction-vulnerability-study-final.pdf
- Zhang, G., Robertson, P. K. & Brachman, R. W. I. (2002). 'Estimating liquefaction-induced ground settlements from CPT for level ground.' Canadian Geotechnical Journal - October 2002, NCR Research Press, 39, 1168-1180.

ATTACHMENTS



- Legend**
- KGA Hand Auger & Scala Penetrometer Test (2021)
 - ▲ KGA CPT 2021
 - ⊗ KGA Hand Auger & Scala Penetrometer (2026)
 - ▲ KGA CPT 2026
 - Site Boundary

0 50 m 100 m
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KGA
Geotechnical
Auckland - 09 479 6155
Christchurch - 03 343 5302

Produced by **Datanest.earth**

Title: Site Plan		
Client: Sabys 101 Ltd		Size: A3
Project: 6 Wroots Road & 101 Sabys Road, Kennedys Bush	Drawn: JB	Drawing No.: 1
Date: 17-12-2025	Checked: AN	
Proj No: K250791	Scale: 1:5000	Version: A



Legend
□ Site Boundary
X Test Locations

0 50 m 100 m
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Produced by **Datanest.earth**

Title: Depth to Gravels

Client: Sabys 101 Ltd		Size: A3
Project: 6 Wroots Road & 101 Sabys Road, Kennedys Bush	Drawn: JB	Drawing No.: 2
Date: 14-01-2026	Checked: AN	
Proj No: K250791	Scale: 1:5000	Version: A



Legend

- Test Locations
- Site Boundary

0 50 m 100 m
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Produced by **Datanest.earth**

Title: Depth of soft soils (<1MPa)

Client: Sabys 101 Ltd		Size: A3
Project: 6 Wroots Road & 101 Sabys Road, Kennedys Bush	Drawn: JB	Drawing No.: 3
Date: 14-01-2026	Checked: AN	
Proj No: K250791	Scale: 1:5000	Version: A



Legend

- X CPT Locations
- Site Boundary

0 50 m 100 m
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Produced by **Datanest.earth**

Title:
Liquefaction Induced Settlements (SLSB/ULS)

Client: Sabys 101 Ltd		Size: A3
Project: 6 Wroots Road & 101 Sabys Road, Kennedys Bush	Drawn: JB	Drawing No.: 4
Date: 14-01-2026	Checked: AN	
Proj No: K250791	Scale: 1:5000	Version: A



Legend

- TC2
- Hybrid TC2/TC3
- TC3
- Site Boundary

0 50 m 100 m
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Produced by **Datanest.earth**

Title: Technical Categorisation Plan		
Client: Sabys 101 Ltd		Size: A3
Project: 6 Wroots Road & 101 Sabys Road, Kennedys Bush	Drawn: JB	Drawing No.: 5
Date: 14-01-2026	Checked: AN	
Proj No: K250791	Scale: 1:5000	Version: A

Job No.: K250791

Hole No.:	HA01/SP01
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Date: 13/01/2026

Logged By: KF/JB

Sheet:	2.1
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Sheet: 2.1

[illegible]

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS. Co-ordinates are in NZTM unless otherwise specified.

Water	Shear Vane	Other Comments
▼ Standing Water Level ▽ Water Level At Time Of Drilling ↵ Out Flow ➡ In Flow	Corrected as per NZGS Guidelines Vane No.: UTP = Unable To Penetrate + = Peak Exceeded - = No Result	Hole collapse to 2.6m depth following completion of investigation.



Printed: 14/01/2026 3:59:13 pm

Job No.: K250791

Hole No.: HA03/SP03

Date: 13/01/2026

Logged By: KF/JB

Sheet:	2.3
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Sheet:	2.3
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Printed: 14/01/2026 3:59:15 pm

Job No.: K210506

Hole No.: HA01/SP01

Date: 25/06/2021

Logged By:	AH
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Ground Level: 11.2

Sheet:	2A
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Notes & Abbreviations

Other Comments

- Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result



Job No.: K210506

Hole No.: HA03/SP03

Date: 25/06/2021

Logged By: AH

Ground Level: 13

Sheet:	2C
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Notes & Abbreviations

Water

Shear Vane

Other Comments

 Standing Water Level
 Water Level At Time Of Drilling
 Out Flow  In Flow

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result



Job No.: K210506

Hole No.: HA04/SP04

Date: 25/06/2021

Logged By:	AH
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Ground Level: 12.5

Sheet:	2D
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Notes & Abbreviations

Other Comments

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result



Job No.: K210506

Hole No.: HA05/SP05

Date: 25/06/2021

Logged By: AH

Ground Level: 12.8

Sheet:	2E
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Notes & Abbreviations

Water

Shear Vane

Other Comments

 Standing Water Level
 Water Level At Time Of Drilling
 Out Flow  In Flow

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result



Job No.: K210506

Hole No.: HA06/SP06

Date: 25/06/2021

Logged By:	AH
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Ground Level: 12.9

Sheet: 2F

Notes & Abbreviations

Water

Shear Vane

Other Comments

 Standing Water Level
 Water Level At Time Of Drilling
 Out Flow  In Flow

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result



HAND AUGER AND SCALA LOG

Job No.: K210506

Client: Davie Lovell-Smith

Hole No.: HA07/SP07

Project: Geotechnical Investigation

Date: 25/06/2021

Location: 101 Sabys Road, Halswell, Christchurch

Logged By: AH

Coordinates: E 1564903.9, N 5173389.4

Ground Level: 14.1

Sheet: 2G

RL	Subsurface Conditions	Depth (m)	Groundwater	Geological Unit	Graphic Log	Scala Penetrometer (blows / 50mm)															
13.7	Organic SILT, minor sand, trace rootlets, dark brown, moist, non-plastic, non-dilatant; sand, fine; organics, amorphous.					0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
13.5	Silty SAND, light brownish grey. Loose, moist, poorly graded; sand, fine.	0.5				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
13.2	Fine SAND, minor silt, light brownish grey. Loose, moist, poorly graded.					0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
13	Silty SAND, light brownish grey. Loose, moist, poorly graded; sand, fine.	1.0				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
12.5	Fine SAND, some silt, light brownish grey. Loose, moist, poorly graded. 1.30m: Minor silt. 1.50m: Some silt.	1.5				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
11.9	Silty SAND, light brownish grey. Loose, moist, poorly graded; sand, fine.	2.0				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
11.55	Fine to medium SAND, trace silt, light grey with orange mottling. Loose, moist, poorly graded. 2.50m: Saturated.	2.5				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
11.3	SILT, trace sand and organics, bluish grey, saturated, non-plastic, non-dilatant; sand, fine; organics, fibrous.					0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
11.1	Fine SAND, some silt, bluish grey. Medium dense, saturated, poorly graded. 3.00m: End of hole (target depth).	3.0				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS. Co-ordinates are in NZTM unless otherwise specified.

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ↔ Out Flow ▷ In Flow

Shear Vane

- Corrected as per NZGS Guidelines
- Vane No.:
- UTP = Unable To Penetrate
- + = Peak Exceeded
- = No Result

Other Comments



Job No.: K210506

Hole No.: HA08/SP08

Date: 25/06/2021

Logged By:	AH
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Sheet:	2H
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Sheet:	2H
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Notes & Abbreviations

Water

 Standing Water Level

 Water Level At Time Of Drilling

 Out Flow  In Flow

Other Comments



HAND AUGER AND SCALA LOG

Job No.: K210506

Client: Davie Lovell-Smith

Hole No.: HA09/SP09

Project: Geotechnical Investigation

Date: 25/06/2021

Location: 101 Sabys Road, Halswell, Christchurch

Logged By: AH

Coordinates: E 1564814.0, N 5173252.2

Ground Level: 13.1

Sheet: 2I

RL	Subsurface Conditions	Depth (m)	Groundwater	Geological Unit	Graphic Log	Scala Penetrometer (blows / 50mm)															
12.75	Organic SILT, minor sand, trace rootlets, dark brown, moist, non-plastic, non-dilatant; sand, fine; organics, amorphous.			TOPSOIL		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
12.3	Silty SAND, light brownish grey. Loose, moist, poorly graded; sand, fine.	0.5				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
12.1	Sandy SILT, greyish brown, moist, non-plastic, non-dilatant; sand, fine.	1.0				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
11.6	SILT, some sand, dark brown, moist, non-plastic, non-dilatant; sand, fine. 1.10m: Trace sand. 1.25m: Minor sand, light yellowish grey with orange mottling.	1.5				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
10.4	Fine SAND, some silt, light brownish grey. Medium dense, moist, poorly graded. 1.55m: Saturated. 1.65m: Sand becomes fine to medium, trace silt. 1.95m: Bluish grey. 2.50m: Trace organics; fibrous.	2.0				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
10.1	SILT, trace sand and organics, bluish grey, saturated, non-plastic, non-dilatant; sand, fine; organics, fibrous. 3.00m: End of hole (target depth).	3.0				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS. Co-ordinates are in NZTM unless otherwise specified.

Water

- Standing Water Level
- Water Level At Time Of Drilling
- Out Flow In Flow

Shear Vane

- Corrected as per NZGS Guidelines
- Vane No.:
- UTP = Unable To Penetrate
- + = Peak Exceeded
- = No Result

Other Comments



HAND AUGER AND SCALA LOG

Job No.: K210506

Client: Davie Lovell-Smith

Hole No.: HA10/SP10

Project: Geotechnical Investigation

Date: 25/06/2021

Location: 101 Sabys Road, Halswell, Christchurch

Logged By: AH

Coordinates: E 1564911.2, N 5173318.9

Ground Level: 13.4

Sheet: 2J

RL	Subsurface Conditions	Depth (m)	Groundwater	Geological Unit	Graphic Log	Scala Penetrometer (blows / 50mm)															
13.1	Organic SILT, minor sand, trace rootlets, dark brown, moist, non-plastic, non-dilatant; sand, fine; organics, amorphous.			TOPSOIL		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
12.7	SILT, trace sand, light brownish grey, moist, non-plastic, non-dilatant; sand, fine. 0.50m: Minor sand.	0.5		SPRINGSTON FORMATION (TERRESTRIAL)		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
12.5	Silty SAND, light brownish grey. Medium dense, moist, poorly graded; sand, fine.					0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
11.85	Fine SAND, some silt, light brownish grey with orange mottling. Medium dense, moist, poorly graded. 1.40m: Strong orange mottling.	1.0				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
11.5	Silty SAND, light grey. Loose, moist to wet, poorly graded; sand, fine.					0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
11.2	Fine SAND, some silt, light brownish grey. Loose, saturated, poorly graded. 2.10m: Bluish grey.	2.0				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
10.7	SILT, minor sand, trace organics, bluish grey, saturated, non-plastic, non-dilatant; sand, fine; organics, fibrous.	2.5				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
10.4	Silty SAND, trace organics, bluish grey. Medium dense, saturated, poorly graded; sand, fine; organics, fibrous. 3.00m: End of hole (target depth).	3.0				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS. Co-ordinates are in NZTM unless otherwise specified.

Water

▼ Standing Water Level
 ▼ Water Level At Time Of Drilling
 ◀ Out Flow ▶ In Flow

Shear Vane

Corrected as per NZGS Guidelines
 Vane No.:
 UTP = Unable To Penetrate
 + = Peak Exceeded
 - = No Result

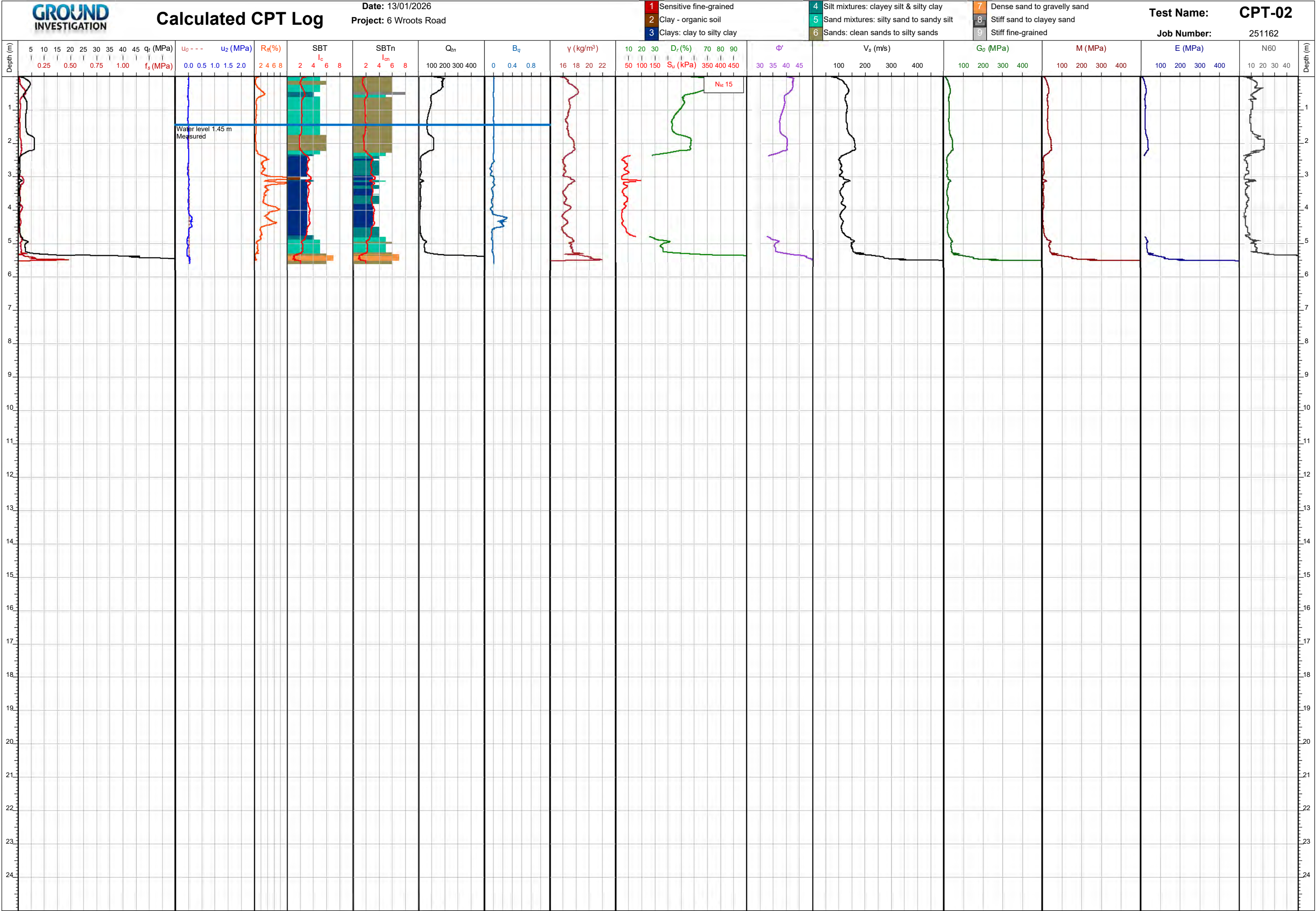
Other Comments

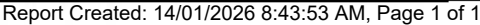


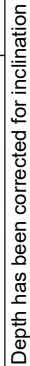




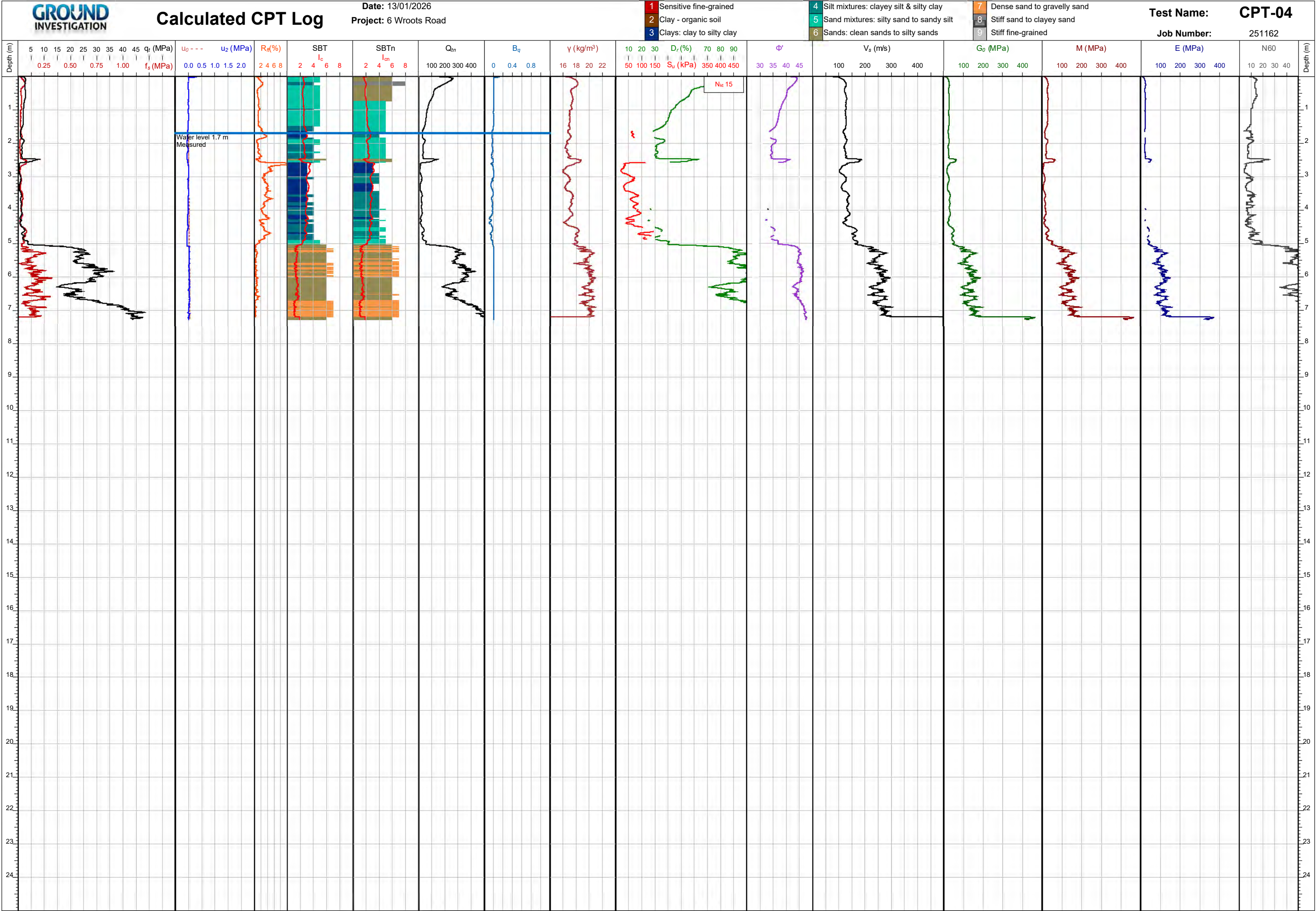




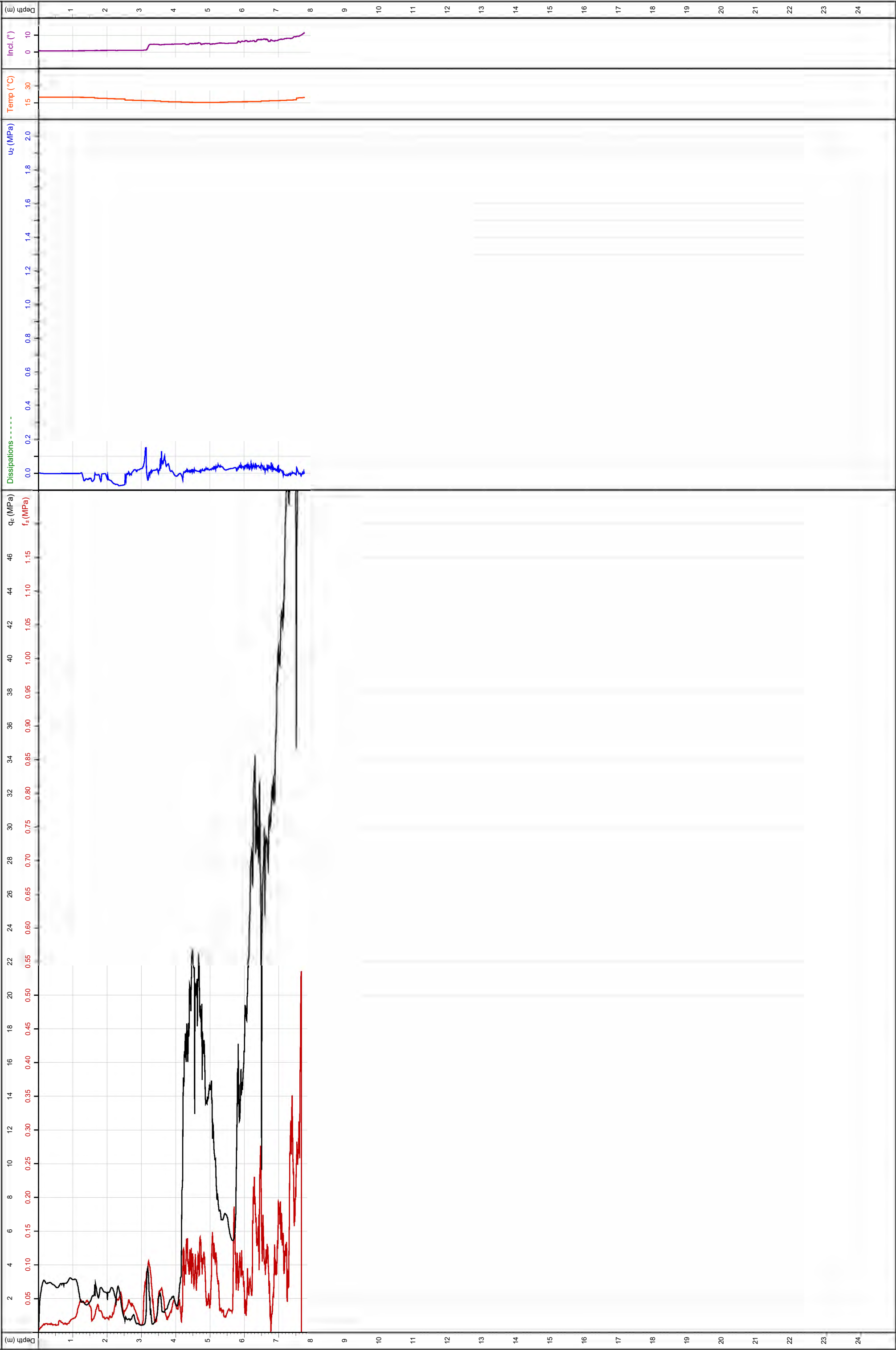




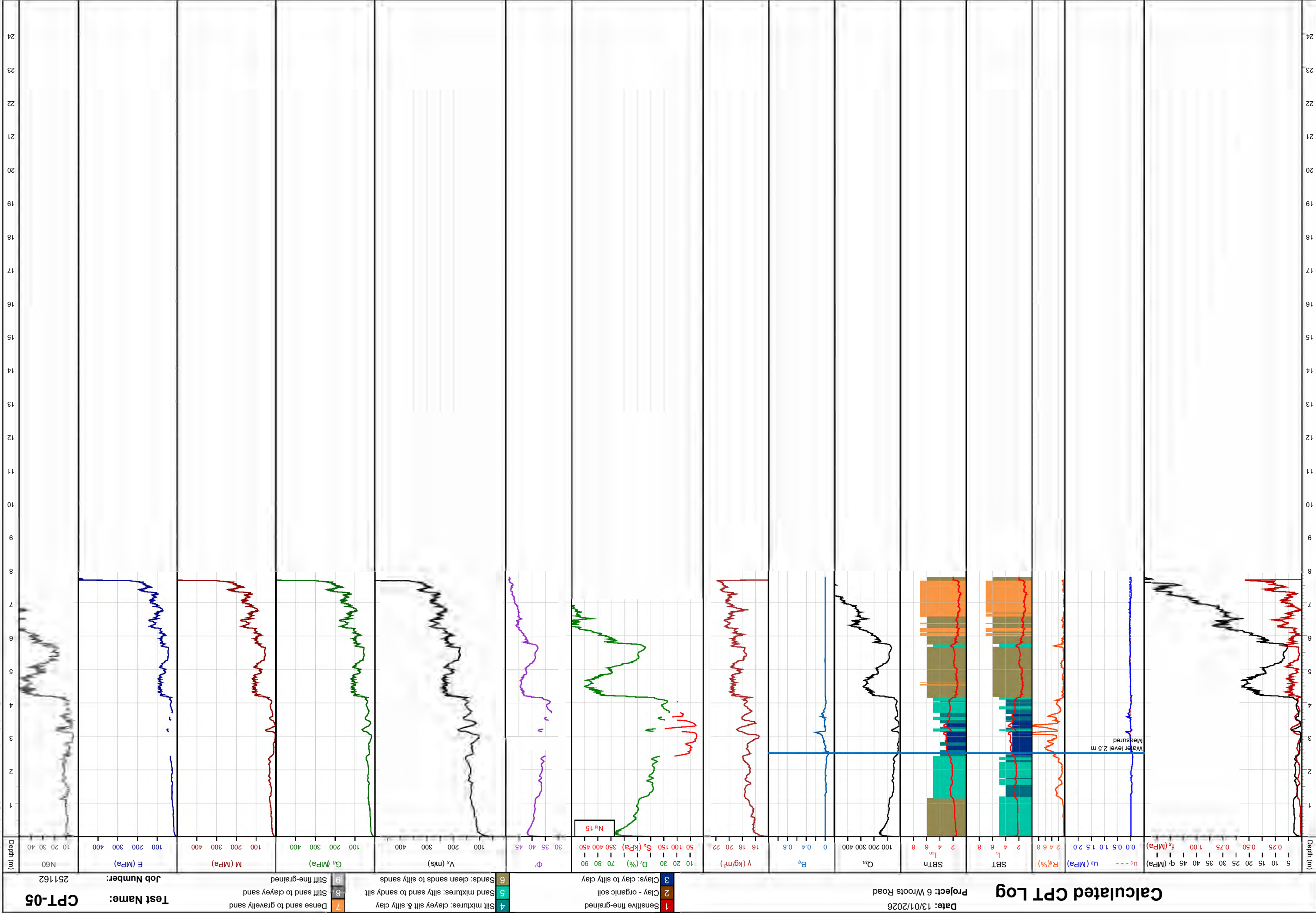




Measured CPT Log



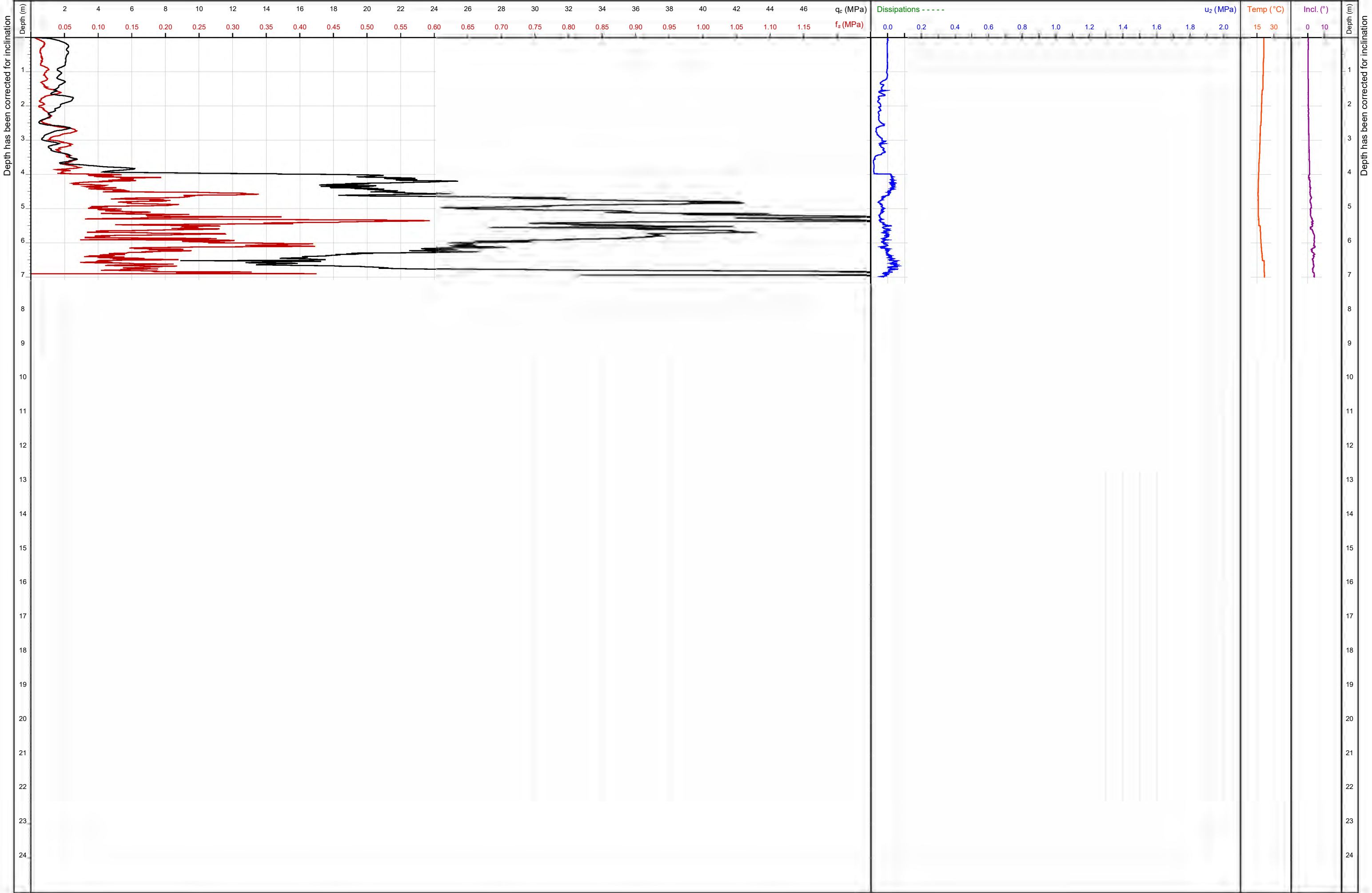
Depth has been corrected for inclination



Measured CPT Log

Client: KGA Geotechnical Group Ltd - Christchurch
Project: 6 Wroots Road
Remarks: Field water measurement: Measured after testing, depth: 0.75 m
Depth (m): 6.99
Termination: High cone end resistance

Standard: ISO 22476-1:2012 CETANZ TG6
Date: 13/01/2026
Cone Ref: 71668
Test Name: CPT-06
Job Number: 251162



Calculated CPT Log

Date: 13/01/2026
Project: 6 Wroots Road

1 Sensitive fine-grained

2 Clay - organic soil

3 Clays: clay to silty clay

4 Silt mixtures: clayey silt & silty clay

5 Sand mixtures: silty sand to sandy silt

6 Sands: clean sands to silty sands

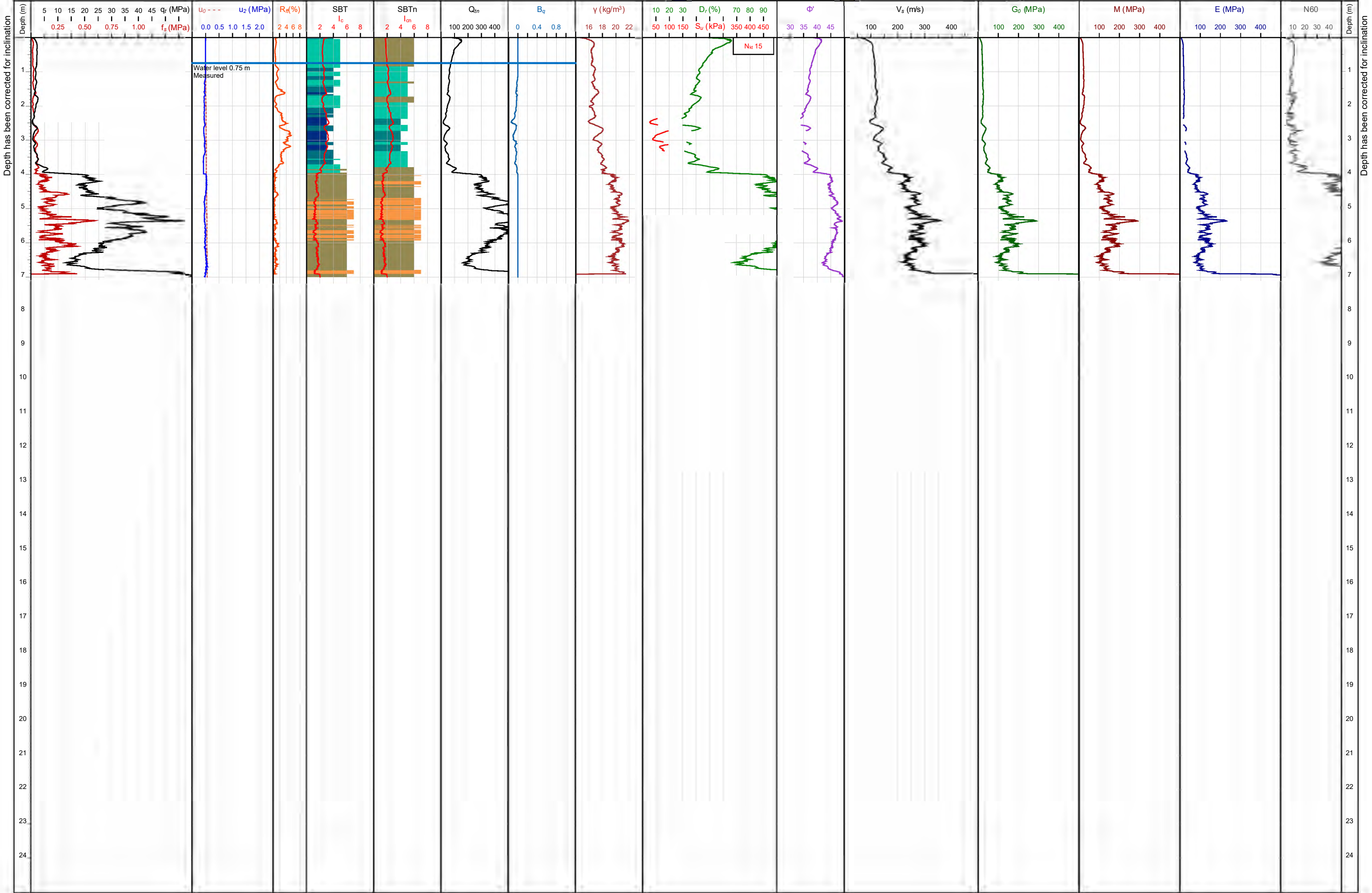
7 Dense sand to gravelly sand

8 Stiff sand to clayey sand

9 Stiff fine-grained

Test Name: CPT-06

Job Number: 251162



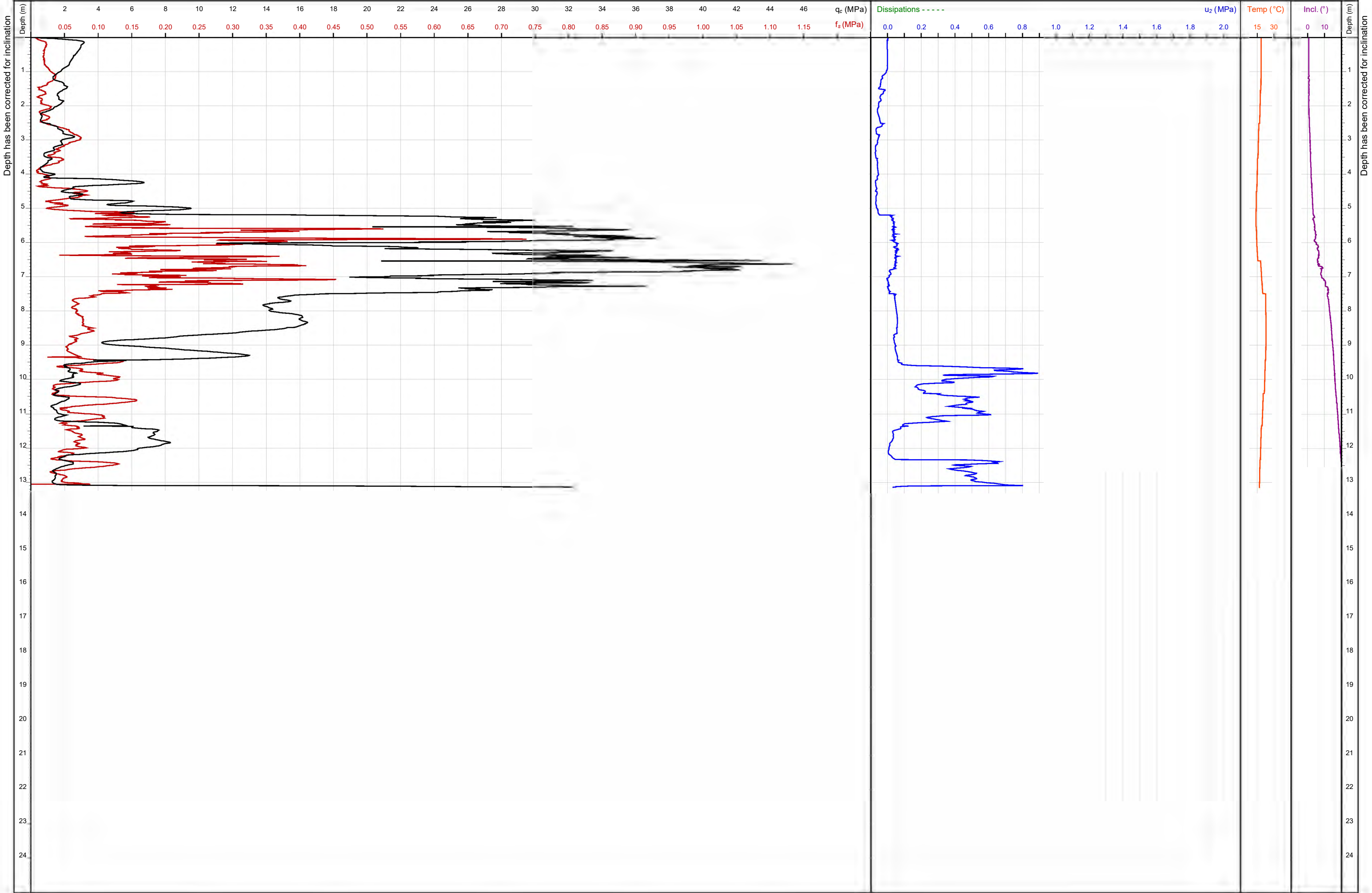
Measured CPT Log

Client: KGA Geotechnical Group Ltd - Christchurch
Project: 6 Wroots Road
Remarks: Field water measurement: Unknown, depth: 0 m

Depth (m): 13.14
Termination: Danger of buckling rods

Standard: ISO 22476-1:2012 CETANZ TG6
Date: 13/01/2026
Cone Ref: 71617

Test Name: CPT-07
Job Number: 251162



Calculated CPT Log

Date: 13/01/2026
Project: 6 Wroots Road

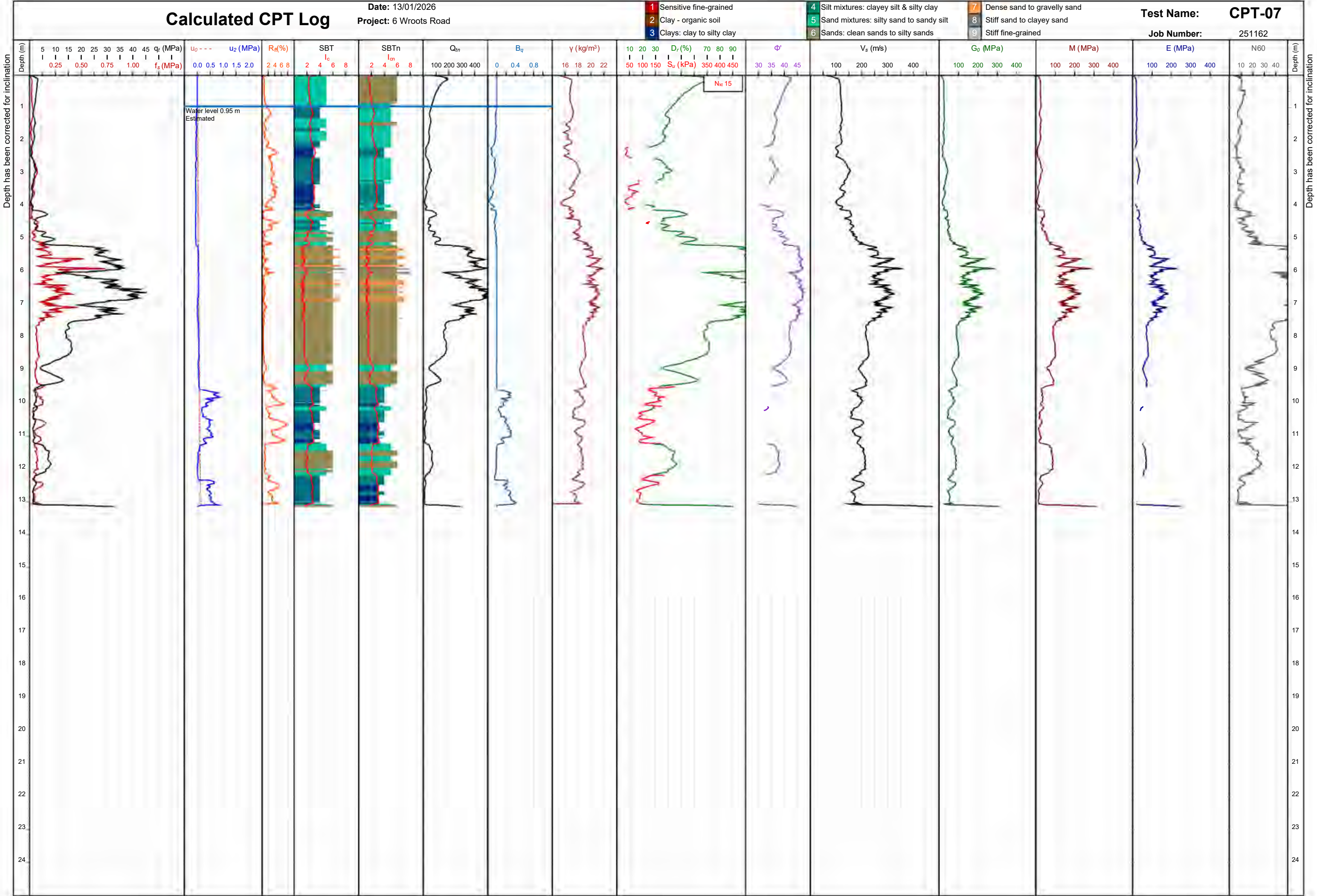
- 1 Sensitive fine-grained
- 2 Clay - organic soil
- 3 Clays: clay to silty clay

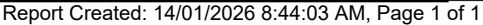
- 4 Silt mixtures: clayey silt & silty clay
- 5 Sand mixtures: silty sand to sandy silt
- 6 Sands: clean sands to silty sands

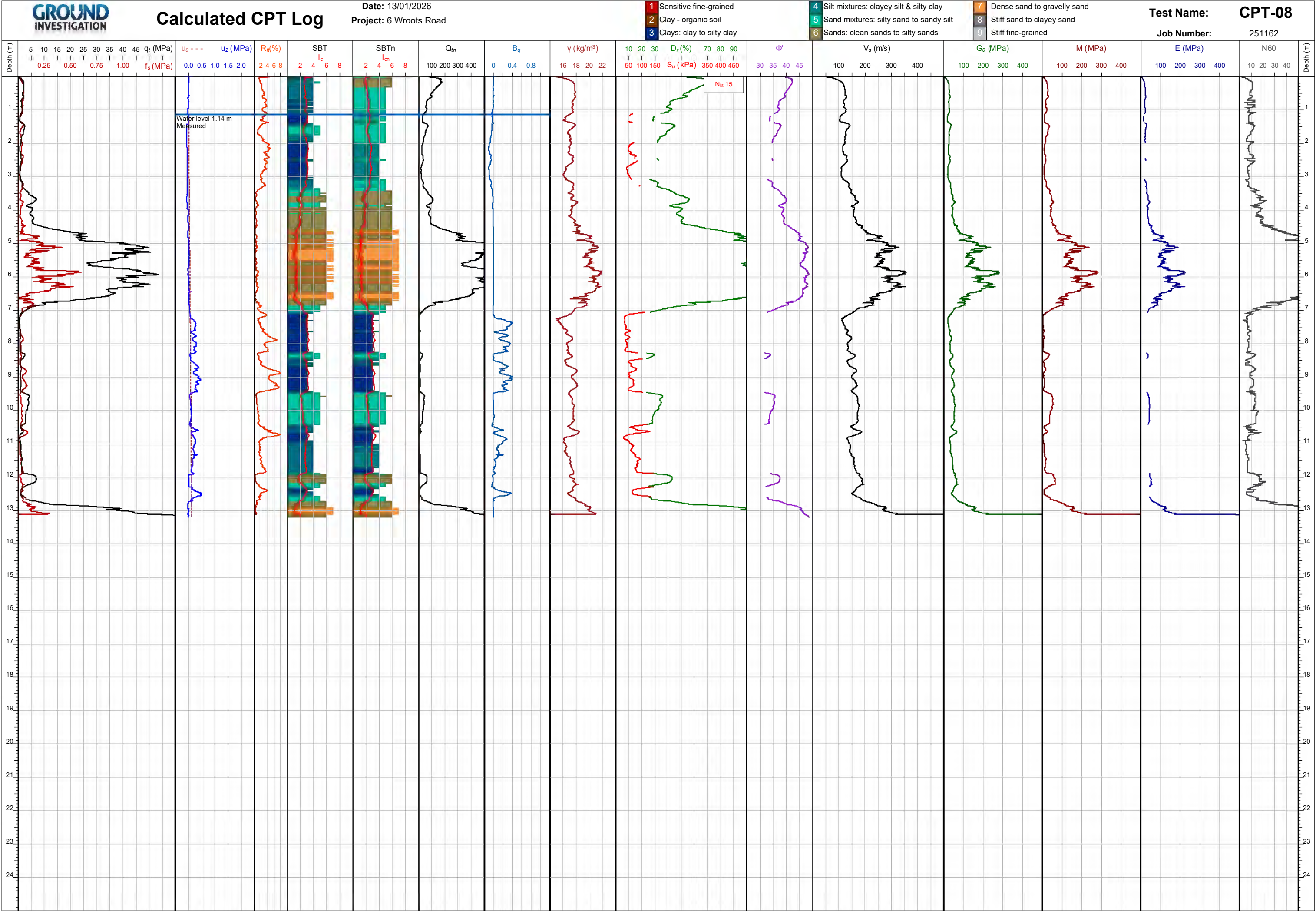
- 7 Dense sand to gravelly sand
- 8 Stiff sand to clayey sand
- 9 Stiff fine-grained

Test Name: CPT-07

Job Number: 251162











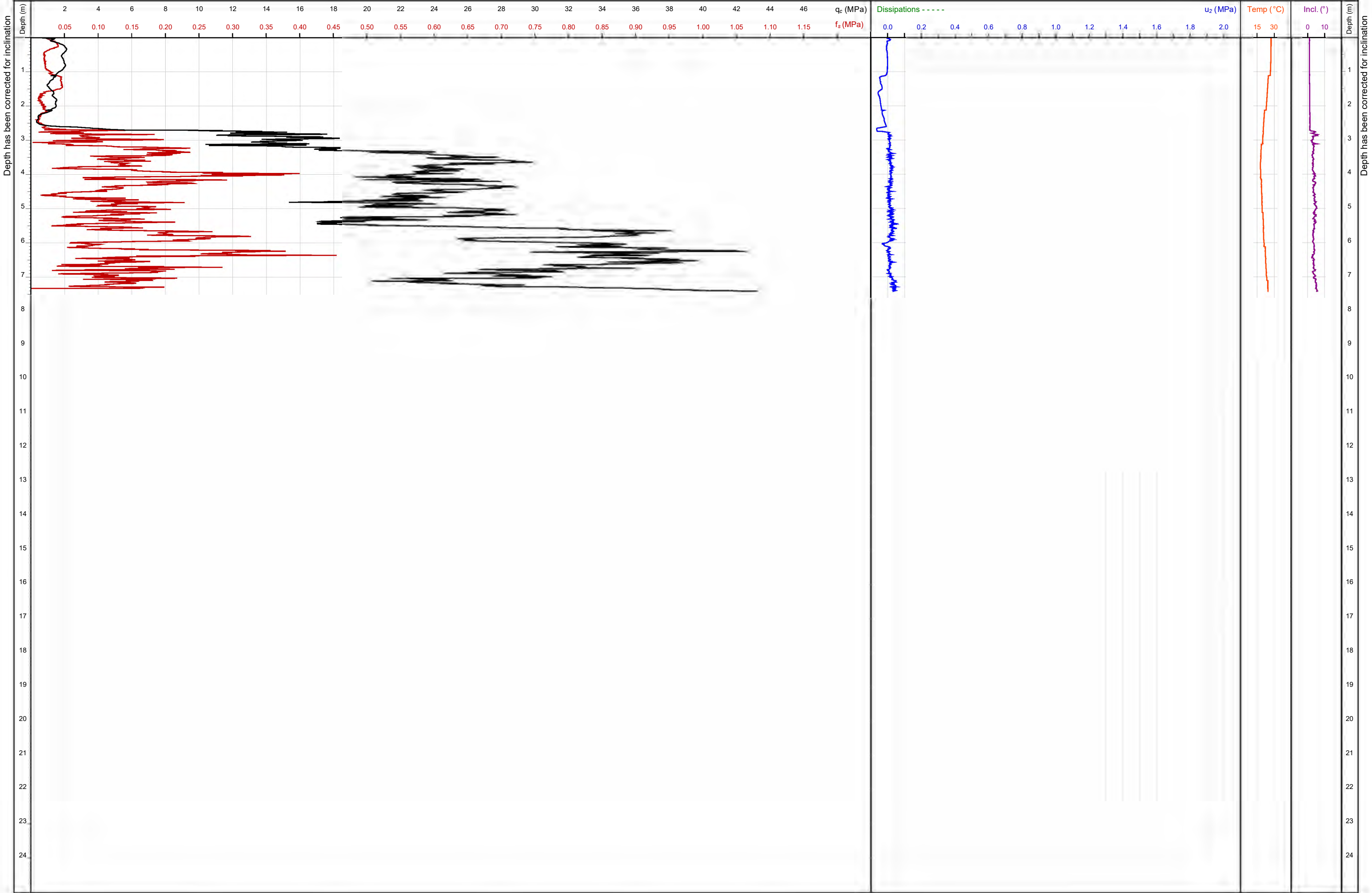
Measured CPT Log

Client: KGA Geotechnical Group Ltd - Christchurch
Project: 6 Wroots Road
Remarks: Field water measurement: Measured after testing, depth: 0.7 m

Depth (m): 7.42
Termination: Limit of reaction force

Standard: ISO 22476-1:2012 CETANZ TG6
Date: 13/01/2026
Cone Ref: 71668

Test Name: CPT-10
Job Number: 251162



Calculated CPT Log

Date: 13/01/2026
Project: 6 Wroots Road

- 1

Sensitive fine-grained
- 2

Clay - organic soil
- 3

Clays: clay to silty clay
- 4

Silt mixtures: clayey silt & silty clay
- 5

Sand mixtures: silty sand to sandy silt
- 6

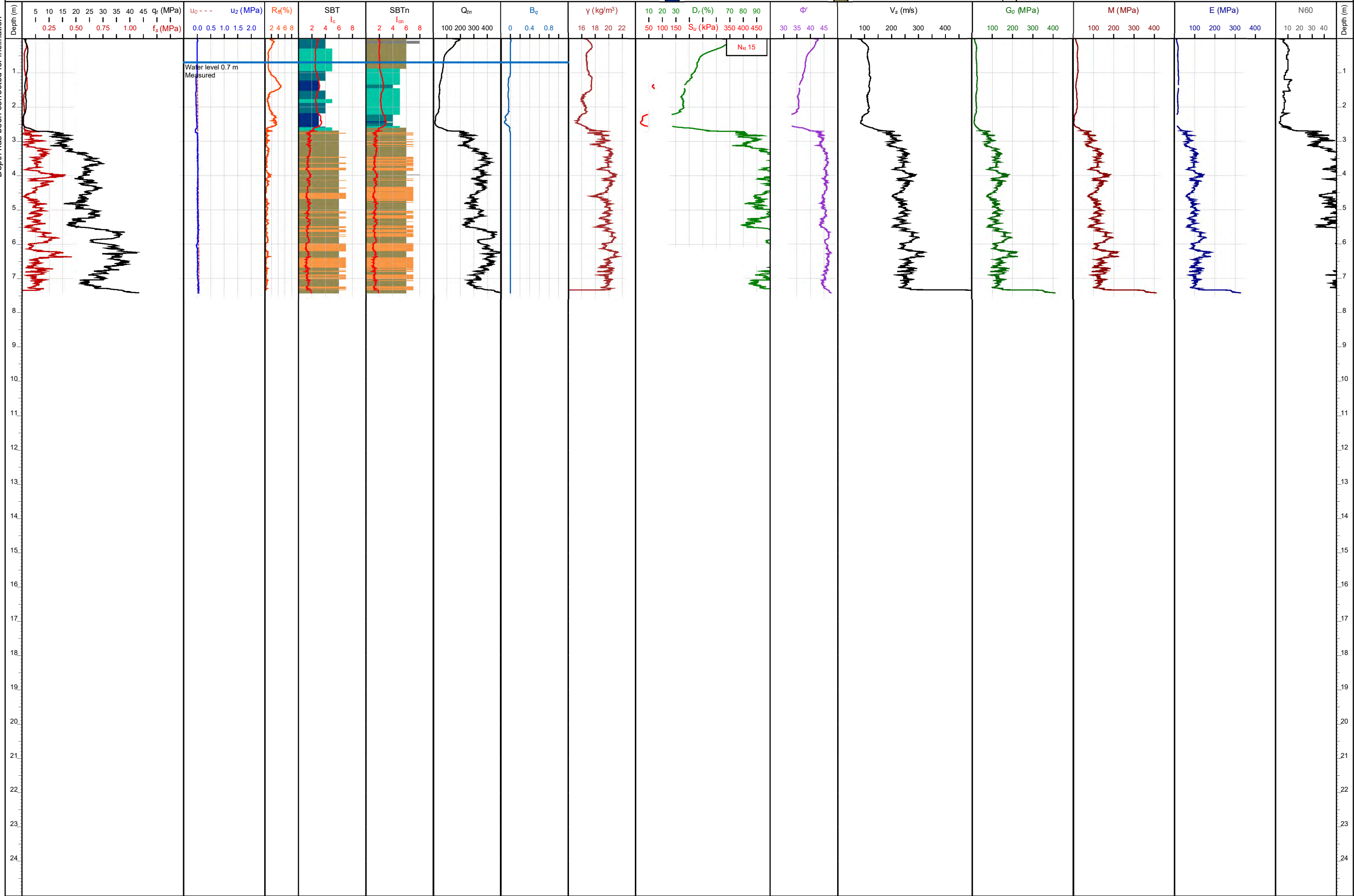
Sands: clean sands to silty sands
- 7

Dense sand to gravelly sand
- 8

Stiff sand to clayey sand
- Stiff fine-grained

Test Name: CPT-10
Job Number: 251162

Depth has been corrected for inclination



Depth has been corrected for inclination

Measured CPT Log

Client: KGA Geotechnical Group Ltd - Christchurch
Project: 6 Wroots Road
Remarks: Field water measurement: Measured after testing, depth: 1.6 m

Depth (m): 4.32
Termination: High cone end resistance

Standard: ISO 22476-1:2012 CETANZ TG6
Date: 13/01/2026
Cone Ref: 71617

Test Name: CPT-11
Job Number: 251162



Calculated CPT Log

Date: 13/01/2026
Project: 6 Wroots Road

- 1

Sensitive fine-grained
- 2

Clay - organic soil
- 3

Clays: clay to silty clay
- 4

Silt mixtures: clayey silt & silty clay
- 5

Sand mixtures: silty sand to sandy silt
- 6

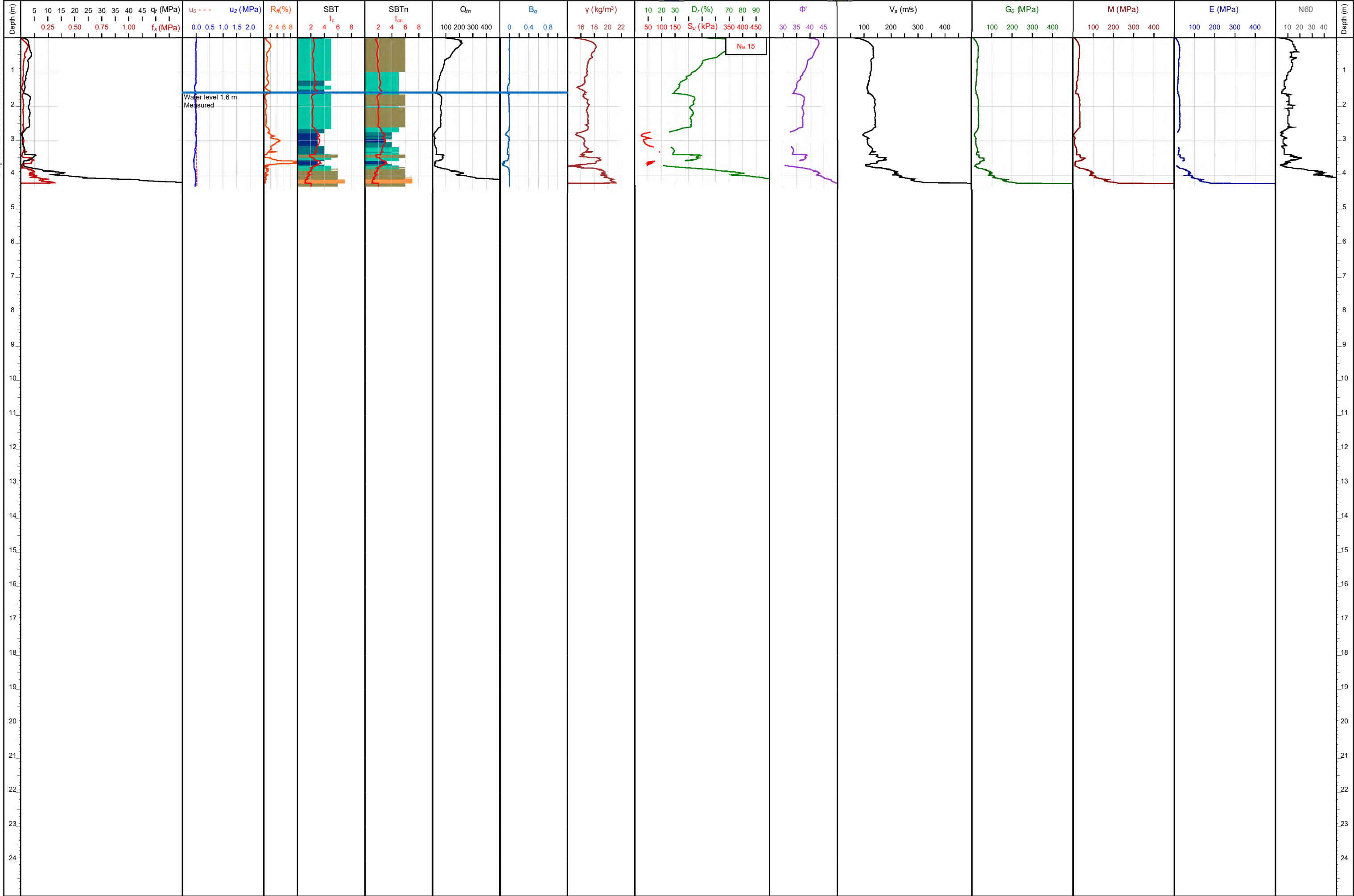
Sands: clean sands to silty sands
- 7

Dense sand to gravelly sand
- 8

Stiff sand to clayey sand
- Stiff fine-grained

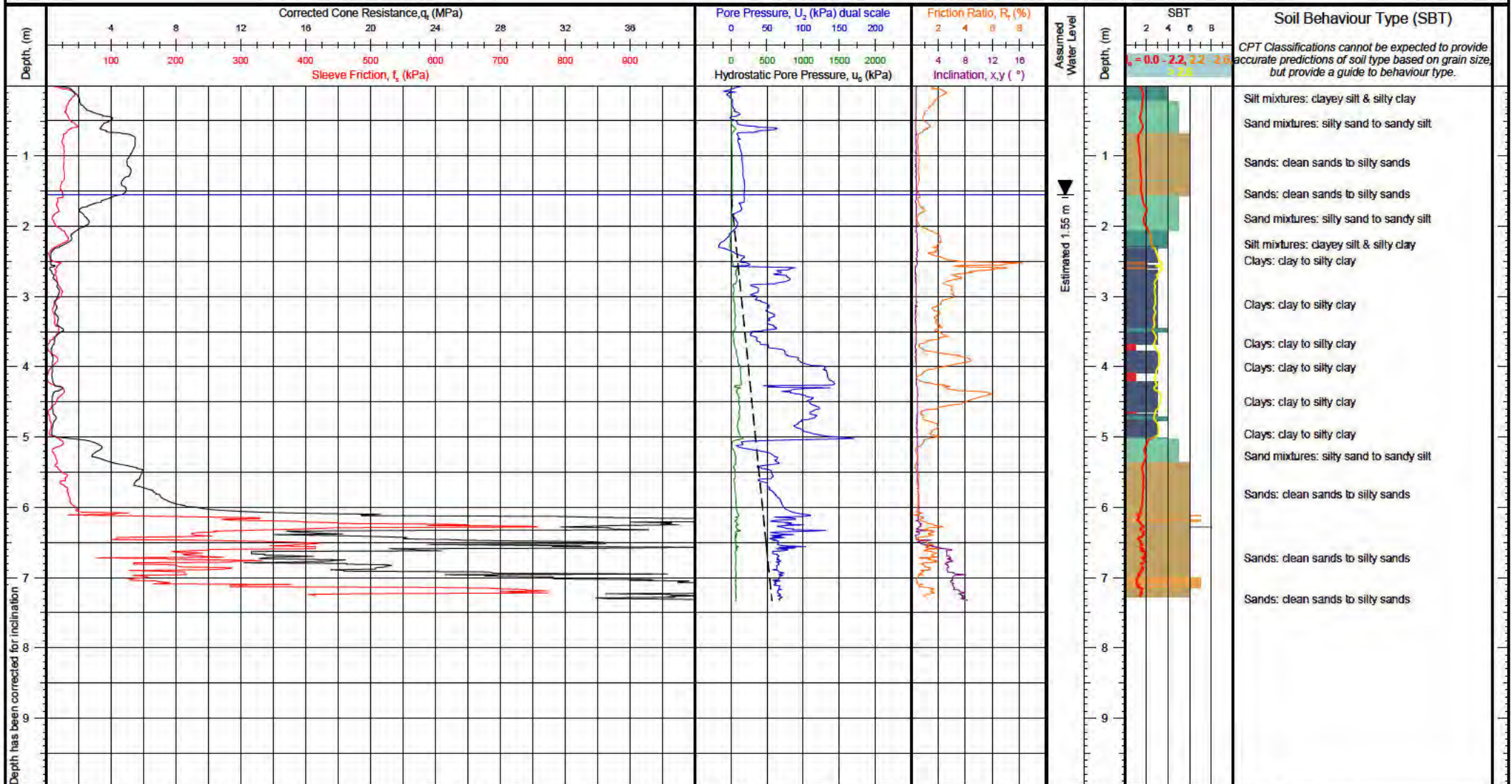
Test Name: CPT-11
Job Number: 251162

Depth has been corrected for inclination



Depth has been corrected for inclination

CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical
Project: 101 Sabys Road
Location: Halswell, Christchurch
Engineer: Abilio Nogueira
Contractor: Ground Investigation Ltd

Operator: Brendon Lemm
Cone Ref: MKJ333
Cone Type: 10cm² Compression
Area Ratio: 0.80
Filter Type: u_2

NZTM 2000 N, E (m): 5173226.89, 1564379.04
WGS84 (deg): -43.593078, 172.558710
Location Method: Handheld GPS
Surveyor:

Elevation (m): Unknown
Date of Test: 24/06/2021
Depth (m): 7.33
Pre Drill (m): N/A

Client Reference:

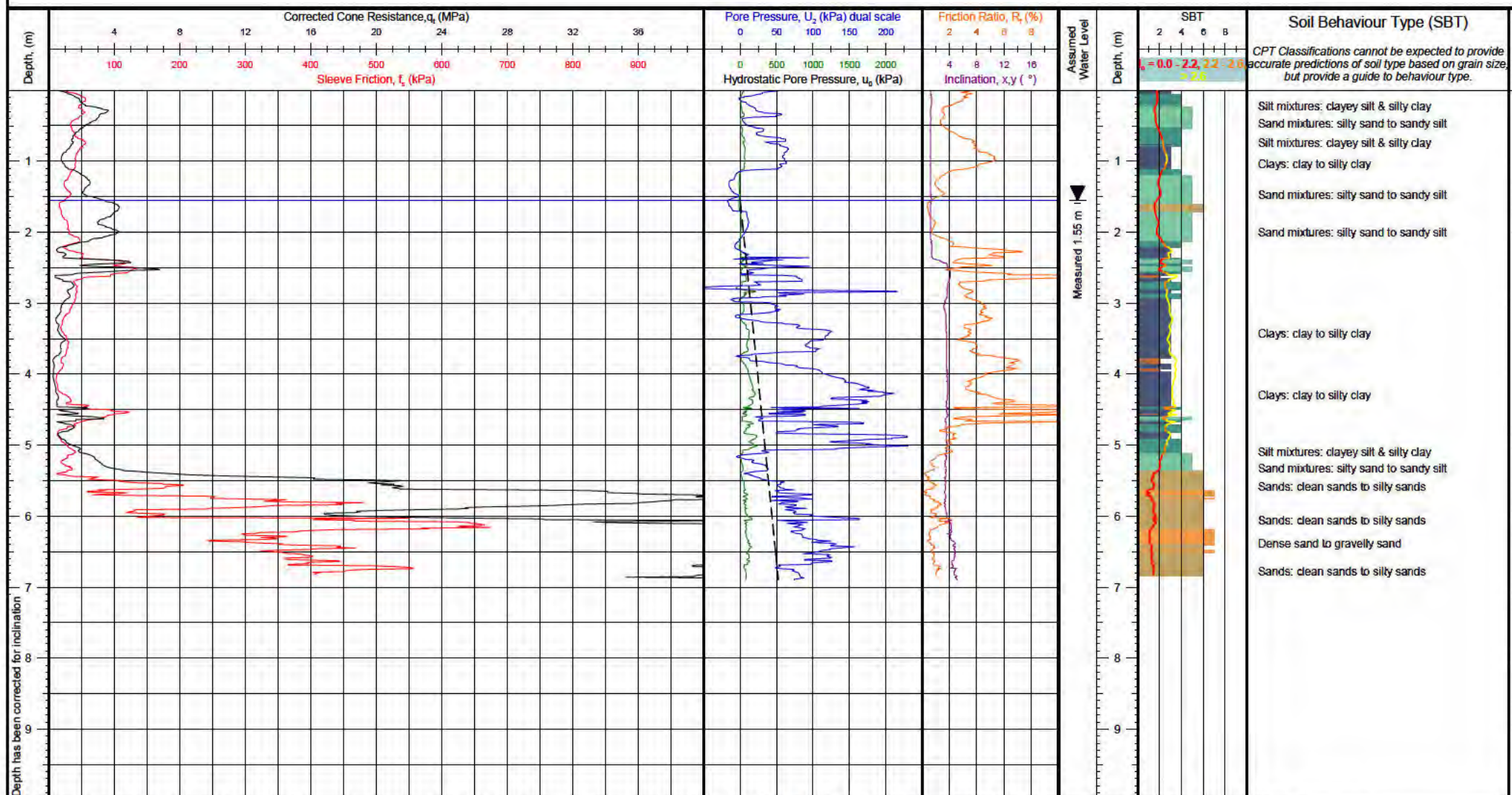
Test Number: CPT-01

G.I. Job Ref: 210810

Comments:

Termination Reason: Inclination high or rapid increase

CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical
Project: 101 Sabys Road
Location: Halswell, Christchurch
Engineer: Abilio Nogueira
Contractor: Ground Investigation Ltd

Operator: Brendon Lemm
Cone Ref: MKJ333
Cone Type: 10cm² Compression
Area Ratio: 0.80
Filter Type: u_2

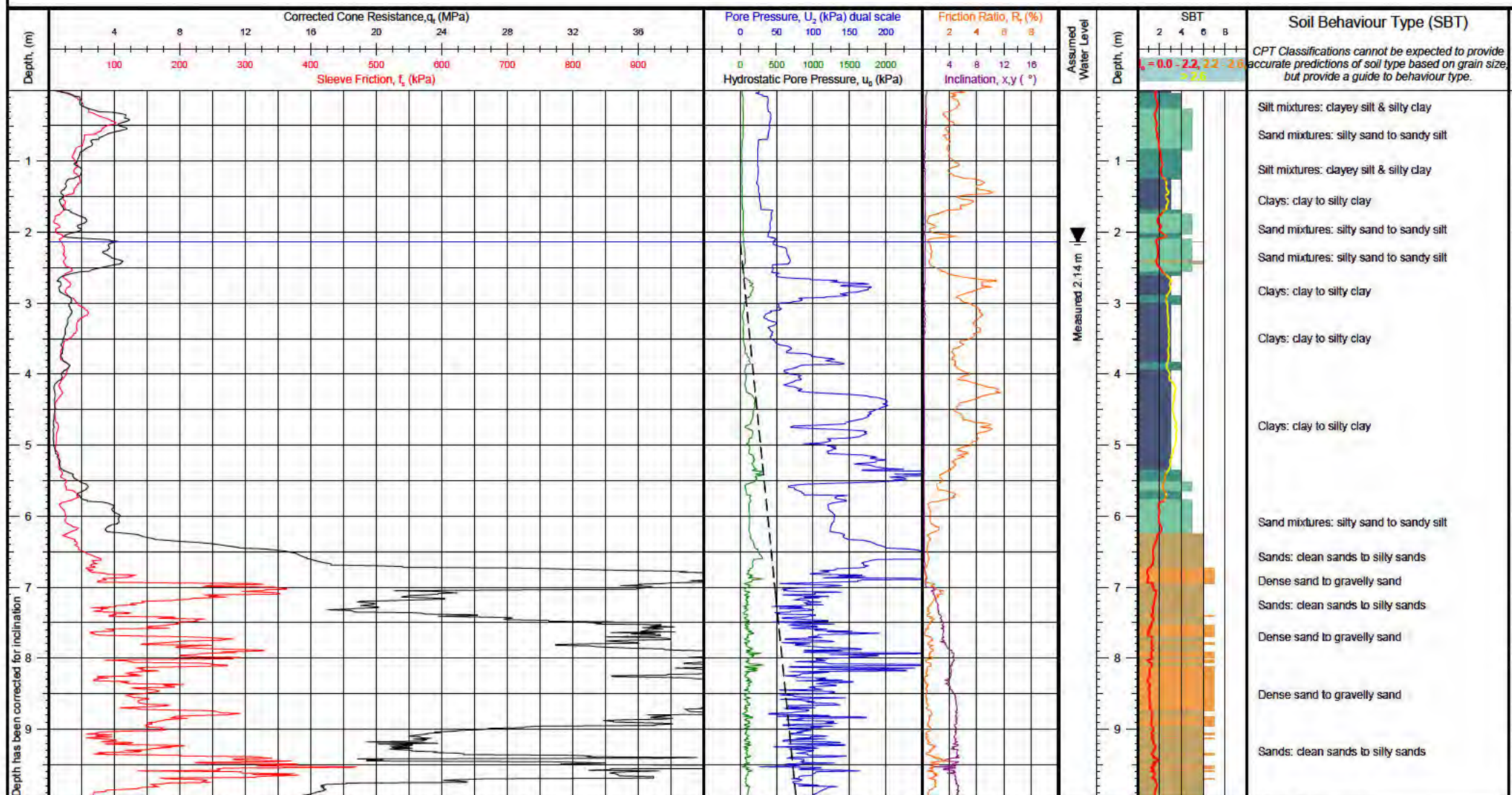
NZTM 2000 N, E (m): 5173306.86, 1564506.32
WGS84 (deg): -43.592364, 172.560292
Location Method: Handheld GPS
Surveyor:
Termination Reason: Limit of reaction force

Elevation (m): Unknown
Date of Test: 24/06/2021
Depth (m): 6.90
Pre Drill (m): N/A

Client Reference:
Test Number: CPT-02
G.I. Job Ref: 210810

Comments:

CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical
Project: 101 Sabys Road
Location: Halswell, Christchurch
Engineer: Abilio Nogueira
Contractor: Ground Investigation Ltd

Operator: Brendon Lemm
Cone Ref: MKJ309
Cone Type: 10cm² Compression
Area Ratio: 0.80
Filter Type: u₂

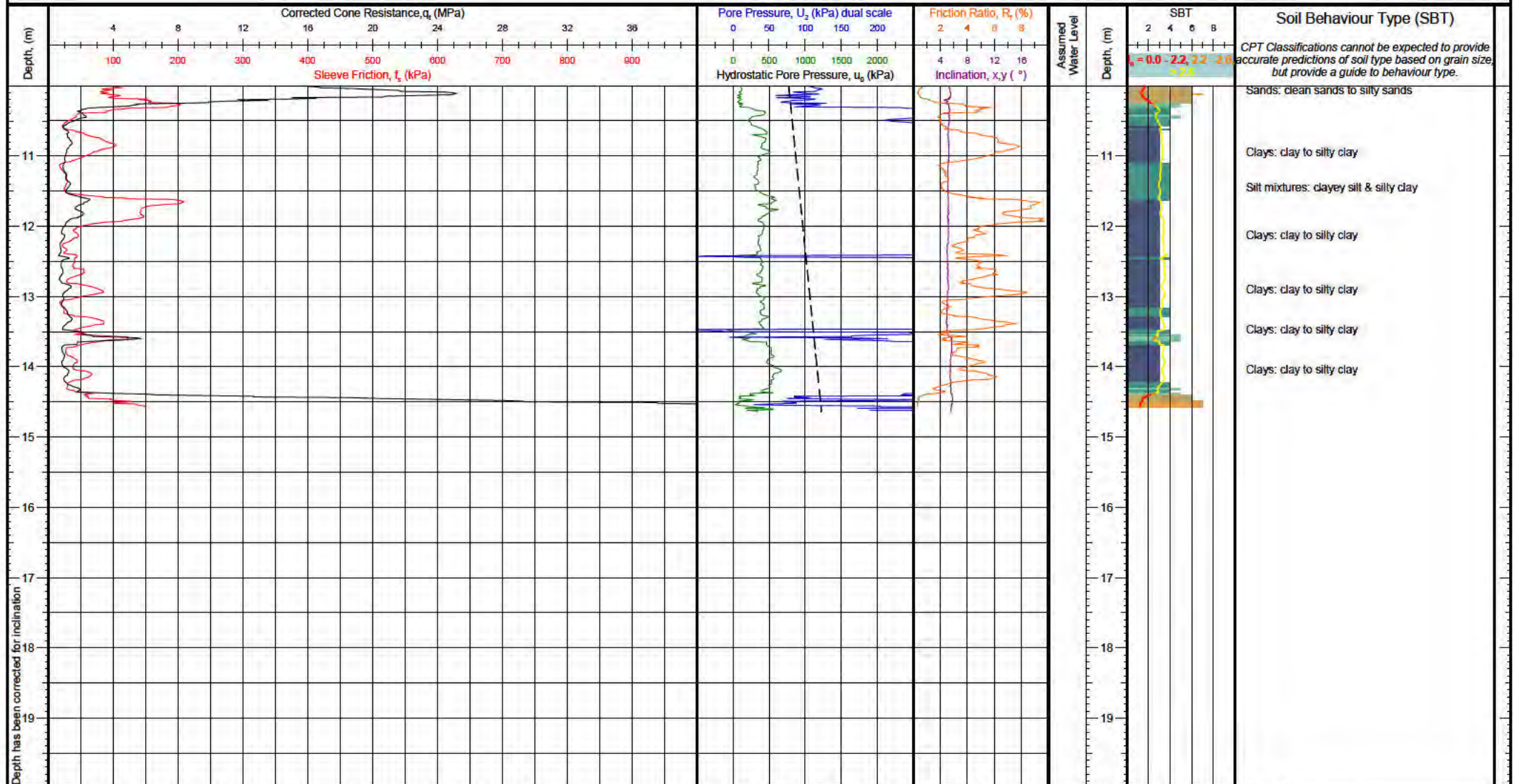
NZTM 2000 N, E (m): 5173342.88, 1564554.16
WGS84 (deg): -43.592042, 172.560887
Location Method: Handheld GPS
Surveyor:
Termination Reason: Limit of reaction force

Elevation (m): Unknown
Date of Test: 23/06/2021
Depth (m): 14.64
Pre Drill (m): N/A

Client Reference:
Test Number: CPT-03
G.I. Job Ref: 210810

Comments:

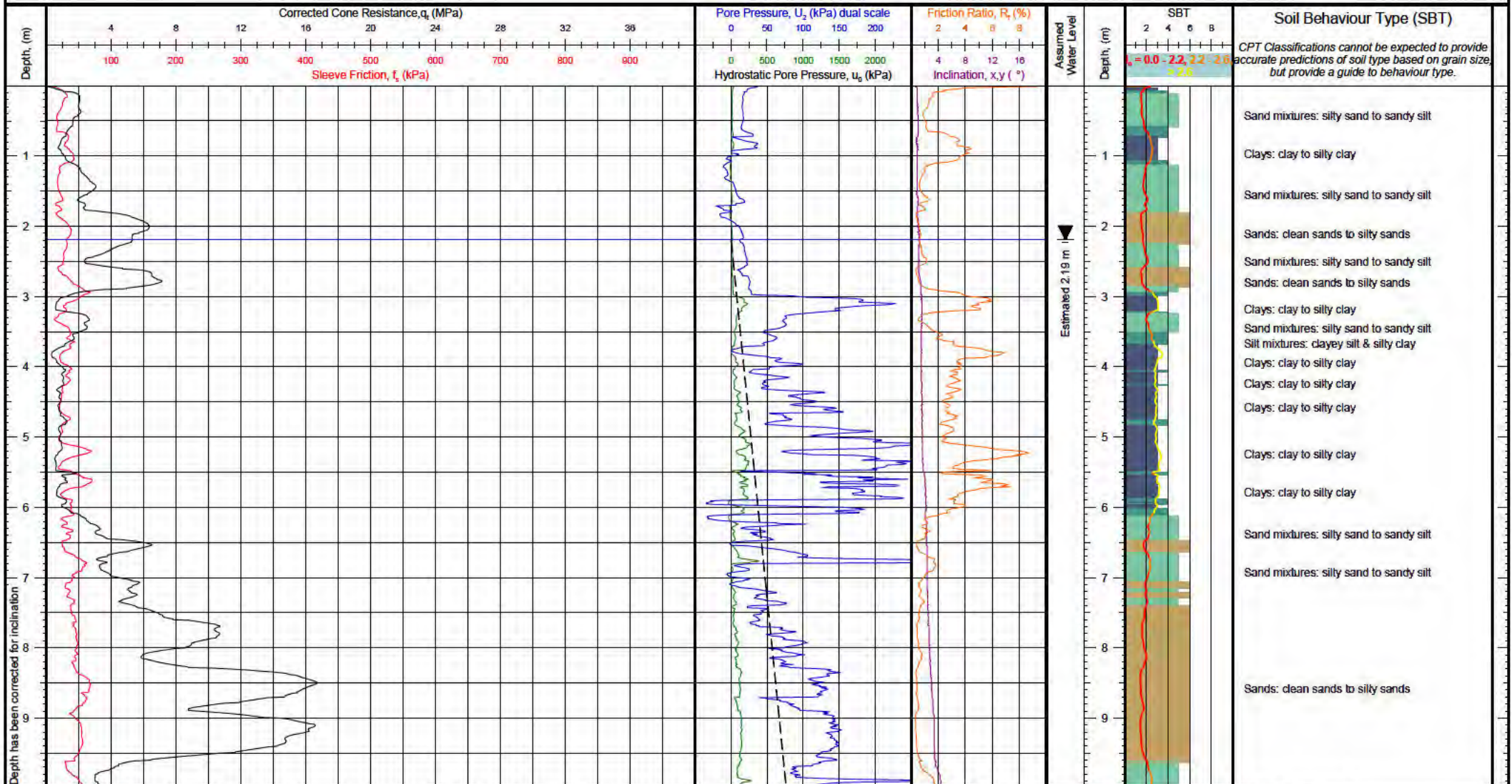
CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical Project: 101 Sabys Road Location: Halswell, Christchurch Engineer: Abilio Nogueira Contractor: Ground Investigation Ltd	Operator: Brendon Lemm Cone Ref: MKJ309 Cone Type: 10cm ² Compression Area Ratio: 0.80 Filter Type: u_2	NZTM 2000 N, E (m): 5173342.88, 1564554.16 WGS84 (deg): -43.592042, 172.560887 Location Method: Handheld GPS Surveyor: Termination Reason: Limit of reaction force	Elevation (m): Unknown Date of Test: 23/06/2021 Depth (m): 14.64 Pre Drill (m): N/A	Client Reference:
				Test Number: CPT-03 G.I. Job Ref: 210810

Comments:

CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical
Project: 101 Sabys Road
Location: Halswell, Christchurch
Engineer: Abilio Nogueira
Contractor: Ground Investigation Ltd

Operator: Brendon Lemm
Cone Ref: MKJ333
Cone Type: 10cm² Compression
Area Ratio: 0.80
Filter Type: u_2

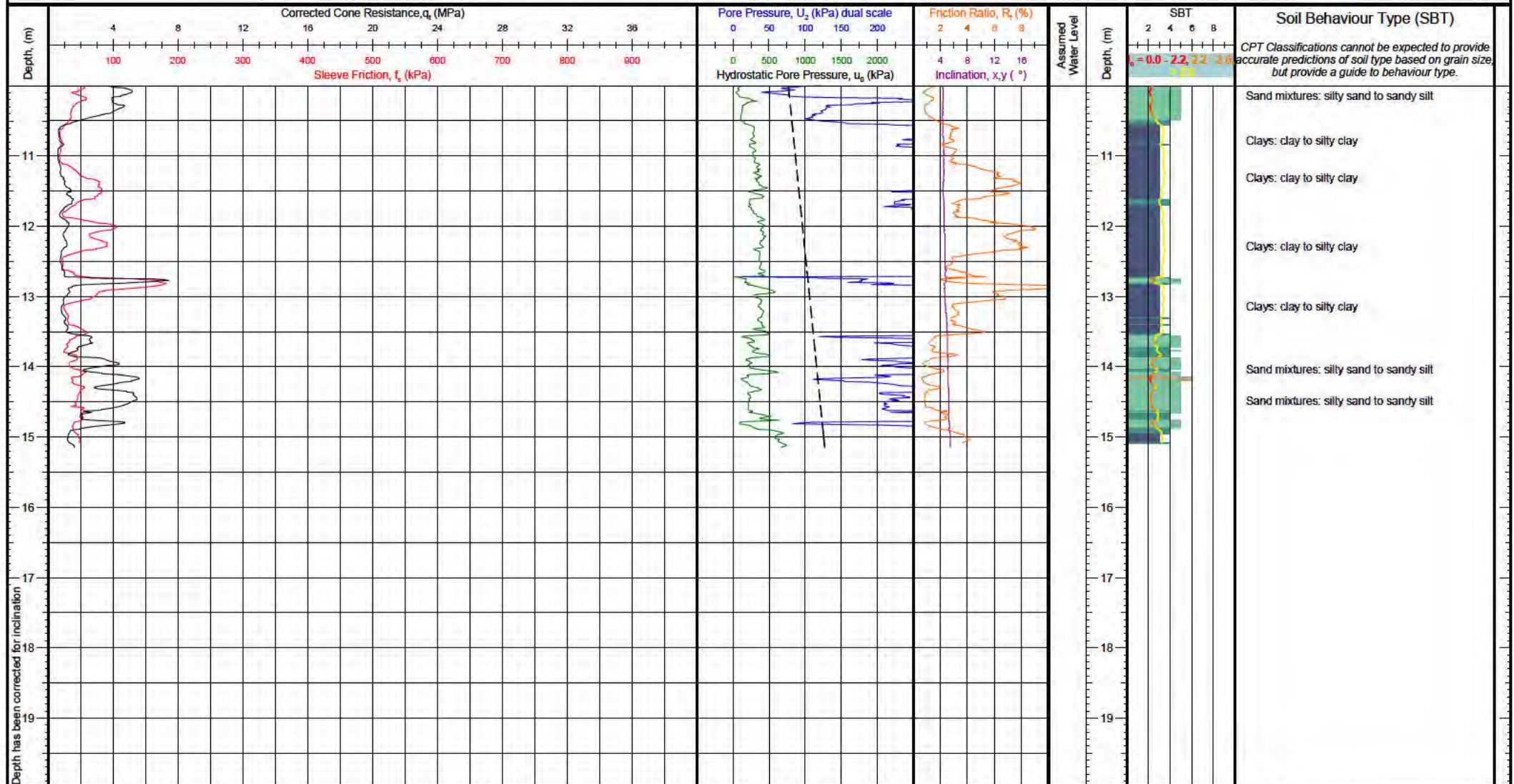
NZTM 2000 N, E (m): 5173410.61, 1564657.53
WGS84 (deg): -43.591437, 172.562172
Location Method: Handheld GPS
Surveyor:
Termination Reason: Target depth

Elevation (m): Unknown
Date of Test: 23/06/2021
Depth (m): 15.15
Pre Drill (m): N/A

Client Reference:
Test Number: CPT-04
G.I. Job Ref: 210810

Comments:

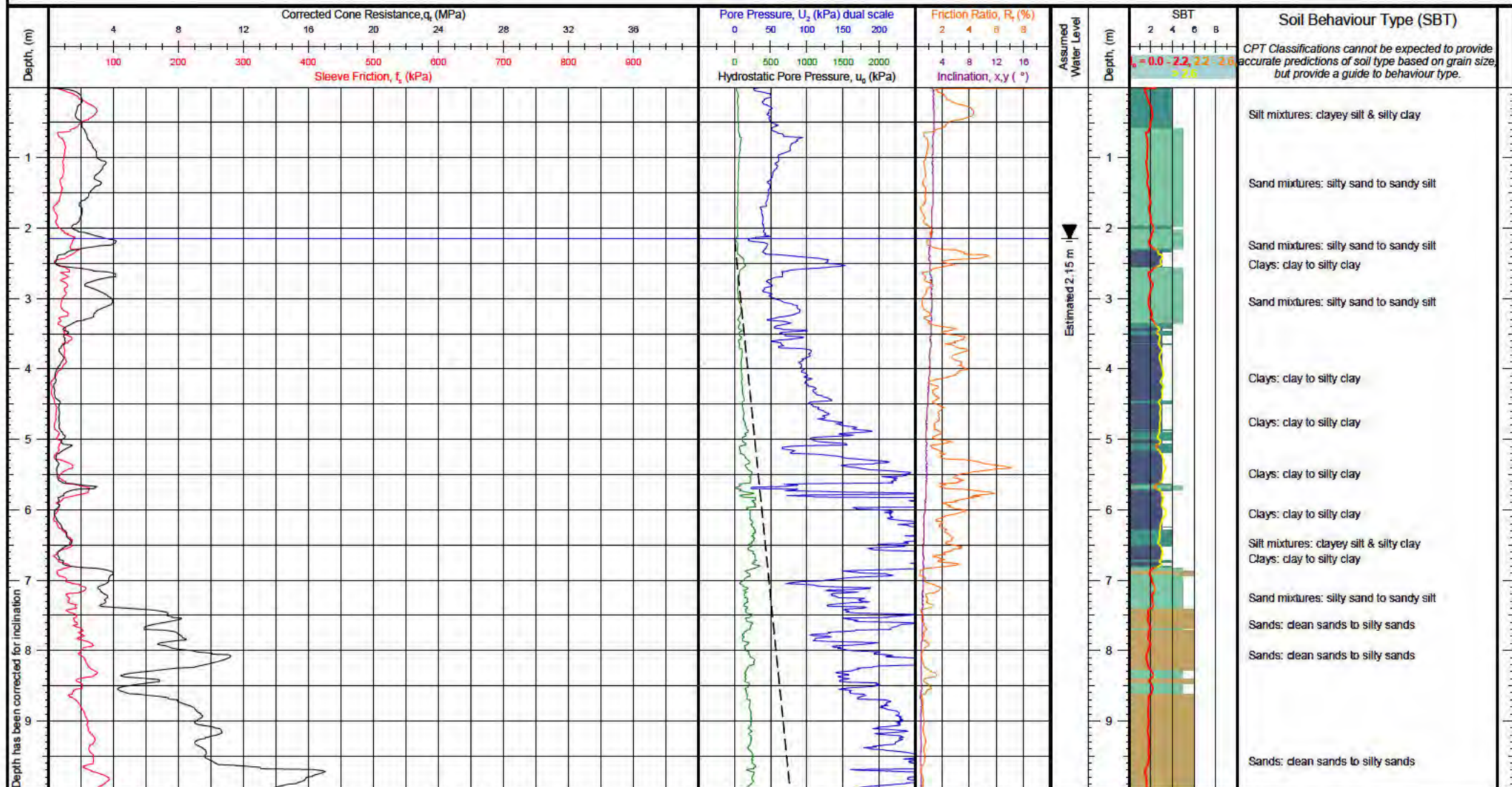
CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical Project: 101 Sabys Road Location: Halswell, Christchurch Engineer: Abilio Nogueira Contractor: Ground Investigation Ltd	Operator: Brendon Lemm Cone Ref: MKJ333 Cone Type: 10cm ² Compression Area Ratio: 0.80 Filter Type: u_2	NZTM 2000 N, E (m): 5173410.61, 1564657.53 WGS84 (deg): -43.591437, 172.562172 Location Method: Handheld GPS Surveyor: Termination Reason: Target depth	Elevation (m): Unknown Date of Test: 23/06/2021 Depth (m): 15.15 Pre Drill (m): N/A	Client Reference:
				Test Number: CPT-04 G.I. Job Ref: 210810

Comments:

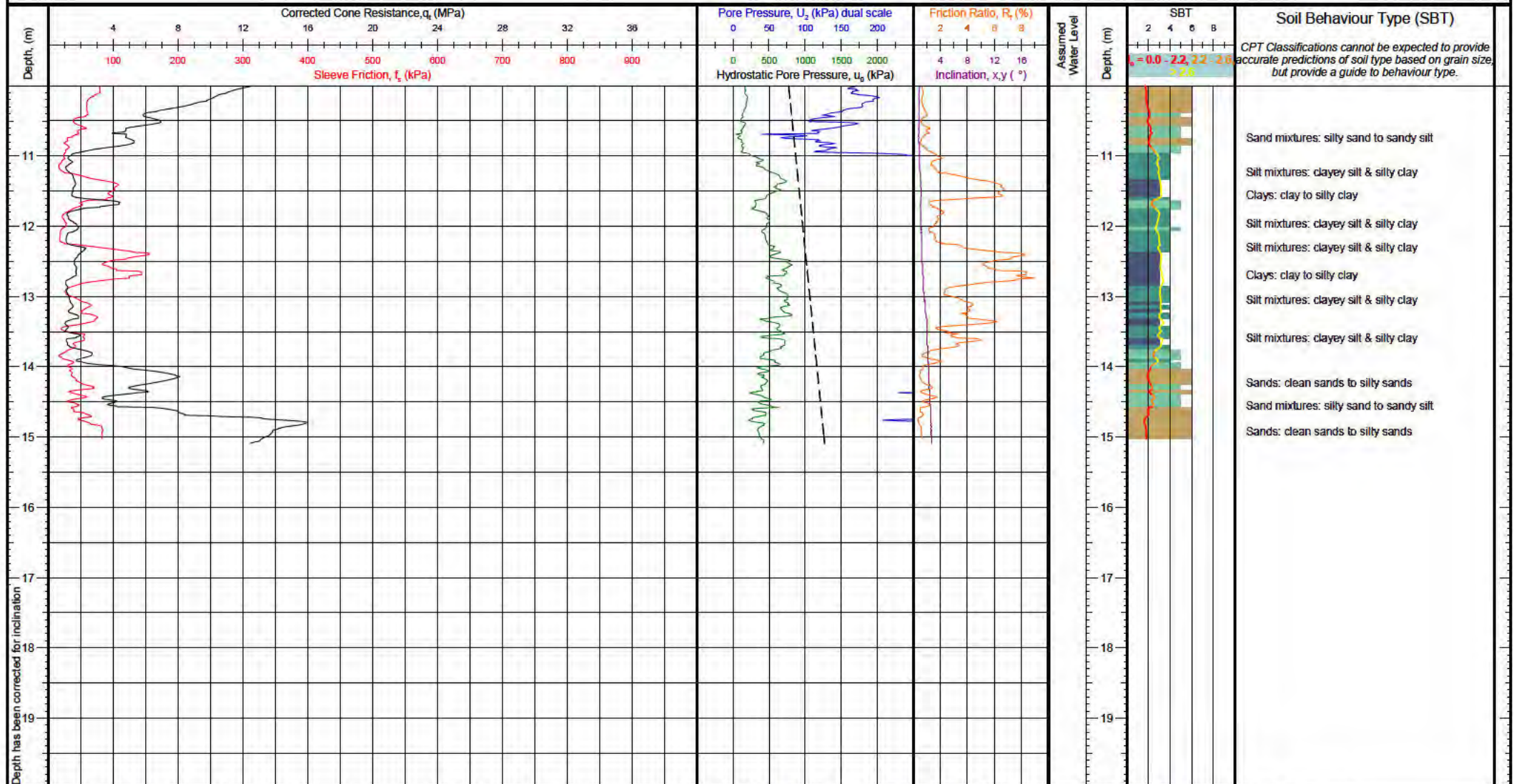
CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical	Operator: Brendon Lemm	NZTM 2000 N, E (m): 5173458.55, 1564733.89	Elevation (m): Unknown	Client Reference:
Project: 101 Sabys Road	Cone Ref: MKJ309	WGS84 (deg): -43.591009, 172.563121	Date of Test: 23/06/2021	
Location: Halswell, Christchurch	Cone Type: 10cm ² Compression	Location Method: Handheld GPS	Depth (m): 15.09	Test Number: CPT-05
Engineer: Abilio Nogueira	Area Ratio: 0.80	Surveyor:	Pre Drill (m): N/A	
Contractor: Ground Investigation Ltd	Filter Type: u ₂	Termination Reason: Target depth		G.I. Job Ref: 210810

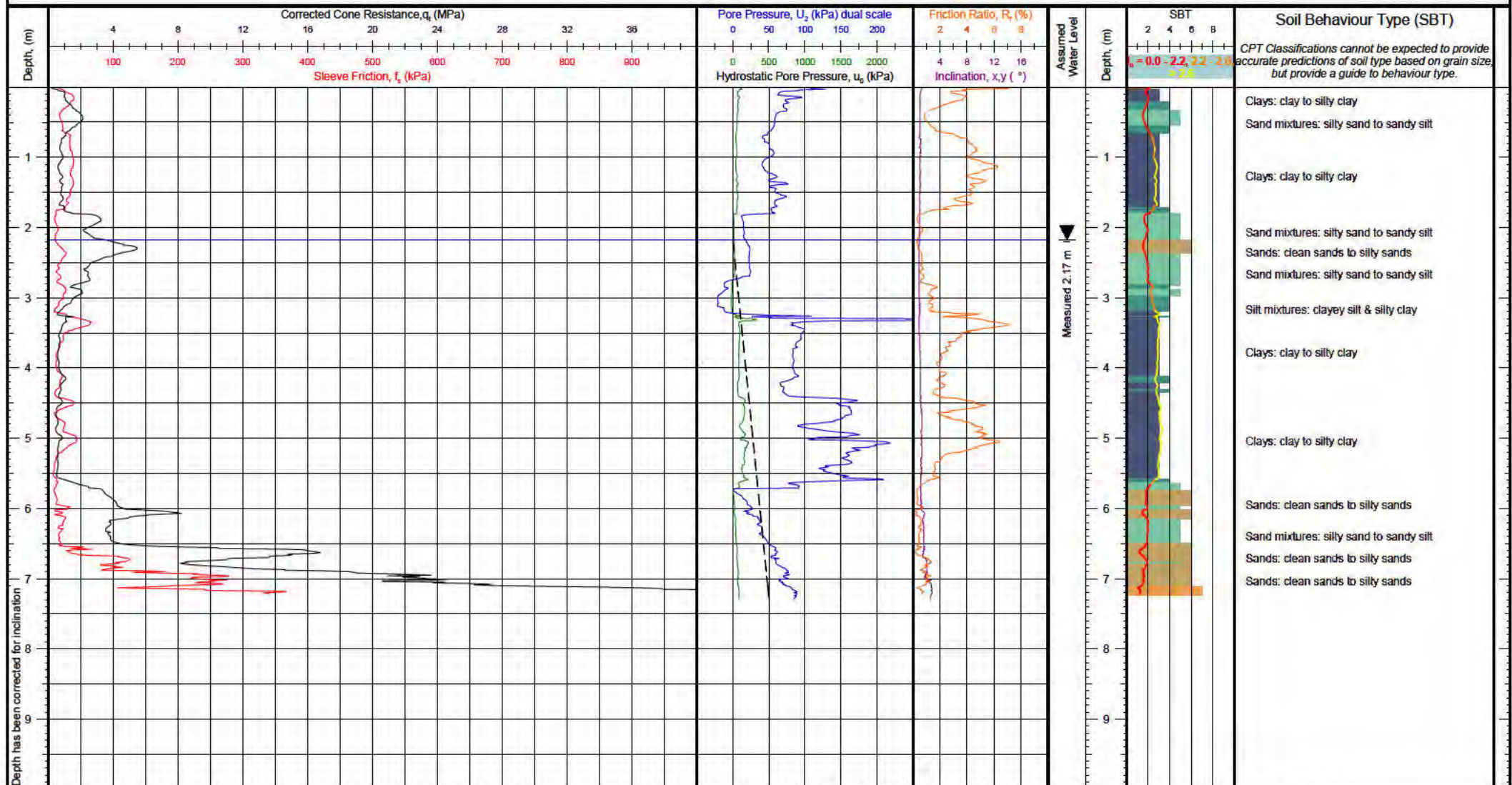
Comments:

CONE PENETRATION TEST (CPT) LOG



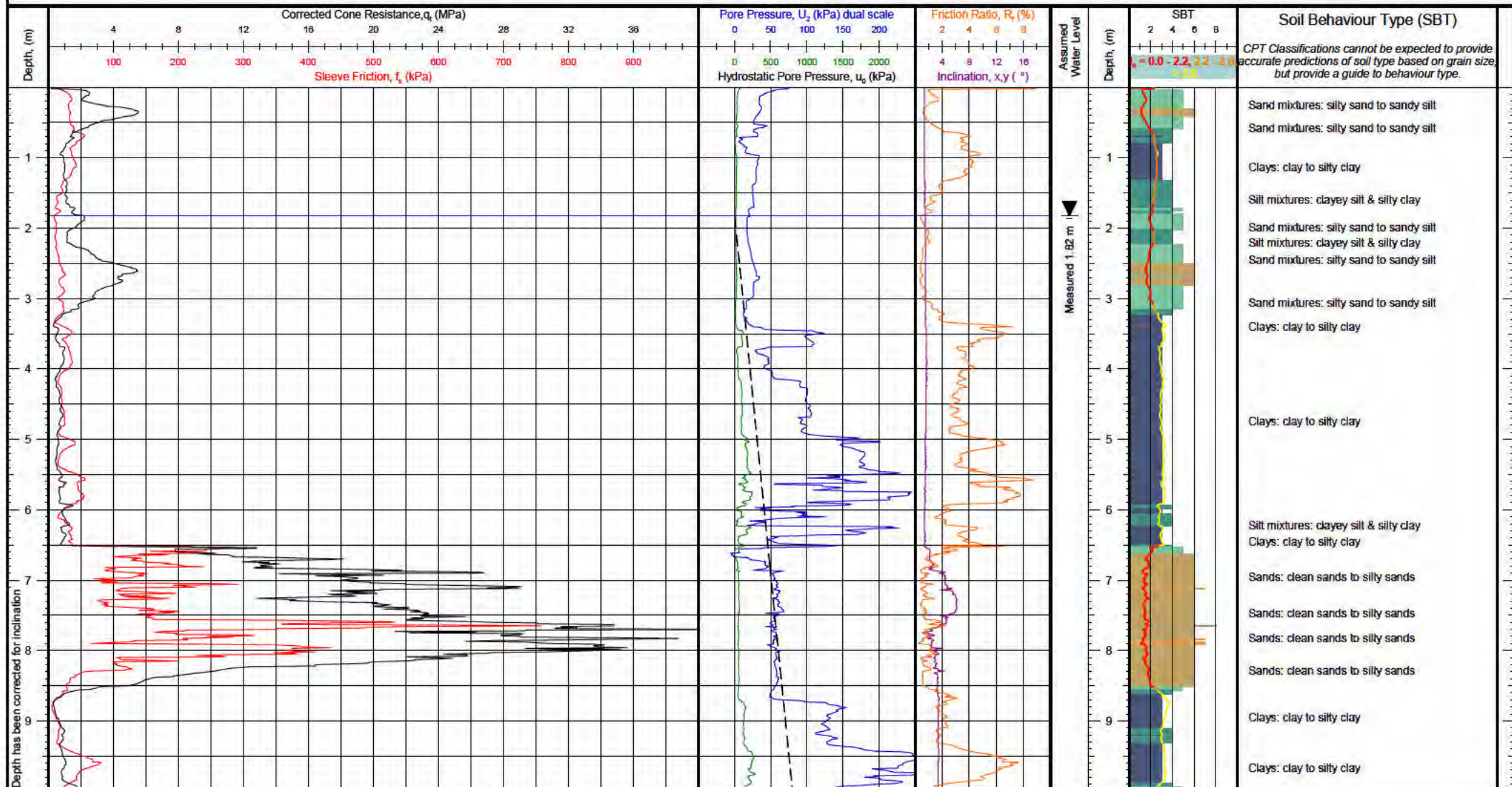
Client: KGA Geotechnical Project: 101 Sabys Road Location: Halswell, Christchurch Engineer: Abilio Nogueira Contractor: Ground Investigation Ltd Comments:	Operator: Brendon Lemm Cone Ref: MKJ309 Cone Type: 10cm ² Compression Area Ratio: 0.80 Filter Type: u_2	NZTM 2000 N, E (m): 5173458.55, 1564733.89 WGS84 (deg): -43.591009, 172.563121 Location Method: Handheld GPS Surveyor: Termination Reason: Target depth	Elevation (m): Unknown Date of Test: 23/06/2021 Depth (m): 15.09 Pre Drill (m): N/A	Client Reference: Test Number: CPT-05 G.I. Job Ref: 210810
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CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical	Operator: Brendon Lemm	NZTM 2000 N, E (m): 5173172.82, 1564446.49	Elevation (m): Unknown	Client Reference:
Project: 101 Sabys Road	Cone Ref: MKJ333	WGS84 (deg): -43.593568, 172.559542	Date of Test: 21/06/2021	
Location: Halswell, Christchurch	Cone Type: 10cm ² Compression	Location Method: Handheld GPS	Depth (m): 7.29	Test Number: CPT-06
Engineer: Abilio Nogueira	Area Ratio: 0.80	Surveyor:	Pre Drill (m): N/A	
Contractor: Ground Investigation Ltd	Filter Type: u_2	Termination Reason: High cone end resistance		G.I. Job Ref: 210810
Comments:				

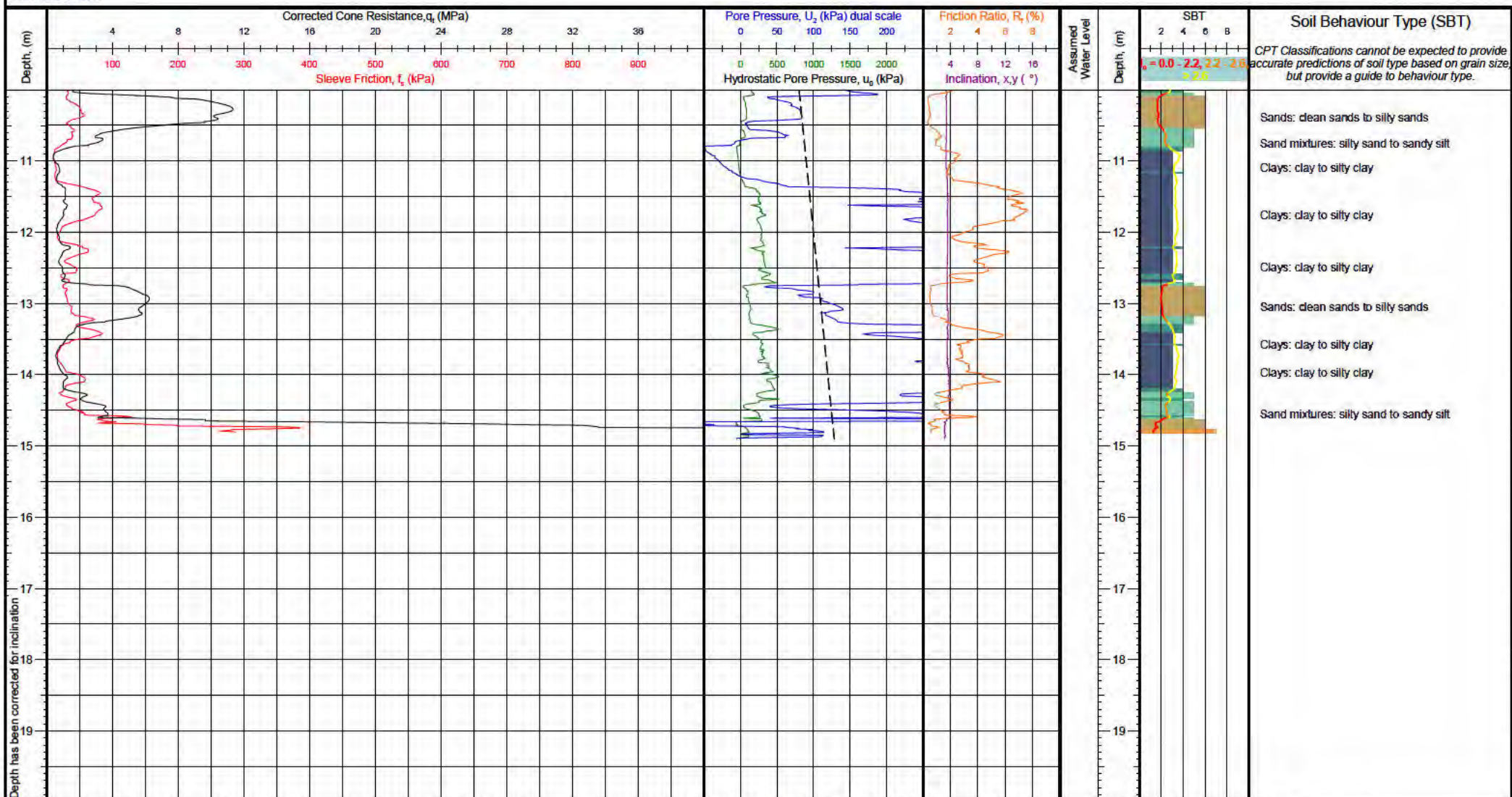
CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical	Operator: Brendon Lemm	NZTM 2000 N, E (m): 5173250.23, 1564551.18	Elevation (m): Unknown	Client Reference:
Project: 101 Sabys Road	Cone Ref: MKJ333	WGS84 (deg): -43.592876, 172.560844	Date of Test: 22/06/2021	
Location: Halswell, Christchurch	Cone Type: 10cm ² Compression	Location Method: Handheld GPS	Depth (m): 14.90	Test Number: CPT-07
Engineer: Abilio Nogueira	Area Ratio: 0.80	Surveyor:	Pre Drill (m): N/A	
Contractor: Ground Investigation Ltd	Filter Type: u_2	Termination Reason: High cone end resistance		G.I. Job Ref: 210810

Comments:

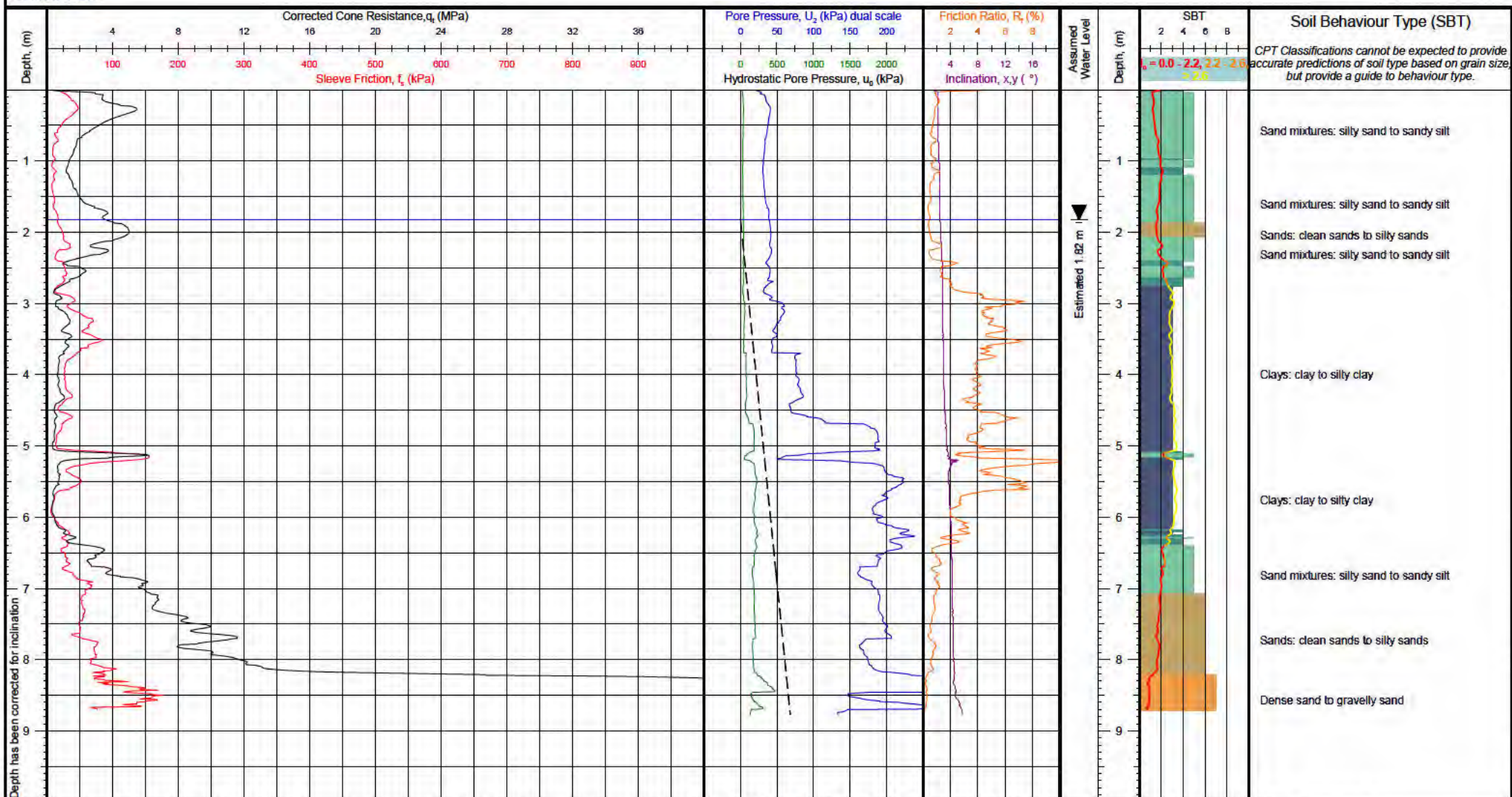
CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical Project: 101 Sabys Road Location: Halswell, Christchurch Engineer: Abilio Nogueira Contractor: Ground Investigation Ltd	Operator: Brendon Lemm Cone Ref: MKJ333 Cone Type: 10cm ² Compression Area Ratio: 0.80 Filter Type: u_2	NZTM 2000 N, E (m): 5173250.23, 1564551.18 WGS84 (deg): -43.592876, 172.560844 Location Method: Handheld GPS Surveyor: Termination Reason: High cone end resistance	Elevation (m): Unknown Date of Test: 22/06/2021 Depth (m): 14.90 Pre Drill (m): N/A	Client Reference: Test Number: CPT-07 G.I. Job Ref: 210810
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Comments:

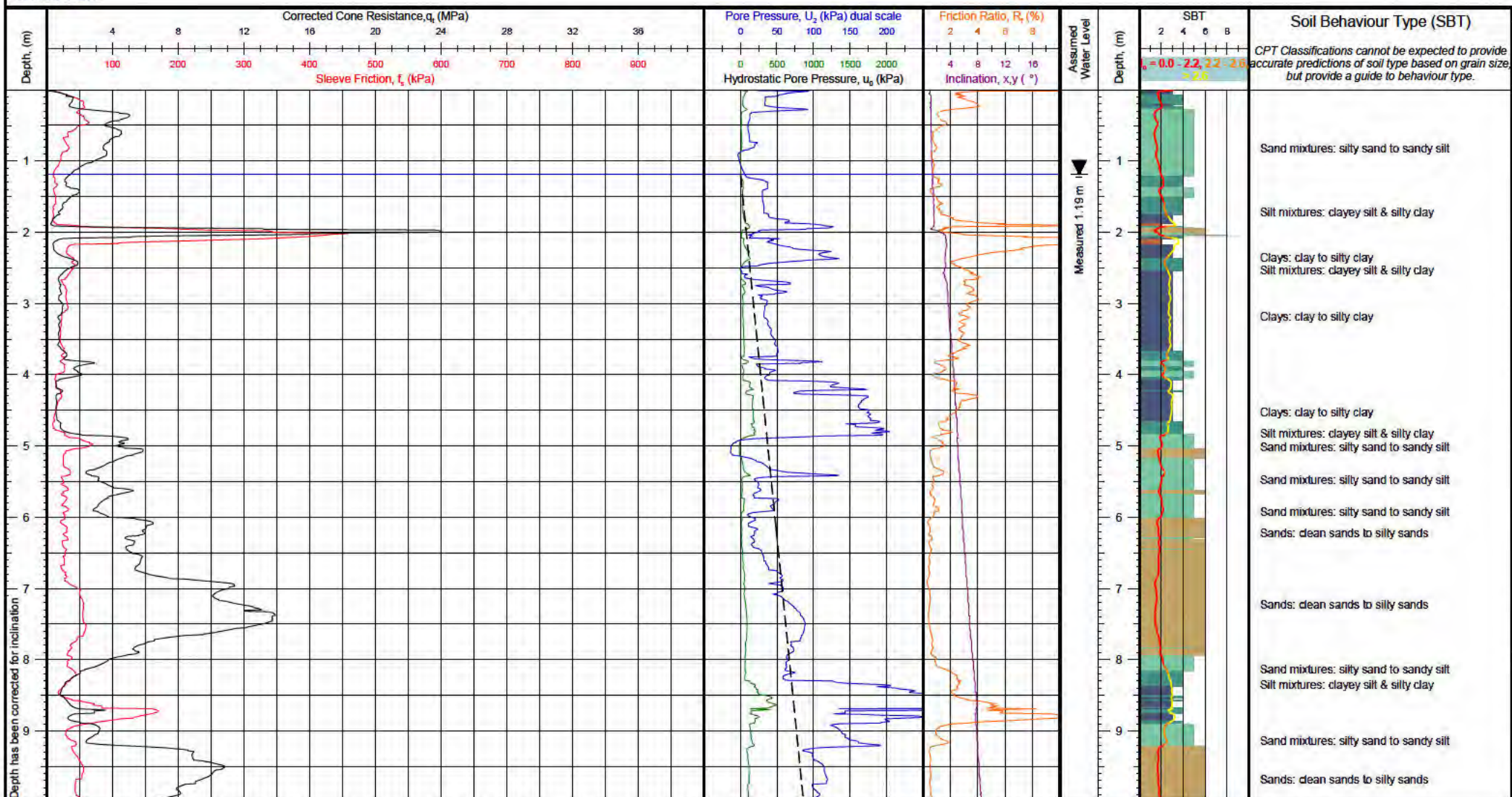
CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical	Operator: Brendon Lemm	NZTM 2000 N, E (m): 5173287.52, 1564629.36	Elevation (m): Unknown	Client Reference:
Project: 101 Sabys Road	Cone Ref: MKJ309	WGS84 (deg): -43.592544, 172.561815	Date of Test: 22/06/2021	
Location: Halswell, Christchurch	Cone Type: 10cm ² Compression	Location Method: Handheld GPS	Depth (m): 8.77	Test Number: CPT-08
Engineer: Abilio Nogueira	Area Ratio: 0.80	Surveyor:	Pre Drill (m): N/A	
Contractor: Ground Investigation Ltd	Filter Type: u ₂	Termination Reason: Limit of reaction force		G.I. Job Ref: 210810

Comments:

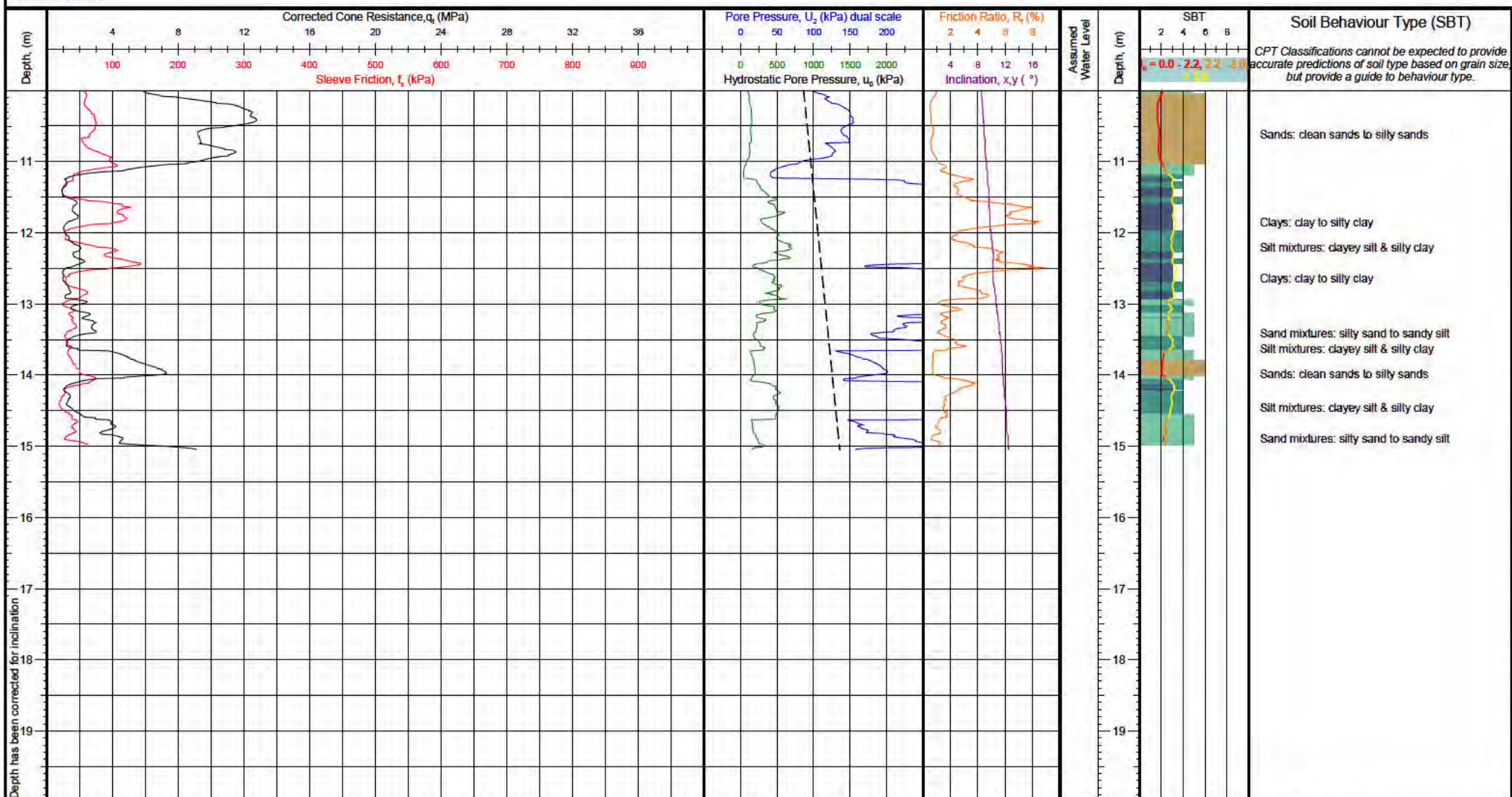
CONE PENETRATION TEST (CPT) LOG



Client: KGa Geotechnical Project: 101 Sabys Road Location: Halswell, Christchurch Engineer: Abilio Nogueira Contractor: Ground Investigation Ltd	Operator: Brendon Lemm Cone Ref: MKJ333 Cone Type: 10cm ² Compression Area Ratio: 0.80 Filter Type: u_2	NZTM 2000 N, E (m): 5173330.02, 1564686.21 WGS84 (deg): -43.592164, 172.562522 Location Method: Handheld GPS Surveyor: Termination Reason: Target depth	Elevation (m): Unknown Date of Test: 22/06/2021 Depth (m): 15.05 Pre Drill (m): N/A	Client Reference:
				Test Number: CPT-09 G.I. Job Ref: 210810

Comments:

CONE PENETRATION TEST (CPT) LOG



Client:	KGA Geotechnical
Project:	101 Sabys Road
Location:	Halswell, Christchurch
Engineer:	Abilio Nogueira
Contractor:	Ground Investigation Ltd

Operator: Brendon Lemm
Cone Ref: MKJ333
Cone Type: 10cm² Compression
Area Ratio: 0.80
Filter Type: u₂

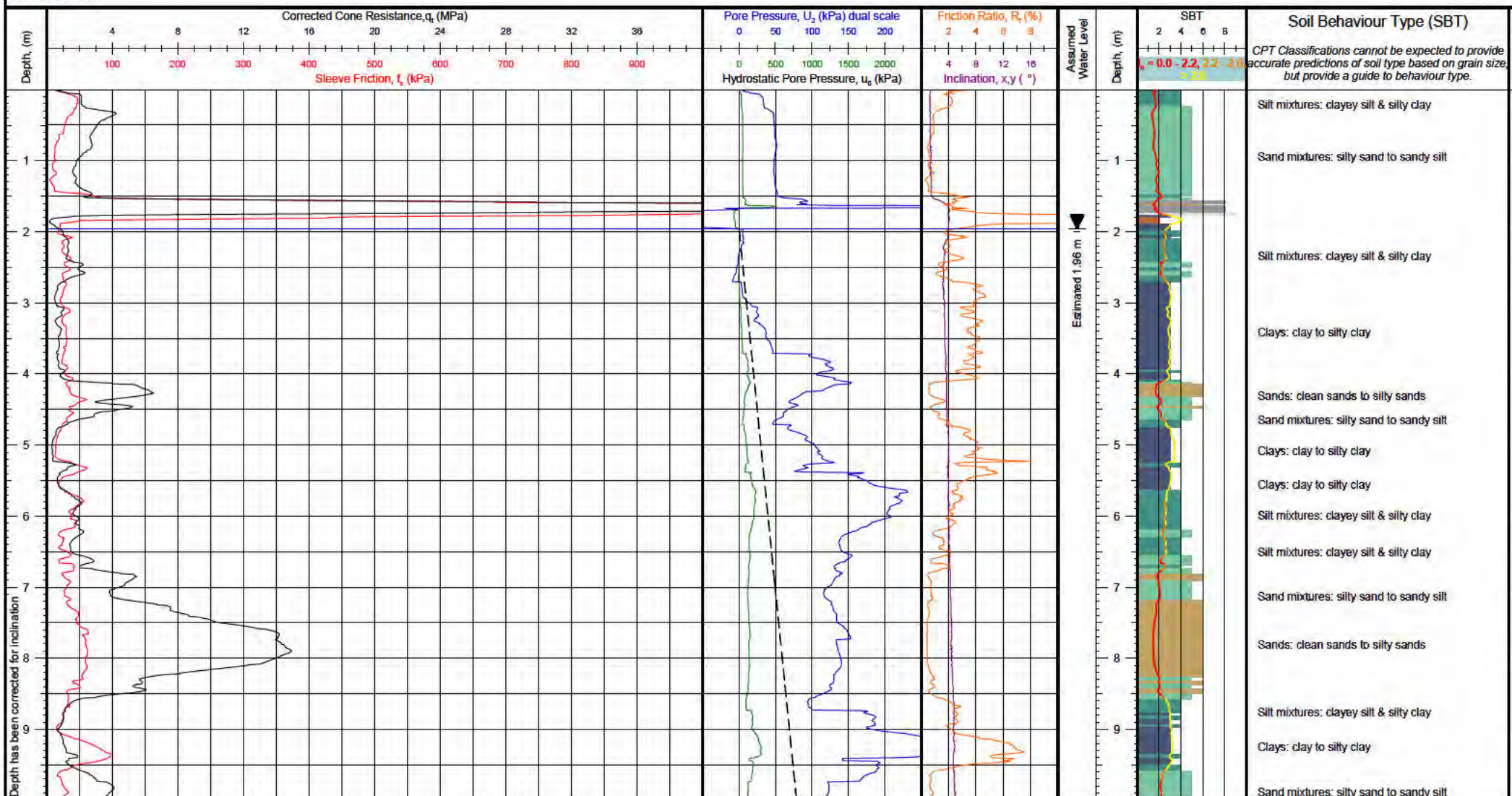
NZTM 2000 N, E (m):	5173330.02, 1564686.21
WGS84 (deg):	-43.592164, 172.562522
Location Method:	Handheld GPS
Surveyor:	
Termination Reason:	Target depth

Elevation (m):	Unknown
Date of Test:	22/06/2021
Depth (m):	15.05
Pre Drill (m):	N/A

Client Reference:	
Test Number:	CPT-09
G.I. Job Ref:	210810

Comments:

CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical
Project: 101 Sabys Road
Location: Halswell, Christchurch
Engineer: Abilio Nogueira
Contractor: Ground Investigation Ltd

Operator: Brendon Lemm
Cone Ref: MKJ309
Cone Type: 10cm² Compression
Area Ratio: 0.80
Filter Type: u_2

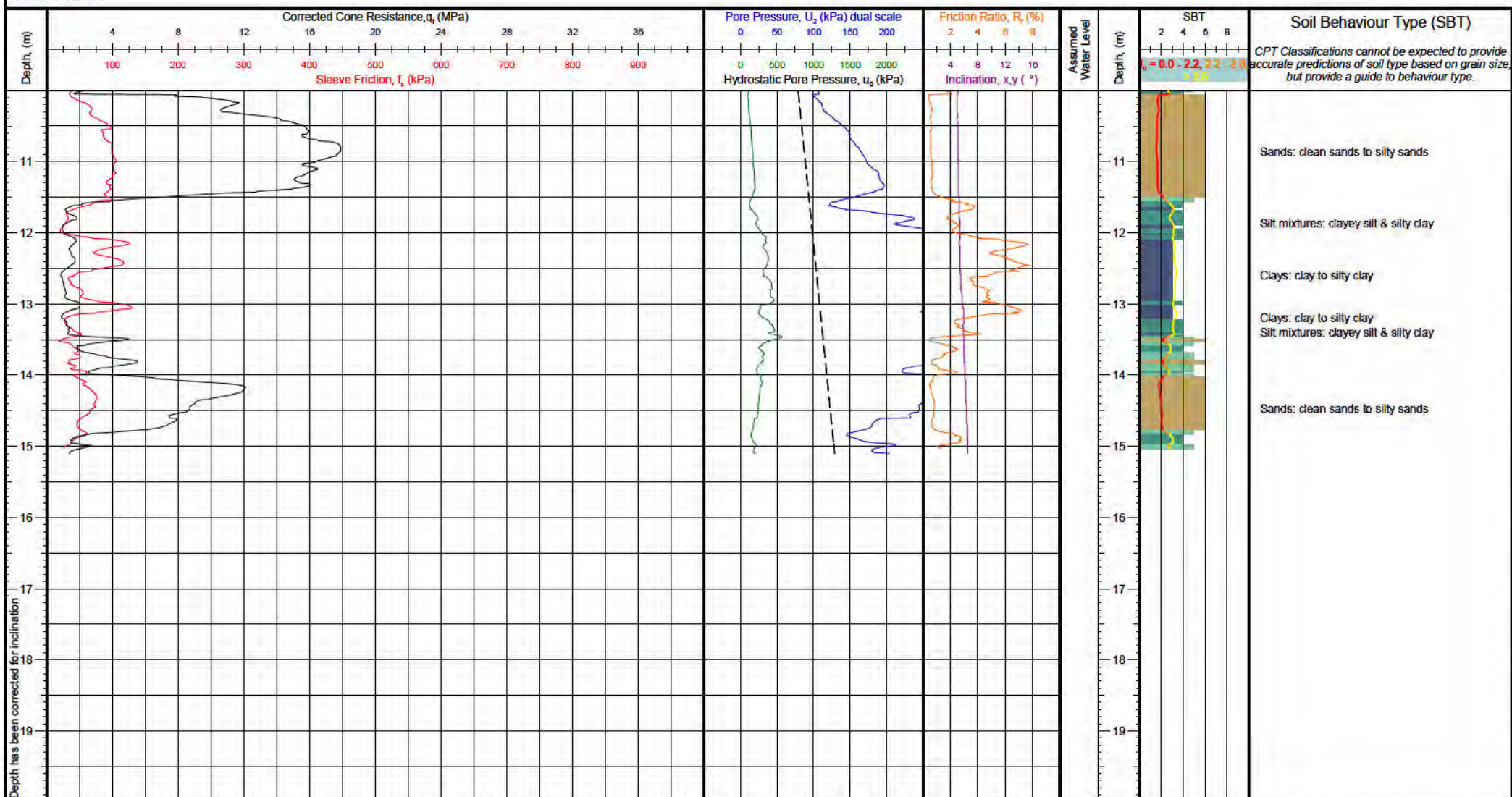
NZTM 2000 N, E (m): 5173379.90, 1564773.05
WGS84 (deg): -43.591719, 172.563601
Location Method: Handheld GPS
Surveyor:
Termination Reason: Target depth

Elevation (m): Unknown
Date of Test: 23/06/2021
Depth (m): 15.10
Pre Drill (m): N/A

Client Reference:
Test Number: CPT-10
G.I. Job Ref: 210810

Comments:

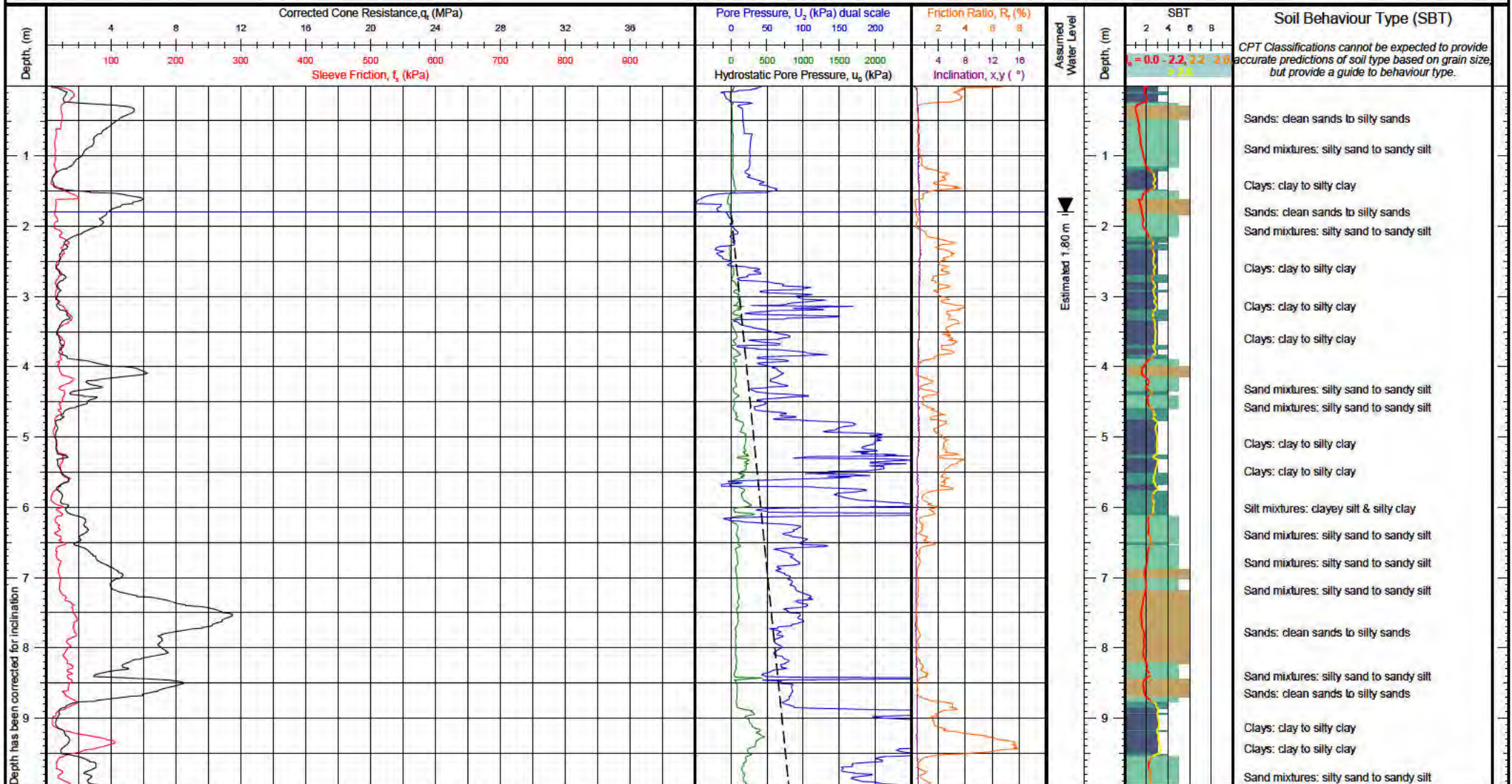
CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical	Operator: Brendon Lemm	NZTM 2000 N, E (m): 5173379.90, 1564773.05	Elevation (m): Unknown	Client Reference:
Project: 101 Sabys Road	Cone Ref: MKJ309	WGS84 (deg): -43.591719, 172.563601	Date of Test: 23/06/2021	
Location: Halswell, Christchurch	Cone Type: 10cm ² Compression	Location Method: Handheld GPS	Depth (m): 15.10	Test Number: CPT-10
Engineer: Abilio Nogueira	Area Ratio: 0.80	Surveyor:	Pre Drill (m): N/A	
Contractor: Ground Investigation Ltd	Filter Type: u_2	Termination Reason: Target depth		G.I. Job Ref: 210810

Comments:

CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical
Project: 101 Sabys Road
Location: Halswell, Christchurch
Engineer: Abilio Nogueira
Contractor: Ground Investigation Ltd

Operator: Brendon Lemm
Cone Ref: MKJ333
Cone Type: 10cm² Compression
Area Ratio: 0.80
Filter Type: u_2

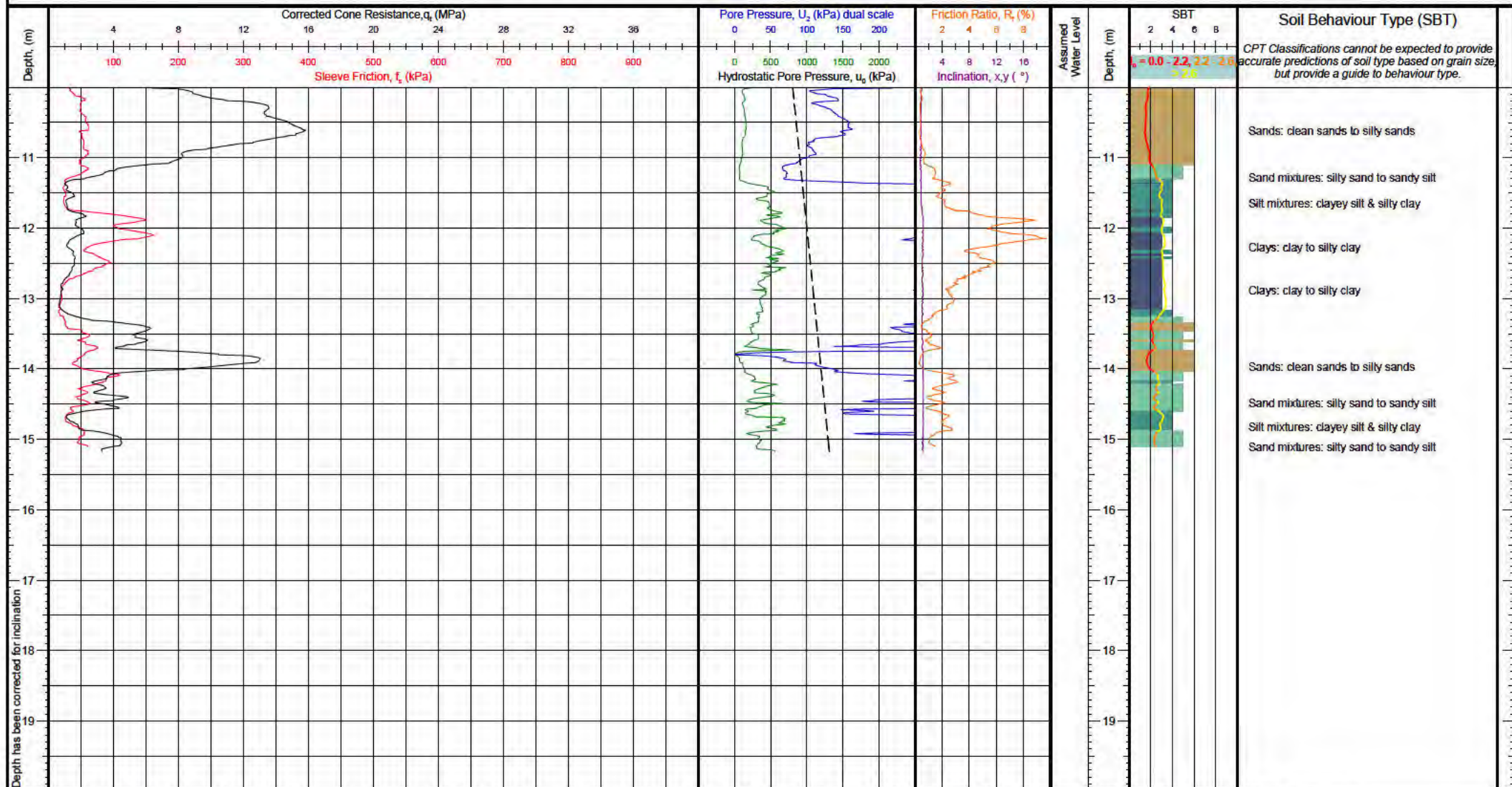
NZTM 2000 N, E (m): 5173423.70, 1564843.53
WGS84 (deg): -43.591328, 172.564477
Location Method: Handheld GPS
Surveyor:
Termination Reason: Target depth

Elevation (m): Unknown
Date of Test: 23/06/2021
Depth (m): 15.17
Pre Drill (m): N/A

Client Reference:
Test Number: CPT-11
G.I. Job Ref: 210810

Comments:

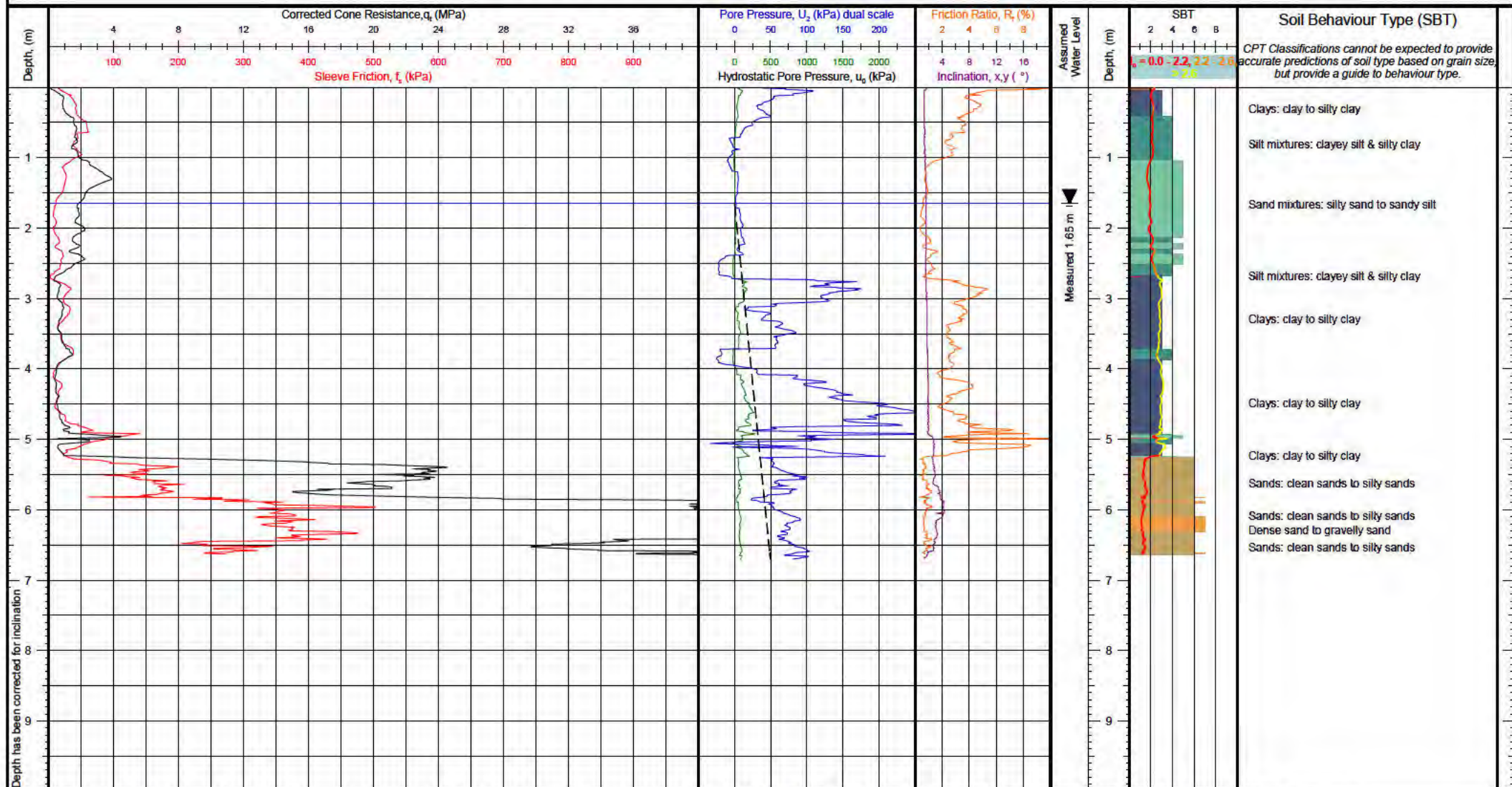
CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical Project: 101 Sabys Road Location: Halswell, Christchurch Engineer: Abilio Nogueira Contractor: Ground Investigation Ltd	Operator: Brendon Lemm Cone Ref: MKJ333 Cone Type: 10cm ² Compression Area Ratio: 0.80 Filter Type: u_2	NZTM 2000 N, E (m): 5173423.70, 1564843.53 WGS84 (deg): -43.591328, 172.564477 Location Method: Handheld GPS Surveyor: Termination Reason: Target depth	Elevation (m): Unknown Date of Test: 23/06/2021 Depth (m): 15.17 Pre Drill (m): N/A	Client Reference:
				Test Number: CPT-11 G.I. Job Ref: 210810

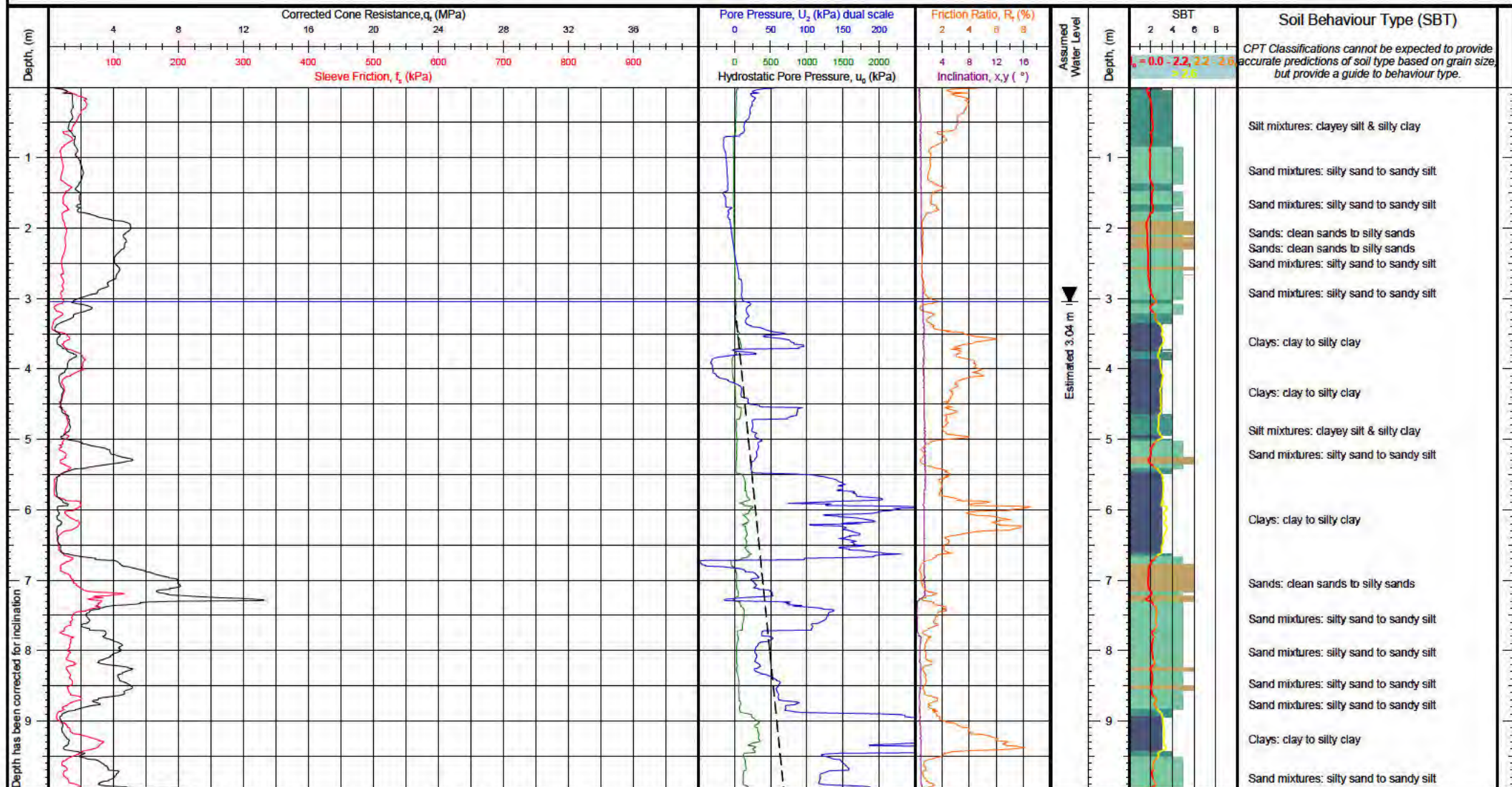
Comments:

CONE PENETRATION TEST (CPT) LOG



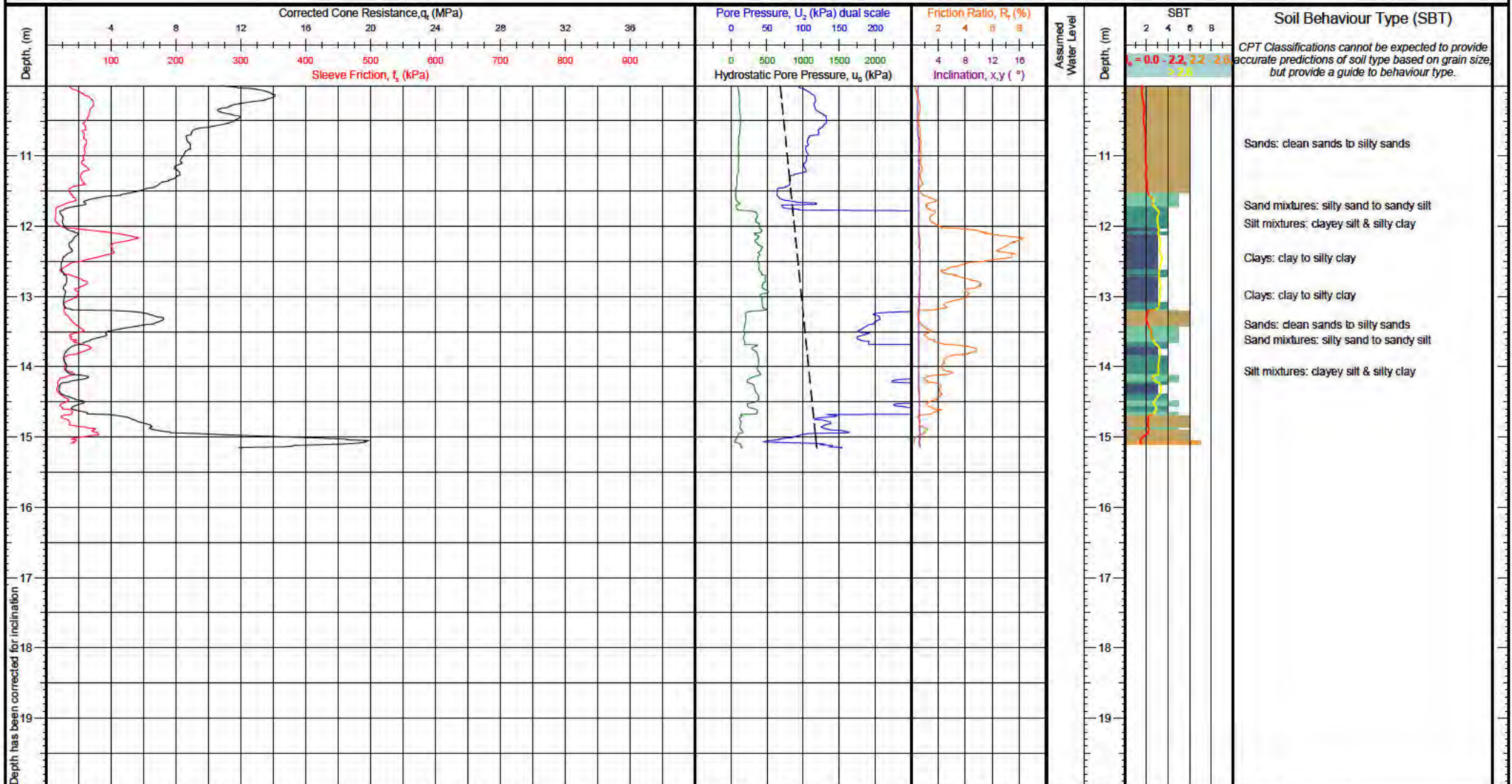
Client: KGA Geotechnical	Operator: Brendon Lemm	NZTM 2000 N, E (m): 5173144.19, 1564493.13	Elevation (m): Unknown	Client Reference:
Project: 101 Sabys Road	Cone Ref: MKJ333	WGS84 (deg): -43.593828, 172.560118	Date of Test: 21/06/2021	
Location: Halswell, Christchurch	Cone Type: 10cm ² Compression	Location Method: Handheld GPS	Depth (m): 6.70	Test Number: CPT-12
Engineer: Abilio Nogueira	Area Ratio: 0.80	Surveyor:	Pre Drill (m): N/A	
Contractor: Ground Investigation Ltd	Filter Type: u_2	Termination Reason: Limit of reaction force		G.I. Job Ref: 210810
Comments:				

CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical	Operator: Brendon Lemm	NZTM 2000 N, E (m): 5173184.77, 1564626.35	Elevation (m): Unknown	Client Reference:
Project: 101 Sabys Road	Cone Ref: MKJ333	WGS84 (deg): -43.593469, 172.561771	Date of Test: 21/06/2021	
Location: Halswell, Christchurch	Cone Type: 10cm ² Compression	Location Method: Handheld GPS	Depth (m): 15.16	Test Number: CPT-13
Engineer: Abilio Nogueira	Area Ratio: 0.80	Surveyor:	Pre Drill (m): N/A	
Contractor: Ground Investigation Ltd	Filter Type: u_2	Termination Reason: Target depth		G.I. Job Ref: 210810
Comments:				

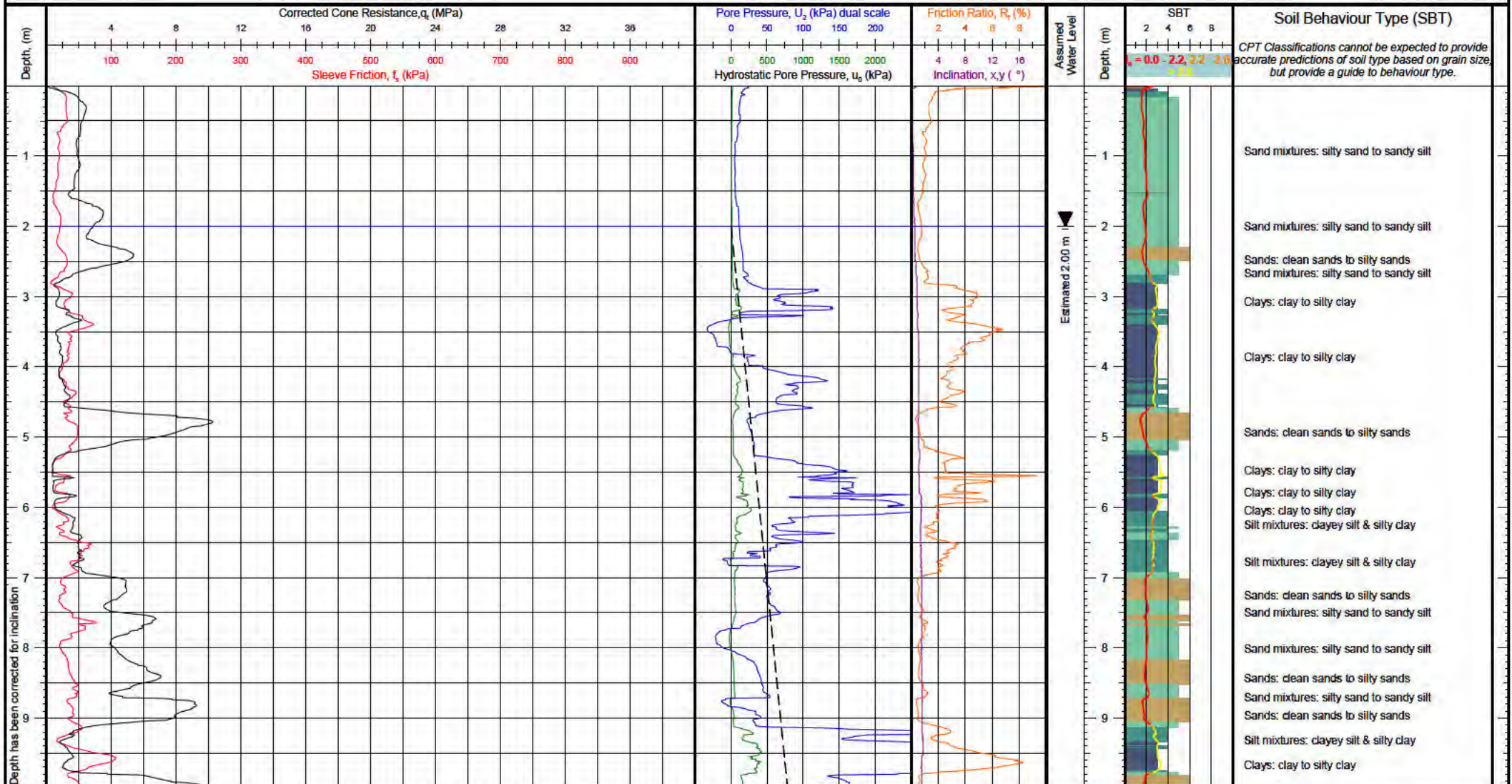
CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical Project: 101 Sabys Road Location: Halswell, Christchurch Engineer: Abilio Nogueira Contractor: Ground Investigation Ltd	Operator: Brendon Lemm Cone Ref: MKJ333 Cone Type: 10cm ² Compression Area Ratio: 0.80 Filter Type: u_2	NZTM 2000 N, E (m): 5173184.77, 1564626.35 WGS84 (deg): -43.593469, 172.561771 Location Method: Handheld GPS Surveyor: Termination Reason: Target depth	Elevation (m): Unknown Date of Test: 21/06/2021 Depth (m): 15.16 Pre Drill (m): N/A	Client Reference:
				Test Number: CPT-13 G.I. Job Ref: 210810

Comments:

CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical
Project: 101 Sabys Road
Location: Halswell, Christchurch
Engineer: Abilio Nogueira
Contractor: Ground Investigation Ltd

Operator: Brendon Lemm
Cone Ref: MKJ333
Cone Type: 10cm² Compression
Area Ratio: 0.80
Filter Type: u_2

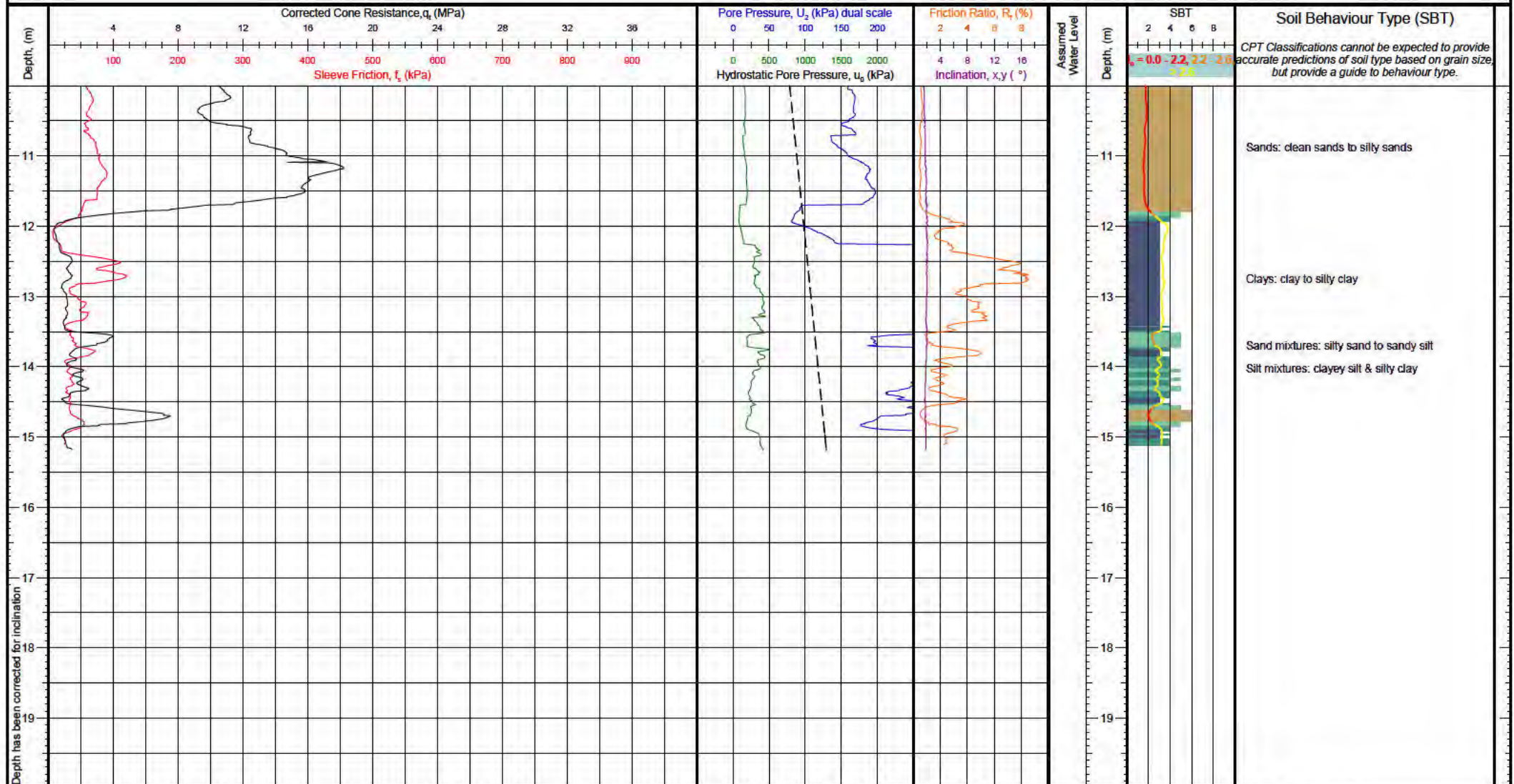
NZTM 2000 N, E (m): 5173255.64, 1564733.50
WGS84 (deg): -43.592836, 172.563103
Location Method: Handheld GPS
Surveyor:
Termination Reason: Target depth

Elevation (m): Unknown
Date of Test: 22/06/2021
Depth (m): 15.18
Pre Drill (m): N/A

Client Reference:
Test Number: CPT-14
G.I. Job Ref: 210810

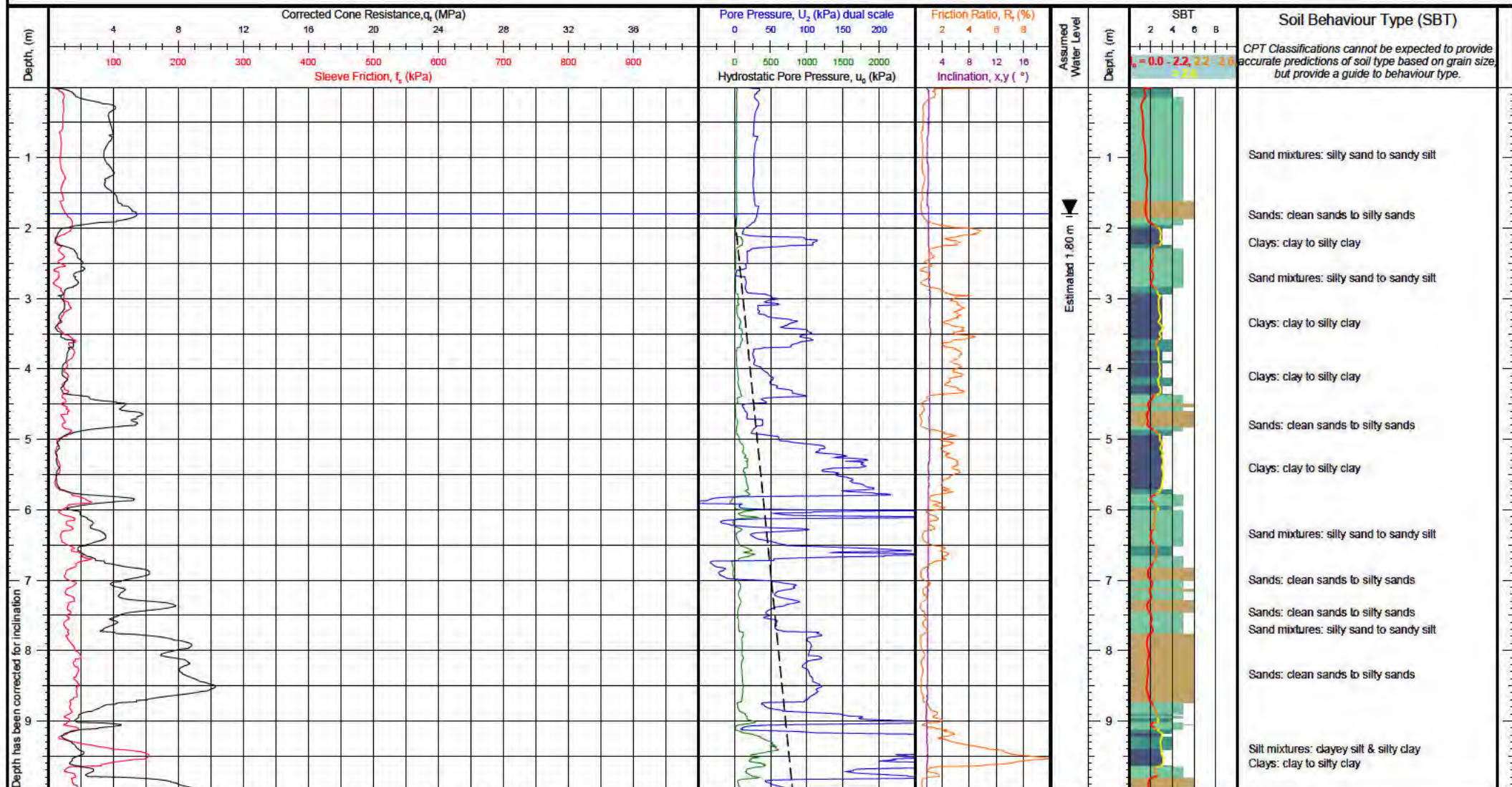
Comments:

CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical	Operator: Brendon Lemm	NZTM 2000 N, E (m): 5173255.64, 1564733.50	Elevation (m): Unknown	Client Reference:
Project: 101 Sabys Road	Cone Ref: MKJ333	WGS84 (deg): -43.592836, 172.563103	Date of Test: 22/06/2021	
Location: Halswell, Christchurch	Cone Type: 10cm ² Compression	Location Method: Handheld GPS	Depth (m): 15.18	Test Number: CPT-14
Engineer: Abilio Nogueira	Area Ratio: 0.80	Surveyor:	Pre Drill (m): N/A	
Contractor: Ground Investigation Ltd	Filter Type: u_2	Termination Reason: Target depth		G.I. Job Ref: 210810
Comments:				

CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical
Project: 101 Sabys Road
Location: Halswell, Christchurch
Engineer: Abilio Nogueira
Contractor: Ground Investigation Ltd

Operator: Brendon Lemm
Cone Ref: MKJ333
Cone Type: 10cm² Compression
Area Ratio: 0.80
Filter Type: u_2

NZTM 2000 N, E (m): 5173324.97, 1564844.70
WGS84 (deg): -43.592217, 172.564485
Location Method: Handheld GPS
Surveyor:
Termination Reason: Target depth

Elevation (m): Unknown
Date of Test: 22/06/2021
Depth (m): 15.45
Pre Drill (m): N/A

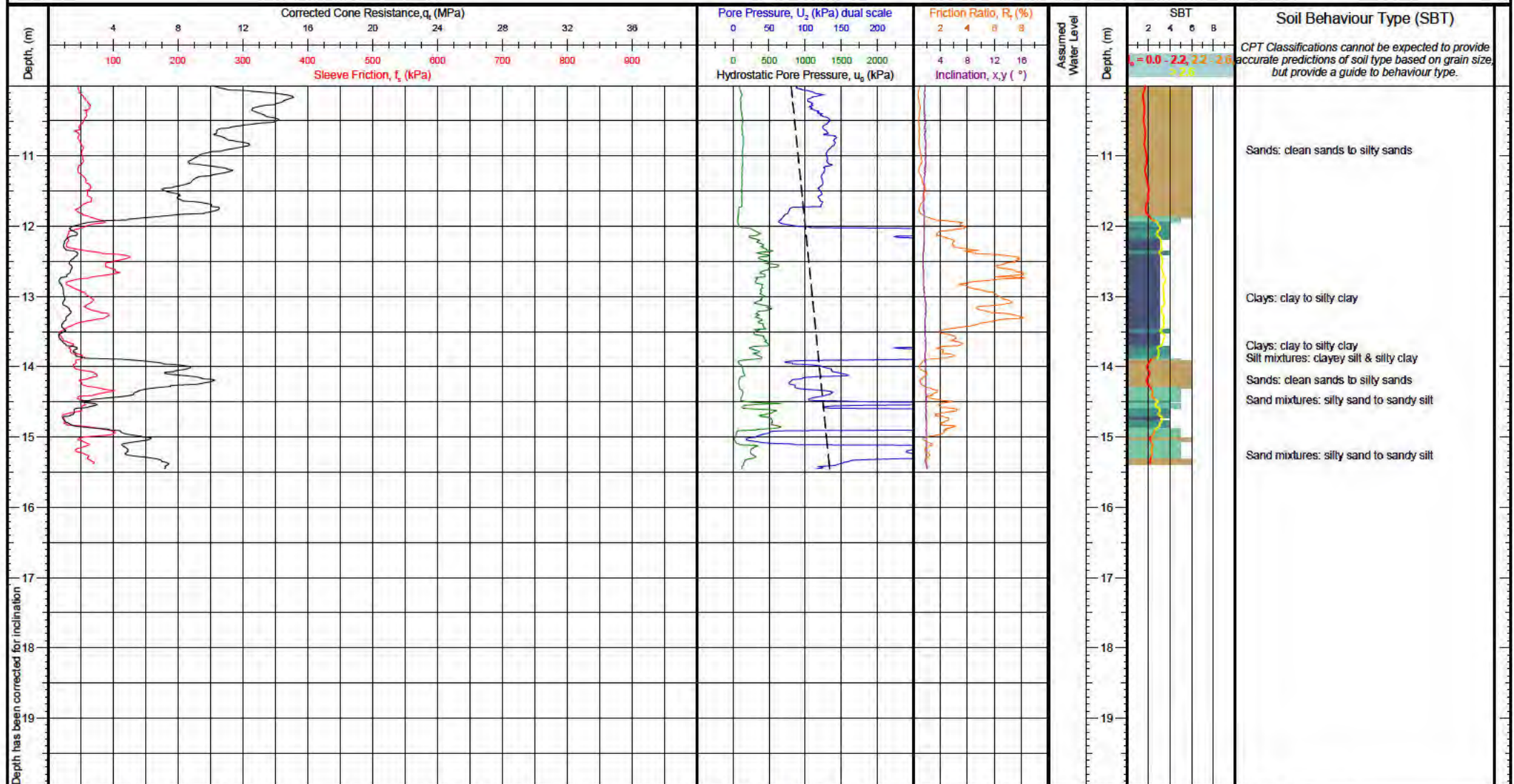
Client Reference:

Test Number: CPT-15

G.I. Job Ref: 210810

Comments:

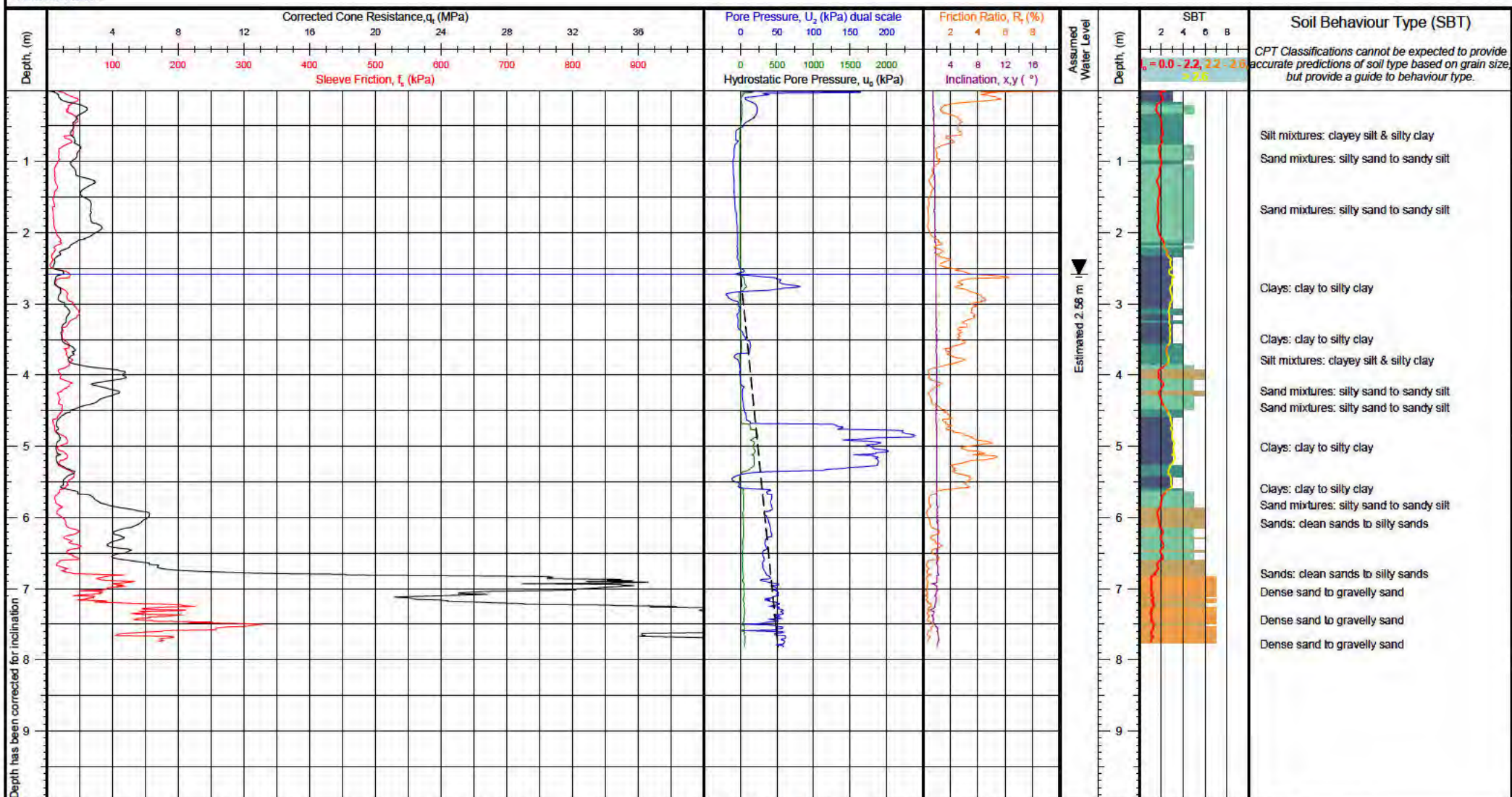
CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical Project: 101 Sabys Road Location: Halswell, Christchurch Engineer: Abilio Nogueira Contractor: Ground Investigation Ltd	Operator: Brendon Lemm Cone Ref: MKJ333 Cone Type: 10cm ² Compression Area Ratio: 0.80 Filter Type: u_2	NZTM 2000 N, E (m): 5173324.97, 1564844.70 WGS84 (deg): -43.592217, 172.564485 Location Method: Handheld GPS Surveyor: Termination Reason: Target depth	Elevation (m): Unknown Date of Test: 22/06/2021 Depth (m): 15.45 Pre Drill (m): N/A	Client Reference:
				Test Number: CPT-15 G.I. Job Ref: 210810

Comments:

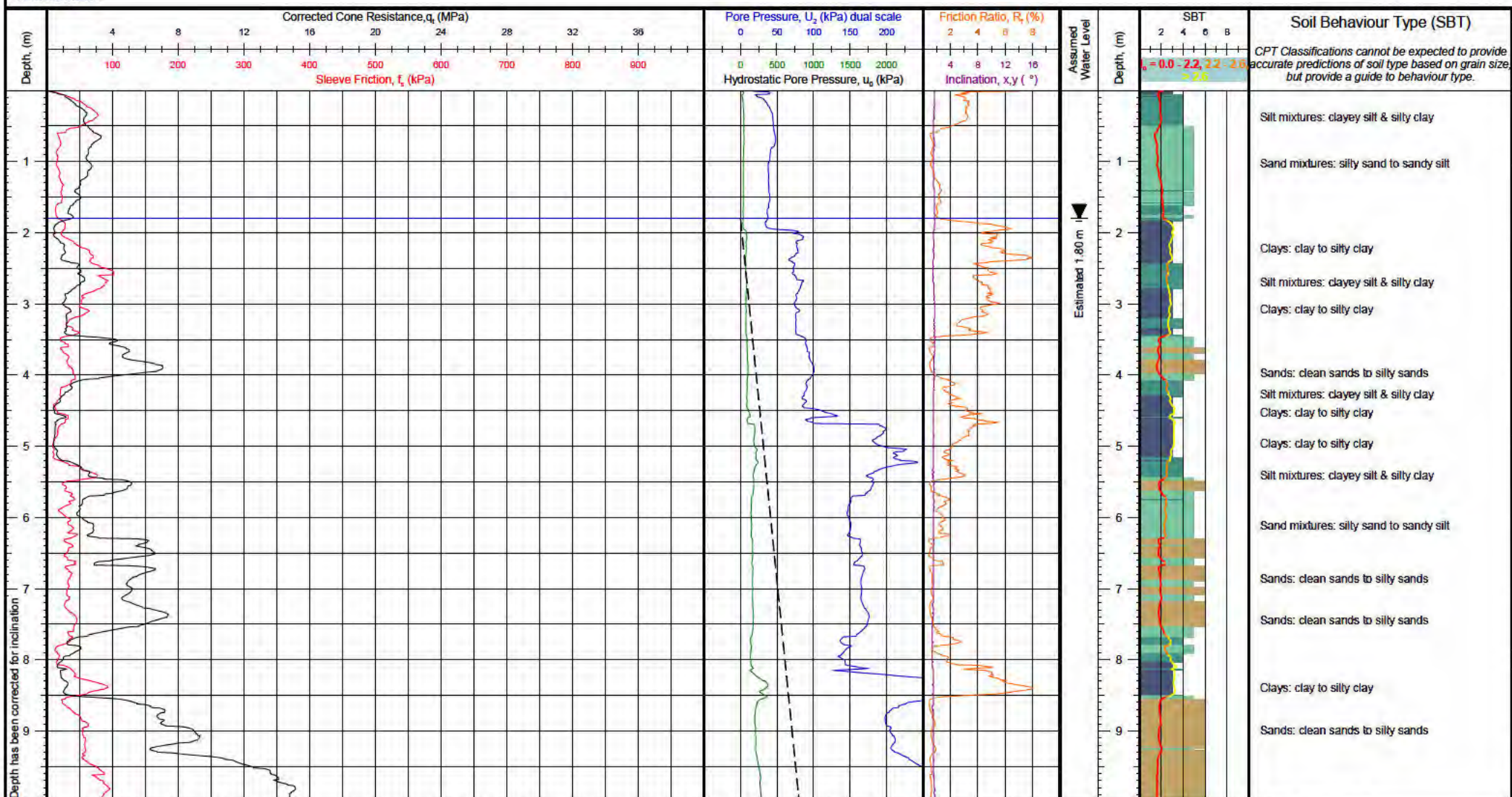
CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical	Operator: Brendon Lemm	NZTM 2000 N, E (m): 5173150.20, 1564663.34	Elevation (m): Unknown	Client Reference:
Project: 101 Sabys Road	Cone Ref: MKJ333	WGS84 (deg): -43.593782, 172.562227	Date of Test: 21/06/2021	
Location: Halswell, Christchurch	Cone Type: 10cm ² Compression	Location Method: Handheld GPS	Depth (m): 7.82	Test Number: CPT-16
Engineer: Abilio Nogueira	Area Ratio: 0.80	Surveyor:	Pre Drill (m): N/A	
Contractor: Ground Investigation Ltd	Filter Type: u ₂	Termination Reason: Limit of reaction force		G.I. Job Ref: 210810

Comments:

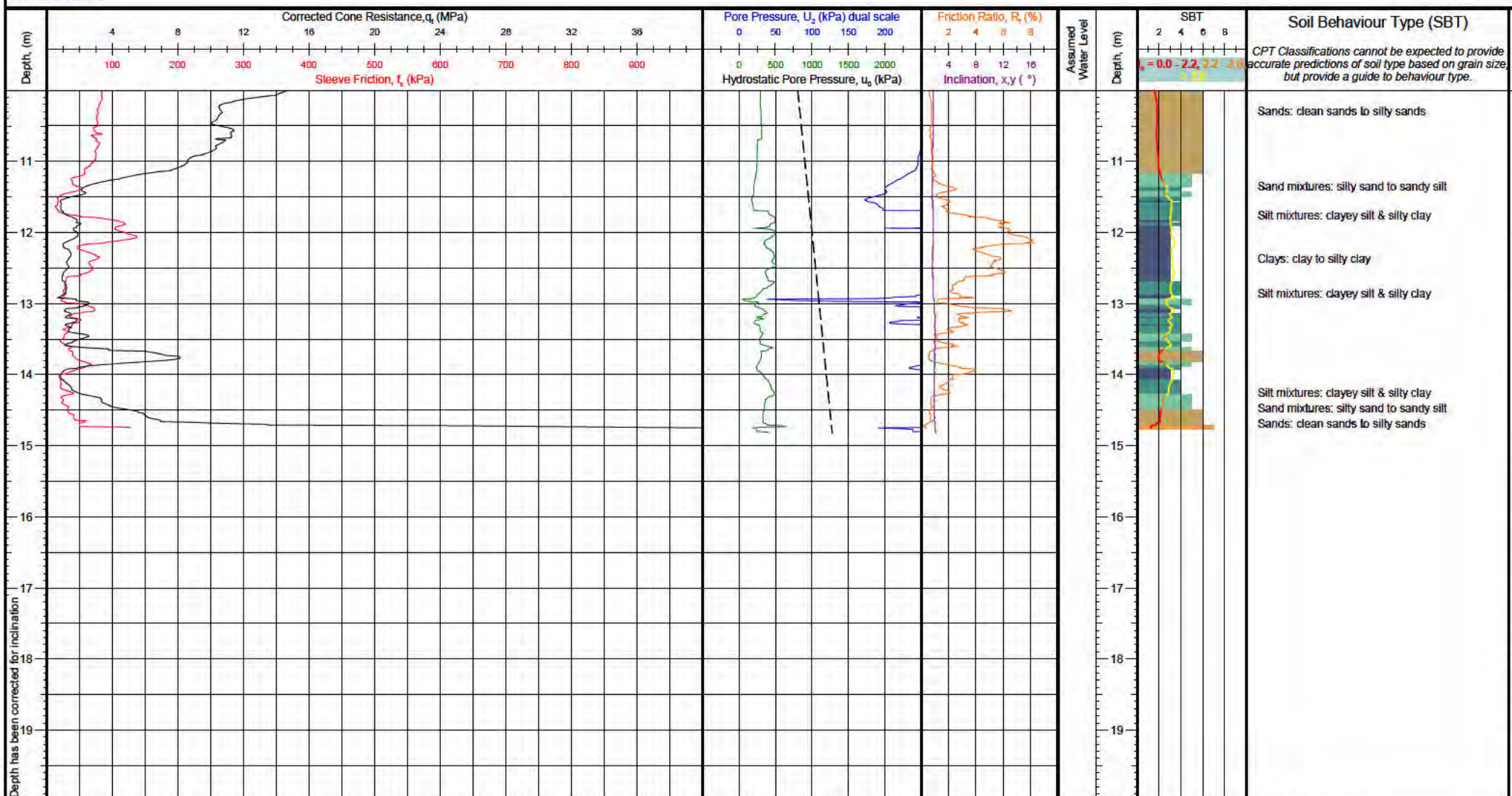
CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical	Operator: Brendon Lemm	NZTM 2000 N, E (m): 5173196.95, 1564788.78	Elevation (m): Unknown	Client Reference:
Project: 101 Sabys Road	Cone Ref: MKJ309	WGS84 (deg): -43.593367, 172.563784	Date of Test: 22/06/2021	
Location: Halswell, Christchurch	Cone Type: 10cm ² Compression	Location Method: Handheld GPS	Depth (m): 14.82	Test Number: CPT-17
Engineer: Abilio Nogueira	Area Ratio: 0.80	Surveyor:	Pre Drill (m): N/A	
Contractor: Ground Investigation Ltd	Filter Type: u ₂	Termination Reason: High cone end resistance		G.I. Job Ref: 210810

Comments:

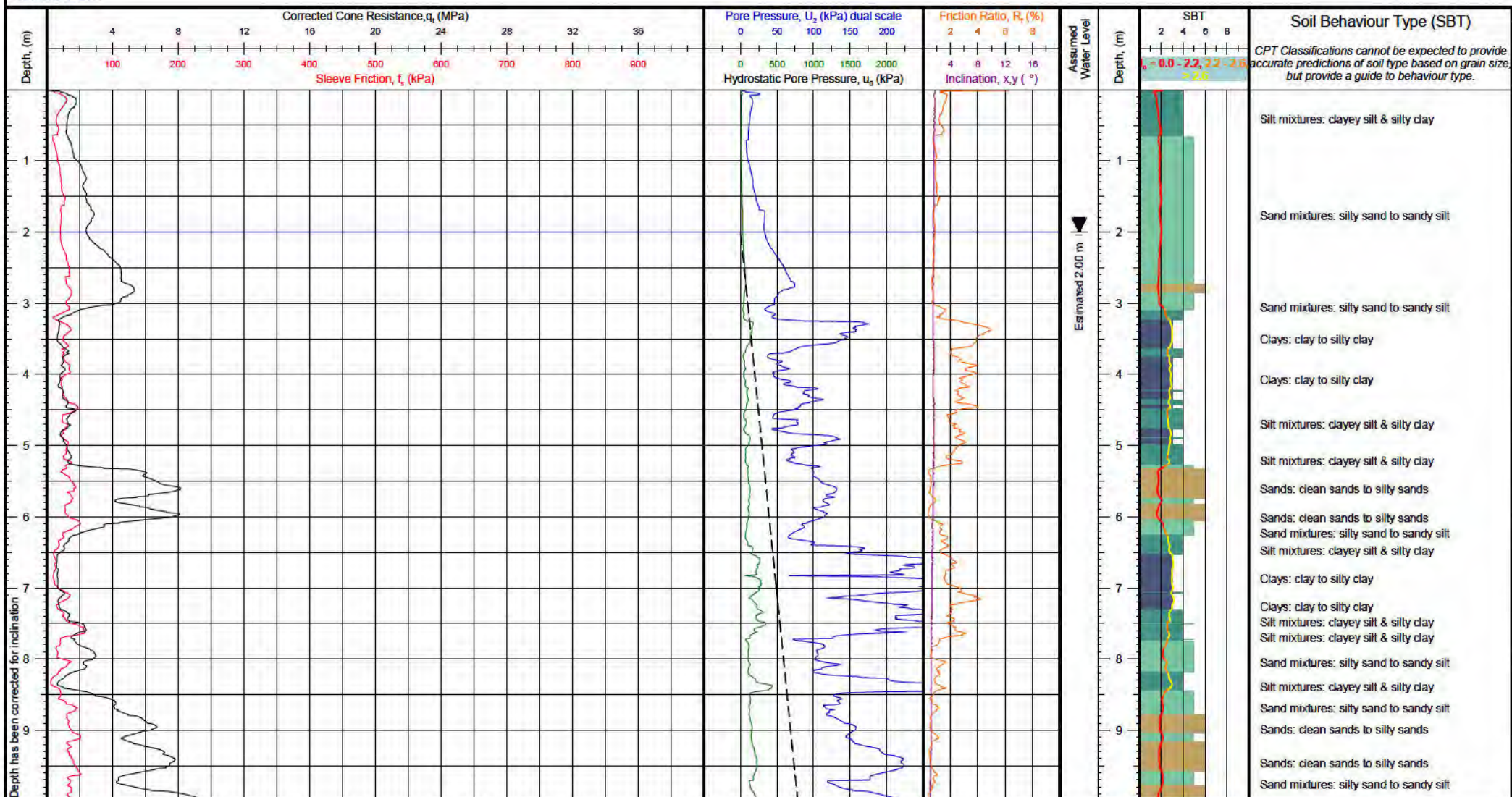
CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical	Operator: Brendon Lemm	NZTM 2000 N, E (m): 5173196.95, 1564788.78	Elevation (m): Unknown	Client Reference:
Project: 101 Sabys Road	Cone Ref: MKJ309	WGS84 (deg): -43.593367, 172.563784	Date of Test: 22/06/2021	
Location: Halswell, Christchurch	Cone Type: 10cm ² Compression	Location Method: Handheld GPS	Depth (m): 14.82	Test Number: CPT-17
Engineer: Abilio Nogueira	Area Ratio: 0.80	Surveyor:	Pre Drill (m): N/A	
Contractor: Ground Investigation Ltd	Filter Type: u ₂	Termination Reason: High cone end resistance		G.I. Job Ref: 210810

Comments:

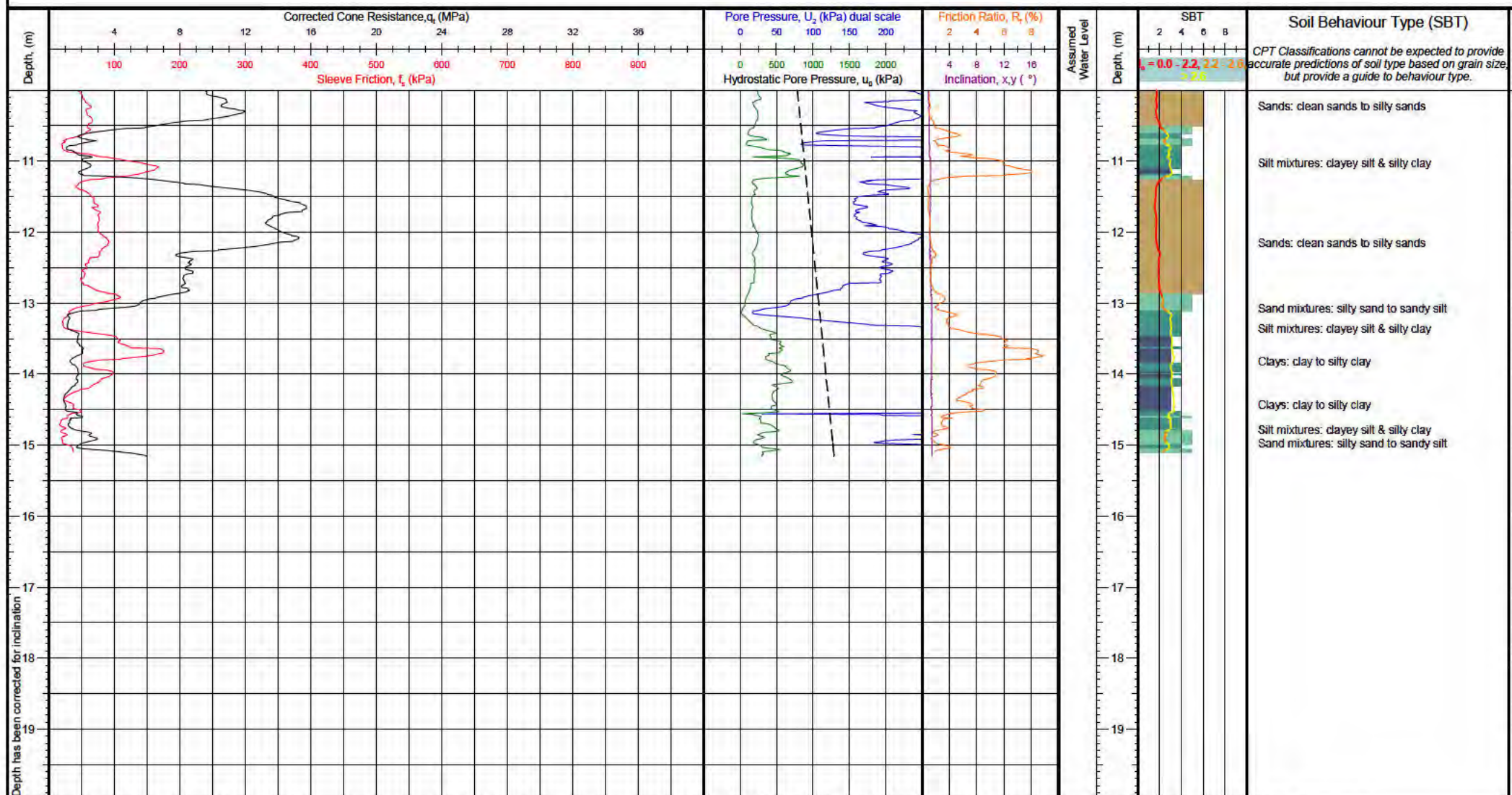
CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical	Operator: Brendon Lemm	NZTM 2000 N, E (m): 5173251.70, 1564872.61	Elevation (m): Unknown	Client Reference:
Project: 101 Sabys Road	Cone Ref: MKJ309	WGS84 (deg): -43.592878, 172.564826	Date of Test: 22/06/2021	
Location: Halswell, Christchurch	Cone Type: 10cm ² Compression	Location Method: Handheld GPS	Depth (m): 15.16	Test Number: CPT-18
Engineer: Abilio Nogueira	Area Ratio: 0.80	Surveyor:	Pre Drill (m): N/A	
Contractor: Ground Investigation Ltd	Filter Type: u ₂	Termination Reason: Target depth		G.I. Job Ref: 210810

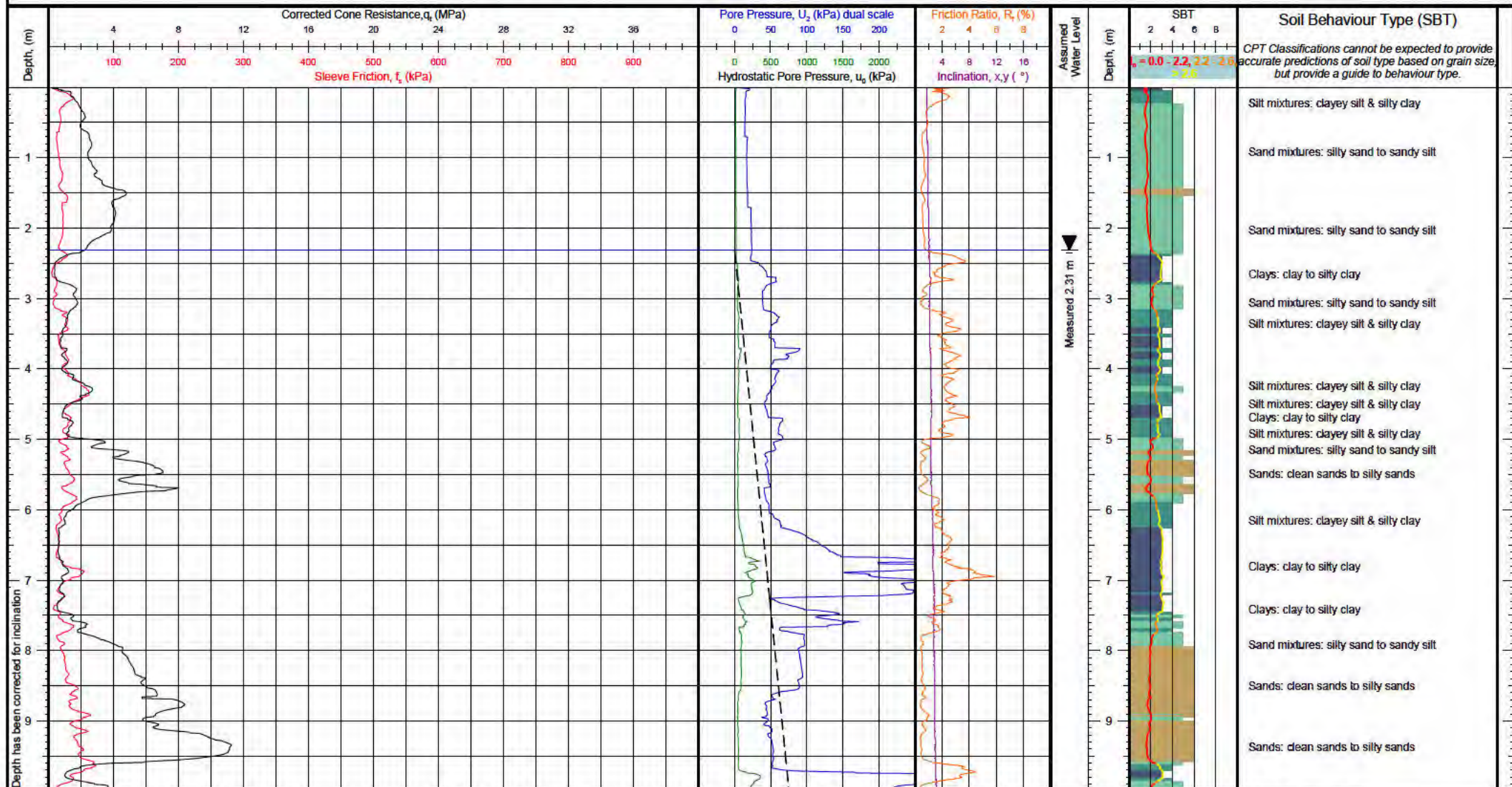
Comments:

CONE PENETRATION TEST (CPT) LOG



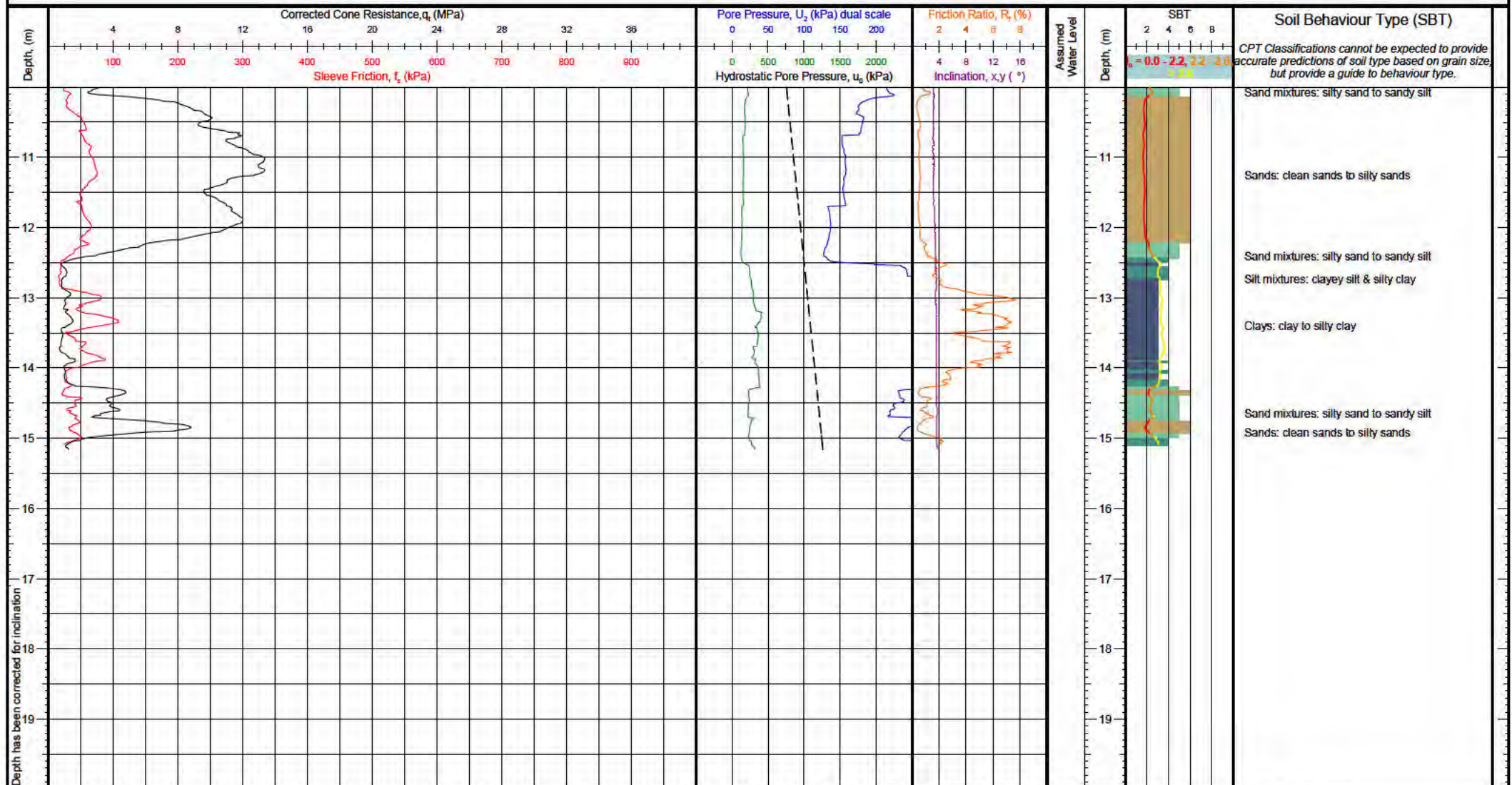
Client: KGA Geotechnical Project: 101 Sabys Road Location: Halswell, Christchurch Engineer: Abilio Nogueira Contractor: Ground Investigation Ltd Comments:	Operator: Brendon Lemm Cone Ref: MKJ309 Cone Type: 10cm ² Compression Area Ratio: 0.80 Filter Type: u ₂	NZTM 2000 N, E (m): 5173251.70, 1564872.61 WGS84 (deg): -43.592878, 172.564826 Location Method: Handheld GPS Surveyor: Termination Reason: Target depth	Elevation (m): Unknown Date of Test: 22/06/2021 Depth (m): 15.16 Pre Drill (m): N/A	Client Reference:
				Test Number: CPT-18 G.I. Job Ref: 210810

CONE PENETRATION TEST (CPT) LOG



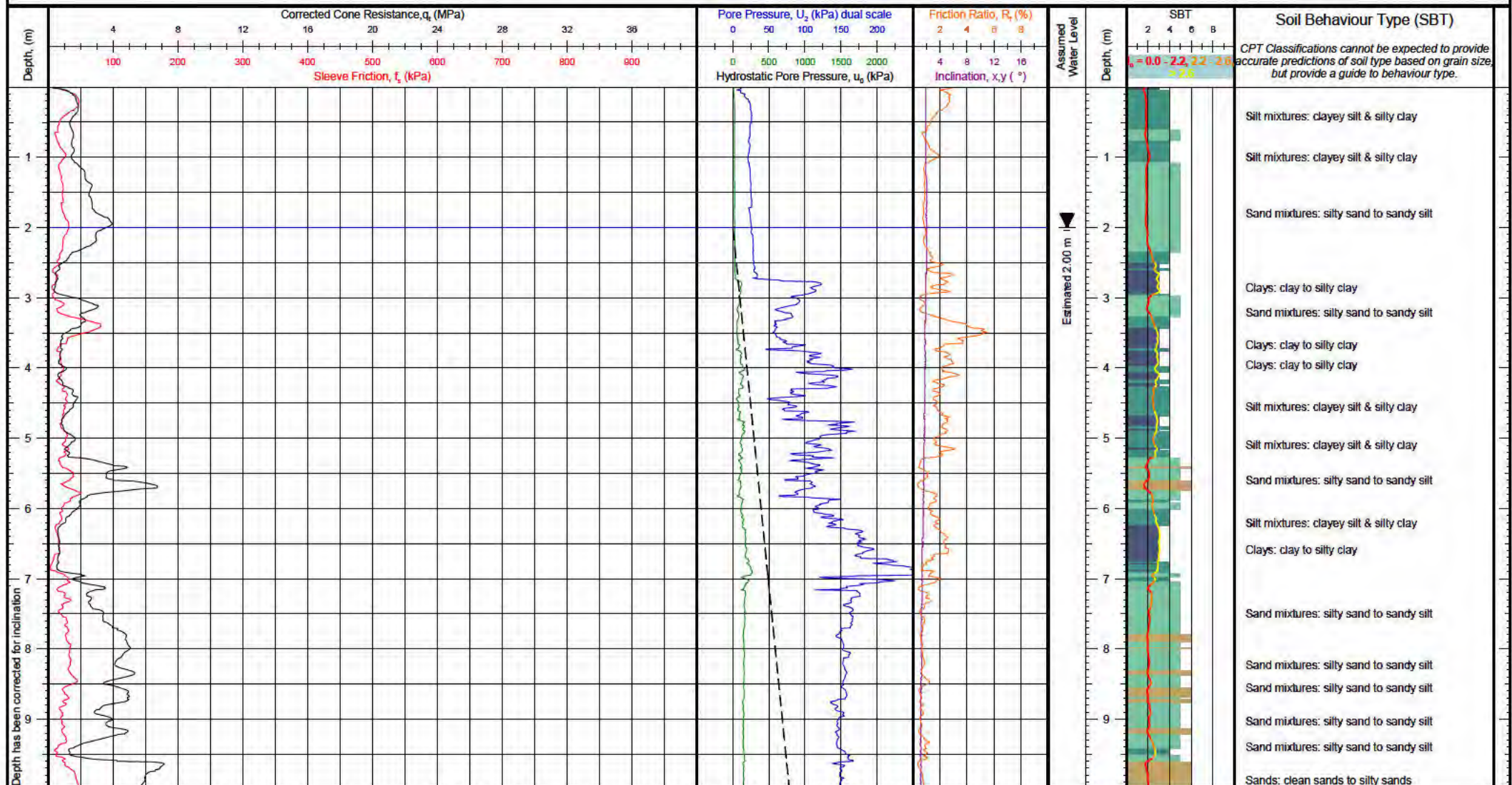
Client: KGA Geotechnical	Operator: Brendon Lemm	NZTM 2000 N, E (m): 5173308.94, 1564944.07	Elevation (m): Unknown	Client Reference:
Project: 101 Sabys Road	Cone Ref: MKJ333	WGS84 (deg): -43.592366, 172.565715	Date of Test: 23/06/2021	
Location: Halswell, Christchurch	Cone Type: 10cm ² Compression	Location Method: Handheld GPS	Depth (m): 15.16	Test Number: CPT-19
Engineer: Abilio Nogueira	Area Ratio: 0.80	Surveyor:	Pre Drill (m): N/A	
Contractor: Ground Investigation Ltd	Filter Type: u_2	Termination Reason: Target depth		G.I. Job Ref: 210810
Comments:				

CONE PENETRATION TEST (CPT) LOG



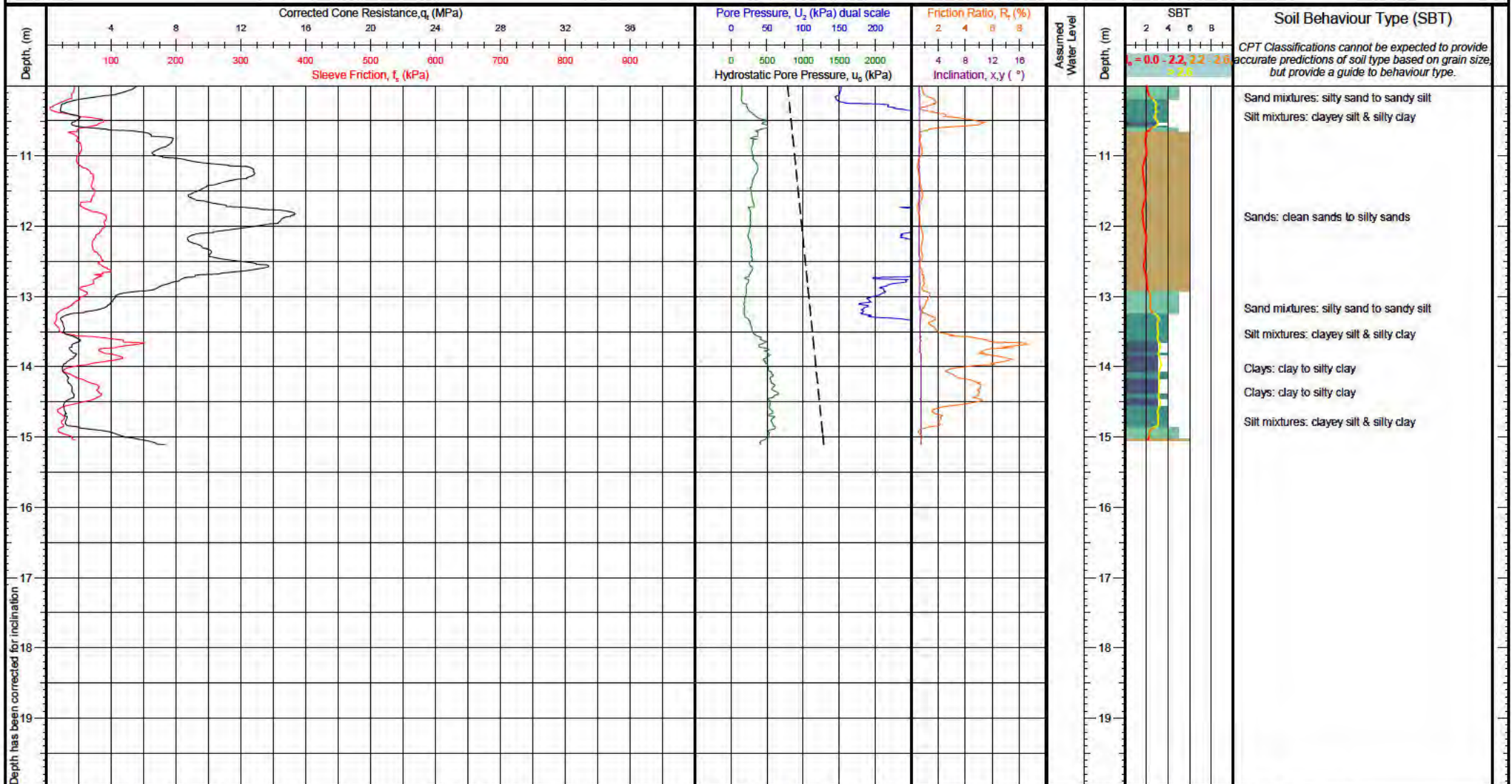
Client: KGA Geotechnical	Operator: Brendon Lemm	NZTM 2000 N, E (m): 5173308.94, 1564944.07	Elevation (m): Unknown	Client Reference:
Project: 101 Sabys Road	Cone Ref: MKJ333	WGS84 (deg): -43.592366, 172.565715	Date of Test: 23/06/2021	
Location: Halswell, Christchurch	Cone Type: 10cm ² Compression	Location Method: Handheld GPS	Depth (m): 15.16	Test Number: CPT-19
Engineer: Abilio Nogueira	Area Ratio: 0.80	Surveyor:	Pre Drill (m): N/A	
Contractor: Ground Investigation Ltd	Filter Type: u_2	Termination Reason: Target depth		G.I. Job Ref: 210810
Comments:				

CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical	Operator: Brendon Lemm	NZTM 2000 N, E (m): 5173361.52, 1564995.62	Elevation (m): Unknown	Client Reference:
Project: 101 Sabys Road	Cone Ref: MKJ309	WGS84 (deg): -43.591895, 172.566357	Date of Test: 23/06/2021	
Location: Halswell, Christchurch	Cone Type: 10cm ² Compression	Location Method: Handheld GPS	Depth (m): 15.11	Test Number: CPT-20
Engineer: Abilio Nogueira	Area Ratio: 0.80	Surveyor:	Pre Drill (m): N/A	
Contractor: Ground Investigation Ltd	Filter Type: u_2	Termination Reason: Target depth		G.I. Job Ref: 210810
Comments:				

CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical Project: 101 Sabys Road Location: Halswell, Christchurch Engineer: Abilio Nogueira Contractor: Ground Investigation Ltd	Operator: Brendon Lemm Cone Ref: MKJ309 Cone Type: 10cm ² Compression Area Ratio: 0.80 Filter Type: u_2	NZTM 2000 N, E (m): 5173361.52, 1564995.62 WGS84 (deg): -43.591895, 172.566357 Location Method: Handheld GPS Surveyor: Termination Reason: Target depth	Elevation (m): Unknown Date of Test: 23/06/2021 Depth (m): 15.11 Pre Drill (m): N/A	Client Reference:
				Test Number: CPT-20 G.I. Job Ref: 210810

Comments:



APPENDIX A

Third Party Documents



AMENDMENTS :

AMENDMENT	DATE	DESCRIPTION

NOTES :

1. Areas and dimensions are approximate only and 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 concept & discussion purposes only. No liability is accepted if the plan is used for any other purposes.

4. Contours shown are from LINZ Data at 0.5m Contour Intervals and Interns of LINZ Vertical Datum 2016.

Medium Density

Road to Vest

Landscape/Esplanade

Waterway

Stormwater Reserve

SDC

CCC

Total Area :

Comprised in:

DAVE 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:

X

SHEET TITLE:

X

DRAWING STATUS

For Discussion Purposes

SCALE: 1:2000@A1 1:4000@A3

DATE: December 2025

CAD FILE : J:\20445\SUBCON\20445 FRANCO FTA CONCEPT LAYOUT.dwg

REVISION :

DRAWING No: H.20445

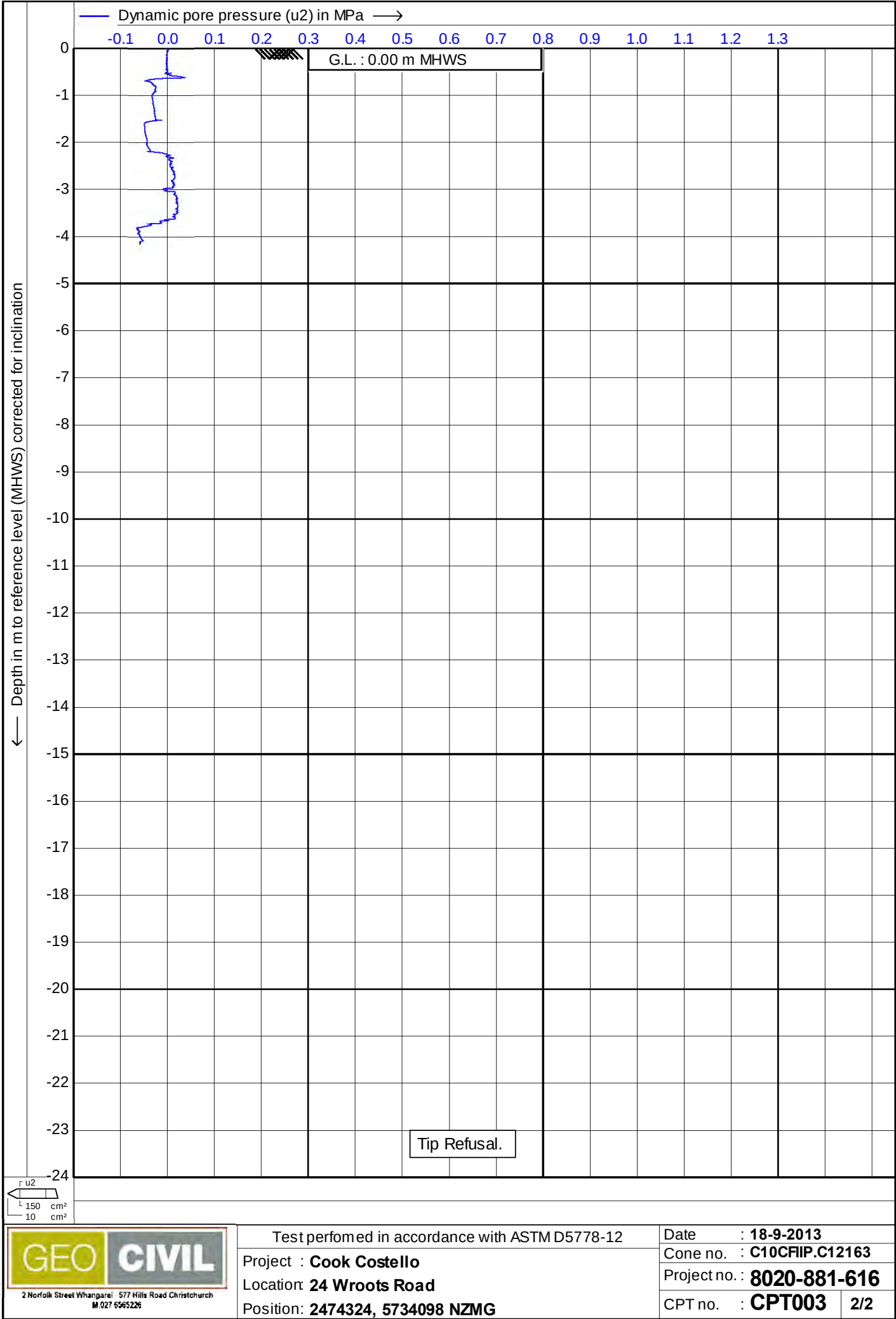
SHEET No: 1 OF 1

RO

APPENDIX B

Background Information Documents







TONKIN & TAYLOR LTD

BOREHOLE LOG

BH No: HAL-POD01-BHCPT006
Hole Location: 616 Halswell Road

SHEET 1 OF 2

PROJECT: CHCH TC3 GEOTECHNICAL INVESTIGATIONS						LOCATION: HALSWELL						JOB No: 52003.000					
CO-ORDINATES: 5734670.24 mN 2474657.46 mE						DRILL TYPE: Roto-Sonic						HOLE STARTED: 31/10/12					
R.L.: 12.79 m						DRILL METHOD: PQDT/Auto SPT						HOLE FINISHED: 31/10/12					
DATUM: NZMG, MSL (CCC 20/01/12 Datum -9.043m)						DRILL FLUID: LP2000						DRILLED BY: Pro-Drill					
												LOGGED BY: HW-TA CHECKED: BMcd					
GEOLOGICAL						ENGINEERING DESCRIPTION											
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE WEATHERING CONDITION	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION
																	Soil type, minor components, plasticity or particle size, colour.
ROCK DESCRIPTION																	
Substance: Rock type, particle size, colour, 																	

T-T DATATEMPLATE-SPT.GDT reb

Log Scale 1:50

BORELOG-TC3 720016 HAL-POD01.GPJ 18-Apr-2013



TONKIN & TAYLOR LTD

BOREHOLE LOG

BH No: HAL-POD01-BHCPT006
Hole Location: 616 Halswell Road

SHEET 2 OF 2

PROJECT: CHCH TC3 GEOTECHNICAL INVESTIGATIONS				LOCATION: HALSWELL				JOB No: 52003.000										
CO-ORDINATES: 5734670.24 mN 2474657.46 mE				DRILL TYPE: Roto-Sonic				HOLE STARTED: 31/10/12										
R.L.: 12.79 m				DRILL METHOD: PQDT/Auto SPT				HOLE FINISHED: 31/10/12										
DATUM: NZMG, MSL (CCC 20/01/12 Datum -9.043m)				DRILL FLUID: LP2000				LOGGED BY: HW-TA CHECKED: BMcD										
GEOLOGICAL				ENGINEERING DESCRIPTION														
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSION STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION
																		Substance: Rock type, particle size, colour,

T-T DATATEMPLATE-SPT.GDT reb

Log Scale 1:50

BORELOG-TC3 720016 HAL-POD01.GPJ 18-Apr-2013

Engineering Log - Borehole

client: **LAG Insurance**

principal: =

project: **LAG Insurance Claims**

location: **43 Candys Road, Halswell, Christchurch**

Borehole ID. **BH1**

sheet: 1 of 3

project no. **GENZCHRI15217ASE**

date started: **01 May 2014**

date completed: **01 May 2014**

logged by: **A. Awad**

checked by: **H. MacMurray**

position: Not Specified

surface elevation: Not Specified

angle from horizontal: 90°

drill model: Sonic Drill Rig. Track mounted

hole diameter : 150 mm

drilling information					material substance											
method & support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations				
HA N HO3		01/05/14 13.45 01/05/14 10.30	SPT 1, 1, 1, 1, 2, 1 N=5	01/05/14 13.45 01/05/14 10.30	1.0		SM	Asphalt/ bitumen. Silty GRAVEL: fine to coarse grained, poorly graded, rounded, silt is dark brown, trace rootlets. Silty SAND: fine grained, pale brown, trace rootlets.	D M	VL		PAVEMENT FILL SPRINGSTON FORMATION				
					2.0		SP	SAND: fine to medium grained, grey/ dark grey. Becomes more grey brown	W	MD						
					3.0			Becomes dark grey/ dark blue grey	S							
					4.0		OL	ORGANIC SILT: low liquid limit, dark brown/ black, with some roots, has slight organic odour.	S							
							MH	Clayey SILT: medium to high liquid limit, brown grey. With some pockets of dark brown/ black organic silt and fine roots								
					5.0		OL	ORGANIC SILT: low liquid limit, dark brown, with some rootlets.								
							MH	Clayey SILT: medium to high liquid limit, brown grey. Becomes more grey								

method AD auger drilling* AS auger screwing* RR roller/ticone W washbore CT cable tool HA hand auger DT diatube B blank bit V V bit T TC bit * bit shown by suffix e.g. AD/T	support M mud C casing N nil penetration water 10-Oct-12 water level on date shown water inflow water outflow	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shear; peak/remoulded (kPa) R refusal HB hammer bouncing	classification symbol & soil description based on Unified Classification System moisture D dry M moist W wet S saturated	consistency / relative density VS very soft S soft F firm St stiff VSlt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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Engineering Log - Borehole

client: **IAG Insurance**

principal: -

project: **IAG Insurance Claims**location: **43 Candys Road, Halswell, Christchurch**Borehole ID: **BH1**

sheet: 2 of 3

project no. **GENZCHRI15217ASE**date started: **01 May 2014**date completed: **01 May 2014**logged by: **A. Awad**checked by: **H. MacMurray**

position: Not Specified

surface elevation: Not Specified

angle from horizontal: 90°

drill model: Sonic Drill Rig, Track mounted

hole diameter: 150 mm

drilling information					material substance							
method & support	1 penetration	2 water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components	moisture condition	consistency / relative density	hand penetrometer (kPa)	structure and additional observations
H03			SPT 3, 5, 6, 5, 3, 2 Nc=16		7.0		GM GP	Silty GRAVEL: fine to coarse grained, poorly graded, rounded, grey.	S	MD - D		SPRINGSTON FORMATION
			Sandy GRAVEL: medium to coarse grained, rounded, dark grey/ dark blue grey, medium to coarse sand.									
			SPT 7, 14, 12, 9, 6, 6 Nc=33		8.0		SW	Gravelly SAND: medium to coarse grained, dark blue grey, medium to coarse rounded gravel, trace of rounded cobbles (up to 80mm in size).				
			SPT 10, 18, 15, 14, 14, 7/10mm Nc=R					9.0		SM	Silty SAND: fine to medium grained, poorly graded, grey/ dark grey.	
			10.0			ML	SILT: low liquid limit, grey/ dark grey, trace of fine sand, trace of medium rounded gravel.					
								OL	ORGANIC SILT: low liquid limit, dark brown, trace of fine roots, has organic odour.			
					11.0				ML	Sandy SILT: low liquid limit, grey, fine sand, has slight organic odour, trace of fine roots.		

method AD auger drilling* AS auger screwing* RR roller/tricone W washbore CT cable tool HA hand auger DT diatube B blank bit V V bit T TC bit * bit shown by suffix e.g. AD/T	support M mud C casing N nil penetration  no resistance ranging to refusal water  10-Oct-12 water level on date shown water inflow water outflow	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shear, peak/remoulded (kPa) R refusal HB hammer bouncing	classification symbol & soil description based on Unified Classification System moisture D dry M moist W wet S saturated	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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CDF_0_0_04BB.GLB Log COF BOREHOLE: NON CORED GENZCHRI15217ASE GINT DATABASE.GPJ <<DrawingFile>> 02/05/2014 11:53



Engineering Log - Borehole

client: **IAG Insurance**

principal: -

project: **IAG Insurance Claims**location: **43 Candys Road, Halswell, Christchurch**Borehole ID: **BH1**

sheet: 3 of 3

project no. **GENZCHRI15217ASE**date started: **01 May 2014**date completed: **01 May 2014**logged by: **A. Awad**checked by: **H. MacMurray**

position: Not Specified

surface elevation: Not Specified

angle from horizontal: 90°

drill model: Sonic Drill Rig, Track mounted

hole diameter: 150 mm

drilling information				material substance					
method & support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description	structure and additional observations
			SPT 0, 1, 1, 2, 2, 2 N=7		13.0		Pt	PEAT: non plastic, dark brown, amorphous, has organic odour, with some fibrous material (wood chips, fine roots). Becomes more fibrous, with a layered structure Becomes more amorphous	SPRINGSTON FORMATION
			SPT 1, 1, 4, 4, 3, 3 N=14		14.0		SM SP	Silty SAND: fine to medium grained, poorly graded, dark grey. SAND: fine to medium grained, dark grey/ dark blue grey.	
							ML Pl	SILT: low to medium liquid limit, grey/ dark grey, has slight organic odour.	
							OL	PEAT: non plastic, dark brown, amorphous, has organic odour.	
								ORGANIC SILT: low liquid limit, dark brown, has organic odour.	
			SPT 0, 0, 1, 1, 1, 1 N=4		15.0				
							SP	SAND: medium to coarse grained, dark blue grey, trace of medium to coarse rounded gravel.	
			SPT 1, 1, 7, 10, 9, 12 N=38		16.0				
					17.0			Borehole BH1 terminated at 16.95 m Target stratum	

method AD auger drilling* AS auger screwing* RR roller/tricone W washbore CT cable tool HA hand auger DT diatube B blank bit V V bit T TC bit * bit shown by suffix e.g. AD/T	support M mud C casing N nil penetration water water inflow water outflow	samples & field tests B bulk disturbed sample D disturbed sample E environmental sample SS split spoon sample U## undisturbed sample ##mm diameter HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shear, peak/remoulded (kPa) R refusal HB hammer bouncing	classification symbol & soil description based on Unified Classification System moisture D dry M moist W wet S saturated	consistency / relative density VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense
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 Soil Borehole Log		Location: 20 Muir Avenue, Halswell, Christchurch				Reference: GA_18503									
		Grid: -				Datum: MSL									
						North (m): 5173463 East (m): 1565018 Elevation (m): 13 Hole Depth (m): 17.45 Orientation (°): - Inclination (°): 90									
Formation	Graphic Log	Description	USC	Moisture Condition	Consistency / Density	Water Observations	Depth	TCR (%)			SPT N-value (Uncorrected)			Samples & In-situ Testing	Backfill & Installation
								25	50	75	100	10	20		
	N/R	Silty fine SAND, dark brown, wet, poorly graded, rootlets down to 0.1 m bgl. (TOPSOIL).					0.50								
	N/R	Silty fine to medium SAND, brown, saturated, poorly graded.					1.00								
	N/R	Core Loss.					1.49								
		Silty fine to medium SAND with traces of wood, brown, saturated, poorly graded.					2.00								
		Medium SAND, grey mottled orange, very loose, saturated, poorly graded.					2.50								
		Fine SAND with some silt, dark grey, loose, saturated, poorly graded.					3.00								
		Sandy SILT with traces of organic material, grey, firm, saturated, low plasticity. Sand in fine.					3.51								
		SILT with some fine sand, brownish grey, soft, saturated, low plasticity, layer of fine to medium SAND that is medium dense between 5.0 - 5.45 m bgl.					4.00								
							4.50								
							5.00								
							5.49								
		Medium SAND with minor silt, grey, medium dense, saturated, poorly graded.					6.00								
		SILT with some fine sand, brownish grey, soft, saturated, low plasticity.					6.50								
		Medium SAND with minor silt, grey, medium dense, saturated, poorly graded.					7.00								
		SILT with some fine sand, brownish grey, soft, saturated, low plasticity.					7.51								
		Fine SAND with minor silt and traces of organic material, grey, loose, saturated, poorly graded.					8.00								
							8.50								
							9.00								
		Sandy SILT, grey, firm, saturated, low plasticity. Sand is fine.					9.49								
		Fine to medium SAND with traces of silt, grey, loose to medium dense, saturated, poorly graded.					10.00								
		SILT with some fine sand and traces of wood, brownish grey, soft, saturated, high plasticity. A layer of organic material between 10.4 - 10.5 m bgl.					10.50								
		Medium SAND, grey, medium dense, saturated, poorly graded.					11.00								
							11.51								
							12.00								
							12.50								
		Peaty SILT with minor organic material, blackish grey, firm, saturated, medium plasticity.					13.00								
							13.49								
							14.00								
							14.50								
		Gravelly medium to coarse SAND with traces of silt, brownish grey, dense, saturated, well-graded.					15.00								
							15.51								
							16.00								
							16.50								
							17.00								
EOH: 17.45 m															
Driller -		Logger DG		Remarks Borehole logged in accordance with NZGS guideline "Field description of soil and rock" 2005 Vane tests completed in accordance with NZGS guideline											
Drill Method / Rig HQ3															
Start Date 27/06/2013		Checked By JGF													
End Date -															
														Hole Depth 17.45m	
Page 1 of 1															



BOREHOLE No: BH02

MACHINE BOREHOLE LOG

SHEET 1 of 2

PROJECT: CCC Halswell ODP		JOB NUMBER: 3205665	
SITE LOCATION: Halswell, Christchurch		CLIENT: Christchurch City Council	
CIRCUIT: NZTM		BOREHOLE LOCATION: 101 Sabys Rd	
COORDINATES: N 5,173,353.43 m		R L: 21.77 m	
E 1,564,554.45 m		DATUM: Christchurch Drainage Datum	

DRILLING				IN-SITU TESTS			SAMPLES	DEPTH (m)	GRAPHIC LOG	USCS	MOISTURE	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R.L. (m)
FLUID LOSS	WATER LEVEL	CORE RECOVERY	METHOD	RQD	CASING	SV								
		100 %	SPT					2		ML	M	Firm, SILT, minor clay, trace fine sand, trace rootlets; brown; moist, low plasticity when wetted.	Topsoil	21
		100 %	Sonic					2		ML	M	'Soft', fine sandy SILT, trace clay; brownish grey; moist, non plastic, slightly cohesive.		
		100 %	SPT					1		MH	M	'Soft to firm', clayey SILT; brownish grey; moist, high plasticity.	Springston Formation	20
		100 %	Sonic					1		SP	S	Loose, fine to medium SAND, trace silt, trace clay; light brown; saturated, non plastic.		
		100 %	SPT					2		M		Grey; moist.		
		100 %	Sonic					2		ML	M	'Firm', SILT, trace fine sand; grey; moist, non plastic, dilatant.		
		100 %	SPT					3		MH	M	Moderately thin (70mm) lens of fibrous PEAT; brown; moist, non plastic. Moderately decomposed [H5].		
		100 %	Sonic					3				Soft to firm, clayey SILT; grey; moist, high plasticity.		
		100 %	SPT					4		PT	M	'Soft', fibrous PEAT; dark brown; moist, non plastic. Moderately decomposed [H5].		
		100 %	Sonic					4		OH	M	Soft, organic clayey SILT; greyish brown; moist, high plasticity. Organics: wood fragments, roots.		
		100 %	SPT					5		ML	M	'Soft', fine sandy SILT, trace clay, trace organics; grey; moist, low plasticity. Organics: roots.		
		100 %	Sonic					5		SP	S	Loose to medium dense, fine to medium SAND, some silt; grey; saturated, non plastic.		
		100 %	SPT					6				Fine to coarse SAND.		15
		100 %	Sonic					6		GW	S	Medium dense, fine to coarse sandy fine to coarse GRAVEL, trace cobbles, trace silt; grey; saturated, non plastic. Gravel/cobbles: SW, subangular to subrounded, greywacke.		
		70 %	SPT					7				Trace fine to coarse sand.		
		100 %	Sonic					7						
		100 %	SPT					8						14
		100 %	Sonic					8						
		100 %	SPT					9						
		100 %	Sonic					9						
DATE STARTED: 27/1/14		DRILLED BY: Pro-Drill (Auck) Ltd		COMMENTS: Coordinates and elevation data obtained from survey. Artesian conditions in Riccarton Gravel. Groundwater level not measured. Von Post peat classification used.										
DATE FINISHED: 27/1/14		EQUIPMENT: Fraste XL2												
LOGGED BY: OKD		DRILL METHOD: Sonic												
SHEAR VANE No: N/A		DRILL FLUID: Water + drill pro												
		DIAMETER/INCLINATION: 120 mm / 90°												
FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET												Revision B		

A4 Scale 1:50



BOREHOLE No: BH02

MACHINE BOREHOLE LOG

SHEET 2 of 2

PROJECT: CCC Halswell ODP		JOB NUMBER: 3205665	
SITE LOCATION: Halswell, Christchurch		CLIENT: Christchurch City Council	
CIRCUIT: NZTM		BOREHOLE LOCATION: 101 Sabys Rd	
COORDINATES: N 5,173,353.43 m		R L: 21.77 m	
E 1,564,554.45 m		DATUM: Christchurch Drainage Datum	

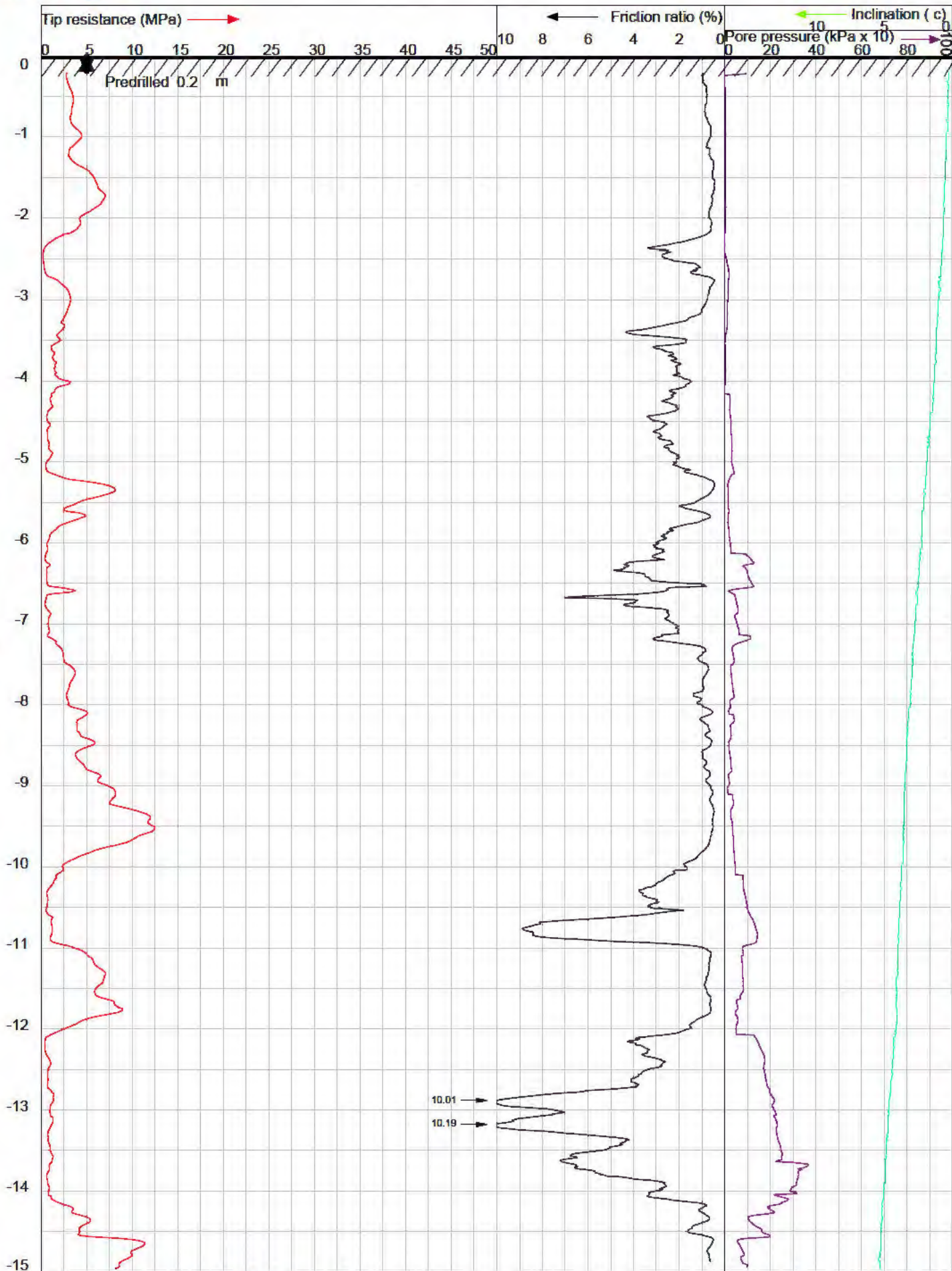
DRILLING				IN-SITU TESTS			SAMPLES	DEPTH (m)	GRAPHIC LOG	USCS	MOISTURE	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R.L. (m)
FLUID LOSS	WATER LEVEL	CORE RECOVERY	METHOD	RQD	CASING	SV								
		100 %	Sonic					1		GW	S	Medium dense, fine to coarse GRAVEL, trace cobbles, trace fine to coarse sand, trace silt; grey, saturated, non plastic. Gravel/cobbles: SW, subangular to subrounded, greywacke.	Springston Formation (Contd.)	11
		100 %	SPT					0		SP	S	'Loose to medium dense', fine to medium SAND, some silt; grey, saturated, non plastic.		11
		100 %	Sonic					2		ML	S	Firm, clayey SILT, some fine sand, trace organics; grey, saturated, high plasticity. Organics: leaves, stems.		11
		100 %	Sonic					2				10.5m depth: some fibrous PEAT; black; moist, non plastic (for 100mm).		11
		100 %	Sonic					2				10.95m depth: sand absent.		11
		100 %	Sonic					1		PT	M	'Firm', fibrous PEAT; black; moist, non plastic. Organics: rootlets, wood fragments. Moderately decomposed [H5].	Springston Formation (Contd.)	10
		100 %	SPT					2		SM	M	'Loose', silty fine SAND, trace organics; grey; moist, non plastic. Organics: plant remains.		10
		100 %	Sonic					2		OH	M	Firm, organic clayey SILT; grey and black; moist, high plasticity. Organics: peat, wood fragments, roots.		10
		100 %	Sonic					2				Thinly to moderately thickly interbedded with moderately thin (60mm) to moderately thick (250mm) lenses of fibrous PEAT; black; moist, non plastic. Moderately decomposed [H5].		9
		100 %	SPT					0					Riccarton Gravel	8
		100 %	Sonic					1						7
		100 %	Sonic					1						7
		70 %	SPT					8		GW	S	Dense, fine to coarse sandy fine to coarse GRAVEL, some silt; grey; saturated, non plastic. Gravel: SW, subangular to subrounded, greywacke.	Riccarton Gravel	6
								12				Brown.		6
								10						6
								9						6
								6						6
								6						6
								N=31				END OF LOG @ 15.45 m		6
														5
														4
														3
														2

DATE STARTED: 27/1/14	DRILLED BY: Pro-Drill (Auck) Ltd	COMMENTS: Coordinates and elevation data obtained from survey. Artesian conditions in Riccarton Gravel. Groundwater level not measured. Von Post peat classification used.
DATE FINISHED: 27/1/14	EQUIPMENT: Fraste XL2	
LOGGED BY: OKD	DRILL METHOD: Sonic	
SHEAR VANE No: N/A	DRILL FLUID: Water + drill pro	
	DIAMETER/INCLINATION: 120 mm / 90°	

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

Revision B

DEPTH IN METERS BELOW GROUND LEVEL



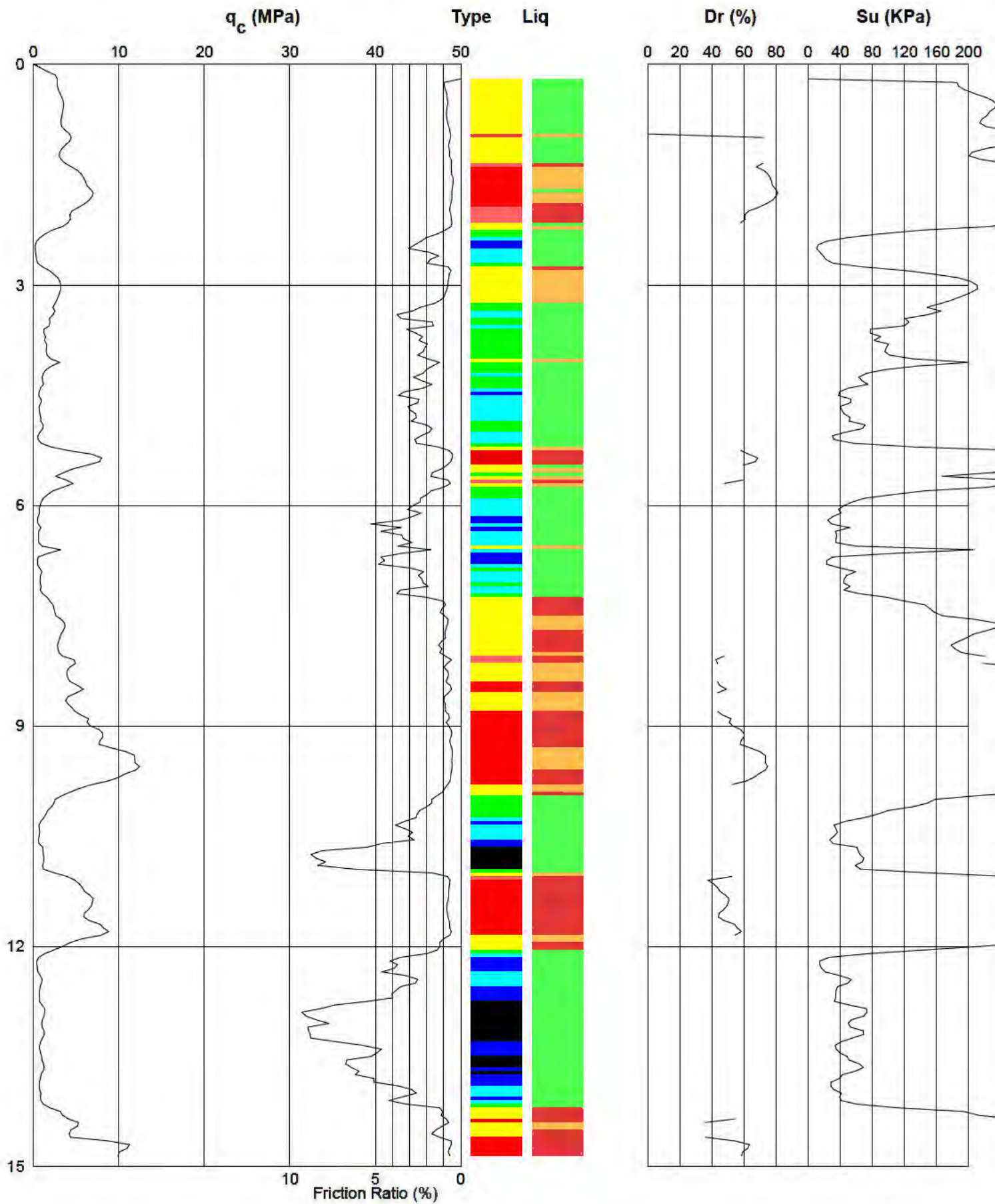
CLIENT : MWH / Mainzeal JV
LOCATION : 89 Sabys Road, Christchurch
DATE : 1-3-2013
OPERATOR : S.Cardona
REMARK 1 : CPTu001
REMARK 2 : Target Depth

JOB # : 11761
TEST # : 1
CONE TYPE/SERIAL # : I-CFXYP20-10/081034T

McMILLAN
DRILLING SERVICES

120 High St Southbridge CANTERBURY NZ
Ph +64 3 324 2571 Fax +64 3 324 2431
www.drilling.co.nz

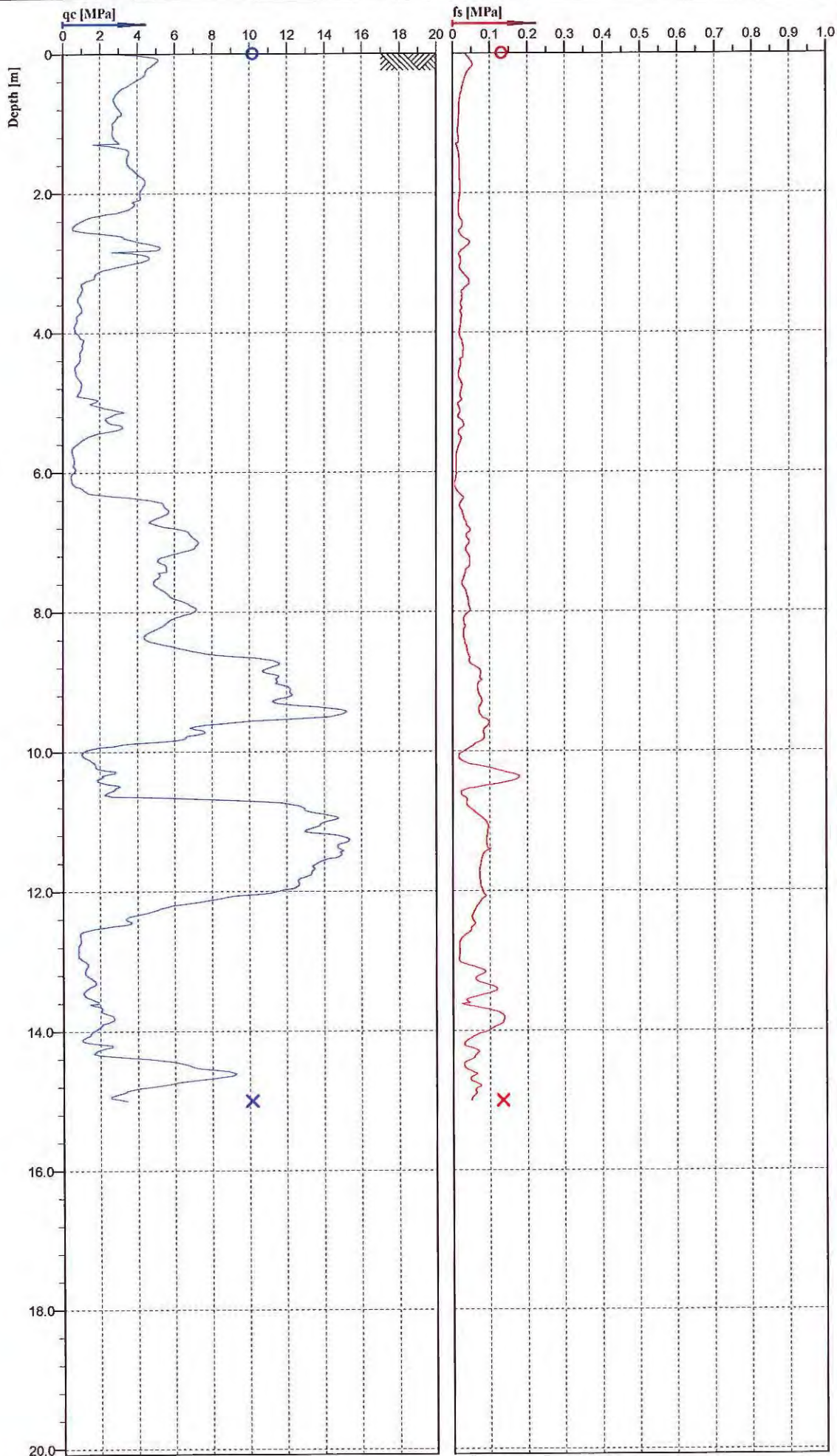
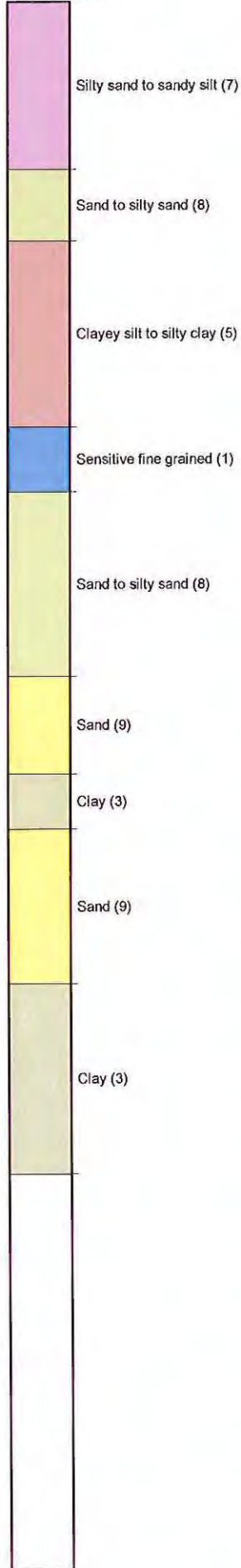
PIEZOCONE PENETROMETER TEST (CPTU) INTERPRETIVE REPORT



Job No: 11761
 CPT No: CPTu001
 Project: MWH / Mainzeal JV
 Location: 89 Sabys Road, Christchurch

Date: 1-3-2013
 Operator: S.Cardona
 Remark: Target Depth

Classification by
Robertson 1986

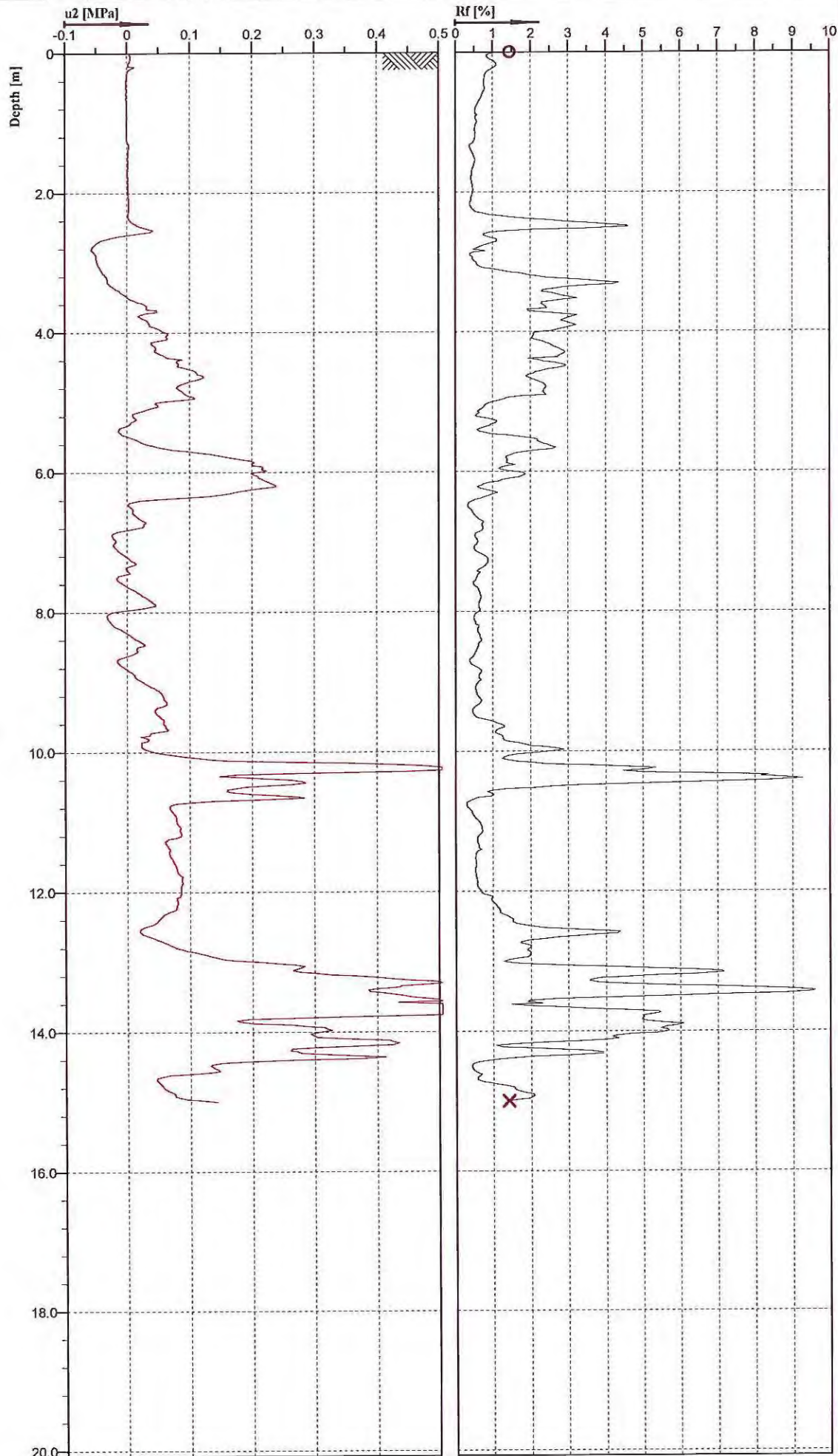
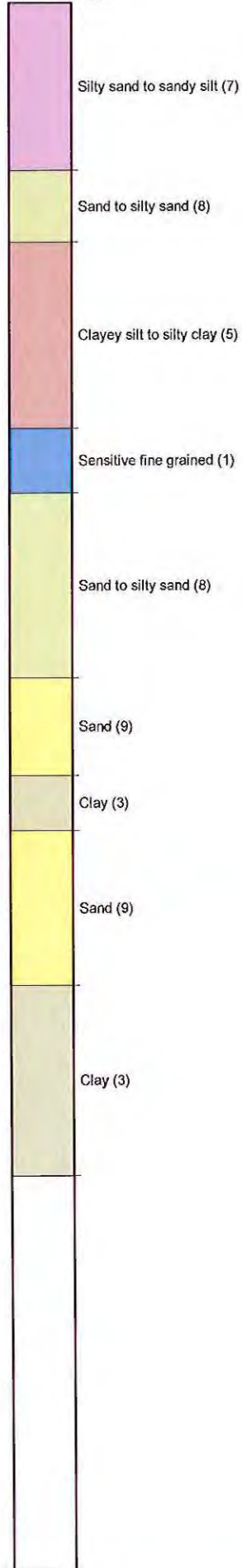


PRO-DRILL
SPECIALIST DRILLING ENGINEERS

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

Location:	HALLSWELL	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test no:	CPT16
Project ID:		Client:	BECA	Date:	27/01/2014	Scale:	1 : 80
Project:	101 SABYS RD			Page:	1/1	Fig:	
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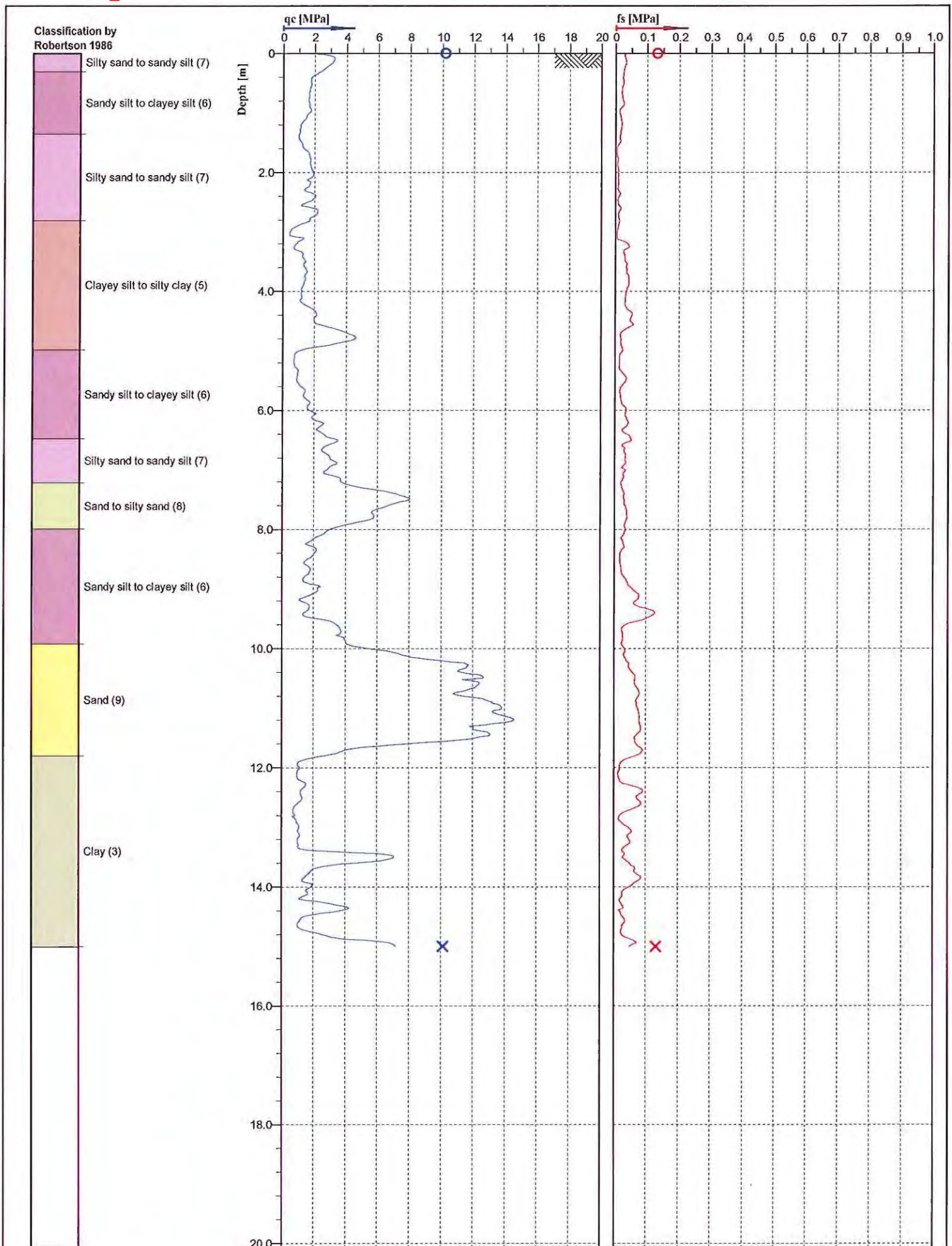
Classification by
Robertson 1986



PRO-DRILL
SPECIALIST DRILLING ENGINEERS

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

Location:	HALLSWELL	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test no:	CPT16
Project ID:		Client:	BECA	Date:	27/01/2014	Scale:	1 : 80
Project:	101 SABYS RD			Page:	1/1	Fig:	
				File:	101SabysRdCPT16.cpt		

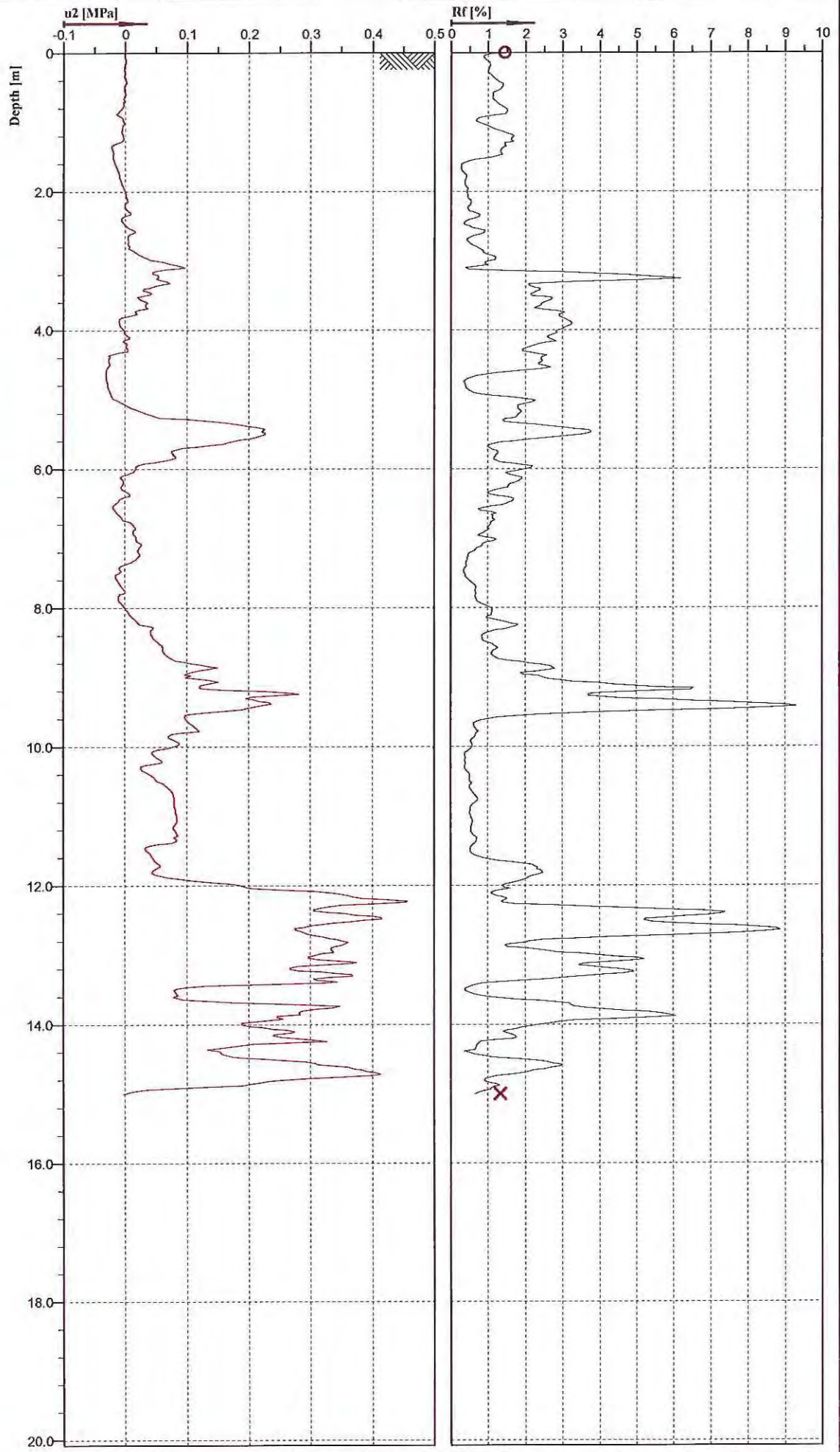
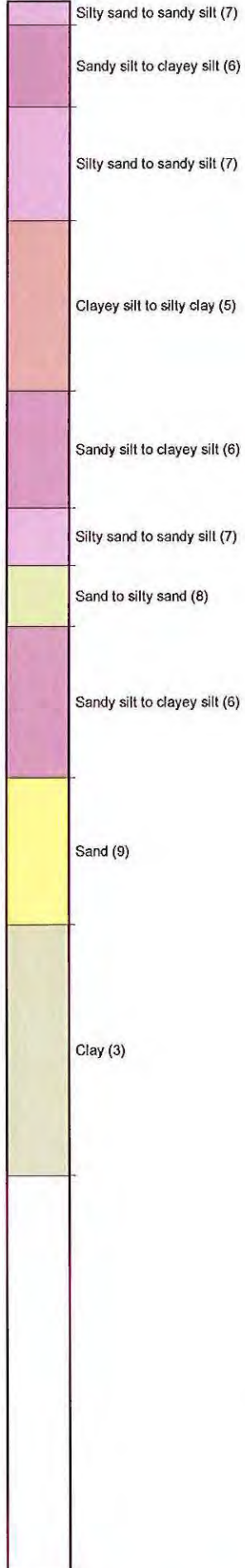


PRO-DRILL
SPECIALIST DRILLING ENGINEERS

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

Location:	HALLSWELL	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test no:	CPT15
Project ID:		Client:	BECA	Date:	27/01/2014	Scale:	1 : 80
Project:	101 SABYS RD			Page:	1/1	Fig:	
				File:	101SabvsRdCPT15.cpt		

Classification by
Robertson 1986



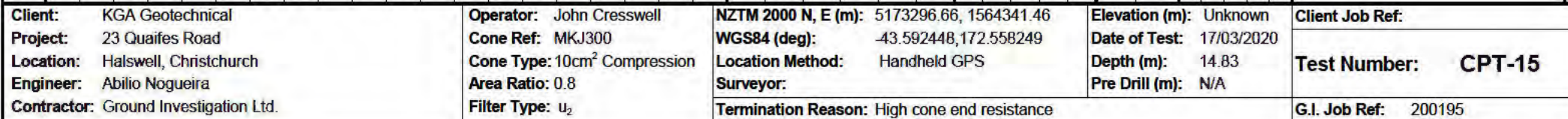
Cone No: 4439
Tip area [cm²]: 10
Sleeve area [cm²]: 150

Location:	HALLSWELL	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test no:	CPT15
Project ID:		Client:	BECA	Date:	27/01/2014	Scale:	1 : 80
Project:	101 SABYS RD			Page:	1/1	Fig:	
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PRO-DRILL
SPECIALIST DRILLING ENGINEERS

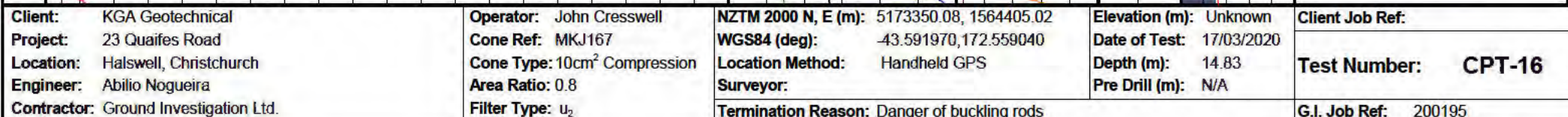
Comments:			
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GROUND INVESTIGATION



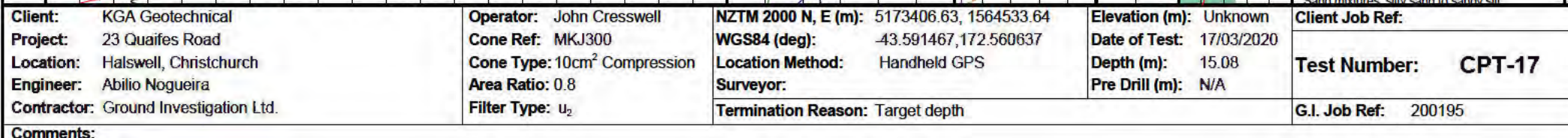
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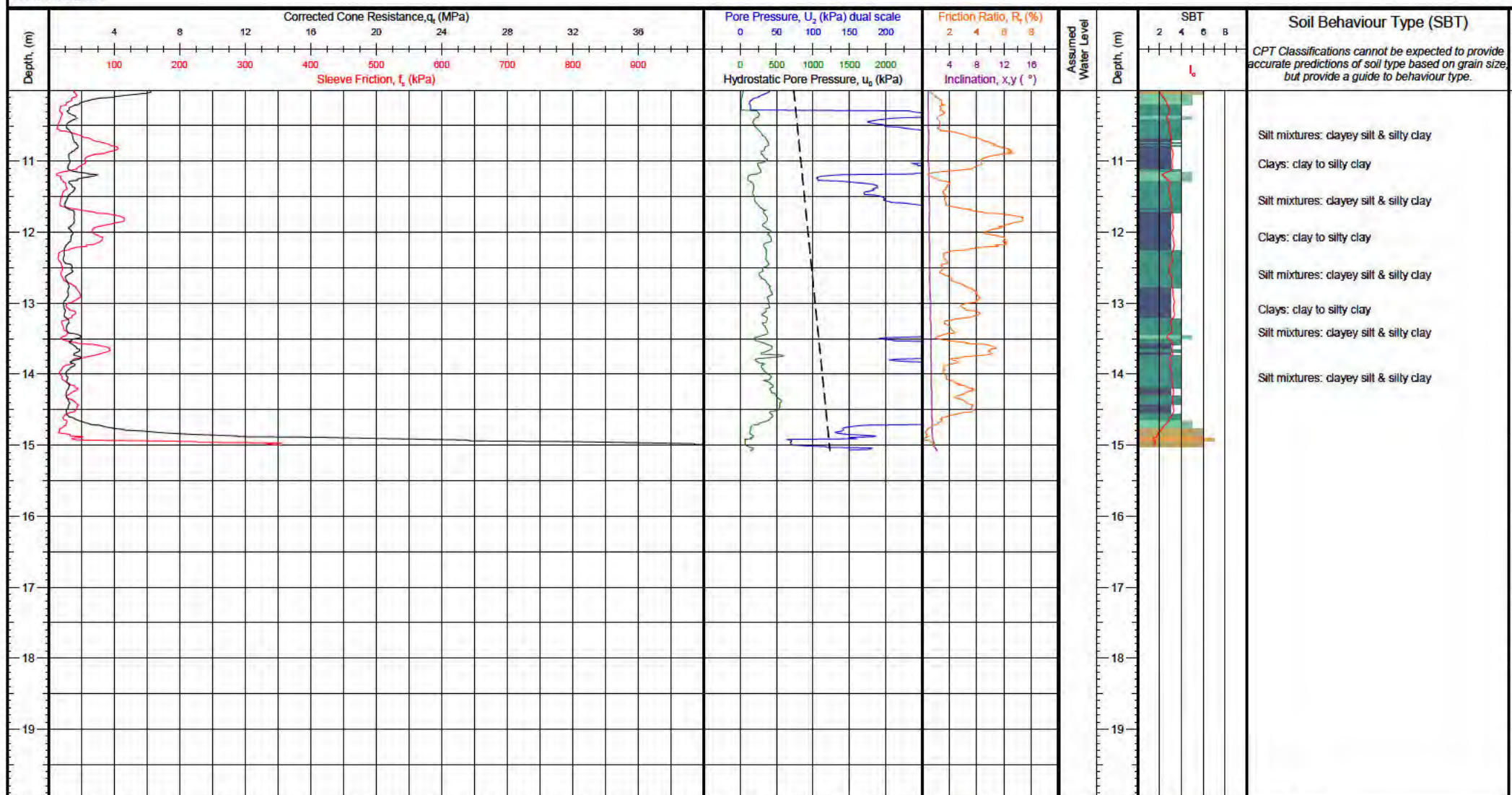
GROUND INVESTIGATION



GD ID: CPT 143395

Client: KGA Geotechnical	Operator: John Cresswell	NZTM 2000 N, E (m): 5173350.08, 1564405.02	Elevation (m): Unknown	Client Job Ref:
Project: 23 Quaifes Road	Cone Ref: MKJ167	WGS84 (deg): -43.591970, 172.559040	Date of Test: 17/03/2020	
Location: Halswell, Christchurch	Cone Type: 10cm ² Compression	Location Method: Handheld GPS	Depth (m): 14.83	Test Number: CPT-16
Engineer: Abilio Nogueira	Area Ratio: 0.8	Surveyor:	Pre Drill (m): N/A	
Contractor: Ground Investigation Ltd.	Filter Type: u ₂	Termination Reason: Danger of buckling rods		G.I. Job Ref: 200195
Comments:				





Client: KGA Geotechnical
Project: 23 Quaiques Road
Location: Halswell, Christchurch
Engineer: Abilio Nogueira
Contractor: Ground Investigation Ltd.

Operator: John Cresswell
Cone Ref: MKJ300
Cone Type: 10cm² Compression
Area Ratio: 0.8
Filter Type: u₂

NZTM 2000 N, E (m):	5173406.63, 1564533.64
WGS84 (deg):	-43.591467, 172.560637
Location Method:	Handheld GPS
Surveyor:	
Termination Reason:	Target depth

Elevation (m):	Unknown
Date of Test:	17/03/2020
Depth (m):	15.08
Pre Drill (m):	N/A

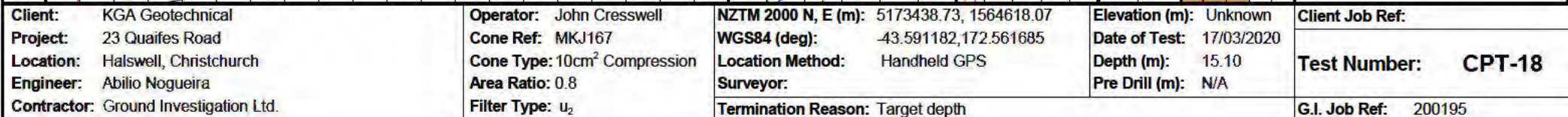
Client Job Ref:

Test Number: CPT-17

G.I. Job Ref:	200195
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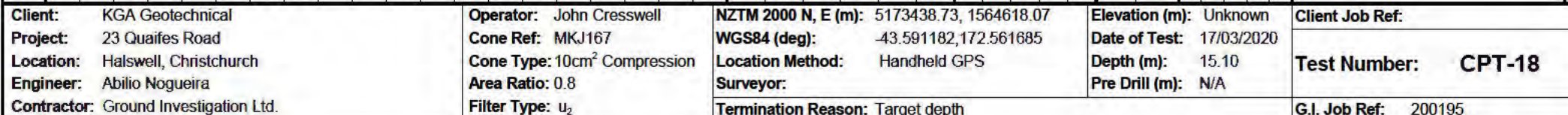
Comments:

GROUND INVESTIGATION

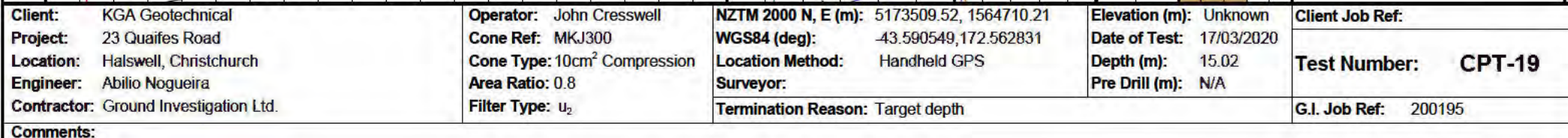


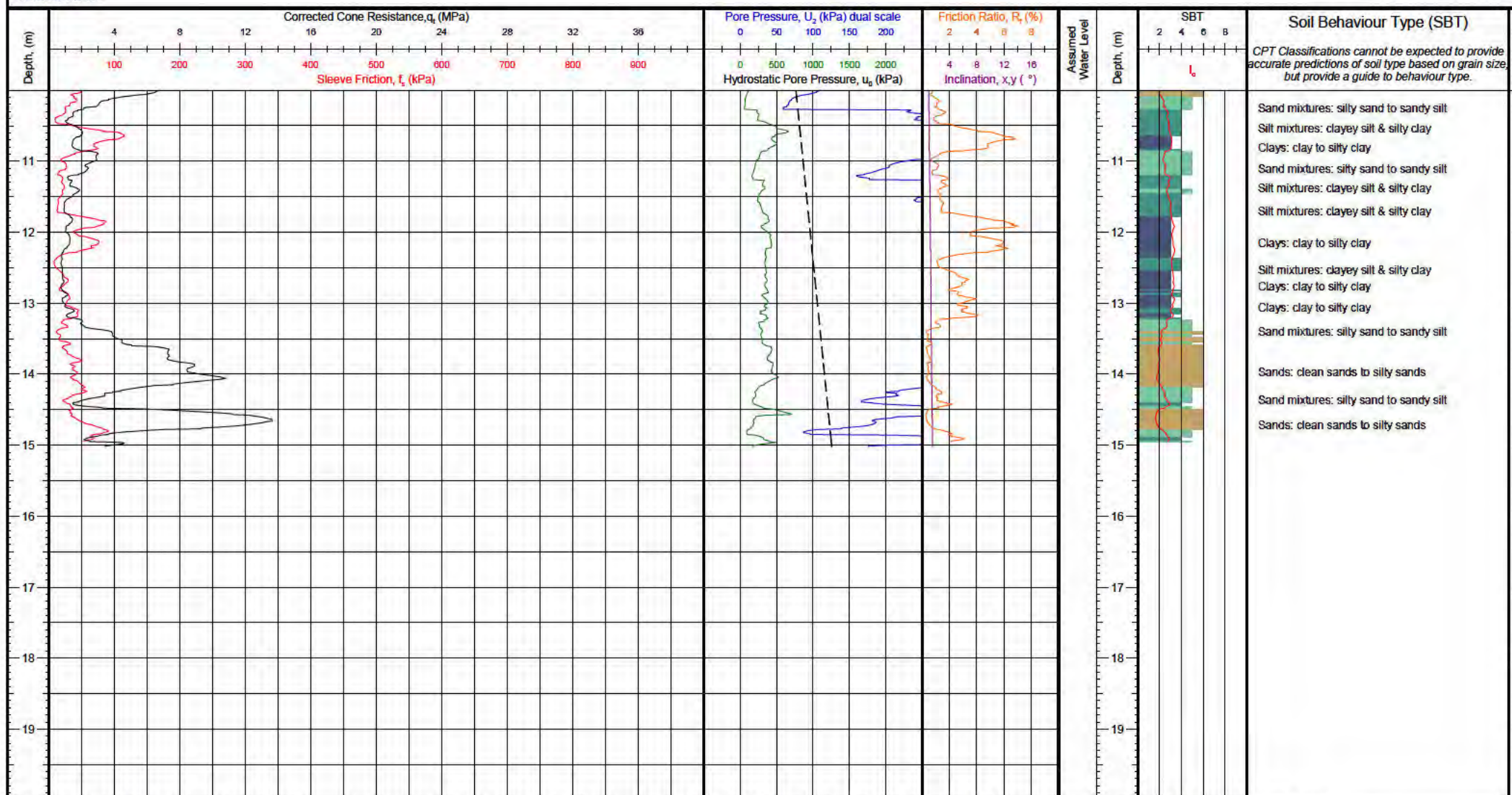
Comments:

GROUND INVESTIGATION



Comments:





Client: KGA Geotechnical
Project: 23 Quaiques Road
Location: Halswell, Christchurch
Engineer: Abilio Nogueira
Contractor: Ground Investigation Ltd.

Operator: John Cresswell
Cone Ref: MKJ300
Cone Type: 10cm² Compression
Area Ratio: 0.8
Filter Type: u₂

NZTM 2000 N, E (m):	5173509.52, 1564710.21
WGS84 (deg):	-43.590549, 172.562831
Location Method:	Handheld GPS
Surveyor:	
Termination Reason:	Target depth

Elevation (m):	Unknown
Date of Test:	17/03/2020
Depth (m):	15.02
Pre Drill (m):	N/A

Client Job Ref:

Test Number: CPT-19

G.I. Job Ref:	200195
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Comments:

 Soil Borehole Log		Location: 696 Halswell Road, Halswell						Reference: GA_15883			
		Grid: NZTM						Datum: MSL			
		North (m): 5172447 East (m): 1564472 Elevation (m): 11 Hole Depth (m): 16.45 Orientation (°): - Inclination (°): 90									
Formation	Graphic Log	Description	USC	Moisture Condition	Consistency / Density	Water Observations	Depth	TCR (%)	SPT N-value (Uncorrected)	Samples & In-situ Testing	Backfill & Installation
		Concrete					0.50				
		Fine SAND with trace organics; brown, mottled orange. Loose to very loose; dry to moist; poorly graded; organics, roots.		D-M	VL-L		1.00			SPT N = 4 Depth: 1.00m Type: Raymond Split Spoon 1, 0 / 1, 1, 1, 1 450mm penetration	
		Fine SAND with minor silt and trace organics; grey mottled orange. Loose; moist; poorly graded; organics, rootlets.	SP				2.00			SPT N = 7 Depth: 2.00m Type: Raymond Split Spoon 1, 1 / 2, 1, 2, 2 450mm penetration	
				M	L		3.00			SPT N = 9 Depth: 3.00m Type: Raymond Split Spoon 2, 1 / 2, 2, 3, 2 450mm penetration	
		Sandy fine to coarse GRAVEL; grey. Medium dense; wet to saturated; well graded; rounded to angular; sand, fine to coarse.					4.00			SPT N = 14 Depth: 4.00m Type: Raymond Split Spoon 4, 4 / 4, 4, 3, 3 450mm penetration	
					MD		5.00			SPT N = 20 Depth: 5.00m Type: Raymond Split Spoon 2, 4 / 8, 4, 4, 4 450mm penetration	
		Becoming dense from 6m.		W-S			6.00			SPT N = 32 Depth: 6.00m Type: Raymond Split Spoon 3, 8 / 9, 9, 7, 7 450mm penetration	
			GW				7.00			SPT N = 39 Depth: 7.00m Type: Raymond Split Spoon 6, 12 / 11, 10, 9, 9 450mm penetration	
		Becoming saturated from 7m.		S	D		8.00			SPT N = 50+ Depth: 8.00m Type: Raymond Split Spoon 7, 9 / 37, 13 300mm penetration	
		Becoming very dense from 8m.		W-S	VD		9.00			SPT N = 32 Depth: 9.00m Type: Raymond Split Spoon 9, 5 / 7, 5, 9, 11 450mm penetration	
		Becoming dense from 9m.	GP	S	D		9.50			SPT N = 8 Depth: 10.00m	
Driller McNeills		Logger MW		Remarks Coordinates and elevation are estimates only Borehole logged in accordance with NZGS guideline "Field description of soil and rock" 2005 Vane tests completed in accordance with NZGS guideline							
Drill Method / Rig C6 Casagrande		Checked By LF									
Start Date 13/12/2012											
End Date 17/12/2012											
										Hole Depth 16.45m	
Page 1 of 2											

 Soil Borehole Log		Location: 696 Halswell Road, Halswell						Reference: GA_15883			
		Grid: NZTM Datum: MSL						North (m): 5172447 East (m): 1564472 Elevation (m): 11 Hole Depth (m): 16.45 Orientation (°): - Inclination (°): 90			
Formation	Graphic Log	Description	USC	Moisture Condition	Consistency / Density	Water Observations	Depth	TCR (%)	SPT N-value	Samples & In-situ Testing	Backfill & Installation
								25 50 75 100	(Uncorrected) 10 20 30 40		
		Gravelly SILT with some organics; dark brown. Firm; wet; low plasticity; gravel, fine to coarse; organics, spongy peaty plant fibres.	ML	W	F		10.50			Type: Raymond Split Spoon 7, 2 / 2, 2, 2, 2 450mm penetration	Bentonite
		Clayey SILT and some organics with trace sand and gravel; dark greyish brown. Firm; saturated; low plasticity; organics, spongy; sand, fine; gravel, medium.		S		11.00			SPT N = 8 Depth: 11.00m Type: Raymond Split Spoon 1, 2 / 1, 2, 2, 3 450mm penetration		
		Highly organic SILT; dark brownish black. Stiff; moist; low plasticity; organics, plant fibres and wood.	OL	M	St		12.00			SPT N = 9 Depth: 12.00m Type: Raymond Split Spoon 2, 1 / 1, 2, 3, 3 450mm penetration	Surrounding ground collapse
		Sandy SILT; grey. Stiff; wet; low plasticity; sand, fine.		W		13.00			SPT N = 11 Depth: 13.00m Type: Raymond Split Spoon 1, 2 / 3, 2, 3, 3 450mm penetration		
		Sandy fine to coarse GRAVEL; grey. Very dense; moist; wet; well graded; angular to rounded; sand, fine to coarse.	GW	M	VD		14.00			SPT N = 11 Depth: 14.00m Type: Raymond Split Spoon 14, 17 / 18, 16, 14, 2 380mm penetration	
		Becoming dense from 16m.		S		15.00			SPT N = 50+ Depth: 15.00m Type: Raymond Split Spoon 6, 7 / 8, 12, 13, 14 450mm penetration		
							16.00			SPT N = 47 Depth: 16.00m Type: Raymond Split Spoon 6, 7 / 8, 12, 13, 14 450mm penetration	
EOH: 16.45 m											
Driller McNeills Drill Method / Rig C6 Casagrande Start Date 13/12/2012 End Date 17/12/2012		Logger MW Checked By LF		Remarks Coordinates and elevation are estimates only Borehole logged in accordance with NZGS guideline "Field description of soil and rock" 2005 Vane tests completed in accordance with NZGS guideline							
										Hole Depth 16.45m Page 2 of 2	

RILEY CONSULTANTS LIMITED 395 Madras Street Christchurch Tel: +643 3794402 Fax: +643 3794403		BORE HOLE LOG			
Project: 9 Trices Road		Location: Halswell, Christchurch		Hole position: Refer to Site Plan	
Job No.: 14806/38	Start Date: 28-07-14 Finish Date: 29-07-14	Ground Level (m): 21.00	Co-Ordinates (NZTM2000): E 1,563,562.0 N 5,172,844.0		No.: BH1
Client: Vero Insurance		Hole Depth: 17.15 m			Sheet: 1 of 3

Type	Run	Fluid & Water	Legend	Geological Description (refer to separate Geotechnical and Geological Information sheet for further information)	Elevation (m)	Depth (m)	Tests	Samples / Sample Description	Backfill / Piezometer
DP	0.00			SILT with trace clay and rootlets; dark brown. Moist; low plasticity. (TOPSOIL)	+20.70				
				Fine to medium SAND with trace silt; brown grey. Moist. (YALDHURST MEMBER, SPRINGSTON FORMATION)	+20.30				
				0.40m Grades to silty fine SAND with trace rootlets.	+20.00	1			
				SILT with minor clay; grey mottled orange. Soft; moist; high plasticity.	+19.48				
				0.90m Grades to trace clay.					
SPT	1.52			1m to 1.52m - no recovery.			SPT 1.52 m 0, 0, 0, 1, 1, 0; N = 2	SPT -	
				Fine to medium SAND with trace silt; grey. Very loose; wet.		2			
DP					+18.05				
SPT	3.02			SILT; grey. Very soft; saturated; non-plastic; dilatant.		3	SPT 3.02 m 0, 1, 0, 1, 0, 0; N = 1	SPT -	
				3.45m Grades to trace to minor clay and trace organics. Moderate plasticity.		4			
DP					+16.63				
SPT	4.57			Silty fine to coarse GRAVEL with trace sand; grey. Medium dense; moist; sand, fine to coarse; gravel, subrounded to angular, slightly weathered, greywacke, possible cobbles recovered as angular to subangular gravel (drilling breaks).	+16.00	5	SPT 4.57 m 6, 7, 8, 6, 5, 10; Nc = 29		
DP									
SPT	6.02			Sandy fine to coarse GRAVEL with some silt; grey. Medium dense; wet; sand, fine to coarse; gravel, subrounded to angular, slightly weathered, greywacke, possible cobbles recovered as angular to subangular gravel (drilling breaks).		6	SPT 6.02 m 8, 10, 10, 7, 8, 12; Nc = 37		
DP									
SPT	7.57			6.02m Grades to dense.		7			
DP									
SPT				6.50m Grades to fine to coarse GRAVEL with minor sand.		8	SPT 7.57 m 5, 7, 8, 8, 7, 7; Nc = 30		
DP					+12.74				

Explanations: Water Strike (1st, 2nd...) Water Rise (1st, 2nd...) and Rise Time (minutes) Small Disturbed Sample (SDS) Large Disturbed Sample (LDS) Standard Penetration Test (SPT)	Soil Types: CLAY SILT SAND GRAVEL NO RECOVERY	Backfill: Bentonite Grout Drill arisings or collapsed hole Filter material	Remarks: 1. Co-ordinates provided by McMillan Drilling Ltd and subject to survey confirmation. 2. Consistency strength based on visual description of recovered sample. 3. Driller notes: added water to hole from 0m to 17m. Total volume added = 700 litres 4. Driller notes: water level = 0.45m depth when casing = 12.1m depth.
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All dimensions in metres Scale 1:50	Contractor: McMillan Drilling	Rig/Plant Used: Direct Push Sampler	Driller: CN	Logged by: GG	Checked by: EL
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 RILEY CONSULTANTS Engineers and Geologists		Riley Consultants Limited 395 Madras Street Christchurch Tel: +643 3794402 Fax: +643 3794403		BORE HOLE LOG					
Project: 9 Trices Road		Location: Halswell, Christchurch		Hole position: Refer to Site Plan		No.: BH1			
Job No.: 14806/38		Start Date: 28-07-14 Finish Date: 29-07-14		Ground Level (m): 21.00		Co-Ordinates (NZTM2000): E 1,563,562.0 N 5,172,844.0			
Client: Vero Insurance				Hole Depth: 17.15 m		Sheet: 2 of 3			
Type	Run	Fluid & Water	Legend	Geological Description (refer to separate Geotechnical and Geological Information sheet for further information)	Elevation (m)	Depth (m)	Tests	Samples / Sample Description	Backfill / Piezometer
DP	7.57		x x x	Organic SILT minor to trace clay; grey mottled brown, bedded. Soft; moist; high plasticity; bedding, subhorizontal, thin; organics, fibrous and amorphous, wood fragments, leaves, stems, sulphurous odour. <i>(continued)</i> 8.35m Trace organics. 8.70m PEAT layer ~100mm thick.			SPT 9.07 m 0, 1, 0, 1, 1, 1; N = 3	SPT -	
SPT	9.07		x x x						
DP			x x x						
SPT	10.67		x x x	Fine SAND with trace silt; grey. Loose; wet.	+10.20		SPT 10.67 m 0, 1, 2, 2, 2, 3; N = 9	SPT -	
DP			x x x						
SPT	12.17		x x x	PEAT consisting of decomposing wood.	+8.94				
DP			x x x	SILT with minor clay and organics; grey mottled dark brown. Firm; moist; moderate plasticity; organics, fibrous, stems, leaves.	+8.60		SPT 12.17 m 0, 1, 1, 2, 5, 6; N = 14	SPT -	
DP				Sandy fine to coarse GRAVEL with minor silt; grey. Medium dense; saturated; sand, fine to coarse; gravel, subrounded to angular, slightly weathered, greywacke, possible cobbles recovered as angular to subangular gravel (drilling breaks); clast supported.					
SPT	13.67			13.67m Grades to very dense.			SPT 13.67 m 4, 10, 20, 15, 13, 14; Nc = 62		
DP				Fine to coarse GRAVEL with some sand and trace silt; brown. Very dense; saturated; sand, fine to coarse; gravel, subrounded to angular, slightly weathered, greywacke, possible cobbles recovered as angular to subangular gravel (drilling breaks).	+6.60				
SPT	15.27						SPT 15.27 m 5, 11, 11, 11, 13, 15; Nc = 50		
DP				Sandy fine to coarse GRAVEL with trace silt; brown. Very dense; saturated; sand, fine to coarse; gravel, subrounded to angular, slightly weathered, greywacke, possible cobbles recovered as angular to subangular gravel (drilling break); matrix supported; sand lenses.	+5.20				

Explanations:

- Water Strike (1st, 2nd...)
- Water Rise (1st, 2nd...) and Rise Time (minutes)
- Small Disturbed Sample (SDS)
- Large Disturbed Sample (LDS)
- Standard Penetration Test (SPT)

Soil Types:

- CLAY
- SILT
- SAND
- GRAVEL
- TOPSOIL
- PEAT
- FILL
- NO RECOVERY

Backfill:

- Bentonite
- Grout
- Drill arisings or collapsed hole
- Filter material

Remarks

- Co-ordinates provided by McMillan Drilling Ltd and subject to survey confirmation.
- Consistency strength based on visual description of recovered sample.
- Driller notes: added water to hole from 0m to 17m. Total volume added = 700 litres
- Driller notes: water level = 0.45m depth when casing = 12.1m depth.

All dimensions in metres
Scale 1:50

Contractor:
McMillan Drilling

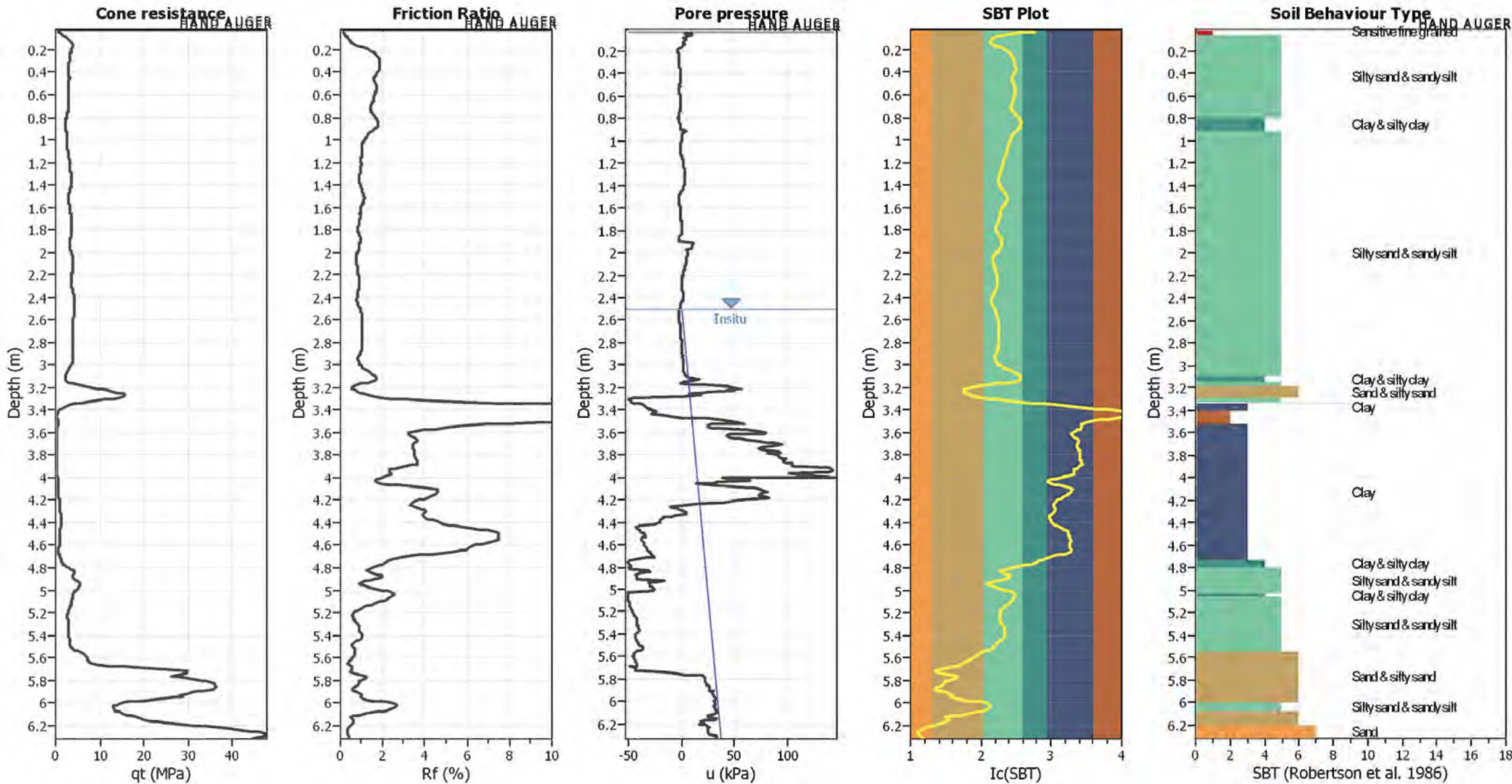
Rig/Plant Used:
Direct Push Sampler

Driller:
CN

Logged by:
GG

Checked by:
EL

CPT basic interpretation plots



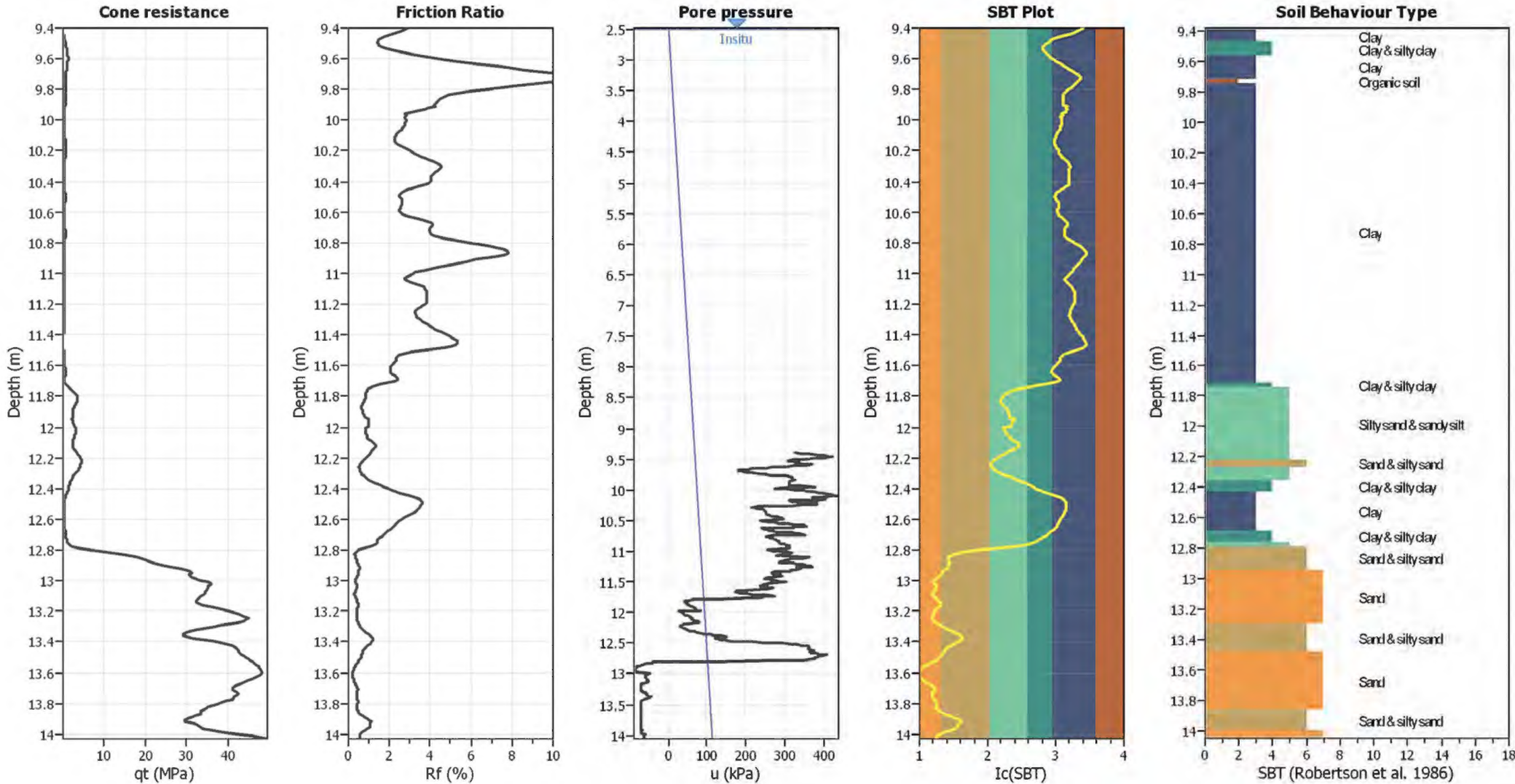
Input parameters and analysis data

Analysis method:	I&B (2008)	Depth to GWT (erthq.):	2.50 m	Fill weight:	N/A
Fines correction method:	R&W (1998)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	2.50 m	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

CPT basic interpretation plots



Input parameters and analysis data

Analysis method:	I&B (2008)	Depth to GWT (erthq.):	2.50 m	Fill weight:	N/A
Fines correction method:	R&W (1998)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _g applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	2.50 m	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

LLUR Extract:

Start your LLUR search here

Type into the search bar below to find properties by address or legal description. Alternatively you can search using the interactive map.

Having trouble finding your address?

Search by address or legal description

Reset search



You have the following **Land Parcels** selected. These are being used to search for intersecting records in the Listed Land Use Register.

Reset Search

Legal Description Titles Valuation No

4 PARCELS ADDED

Thank you for your enquiry

Need help understanding these results?

Summary

The Listed Land Use Register does not currently have any information about a Hazardous Activities and Industries List site on your selected land parcel.

An investigation has occurred at this land parcel.

If you would like a property statement, please click or tap the Request a Property Statement button below.

I would like to...

Request a Property Statement

What is a Property Statement?

Detailed Results

The following **Investigations** were found within your search area.

What is an Investigation?

No.	Type	Investigation Title	Report Date
INV371493	Detailed Site Investigation	Soil Sampling - 6 Wroots Road, Kennedys Bush	28 Sep 2023

Start your LLUR search here

Type into the search bar below to find properties by address or legal description. Alternatively you can search using the interactive map.

Having trouble finding your address?

Search by address or legal description

Reset search



You have the following **Land Parcels** selected. These are being used to search for intersecting records in the Listed Land Use Register.

Reset Search

Legal Description Titles Valuation No

Thank you for your enquiry

Need help understanding these results?

Summary

The Listed Land Use Register does not currently have any information about a Hazardous Activities and Industries List site on your selected land parcels.

If you would like a property statement, please click or tap the Request a Property Statement button below.

I would like to...

Request a Property Statement

What is a Property Statement?

New Zealand Geotechnical Database: Property Summary Report

General Property Information

Property Address	101 Sabys Rd		
QPID #	2372687	Suburb	Halswell
Valuation Reference No	23562/6901	DPID #	
Legal Description	LOTS 2, 3 DP 68573		
Easting (NZTM)	1564714	Northing (NZTM)	5173441
CERA Zone	Green	MBIE Technical Category	N/A - Rural & Unmapped

Liquefaction Observations

Earthquake	4 Sept 2010	22 Feb 2011	13 June 2011
Liquefaction Observed [from aerial photos]	Not Mapped	Not Mapped	Not Mapped
Ground Surface Observation Category	Not Inspected	Not Inspected	Refer to Road Map

Discrepancies are possible between observations from aerial photography and ground based observations. Refer to notes 1 & 2.

Property Surface Elevation from LiDAR Surveys (m LVD37)

Survey Dates	Pre Quake	5 Sep 2010	8 Mar-30 May 2011	18 Jul - 3 Sep 2011	17 - 18 Feb 2012
Maximum Elevation					
95 percentile					
Mean Elevation					
5 percentile					
Minimum Elevation					

Refer to note 3.

Cumulative Property Elevation Changes from LiDAR Surveys (m LVD37)

Period: Pre Quake -	to 5 Sep 2010	to 30 May 2011	to 3 Sep 2011	to 18 Feb 2012
Surface Change				
Other Change				
Tectonic Change	- 0.01	- 0.02	- 0.02	- 0.02

Refer to note 3.

Interpolated Ground Water Surface Elevation at the time of each Earthquake (m LVD37)

Earthquake	Sep 2010	Feb 2011	Jun 2011	Dec 2011
Surface Elevation				

For back analysis purpose only. Refer to note 4.

Design Ground Water Surface Elevations (m LVD37)

	Median surface	Median with surrogates	85 percentile offset	15 percentile offset
Surface Elevation				

Refer to note 5.

