Appendix K Preliminary Geotechnical Assessment

Fast Track Approvals Act Application

Foxton Solar Farm

Genesis Energy Limited

SLR Project No.: 810.V14848.00001

13 February 2026

PRELIMINARY GEOTECHNICAL ASSESSMENT REPORT

Foxton Solar Farm

for Solar-Gen Joint Venture








Rev A - 18/04/2023

BTW COMPANY

SURVEYING | ENGINEERING | PLANNING & ENVIRONMENT

Foxton Solar Farm

for Solar-Gen Joint Venture

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1 INTRODUCTION

BTW Company Ltd (BTW) was engaged by client, Solar-Gen Joint Venture, to provide geotechnical investigation and assessment services for the proposed photovoltaic solar farm at Motuiti Farms Limited, farm number 26480, and property titles ML 2994, ML 2995, ML 3344, ML5355 and LT 426736, located on Wall Road, Foxton, Horowhenua, New Zealand, hereafter referred to as 'the site'.

This Geotechnical Assessment Report (GAR) presents interpretation of the geotechnical investigation for the site which includes the analysis and assessment of Cone Penetration Test (CPT) data, test pits, Scala penetrometer data and associated laboratory testing along with engineering recommendations with regards to the proposed development plans.

The scope of work undertaken and documented in this report includes the following, completed in general accordance with the BTW proposal titled *'Foxton – Cost Estimate for Preliminary Geotechnical Investigation and Assessment and Pile Testing',* dated 10 February 2023 and the BTW proposal titled '*Foxton – Proposed Scope of Preliminary Geotechnical Investigation and Assessment – Revision 1*", dated 19 January 2023.

- Site Geotechnical Investigations:
  - Project administration and sub-contractor engagement.
  - Site walkover assessment, geomorphological mapping and underground service clearance.
  - Seventeen (17) cone penetrometer tests (CPT) to a depth of 20 m below existing ground level (BEGL) or prior refusal.
  - Eight (8) machine excavated test pits completed to a depth of 4.0 m BEGL or prior refusal.
  - Ten (10) standalone Scala penetrometer tests completed to a depth of 2.0 m BEGL or prior refusal.
  - Four (4) thermal resistivity tests at locations provided by the client undertaken within 1 m deep test pits.
  - Schedule of geotechnical laboratory testing.
- Preliminary Geotechnical Assessment Reporting:
  - The findings from the desktop study, site walkover assessment and geomorphological mapping.
  - The finalised CPT results, test pit, and Scala penetrometer logs with a plan showing the location of the tests.
  - A description of the subsurface conditions and engineering properties of the soil materials encountered, including documentation of groundwater levels.
  - An assessment of the suitability of the site for the proposed development from a geotechnical perspective.
  - Preliminary recommendation of solar panel mount pile foundation system, and infrastructure foundations.
  - An assessment on the seismic subsoil classification as per NZS 1170.5.
  - Quantitative assessment of seismic liquefaction hazard.

- Provision of factual laboratory soil testing reports with preliminary comment on expected soil aggressivity.
- Provision of factual laboratory thermal resistivity analysis reports.
- An assessment of groundwater levels on the site and associated implications for constructability.
- Earthworks and foundation construction considerations.

2 SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 Site Description

The site is a sub-rectangular shaped polygon with an approximate total area of 713 hectares (ha) and is located at farm number 26480, Wall Road, Foxton, Horowhenua, New Zealand (Figure 2.1). It is noted that the geotechnical investigation and assessment covered by this report excludes the areas within the red dashed polygons in Figure 2.1.

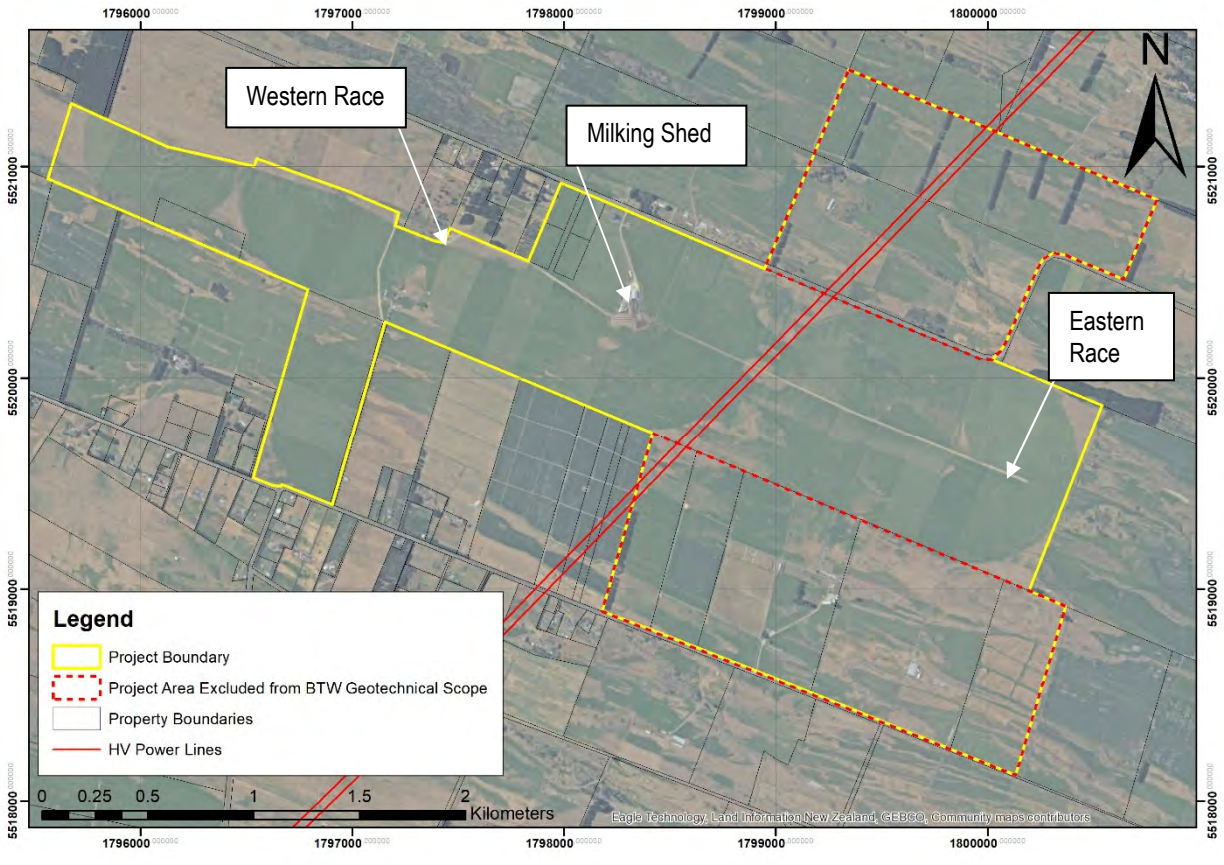


Figure 2.1: Map showing location of site within the Foxton area.

High voltage power lines bisect the eastern portion of the site and are generally orientated in a northeast-southwest alignment.

The site is currently used as pastoral farmland, populated with a dense covering of rural grass, shrubbery and minor scattered medium to large sized trees. The farm paddocks are largely accessed by farm races which extend from a central milking shed approximately 2 km east southeast (eastern race), 2.7 km stepped in a west-northwest direction (western race) and 1.4 km north (north-south race) from an entrance way located at 231 Motuiti Road. An alignment of medium to large sized trees border a section along the eastern side of the north-south race from Motuiti Road for approximately 900 m.

A paved driveway extending from the farm entrance on Wall Road leads to the rotary milking shed, open bay and feed storage sheds, oxidation pond and a feed pad approximately 390 m (geodesic distance) southeast of the farm entrance. Two single-storey milkers' quarters are located approximately 65 m southeast and southwest of the farm entrance with two more single-storey milkers' quarters located approximately 1100 m and 1160 m west southwest of the milking shed,

adjacent the north-south race. An old rectangle shaped open bay shed is also located approximately 1060 m west northwest.

The site is heavily irrigated with six pivot irrigation systems installed across the farm which individually span a length of between approximately 360 m and 470 m long. The total combined pivot length is approximately 2,666 m with a total irrigated area of approximately 289 ha (Figure 2.2). Two water bores, denoted Bore 1 and Bore 2, facilitate the pivots and the 141 troughs, with underground water lines connecting each group of troughs (Figure 2.3).

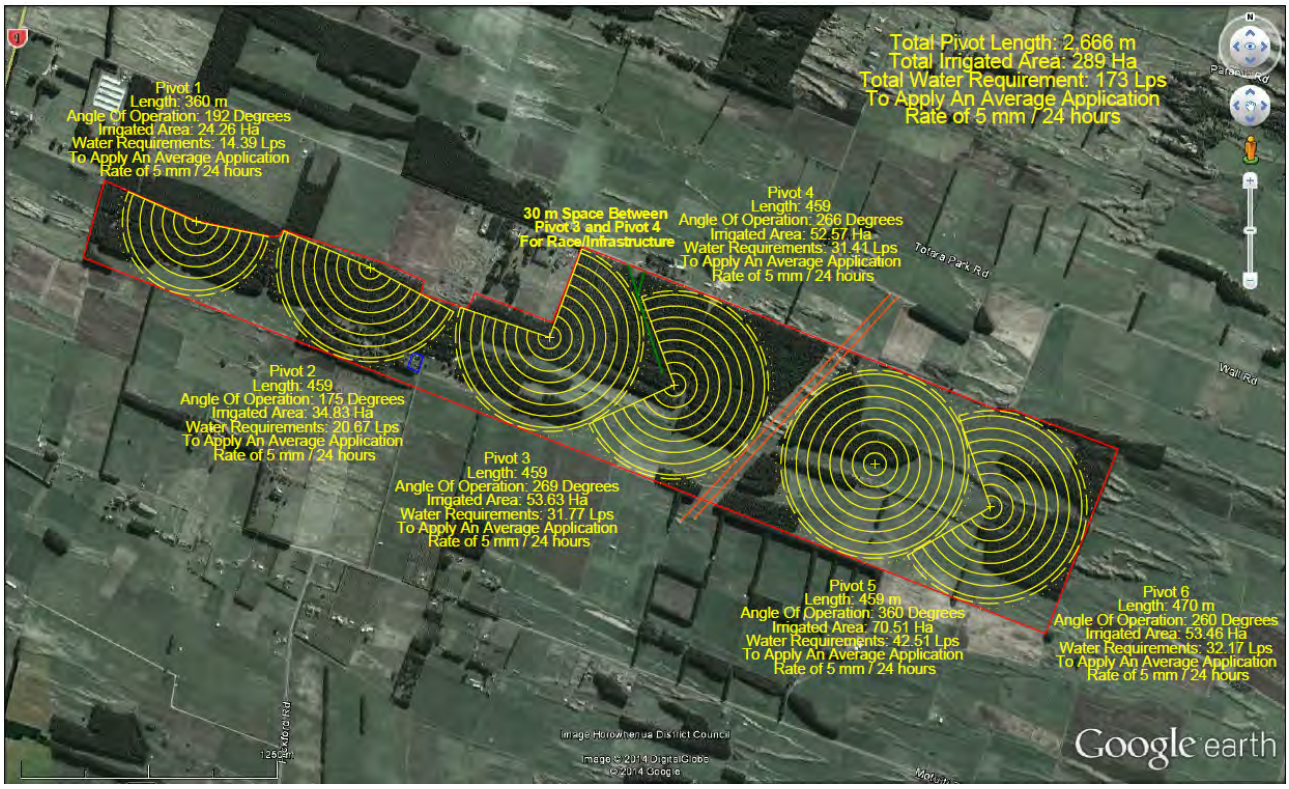


Figure 2.2: Pivot Plan (source: Ref: Waterforce, Preliminary Irrigation Proposal Option 3, date 17/10/2014).

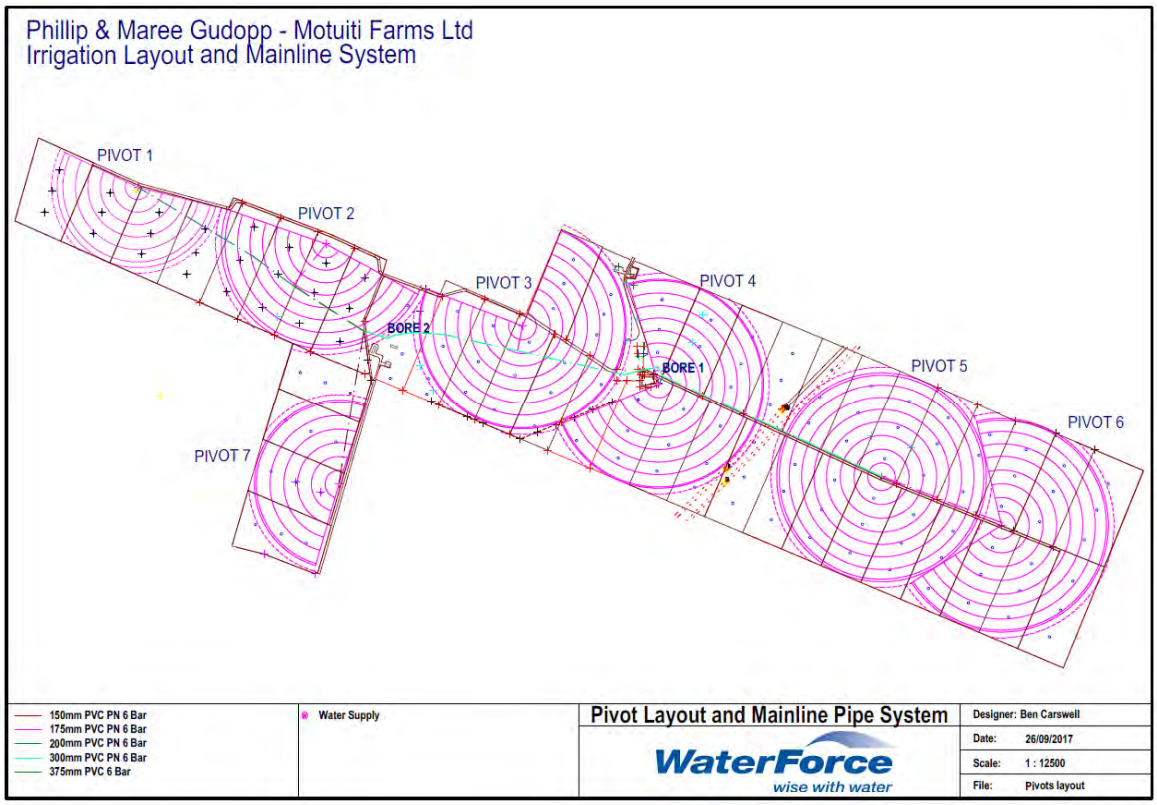


Figure 2.3: Mainline Pipe System (source: Ref: Waterforce, Pivot Layout and Mainline Pipe System, date 26/09/2017).

Horowhenua District topographic heat map indicates the site is relatively flat to gently undulating with elevation fluctuations from approximately 20 m RL to 30 m RL across the site, as shown in Figure 2.4. The map shows an area of correspondingly high elevation in the central southern portion of the site however onsite observations confirm the elevation for this area is comparable to the elevation range of the overall site.

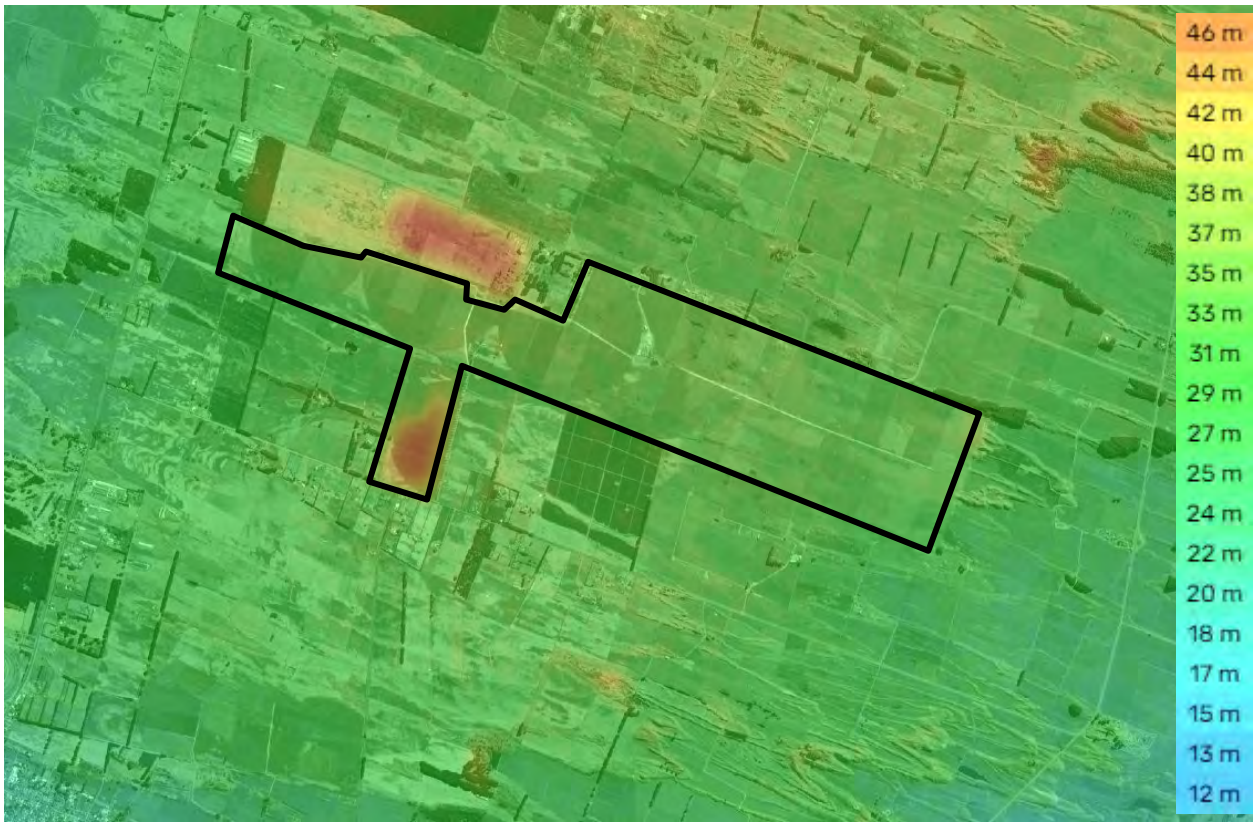


Figure 2.4: Horowhenua District topographic map (source: Horowhenua District, Manawatū-Whanganui, New Zealand (-40.76871 175.13535 -40.38595 175.62534).

2.2 Proposed Development

No development plans of the proposed solar farm have been provided; however, we understand that ground mounted solar photovoltaic (PV) panels positioned in linear arrays across the farm will be used.

Components of the development will likely comprise the following:

- Access roads within the solar arrays.
- Upgrade of farm races including possibly new culverts and vehicle crossings.
- Inverters.
- Transformer stations.
- Auxiliary transformers.
- Construction laydown
- Project Substation.
- Low voltage and high voltage cables.

It is understood the preferred foundation option for the solar panel ground mounts will be driven steel piles.

3 DESKTOP STUDY

3.1 New Zealand Geotechnical Database

The New Zealand Geotechnical Database (NZGD) was searched for any investigations in close proximity to the site. The closest project contained within the database was completed by Riley Consultants Ltd on 22 March 1994 with test locations situated approximately 4,450 m and 4,550 m southeast of the oxidation pond with a spacing of approximately 630 m.

Key geotechnical findings deemed pertinent to the solar farm project are presented below:

- Generally, beneath the approximate 0.5 m to 0.6 m thick surficial sandy silt topsoil the soils comprised varying compositions of sand and silt material.
- The test location positioned on the floodplain of the Manawatu River generally comprised a mantle of firm; non-plastic; brownish grey, mottled orange; moist, silt with some fine sand. A thin interbedded layer of non-plastic; grey with some brown; fine sand with some silt; from approximately 2.6 m BEGL to 2.8 m BEGL was encountered overlying a basal layer of moderately plastic; bluish grey; limonite stained, silt with some fine sand and minor clay to a maximum investigation depth of approximately 3.2 m BEGL.
- The test location adjacent Himatangi Block Road comprised a non-plastic; dark brown, moist, silty sand overlying a grey, fine to medium sand to a maximum investigation depth of approximately 3.5 m BEGL.
- Groundwater was likely encountered around the maximum investigation depth of 3.5 m BEGL evident by the soil moisture becoming wet at approximately 3.3 m BEGL.

3.2 Historical Images

An examination of an historical aerial image of the site was undertaken to determine any prior land use activities or redevelopment which may be pertinent to the proposed solar farm. The oldest aerial that could be accessed was 2001. A summary of the findings from the desktop study are presented below.

- Historical Aerial Image 2001 – Figure 3.1
  - The image shows the site was used predominantly as pine plantation evident by the dense clusters of large sized, mature trees and linear arrays of small to medium trees that have recently been planted.
  - The remaining land is populated with localised rural grasses and shrubbery. The land does not appear to be irrigated, evident by areas of brown coloured, barren land.
  - A northeast-southwest orientated strip of cleared farmland is present through the central eastern portions of the site which shows the approximate location of a high voltage overhead powerline that bisects through the property.
  - Dirt access tracks can be seen on the image along with linear fence lines that differentiate each paddock.
  - The westernmost milkers' quarters and rectangle shaped open bay shed are both present as seen in their current position today.
- Historical Aerial Image 2010 – Figure 3.2
  - The site remains as pine plantation with vegetation becoming increasingly more mature evident by the dark clusters of large sized trees.

  - Aerial imagery shows the site is scattered with relict dune systems characteristic of the localised landscape.
  - Some areas, notably in the central southern portion of site, adjacent Motuiti Road have had pine harvested and replanted.
  - The strip of cleared farmland, where the overhead powerline bisects the site also remains.
- Historical Aerial Image 2015 – Figure 3.3
  - Following an aerial image in April 2014, areas in the central and eastern portion of the site have been harvested, but not replanted.
  - Inferred earthworks operations in these harvested areas ensued, evident by the exposed subgrade and levelled dune systems.
  - The eastern race has been constructed along with two pivot irrigation systems installed and Bore 1 in the central and eastern regions of the site suggesting the farm was transformed into pastoral farmland around this time.
  - Between April 2014 and October 2015, the driveway extending from Wall Road, milking shed, open bay sheds, and the oxidation pond have been constructed.
- Historical Aerial Image 2022 – Figure 3.4
  - The site as seen today, and as discussed in Section 2.1.
  - The site was fully harvested between March 2016 and August 2017, undergoing extensive earthworks in the western region to transform into relatively flat to gently sloping pastoral farmland evident by the addition of further pivot irrigation systems, Bore 2, and the western race.
  - Additional development occurred neighbouring the milking sheds with the construction of the feed pad and auxiliary sheds between March 2016 and 2018.

In general, the site was used primarily as pine plantation until approximately 2015 when extensive earthworks occurred across the site between 2015 and 2017 transforming the land into relatively flat to gently sloping, irrigated pastoral farmland. Associated farm developments to support the transformation were constructed during this time, including a rotary milking shed and neighbouring auxiliary developments and dwellings.



Figure 3.1: 2001 Aerial Image (source: Retrolens).



Figure 3.2: March 2010 Aerial Image (source: Google Earth Pro).



Figure 3.3: October 2015 Aerial Image (source: Google Earth Pro).



Figure 3.4: 2022 Aerial Image (source: Google Earth Pro).

3.3 Published Geology

Examination of Institute of Geological and Nuclear Sciences (GNS) webmap indicates the site is located within an area likely underlain by Holocene stable dune deposits and the Himatangi Anticline, which bisects through the centre in a north-northeast to south-southwest orientation (Figure 3.5). The dune deposits are described as undifferentiated dunes and associated facies of the Pakihi Supergroup comprising sand, mud and peat.

These Holocene Dune Deposits, known locally as Foxton Dune Sands are identified as aeolian veneer deposits formed from aeolian processes as sand dunes migrated inland from the west coast of Foxton. The first advance, termed the Foxton Phase, was the most active with dunes migrating up to 16 km inland from the former coastline. These Foxton Dune Sands consists of c. 12 m of well-sorted, cross bedded, fine dune sand which records the final encroachment of parabolic dunes into this area and is responsible for the present dune topography (Shepherd & Lees, 2012).

Uncontrolled or non-engineered fill material is also expected within the site given the extensive earthworks that occurred when the land was transformed from its previous land use as pine plantation to now pastoral farmland (Section 3.2).

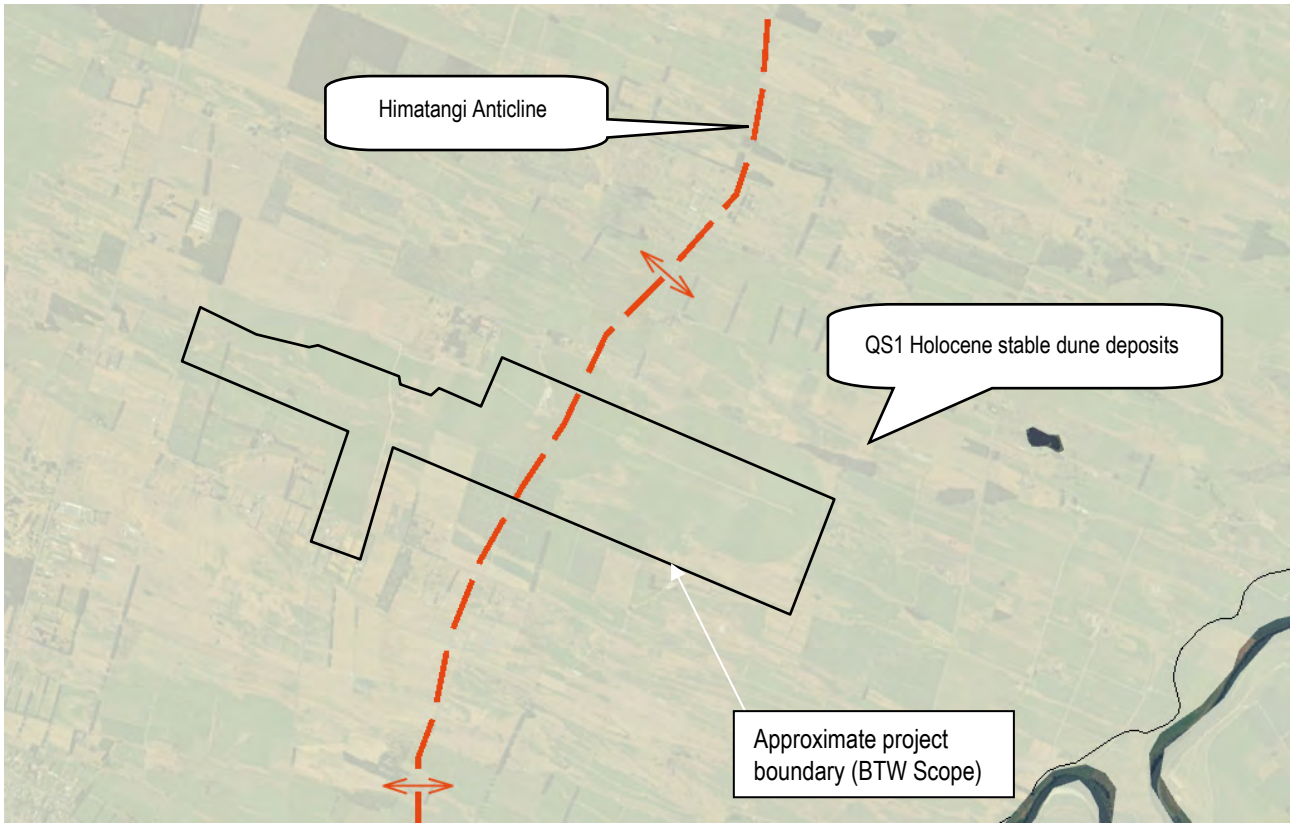


Figure 3.5: Geological Map showing underlying geology (source: https://data.gns.cri.nz/geology/).

4 SITE WALKOVER OBSERVATIONS

A walkover assessment and geomorphological mapping of the site was undertaken by a BTW site engineer on 23 and 24 February 2023. A summary of the site walkover observations pertinent to the development is presented below:

- The site is characterised by pastoral farmland, populated with a dense covering of rural grass, shrubbery and scattered medium to large sized trees that is largely concentrated to the milkers' quarters adjacent the north-south race (All Figures, Figure 4.5).
- A relatively evenly spaced alignment of medium to large sized trees border the eastern side of the north-south race from the central milkers quarters to Motuiti Road (Figure 4.3).
- The site is also characteristic of manmade drainage swales of varying depths from relatively shallow to up to 1 m deep that have been excavated as a means for onsite stormwater management. The drainage swales are populated with typical wetland vegetation and were mainly evident in the central to western regions of the site. Groundwater within these swales was observed at or near the surface (Figure 4.1, Figure 4.7, Figure 4.12, Figure 4.13, Figure 4.14).
- Generally, the site is relatively flat to gently undulating with elevation fluctuations from approximately 20 m RL to 30 m RL across the site. Aerial imagery in conjunction with our onsite observations show the site has been earthworked to achieve the current geomorphology. This is evident by the neighbouring landscapes which have much more extensive undulations which are characteristic of the local area (Figure 4.6, Figure 4.12, Figure 4.13, Figure 4.14).
- The milking shed and auxiliary farm buildings are located in the central portion of the site with farm races extending east and west, and north from an entrance way located at 231 Motuiti Road (Figure 4.6, Figure 4.9, Figure 4.10).
- The site is heavily irrigated with six pivot irrigation systems installed across the farm that move around a centre point. Two water bores, denoted Bore 1 and Bore 2, facilitate the pivots and the 141 troughs. Bore 1 is located approximately 80 m southeast of the milking shed, while Bore 2 is located approximately 50 m northwest of the old open bay shed in the central portion of the site (Figure 4.2, Figure 4.5, Figure 4.8, Figure 4.10).
- The underground trough water lines run perpendicular to the paddocks with troughs grouped in pods that are differentiated by geographic location. Each pod has underground water lines that connect the troughs as well as lines connected to neighbouring pods and the bores (Figure 4.11).
- A high voltage overhead powerline, operated by Transpower, bisects on a northeast to southwest orientation through the central regions of the property. No earthworks has occurred beneath the overhead powerlines (Figure 4.8, Figure 4.9, Figure 4.11, Figure 4.13, Figure 4.14).



Figure 4.1: Easternmost point of site looking west. A drianage swale is evdient in the foreground.



Figure 4.2: View from TP01 looking southeast.



Figure 4.3: View from TP05 looking northeast.



Figure 4.4: View from TP05 looking south.



Figure 4.5: Bore 2 looking south with the old ope bay shed and milkers quarters in the background.



Figure 4.6: View from CPT06 looking north showing the western race.



Figure 4.7: View from CPT09 looking south showing drainage swales.



Figure 4.8: View from CPT10 looking east showing pivot tracks and Pivot 4.



Figure 4.9: View from TP06 facing east showing eastern race and high voltage powerlines.



Figure 4.10: Eastern view of Bore 1, oxidation pond, the milking shed and milkers quarters.



Figure 4.11: View from centre of the eastern race looking north showing powerlines and trough alignment.



Figure 4.12: View facing east from CPT11 showing manmade drainage swales and powerlines.



Figure 4.13: View from CPT 13 looking west.



Figure 4.14: View from CPT16 facing east showing drainage swale.

5 GEOTECHNICAL INVESTIGATION

5.1 Field Investigation

An intrusive geotechnical investigation was undertaken by BTW over two periods. The first period was between 23 February and 24 February 2023 in which the service clearance and Scala penetrometers were conducted; and the second between 27 February and 28 February 2023 where all other testing was completed. The field investigation comprised the following scope of works:

- Seventeen (17) cone penetrometer tests (CPT), denoted CPT01 to CPT17, to a depth of between approximately 6.61 m and 9.94 m below existing ground level (BEGL) where effective refusal was encountered.
- Eight (8) machine excavated test pits, denoted TP01 to TP08, to a depth of between approximately 2.4 m and 3.2 m BEGL where practical refusal on running sands was encountered. Representative small and bulk disturbed samples were collected from the excavated spoil to provide samples for laboratory testing.
- Eight (8) Scala penetrometer tests from surface, or through the base of the test pit, to a depth of between approximately 2.1 m and 2.5 m BEGL where target depth was achieved. These tests were conducted adjacent each test pit location.
- Ten (10) standalone Scala penetrometer tests, denoted SP01 to SP10, from surface to a depth of between approximately 1.2 m and 2.5 m BEGL where target depth was achieved.
- Four (4) thermal resistivity tests at investigation locations TP01, TP03, TP06 and TP08 conducted in the base of the pit, at a depth of approximately 1 m BEGL.
- Schedule of geotechnical soil laboratory testing.

Ground conditions exposed within the test pits were logged in accordance with the Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZGS 2005).

Scala penetrometer testing was conducted at each investigation location. Testing was undertaken in accordance with NZS 4402 Determination of the Penetration Resistance of a Soil, Hand method using a dynamic cone penetrometer (NZS 1988).

Test pits were backfilled with recovered spoil material, and CPT holes were backfilled with bentonite chips following testing.

The approximate location of each CPT test site is presented in Figure 5.1 and the approximate location of each test pit and standalone Scala penetrometer test is presented in Figure 5.2. A summary of the field investigation activities undertaken by BTW is presented in the following sections below.

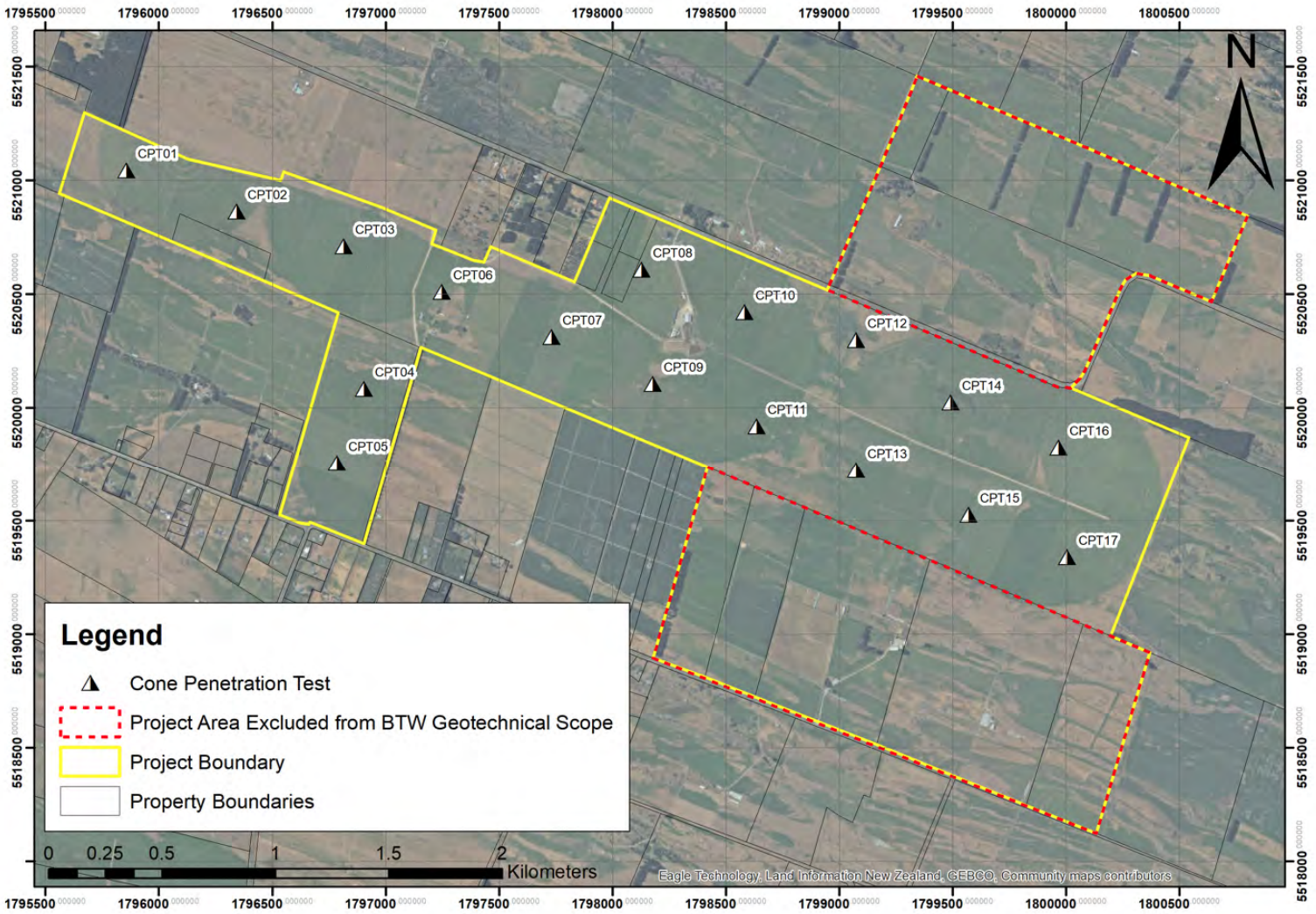


Figure 5.1: CPT site investigation location plan.

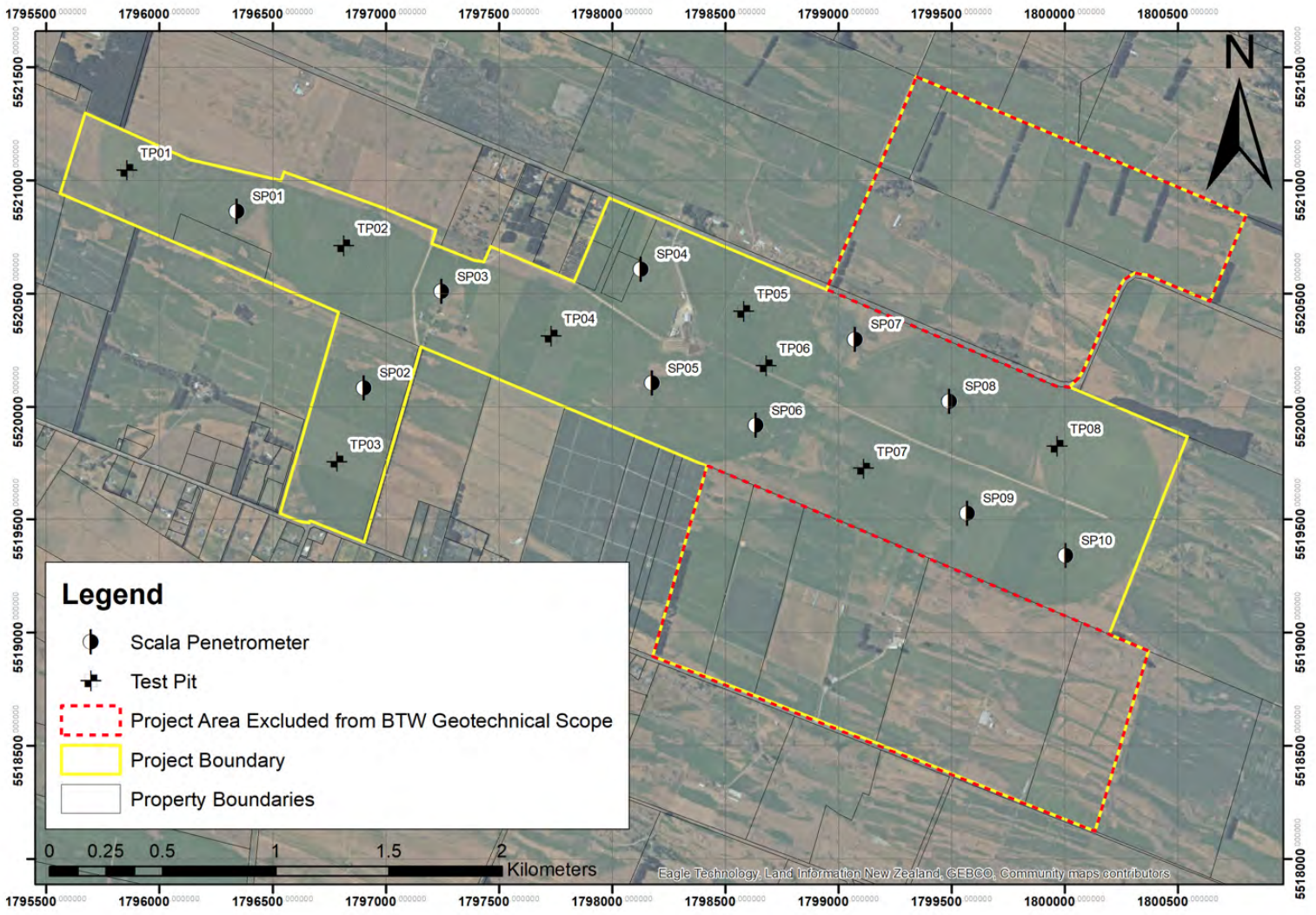


Figure 5.2: Test pit and Scala penetrometer site investigation plan.

5.2 Cone Penetrometer Testing

A total of seventeen (17) Cone Penetrometer Tests (CPT's), denoted CPT01 to CPT17, were completed by subconsultant WSP on 27 and 28 February 2023, using a Geomil Panther-100, track mounted, 10 tonne dead weight rig (ID: CPT03). The planned target depth for each CPT test was 20 m BEGL, however CPT effective refusal was encountered in all CPT's at a depth of between approximately 6.61 m and 9.94 m BEGL.

A summary of the CPT investigation is presented in Table 5.1, approximate test locations are presented in Figure 5.1, and the raw CPT test result reports are provided in Appendix A.

Table 5.1: Summary of CPT Investigation

CPT ID	Type	Easting (NZTM) [1]	Northing (NZTM) [1]	Surface elevation (Metres, RL) [1,2]	Termination Depth (Metres, BEGL)	Termination Remarks
CPT01	Piezocone CPT	1795857	5521044	23	6.96	Refusal 10 Tonne
CPT02		1796342	5520863	27	6.83	
CPT03		1796815	5520711	27	7.23	
CPT04		1796903	5520084	27	7.58	
CPT05		1796785	5519756	28	8.23	
CPT06		1797247	5520509	27	9.47	
CPT07		1797730	5520311	28	7.09	
CPT08		1798128	5520607	26	8.87	
CPT09		1798176	5520105	26	7.45	
CPT10		1798581	5520421	27	7.21	
CPT11		1798635	5519918	26	6.61	
CPT12		1799074	5520298	26	7.34	
CPT13		1799074	5519725	25	7.98	
CPT14		1799490	5520024	24	9.94	
CPT15		1799570	5519526	25	8.02	
CPT16		1799966	5519825	25	6.73	
CPT17		1800004	5519340	23	6.66	

Note 1: Easting and Northing from handheld GPS; accuracy + / - 3 m. Elevation estimated from Horowhenua District topographic map; accuracy + / - 5 m.

Note 2: Local mean sea level datum: NZVD 2016.

5.3 Test Pits

A total of eight (8) machine excavated test pits, denoted TP01 to TP08, were completed by subcontractor SKF Contracting on 27 and 28 February 2023 using a 3.8 tonne excavator fitted with a 900 mm bucket to a depth of between approximately 2.4 m and 3.2 m BEGL where practical refusal on running sands was encountered. Representative disturbed small and bulk samples were collected from the excavated spoil to provide samples for subsequent laboratory testing.

A summary of the test pit investigation is presented in Table 5.2, with approximate test locations presented in Figure 5.2. Final test pit logs which include associated in-situ testing, a list of relevant notes and abbreviations used on the logs are provided in Appendix A.

Table 5.2: Summary of Test Pit Investigation

Test ID	Type	Easting (NZTM)[1]	Northing (NZTM)[1]	Surface Elevation (Metres, RL)[1,2]	Termination Depth (Metres, BEGL)	Termination Remarks
TP01	Test pit fitted with a 900 mm flat tooth bucket	1795857	5521044	23	3.2	Practical refusal, running sands
TP02		1796815	5520711	27	3.2	
TP03		1796785	5519756	28	3.1	
TP04		1797730	5520311	28	3.0	
TP05		1798581	5520421	27	3.0	
TP06		1798681	5520180	26	3.0	
TP07		1799111	5519725	25	2.4	
TP08		1799966	5519825	25	2.9	

Note 1: Easting and Northing from handheld GPS; accuracy + / - 3 m. Elevation estimated from Horowhenua District topographic map; accuracy + / - 5 m.

Note 2: Local mean sea level datum: NZVD 2016.

5.4 Scala Penetrometer Testing

A total of ten (10) standalone Scala penetrometer tests, denoted SP01 to SP10, were completed from surface to a depth of between approximately 1.2 m and 2.5 m BEGL where practical refusal was encountered, or target depth was achieved.

An additional eight (8) Scala penetrometer tests were undertaken adjacent each test pit location to a target depth of between approximately 2.1 m and 2.5 m BEGL where effective refusal was encountered, or target depth was achieved.

A summary of the Scala penetrometer investigation is presented in Table 5.3. Test locations are presented in Figure 5.2, with Scala penetrometer plots presented in Appendix B.

Table 5.3: Summary of Scala Penetrometer Investigation.

Test ID	Type	Easting (NZTM)[1]	Northing (NZTM)[1]	Surface Elevation (Metres, RL)[1,2]	Termination Depth (Metres, BEGL)	Termination Remarks
SP01	20mm Diameter Scala Penetrometer	1796342	5520863	27	2.4	Effective Refusal
SP02		1796903	5520084	27	2.5	Target Depth
SP03		1797247	5520509	26	2.5	Target Depth
SP04		1798128	5520607	26	1.6	Effective Refusal
SP05		1798176	5520105	26	1.2	Effective Refusal
SP06		1798635	5519918	26	2.5	Target Depth
SP07		1799074	5520298	24	2.5	Target Depth
SP08		1799490	5520024	25	2.5	Target Depth
SP09		1799570	5519526	23	2.5	Target Depth
SP10		1800004	5519340	23	2.5	Target Depth
TP01		1795857	5521044	27	2.2	Effective Refusal
TP02		1796815	5520711	28	2.5	Target Depth
TP03		1796785	5519756	28	2.5	Target Depth

Test ID	Type	Easting (NZTM)[1]	Northing (NZTM)[1]	Surface Elevation (Metres, RL)[1,2]	Termination Depth (Metres, BEGL)	Termination Remarks
TP04		1797730	5520311	27	2.5	Target Depth
TP05		1798581	5520421	26	2.5	Target Depth
TP06		1798681	5520180	25	2.1	Effective Refusal
TP07		1799111	5519725	25	2.5	Target Depth
TP08		1799966	5519825	27	2.5	Target Depth

Note 1: Easting and Northing from handheld GPS; accuracy + / - 3 m. Elevation estimated from Horowhenua District topographic map; accuracy + / - 5 m.

Note 2: Local mean sea level datum: NZVD 2016.

5.5 Thermal Resistivity Tests

A total of four (4) in-situ thermal resistivity tests were completed within the base of test pit locations TP01, TP03, TP06 and TP08 at approximately 1.0 m BEGL by subconsultant WSP.

The test involved the excavator removing an overburden of approximately 1.0 m of material. A 100 mm diameter aluminium test tube was then pushed into the ground using the excavator bucket to a depth of up to approximately 0.45 m BEGL to collect an undisturbed sample. A bulk disturbed sample was then collected from adjacent the push tube for compaction assessments to determine a density and moisture for the resistivity test.

A summary of each thermal resistivity test is presented in Table 5.4, with approximate test locations presented in Figure 5.2. Final test pit logs are provided in Appendix A and the laboratory test certificates are presented in Appendix C.

Table 5.4: Summary of Thermal Resistivity Investigation

Test ID	Type	Easting (NZTM)[1]	Northing (NZTM)[1]	Surface Elevation (Metres, RL)[1,2]	Test Depth (Metres, BEGL)
TP01	Test pit fitted with a 900 mm bucket	1795857	5521044	23	1.0
TP03		1796785	5519756	27	1.0
TP06		1798681	5520180	28	1.0
TP08		1799966	5519825	28	1.0

Note 1: Easting and Northing from handheld GPS; accuracy + / - 3 m. Elevation estimated from Horowhenua District topographic map; accuracy + / - 5 m.

Note 2: Local mean sea level datum: NZVD 2016.

5.6 Groundwater

Static groundwater was encountered within all test pits locations and CPT03 at the time of the intrusive investigation. In all other CPT locations groundwater was unable to be dipped due to hole collapse.

A summary of the groundwater levels intersected during the site investigation is provided below in Table 5.5. The location of these test sites is provided in Figure 5.1 and Figure 5.2.

Groundwater levels encountered during the site investigation, which was undertaken in late summer conditions (February 2023), may not reflect high groundwater conditions experienced over the winter period where frequent and prolonged rainfall is common. It is expected that static ground water level will likely be higher during late winter and start of spring seasonal periods.

Table 5.5: Summary of Measured Groundwater Depths

Test ID	Water level depth (Metres, BEGL)	Test site surface elevation (Metres, RL) [1]	Water level elevation (Metres, RL)[1]	CPT Hole Collapse Depth (Metres, BEGL)	Inferred water level reading type	Date
CPT01	-	23	-	0.4	-	28/02/2023
CPT02	-	27	-	0.7	-	28/02/2023
CPT03	0.6	27	26.4	-	Perched	28/02/2023
CPT04	-	27	-	1.1	-	28/02/2023
CPT05	-	28	-	1.6	-	28/02/2023
CPT06	-	27	-	2.3	-	28/02/2023
CPT07	-	28	-	0.8	-	28/02/2023
CPT08	-	26	-	0.8	-	28/02/2023
CPT09	-	26	-	0.3	-	28/02/2023
CPT10	-	27	-	0.6	-	28/02/2023
CPT11	-	26	-	0.3	-	27/02/2023
CPT12	-	26	-	1.5	-	28/02/2023
CPT13	-	25	-	0.8	-	27/02/2023
CPT14	-	24	-	0.3	-	28/02/2023
CPT15	-	25	-	1.0	-	27/02/2023
CPT16	-	25	-	1.2	-	27/02/2023
CPT17	-	23	-	1.3	-	27/02/2023
TP01	1.8	23	21.2	-	Static	28/02/2023
TP02	1.5	27	25.5	-	Static	28/02/2023
TP03	1.6	28	26.4	-	Static	28/02/2023
TP04	1.6	28	26.4	-	Static	27/02/2023
TP05	1.0	27	26.0	-	Static	27/02/2023
TP06	1.0	26	25.0	-	Static	28/02/2023
TP07	1.0	25	24.0	-	Static	27/02/2023
TP08	1.25	25	23.75	-	Static	28/02/2023

Note 1: Surface elevation estimated from Horowhenua District topographic map; accuracy + / - 5 m.

6 LABORATORY TESTING

A programme of soil laboratory testing was carried out on representative disturbed and undisturbed samples collected during the test pit investigation described above generally in accordance with the requirements of the latest edition of the standards outlined in Table 6.1 (where applicable).

Laboratory testing schedules were devised and scheduled by BTW and carried out by WSP New Plymouth (PSD, moisture content, Atterberg limits, linear shrinkage, compaction), WSP Wellington (thermal resistivity), Hill Laboratories (soil aggressivity suite) and WSP Auckland (electrical resistivity).

A summary of the number and type of laboratory tests conducted, and the test method followed is presented in Table 6.1. Laboratory test certificates are presented in Appendix C.

Table 6.1: Summary of Laboratory Testing.

Sample Type	Sample Analysis	Quantity	Test Method
Soil Geomechanics	Particle Size Distribution (PSD); sand dry sieve	4	NZ4407, 4402
	Water Content	5	NZ4407, 4402, 3111
	Atterberg Limits	2	NZ4407, 4402
	Linear Shrinkage	2	NZ4402
	Vibratory Compaction	1	NZ4407, 4402
Soil Aggressivity Suite	Potassium Dihydrogen orthophosphate, Chloride, pH, Sulphate	5	APHA 4110 B
	Electrical Resistivity	4	BS 1377: Part 3: 1990. Section 10.4
Thermal Resistivity	4-Point Thermal resistivity test	4	ASTM D5334-14

6.1 Laboratory test results

6.1.1 Soil Geomechanics

Results of the soil geomechanics laboratory tests completed by WSP New Plymouth and WSP Hamilton is summarised in Table 6.2 below. The test location of each sample is presented in Figure 5.2 and the laboratory test certificates are presented in Appendix C.

Table 6.2: Summary of Soil Mechanics Laboratory Test Results

Test Location ID	Sample Depth (m, BEGL)	Gravel (%)	Sand (%)	Fines (%)	WC (%)	MDD (t/m^3)	OWC (%)	NWC (%)	LL	PL	PI	LS
TP01	1.5 – 2.0	0	99	1	18.2	1.66	18	16.6	-	-	-	-
TP03	0.5 – 1.0	0	100	0	7.1	-	-	-	-	-	-	-
TP05	1.0 – 1.5	0	100	0	11.3	-	-	-	-	-	-	-
TP05	2.2 – 2.5	-	-	-	220.6	-	-	-	412	380	32	35
TP07	2.0 – 2.4	0	100	0	23.9	-	-	-	-	-	-	-
TP08	0.15 – 0.3	-	-	-	27.9	-	-	-	NO	NO	NP	4

Note: Gravel, sand and fines percentages are by weight, WC = water content, MDD = maximum dry density, OWC = optimum water content, NWC = natural water content, LL = liquid limit, PL = plasticity limit, PI = plasticity index, LS = linear shrinkage, SS = shrink/swell index, NO = not obtainable, NP = non-plastic.

6.1.2 Soil Aggressivity Suite

Results of the soil aggressivity suite laboratory tests completed by Hills Laboratories is summarised in Table 6.3 below. The test location of each sample is presented in Figure 5.2 and the laboratory certificates along with the method description for each test is presented in Appendix C.

Table 6.3: Summary of Soil Aggressivity Laboratory Test Results

Test Location ID	Material Description	Sample Depth (m, BEGL)	Chloride (mg/kg dry weight)	pH (units)	Sulphate (mg/kg dry weight)	Electrical Resistivity – Initial (Ω.cm)	Electrical Resistivity – 1hr Saturated (Ω.cm)
TP01	SAND	1.5 – 2.0	<3	6.7	<3	37100	36600
TP03	SAND	0.5 – 1.0	<3	6.8	<3	23300	23400
TP04	SAND	1.0 – 1.5	11	6.3	16	6500	6500
TP05	PEAT	2.2 – 2.5	230	6.3	45	NA – not enough sample mass	
TP07	SAND	2.0 – 2.4	9	7.2	5	14100	14000

Note 1: Note: one part per million (ppm) = one milligram/kilogram (mg/kg).

6.1.3 Thermal Resistivity

Thermal resistivity testing was undertaken at four locations on site. A summary of samples acquired during the site investigation is presented in Table 6.4. The test location of each sample is presented in Figure 5.2 and the laboratory test certificates are presented in Appendix C.

Table 6.4: Summary of Thermal Resistivity Laboratory Test Results

Test Location ID	Sample Depth (m, BEGL)	Sampling Method	Sample Date
TP01	1.0	Push Tube and Bulk Sample	28/02/2023
TP03	1.0	Push Tube and Bulk Sample	28/02/2023
TP06	1.0	Push Tube and Bulk Sample	28/02/2023
TP08	1.0	Push Tube and Bulk Sample	28/02/2023

7 SUBSURFACE CONDITONS

7.1 Soil Stratigraphy

In general, below the surficial topsoil layer, materials recovered during the intrusive geotechnical investigation comprised four main geotechnical units. The description of these units is presented below in order of increasing geological age.

- Unit 0 – Uncontrolled Fill; loose to medium dense; dark brown, grey, grey brown, orange, Sand with minor to some silt; trace organics, roots, rootlets and small branches; vegetation cover; non plastic; sand, fine to medium grained; uniformly graded; moist; overlying,
- Unit 1 – Upper Holocene Windblown Deposits; loose to very dense; dark, grey, grey brown, grey blue, orange streaks, Sand with some trace silt; trace roots, rootlets and branches; non plastic; sand, fine to medium grained; uniformly graded; moist to saturated; overlying,
- Unit 2 – Lower Holocene Windblown Deposits; dense to very dense; grey brown, grey blue, Sand; fine to medium grained; uniformly graded; wet to saturated; overlying,
- Unit 3 – Holocene Swamp Deposits, medium dense; dark brown, black, minor grey and orange, Peat with some silt and sand; fibrous; low plasticity; sand, fine to medium grained; moist to wet.

Uncontrolled fill material was observed within test pits TP01, TP02, TP04, TP05, TP06, TP07 and TP08, however, is expected to be encountered across the majority of the site given the transformation in land use activities. We were unable to delineate uncontrolled fill layers from the CPT traces therefore the approximate depth range of this layer (Unit 0) has been interpreted using only test pit data.

A generalised soil profile is presented below in Table 7.1, with finalised CPT results, test pit logs and Scala penetrometer results provided in Appendix A and Appendix B respectively. Geotechnical sections of each CPT plot using the software package CPeT-IT have been provided in Appendix D. Parameters resulting from these sections are shown in Table 7.1.

Table 7.1: Subsurface Soil Profile

Unit No.	Formation	Approximate depth to top of layer (Metres, BEGL)[1]	Average elevation of top of layer (Metres, RL) [1]	Approximate layer thickness (Metres BEGL) [1]	Estimated Undrained Shear Strength (S_u, kPa) [2]	Average CPT cone resistance (q_t, MPa) [3]	Estimated N_{60} [3]	Estimated Constrained Modulus (E'_{oed}) [3]
0	UNCONTROLLED FILL	Surface	26.0	0.26 (0.1 – 0.42)	-	-	-	-
1	UPPER HOLOCENE WINDBLOWN DEPOSITS	0 - 0.26	25.74 – 26.0	3.0 (1.0 – 5.1)	0.00	9.01	10 - 25	31.99 – 76.3
2	LOWER HOLOCENE WINDBLOWN DEPOSITS	3.33 (1.0 – 5.6)	22.67 (20.4 – 25.0)	>9.94	0.00	19.88	27 – 45	84.17 – 136.96
3	HOLOCENE SWAMP DEPOSITS	3.7 (1.95 – 5.45)	22.30 (20.55 – 24.05)	0.60 (0.3 – 1.15)	0.00 – 12.48	2.95	3 – 16	19.0 – 68.39

Note 1: Values shown as Average (Min-Max). Average elevation 26.0 m RL.
Note 2: Estimate from shear vane reading or CPT estimated values.
Note 3: CPT estimated values.

7.2 Groundwater Assessment

Groundwater was encountered at a depth of between approximately 0.6 m and 1.8 m below existing ground level (BEGL) within all test pit locations and in CPT03. In all other CPT locations groundwater was unable to be dipped due to impeding hole collapse of the running sands.

It should be noted that the CPT test holes were dipped for groundwater immediately following their completion so the CPT03 reading measured was likely a perched groundwater level and not a static groundwater level. Groundwater level within the test pits was measured using a level staff. Recordings were taken when groundwater was observed pooling at the base of the pit and could be seen seeping in from the sides of the pit, so these results are considered near static conditions. The static groundwater depth is estimated to be between approximately 1.0 m and 1.8 m BEGL.

Static groundwater level within the underlying soils will likely fluctuate with seasonal variations in precipitation and run-off, tending to rise during periods of prolonged precipitation and decrease during the drier summer months therefore we would expect the static groundwater level will likely be higher during winter months.

8 GEOTECHNICAL ASSESSMENT

8.1 Static Consolidation Settlement

Generally, we expect the static settlement due to building loads to be tolerable given then site is extensively underlain with granular soil materials and thin lenses of cohesive / organic soils. Preliminary settlement analysis of CPT10 and CPT11 data using Geologismiki CPeT-IT software indicates that static settlement near the location of the proposed solar building infrastructure (i.e. Substation near TP06) will likely be less than 25 mm and within tolerable limits when considering the Building Code, Appendix B Section B1/VM4, clause B1.0.2 which states that foundation design should limit the probable maximum differential settlement over a horizontal distance of 6 m to no more than 25 mm.

8.2 Seismic Hazard Assessment

8.2.1 Site Subsoil Category

Based on the subsoil ground profile obtained from the geotechnical investigations, regional ground investigation data, and published geology, the site subsoil class is determined to be D (Deep soil sites), in accordance with NZS 1170.5 Section 3.1.3.

8.3 Liquefaction

8.3.1 Liquefaction Potential

Liquefaction defined

Liquefaction refers to the strength loss and deformation, caused by cyclic loading (i.e. during earthquake shaking), in loose saturated granular soils with poor drainage, such as silty sands or sands and gravels capped by or containing layers of impermeable sediments.

During shaking the loose sands decrease in volume, which produces an increase in their pore water pressure and consequently a decrease in shear strength, developing characteristics similar to those of a liquid. Liquefaction may develop at any depth of a sand deposit where a critical combination of in-situ density and cyclic deformation occurs.

However, liquefaction that occurs within the top 10 m of the soil profile has the greatest probability of creating surface manifestations i.e., sand boils and differential settlement (MBIE 2021b).

Liquefaction potential at the site

Below the surficial topsoil and uncontrolled fill layers, the subsurface soils comprise Holocene Windblown Deposits; described as loose to very dense; moist to saturated sand with some trace silt; with trace inclusions of roots, rootlets and branches.

Interbedded within the Holocene Windblown Deposits are thin layers of Holocene Swamp Deposits; described as medium dense; moist to wet; fibrous peat with some silt and sand. Static groundwater within the site is known to fluctuate seasonally but is generally considered to be encountered at relatively shallow depths between approximately 1.0 m – 1.8 m BEGL.

The Holocene dune deposits encountered across the site are characterised by younger sandy and silty soils with shallower groundwater. These characteristics are generally indicative of greater liquefaction vulnerability.

8.3.2 Liquefaction Assessment

Approach to liquefaction assessment

The liquefaction assessment was undertaken using Geologismiki software (CLiq v.3.5.2.5) and the calculation method of Boulanger and Idriss (2014). Seismic deformation of loose soil above the groundwater table at the site is estimated to be negligible and that can be further supported by the procedure of Tokimatsu and Seed (1987).

The factor of safety against triggering liquefaction, FS_{liq} (FS_{liq}= CRR/CSR, where CRR = Cyclic Resistance Ratio and CSR = Cyclic Stress Ratio) was determined for soils that are susceptible to liquefaction. The analysis was conducted using an assumed groundwater depth of 1.0 m below ground level.

The design ground motions (SLS and ULS) for the IL2 structure has been determined from the recently revised MBIE Module 1 guidelines for Earthquake Geotechnical Engineering Practice (MBIE, 2021a) which have provided updated peak ground acceleration (PGA) and earthquake magnitude (M) values for across New Zealand. The design ground motions are presented in Table 8.1.

Table 8.1: Seismic design cases for Importance Level 2 structure

Load Case	Magnitude	PGA (Note 1)	Return Period (years)
Serviceability Limit State (SLS)	6.4	0.13	25
Ultimate Limit State (ULS)	7.5	0.55	500

Note 1: PGA for the liquefaction assessment has been assessed based on the recommended values in Appendix A, Table A1, MBIE 2021 for the Levin area:

Design Life	50 years
Building importance level	IL2
Return period	1/25 year (SLS), 1.0 for 1/500 year (ULS)
Subsoil class	D - Deep Soils (NZS 1170.5 Section 3.1.3)
PGA	0.13 (SLS) and 0.55 (ULS) (Appendix A, Table A1, MBIE 2021)
Earthquake effective magnitude	6.4 (SLS) and 7.5 (ULS) (Appendix A, Table A1, MBIE 2021)

8.3.3 Liquefaction Hazard

The calculated risk for liquefaction effects to this property for the analysed soil profile is summarised in Table 8.2. The assessment outputs are provided in Appendix E.

Table 8.2: Summary of liquefaction indicators

	SLS – IL2		ULS – IL2	
CPT ID	Liquefaction Potential Index (LPI)[1]	Liquefaction Severity Number (LSN)[1]	Liquefaction Potential Index (LPI)[1]	Liquefaction Severity Number (LSN)[1]
CPT01	0	0.23	5.7	15.1
CPT02	0	0.03	4.9	11.6
CPT03	0	1.4	9.6	17.7
CPT04	0	3.9	24.2	48
CPT05	0.02	2.1	19.0	40.1
CPT06	0	2.8	15.1	34.0

	SLS – IL2		ULS – IL2	
CPT ID	Liquefaction Potential Index (LPI)[1]	Liquefaction Severity Number (LSN)[1]	Liquefaction Potential Index (LPI)[1]	Liquefaction Severity Number (LSN)[1]
CPT07	0	0.4	6.4	11.0
CPT08	0	0.4	4.1	4.8
CPT09	0	0.0	3.3	4.9
CPT10	0	0.2	3.0	5.3
CPT11	0	0.2	7.0	17.2
CPT12	0.02	2.3	14.4	38.2
CPT13	0	4.0	13.9	28.1
CPT14	0.03	2.9	14.2	27.3
CPT15	0.02	0.8	8.0	9.3
CPT16	0	0.3	7.8	12.5
CPT17	0	0.2	4.2	6.8

Note 1: Earthquake Geotechnical Engineering Practice, Module 3 (MBIE, 2021b), Table 5.1; L0 Insignificant - Blue, L1 Mild – Green, L2 Moderate – Yellow, L3 High – Orange, L4 Severe – Red.

Based on the information contained in Table 8.2 for the analysed soil interval, the general performance levels for liquified deposits as shown in *Earthquake Geotechnical Engineering Practice, Module 3* (MBIE, 2021b), for the site can be described as follows (refer

Figure 5.1):

- The site meets the following performance level for a SLS event for the analysed soil interval: **L0, with insignificant effects** with no significant excess pore water pressures (no liquefaction).
- CPT08, CP09, CPT10, CPT17 meet the following performance level for a ULS event for the analysed soil interval: **L1, with mild effects** from excess pore water pressure and liquefaction; limited excess pore water pressures, negligible deformation of the ground and small settlements.
- CPT01, CPT02, CPT07, CPT15, CPT16 meet the following performance level: **L2, with moderate effects**; liquefaction occurring in limited thickness (small proportion of the deposit, say 10 percent or less) and lateral extent; ground deformation results in relatively small differential settlements.
- CPT03, CPT11, CPT13, CPT14 meet the following performance level: **L3, with high effects**; liquefaction occurring in a significant portion of the deposit (30 to 50 percent) resulting in moderate to large differential movements, and settlement of the ground in the order of 100 mm to 200 mm.
- CPT04, CPT05, CPT06, CPT12 meet the following performance level: **L4, with severe effects** with complete liquefaction in most of the deposit resulting in excessive differential settlements and total settlement of over 200 mm.

8.3.4 Liquefaction-Induced Reconsolidation Settlement

The assessment of liquefaction-induced reconsolidation settlement was performed using the procedure of Boulanger and Idriss (2014). The assessment outputs are provided in Appendix E.

The estimated liquefaction-induced vertical settlements should be tempered noting that published research (Martin and Lew 1999; NZGS 2016) estimates that differential settlement is in the order of one half to two thirds of total settlement.

The data in Table 8.3 shows that the estimated liquefaction-induced vertical settlement calculated across the site as a whole for the two seismic conditions presented in Appendix E.

Table 8.3: Overall liquefaction-induced vertical settlement under SLS and ULS ground motion

CPT ID	Earthquake Magnitude (Mw)	PGA (g)	Return Period (years)	Estimated Liquefaction Induced Vertical Settlements (mm)	Estimated Differential Settlements (mm)
All	6.4	0.13 (SLS)	25	Negligible to < 15	Negligible
CPT08, CP09, CPT10, CPT17	7.5	0.55 (ULS)	500	20 – 30	15 – 20
CPT01, CPT02, CPT07, CPT15, CPT16				30 – 45	20 – 30
CPT03, CPT11, CPT13, CPT14				45 – 90	30 – 60
CPT04, CPT05, CPT06, CPT12				90 – 130	60 – 90

The following conclusions can be made from the assessment of liquefaction-induced settlement:

- Negligible differential settlements are expected for a SLS event.
- Minor differential settlements of less than 30 mm can generally be expected near test locations CPT08, CP09, CPT10, CPT17 and CPT01, CPT02, CPT07, CPT15, CPT16.

- Moderate differential settlements of less than 90 mm can generally be expected near test locations CPT03, CPT11, CPT13, CPT14 and CPT04, CPT05, CPT06, CPT12.

8.3.5 Liquefaction Hazard Discussion

The cone penetrometer testing (CPT) data and liquefaction analysis indicates that a liquefaction hazard exists at the site which will require foundation design mitigation (i.e., deeper pile embedment) dependant on the solar panel mount system tolerance to differential settlement.

A preliminary liquefaction hazard domain map is presented in Figure 8.1. Generally, the analysis indicates the following likely piling depths may be required to reduce the impact of liquefaction induced differential settlement to an acceptable level:

- Minor Differential Settlement Domain: 2.5 m to 4.5 m BEGL.
- Moderate Differential Settlement Domain: 4.0 m to 7.0 m BEGL.

Further intrusive CPT testing will be required to more accurately delineate the lateral extents of the liquefaction hazard domains. In-situ pile testing and further detailed geotechnical investigation and analysis will inform foundation design and will allow piling depths to be optimised as the site design evolves.

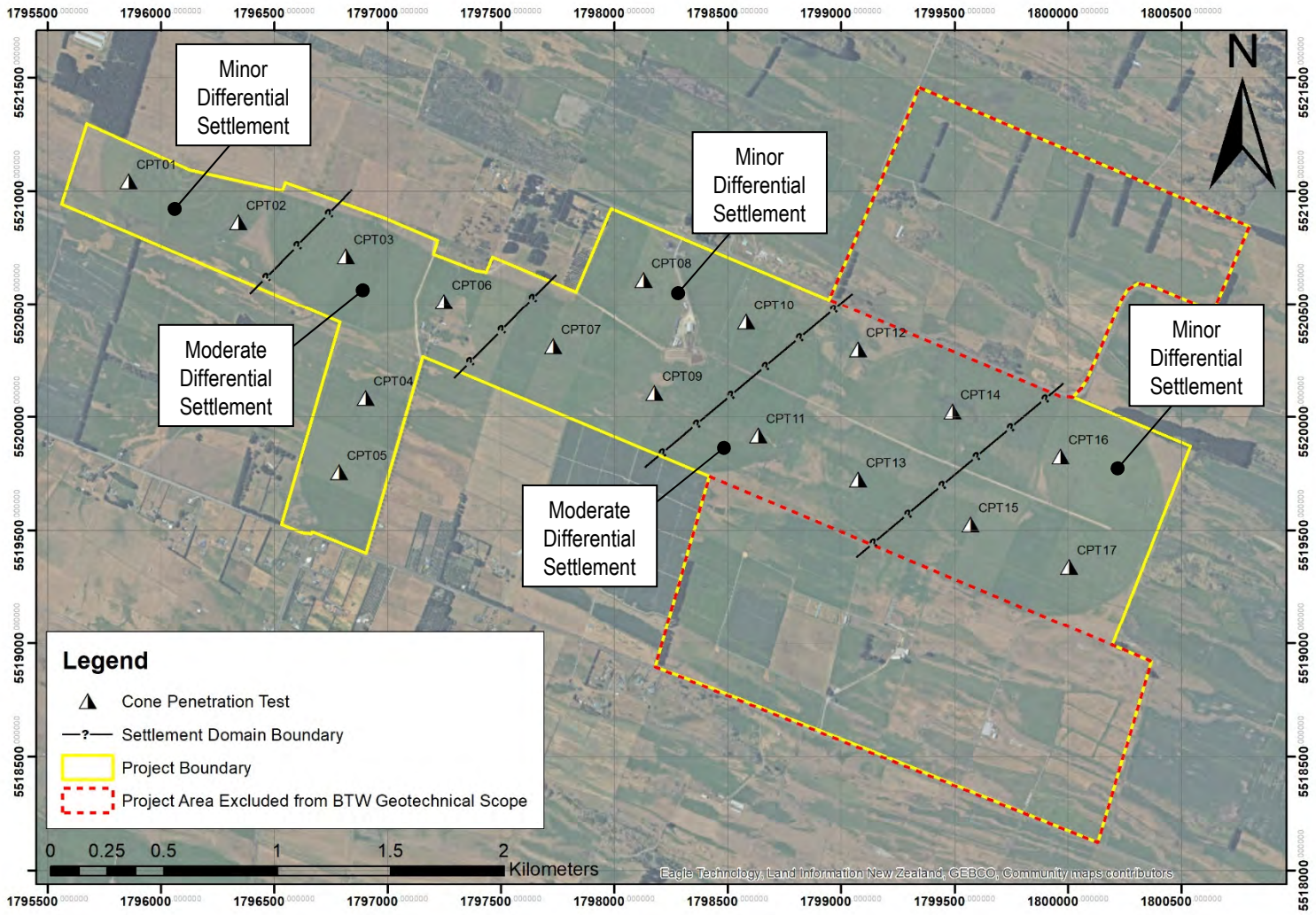


Figure 8.1: Preliminary map showing expected settlement domains

8.3.6 Lateral Spreading

Lateral displacement of flat to gently sloping ground as a result of liquefaction in a shallow underlying soil layer is termed lateral spreading. Ground surface deformation associated with lateral spreading is considered in terms of global lateral displacement and differential lateral displacement (lateral stretch). Global lateral displacement is the amount of uniform translation of the ground surface at a site while lateral stretch is the amount of extension or differential translation of the ground surface across a site.

Lateral spreading can extend to large distances away from a free face during severe earthquake conditions. The spatial extent of lateral spreading is influenced by a range of factors, such as variations in the underlying geological formation and soil characteristics, extent of lenses of liquefied soil, ground topography and the three-dimensional geometry of the free face. Severity of liquefaction effects decreases with increasing density of the soils, and importantly the mechanism of ground deformation also changes as the density of the soil increases.

The following factors contribute to assessment of the susceptibility of the site to lateral spreading:

- Presence of gently sloping ground or presence of a free face.
- Distance from a free face: lateral displacements within a laterally spreading mass will generally decrease with distance from the free face.
- Continuity of the liquefiable layer between site and free face. Lateral spreading is unlikely to be of significant concern where the depth to the uppermost liquefiable layer (below the free face) is greater than twice the height of the free face.

Lateral spreading is expected to be minor due to the generally flat to very gently sloping ground present across the site and absence of free faces. Onerous ground improvement design mitigation to address the hazard of lateral spreading is not expected to be required for the project.

8.4 Ground Considerations

Groundwater was encountered at a depth of between approximately 0.6 m and 1.8 m below existing ground level (BEGL) within all test pit locations and in CPT03. Deep excavations for basement structures are generally not recommended or expected for the site. If these are required then shoring, likely in the form of sheet piling will be required due to the high groundwater table and the underlying granular soils.

Considering the solar panels will likely be supported on driven pile foundations with no significant excavation undertaken at each site, it is considered unlikely that there will be significant issues relating to groundwater pile construction.

Excavated (unlined/unsupported) holes, such as unlined auger holes will be prone to collapse.

8.5 Soil Expansivity

The site is primarily underlain by Holocene Wind Blown Deposits, with minor lenses of Holocene Swamp Deposits.

The Holocene Wind Blown Deposits are considered to be non-expansive due to the non-plastic granular nature of the soil.

The underlying lenses of Holocene Swamp Deposits may be susceptible to soil expansion depending on the clay content of the material, however these soil lenses are generally expected to

be fully below the groundwater table throughout the year (i.e., not subject to wetting and drying) and as such the anticipated risk of expansive soil and associated ground movement is considered to be low.

8.6 Soil Aggressivity for Steel Piles

The soil exposure classification was assessed in accordance with the Australian Standard, AS2159-2009, (Piling – Design and Installation), and Standards New Zealand Technical Specification (SNZ TS) 3404:2018, which outline the design recommendations for concrete and steel foundation materials based on the results of aggressivity suite testing. The exposure classification for steel piles based on aggressivity results is summarised below.

- For steel piles an exposure classification of "Non-aggressive" (AS2159-2009) and "Non-corrosive" (3404:2018) is recommended, based on the following:
  - Soil pH is between 6.3 and 7.2 for all samples.
  - Soil Chloride is 11 or less ppm for the sand samples, and 230 ppm for the peat sample.
  - Soil Sulphate is 16 or less ppm for sand samples, and 45 ppm for the peat sample.
  - Soil electrical resistivity is between 6,500 and 37,100 for the sand samples. Note electrical resistivity for the peat sample was not obtainable.

9 PRELIMINARY FOUNDATION RECOMMENDATIONS

9.1 Solar Panel Arrays

9.1.1 Driven Steel Piles

It is understood that driven steel piles are the preferred foundation option for the project, these being 150UC30.0 and 150UB14.0, or W6 x 20 and W6 x 9 steel sections.

The preferred driven steel pile foundation for the solar panel arrays is considered suitable for the site. The following design considerations are provided:

- Generally, it is expected that the dense to very dense Holocene Wind Blown Deposit sands will provide suitable bearing stratum for the driven piles.
- It is anticipated that the liquefaction hazard will govern the required piling depth. Preliminary piling depths for the two interpreted liquefaction domains (Figure 8.1) are provided below:
  - Minor Differential Settlement Domain: 2.5 m to 4.5 m BEGL.
  - Moderate Differential Settlement Domain: 4.0 m to 7.0 m BEGL.
- Pre-drilling of pile holes is not expected to be required.
- The pile designer should consider the impact of negative skin friction for the section of pile within soils subject to liquefaction induced reconsolidation settlement.
- The pile designed should consider the impact of vibration during installation, associated construction related settlement, and the impact to nearby infrastructure where required.
- Further intrusive CPT testing will be required to more accurately delineate the lateral extents of the liquefaction hazard domains. In-situ pile testing and further detailed geotechnical investigation and analysis will inform foundation design and will allow piling depths to be optimised as the site design evolves.

9.1.2 Screw Piles

Screw piles are considered a feasible option for the site, with the dense to very dense Holocene Wind Blown Deposits likely providing a suitable bearing stratum for the pile helix. These types of piles will likely have a similar embedment depth to driven steel piles and may be preferrable in areas where construction vibration is required to be minimised.

9.2 Substation Buildings

The ground conditions present onsite are generally considered suitable for specifically designed shallow foundations for substation buildings or other proposed ancillary structures. The following design considerations are provided:

- A specifically designed reinforced concrete Raft or Mat foundation is recommended. The building structure may be required to mitigate liquefaction induced differential settlement (refer Section 8.3.5) depending on the location of the building.
- Uncontrolled filling, where encountered at subgrade level, shall be excavated and replaced with suitably compacted engineered fill. Further earthworks recommendations are provided in Section 10.

10 EARTHWORKS

10.1 General Recommendations

Significant earthworks are not expected across the site due to the relatively flat to gentle slope gradients that were largely formed during previous earthworks of the site.

All earthworks, including excavation, preparation of subgrade and backfill should be performed in accordance with the geotechnical recommendations presented within this report and applicable portions of the New Zealand Standard 4431:2022 entitled, 'Engineering fill construction for light weight structures'. All earthworks should be performed under the observations and testing of a suitably experienced and qualified Geo-Professional familiar with the contents of this report.

10.2 Clearing and Site Preparations

Prior to construction, the site should be cleared of all obstructions, including designated utilities, concrete slabs and other foundation elements, hardscape and associate subgrade fill, rubble and debris.

Holes resulting from the removal of underground obstructions including uncontrolled fill extending below the finished grade should be cleared and backfilled with engineered fill or other suitable material that is appropriately benched into the natural ground and be approved by a suitably qualified and experienced Geo-Professional.

Before the start of earthworks operations, the construction area should be cleared of vegetation and stripped of miscellaneous debris and other deleterious material. Organic matter and all other material that may interfere with the completion of works should be remove from the construction area. Vegetation and organic matter should not be incorporated into engineered fill.

10.3 Compaction

If engineered fill is required as part of the proposed development, it will likely comprise site won material. Any engineered fill should be compacted to a minimum of 95 percent of the maximum dry density as determined by NZS 4402: Test 4.1.1, NZ Standard Compaction Test, or other approved testing method. Fill material should be spread and compacted in lifts not exceeding 200 mm in uncompacted thickness for cohesive material and lifts not exceeding 300 mm in uncompacted thickness for granular material.

10.4 Surface Drainage

Positive surface gradients should be provided adjacent to buildings to direct surface run-off away from foundations and slabs toward suitable discharge facilities. Similarly, roof downpipes should be connected to suitable discharge facilities. Ponding of surface water should not be allowed adjacent to buildings or pavements in order to maximise foundation and stormwater performance.

10.5 Temporary Works

Any temporary works or temporary supporting systems (such as showing, sheet piling, platforms, scaffoldings etc.) required for the completion of construction works shall be designed and provided by suitably qualified personal and in accordance with all relevant standards and legislation.

11 FURTHER GEOTECHNICAL WORK

The purpose of this report is to provide preliminary geotechnical investigation and assessment for the proposed solar development. Further intrusive geotechnical investigation and assessment is recommended at the following design phase to inform detailed design of solar panel array and infrastructure foundations.

The following recommendations for further geotechnical work are provided for the project:

- Detailed Cone Penetrometer Testing (CPT) program across the entire project site to accurately delineate the lateral extent of liquefaction hazard domains.
- Test pitting, Scala penetrometer testing and laboratory testing within the project areas currently outside of the scope of this report (refer Figure 2.1).
- Pile driveability, pile lateral capacity and axial capacity testing.
- Thermal resistivity testing of soils at the location of underground cabling once known.

11.1 Distribution

This report has been produced by BTW Company Ltd for the client, Solar-Gen Joint Venture and is solely for the clients use for which the report was intended, in accordance with the agreed scope. The reliance/use of this report and/or the information within this report by any person or business which BTW Company Ltd have not given prior consent, is at the persons or business own risk.

11.2 Limitations

The recommendations made within this report have been concluded from the Cone Penetrometer Test results, test pit observations, Scala penetrometer tests, and laboratory test results, and it is not intended to remove the necessity for the normal inspection of actual conditions at the time of construction.

The nature and continuity of subsoil conditions at locations other than the intrusive test sites are inferred and it should be appreciated that actual conditions could vary from the assumed model. If ground conditions are found to vary from that described or assumed, the matter should in the first instance be referred back to BTW for comment.

12 REFERENCES

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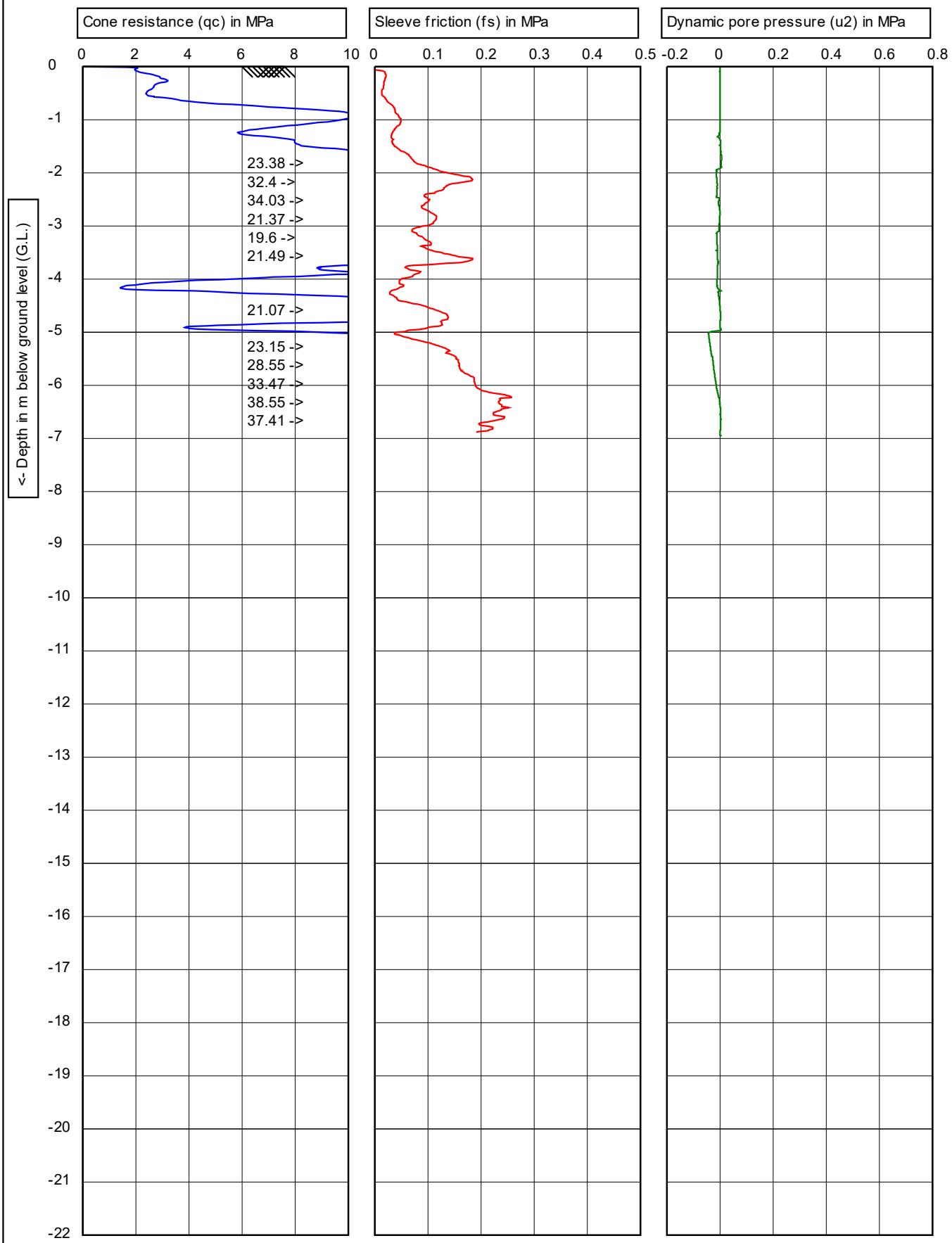
Shepherd & Lees (1987). Holocene alluviation and transgressive dune activity in the lower Manawatu Valley, New Zealand Journal of Geology and Geophysics, 30:2, 175-187.

SNZ TS 4304:2018. Durability requirements for streel structures and components. Available from Standards New Zealand.

Tokimatsu K, Seed, H.B., 1987. Evaluation of settlements in sands due to earthquake shaking. Journal of Geotechnical Engineering 113 (8): 861-878.

Townsend, D.B., Kamp, P.J.J. and Vonk, A., 2008: Geology of the Taranaki area. Institute of Geological and Nuclear Sciences 1:250 000 geological map 11. Lower Hutt, New Zealand. GNS Science.

APPENDIX A CONE PENETROMETER TEST RESULTS



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.4m

WSP

ACCREDITED IANZ TESTING LABORATORY

Test results indicated as not accredited are outside the scope of the laboratory's accreditation

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

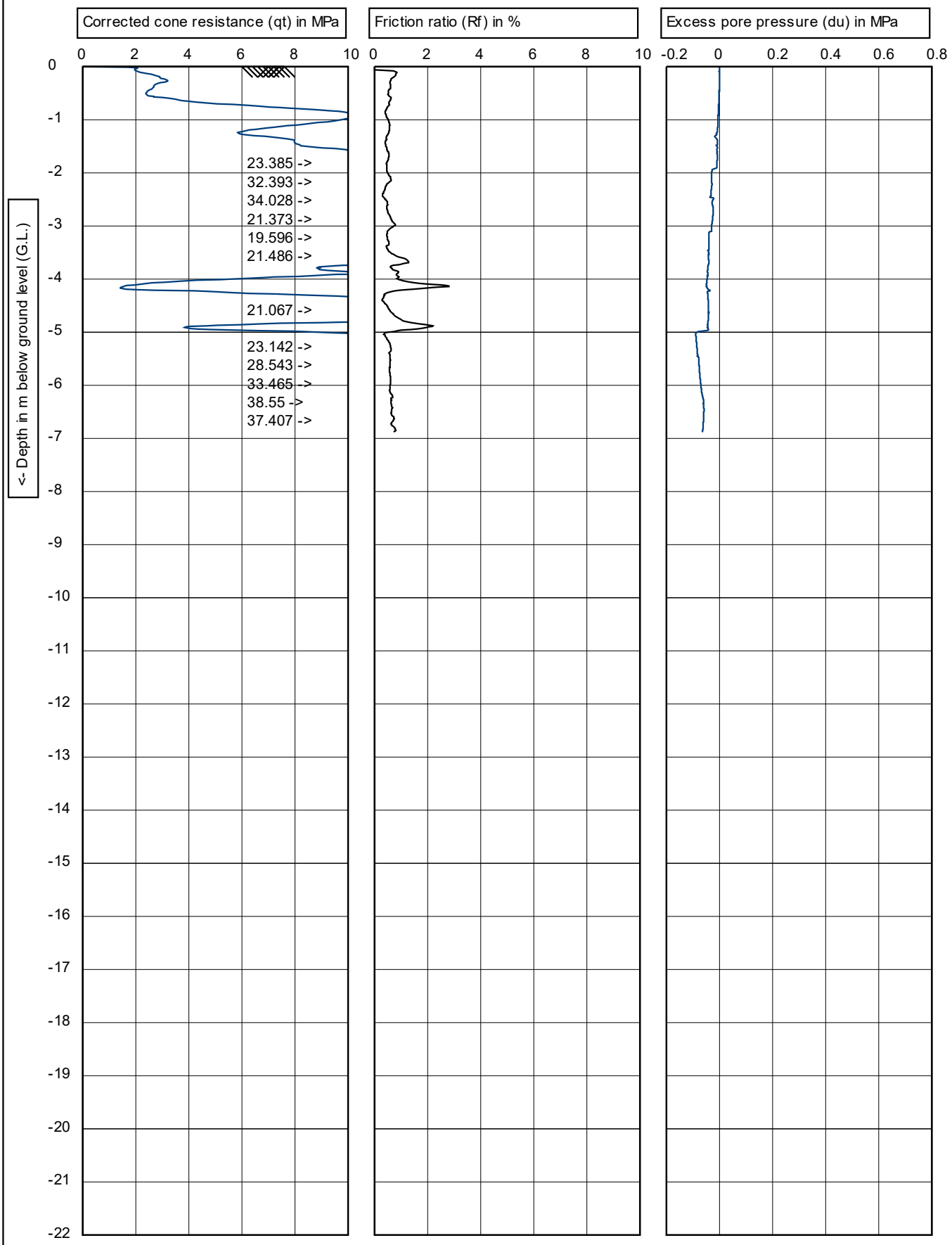
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Location: **Foxton (3007425)**

Position: **1795857, 5521044 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**01**

1.49



Graphs on this page are not IANZ accredited

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

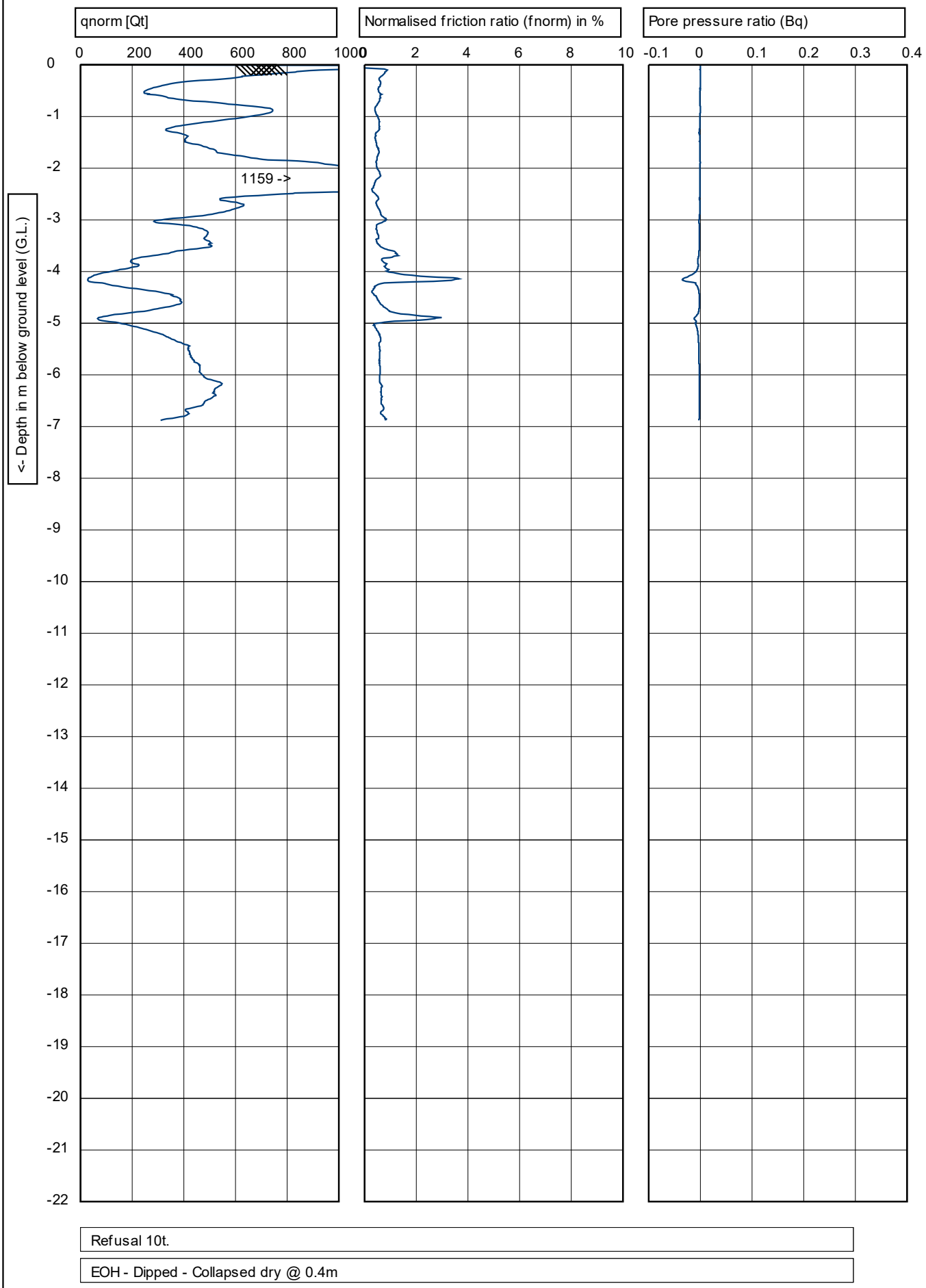
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1795857, 5521044 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**01**

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Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.4m

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

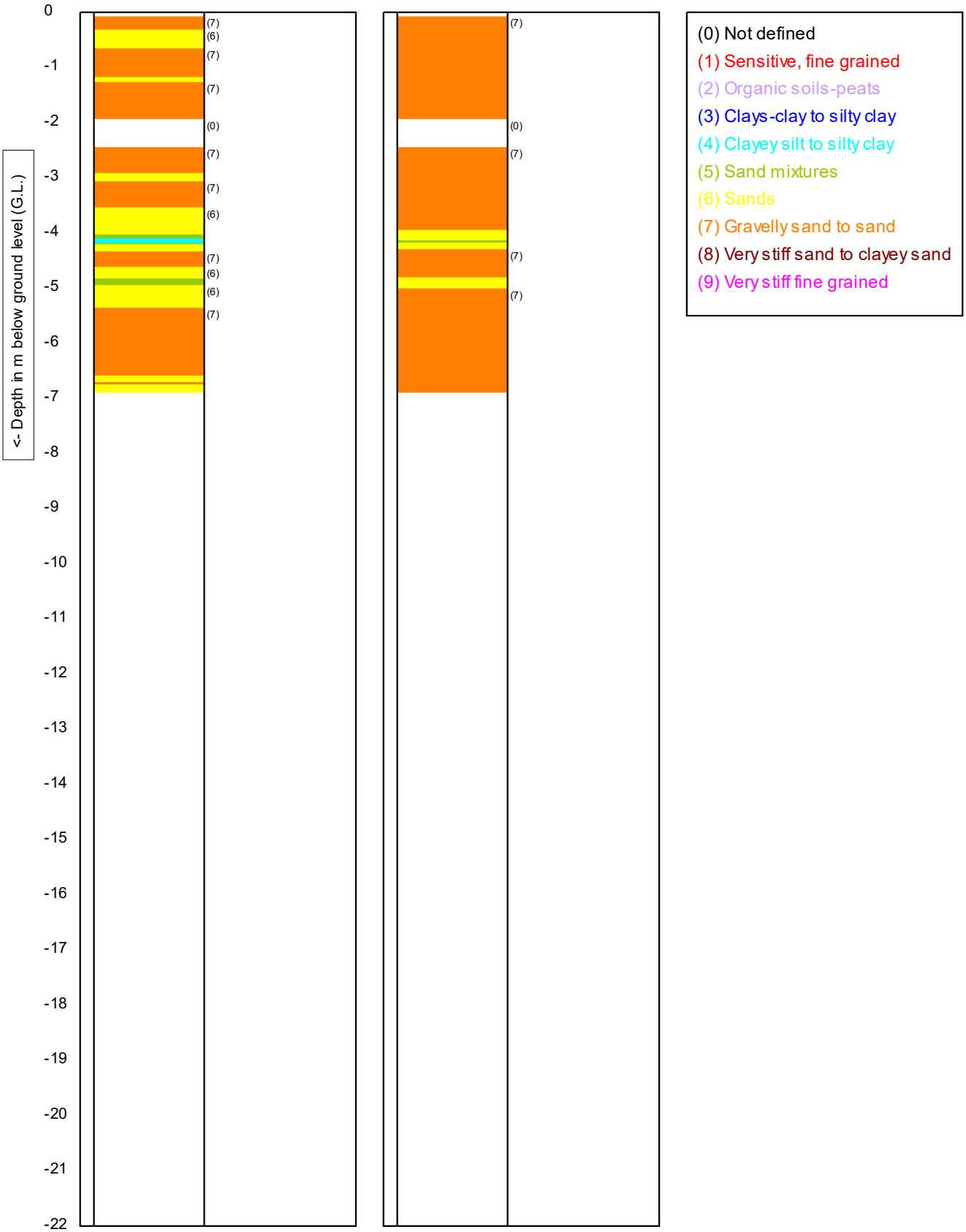
Position: **1795857, 5521044 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**01**

1.49

Soil Classification (using Fr)

Soil Classification (using Bq)



Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

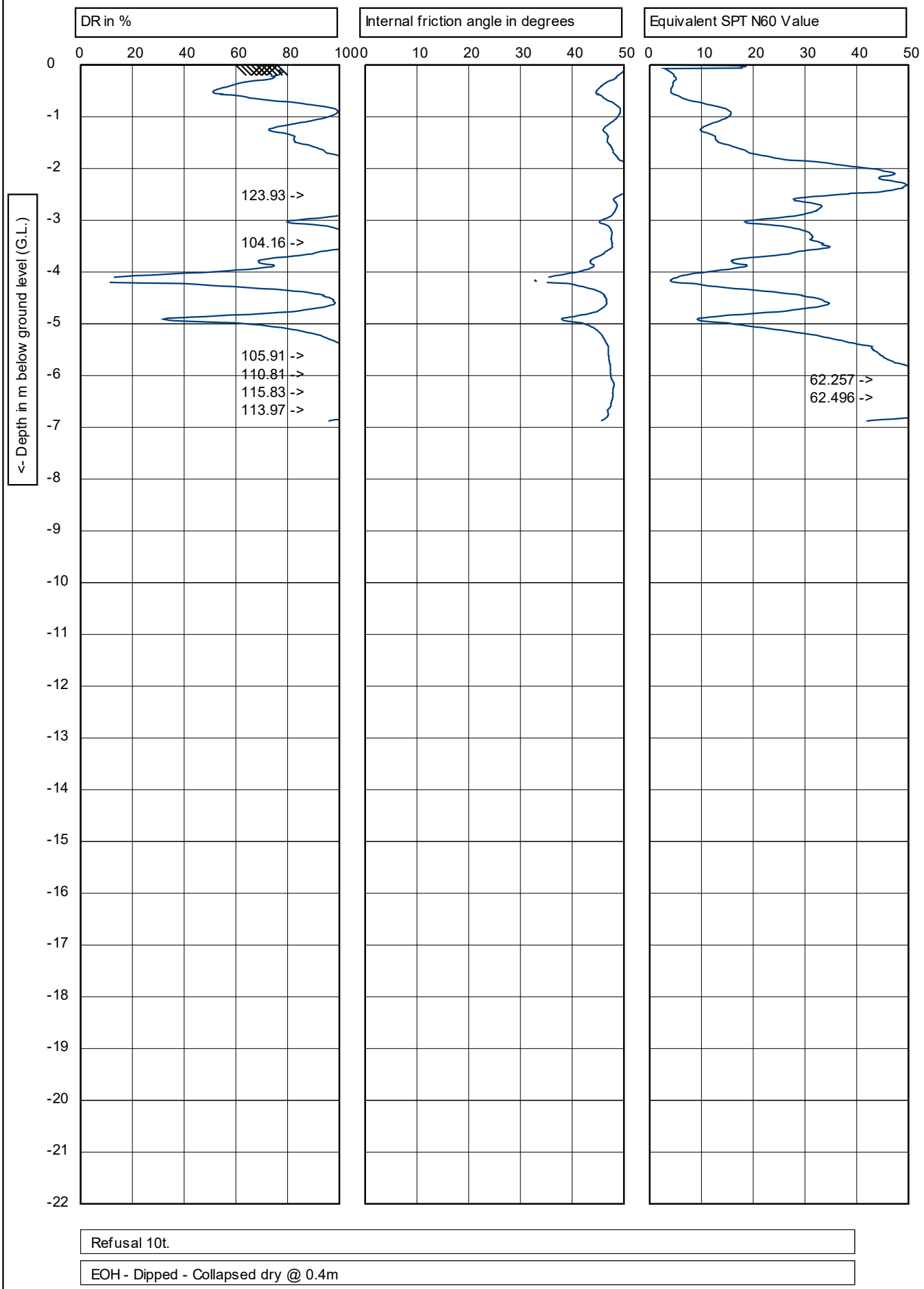
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1795857, 5521044 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**01**

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Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.4m

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

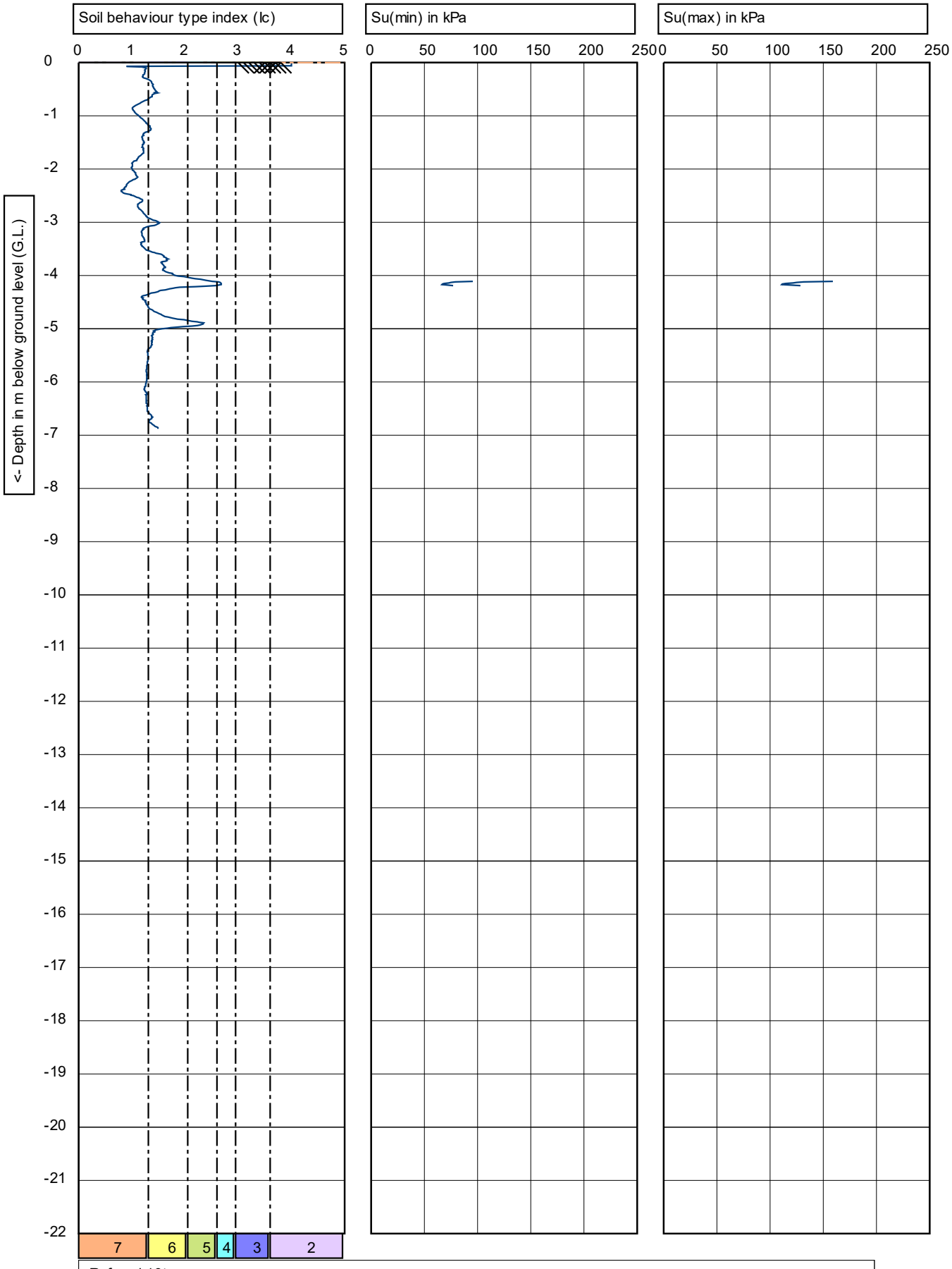
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1795857, 5521044 NZTM**

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Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**01**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.4m

Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1795857, 5521044 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**01** **6/6**

1.49

CONE PENETRATION TEST REPORT

Client :	BTW Company Limited	
Project :	231 Motuiti Rd	
Location :	Foxton (3007425)	
Hole Number:	01	
Tested by :	J Kavanaugh/ L Curtis	
Date tested :	28/02/23	
Coordinates :	1795857	E
	5521044	N
Elevation :	10m	
Water level :	EOH - Dipped - Collapsed dry @ 0.4m	

Project No :	2-68124,00
Lab Ref No :	HA10441_01
Client Ref No :	3007425

Test Results

Start Time	3:44:00 PM
Time at penetration	3:50:02 PM
End Time	12:06:02 AM
Reference level	0
Ground level	0
Predrill	0
Penetration Depth	6.96
Remarks	Refusal 10t.
GPS Type	Garmin eTrex 20
GPS Accuracy	+ / - 3m
GPS Reference Grid	NZTM
GPS Datum	MSL
Rig Type	GeoMil Panther 100/ Flex 200
Rig ID	CPT03
Reaction Force	Dead weight 10/22 tonnes
Data Acquisition (Digitizer)	GeoMil GME500
Acquisition Program	GeoMil CPTest
Reporting Program	GeoMil CPTask
Cone Type	C10 (10 Tonne Compression)
Cross Sectional Area	10cm2
Cone Area Ratio	0.8
Fluid Type	Silicone Fluid
Friction Reducer	0.55m behind base of cone
Application Class (ISO 22476-1)	3
Test Type (ISO 22476-1)	TE2 (Measured Cone and Sleeve)
Back Fill Method	Bentonite
Observations During Testing	0

Test Methods: ASTM D5778-12
ISO 22476-1:2012

Date tested : 28/02/23
Date reported : 17/03/23

IANZ Approved Signatory

Designation : *CPT North Island Manager*
Date : 17/03/23

This report may only be reproduced in full, including corresponding calibration data, daily logs, and CPT graphs.

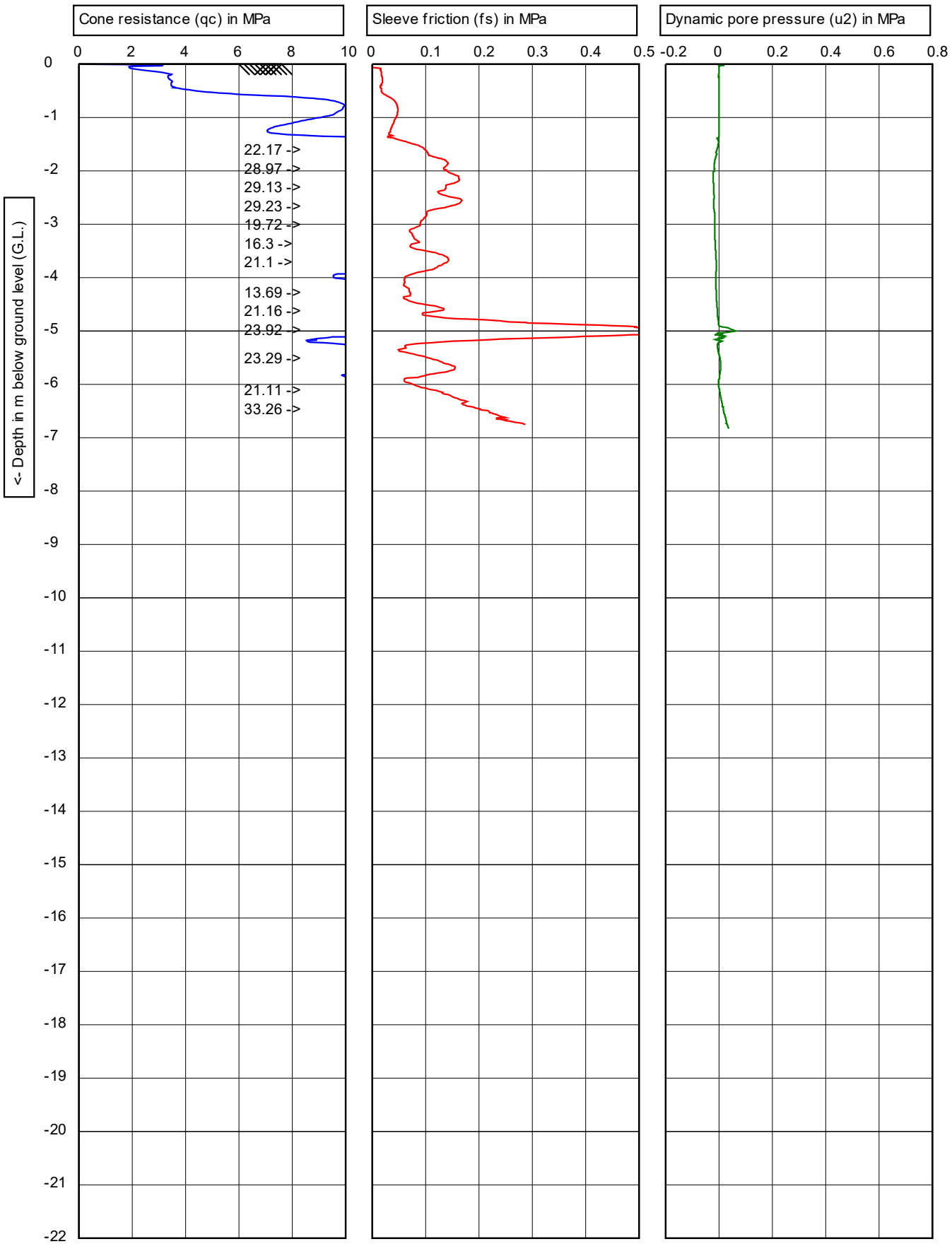
ACCREDITED IANZ TESTING LABORATORY

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

WSP
Hamilton (Fox St)
Quality Management Systems Certified to ISO 9001

4 Fox Street
Private Bag 3057, Waikato Mail Centre,
3240, Hamilton, New Zealand

Telephone +64 7 856 2870
Website www.wsp.com/nz



Test results indicated as not accredited are outside the scope of the laboratory's accreditation

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

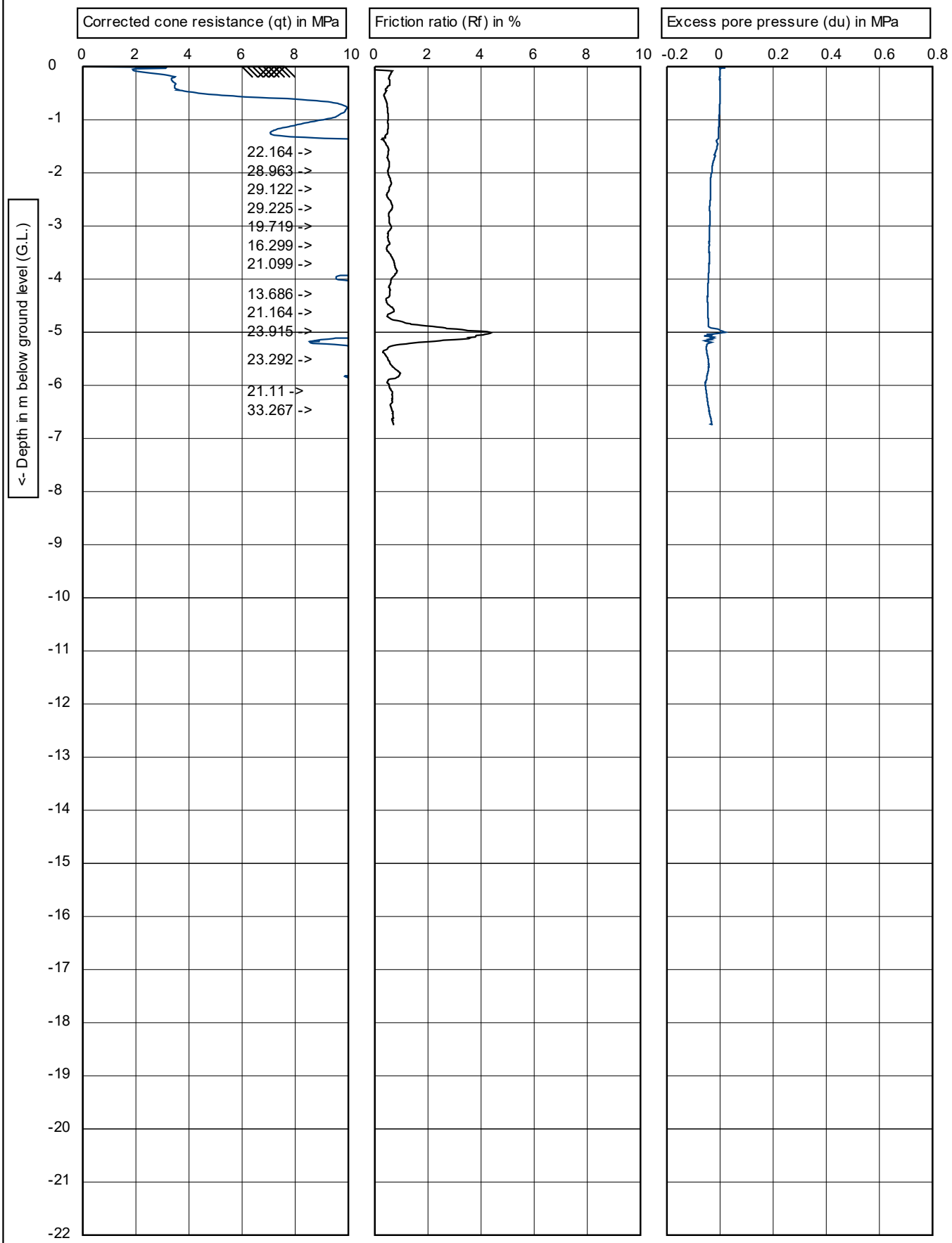
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Location: **Foxton (3007425)**

Position: **1796342, 5520863 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**02**

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Graphs on this page are not IANZ accredited

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Test according ASTM D5778:12 & ISO 22476-1:2012

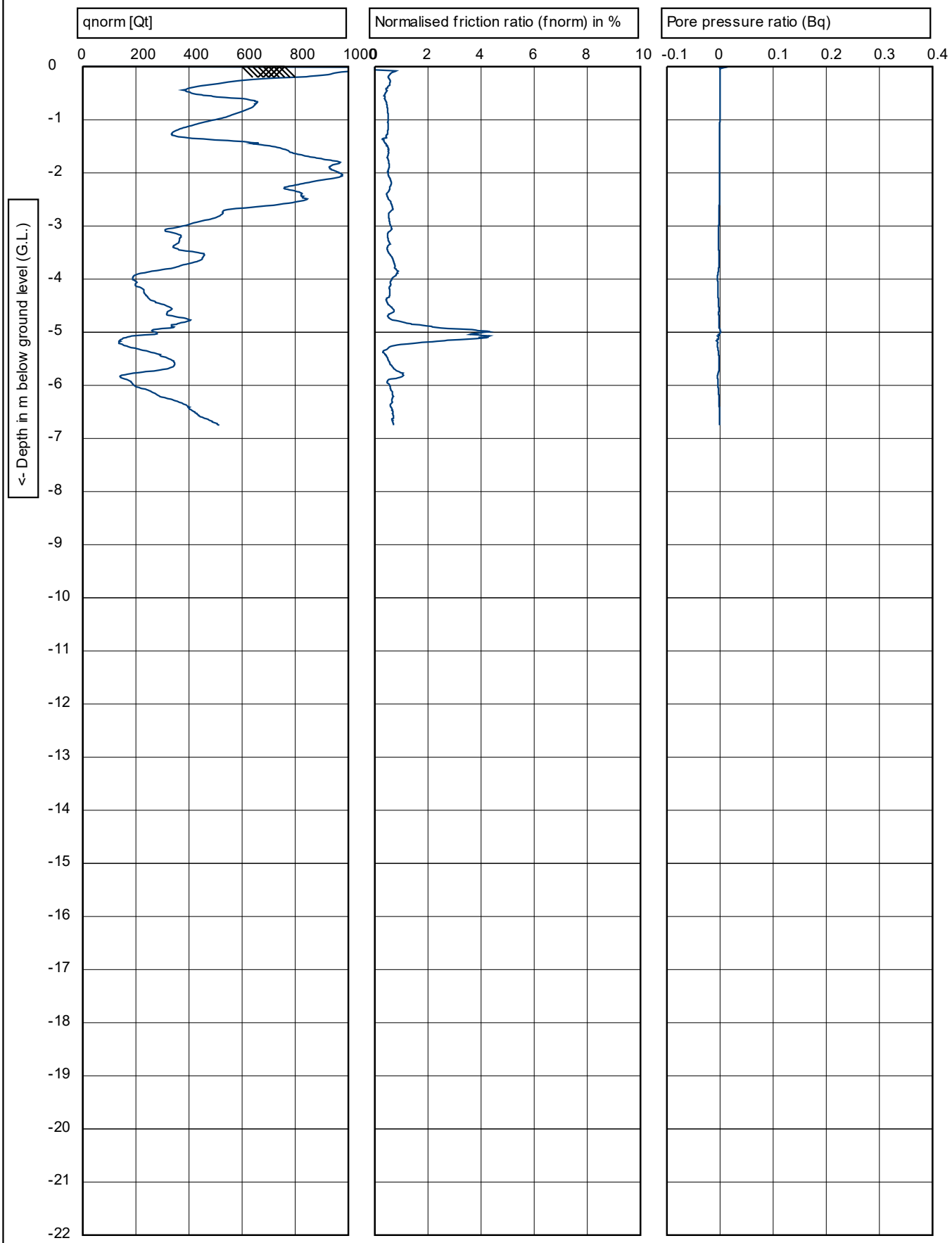
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Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1796342, 5520863 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**02**



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.7m

Graphs on this page are not IANZ accredited

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L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

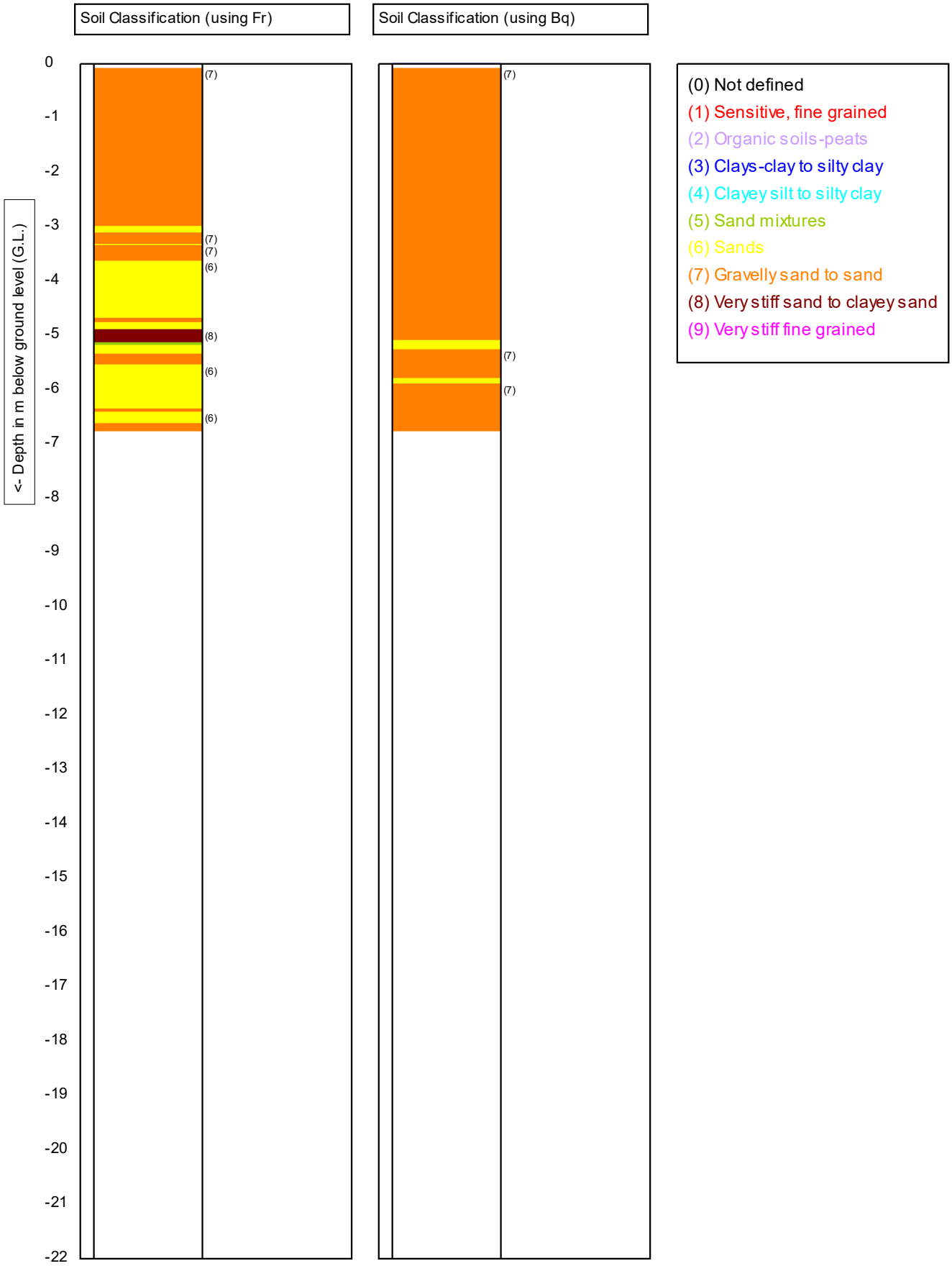
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1796342, 5520863 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**02**

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Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

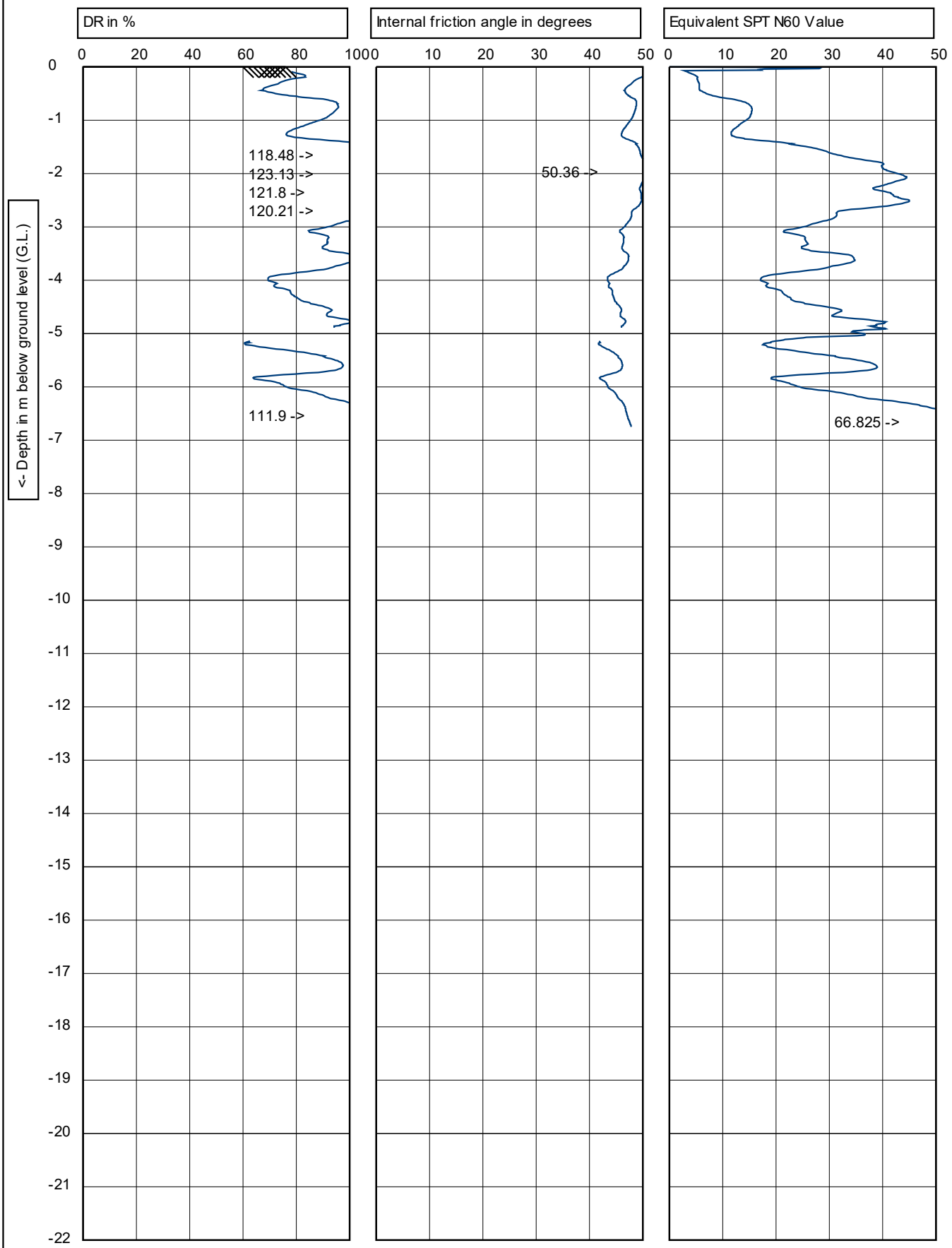
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1796342, 5520863 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**02**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.7m

WSP

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

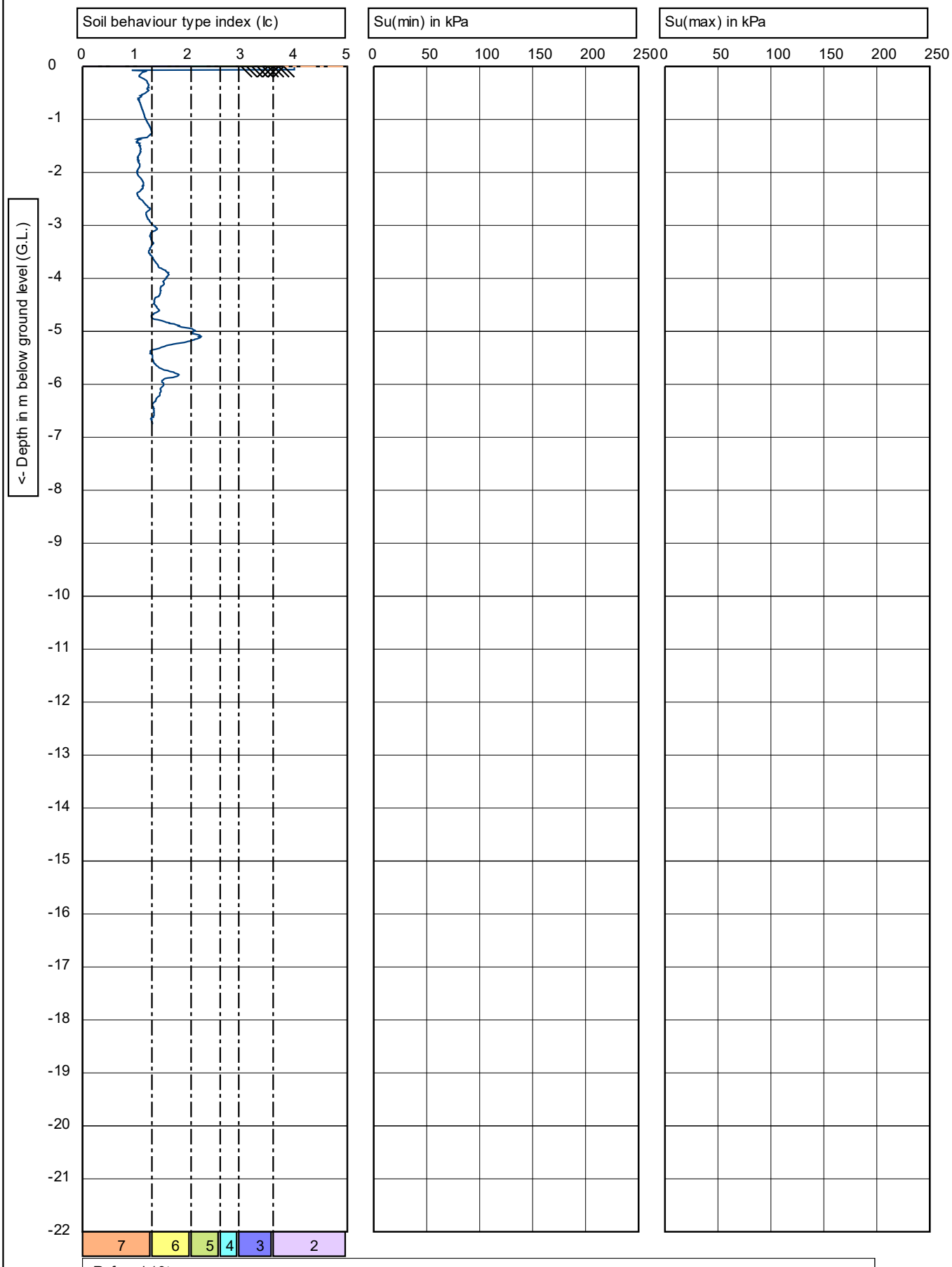
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1796342, 5520863 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**02**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.7m

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1796342, 5520863 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**02** **6/6**

1.49

CONE PENETRATION TEST REPORT

Client :	BTW Company Limited	
Project :	231 Motuiti Rd	
Location :	Foxton (3007425)	
Hole Number:	02	
Tested by :	J Kavanaugh/ L Curtis	
Date tested :	28/02/23	
Coordinates :	1796342	E
	5520863	N
Elevation :	11m	
Water level :	EOH - Dipped - Collapsed dry @ 0.7m	

Project No :	2-68124,00
Lab Ref No :	HA10441_02
Client Ref No :	3007425

Test Results

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Time at penetration	3:11:14 PM
End Time	12:06:14 AM
Reference level	0
Ground level	0
Predrill	0
Penetration Depth	6.83
Remarks	Refusal 10t.
GPS Type	Garmin eTrex 20
GPS Accuracy	+ / - 3m
GPS Reference Grid	NZTM
GPS Datum	MSL
Rig Type	GeoMil Panther 100/ Flex 200
Rig ID	CPT03
Reaction Force	Dead weight 10/22 tonnes
Data Acquisition (Digitizer)	GeoMil GME500
Acquisition Program	GeoMil CPTest
Reporting Program	GeoMil CPTask
Cone Type	C10 (10 Tonne Compression)
Cross Sectional Area	10cm2
Cone Area Ratio	0.8
Fluid Type	Silicone Fluid
Friction Reducer	0.55m behind base of cone
Application Class (ISO 22476-1)	3
Test Type (ISO 22476-1)	TE2 (Measured Cone and Sleeve)
Back Fill Method	Bentonite
Observations During Testing	0

Test Methods: ASTM D5778-12
ISO 22476-1:2012

Date tested : 28/02/23
Date reported : 17/03/23

IANZ Approved Signatory

Designation : *CPT North Island Manager*
Date : 17/03/23

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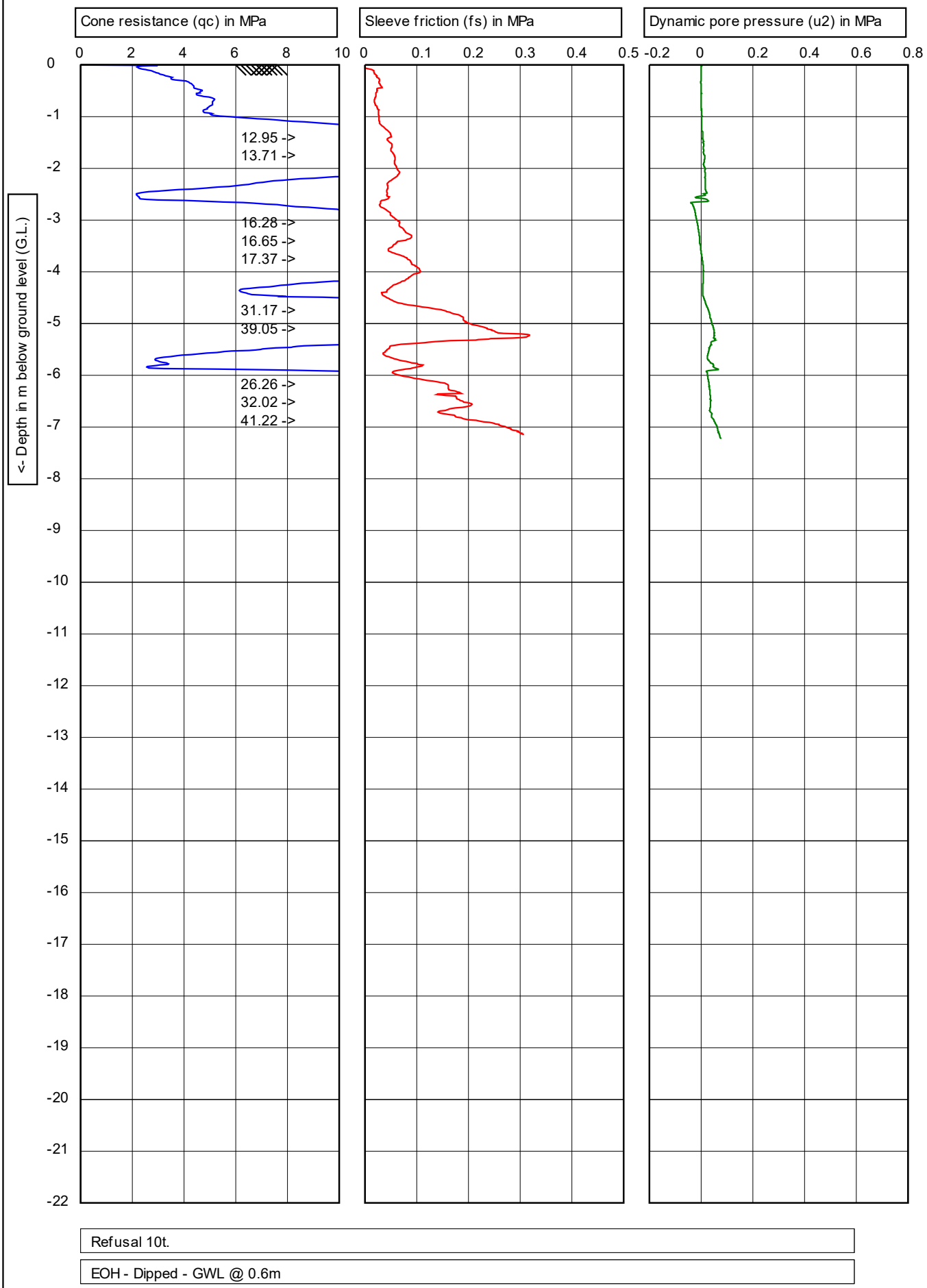
ACCREDITED IANZ TESTING LABORATORY

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Quality Management Systems Certified to ISO 9001

4 Fox Street
Private Bag 3057, Waikato Mail Centre,
3240, Hamilton, New Zealand

Telephone +64 7 856 2870
Website www.wsp.com/nz



Refusal 10t.

EOH - Dipped - GWL @ 0.6m

Test results indicated as not accredited are outside the scope of the laboratory's accreditation

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

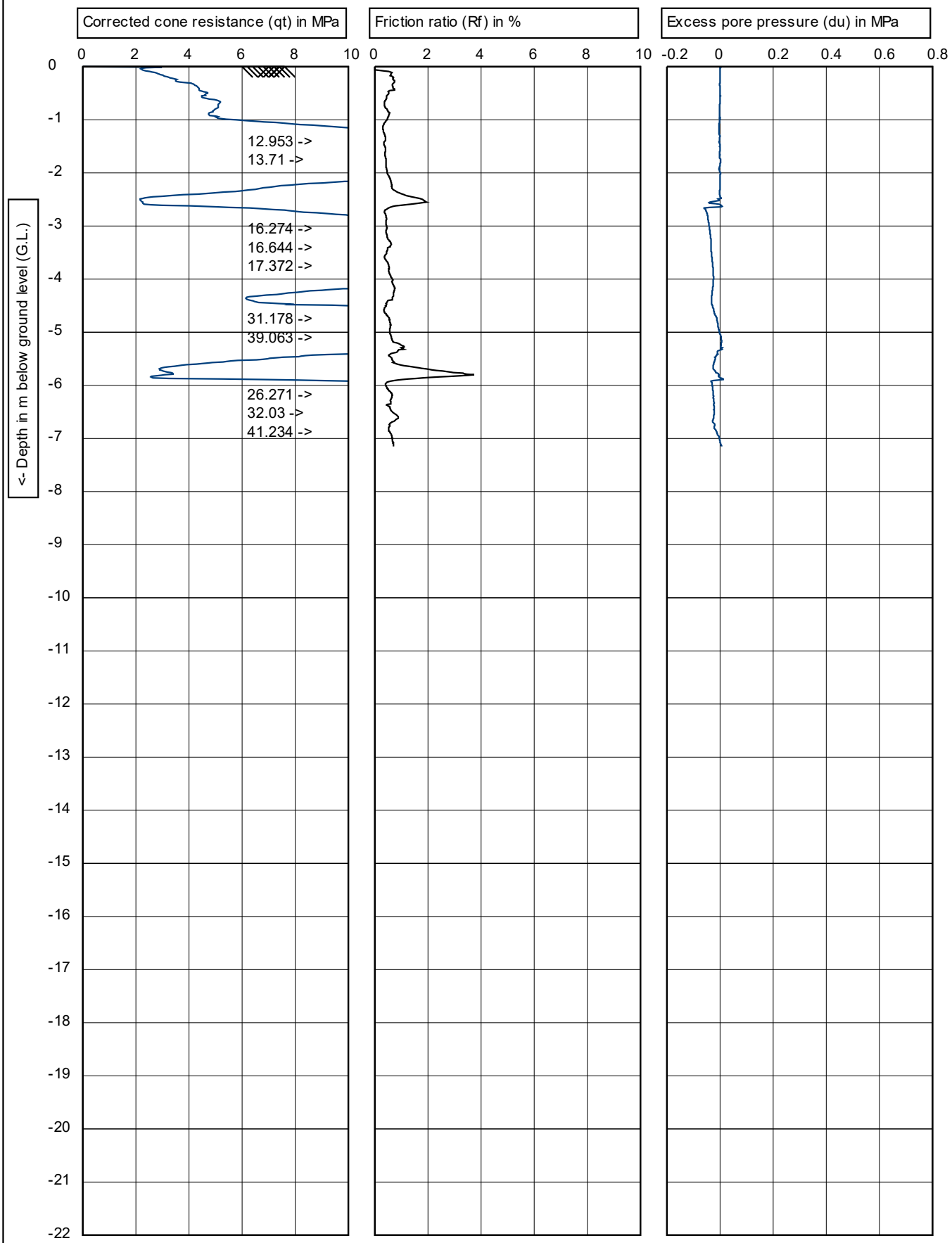
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1796815, 5520711 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**03**

1.49



Graphs on this page are not IANZ accredited

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

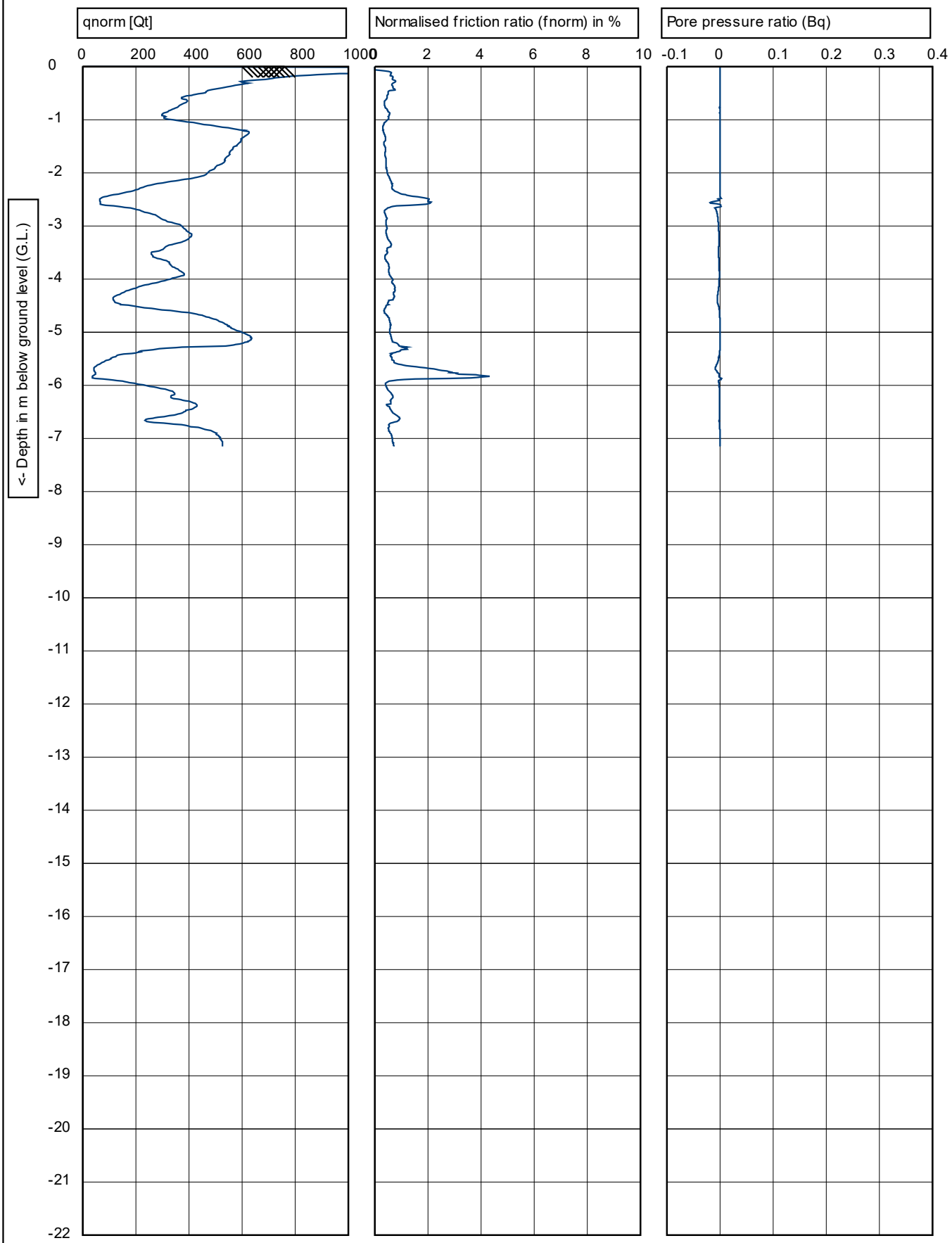
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1796815, 5520711 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**03**

1.49



Refusal 10t.

EOH - Dipped - GWL @ 0.6m

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L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1796815, 5520711 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**03**

1.49



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r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

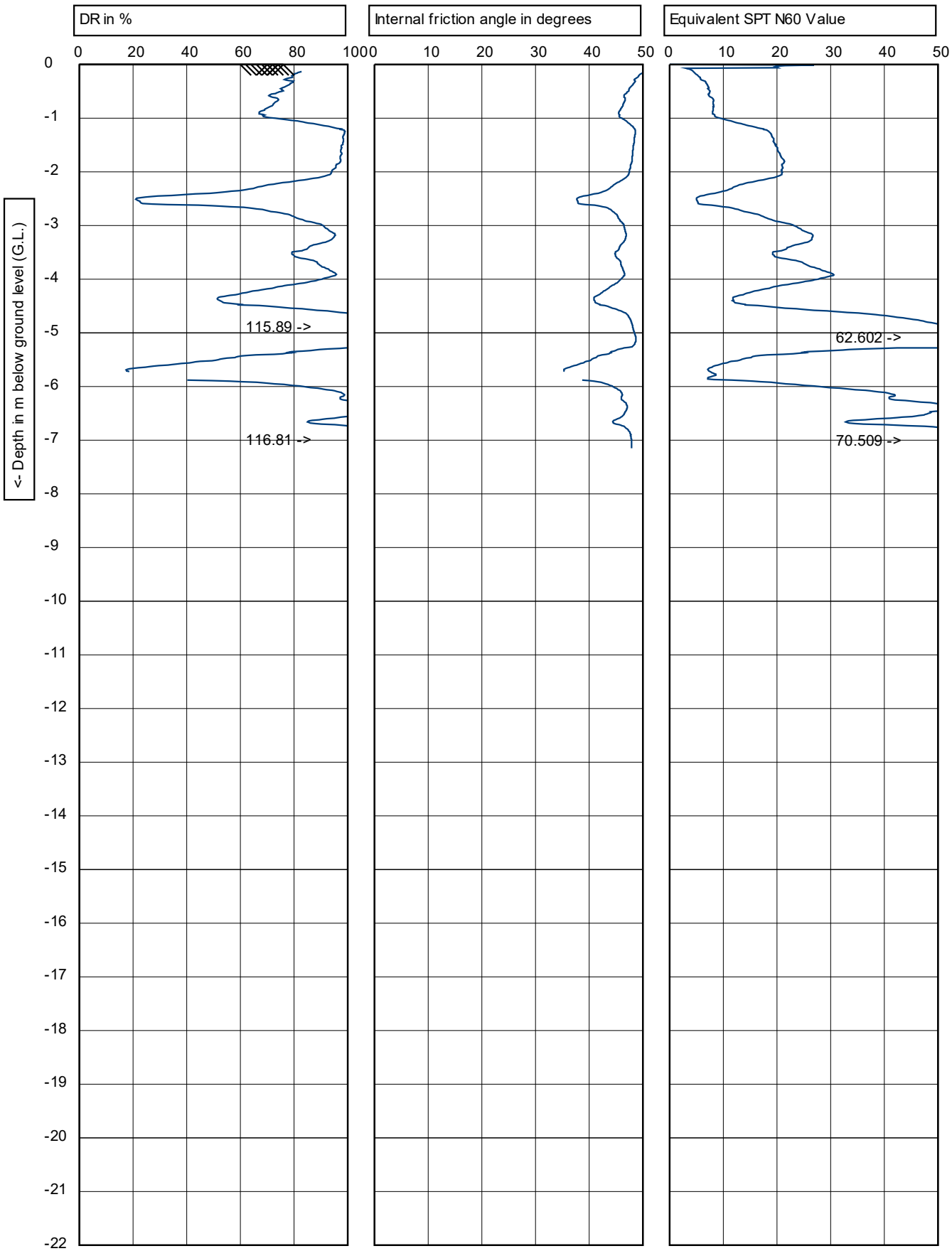
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1796815, 5520711 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**03**

1.49



Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

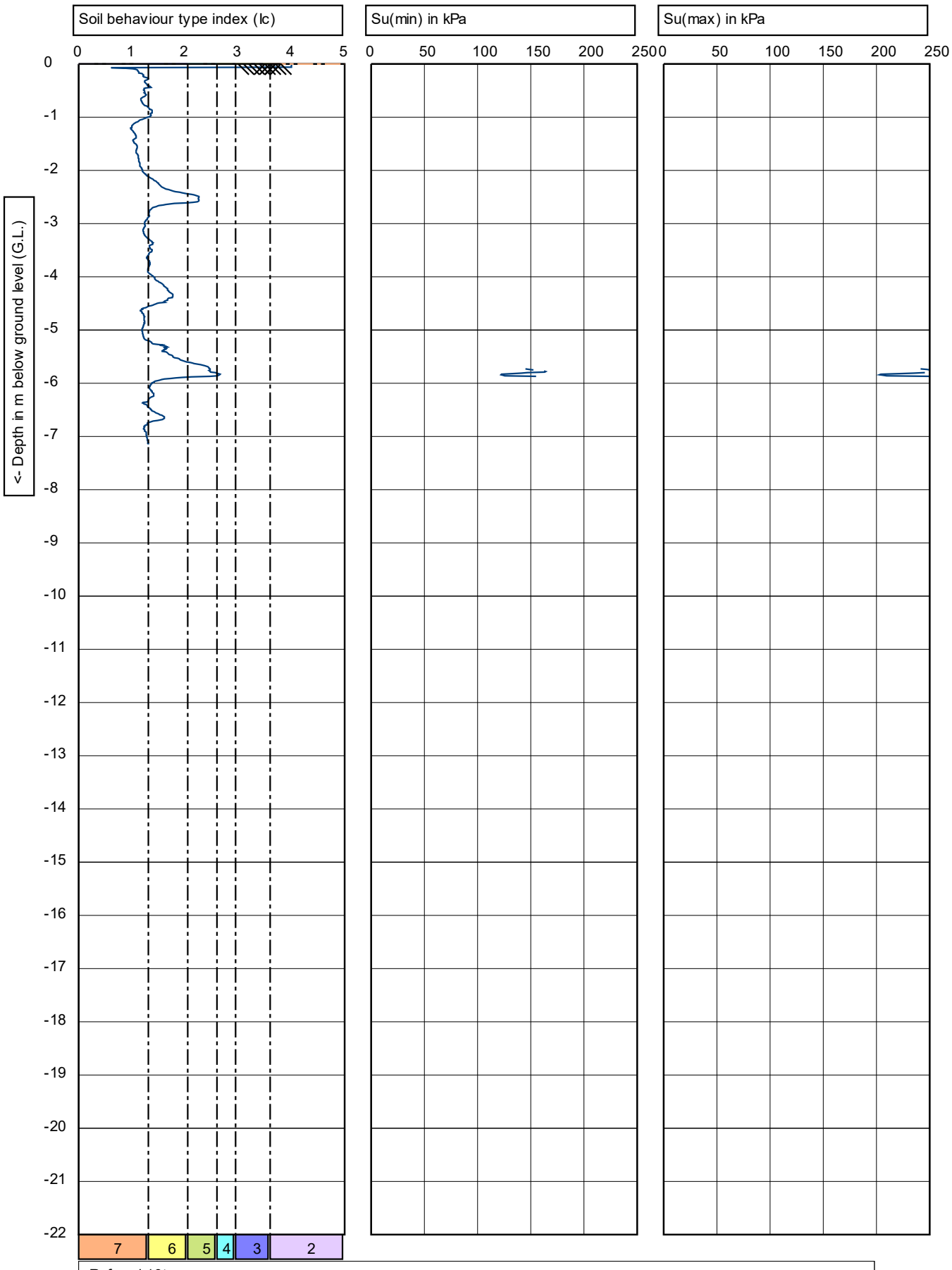
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1796815, 5520711 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**03**

1.49



Refusal 10t.

EOH - Dipped - GWL @ 0.6m

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r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1796815, 5520711 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**03** **6/6**

1.49

CONE PENETRATION TEST REPORT

Client :	BTW Company Limited	
Project :	231 Motuiti Rd	
Location :	Foxton (3007425)	
Hole Number:	03	
Tested by :	J Kavanaugh/ L Curtis	
Date tested :	28/02/23	
Coordinates :	1796815	E
	5520711	N
Elevation :	12m	
Water level :	EOH - Dipped - GWL @ 0.6m	

Project No :	2-68124,00
Lab Ref No :	HA10441_03
Client Ref No :	3007425

Test Results

Start Time	2:24:00 PM
Time at penetration	2:30:33 PM
End Time	12:06:33 AM
Reference level	0
Ground level	0
Predrill	0
Penetration Depth	7.23
Remarks	Refusal 10t.
GPS Type	Garmin eTrex 20
GPS Accuracy	+ / - 3m
GPS Reference Grid	NZTM
GPS Datum	MSL
Rig Type	GeoMil Panther 100/ Flex 200
Rig ID	CPT03
Reaction Force	Dead weight 10/22 tonnes
Data Acquisition (Digitizer)	GeoMil GME500
Acquisition Program	GeoMil CPTest
Reporting Program	GeoMil CPTask
Cone Type	C10 (10 Tonne Compression)
Cross Sectional Area	10cm2
Cone Area Ratio	0.8
Fluid Type	Silicone Fluid
Friction Reducer	0.55m behind base of cone
Application Class (ISO 22476-1)	3
Test Type (ISO 22476-1)	TE2 (Measured Cone and Sleeve)
Back Fill Method	Bentonite
Observations During Testing	0

Test Methods: ASTM D5778-12
ISO 22476-1:2012

Date tested : 28/02/23
Date reported : 17/03/23

IANZ Approved Signatory

Designation : *CPT North Island Manager*
Date : 17/03/23

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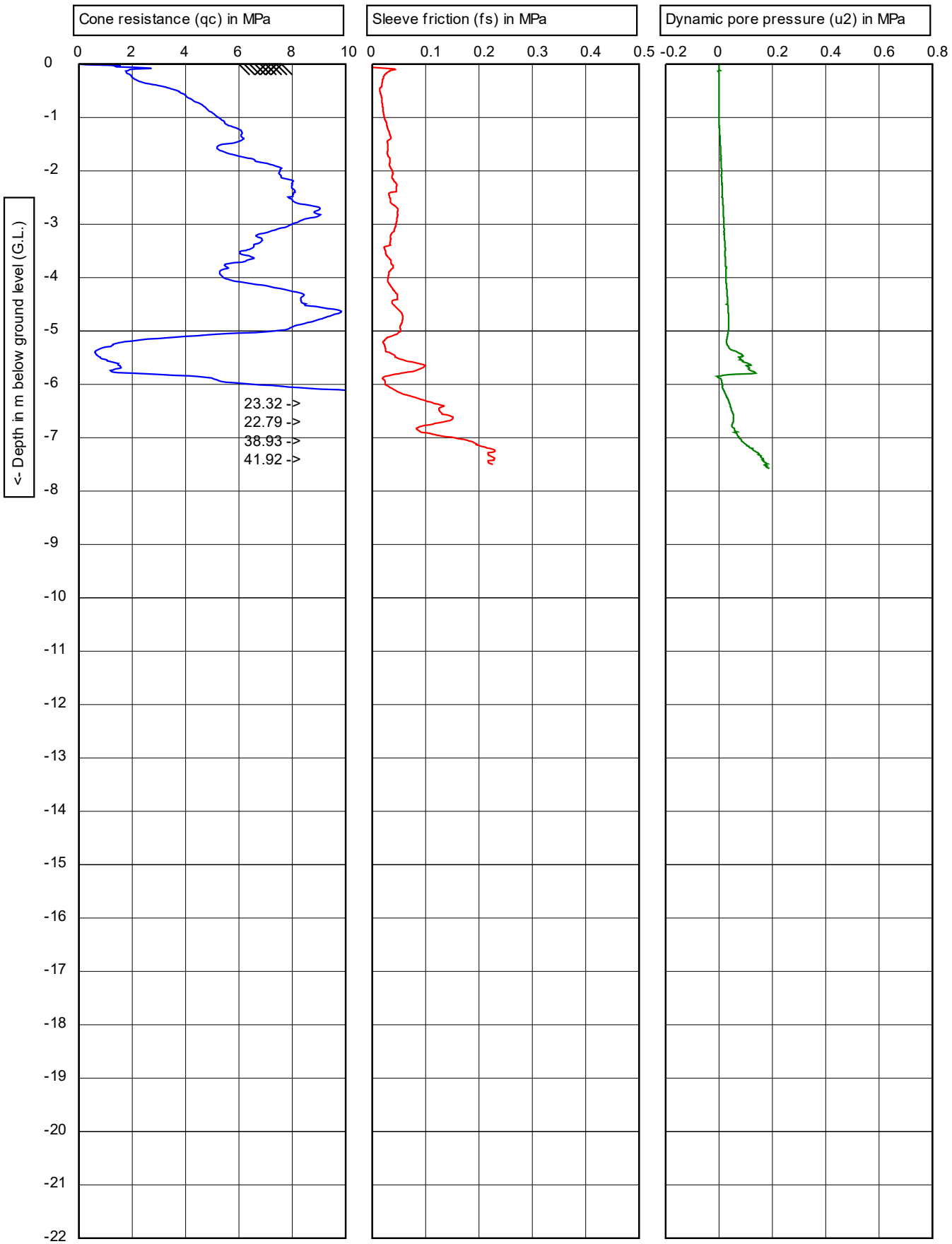
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Website www.wsp.com/nz



Refusal 10t.

EOH - Dipped - Collapsed dry @ 1.1m

WSP

ACCREDITED IANZ TESTING LABORATORY

Test results indicated as not accredited are outside the scope of the laboratory's accreditation

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

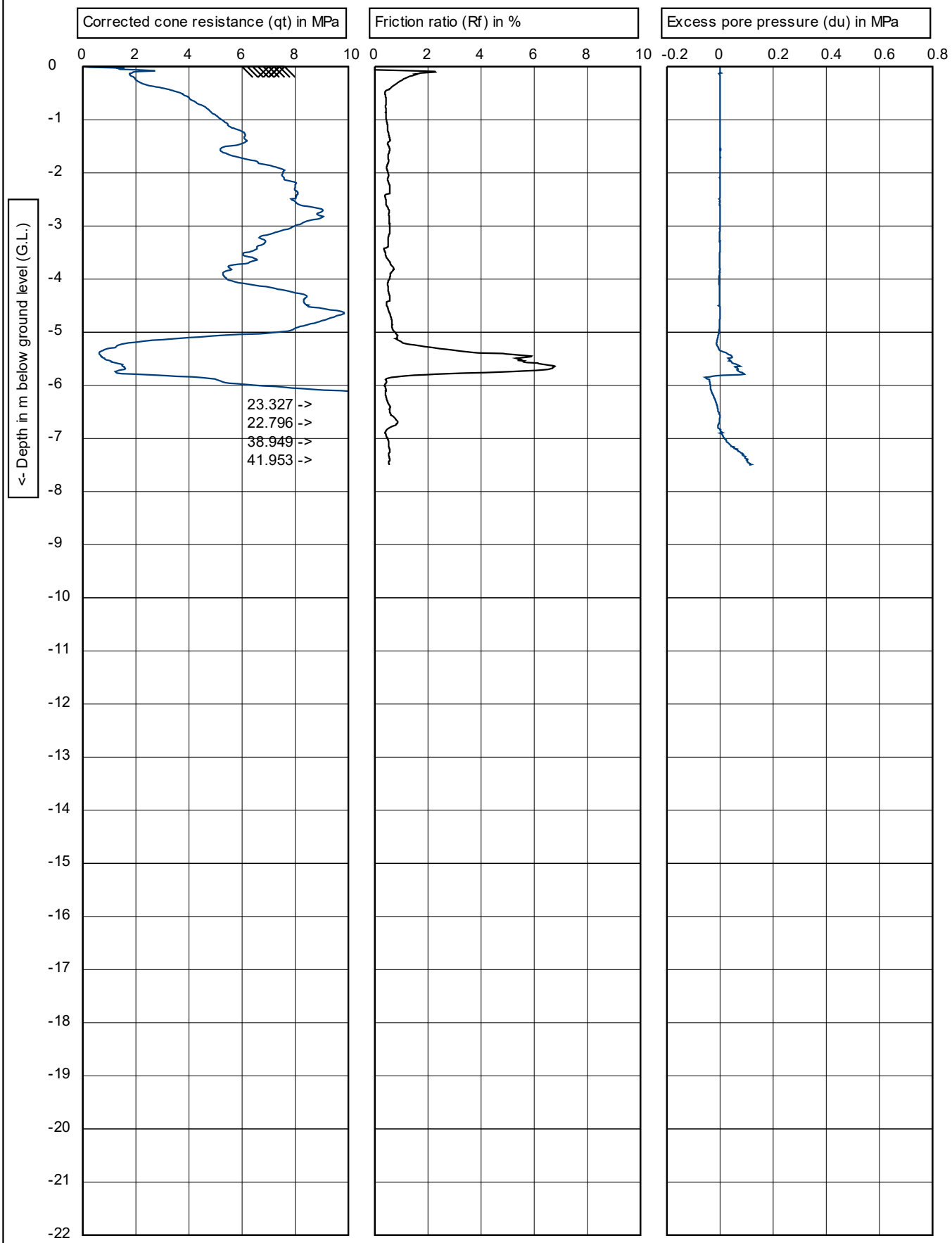
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1796903, 5520084 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**04**

1.49



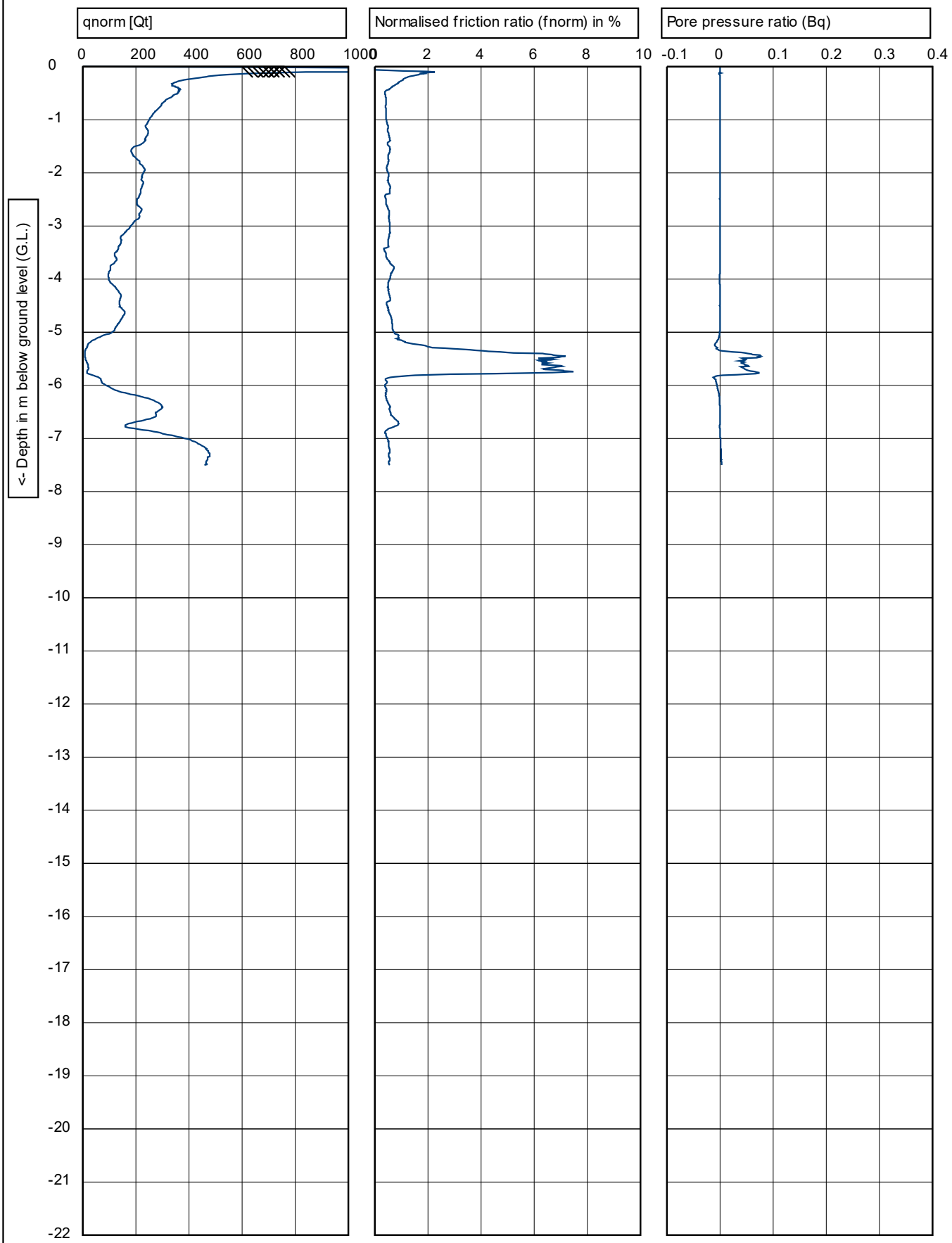
Refusal 10t.

EOH - Dipped - Collapsed dry @ 1.1m

Graphs on this page are not IANZ accredited

r u2 / L 150 cm² / 10 cm²	Test according ASTM D5778:12 & ISO 22476-1:2012	Predrill:	**0.00 m Predrilled**
	G.L.: **0.00 m MSL**	Date:	**28/02/2023**
Project:	**231 Motuiti Rd**	Cone no.:	**C10CFIIP.C181009**
Location:	**Foxton (3007425)**	Project no.:	**2-68124.00_HA10441**
Position:	**1796903, 5520084 NZTM**	CPT no.:	**04** **2/6**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 1.1m

Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

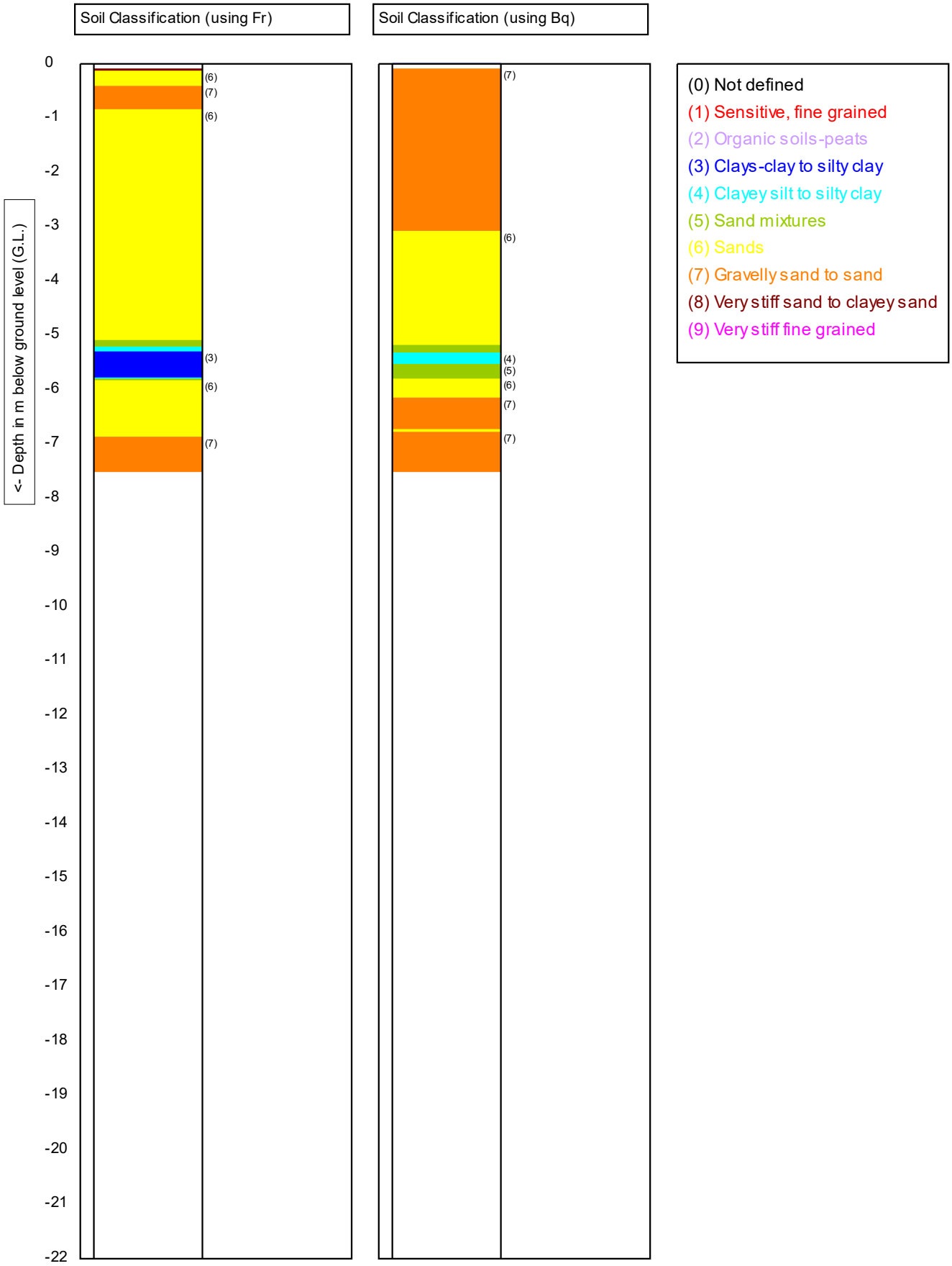
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1796903, 5520084 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**04**

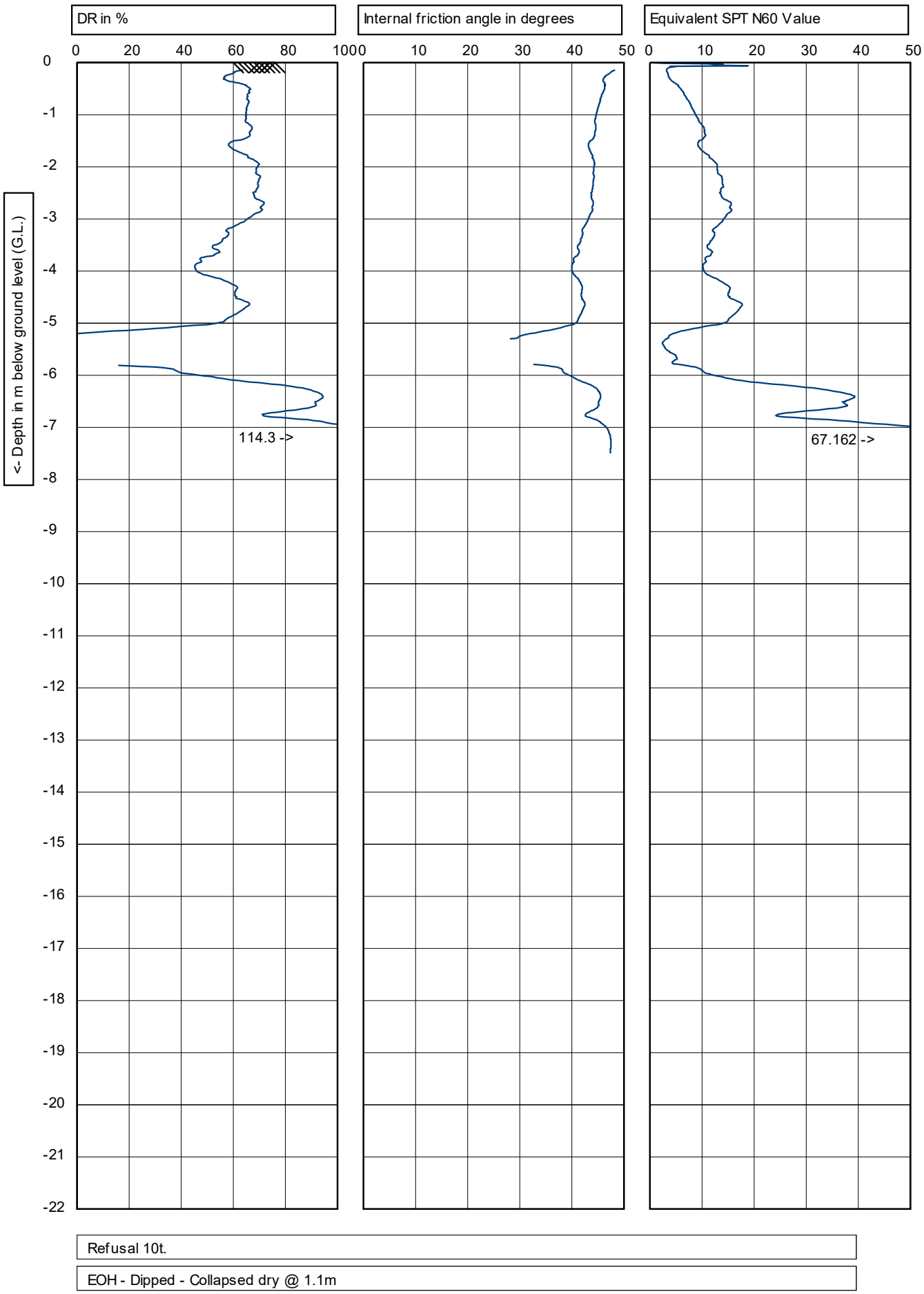
1.49



Graphs on this page are not IANZ accredited

r u2 / L 150 cm² / 10 cm²	Test according ASTM D5778:12 & ISO 22476-1:2012	Predrill:	**0.00 m Predrilled**
	G.L.: **0.00 m MSL**	Date:	**28/02/2023**
Project:	**231 Motuiti Rd**	Cone no.:	**C10CFIIP.C181009**
Location:	**Foxton (3007425)**	Project no.:	**2-68124.00_HA10441**
Position:	**1796903, 5520084 NZTM**	CPT no.:	**04** 4/6

1.49



Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

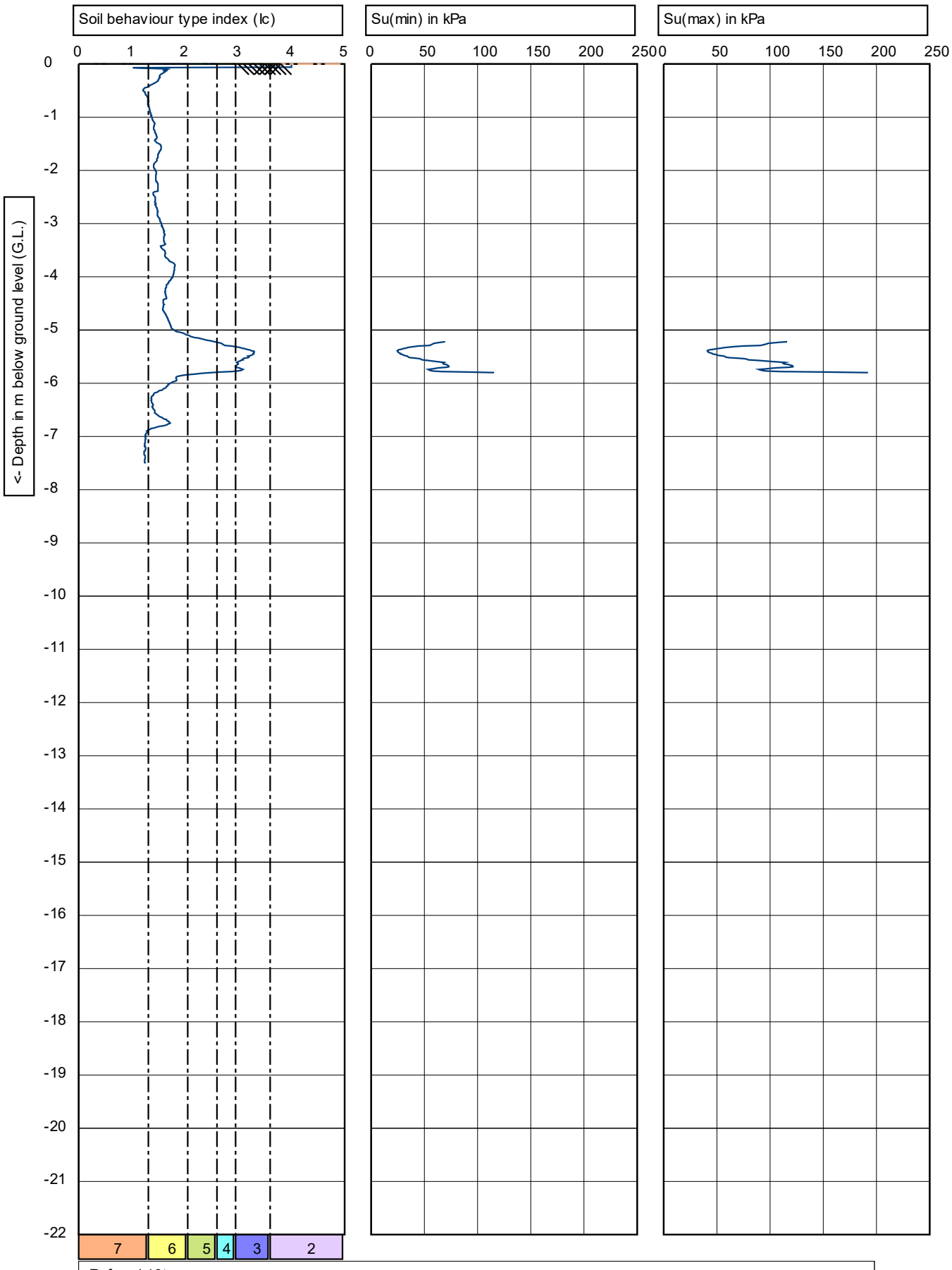
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1796903, 5520084 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**04**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 1.1m

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1796903, 5520084 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**04** **6/6**

1.49

CONE PENETRATION TEST REPORT

Client :	BTW Company Limited
Project :	231 Motuiti Rd
Location :	Foxton (3007425)
Hole Number:	04
Tested by :	J Kavanaugh/ L Curtis
Date tested :	28/02/23
Coordinates :	1796903 E
	5520084 N
Elevation :	8m
Water level :	EOH - Dipped - Collapsed dry @ 1.1m

Project No :	2-68124,00
Lab Ref No :	HA10441_04
Client Ref No :	3007425

Test Results

Start Time	12:32:00 PM
Time at penetration	12:38:32 PM
End Time	12:06:32 AM
Reference level	0
Ground level	0
Predrill	0
Penetration Depth	7.58
Remarks	Refusal 10t.
GPS Type	Garmin eTrex 20
GPS Accuracy	+ / - 3m
GPS Reference Grid	NZTM
GPS Datum	MSL
Rig Type	GeoMil Panther 100/ Flex 200
Rig ID	CPT03
Reaction Force	Dead weight 10/22 tonnes
Data Acquisition (Digitizer)	GeoMil GME500
Acquisition Program	GeoMil CPTest
Reporting Program	GeoMil CPTask
Cone Type	C10 (10 Tonne Compression)
Cross Sectional Area	10cm2
Cone Area Ratio	0.8
Fluid Type	Silicone Fluid
Friction Reducer	0.55m behind base of cone
Application Class (ISO 22476-1)	3
Test Type (ISO 22476-1)	TE2 (Measured Cone and Sleeve)
Back Fill Method	Bentonite
Observations During Testing	0
Test Methods:	ASTM D5778-12
	ISO 22476-1:2012

Date tested : 28/02/23
Date reported : 17/03/23

IANZ Approved Signatory

Designation : *CPT North Island Manager*
Date : 17/03/23

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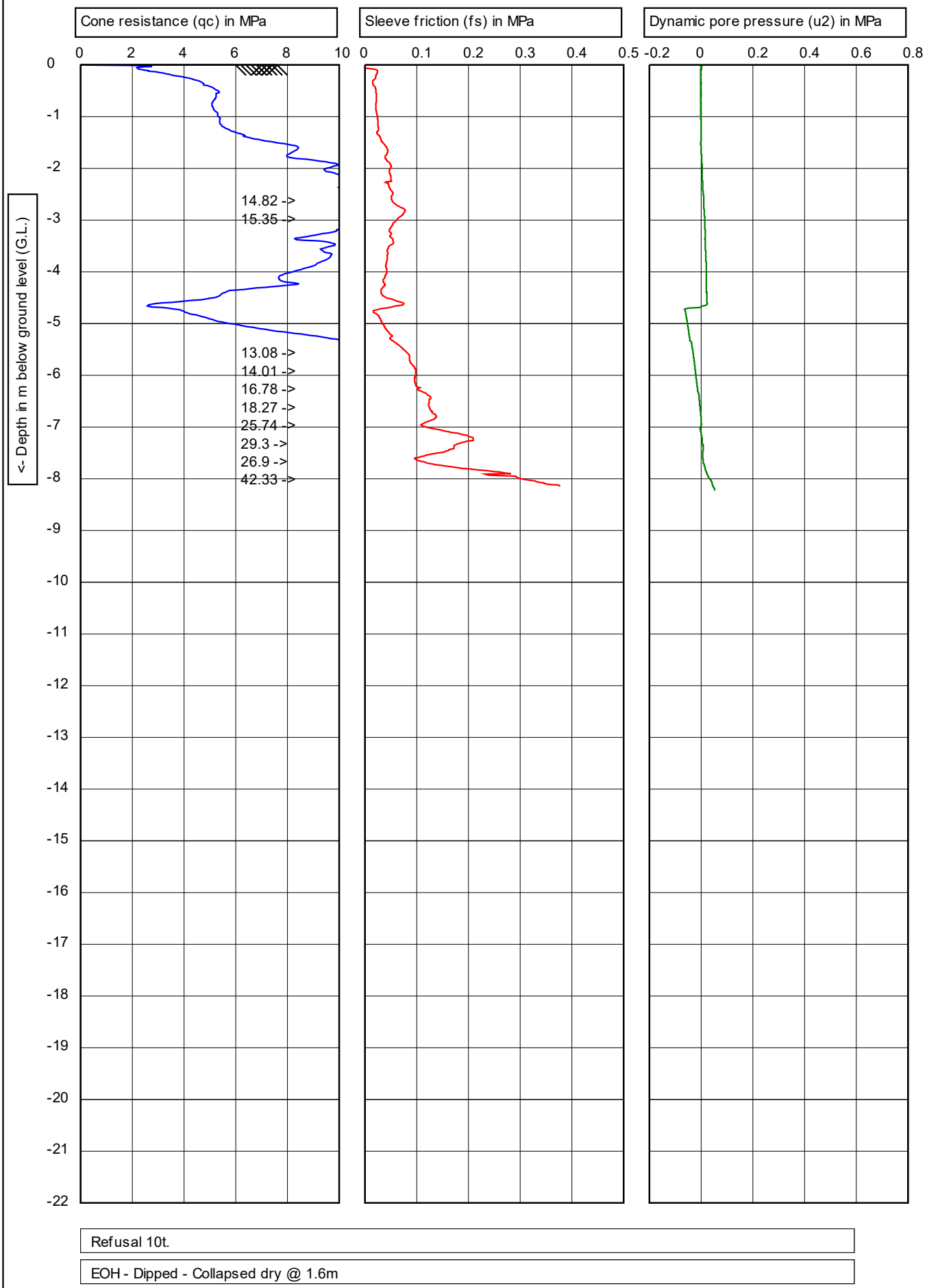
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Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

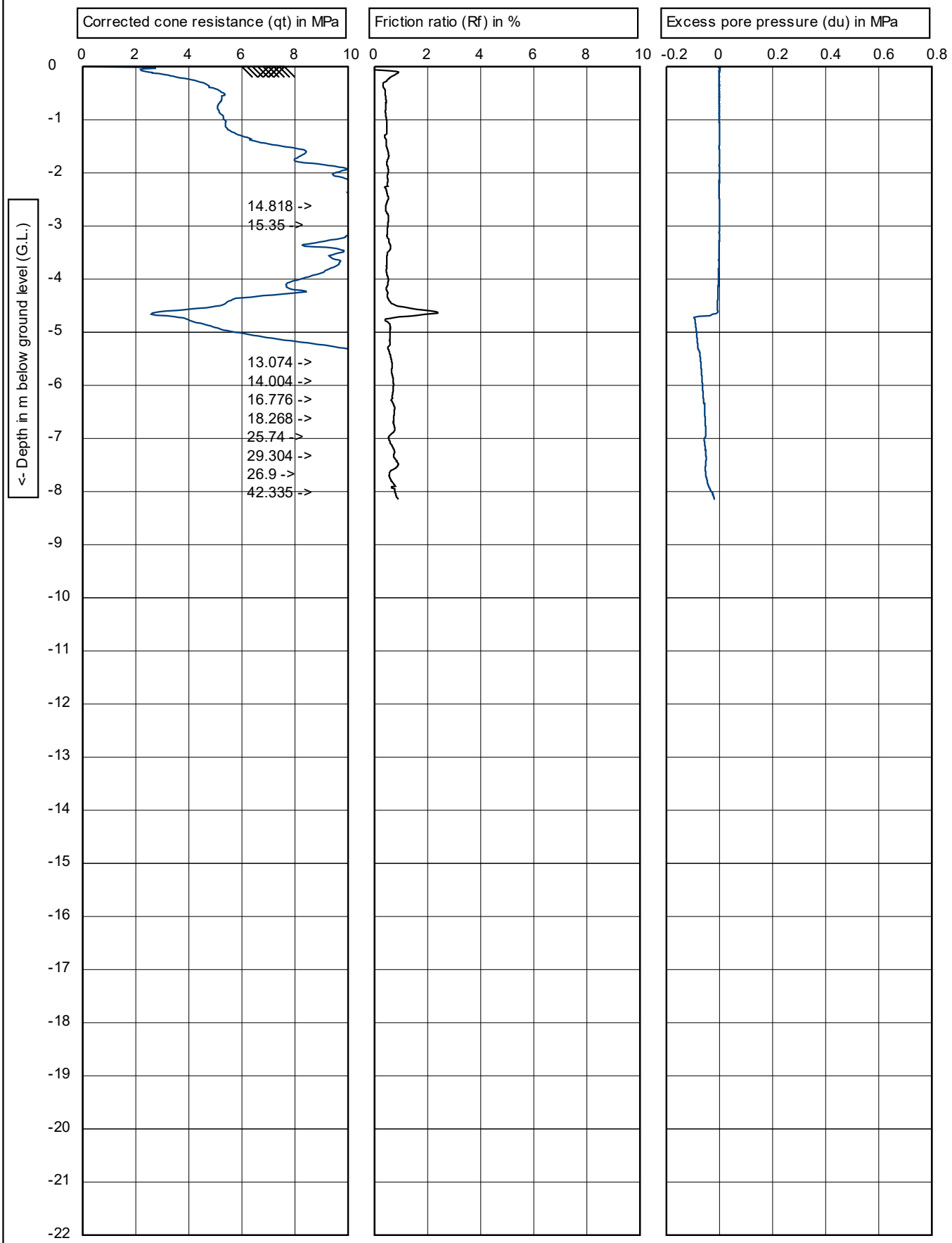
Location: **Foxton (3007425)**

Position: **1796785, 5519756 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**05**

Test results indicated as not accredited are outside the scope of the laboratory's accreditation

1.49



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Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

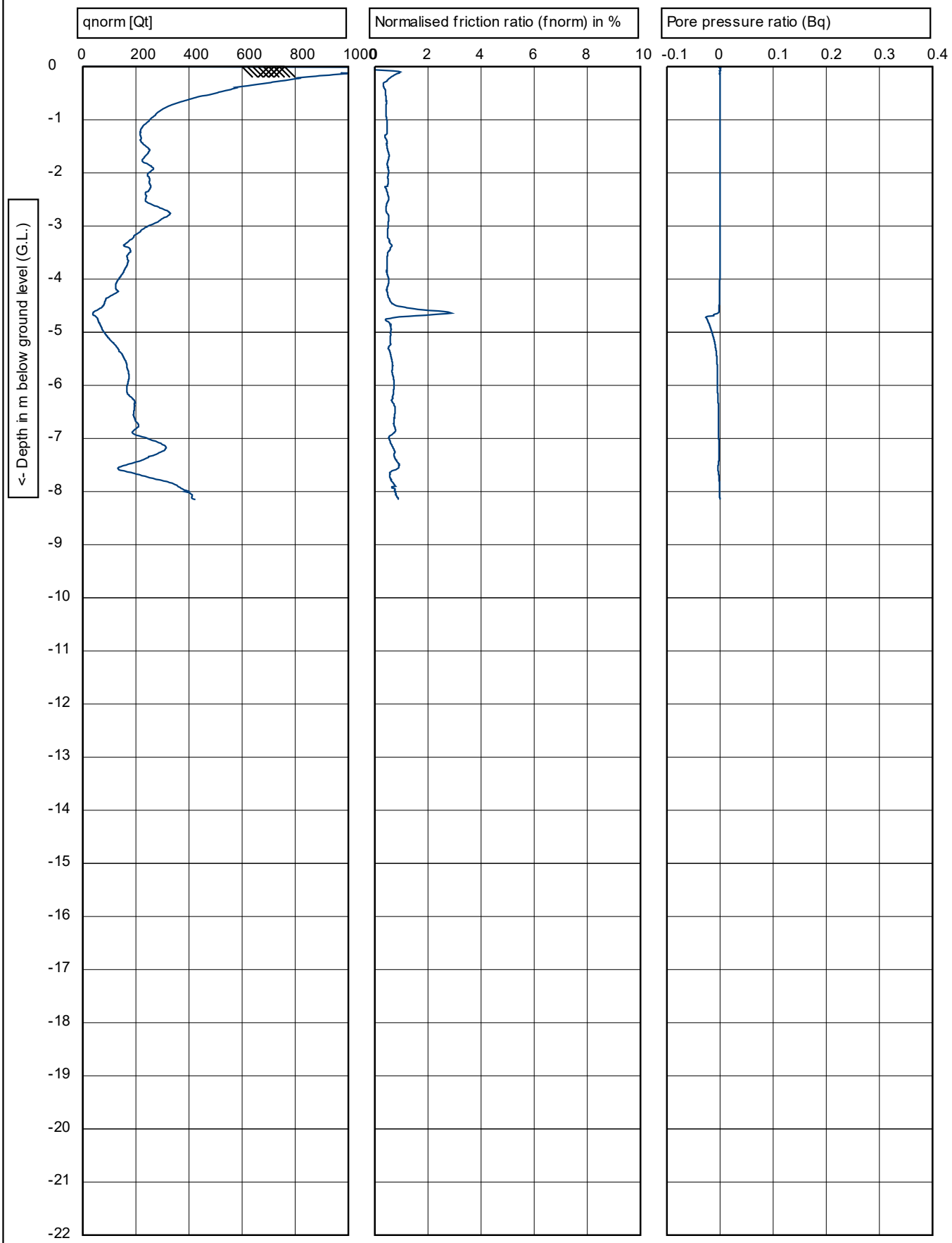
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1796785, 5519756 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**05**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 1.6m

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r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

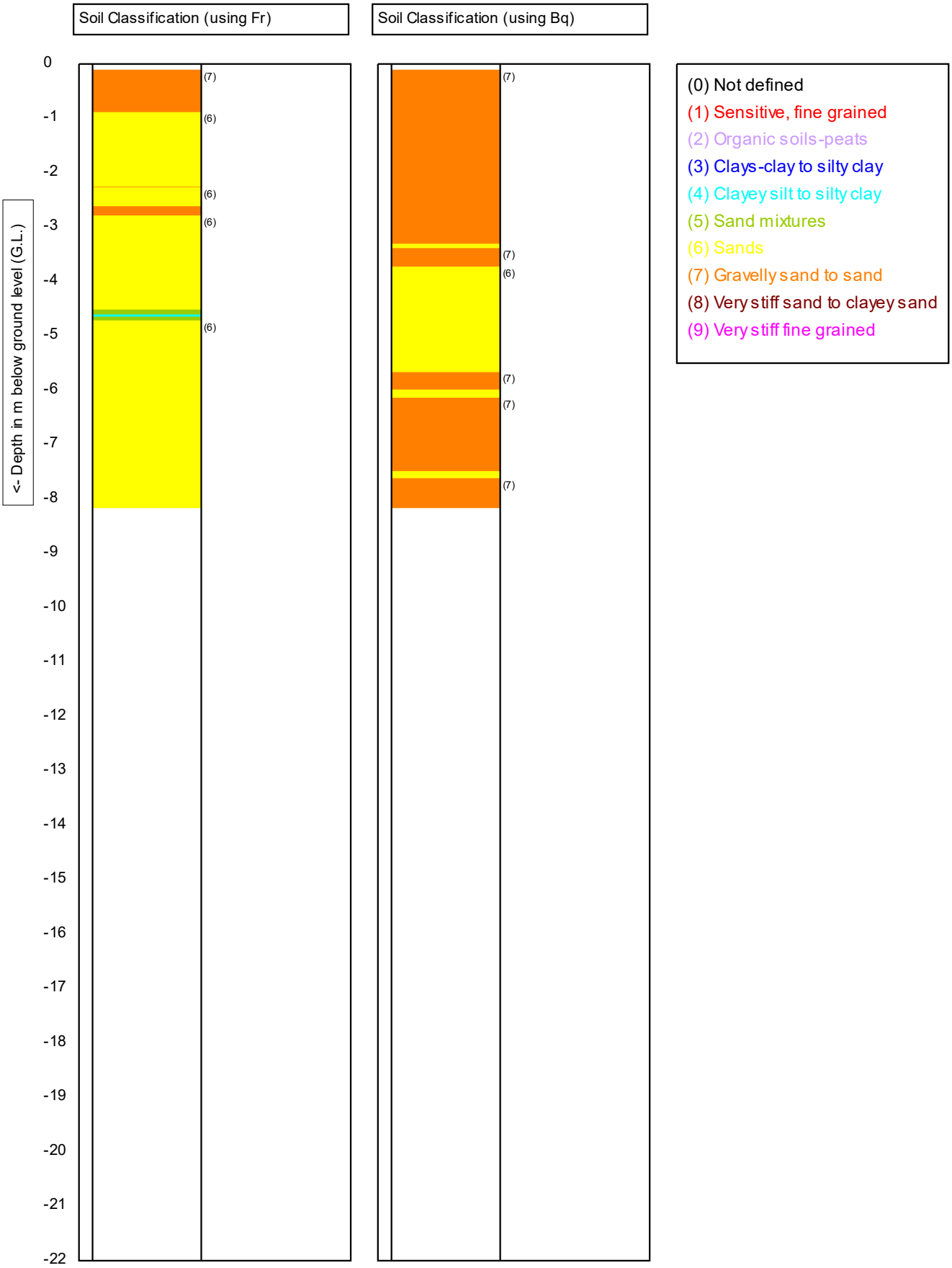
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1796785, 5519756 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**05** **3/6**

1.49



Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

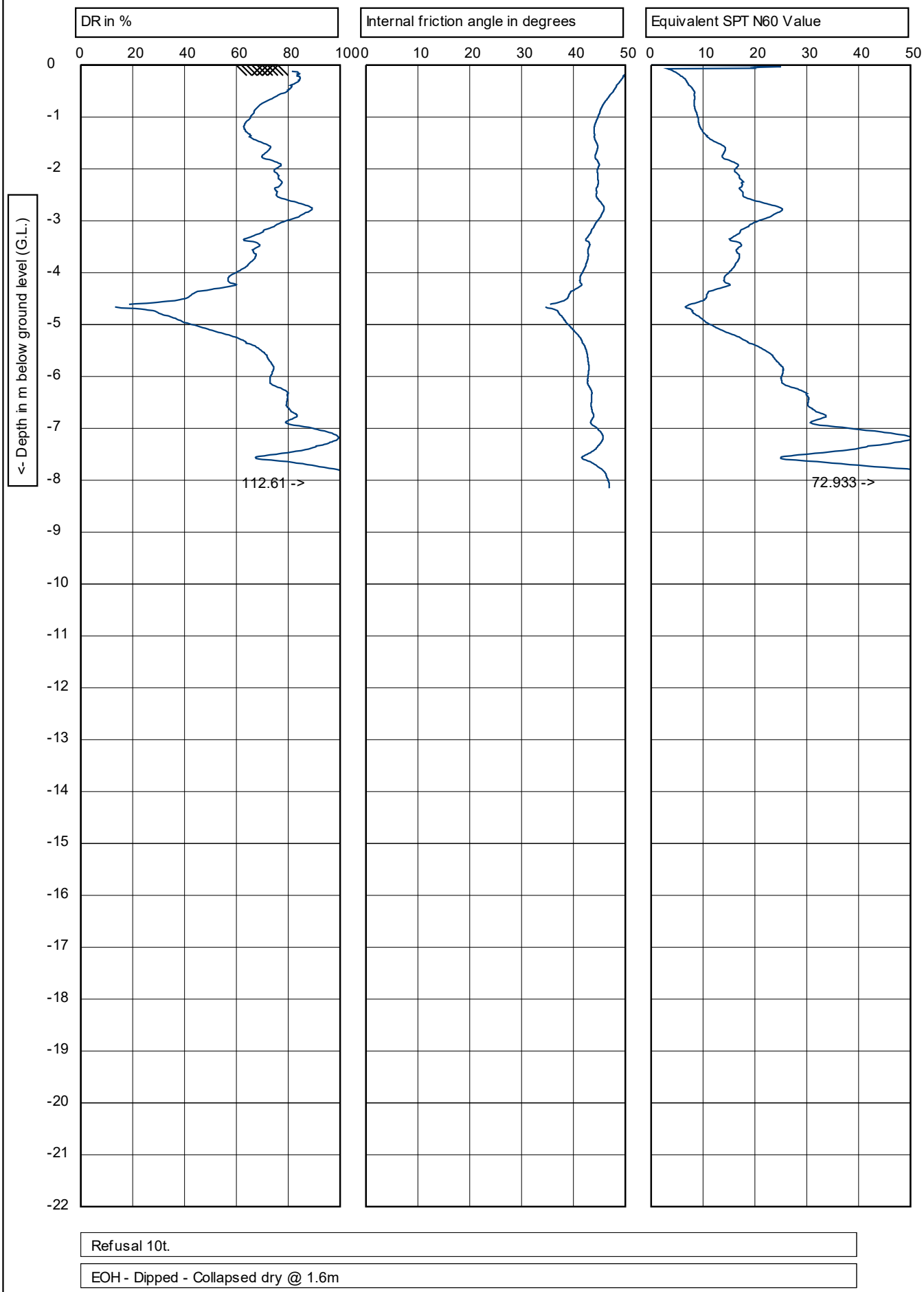
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1796785, 5519756 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**05**

1.49



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r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

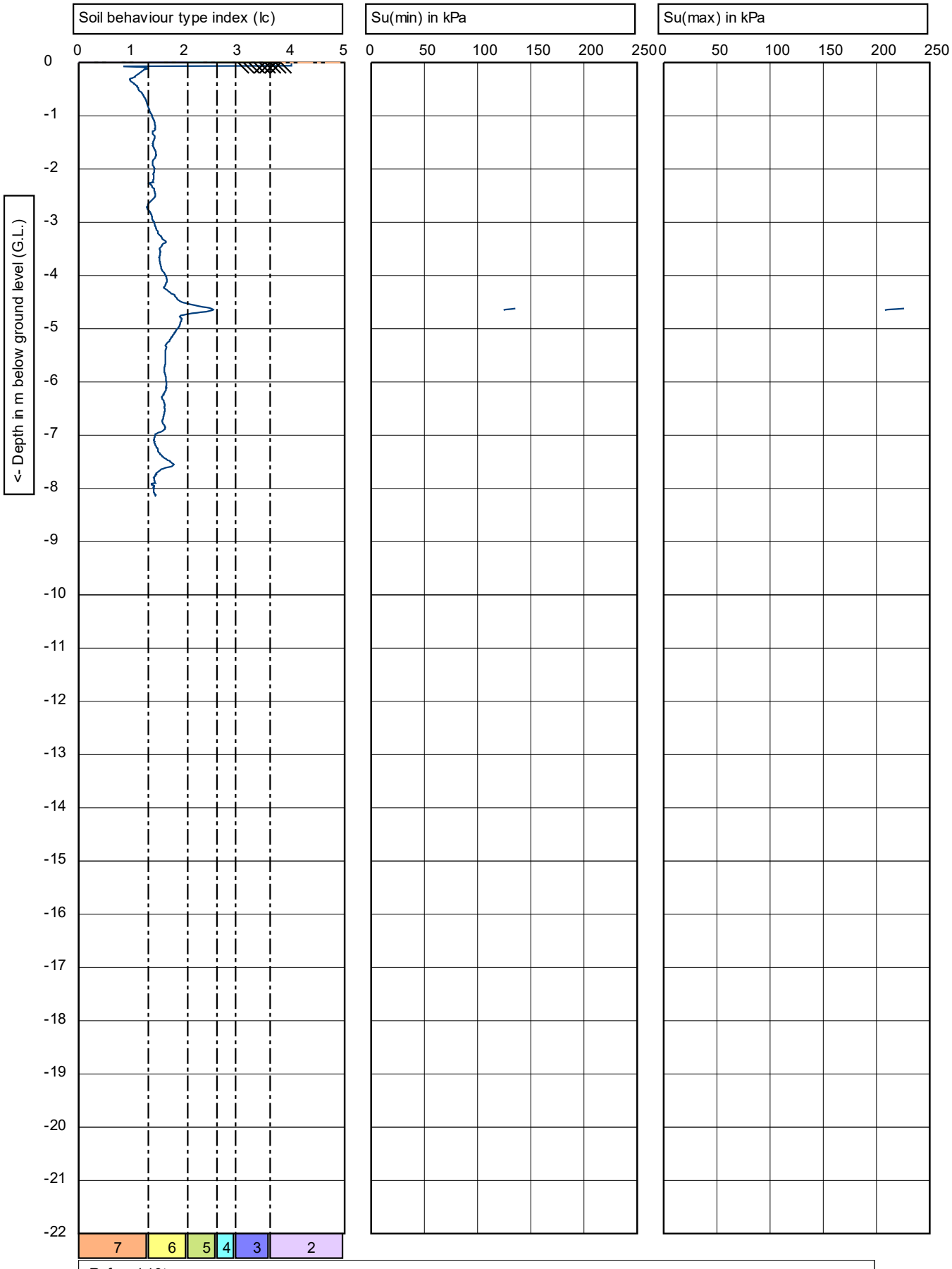
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1796785, 5519756 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**05**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 1.6m

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1796785, 5519756 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**05** **6/6**

1.49

CONE PENETRATION TEST REPORT

Client :	BTW Company Limited
Project :	231 Motuiti Rd
Location :	Foxton (3007425)
Hole Number:	05
Tested by :	J Kavanaugh/ L Curtis
Date tested :	28/02/23
Coordinates :	1796785 E
	5519756 N
Elevation :	7m
Water level :	EOH - Dipped - Collapsed dry @ 1.6m

Project No :	2-68124,00
Lab Ref No :	HA10441_05
Client Ref No :	3007425

Test Results

Start Time	1:10:00 PM
Time at penetration	1:17:15 PM
End Time	12:07:15 AM
Reference level	0
Ground level	0
Predrill	0
Penetration Depth	8.23
Remarks	Refusal 10t.
GPS Type	Garmin eTrex 20
GPS Accuracy	+ / - 3m
GPS Reference Grid	NZTM
GPS Datum	MSL
Rig Type	GeoMil Panther 100/ Flex 200
Rig ID	CPT03
Reaction Force	Dead weight 10/22 tonnes
Data Acquisition (Digitizer)	GeoMil GME500
Acquisition Program	GeoMil CPTest
Reporting Program	GeoMil CPTask
Cone Type	C10 (10 Tonne Compression)
Cross Sectional Area	10cm2
Cone Area Ratio	0.8
Fluid Type	Silicone Fluid
Friction Reducer	0.55m behind base of cone
Application Class (ISO 22476-1)	3
Test Type (ISO 22476-1)	TE2 (Measured Cone and Sleeve)
Back Fill Method	Bentonite
Observations During Testing	0

Test Methods: ASTM D5778-12
ISO 22476-1:2012

Date tested : 28/02/23
Date reported : 17/03/23

IANZ Approved Signatory

Designation : *CPT North Island Manager*
Date : 17/03/23

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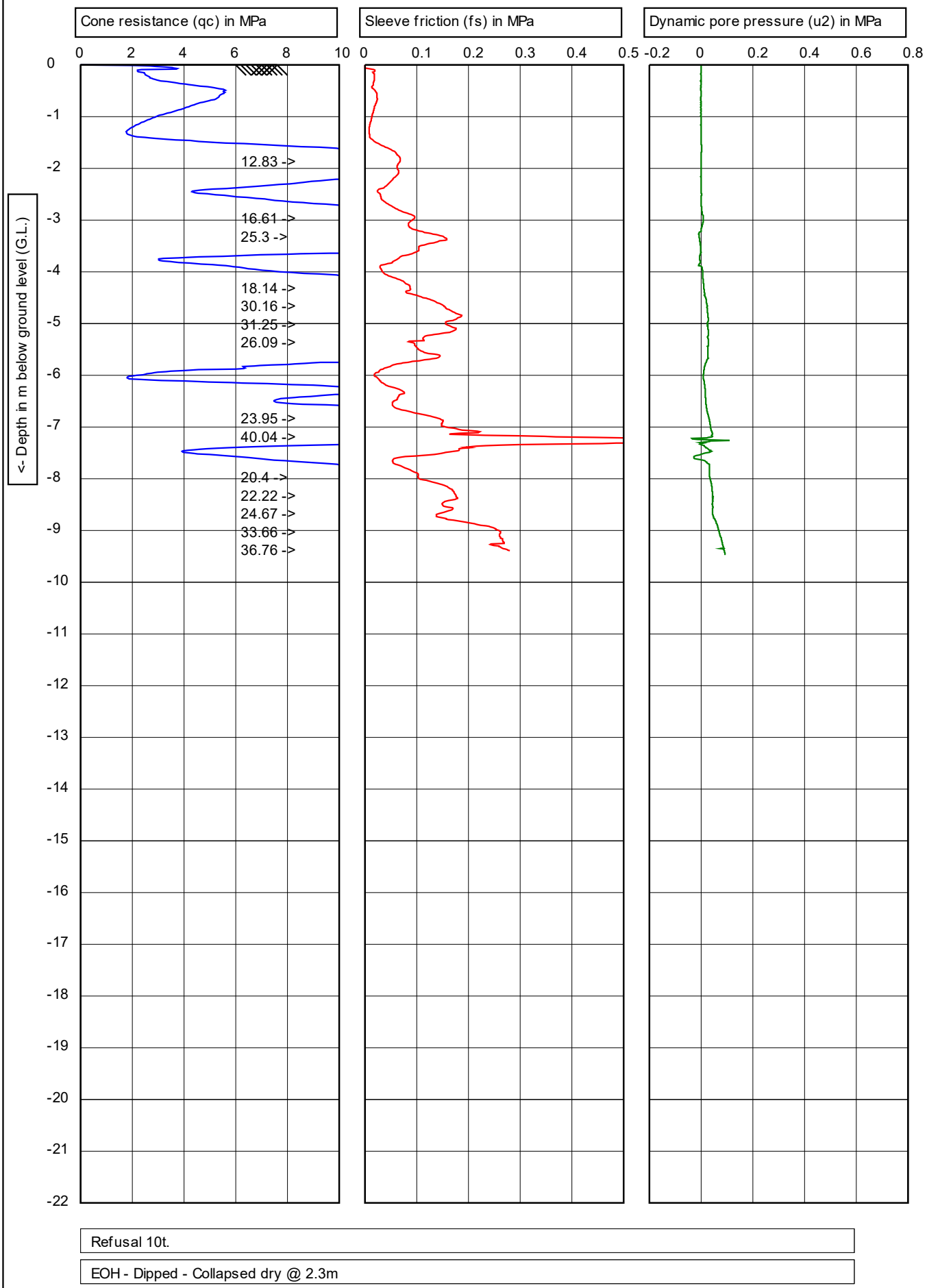
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Refusal 10t.

EOH - Dipped - Collapsed dry @ 2.3m

Test results indicated as not accredited are outside the scope of the laboratory's accreditation

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

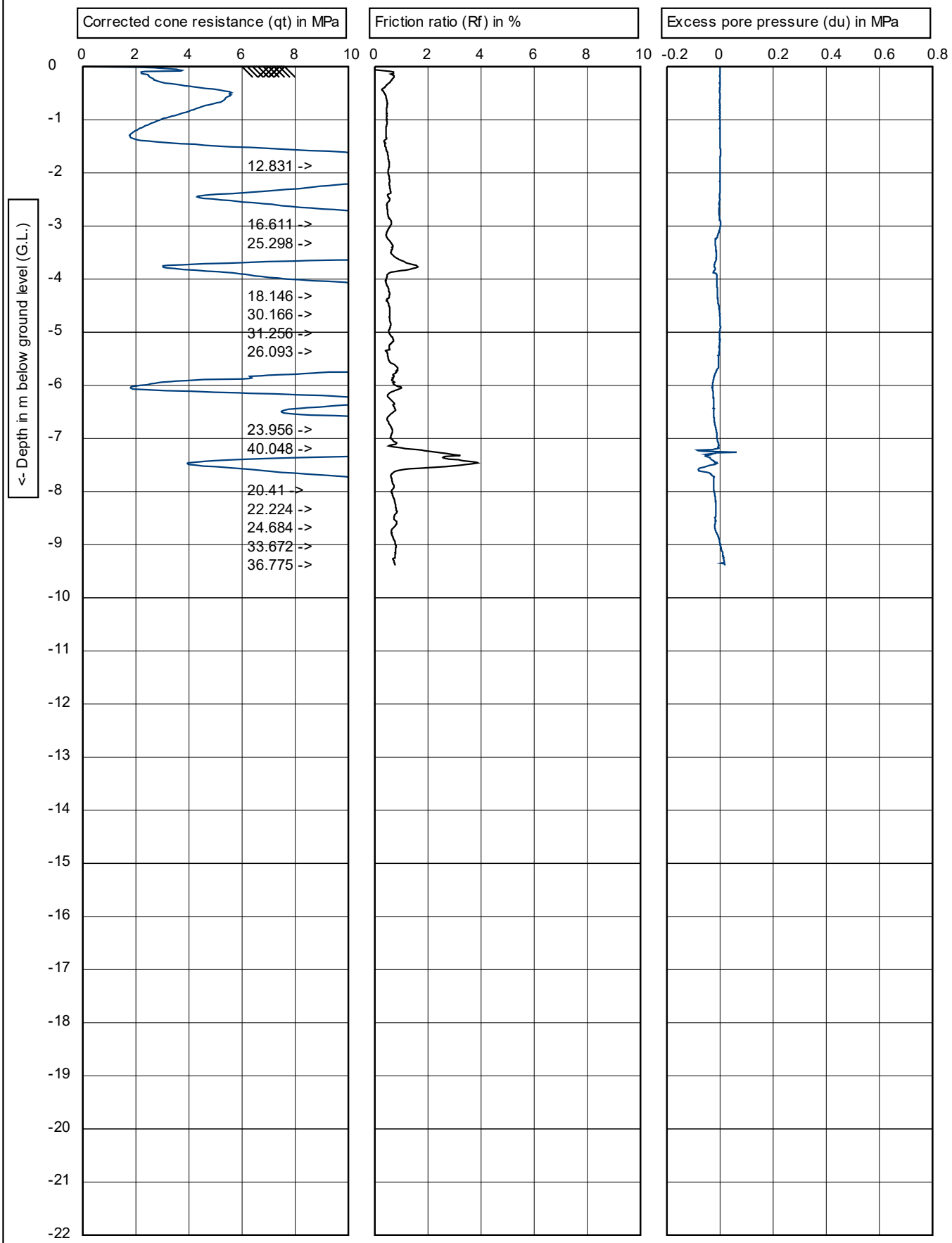
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1797247, 5520509 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**06**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 2.3m

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

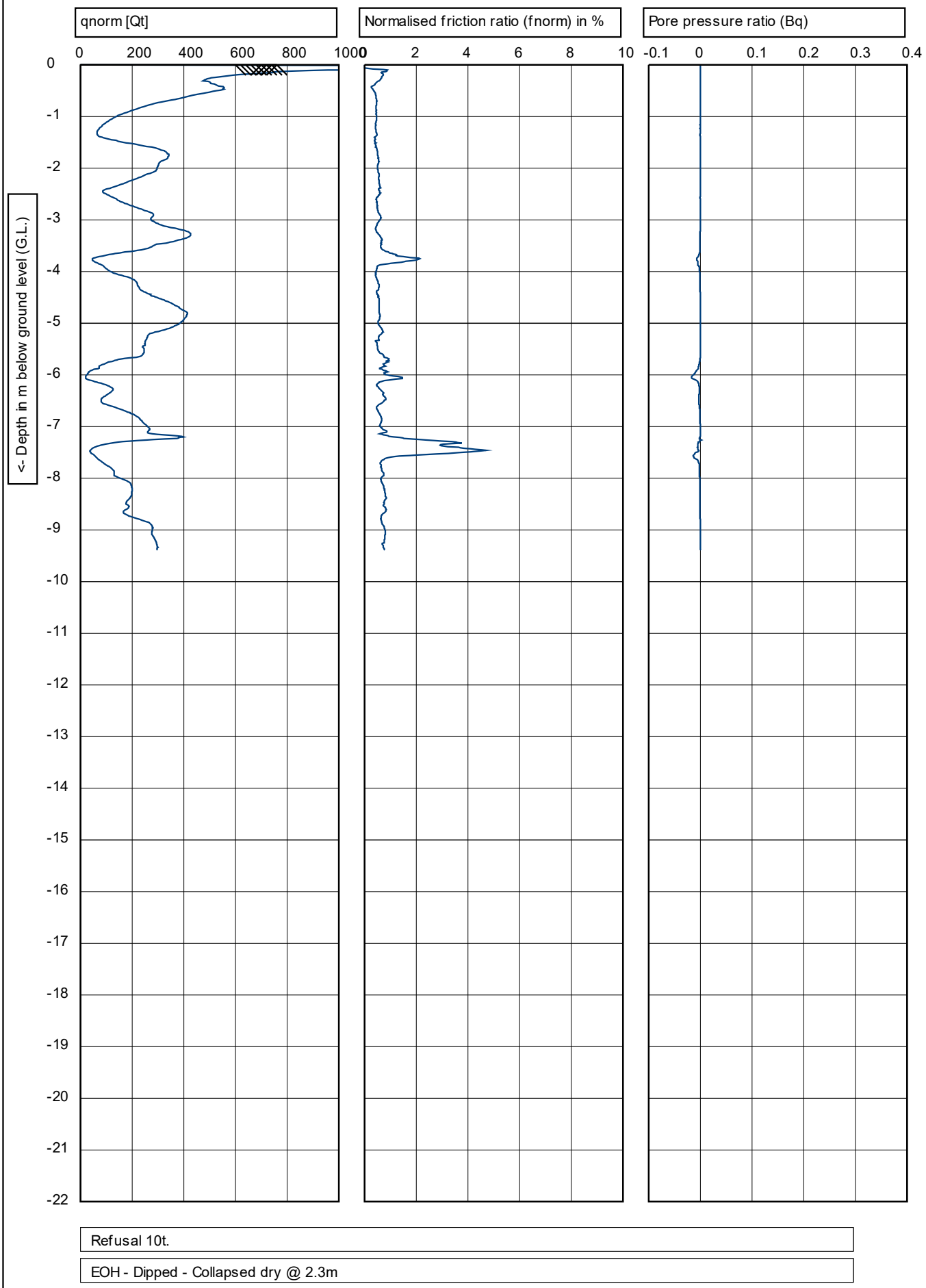
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1797247, 5520509 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**06**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 2.3m

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r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

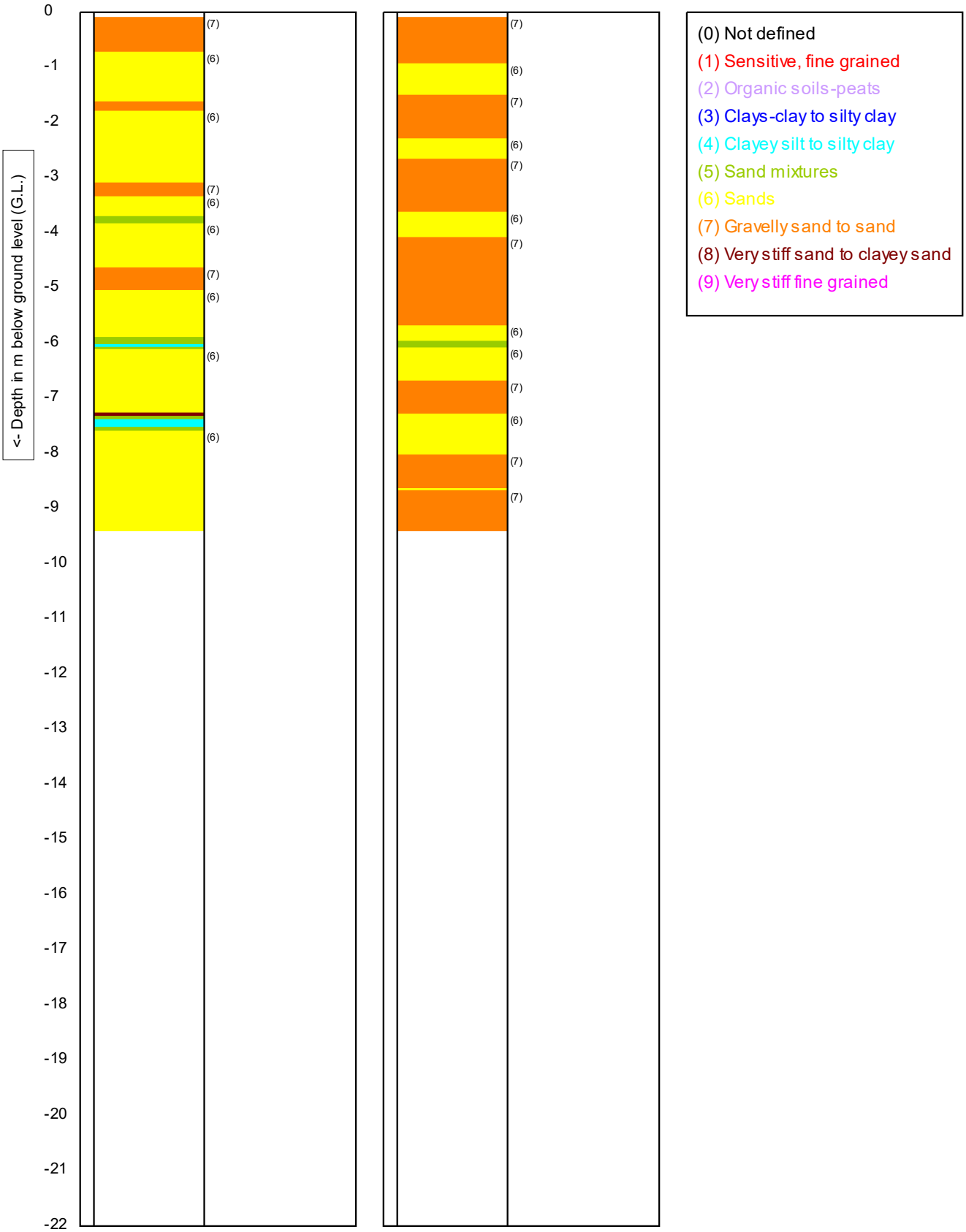
Position: **1797247, 5520509 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**06** **3/6**

1.49

Soil Classification (using Fr)

Soil Classification (using Bq)



Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

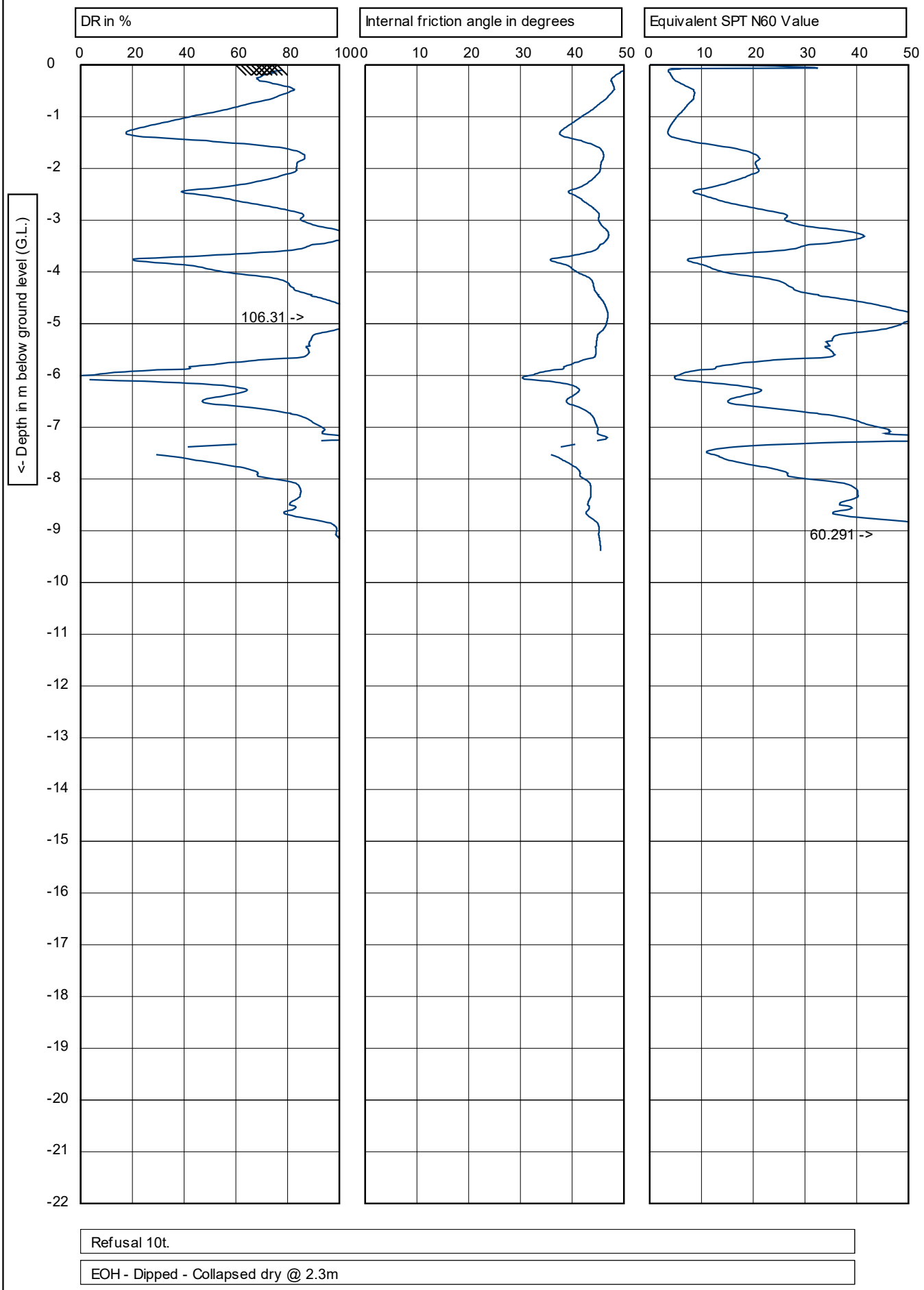
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1797247, 5520509 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**06**

1.49



WSP

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

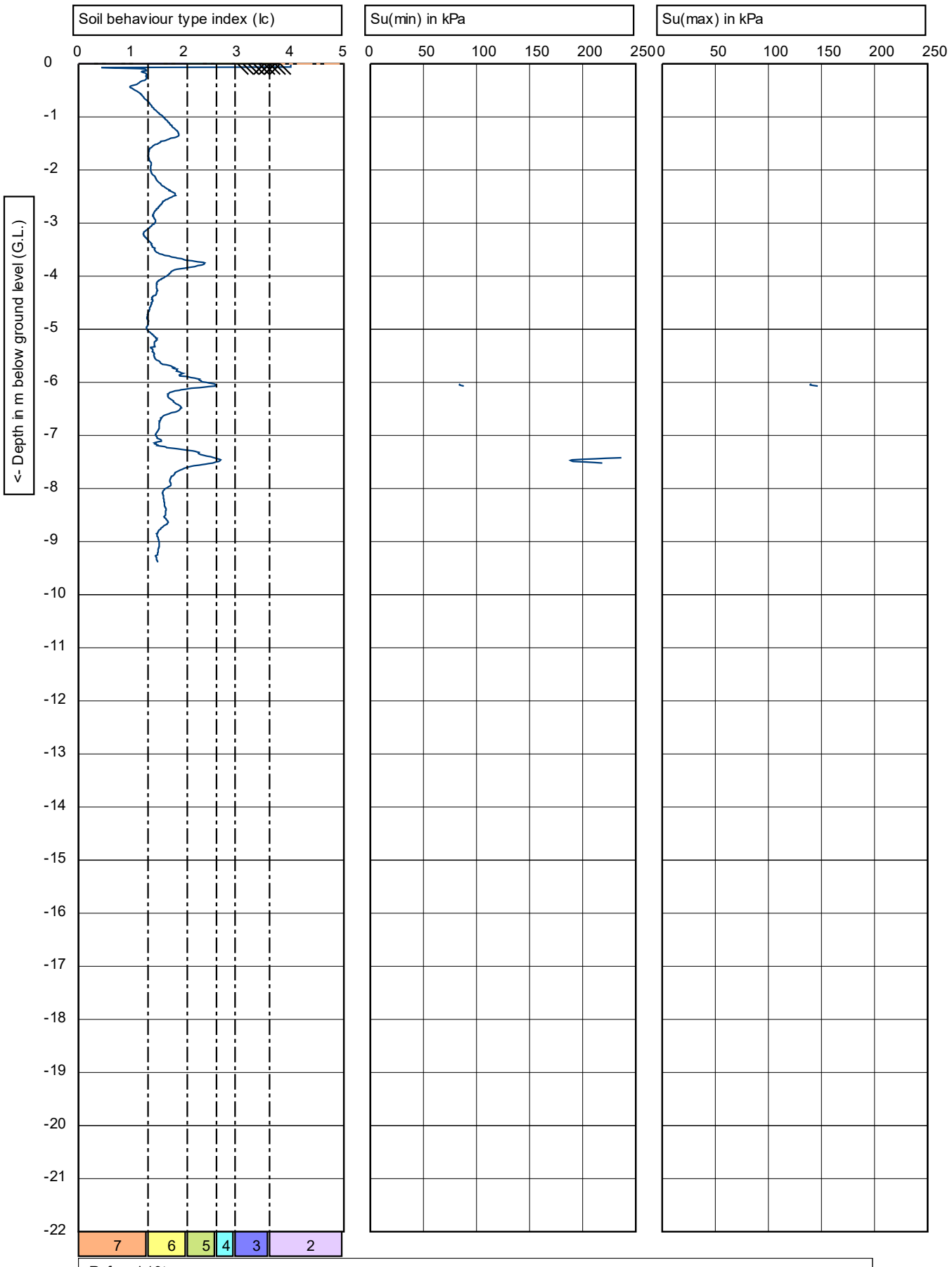
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1797247, 5520509 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**06** **5/6**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 2.3m

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1797247, 5520509 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**06** **6/6**

1.49

CONE PENETRATION TEST REPORT

Client :	BTW Company Limited	
Project :	231 Motuiti Rd	
Location :	Foxton (3007425)	
Hole Number:	06	
Tested by :	J Kavanaugh/ L Curtis	
Date tested :	28/02/23	
Coordinates :	1797247	E
	5520509	N
Elevation :	13m	
Water level :	EOH - Dipped - Collapsed dry @ 2.3m	

Project No :	2-68124,00
Lab Ref No :	HA10441_06
Client Ref No :	3007425

Test Results

Start Time	4:45:00 PM
Time at penetration	4:52:59 PM
End Time	12:07:59 AM
Reference level	0
Ground level	0
Predrill	0
Penetration Depth	9.47
Remarks	Refusal 10t.
GPS Type	Garmin eTrex 20
GPS Accuracy	+ / - 3m
GPS Reference Grid	NZTM
GPS Datum	MSL
Rig Type	GeoMil Panther 100/ Flex 200
Rig ID	CPT03
Reaction Force	Dead weight 10/22 tonnes
Data Acquisition (Digitizer)	GeoMil GME500
Acquisition Program	GeoMil CPTest
Reporting Program	GeoMil CPTask
Cone Type	C10 (10 Tonne Compression)
Cross Sectional Area	10cm2
Cone Area Ratio	0.8
Fluid Type	Silicone Fluid
Friction Reducer	0.55m behind base of cone
Application Class (ISO 22476-1)	3
Test Type (ISO 22476-1)	TE2 (Measured Cone and Sleeve)
Back Fill Method	Bentonite
Observations During Testing	0
Test Methods:	ASTM D5778-12
	ISO 22476-1:2012

Date tested : 28/02/23
Date reported : 17/03/23

IANZ Approved Signatory

Designation : *CPT North Island Manager*
Date : 17/03/23

This report may only be reproduced in full, including corresponding calibration data, daily logs, and CPT graphs.

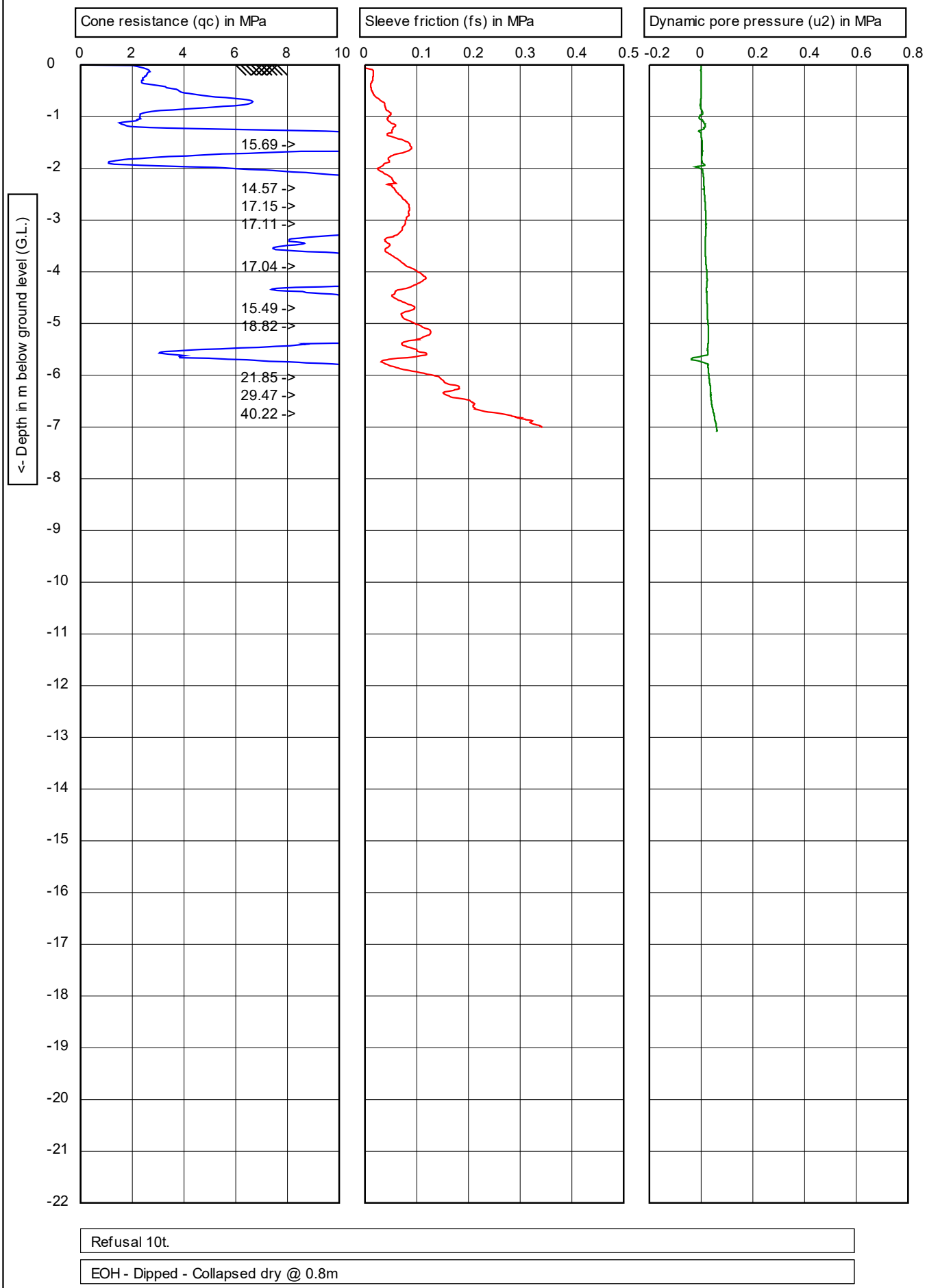
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3240, Hamilton, New Zealand

Telephone +64 7 856 2870
Website www.wsp.com/nz



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.8m

Test results indicated as not accredited are outside the scope of the laboratory's accreditation

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

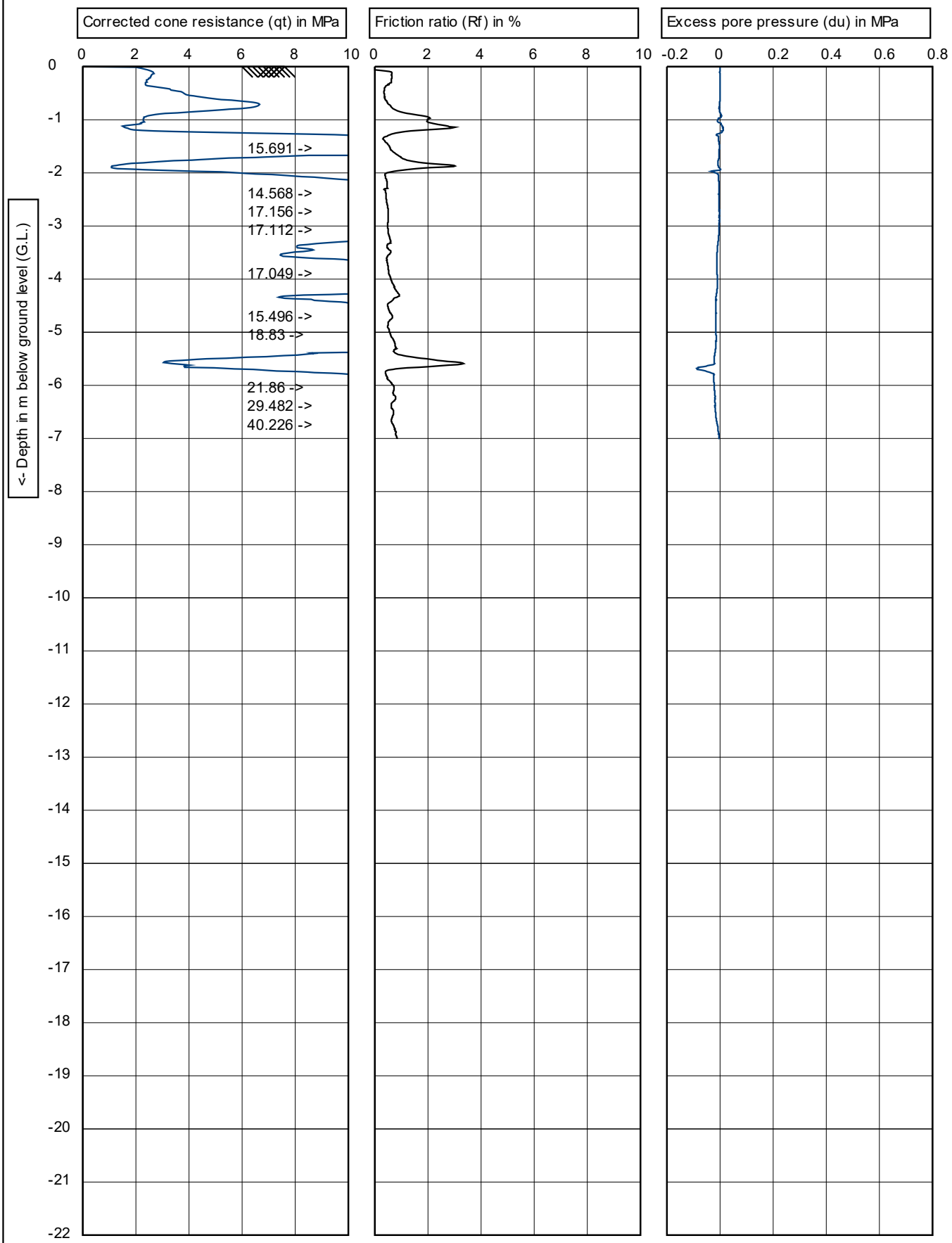
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1797730, 5520311 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**07**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.8m

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

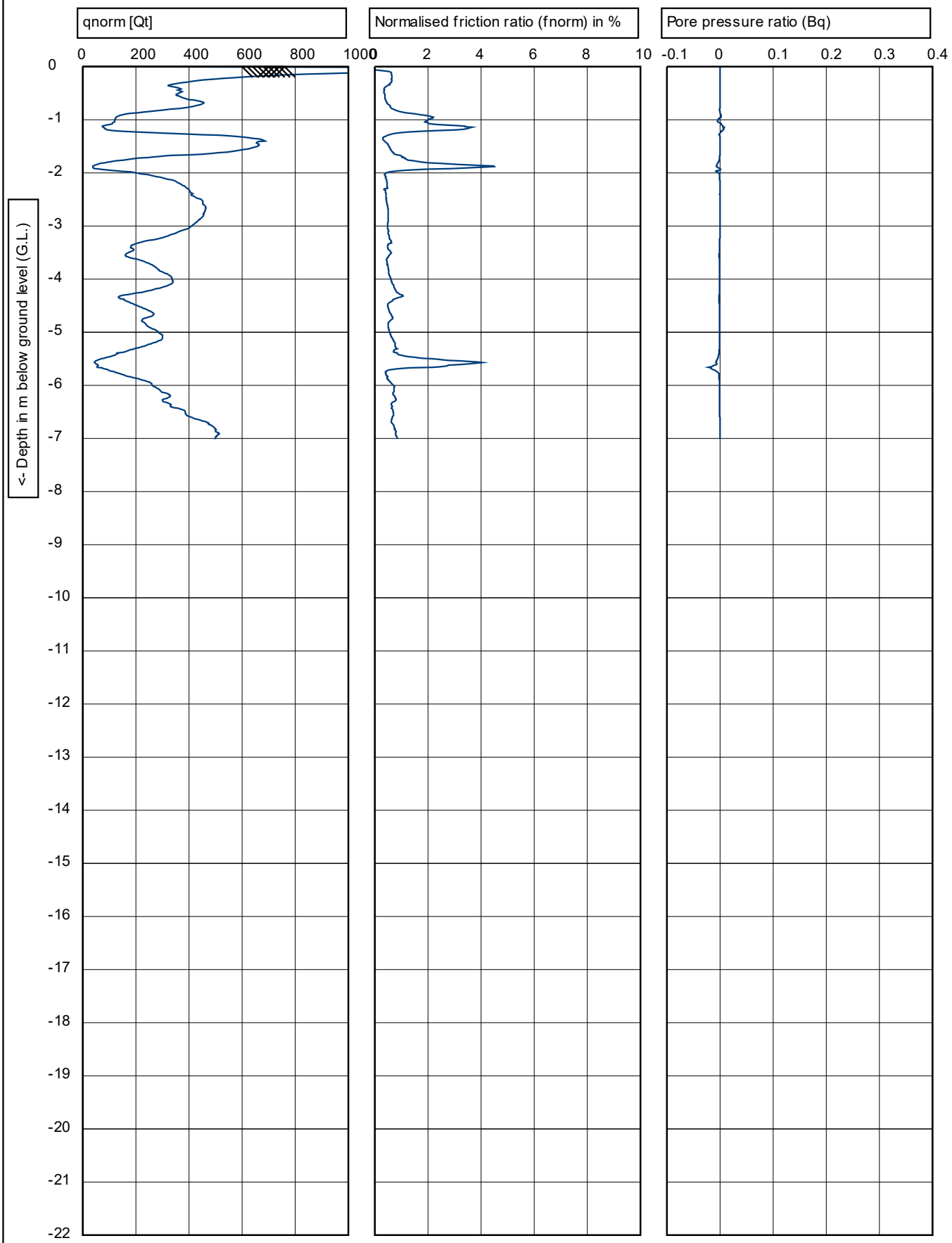
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1797730, 5520311 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**07**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.8m

Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

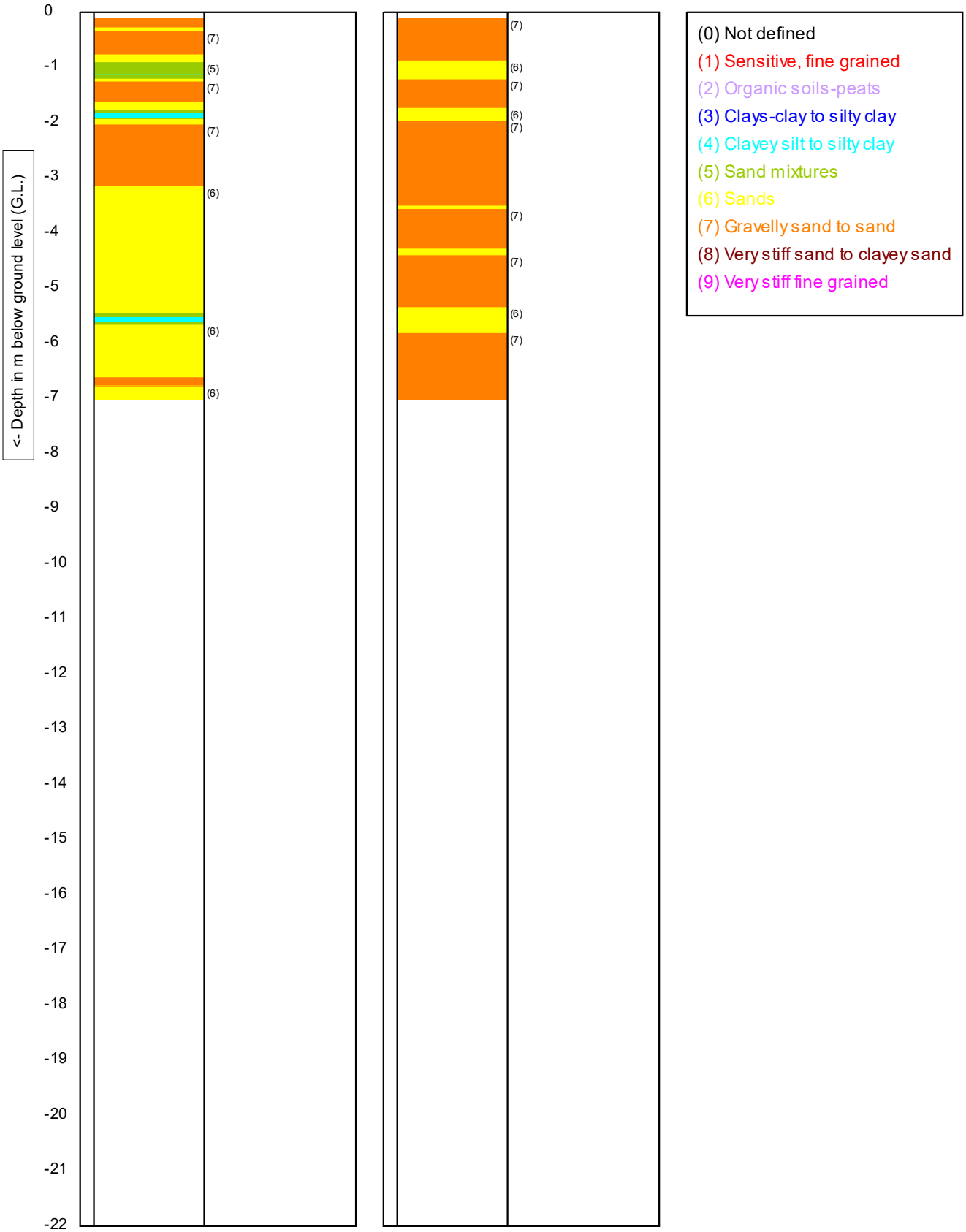
Position: **1797730, 5520311 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**07**

1.49

Soil Classification (using Fr)

Soil Classification (using Bq)



Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

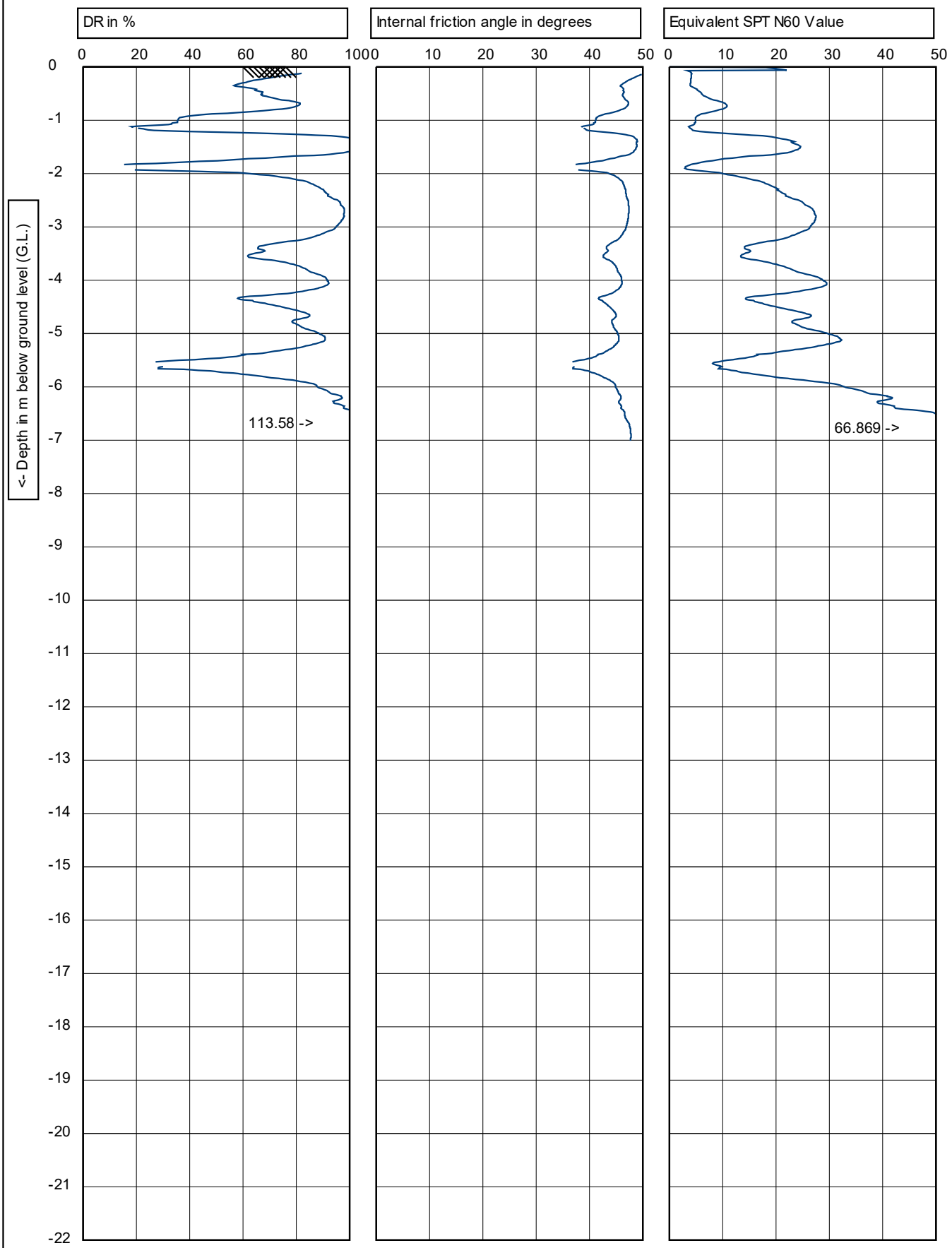
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1797730, 5520311 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**07**

1.49



WSP

Graphs on this page are not IANZ accredited

1.49

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

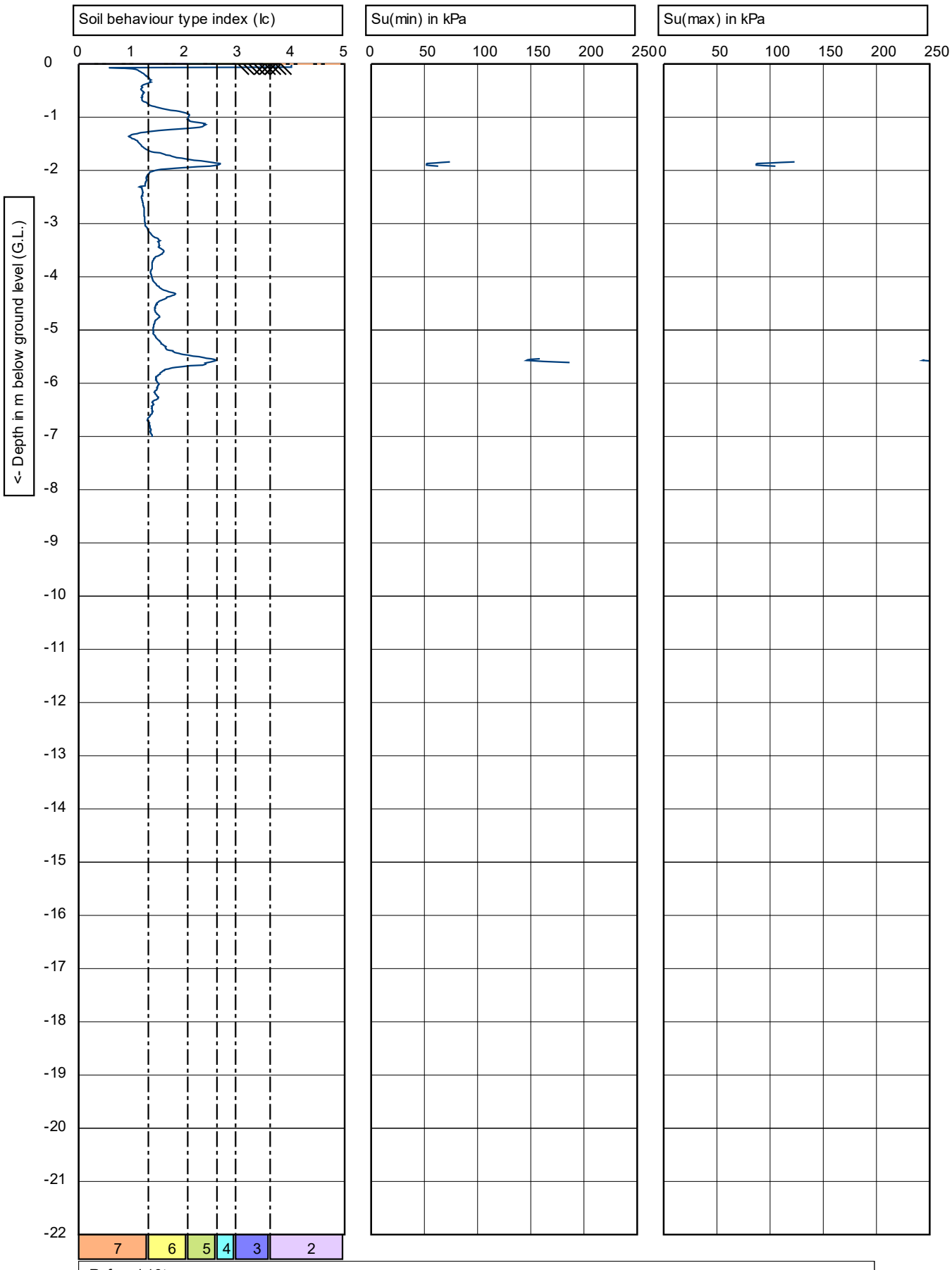
G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1797730, 5520311 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**07** **5/6**



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.8m

Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1797730, 5520311 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**07** **6/6**

1.49

CONE PENETRATION TEST REPORT

Client :	BTW Company Limited	
Project :	231 Motuiti Rd	
Location :	Foxton (3007425)	
Hole Number:	07	
Tested by :	J Kavanaugh/ L Curtis	
Date tested :	28/02/23	
Coordinates :	1797730	E
	5520311	N
Elevation :	13m	
Water level :	EOH - Dipped - Collapsed dry @ 0.8m	

Project No :	2-68124,00
Lab Ref No :	HA10441_07
Client Ref No :	3007425

Test Results

Start Time	11:28:00 AM
Time at penetration	11:34:13 AM
End Time	12:06:13 AM
Reference level	0
Ground level	0
Predrill	0
Penetration Depth	7.09
Remarks	Refusal 10t.
GPS Type	Garmin eTrex 20
GPS Accuracy	+ / - 3m
GPS Reference Grid	NZTM
GPS Datum	MSL
Rig Type	GeoMil Panther 100/ Flex 200
Rig ID	CPT03
Reaction Force	Dead weight 10/22 tonnes
Data Acquisition (Digitizer)	GeoMil GME500
Acquisition Program	GeoMil CPTest
Reporting Program	GeoMil CPTask
Cone Type	C10 (10 Tonne Compression)
Cross Sectional Area	10cm2
Cone Area Ratio	0.8
Fluid Type	Silicone Fluid
Friction Reducer	0.55m behind base of cone
Application Class (ISO 22476-1)	3
Test Type (ISO 22476-1)	TE2 (Measured Cone and Sleeve)
Back Fill Method	Bentonite
Observations During Testing	0

Test Methods: ASTM D5778-12
ISO 22476-1:2012

Date tested : 28/02/23
Date reported : 17/03/23

IANZ Approved Signatory

Designation : *CPT North Island Manager*
Date : 17/03/23

This report may only be reproduced in full, including corresponding calibration data, daily logs, and CPT graphs.