Terms of Use for this Report

Terms of Use

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Important notice

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Notes

1. Liquefaction Observations

The Observed Liquefaction is based on the quantity of ejected liquefaction material deposited on the streets as visually identified using aerial photographs. For more details, see the notes accompanying "Liquefaction Interpreted from Aerial Photography", Map Layer CGD0200.

2. The Ground Surface Observation

The Ground Surface Observation Category is based on the quantities of material ejected due to liquefaction and observations of lateral spreading collated from either on-foot rapid inspection of individual properties or road inspections following each significant earthquake. For more details, see the notes accompanying "Liquefaction and Lateral Spreading Observations", Map Layer CGD0300.

3. Vertical Elevations and Movements

Vertical Elevations and Movements are based on Airborne LiDAR acquired following each of the significant earthquakes, and on digital elevation models developed from that LiDAR. Residual change is calculated using the mean elevation change for the whole property. The tectonic elevation changes are uniform (for practical purposes) over the whole property. For more details, see the notes accompanying "LiDAR and Digital Elevation Models", Map Layer CGD0500 and "Vertical Ground Movements", Map Layer CGD0600.

4. The Ground Water Elevations

The Ground Water Elevations are based on Water level dip measurements from wells that were converted to free surface elevations, based on surveyed well-head levels. The free surface elevations only provide mean values at the time of each earthquake and are only suitable for back analysis purpose. For more details, see the notes accompanying "Groundwater Level Contours", Map Layer CGD0800.

5. Design Ground Water Elevations

The two design ground water surface elevations are interpolated median water level dip measurements for wells with long-term (> 12 month) records and wells with short-term records augmented by surrogate median estimates. Designers need to decide which surface is more appropriate based on specific engineering requirements and their own local site observations. Add the 85th percentile offset to the appropriate median and subtract the 15th percentile offset (as indicated by the - sign) from the same median. For more details, see the report and notes accompanying "GNS Science Median Water Table Elevations (Version 2)", Map Layer CGD5160.

General notes

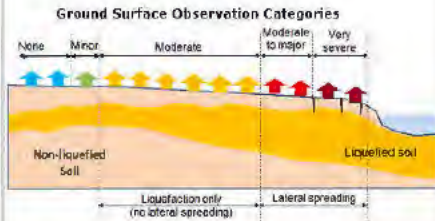
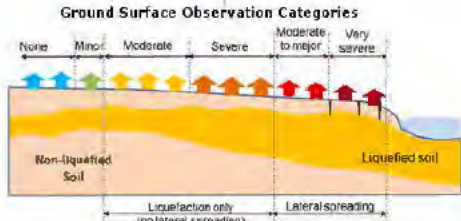
All information presented in this property report should be interpreted holistically, accounting for both the interdependence of the recorded information and the information for the surrounding properties and subsurface ground. Movements are the approximate averaged ground surface movement for the nominated property. The data tabulated above should be considered within the context of the patterns of the wider region, and limitations of the data. Engineering judgment should be applied when assessing this data.

New Zealand Geotechnical Database: Property Summary Report

General Property Information

Property Address	6 Wroots Rd		
QPID #	1291983	Suburb	Kennedys Bush
Valuation Reference No	23561/33700	DPID #	
Legal Description	PT LOT 1 DP 1537-BAL AT 23562-06900		
Easting (NZTM)	1564402	Northing (NZTM)	5172530
CERA Zone	Green	MBIE Technical Category	TC3

Liquefaction Observations

Earthquake	4 Sept 2010	22 Feb 2011	13 June 2011
Liquefaction Observed [from aerial photos]	Not Mapped	Not Mapped	Not Mapped
Ground Surface Observation Category	Not Inspected	Not Inspected	Refer to Road Map
			

Discrepancies are possible between observations from aerial photography and ground based observations. Refer to notes 1 & 2.

Property Surface Elevation from LiDAR Surveys (m LVD37)

Survey Dates	Pre Quake	5 Sep 2010	8 Mar-30 May 2011	18 Jul - 3 Sep 2011	17 - 18 Feb 2012
Maximum Elevation					
95 percentile					
Mean Elevation					
5 percentile					
Minimum Elevation					

Refer to note 3.

Cumulative Property Elevation Changes from LiDAR Surveys (m LVD37)

Period: Pre Quake -	to 5 Sep 2010	to 30 May 2011	to 3 Sep 2011	to 18 Feb 2012
Surface Change				
Other Change				
Tectonic Change	- 0.01	- 0.01	- 0.01	- 0.01

Refer to note 3.

Interpolated Ground Water Surface Elevation at the time of each Earthquake (m LVD37)

Earthquake	Sep 2010	Feb 2011	Jun 2011	Dec 2011
Surface Elevation				

For back analysis purpose only. Refer to note 4.

Design Ground Water Surface Elevations (m LVD37)

	Median surface	Median with surrogates	85 percentile offset	15 percentile offset
Surface Elevation				

Refer to note 5.

Terms of Use for this Report

Terms of Use

The data in this report is governed by the Terms of use of the New Zealand Geotechnical Database. This binds all users of the data. The Terms of Use are found at <https://nzgd.org.nz>

Important notice

The information in this report was extracted from the New Zealand Geotechnical Database (<https://nzgd.org.nz>), which were prepared and/or compiled for the Earthquake Commission (EQC) to assist in assessing insurance claims made under the Earthquake Commission Act 1993 and/or for the Canterbury Earthquake Recovery Authority (CERA). The source maps and data were not intended for any other purpose. EQC, CERA, their data suppliers and their engineers, Tonkin & Taylor, have no liability for any use of the maps and data or for the consequences of any person relying on them in any way. This "Important notice" must be reproduced wherever this data or any derivatives are reproduced.

Notes

1. Liquefaction Observations

The Observed Liquefaction is based on the quantity of ejected liquefaction material deposited on the streets as visually identified using aerial photographs. For more details, see the notes accompanying "Liquefaction Interpreted from Aerial Photography", Map Layer CGD0200.

2. The Ground Surface Observation

The Ground Surface Observation Category is based on the quantities of material ejected due to liquefaction and observations of lateral spreading collated from either on-foot rapid inspection of individual properties or road inspections following each significant earthquake. For more details, see the notes accompanying "Liquefaction and Lateral Spreading Observations", Map Layer CGD0300.

3. Vertical Elevations and Movements

Vertical Elevations and Movements are based on Airborne LiDAR acquired following each of the significant earthquakes, and on digital elevation models developed from that LiDAR. Residual change is calculated using the mean elevation change for the whole property. The tectonic elevation changes are uniform (for practical purposes) over the whole property. For more details, see the notes accompanying "LiDAR and Digital Elevation Models", Map Layer CGD0500 and "Vertical Ground Movements", Map Layer CGD0600.

4. The Ground Water Elevations

The Ground Water Elevations are based on Water level dip measurements from wells that were converted to free surface elevations, based on surveyed well-head levels. The free surface elevations only provide mean values at the time of each earthquake and are only suitable for back analysis purpose. For more details, see the notes accompanying "Groundwater Level Contours", Map Layer CGD0800.

5. Design Ground Water Elevations

The two design ground water surface elevations are interpolated median water level dip measurements for wells with long-term (> 12 month) records and wells with short-term records augmented by surrogate median estimates. Designers need to decide which surface is more appropriate based on specific engineering requirements and their own local site observations. Add the 85th percentile offset to the appropriate median and subtract the 15th percentile offset (as indicated by the - sign) from the same median. For more details, see the report and notes accompanying "GNS Science Median Water Table Elevations (Version 2)", Map Layer CGD5160.

General notes

All information presented in this property report should be interpreted holistically, accounting for both the interdependence of the recorded information and the information for the surrounding properties and subsurface ground. Movements are the approximate averaged ground surface movement for the nominated property. The data tabulated above should be considered within the context of the patterns of the wider region, and limitations of the data. Engineering judgment should be applied when assessing this data.



APPENDIX C

Site Photographs

Aerial Photograph, February 2011:



Notes:

1. Aerial photograph sourced from NZ Geotechnical Database

Site Photographs:



APPENDIX D

Liquefaction Analyses

LIQUEFACTION ANALYSIS REPORT

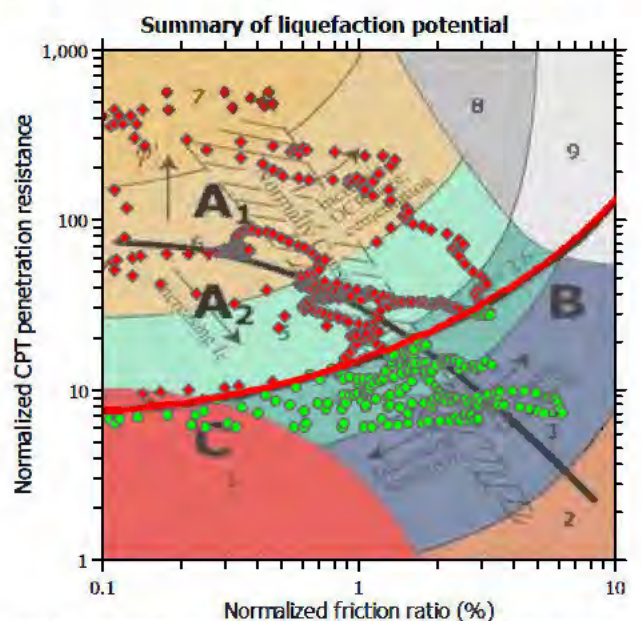
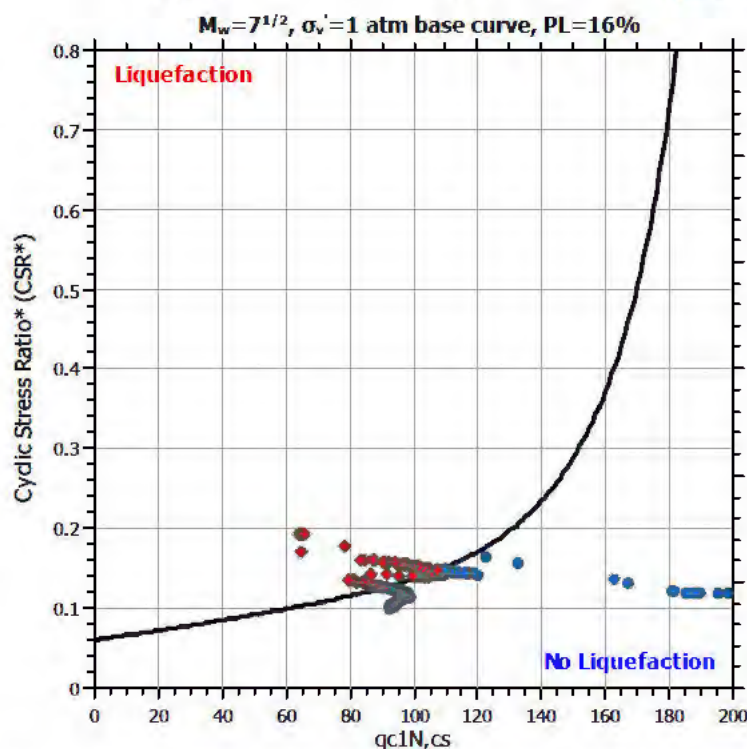
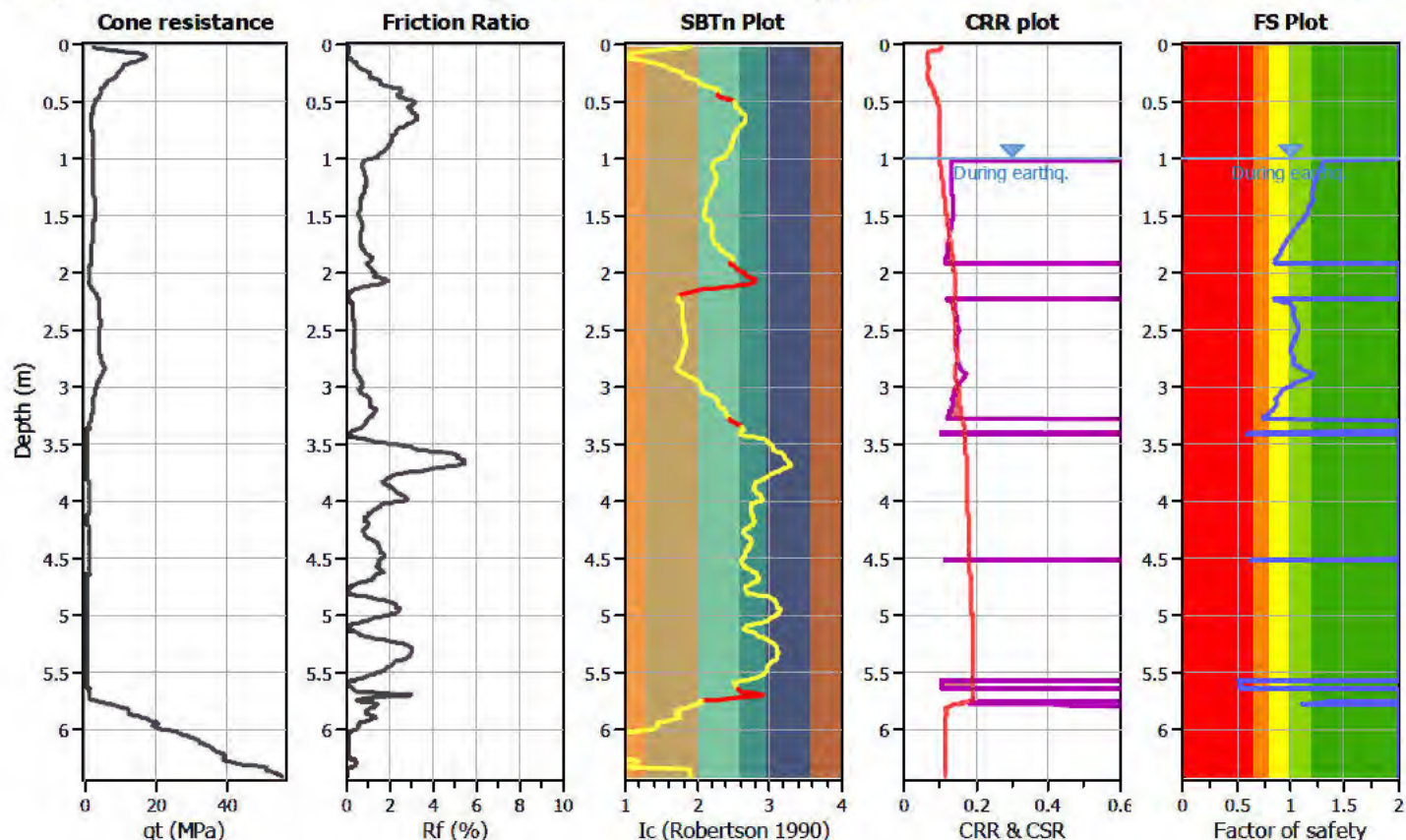
Project title : K250791

Location : 6 Wroots Rd & 101 Sabys Road

CPT file : CPT-01

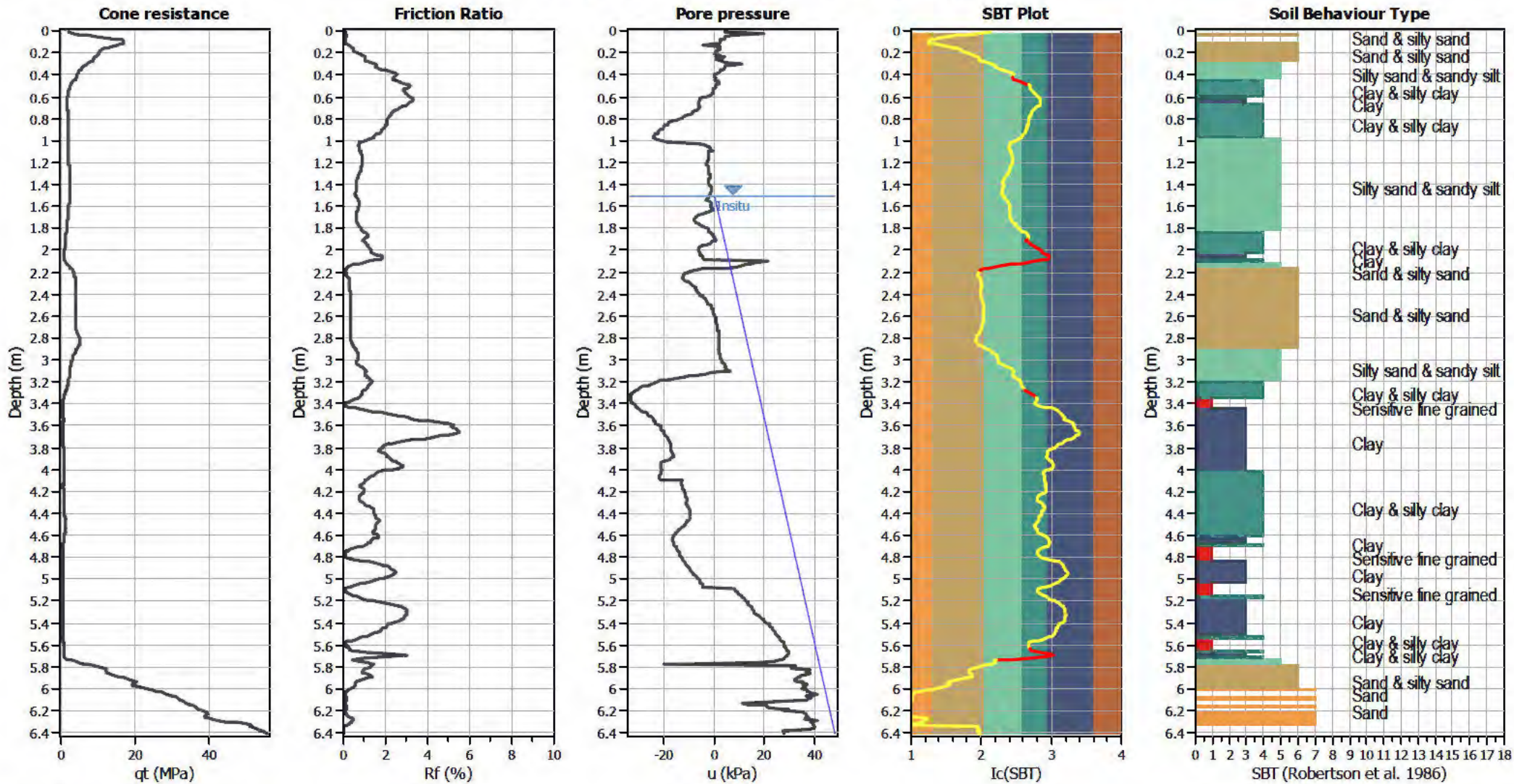
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Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



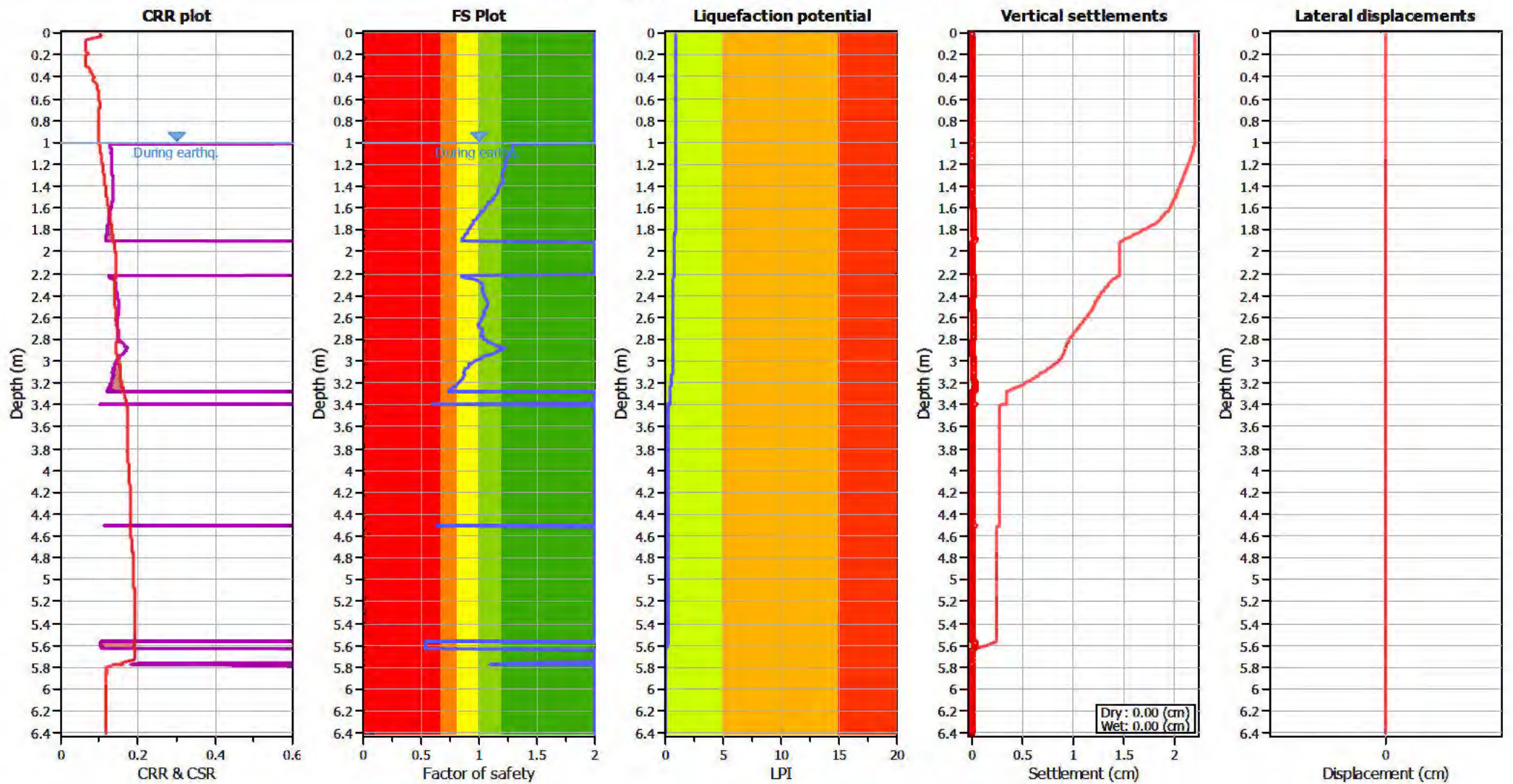
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Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (earthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _σ applied:	Yes
Earthquake magnitude M _w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

Red	Almost certain it will liquefy
Orange	Very likely to liquefy
Yellow	Liquefaction and no liq. are equally likely
Light Green	Unlike to liquefy
Dark Green	Almost certain it will not liquefy

LPI color scheme

Red	Very high risk
Orange	High risk
Yellow	Low risk

LIQUEFACTION ANALYSIS REPORT

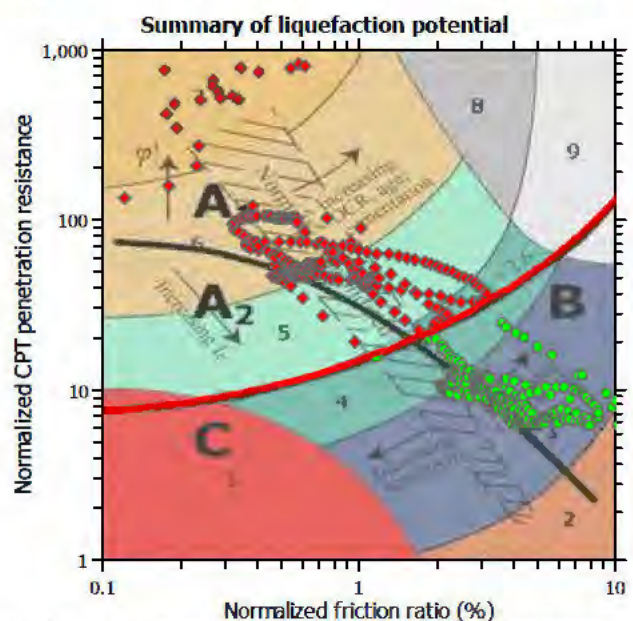
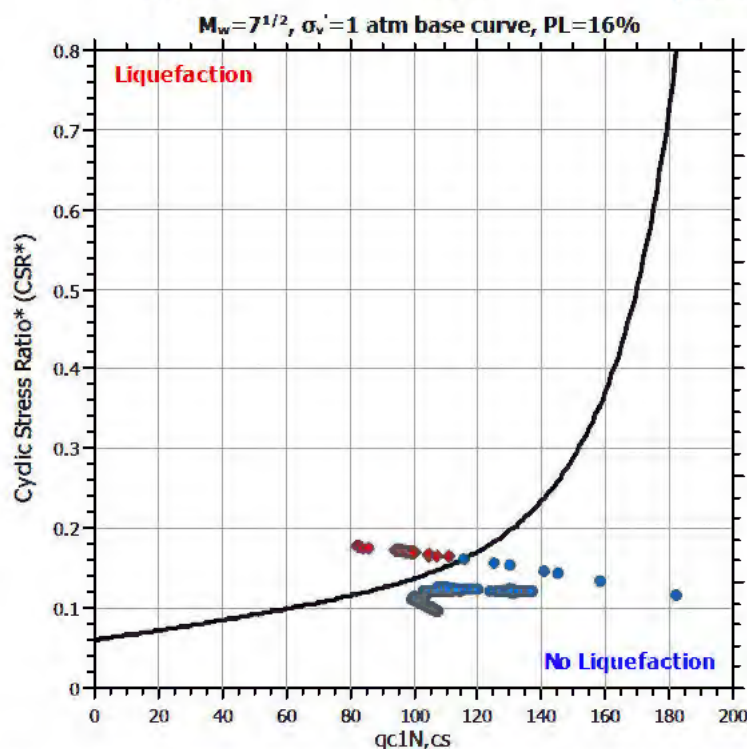
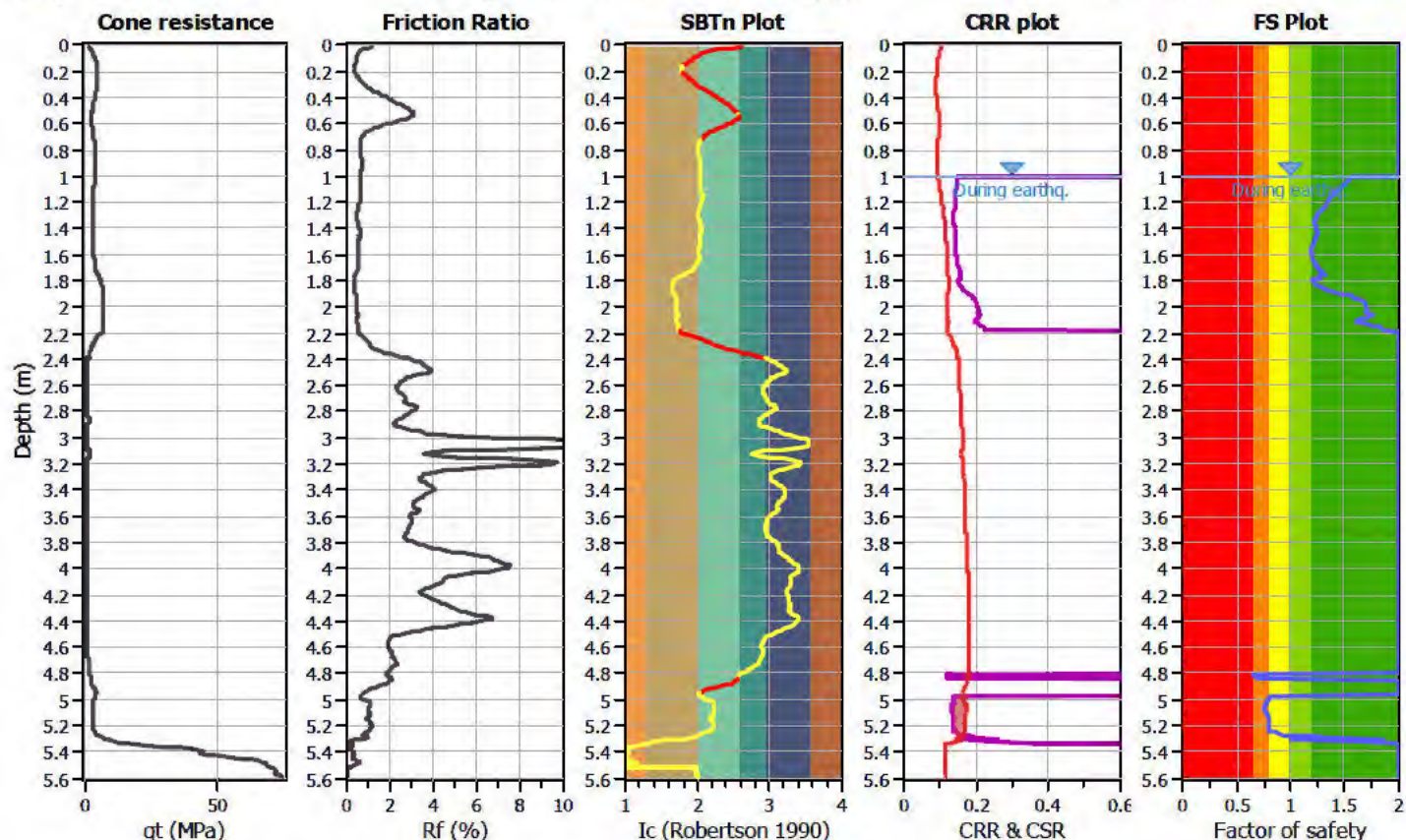
Project title : K250791

Location : 6 Wrooots Rd & 101 Sabys Road

CPT file : CPT-02

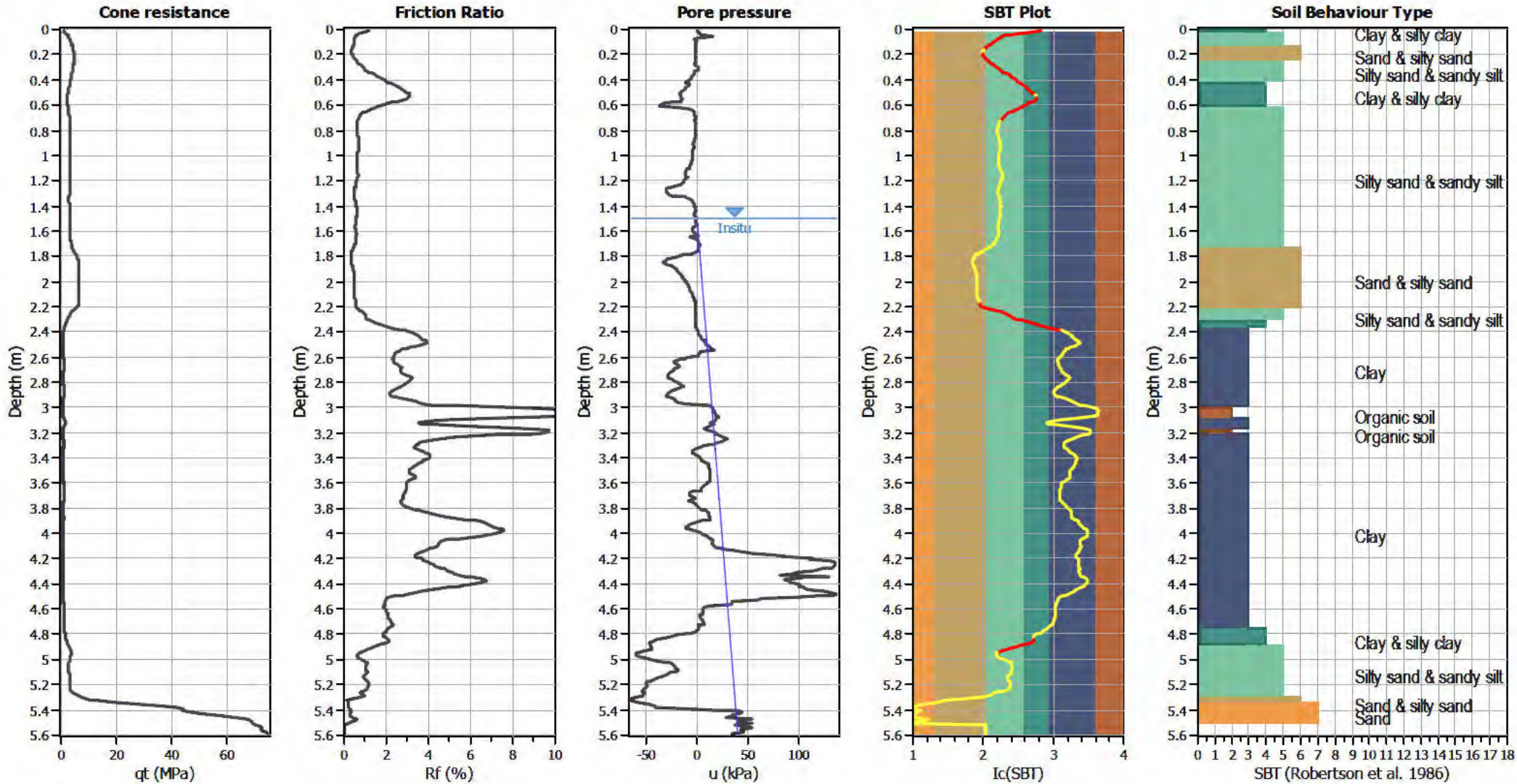
Input parameters and analysis data

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Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	10.00 m
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



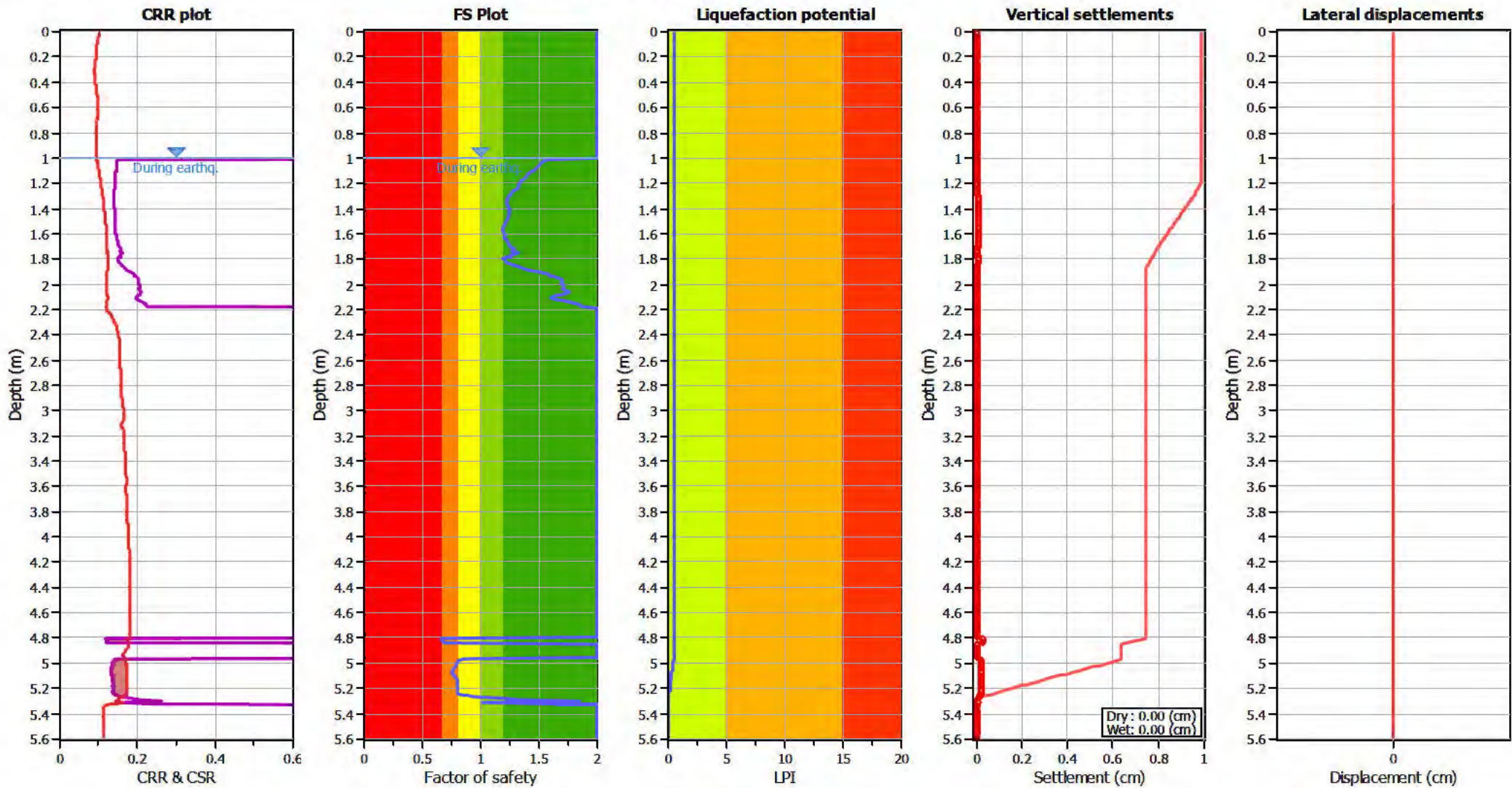
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Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude M_w : 6.00
Peak ground acceleration: 0.19
Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: Yes
 K_{σ} applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: Yes
Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
Very likely to liquefy
Liquefaction and no liq. are equally likely
Unlike to liquefy
Almost certain it will not liquefy

LPI color scheme

Very high risk
High risk
Low risk

LIQUEFACTION ANALYSIS REPORT

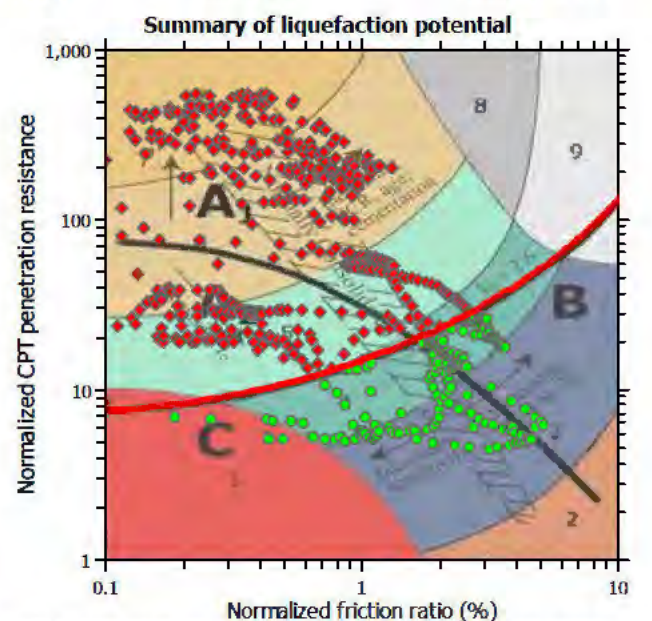
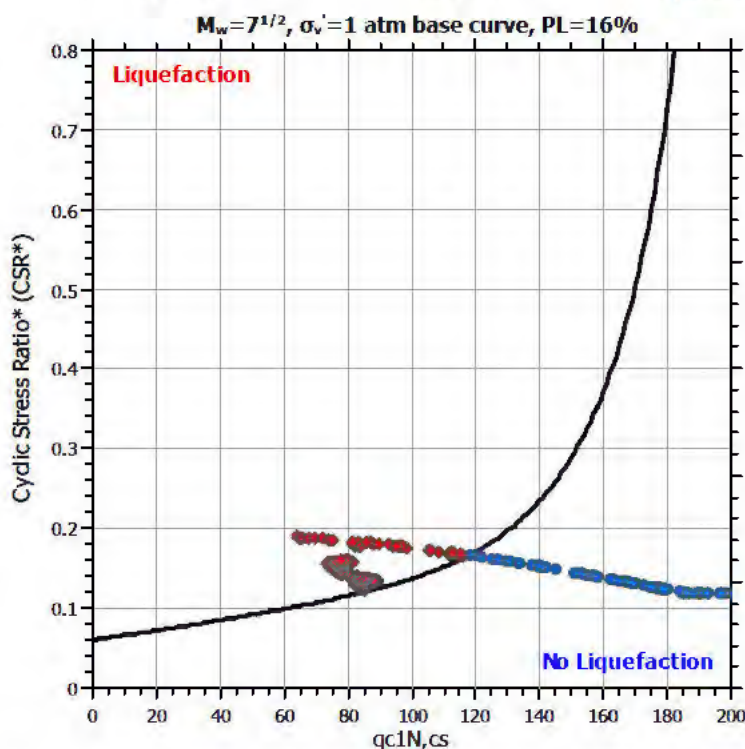
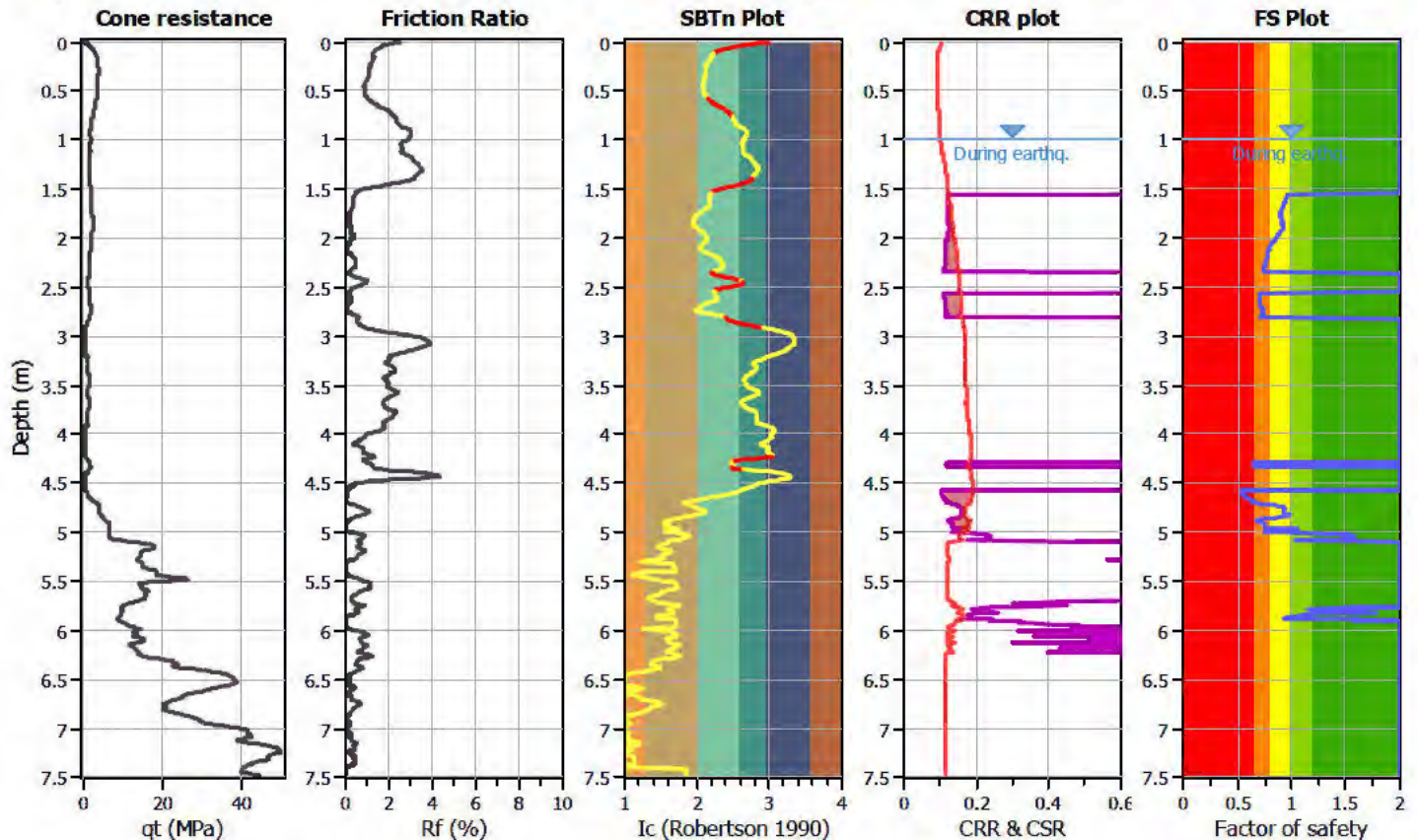
Project title : K250791

Location : 6 Wroots Rd & 101 Sabys Road

CPT file : CPT-03

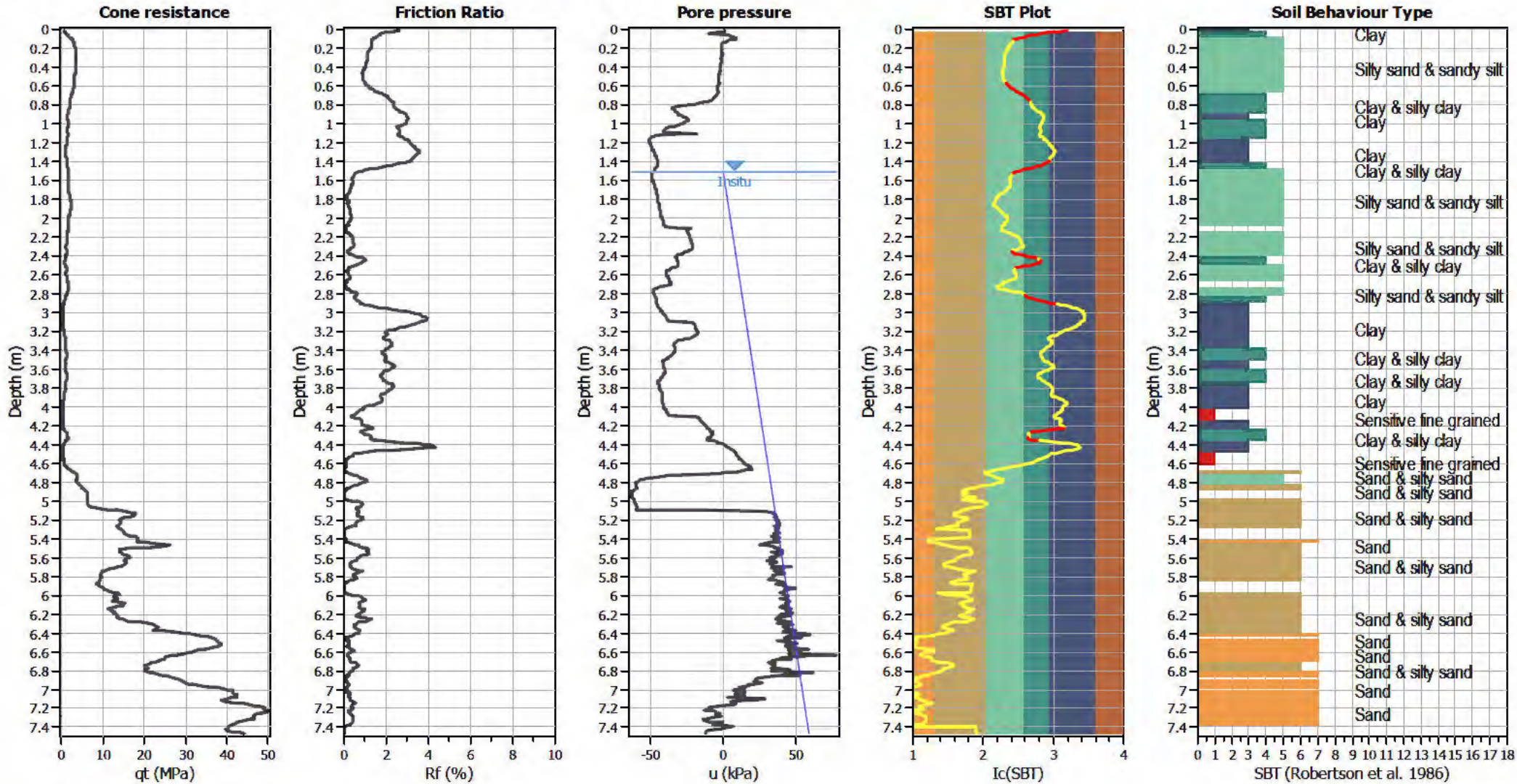
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Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



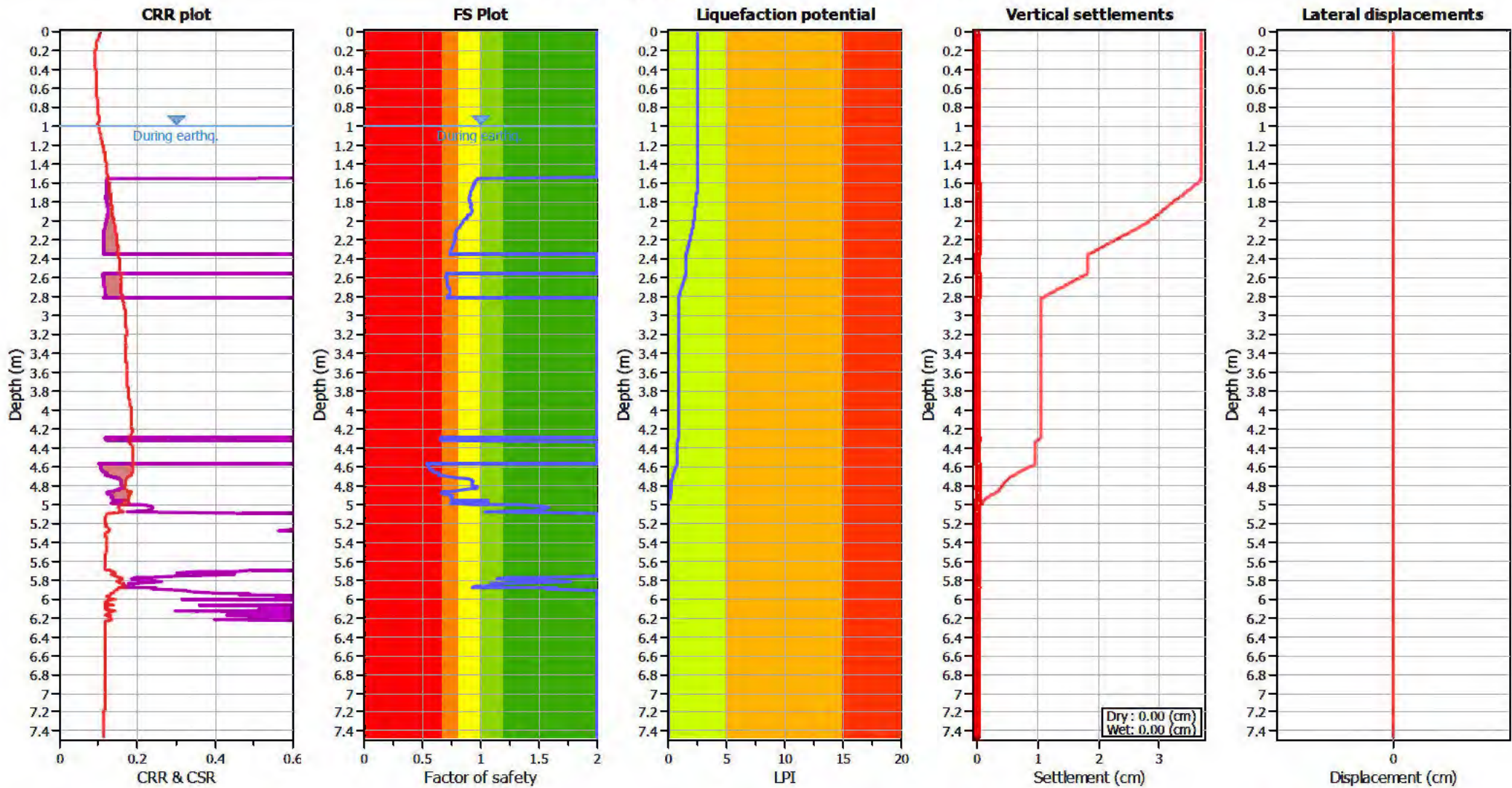
Input parameters and analysis data

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Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



LIQUEFACTION ANALYSIS REPORT

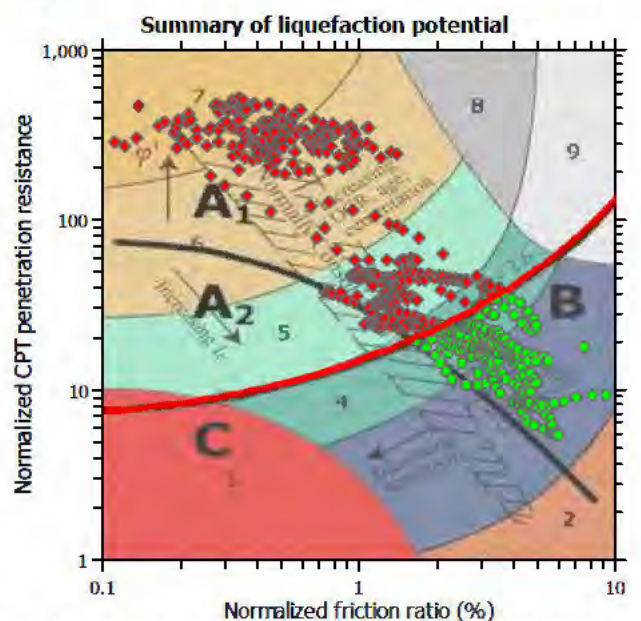
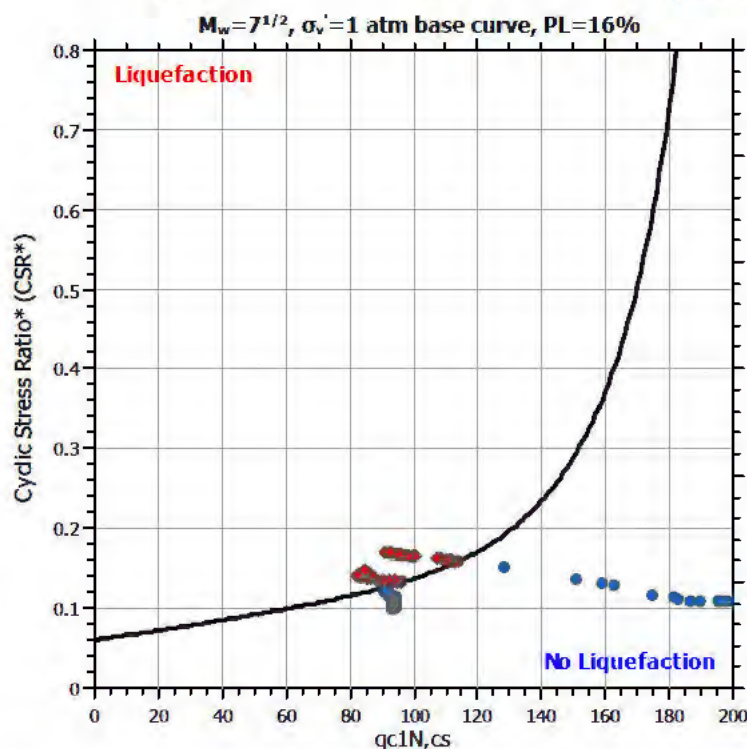
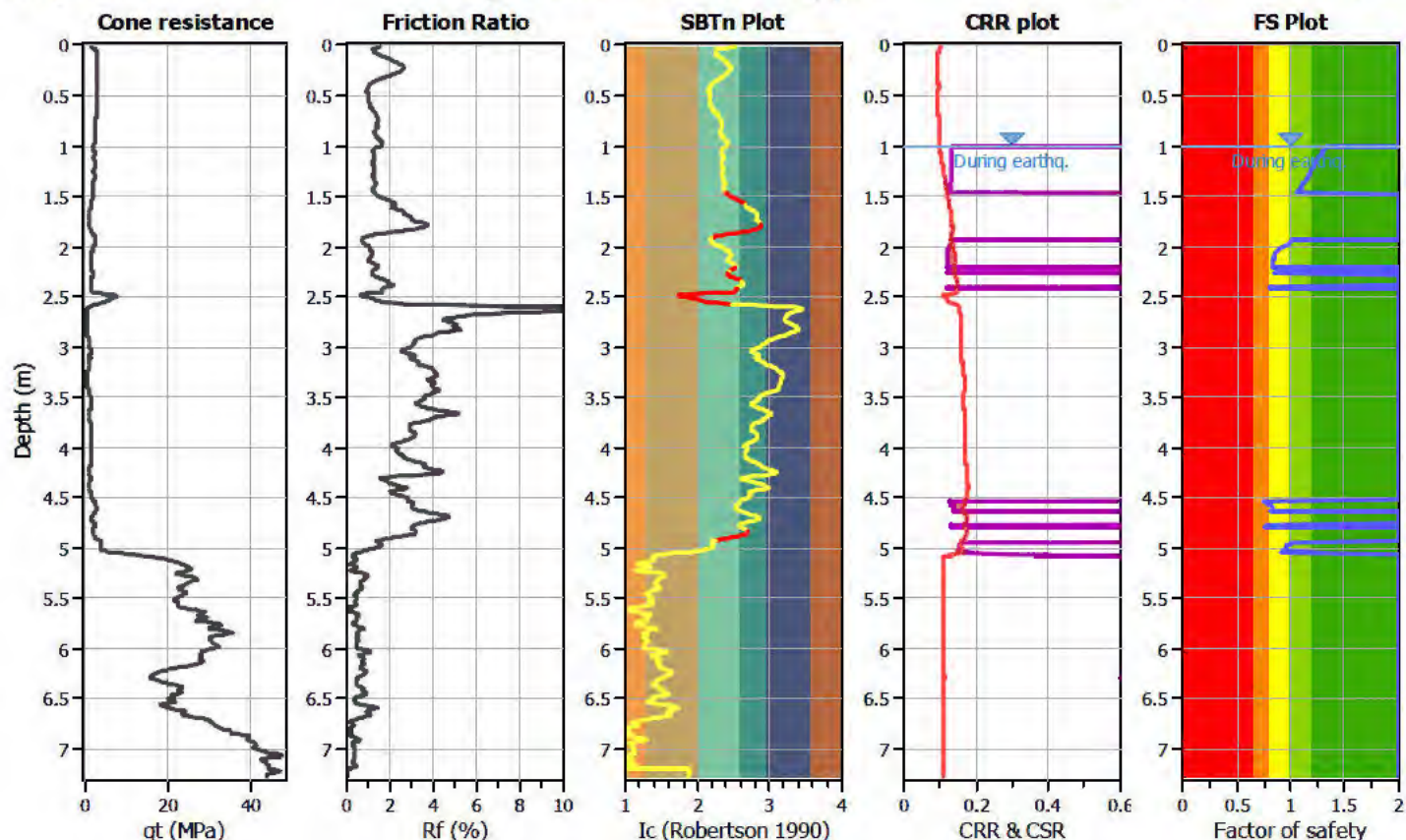
Project title : K250791

Location : 6 Wroots Rd & 101 Sabys Road

CPT file : CPT-04

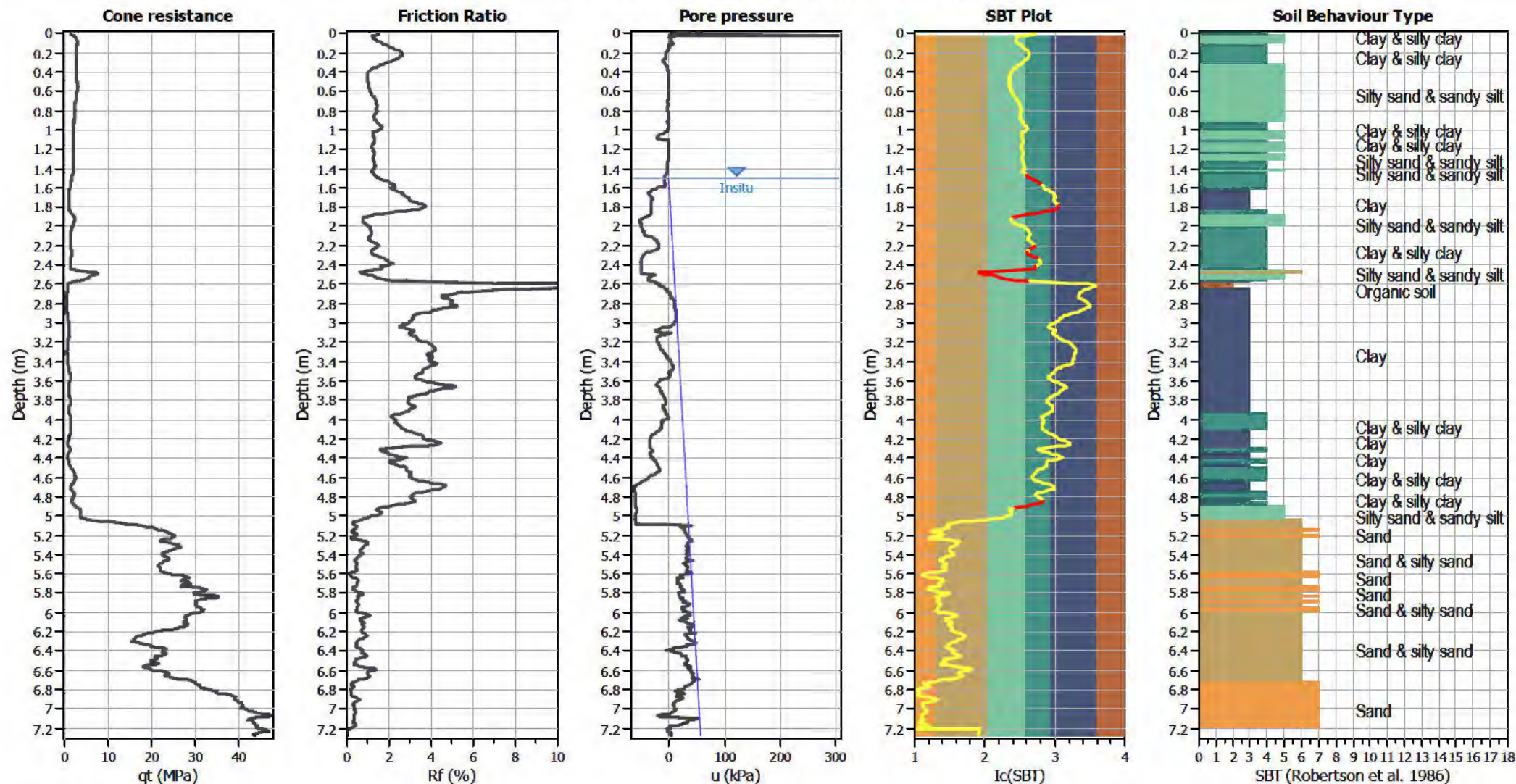
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Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Pore pressure



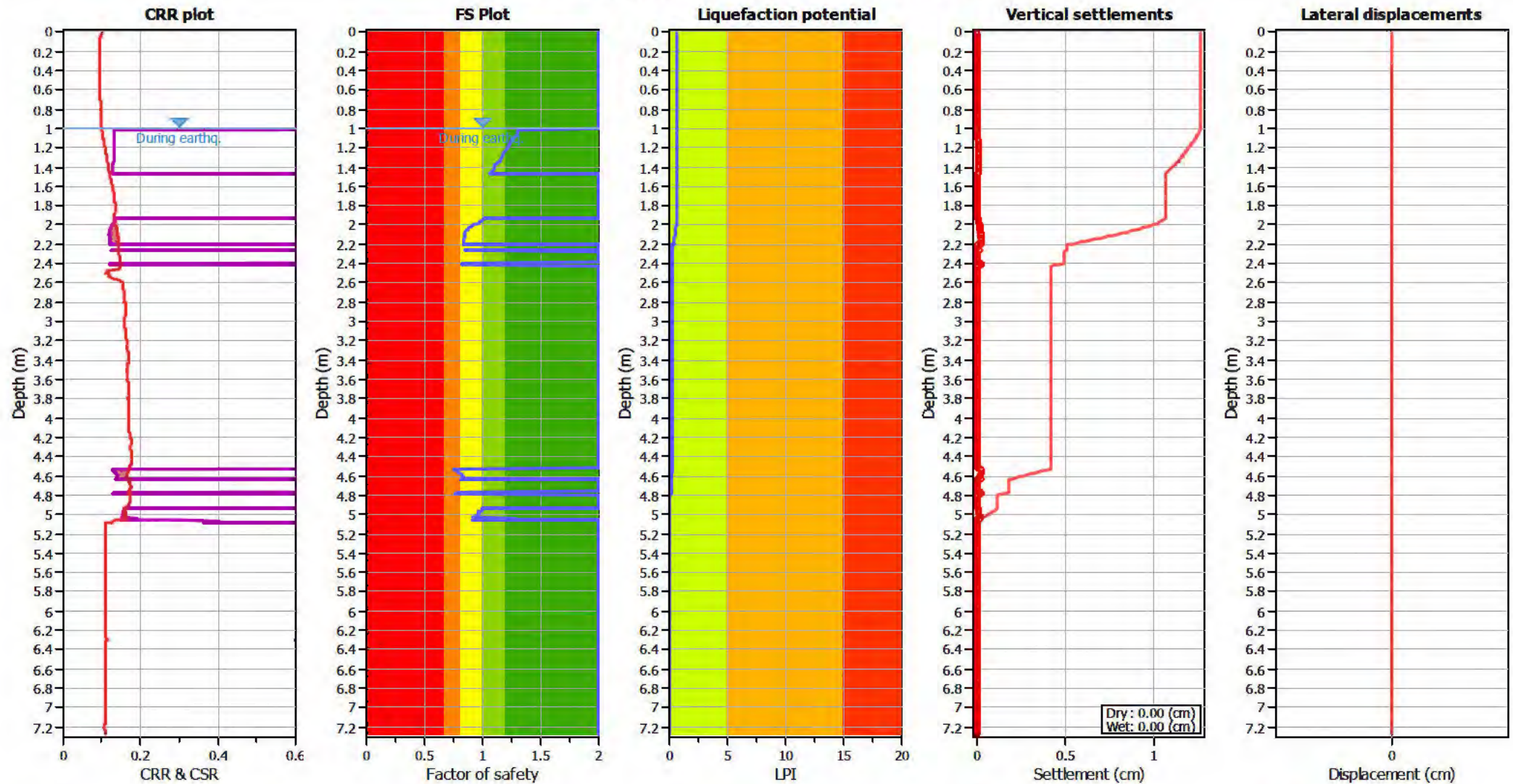
Input parameters and analysis data

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Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _o applied:	Yes
Earthquake magnitude M _w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

- | | | |
|---------------------------|-----------------------------|----------------------------|
| 1. Sensitive fine grained | 4. Clayey silt to silty | 7. Gravely sand to sand |
| 2. Organic material | 5. Silty sand to sandy silt | 8. Very stiff sand to |
| 3. Clay to silty clay | 6. Clean sand to silty sand | 9. Very stiff fine grained |

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 6.00
 Peak ground acceleration: 0.19
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

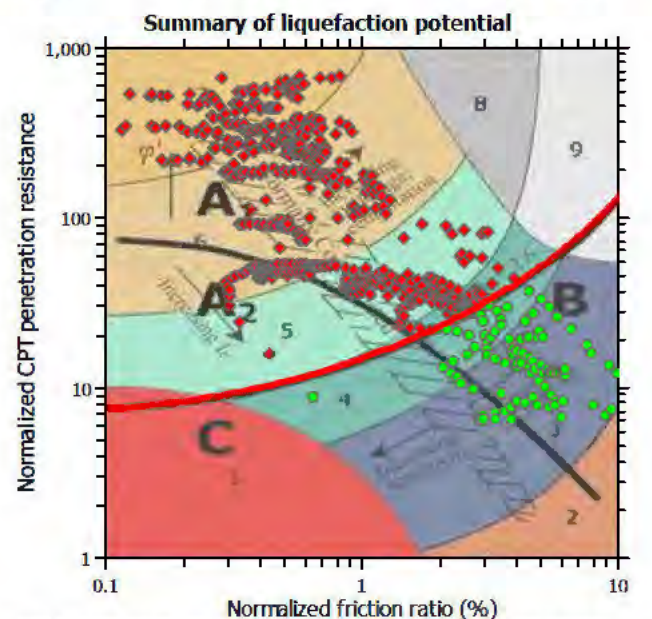
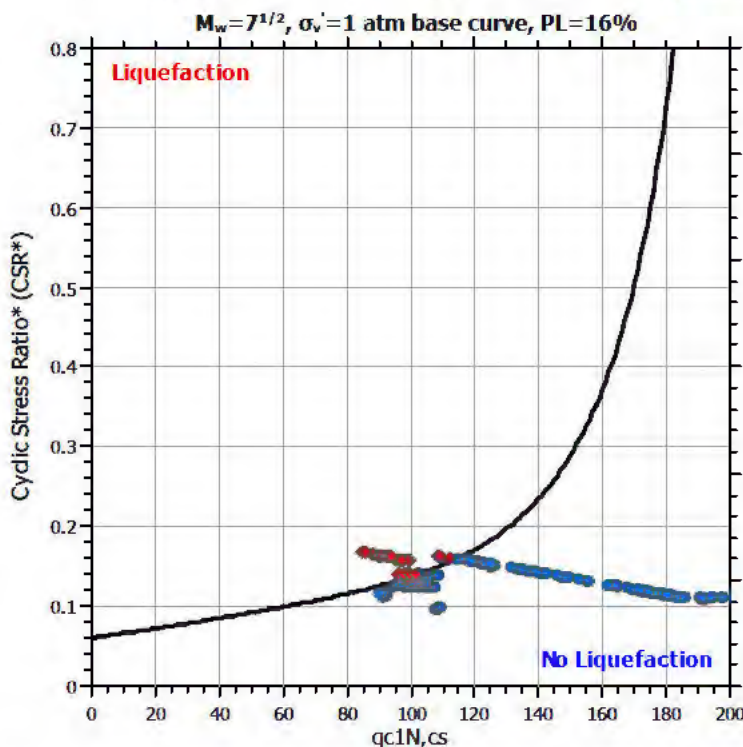
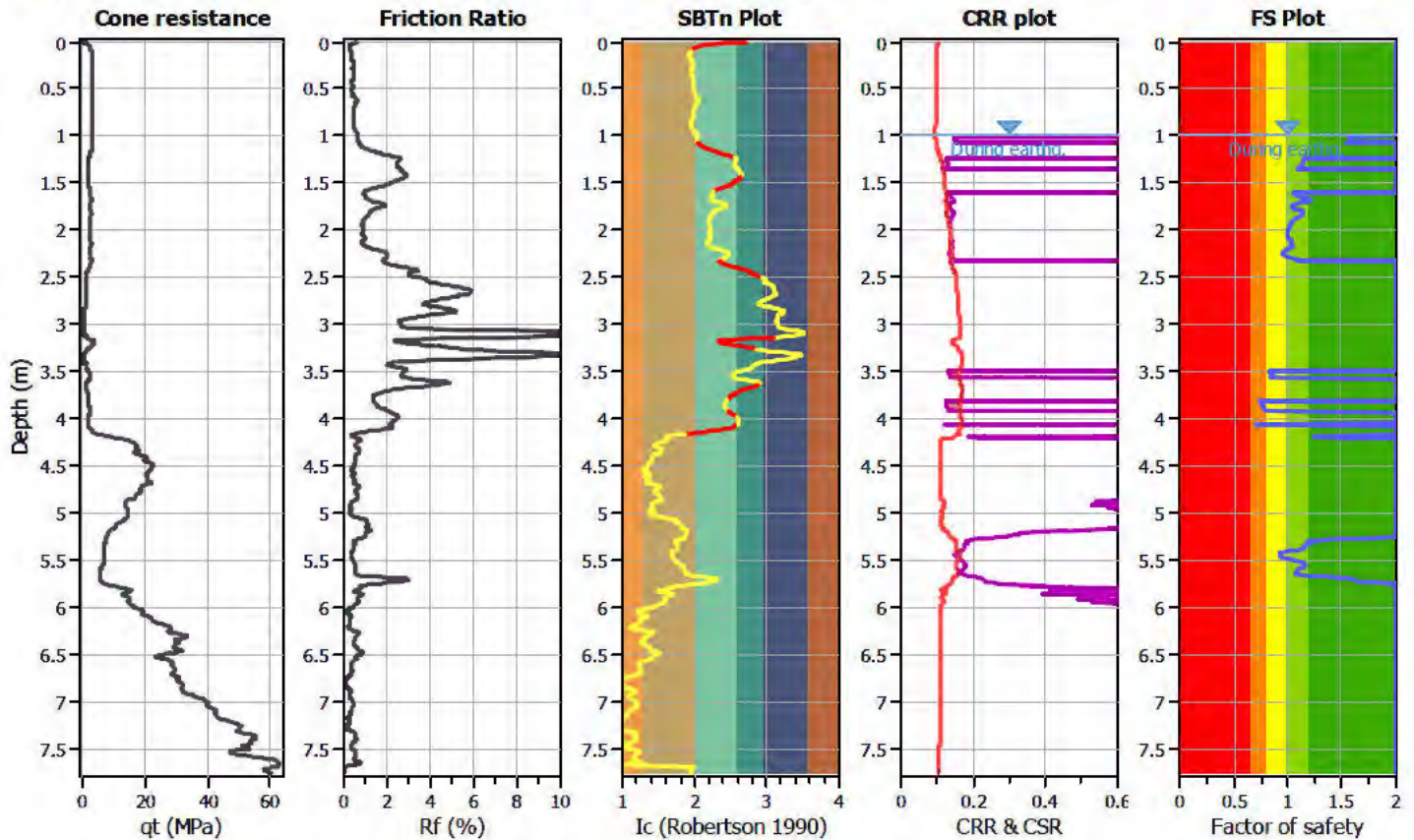
Project title : K250791

Location : 6 Wroots Rd & 101 Sabys Road

CPT file : CPT-05

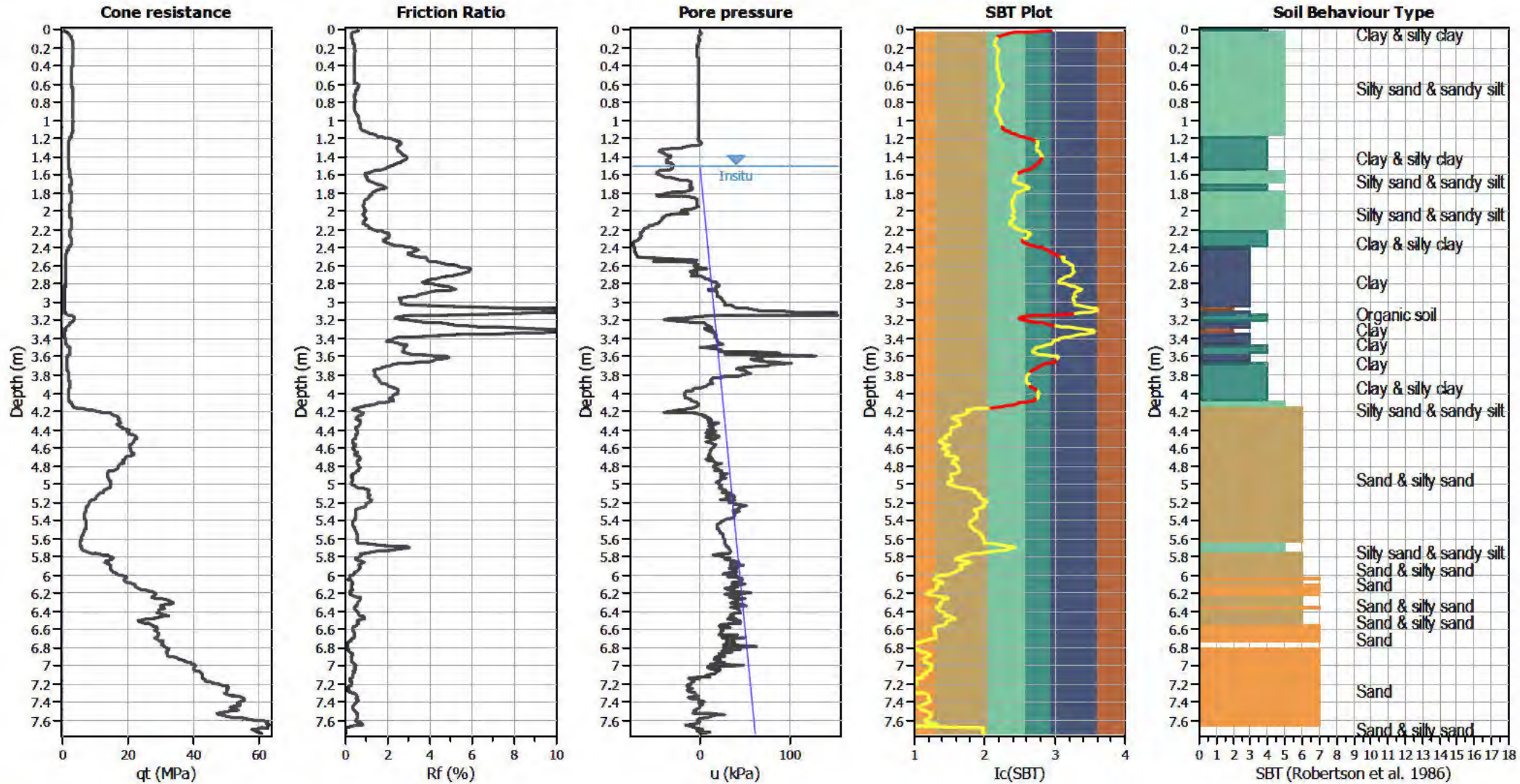
Input parameters and analysis data

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Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	10.00 m
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



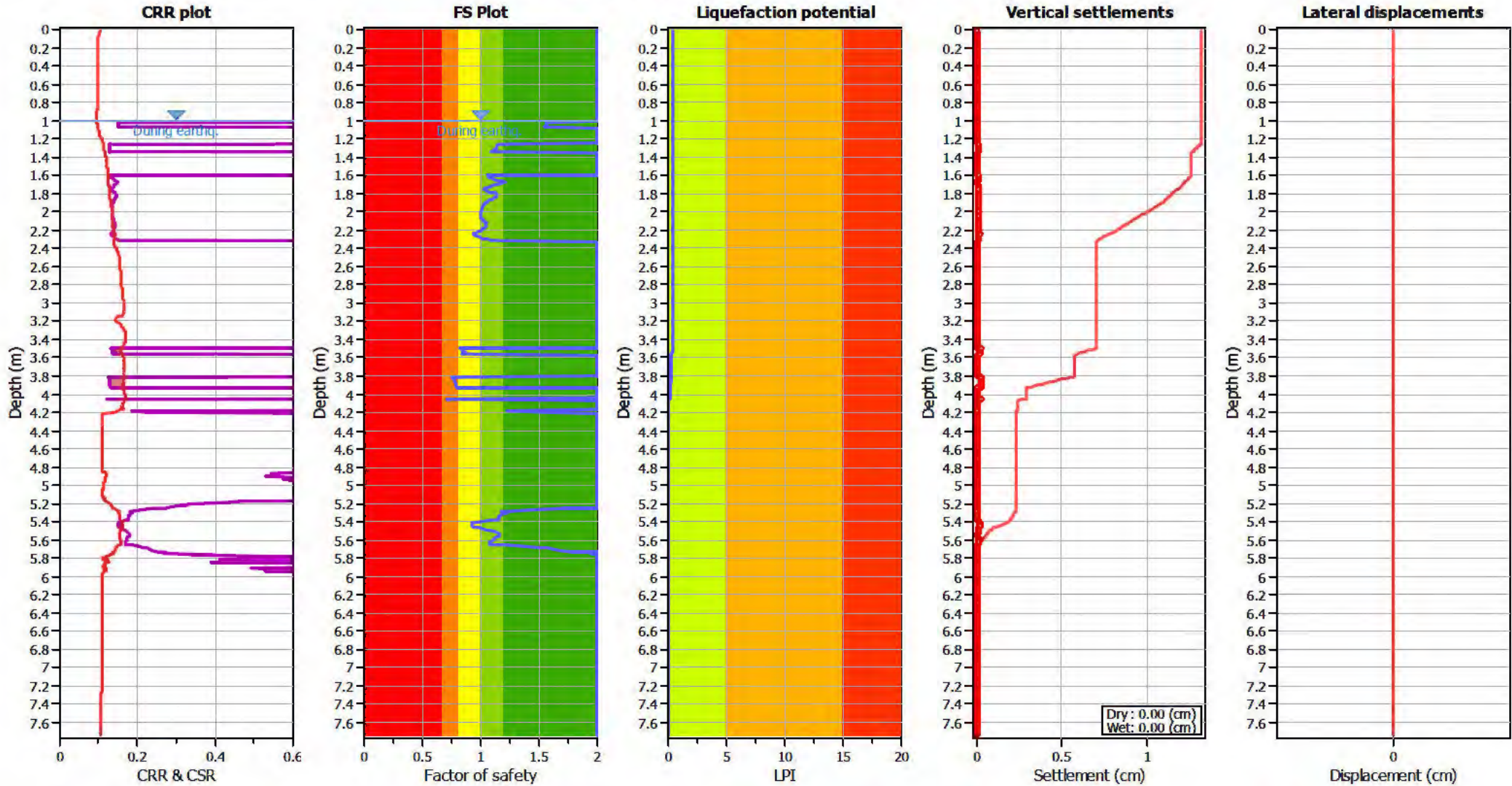
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Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _σ applied:	Yes
Earthquake magnitude M _w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

Red	Almost certain it will liquefy
Orange	Very likely to liquefy
Yellow	Liquefaction and no liq. are equally likely
Green	Unlike to liquefy
Dark Green	Almost certain it will not liquefy

LPI color scheme

Red	Very high risk
Orange	High risk
Yellow	Low risk

LIQUEFACTION ANALYSIS REPORT

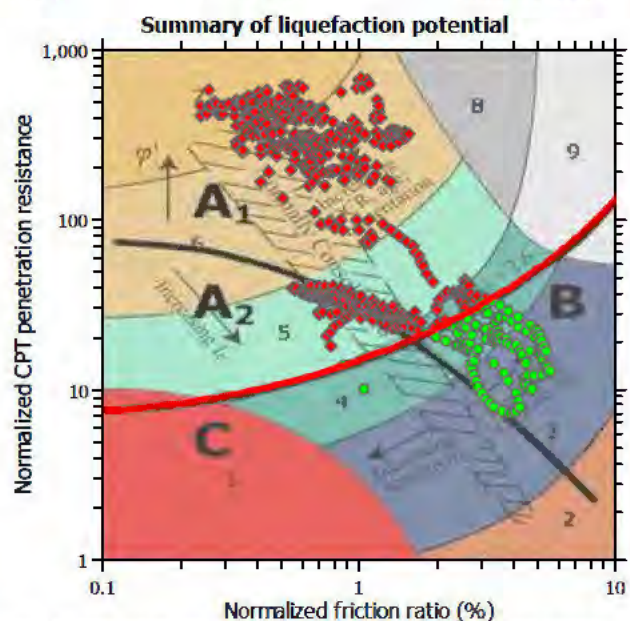
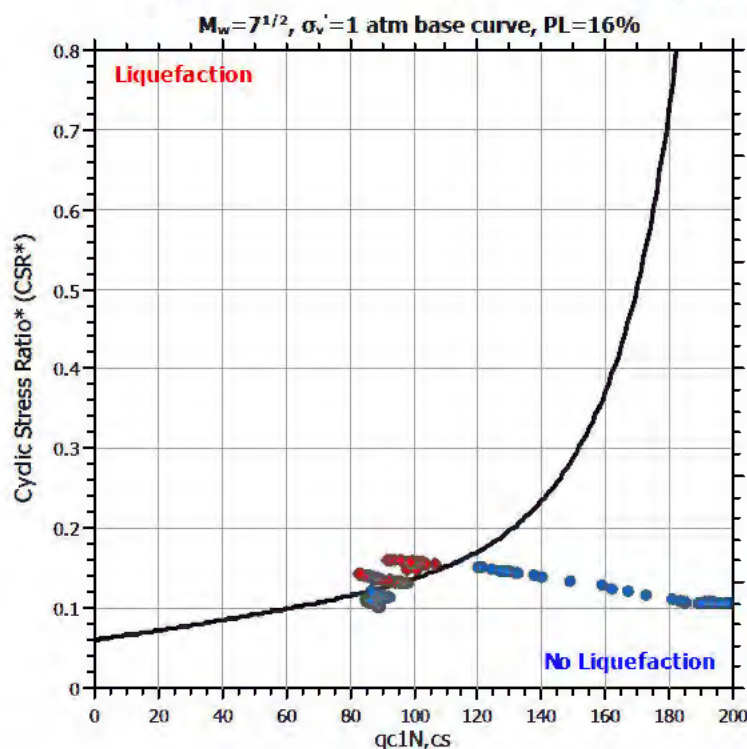
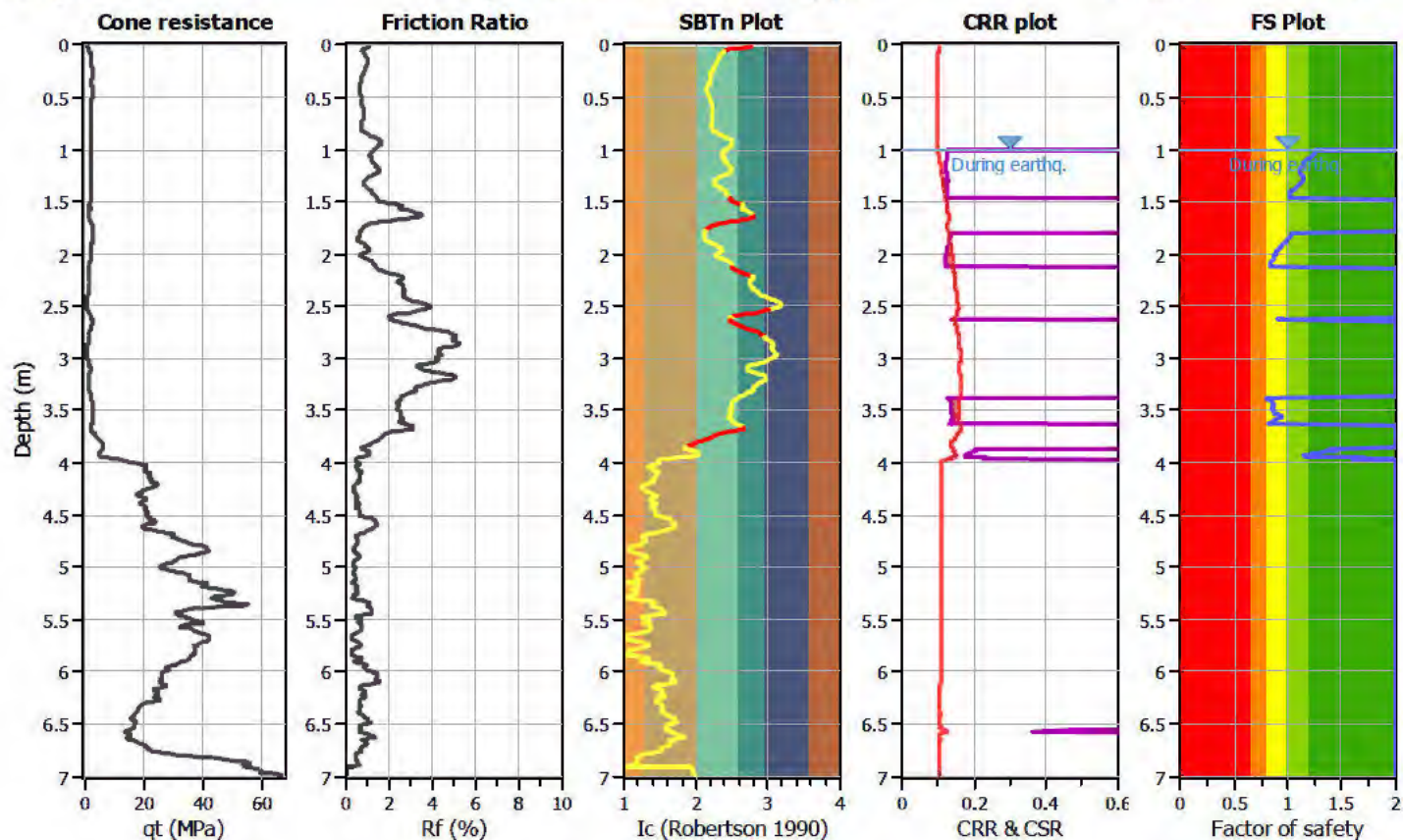
Project title : K250791

Location : 6 Wroots Rd & 101 Sabys Road

CPT file : CPT_06

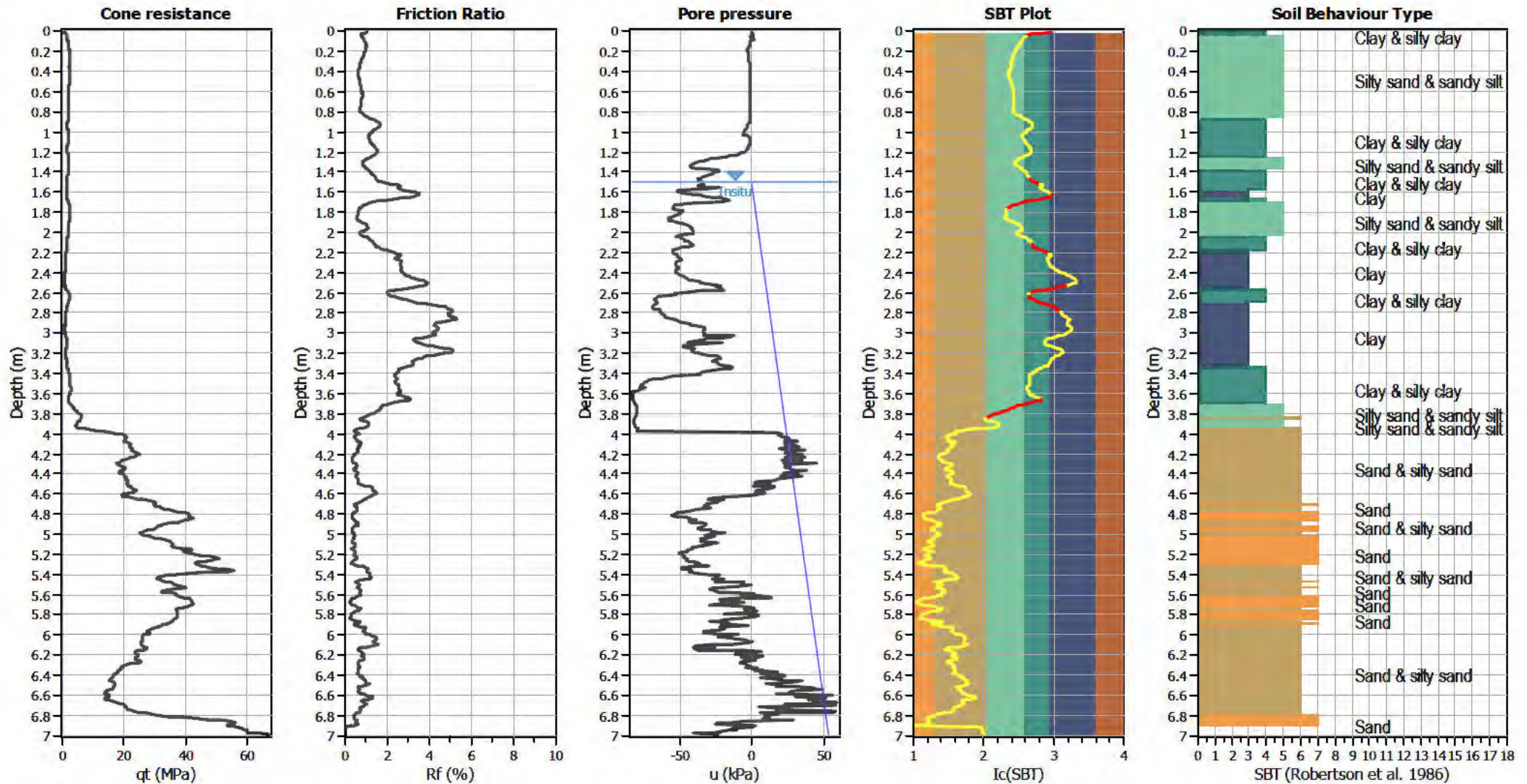
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	10.00 m
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



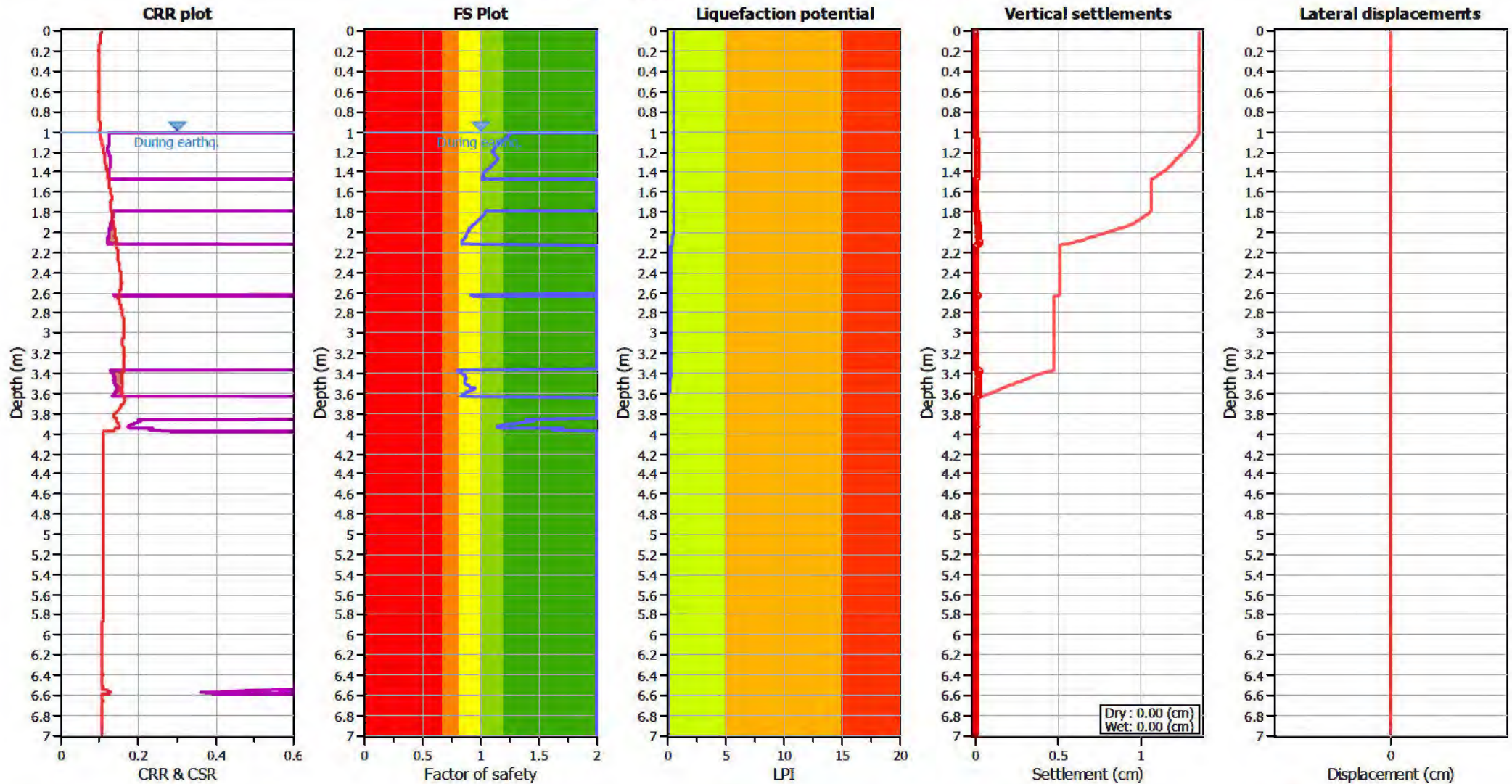
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 6.00
 Peak ground acceleration: 0.19
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

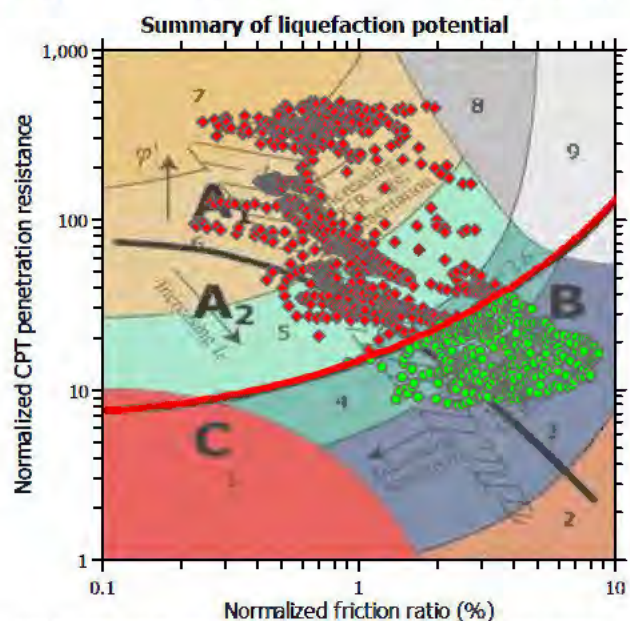
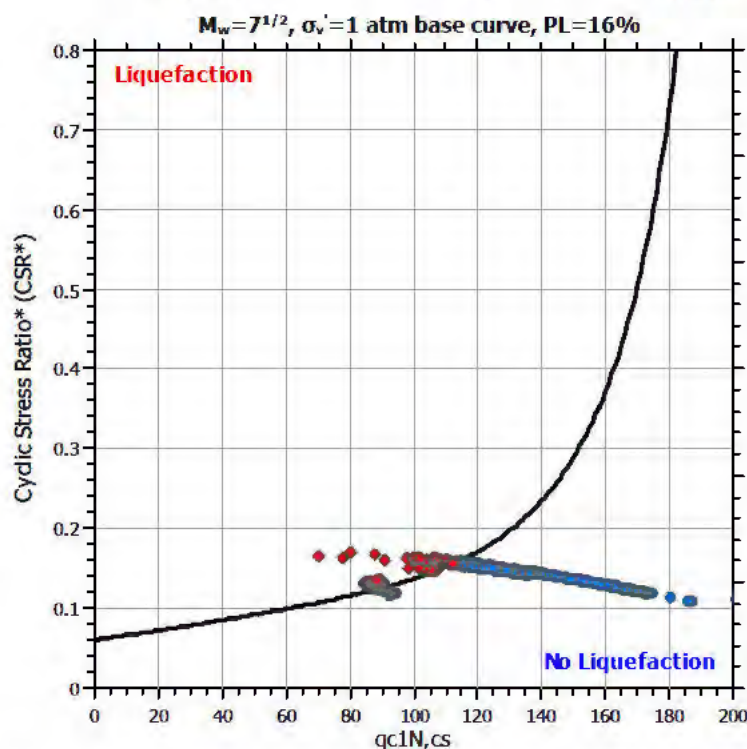
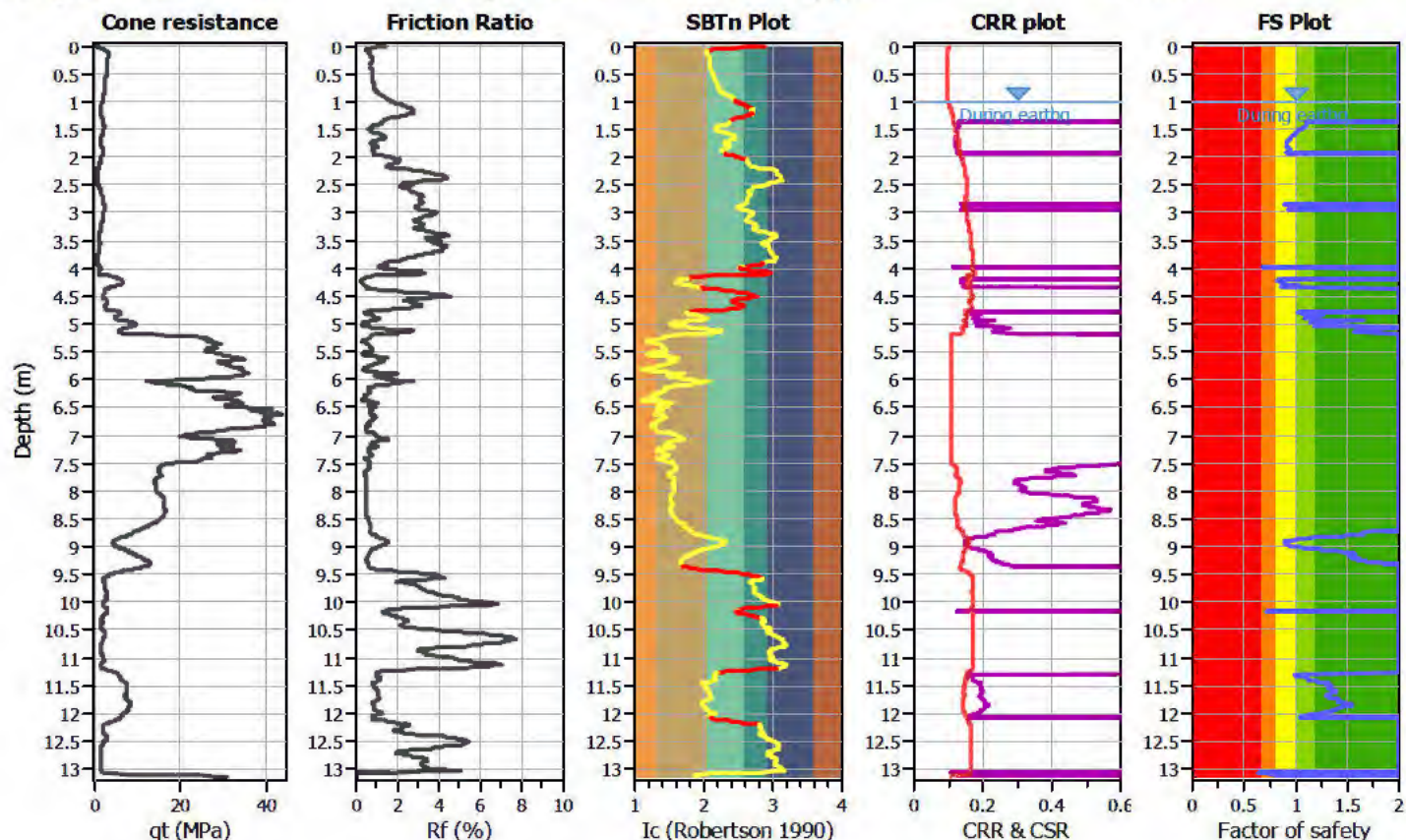
Project title : K250791

Location : 6 Wroots Rd & 101 Sabys Road

CPT file : CPT-07

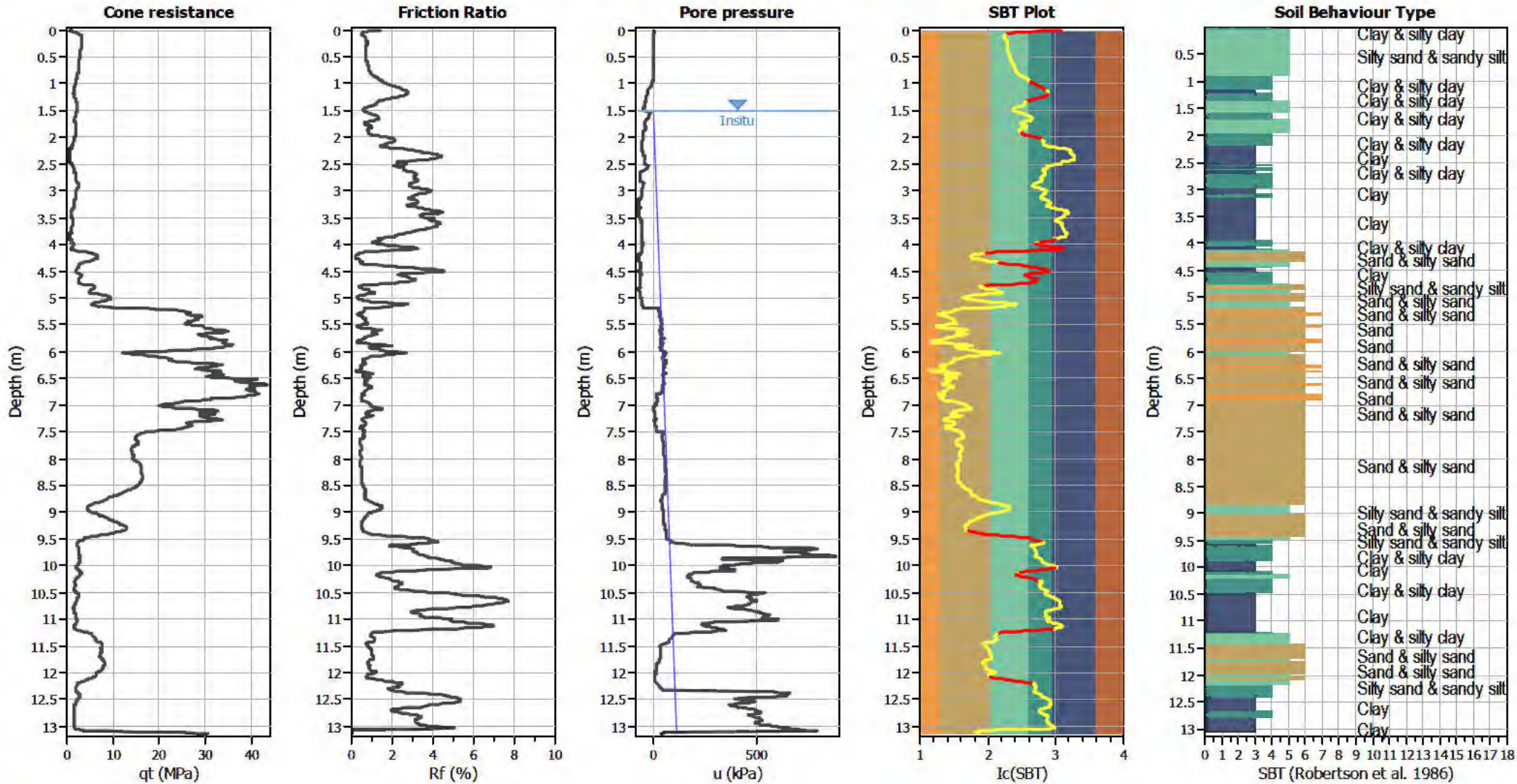
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	N/A
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



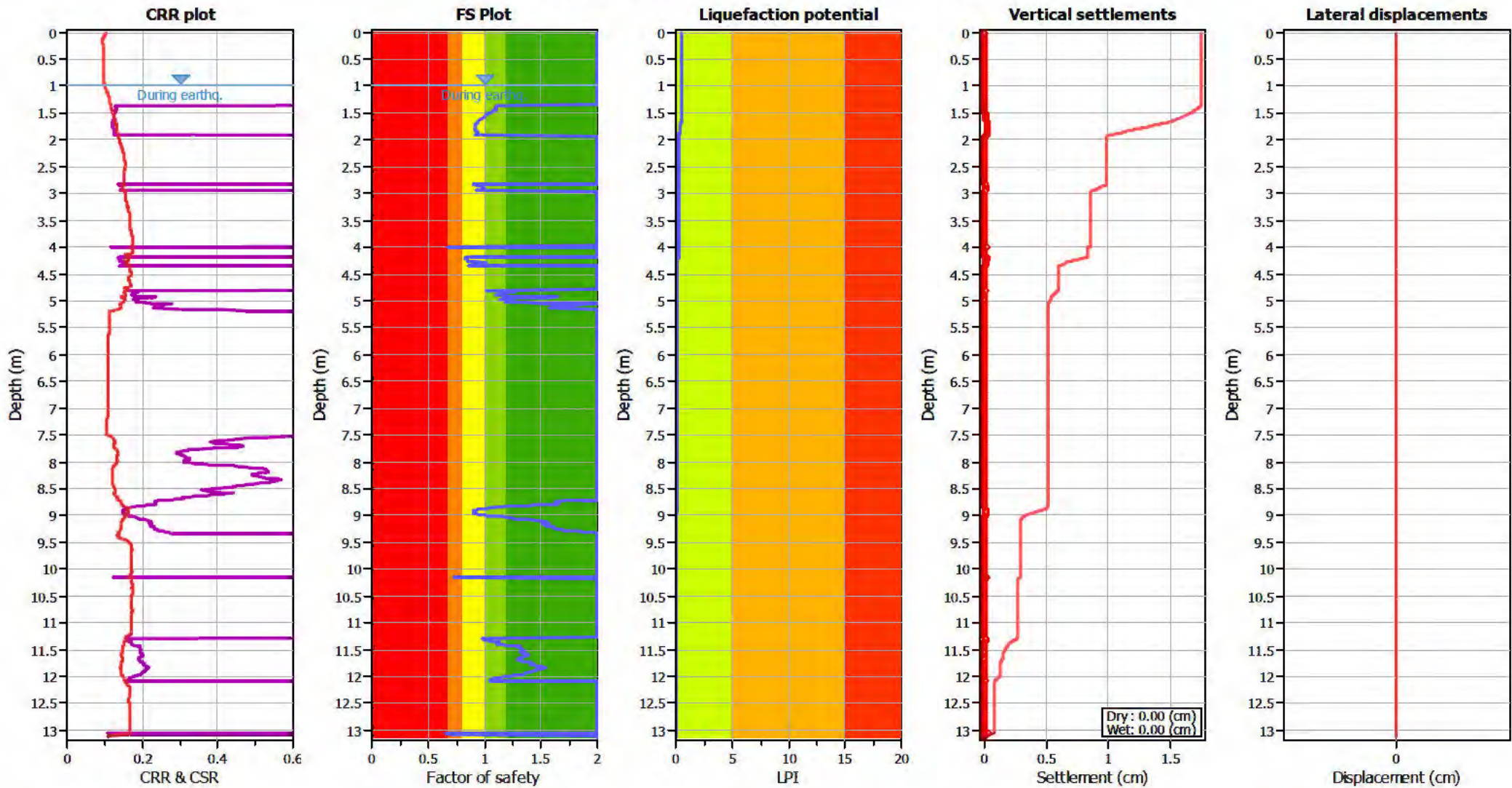
Input parameters and analysis data

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Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _o applied:	Yes
Earthquake magnitude M _w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (earthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _o applied:	Yes
Earthquake magnitude M _w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

Red	Almost certain it will liquefy
Orange	Very likely to liquefy
Yellow	Liquefaction and no liq. are equally likely
Green	Unlike to liquefy
Dark Green	Almost certain it will not liquefy

LPI color scheme

Red	Very high risk
Orange	High risk
Yellow	Low risk

LIQUEFACTION ANALYSIS REPORT

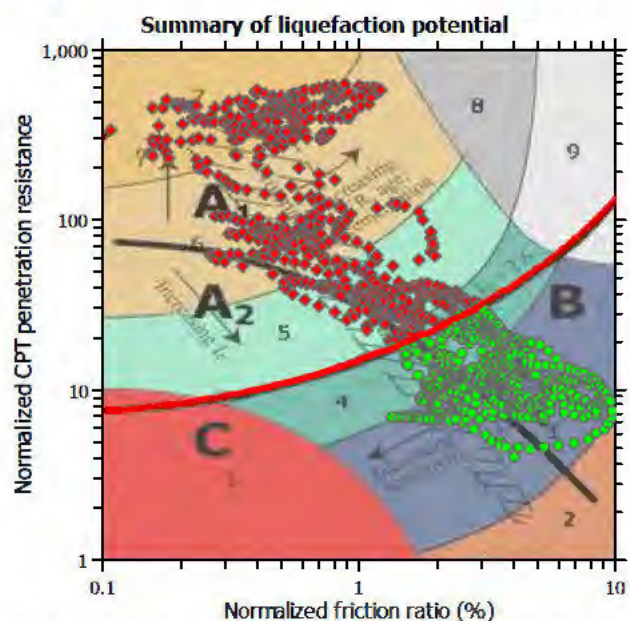
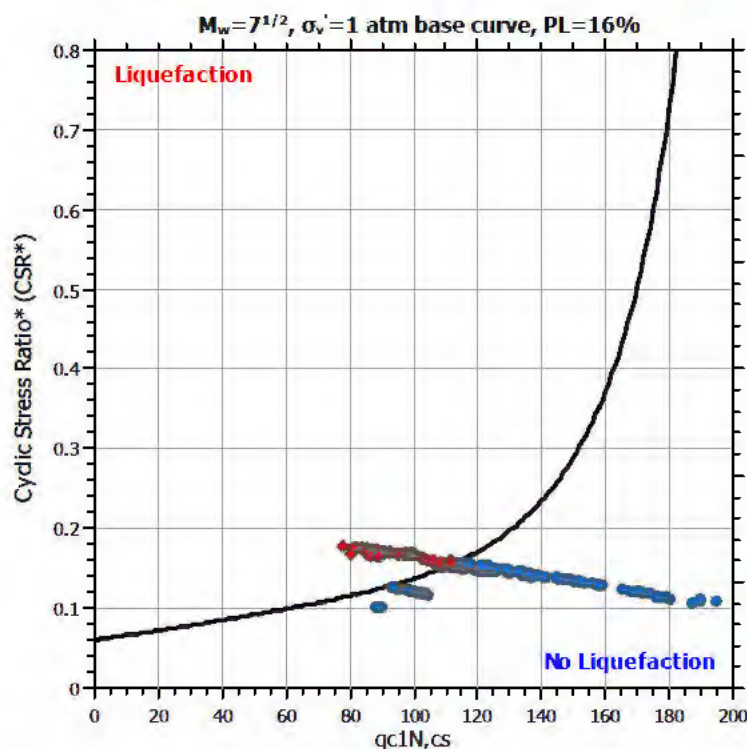
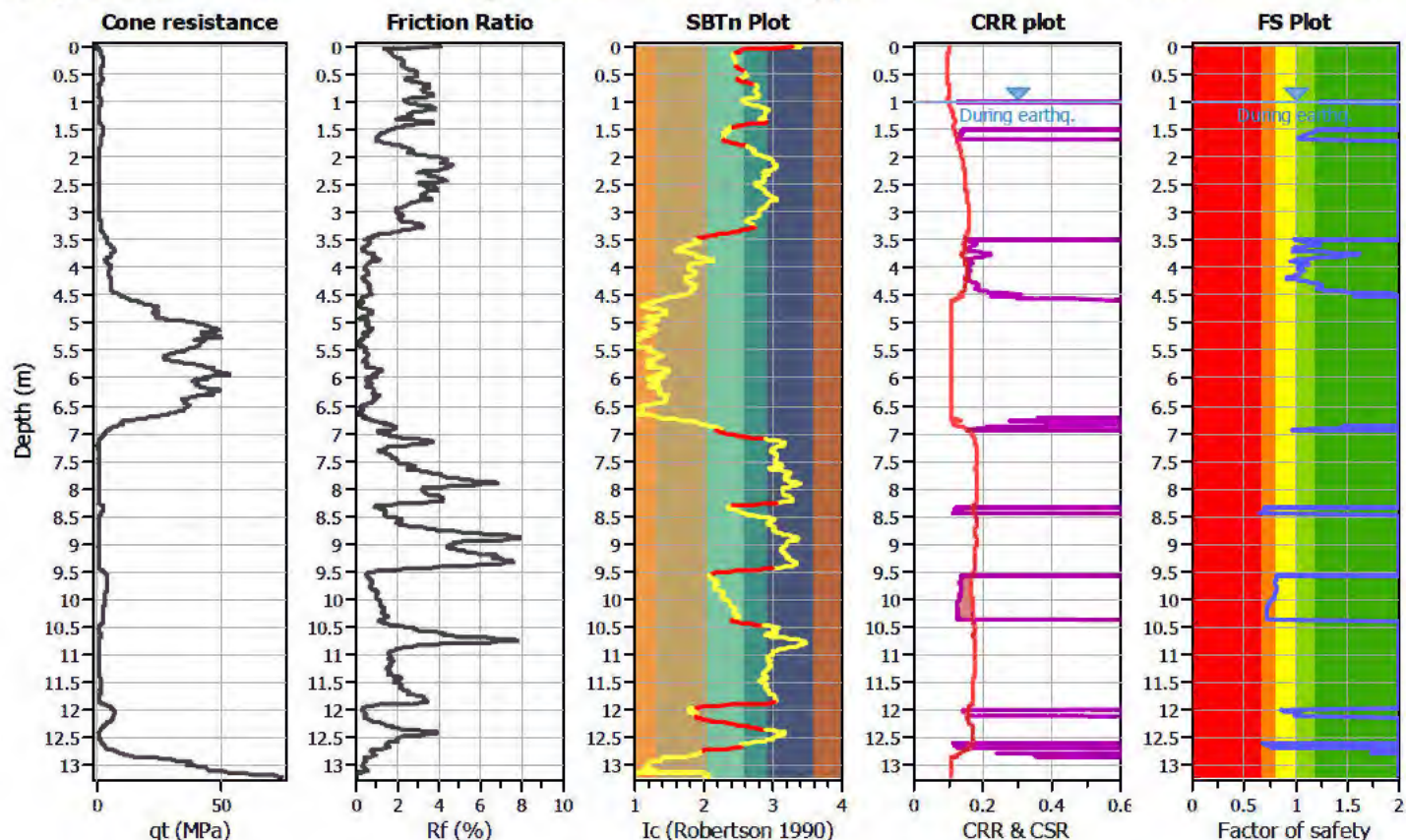
Project title : K250791

Location : 6 Wroots Rd & 101 Sabys Road

CPT file : CPT-08

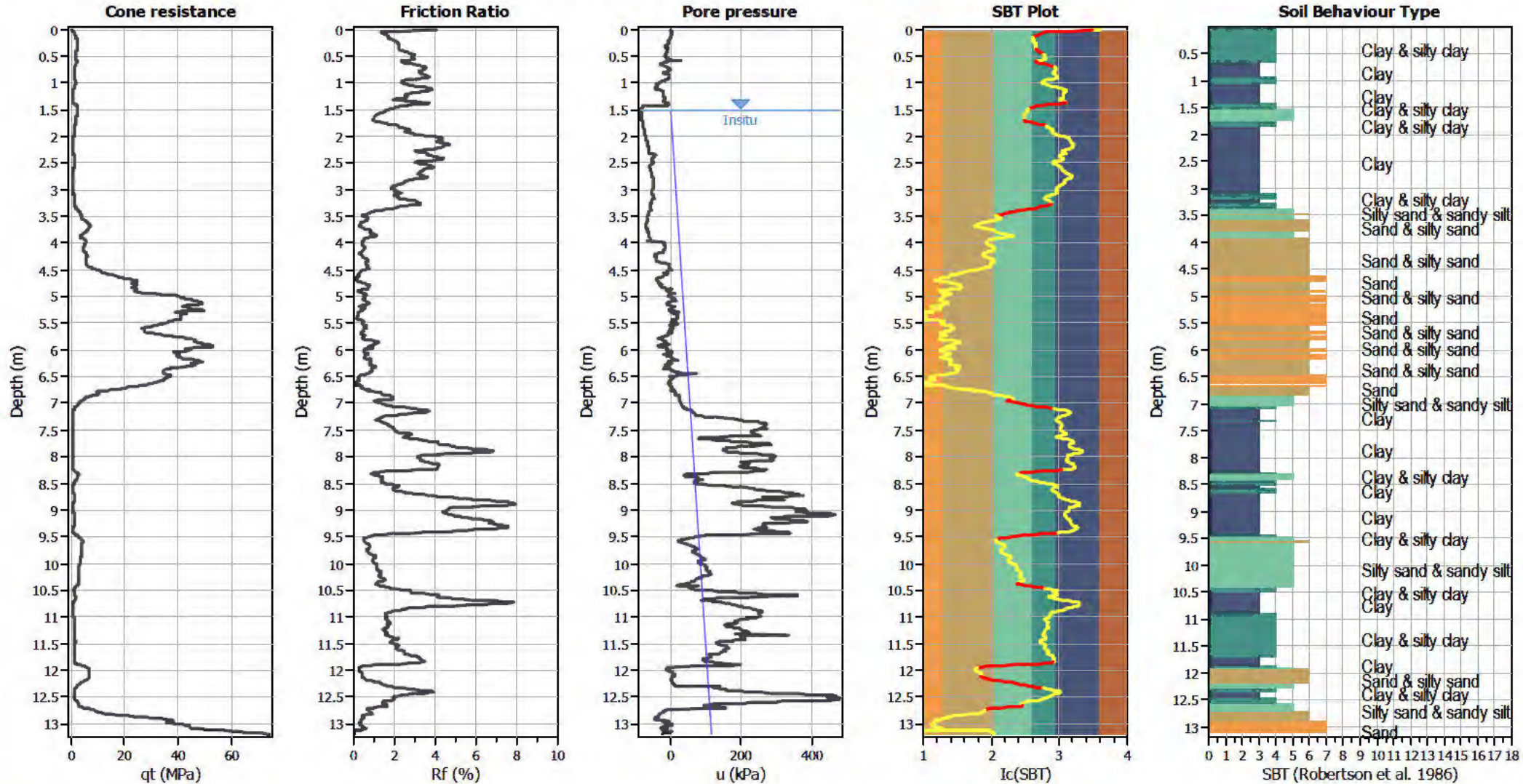
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	N/A
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



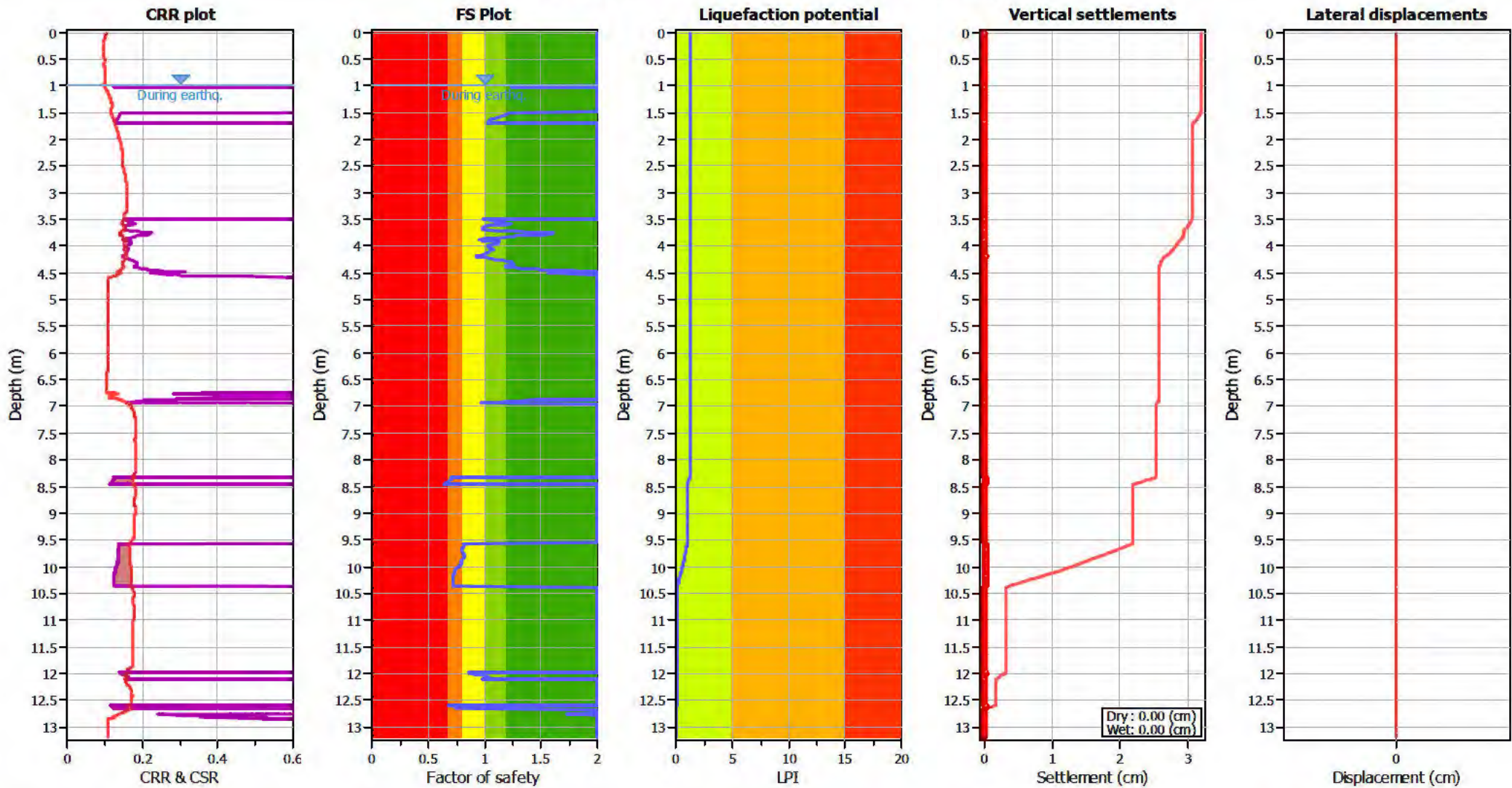
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _o applied:	Yes
Earthquake magnitude M _w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude M_w : 6.00
Peak ground acceleration: 0.19
Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: Yes
 K_{σ} applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: No
Limit depth: N/A

F.S. color scheme

Red: Almost certain it will liquefy
Orange: Very likely to liquefy
Yellow: Liquefaction and no liq. are equally likely
Green: Unlike to liquefy
Dark Green: Almost certain it will not liquefy

LPI color scheme

Red: Very high risk
Orange: High risk
Yellow: Low risk

LIQUEFACTION ANALYSIS REPORT

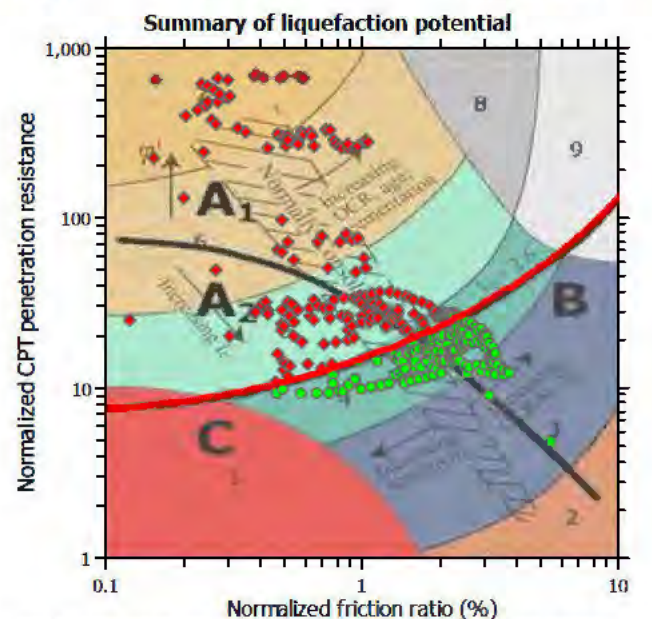
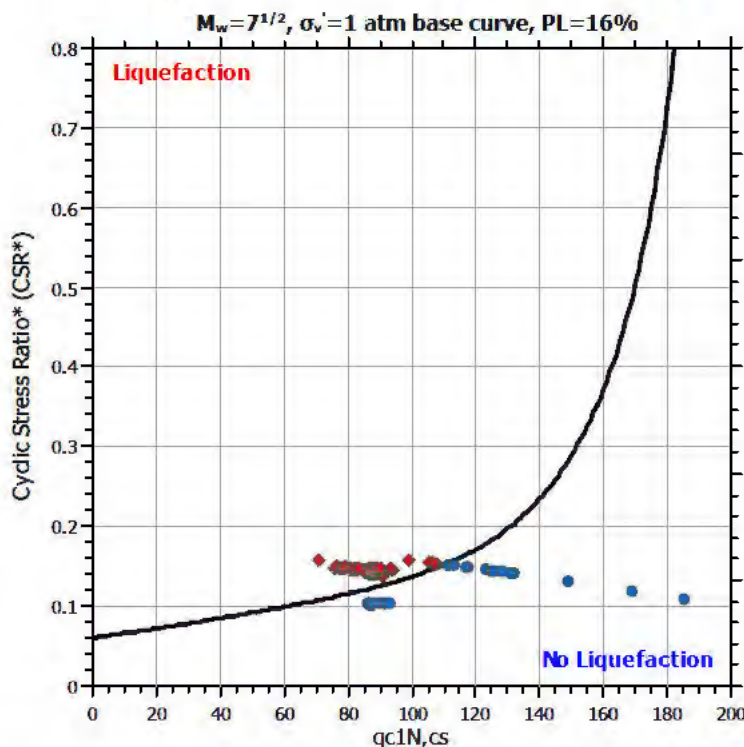
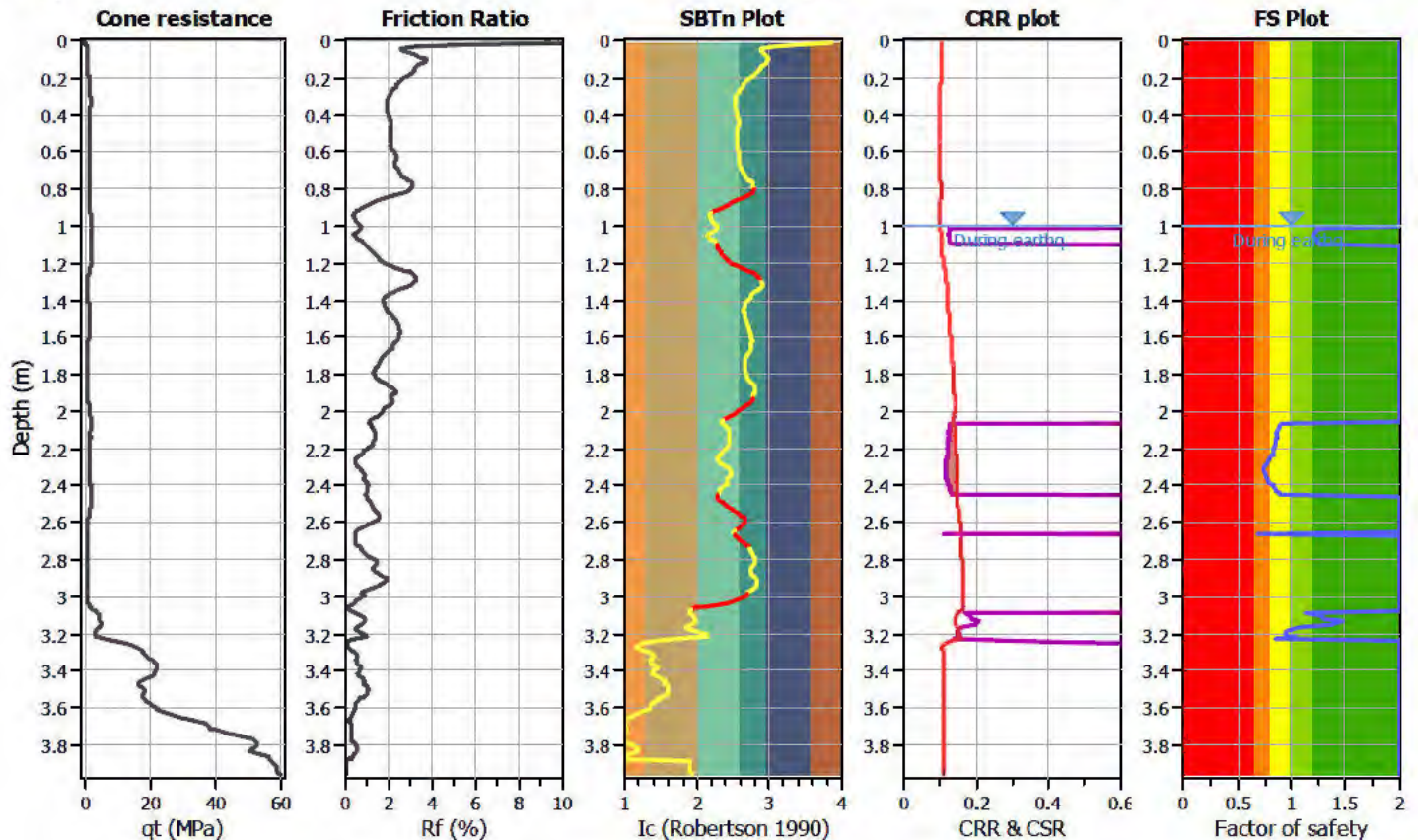
Project title : K250791

Location : 6 Wroots Rd & 101 Sabys Road

CPT file : CPT-09

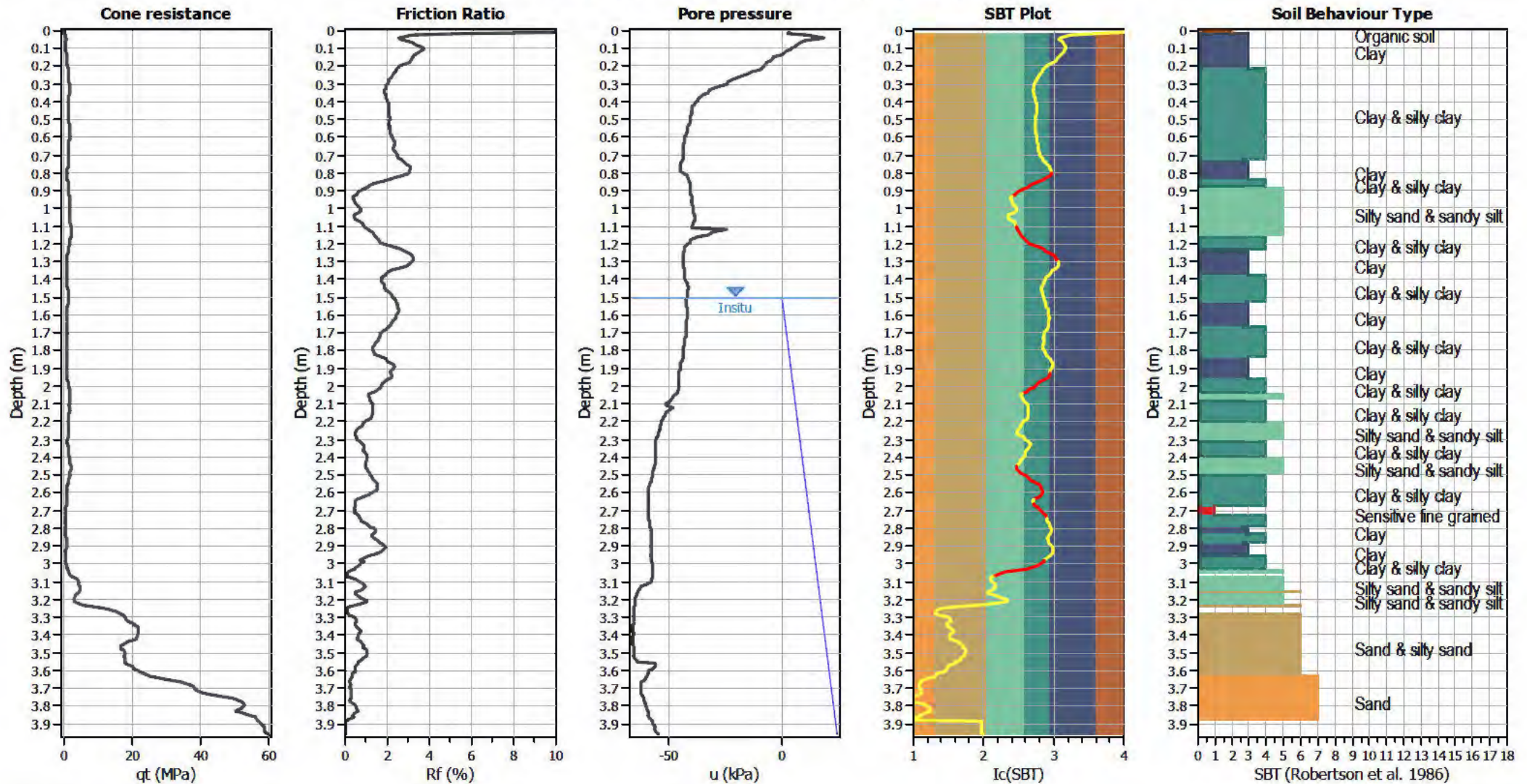
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	10.00 m
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



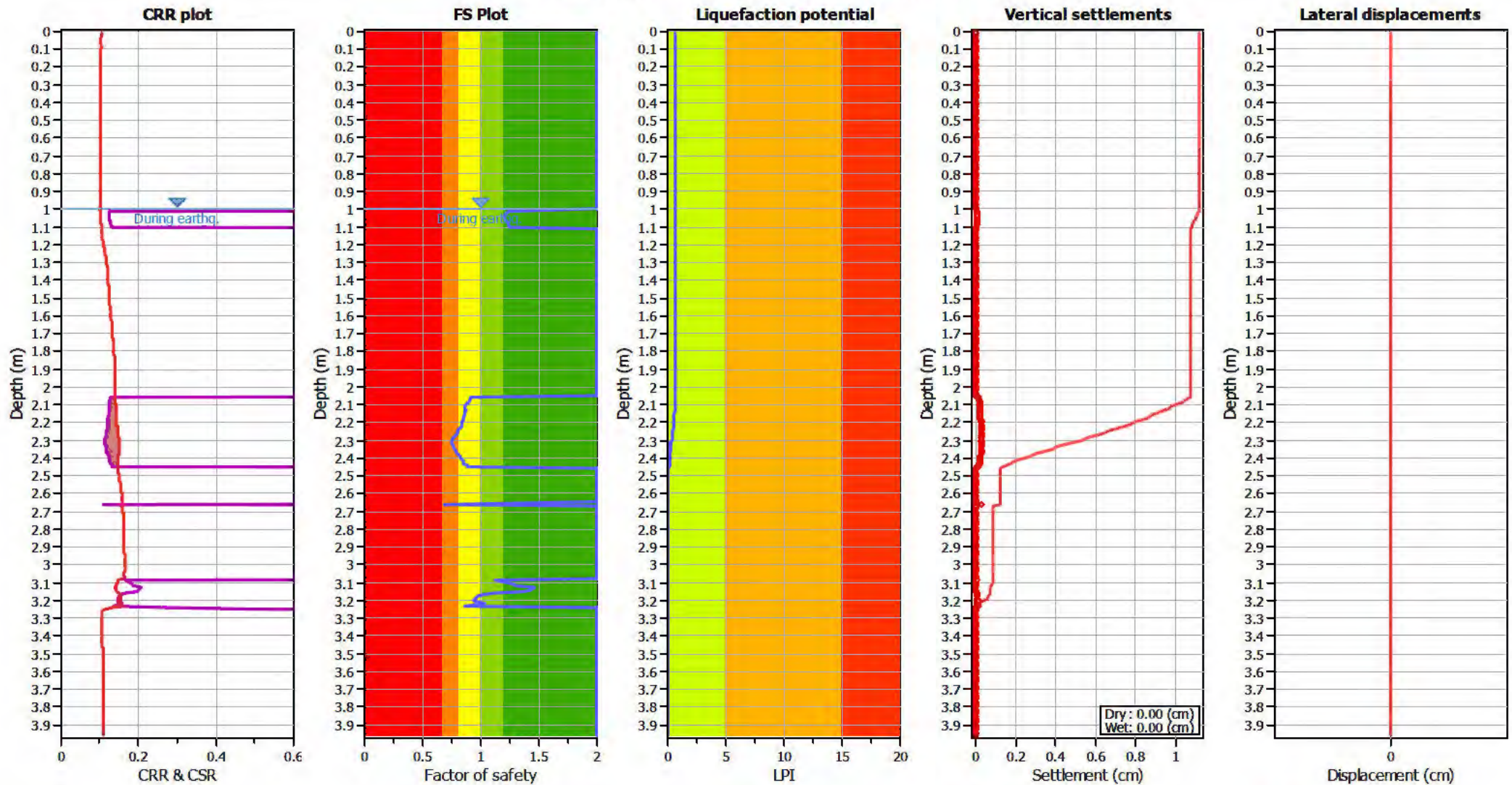
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 6.00
 Peak ground acceleration: 0.19
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

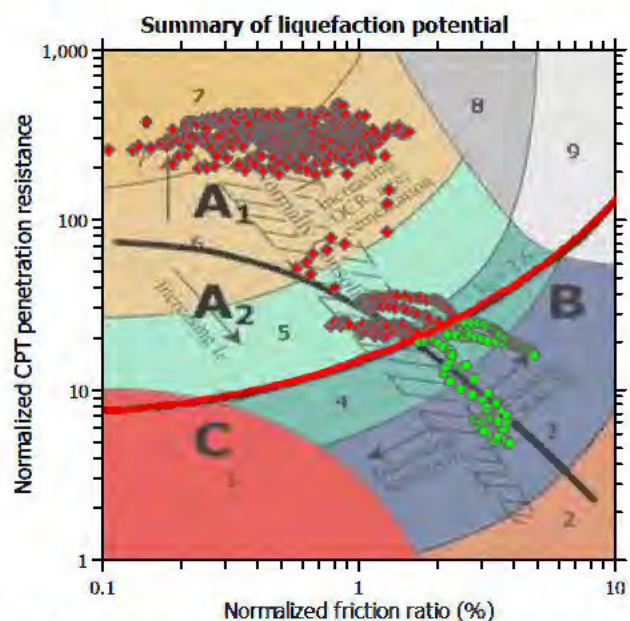
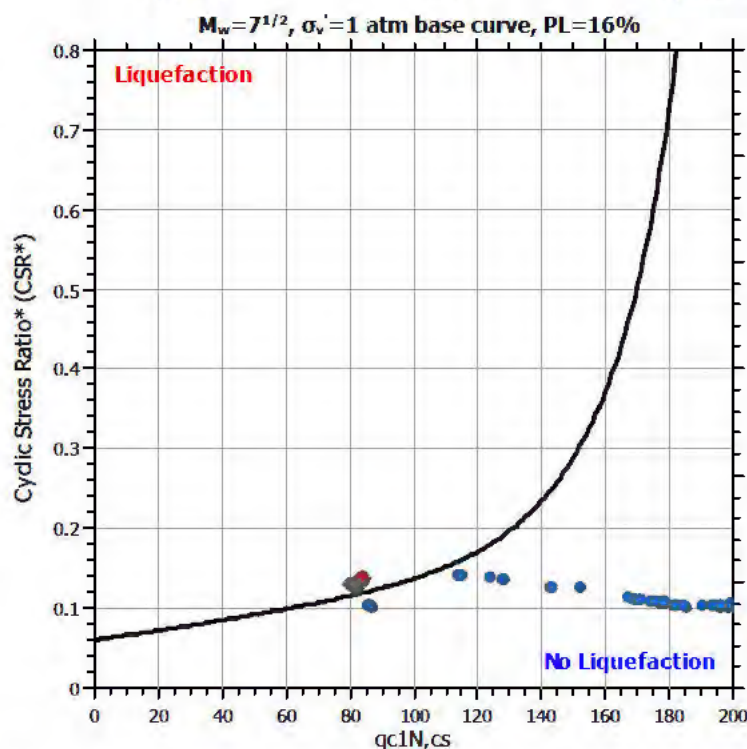
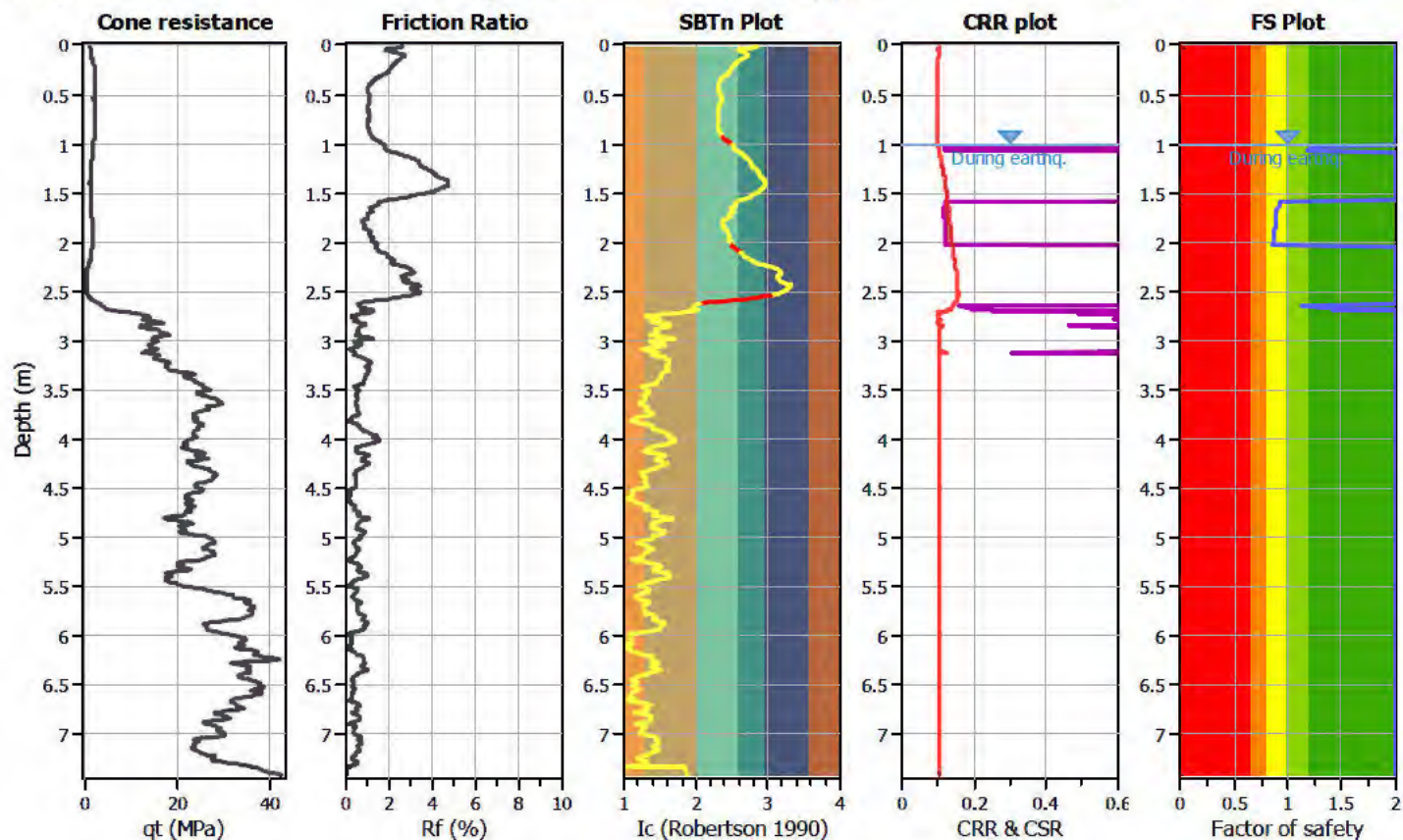
Project title : K250791

Location : 6 Wrooots Rd & 101 Sabys Road

CPT file : CPT-10

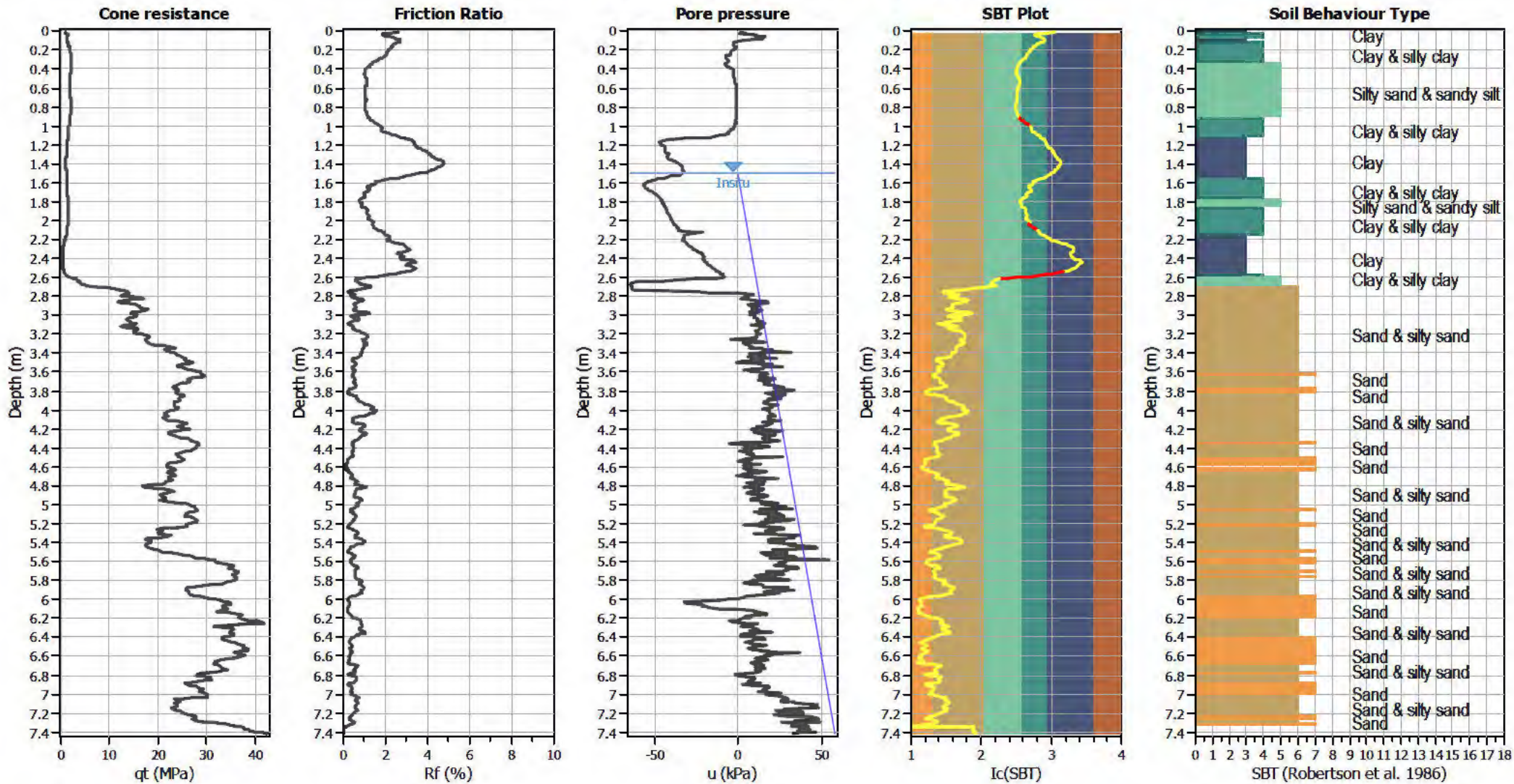
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots

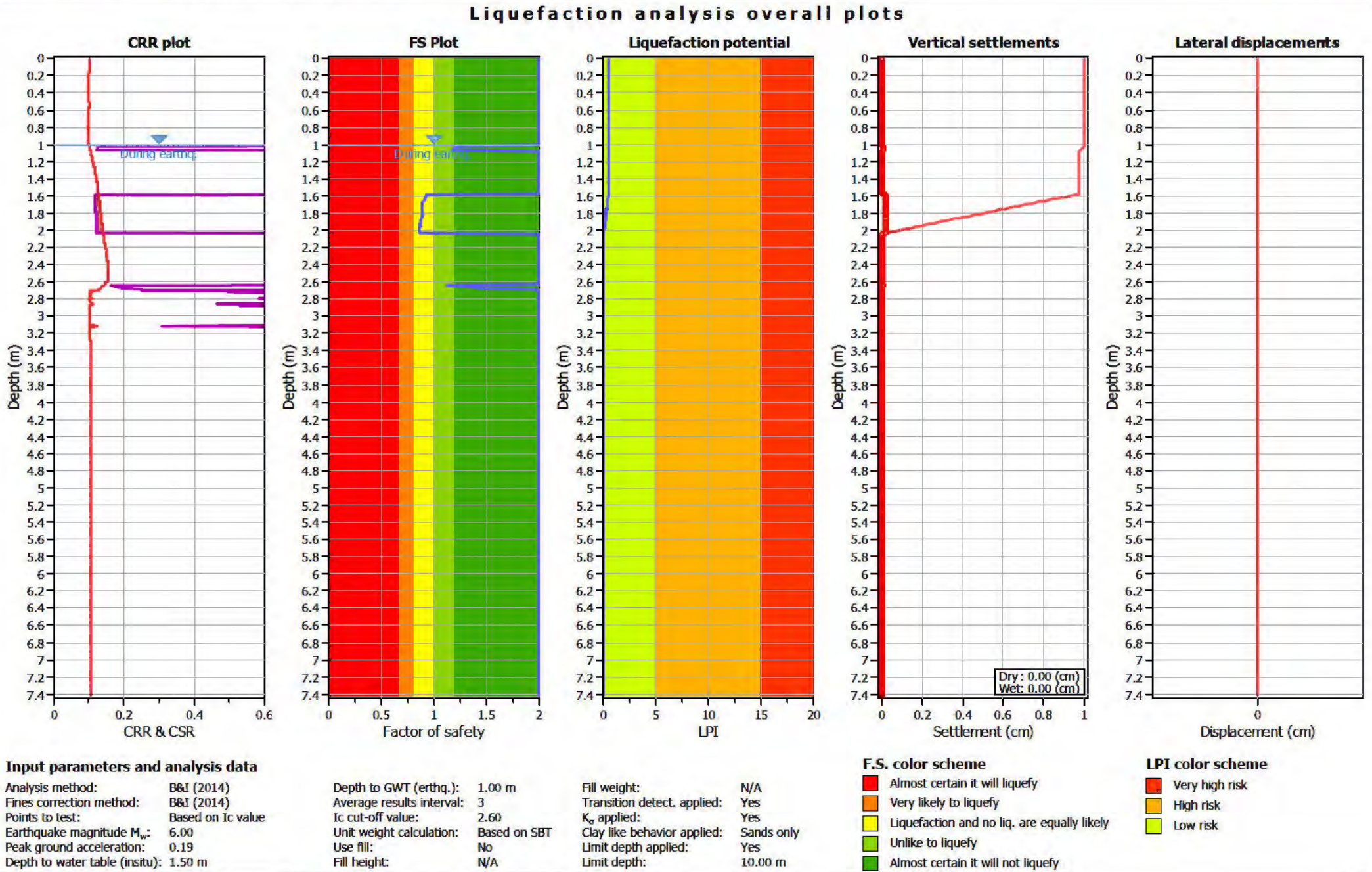


Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _o applied:	Yes
Earthquake magnitude M _w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained



LIQUEFACTION ANALYSIS REPORT

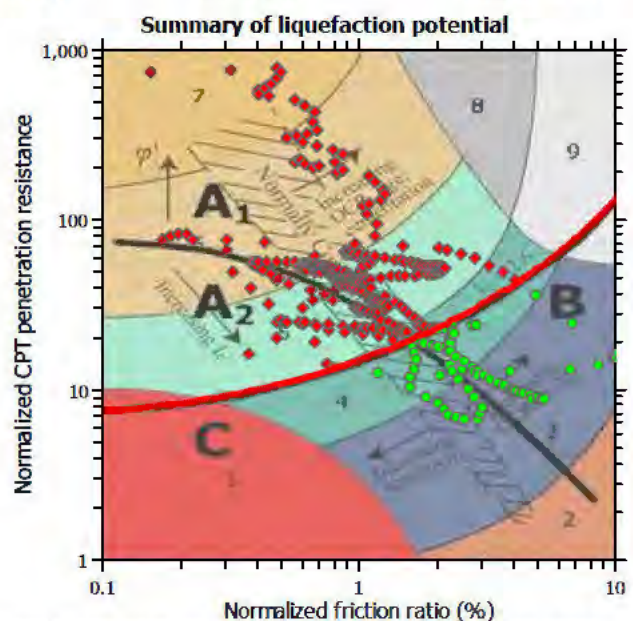
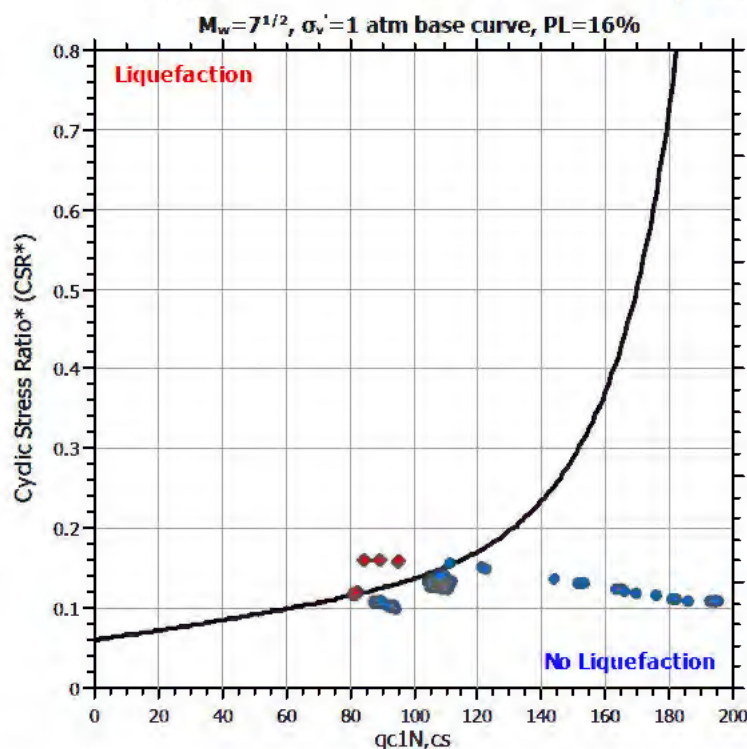
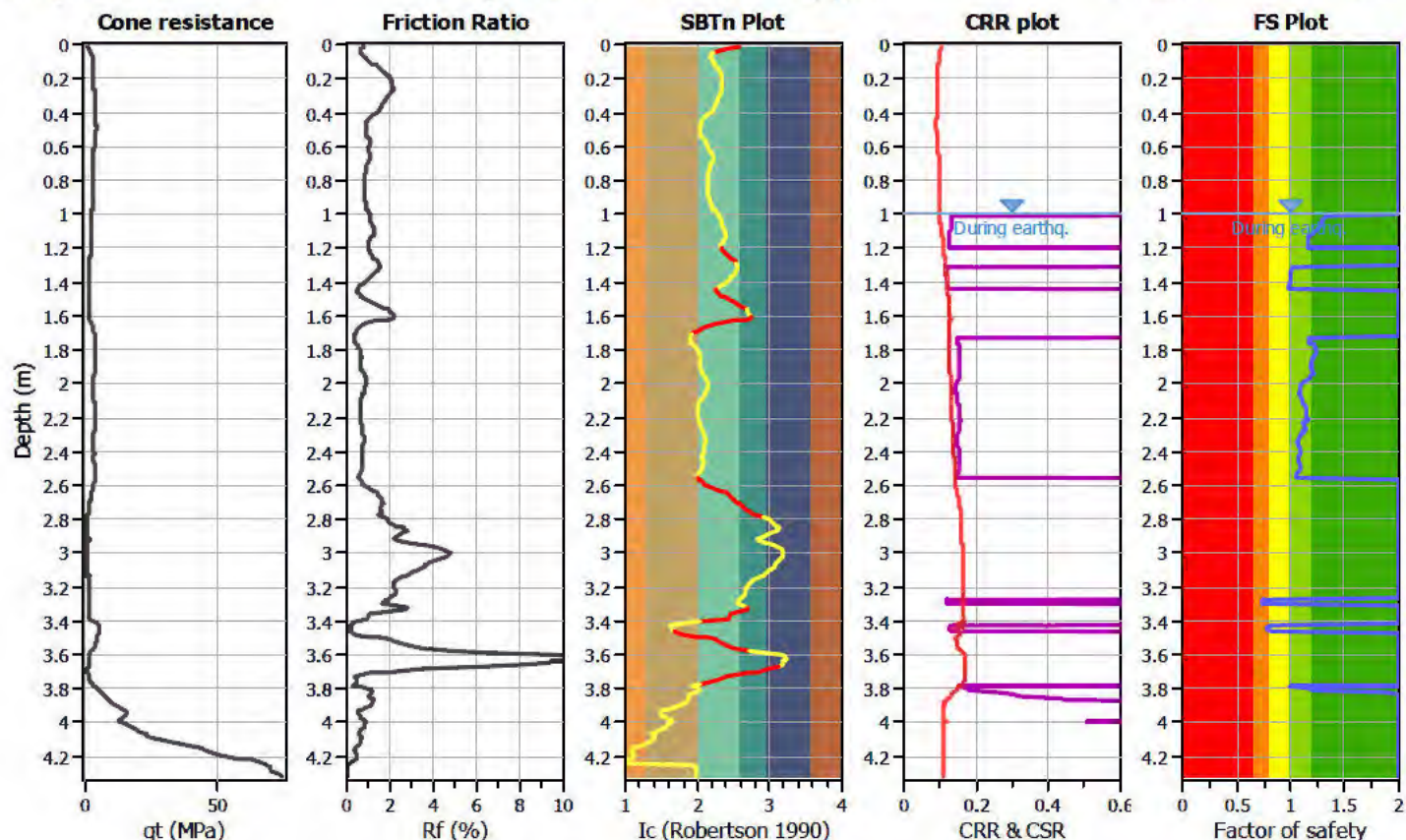
Project title : K250791

Location : 6 Wroots Rd & 101 Sabys Road

CPT file : CPT-11

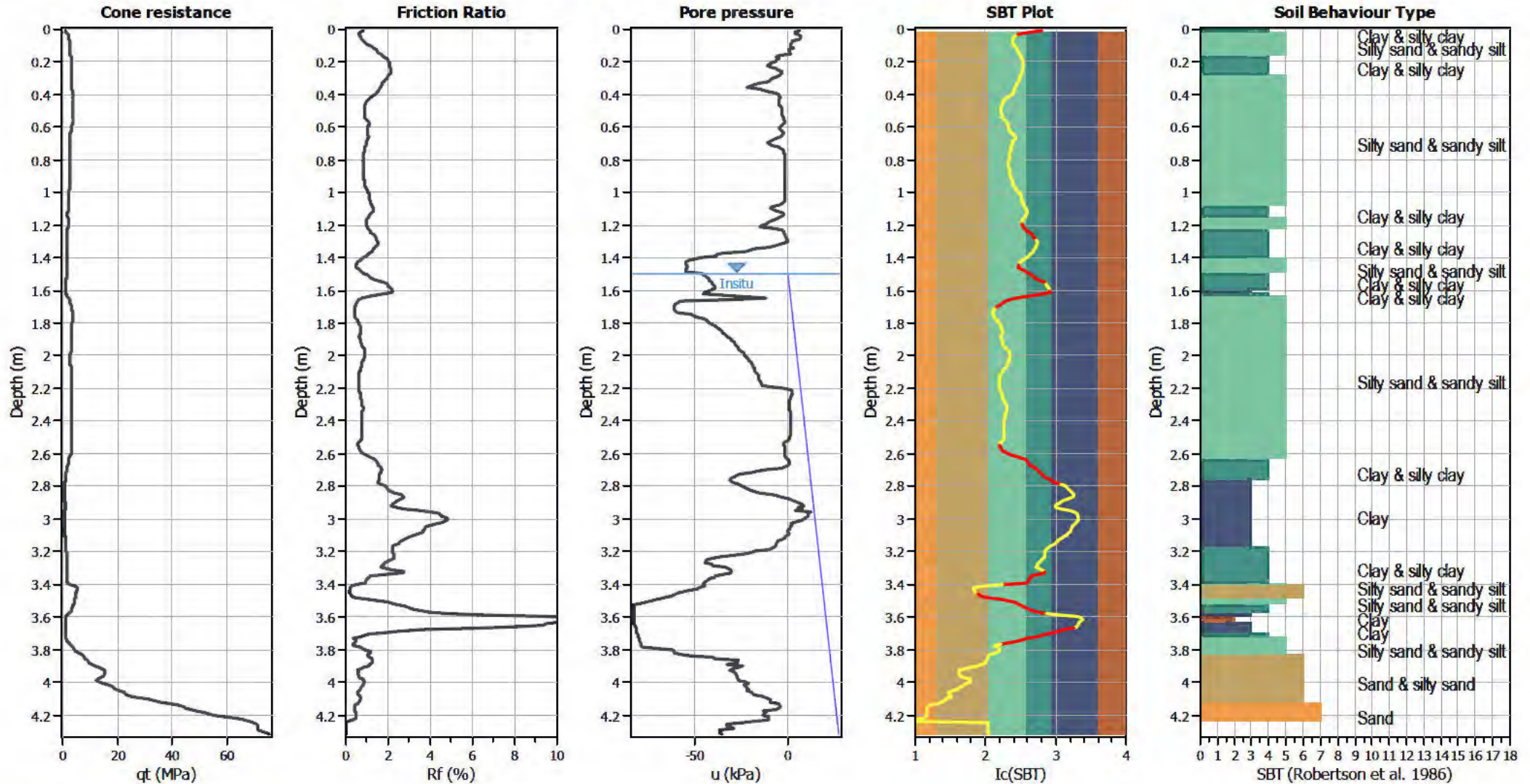
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	10.00 m
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



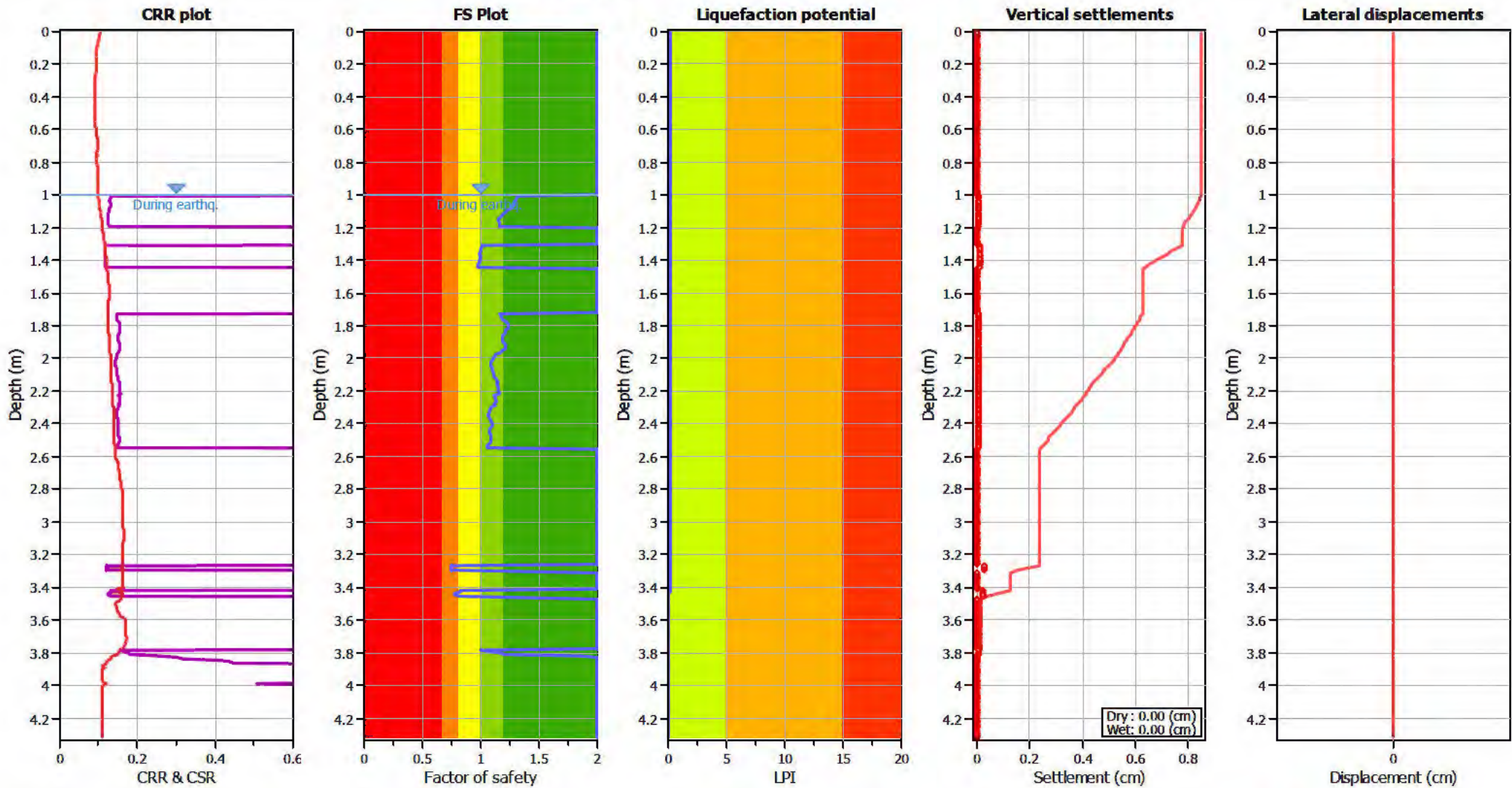
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude M_w : 6.00
Peak ground acceleration: 0.19
Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: Yes
 K_{σ} applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: Yes
Limit depth: 10.00 m

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

LIQUEFACTION ANALYSIS REPORT

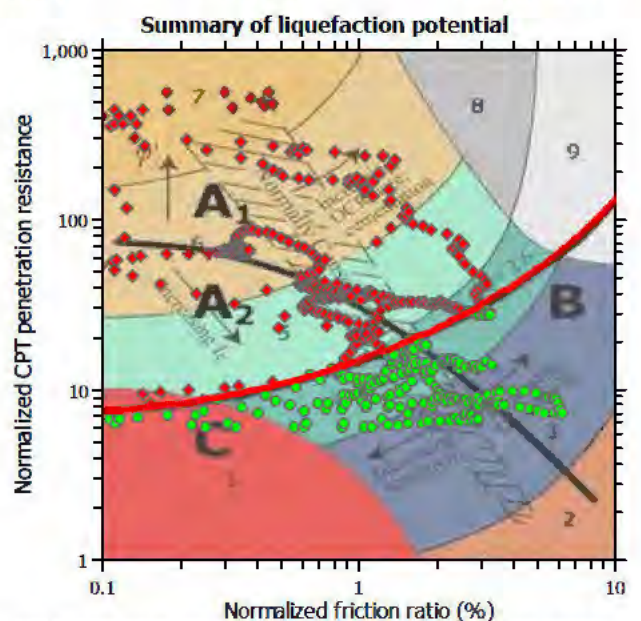
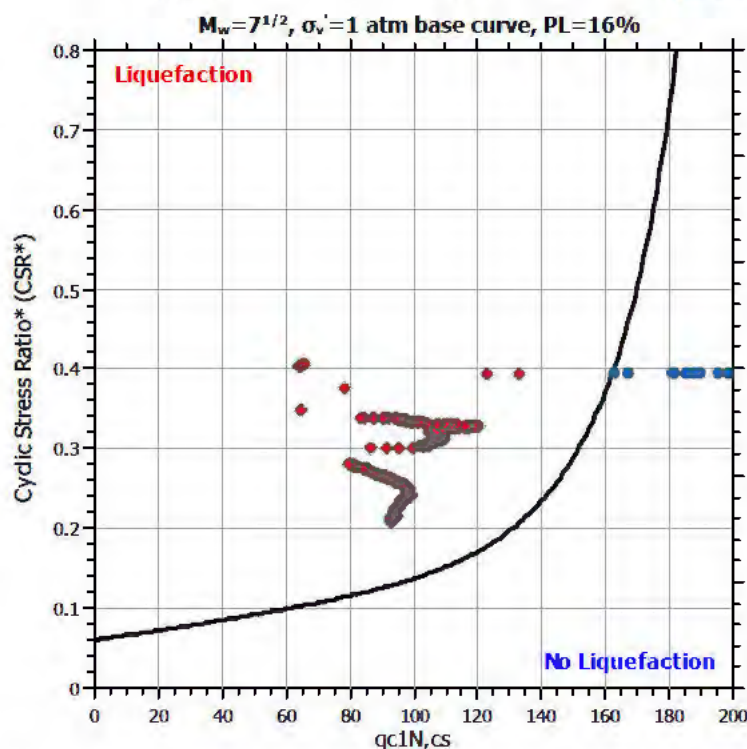
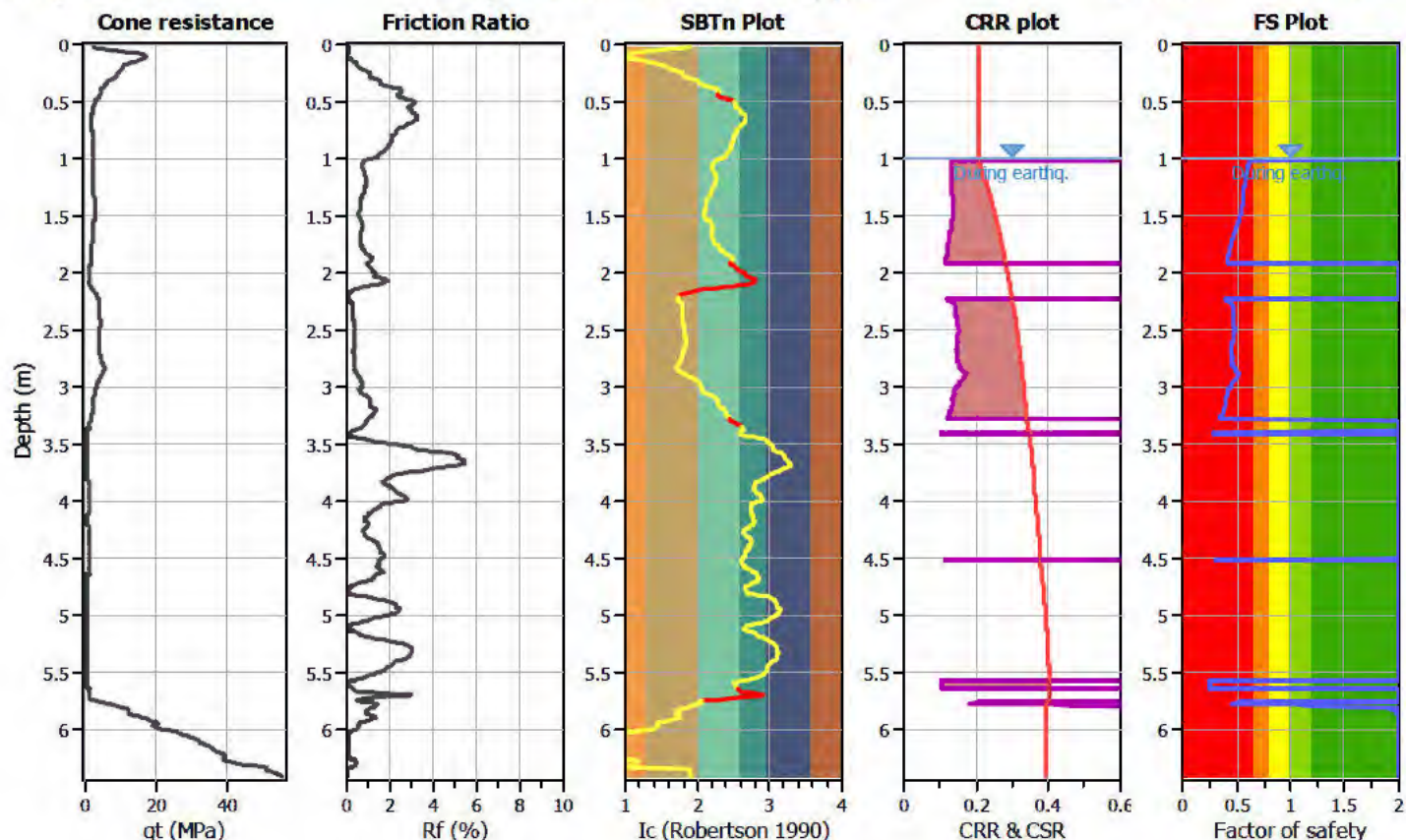
Project title : K250791

Location : 6 Wroots Rd & 101 Sabys Rd

CPT file : CPT-01

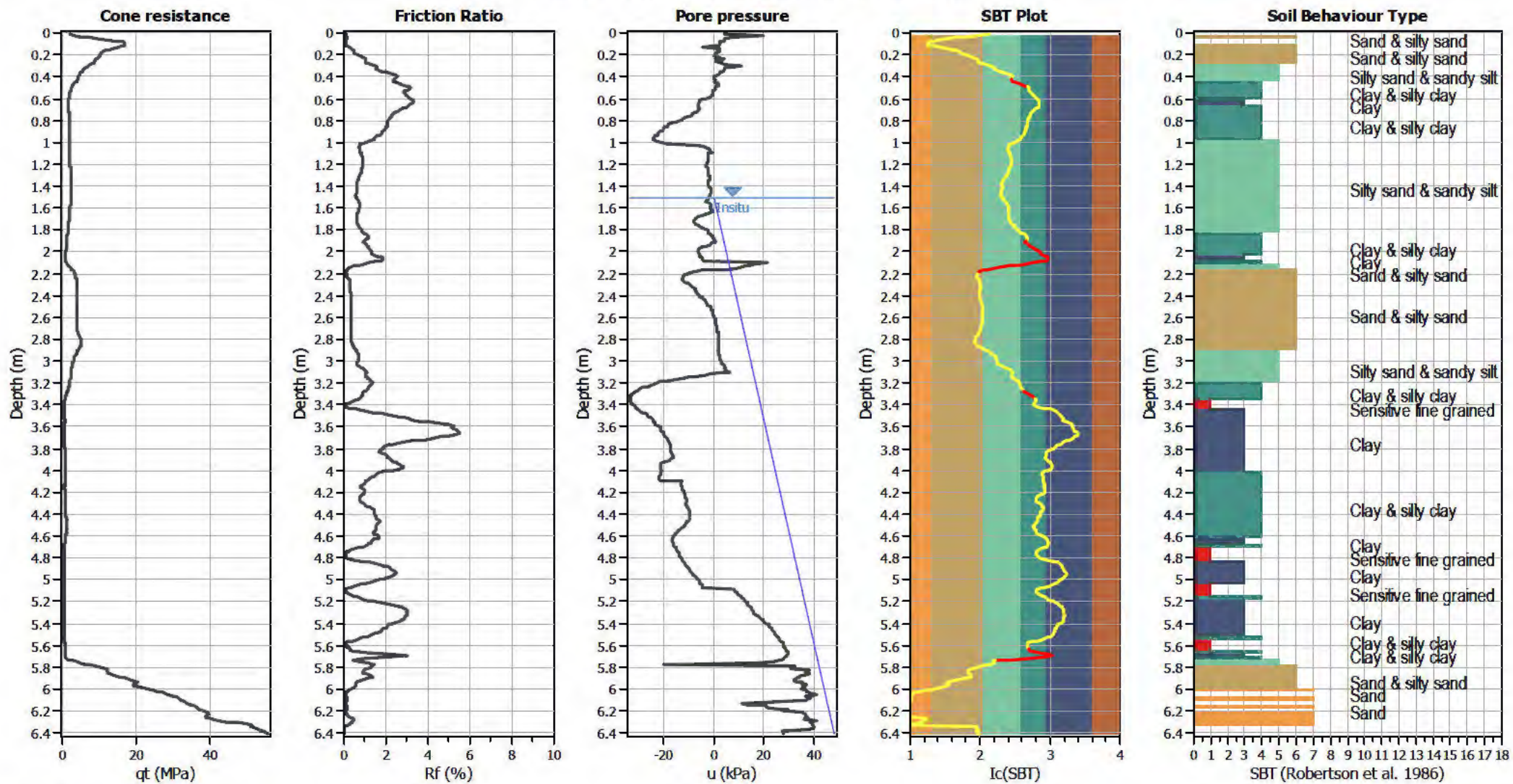
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



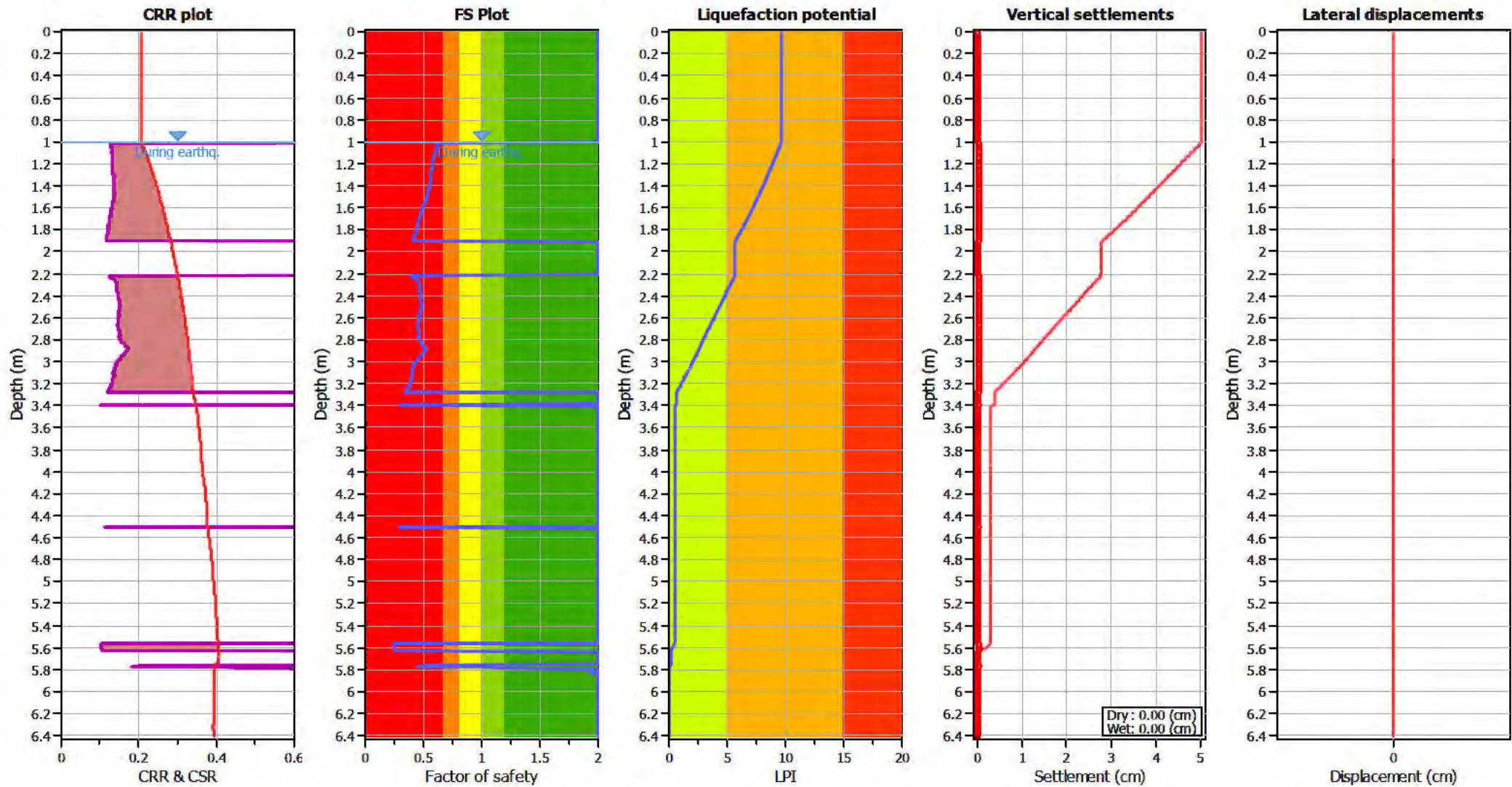
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude M_w : 7.50
Peak ground acceleration: 0.35
Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: Yes
 K_w applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: Yes
Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
Very likely to liquefy
Liquefaction and no liq. are equally likely
Unlike to liquefy
Almost certain it will not liquefy

LPI color scheme

Very high risk
High risk
Low risk

LIQUEFACTION ANALYSIS REPORT

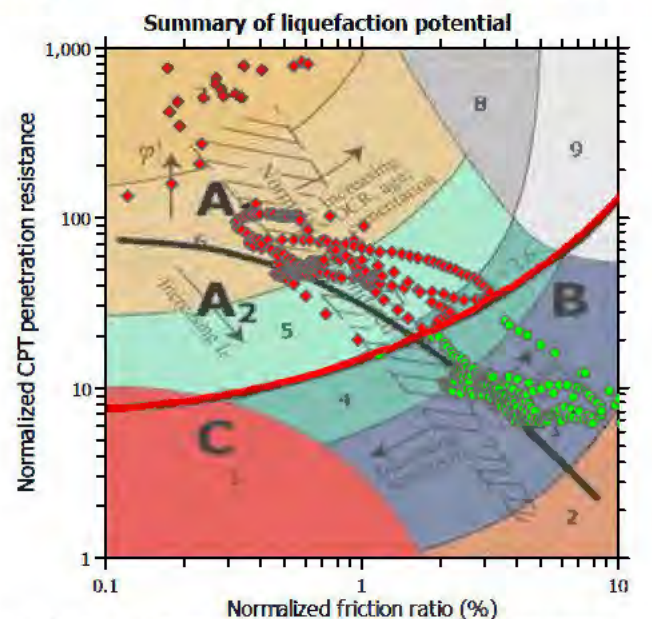
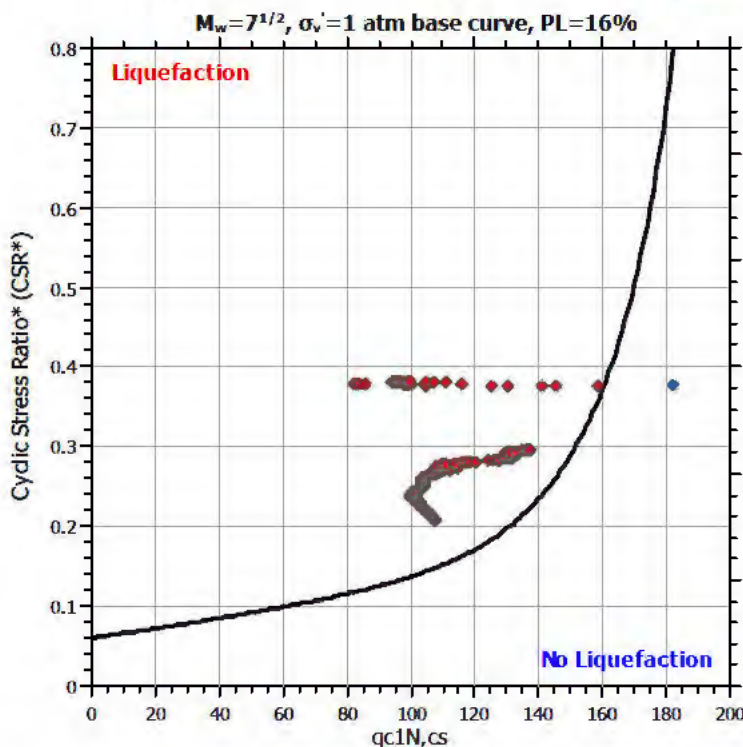
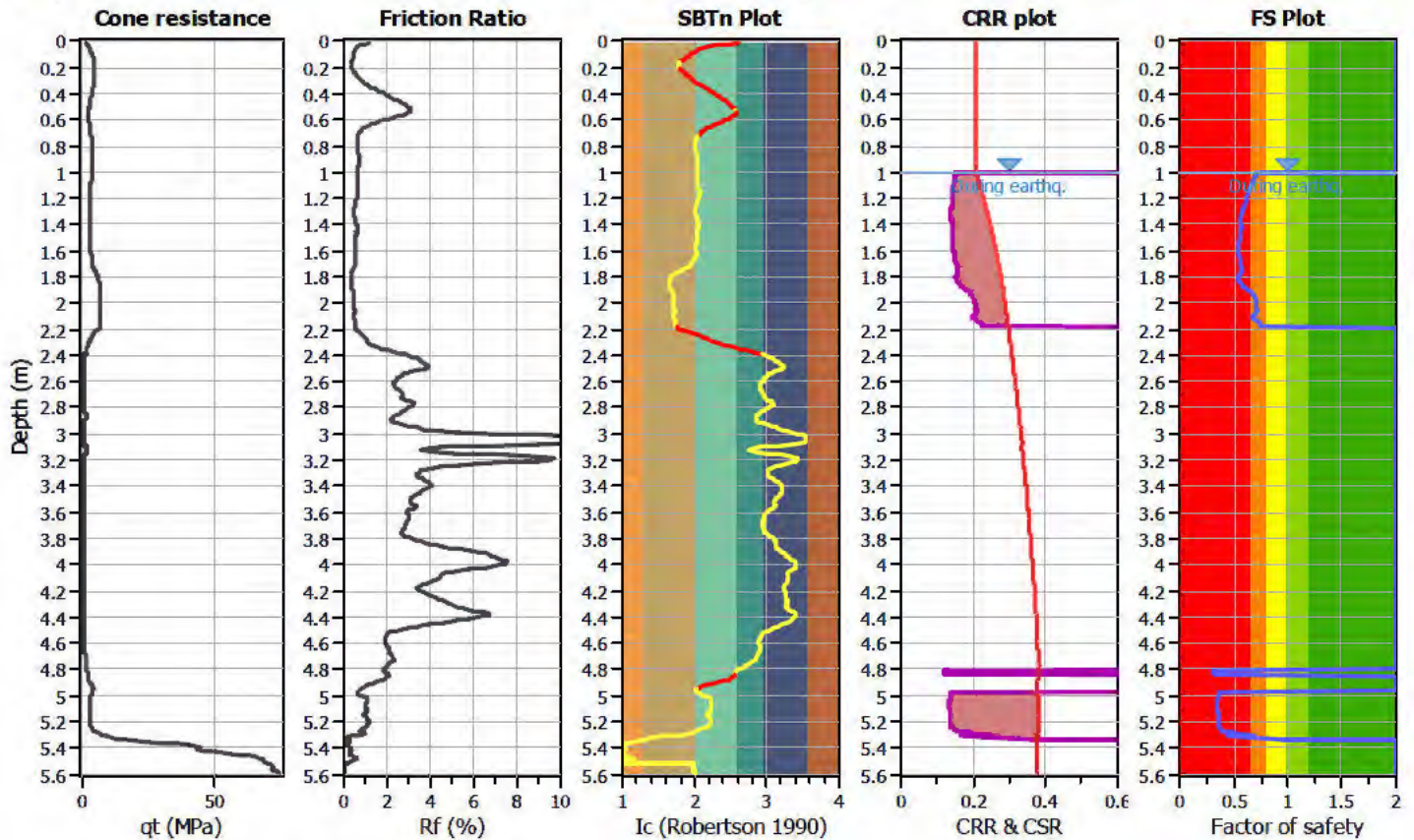
Project title : K250791

Location : 6 Wrooots Rd & 101 Sabys Rd

CPT file : CPT-02

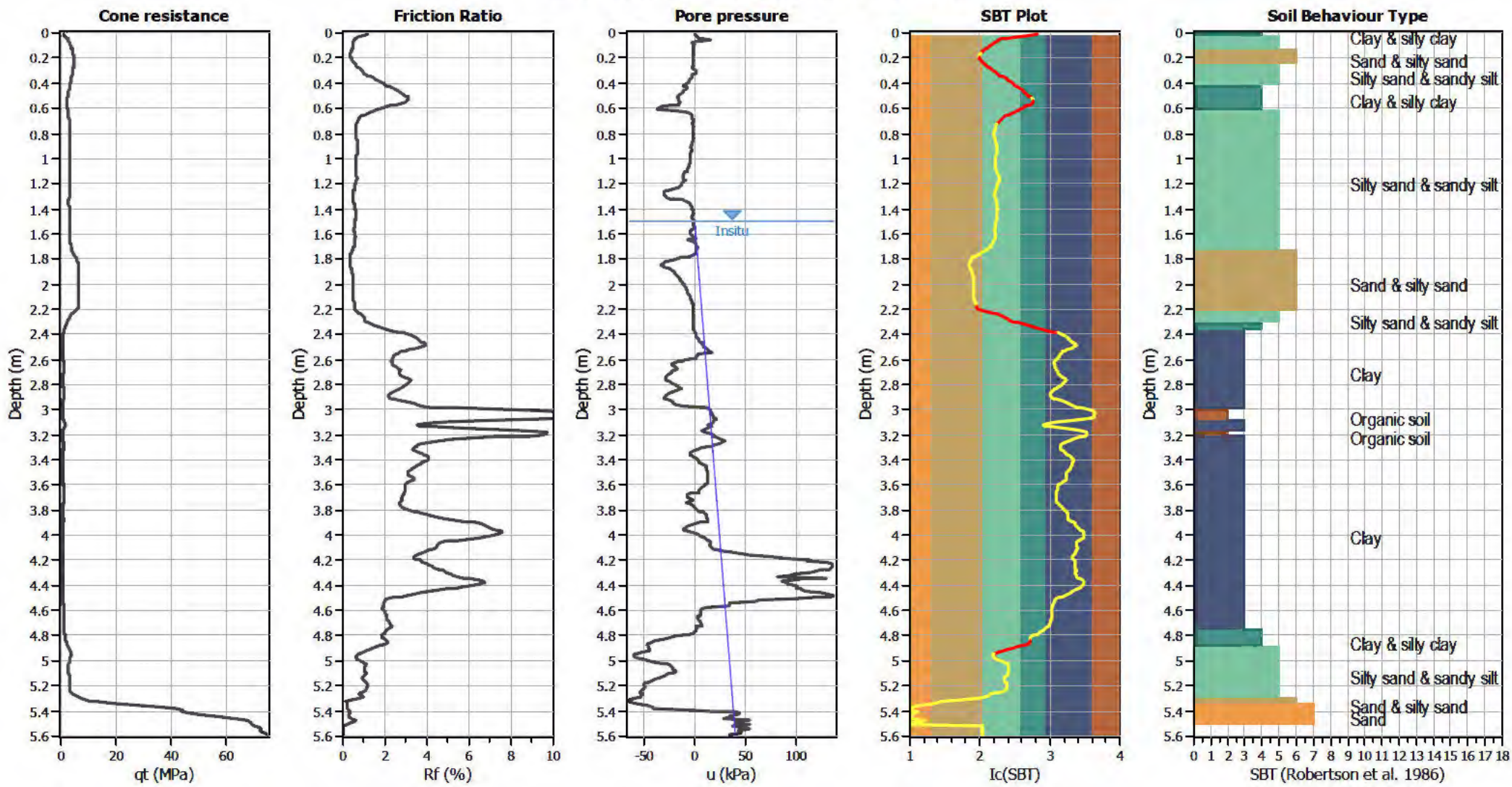
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_v applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots

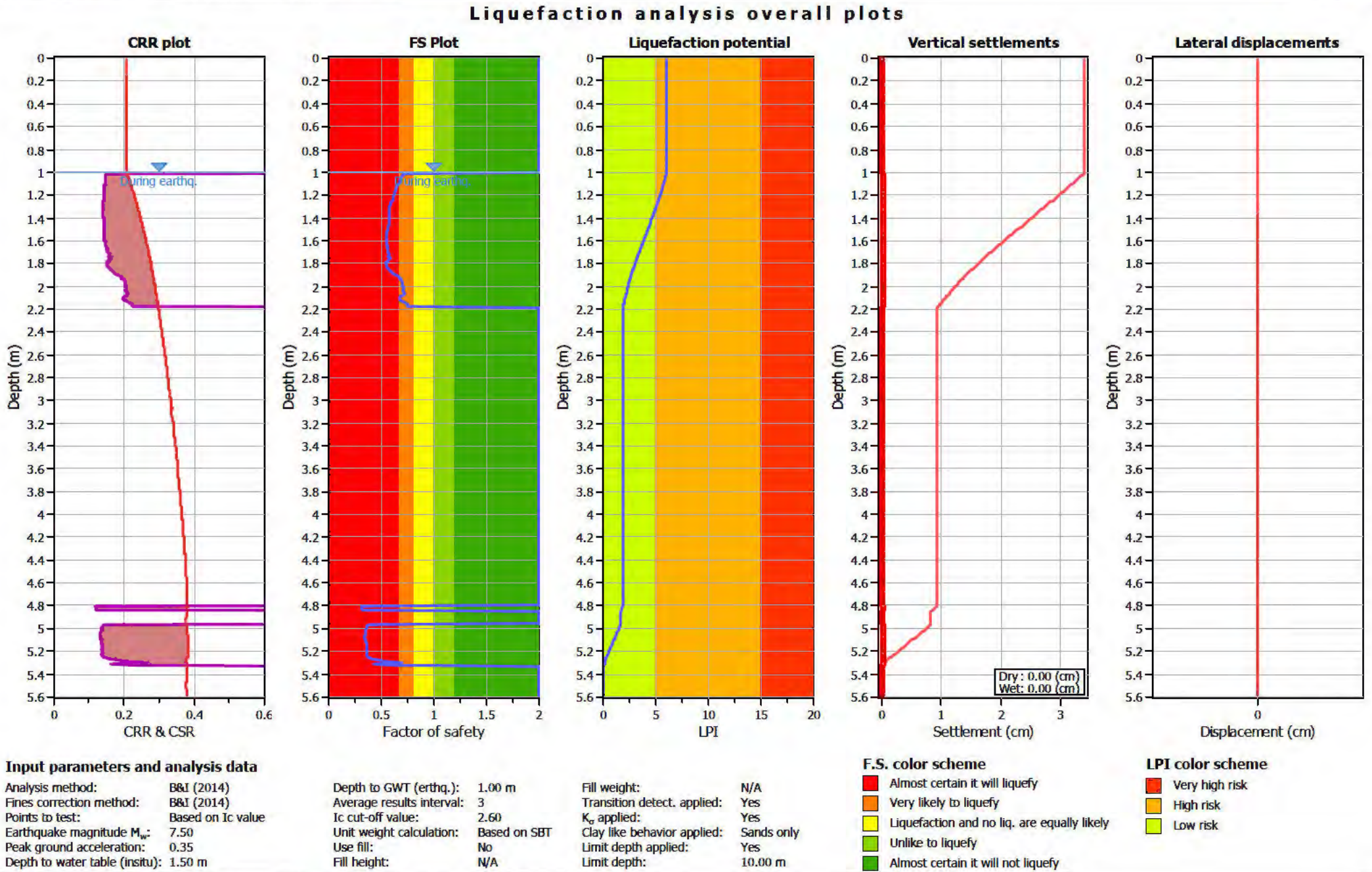


Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained



LIQUEFACTION ANALYSIS REPORT

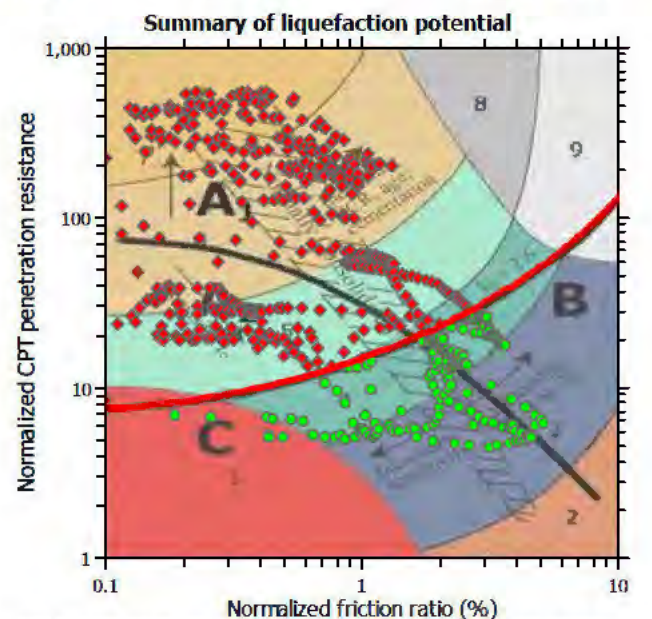
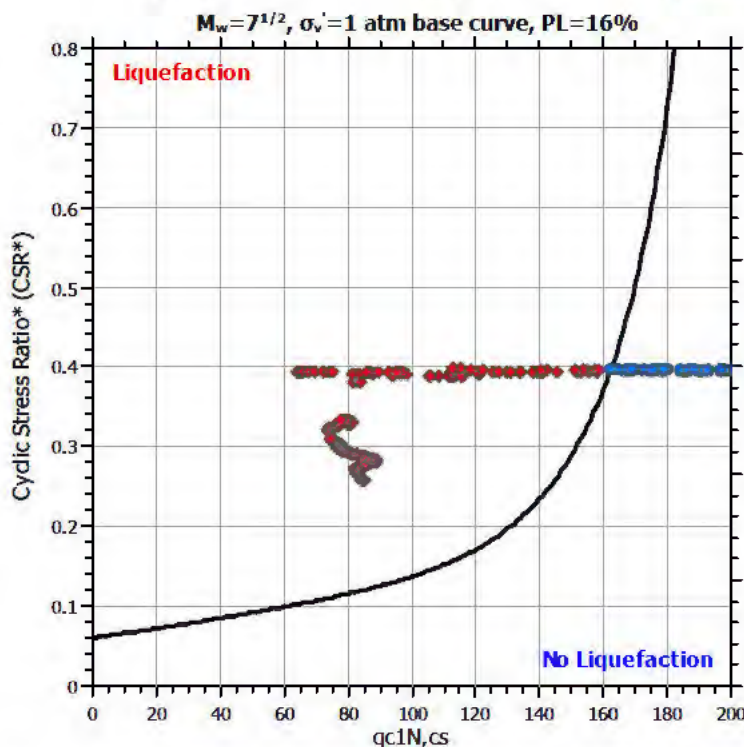
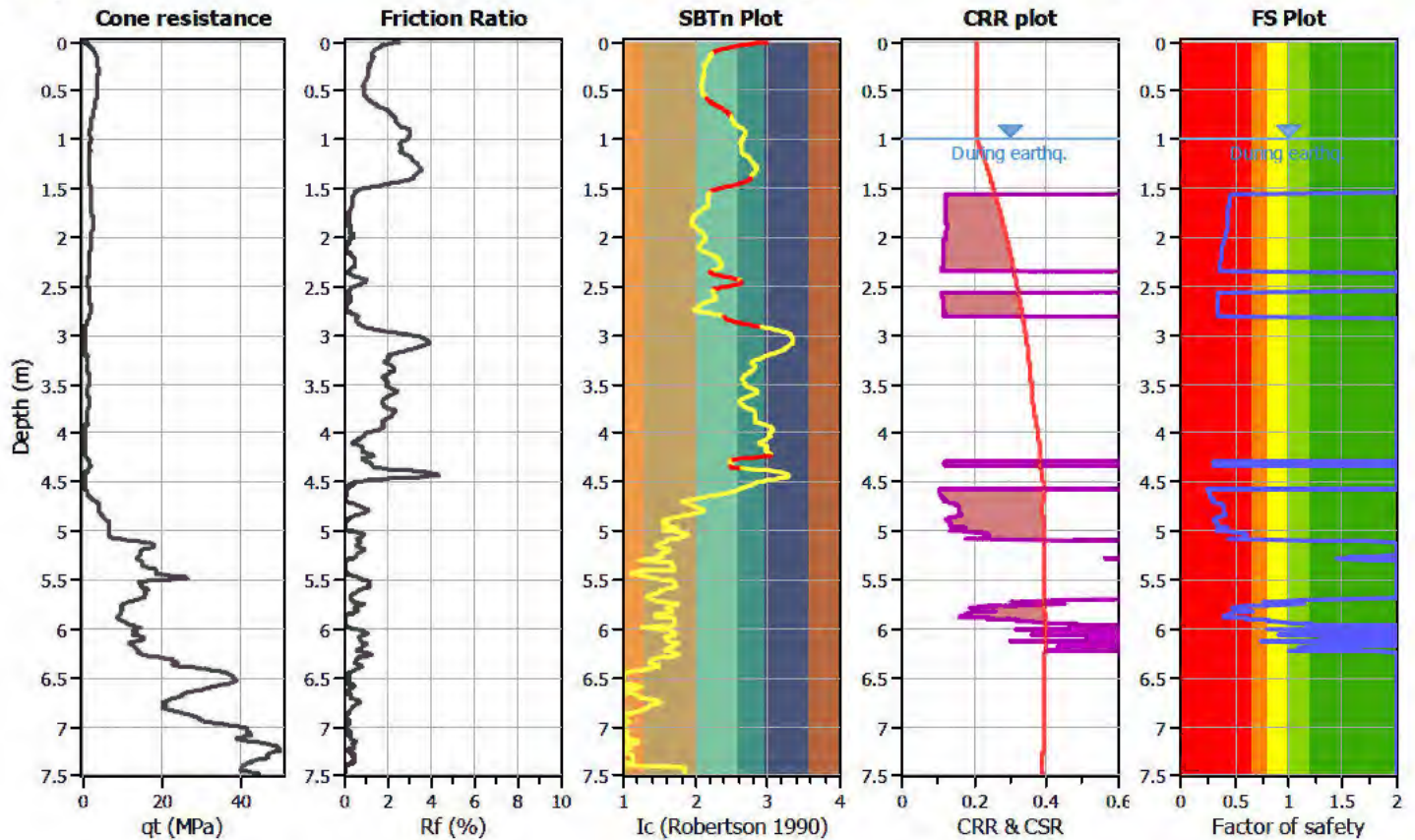
Project title : K250791

Location : 6 Wrooots Rd & 101 Sabys Rd

CPT file : CPT-03

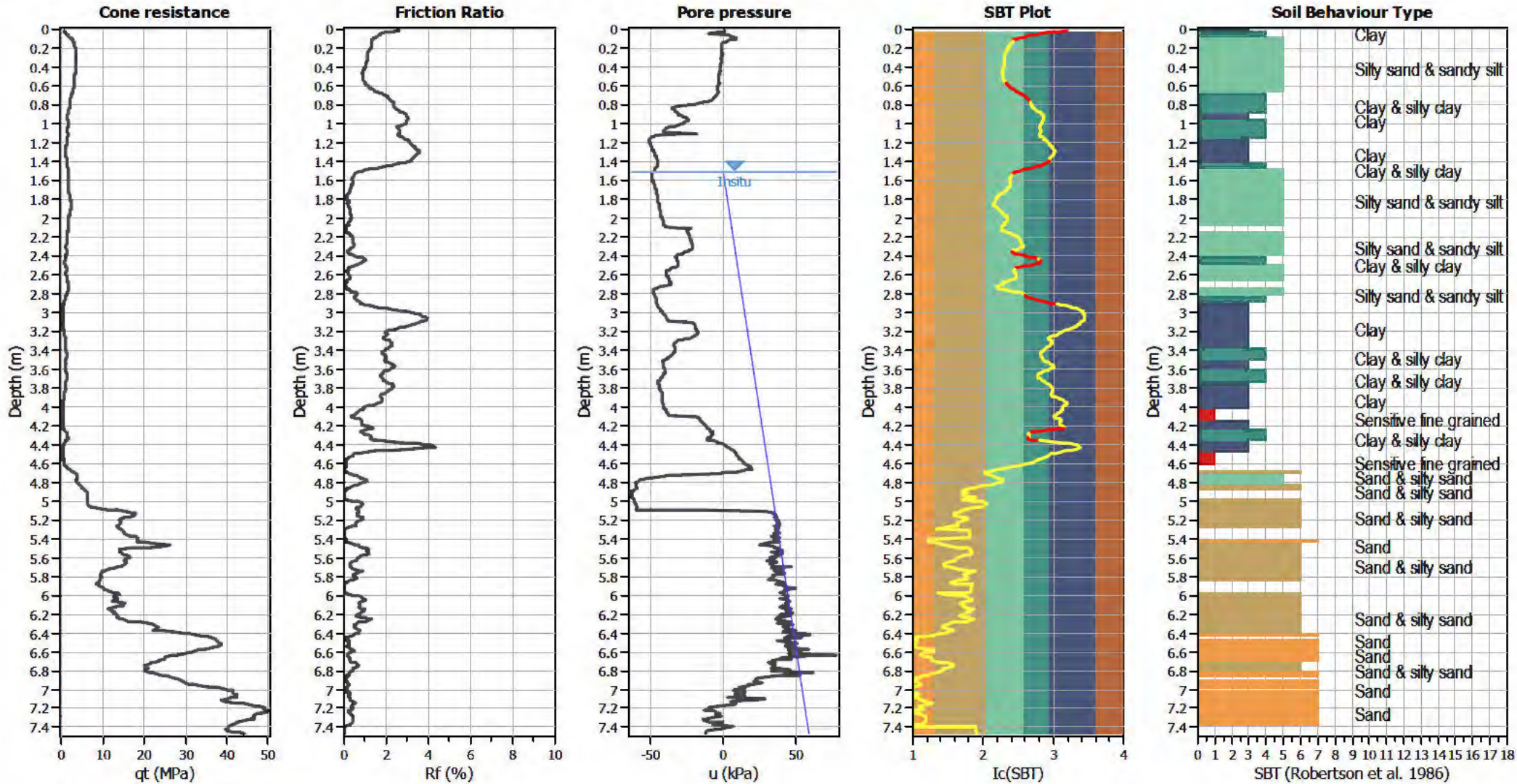
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



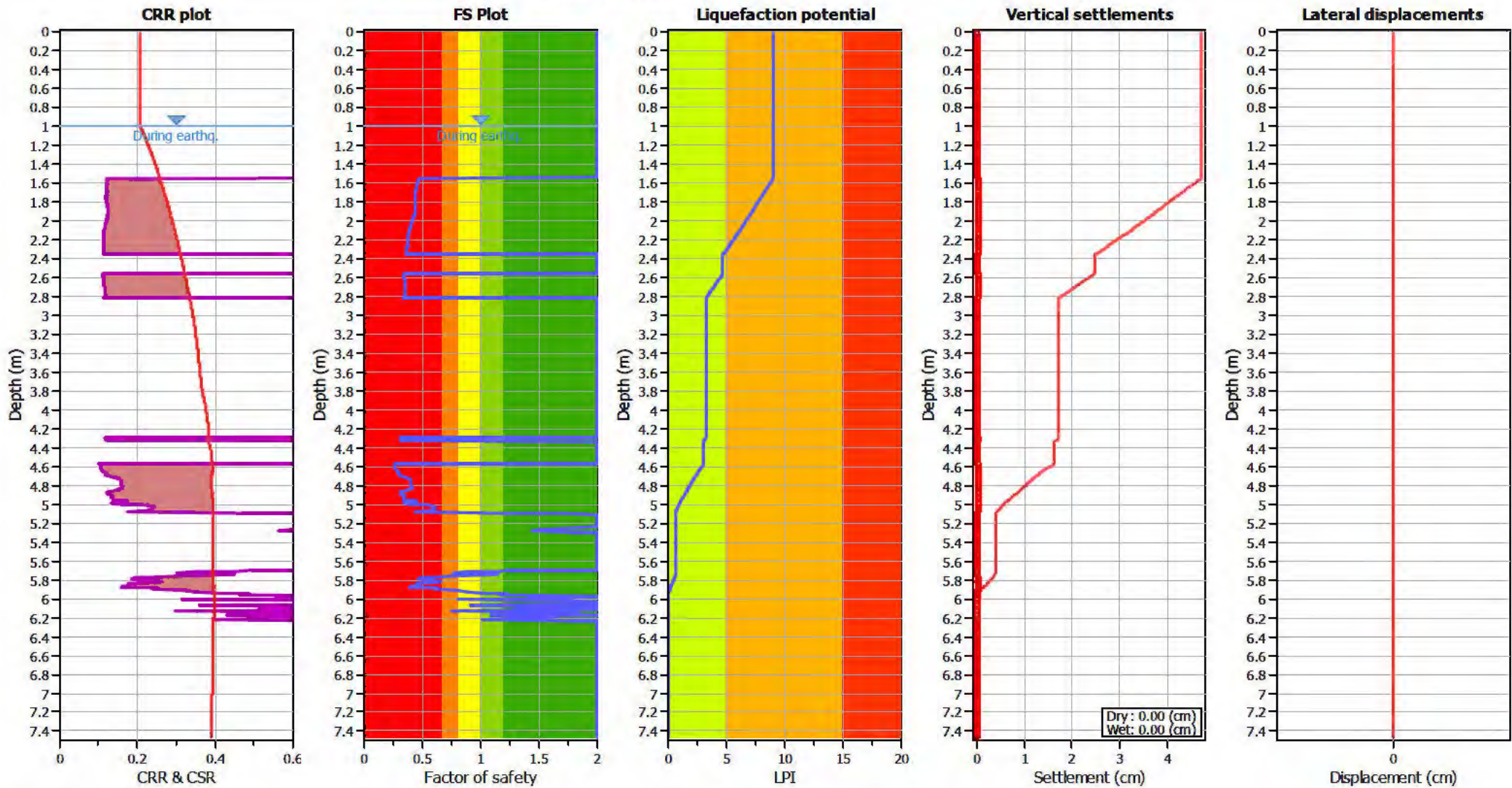
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude M_w : 7.50
Peak ground acceleration: 0.35
Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: Yes
 K_{σ} applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: Yes
Limit depth: 10.00 m

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

LIQUEFACTION ANALYSIS REPORT

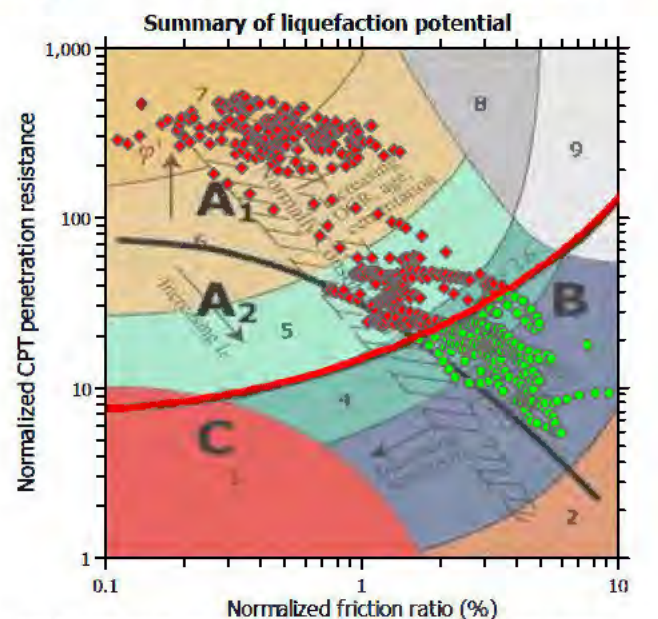
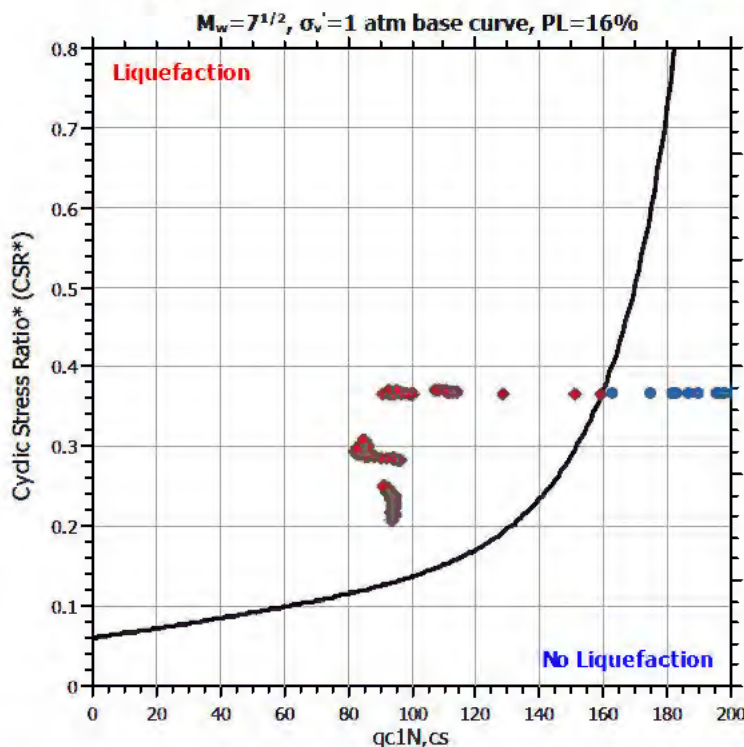
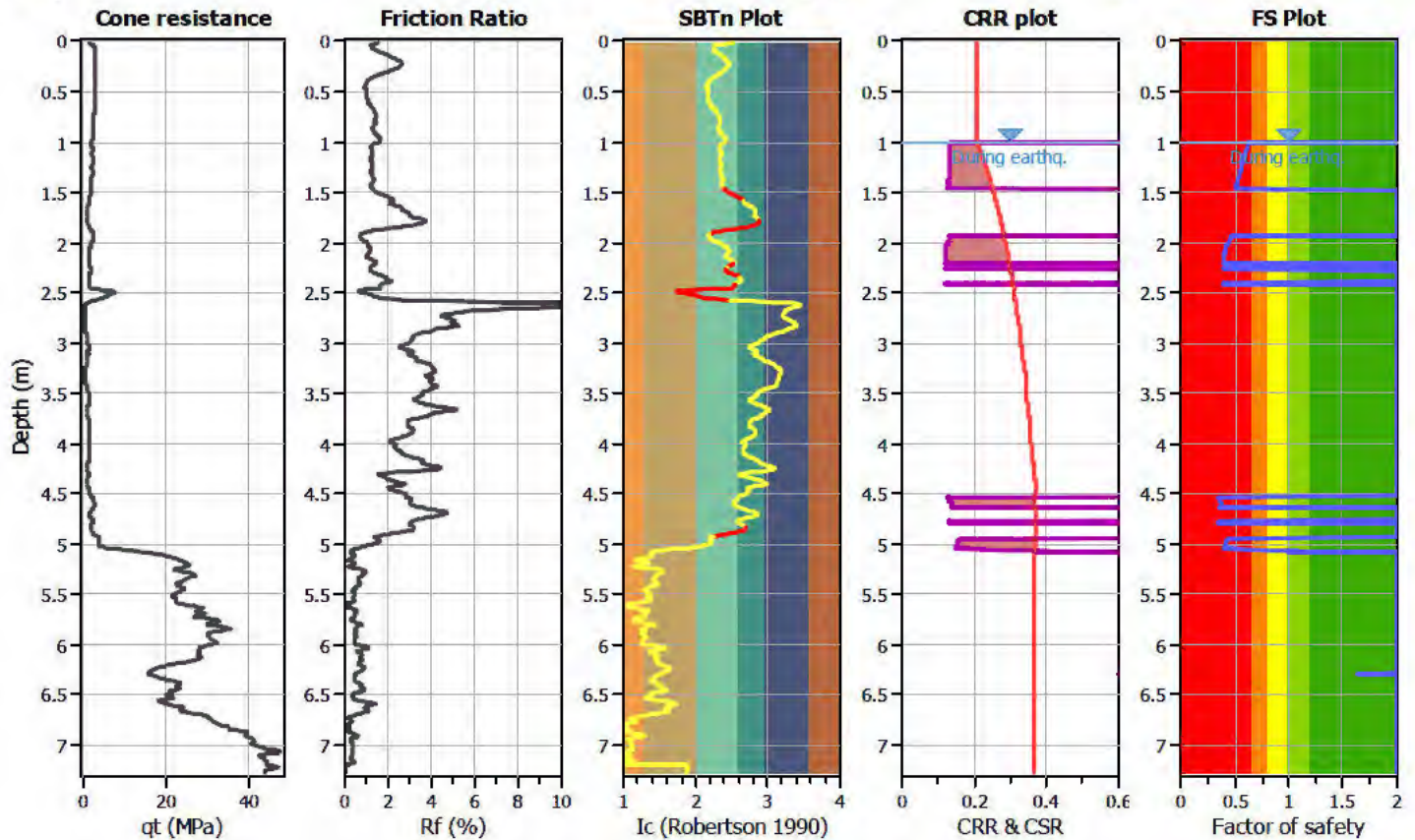
Project title : K250791

Location : 6 Wroots Rd & 101 Sabys Rd

CPT file : CPT-04

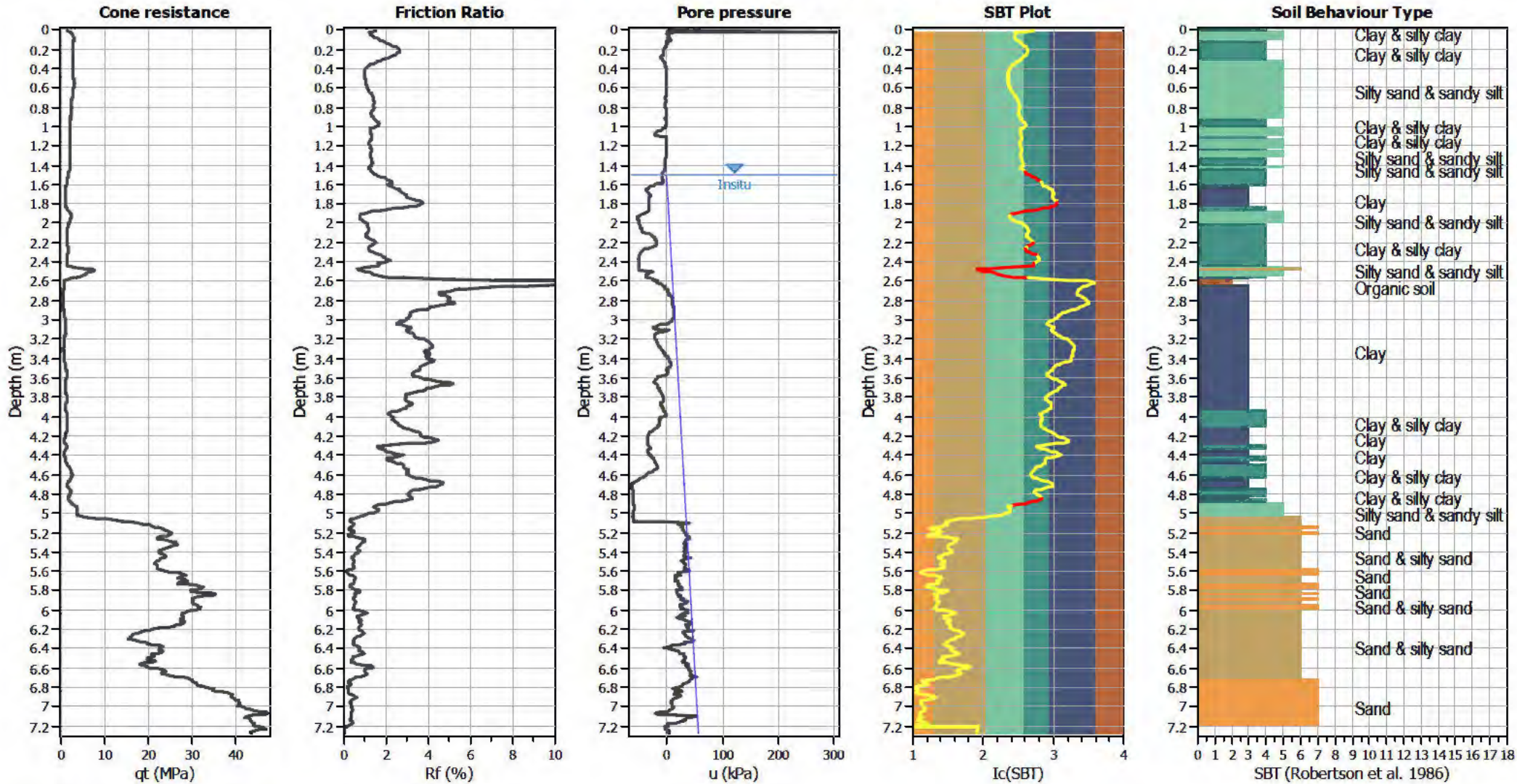
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



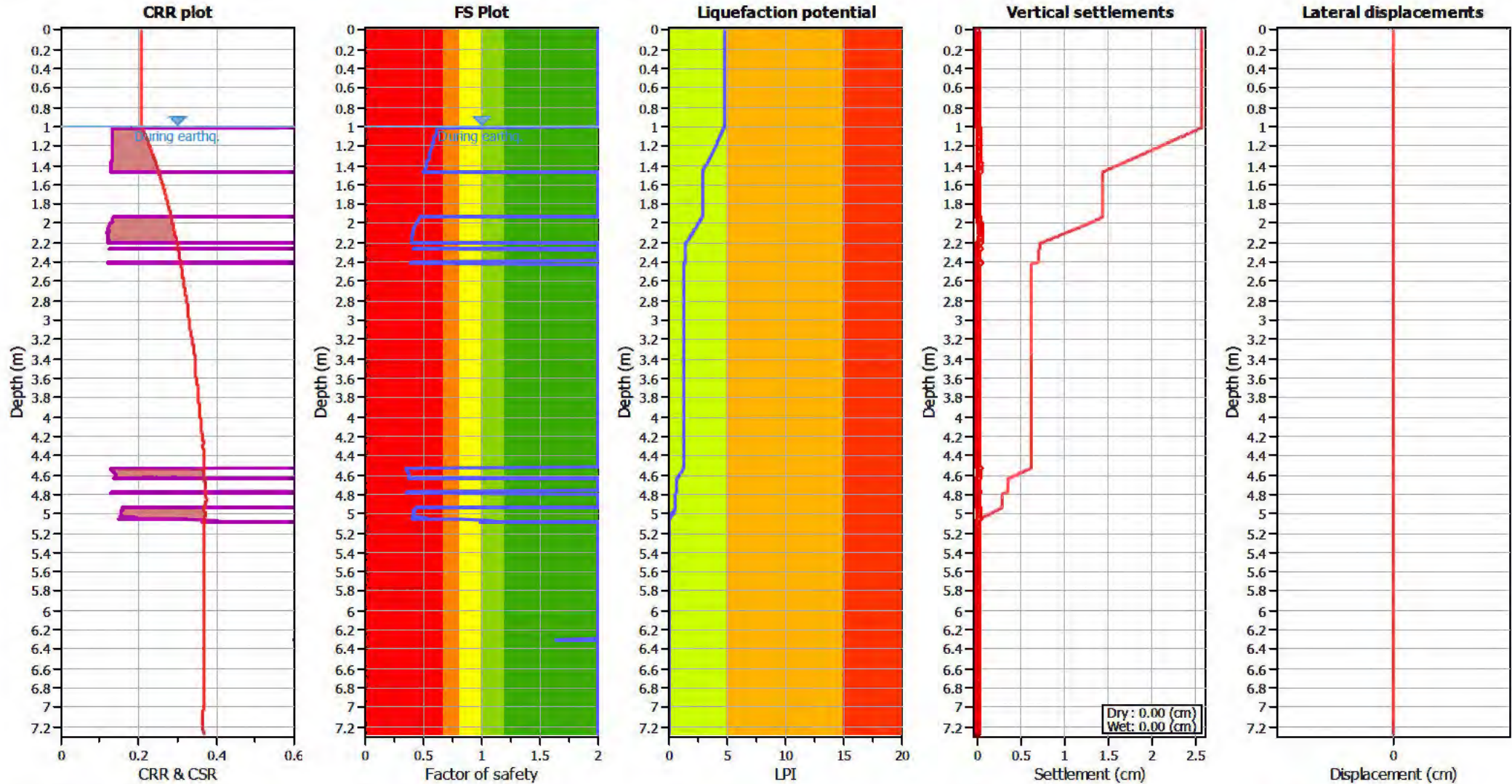
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



LIQUEFACTION ANALYSIS REPORT

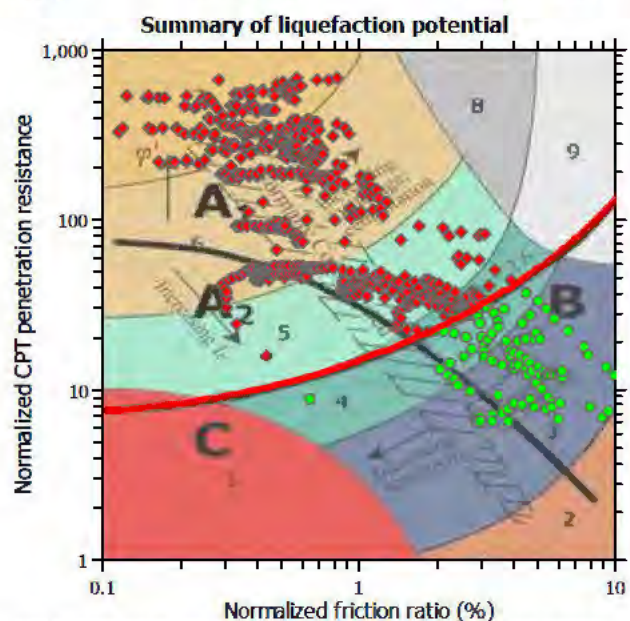
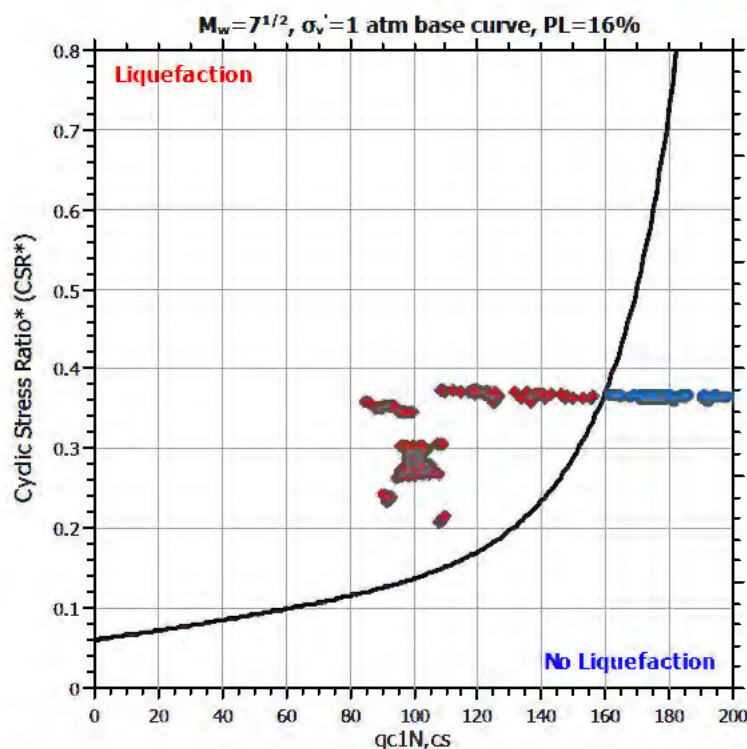
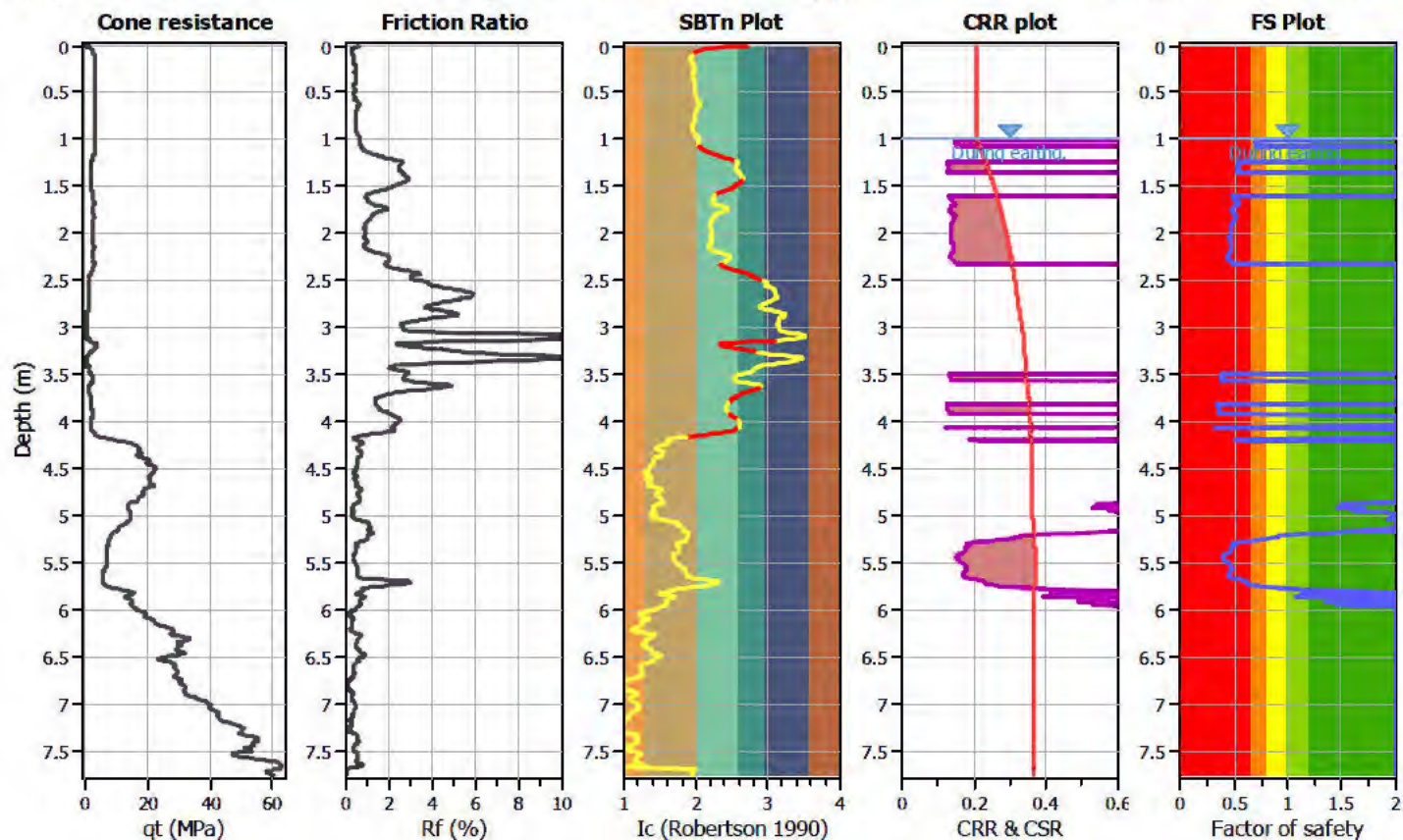
Project title : K250791

Location : 6 Wroots Rd & 101 Sabys Rd

CPT file : CPT-05

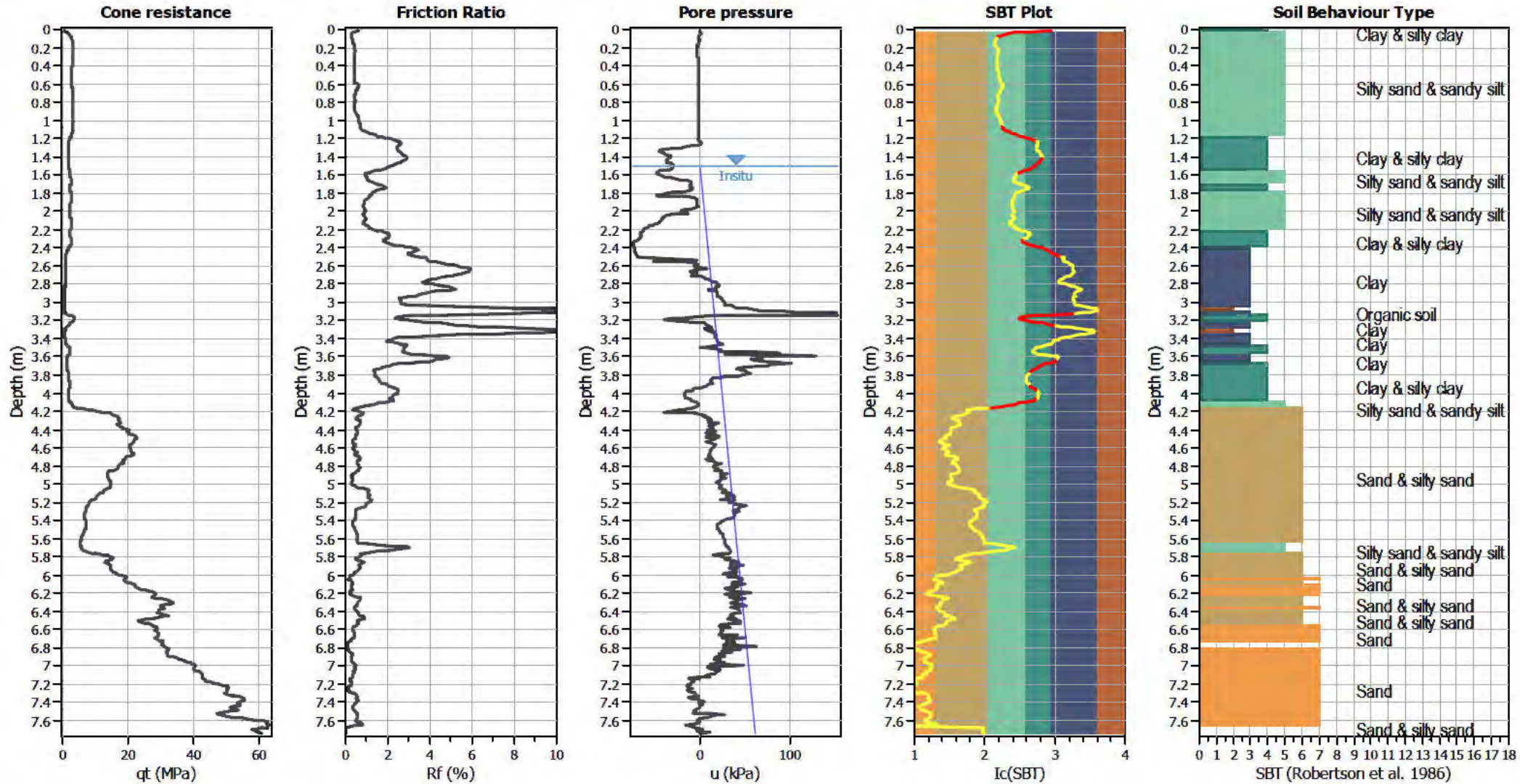
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	10.00 m
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



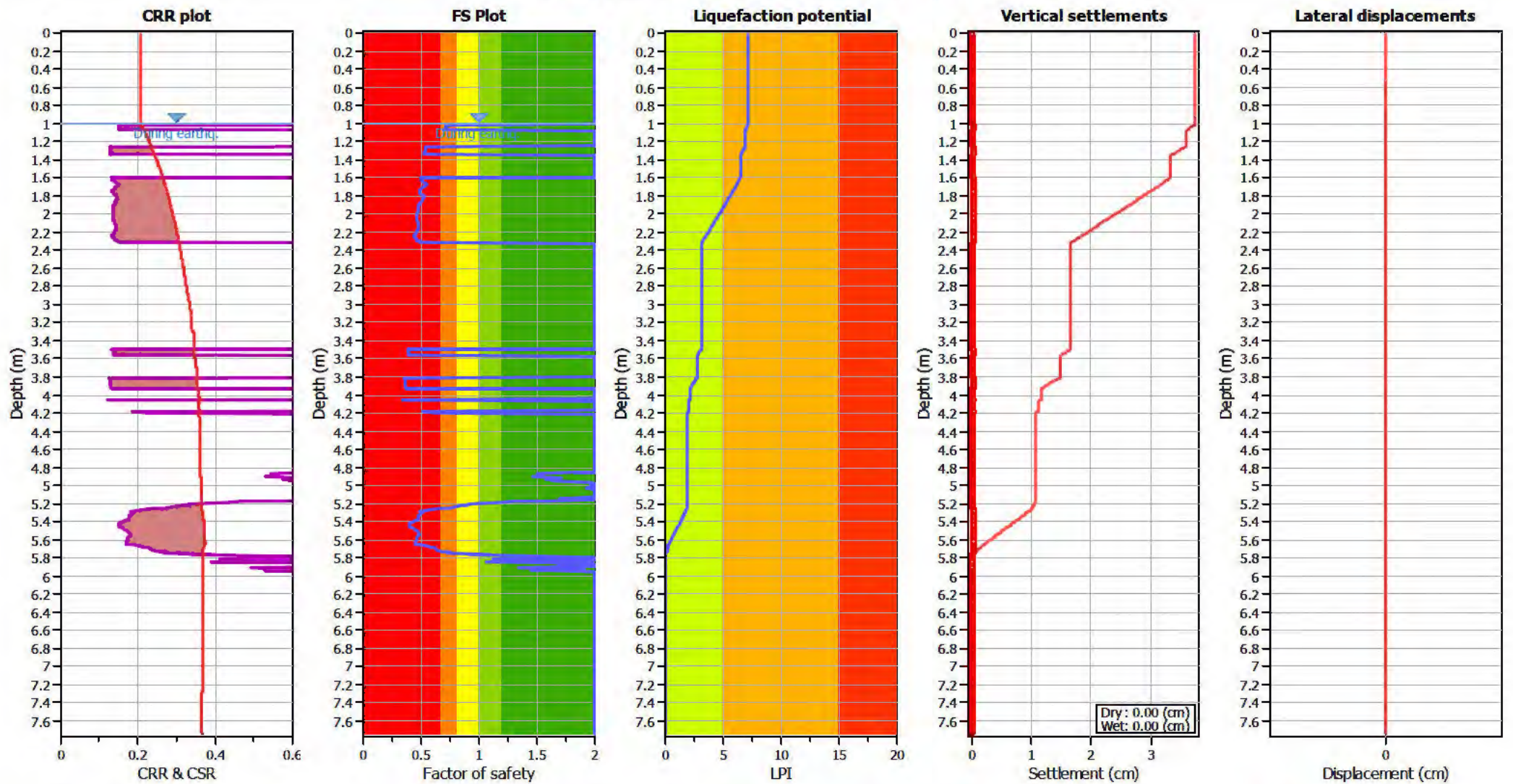
Input parameters and analysis data

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Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _o applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude M_w : 7.50
Peak ground acceleration: 0.35
Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: Yes
 K_w applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: Yes
Limit depth: 10.00 m

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

LIQUEFACTION ANALYSIS REPORT

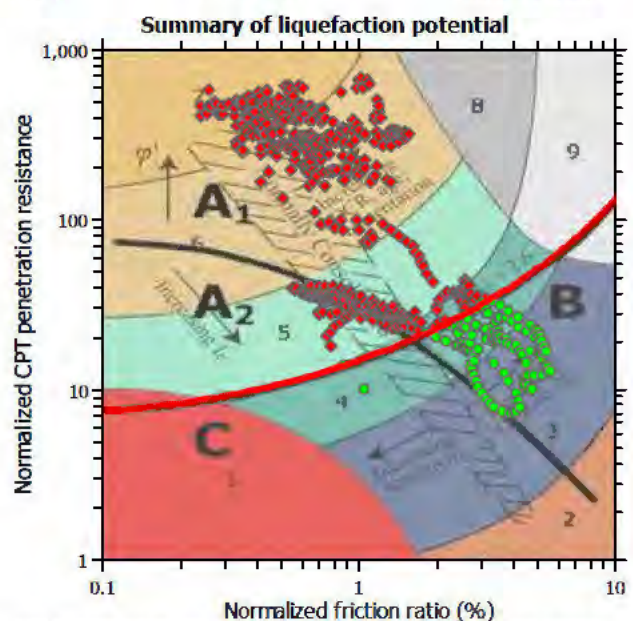
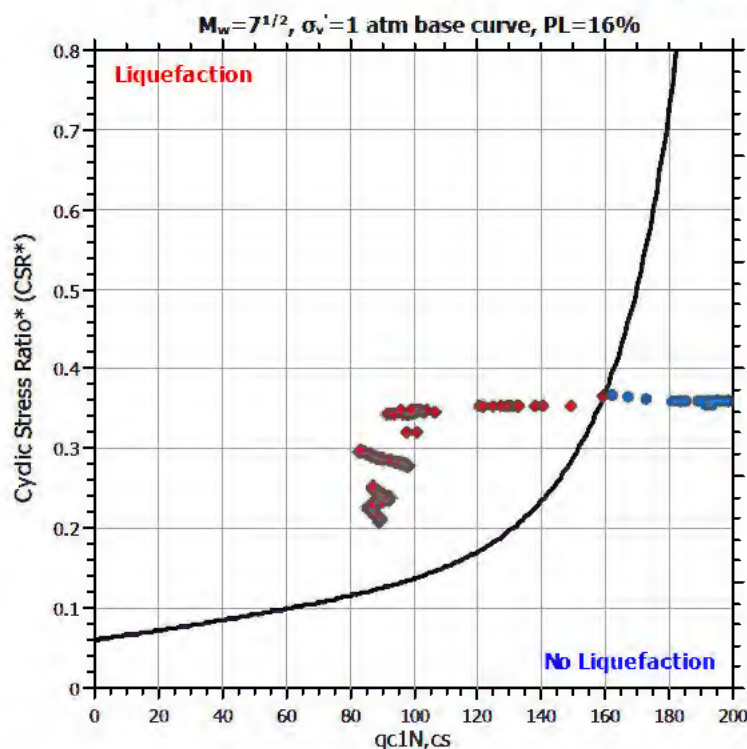
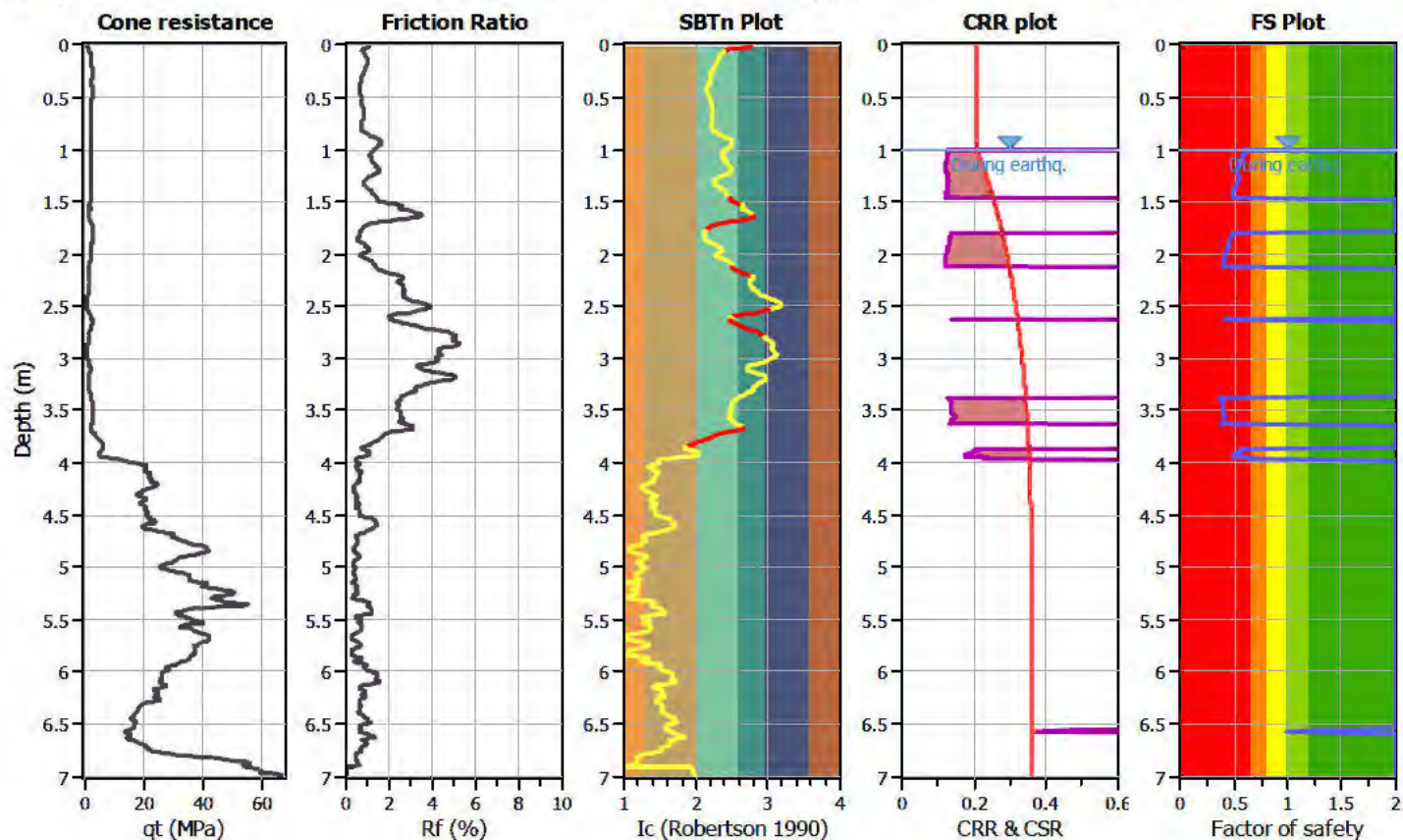
Project title : K250791

Location : 6 Wroots Rd & 101 Sabys Rd

CPT file : CPT_06

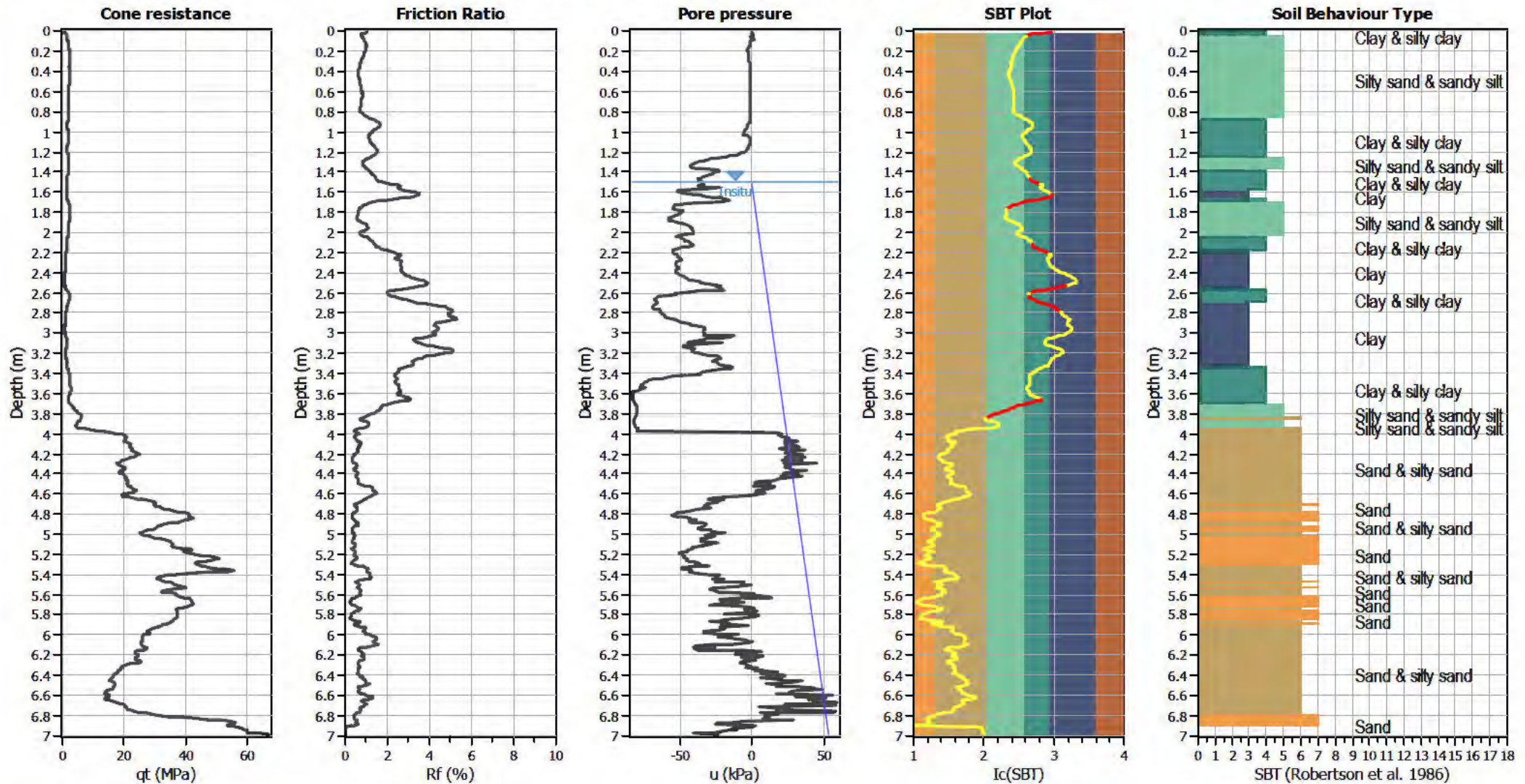
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



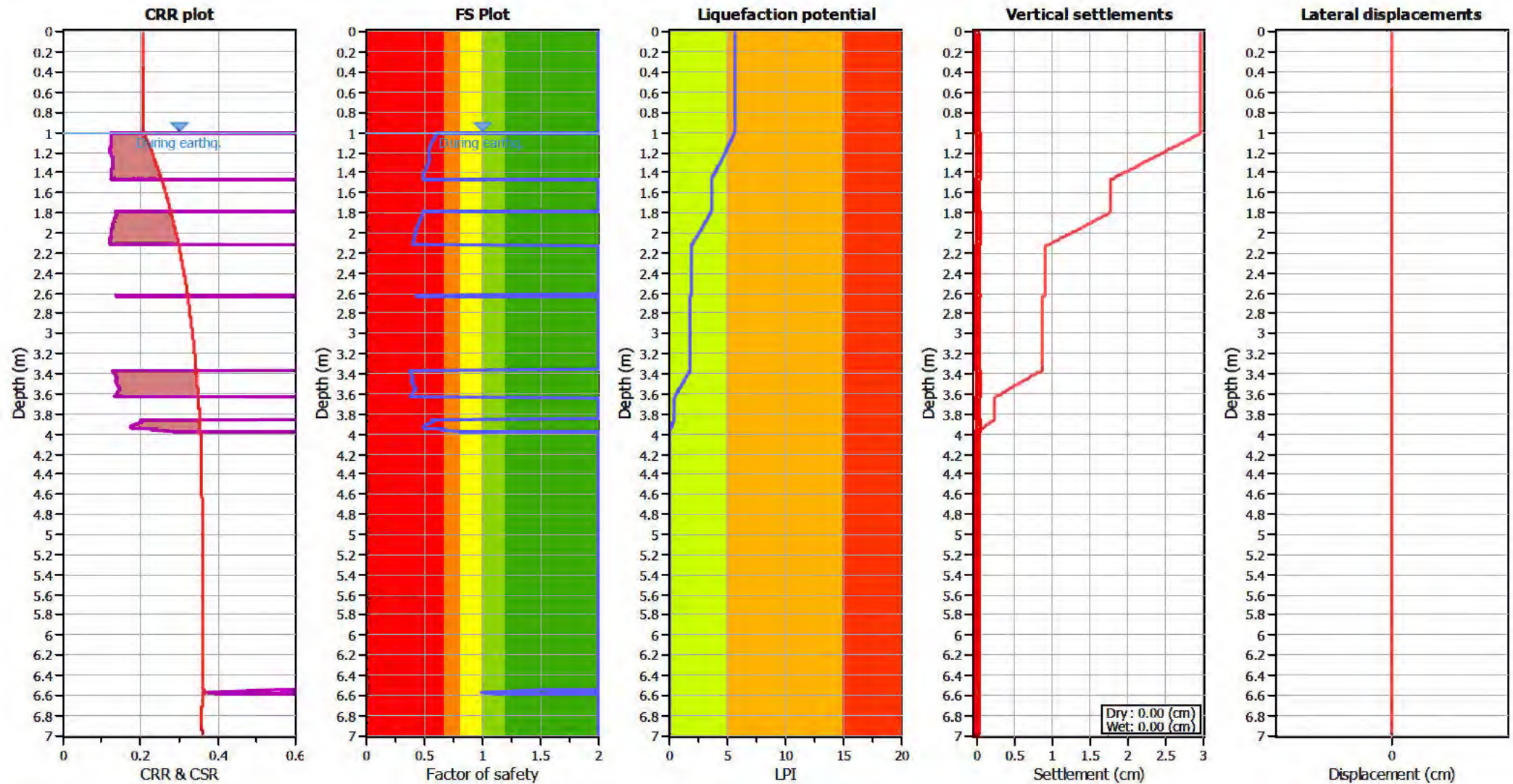
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Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude M_w : 7.50
Peak ground acceleration: 0.35
Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: Yes
 K_{α} applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: Yes
Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
Very likely to liquefy
Liquefaction and no liq. are equally likely
Unlike to liquefy
Almost certain it will not liquefy

LPI color scheme

Very high risk
High risk
Low risk

LIQUEFACTION ANALYSIS REPORT

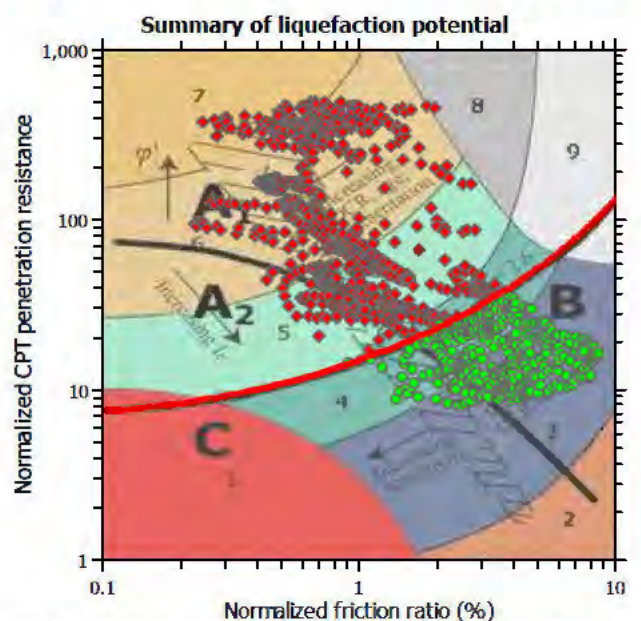
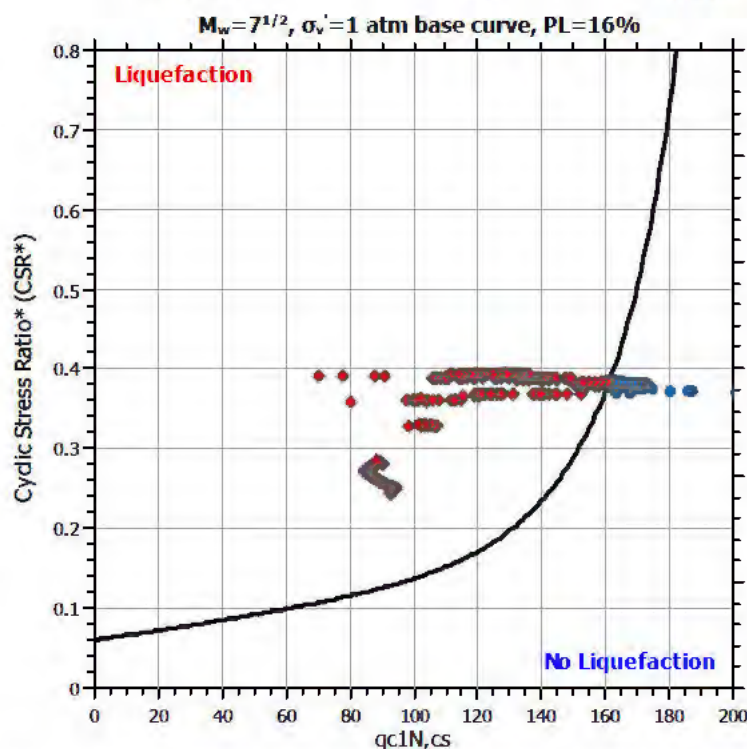
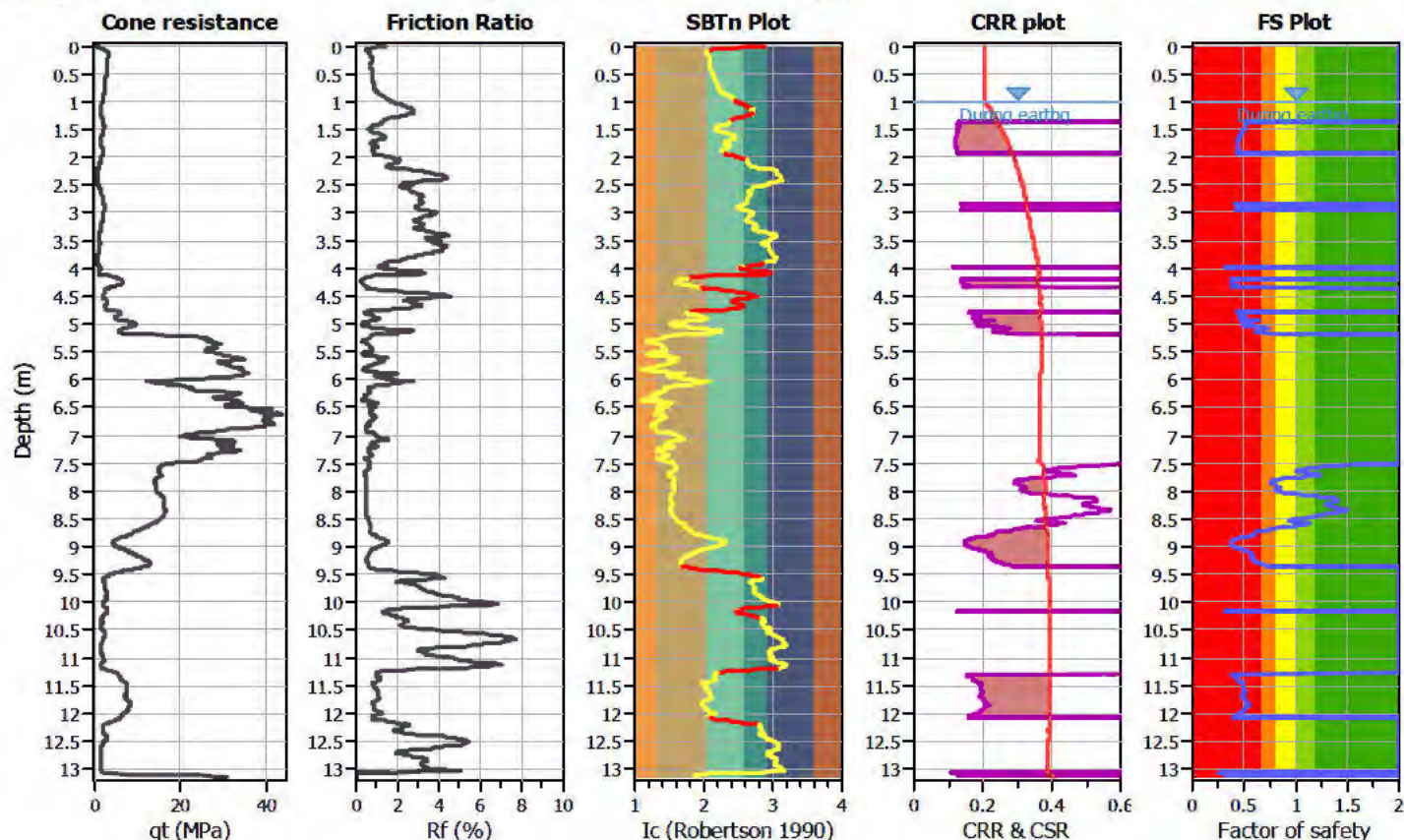
Project title : K250791

Location : 6 Wrooots Rd & 101 Sabys Rd

CPT file : CPT-07

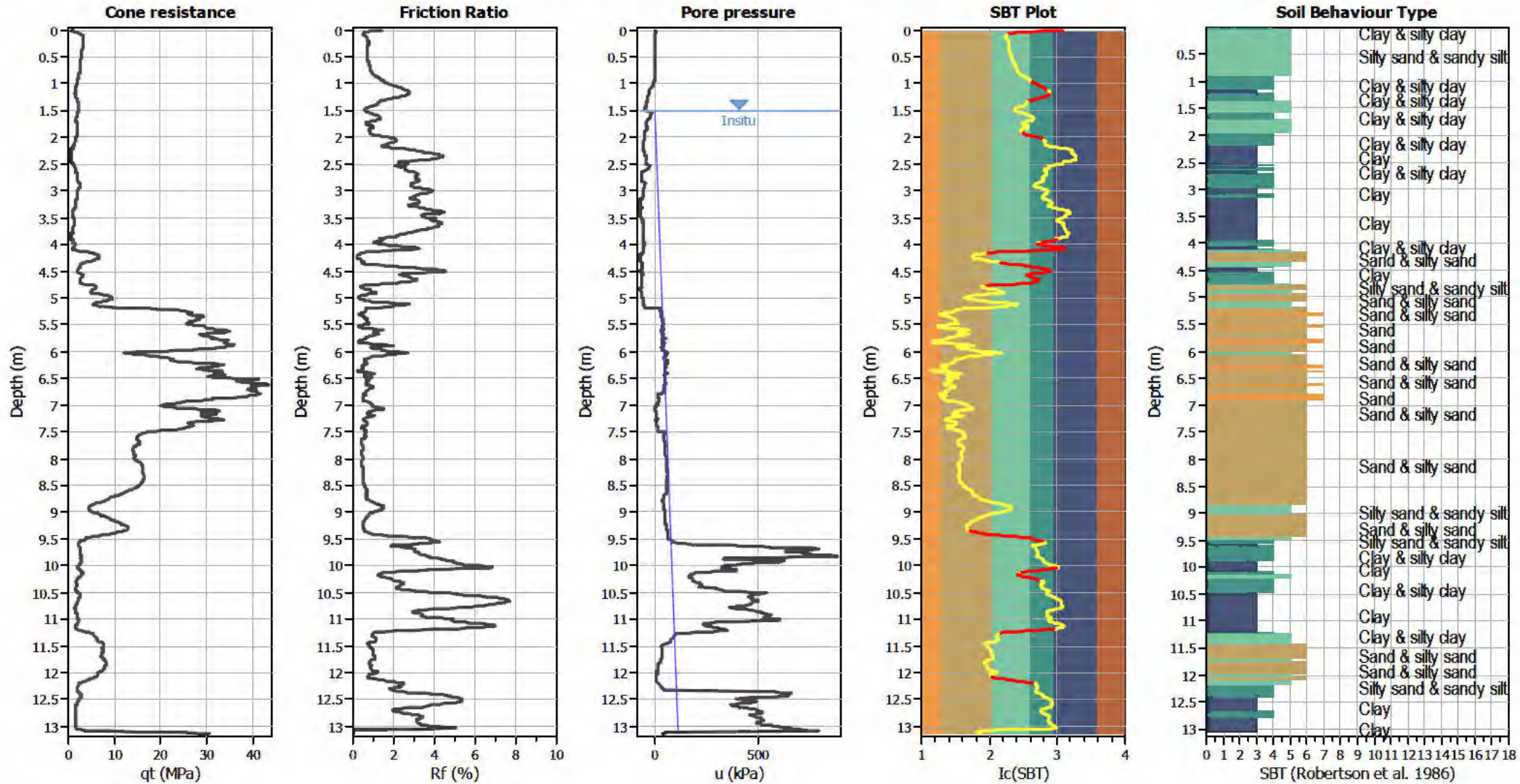
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots

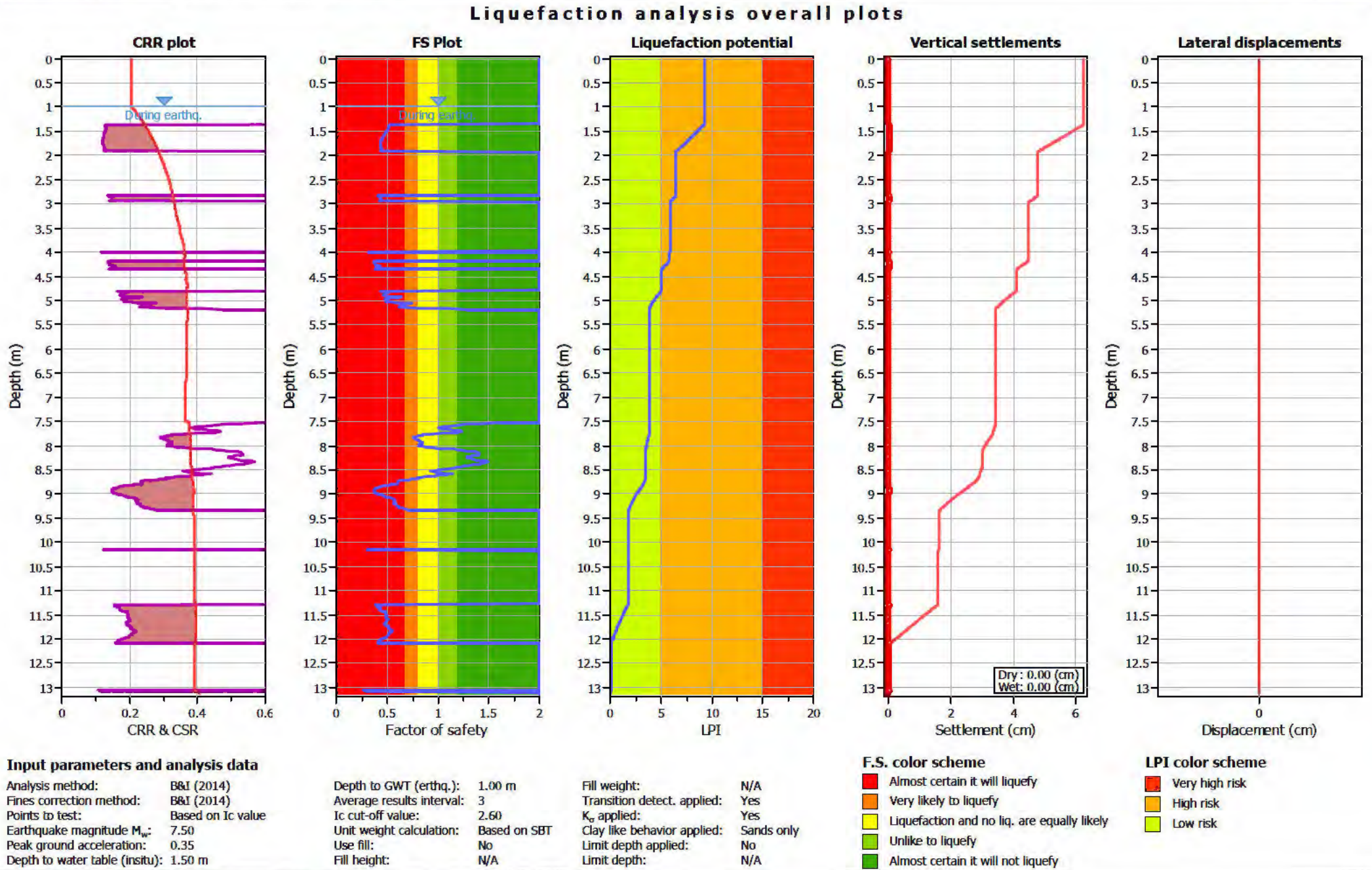


Input parameters and analysis data

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Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained



LIQUEFACTION ANALYSIS REPORT

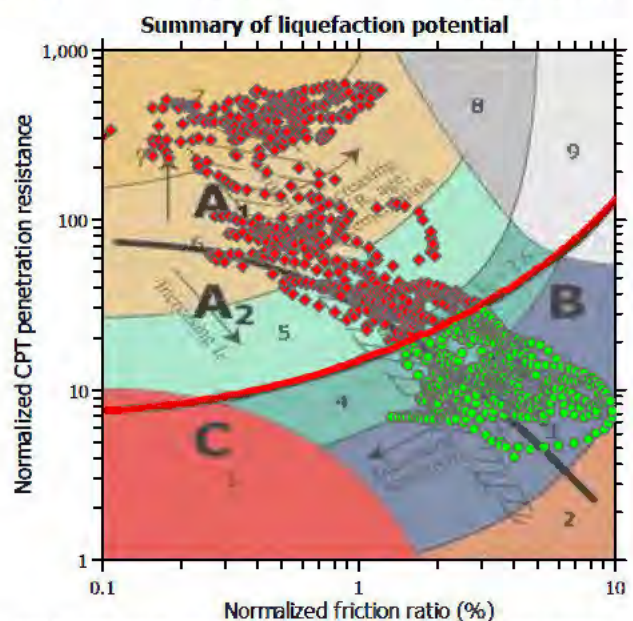
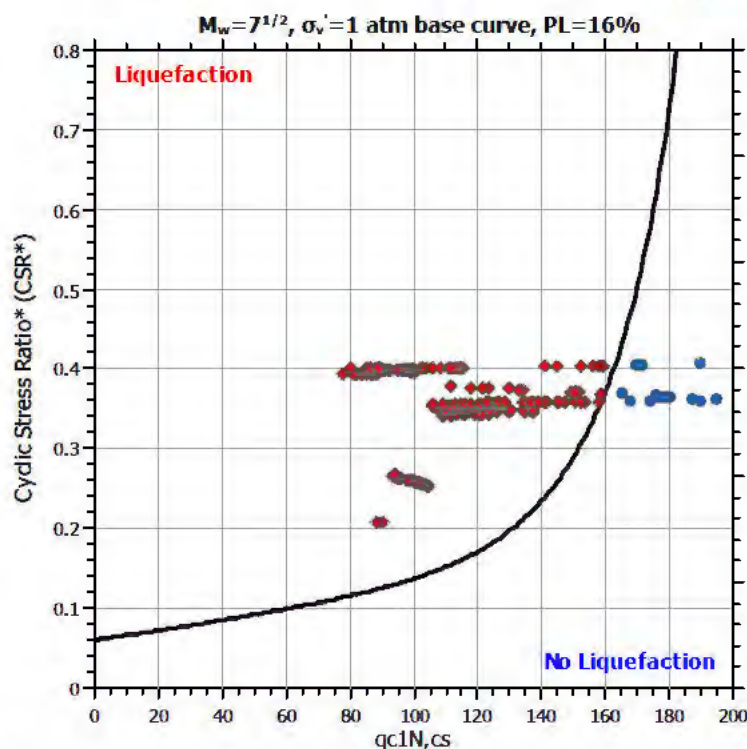
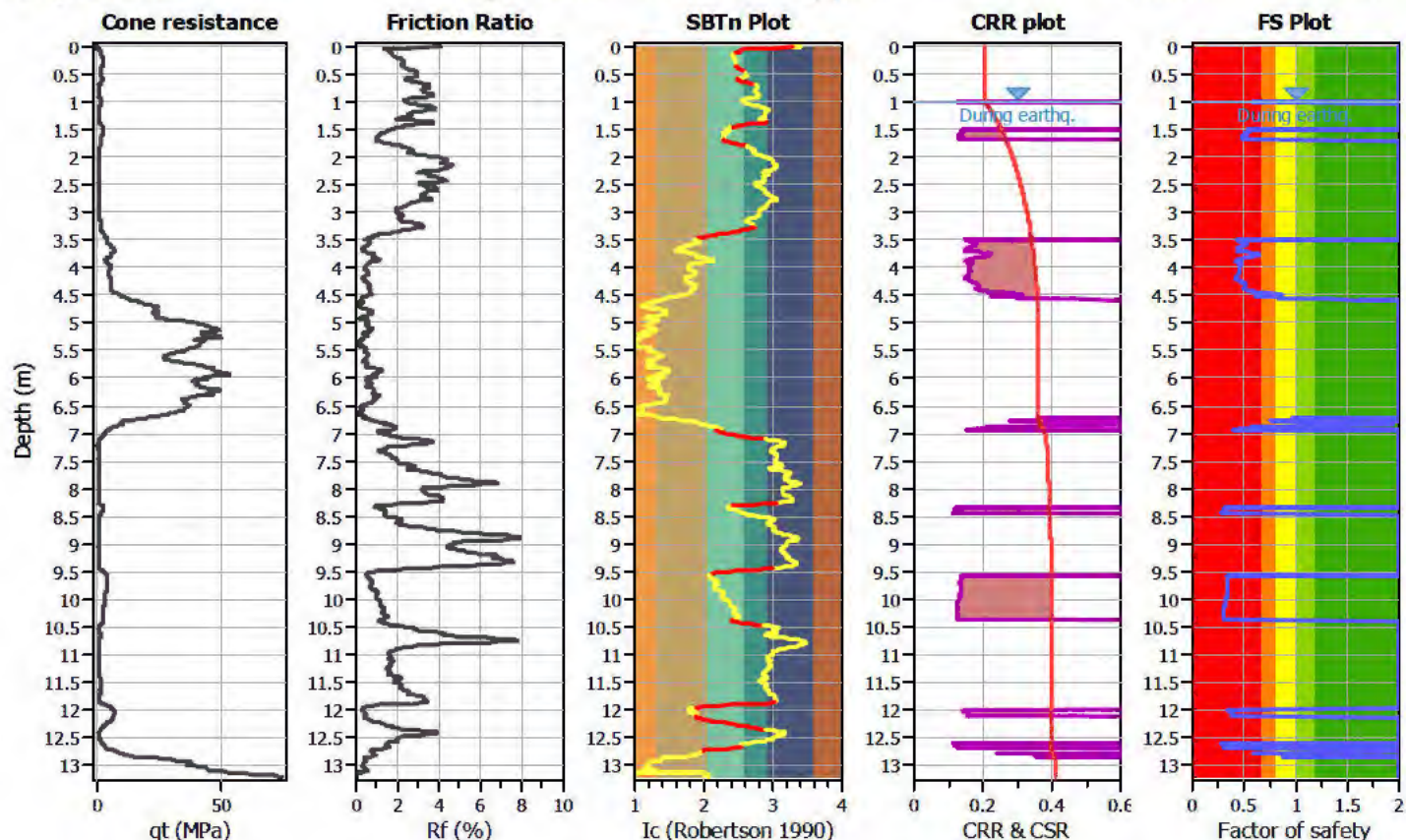
Project title : K250791

Location : 6 Wroots Rd & 101 Sabys Rd

CPT file : CPT-08

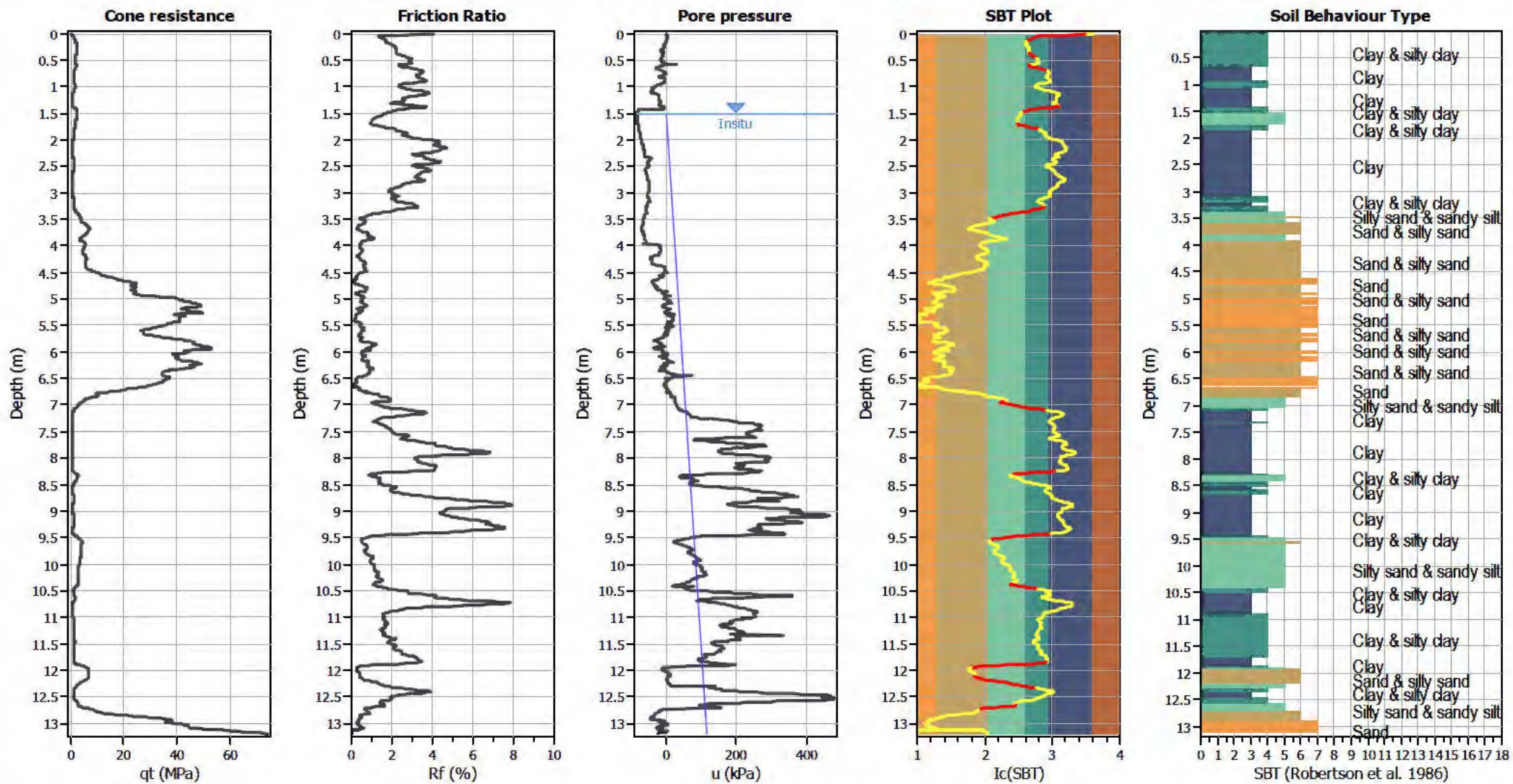
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



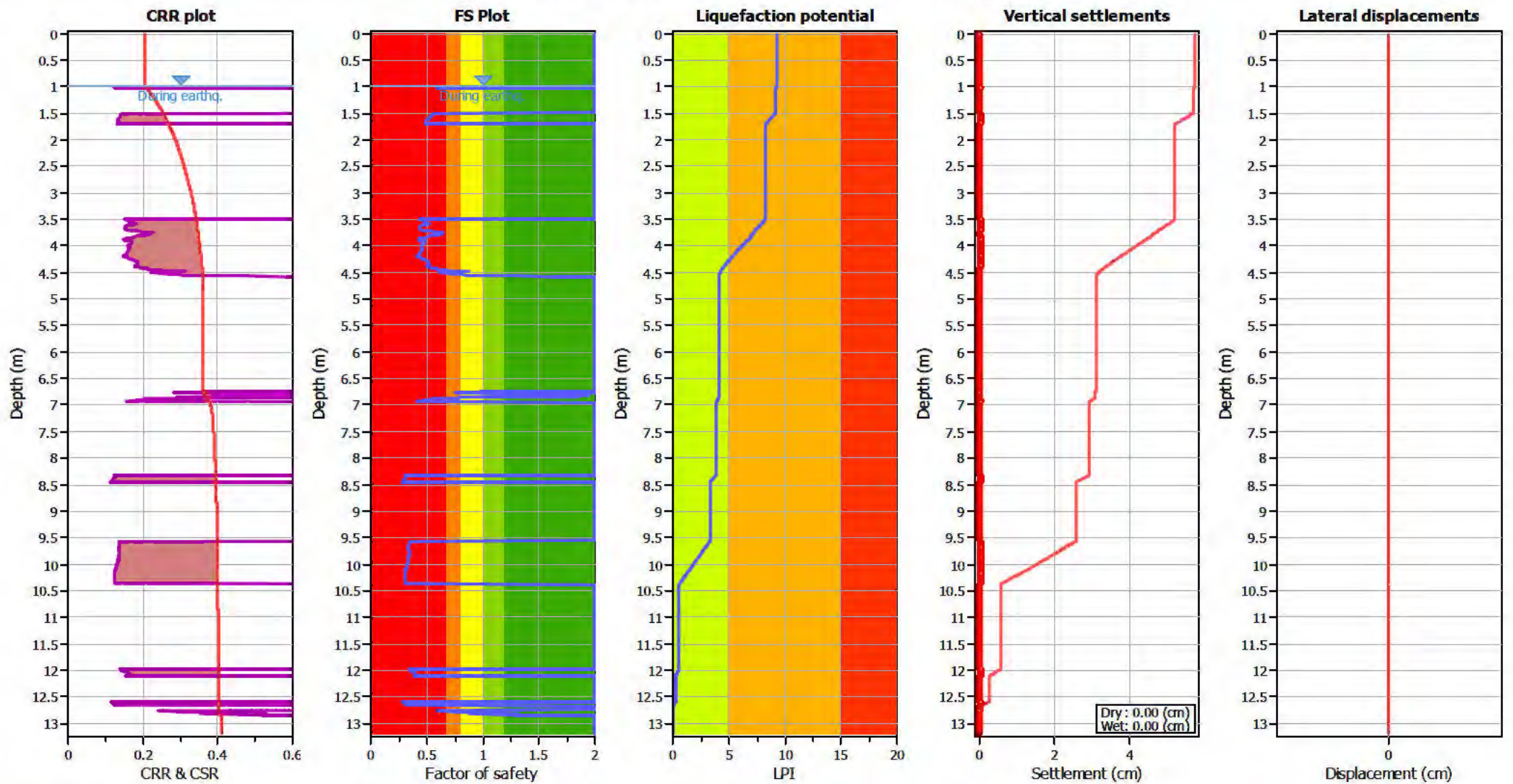
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _σ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

Red	Almost certain it will liquefy
Orange	Very likely to liquefy
Yellow	Liquefaction and no liq. are equally likely
Green	Unlike to liquefy
Dark Green	Almost certain it will not liquefy

LPI color scheme

Red	Very high risk
Orange	High risk
Yellow	Low risk

LIQUEFACTION ANALYSIS REPORT

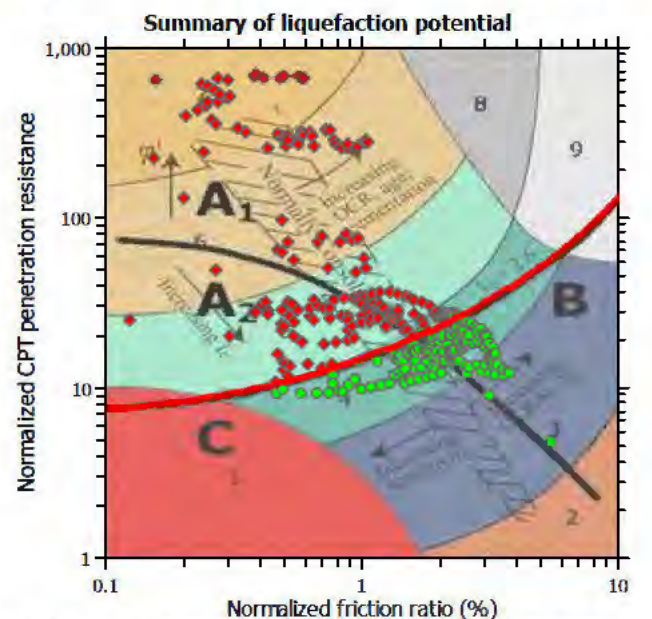
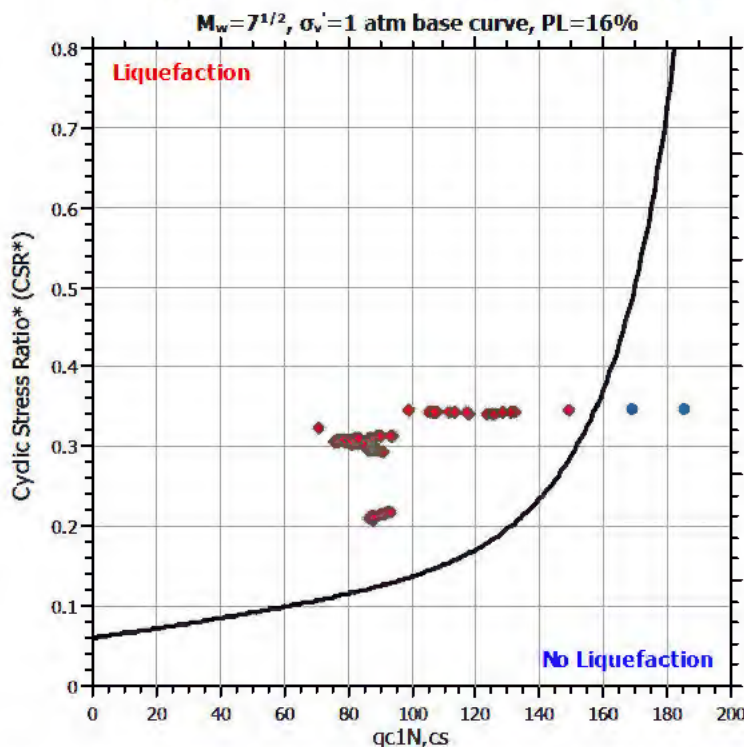
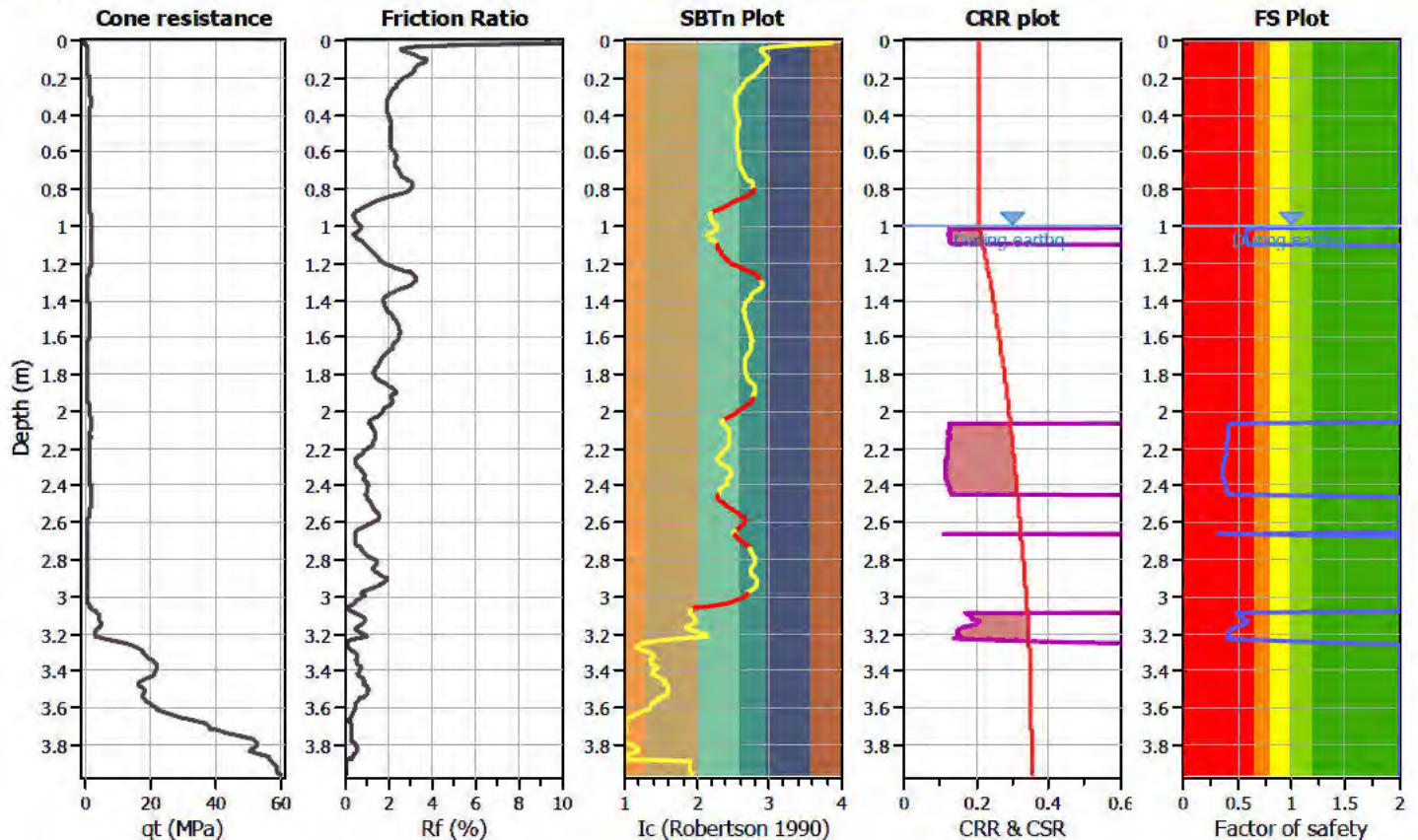
Project title : K250791

Location : 6 Wrooots Rd & 101 Sabys Rd

CPT file : CPT-09

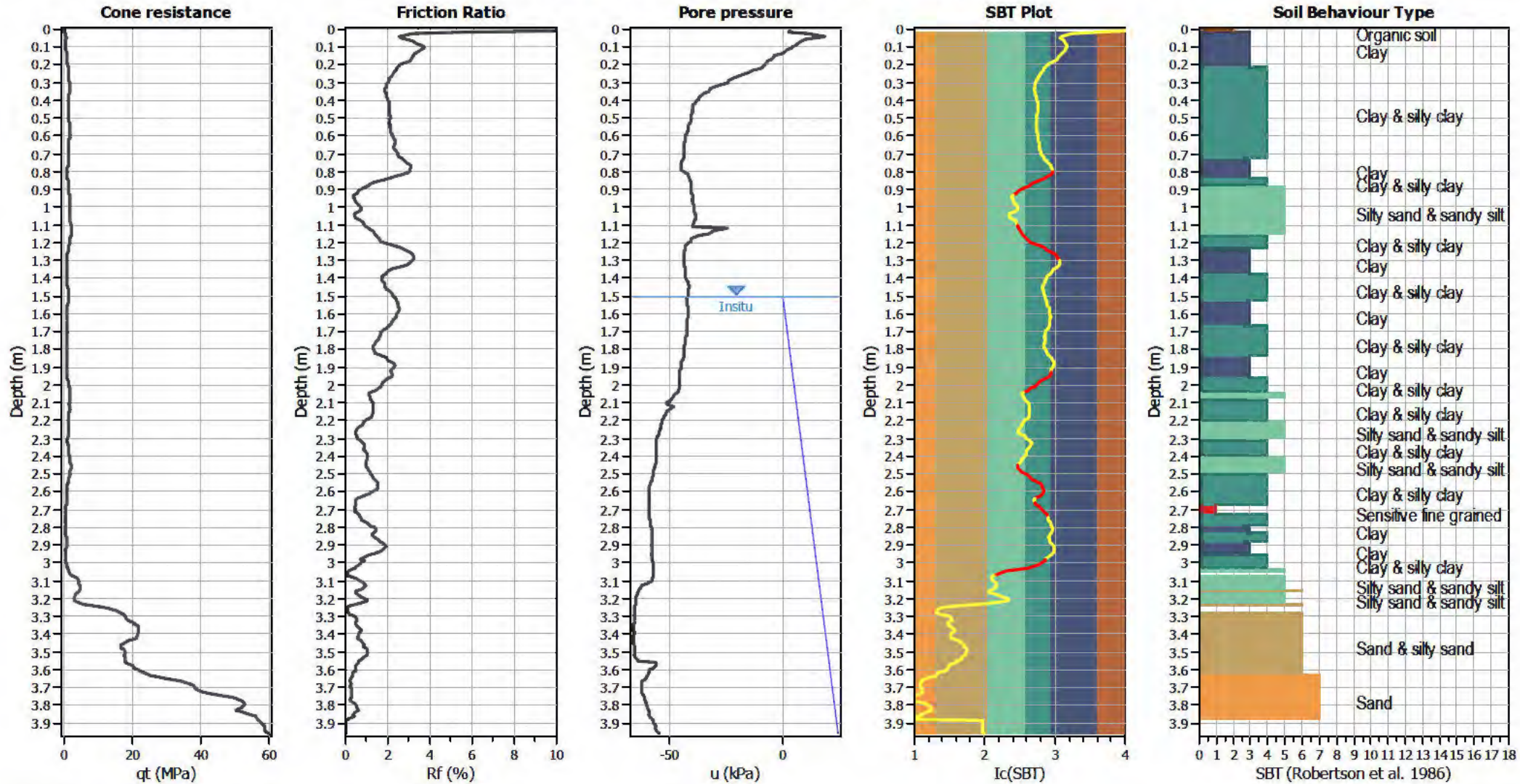
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	10.00 m
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots

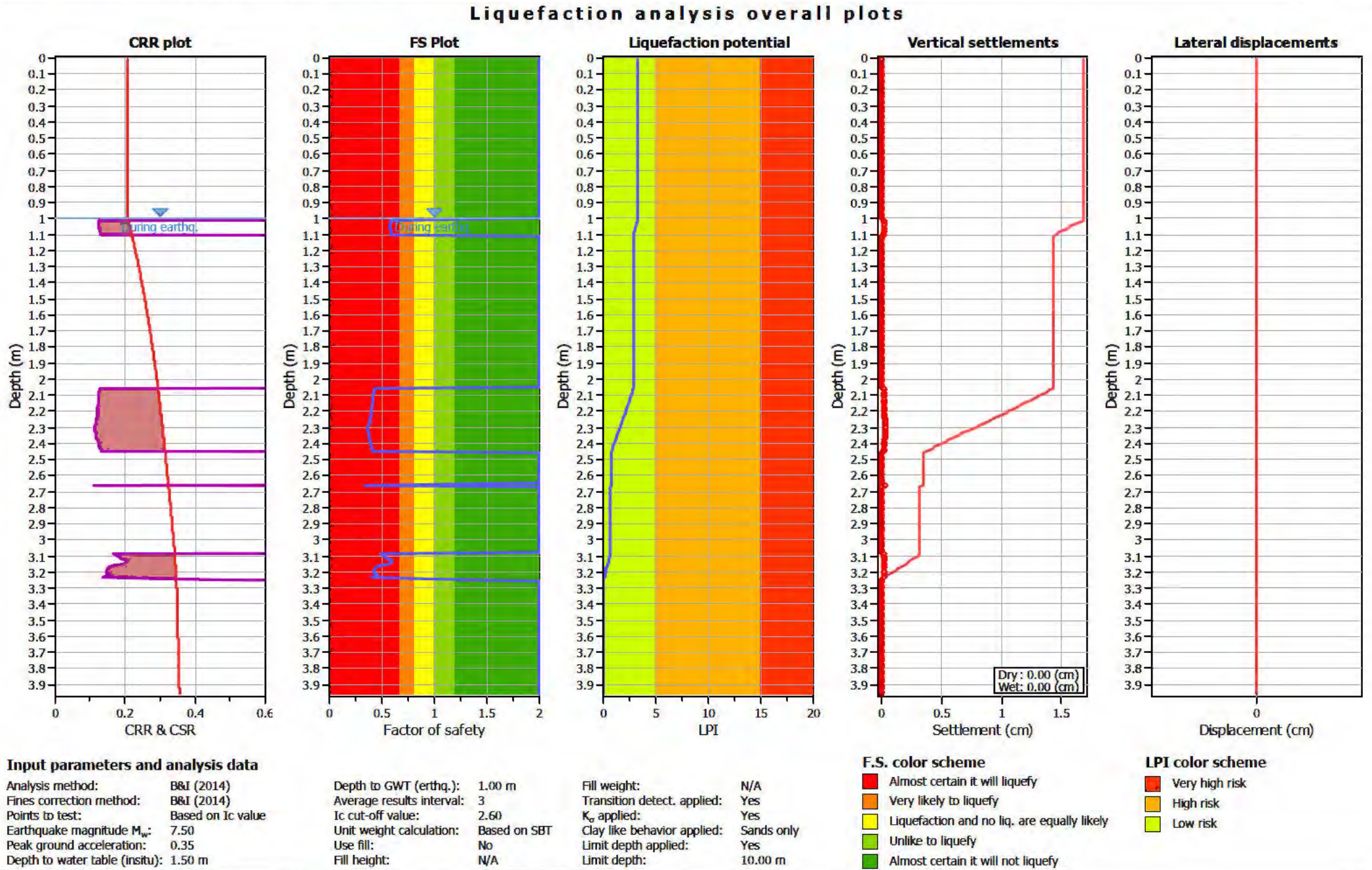


Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained



LIQUEFACTION ANALYSIS REPORT

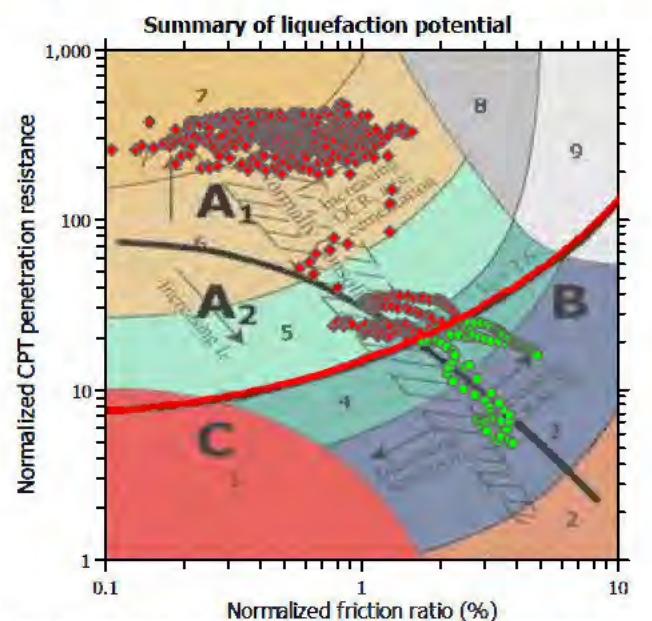
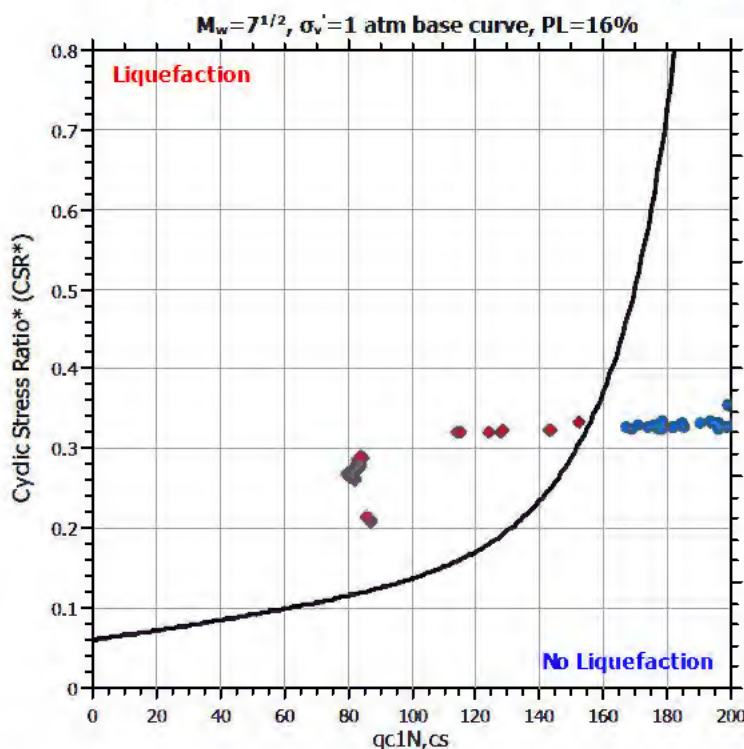
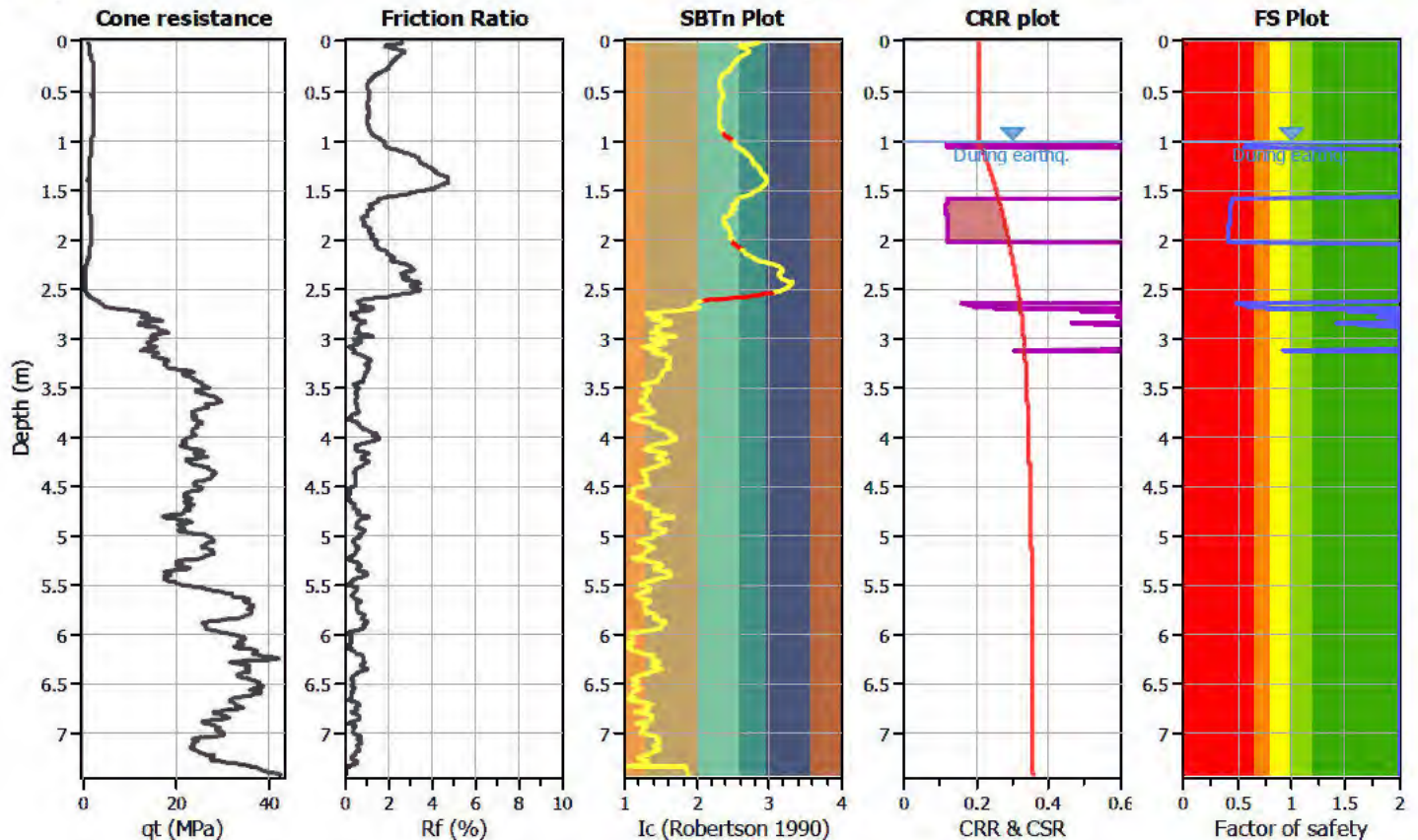
Project title : K250791