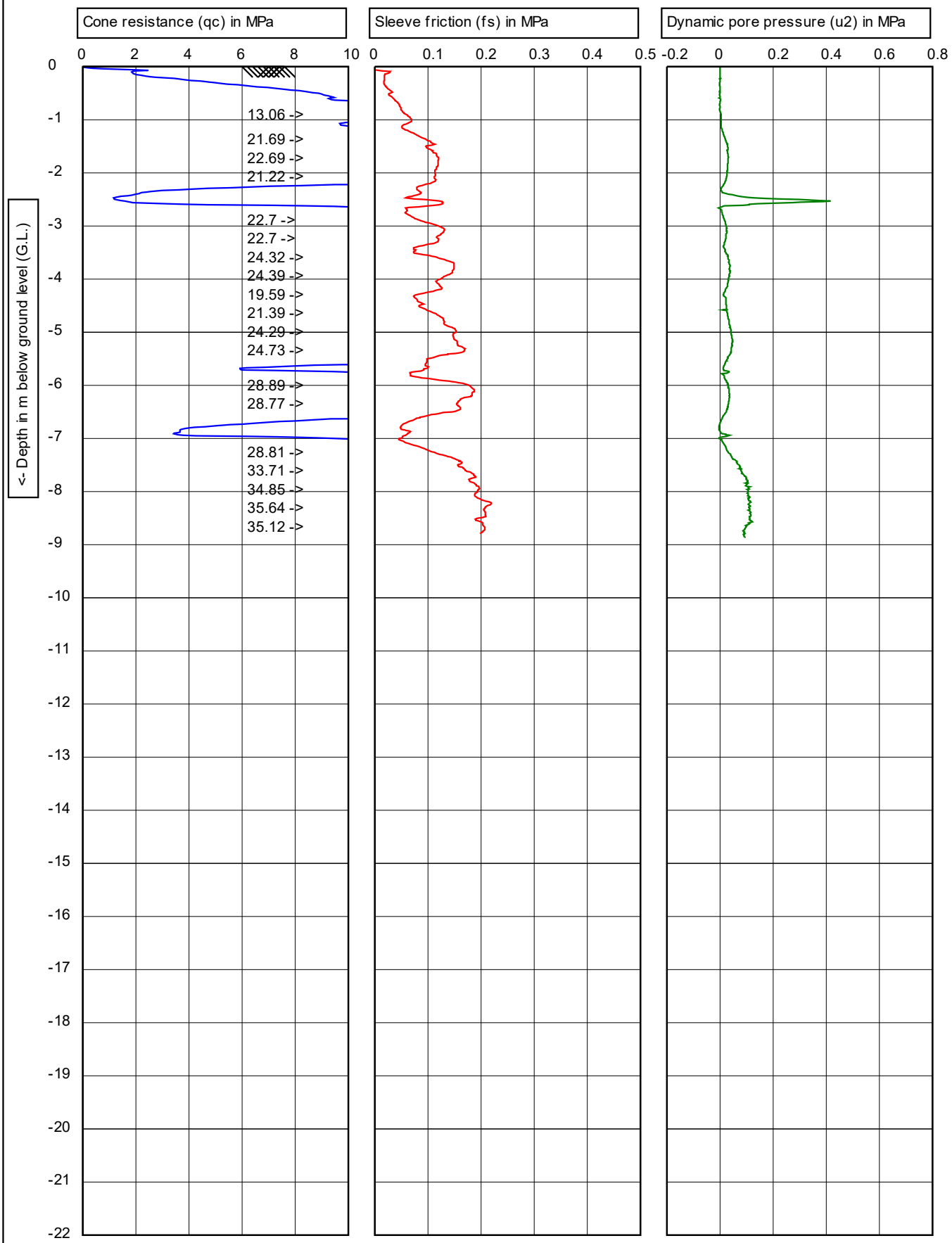
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Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

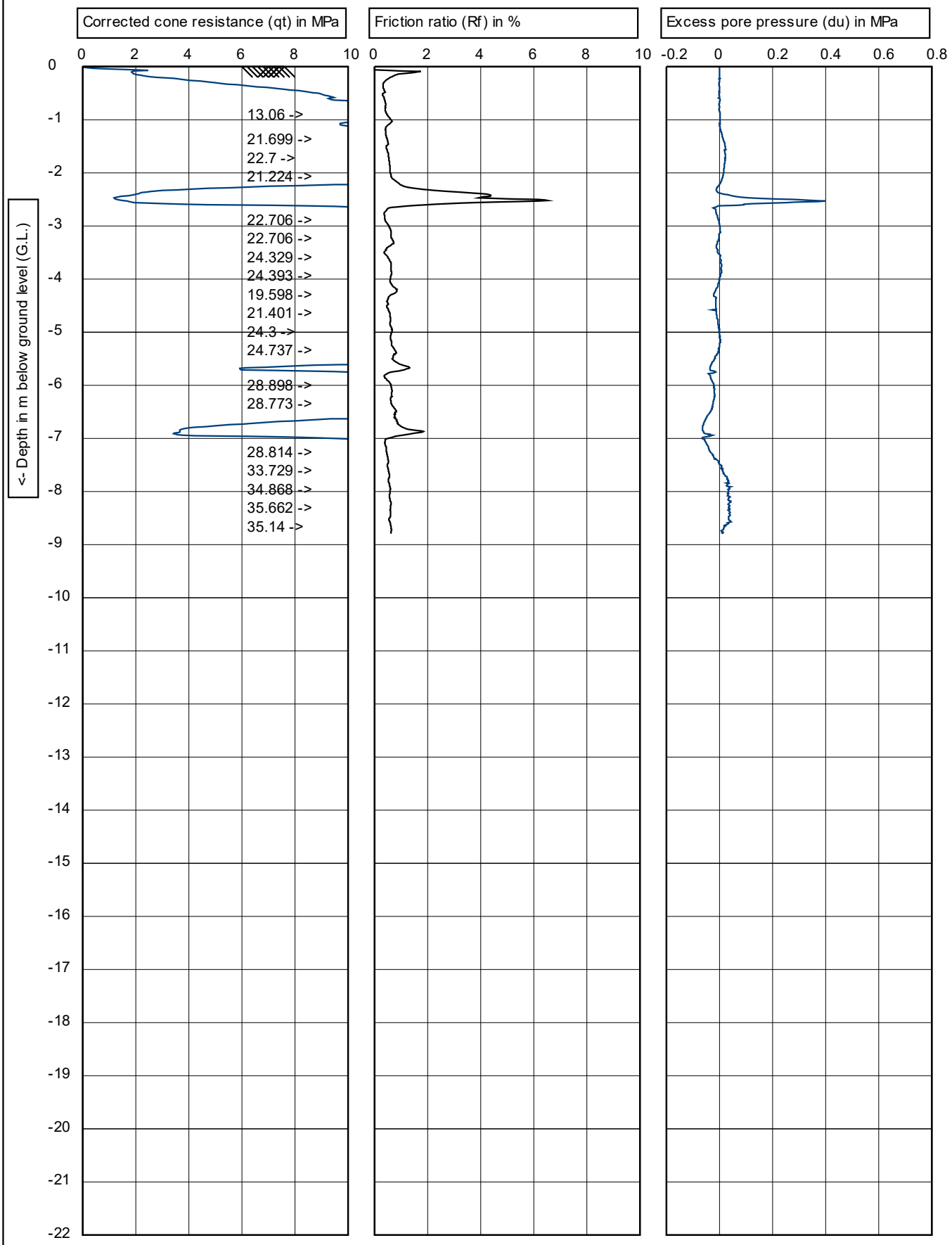
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1798128, 5520607 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**08**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.8m

Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

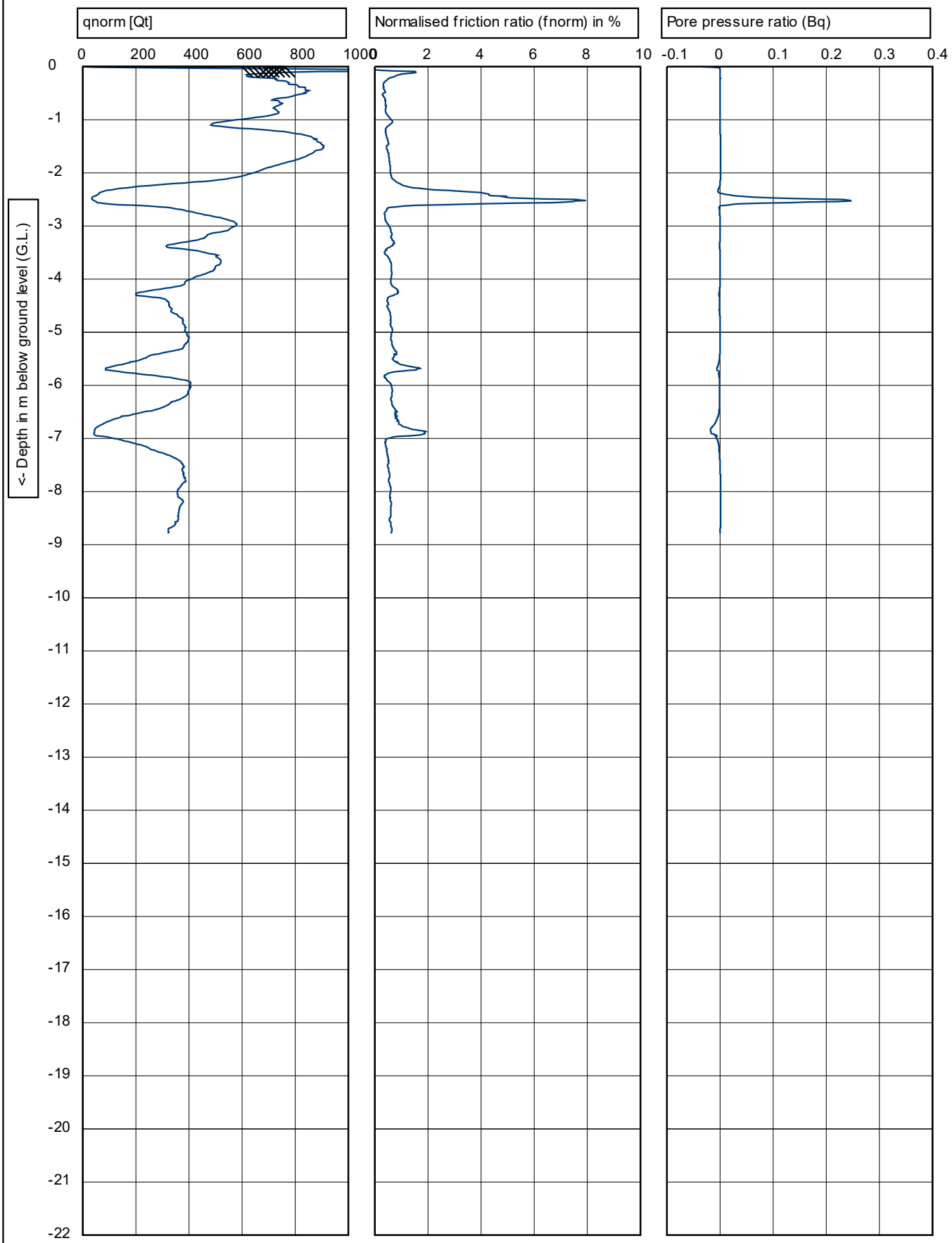
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1798128, 5520607 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**08**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.8m

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r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

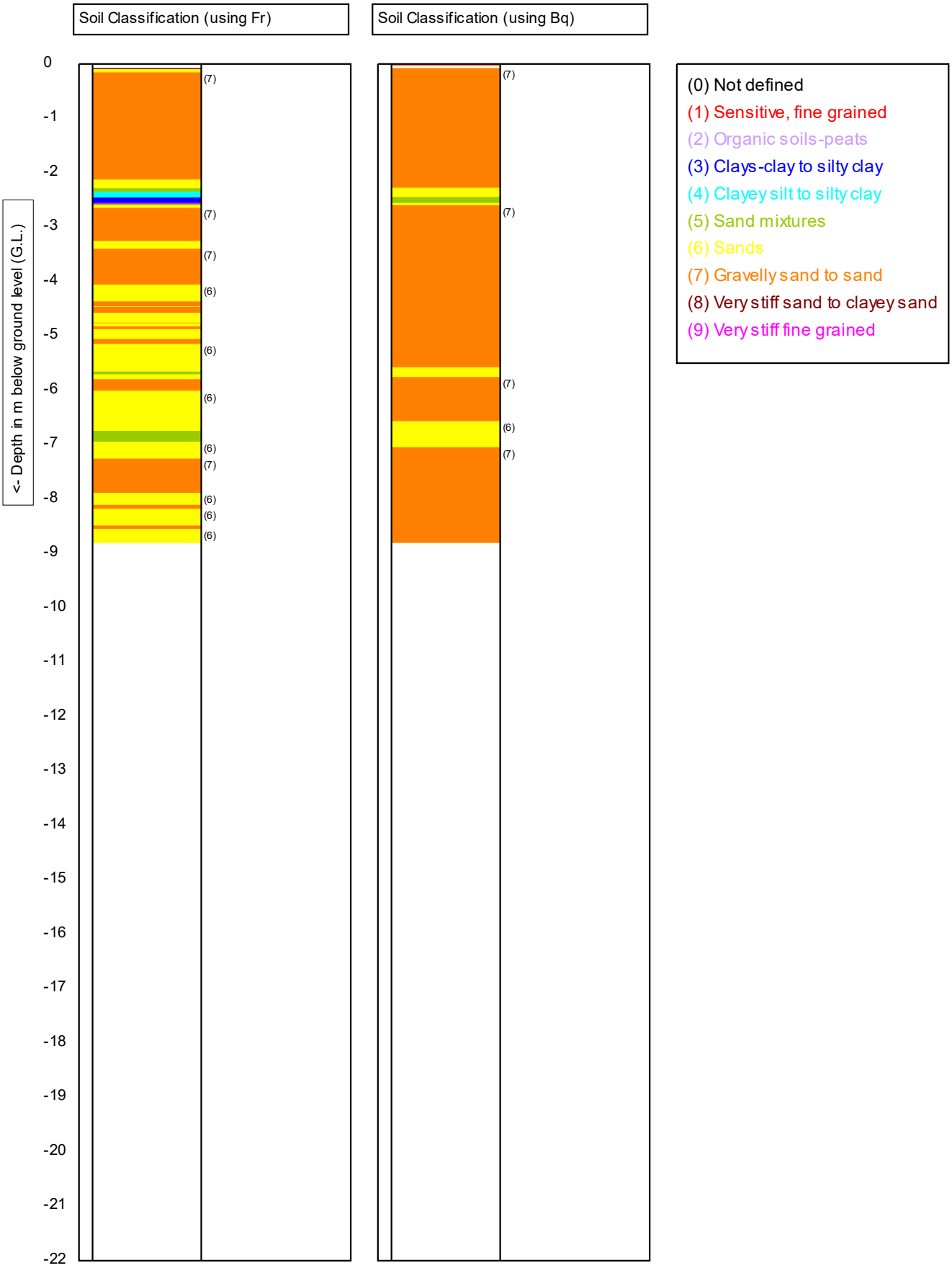
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1798128, 5520607 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**08**

1.49



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r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

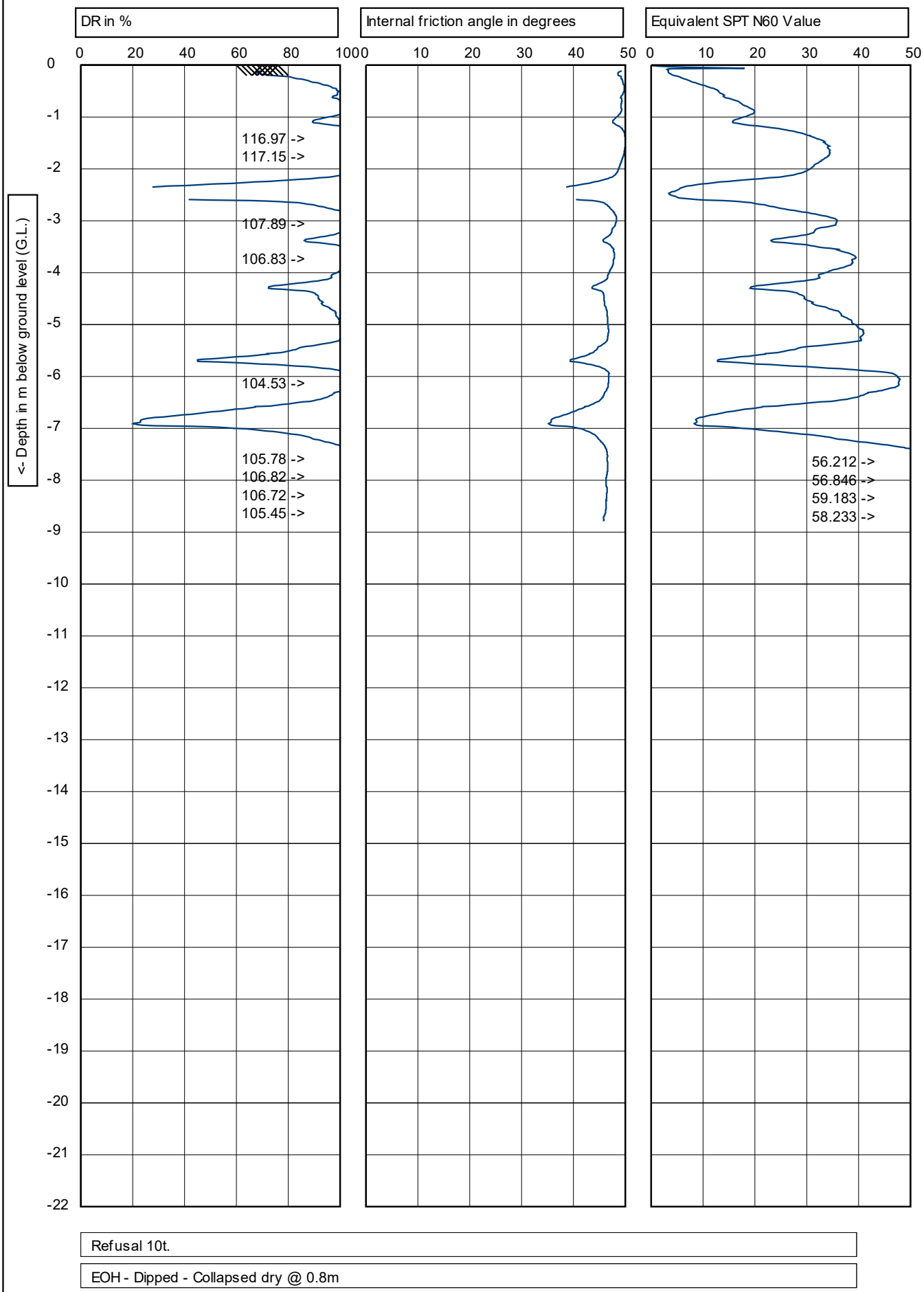
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1798128, 5520607 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**08** **4/6**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.8m

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

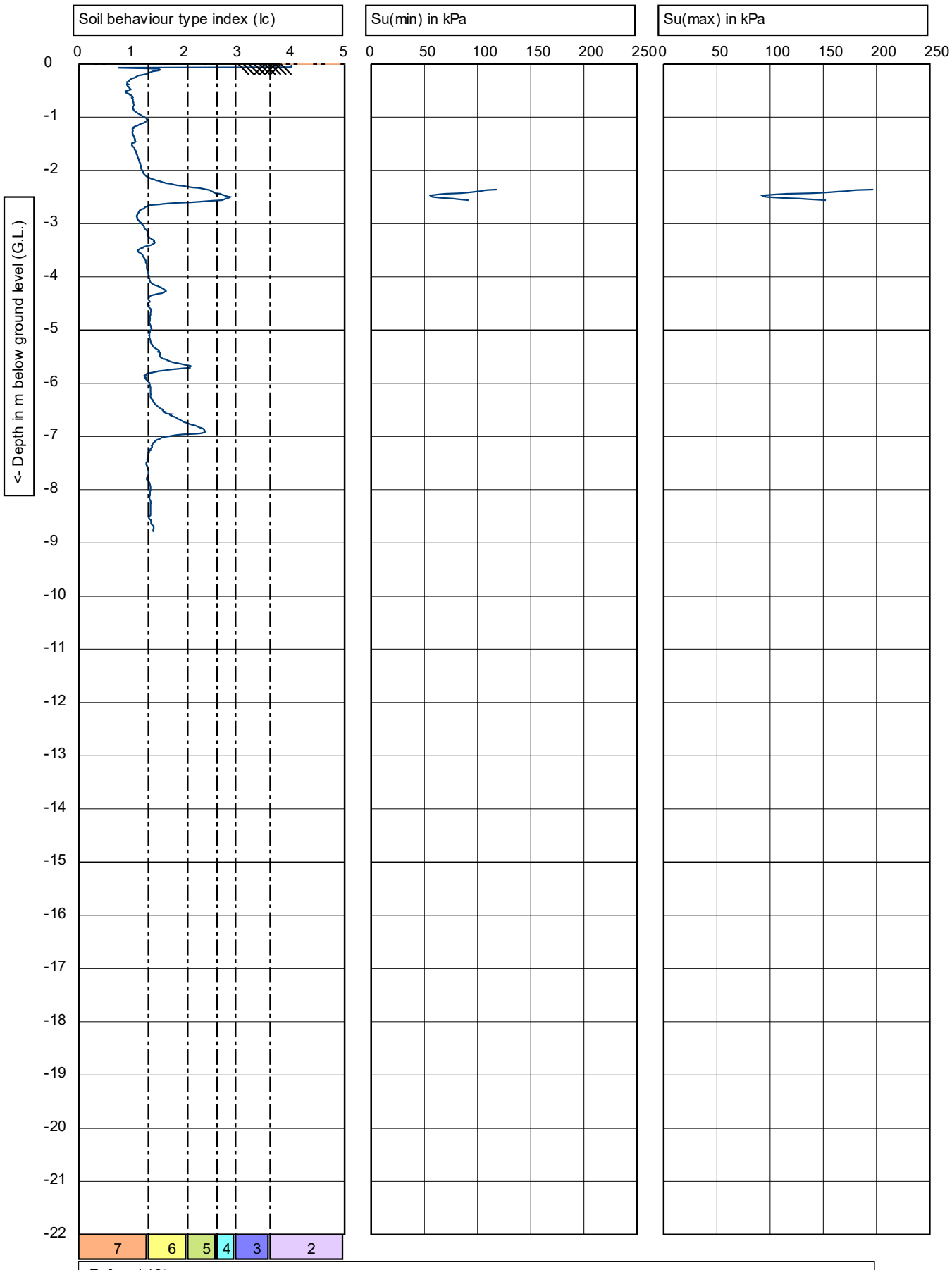
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1798128, 5520607 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**08** **5/6**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.8m

WSP

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1798128, 5520607 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**08** **6/6**

1.49

CONE PENETRATION TEST REPORT

Client :	BTW Company Limited	
Project :	231 Motuiti Rd	
Location :	Foxton (3007425)	
Hole Number:	08	
Tested by :	J Kavanaugh/ L Curtis	
Date tested :	28/02/23	
Coordinates :	1798128	E
	5520607	N
Elevation :	14m	
Water level :	EOH - Dipped - Collapsed dry @ 0.8m	

Project No :	2-68124,00
Lab Ref No :	HA10441_08
Client Ref No :	3007425

Test Results

Start Time	10:46:00 AM
Time at penetration	10:53:31 AM
End Time	12:07:31 AM
Reference level	0
Ground level	0
Predrill	0
Penetration Depth	8.87
Remarks	Refusal 10t.
GPS Type	Garmin eTrex 20
GPS Accuracy	+ / - 3m
GPS Reference Grid	NZTM
GPS Datum	MSL
Rig Type	GeoMil Panther 100/ Flex 200
Rig ID	CPT03
Reaction Force	Dead weight 10/22 tonnes
Data Acquisition (Digitizer)	GeoMil GME500
Acquisition Program	GeoMil CPTest
Reporting Program	GeoMil CPTask
Cone Type	C10 (10 Tonne Compression)
Cross Sectional Area	10cm2
Cone Area Ratio	0.8
Fluid Type	Silicone Fluid
Friction Reducer	0.55m behind base of cone
Application Class (ISO 22476-1)	3
Test Type (ISO 22476-1)	TE2 (Measured Cone and Sleeve)
Back Fill Method	Bentonite
Observations During Testing	0

Test Methods: ASTM D5778-12
ISO 22476-1:2012

Date tested : 28/02/23
Date reported : 17/03/23

IANZ Approved Signatory

Designation : *CPT North Island Manager*
Date : 17/03/23

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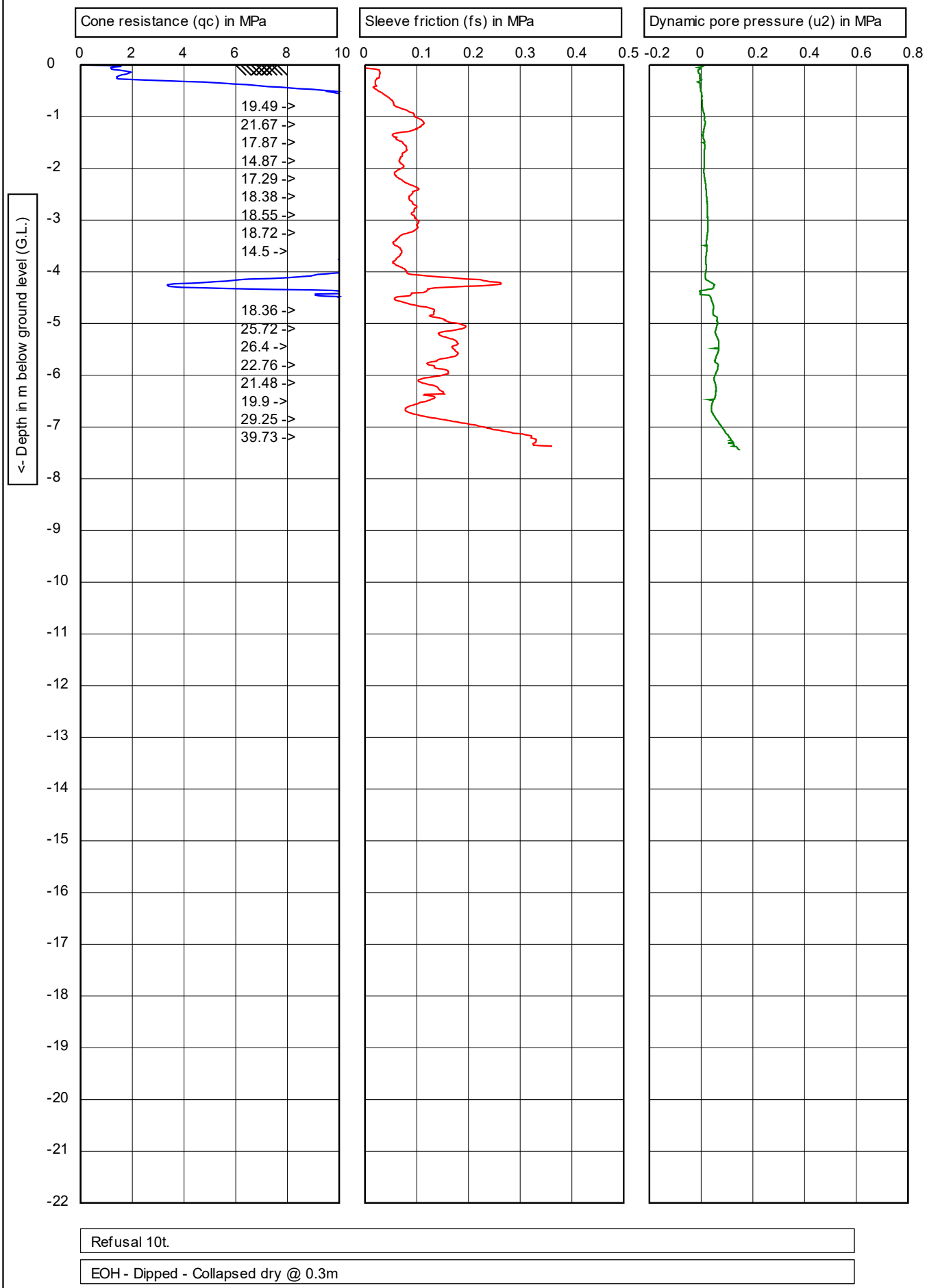
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Website www.wsp.com/nz



Test results indicated as not accredited are outside the scope of the laboratory's accreditation

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

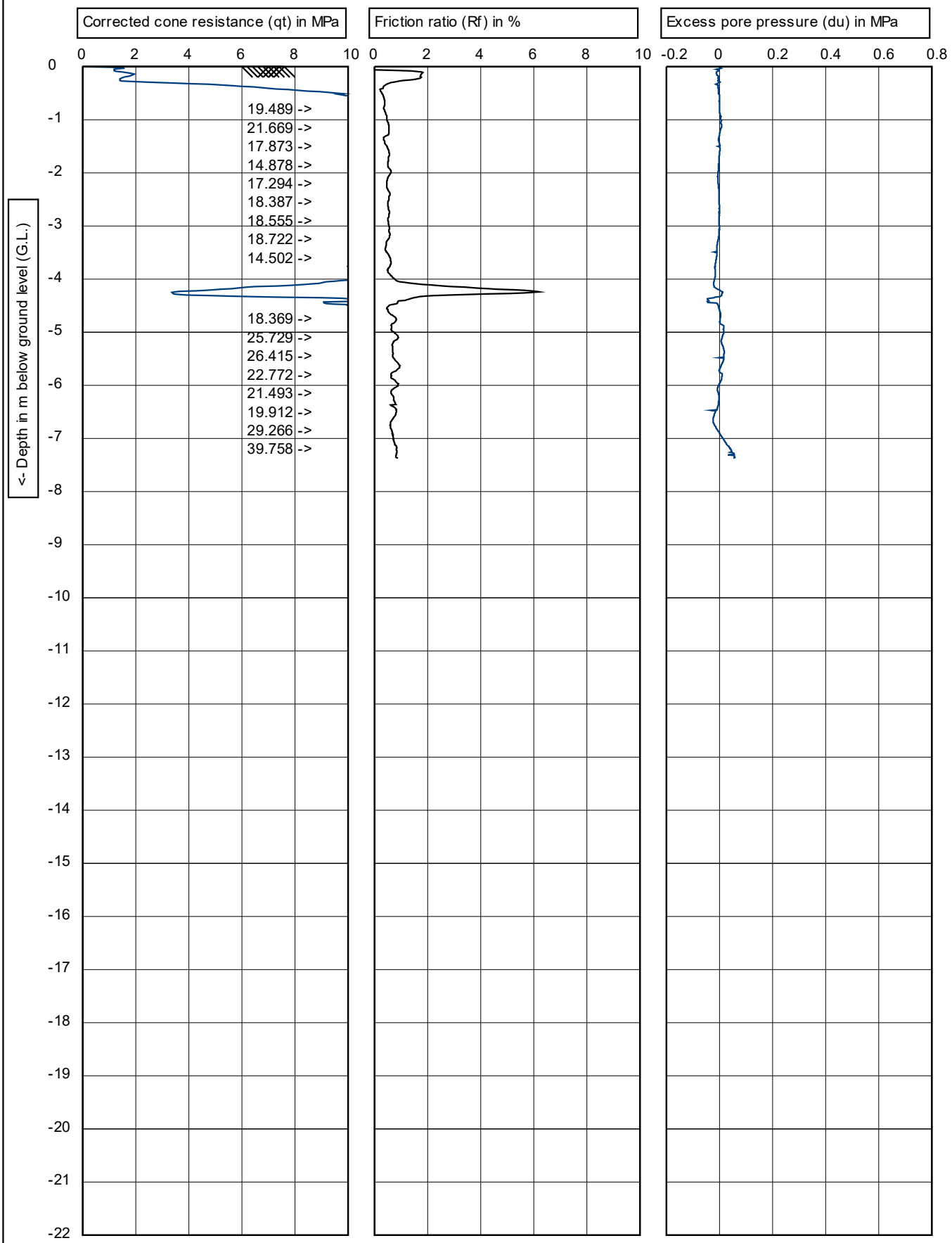
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1798176, 5520105 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**09**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.3m

Graphs on this page are not IANZ accredited

u2 150 cm² 10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

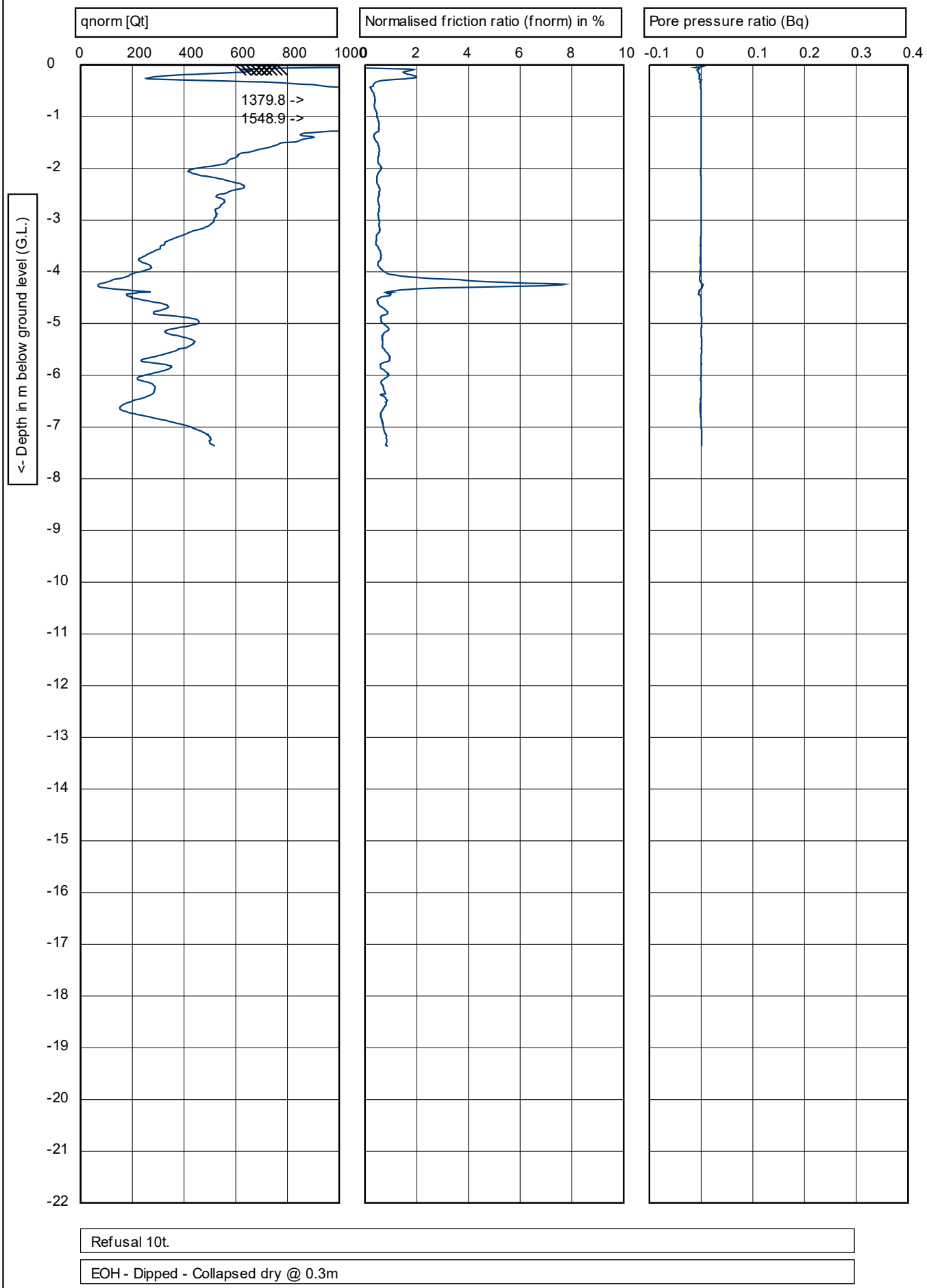
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1798176, 5520105 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**09**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.3m

WSP

Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

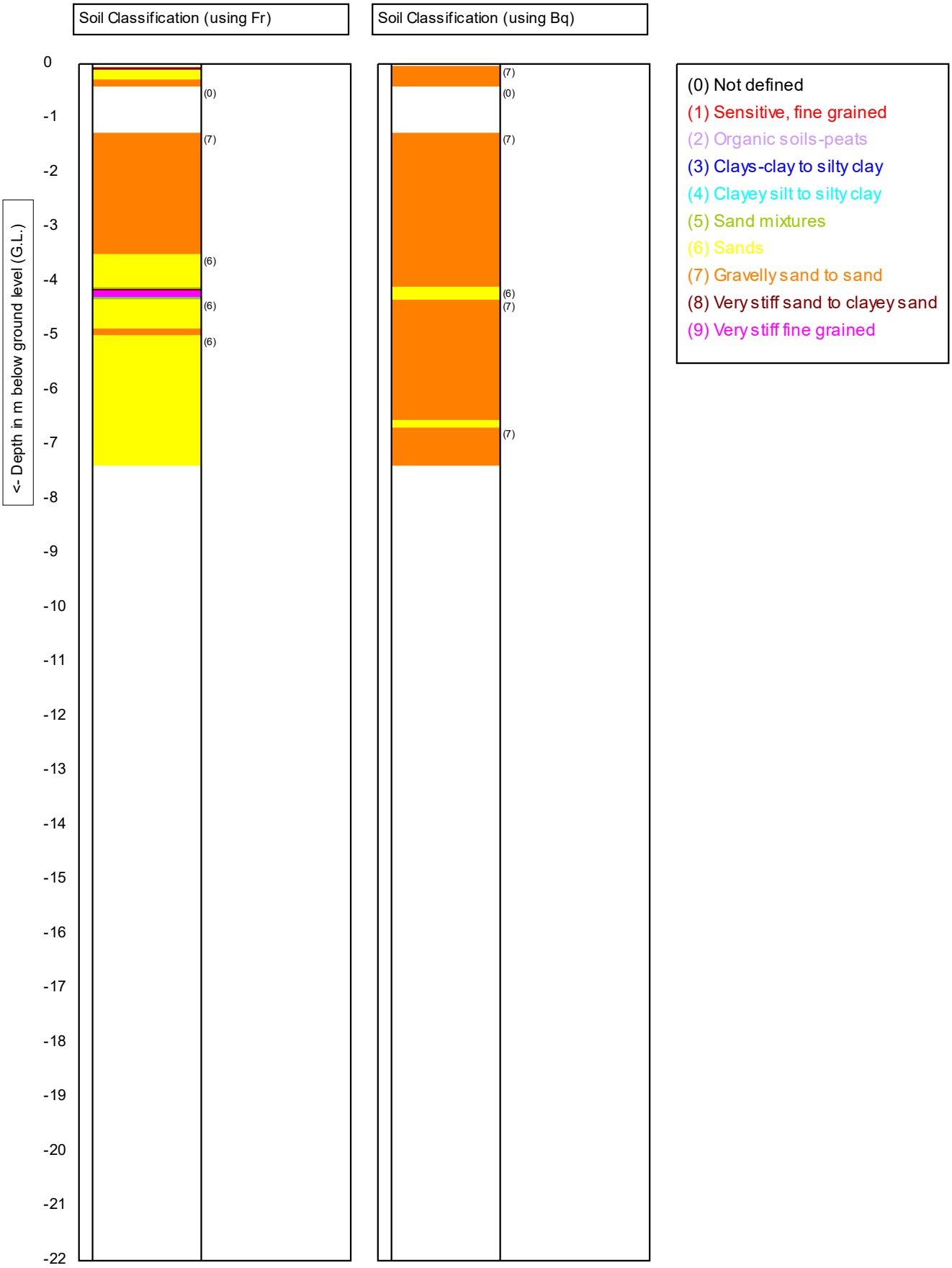
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1798176, 5520105 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**09** **3/6**

1.49



Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

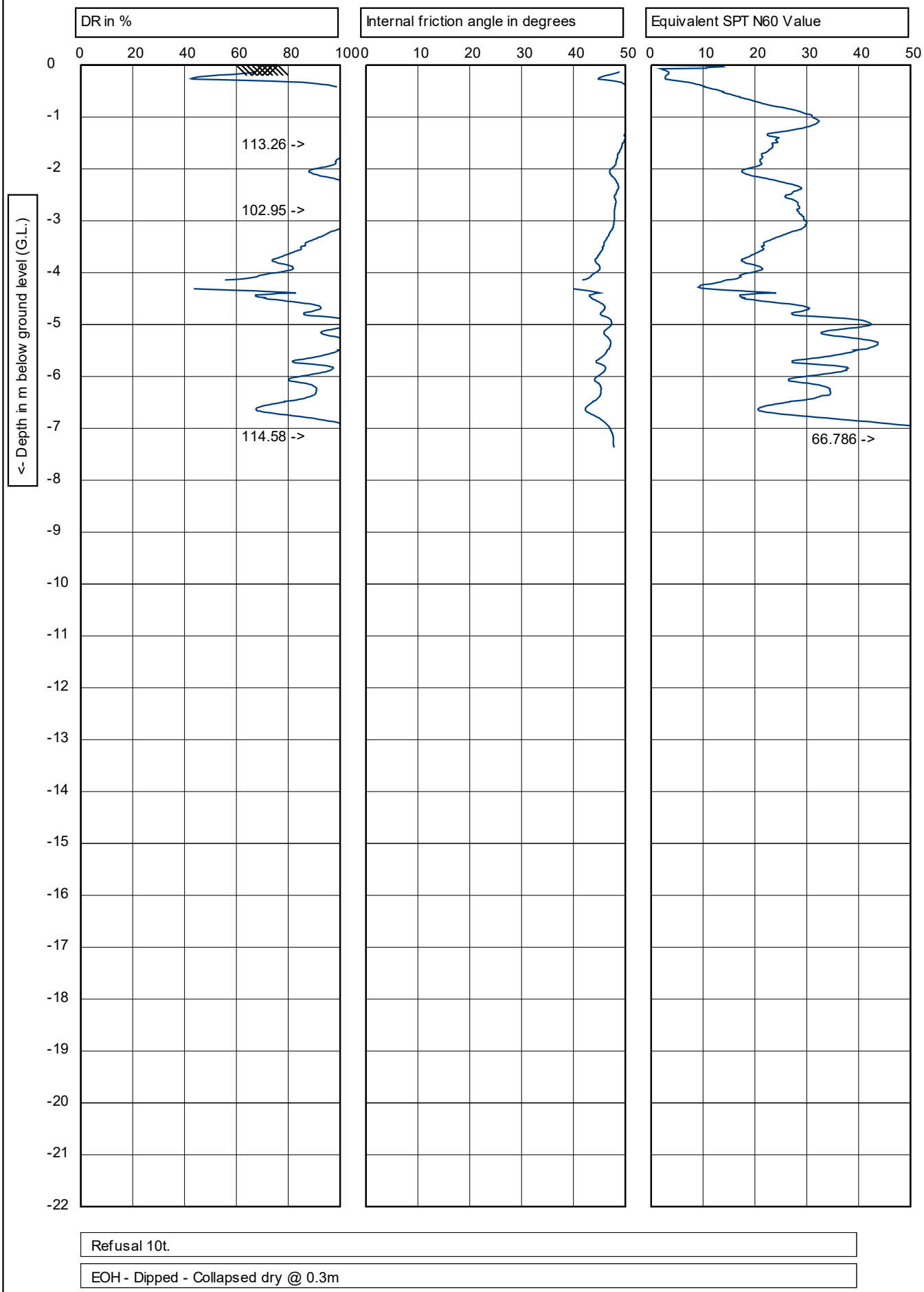
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1798176, 5520105 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**09**

1.49



Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

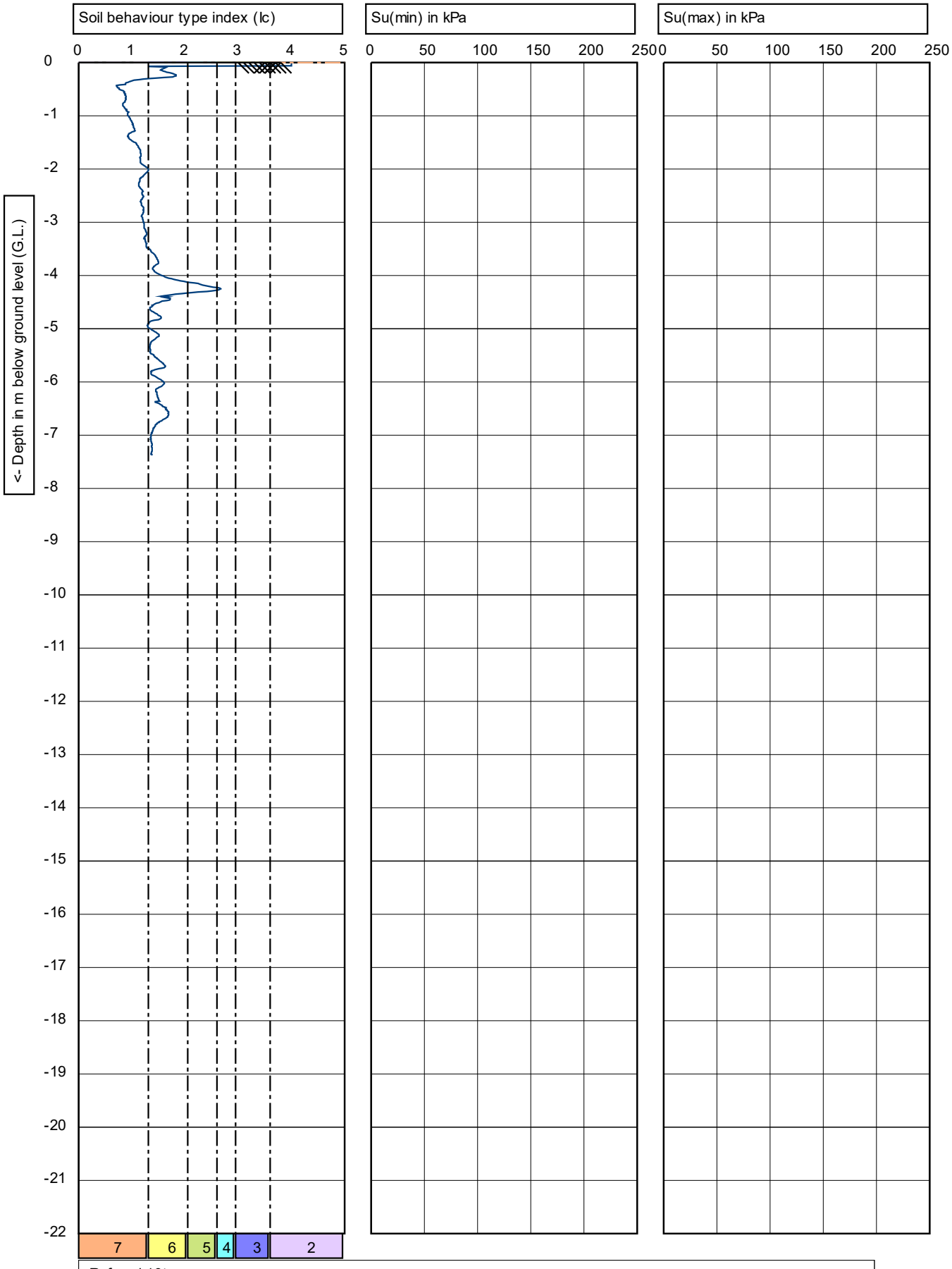
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1798176, 5520105 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**09**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.3m

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1798176, 5520105 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**09** **6/6**

1.49

CONE PENETRATION TEST REPORT

Client :	BTW Company Limited	
Project :	231 Motuiti Rd	
Location :	Foxton (3007425)	
Hole Number:	09	
Tested by :	J Kavanaugh/ L Curtis	
Date tested :	28/02/23	
Coordinates :	1798176	E
	5520105	N
Elevation :	12m	
Water level :	EOH - Dipped - Collapsed dry @ 0.3m	

Project No :	2-68124,00
Lab Ref No :	HA10441_09
Client Ref No :	3007425

Test Results

Start Time	10:13:00 AM
Time at penetration	10:19:51 AM
End Time	12:06:51 AM
Reference level	0
Ground level	0
Predrill	0
Penetration Depth	7.45
Remarks	Refusal 10t.
GPS Type	Garmin eTrex 20
GPS Accuracy	+ / - 3m
GPS Reference Grid	NZTM
GPS Datum	MSL
Rig Type	GeoMil Panther 100/ Flex 200
Rig ID	CPT03
Reaction Force	Dead weight 10/22 tonnes
Data Acquisition (Digitizer)	GeoMil GME500
Acquisition Program	GeoMil CPTest
Reporting Program	GeoMil CPTask
Cone Type	C10 (10 Tonne Compression)
Cross Sectional Area	10cm2
Cone Area Ratio	0.8
Fluid Type	Silicone Fluid
Friction Reducer	0.55m behind base of cone
Application Class (ISO 22476-1)	3
Test Type (ISO 22476-1)	TE2 (Measured Cone and Sleeve)
Back Fill Method	Bentonite
Observations During Testing	0

Test Methods: ASTM D5778-12
ISO 22476-1:2012

Date tested : 28/02/23
Date reported : 17/03/23

IANZ Approved Signatory

Designation : *CPT North Island Manager*
Date : 17/03/23

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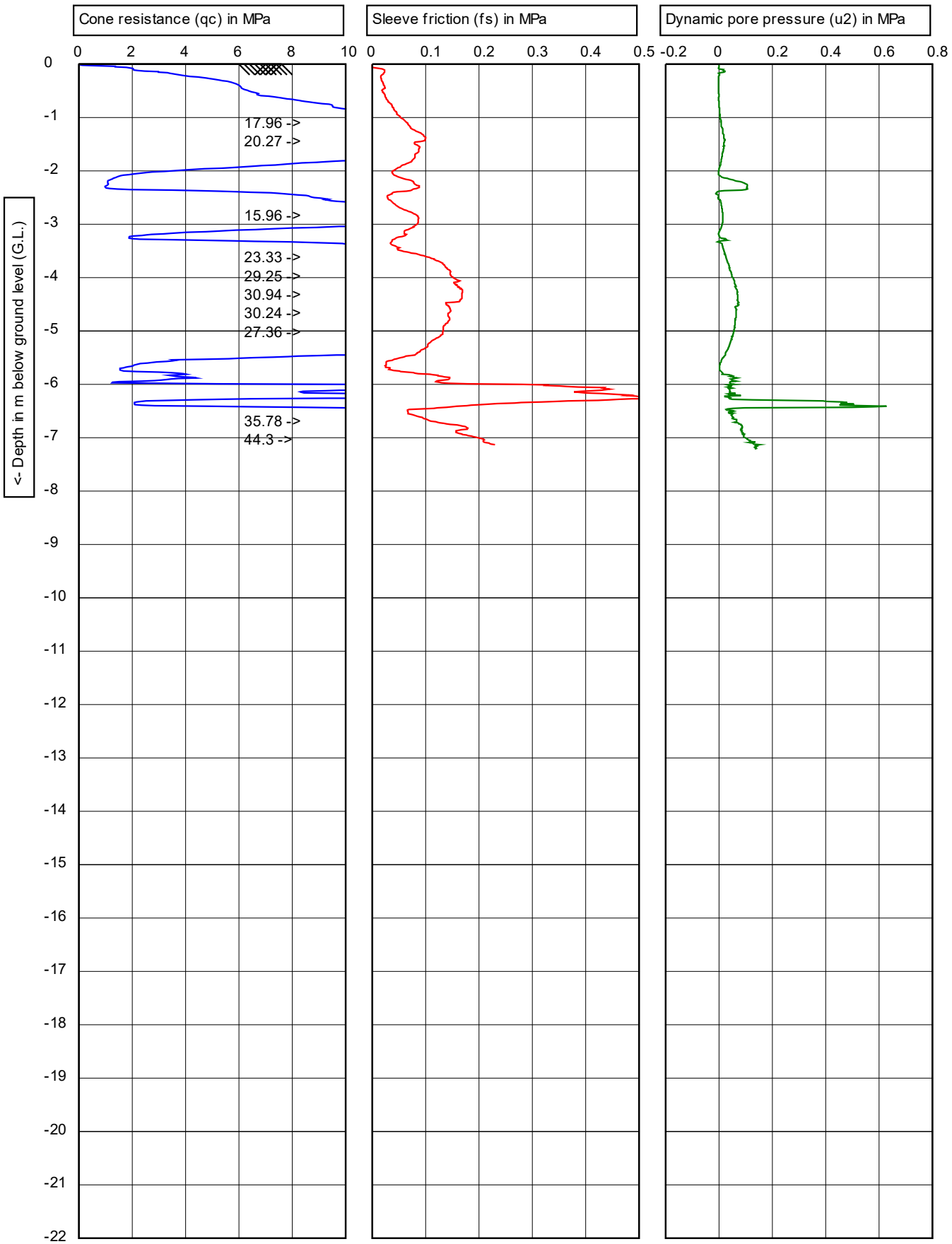
ACCREDITED IANZ TESTING LABORATORY

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

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Hamilton (Fox St)
Quality Management Systems Certified to ISO 9001

4 Fox Street
Private Bag 3057, Waikato Mail Centre,
3240, Hamilton, New Zealand

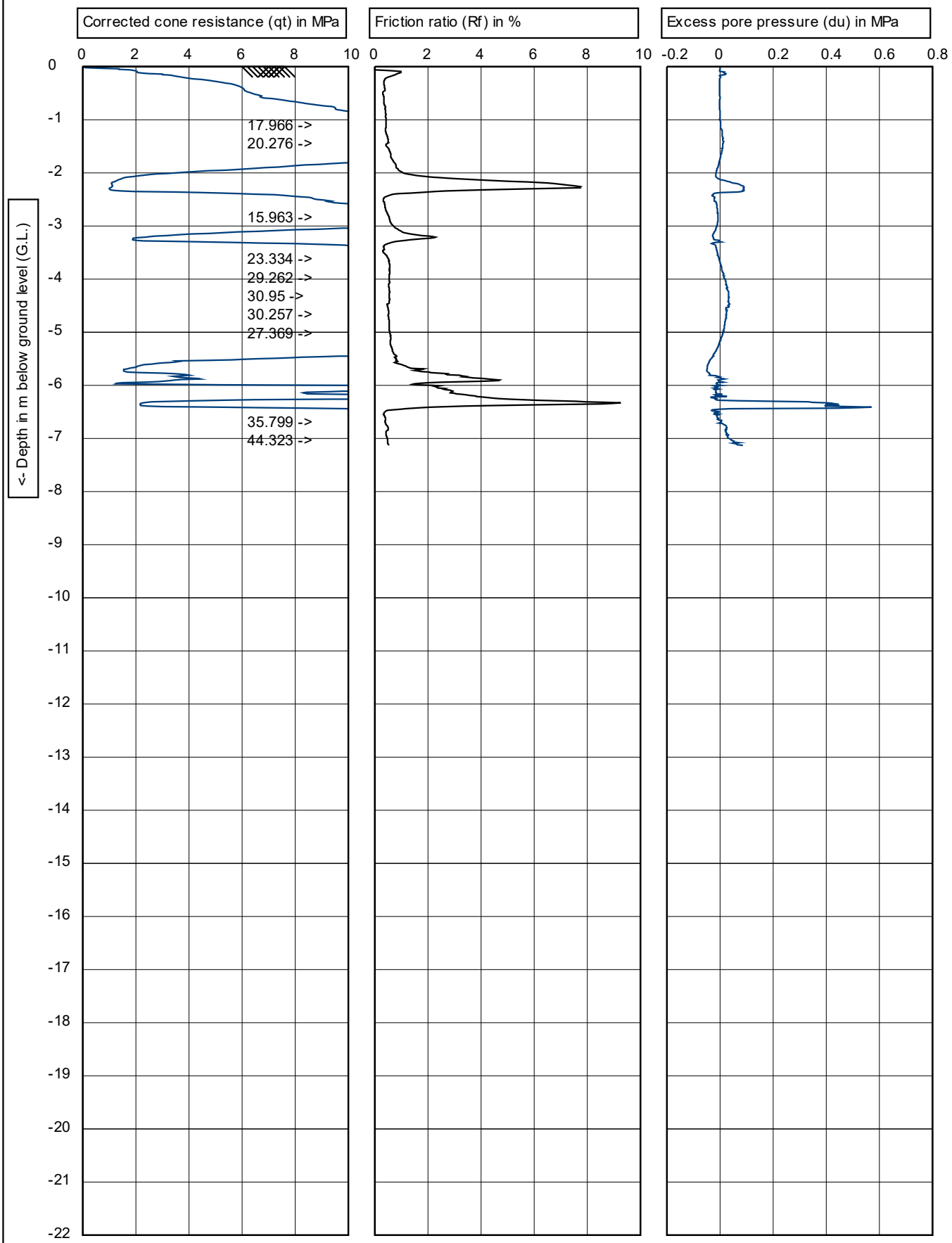
Telephone +64 7 856 2870
Website www.wsp.com/nz



Test according ASTM D5778:12 & ISO 22476-1:2012		Predrill:	0.00 m Predrilled
G.L.: 0.00 m MSL		Date:	28/02/2023
Project:	231 Motuiti Rd	Cone no.:	C10CFIIP.C181009
Location:	Foxton (3007425)	Project no.:	2-68124.00_HA10441
Position:	1798581, 5520421 NZTM	CPT no.:	10 1/6

Test results indicated as not accredited are outside the scope of the laboratory's accreditation

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.6m

Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

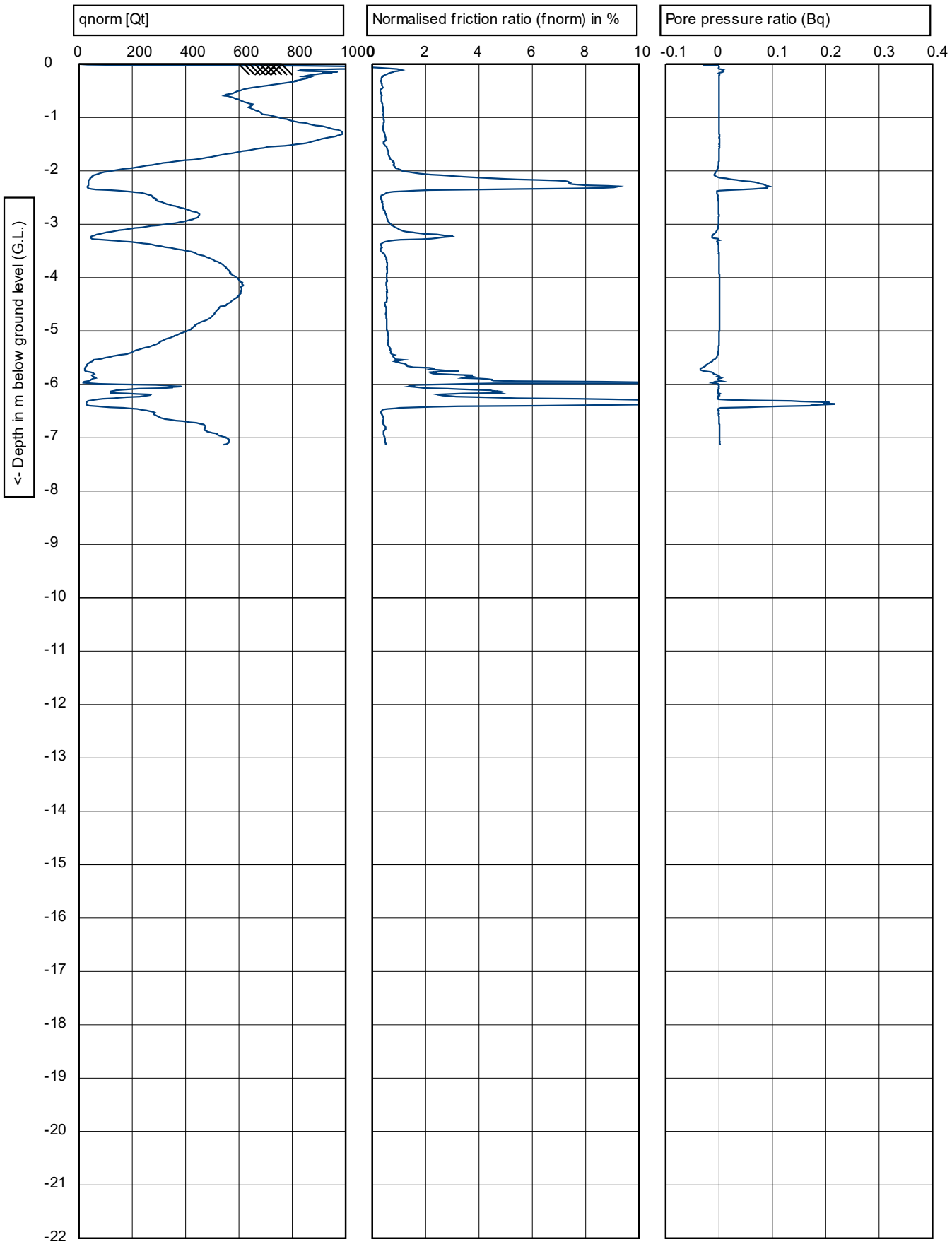
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1798581, 5520421 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**10** **2/6**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.6m

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

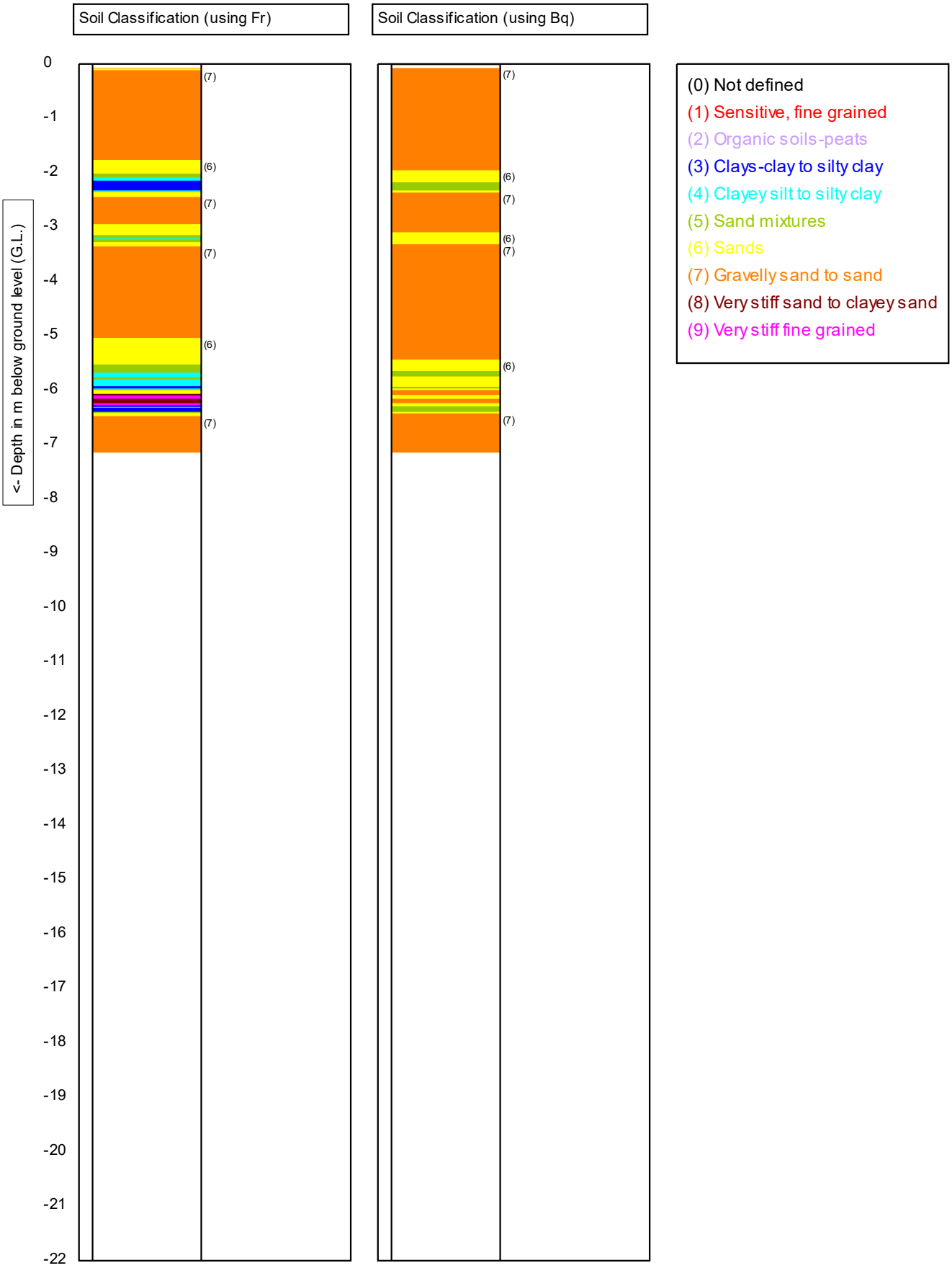
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1798581, 5520421 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**10** **3/6**

1.49



Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

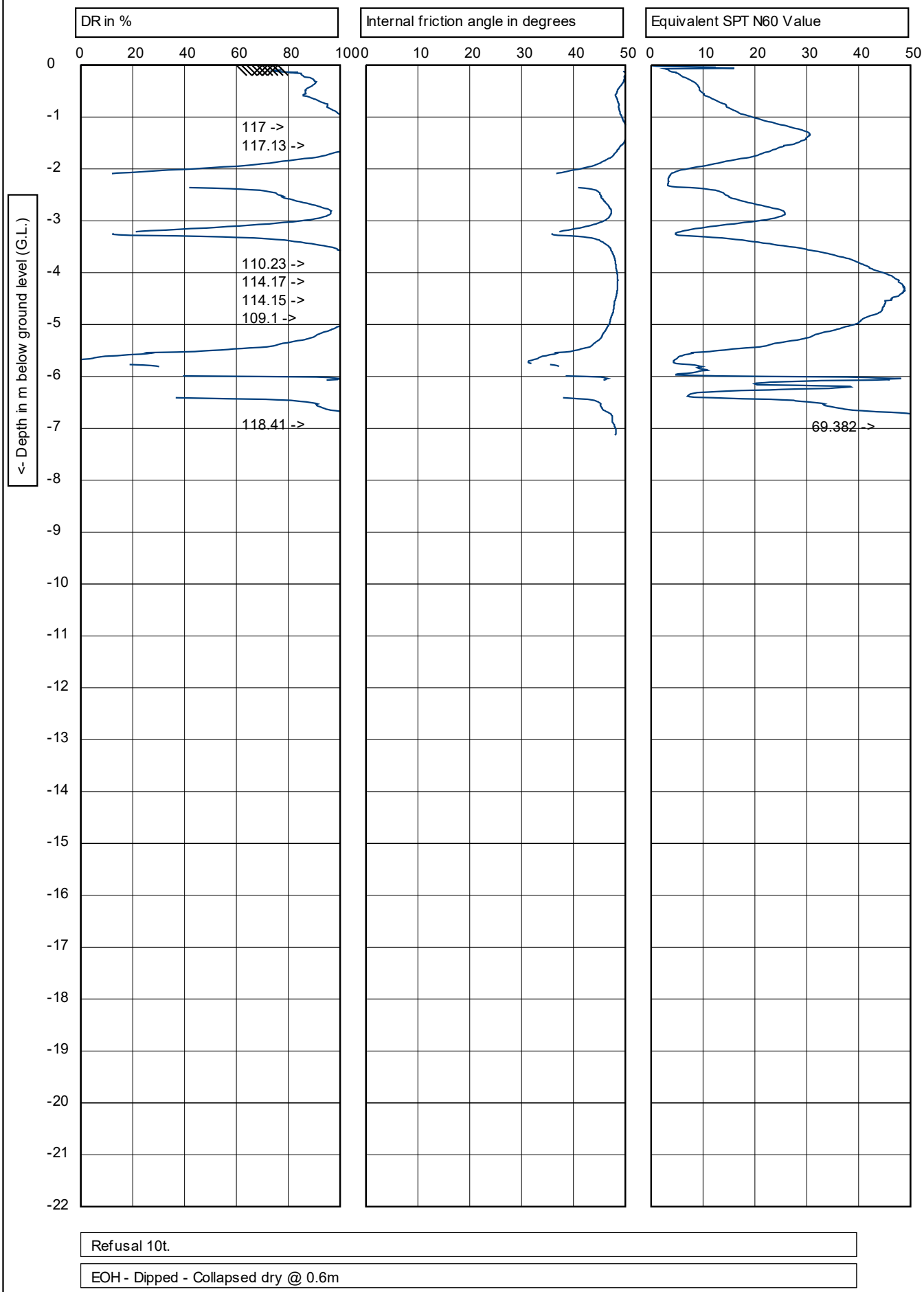
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1798581, 5520421 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**10** **4/6**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.6m

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

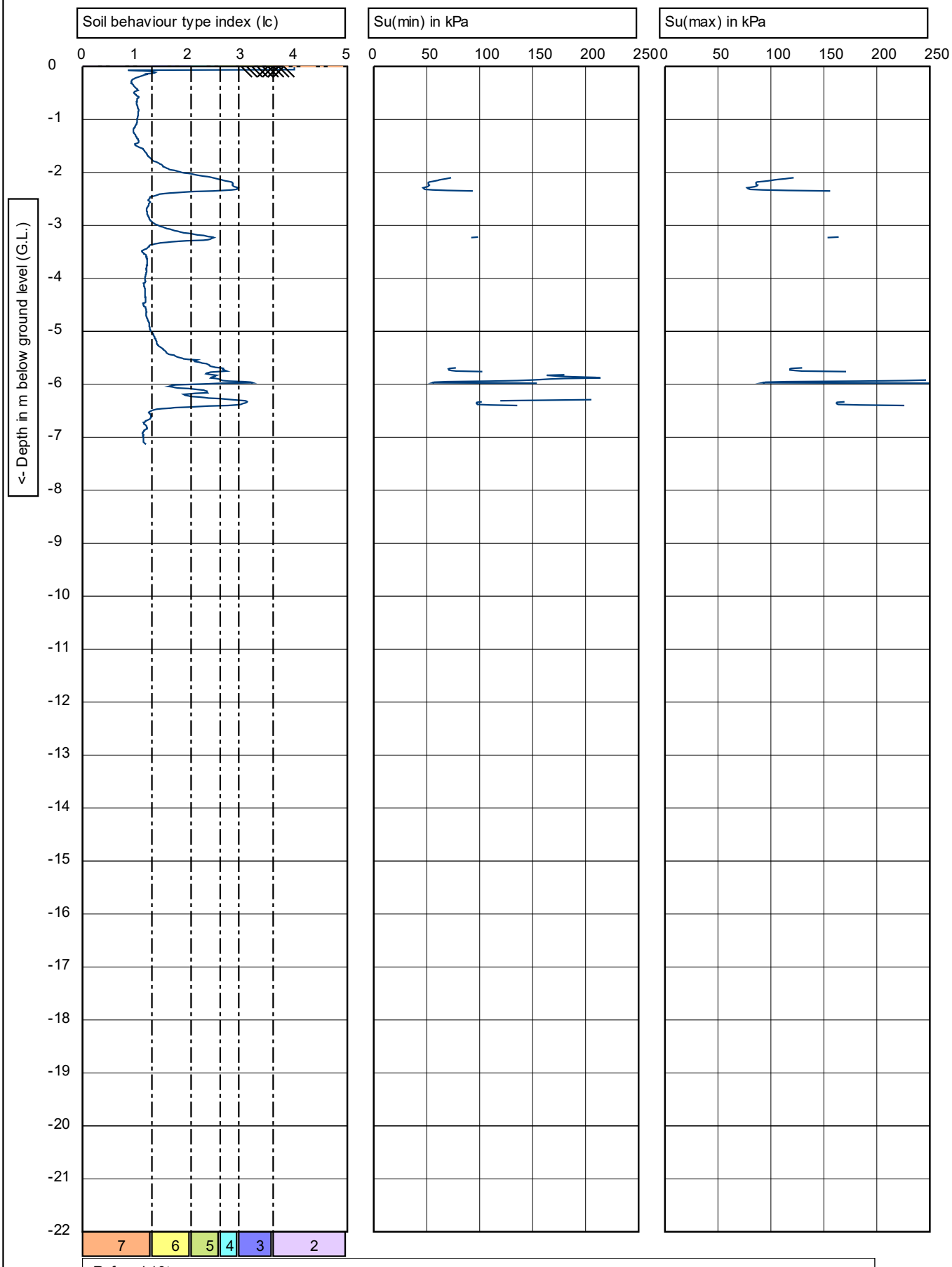
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1798581, 5520421 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**10** **5/6**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.6m

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1798581, 5520421 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**10** **6/6**

1.49

CONE PENETRATION TEST REPORT

Client :	BTW Company Limited
Project :	231 Motuiti Rd
Location :	Foxton (3007425)
Hole Number:	10
Tested by :	J Kavanaugh/ L Curtis
Date tested :	28/02/23
Coordinates :	1798581 E
	5520421 N
Elevation :	20m
Water level :	EOH - Dipped - Collapsed dry @ 0.6m

Project No :	2-68124,00
Lab Ref No :	HA10441_10
Client Ref No :	3007425

Test Results

Start Time	9:31:00 AM
Time at penetration	9:37:21 AM
End Time	12:06:21 AM
Reference level	0
Ground level	0
Predrill	0
Penetration Depth	7.21
Remarks	Refusal 10t.
GPS Type	Garmin eTrex 20
GPS Accuracy	+ / - 3m
GPS Reference Grid	NZTM
GPS Datum	MSL
Rig Type	GeoMil Panther 100/ Flex 200
Rig ID	CPT03
Reaction Force	Dead weight 10/22 tonnes
Data Acquisition (Digitizer)	GeoMil GME500
Acquisition Program	GeoMil CPTest
Reporting Program	GeoMil CPTask
Cone Type	C10 (10 Tonne Compression)
Cross Sectional Area	10cm2
Cone Area Ratio	0.8
Fluid Type	Silicone Fluid
Friction Reducer	0.55m behind base of cone
Application Class (ISO 22476-1)	3
Test Type (ISO 22476-1)	TE2 (Measured Cone and Sleeve)
Back Fill Method	Bentonite
Observations During Testing	0
Test Methods:	ASTM D5778-12
	ISO 22476-1:2012

Date tested : 28/02/23
Date reported : 17/03/23

IANZ Approved Signatory

Designation : *CPT North Island Manager*
Date : 17/03/23

This report may only be reproduced in full, including corresponding calibration data, daily logs, and CPT graphs.

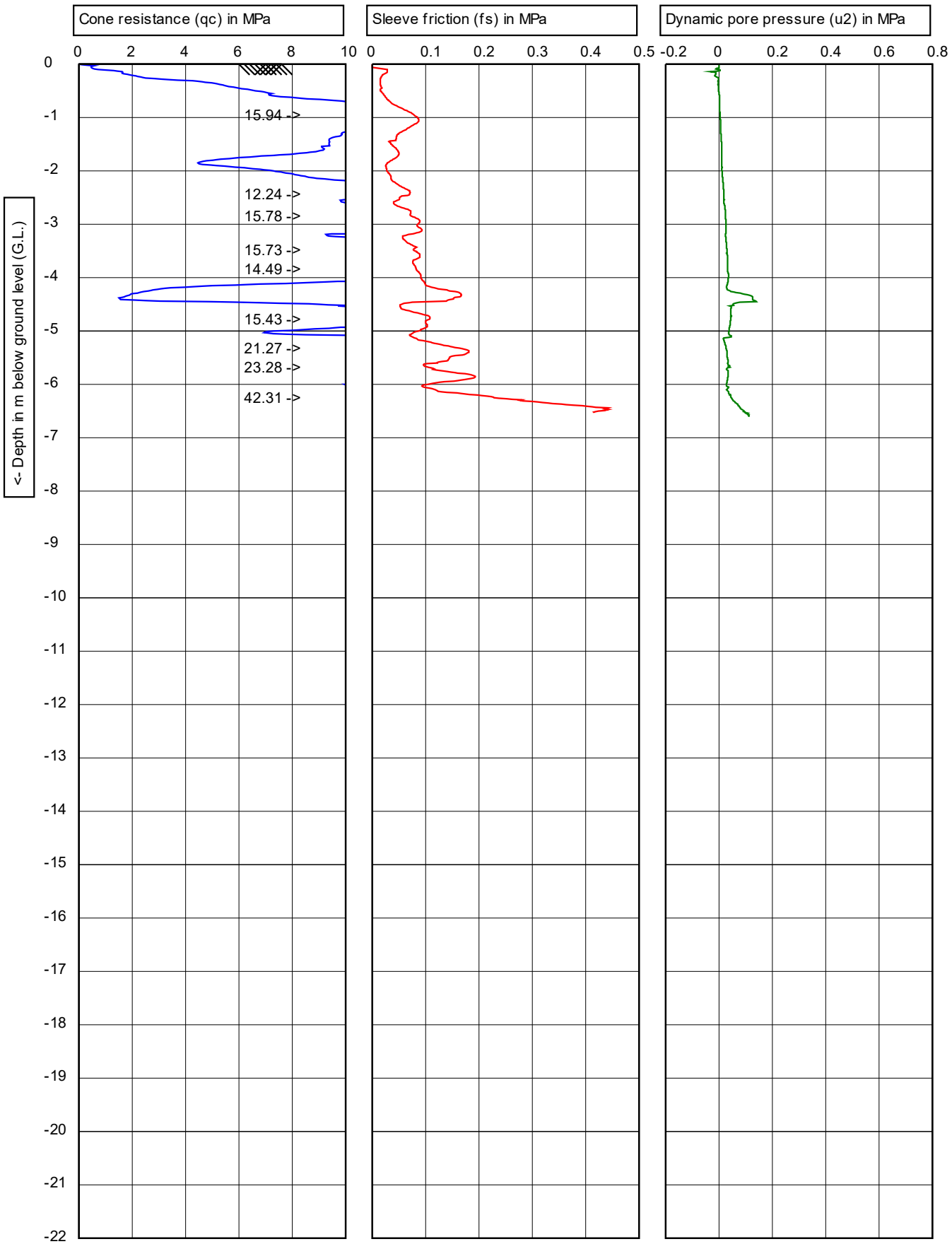
ACCREDITED IANZ TESTING LABORATORY

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Telephone +64 7 856 2870
Website www.wsp.com/nz



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.3m

Test results indicated as not accredited are outside the scope of the laboratory's accreditation

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

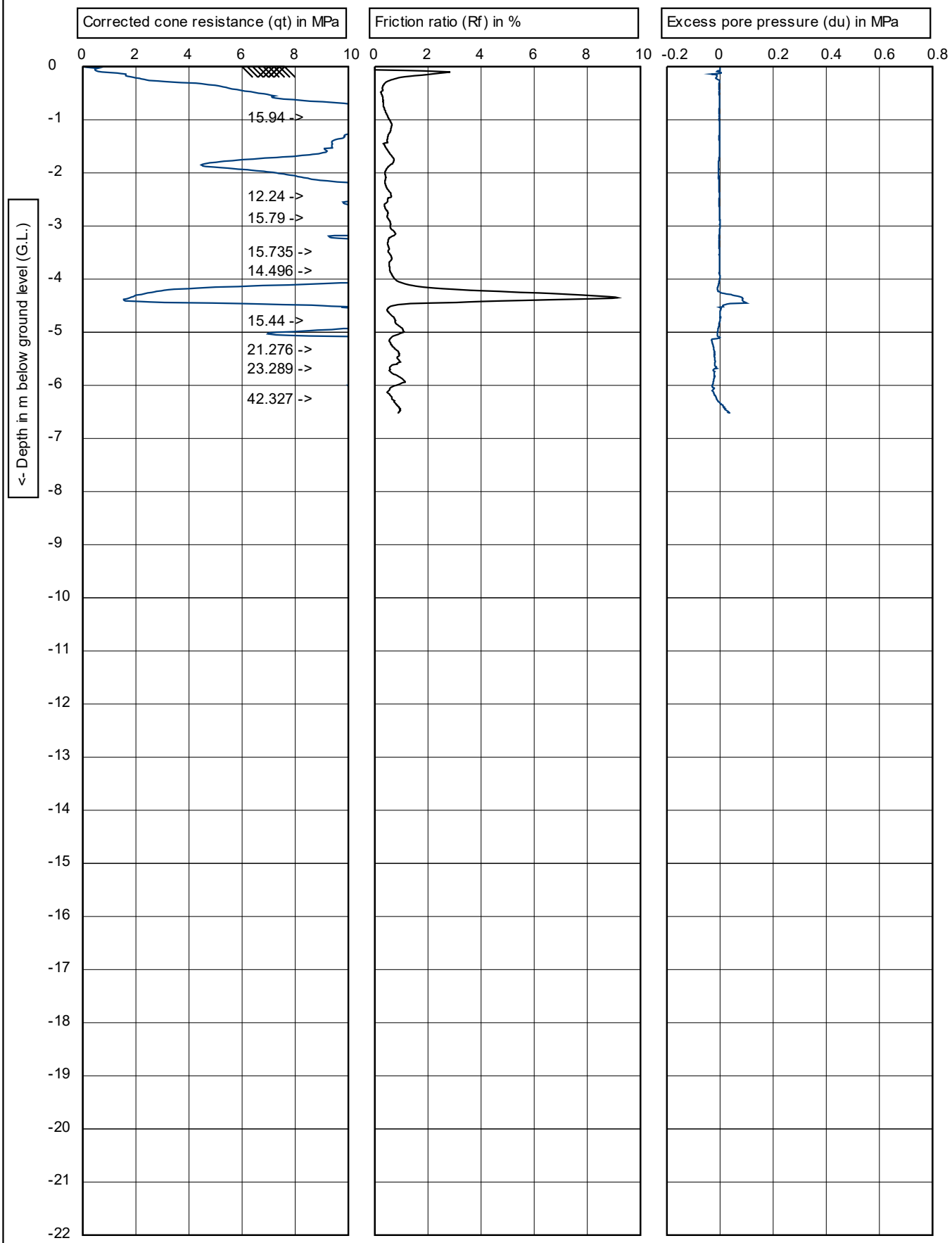
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1798635, 5519918 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**11** **1/6**

1.49



Graphs on this page are not IANZ accredited

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

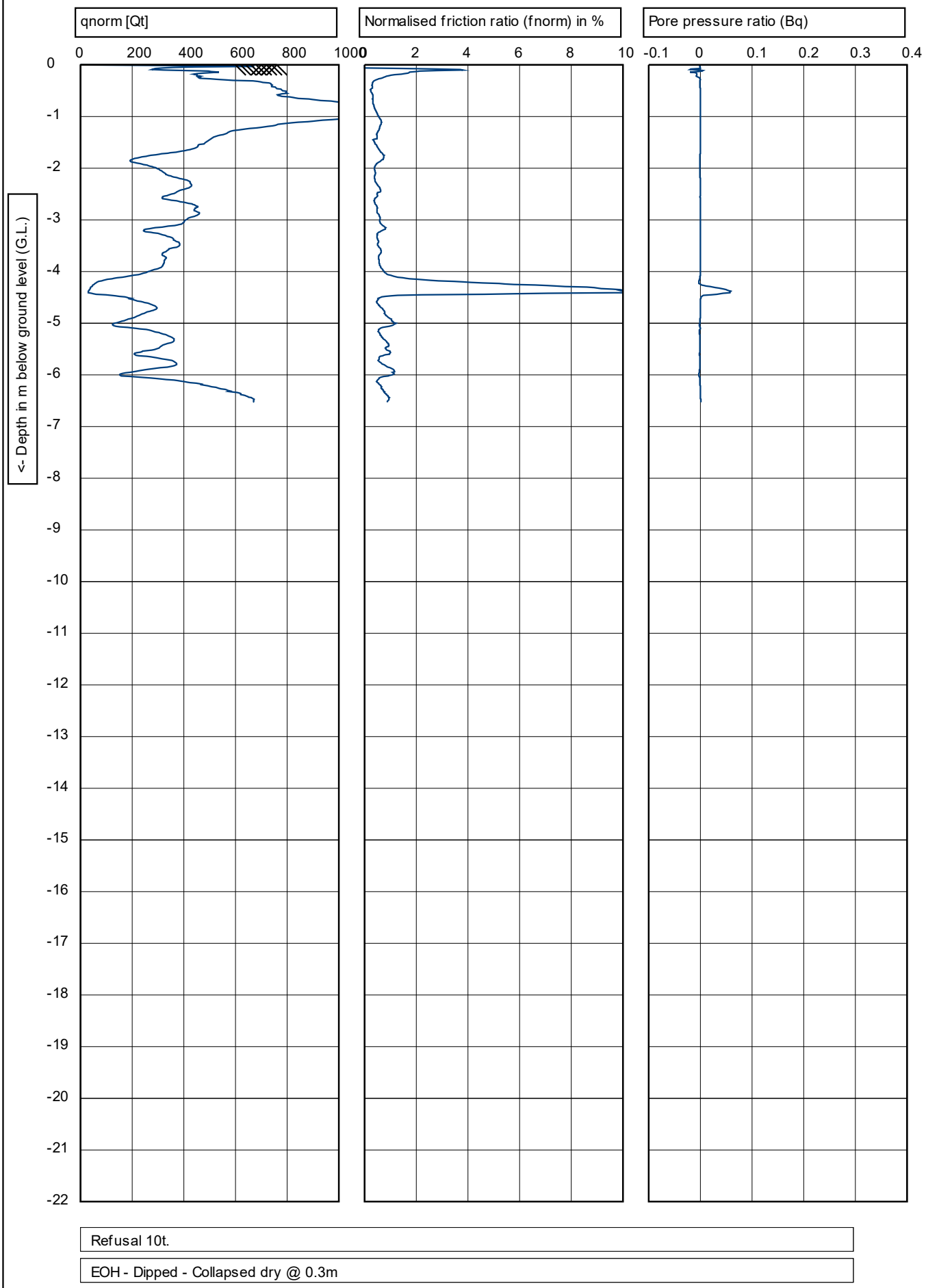
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1798635, 5519918 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**11** **2/6**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.3m

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

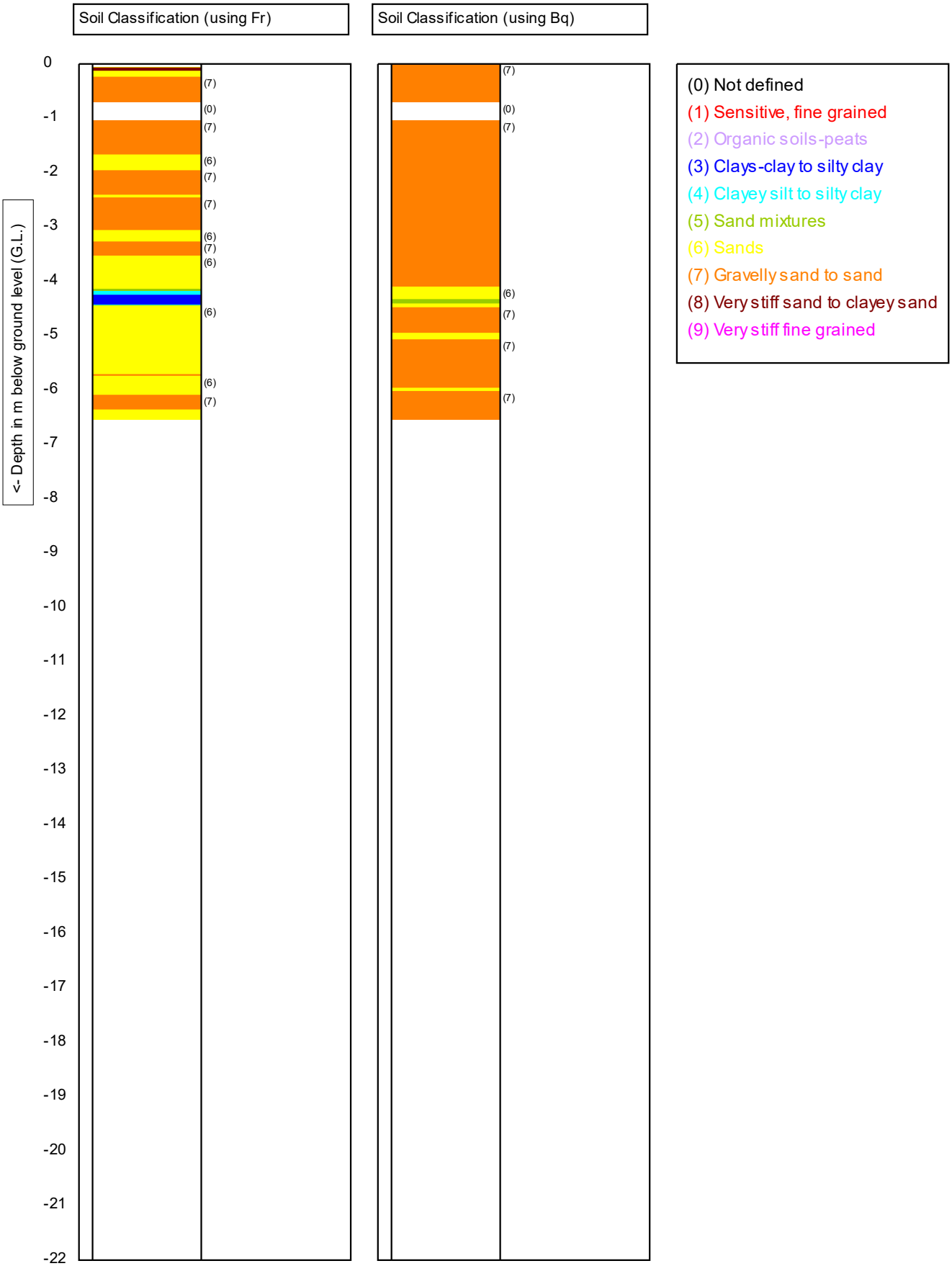
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1798635, 5519918 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**11** **3/6**

1.49



Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

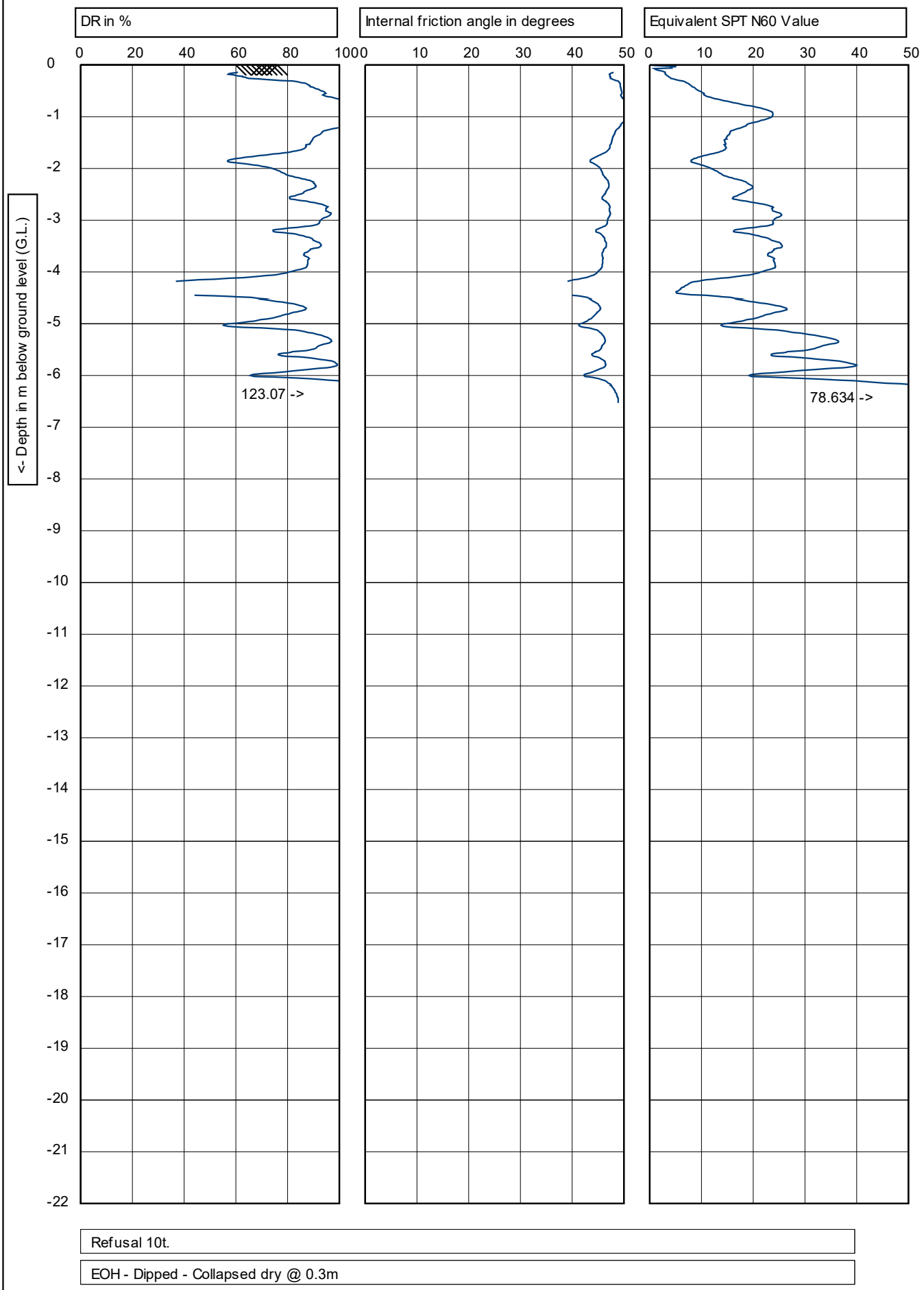
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1798635, 5519918 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**11** **4/6**

1.49

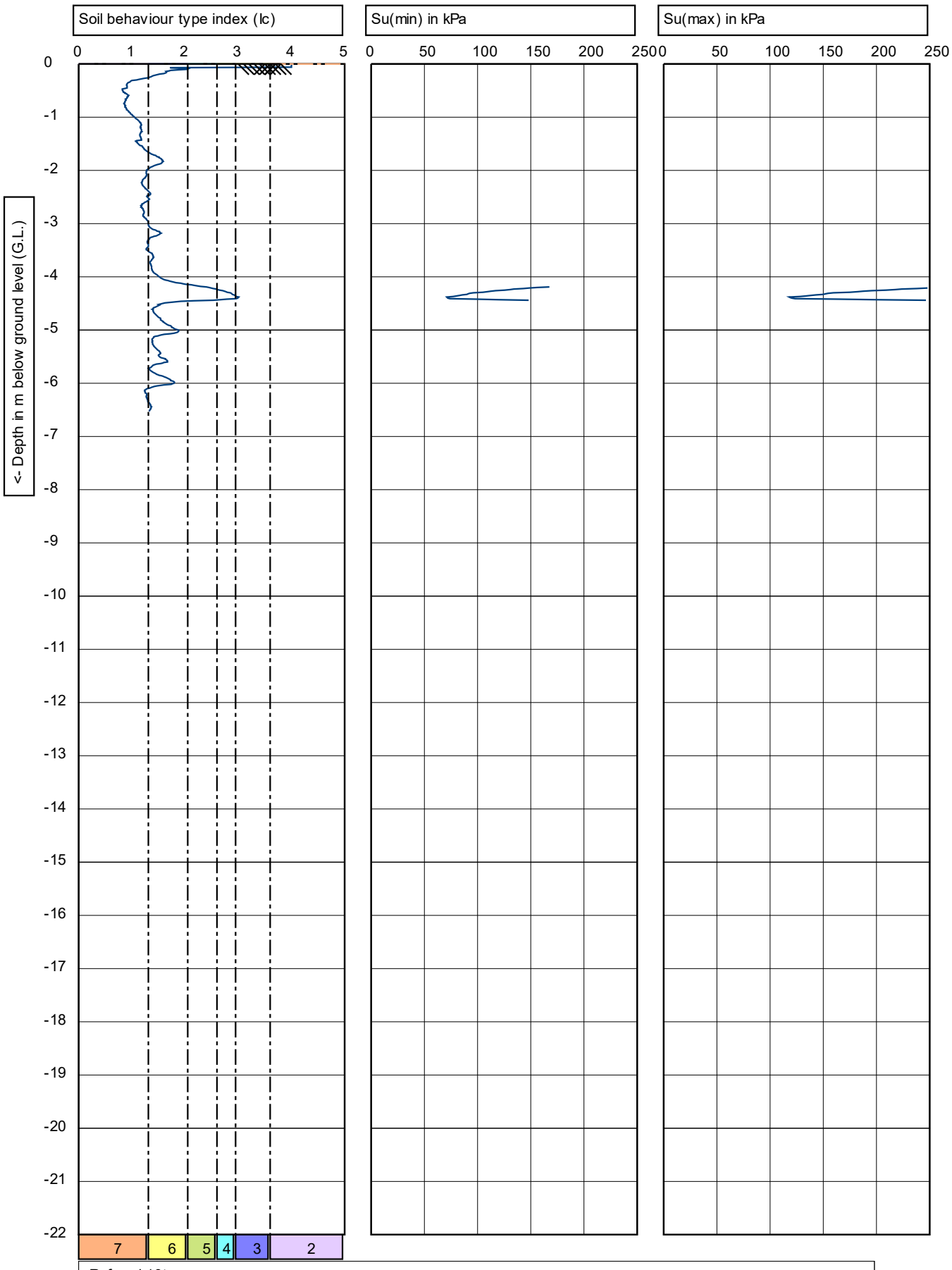


WSP

Graphs on this page are not IANZ accredited

1.49

r u2 / L 150 cm² / 10 cm²	Test according ASTM D5778:12 & ISO 22476-1:2012	Predrill:	**0.00 m Predrilled**
	G.L.: **0.00 m MSL**	Date:	**27/02/2023**
Project:	**231 Motuiti Rd**	Cone no.:	**C10CFIIP.C21082**
Location:	**Foxton (3007425)**	Project no.:	**2-68124.00_HA10441**
Position:	**1798635, 5519918 NZTM**	CPT no.:	**11** **5/6**



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.3m

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1798635, 5519918 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**11** **6/6**

1.49

CONE PENETRATION TEST REPORT

Client :	BTW Company Limited	
Project :	231 Motuiti Rd	
Location :	Foxton (3007425)	
Hole Number:	11	
Tested by :	J Kavanaugh/ L Curtis	
Date tested :	27/02/23	
Coordinates :	1798635	E
	5519918	N
Elevation :	32m	
Water level :	EOH - Dipped - Collapsed dry @ 0.3m	

Project No :	2-68124.00
Lab Ref No :	HA10441_11
Client Ref No :	3007425

Test Results

Start Time	1:47:00 PM
Time at penetration	1:53:18 PM
End Time	12:06:18 AM
Reference level	0
Ground level	0
Predrill	0
Penetration Depth	6.61
Remarks	Refusal 10t.
GPS Type	Garmin eTrex 20
GPS Accuracy	+ / - 3m
GPS Reference Grid	NZTM
GPS Datum	MSL
Rig Type	GeoMil Panther 100/ Flex 200
Rig ID	CPT03
Reaction Force	Dead weight 10/22 tonnes
Data Acquisition (Digitizer)	GeoMil GME500
Acquisition Program	GeoMil CPTest
Reporting Program	GeoMil CPTask
Cone Type	C10 (10 Tonne Compression)
Cross Sectional Area	10cm2
Cone Area Ratio	0.8
Fluid Type	Silicone Fluid
Friction Reducer	0.55m behind base of cone
Application Class (ISO 22476-1)	3
Test Type (ISO 22476-1)	TE2 (Measured Cone and Sleeve)
Back Fill Method	Bentonite
Observations During Testing	0
Test Methods:	ASTM D5778-12
	ISO 22476-1:2012

Date tested : 27/02/23
Date reported : 17/03/23

IANZ Approved Signatory

Designation : *CPT North Island Manager*
Date : 17/03/23

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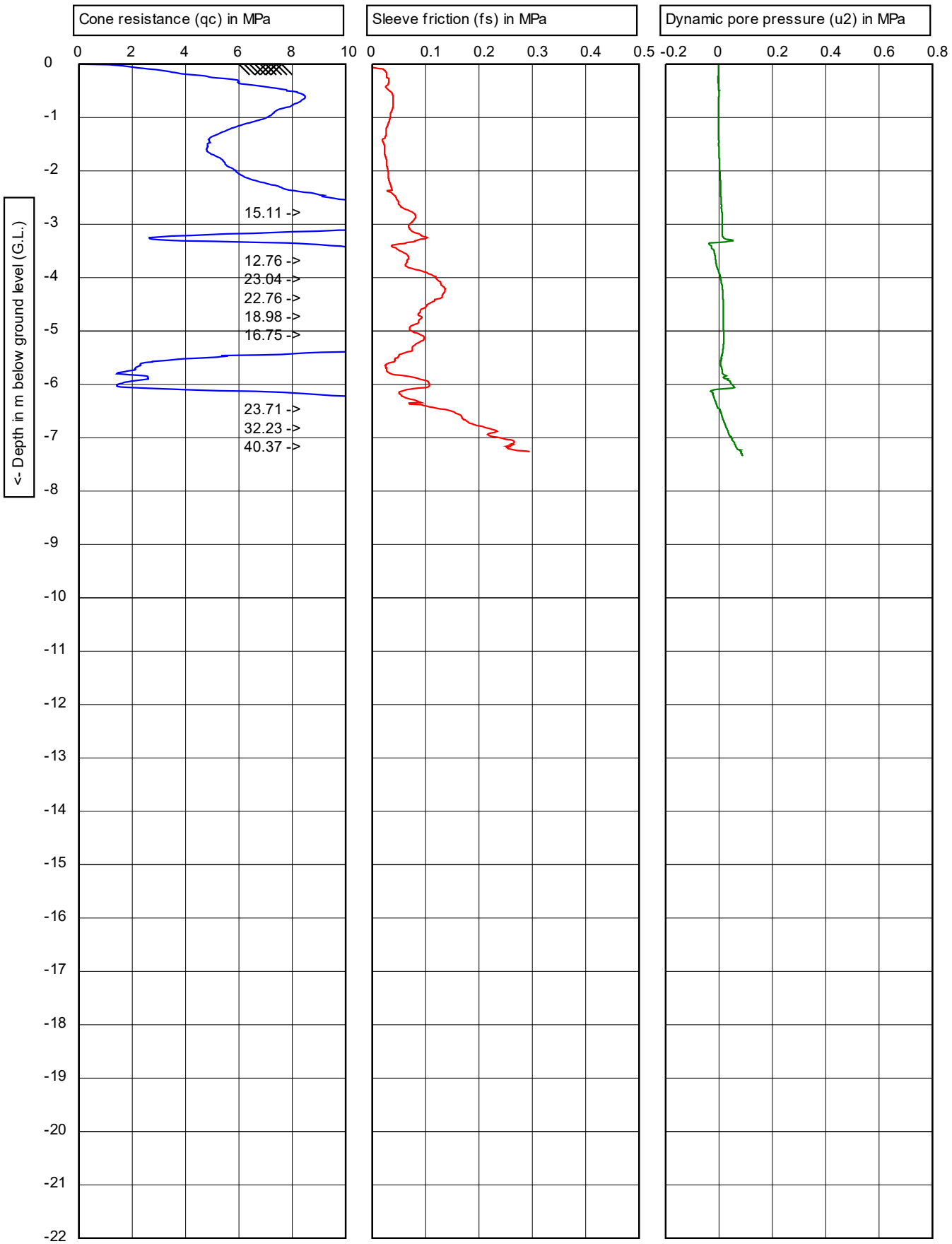
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Website www.wsp.com/nz



Refusal 10t.

EOH - Dipped - Collapsed dry @ 1.5m

Test results indicated as not accredited are outside the scope of the laboratory's accreditation

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

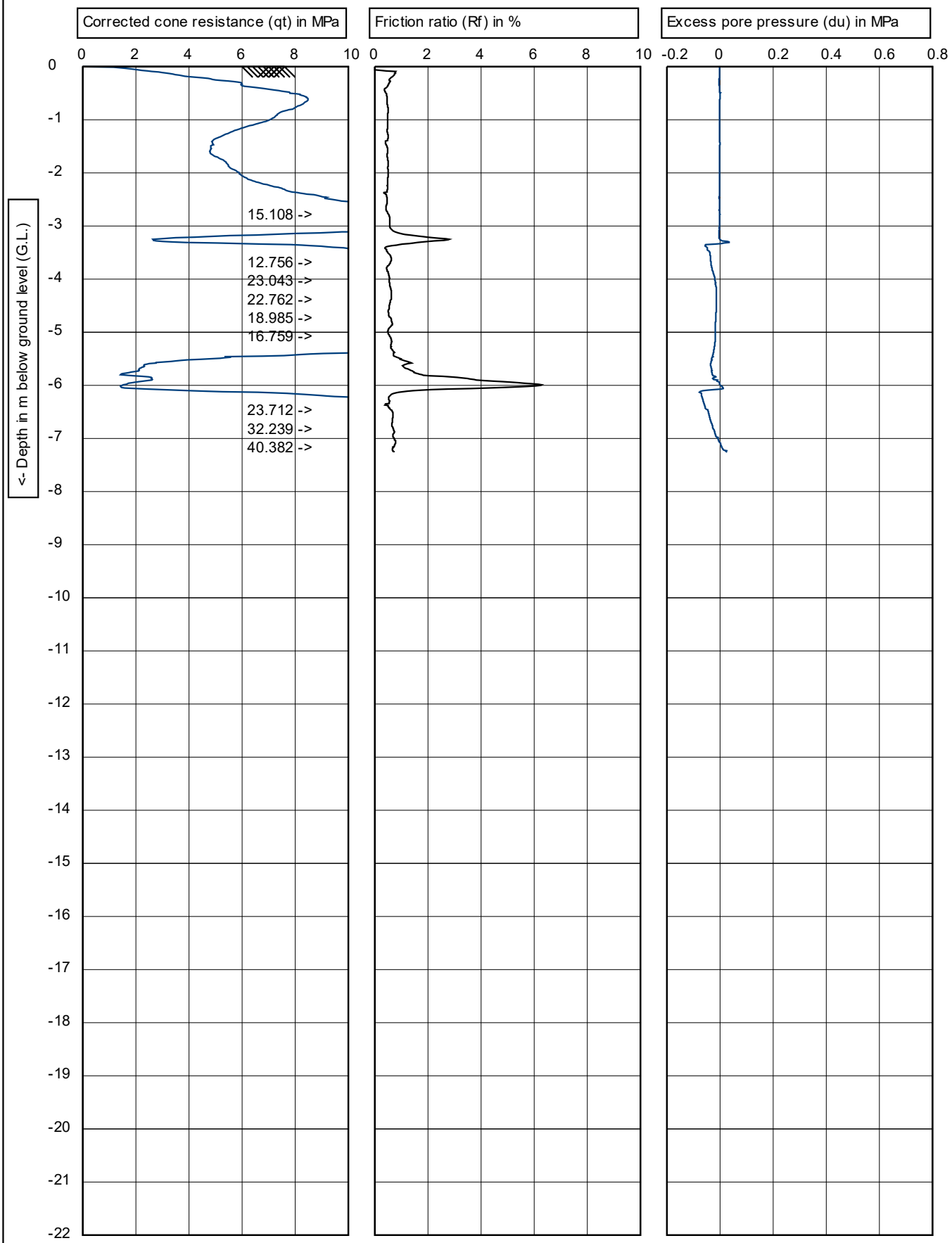
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799074, 5520298 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**12**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 1.5m

Graphs on this page are not IANZ accredited

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

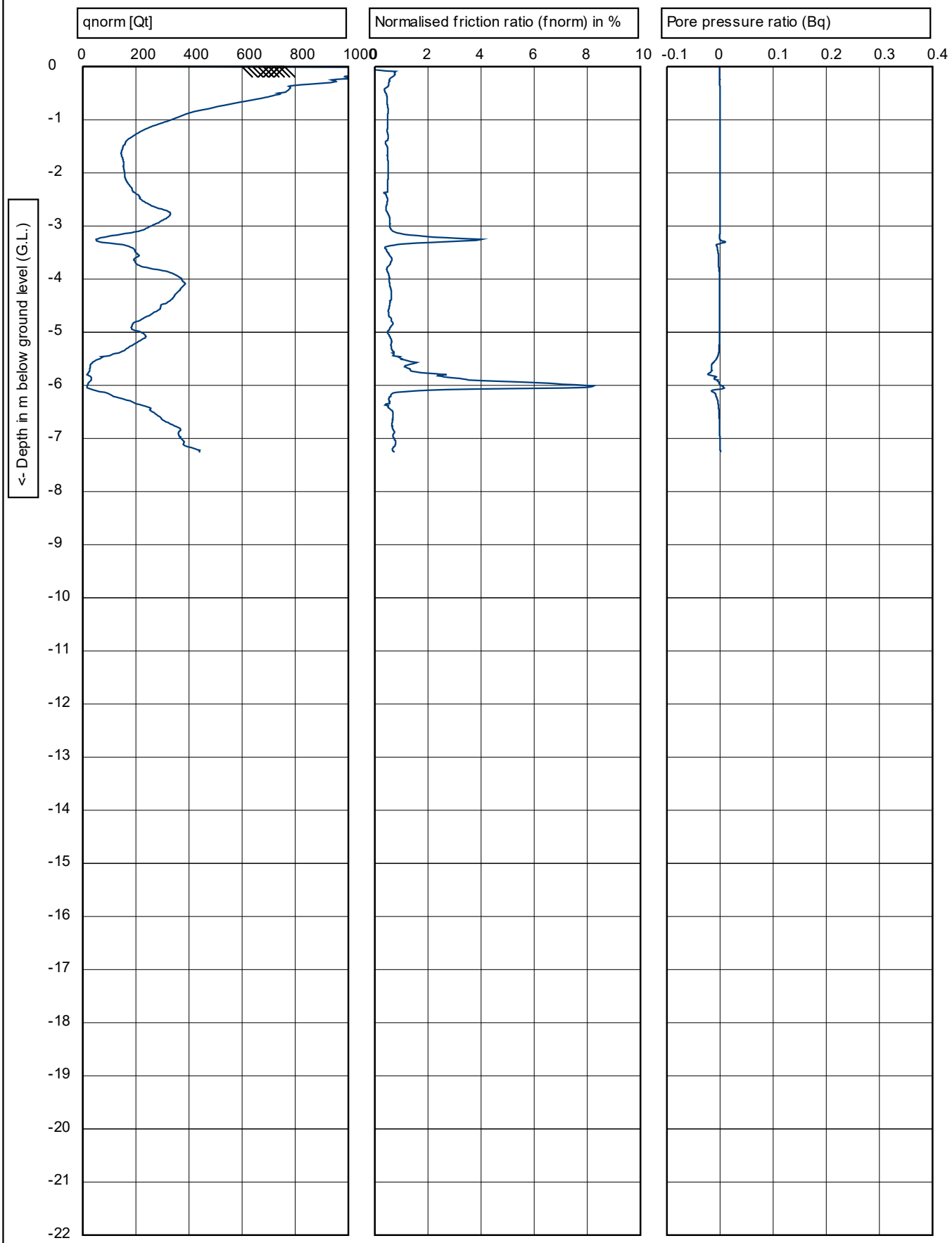
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799074, 5520298 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**12**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 1.5m

Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

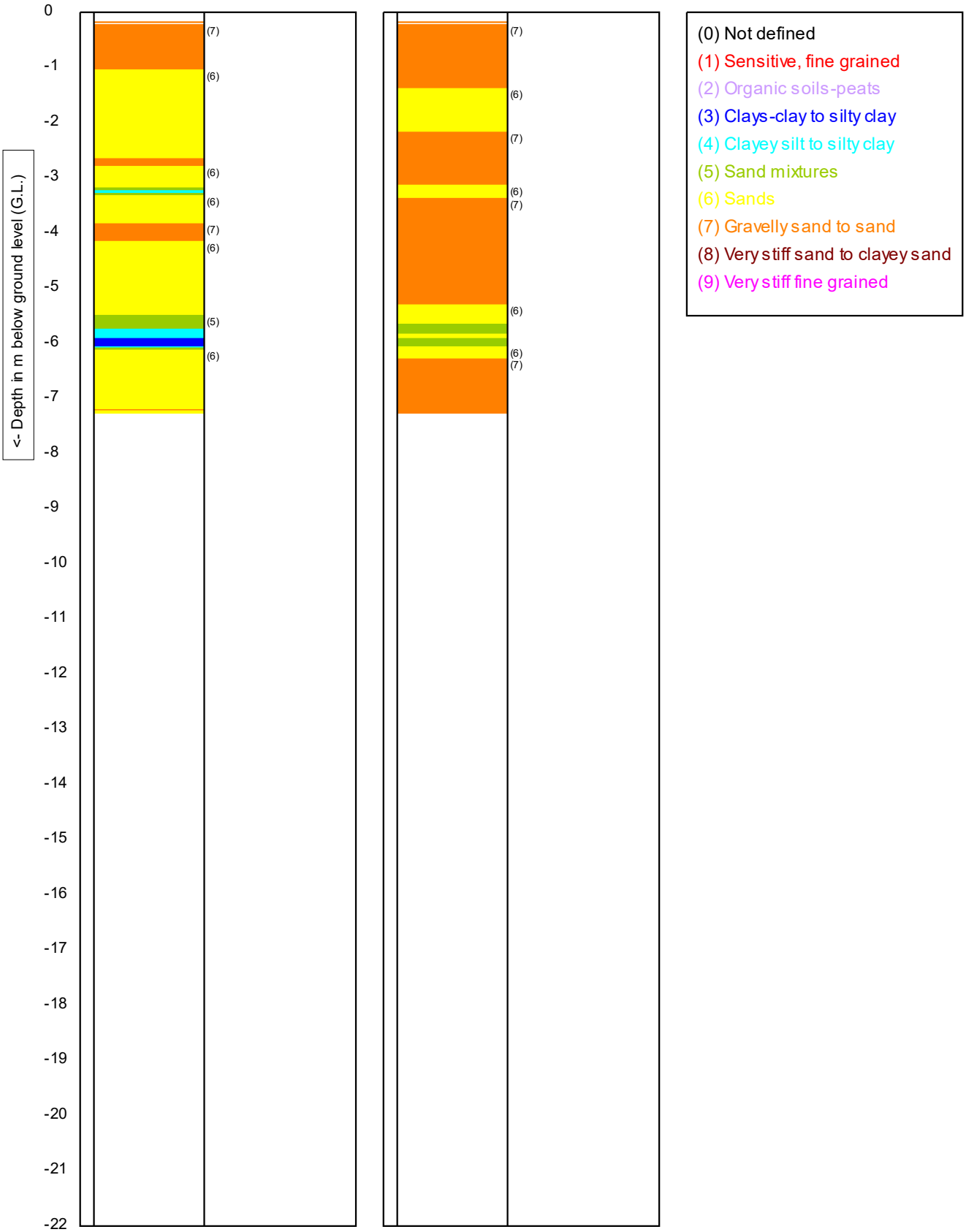
Position: **1799074, 5520298 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**12** **3/6**

1.49

Soil Classification (using Fr)

Soil Classification (using Bq)



(0) Not defined
(1) Sensitive, fine grained
(2) Organic soils-peats
(3) Clays-clay to silty clay
(4) Clayey silt to silty clay
(5) Sand mixtures
(6) Sands
(7) Gravelly sand to sand
(8) Very stiff sand to clayey sand
(9) Very stiff fine grained

Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

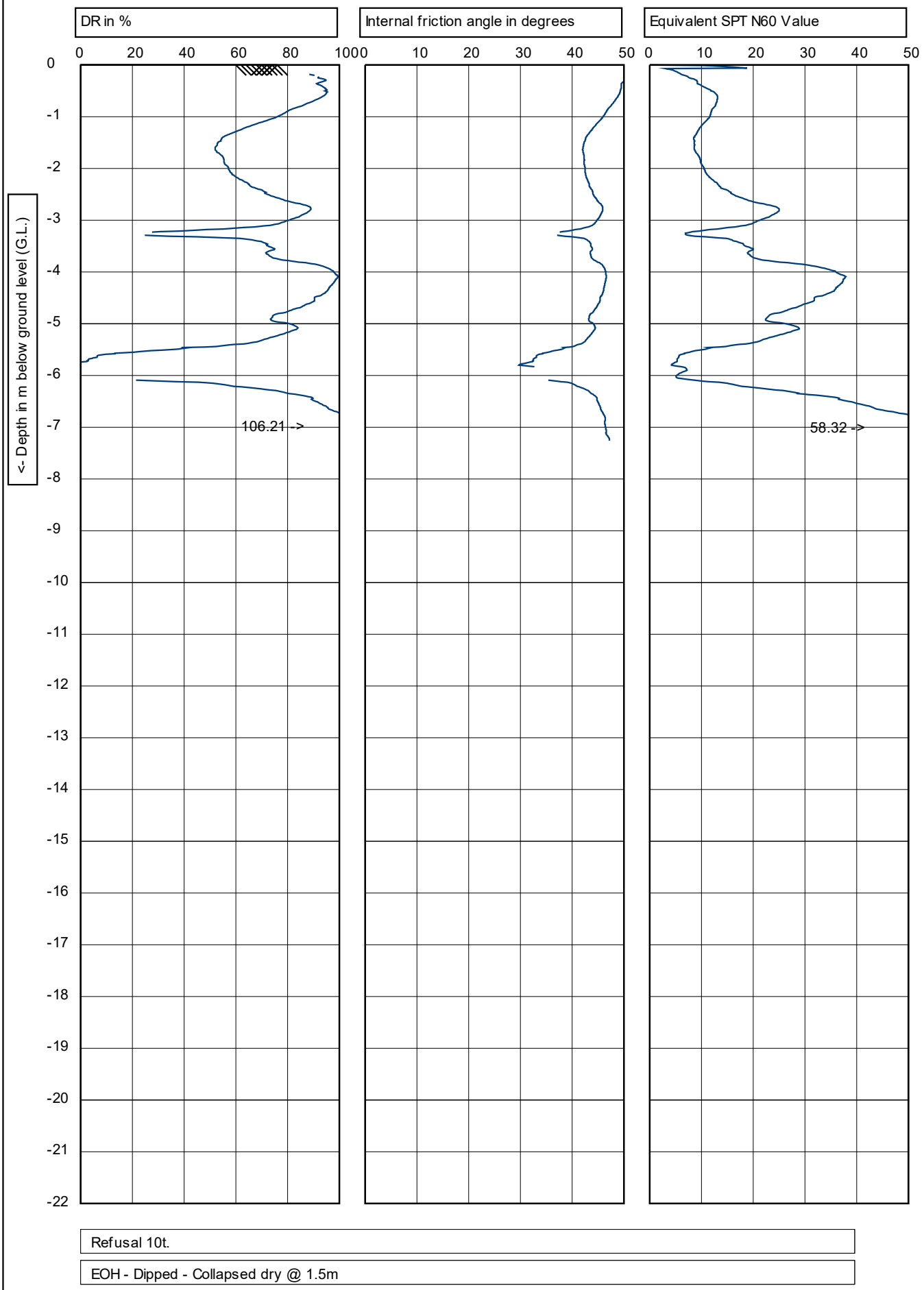
Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**
Location: **Foxton (3007425)**
Position: **1799074, 5520298 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**12**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 1.5m

WSP

Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

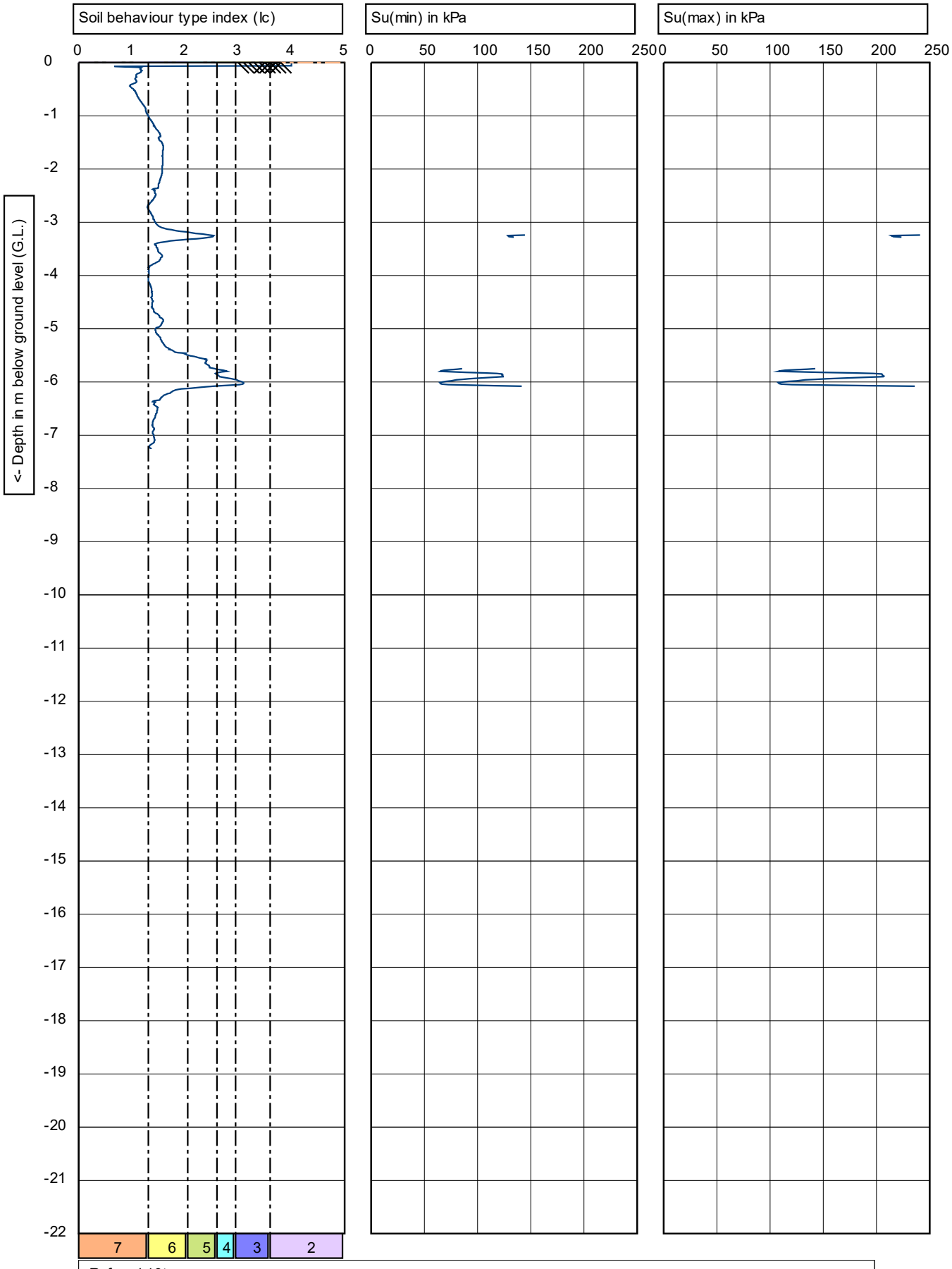
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799074, 5520298 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**12** **5/6**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 1.5m

Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799074, 5520298 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**12** **6/6**

1.49

CONE PENETRATION TEST REPORT

Client :	BTW Company Limited
Project :	231 Motuiti Rd
Location :	Foxton (3007425)
Hole Number:	12
Tested by :	J Kavanaugh/ L Curtis
Date tested :	28/02/23
Coordinates :	1799074 E
	5520298 N
Elevation :	17m
Water level :	EOH - Dipped - Collapsed dry @ 1.5m

Project No :	2-68124,00
Lab Ref No :	HA10441_12
Client Ref No :	3007425

Test Results

Start Time	8:56:00 AM
Time at penetration	9:02:37 AM
End Time	12:06:37 AM
Reference level	0
Ground level	0
Predrill	0
Penetration Depth	7.34
Remarks	Refusal 10t.
GPS Type	Garmin eTrex 20
GPS Accuracy	+ / - 3m
GPS Reference Grid	NZTM
GPS Datum	MSL
Rig Type	GeoMil Panther 100/ Flex 200
Rig ID	CPT03
Reaction Force	Dead weight 10/22 tonnes
Data Acquisition (Digitizer)	GeoMil GME500
Acquisition Program	GeoMil CPTest
Reporting Program	GeoMil CPTask
Cone Type	C10 (10 Tonne Compression)
Cross Sectional Area	10cm2
Cone Area Ratio	0.8
Fluid Type	Silicone Fluid
Friction Reducer	0.55m behind base of cone
Application Class (ISO 22476-1)	3
Test Type (ISO 22476-1)	TE2 (Measured Cone and Sleeve)
Back Fill Method	Bentonite
Observations During Testing	0
Test Methods:	ASTM D5778-12
	ISO 22476-1:2012

Date tested : 28/02/23
Date reported : 17/03/23

IANZ Approved Signatory

Designation : *CPT North Island Manager*
Date : 17/03/23

This report may only be reproduced in full, including corresponding calibration data, daily logs, and CPT graphs.

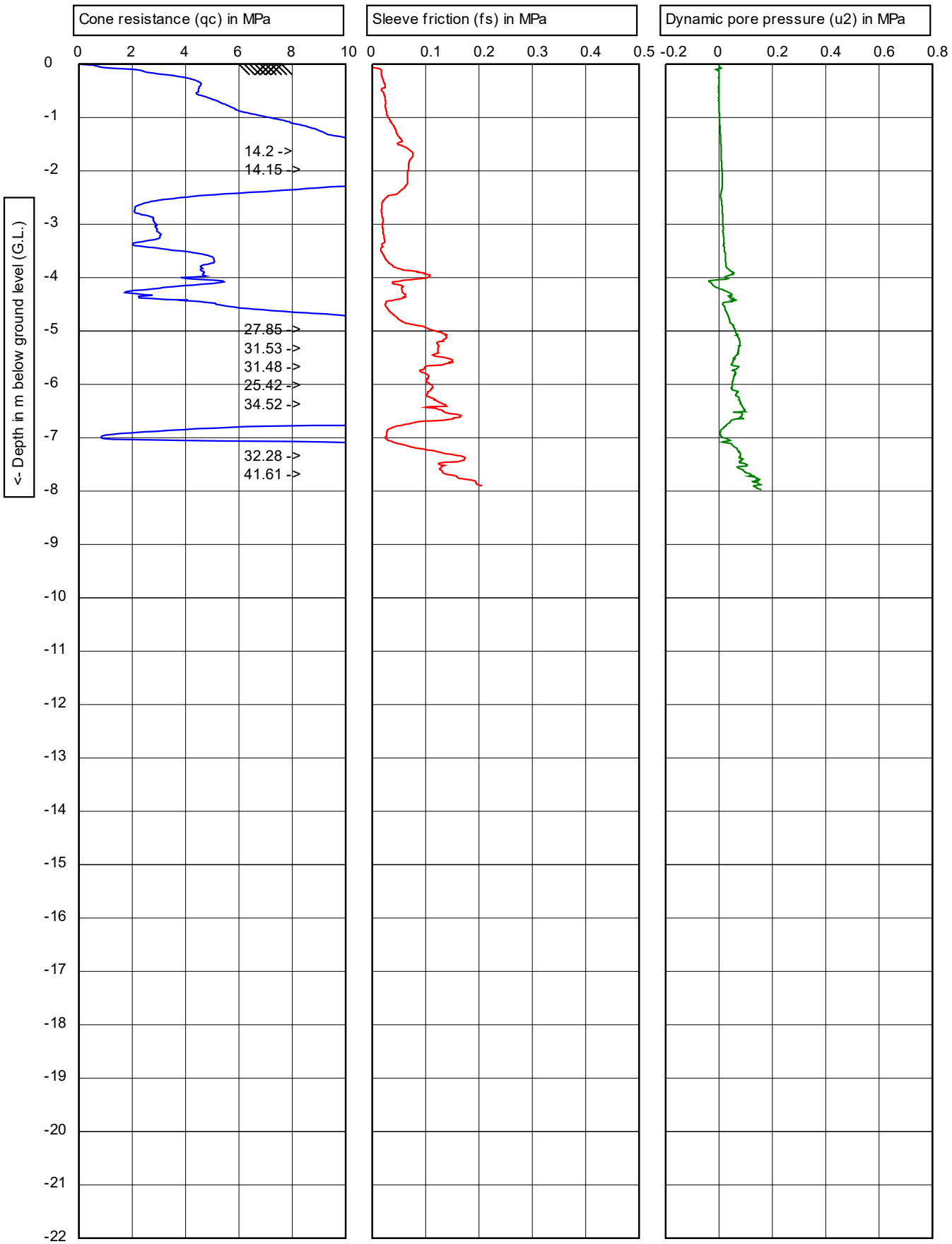
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4 Fox Street
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3240, Hamilton, New Zealand

Telephone +64 7 856 2870
Website www.wsp.com/nz



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.8m

Test results indicated as not accredited are outside the scope of the laboratory's accreditation

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

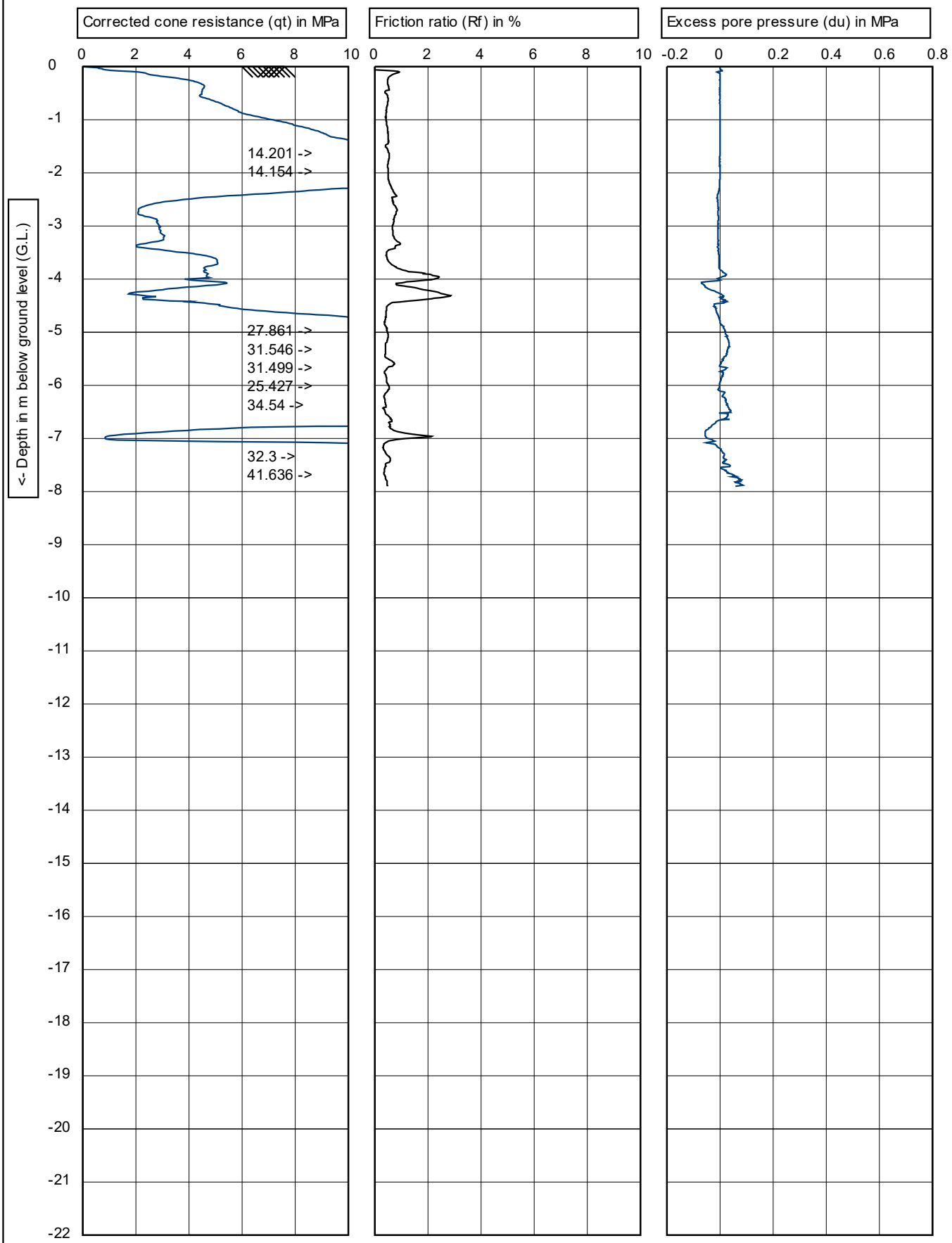
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799111, 5519725 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**13**

1.49



Graphs on this page are not IANZ accredited

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

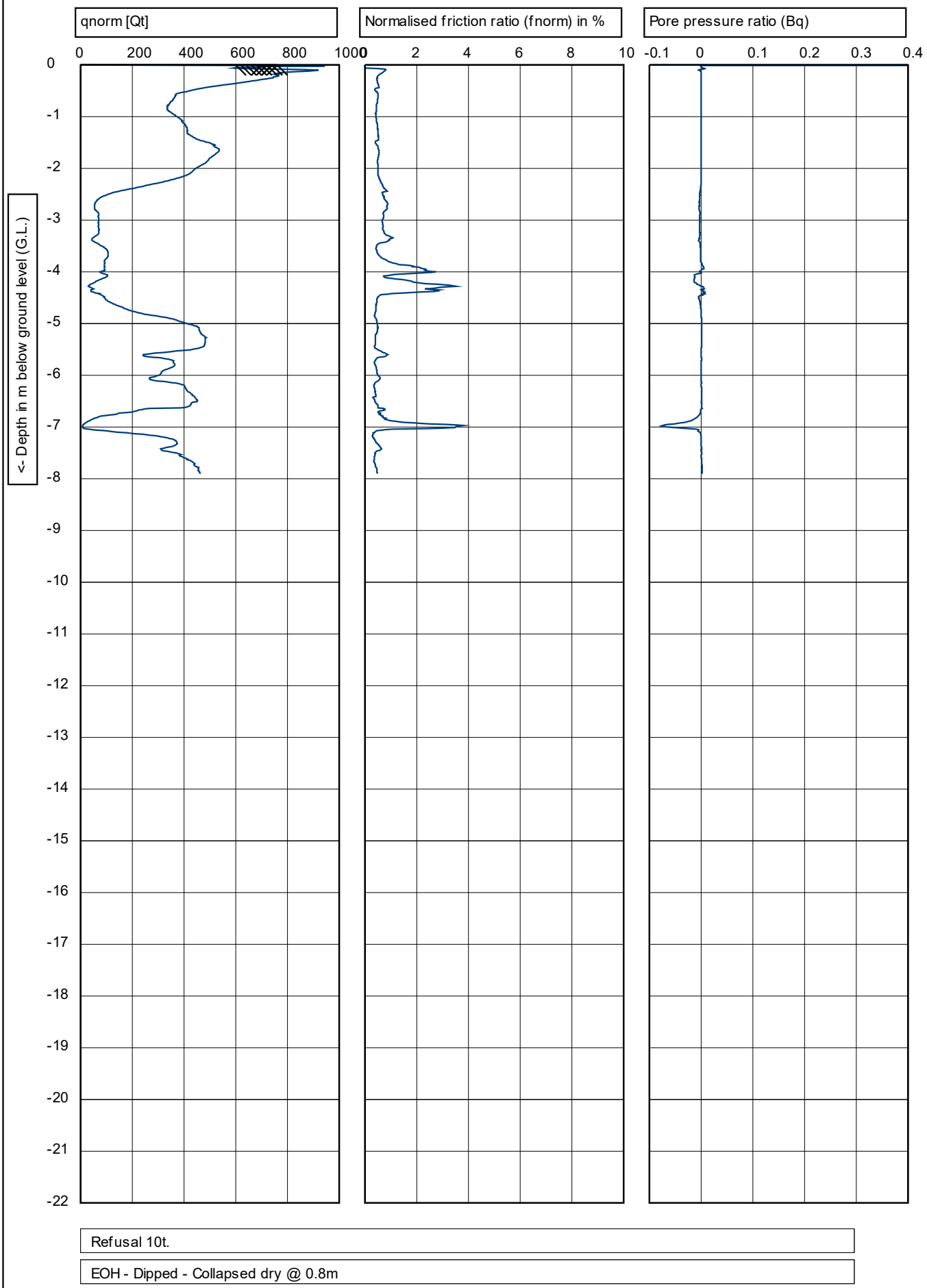
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799111, 5519725 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**13**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.8m

Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

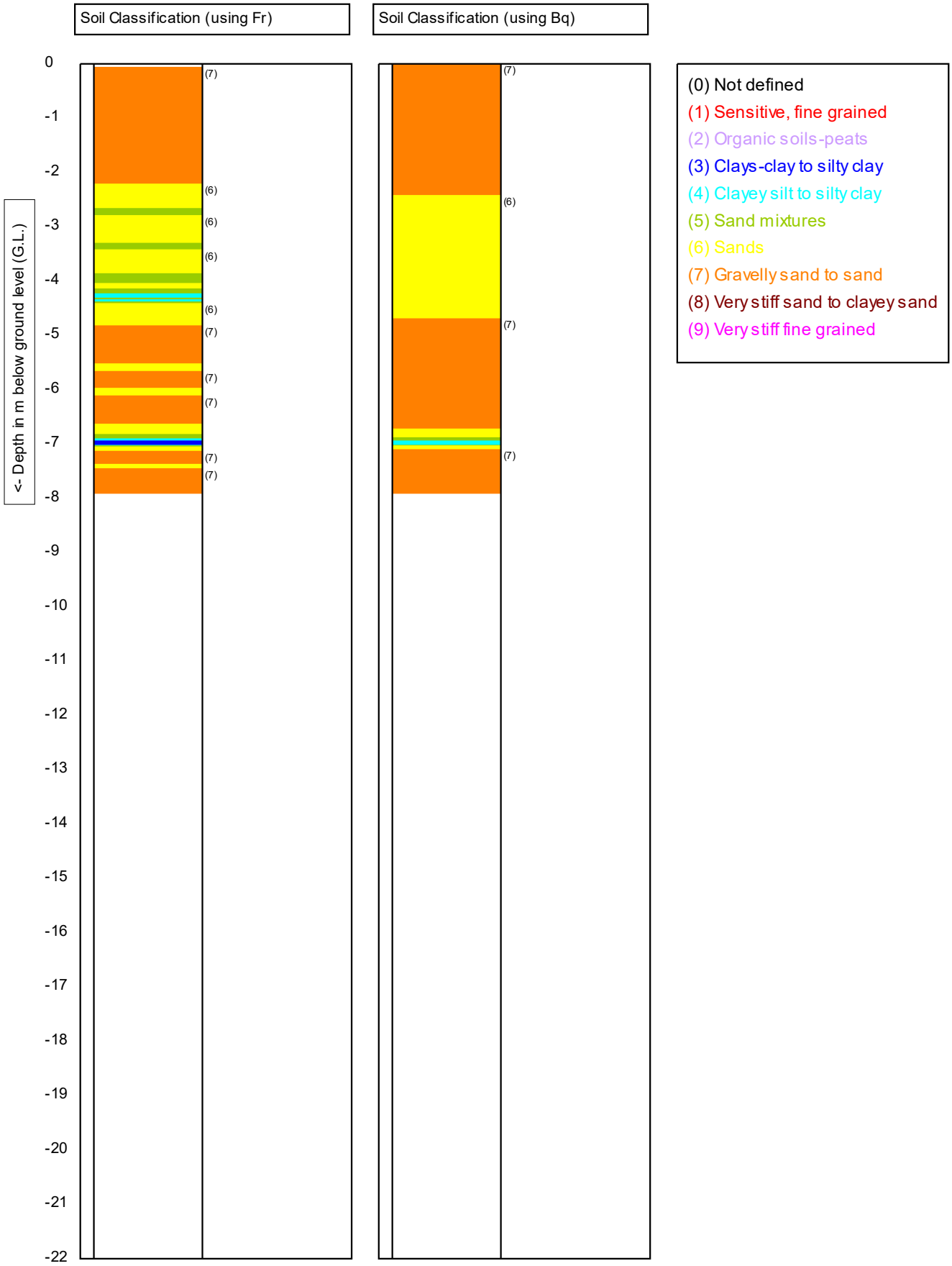
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799111, 5519725 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**13**

1.49



Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

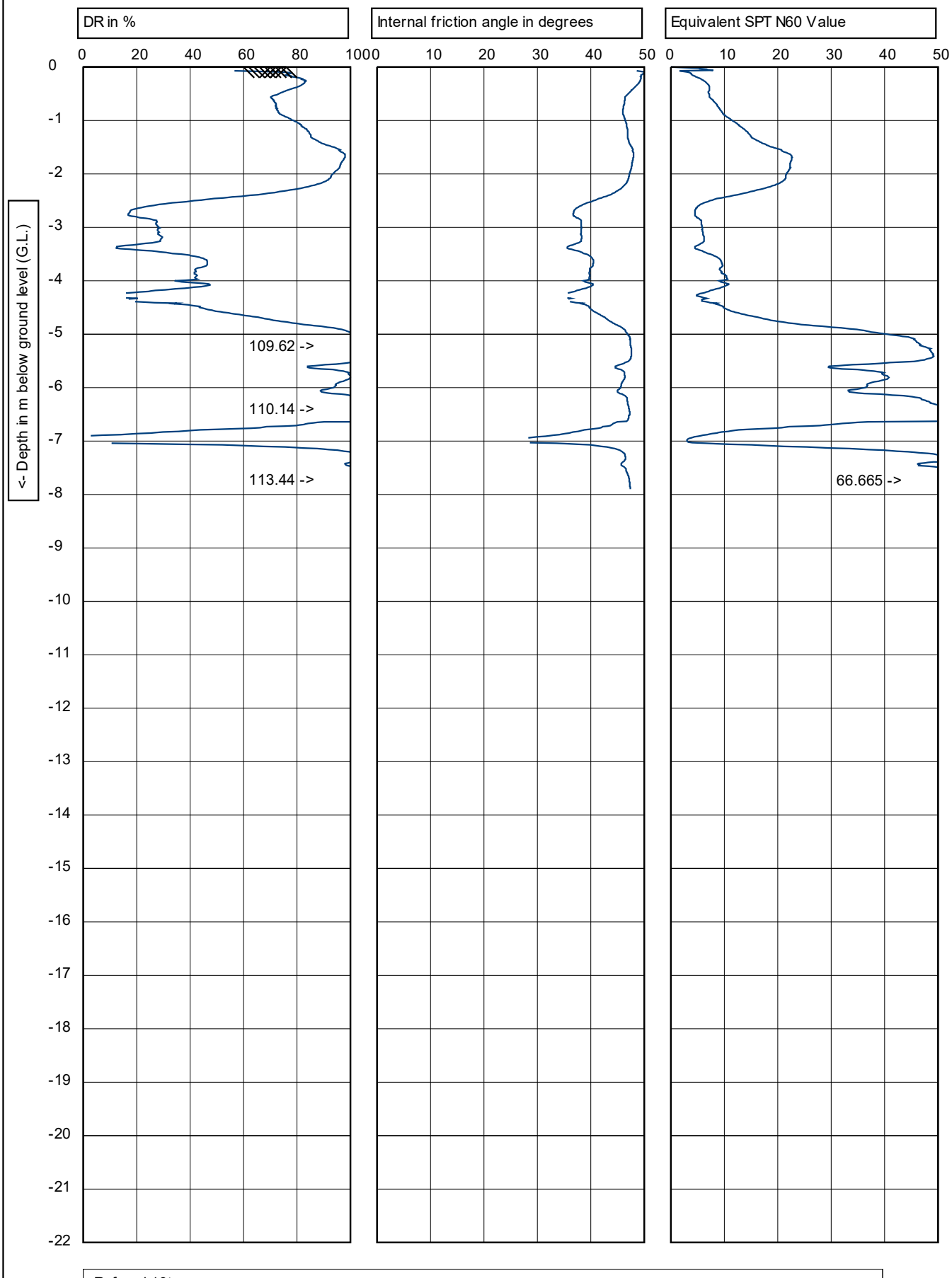
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799111, 5519725 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**13** **4/6**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.8m

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

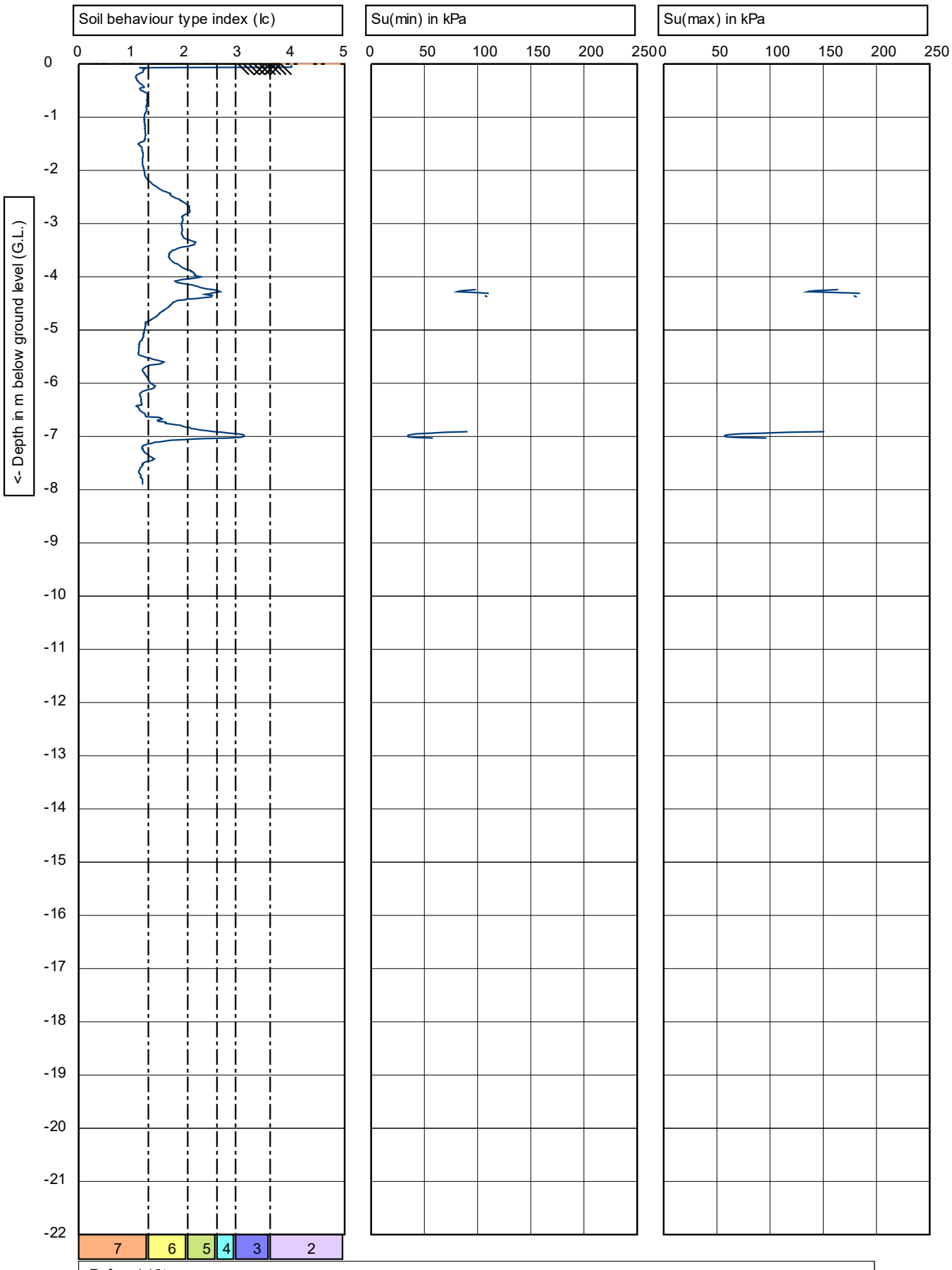
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799111, 5519725 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**13** **5/6**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.8m

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799111, 5519725 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**13** **6/6**

1.49

CONE PENETRATION TEST REPORT

Client :	BTW Company Limited	
Project :	231 Motuiti Rd	
Location :	Foxton (3007425)	
Hole Number:	13	
Tested by :	J Kavanaugh/ L Curtis	
Date tested :	27/02/23	
Coordinates :	1799111	E
	5519725	N
Elevation :	20m	
Water level :	EOH - Dipped - Collapsed dry @ 0.8m	

Project No :	2-68124.00
Lab Ref No :	HA10441_13
Client Ref No :	3007425

Test Results

Start Time	2:38:00 PM
Time at penetration	2:46:03 PM
End Time	12:08:03 AM
Reference level	0
Ground level	0
Predrill	0
Penetration Depth	7.98
Remarks	Refusal 10t.
GPS Type	Garmin eTrex 20
GPS Accuracy	+ / - 3m
GPS Reference Grid	NZTM
GPS Datum	MSL
Rig Type	GeoMil Panther 100/ Flex 200
Rig ID	CPT03
Reaction Force	Dead weight 10/22 tonnes
Data Acquisition (Digitizer)	GeoMil GME500
Acquisition Program	GeoMil CPTest
Reporting Program	GeoMil CPTask
Cone Type	C10 (10 Tonne Compression)
Cross Sectional Area	10cm2
Cone Area Ratio	0.8
Fluid Type	Silicone Fluid
Friction Reducer	0.55m behind base of cone
Application Class (ISO 22476-1)	3
Test Type (ISO 22476-1)	TE2 (Measured Cone and Sleeve)
Back Fill Method	Bentonite
Observations During Testing	0
Test Methods:	ASTM D5778-12
	ISO 22476-1:2012

Date tested : 27/02/23
Date reported : 17/03/23

IANZ Approved Signatory

Designation : *CPT North Island Manager*
Date : 17/03/23

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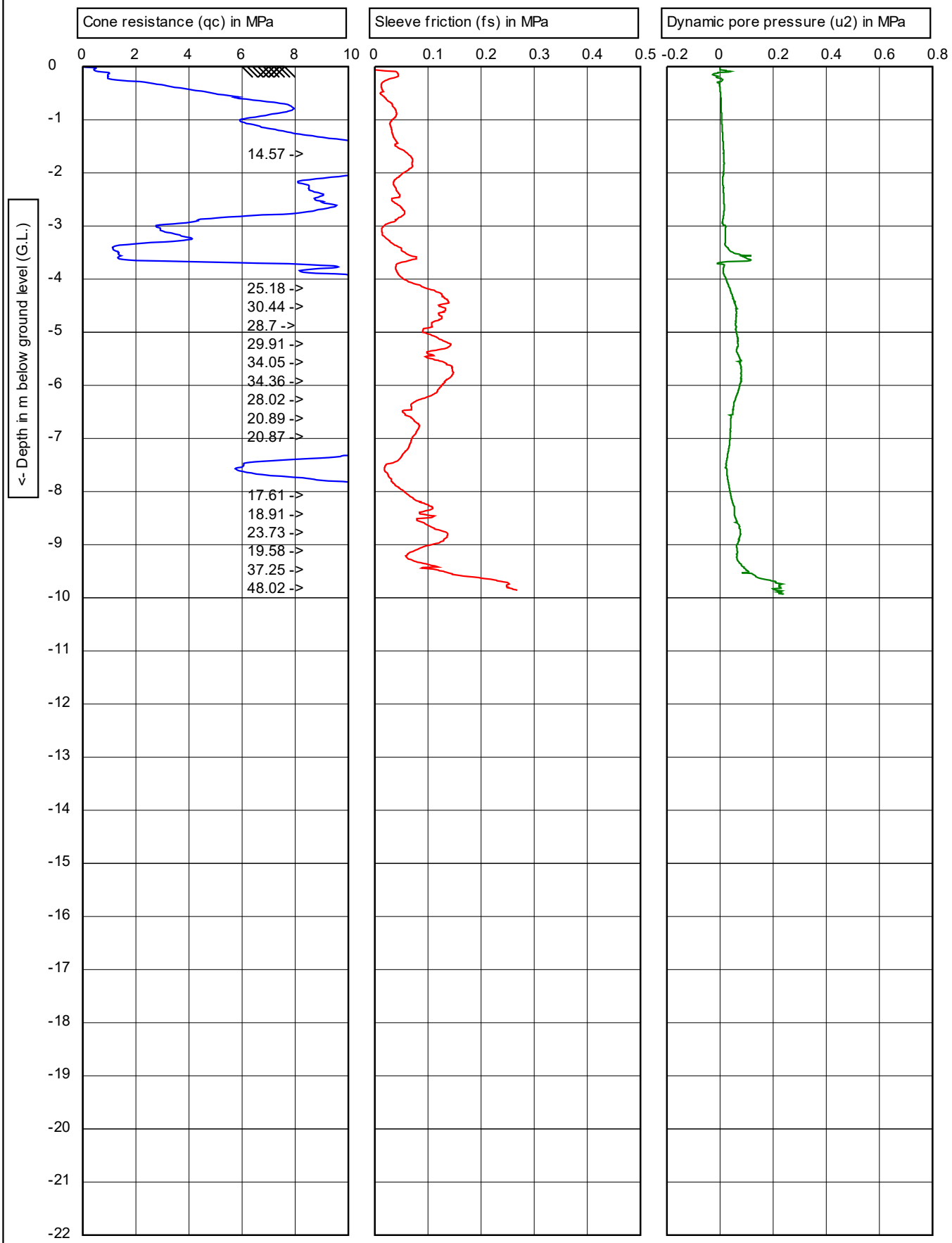
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Website www.wsp.com/nz



Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

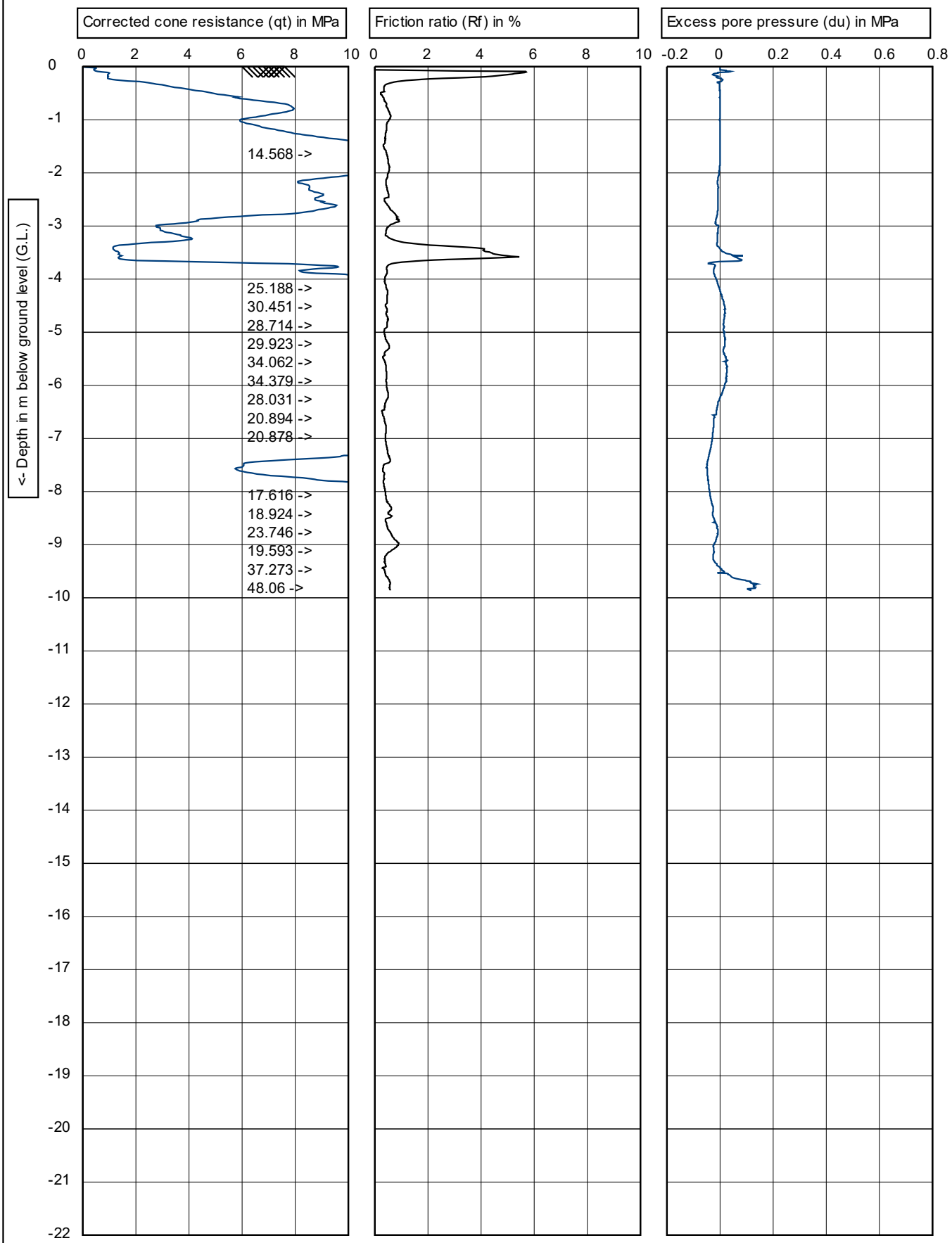
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799490, 5520024 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**14**

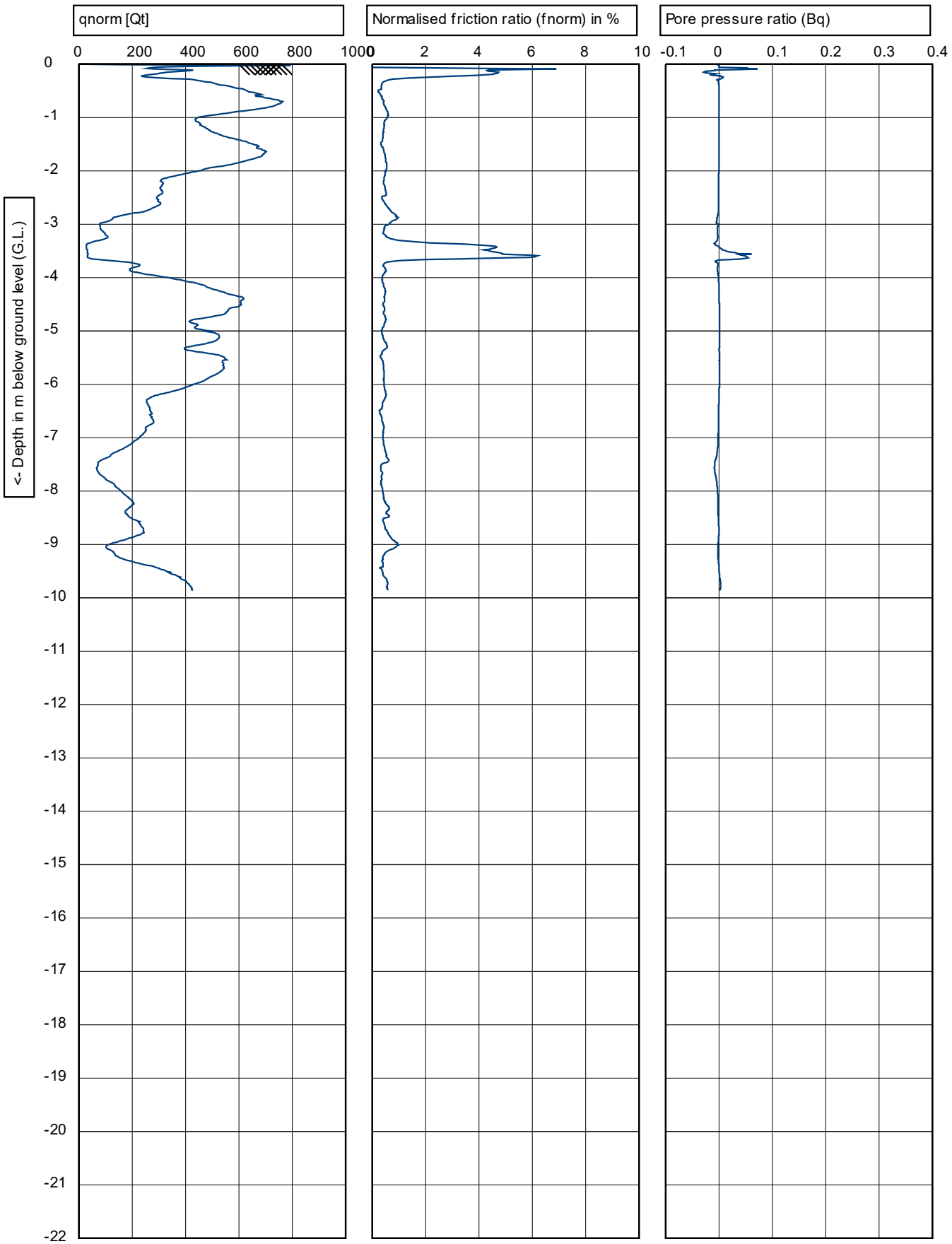
Test results indicated as not accredited are outside the scope of the laboratory's accreditation



Graphs on this page are not IANZ accredited

Test according ASTM D5778:12 & ISO 22476-1:2012		Predrill:	0.00 m Predrilled
G.L.: 0.00 m MSL		Date:	28/02/2023
Project:	231 Motuiti Rd	Cone no.:	C10CFIIP.C181009
Location:	Foxton (3007425)	Project no.:	2-68124.00_HA10441
Position:	1799490, 5520024 NZTM	CPT no.:	14 2/6

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.3m

Graphs on this page are not IANZ accredited

u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

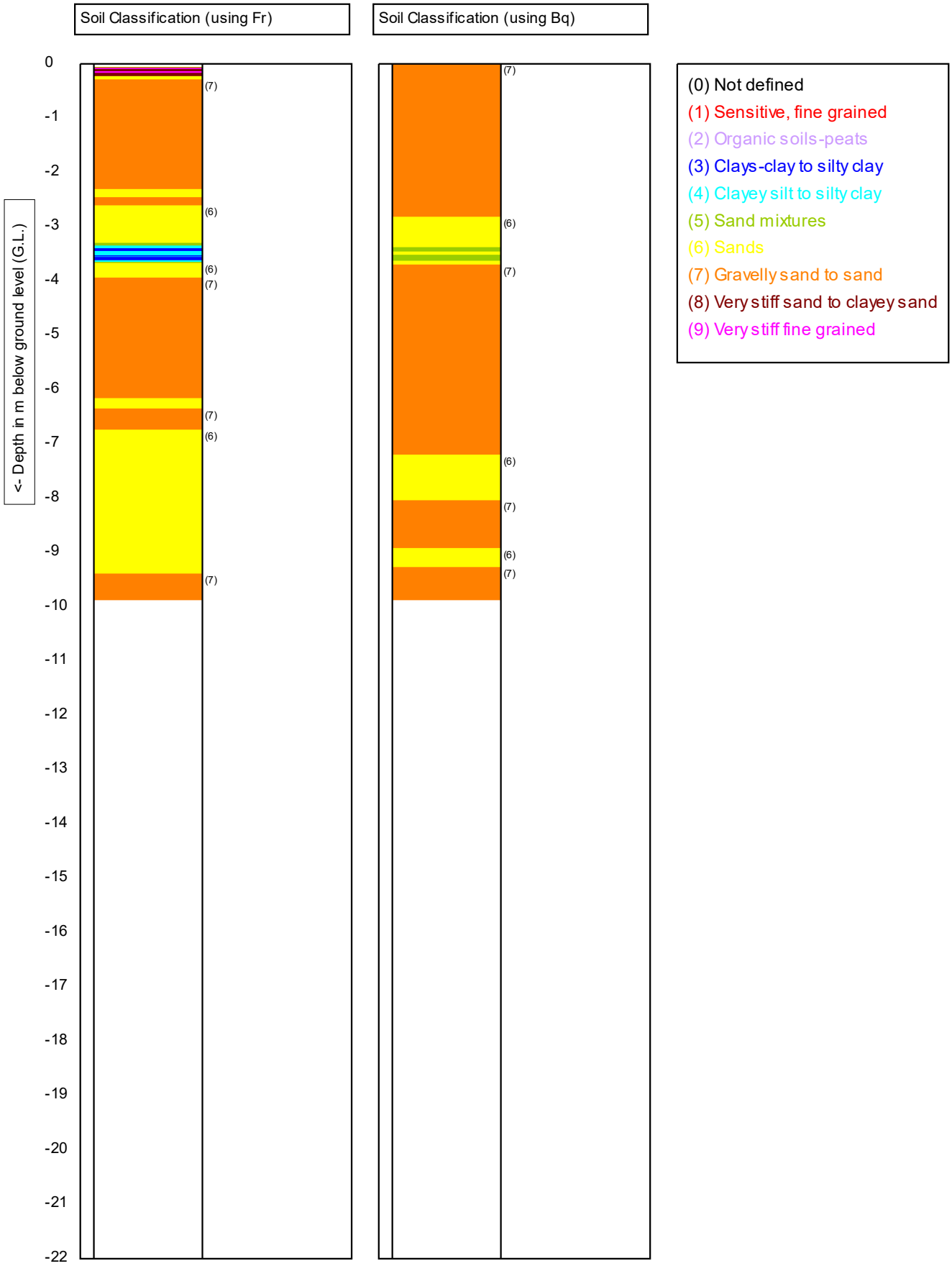
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799490, 5520024 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**14** **3/6**

1.49



Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

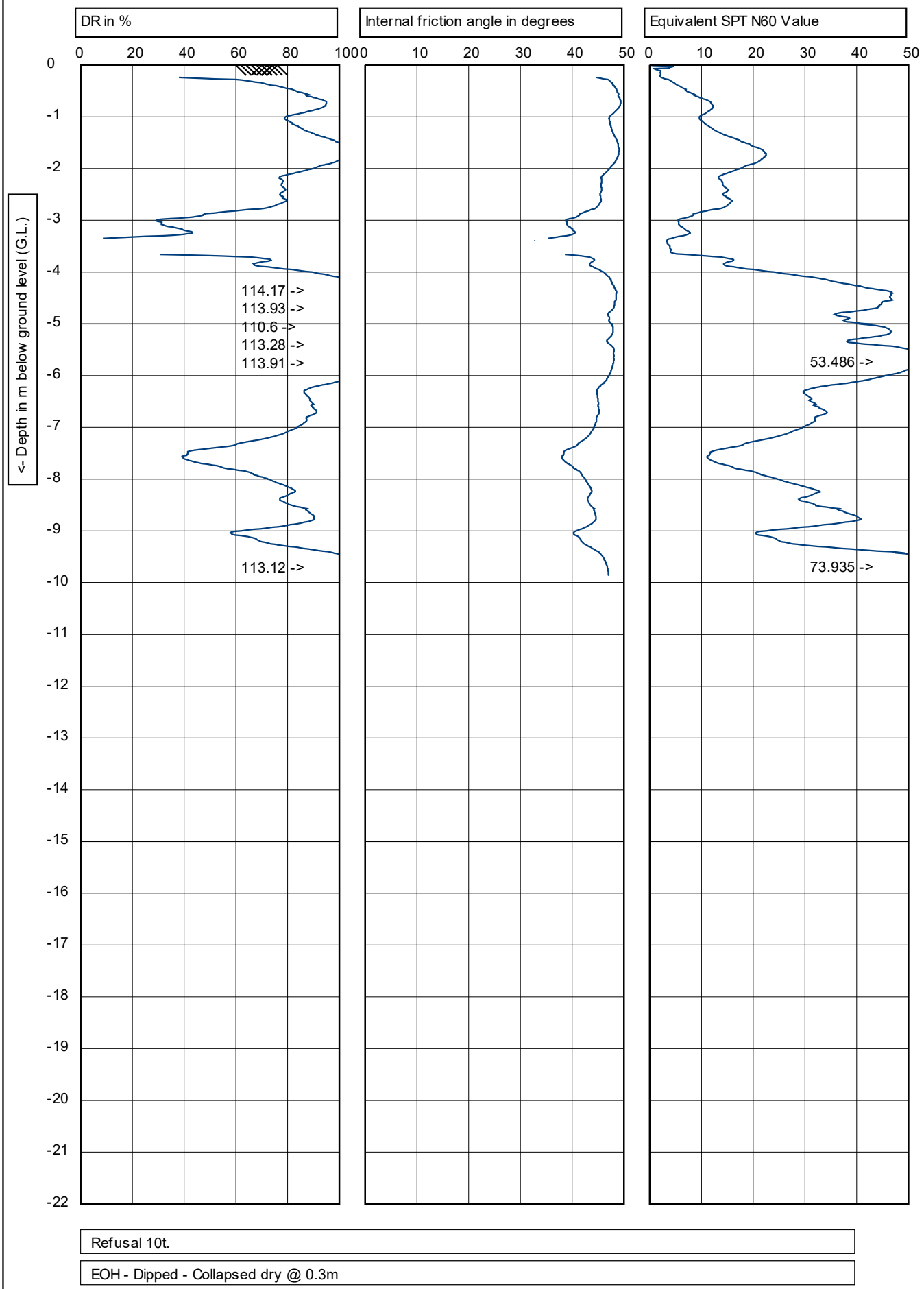
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799490, 5520024 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**14** **4/6**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.3m

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

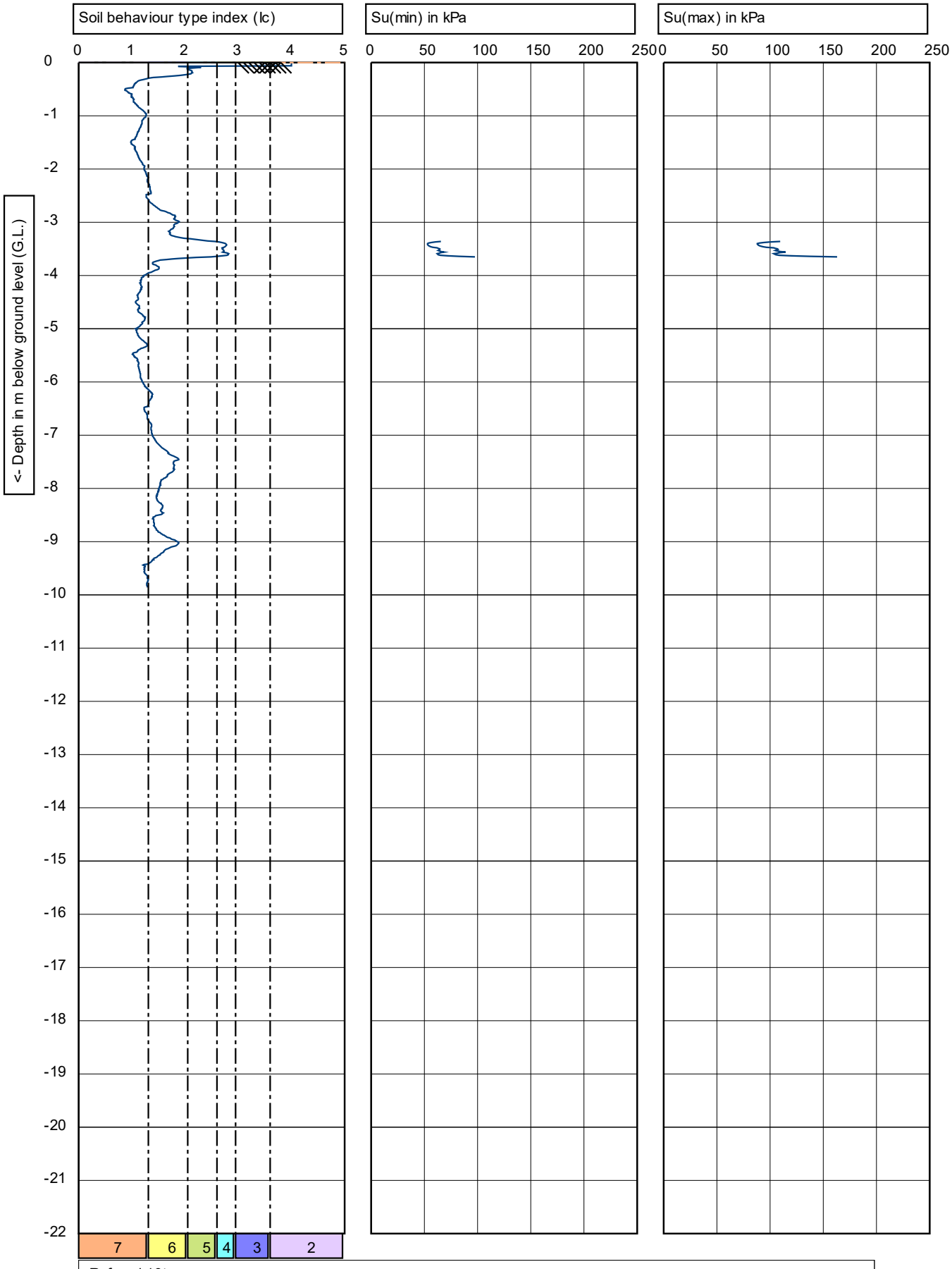
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799490, 5520024 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**14** **5/6**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 0.3m

Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799490, 5520024 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**28/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**14** **6/6**

1.49

CONE PENETRATION TEST REPORT

Client :	BTW Company Limited	
Project :	231 Motuiti Rd	
Location :	Foxton (3007425)	
Hole Number:	14	
Tested by :	J Kavanaugh/ L Curtis	
Date tested :	28/02/23	
Coordinates :	1799490	E
	5520024	N
Elevation :	15m	
Water level :	EOH - Dipped - Collapsed dry @ 0.3m	

Project No :	2-68124,00
Lab Ref No :	HA10441_14
Client Ref No :	3007425

Test Results

Start Time	8:08:00 AM
Time at penetration	8:17:29 AM
End Time	12:09:29 AM
Reference level	0
Ground level	0
Predrill	0
Penetration Depth	9.94
Remarks	Refusal 10t.
GPS Type	Garmin eTrex 20
GPS Accuracy	+ / - 3m
GPS Reference Grid	NZTM
GPS Datum	MSL
Rig Type	GeoMil Panther 100/ Flex 200
Rig ID	CPT03
Reaction Force	Dead weight 10/22 tonnes
Data Acquisition (Digitizer)	GeoMil GME500
Acquisition Program	GeoMil CPTest
Reporting Program	GeoMil CPTask
Cone Type	C10 (10 Tonne Compression)
Cross Sectional Area	10cm2
Cone Area Ratio	0.8
Fluid Type	Silicone Fluid
Friction Reducer	0.55m behind base of cone
Application Class (ISO 22476-1)	3
Test Type (ISO 22476-1)	TE2 (Measured Cone and Sleeve)
Back Fill Method	Bentonite
Observations During Testing	0
Test Methods:	ASTM D5778-12
	ISO 22476-1:2012

Date tested : 28/02/23
Date reported : 17/03/23

IANZ Approved Signatory

Designation : *CPT North Island Manager*
Date : 17/03/23

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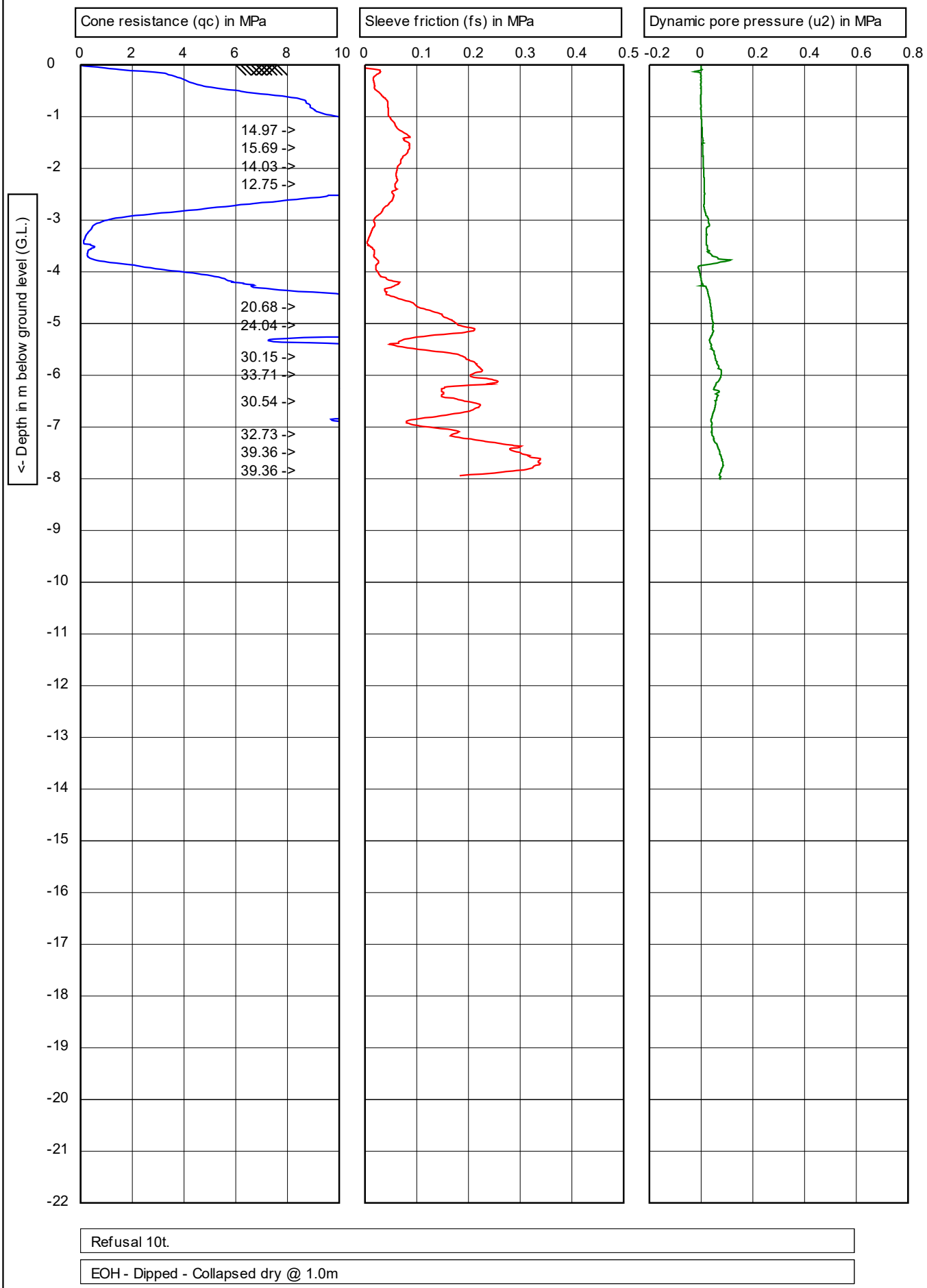
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Website www.wsp.com/nz



Refusal 10t.

EOH - Dipped - Collapsed dry @ 1.0m

Test results indicated as not accredited are outside the scope of the laboratory's accreditation

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

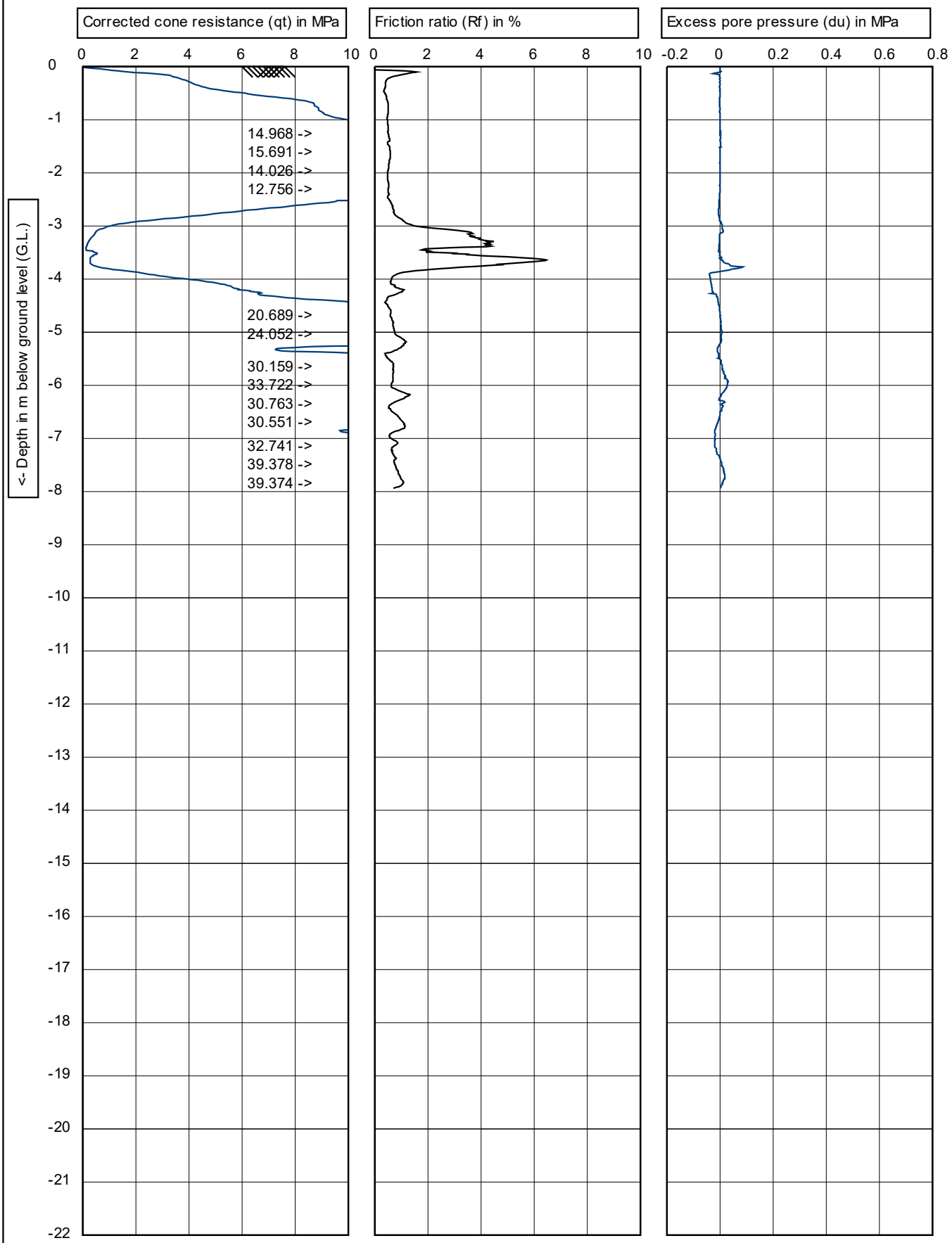
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799570, 5519526 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**15**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 1.0m

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

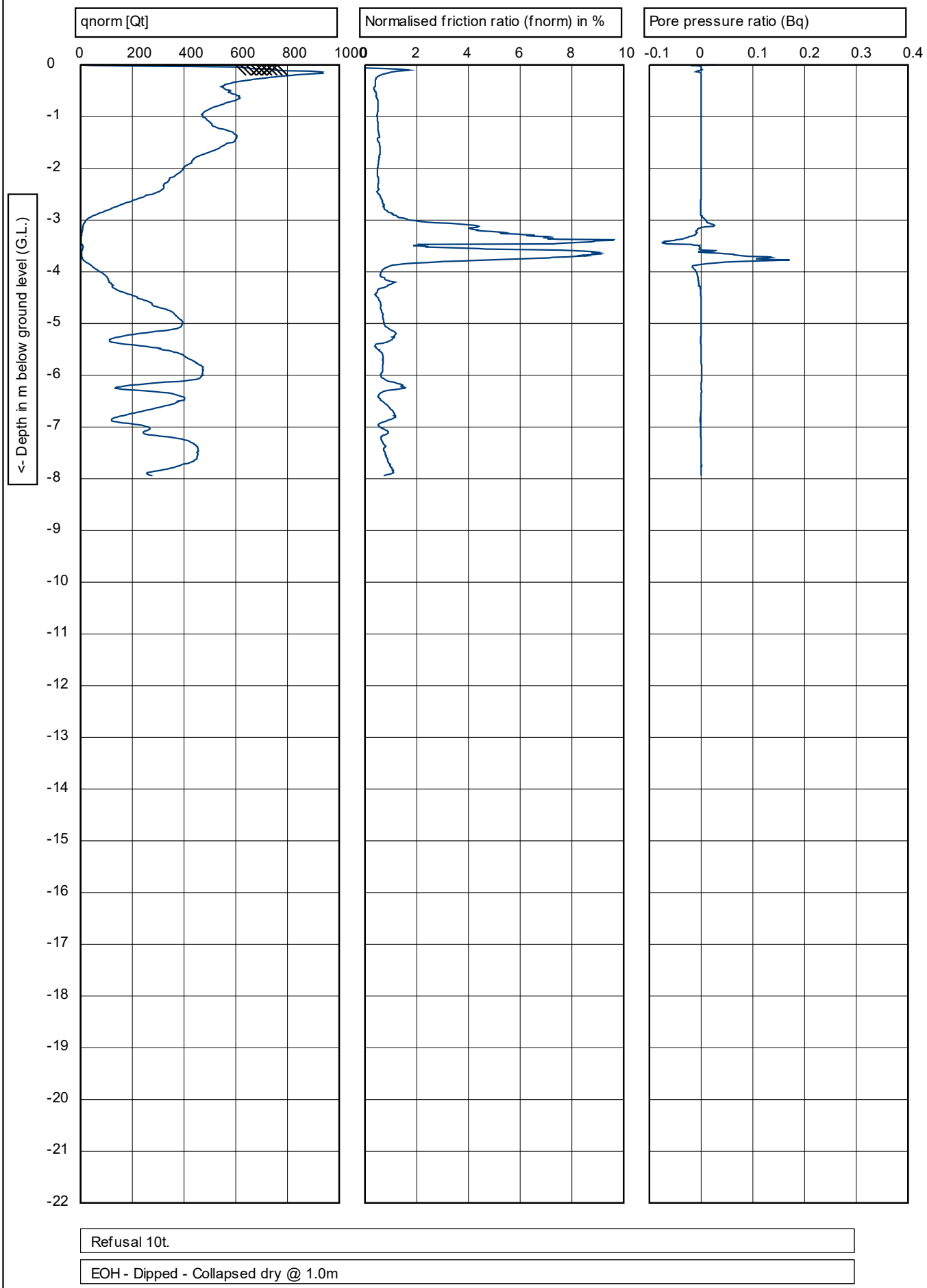
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799570, 5519526 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**15**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 1.0m

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

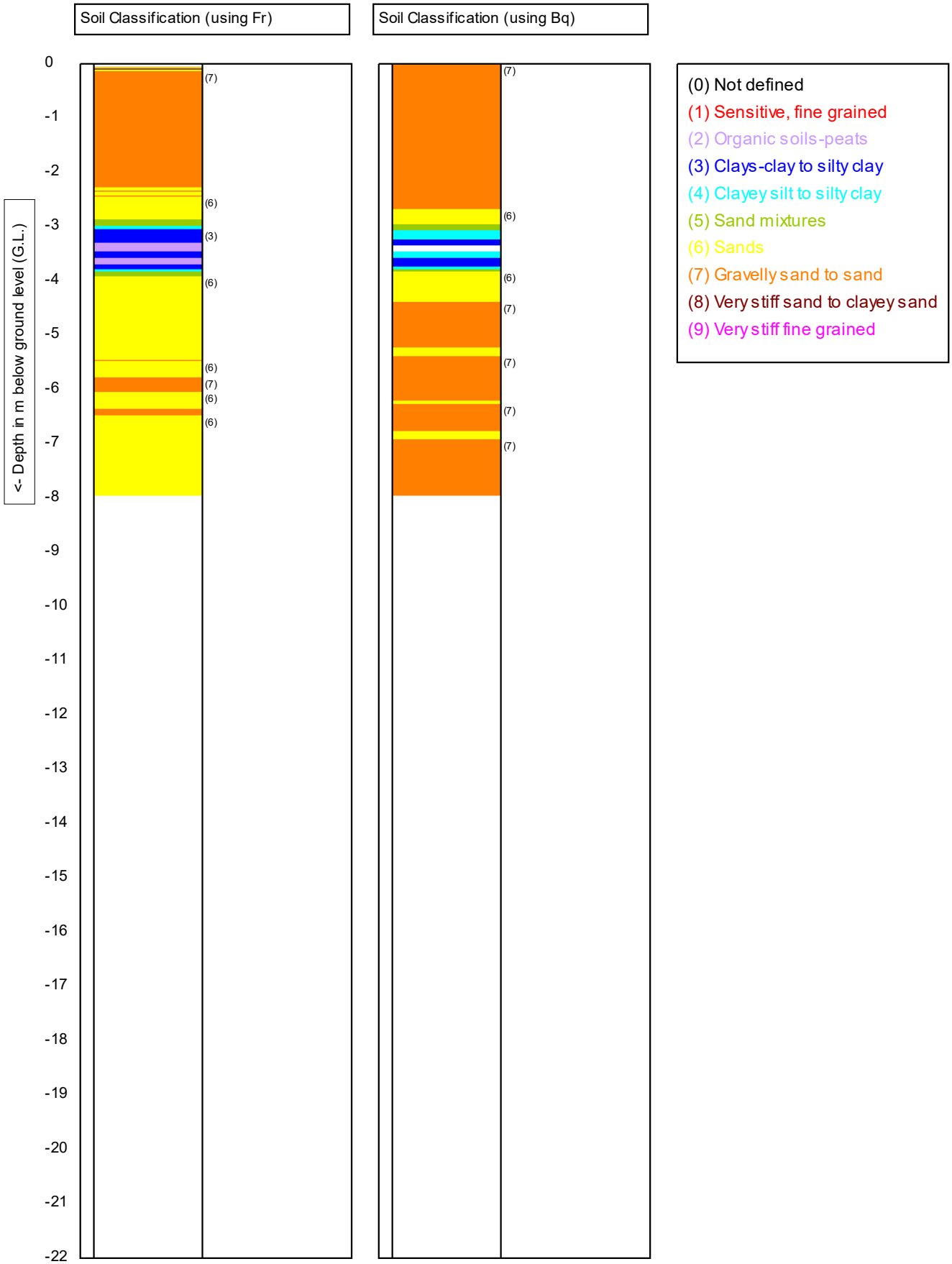
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799570, 5519526 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**15** **3/6**

1.49



Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

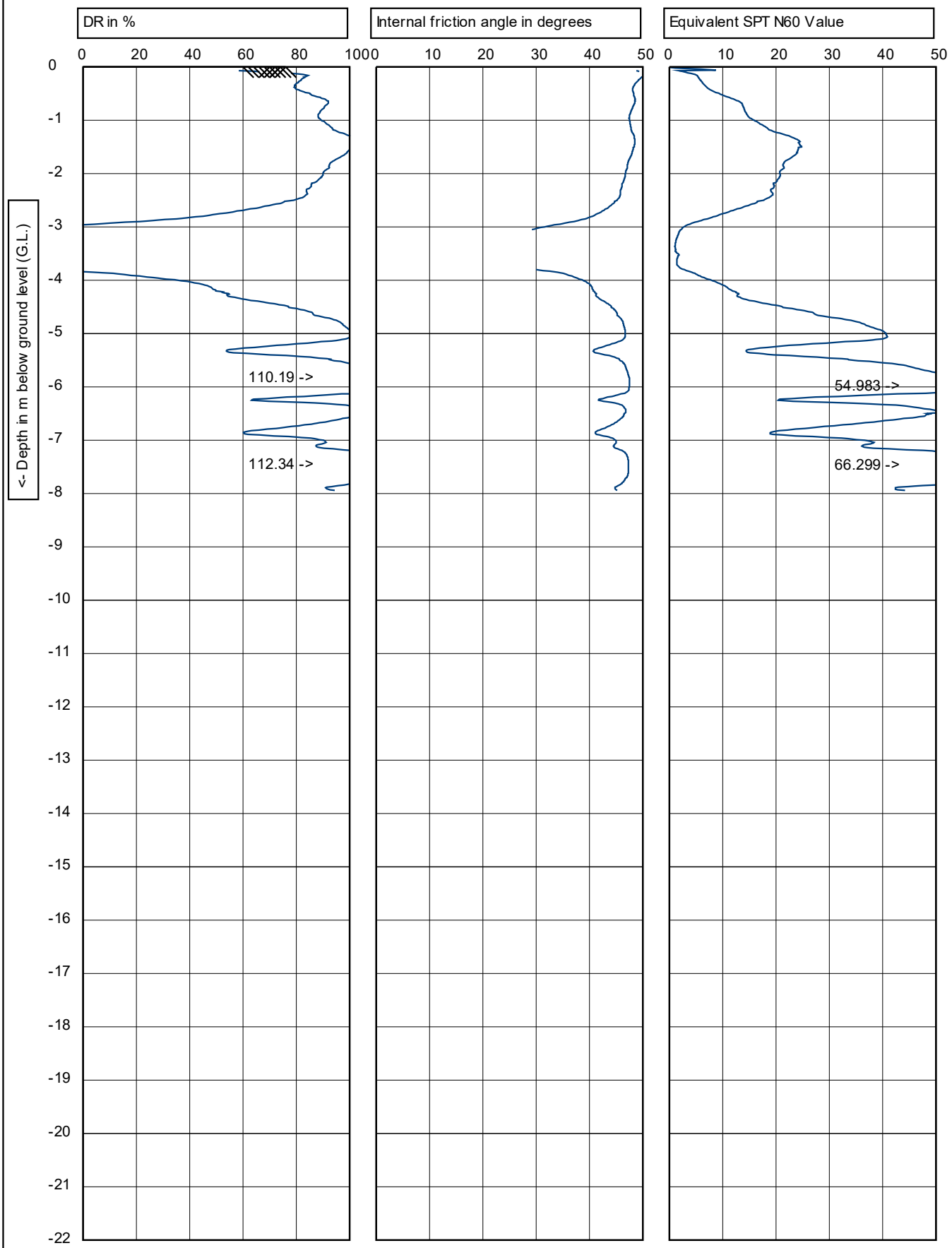
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799570, 5519526 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**15** **4/6**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 1.0m

WSP

Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

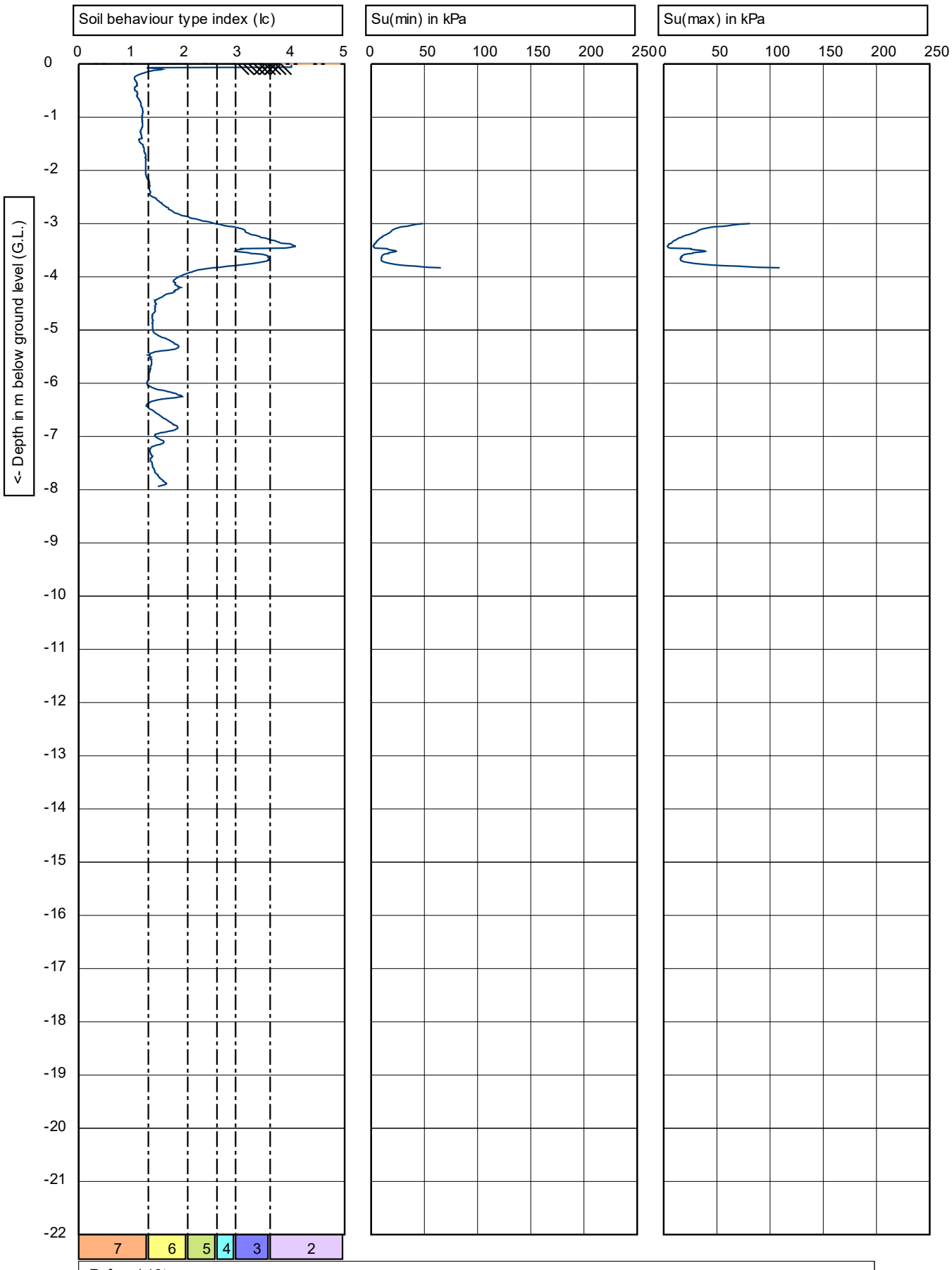
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799570, 5519526 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**15** **5/6**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 1.0m

Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799570, 5519526 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**15** **6/6**

1.49

CONE PENETRATION TEST REPORT

Client :	BTW Company Limited	
Project :	231 Motuiti Rd	
Location :	Foxton (3007425)	
Hole Number:	15	
Tested by :	J Kavanaugh/ L Curtis	
Date tested :	27/02/23	
Coordinates :	1799570	E
	5519526	N
Elevation :	21m	
Water level :	EOH - Dipped - Collapsed dry @ 1.0m	

Project No :	2-68124.00
Lab Ref No :	HA10441_15
Client Ref No :	3007425

Test Results

Start Time	3:26:00 PM
Time at penetration	3:32:58 PM
End Time	12:06:58 AM
Reference level	0
Ground level	0
Predrill	0
Penetration Depth	8.02
Remarks	Refusal 10t.
GPS Type	Garmin eTrex 20
GPS Accuracy	+ / - 3m
GPS Reference Grid	NZTM
GPS Datum	MSL
Rig Type	GeoMil Panther 100/ Flex 200
Rig ID	CPT03
Reaction Force	Dead weight 10/22 tonnes
Data Acquisition (Digitizer)	GeoMil GME500
Acquisition Program	GeoMil CPTest
Reporting Program	GeoMil CPTask
Cone Type	C10 (10 Tonne Compression)
Cross Sectional Area	10cm2
Cone Area Ratio	0.8
Fluid Type	Silicone Fluid
Friction Reducer	0.55m behind base of cone
Application Class (ISO 22476-1)	3
Test Type (ISO 22476-1)	TE2 (Measured Cone and Sleeve)
Back Fill Method	Bentonite
Observations During Testing	0

Test Methods: ASTM D5778-12
ISO 22476-1:2012

Date tested : 27/02/23
Date reported : 17/03/23

IANZ Approved Signatory

Designation : *CPT North Island Manager*
Date : 17/03/23

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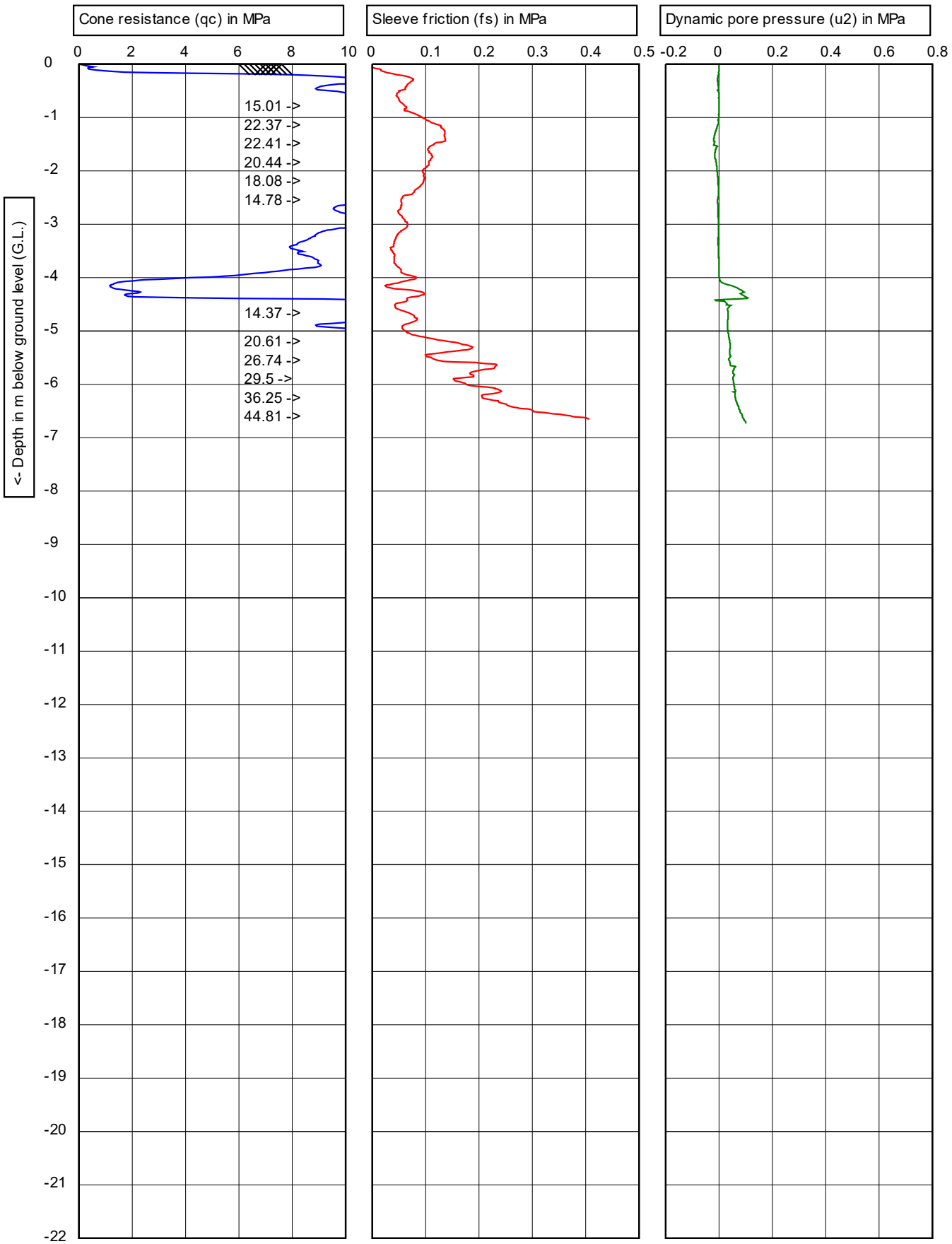
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Quality Management Systems Certified to ISO 9001

4 Fox Street
Private Bag 3057, Waikato Mail Centre,
3240, Hamilton, New Zealand

Telephone +64 7 856 2870
Website www.wsp.com/nz



Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

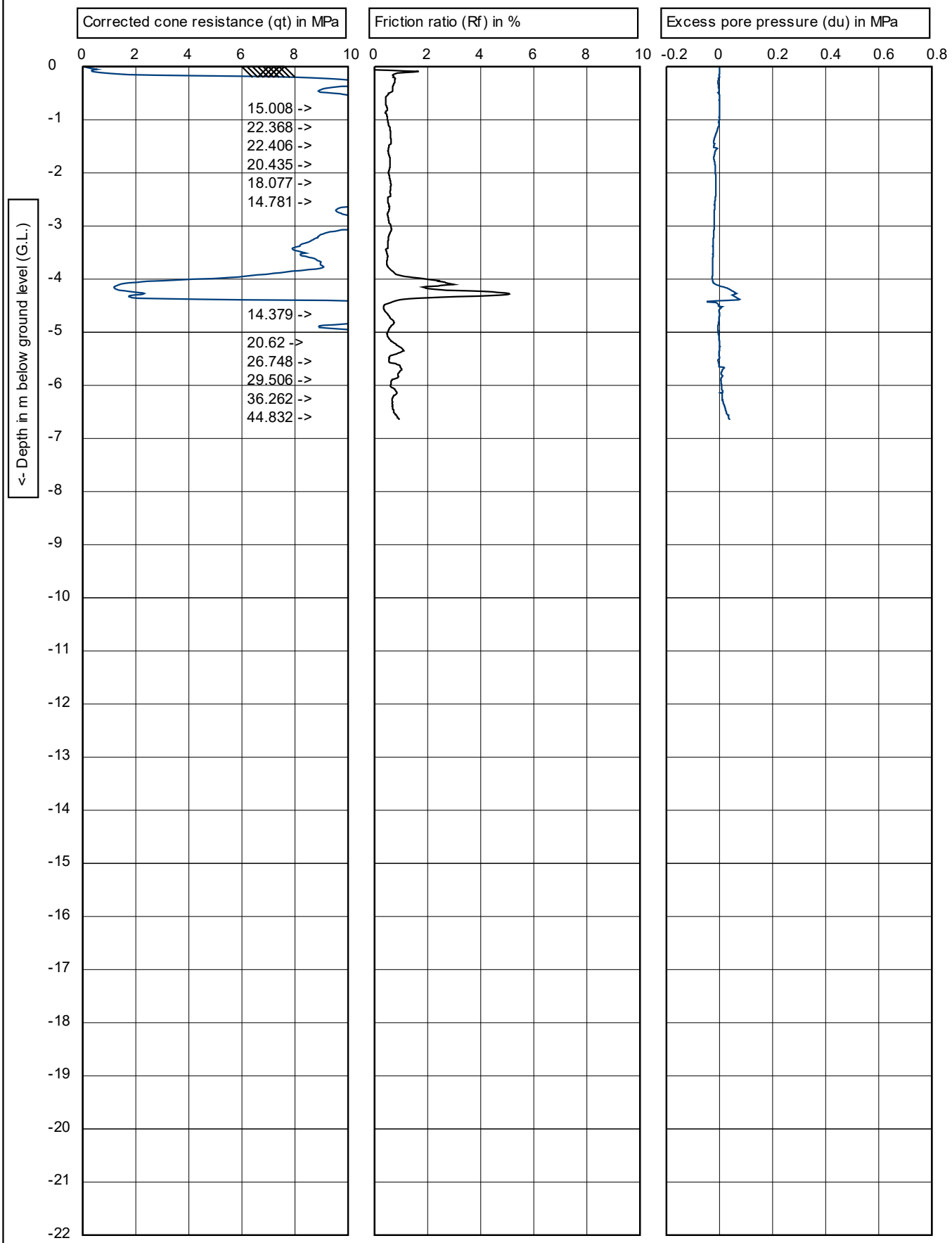
Location: **Foxton (3007425)**

Position: **1799966, 5519825 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**16**

Test results indicated as not accredited are outside the scope of the laboratory's accreditation

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 1.2m

Graphs on this page are not IANZ accredited

r u2 L 150 cm² 10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

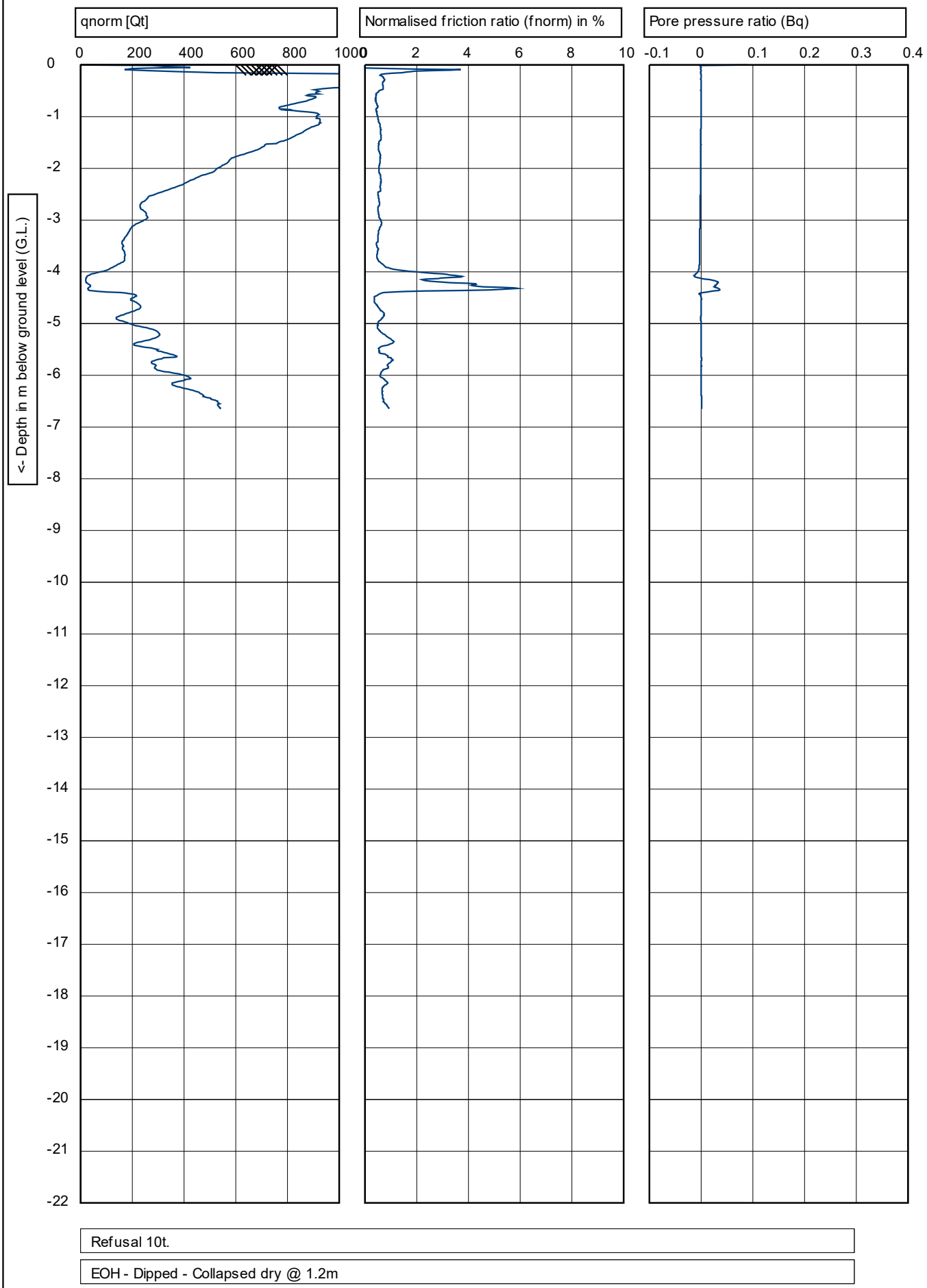
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799966, 5519825 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**16**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 1.2m

Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

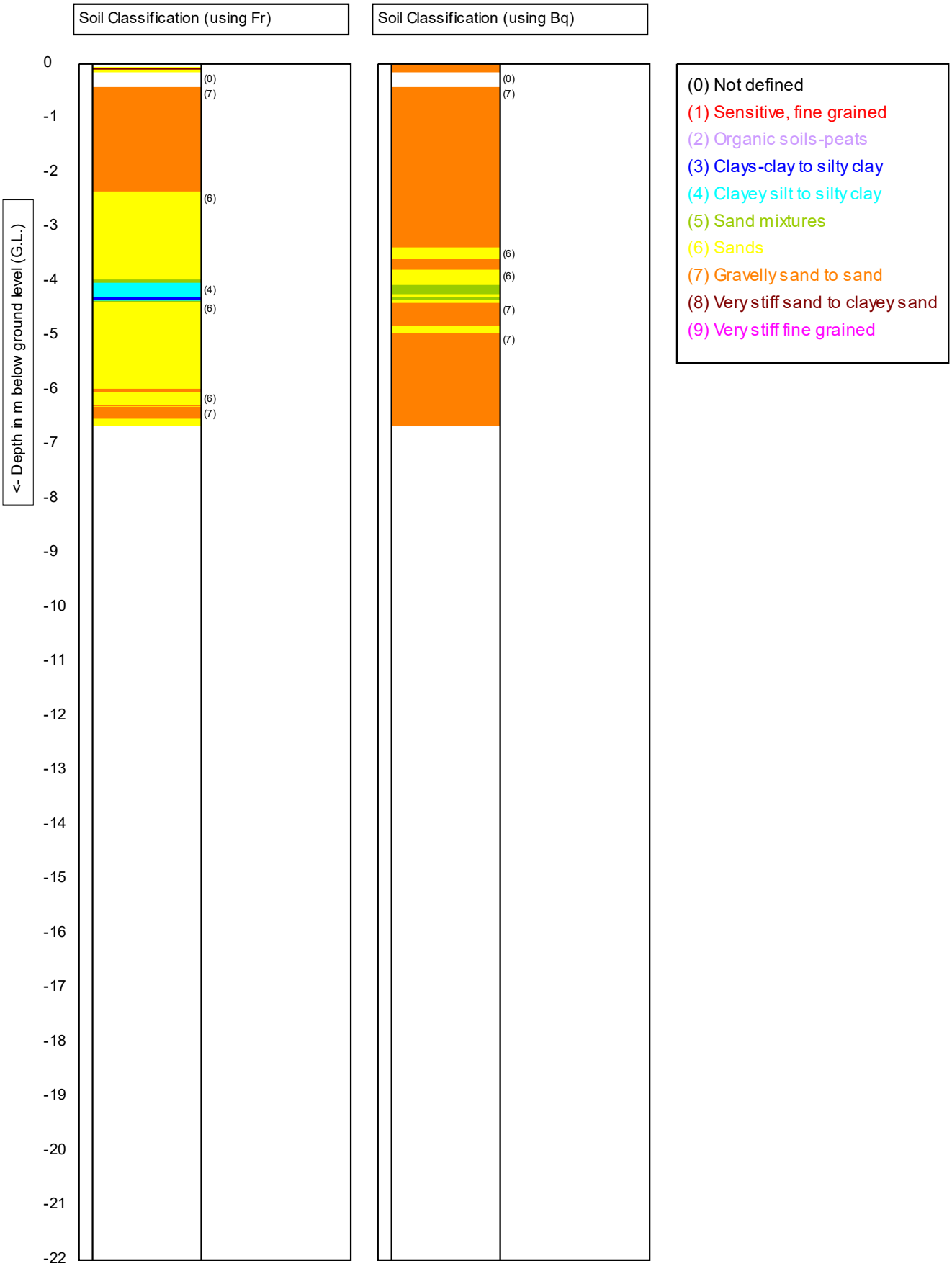
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799966, 5519825 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**16** **3/6**

1.49



Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

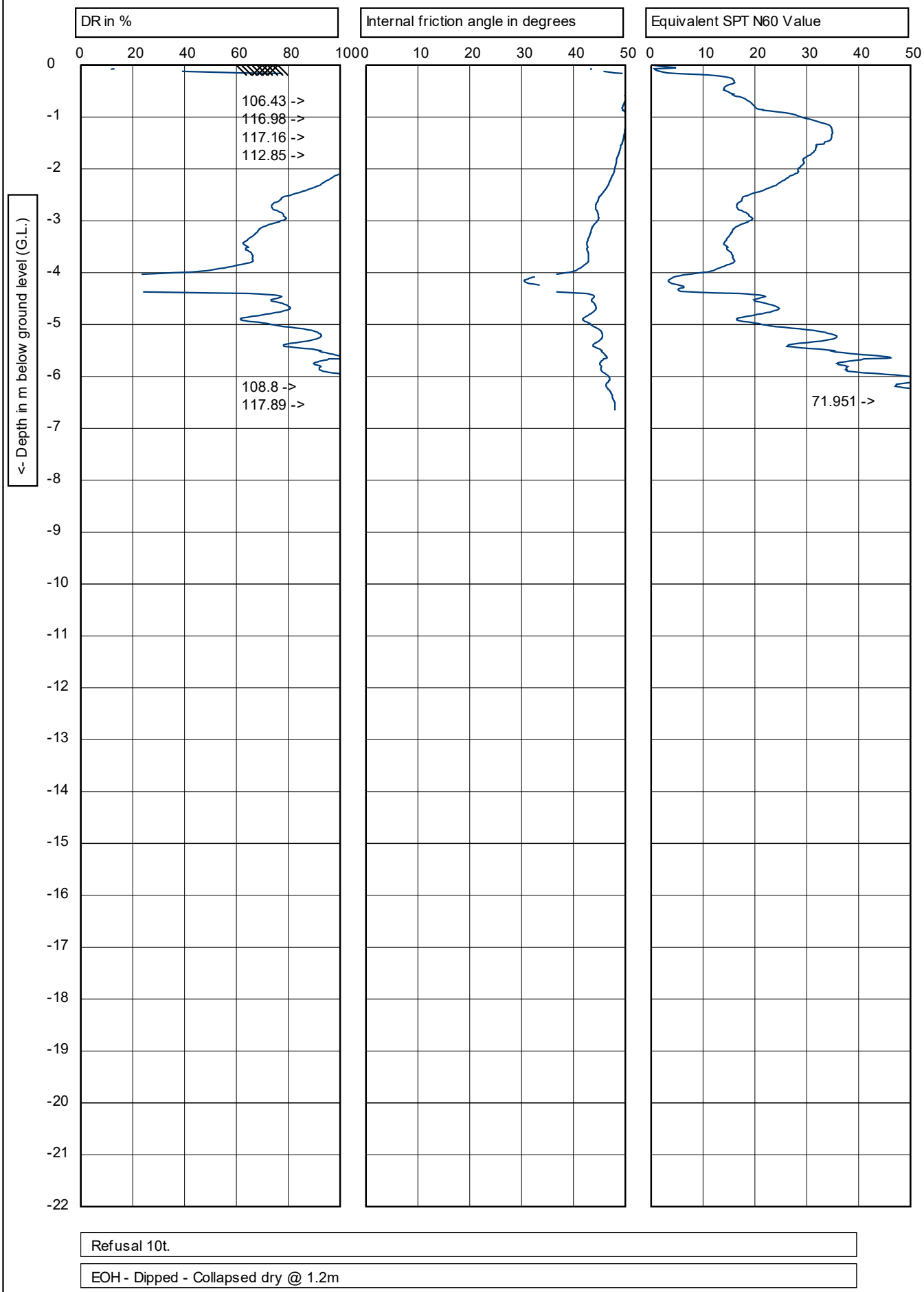
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799966, 5519825 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**16**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 1.2m

Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

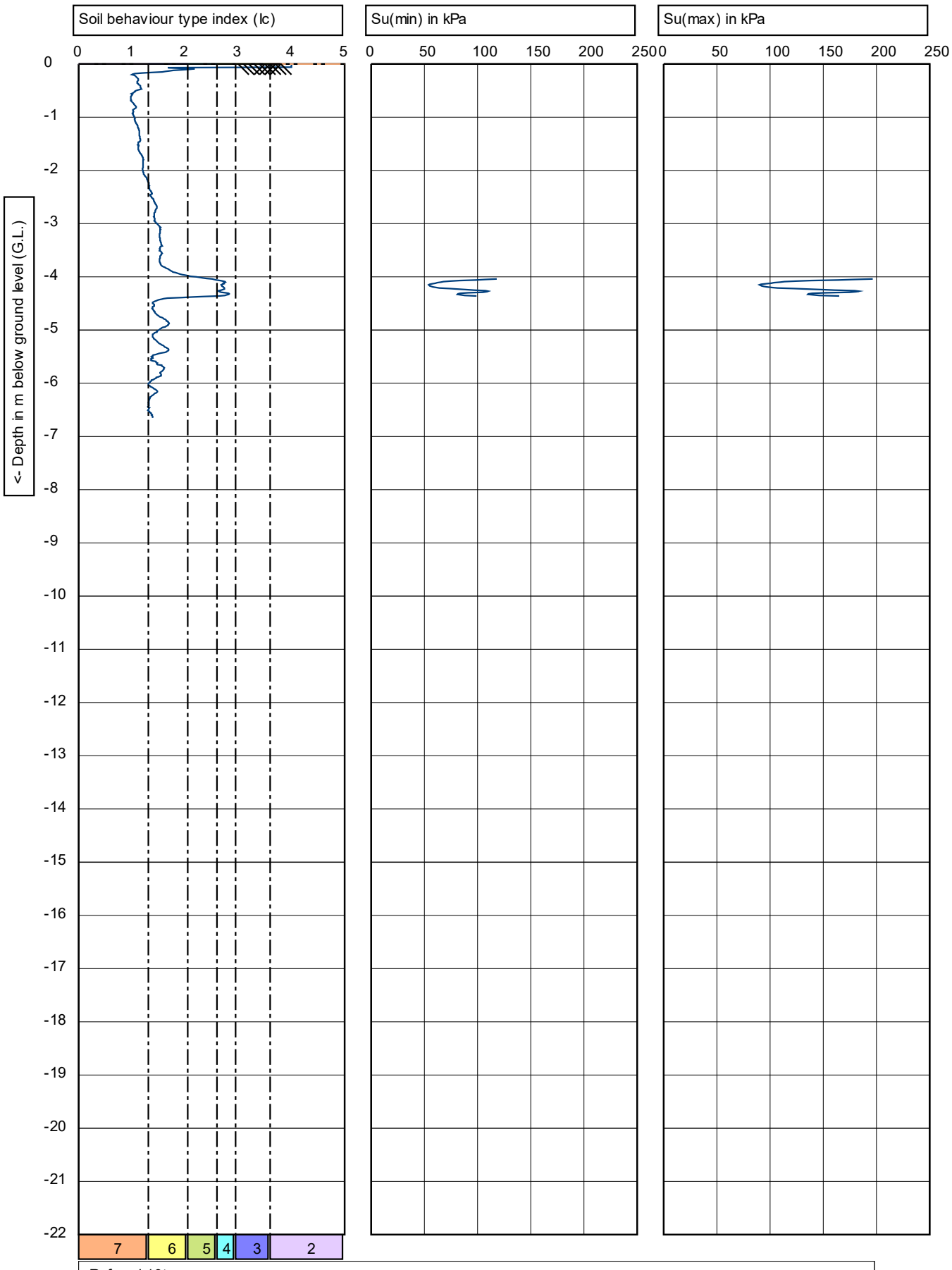
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799966, 5519825 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**16** **5/6**

1.49



Refusal 10t.