Location : 6 Wrooots Rd & 101 Sabys Rd

CPT file : CPT-10

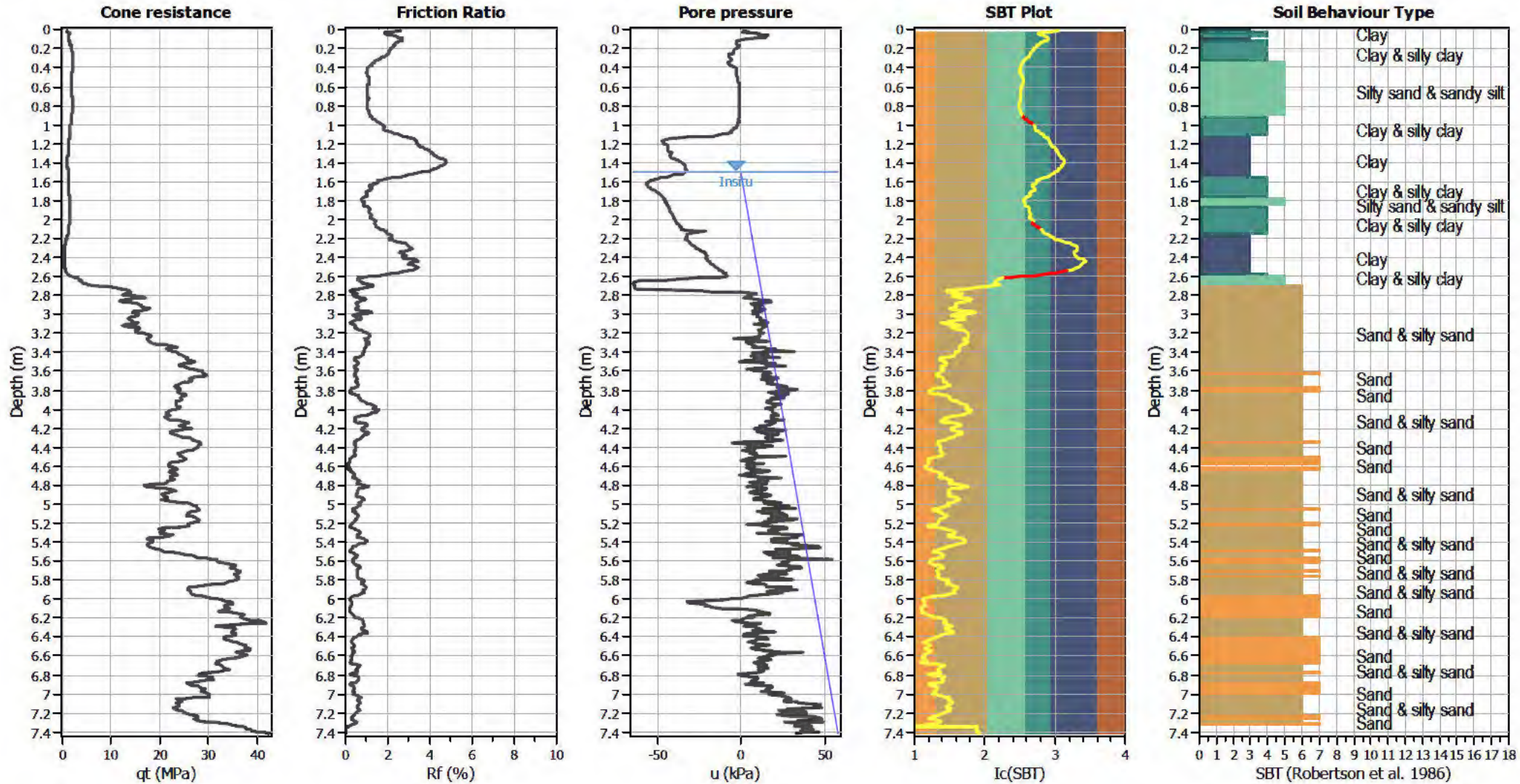
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



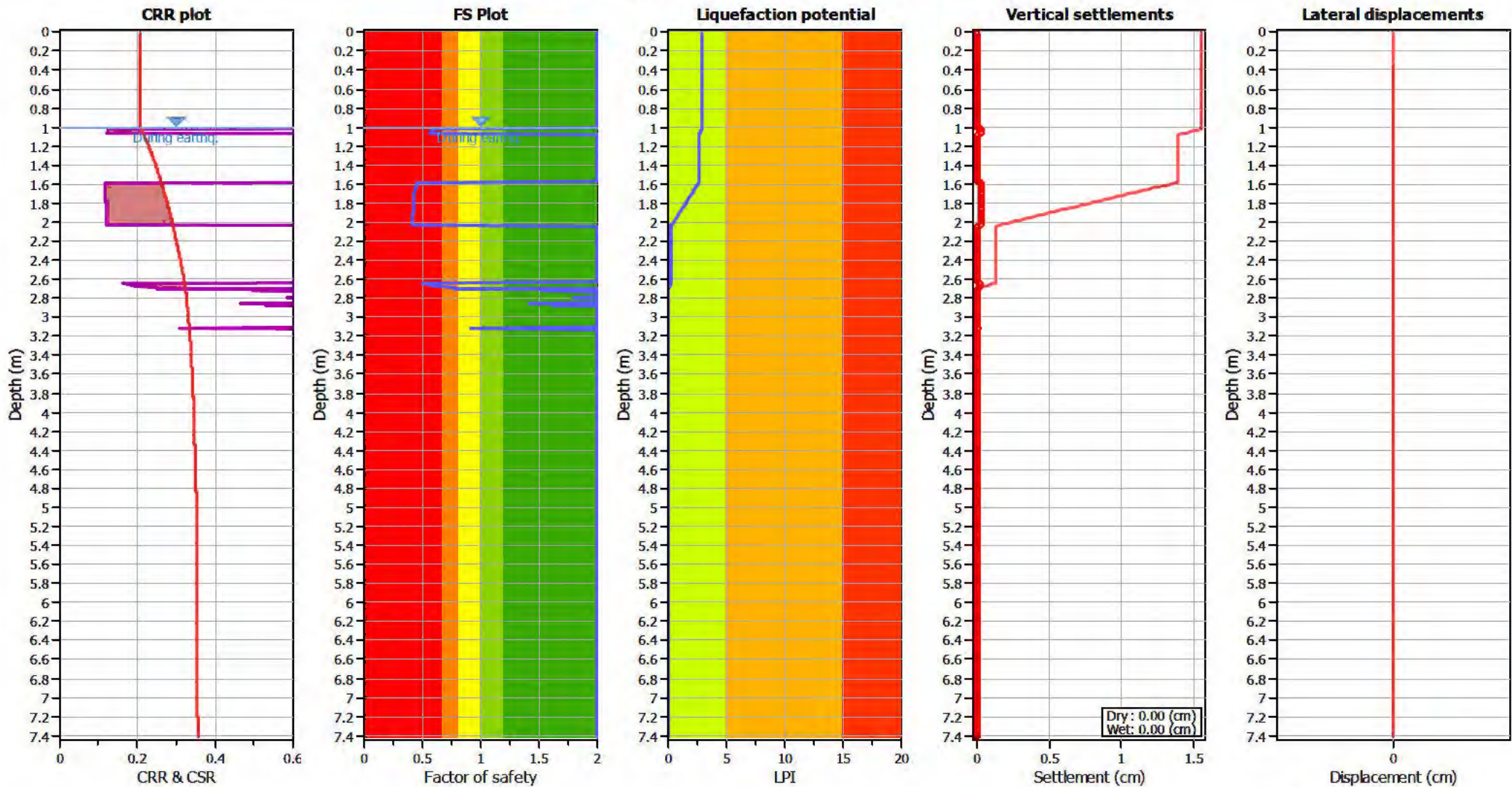
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

Red	Almost certain it will liquefy
Orange	Very likely to liquefy
Yellow	Liquefaction and no liq. are equally likely
Light Green	Unlike to liquefy
Dark Green	Almost certain it will not liquefy

LPI color scheme

Red	Very high risk
Orange	High risk
Yellow	Low risk

LIQUEFACTION ANALYSIS REPORT

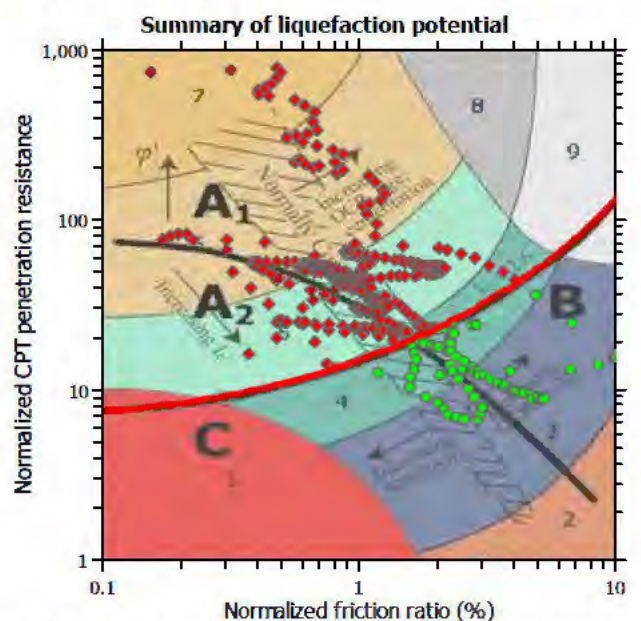
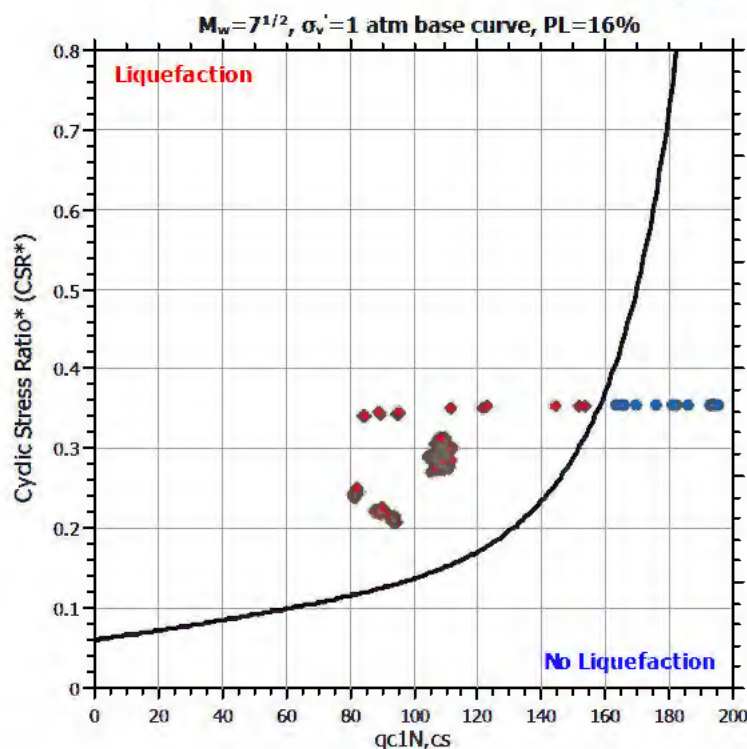
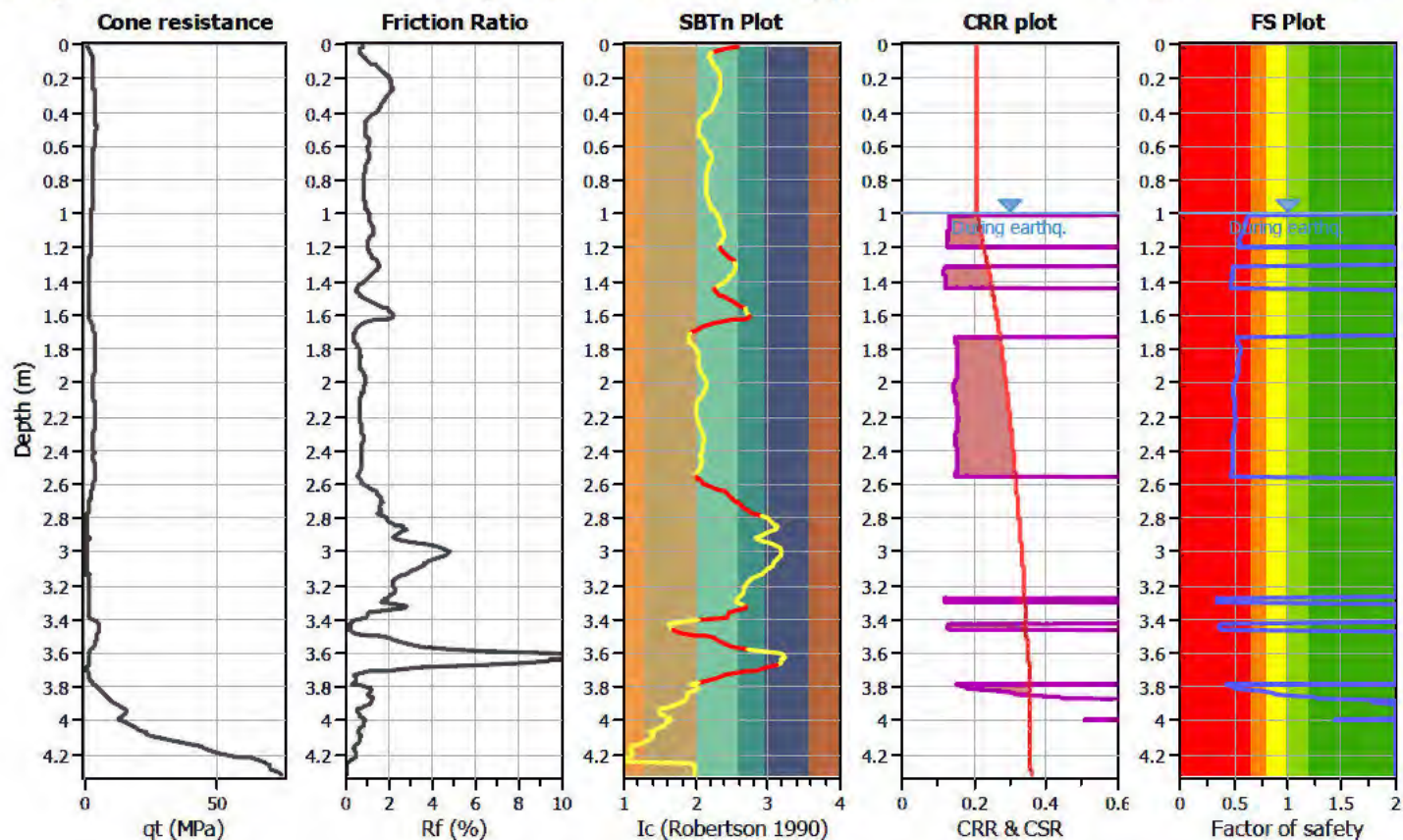
Project title : K250791

Location : 6 Wroots Rd & 101 Sabys Rd

CPT file : CPT-11

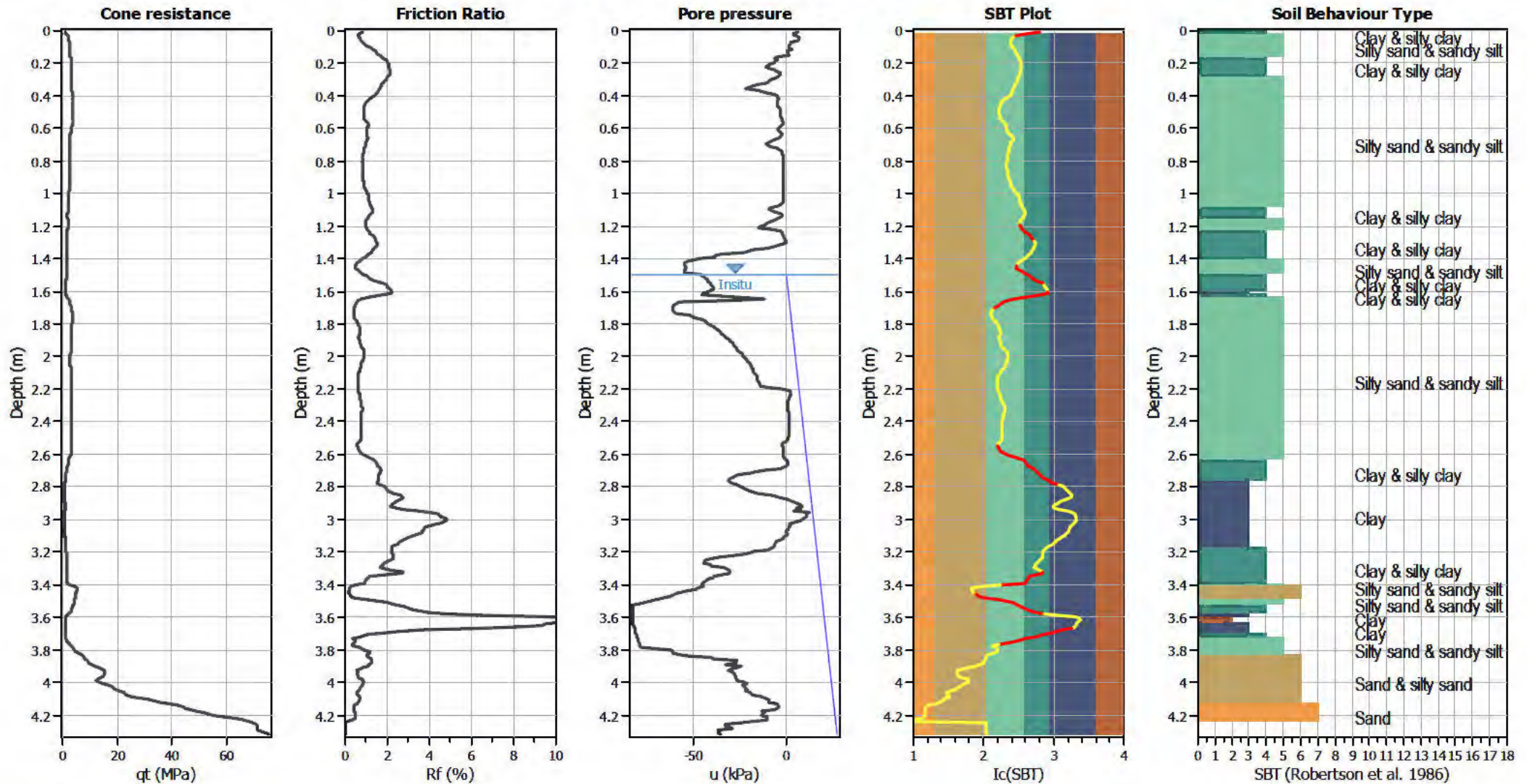
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



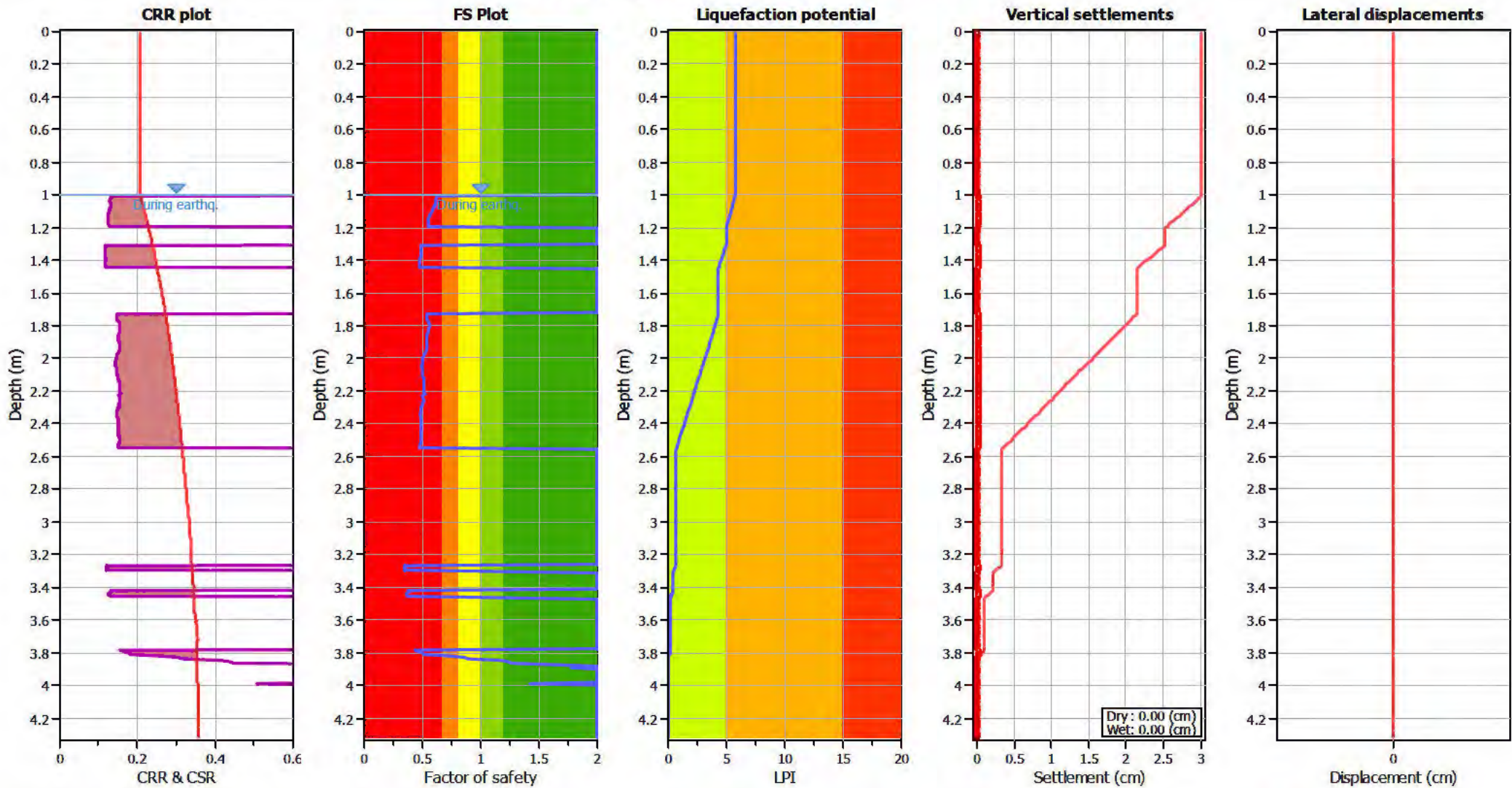
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (earthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _σ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

Red	Almost certain it will liquefy
Orange	Very likely to liquefy
Yellow	Liquefaction and no liq. are equally likely
Green	Unlike to liquefy
Dark Green	Almost certain it will not liquefy

LPI color scheme

Red	Very high risk
Orange	High risk
Yellow	Low risk

LIQUEFACTION ANALYSIS REPORT

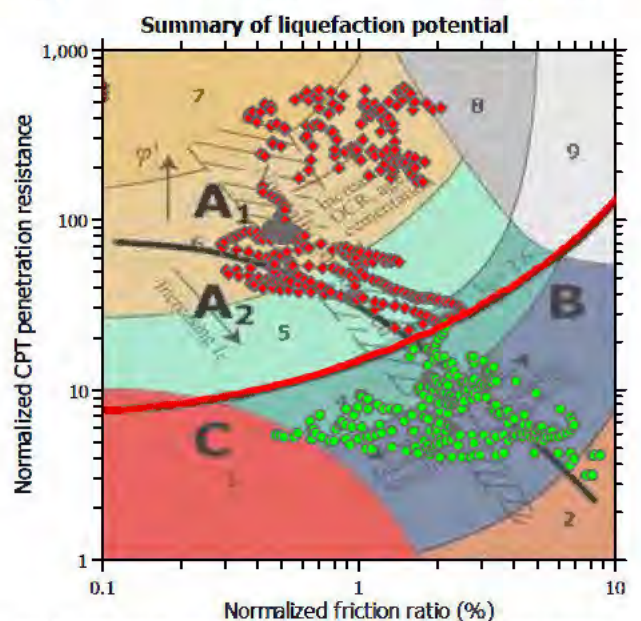
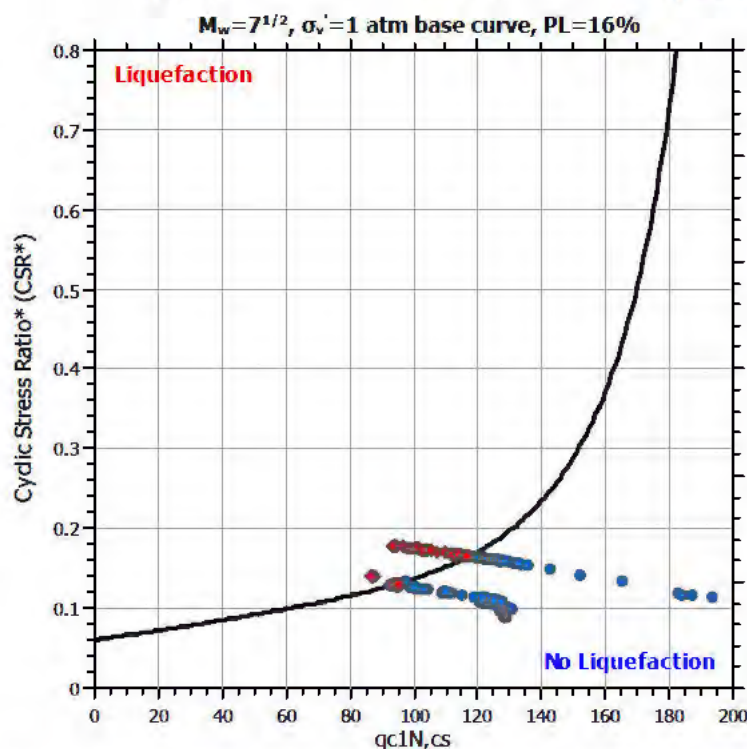
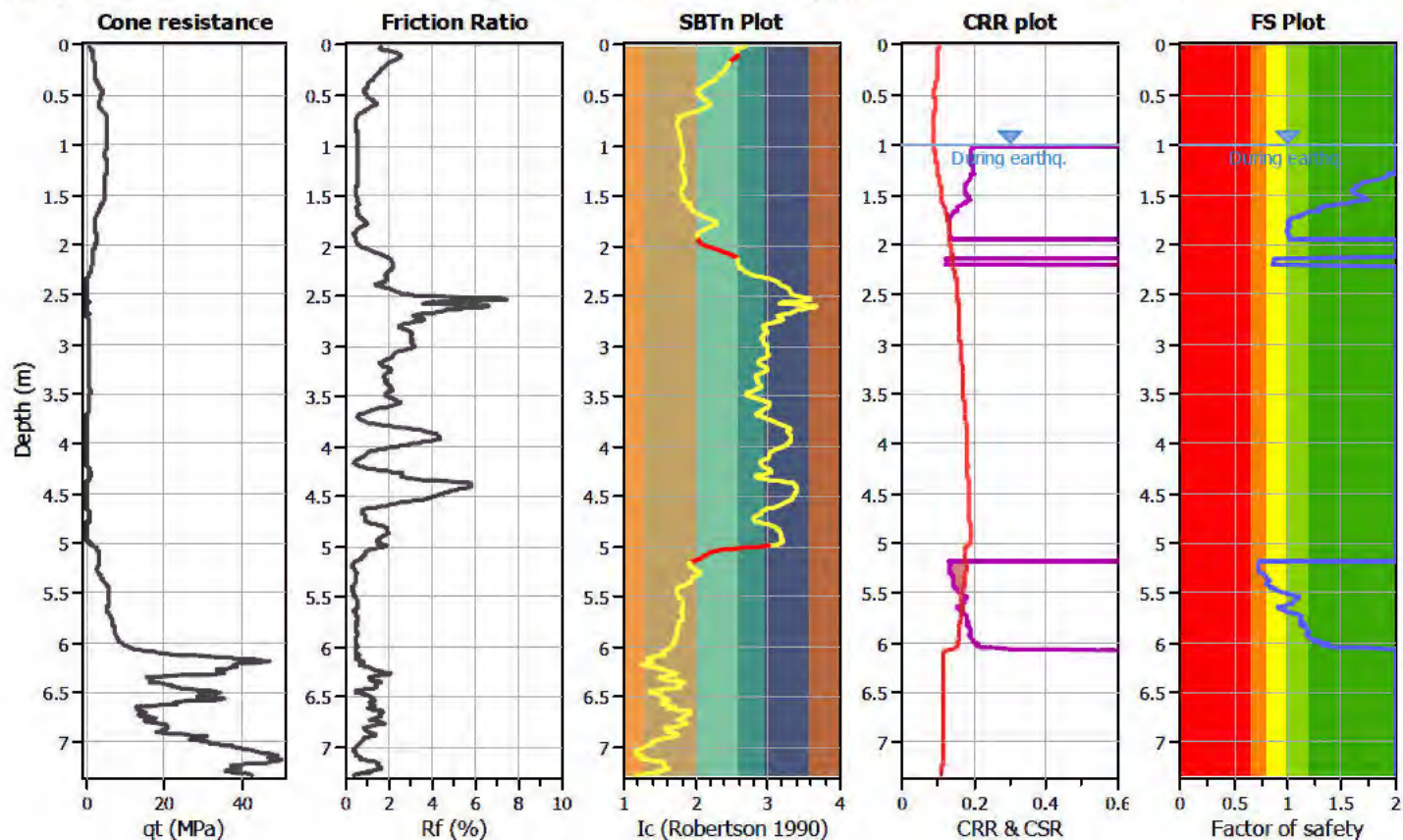
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-01 SLS2

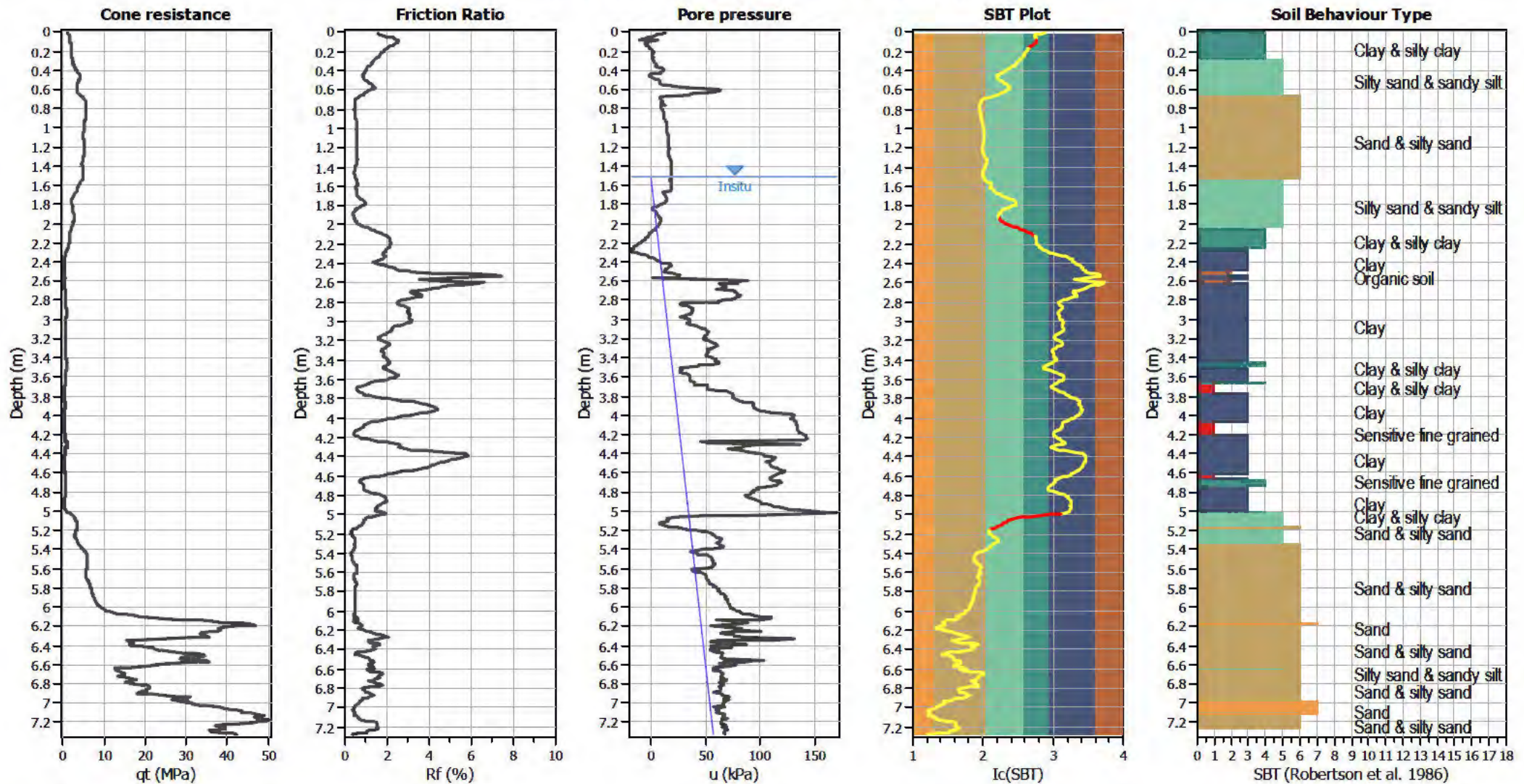
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 6.00
 Peak ground acceleration: 0.19
 Depth to water table (insitu): 1.50 m

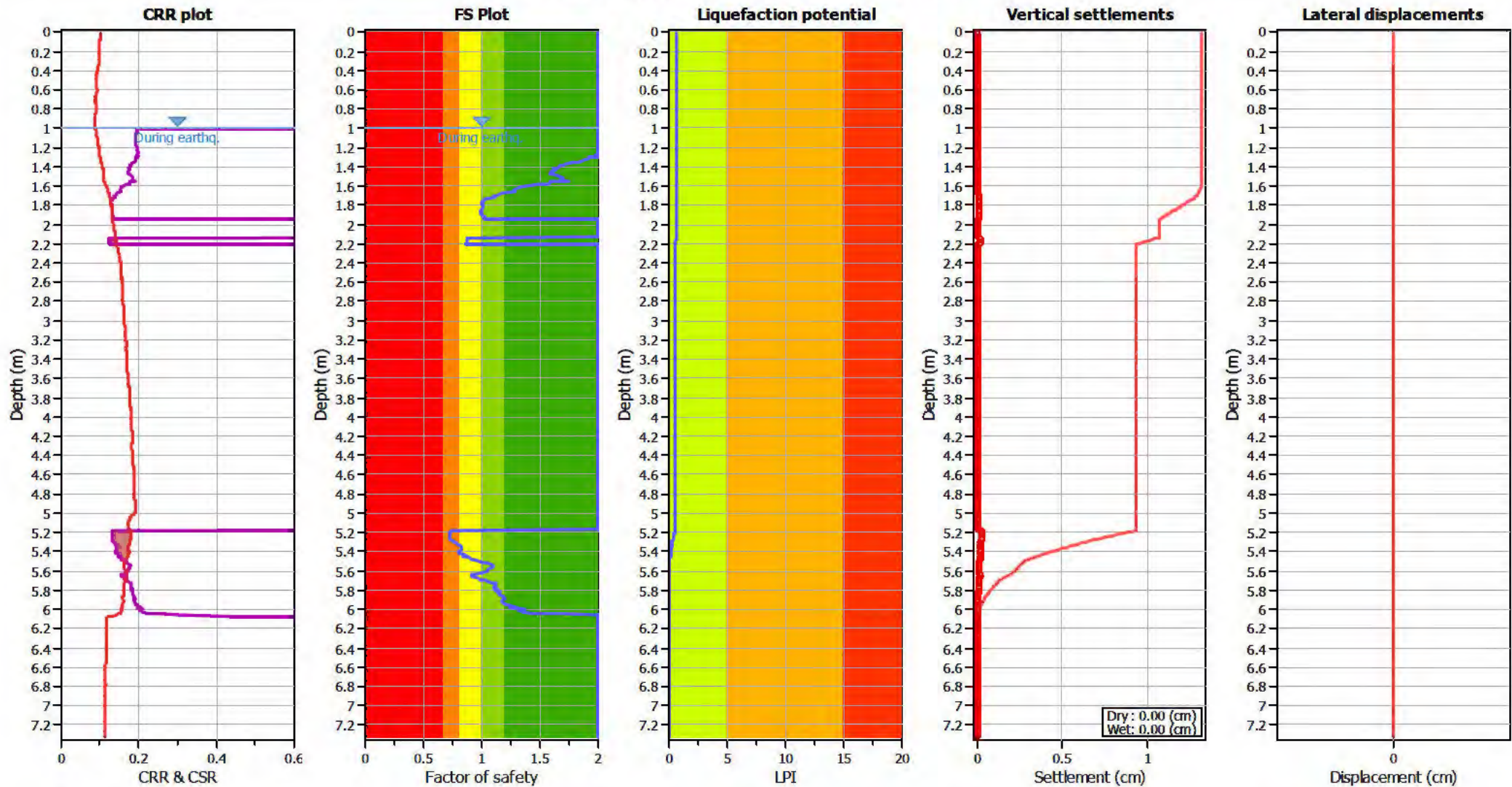
Depth to GWT (erthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_0 applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

SBT legend

- | | | |
|---------------------------|-----------------------------|----------------------------|
| 1. Sensitive fine grained | 4. Clayey silt to silty | 7. Gravely sand to sand |
| 2. Organic material | 5. Silty sand to sandy silt | 8. Very stiff sand to |
| 3. Clay to silty clay | 6. Clean sand to silty sand | 9. Very stiff fine grained |

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 6.00
 Peak ground acceleration: 0.19
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

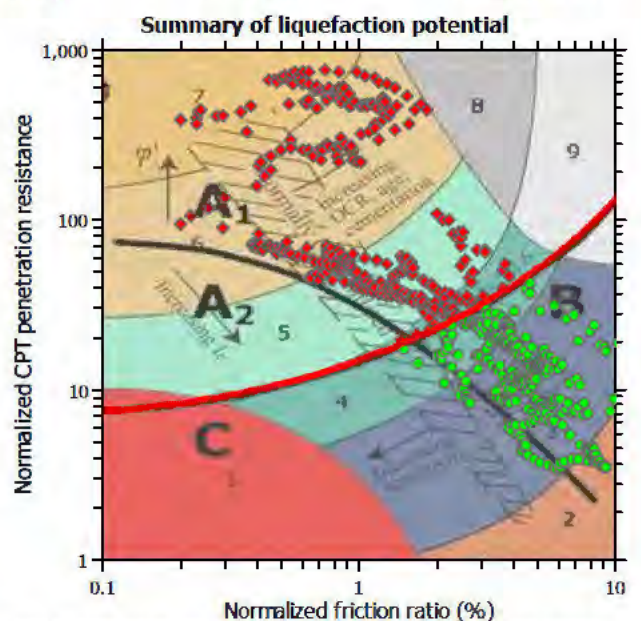
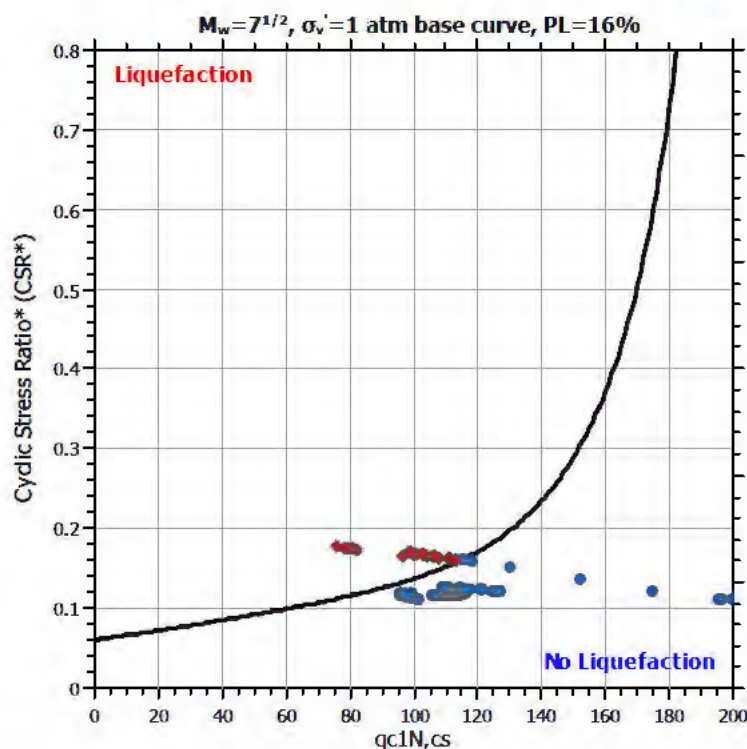
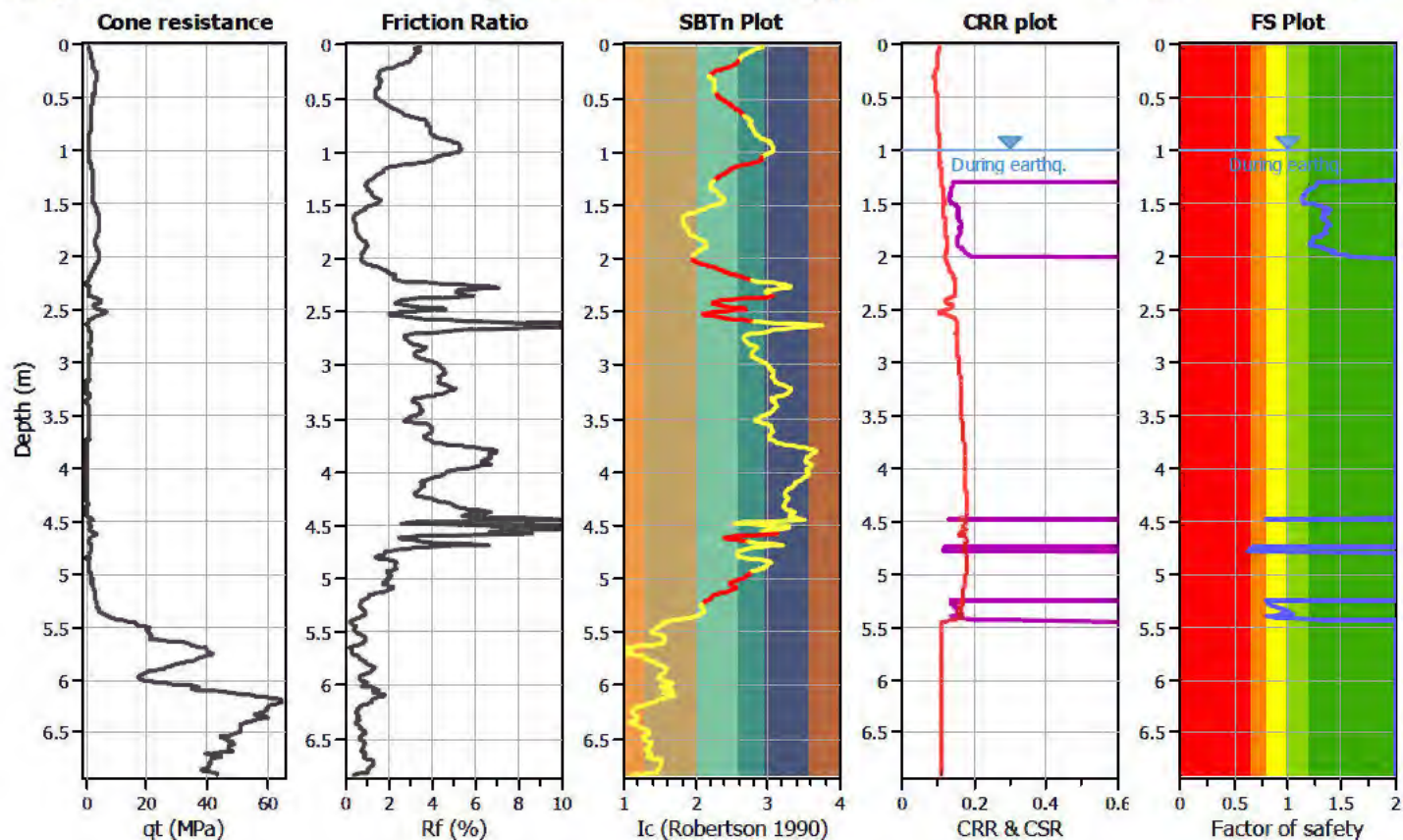
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-02 SLS2

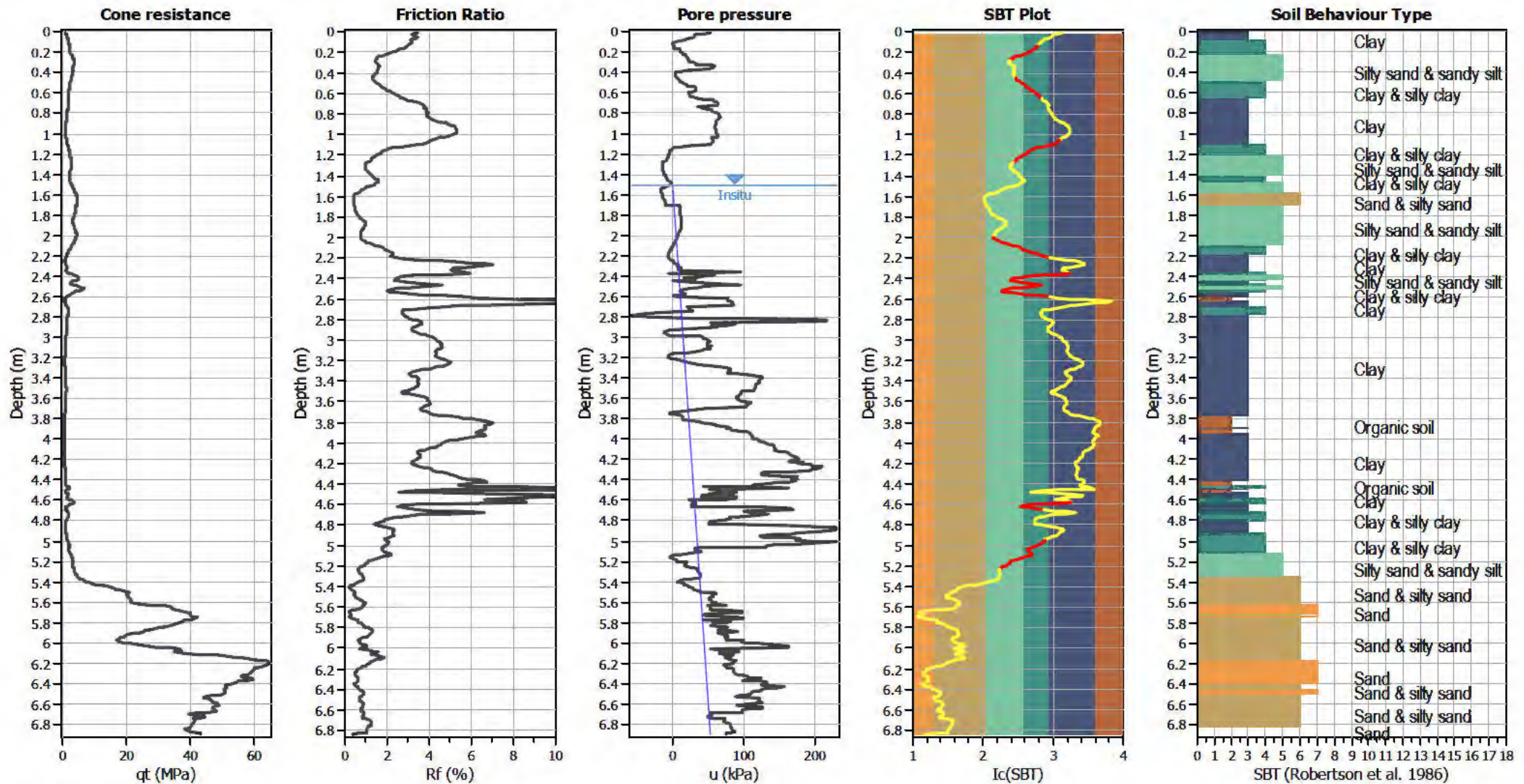
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 6.00
 Peak ground acceleration: 0.19
 Depth to water table (insitu): 1.50 m

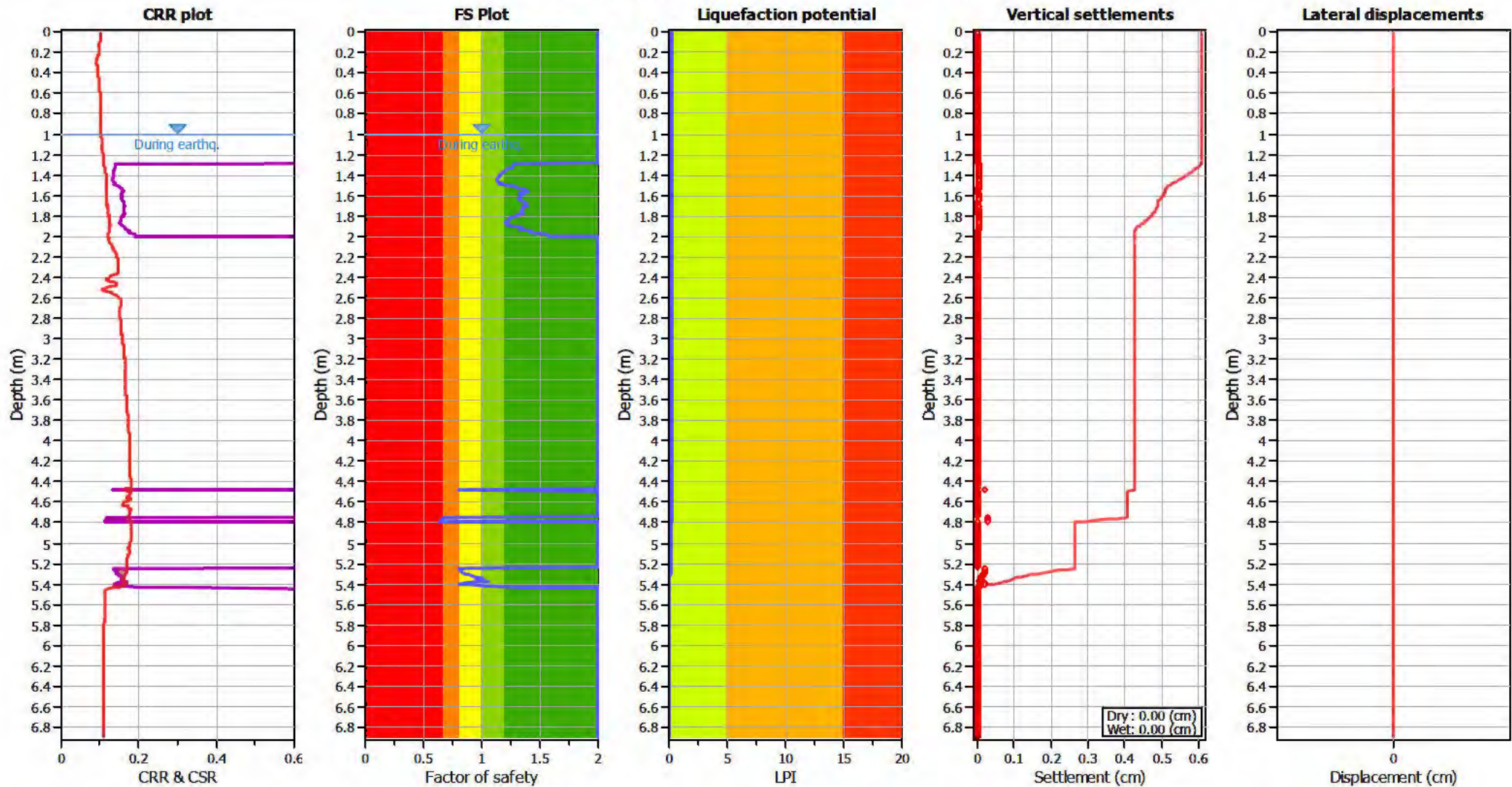
Depth to GWT (erthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_σ applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

SBT legend

- | | | |
|---------------------------|-----------------------------|----------------------------|
| 1. Sensitive fine grained | 4. Clayey silt to silty | 7. Gravely sand to sand |
| 2. Organic material | 5. Silty sand to sandy silt | 8. Very stiff sand to |
| 3. Clay to silty clay | 6. Clean sand to silty sand | 9. Very stiff fine grained |

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 6.00
 Peak ground acceleration: 0.19
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_w applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

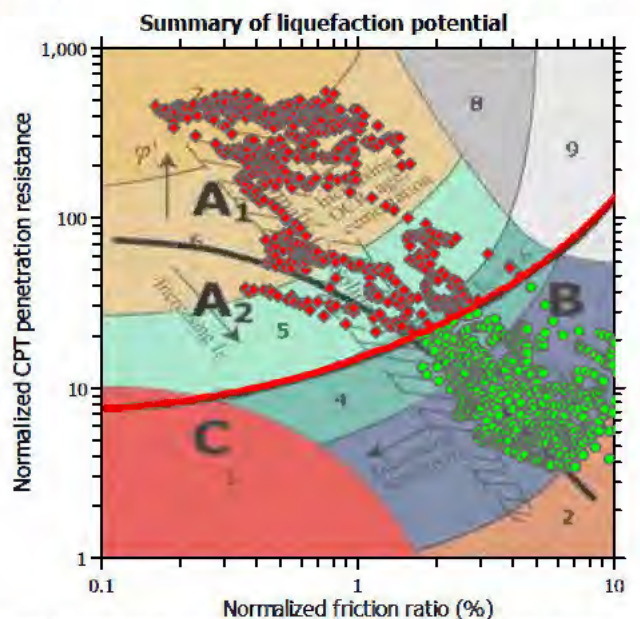
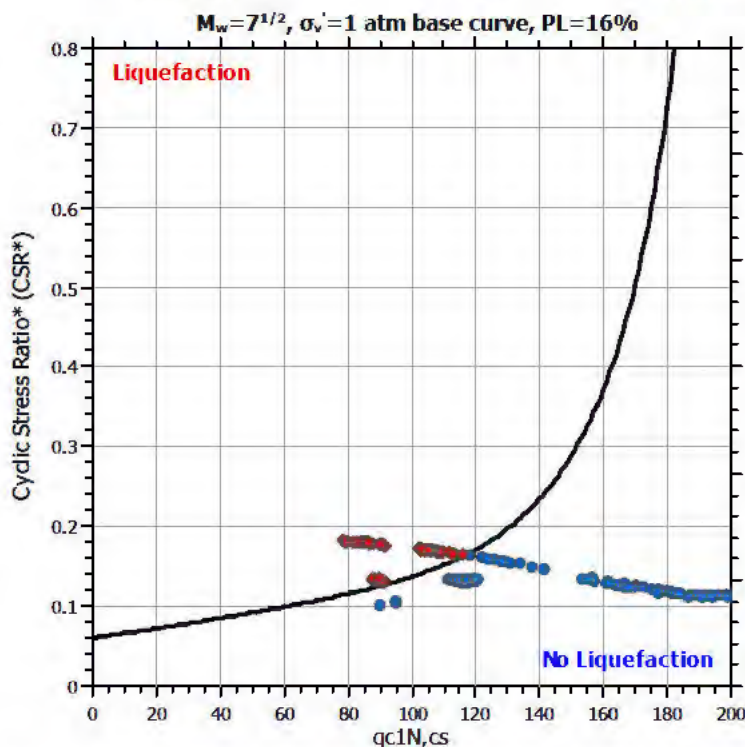
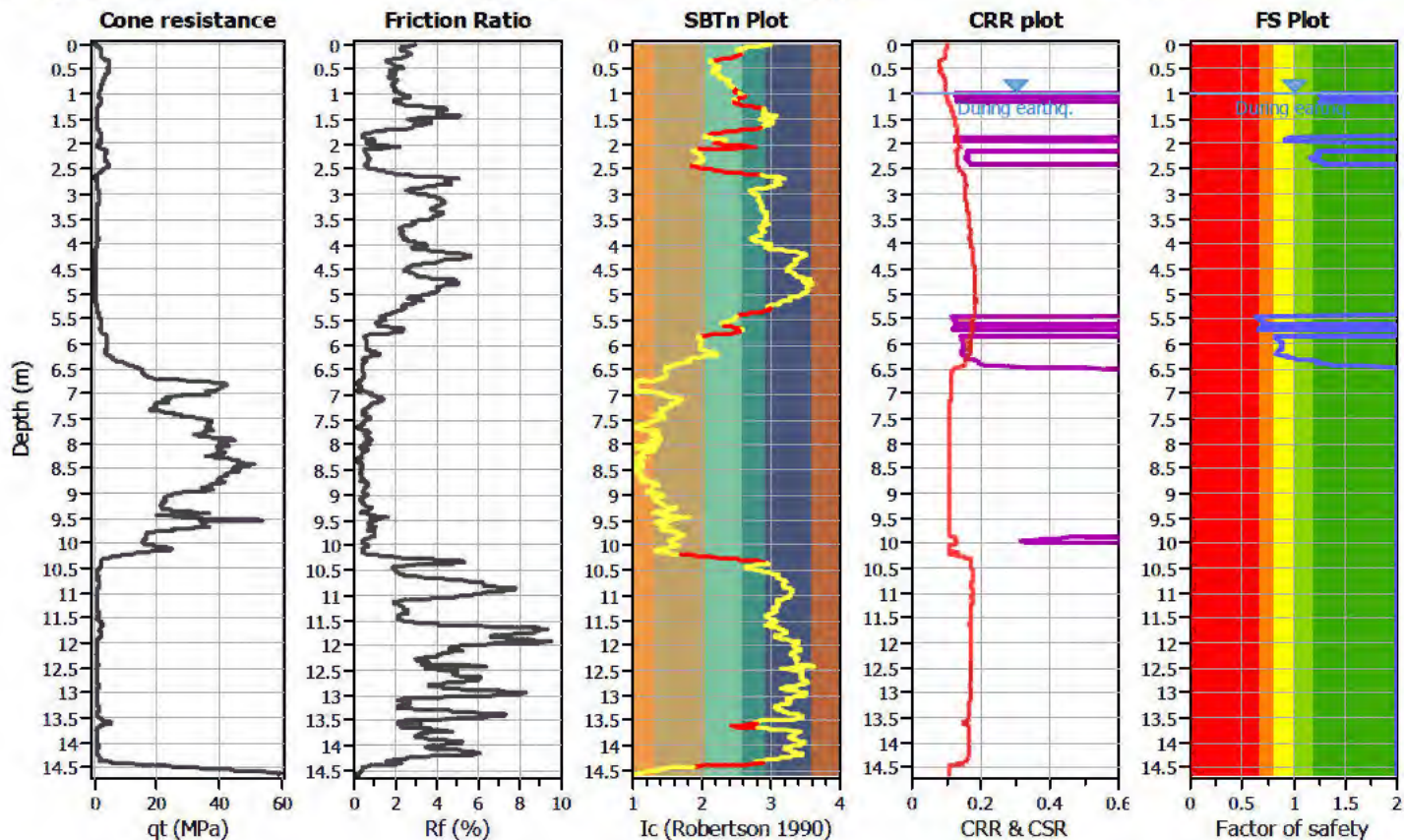
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-03 SLS2

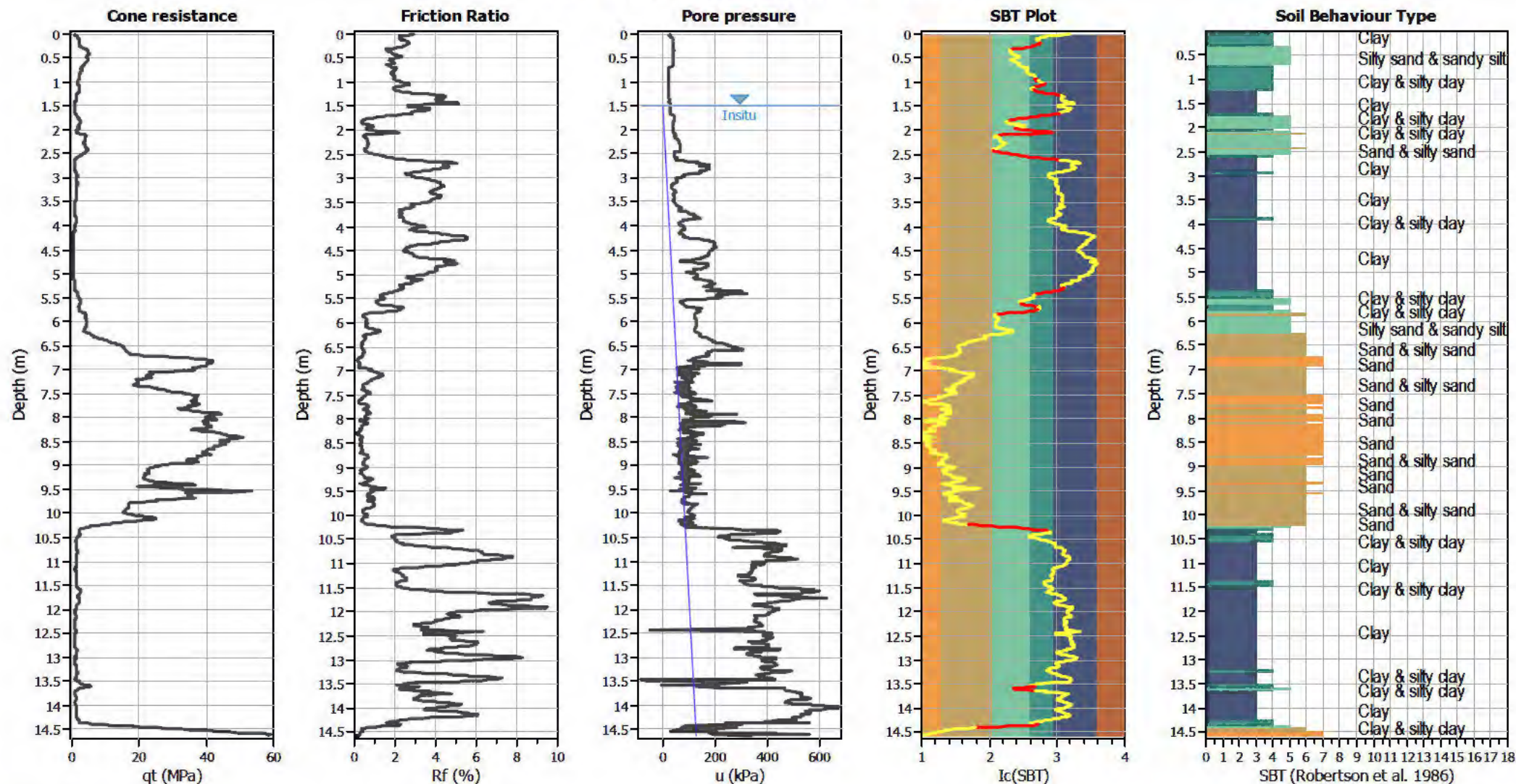
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Pore pressure



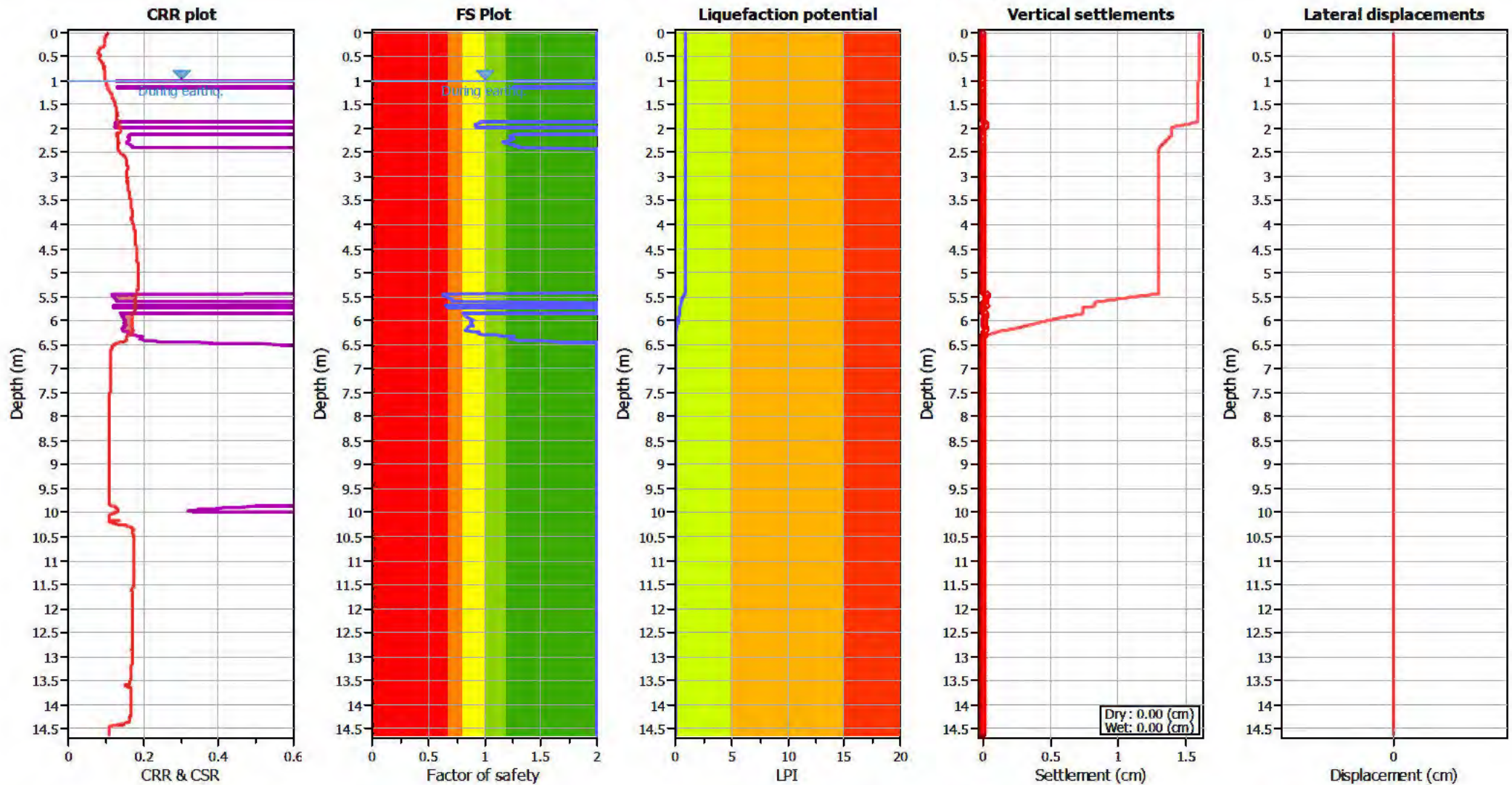
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _o applied:	Yes
Earthquake magnitude M _w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

- | | | |
|---------------------------|-----------------------------|----------------------------|
| 1. Sensitive fine grained | 4. Clayey silt to silty | 7. Gravely sand to sand |
| 2. Organic material | 5. Silty sand to sandy silt | 8. Very stiff sand to |
| 3. Clay to silty clay | 6. Clean sand to silty sand | 9. Very stiff fine grained |

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 6.00
 Peak ground acceleration: 0.19
 Depth to water table (insitu): 1.50 m

Depth to GWT (erthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

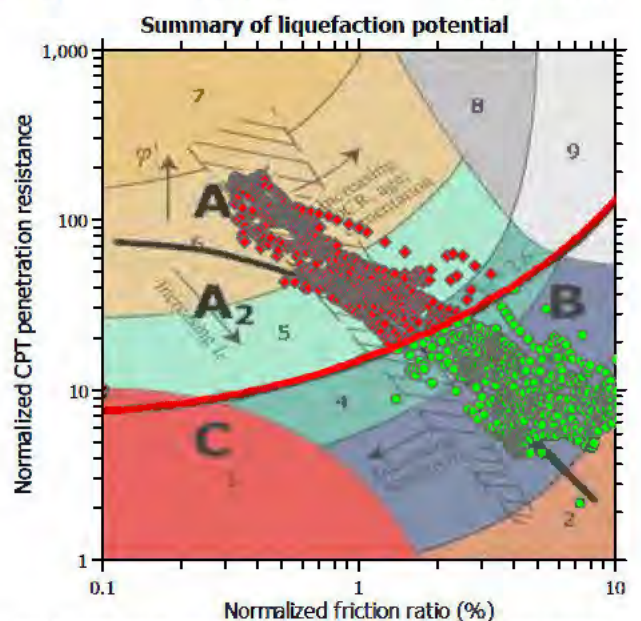
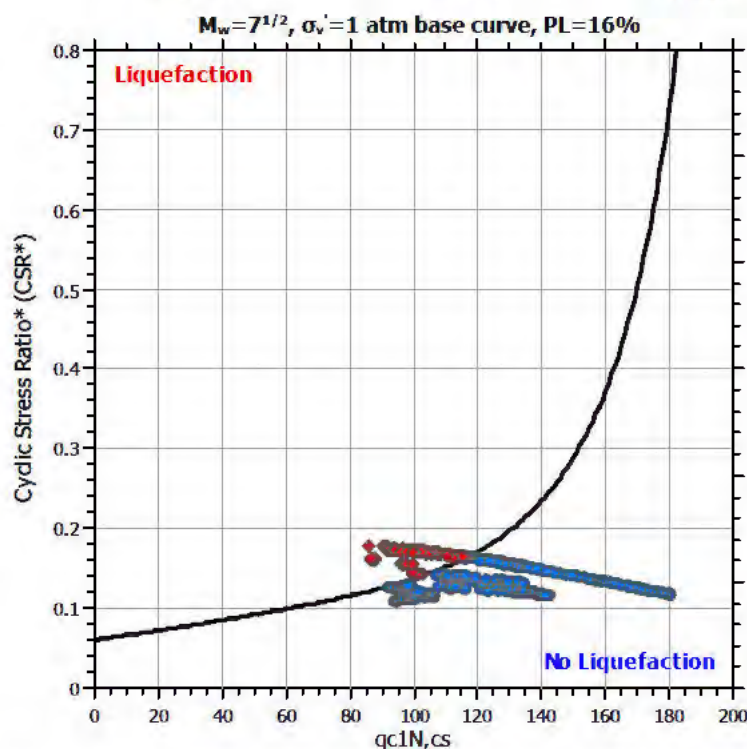
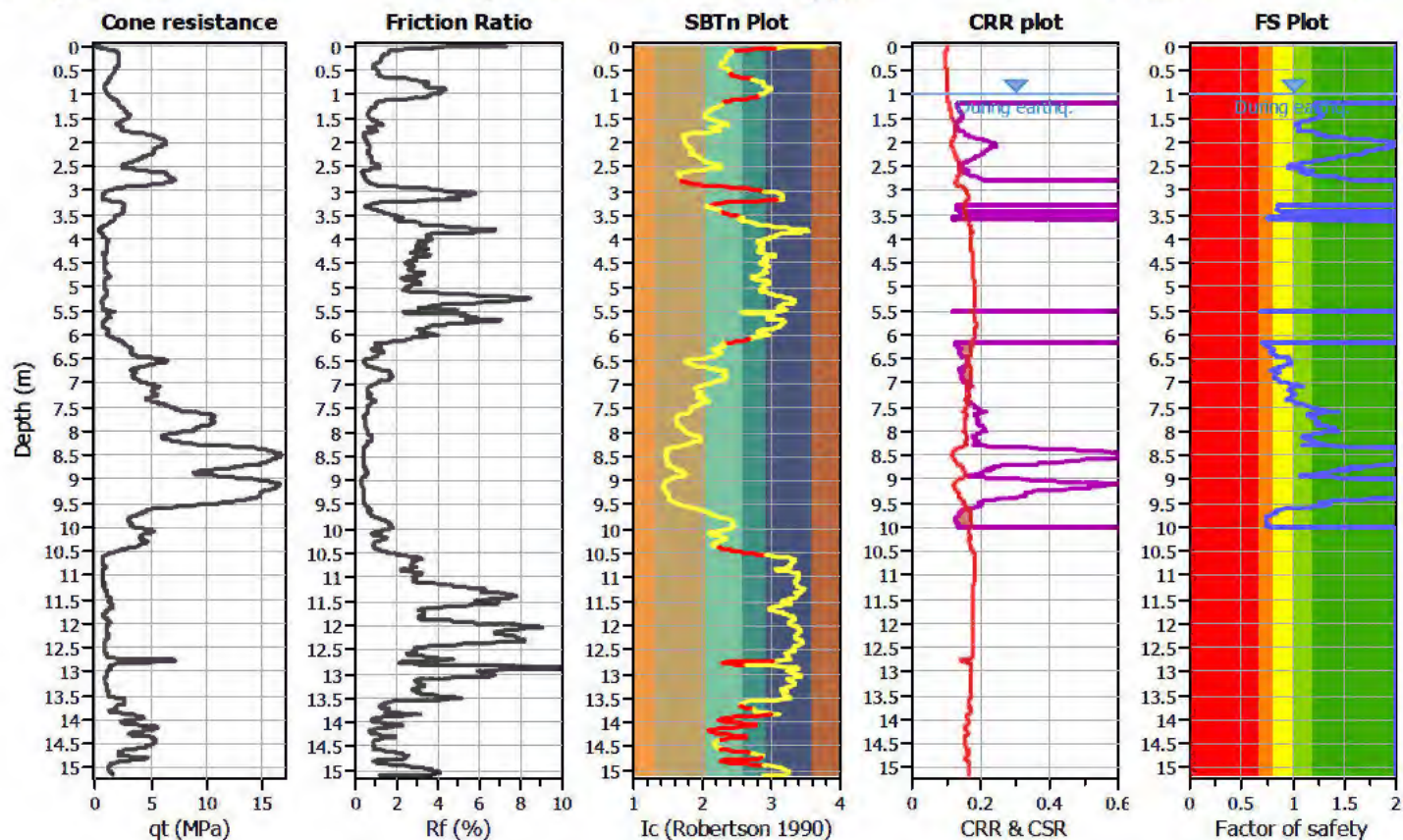
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-04 SLS2

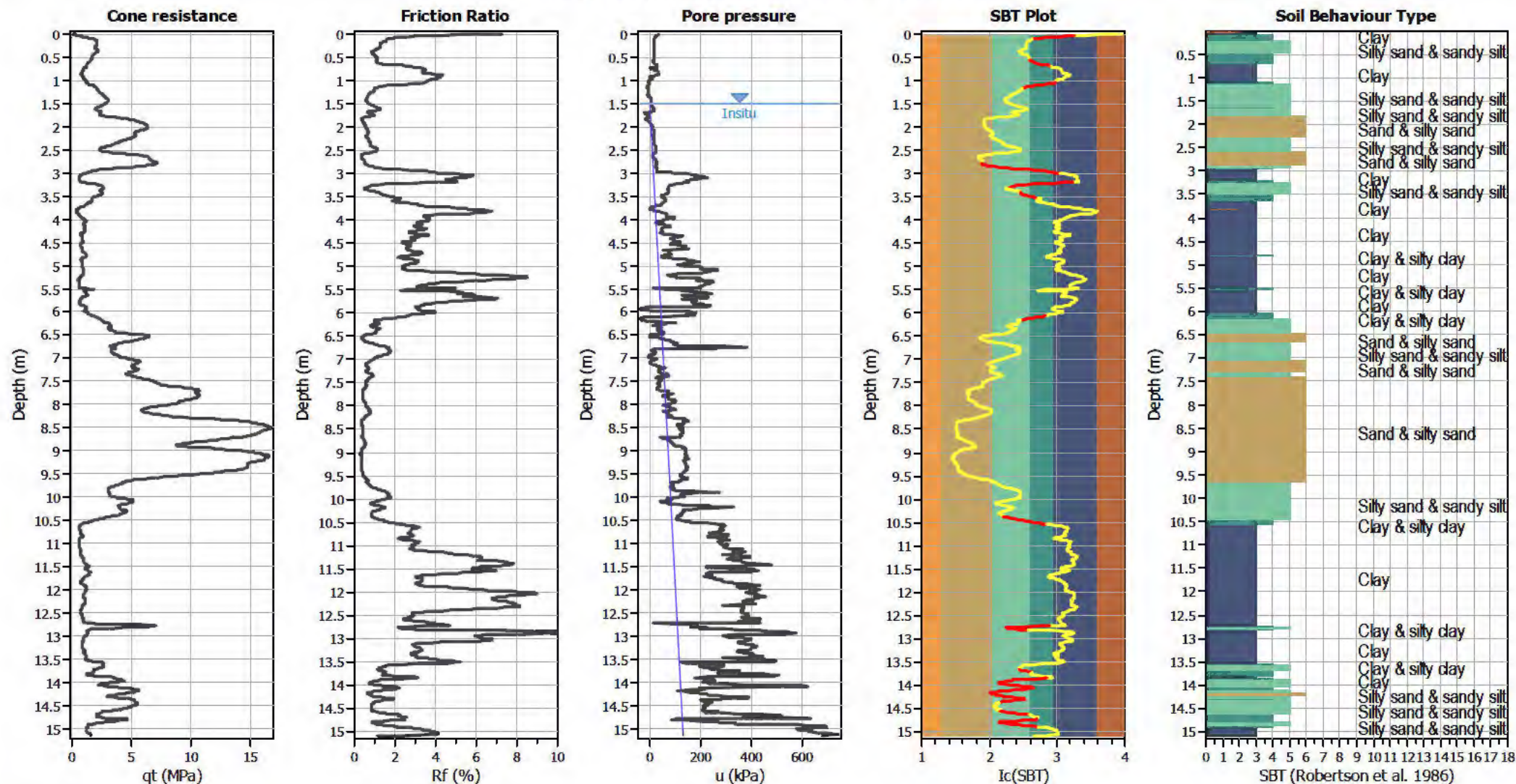
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Pore pressure



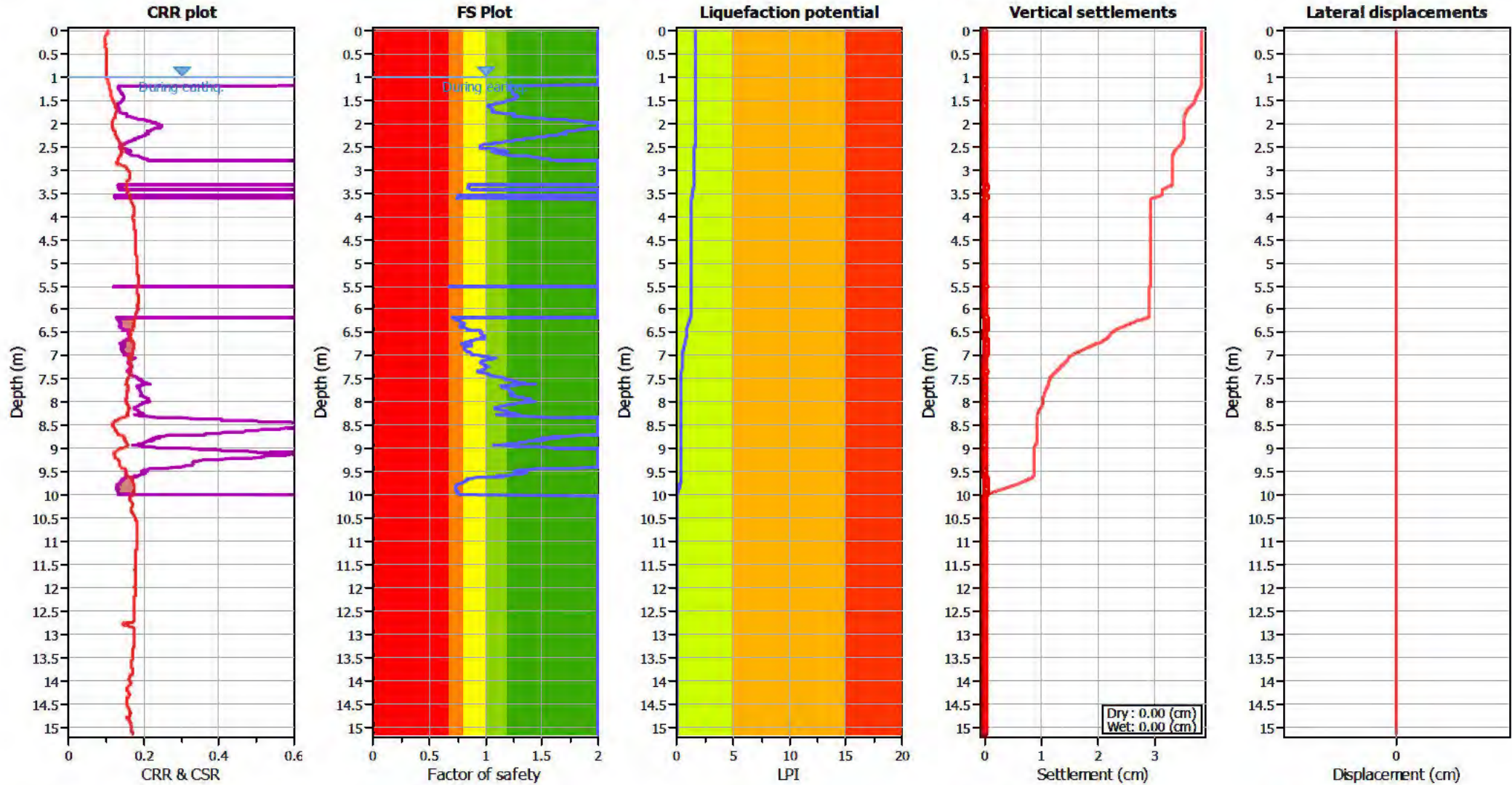
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _o applied:	Yes
Earthquake magnitude M _w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

- | | | |
|---------------------------|-----------------------------|----------------------------|
| 1. Sensitive fine grained | 4. Clayey silt to silty | 7. Gravely sand to sand |
| 2. Organic material | 5. Silty sand to sandy silt | 8. Very stiff sand to |
| 3. Clay to silty clay | 6. Clean sand to silty sand | 9. Very stiff fine grained |

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude M_w : 6.00
Peak ground acceleration: 0.19
Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: Yes
 K_{σ} applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: Yes
Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
Very likely to liquefy
Liquefaction and no liq. are equally likely
Unlike to liquefy
Almost certain it will not liquefy

LPI color scheme

Very high risk
High risk
Low risk

LIQUEFACTION ANALYSIS REPORT

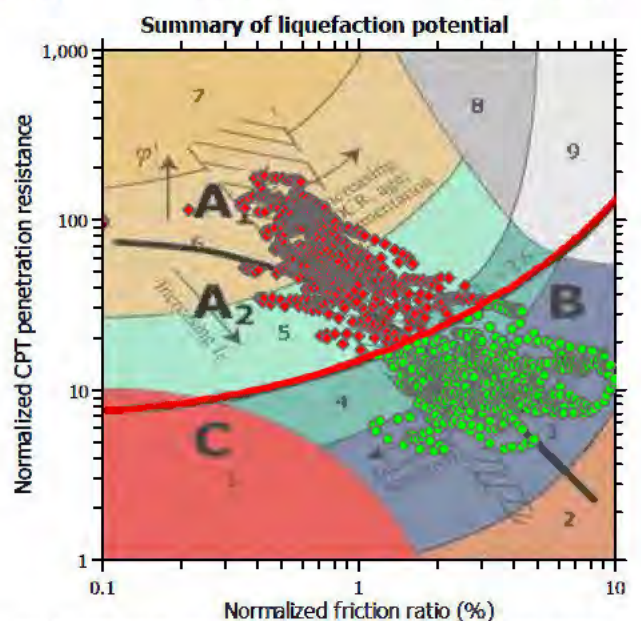
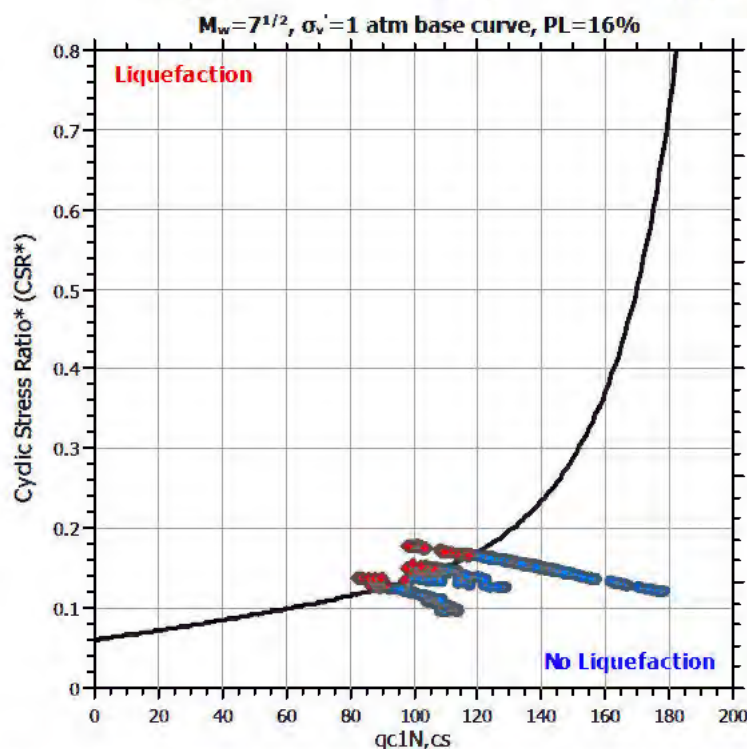
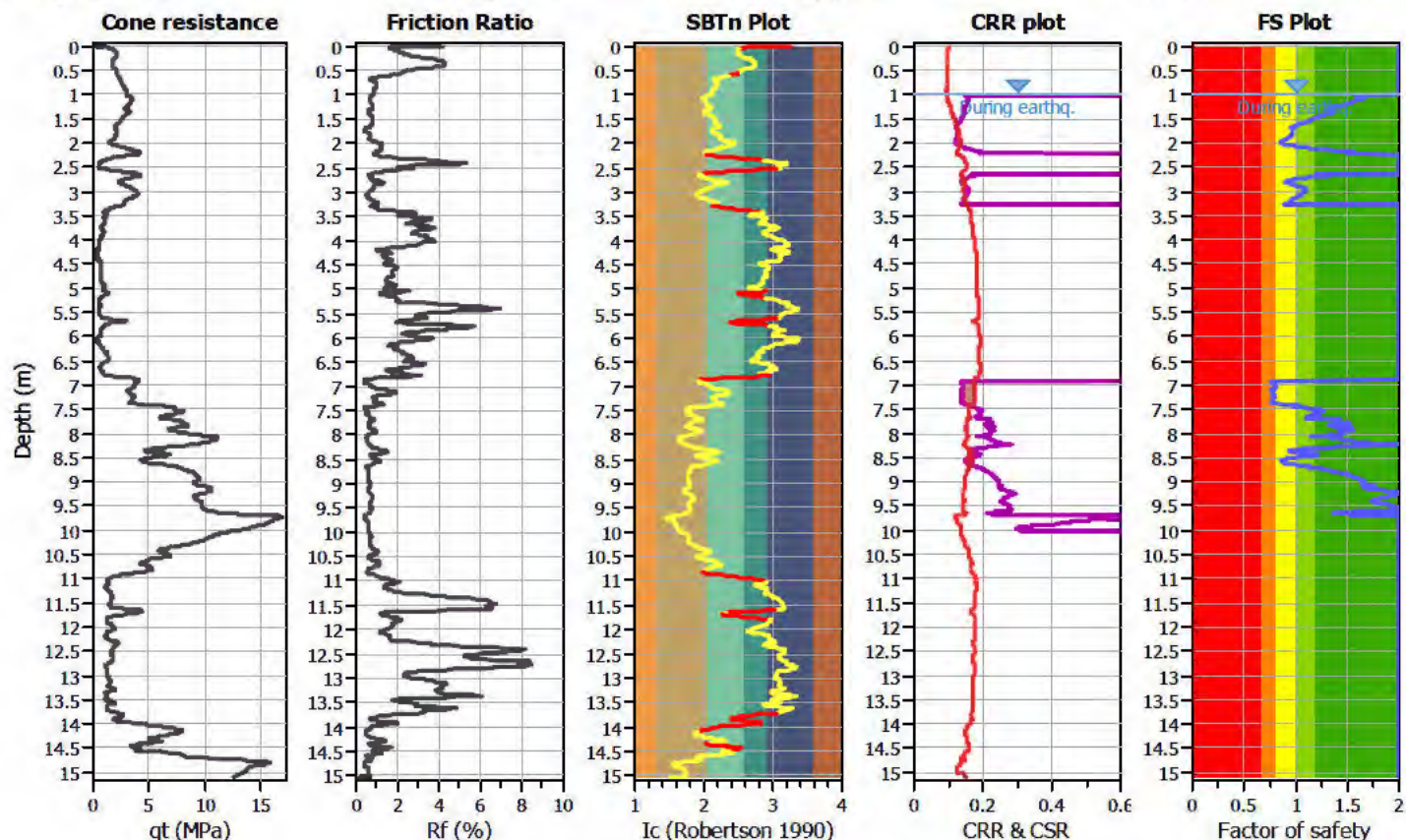
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-05 SLS2

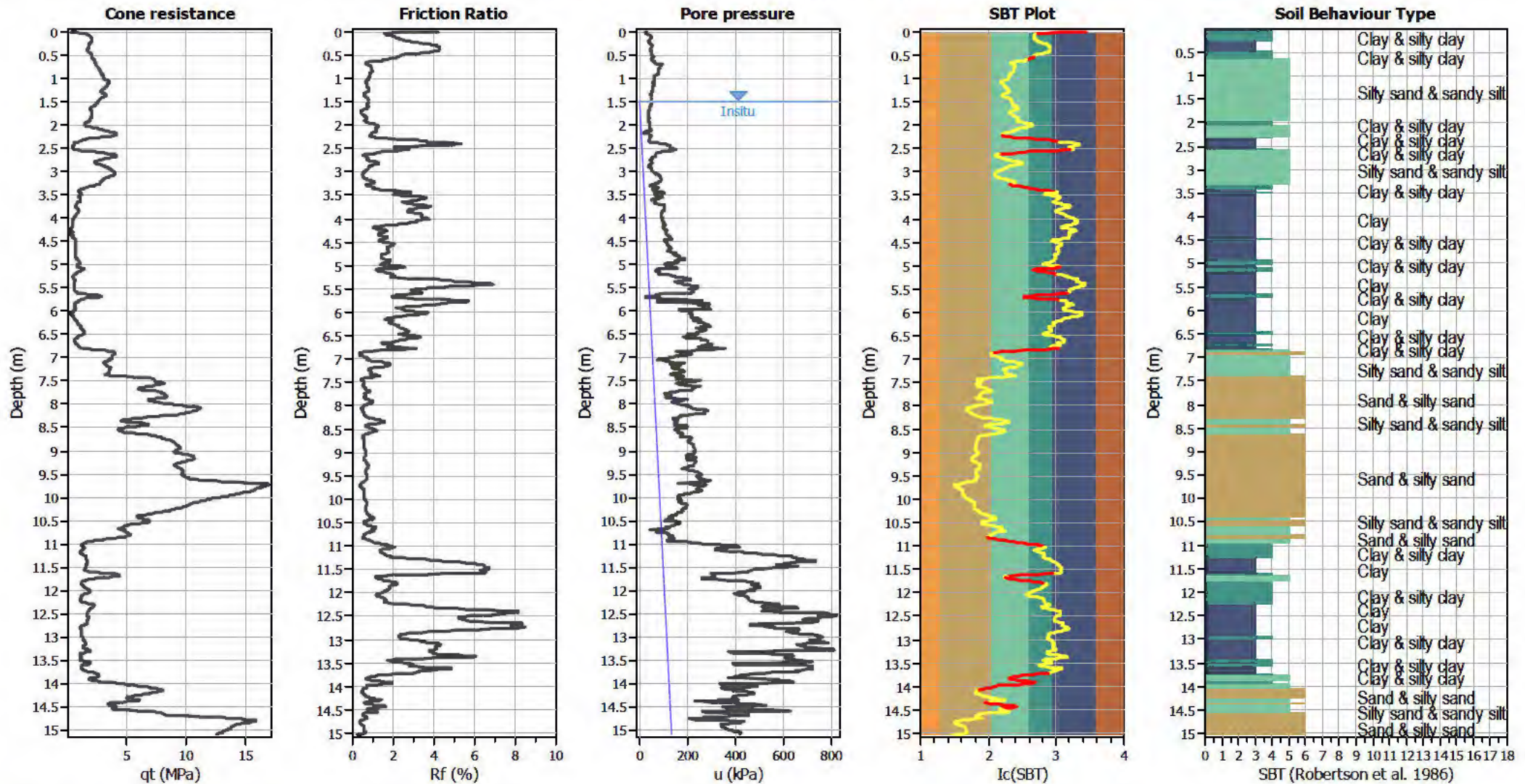
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



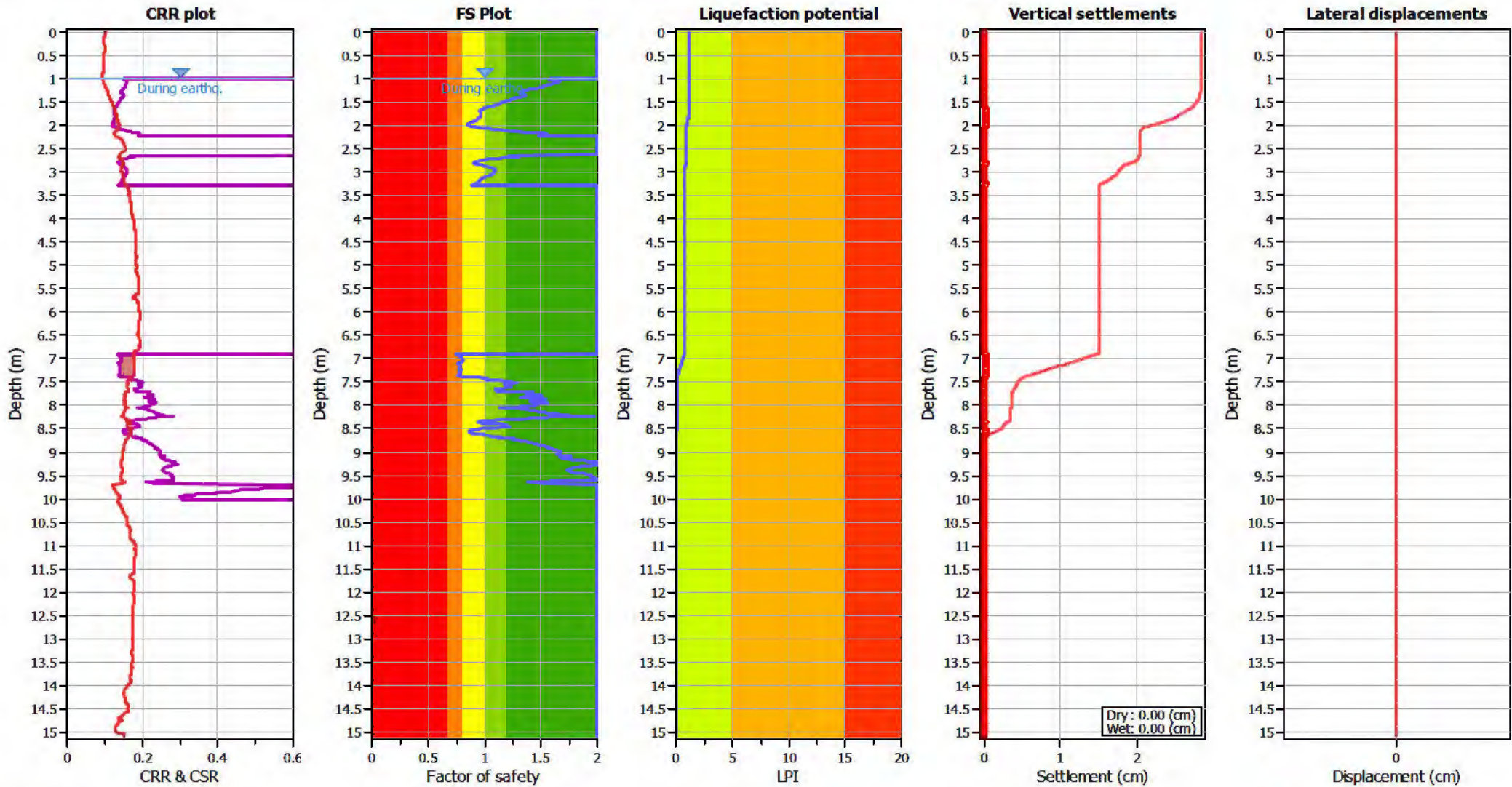
Input parameters and analysis data

Analysis method:	B&J (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&J (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{α} applied:	Yes
Earthquake magnitude M_w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude M_w : 6.00
Peak ground acceleration: 0.19
Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: Yes
 K_{σ} applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: Yes
Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
Very likely to liquefy
Liquefaction and no liq. are equally likely
Unlike to liquefy
Almost certain it will not liquefy

LPI color scheme

Very high risk
High risk
Low risk

LIQUEFACTION ANALYSIS REPORT

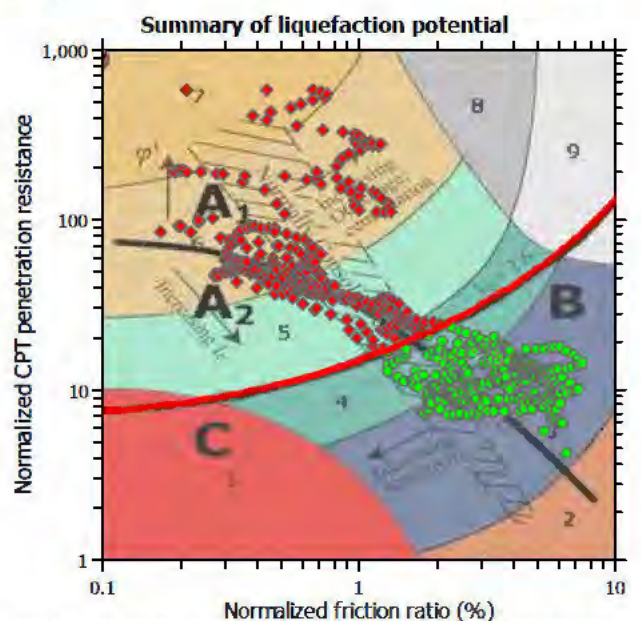
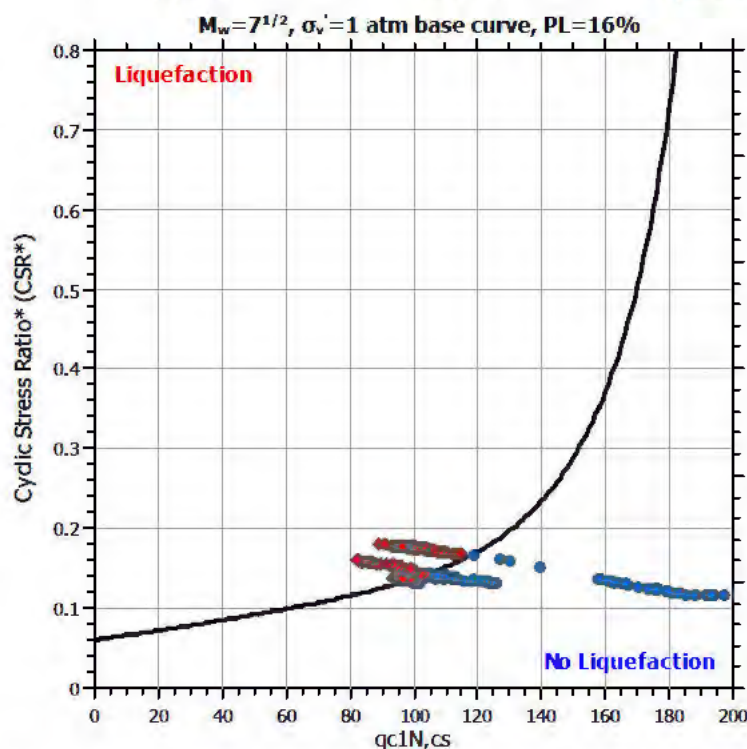
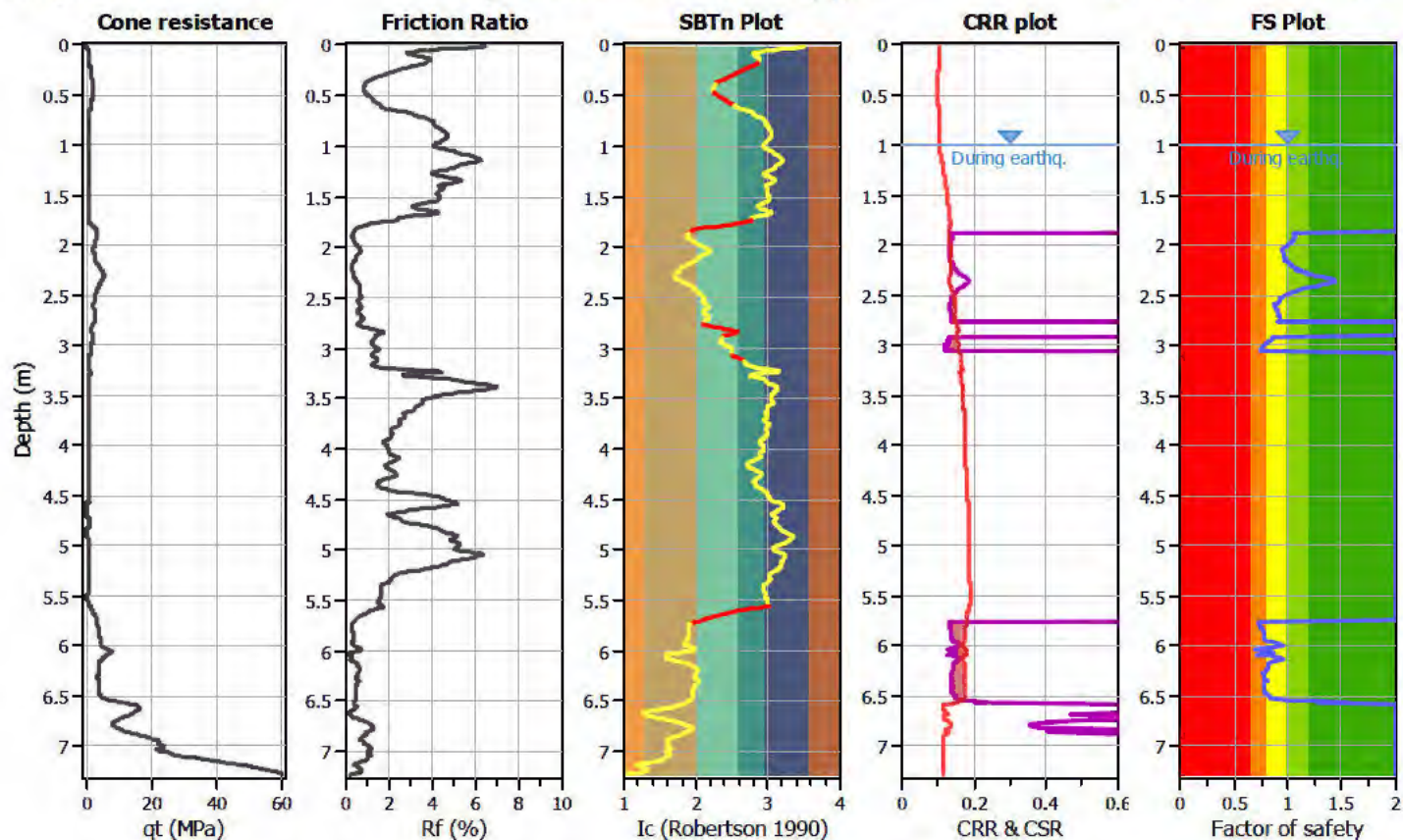
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-06 SLS2

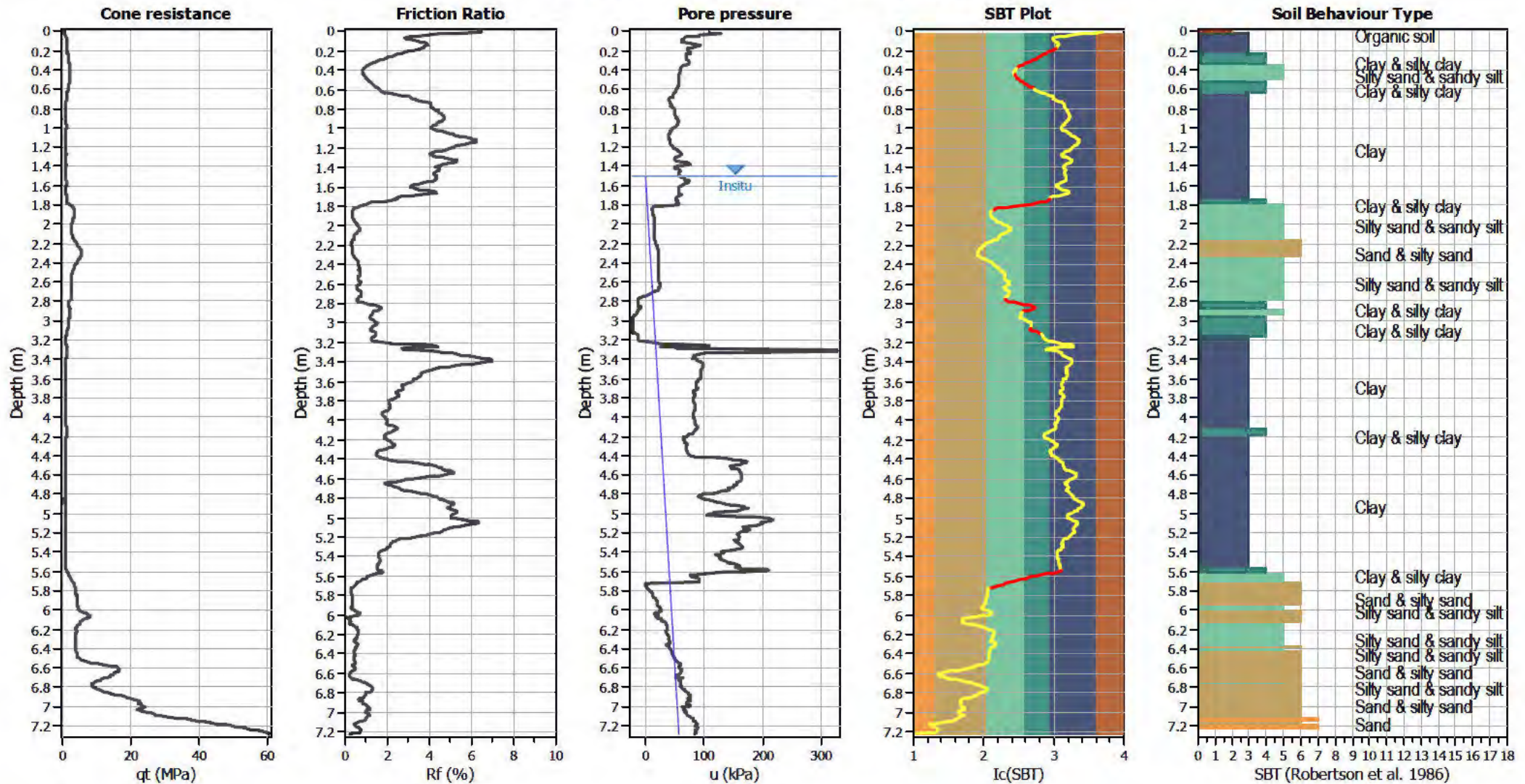
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on I_c value
 Earthquake magnitude M_w : 6.00
 Peak ground acceleration: 0.19
 Depth to water table (insitu): 1.50 m

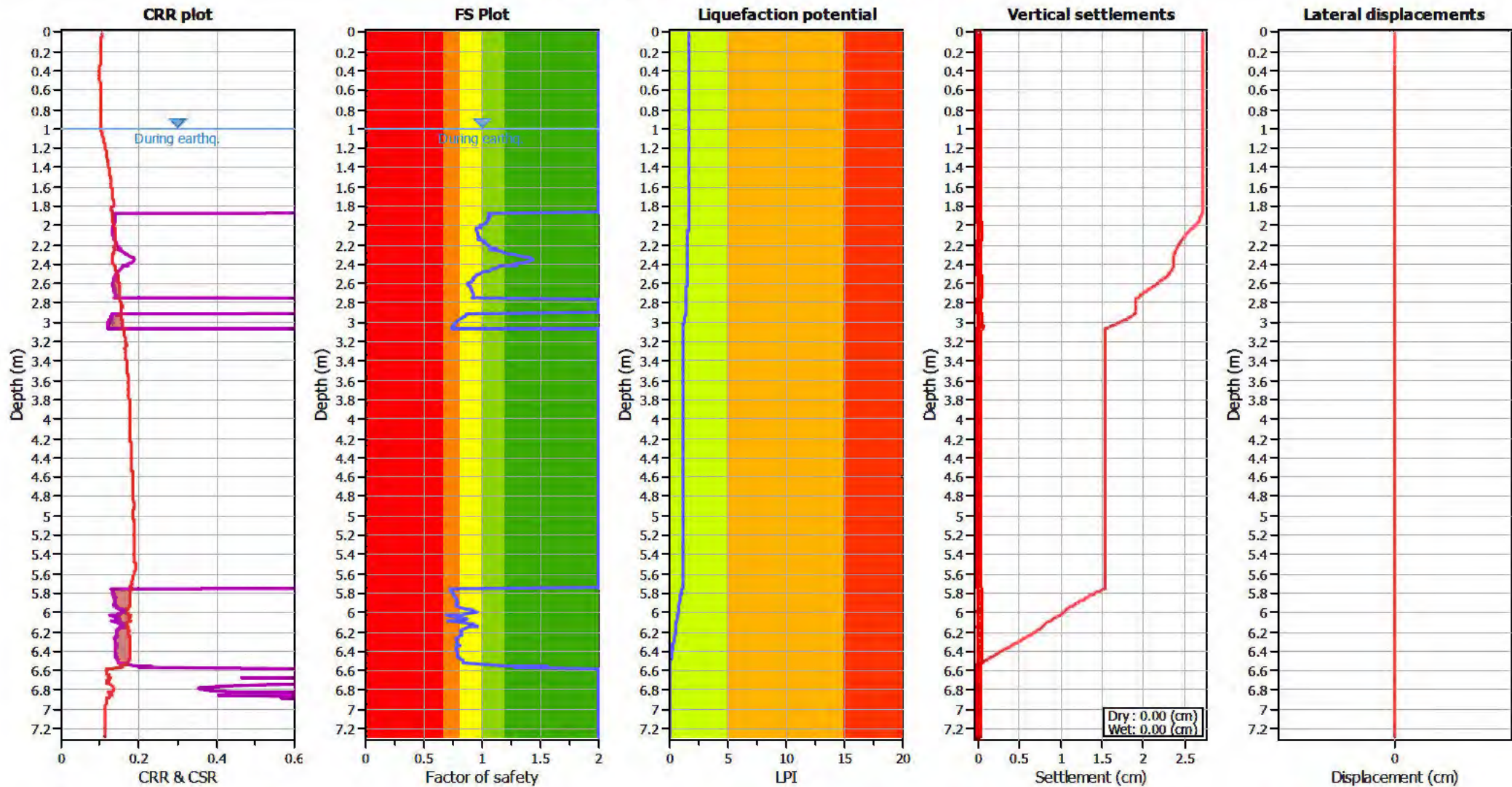
Depth to GWT (erthq.): 1.00 m
 Average results interval: 3
 I_c cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

SBT legend

- | | | |
|---------------------------|-----------------------------|----------------------------|
| 1. Sensitive fine grained | 4. Clayey silt to silty | 7. Gravely sand to sand |
| 2. Organic material | 5. Silty sand to sandy silt | 8. Very stiff sand to |
| 3. Clay to silty clay | 6. Clean sand to silty sand | 9. Very stiff fine grained |

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 6.00
 Peak ground acceleration: 0.19
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

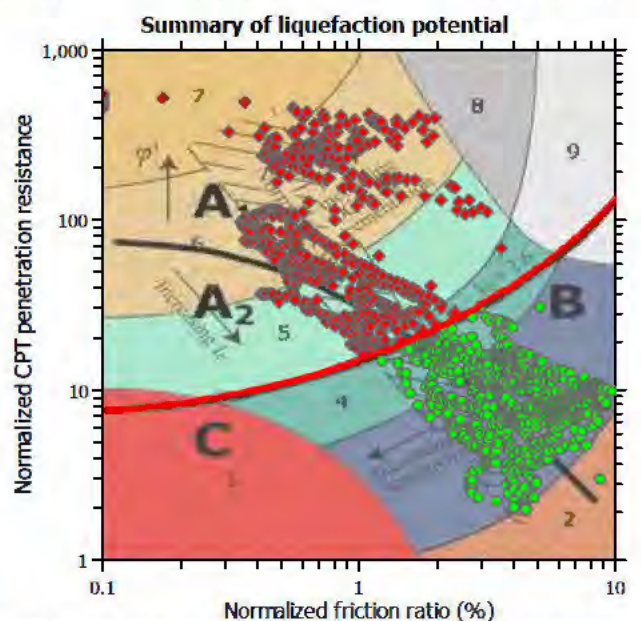
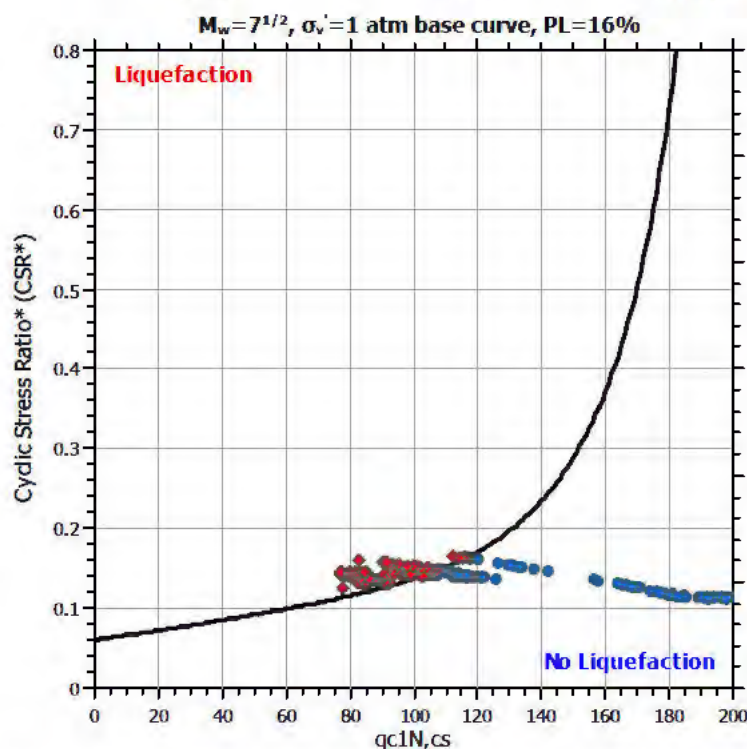
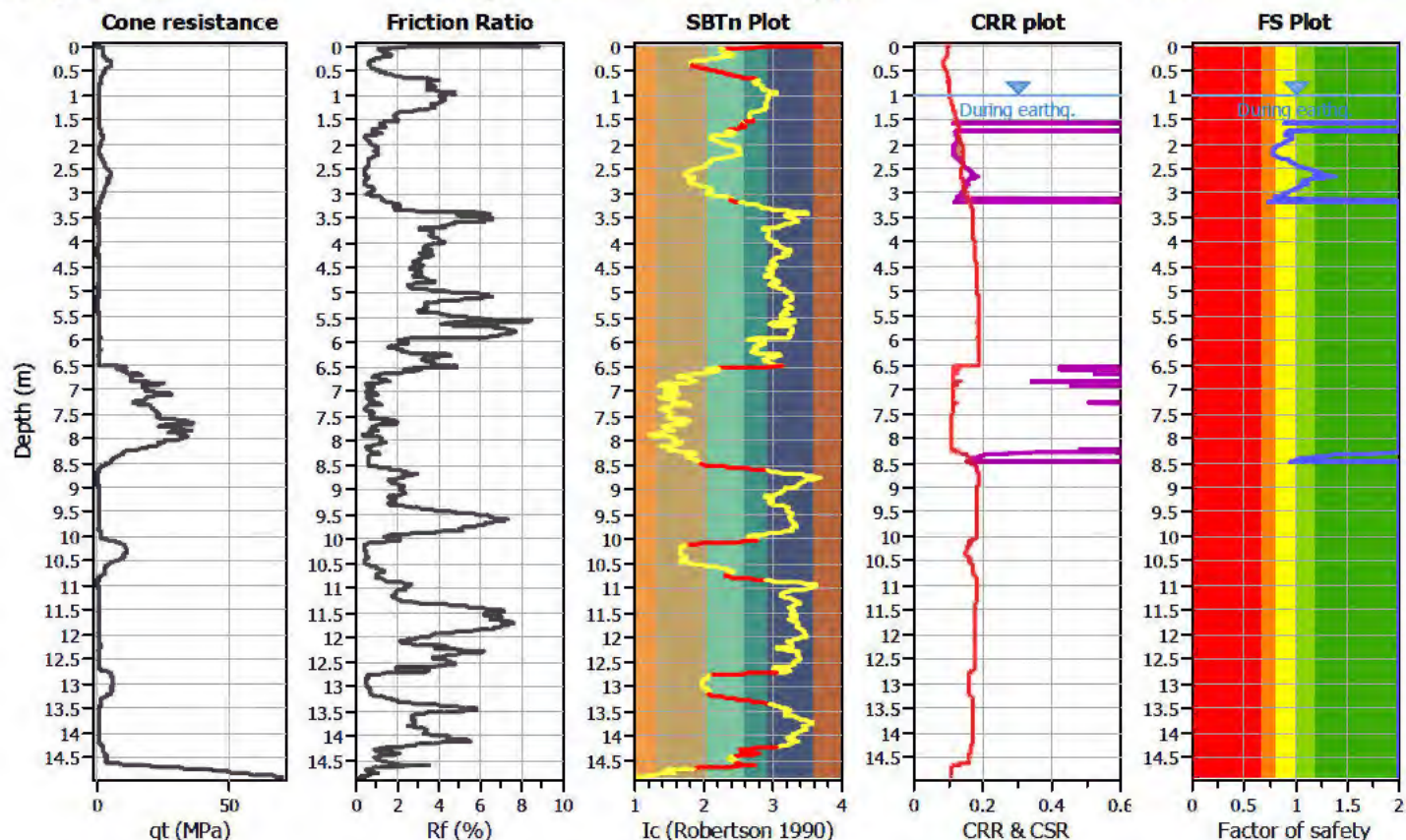
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-07 SLS2

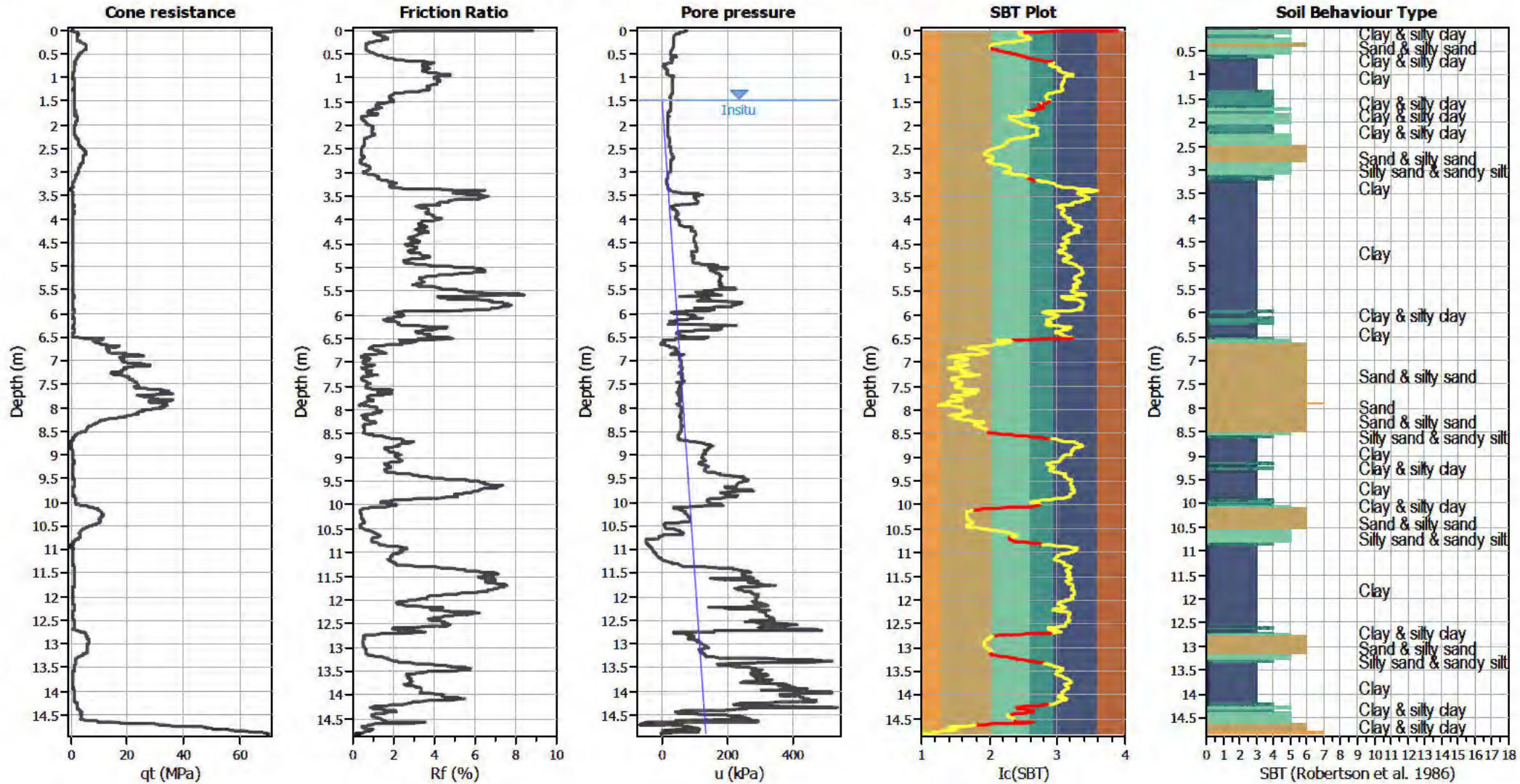
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



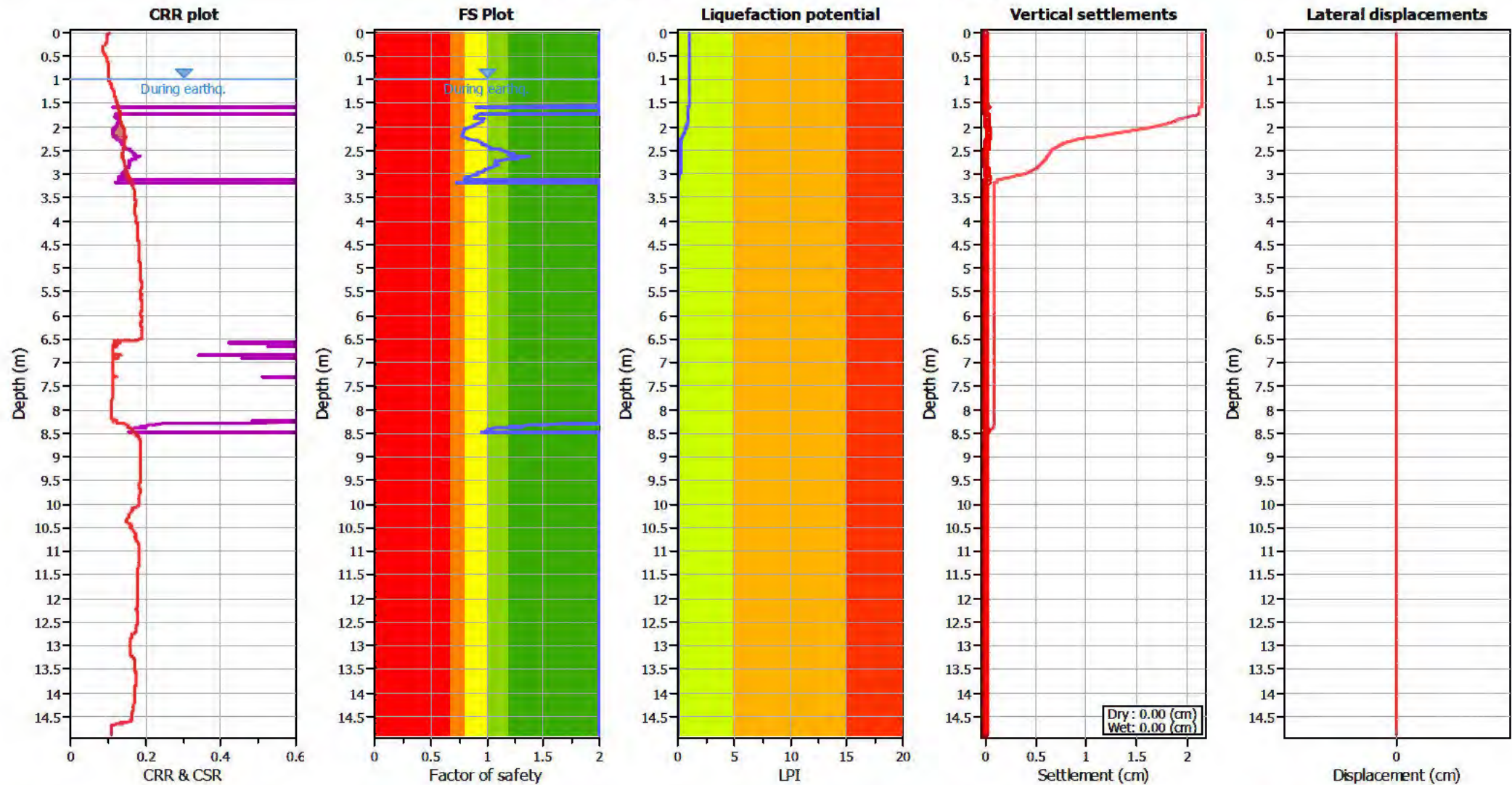
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _o applied:	Yes
Earthquake magnitude M _w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 6.00
 Peak ground acceleration: 0.19
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_σ applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

■ Almost certain it will liquefy
■ Very likely to liquefy
■ Liquefaction and no liq. are equally likely
■ Unlike to liquefy
■ Almost certain it will not liquefy

LPI color scheme

■ Very high risk
■ High risk
■ Low risk

LIQUEFACTION ANALYSIS REPORT

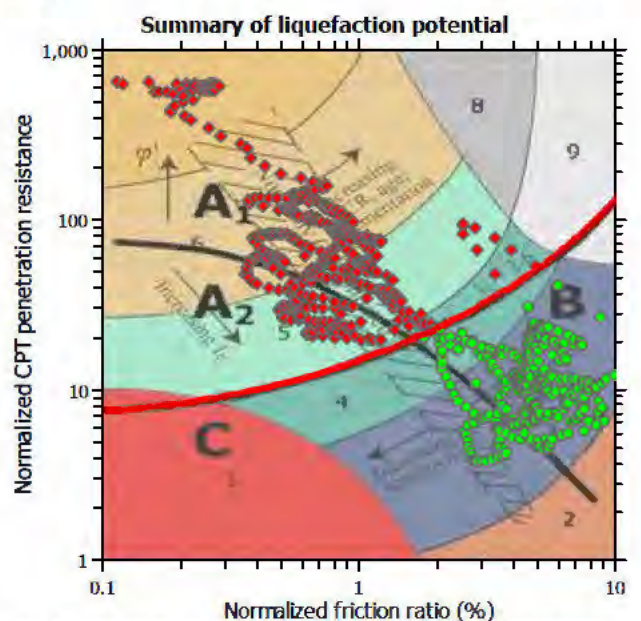
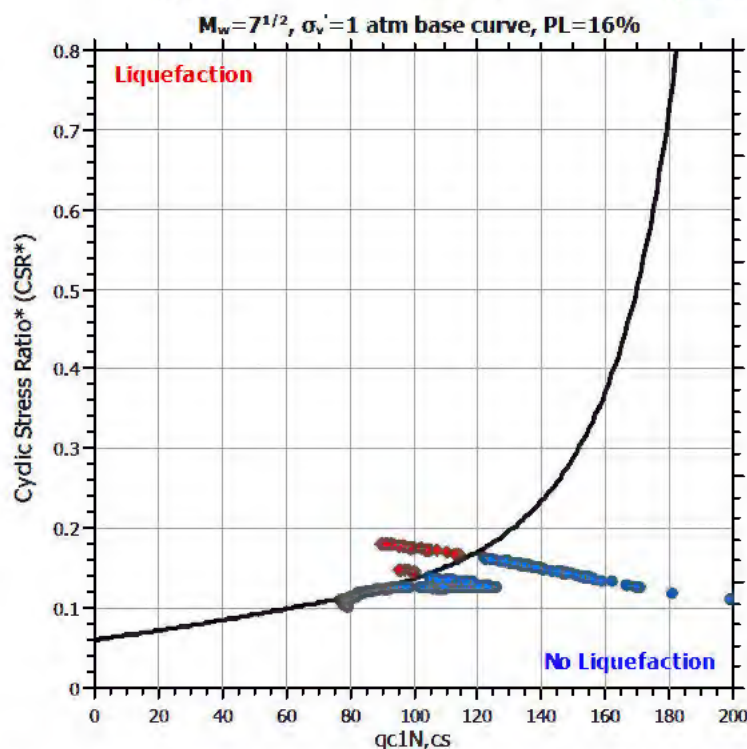
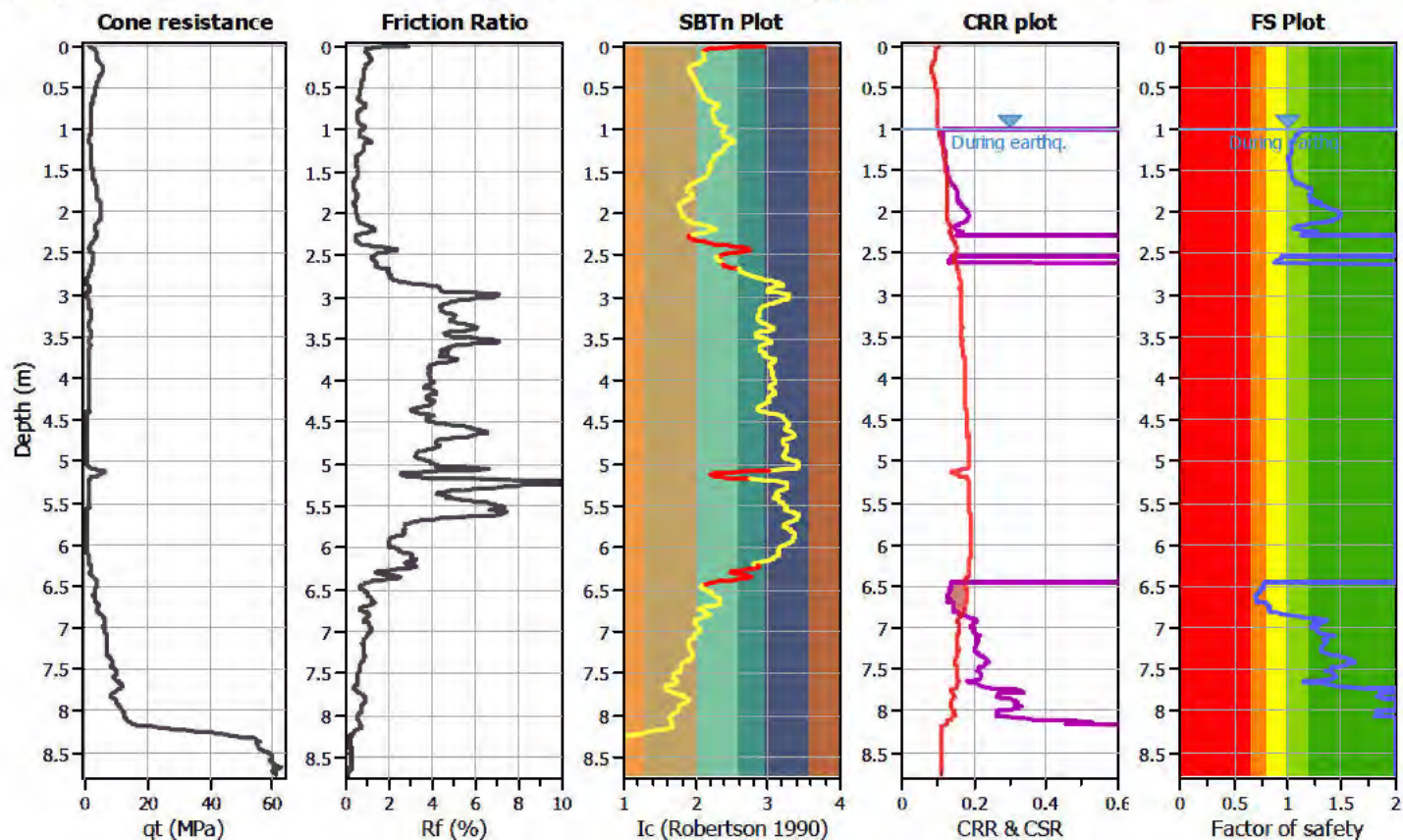
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-08 SLS2

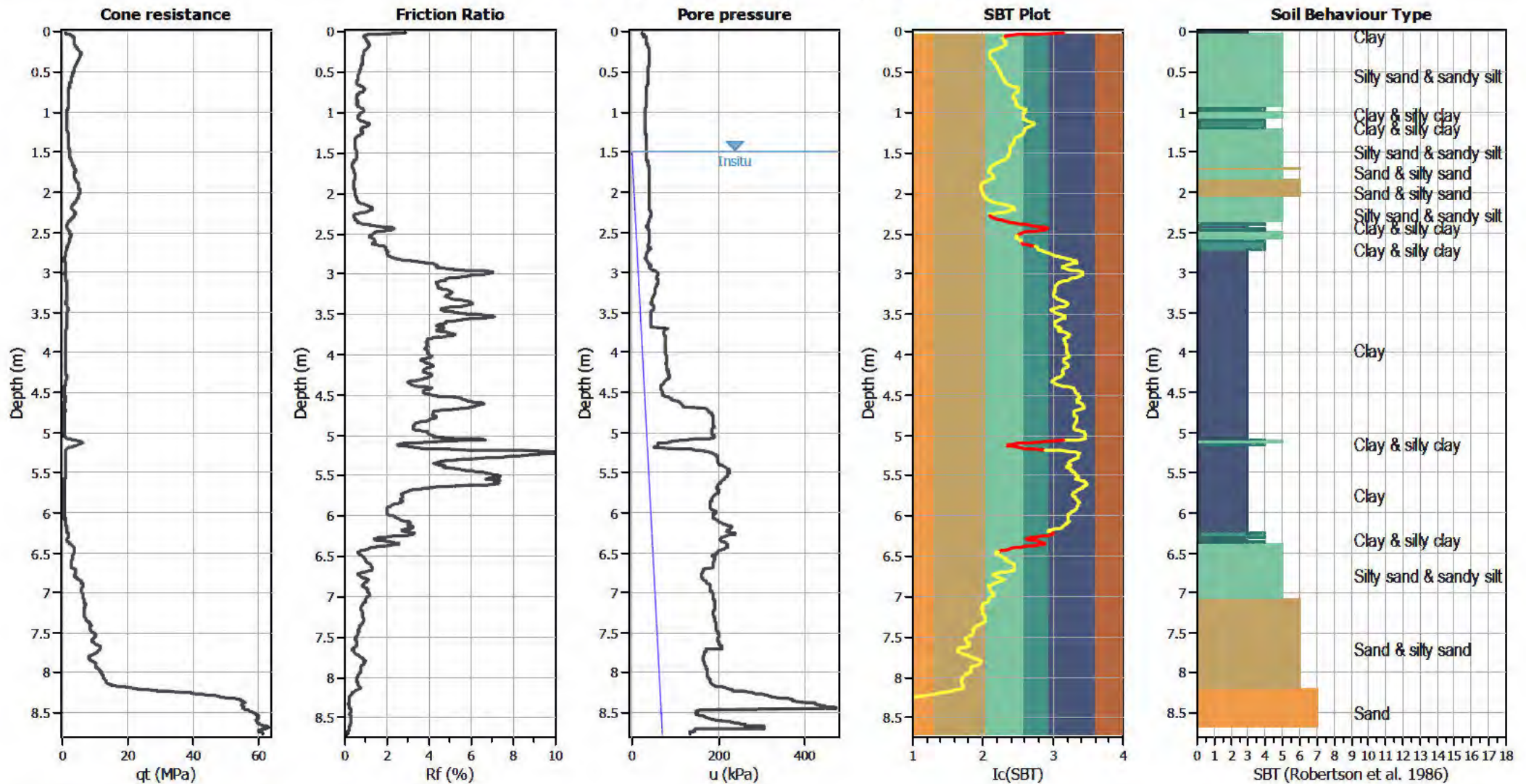
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



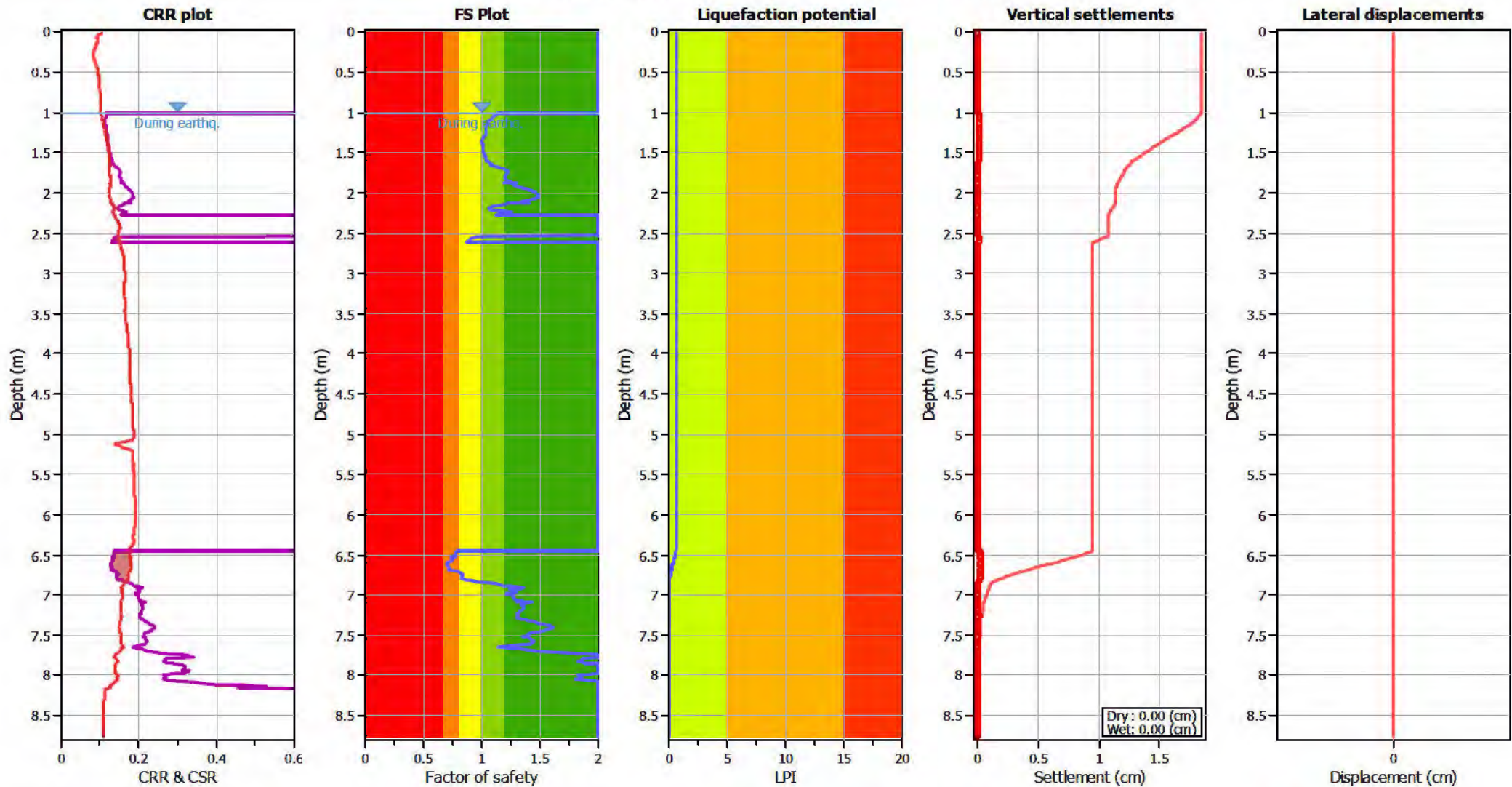
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 6.00
 Peak ground acceleration: 0.19
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

■ Almost certain it will liquefy
■ Very likely to liquefy
■ Liquefaction and no liq. are equally likely
■ Unlikely to liquefy
■ Almost certain it will not liquefy

LPI color scheme

■ Very high risk
■ High risk
■ Low risk

LIQUEFACTION ANALYSIS REPORT

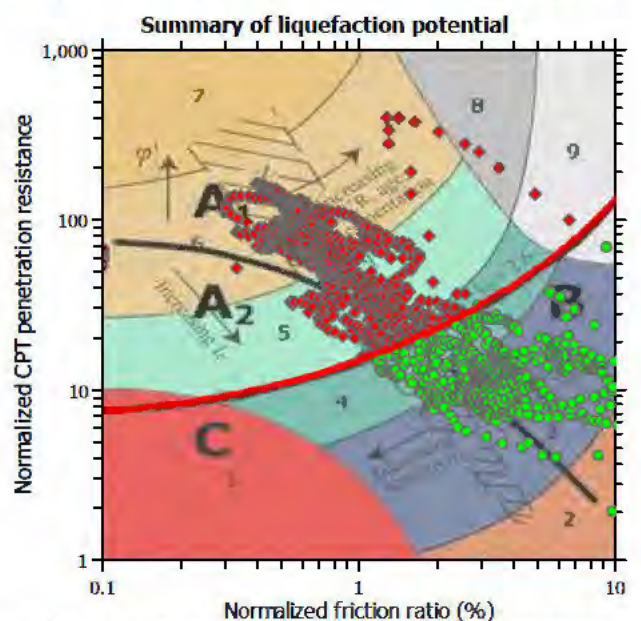
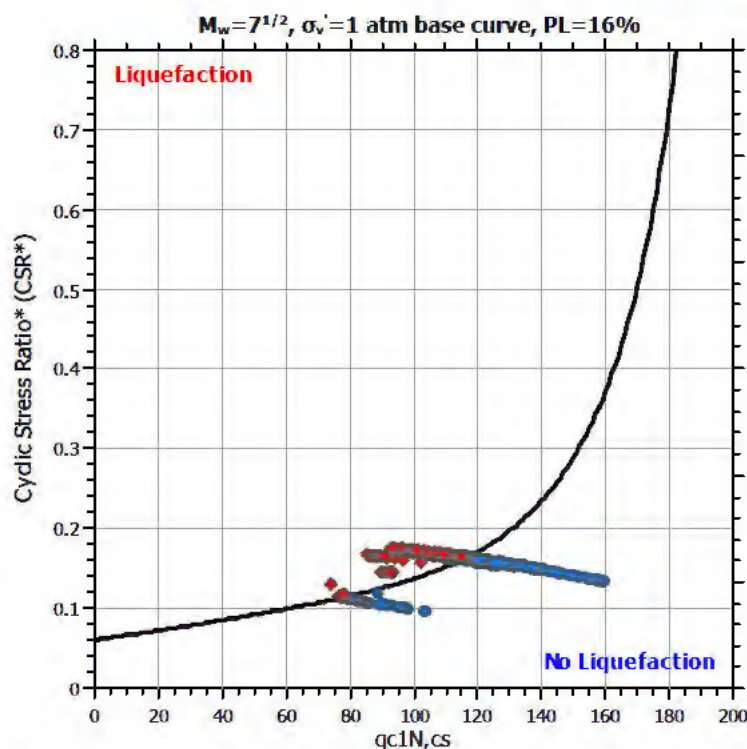
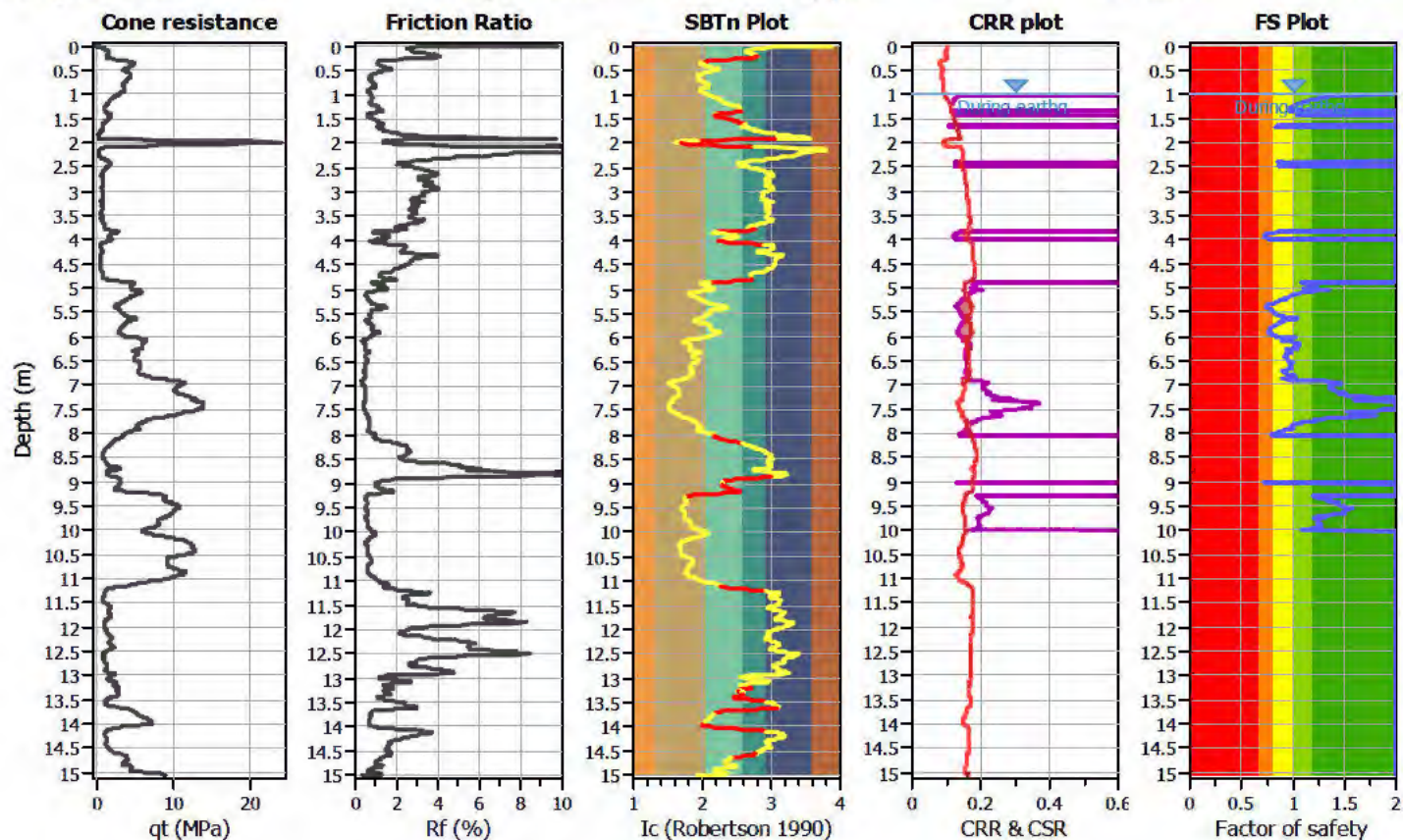
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-09 SLS2

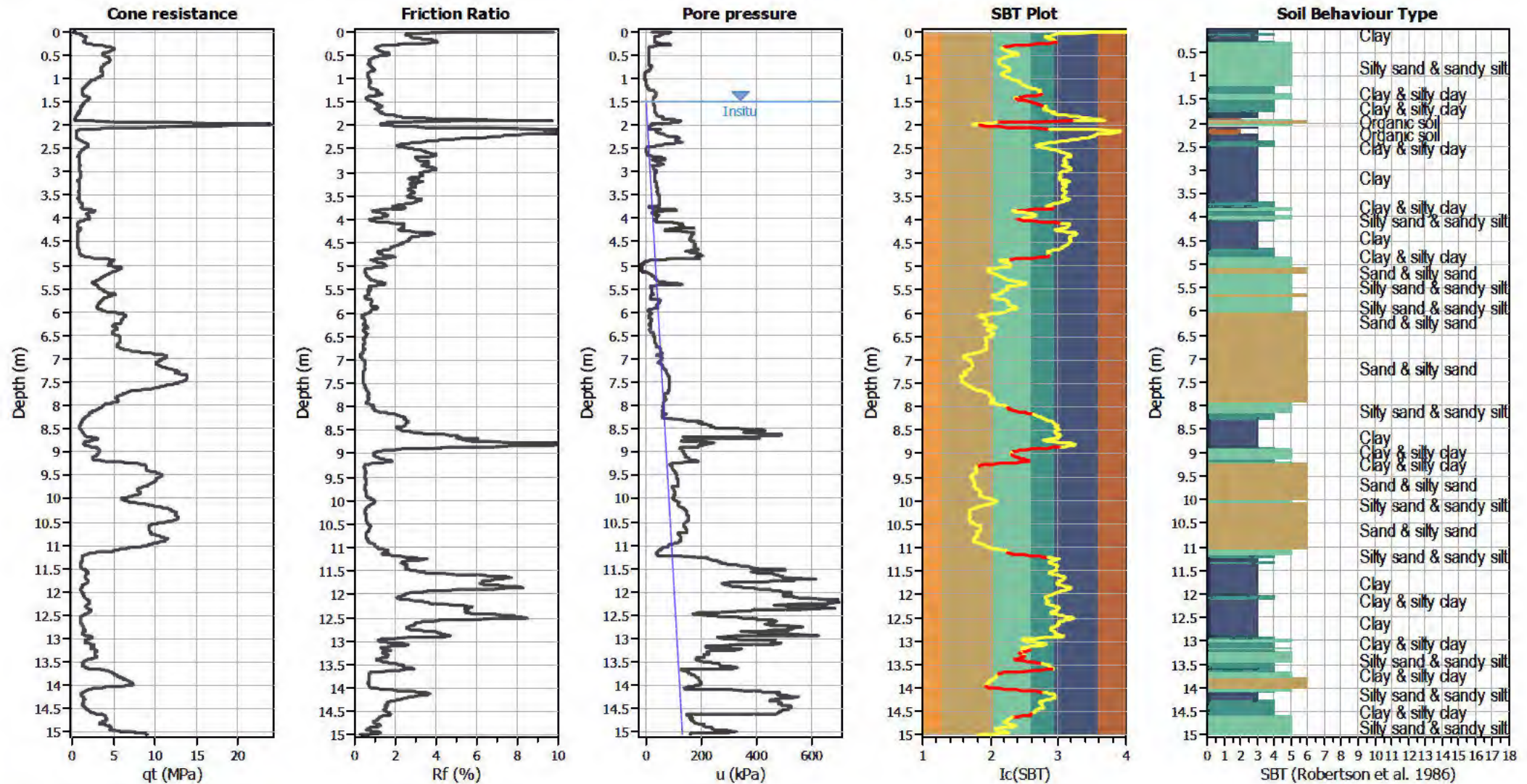
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



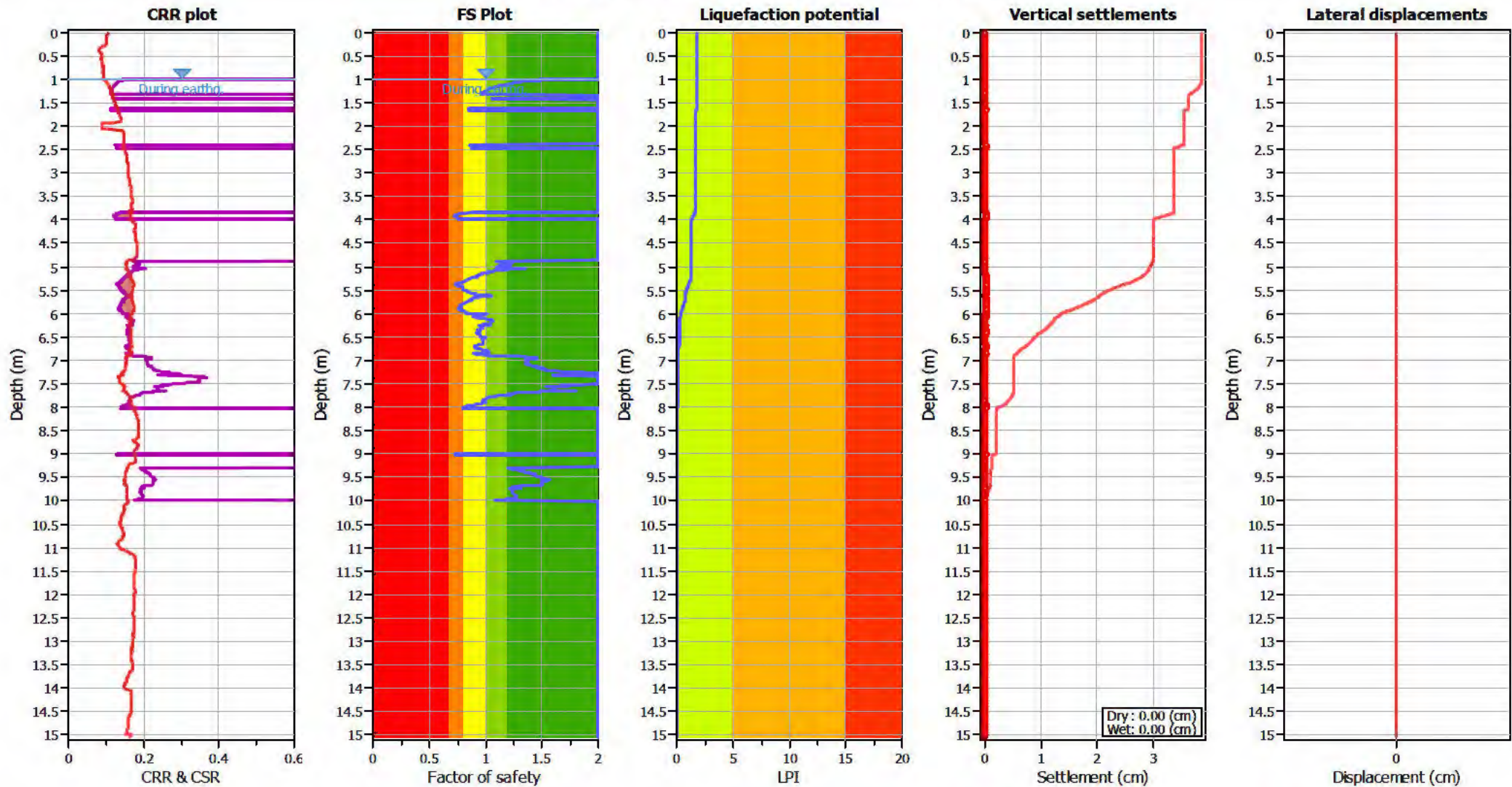
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{α} applied:	Yes
Earthquake magnitude M_w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 6.00
 Peak ground acceleration: 0.19
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

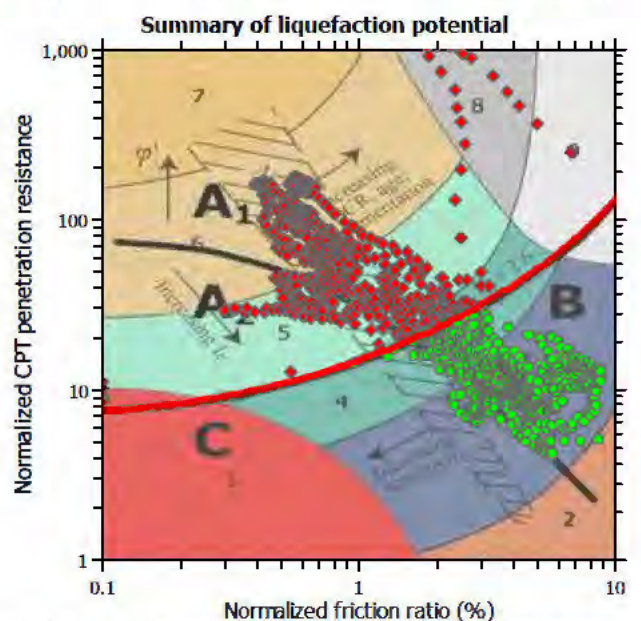
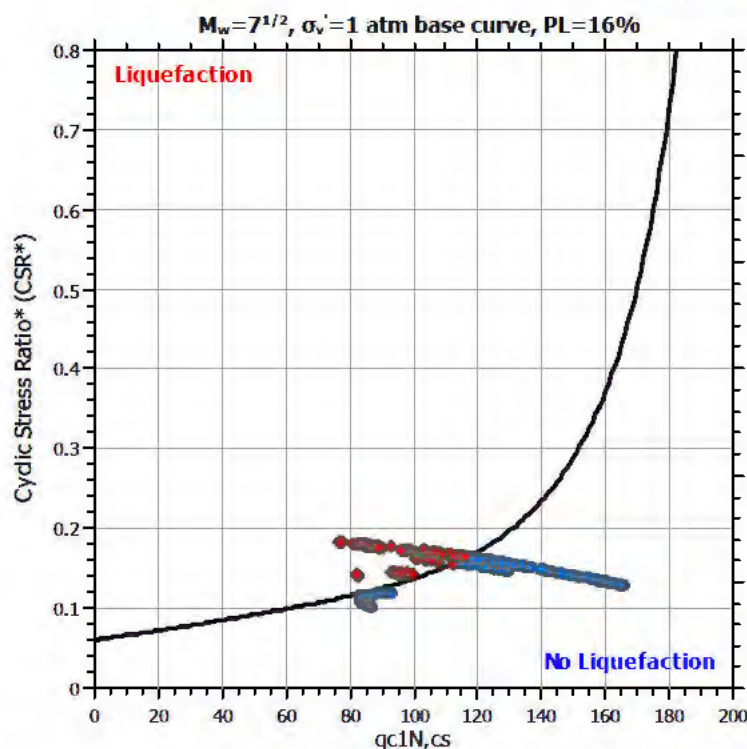
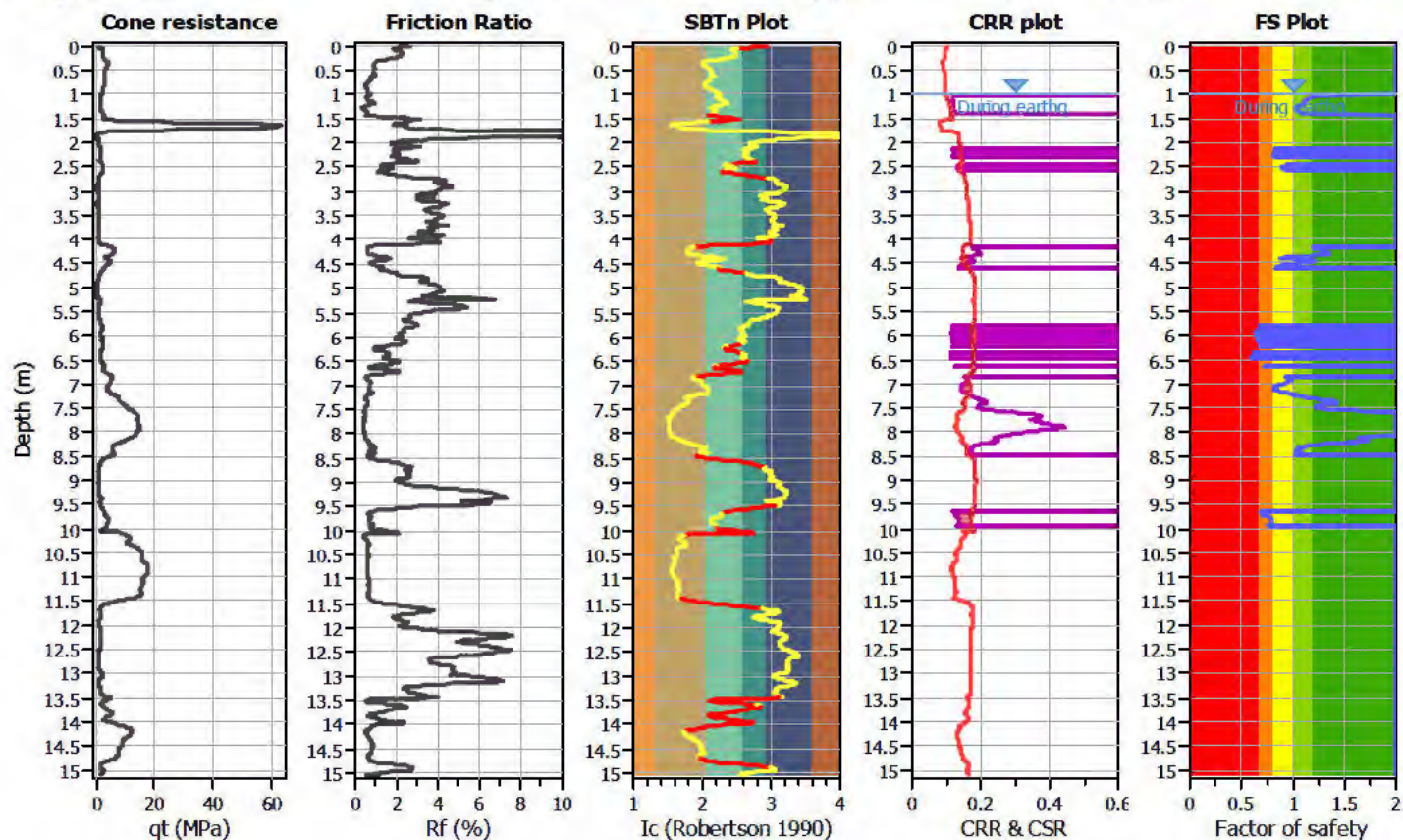
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-10 SLS2

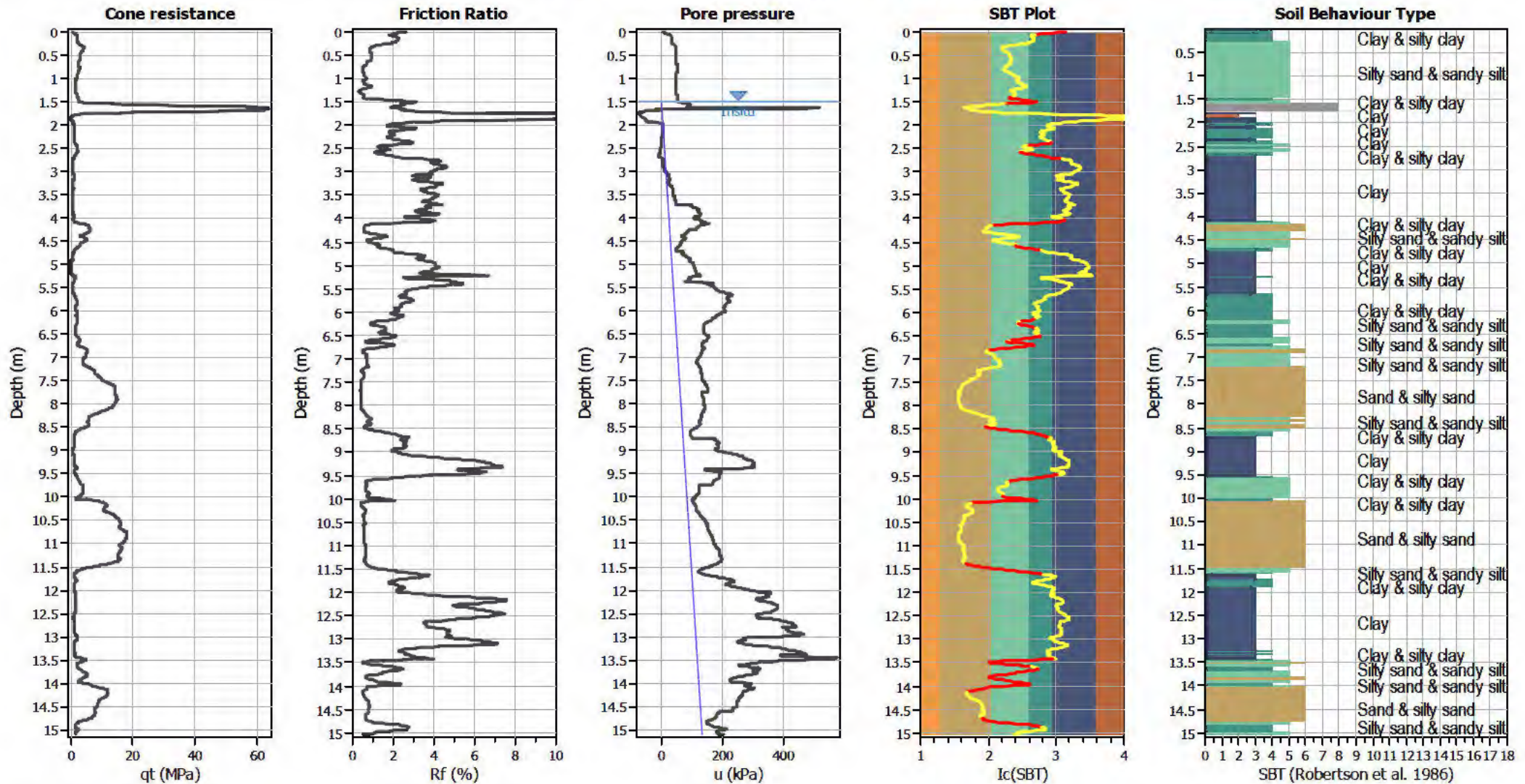
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



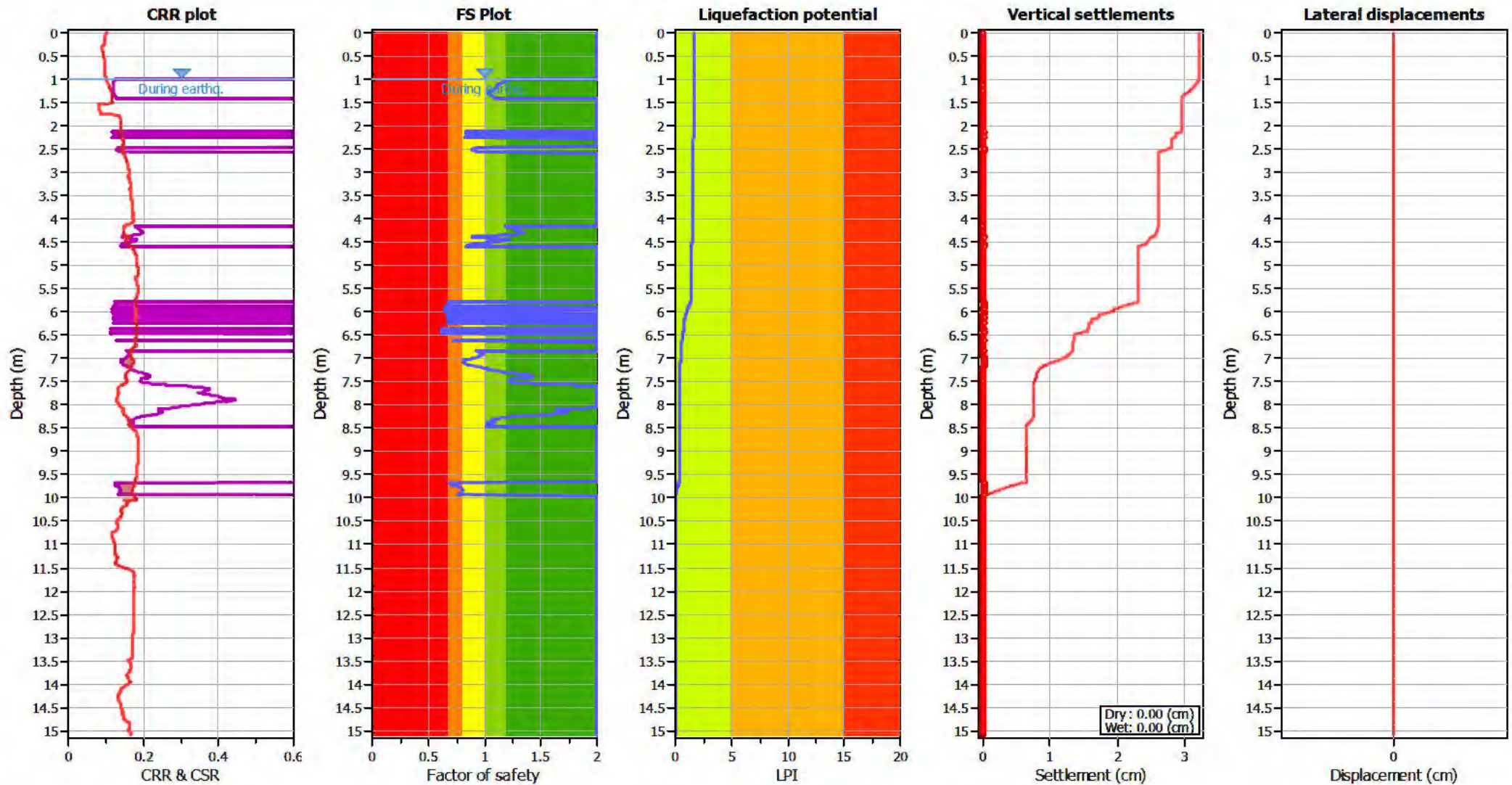
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 6.00
 Peak ground acceleration: 0.19
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

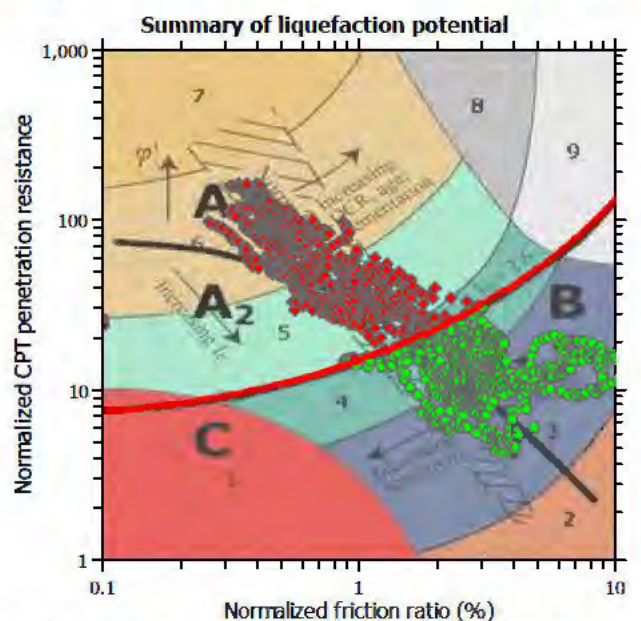
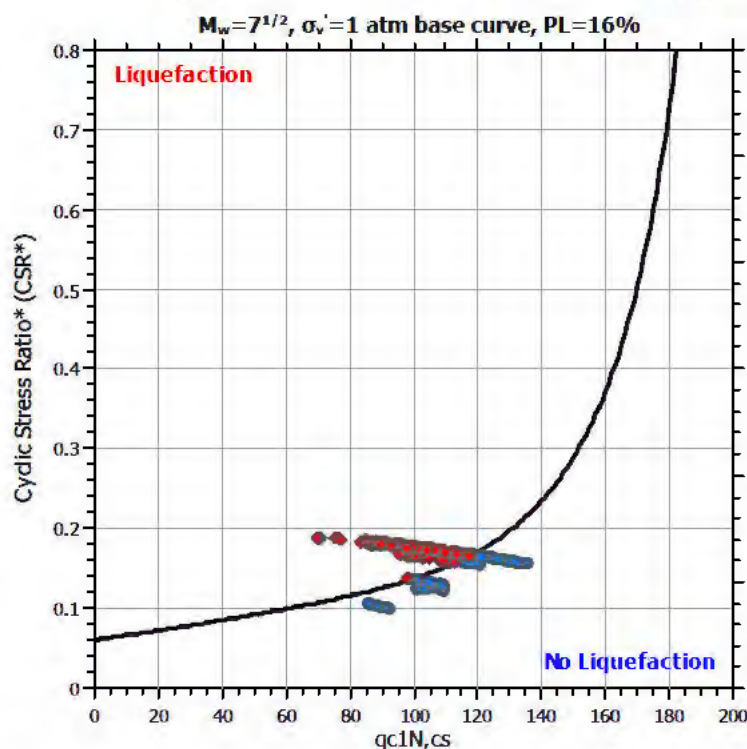
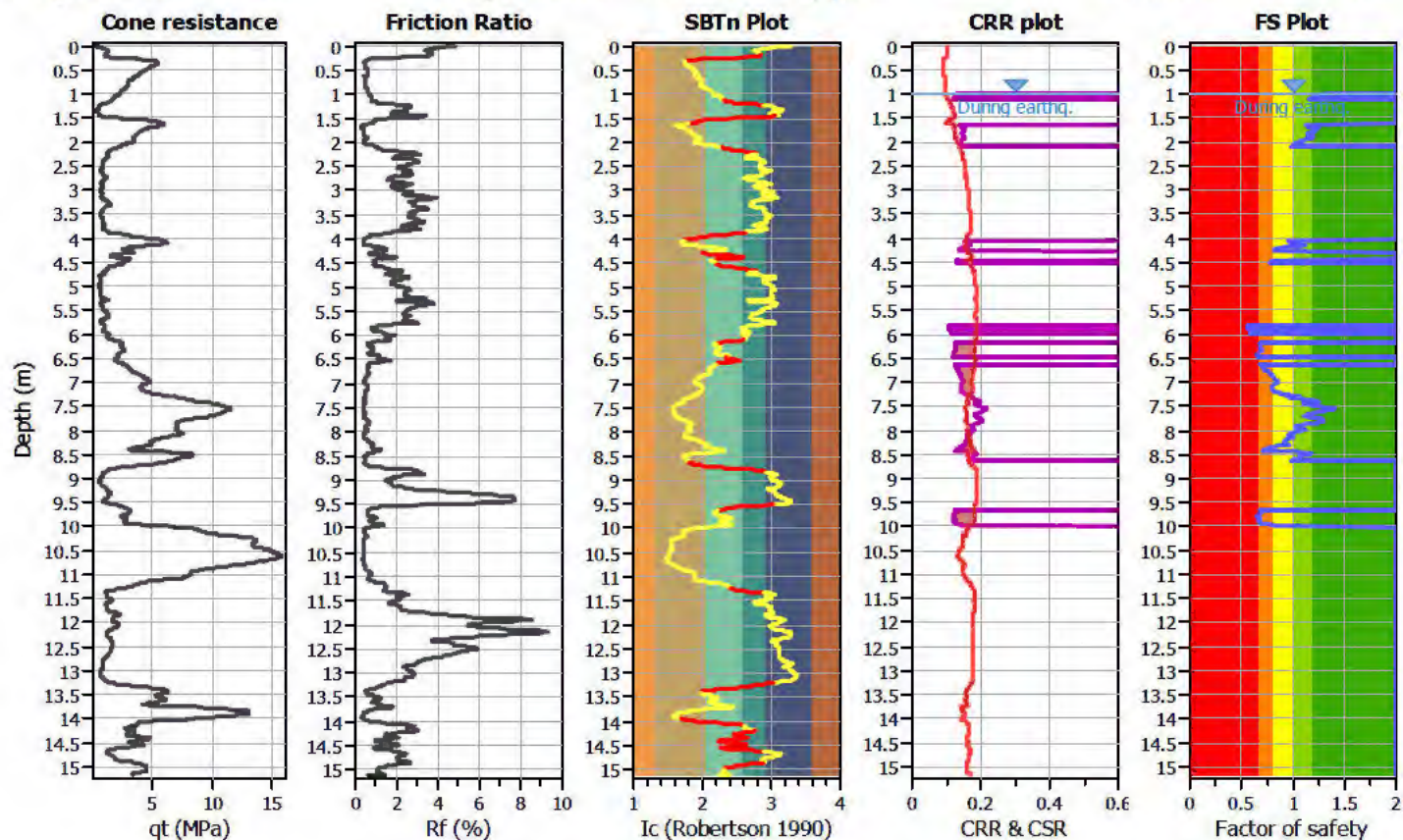
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-11 SLS2

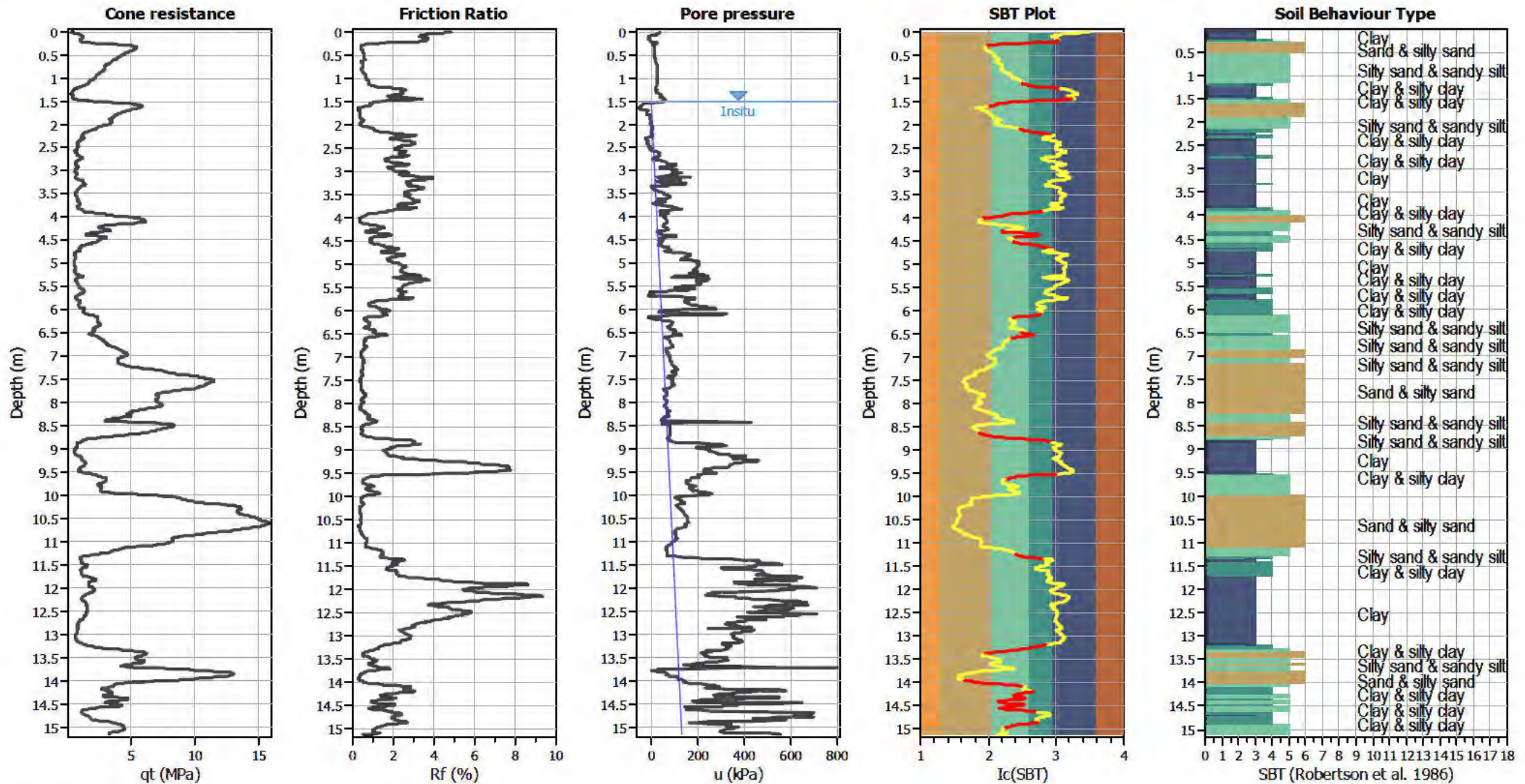
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	10.00 m
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_v applied:	Yes	MSF method:	Method based



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



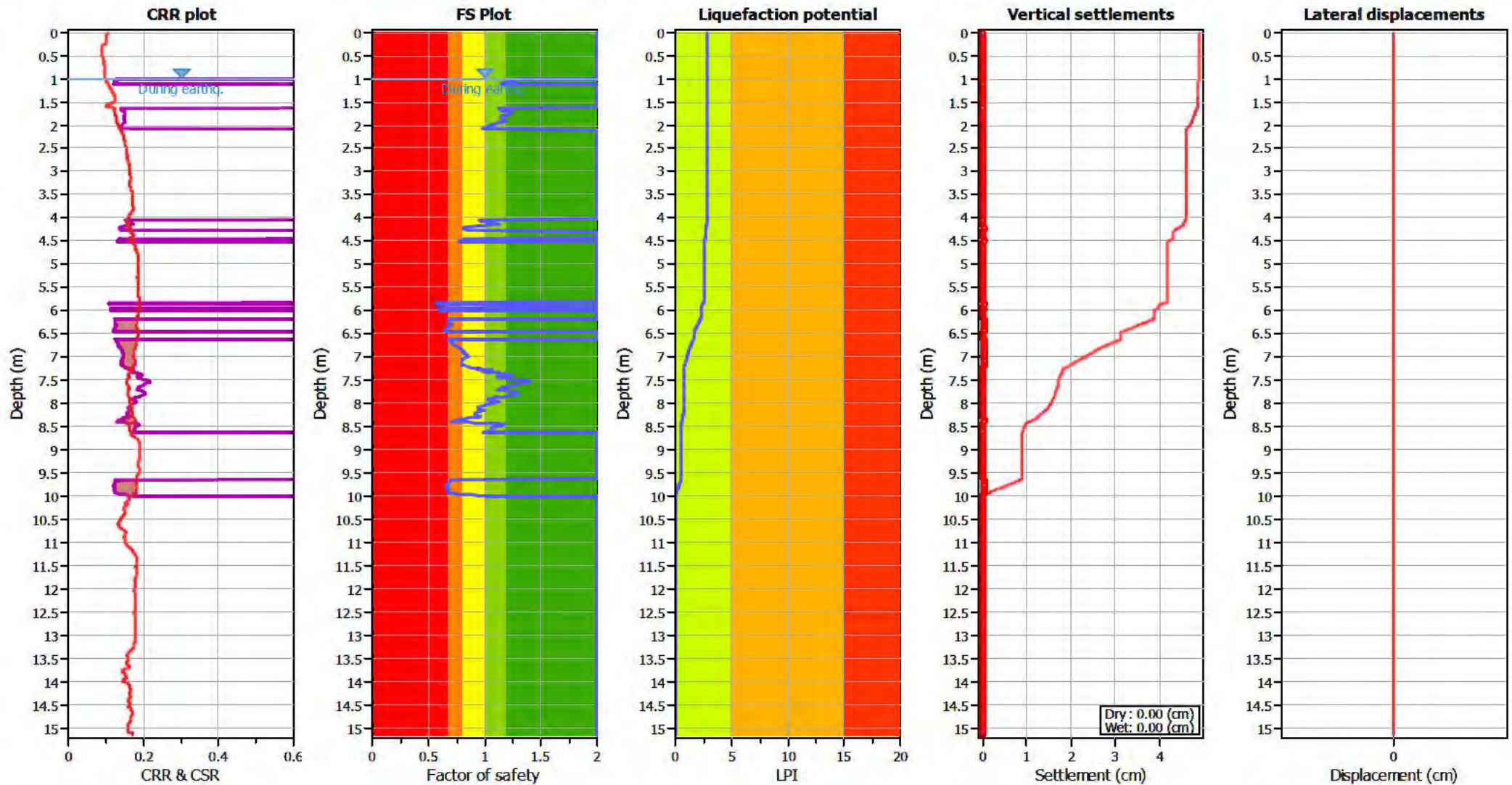
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{α} applied:	Yes
Earthquake magnitude M_w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 6.00
 Peak ground acceleration: 0.19
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

■ Almost certain it will liquefy
■ Very likely to liquefy
■ Liquefaction and no liq. are equally likely
■ Unlike to liquefy
■ Almost certain it will not liquefy

LPI color scheme

■ Very high risk
■ High risk
■ Low risk

LIQUEFACTION ANALYSIS REPORT

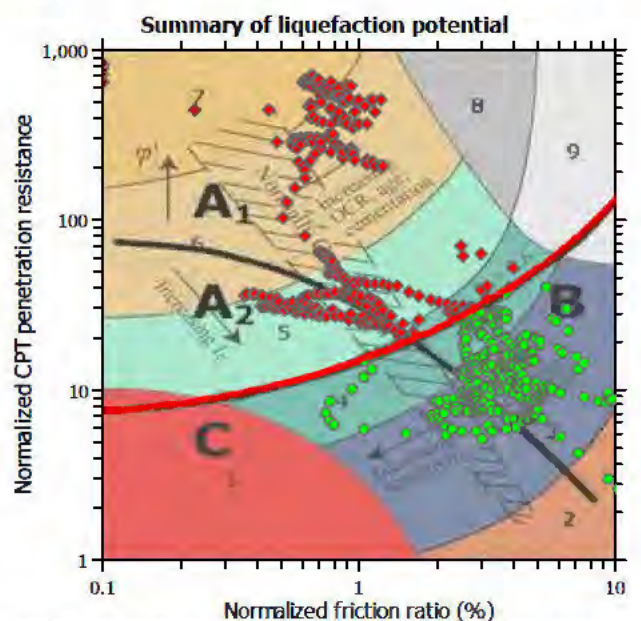
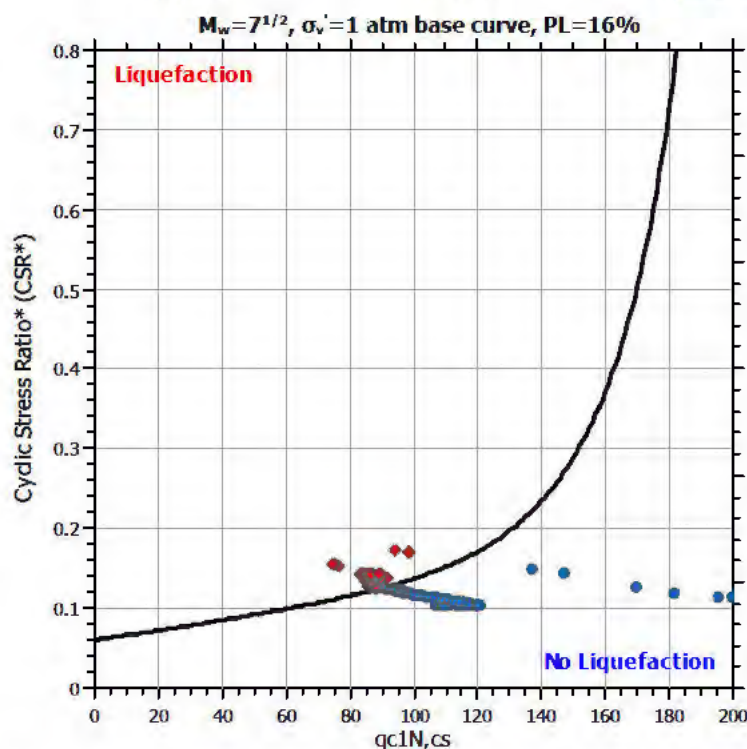
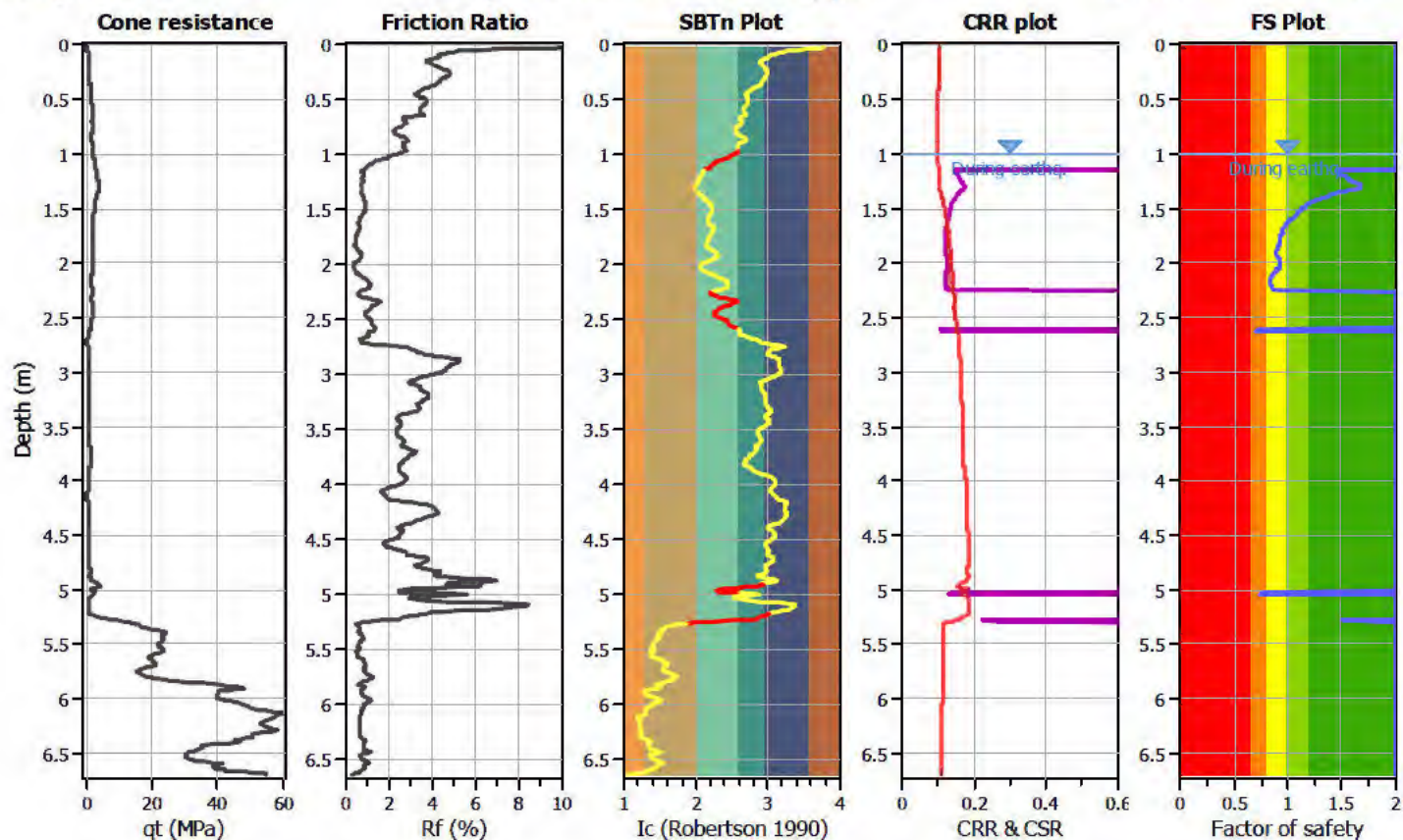
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-12 SLS2

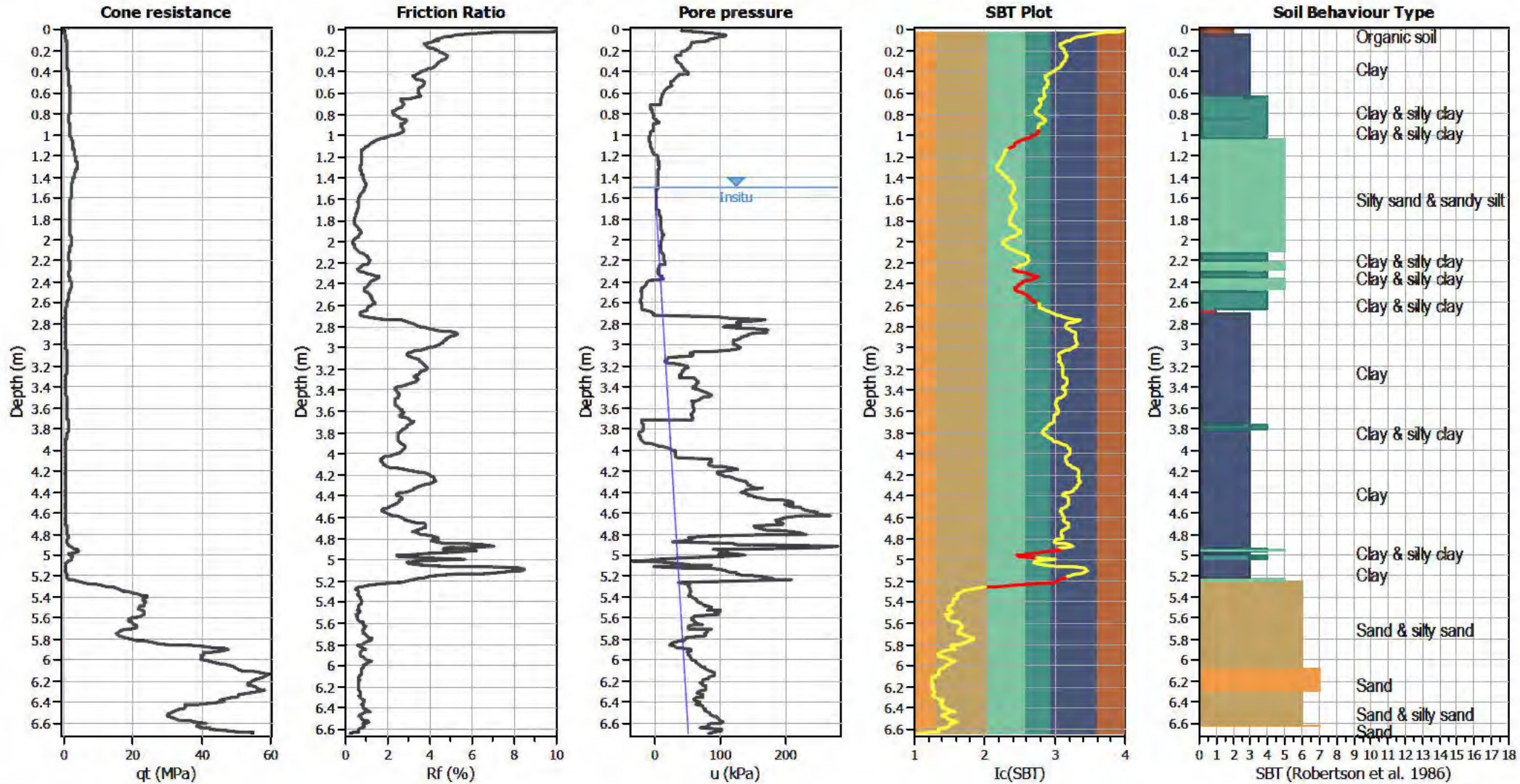
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



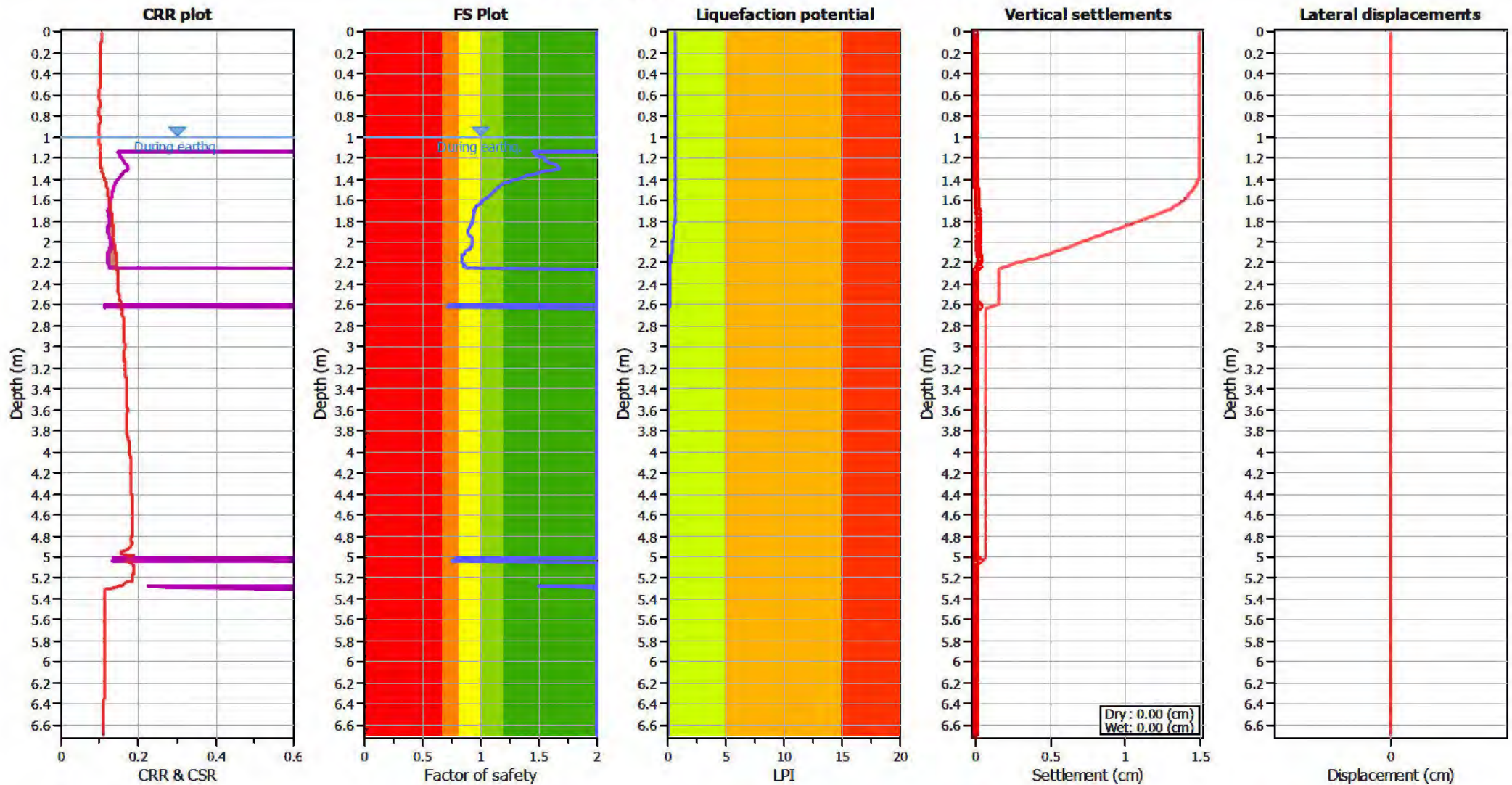
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 6.00
 Peak ground acceleration: 0.19
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

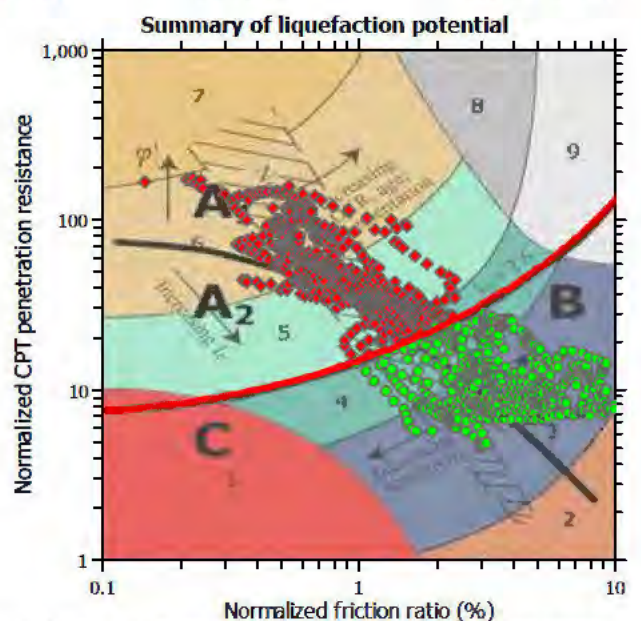
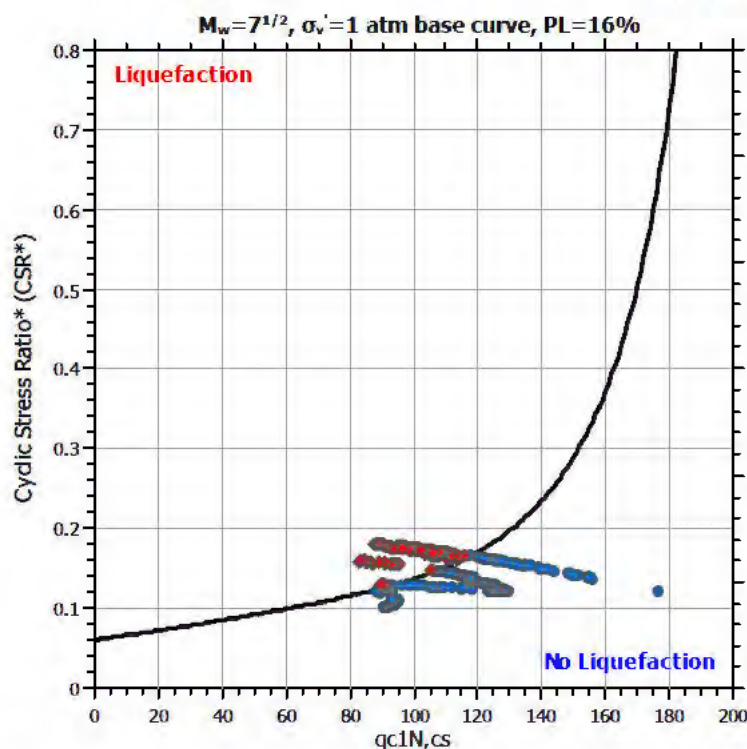
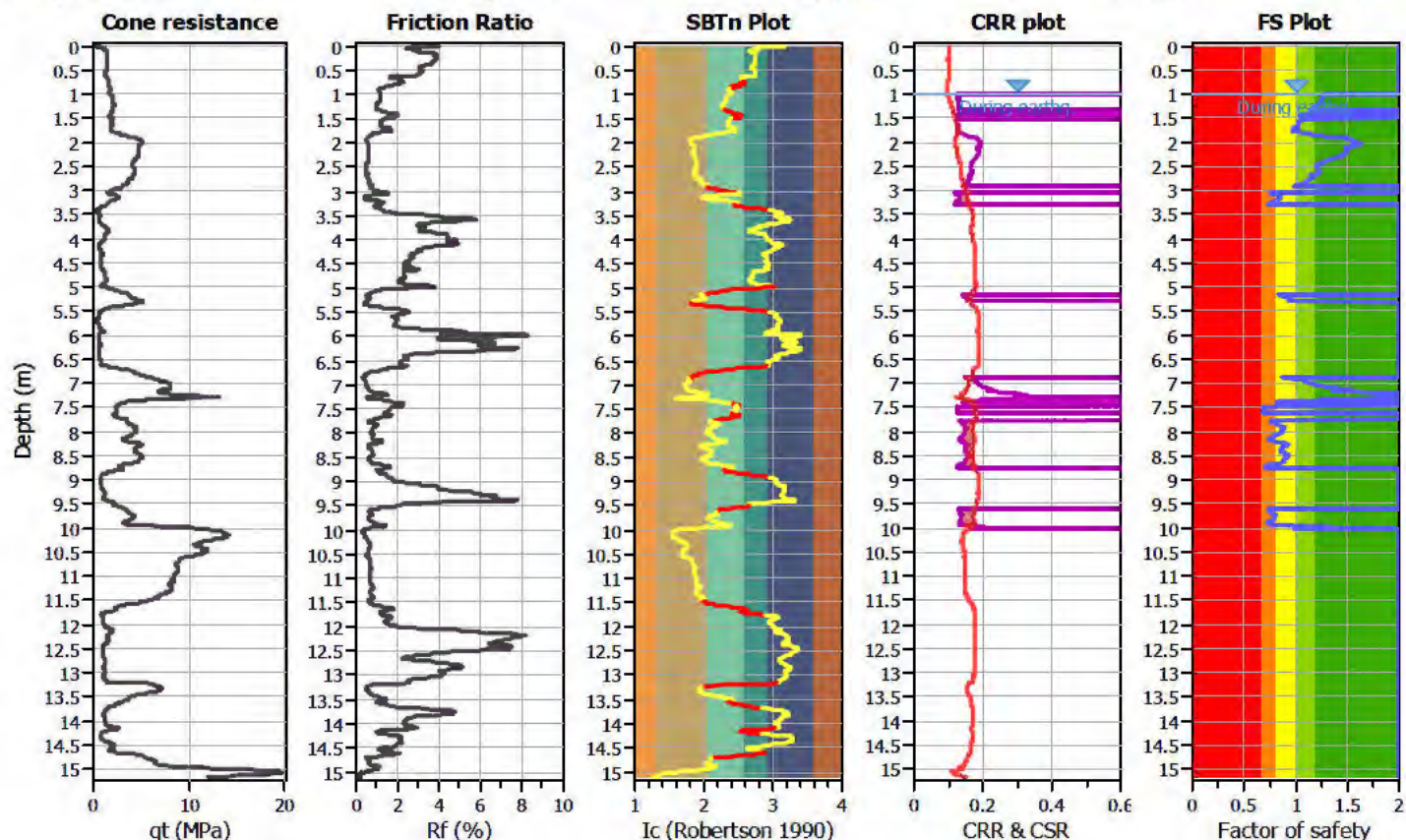
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-13 SLS2

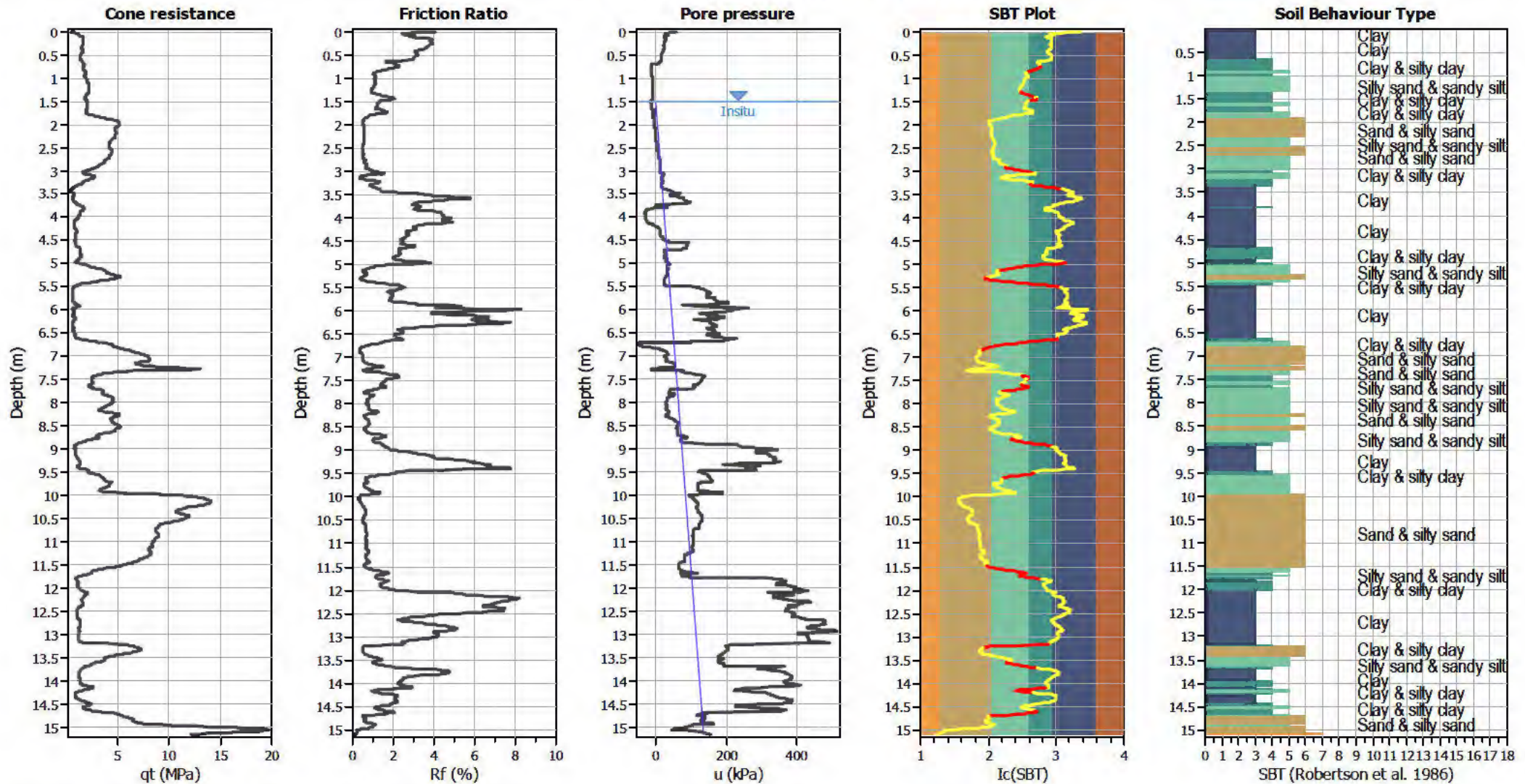
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	6.00	Unit cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



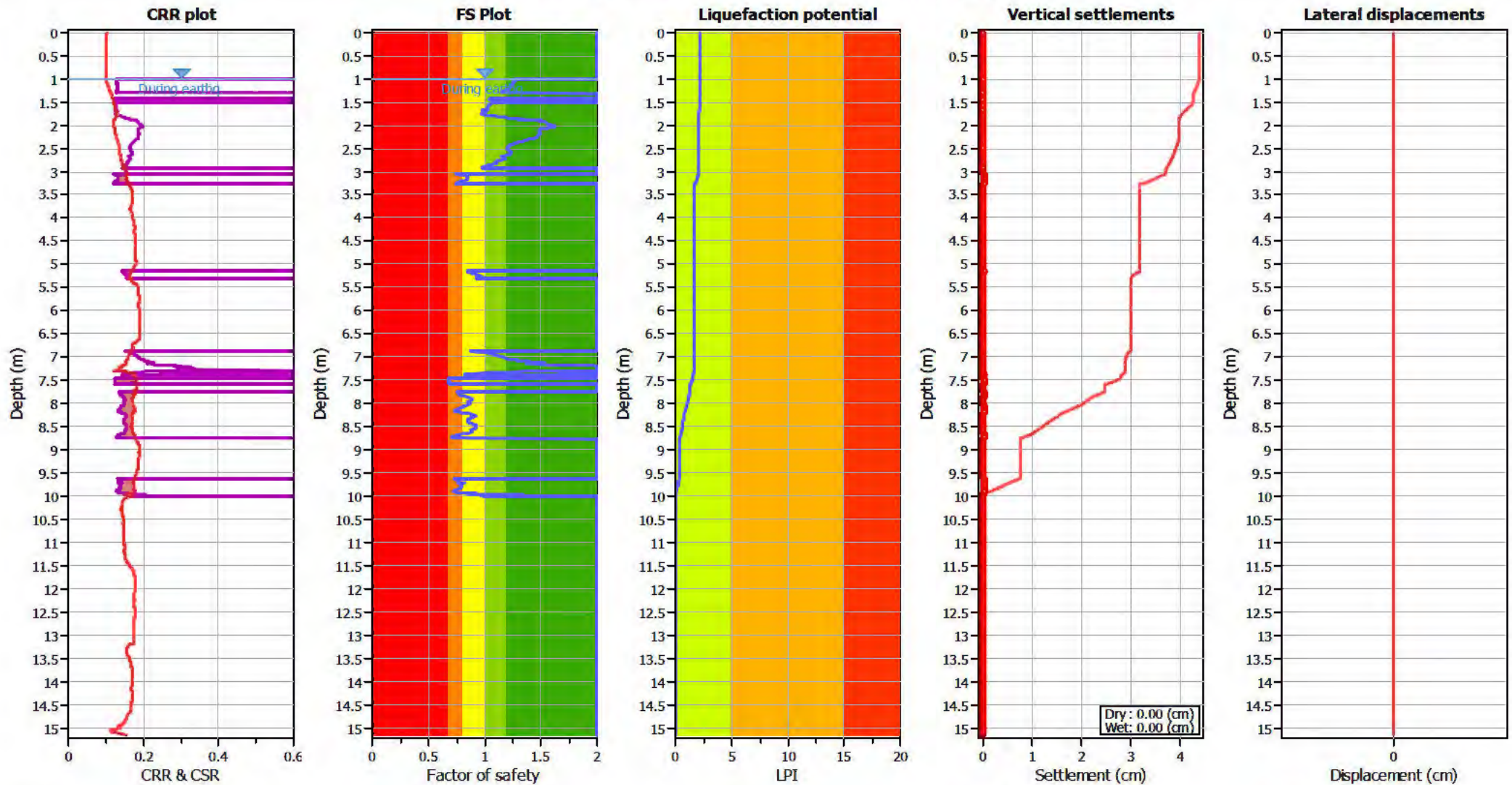
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 6.00
 Peak ground acceleration: 0.19
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

■ Almost certain it will liquefy
■ Very likely to liquefy
■ Liquefaction and no liq. are equally likely
■ Unlike to liquefy
■ Almost certain it will not liquefy

LPI color scheme

■ Very high risk
■ High risk
■ Low risk

LIQUEFACTION ANALYSIS REPORT

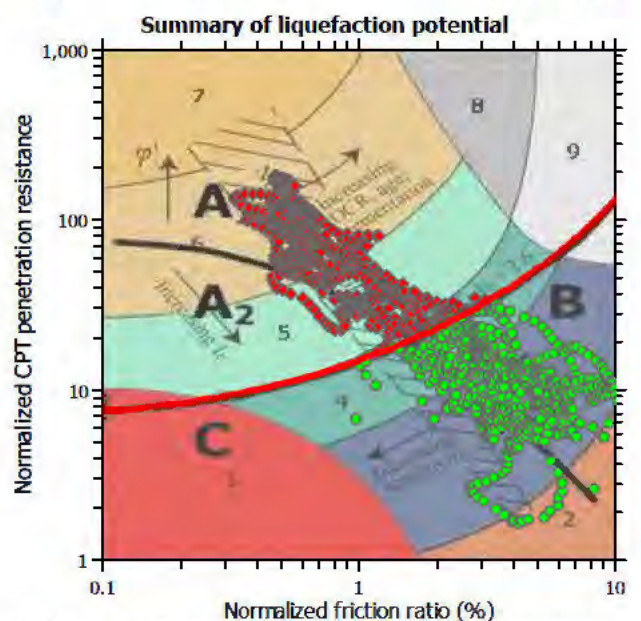
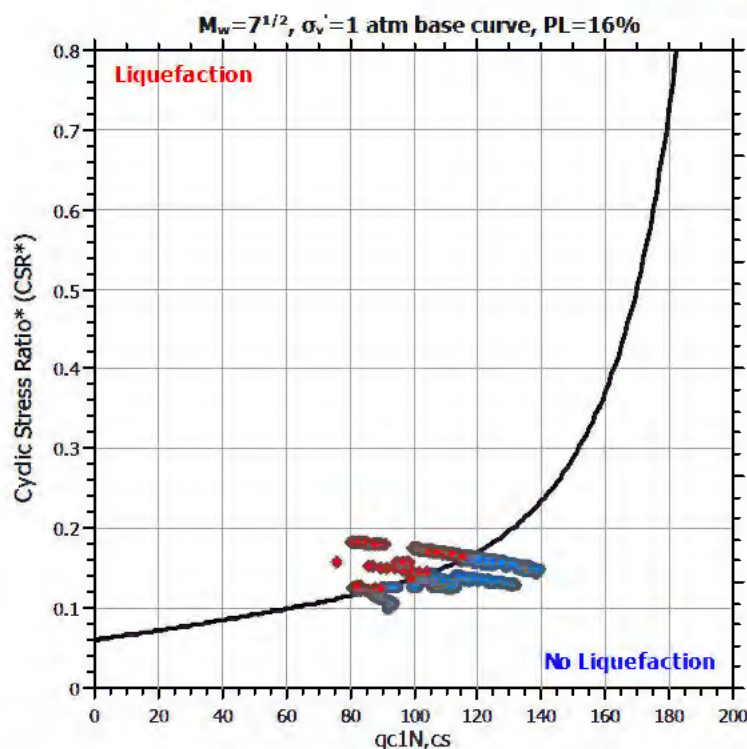
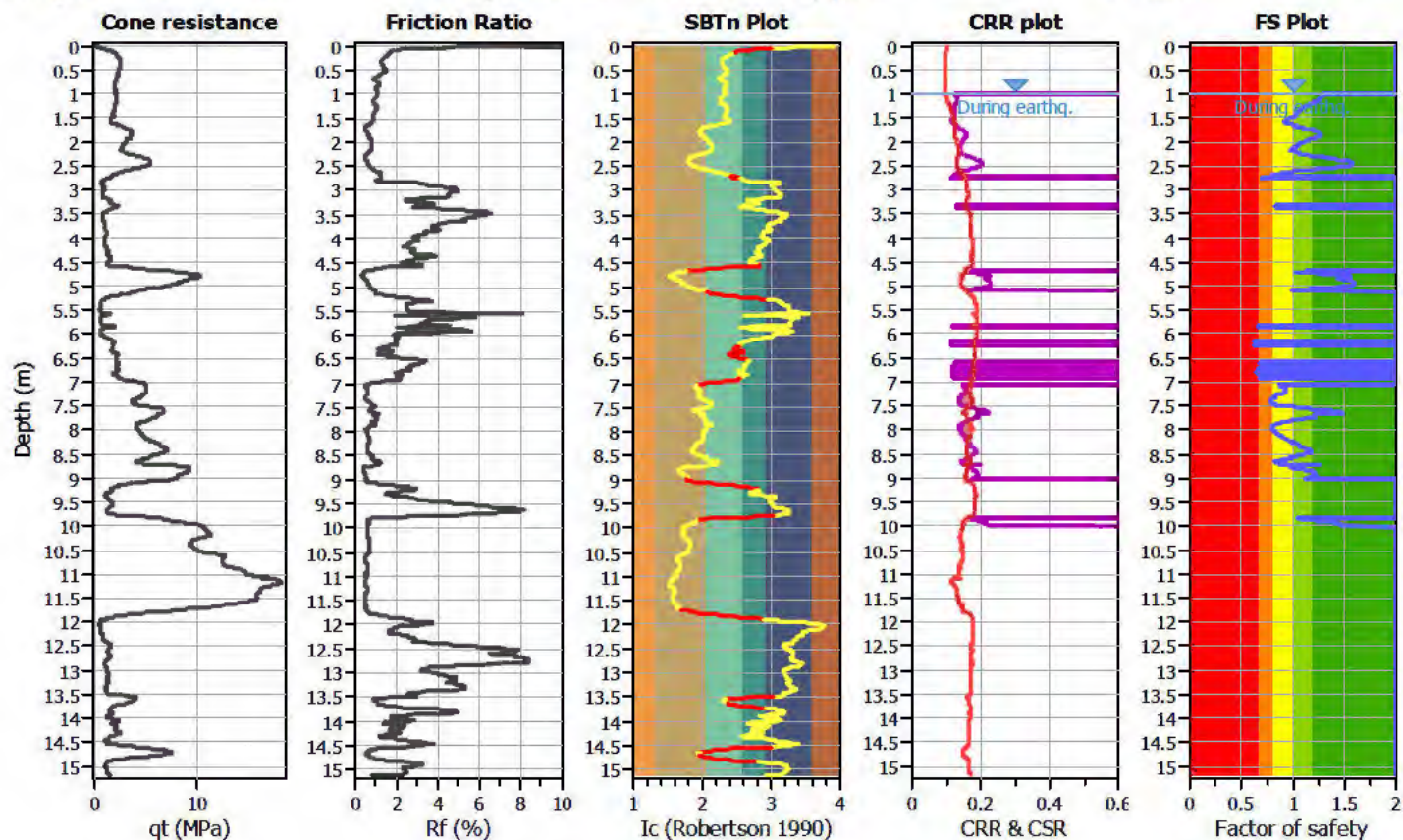
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-14 SLS2

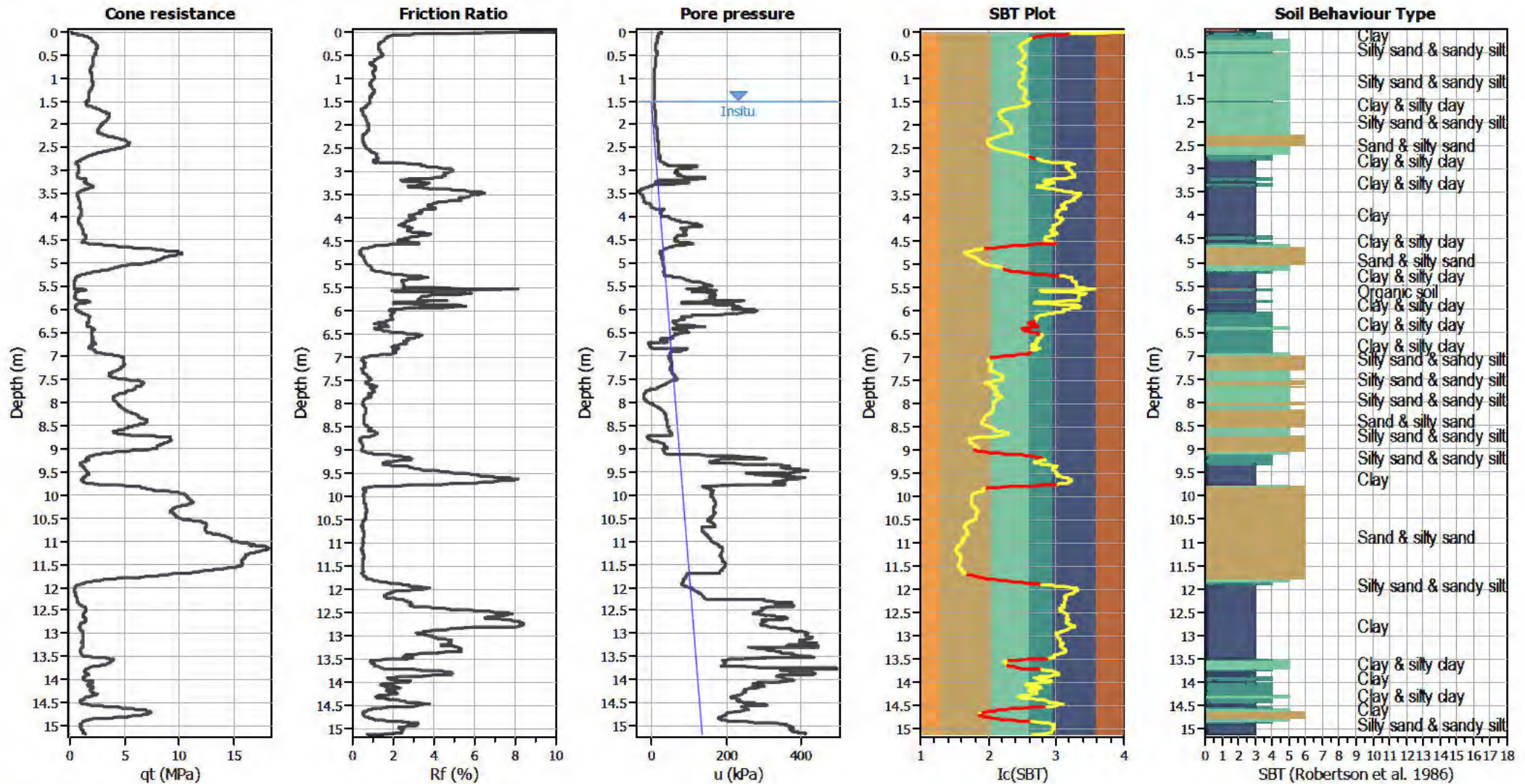
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



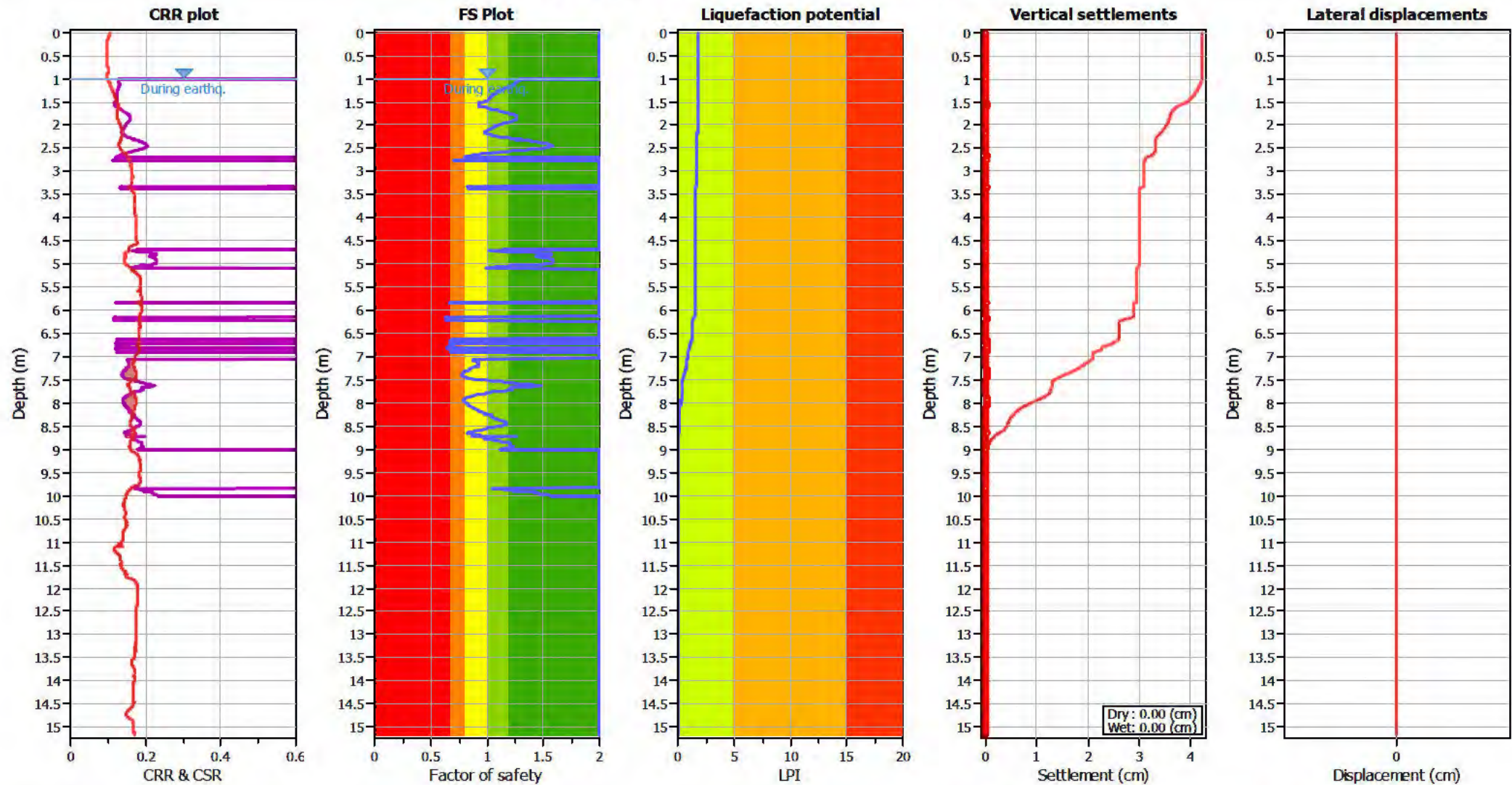
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_a applied:	Yes
Earthquake magnitude M_w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 6.00
 Peak ground acceleration: 0.19
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_a applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

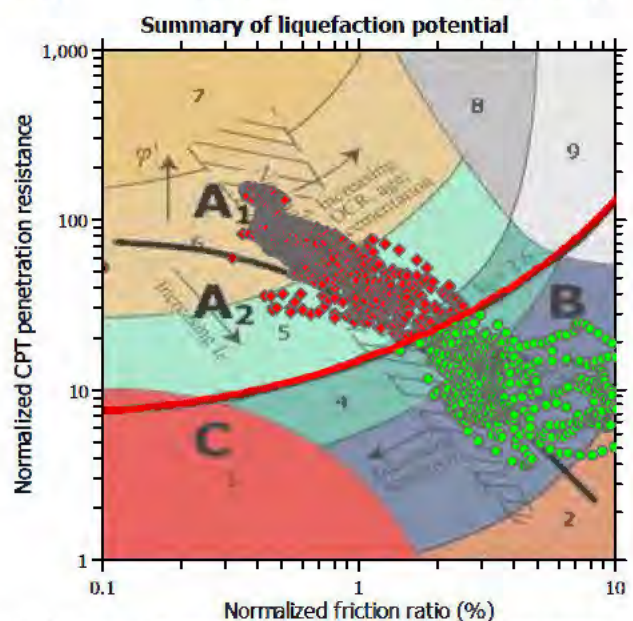
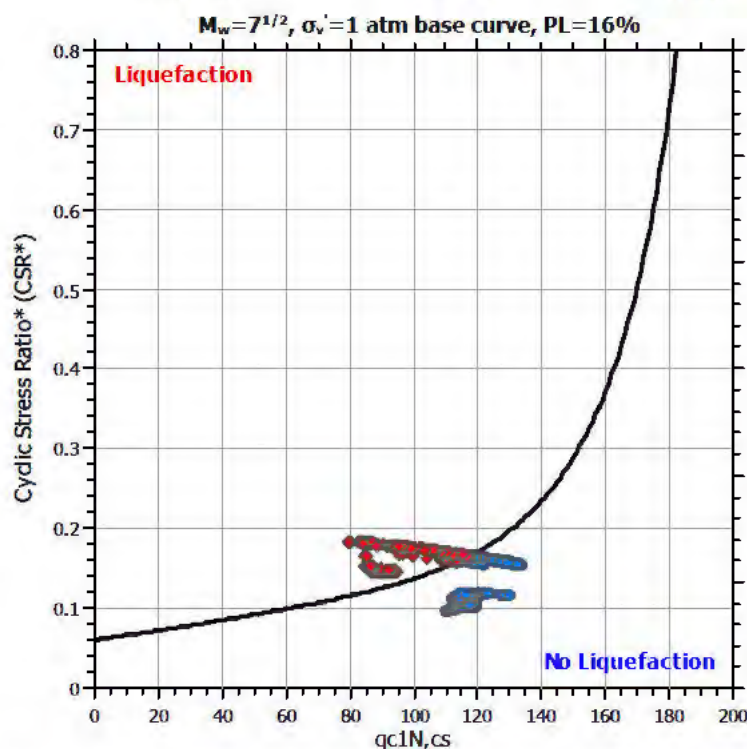
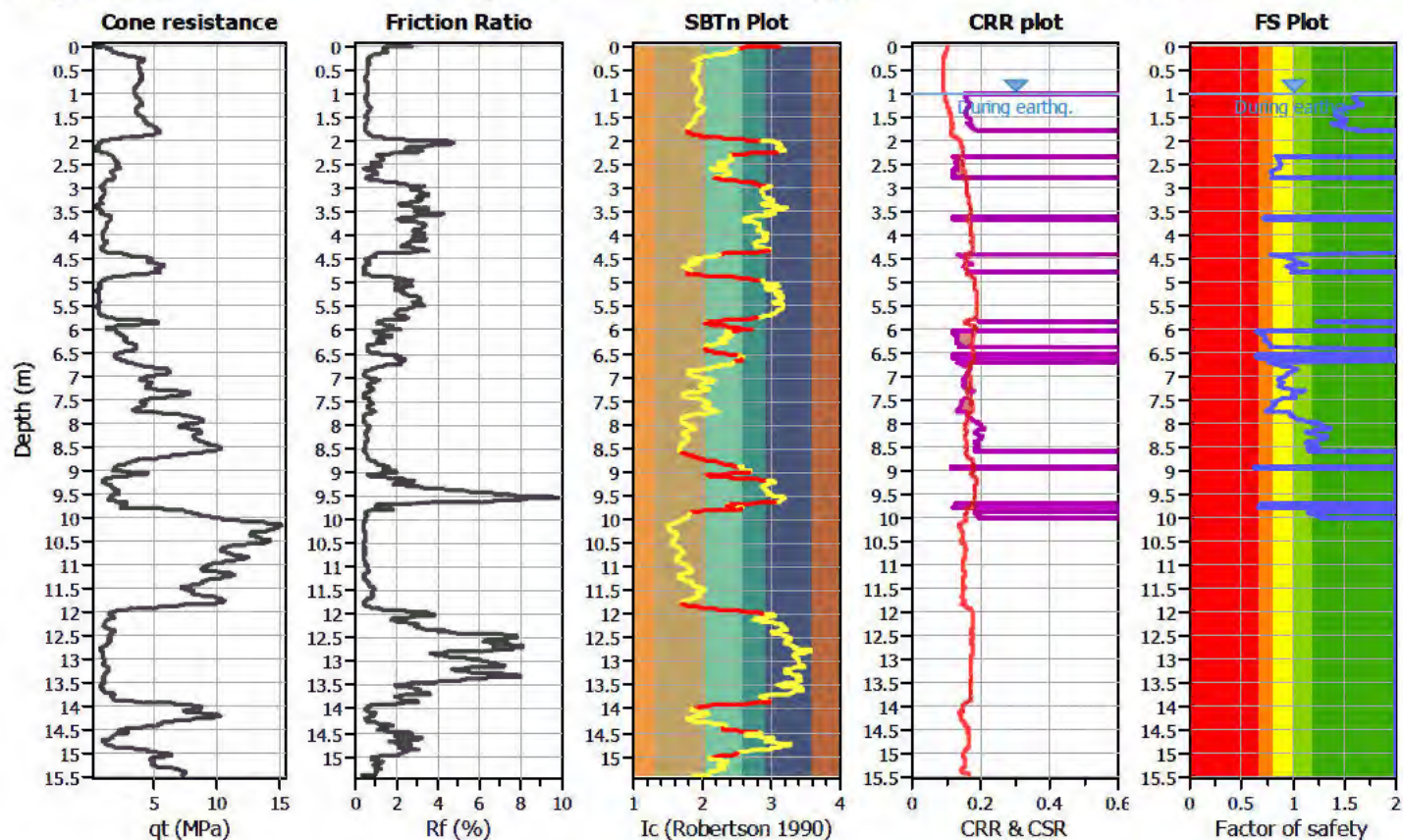
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-15 SLS2

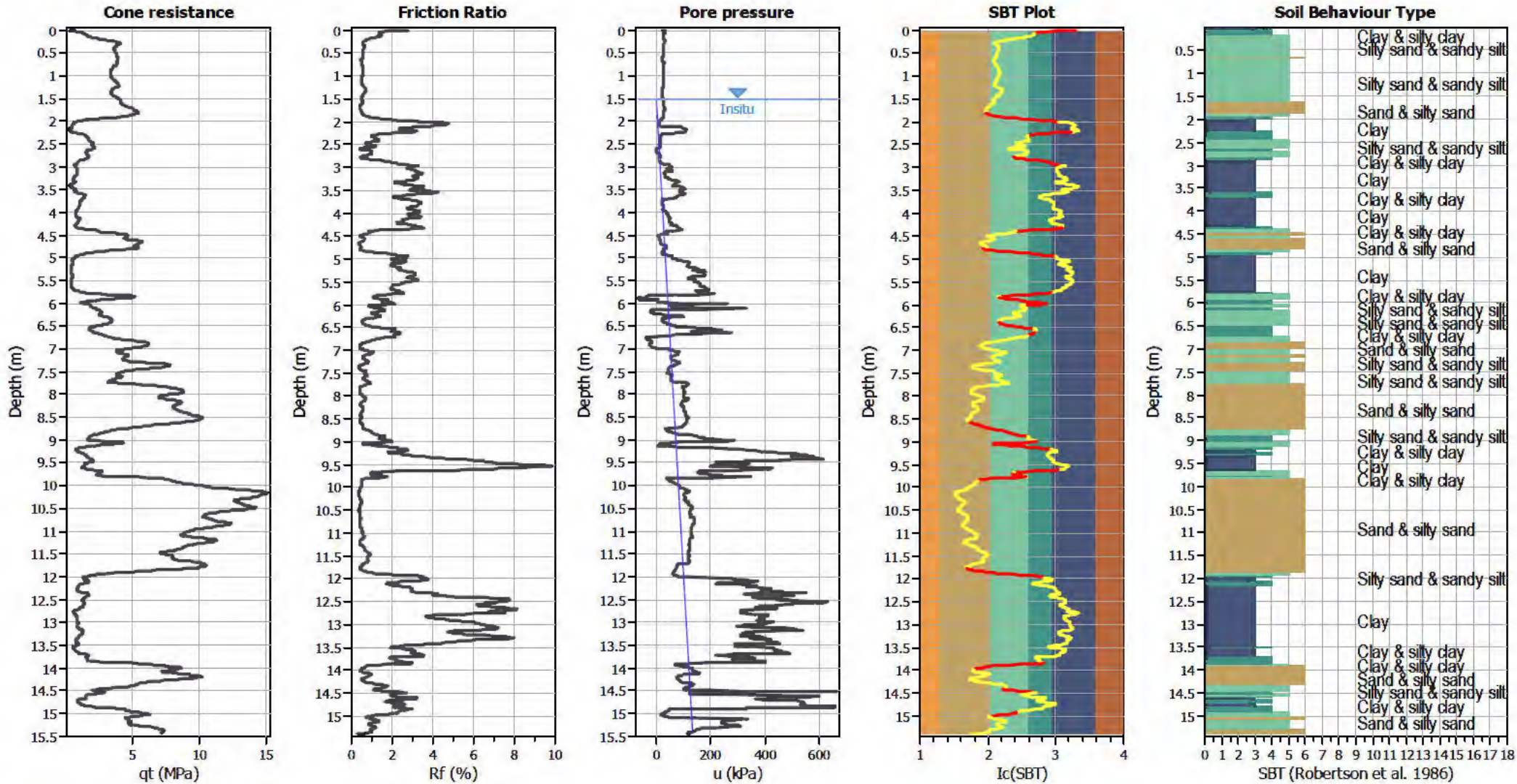
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	10.00 m
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



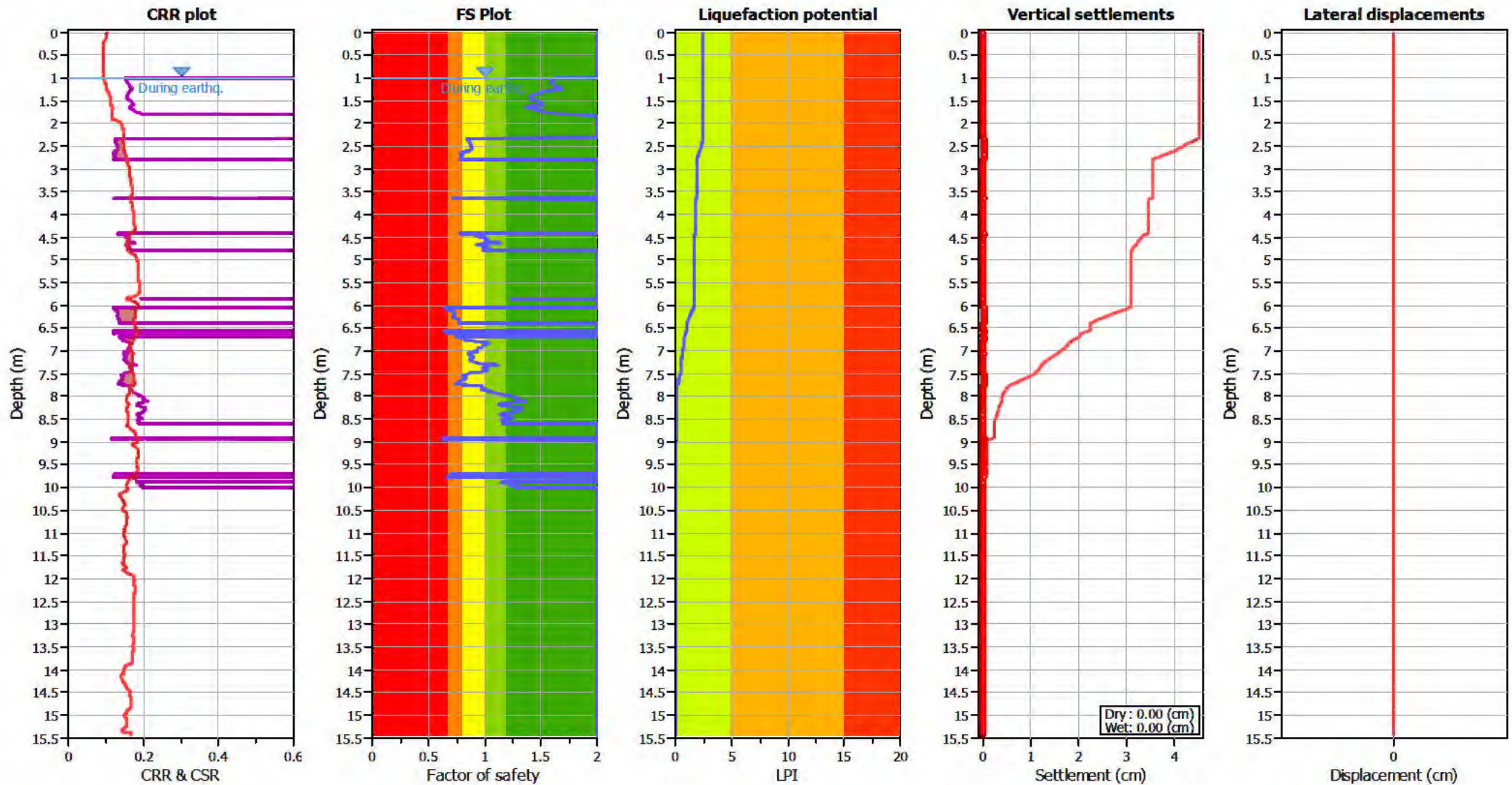
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 6.00
 Peak ground acceleration: 0.19
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

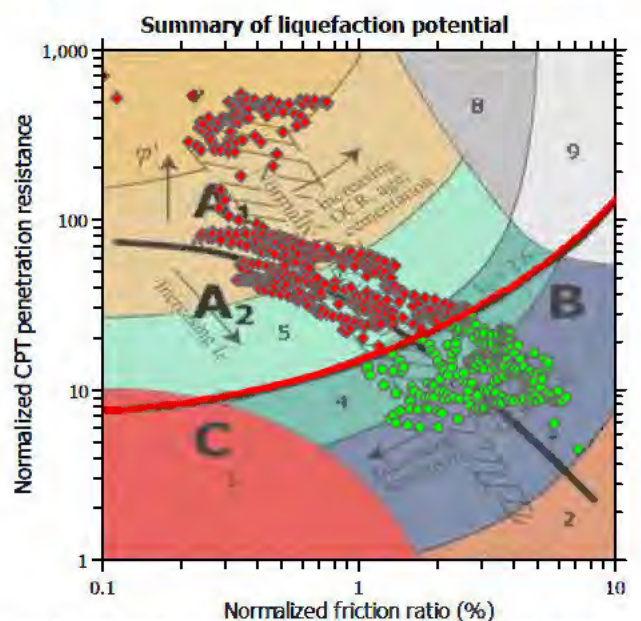
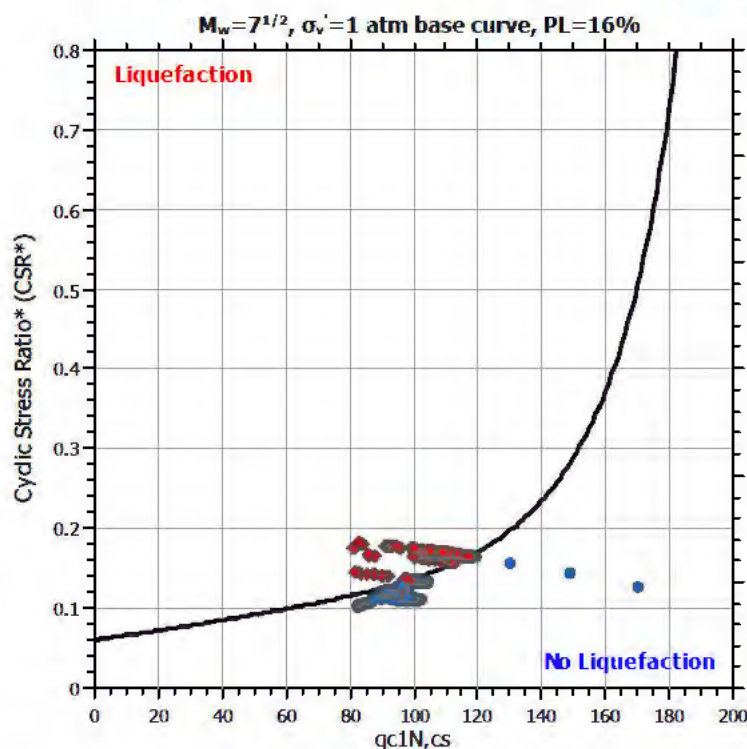
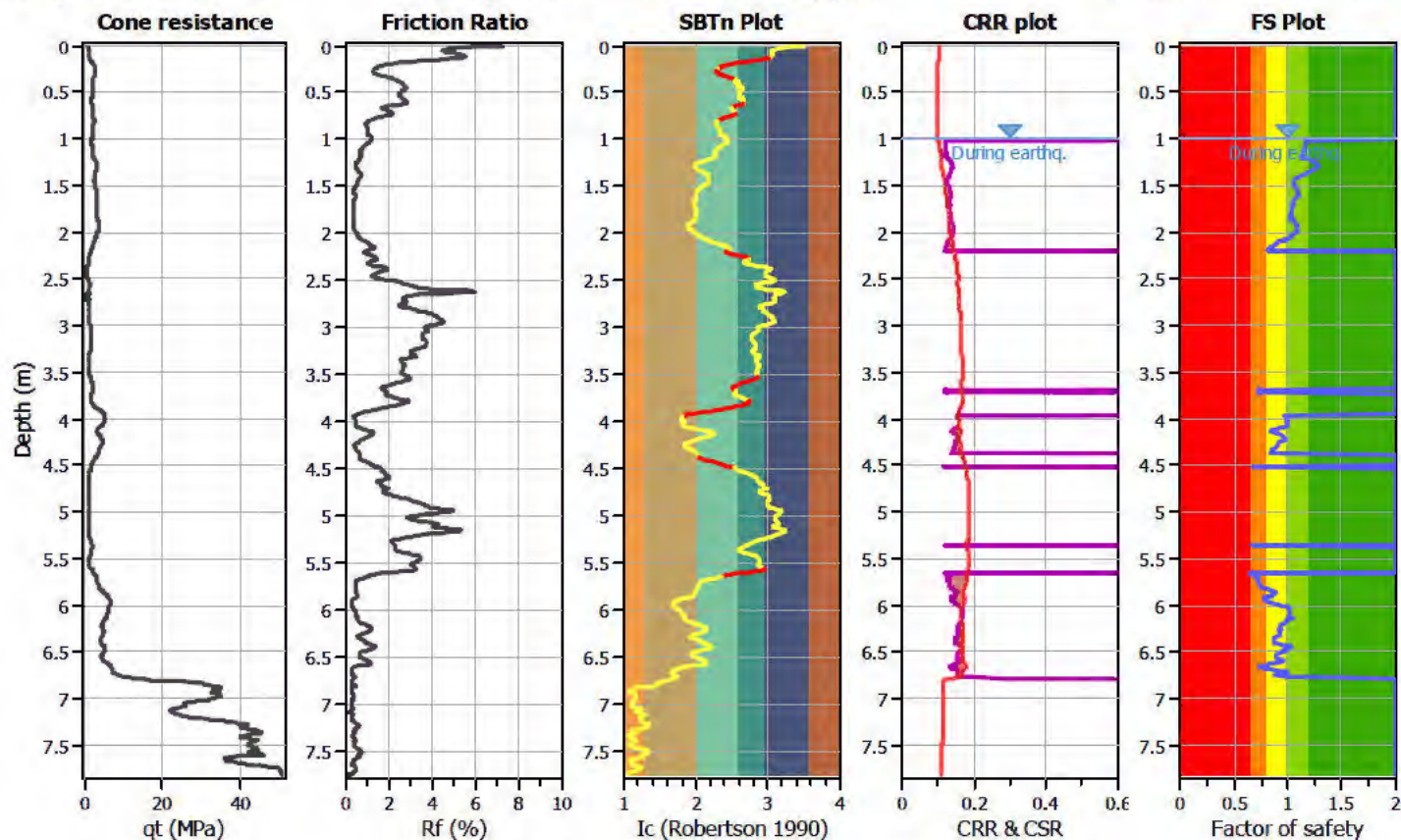
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-16 SLS2

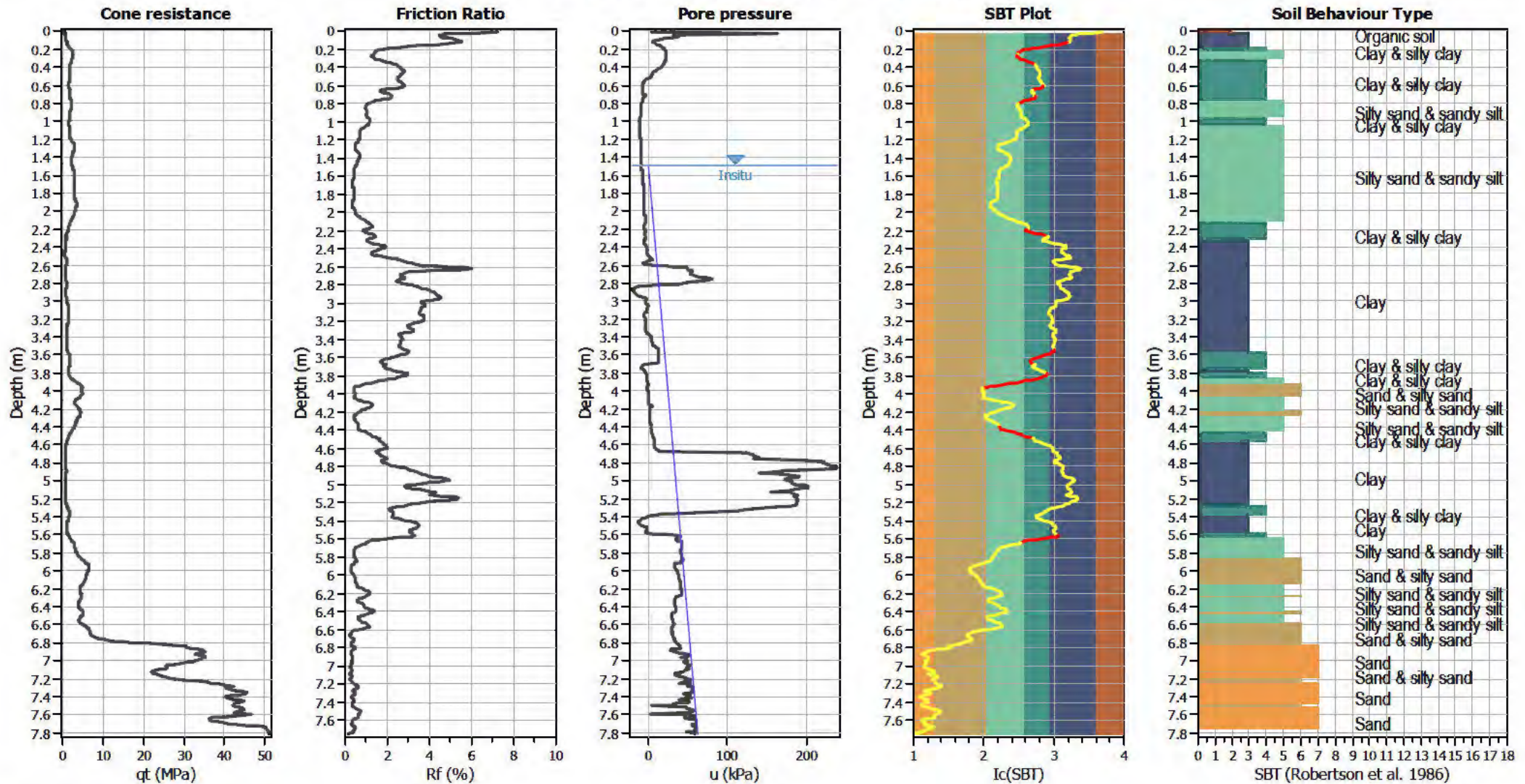
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



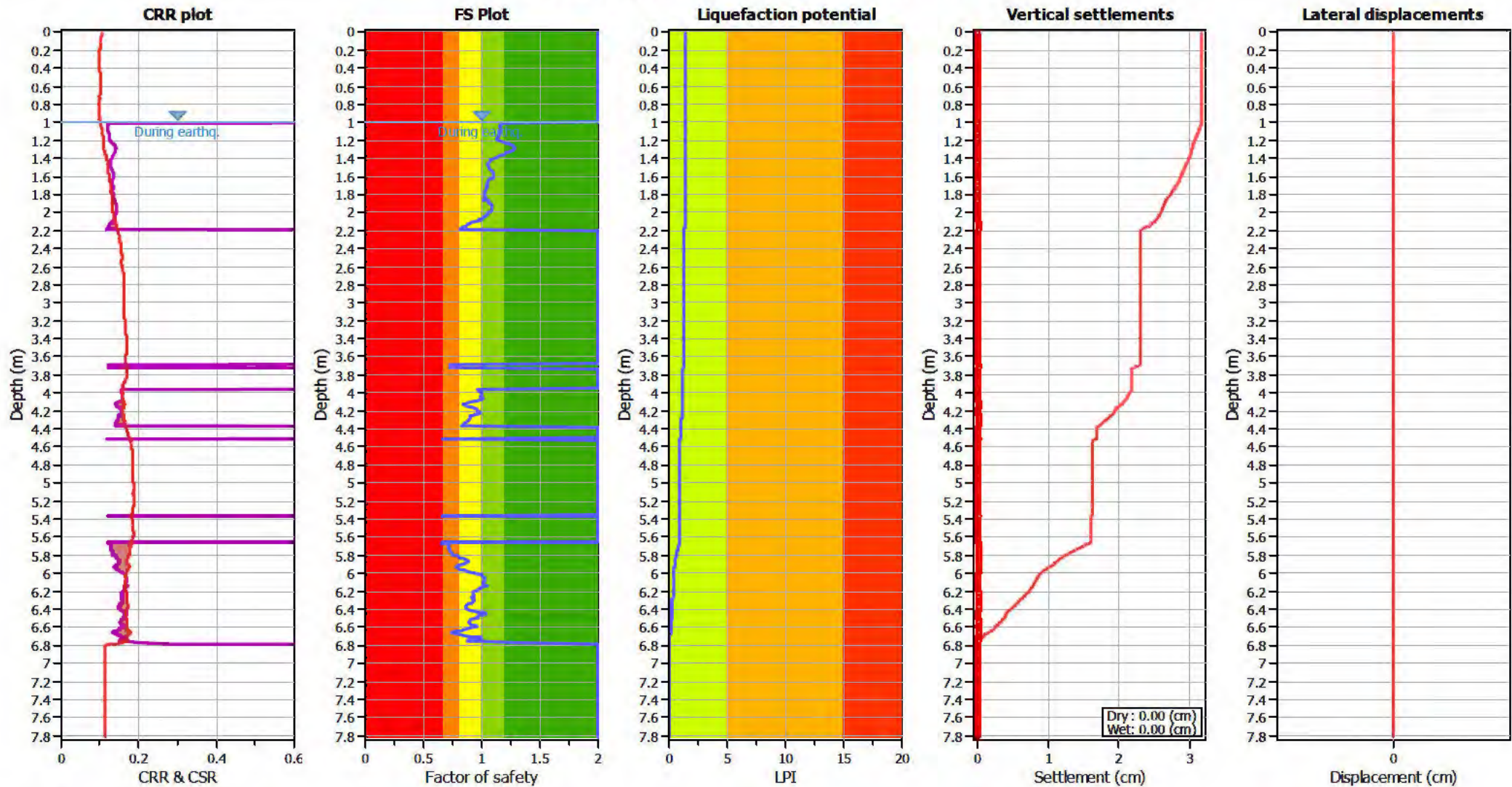
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 6.00
 Peak ground acceleration: 0.19
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

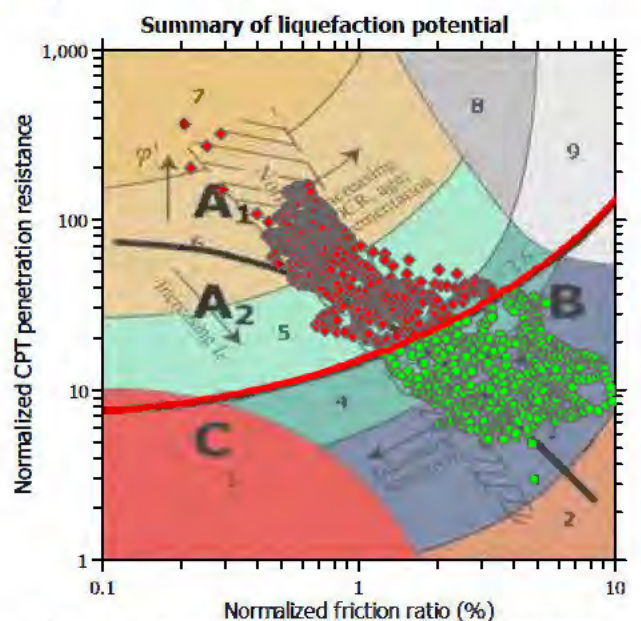
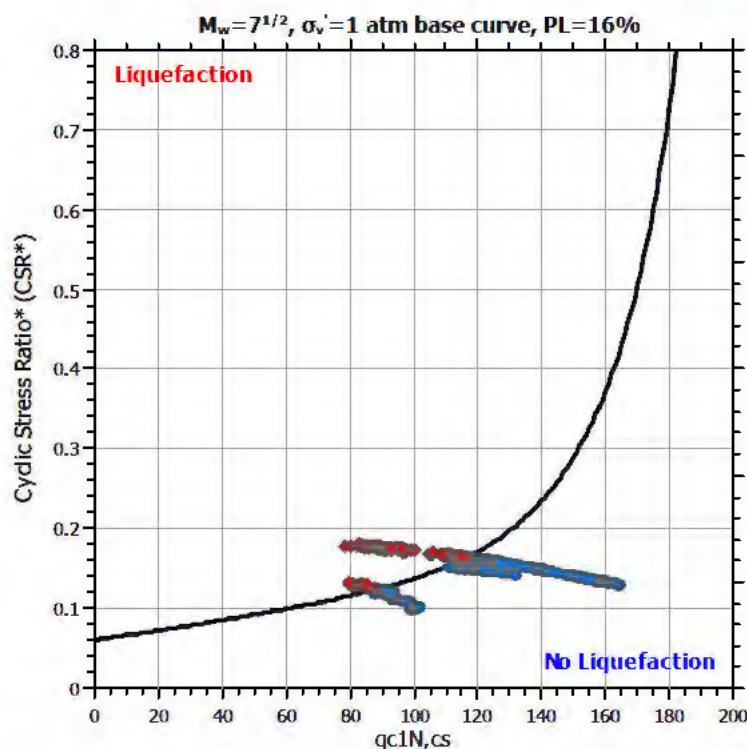
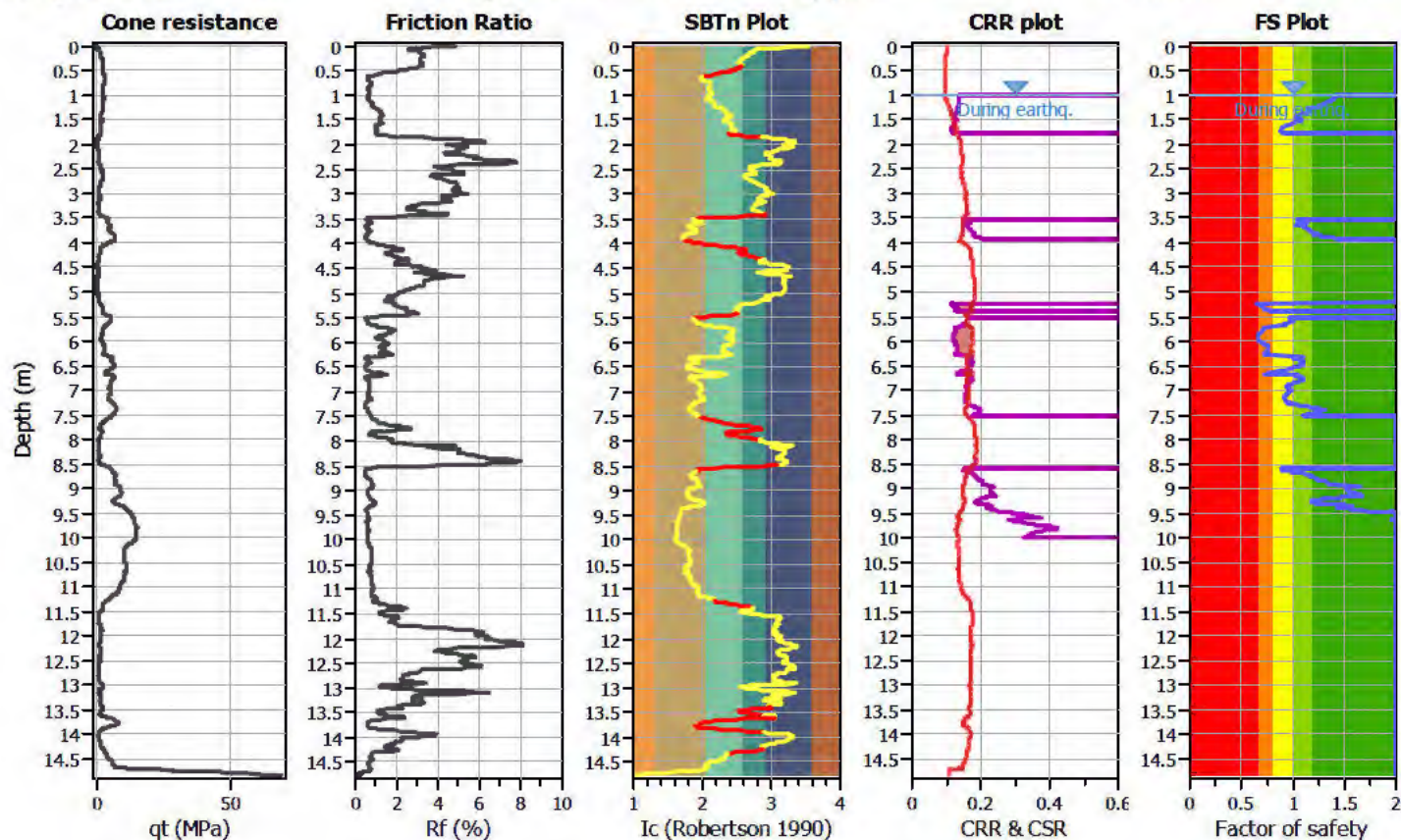
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-17 SLS2

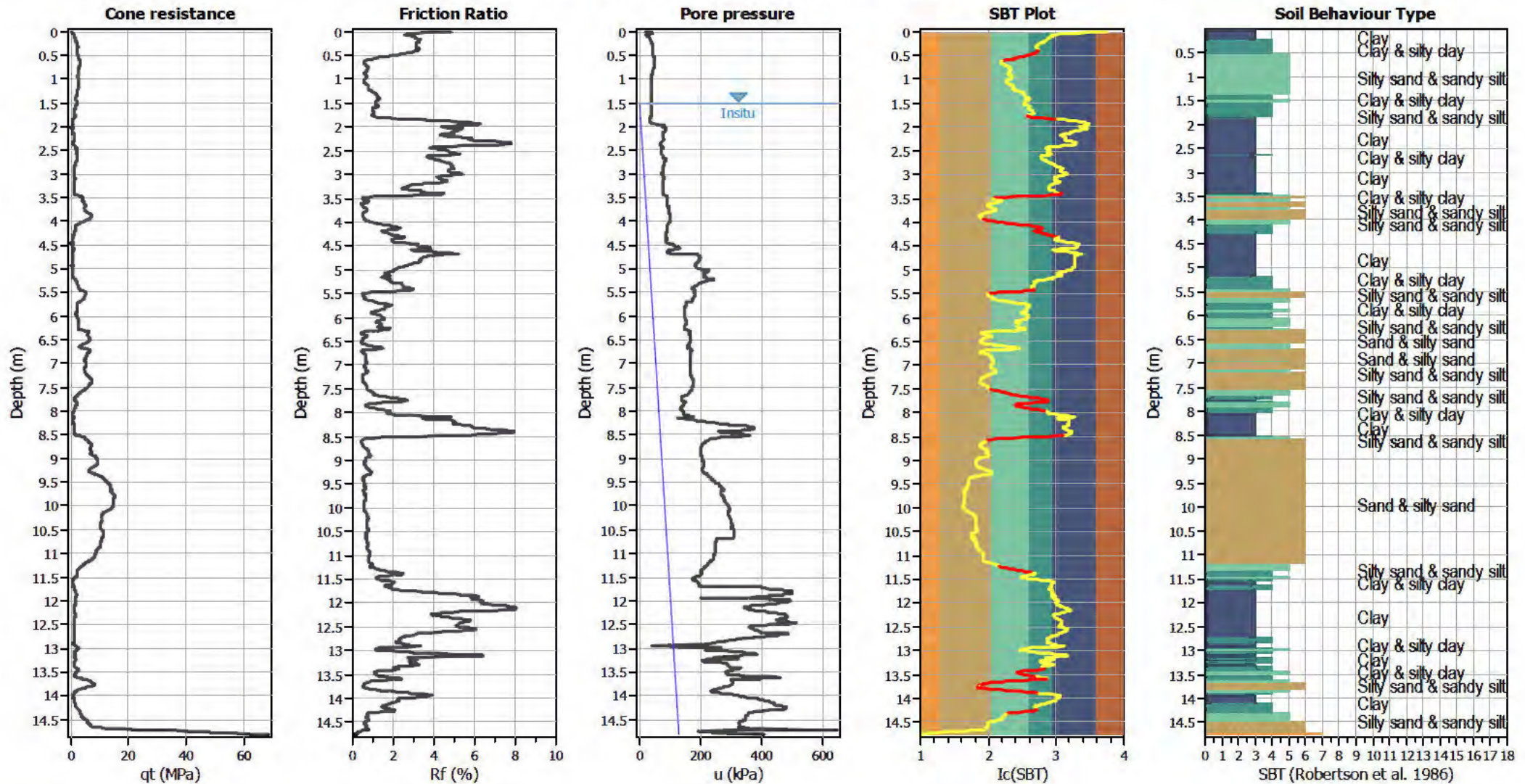
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



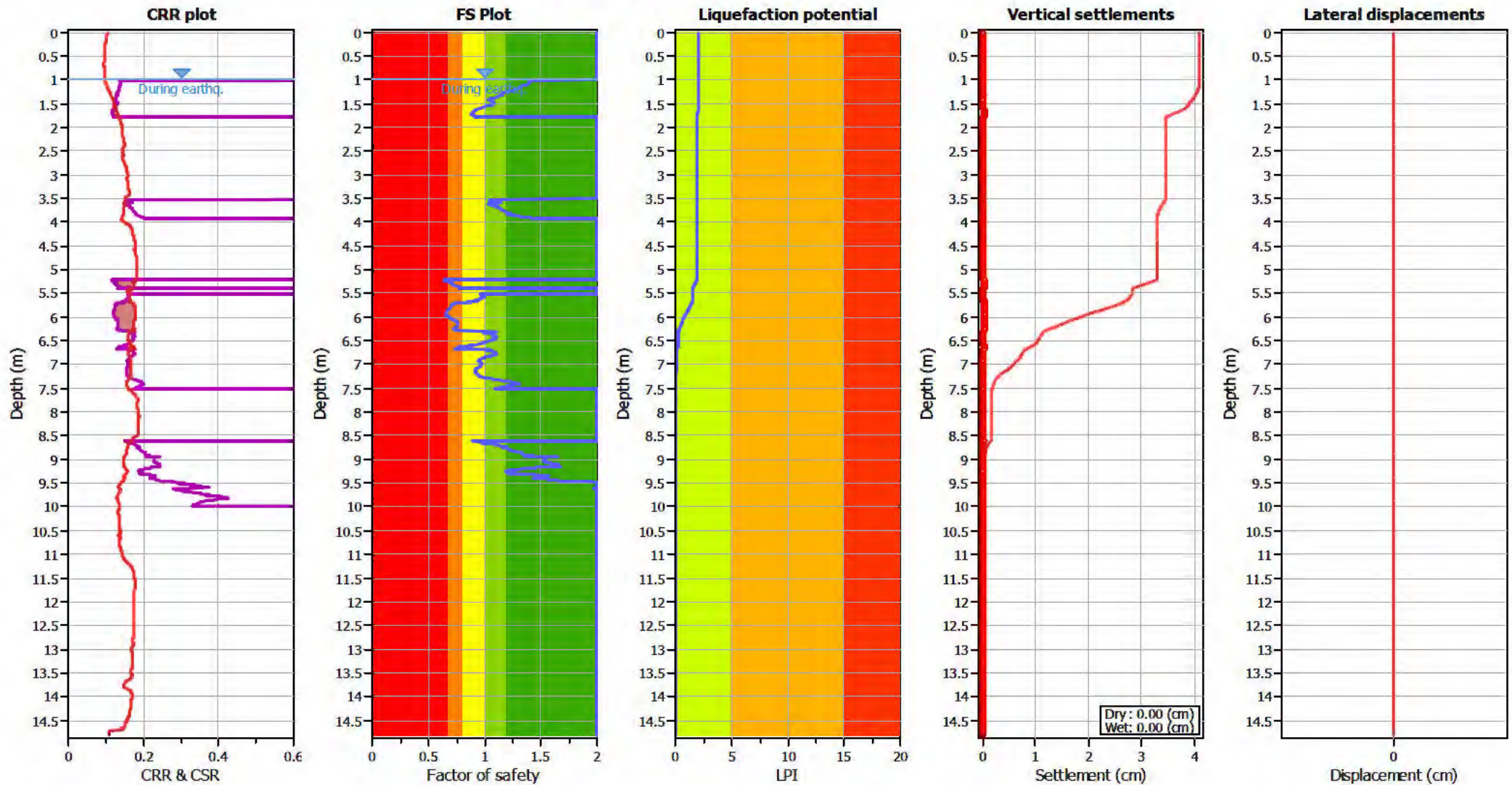
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_o applied:	Yes
Earthquake magnitude M_w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 6.00
 Peak ground acceleration: 0.19
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Red: Almost certain it will liquefy
 Orange: Very likely to liquefy
 Yellow: Liquefaction and no liq. are equally likely
 Green: Unlike to liquefy
 Dark Green: Almost certain it will not liquefy

LPI color scheme

Red: Very high risk
 Orange: High risk
 Yellow: Low risk

LIQUEFACTION ANALYSIS REPORT

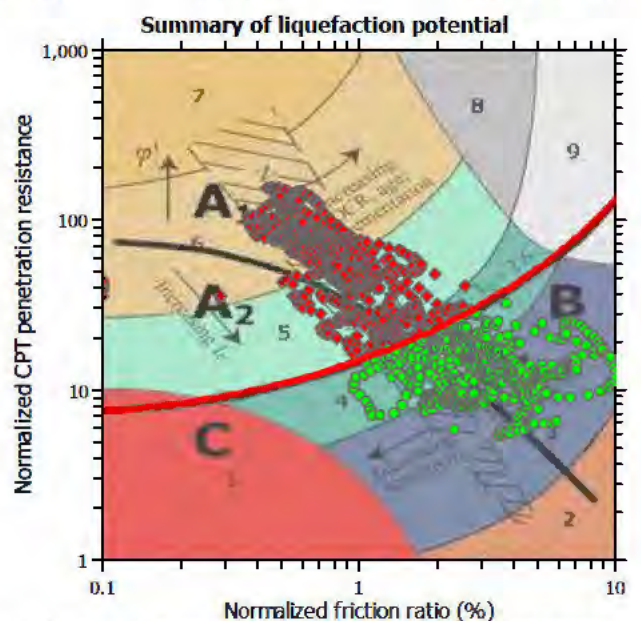
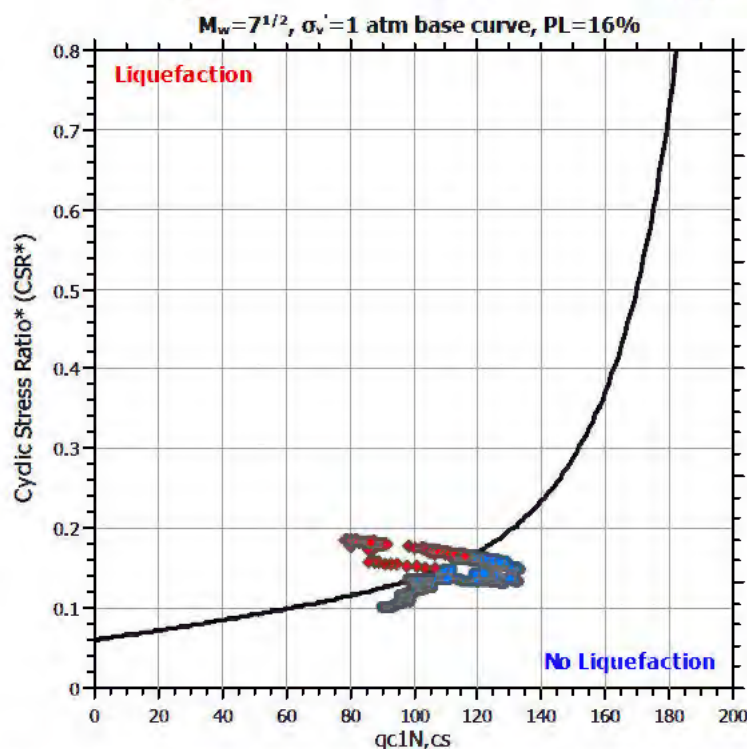
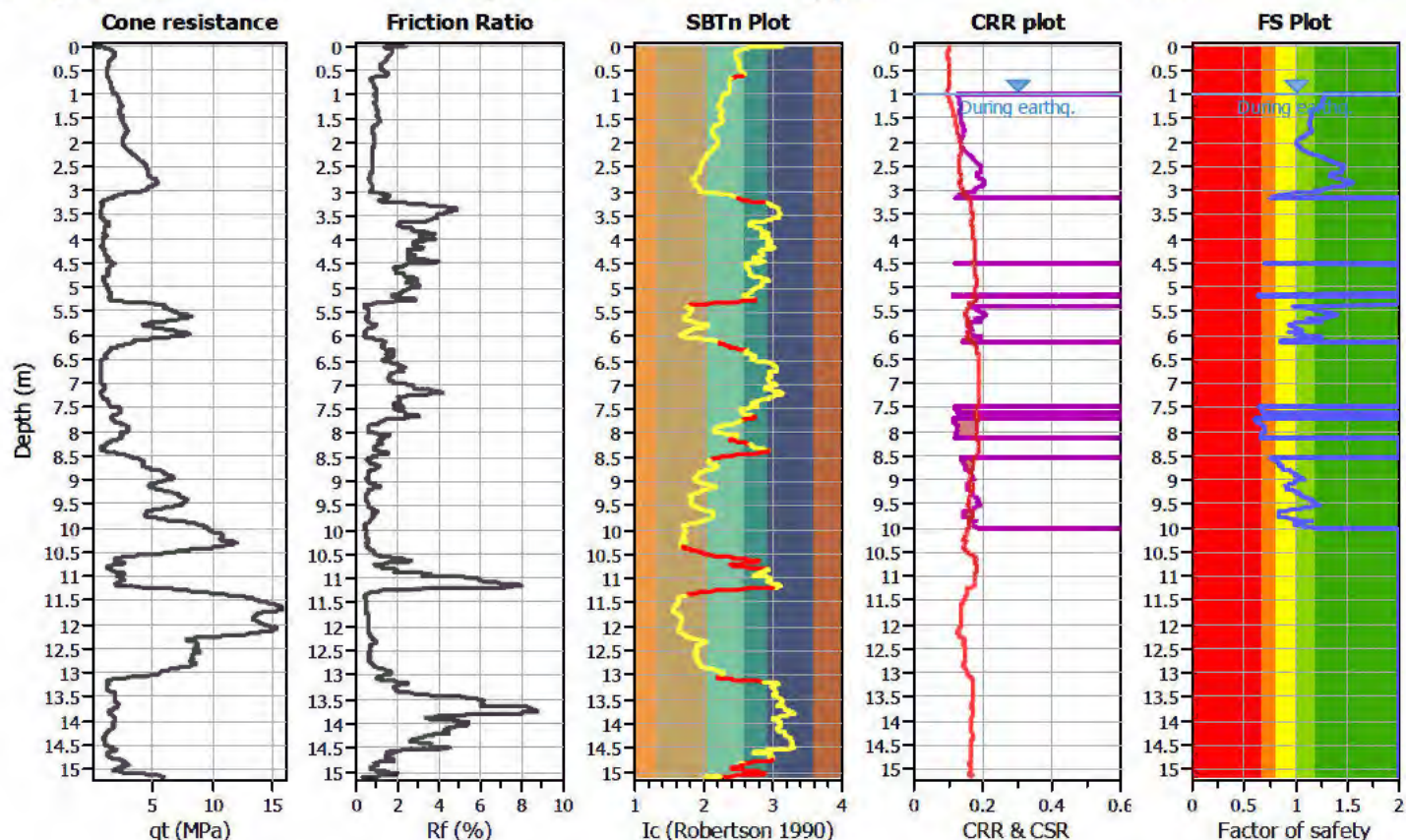
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-18 SLS2

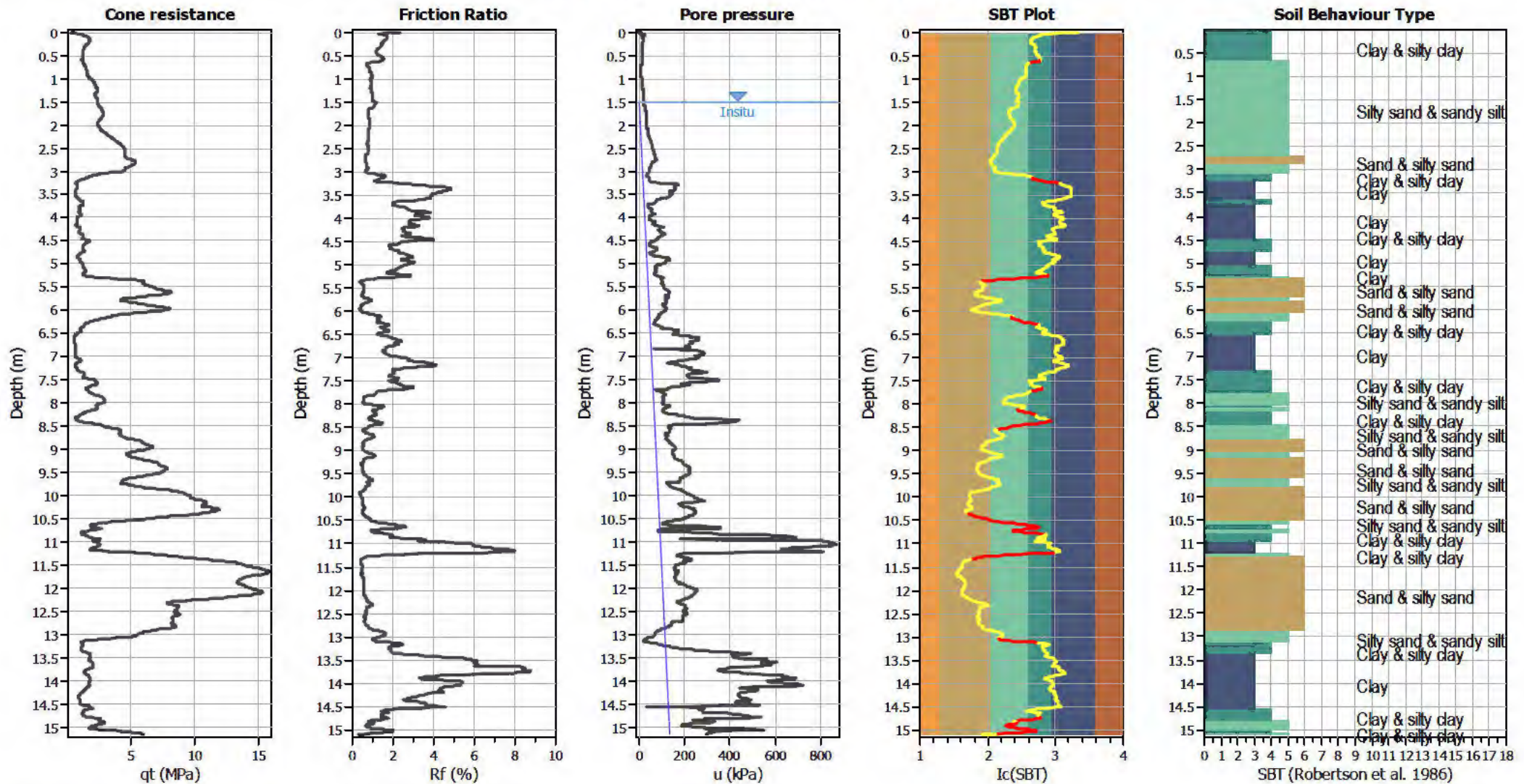
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



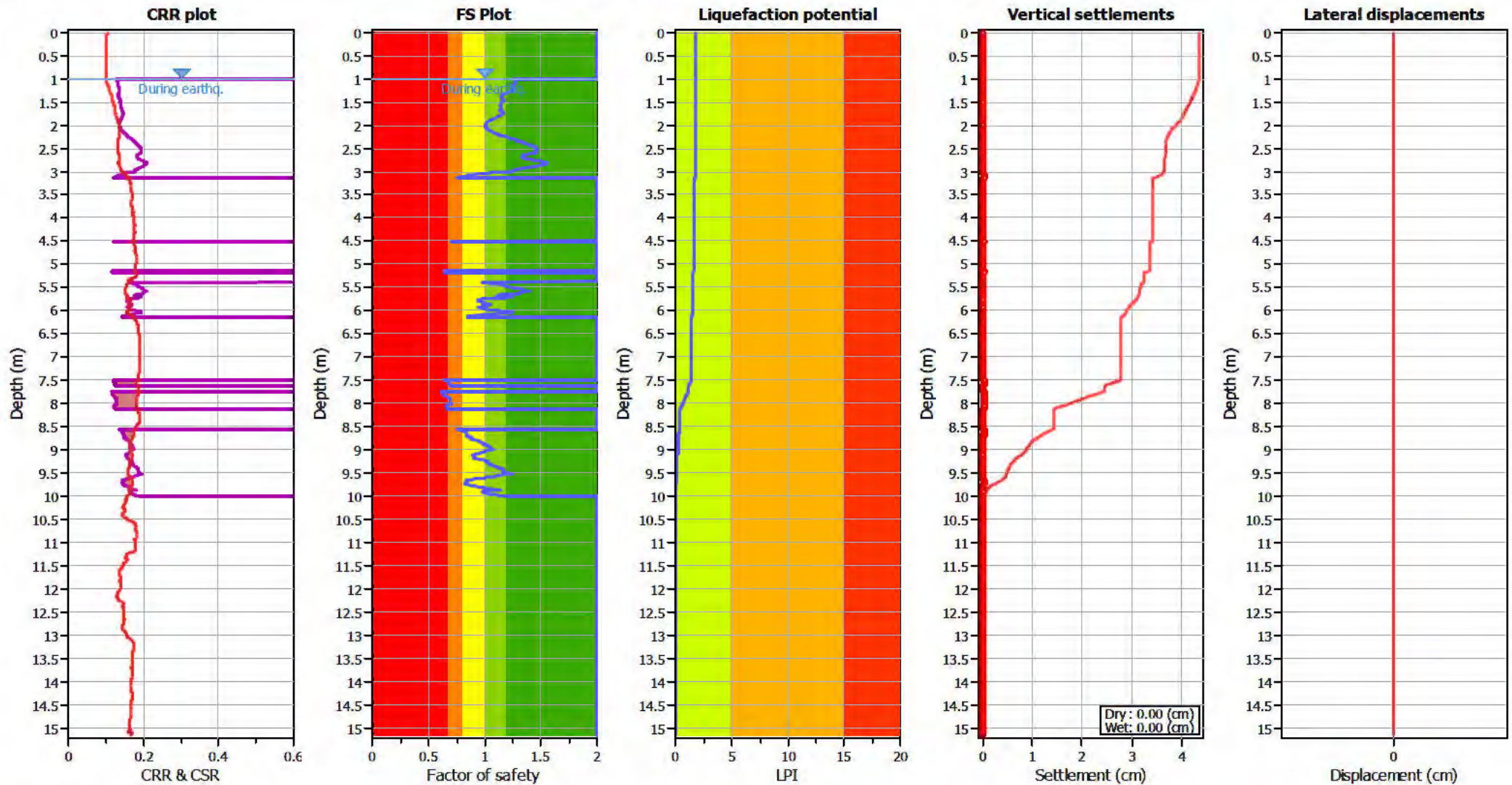
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{α} applied:	Yes
Earthquake magnitude M_w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 6.00
 Peak ground acceleration: 0.19
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

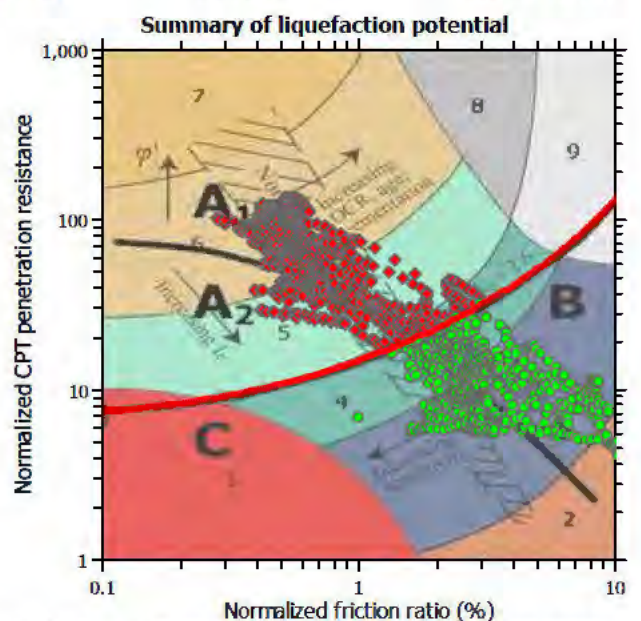
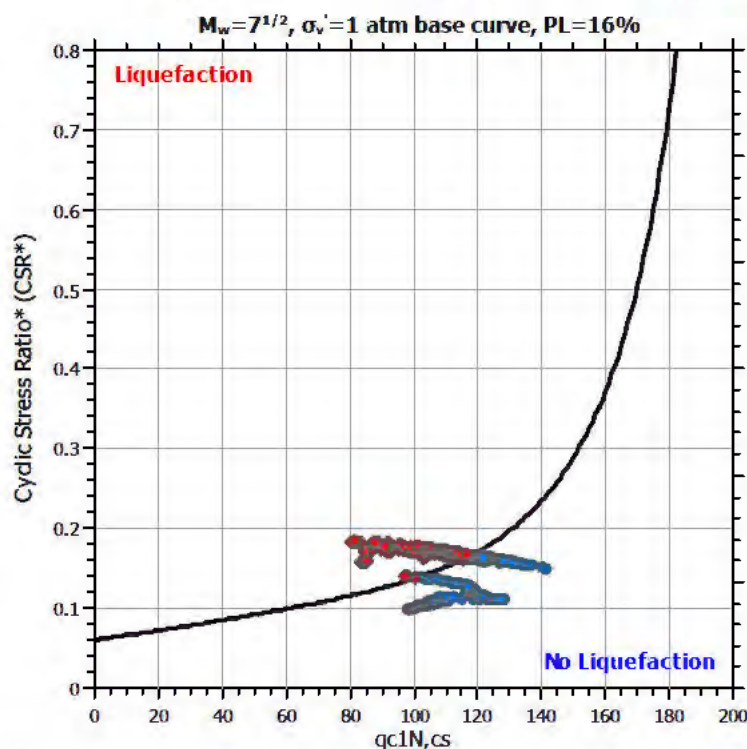
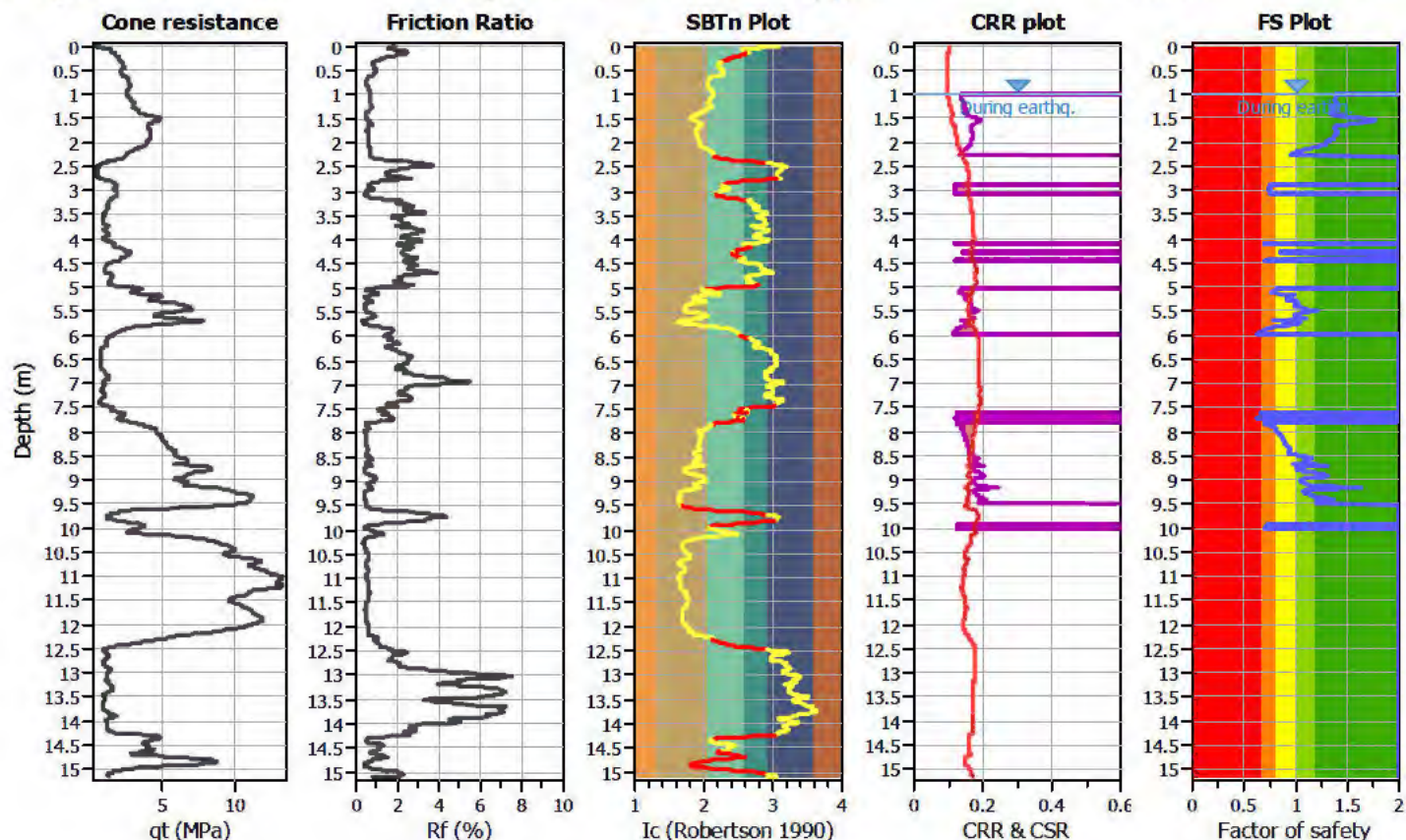
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

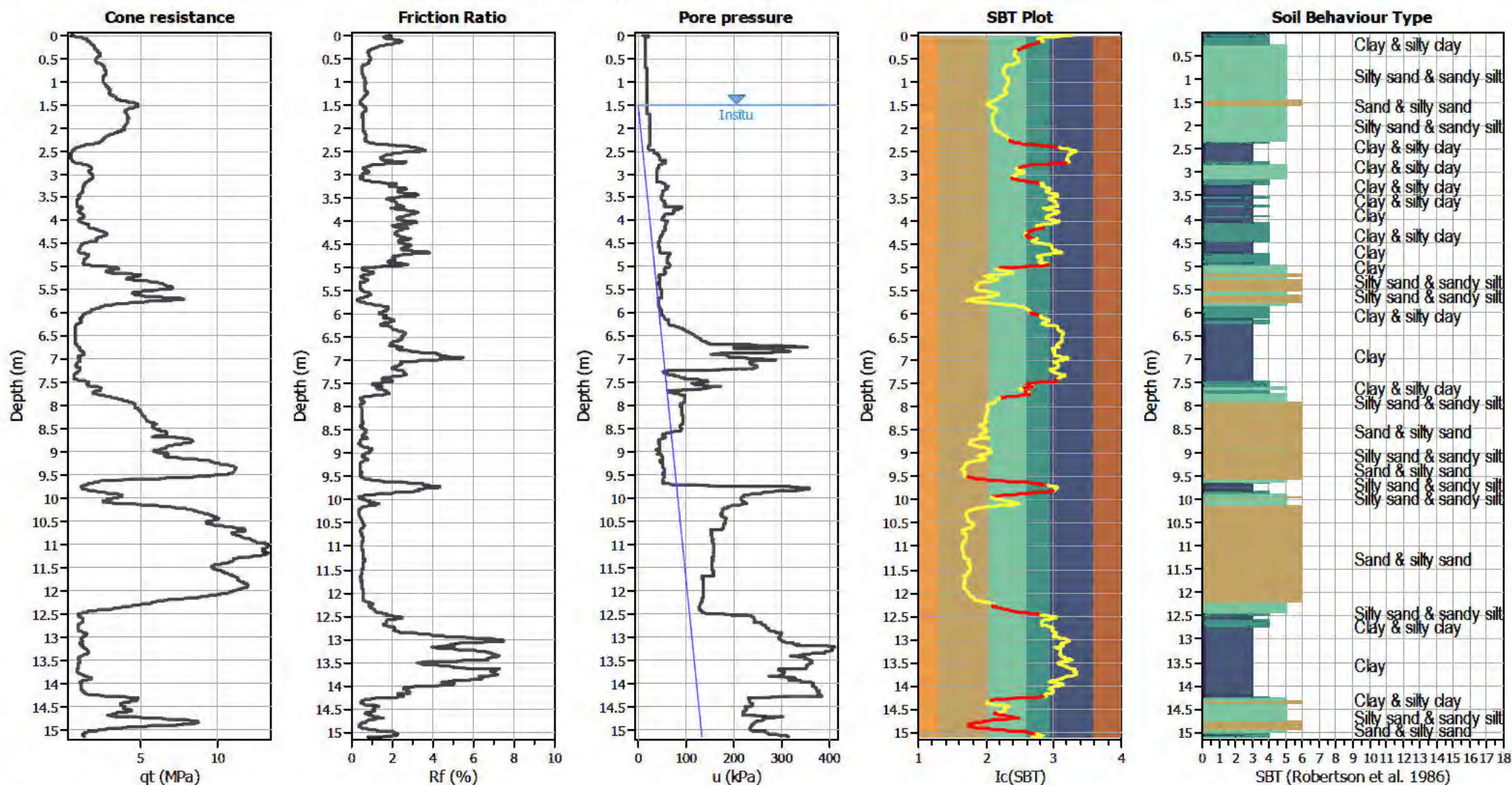
CPT file : CPT-19 SLS2

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry



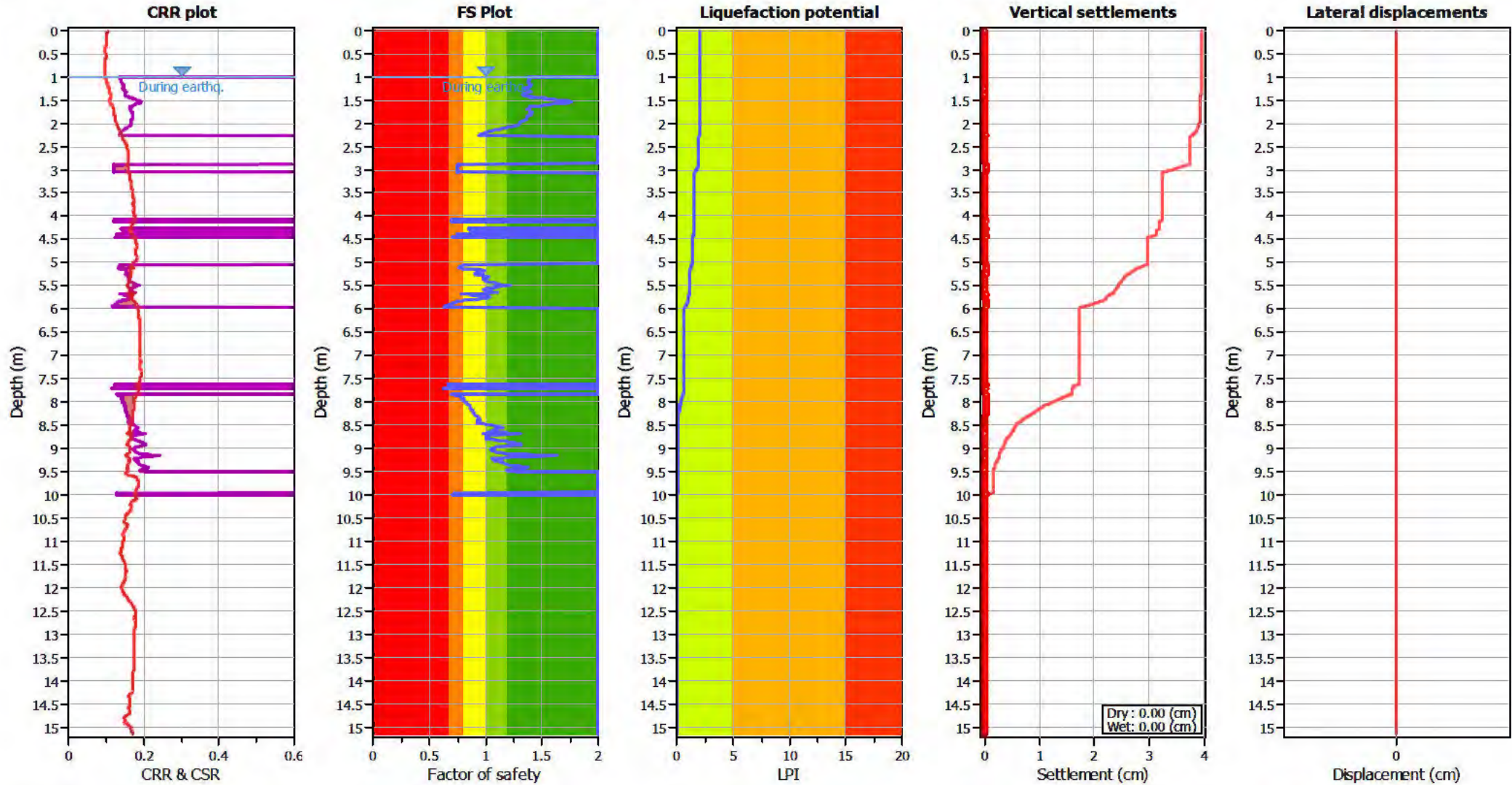
Analysis method:	B&J (2014)
Fines correction method:	B&J (2014)
Points to test:	Based on Ic value
Earthquake magnitude M_w :	6.00
Peak ground acceleration:	0.19
Depth to water table (instu):	1.50 m