EOH - Dipped - Collapsed dry @ 1.2m

WSP

Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1799966, 5519825 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C21082**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**16** **6/6**

1.49

CONE PENETRATION TEST REPORT

Client :	BTW Company Limited	
Project :	231 Motuiti Rd	
Location :	Foxton (3007425)	
Hole Number:	16	
Tested by :	J Kavanaugh/ L Curtis	
Date tested :	27/02/23	
Coordinates :	1799966	E
	5519825	N
Elevation :	21m	
Water level :	EOH - Dipped - Collapsed dry @ 1.2m	

Project No :	2-68124.00
Lab Ref No :	HA10441_16
Client Ref No :	3007425

Test Results

Start Time	4:53:00 PM
Time at penetration	4:59:04 PM
End Time	12:06:04 AM
Reference level	0
Ground level	0
Predrill	0
Penetration Depth	6.73
Remarks	Refusal 10t.
GPS Type	Garmin eTrex 20
GPS Accuracy	+ / - 3m
GPS Reference Grid	NZTM
GPS Datum	MSL
Rig Type	GeoMil Panther 100/ Flex 200
Rig ID	CPT03
Reaction Force	Dead weight 10/22 tonnes
Data Acquisition (Digitizer)	GeoMil GME500
Acquisition Program	GeoMil CPTest
Reporting Program	GeoMil CPTask
Cone Type	C10 (10 Tonne Compression)
Cross Sectional Area	10cm2
Cone Area Ratio	0.8
Fluid Type	Silicone Fluid
Friction Reducer	0.55m behind base of cone
Application Class (ISO 22476-1)	3
Test Type (ISO 22476-1)	TE2 (Measured Cone and Sleeve)
Back Fill Method	Bentonite
Observations During Testing	0
Test Methods:	ASTM D5778-12
	ISO 22476-1:2012

Date tested : 27/02/23
Date reported : 17/03/23

IANZ Approved Signatory

Designation : *CPT North Island Manager*
Date : 17/03/23

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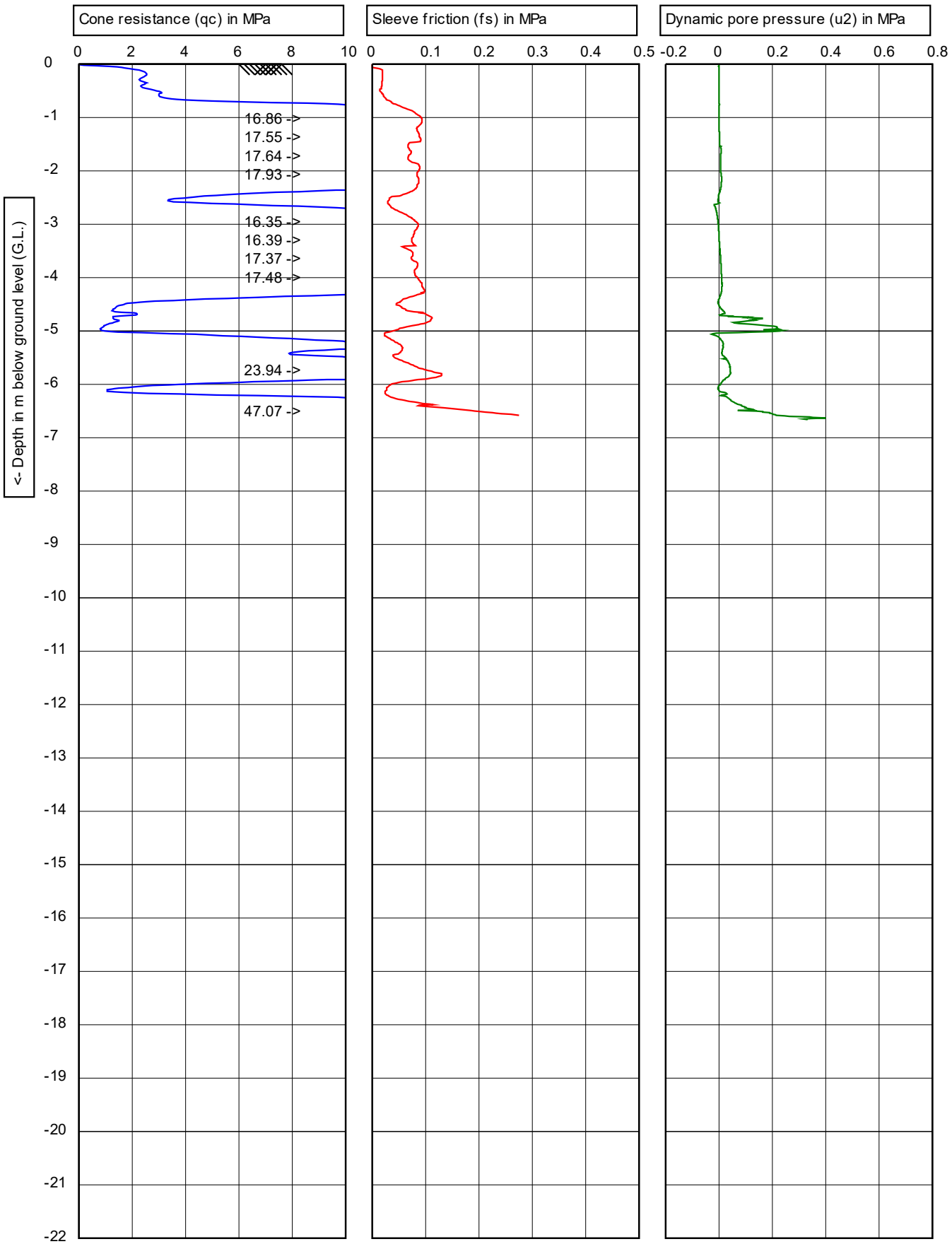
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Website www.wsp.com/nz



Test results indicated as not accredited are outside the scope of the laboratory's accreditation

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

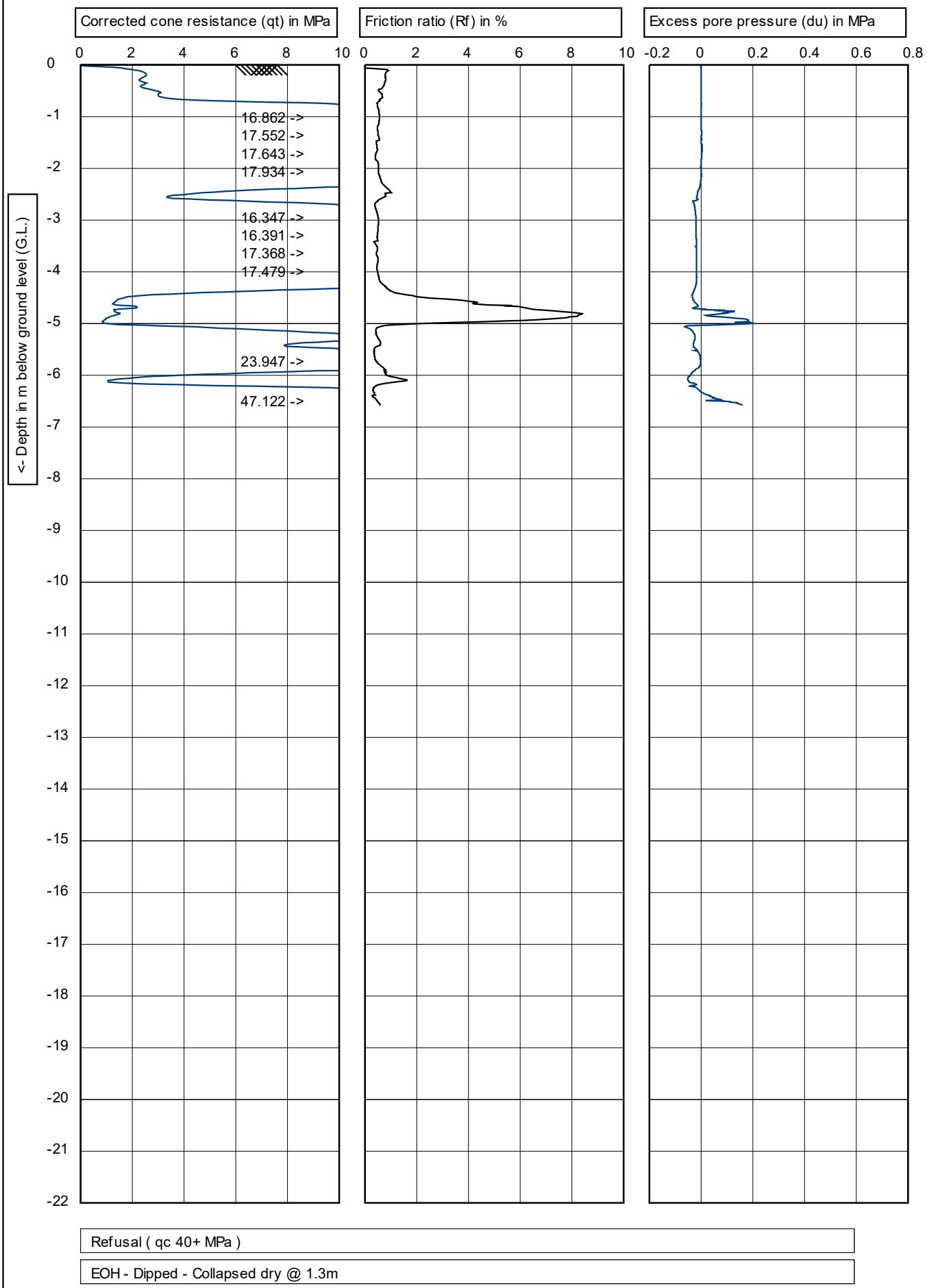
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1800004, 5519340 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**17**

1.49



Graphs on this page are not IANZ accredited

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

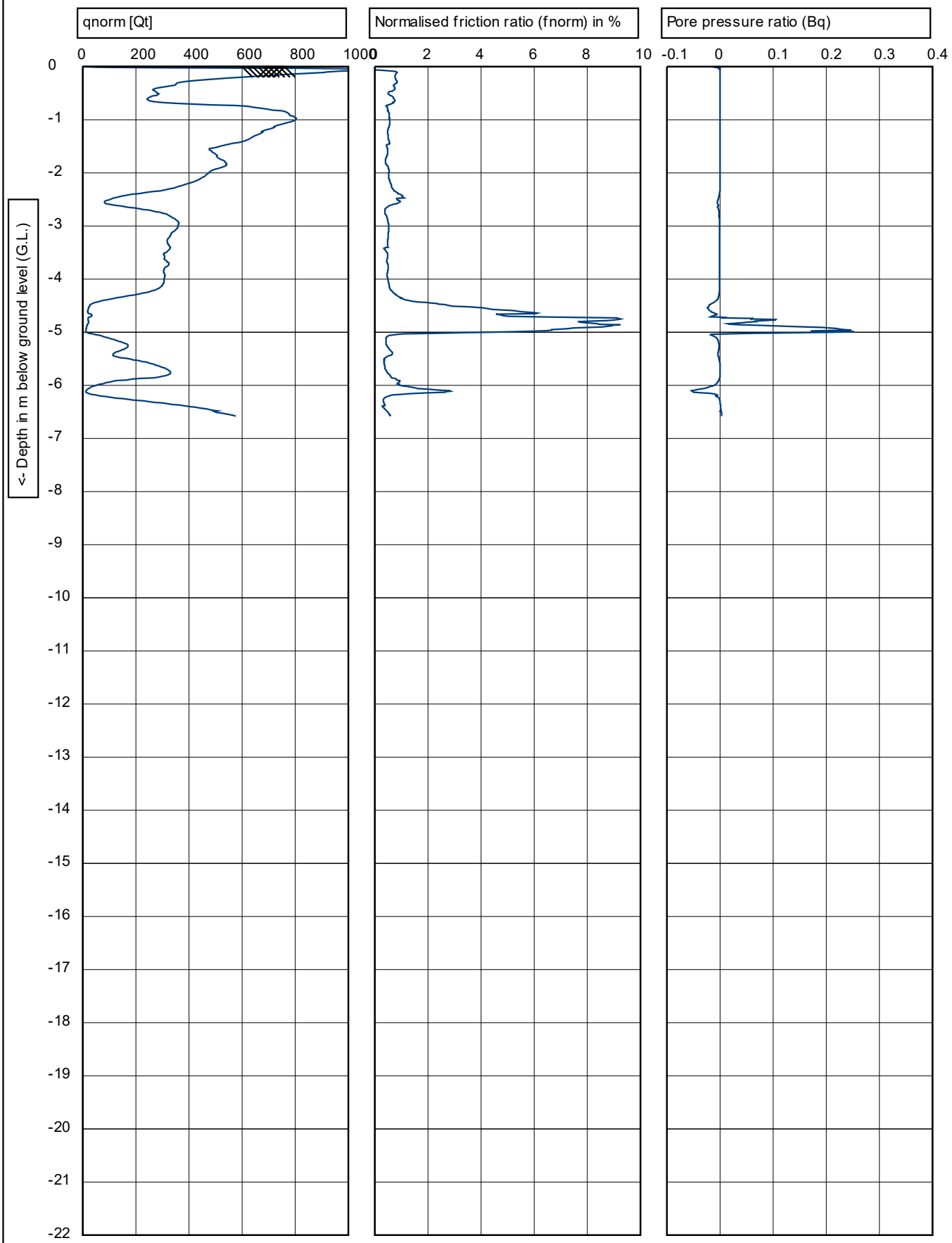
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1800004, 5519340 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**17** **2/6**

1.49



Refusal (qc 40+ MPa)

EOH - Dipped - Collapsed dry @ 1.3m

Graphs on this page are not IANZ accredited

r u2
150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

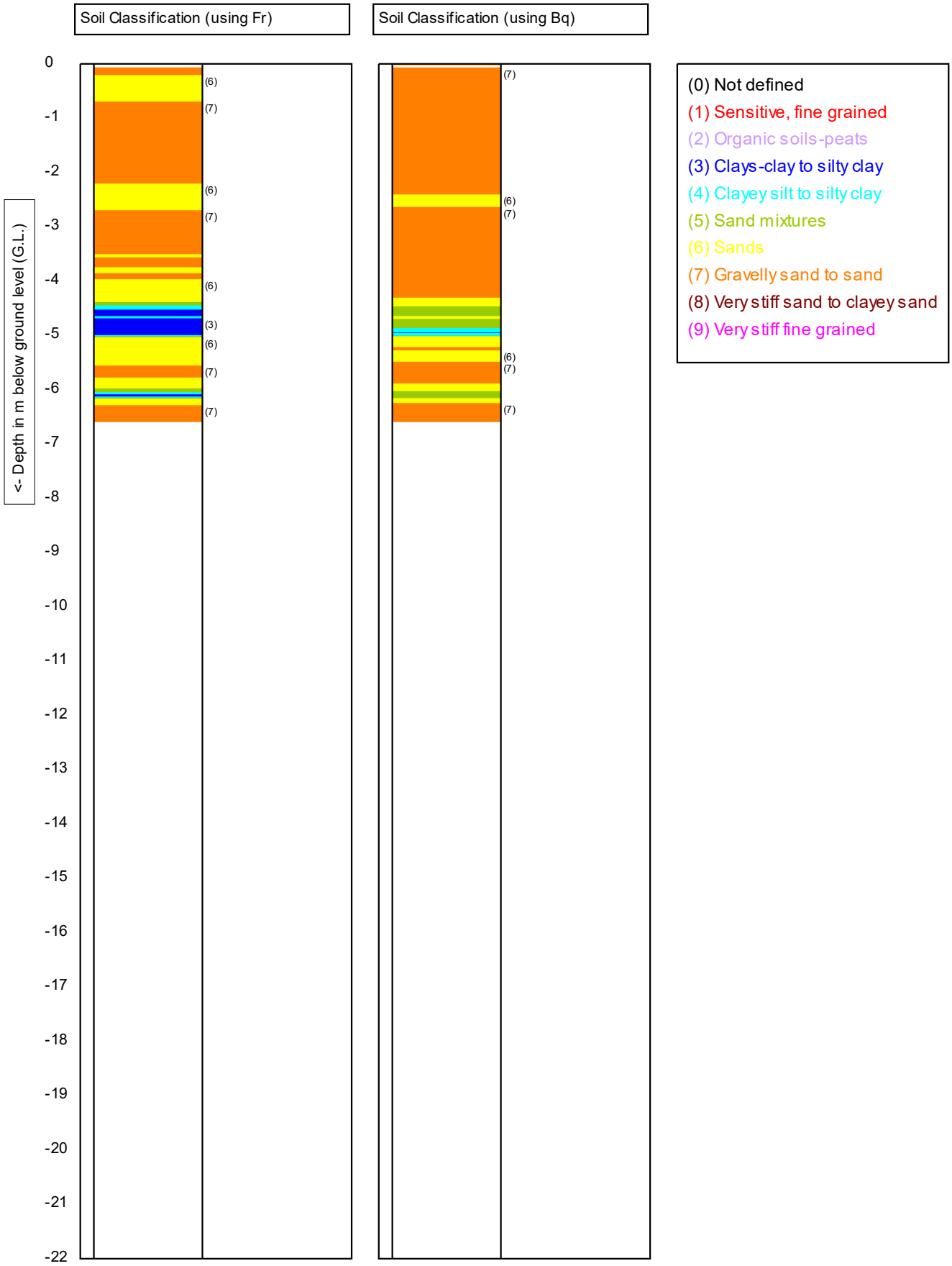
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1800004, 5519340 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**17**

1.49



Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

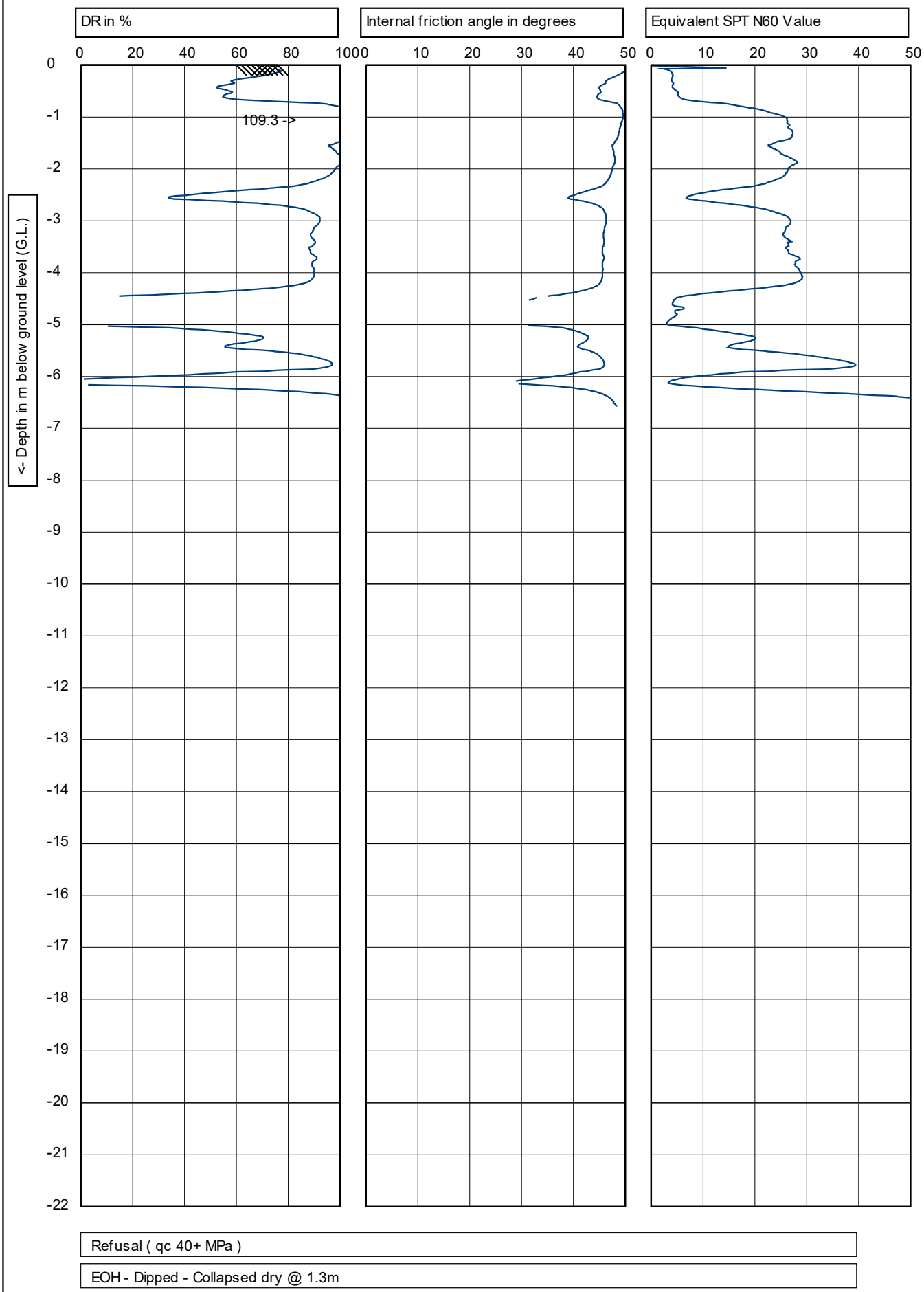
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1800004, 5519340 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**17**

1.49



Refusal (qc 40+ MPa)

EOH - Dipped - Collapsed dry @ 1.3m

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

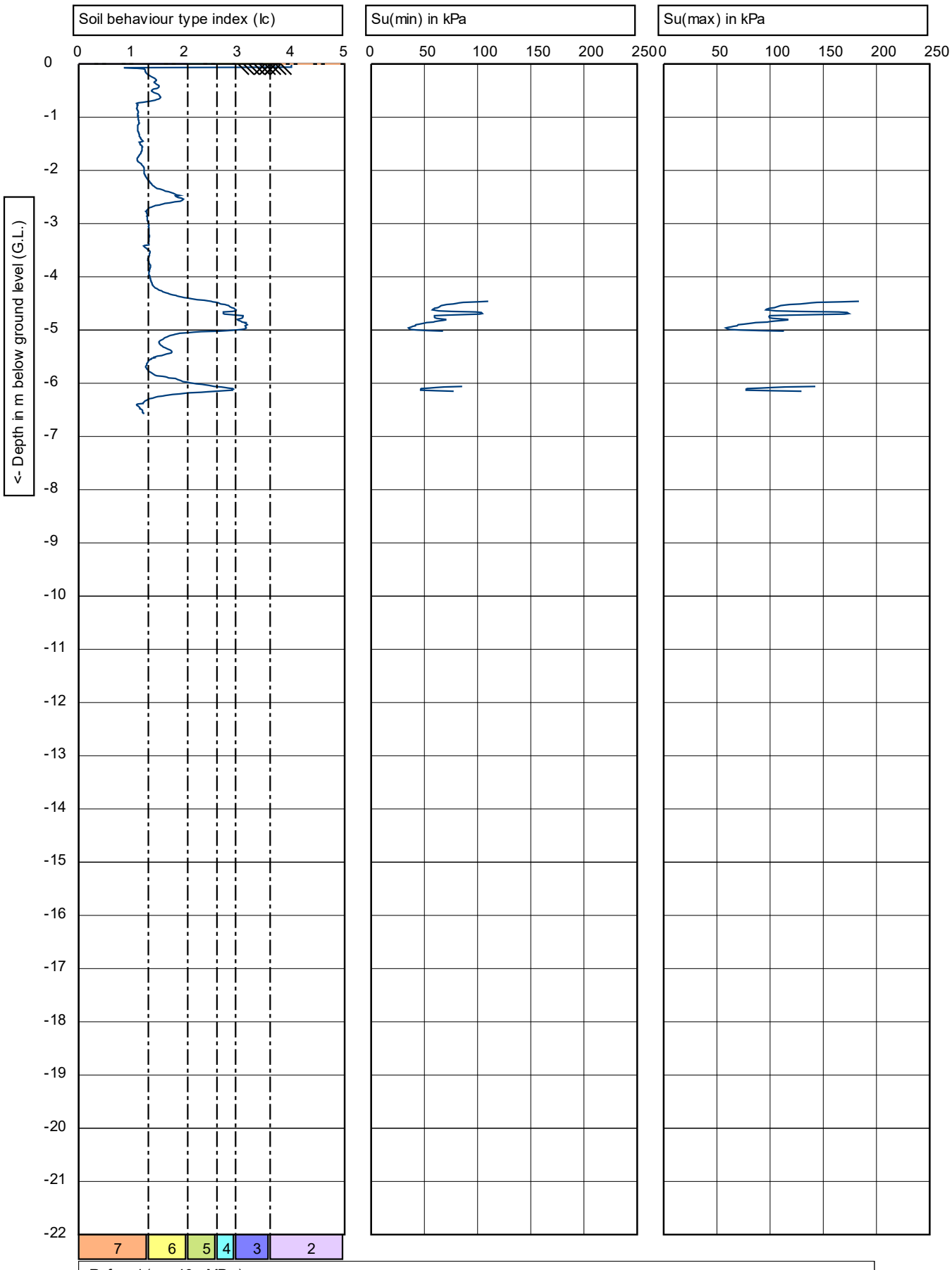
Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1800004, 5519340 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**17** **5/6**

1.49



Refusal (qc 40+ MPa)

EOH - Dipped - Collapsed dry @ 1.3m

Graphs on this page are not IANZ accredited

r u2
L 150 cm²
10 cm²

Test according ASTM D5778:12 & ISO 22476-1:2012

G.L.: **0.00 m MSL**

Project: **231 Motuiti Rd**

Location: **Foxton (3007425)**

Position: **1800004, 5519340 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**27/02/2023**
Cone no.:	**C10CFIIP.C181009**
Project no.:	**2-68124.00_HA10441**
CPT no.:	**17** **6/6**

1.49

CONE PENETRATION TEST REPORT

Client :	BTW Company Limited
Project :	231 Motuiti Rd
Location :	Foxton (3007425)
Hole Number:	17
Tested by :	J Kavanaugh/ L Curtis
Date tested :	27/02/23
Coordinates :	1800004 E
	5519340 N
Elevation :	19m
Water level :	EOH - Dipped - Collapsed dry @ 1.3m

Project No :	2-68124.00
Lab Ref No :	HA10441_17
Client Ref No :	3007425

Test Results

Start Time	4:09:00 PM
Time at penetration	4:14:51 PM
End Time	12:05:51 AM
Reference level	0
Ground level	0
Predrill	0
Penetration Depth	6.66
Remarks	Refusal (qc 40+ MPa)
GPS Type	Garmin eTrex 20
GPS Accuracy	+ / - 3m
GPS Reference Grid	NZTM
GPS Datum	MSL
Rig Type	GeoMil Panther 100/ Flex 200
Rig ID	CPT03
Reaction Force	Dead weight 10/22 tonnes
Data Acquisition (Digitizer)	GeoMil GME500
Acquisition Program	GeoMil CPTest
Reporting Program	GeoMil CPTask
Cone Type	C10 (10 Tonne Compression)
Cross Sectional Area	10cm2
Cone Area Ratio	0.8
Fluid Type	Silicone Fluid
Friction Reducer	0.55m behind base of cone
Application Class (ISO 22476-1)	3
Test Type (ISO 22476-1)	TE2 (Measured Cone and Sleeve)
Back Fill Method	Bentonite
Observations During Testing	0
Test Methods:	ASTM D5778-12
	ISO 22476-1:2012

Date tested : 27/02/23
Date reported : 17/03/23

IANZ Approved Signatory

Designation : *CPT North Island Manager*
Date : 17/03/23

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Telephone +64 7 856 2870
Website www.wsp.com/nz

calibration certificate

AC10CFIIP.C21082 / 002

Geomil equipment

World's first manufacturer of CPT equipment

Cone number	AC10CFIIP.C21082	**Client**	WSP New Zealand Ltd - Hamilton Laboratory
Kind of cone	Compression		4 Fox Street
Calibration date	30-Nov-2022		3216 Hamilton
			New Zealand

Channel 1	Cone resistance (q_c) $q_c = Q_c / A_c$	**Channel 2**	Local sleeve friction (f_s) $f_s = F_s / A_s$	**Channel 3**	Pore pressure (u)
Range	0 ... 100 kN	**Range**	0 ... 22.5 kN	**Range**	0 ... 50 bar
A_c	1000 mm²	**A_s**	15000 mm²		
Zero load reading	193 mV	**Zero load reading**	237 mV	**Zero load reading**	237 mV
a-factor	0.8	**b-factor**	0		
		Offset	80 mm		

Q_c Load (kN)	Eqv. q_c (MPa)	Output (mV)	F_s Load (kN)	Eqv. f_s (MPa)	Output (mV)	Pressure (bar)	Eqv. u (MPa)	Output (mV)
0	0	0	0.00	0.00	0	0	0.0	0
10	10	843	2.25	0.15	852	5	0.5	819
20	20	1682	4.50	0.30	1715	10	1.0	1641
30	30	2524	6.75	0.45	2587	15	1.5	2462
40	40	3365	9.00	0.60	3459	20	2.0	3282
50	50	4202	11.25	0.75	4318	25	2.5	4102
60	60	5043	13.50	0.90	5187	30	3.0	4918
70	70	5878	18.00	1.20	6901	35	3.5	5734
80	80	6717	20.25	1.35	7783	40	4.0	6546
90	90	7547	22.50	1.50	8639	45	4.5	7358
100	100	8384	20.25	1.35	7780	50	5.0	8177
90	90	7552	18.00	1.20	6921			
80	80	6719	13.50	0.90	5224			
70	70	5881	11.25	0.75	4349			
60	60	5046	9.00	0.60	3484			
50	50	4207	6.75	0.45	2613			
40	40	3368	4.50	0.30	1736			
30	30	2530	2.25	0.15	868			
20	20	1691	0.00	0.00	0			
10	10	844						
0	0	1						

Zero load error	0.01 %	**Zero load error**	0.00 %	**Zero load error**	0.01 %
Max. linearity	0.19 %	**Max. linearity**	0.51 %	**Max. linearity**	0.17 %
Max. hysteresis	0.11 %	**Max. hysteresis**	0.63 %		

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calibration certificate

AC10CFIIP.C21082 / 002

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Channel 4	Inclination X	**Channel 5**	Inclination Y	**Channel 6**	None
Range	-20 ... 20 °	**Range**	-20 ... 20 °		

Angle (°)	**Output (mV)**	**Angle (°)**	**Output (mV)**
-20	2550	-20	2538
-15	2621	-15	2603
-10	2700	-10	2679
-5	2769	-5	2754
0	2856	0	2834
5	2931	5	2908
10	3003	10	2981
15	3082	15	3051
20	3145	20	3122

Calibration instrument(s)	**Certificate number(s)**	**Date(s)**
GCU1000/1-091026-249/1	3575621.00501.1	14-Oct-2022

Remark

We declare that the electrical cone with serial number AC10CFIIP.C21082 has been calibrated and that the specifications are according to the ISO 22476-1:2012/Cor 1:2013 (Geotechnical investigation and testing – Field testing - Part 1: Electrical cone and piezocone penetration test). The calibrations are traceable to national and international standards.

Date	30-Nov-2022	**Date**	30-Nov-2022
Calibrated by	T. van Arnhem	**Approved by**	G. Dekker
Signature		**Signature**	

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calibration certificate

AC10CFIIP.C181009 / 002

Geomil equipment

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Cone number	AC10CFIIP.C181009	**Client**	WSP New Zealand Ltd - Napier Laboratory
Kind of cone	Compression		90 Prebensen Drive
Calibration date	18-Aug-2022		4110 Napier
			New Zealand

Channel 1	Cone resistance (q_c) $q_c = Q_c / A_c$	**Channel 2**	Local sleeve friction (f_s) $f_s = F_s / A_s$	**Channel 3**	Pore pressure (u)
Range	0 ... 100 kN	**Range**	0 ... 22.5 kN	**Range**	0 ... 50 bar
A_c	1000 mm²	**A_s**	15000 mm²		
Zero load reading	216 mV	**Zero load reading**	208 mV	**Zero load reading**	194 mV
a-factor	0.8	**b-factor**	0		
		Offset	80 mm		

Q_c Load (kN)	Eqv. q_c (MPa)	Output (mV)	F_s Load (kN)	Eqv. f_s (MPa)	Output (mV)	Pressure (bar)	Eqv. u (MPa)	Output (mV)
0	0	0	0.00	0.00	0	0	0.0	0
10	10	845	2.25	0.15	768	5	0.5	799
20	20	1692	4.50	0.30	1558	10	1.0	1604
30	30	2539	6.75	0.45	2349	15	1.5	2408
40	40	3381	9.00	0.60	3140	20	2.0	3213
50	50	4226	11.25	0.75	3942	25	2.5	4015
60	60	5069	13.50	0.90	4739	30	3.0	4820
70	70	5909	18.00	1.20	6321	35	3.5	5625
80	80	6750	20.25	1.35	7119	40	4.0	6426
90	90	7590	22.50	1.50	7924	45	4.5	7229
100	100	8423	20.25	1.35	7137	50	5.0	8031
90	90	7592	18.00	1.20	6348			
80	80	6749	13.50	0.90	4761			
70	70	5911	11.25	0.75	3970			
60	60	5071	9.00	0.60	3178			
50	50	4228	6.75	0.45	2389			
40	40	3384	4.50	0.30	1585			
30	30	2539	2.25	0.15	797			
20	20	1695	0.00	0.00	0			
10	10	849						
0	0	2						

Zero load error	0.02 %	**Zero load error**	0.00 %	**Zero load error**	0.01 %
Max. linearity	0.20 %	**Max. linearity**	0.37 %	**Max. linearity**	0.05 %
Max. hysteresis	0.05 %	**Max. hysteresis**	0.51 %		

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calibration certificate

AC10CFIIP.C181009 / 002

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Channel 4	Inclination X	**Channel 5**	Inclination Y	**Channel 6**	None
Range	-20 ... 20 °	**Range**	-20 ... 20 °		

Angle (°)	**Output (mV)**	**Angle (°)**	**Output (mV)**
-20	2510	-20	2503
-15	2579	-15	2565
-10	2656	-10	2644
-5	2734	-5	2716
0	2802	0	2785
5	2884	5	2864
10	2961	10	2938
15	3030	15	3008
20	3108	20	3081

Calibration instrument(s)	**Certificate number(s)**	**Date(s)**
GCU1000/1-091026-249/1	2663176.00501.1	16-Sep-2021

Remark

We declare that the electrical cone with serial number AC10CFIIP.C181009 has been calibrated and that the specifications are according to the ISO 22476-1:2012/Cor 1:2013 (Geotechnical investigation and testing – Field testing - Part 1: Electrical cone and piezocone penetration test). The calibrations are traceable to national and international standards.

Date	18-Aug-2022	**Date**	23-Aug-2022
Calibrated by	B. Verduijn	**Approved by**	G. Dekker
Signature		**Signature**	

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APPENDIX B TEST PIT LOGS AND SCALA PENETROMETER PLOTS

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INVESTIGATION LOG

HOLE NO.: TP01

CLIENT: Genesis
PROJECT: Foxton Solar Farm
JOB NO.: 221200

SITE LOCATION: Foxton, New Zealand
START DATE: 28/03/2023
CO-ORDINATES: 1795857.0mE, 5521044.0mN (NZTM)
ELEVATION: 23m (NZVD2016)
END DATE: 28/02/2023
CONTRACTOR: SKF Contracting
RIG: 3.8T excavator
DRILLER: S. Flavell
LOGGED BY: M. Owen

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa)	WATER
Sandy TOPSOIL; grey brown. Moist; topsoil, trace organics and rootlets; vegetation cover; sand, fine to medium.		0	TS	1		
SAND, with trace roots and branches and silt; grey brown . Loose; non-plastic; moist; uniformly graded; sand, fine to medium; [UNCONTROLLED FILL].		0.2		2, 2, 1		
0.5m - 0.7m: black sandy layer, likely containing organic material		0.4		2, 3		
SAND, with trace roots and branches and silt; grey brown . Medium dense; non-plastic; moist; uniformly graded; sand, fine to medium; [UPPER HOLOCENE WINDBLOWN DEPOSITS].		0.6		4, 4, 6		
0.8m: becoming grey streaked orange		0.8		6, 7		
1.2m - 1.6m: becoming loose		1.0		6, 3		
1.3m: Scala conducted through base of test pit		1.2		2, 2, 3		
	B	1.4		5, 5		
1.8m: becoming wet to saturated, dense		1.6		10		▼ 28/02/2023
SAND, with trace silt; grey brown. Dense; wet; uniformly graded; sand, fine to medium; [LOWER HOLOCENE WINDBLOWN DEPOSITS].		1.8		16		
2.0m: becoming wet, very dense		2.0		22 >>, 28 >>		
SAND; grey blue. Wet; uniformly graded; sand, fine to medium; inferred very dense. [LOWER HOLOCENE WINDBLOWN DEPOSITS] . EOH: 3.20m		2.2 2.4 2.6 2.8 3.0 3.2 3.4				

VANE SHEAR STRENGTH (kPa) — Vane: 50, 100, 150, 200 — Values

PHOTO(S)



REMARKS

Reviewed by: JS
Reviewed date: 23/03/2023
Equipment: 3.8T excavator with a 900 mm flat edge bucket attachment and 20 mm diameter Scala penetrometer.
Pit dimensions: 4 m x 4 m.
Test pit practical refusal at 3.2 m BEGL due to running sands.
Scala penetrometer effective refusal at 2.2 m BEGL.
Groundwater was encountered at 1.8 m BEGL.
Coordinates estimated from on-site GPS measurements (NZTM), GPS accuracy ±3 m.
Elevation estimated from GPS Datum (MSL), GPS accuracy ±5 m.

WATER

- ▼ Standing Water Level
- ▷ Out flow
- ◁ In flow

INVESTIGATION TYPE

- ☐ Hand Auger
- ☑ Test Pit

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INVESTIGATION LOG

HOLE NO.: TP02

CLIENT: Genesis
PROJECT: Foxton Solar Farm
JOB NO.: 221200

SITE LOCATION: Foxton, New Zealand
START DATE: 28/02/2023
CO-ORDINATES: 1796815.0mE, 5520711.0mN (NZTM)
ELEVATION: 27m (NZVD2016)
END DATE: 28/02/2023
CONTRACTOR: SKF Contracting
RIG: 3.8T excavator
DRILLER: S. Flavell
LOGGED BY: M. Owen

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa)	WATER
Sandy TOPSOIL; dark brown, grey. Moist; topsoil, trace organics, roots and rootlets; vegetation cover; sand, fine to medium.		0.0	TS JK	2		
SAND, with trace rootlets and silt; grey brown . Loose; non-plastic; moist; uniformly graded; sand, fine to medium; [UNCONTROLLED FILL].		0.2		2		
		0.4		2		
SAND, with trace roots and branches; grey. Loose; moist; uniformly graded; sand, fine to medium; [UPPER HOLOCENE WINDBLOWN DEPOSITS].		0.6		3		
		0.8		3		
1.0m: large branches uncovered		1.0		3		
1.1m: Scala conducted through base of test pit		1.2		2		
		1.4		2		
1.5m: becoming grey blue with minor orange streaks 1.5m: becoming wet to saturated, medium dense		1.6		3		▼ 28/02/2023
1.6m: with orange streaks		1.8		3		
1.7m - 1.8m: high concentration of roots and branches, dark brown	D	2.0		4		
1.8m: becoming dense		2.2		4		
		2.4		5		
		2.6		7		
2.6m: buried tree root, dark brown		2.8		10		
		3.0		13		
SAND; grey blue speckled white. Wet; uniformly graded; sand, fine to medium; inferred very dense. [LOWER HOLOCENE WINDBLOWN DEPOSITS] .	D	3.2		11		
EOH: 3.20m		3.4		9		
				8		
				4		
				3		

PHOTO(S)



REMARKS

Reviewed by: JS
Reviewed date: 23/03/2023
Equipment: 3.8T excavator with a 900 mm flat edge bucket attachment and 20 mm diameter Scala penetrometer.
Pit dimensions: 3.5 m x 3 m.
Test pit practical refusal at 3.2 m BEGL due to running sands.
Scala penetrometer target depth achieved at 2.5 m BEGL.
Groundwater was encountered at 1.5 m BEGL.
Coordinates estimated from on-site GPS measurements (NZTM), GPS accuracy ±3 m.
Elevation estimated from GPS Datum (MSL), GPS accuracy ±5 m.

WATER

- ▼ Standing Water Level
- ▷ Out flow
- ◁ In flow

INVESTIGATION TYPE

- ☐ Hand Auger
- ☑ Test Pit

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INVESTIGATION LOG

HOLE NO.: TP03

CLIENT: Genesis
PROJECT: Foxton Solar Farm
JOB NO.: 221200

SITE LOCATION: Foxton, New Zealand
START DATE: 28/02/2023
CO-ORDINATES: 1796785.0mE, 5519756.0mN (NZTM)
ELEVATION: 28m (NZVD2016)
END DATE: 28/02/2023
CONTRACTOR: SKF Contracting
RIG: 3.8T excavator
DRILLER: S. Flavell
LOGGED BY: M. Owen

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa)	WATER
Sandy TOPSOIL; dark brown. Moist; topsoil, trace organics and rootlets; vegetation cover; sand, fine to medium.		0.0	TS	1		
SAND; grey brown . Medium dense; moist; uniformly graded; sand, fine to medium; [UPPER HOLOCENE WINDBLOWN DEPOSITS].		0.2		2, 5, 6, 6, 7, 6, 7, 7, 6, 5, 6, 5, 5		
1.4m: Scala conducted through base of test pit	B	0.4				
SAND; grey streaked orange. Medium dense; wet to saturated; uniformly graded; sand, fine to medium; [UPPER HOLOCENE WINDBLOWN DEPOSITS].		0.6				
SAND; grey blue streaked orange. Medium dense; wet; uniformly graded; sand, fine to medium; [UPPER HOLOCENE WINDBLOWN DEPOSITS].		0.8				
1.9m: becoming dense		1.0				
2.1m: becoming medium dense		1.2				
2.6m: becoming grey blue		1.4		4, 4, 4, 4, 7, 8, 8, 6, 6, 6, 7		
EOH: 3.10m		1.6				28/02/2023
		1.8				
		2.0				
		2.2				
		2.4				
		2.6				
		2.8				
		3.0				
		3.2				
		3.4				

Vane: Values

PHOTO(S)



REMARKS

Reviewed by: JS
Reviewed date: 23/03/2023
Equipment: 3.8T excavator with a 900 mm flat edge bucket attachment and 20 mm diameter Scala penetrometer.
Pit dimensions: 4 m x 4 m.
Test pit practical refusal at 3.1 m BEGL due to running sands.
Scala penetrometer target depth achieved at 2.5 m BEGL.
Groundwater was encountered at 1.6 m BEGL.
Coordinates estimated from on-site GPS measurements (NZTM), GPS accuracy ±3 m.
Elevation estimated from GPS Datum (MSL), GPS accuracy ±5 m.

WATER

- ▼ Standing Water Level
- ▷ Out flow
- ◁ In flow

INVESTIGATION TYPE

- ☐ Hand Auger
- ☑ Test Pit

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INVESTIGATION LOG

HOLE NO.: TP04

CLIENT: Genesis
PROJECT: Foxton Solar Farm

JOB NO.: 221200

SITE LOCATION: Foxton, New Zealand
START DATE: 27/02/2023
CO-ORDINATES: 1797730.0mE, 5520311.0mN (NZTM)
ELEVATION: 28m (NZVD2016)
END DATE: 27/02/2023
CONTRACTOR: SKF Contracting
RIG: 3.8T excavator
DRILLER: S. Flavell
LOGGED BY: M. Owen

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa)	WATER
Sandy TOPSOIL, with some silt; grey brown. Non-plastic; moist; topsoil, trace organics, roots and rootlets; vegetation cover; sand, fine to medium.		0.0	TS	2		
SAND, with trace roots, rootlets and branches and silt; grey brown. Loose; non-plastic; moist; uniformly graded; sand, fine to medium; [UNCONTROLLED FILL].		0.2		2, 3, 2, 1		
SAND, with trace roots and rootlets; grey. Loose; moist; uniformly graded; sand, fine to medium; [UPPER HOLOCENE WINDBLOWN DEPOSITS].		0.6		3, 3, 3		
0.8m: becoming medium dense		0.8		4, 4		
1.0m: with some orange streaks		1.0		3		
1.1m: Scala conducted through base of test pit	B	1.2		4, 4, 4		
1.4m: becoming grey		1.4		6		
1.5m: becoming dense		1.5		9		
1.6m: becoming wet to saturated		1.6		10, 10		▼ 28/02/2023
PEAT, with some silt and sand; black, dark brown, grey, orange. Low plasticity; moist to wet; Peat, root fibres ; sand, fine to medium, interbedded; [HOLOCENE SWAMP DEPOSITS].		1.8		7		
SAND; grey, minor orange streaks. Dense; wet; uniformly graded; sand, fine to medium; [LOWER HOLOCENE WINDBLOWN DEPOSITS].		2.0		3, 7, 8		
SAND; grey blue. Wet; uniformly graded; sand, fine to medium; inferred dense. [LOWER HOLOCENE WINDBLOWN DEPOSITS].		2.2		10, 11		
EOH: 3.00m		2.4		14		
		2.6				
		2.8				
		3.0				
		3.2				
		3.4				

Vane: Values

PHOTO(S)



REMARKS

Reviewed by: JS
Reviewed date: 23/03/2023
Equipment: 3.8T excavator with a 900 mm flat edge bucket attachment and 20 mm diameter Scala penetrometer.
Pit dimensions: 4 m x 4 m.
Test pit practical refusal at 3.0 m BEGL due to running sands.
Scala penetrometer target depth achieved at 2.5 m BEGL.
Groundwater was encountered at 1.6 m BEGL.
Coordinates estimated from on-site GPS measurements (NZTM), GPS accuracy ±3 m.
Elevation estimated from GPS Datum (MSL), GPS accuracy ±5 m.

WATER

- ▼ Standing Water Level
- ▷ Out flow
- ◁ In flow

INVESTIGATION TYPE

- ☐ Hand Auger
- ☑ Test Pit

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INVESTIGATION LOG

HOLE NO.: TP05

CLIENT: Genesis
PROJECT: Foxton Solar Farm
JOB NO.: 221200

SITE LOCATION: Foxton, New Zealand
START DATE: 27/02/2023
CO-ORDINATES: 1798581.0mE, 5520421.0mN (NZTM)
ELEVATION: 27m (NZVD2016)
END DATE: 27/02/2023
CONTRACTOR: SKF Contracting
RIG: 3.8T excavator
DRILLER: S. Flavell
LOGGED BY: M. Owen

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa)	WATER
Sandy TOPSOIL; grey brown. Moist; topsoil, trace organics and rootlets; vegetation cover; sand, fine to medium.		0.0	TS	1, 2		
SAND, with trace roots and rootlets and silt; grey, minor orange streaks. Medium dense; non-plastic; moist; uniformly graded; sand, fine to medium; [UNCONTROLLED FILL].		0.2		5, 5, 5		
SAND, with trace roots and rootlets; grey, minor orange streaks. Medium dense; moist; uniformly graded; sand, fine to medium; [UPPER HOLOCENE WINDBLOWN DEPOSITS].		0.4		4, 4		
		0.6		6, 6		
		0.8		7, 8		
1.0m: branch uncovered, ~15 mm diameter, wet to saturated, dense	B	1.0		11, 15		▼ 27/02/2023
1.3m: Scala conducted through base of test pit, medium dense		1.2		4, 6, 6, 6, 5		
SAND, with trace roots and rootlets; grey blue. Dense; wet; uniformly graded; sand, fine to medium; [UPPER HOLOCENE WINDBLOWN DEPOSITS].		1.6		8, 8		
2.0m: becoming loose		1.8		2, 2		
PEAT, with some silt; black, dark brown. Low plasticity; moist to wet; Peat, root fibres; [HOLOCENE SWAMP DEPOSITS].	B	2.0		5, 5, 9		
SAND; grey blue. Wet; uniformly graded; sand, fine to medium; inferred dense. [LOWER HOLOCENE WINDBLOWN DEPOSITS].		2.2				
EOH: 3.00m		2.4				
		2.6				
		2.8				
		3.0				
		3.2				
		3.4				

PHOTO(S)



REMARKS

Reviewed by: JS
Reviewed date: 23/03/2023
Equipment: 3.8T excavator with a 900 mm flat edge bucket attachment and 20 mm diameter Scala penetrometer.
Pit dimensions: 5 m x 4 m.
Test pit practical refusal at 3.0 m BEGL due to running sands.
Scala penetrometer target depth achieved at 2.5 m BEGL.
Groundwater was encountered at 1.0 m BEGL.
Coordinates estimated from on-site GPS measurements (NZTM), GPS accuracy ±3 m.
Elevation estimated from GPS Datum (MSL), GPS accuracy ±5 m.

WATER

- ▼ Standing Water Level
- ▷ Out flow
- ◁ In flow

INVESTIGATION TYPE

- ☐ Hand Auger
- ☑ Test Pit

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INVESTIGATION LOG

HOLE NO.: TP06

CLIENT: Genesis
PROJECT: Foxton Solar Farm

JOB NO.: 221200

SITE LOCATION: Foxton, New Zealand
START DATE: 28/02/2023
CO-ORDINATES: 1798681.0mE, 5520180.0mN (NZTM)
ELEVATION: 26m (NZVD2016)
END DATE: 28/02/2023
CONTRACTOR: SKF Contracting
RIG: 3.8T excavator
DRILLER: S. Flavell
LOGGED BY: M. Owen

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa)	WATER
Sandy TOPSOIL; dark brown. Moist; topsoil, trace organics, rootlets and small branches; vegetation cover; sand, fine to medium.		0.0	TS	2		
SAND, with trace roots, rootlets and branches and silt; grey brown. Loose; non-plastic; moist; uniformly graded; sand, fine to medium; [UNCONTROLLED FILL].		0.2		2, 3		
		0.4		2, 2, 2		
SAND, with trace roots, rootlets and branches; grey streaked orange. Loose; moist; uniformly graded; sand, fine to medium; [UPPER HOLOCENE WINDBLOWN DEPOSITS].		0.6		3		
		0.8		2, 2		
0.9m: becoming very loose		1.0		1, 1		▼ 28/02/2023
1.0m: becoming wet to saturated						
1.1m: Scala conducted through base of test pit		1.2		1		
1.3m: becoming loose				3		
1.4m - 1.6m: layer of roots, rootlets and branches uncovered		1.4		3		
1.5m: becoming medium dense		1.6		5, 7		
1.7m: becoming dense		1.8		12, 14		
1.9m: becoming very dense		2.0		18, 22 >>		
		2.2				
SAND; grey blue. Wet; uniformly graded; sand, fine to medium; inferred very dense. [INFERRED LOWER HOLOCENE WINDBLOWN DEPOSITS].		2.4				
		2.6				
		2.8				
EOH: 3.00m		3.0				
		3.2				
		3.4				

Vane: Values

PHOTO(S)



REMARKS

Reviewed by: JS
Reviewed date: 23/03/2023
Equipment: 3.8T excavator with a 900 mm flat edge bucket attachment and 20 mm diameter Scala penetrometer.
Pit dimensions: 3 m x 3 m.
Test pit practical refusal at 3.0 m BEGL due to running sands.
Scala penetrometer effective refusal at 2.1 m BEGL.
Groundwater was encountered at 1.0 m BEGL.
Coordinates estimated from on-site GPS measurements (NZTM), GPS accuracy ±3 m.
Elevation estimated from GPS Datum (MSL), GPS accuracy ±5 m.

WATER

- ▼ Standing Water Level
- ▷ Out flow
- ◁ In flow

INVESTIGATION TYPE

- ☐ Hand Auger
- ☑ Test Pit

Generated with CORE-GS by Geroc - Hand Auger - scala & vane bars - 18/04/2023 4:01:49 pm

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INVESTIGATION LOG

HOLE NO.: TP07

CLIENT: Genesis
PROJECT: Foxton Solar Farm
JOB NO.: 221200

SITE LOCATION: Foxton, New Zealand
START DATE: 27/02/2023
CO-ORDINATES: 1799111.0mE, 5519725.0mN (NZTM)
ELEVATION: 25m (NZVD2016)
END DATE: 27/02/2023
CONTRACTOR: SKF Contracting
RIG: 3.8T excavator
DRILLER: S. Flavell
LOGGED BY: M. Owen

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)
Sandy TOPSOIL, with some silt; dark brown. Non-plastic; moist; topsoil, trace organics and rootlets; vegetation cover; sand, fine to medium.		0.0
SAND, with trace rootlets and silt; dark brown. Medium dense; non-plastic; moist; uniformly graded; sand, fine to medium; [UNCONTROLLED FILL].		0.2
SAND, with trace roots and rootlets; grey, with some pale orange streaks. Medium dense; moist; uniformly graded; sand, fine to medium; [UPPER HOLOCENE WINDBLOWN DEPOSITS].		0.4
		0.6
		0.8
1.0m: Scala conducted through base of test pit, very loose		1.0
		1.2
		1.4
1.5m: becoming medium dense		1.6
1.8m: becoming dense		1.8
SAND; grey blue. Medium dense; wet; uniformly graded; sand, fine to medium; [UPPER HOLOCENE WINDBLOWN DEPOSITS].	B	2.0
EOH: 2.40m		2.2
		2.4
		2.6
		2.8
		3.0
		3.2
		3.4

LEGEND: TS

SCALA PENETROMETER (Blows / 100mm)

Depth (m)	Blows / 100mm
0.0	1
0.2	3, 3
0.4	4, 4
0.6	3, 4
0.8	3, 4
1.0	4, 4
1.2	1, 1, 1, 1, 1
1.4	1
1.6	4, 5
1.8	5, 8
2.0	8
2.2	7, 7
2.4	6, 4, 5

VANE SHEAR STRENGTH (kPa) — Vane: Values

WATER: 27/02/2023

PHOTO(S)



REMARKS

Reviewed by: JS
Reviewed date: 23/03/2023
Equipment: 3.8T excavator with a 900 mm flat edge bucket attachment and 20 mm diameter Scala penetrometer.
Pit dimensions: 3 m x 3 m.
Test pit practical refusal at 2.4 m BEGL due to running sands.
Scala penetrometer target depth achieved at 2.5 m BEGL.
Groundwater was encountered at 1.0 m BEGL.
Coordinates estimated from on-site GPS measurements (NZTM), GPS accuracy ±3 m.
Elevation estimated from GPS Datum (MSL), GPS accuracy ±5 m.

WATER
- ▼ Standing Water Level
- ▷ Out flow
- ◁ In flow

INVESTIGATION TYPE
- ☐ Hand Auger
- ☑ Test Pit

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INVESTIGATION LOG

HOLE NO.: TP08

CLIENT: Genesis
PROJECT: Foxton Solar Farm
JOB NO.: 221200

SITE LOCATION: Foxton, New Zealand
START DATE: 28/02/2023
CO-ORDINATES: 1799966.0mE, 5519825.0mN (NZTM)
ELEVATION: 25m (NZVD2016)
END DATE: 28/02/2023
CONTRACTOR: SKF Contracting
RIG: 3.8T excavator
DRILLER: S. Flavell
LOGGED BY: M. Owen

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa)	WATER
Sandy TOPSOIL; dark brown. Moist; topsoil, trace organics and rootlets; vegetation cover; sand, fine to medium.		0.0	TS	1		
SAND, with trace rootlets and small branches and silt; grey brown, orange. Medium dense to dense; non-plastic; moist; uniformly graded; sand, fine to medium; [UNCONTROLLED FILL].	D	0.2		5, 8, 7, 7		
SAND, with trace rootlets; dark grey. Dense; moist; uniformly graded; sand, fine to medium; [UPPER HOLOCENE WINDBLOWN DEPOSITS].		0.4		8, 9, 10, 11		
SAND; grey, minor orange streaks. Dense; moist; uniformly graded; sand, fine to medium; [UPPER HOLOCENE WINDBLOWN DEPOSITS].		0.6		11, 10, 9		
1.2m: Scala conducted through base of test pit, becoming loose 1.3m: becoming wet to saturated		0.8		2		
1.4m: becoming medium dense		1.0		3, 4, 4, 4		
		1.2		5, 7		
1.9m: becoming dense		1.4		8, 8, 9		
		1.6		12, 13, 16		
SAND; grey blue. Wet; uniformly graded; sand, fine to medium; inferred dense. [LOWER HOLOCENE WINDBLOWN DEPOSITS].		1.8				
EOH: 2.90m		2.0				
		2.2				
		2.4				
		2.6				
		2.8				
		3.0				
		3.2				
		3.4				

28/02/2023

PHOTO(S)



REMARKS

Reviewed by: JS
Reviewed date: 23/03/2023
Equipment: 3.8T excavator with a 900 mm flat edge bucket attachment and 20 mm diameter Scala penetrometer.
Pit dimensions: 3 m x 3 m.
Test pit practical refusal at 2.9 m BEGL due to running sands.
Scala penetrometer target depth achieved at 2.5 m BEGL.
Groundwater was encountered at 1.25 m BEGL.
Coordinates estimated from on-site GPS measurements (NZTM), GPS accuracy ±3 m.
Elevation estimated from GPS Datum (MSL), GPS accuracy ±5 m.

WATER

- ▼ Standing Water Level
- ▷ Out flow
- ◁ In flow

INVESTIGATION TYPE

- ☐ Hand Auger
- ☑ Test Pit

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INVESTIGATION LOG

HOLE NO.: SP01

CLIENT: Genesis
PROJECT: Foxton Solar Farm
JOB NO.: 221200

SITE LOCATION: Foxton, New Zealand
START DATE: 24/02/2023
CO-ORDINATES: 1796342.0mE, 5520863.0mN (NZTM)
ELEVATION: 27m (NZVD2016)
END DATE: 24/02/2023
CONTRACTOR: BTW Co. Ltd.
RIG: 20 mm Diameter Scala Penetror
DRILLER: M. Owen
LOGGED BY: M. Owen

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane: Values	WATER
EOH: 2.40m		0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.4, 2.6, 2.8, 3.0, 3.2, 3.4		1, 2, 3, 2, 3, 4, 5, 6, 6, 5, 5, 3, 2, 2, 6, 9, 13, 14, 12, 15, 17, 19, 20, 21 >>		Groundwater Not Encountered

PHOTO(S)

REMARKS

Reviewed by: JS
Reviewed date: 23/03/2023
Equipment: 20 mm diameter Scala penetrometer.
Scala penetrometer effective refusal at 2.4 m BEGL.
Coordinates estimated from on-site GPS measurements (NZTM), GPS accuracy ±3 m.
Elevation estimated from GPS Datum (MSL), GPS accuracy ±5 m.

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- Hand Auger
- Test Pit

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INVESTIGATION LOG

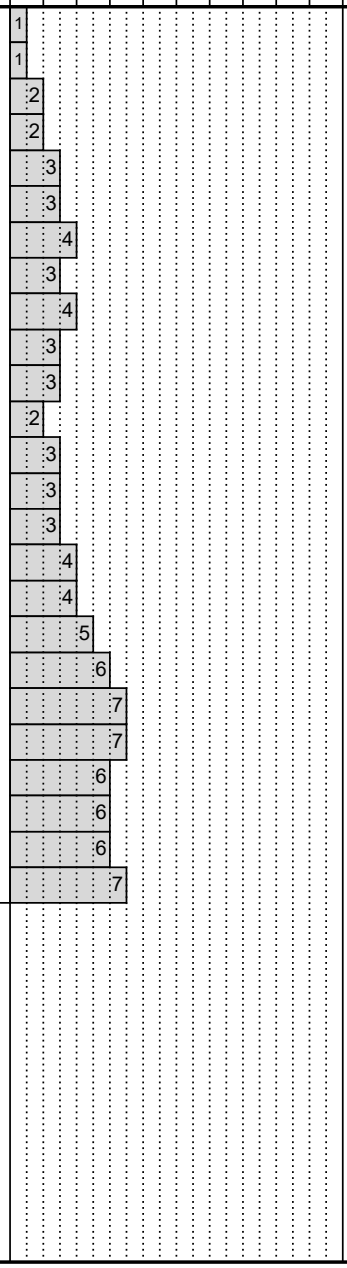
HOLE NO.: SP02

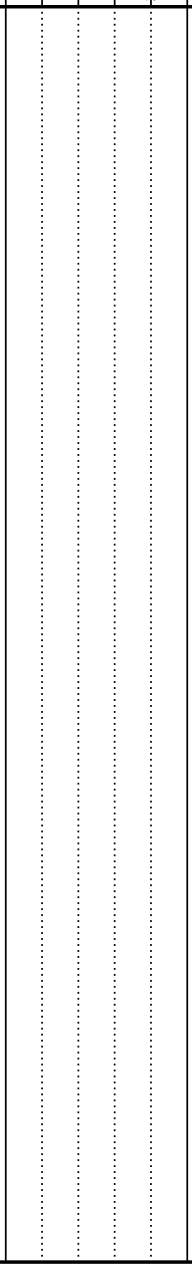
CLIENT: Genesis
PROJECT: Foxton Solar Farm

JOB NO.: 221200

SITE LOCATION: Foxton, New Zealand
START DATE: 24/02/2023
CO-ORDINATES: 1796903.0mE, 5520084.0mN (NZTM)
ELEVATION: 27m (NZVD2016)
END DATE: 24/02/2023
CONTRACTOR: BTW Co. Ltd.
RIG: 20 mm Diameter Scala Penetror
DRILLER: M. Owen
LOGGED BY: M. Owen

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane: Values	WATER
EOH: 2.50m						Groundwater Not Encountered





PHOTO(S)

REMARKS

Reviewed by: JS
Reviewed date: 23/03/2023
Equipment: 20 mm diameter Scala penetrometer.
Scala penetrometer target depth achieved at 2.5 m BEGL.
Coordinates estimated from on-site GPS measurements (NZTM), GPS accuracy ±3 m.
Elevation estimated from GPS Datum (MSL), GPS accuracy ±5 m.

WATER

- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE

- Hand Auger
- Test Pit

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INVESTIGATION LOG

HOLE NO.: SP03

CLIENT: Genesis
PROJECT: Foxton Solar Farm

JOB NO.: 221200

SITE LOCATION: Foxton, New Zealand
START DATE: 24/02/2023
CO-ORDINATES: 1797247.0mE, 5520509.0mN (NZTM)
ELEVATION: 27m (NZVD2016)
END DATE: 24/02/2023
CONTRACTOR: BTW Co. Ltd.
RIG: 20 mm Diameter Scala Penetror
DRILLER: M. Owen
LOGGED BY: M. Owen

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane:	WATER
EOH: 2.50m				2 4 6 8 10 12 14 16 18	50 100 150 200 Values	Groundwater Not Encountered

Scala penetrometer blows per 100mm: 1, 1, 2, 2, 3, 3, 4, 3, 2, 2, 2, 1, 1, 1, 2, 4, 7, 10, 8, 10, 10, 7, 6, 3, 5

Depth (m): 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.4, 2.6, 2.8, 3.0, 3.2, 3.4

PHOTO(S)

REMARKS

Reviewed by: JS
Reviewed date: 23/03/2023
Equipment: 20 mm diameter Scala penetrometer.
Scala penetrometer target depth achieved at 2.5 m BEGL.
Coordinates estimated from on-site GPS measurements (NZTM), GPS accuracy ±3 m.
Elevation estimated from GPS Datum (MSL), GPS accuracy ±5 m.

WATER

- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE

- Hand Auger
- Test Pit

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INVESTIGATION LOG

HOLE NO.: SP04

CLIENT: Genesis
PROJECT: Foxton Solar Farm

JOB NO.: 221200

SITE LOCATION: Foxton, New Zealand
START DATE: 23/02/2023
CO-ORDINATES: 1798128.0mE, 5520607.0mN (NZTM)
ELEVATION: 26m (NZVD2016)
END DATE: 23/02/2023
CONTRACTOR: BTW Co. Ltd.
RIG: 20 mm Diameter Scala Penetror
DRILLER: M. Owen
LOGGED BY: M. Owen

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa)	WATER
EOH: 1.60m				1, 2, 4, 5, 6, 6, 7, 6, 7, 5, 8, 12, 17, 17, 22 >>, 26 >>		Groundwater Not Encountered

PHOTO(S)

REMARKS

Reviewed by: JS
Reviewed date: 23/03/2023
Equipment: 20 mm diameter Scala penetrometer.
Scala penetrometer effective refusal at 1.6 m BEGL.
Coordinates estimated from on-site GPS measurements (NZTM), GPS accuracy ±3 m.
Elevation estimated from GPS Datum (MSL), GPS accuracy ±5 m.

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- Hand Auger
- Test Pit

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INVESTIGATION LOG

HOLE NO.: SP05

CLIENT: Genesis
PROJECT: Foxton Solar Farm

JOB NO.: 221200

SITE LOCATION: Foxton, New Zealand
START DATE: 24/02/2023
CO-ORDINATES: 1798176.0mE, 5520105.0mN (NZTM)
ELEVATION: 26m (NZVD2016)
END DATE: 24/02/2023
CONTRACTOR: BTW Co. Ltd.
RIG: 20 mm Diameter Scala Penetror
DRILLER: M. Owen
LOGGED BY: M. Owen

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane: Values	WATER
EOH: 1.20m		0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.4, 2.6, 2.8, 3.0, 3.2, 3.4		1, 1, 1, 4, 7, 8, 11, 14, 19, 20, 23 >>, 22 >>		Groundwater Not Encountered

PHOTO(S)

REMARKS

Reviewed by: JS
Reviewed date: 23/03/2023
Equipment: 20 mm diameter Scala penetrometer.
Scala penetrometer effective refusal at 1.2 m BEGL.
Coordinates estimated from on-site GPS measurements (NZTM), GPS accuracy ±3 m.
Elevation estimated from GPS Datum (MSL), GPS accuracy ±5 m.

WATER

- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE

- Hand Auger
- Test Pit

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INVESTIGATION LOG

HOLE NO.: SP06

CLIENT: Genesis
PROJECT: Foxton Solar Farm

JOB NO.: 221200

SITE LOCATION: Foxton, New Zealand
START DATE: 23/02/2023
CO-ORDINATES: 1798635.0mE, 5519918.0mN (NZTM)
ELEVATION: 26m (NZVD2016)
END DATE: 23/02/2023
CONTRACTOR: BTW Co. Ltd.
RIG: 20 mm Diameter Scala Penetror
DRILLER: M. Owen
LOGGED BY: M. Owen

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane: Values	WATER
EOH: 2.50m				1, 1, 2, 5, 7, 7, 11, 10, 13, 23 >>, 19, 13, 13, 8, 10, 10, 9, 6, 5, 9, 10, 12, 15, 18, 22 >>		Groundwater Not Encountered

PHOTO(S)

REMARKS

Reviewed by: JS
Reviewed date: 23/03/2023
Equipment: 20 mm diameter Scala penetrometer.
Scala penetrometer target depth achieved at 2.5 m BEGL.
Coordinates estimated from on-site GPS measurements (NZTM), GPS accuracy ±3 m.
Elevation estimated from GPS Datum (MSL), GPS accuracy ±5 m.

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- Hand Auger
- Test Pit

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INVESTIGATION LOG

HOLE NO.: SP07

CLIENT: Genesis
PROJECT: Foxton Solar Farm
JOB NO.: 221200

SITE LOCATION: Foxton, New Zealand
START DATE: 23/02/2023
CO-ORDINATES: 1799074.0mE, 5520298.0mN (NZTM)
ELEVATION: 26m (NZVD2016)
END DATE: 23/02/2023
CONTRACTOR: BTW Co. Ltd.
RIG: 20 mm Diameter Scala Penetror
DRILLER: M. Owen
LOGGED BY: M. Owen

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane:	WATER
EOH: 2.50m				2 2 2 2 4 2 7 8 9 7 5 4 4 3 3 3 3 4 4 4 4 5 7 7 8	Values	Groundwater Not Encountered

PHOTO(S)

REMARKS

Reviewed by: JS
Reviewed date: 23/03/2023
Equipment: 20 mm diameter Scala penetrometer.
Scala penetrometer target depth achieved at 2.5 m BEGL.
Coordinates estimated from on-site GPS measurements (NZTM), GPS accuracy ±3 m.
Elevation estimated from GPS Datum (MSL), GPS accuracy ±5 m.

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- Hand Auger
- Test Pit

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INVESTIGATION LOG

HOLE NO.: SP08

CLIENT: Genesis
PROJECT: Foxton Solar Farm

JOB NO.: 221200

SITE LOCATION: Foxton, New Zealand
START DATE: 23/02/2023
CO-ORDINATES: 1799490.0mE, 5520024.0mN (NZTM)
ELEVATION: 24m (NZVD2016)
END DATE: 23/02/2023
CONTRACTOR: BTW Co. Ltd.
RIG: 20 mm Diameter Scala Penetror
DRILLER: M. Owen
LOGGED BY: M. Owen

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane: Values	WATER
EOH: 2.50m				1, 1, 1, 2, 3, 4, 5, 5, 8, 12, 12, 9, 9, 9, 10, 9, 11, 12, 12, 14, 11, 10, 11, 12, 13		Groundwater Not Encountered

PHOTO(S)

REMARKS

Reviewed by: JS
Reviewed date: 23/03/2023
Equipment: 20 mm diameter Scala penetrometer.
Scala penetrometer target depth achieved at 2.5 m BEGL.
Coordinates estimated from on-site GPS measurements (NZTM), GPS accuracy ±3 m.
Elevation estimated from GPS Datum (MSL), GPS accuracy ±5 m.

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- Hand Auger
- Test Pit

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INVESTIGATION LOG

HOLE NO.: SP09

CLIENT: Genesis
PROJECT: Foxton Solar Farm

JOB NO.: 221200

SITE LOCATION: Foxton, New Zealand
START DATE: 23/02/2023
CO-ORDINATES: 1799570.0mE, 5519526.0mN (NZTM)
ELEVATION: 25m (NZVD2016)
END DATE: 23/02/2023
CONTRACTOR: BTW Co. Ltd.
RIG: 20 mm Diameter Scala Penetror
DRILLER: M. Owen
LOGGED BY: M. Owen

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa) Vane: Values	WATER
EOH: 2.50m				1, 2, 3, 4, 3, 4, 5, 6, 7, 6, 6, 6, 7, 10, 10, 15, 18, 17, 16, 16, 16, 16, 18, 17, 17		Groundwater Not Encountered

PHOTO(S)

REMARKS

Reviewed by: JS
Reviewed date: 23/03/2023
Equipment: 20 mm diameter Scala penetrometer.
Scala penetrometer target depth achieved at 2.5 m BEGL.
Coordinates estimated from on-site GPS measurements (NZTM), GPS accuracy ±3 m.
Elevation estimated from GPS Datum (MSL), GPS accuracy ±5 m.

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- Hand Auger
- Test Pit

Generated with CORE-GS by Geroc - Hand Auger - scala & vane bars - 18/04/2023 4:01:44 pm

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INVESTIGATION LOG

HOLE NO.: SP10

CLIENT: Genesis
PROJECT: Foxton Solar Farm

JOB NO.: 221200

SITE LOCATION: Foxton, New Zealand
START DATE: 23/02/2023
CO-ORDINATES: 1800004.0mE, 5519340.0mN (NZTM)
ELEVATION: 23m (NZVD2016)
END DATE: 23/02/2023
CONTRACTOR: BTW Co. Ltd.
RIG: 20 mm Diameter Scala Penetror
DRILLER: M. Owen
LOGGED BY: M. Owen

MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 100mm)	VANE SHEAR STRENGTH (kPa)	WATER
EOH: 2.50m				2 2 2 3 2 3 4 3 7 10 11 9 9 8 7 8 8 10 11 13 15 16 17 15 17	Vane: Values	Groundwater Not Encountered

PHOTO(S)

REMARKS

Reviewed by: JS
Reviewed date: 23/03/2023
Equipment: 20 mm diameter Scala penetrometer.
Scala penetrometer target depth achieved at 2.5 m BEGL.
Coordinates estimated from on-site GPS measurements (NZTM), GPS accuracy ±3 m.
Elevation estimated from GPS Datum (MSL), GPS accuracy ±5 m.

WATER
- Standing Water Level
- Out flow
- In flow

INVESTIGATION TYPE
- Hand Auger
- Test Pit

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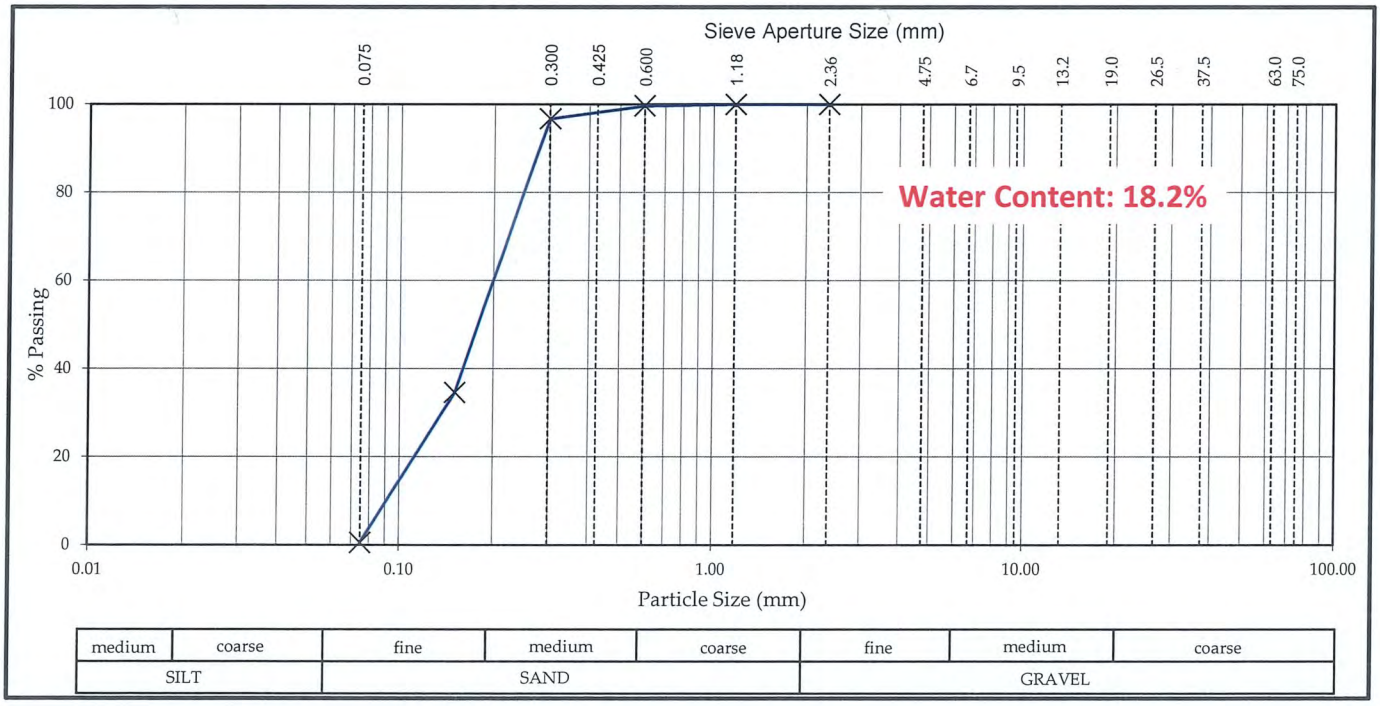
APPENDIX C LABORATORY TEST RESULTS

DRY SIEVE ANALYSIS
TEST REPORT

Project :	Foxton Solar Farm QA
Location :	TP01
Client :	BTW Company Ltd
Contractor :	N/A
Sampled by :	Mitch Owen
Date sampled :	28/02/23
Sampling method :	Not Stated
Sample description :	Sand
Sample condition	As received
Bore hole no :	TP01
Depth (m) :	Not Stated

Project No :	5-NBTW0.00
Lab Ref No :	NP2400-1
Client Ref No :	

Sieve Analysis							
Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing
75.00	-	19.00	-	4.75	-	0.425	-
63.00	-	13.20	-	2.36	100	0.300	97
37.50	-	9.50	-	1.18	100	0.150	35
26.50	-	6.70	-	0.600	100	0.075	1



Test Method	Notes
NZS 4407 : 2015 Test 3.8.2 NZS 4407 : 2015: Test 3.1	History: Oven Dried Fraction tested: Whole Sample Dispersant Used: None

Date tested : 09/03/23
Date reported : 09/03/23

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.
This report may only be reproduced in full

Approved Signatory
Rowan Carlyle
Designation : *Laboratory Manager*
Date : 09/03/23

ACCREDITED IANZ TESTING LABORATORY

Test results indicated as not accredited are outside the scope of the laboratory's accreditation

WSP
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New Zealand

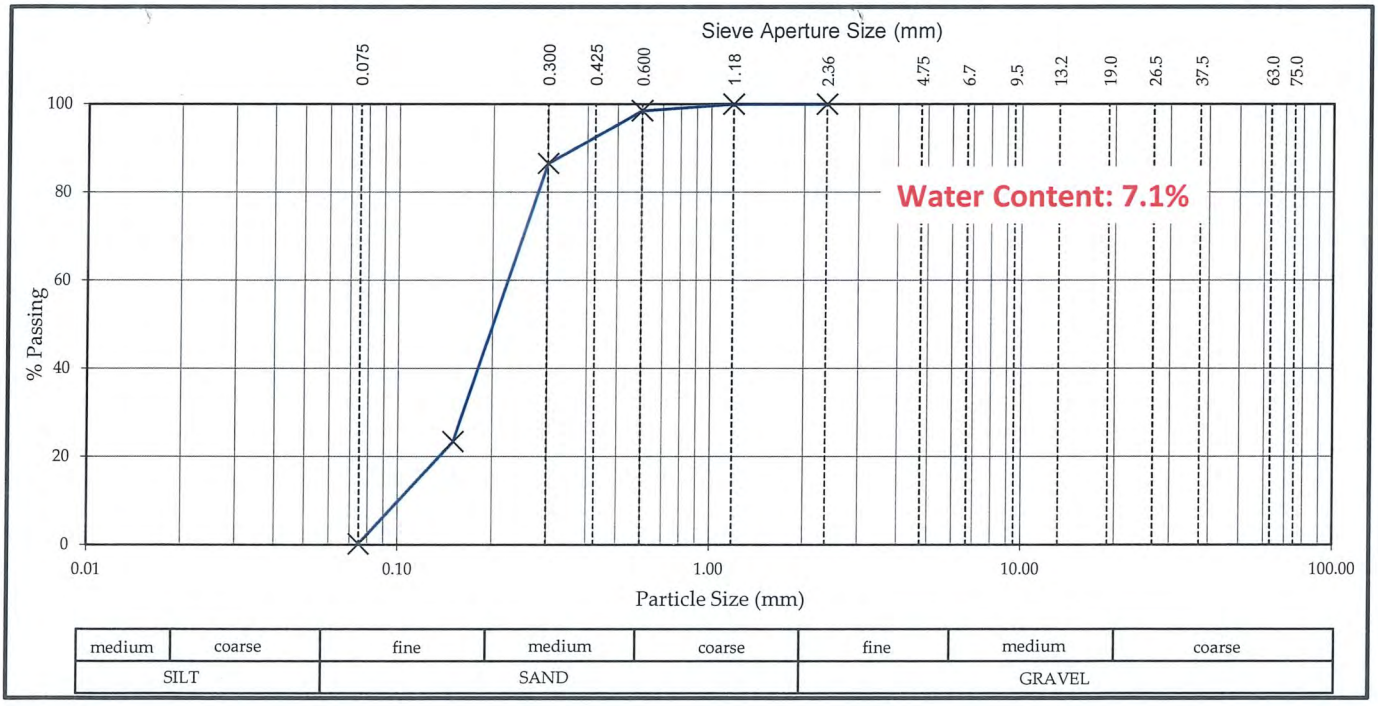
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DRY SIEVE ANALYSIS
TEST REPORT

Project :	Foxton Solar Farm QA
Location :	TP03
Client :	BTW Company Ltd
Contractor :	N/A
Sampled by :	Mitch Owen
Date sampled :	28/02/23
Sampling method :	Not Stated
Sample description :	Sand
Sample condition	As received
Bore hole no :	TP03
Depth (m) :	Not Stated

Project No :	5-NBTW0.00
Lab Ref No :	NP2400-2
Client Ref No :	

Sieve Analysis							
Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing
75.00	-	19.00	-	4.75	-	0.425	-
63.00	-	13.20	-	2.36	100	0.300	87
37.50	-	9.50	-	1.18	100	0.150	23
26.50	-	6.70	-	0.600	98	0.075	0



Test Method	Notes
NZS 4407 : 2015 Test 3.8.2 NZS 4407 : 2015: Test 3.1	History: Oven Dried Fraction tested: Whole Sample Dispersant Used: None

Date tested : 09/03/23
Date reported : 09/03/23

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.
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Approved Signatory
Rowan Carlyle
Designation : *Laboratory Manager*
Date : 09/03/23

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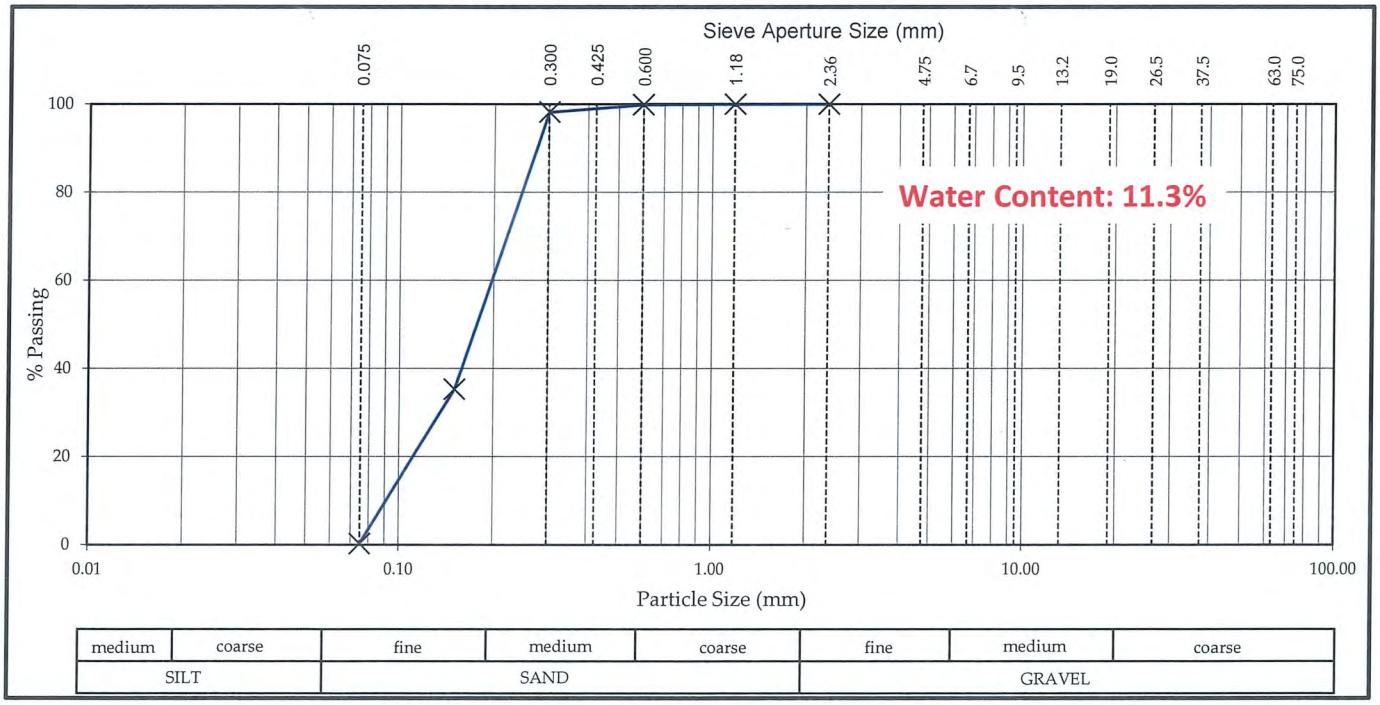
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Website www.wsp.com/nz

DRY SIEVE ANALYSIS
TEST REPORT

Project :	Foxton Solar Farm QA
Location :	TP05
Client :	BTW Company Ltd
Contractor :	N/A
Sampled by :	Mitch Owen
Date sampled :	28/02/23
Sampling method :	Not Stated
Sample description :	Sand
Sample condition	As received
Bore hole no :	TP05
Depth (m) :	Not Stated

Project No :	5-NBTW0.00
Lab Ref No :	NP2400-3
Client Ref No :	

Sieve Analysis							
Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing
75.00	-	19.00	-	4.75	-	0.425	-
63.00	-	13.20	-	2.36	100	0.300	98
37.50	-	9.50	-	1.18	100	0.150	35
26.50	-	6.70	-	0.600	100	0.075	0



Test Method	Notes
NZS 4407 : 2015 Test 3.8.2 NZS 4407 : 2015: Test 3.1	History: Oven Dried Fraction tested: Whole Sample Dispersant Used: None

Date tested : 09/03/23
Date reported : 09/03/23

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Approved Signatory
Rowan Carlyle
Designation : *Laboratory Manager*
Date : 09/03/23

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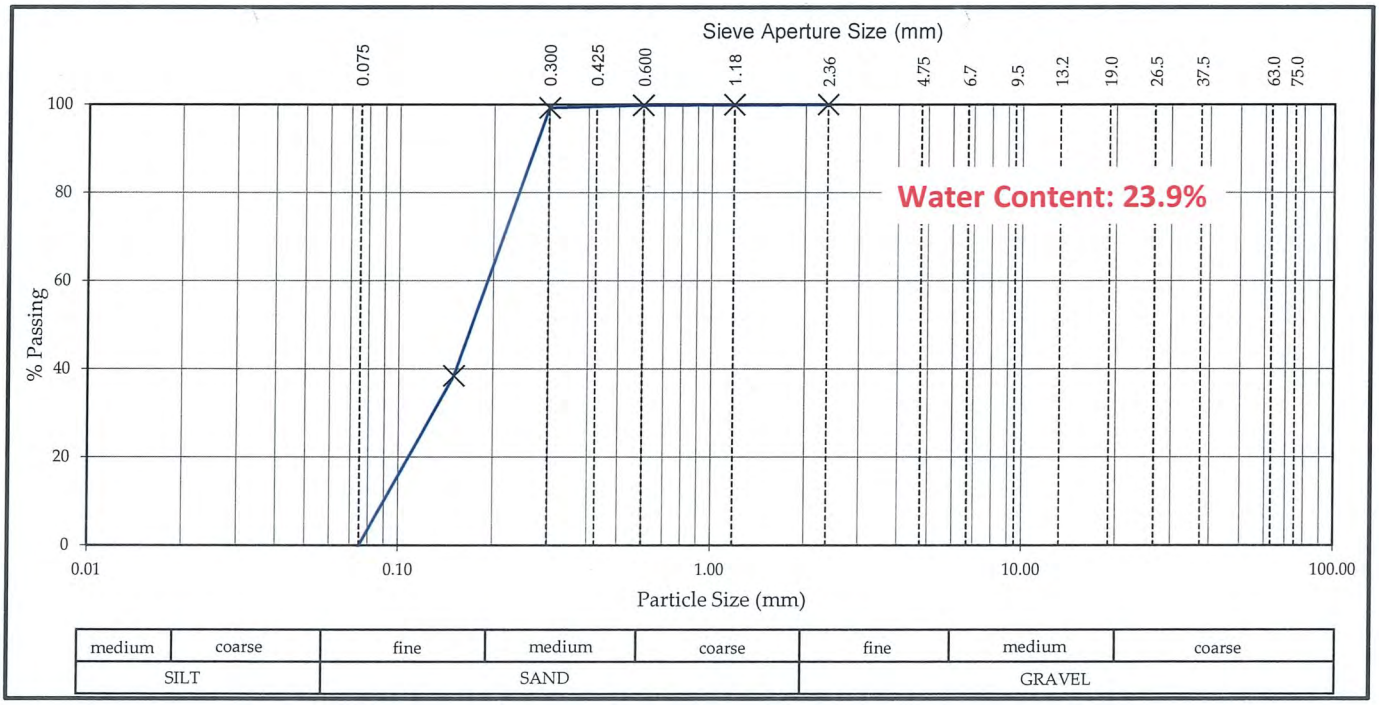
DRY SIEVE ANALYSIS
TEST REPORT

Project :	Foxton Solar Farm QA
Location :	TP07
Client :	BTW Company Ltd
Contractor :	N/A
Sampled by :	Mitch Owen
Date sampled :	28/02/23
Sampling method :	Not Stated
Sample description :	Sand
Sample condition	As received
Bore hole no :	TP07
Depth (m) :	Not Stated

Project No :	5-NBTW0.00
Lab Ref No :	NP2400-4
Client Ref No :	

Sieve Analysis

Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing
75.00	-	19.00	-	4.75	-	0.425	-
63.00	-	13.20	-	2.36	100	0.300	99
37.50	-	9.50	-	1.18	100	0.150	38
26.50	-	6.70	-	0.600	100	0.075	0



Test Method	Notes
NZS 4407 : 2015 Test 3.8.2 NZS 4407 : 2015: Test 3.1	History: Oven Dried Fraction tested: Whole Sample Dispersant Used: None

Date tested : 09/03/23
Date reported : 09/03/23

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.
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Approved Signatory
Rowan Carlyle
Designation : *Laboratory Manager*
Date : 09/03/23

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LIQUID LIMIT,PLASTIC LIMIT, PLASTICITY INDEX TEST REPORT

Project:	Foxton Solar Farm
Location:	Foxton
Client:	BTW Company Ltd
Contractor:	N/A
Sampled by:	Mitch Owen
Sampling method:	Disturbed samples
Sample description:	TP 05 Peat - Black
Sample condition:	As Received
Sample reference:	-
Sample depth:	2.2 to 2.5m

Project number:	5-NBTW0.00
Lab ref number:	NP2400-3.1
Client ref number:	221200
Folder number:	-

Test Results

As received water content: 220.6%

Liquid limit: 412

Plastic limit: 380

Plasticity Index: 32

Linear Shrinkage: 35

Test methods		Notes
Water Content:	NZS 4402 : 1986, Test 2.1	Test performed on: Fraction passing 0.425mm test sieve
Liquid Limit:	NZS 4402 : 1986, Test 2.2	Sample descriptions are not covered by IANZ accreditation.
Plastic Limit:	NZS 4402 : 1986, Test 2.3	Balance readable to 2 decimal places used.
Plasticity Index:	NZS 4402 : 1986, Test 2.4	Linear shrinkage: NZS 4402 : 1986, Test 2.6

Date tested : 09/03/23
Date reported : 10/03/23

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.
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Approved Signatory
Rowan Carlyle
Designation : *Laboratory Manager*
Date : 10/03/23

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PLASTICITY INDEX FOR AGGREGATES
TEST REPORT

Project:	Foxton Solar Farm
Location:	Foxton
Client:	BTW Company Ltd
Contractor:	N/A
Sampled by:	Mitch Owen
Date sampled:	27/02/23
Sampling method:	Disturbed samples
Sample description:	TP 08 Silty SAND, dark brownish Grey
Sample condition:	As Received
Sample reference:	-
Sample depth:	0.15 to 0.3m
Date received:	7/03/23

Project number:	5-NBTW0.00
Lab ref number:	NP2400-5
Client ref number:	221200
Folder number:	

Test Results

As rec'd water content (%) 27.9%

Cone Penetration limit: 44

Plastic limit: Unable to Roll Threads

Plasticity Index: Non plastic

Linear Shrinkage : 4

Test methods		Notes
Water Content:	NZS 4407 : 2015 Test 3.1	Test performed on: Fraction passing 0.425mm test sieve
Cone Penetration Limit:	NZS 4407 : 2015 Test 3.2	Sample descriptions are not covered by IANZ accreditation.
Plastic Limit:	NZS 4407 : 2015 Test 3.3	Balance readable to 2 decimal places used.
Plasticity Index:	NZS 4407 : 2015 Test 3.4	Linear shrinkage: NZS 4402 : 1986, Test 2.6

Date tested: 09/03/23
Date reported: 10/03/23

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.
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IANZ Approved Signatory
Rowan Carlyle
Designation: *Laboratory Manager*
Date: 10/03/23

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DRY DENSITY / WATER CONTENT RELATIONSHIP
VIBRATING COMPACTION

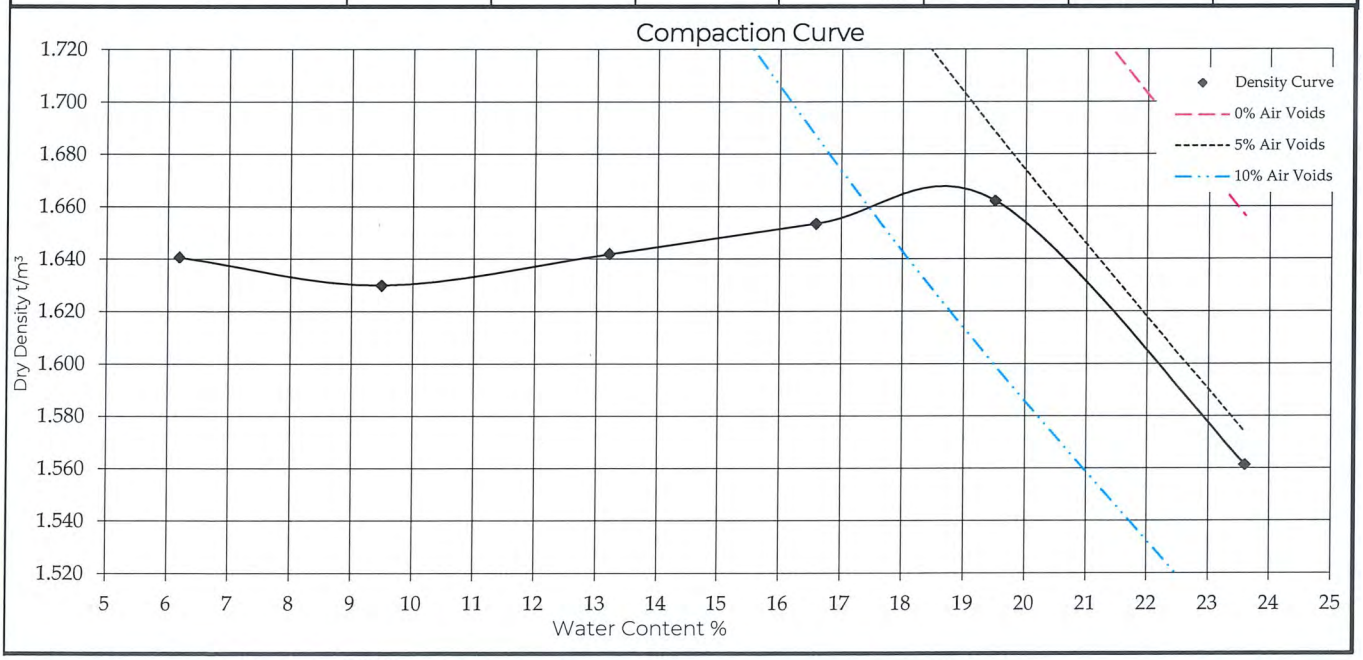
Project :	Foxton Solar Farm QA
Location :	Foxton, NZ
Client :	BTW Company Ltd
Contractor :	N/A
Sampled by :	Mitch Owen
Date sampled :	28/02/23
Sampling method :	Disturbed Samples
Sample description :	Sand
Sample condition :	As Received
Solid density :	2.72 t/m³ (Assumed)
Source :	TP01

Project No :	5-NBTW0.00
Lab Ref No :	NP2400-1.1
Client Ref No :	3007451

Test Results

Maximum dry density	1.66 t/m³	Natural water content	16.6 %
Optimum water content	18 %	Fraction tested	Whole

Sample ID		A	B	C	Nat	D	E	
Bulk density	t/m³	1.742	1.785	1.859	1.928	1.986	1.930	
Water content	%	6.2	9.5	13.2	16.6	19.5	23.6	
Dry density	t/m³	1.641	1.630	1.642	1.653	1.662	1.561	
Sample condition								



Test Methods		Notes
Compaction	NZS 4402 : 1986 : Test 4.1.3	

Date tested : 08/03/23
Date reported : 14/03/23

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.
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Approved Signatory
Rowan Carlyle
Designation : *Laboratory Manager*
Date : 14/03/23

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ELECTRICAL RESISTIVITY TEST REPORT

Project:	Foxton Solar Farm
Location:	Foxton, NZ
Client:	BTW Company Ltd
Contractor:	N/A
Sampled by:	Mitch Owen
Date sampled:	27-28/02/23
Sampling method:	Disturbed Samples
Sample description:	Sand
Sample condition:	As Received
Sample reference:	TP01
Sample depth (m):	1.5 - 2.0
Sample history:	Unknown
Compaction method:	Hand Tampered

Project number:	1-LA647.00
Lab ref number:	AL8700/1
Client ref number:	221200
Order number:	3007451

Test results

Bulk density (t/m³)	1.85
Dry density (t/m³)	1.57
As received water content (%)	18.8
As compacted water content (%)	17.7
Saturated water content (%)	23.6
Test temperature (°C)	20
Compacted sample dimensions (mm)	100H x 100W x 200L
Mass water required to saturate soil (g)	184

Resistivity @ 20°C (Initial) (Ω.m)	371
Resistivity @ 20°C (after 1 hour of saturation) (Ω.m)	366

Notes

Highest compaction that can be achieved by hand tampered
Target dry density: 1.577 t/m³, 95% of Maximum Dry Density

Test Methods

Electrical Resistivity: BS 1377: Part 3: 1990. Section 10.4 (Open container method)

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.

Date tested: 23/03/23

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IANZ Approved Signatory

Thirushen Pillay

Civil Engineering Technician

Date : 27/03/23

ACCREDITED IANZ TESTING LABORATORY

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ELECTRICAL RESISTIVITY TEST REPORT

Project:	Foxton Solar Farm
Location:	Foxton, NZ
Client:	BTW Company Ltd
Contractor:	N/A
Sampled by:	Mitch Owen
Date sampled:	27-28/02/23
Sampling method:	Disturbed Samples
Sample description:	Sand
Sample condition:	As Received
Sample reference:	TP03
Sample depth (m):	0.5 - 1.0
Sample history:	Unknown
Compaction method:	Hand Tampered

Project number:	1-LA647.00
Lab ref number:	AL8700/2
Client ref number:	221200
Order number:	3007451

Test results

Bulk density (t/m³)	1.86
Dry density (t/m³)	1.58
As received water content (%)	7.5
As compacted water content (%)	17.5
Saturated water content (%)	21.9
Test temperature (°C)	22
Compacted sample dimensions (mm)	100H x 100W x 200L
Mass water required to saturate soil (g)	137

Resistivity @ 20°C (Initial) (Ω.m)	233
Resistivity @ 20°C (after 1 hour of saturation) (Ω.m)	234

Notes

Highest compaction that can be achieved by hand tampered
Target dry density: 1.577 t/m³, 95% of Maximum Dry Density

Test Methods

Electrical Resistivity: BS 1377: Part 3: 1990. Section 10.4 (Open container method)

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.

Date tested: 23/03/23

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IANZ Approved Signatory

Thirushen Pillay

Civil Engineering Technician

Date : 27/03/23

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ELECTRICAL RESISTIVITY TEST REPORT

Project:	Foxton Solar Farm
Location:	Foxton, NZ
Client:	BTW Company Ltd
Contractor:	N/A
Sampled by:	Mitch Owen
Date sampled:	27-28/02/23
Sampling method:	Disturbed Samples
Sample description:	Sand
Sample condition:	As Received
Sample reference:	TP04
Sample depth (m):	1.0 - 1.5
Sample history:	Unknown
Compaction method:	Hand Tampered

Project number:	1-LA647.00
Lab ref number:	AL8700/3
Client ref number:	221200
Order number:	3007451

Test results

Bulk density (t/m³)	1.86
Dry density (t/m³)	1.57
As received water content (%)	17.1
As compacted water content (%)	18.3
Saturated water content (%)	22.2
Test temperature (°C)	22
Compacted sample dimensions (mm)	100H x 100W x 200L
Mass water required to saturate soil (g)	122

Resistivity @ 20°C (Initial) (Ω.m)	65
Resistivity @ 20°C (after 1 hour of saturation) (Ω.m)	65

Notes

Highest compaction that can be achieved by hand tampered
Target dry density: 1.577 t/m³, 95% of Maximum Dry Density

Test Methods

Electrical Resistivity: BS 1377: Part 3: 1990. Section 10.4 (Open container method)

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.

Date tested: 23/03/23

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Thirushen Pillay

Civil Engineering Technician

Date : 27/03/23

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ELECTRICAL RESISTIVITY TEST REPORT

Project:	Foxton Solar Farm
Location:	Foxton, NZ
Client:	BTW Company Ltd
Contractor:	N/A
Sampled by:	Mitch Owen
Date sampled:	27-28/02/23
Sampling method:	Disturbed Samples
Sample description:	Sand
Sample condition:	As Received
Sample reference:	TP07
Sample depth (m):	2.0 - 2.4
Sample history:	Unknown
Compaction method:	Hand Tampered

Project number:	1-LA647.00
Lab ref number:	AL8700/4
Client ref number:	221200
Order number:	3007451

Test results

Bulk density (t/m³)	1.86
Dry density (t/m³)	1.58
As received water content (%)	23.3
As compacted water content (%)	17.9
Saturated water content (%)	23.1
Test temperature (°C)	21
Compacted sample dimensions (mm)	100H x 100W x 200L
Mass water required to saturate soil (g)	163

Resistivity @ 20°C (Initial) (Ω.m)	141
Resistivity @ 20°C (after 1 hour of saturation) (Ω.m)	140

Notes

Highest compaction that can be achieved by hand tampered
Target dry density: 1.577 t/m³, 95% of Maximum Dry Density

Test Methods

Electrical Resistivity: BS 1377: Part 3: 1990. Section 10.4 (Open container method)

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.

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Date tested: 23/03/23

IANZ Approved Signatory

Date : 27/03/23

Thirushen Pillay

Civil Engineering Technician

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E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	BTW Company Limited	**Lab No:**	3193411 SPv1
Contact:	James Stringer C/- BTW Company Limited PO Box 551 New Plymouth 4340	**Date Received:**	08-Mar-2023
		Date Reported:	17-Mar-2023
		Quote No:	122766
		Order No:	221200
		Client Reference:	BTW221200
		Submitted By:	James Stringer

Sample Type: Soil

Sample Name:		TP01_1.5-2m 28-Feb-2023	TP03_0.5-1m 28-Feb-2023	TP04_1-1.5m 27-Feb-2023	TP07_2-2.4m 27-Feb-2023	TP05_2.2-2.5m 27-Feb-2023
Lab Number:		3193411.1	3193411.2	3193411.3	3193411.4	3193411.5
Chloride	mg/kg dry wt	< 3	< 3	11	9	230
pH	pH Units	6.7	6.8	6.3	7.2	6.3
Sulphate	mg/kg dry wt	< 3	< 3	16	5	45

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-5
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-	1-5
Soil Prep Dry & Sieve for Agriculture	Air dried at 35°C and sieved, <2mm fraction.	-	1-5
0.02M potassium dihydrogen ortho-phosphate extraction	(1:5) ratio of sample (g):0.02M potassium dihydrogen ortho-phosphate extractant (mL), analysis by Ion Chromatography. In House.	-	1-5
Chloride	Ion Chromatography determination of a potassium phosphate extract of an environmental solid. APHA 4110 B (modified) 23rd ed. 2017.	3 mg/kg dry wt	1-5
pH	1:2 (v/v) soil : water slurry followed by potentiometric determination of pH. In-house.	0.1 pH Units	1-5
Sulphate	Ion Chromatography determination of a potassium phosphate extract of an environmental solid. APHA 4110 B (modified) 23rd ed. 2017.	3 mg/kg dry wt	1-5

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 08-Mar-2023 and 17-Mar-2023. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental

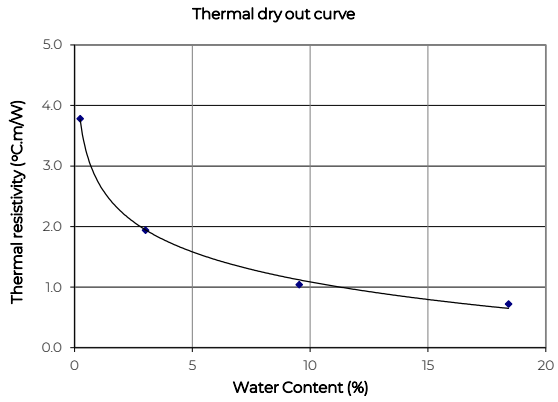
THERMAL RESISTIVITY TEST REPORT

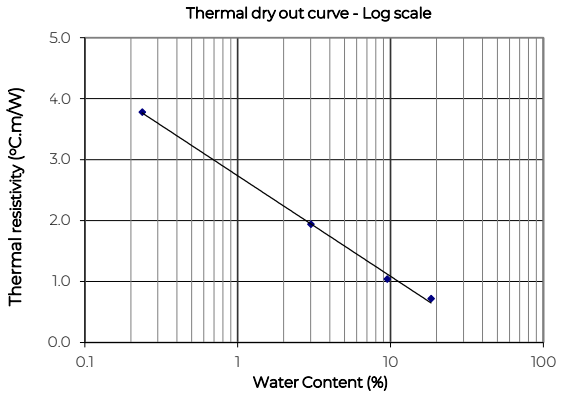
Project :	BTW221200
Location :	228-206 Motuiti Road, Foxton 4891
Client :	BTW Company
Contractor :	SKF Contracting
Sampled by :	G.Bentley + J. Richards (WSP)
Date sampled:	28/02/2023
Sampling method:	Push Tube + Bulk sample
Sample history:	As received

Project No:	5-22000.67
Sample No:	OR2482/1
Client Ref:	PO#3007424

Test Results

WSP Sample No:			OR2482/1A	OR2482/1B	OR2482/1C	OR2482/1D	-	-
Sample source:			Test Pit 1				-	-
Sample description:			Dune Sand				-	-
Water content		%	18.4	9.5	3.0	0.24	-	-
Thermal Resistivity		°C.m/W	0.72	1.04	1.94	3.78	-	-
Water content (as rec'd)	w	%	20.3	←	←	←	-	-
Bulk density	ρ	t/m^3	n/a	←	←	←	-	-
Dry density	ρ_d	t/m^3	n/a	←	←	←	-	-
Compacted water content		%	18.4	←	←	←	-	-
Compacted bulk density	ρ	t/m^3	1.83	←	←	←	-	-
Compacted dry density	ρ_d	t/m^3	1.55	←	←	←	-	-
Compaction percent (Insitu)		%	101	←	←	←	-	-





Test Methods		Notes
Water content	NZS 4402:1986 test 2.1	Intermediate water contents calculated by mass loss.
Thermal resistivity	Thermal resistivity testing is carried out in accordance with ASTM D5334-14. The detailed methodology includes in-house technical developments and improvements.	Thermal dry out curve line is MS-Excel calculated logarithmic scale of best fit and valid for the stated range tested # Target density = 100% Insitu density (DD = 1.53 t/m3 WC = 20.3%). Compacted specimen size(mm) 130Ø x 288 100% passing 4.75mm. All information supplied by client.

Date tested: 01 - 25/03/2023

Reported by: ZJF

Date reported: 11/04/2023

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Website www.wsp.com/en-nz

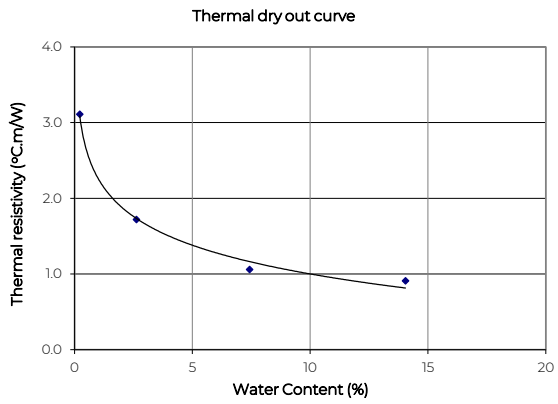
THERMAL RESISTIVITY TEST REPORT

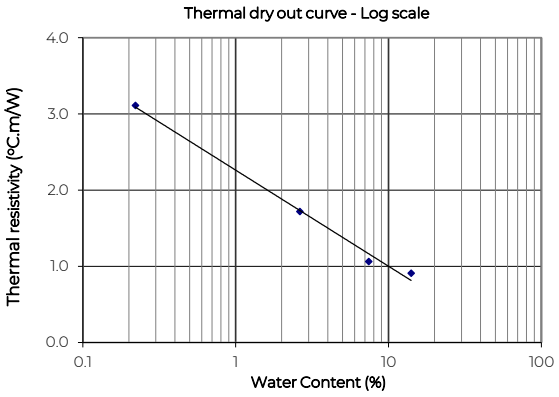
Project :	BTW221200
Location :	228-206 Motuiti Road, Foxton 4891
Client :	BTW Company
Contractor :	SKF Contracting
Sampled by :	G.Bentley + J. Richards (WSP)
Date sampled:	28/02/2023
Sampling method:	Push Tube + Bulk sample
Sample history:	As received

Project No:	5-22000.67
Sample No:	OR2482/2
Client Ref:	PO#3007424

Test Results

WSP Sample No:			OR2482/2A	OR2482/2B	OR2482/2C	OR2482/2D	-	-
Sample source:			Test Pit 5				-	-
Sample description:			Dune Sand				-	-
Water content		%	14.0	7.4	2.6	0.22	-	-
Thermal Resistivity		°C.m/W	0.91	1.06	1.72	3.11	-	-
Water content (as rec'd)	w	%	16.6	←	←	←	-	-
Bulk density	ρ	t/m^3	n/a	←	←	←	-	-
Dry density	ρ_d	t/m^3	n/a	←	←	←	-	-
Compacted water content		%	14.1	←	←	←	-	-
Compacted bulk density	ρ	t/m^3	1.83	←	←	←	-	-
Compacted dry density	ρ_d	t/m^3	1.60	←	←	←	-	-
Compaction percent (Insitu)		%	102	←	←	←	-	-





Test Methods		Notes
Water content	NZS 4402:1986 test 2.1	Intermediate water contents calculated by mass loss.
Thermal resistivity	Thermal resistivity testing is carried out in accordance with ASTM D5334-14. The detailed methodology includes in-house technical developments and improvements.	Thermal dry out curve line is MS-Excel calculated logarithmic scale of best fit and valid for the stated range tested # Target density = 100% Insitu density (DD = 1.57 t/m3 WC = 16.6%). Compacted specimen size(mm) 130Ø x 288 100% passing 4.75 mm. All information supplied by client.

Date tested: 1 - 28/03/2023

Reported by: ZJF

Date reported: 11/04/2023

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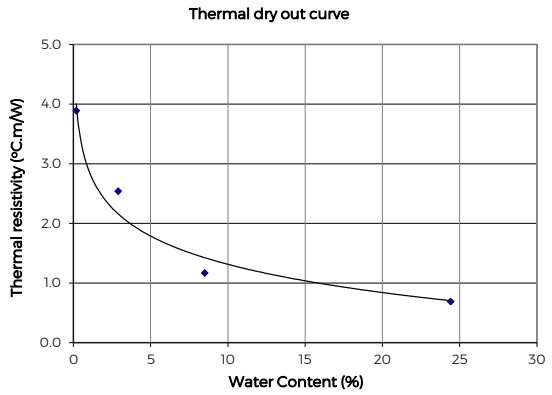
THERMAL RESISTIVITY TEST REPORT

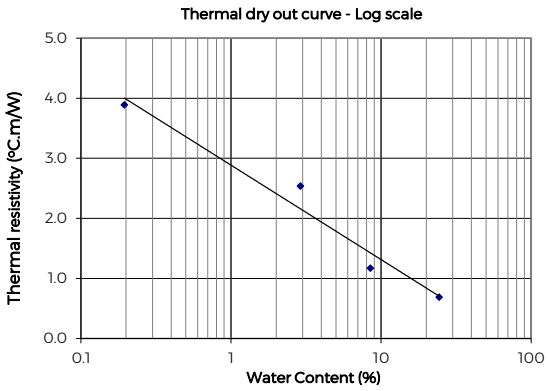
Project :	BTW221200
Location :	228-206 Motuiti Road, Foxton 4891
Client :	BTW Company
Contractor :	SKF Contracting
Sampled by :	G.Bentley + J. Richards (WSP)
Date sampled:	28/02/2023
Sampling method:	Push Tube + Bulk sample
Sample history:	As received

Project No:	5-22000.67
Sample No:	OR2482/3
Client Ref:	PO#3007424

Test Results

WSP Sample No:			OR2482/3A	OR2482/3B	OR2482/3C	OR2482/3D	-	-
Sample source:			Test Pit 11				-	-
Sample description:			Dune Sand				-	-
Water content		%	24.4	8.5	2.9	0.20	-	-
Thermal Resistivity		°C.m/W	0.69	1.17	2.54	3.89	-	-
Water content (as rec'd)	w	%	25.0	←	←	←	-	-
Bulk density	ρ	t/m^3	n/a	←	←	←	-	-
Dry density	ρ_d	t/m^3	n/a	←	←	←	-	-
Compacted water content		%	24.4	←	←	←	-	-
Compacted bulk density	ρ	t/m^3	1.91	←	←	←	-	-
Compacted dry density	ρ_d	t/m^3	1.53	←	←	←	-	-
Compaction percent (Insitu)		%	99	←	←	←	-	-





Test Methods		Notes
Water content	NZS 4402:1986 test 2.1	Intermediate water contents calculated by mass loss.
Thermal resistivity	Thermal resistivity testing is carried out in accordance with ASTM D5334-14. The detailed methodology includes in-house technical developments and improvements.	Thermal dry out curve line is MS-Excel calculated logarithmic scale of best fit and valid for the stated range tested # Target density = 100% Insitu density (DD = 1.54 t/m3 WC = 25%). Compacted specimen size(mm) 130Ø x 338 100% passing 4.75mm. All information supplied by client.

Date tested: 01/03 - 07/04/2023

Reported by: DWP

Date reported: 14/04/2023

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PO Box 30 845, Lower Hutt, 5040
New Zealand

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Facsimile +64 4 587 0604
Website www.wsp.com/en-nz

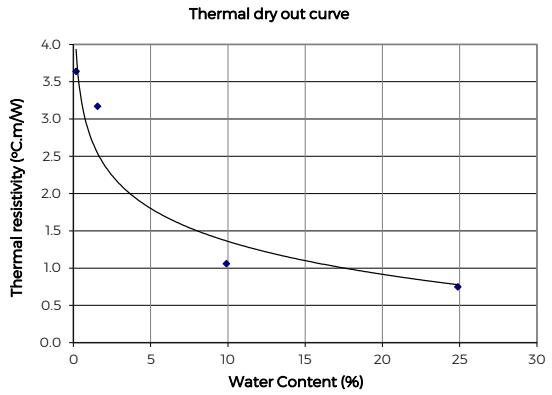
THERMAL RESISTIVITY TEST REPORT

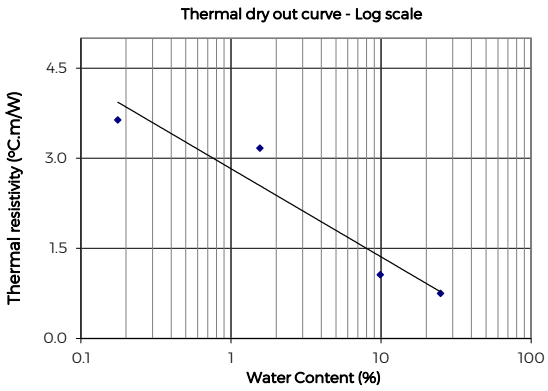
Project :	BTW221200
Location :	228-206 Motuiti Road, Foxton 4891
Client :	BTW Company
Contractor :	SKF Contracting
Sampled by :	G.Bentley + J. Richards (WSP)
Date sampled:	28/02/2023
Sampling method:	Push Tube + Bulk sample
Sample history:	As received

Project No:	5-22000.67
Sample No:	OR2482/4
Client Ref:	PO#3007424

Test Results

WSP Sample No:			OR2482/4A	OR2482/4B	OR2482/4C	OR2482/4D	-	-
Sample source:			Test Pit 17				-	-
Sample description:			Dune Sand				-	-
Water content		%	24.9	9.9	1.6	0.2	-	-
Thermal Resistivity		°C.m/W	0.75	1.06	3.17	3.64	-	-
Water content (as rec'd)	w	%	25.7	←	←	←	-	-
Bulk density	ρ	t/m^3	n/a	←	←	←	-	-
Dry density	ρ_d	t/m^3	n/a	←	←	←	-	-
Compacted water content		%	24.9	←	←	←	-	-
Compacted bulk density	ρ	t/m^3	1.86	←	←	←	-	-
Compacted dry density	ρ_d	t/m^3	1.49	←	←	←	-	-
Compaction percent (Insitu)		%	101	←	←	←	-	-





Test Methods		Notes
Water content	NZS 4402:1986 test 2.1	Intermediate water contents calculated by mass loss.
Thermal resistivity	Thermal resistivity testing is carried out in accordance with ASTM D5334-14. The detailed methodology includes in-house technical developments and improvements.	Thermal dry out curve line is MS-Excel calculated logarithmic scale of best fit and valid for the stated range tested # Target density = 100% Insitu density (DD = 1.48 t/m3 WC = 25.7%). Compacted specimen size(mm) 130Ø x 438 100% Passing 4.75mm All information supplied by client.

Date tested: 01/03 - 12/04/2023

Reported by: DWP

Date reported: 14/04/2023

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New Zealand

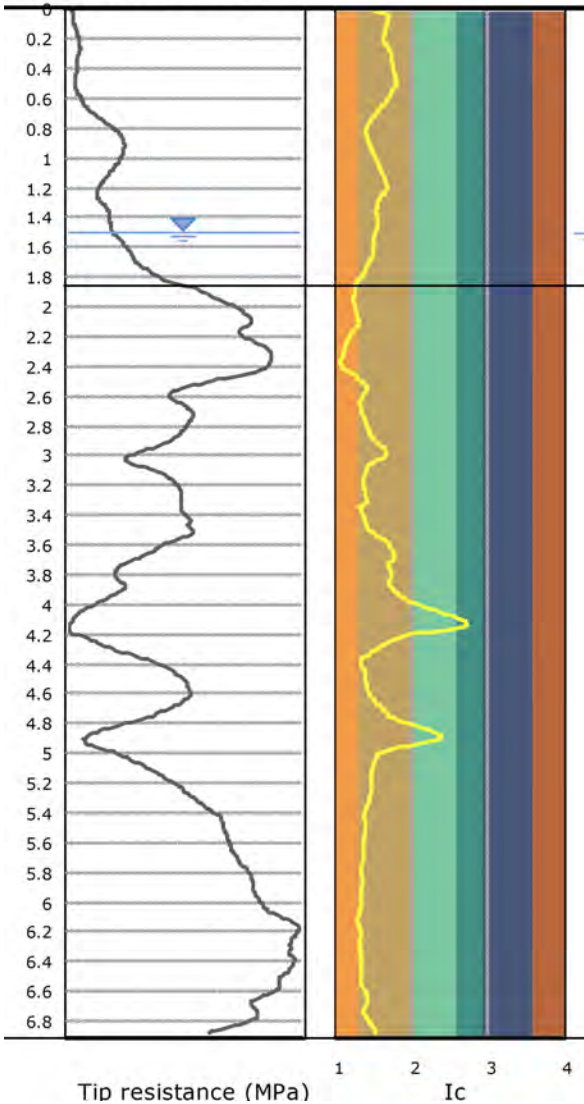
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APPENDIX D GEOTECHNICAL SECTIONS

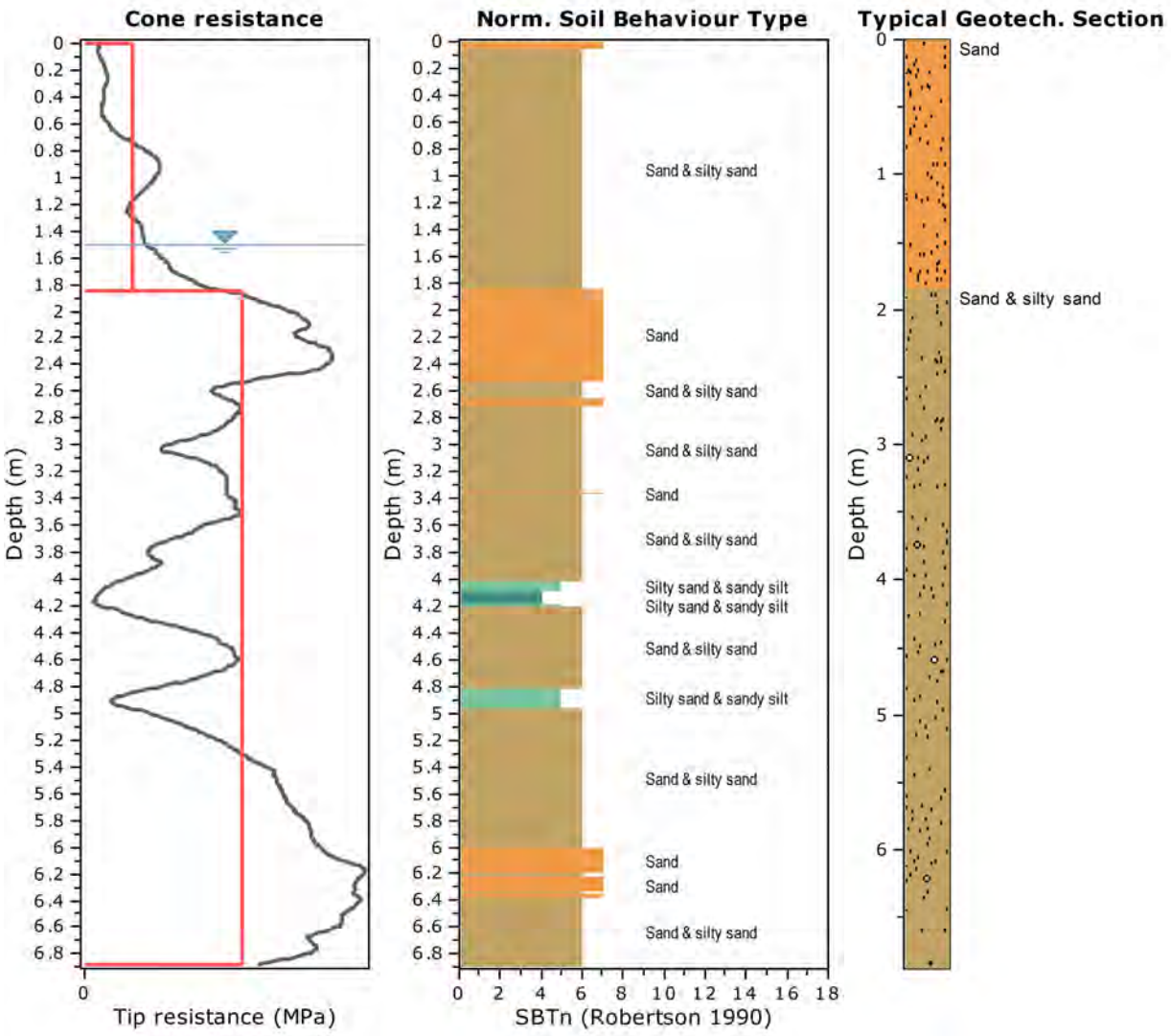
BTW Company
Engineering Geologists, Civil Engineers
179 Courtenay Street, New Plymouth
www.btw.nz

CPT: CPT01
Total depth: 6.88 m, Date: 24/03/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project: **Foxton Solar Farm**
Location: **Foxton, New Zealand**



Depth (m)	Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
0.00	Sand	6.6	1.71E-4	13.7	33.5	68.0	40.7	41.9	40.2	-	-	-	17.5
1.85	Sand & silty sand	21.6	6.45E-4	39.4	93.2	85.5	43.5	114.7	122.3	-	-	-	19.6



Tabular results

.:: Layer No: 1 ::.

Code: Unit 1 **Start depth:** 0.00 (m), **End depth:** 1.85 (m)

Description: Sand

Basic results	Estimation results	
Total cone resistance: 6.63 ±3.56 MPa	Permeability: 1.71E-04 ±1.27E-04 m/s	Constrained Mod.: 41.94 ±19.20 MPa
Sleeve friction: 33.31 ±17.19 kPa	N_{60}: 13.67 ±6.33 blows	Go: 40.21 ±19.80 MPa
Ic: 1.54 ±0.31	Es: 33.46 ±15.32 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 7	Dr (%): 67.99 ±10.27	Su ratio: 0.00 ±0.00
SBTn description: Sand	φ (degrees): 40.67 ±4.55 °	O.C.R.: 0.00 ±0.00
	Unit weight: 17.47 ±1.05 kN/m³	

.:: Layer No: 2 ::.

Code: Unit 2 **Start depth:** 1.85 (m), **End depth:** 6.88 (m)

Description: Sand & silty sand

Basic results	**Estimation results**	
Total cone resistance: 21.61 ±9.83 MPa	Permeability: 6.45E-04 ±7.87E-04 m/s	Constrained Mod.: 114.67 ±38.22 MPa
Sleeve friction: 129.23 ±58.66 kPa	N_{60}: 39.44 ±15.31 blows	Go: 122.27 ±43.16 MPa
Ic: 1.49 ±0.29	Es: 93.25 ±28.46 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 85.46 ±16.68	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 43.51 ±2.88 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.56 ±0.80 kN/m³	

Summary table of mean values

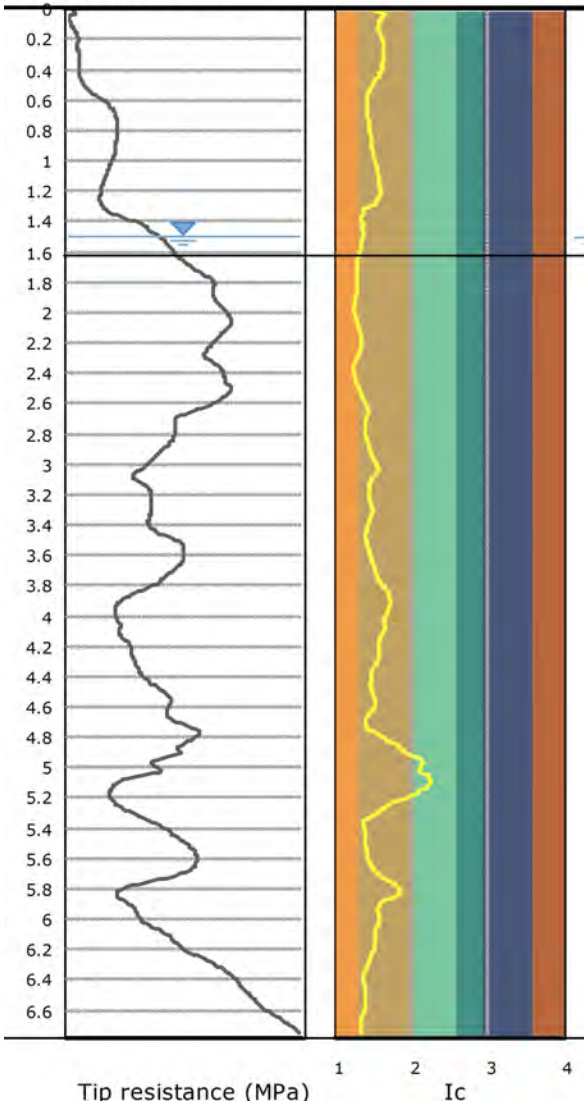
From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_O (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
0.00	1.85	1.71E-04	13.7	33.5	68.0	40.7	41.9	40.2	0.0	0.0	0.0	17.5
1.85		(±1.27E-04)	(±6.3)	(±15.3)	(±10.3)	(±4.6)	(±19.2)	(±19.8)	(±0.0)	(±0.0)	(±0.0)	(±1.1)
1.85	5.03	6.45E-04	39.4	93.2	85.5	43.5	114.7	122.3	0.0	0.0	0.0	19.6
6.88		(±7.87E-04)	(±15.3)	(±28.5)	(±16.7)	(±2.9)	(±38.2)	(±43.2)	(±0.0)	(±0.0)	(±0.0)	(±0.8)

Depth values presented in this table are measured from free ground surface

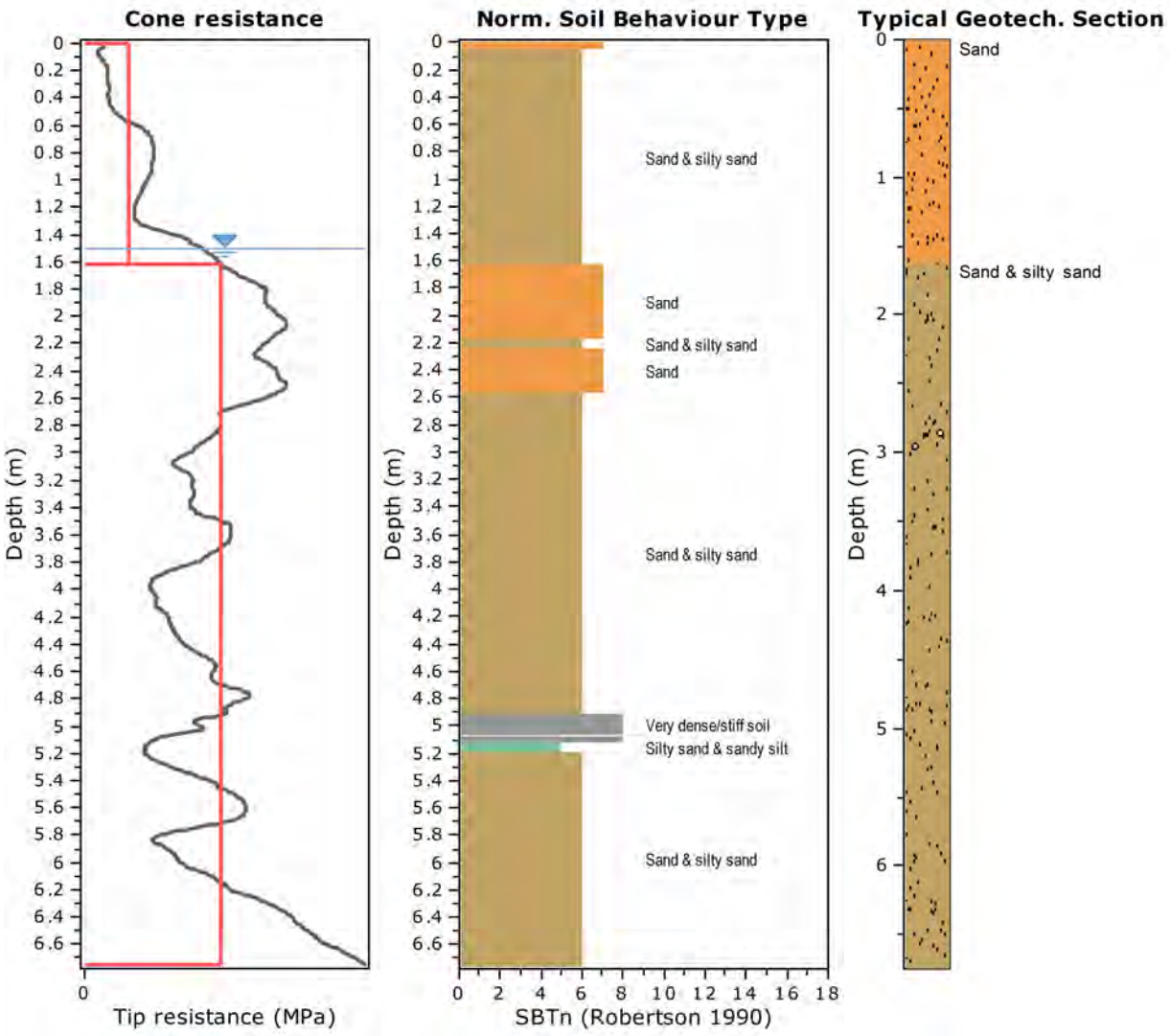
BTW Company
Engineering Geologists, Civil Engineers
179 Courtenay Street, New Plymouth
www.btw.nz

CPT: CPT02
Total depth: 6.75 m, Date: 24/03/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project: **Foxton Solar Farm**
Location: **Foxton, New Zealand**



Depth (m)	Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
0.00	Sand	6.4	2.24E-4	12.8	30.3	71.4	41.6	38.0	36.1	-	-	-	17.3
1.62	Sand & silty sand	19.7	4.22E-4	37.8	92.7	83.6	43.2	116.0	123.3	-	-	-	19.6



Tabular results

.:: Layer No: 1 ::.

Code: Unit 1 **Start depth:** 0.00 (m), **End depth:** 1.62 (m)

Description: Sand

Basic results

Total cone resistance: 6.35 ±2.84 MPa
Sleeve friction: 29.57 ±14.22 kPa
Ic: 1.46 ±0.34
SBT_n: 7
SBTn description: Sand

Estimation results

Permeability: 2.24E-04 ±1.18E-04 m/s
N_{60}: 12.83 ±5.07 blows
Es: 30.35 ±12.91 MPa
Dr (%): 71.44 ±9.07
φ (degrees): 41.61 ±5.47 °
Unit weight: 17.32 ±1.07 kN/m³
Constrained Mod.: 38.03 ±16.18 MPa
Go: 36.12 ±16.41 MPa
Su: 0.00 ±0.00 kPa
Su ratio: 0.00 ±0.00
O.C.R.: 0.00 ±0.00

.:: Layer No: 2 ::.

Code: Unit 2 **Start depth:** 1.62 (m), **End depth:** 6.75 (m)

Description: Sand & silty sand

Basic results	**Estimation results**	
Total cone resistance: 19.74 ±6.93 MPa	Permeability: 4.22E-04 ±3.72E-04 m/s	Constrained Mod.: 116.03 ±32.12 MPa
Sleeve friction: 144.10 ±105.54 kPa	N_{60}: 37.84 ±10.72 blows	Go: 123.31 ±39.12 MPa
Ic: 1.51 ±0.21	Es: 92.67 ±25.76 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 83.61 ±12.85	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 43.19 ±2.32 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.64 ±0.67 kN/m³	

Summary table of mean values

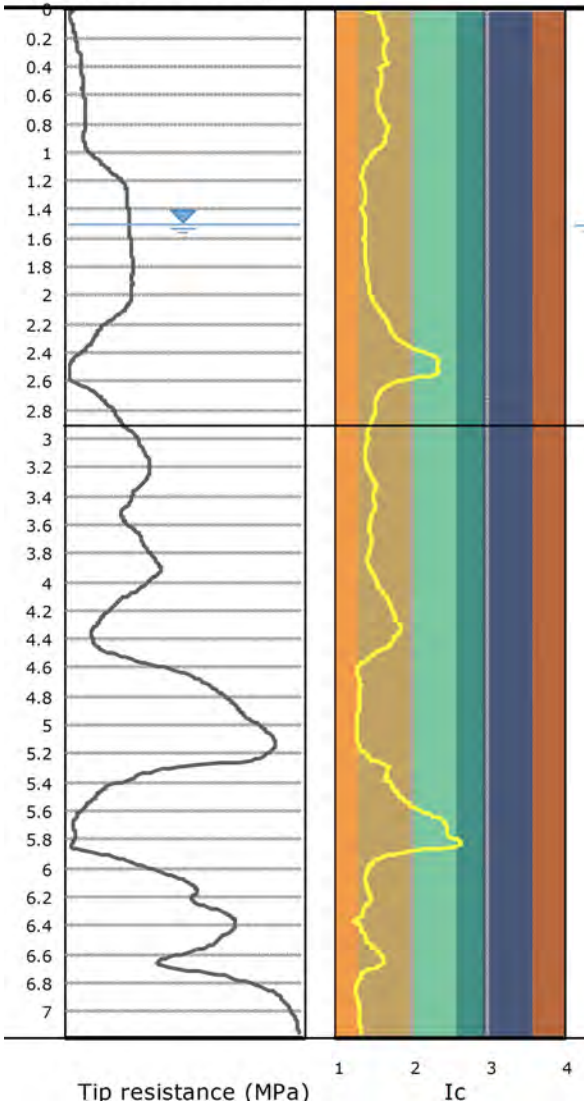
From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_O (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
0.00	1.62	2.24E-04	12.8	30.3	71.4	41.6	38.0	36.1	0.0	0.0	0.0	17.3
1.62		(±1.18E-04)	(±5.1)	(±12.9)	(±9.1)	(±5.5)	(±16.2)	(±16.4)	(±0.0)	(±0.0)	(±0.0)	(±1.1)
1.62	5.13	4.22E-04	37.8	92.7	83.6	43.2	116.0	123.3	0.0	0.0	0.0	19.6
6.75		(±3.72E-04)	(±10.7)	(±25.8)	(±12.9)	(±2.3)	(±32.1)	(±39.1)	(±0.0)	(±0.0)	(±0.0)	(±0.7)

Depth values presented in this table are measured from free ground surface

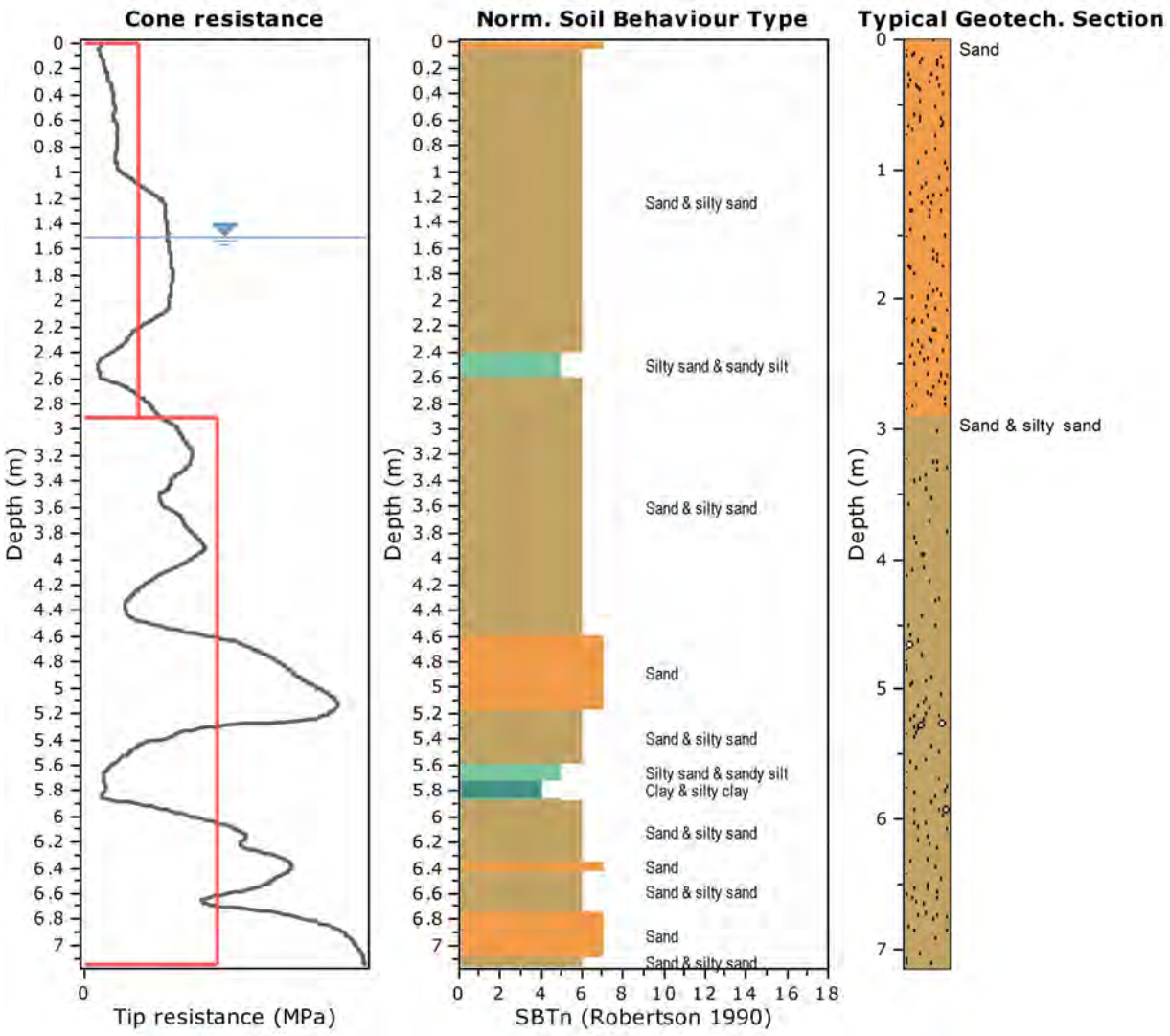
BTW Company
Engineering Geologists, Civil Engineers
179 Courtenay Street, New Plymouth
www.btw.nz

CPT: CPT03
Total depth: 7.15 m, Date: 24/03/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project: **Foxton Solar Farm**
Location: **Foxton, New Zealand**



Depth (m)	Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
0.00	Sand	8.3	2.82E-4	16.4	39.2	70.7	41.1	49.2	47.6	-	-	-	17.7
2.90	Sand & silty sand	20.5	4.32E-4	38.2	92.7	80.4	42.6	113.1	121.1	-	-	-	19.4



Tabular results

.:: Layer No: 1 ::.

Code: Unit 1 **Start depth:** 0.00 (m), **End depth:** 2.90 (m)

Description: Sand

Basic results

Total cone resistance: 8.32 ±4.06 MPa
Sleeve friction: 37.55 ±16.63 kPa
Ic: 1.49 ±0.27
SBT_n: 7
SBTn description: Sand

Estimation results

Permeability: 2.82E-04 ±2.12E-04 m/s
N_{60}: 16.41 ±6.82 blows
Es: 39.24 ±15.65 MPa
Dr (%): 70.68 ±9.40
φ (degrees): 41.06 ±4.15 °
Unit weight: 17.74 ±0.96 kN/m³

Constrained Mod.: 49.18 ±19.61 MPa
Go: 47.62 ±20.37 MPa
Su: 0.00 ±0.00 kPa
Su ratio: 0.00 ±0.00
O.C.R.: 0.00 ±0.00

.:: Layer No: 2 ::.

Code: Unit 2 **Start depth:** 2.90 (m), **End depth:** 7.15 (m)

Description: Sand & silty sand

Basic results	**Estimation results**	
Total cone resistance: 20.47 ±11.70 MPa	Permeability: 4.32E-04 ±3.83E-04 m/s	Constrained Mod.: 113.08 ±46.62 MPa
Sleeve friction: 128.47 ±76.09 kPa	N_{60}: 38.20 ±18.55 blows	Go: 121.14 ±52.99 MPa
Ic: 1.55 ±0.30	Es: 92.67 ±35.69 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 80.44 ±18.59	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 42.65 ±3.40 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.44 ±0.95 kN/m³	

Summary table of mean values

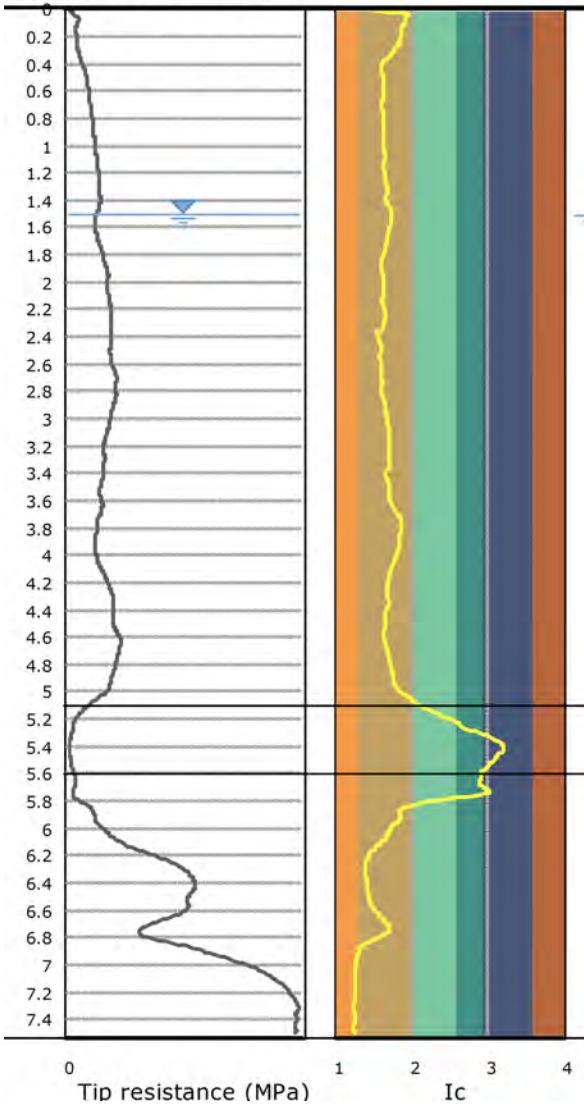
From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_O (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
0.00	2.90	2.82E-04	16.4	39.2	70.7	41.1	49.2	47.6	0.0	0.0	0.0	17.7
2.90		(±2.12E-04)	(±6.8)	(±15.6)	(±9.4)	(±4.2)	(±19.6)	(±20.4)	(±0.0)	(±0.0)	(±0.0)	(±1.0)
2.90	4.25	4.32E-04	38.2	92.7	80.4	42.6	113.1	121.1	0.0	0.0	0.0	19.4
7.15		(±3.83E-04)	(±18.5)	(±35.7)	(±18.6)	(±3.4)	(±46.6)	(±53.0)	(±0.0)	(±0.0)	(±0.0)	(±0.9)

Depth values presented in this table are measured from free ground surface

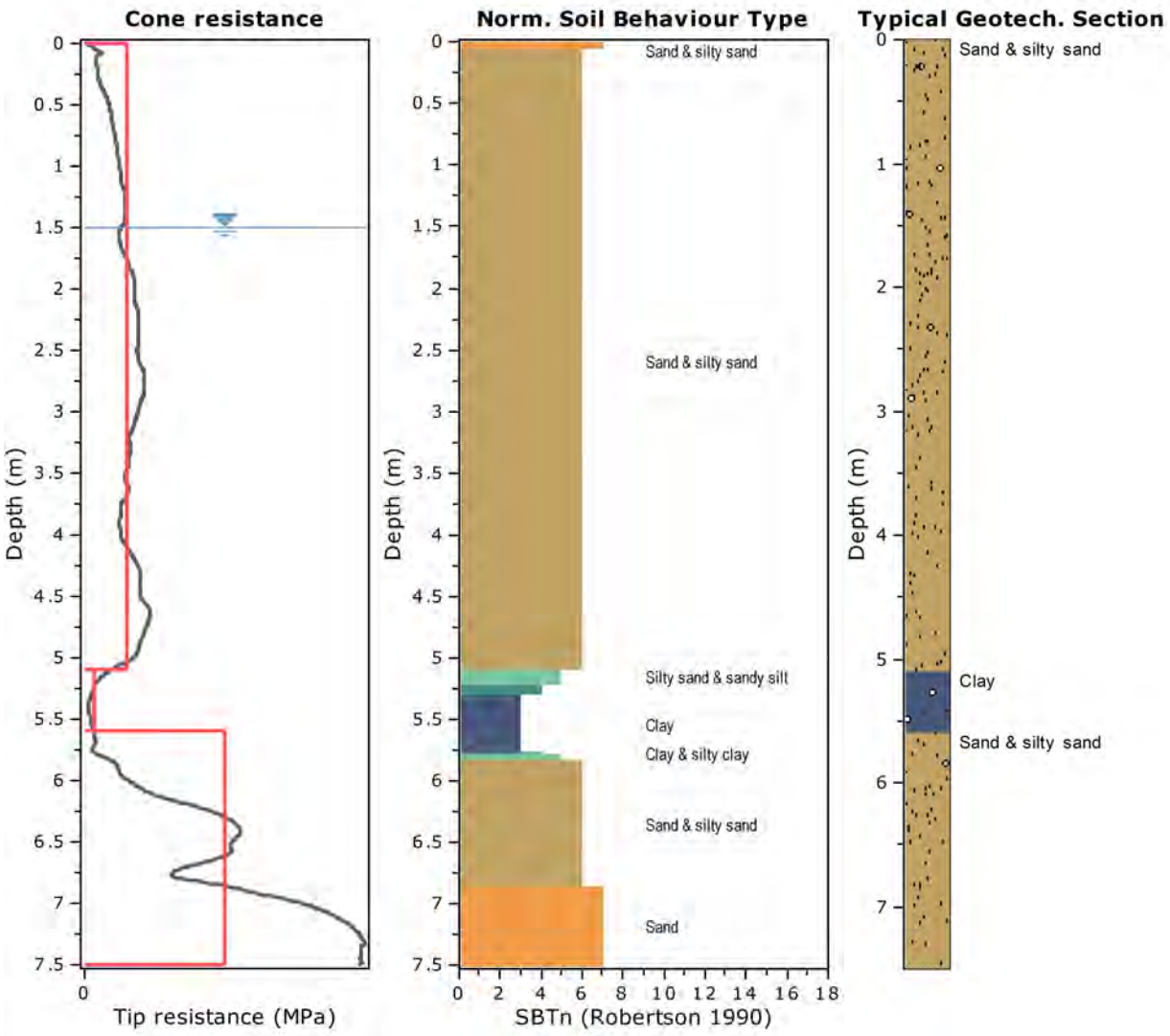
BTW Company
Engineering Geologists, Civil Engineers
179 Courtenay Street, New Plymouth
www.btw.nz

CPT: CPT04
Total depth: 7.50 m, Date: 24/03/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project: **Foxton Solar Farm**
Location: **Foxton, New Zealand**



Depth (m)	Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
0.00	Sand & silty sand	6.4	7.39E-5	14.3	38.7	58.8	38.5	48.5	46.2	-	-	-	17.6
5.10	Clay	1.4	4.73E-7	5.6	-	-	-	16.7	30.9	60.1	1.0	4.8	17.0
5.60	Sand & silty sand	20.8	5.53E-4	38.0	95.3	80.4	42.6	108.7	118.3	-	-	-	19.3



Tabular results

.:: Layer No: 1 ::.

Code: Unit 1 **Start depth:** 0.00 (m), **End depth:** 5.10 (m)

Description: Sand & silty sand

Basic results

Total cone resistance: 6.43 ±1.97 MPa
Sleeve friction: 34.06 ±11.42 kPa
Ic: 1.67 ±0.20
SBT_n: 6
SBTn description: Sand & silty sand

Estimation results

Permeability: 7.39E-05 ±3.44E-05 m/s
N_{60}: 14.26 ±3.97 blows
Es: 38.66 ±11.30 MPa
Dr (%): 58.77 ±6.58
φ (degrees): 38.46 ±2.58 °
Unit weight: 17.65 ±0.66 kN/m³

Constrained Mod.: 48.46 ±14.17 MPa
Go: 46.21 ±14.42 MPa
Su: 0.00 ±0.00 kPa
Su ratio: 0.00 ±0.00
O.C.R.: 0.00 ±0.00

.:: Layer No: 2 ::.

Code: Unit 3 **Start depth:** 5.10 (m), **End depth:** 5.60 (m)

Description: Clay

Basic results	**Estimation results**	
Total cone resistance: 1.36 ±0.87 MPa	Permeability: 4.73E-07 ±1.11E-06 m/s	Constrained Mod.: 16.71 ±11.94 MPa
Sleeve friction: 35.32 ±16.52 kPa	N_{60}: 5.61 ±1.92 blows	Go: 30.95 ±6.81 MPa
Ic: 2.80 ±0.37	Es: 0.00 ±0.00 MPa	Su: 60.14 ±19.10 kPa
SBT_n: 3	Dr (%): 0.00 ±0.00	Su ratio: 1.04 ±0.31
SBTn description: Clay	φ (degrees): 0.00 ±0.00 °	O.C.R.: 4.79 ±1.43
	Unit weight: 17.05 ±0.47 kN/m³	

.:: Layer No: 3 ::.

Code: Unit 2 **Start depth:** 5.60 (m), **End depth:** 7.50 (m)

Description: Sand & silty sand

Basic results	**Estimation results**	
Total cone resistance: 20.84 ±13.48 MPa	Permeability: 5.53E-04 ±5.43E-04 m/s	Constrained Mod.: 108.73 ±51.86 MPa
Sleeve friction: 119.61 ±64.94 kPa	N_{60}: 37.99 ±20.67 blows	Go: 118.31 ±54.32 MPa
Ic: 1.63 ±0.50	Es: 95.29 ±34.98 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 80.38 ±19.53	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 42.59 ±3.91 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.29 ±1.10 kN/m³	

Summary table of mean values

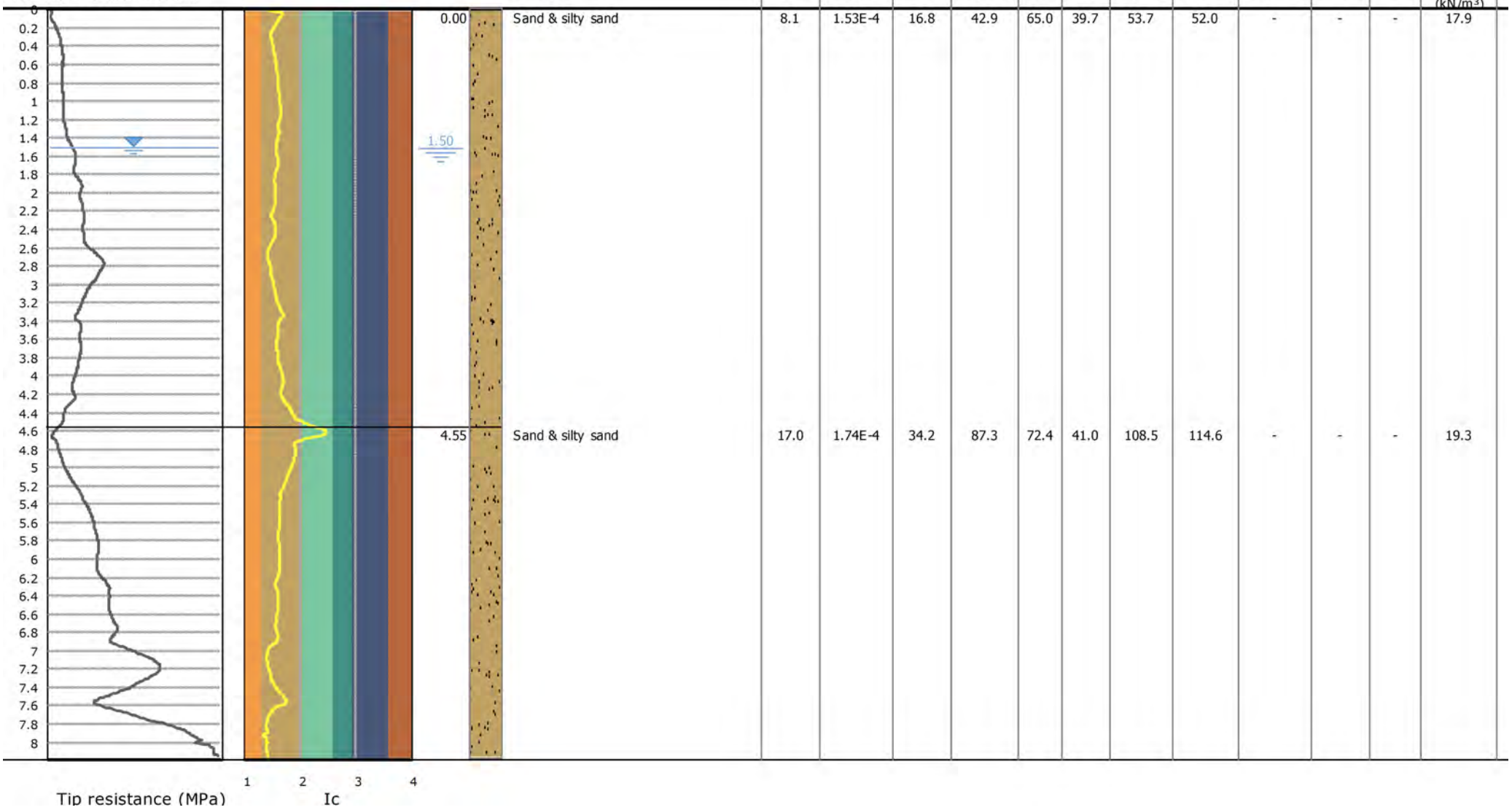
From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_O (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
0.00	5.10	7.39E-05	14.3	38.7	58.8	38.5	48.5	46.2	0.0	0.0	0.0	17.6
5.10		(±3.44E-05)	(±4.0)	(±11.3)	(±6.6)	(±2.6)	(±14.2)	(±14.4)	(±0.0)	(±0.0)	(±0.0)	(±0.7)
5.10	0.50	4.73E-07	5.6	0.0	0.0	0.0	16.7	30.9	60.1	1.0	4.8	17.0
5.60		(±1.11E-06)	(±1.9)	(±0.0)	(±0.0)	(±0.0)	(±11.9)	(±6.8)	(±19.1)	(±0.3)	(±1.4)	(±0.5)
5.60	1.90	5.53E-04	38.0	95.3	80.4	42.6	108.7	118.3	0.0	0.0	0.0	19.3
7.50		(±5.43E-04)	(±20.7)	(±35.0)	(±19.5)	(±3.9)	(±51.9)	(±54.3)	(±0.0)	(±0.0)	(±0.0)	(±1.1)

Depth values presented in this table are measured from free ground surface

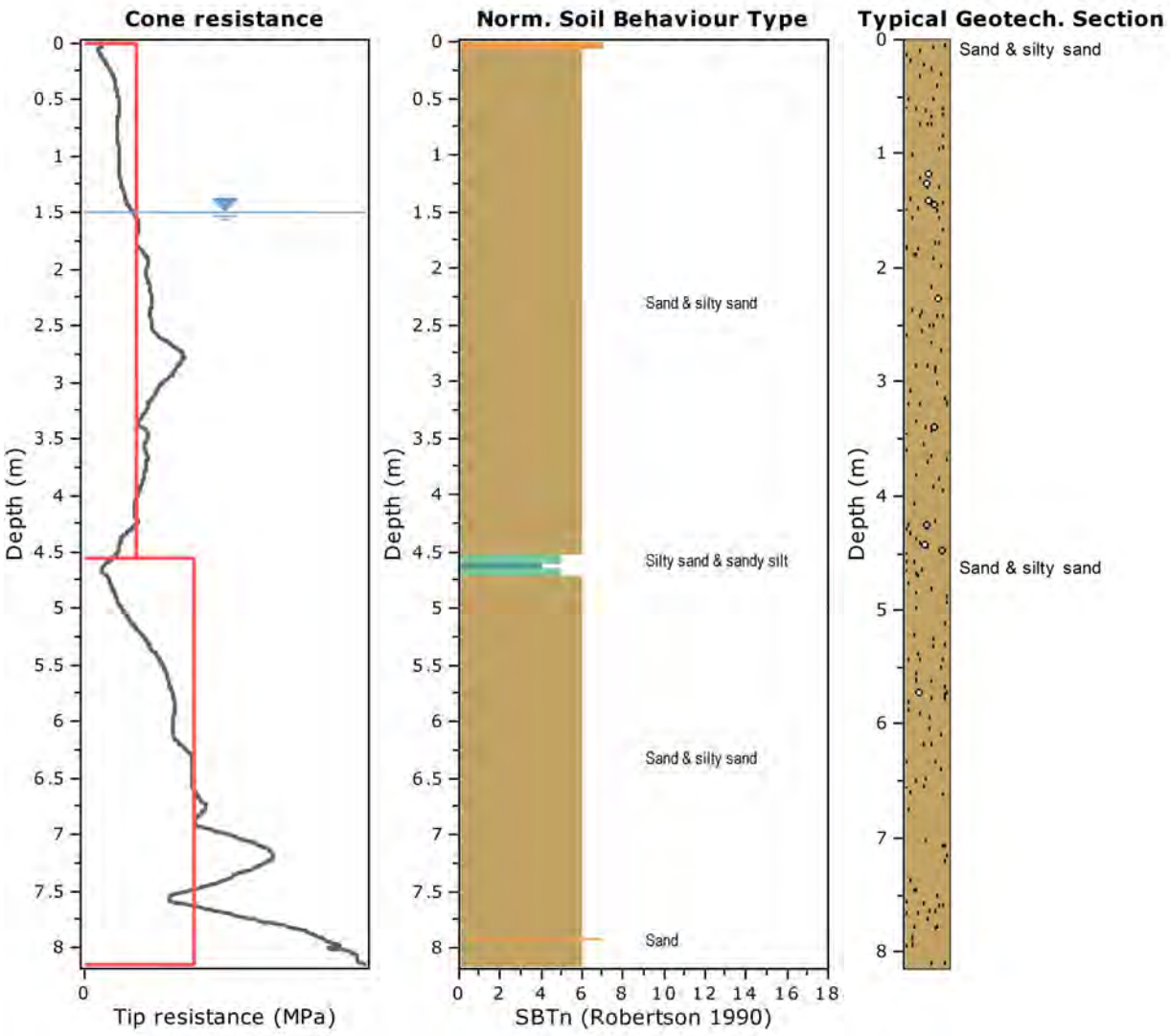
BTW Company
Engineering Geologists, Civil Engineers
179 Courtenay Street, New Plymouth
www.btw.nz

CPT: CPT05
Total depth: 8.15 m, Date: 24/03/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project: **Foxton Solar Farm**
Location: **Foxton, New Zealand**



Depth (m)	Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
0.00	Sand & silty sand	8.1	1.53E-4	16.8	42.9	65.0	39.7	53.7	52.0	-	-	-	17.9
4.55	Sand & silty sand	17.0	1.74E-4	34.2	87.3	72.4	41.0	108.5	114.6	-	-	-	19.3



Tabular results

.:: Layer No: 1 ::.

Code: Unit 1 **Start depth:** 0.00 (m), **End depth:** 4.55 (m)

Description: Sand & silty sand

Basic results	Estimation results	
Total cone resistance: 8.12 ±2.89 MPa	Permeability: 1.53E-04 ±8.54E-05 m/s	Constrained Mod.: 53.72 ±16.66 MPa
Sleeve friction: 39.00 ±15.02 kPa	N_{60}: 16.85 ±5.23 blows	Go: 51.97 ±17.41 MPa
Ic: 1.57 ±0.20	Es: 42.86 ±13.30 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 65.03 ±7.94	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 39.72 ±3.21 °	O.C.R.: 0.00 ±0.00
	Unit weight: 17.86 ±0.76 kN/m³	

.:: Layer No: 2 ::.

Code: Unit 2 **Start depth:** 4.55 (m), **End depth:** 8.15 (m)

Description: Sand & silty sand

Basic results	**Estimation results**	
Total cone resistance: 16.97 ±9.58 MPa	Permeability: 1.74E-04 ±1.63E-04 m/s	Constrained Mod.: 108.55 ±43.55 MPa
Sleeve friction: 119.31 ±73.31 kPa	N_{60}: 34.19 ±16.34 blows	Go: 114.62 ±50.47 MPa
Ic: 1.64 ±0.21	Es: 87.33 ±34.14 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 72.35 ±16.83	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 41.02 ±3.02 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.29 ±0.97 kN/m³	

Summary table of mean values

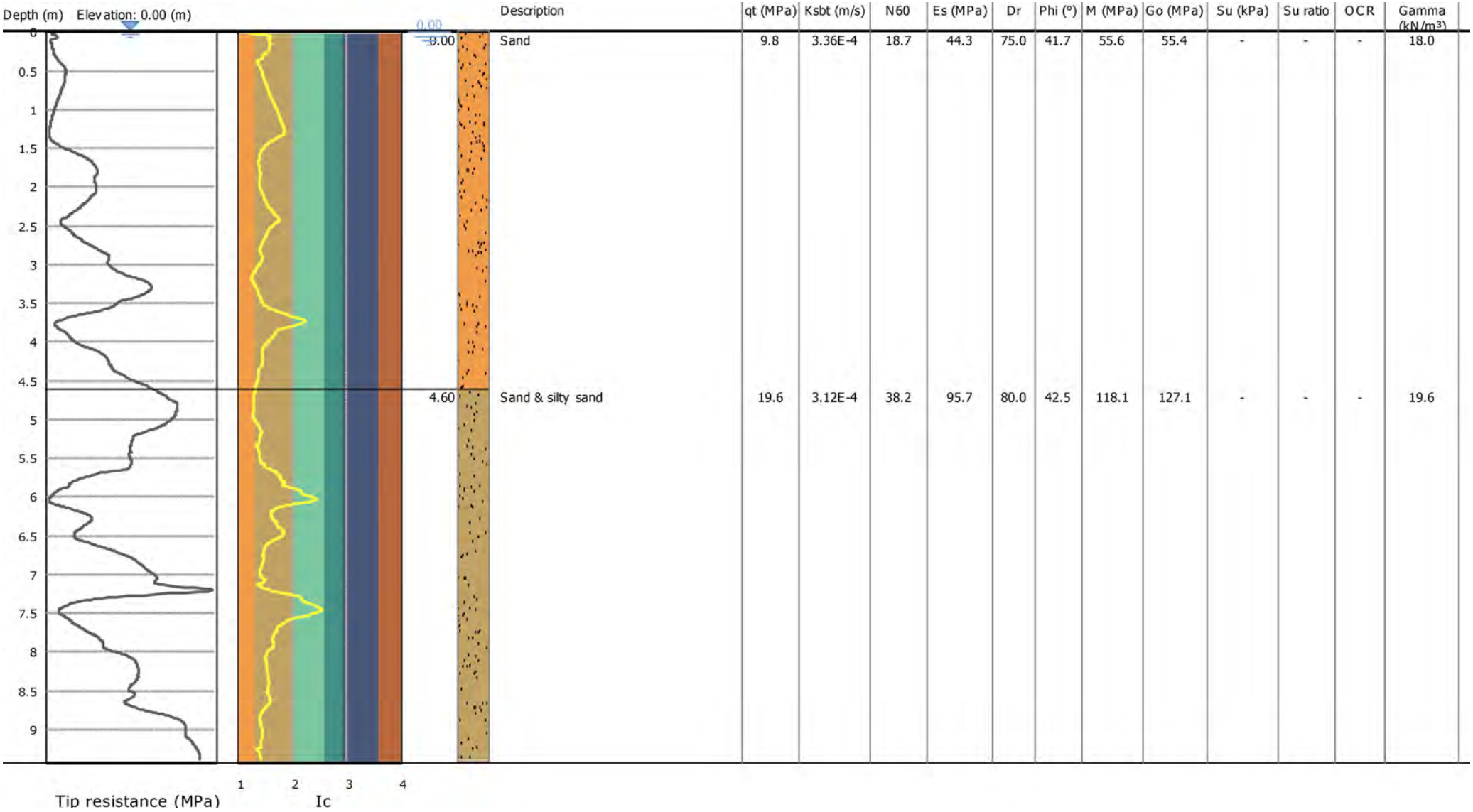
From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_O (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
0.00	4.55	1.53E-04	16.8	42.9	65.0	39.7	53.7	52.0	0.0	0.0	0.0	17.9
4.55		(±8.54E-05)	(±5.2)	(±13.3)	(±7.9)	(±3.2)	(±16.7)	(±17.4)	(±0.0)	(±0.0)	(±0.0)	(±0.8)
4.55	3.60	1.74E-04	34.2	87.3	72.4	41.0	108.5	114.6	0.0	0.0	0.0	19.3
8.15		(±1.63E-04)	(±16.3)	(±34.1)	(±16.8)	(±3.0)	(±43.5)	(±50.5)	(±0.0)	(±0.0)	(±0.0)	(±1.0)

Depth values presented in this table are measured from free ground surface

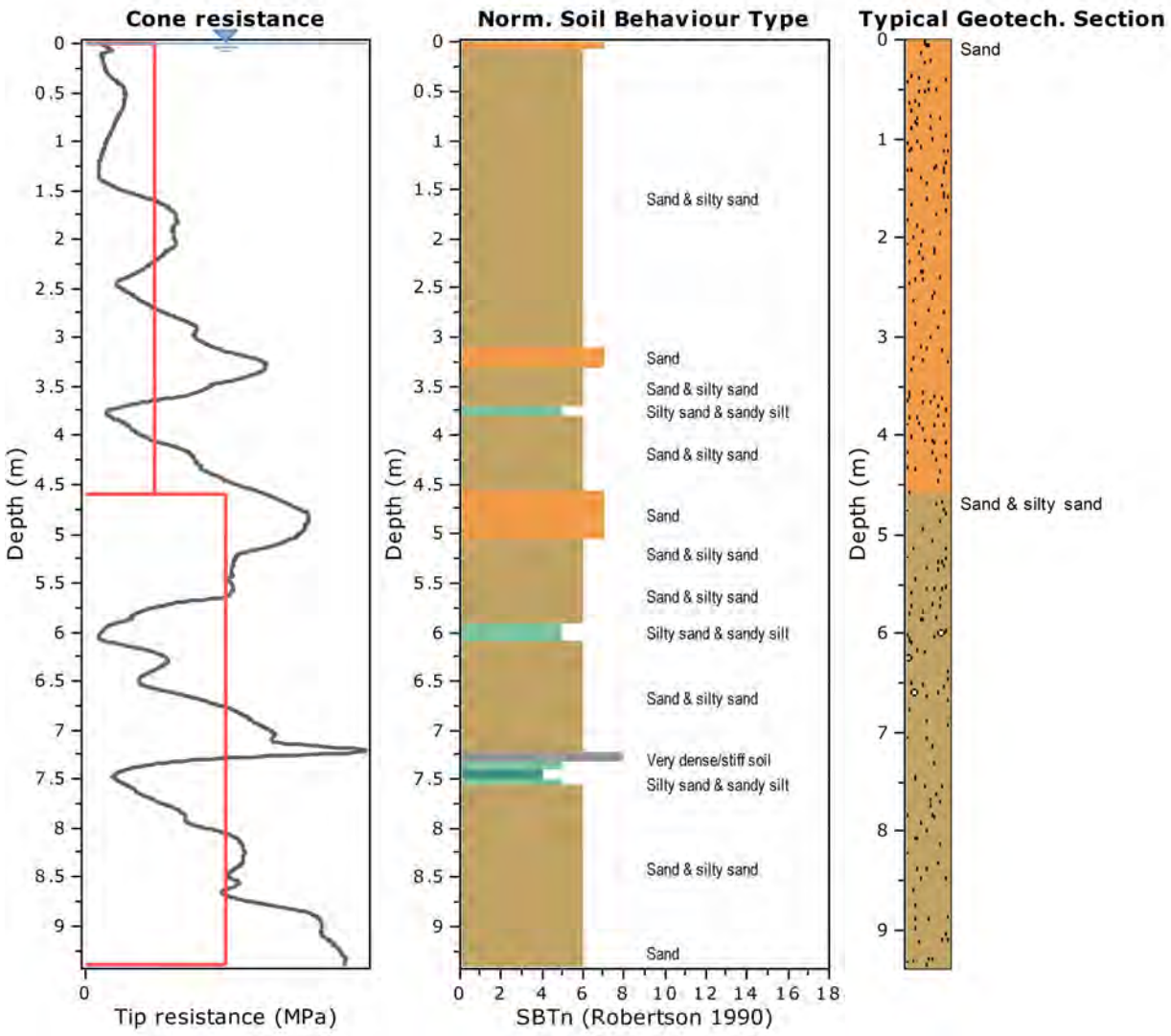
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Engineering Geologists, Civil Engineers
179 Courtenay Street, New Plymouth
www.btw.nz

CPT: CPT06
Total depth: 9.39 m, Date: 24/03/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project: **Foxton Solar Farm**
Location: **Foxton, New Zealand**



Depth (m)	Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
0.00	Sand	9.8	3.36E-4	18.7	44.3	75.0	41.7	55.6	55.4	-	-	-	18.0
4.60	Sand & silty sand	19.6	3.12E-4	38.2	95.7	80.0	42.5	118.1	127.1	-	-	-	19.6



Tabular results

.:: Layer No: 1 ::.

Code: Unit 1 **Start depth:** 0.00 (m), **End depth:** 4.60 (m)

Description: Sand

Basic results

Total cone resistance: 9.78 ±6.52 MPa
Sleeve friction: 53.04 ±37.79 kPa
Ic: 1.51 ±0.25
SBT_n: 7
SBTn description: Sand

Estimation results

Permeability: 3.36E-04 ±2.93E-04 m/s
N_{60}: 18.68 ±11.07 blows
Es: 44.35 ±24.12 MPa
Dr (%): 75.01 ±15.73
φ (degrees): 41.75 ±4.75 °
Unit weight: 17.96 ±1.30 kN/m³

Constrained Mod.: 55.55 ±30.24 MPa
Go: 55.41 ±32.93 MPa
Su: 0.00 ±0.00 kPa
Su ratio: 0.00 ±0.00
O.C.R.: 0.00 ±0.00

.:: Layer No: 2 ::.

Code: Unit 2 **Start depth:** 4.60 (m), **End depth:** 9.39 (m)

Description: Sand & silty sand

Basic results	**Estimation results**	
Total cone resistance: 19.57 ±9.63 MPa	Permeability: 3.12E-04 ±3.07E-04 m/s	Constrained Mod.: 118.11 ±44.27 MPa
Sleeve friction: 148.24 ±95.67 kPa	N_{60}: 38.20 ±16.05 blows	Go: 127.07 ±50.99 MPa
Ic: 1.60 ±0.28	Es: 95.68 ±34.55 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 79.96 ±19.23	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 42.48 ±3.36 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.59 ±0.98 kN/m³	

Summary table of mean values

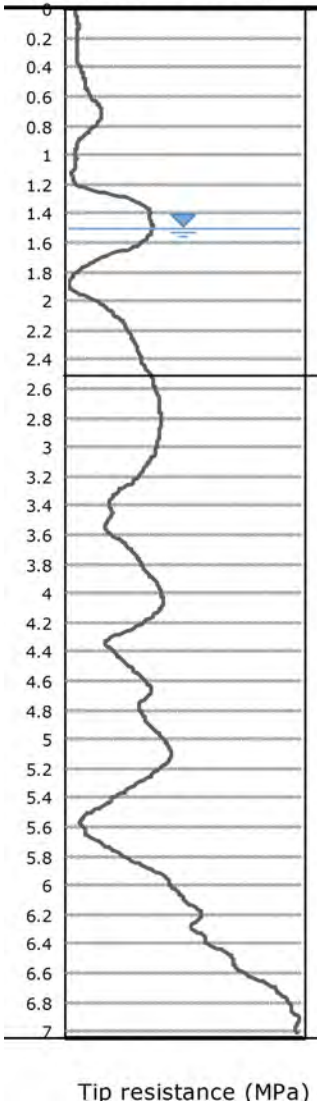
From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_O (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
0.00	4.60	3.36E-04	18.7	44.3	75.0	41.7	55.6	55.4	0.0	0.0	0.0	18.0
4.60		(±2.93E-04)	(±11.1)	(±24.1)	(±15.7)	(±4.7)	(±30.2)	(±32.9)	(±0.0)	(±0.0)	(±0.0)	(±1.3)
4.60	4.79	3.12E-04	38.2	95.7	80.0	42.5	118.1	127.1	0.0	0.0	0.0	19.6
9.39		(±3.07E-04)	(±16.0)	(±34.6)	(±19.2)	(±3.4)	(±44.3)	(±51.0)	(±0.0)	(±0.0)	(±0.0)	(±1.0)

Depth values presented in this table are measured from free ground surface

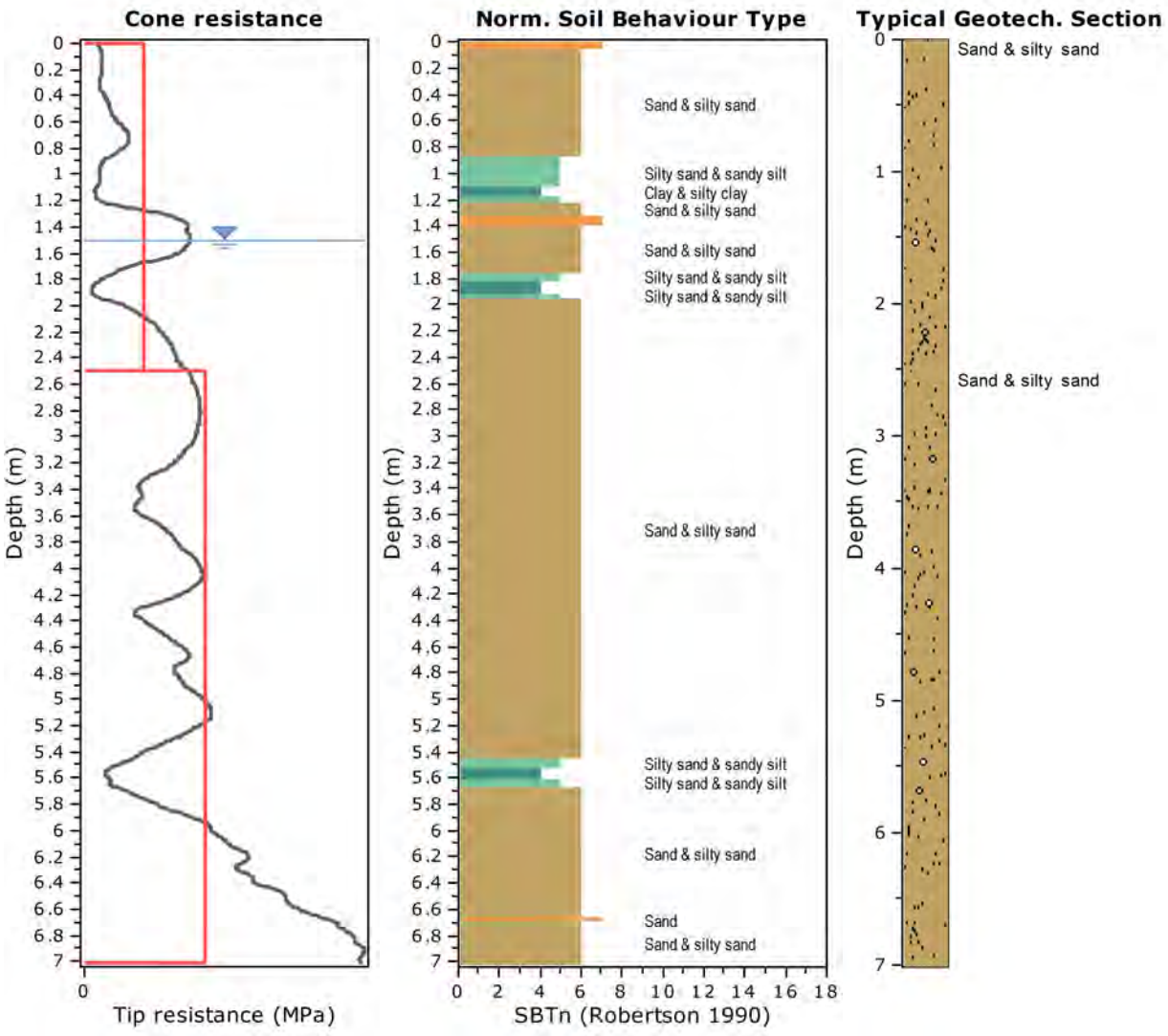
BTW Company
Engineering Geologists, Civil Engineers
179 Courtenay Street, New Plymouth
www.btw.nz

CPT: CPT07
Total depth: 7.01 m, Date: 24/03/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project: **Foxton Solar Farm**
Location: **Foxton, New Zealand**



Depth (m)	Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
0.00	Sand & silty sand	8.9	2.42E-4	17.8	45.3	69.8	41.1	54.6	54.8	-	-	-	18.0
2.50	Sand & silty sand	18.0	2.39E-4	35.2	88.5	77.0	42.0	108.9	115.8	-	-	-	19.4



Tabular results

.:: Layer No: 1 ::.

Code: Unit 1 **Start depth:** 0.00 (m), **End depth:** 2.50 (m)

Description: Sand & silty sand

Basic results

Total cone resistance: 8.90 ±5.73 MPa
Sleeve friction: 50.44 ±24.70 kPa
Ic: 1.63 ±0.39
SBT_n: 6
SBTn description: Sand & silty sand

Estimation results

Permeability: 2.42E-04 ±2.23E-04 m/s
N_{60}: 17.78 ±9.71 blows
Es: 45.26 ±20.80 MPa
Dr (%): 69.84 ±13.76
φ (degrees): 41.06 ±3.86 °
Unit weight: 18.00 ±1.11 kN/m³
Constrained Mod.: 54.61 ±26.88 MPa
Go: 54.78 ±27.60 MPa
Su: 0.00 ±0.00 kPa
Su ratio: 0.00 ±0.00
O.C.R.: 0.00 ±0.00

.:: Layer No: 2 ::.

Code: Unit 2 **Start depth:** 2.50 (m), **End depth:** 7.01 (m)

Description: Sand & silty sand

Basic results	**Estimation results**	
Total cone resistance: 17.95 ±9.66 MPa	Permeability: 2.39E-04 ±1.83E-04 m/s	Constrained Mod.: 108.92 ±41.65 MPa
Sleeve friction: 123.25 ±72.12 kPa	N_{60}: 35.23 ±15.96 blows	Go: 115.79 ±48.02 MPa
Ic: 1.59 ±0.24	Es: 88.45 ±32.26 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 76.96 ±15.08	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 41.97 ±2.65 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.41 ±0.79 kN/m³	

Summary table of mean values

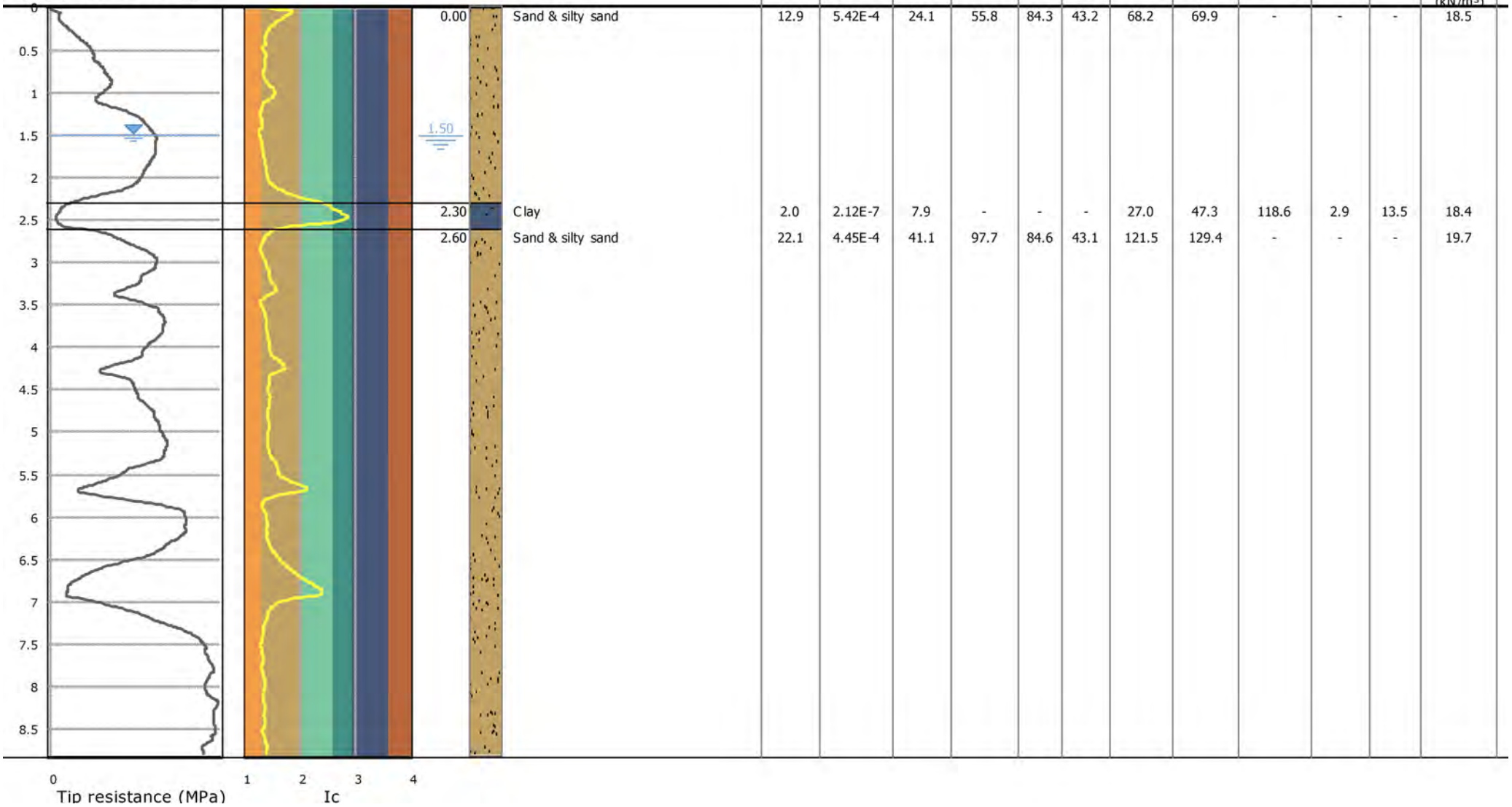
From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_O (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m^3)
0.00	2.50	2.42E-04	17.8	45.3	69.8	41.1	54.6	54.8	0.0	0.0	0.0	18.0
2.50		(±2.23E-04)	(±9.7)	(±20.8)	(±13.8)	(±3.9)	(±26.9)	(±27.6)	(±0.0)	(±0.0)	(±0.0)	(±1.1)
2.50	4.51	2.39E-04	35.2	88.5	77.0	42.0	108.9	115.8	0.0	0.0	0.0	19.4
7.01		(±1.83E-04)	(±16.0)	(±32.3)	(±15.1)	(±2.6)	(±41.6)	(±48.0)	(±0.0)	(±0.0)	(±0.0)	(±0.8)

Depth values presented in this table are measured from free ground surface

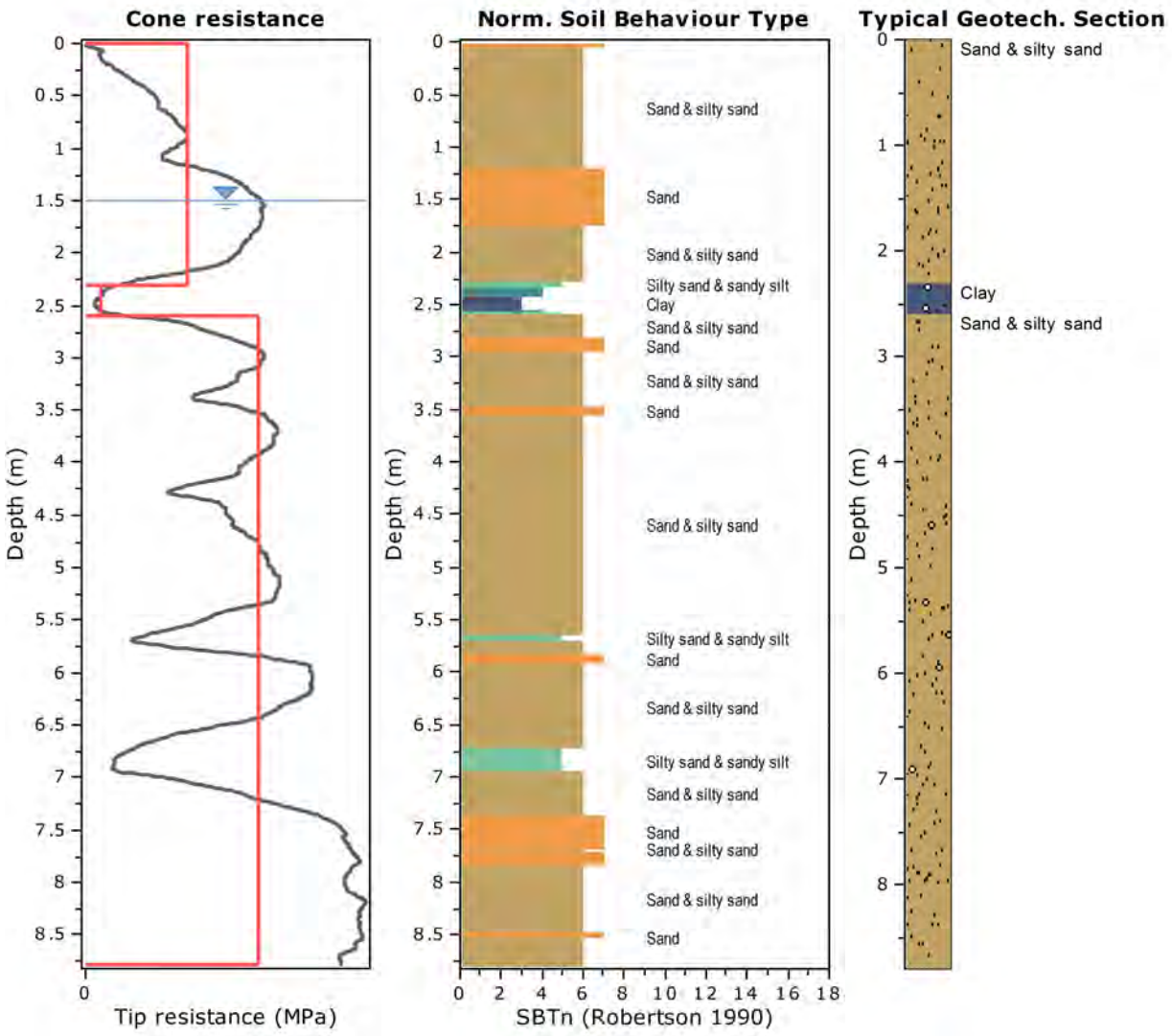
BTW Company
Engineering Geologists, Civil Engineers
179 Courtenay Street, New Plymouth
www.btw.nz

CPT: CPT08
Total depth: 8.79 m, Date: 24/03/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project: **Foxton Solar Farm**
Location: **Foxton, New Zealand**



Depth (m)	Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
0.00	Sand & silty sand	12.9	5.42E-4	24.1	55.8	84.3	43.2	68.2	69.9	-	-	-	18.5
2.30	Clay	2.0	2.12E-7	7.9	-	-	-	27.0	47.3	118.6	2.9	13.5	18.4
2.60	Sand & silty sand	22.1	4.45E-4	41.1	97.7	84.6	43.1	121.5	129.4	-	-	-	19.7



Tabular results

.:: Layer No: 1 ::.

Code: Unit 1 **Start depth:** 0.00 (m), **End depth:** 2.30 (m)

Description: Sand & silty sand

Basic results

Total cone resistance: 12.87 ±6.88 MPa
Sleeve friction: 70.11 ±37.18 kPa
Ic: 1.44 ±0.34
SBT_n: 6
SBTn description: Sand & silty sand

Estimation results

Permeability: 5.42E-04 ±3.37E-04 m/s
N_{60}: 24.10 ±10.98 blows
Es: 55.78 ±23.84 MPa
Dr (%): 84.26 ±12.83
φ (degrees): 43.24 ±2.56 °
Unit weight: 18.50 ±1.22 kN/m³
Constrained Mod.: 68.25 ±30.73 MPa
Go: 69.94 ±32.95 MPa
Su: 0.00 ±0.00 kPa
Su ratio: 0.00 ±0.00
O.C.R.: 0.00 ±0.00

.:: Layer No: 2 ::.

Code: Unit 3 **Start depth:** 2.30 (m), **End depth:** 2.60 (m)

Description: Clay

Basic results	**Estimation results**	
Total cone resistance: 1.98 ±1.00 MPa	Permeability: 2.12E-07 ±5.30E-07 m/s	Constrained Mod.: 27.00 ±13.87 MPa
Sleeve friction: 96.00 ±28.07 kPa	N_{60}: 7.86 ±2.73 blows	Go: 47.26 ±11.56 MPa
Ic: 2.67 ±0.18	Es: 0.00 ±0.00 MPa	Su: 118.59 ±35.66 kPa
SBT_n: 4	Dr (%): 0.00 ±0.00	Su ratio: 2.92 ±0.73
SBTn description: Clay & silty clay	φ (degrees): 0.00 ±0.00 °	O.C.R.: 13.50 ±3.35
	Unit weight: 18.42 ±0.45 kN/m³	

.:: Layer No: 3 ::.

Code: Unit 2 **Start depth:** 2.60 (m), **End depth:** 8.79 (m)

Description: Sand & silty sand

Basic results	**Estimation results**	
Total cone resistance: 22.08 ±8.60 MPa	Permeability: 4.45E-04 ±2.79E-04 m/s	Constrained Mod.: 121.53 ±33.07 MPa
Sleeve friction: 131.46 ±46.49 kPa	N_{60}: 41.14 ±13.54 blows	Go: 129.38 ±37.51 MPa
Ic: 1.50 ±0.24	Es: 97.66 ±25.33 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 84.63 ±15.93	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 43.08 ±2.49 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.66 ±0.62 kN/m³	

Summary table of mean values

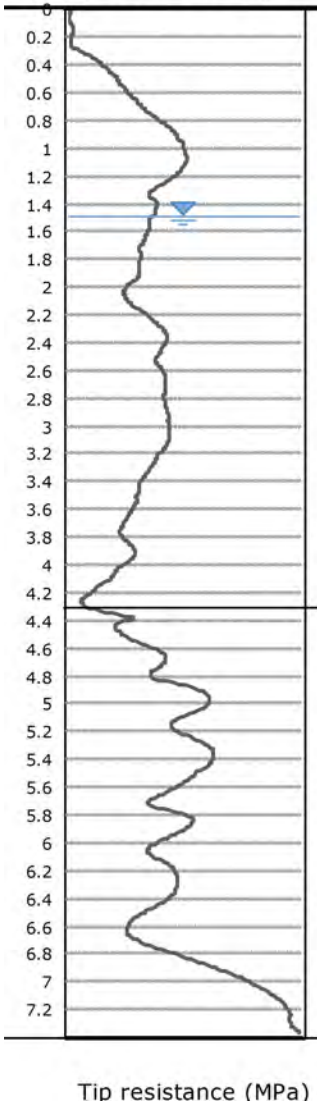
From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_O (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
0.00	2.30	5.42E-04	24.1	55.8	84.3	43.2	68.2	69.9	0.0	0.0	0.0	18.5
2.30		(±3.37E-04)	(±11.0)	(±23.8)	(±12.8)	(±2.6)	(±30.7)	(±33.0)	(±0.0)	(±0.0)	(±0.0)	(±1.2)
2.30	0.30	2.12E-07	7.9	0.0	0.0	0.0	27.0	47.3	118.6	2.9	13.5	18.4
2.60		(±5.30E-07)	(±2.7)	(±0.0)	(±0.0)	(±0.0)	(±13.9)	(±11.6)	(±35.7)	(±0.7)	(±3.4)	(±0.5)
2.60	6.19	4.45E-04	41.1	97.7	84.6	43.1	121.5	129.4	0.0	0.0	0.0	19.7
8.79		(±2.79E-04)	(±13.5)	(±25.3)	(±15.9)	(±2.5)	(±33.1)	(±37.5)	(±0.0)	(±0.0)	(±0.0)	(±0.6)

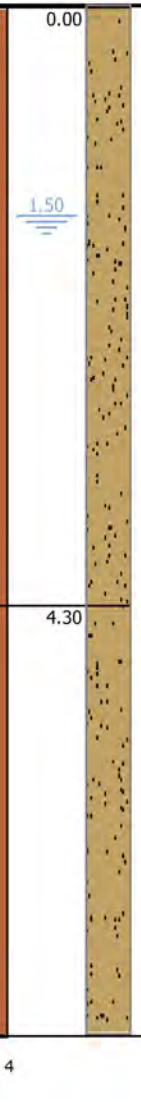
Depth values presented in this table are measured from free ground surface

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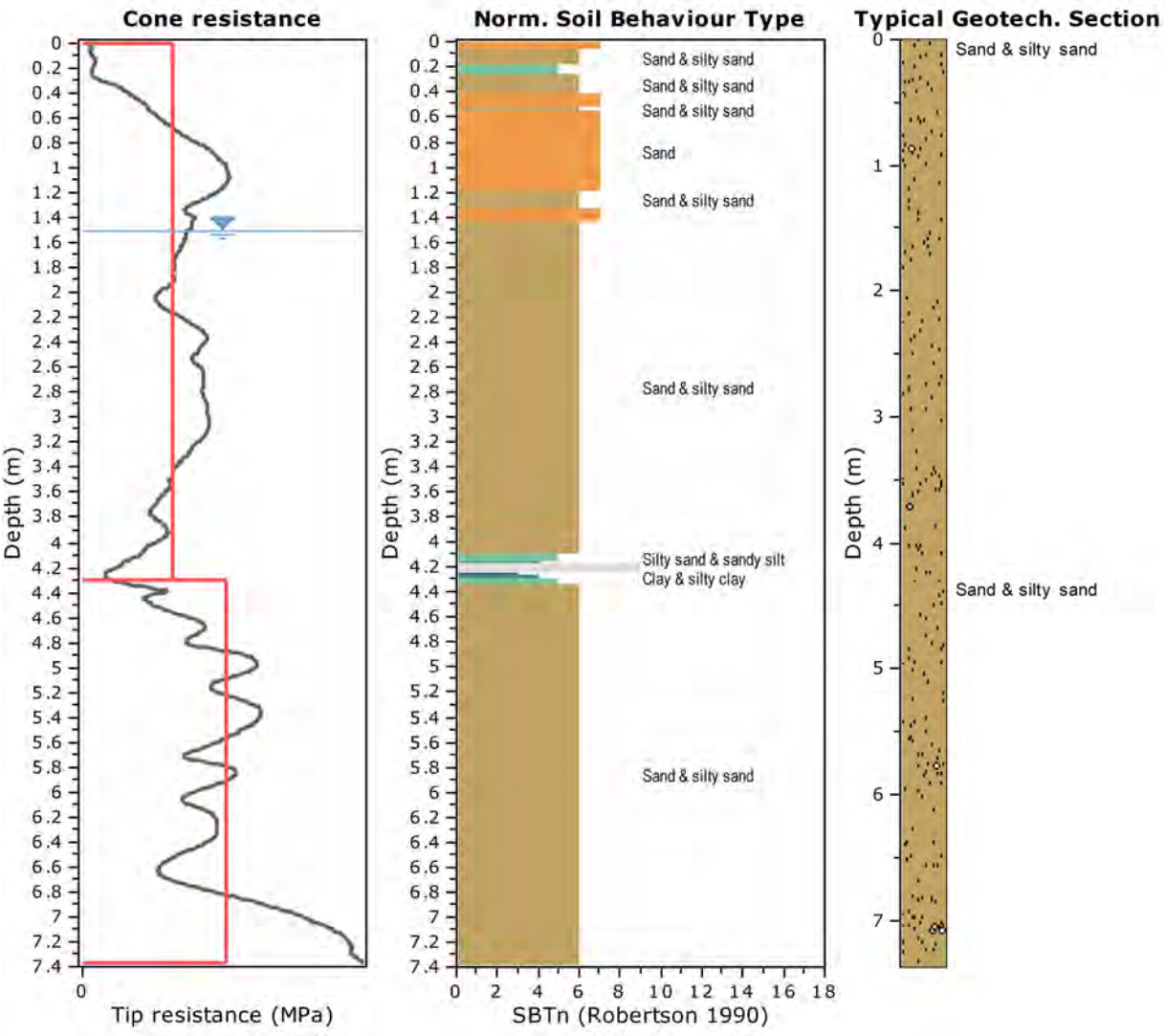
CPT: CPT09
Total depth: 7.37 m, Date: 24/03/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project: **Foxton Solar Farm**
Location: **Foxton, New Zealand**





Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
Sand & silty sand	13.4	4.70E-4	25.6	60.9	80.6	42.7	75.6	78.3	-	-	-	18.8
Sand & silty sand	21.2	2.30E-4	41.8	103.8	82.2	42.8	130.1	139.2	-	-	-	19.9



Tabular results

.:: Layer No: 1 ::.

Code: Unit 1 **Start depth:** 0.00 (m), **End depth:** 4.30 (m)

Description: Sand & silty sand

Basic results

Total cone resistance: 13.38 ±5.19 MPa
Sleeve friction: 78.12 ±41.55 kPa
Ic: 1.49 ±0.33
SBT_n: 6
SBTn description: Sand & silty sand

Estimation results

Permeability: 4.70E-04 ±3.94E-04 m/s
N_{60}: 25.64 ±7.91 blows
Es: 60.92 ±18.46 MPa
Dr (%): 80.55 ±11.50
φ (degrees): 42.74 ±2.81 °
Unit weight: 18.76 ±0.94 kN/m³
Constrained Mod.: 75.62 ±23.01 MPa
Go: 78.27 ±24.81 MPa
Su: 0.00 ±0.00 kPa
Su ratio: 0.00 ±0.00
O.C.R.: 0.00 ±0.00

.:: Layer No: 2 ::.

Code: Unit 2 **Start depth:** 4.30 (m), **End depth:** 7.37 (m)

Description: Sand & silty sand

Basic results	**Estimation results**	
Total cone resistance: 21.22 ±7.84 MPa	Permeability: 2.30E-04 ±1.44E-04 m/s	Constrained Mod.: 130.08 ±33.33 MPa
Sleeve friction: 156.44 ±64.63 kPa	N_{60}: 41.81 ±12.93 blows	Go: 139.23 ±40.09 MPa
Ic: 1.55 ±0.11	Es: 103.79 ±26.59 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 82.21 ±11.64	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 42.77 ±2.10 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.86 ±0.57 kN/m³	

Summary table of mean values

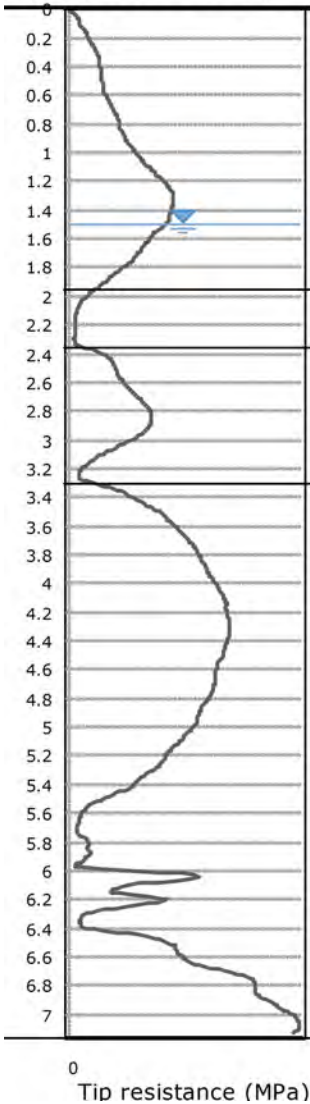
From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_O (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
0.00	4.30	4.70E-04	25.6	60.9	80.6	42.7	75.6	78.3	0.0	0.0	0.0	18.8
4.30		(±3.94E-04)	(±7.9)	(±18.5)	(±11.5)	(±2.8)	(±23.0)	(±24.8)	(±0.0)	(±0.0)	(±0.0)	(±0.9)
4.30	3.07	2.30E-04	41.8	103.8	82.2	42.8	130.1	139.2	0.0	0.0	0.0	19.9
7.37		(±1.44E-04)	(±12.9)	(±26.6)	(±11.6)	(±2.1)	(±33.3)	(±40.1)	(±0.0)	(±0.0)	(±0.0)	(±0.6)

Depth values presented in this table are measured from free ground surface

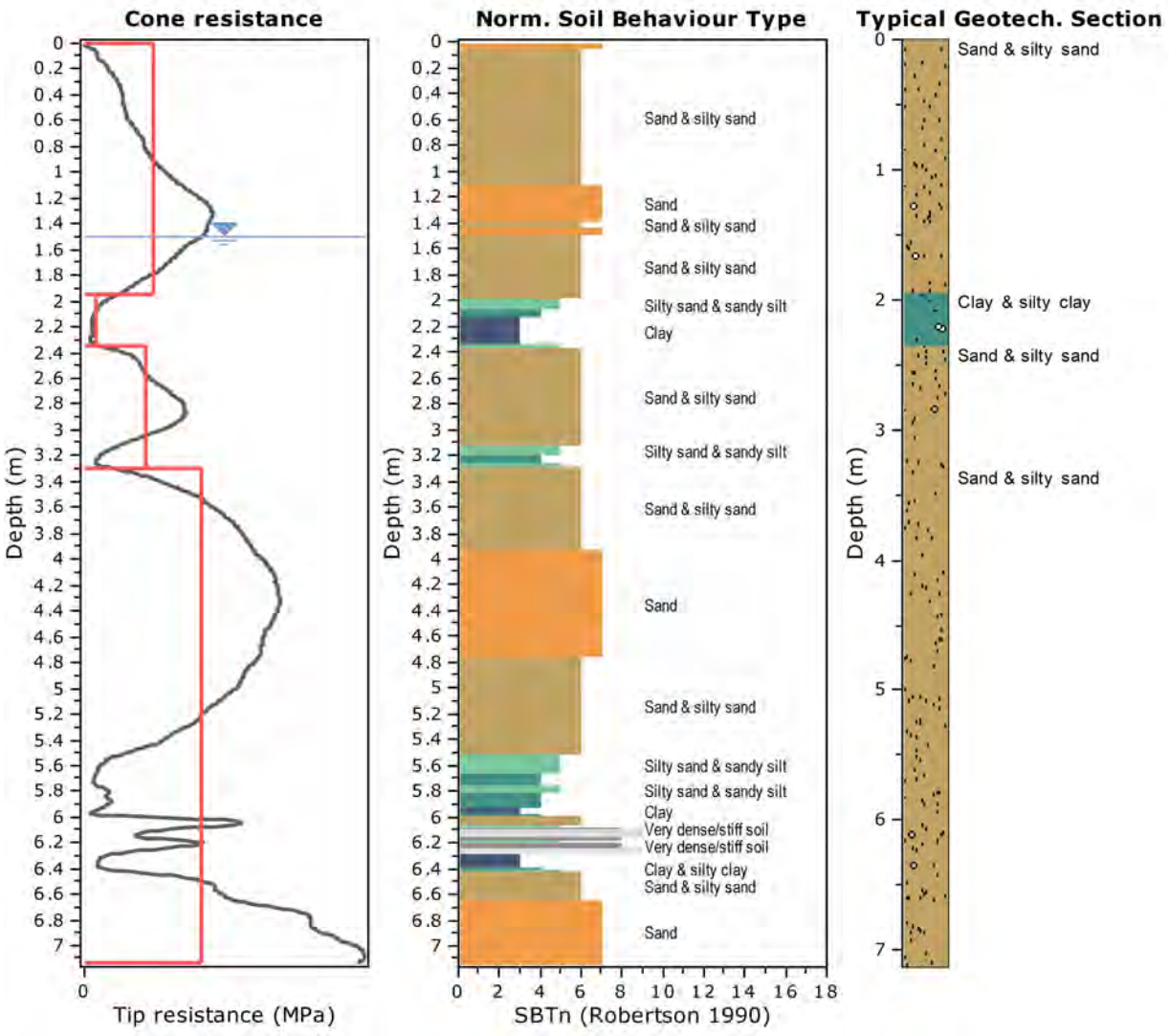
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CPT: CPT10
Total depth: 7.13 m, Date: 24/03/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project: **Foxton Solar Farm**
Location: **Foxton, New Zealand**



Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
Sand & silty sand	10.8	4.64E-4	20.6	47.1	78.6	42.2	58.5	59.5	-	-	-	19.0
Clay & silty clay	1.9	1.69E-6	6.7	-	-	-	24.0	39.1	86.5	2.3	10.5	19.0
Sand & silty sand	9.6	1.70E-4	20.0	55.0	65.2	40.0	65.3	68.2	-	-	-	19.0
Sand & silty sand	18.6	5.20E-4	35.0	89.1	81.3	42.8	103.7	110.4	-	-	-	19.0



Tabular results

.:: Layer No: 1 ::.

Code: Unit 1 **Start depth:** 0.00 (m), **End depth:** 1.95 (m)

Description: Sand & silty sand

Basic results	Estimation results	
Total cone resistance: 10.82 ±5.64 MPa	Permeability: 4.64E-04 ±3.06E-04 m/s	Constrained Mod.: 58.48 ±25.97 MPa
Sleeve friction: 51.18 ±29.05 kPa	N_{60}: 20.57 ±9.01 blows	Go: 59.46 ±26.40 MPa
Ic: 1.41 ±0.28	Es: 47.14 ±20.27 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 78.60 ±11.21	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 42.23 ±2.61 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.00 ±0.00 kN/m³	

.:: Layer No: 2 ::.

Code: Unit 3 **Start depth:** 1.95 (m), **End depth:** 2.35 (m)

Description: Clay & silty clay

Basic results	Estimation results	
Total cone resistance: 1.90 ±1.16 MPa	Permeability: 1.69E-06 ±3.74E-06 m/s	Constrained Mod.: 23.99 ±11.84 MPa
Sleeve friction: 61.24 ±19.05 kPa	N_{60}: 6.71 ±2.26 blows	Go: 39.11 ±4.28 MPa
Ic: 2.59 ±0.35	Es: 0.00 ±0.00 MPa	Su: 86.54 ±20.08 kPa
SBT_n: 4	Dr (%): 0.00 ±0.00	Su ratio: 2.28 ±0.37
SBTn description: Clay & silty clay	φ (degrees): 0.00 ±0.00 °	O.C.R.: 10.51 ±1.71
	Unit weight: 19.00 ±0.00 kN/m³	

.:: Layer No: 3 ::.

Code: Unit 1 **Start depth:** 2.35 (m), **End depth:** 3.30 (m)

Description: Sand & silty sand

Basic results	Estimation results	
Total cone resistance: 9.64 ±4.55 MPa	Permeability: 1.70E-04 ±1.38E-04 m/s	Constrained Mod.: 65.34 ±18.81 MPa
Sleeve friction: 59.40 ±19.71 kPa	N_{60}: 20.01 ±7.23 blows	Go: 68.18 ±16.24 MPa
Ic: 1.73 ±0.35	Es: 55.03 ±11.93 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 65.22 ±12.96	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 39.96 ±1.87 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.00 ±0.00 kN/m³	

.:: Layer No: 4 ::.

Code: Unit 2 **Start depth:** 3.30 (m), **End depth:** 7.13 (m)

Description: Sand & silty sand

Basic results	Estimation results	
Total cone resistance: 18.58 ±11.23 MPa	Permeability: 5.20E-04 ±5.32E-04 m/s	Constrained Mod.: 103.73 ±44.16 MPa
Sleeve friction: 131.50 ±95.35 kPa	N_{60}: 34.99 ±16.83 blows	Go: 110.35 ±40.90 MPa
Ic: 1.65 ±0.48	Es: 89.06 ±31.21 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 81.29 ±19.42	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 42.76 ±3.24 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.00 ±0.00 kN/m³	

Summary table of mean values

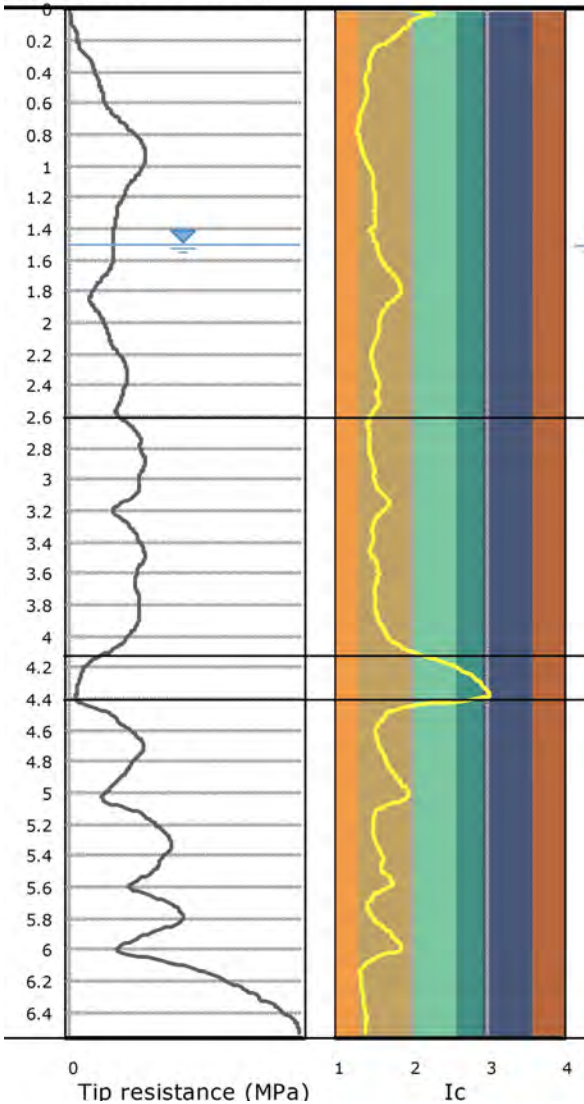
From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_O (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
0.00	1.95	4.64E-04	20.6	47.1	78.6	42.2	58.5	59.5	0.0	0.0	0.0	19.0
1.95		(±3.06E-04)	(±9.0)	(±20.3)	(±11.2)	(±2.6)	(±26.0)	(±26.4)	(±0.0)	(±0.0)	(±0.0)	(±0.0)
1.95	0.40	1.69E-06	6.7	0.0	0.0	0.0	24.0	39.1	86.5	2.3	10.5	19.0
2.35		(±3.74E-06)	(±2.3)	(±0.0)	(±0.0)	(±0.0)	(±11.8)	(±4.3)	(±20.1)	(±0.4)	(±1.7)	(±0.0)
2.35	0.95	1.70E-04	20.0	55.0	65.2	40.0	65.3	68.2	0.0	0.0	0.0	19.0
3.30		(±1.38E-04)	(±7.2)	(±11.9)	(±13.0)	(±1.9)	(±18.8)	(±16.2)	(±0.0)	(±0.0)	(±0.0)	(±0.0)
3.30	3.83	5.20E-04	35.0	89.1	81.3	42.8	103.7	110.4	0.0	0.0	0.0	19.0
7.13		(±5.32E-04)	(±16.8)	(±31.2)	(±19.4)	(±3.2)	(±44.2)	(±40.9)	(±0.0)	(±0.0)	(±0.0)	(±0.0)

Depth values presented in this table are measured from free ground surface

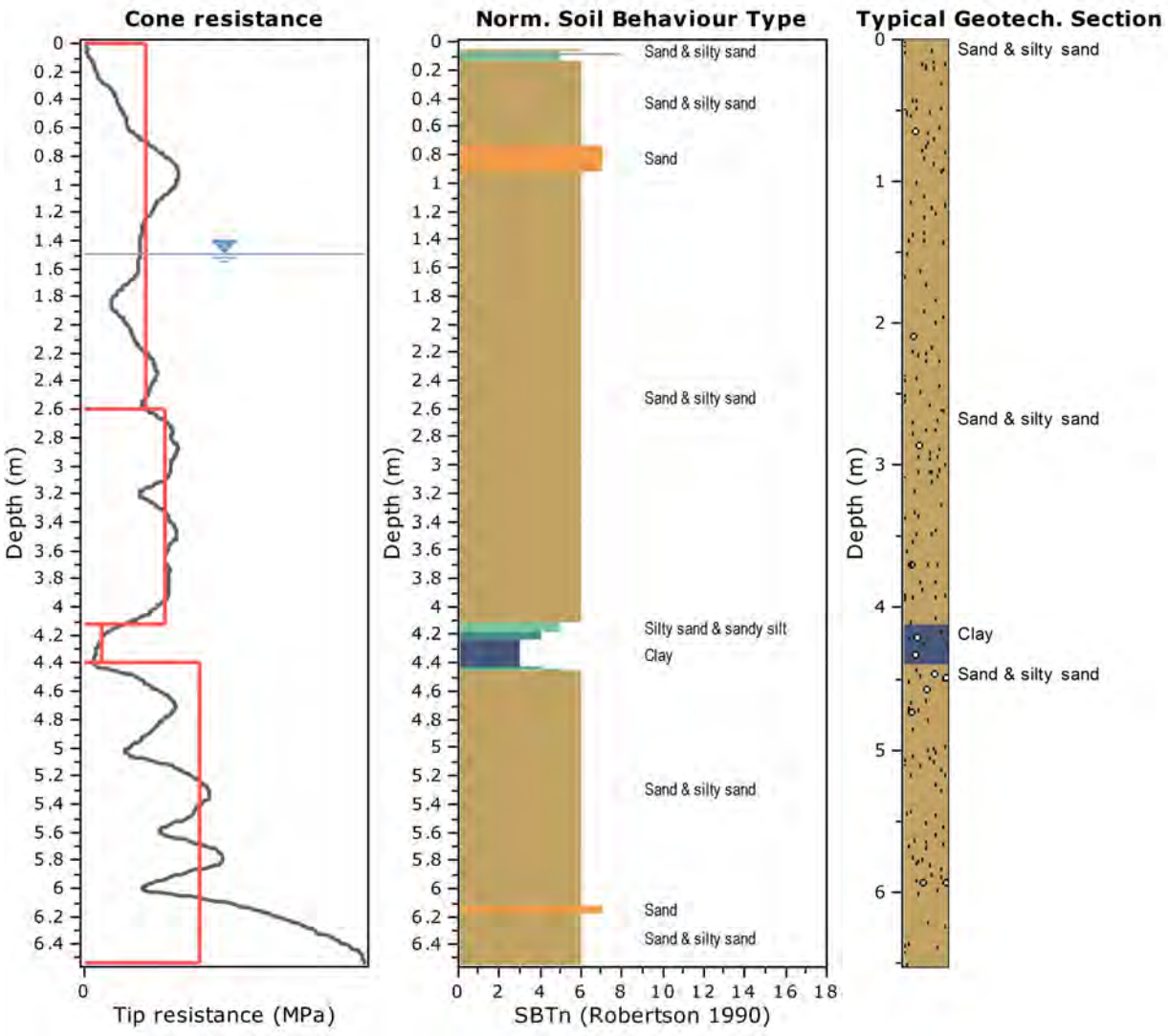
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179 Courtenay Street, New Plymouth
www.btw.nz

CPT: CPT11
Total depth: 6.53 m, Date: 24/03/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project: **Foxton Solar Farm**
Location: **Foxton, New Zealand**



Depth (m)	Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
0.00	Sand & silty sand	10.5	2.58E-4	21.1	52.5	71.3	40.8	64.8	65.9	-	-	-	19.0
2.60	Sand & silty sand	13.5	2.13E-4	27.0	67.9	73.8	41.3	85.1	86.5	-	-	-	19.0
4.12	Clay	3.0	7.52E-7	11.6	-	-	-	40.3	69.7	157.7	2.8	12.9	19.0
4.40	Sand & silty sand	19.5	2.29E-4	38.7	98.9	77.8	42.3	121.3	124.3	-	-	-	19.0



Tabular results

.:: Layer No: 1 ::.

Code: Unit 1 **Start depth:** 0.00 (m), **End depth:** 2.60 (m)

Description: Sand & silty sand

Basic results	Estimation results	
Total cone resistance: 10.51 ±4.02 MPa	Permeability: 2.58E-04 ±2.10E-04 m/s	Constrained Mod.: 64.79 ±22.39 MPa
Sleeve friction: 55.37 ±25.54 kPa	N_{60}: 21.05 ±7.09 blows	Go: 65.88 ±22.75 MPa
Ic: 1.53 ±0.24	Es: 52.46 ±16.84 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 71.26 ±9.20	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 40.81 ±1.60 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.00 ±0.00 kN/m³	

.:: Layer No: 2 ::.

Code: Unit 2 **Start depth:** 2.60 (m), **End depth:** 4.12 (m)

Description: Sand & silty sand

Basic results	Estimation results	
Total cone resistance: 13.51 ±1.90 MPa	Permeability: 2.13E-04 ±9.91E-05 m/s	Constrained Mod.: 85.06 ±6.87 MPa
Sleeve friction: 78.26 ±13.38 kPa	N_{60}: 27.01 ±2.79 blows	Go: 86.48 ±6.99 MPa
Ic: 1.55 ±0.10	Es: 67.87 ±5.48 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 73.77 ±5.14	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 41.26 ±0.85 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.00 ±0.00 kN/m³	

.:: Layer No: 3 ::.

Code: Unit 3 **Start depth:** 4.12 (m), **End depth:** 4.40 (m)

Description: Clay

Basic results	Estimation results	
Total cone resistance: 3.04 ±1.51 MPa	Permeability: 7.52E-07 ±1.67E-06 m/s	Constrained Mod.: 40.28 ±18.54 MPa
Sleeve friction: 139.45 ±25.76 kPa	N_{60}: 11.61 ±3.05 blows	Go: 69.67 ±4.00 MPa
Ic: 2.65 ±0.32	Es: 0.00 ±0.00 MPa	Su: 157.72 ±41.89 kPa
SBT_n: 3	Dr (%): 0.00 ±0.00	Su ratio: 2.78 ±0.65
SBTn description: Clay	φ (degrees): 0.00 ±0.00 °	O.C.R.: 12.86 ±2.99
	Unit weight: 19.00 ±0.00 kN/m³	

.:: Layer No: 4 ::.

Code: Unit 2 **Start depth:** 4.40 (m), **End depth:** 6.53 (m)

Description: Sand & silty sand

Basic results	Estimation results	
Total cone resistance: 19.47 ±11.09 MPa	Permeability: 2.29E-04 ±2.26E-04 m/s	Constrained Mod.: 121.25 ±47.79 MPa
Sleeve friction: 151.29 ±92.59 kPa	N_{60}: 38.66 ±18.25 blows	Go: 124.34 ±46.88 MPa
Ic: 1.62 ±0.27	Es: 98.90 ±36.47 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 77.81 ±14.30	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 42.30 ±2.78 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.00 ±0.00 kN/m³	

Summary table of mean values

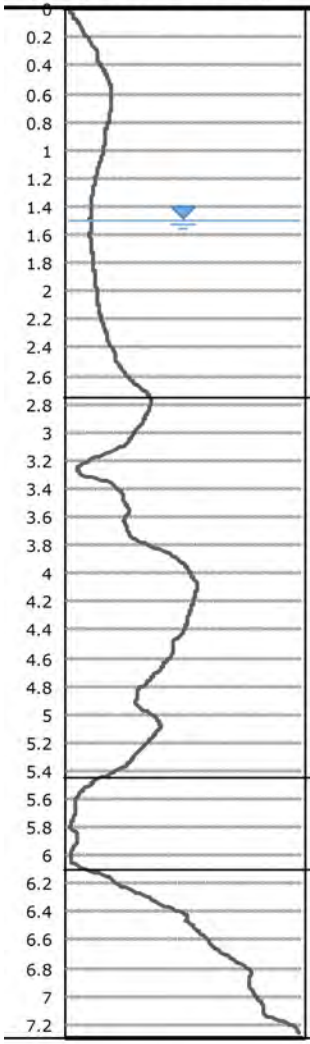
From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_O (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
0.00	2.60	2.58E-04	21.1	52.5	71.3	40.8	64.8	65.9	0.0	0.0	0.0	19.0
2.60		(±2.10E-04)	(±7.1)	(±16.8)	(±9.2)	(±1.6)	(±22.4)	(±22.7)	(±0.0)	(±0.0)	(±0.0)	(±0.0)
2.60	1.52	2.13E-04	27.0	67.9	73.8	41.3	85.1	86.5	0.0	0.0	0.0	19.0
4.12		(±9.91E-05)	(±2.8)	(±5.5)	(±5.1)	(±0.8)	(±6.9)	(±7.0)	(±0.0)	(±0.0)	(±0.0)	(±0.0)
4.12	0.28	7.52E-07	11.6	0.0	0.0	0.0	40.3	69.7	157.7	2.8	12.9	19.0
4.40		(±1.67E-06)	(±3.0)	(±0.0)	(±0.0)	(±0.0)	(±18.5)	(±4.0)	(±41.9)	(±0.6)	(±3.0)	(±0.0)
4.40	2.13	2.29E-04	38.7	98.9	77.8	42.3	121.3	124.3	0.0	0.0	0.0	19.0
6.53		(±2.26E-04)	(±18.3)	(±36.5)	(±14.3)	(±2.8)	(±47.8)	(±46.9)	(±0.0)	(±0.0)	(±0.0)	(±0.0)

Depth values presented in this table are measured from free ground surface

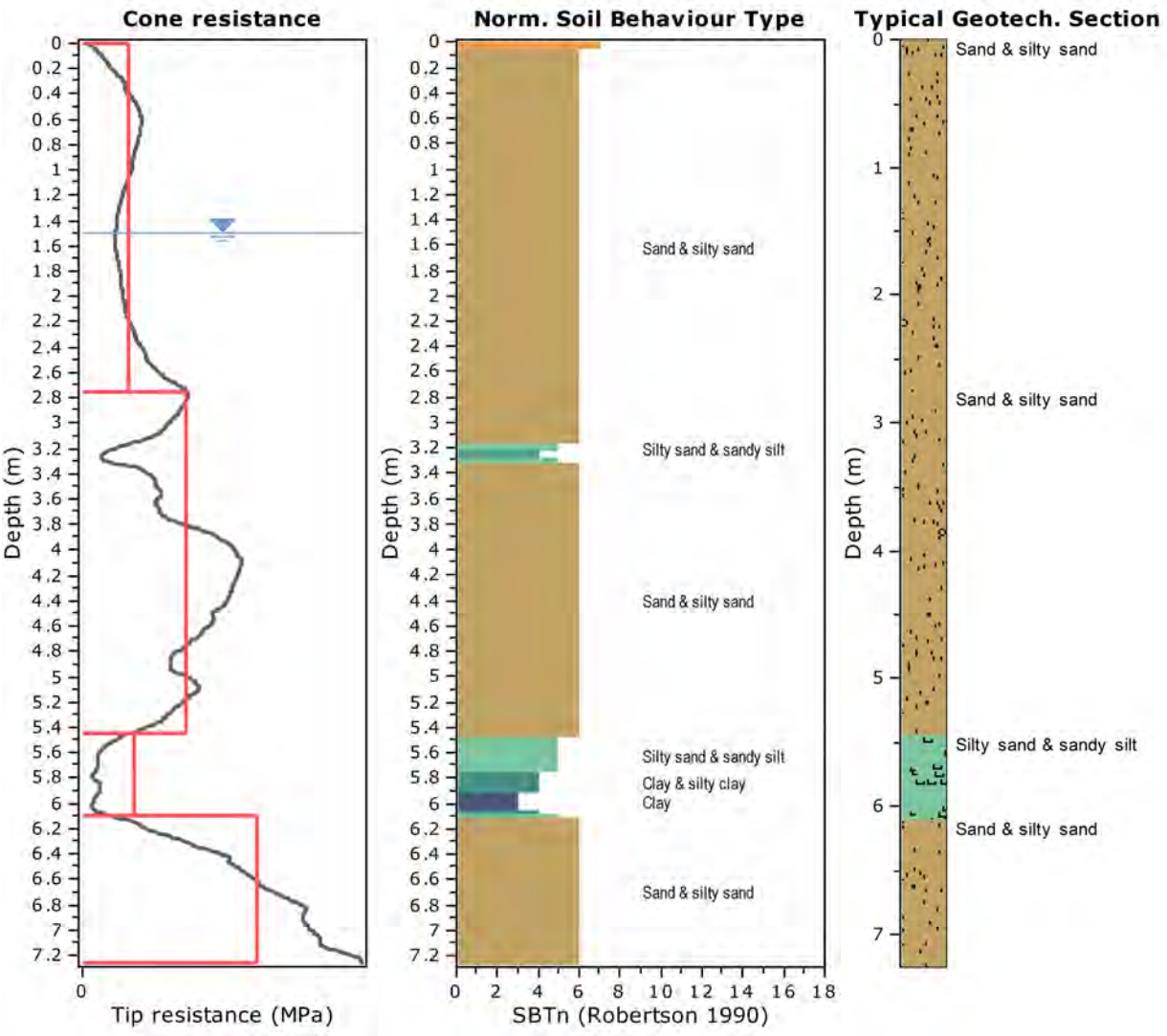
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CPT: CPT12
Total depth: 7.26 m, Date: 24/03/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project: **Foxton Solar Farm**
Location: **Foxton, New Zealand**



Depth (m)	Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
0.00	Sand & silty sand	6.7	1.50E-4	14.1	36.0	64.0	39.5	45.2	45.9	-	-	-	19.0
2.75	Sand & silty sand	14.8	2.47E-4	29.2	73.4	75.2	41.5	90.5	92.8	-	-	-	19.0
5.45	Silty sand & sandy silt	7.4	6.37E-5	17.5	59.0	55.4	38.3	58.2	69.5	-	-	-	19.0
6.10	Sand & silty sand	25.0	3.48E-4	47.2	112.5	85.8	43.3	140.7	143.3	-	-	-	19.0



Tabular results

.:: Layer No: 1 ::.

Code: Unit 1 **Start depth:** 0.00 (m), **End depth:** 2.75 (m)

Description: Sand & silty sand

Basic results

Total cone resistance: 6.71 ±2.34 MPa
Sleeve friction: 31.41 ±10.27 kPa
Ic: 1.57 ±0.26
SBT_n: 6
SBTn description: Sand & silty sand

Estimation results

Permeability: 1.50E-04 ±1.11E-04 m/s
N_{60}: 14.14 ±3.95 blows
Es: 36.03 ±10.26 MPa
Dr (%): 64.03 ±10.40
φ (degrees): 39.54 ±3.57 °
Unit weight: 19.00 ±0.00 kN/m³

Constrained Mod.: 45.16 ±12.86 MPa
Go: 45.92 ±13.08 MPa
Su: 0.00 ±0.00 kPa
Su ratio: 0.00 ±0.00
O.C.R.: 0.00 ±0.00

.:: Layer No: 2 ::.

Code: Unit 2 **Start depth:** 2.75 (m), **End depth:** 5.45 (m)

Description: Sand & silty sand

Basic results	Estimation results	
Total cone resistance: 14.83 ±5.40 MPa	Permeability: 2.47E-04 ±1.58E-04 m/s	Constrained Mod.: 90.53 ±20.86 MPa
Sleeve friction: 88.93 ±25.88 kPa	N_{60}: 29.20 ±8.57 blows	Go: 92.80 ±19.66 MPa
Ic: 1.58 ±0.23	Es: 73.45 ±15.05 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 75.18 ±11.77	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 41.54 ±1.81 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.00 ±0.00 kN/m³	

.:: Layer No: 3 ::.

Code: Unit 3 **Start depth:** 5.45 (m), **End depth:** 6.10 (m)

Description: Silty sand & sandy silt

Basic results	Estimation results	
Total cone resistance: 7.38 ±5.79 MPa	Permeability: 6.37E-05 ±8.63E-05 m/s	Constrained Mod.: 58.23 ±30.78 MPa
Sleeve friction: 67.92 ±26.70 kPa	N_{60}: 17.53 ±9.80 blows	Go: 69.54 ±22.09 MPa
Ic: 2.12 ±0.52	Es: 58.96 ±18.27 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 5	Dr (%): 55.36 ±18.46	Su ratio: 0.00 ±0.00
SBTn description: Silty sand & sandy silt	φ (degrees): 38.31 ±2.80 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.00 ±0.00 kN/m³	

.:: Layer No: 4 ::.

Code: Unit 2 **Start depth:** 6.10 (m), **End depth:** 7.26 (m)

Description: Sand & silty sand

Basic results	Estimation results	
Total cone resistance: 25.00 ±9.66 MPa	Permeability: 3.48E-04 ±1.84E-04 m/s	Constrained Mod.: 140.75 ±41.14 MPa
Sleeve friction: 168.20 ±74.23 kPa	N_{60}: 47.15 ±15.98 blows	Go: 143.31 ±41.40 MPa
Ic: 1.50 ±0.18	Es: 112.46 ±32.49 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 85.81 ±17.31	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 43.33 ±2.95 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.00 ±0.00 kN/m³	

Summary table of mean values

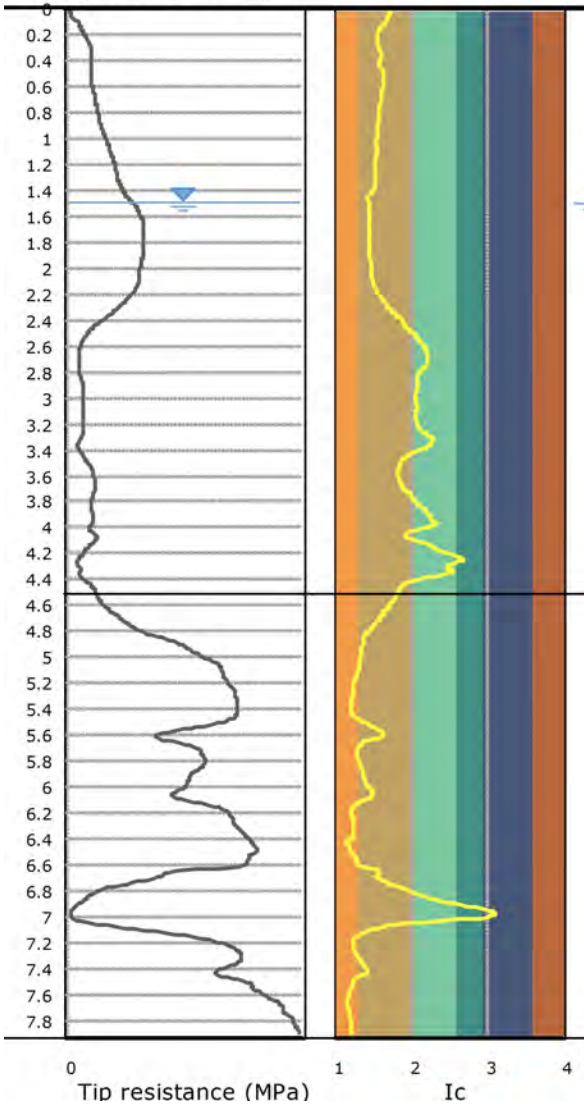
From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_O (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
0.00	2.75	1.50E-04	14.1	36.0	64.0	39.5	45.2	45.9	0.0	0.0	0.0	19.0
2.75		(±1.11E-04)	(±4.0)	(±10.3)	(±10.4)	(±3.6)	(±12.9)	(±13.1)	(±0.0)	(±0.0)	(±0.0)	(±0.0)
2.75	2.70	2.47E-04	29.2	73.4	75.2	41.5	90.5	92.8	0.0	0.0	0.0	19.0
5.45		(±1.58E-04)	(±8.6)	(±15.0)	(±11.8)	(±1.8)	(±20.9)	(±19.7)	(±0.0)	(±0.0)	(±0.0)	(±0.0)
5.45	0.65	6.37E-05	17.5	59.0	55.4	38.3	58.2	69.5	0.0	0.0	0.0	19.0
6.10		(±8.63E-05)	(±9.8)	(±18.3)	(±18.5)	(±2.8)	(±30.8)	(±22.1)	(±0.0)	(±0.0)	(±0.0)	(±0.0)
6.10	1.16	3.48E-04	47.2	112.5	85.8	43.3	140.7	143.3	0.0	0.0	0.0	19.0
7.26		(±1.84E-04)	(±16.0)	(±32.5)	(±17.3)	(±3.0)	(±41.1)	(±41.4)	(±0.0)	(±0.0)	(±0.0)	(±0.0)

Depth values presented in this table are measured from free ground surface

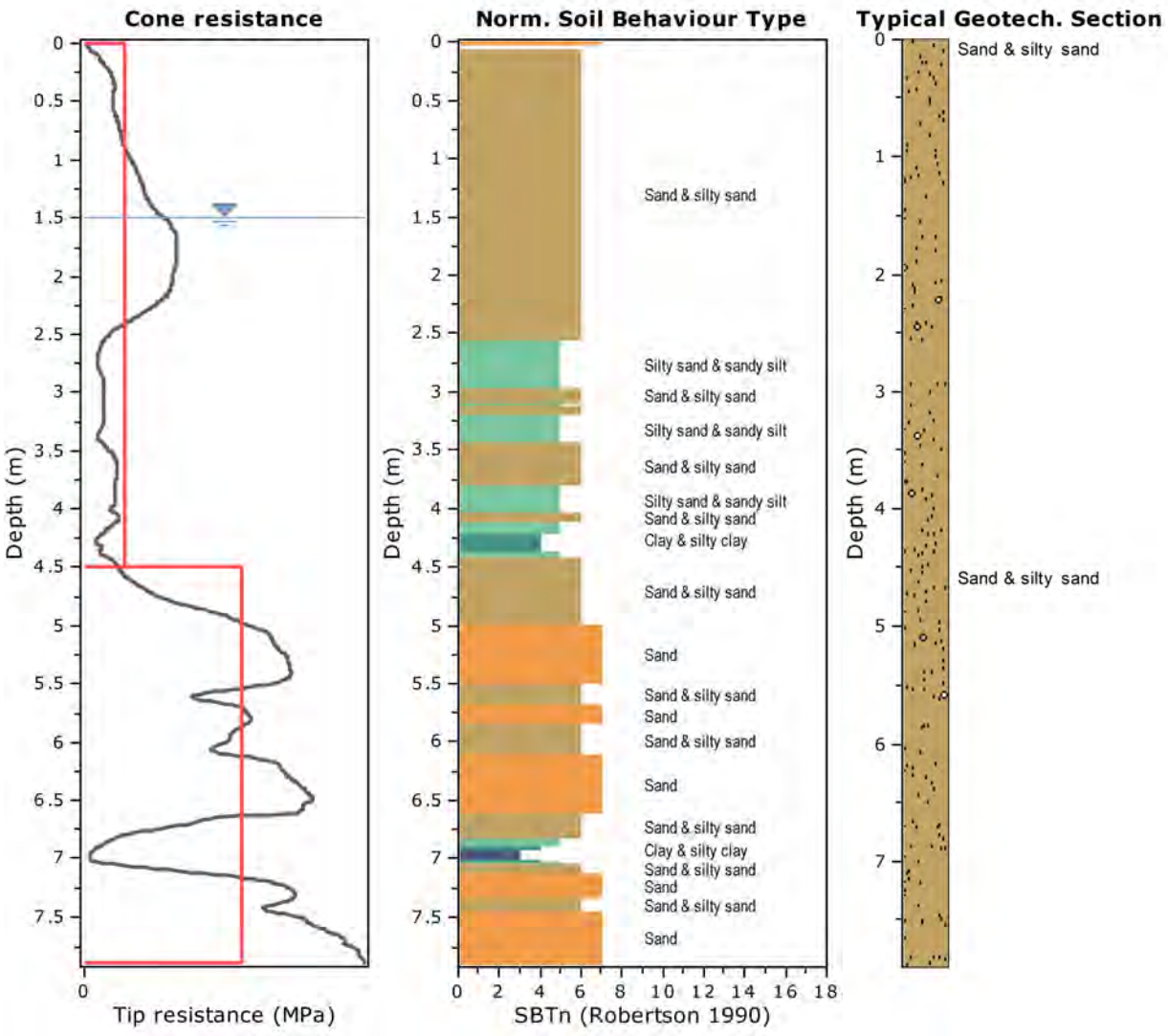
BTW Company
Engineering Geologists, Civil Engineers
179 Courtenay Street, New Plymouth
www.btw.nz

CPT: CPT13
Total depth: 7.90 m, Date: 24/03/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project: **Foxton Solar Farm**
Location: **Foxton, New Zealand**



Depth (m)	Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
0.00	Sand & silty sand	6.2	1.09E-4	13.7	38.7	56.6	38.2	47.0	49.0	-	-	-	19.0
4.50	Sand & silty sand	23.9	9.75E-4	41.5	94.6	85.8	43.2	114.4	117.3	-	-	-	19.0



Tabular results

.:: Layer No: 1 ::.

Code: Unit 1 **Start depth:** 0.00 (m), **End depth:** 4.50 (m)

Description: Sand & silty sand

Basic results	Estimation results	
Total cone resistance: 6.16 ±3.94 MPa	Permeability: 1.09E-04 ±1.22E-04 m/s	Constrained Mod.: 47.02 ±18.42 MPa
Sleeve friction: 39.15 ±22.58 kPa	N_{60}: 13.73 ±6.57 blows	Go: 48.99 ±18.47 MPa
Ic: 1.79 ±0.37	Es: 38.73 ±14.44 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 56.65 ±16.23	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 38.22 ±3.21 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.00 ±0.00 kN/m³	

.:: Layer No: 2 ::.

Code: Unit 2 **Start depth:** 4.50 (m), **End depth:** 7.90 (m)

Description: Sand & silty sand

Basic results	**Estimation results**	
Total cone resistance: 23.93 ±10.81 MPa	Permeability: 9.75E-04 ±7.75E-04 m/s	Constrained Mod.: 114.38 ±37.30 MPa
Sleeve friction: 105.60 ±44.61 kPa	N_{60}: 41.49 ±15.83 blows	Go: 117.29 ±35.45 MPa
Ic: 1.45 ±0.37	Es: 94.59 ±25.15 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 85.81 ±18.36	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 43.24 ±3.33 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.00 ±0.00 kN/m³	

Summary table of mean values

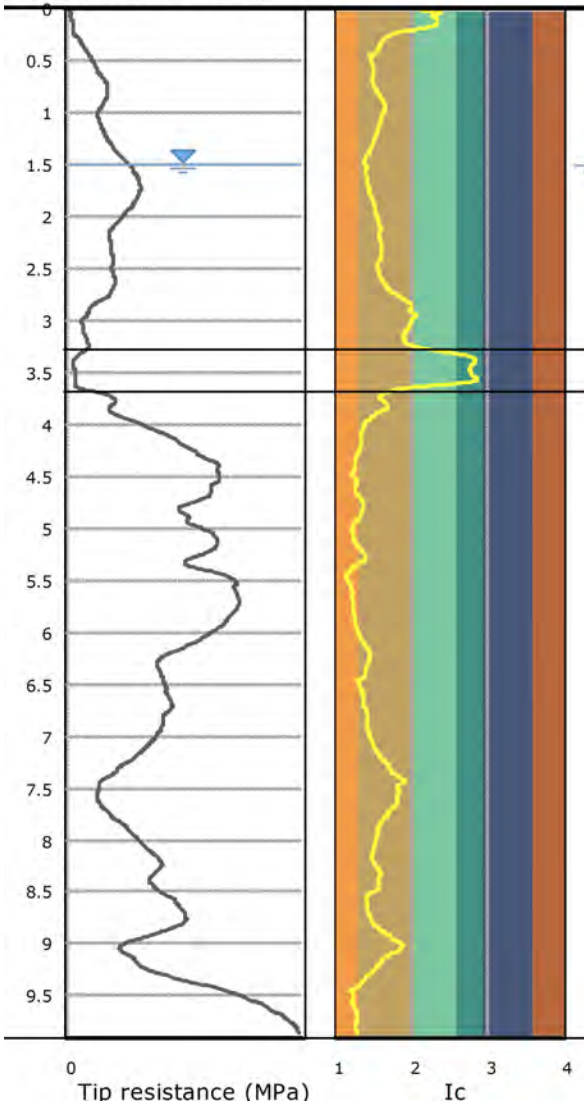
From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_O (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
0.00	4.50	1.09E-04	13.7	38.7	56.6	38.2	47.0	49.0	0.0	0.0	0.0	19.0
4.50		(±1.22E-04)	(±6.6)	(±14.4)	(±16.2)	(±3.2)	(±18.4)	(±18.5)	(±0.0)	(±0.0)	(±0.0)	(±0.0)
4.50	3.40	9.75E-04	41.5	94.6	85.8	43.2	114.4	117.3	0.0	0.0	0.0	19.0
7.90		(±7.75E-04)	(±15.8)	(±25.2)	(±18.4)	(±3.3)	(±37.3)	(±35.5)	(±0.0)	(±0.0)	(±0.0)	(±0.0)

Depth values presented in this table are measured from free ground surface

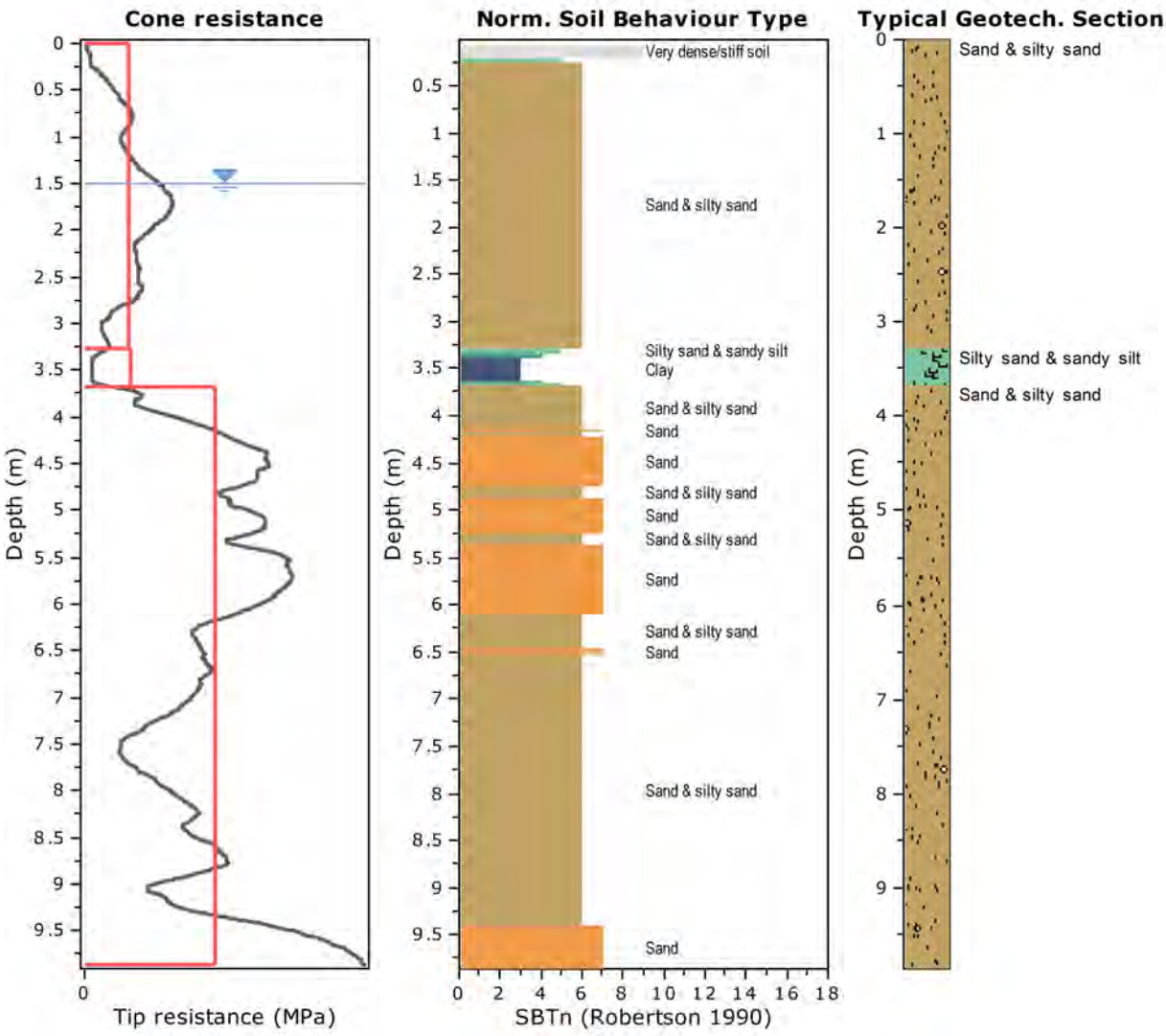
BTW Company
Engineering Geologists, Civil Engineers
179 Courtenay Street, New Plymouth
www.btw.nz

CPT: CPT14
Total depth: 9.86 m, Date: 24/03/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project: **Foxton Solar Farm**
Location: **Foxton, New Zealand**



Depth (m)	Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
0.00	Sand & silty sand	7.4	1.69E-4	15.4	40.9	63.1	39.2	48.8	49.8	-	-	-	19.0
3.27	Silty sand & sandy silt	7.5	1.62E-4	16.1	54.9	62.6	39.2	50.7	59.4	-	-	-	19.0
3.67	Sand & silty sand	21.4	6.79E-4	38.6	88.4	79.6	42.1	110.9	112.7	-	-	-	19.0



Tabular results

.:: Layer No: 1 ::.

Code: Unit 1 **Start depth:** 0.00 (m), **End depth:** 3.27 (m)

Description: Sand & silty sand

Basic results	Estimation results	
Total cone resistance: 7.38 ±3.70 MPa	Permeability: 1.69E-04 ±1.41E-04 m/s	Constrained Mod.: 48.85 ±18.70 MPa
Sleeve friction: 36.74 ±16.71 kPa	N_{60}: 15.38 ±6.34 blows	Go: 49.80 ±18.76 MPa
Ic: 1.62 ±0.32	Es: 40.85 ±13.05 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 63.14 ±11.51	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 39.23 ±2.32 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.00 ±0.00 kN/m³	

.:: Layer No: 2 ::.

Code: Unit 3 **Start depth:** 3.27 (m), **End depth:** 3.67 (m)

Description: Silty sand & sandy silt

Basic results	**Estimation results**	
Total cone resistance: 7.52 ±6.45 MPa	Permeability: 1.62E-04 ±2.46E-04 m/s	Constrained Mod.: 50.75 ±28.77 MPa
Sleeve friction: 52.81 ±15.78 kPa	N_{60}: 16.10 ±10.26 blows	Go: 59.42 ±21.14 MPa
Ic: 2.05 ±0.59	Es: 54.91 ±14.79 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 5	Dr (%): 62.60 ±15.63	Su ratio: 0.00 ±0.00
SBTn description: Silty sand & sandy silt	φ (degrees): 39.23 ±2.58 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.00 ±0.00 kN/m³	

.:: Layer No: 3 ::.