Depth to GWT (erthq.):	1.00 m
Average results interval:	3
Ic cut-off value:	2.60
Unit weight calculation:	Based on
Use fill:	No
Fill height:	N/A

Fill weight:	N/A
Transition detect. applied:	Yes
K _o applied:	Yes
Clay like behavior applied:	Sands only
Limit depth applied:	Yes
Limit depth:	10.00 m

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude M_w : 6.00
Peak ground acceleration: 0.19
Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: Yes
 K_{σ} applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: Yes
Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
Very likely to liquefy
Liquefaction and no liq. are equally likely
Unlike to liquefy
Almost certain it will not liquefy

LPI color scheme

Very high risk
High risk
Low risk

LIQUEFACTION ANALYSIS REPORT

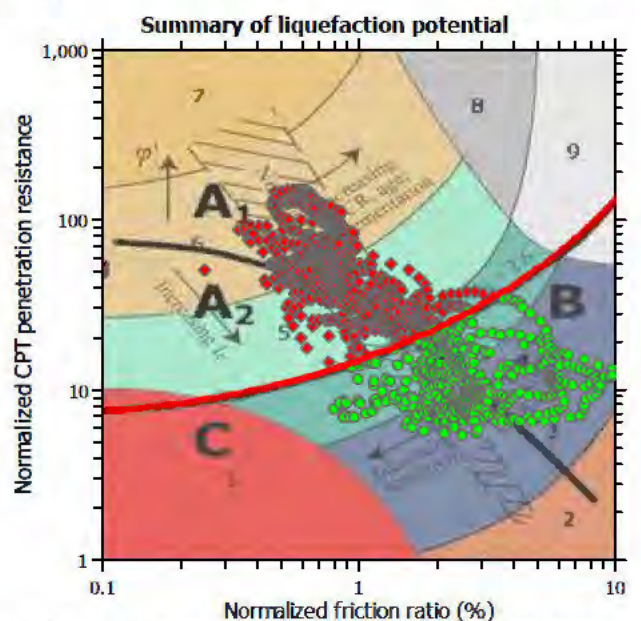
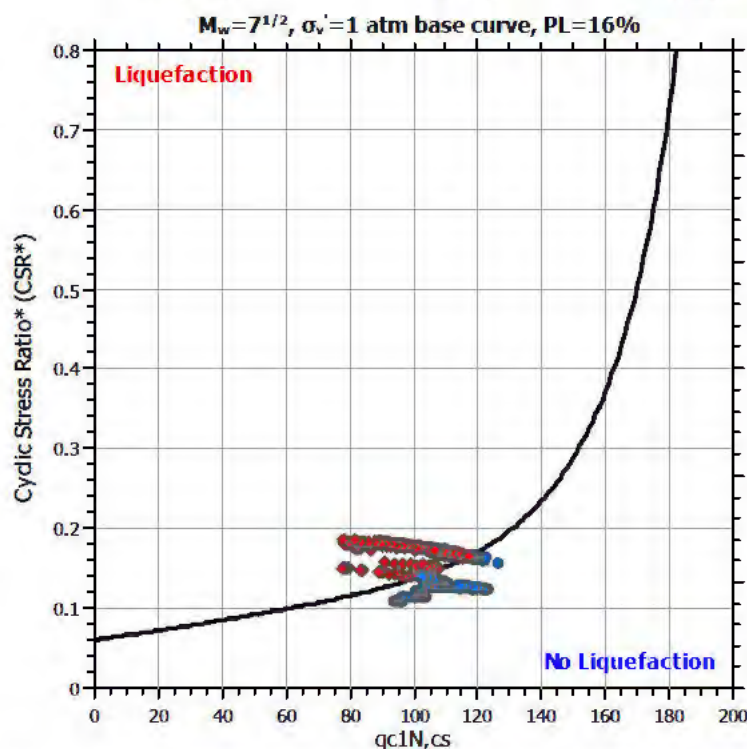
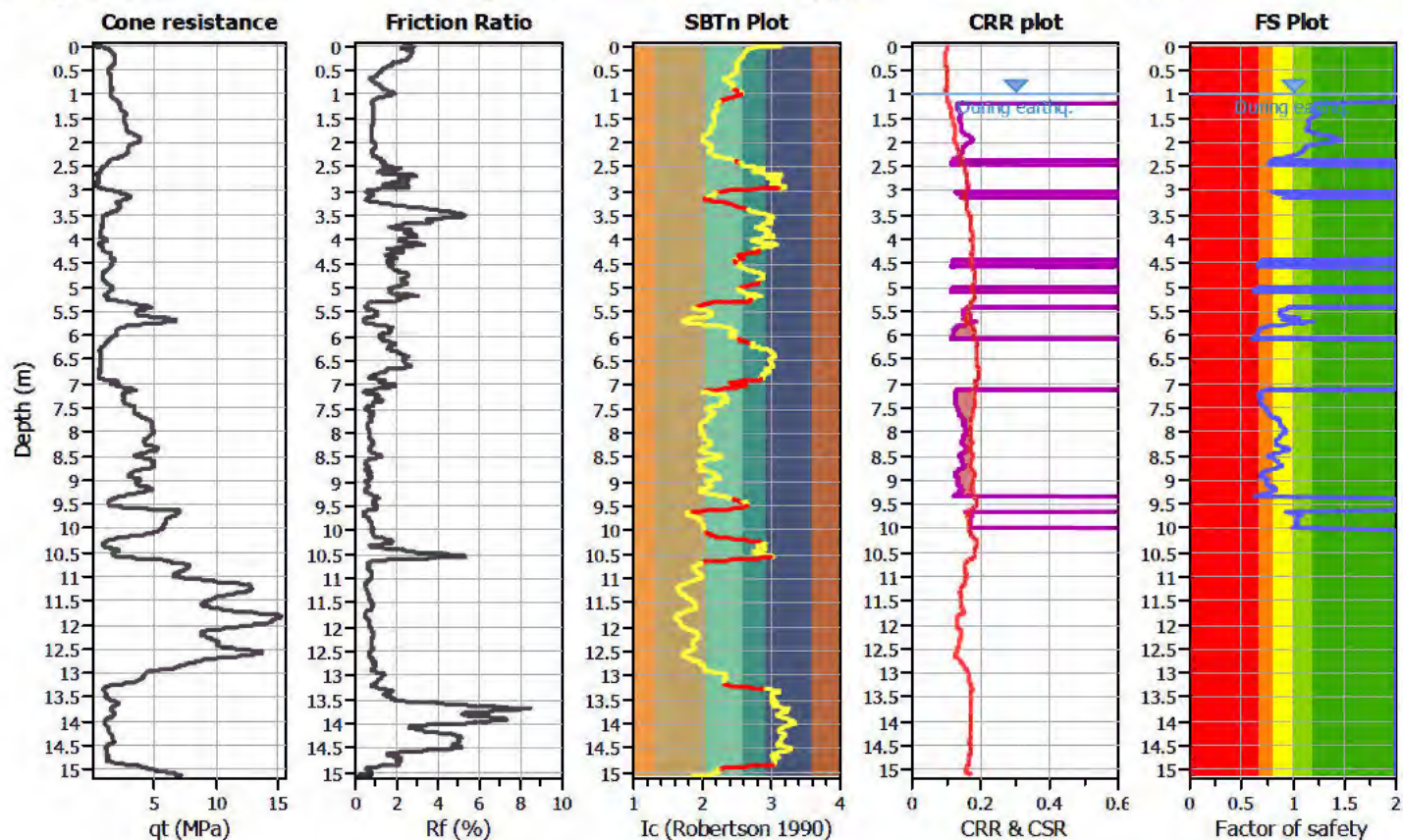
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-20 SLS2

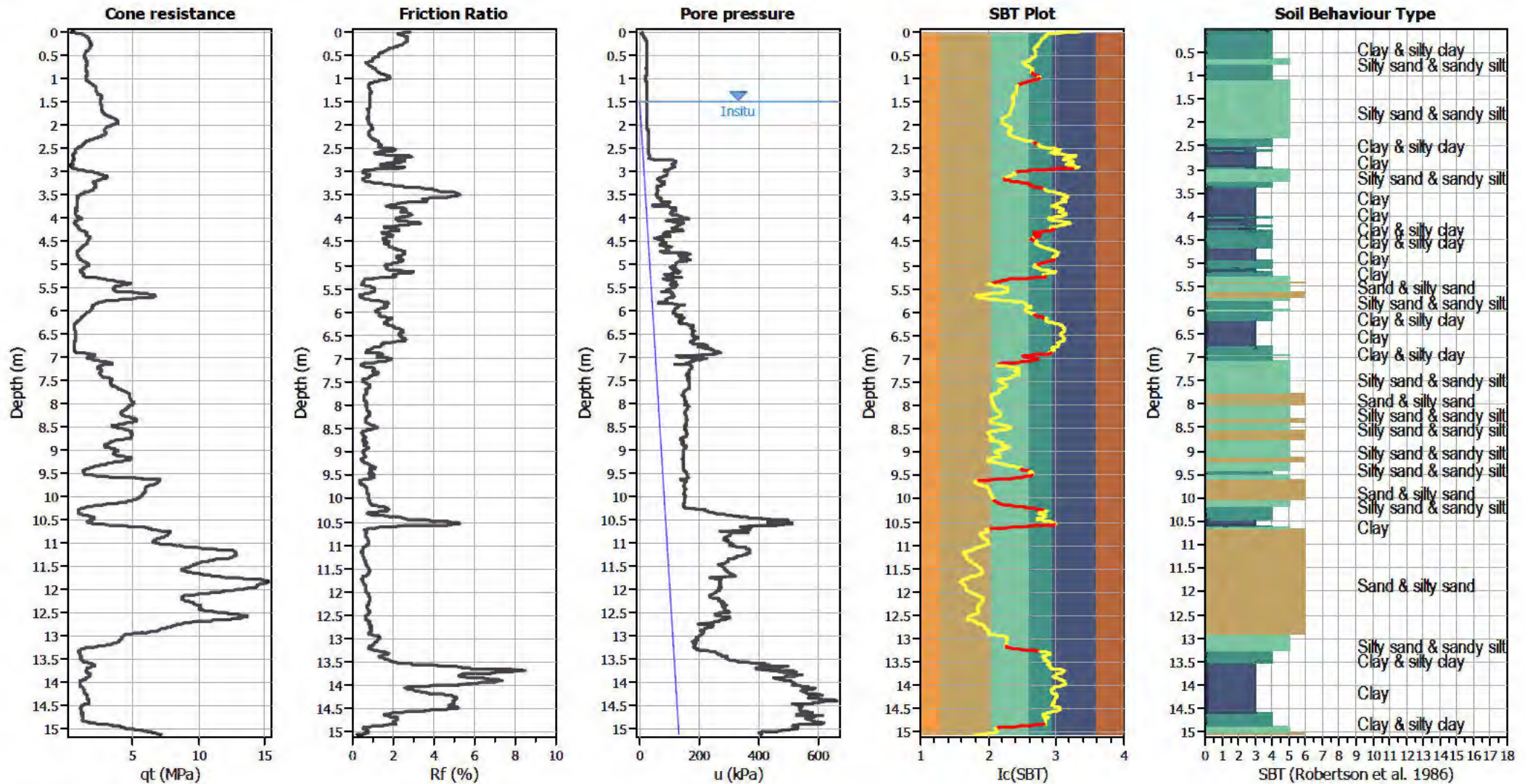
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



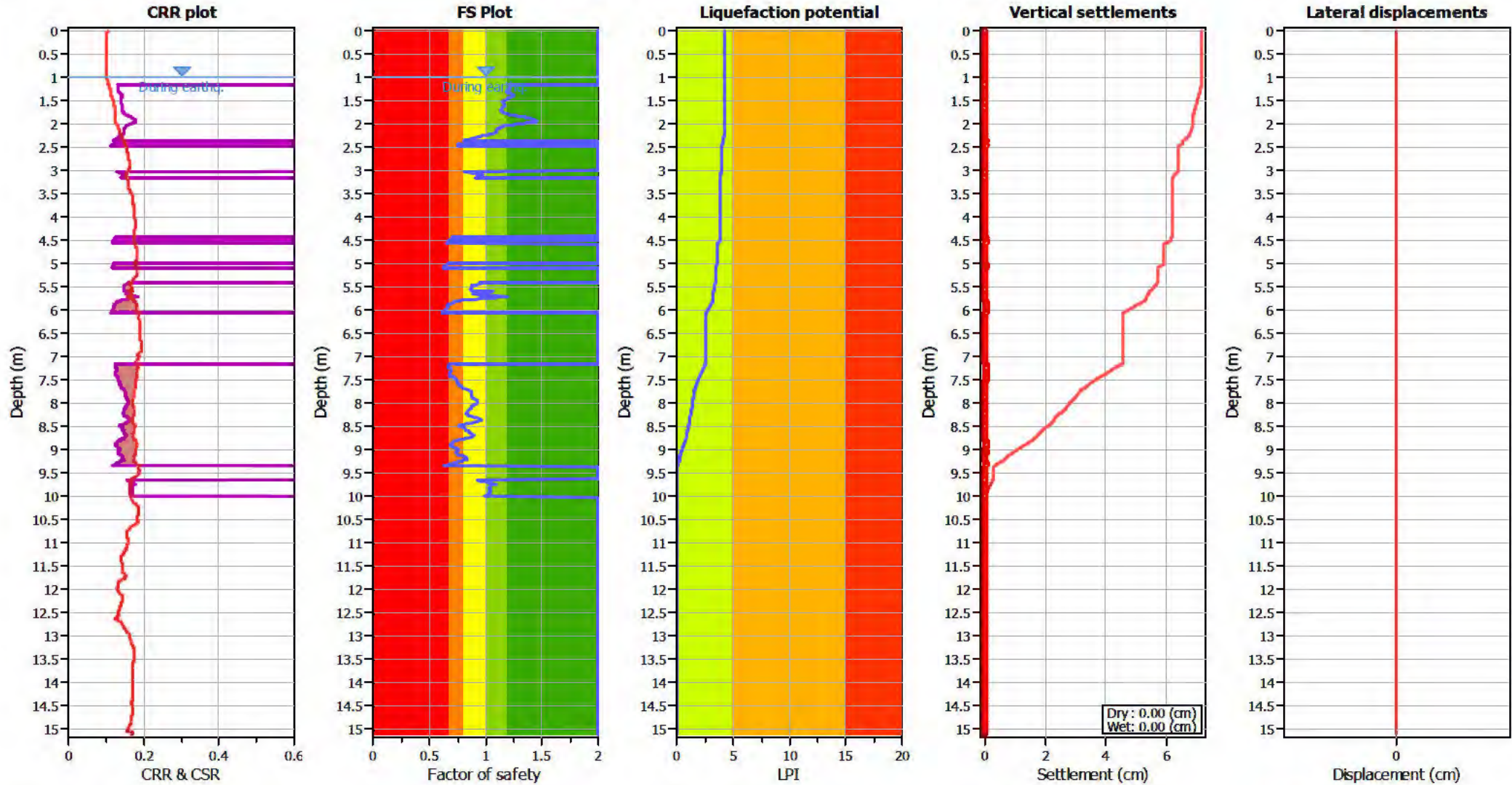
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{α} applied:	Yes
Earthquake magnitude M_w :	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude M_w : 6.00
Peak ground acceleration: 0.19
Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: Yes
 K_{σ} applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: Yes
Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
Very likely to liquefy
Liquefaction and no liq. are equally likely
Unlike to liquefy
Almost certain it will not liquefy

LPI color scheme

Very high risk
High risk
Low risk

LIQUEFACTION ANALYSIS REPORT

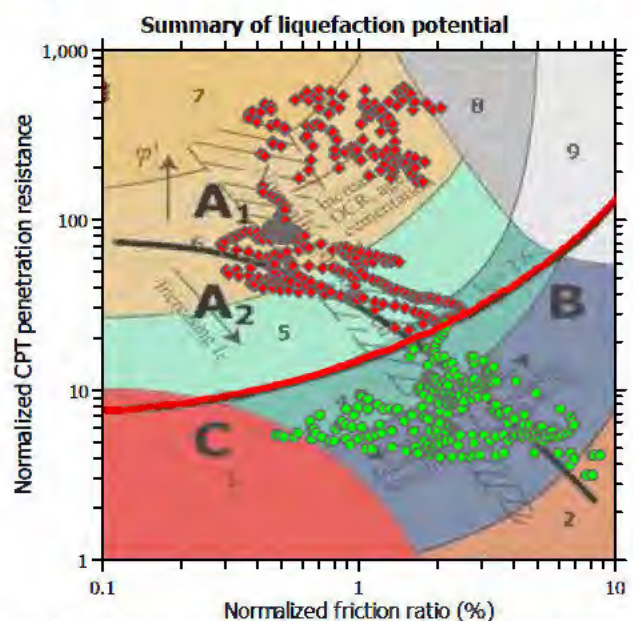
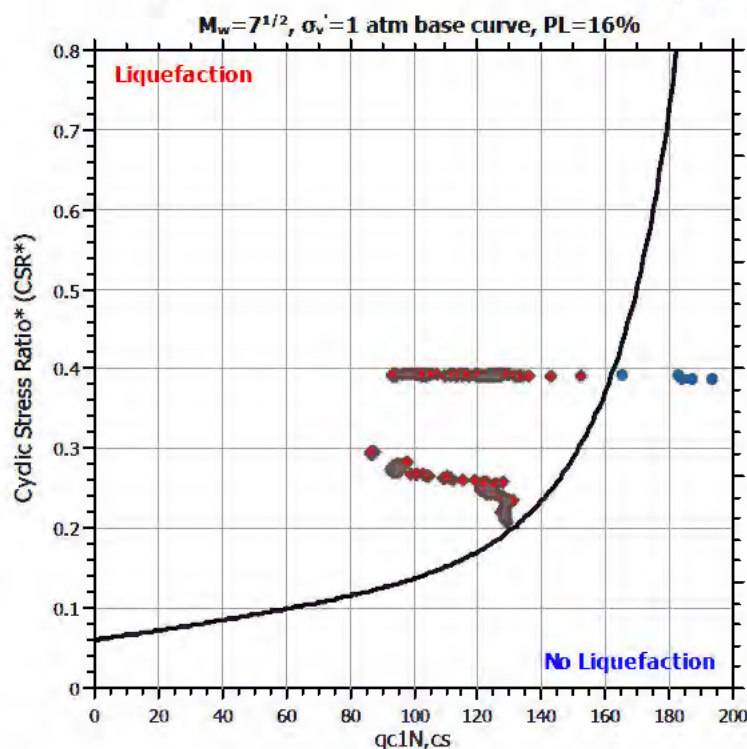
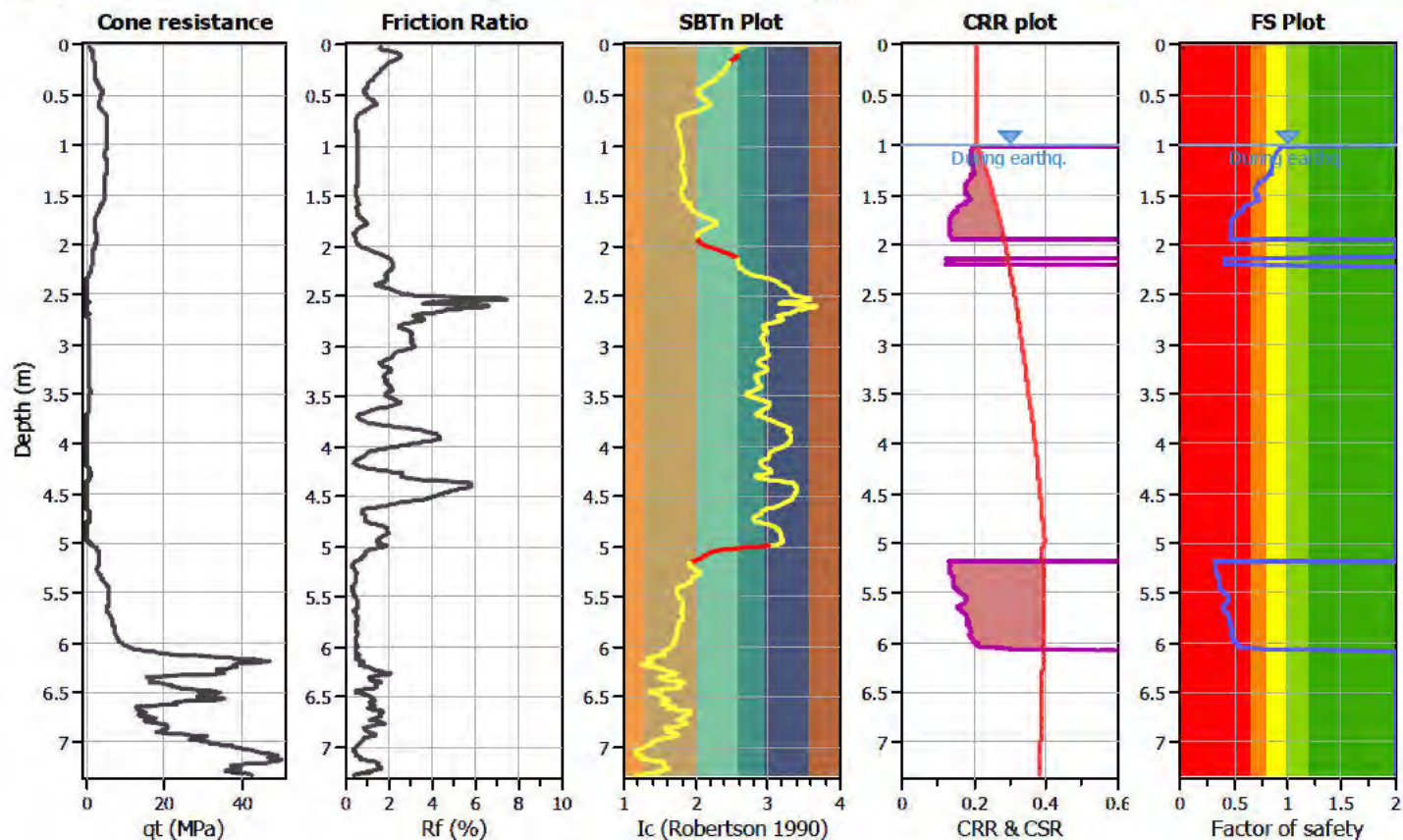
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-01 ULS

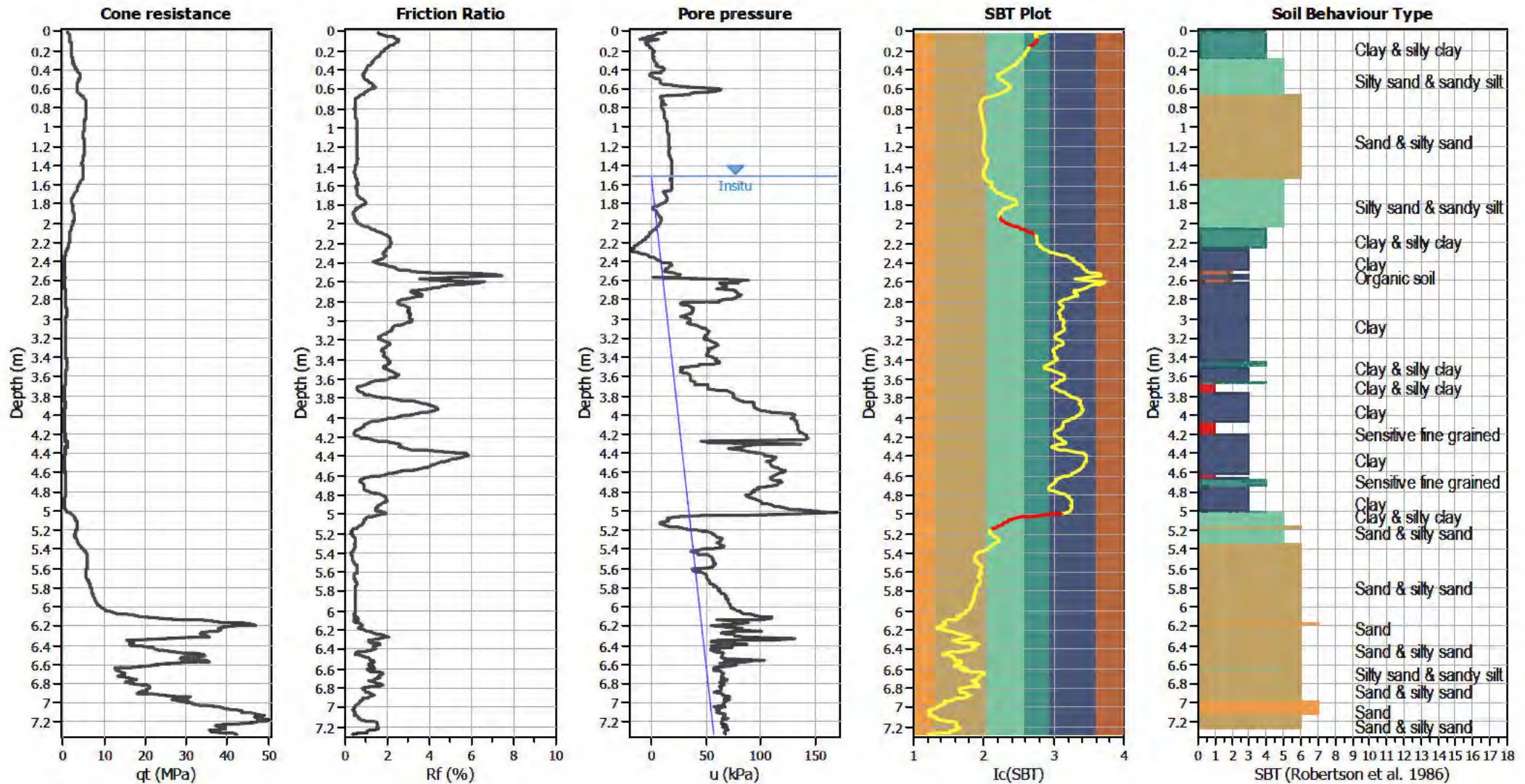
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



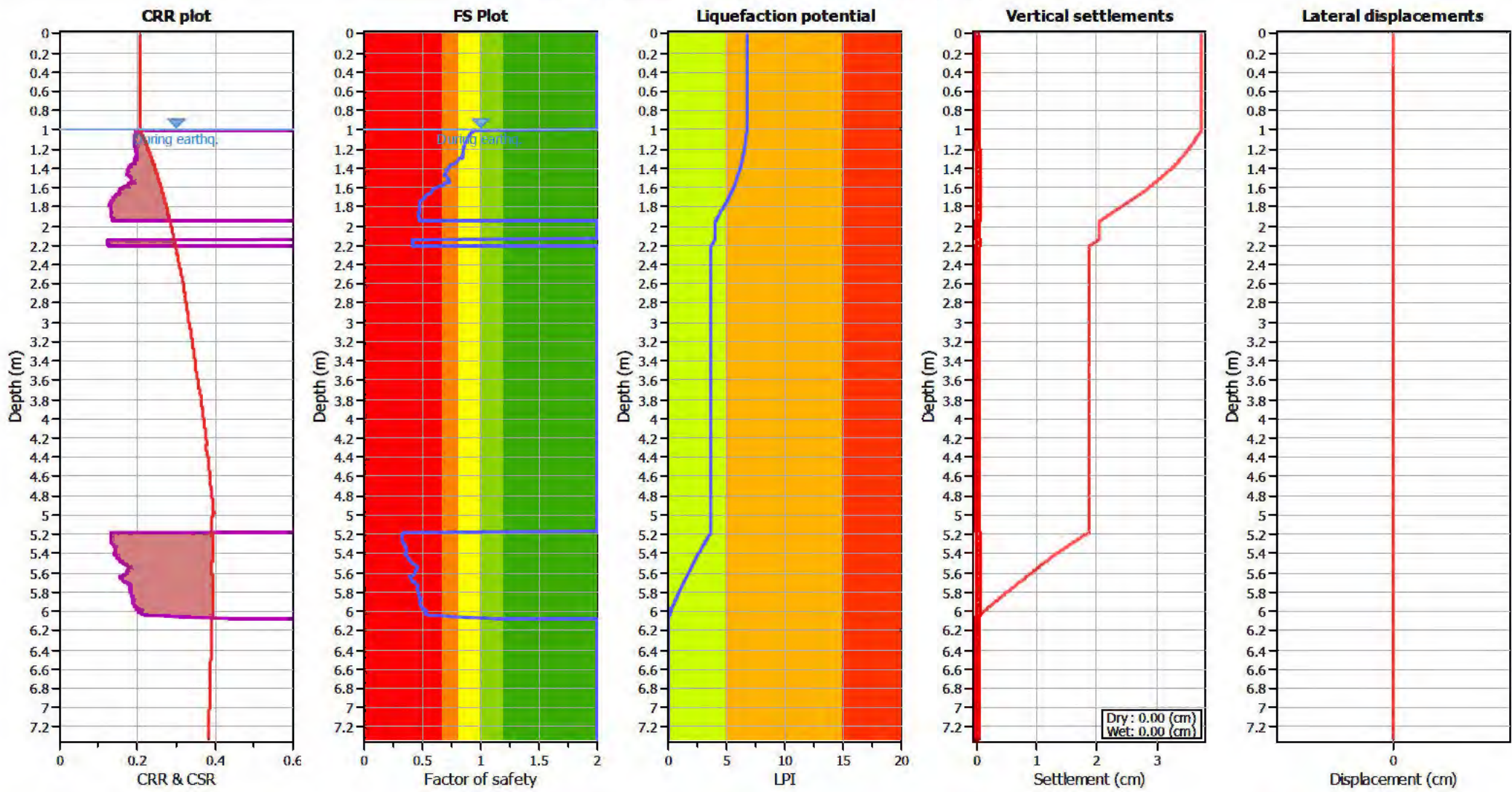
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (earthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _σ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

LIQUEFACTION ANALYSIS REPORT

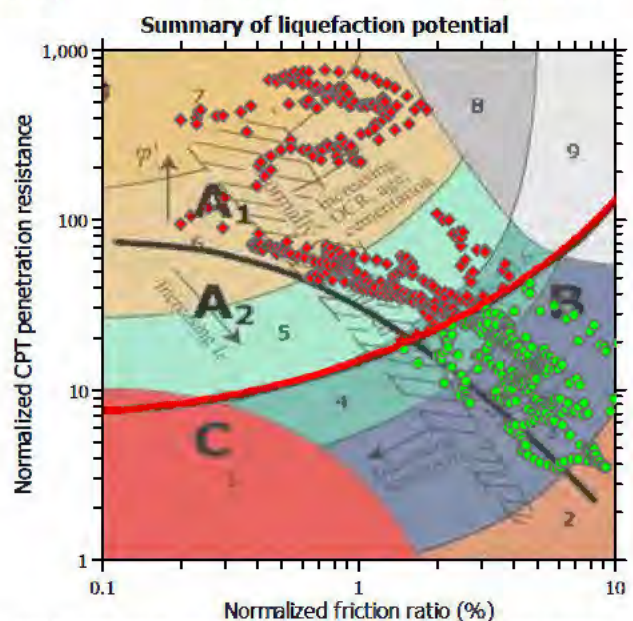
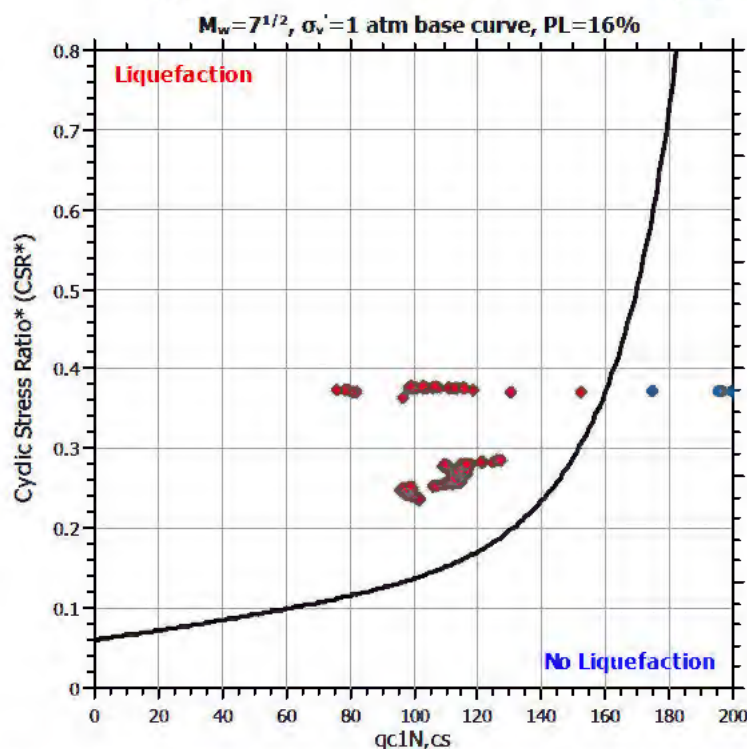
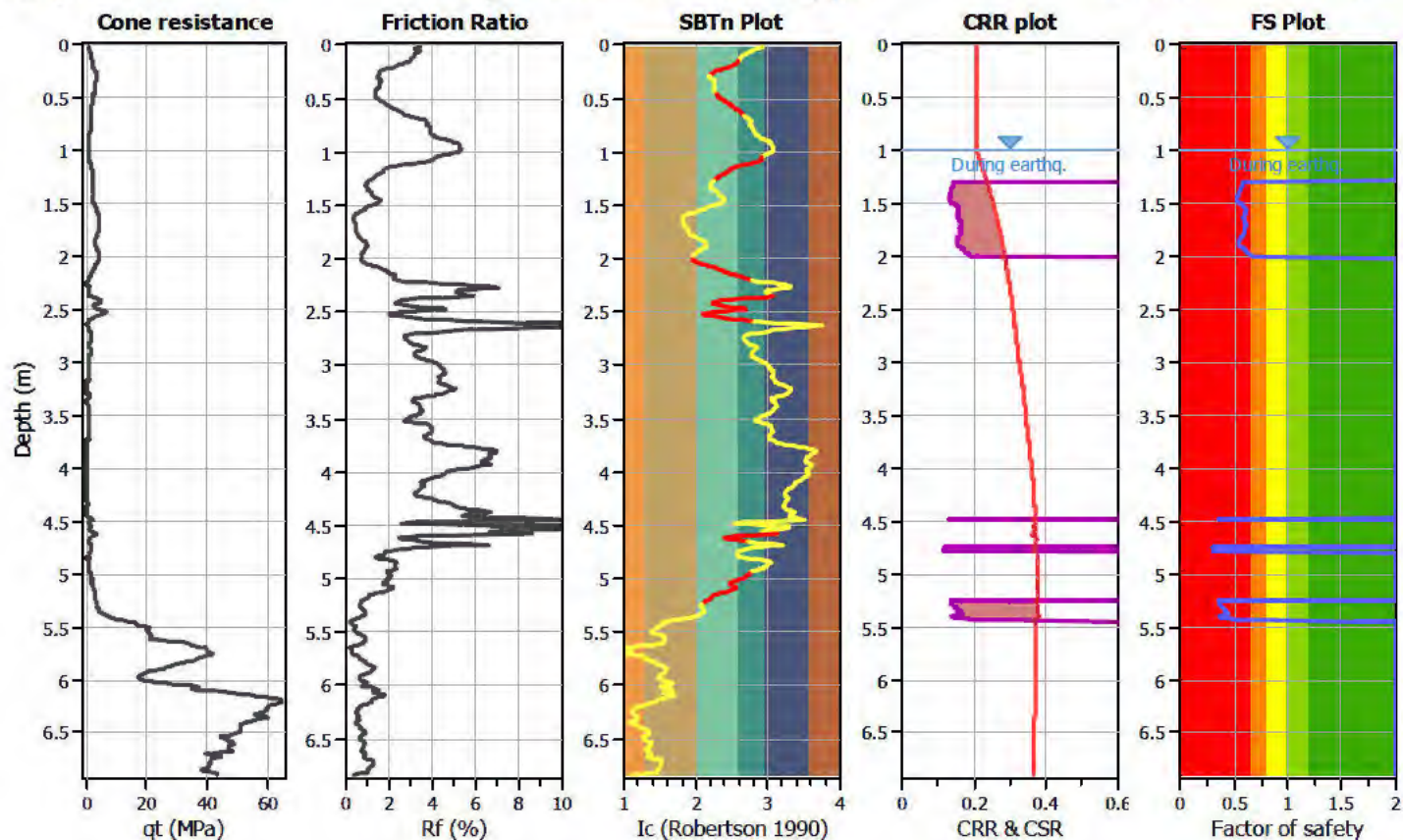
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-02 ULS

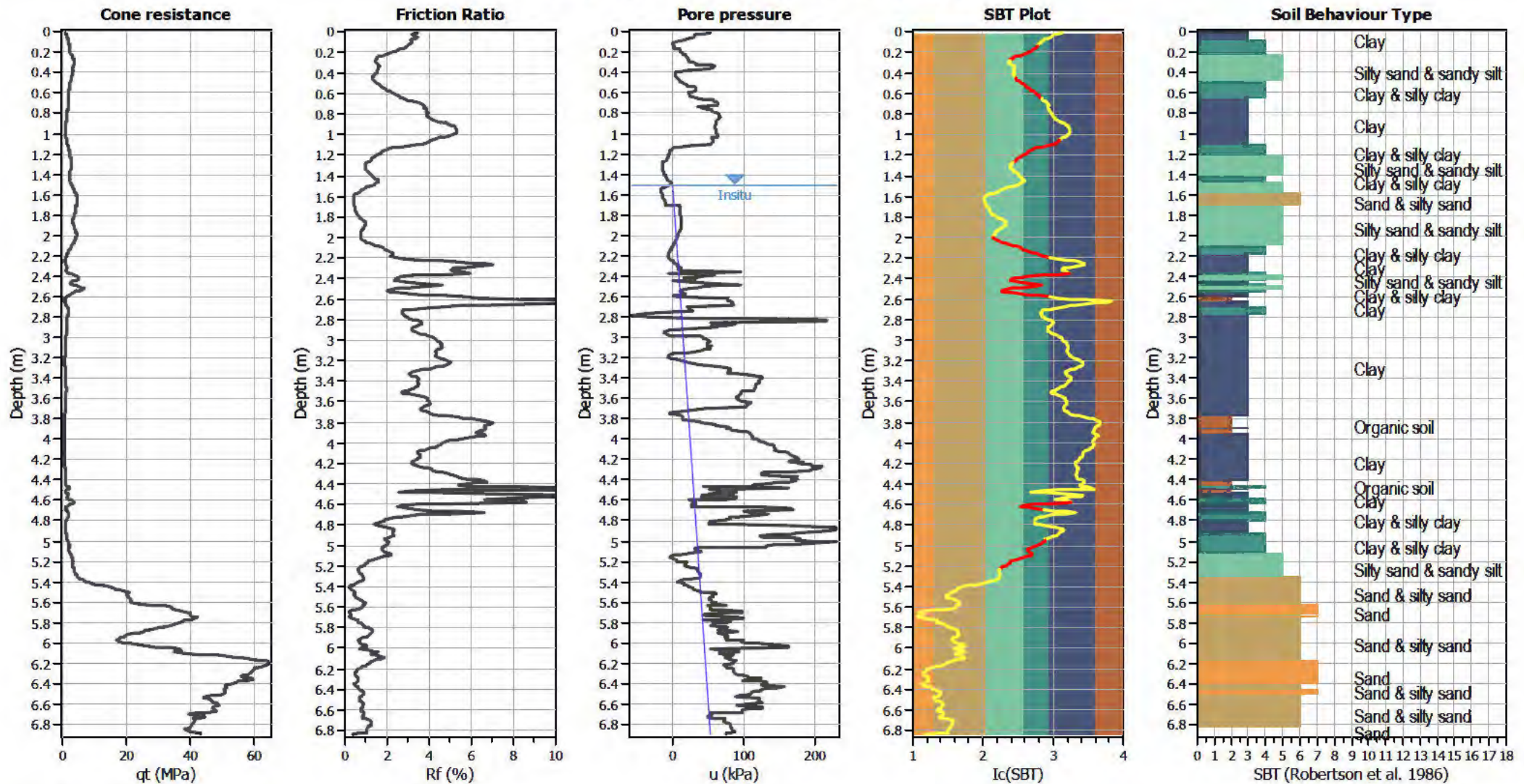
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



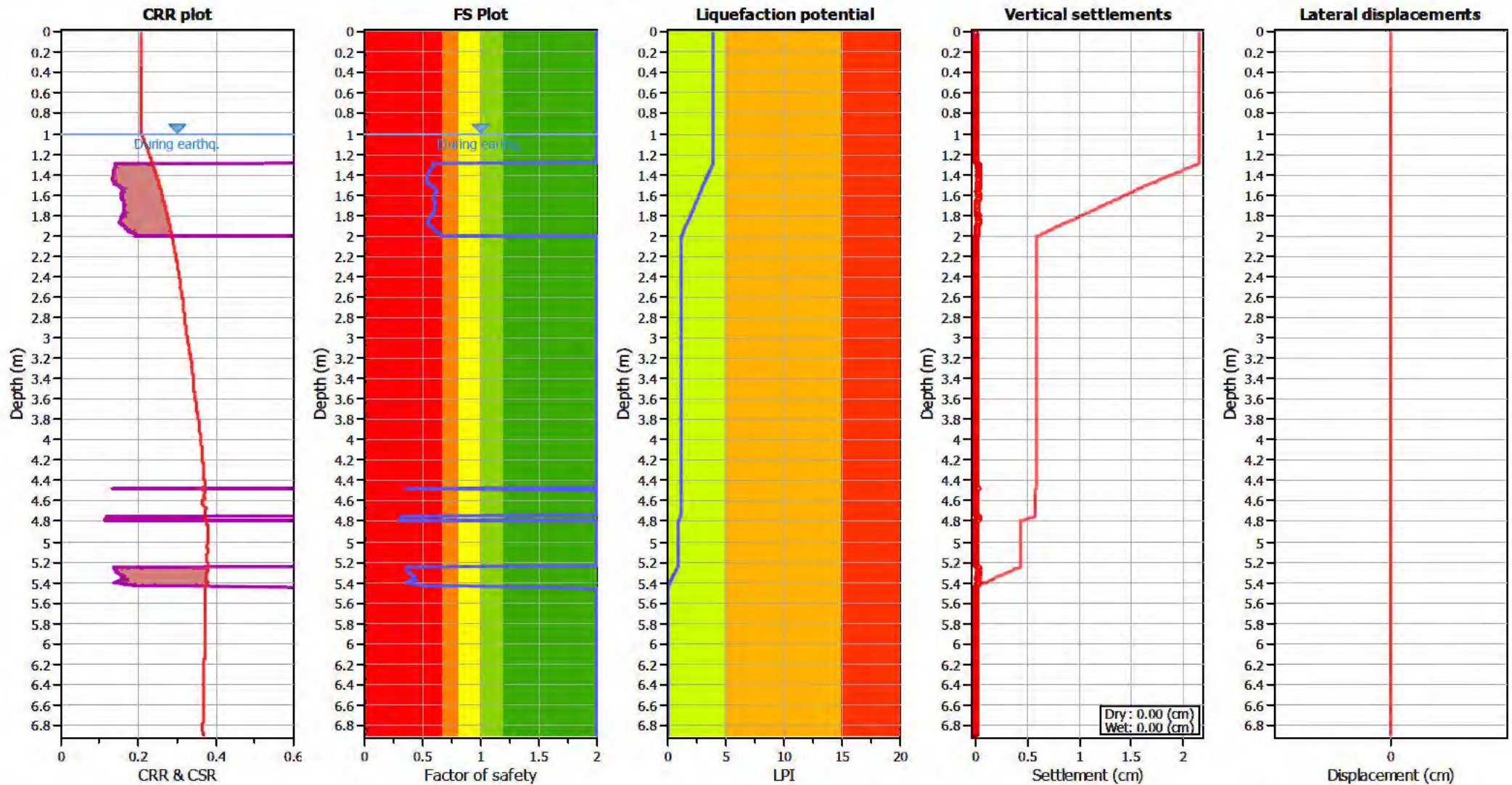
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _o applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 7.50
 Peak ground acceleration: 0.35
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

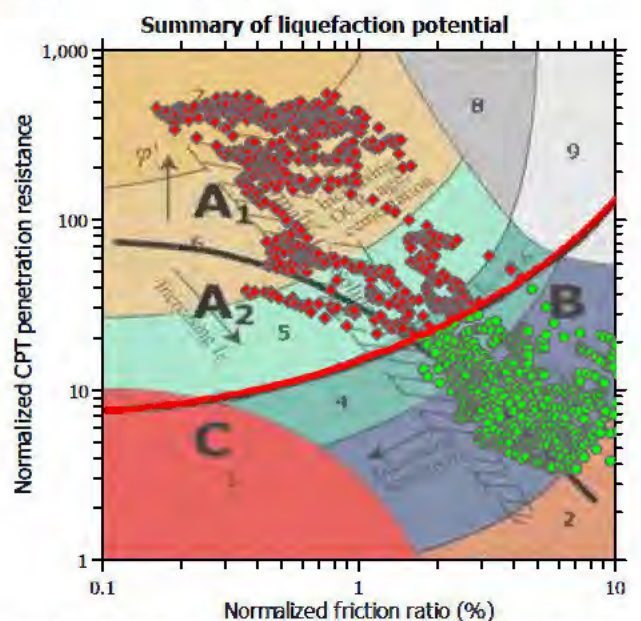
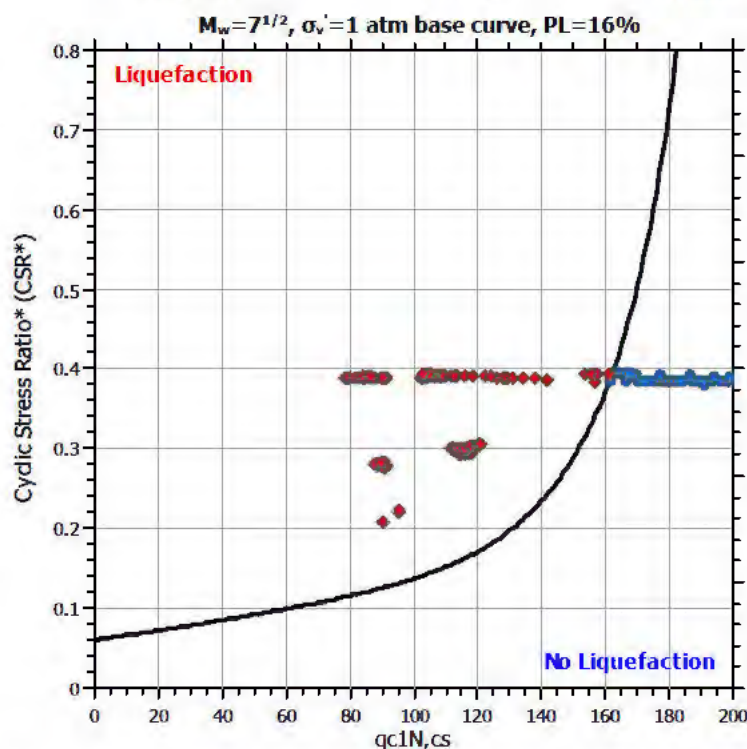
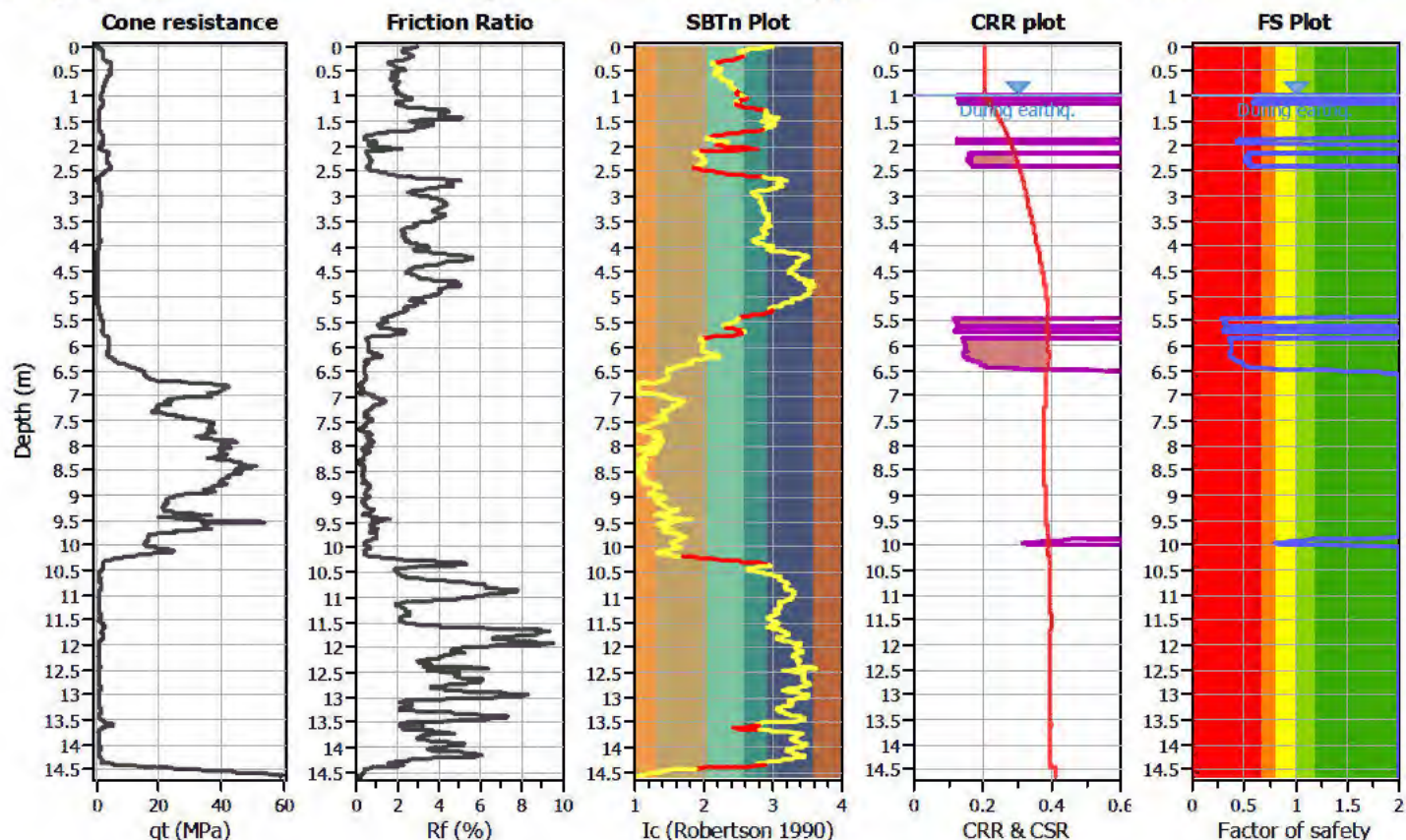
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-03 ULS

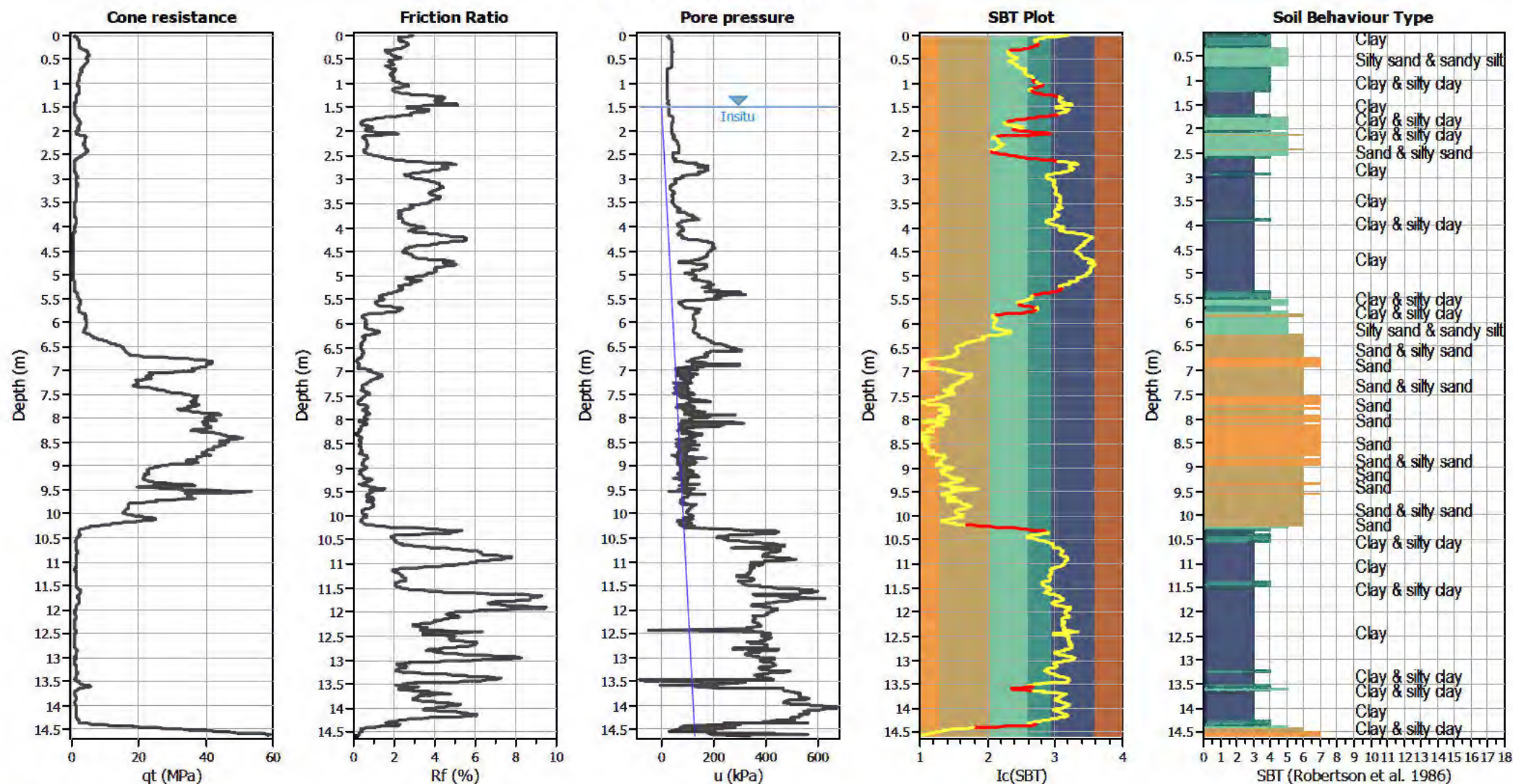
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	10.00 m
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_v applied:	Yes	MSF method:	Method based



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Pore pressure



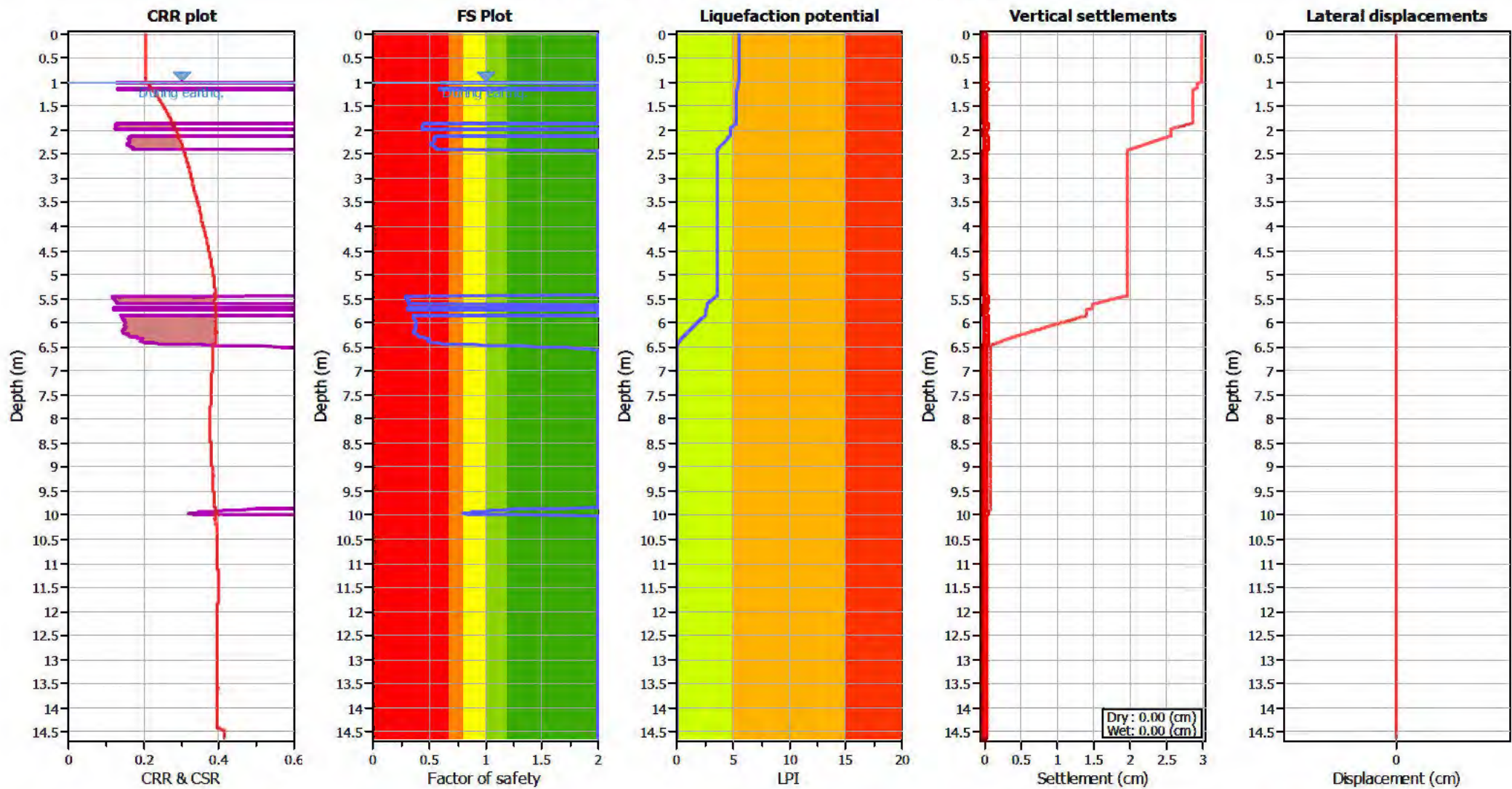
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthg.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _o applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _σ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

Red	Almost certain it will liquefy
Orange	Very likely to liquefy
Yellow	Liquefaction and no liq. are equally likely
Light Green	Unlike to liquefy
Dark Green	Almost certain it will not liquefy

LPI color scheme

Red	Very high risk
Orange	High risk
Yellow	Low risk

LIQUEFACTION ANALYSIS REPORT

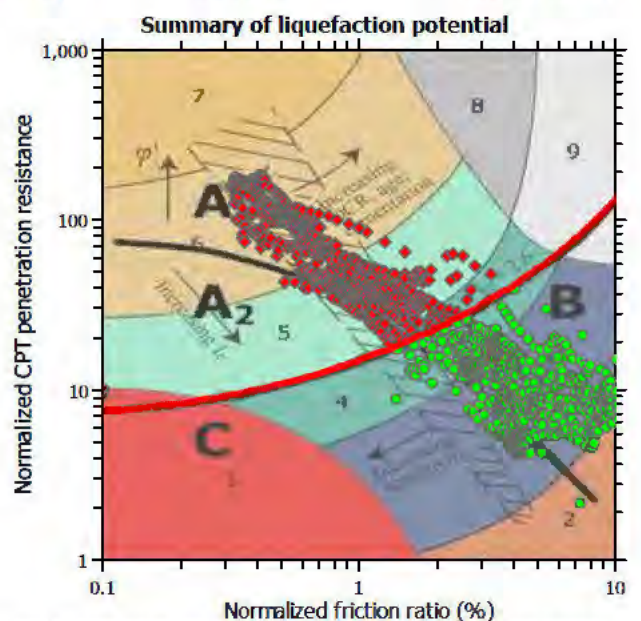
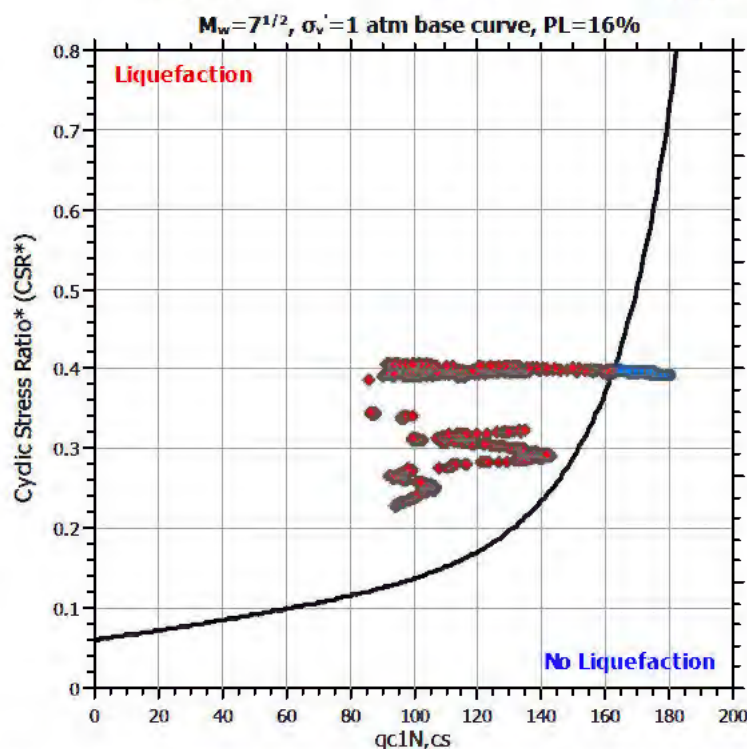
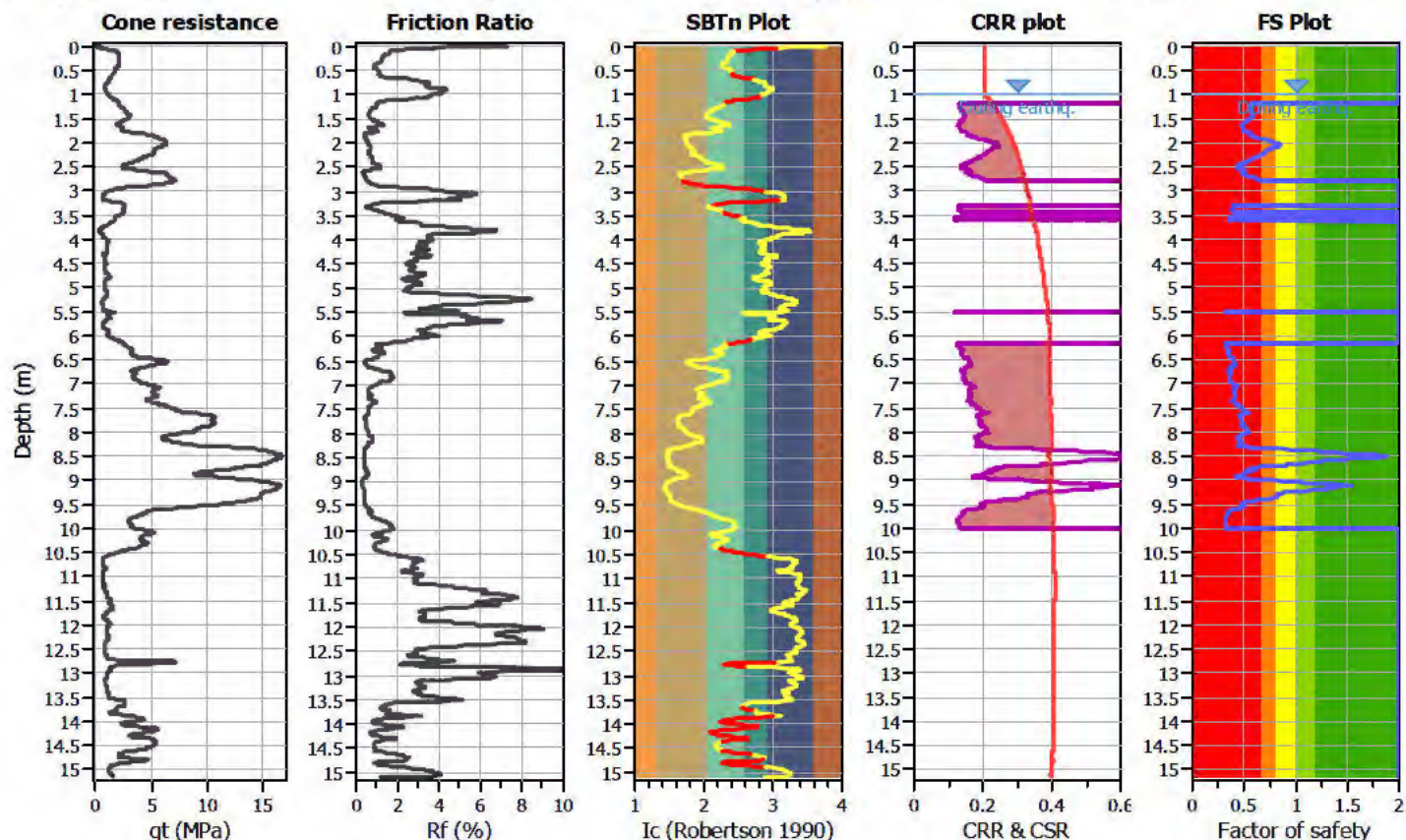
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-04 ULS

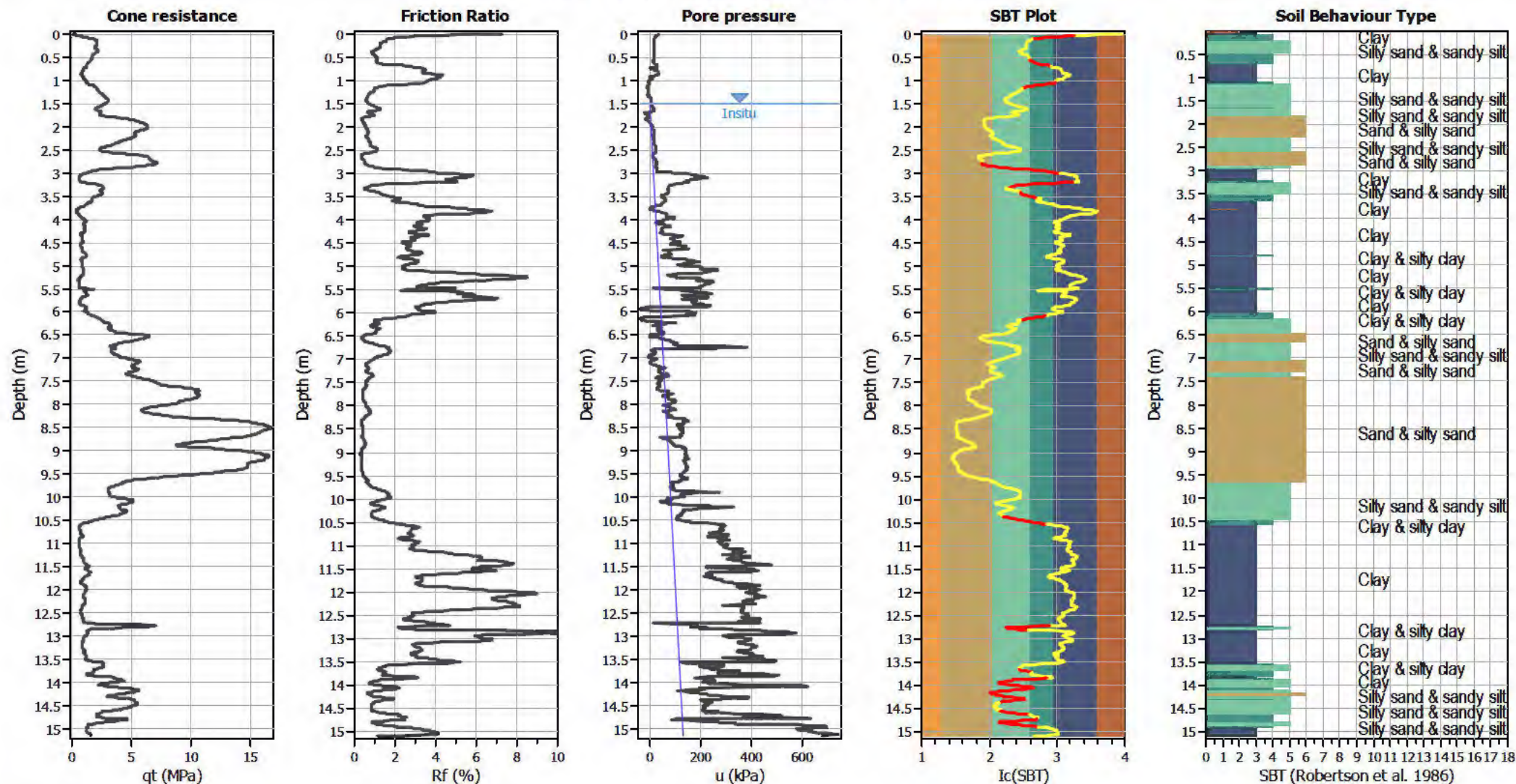
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Pore pressure



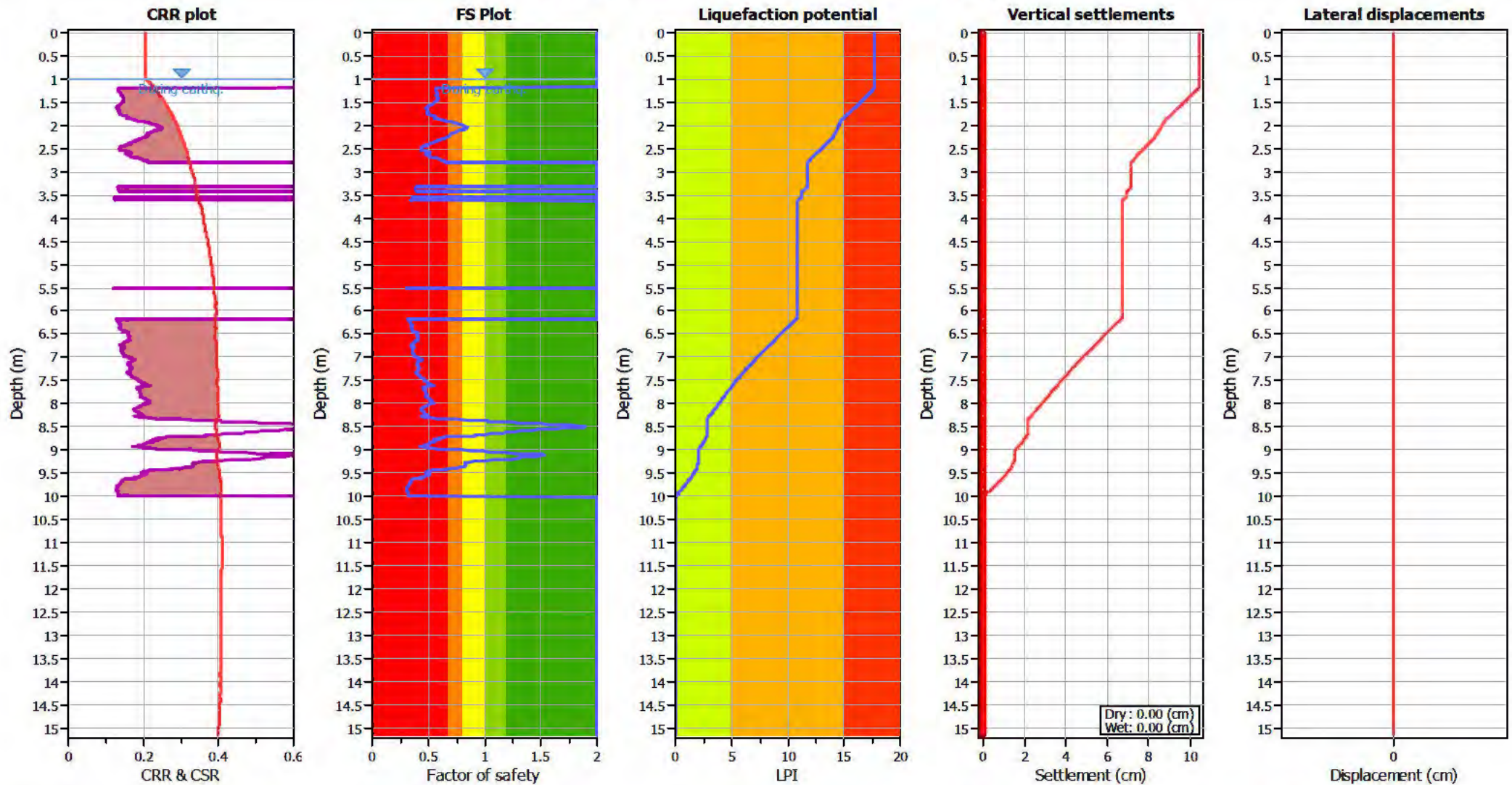
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthg.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _o applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 7.50
 Peak ground acceleration: 0.35
 Depth to water table (insitu): 1.50 m

Depth to GWT (erthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

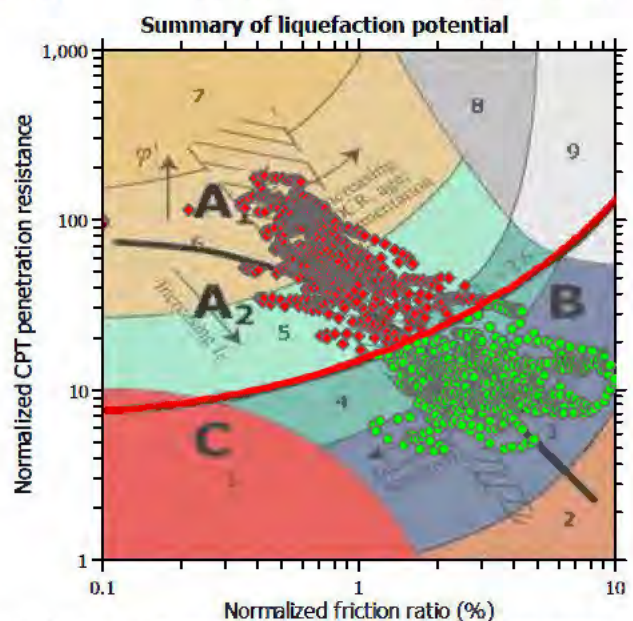
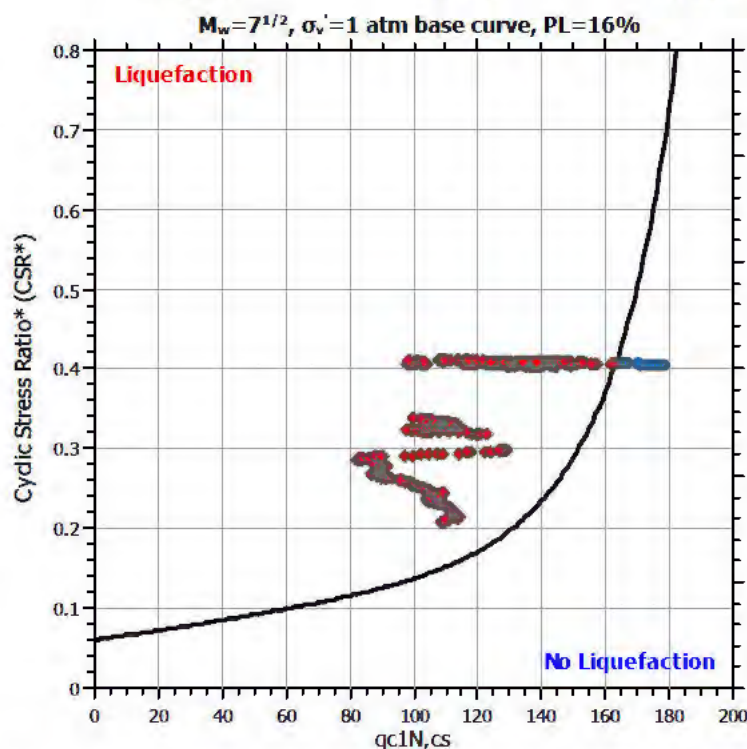
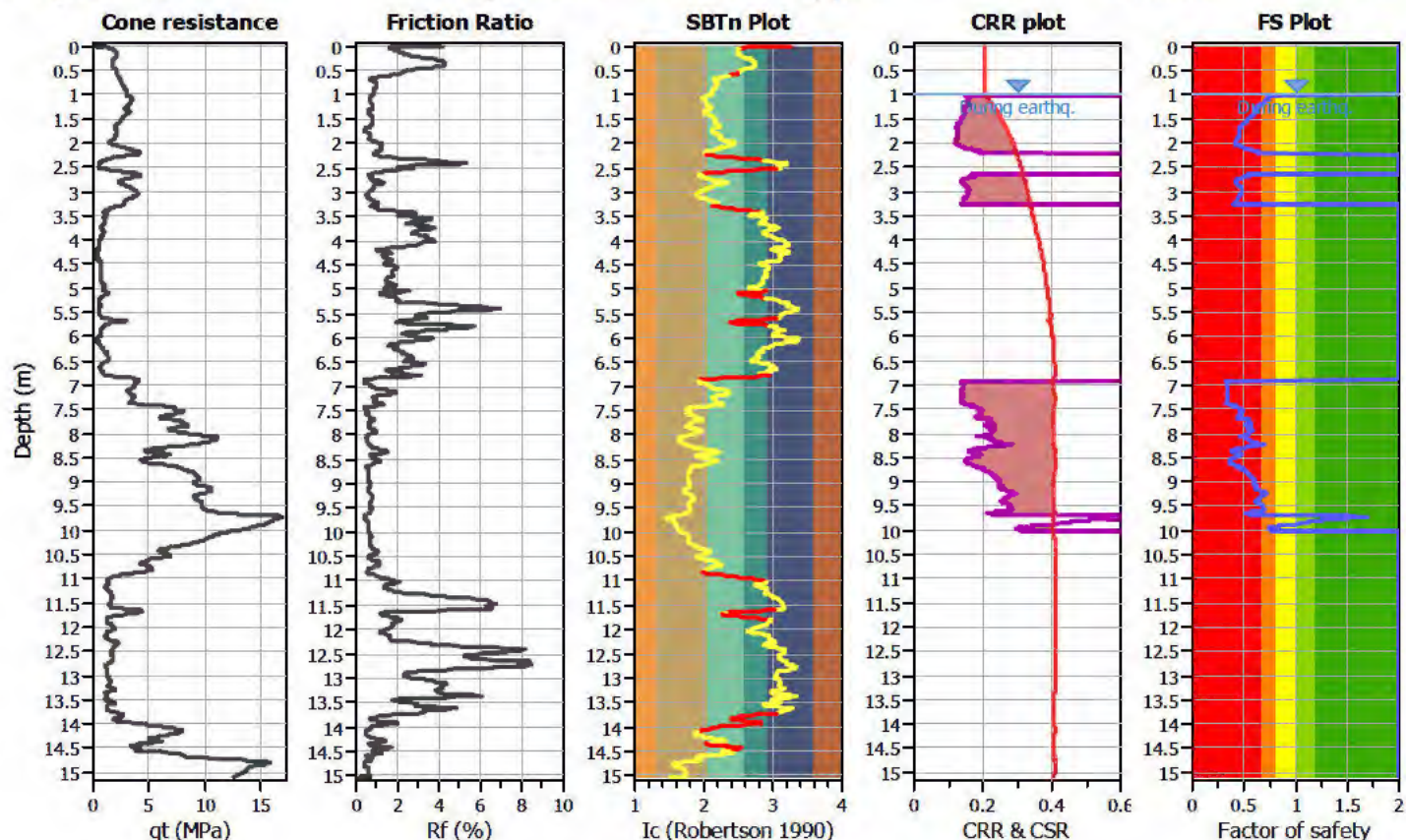
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-05 ULS

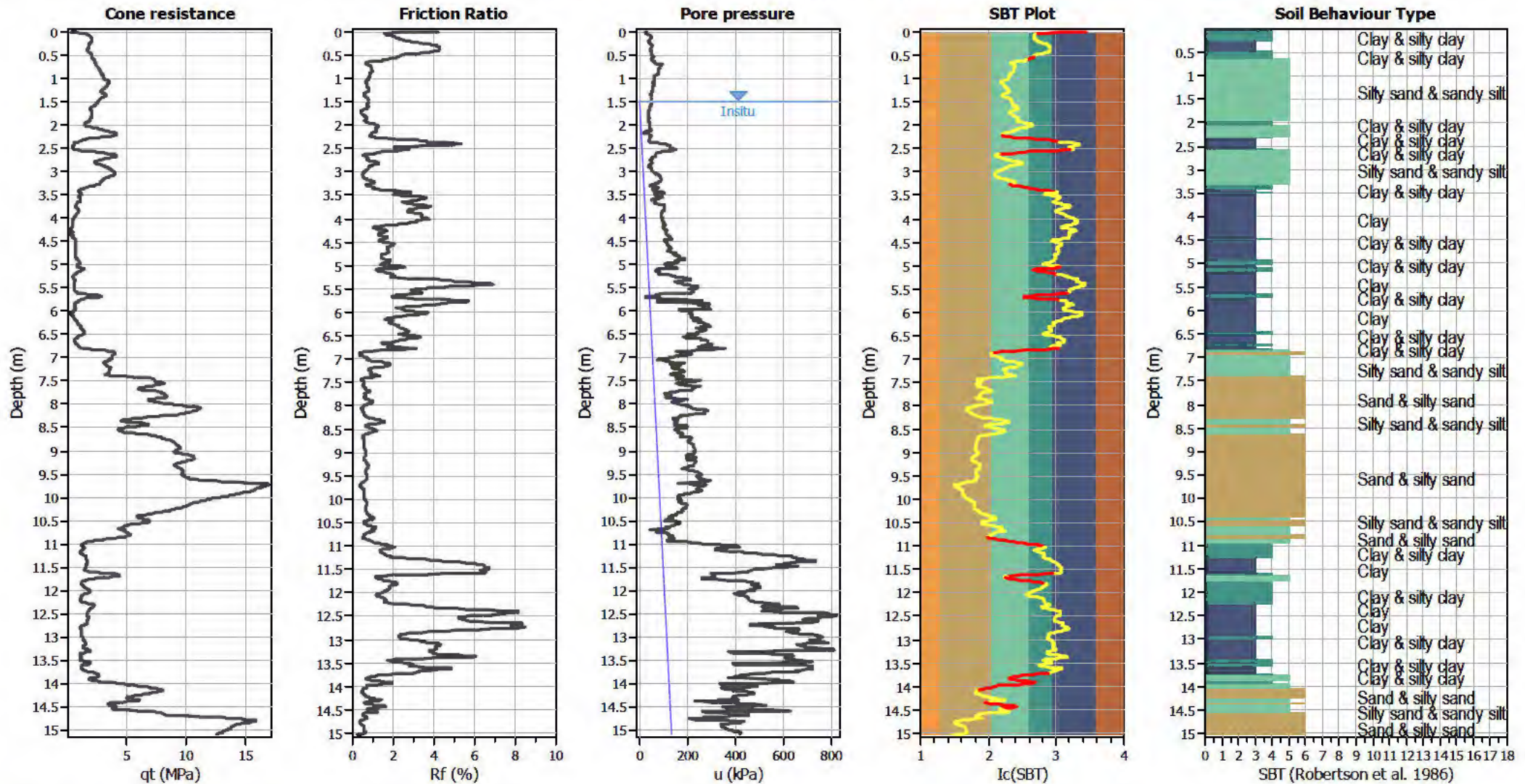
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



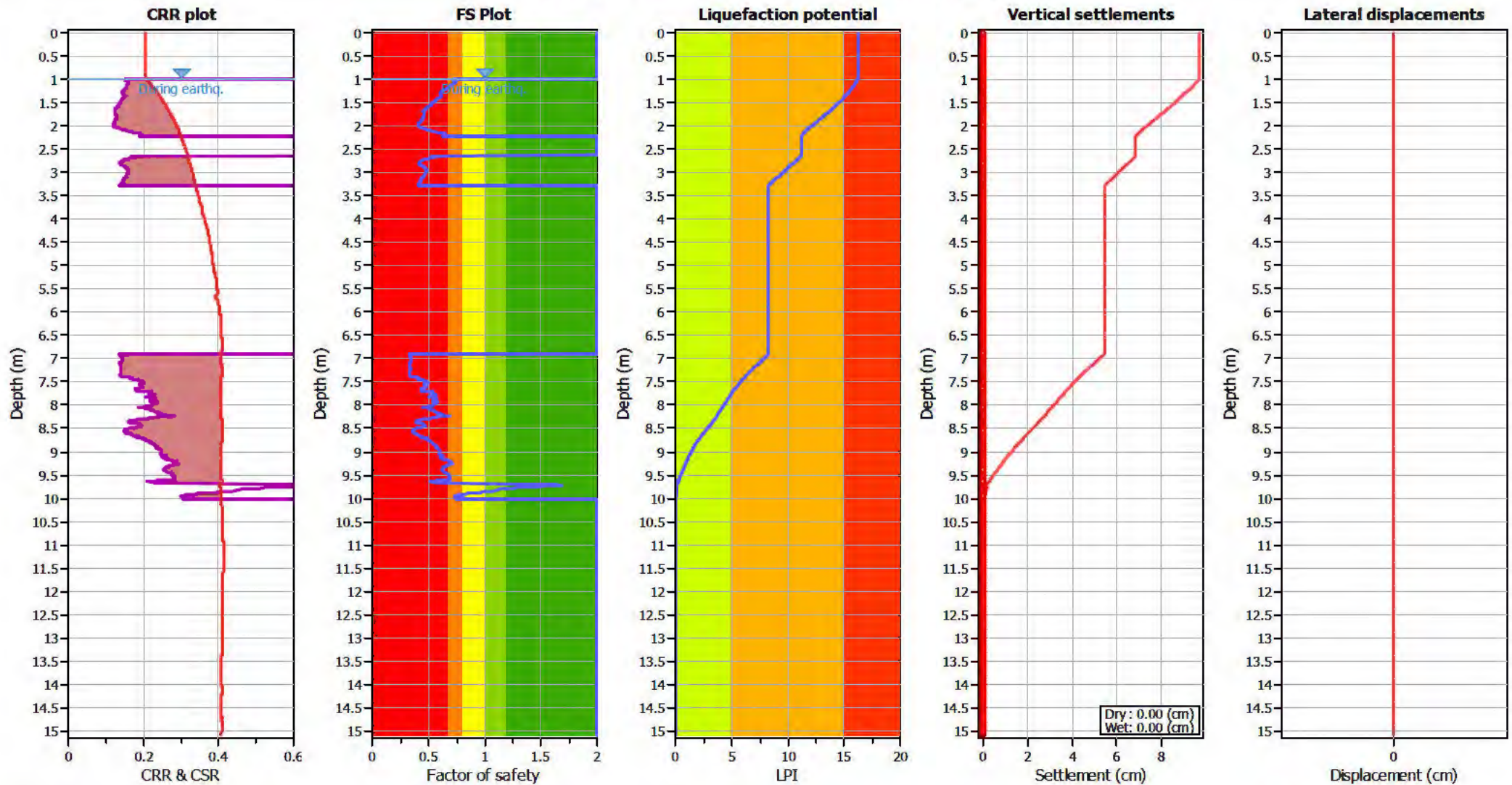
Input parameters and analysis data

Analysis method:	B&J (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&J (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 7.50
 Peak ground acceleration: 0.35
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

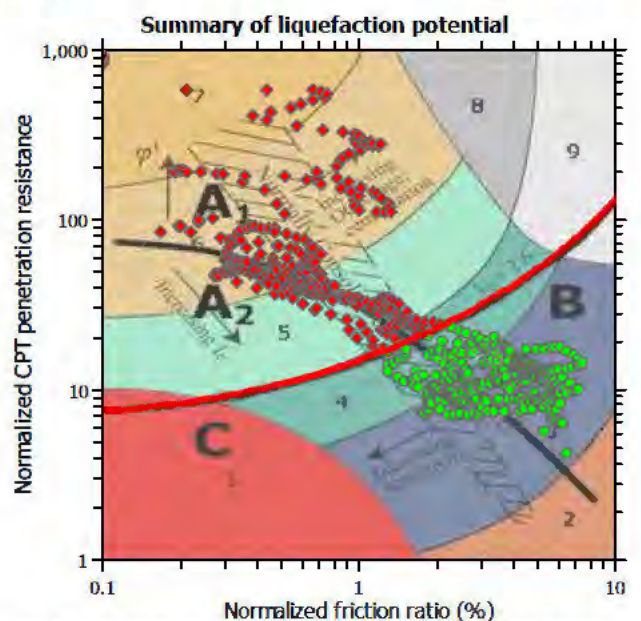
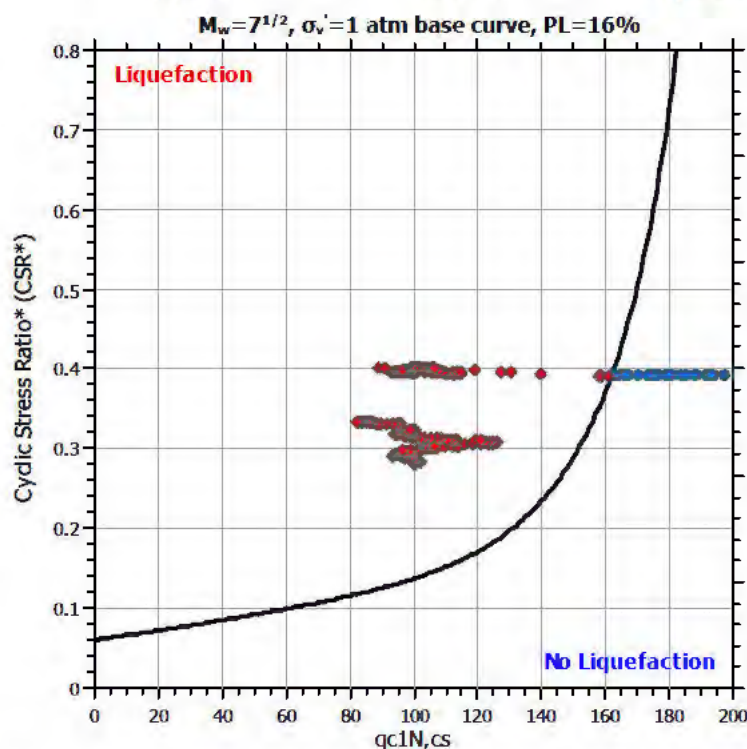
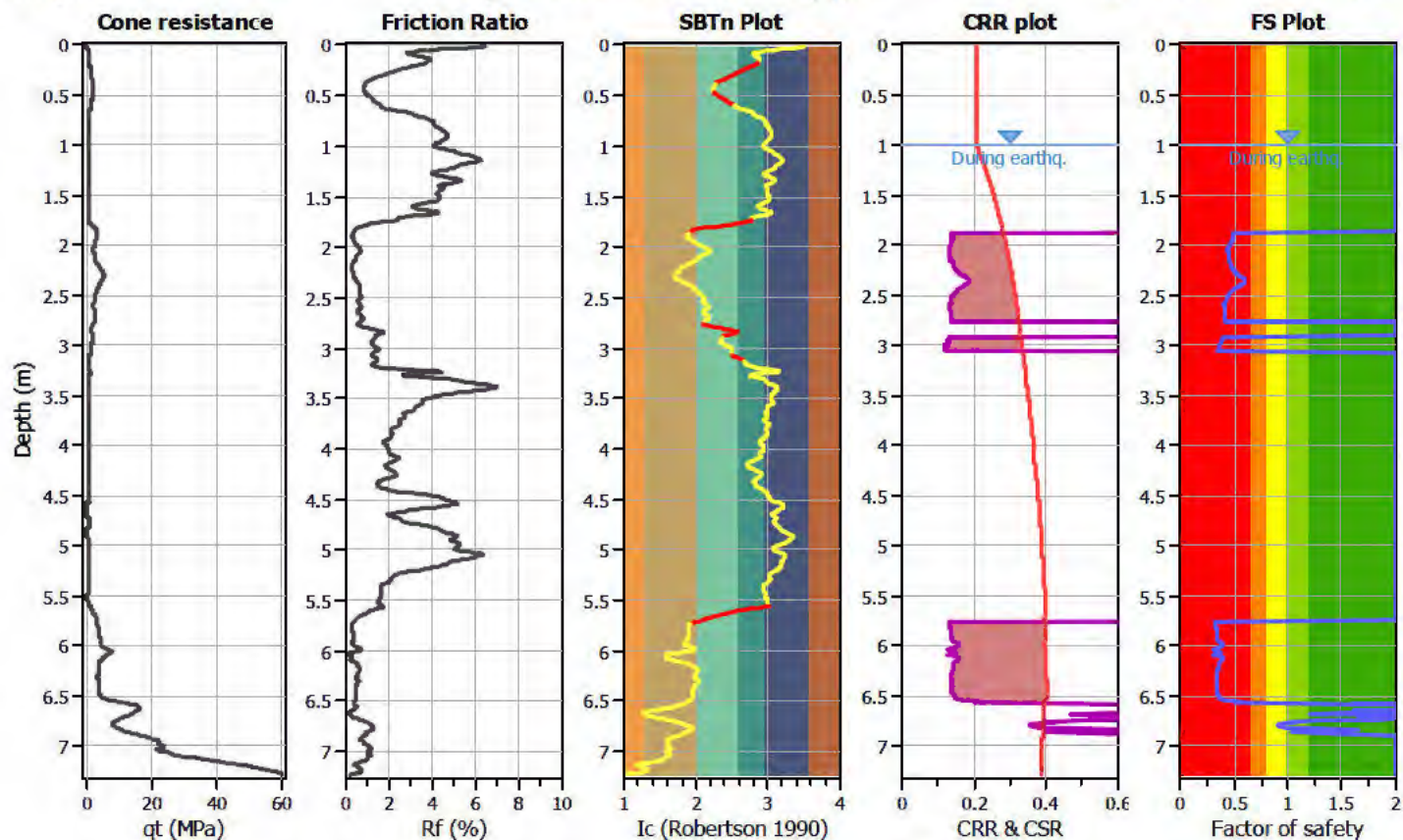
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-06 ULS

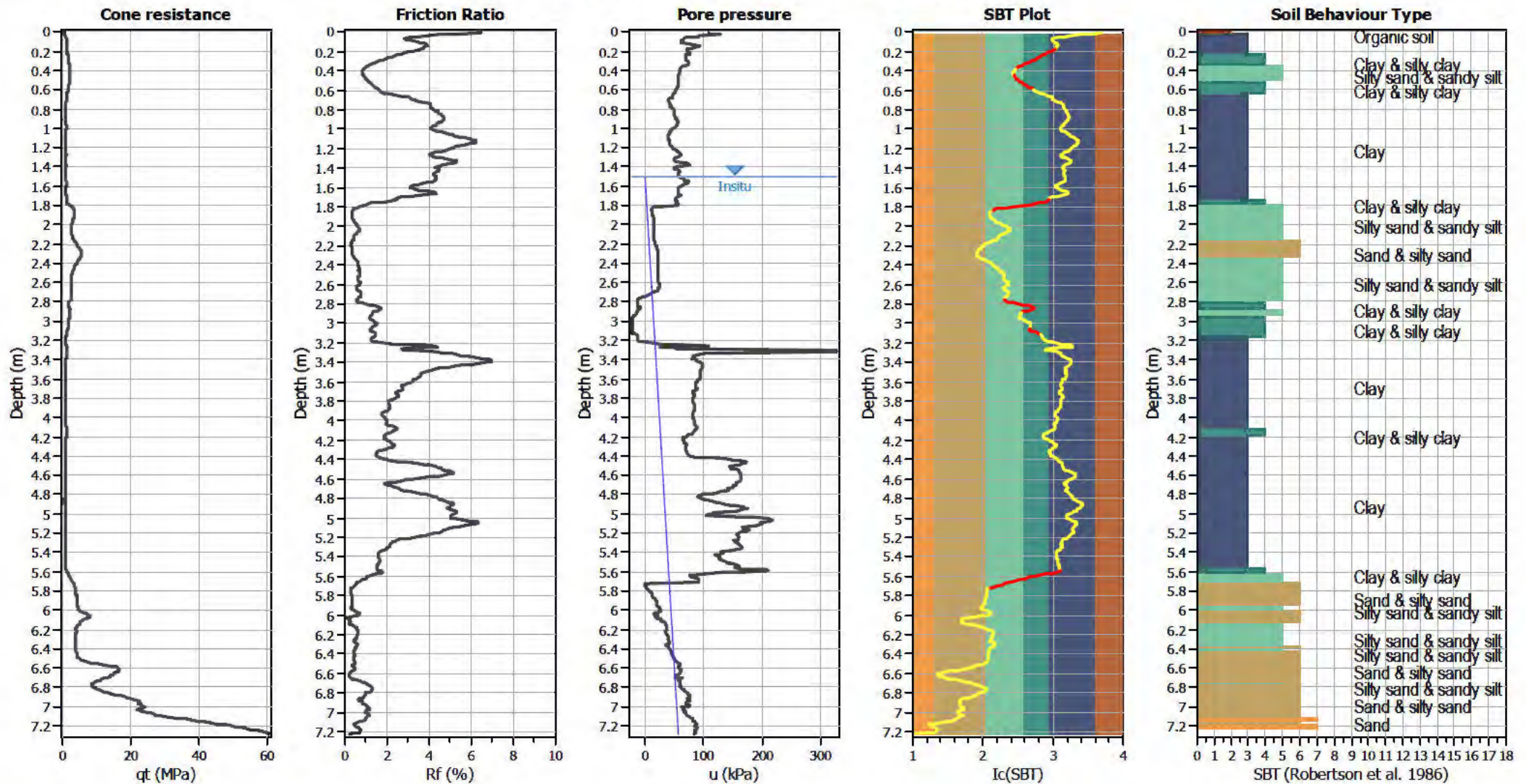
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



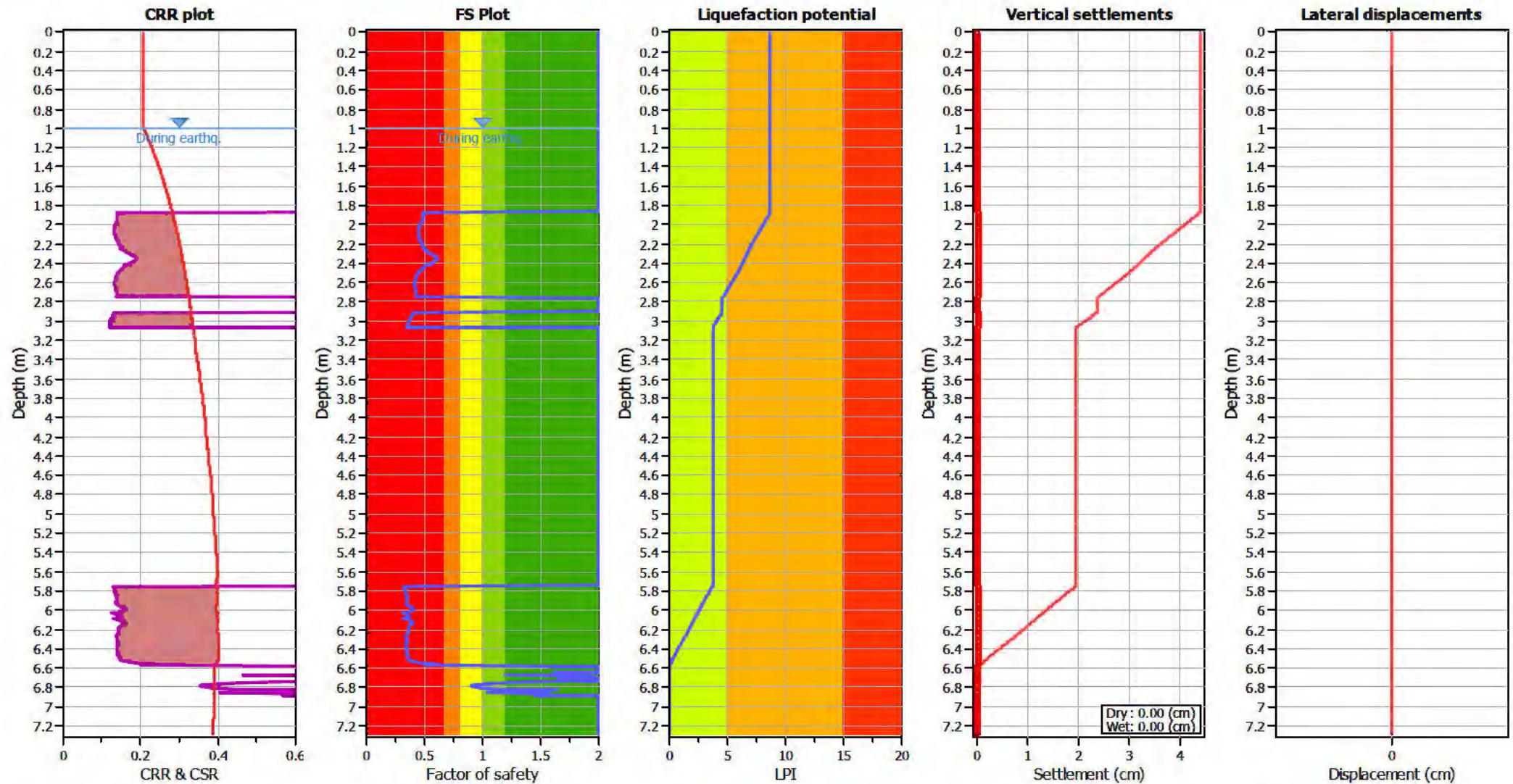
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 7.50
 Peak ground acceleration: 0.35
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_σ applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

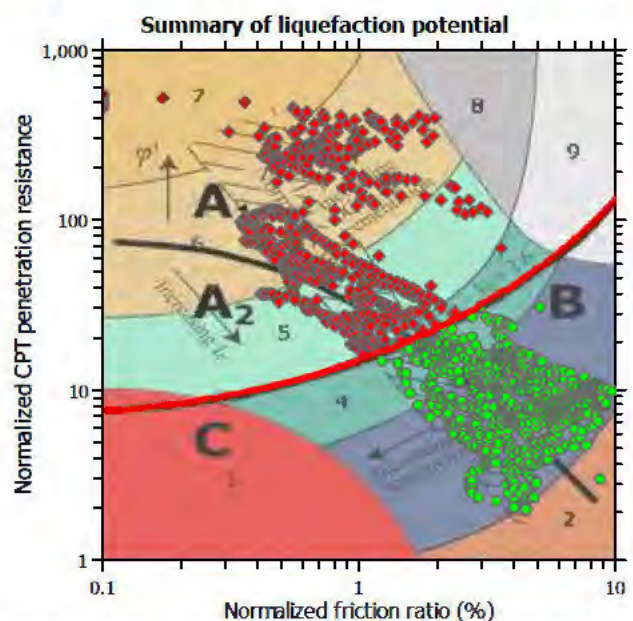
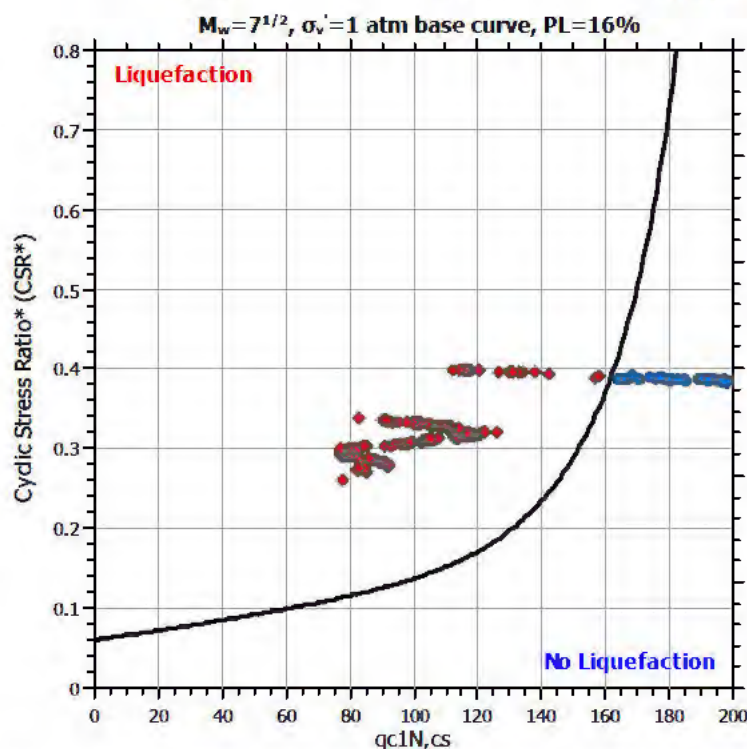
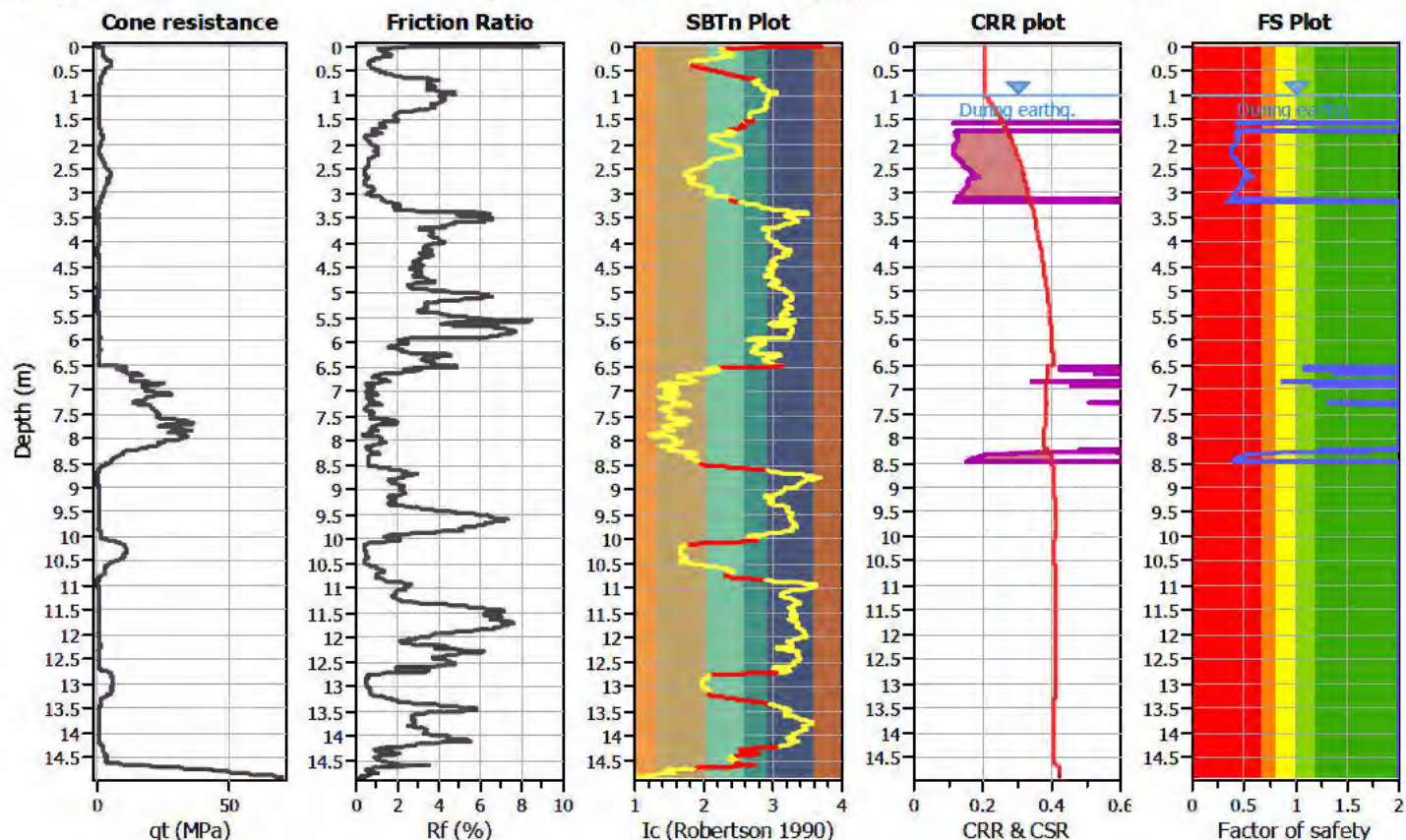
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-07 ULS

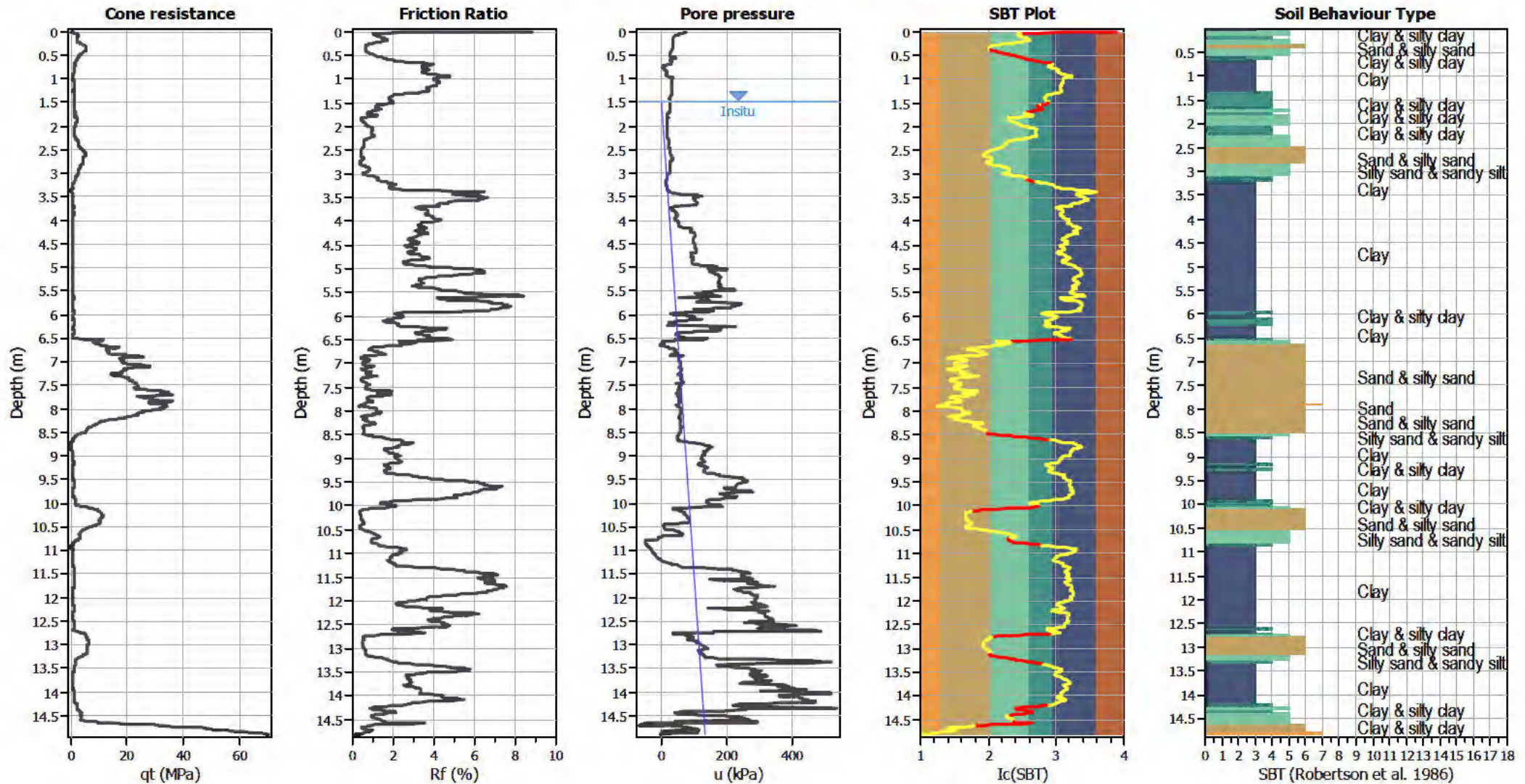
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots

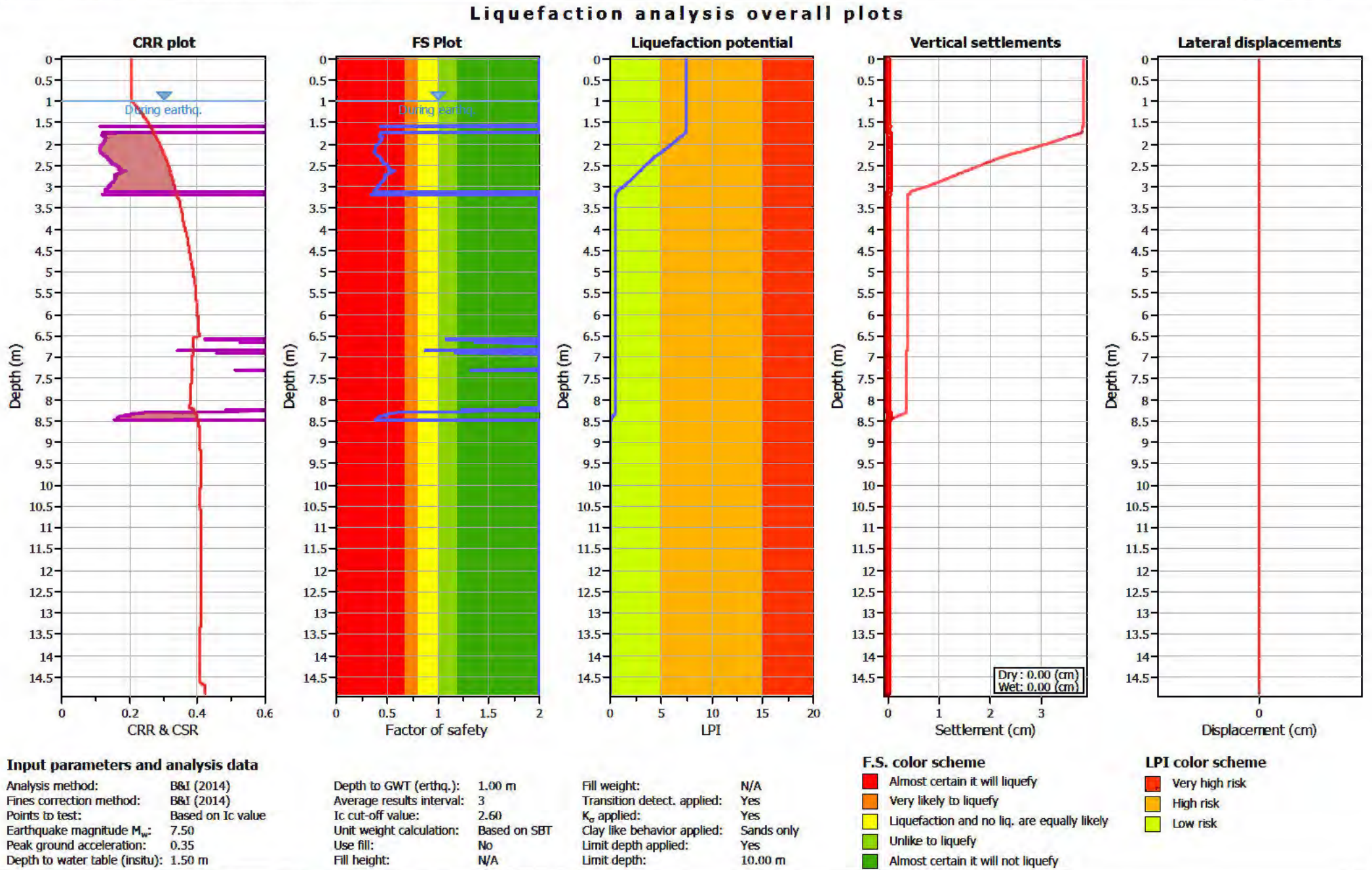


Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained



LIQUEFACTION ANALYSIS REPORT

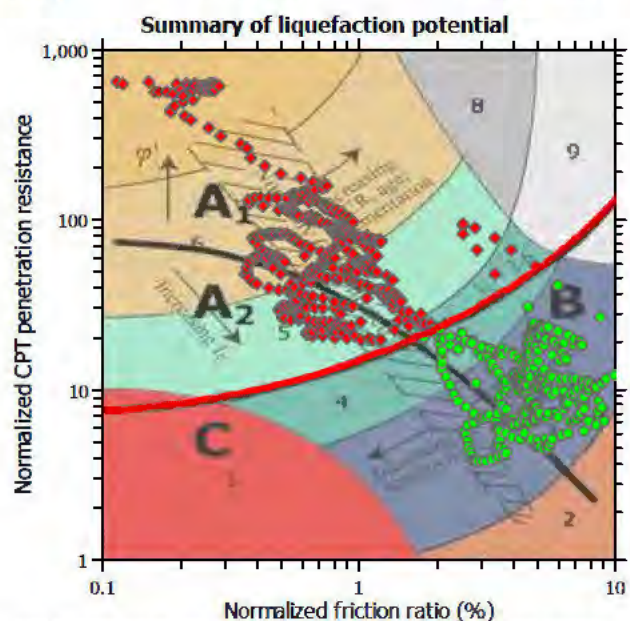
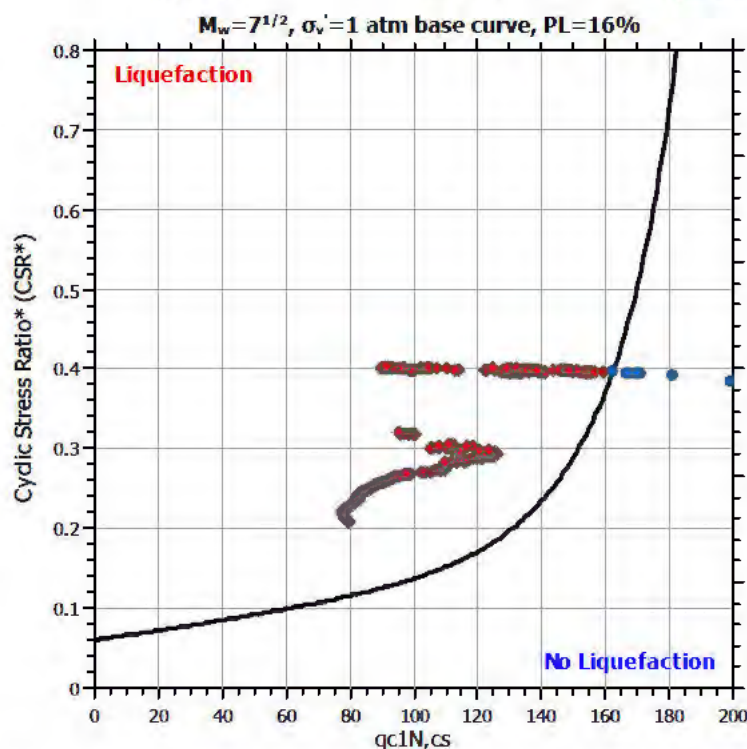
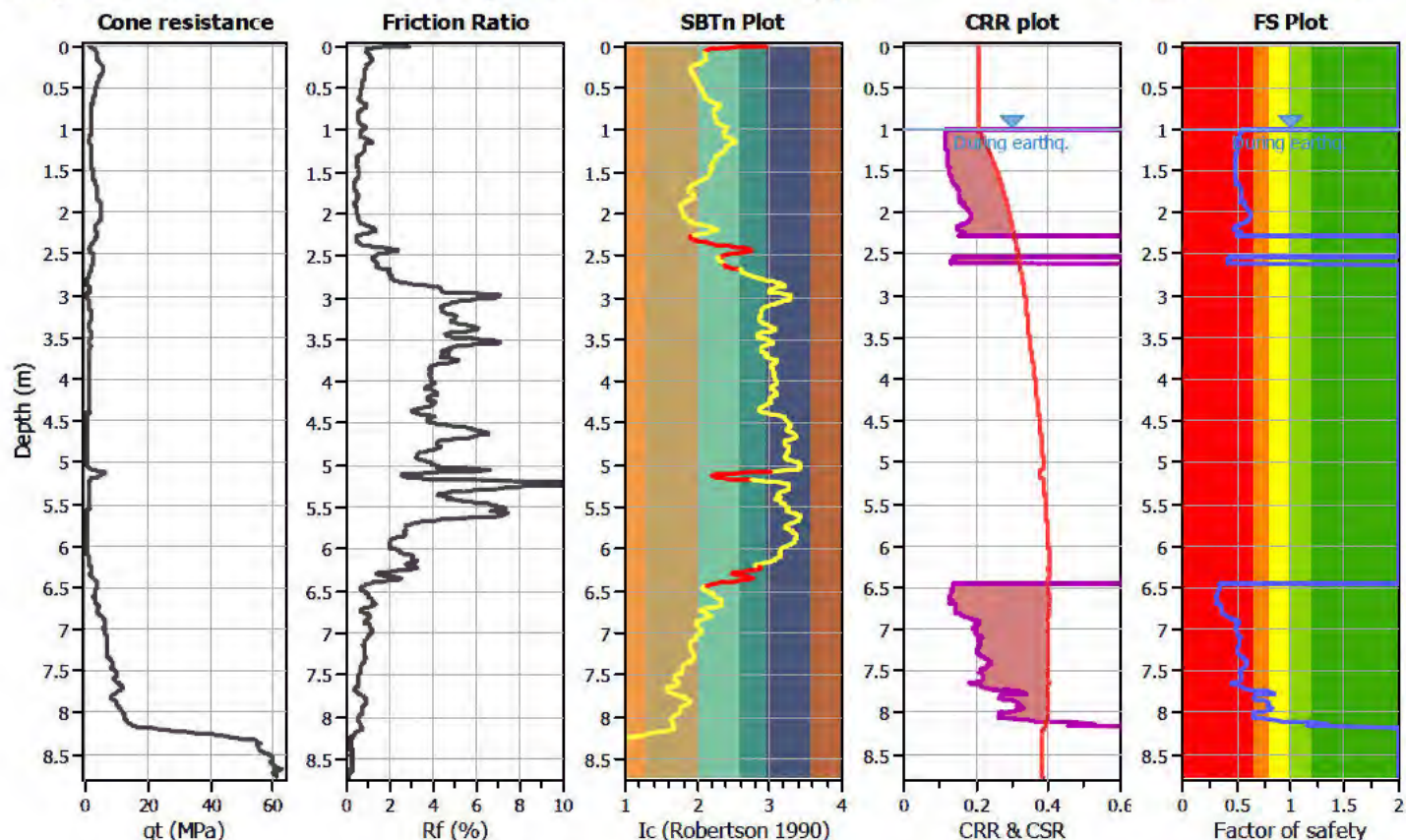
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-08 ULS

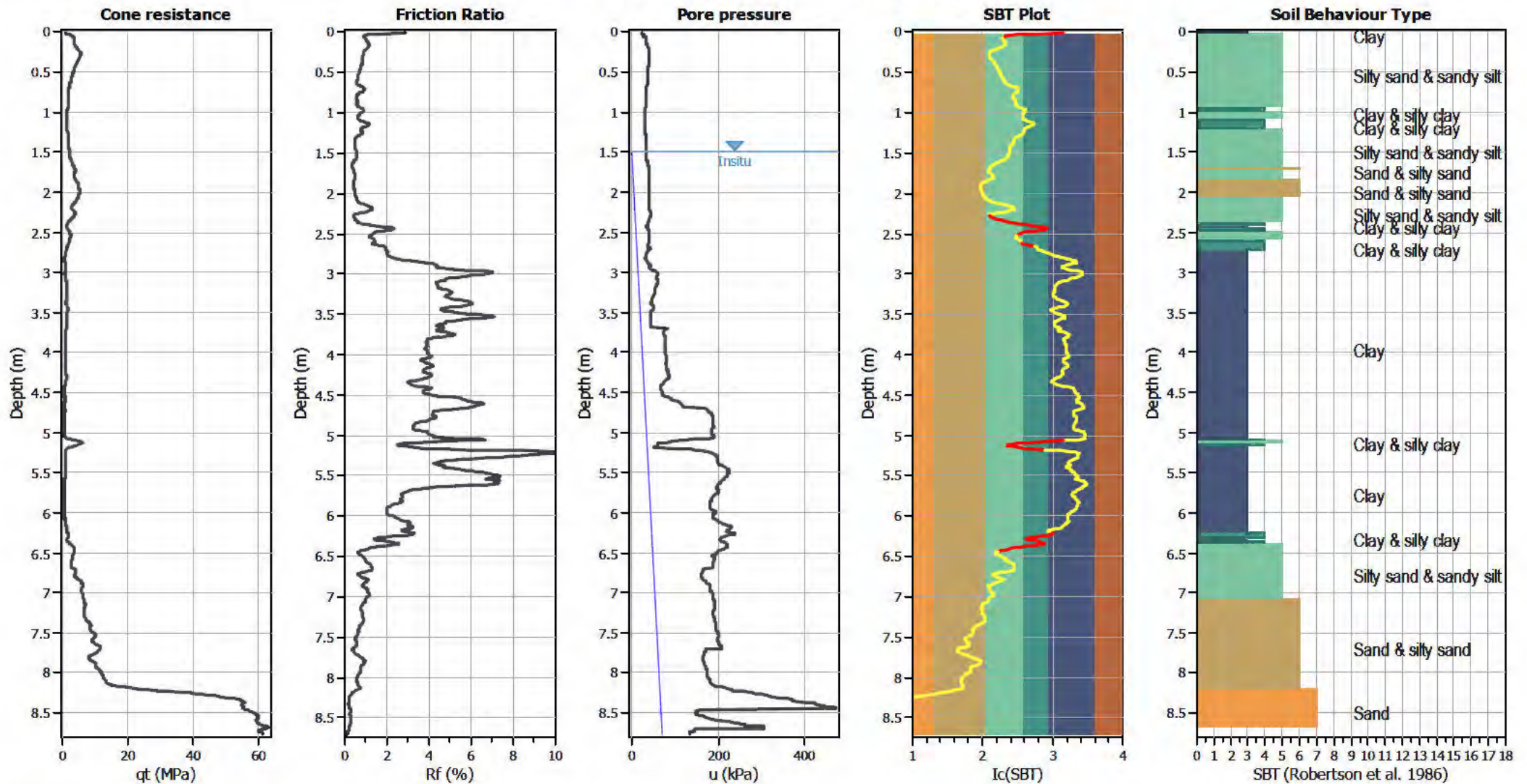
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



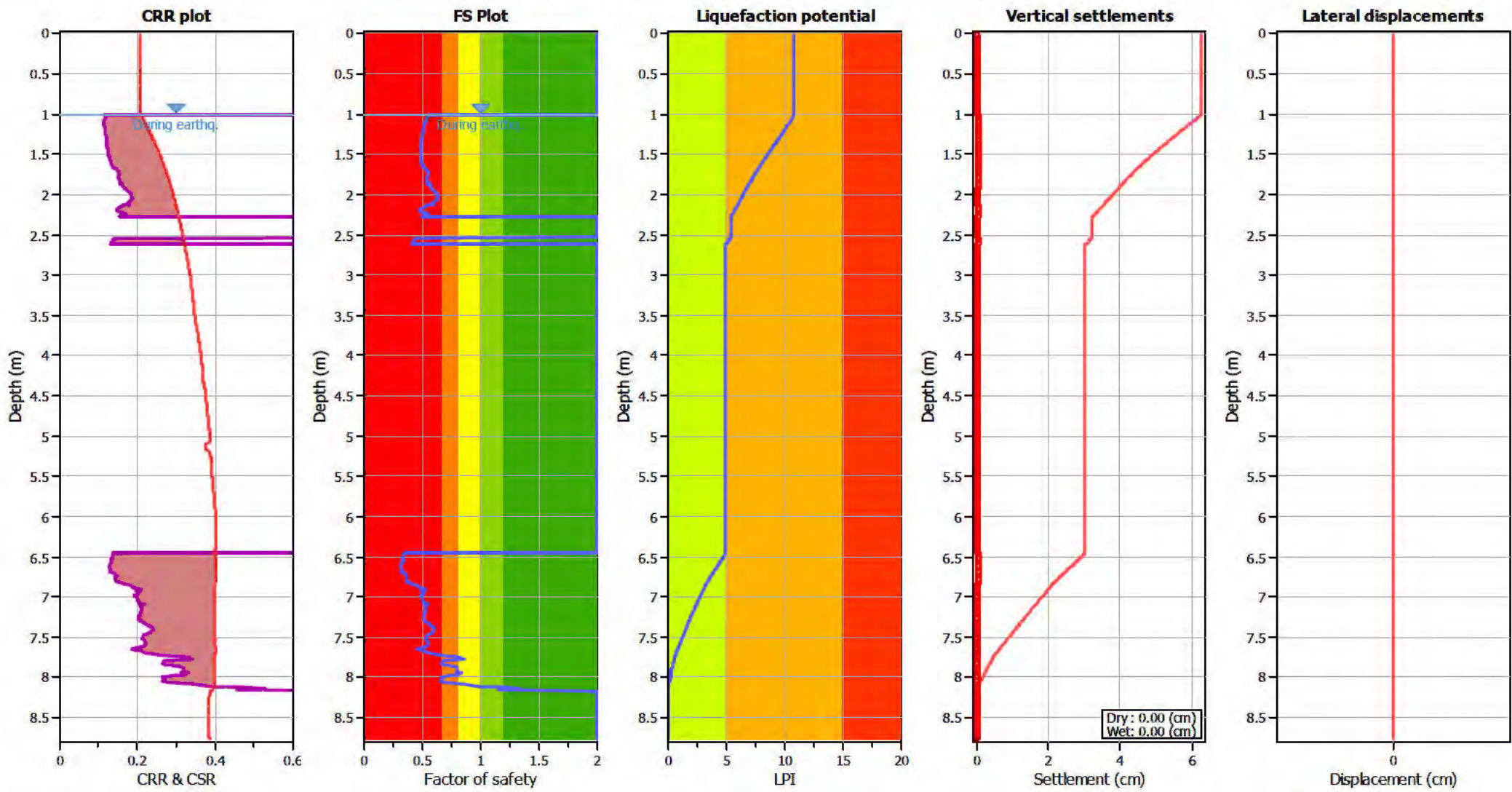
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude M_w : 7.50
Peak ground acceleration: 0.35
Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: Yes
 K_{σ} applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: Yes
Limit depth: 10.00 m

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

LIQUEFACTION ANALYSIS REPORT

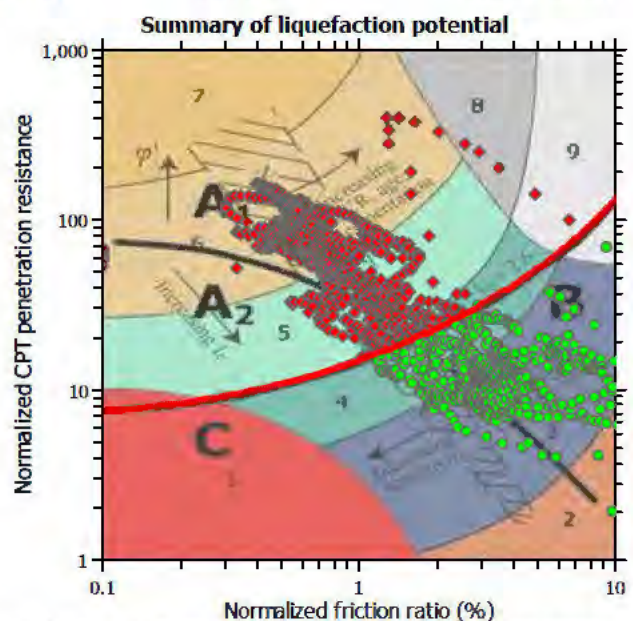
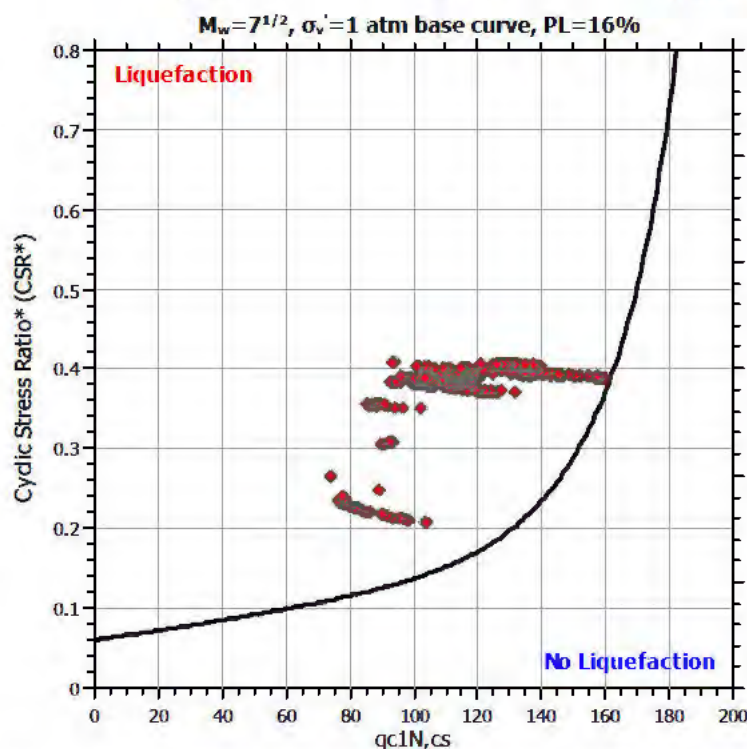
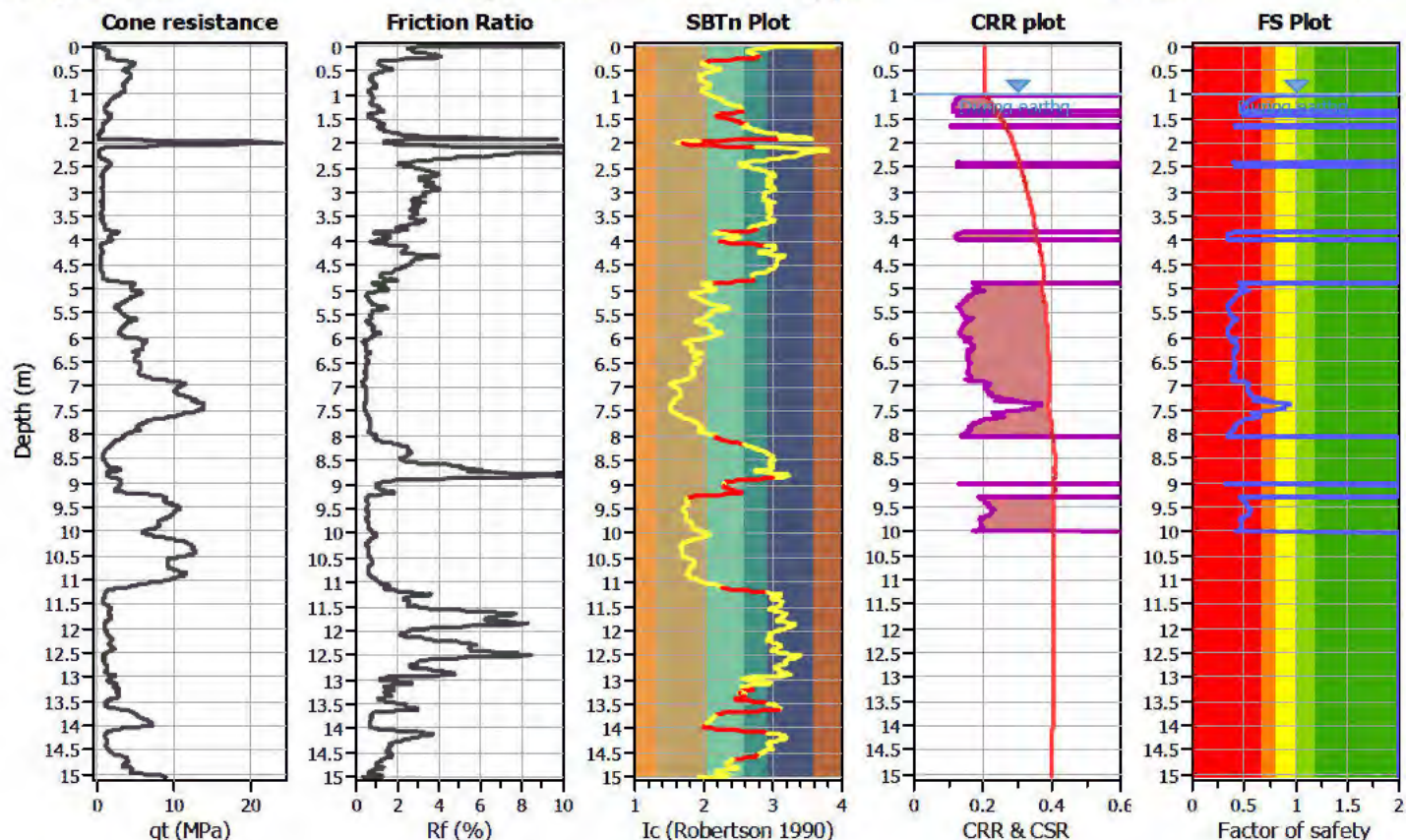
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-09 ULS

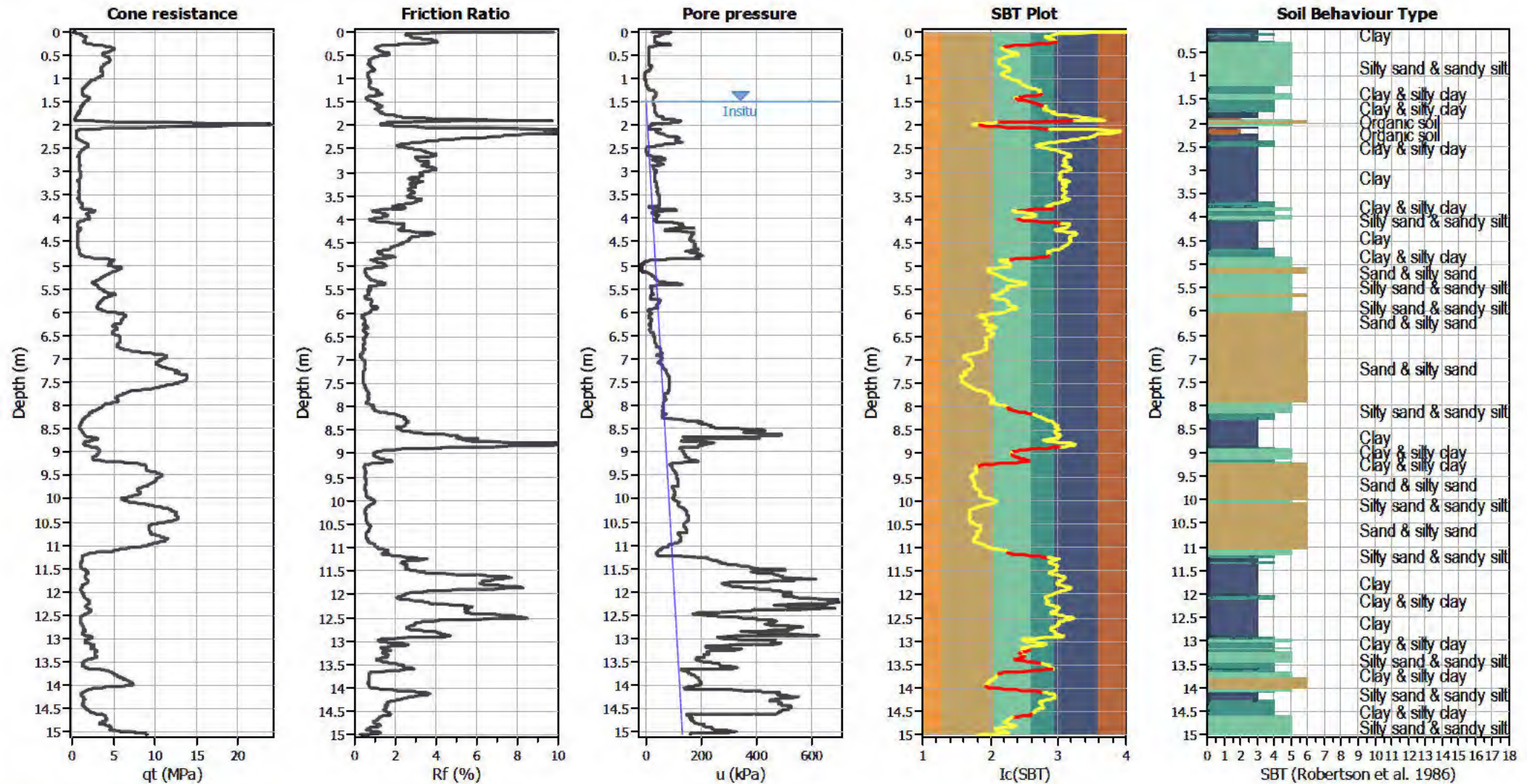
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



Input parameters and analysis data

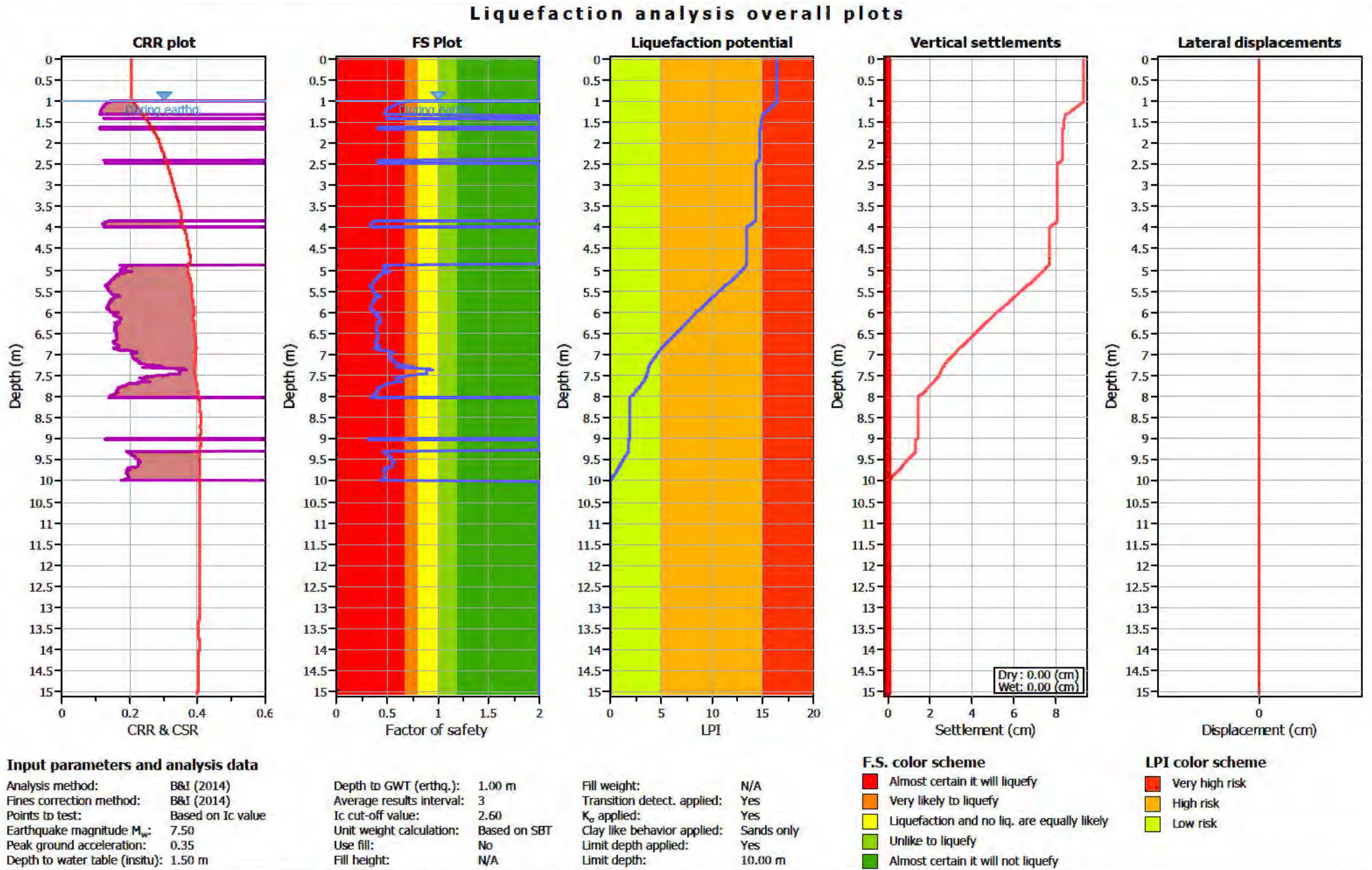
Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on I_c value
 Earthquake magnitude M_w : 7.50
 Peak ground acceleration: 0.35
 Depth to water table (insitu): 1.50 m

Depth to GWT (erthq.): 1.00 m
 Average results interval: 3
 I_c cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_a applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

SBT legend

- | | | |
|---------------------------|-----------------------------|----------------------------|
| 1. Sensitive fine grained | 4. Clayey silt to silty | 7. Gravely sand to sand |
| 2. Organic material | 5. Silty sand to sandy silt | 8. Very stiff sand to |
| 3. Clay to silty clay | 6. Clean sand to silty sand | 9. Very stiff fine grained |



LIQUEFACTION ANALYSIS REPORT

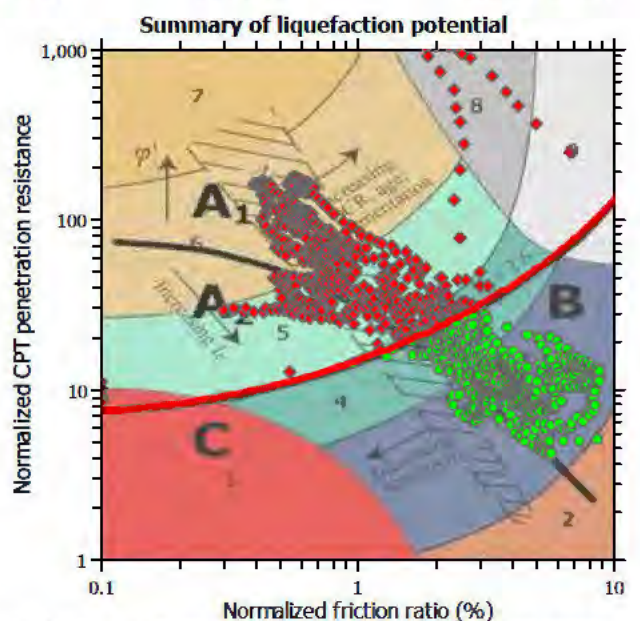
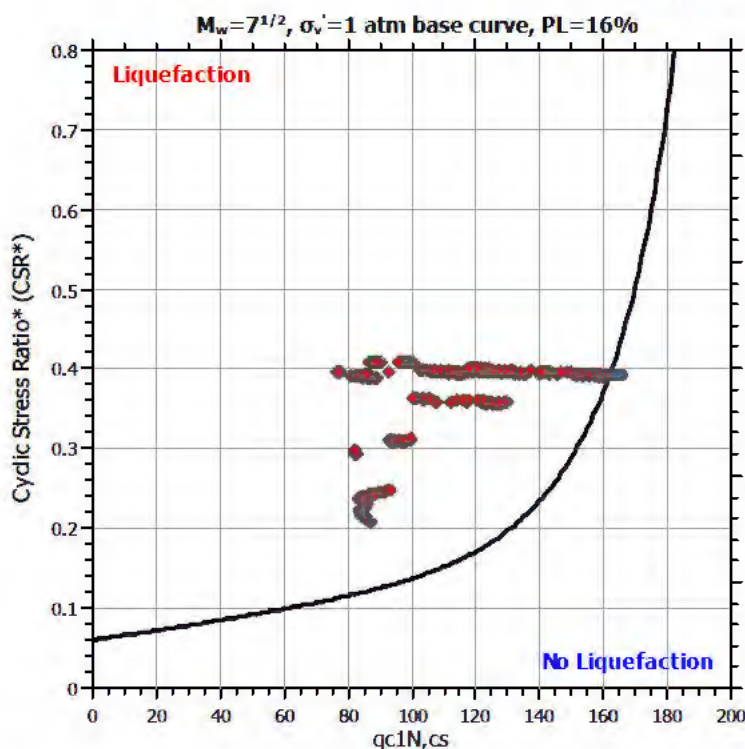
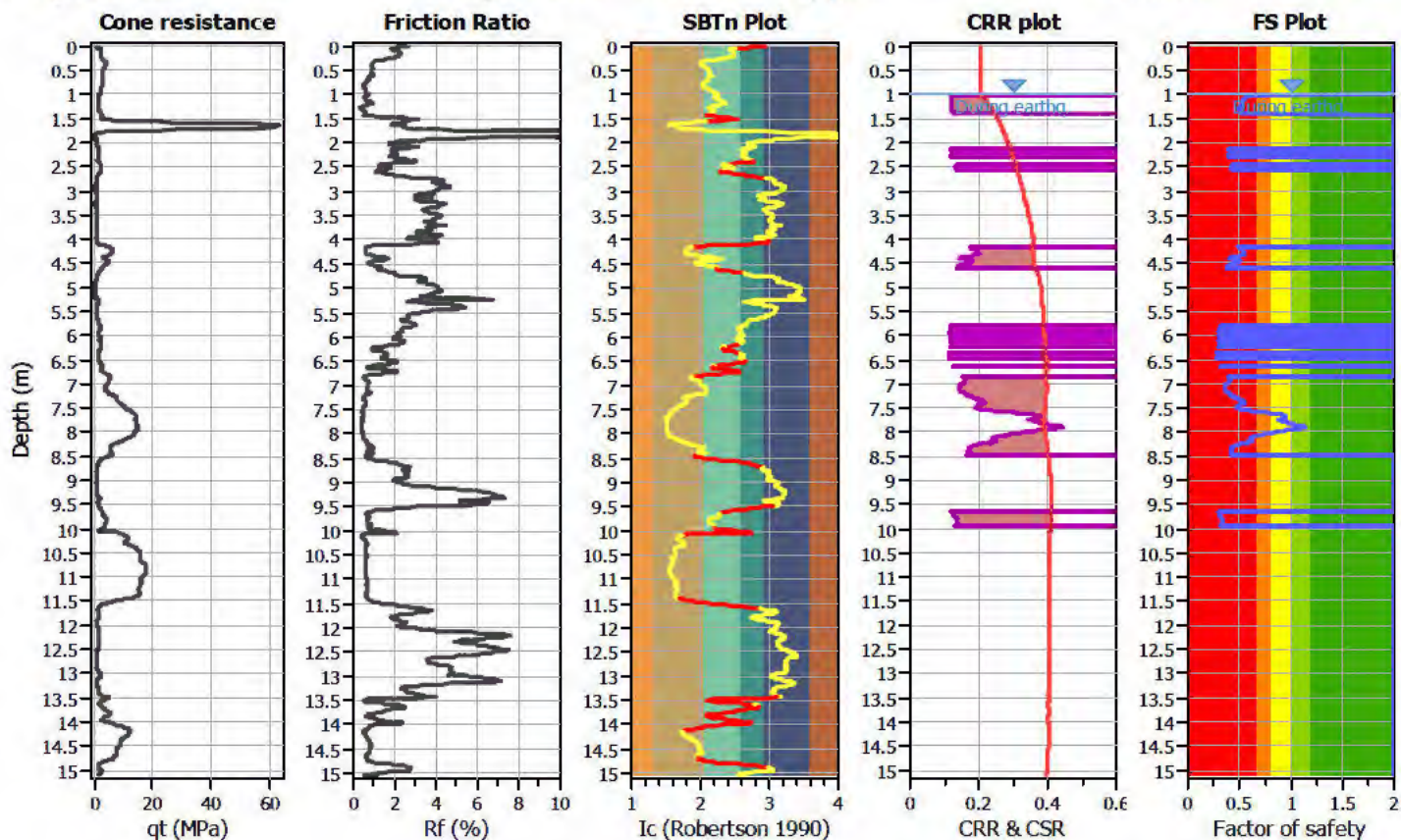
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-10 ULS

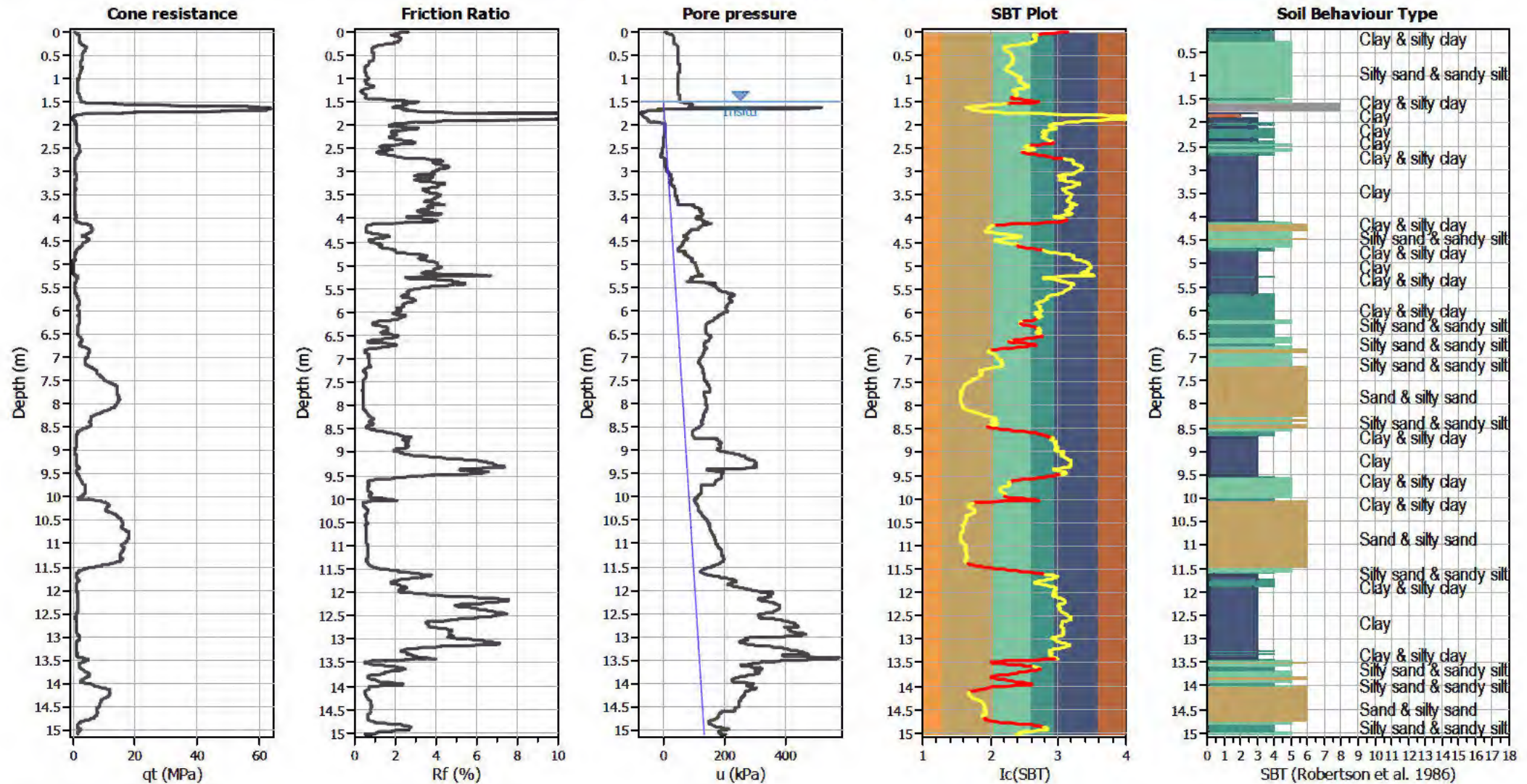
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



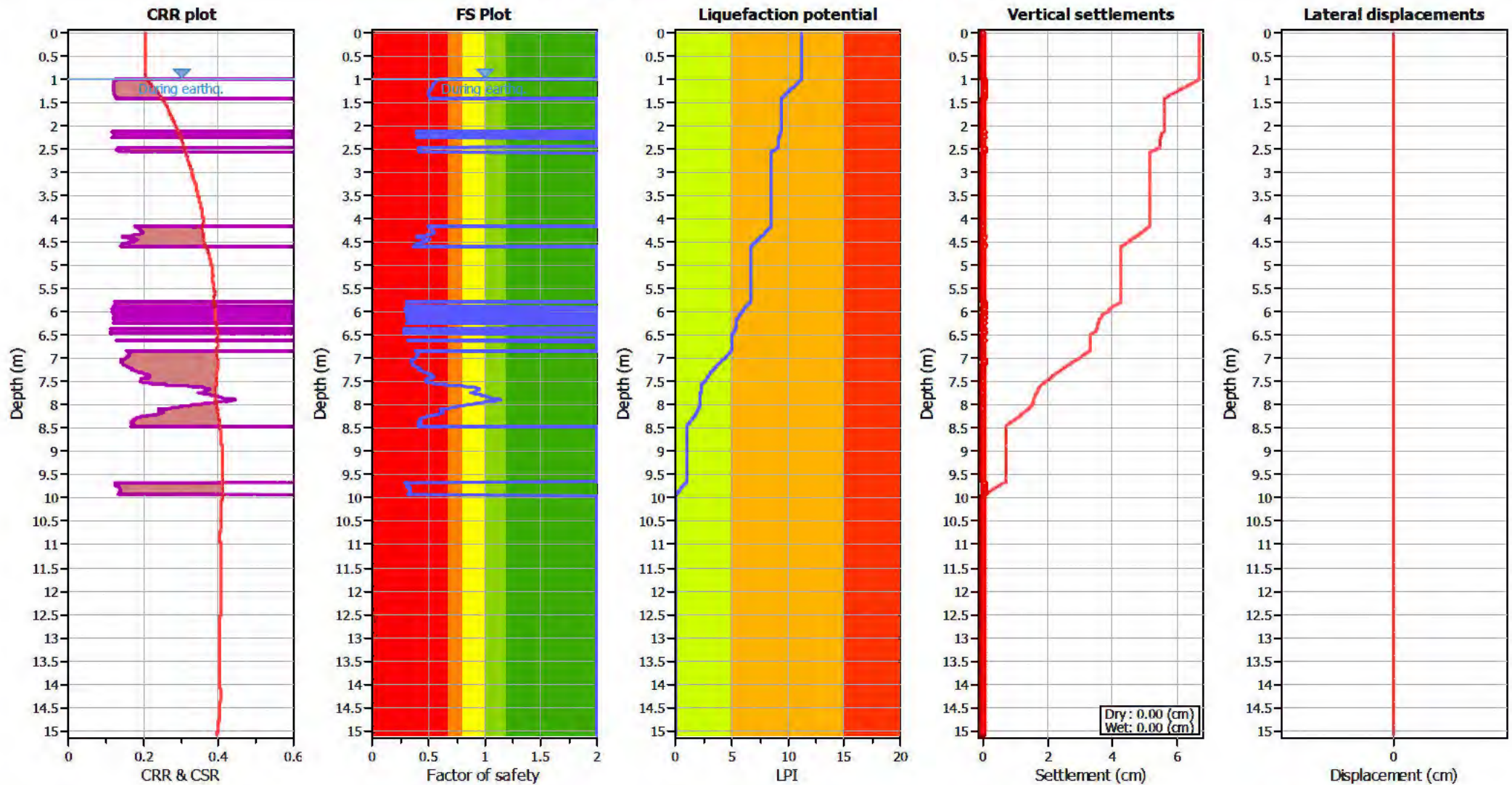
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _o applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 7.50
 Peak ground acceleration: 0.35
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

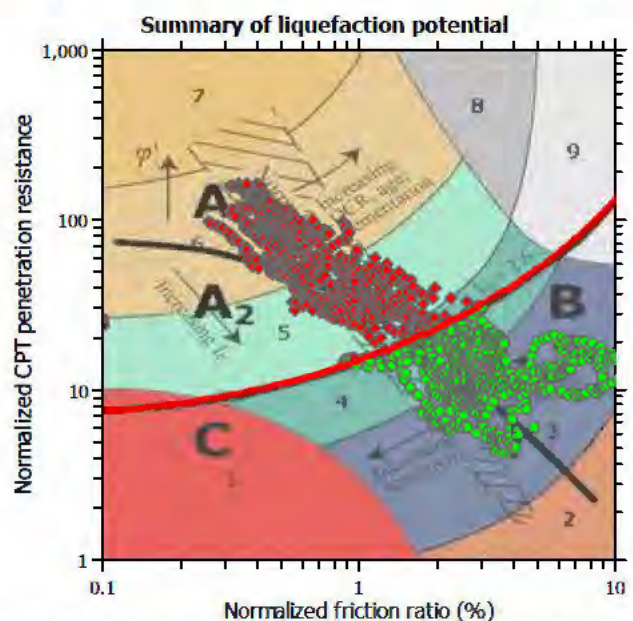
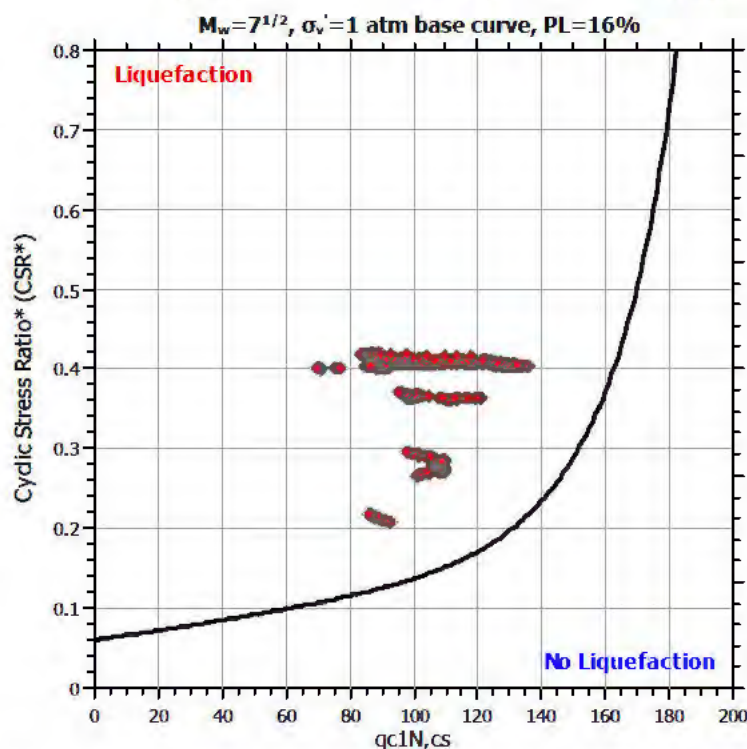
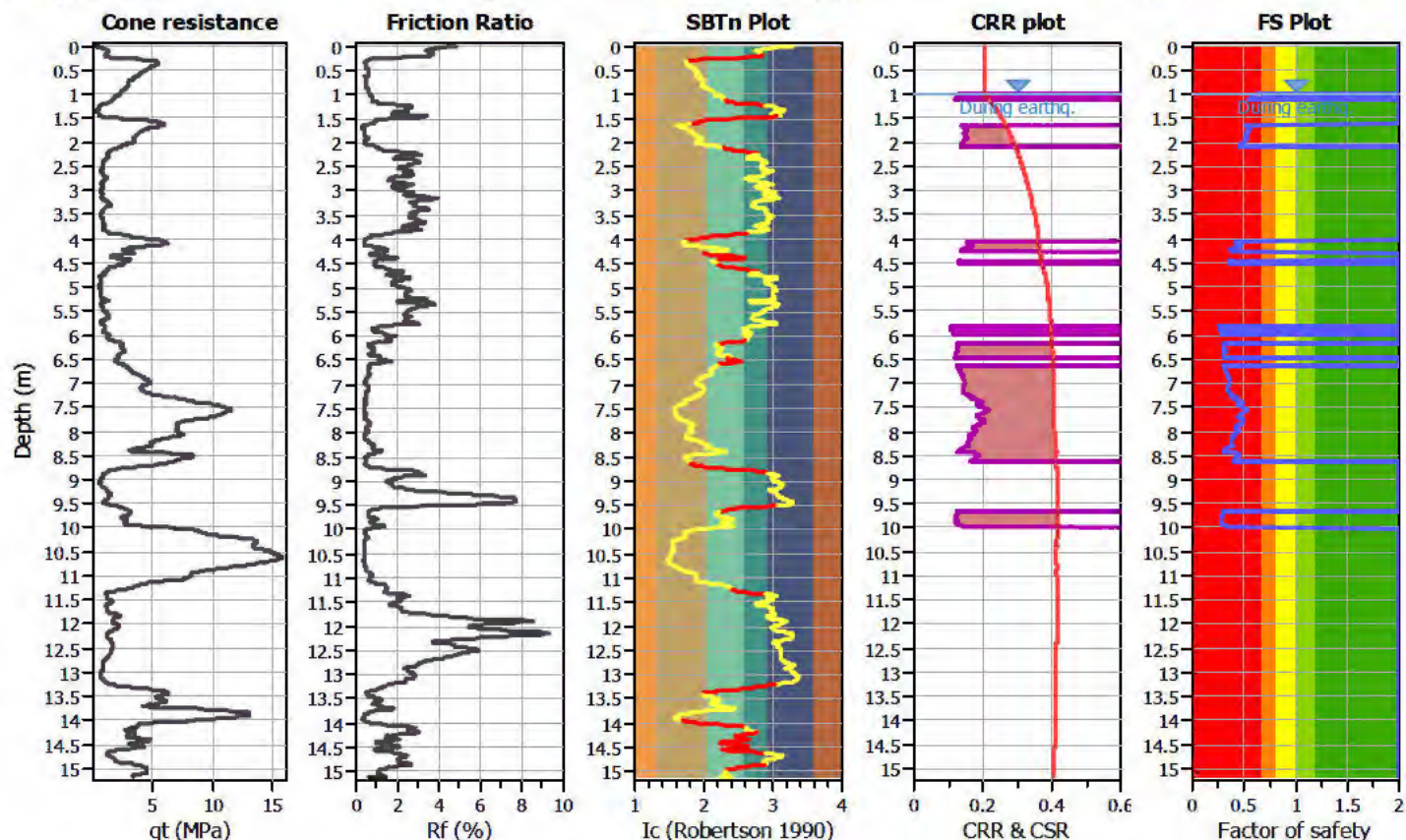
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-11 ULS

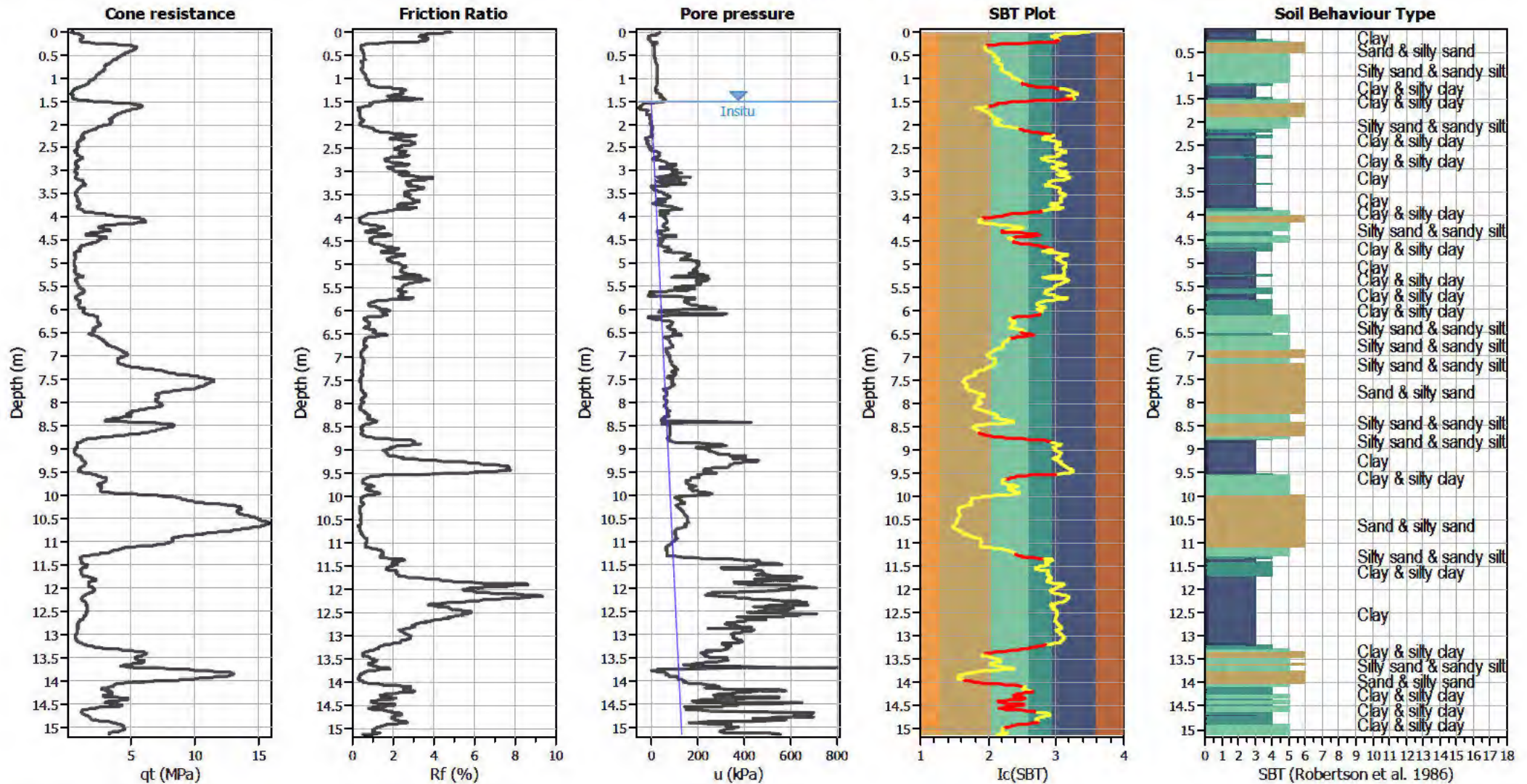
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	10.00 m
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



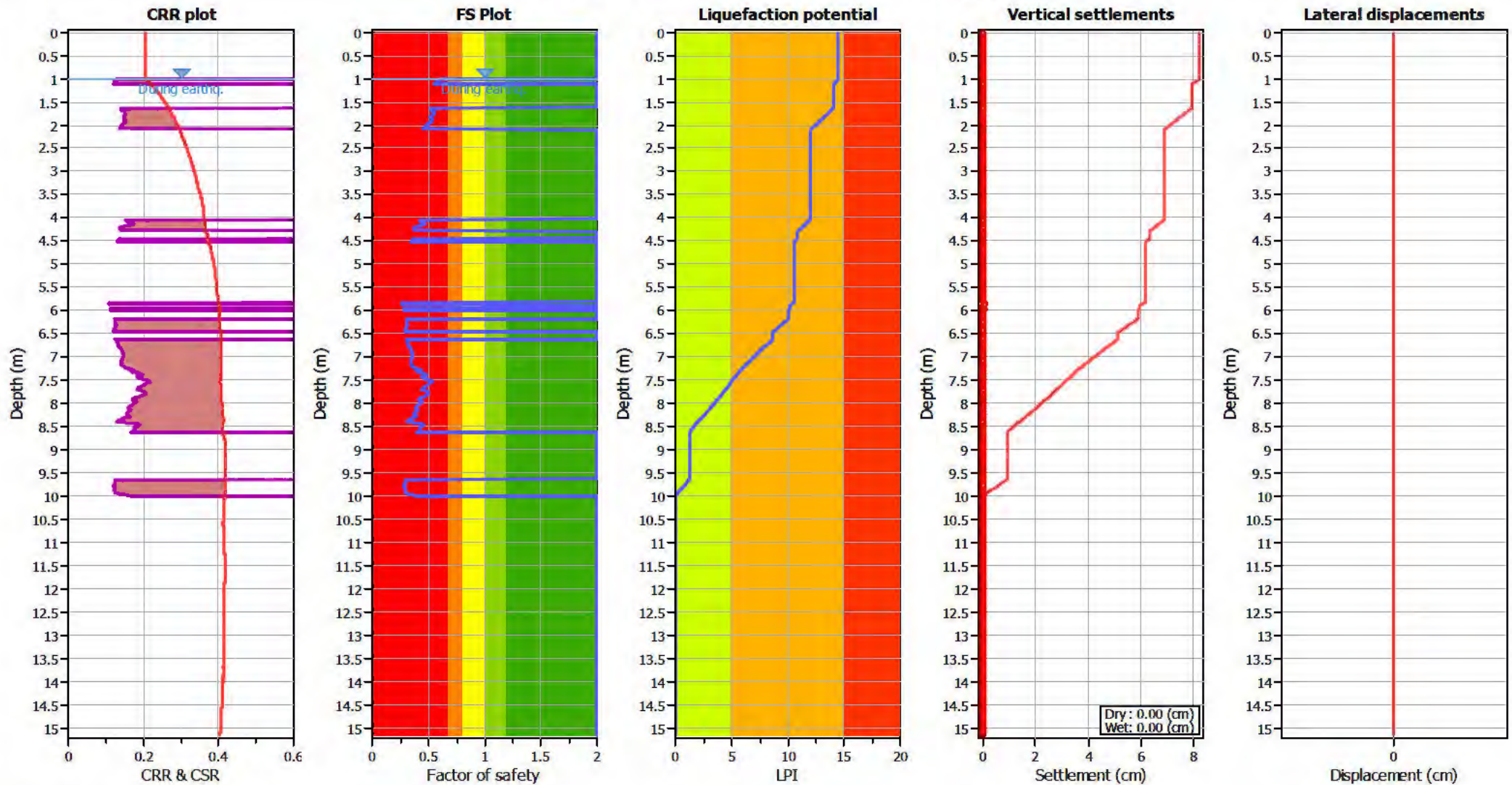
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 7.50
 Peak ground acceleration: 0.35
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

■ Almost certain it will liquefy
■ Very likely to liquefy
■ Liquefaction and no liq. are equally likely
■ Unlike to liquefy
■ Almost certain it will not liquefy

LPI color scheme

■ Very high risk
■ High risk
■ Low risk

LIQUEFACTION ANALYSIS REPORT

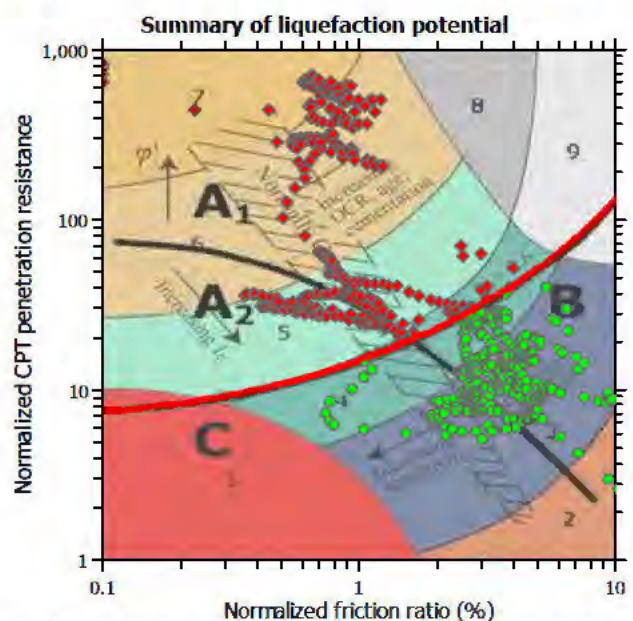
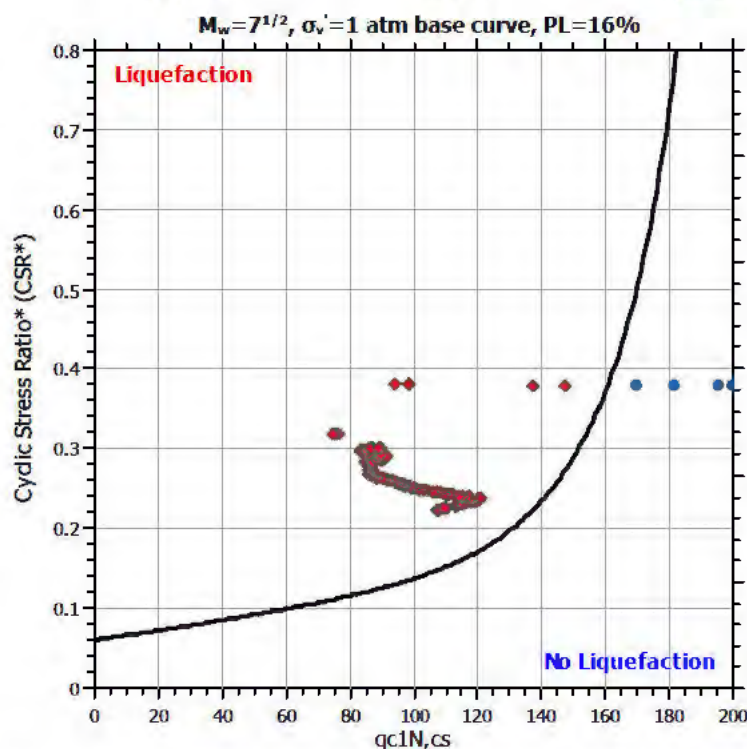
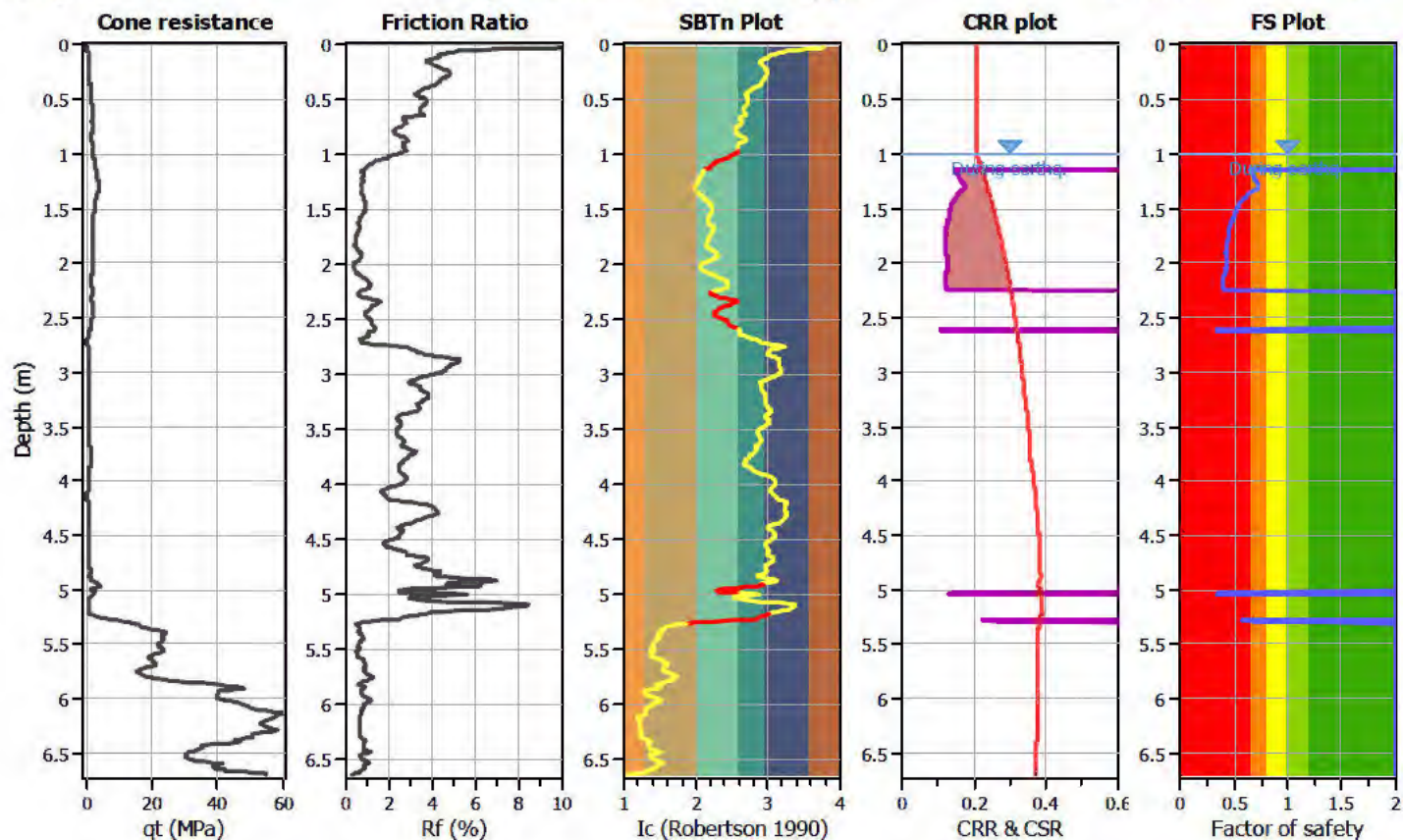
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-12 ULS

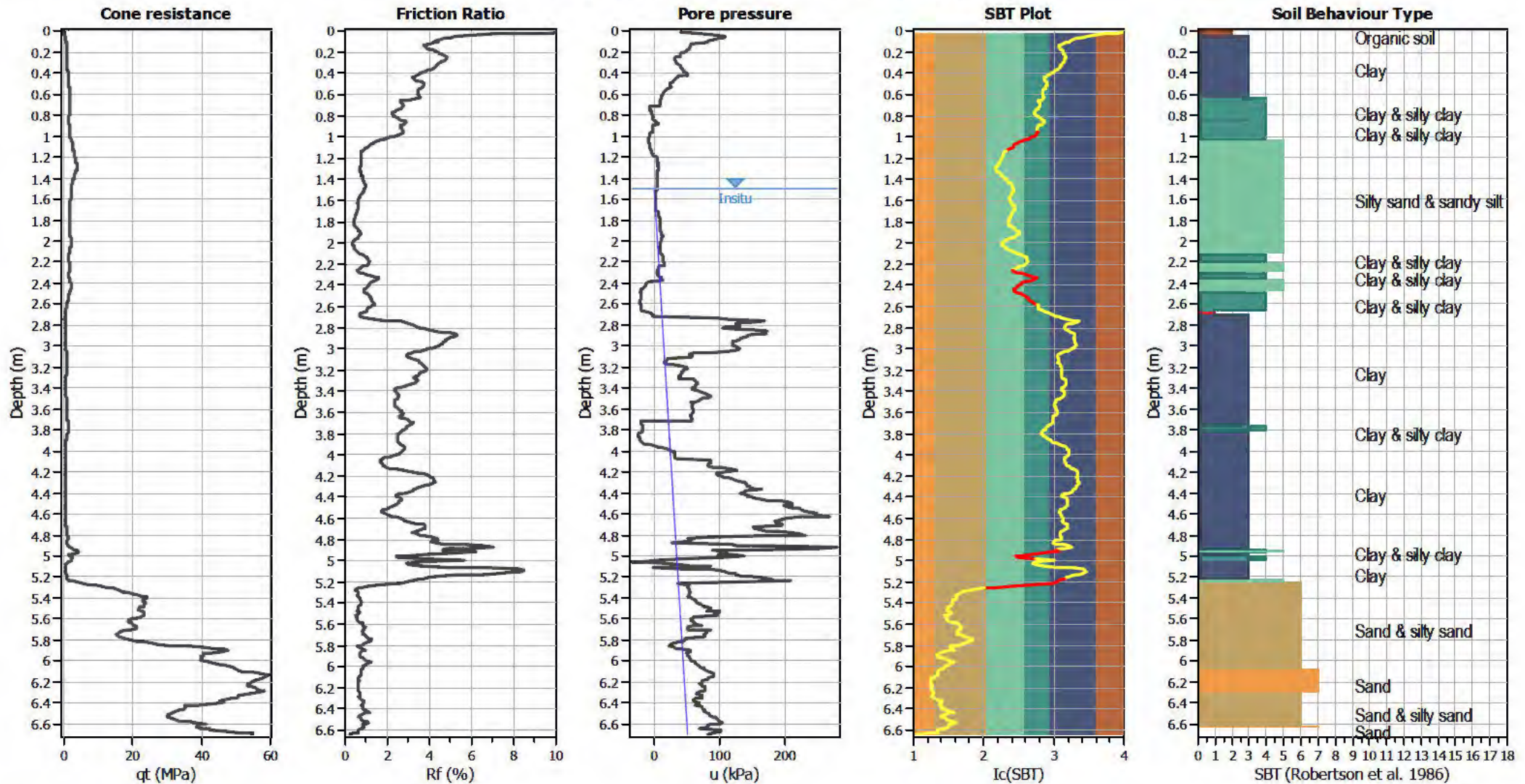
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



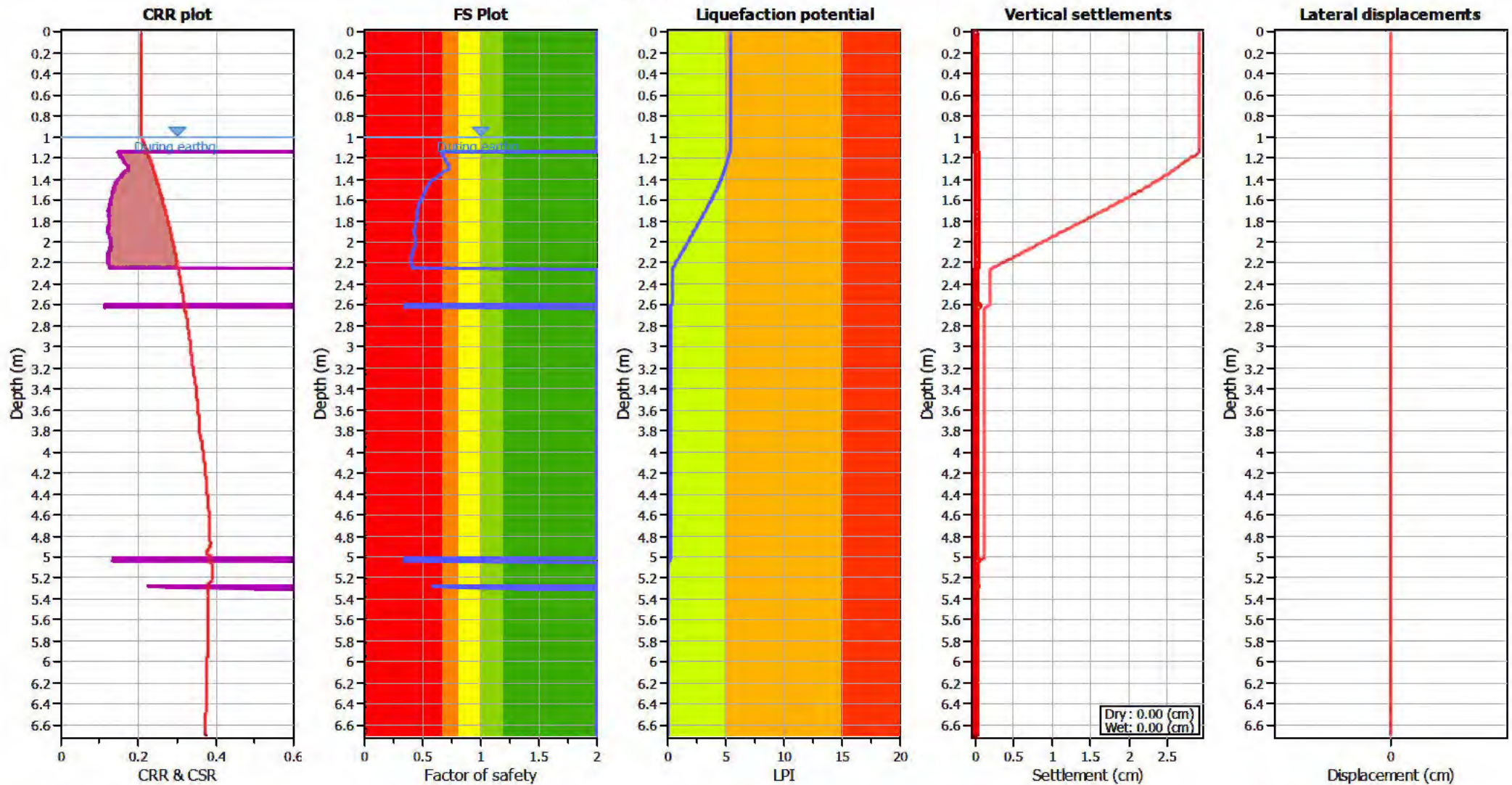
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{α} applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 7.50
 Peak ground acceleration: 0.35
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_w applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

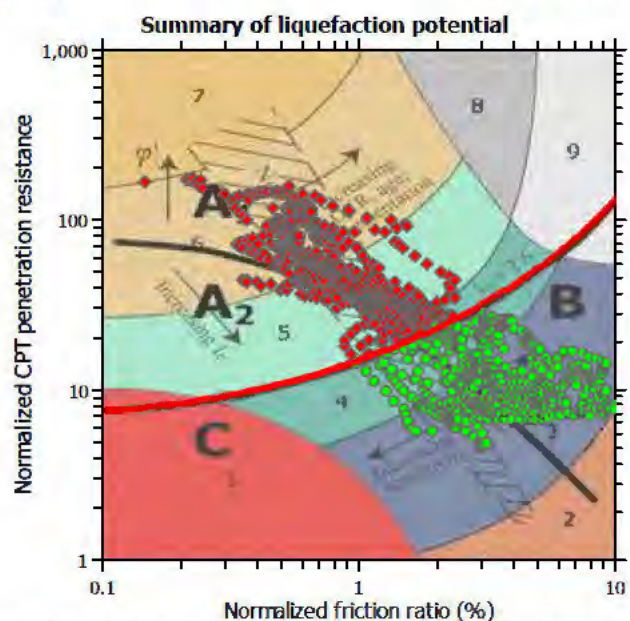
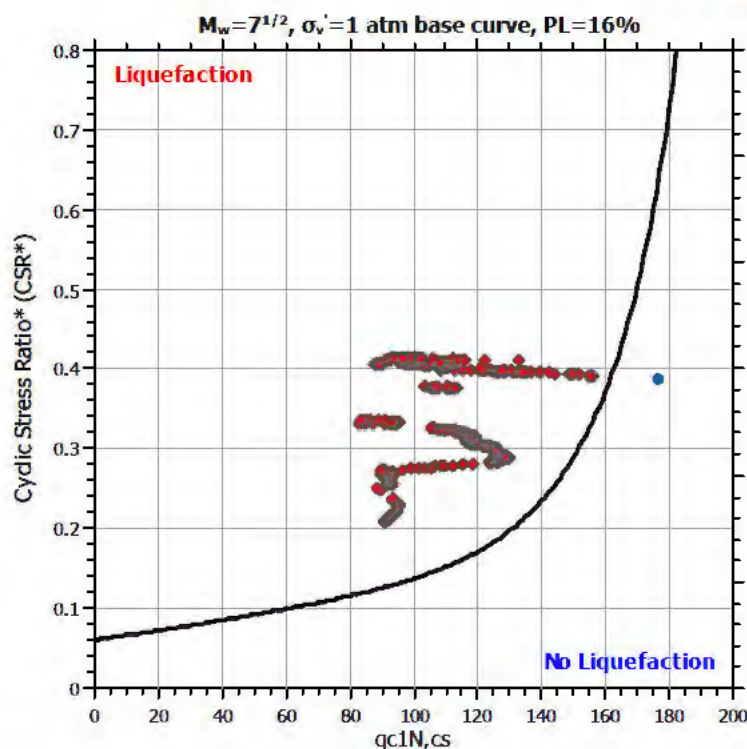
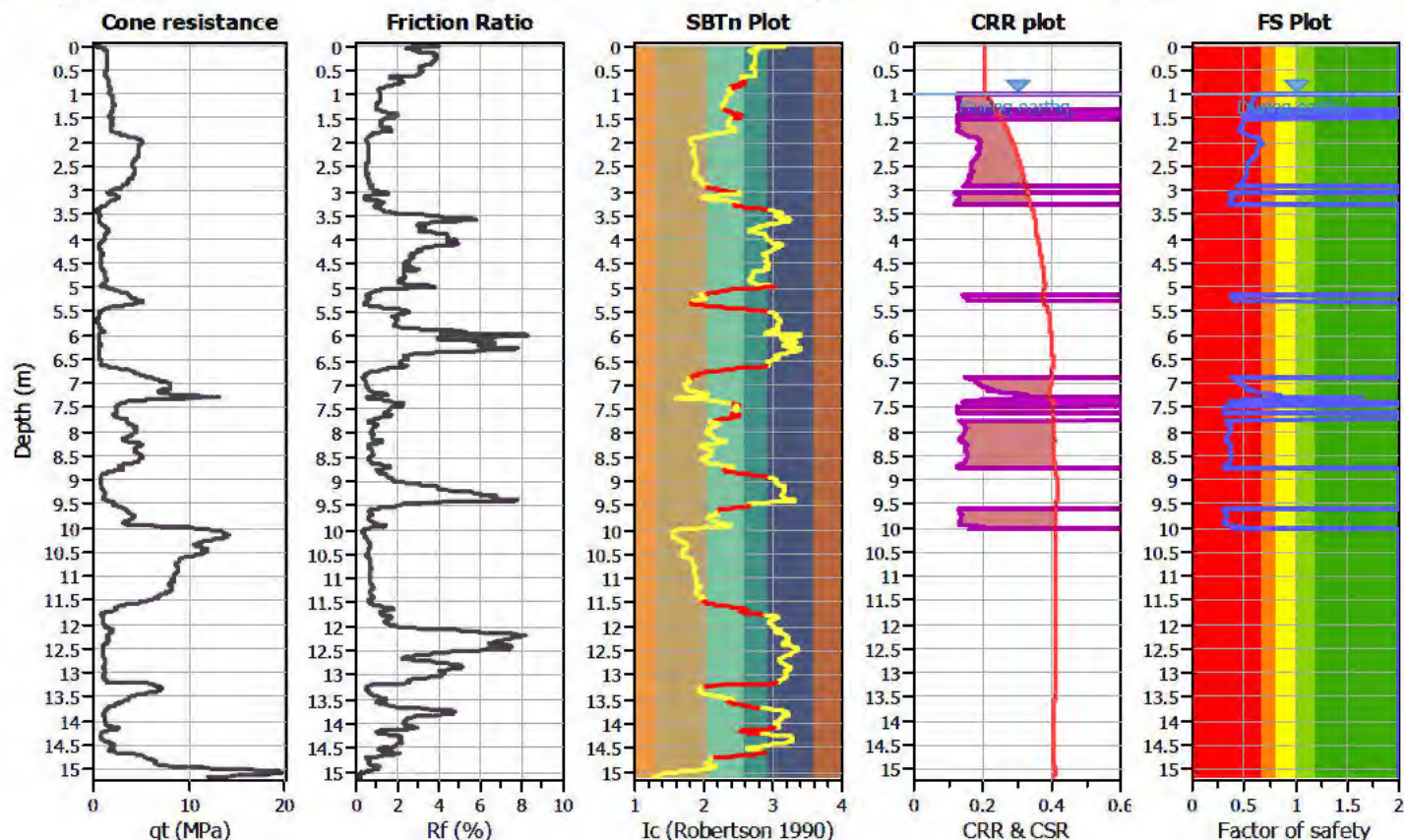
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-13 ULS

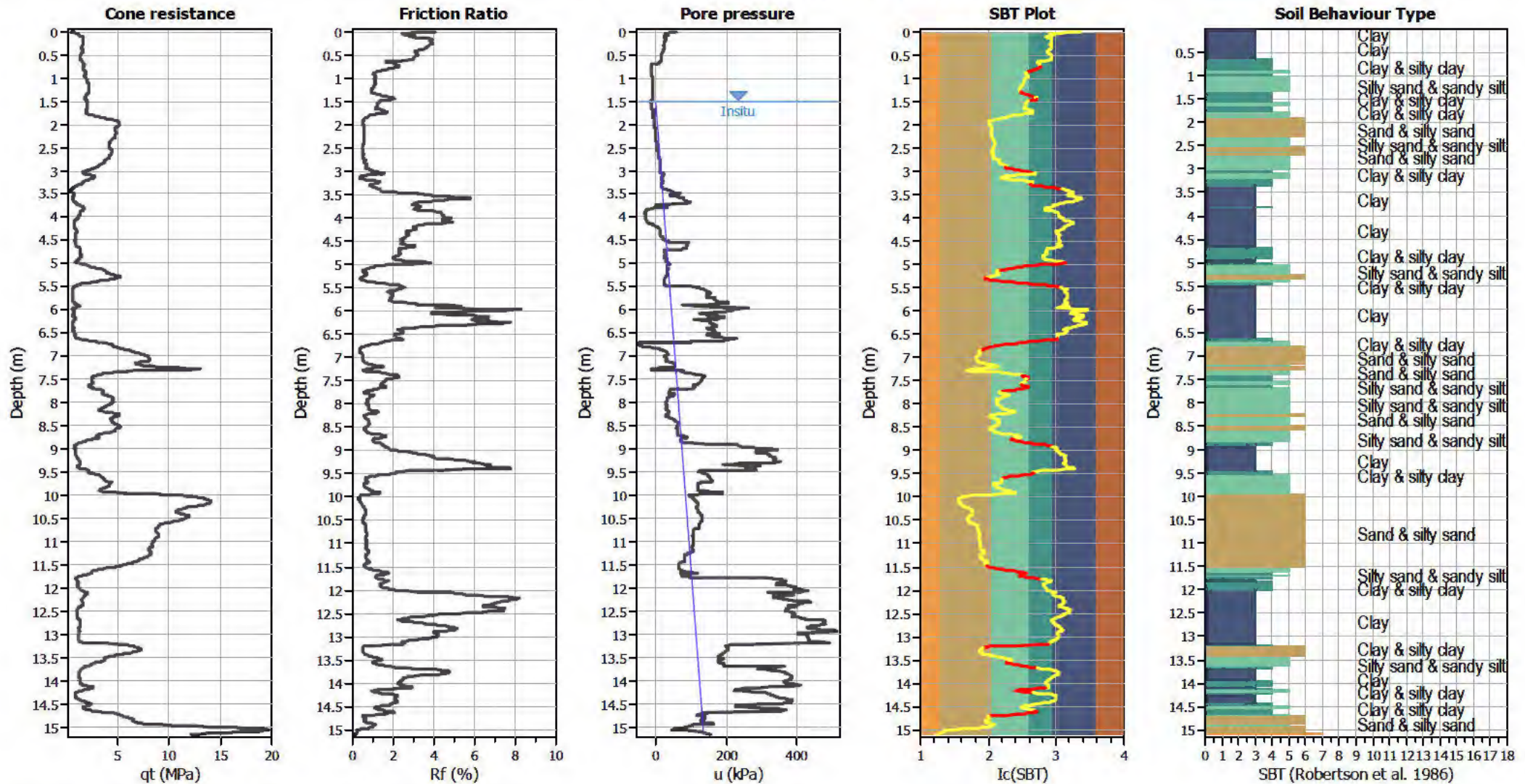
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



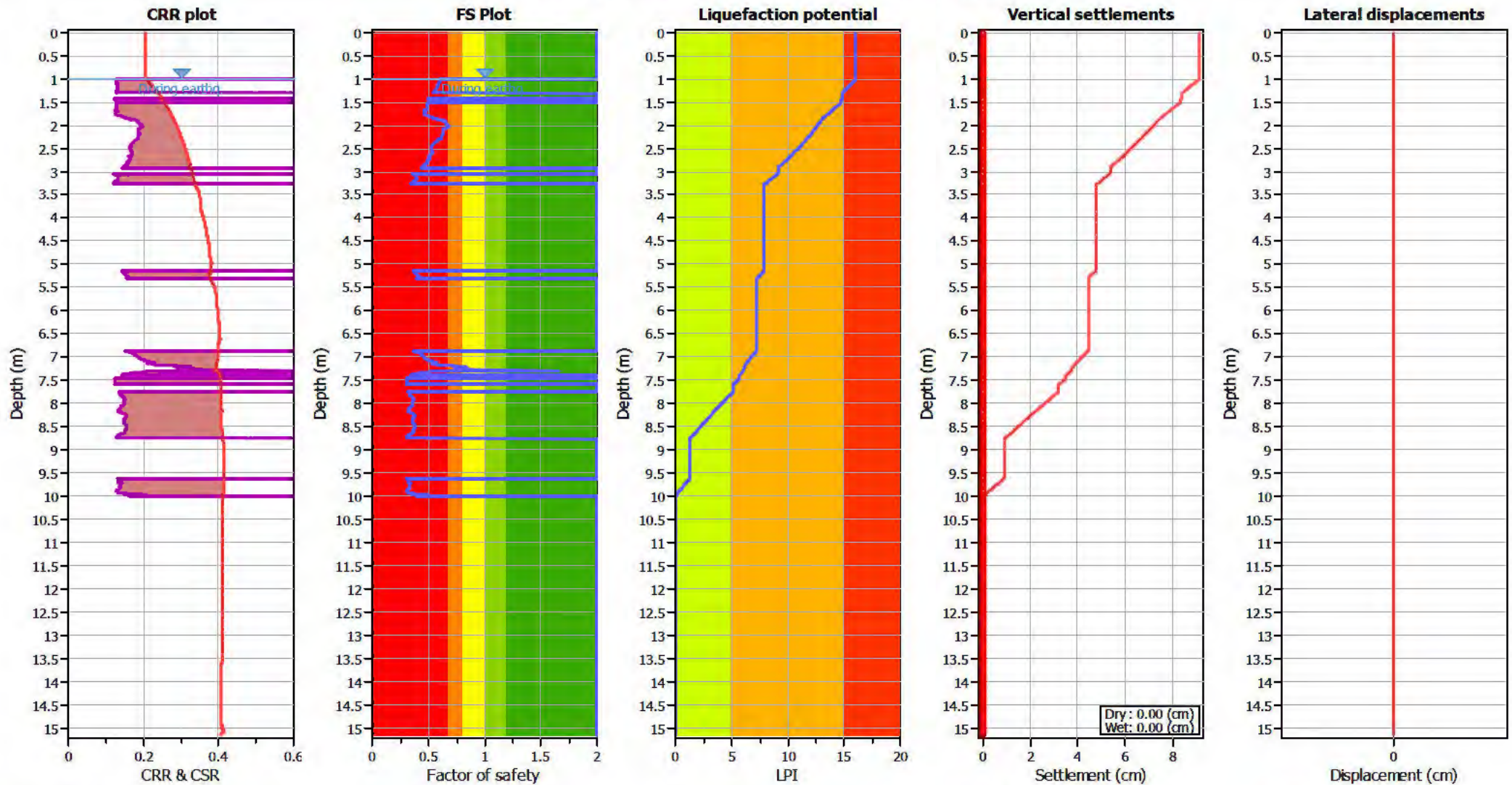
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 7.50
 Peak ground acceleration: 0.35
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

■ Almost certain it will liquefy
■ Very likely to liquefy
■ Liquefaction and no liq. are equally likely
■ Unlike to liquefy
■ Almost certain it will not liquefy

LPI color scheme

■ Very high risk
■ High risk
■ Low risk

LIQUEFACTION ANALYSIS REPORT

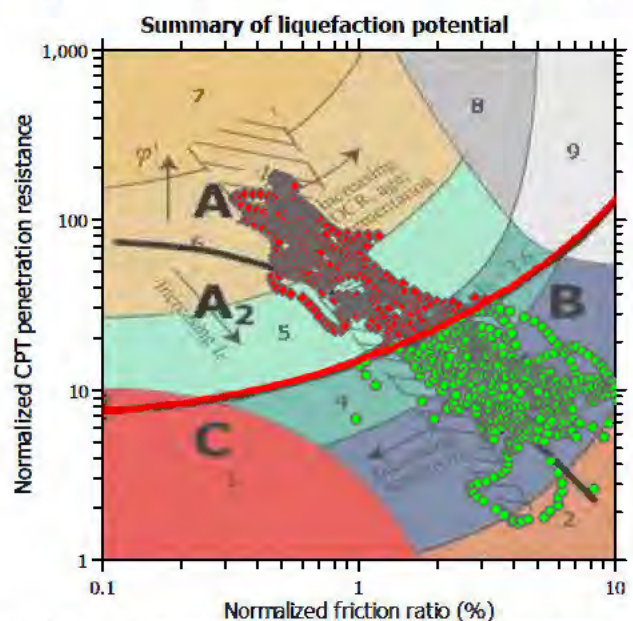
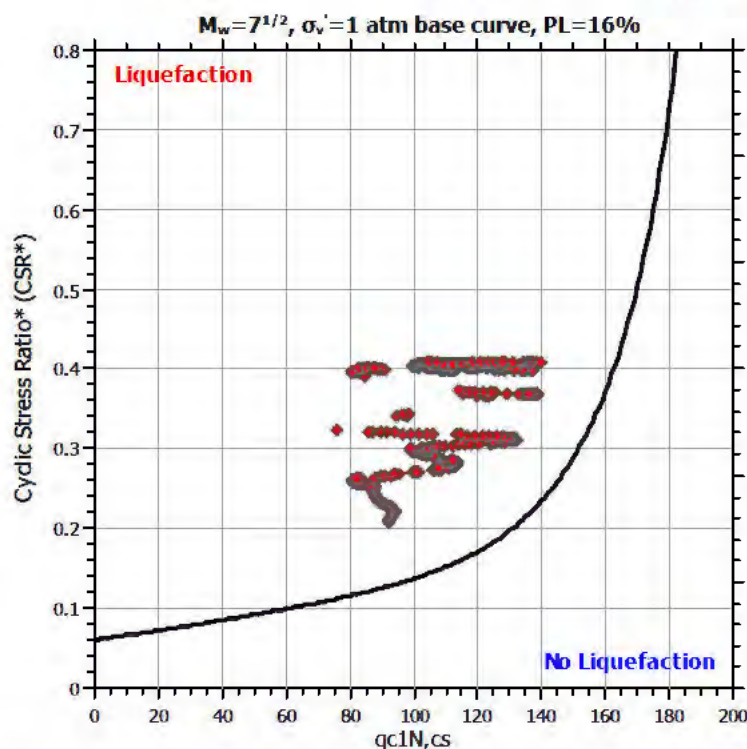
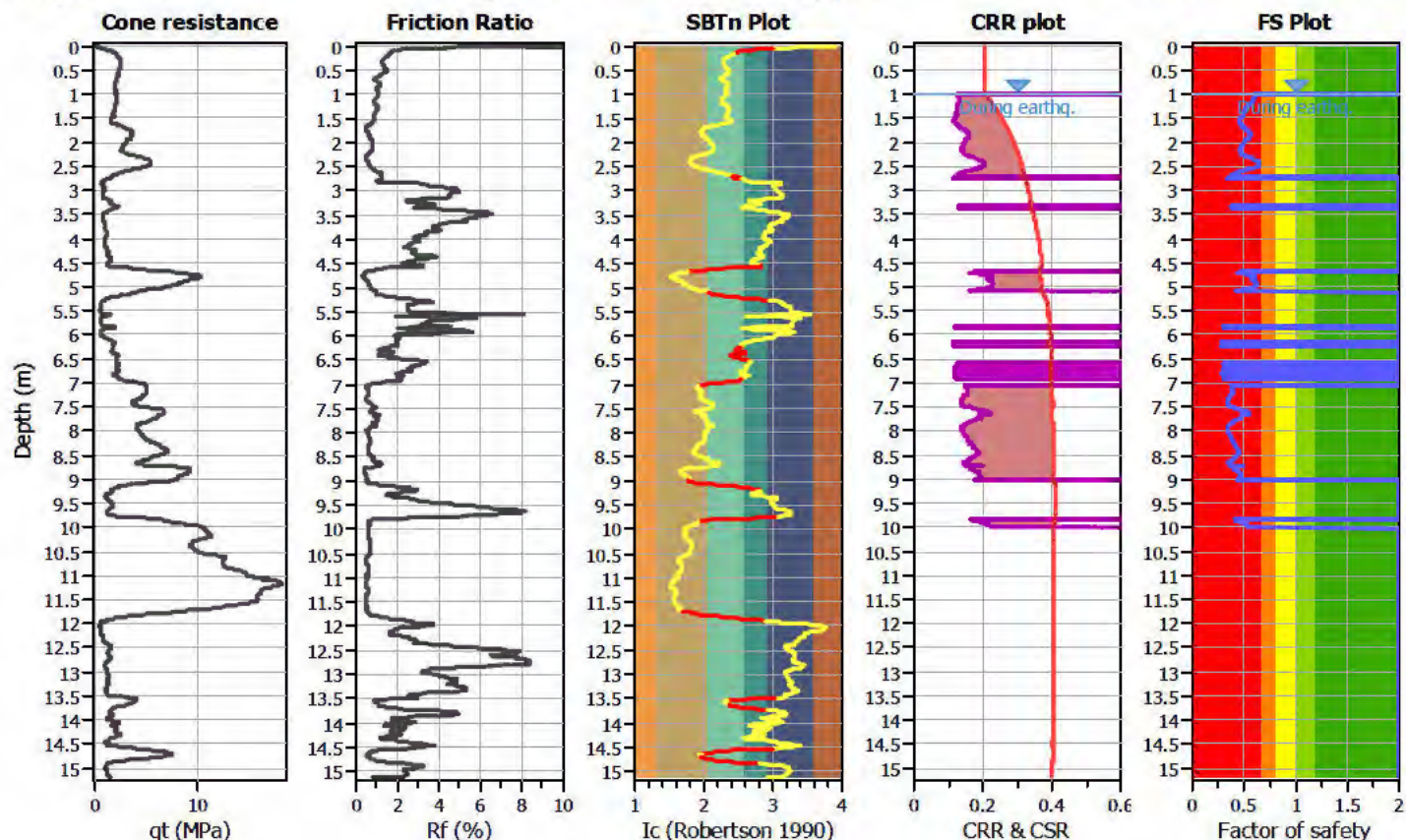
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-14 ULS

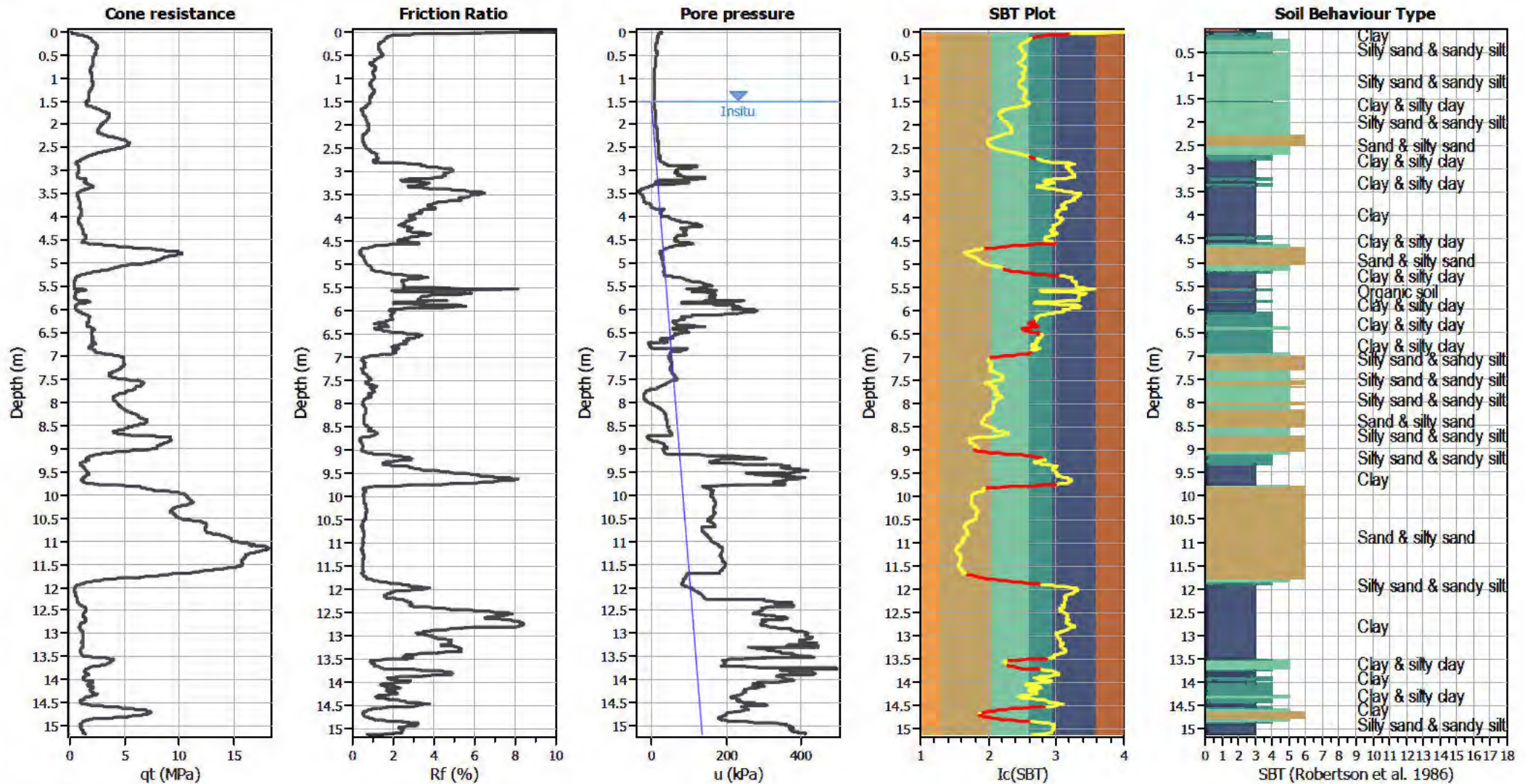
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	10.00 m
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_v applied:	Yes	MSF method:	Method based



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



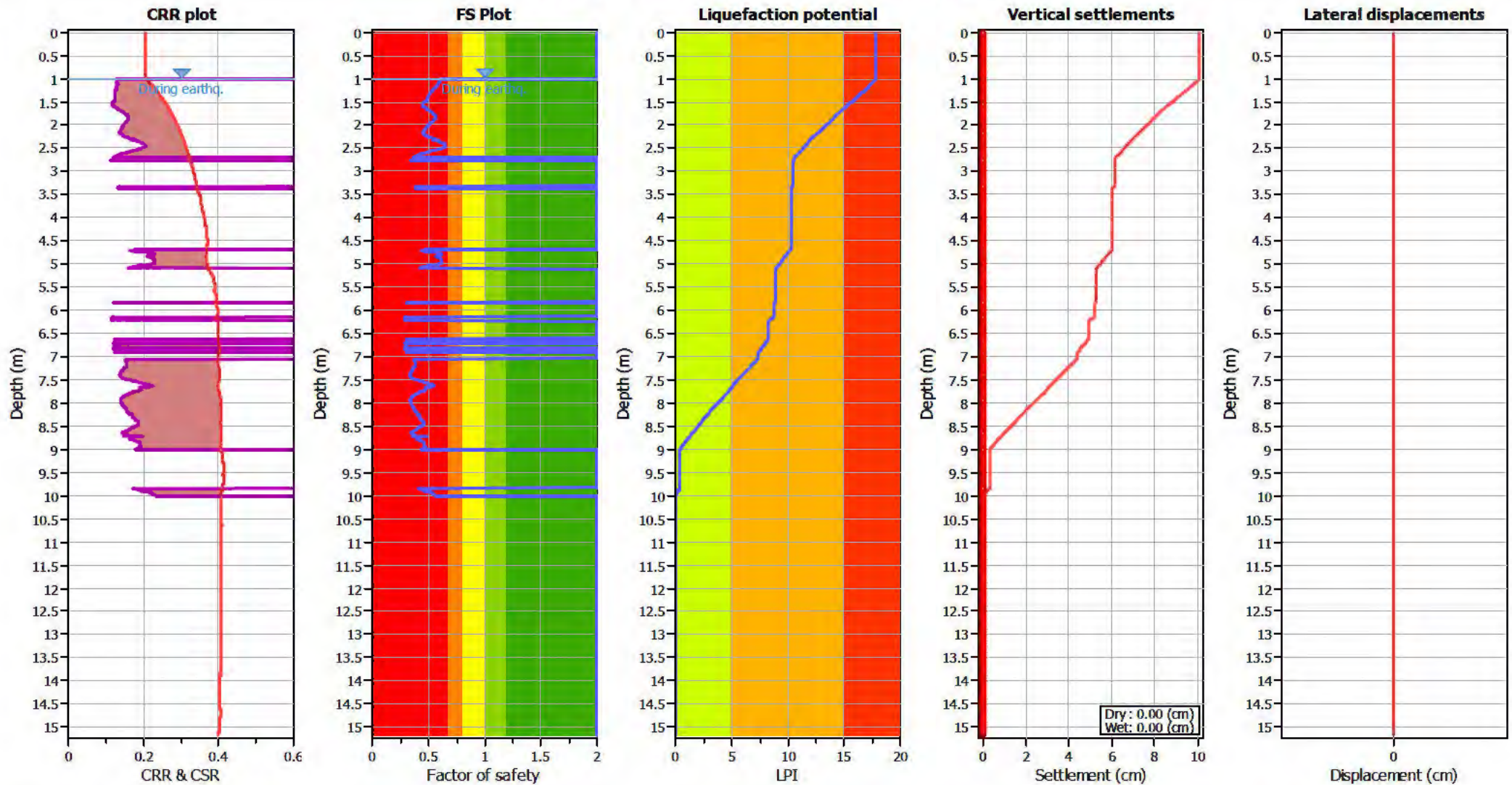
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 7.50
 Peak ground acceleration: 0.35
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

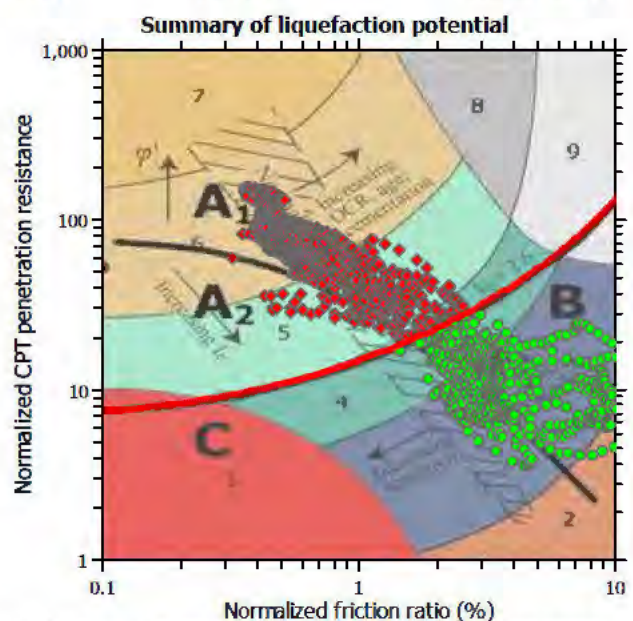
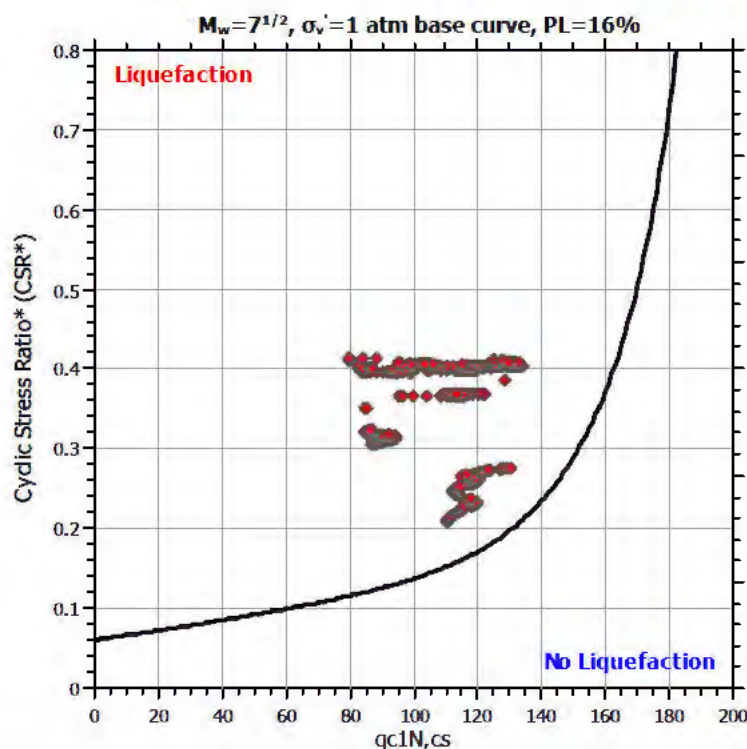
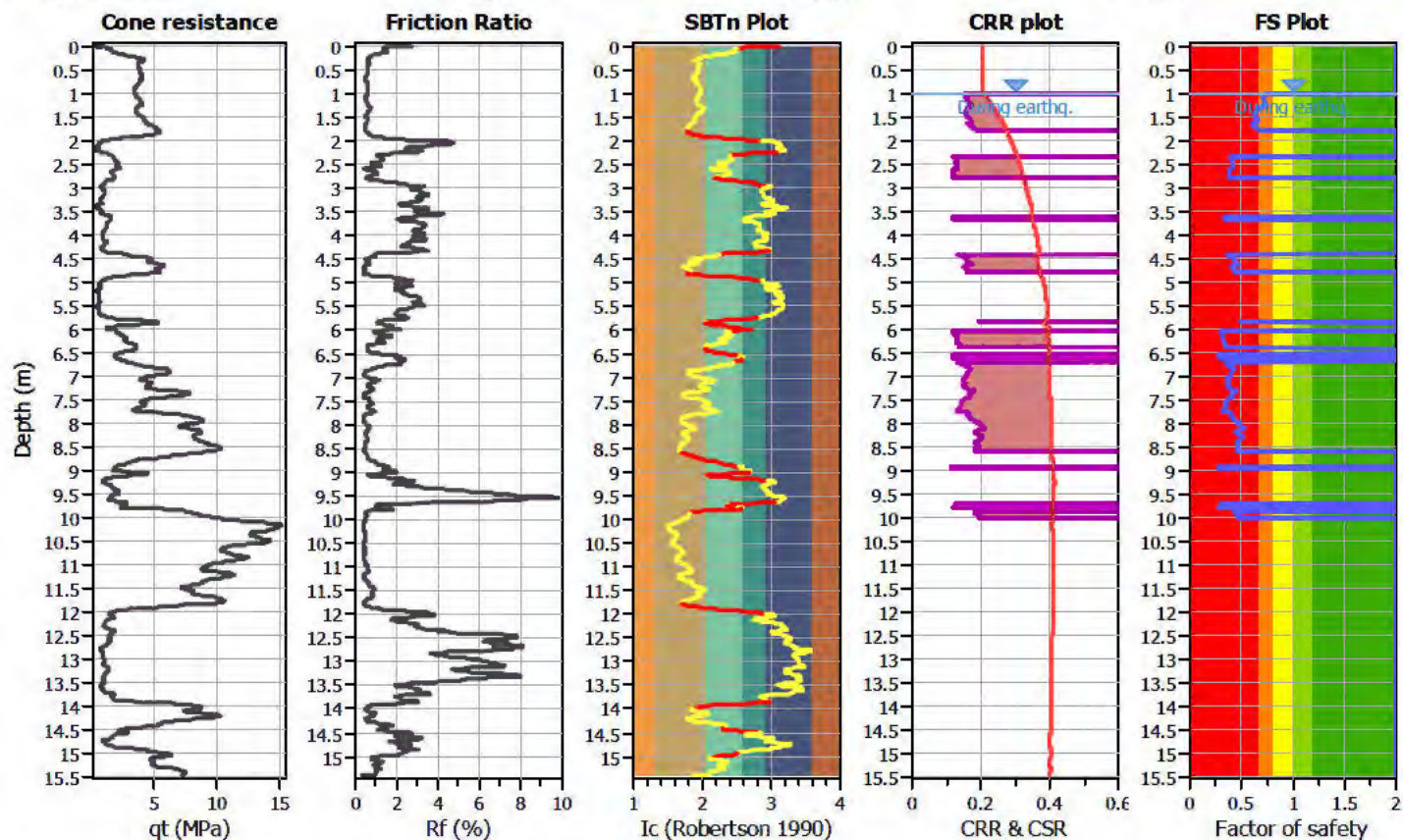
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-15 ULS

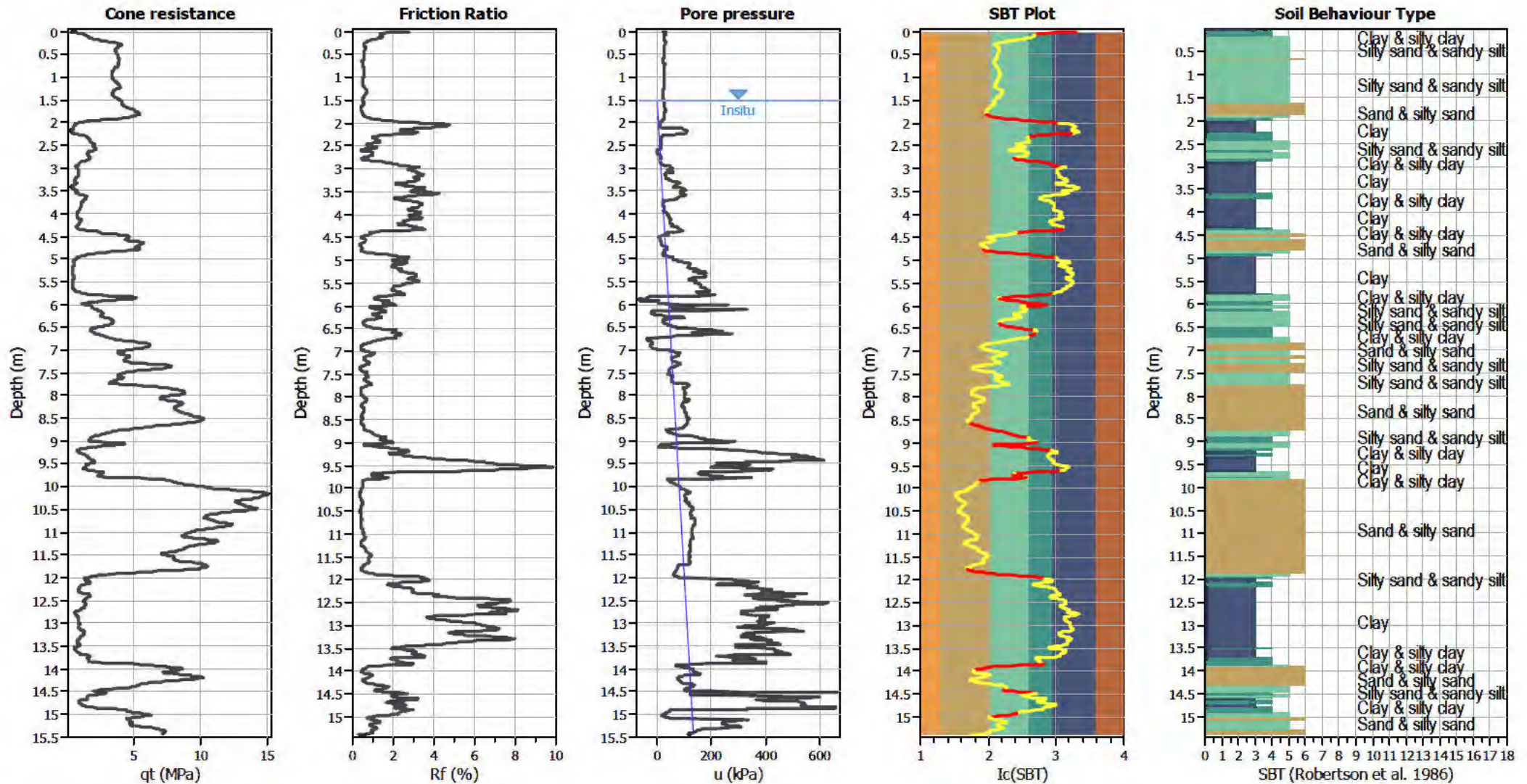
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots

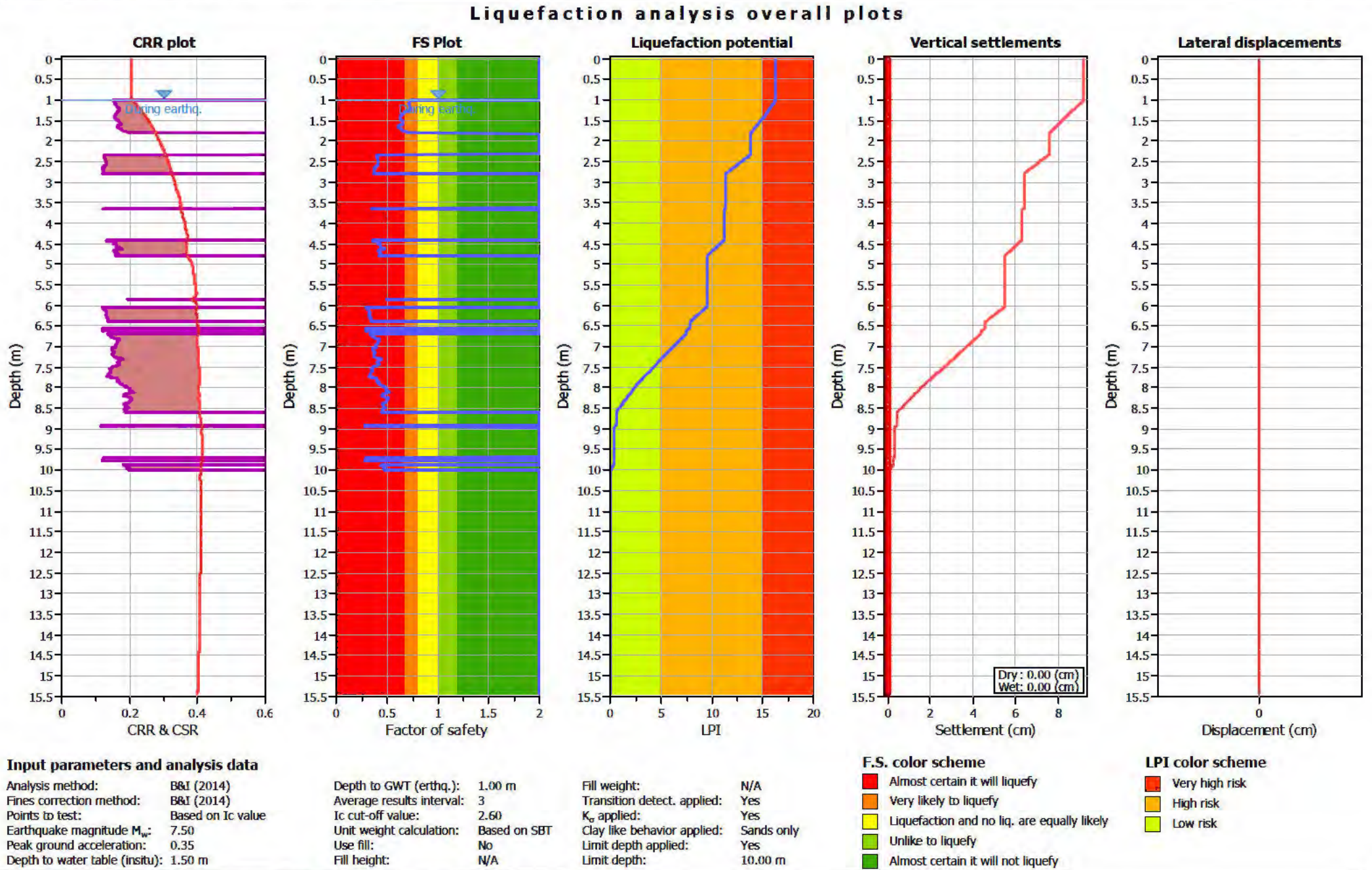


Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_a applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained



LIQUEFACTION ANALYSIS REPORT

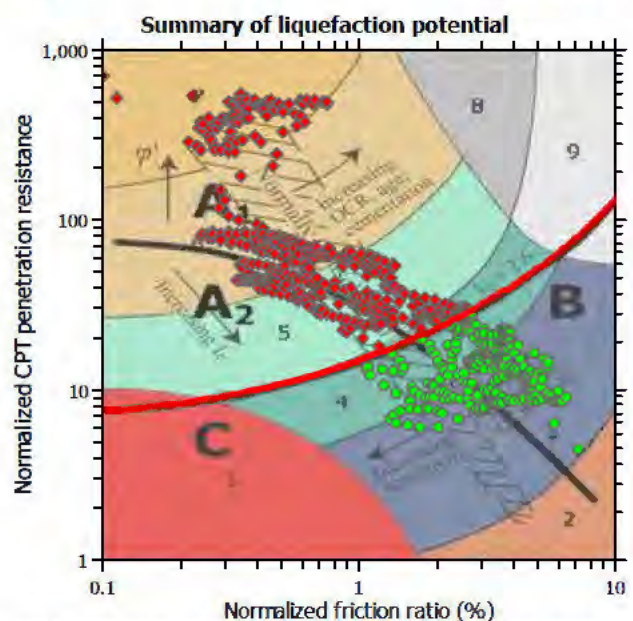
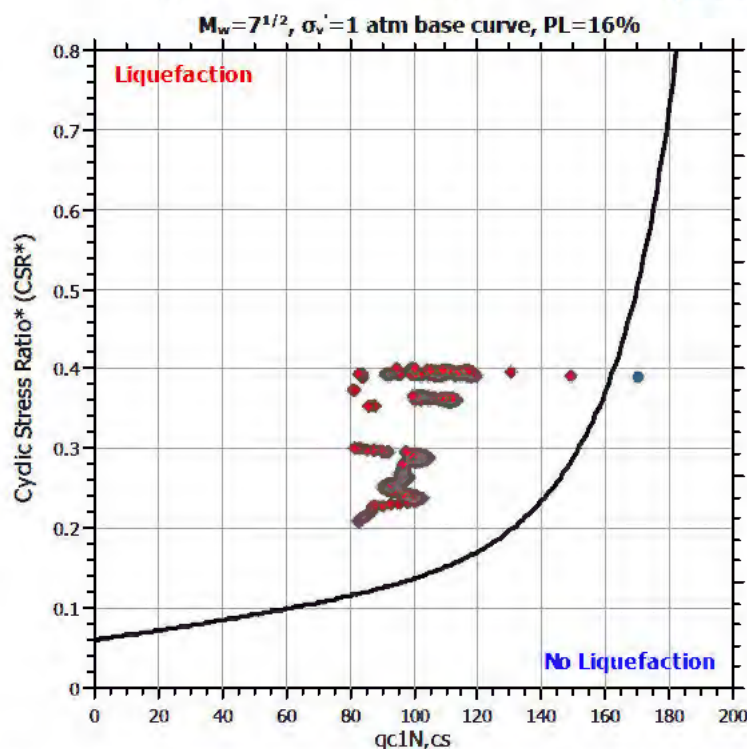
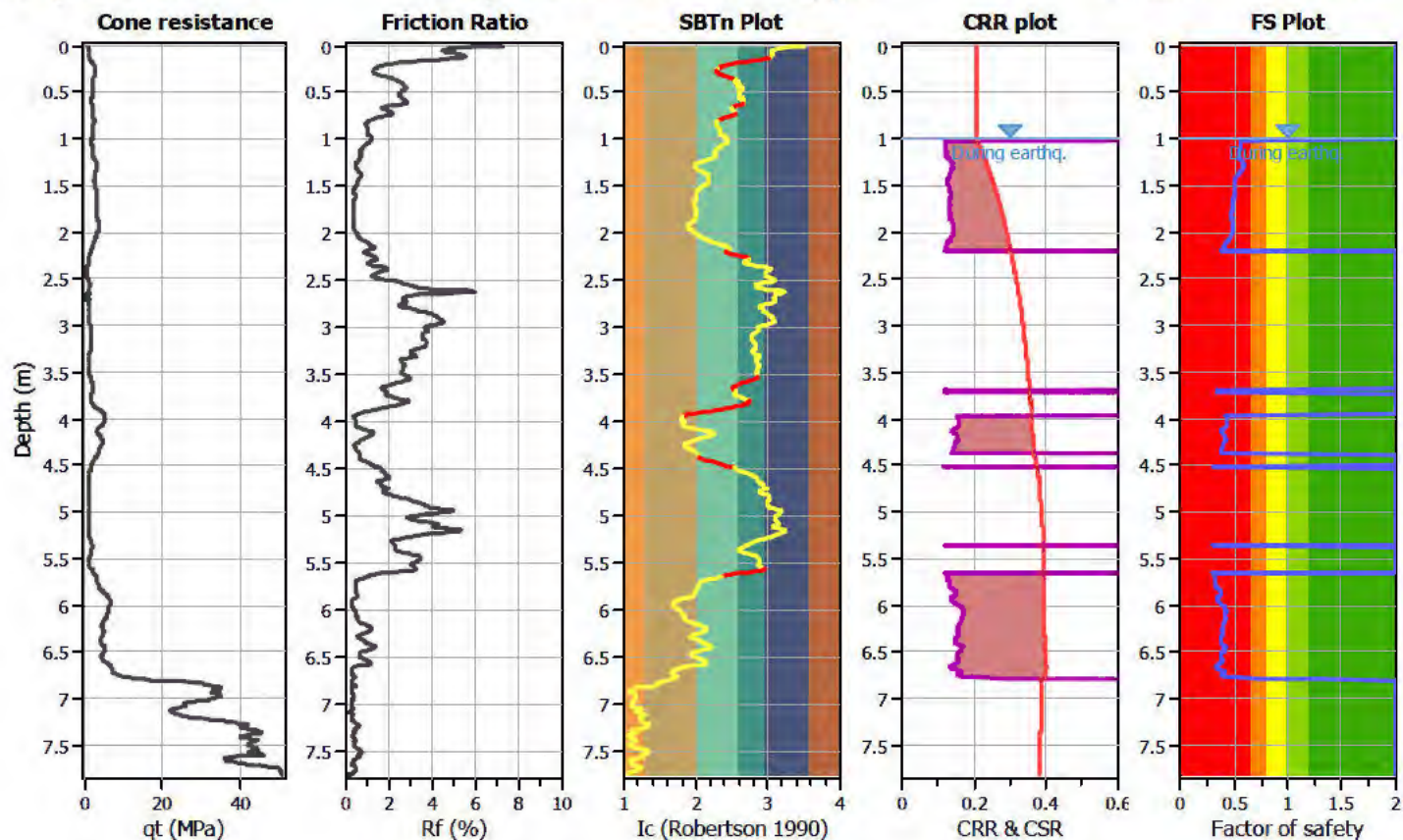
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-16 ULS

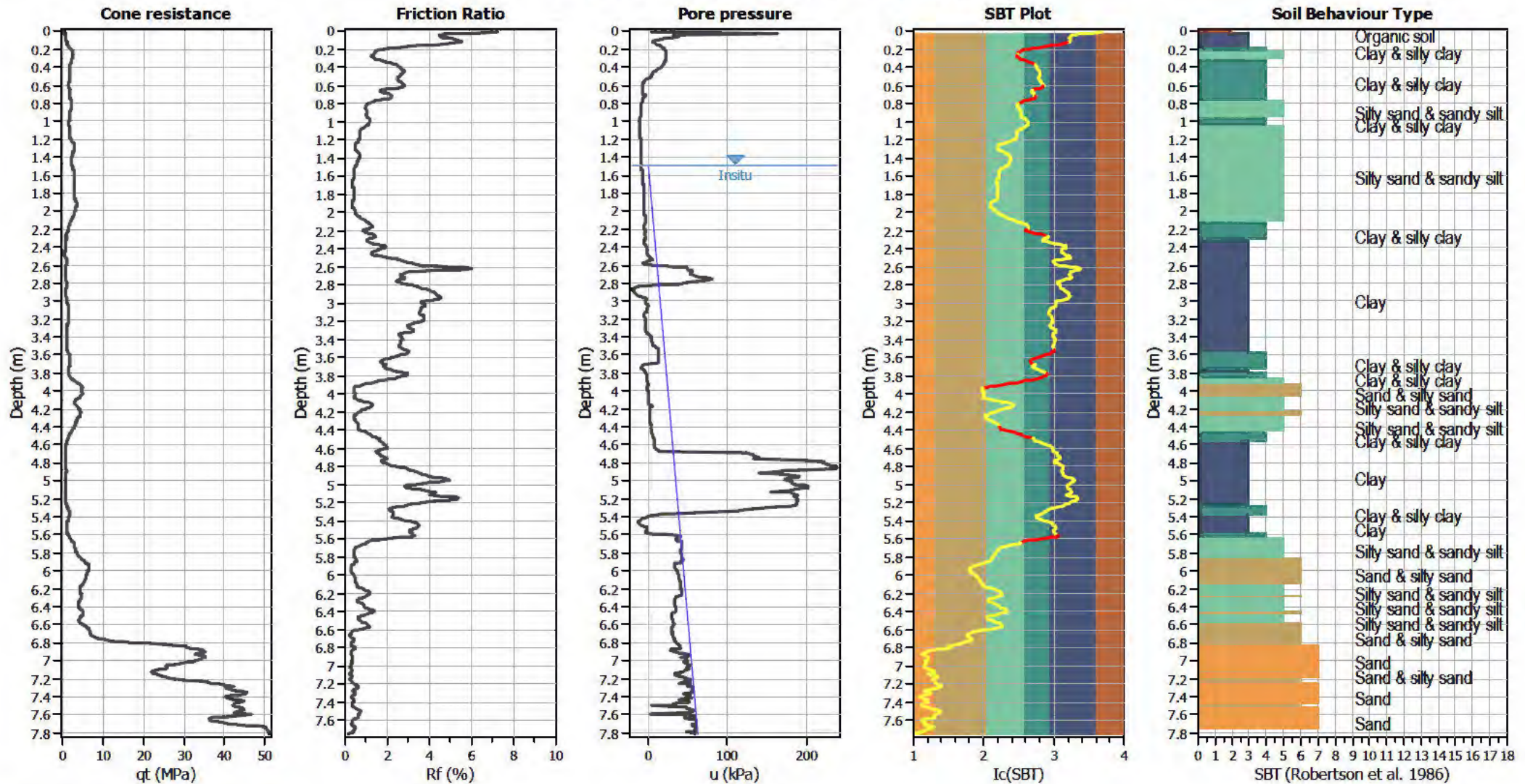
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



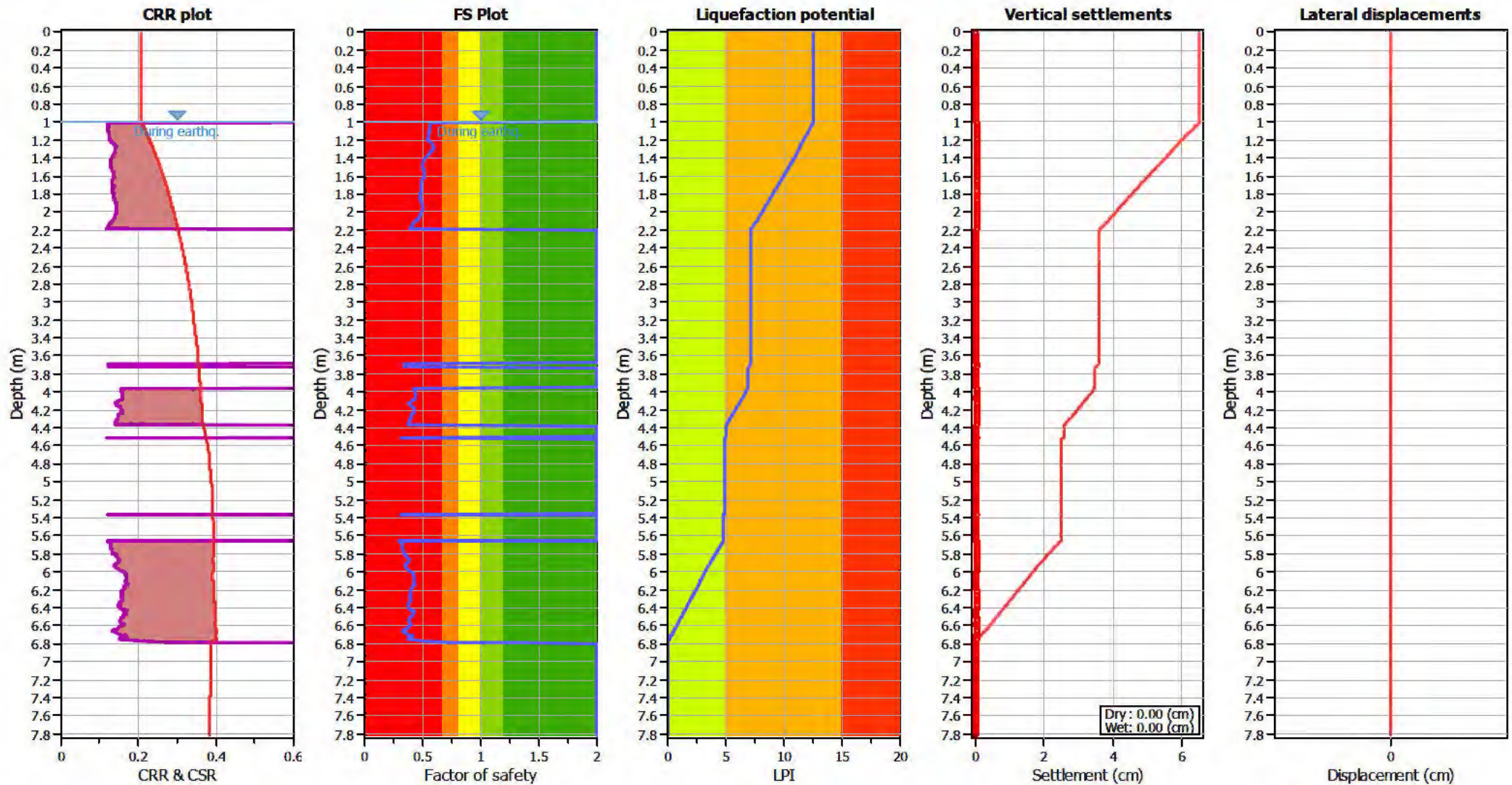
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 7.50
 Peak ground acceleration: 0.35
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

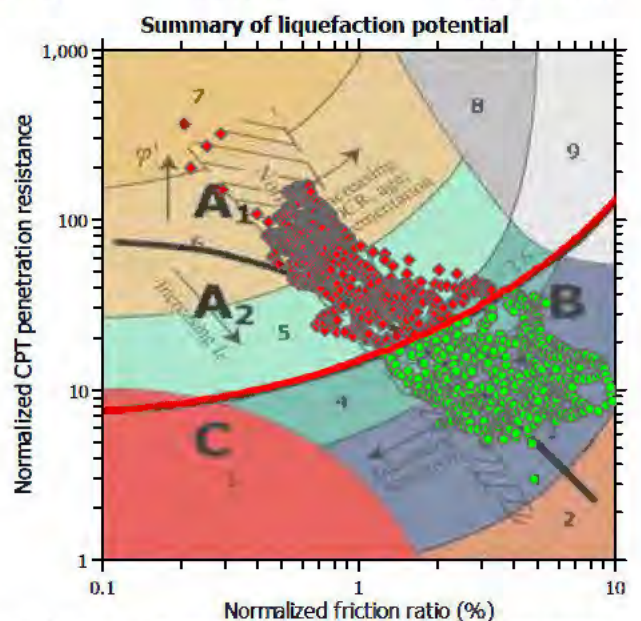
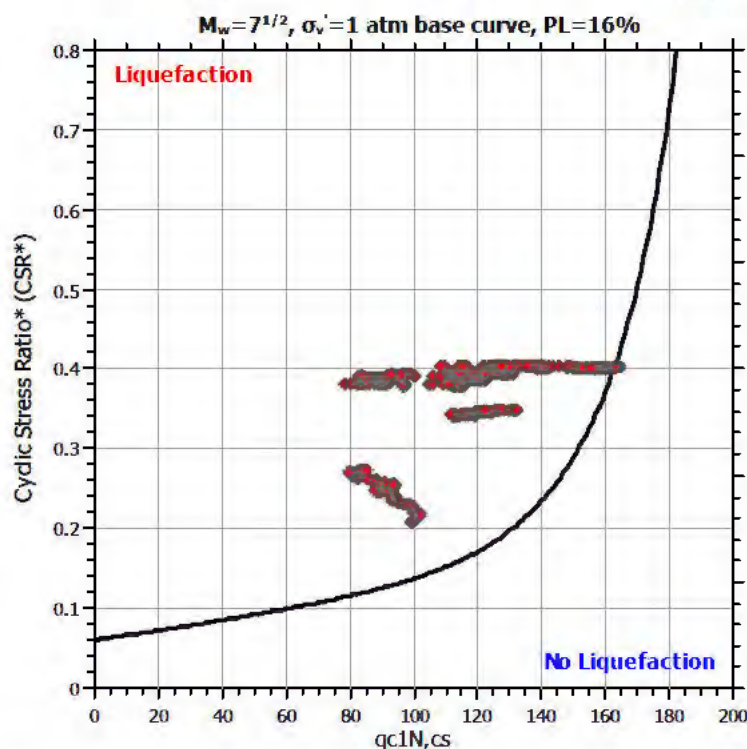
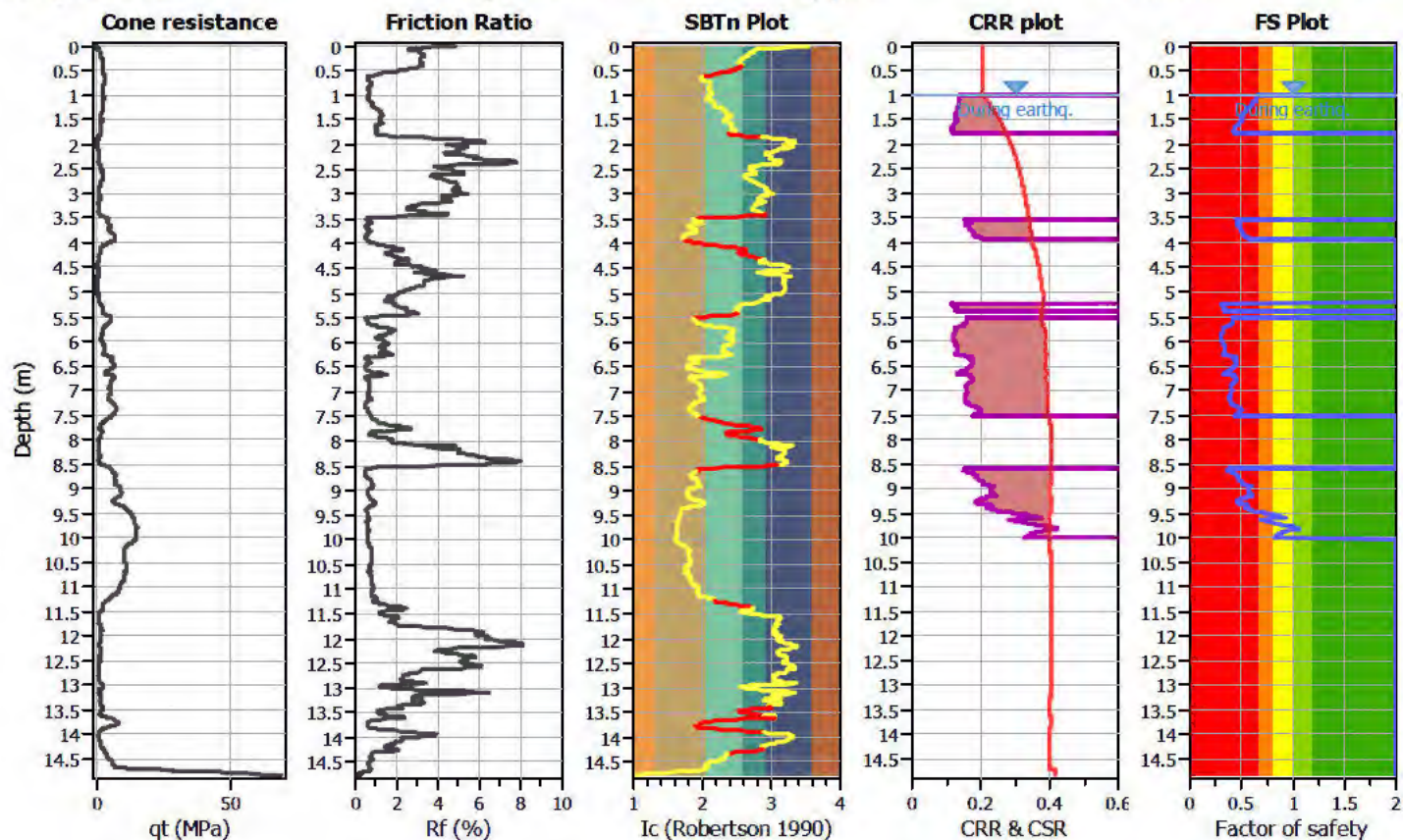
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-17 ULS

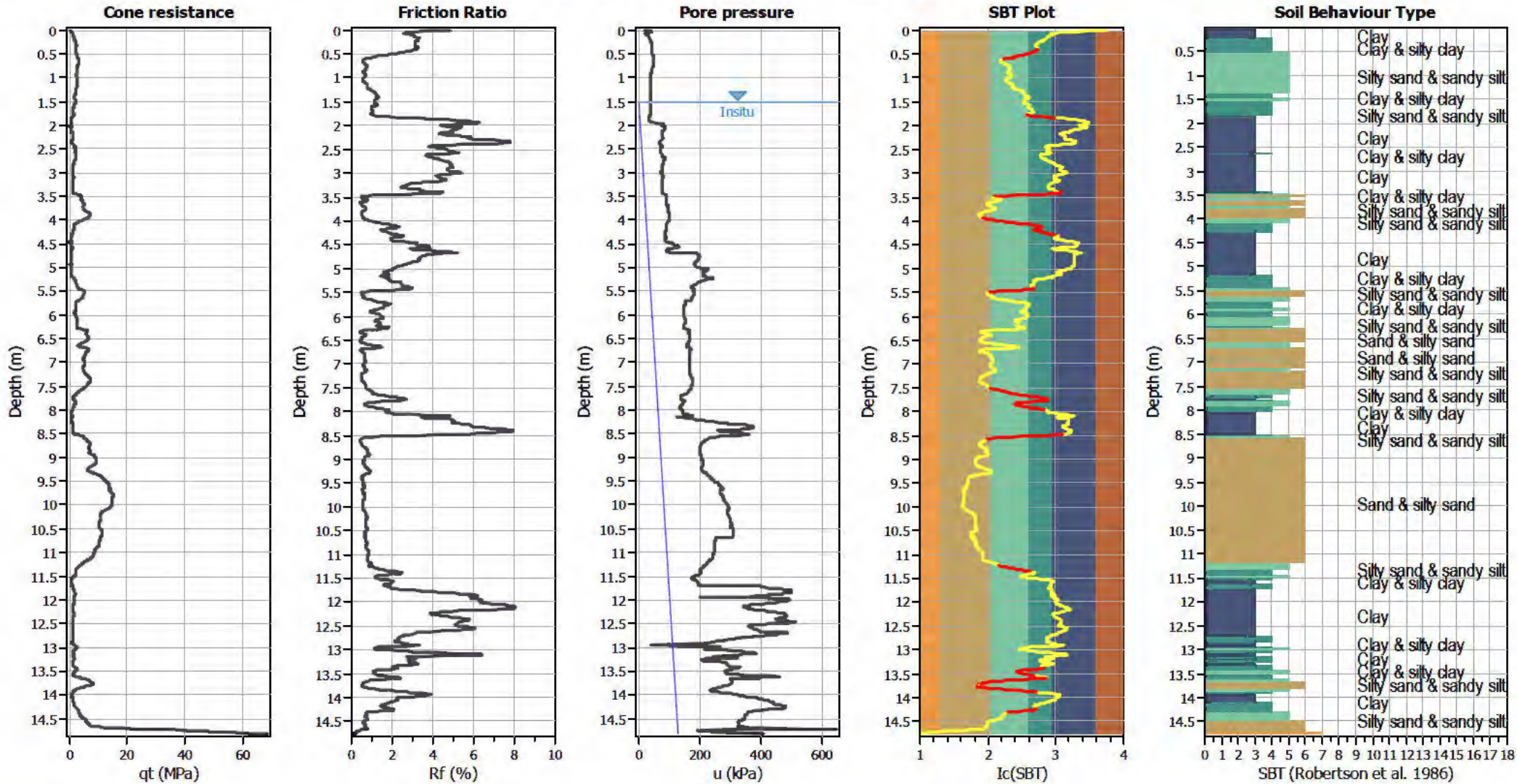
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



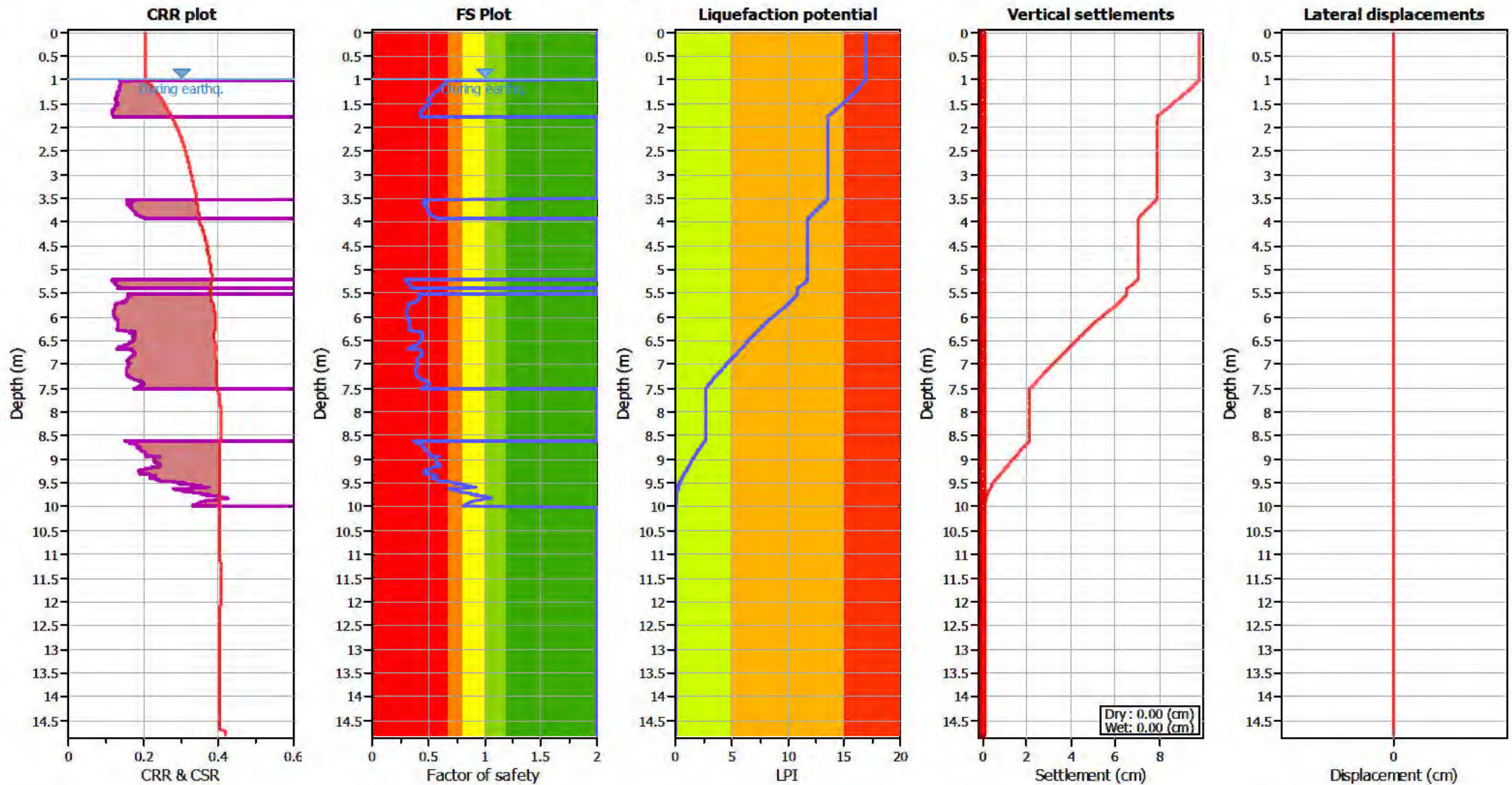
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on I_c value
 Earthquake magnitude M_w : 7.50
 Peak ground acceleration: 0.35
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 I_c cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

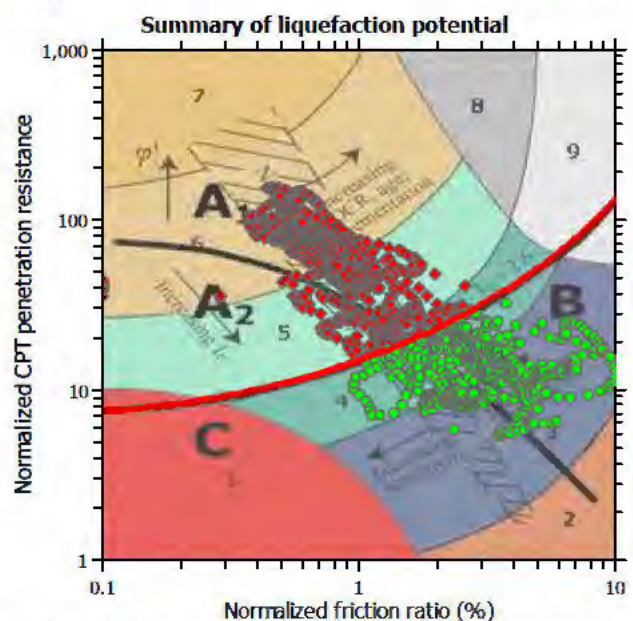
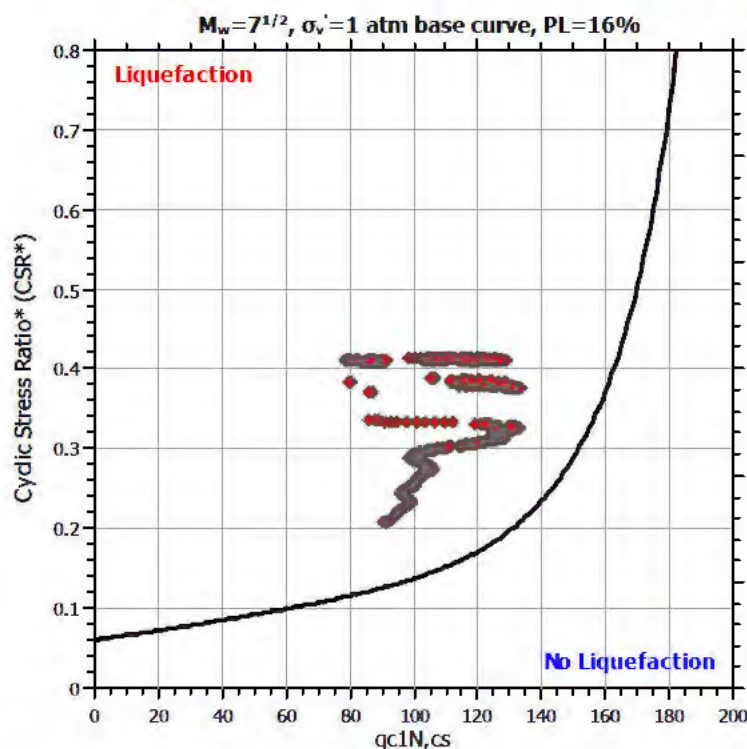
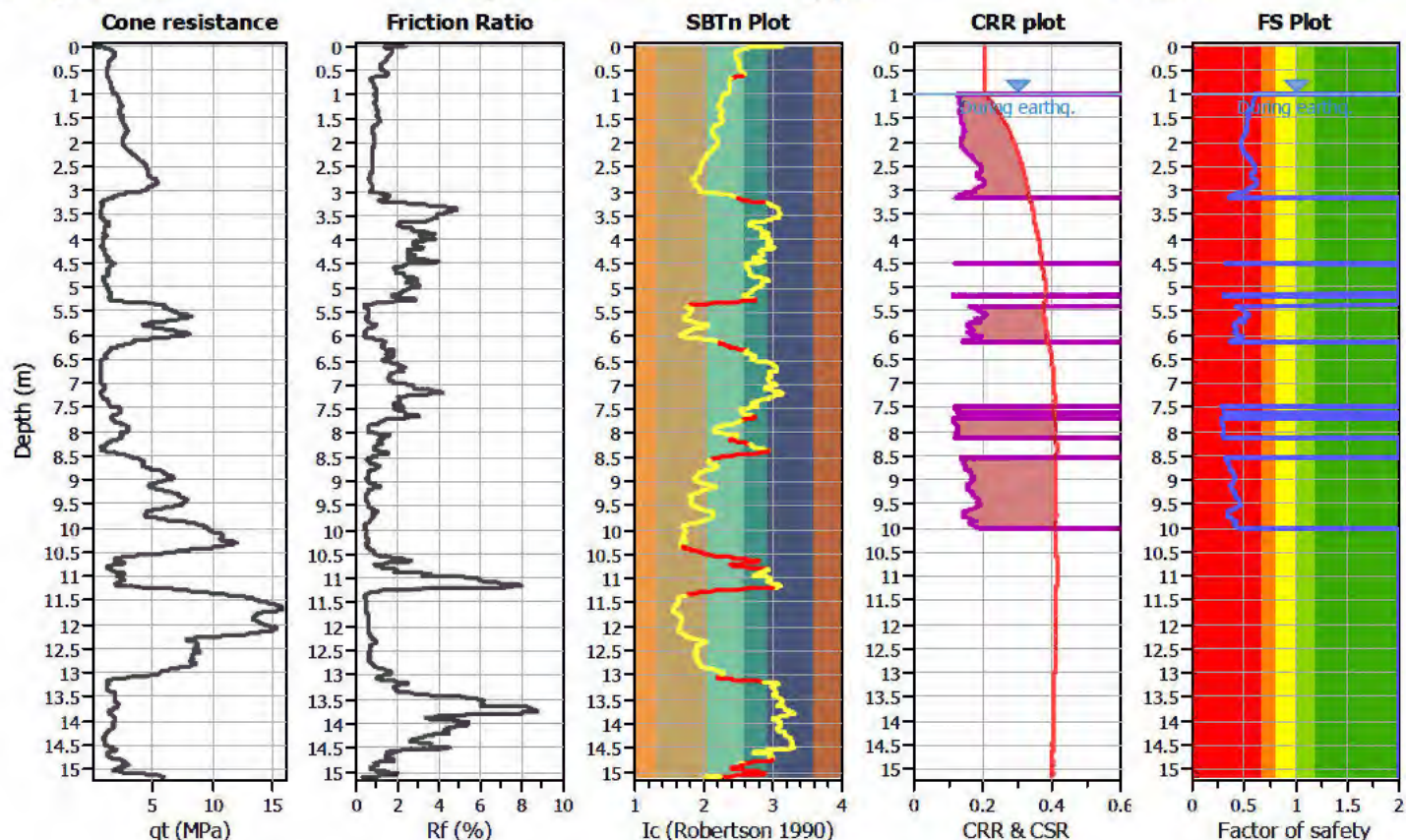
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-18 ULS

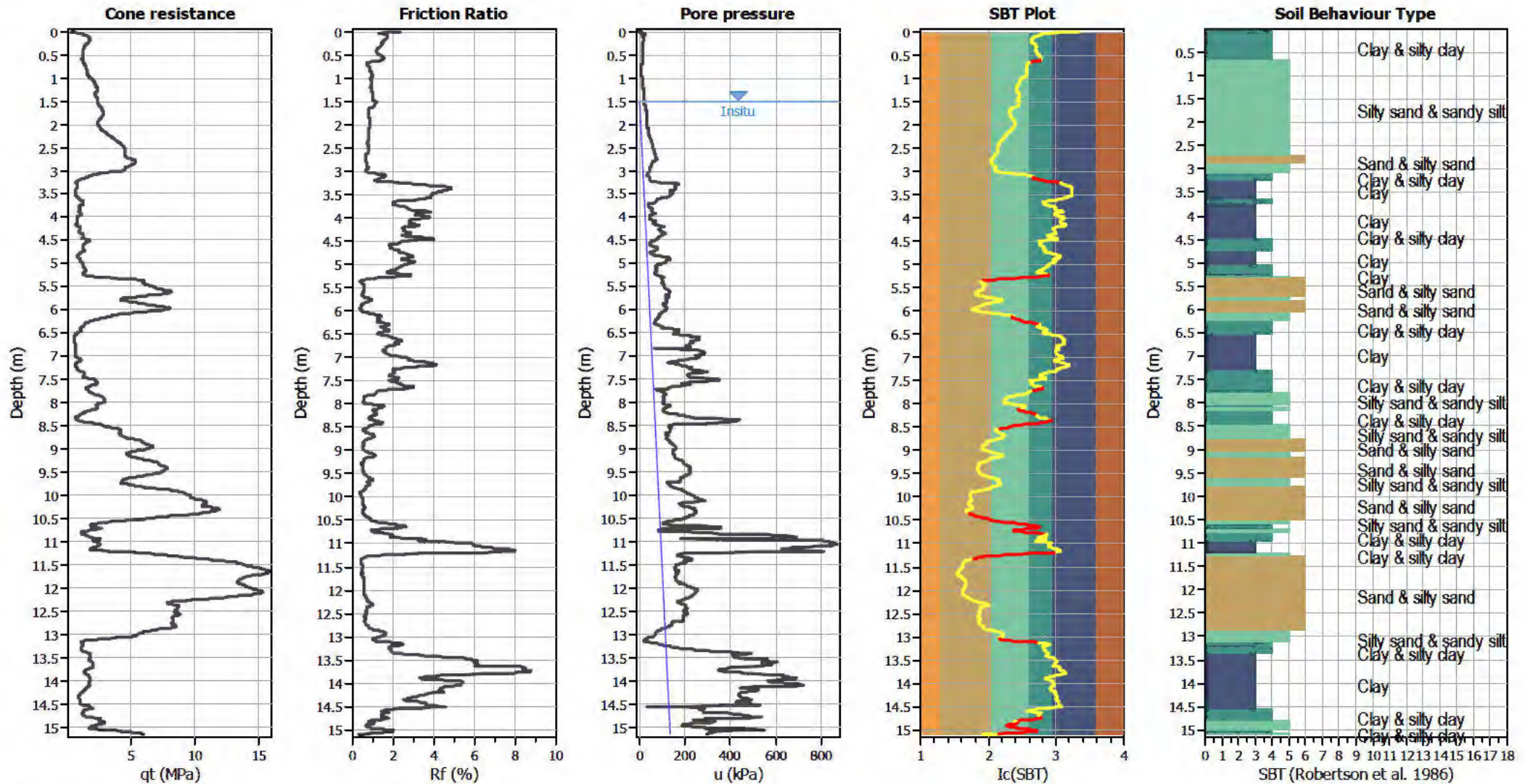
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



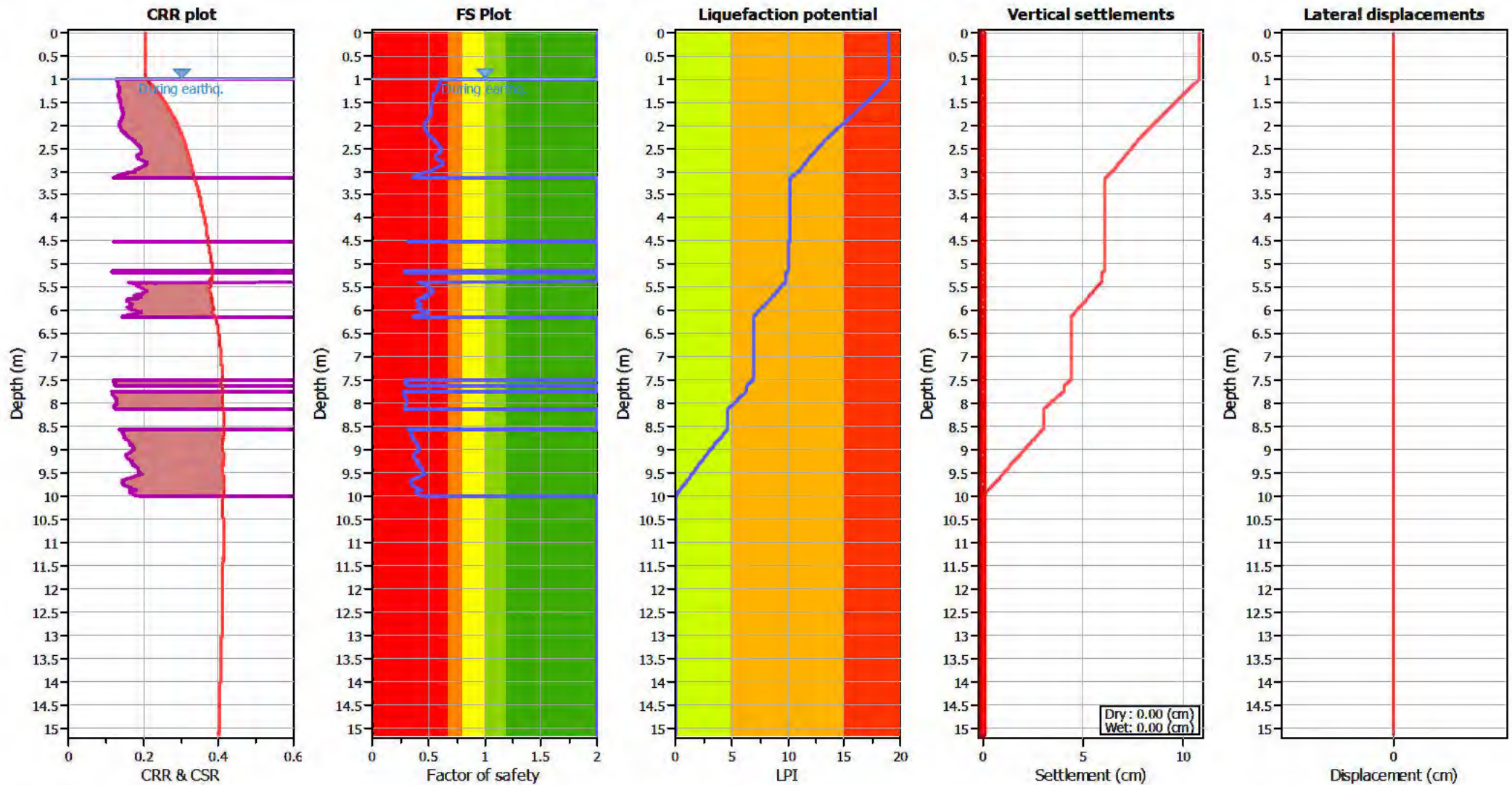
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_a applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 7.50
 Peak ground acceleration: 0.35
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Red: Almost certain it will liquefy
 Orange: Very likely to liquefy
 Yellow: Liquefaction and no liq. are equally likely
 Green: Unlike to liquefy
 Dark Green: Almost certain it will not liquefy

LPI color scheme

Red: Very high risk
 Orange: High risk
 Yellow: Low risk

LIQUEFACTION ANALYSIS REPORT

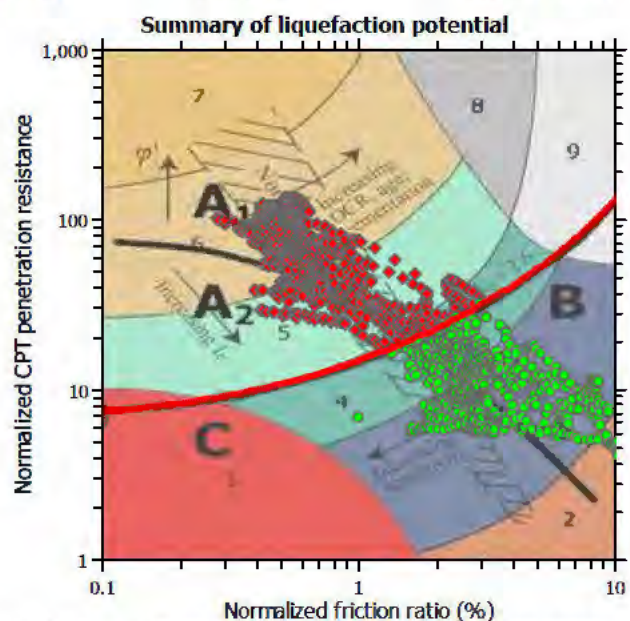
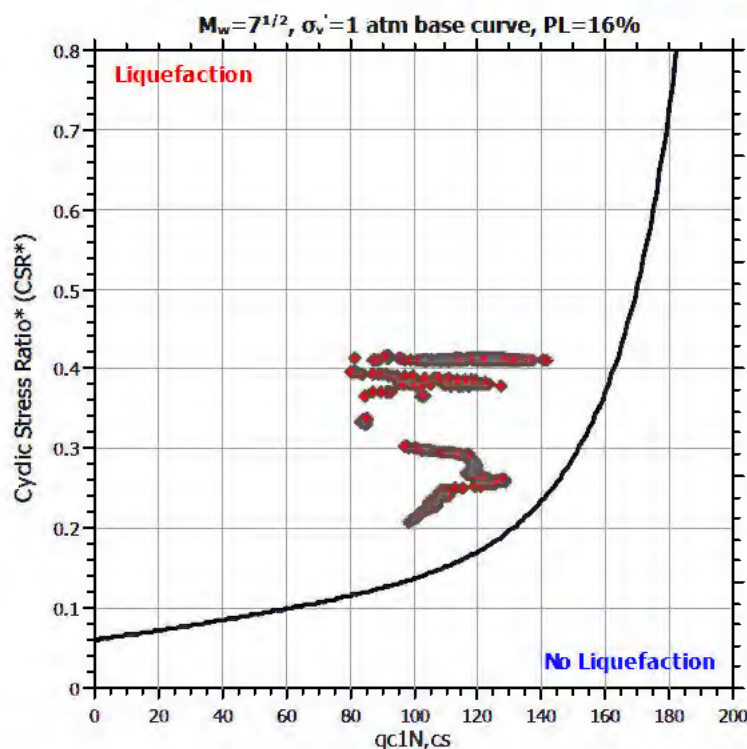
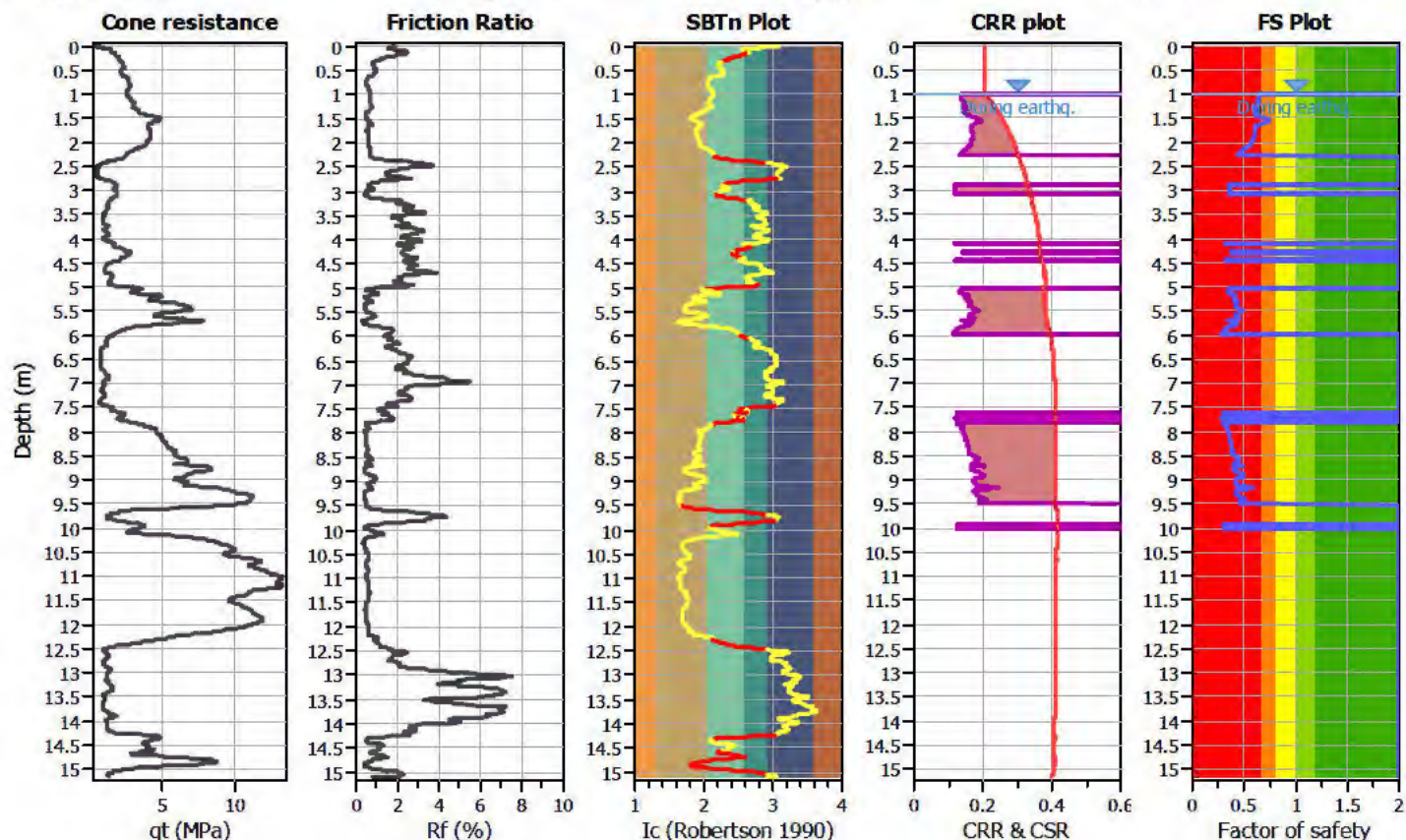
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-19 ULS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	10.00 m
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

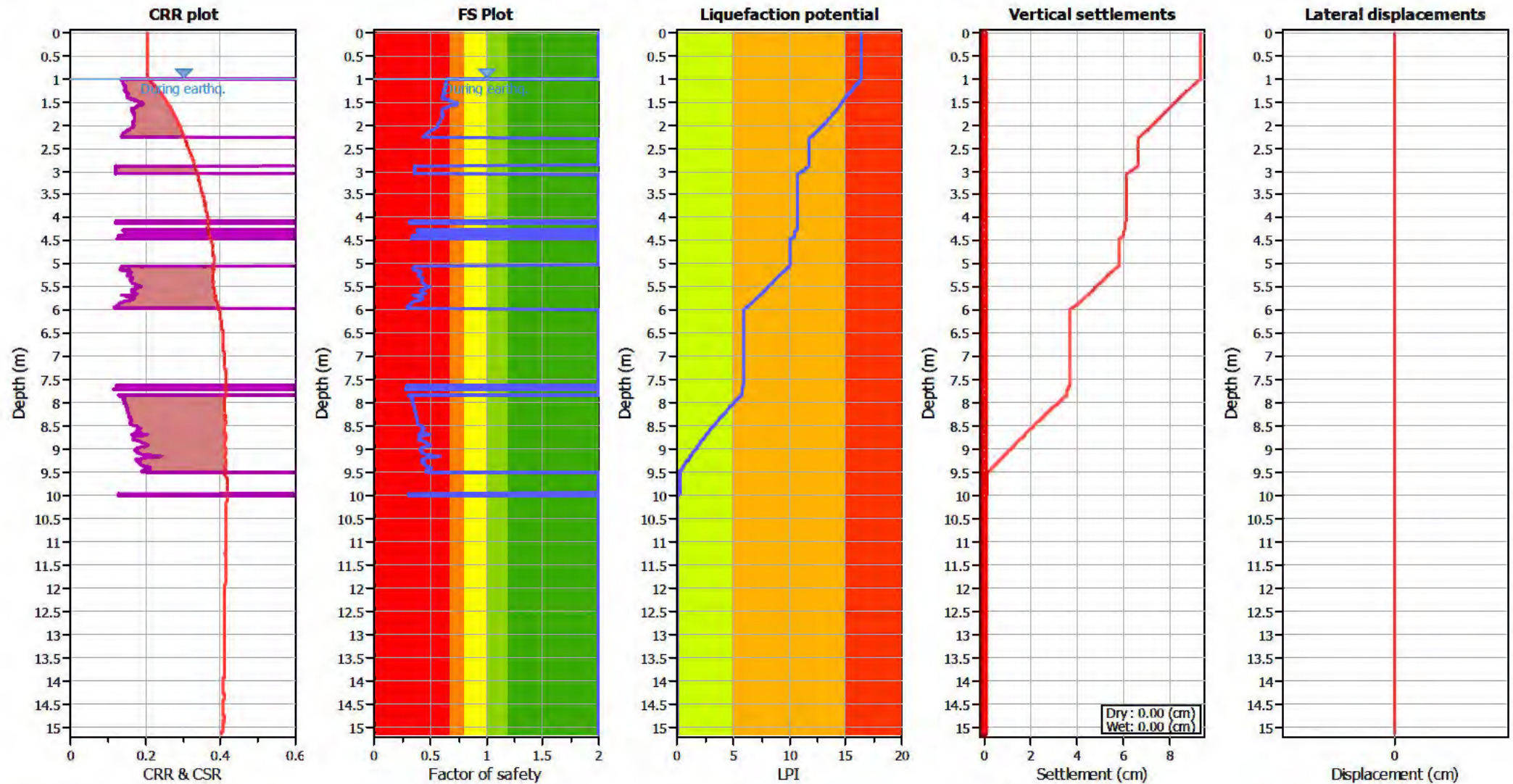


Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Analysis method:	B&J (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&J (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _o applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 7.50
 Peak ground acceleration: 0.35
 Depth to water table (insitu): 1.50 m

Depth to GWT (earthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk

LIQUEFACTION ANALYSIS REPORT

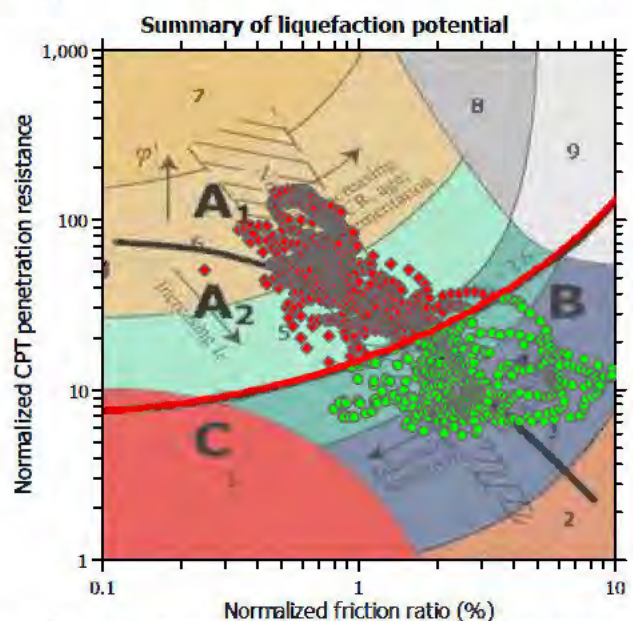
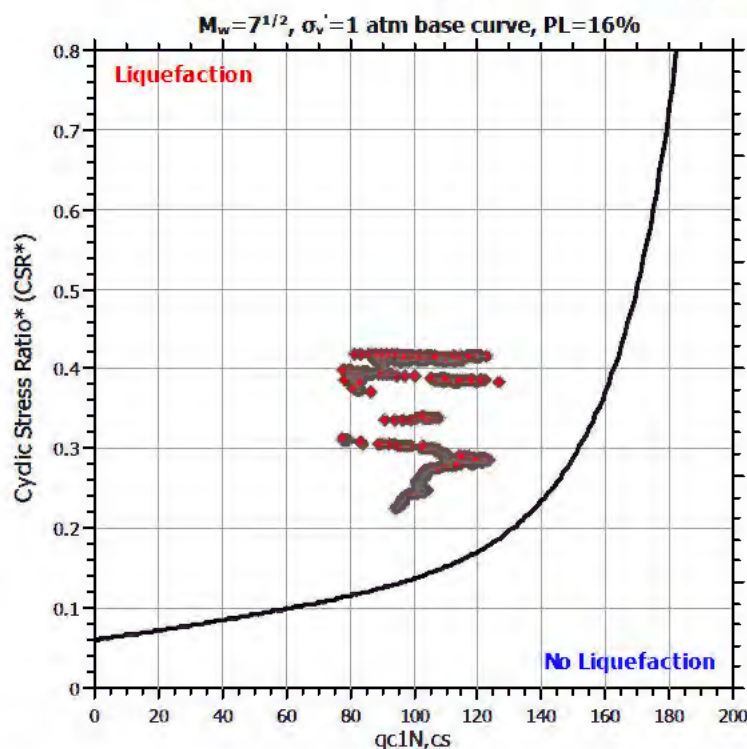
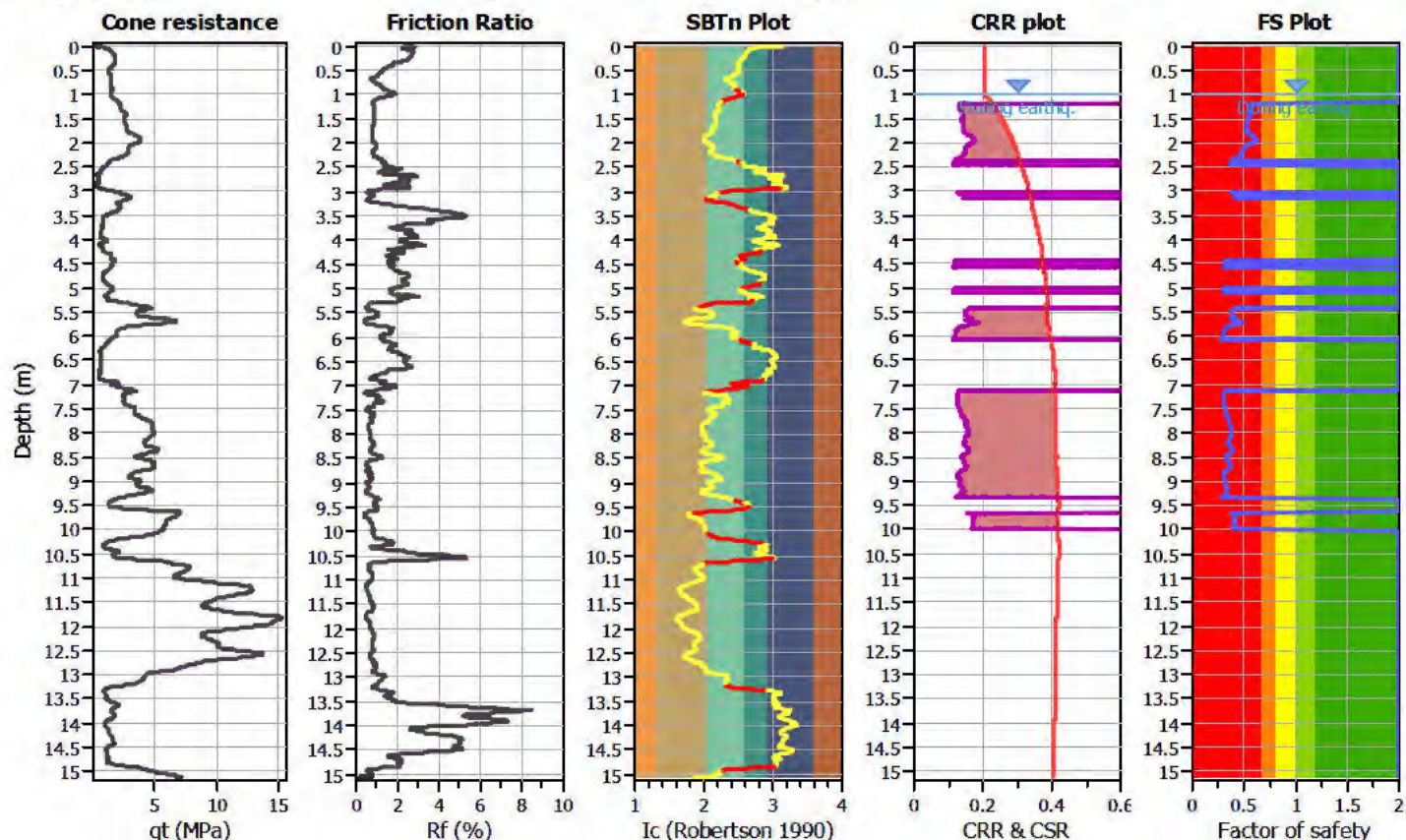
Project title : Geotechnical Investigation

Location : 101 Sabys Road, Halswell, Christchurch

CPT file : CPT-20 ULS

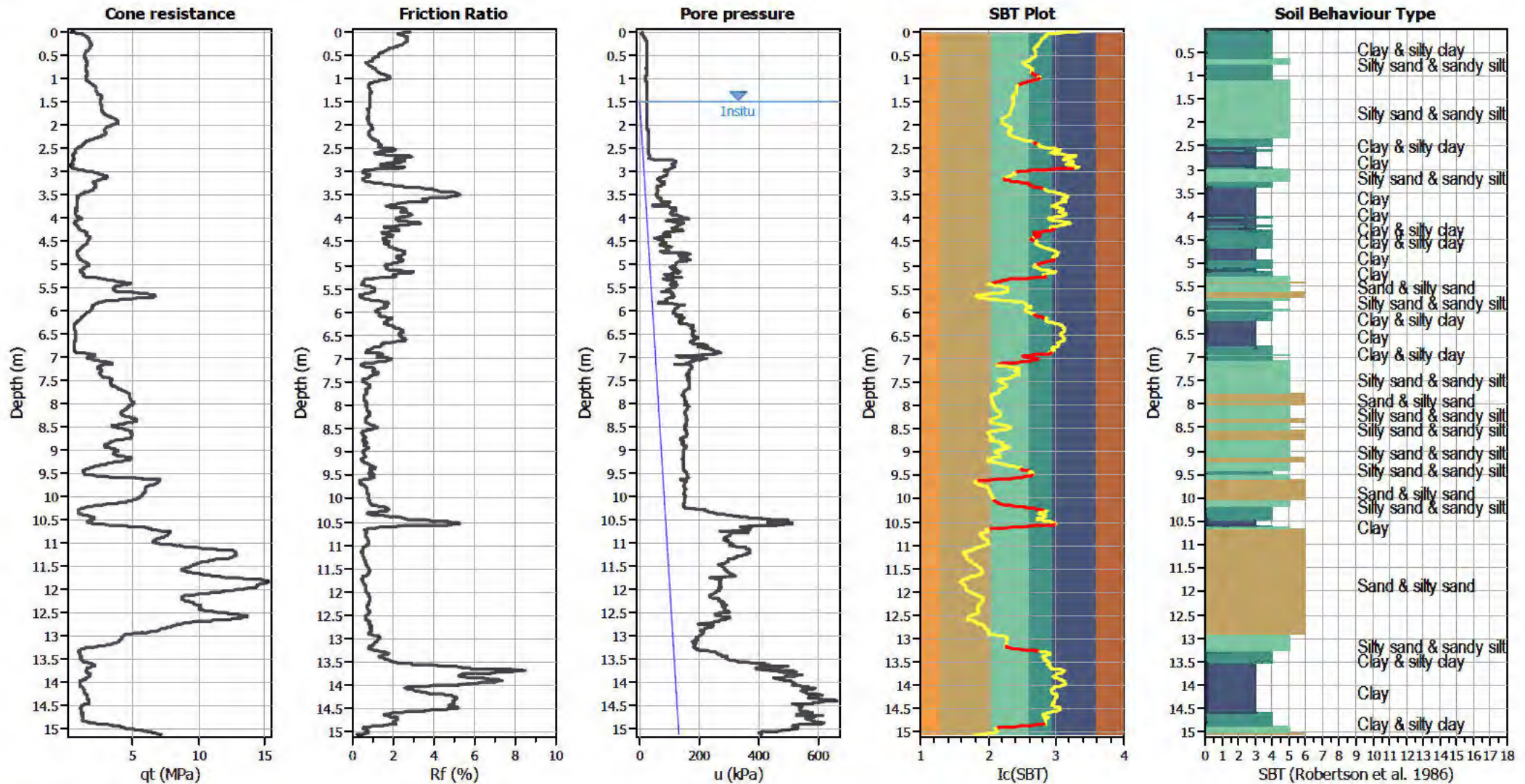
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



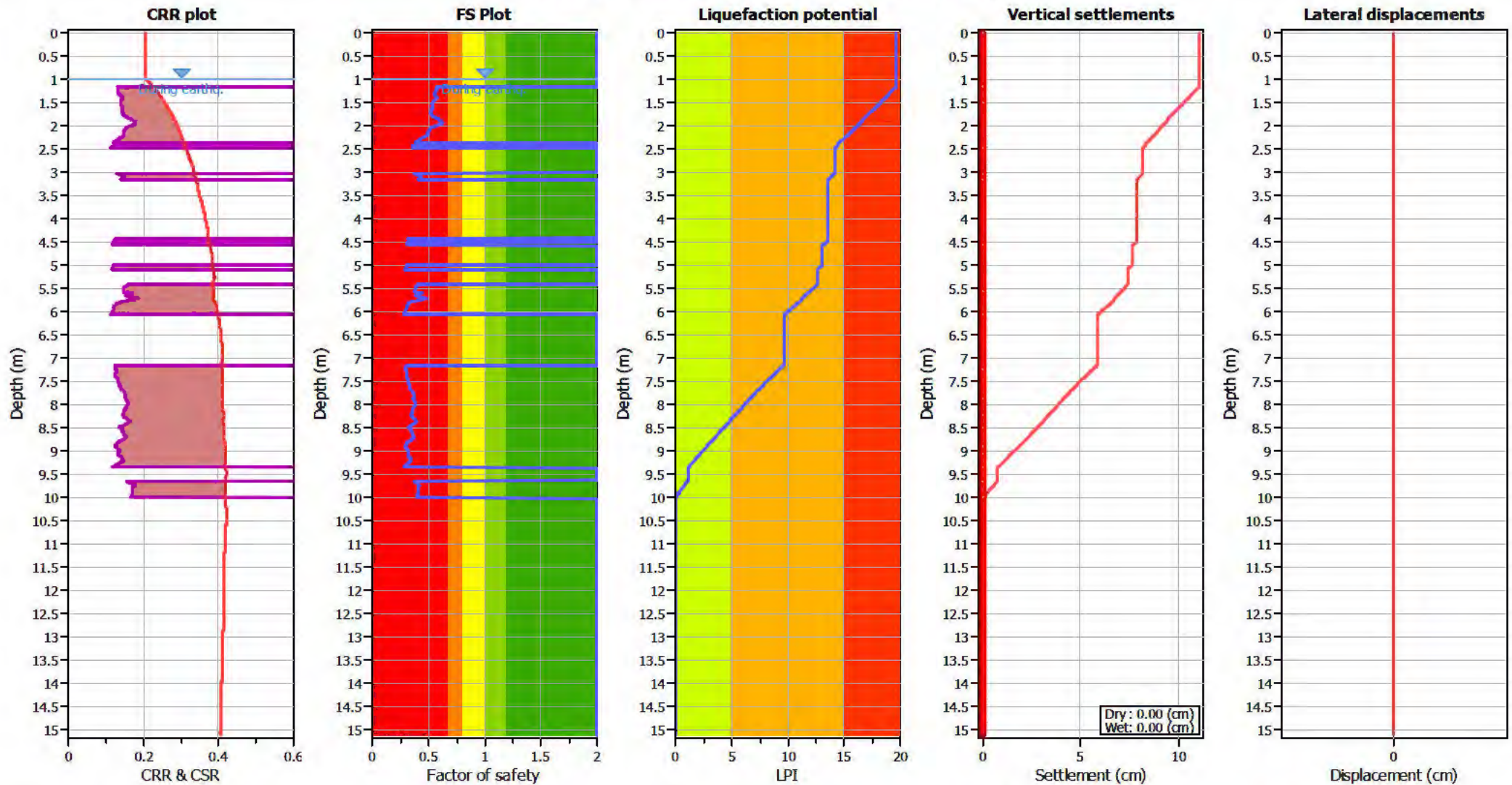
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 7.50
 Peak ground acceleration: 0.35
 Depth to water table (insitu): 1.50 m

Depth to GWT (erthq.): 1.00 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: Yes
 K_{σ} applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: Yes
 Limit depth: 10.00 m

F.S. color scheme

Almost certain it will liquefy
 Very likely to liquefy
 Liquefaction and no liq. are equally likely
 Unlike to liquefy
 Almost certain it will not liquefy

LPI color scheme

Very high risk
 High risk
 Low risk