Code: Unit 2 **Start depth:** 3.67 (m), **End depth:** 9.86 (m)

Description: Sand & silty sand

Basic results	**Estimation results**	
Total cone resistance: 21.42 ±9.15 MPa	Permeability: 6.79E-04 ±6.10E-04 m/s	Constrained Mod.: 110.85 ±30.33 MPa
Sleeve friction: 96.27 ±45.81 kPa	N_{60}: 38.62 ±13.36 blows	Go: 112.71 ±30.84 MPa
Ic: 1.44 ±0.19	Es: 88.45 ±24.20 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 79.57 ±17.01	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 42.14 ±3.14 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.00 ±0.00 kN/m³	

Summary table of mean values

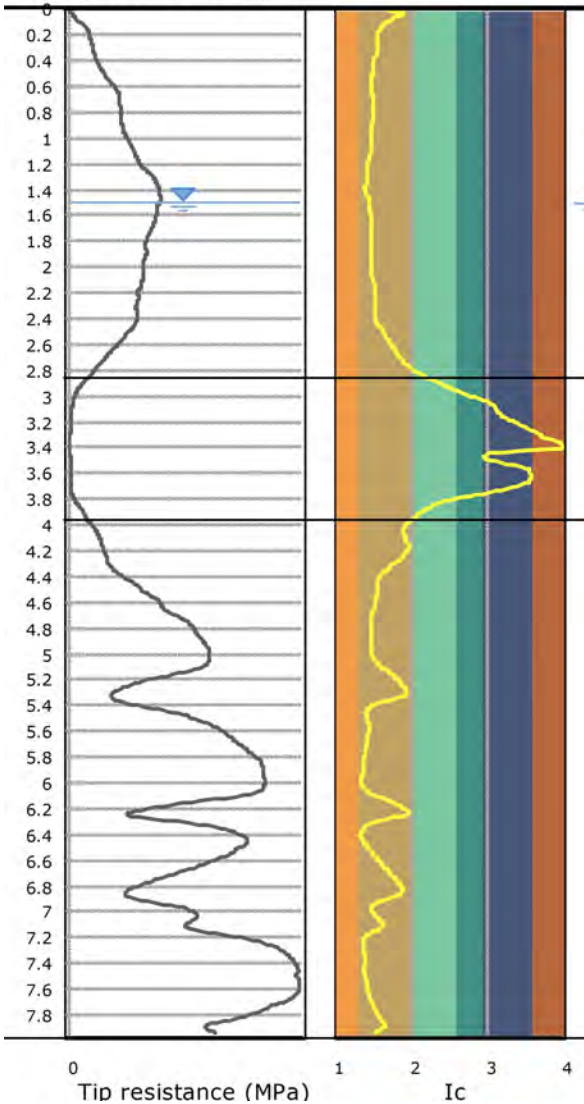
From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_O (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
0.00	3.27	1.69E-04	15.4	40.9	63.1	39.2	48.8	49.8	0.0	0.0	0.0	19.0
3.27		(±1.41E-04)	(±6.3)	(±13.1)	(±11.5)	(±2.3)	(±18.7)	(±18.8)	(±0.0)	(±0.0)	(±0.0)	(±0.0)
3.27	0.40	1.62E-04	16.1	54.9	62.6	39.2	50.7	59.4	0.0	0.0	0.0	19.0
3.67		(±2.46E-04)	(±10.3)	(±14.8)	(±15.6)	(±2.6)	(±28.8)	(±21.1)	(±0.0)	(±0.0)	(±0.0)	(±0.0)
3.67	6.19	6.79E-04	38.6	88.4	79.6	42.1	110.9	112.7	0.0	0.0	0.0	19.0
9.86		(±6.10E-04)	(±13.4)	(±24.2)	(±17.0)	(±3.1)	(±30.3)	(±30.8)	(±0.0)	(±0.0)	(±0.0)	(±0.0)

Depth values presented in this table are measured from free ground surface

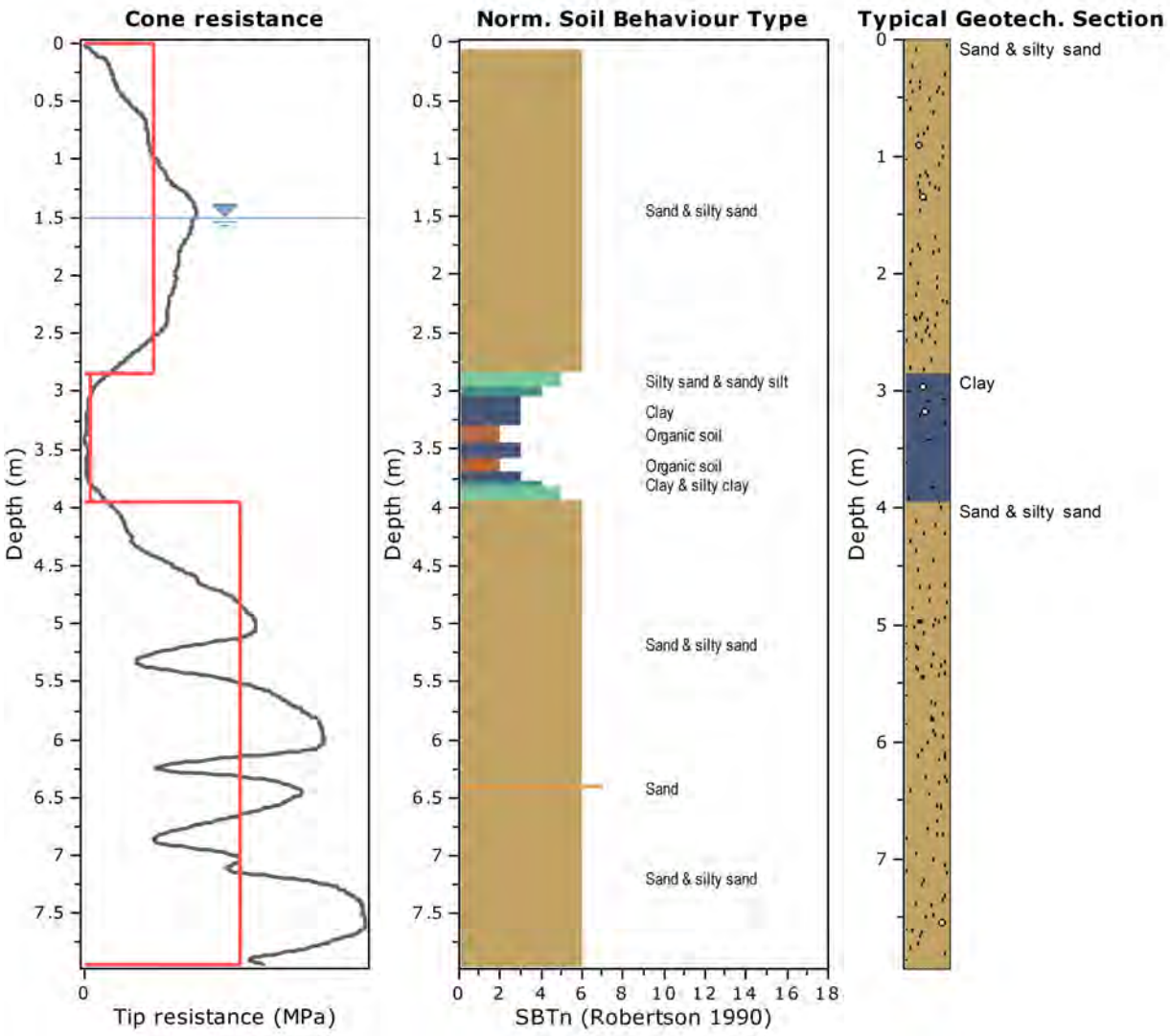
BTW Company
Engineering Geologists, Civil Engineers
179 Courtenay Street, New Plymouth
www.btw.nz

CPT: CPT15
Total depth: 7.94 m, Date: 24/03/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project: **Foxton Solar Farm**
Location: **Foxton, New Zealand**



Depth (m)	Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
0.00	Sand & silty sand	9.8	2.44E-4	19.5	48.3	72.9	41.1	59.3	60.3	-	-	-	19.0
2.85	Clay	0.9	3.87E-7	3.5	-	-	-	9.7	21.3	26.3	0.6	2.6	19.0
3.95	Sand & silty sand	21.9	2.66E-4	42.9	106.2	81.4	42.7	133.1	135.3	-	-	-	19.0



Tabular results

.:: Layer No: 1 ::.

Code: Unit 1 **Start depth:** 0.00 (m), **End depth:** 2.85 (m)

Description: Sand & silty sand

Basic results

Total cone resistance: 9.77 ±4.01 MPa
Sleeve friction: 51.21 ±21.32 kPa
Ic: 1.50 ±0.25
SBT_n: 6
SBTn description: Sand & silty sand

Estimation results

Permeability: 2.44E-04 ±1.16E-04 m/s
N_{60}: 19.51 ±6.78 blows
Es: 48.29 ±15.33 MPa
Dr (%): 72.85 ±9.19
φ (degrees): 41.07 ±1.63 °
Unit weight: 19.00 ±0.00 kN/m³

Constrained Mod.: 59.26 ±20.88 MPa
Go: 60.25 ±21.23 MPa
Su: 0.00 ±0.00 kPa
Su ratio: 0.00 ±0.00
O.C.R.: 0.00 ±0.00

.:: Layer No: 2 ::.

Code: Unit 3 **Start depth:** 2.85 (m), **End depth:** 3.95 (m)

Description: Clay

Basic results	**Estimation results**	
Total cone resistance: 0.85 ±0.86 MPa	Permeability: 3.87E-07 ±9.16E-07 m/s	Constrained Mod.: 9.72 ±12.41 MPa
Sleeve friction: 16.53 ±6.66 kPa	N_{60}: 3.47 ±2.30 blows	Go: 21.30 ±8.89 MPa
Ic: 3.06 ±0.55	Es: 0.00 ±0.00 MPa	Su: 26.26 ±19.86 kPa
SBT_n: 3	Dr (%): 0.00 ±0.00	Su ratio: 0.56 ±0.40
SBTn description: Clay	φ (degrees): 0.00 ±0.00 °	O.C.R.: 2.57 ±1.85
	Unit weight: 19.00 ±0.00 kN/m³	

.:: Layer No: 3 ::.

Code: Unit 2 **Start depth:** 3.95 (m), **End depth:** 7.94 (m)

Description: Sand & silty sand

Basic results	**Estimation results**	
Total cone resistance: 21.90 ±10.26 MPa	Permeability: 2.66E-04 ±2.15E-04 m/s	Constrained Mod.: 133.08 ±45.72 MPa
Sleeve friction: 167.08 ±84.61 kPa	N_{60}: 42.88 ±17.24 blows	Go: 135.31 ±46.48 MPa
Ic: 1.57 ±0.19	Es: 106.18 ±36.48 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 81.41 ±17.88	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 42.68 ±3.12 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.00 ±0.00 kN/m³	

Summary table of mean values

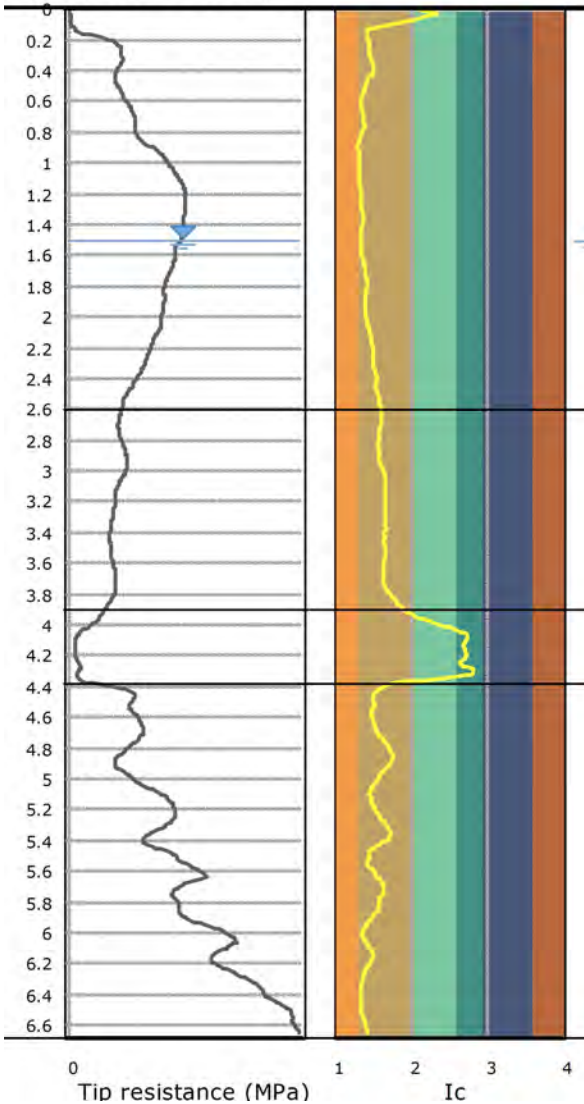
From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_O (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
0.00	2.85	2.44E-04	19.5	48.3	72.9	41.1	59.3	60.3	0.0	0.0	0.0	19.0
2.85		(±1.16E-04)	(±6.8)	(±15.3)	(±9.2)	(±1.6)	(±20.9)	(±21.2)	(±0.0)	(±0.0)	(±0.0)	(±0.0)
2.85	1.10	3.87E-07	3.5	0.0	0.0	0.0	9.7	21.3	26.3	0.6	2.6	19.0
3.95		(±9.16E-07)	(±2.3)	(±0.0)	(±0.0)	(±0.0)	(±12.4)	(±8.9)	(±19.9)	(±0.4)	(±1.8)	(±0.0)
3.95	3.99	2.66E-04	42.9	106.2	81.4	42.7	133.1	135.3	0.0	0.0	0.0	19.0
7.94		(±2.15E-04)	(±17.2)	(±36.5)	(±17.9)	(±3.1)	(±45.7)	(±46.5)	(±0.0)	(±0.0)	(±0.0)	(±0.0)

Depth values presented in this table are measured from free ground surface

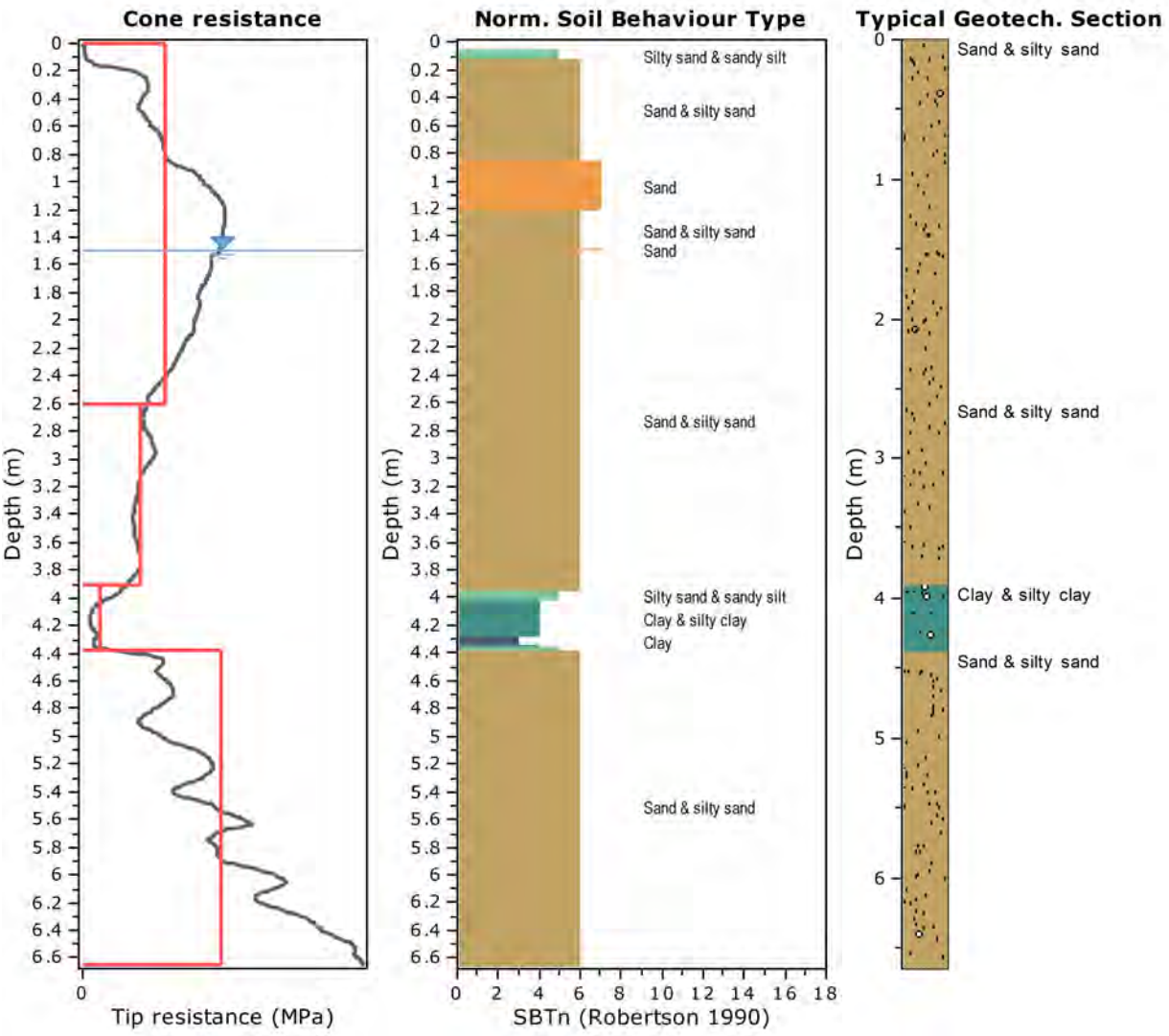
BTW Company
Engineering Geologists, Civil Engineers
179 Courtenay Street, New Plymouth
www.btw.nz

CPT: CPT16
Total depth: 6.65 m, Date: 24/03/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project: **Foxton Solar Farm**
Location: **Foxton, New Zealand**



Depth (m)	Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
0.00	Sand & silty sand	13.1	3.75E-4	25.1	60.4	79.4	42.1	74.6	75.8	-	-	-	19.0
2.60	Sand & silty sand	9.2	9.81E-5	19.6	52.3	62.3	38.9	65.5	66.6	-	-	-	19.0
3.90	Clay & silty clay	2.8	2.60E-6	9.5	-	-	-	34.3	50.8	114.2	2.0	9.3	19.0
4.38	Sand & silty sand	22.0	2.92E-4	42.3	104.0	82.7	42.9	128.9	131.5	-	-	-	19.0



Tabular results

.:: Layer No: 1 ::.

Code: Unit 1 **Start depth:** 0.00 (m), **End depth:** 2.60 (m)

Description: Sand & silty sand

Basic results

Total cone resistance: 13.08 ±5.46 MPa
Sleeve friction: 72.22 ±31.96 kPa
Ic: 1.48 ±0.25
SBT_n: 6
SBTn description: Sand & silty sand

Estimation results

Permeability: 3.75E-04 ±2.88E-04 m/s
N_{60}: 25.14 ±8.37 blows
Es: 60.43 ±16.93 MPa
Dr (%): 79.41 ±15.49
φ (degrees): 42.10 ±2.73 °
Unit weight: 19.00 ±0.00 kN/m³
Constrained Mod.: 74.57 ±23.04 MPa
Go: 75.83 ±23.40 MPa
Su: 0.00 ±0.00 kPa
Su ratio: 0.00 ±0.00
O.C.R.: 0.00 ±0.00

.:: Layer No: 2 ::.

Code: Unit 2 **Start depth:** 2.60 (m), **End depth:** 3.90 (m)

Description: Sand & silty sand

Basic results	Estimation results	
Total cone resistance: 9.23 ±1.05 MPa	Permeability: 9.81E-05 ±2.99E-05 m/s	Constrained Mod.: 65.50 ±4.75 MPa
Sleeve friction: 48.92 ±8.83 kPa	N_{60}: 19.63 ±1.75 blows	Go: 66.60 ±4.83 MPa
Ic: 1.64 ±0.05	Es: 52.26 ±3.79 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 62.25 ±4.09	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 38.92 ±0.84 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.00 ±0.00 kN/m³	

.:: Layer No: 3 ::.

Code: Unit 3 **Start depth:** 3.90 (m), **End depth:** 4.38 (m)

Description: Clay & silty clay

Basic results	Estimation results	
Total cone resistance: 2.82 ±1.90 MPa	Permeability: 2.60E-06 ±5.69E-06 m/s	Constrained Mod.: 34.33 ±19.11 MPa
Sleeve friction: 64.43 ±23.23 kPa	N_{60}: 9.51 ±4.03 blows	Go: 50.82 ±12.54 MPa
Ic: 2.51 ±0.32	Es: 0.00 ±0.00 MPa	Su: 114.21 ±28.57 kPa
SBT_n: 4	Dr (%): 0.00 ±0.00	Su ratio: 2.01 ±0.48
SBTn description: Clay & silty clay	φ (degrees): 0.00 ±0.00 °	O.C.R.: 9.30 ±2.21
	Unit weight: 19.00 ±0.00 kN/m³	

.:: Layer No: 4 ::.

Code: Unit 2 **Start depth:** 4.38 (m), **End depth:** 6.65 (m)

Description: Sand & silty sand

Basic results	Estimation results	
Total cone resistance: 21.95 ±10.26 MPa	Permeability: 2.92E-04 ±2.15E-04 m/s	Constrained Mod.: 128.93 ±45.58 MPa
Sleeve friction: 158.24 ±86.99 kPa	N_{60}: 42.31 ±17.10 blows	Go: 131.48 ±45.58 MPa
Ic: 1.54 ±0.19	Es: 103.99 ±35.29 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 82.68 ±14.15	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 42.94 ±2.71 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.00 ±0.00 kN/m³	

Summary table of mean values

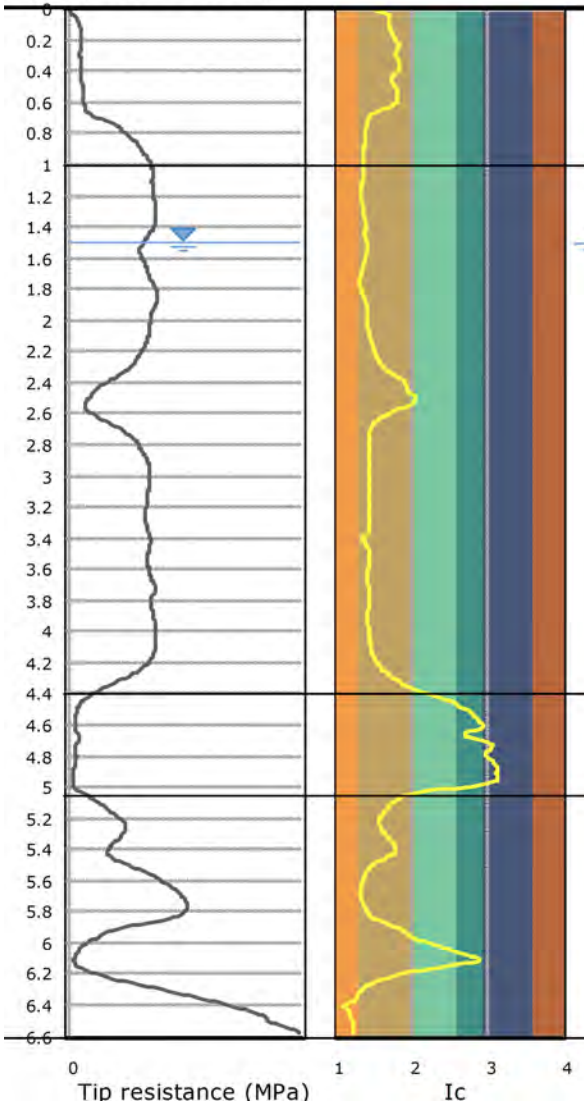
From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_O (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
0.00	2.60	3.75E-04	25.1	60.4	79.4	42.1	74.6	75.8	0.0	0.0	0.0	19.0
2.60		(±2.88E-04)	(±8.4)	(±16.9)	(±15.5)	(±2.7)	(±23.0)	(±23.4)	(±0.0)	(±0.0)	(±0.0)	(±0.0)
2.60	1.30	9.81E-05	19.6	52.3	62.3	38.9	65.5	66.6	0.0	0.0	0.0	19.0
3.90		(±2.99E-05)	(±1.7)	(±3.8)	(±4.1)	(±0.8)	(±4.7)	(±4.8)	(±0.0)	(±0.0)	(±0.0)	(±0.0)
3.90	0.48	2.60E-06	9.5	0.0	0.0	0.0	34.3	50.8	114.2	2.0	9.3	19.0
4.38		(±5.69E-06)	(±4.0)	(±0.0)	(±0.0)	(±0.0)	(±19.1)	(±12.5)	(±28.6)	(±0.5)	(±2.2)	(±0.0)
4.38	2.27	2.92E-04	42.3	104.0	82.7	42.9	128.9	131.5	0.0	0.0	0.0	19.0
6.65		(±2.15E-04)	(±17.1)	(±35.3)	(±14.2)	(±2.7)	(±45.6)	(±45.6)	(±0.0)	(±0.0)	(±0.0)	(±0.0)

Depth values presented in this table are measured from free ground surface

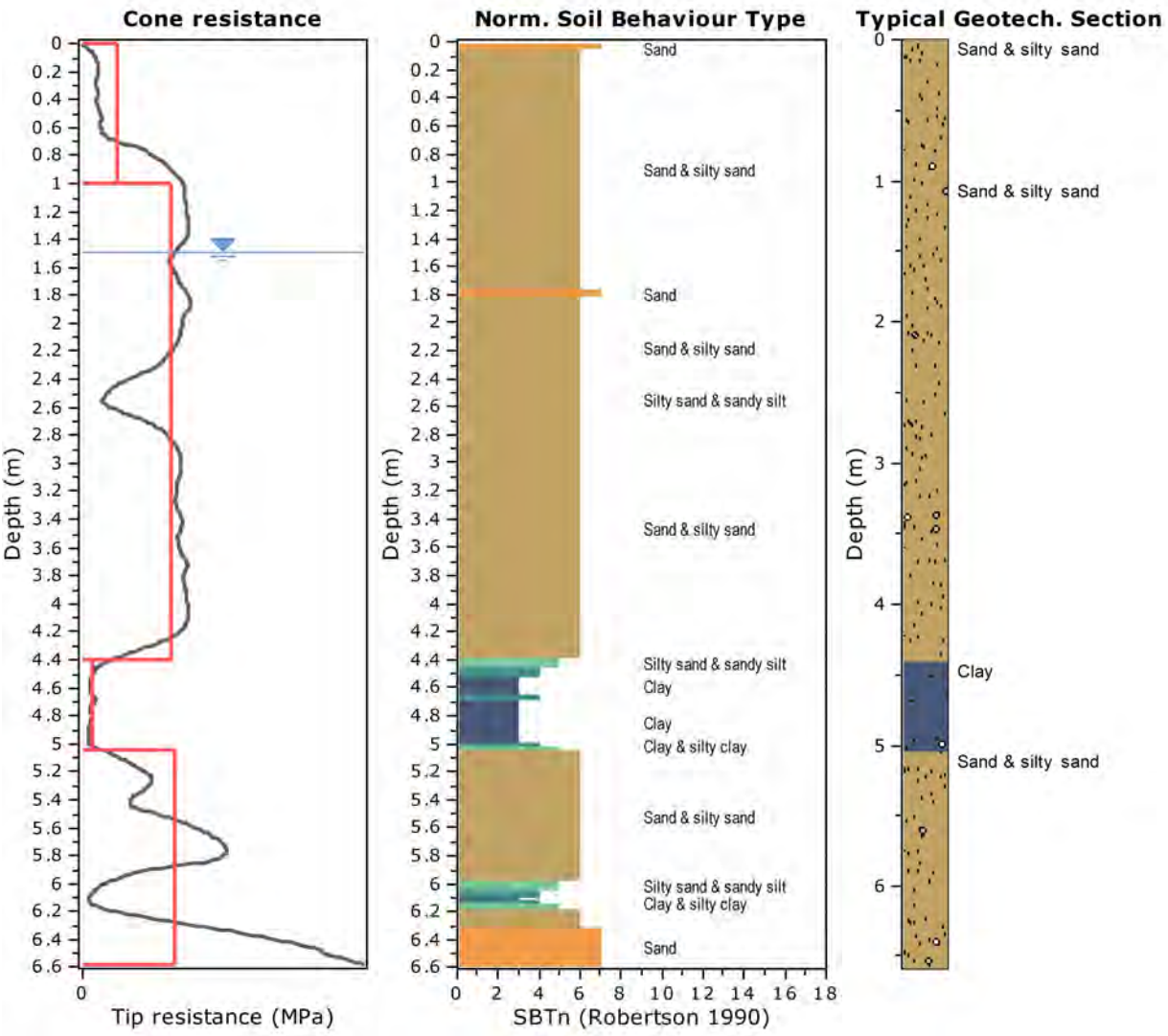
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Engineering Geologists, Civil Engineers
179 Courtenay Street, New Plymouth
www.btw.nz

CPT: CPT17
Total depth: 6.58 m, Date: 24/03/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project: **Foxton Solar Farm**
Location: **Foxton, New Zealand**



Depth (m)	Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
0.00	Sand & silty sand	5.7	1.80E-4	11.9	28.8	67.6	40.6	35.4	36.0	-	-	-	19.0
1.00	Sand & silty sand	14.8	3.79E-4	27.9	67.0	78.6	42.1	83.9	85.3	-	-	-	19.0
4.40	Clay	1.7	3.19E-7	7.3	-	-	-	22.3	47.5	92.4	1.6	7.2	19.0
5.05	Sand & silty sand	15.4	4.89E-4	28.9	73.1	68.5	40.3	86.3	89.3	-	-	-	19.0



Tabular results

.:: Layer No: 1 ::.

Code: Unit 1 **Start depth:** 0.00 (m), **End depth:** 1.00 (m)

Description: Sand & silty sand

Basic results

Total cone resistance: 5.66 ±5.04 MPa
Sleeve friction: 32.20 ±25.37 kPa
Ic: 1.56 ±0.43
SBT_n: 6
SBTn description: Sand & silty sand

Estimation results

Permeability: 1.80E-04 ±2.16E-04 m/s
N_{60}: 11.86 ±8.55 blows
Es: 28.82 ±18.66 MPa
Dr (%): 67.62 ±15.82
φ (degrees): 40.55 ±3.79 °
Unit weight: 19.00 ±0.00 kN/m³
Constrained Mod.: 35.40 ±23.69 MPa
Go: 35.99 ±24.09 MPa
Su: 0.00 ±0.00 kPa
Su ratio: 0.00 ±0.00
O.C.R.: 0.00 ±0.00

.:: Layer No: 2 ::.

Code: Unit 2 **Start depth:** 1.00 (m), **End depth:** 4.40 (m)

Description: Sand & silty sand

Basic results	Estimation results	
Total cone resistance: 14.77 ±3.57 MPa	Permeability: 3.79E-04 ±1.97E-04 m/s	Constrained Mod.: 83.94 ±12.61 MPa
Sleeve friction: 76.26 ±15.76 kPa	N_{60}: 27.93 ±5.49 blows	Go: 85.35 ±12.82 MPa
Ic: 1.49 ±0.16	Es: 66.98 ±10.06 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 78.61 ±11.25	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 42.09 ±1.90 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.00 ±0.00 kN/m³	

.:: Layer No: 3 ::.

Code: Unit 3 **Start depth:** 4.40 (m), **End depth:** 5.05 (m)

Description: Clay

Basic results	Estimation results	
Total cone resistance: 1.70 ±0.93 MPa	Permeability: 3.19E-07 ±9.87E-07 m/s	Constrained Mod.: 22.27 ±12.09 MPa
Sleeve friction: 71.69 ±26.48 kPa	N_{60}: 7.29 ±2.11 blows	Go: 47.51 ±7.77 MPa
Ic: 2.82 ±0.29	Es: 0.00 ±0.00 MPa	Su: 92.41 ±25.43 kPa
SBT_n: 3	Dr (%): 0.00 ±0.00	Su ratio: 1.55 ±0.42
SBTn description: Clay	φ (degrees): 0.00 ±0.00 °	O.C.R.: 7.18 ±1.93
	Unit weight: 19.00 ±0.00 kN/m³	

.:: Layer No: 4 ::.

Code: Unit 2 **Start depth:** 5.05 (m), **End depth:** 6.58 (m)

Description: Sand & silty sand

Basic results	Estimation results	
Total cone resistance: 15.41 ±11.39 MPa	Permeability: 4.89E-04 ±7.14E-04 m/s	Constrained Mod.: 86.30 ±40.42 MPa
Sleeve friction: 72.73 ±51.69 kPa	N_{60}: 28.92 ±17.01 blows	Go: 89.33 ±38.72 MPa
Ic: 1.66 ±0.41	Es: 73.06 ±29.19 MPa	Su: 0.00 ±0.00 kPa
SBT_n: 6	Dr (%): 68.54 ±20.50	Su ratio: 0.00 ±0.00
SBTn description: Sand & silty sand	φ (degrees): 40.31 ±3.86 °	O.C.R.: 0.00 ±0.00
	Unit weight: 19.00 ±0.00 kN/m³	

Summary table of mean values

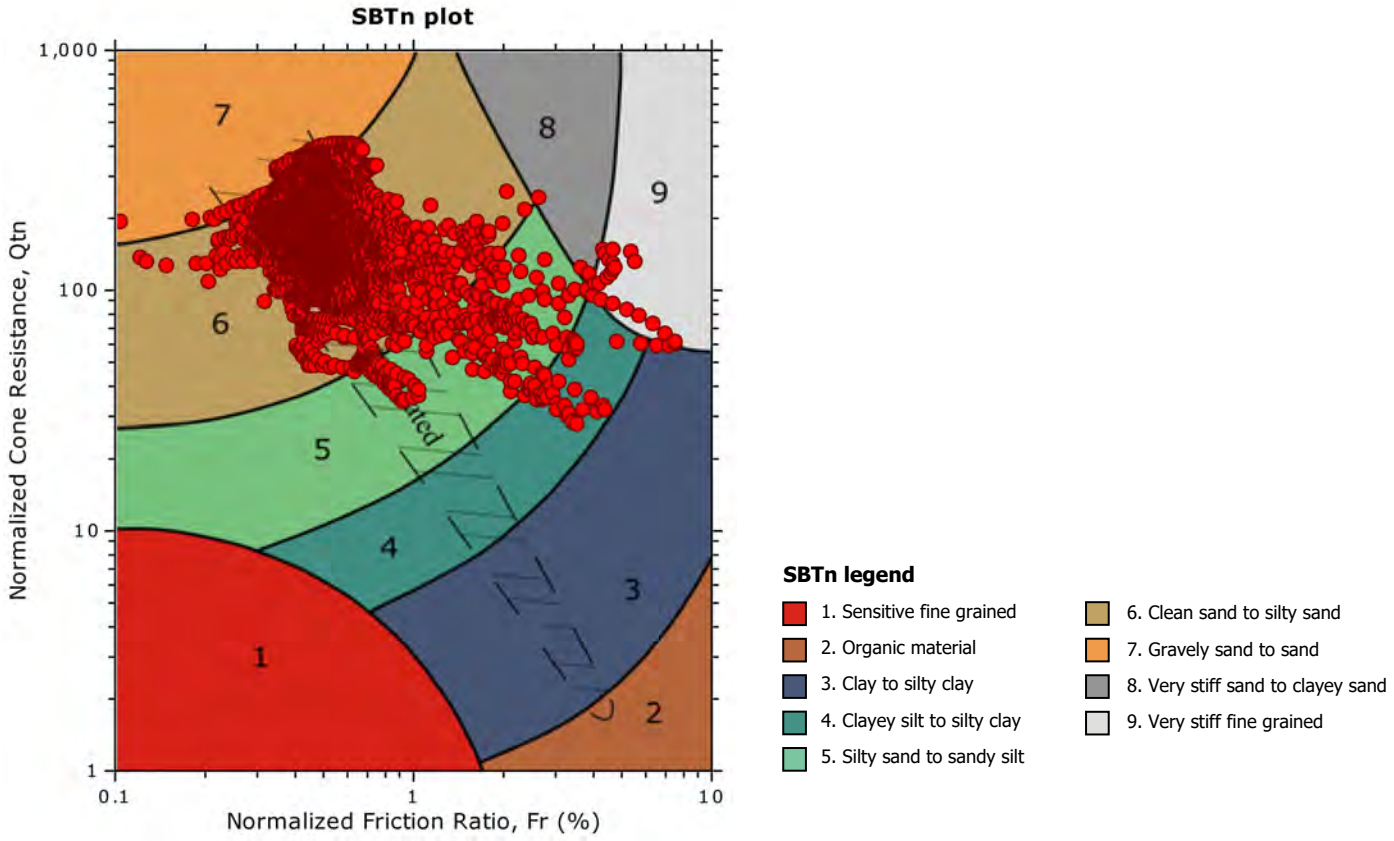
From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_O (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
0.00	1.00	1.80E-04	11.9	28.8	67.6	40.6	35.4	36.0	0.0	0.0	0.0	19.0
1.00		(±2.16E-04)	(±8.6)	(±18.7)	(±15.8)	(±3.8)	(±23.7)	(±24.1)	(±0.0)	(±0.0)	(±0.0)	(±0.0)
1.00	3.40	3.79E-04	27.9	67.0	78.6	42.1	83.9	85.3	0.0	0.0	0.0	19.0
4.40		(±1.97E-04)	(±5.5)	(±10.1)	(±11.3)	(±1.9)	(±12.6)	(±12.8)	(±0.0)	(±0.0)	(±0.0)	(±0.0)
4.40	0.65	3.19E-07	7.3	0.0	0.0	0.0	22.3	47.5	92.4	1.6	7.2	19.0
5.05		(±9.87E-07)	(±2.1)	(±0.0)	(±0.0)	(±0.0)	(±12.1)	(±7.8)	(±25.4)	(±0.4)	(±1.9)	(±0.0)
5.05	1.53	4.89E-04	28.9	73.1	68.5	40.3	86.3	89.3	0.0	0.0	0.0	19.0
6.58		(±7.14E-04)	(±17.0)	(±29.2)	(±20.5)	(±3.9)	(±40.4)	(±38.7)	(±0.0)	(±0.0)	(±0.0)	(±0.0)

Depth values presented in this table are measured from free ground surface

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Project: Foxton Solar Farm

Statistical results for user defined layer Unit 1



:: Tabular results for cone resistance values ::

CPT Name	Start depth (m)	End depth (m)	Average qt (MPa)	No points	StdDev	Min. charact. qt value (MPa)	Min. qt value (MPa)
CPT01	0.00	1.85	6.63	185	3.56	6.20	1.81
CPT02	0.00	1.62	6.35	162	2.84	5.98	1.88
CPT03	0.00	2.90	8.32	290	4.06	7.92	2.15
CPT04	0.00	5.10	6.43	510	1.97	6.28	0.56
CPT05	0.00	4.55	8.12	454	2.89	7.89	2.18
CPT06	0.00	4.60	9.78	459	6.52	9.28	1.77
CPT07	0.00	2.50	8.90	250	5.73	8.30	1.07
CPT08	0.00	2.30	12.87	230	6.88	12.12	0.07
CPT09	0.00	4.30	13.38	429	5.19	12.97	1.17
CPT10	0.00	1.95	10.82	195	5.64	10.15	0.05
CPT10	2.35	3.30	9.64	96	4.55	8.87	1.85
CPT11	0.00	2.60	10.51	260	4.02	10.10	0.18
CPT12	0.00	2.75	6.71	275	2.34	6.48	1.23
CPT13	0.00	4.50	6.16	449	3.94	5.85	0.38
CPT14	0.00	3.27	7.38	327	3.70	7.05	0.21
CPT15	0.00	2.85	9.77	285	4.01	9.38	0.05
CPT16	0.00	2.60	13.08	260	5.46	12.52	0.14

:: Tabular results for cone resistance values ::

CPT Name	Start depth (m)	End depth (m)	Average qt (MPa)	No points	StdDev	Min. charact. qt value (MPa)	Min. qt value (MPa)
CPT17	0.00	1.00	5.66	100	5.04	4.83	0.07
All CPT's			**8.91**	**5216**	**5.20**	**8.79**	**0.05**

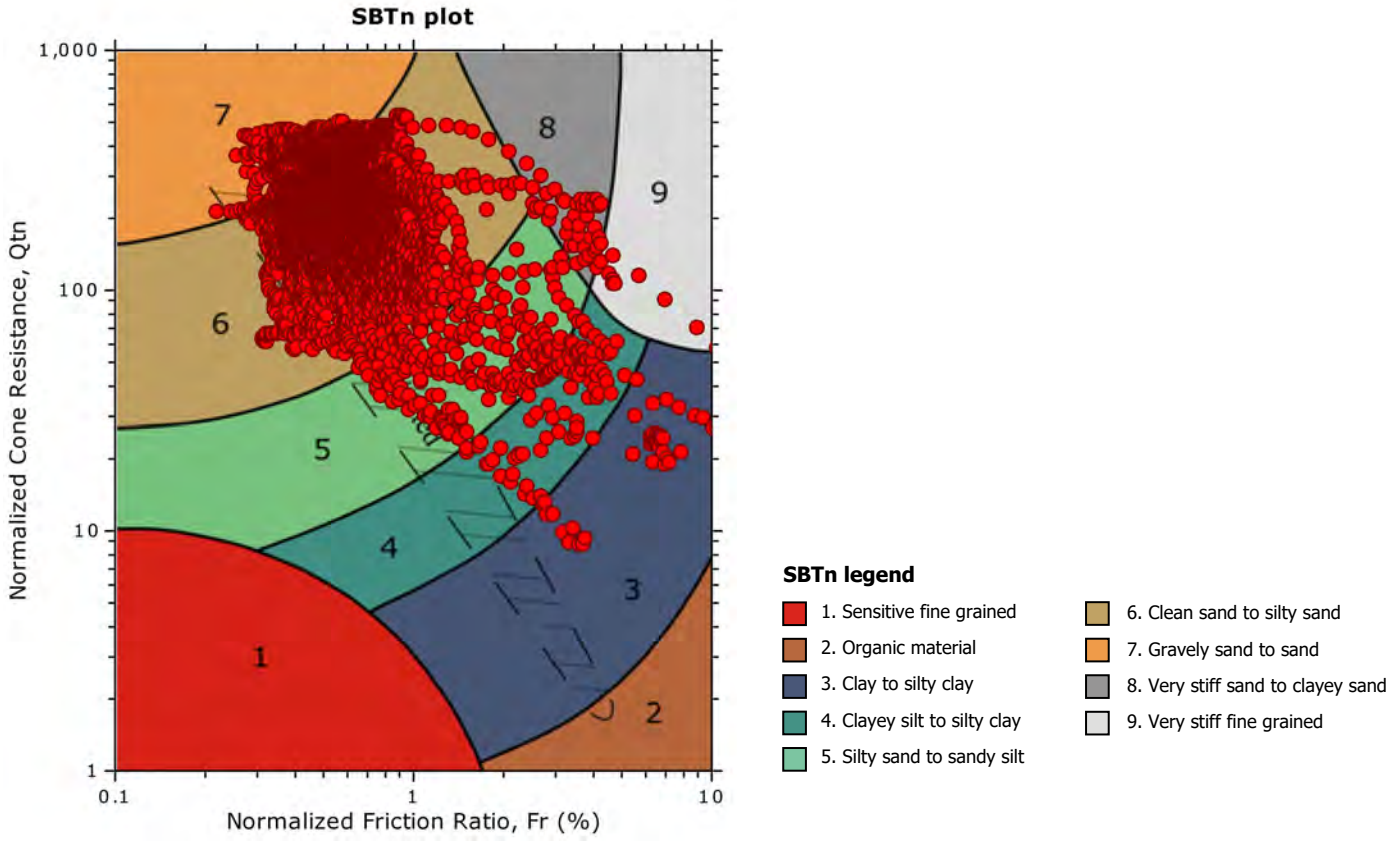
:: Minimum characteristc values for estimated results ::

CPT Name	Ksbt (m/s)	N_{60} (blows/ 30cm)	Es (MPa)	Dr (%)	phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR
CPT01	1.56E-004	13	31.60	66.74	40.11	39.61	37.80	0.00	0.00	0.00
CPT02	2.09E-004	12	28.67	70.26	40.90	35.93	33.99	0.00	0.00	0.00
CPT03	2.61E-004	16	37.72	69.77	40.66	47.28	45.64	0.00	0.00	0.00
CPT04	7.14E-005	14	37.84	58.29	38.28	47.42	45.16	0.00	0.00	0.00
CPT05	1.47E-004	16	41.83	64.41	39.47	52.43	50.62	0.00	0.00	0.00
CPT06	3.14E-004	18	42.49	73.80	41.38	53.22	52.88	0.00	0.00	0.00
CPT07	2.19E-004	17	43.09	68.41	40.65	51.80	51.90	0.00	0.00	0.00
CPT08	5.05E-004	23	53.19	82.86	42.96	64.90	66.35	0.00	0.00	0.00
CPT09	4.39E-004	25	59.45	79.64	42.51	73.79	76.30	0.00	0.00	0.00
CPT10	4.28E-004	20	44.74	77.27	41.92	55.40	56.33	0.00	0.00	0.00
CPT10	1.46E-004	19	53.01	63.02	39.64	62.15	65.43	0.00	0.00	0.00
CPT11	2.36E-004	20	50.74	70.32	40.64	62.50	63.55	0.00	0.00	0.00
CPT12	1.39E-004	14	35.01	63.00	39.19	43.88	44.62	0.00	0.00	0.00
CPT13	9.98E-005	13	37.61	55.39	37.97	45.58	47.55	0.00	0.00	0.00
CPT14	1.57E-004	15	39.66	62.09	39.02	47.14	48.09	0.00	0.00	0.00
CPT15	2.32E-004	19	46.79	71.96	40.91	57.22	58.18	0.00	0.00	0.00
CPT16	3.45E-004	24	58.70	77.83	41.82	72.21	73.43	0.00	0.00	0.00
CPT17	1.44E-004	10	25.72	64.99	39.92	31.47	31.99	0.00	0.00	0.00

Characteristic values are calculated based on 95% reliability and with the assumption that coefficient of variation is not known *a priori*

Project: Foxton Solar Farm

Statistical results for user defined layer Unit 2



:: Tabular results for cone resistance values ::

CPT Name	Start depth (m)	End depth (m)	Average qt (MPa)	No points	StdDev	Min. charact. qt value (MPa)	Min. qt value (MPa)
CPT01	1.85	6.88	21.61	503	9.83	20.89	1.39
CPT02	1.62	6.75	19.74	513	6.93	19.23	8.54
CPT03	2.90	7.15	20.47	425	11.70	19.53	2.53
CPT04	5.60	7.50	20.84	190	13.48	19.22	1.23
CPT05	4.55	8.15	16.97	361	9.58	16.14	2.56
CPT06	4.60	9.39	19.57	480	9.63	18.85	1.79
CPT07	2.50	7.01	17.95	451	9.66	17.20	3.00
CPT08	2.60	8.79	22.08	619	8.60	21.51	3.41
CPT09	4.30	7.37	21.22	308	7.84	20.48	3.66
CPT10	3.30	7.13	18.58	383	11.23	17.63	1.04
CPT11	2.60	4.12	13.51	153	1.90	13.26	6.95
CPT11	4.40	6.53	19.47	214	11.09	18.21	1.54
CPT12	2.75	5.45	14.83	270	5.40	14.28	2.63
CPT12	6.10	7.26	25.00	117	9.66	23.52	3.49
CPT13	4.50	7.90	23.93	341	10.81	22.96	0.82
CPT14	3.67	9.86	21.42	619	9.15	20.81	3.96
CPT15	3.95	7.94	21.90	399	10.26	21.05	3.08

:: Tabular results for cone resistance values ::

CPT Name	Start depth (m)	End depth (m)	Average qt (MPa)	No points	StdDev	Min. charact. qt value (MPa)	Min. qt value (MPa)
CPT16	4.38	6.65	21.95	228	10.26	20.83	3.24
CPT17	1.00	4.40	14.77	340	3.57	14.45	3.33
CPT17	5.05	6.58	15.41	154	11.39	13.89	1.04
All CPT's			**19.88**	**7068**	**9.69**	**19.69**	**0.82**

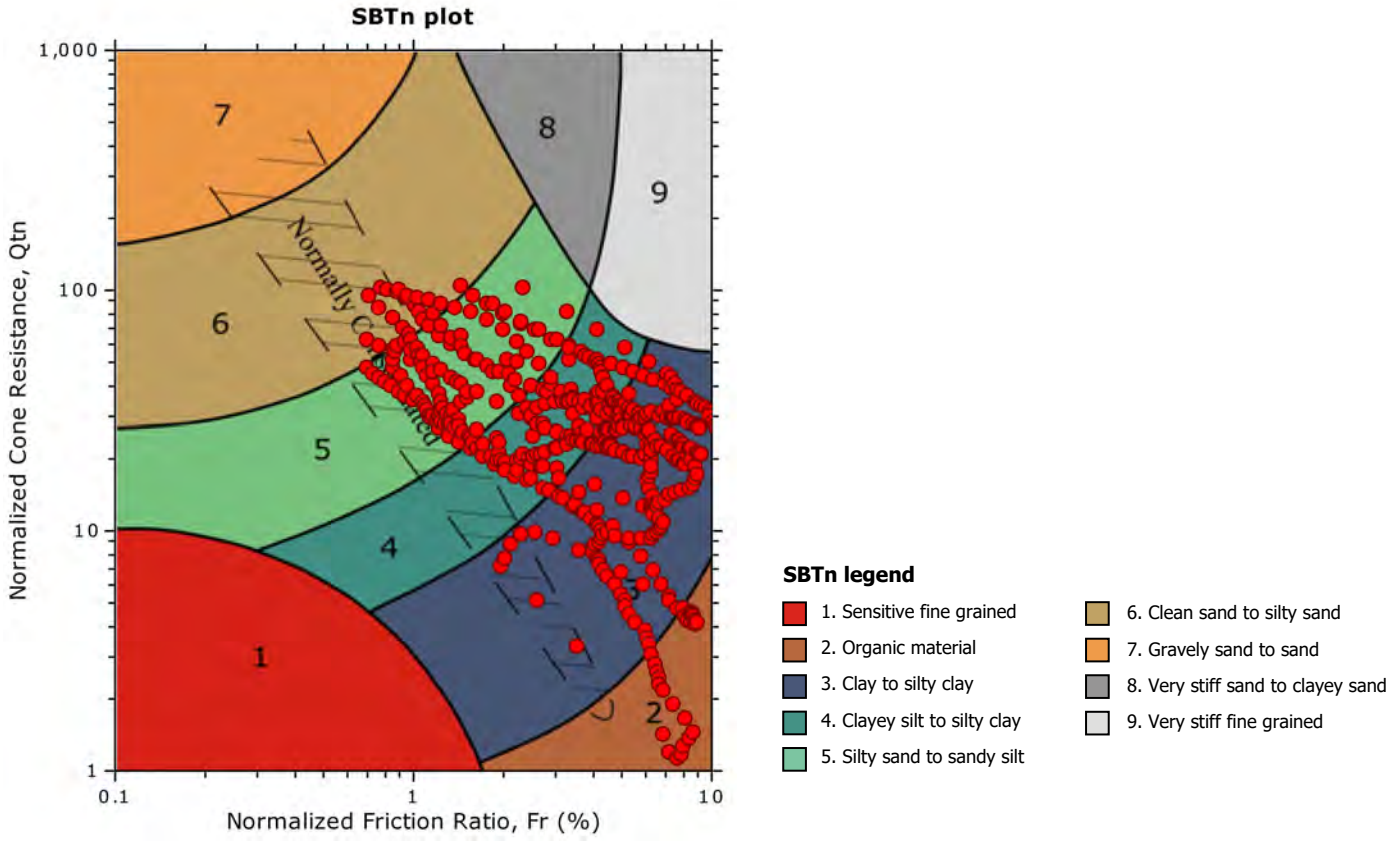
:: Minimum characteristc values for estimated results ::

CPT Name	Ksbt (m/s)	N_{60} (blows/ 30cm)	Es (MPa)	Dr (%)	phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR
CPT01	5.87E-004	38	91.16	84.23	43.30	111.86	119.10	0.00	0.00	0.00
CPT02	3.94E-004	37	90.79	82.68	43.02	113.69	120.46	0.00	0.00	0.00
CPT03	4.02E-004	37	89.82	78.95	42.38	109.35	116.91	0.00	0.00	0.00
CPT04	4.88E-004	36	91.10	78.04	42.12	102.51	111.79	0.00	0.00	0.00
CPT05	1.60E-004	33	84.37	70.89	40.76	104.77	110.24	0.00	0.00	0.00
CPT06	2.89E-004	37	93.08	78.51	42.22	114.78	123.24	0.00	0.00	0.00
CPT07	2.24E-004	34	85.95	75.79	41.77	105.69	112.07	0.00	0.00	0.00
CPT08	4.26E-004	40	95.99	83.58	42.91	119.34	126.90	0.00	0.00	0.00
CPT09	2.16E-004	41	101.29	81.12	42.58	126.95	135.46	0.00	0.00	0.00
CPT10	4.76E-004	34	86.43	79.65	42.49	100.01	106.91	0.00	0.00	0.00
CPT11	1.99E-004	27	67.13	73.08	41.15	84.14	85.55	0.00	0.00	0.00
CPT11	2.04E-004	37	94.78	76.20	41.99	115.85	119.05	0.00	0.00	0.00
CPT12	2.31E-004	28	71.94	73.99	41.36	88.44	90.83	0.00	0.00	0.00
CPT12	3.20E-004	45	107.48	83.15	42.88	134.44	136.96	0.00	0.00	0.00
CPT13	9.06E-004	40	92.35	84.17	42.94	111.05	114.12	0.00	0.00	0.00
CPT14	6.38E-004	38	86.84	78.44	41.93	108.85	110.67	0.00	0.00	0.00
CPT15	2.48E-004	41	103.17	79.93	42.42	129.31	131.47	0.00	0.00	0.00
CPT16	2.68E-004	40	100.12	81.13	42.64	123.95	126.49	0.00	0.00	0.00
CPT17	3.61E-004	27	66.08	77.60	41.92	82.82	84.20	0.00	0.00	0.00
CPT17	3.94E-004	27	69.17	65.81	39.80	80.91	84.17	0.00	0.00	0.00

Characteristic values are calculated based on 95% reliability and with the assumption that coefficient of variation is not known *a priori*

Project: Foxton Solar Farm

Statistical results for user defined layer Unit 3



:: Tabular results for cone resistance values ::

CPT Name	Start depth (m)	End depth (m)	Average qt (MPa)	No points	StdDev	Min. charact. qt value (MPa)	Min. qt value (MPa)
CPT04	5.10	5.60	1.36	51	0.87	1.16	0.62
CPT08	2.30	2.60	1.98	31	1.00	1.67	1.20
CPT10	1.95	2.35	1.90	41	1.16	1.59	1.00
CPT11	4.12	4.40	3.04	28	1.51	2.55	1.54
CPT12	5.45	6.10	7.38	66	5.79	6.19	1.39
CPT14	3.27	3.67	7.52	41	6.45	5.82	1.13
CPT15	2.85	3.95	0.85	111	0.86	0.72	0.12
CPT16	3.90	4.38	2.82	48	1.90	2.36	1.18
CPT17	4.40	5.05	1.70	66	0.93	1.51	0.85
All CPT's			**1.84**	**483**	**1.34**	**1.74**	**0.12**

:: Minimum characteristc values for estimated results ::

CPT Name	Ksbt (m/s)	N_{60} (blows/ 30cm)	Es (MPa)	Dr (%)	phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR
CPT04	2.14E-007	5	0.00	0.00	0.00	13.91	29.35	55.66	0.96	4.45
CPT08	5.01E-008	7	0.00	0.00	0.00	22.77	43.73	107.72	2.70	12.48

:: Minimum characteristc values for estimated results ::

CPT Name	Ksbt (m/s)	N_{60} (blows/ 30cm)	Es (MPa)	Dr (%)	phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR
CPT10	7.09E-007	6	0.00	0.00	0.00	20.88	37.99	81.26	2.18	10.06
CPT11	2.14E-007	11	0.00	0.00	0.00	34.32	68.39	144.24	2.57	11.90
CPT12	4.60E-005	16	55.21	51.57	37.73	51.91	65.00	0.00	0.00	0.00
CPT14	9.76E-005	13	51.02	58.49	38.55	43.18	53.86	0.00	0.00	0.00
CPT15	2.43E-007	3	0.00	0.00	0.00	7.77	19.90	23.13	0.49	2.28
CPT16	1.22E-006	9	0.00	0.00	0.00	29.70	47.78	107.29	1.90	8.77
CPT17	1.16E-007	7	0.00	0.00	0.00	19.79	45.91	87.19	1.47	6.79

Characteristic values are calculated based on 95% reliability and with the assumption that coefficient of variation is not known *a priori*

APPENDIX E LIQUEFACTION ASSESSMENT

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CPT17_SLS results
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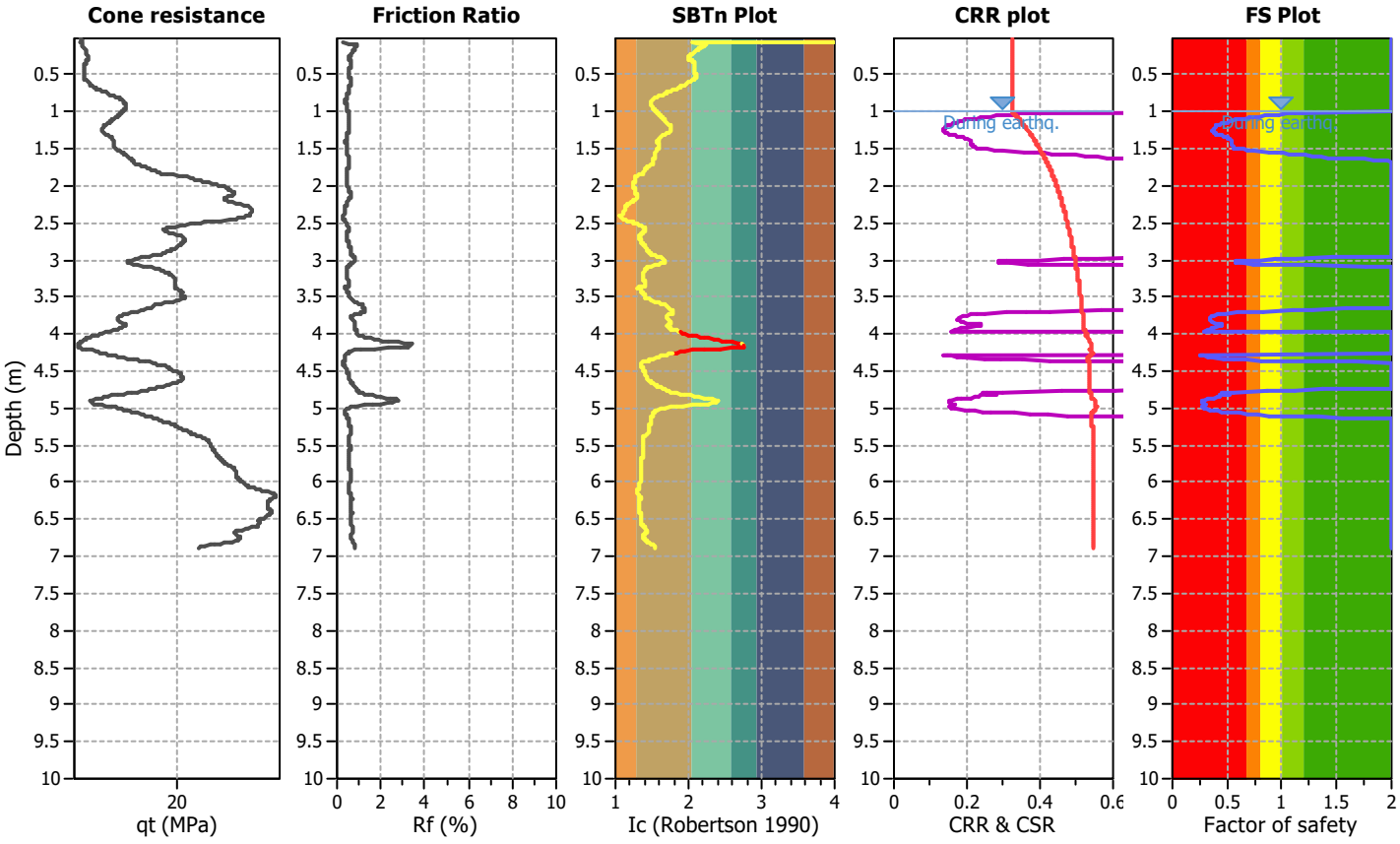
LIQUEFACTION ANALYSIS REPORT

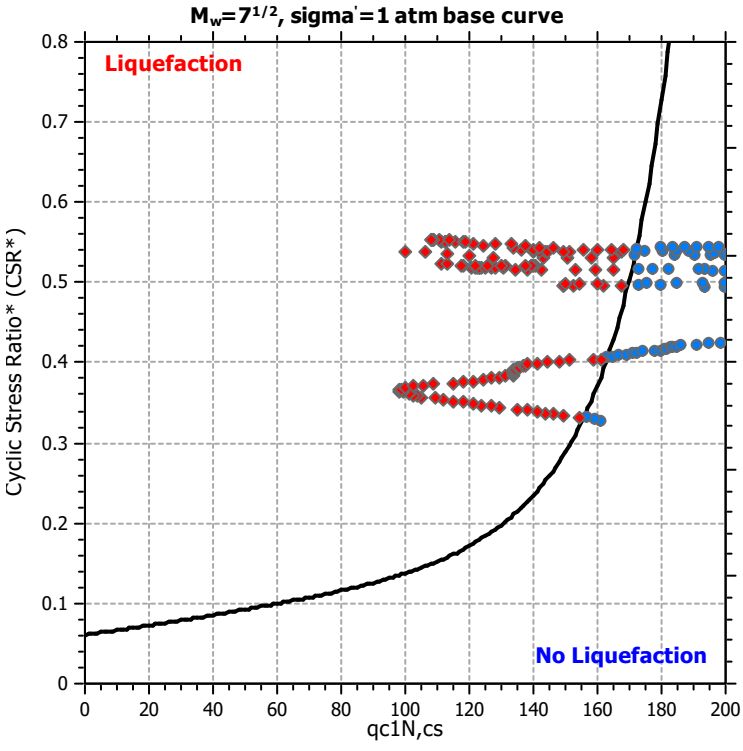
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

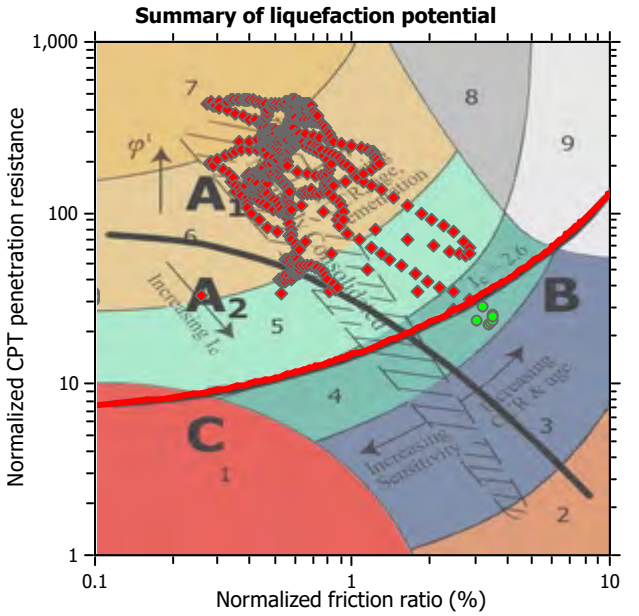
CPT file : CPT01_ULS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

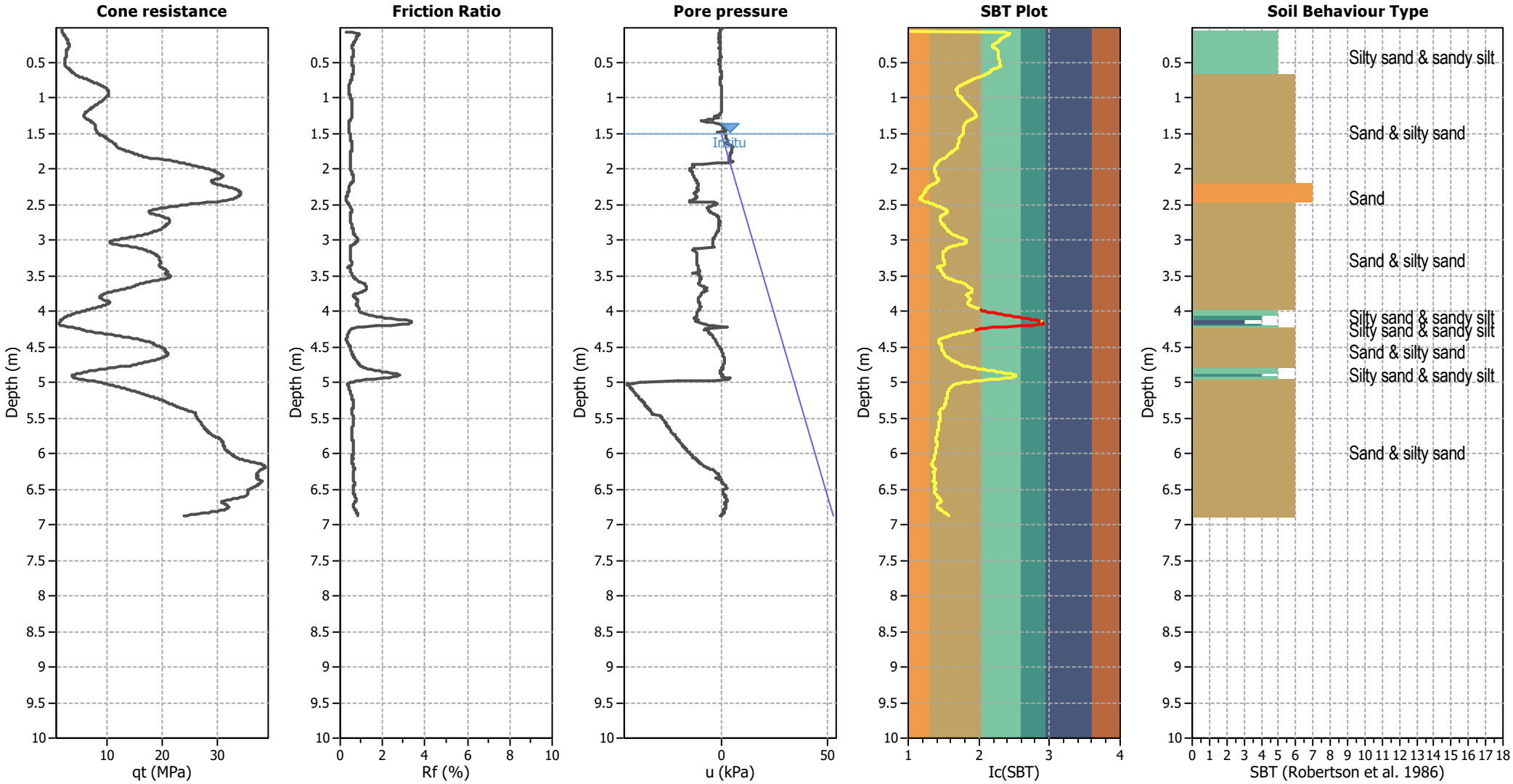






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



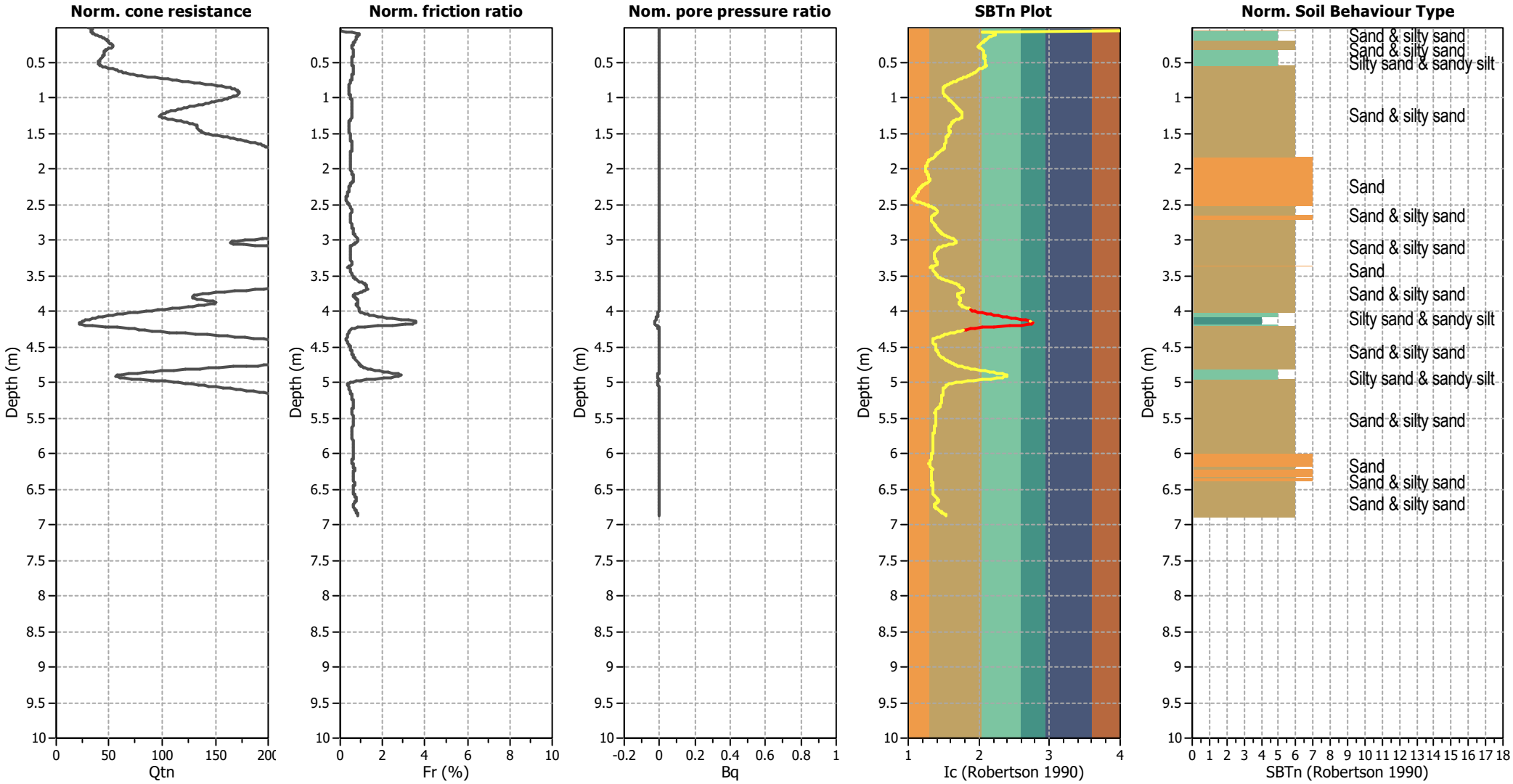
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



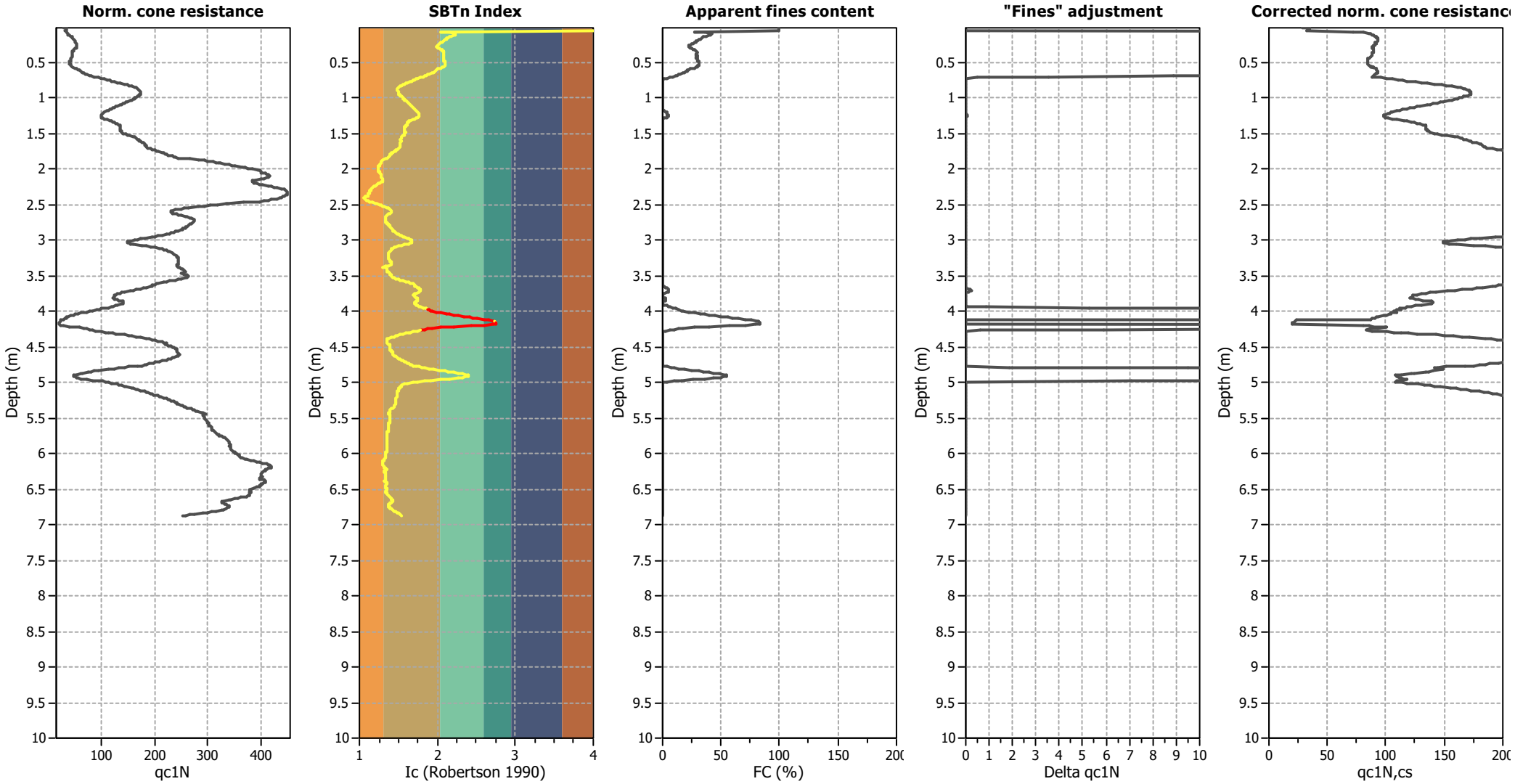
Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

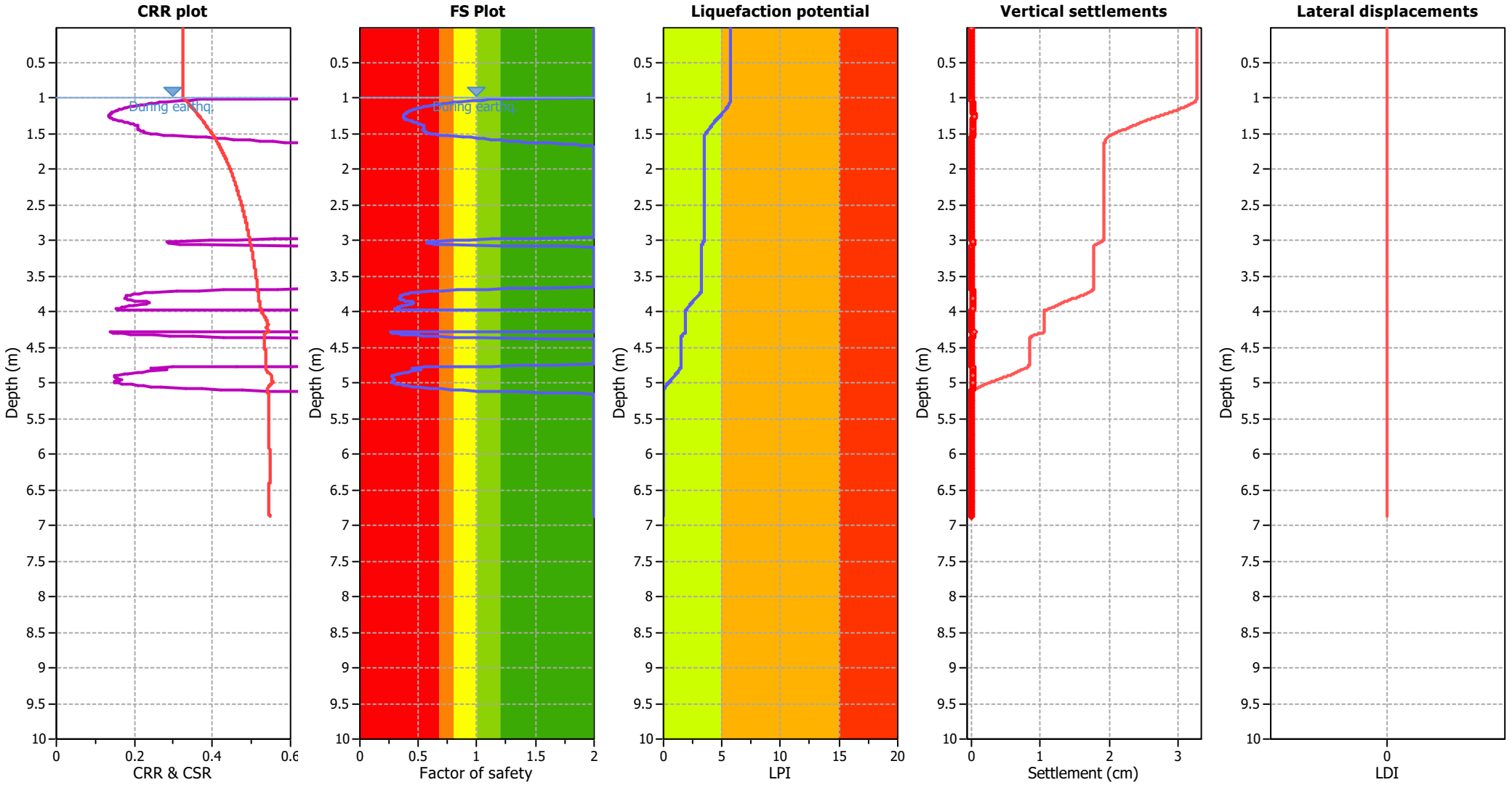
Liquefaction analysis overall plots (intermediate results)



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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

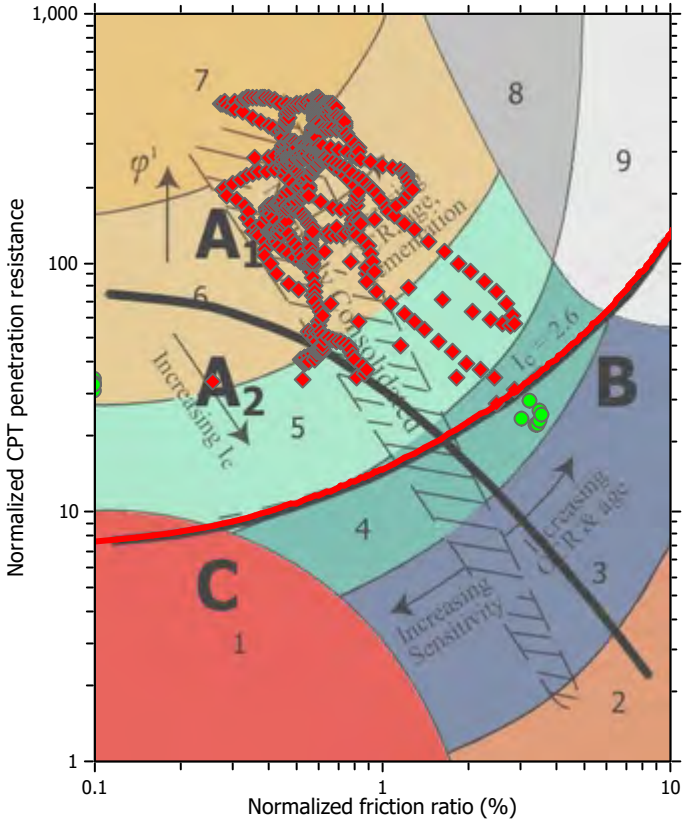
F.S. color scheme

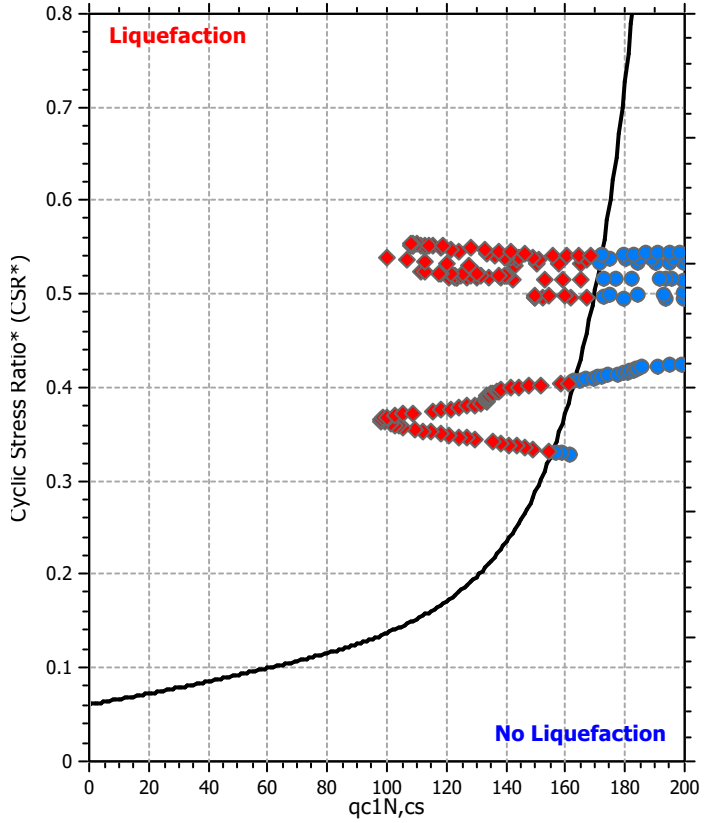
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

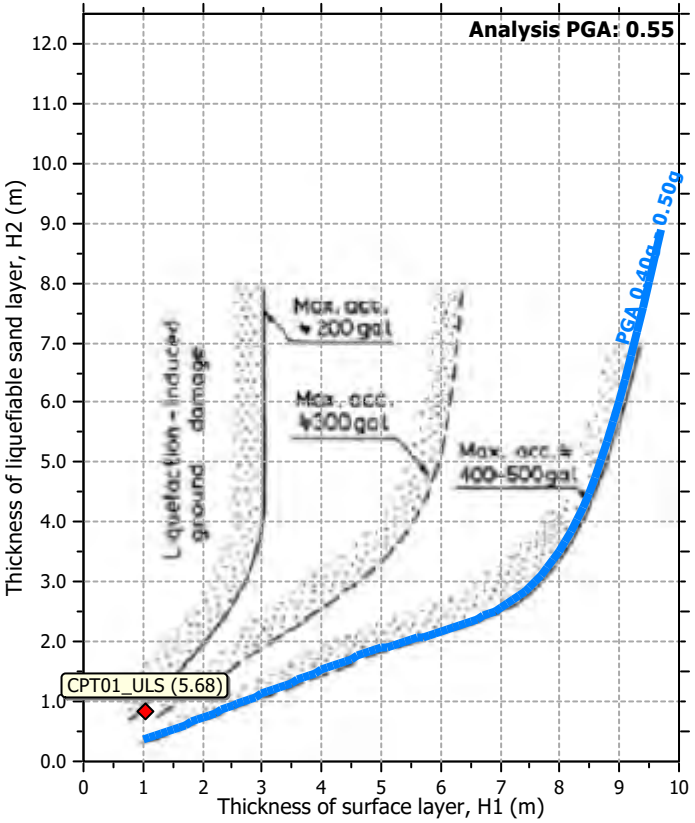
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



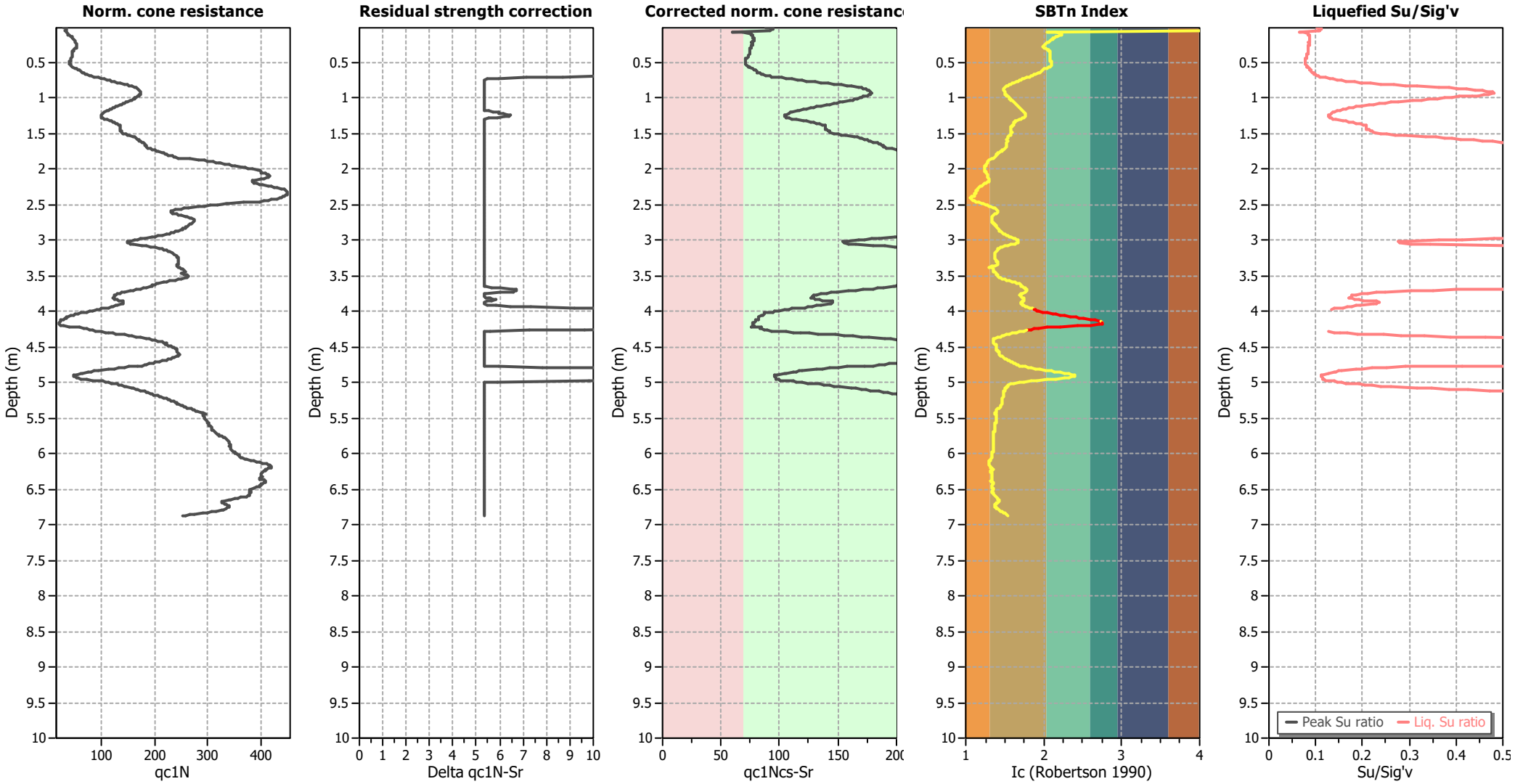




Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

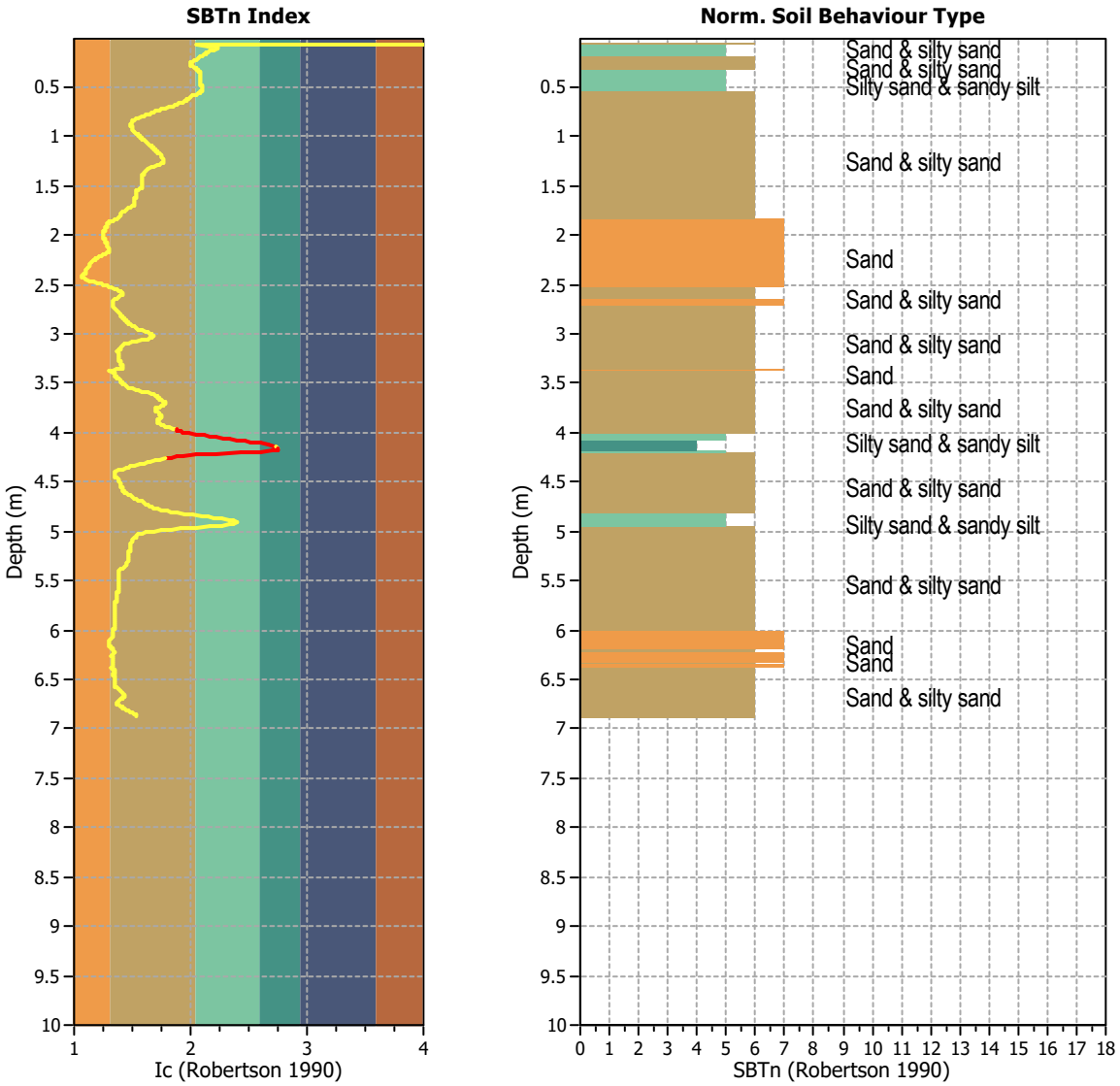
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

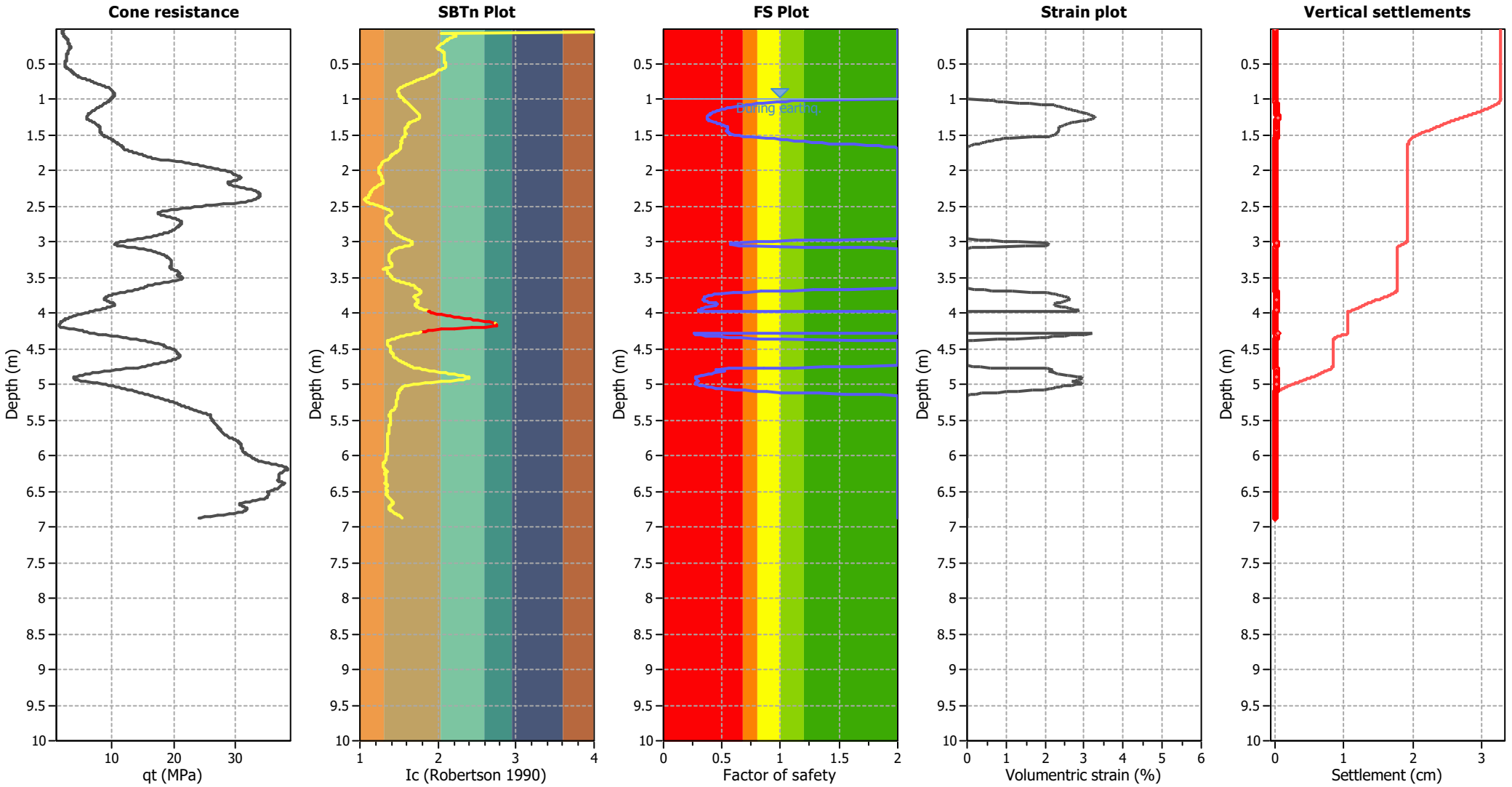
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	688
I_c maximum check value:	3.00	Total points excluded:	29
I_c change ratio value:	0.0100	Exclusion percentage:	4.22%
Minimum number of points in layer:	4	Number of layers detected:	2

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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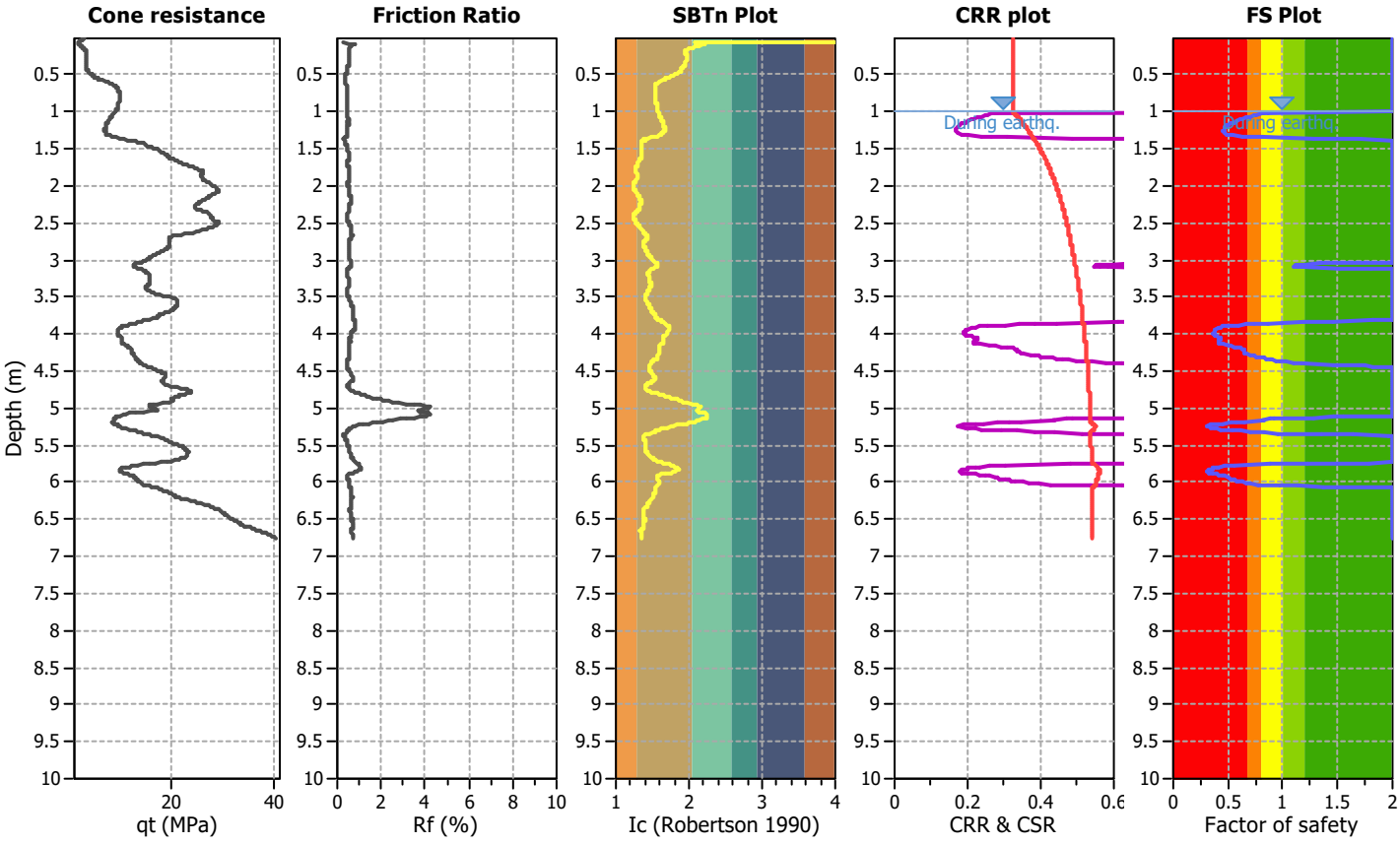
LIQUEFACTION ANALYSIS REPORT

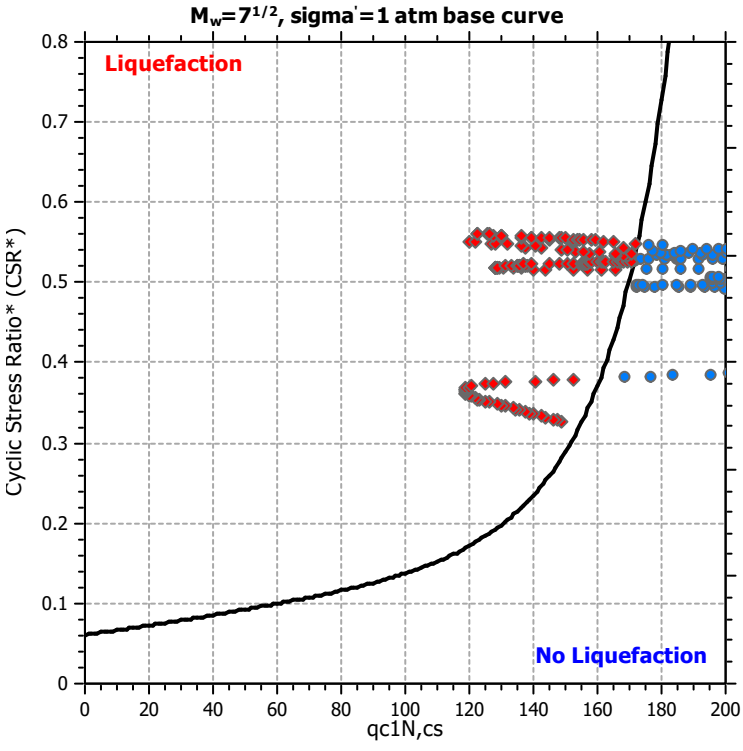
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

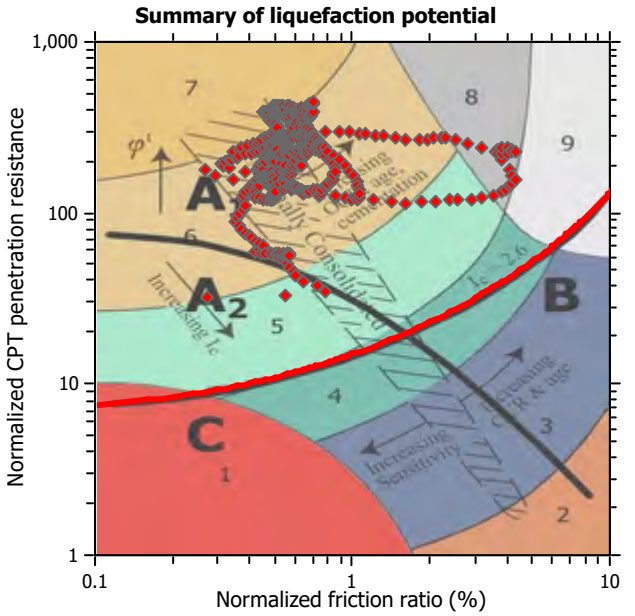
CPT file : CPT02_ULS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

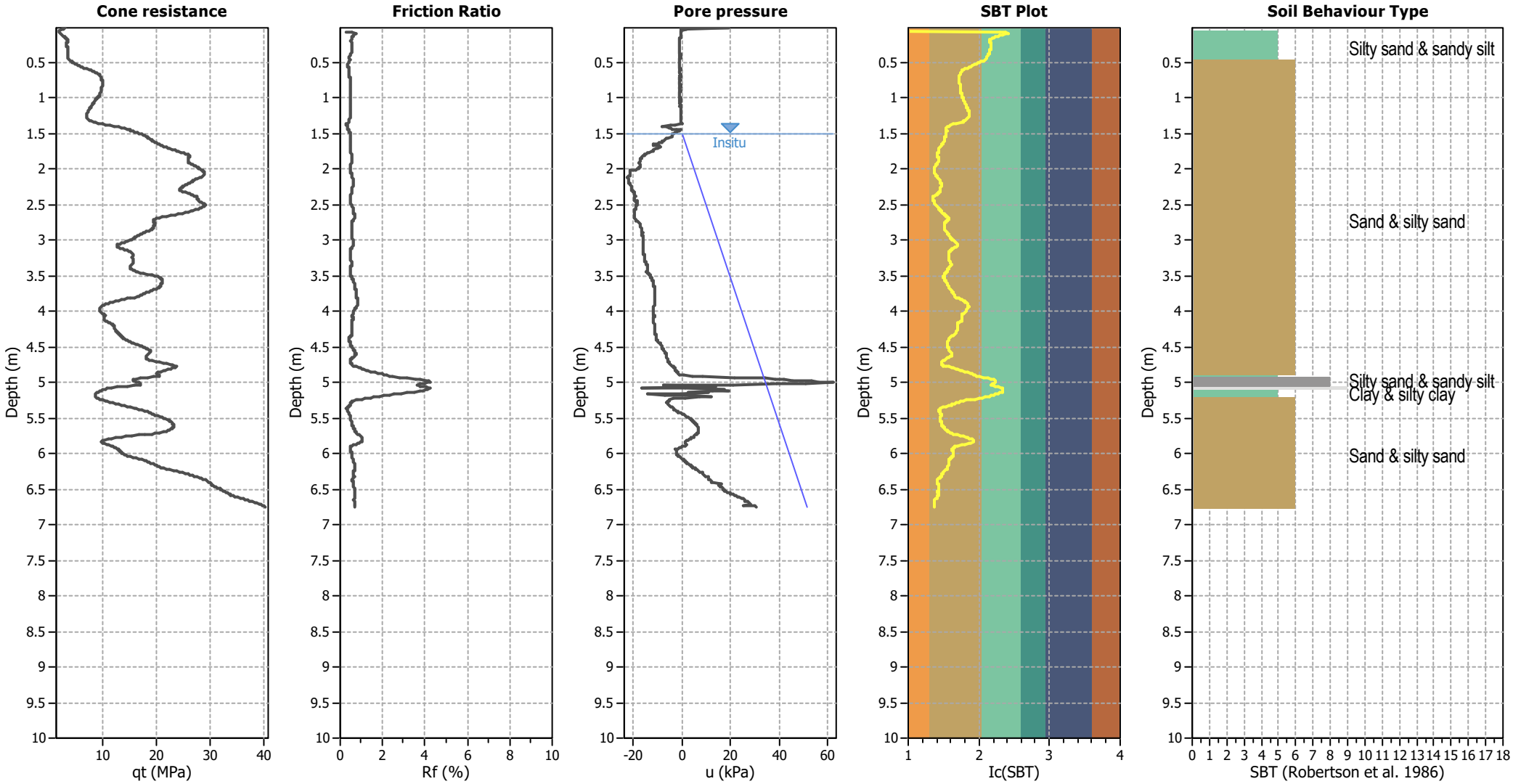






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



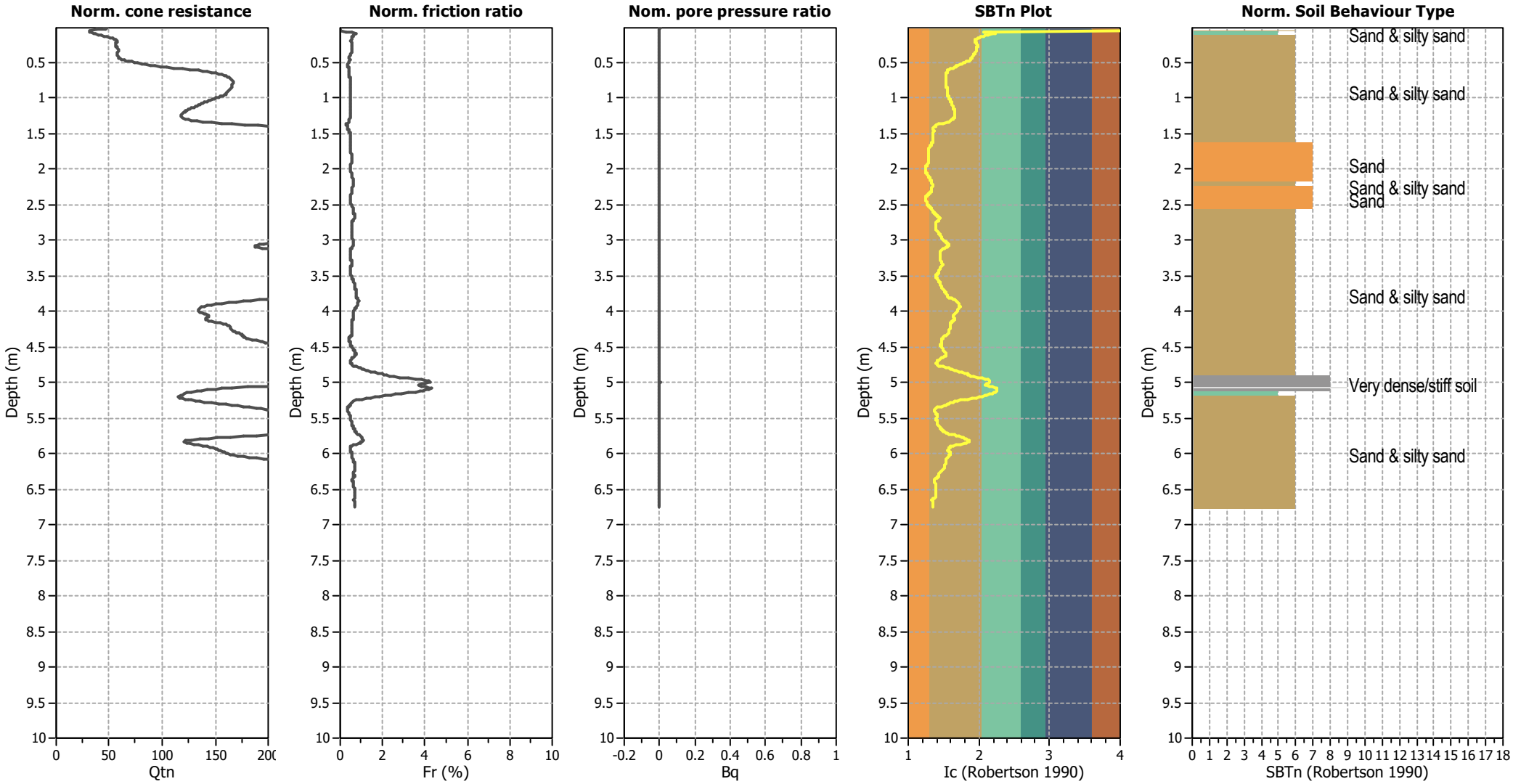
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



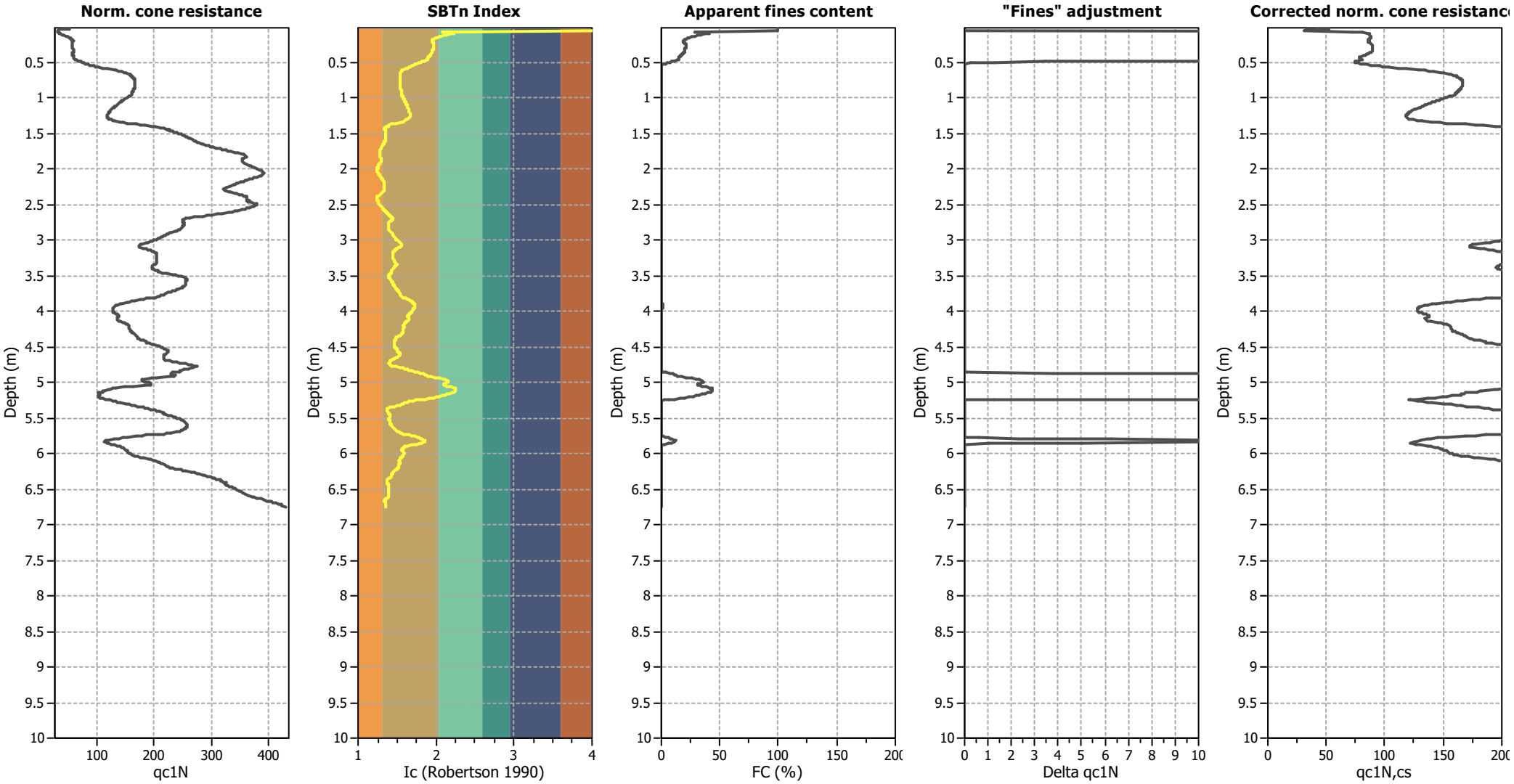
Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

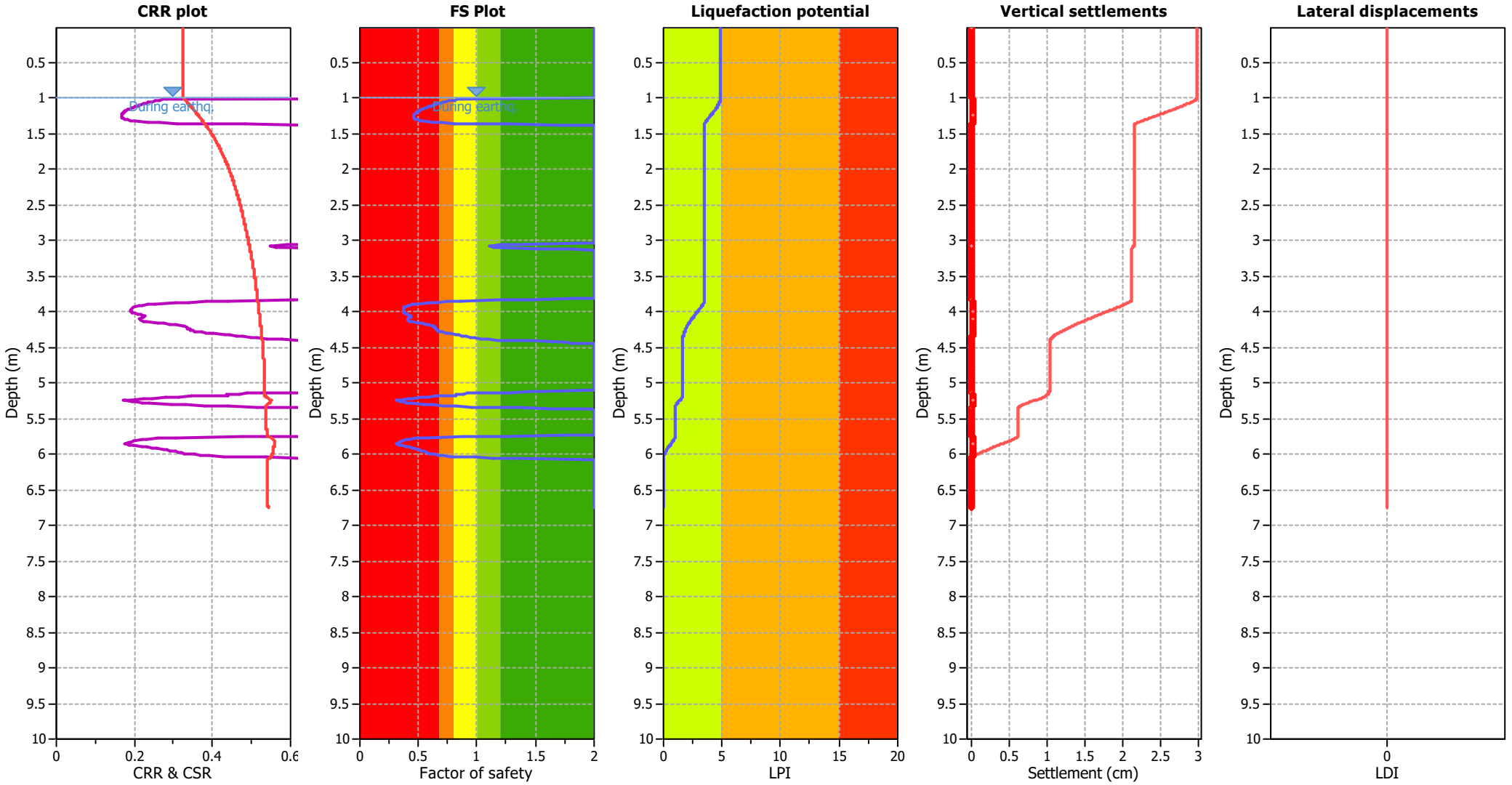
Liquefaction analysis overall plots (intermediate results)



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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

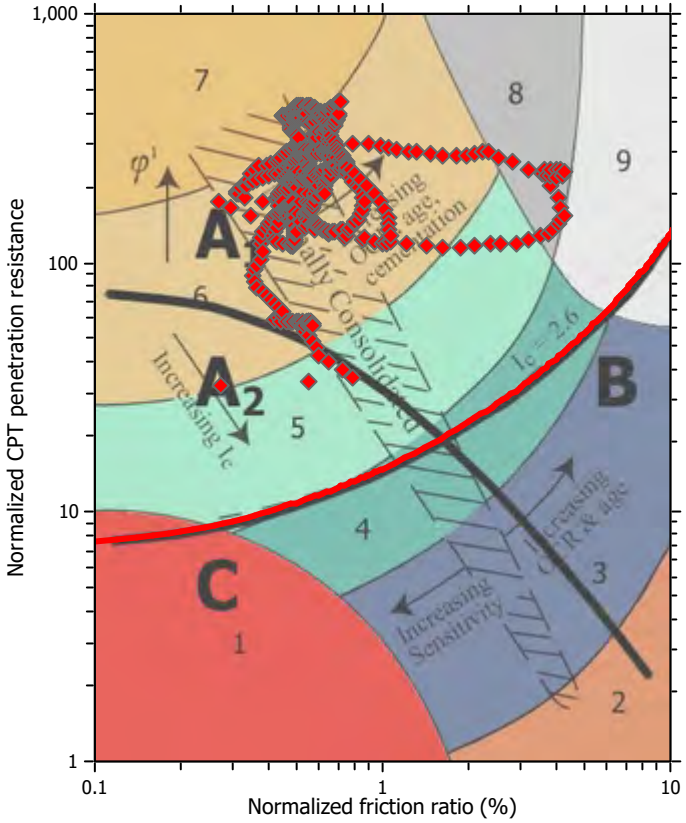
F.S. color scheme

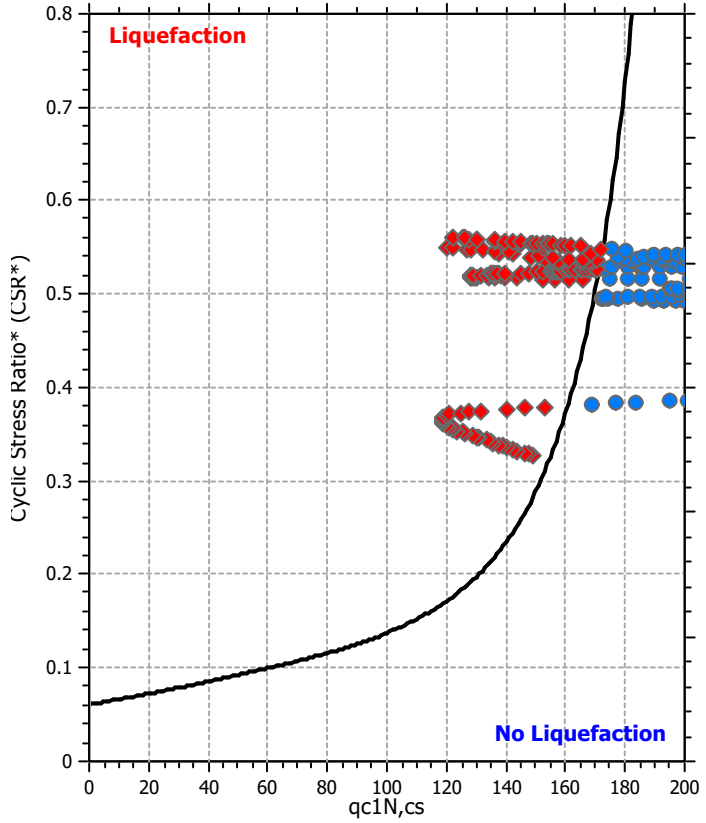
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

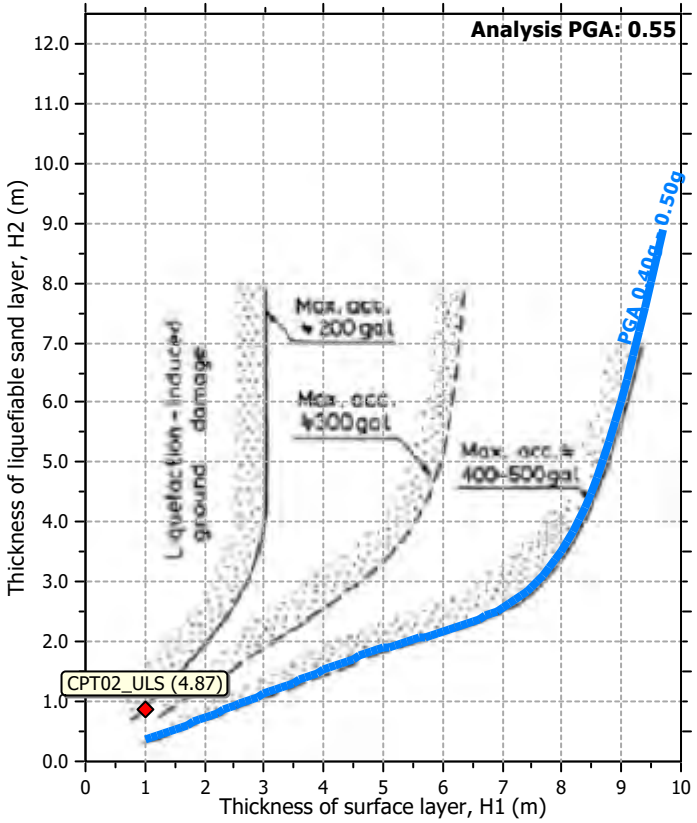
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



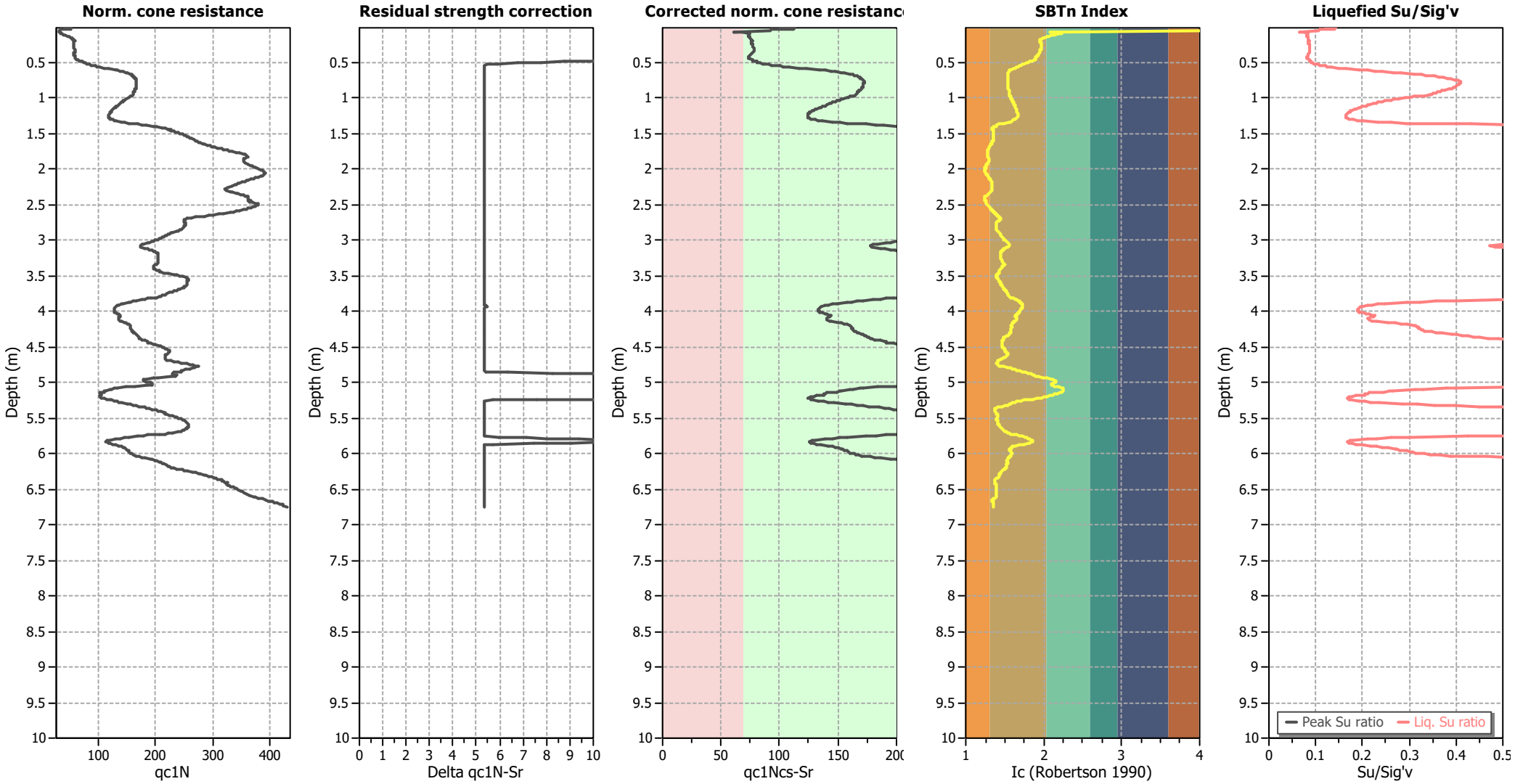




Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

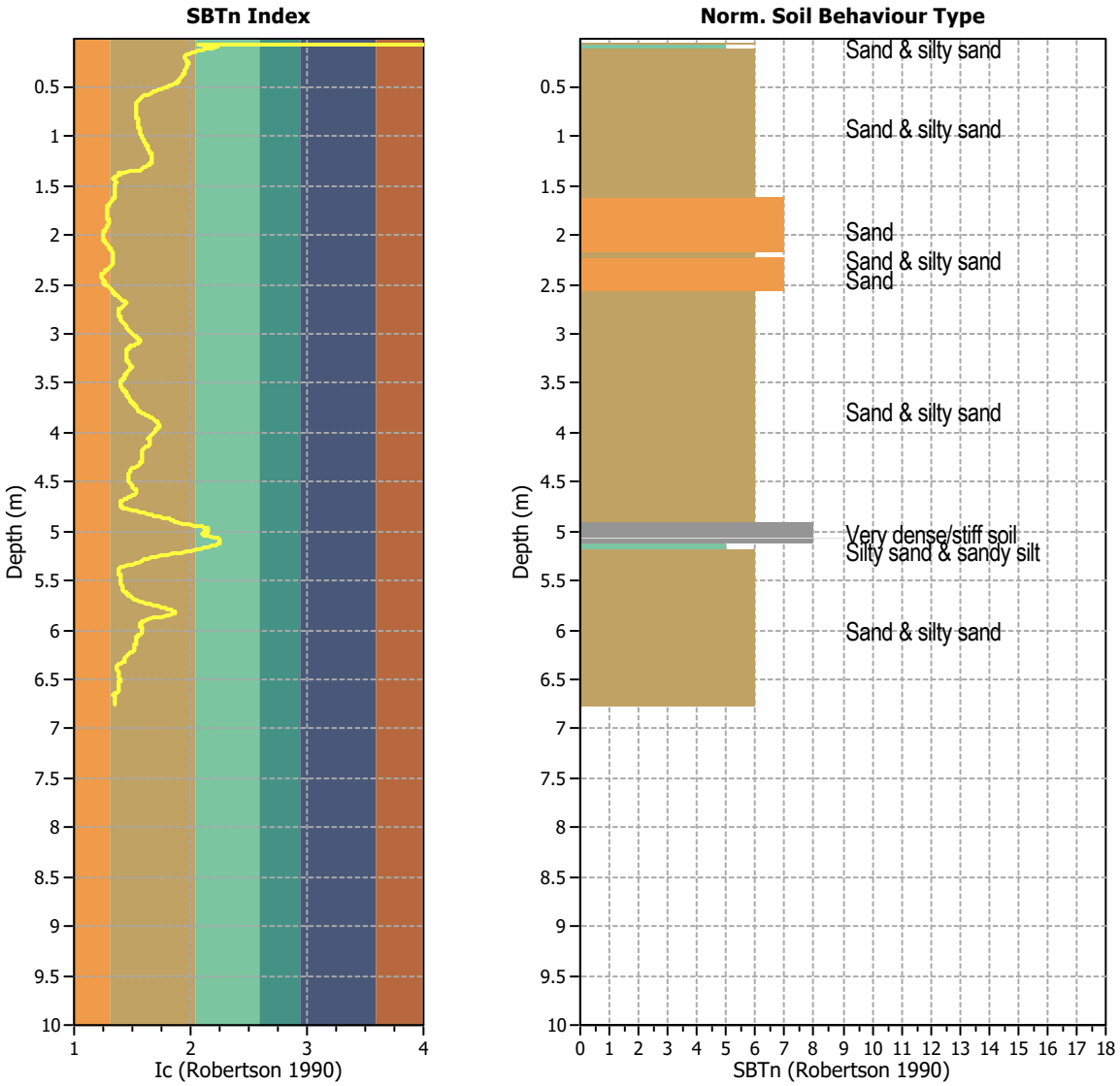
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

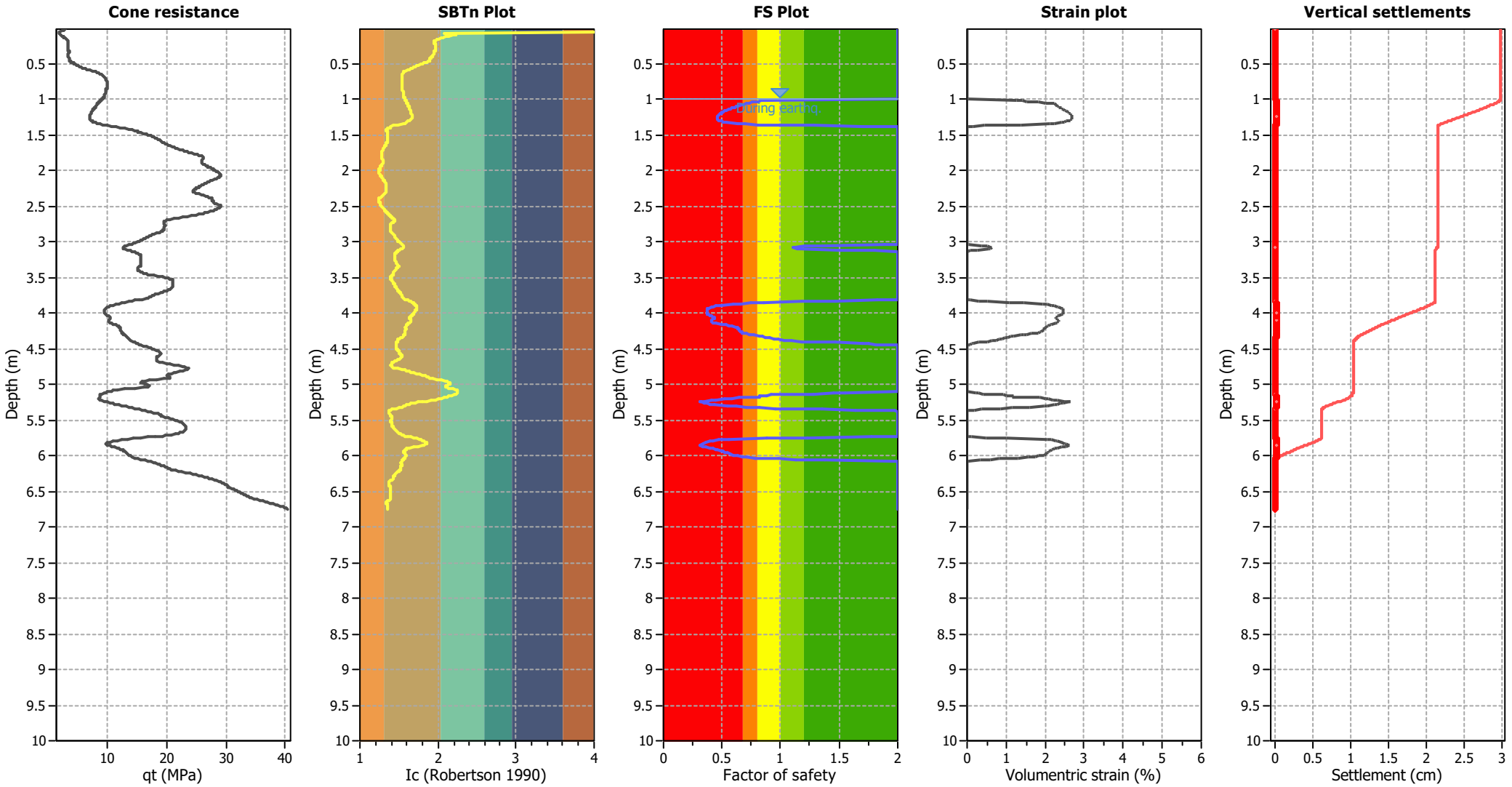
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	675
I_c maximum check value:	3.00	Total points excluded:	0
I_c change ratio value:	0.0100	Exclusion percentage:	0.00%
Minimum number of points in layer:	4	Number of layers detected:	0

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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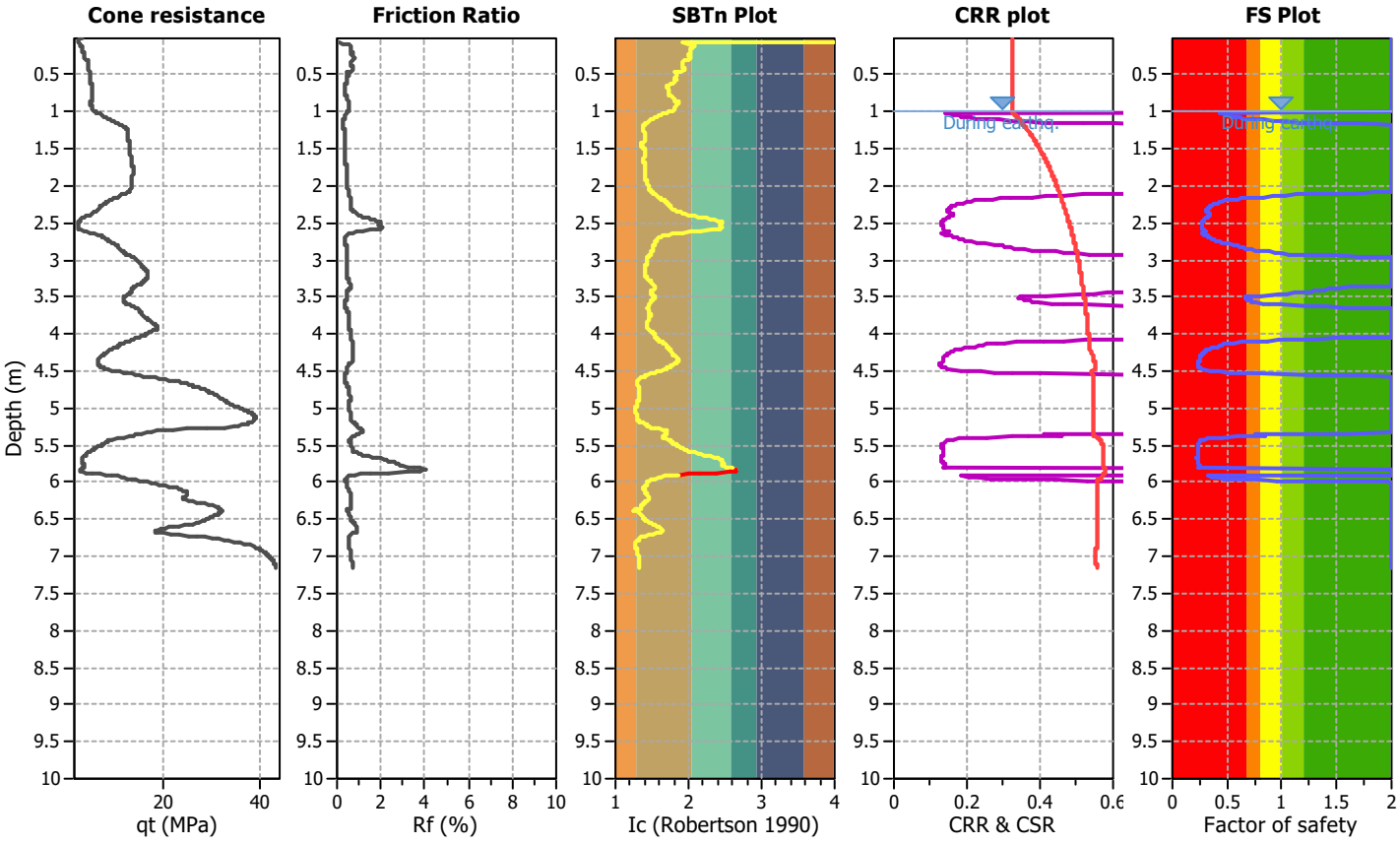
LIQUEFACTION ANALYSIS REPORT

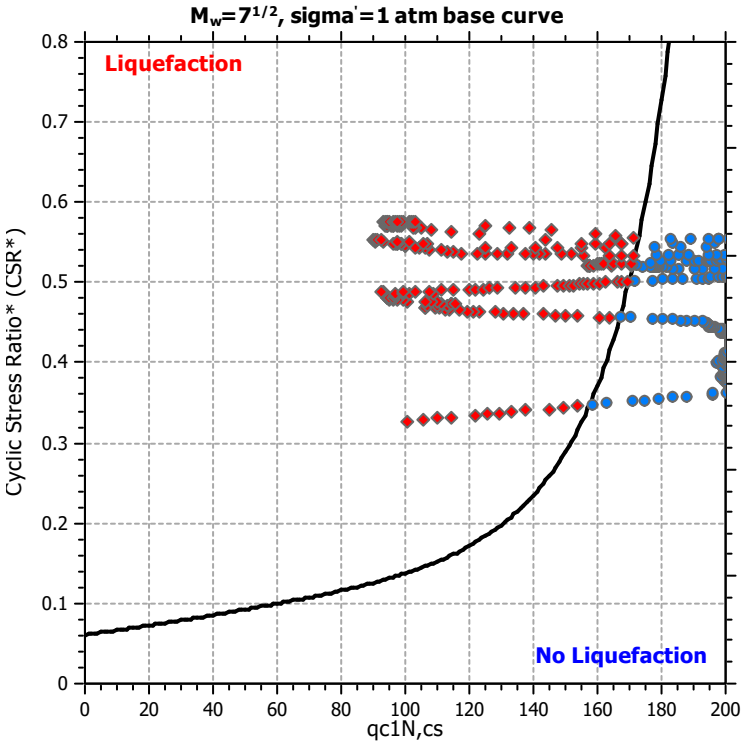
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

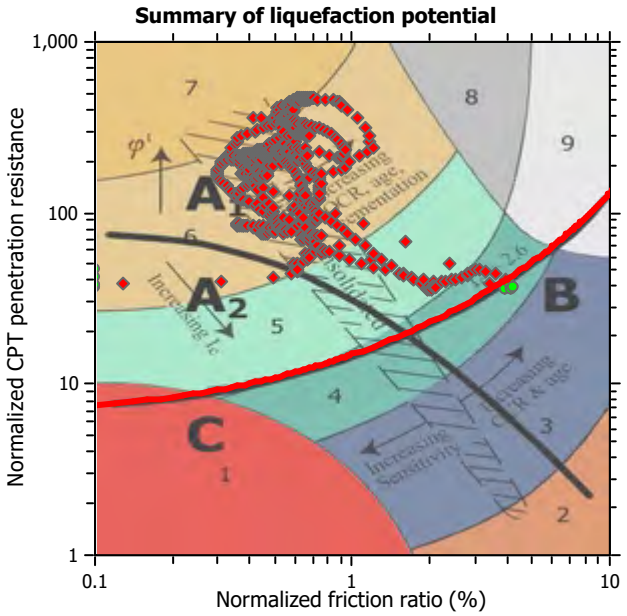
CPT file : CPT03_ULS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

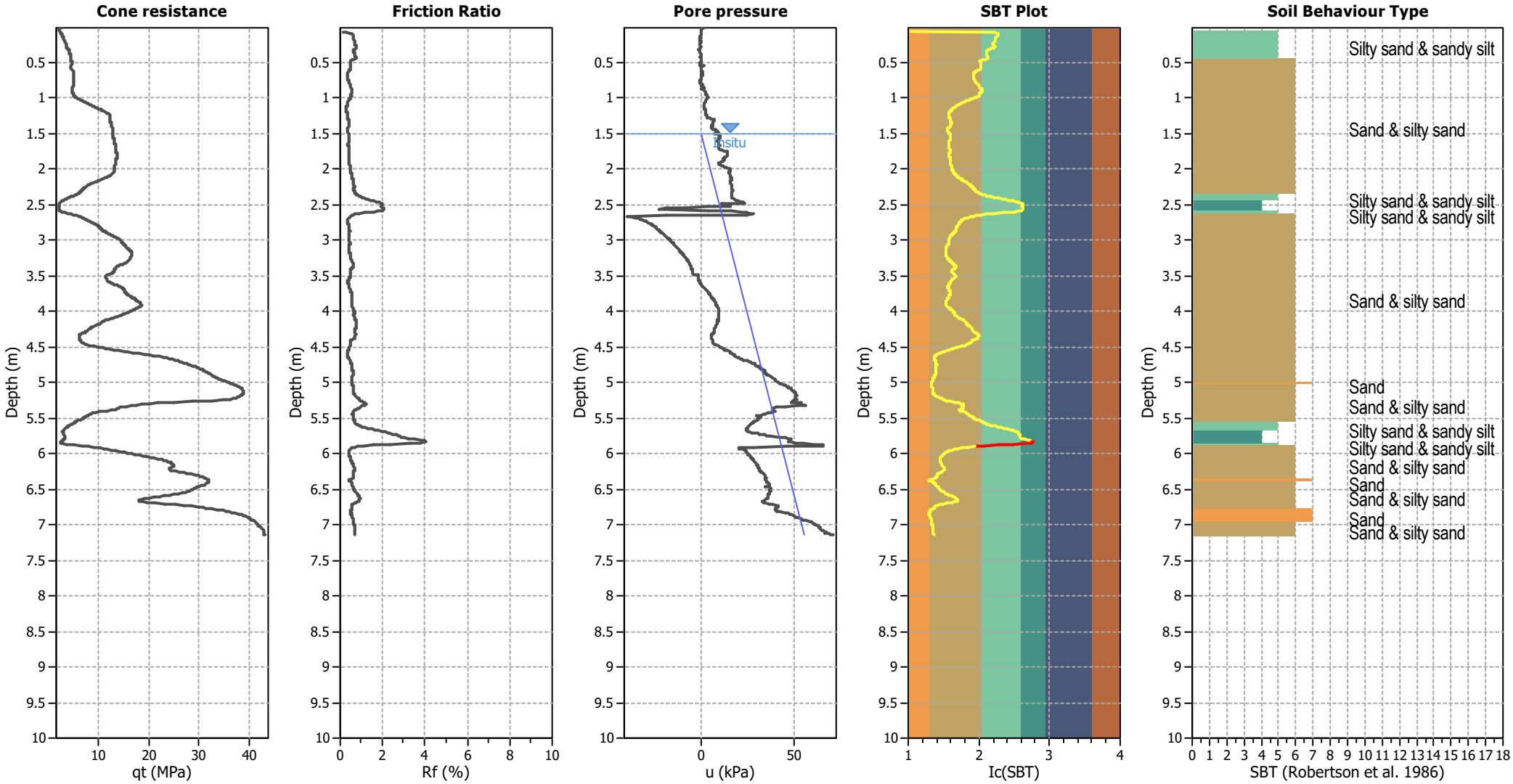






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



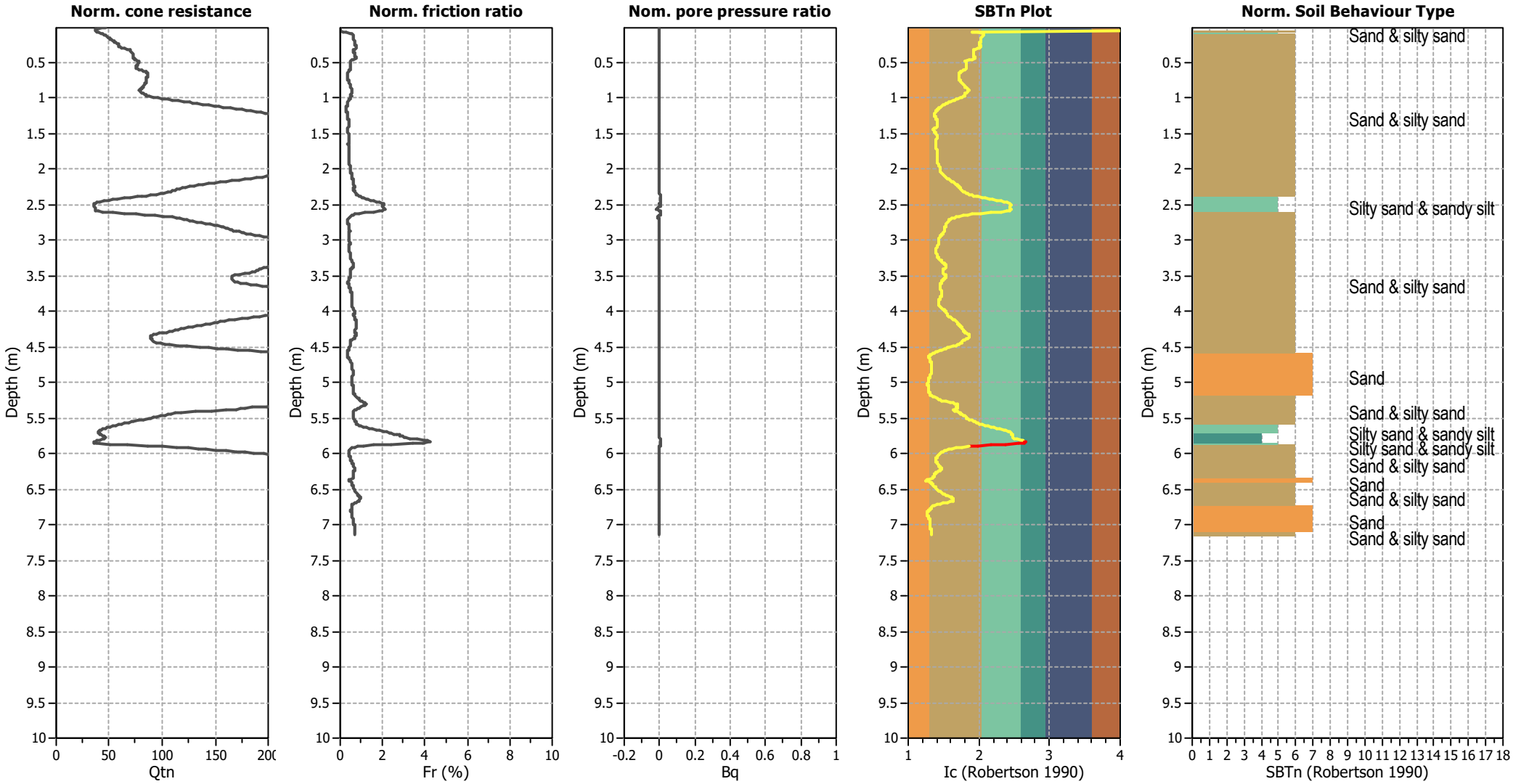
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



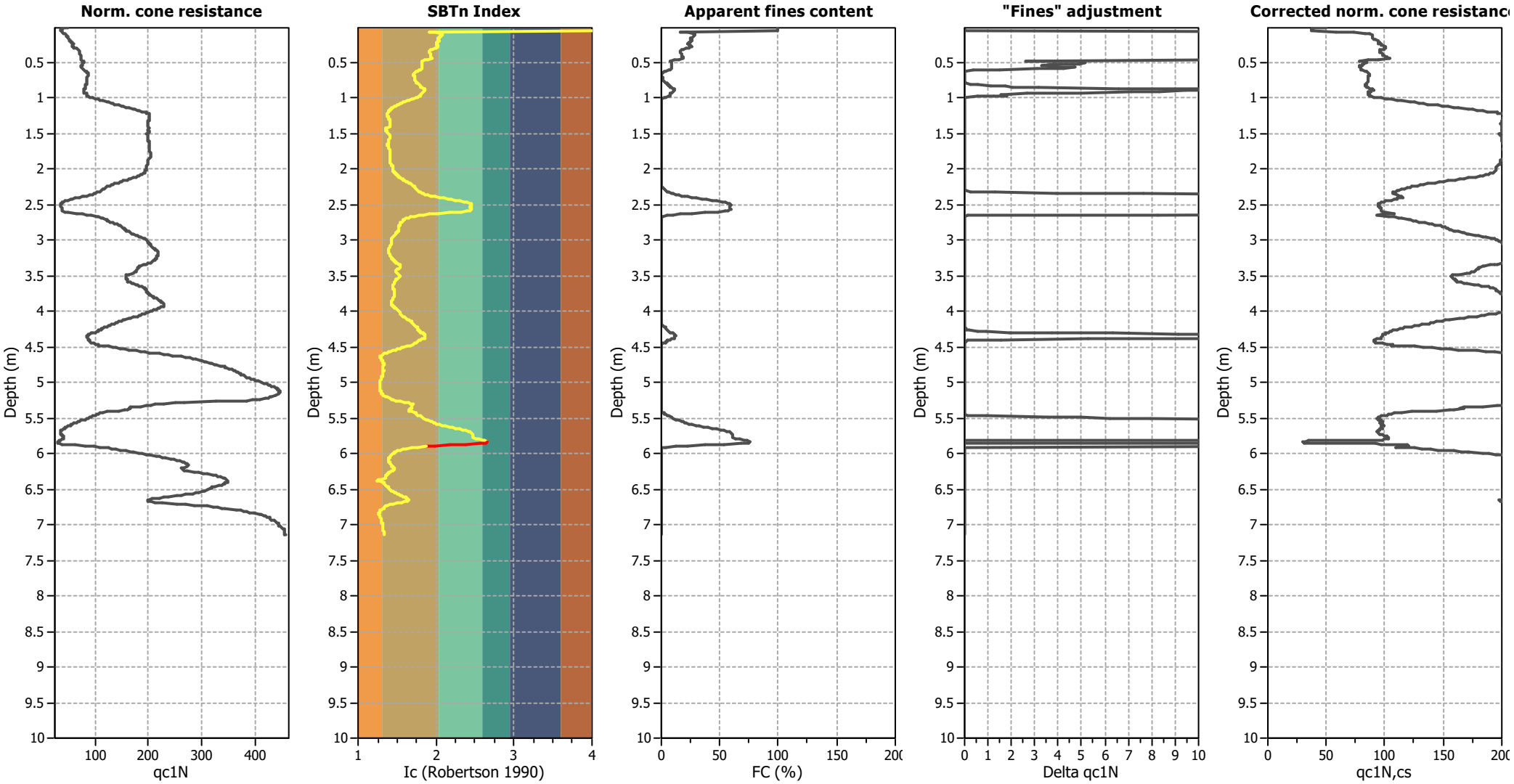
Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

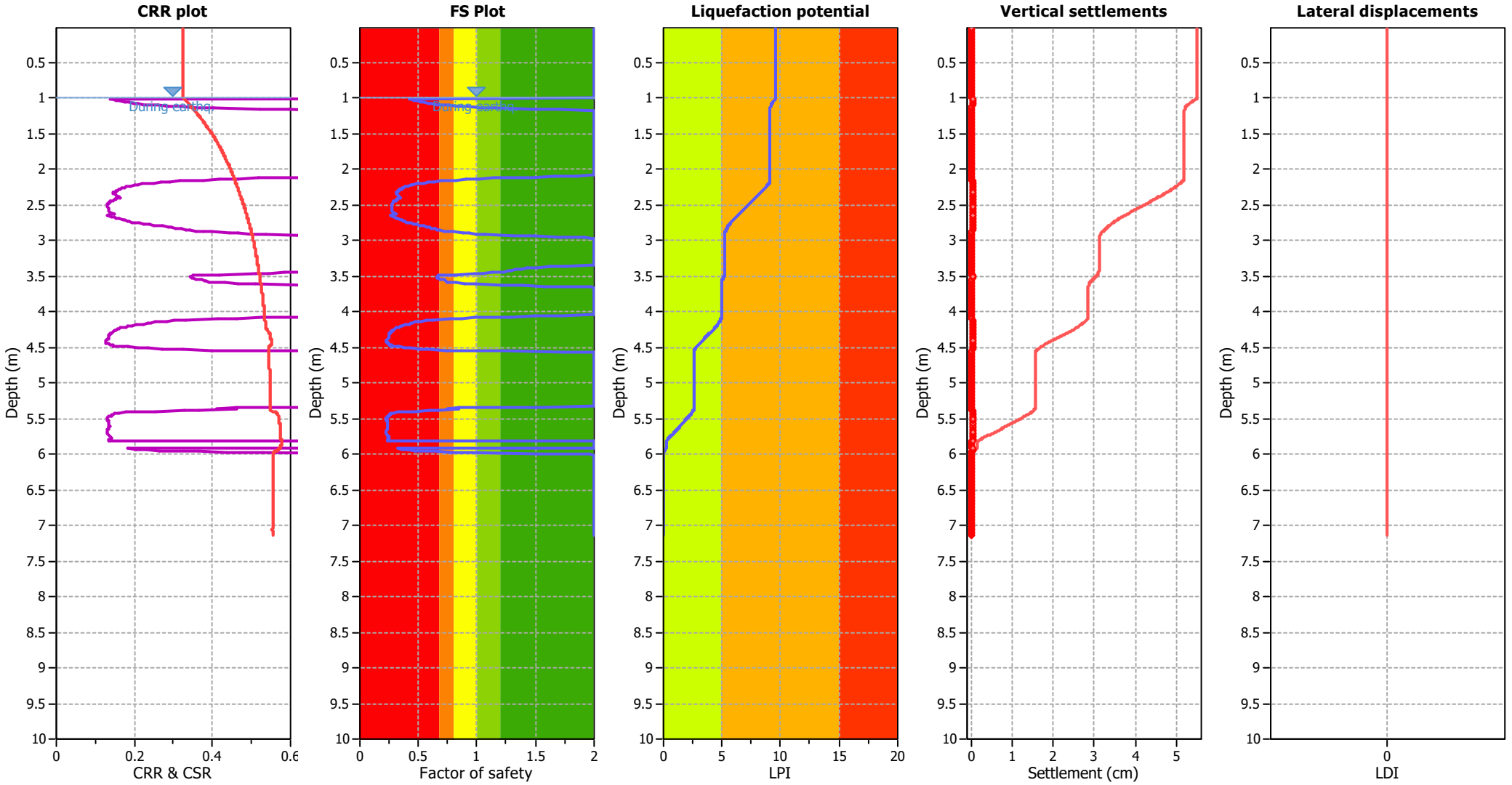
Liquefaction analysis overall plots (intermediate results)



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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

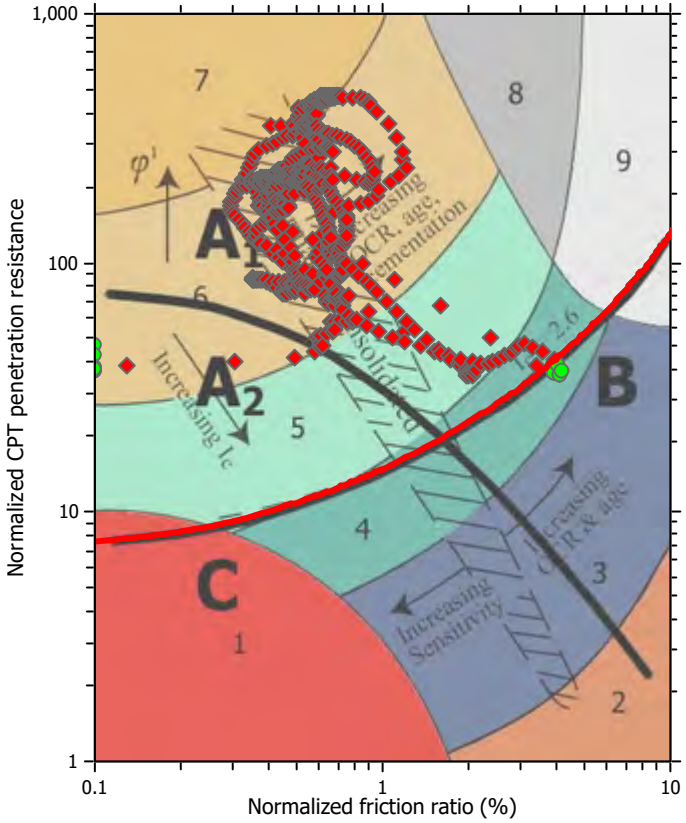
F.S. color scheme

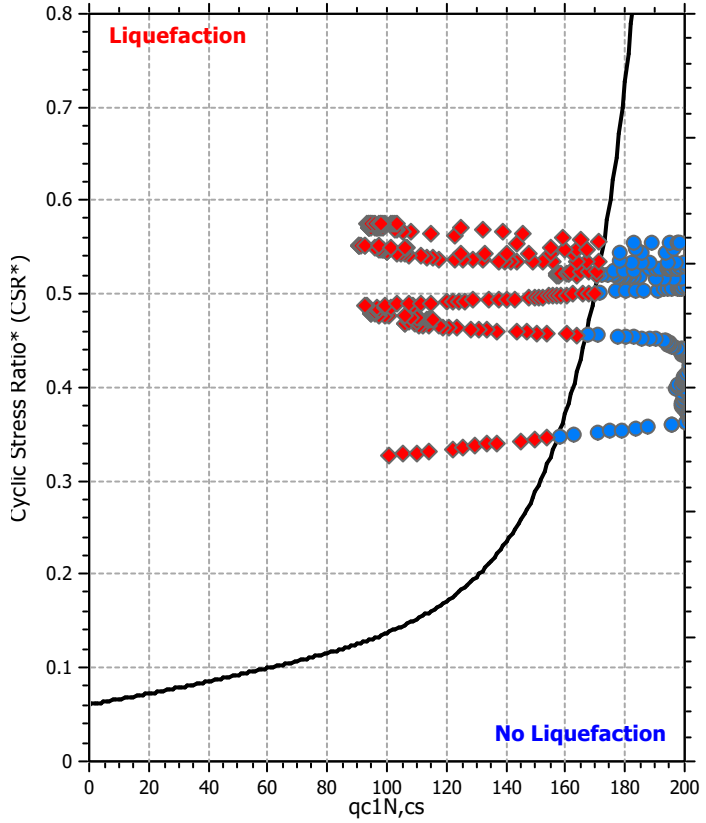
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

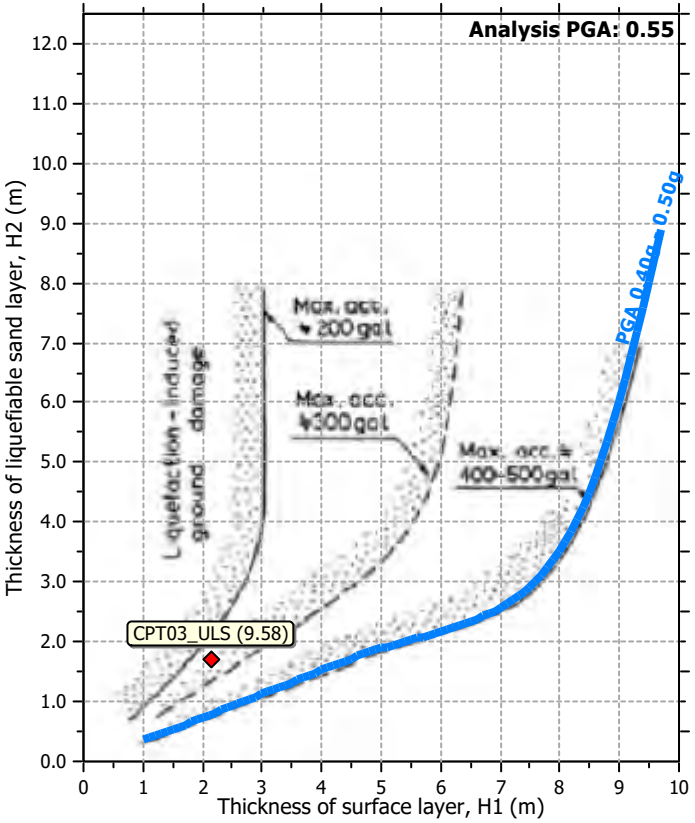
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



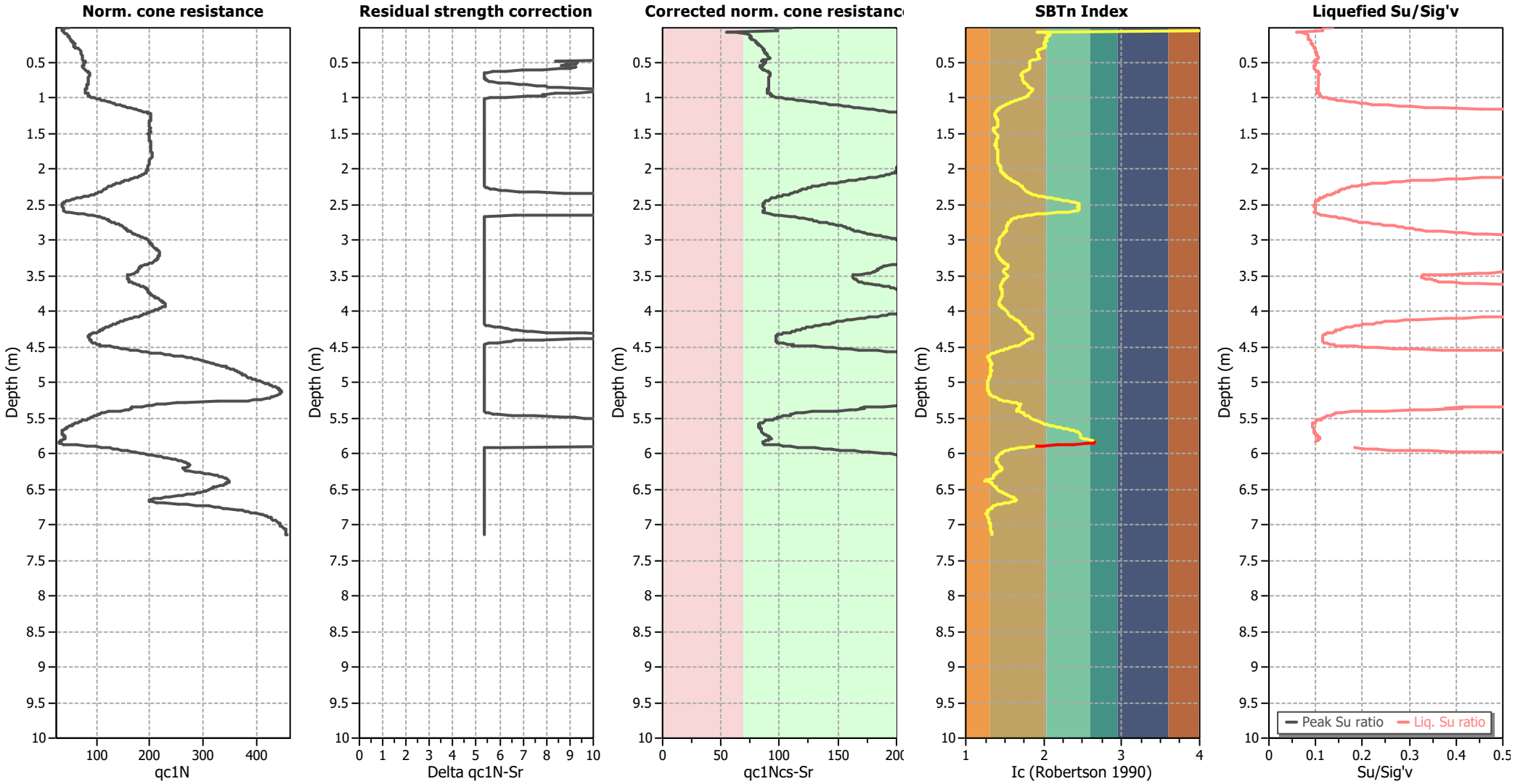




Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

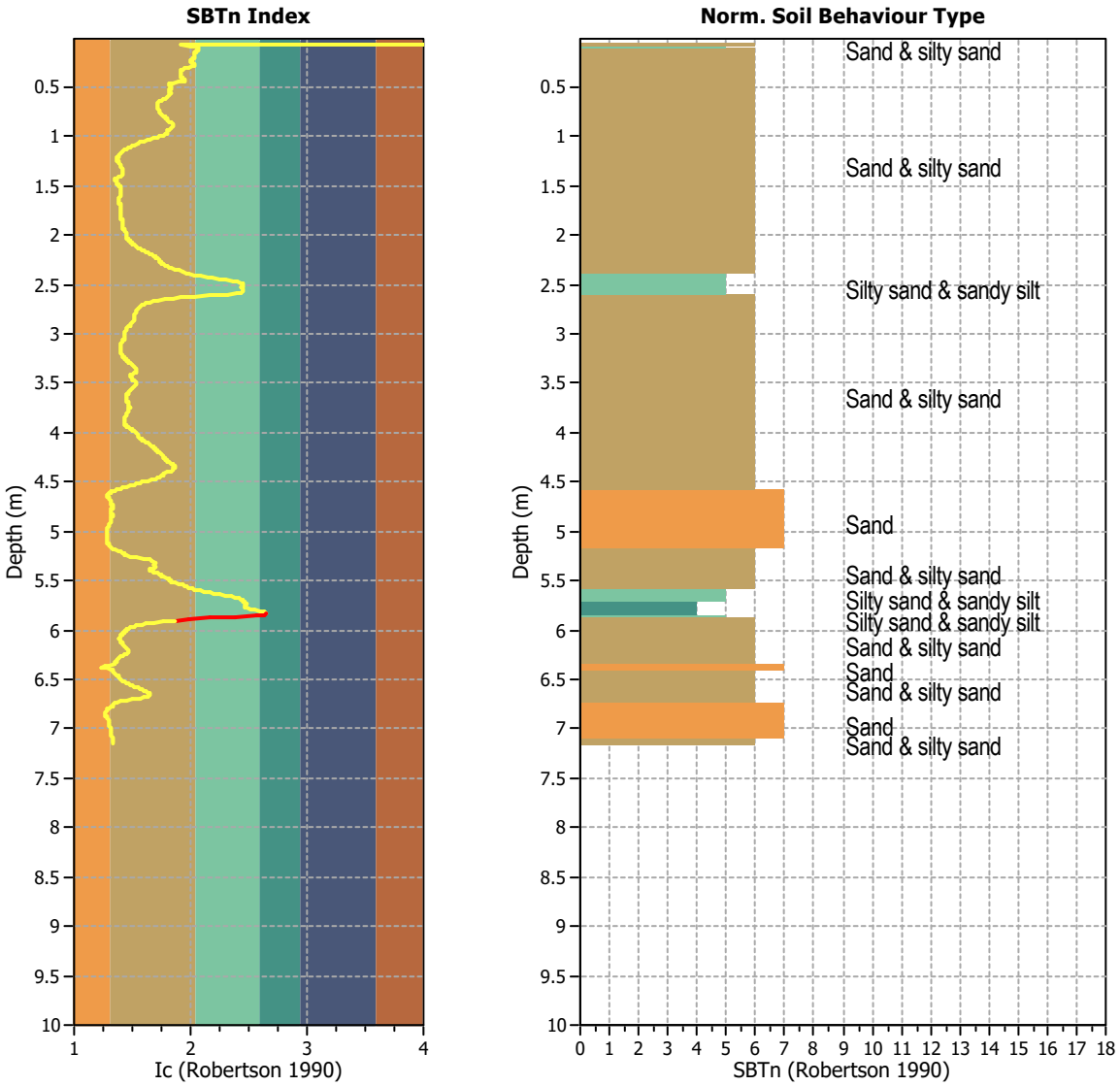
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

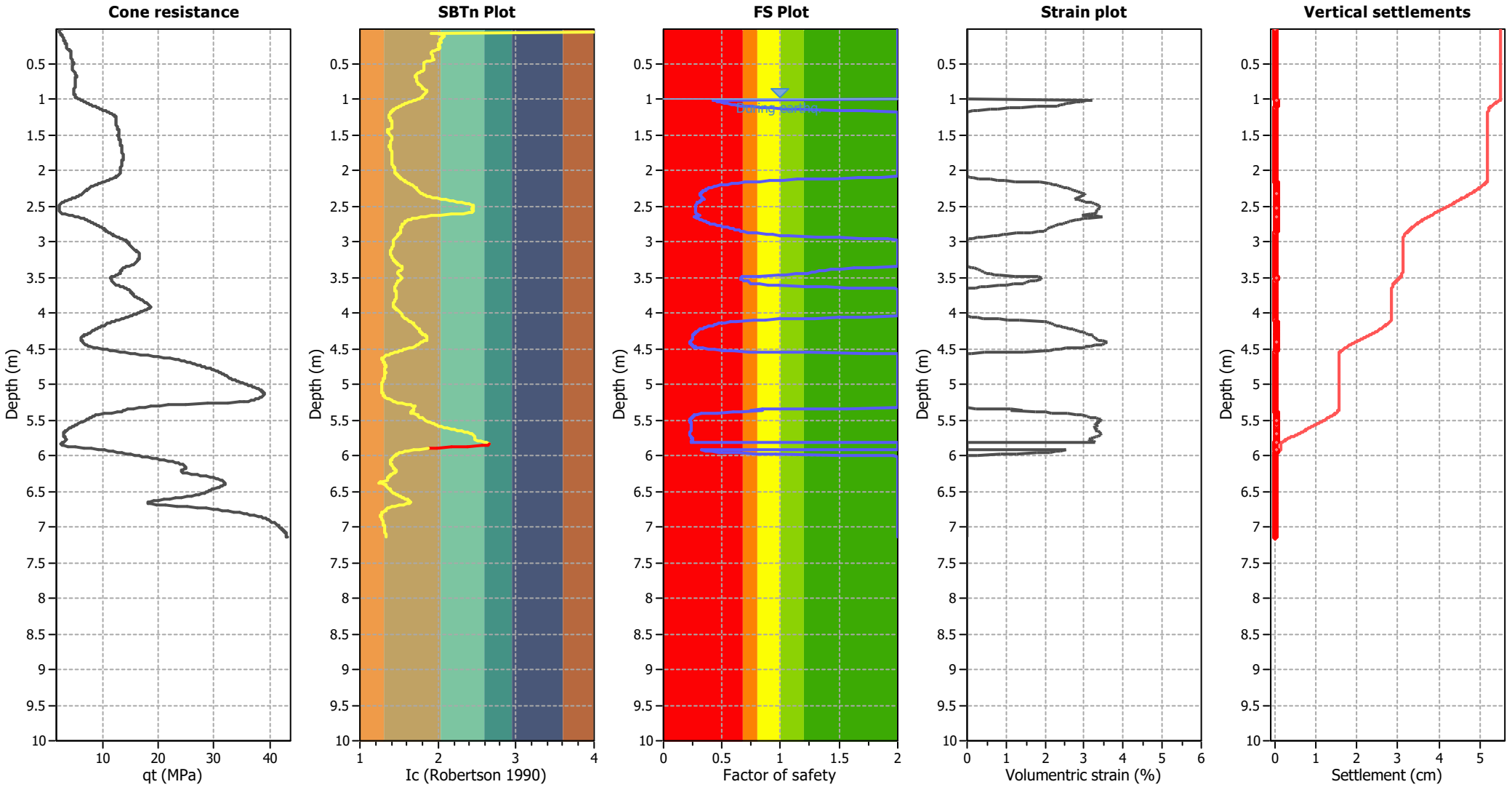
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	715
I_c maximum check value:	3.00	Total points excluded:	8
I_c change ratio value:	0.0100	Exclusion percentage:	1.12%
Minimum number of points in layer:	4	Number of layers detected:	1

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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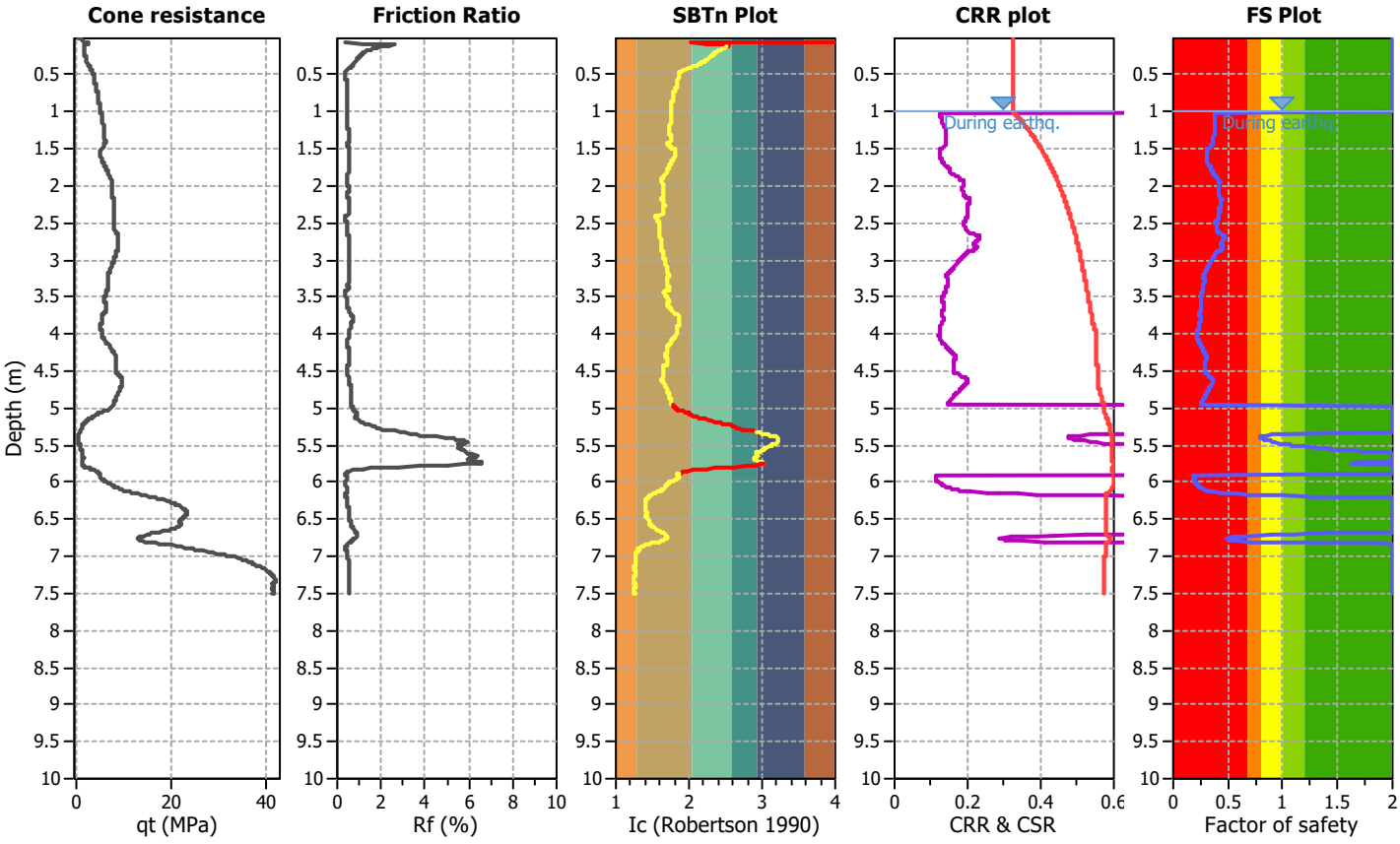
LIQUEFACTION ANALYSIS REPORT

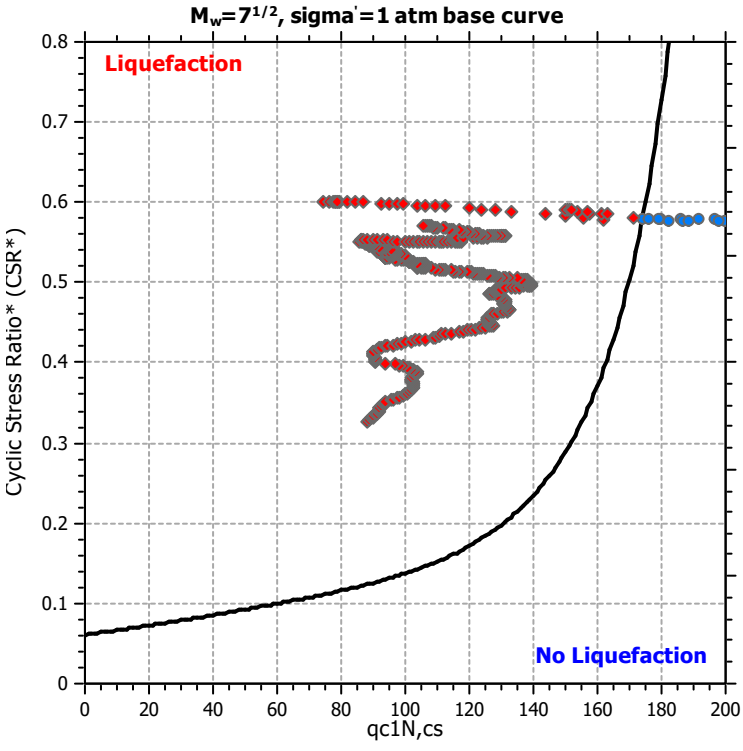
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

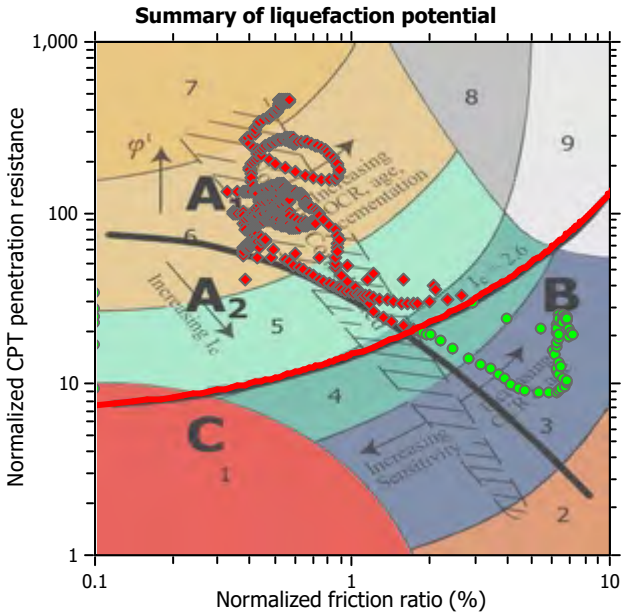
CPT file : CPT04_ULS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

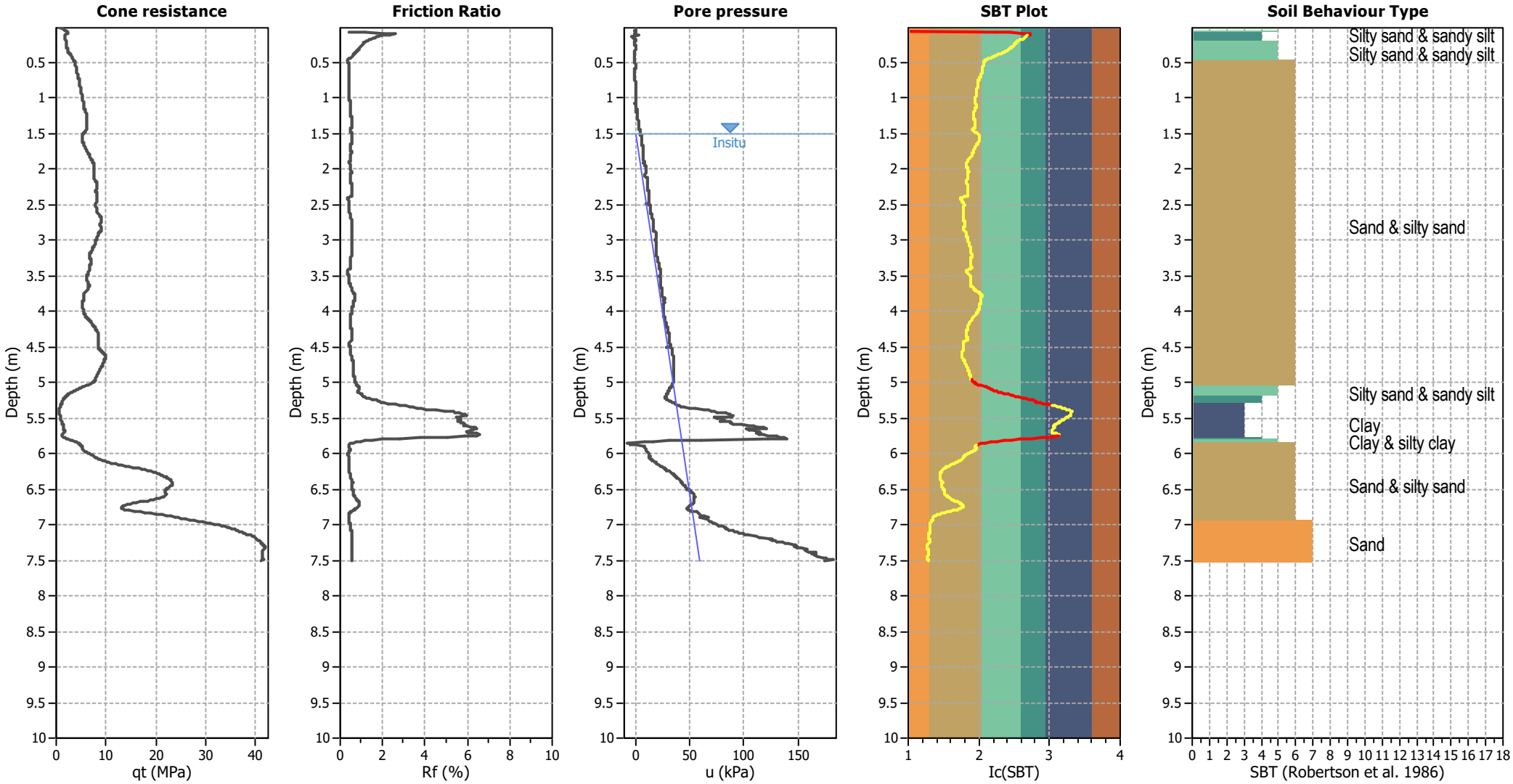






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



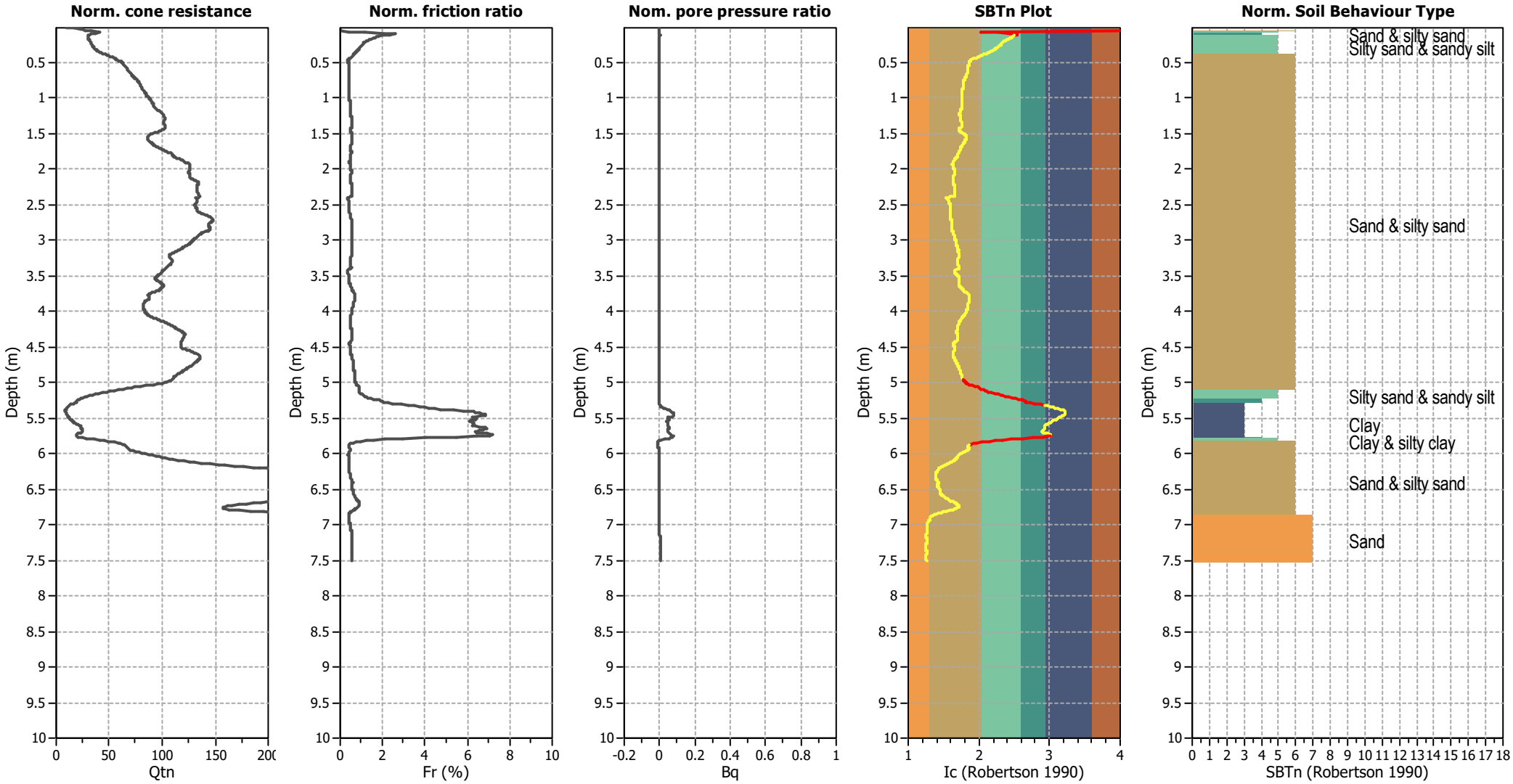
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



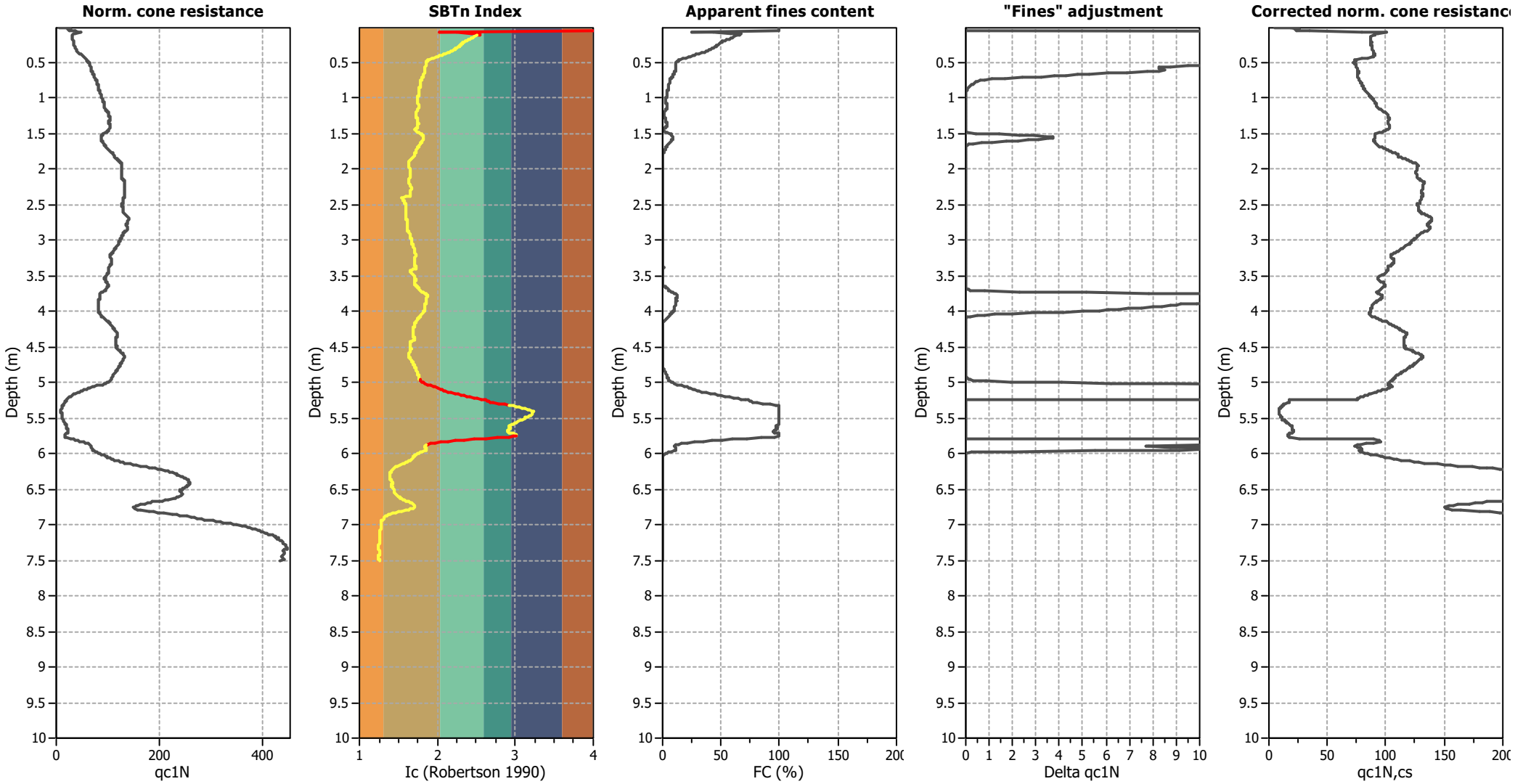
Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

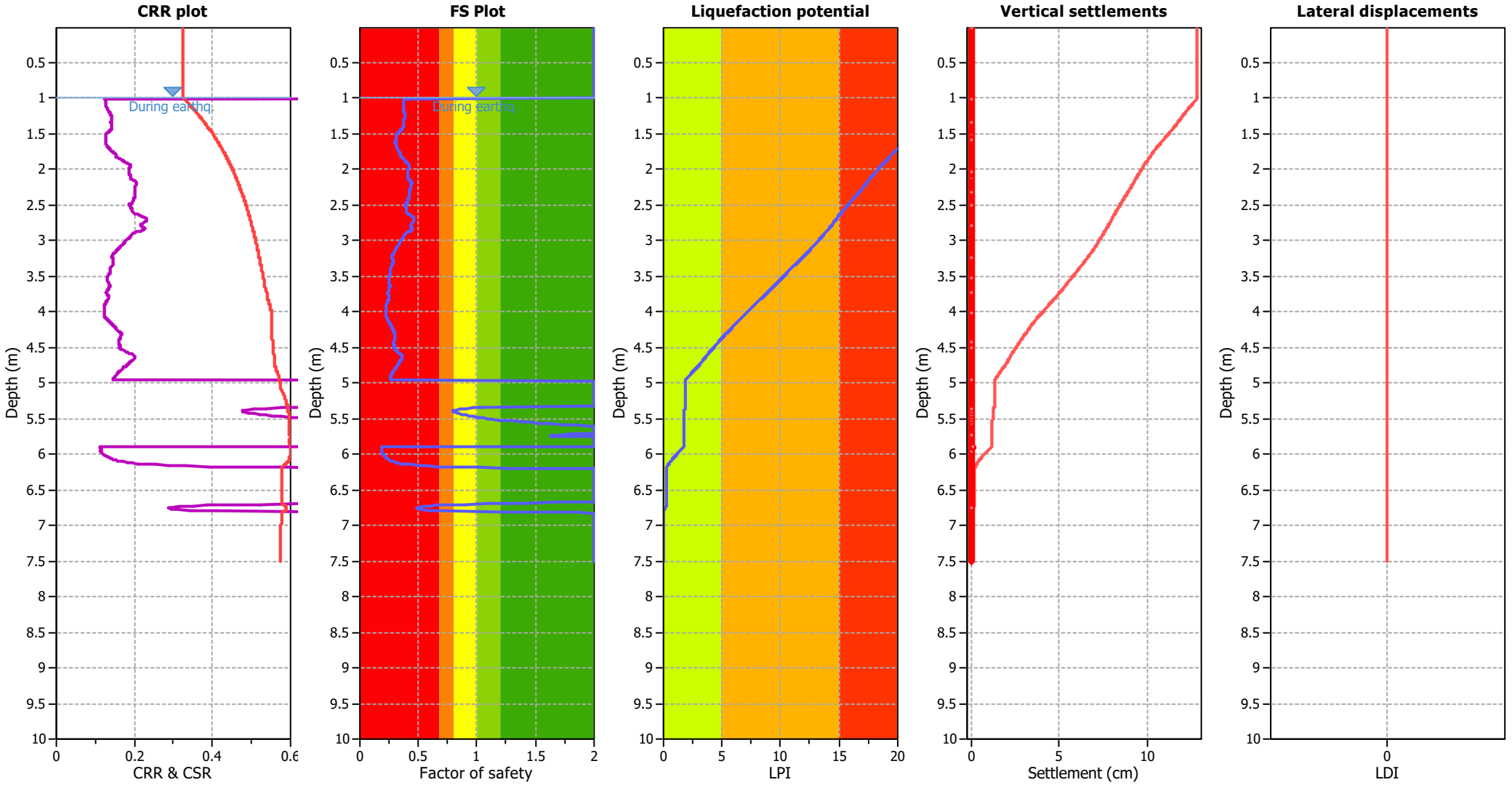
Liquefaction analysis overall plots (intermediate results)



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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

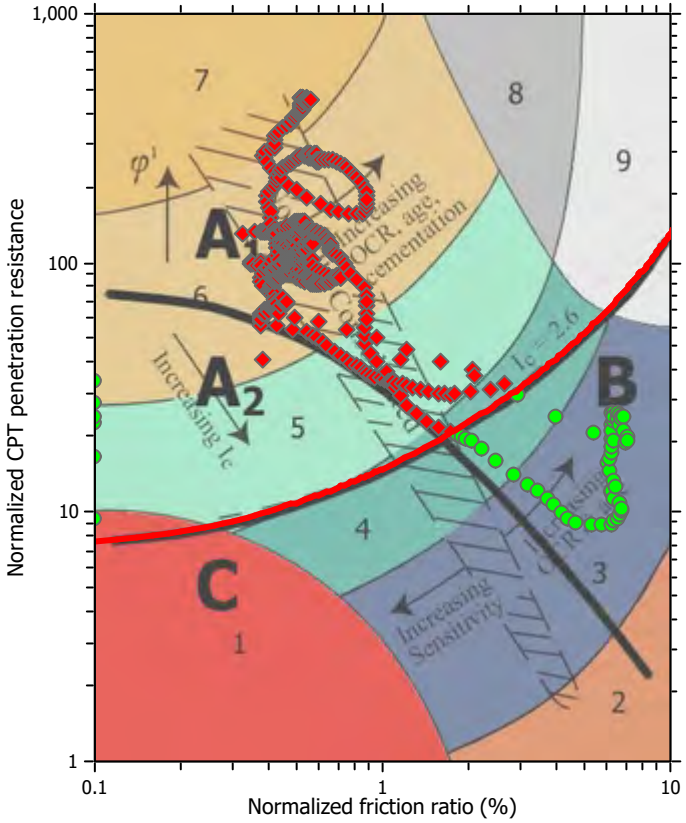
F.S. color scheme

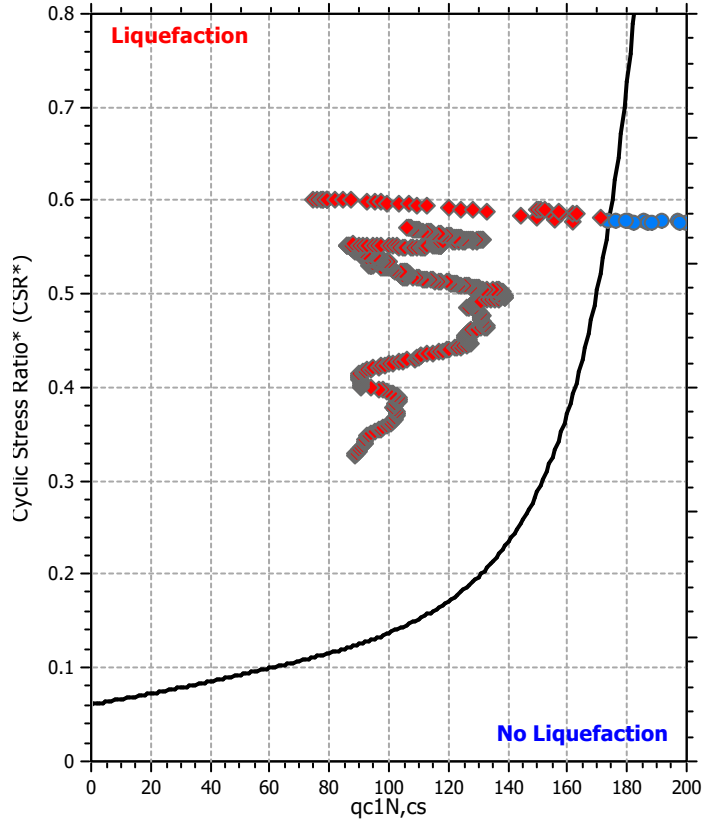
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

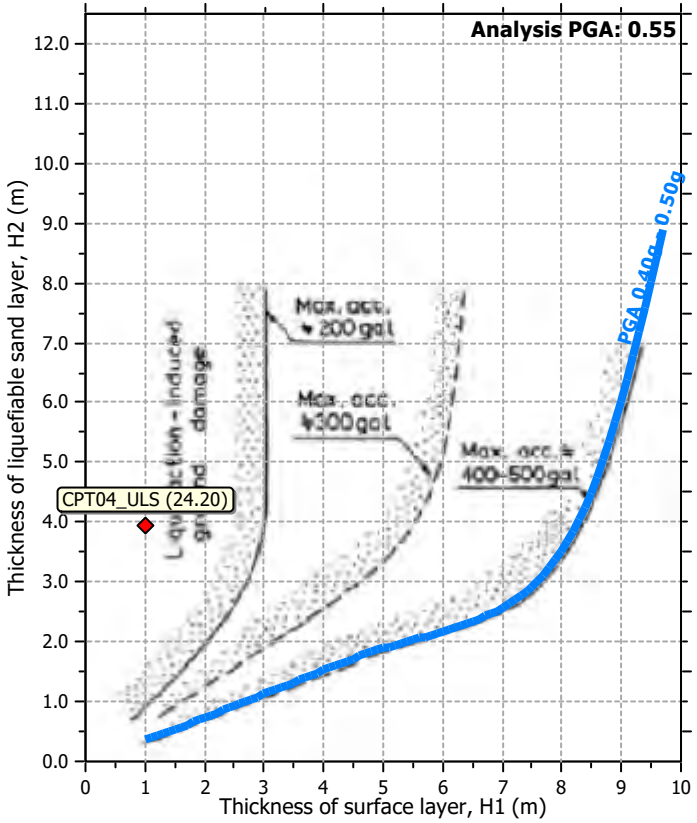
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



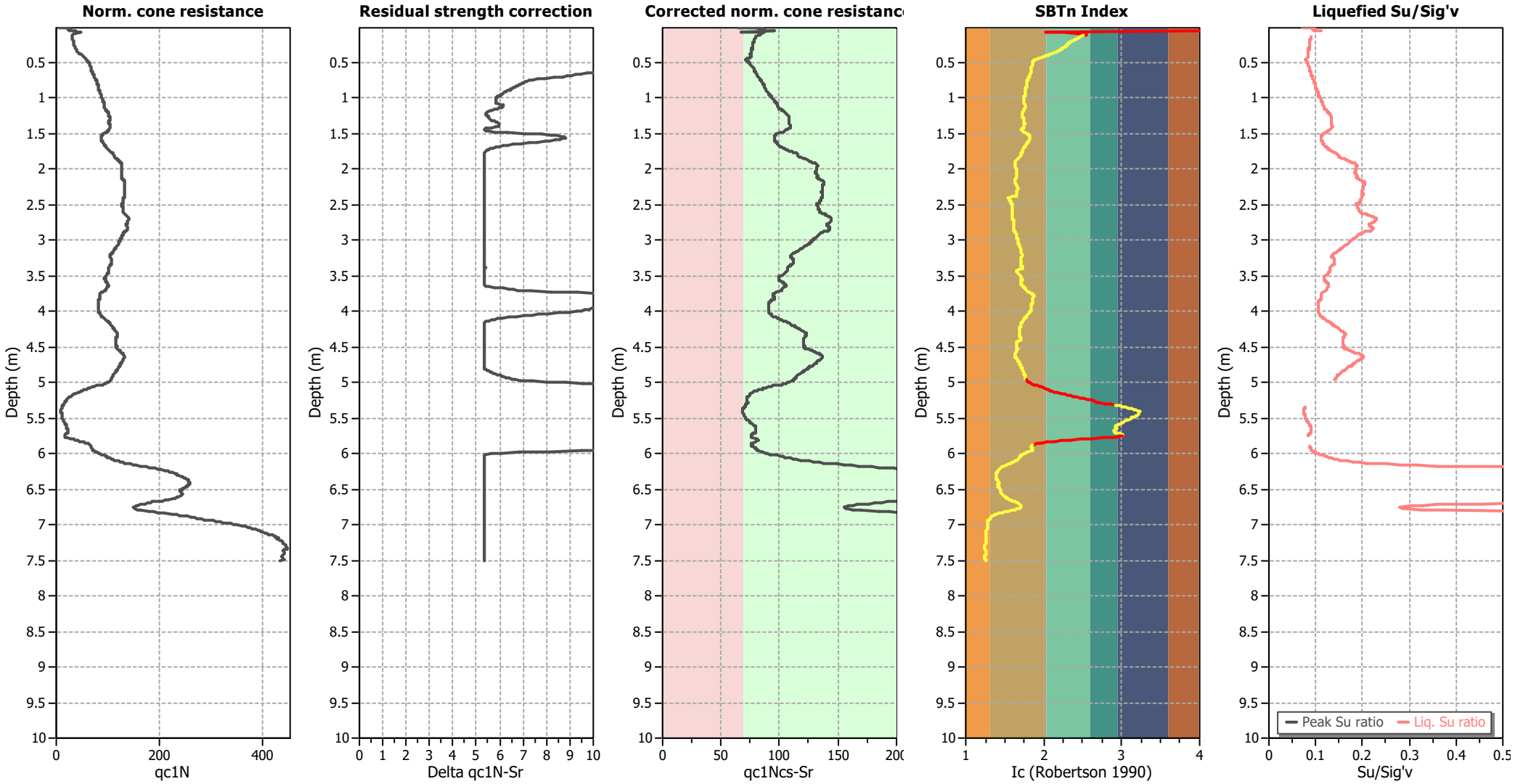




Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

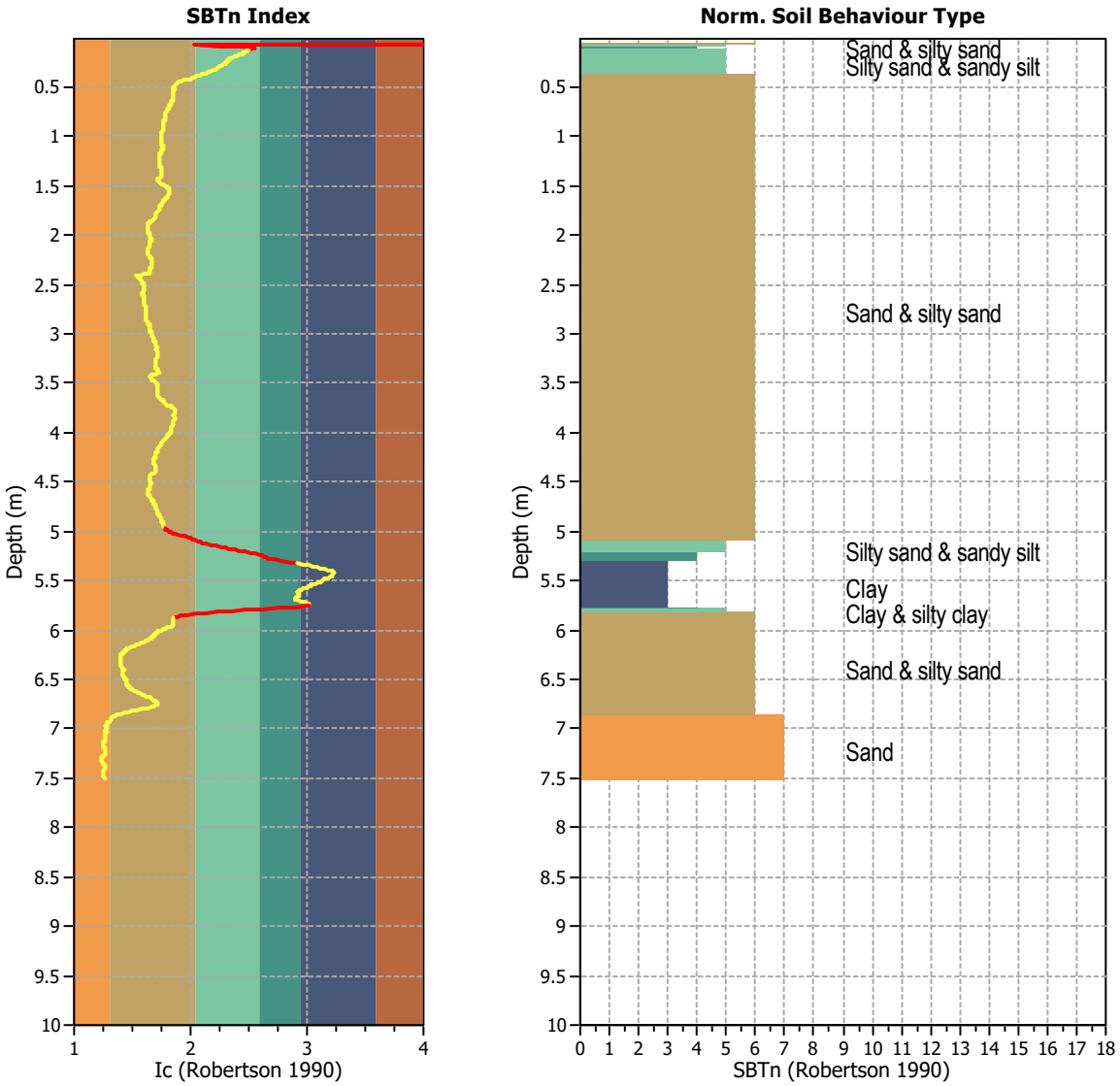
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

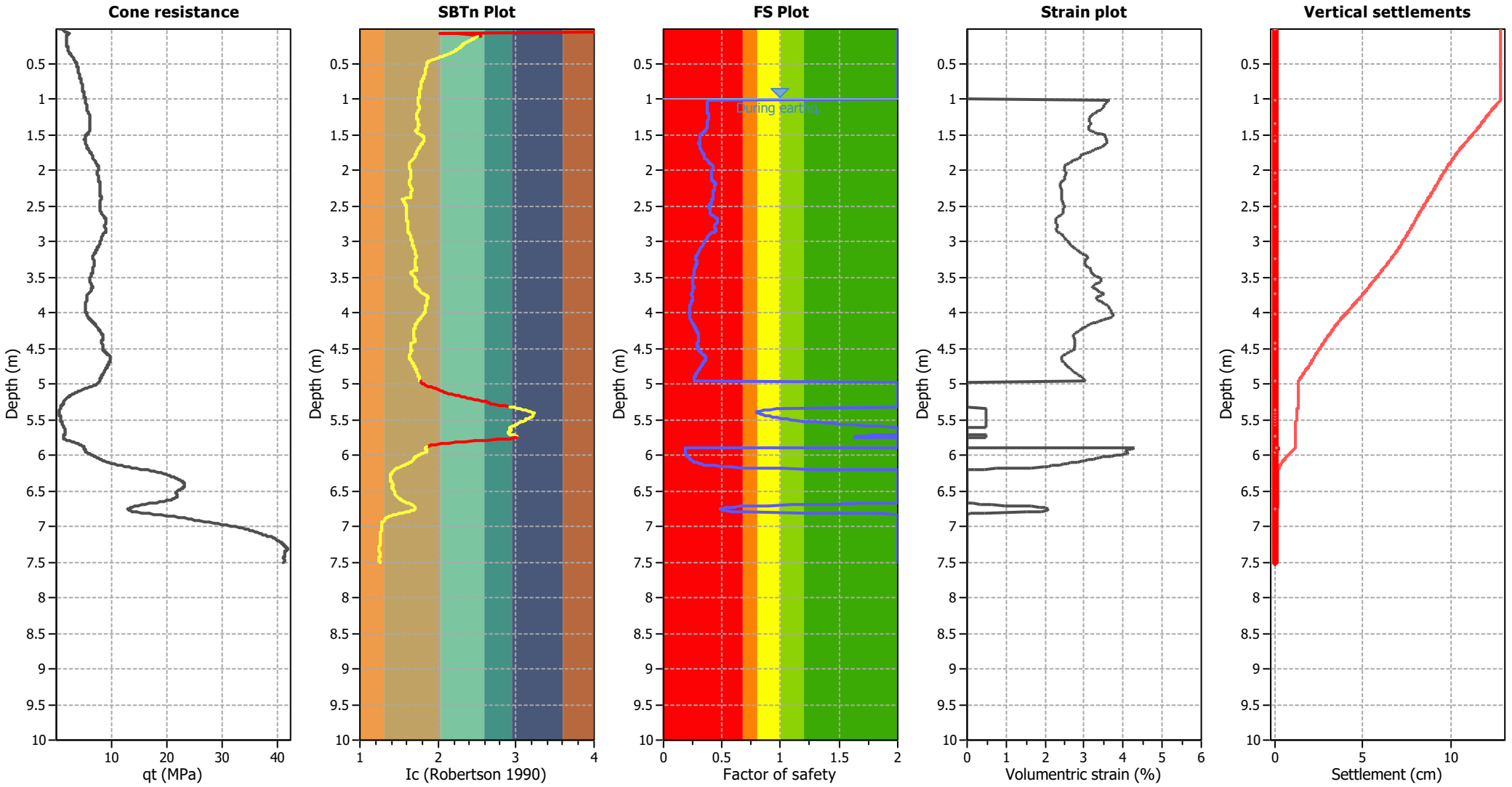
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	750
I_c maximum check value:	3.00	Total points excluded:	59
I_c change ratio value:	0.0100	Exclusion percentage:	7.87%
Minimum number of points in layer:	4	Number of layers detected:	4

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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179 Courtenay Street, New Plymouth
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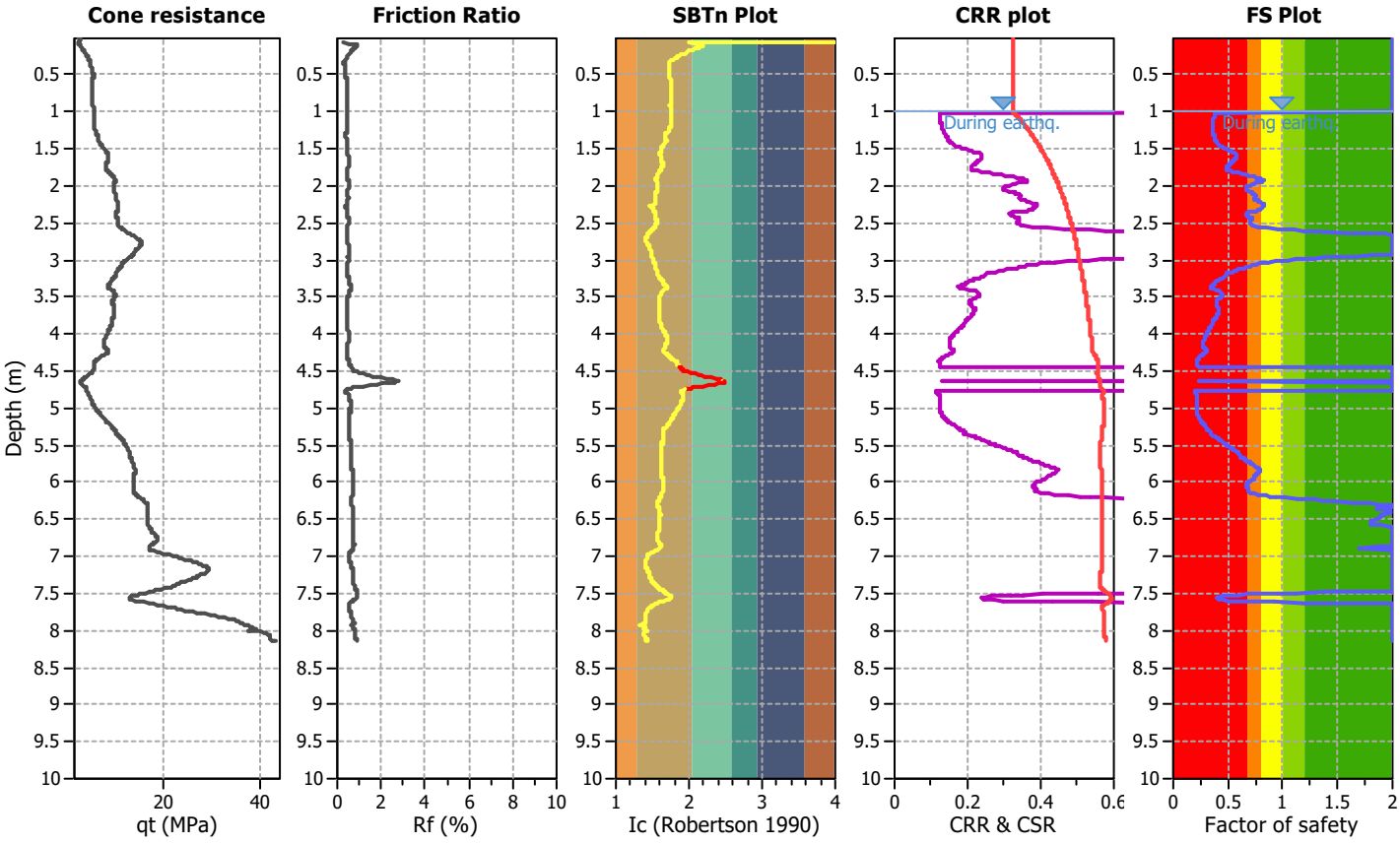
LIQUEFACTION ANALYSIS REPORT

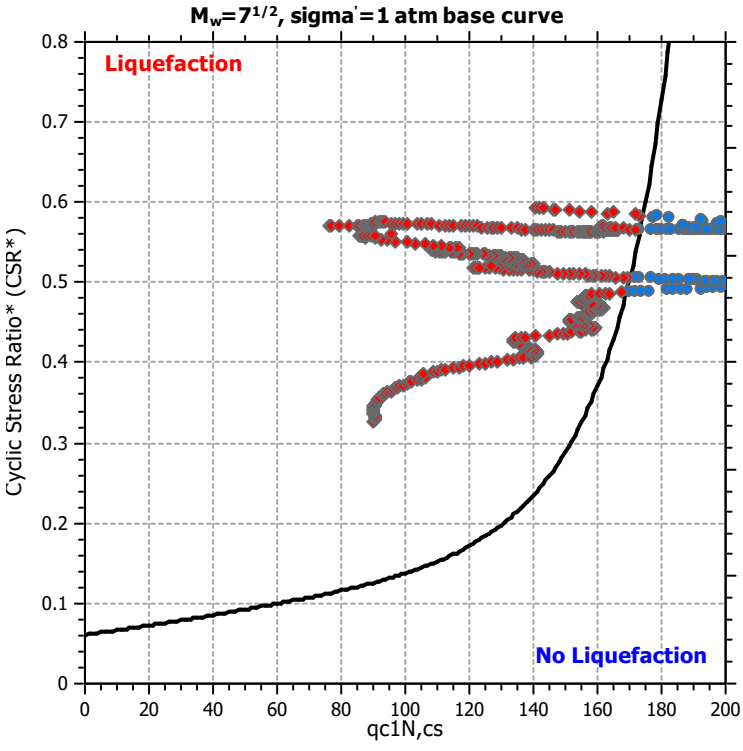
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

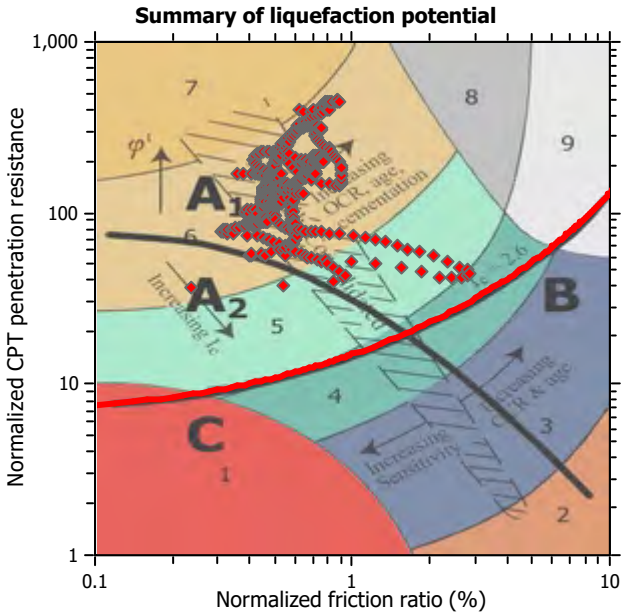
CPT file : CPT05_ULS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

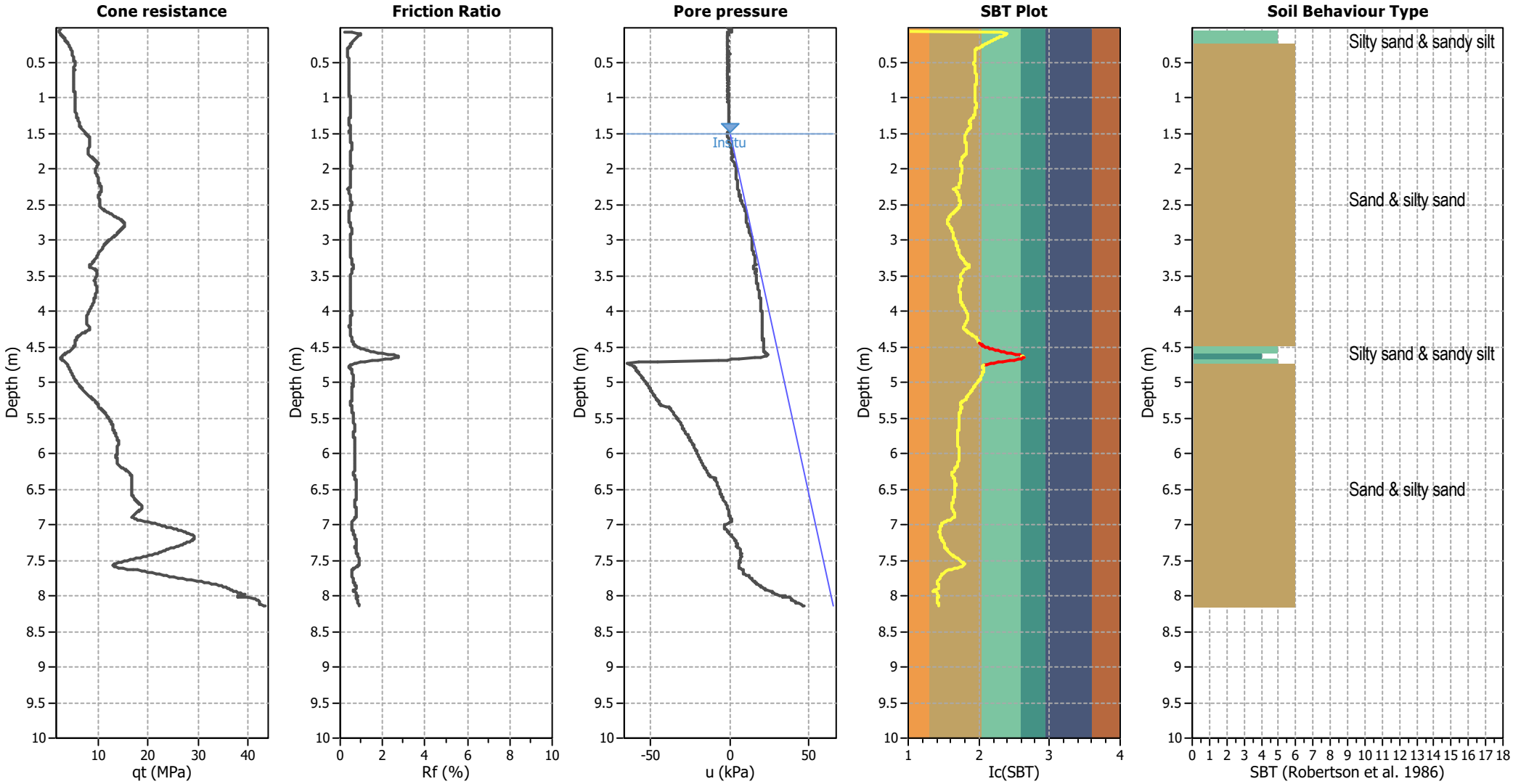






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



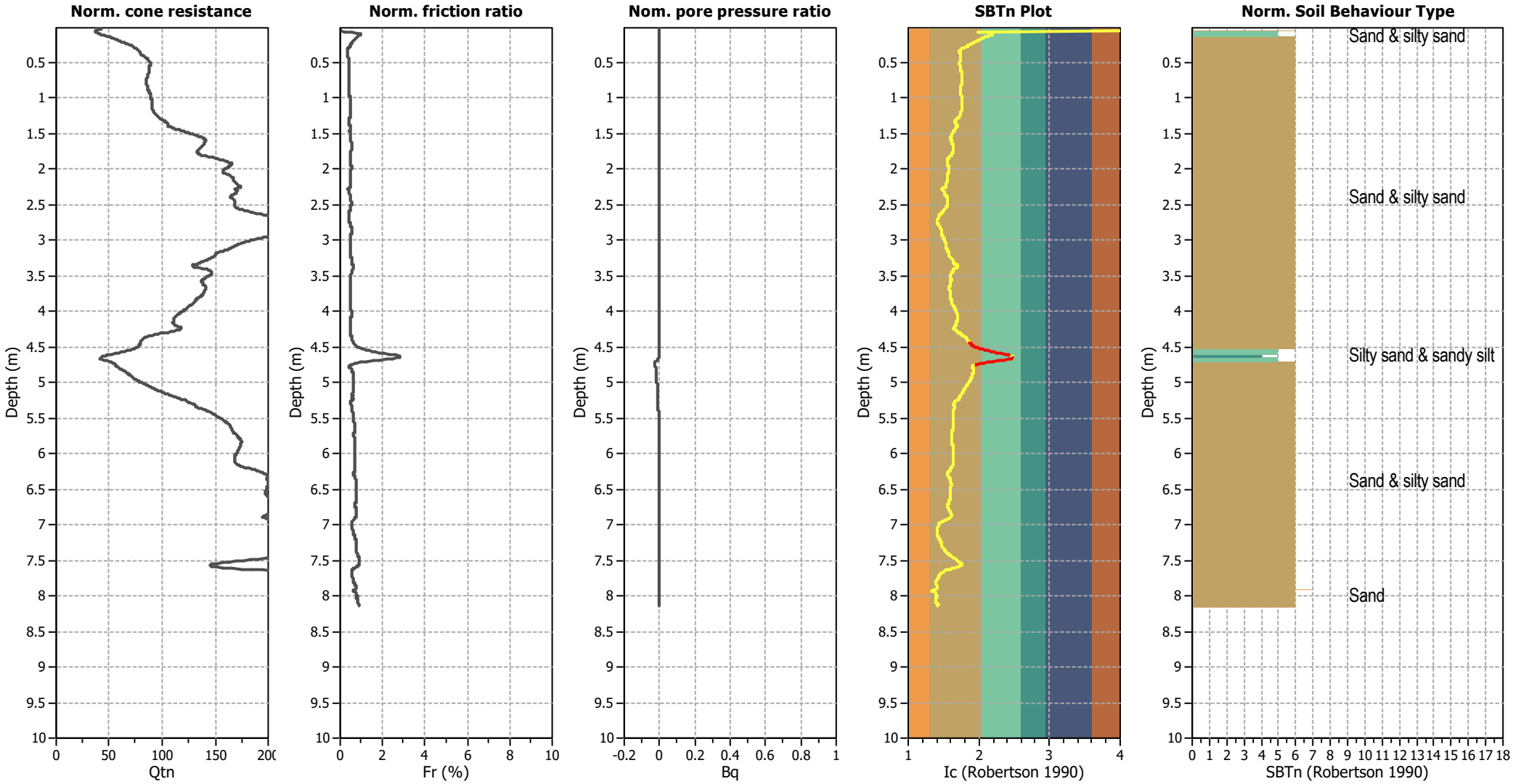
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



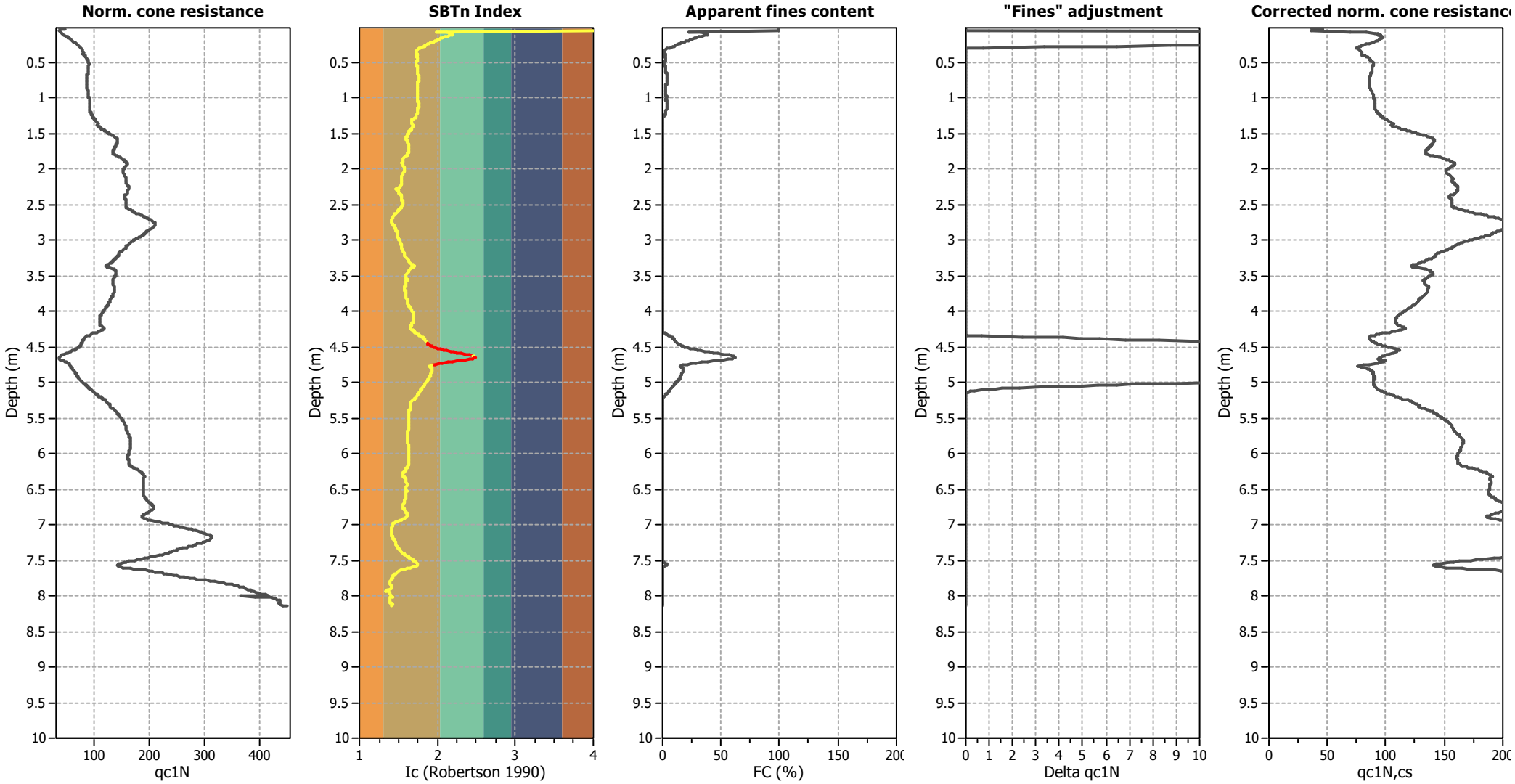
Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

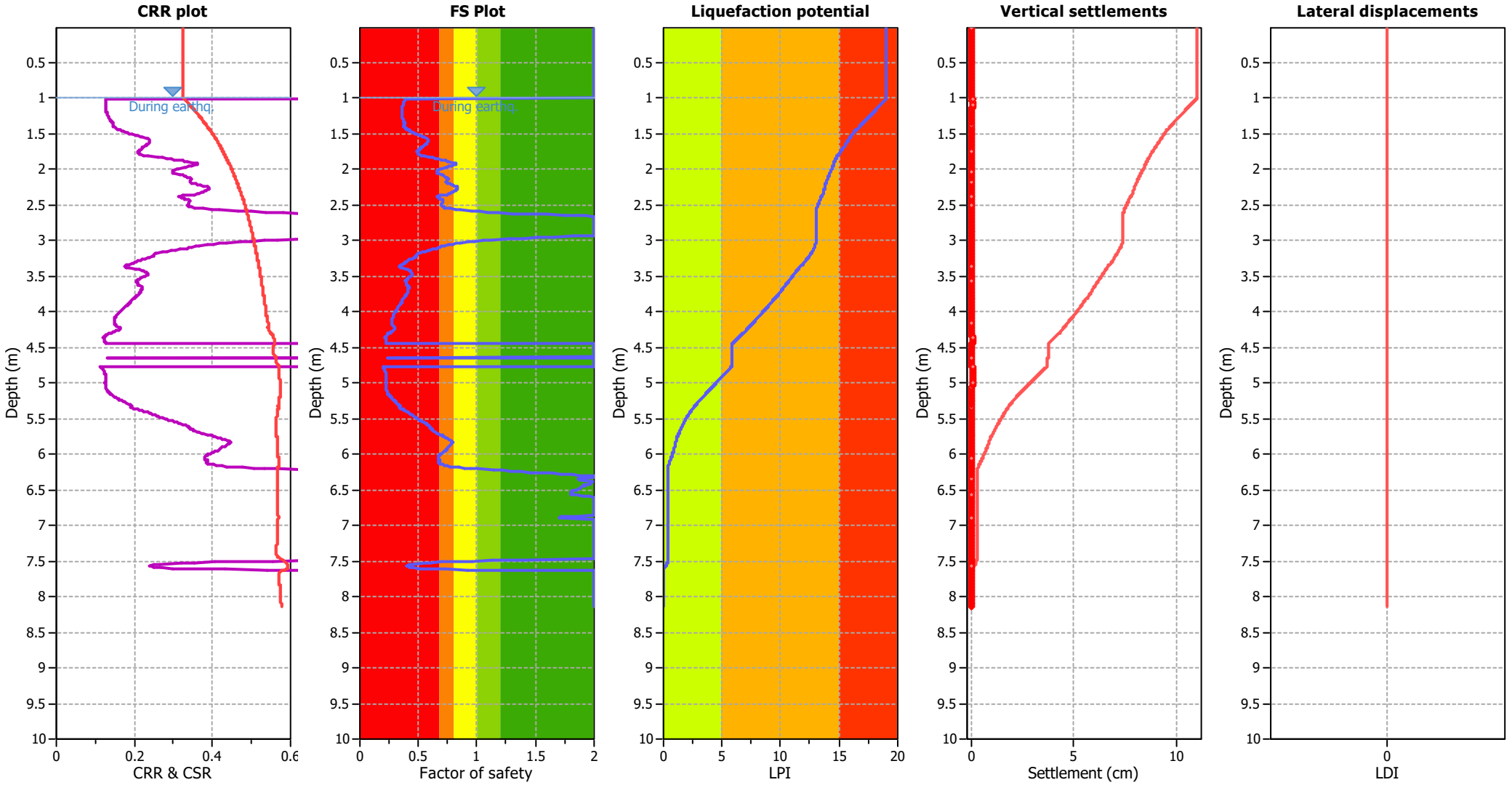
Liquefaction analysis overall plots (intermediate results)



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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

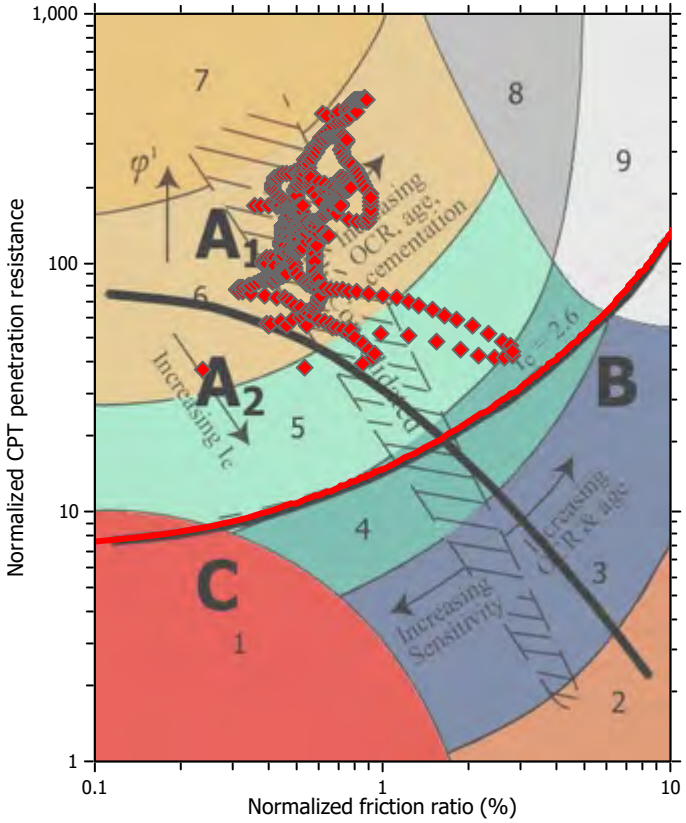
F.S. color scheme

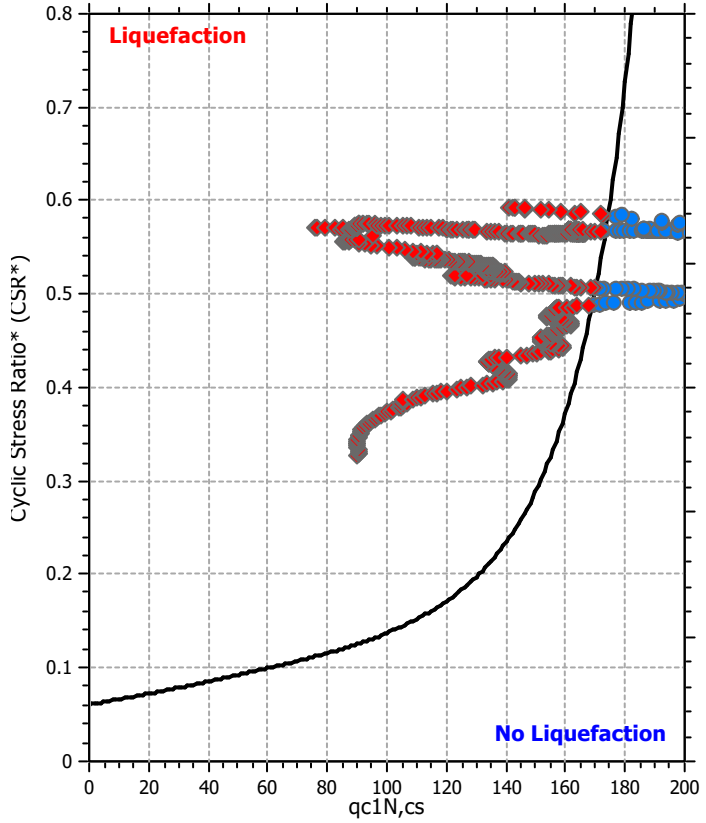
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

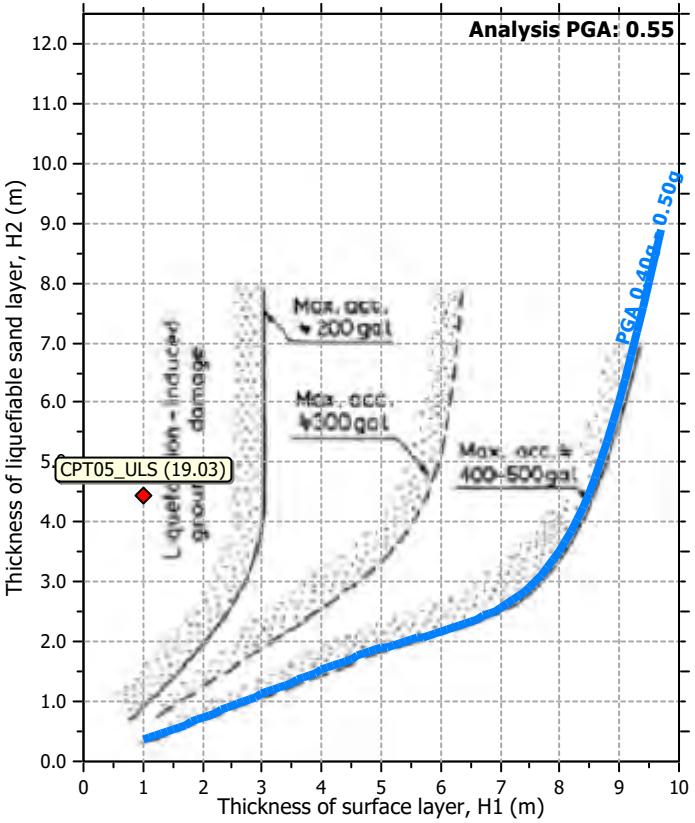
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



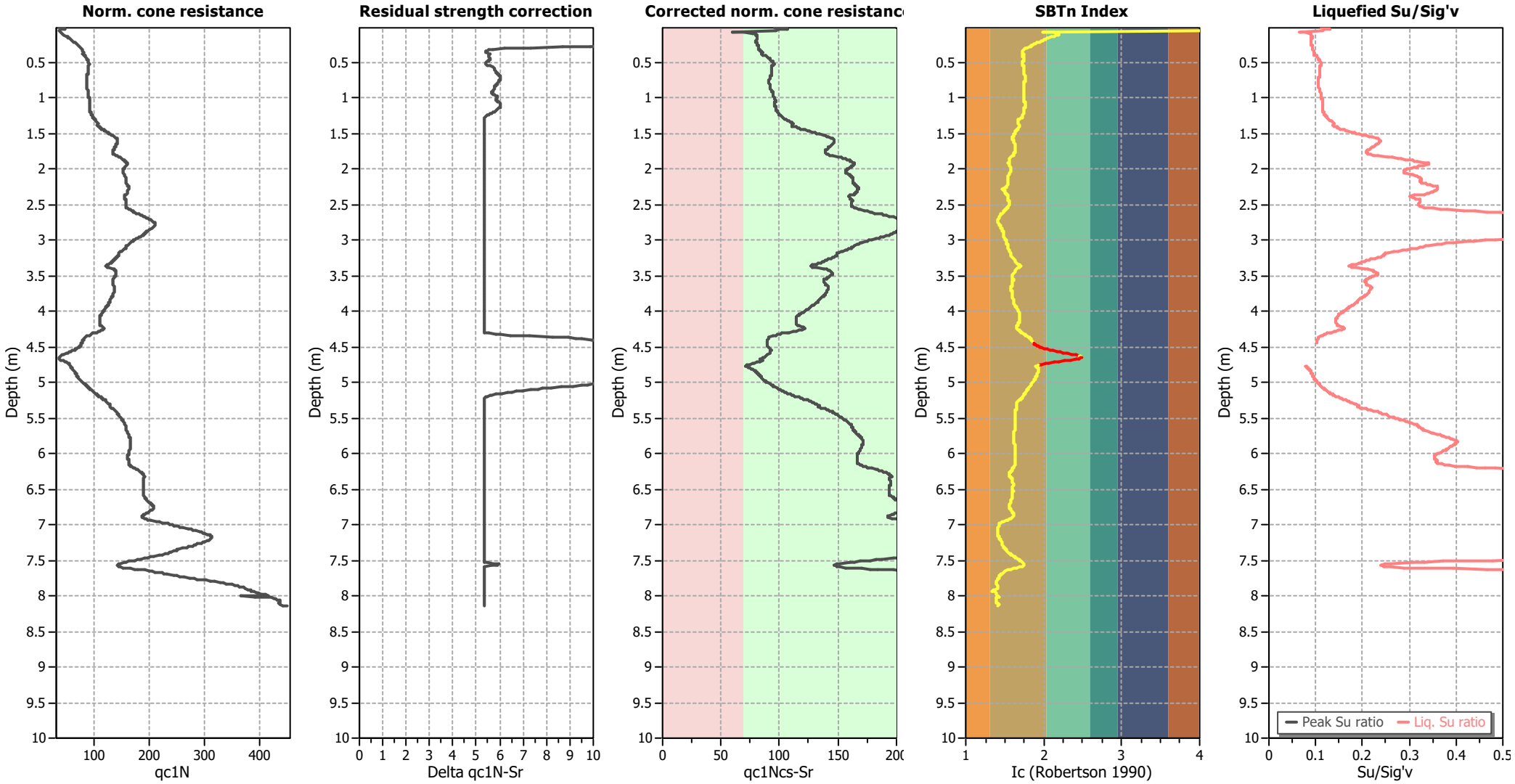




Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

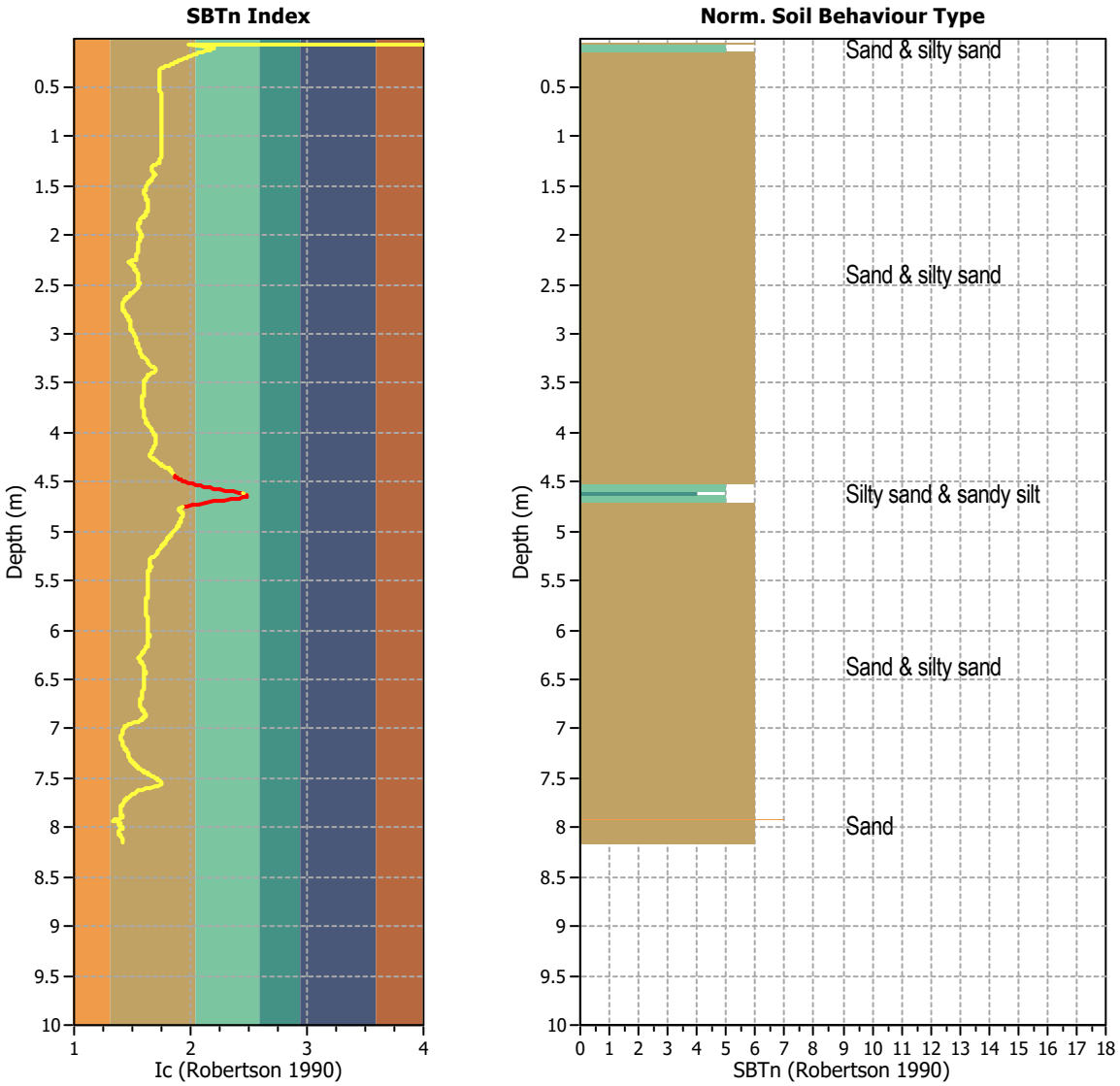
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

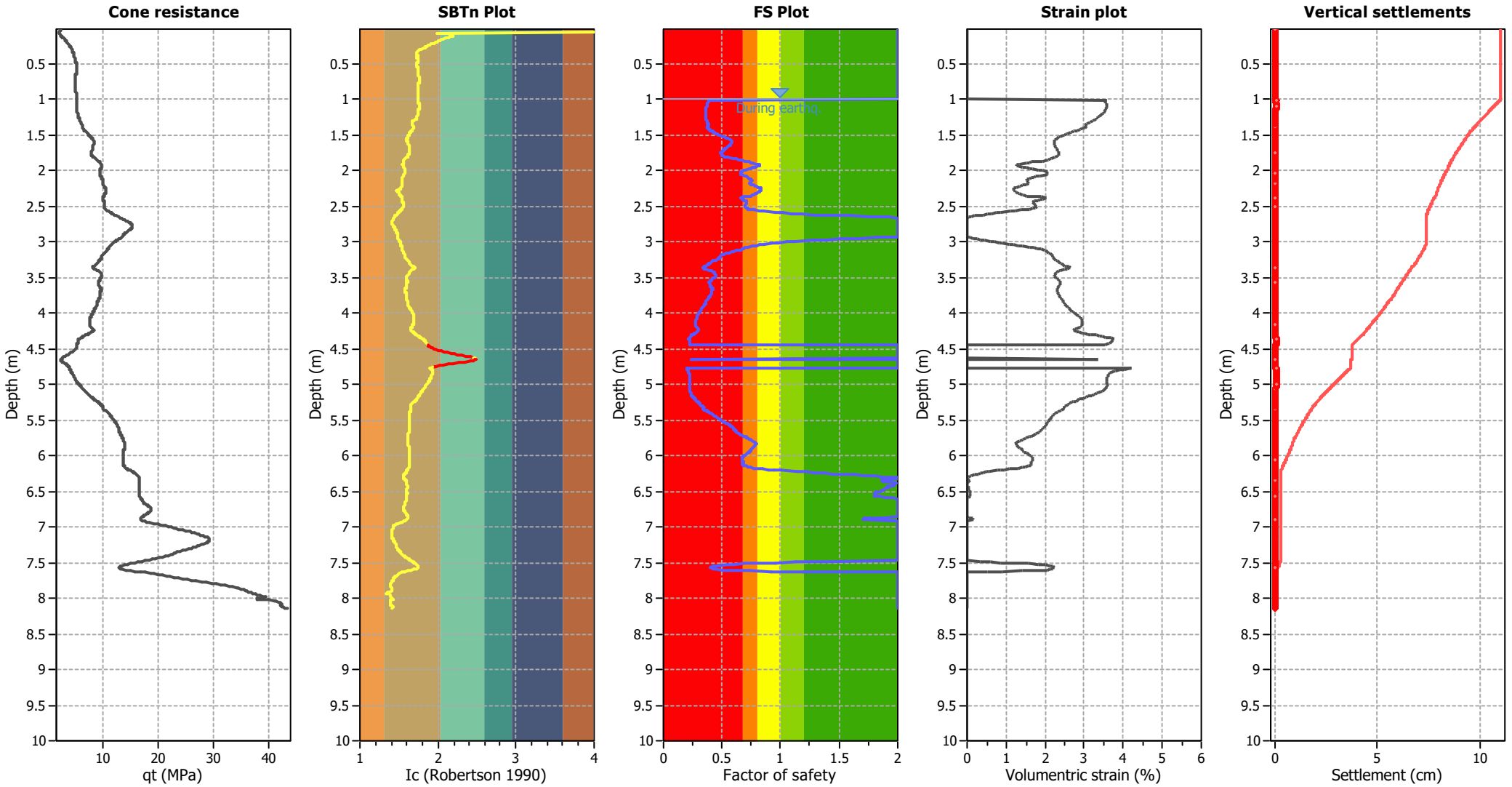
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	815
I_c maximum check value:	3.00	Total points excluded:	31
I_c change ratio value:	0.0100	Exclusion percentage:	3.80%
Minimum number of points in layer:	4	Number of layers detected:	2

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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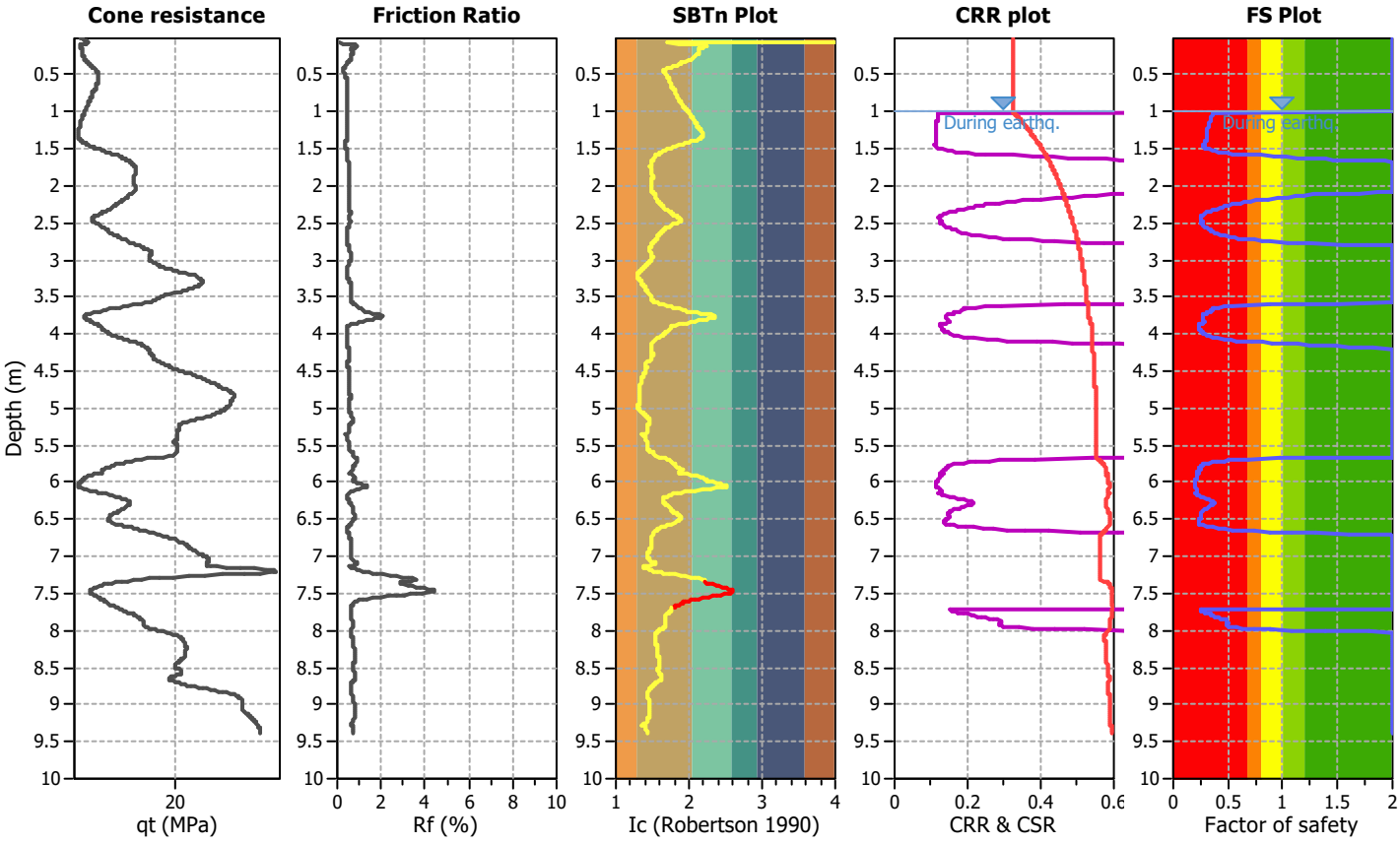
LIQUEFACTION ANALYSIS REPORT

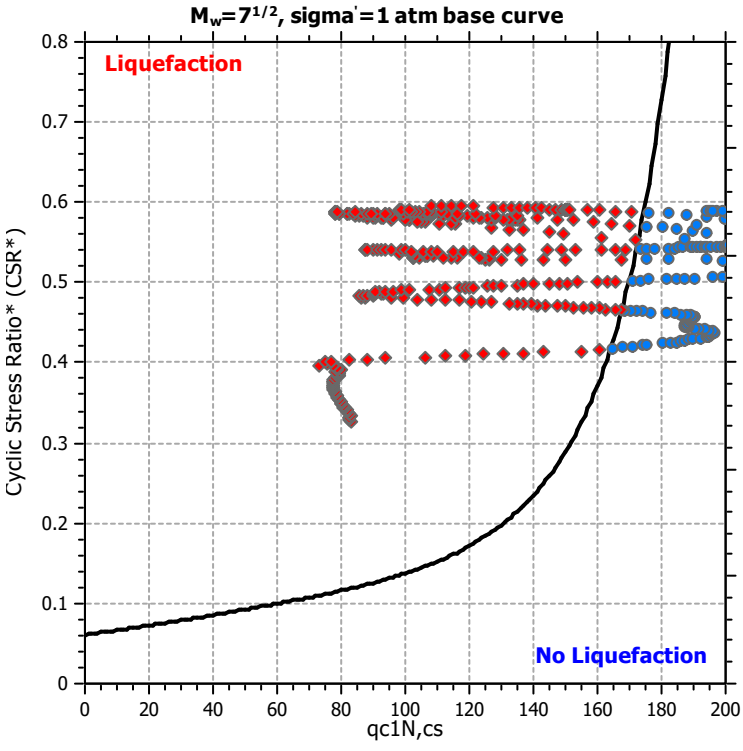
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

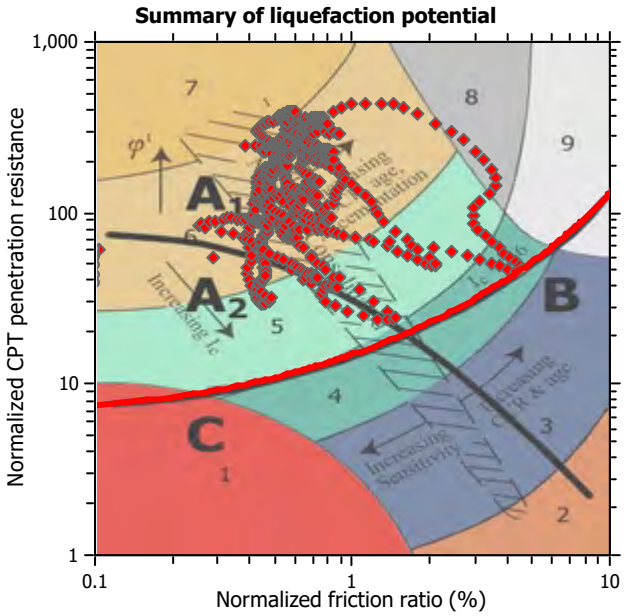
CPT file : CPT06_ULS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

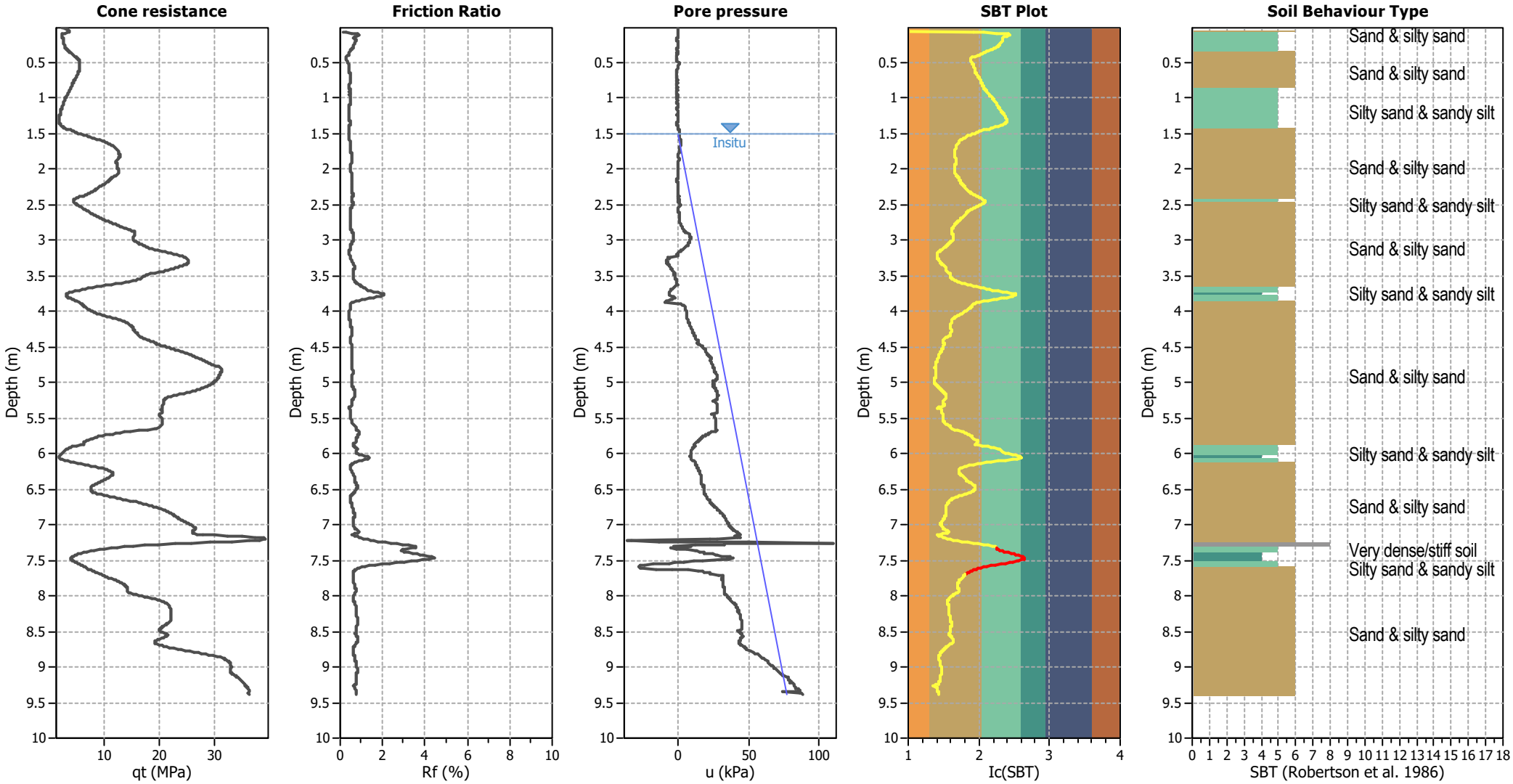






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



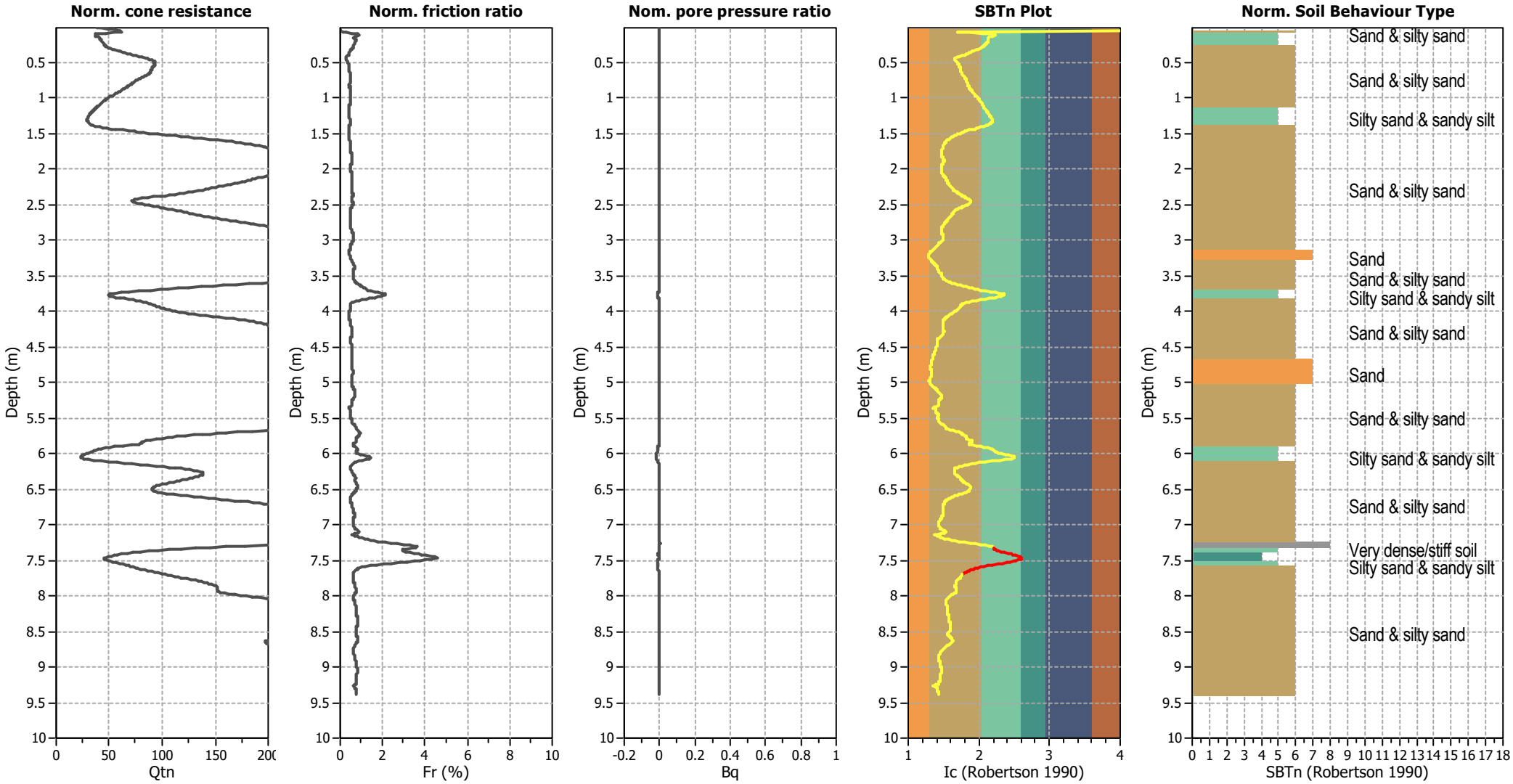
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



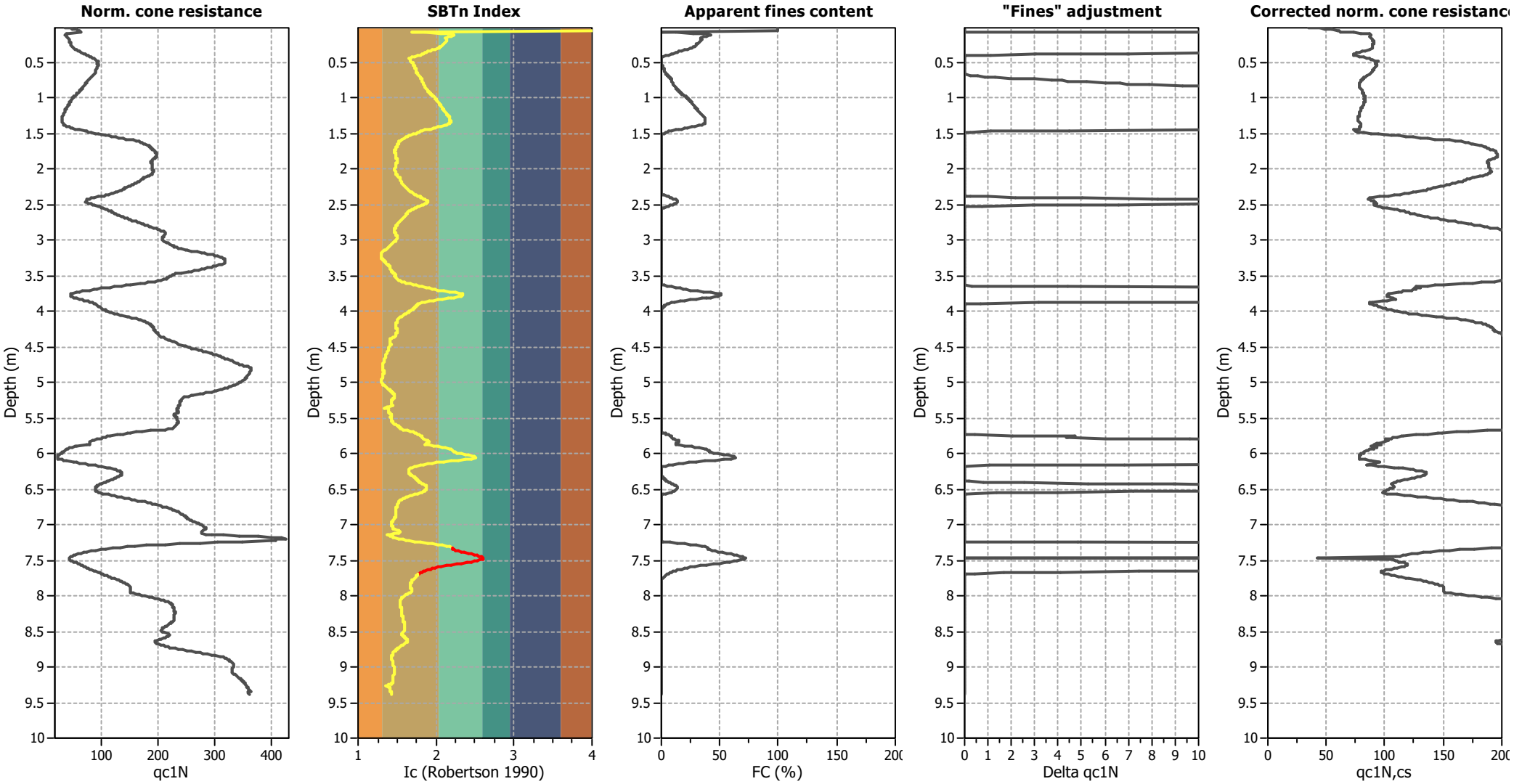
Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

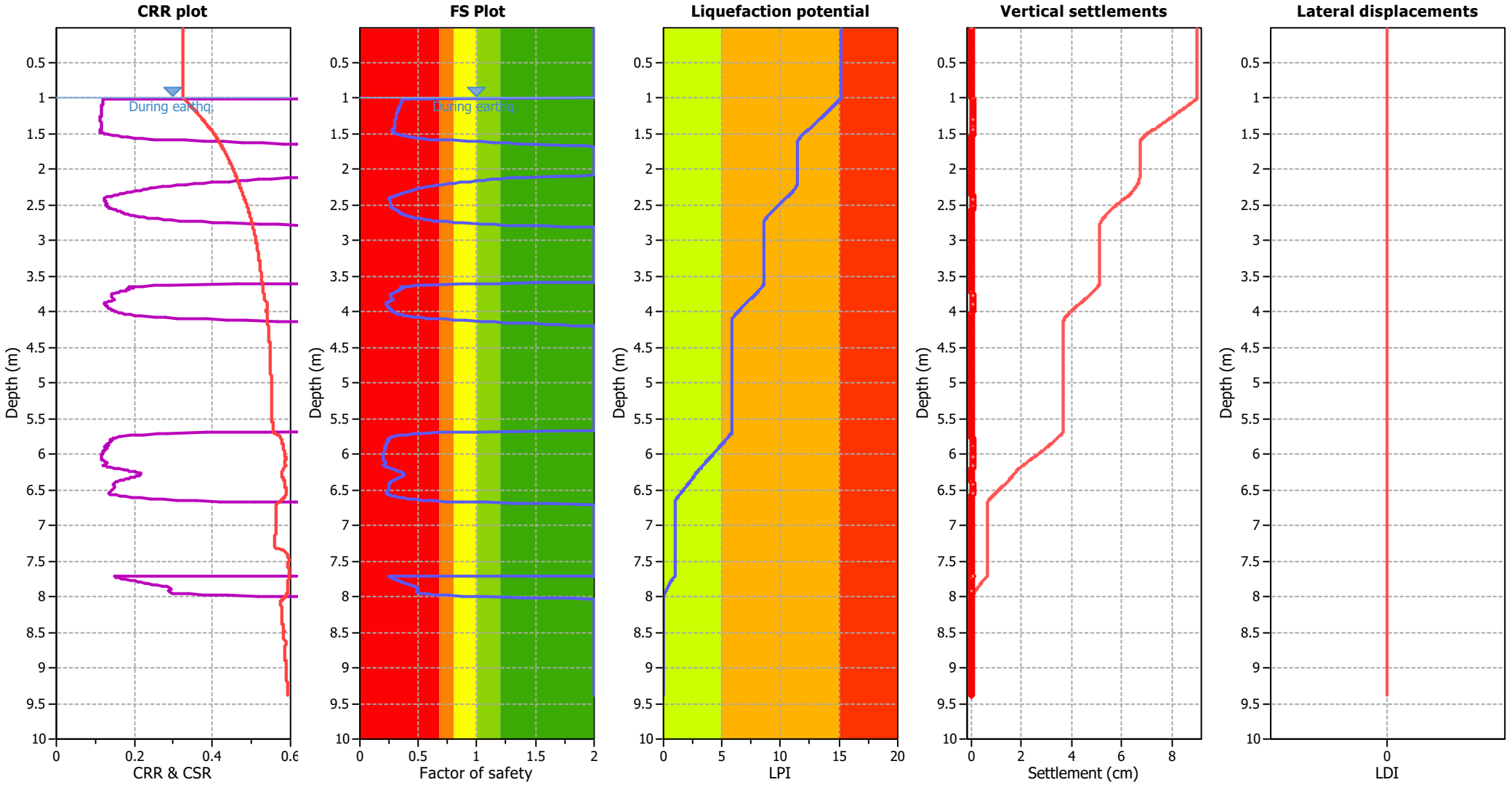
Liquefaction analysis overall plots (intermediate results)



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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

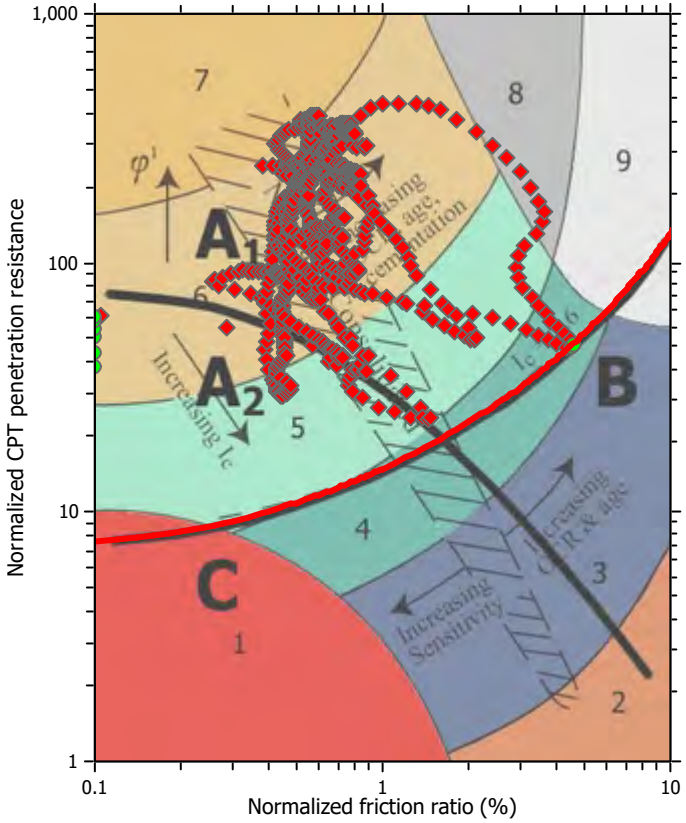
F.S. color scheme

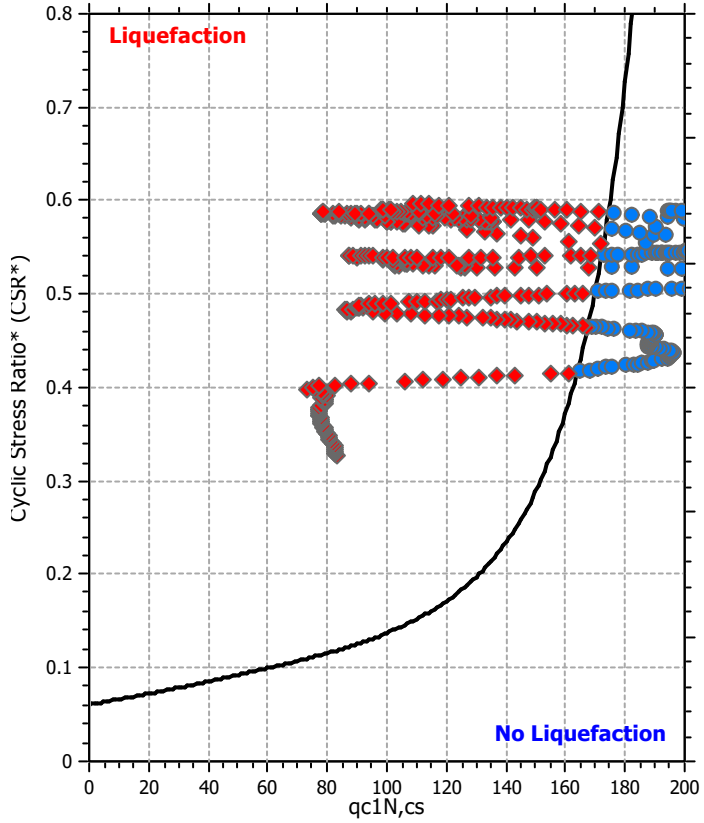
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

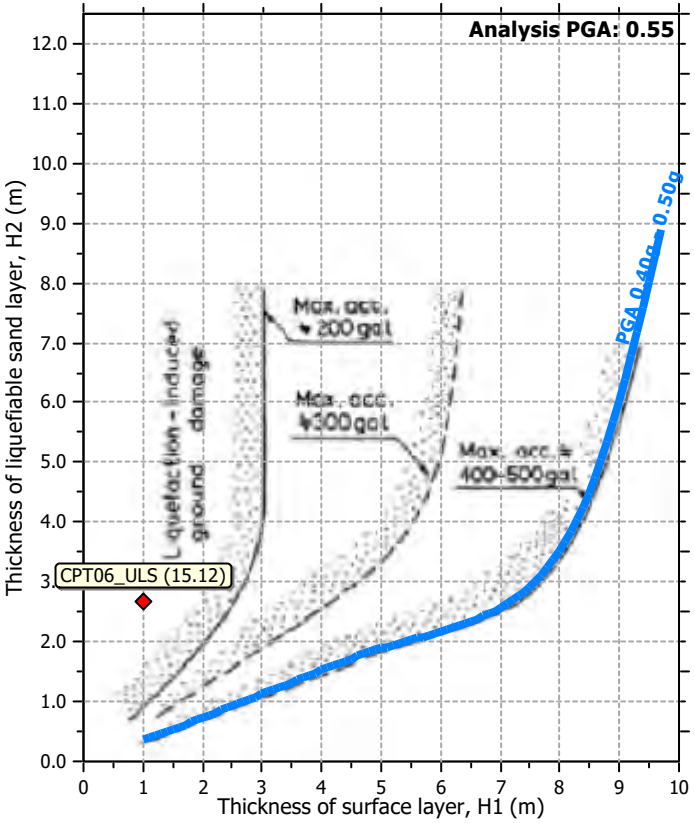
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



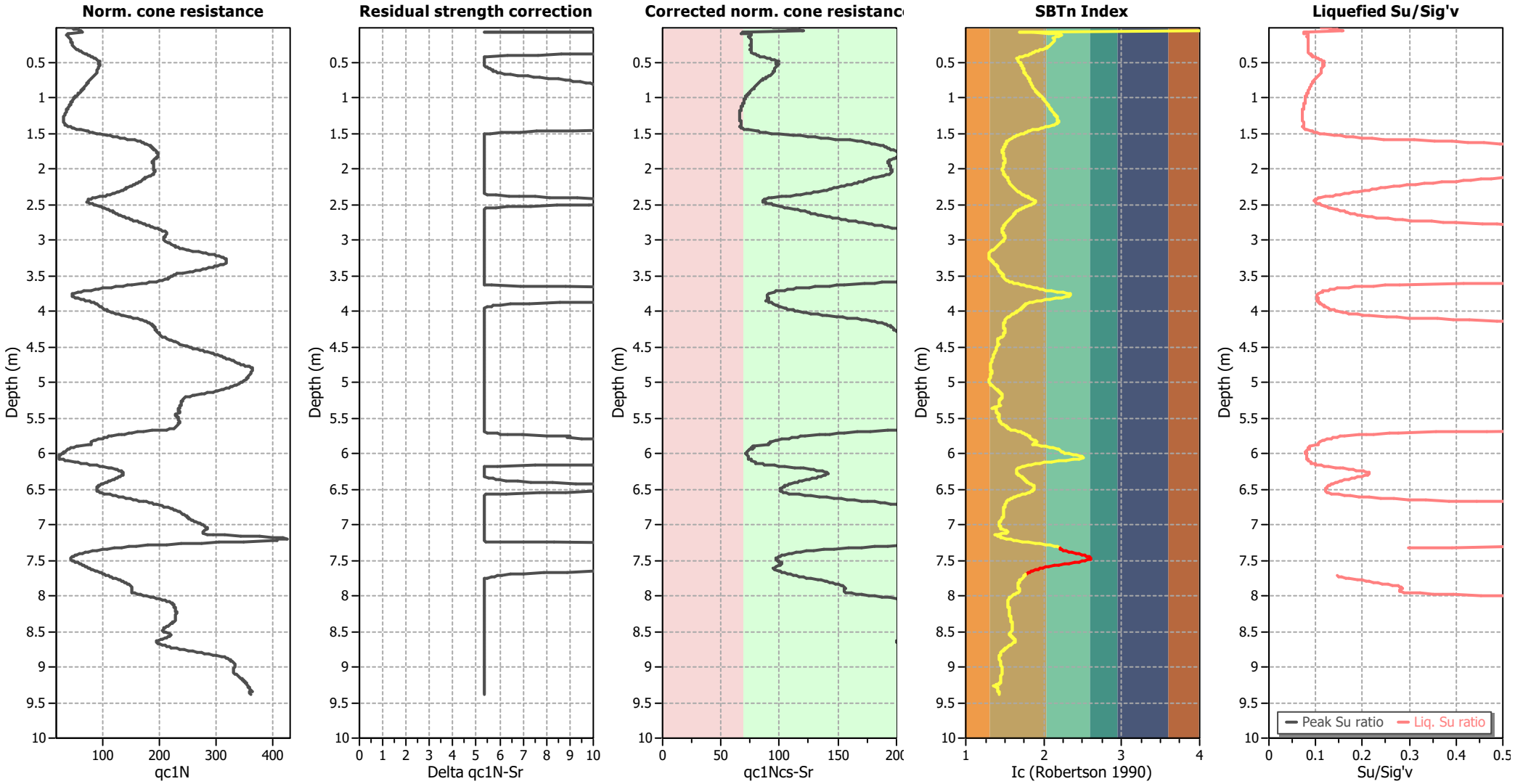




Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

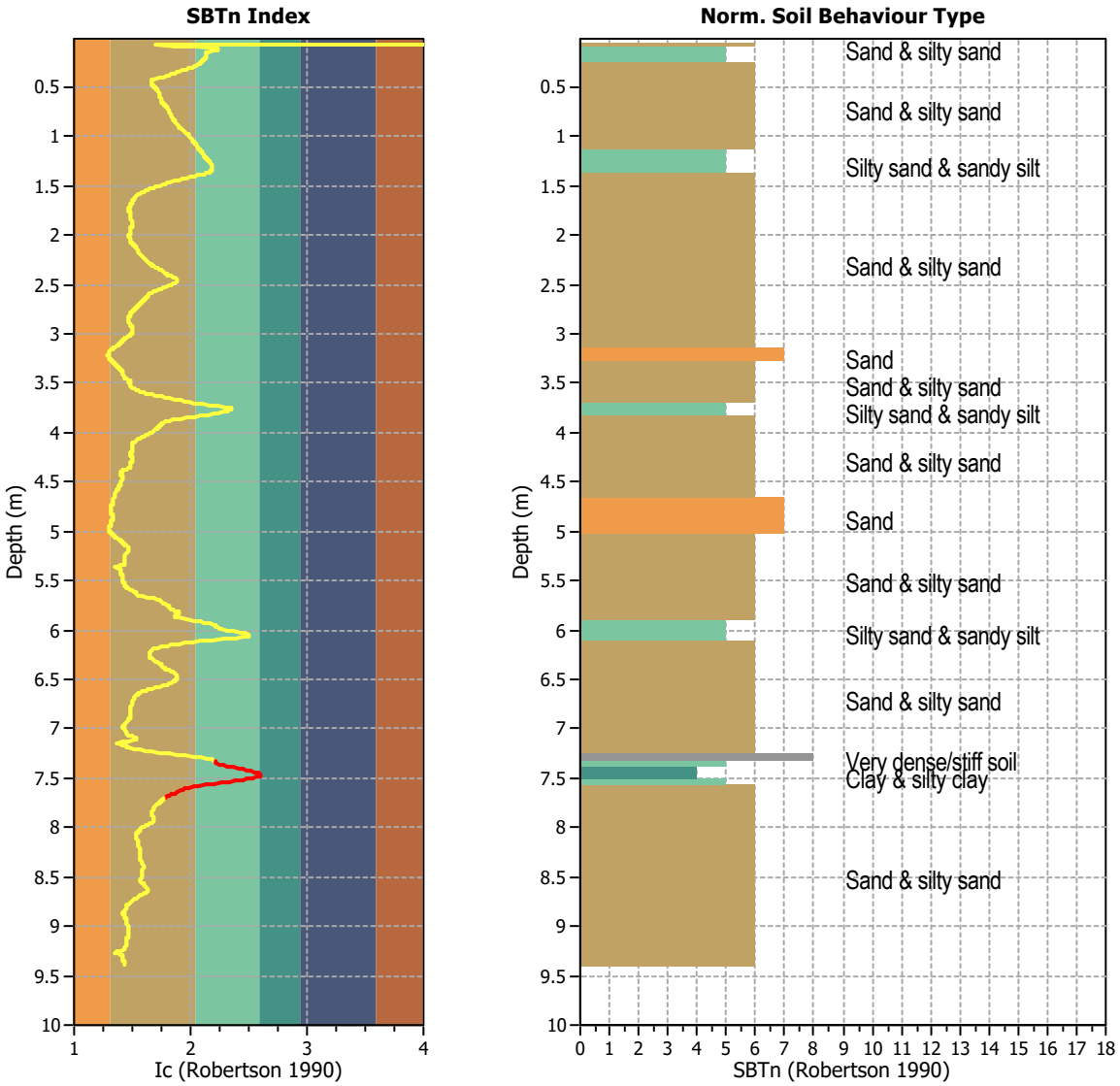
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

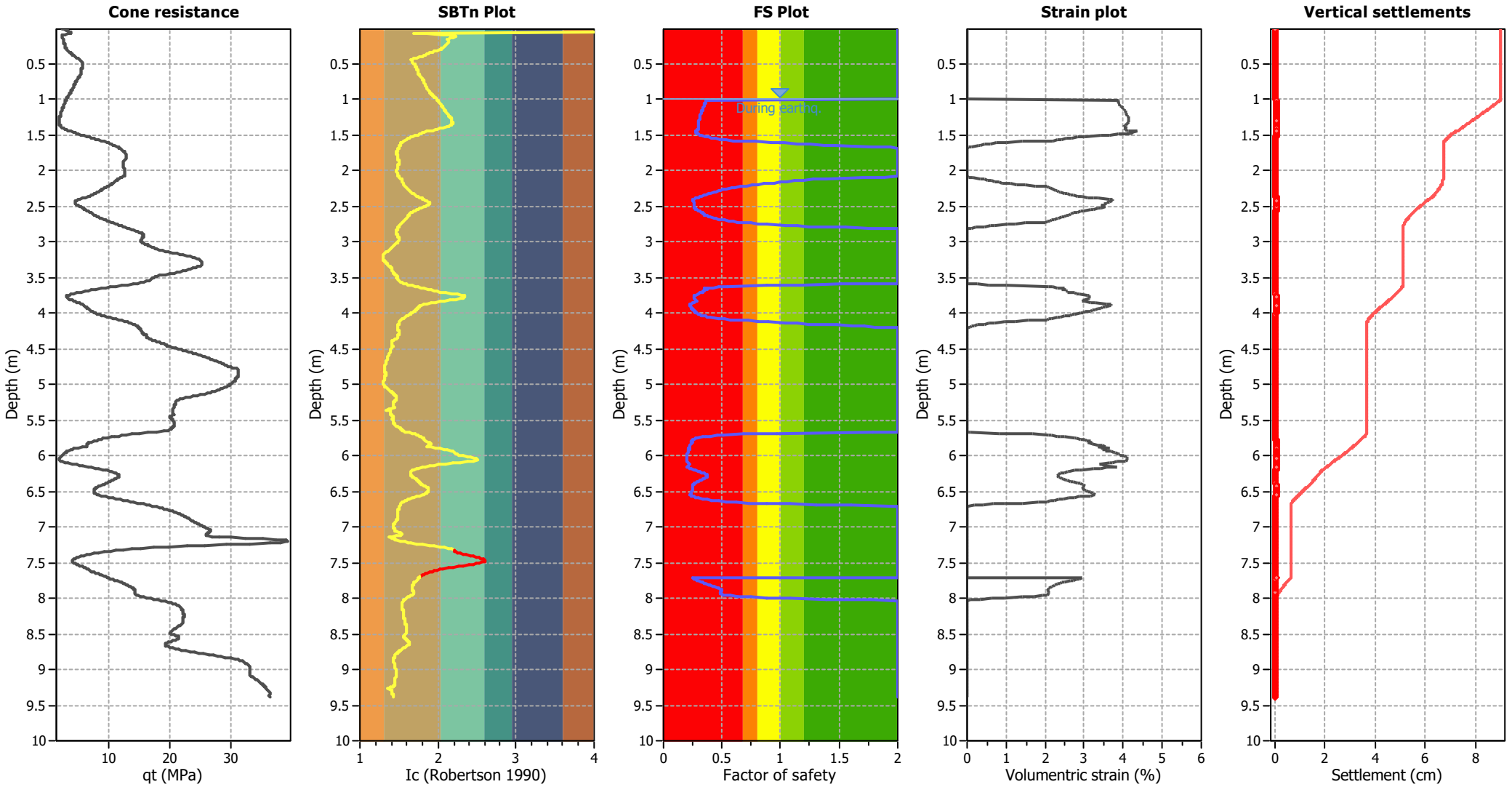
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	939
I_c maximum check value:	3.00	Total points excluded:	38
I_c change ratio value:	0.0100	Exclusion percentage:	4.05%
Minimum number of points in layer:	4	Number of layers detected:	2

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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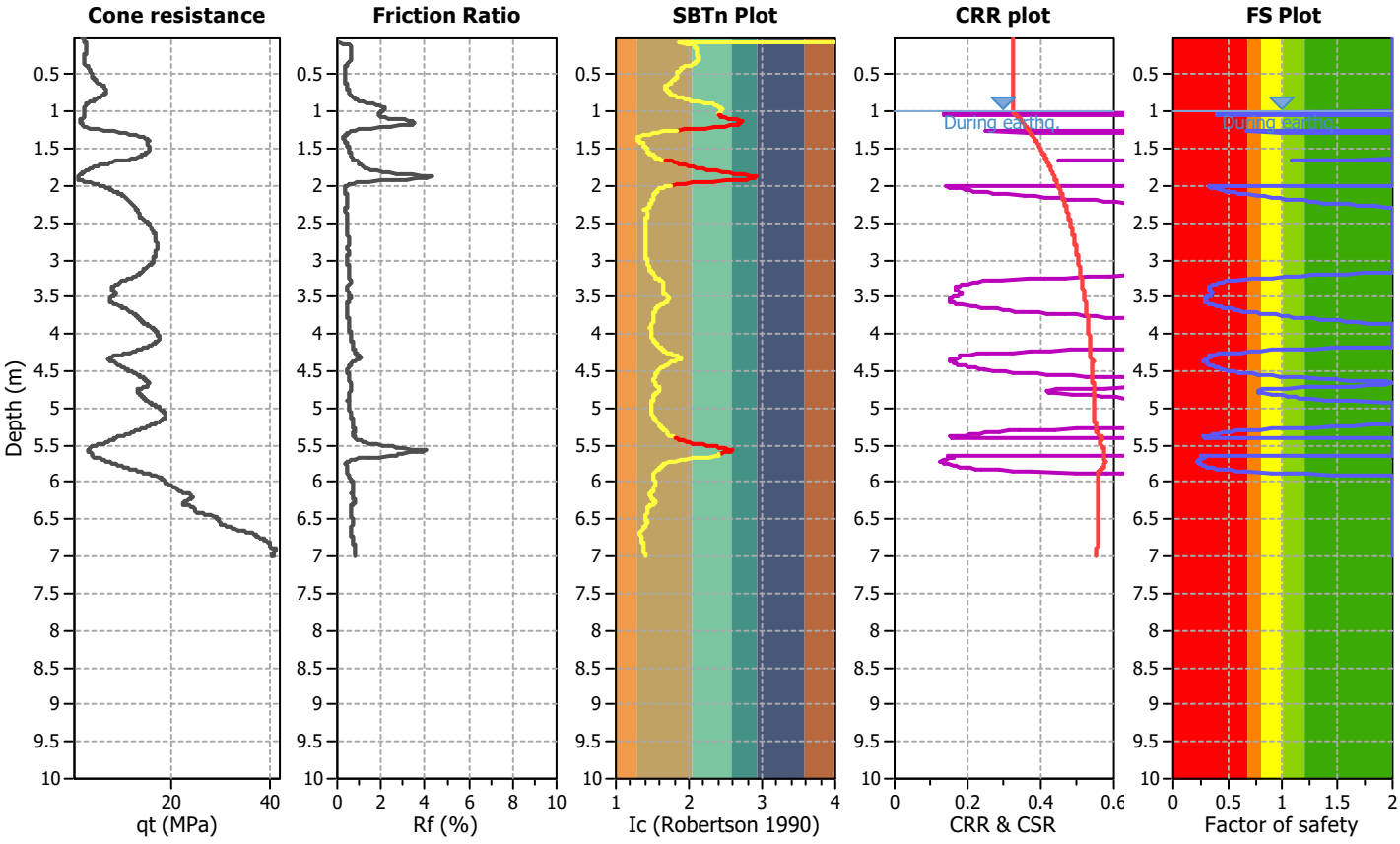
LIQUEFACTION ANALYSIS REPORT

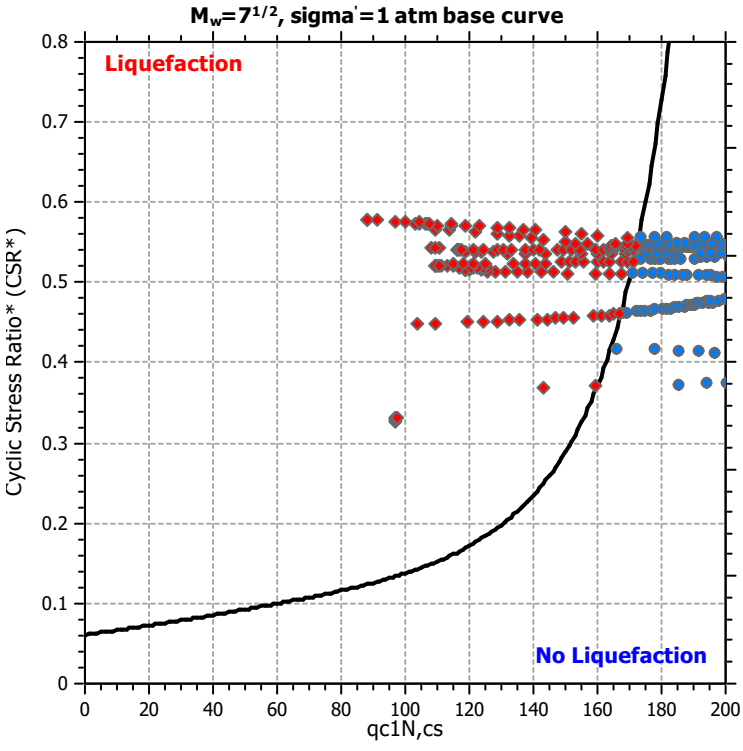
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

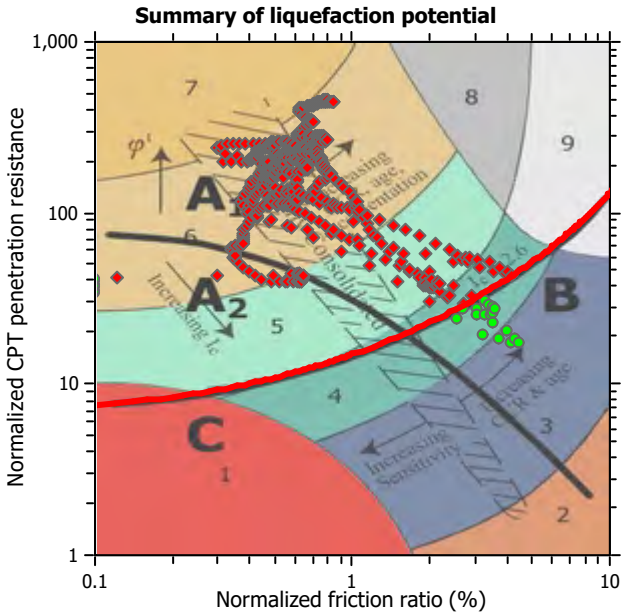
CPT file : CPT07_ULS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

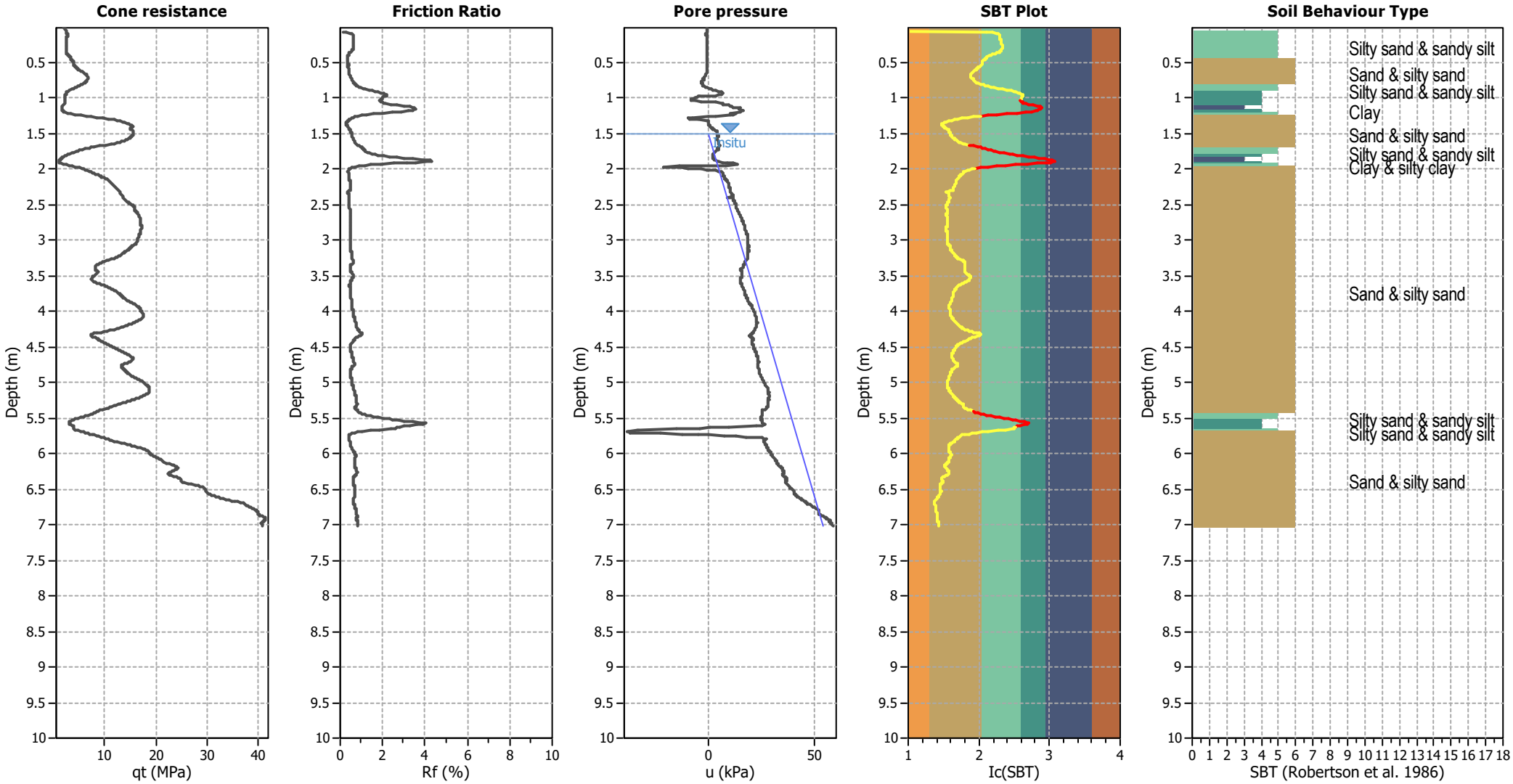






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



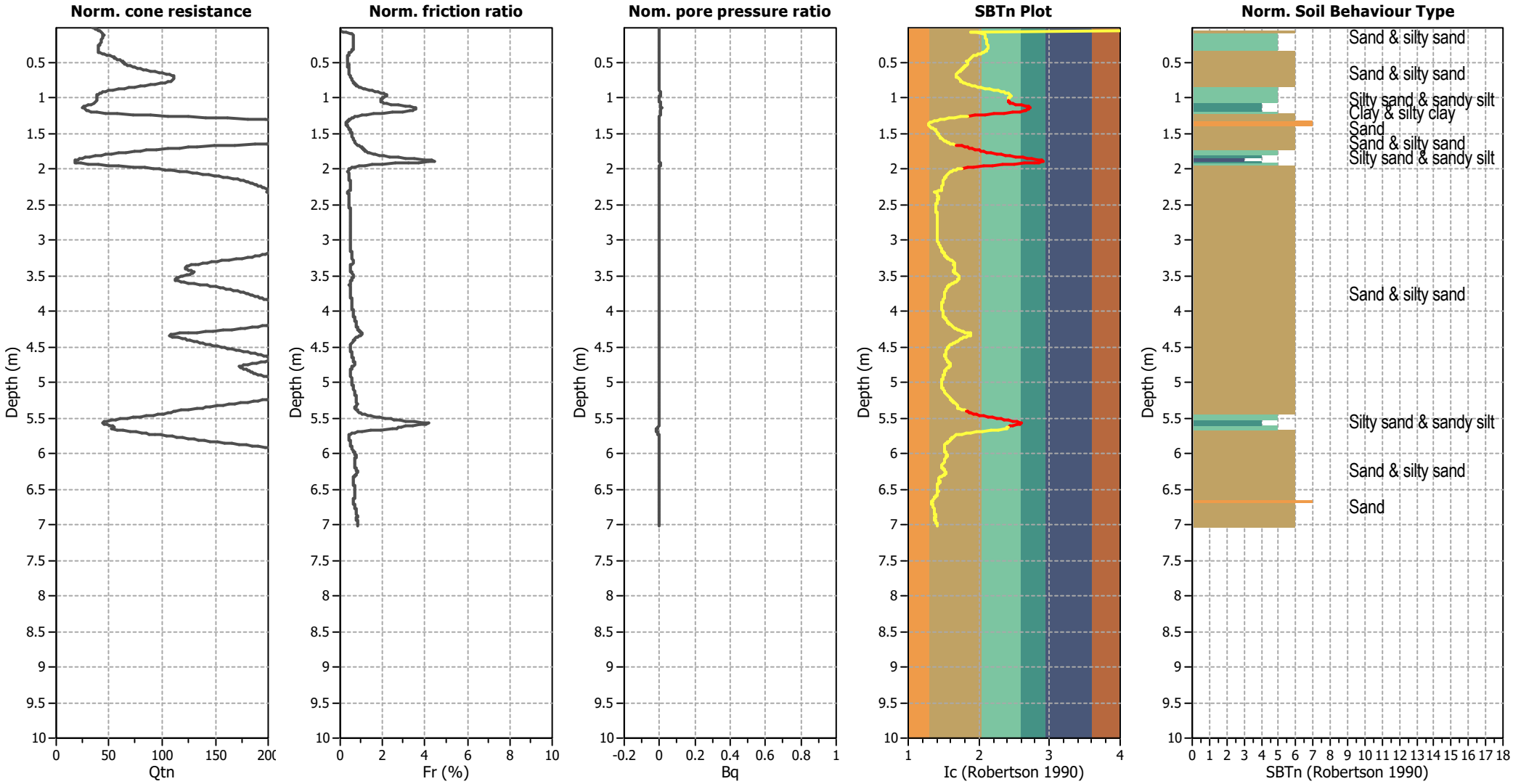
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



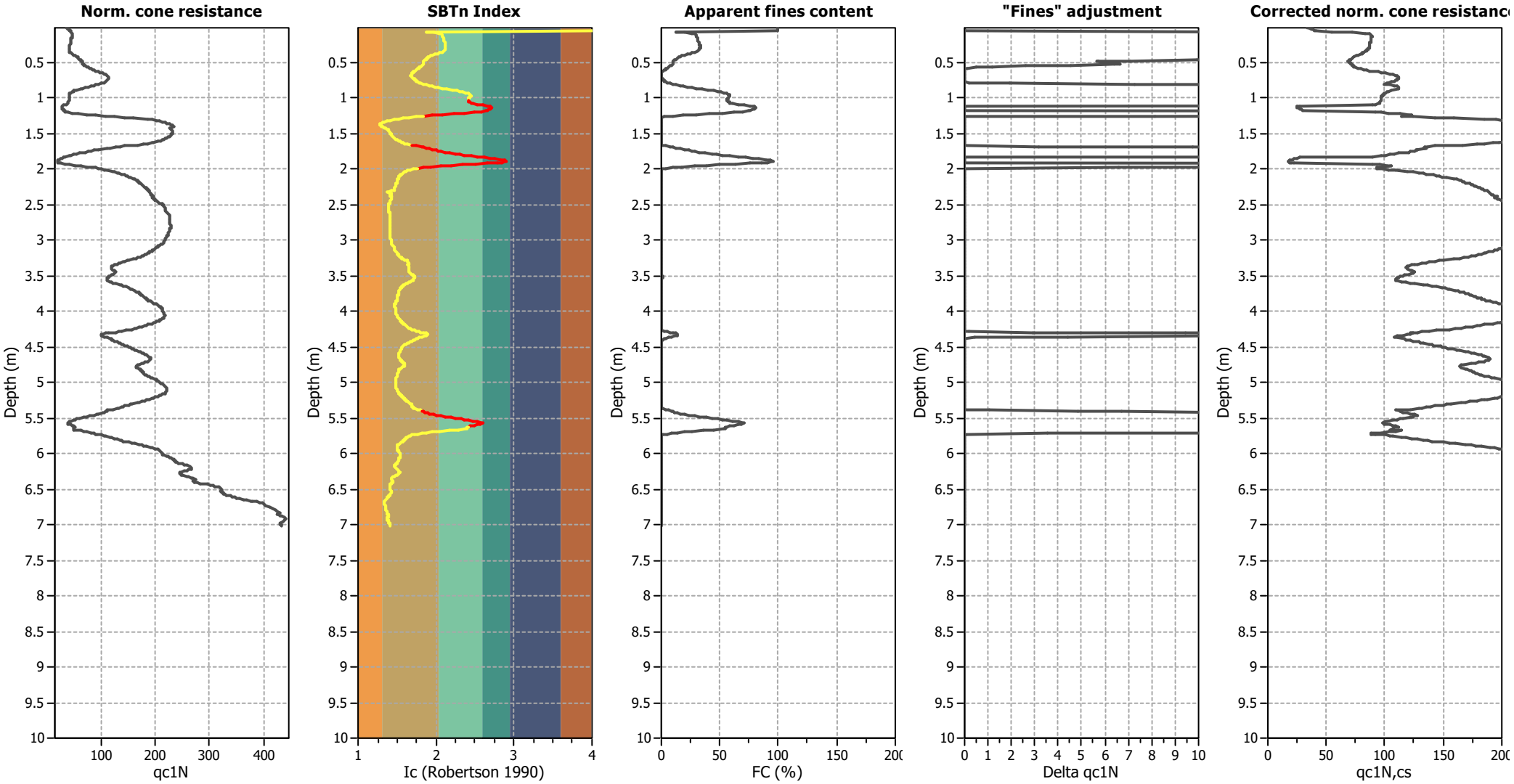
Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

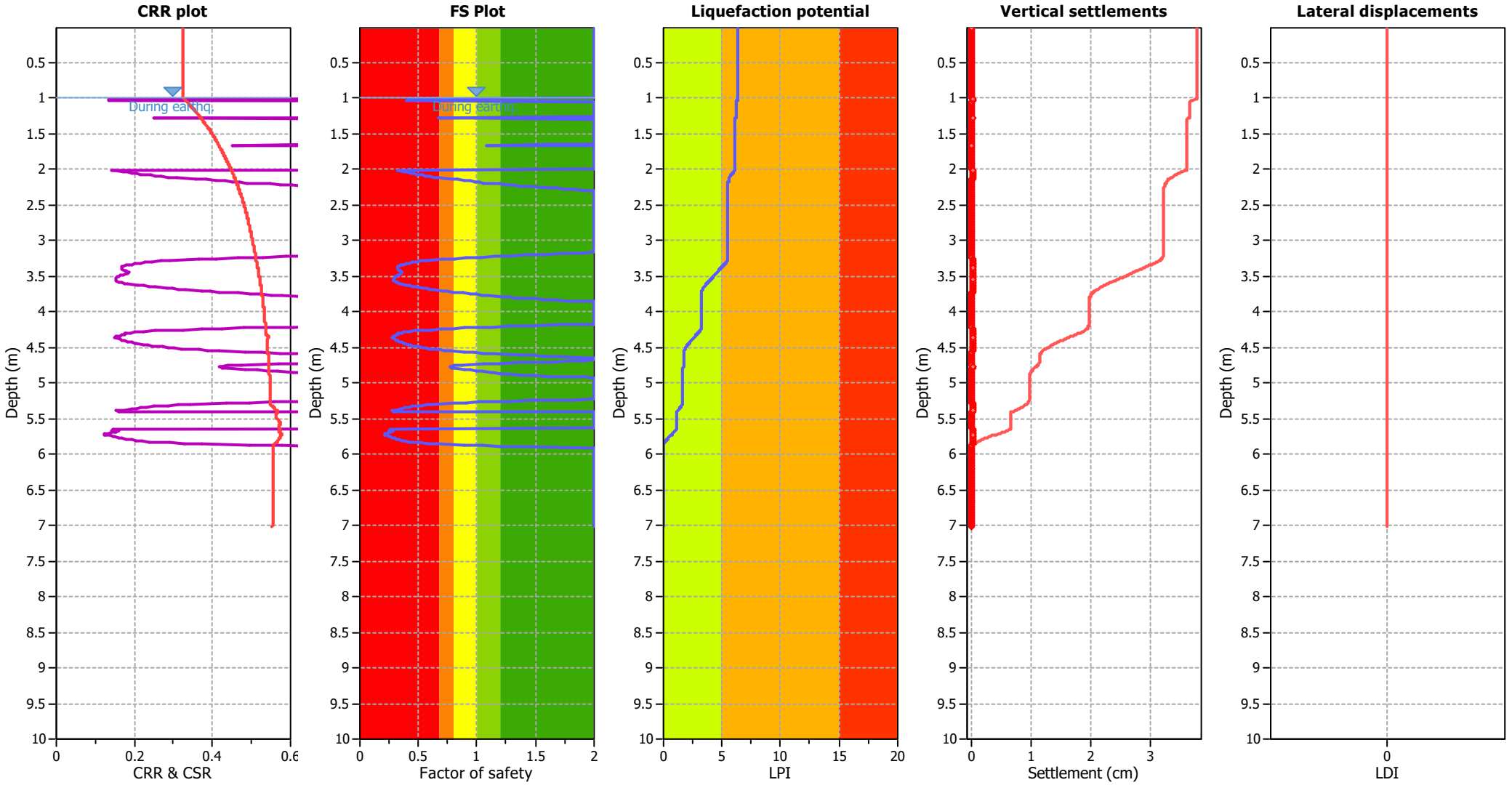
Liquefaction analysis overall plots (intermediate results)



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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

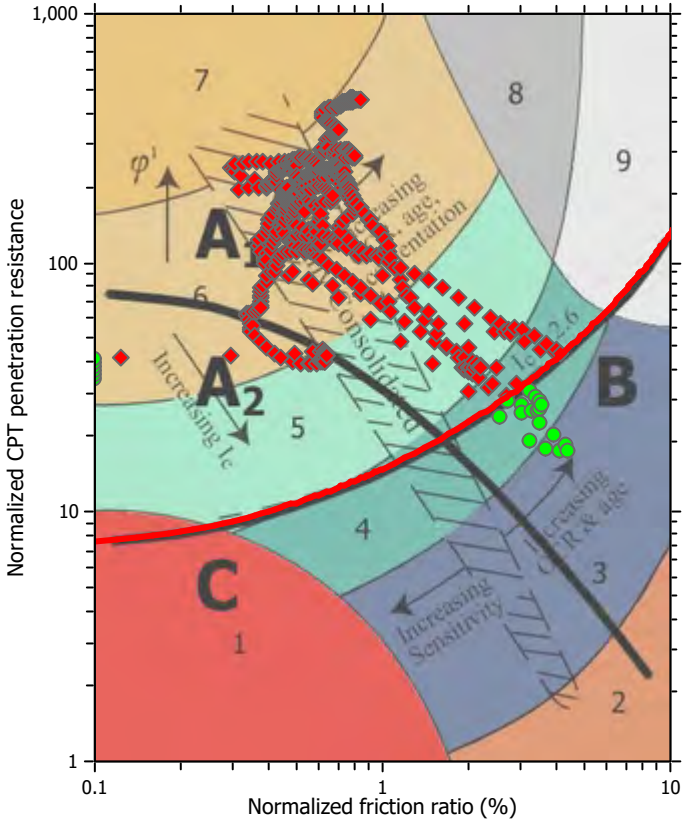
F.S. color scheme

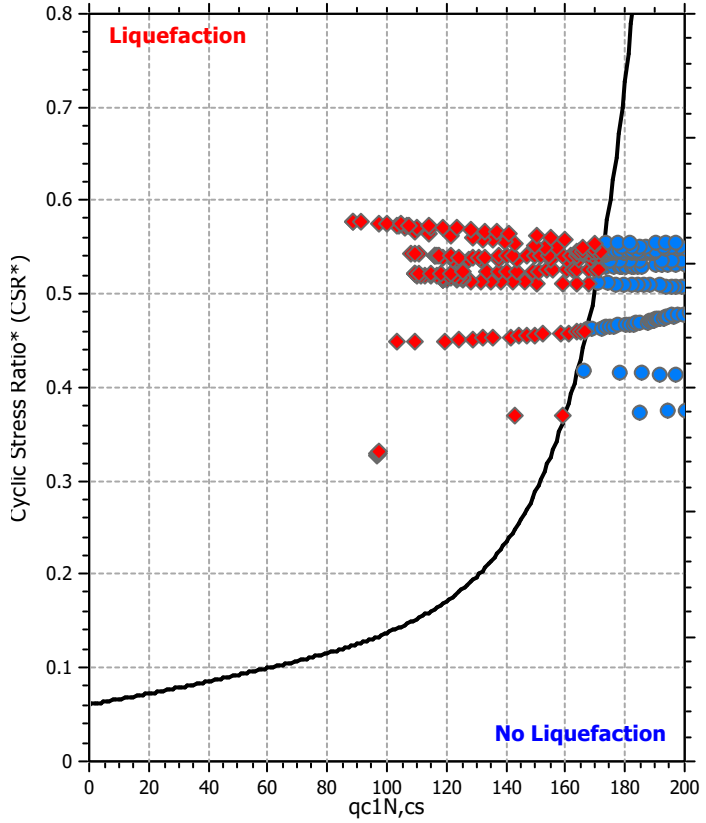
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

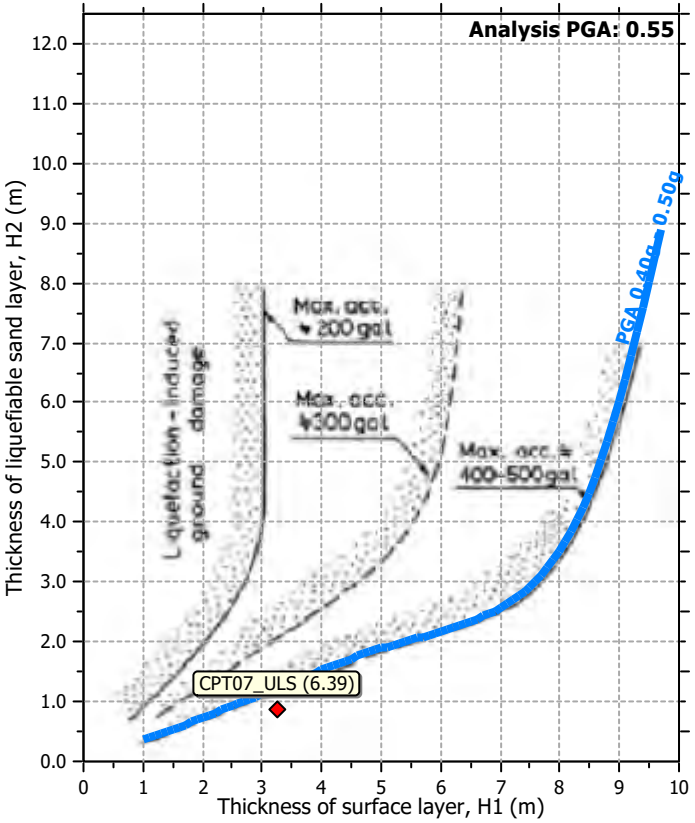
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



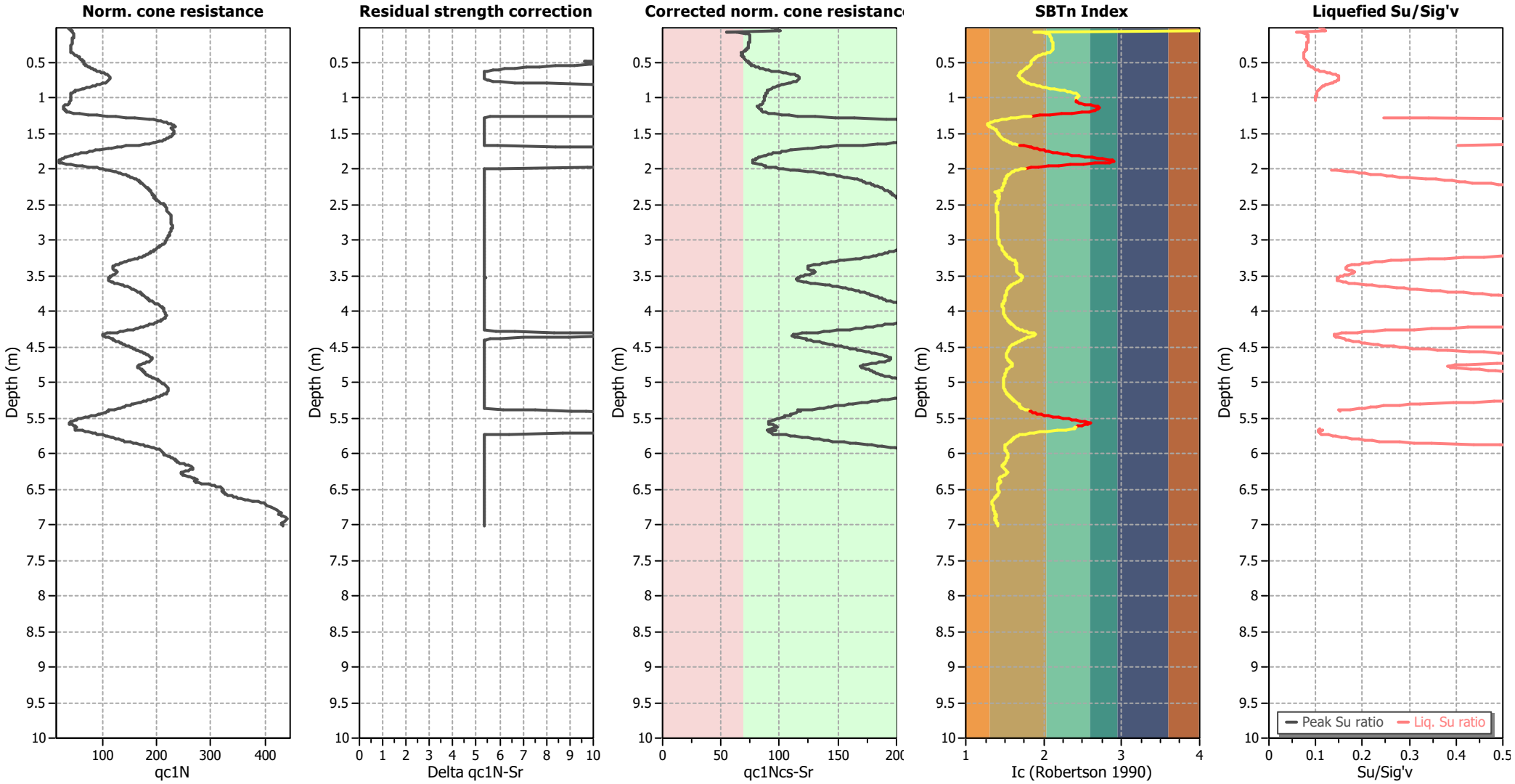




Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

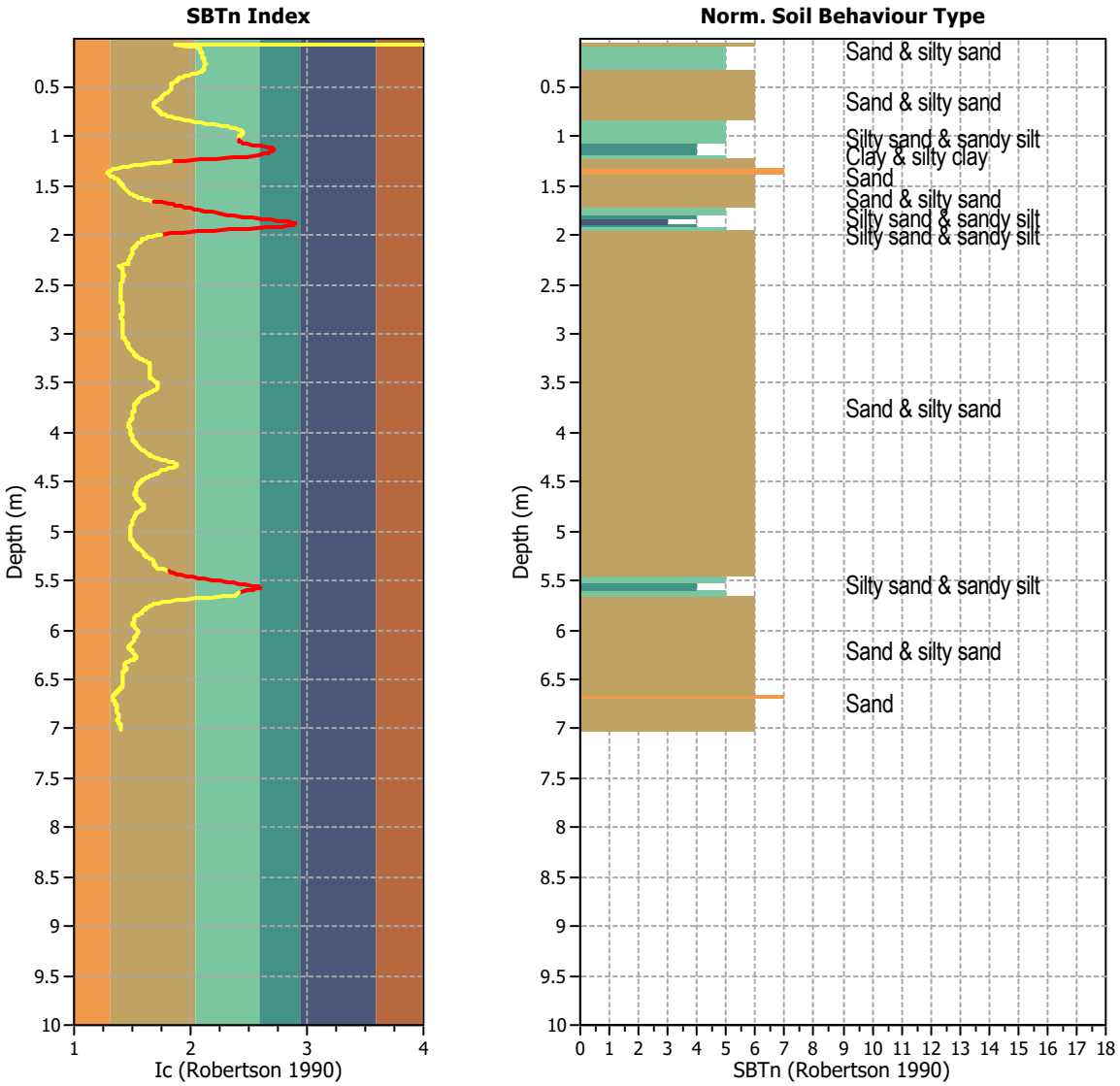
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

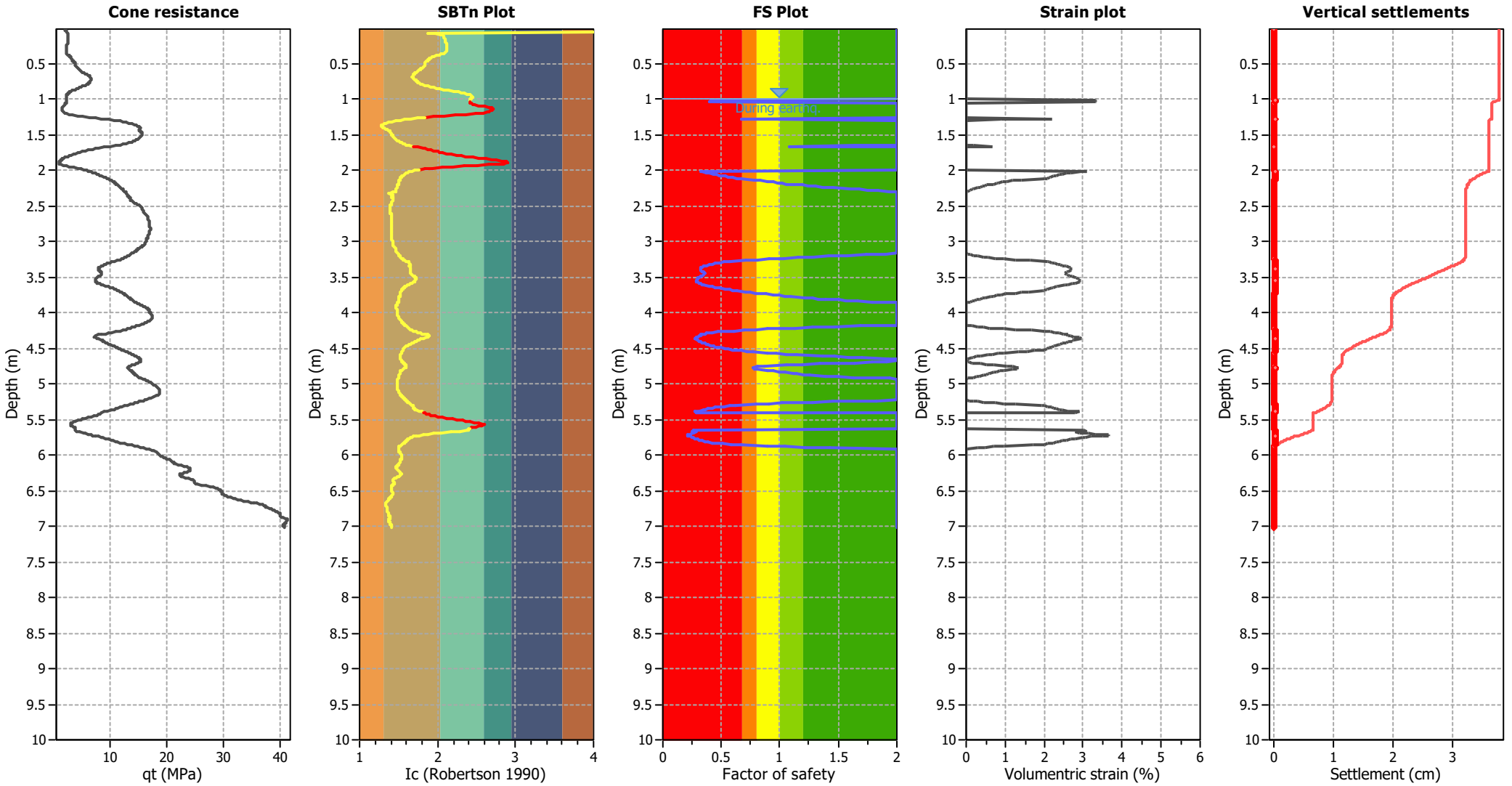
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	701
I_c maximum check value:	3.00	Total points excluded:	81
I_c change ratio value:	0.0100	Exclusion percentage:	11.55%
Minimum number of points in layer:	4	Number of layers detected:	6

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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179 Courtenay Street, New Plymouth
www.btw.nz

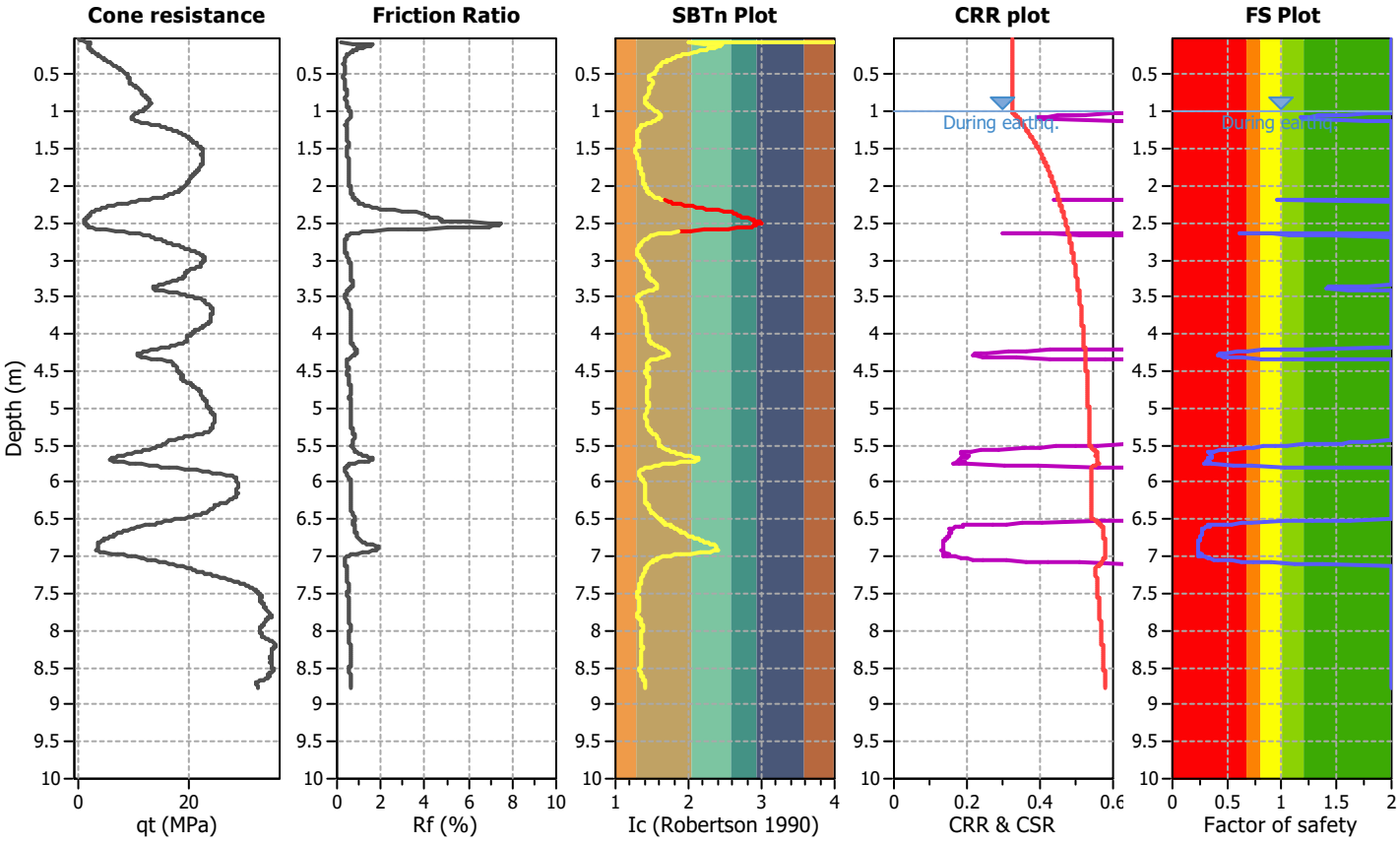
LIQUEFACTION ANALYSIS REPORT

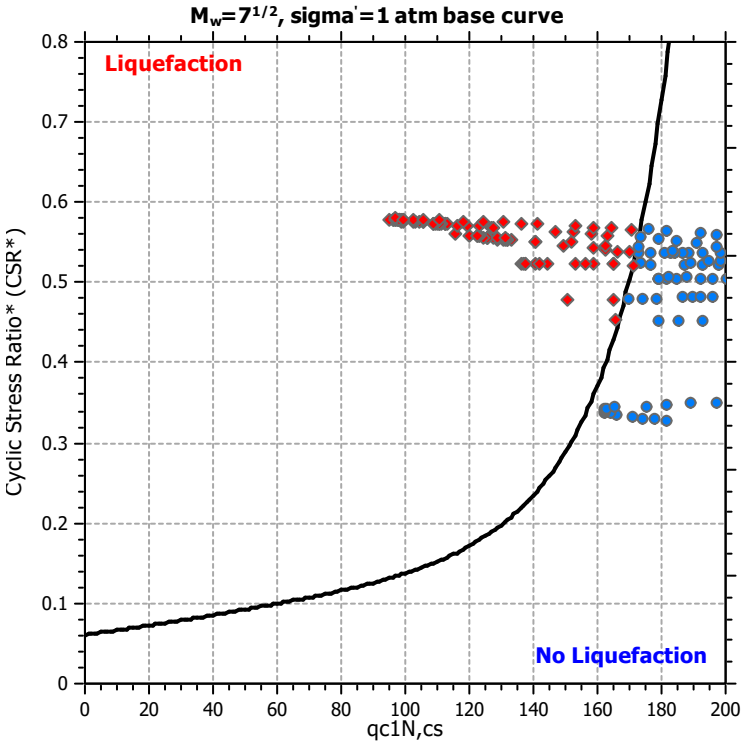
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

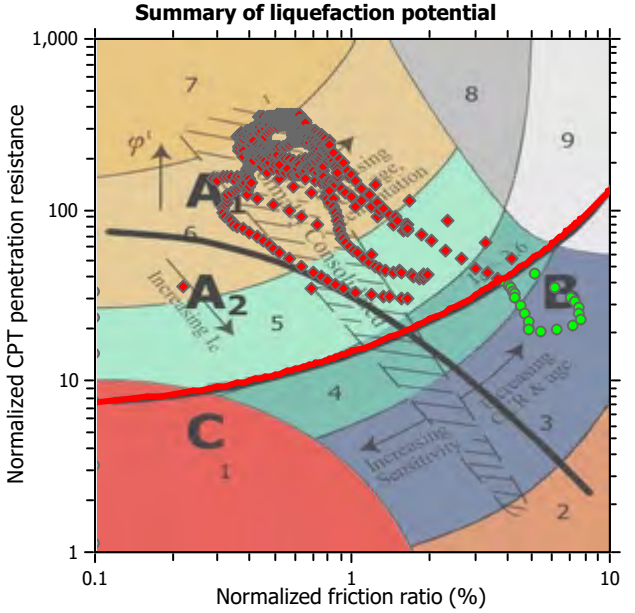
CPT file : CPT08_ULS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

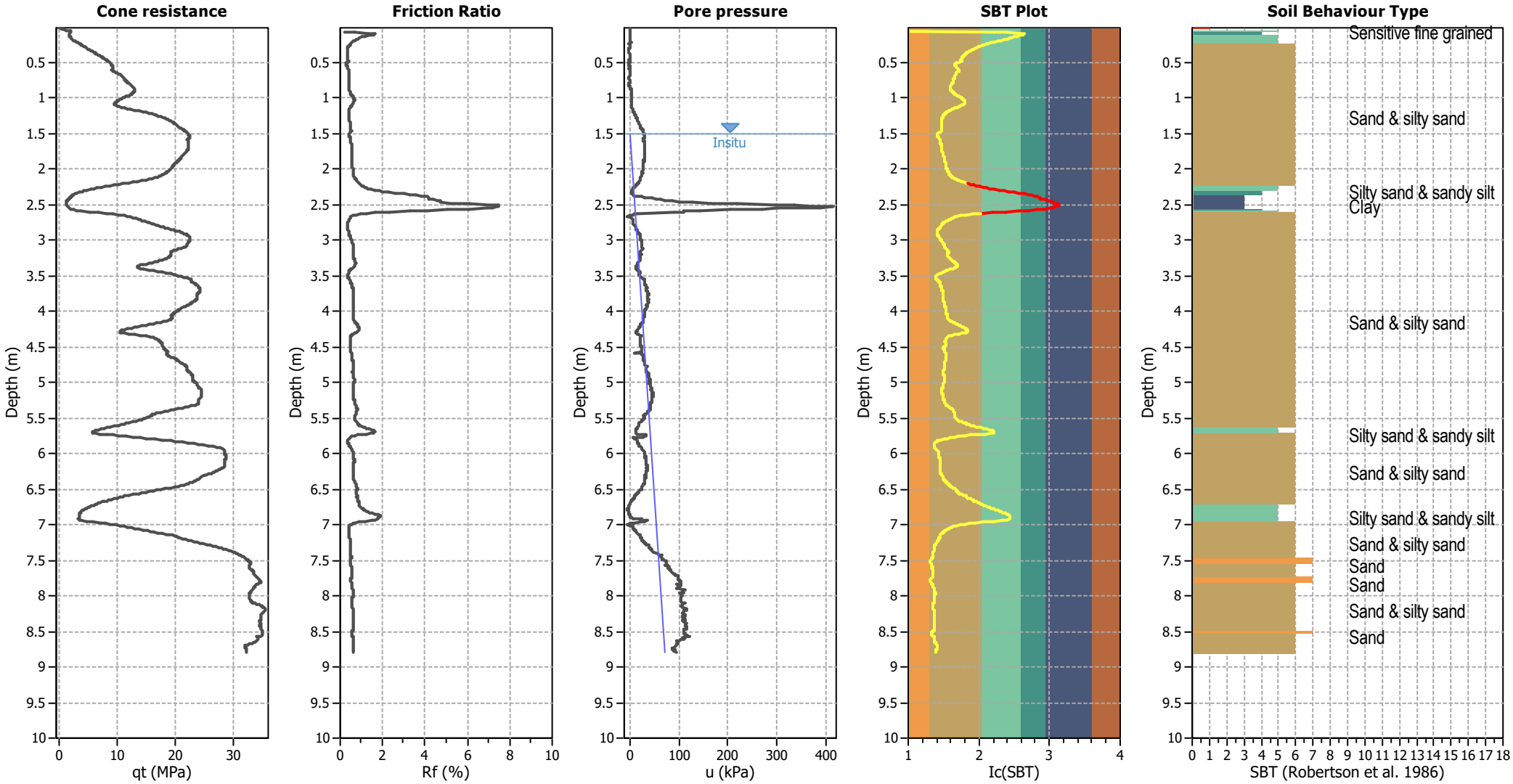






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



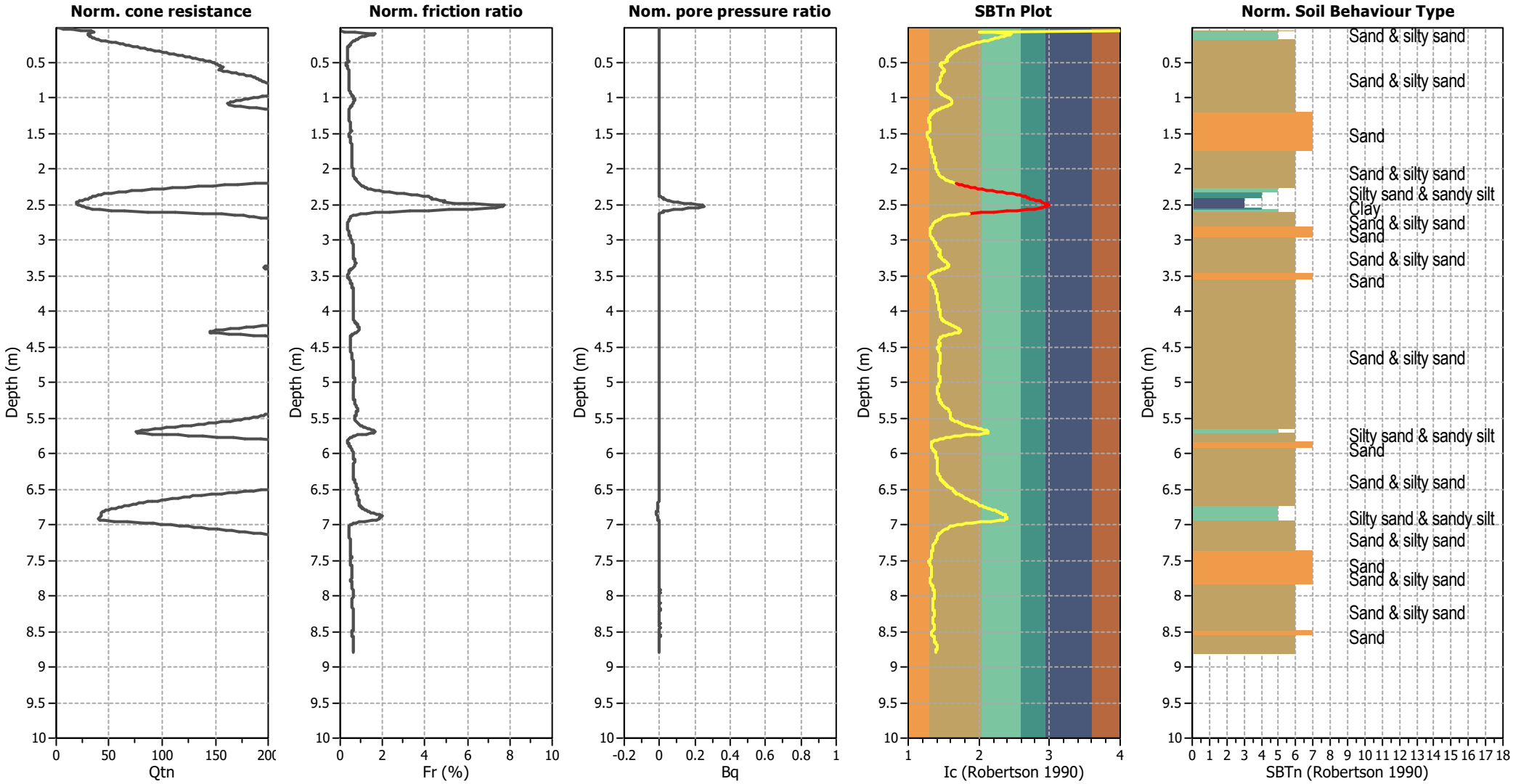
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



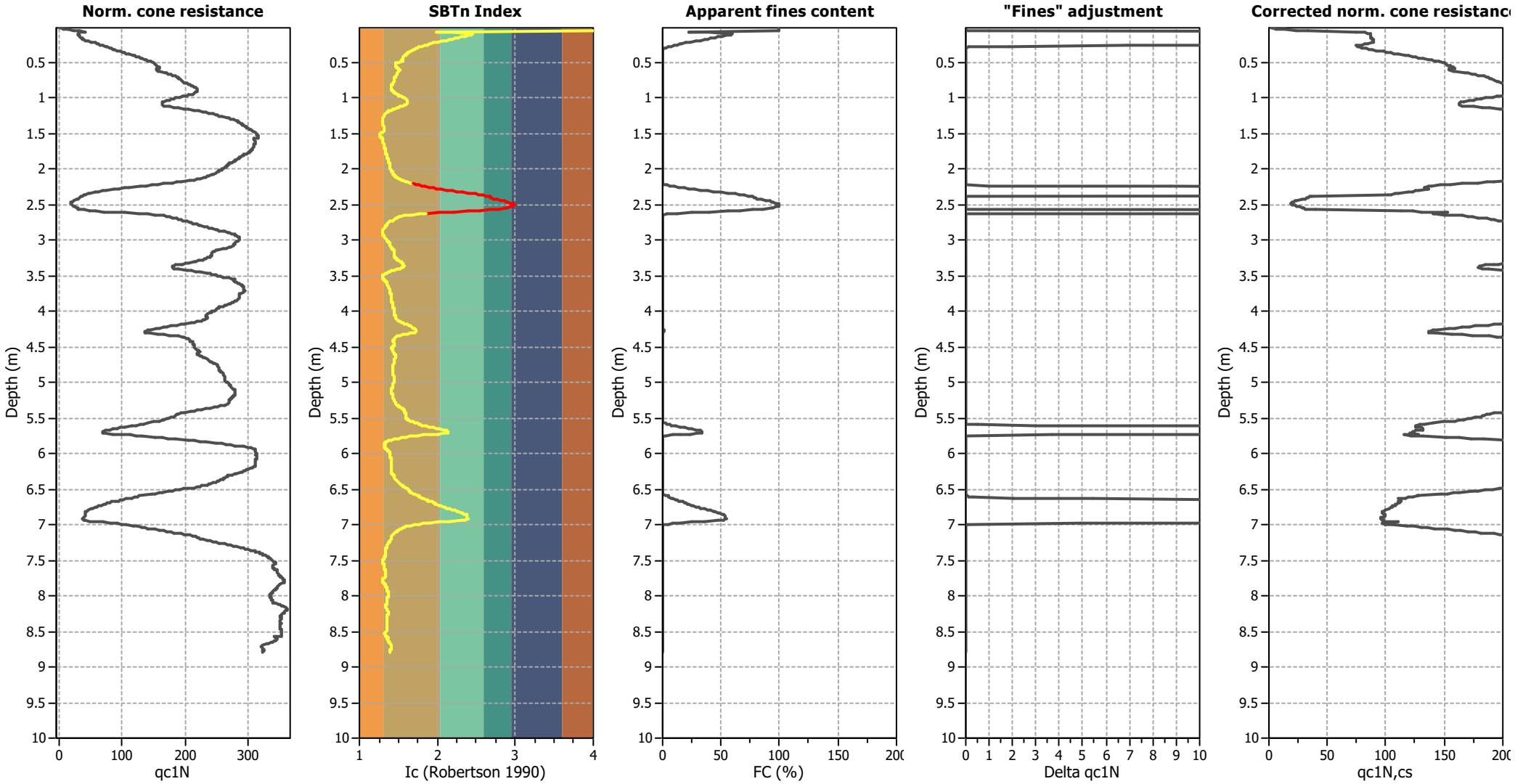
Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

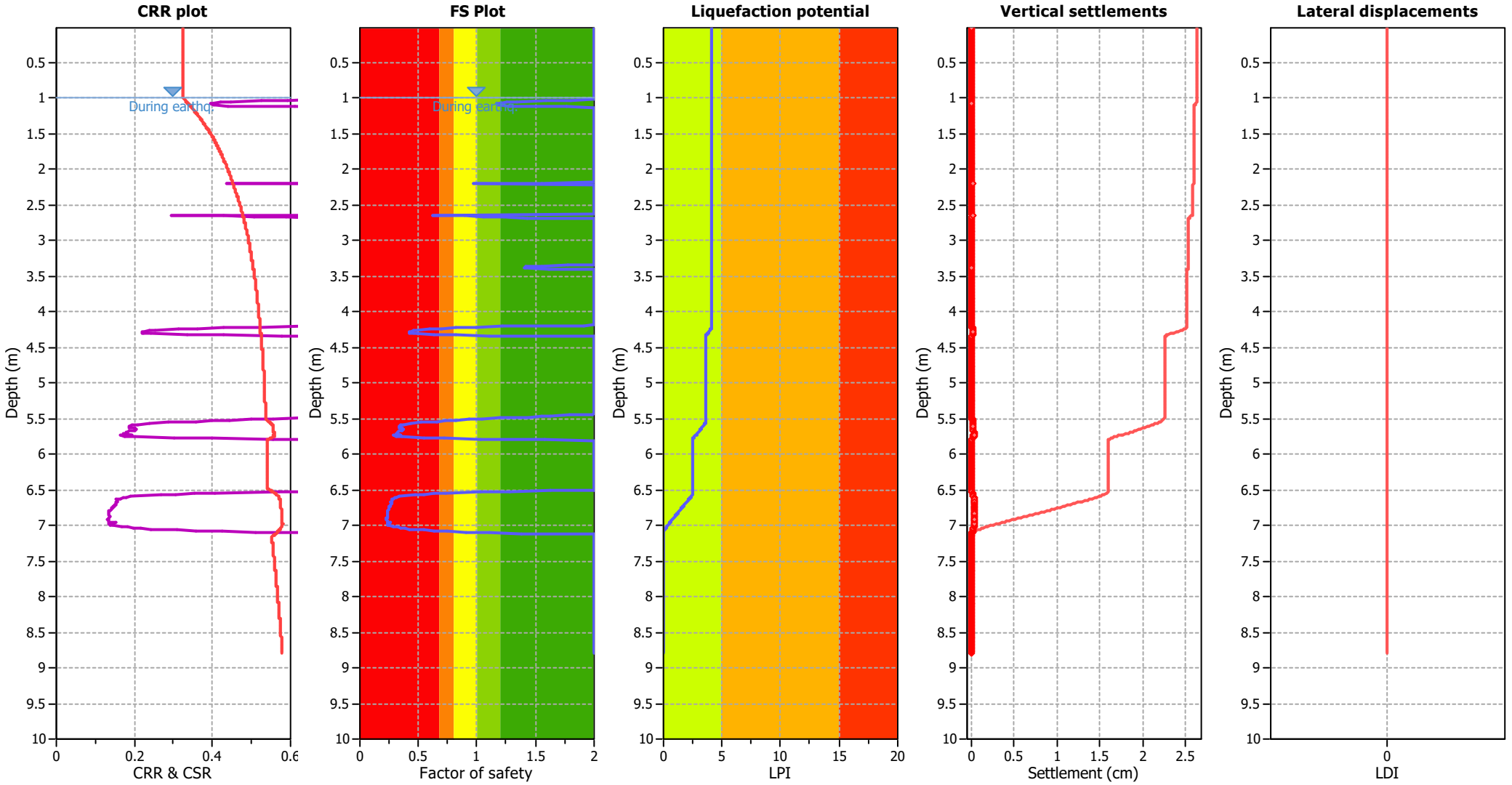
Liquefaction analysis overall plots (intermediate results)



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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

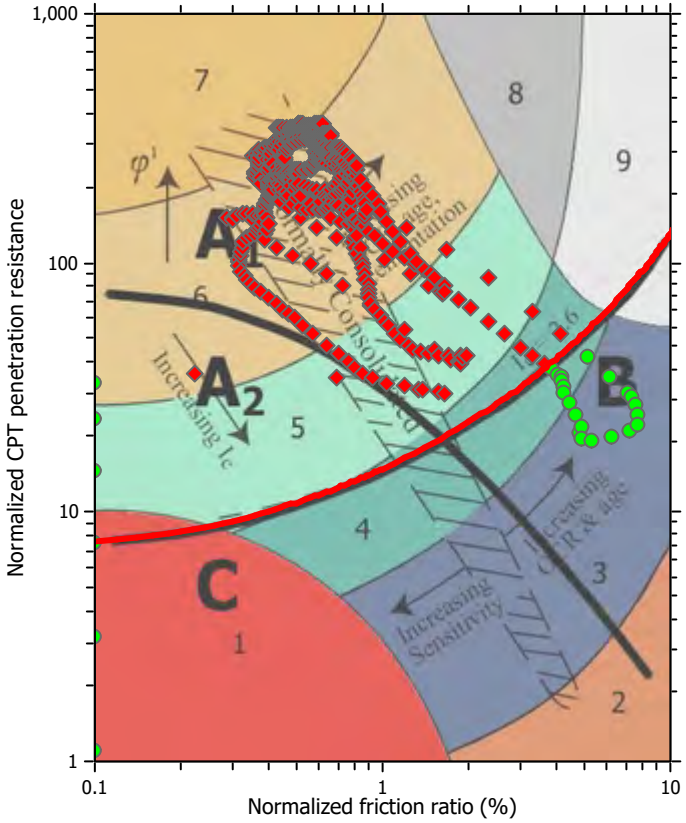
F.S. color scheme

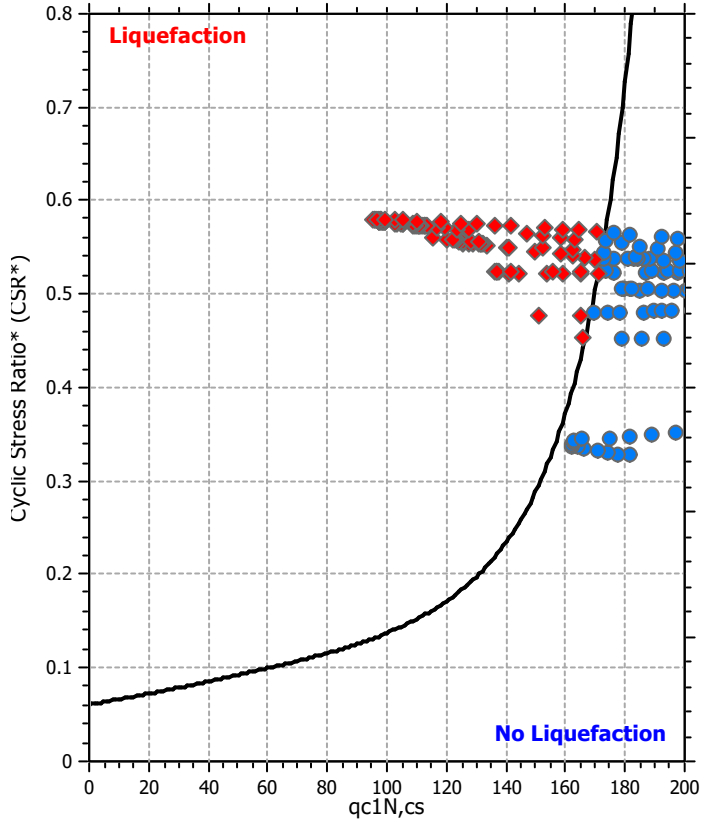
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

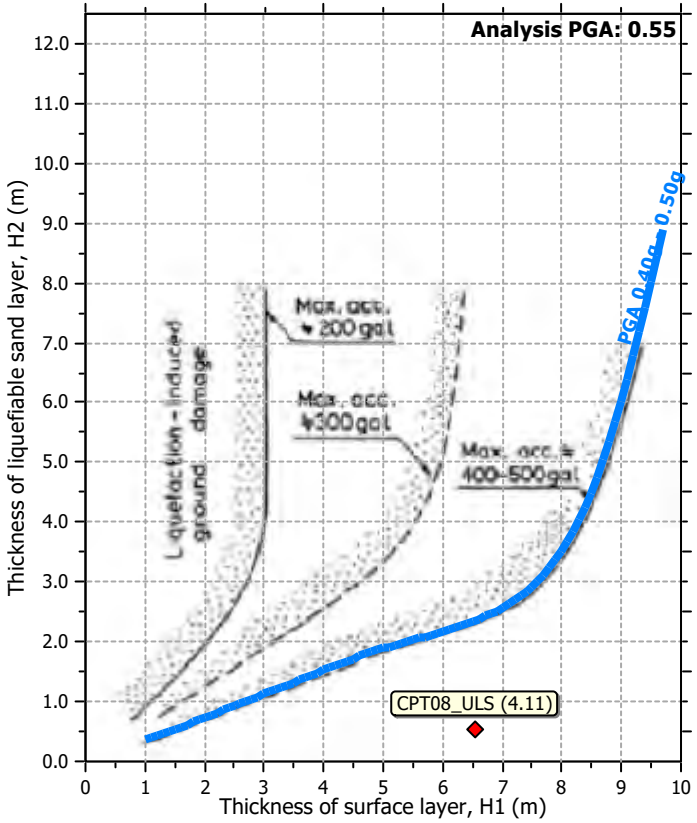
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



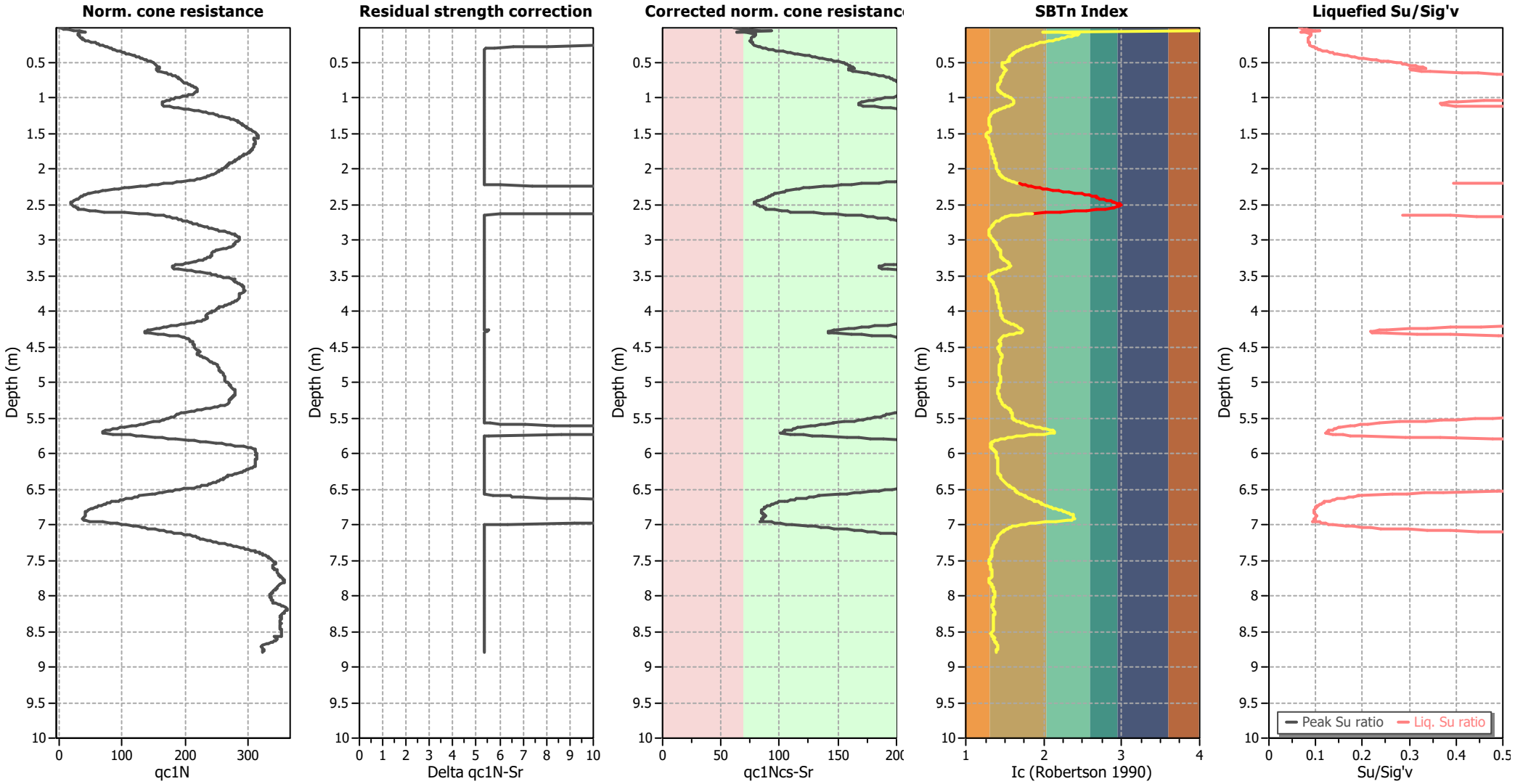




Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

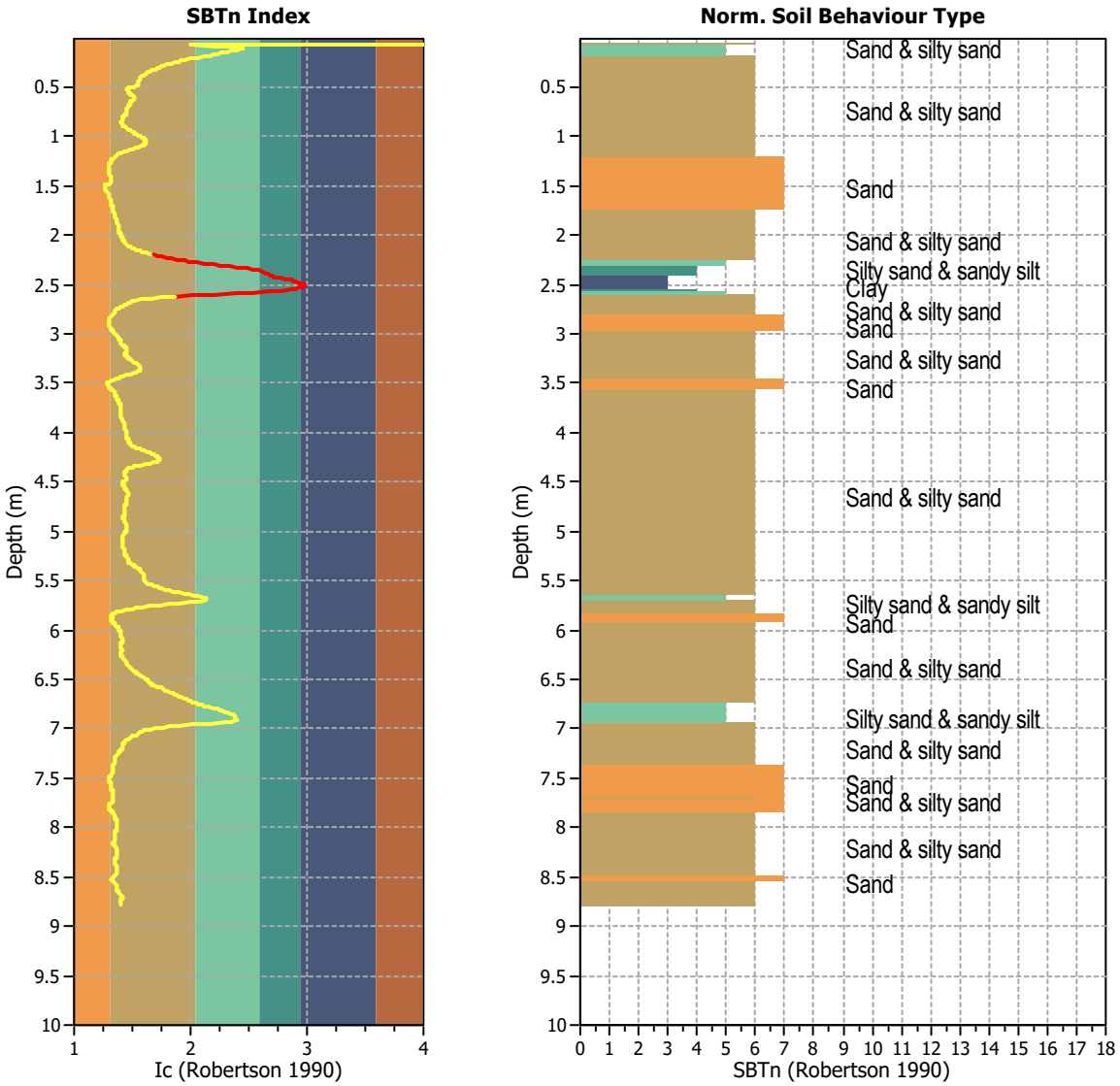
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

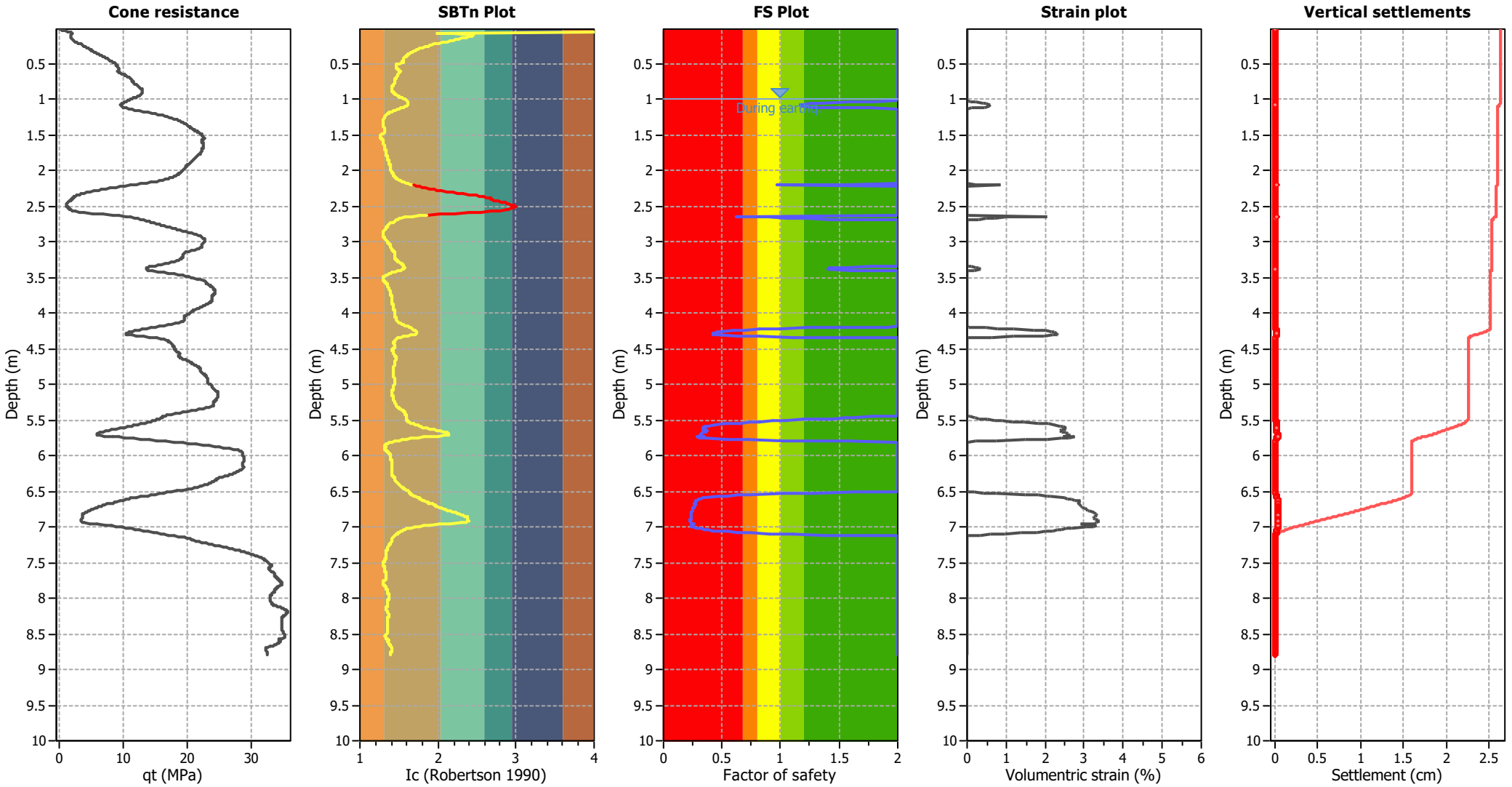
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	879
I_c maximum check value:	3.00	Total points excluded:	43
I_c change ratio value:	0.0100	Exclusion percentage:	4.89%
Minimum number of points in layer:	4	Number of layers detected:	2

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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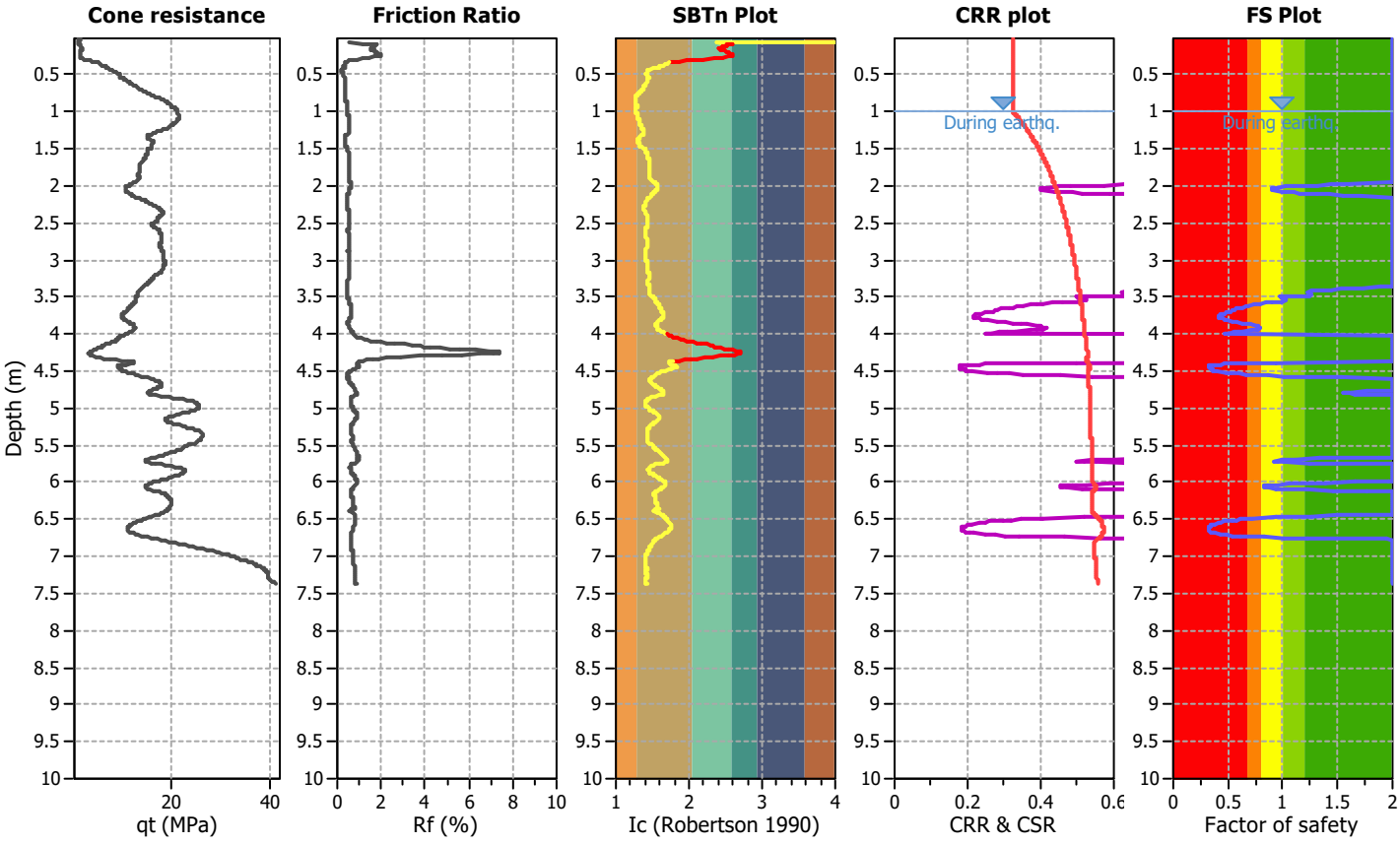
LIQUEFACTION ANALYSIS REPORT

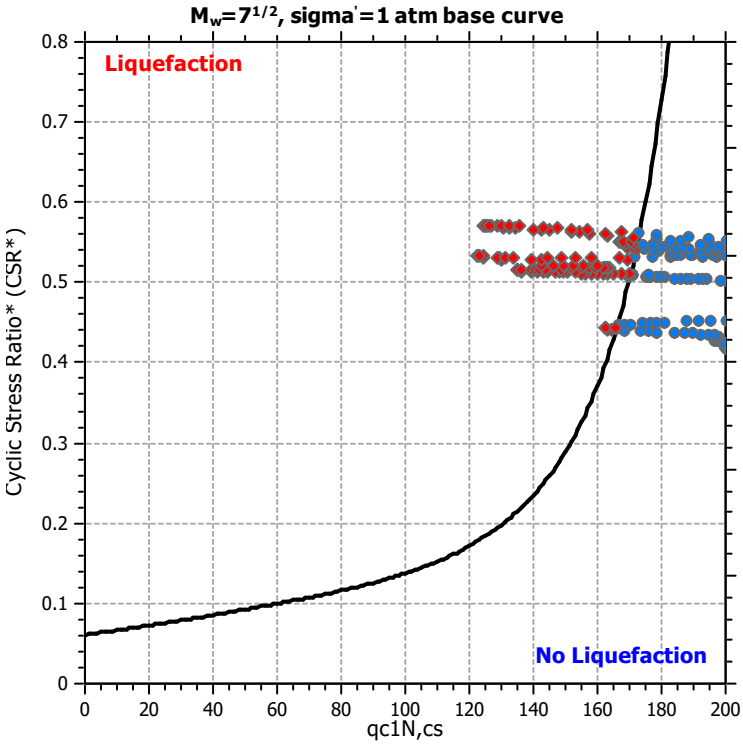
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

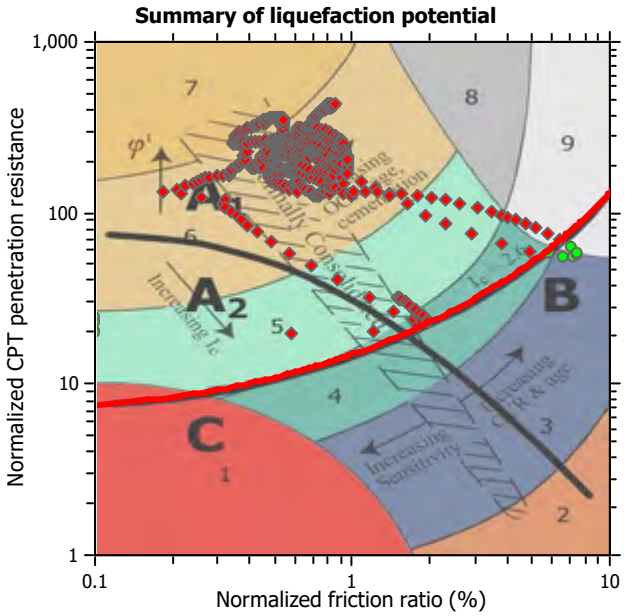
CPT file : CPT09_ULS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

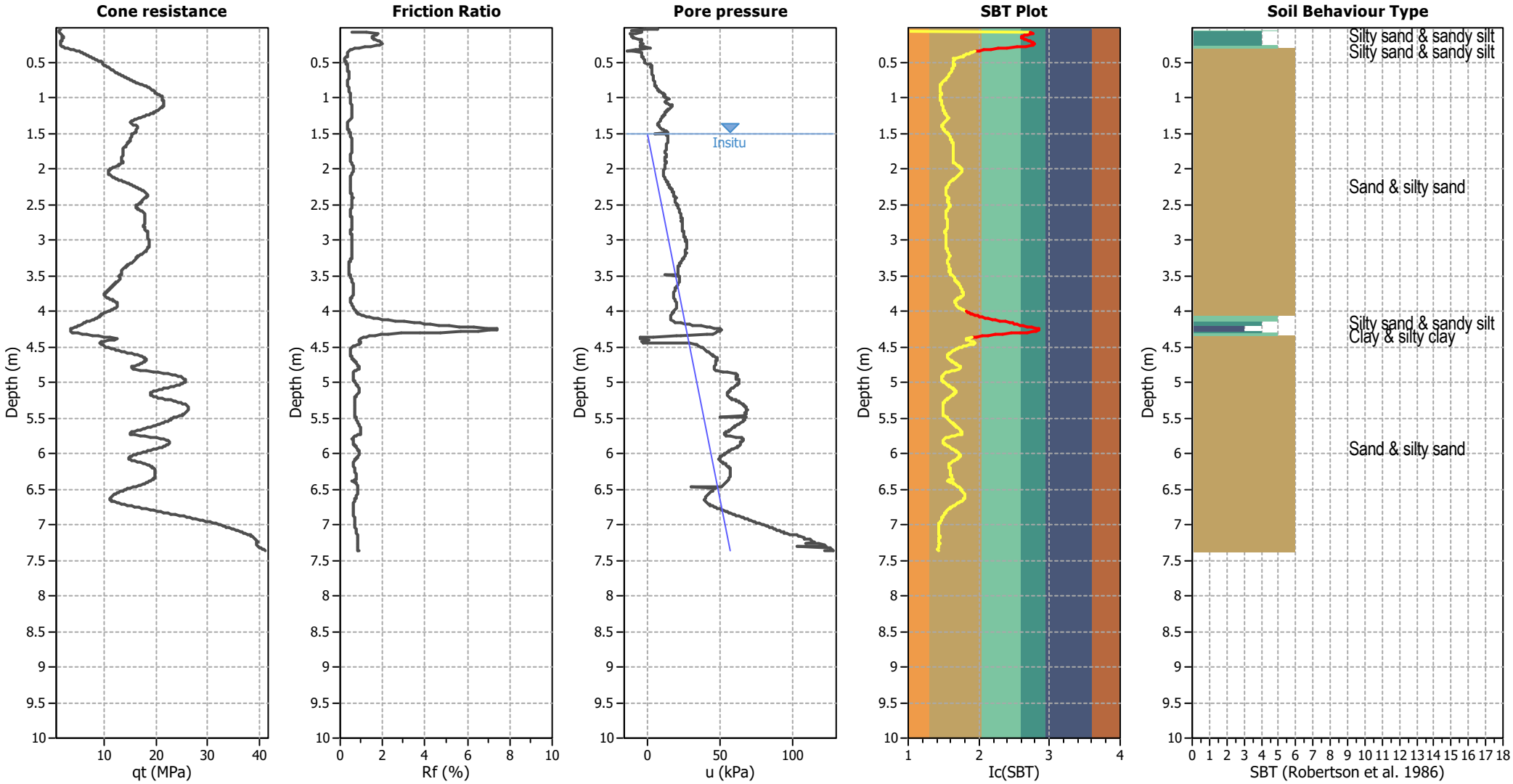






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



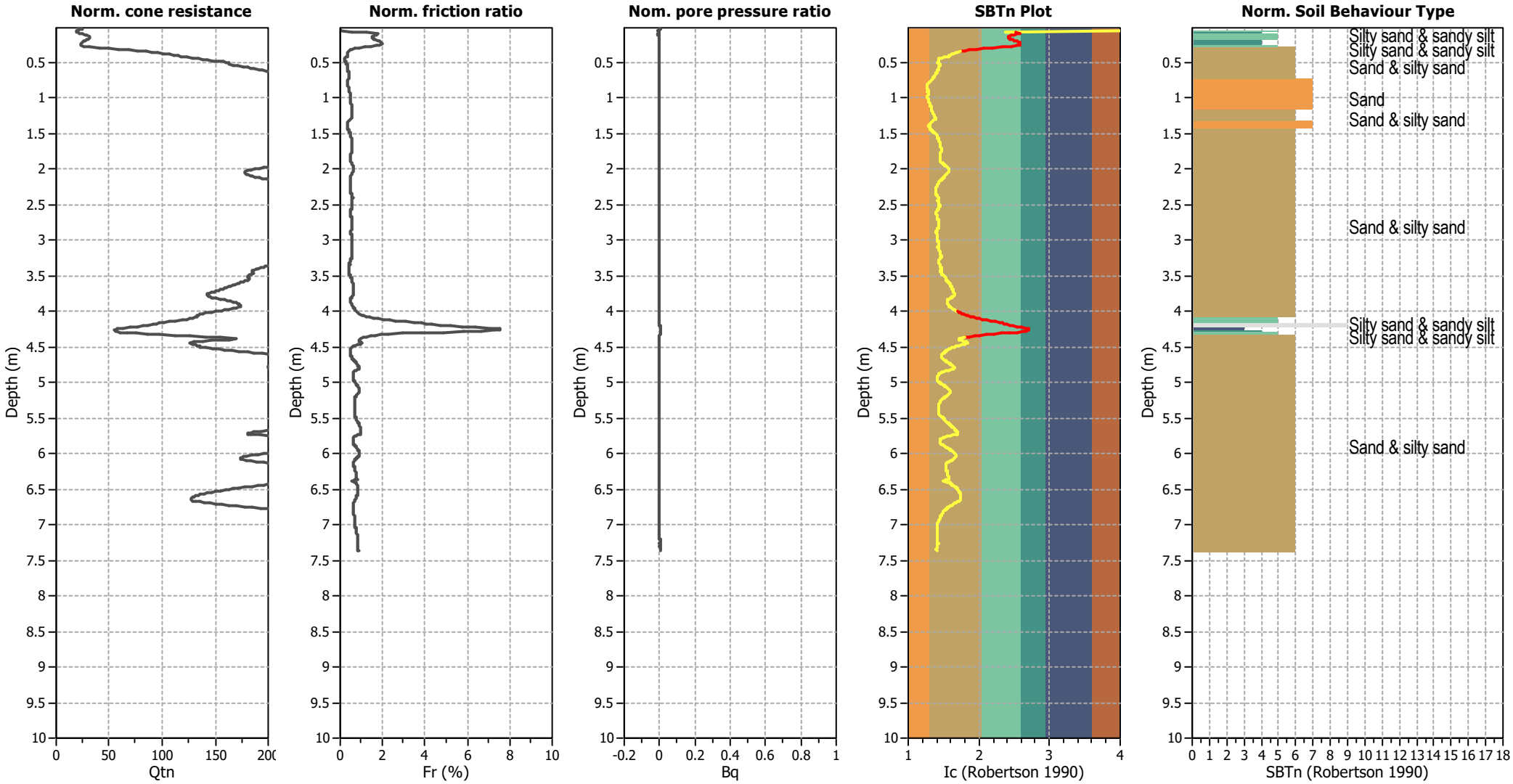
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



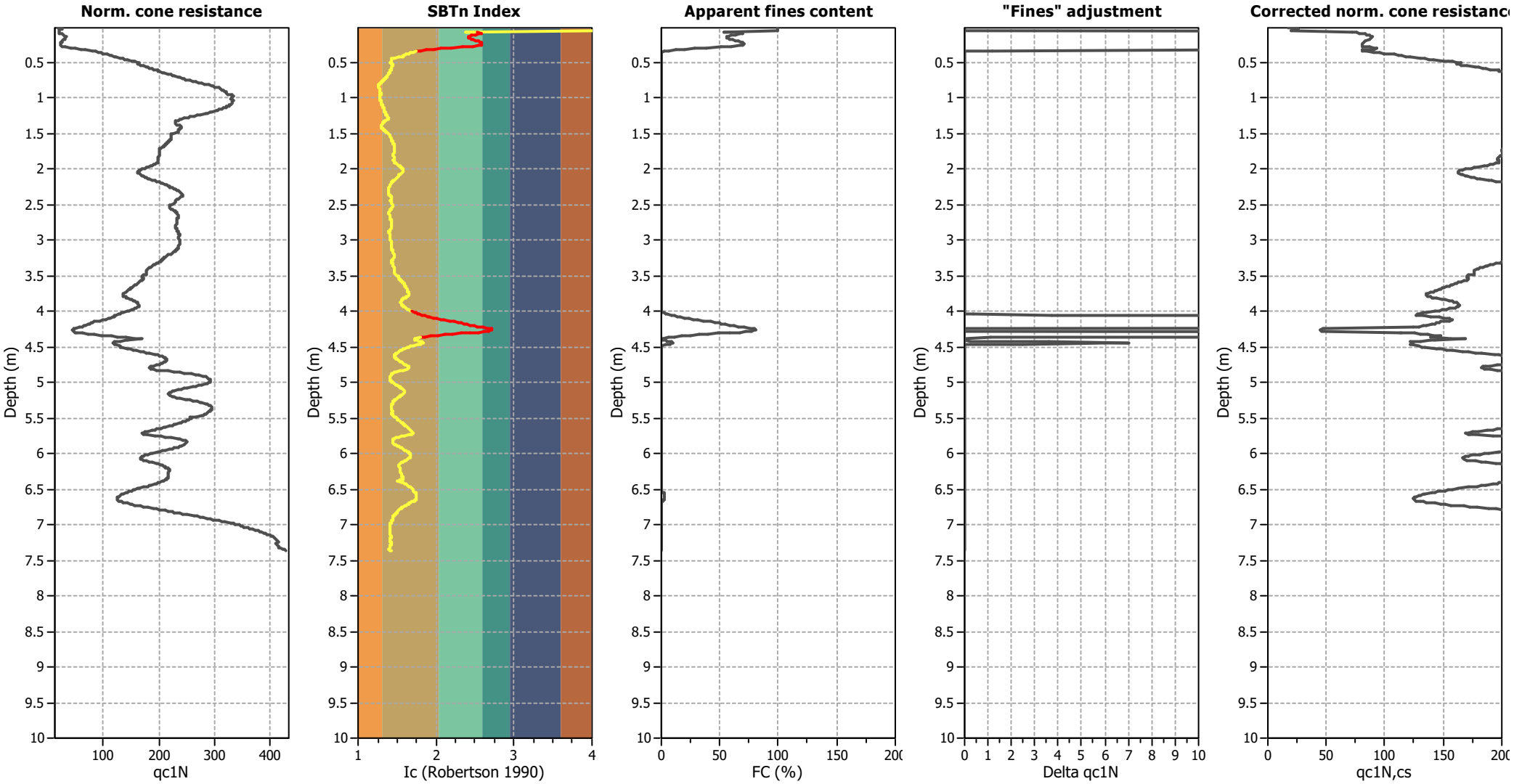
Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

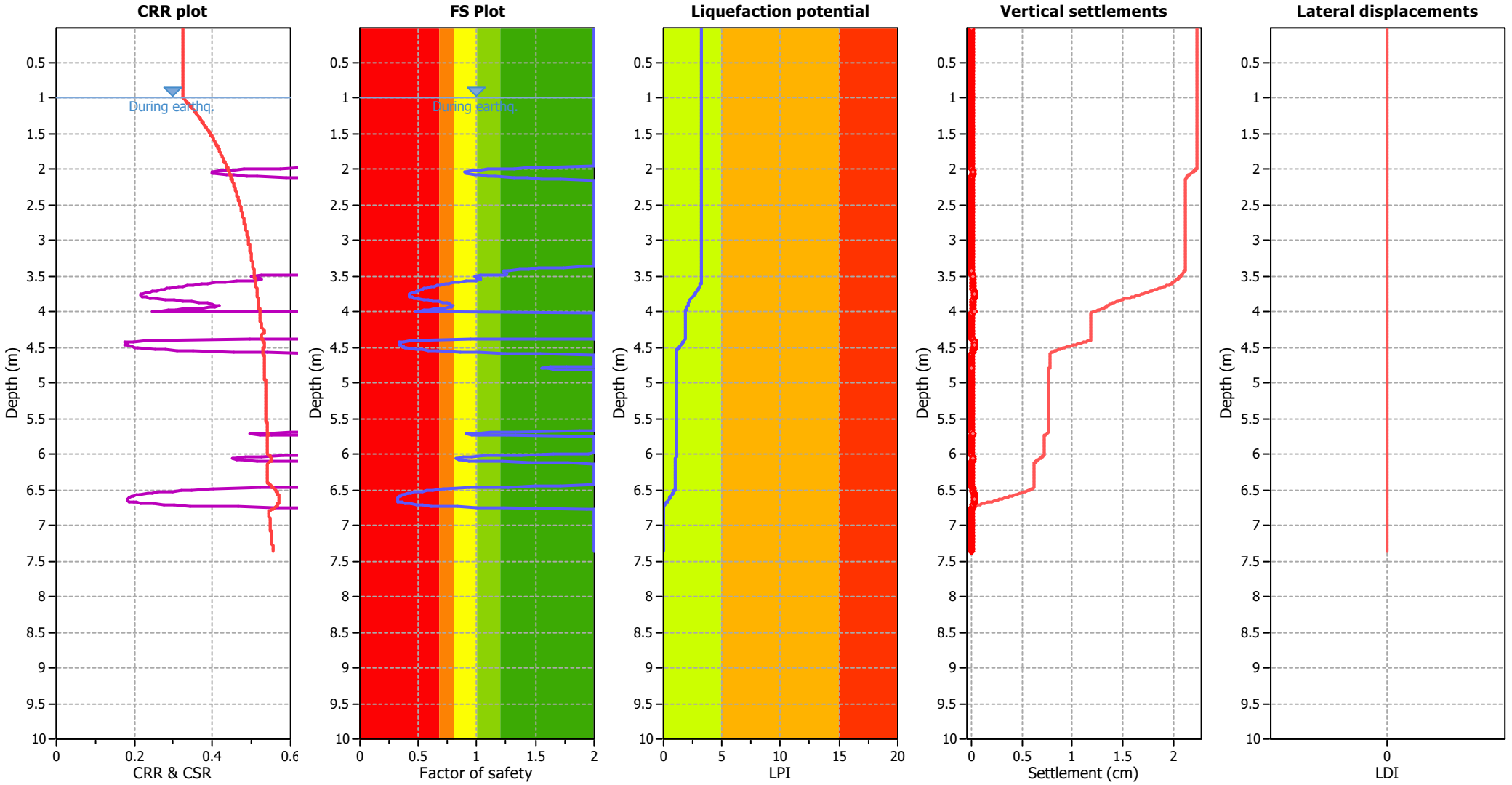
Liquefaction analysis overall plots (intermediate results)



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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

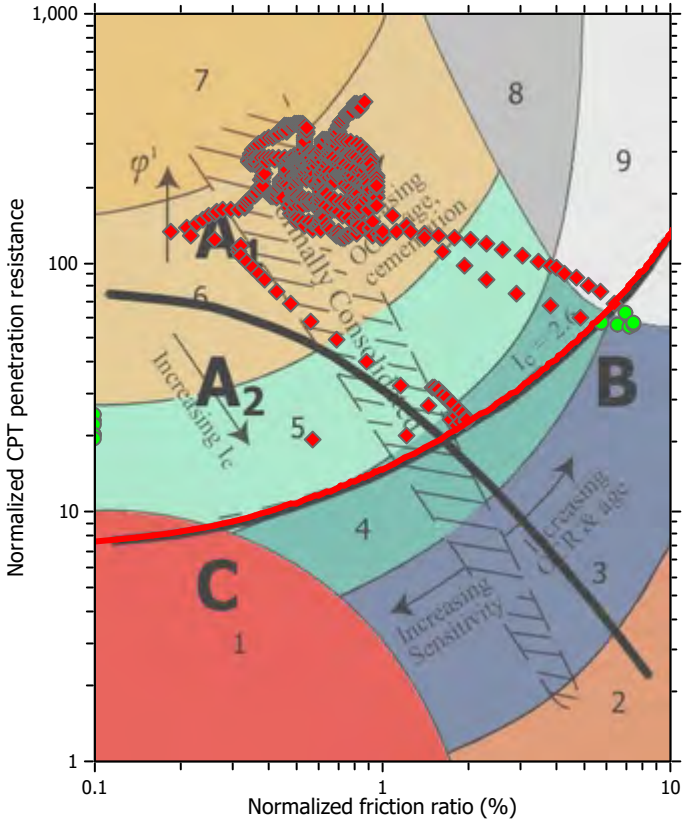
F.S. color scheme

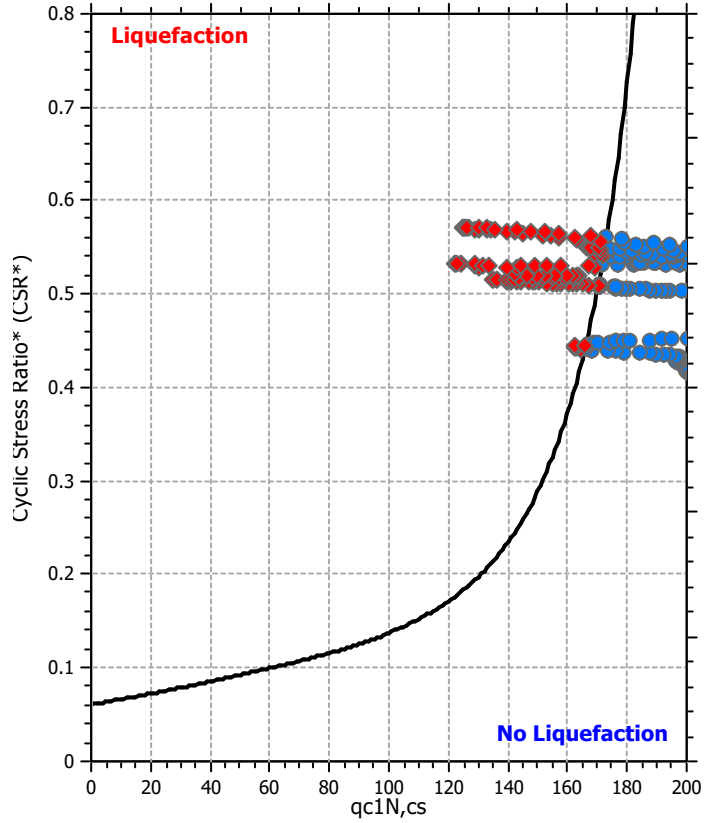
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

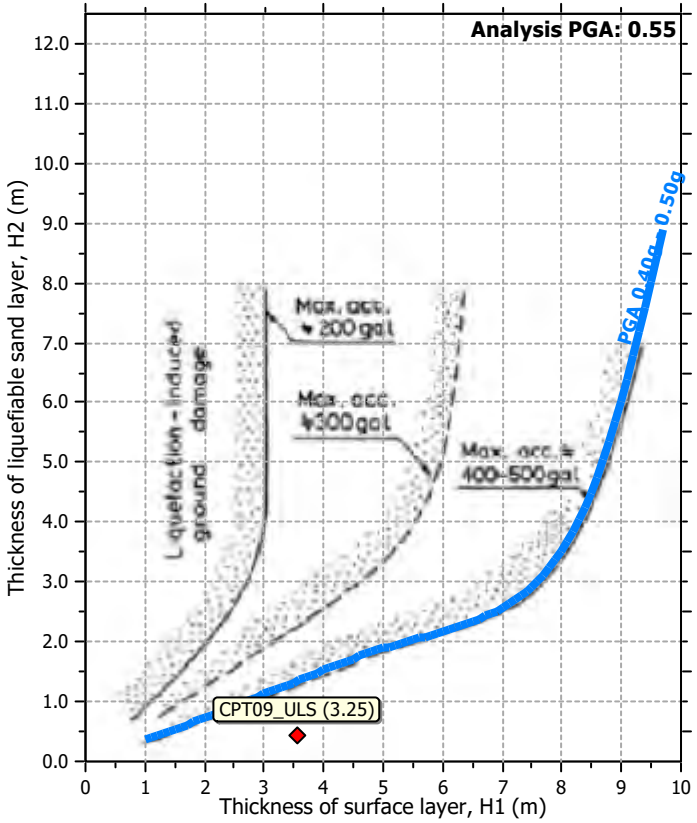
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



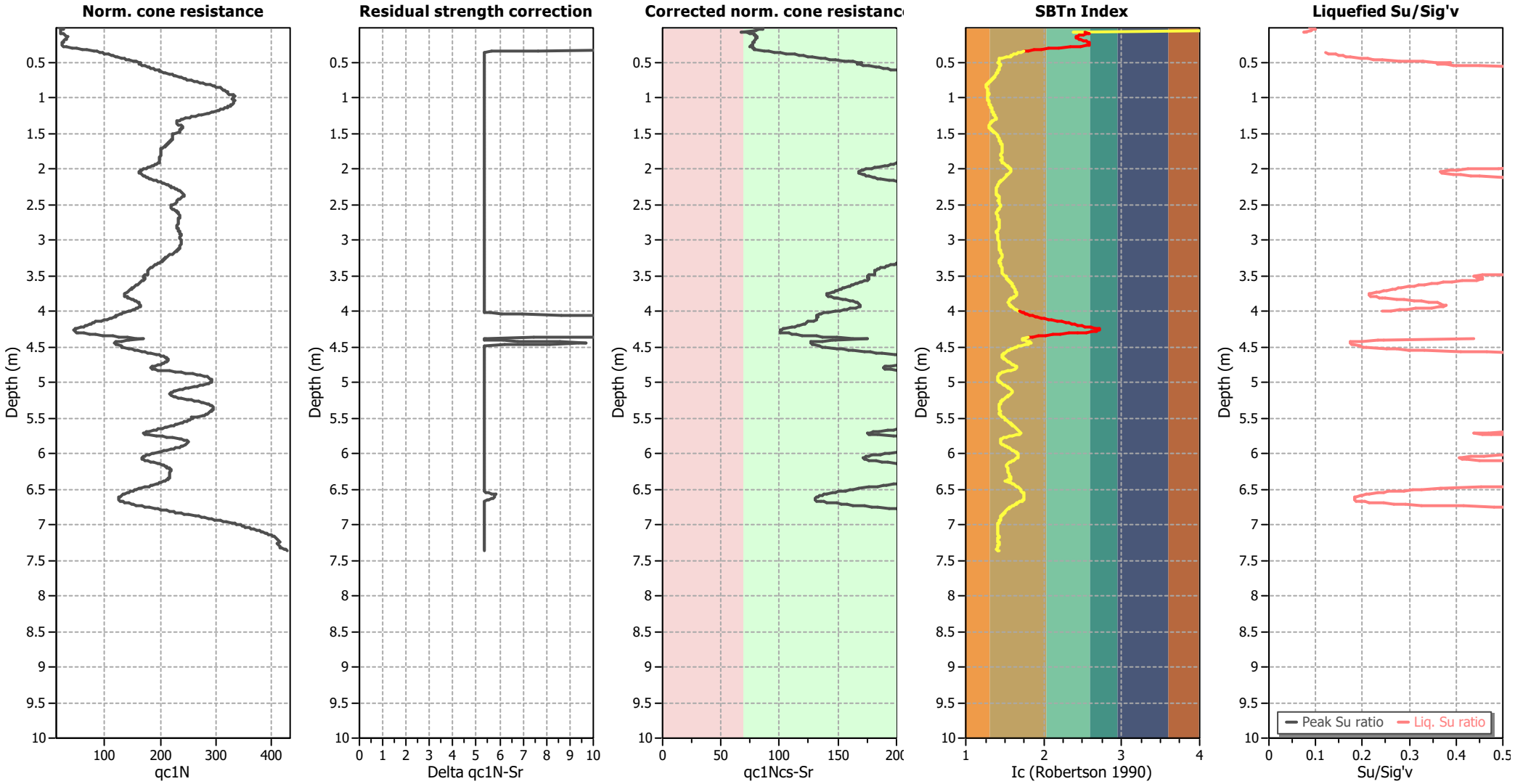




Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

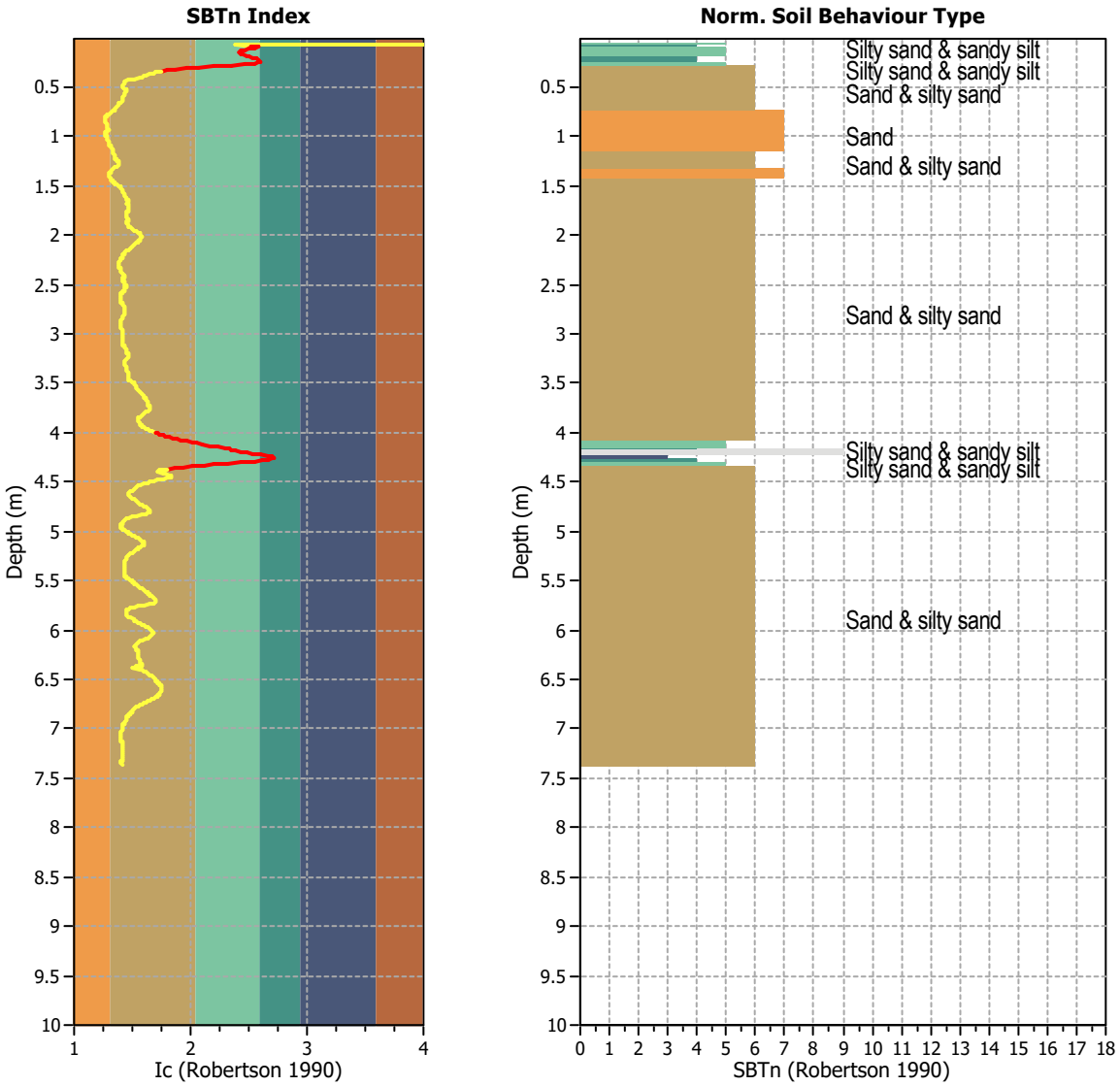
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

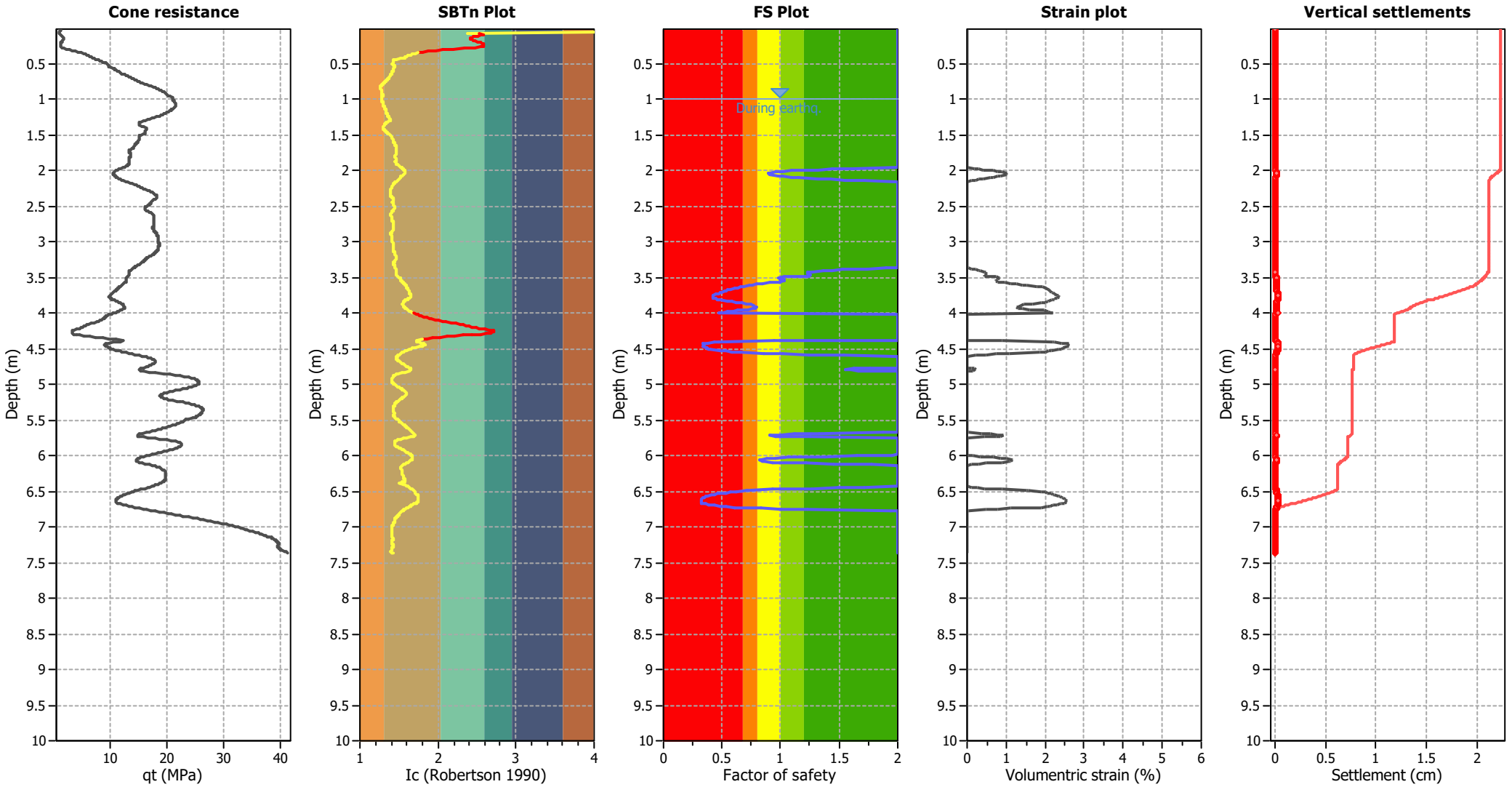
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	737
I_c maximum check value:	3.00	Total points excluded:	65
I_c change ratio value:	0.0100	Exclusion percentage:	8.82%
Minimum number of points in layer:	4	Number of layers detected:	5

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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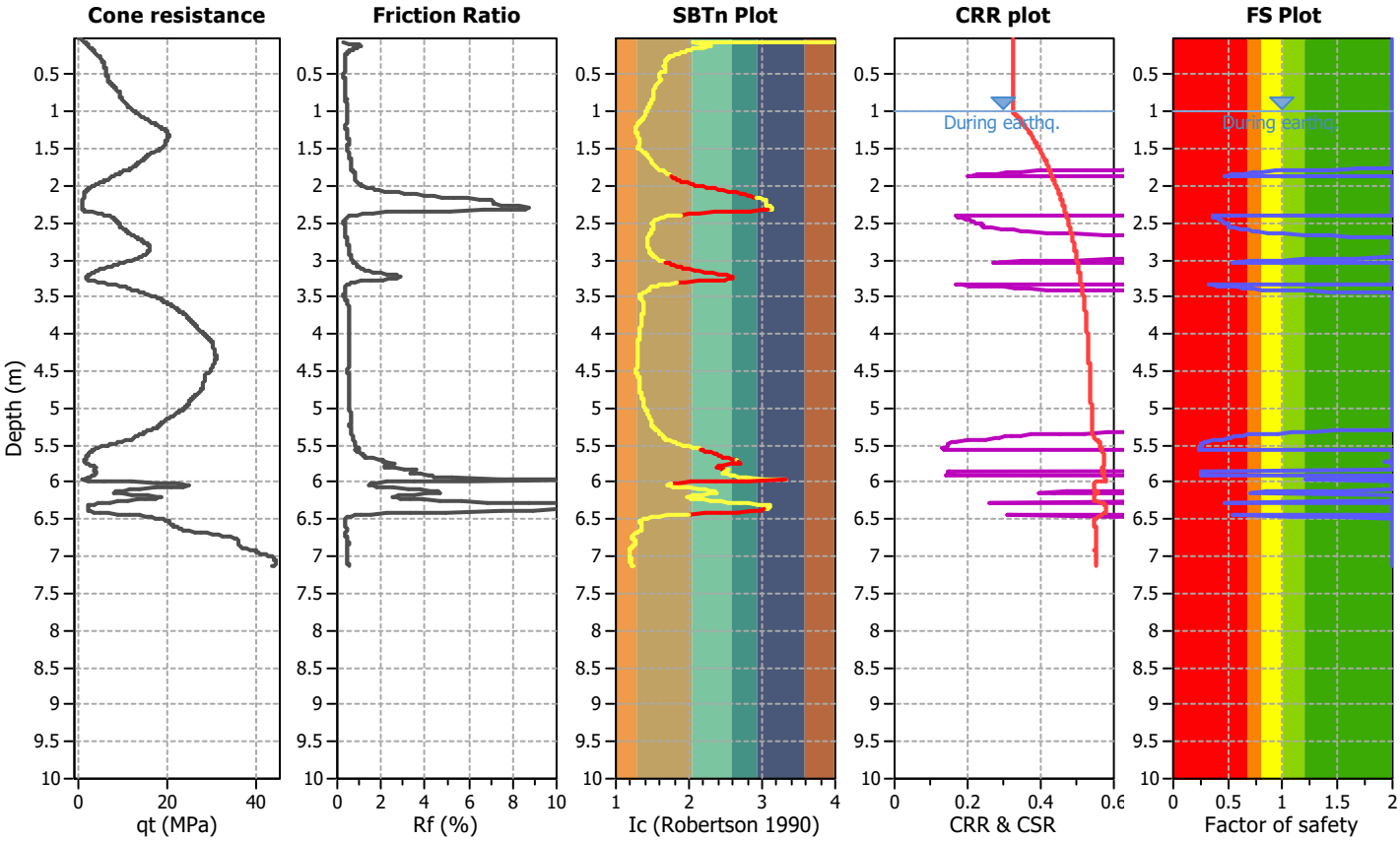
LIQUEFACTION ANALYSIS REPORT

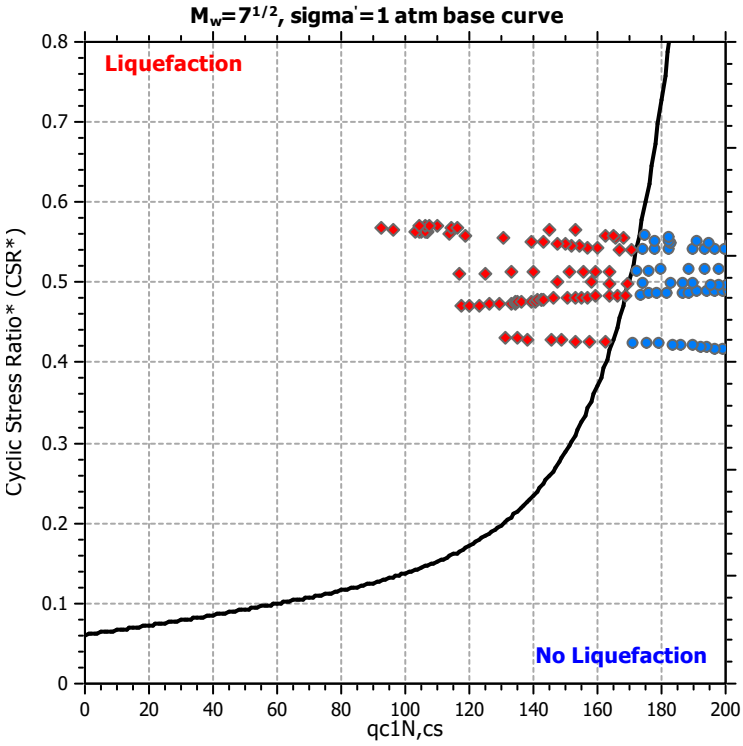
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

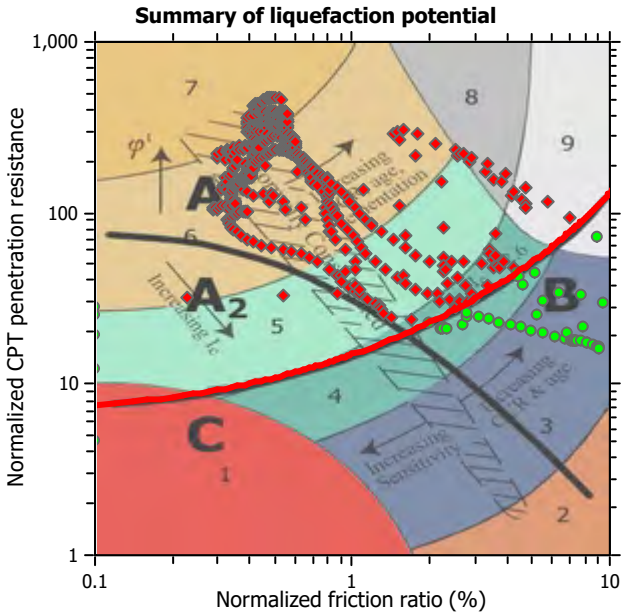
CPT file : CPT10_ULS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

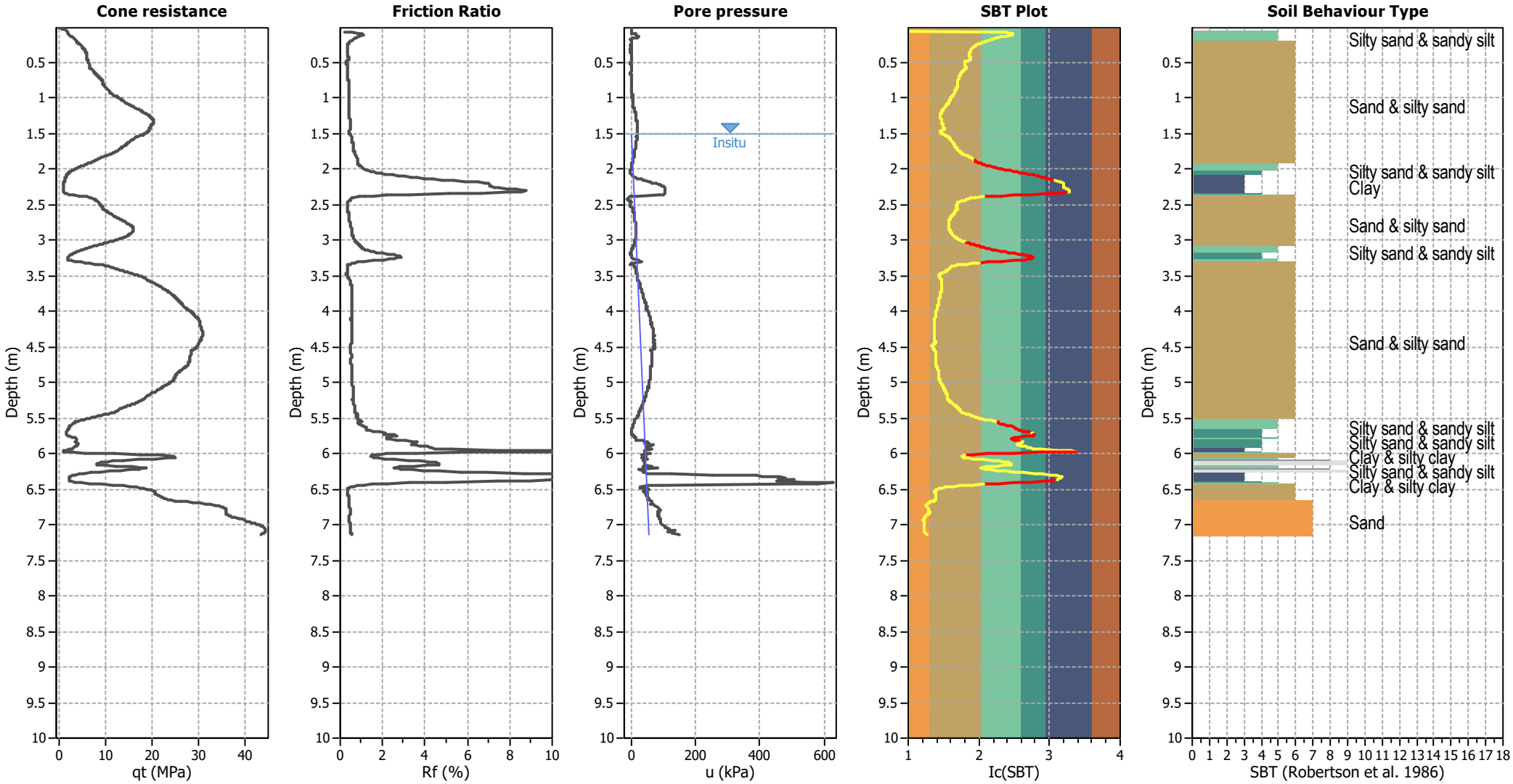






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



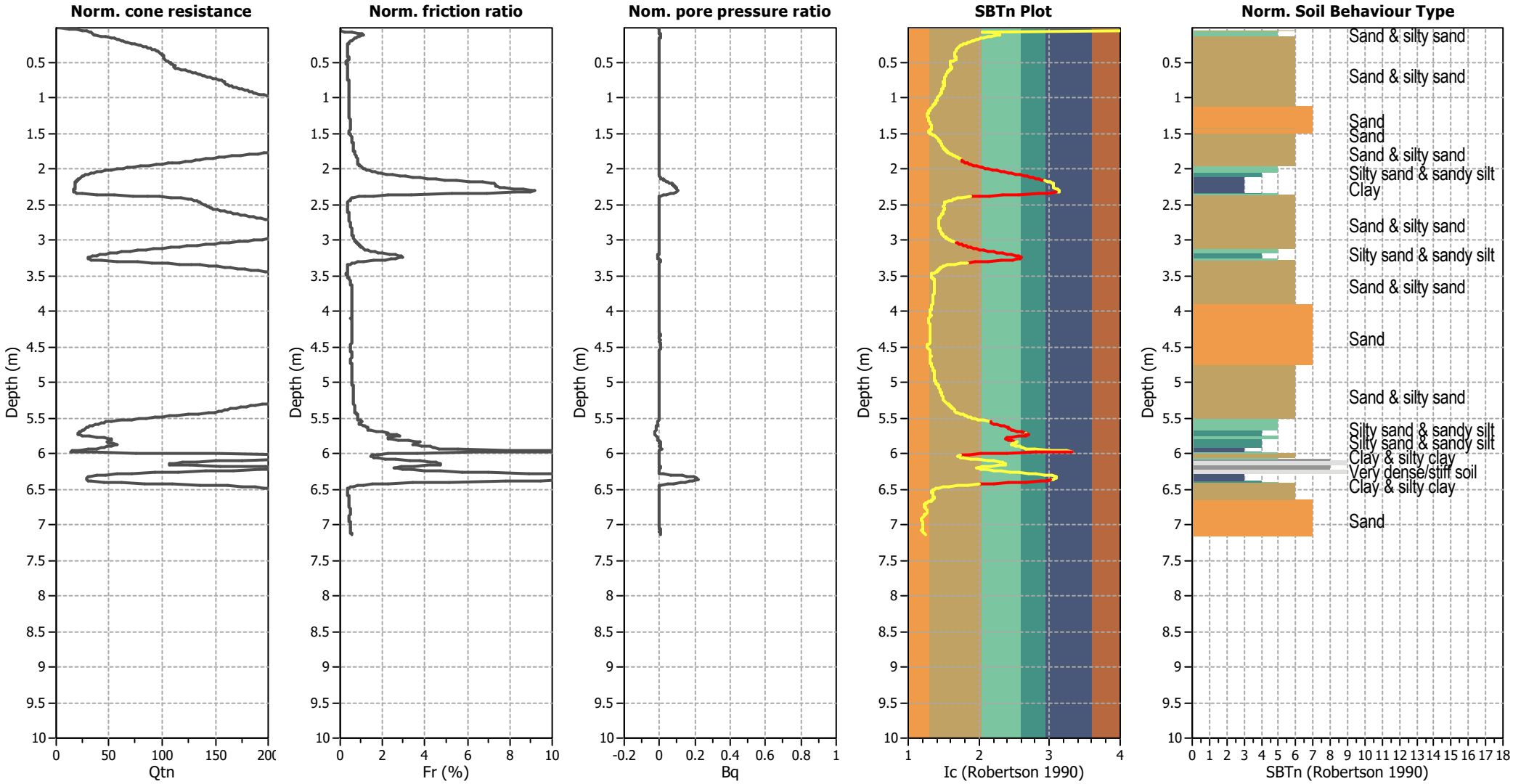
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



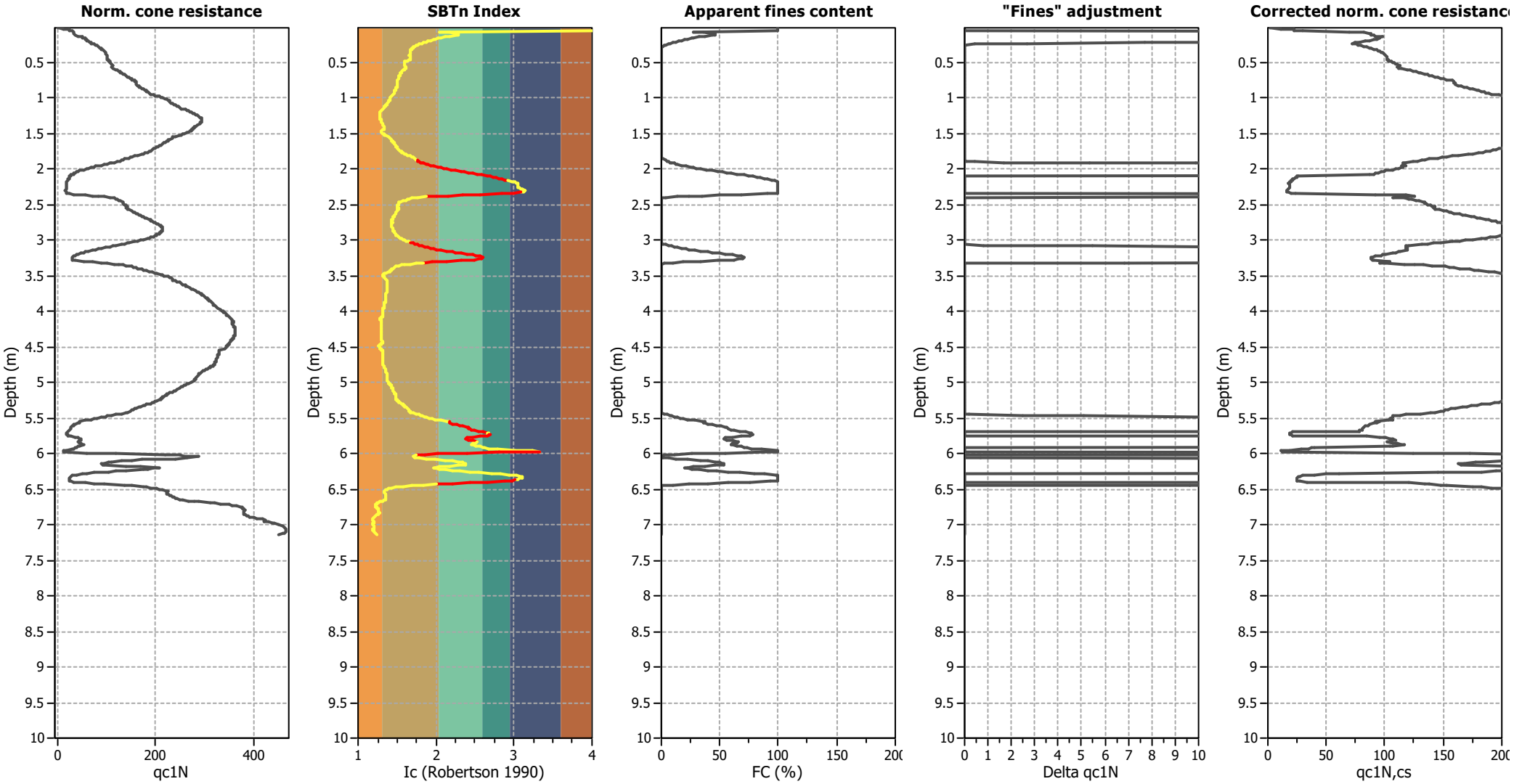
Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

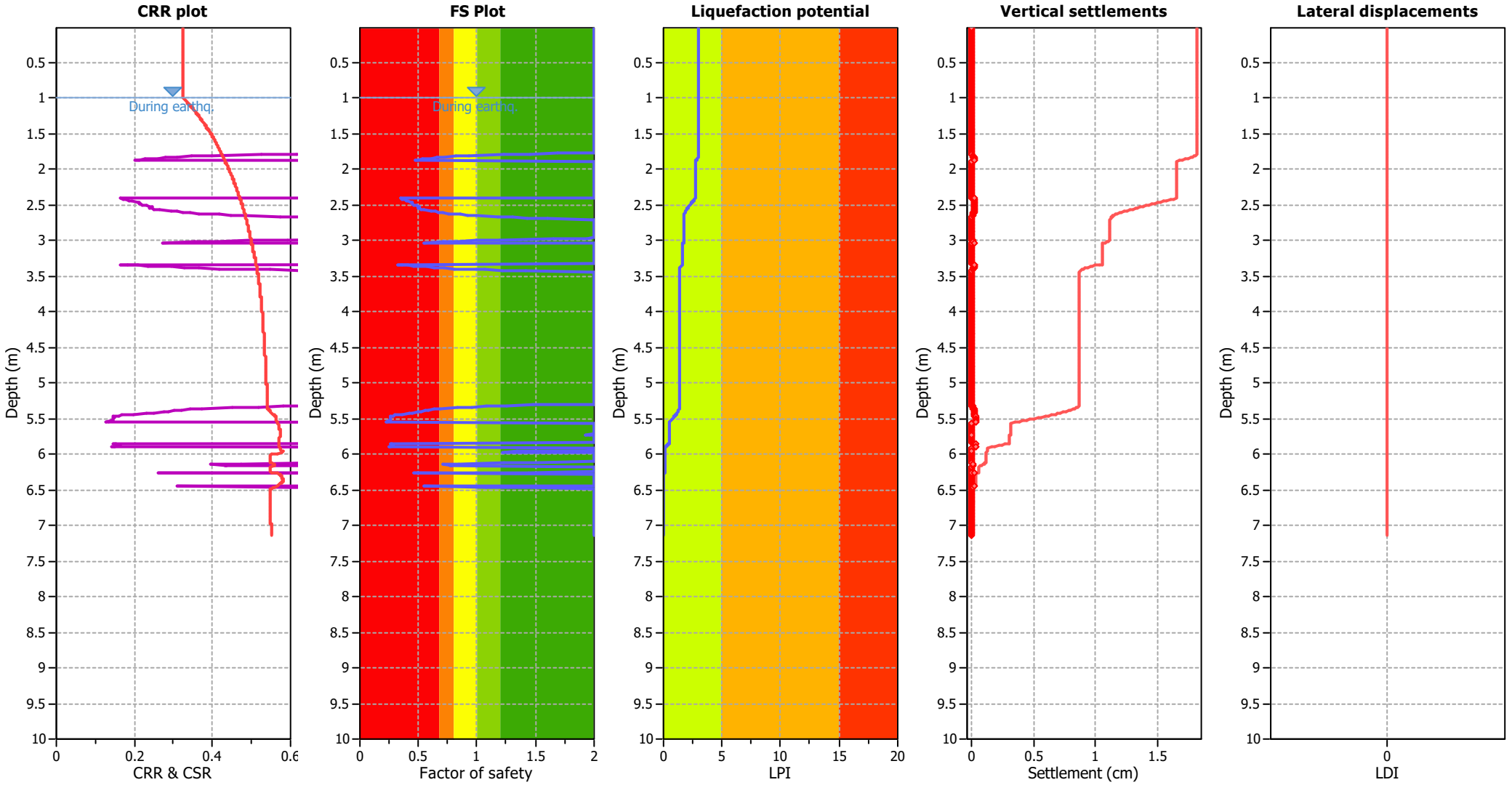
Liquefaction analysis overall plots (intermediate results)



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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

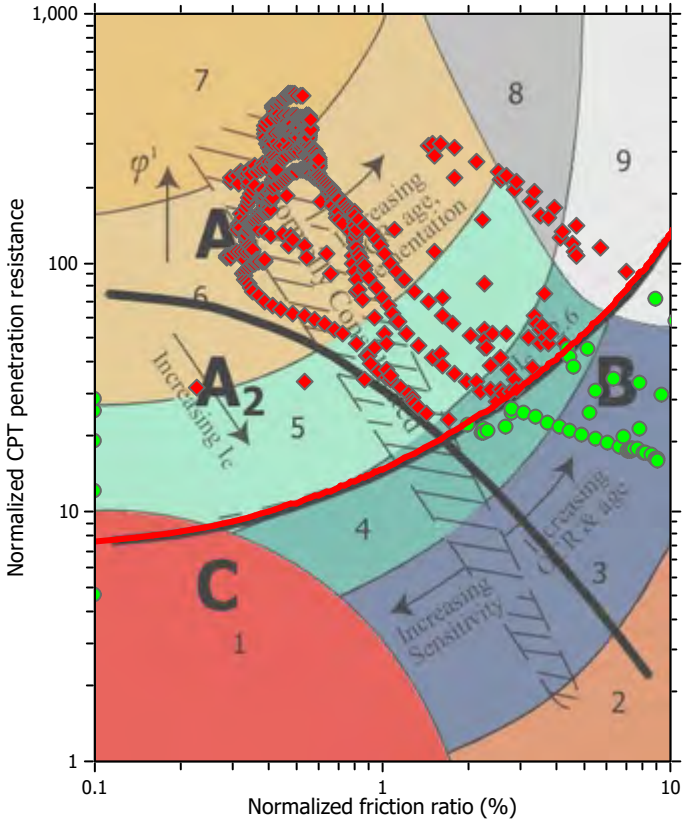
F.S. color scheme

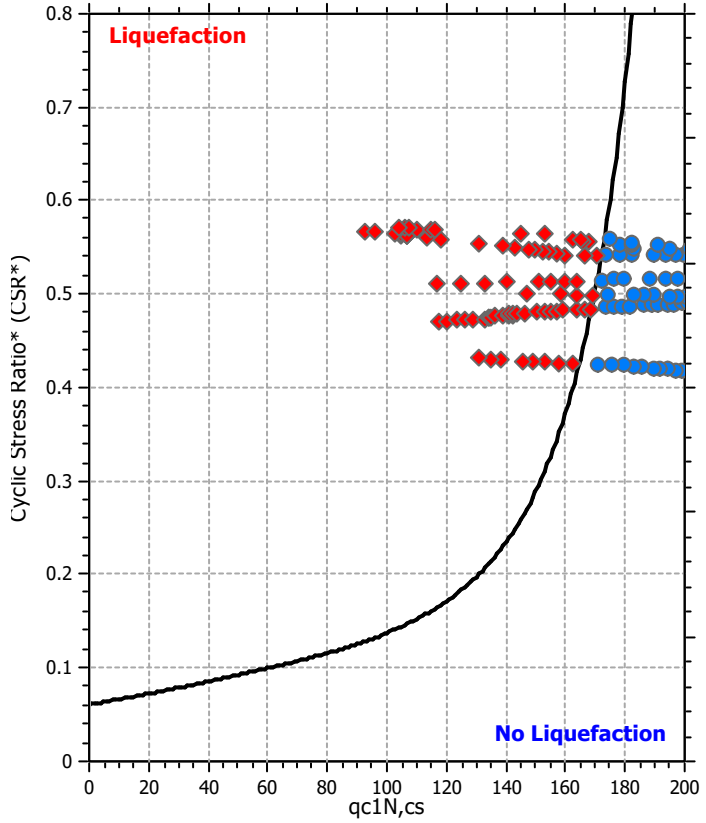
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

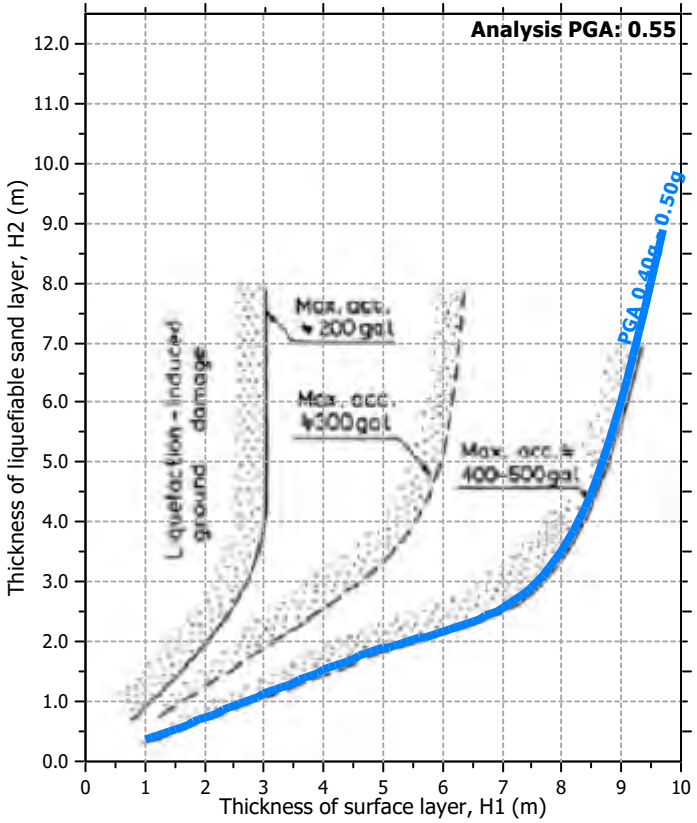
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



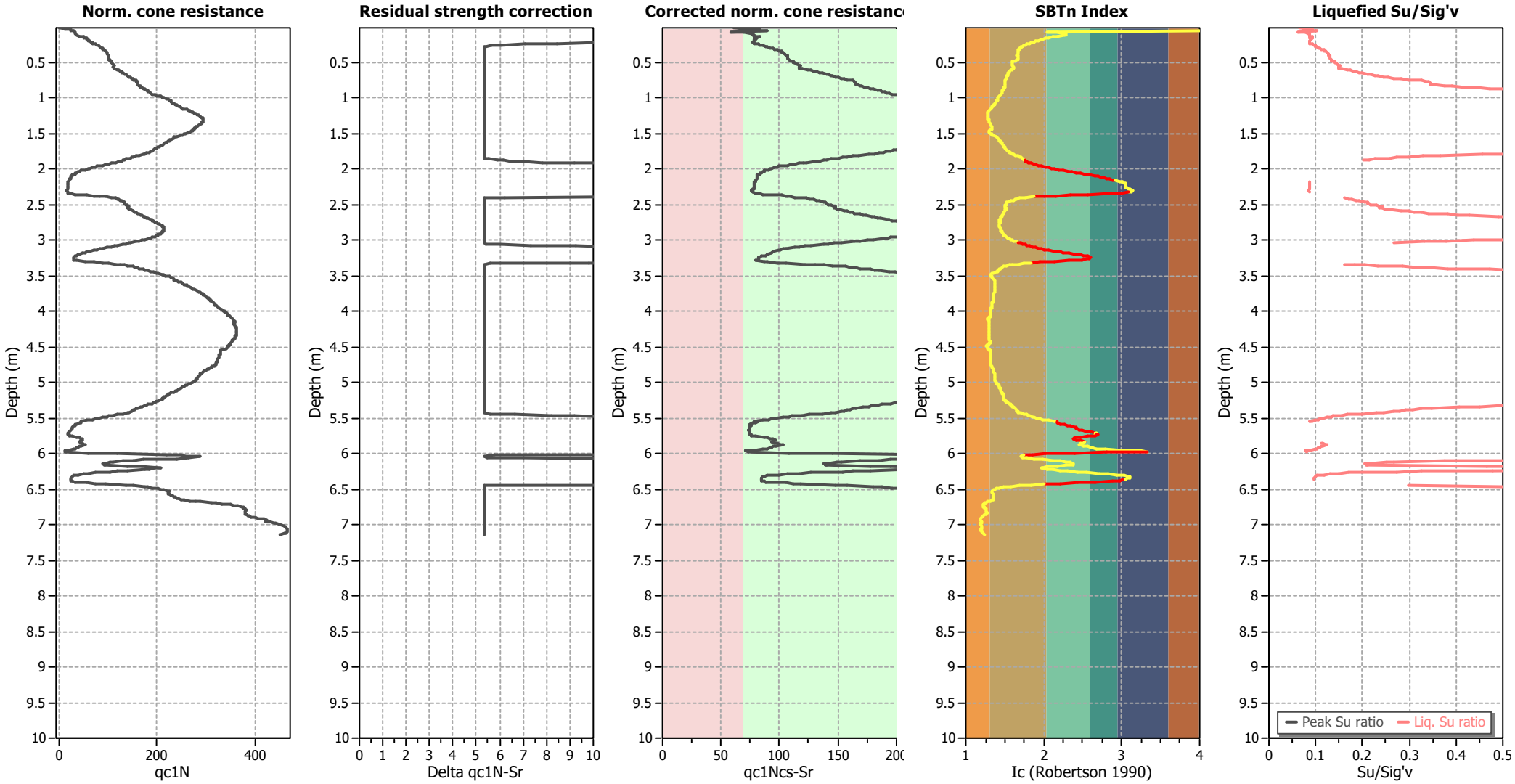




Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

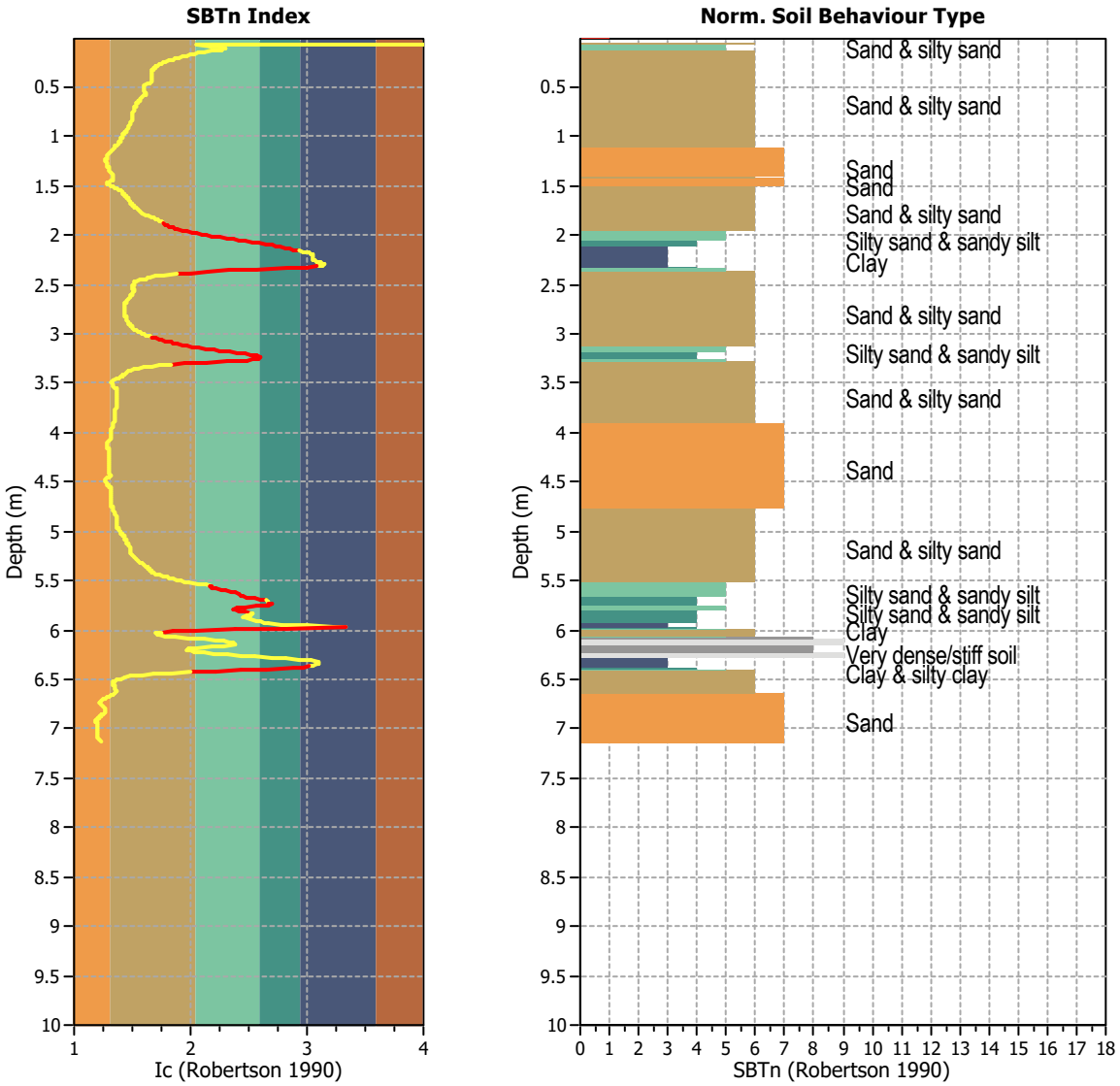
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

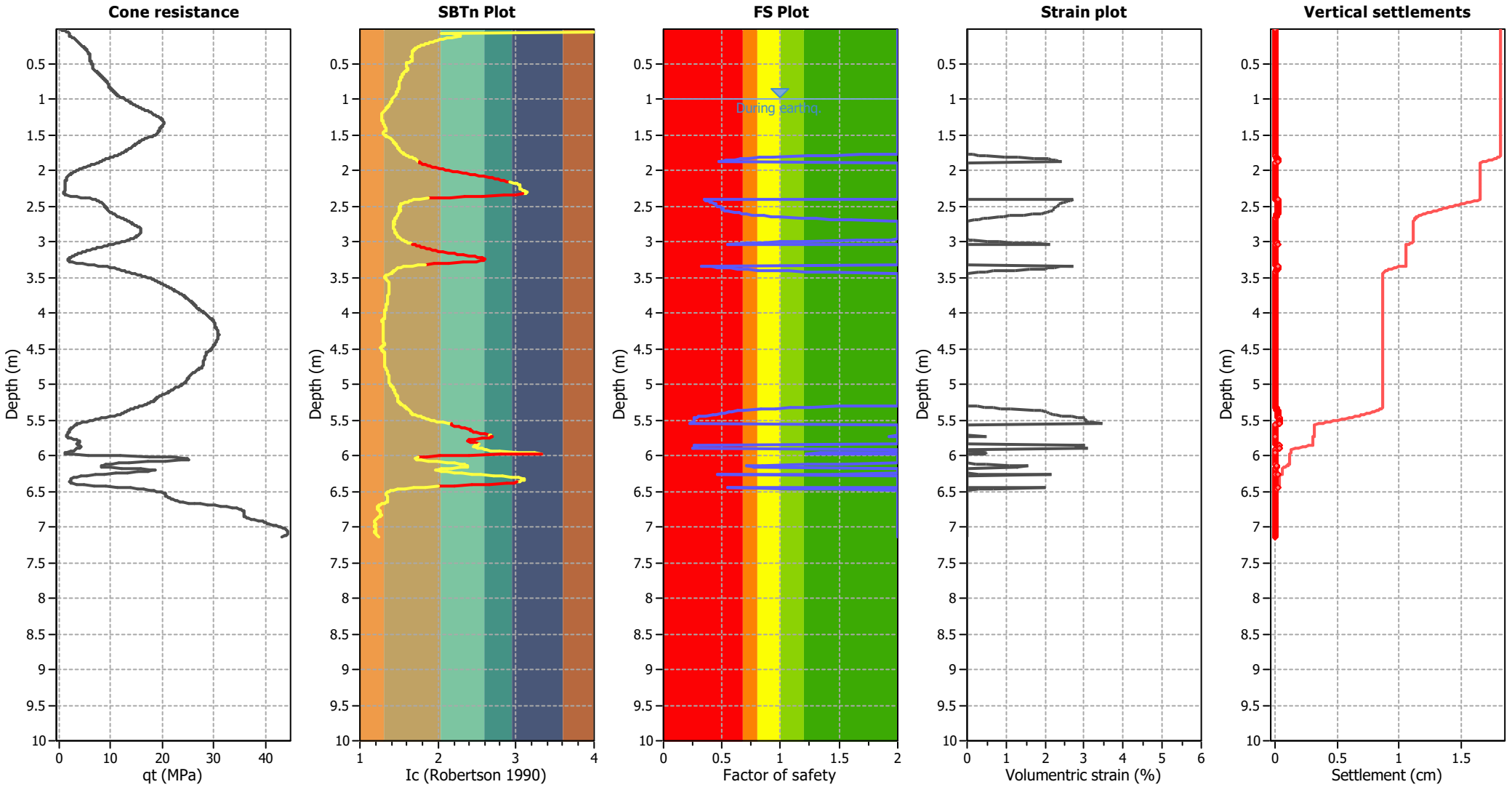
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	713
I_c maximum check value:	3.00	Total points excluded:	107
I_c change ratio value:	0.0100	Exclusion percentage:	15.01%
Minimum number of points in layer:	4	Number of layers detected:	9

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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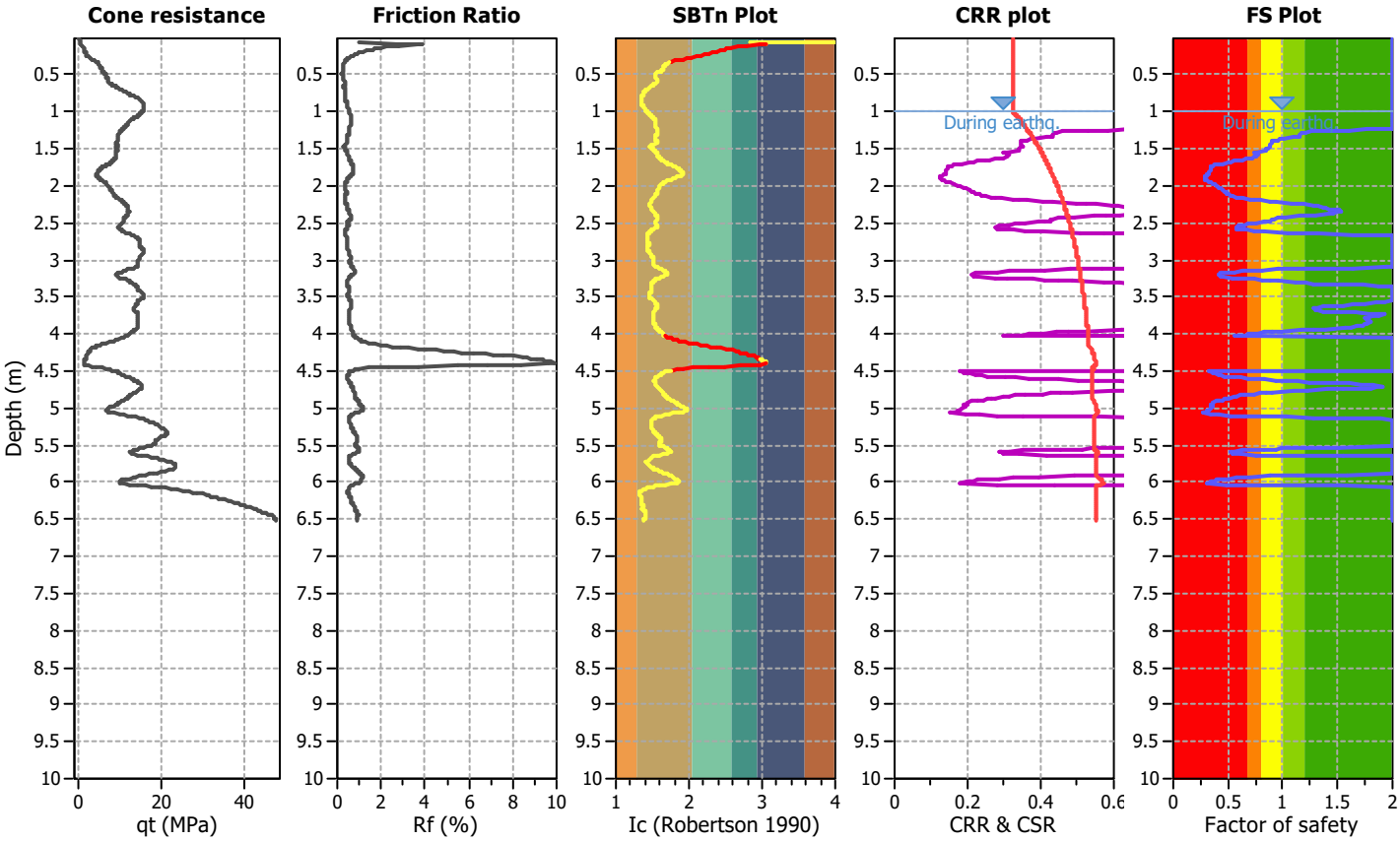
LIQUEFACTION ANALYSIS REPORT

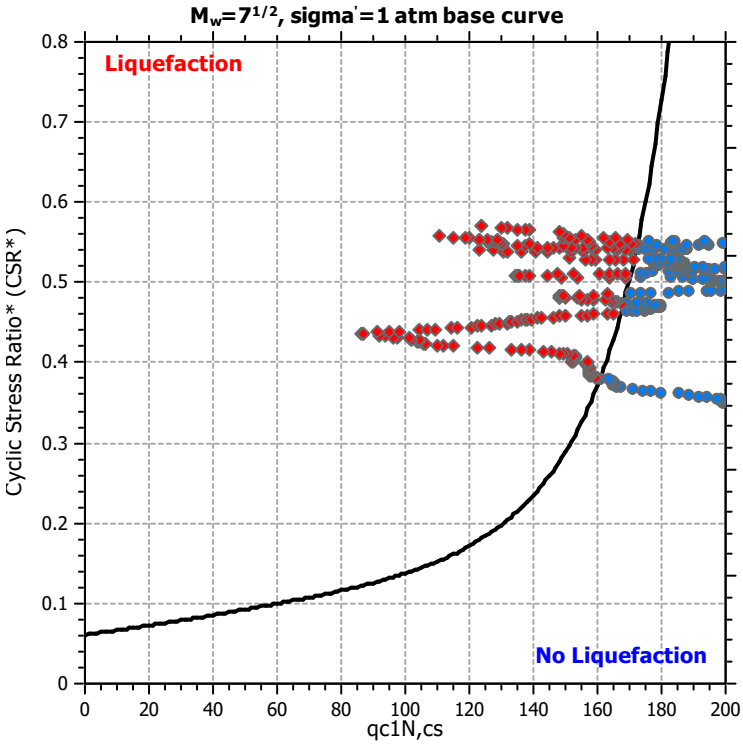
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

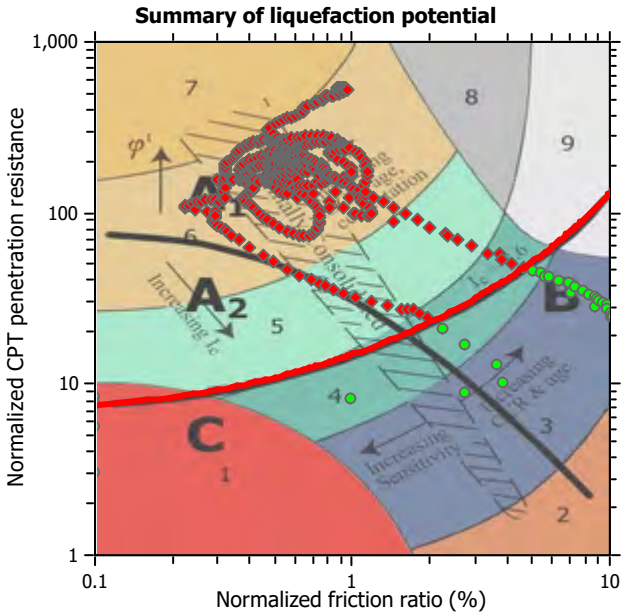
CPT file : CPT11_ULS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

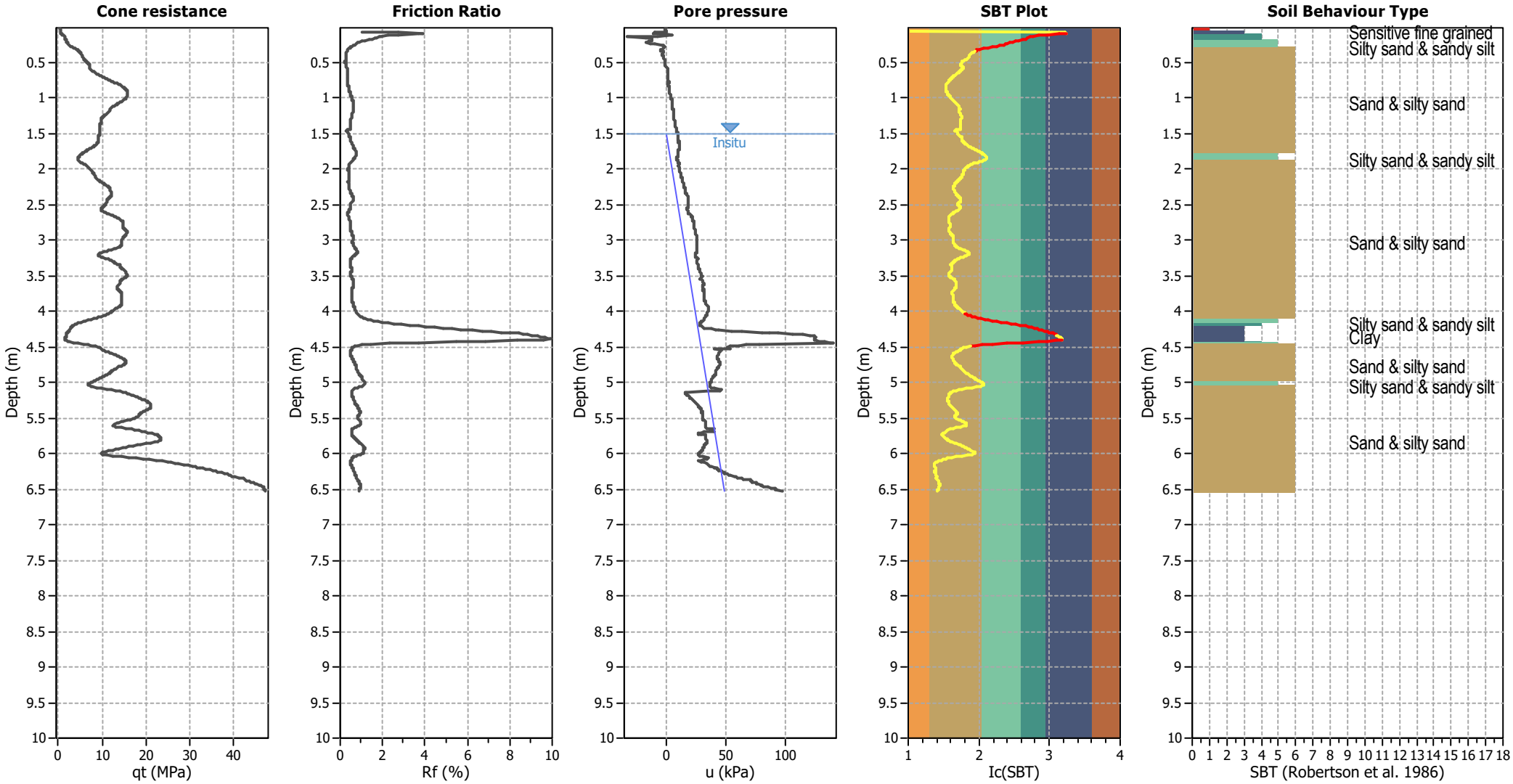






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



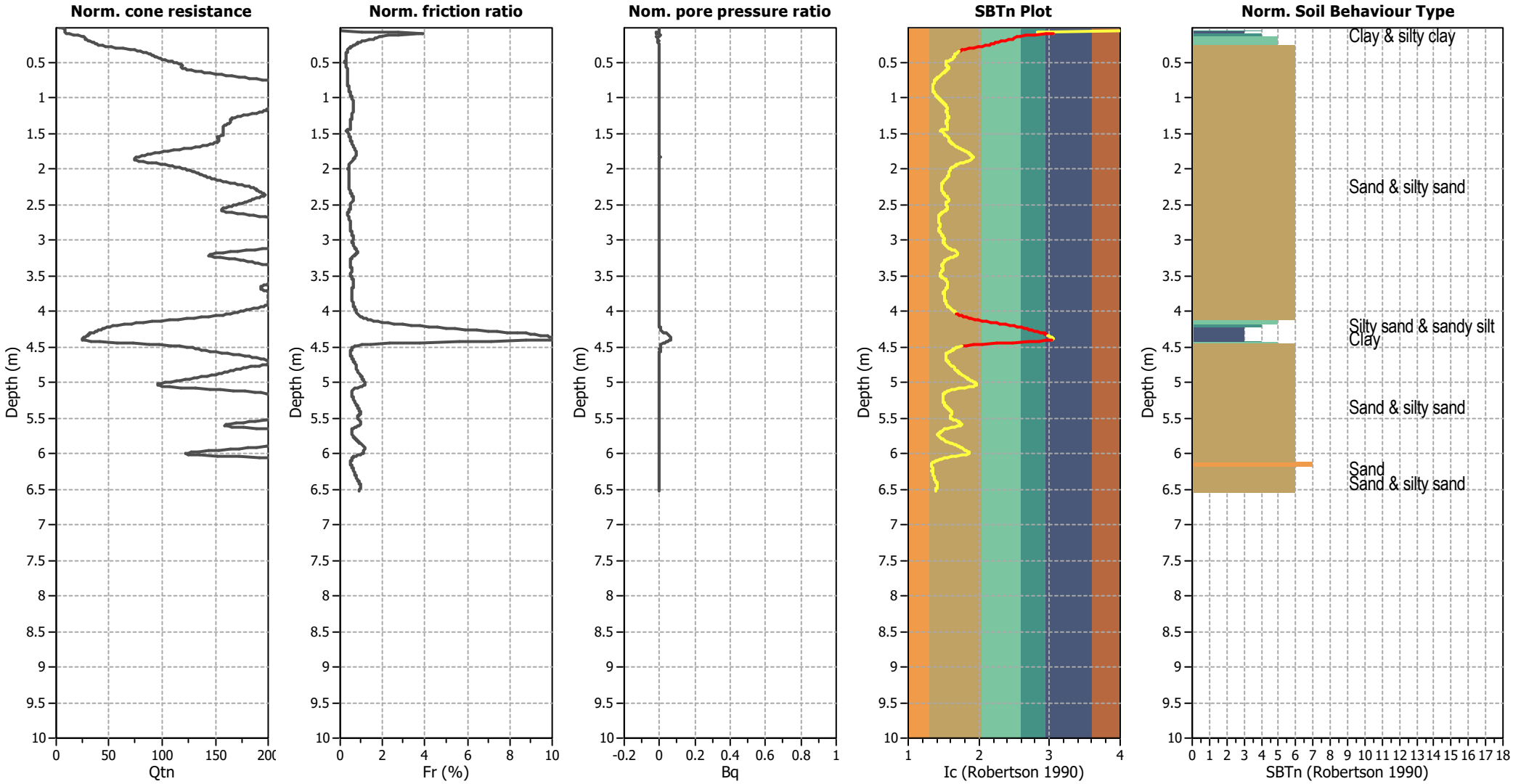
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



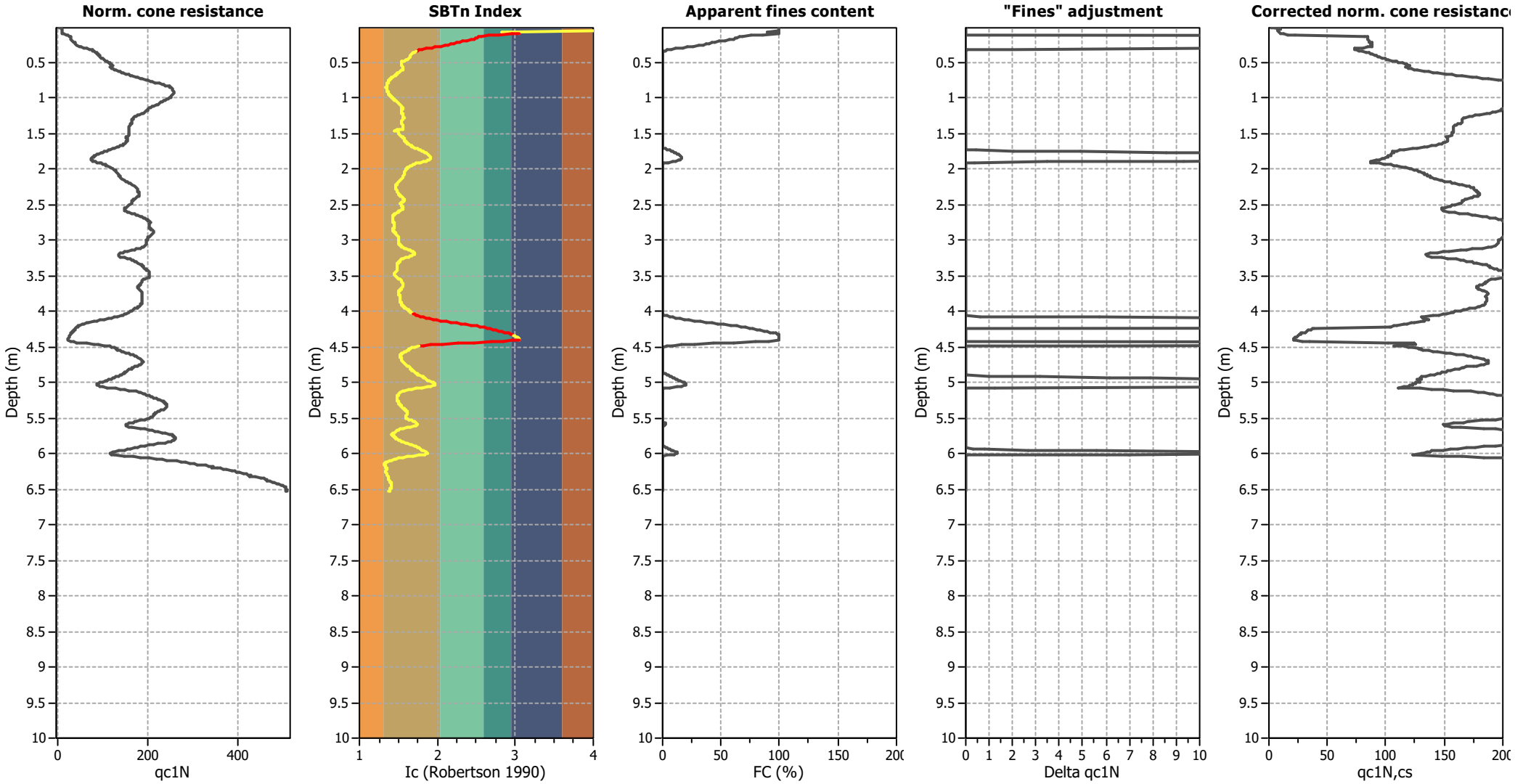
Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

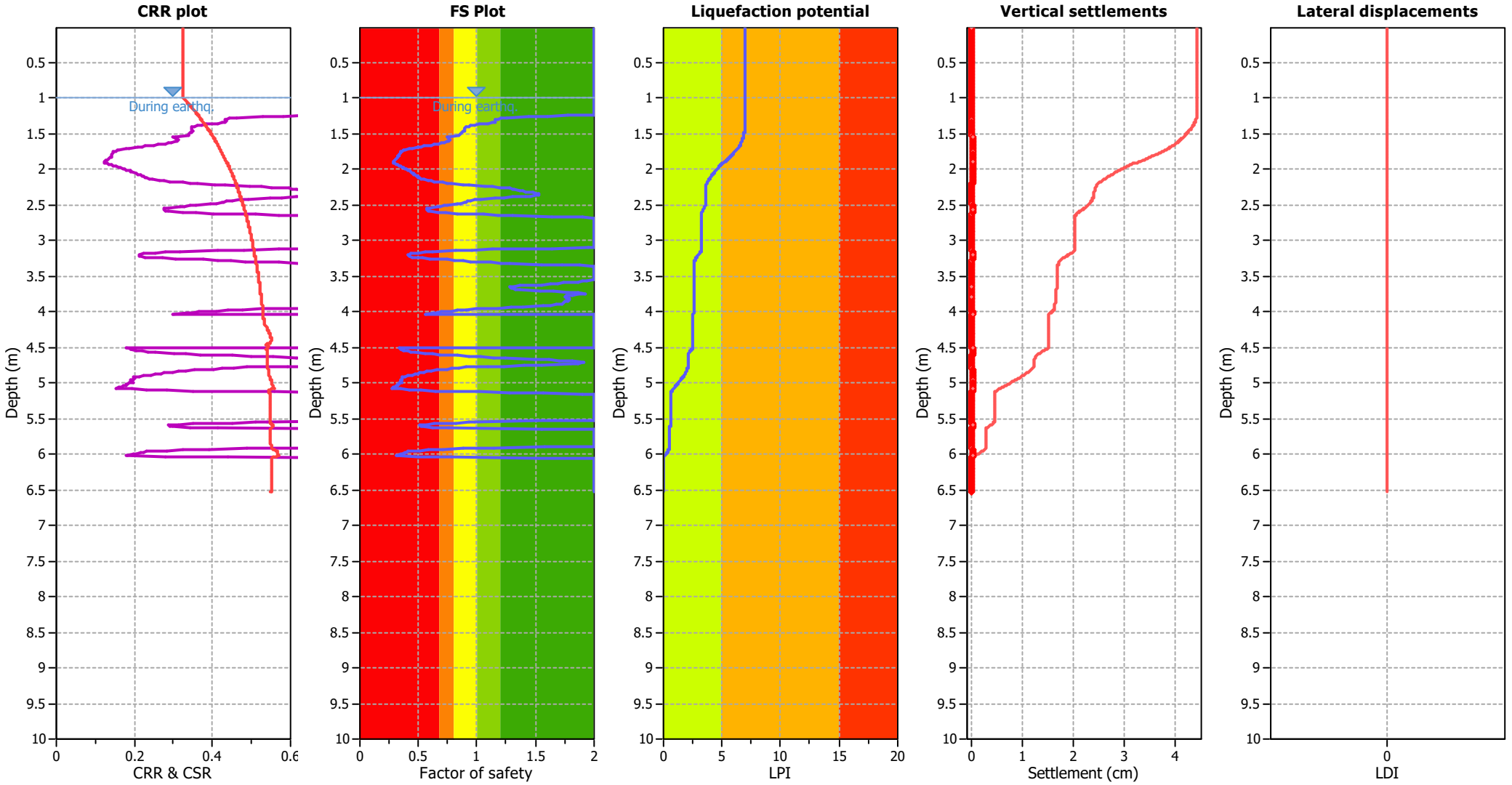
Liquefaction analysis overall plots (intermediate results)



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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

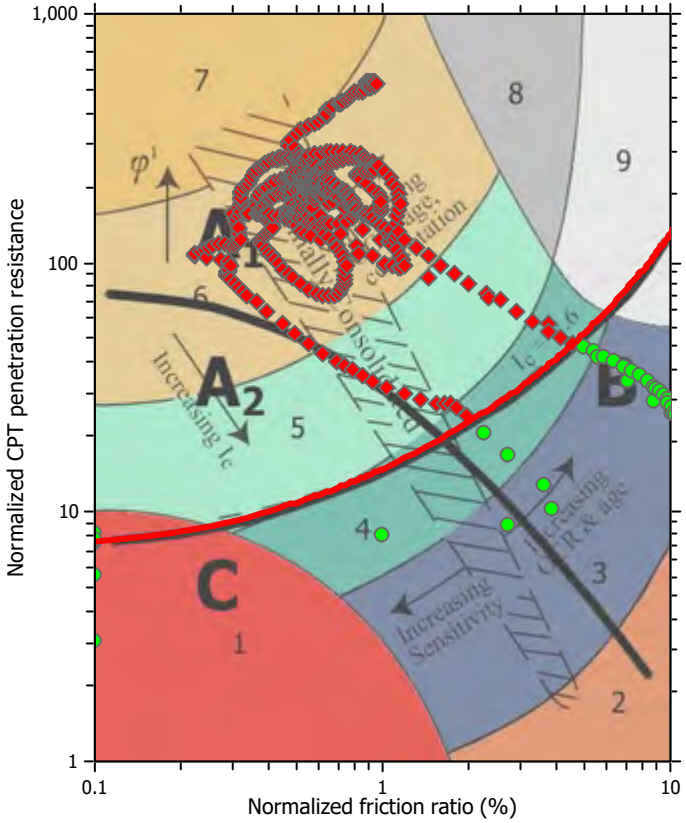
F.S. color scheme

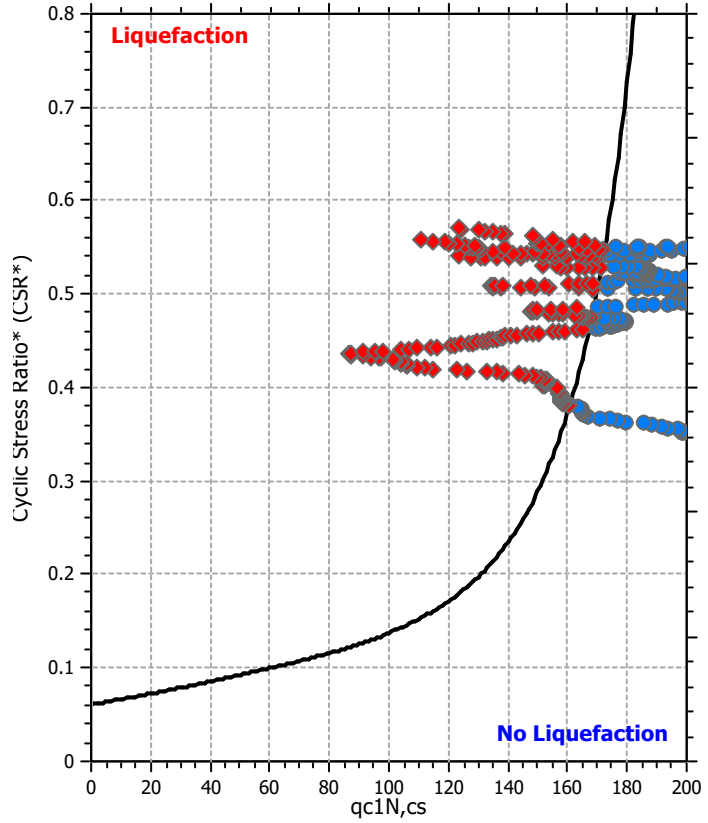
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

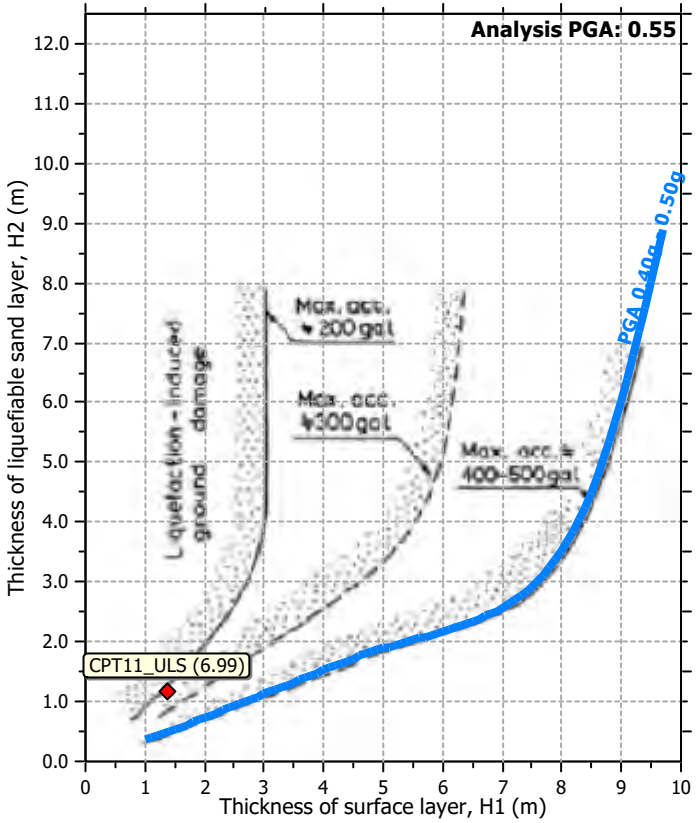
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



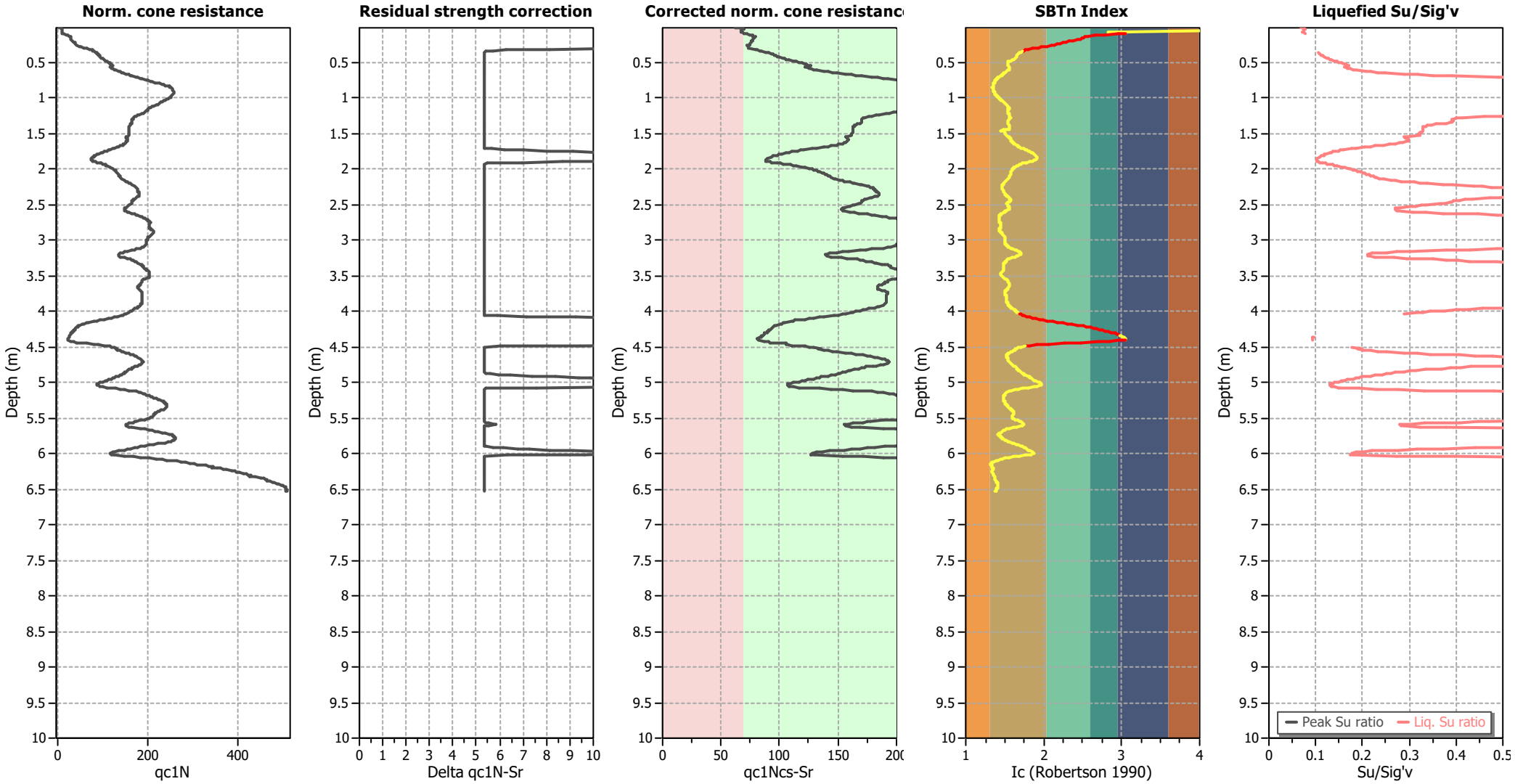




Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

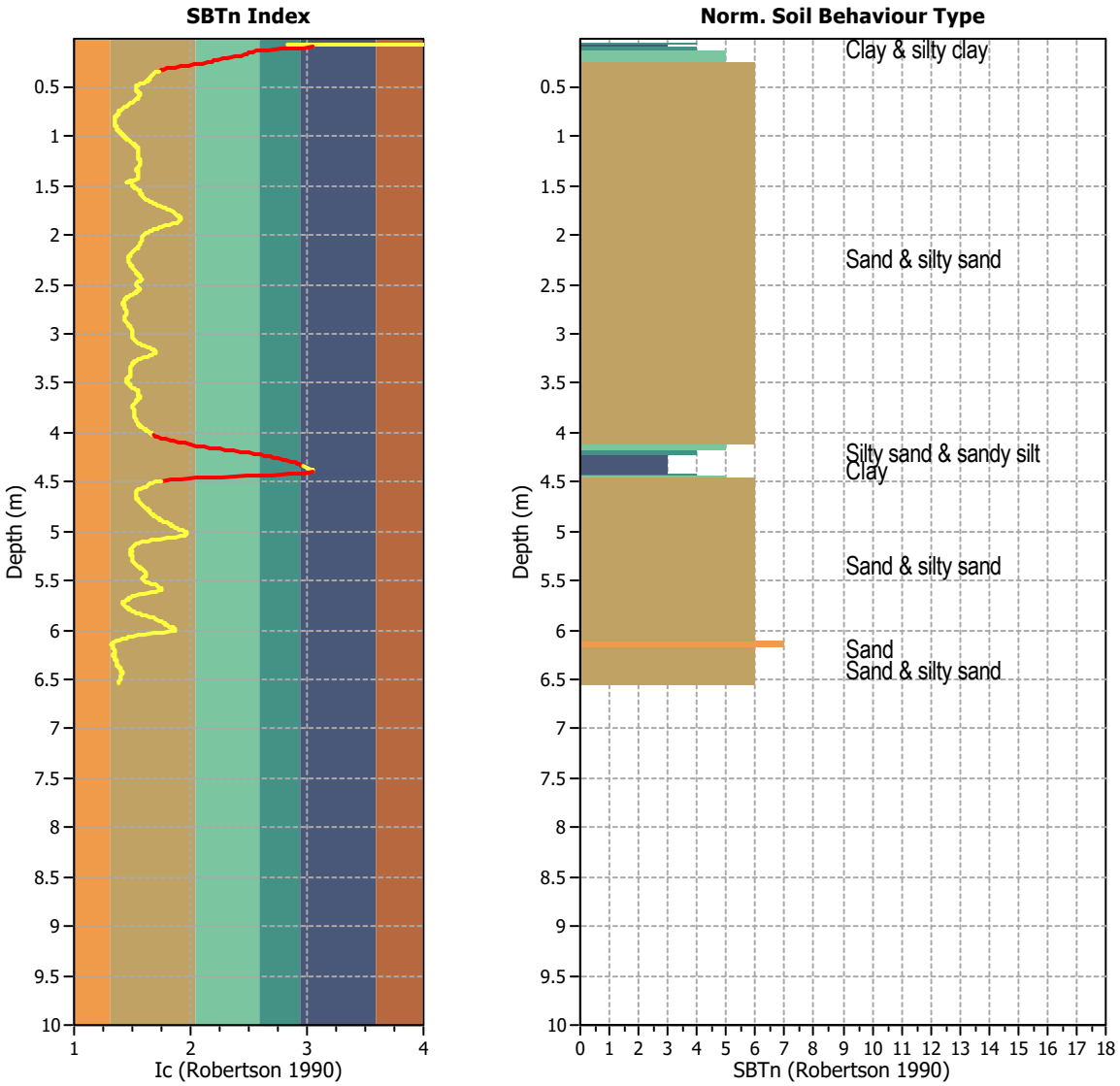
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

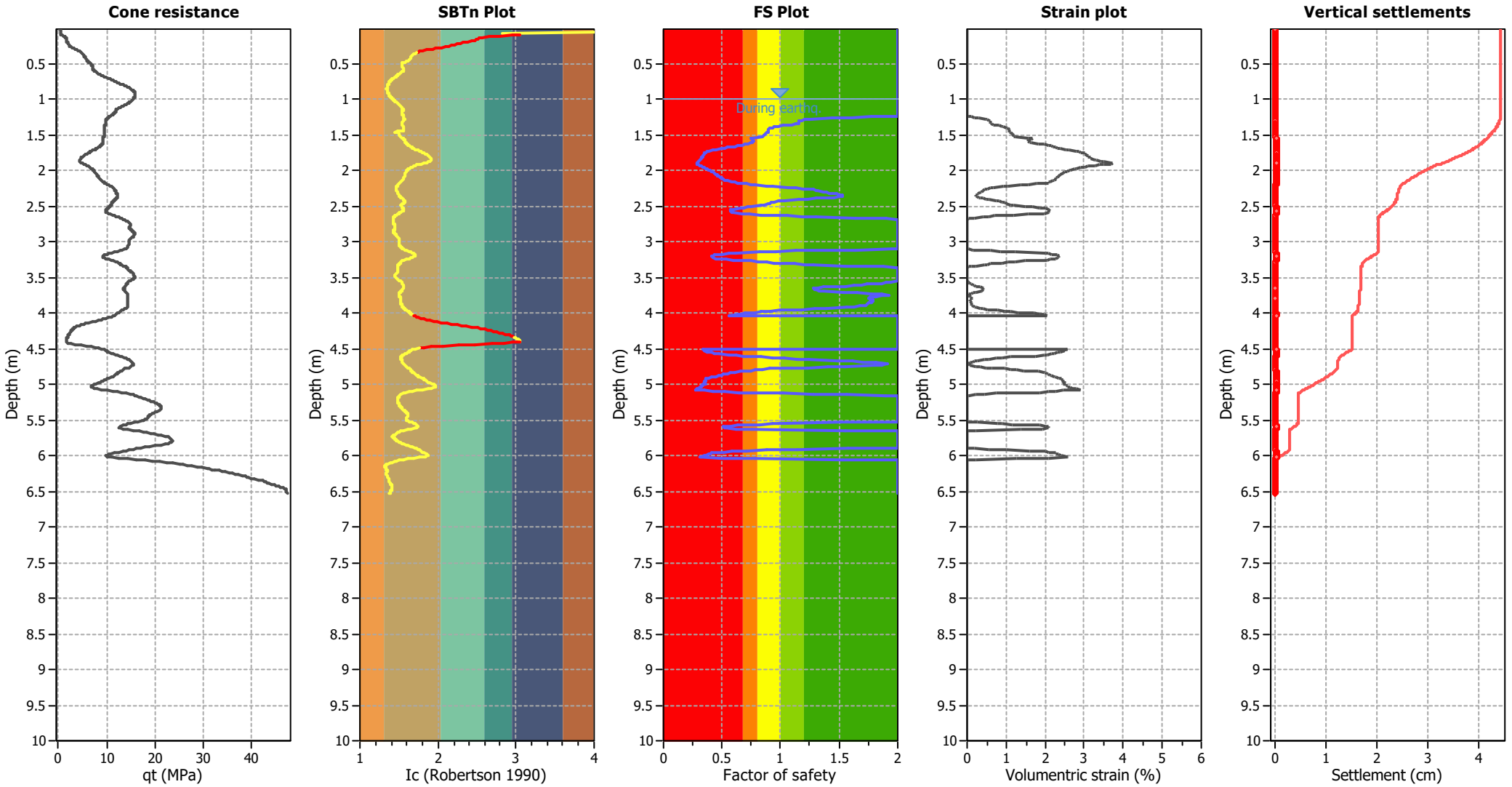
The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties	
I_c minimum check value:	1.70
I_c maximum check value:	3.00
I_c change ratio value:	0.0100
Minimum number of points in layer:	4

General statistics	
Total points in CPT file:	653
Total points excluded:	68
Exclusion percentage:	10.41%
Number of layers detected:	3

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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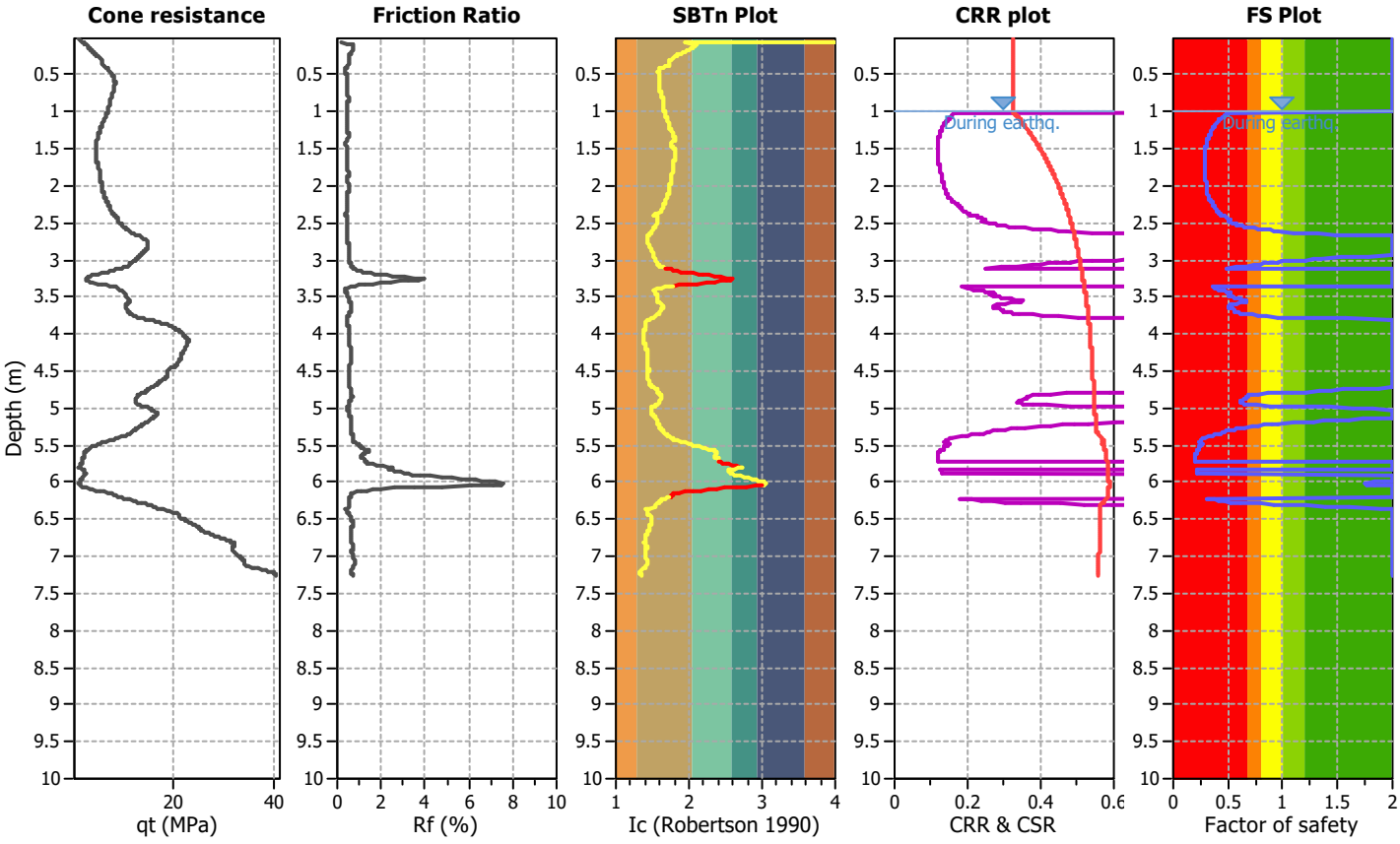
LIQUEFACTION ANALYSIS REPORT

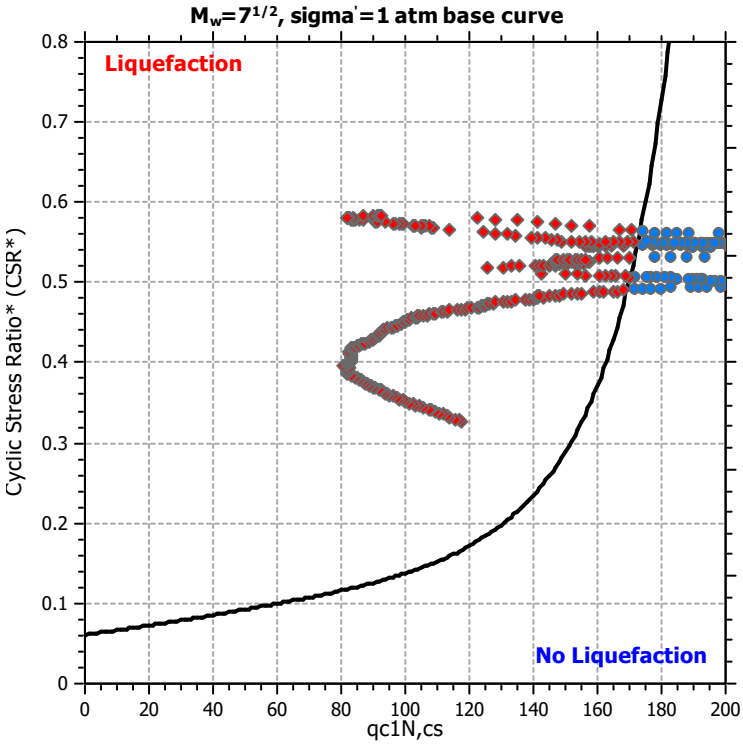
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

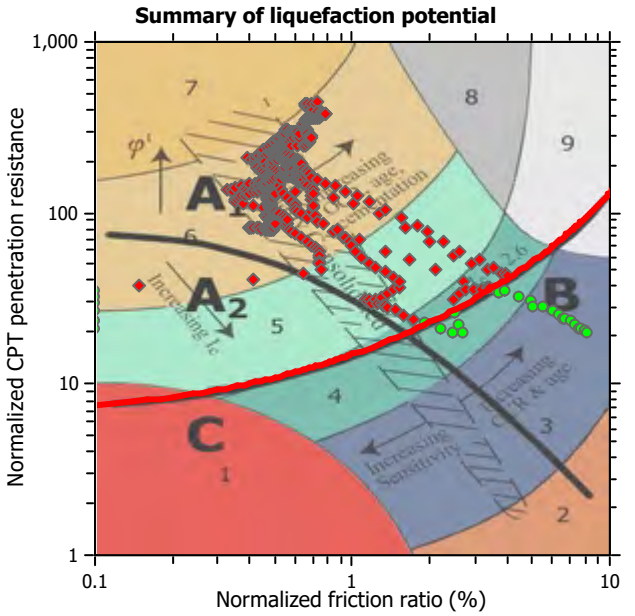
CPT file : CPT12_ULS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

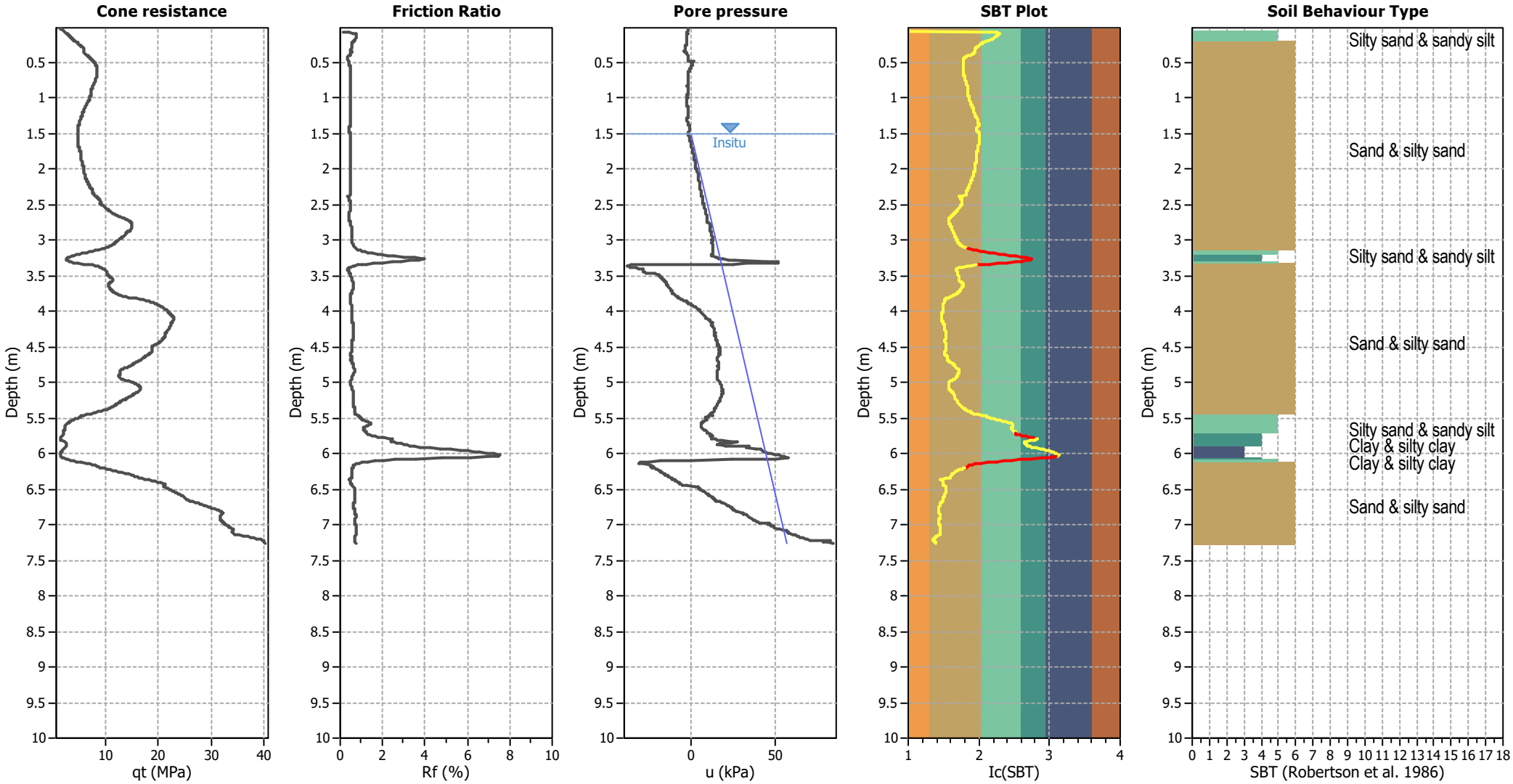






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



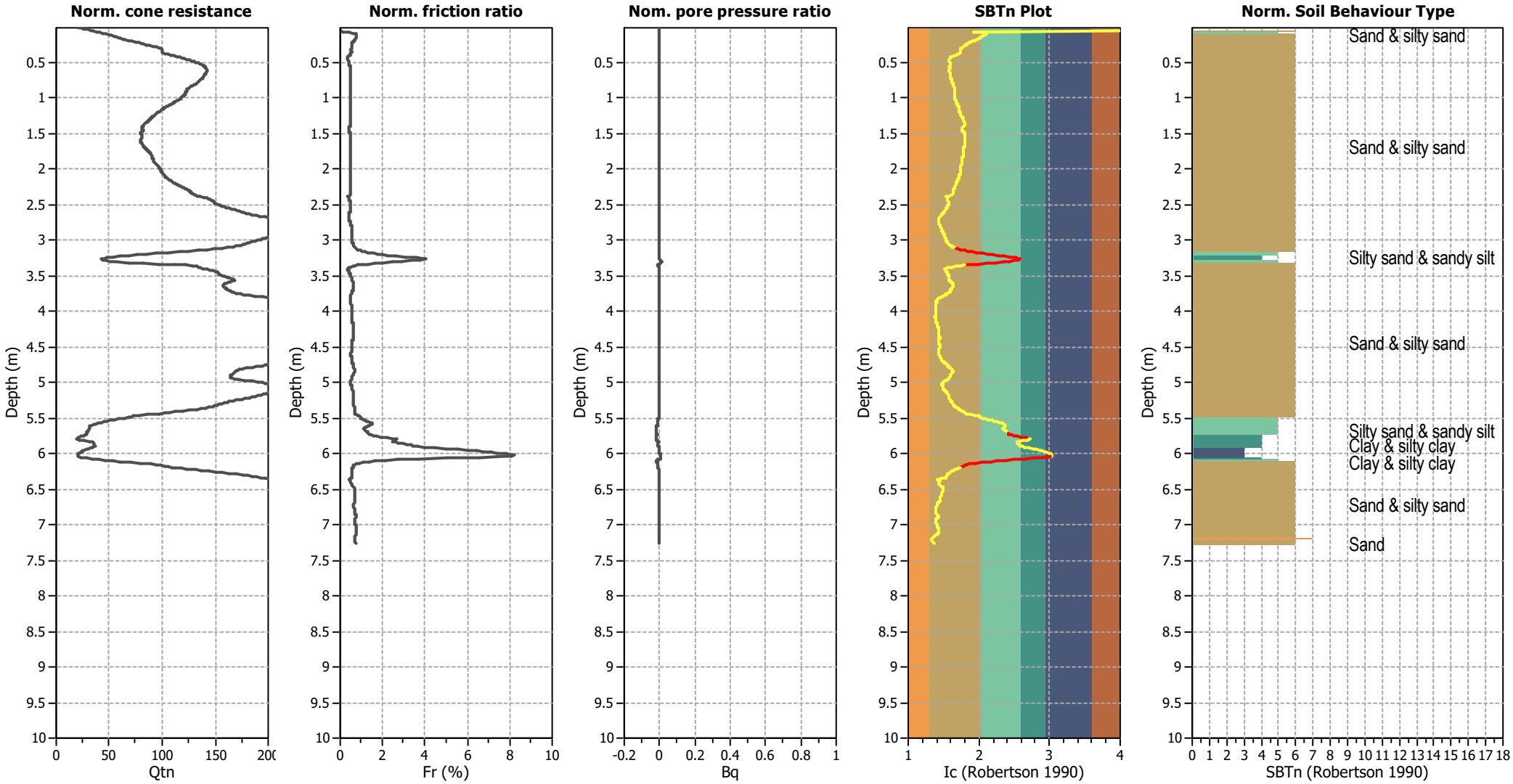
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



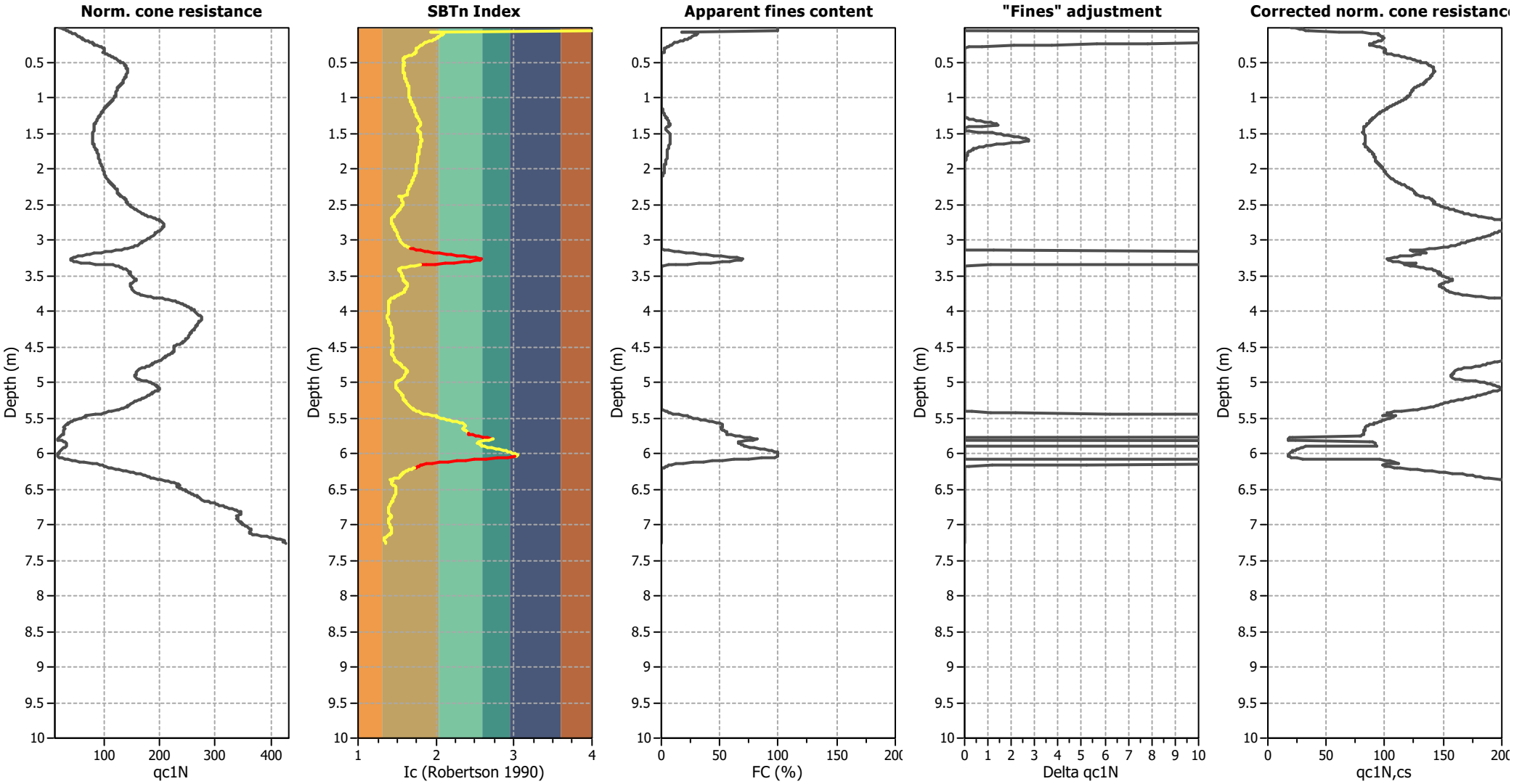
Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

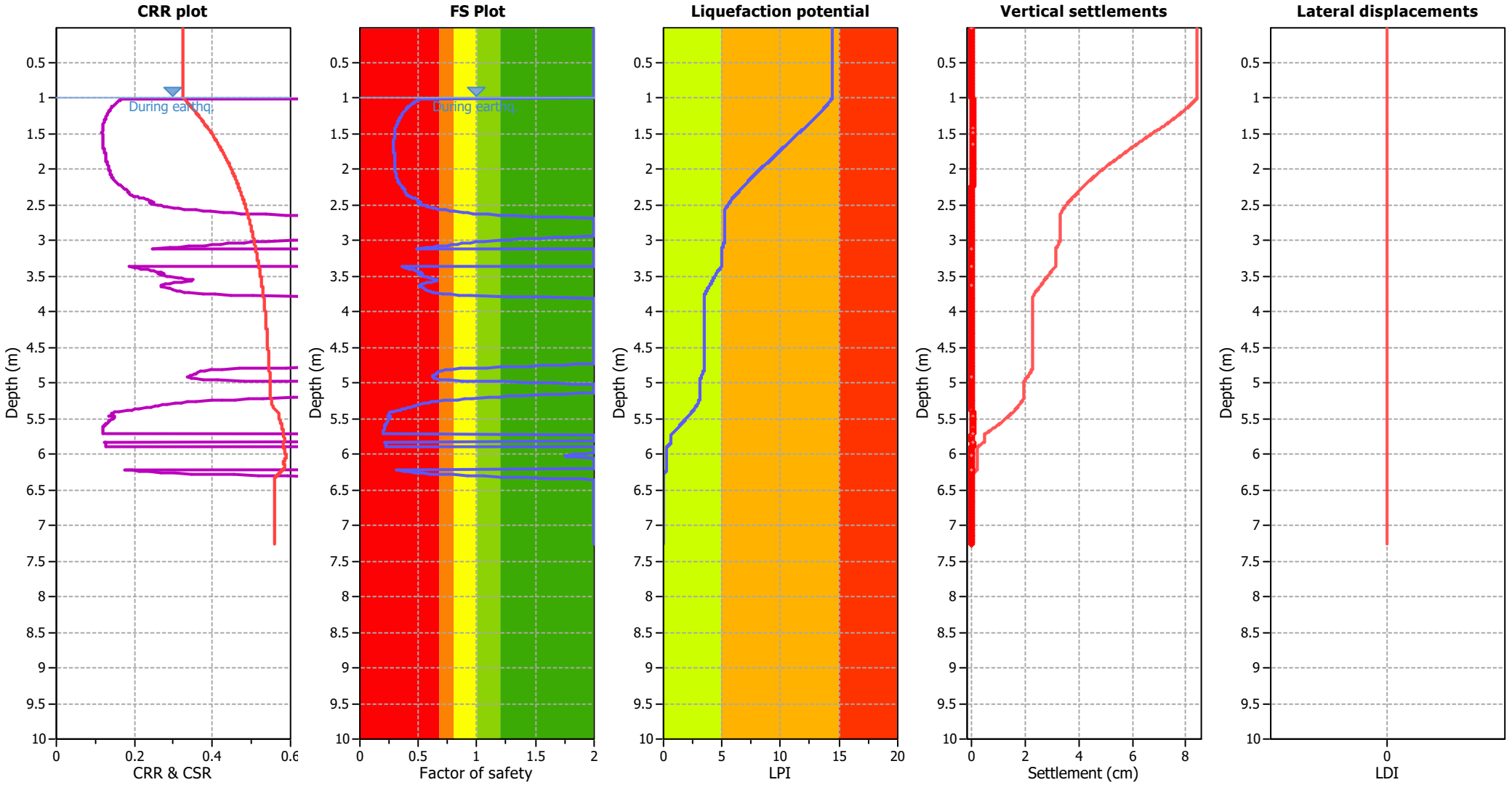
Liquefaction analysis overall plots (intermediate results)



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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

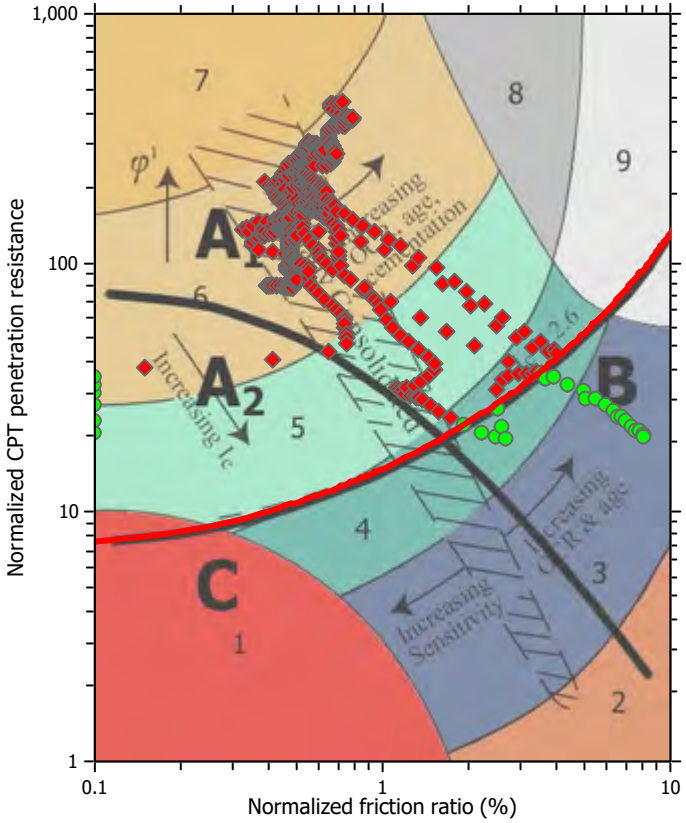
F.S. color scheme

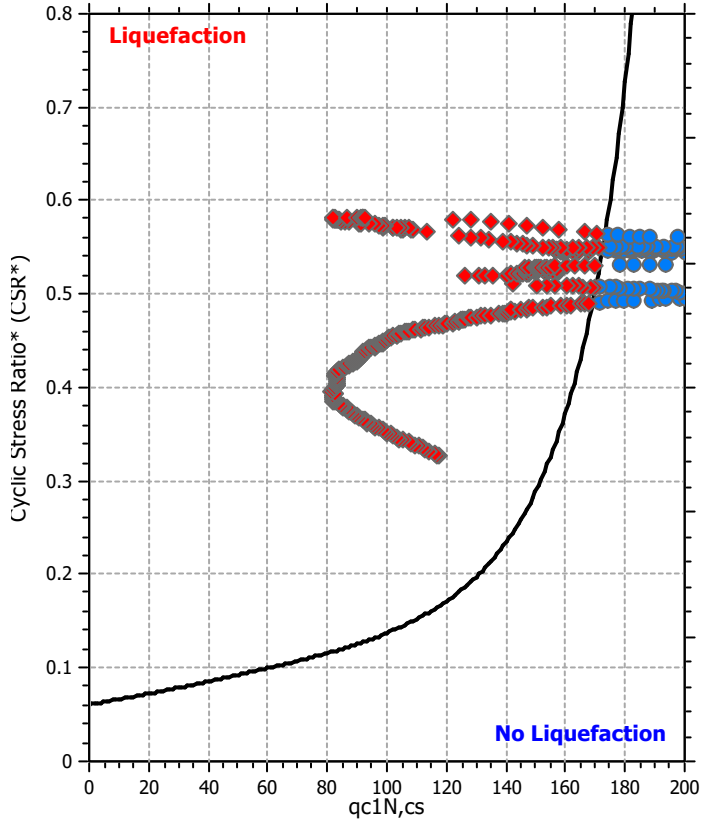
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

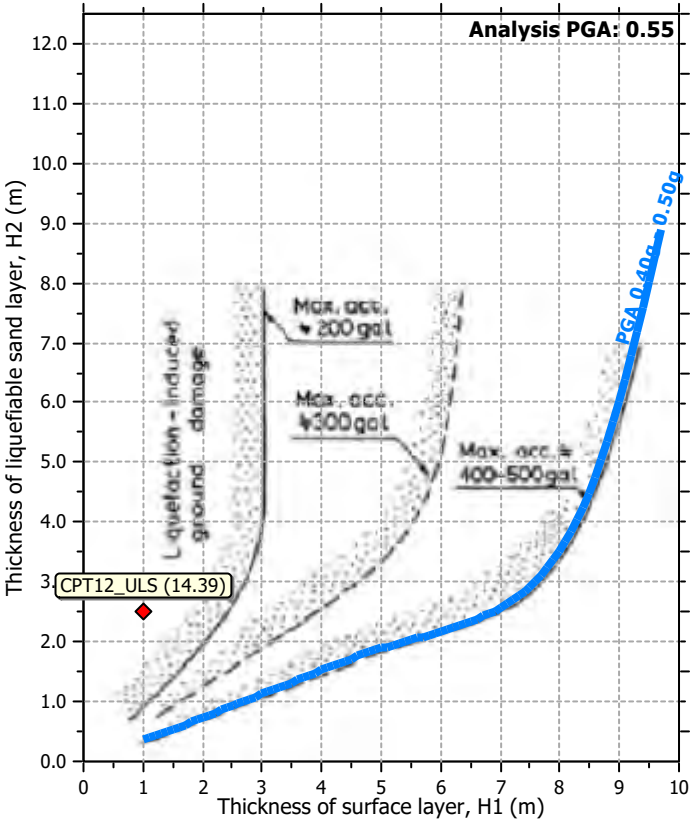
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



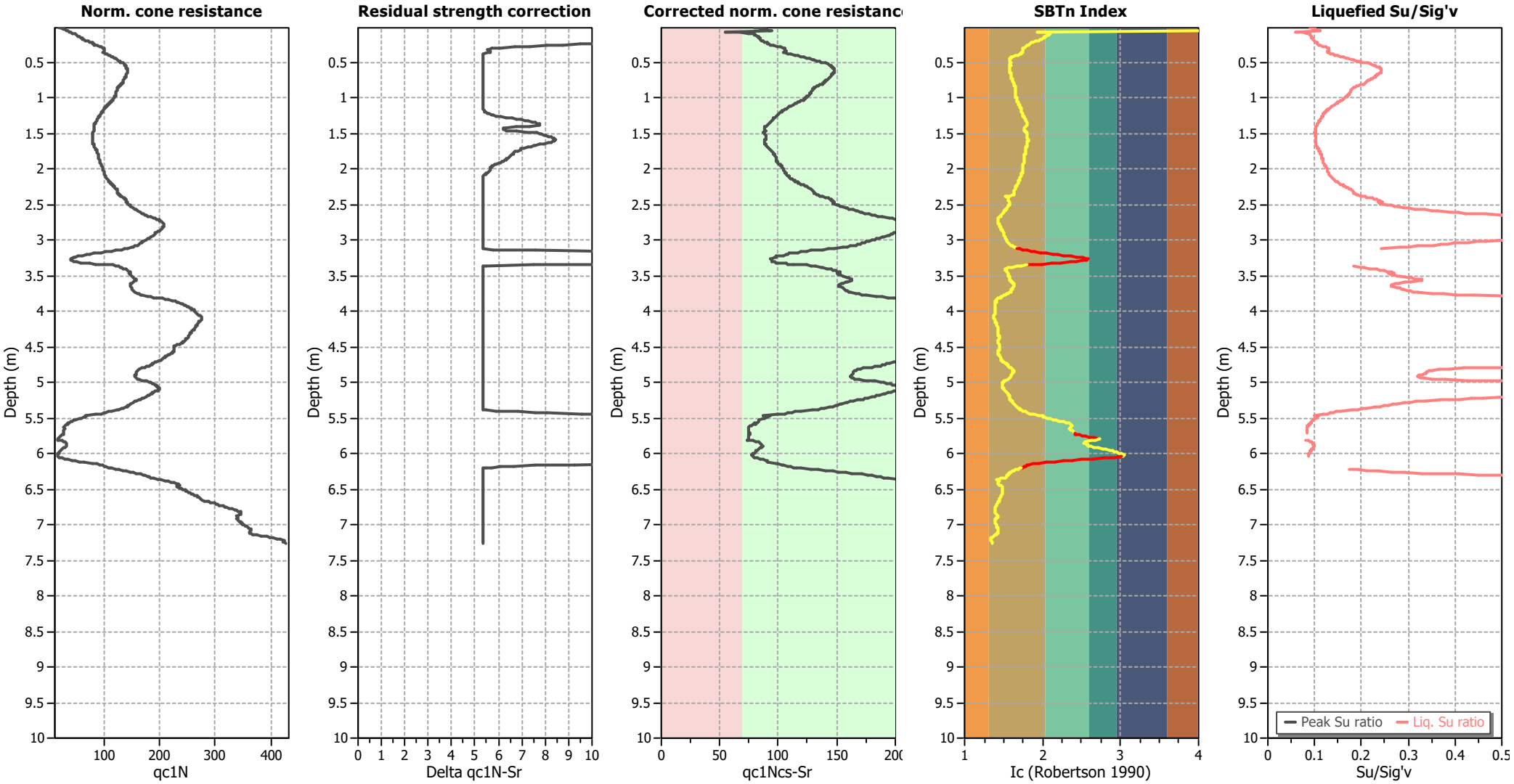




Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

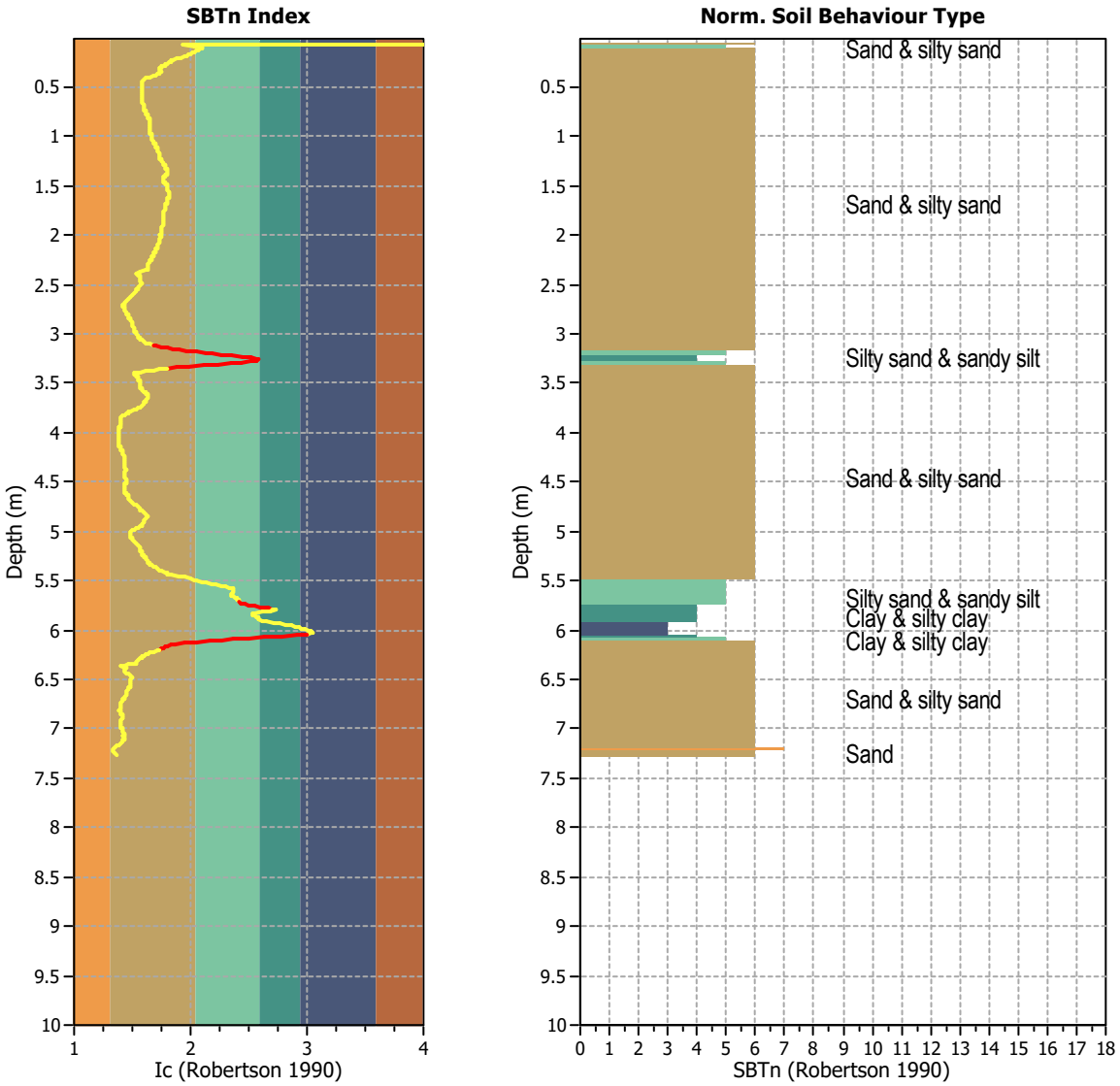
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

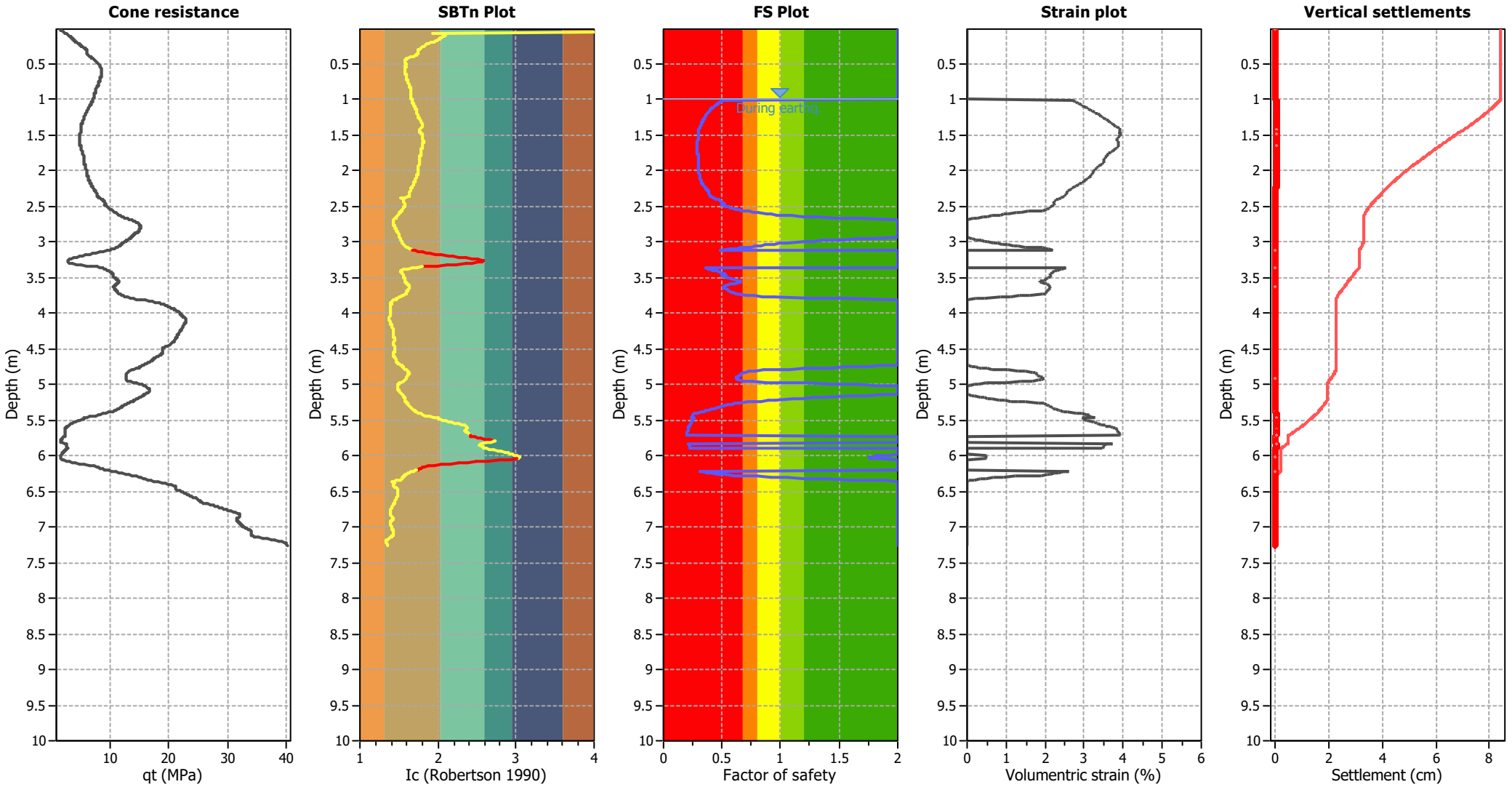
The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties	
I_c minimum check value:	1.70
I_c maximum check value:	3.00
I_c change ratio value:	0.0100
Minimum number of points in layer:	4

General statistics	
Total points in CPT file:	726
Total points excluded:	52
Exclusion percentage:	7.16%
Number of layers detected:	4

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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www.btw.nz

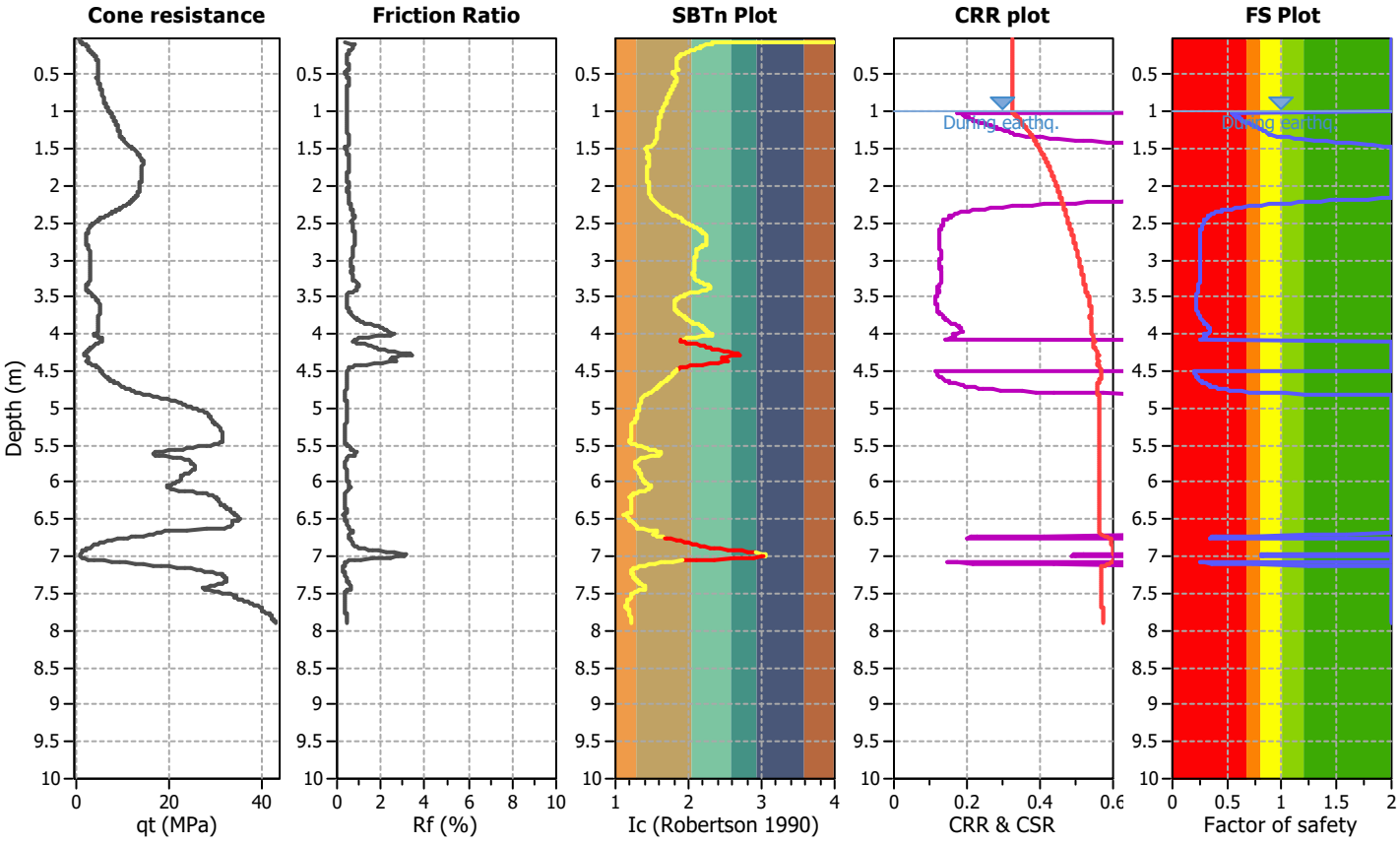
LIQUEFACTION ANALYSIS REPORT

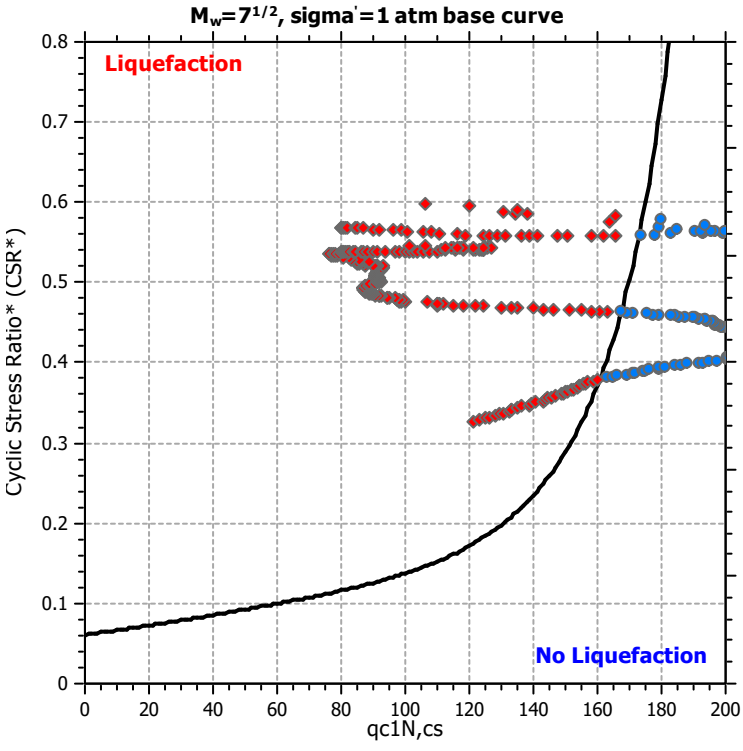
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

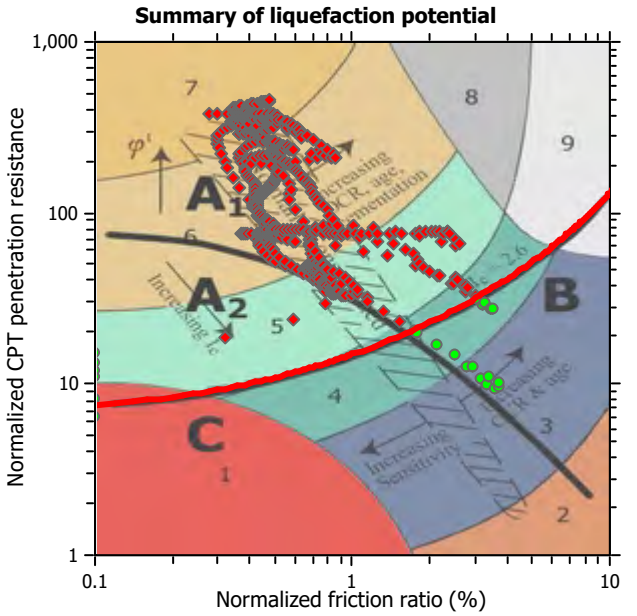
CPT file : CPT13_ULS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

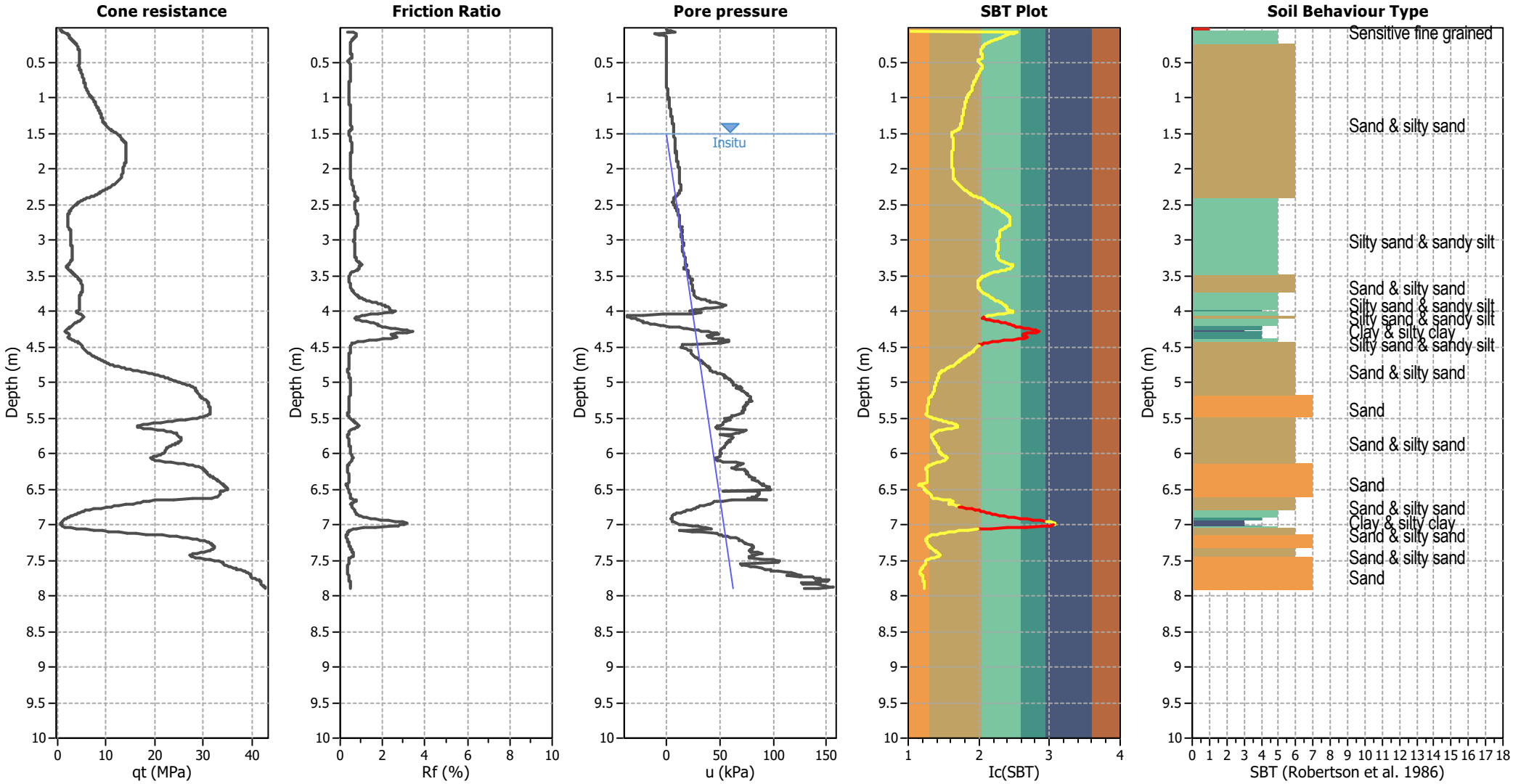






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



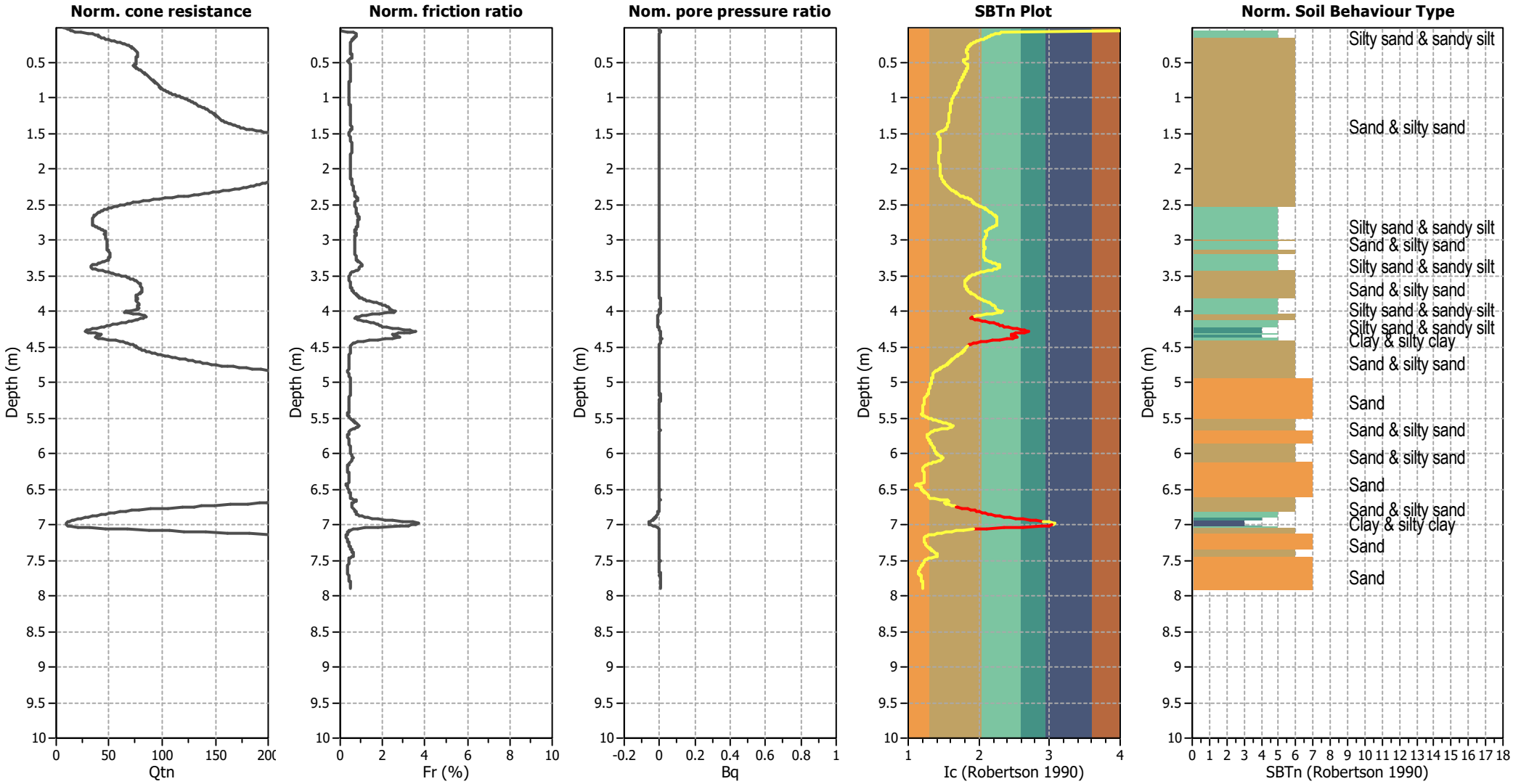
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



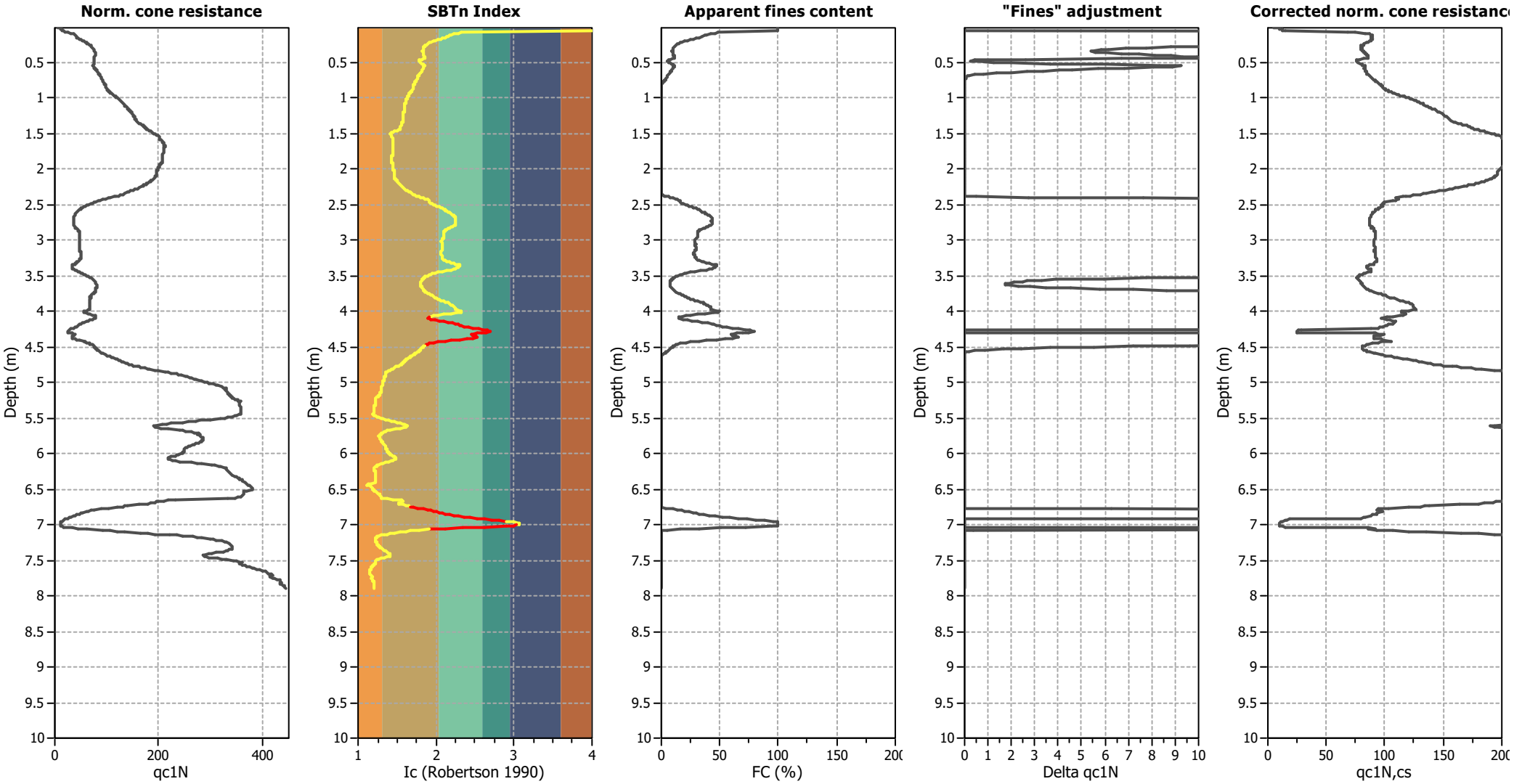
Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

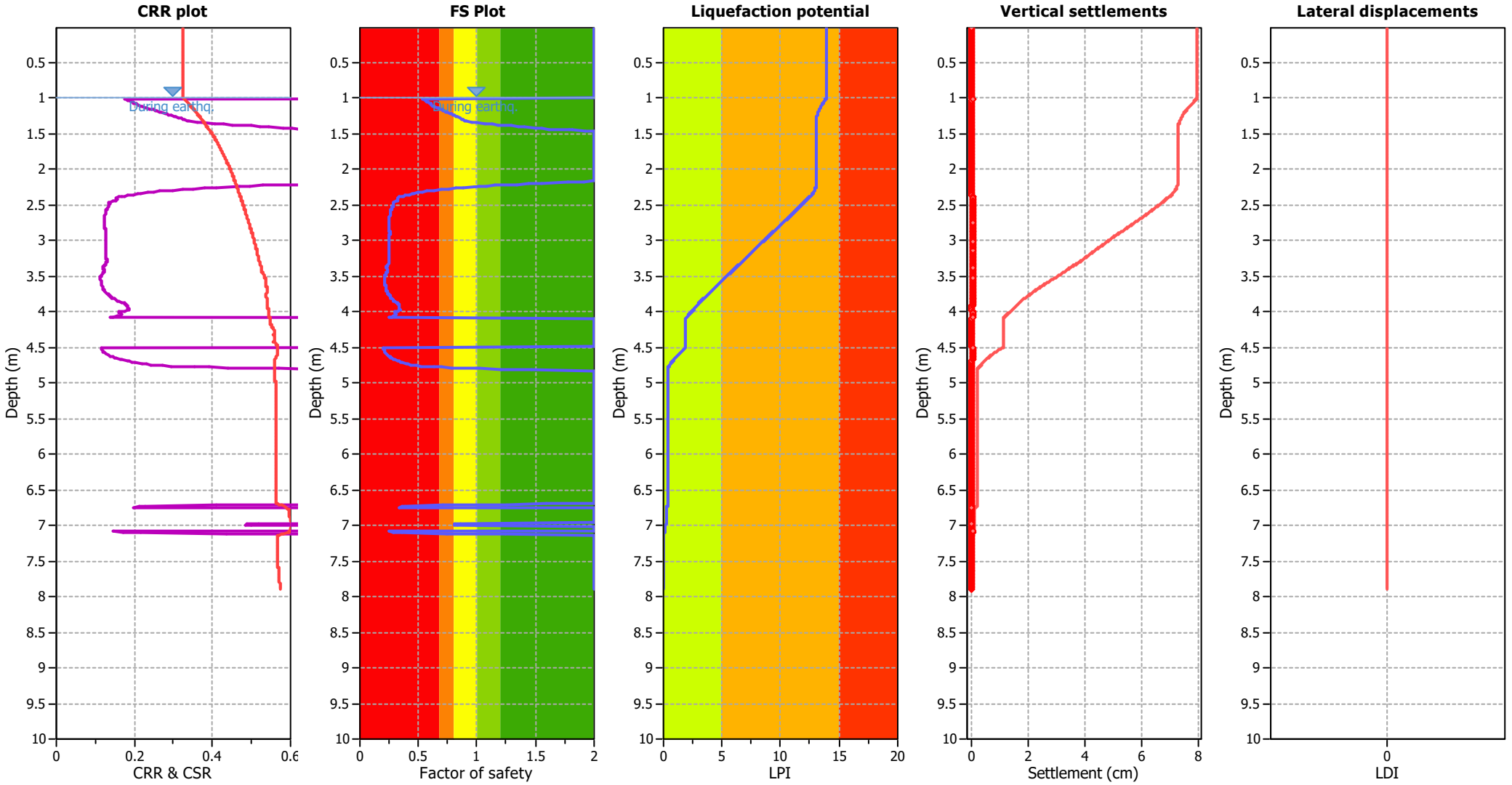
Liquefaction analysis overall plots (intermediate results)



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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

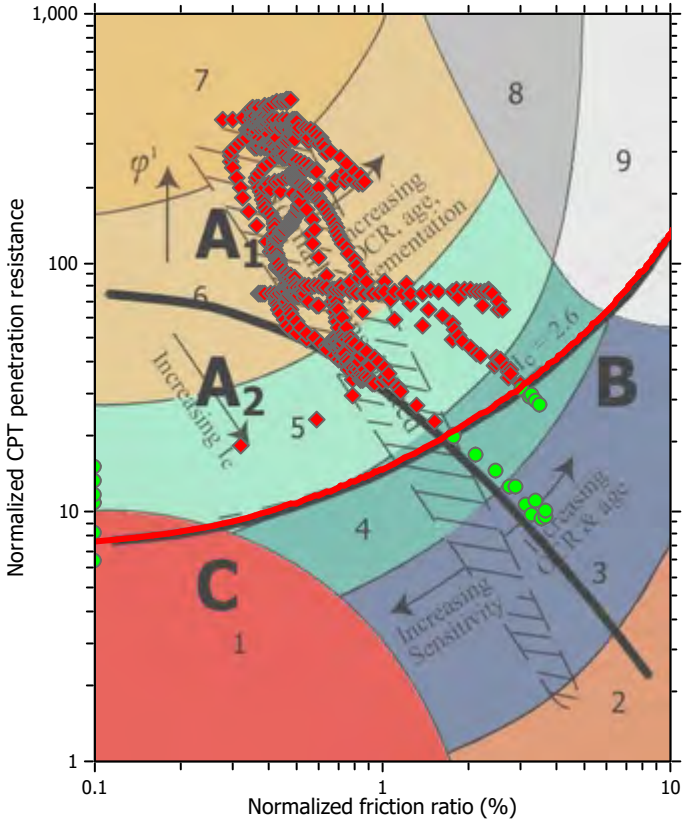
F.S. color scheme

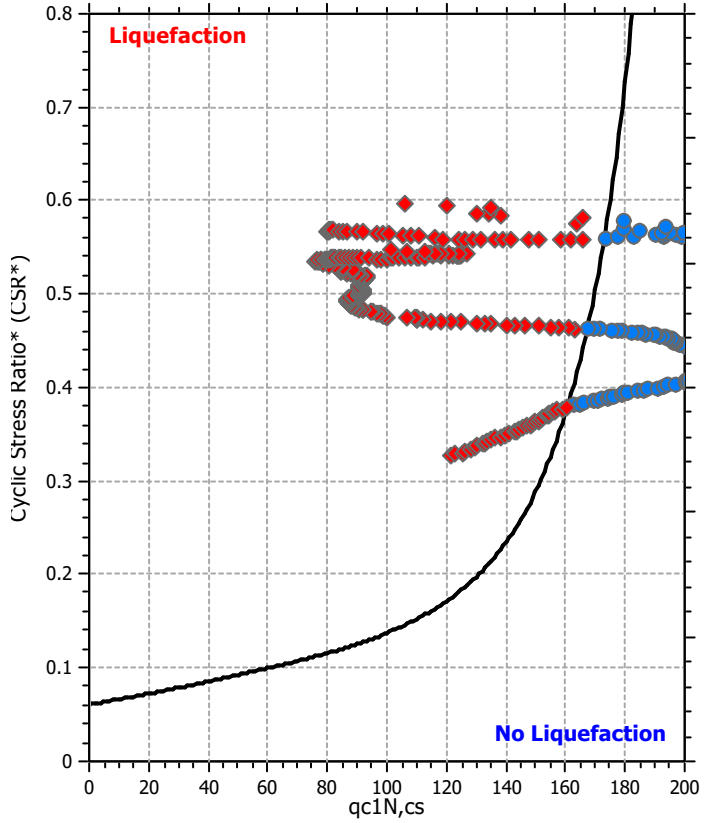
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

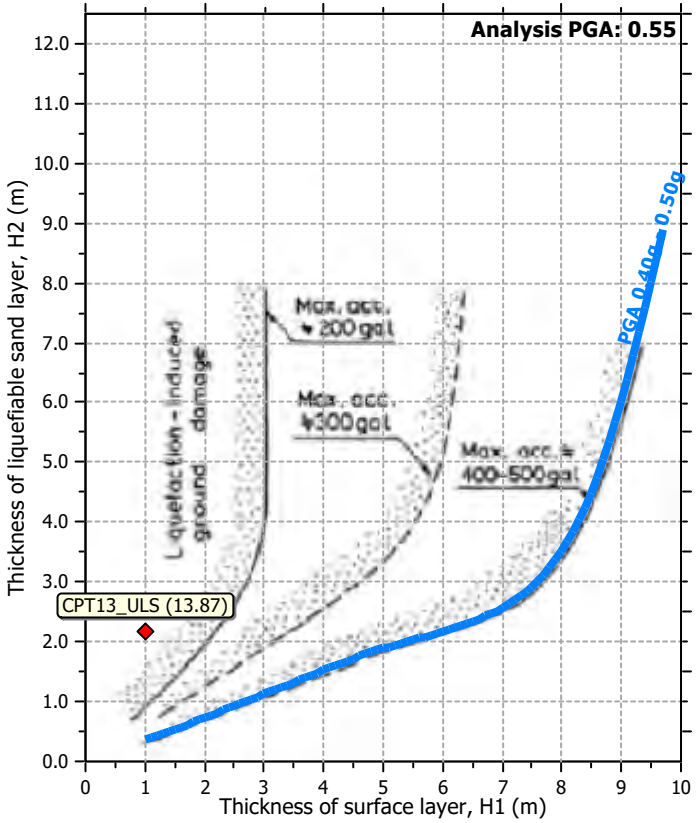
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



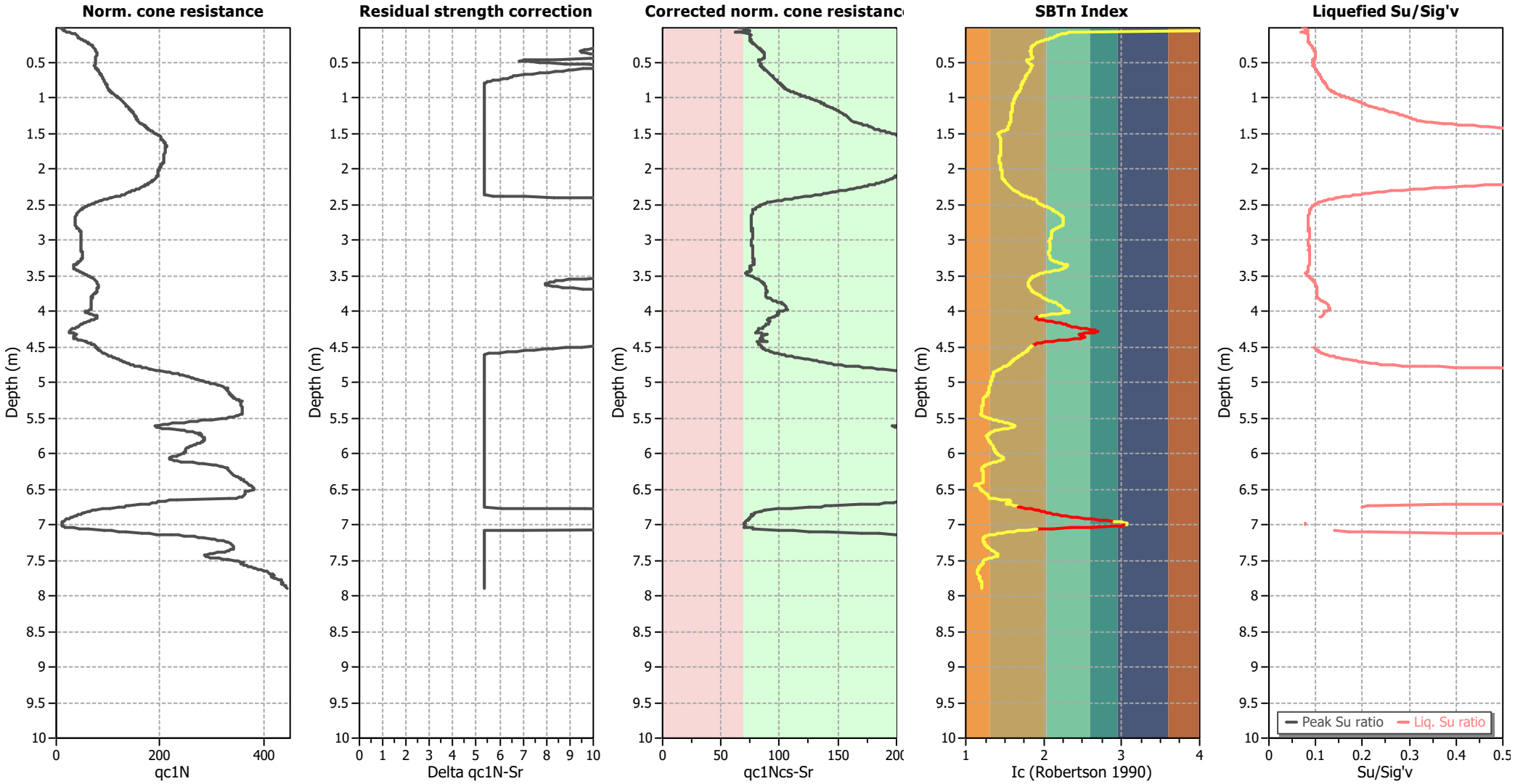




Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

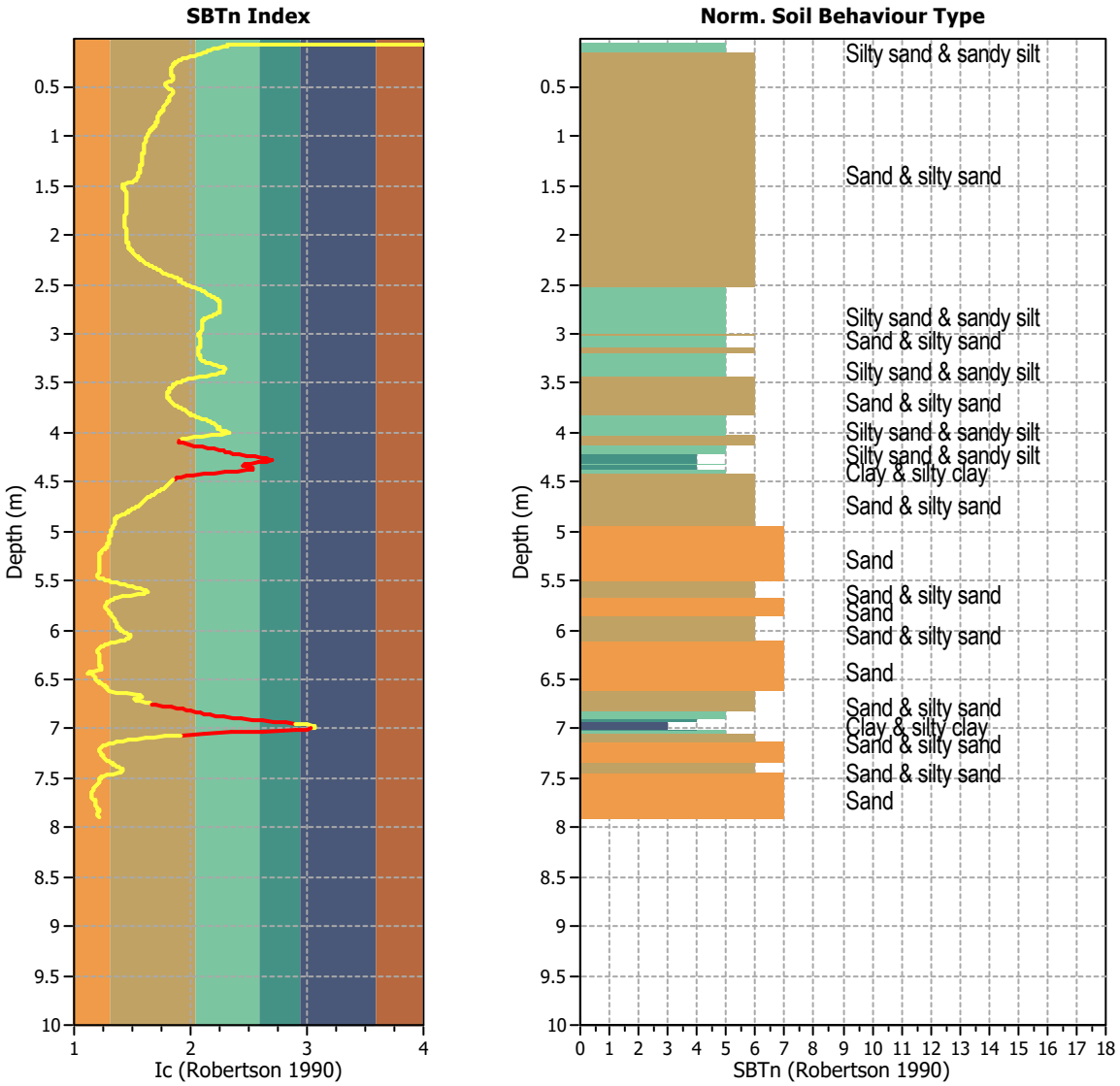
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

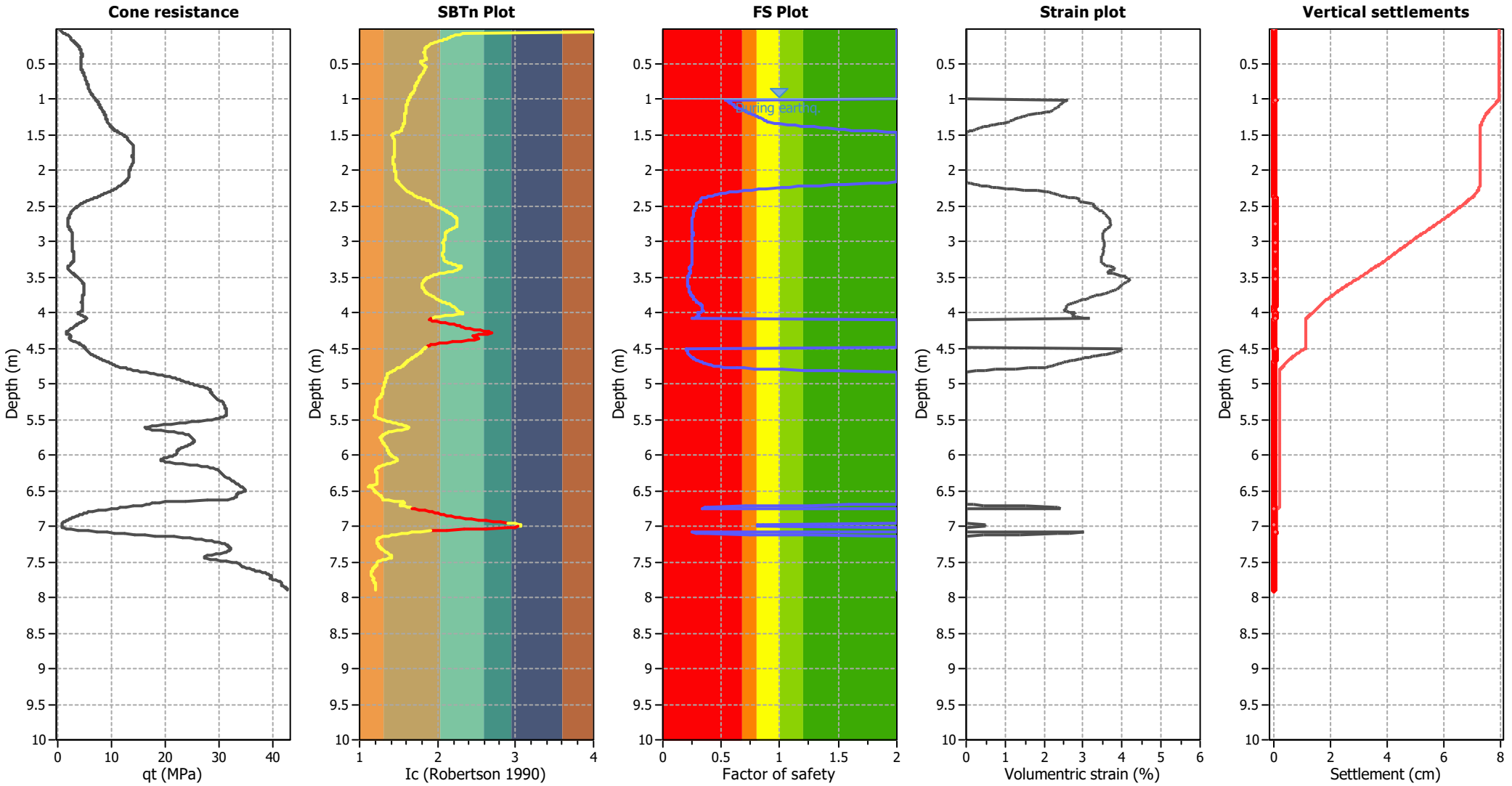
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	790
I_c maximum check value:	3.00	Total points excluded:	71
I_c change ratio value:	0.0100	Exclusion percentage:	8.99%
Minimum number of points in layer:	4	Number of layers detected:	6

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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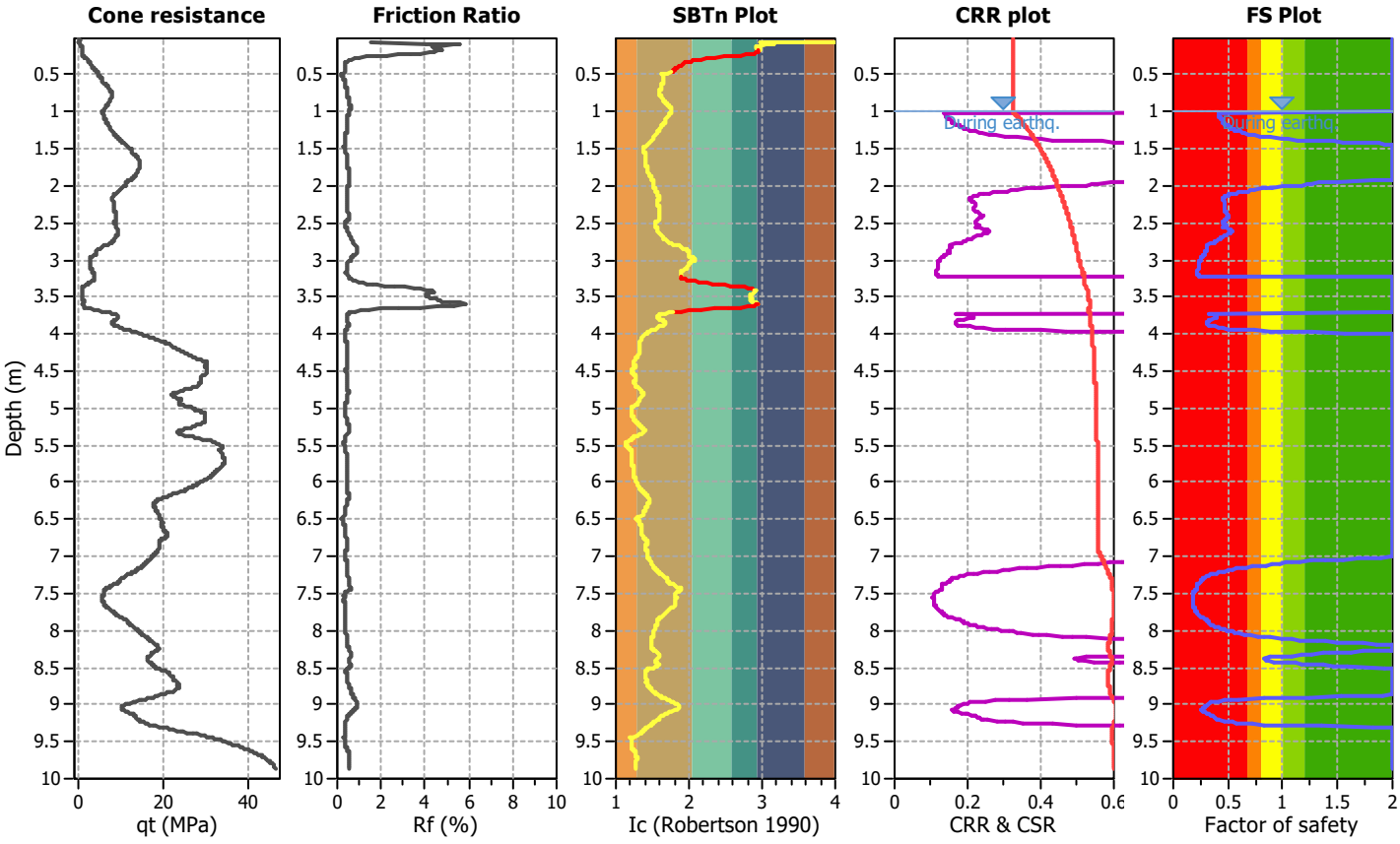
LIQUEFACTION ANALYSIS REPORT

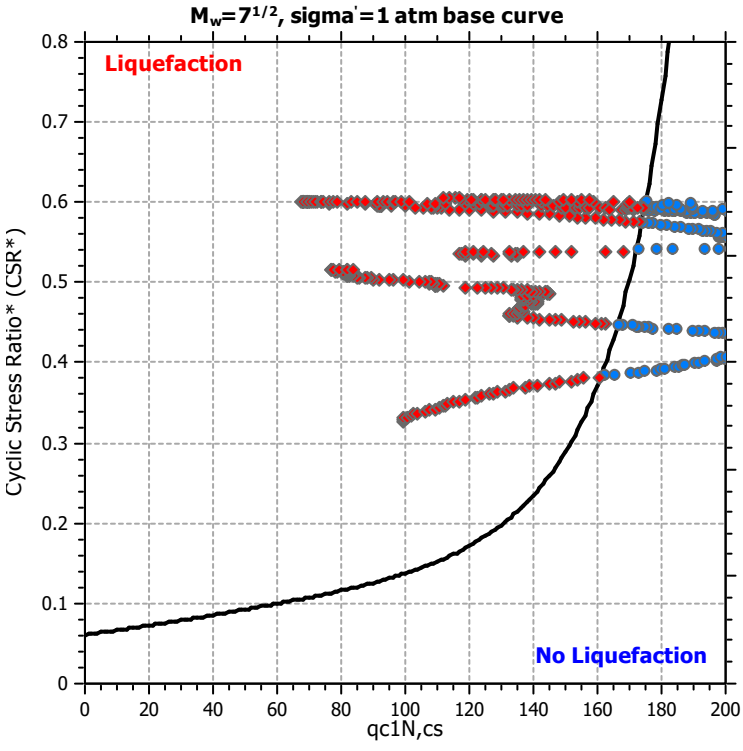
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

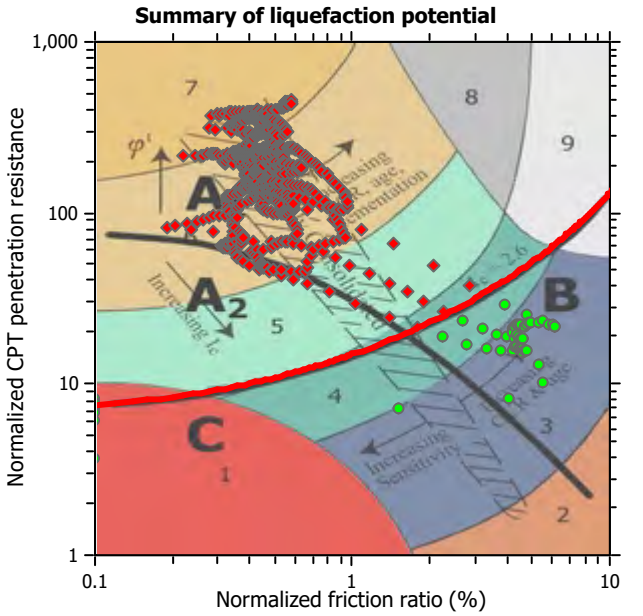
CPT file : CPT14_ULS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

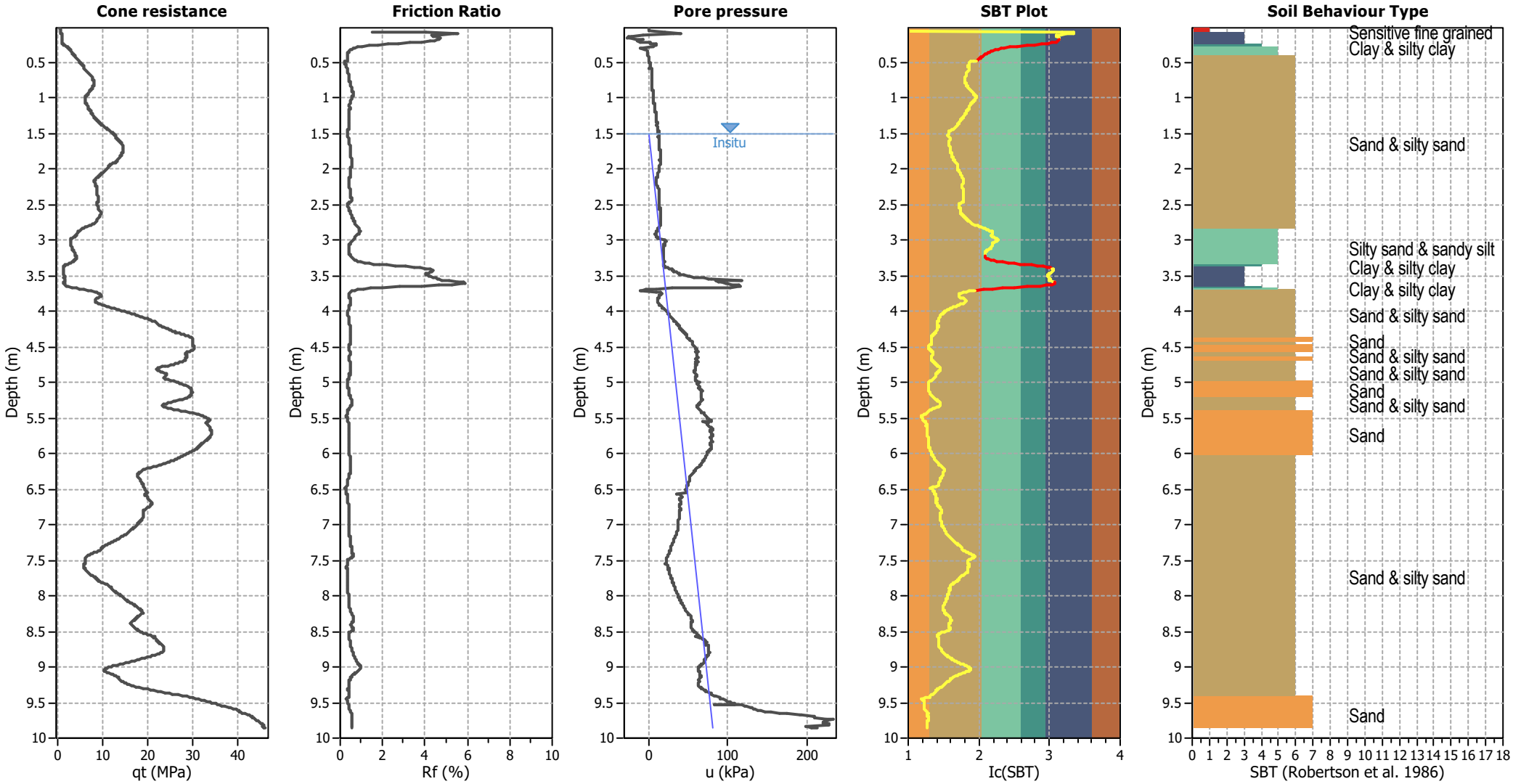






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



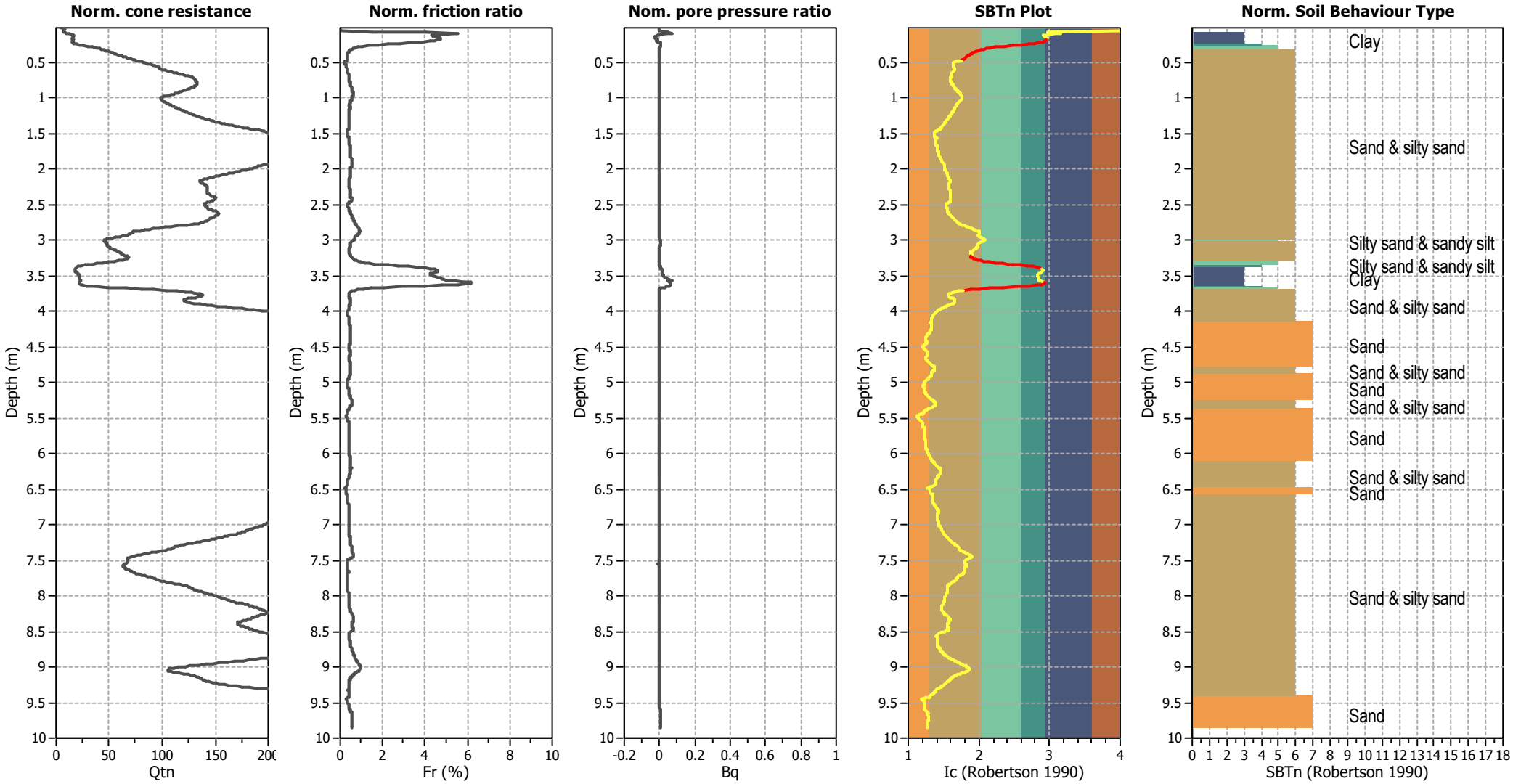
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



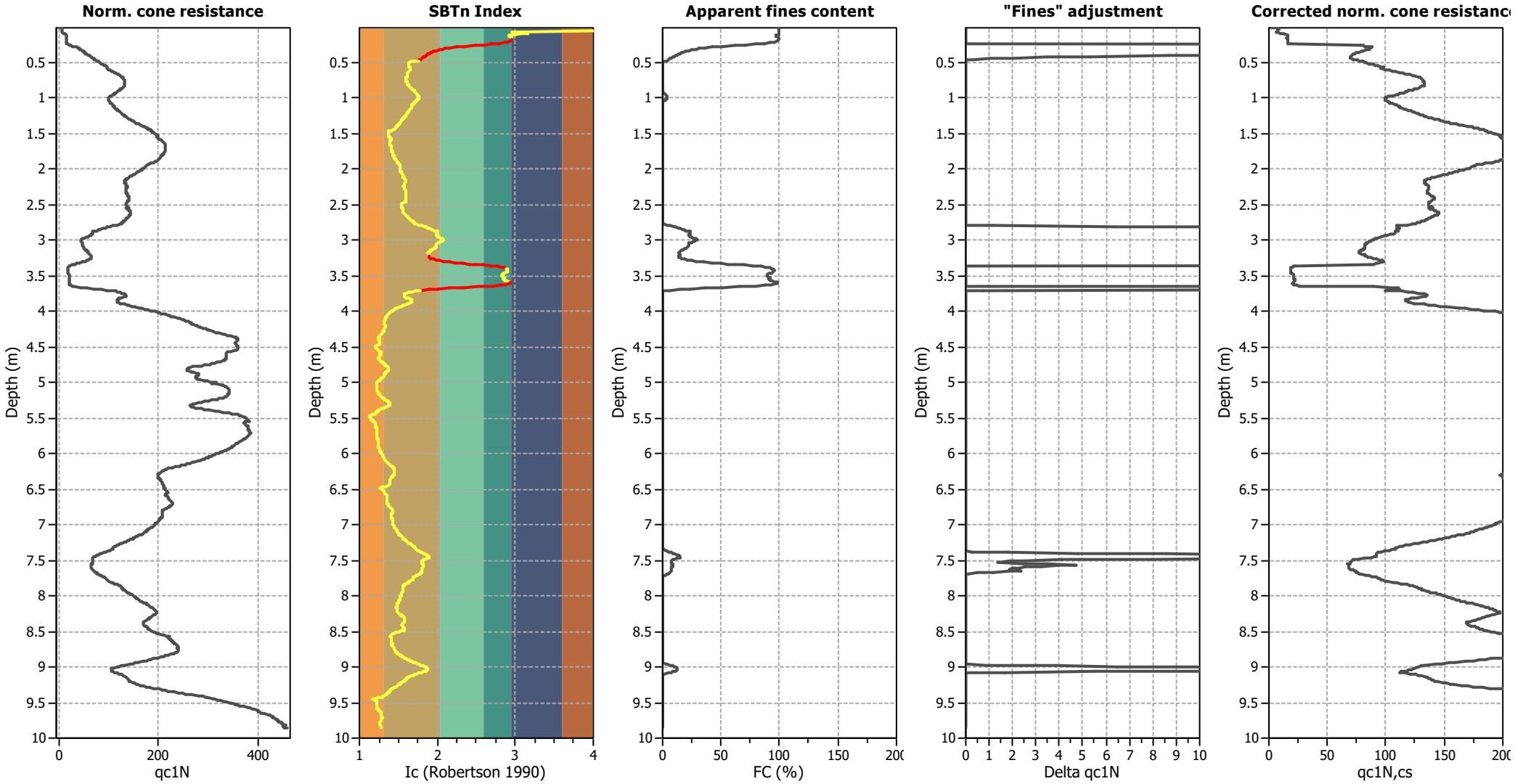
Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

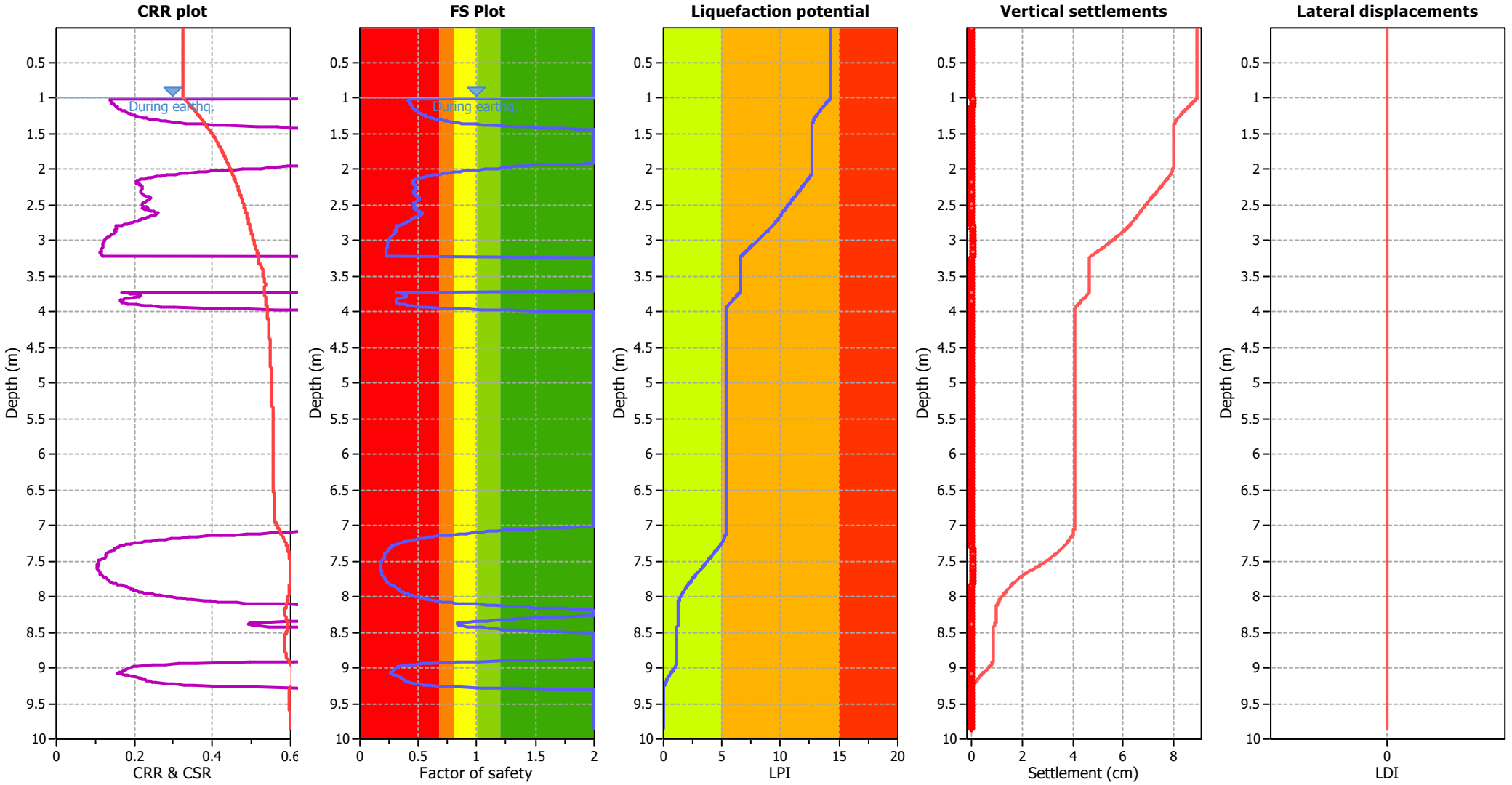
Liquefaction analysis overall plots (intermediate results)



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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

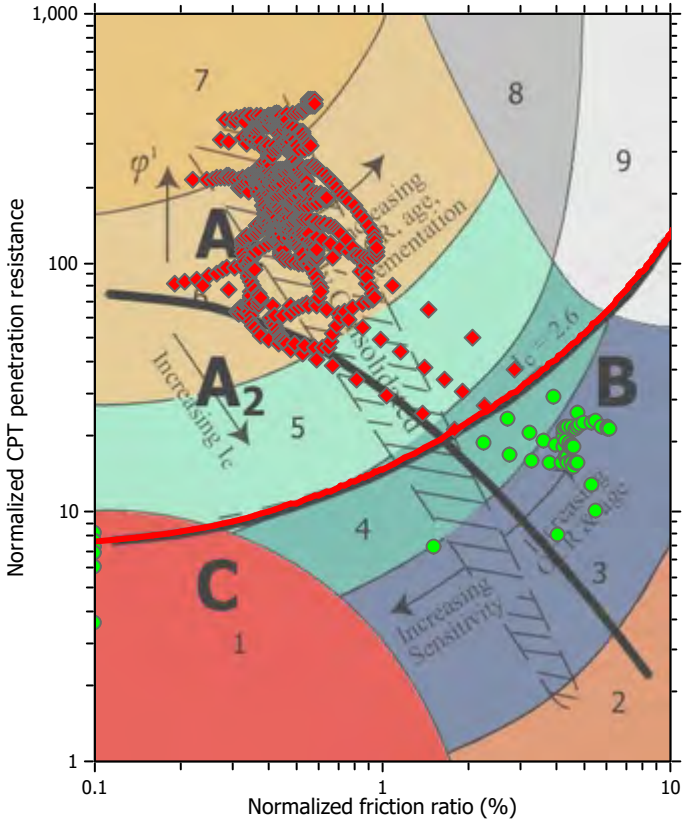
F.S. color scheme

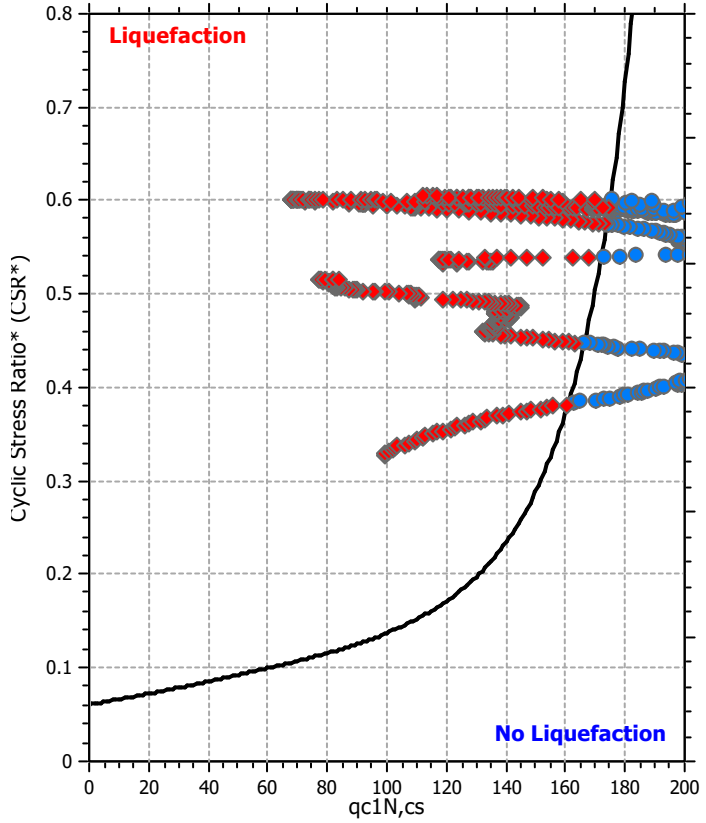
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

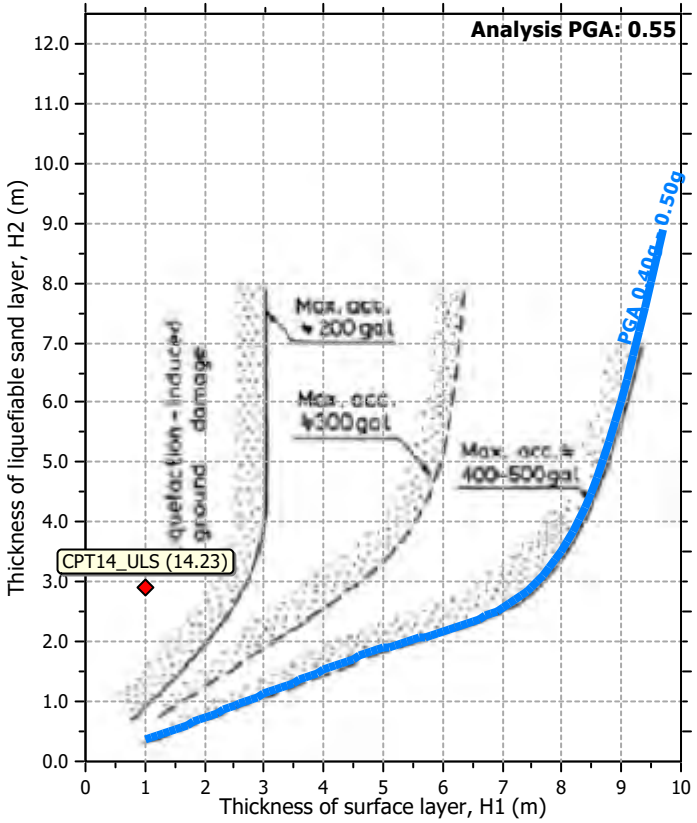
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



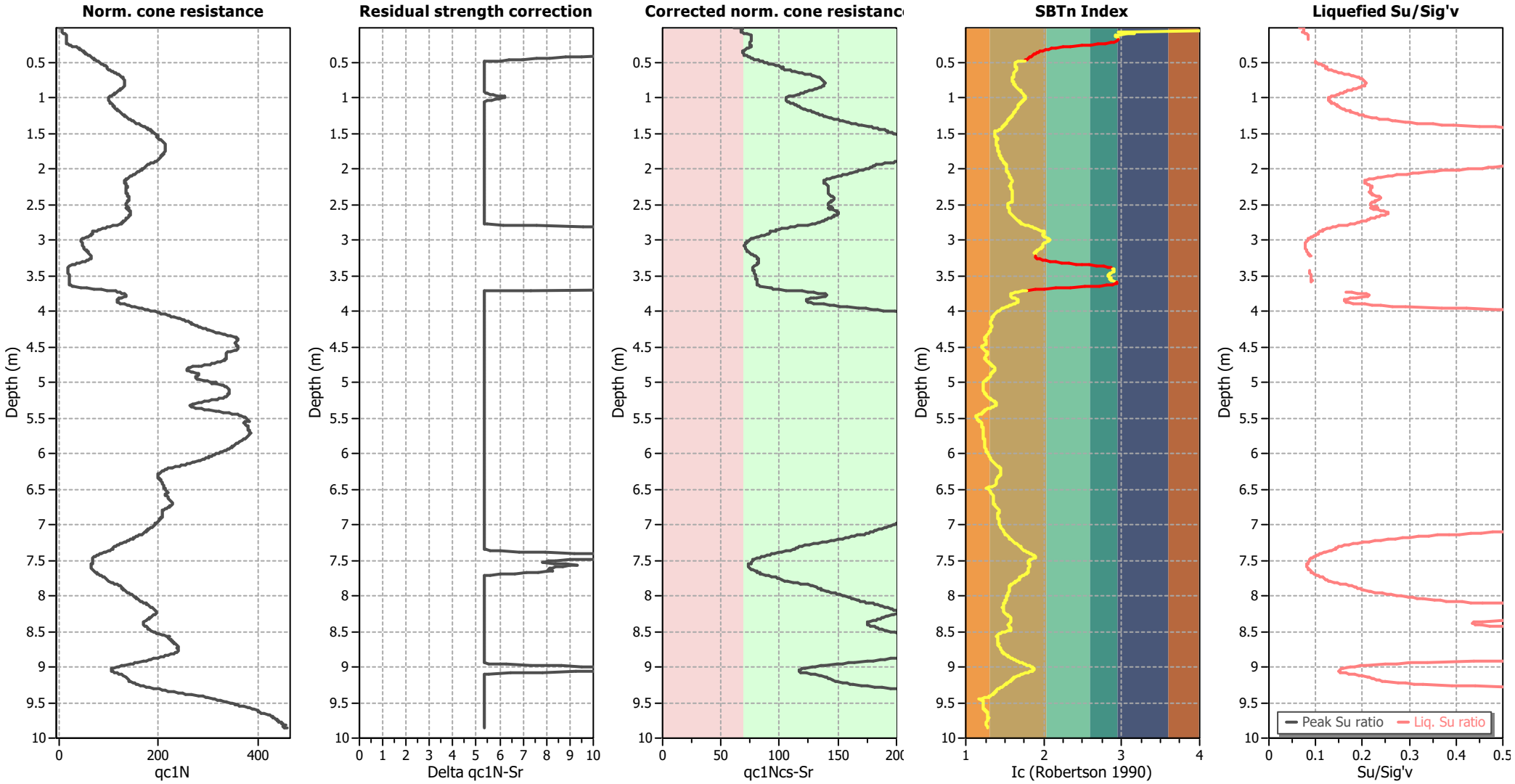




Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

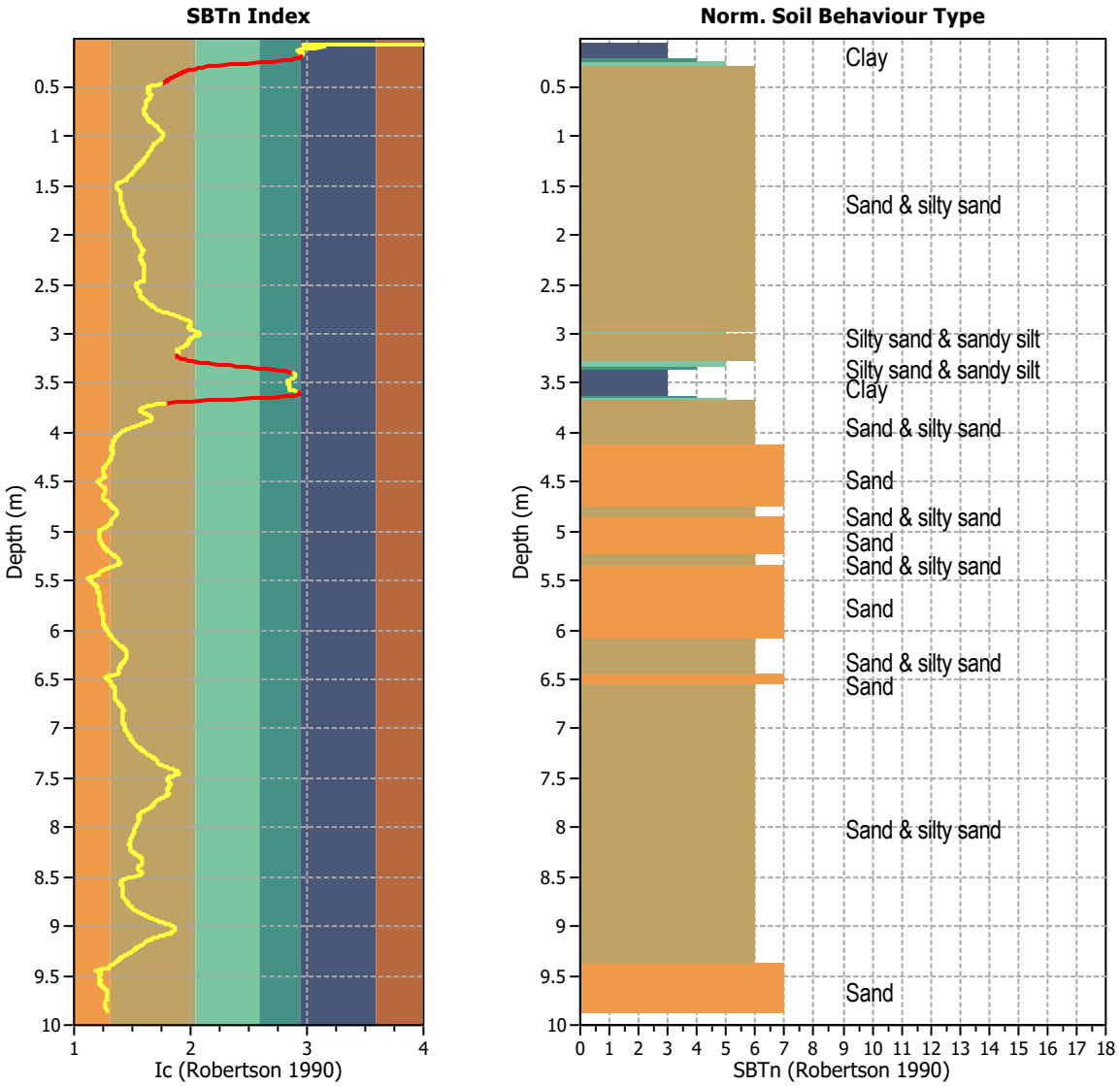
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

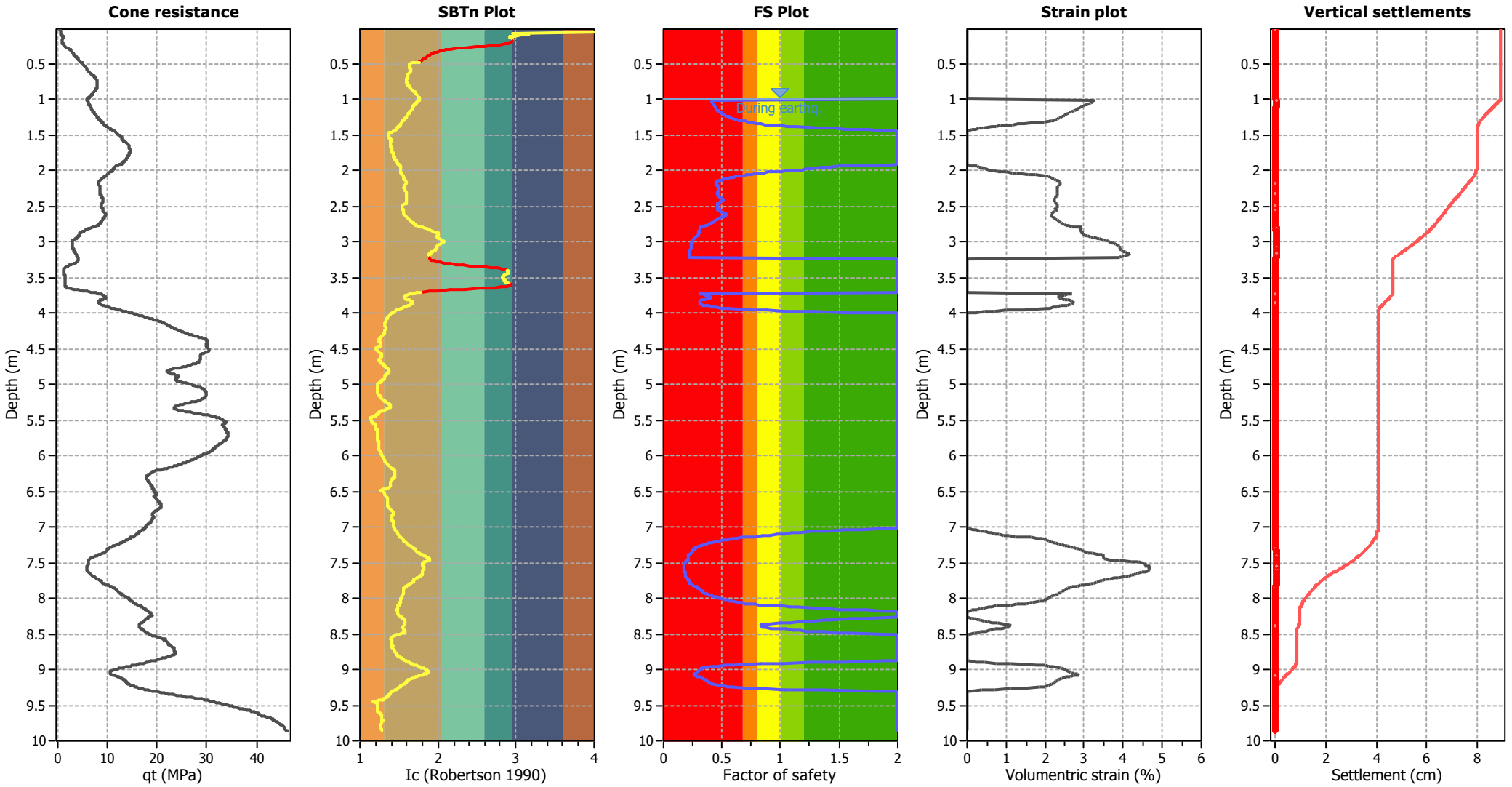
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	986
I_c maximum check value:	3.00	Total points excluded:	61
I_c change ratio value:	0.0100	Exclusion percentage:	6.19%
Minimum number of points in layer:	4	Number of layers detected:	3

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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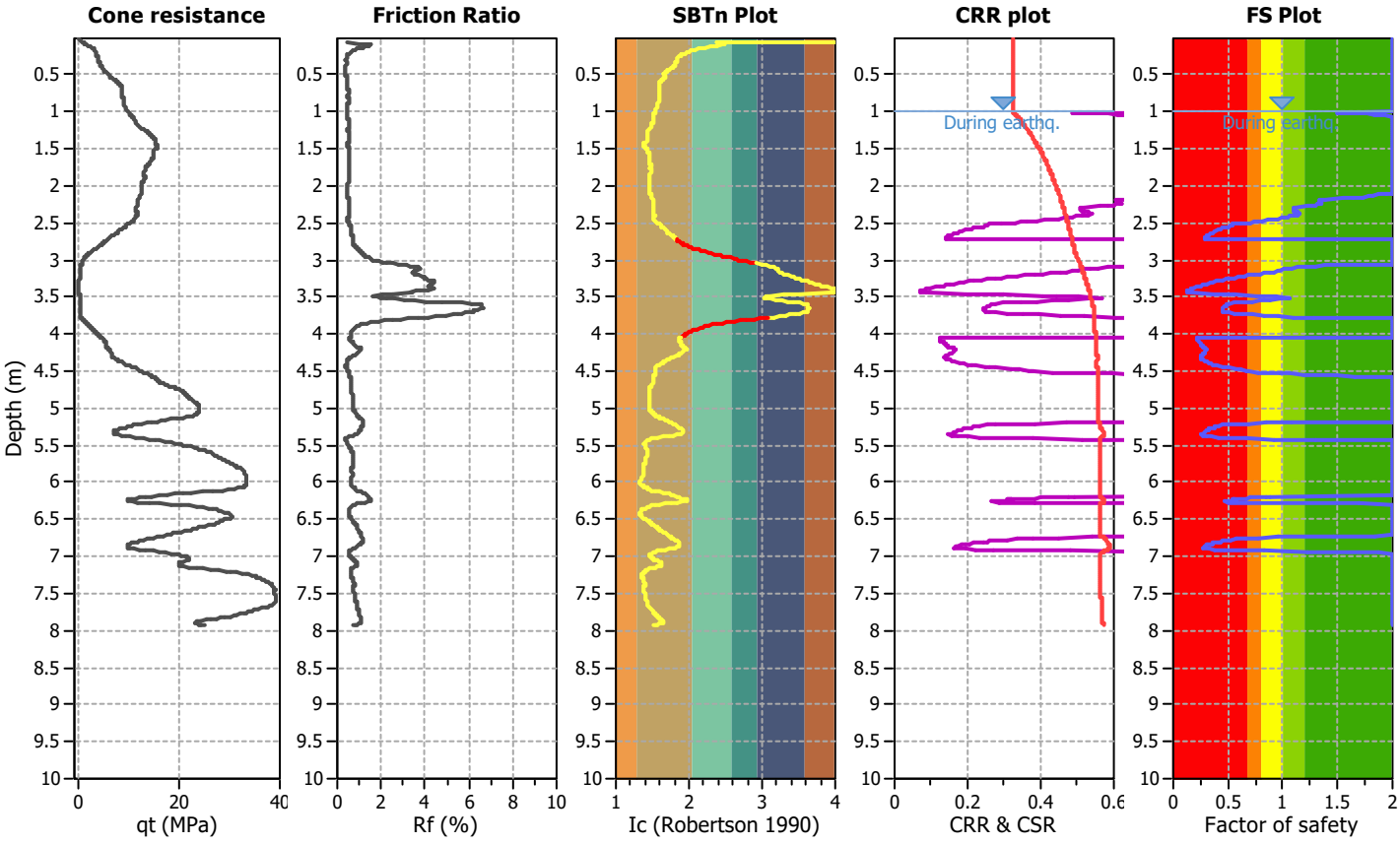
LIQUEFACTION ANALYSIS REPORT

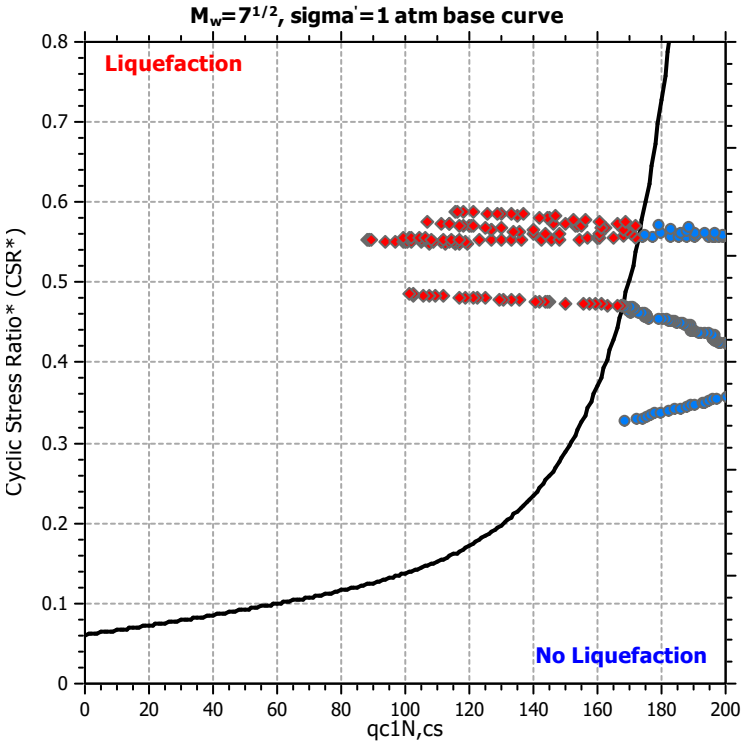
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

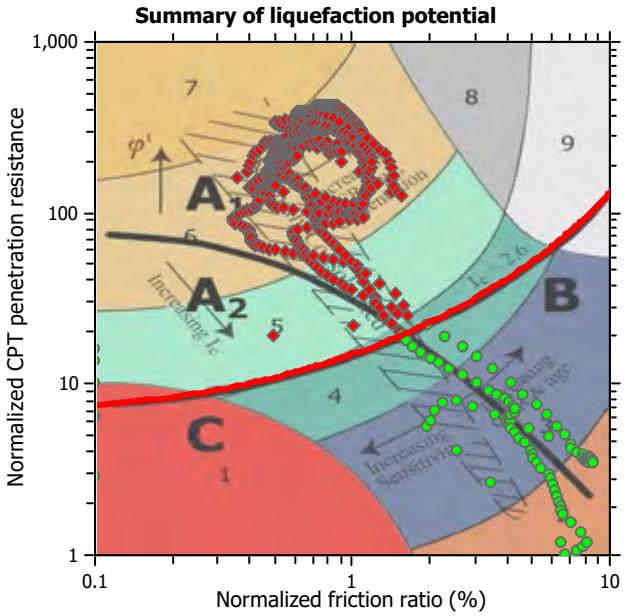
CPT file : CPT15_ULS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

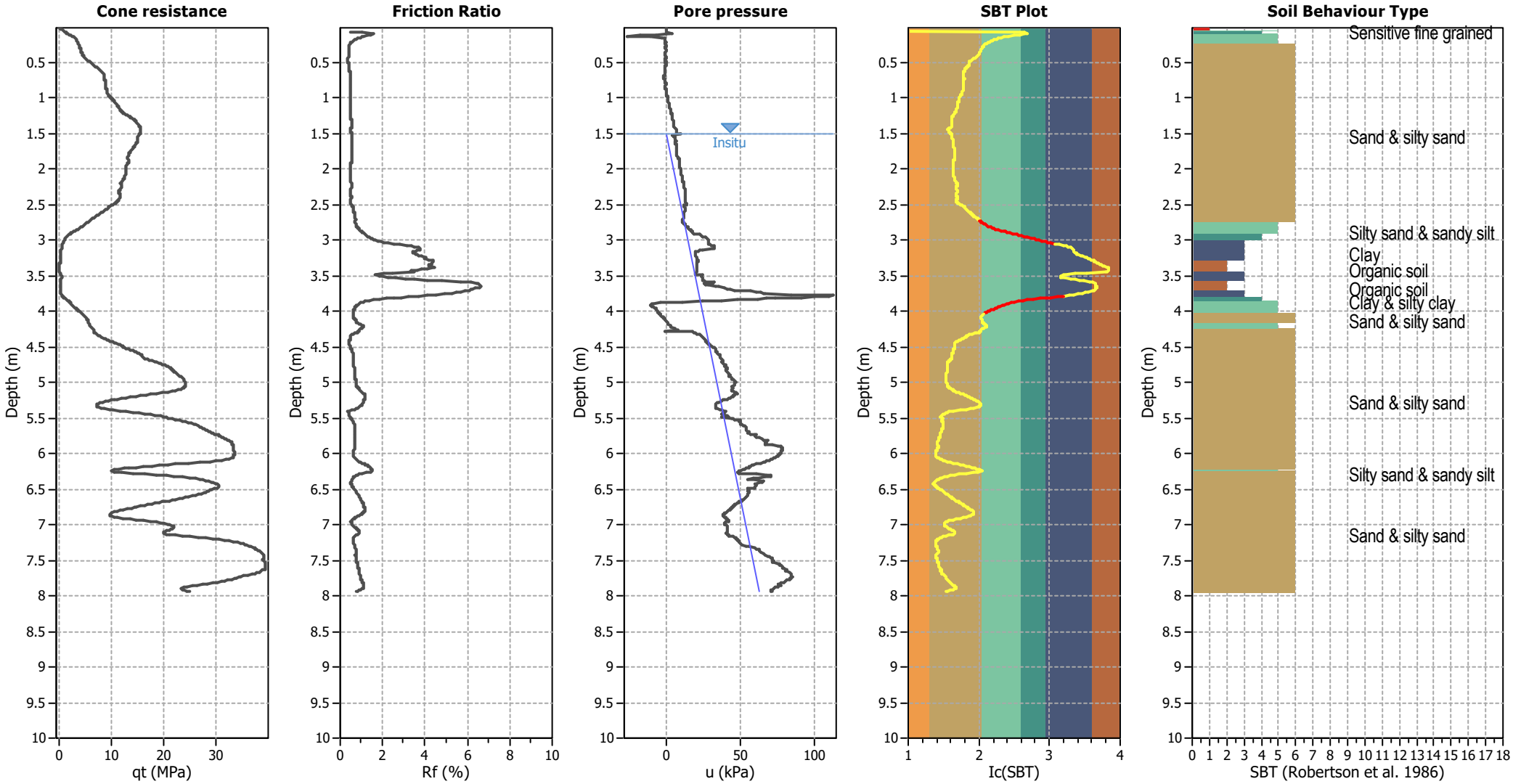






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



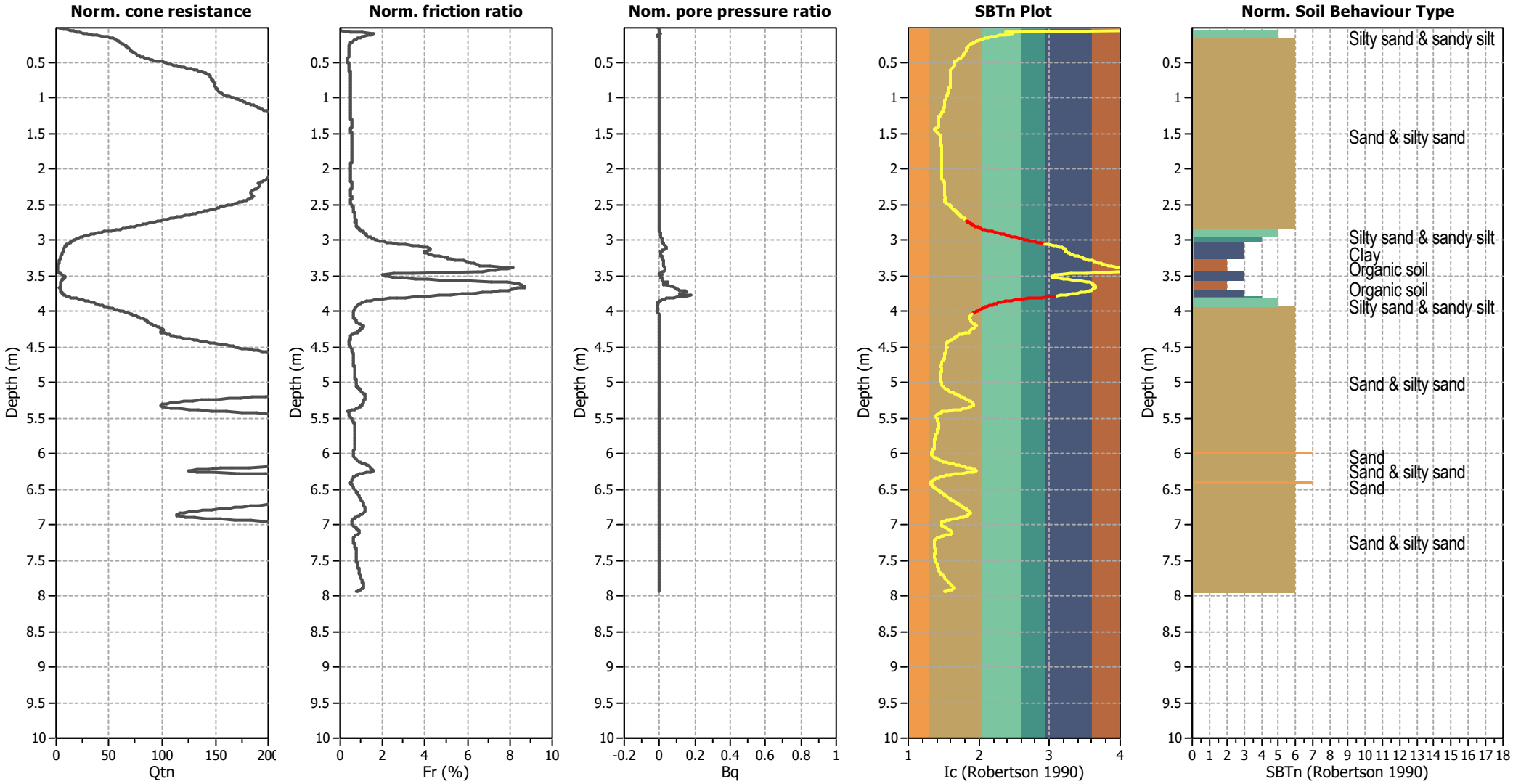
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



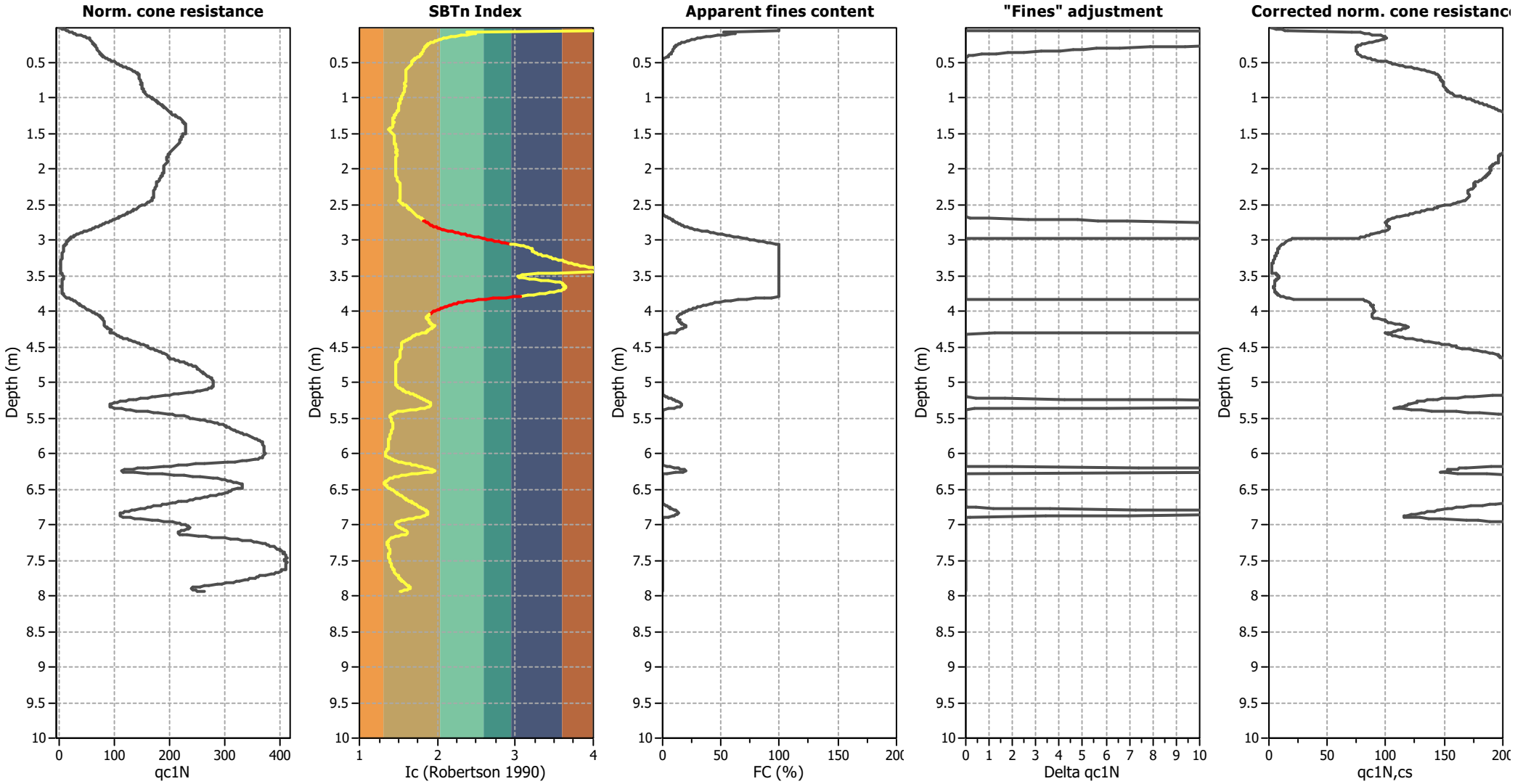
Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

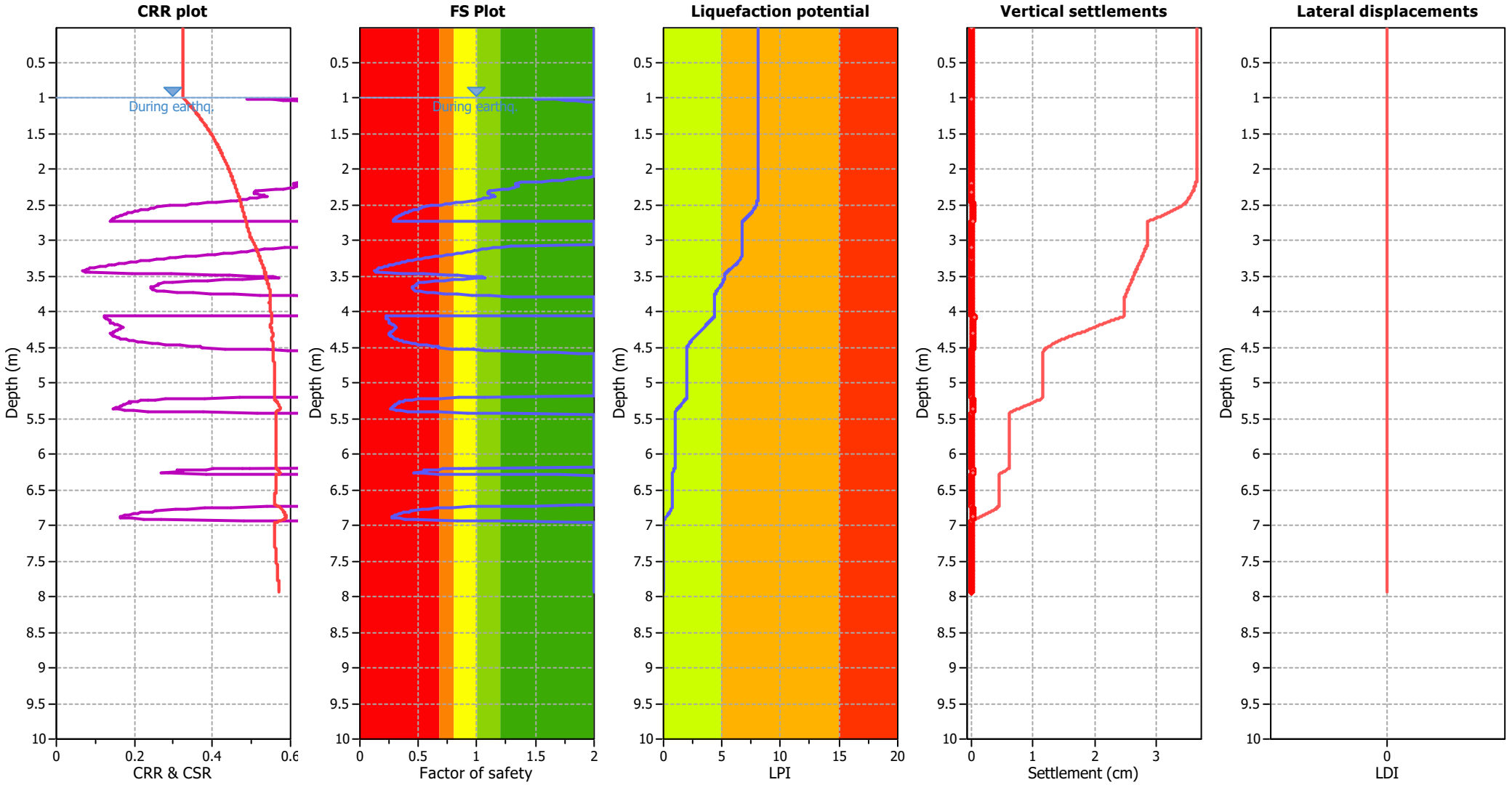
Liquefaction analysis overall plots (intermediate results)



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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

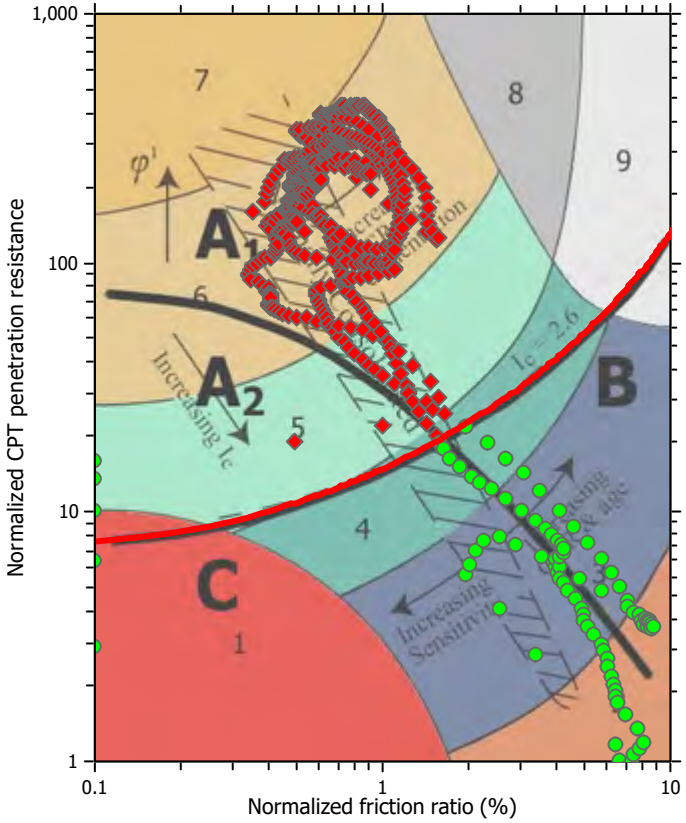
F.S. color scheme

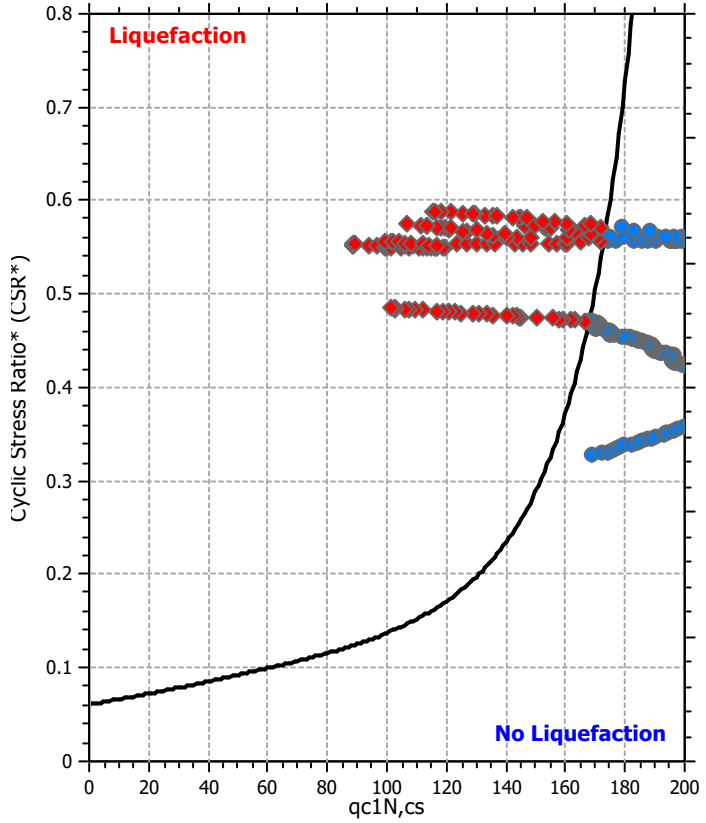
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

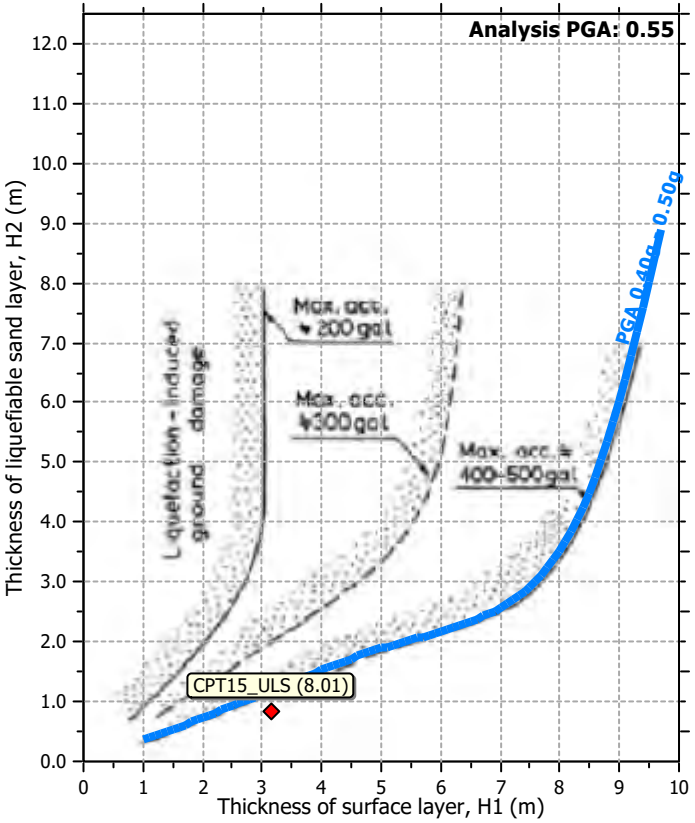
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



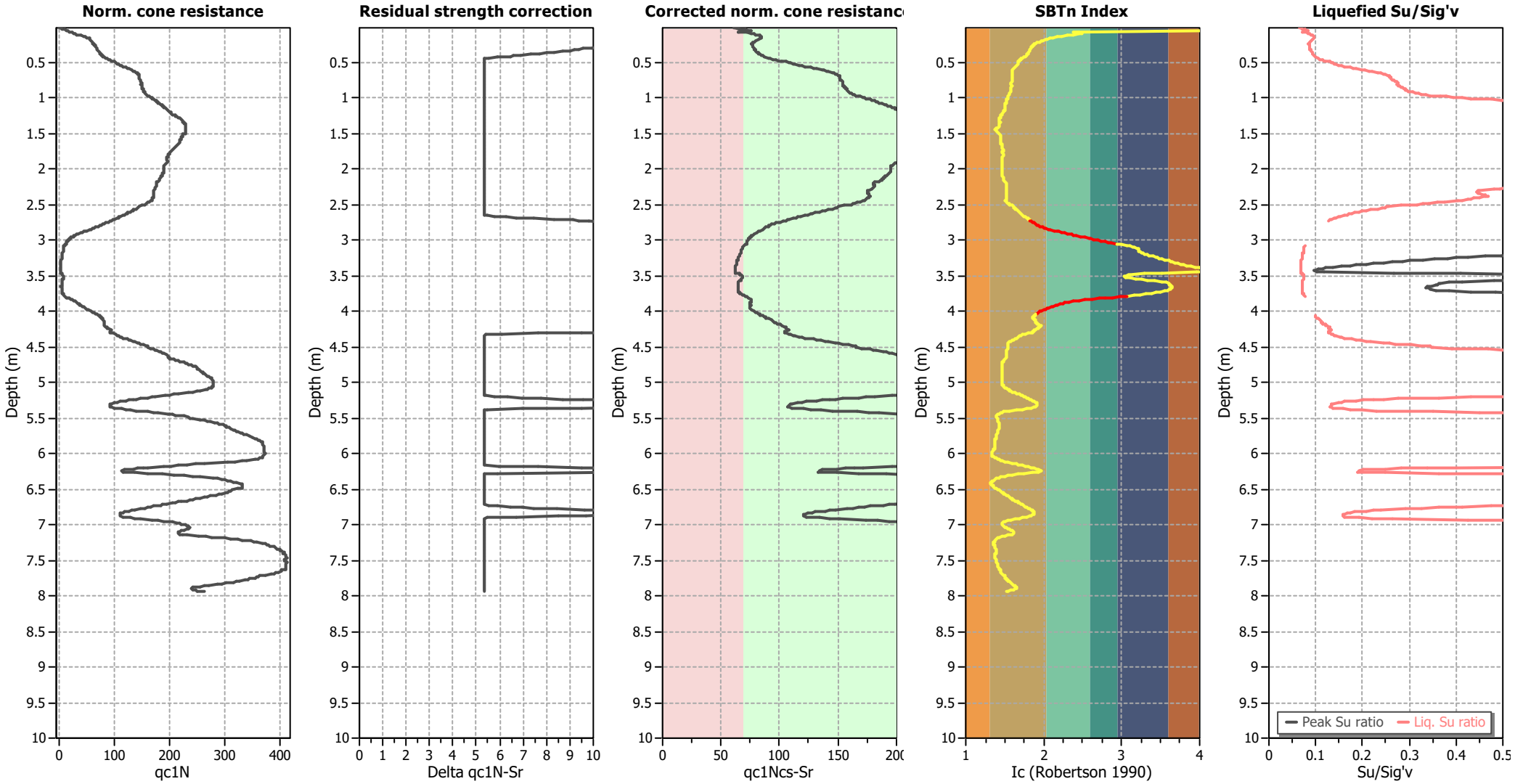




Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

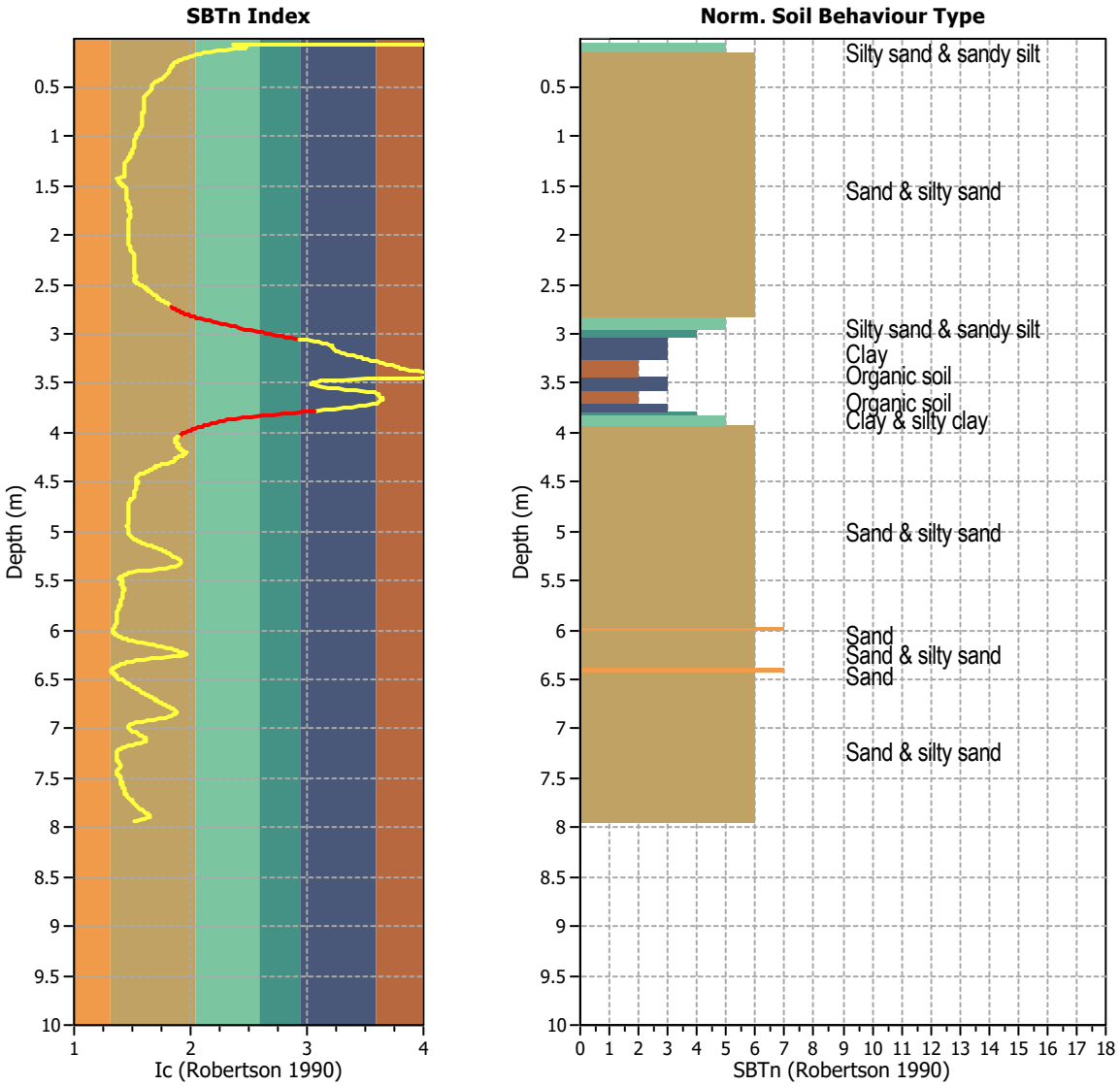
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

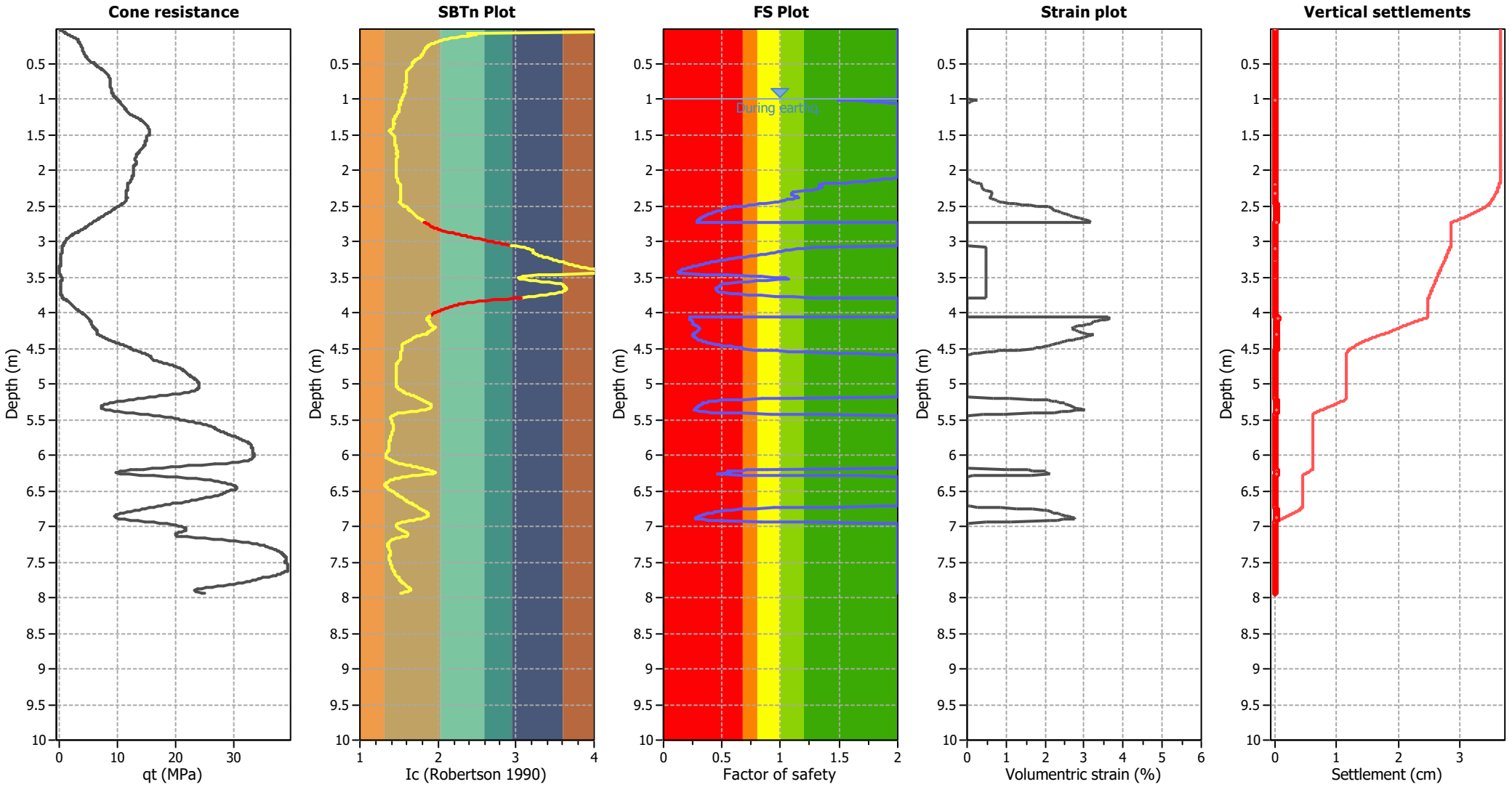
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	794
I_c maximum check value:	3.00	Total points excluded:	61
I_c change ratio value:	0.0100	Exclusion percentage:	7.68%
Minimum number of points in layer:	4	Number of layers detected:	2

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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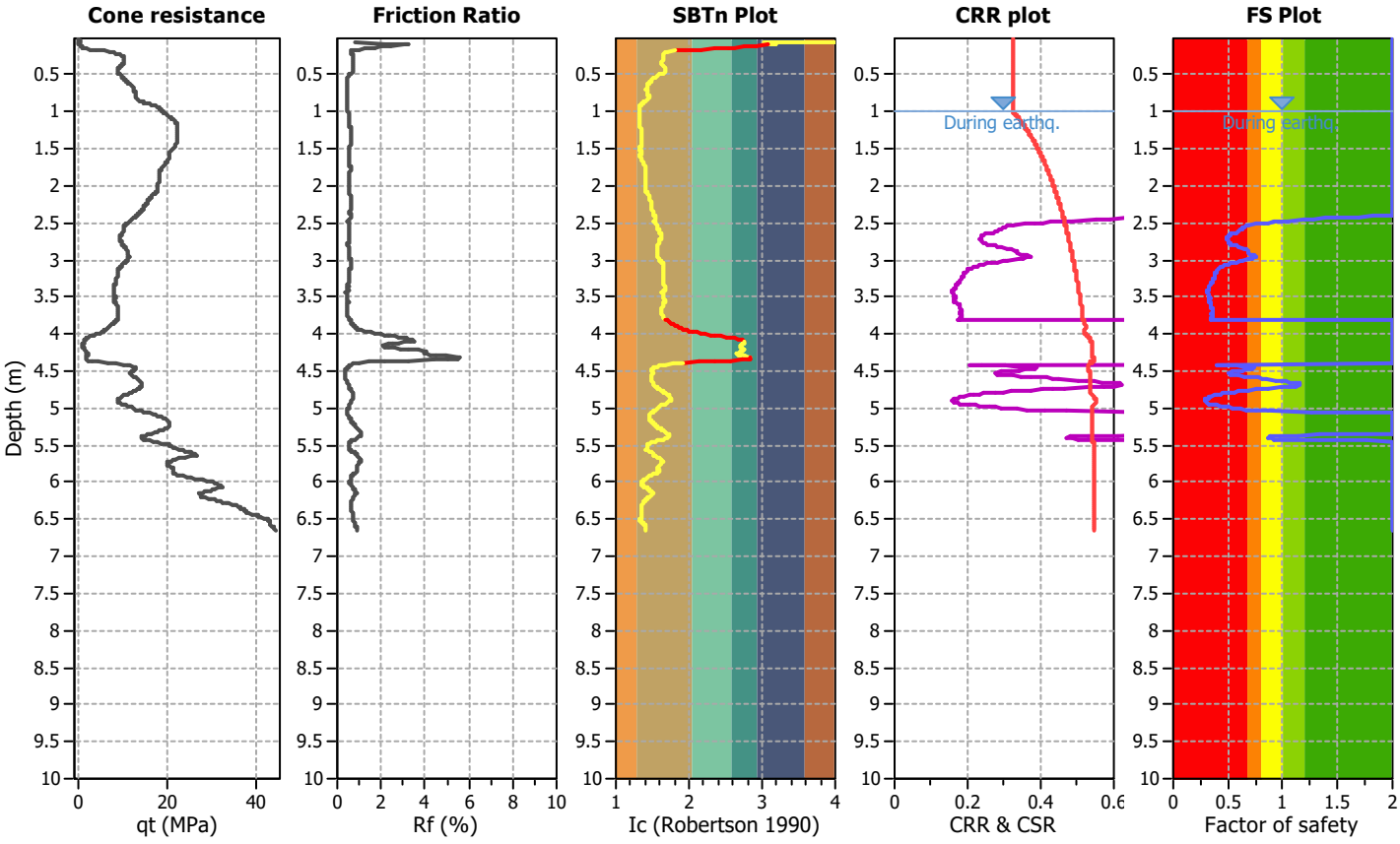
LIQUEFACTION ANALYSIS REPORT

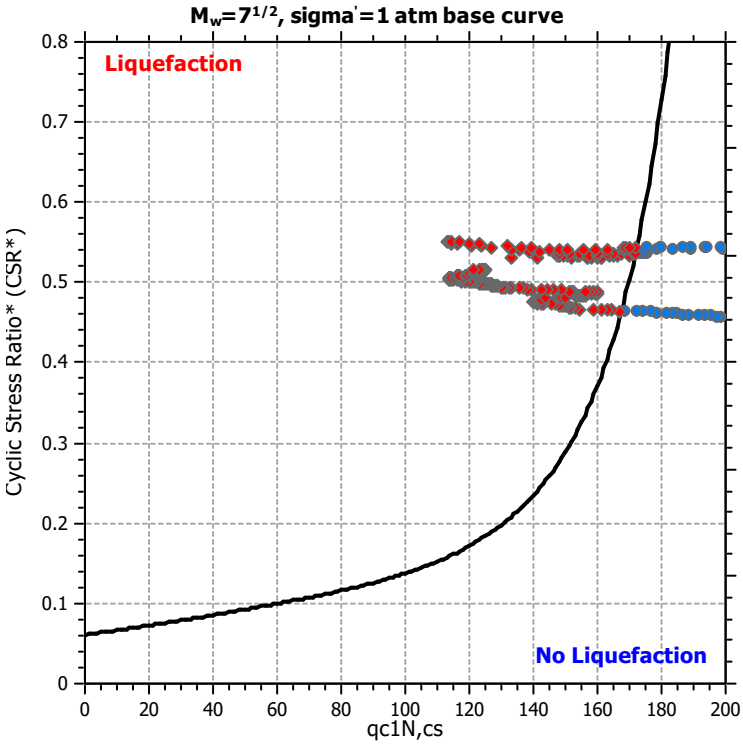
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

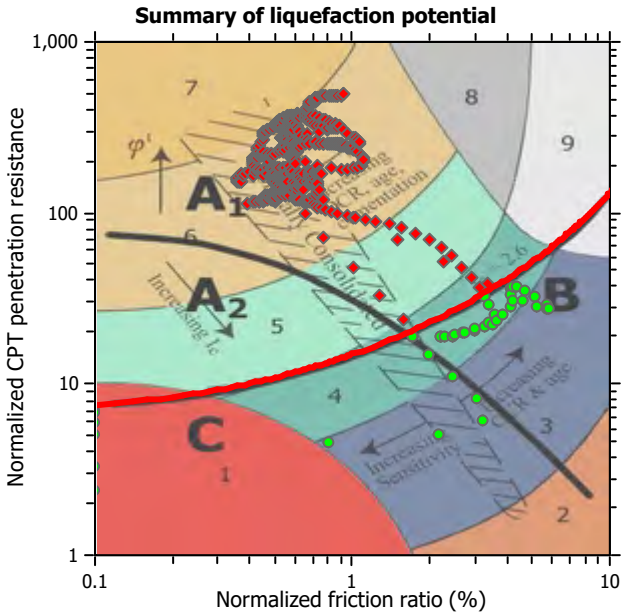
CPT file : CPT16_ULS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

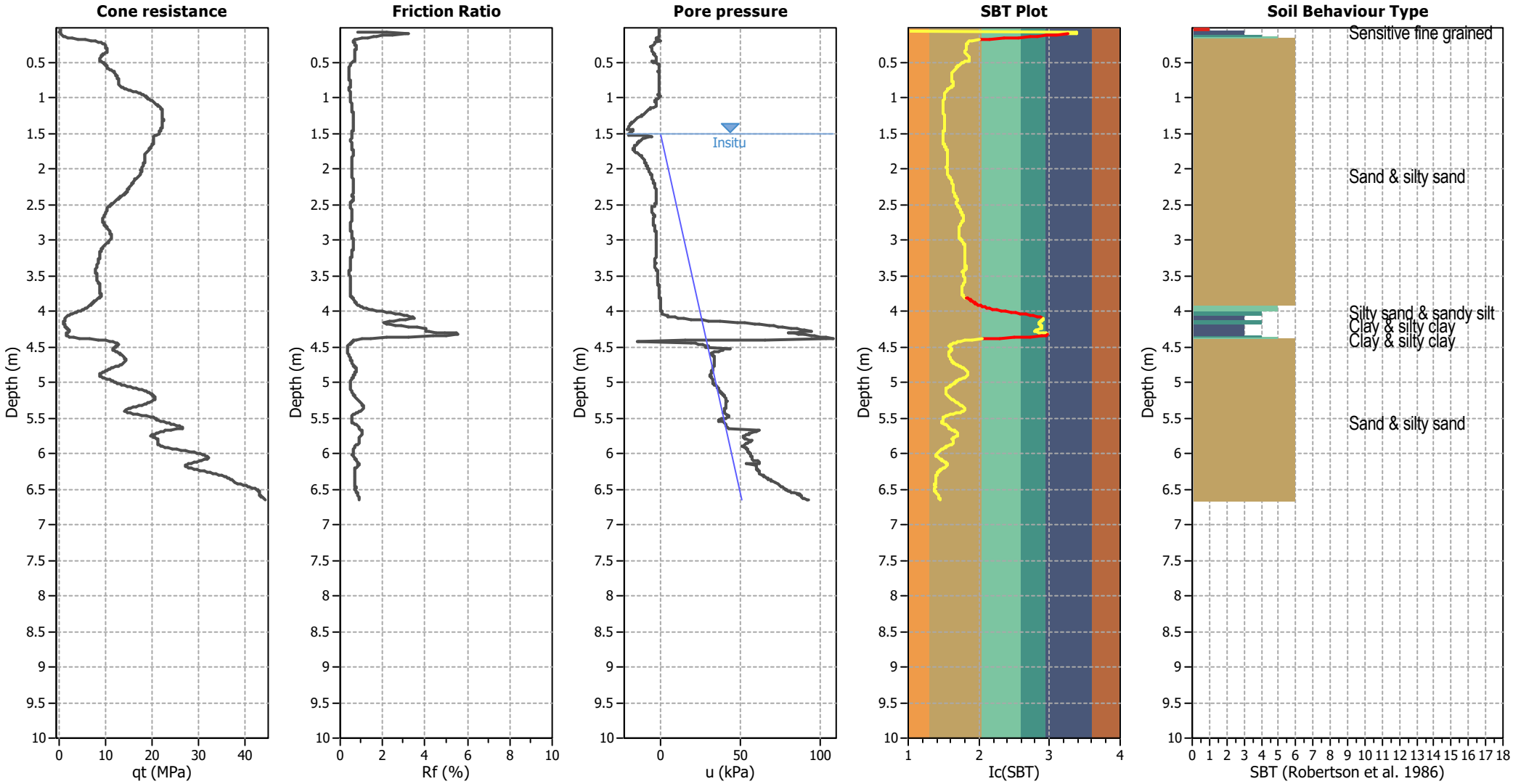






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



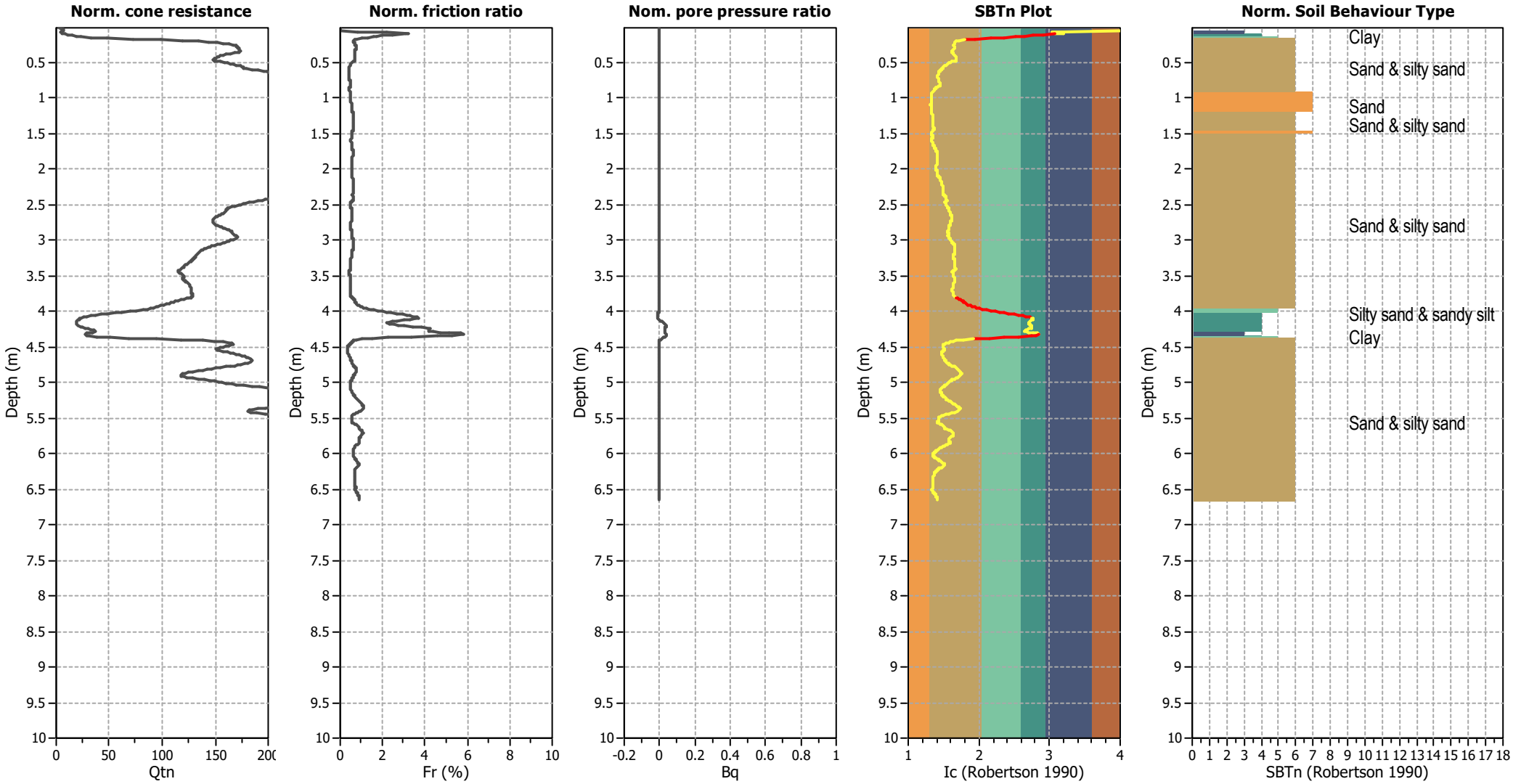
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



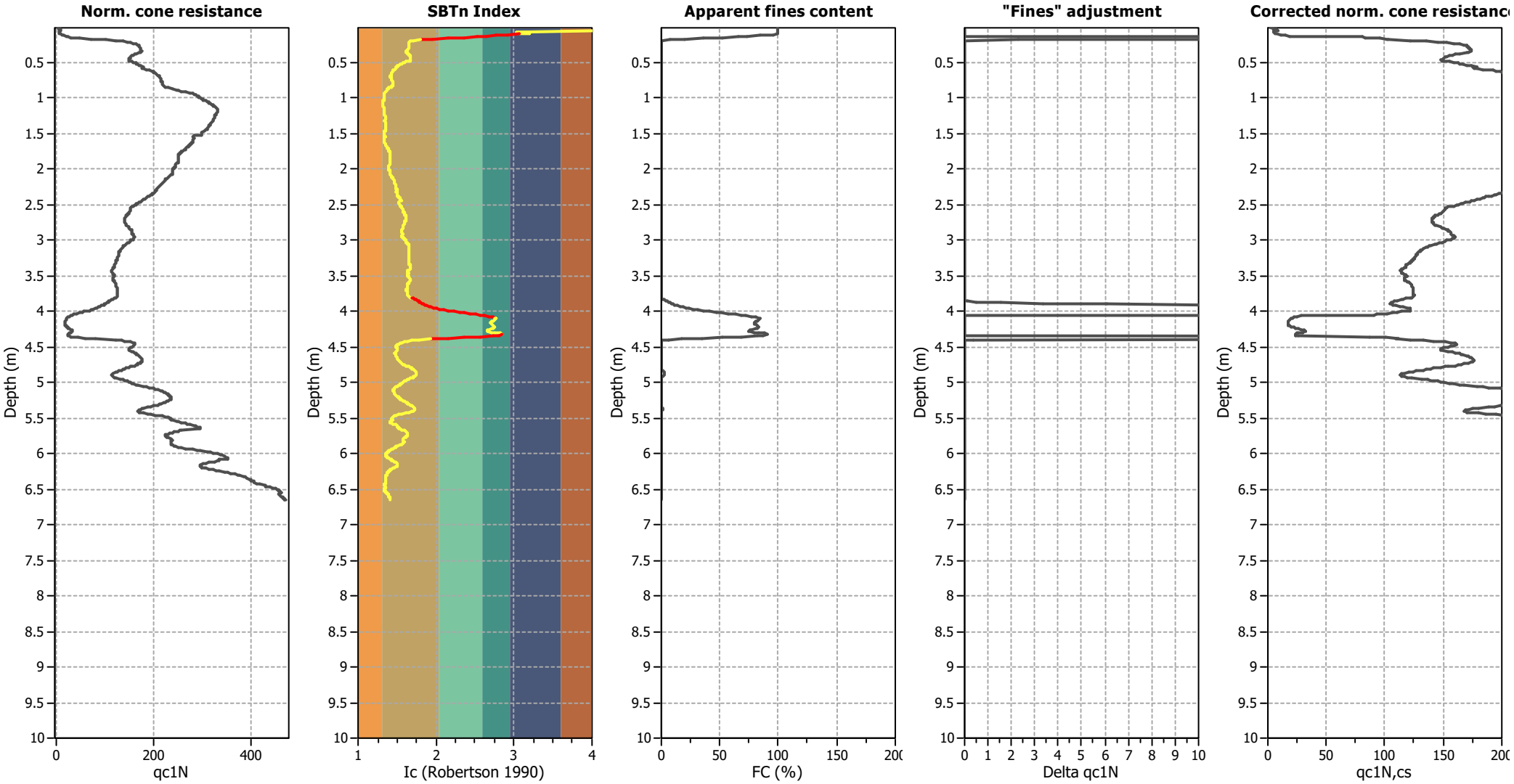
Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

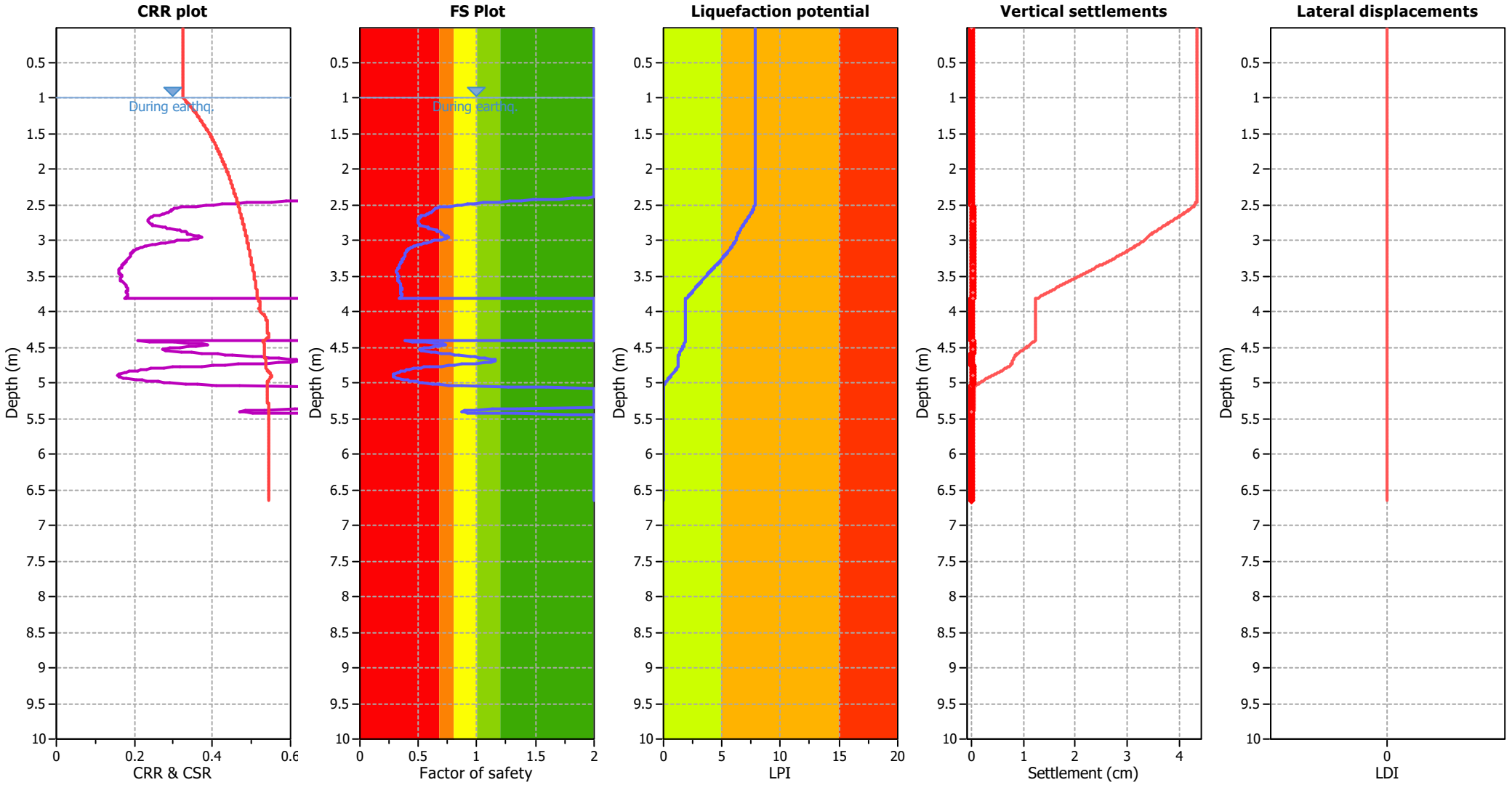
Liquefaction analysis overall plots (intermediate results)



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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

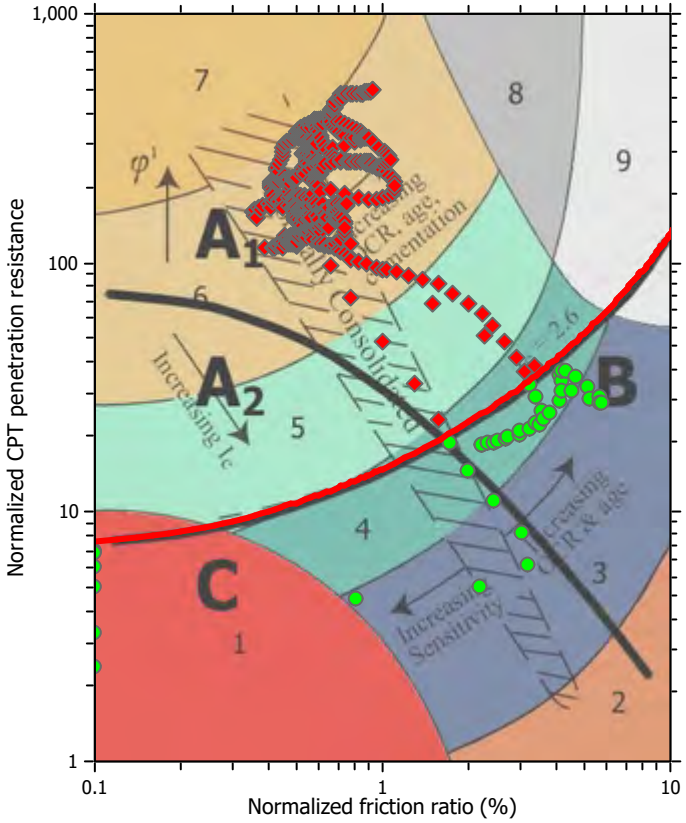
F.S. color scheme

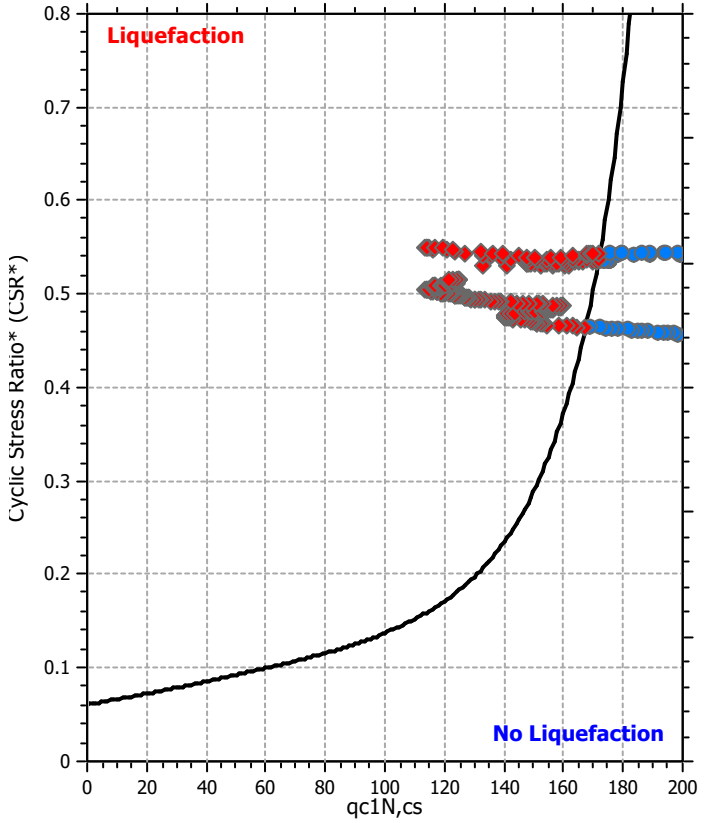
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

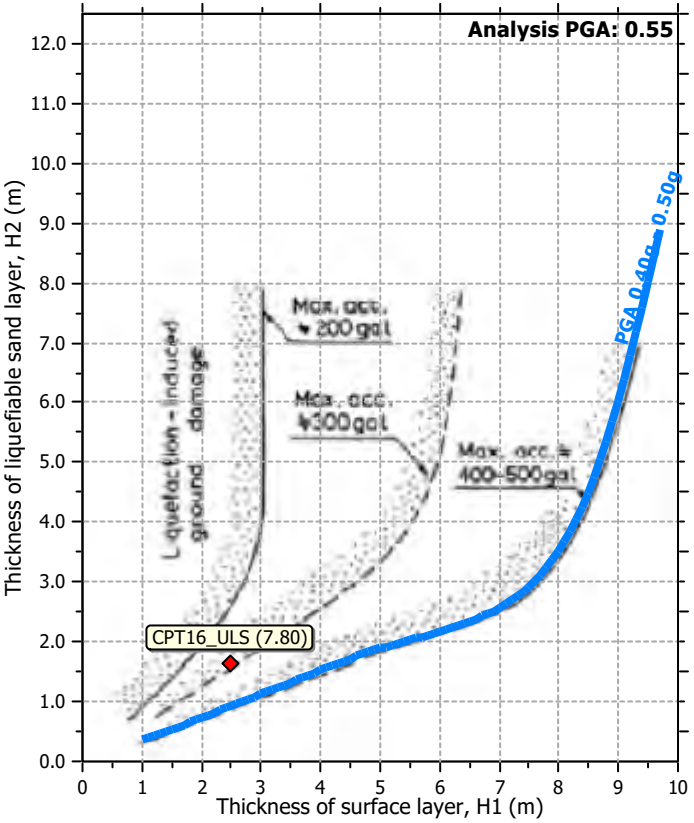
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



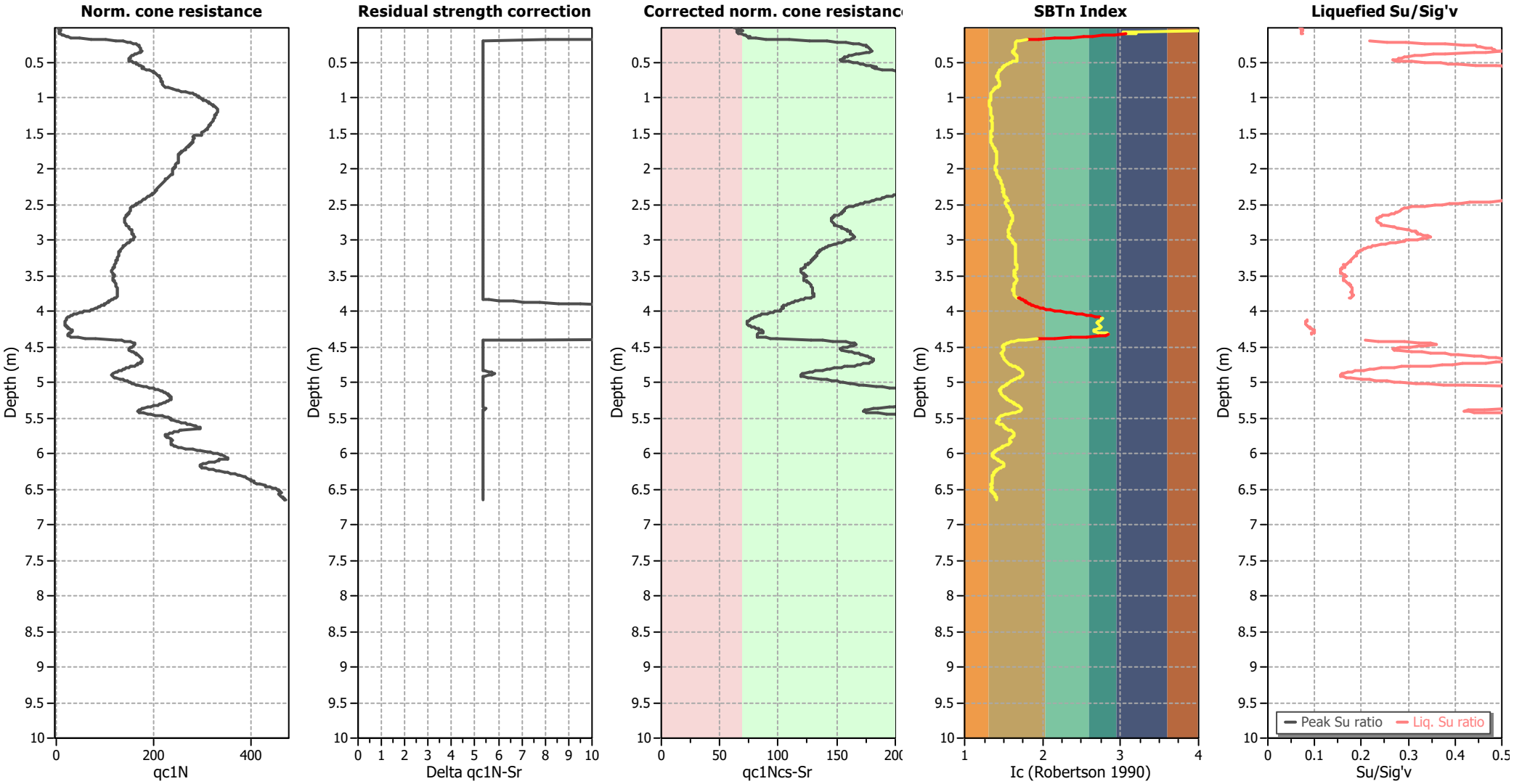




Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

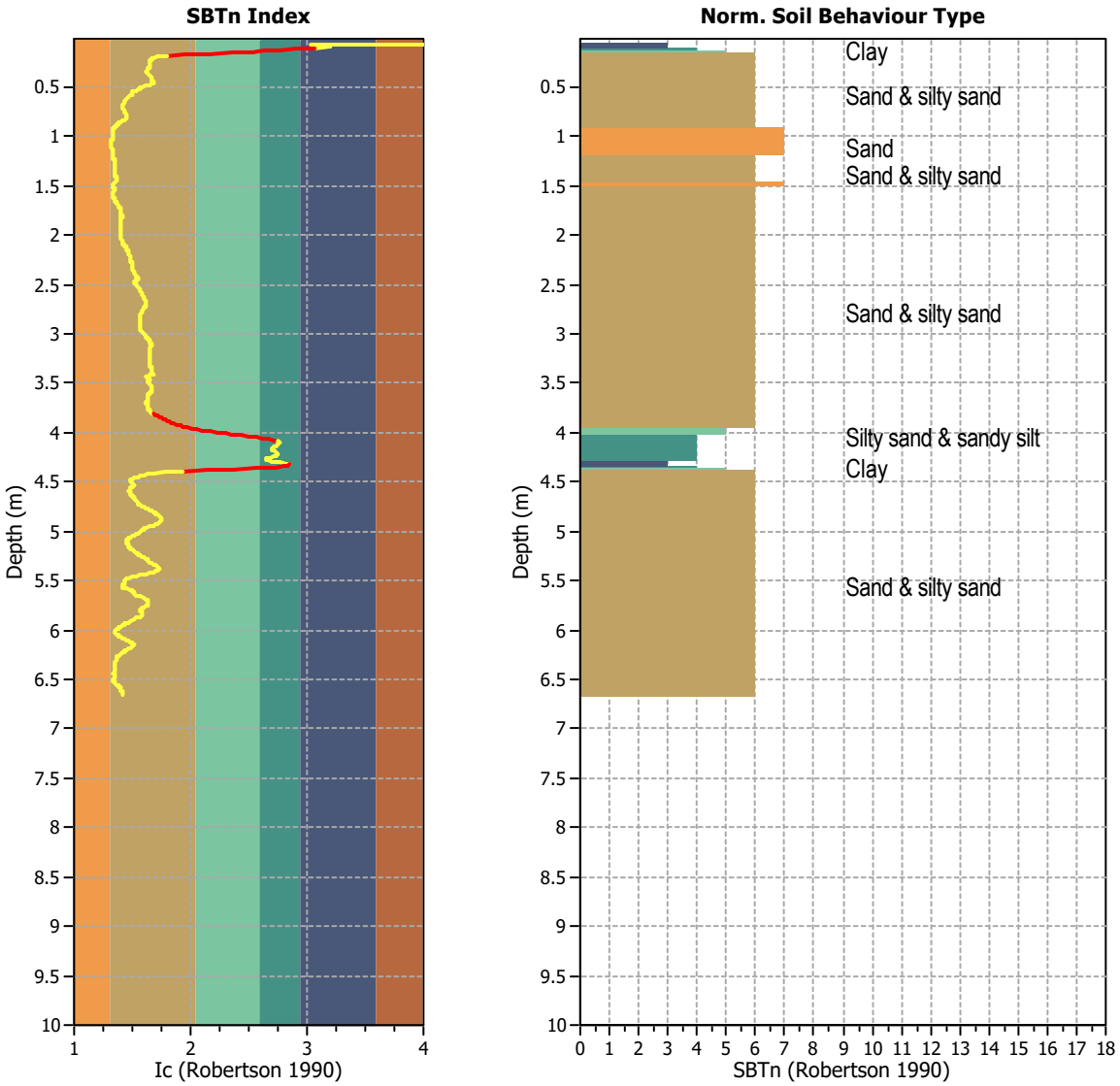
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

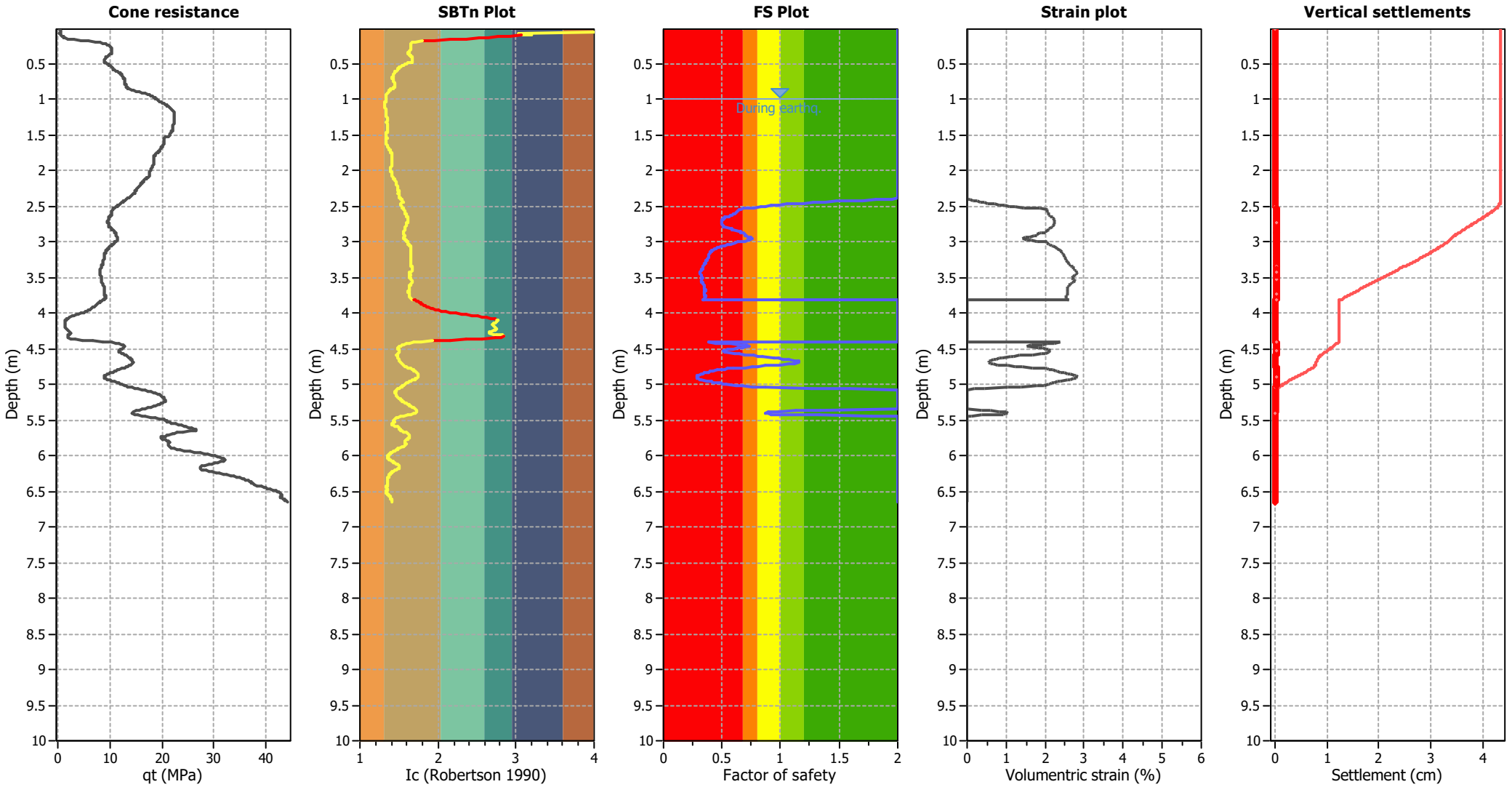
The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties	
I_c minimum check value:	1.70
I_c maximum check value:	3.00
I_c change ratio value:	0.0100
Minimum number of points in layer:	4

General statistics	
Total points in CPT file:	665
Total points excluded:	46
Exclusion percentage:	6.92%
Number of layers detected:	3

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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179 Courtenay Street, New Plymouth
www.btw.nz

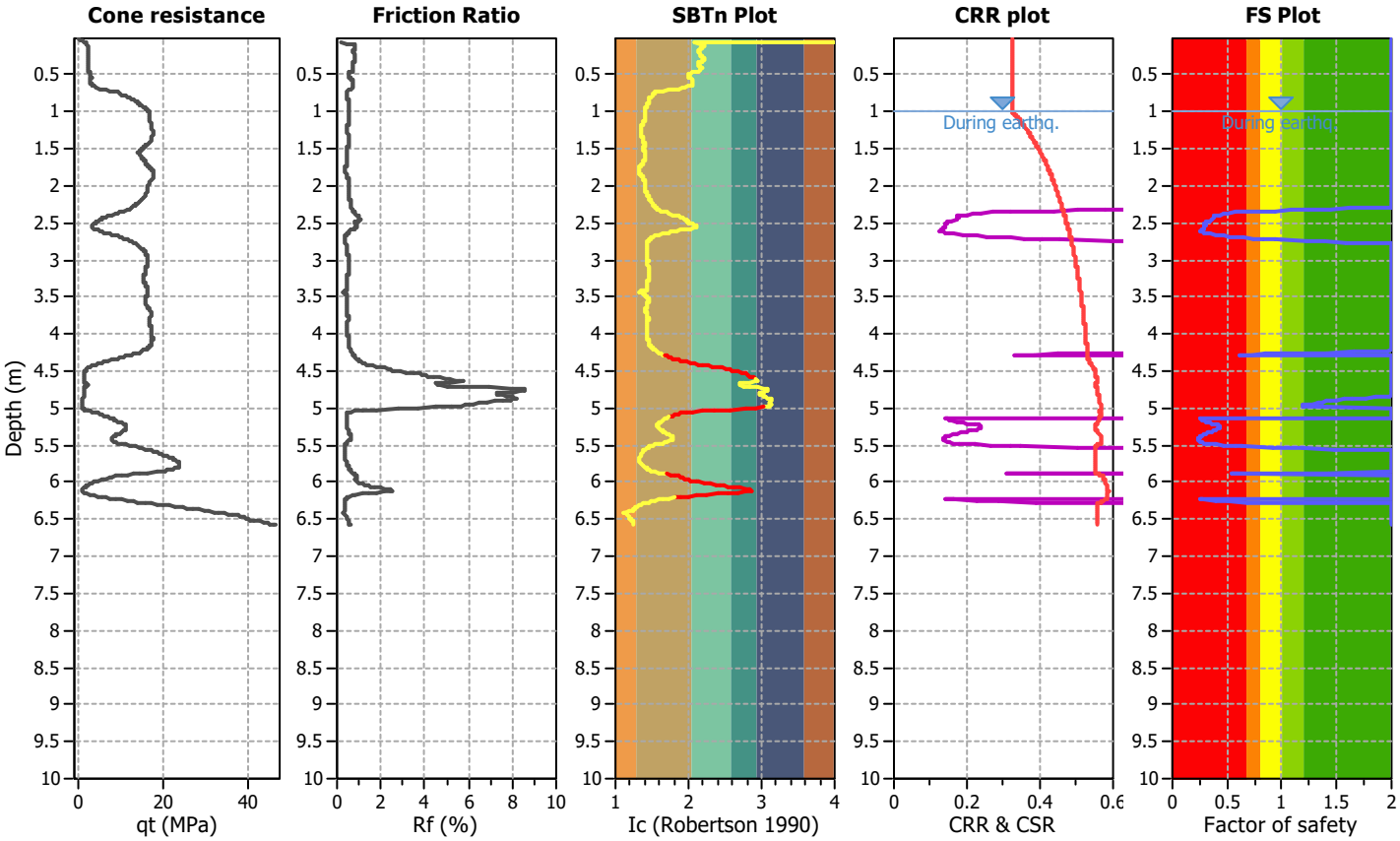
LIQUEFACTION ANALYSIS REPORT

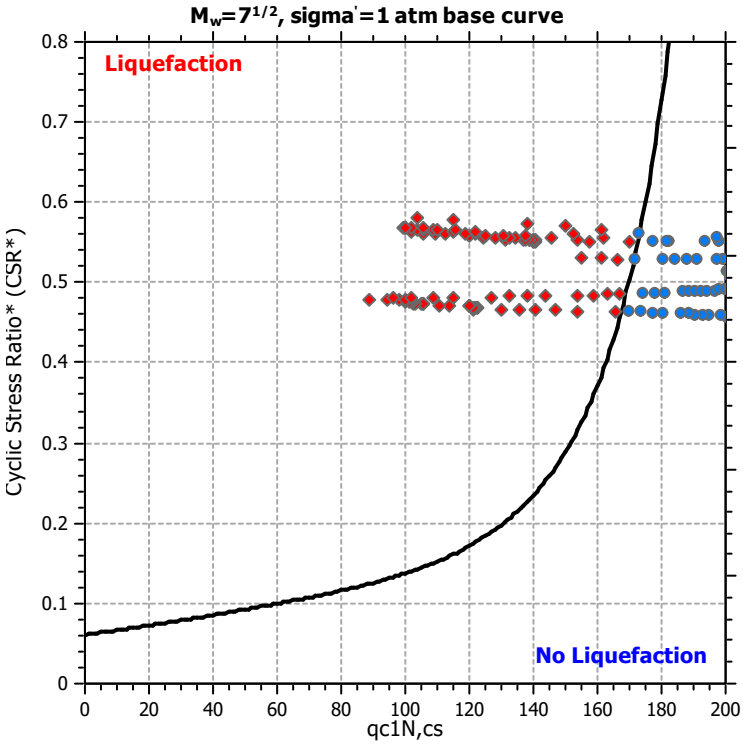
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

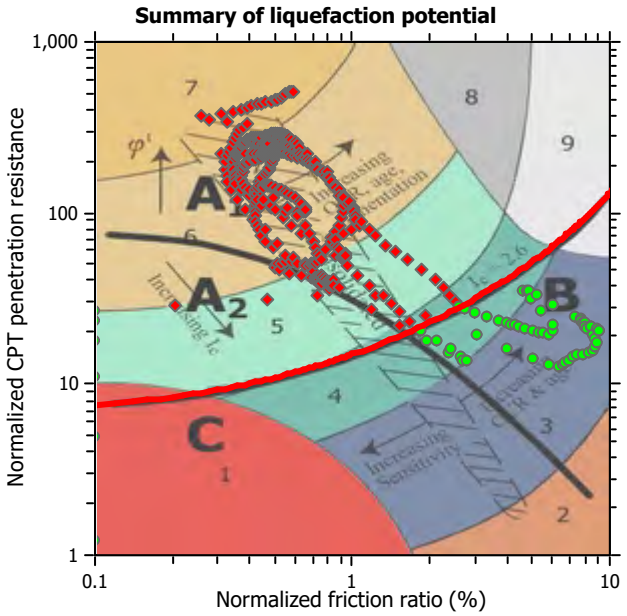
CPT file : CPT17_ULS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

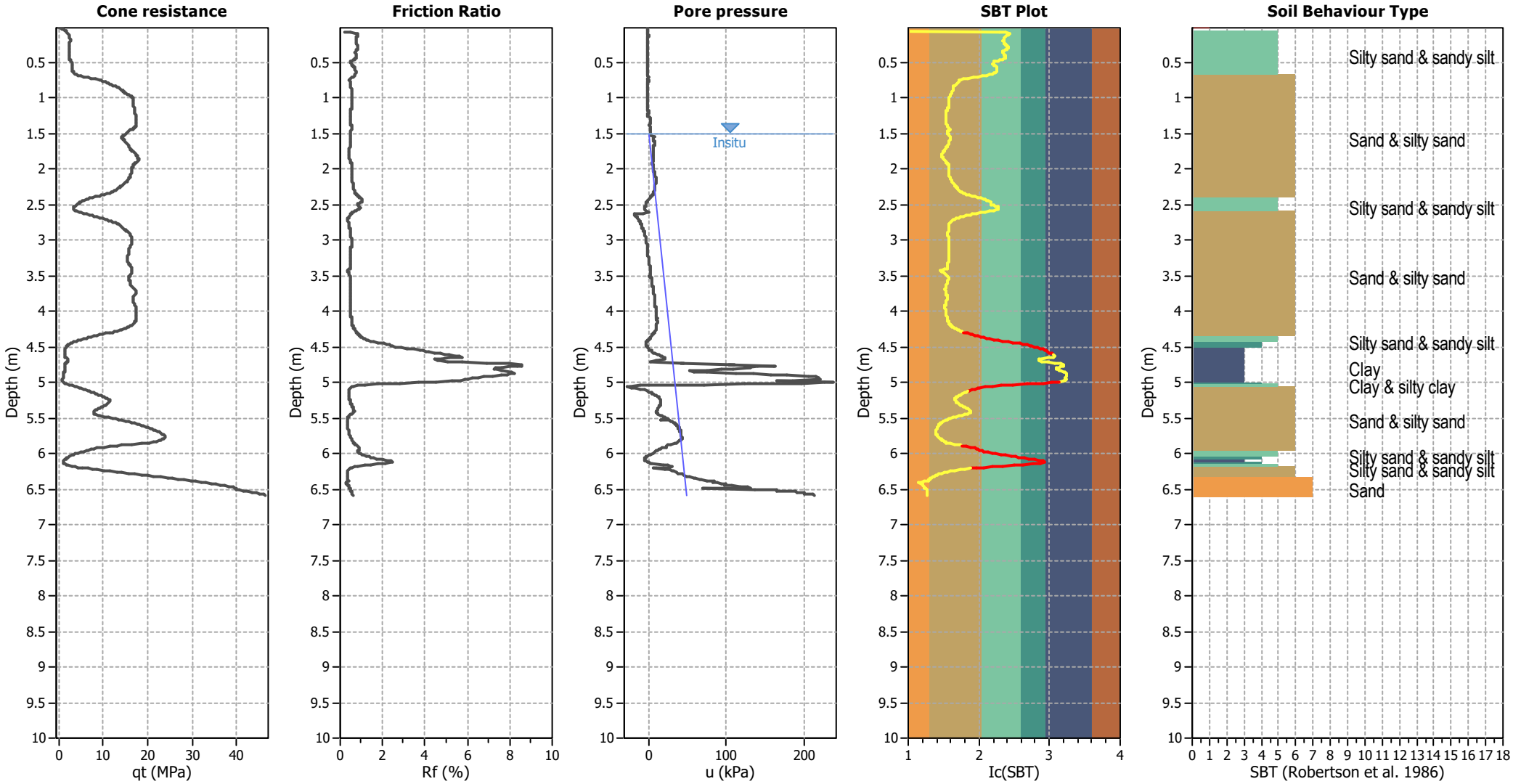






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



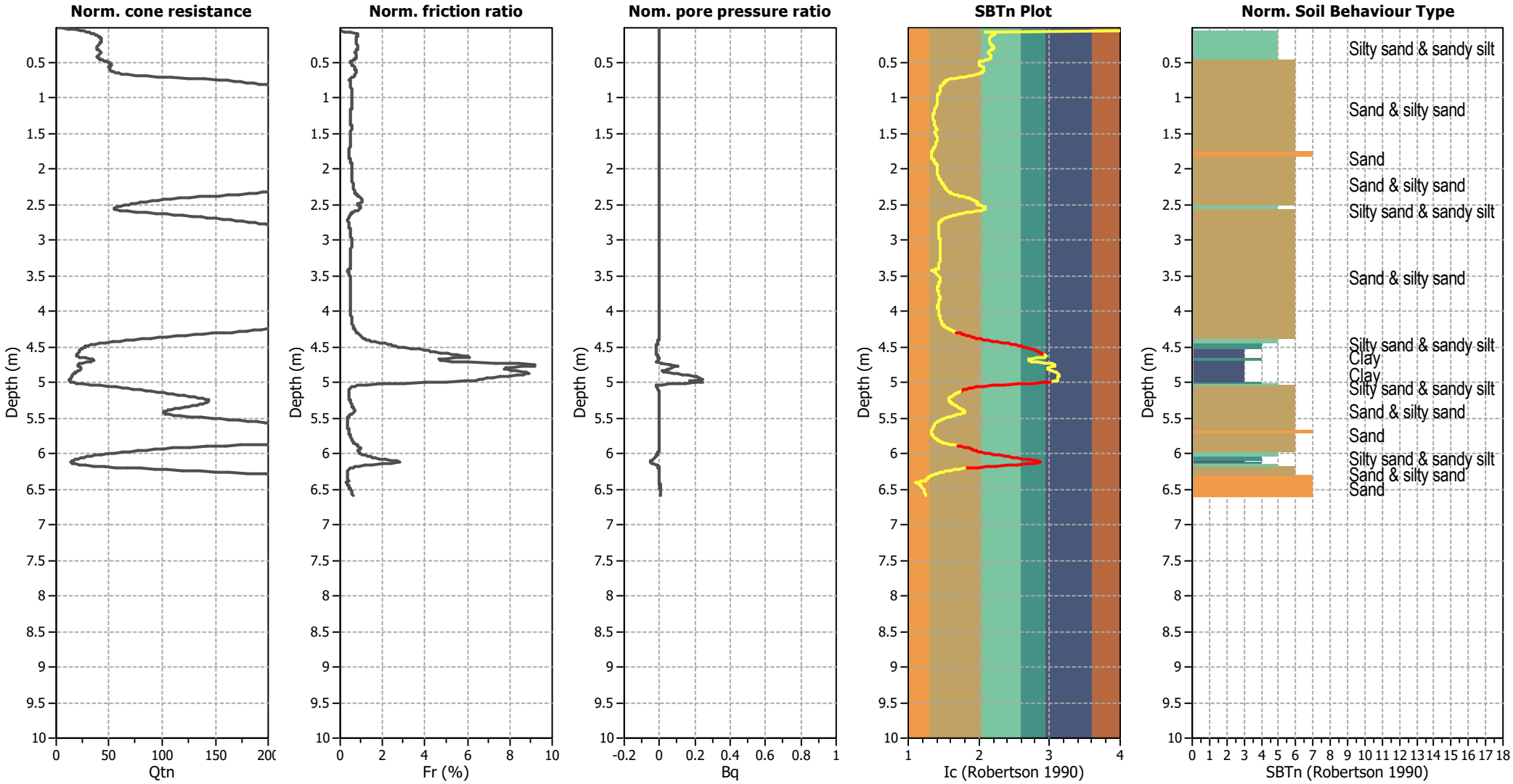
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



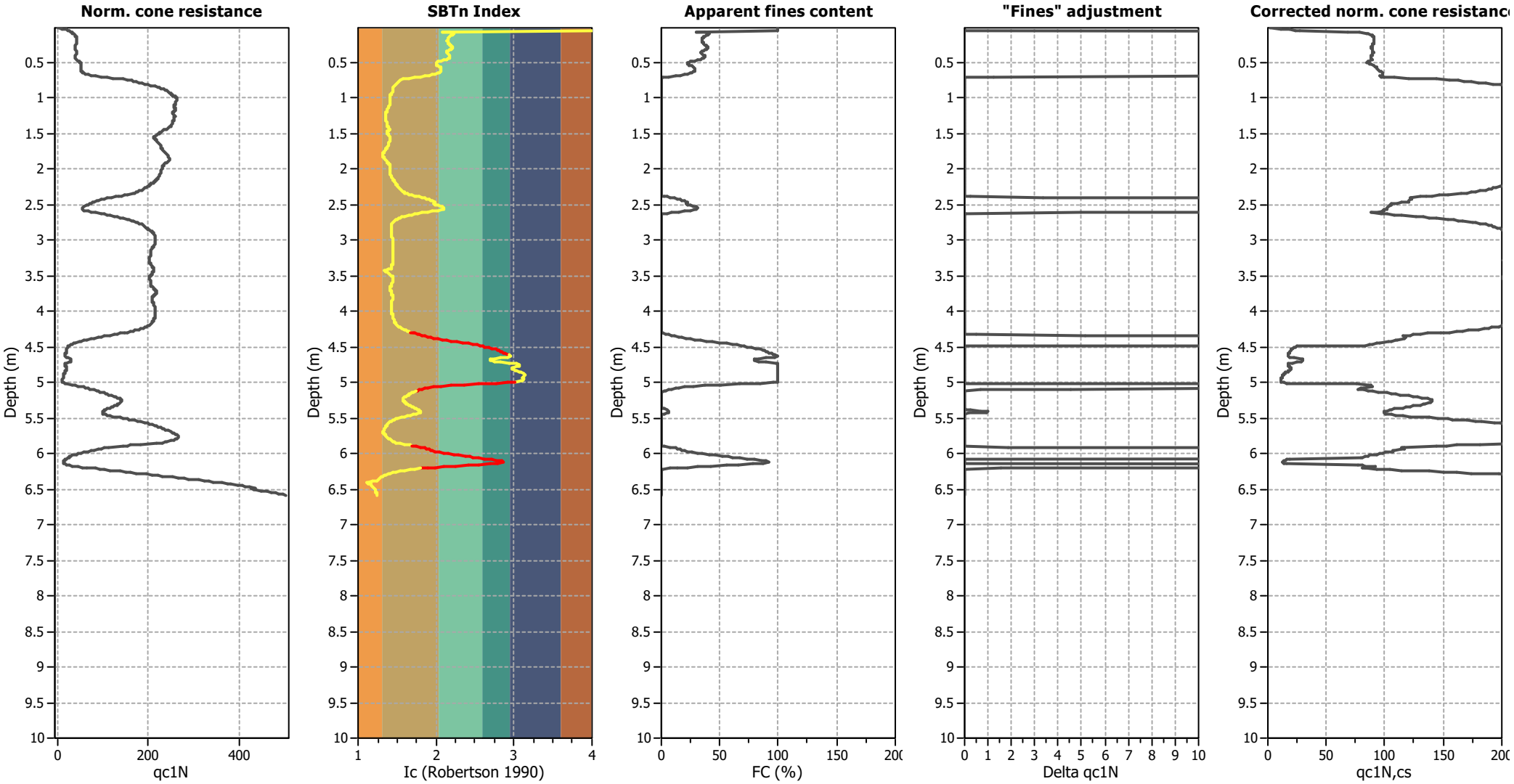
Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

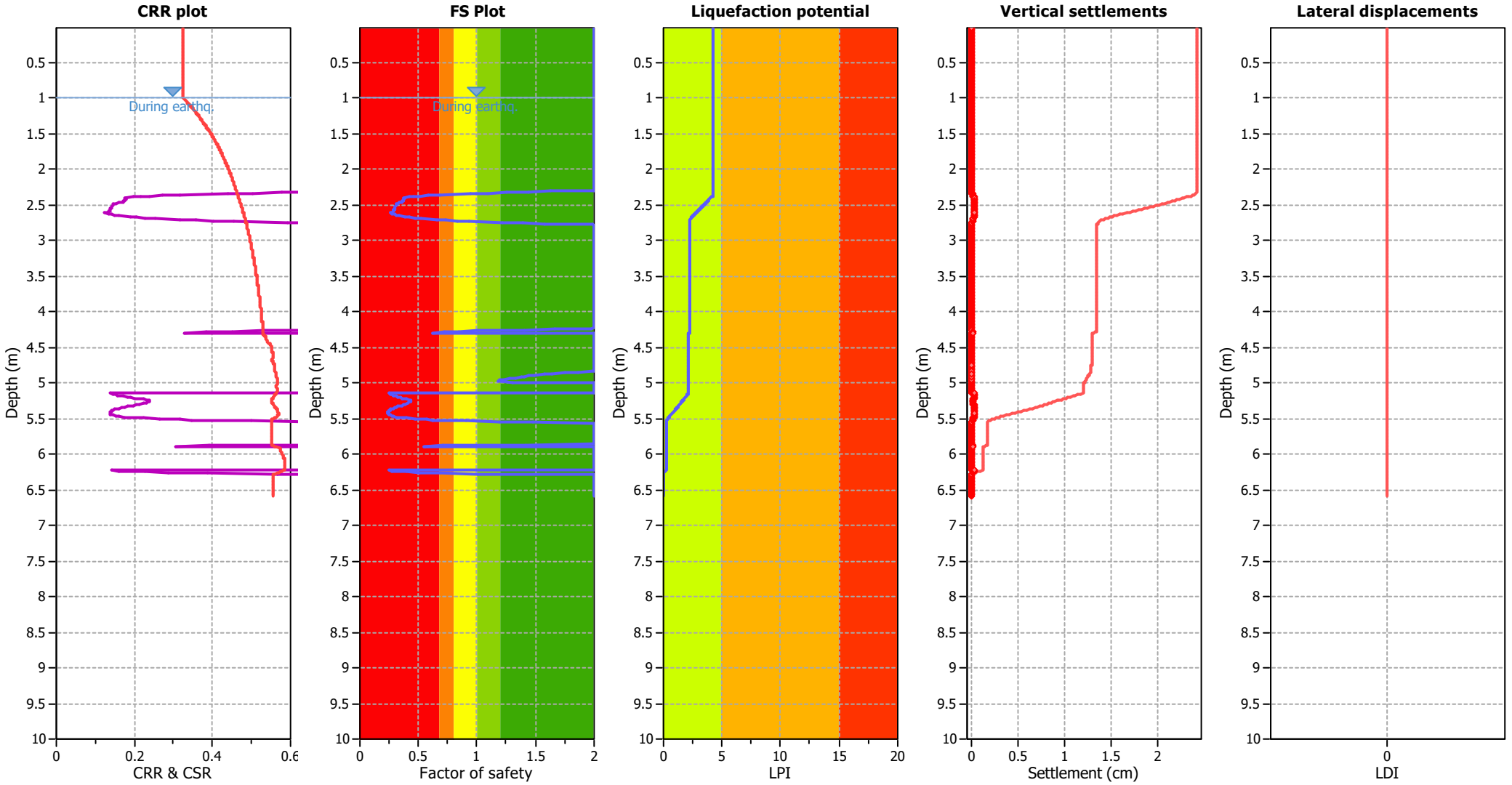
Liquefaction analysis overall plots (intermediate results)



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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

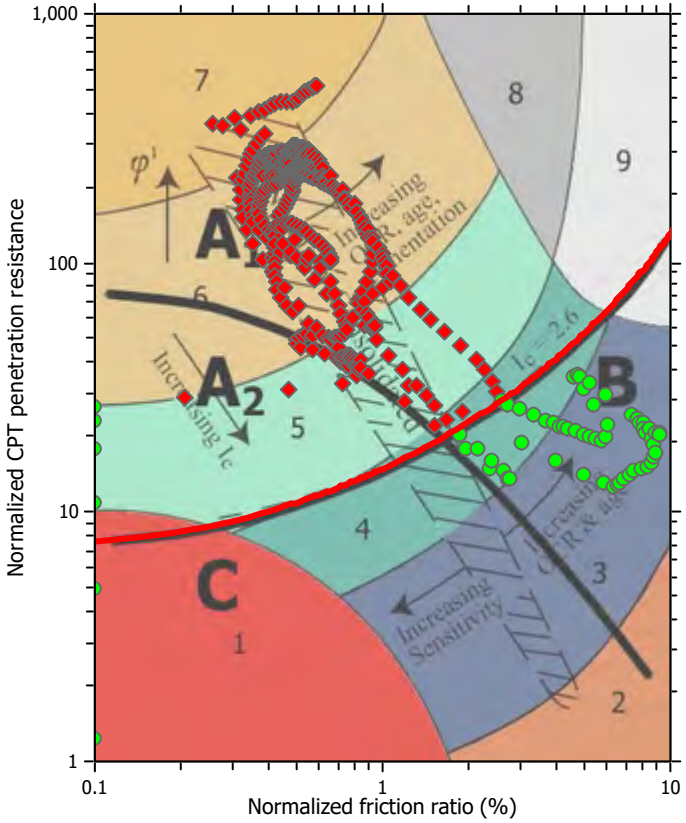
F.S. color scheme

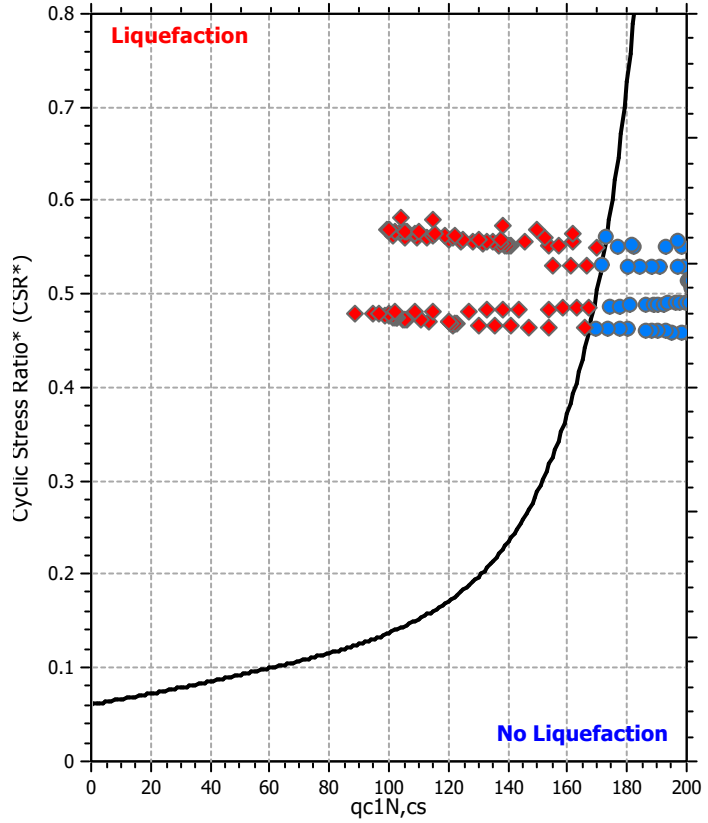
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

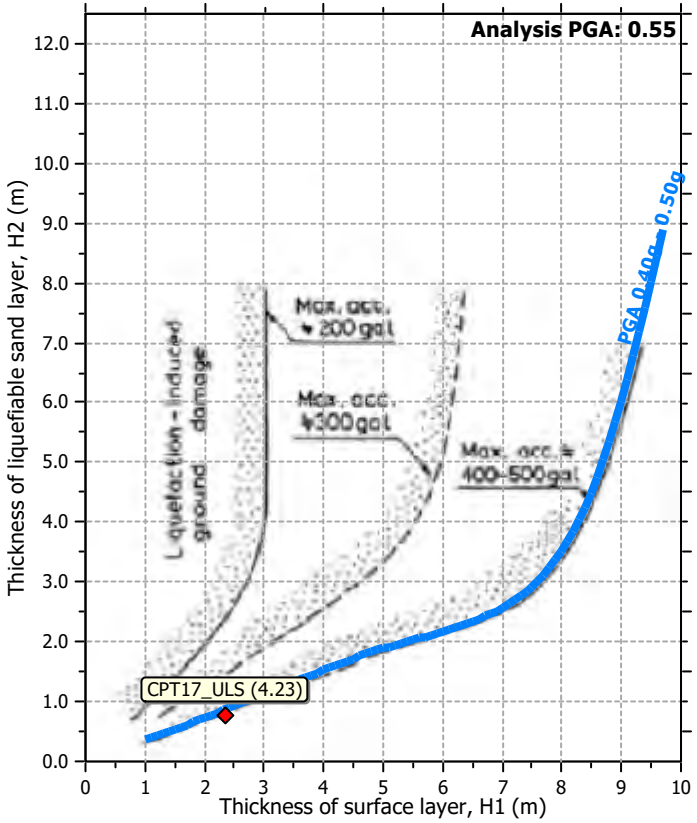
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



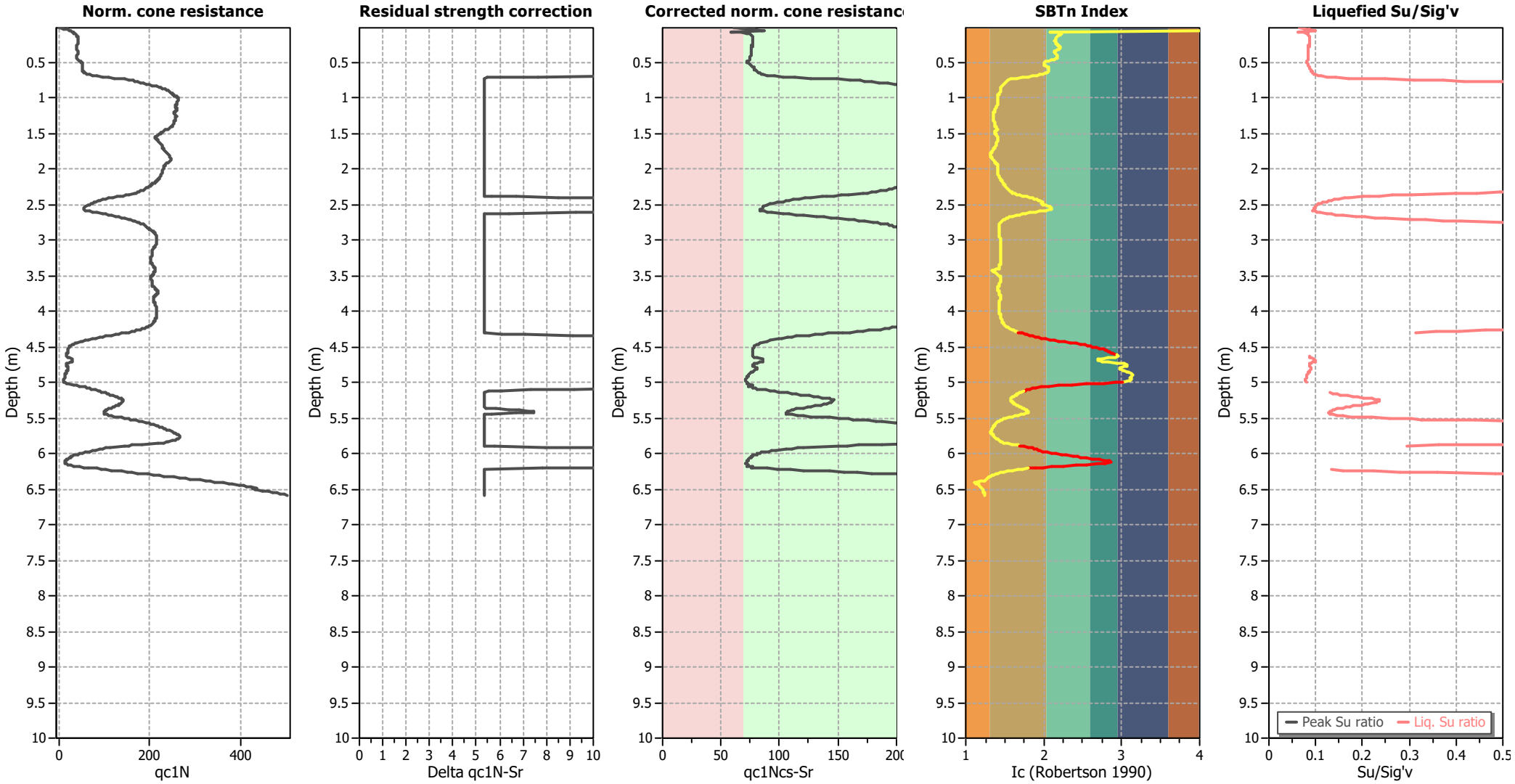




Input parameters and analysis data

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:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

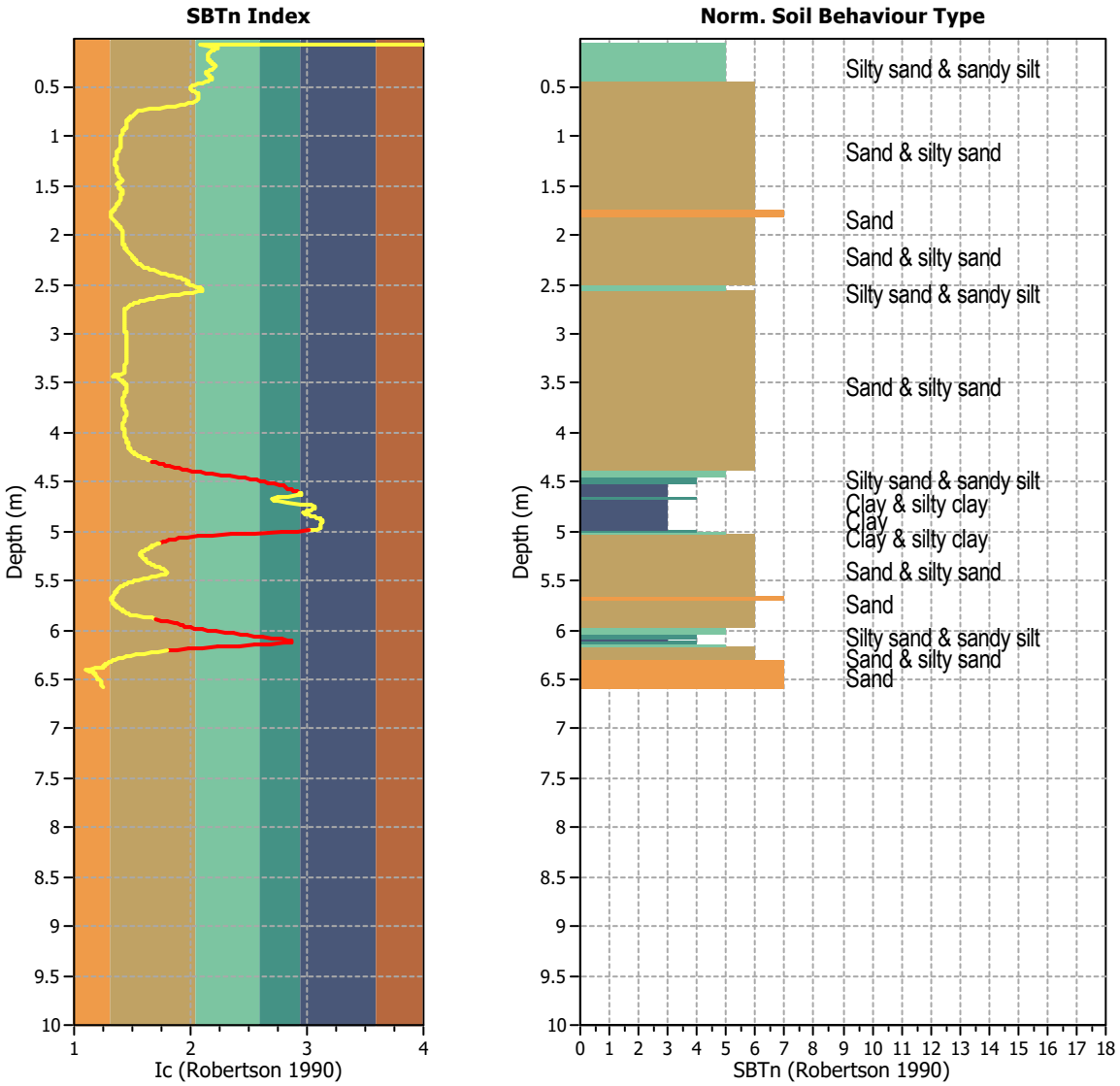
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

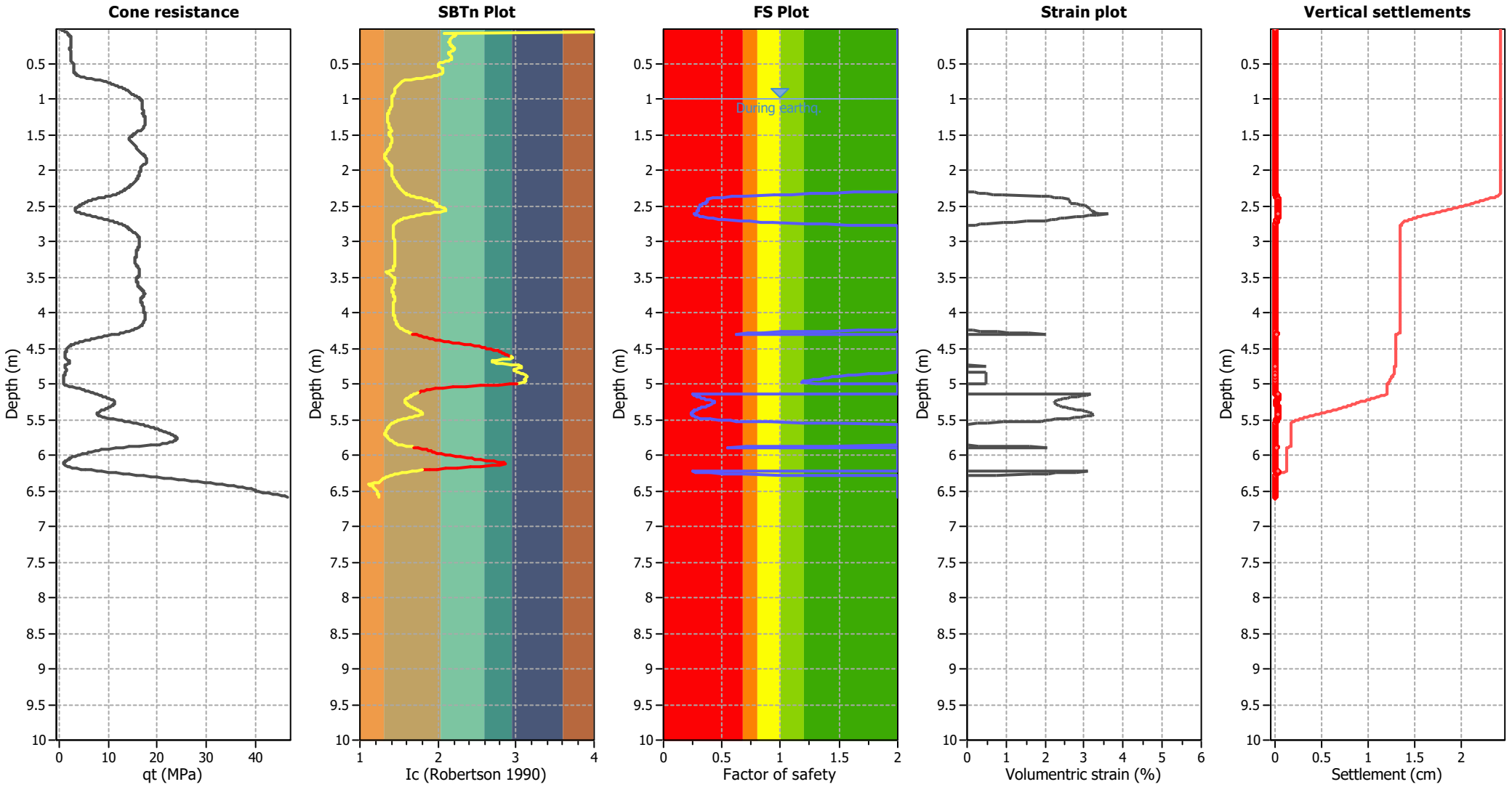
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	658
I_c maximum check value:	3.00	Total points excluded:	80
I_c change ratio value:	0.0100	Exclusion percentage:	12.16%
Minimum number of points in layer:	4	Number of layers detected:	4

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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LIQUEFACTION ANALYSIS REPORT

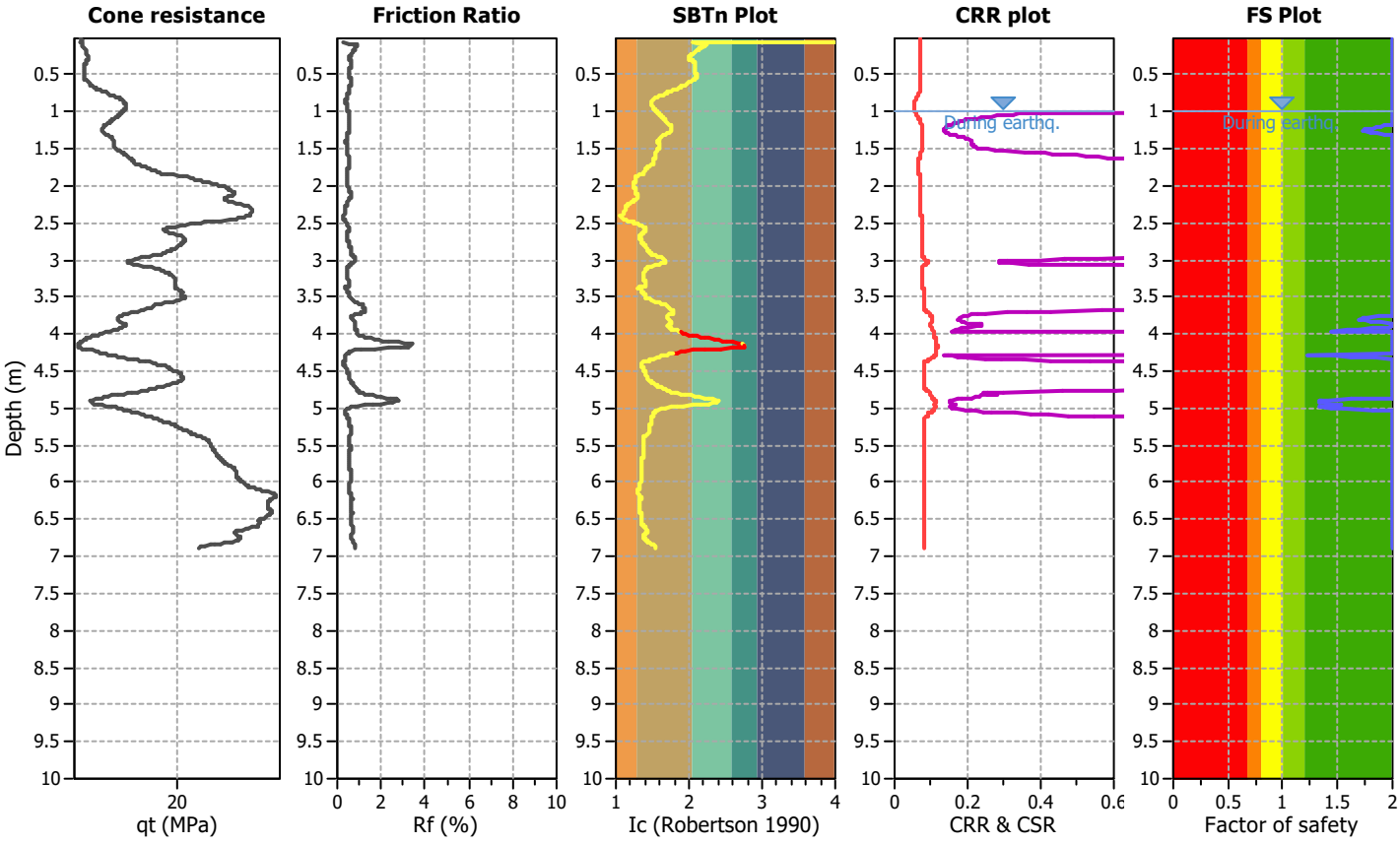
Project title : Foxton Solar Farm

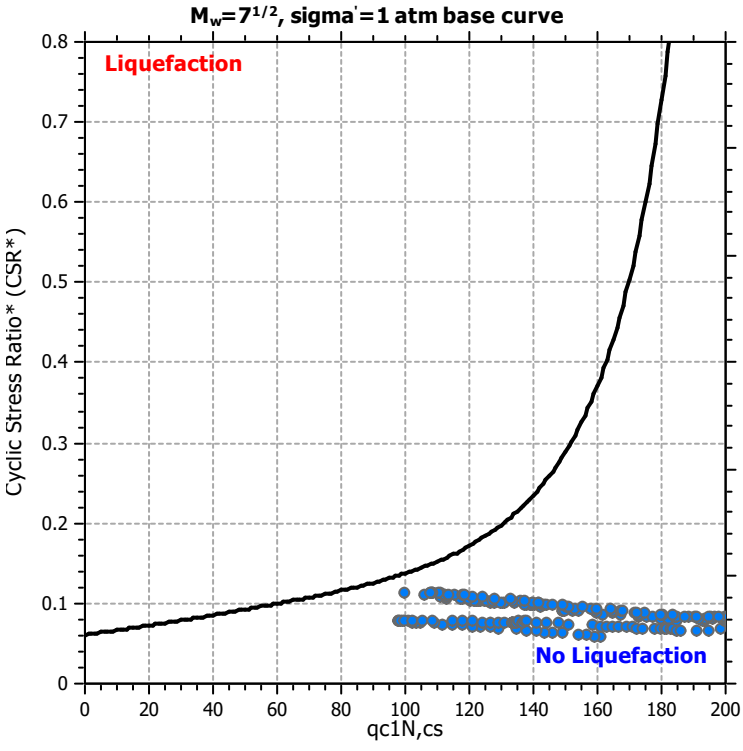
Location : Foxton, New Zealand

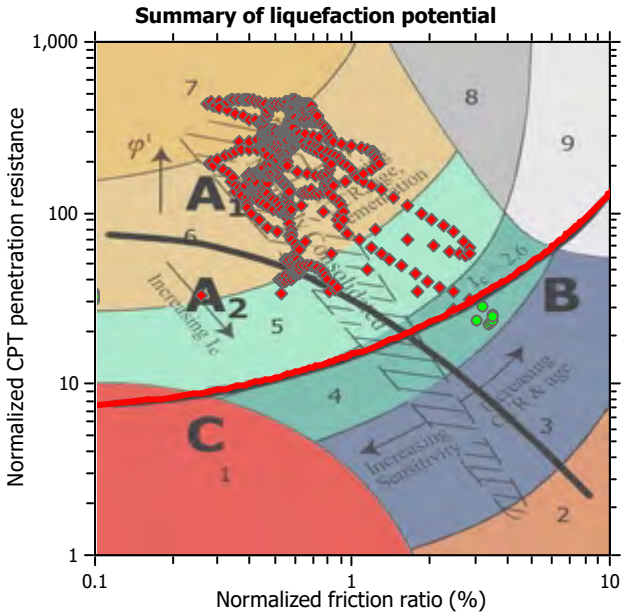
CPT file : CPT01_SLS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	6.40	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

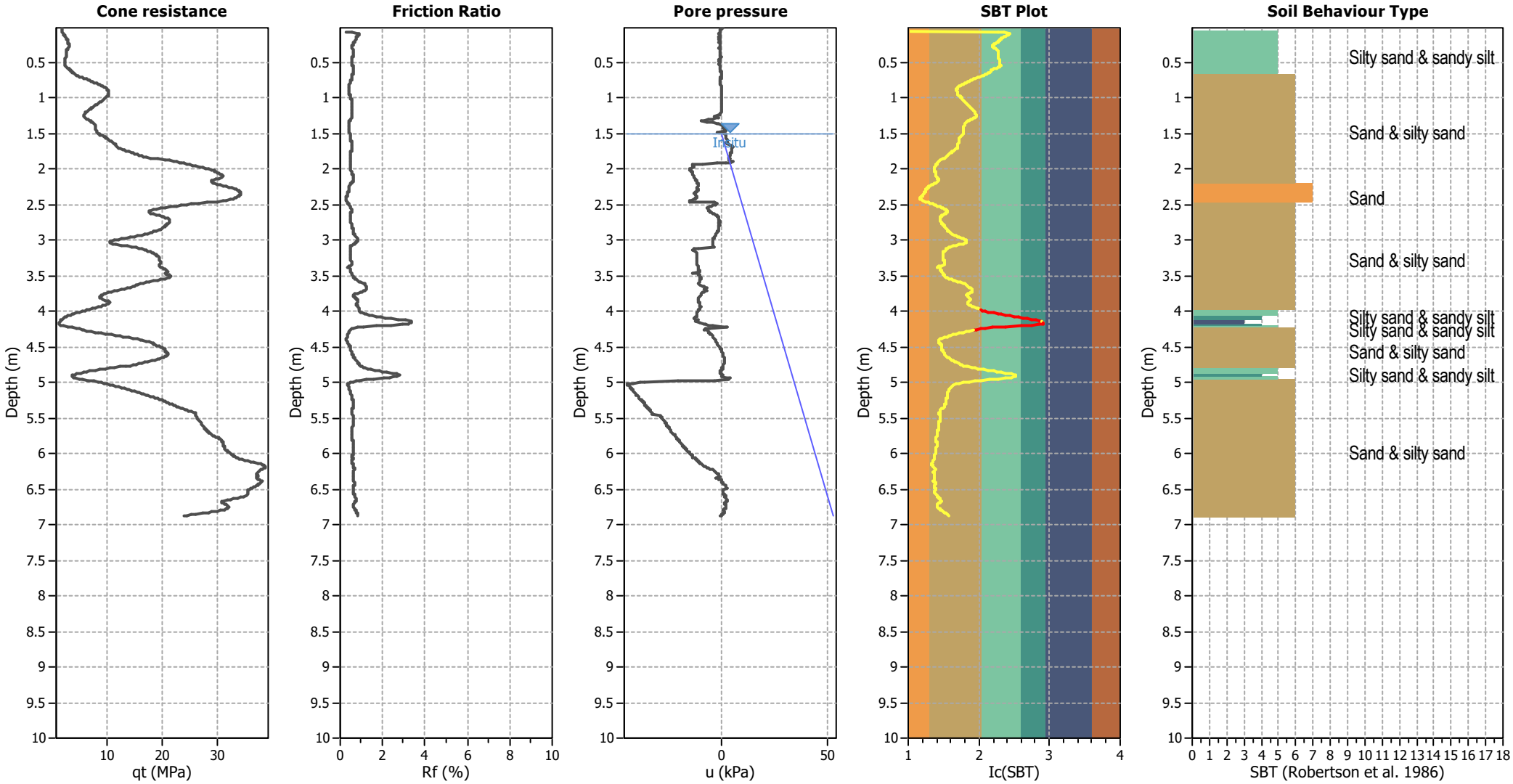






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



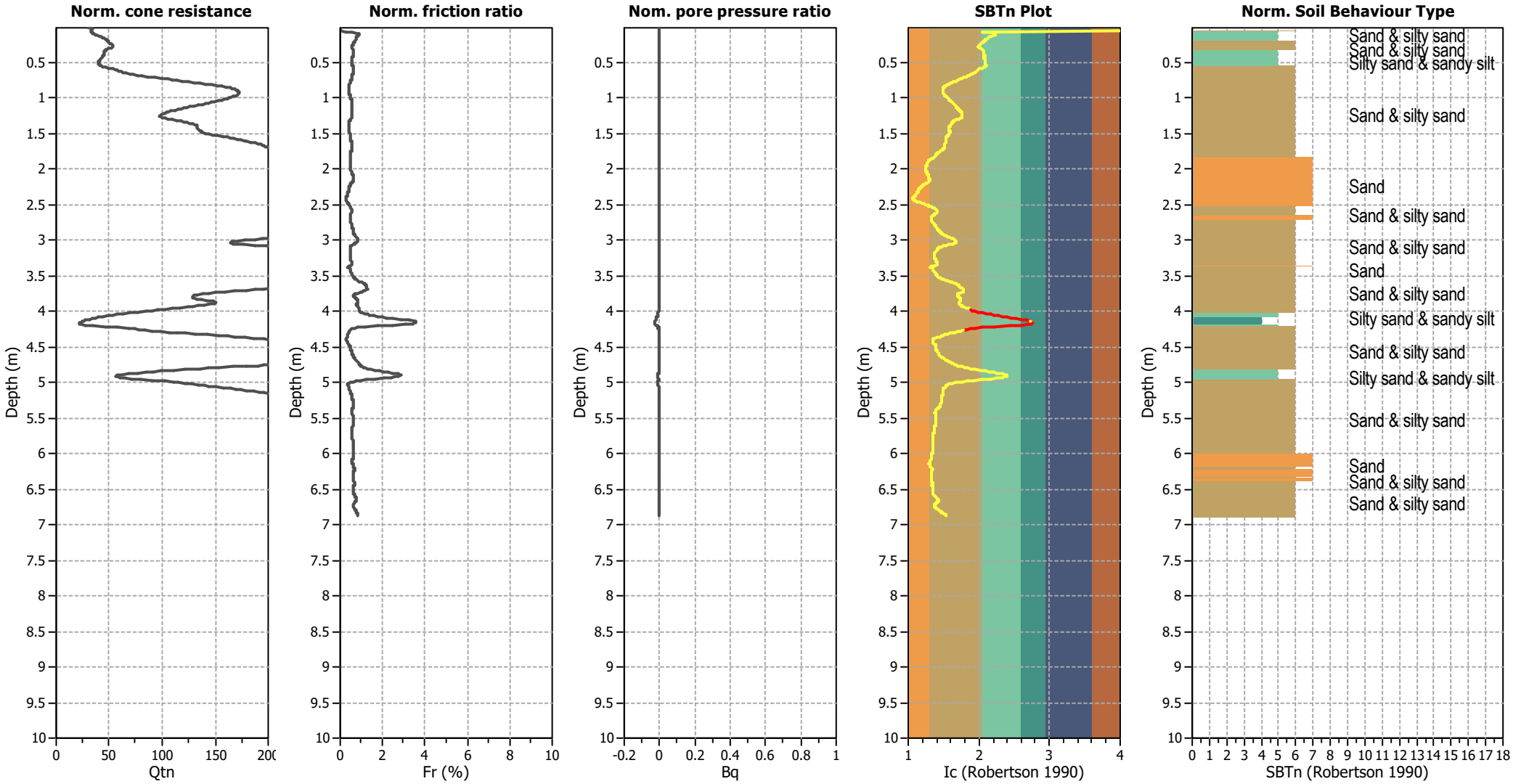
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



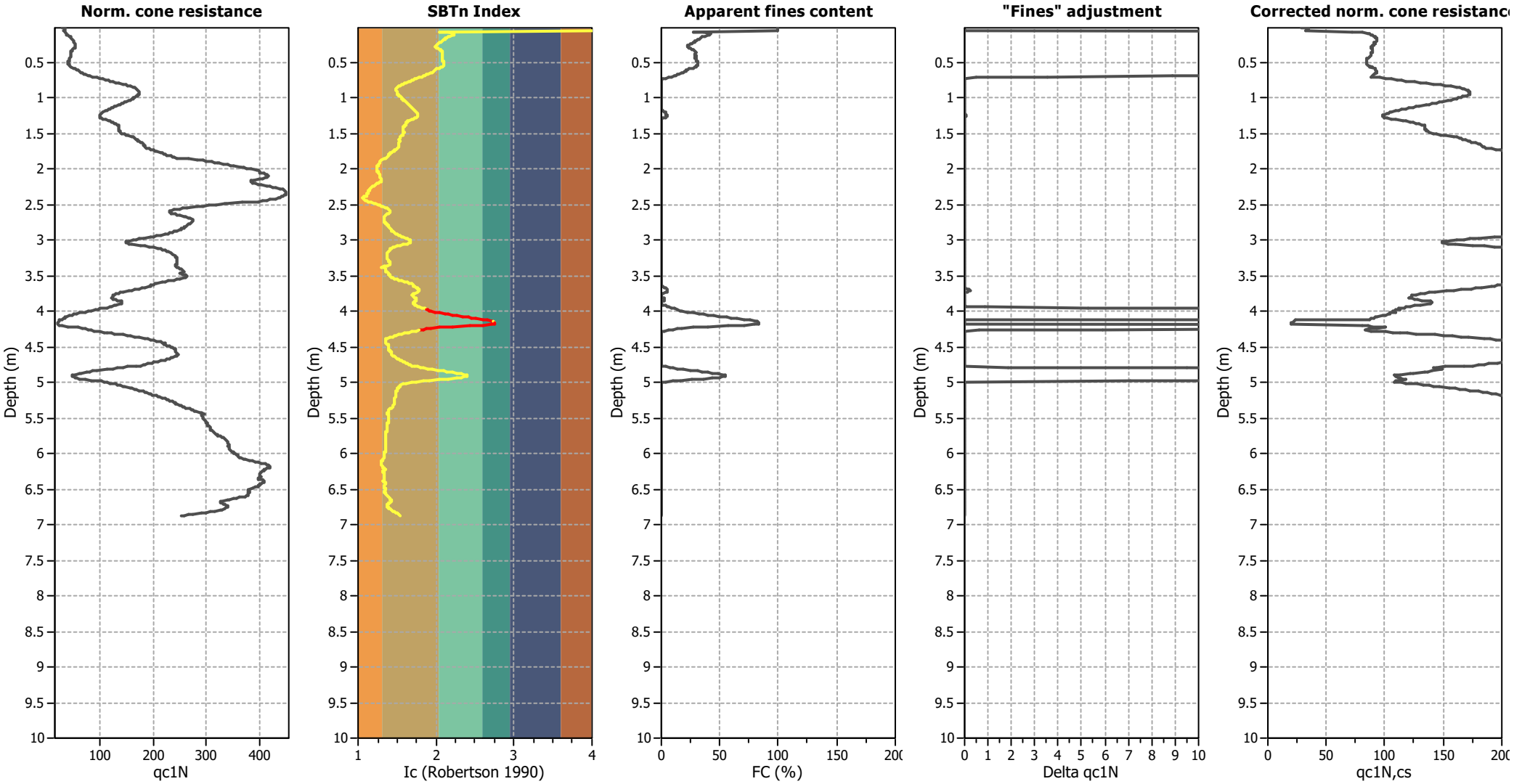
Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

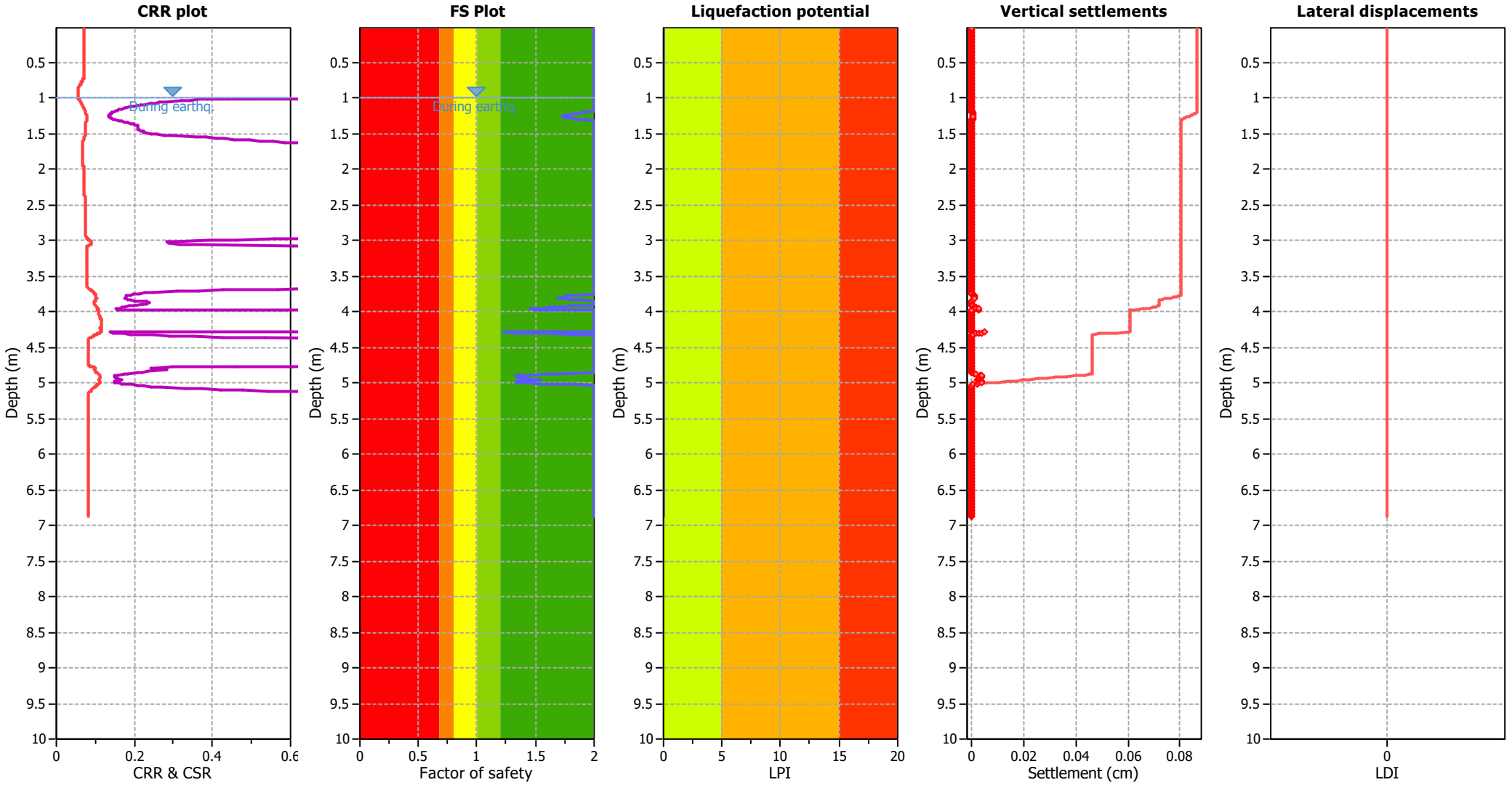
Liquefaction analysis overall plots (intermediate results)



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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

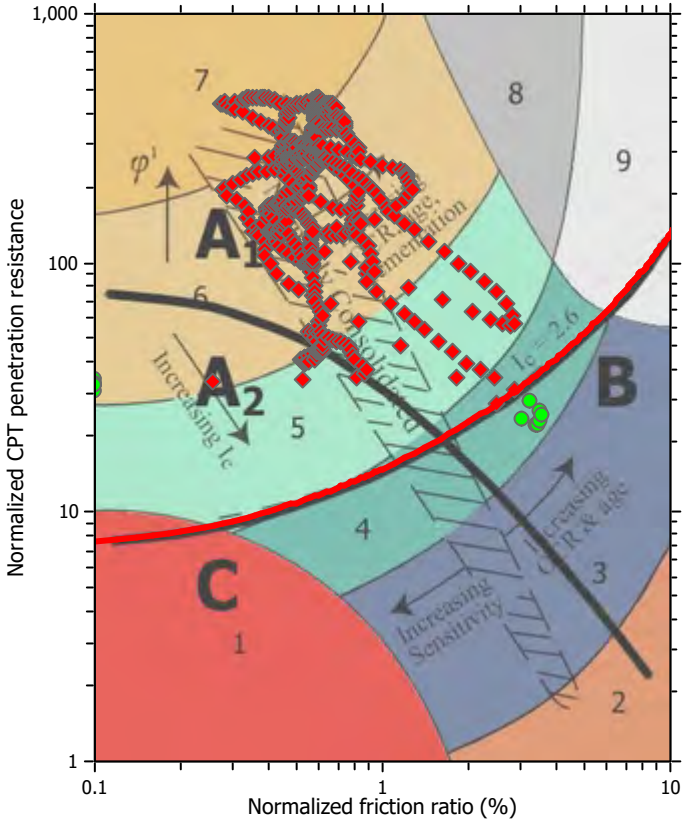
F.S. color scheme

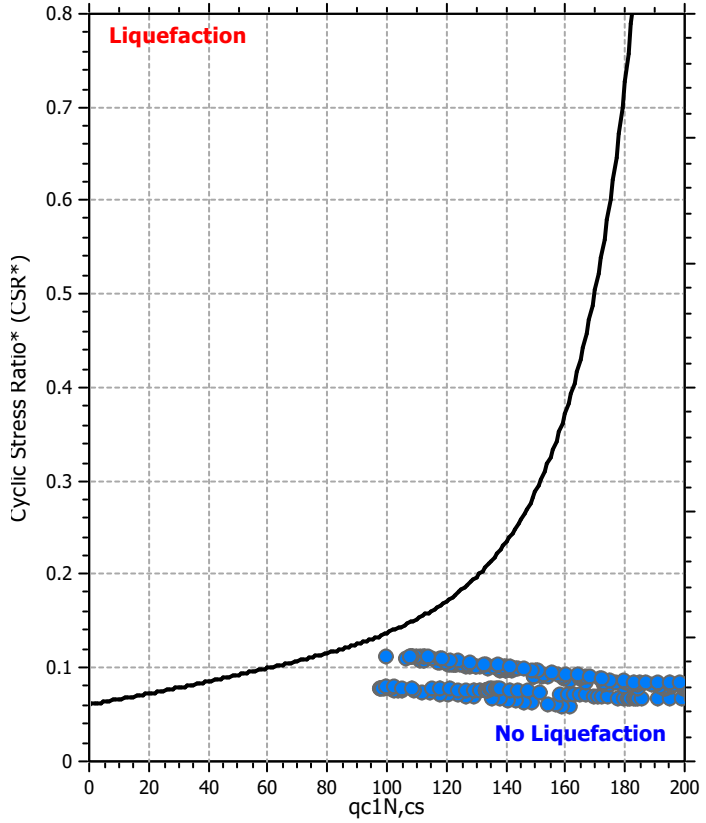
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

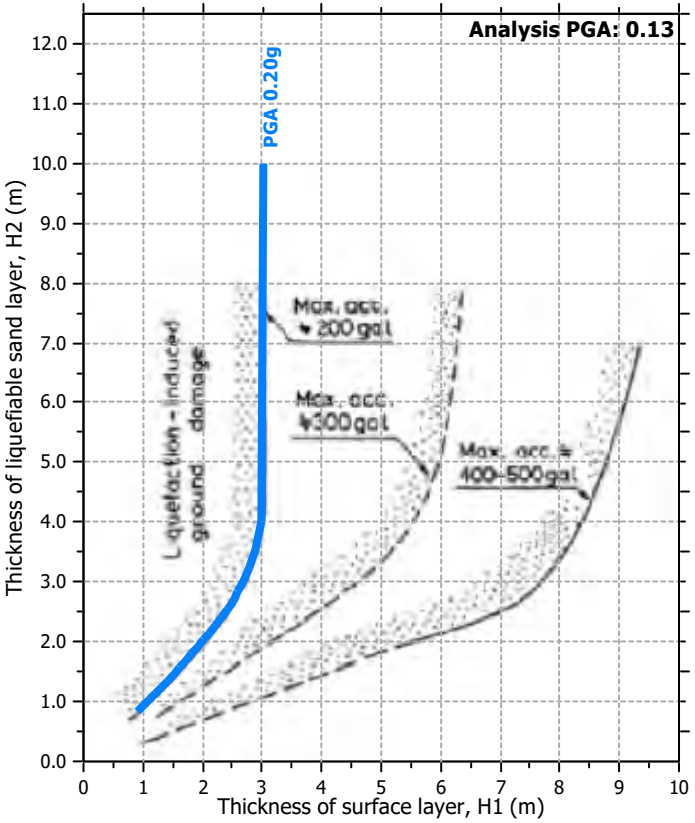
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



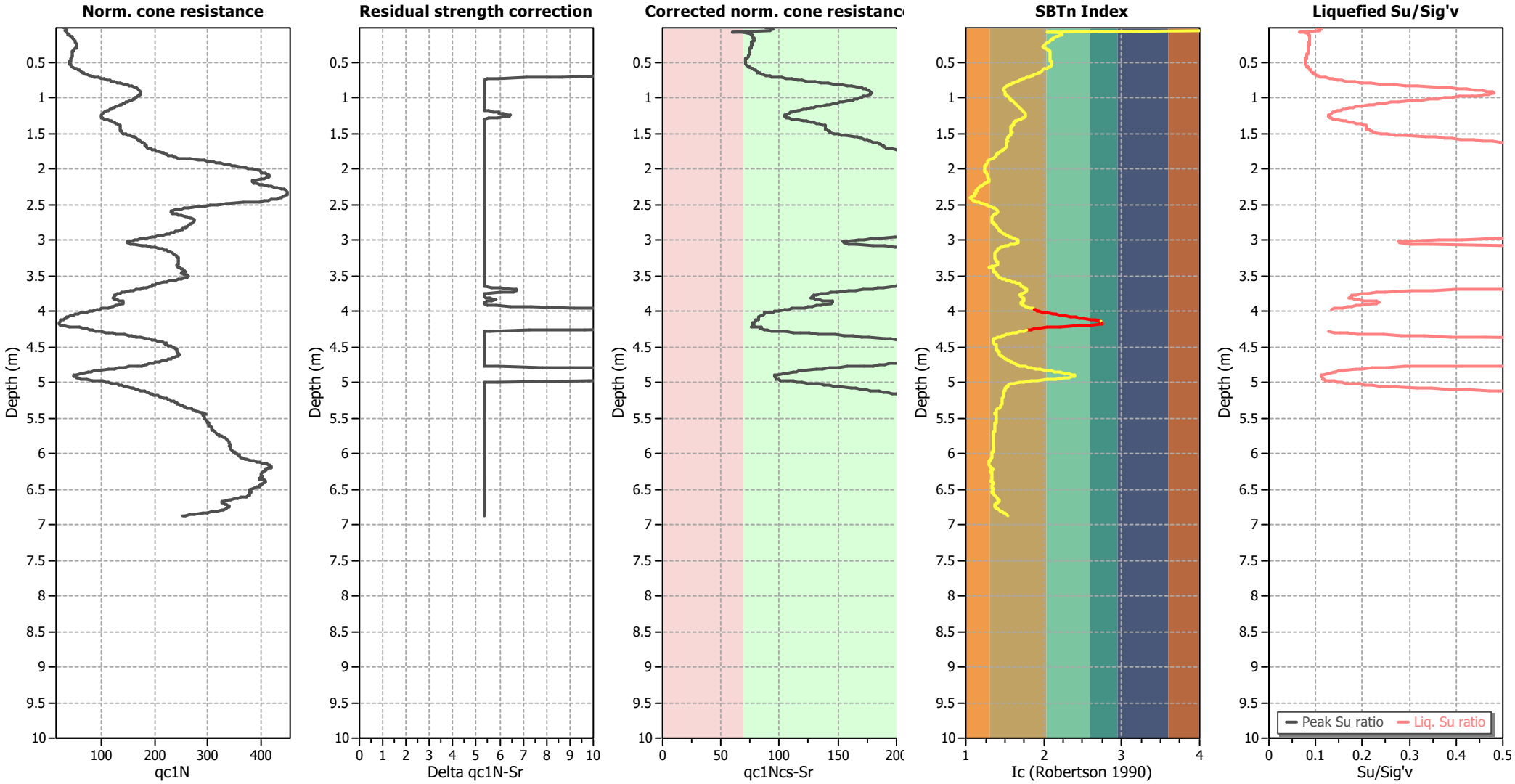




Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

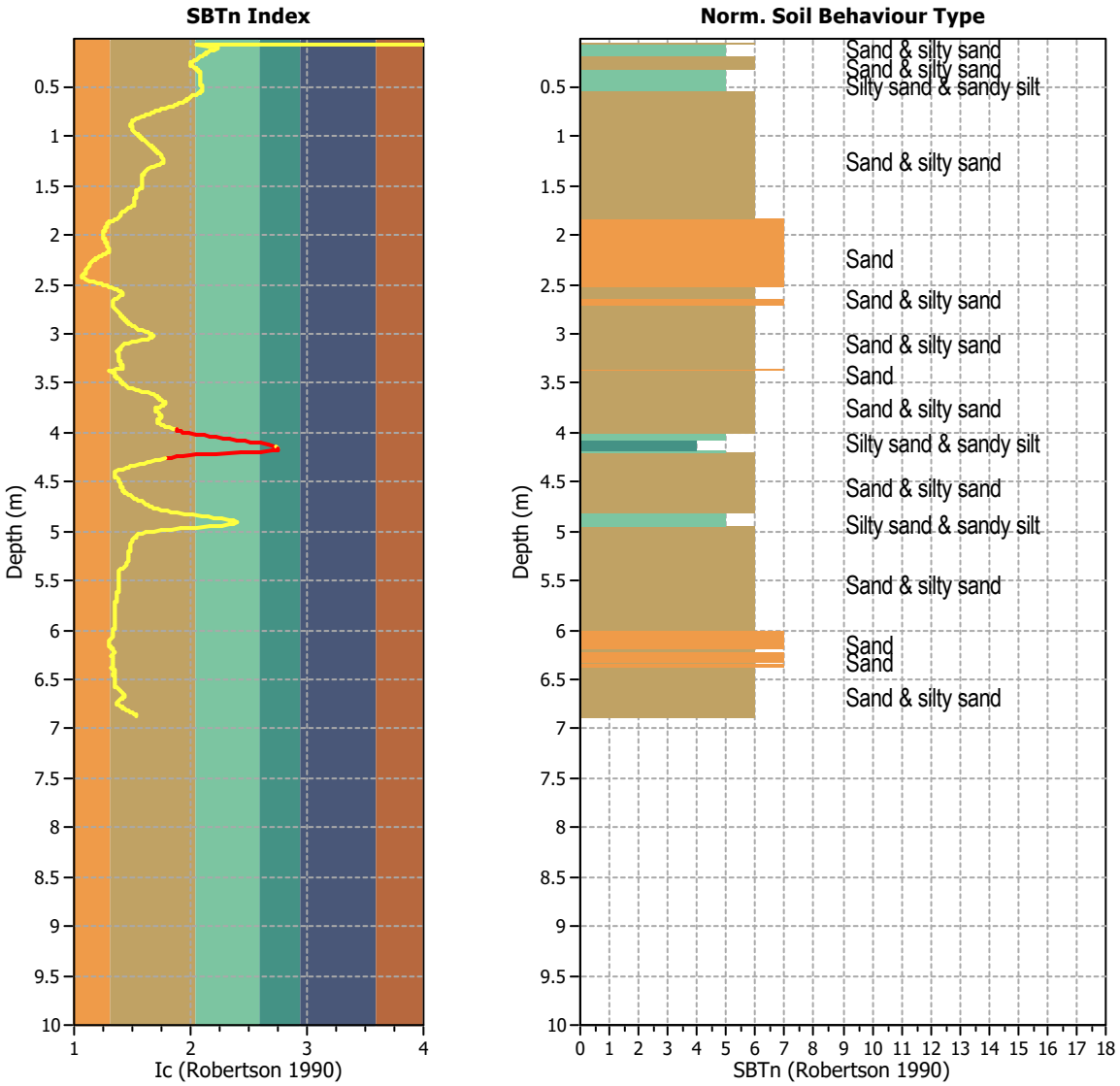
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

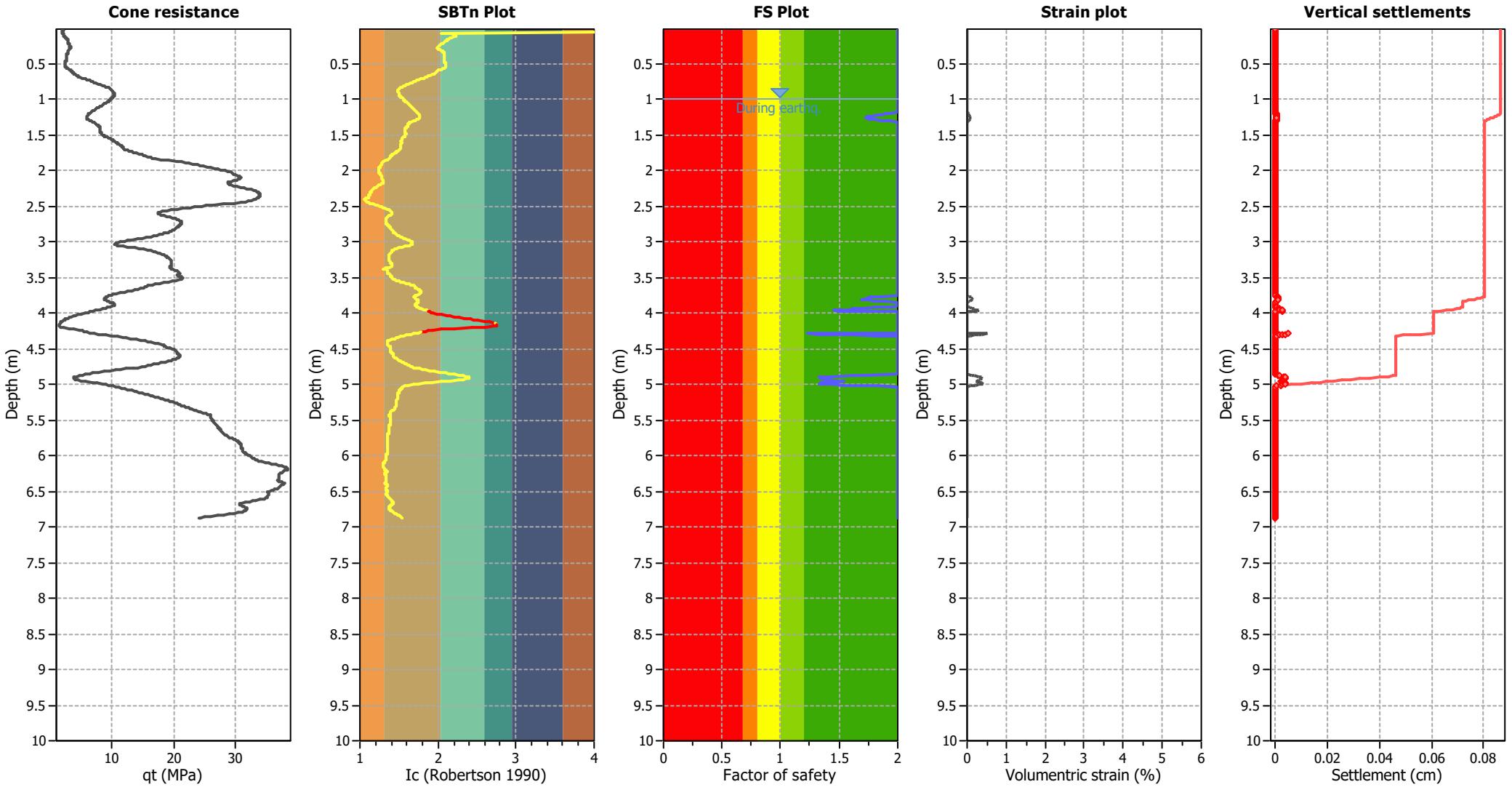
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	688
I_c maximum check value:	3.00	Total points excluded:	29
I_c change ratio value:	0.0100	Exclusion percentage:	4.22%
Minimum number of points in layer:	4	Number of layers detected:	2

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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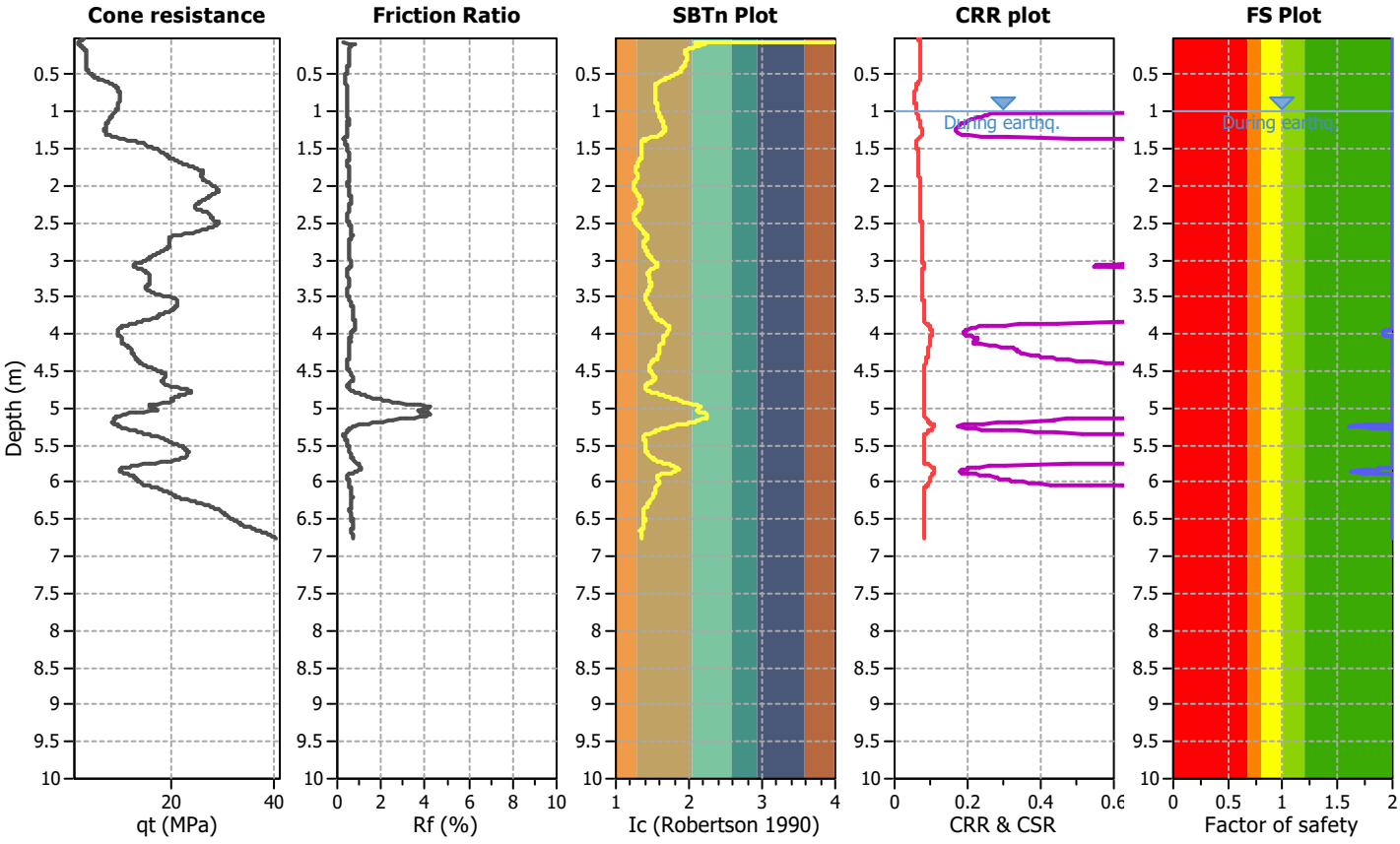
LIQUEFACTION ANALYSIS REPORT

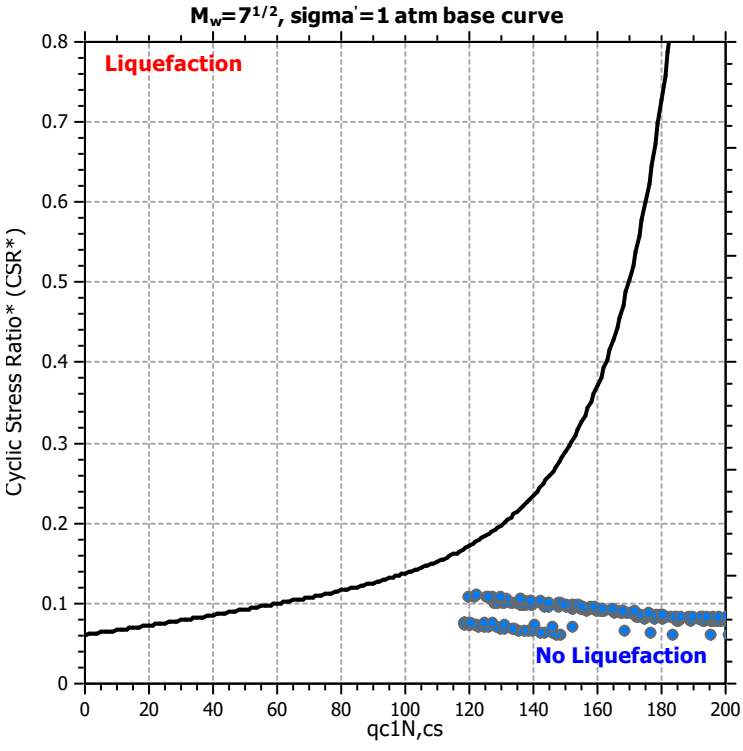
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

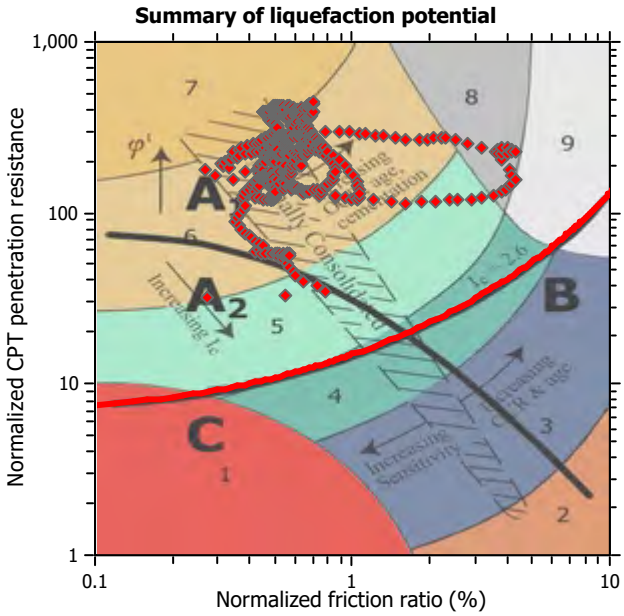
CPT file : CPT02_SLS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	6.40	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

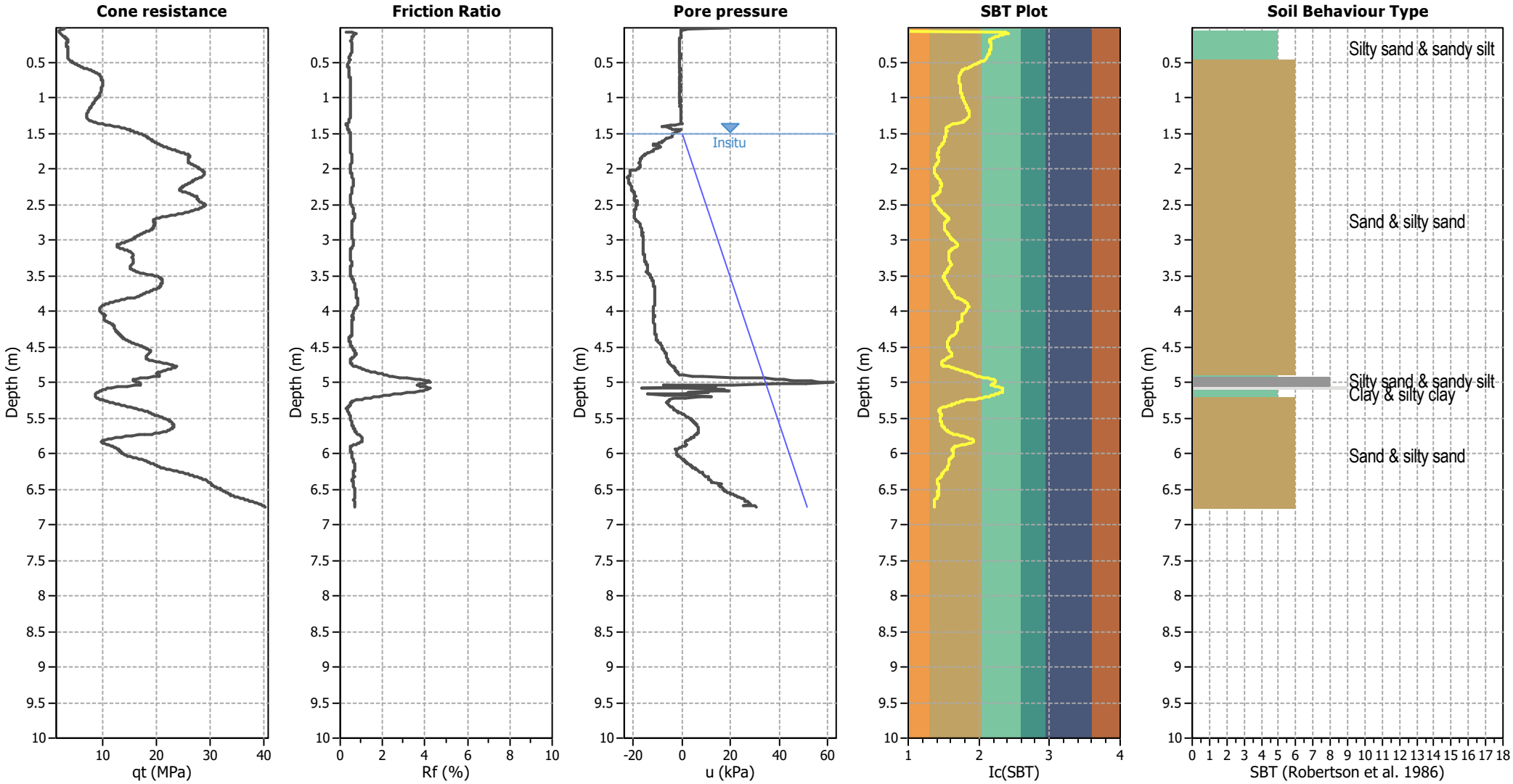






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



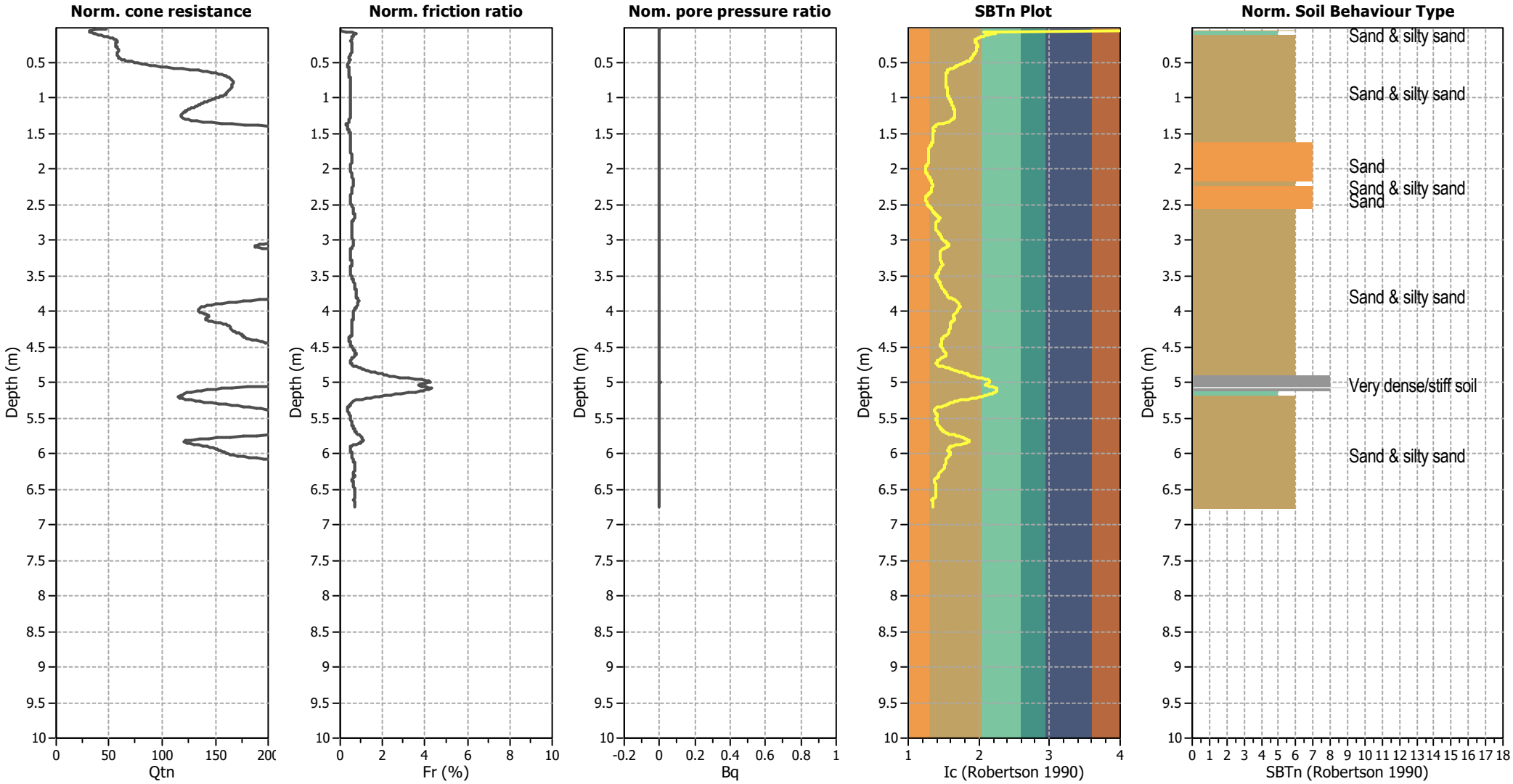
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



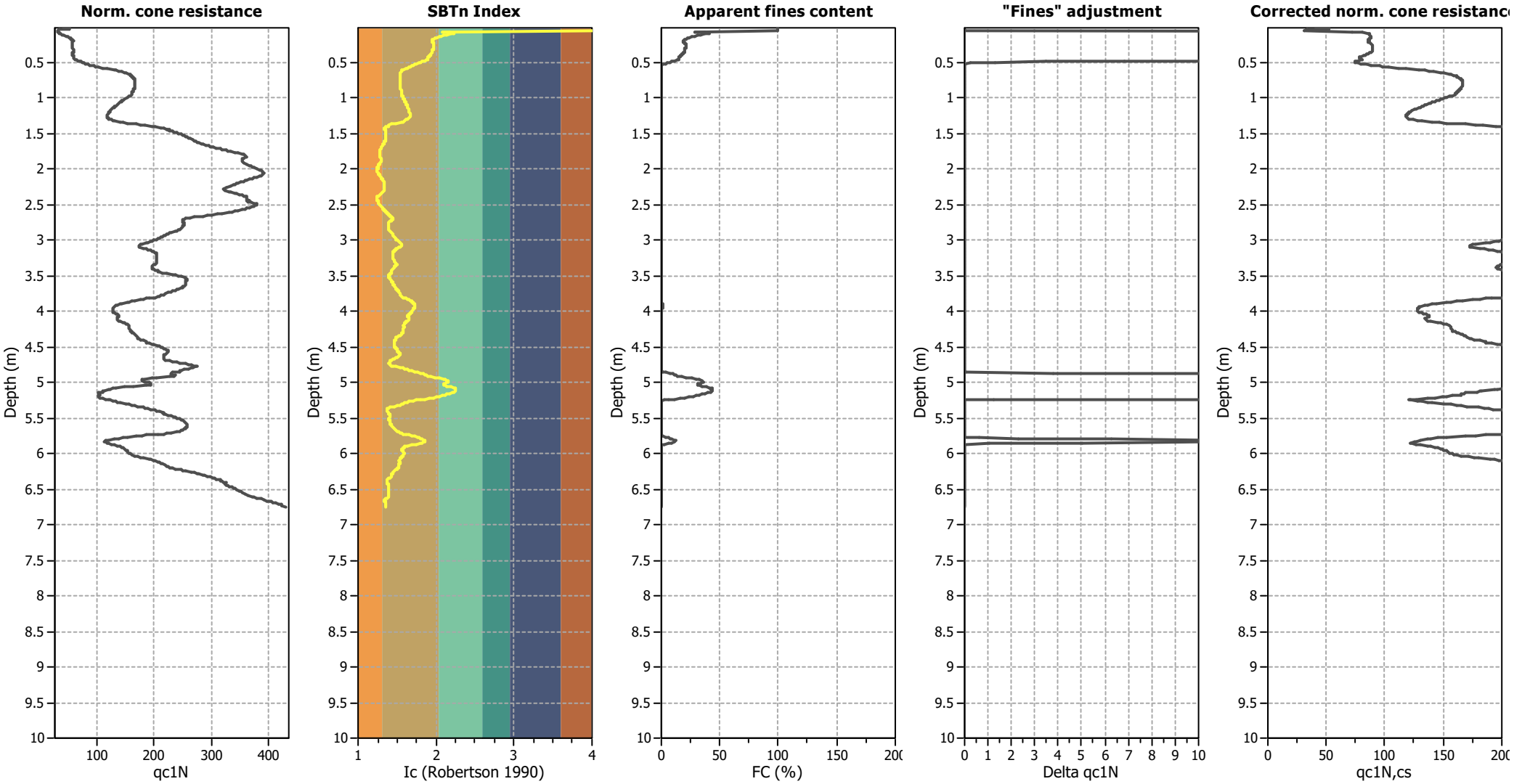
Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

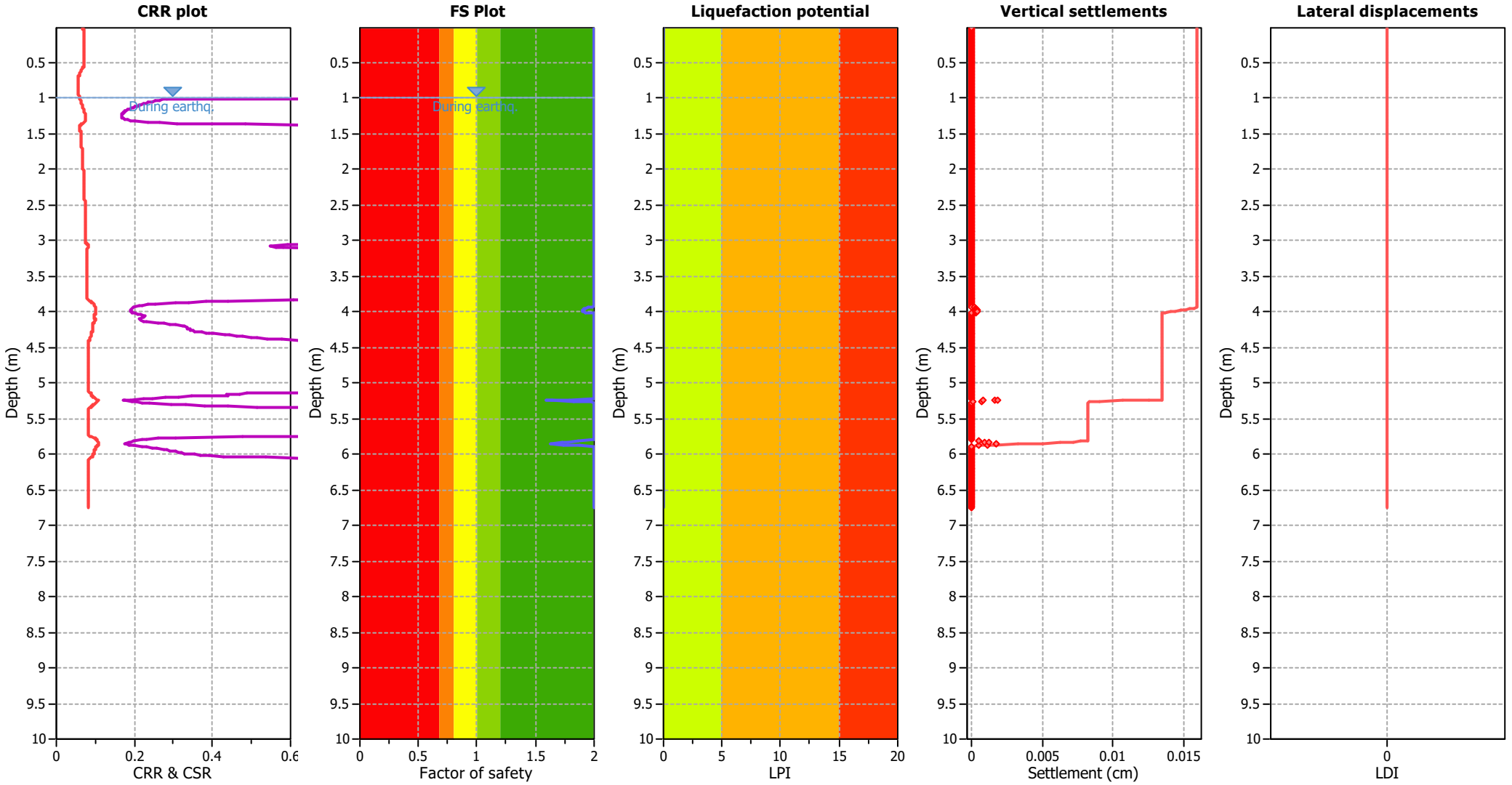
Liquefaction analysis overall plots (intermediate results)



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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

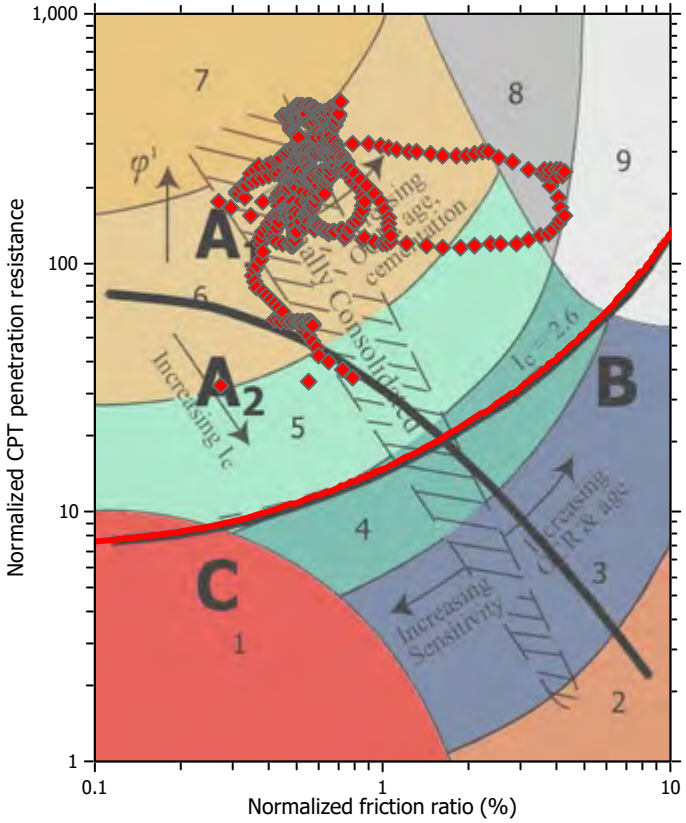
F.S. color scheme

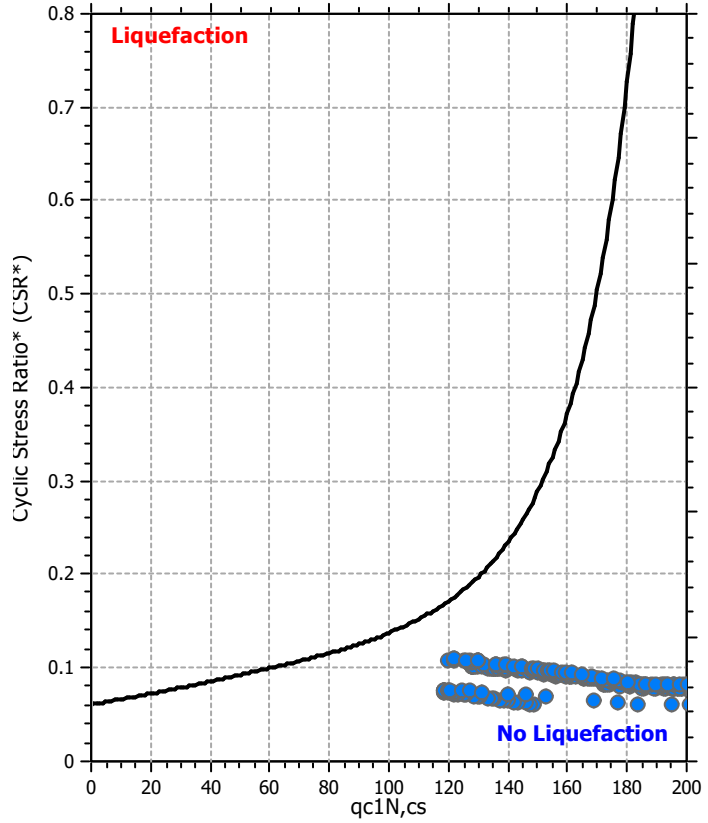
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

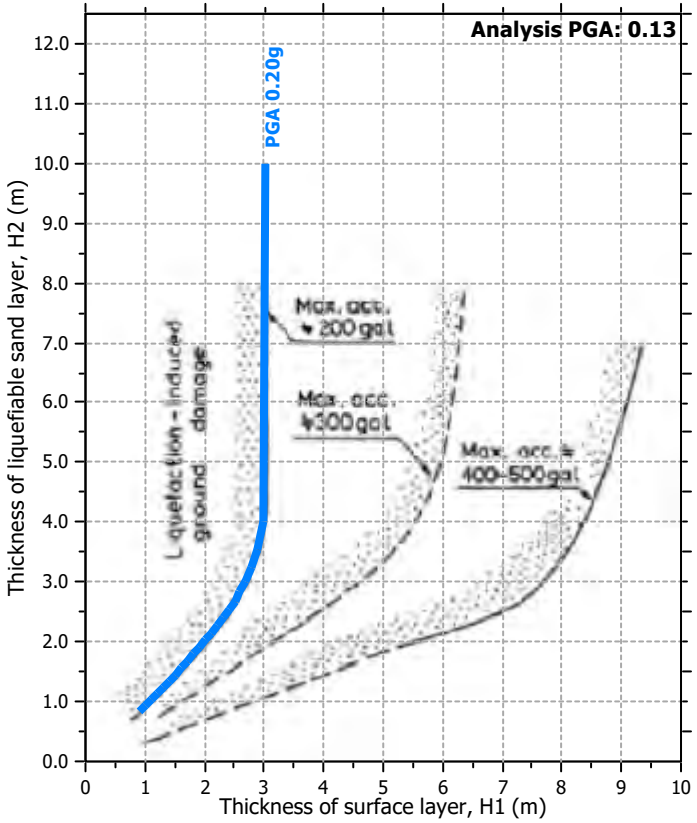
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



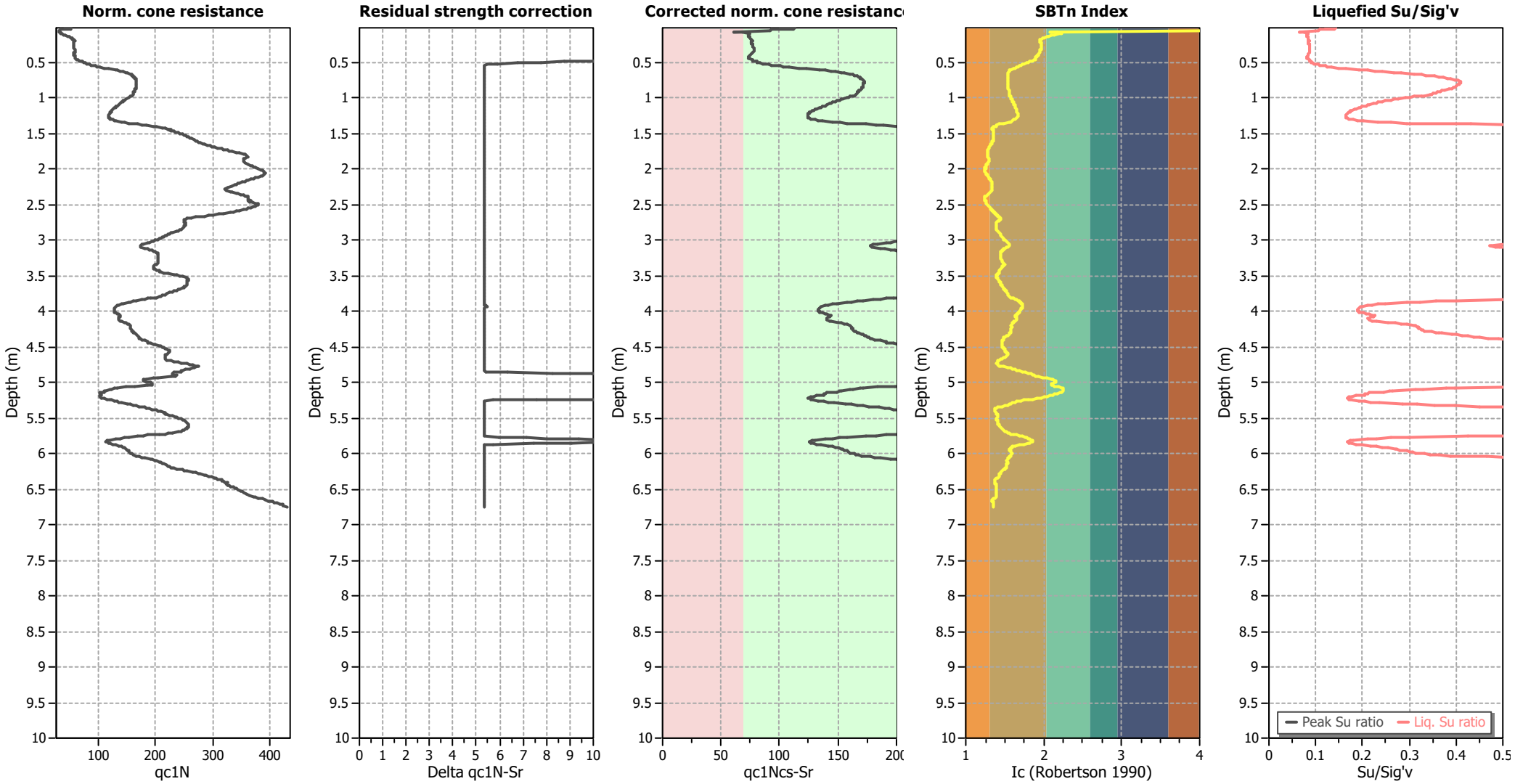




Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

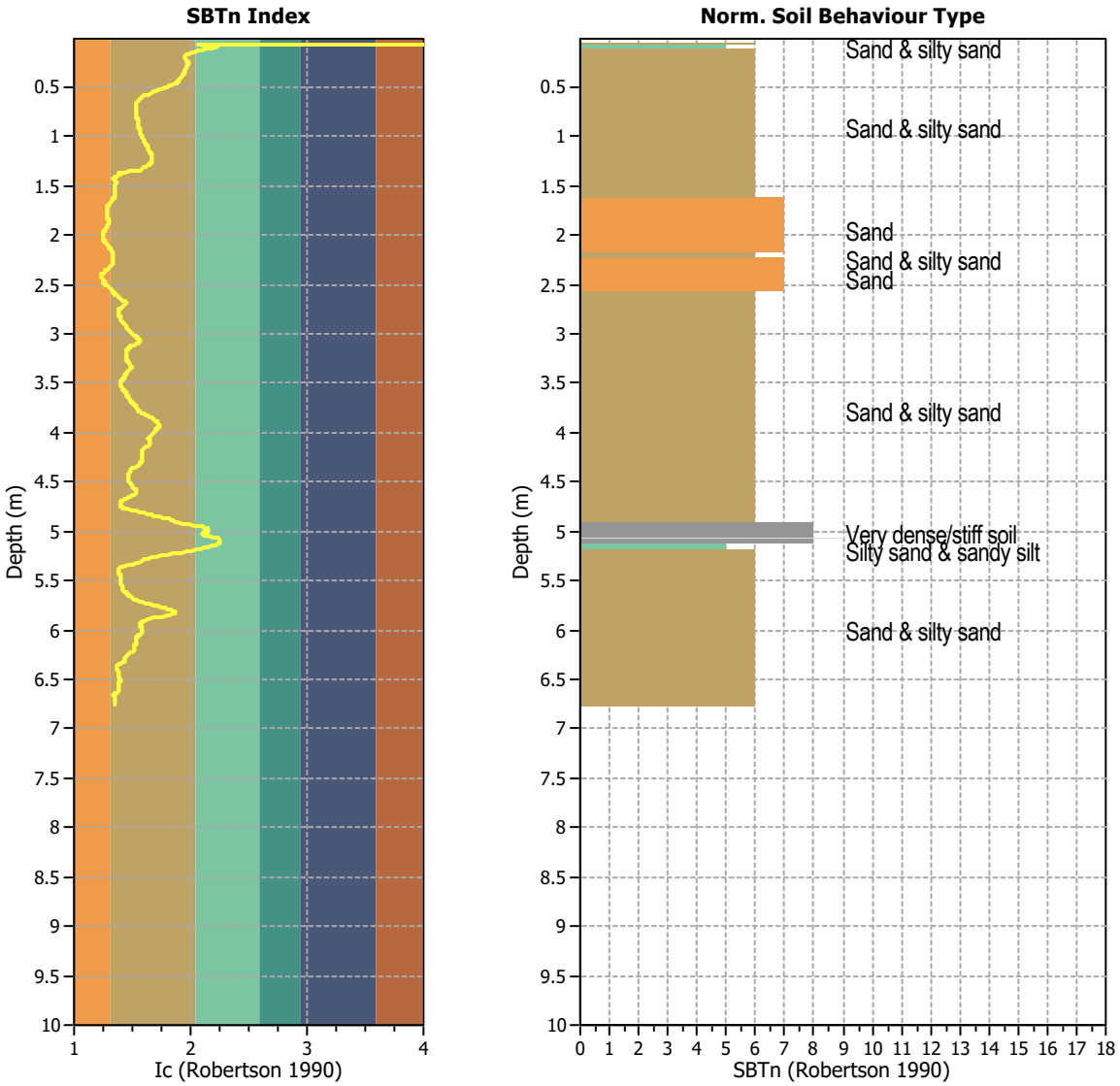
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

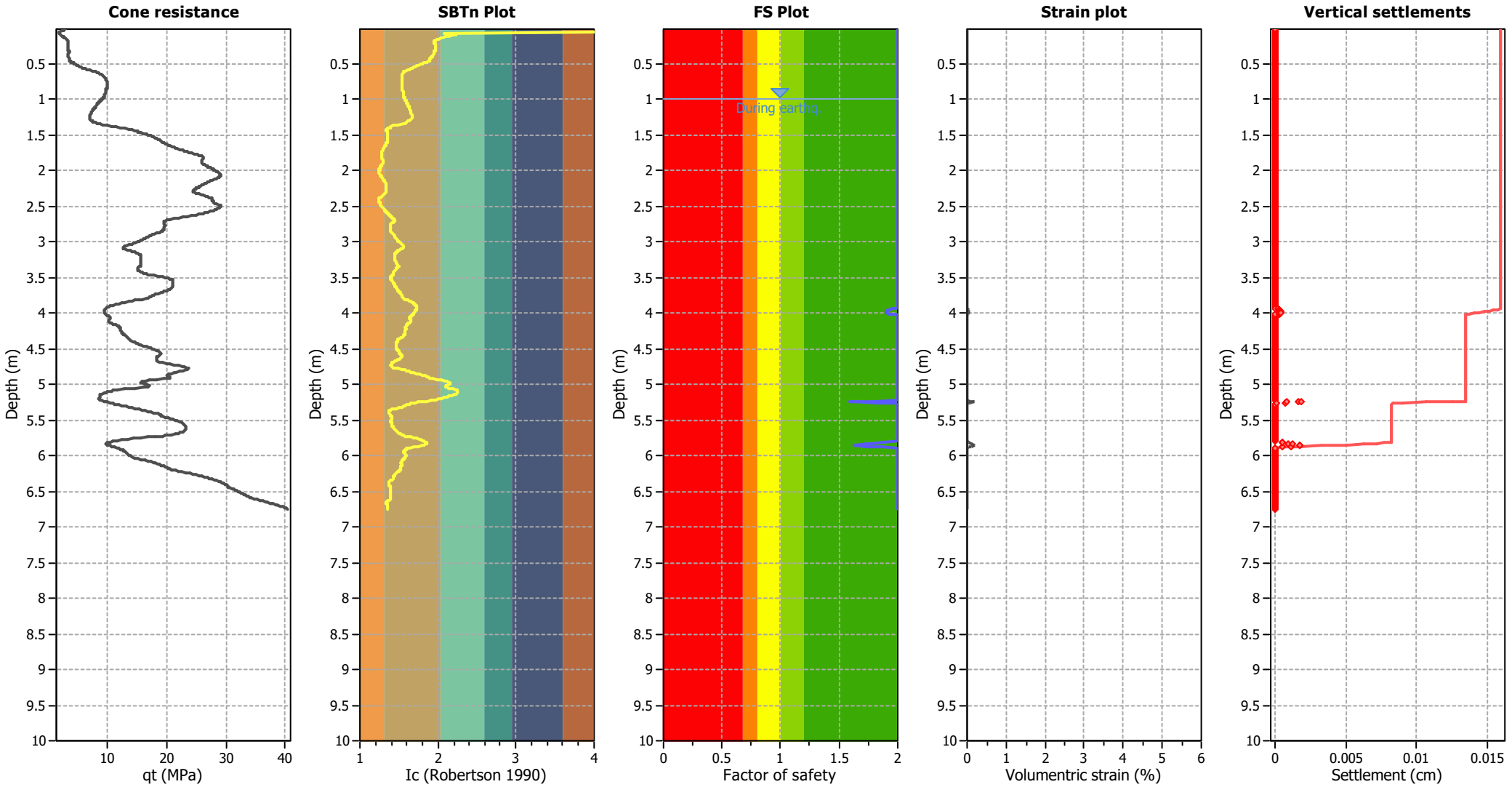
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	675
I_c maximum check value:	3.00	Total points excluded:	0
I_c change ratio value:	0.0100	Exclusion percentage:	0.00%
Minimum number of points in layer:	4	Number of layers detected:	0

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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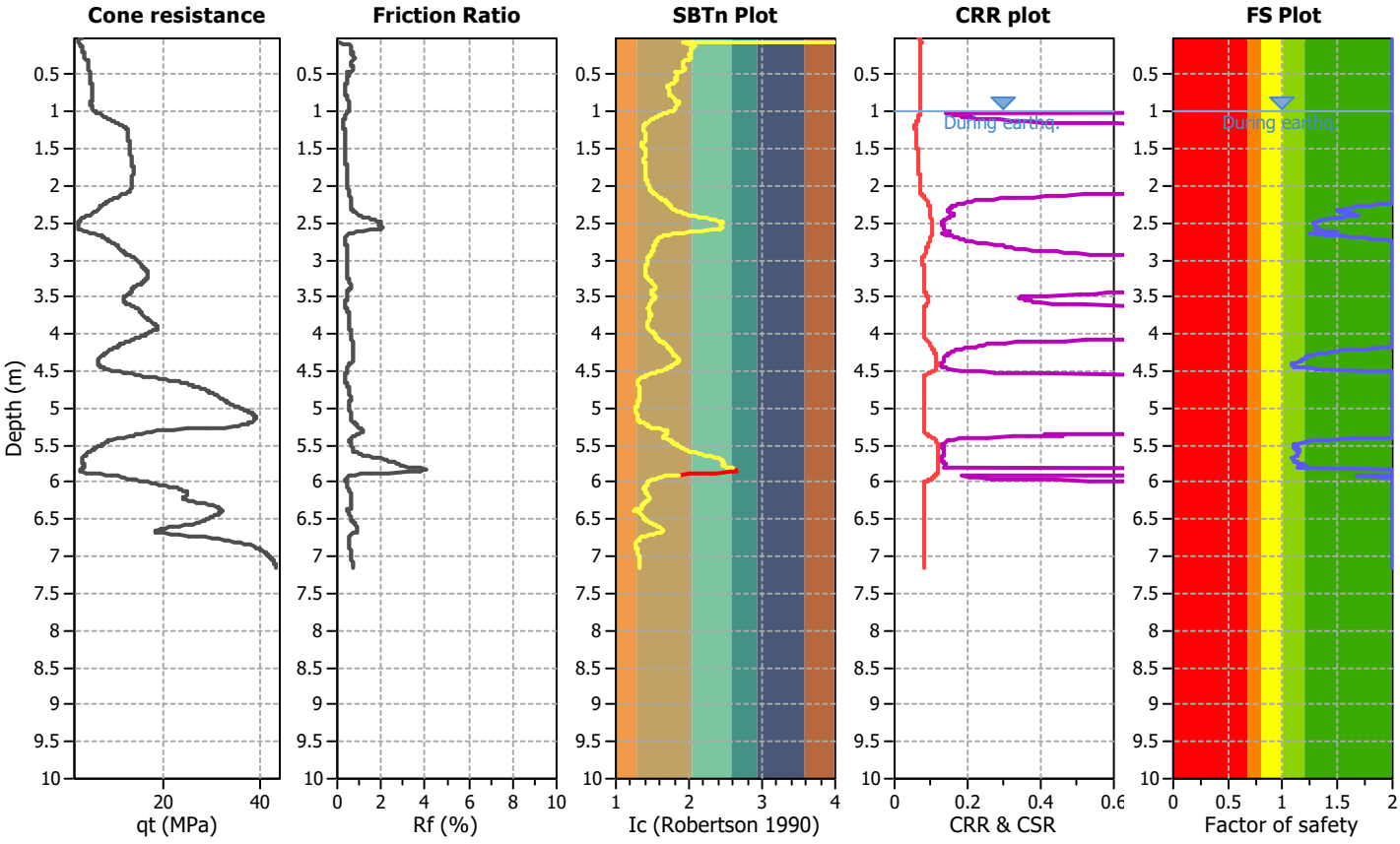
LIQUEFACTION ANALYSIS REPORT

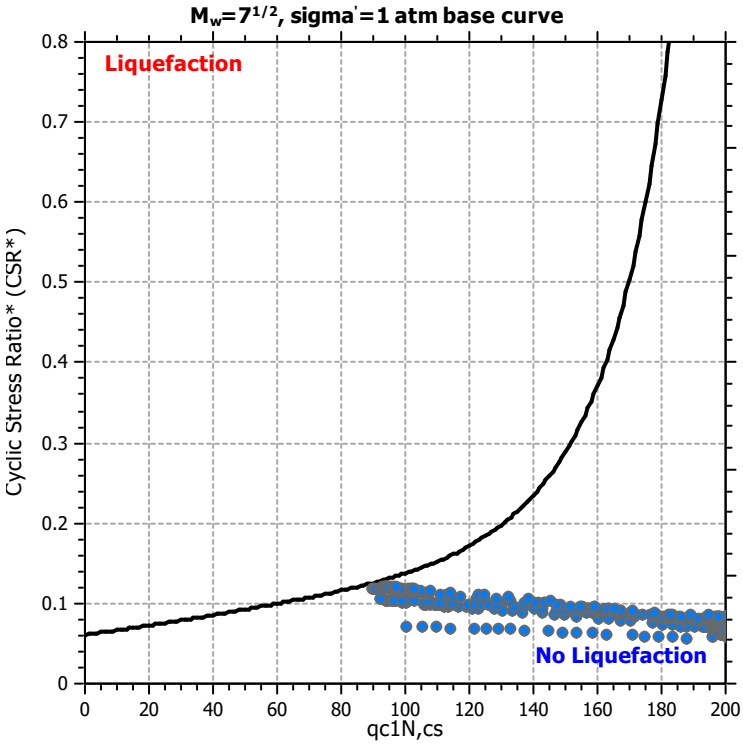
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

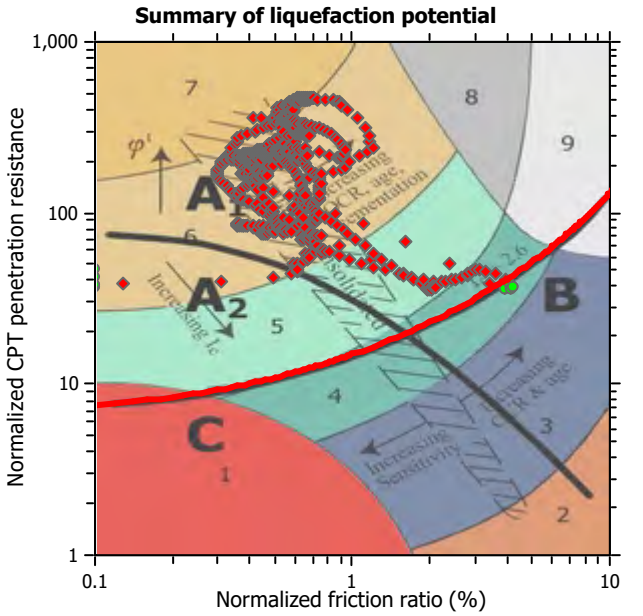
CPT file : CPT03_SLS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	6.40	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

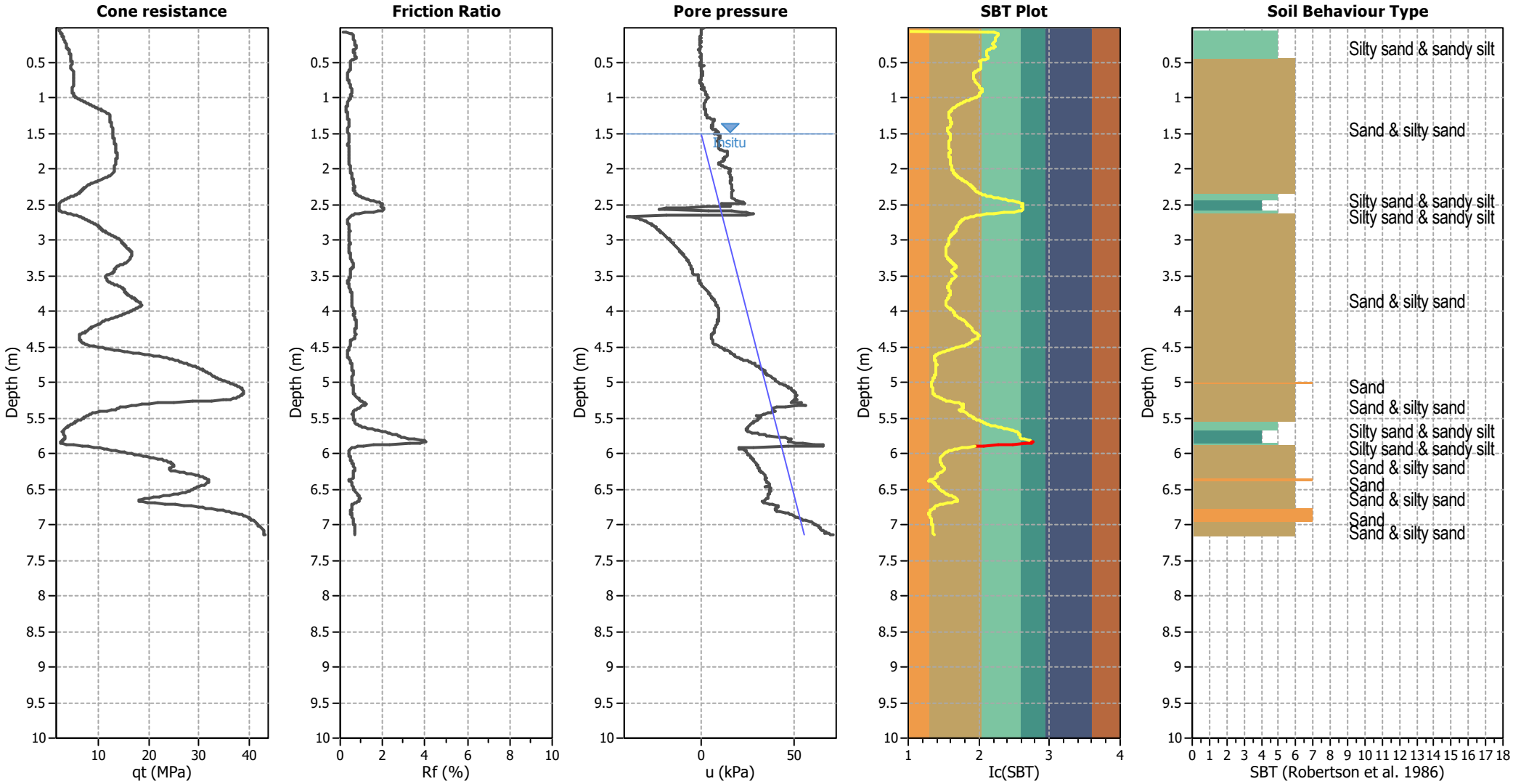






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



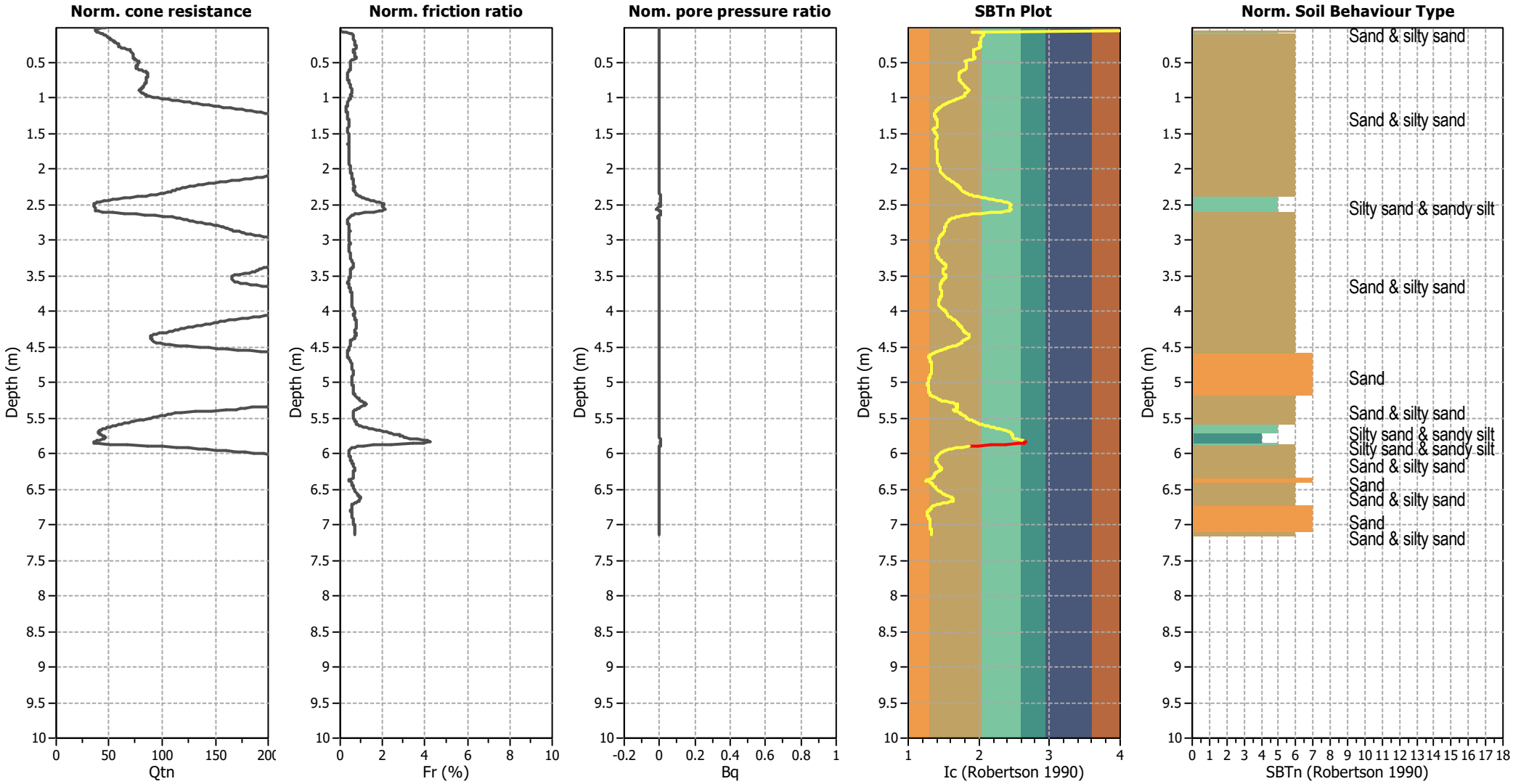
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



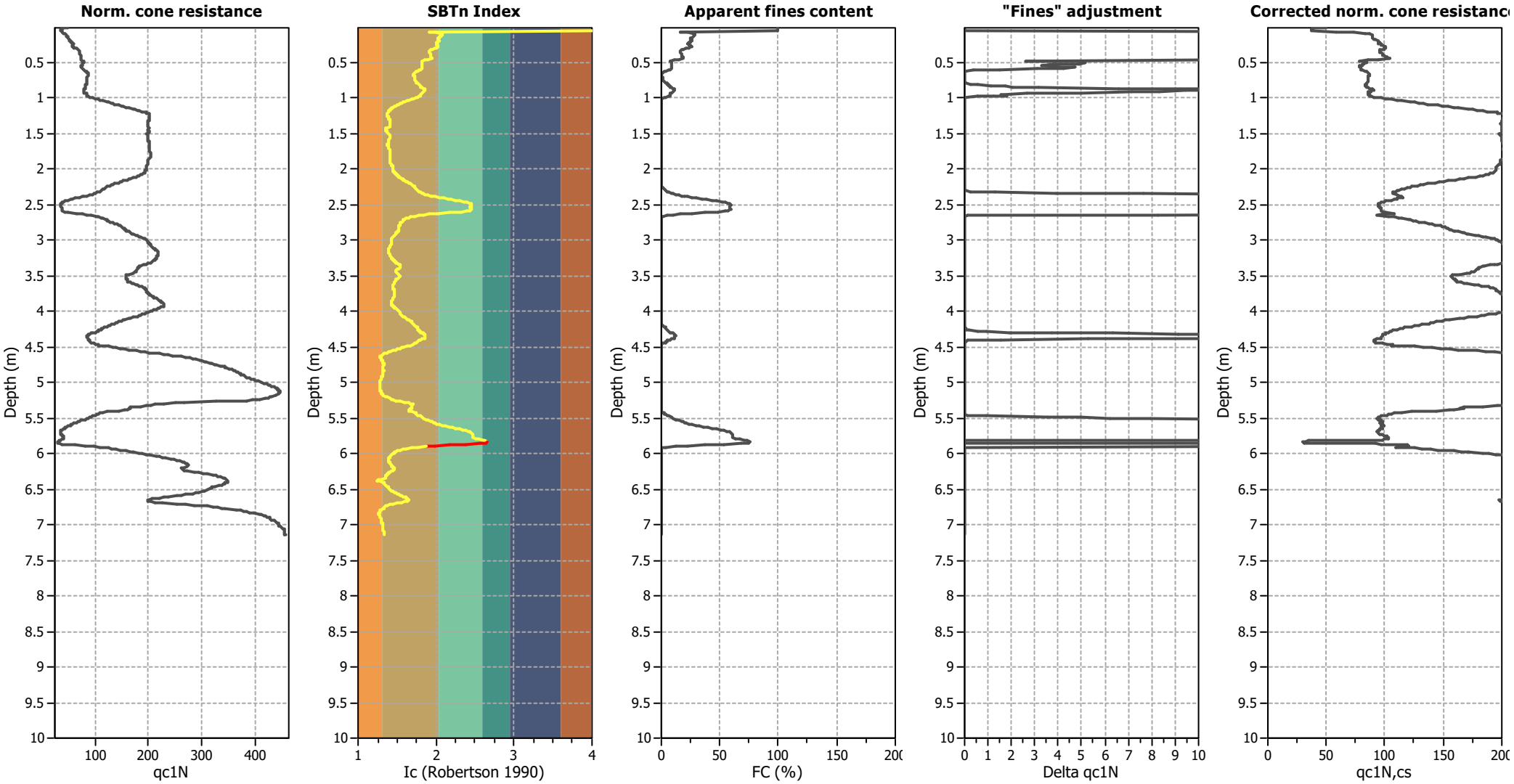
Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

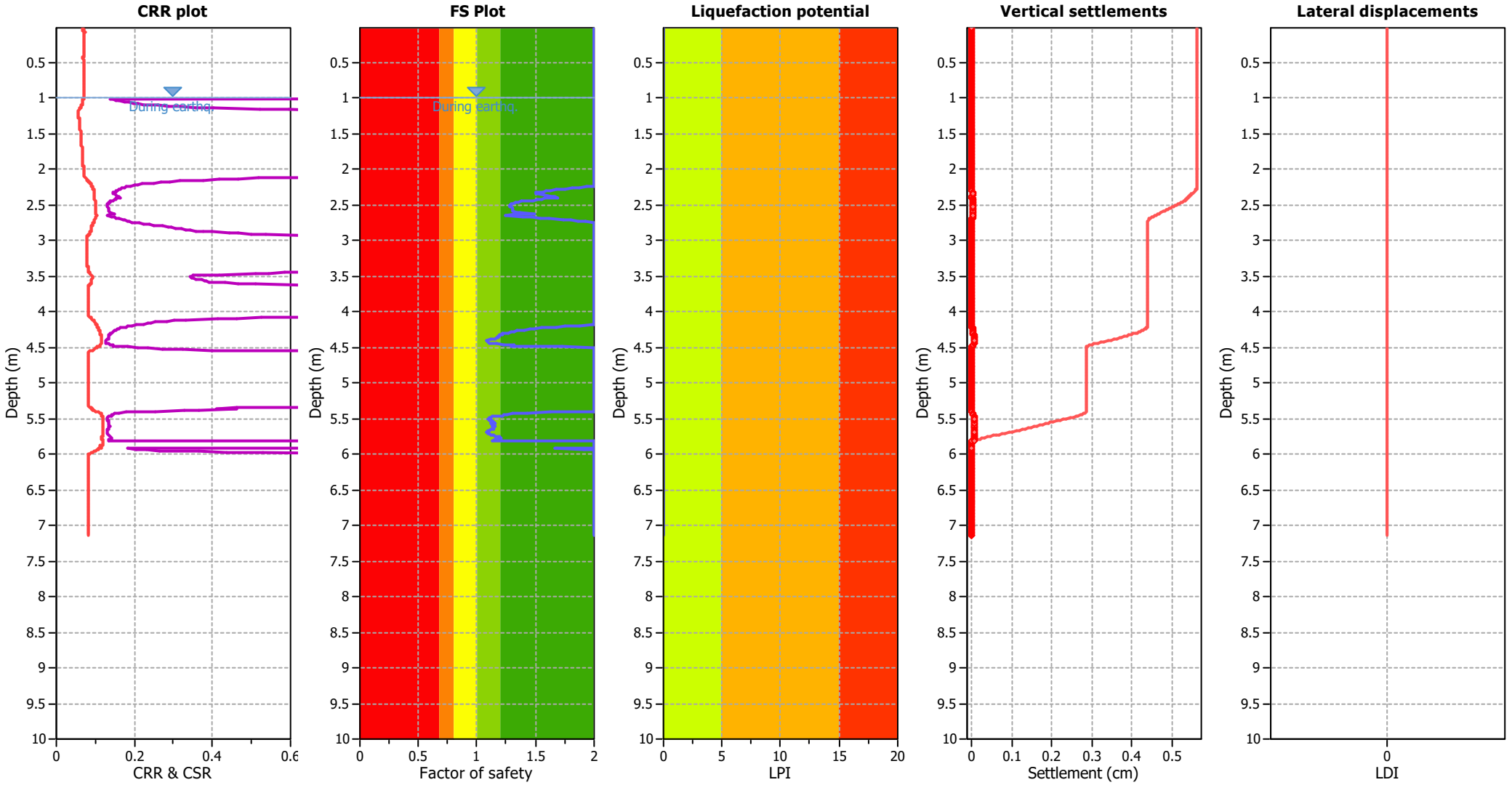
Liquefaction analysis overall plots (intermediate results)



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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

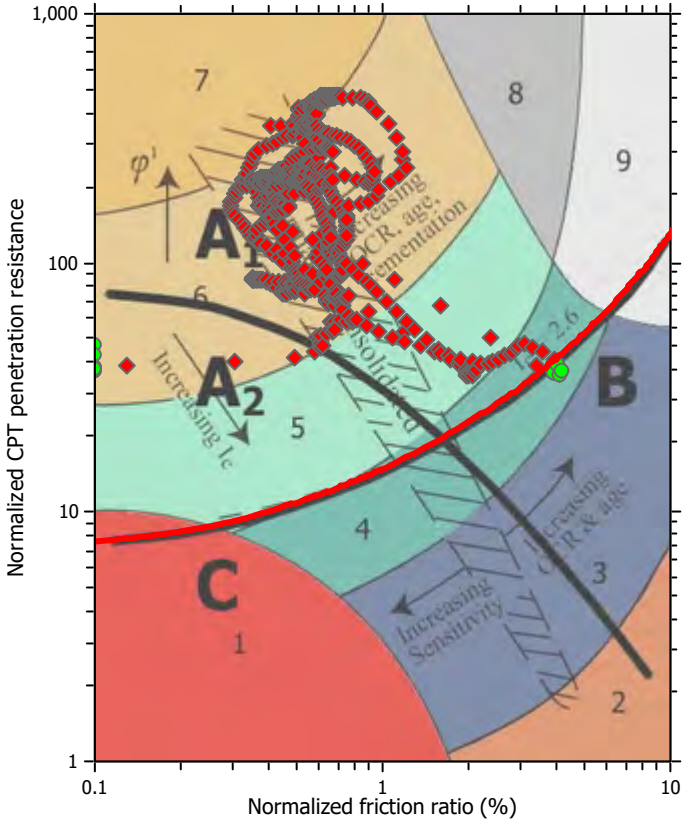
F.S. color scheme

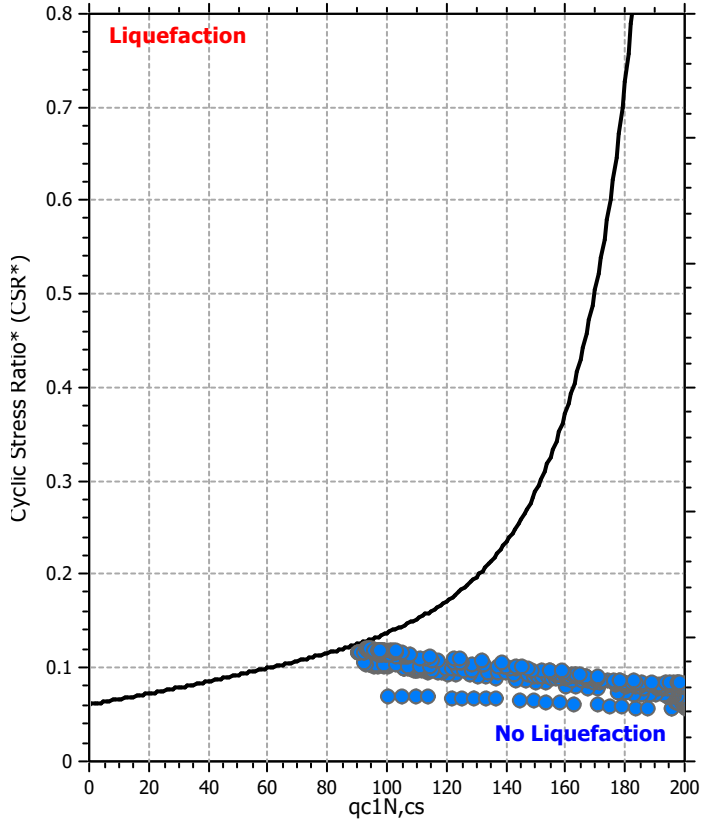
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

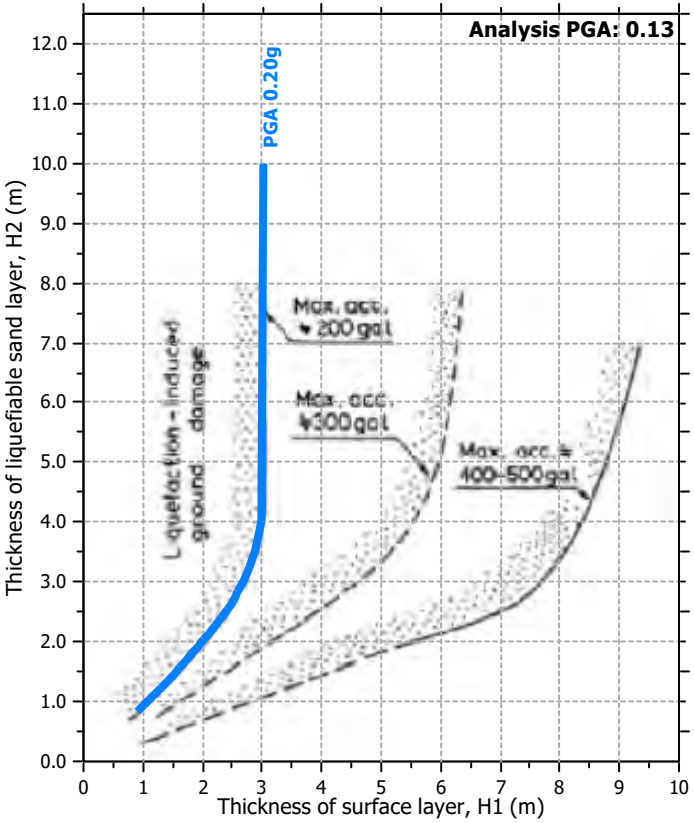
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



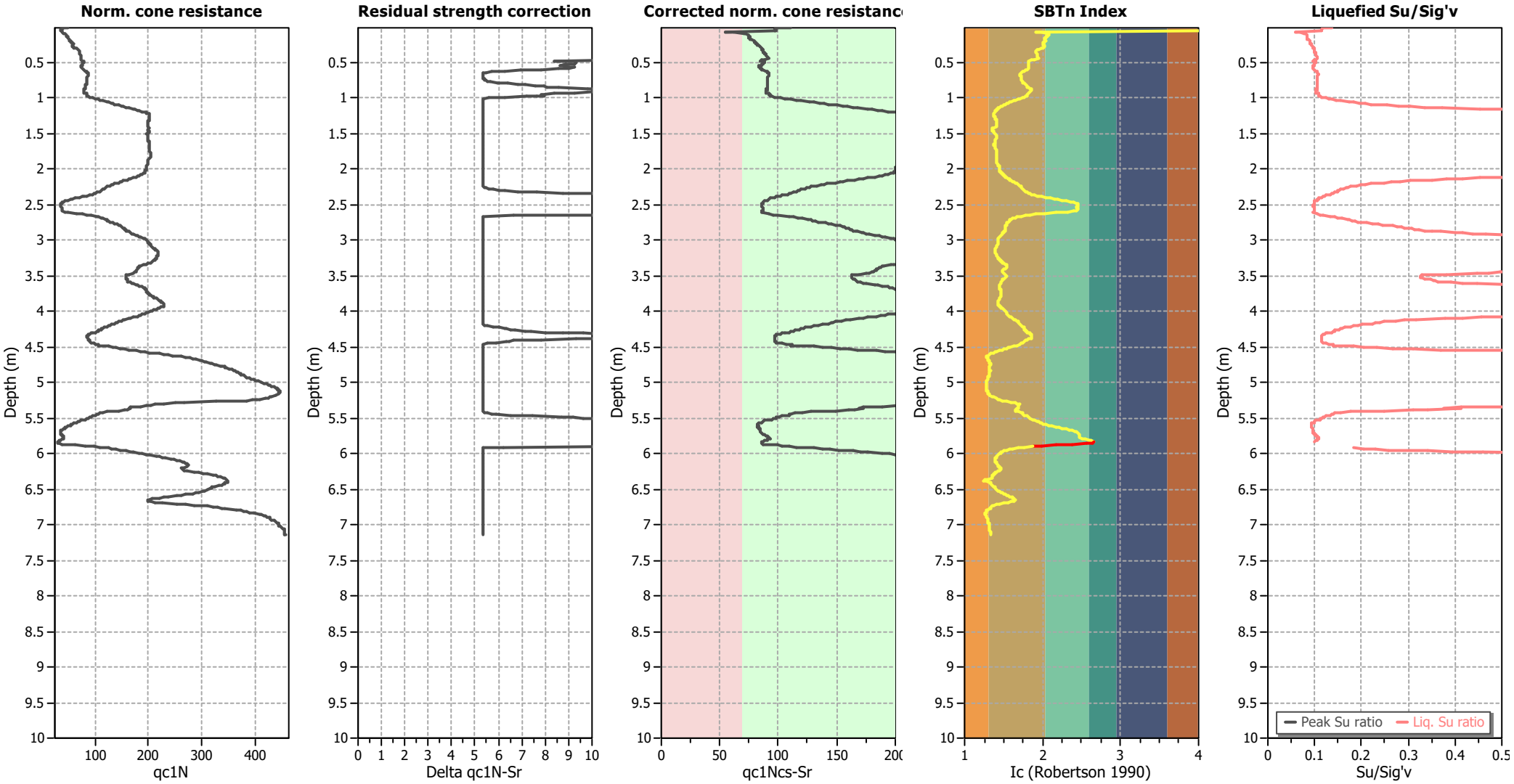




Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

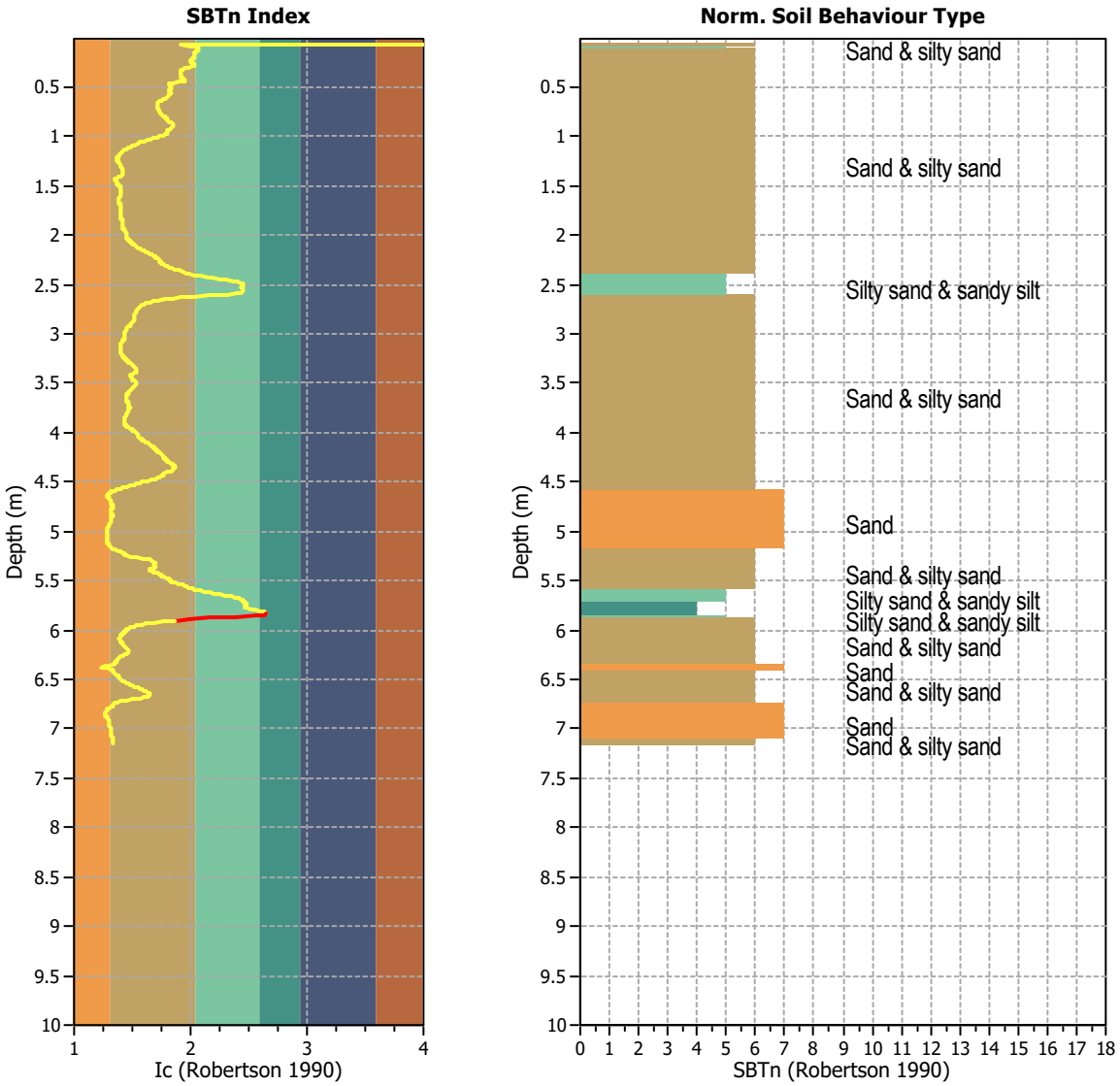
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

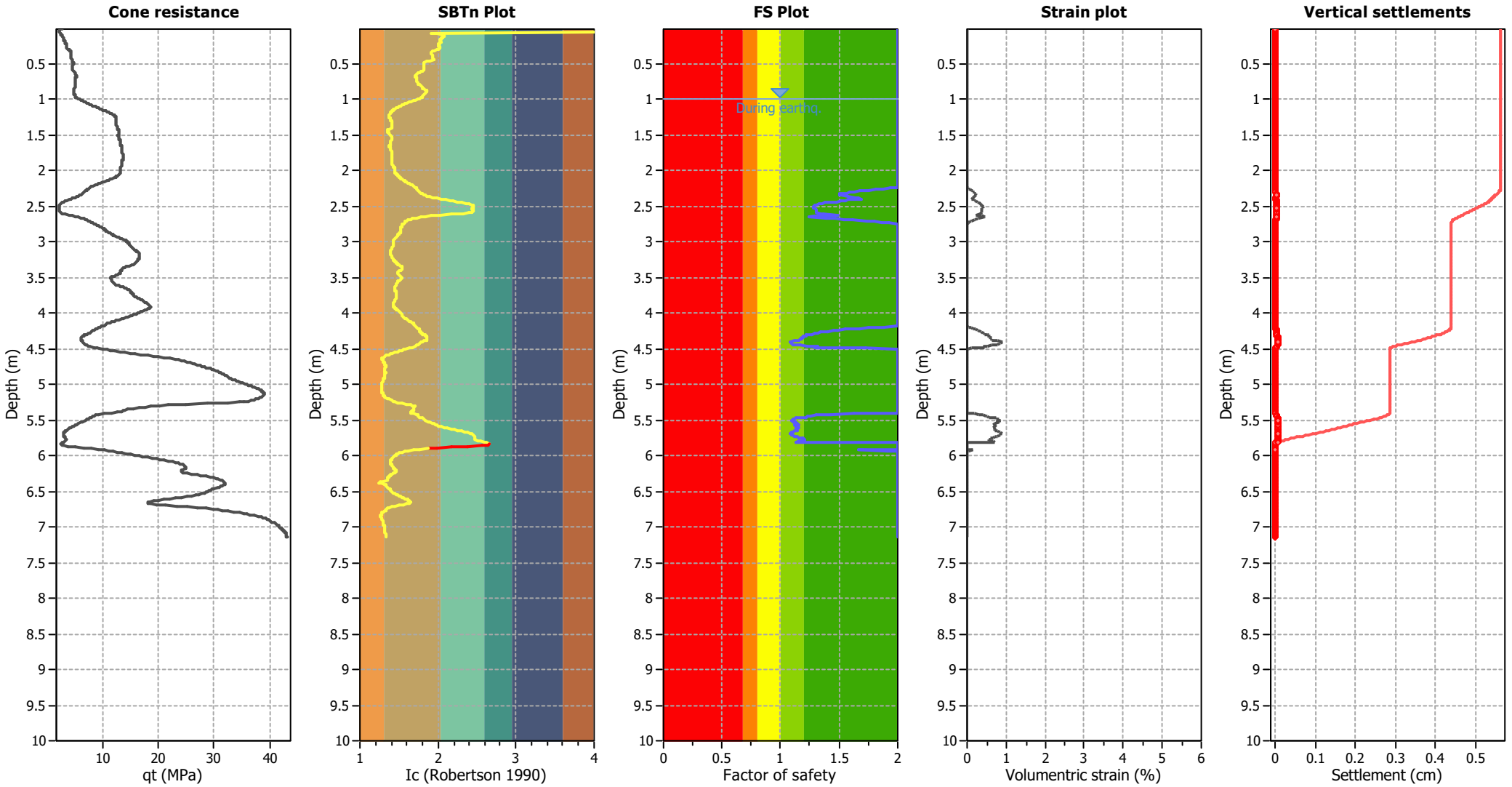
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	715
I_c maximum check value:	3.00	Total points excluded:	8
I_c change ratio value:	0.0100	Exclusion percentage:	1.12%
Minimum number of points in layer:	4	Number of layers detected:	1

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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www.btw.nz

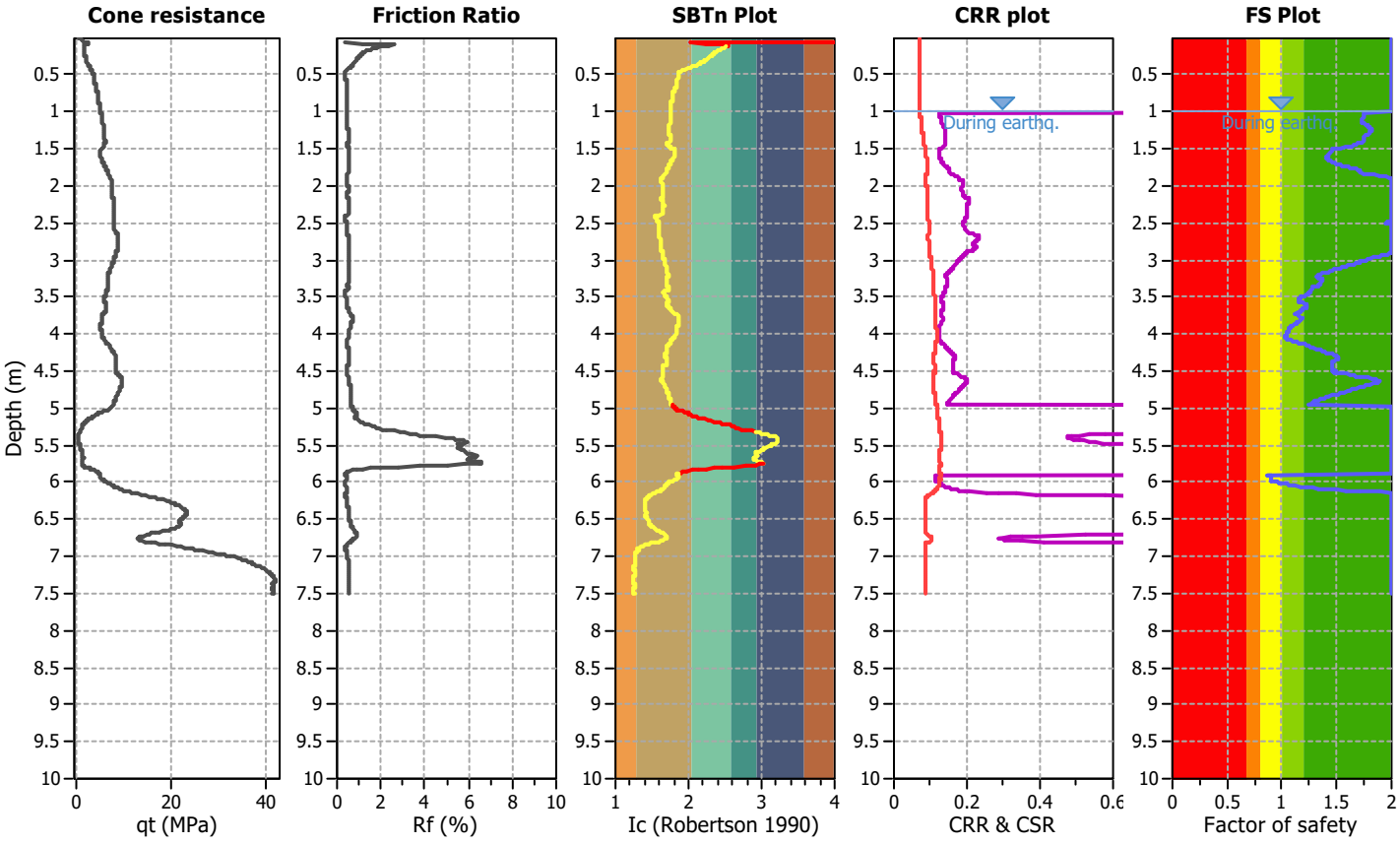
LIQUEFACTION ANALYSIS REPORT

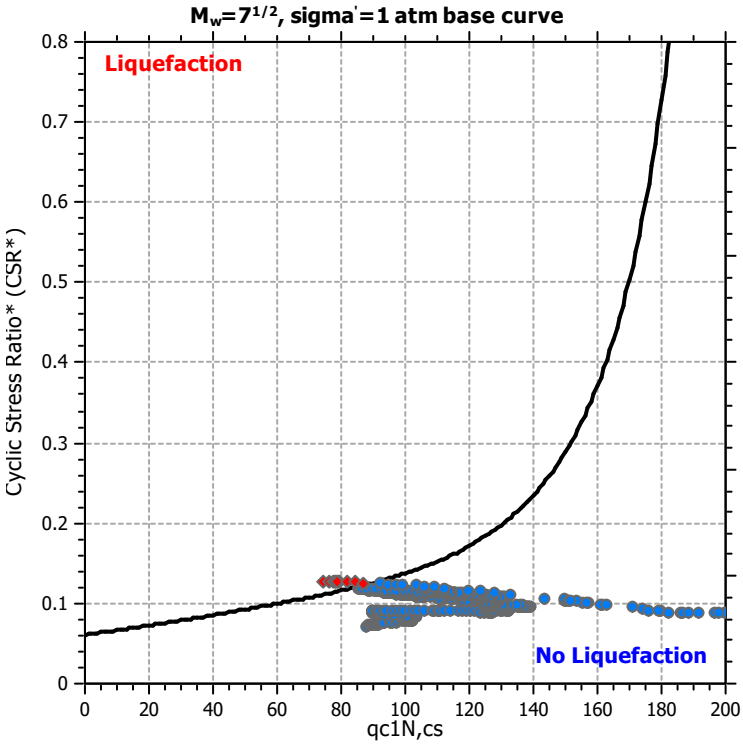
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

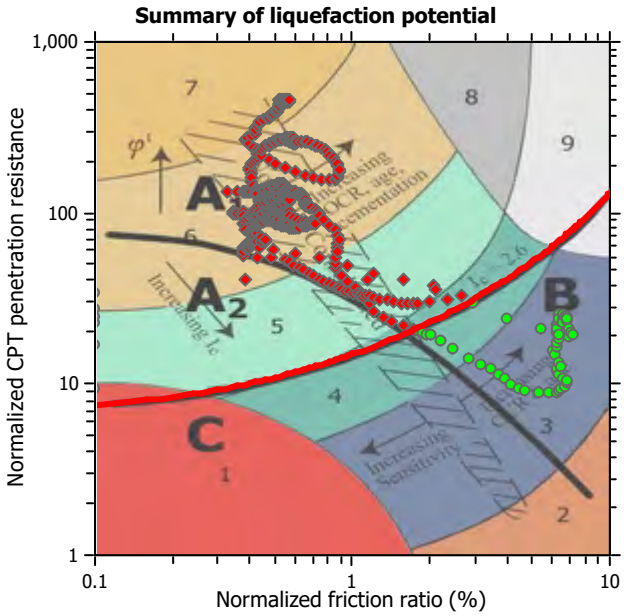
CPT file : CPT04_SLS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	6.40	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

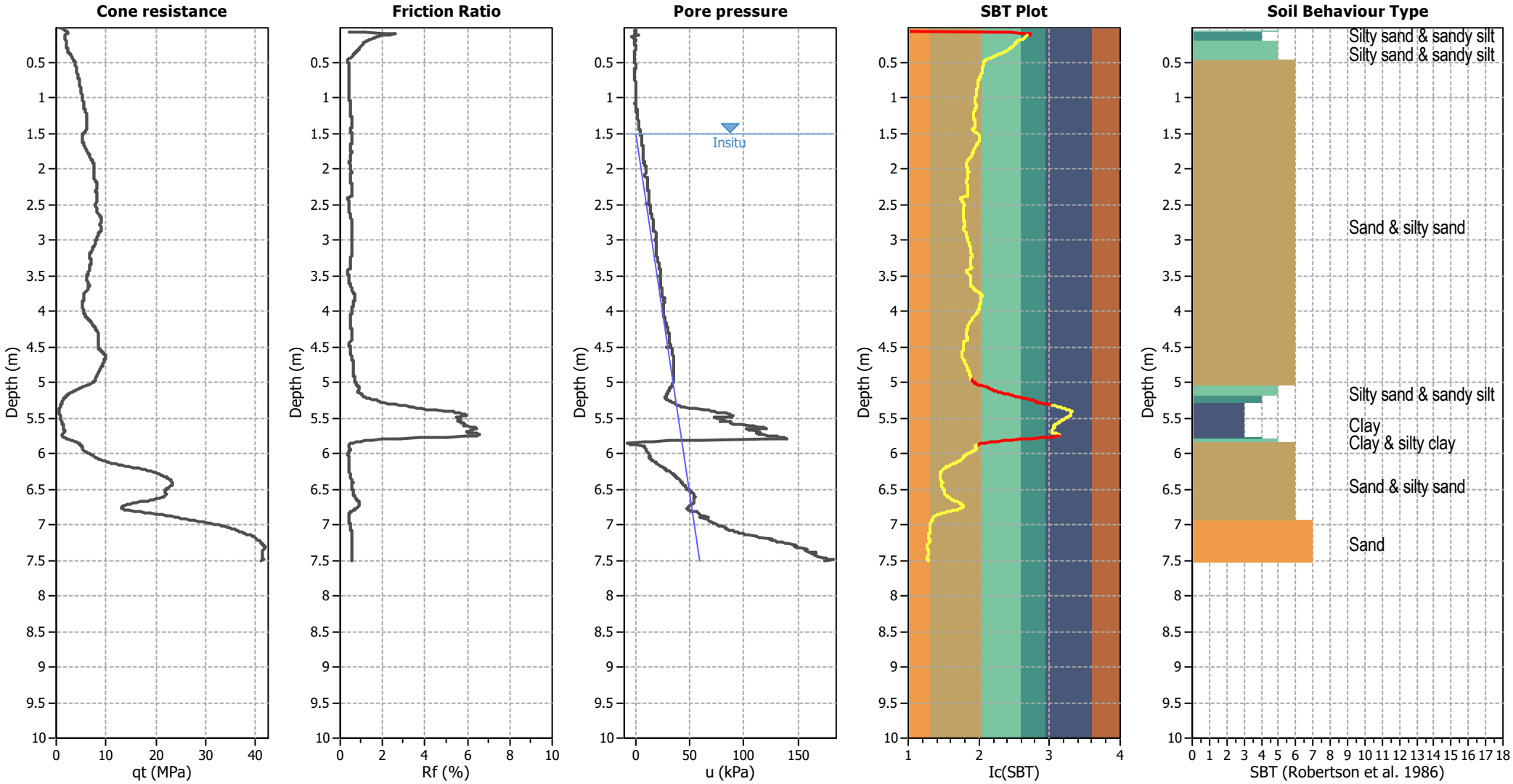






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



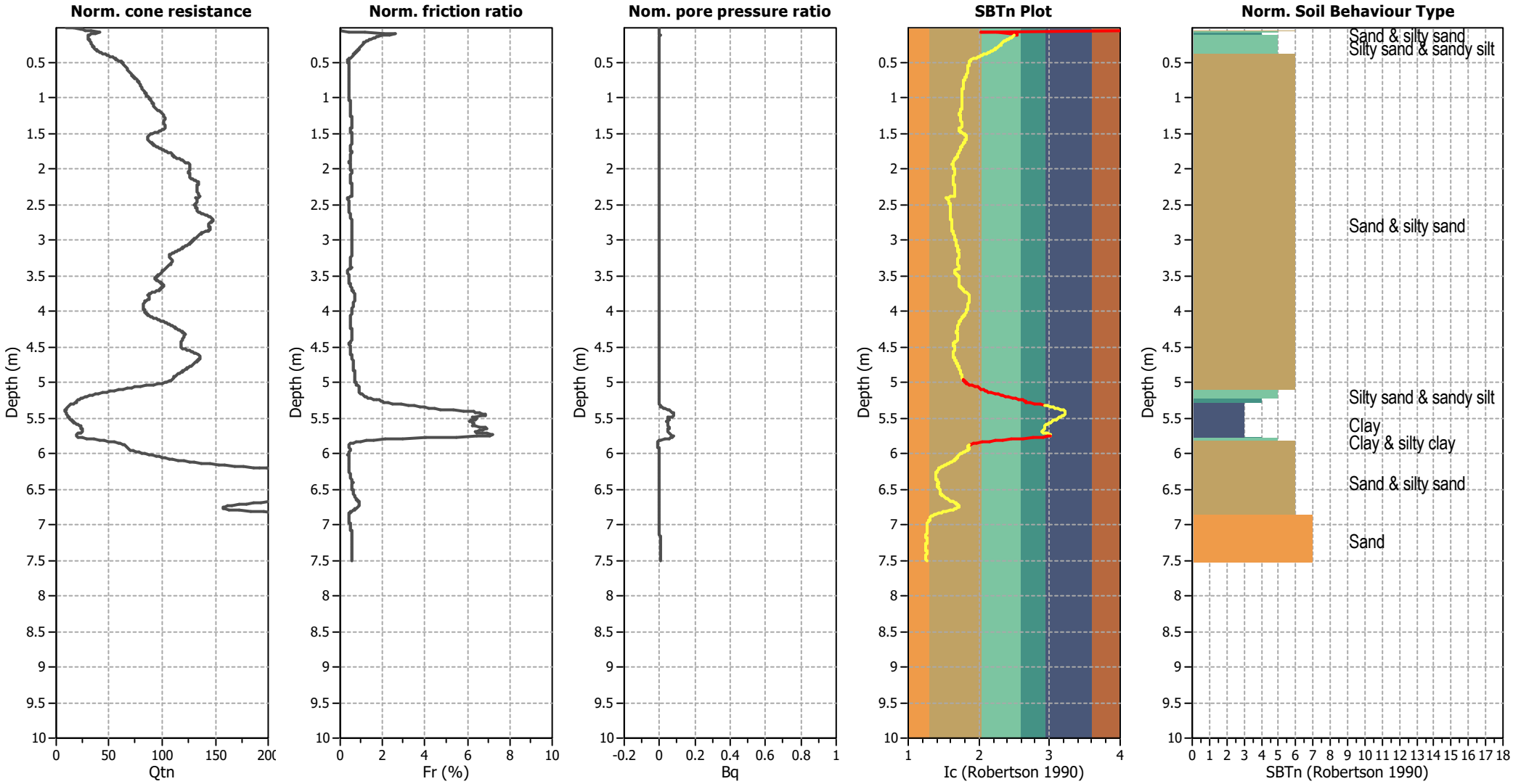
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



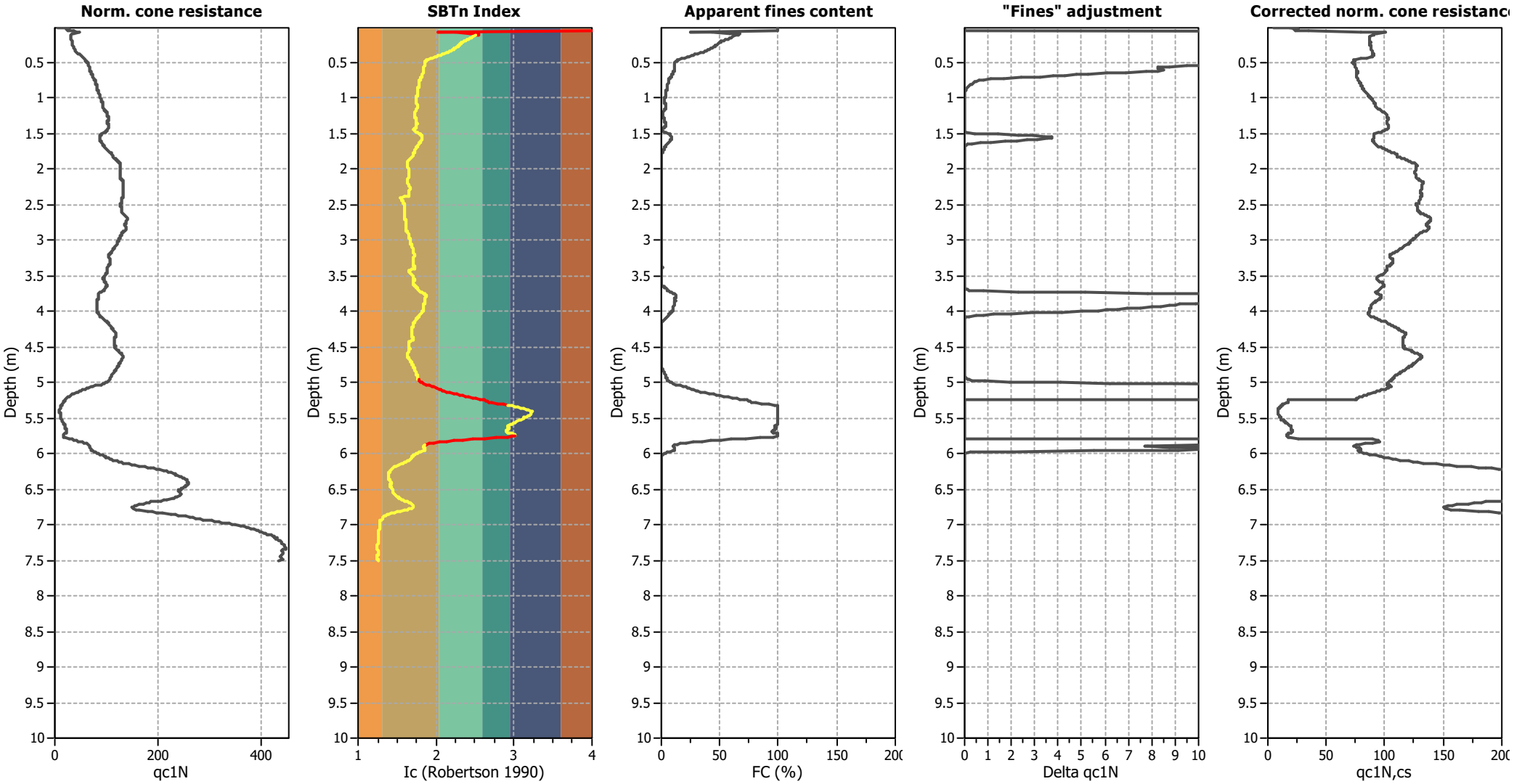
Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

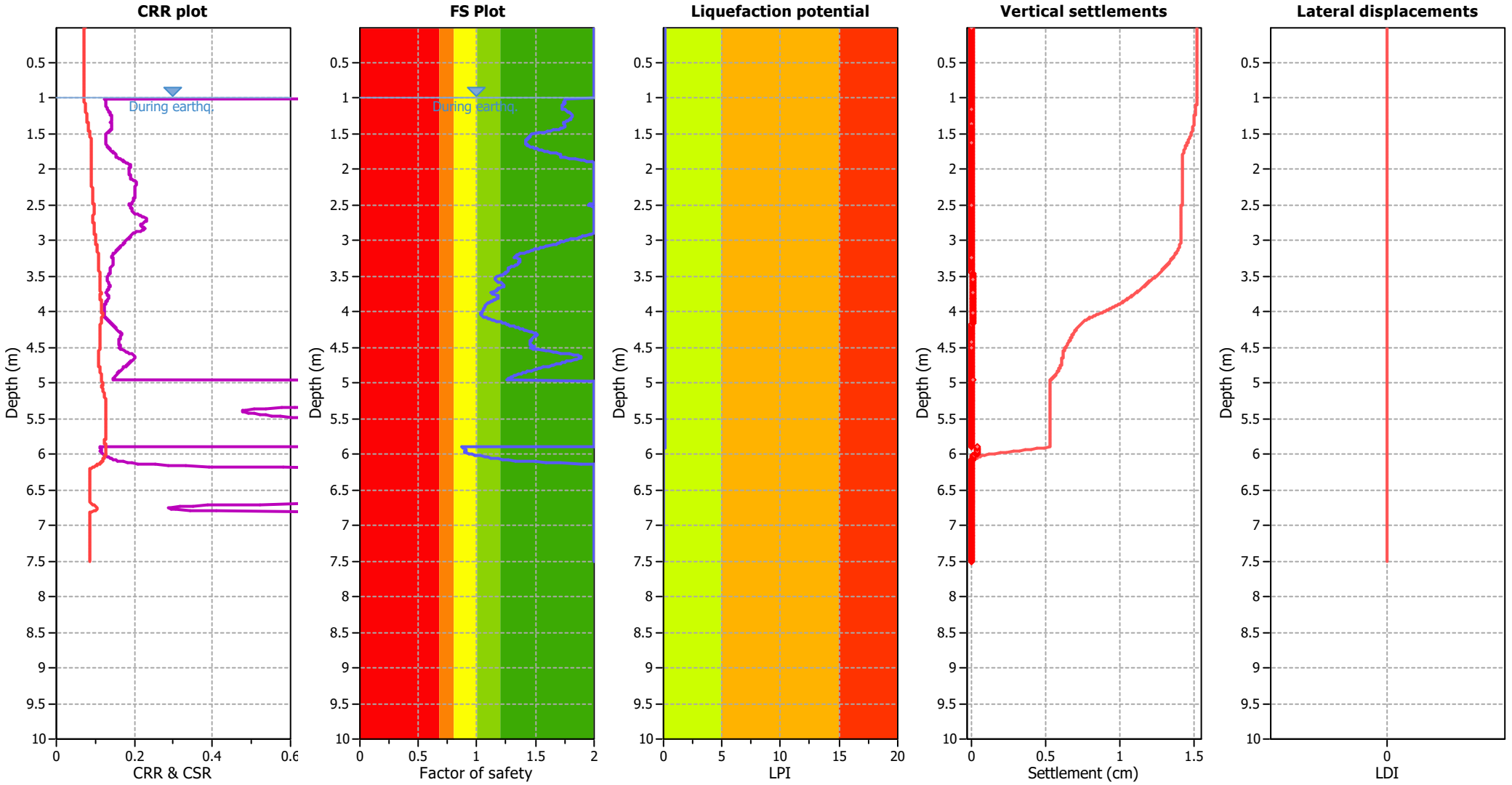
Liquefaction analysis overall plots (intermediate results)



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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

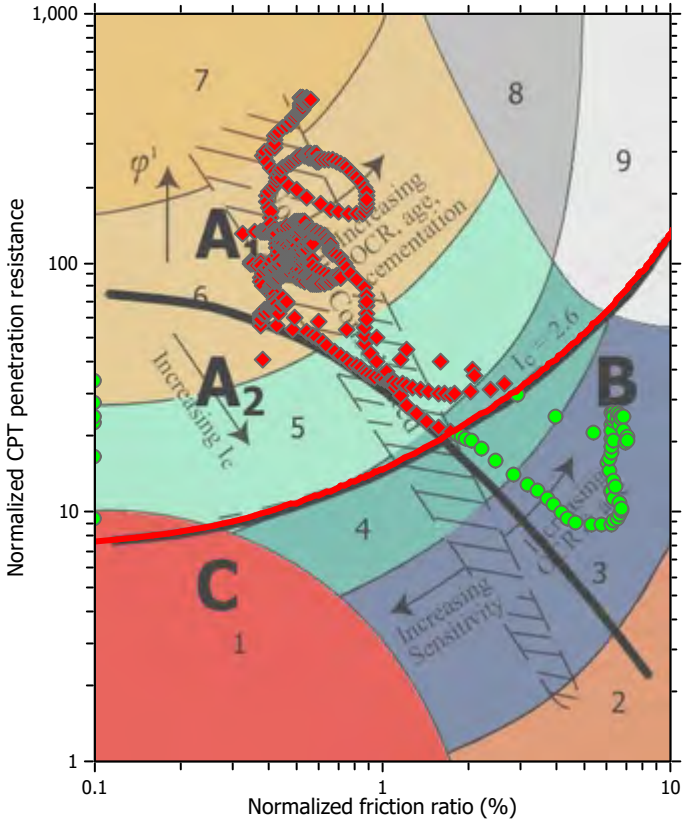
F.S. color scheme

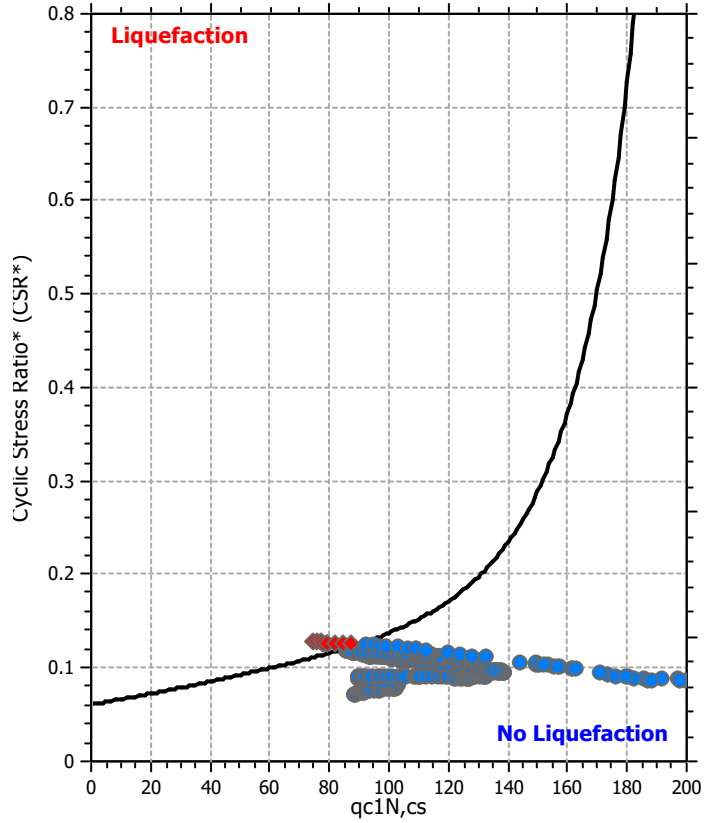
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

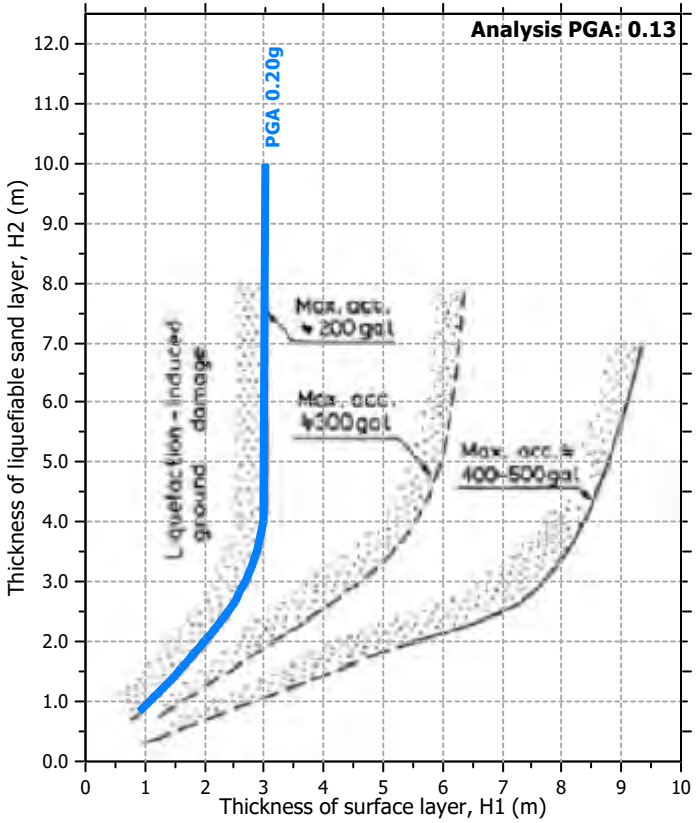
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



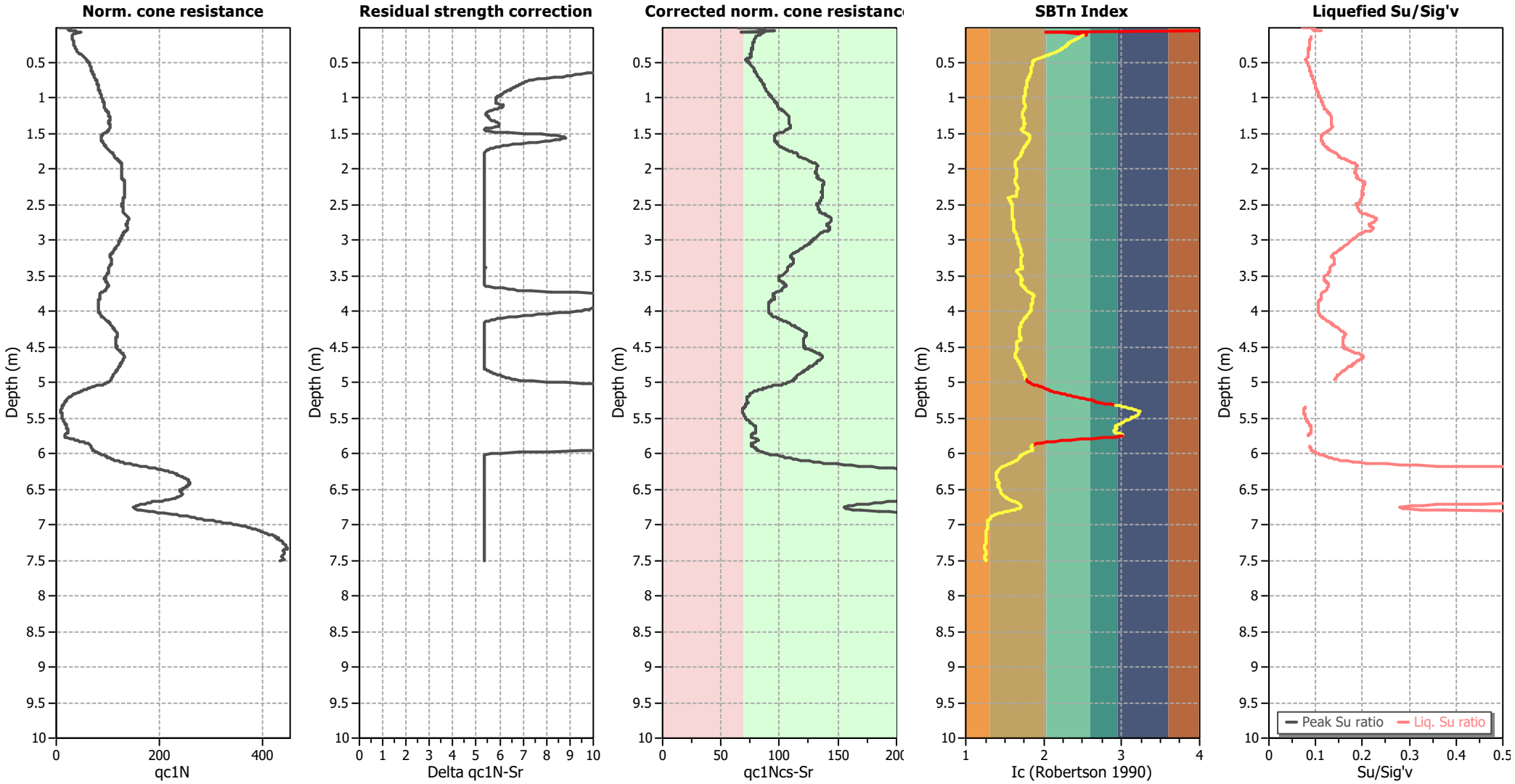




Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

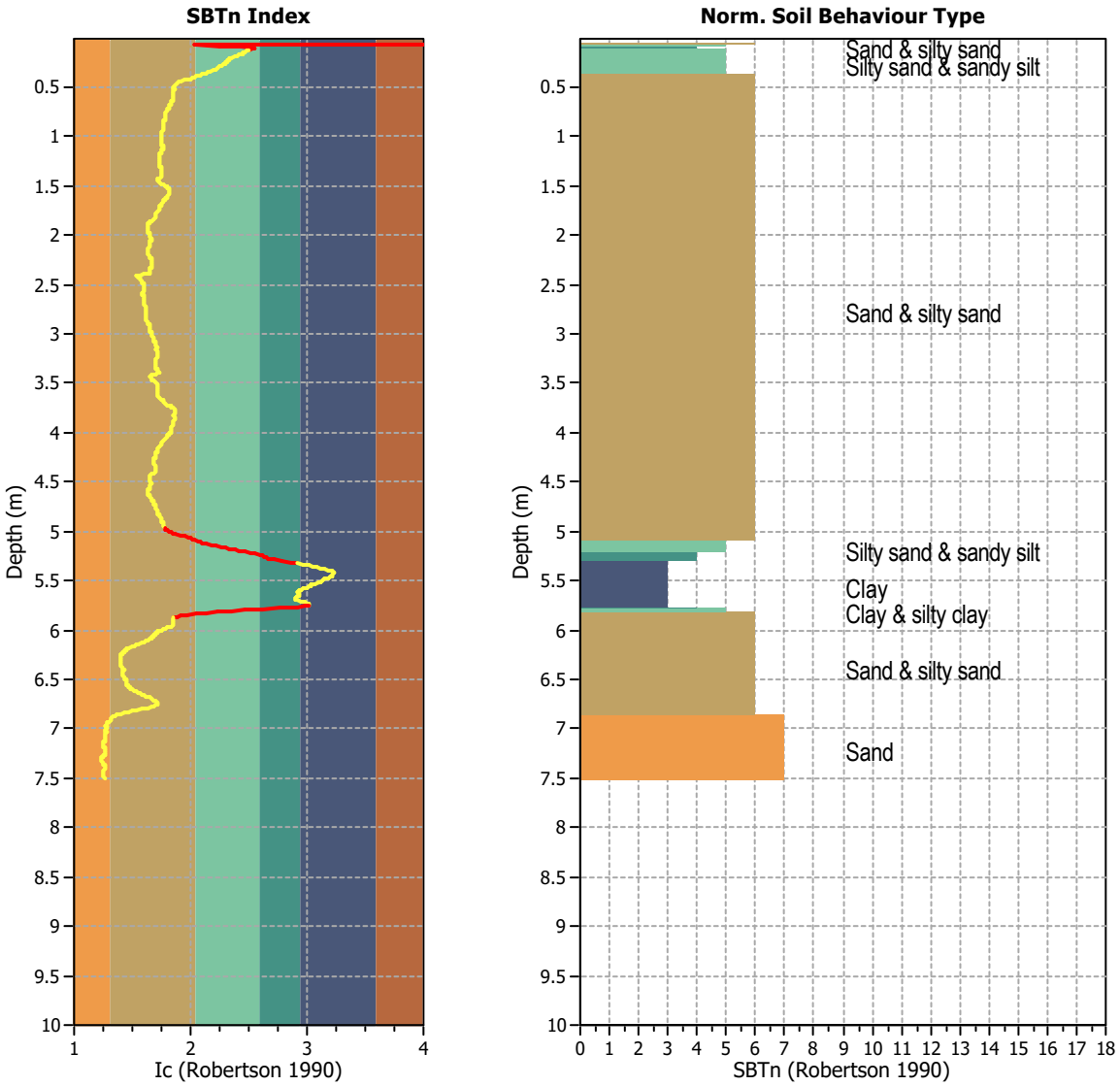
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

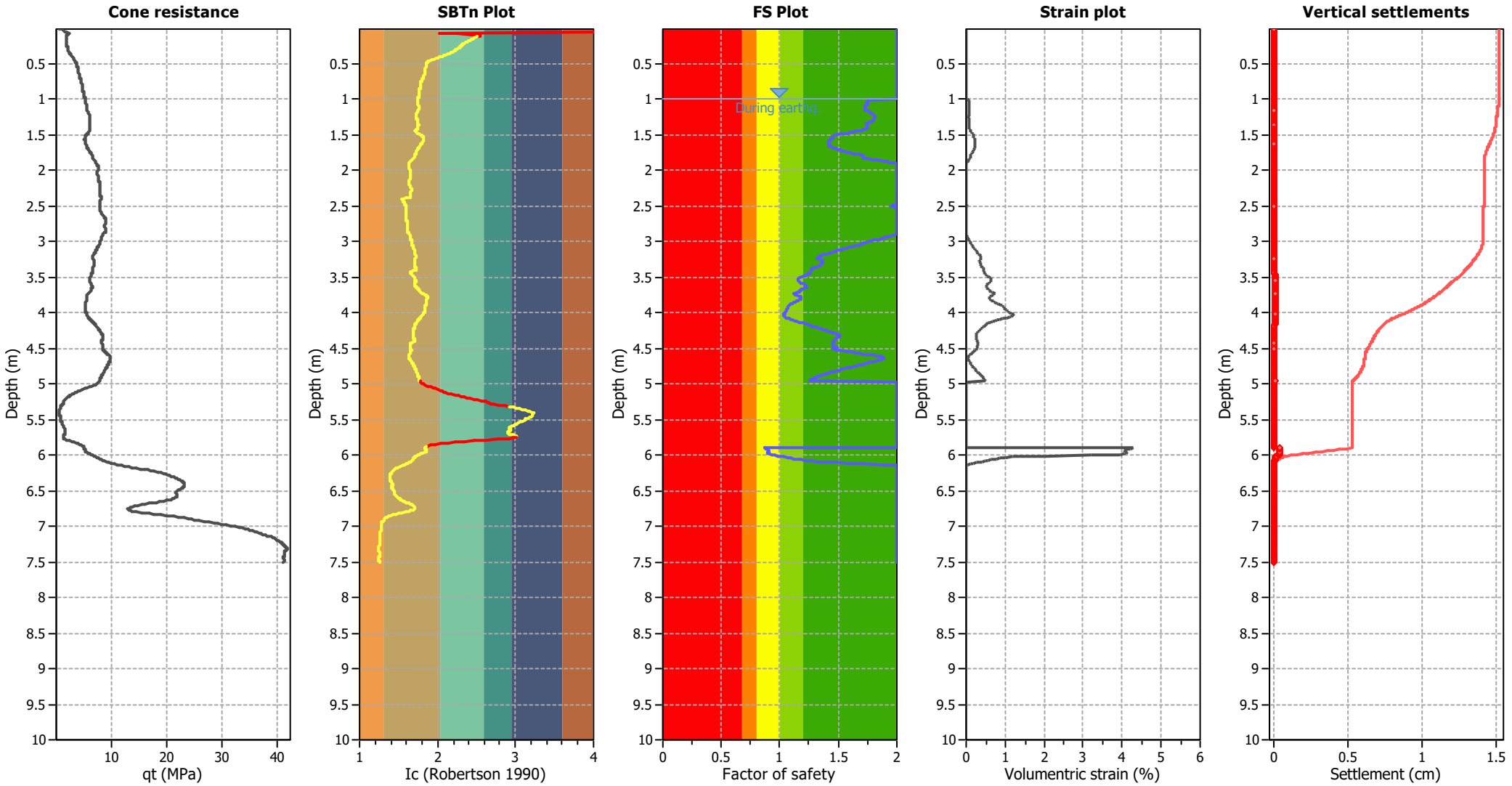
The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties	
I_c minimum check value:	1.70
I_c maximum check value:	3.00
I_c change ratio value:	0.0100
Minimum number of points in layer:	4

General statistics	
Total points in CPT file:	750
Total points excluded:	59
Exclusion percentage:	7.87%
Number of layers detected:	4

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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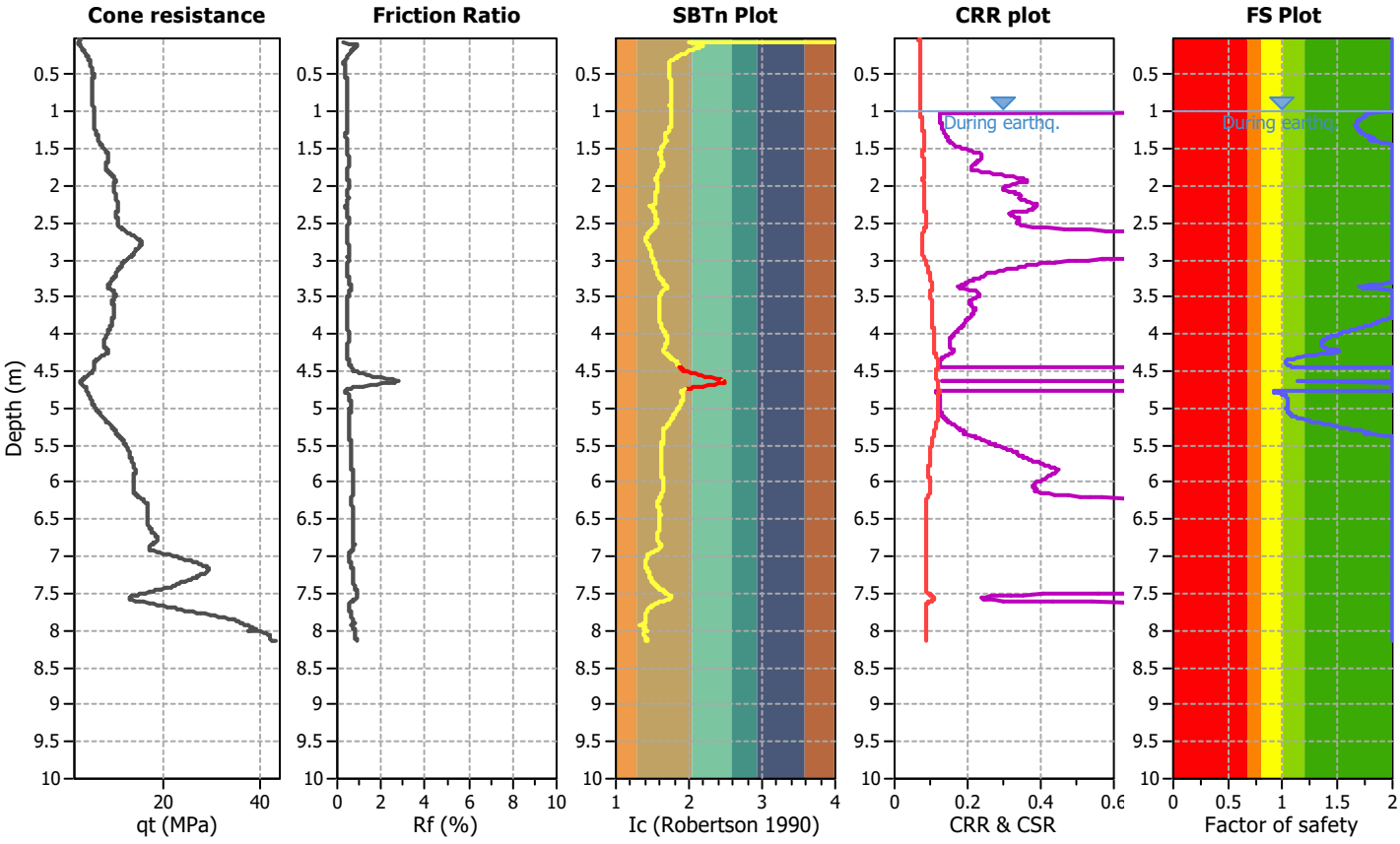
LIQUEFACTION ANALYSIS REPORT

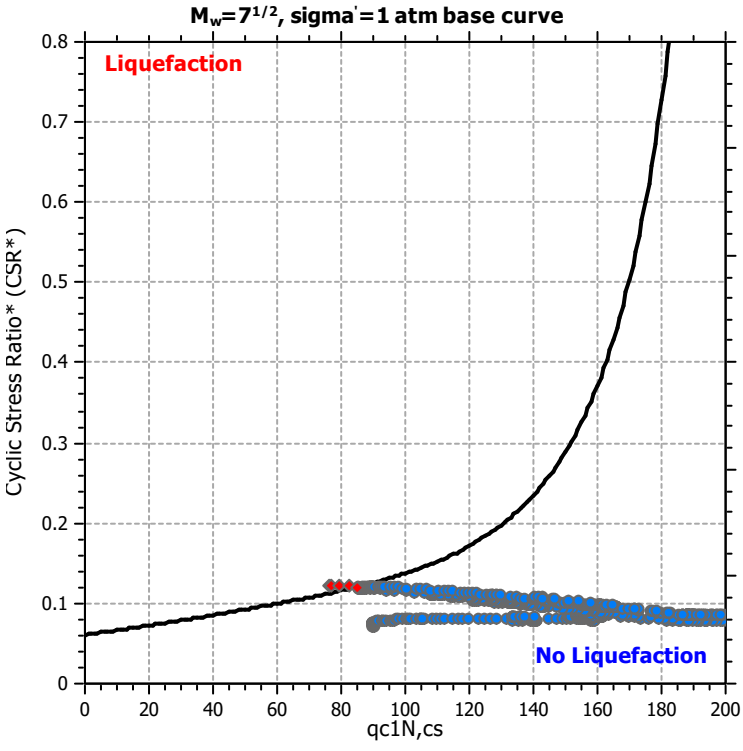
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

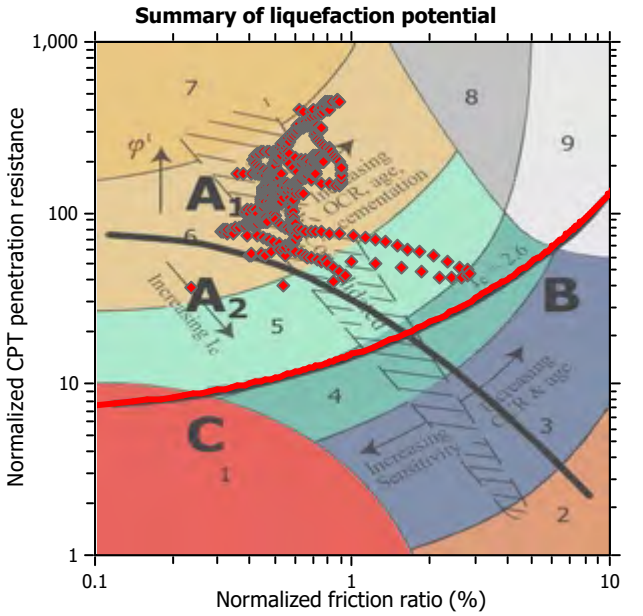
CPT file : CPT05_SLS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	6.40	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

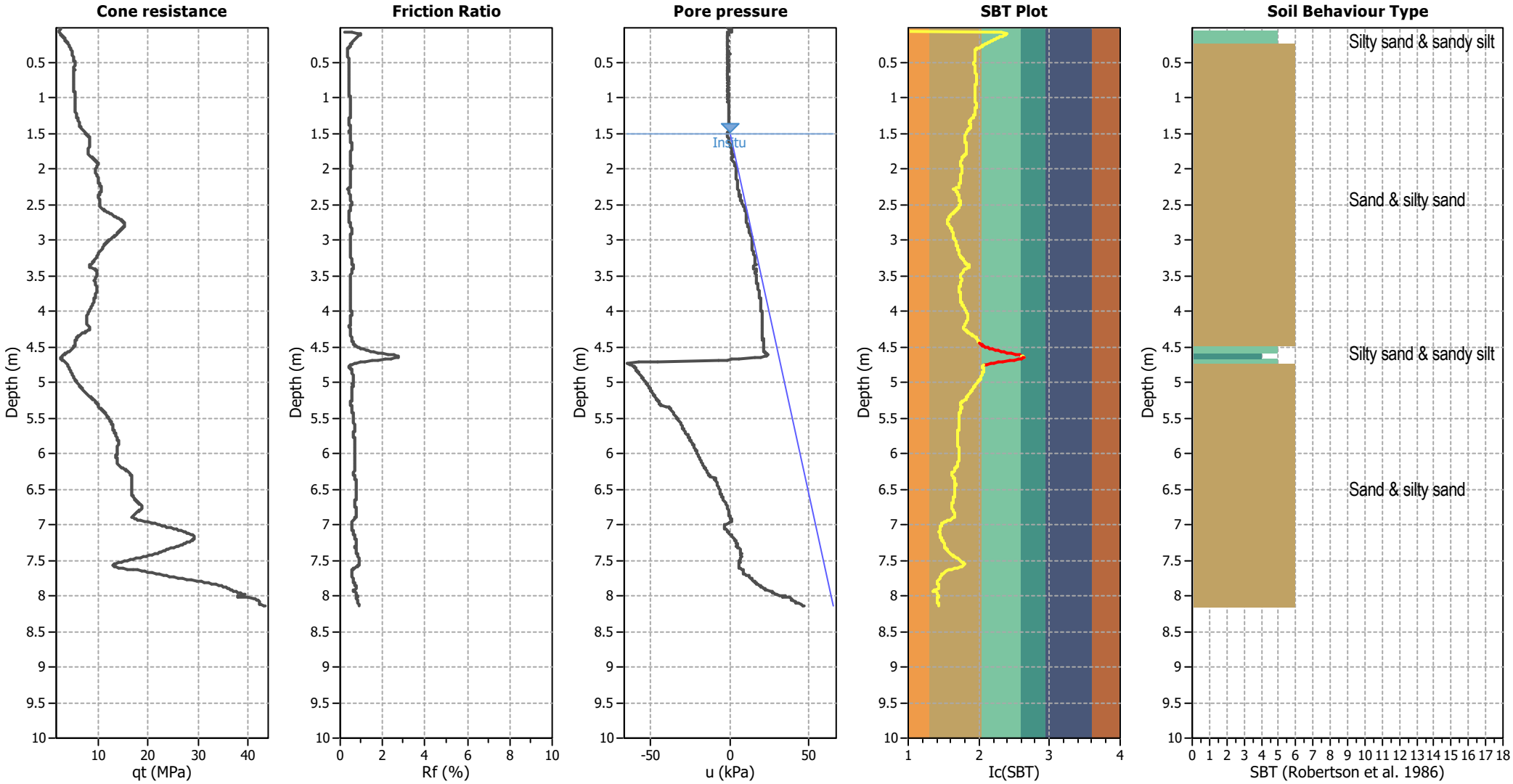






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



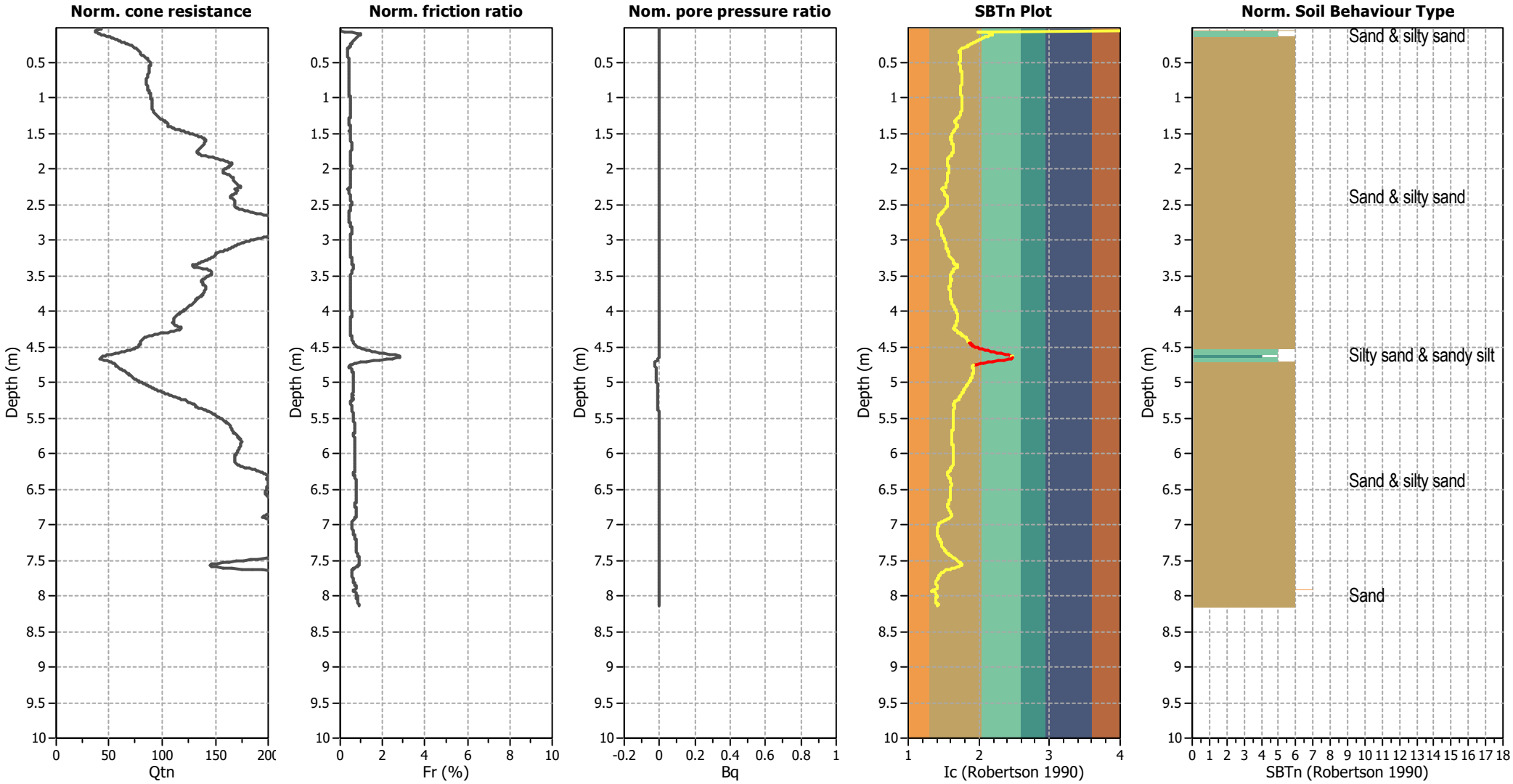
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



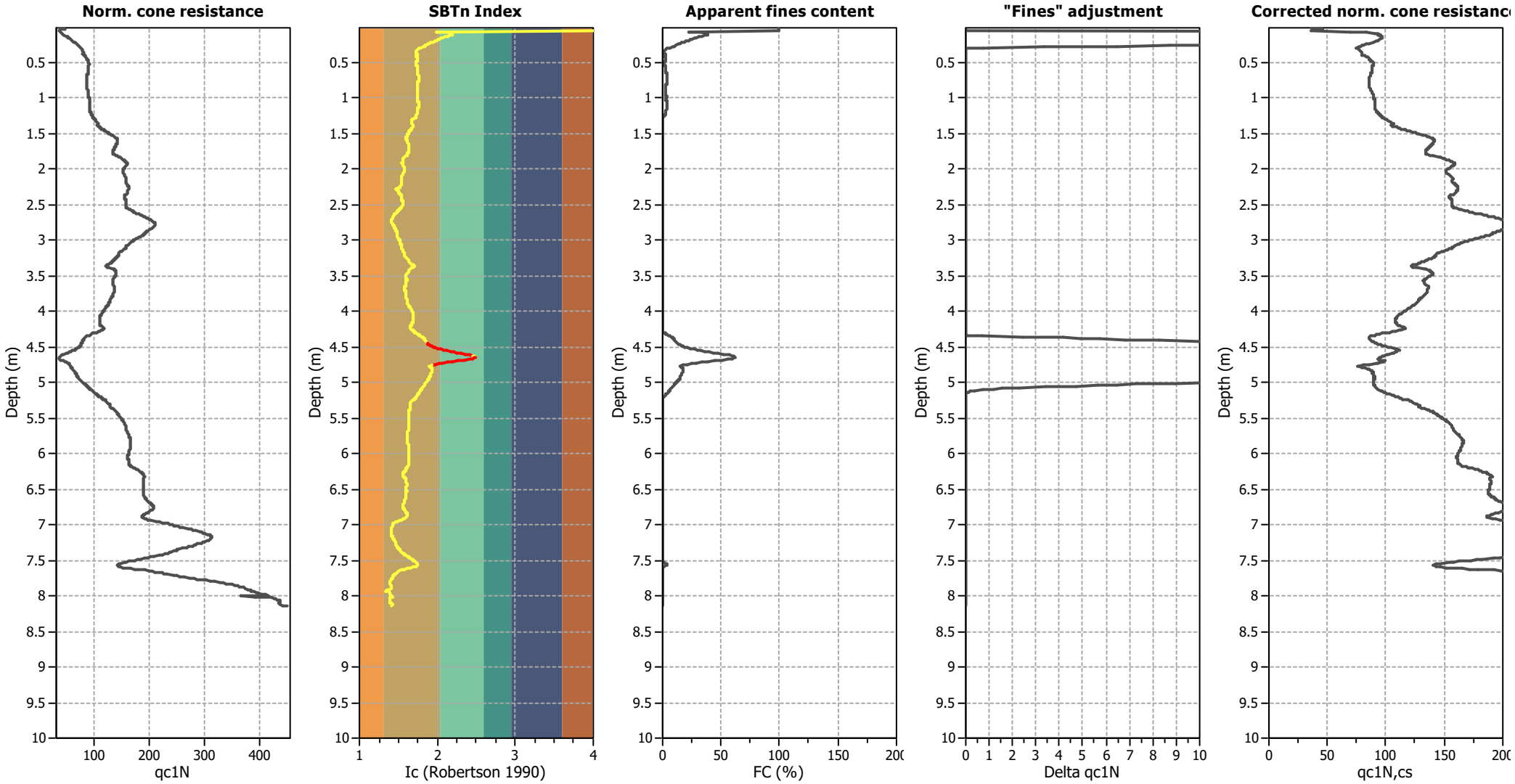
Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

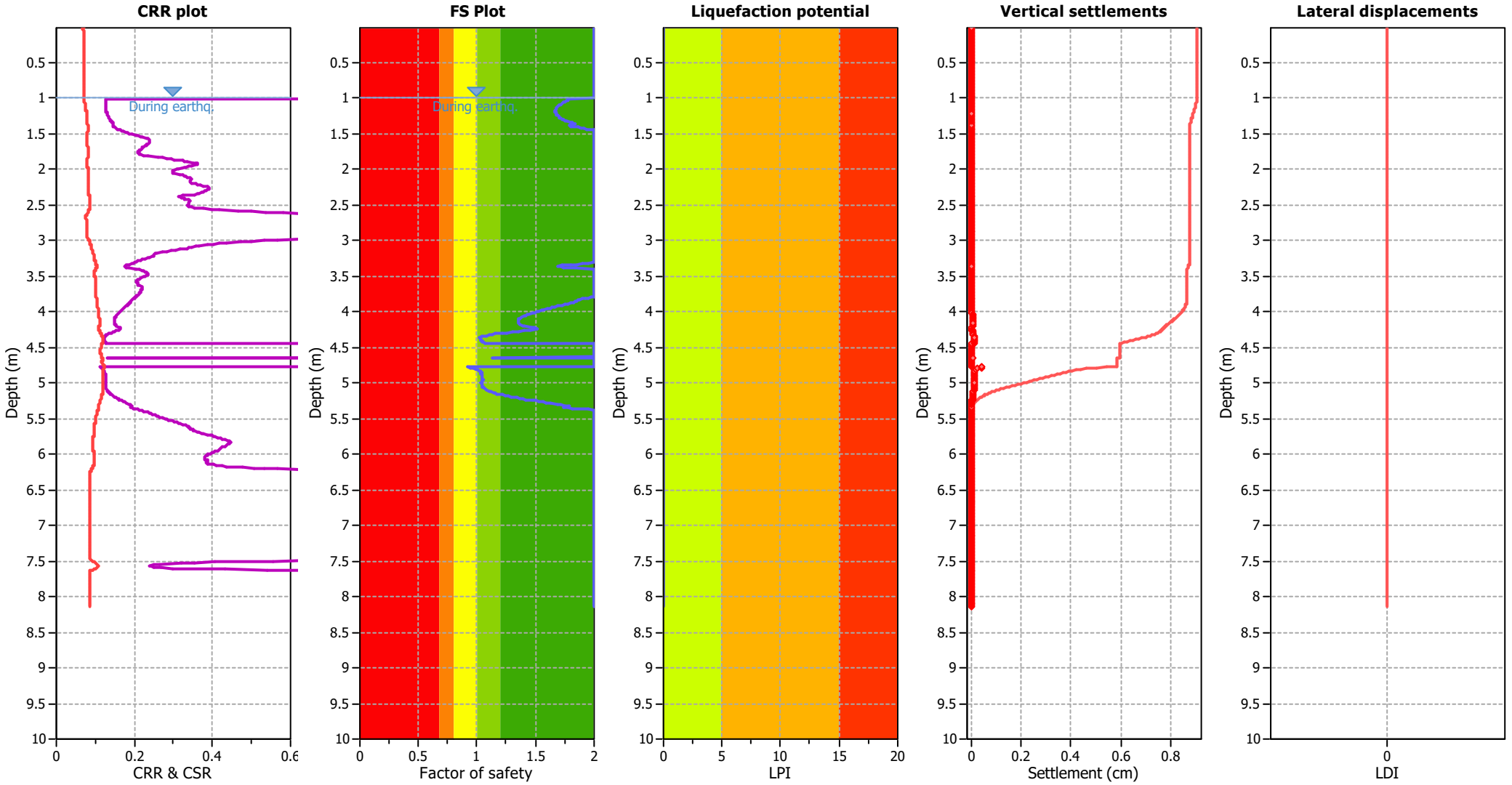
Liquefaction analysis overall plots (intermediate results)



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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

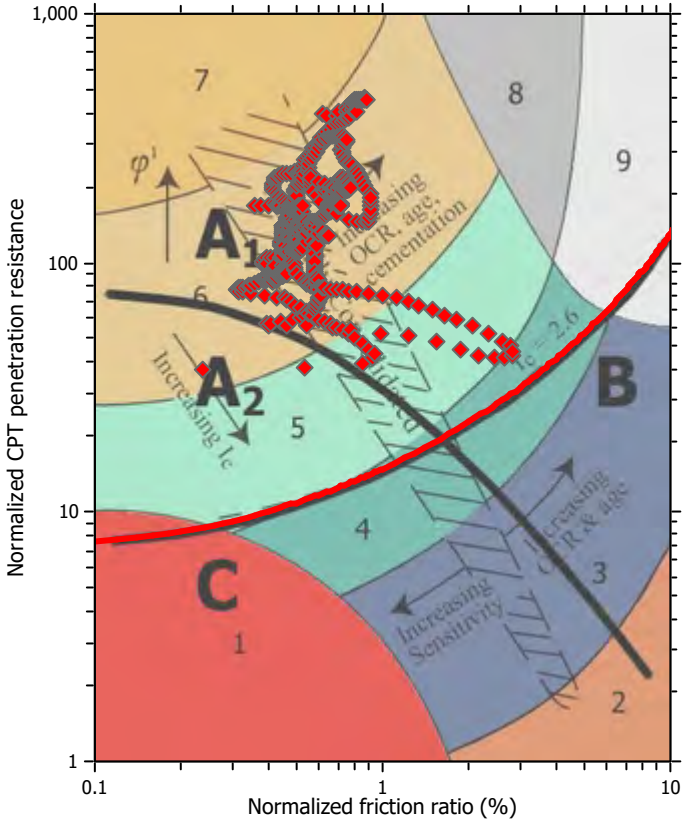
F.S. color scheme

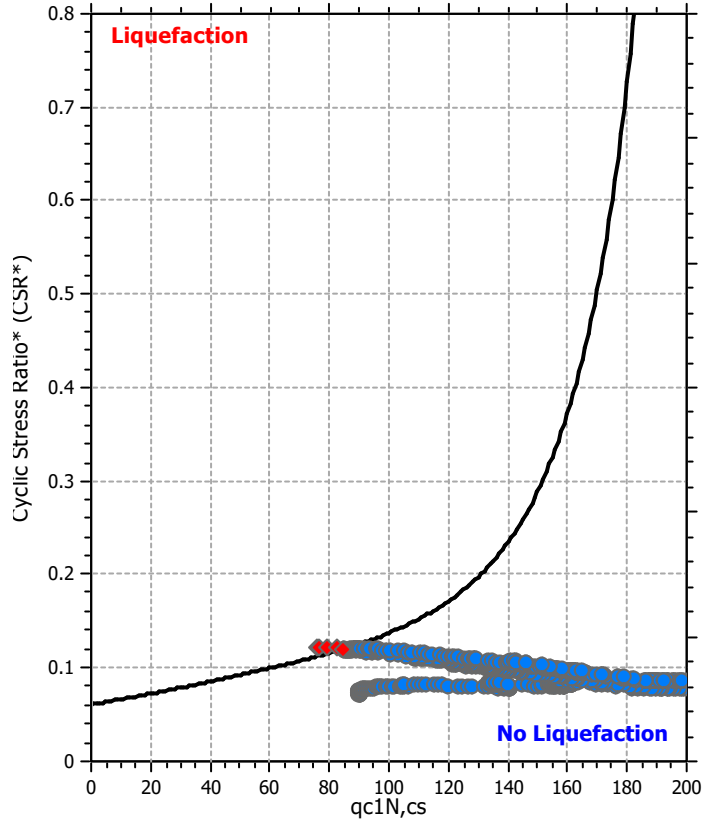
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

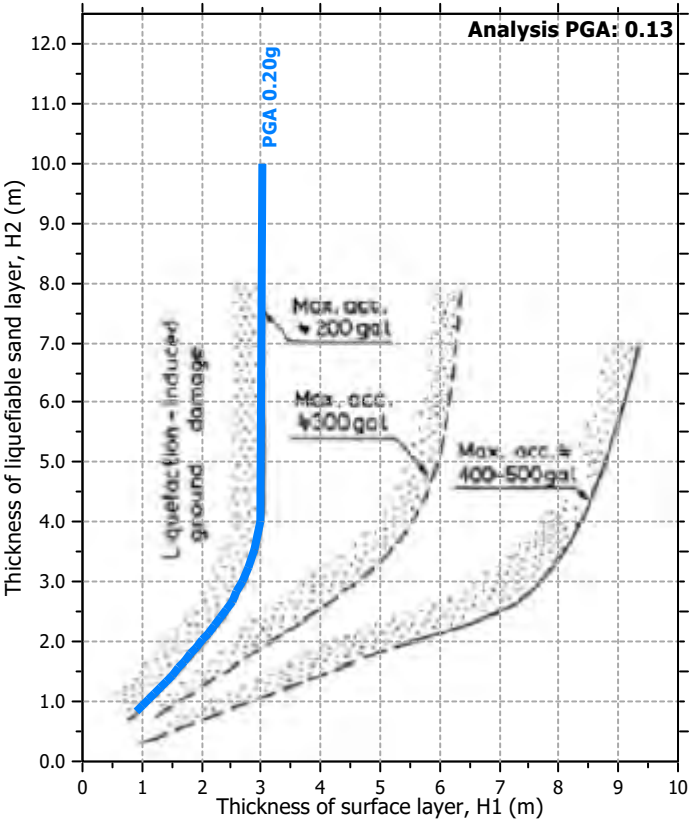
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



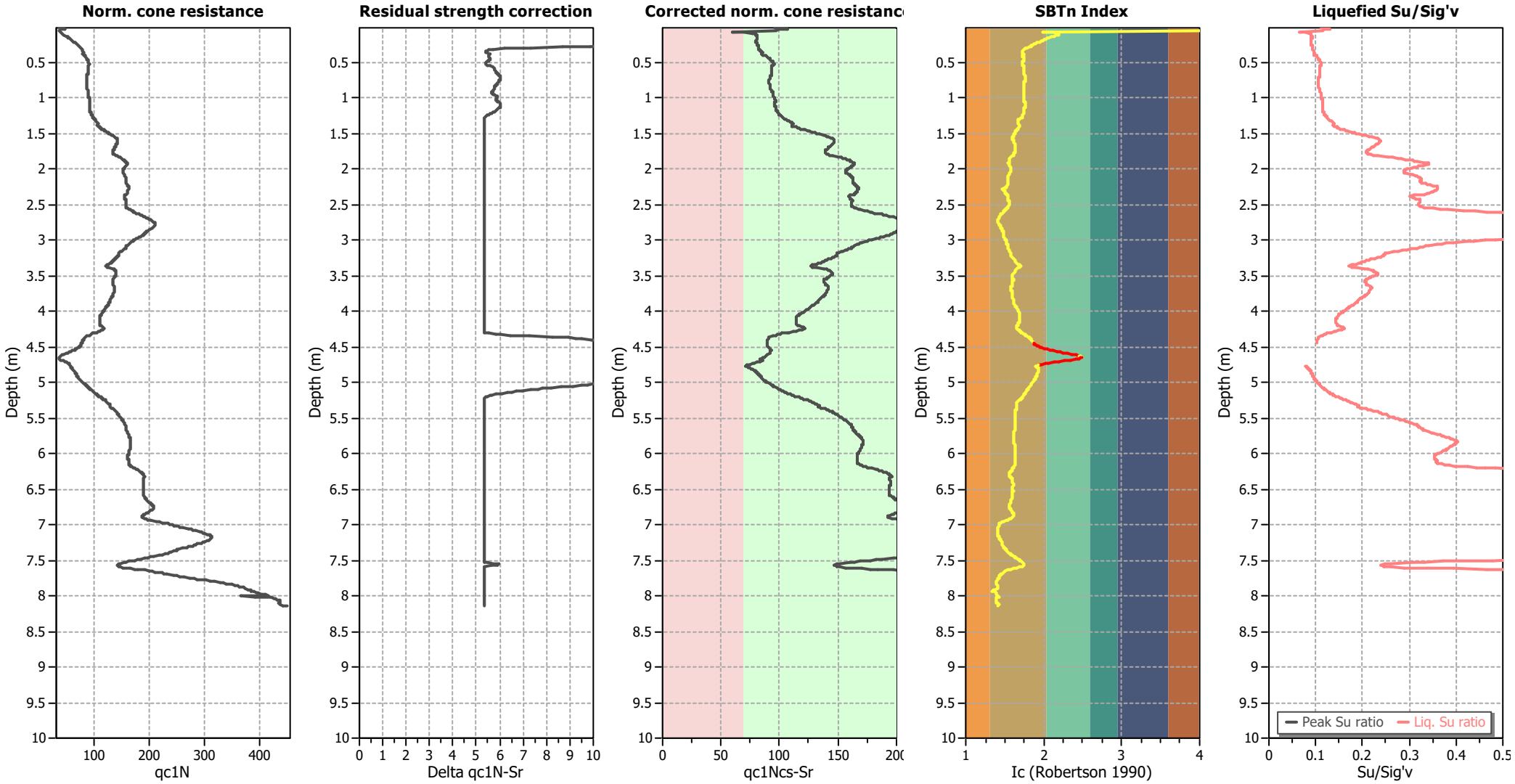




Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

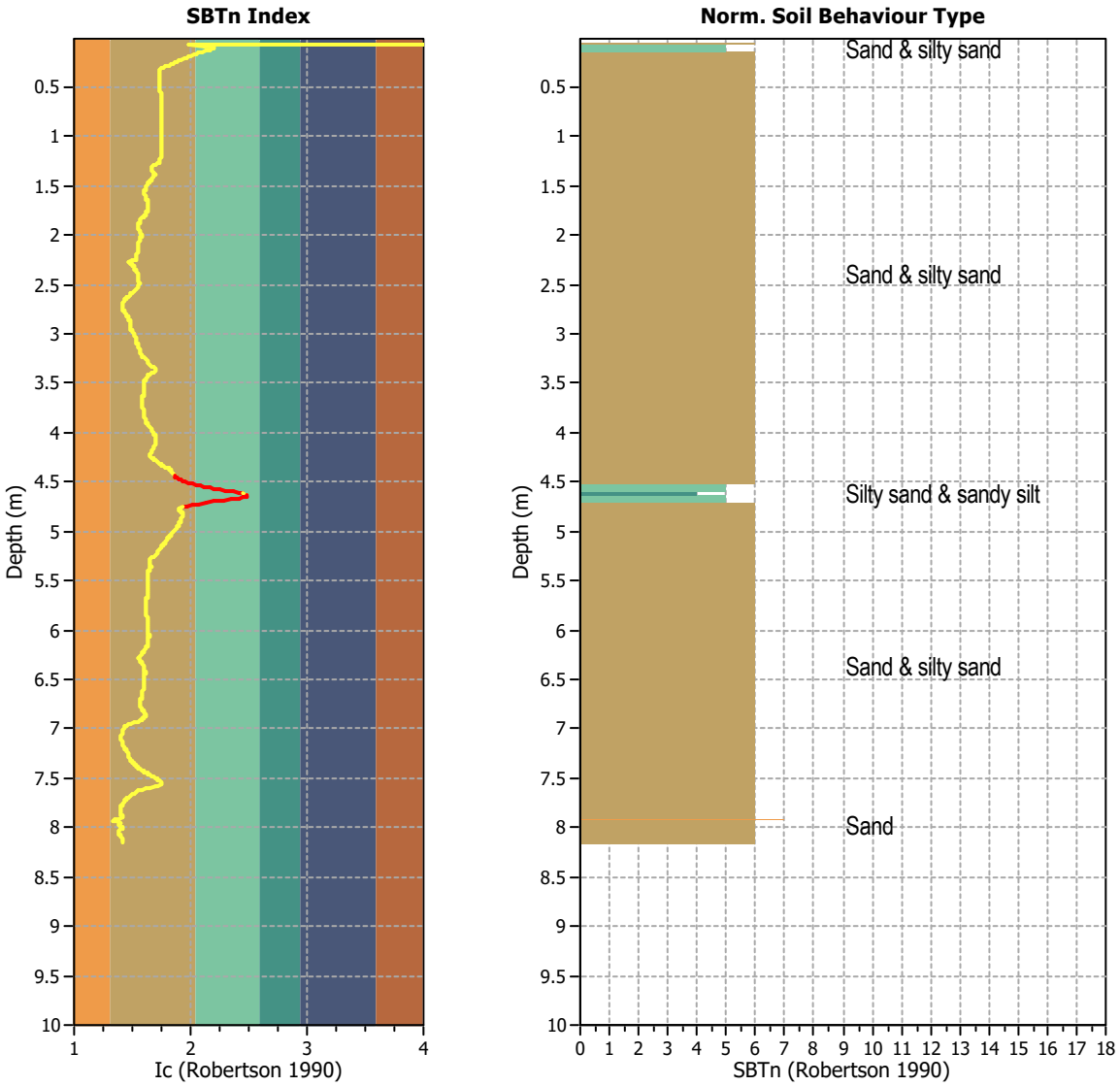
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

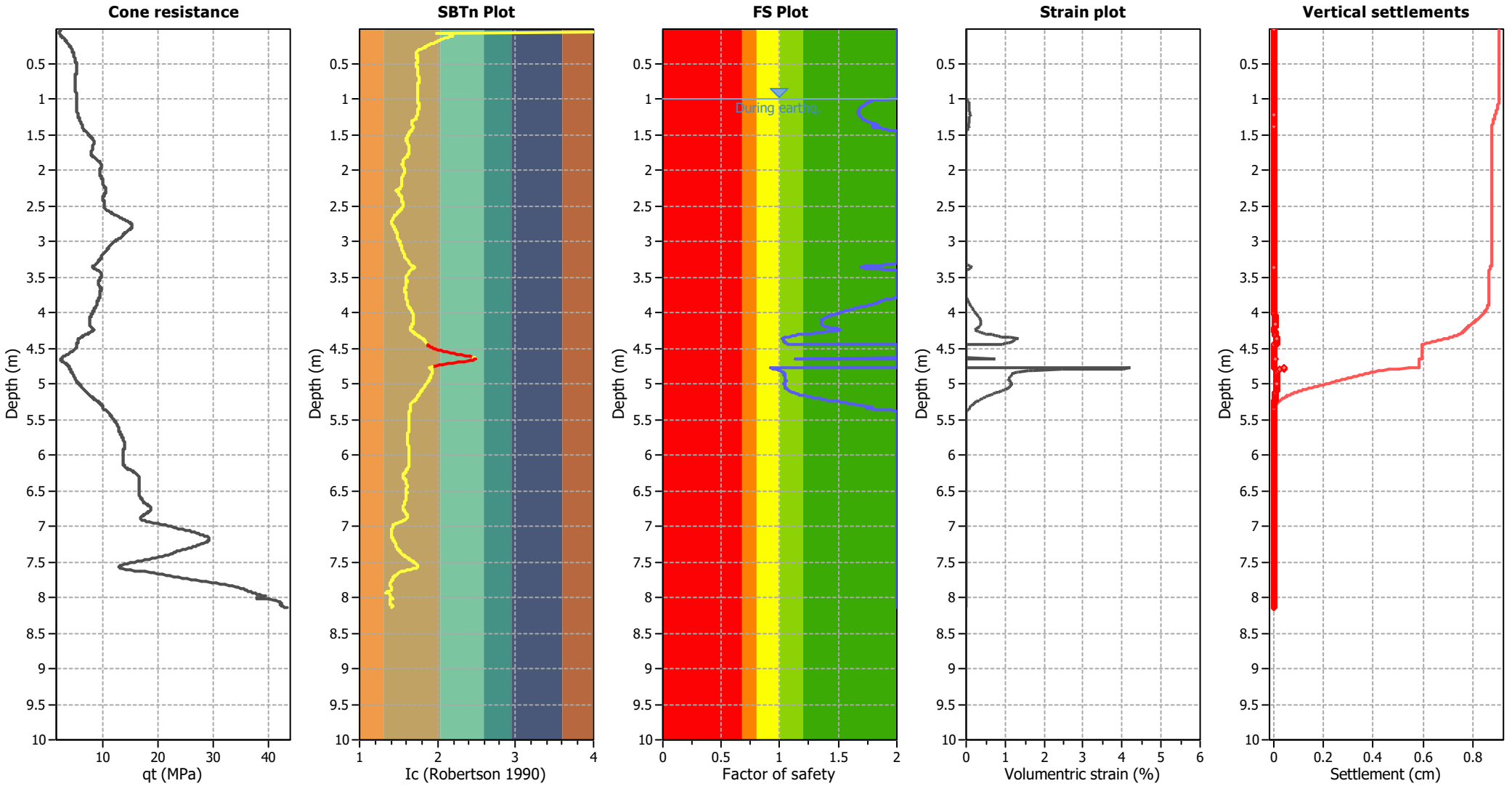
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	815
I_c maximum check value:	3.00	Total points excluded:	31
I_c change ratio value:	0.0100	Exclusion percentage:	3.80%
Minimum number of points in layer:	4	Number of layers detected:	2

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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www.btw.nz

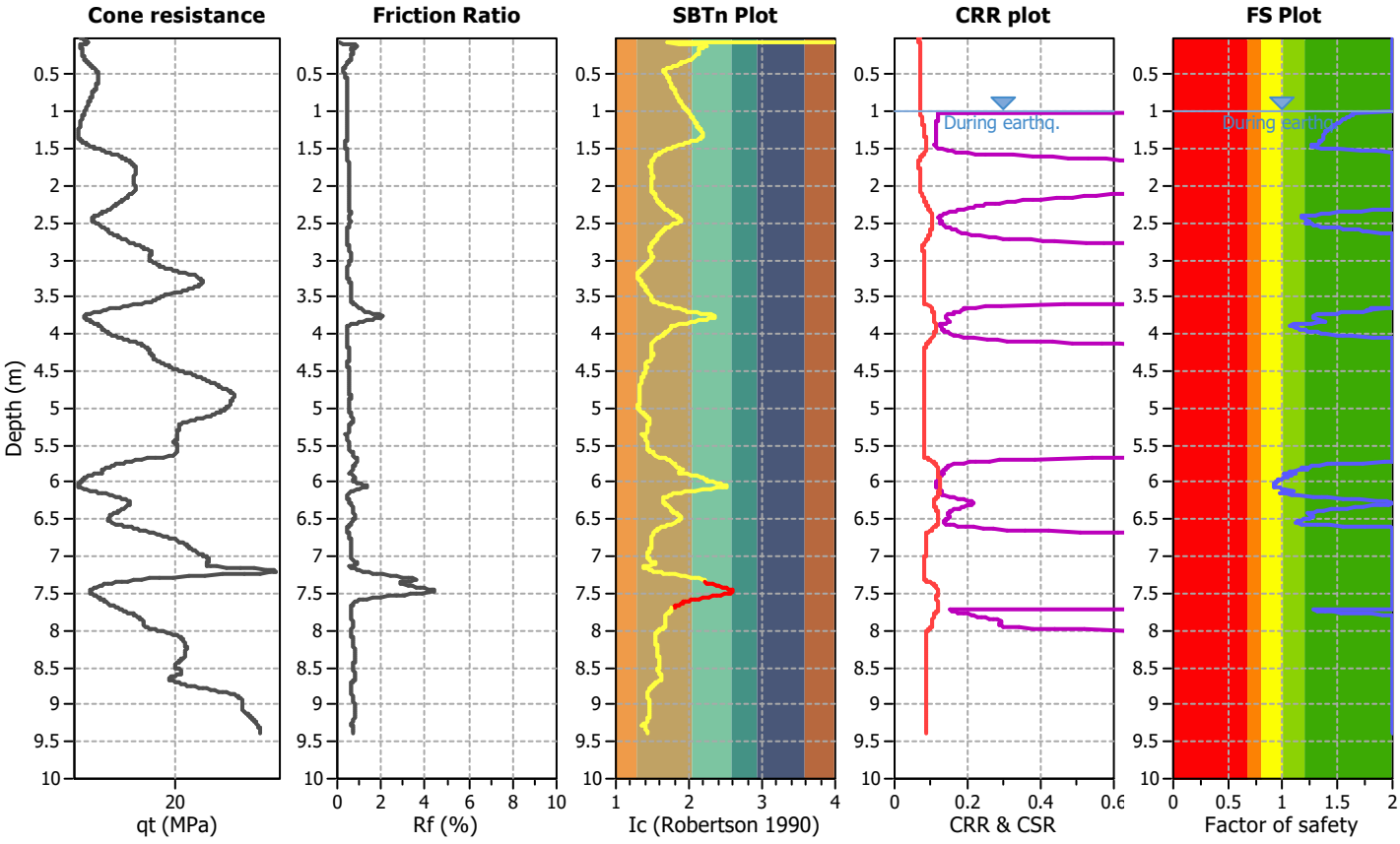
LIQUEFACTION ANALYSIS REPORT

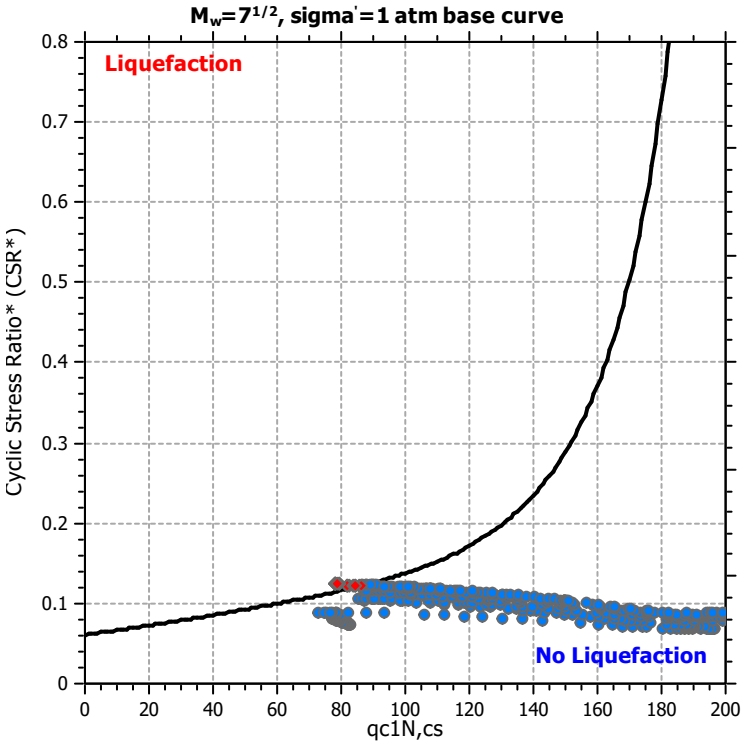
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

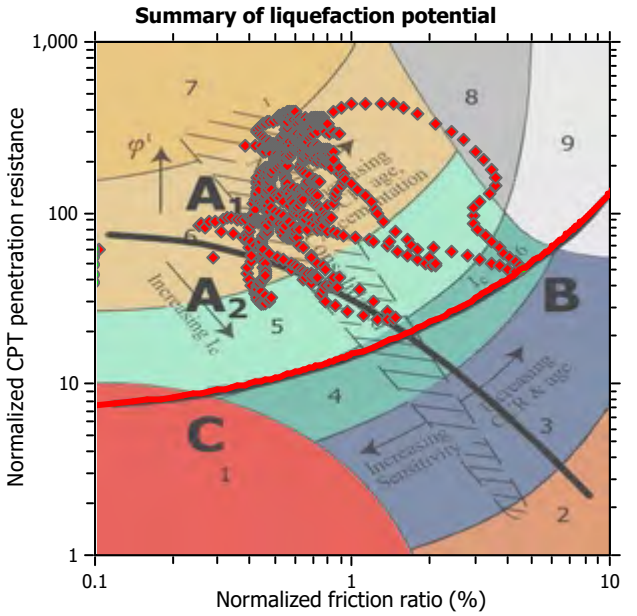
CPT file : CPT06_SLS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	6.40	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

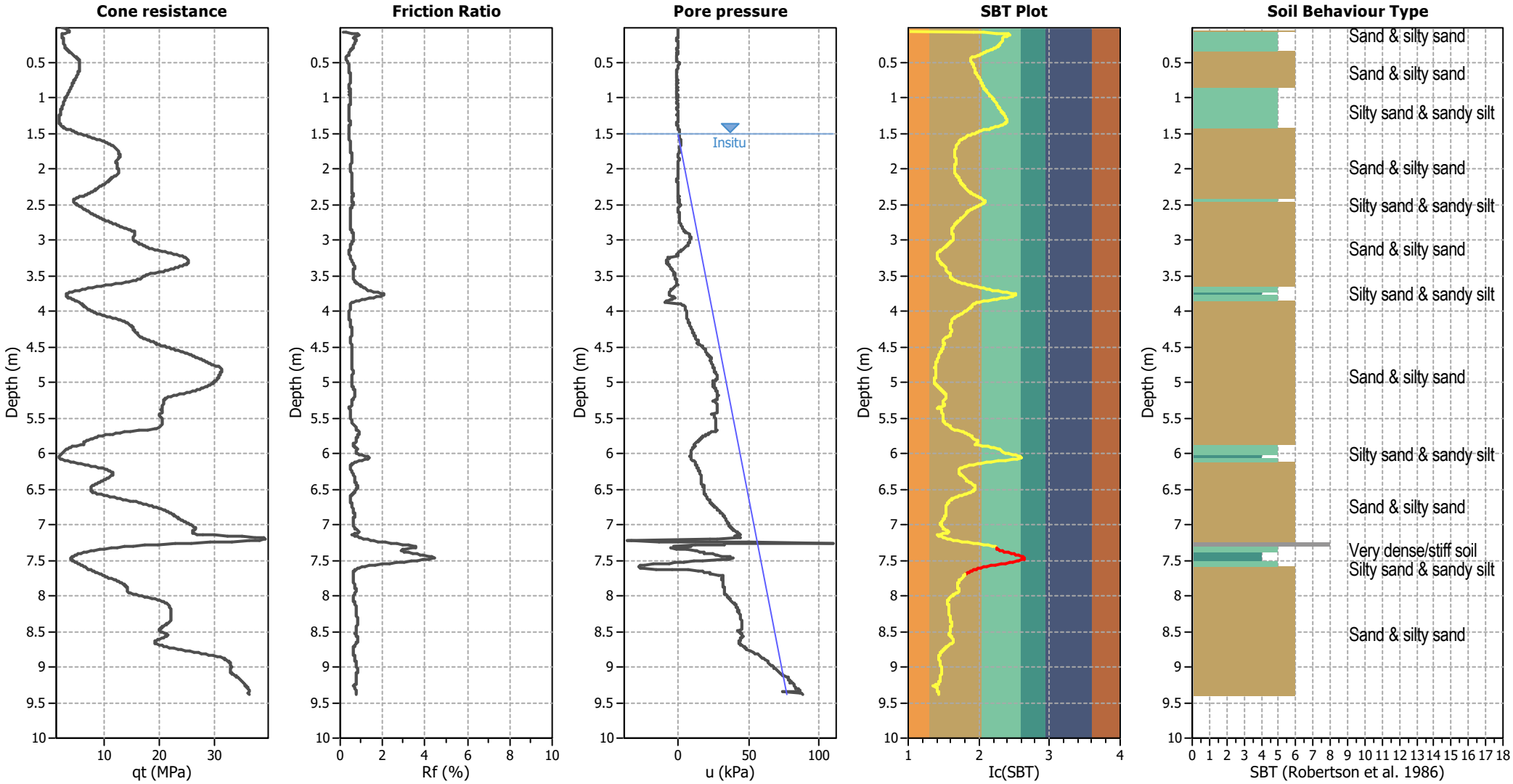






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



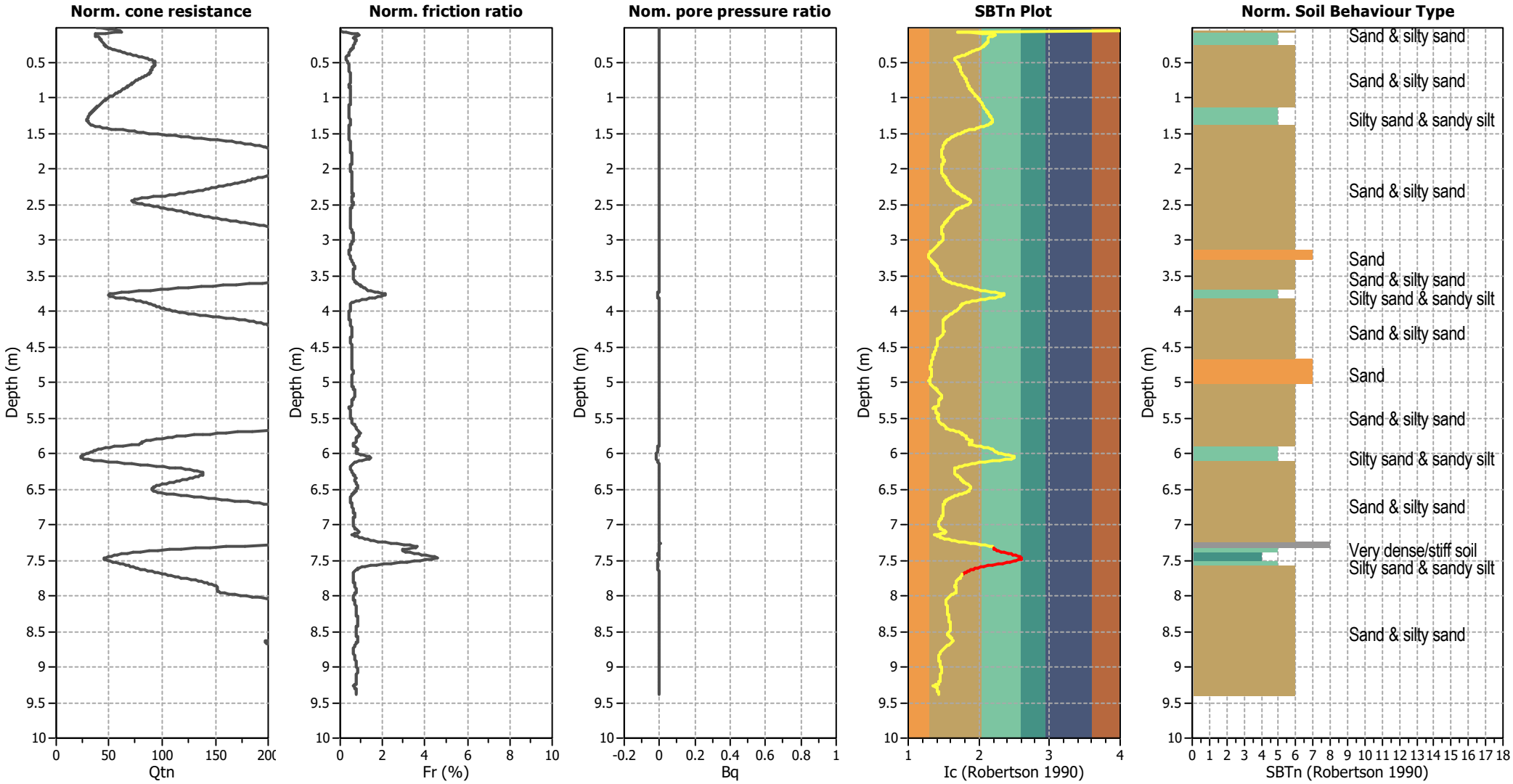
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



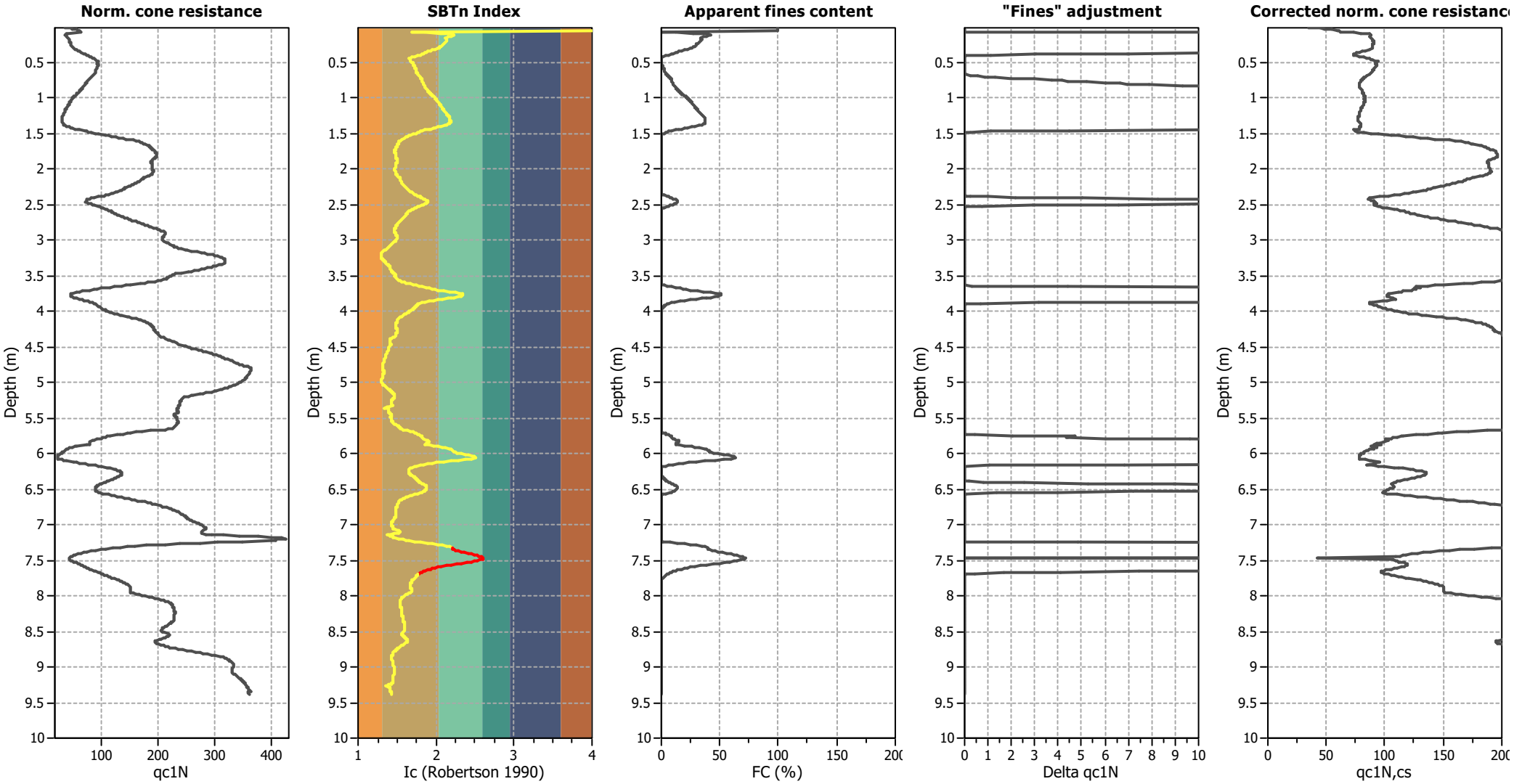
Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

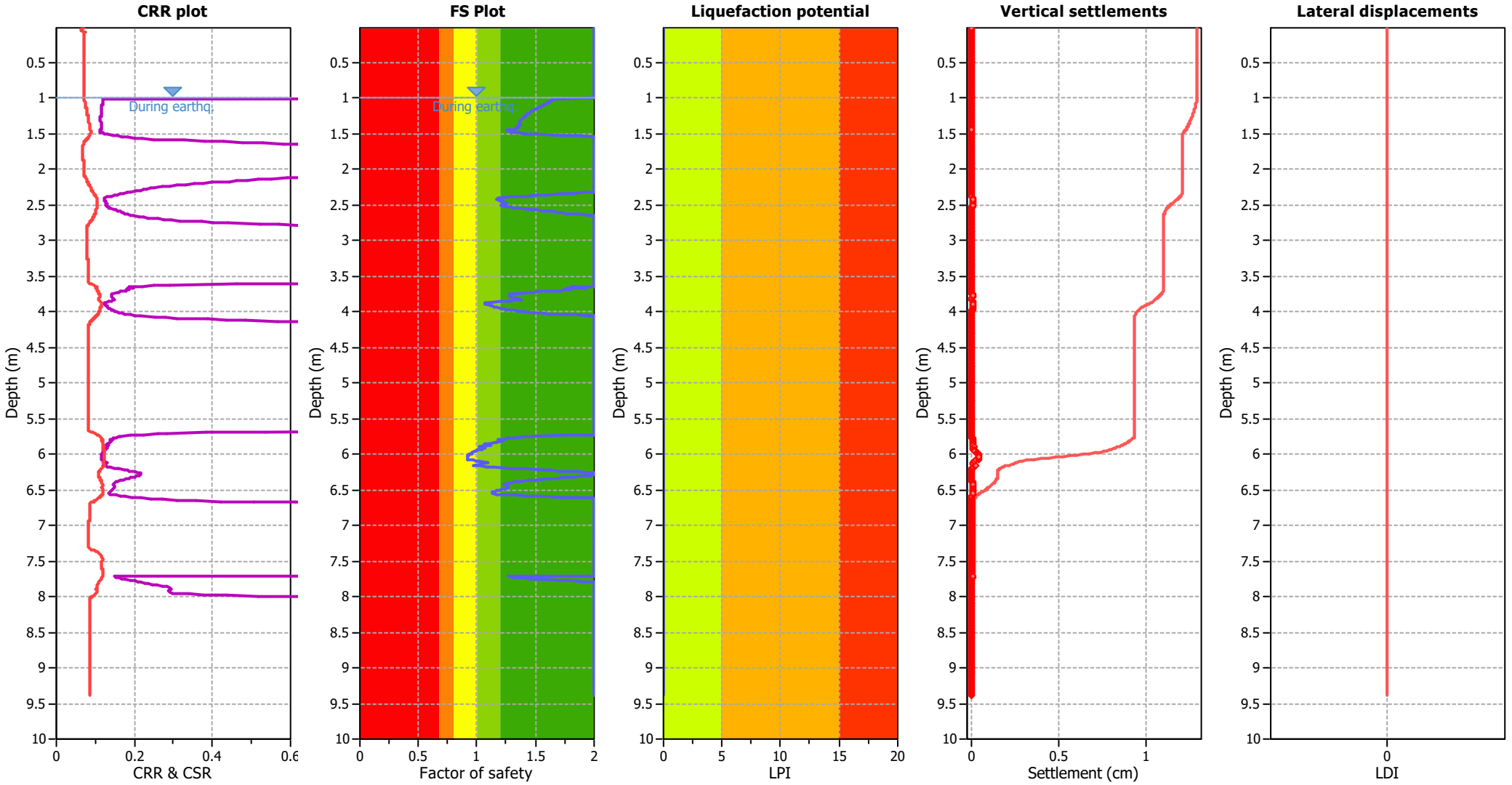
Liquefaction analysis overall plots (intermediate results)



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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

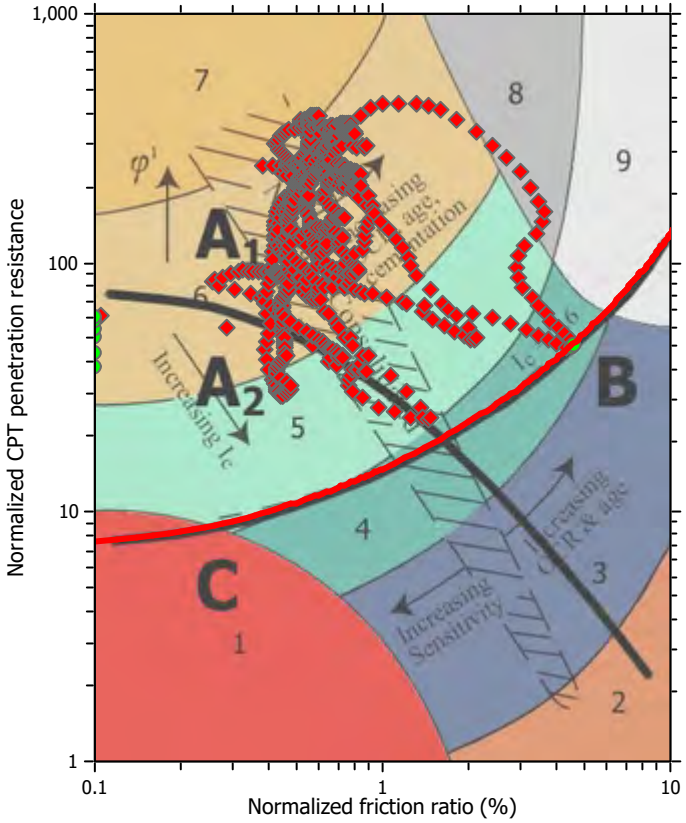
F.S. color scheme

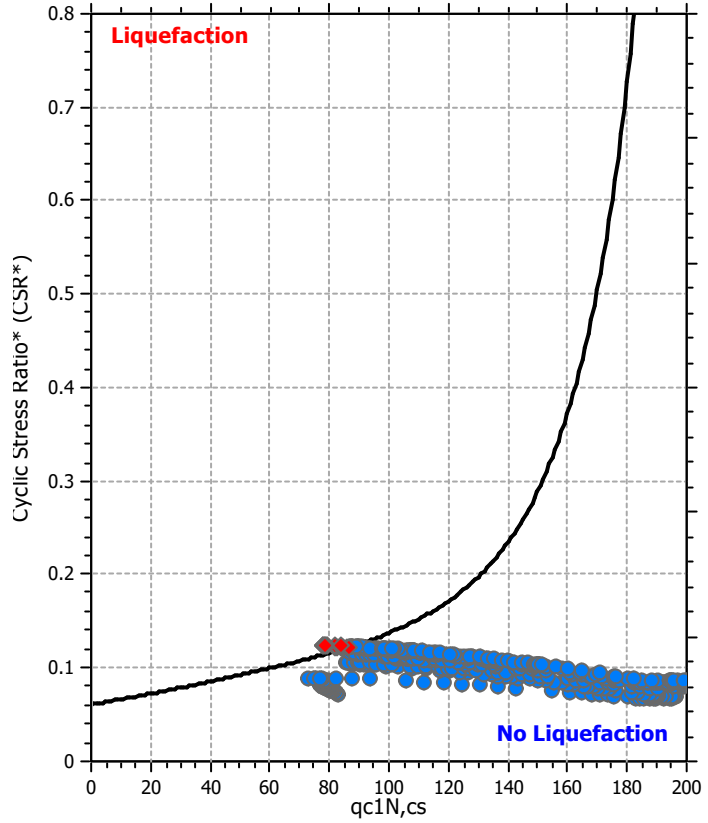
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

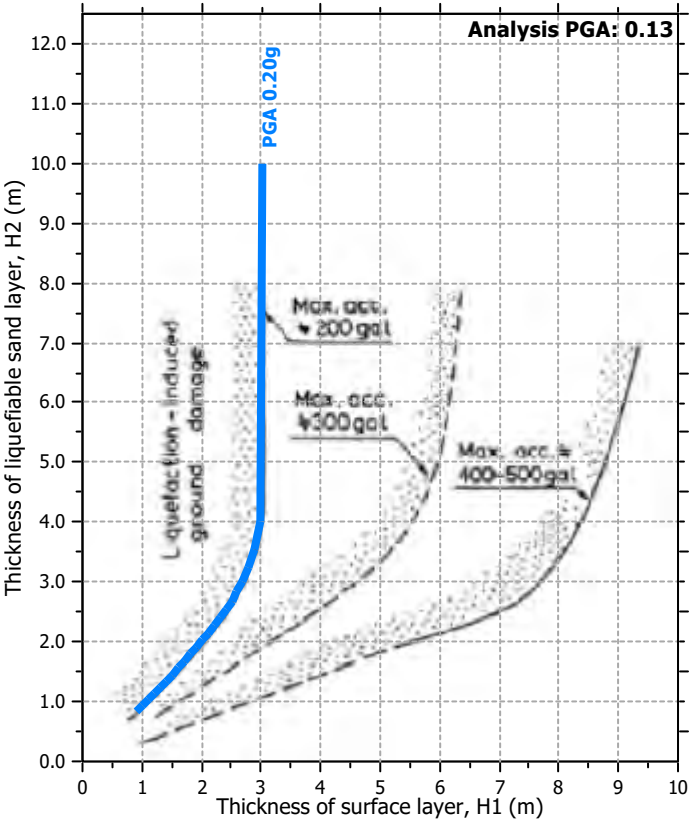
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



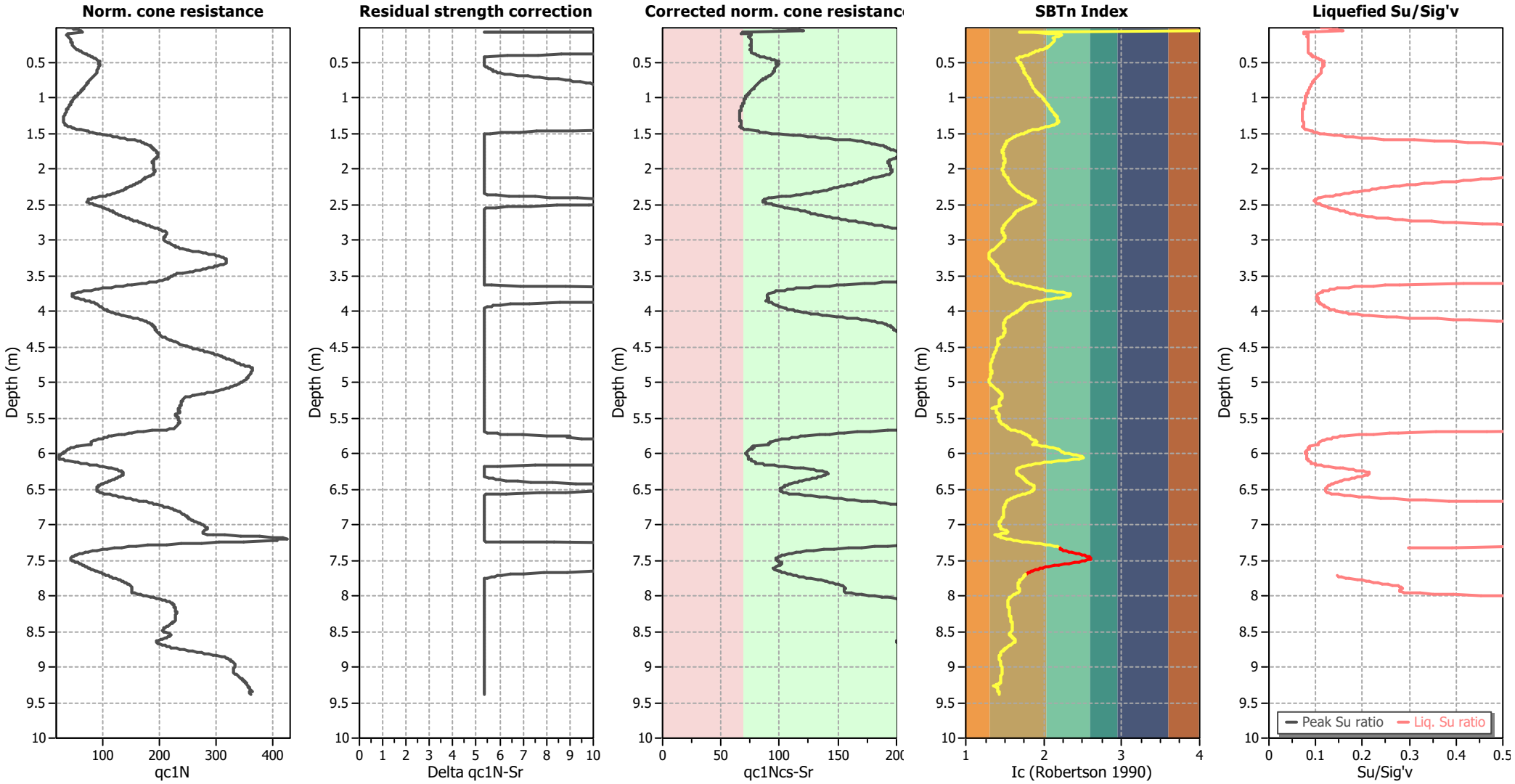




Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

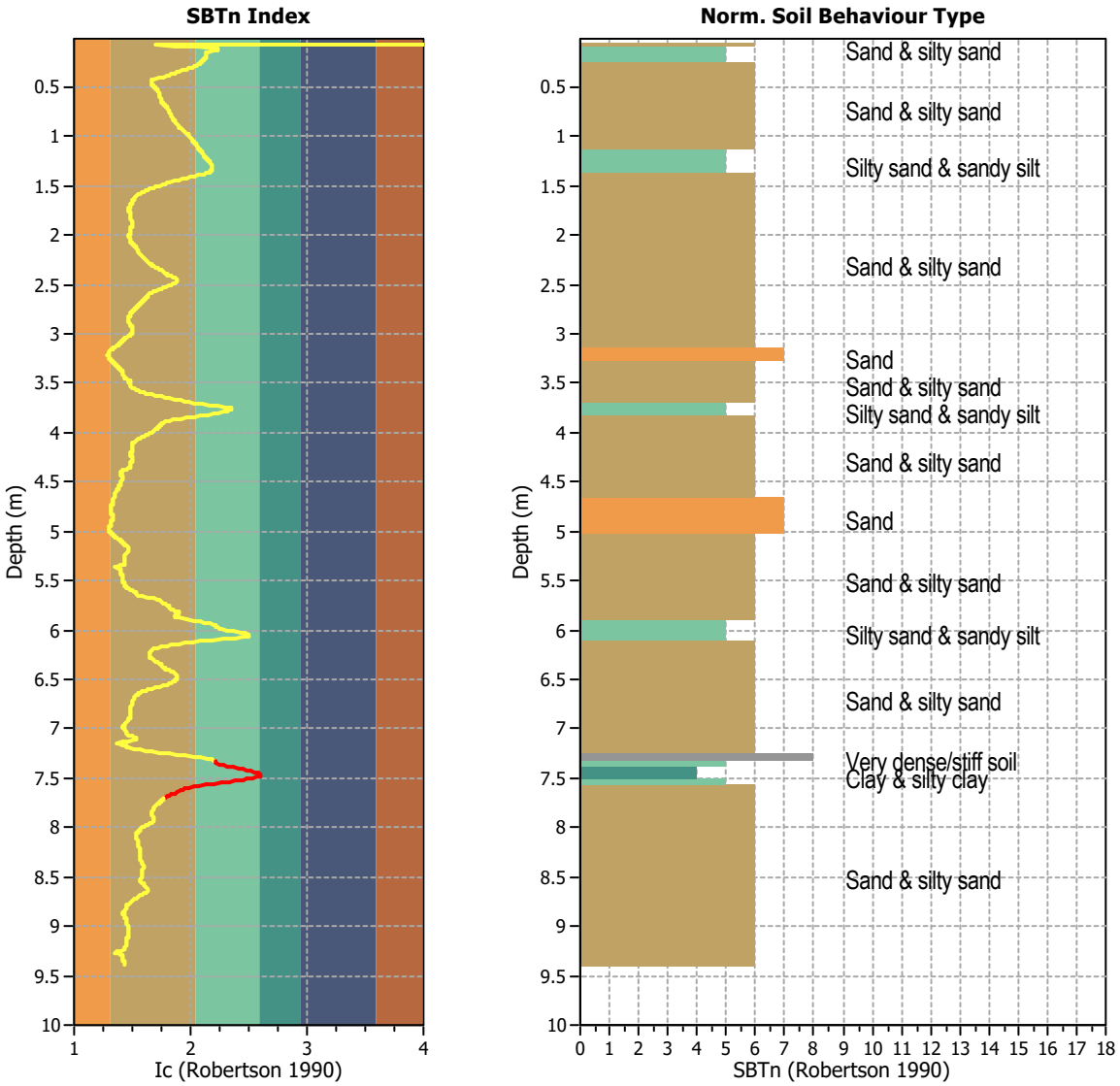
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

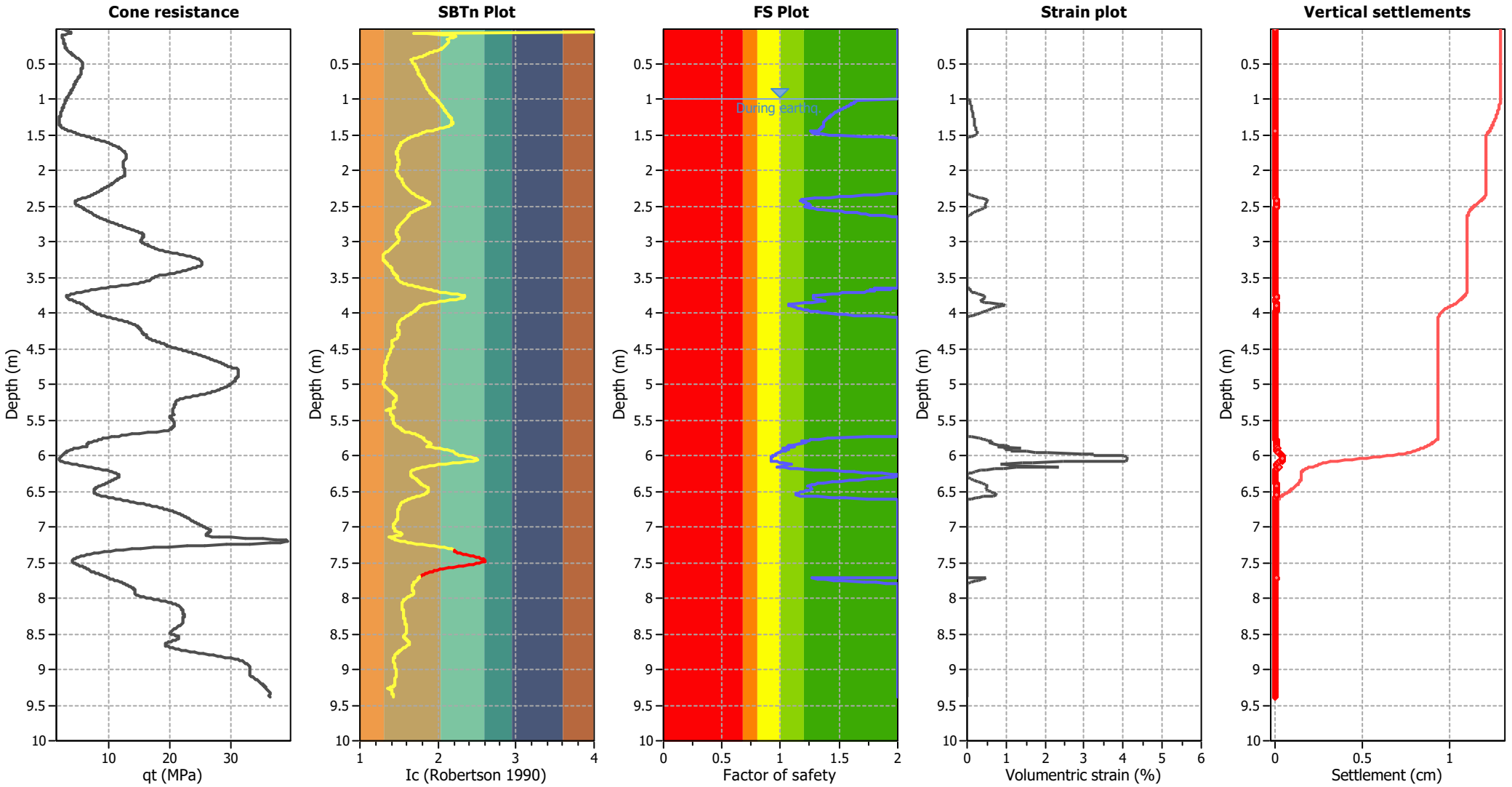
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	939
I_c maximum check value:	3.00	Total points excluded:	38
I_c change ratio value:	0.0100	Exclusion percentage:	4.05%
Minimum number of points in layer:	4	Number of layers detected:	2

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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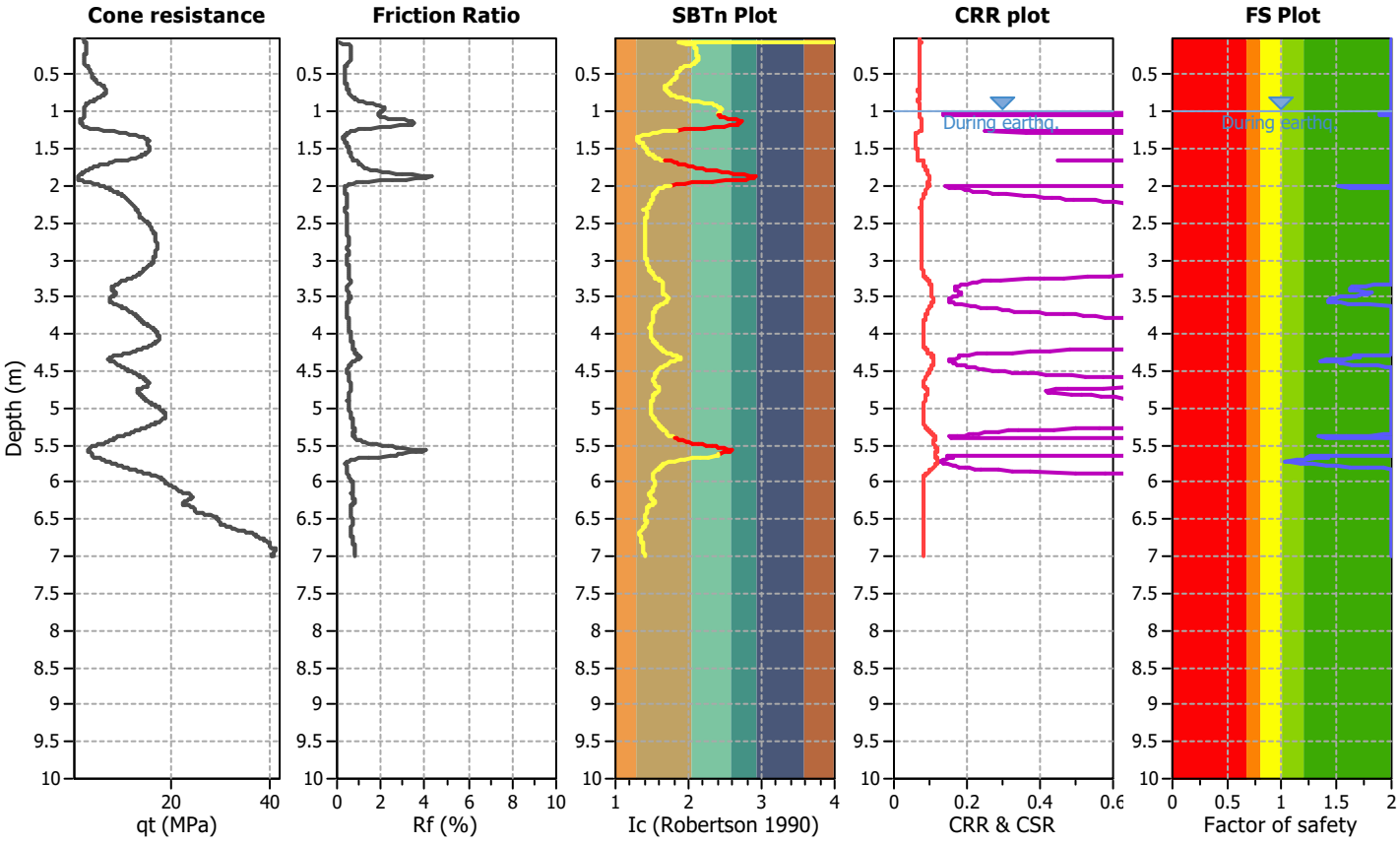
LIQUEFACTION ANALYSIS REPORT

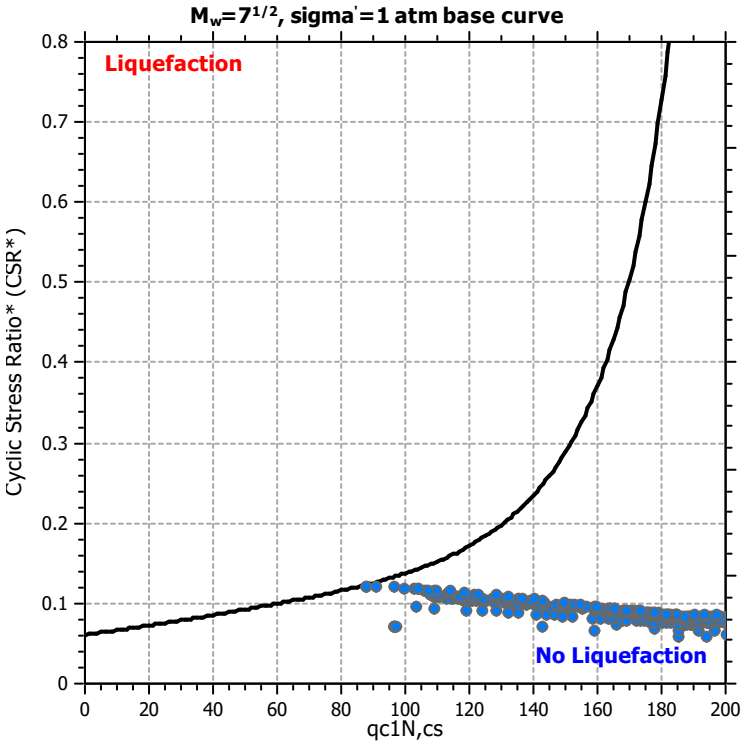
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

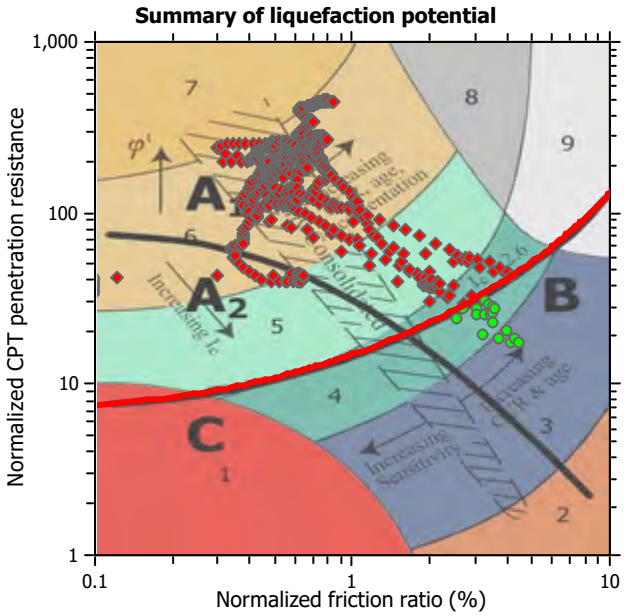
CPT file : CPT07_SLS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	6.40	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

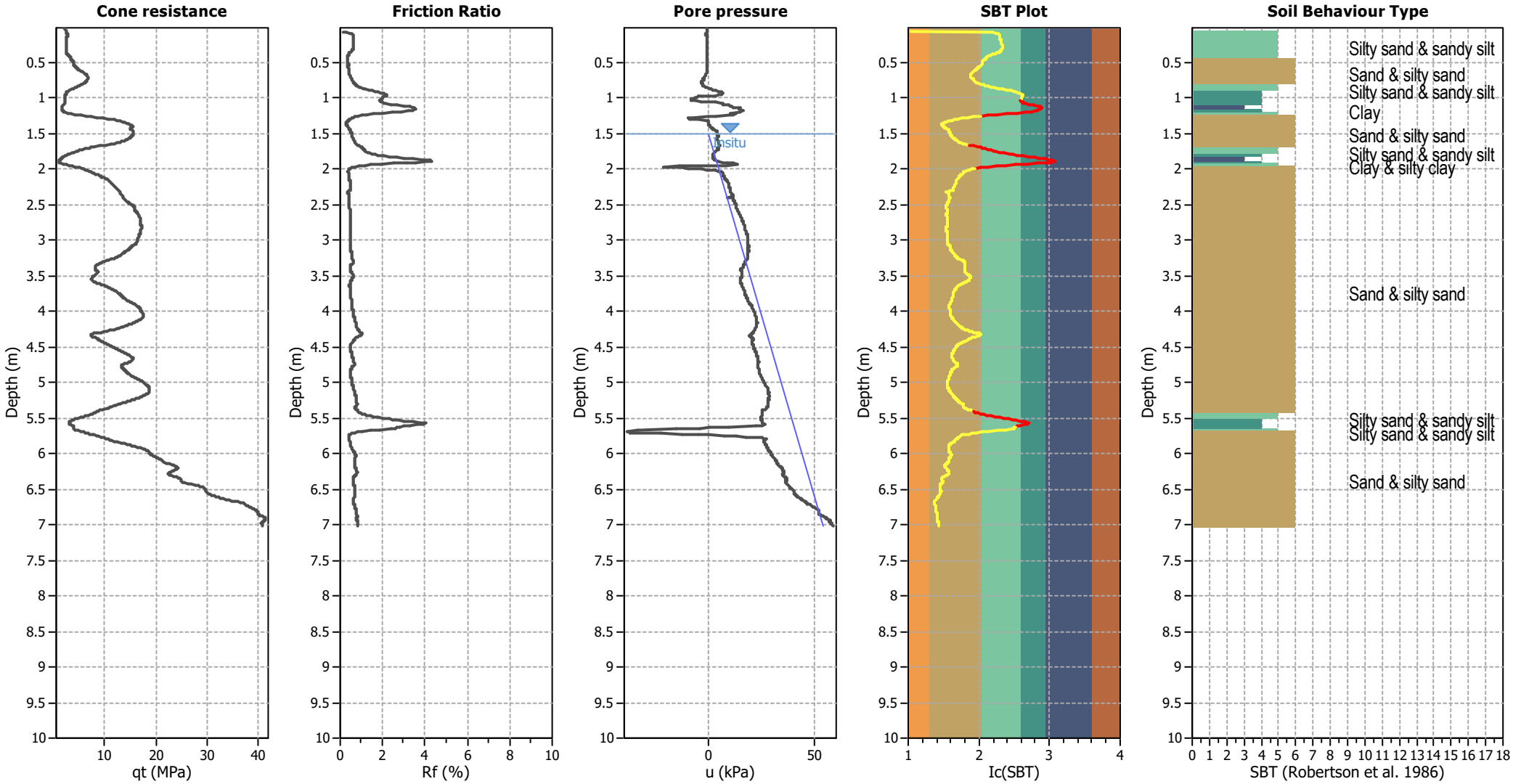






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



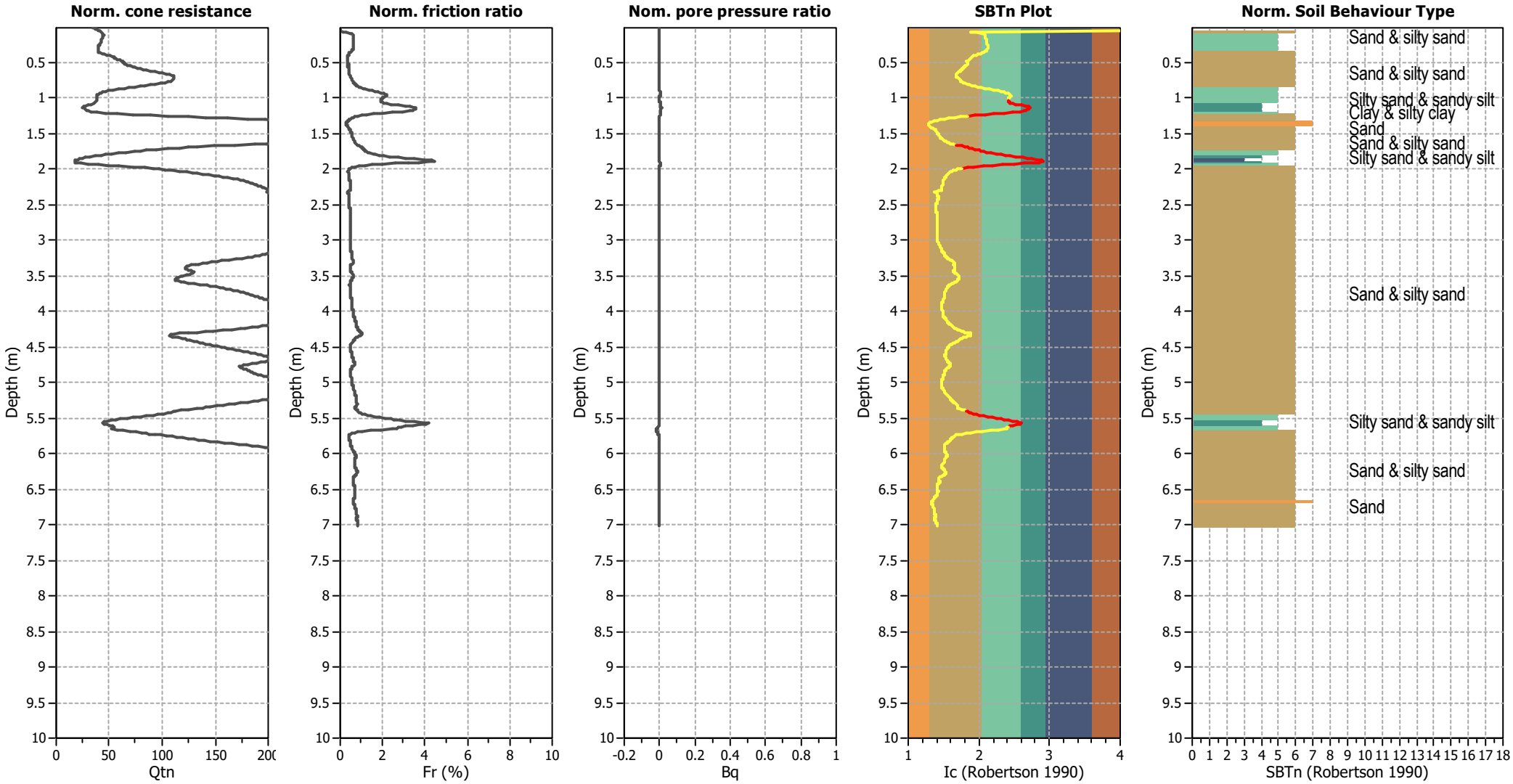
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



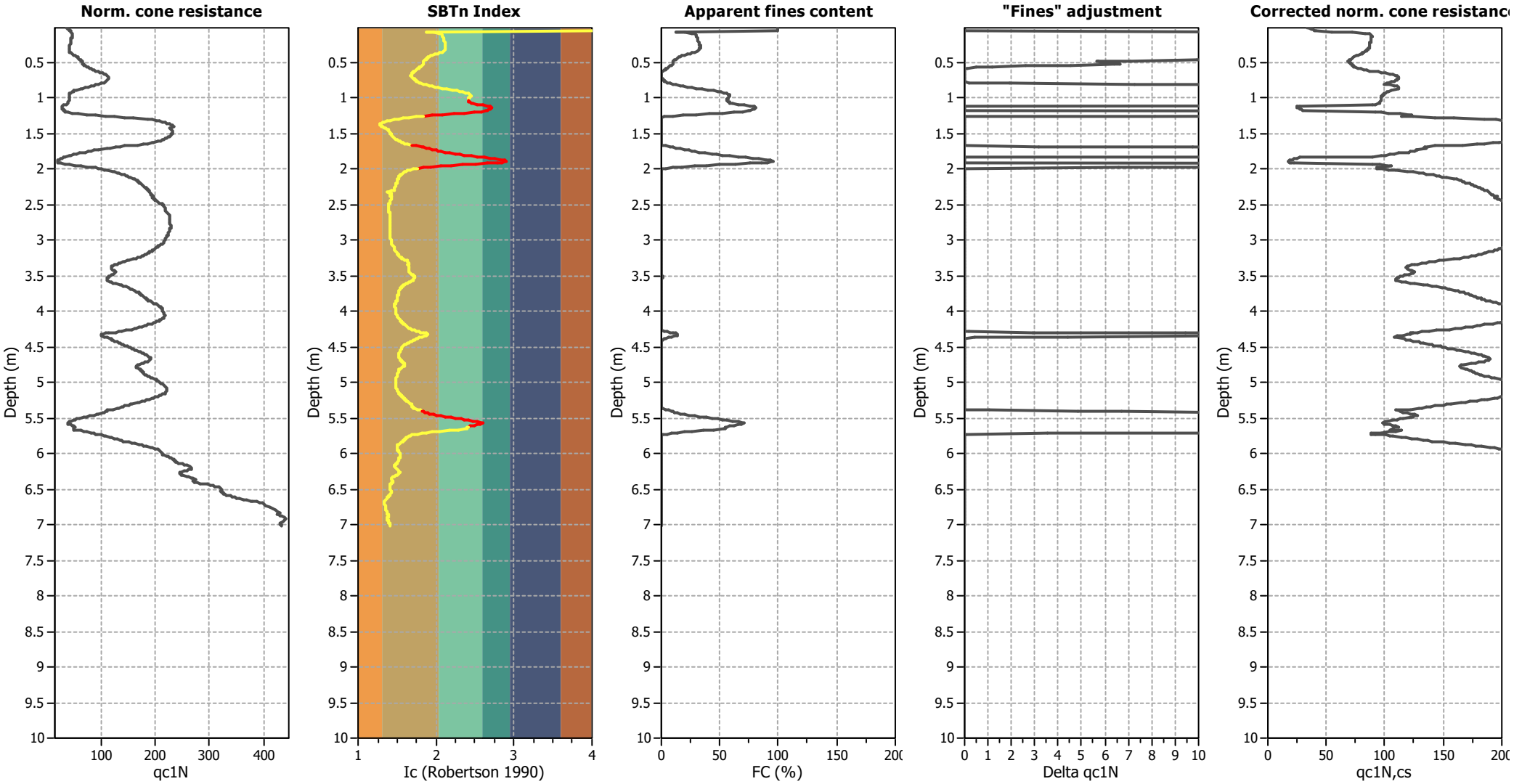
Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

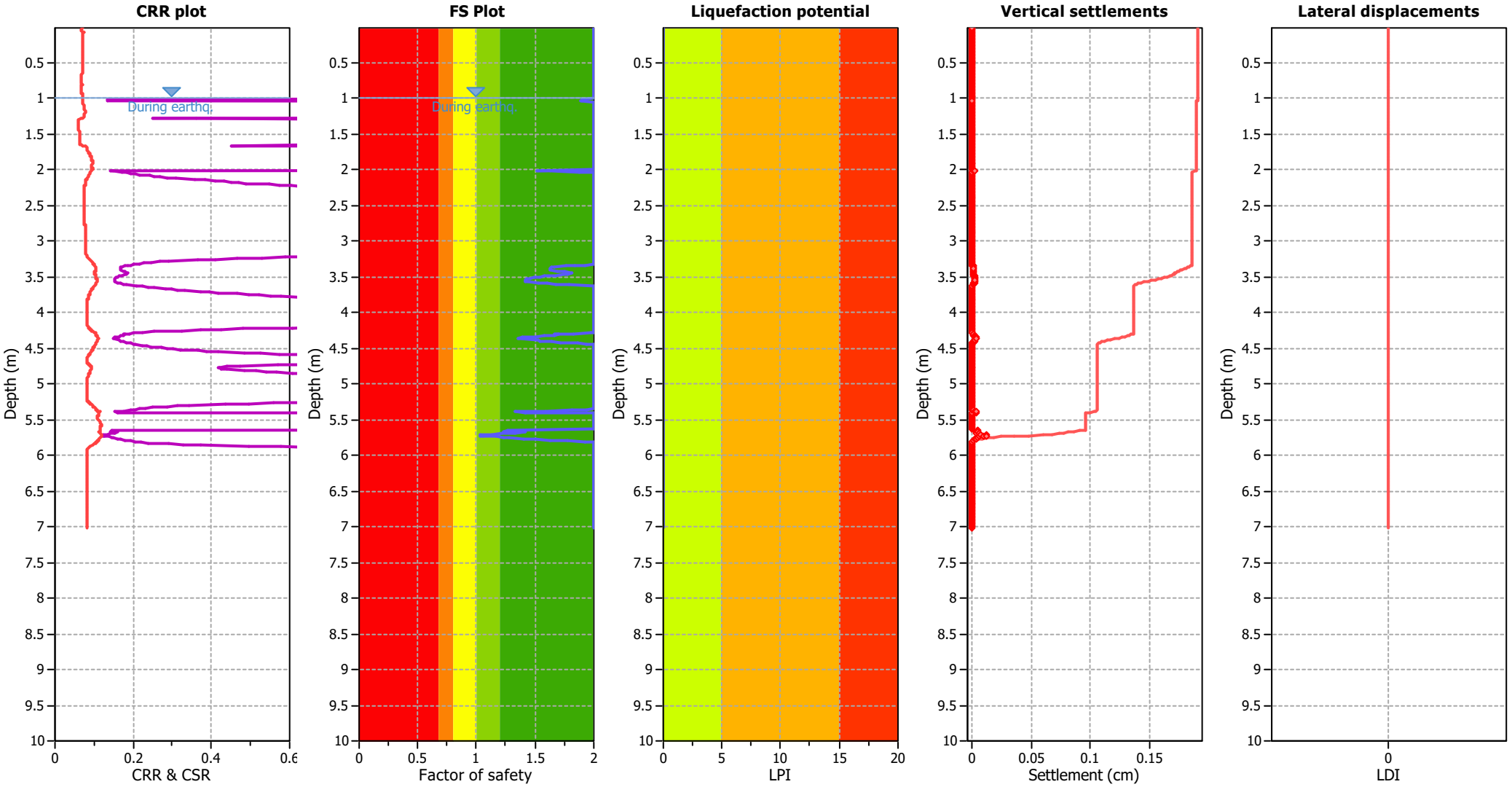
Liquefaction analysis overall plots (intermediate results)



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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

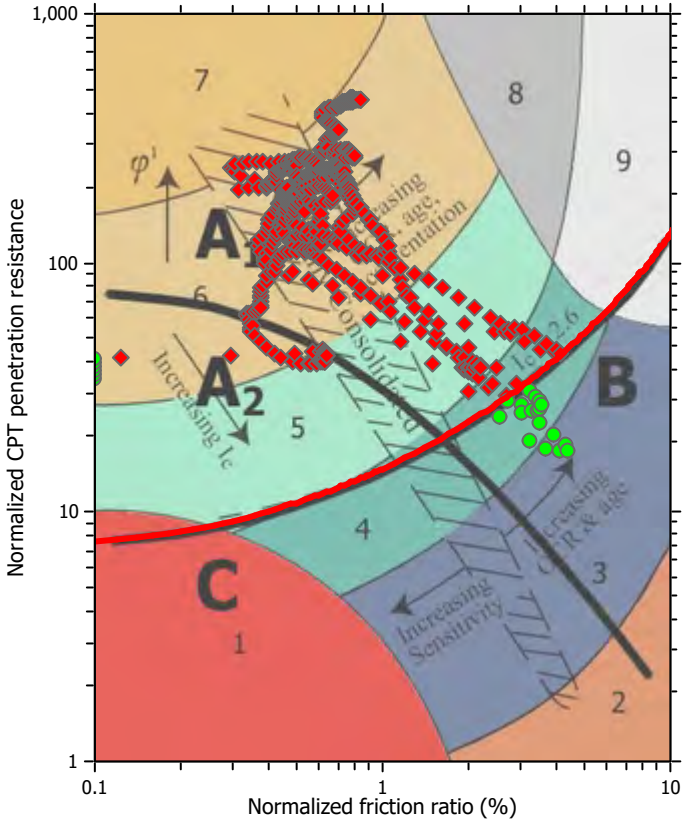
F.S. color scheme

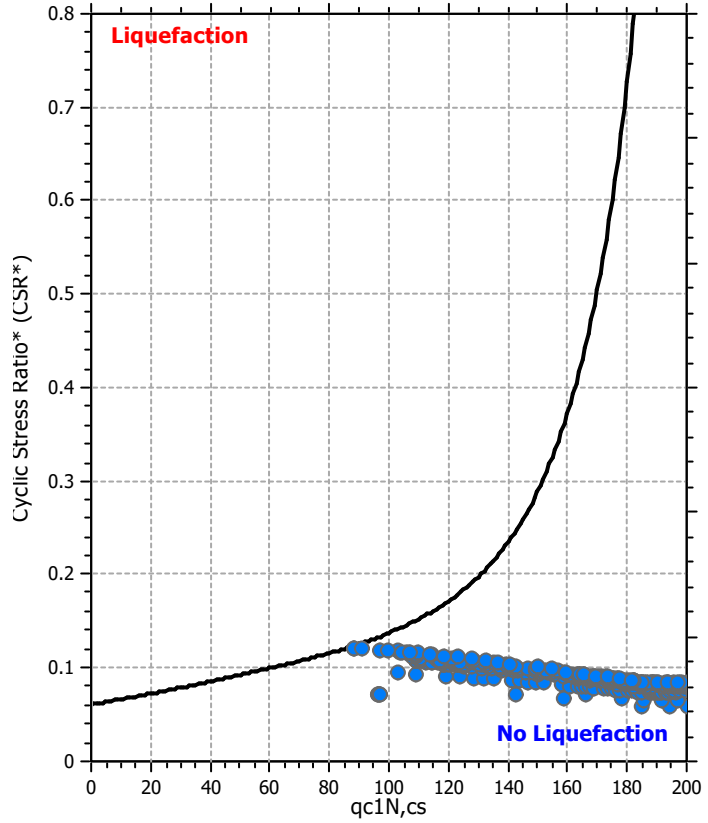
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

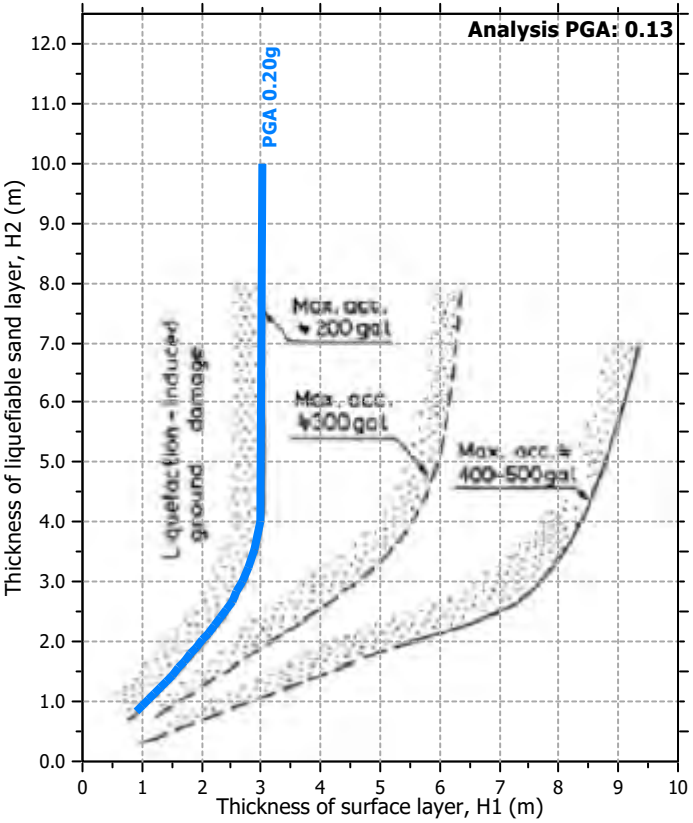
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



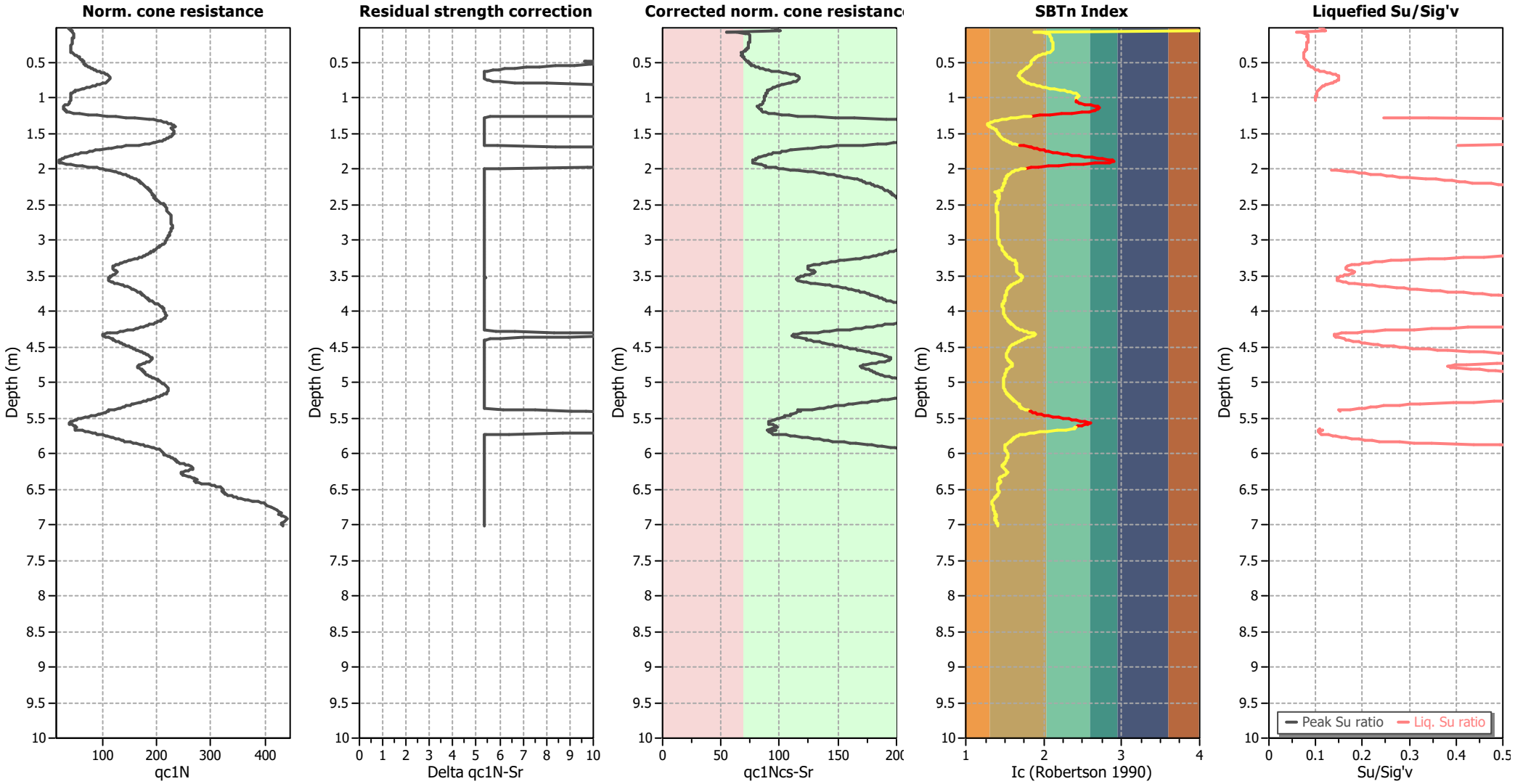




Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

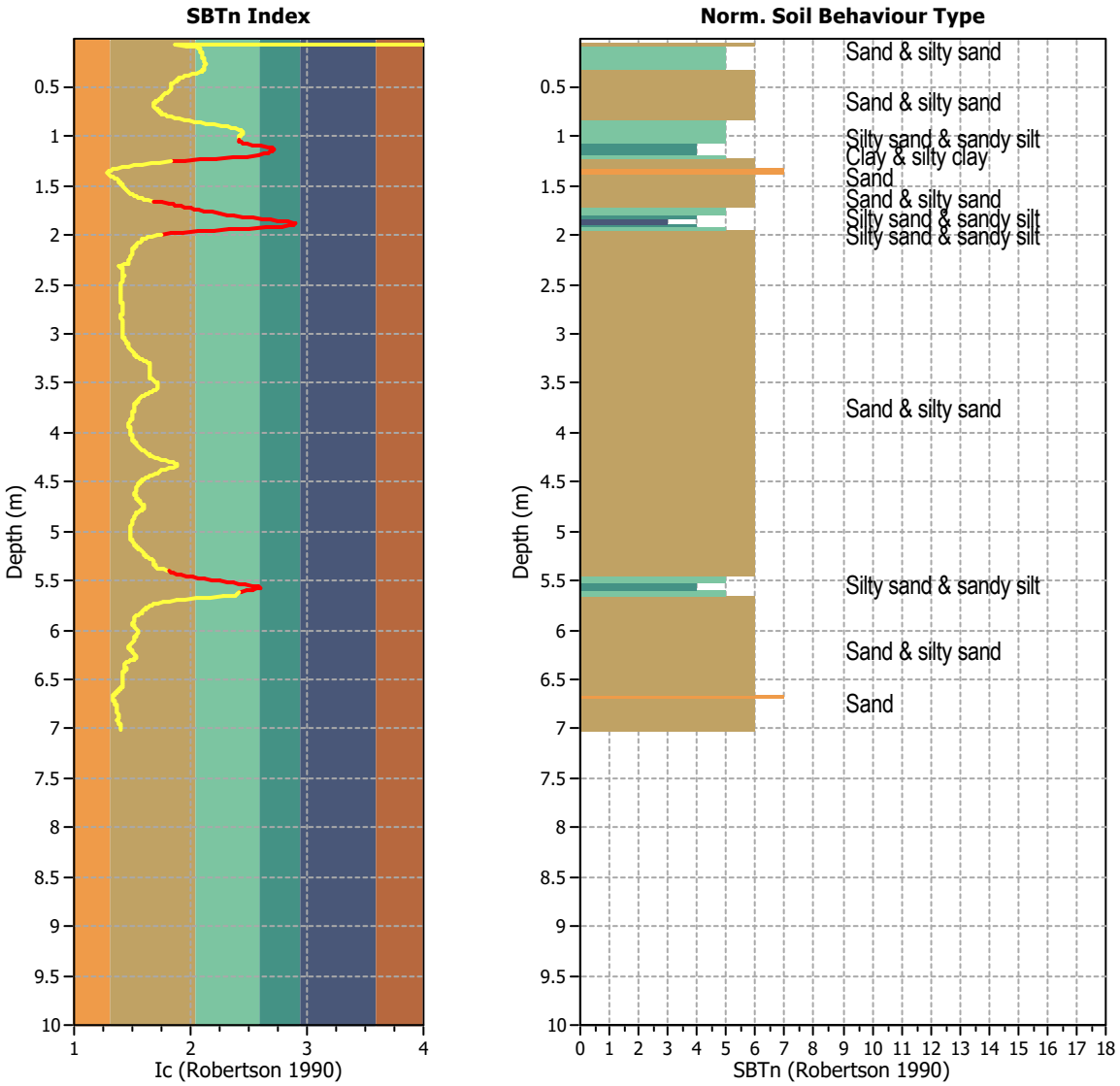
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

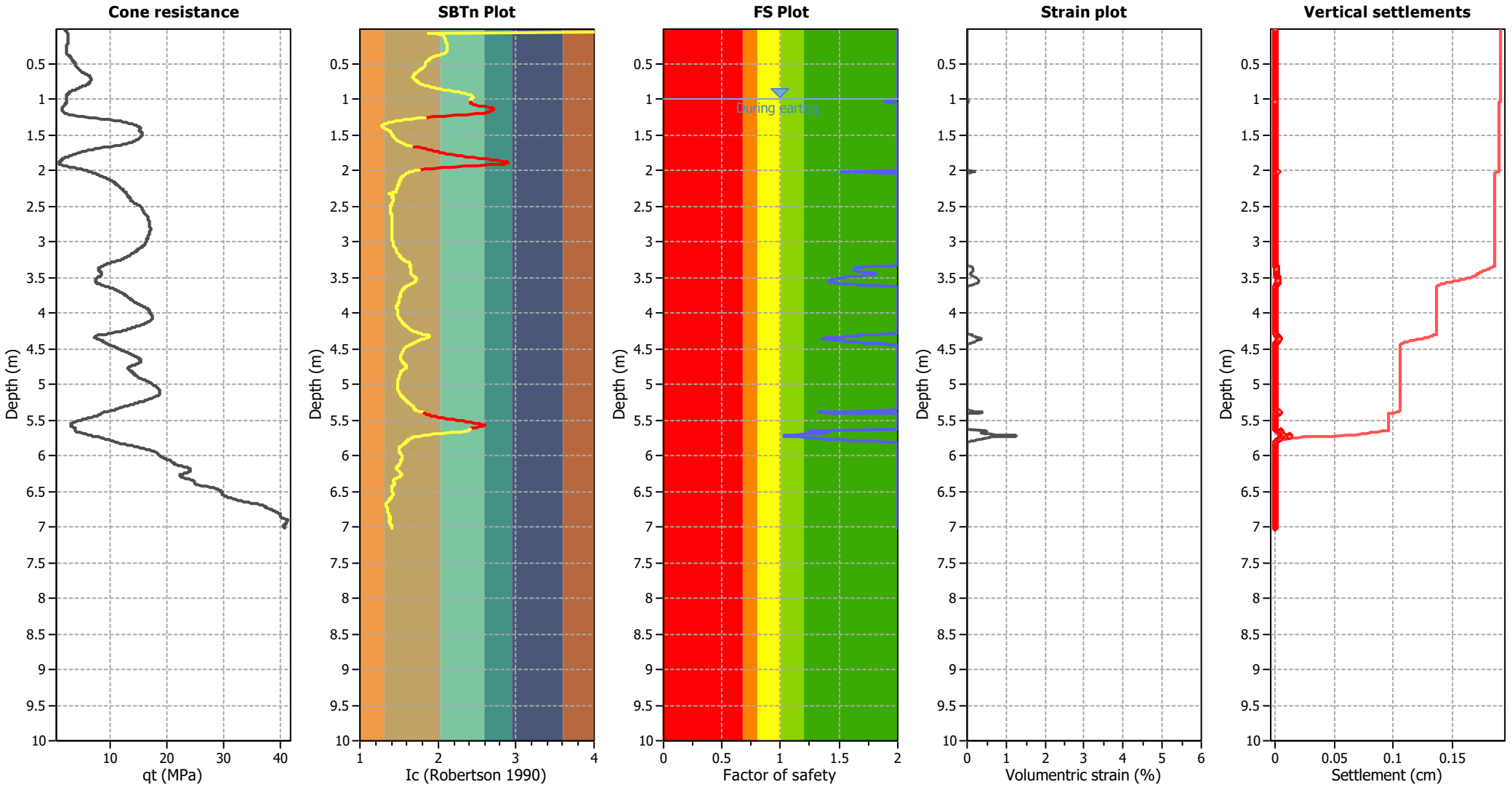
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	701
I_c maximum check value:	3.00	Total points excluded:	81
I_c change ratio value:	0.0100	Exclusion percentage:	11.55%
Minimum number of points in layer:	4	Number of layers detected:	6

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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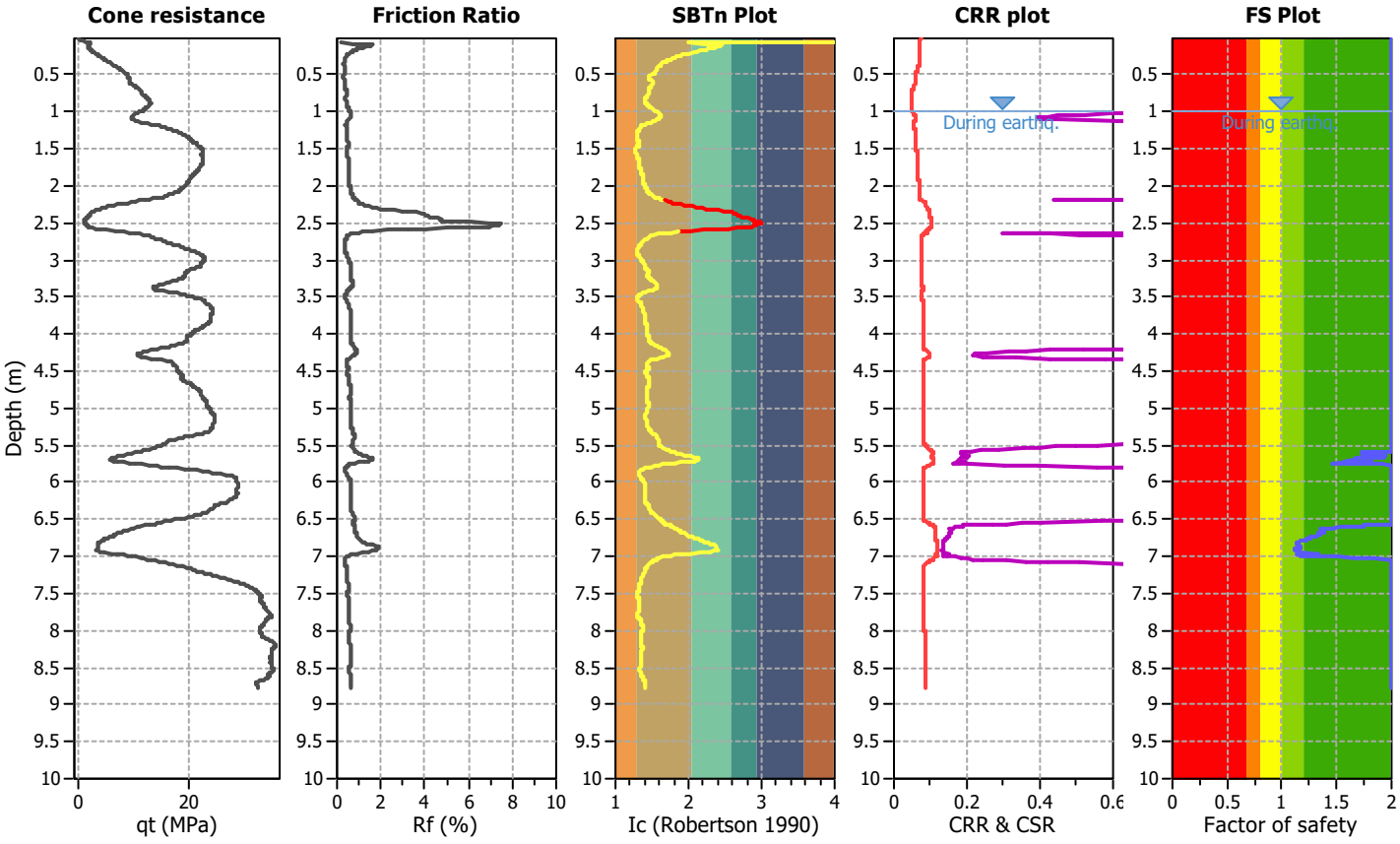
LIQUEFACTION ANALYSIS REPORT

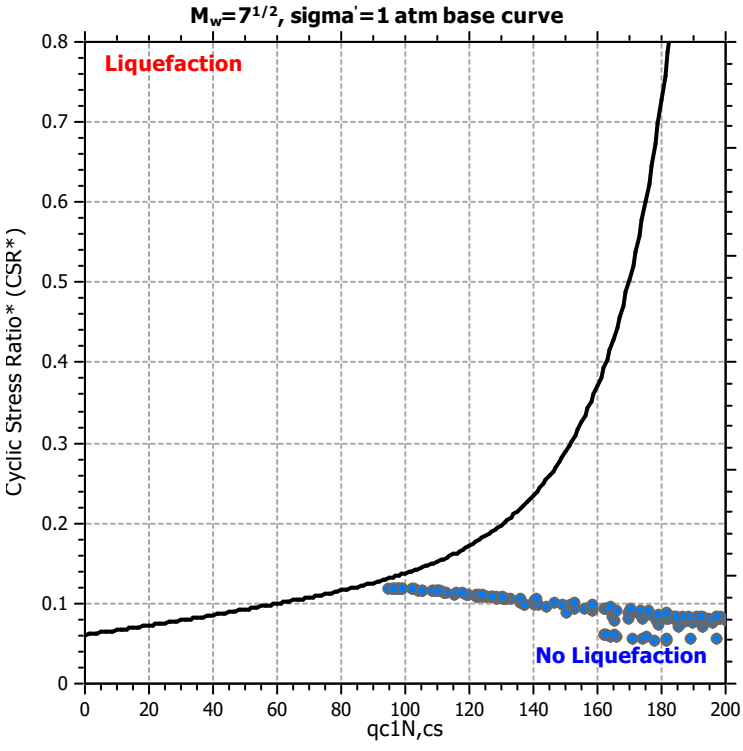
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

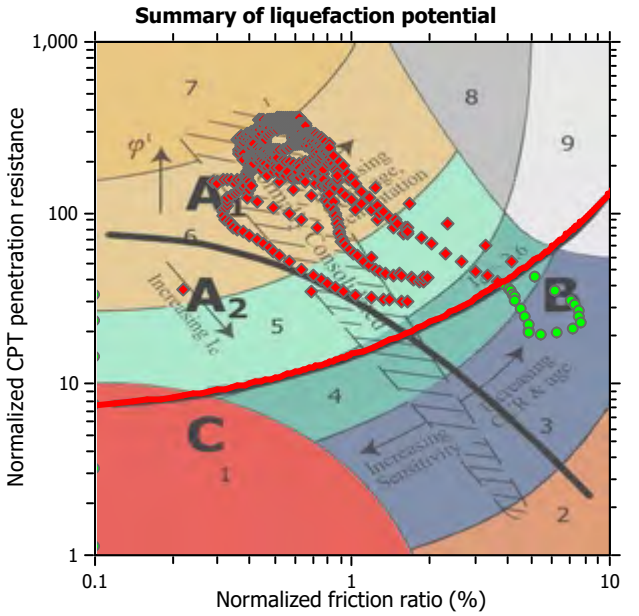
CPT file : CPT08_SLS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	6.40	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

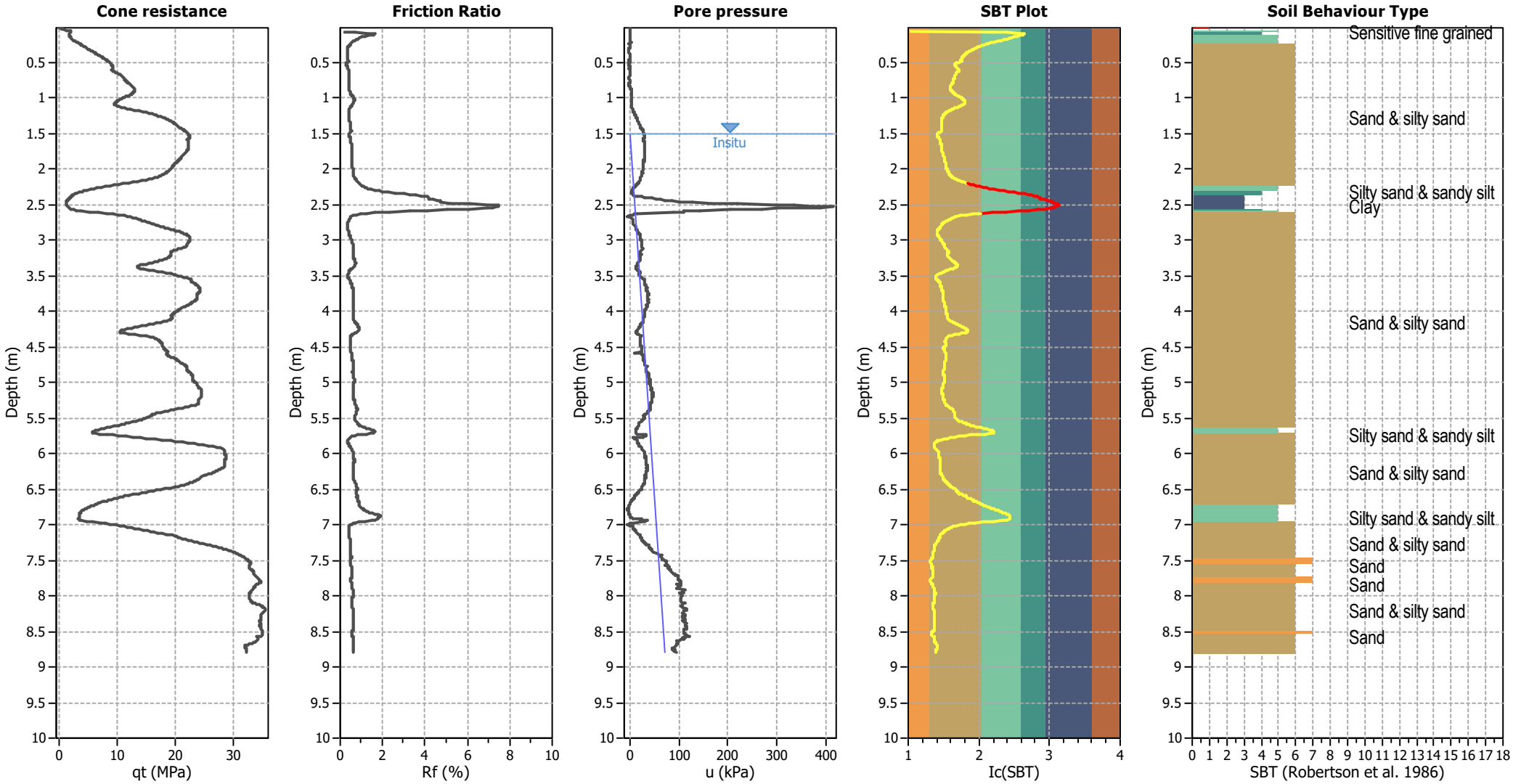






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



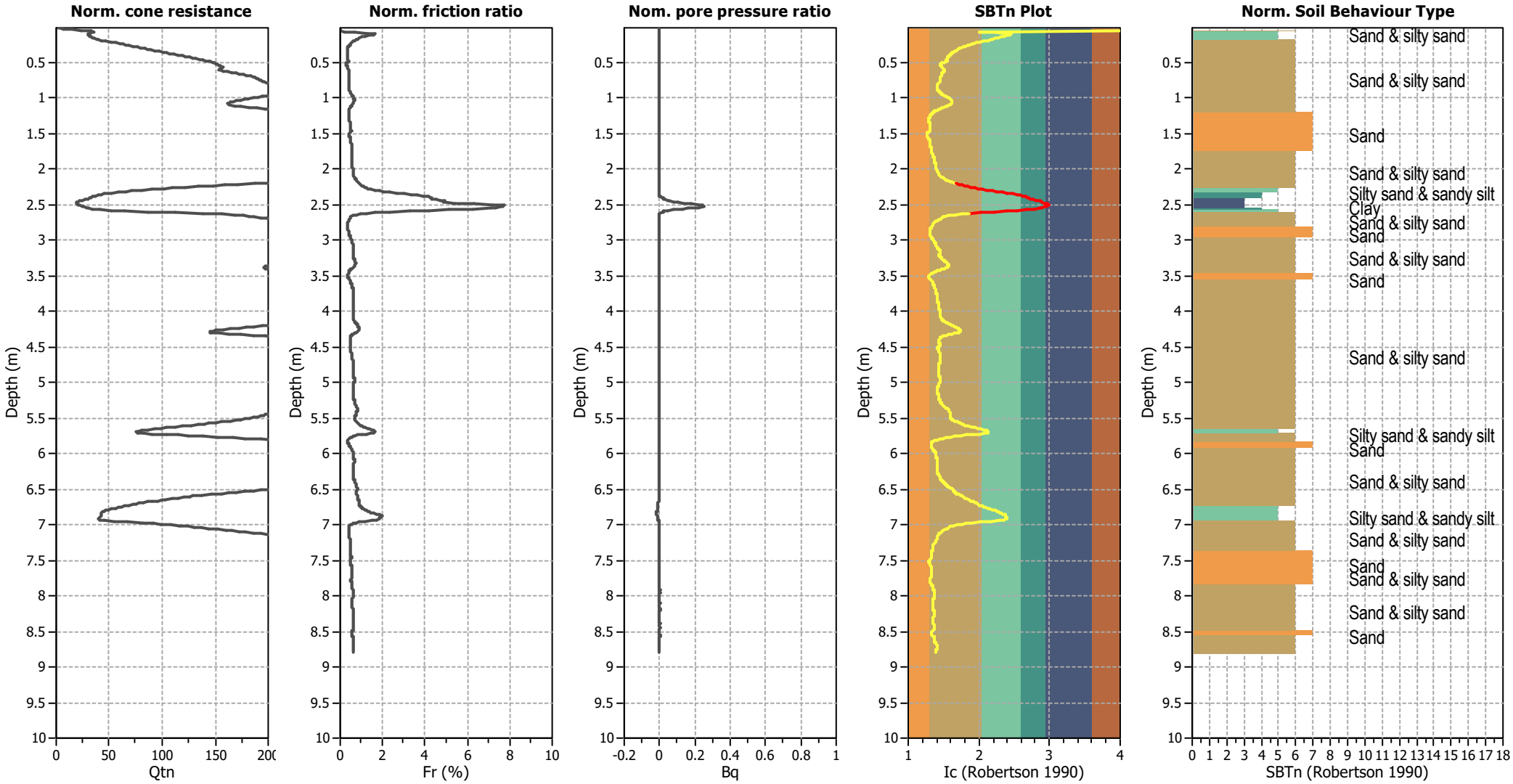
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



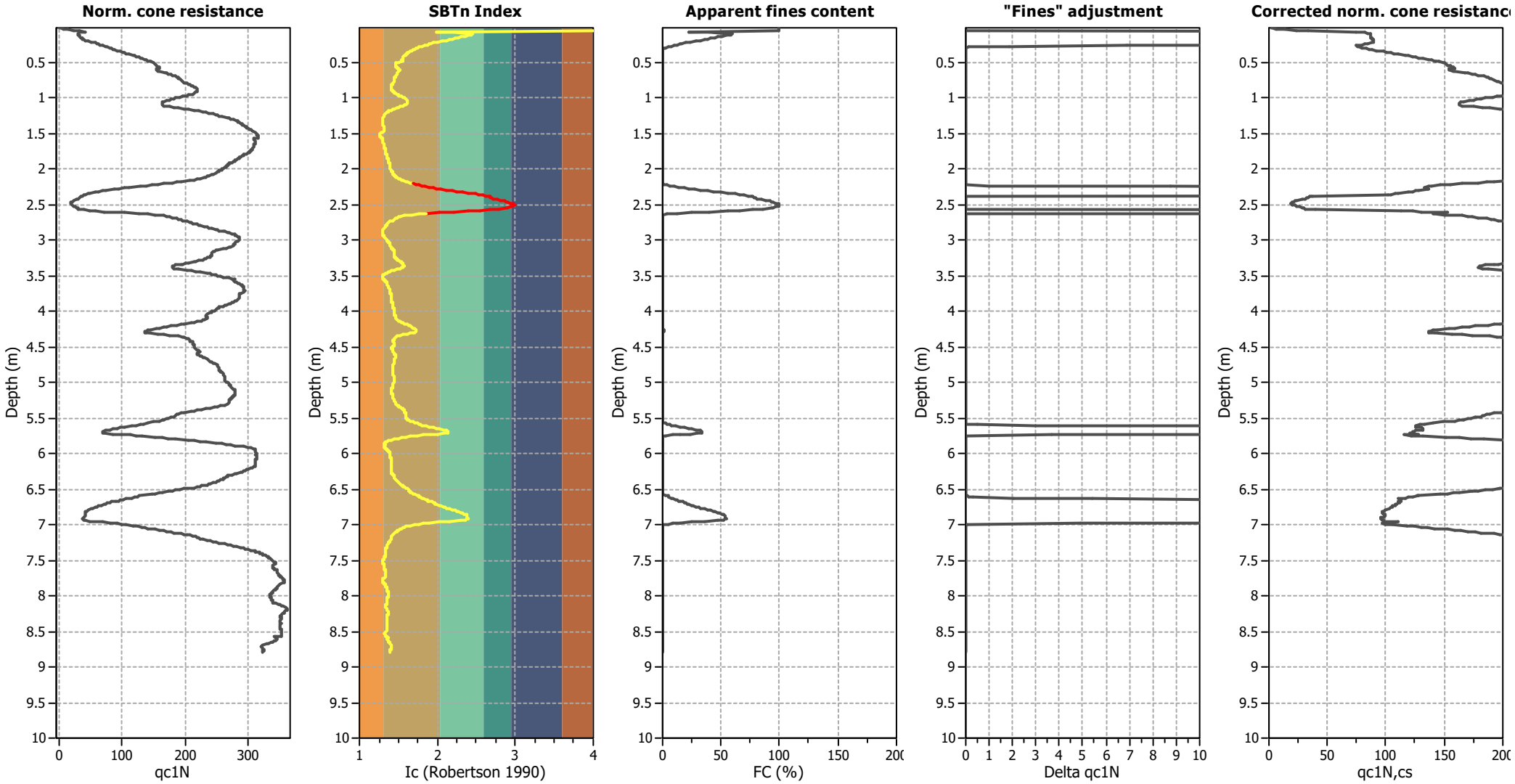
Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

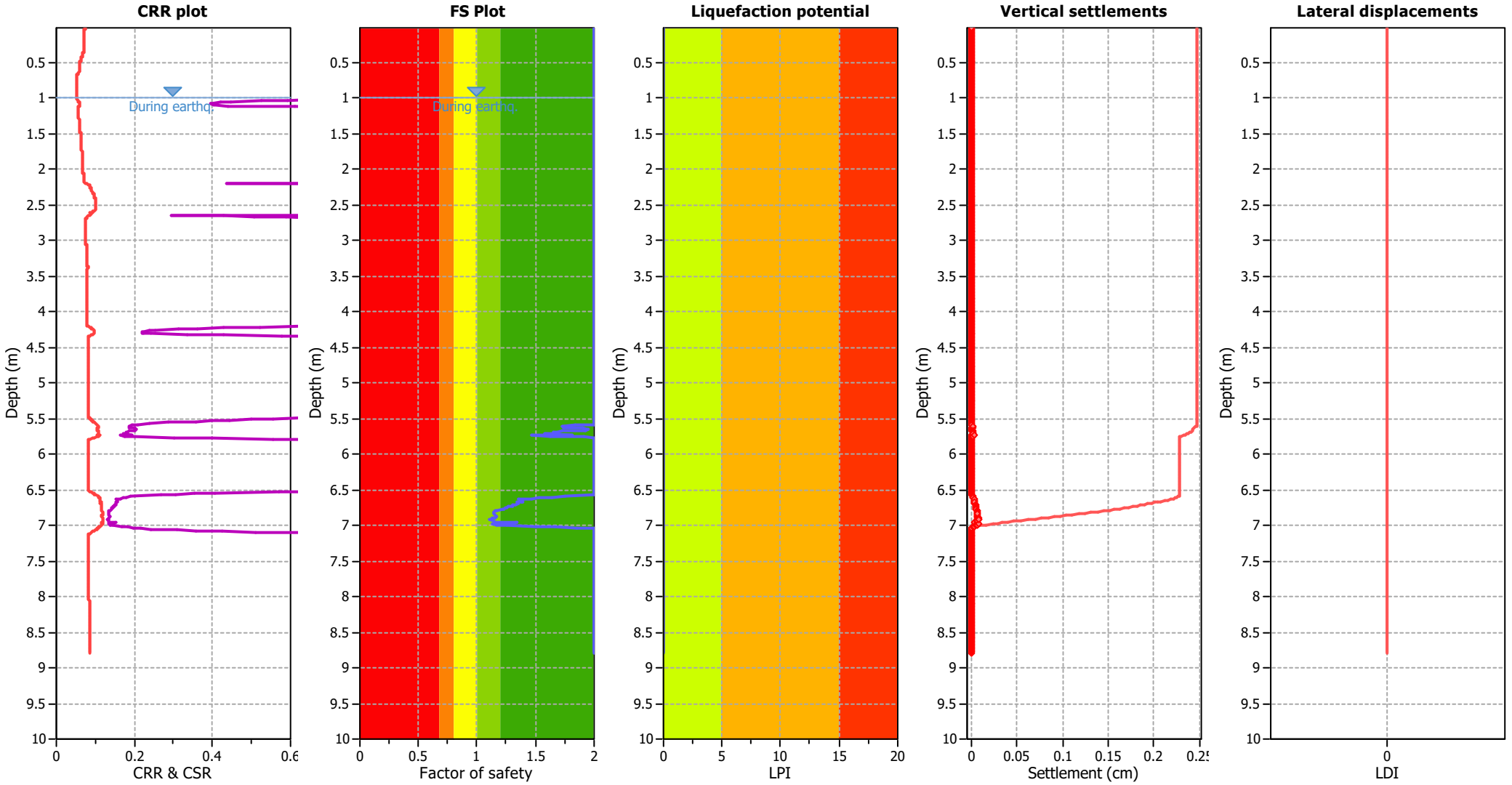
Liquefaction analysis overall plots (intermediate results)



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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

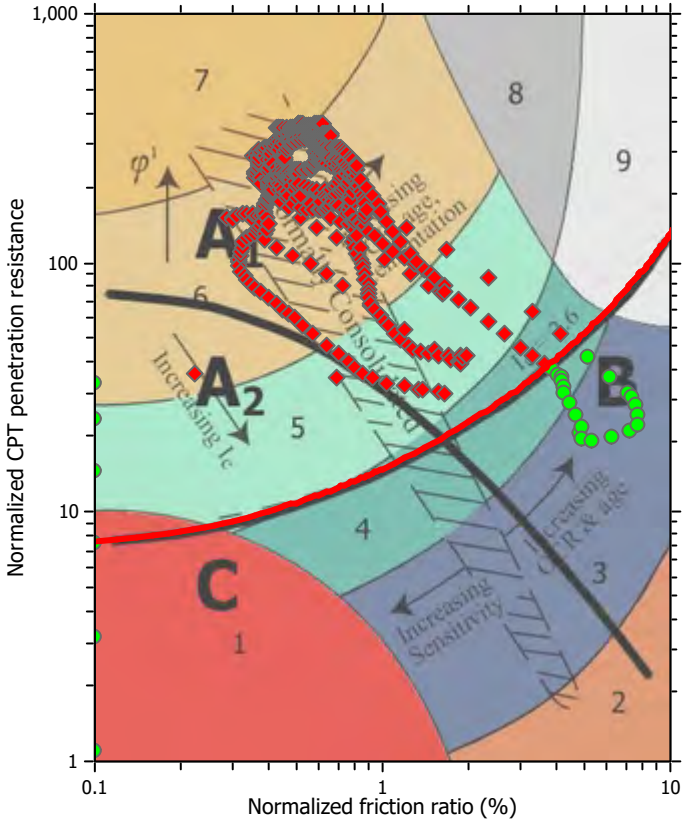
F.S. color scheme

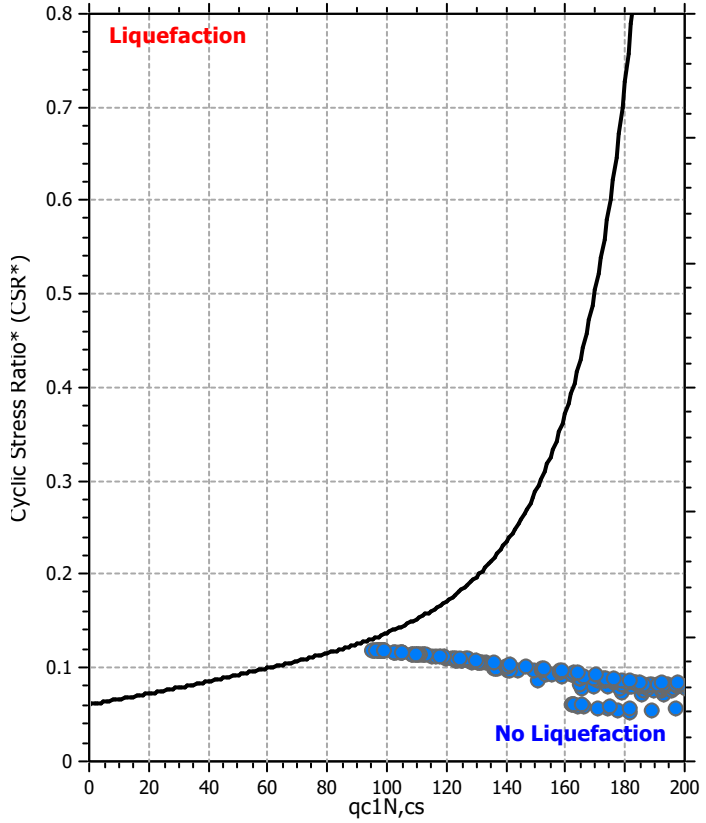
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

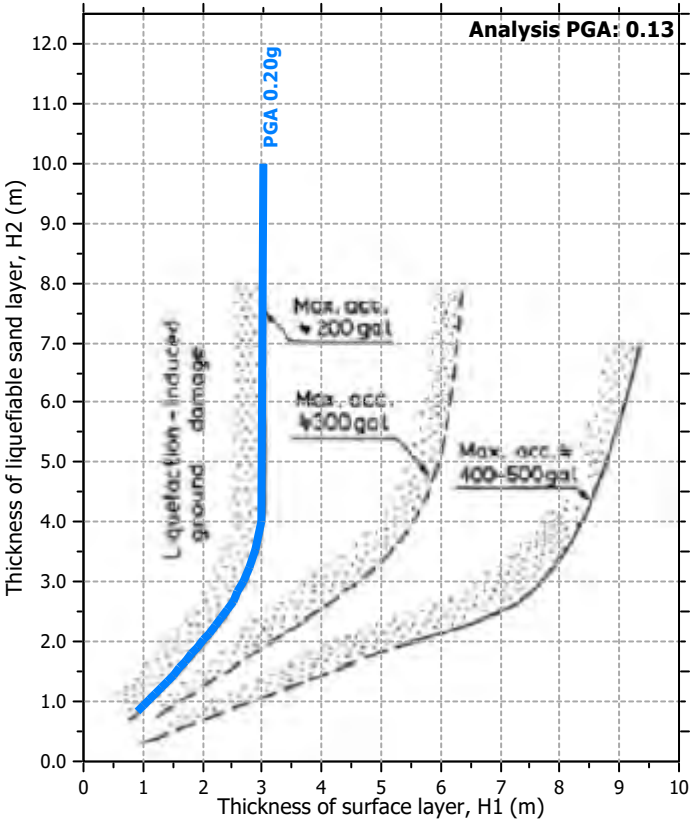
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



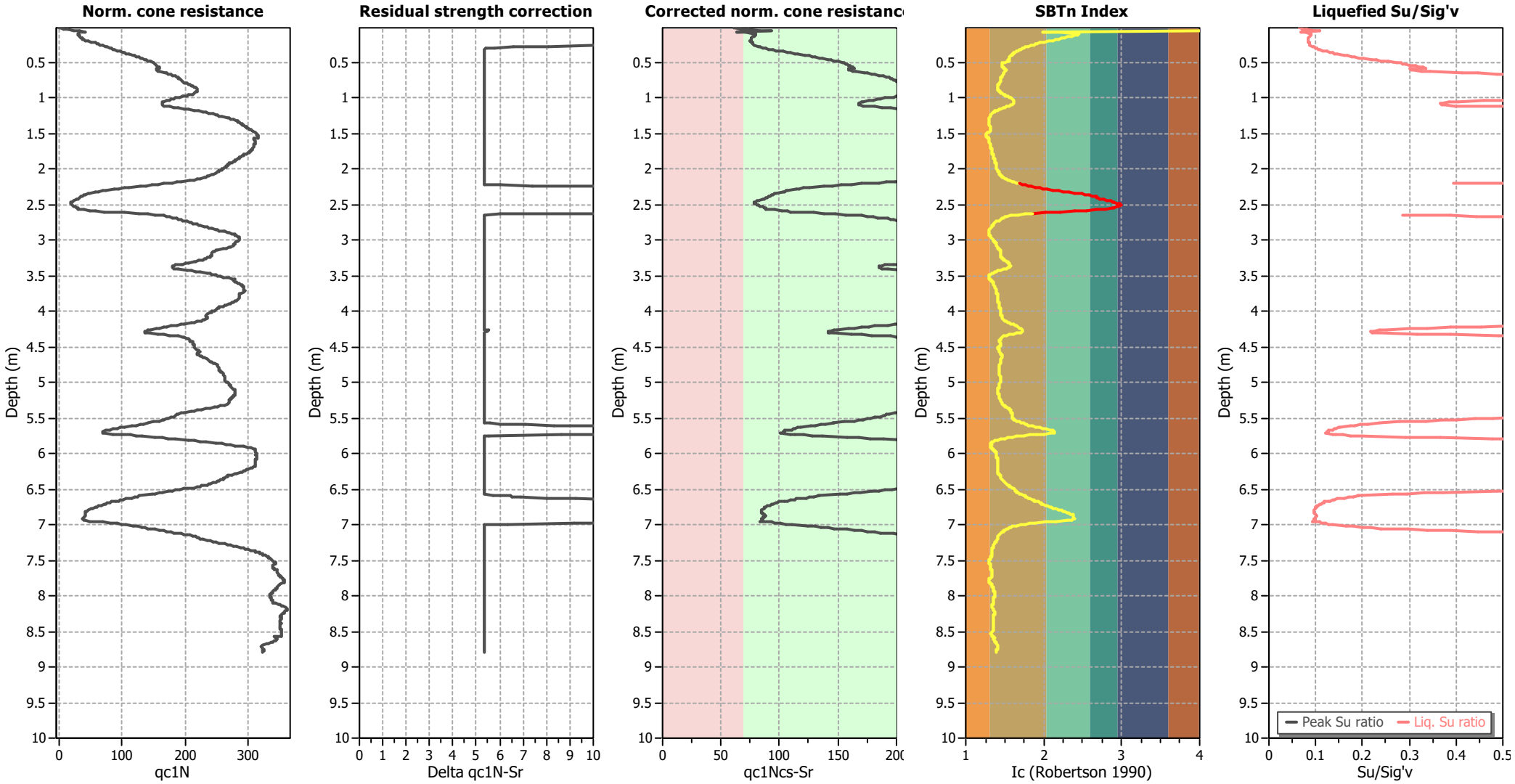




Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

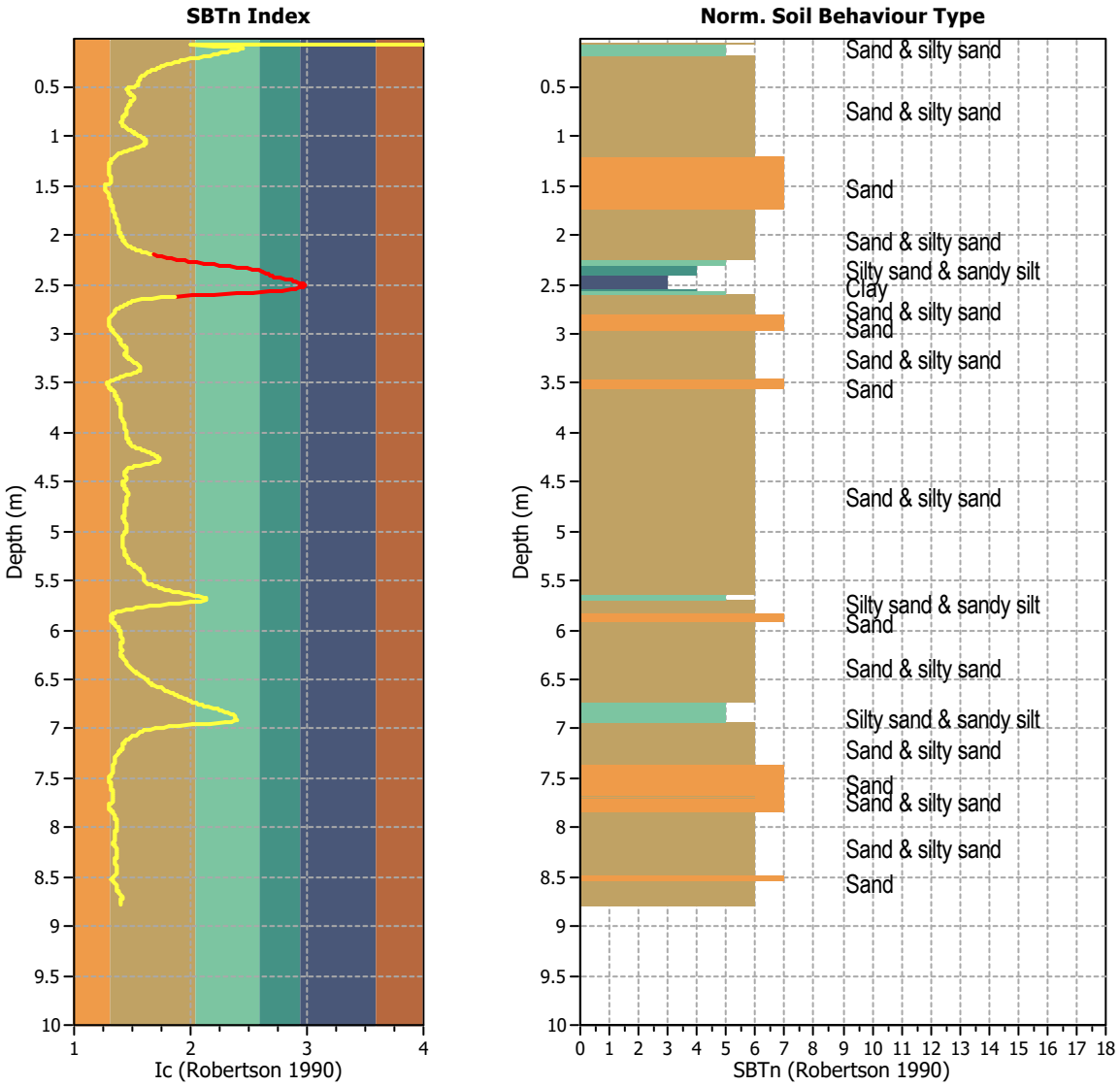
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

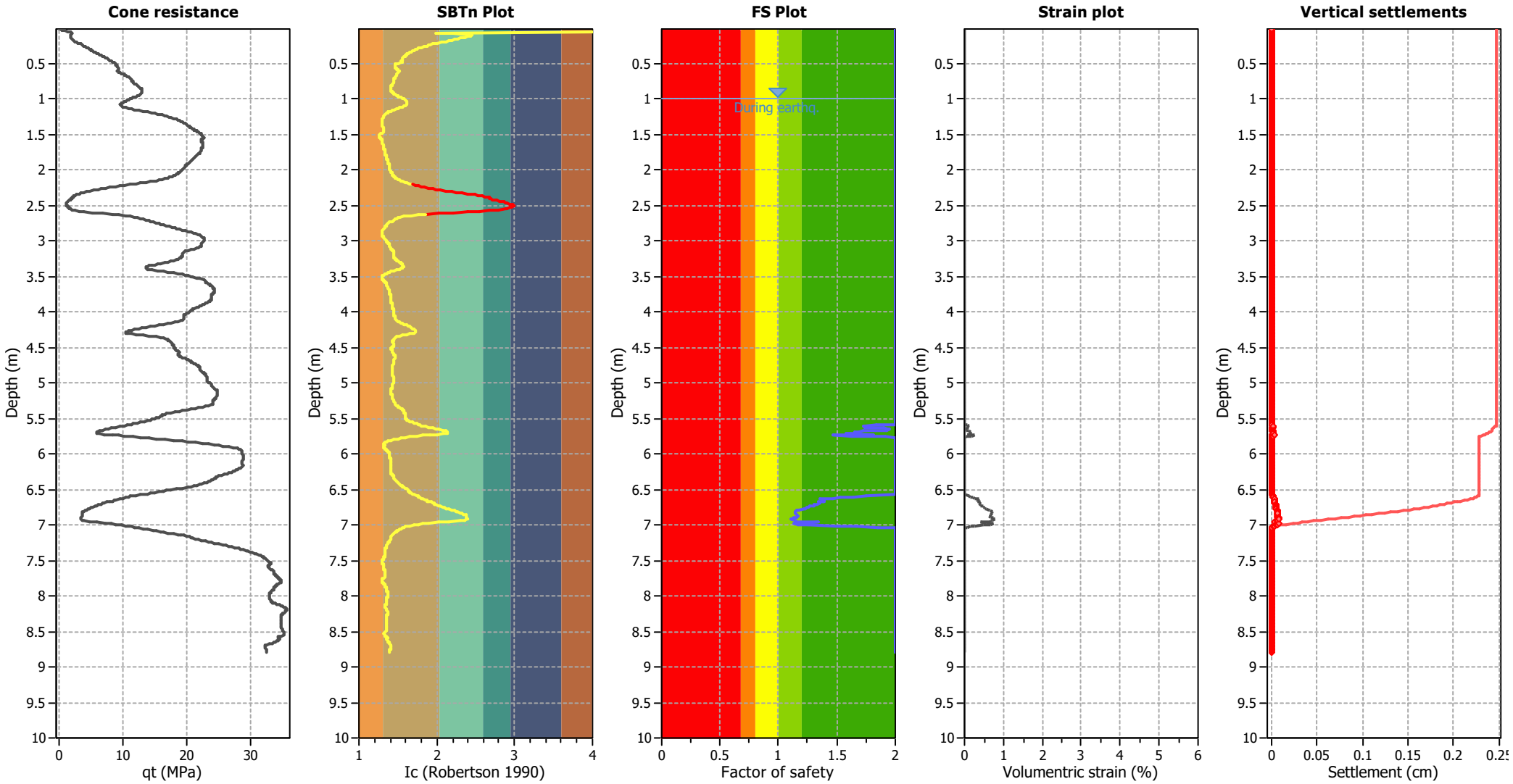
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	879
I_c maximum check value:	3.00	Total points excluded:	43
I_c change ratio value:	0.0100	Exclusion percentage:	4.89%
Minimum number of points in layer:	4	Number of layers detected:	2

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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LIQUEFACTION ANALYSIS REPORT

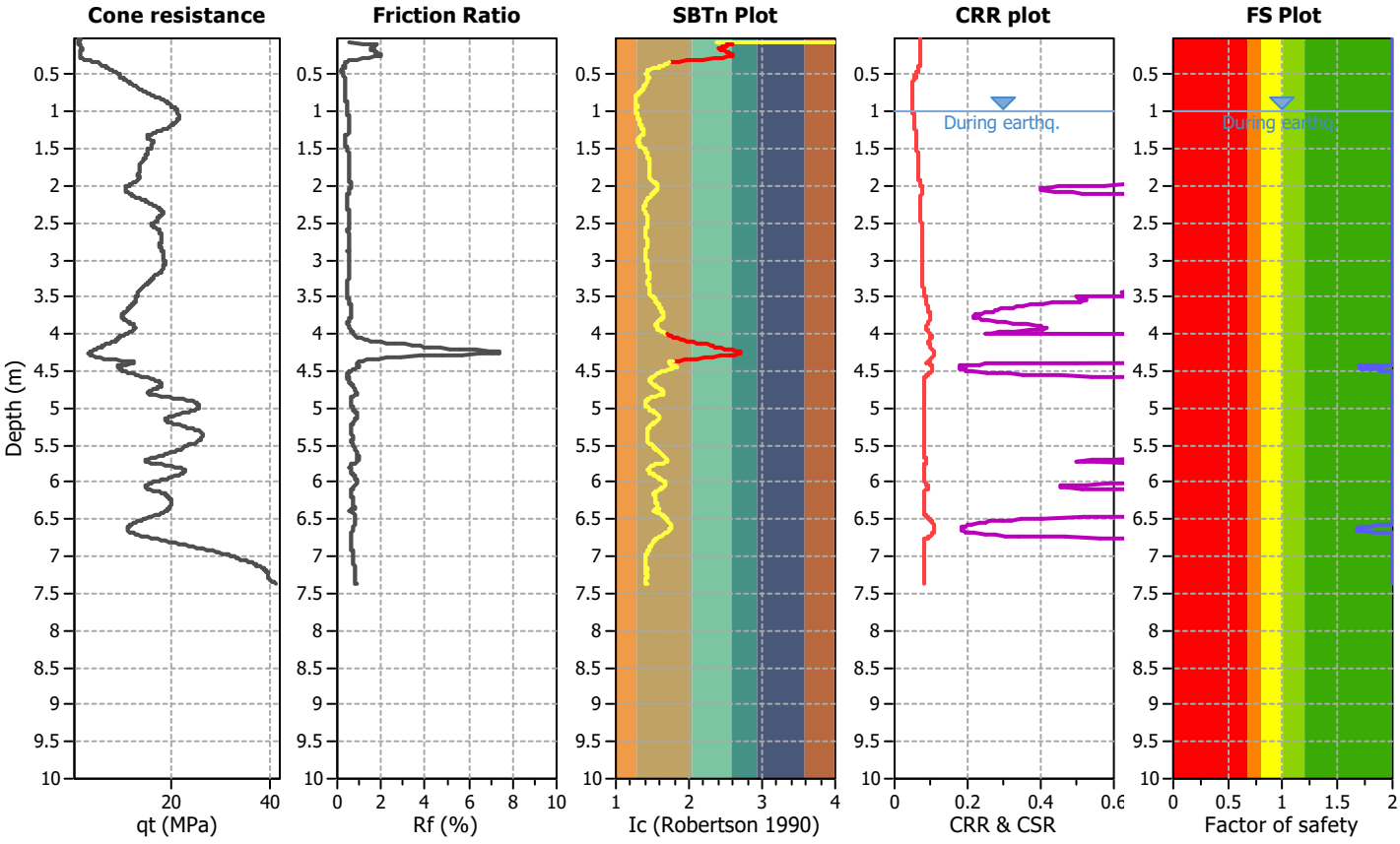
Project title : Foxton Solar Farm

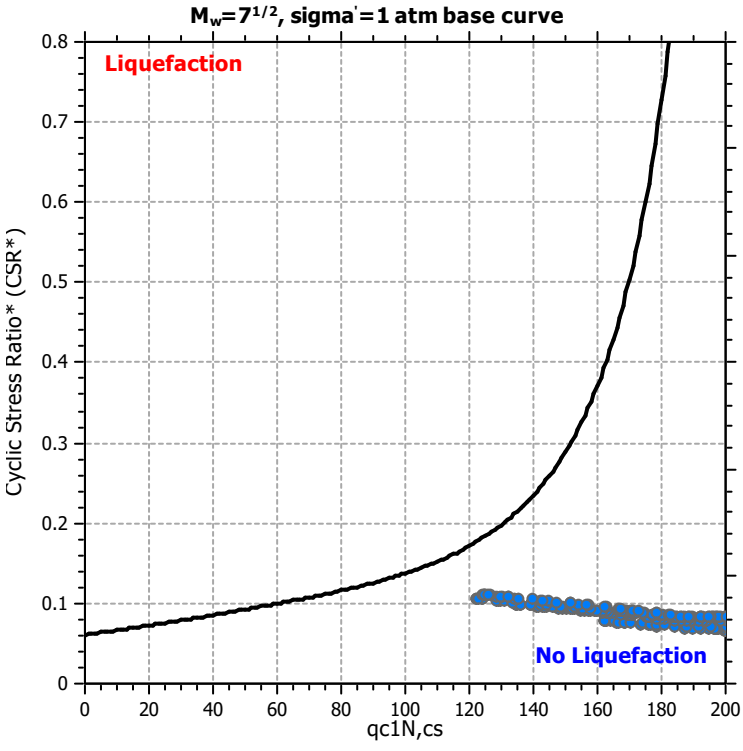
Location : Foxton, New Zealand

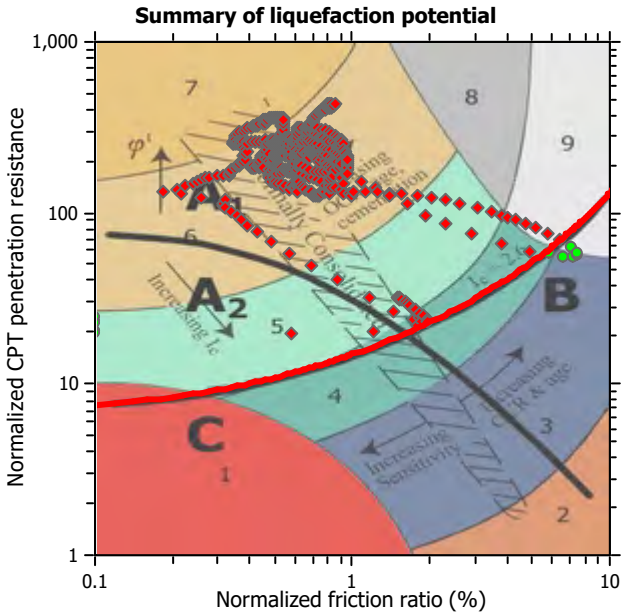
CPT file : CPT09_SLS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	6.40	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

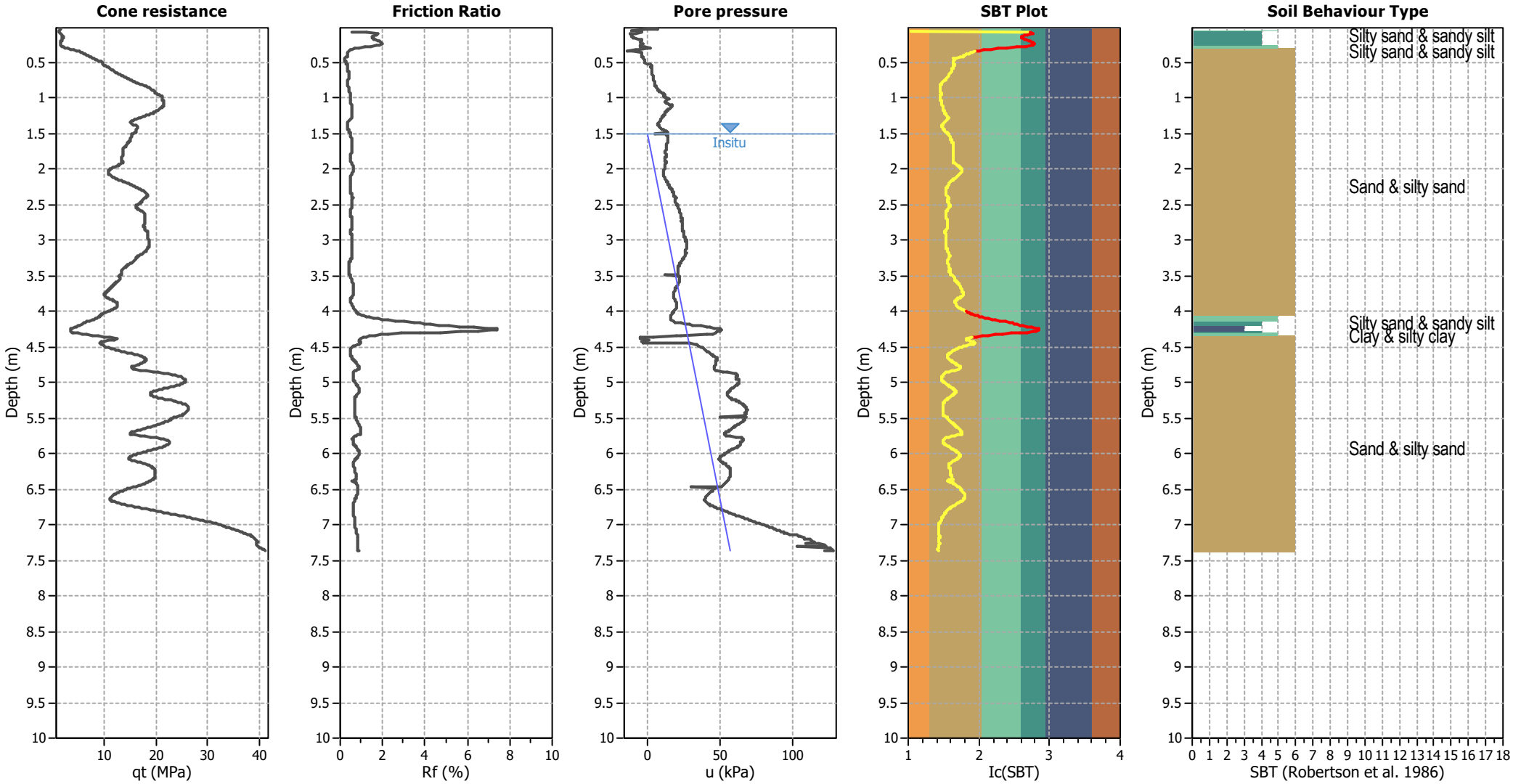






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



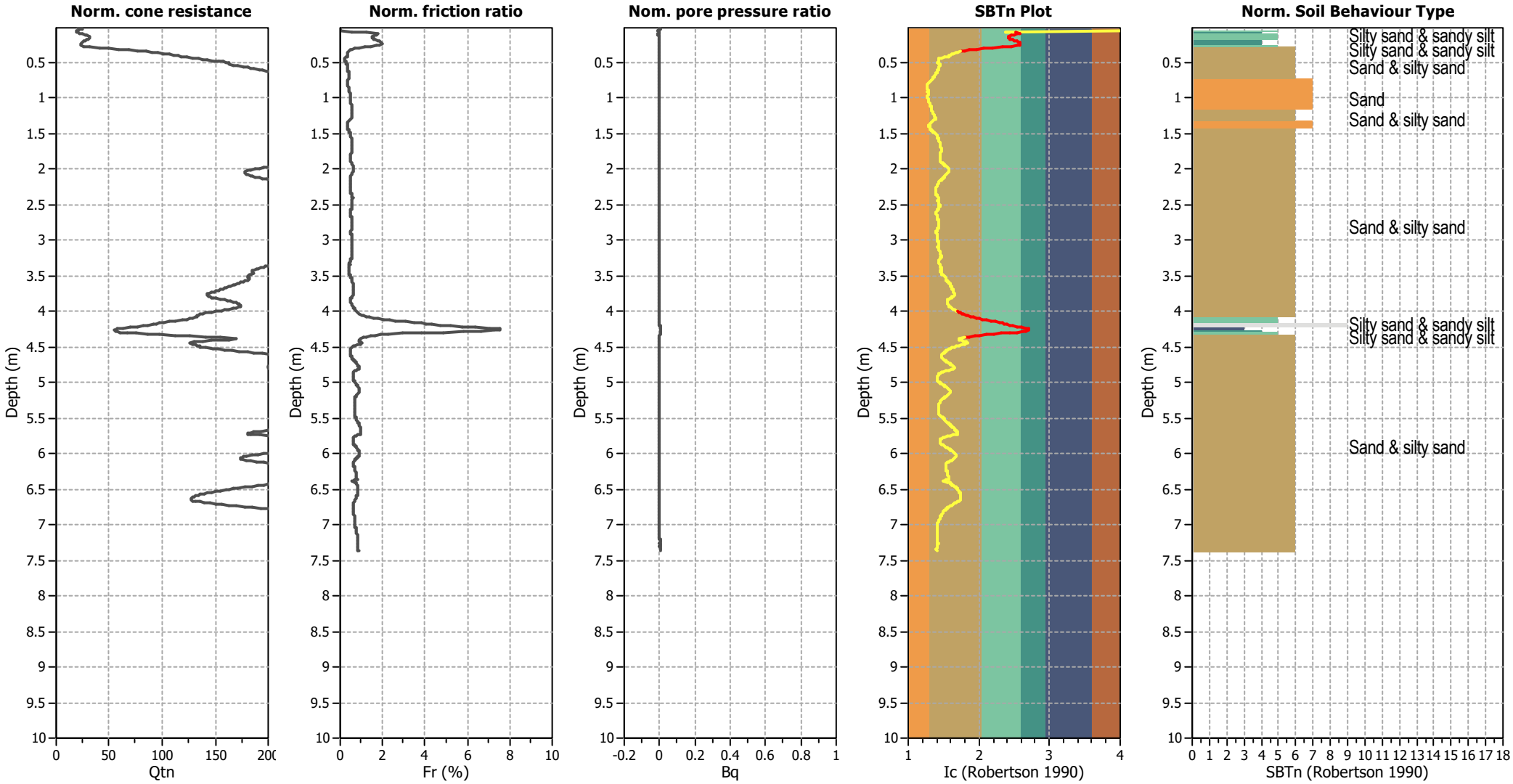
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



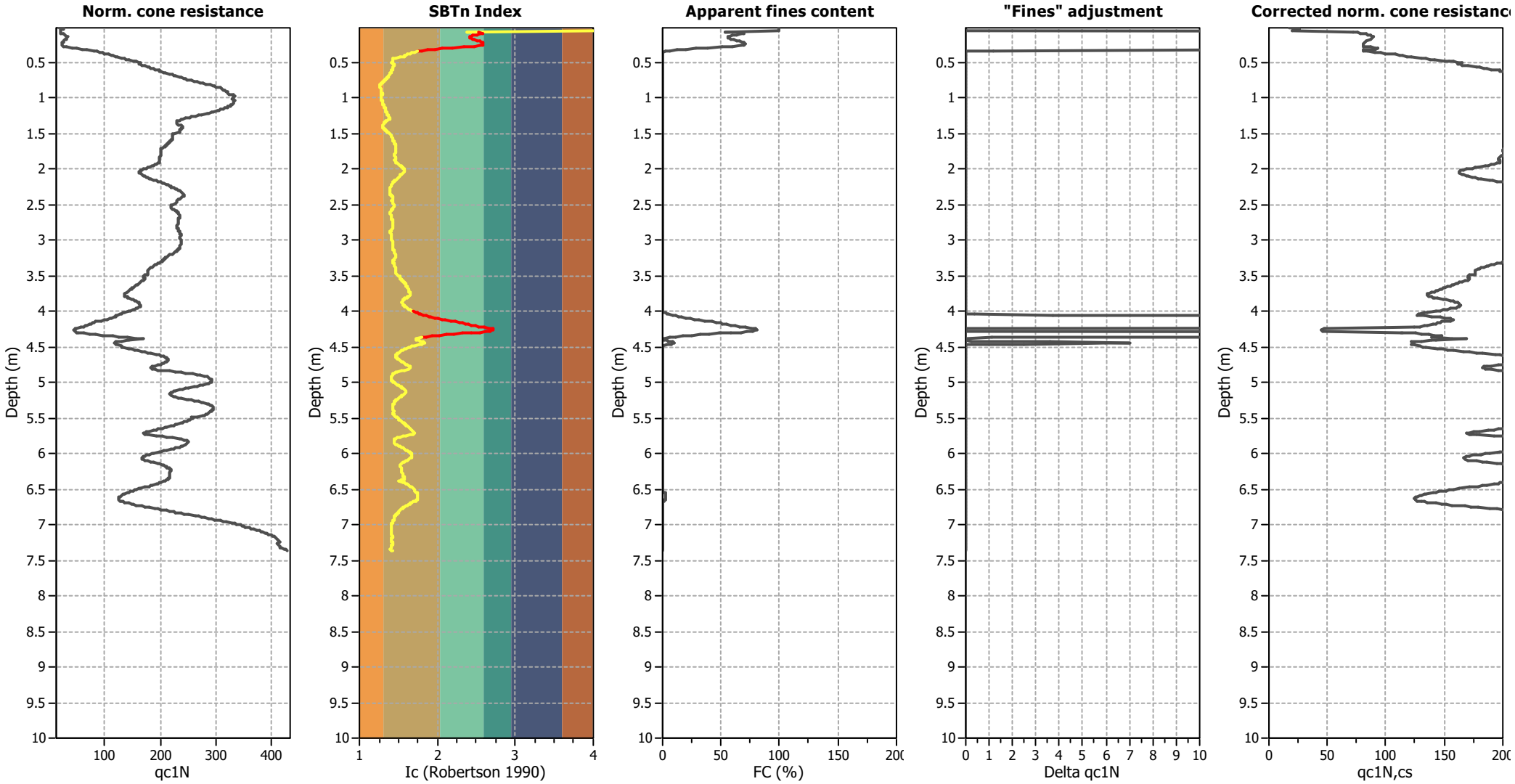
Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

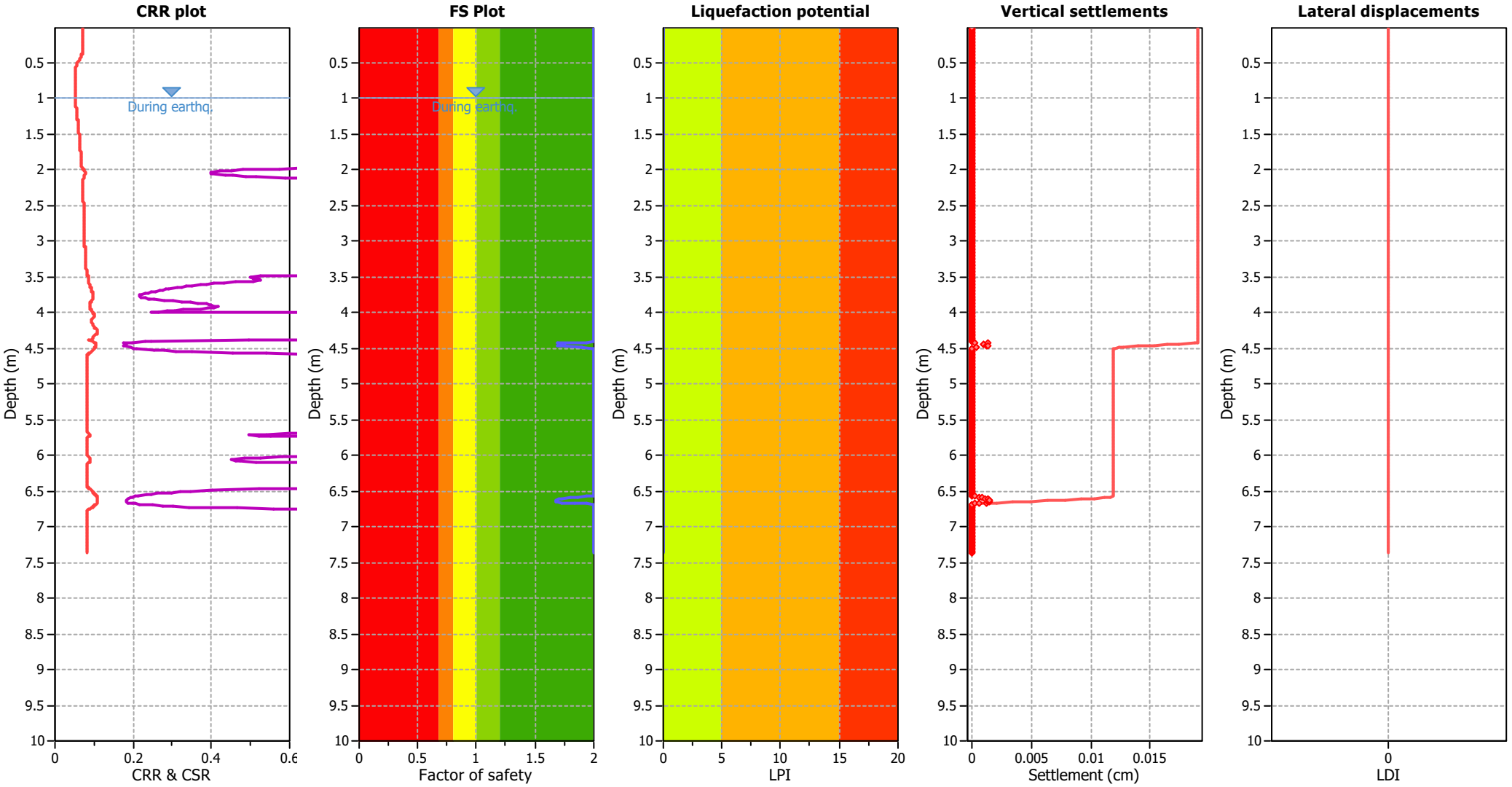
Liquefaction analysis overall plots (intermediate results)



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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

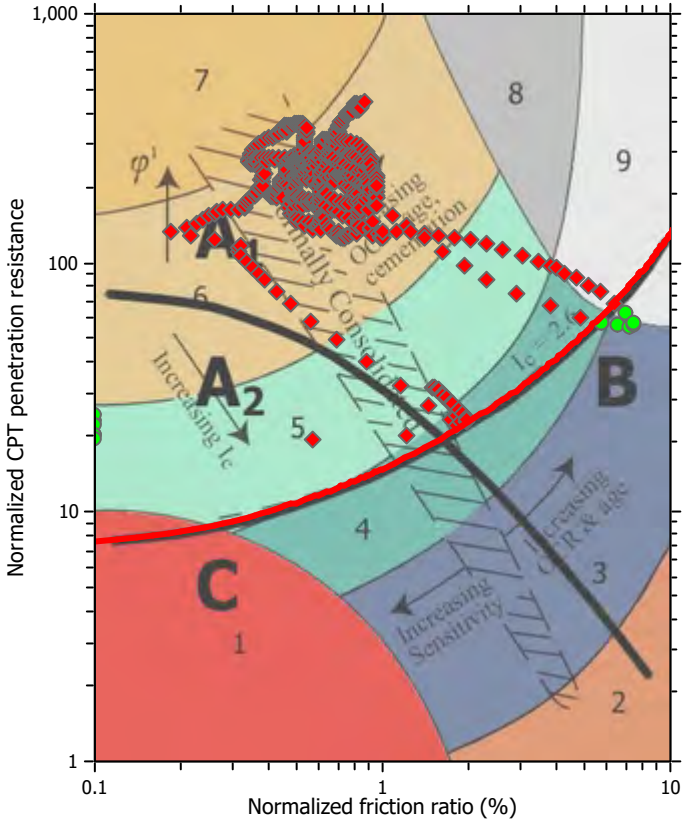
F.S. color scheme

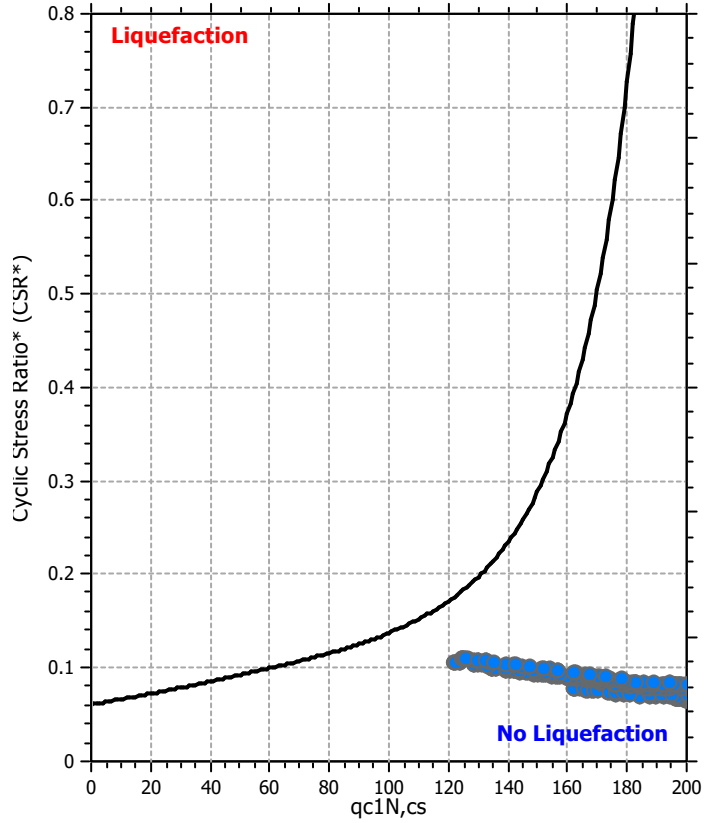
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

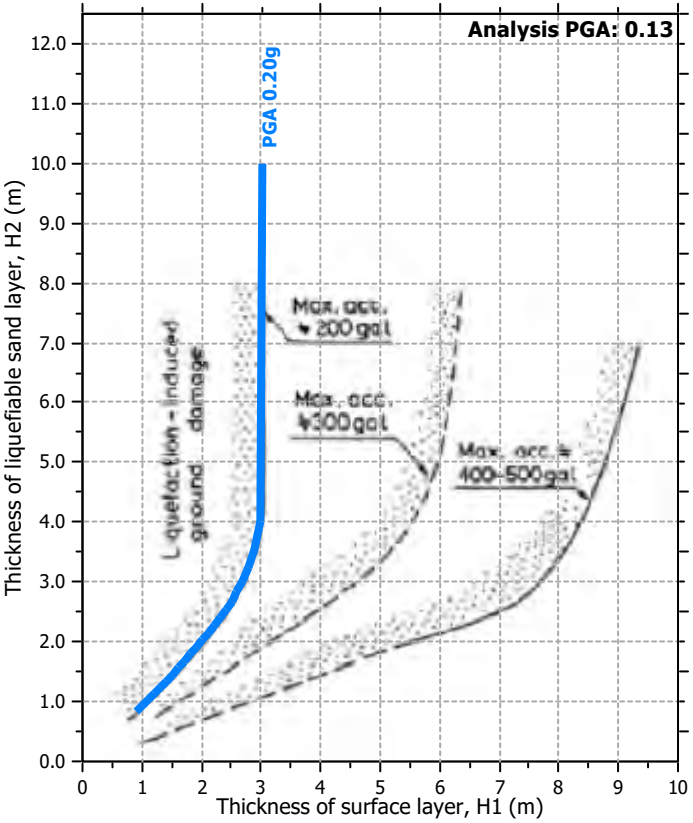
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



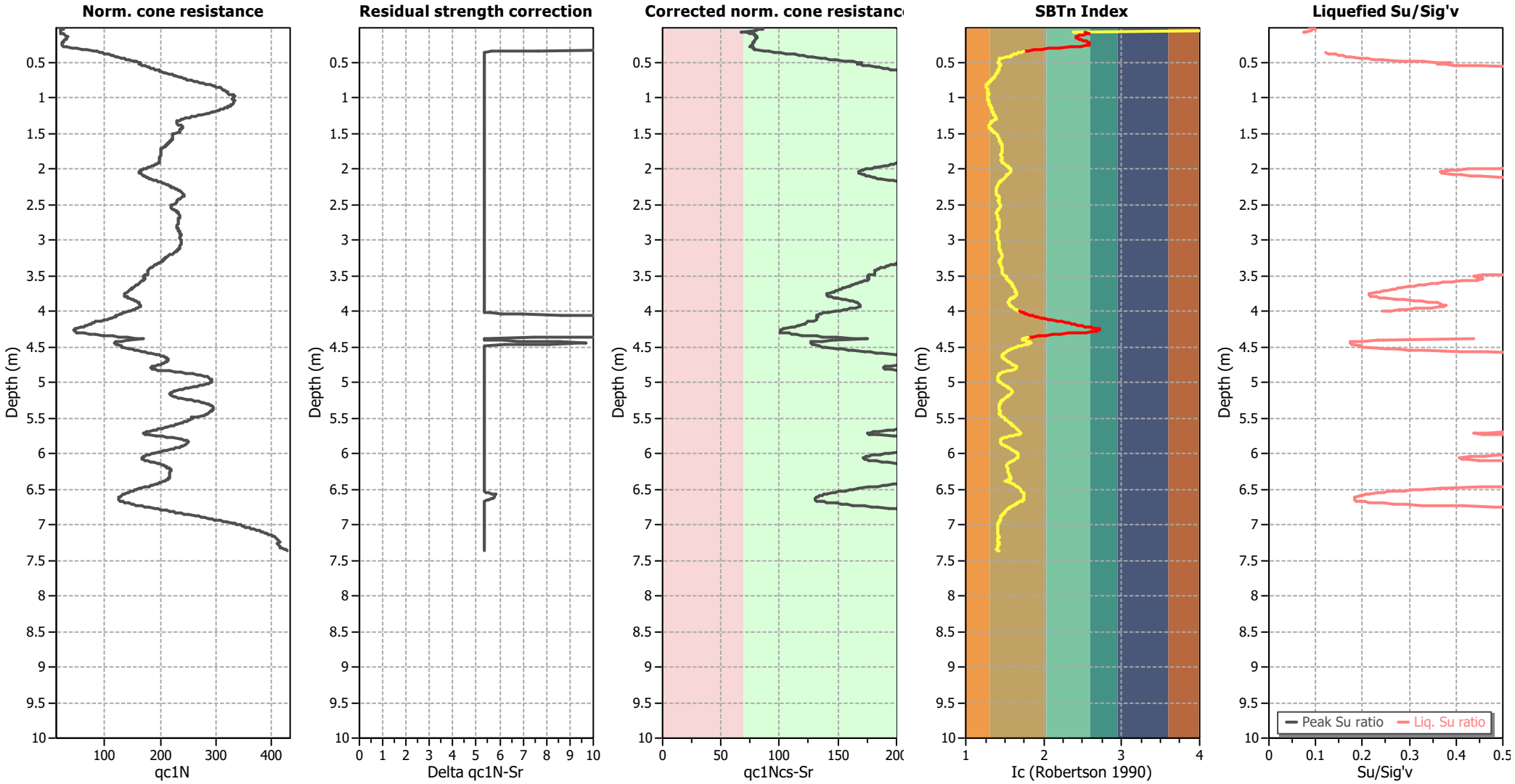




Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

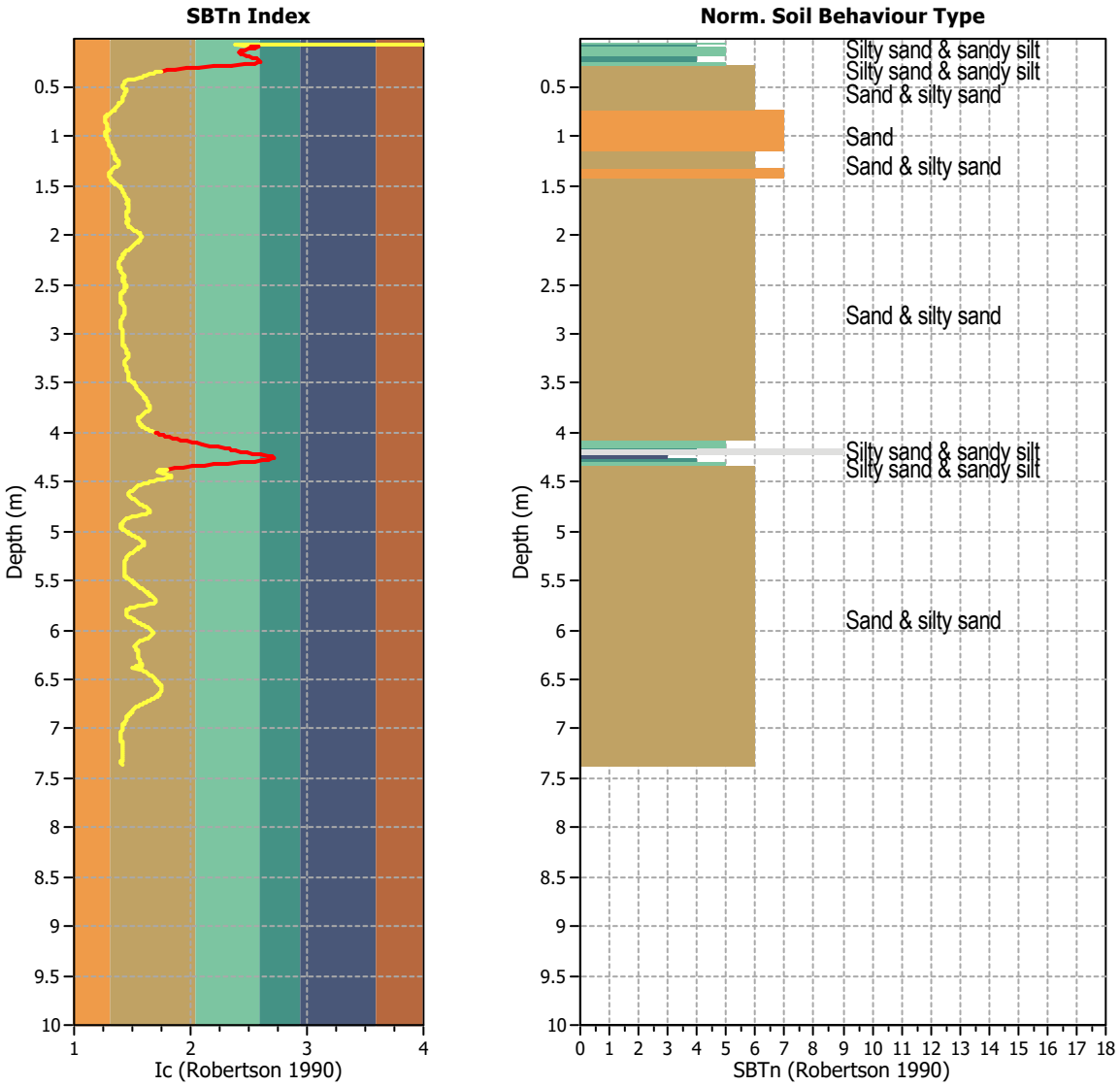
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

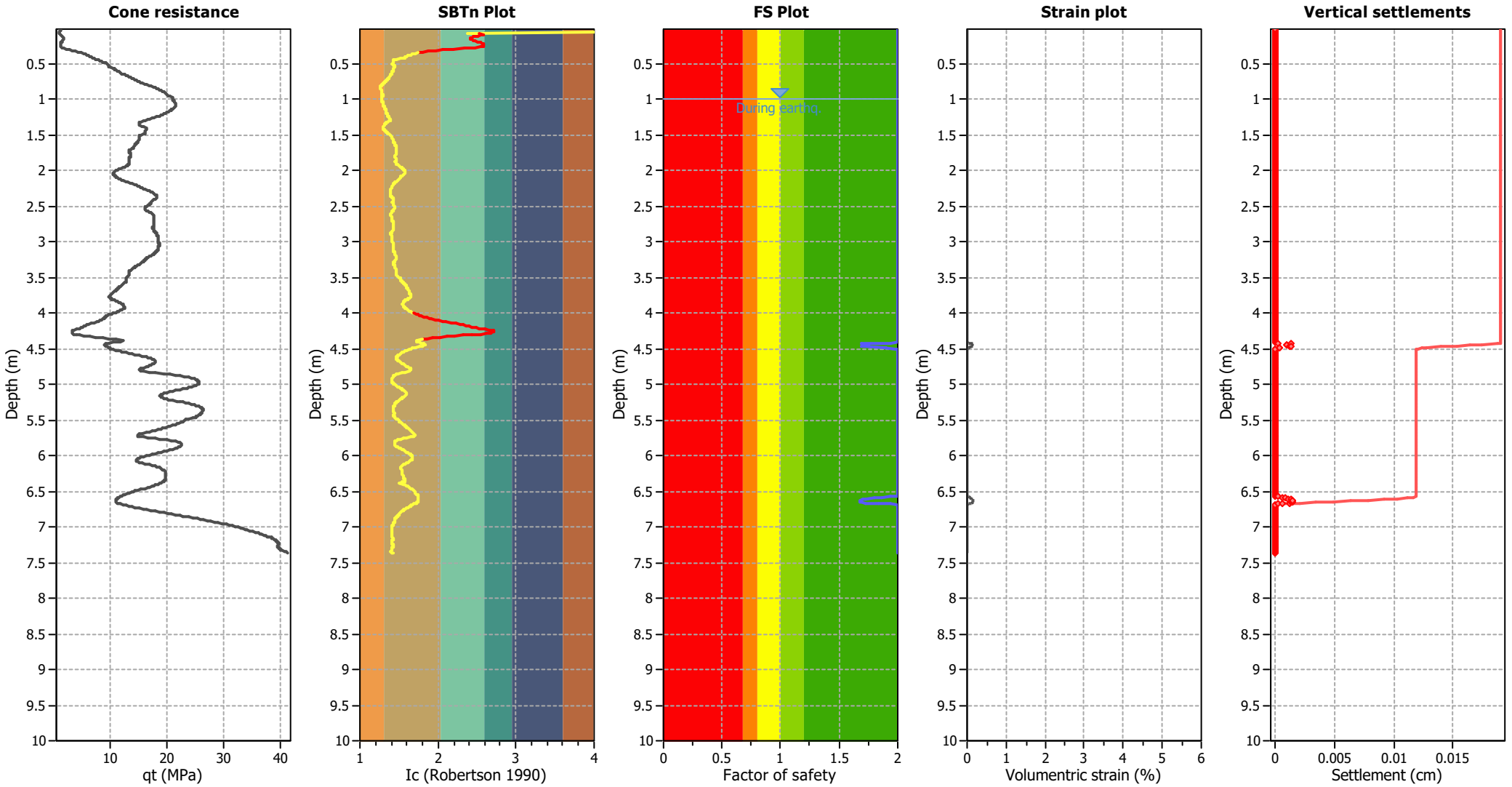
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	737
I_c maximum check value:	3.00	Total points excluded:	65
I_c change ratio value:	0.0100	Exclusion percentage:	8.82%
Minimum number of points in layer:	4	Number of layers detected:	5

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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www.btw.nz

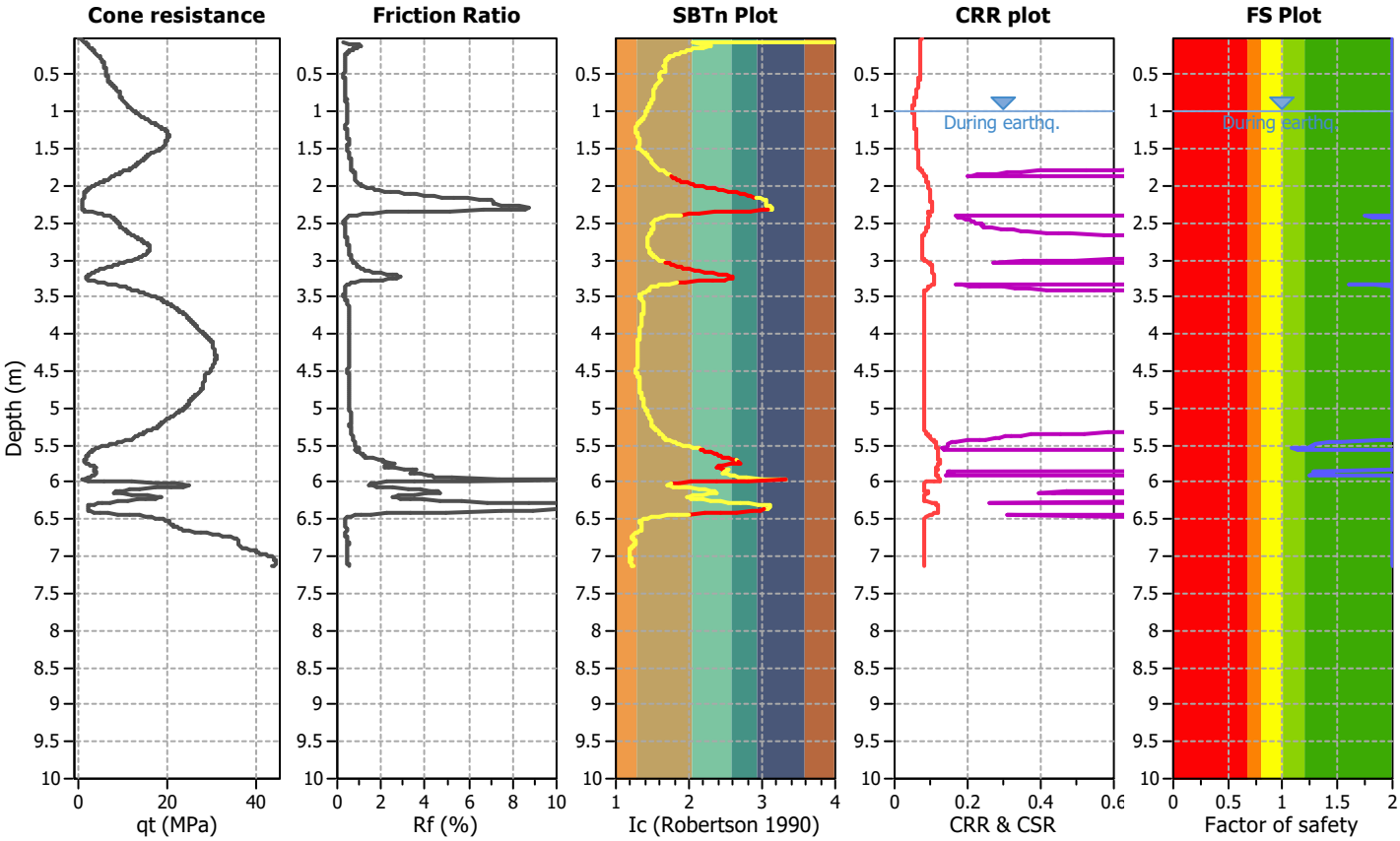
LIQUEFACTION ANALYSIS REPORT

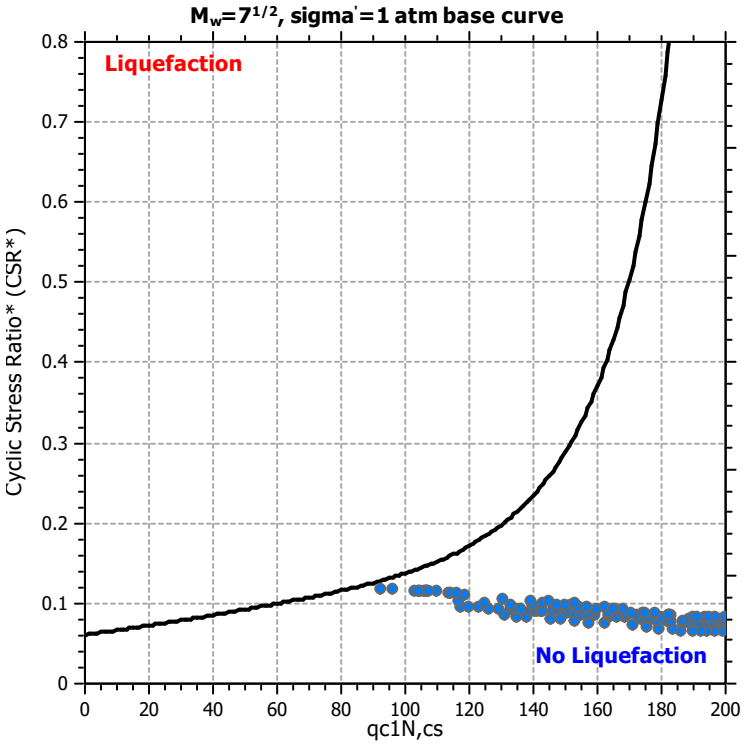
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

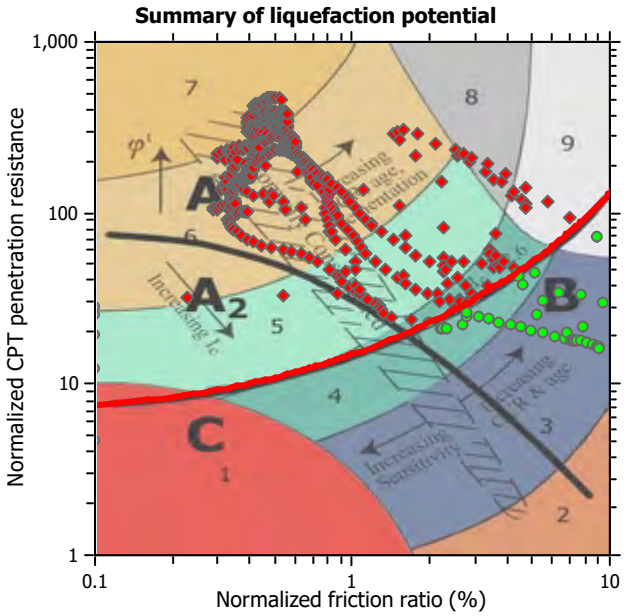
CPT file : CPT10_SLS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	6.40	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

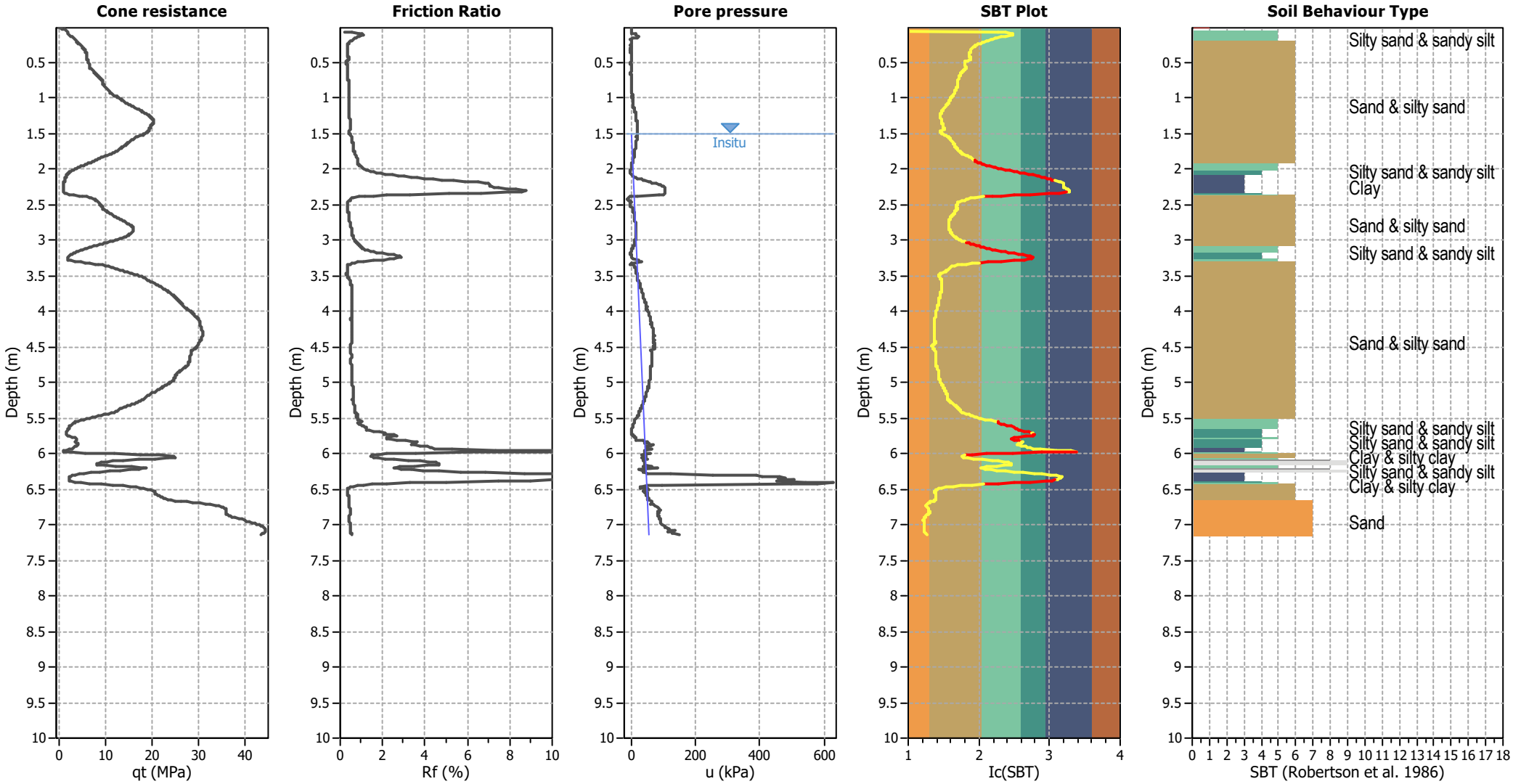






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



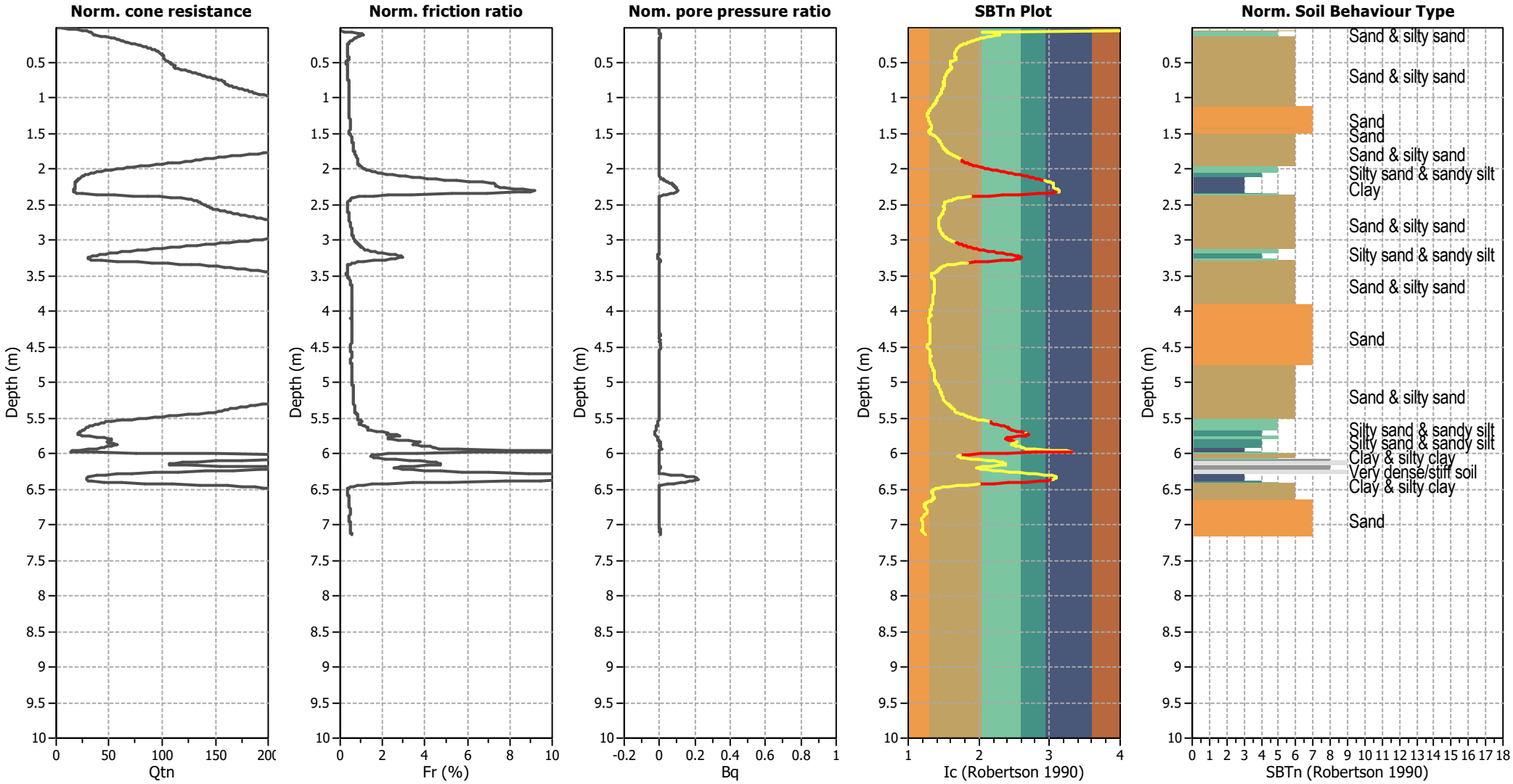
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



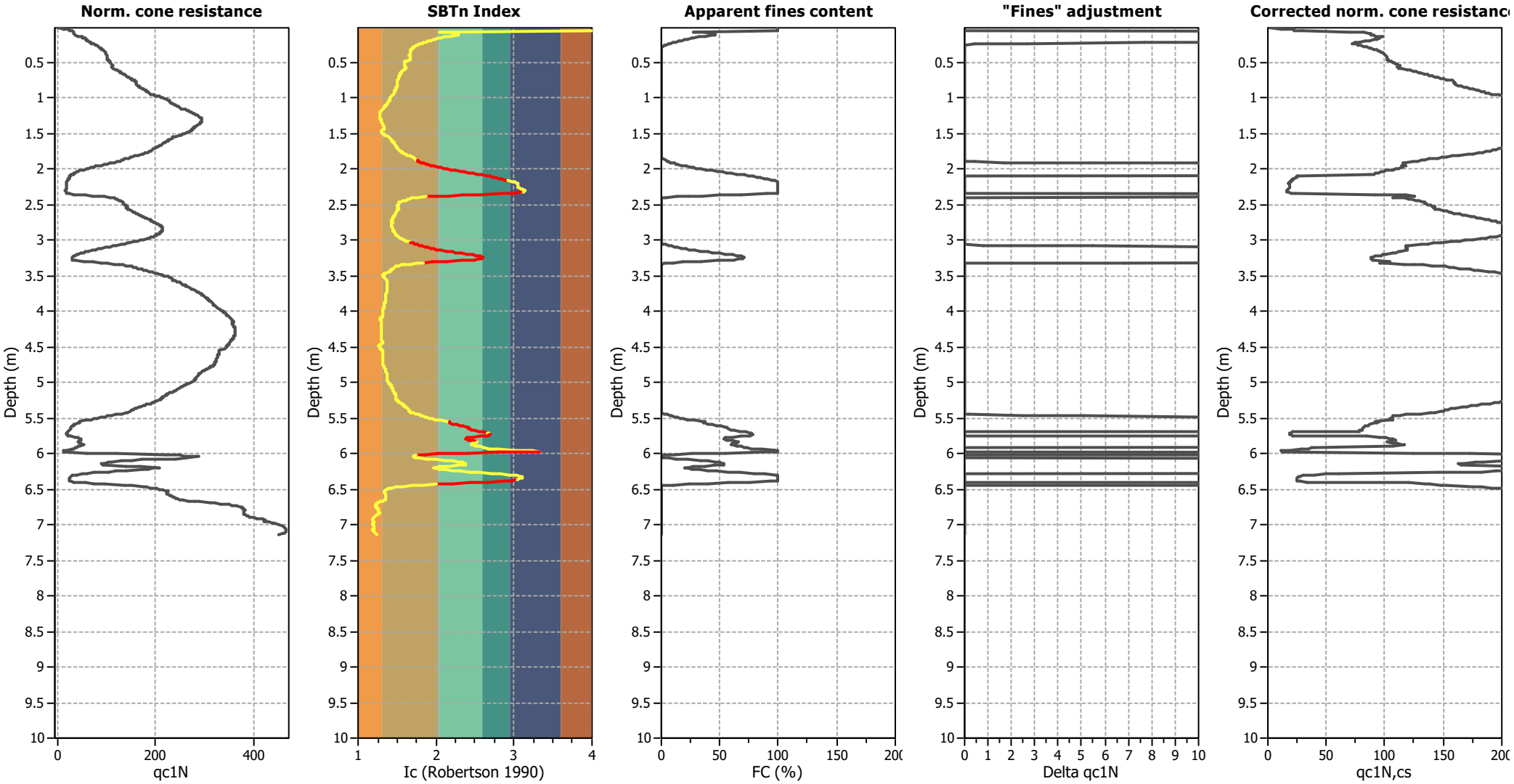
Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

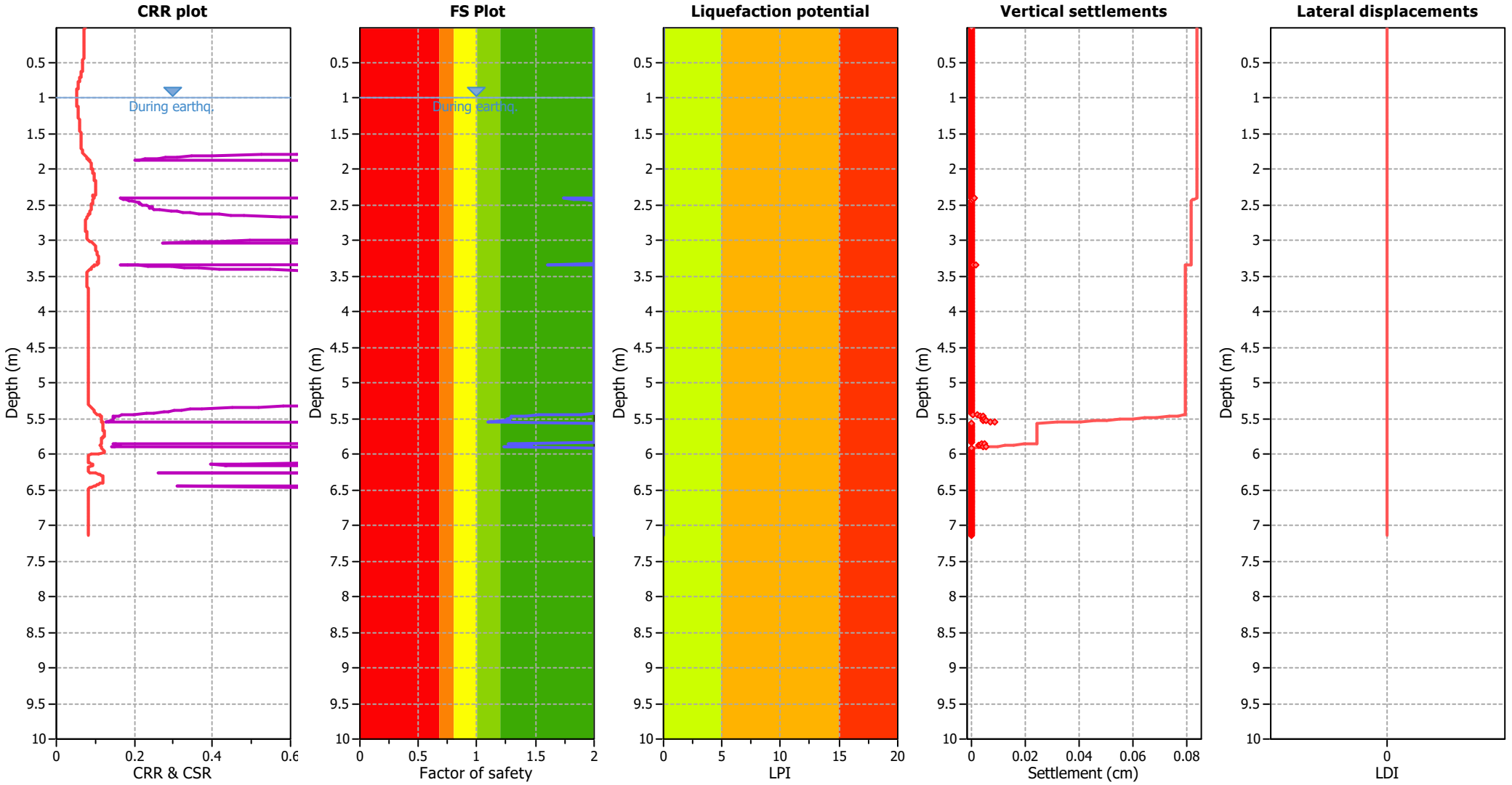
Liquefaction analysis overall plots (intermediate results)



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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

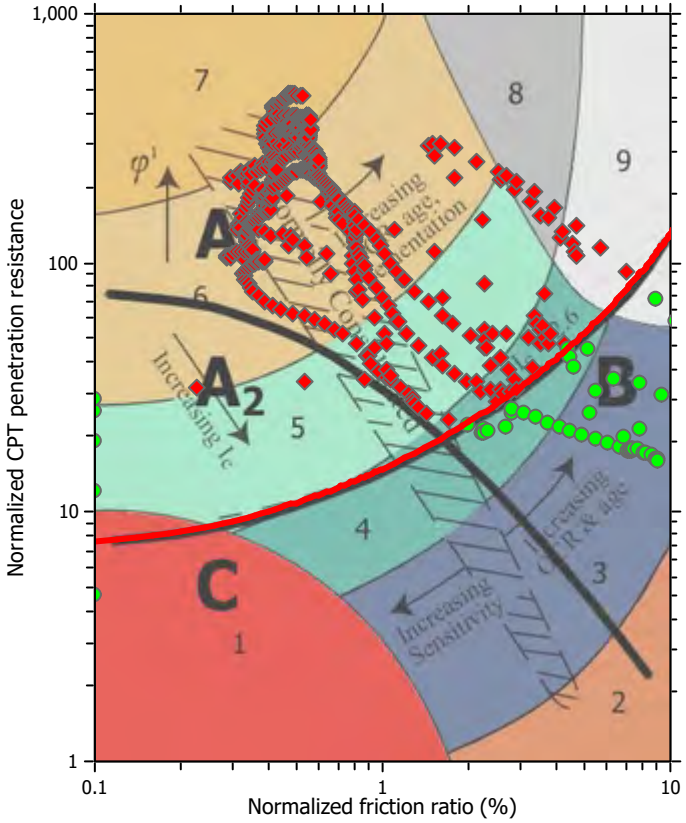
F.S. color scheme

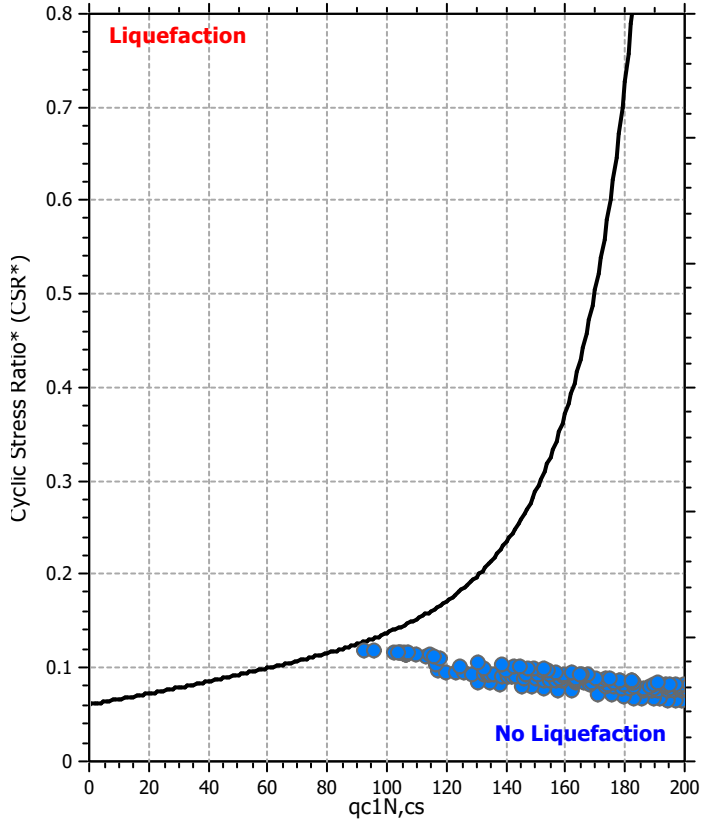
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

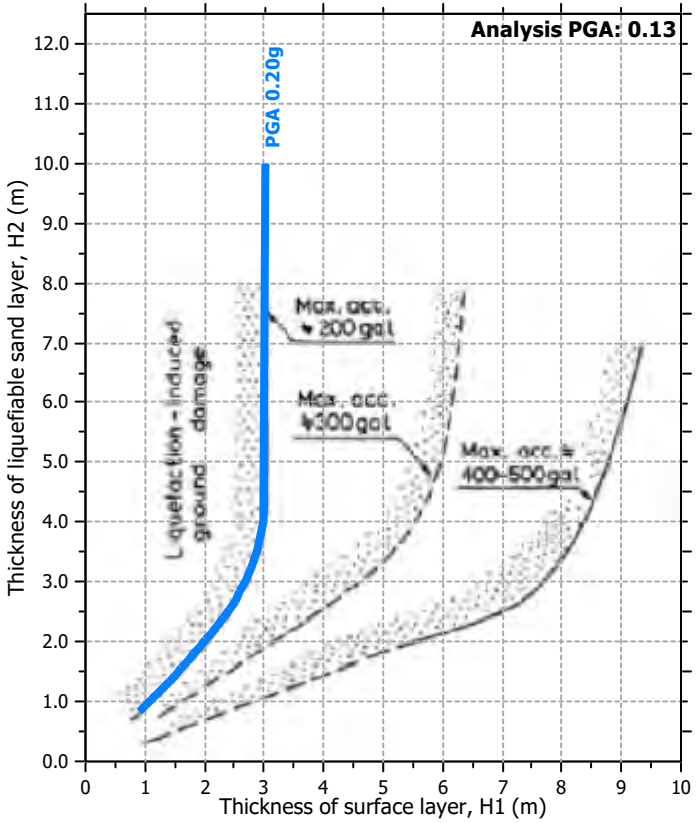
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



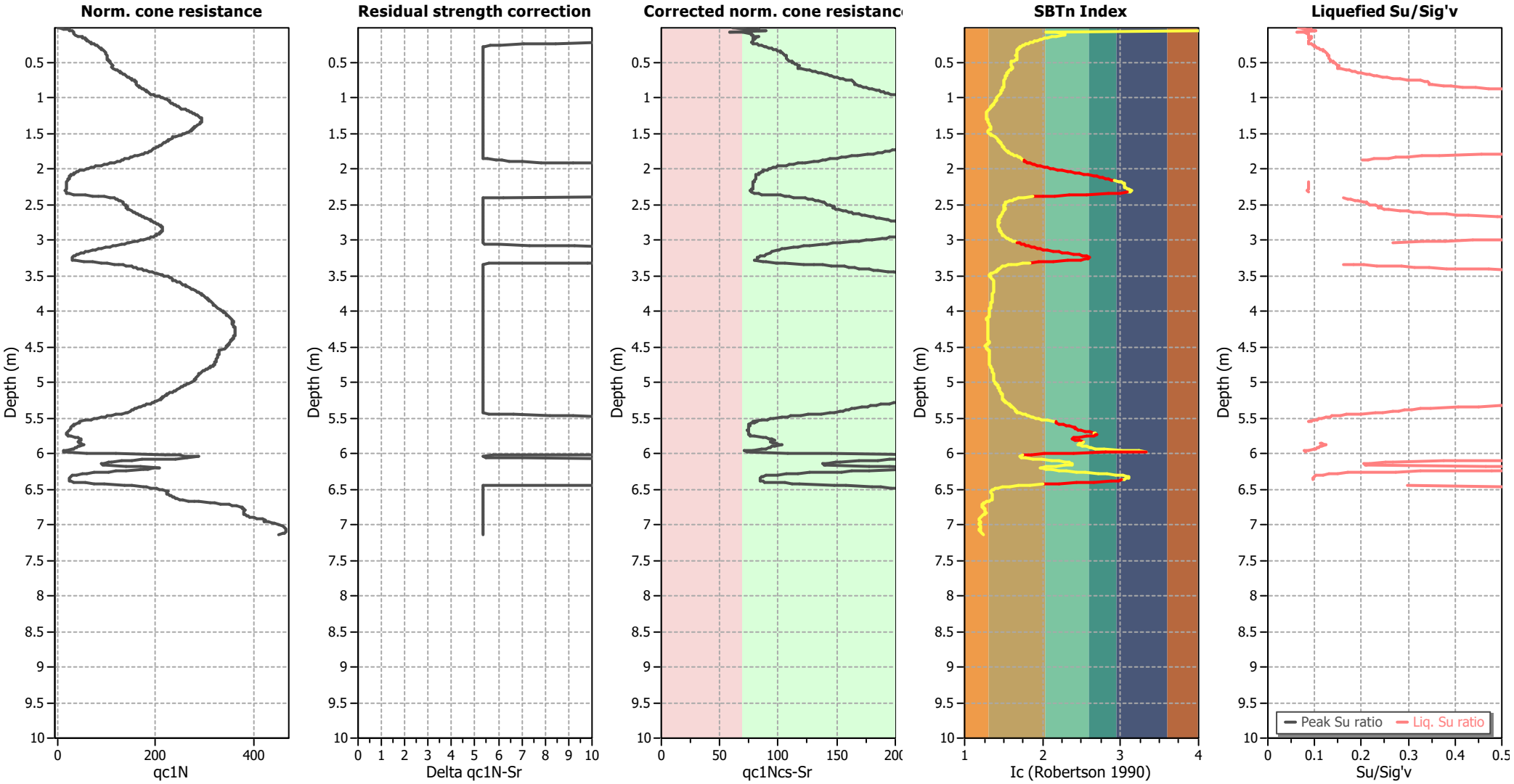




Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

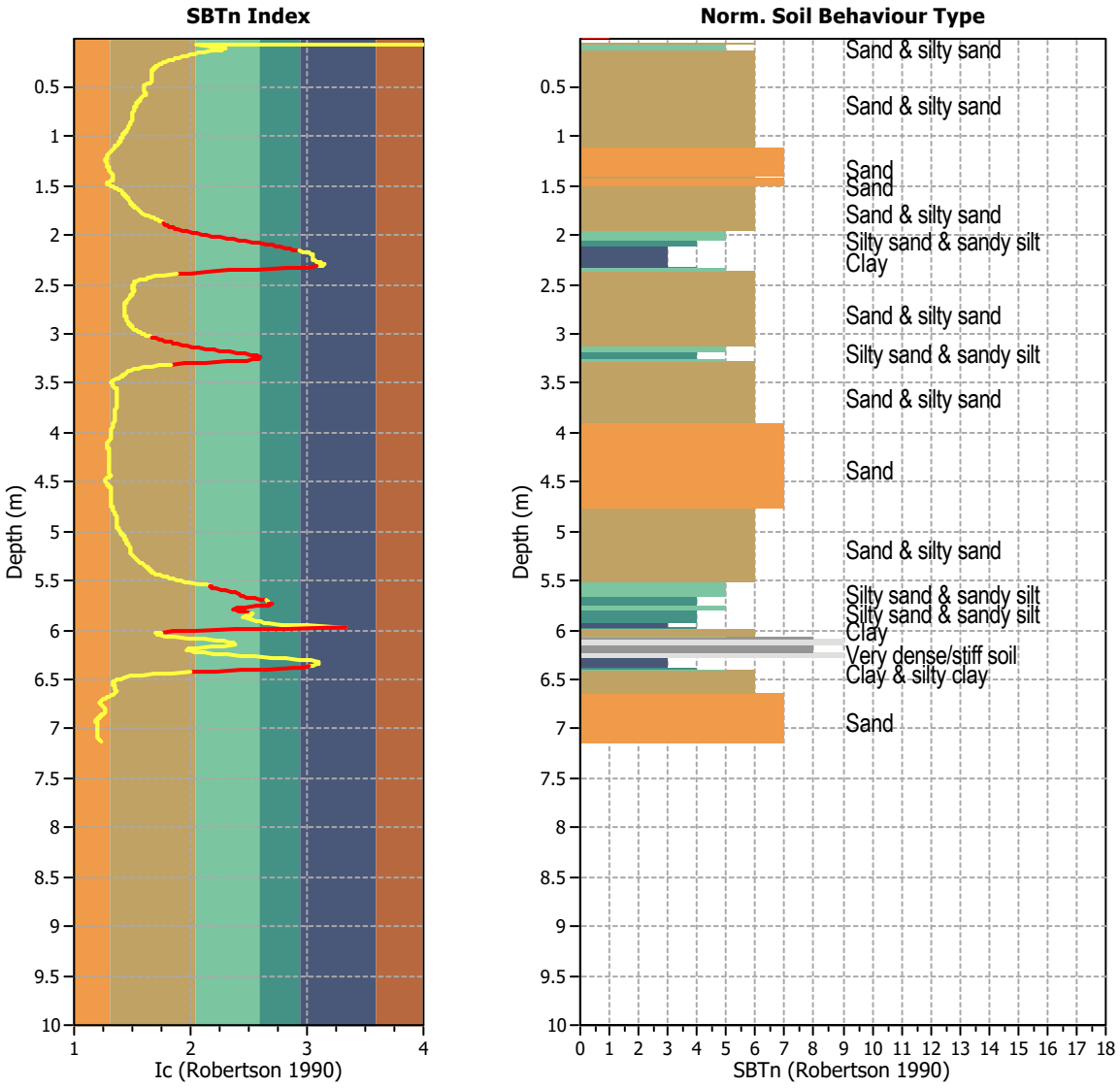
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

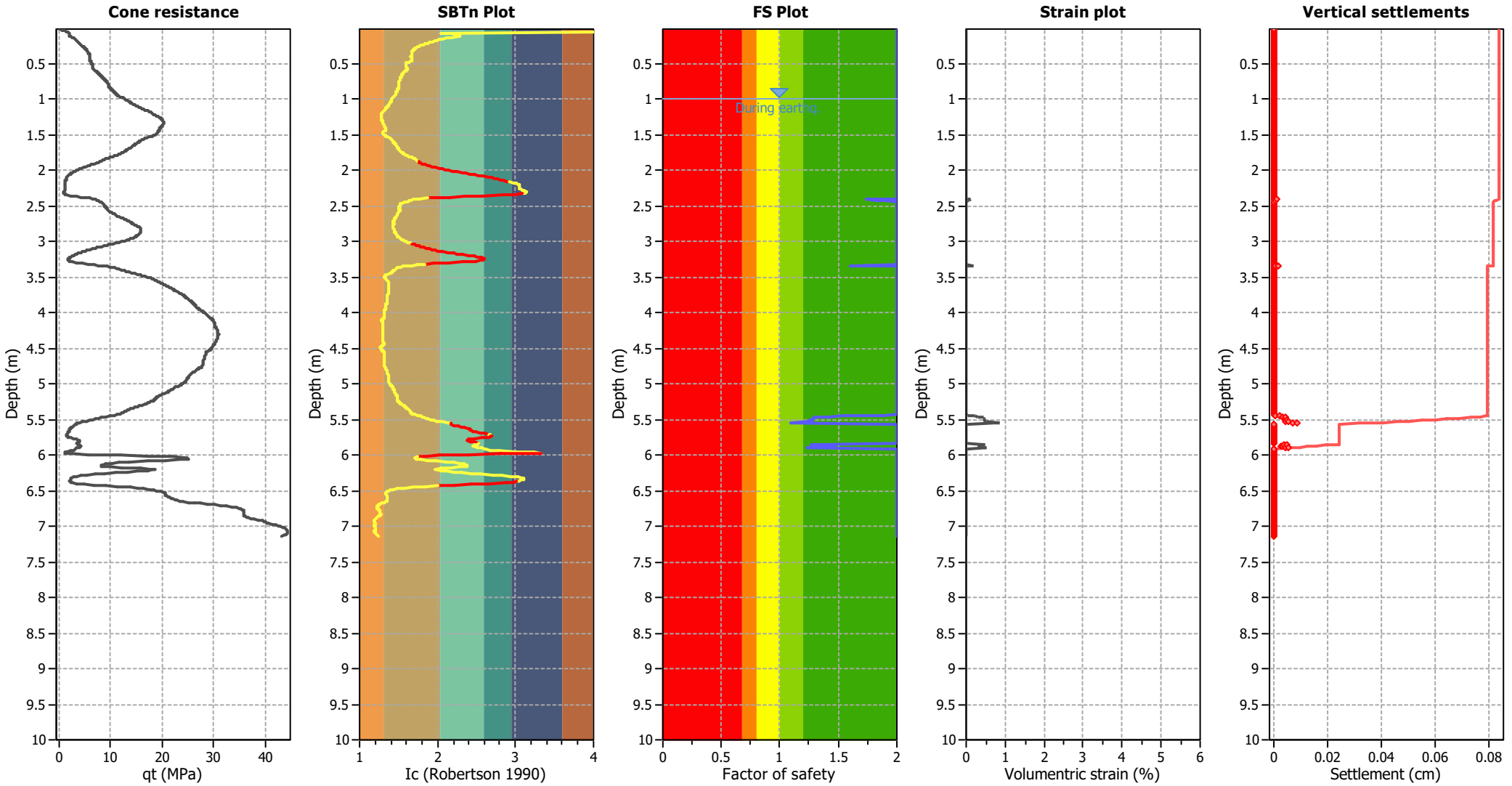
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	713
I_c maximum check value:	3.00	Total points excluded:	107
I_c change ratio value:	0.0100	Exclusion percentage:	15.01%
Minimum number of points in layer:	4	Number of layers detected:	9

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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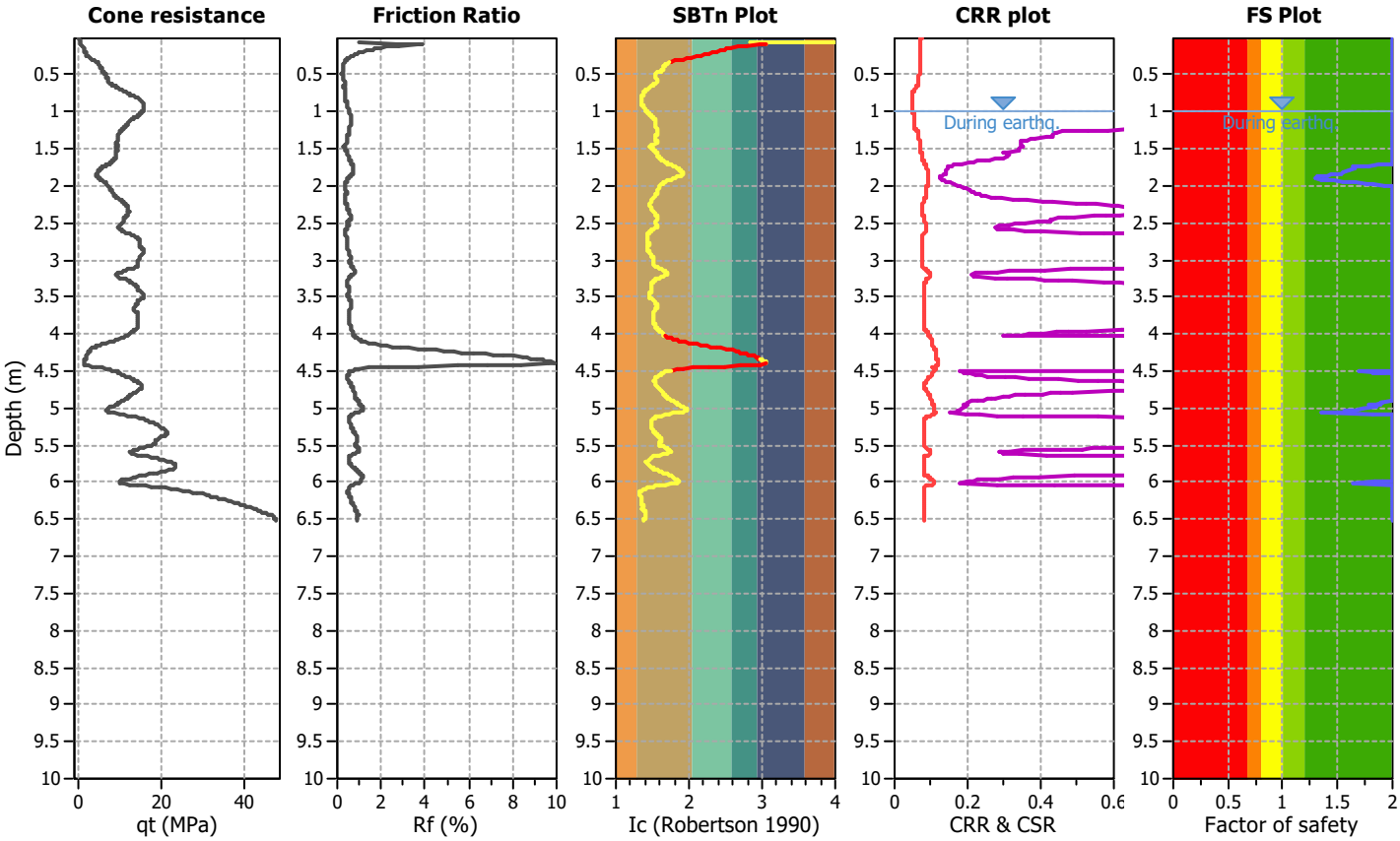
LIQUEFACTION ANALYSIS REPORT

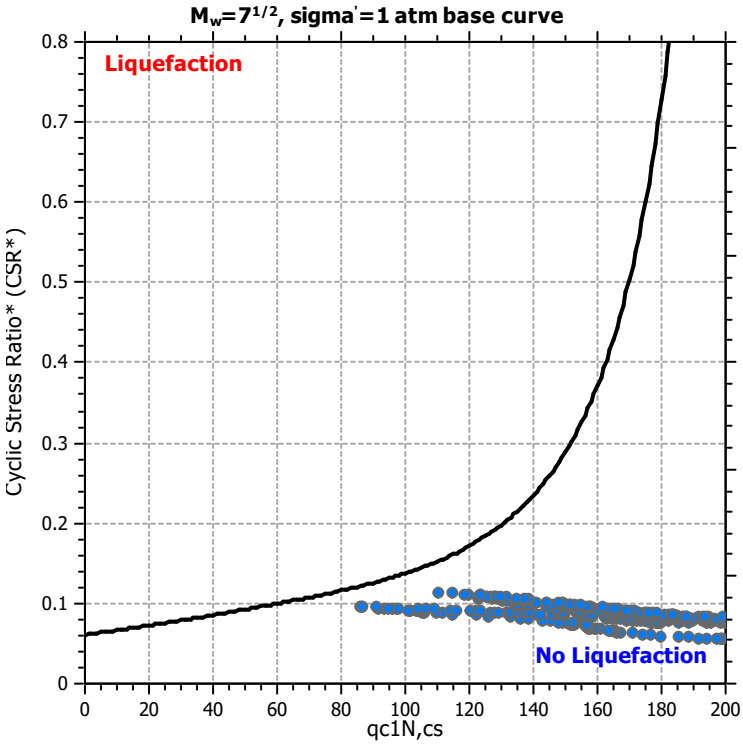
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

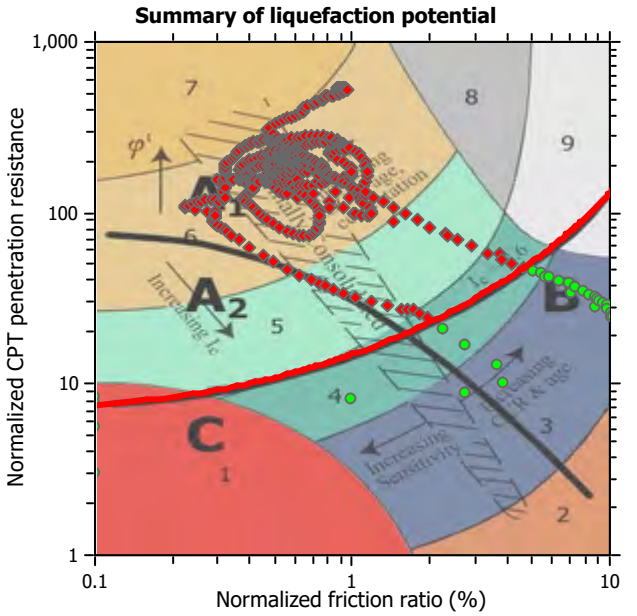
CPT file : CPT11_SLS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	6.40	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

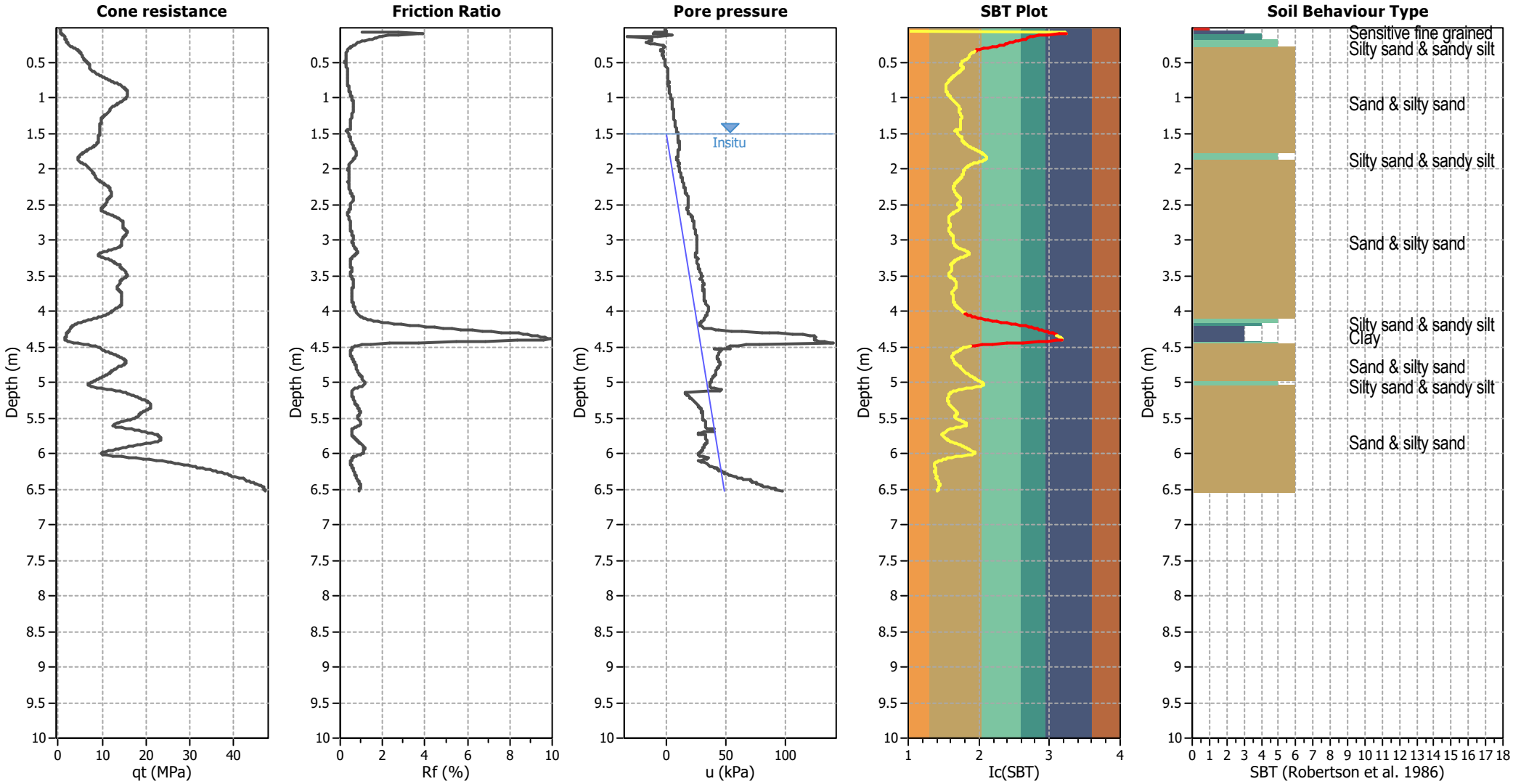






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



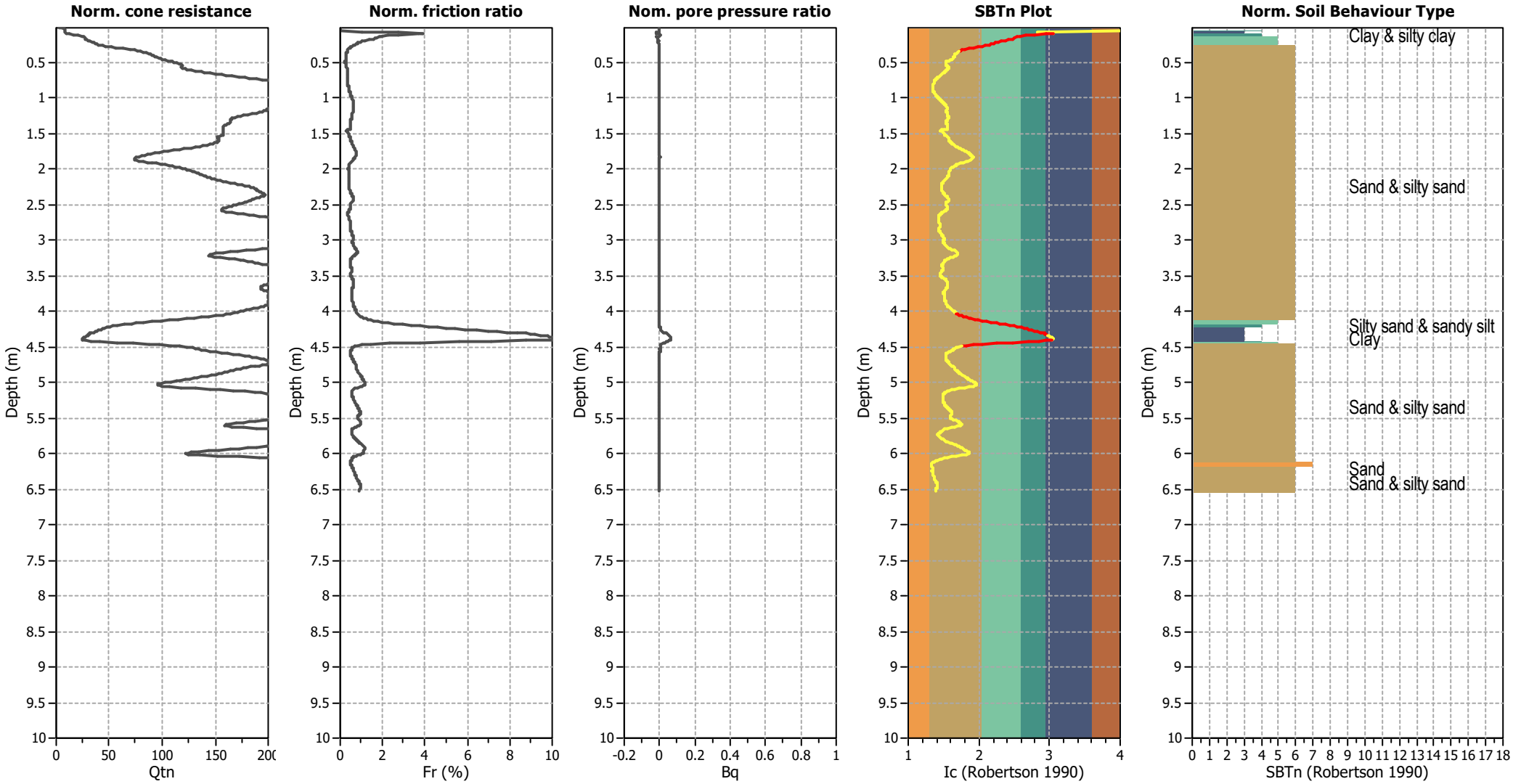
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



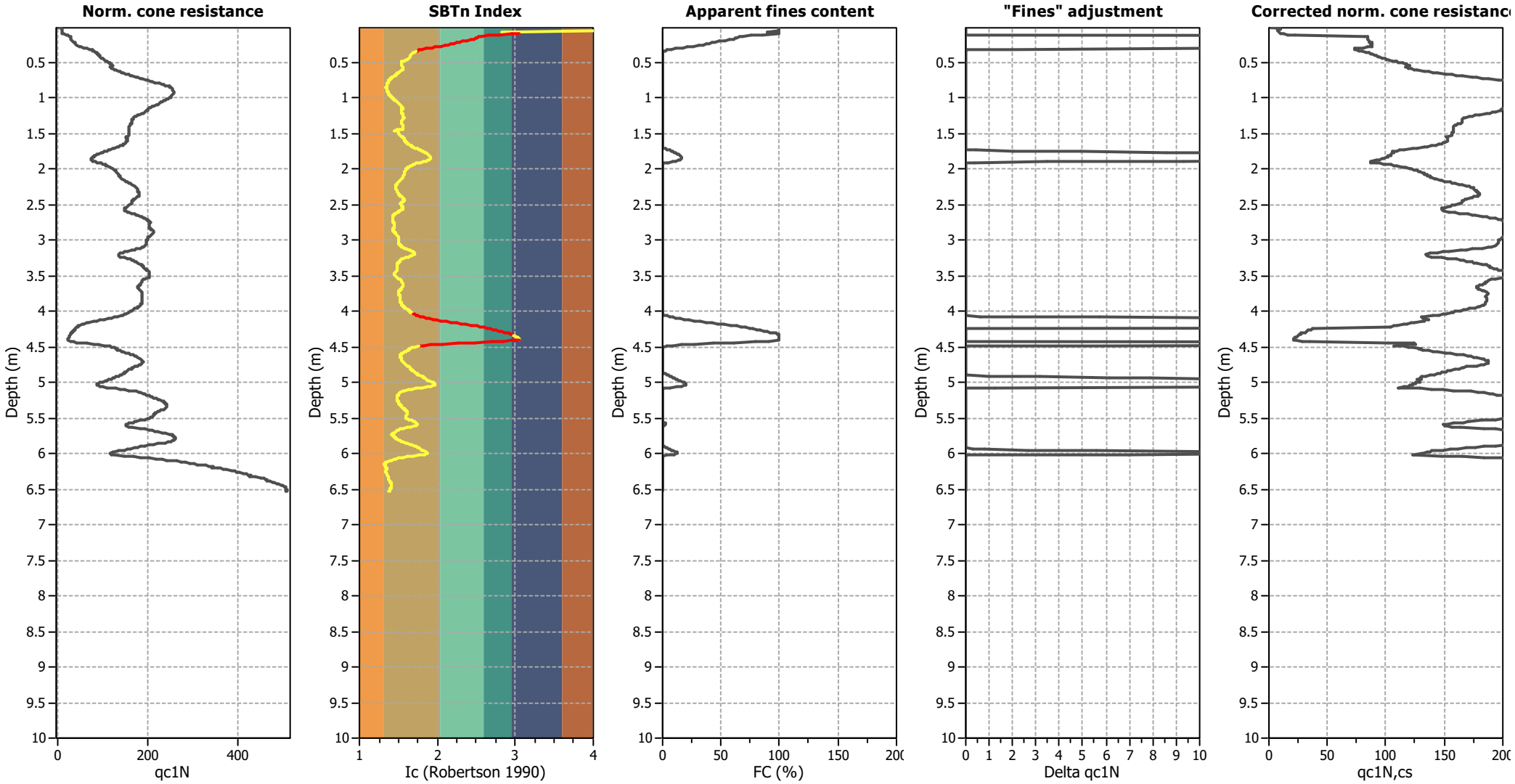
Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

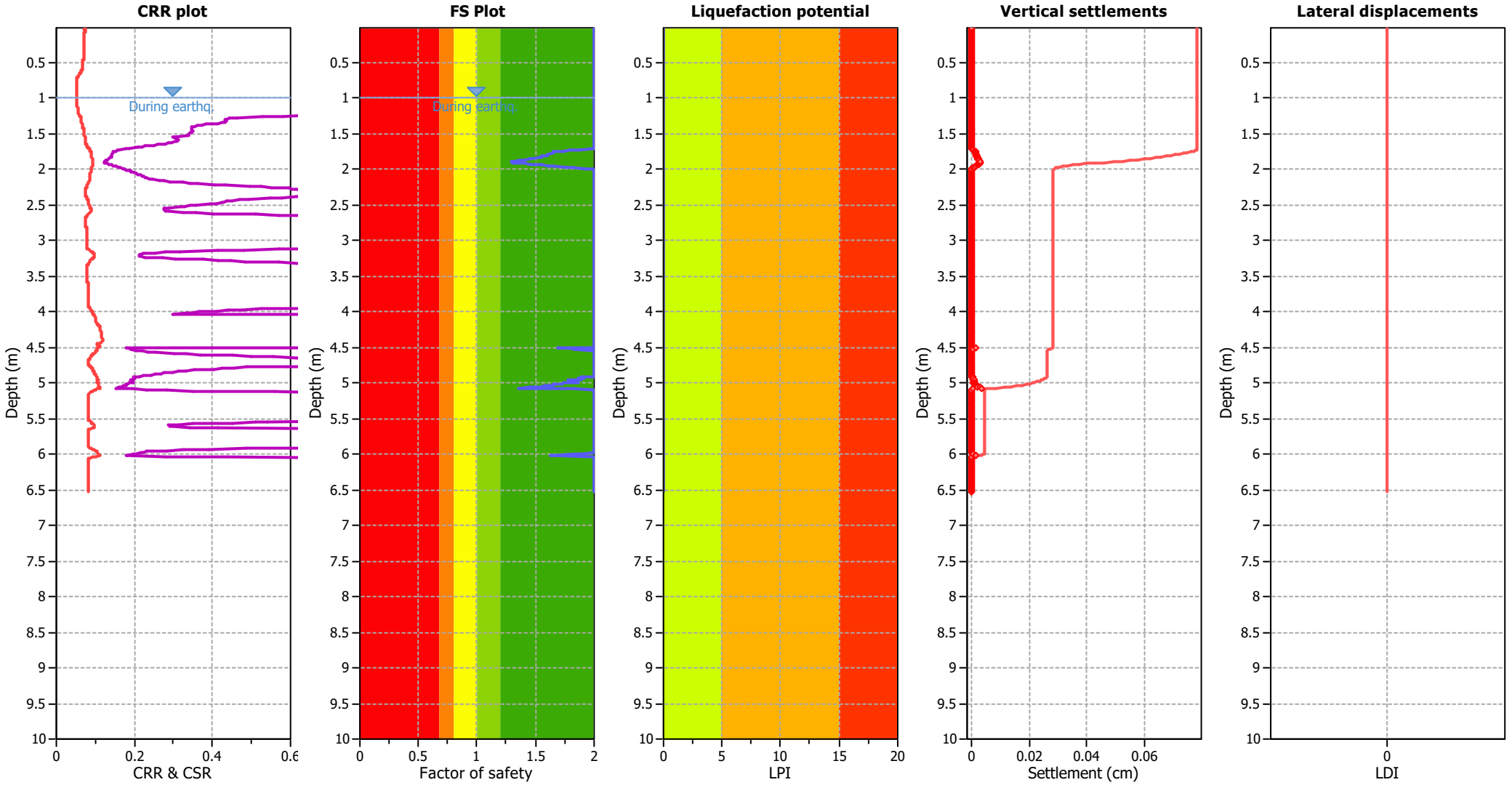
Liquefaction analysis overall plots (intermediate results)



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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

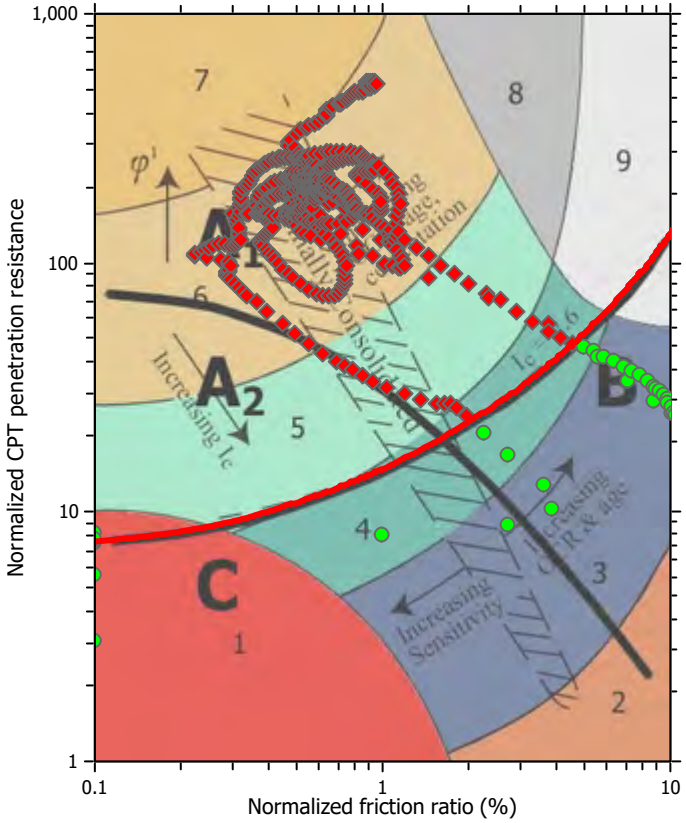
F.S. color scheme

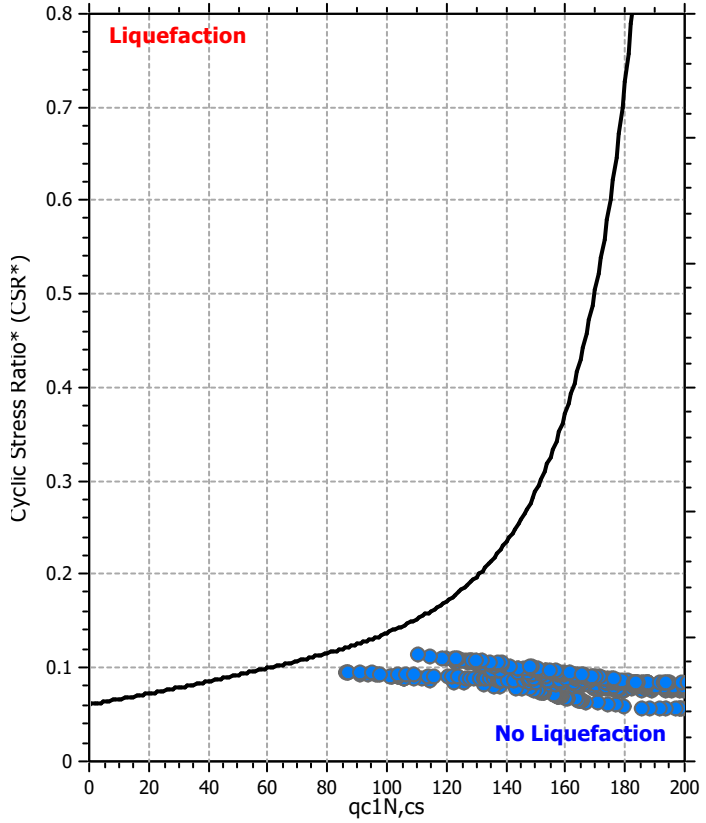
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

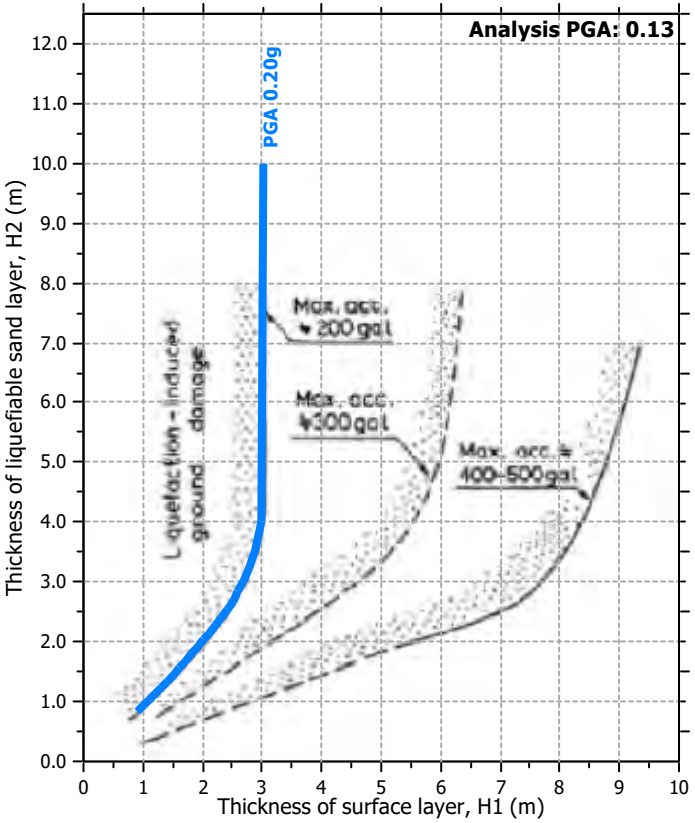
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



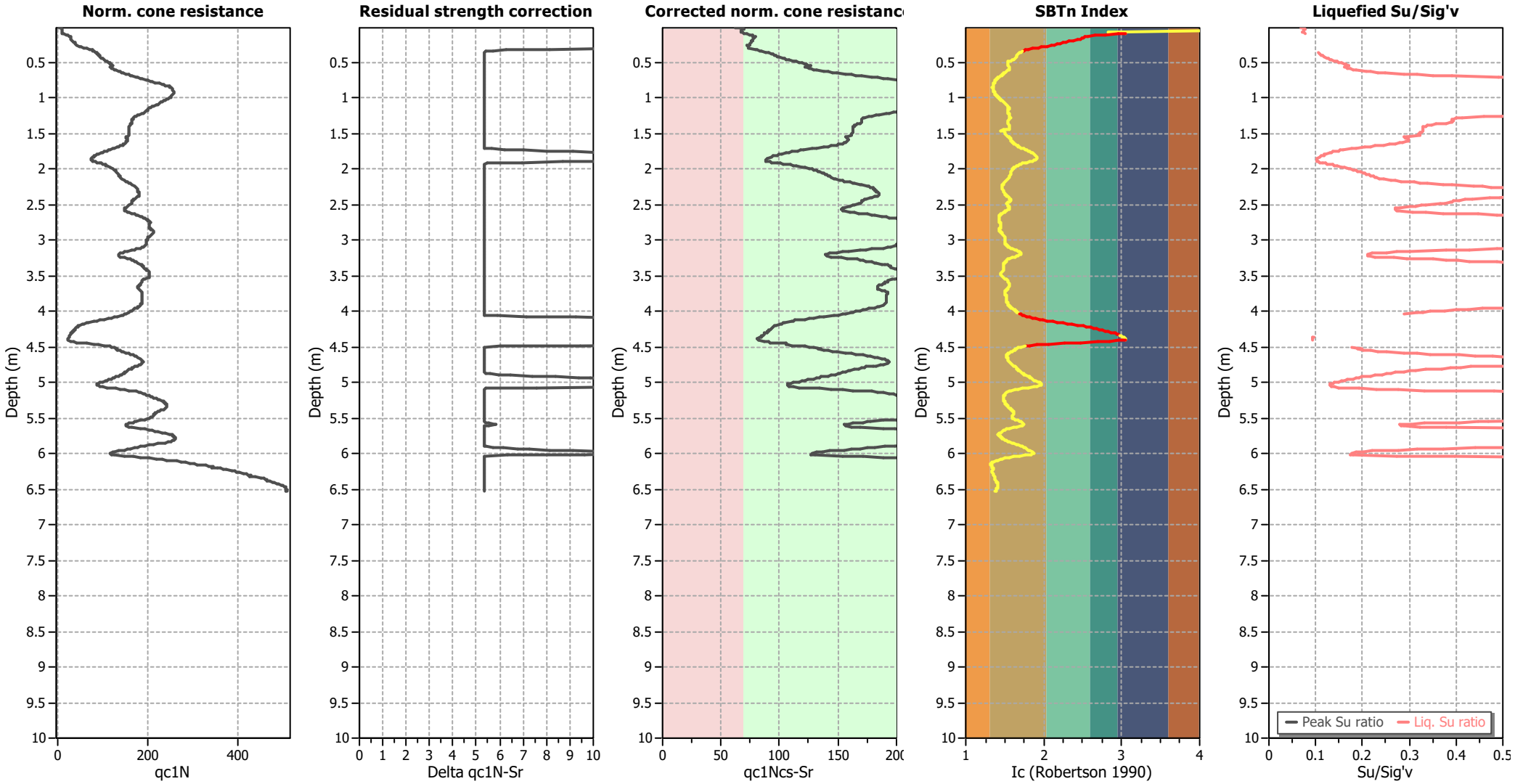




Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

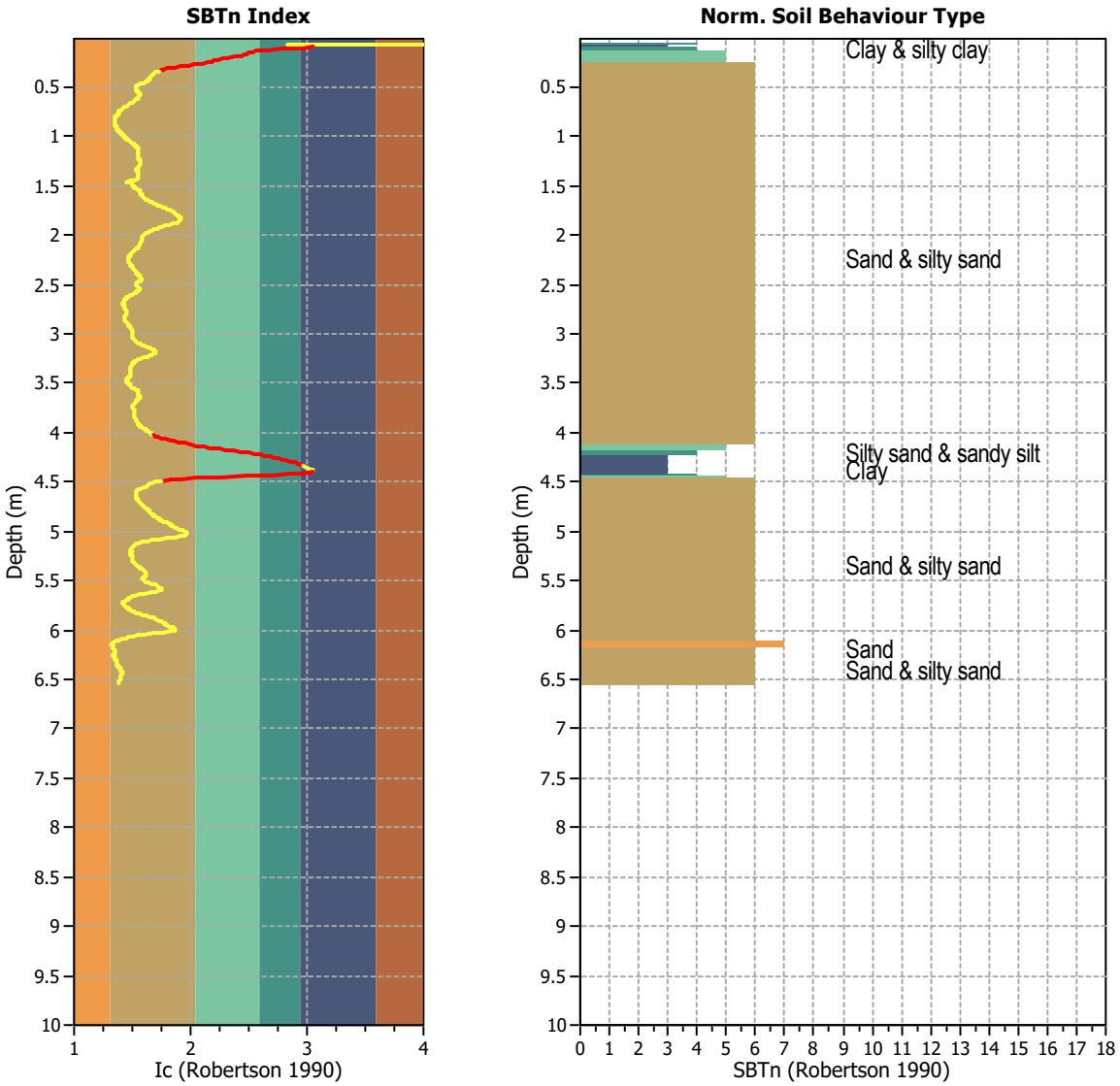
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

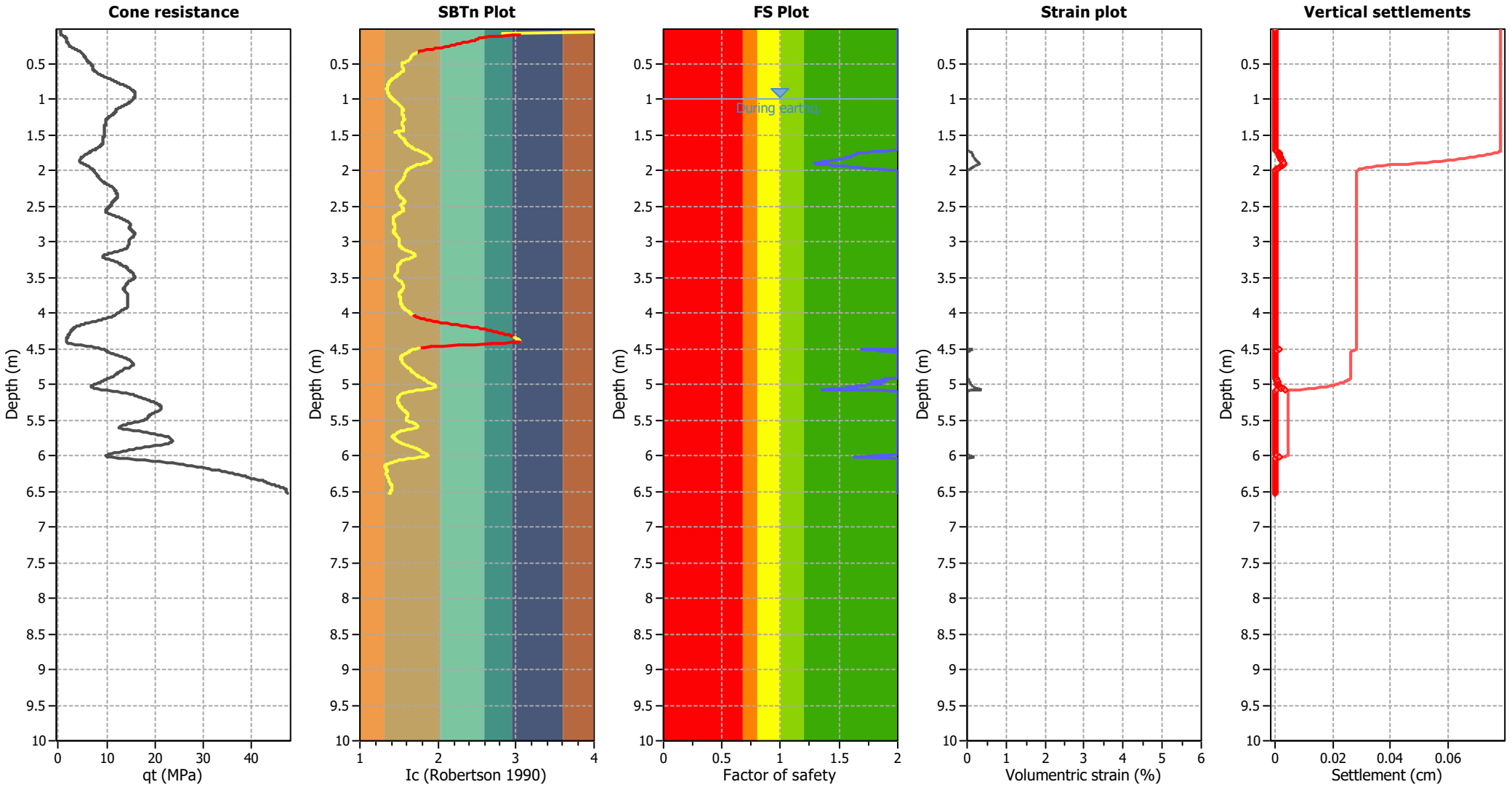
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	653
I_c maximum check value:	3.00	Total points excluded:	68
I_c change ratio value:	0.0100	Exclusion percentage:	10.41%
Minimum number of points in layer:	4	Number of layers detected:	3

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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www.btw.nz

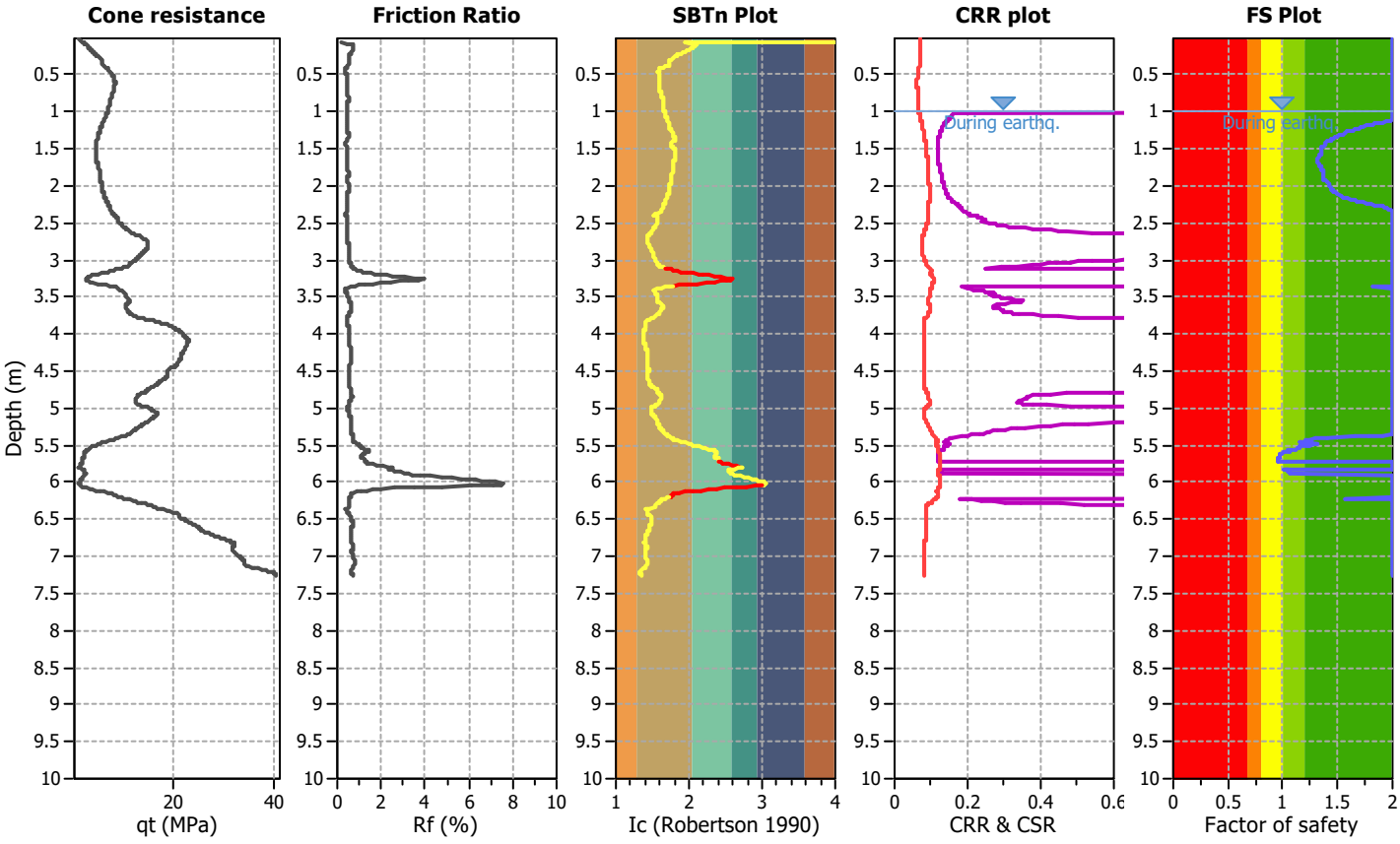
LIQUEFACTION ANALYSIS REPORT

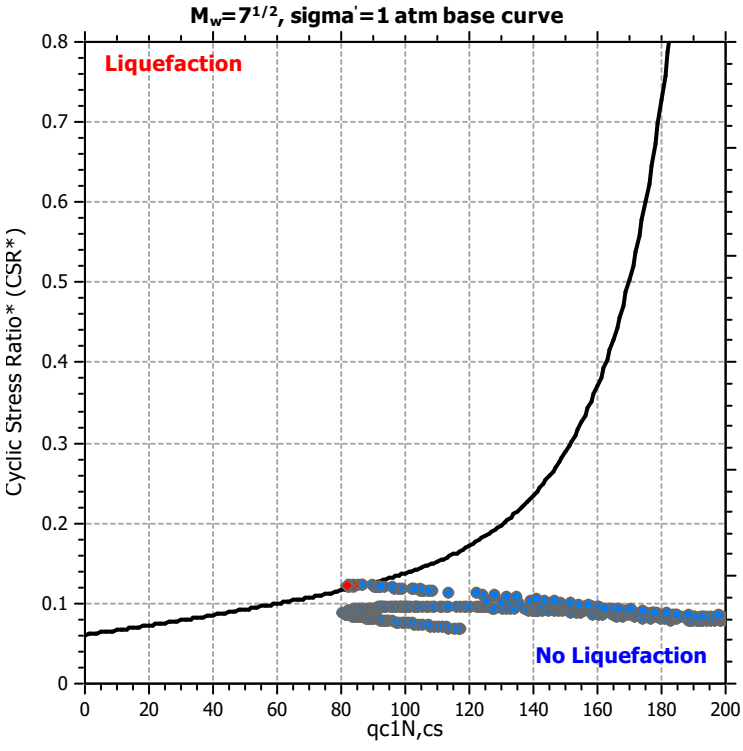
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

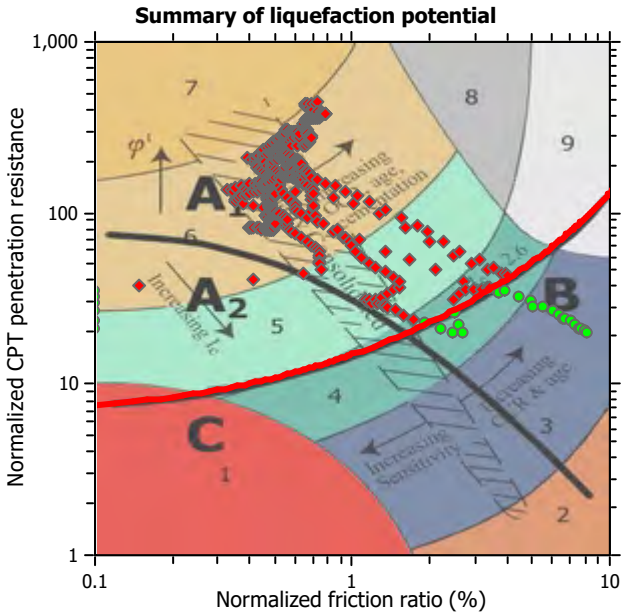
CPT file : CPT12_SLS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	6.40	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

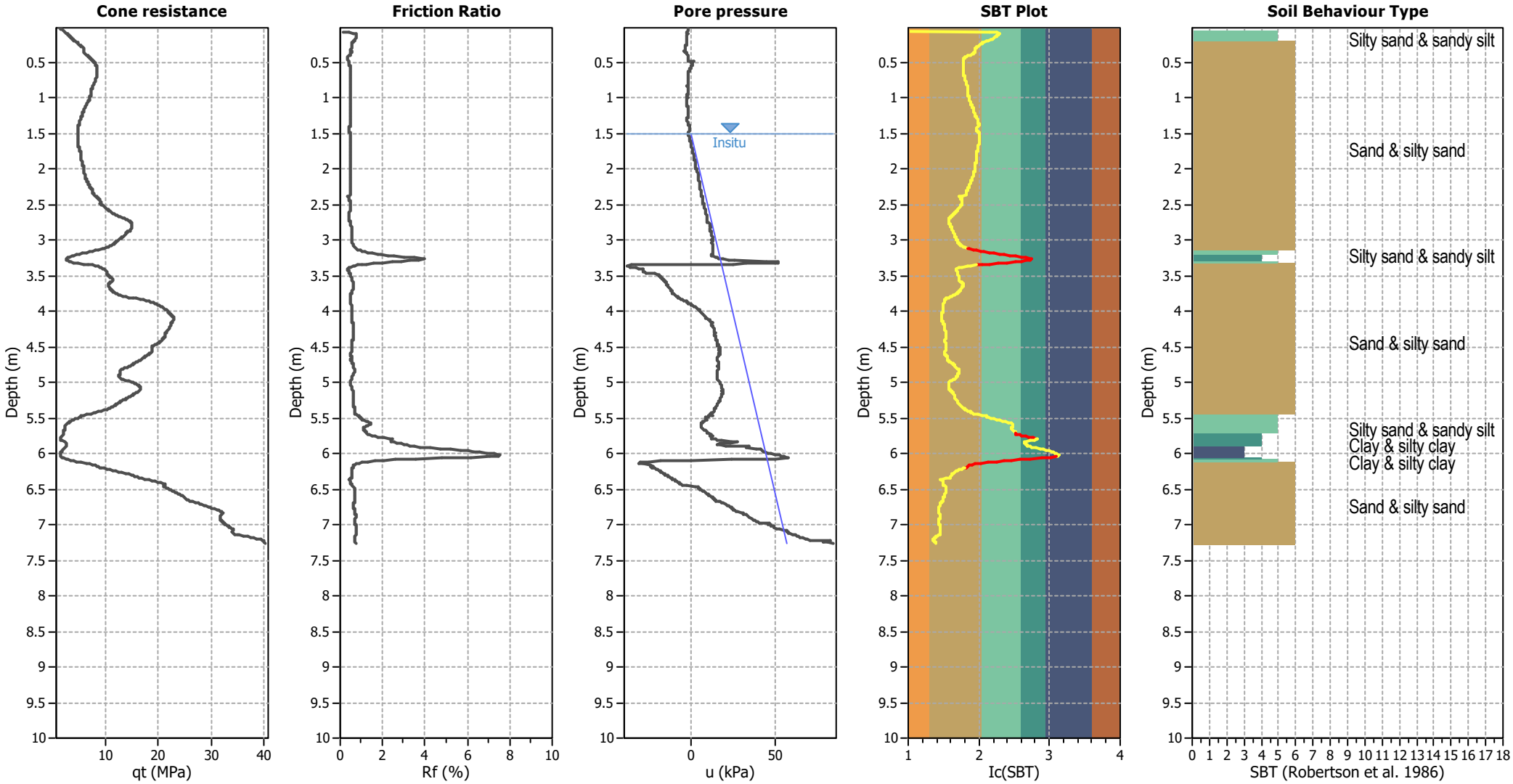






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



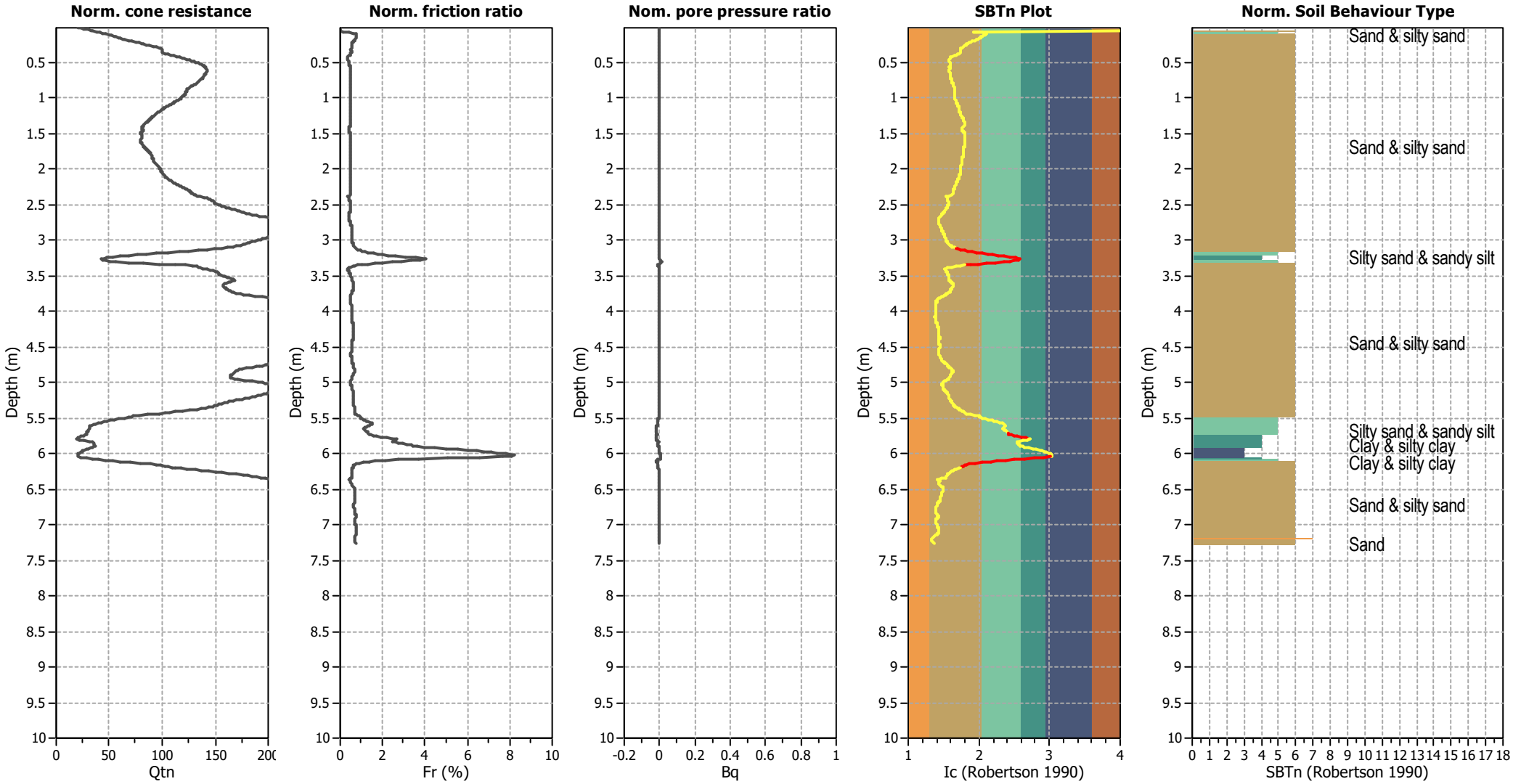
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



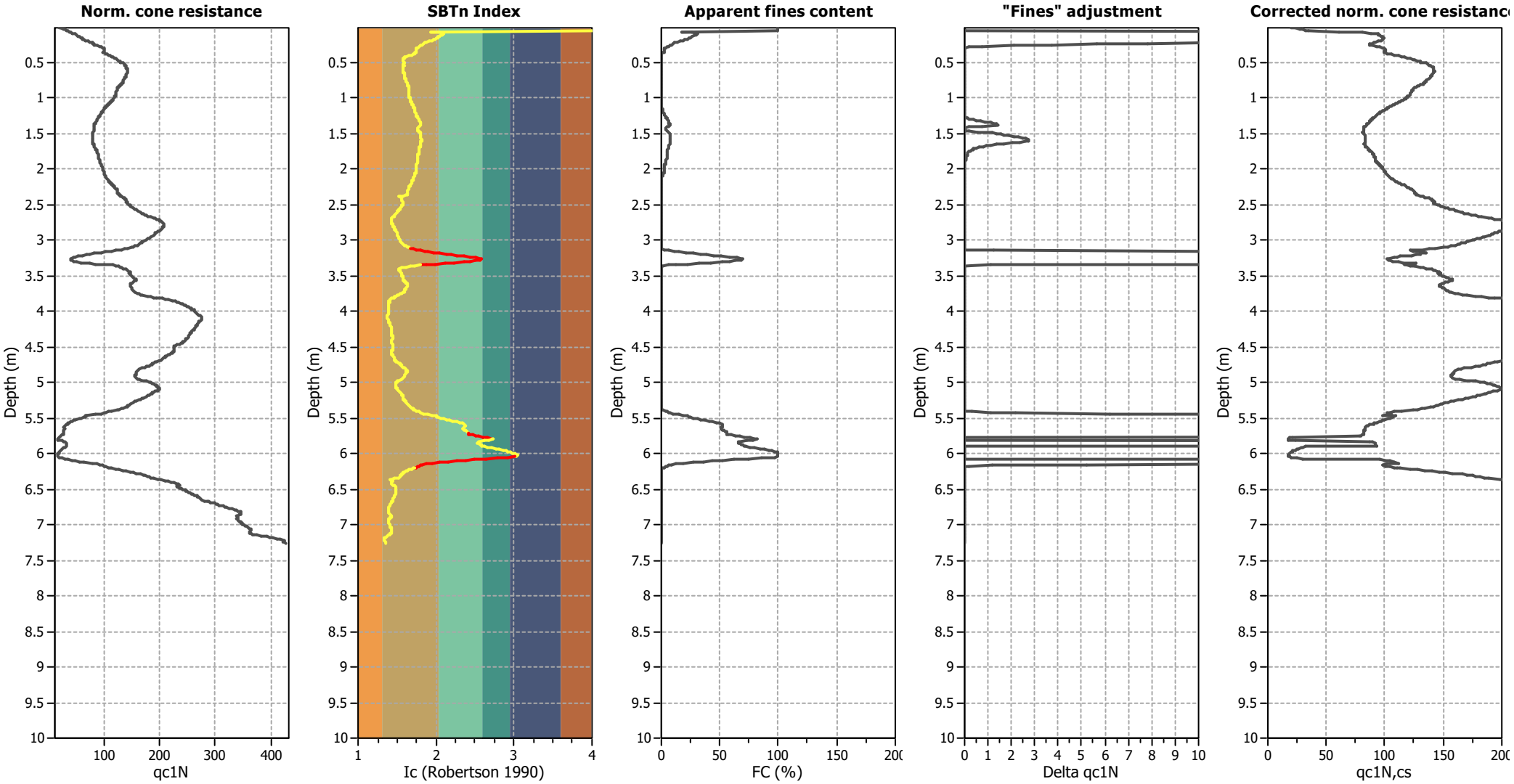
Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

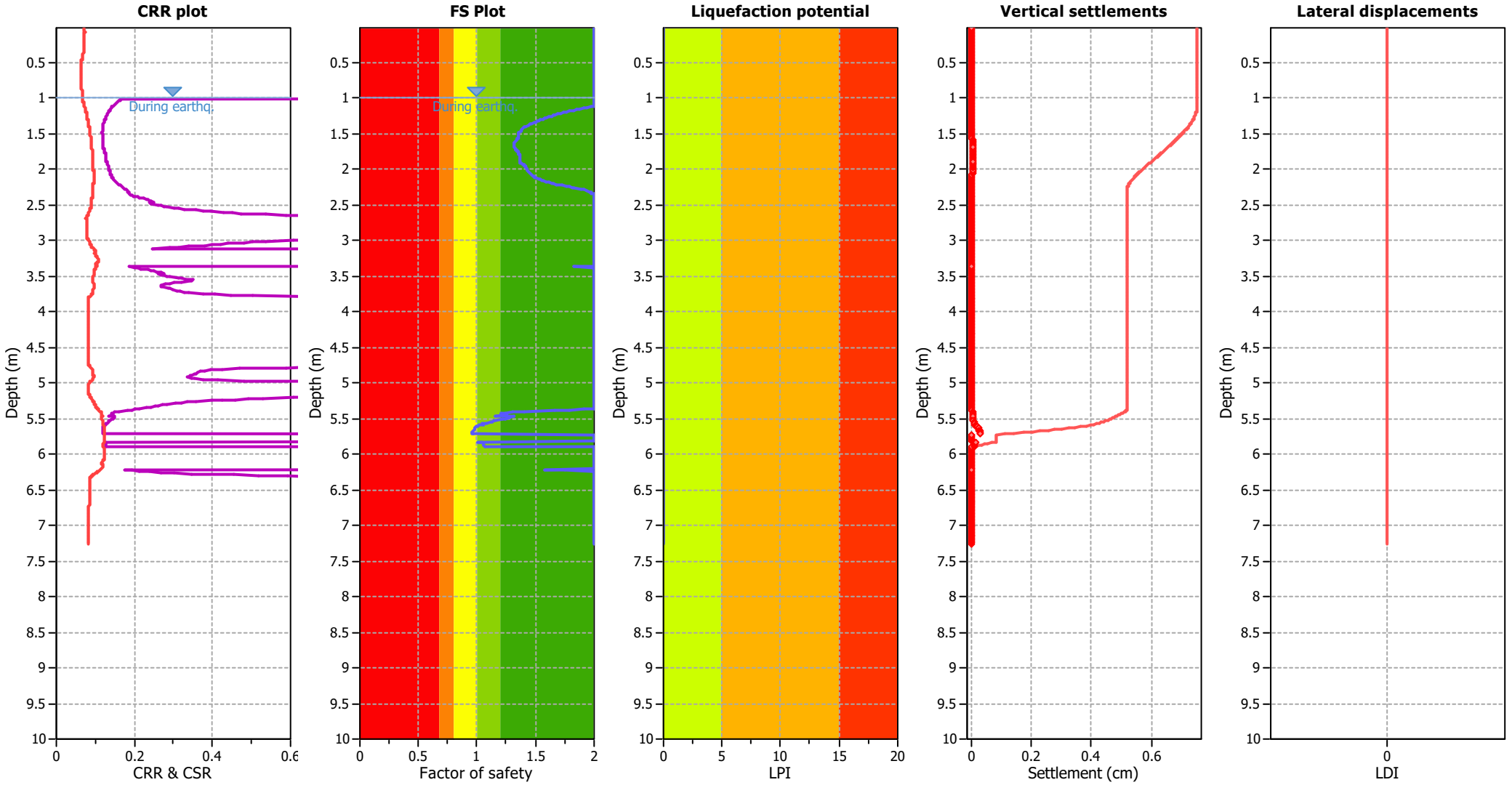
Liquefaction analysis overall plots (intermediate results)



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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

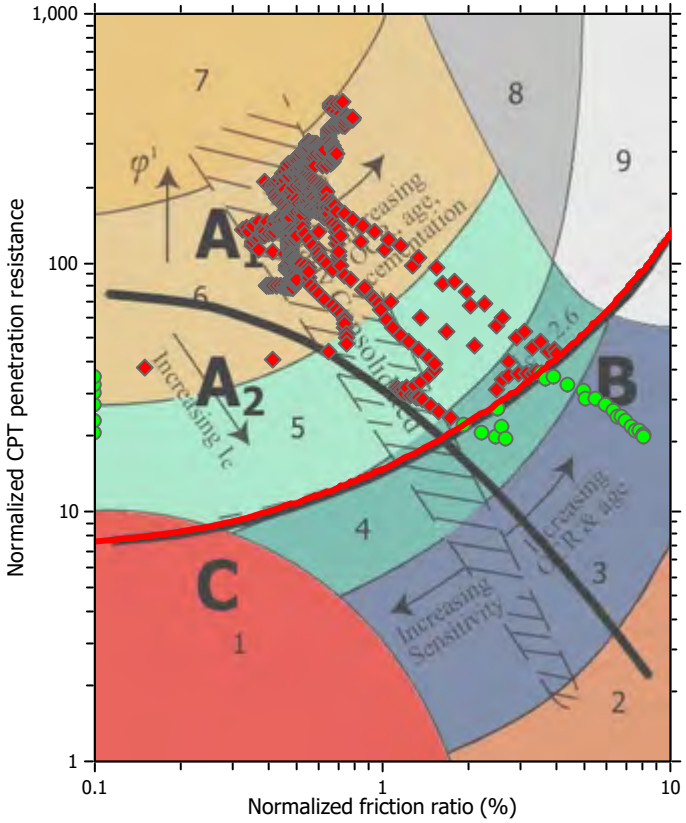
F.S. color scheme

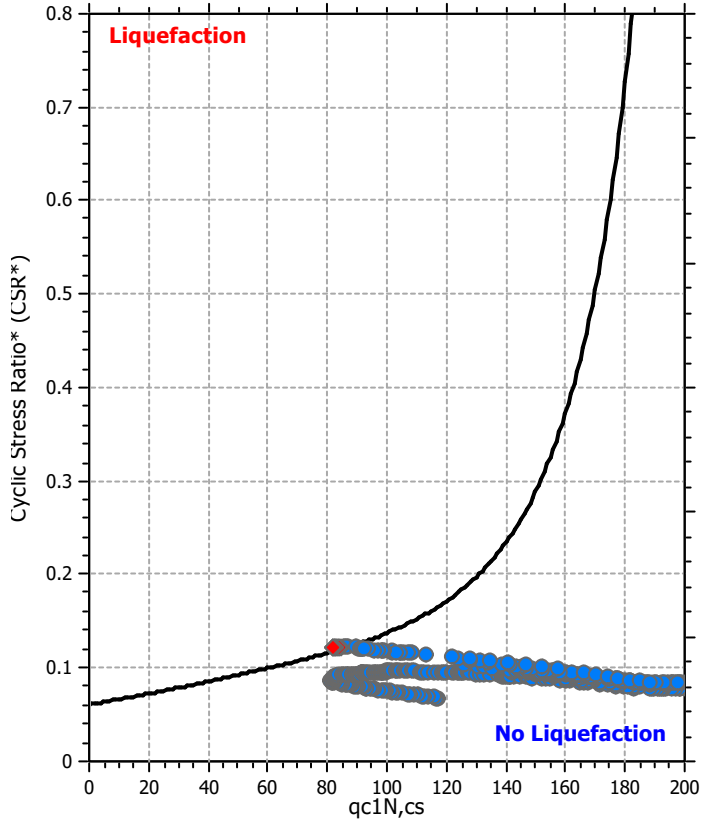
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

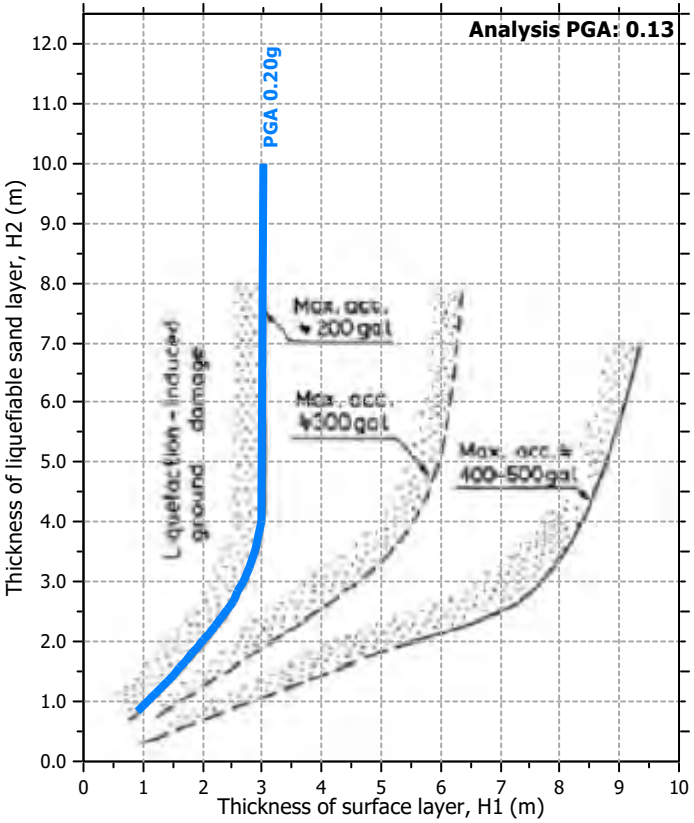
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



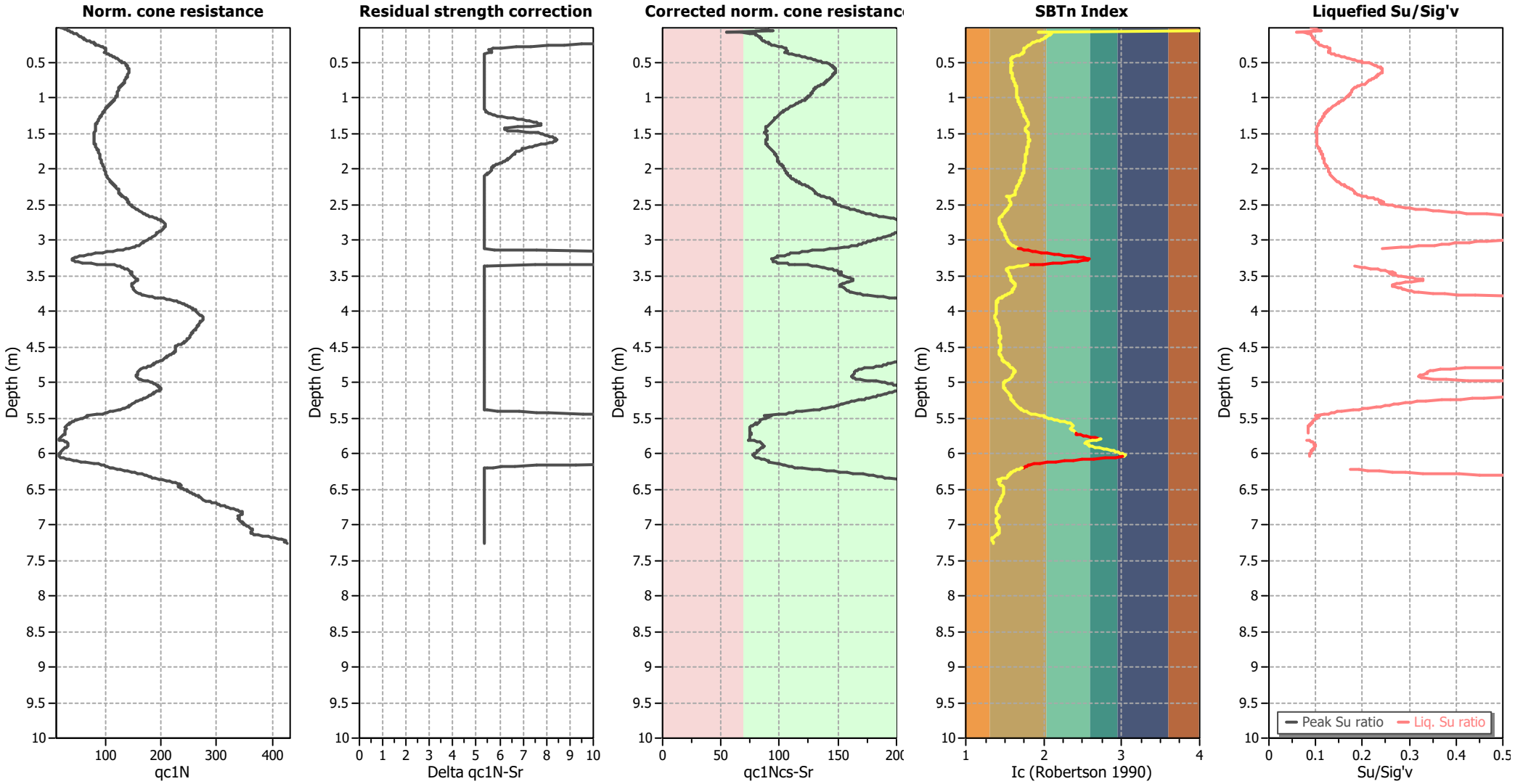




Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

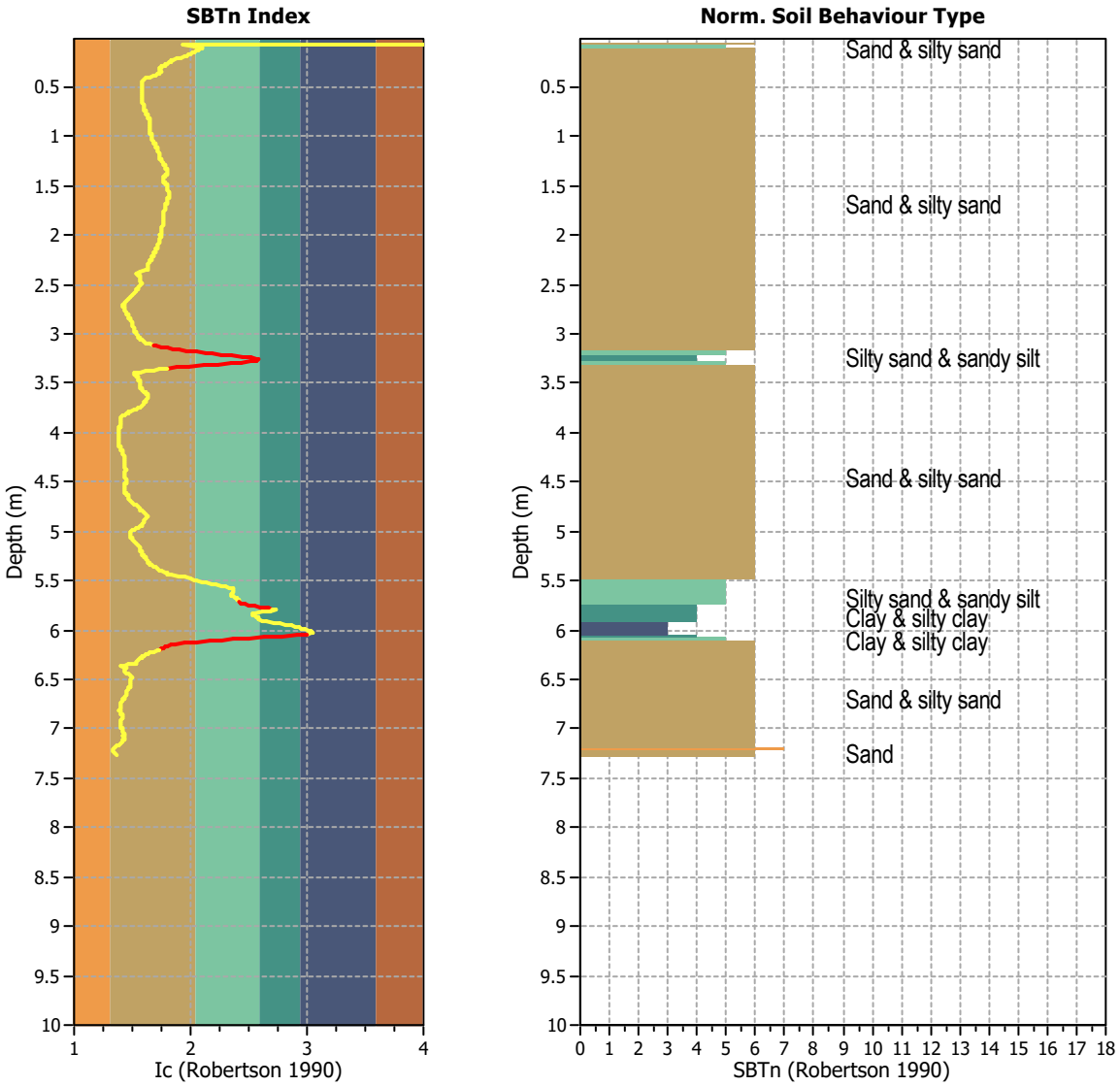
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

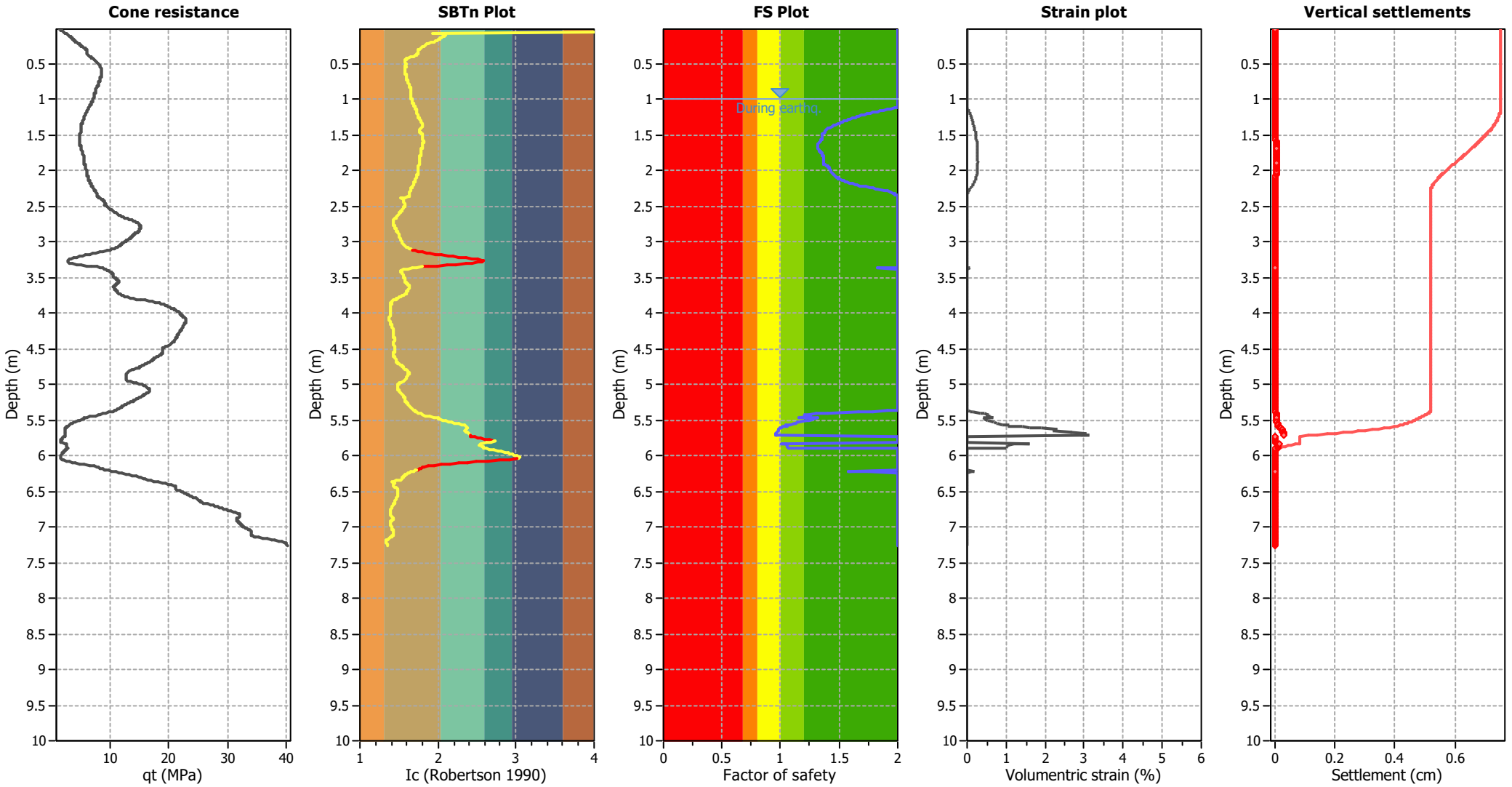
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	726
I_c maximum check value:	3.00	Total points excluded:	52
I_c change ratio value:	0.0100	Exclusion percentage:	7.16%
Minimum number of points in layer:	4	Number of layers detected:	4

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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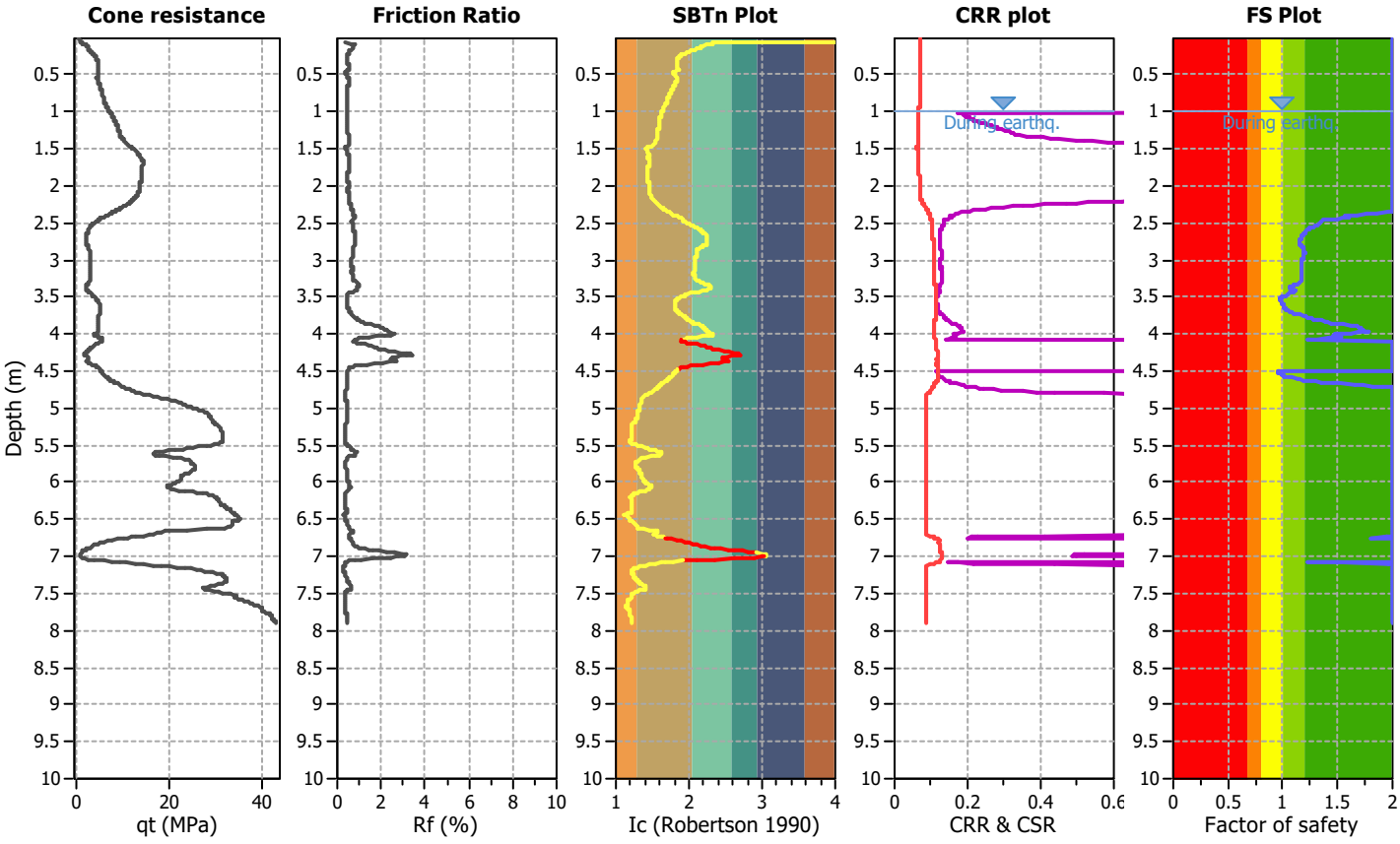
LIQUEFACTION ANALYSIS REPORT

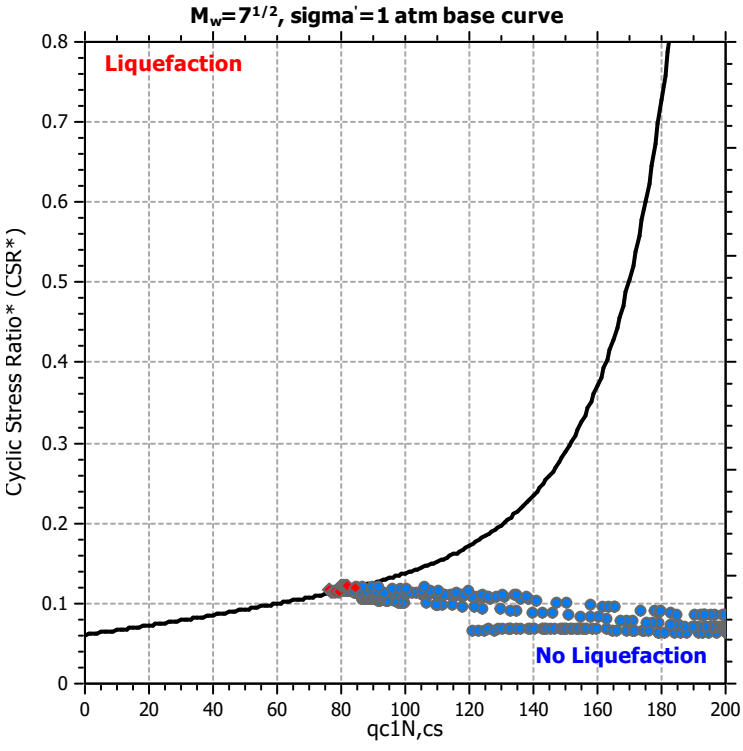
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

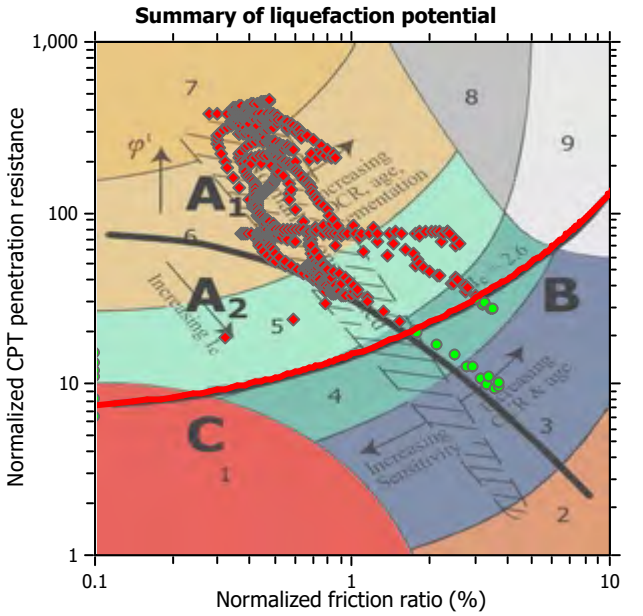
CPT file : CPT13_SLS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	6.40	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

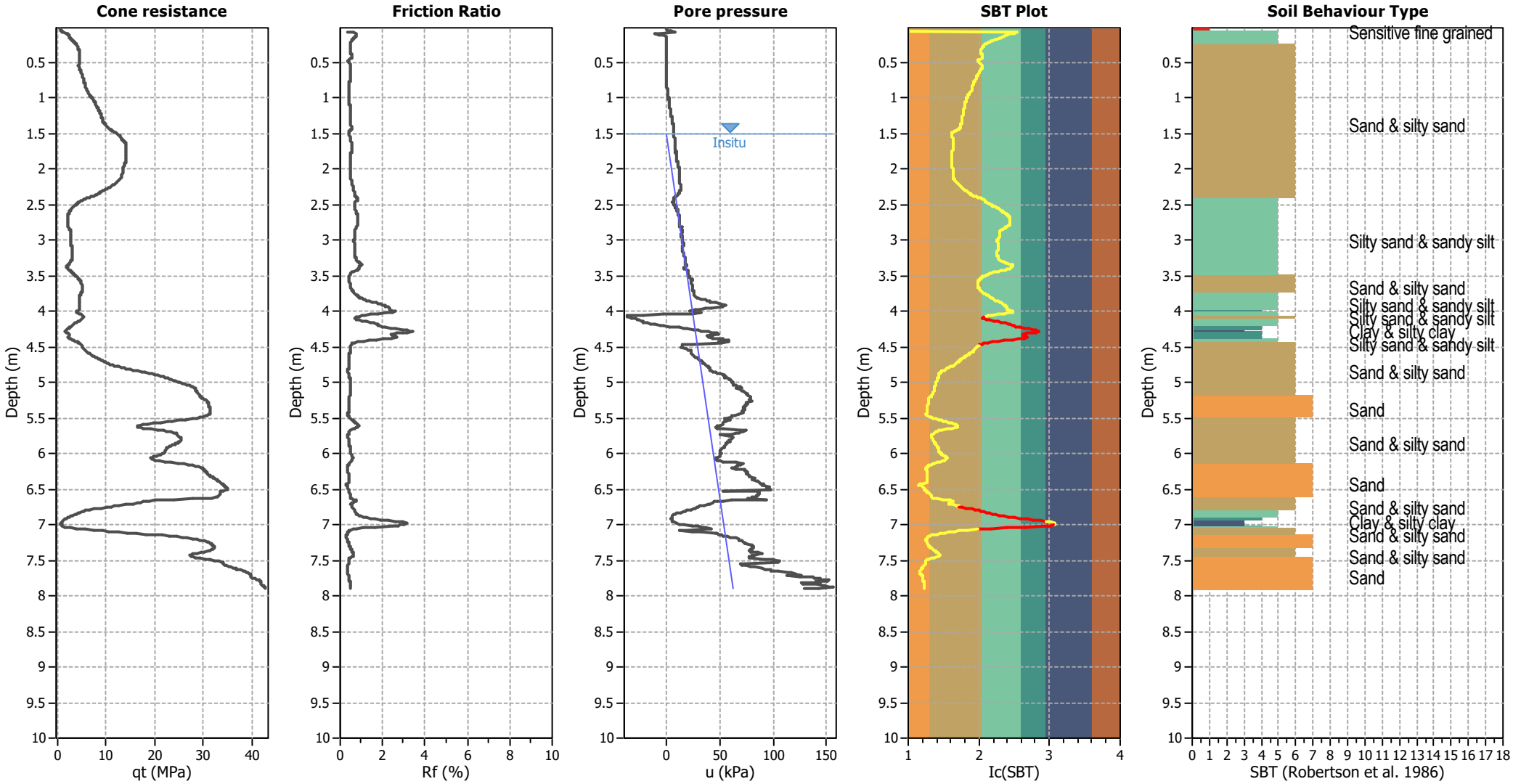






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



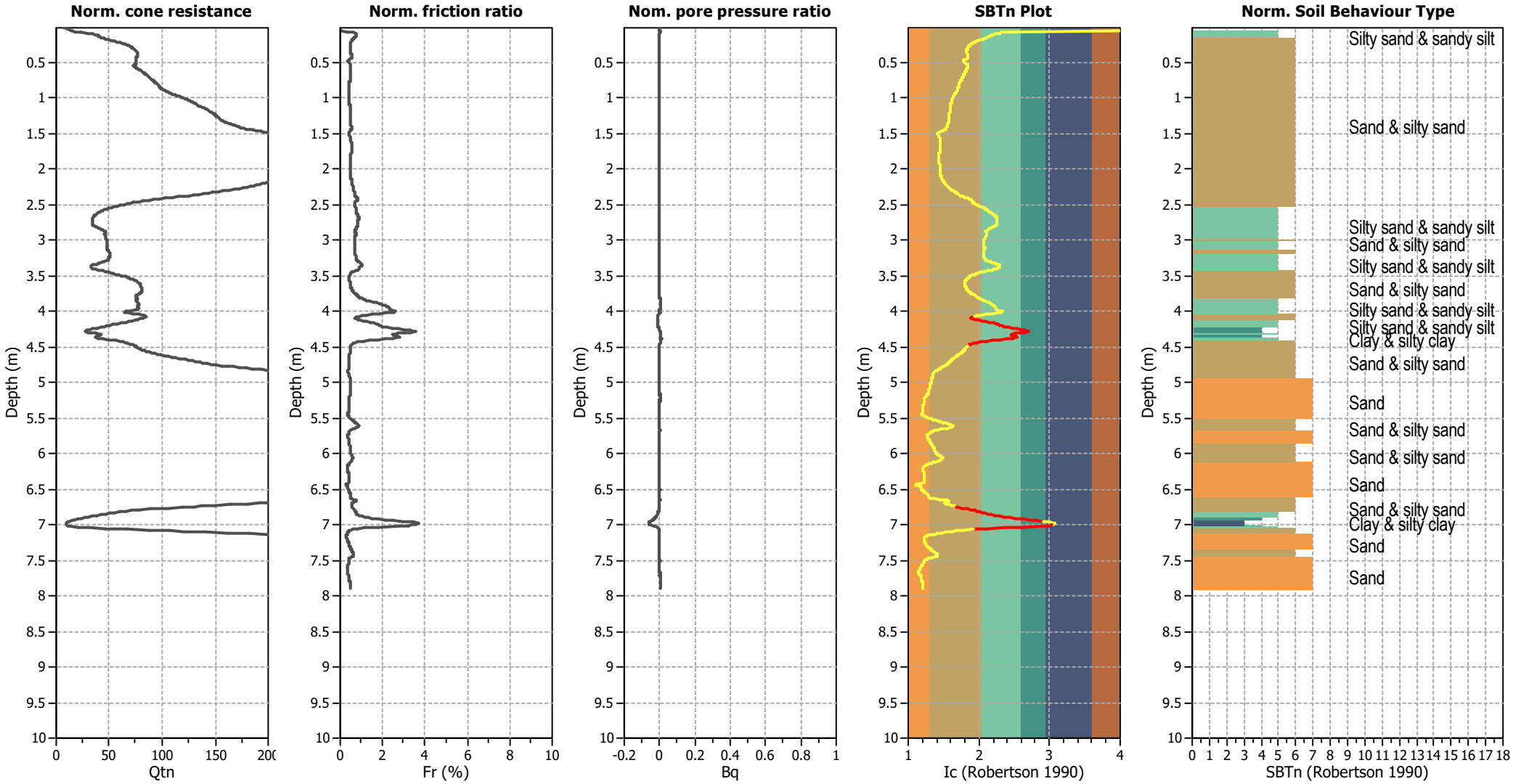
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



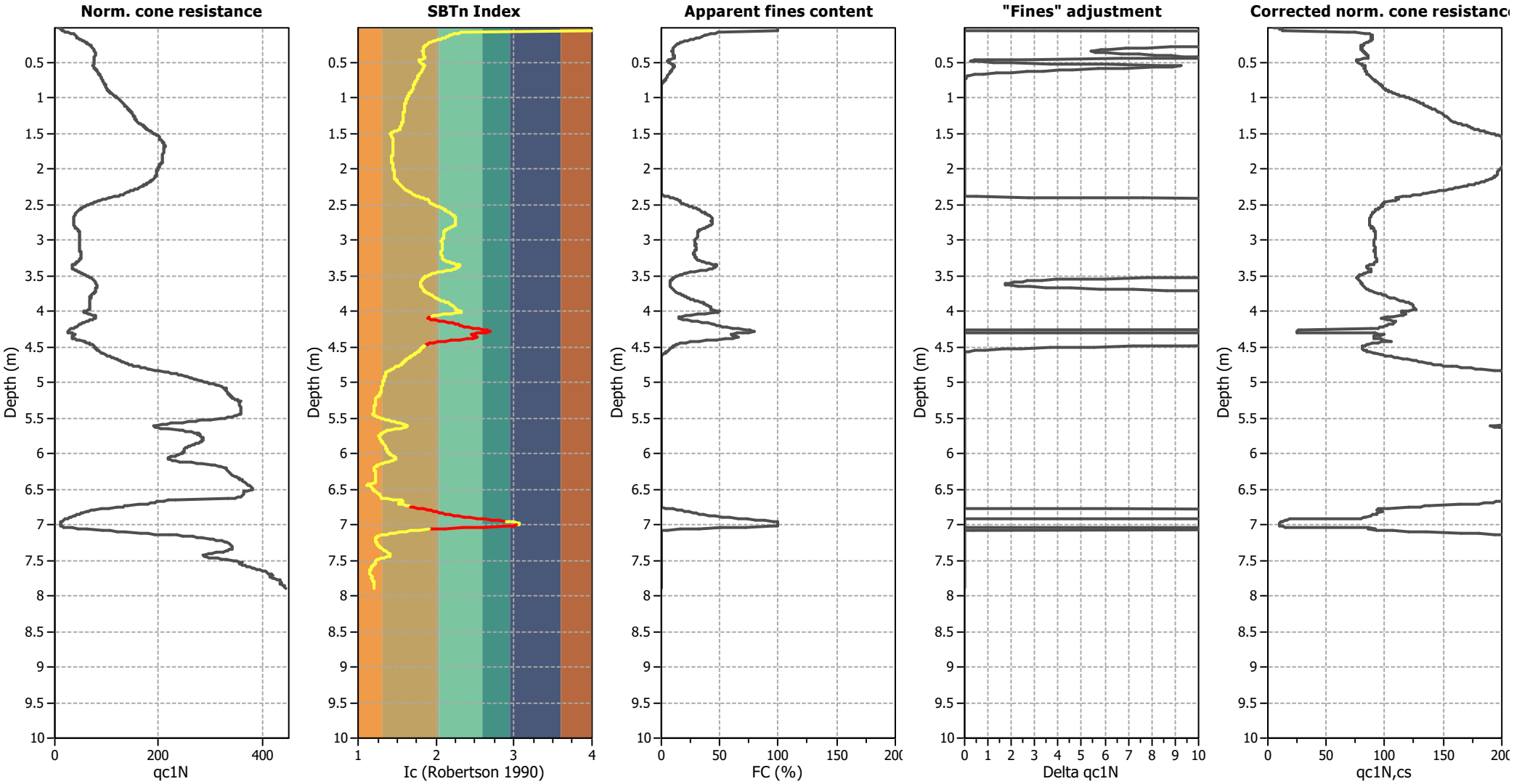
Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

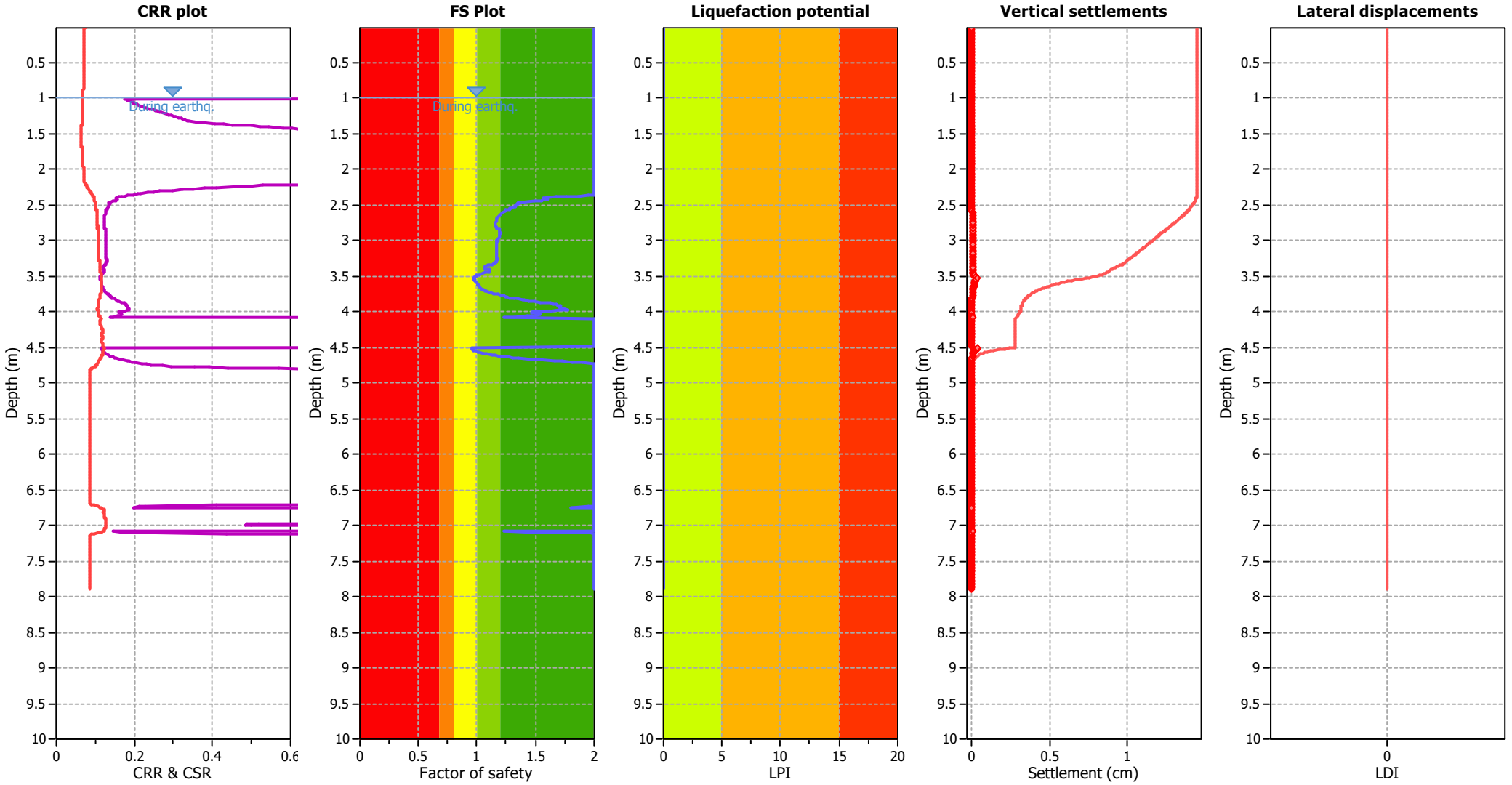
Liquefaction analysis overall plots (intermediate results)



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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

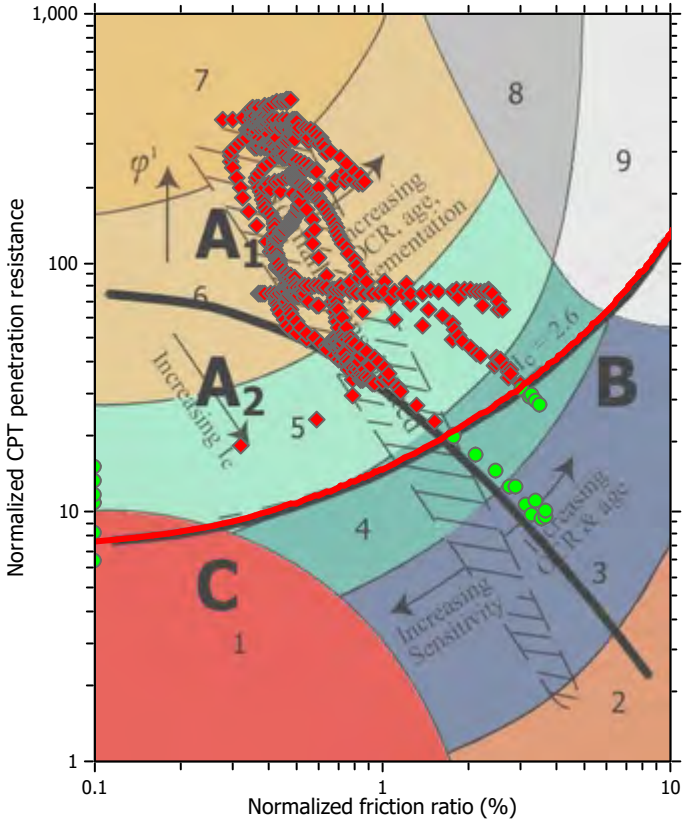
F.S. color scheme

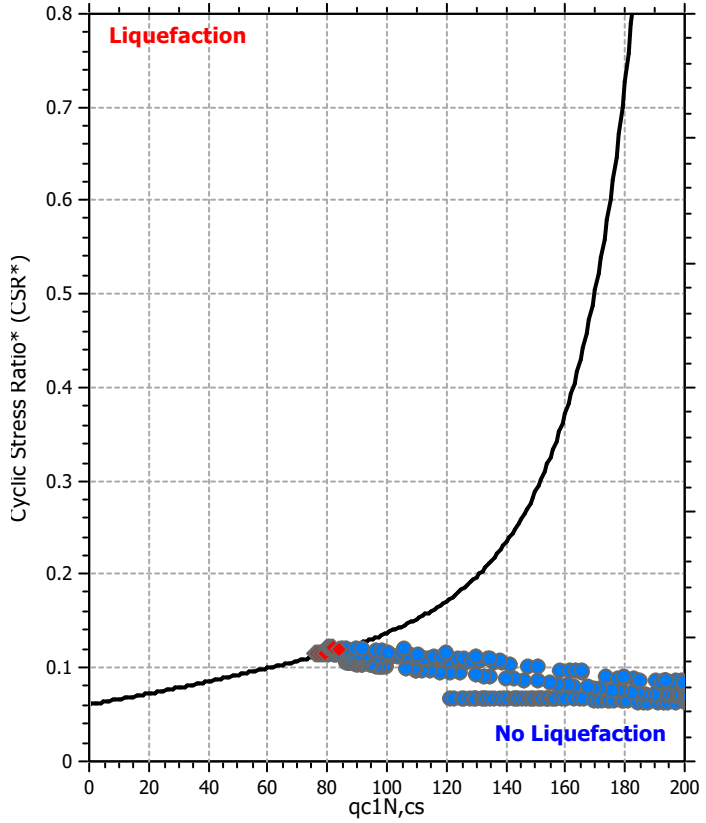
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

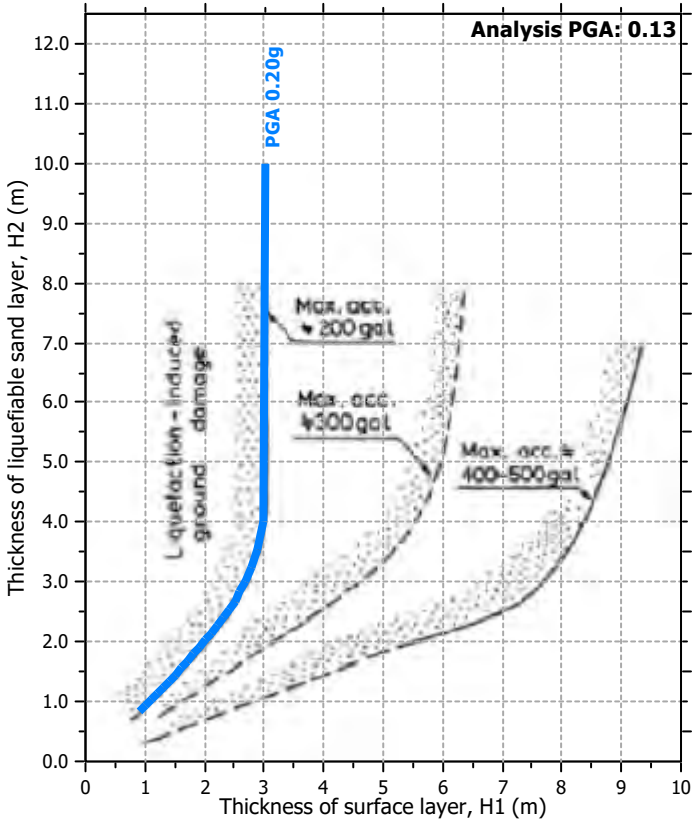
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



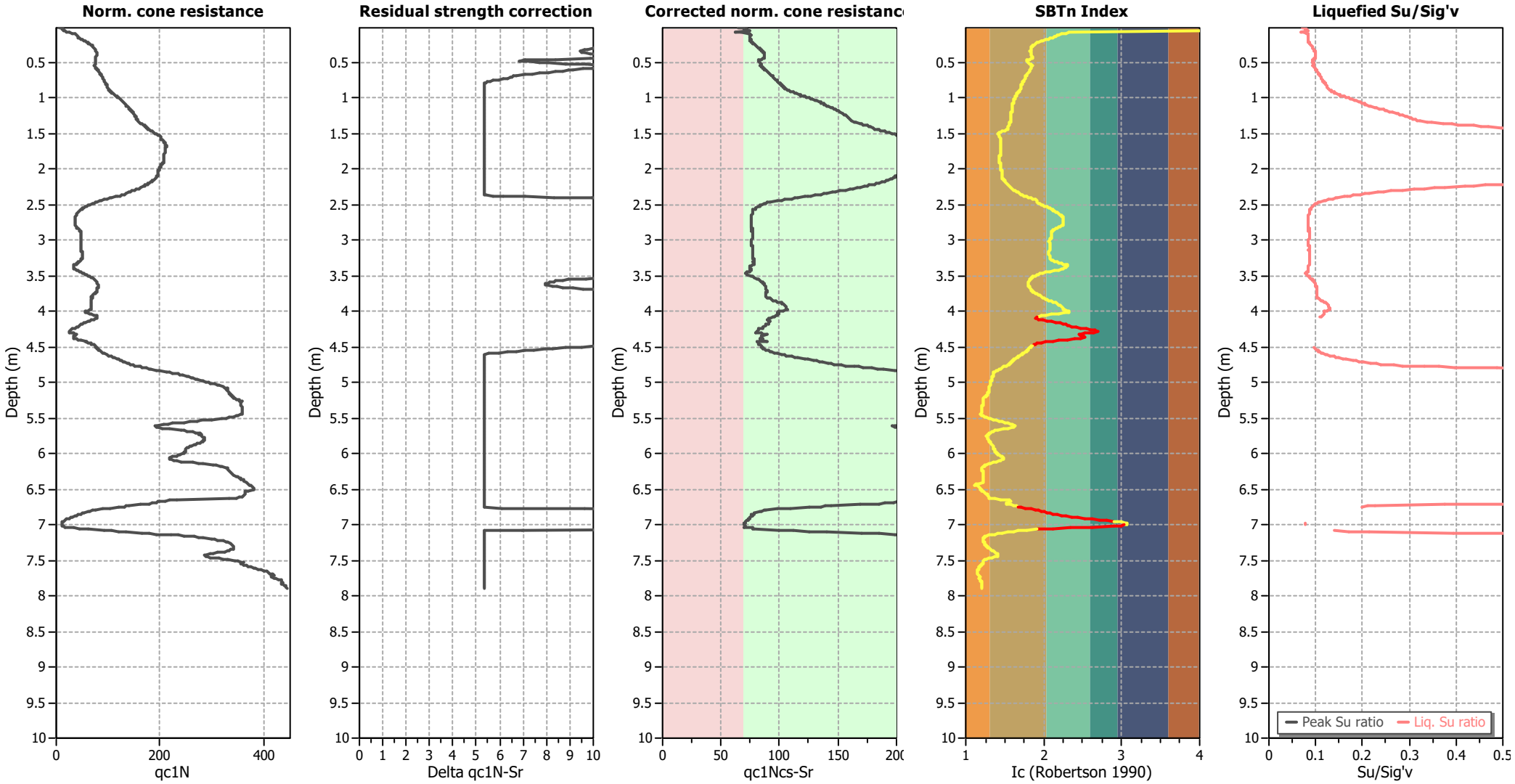




Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

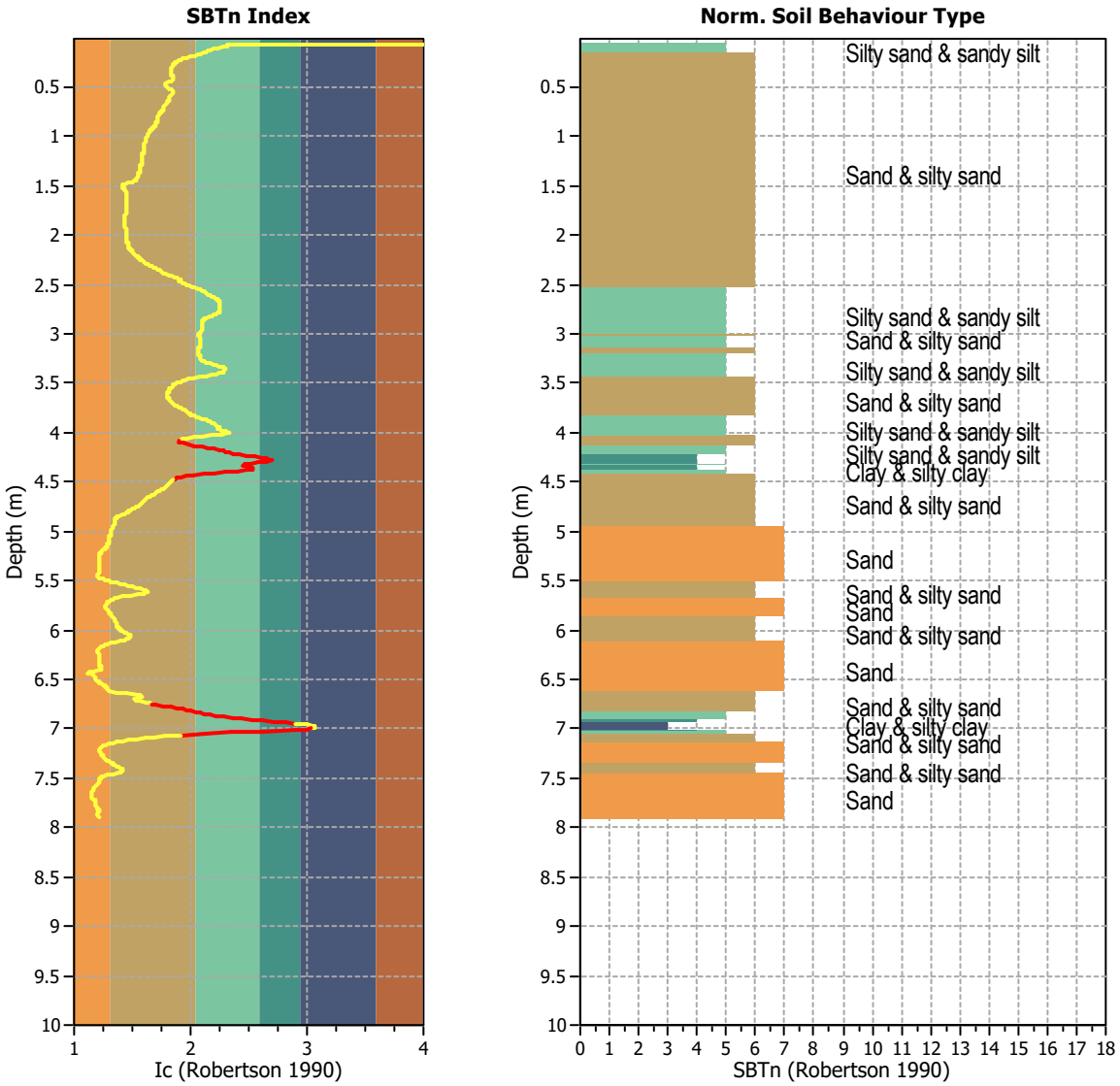
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

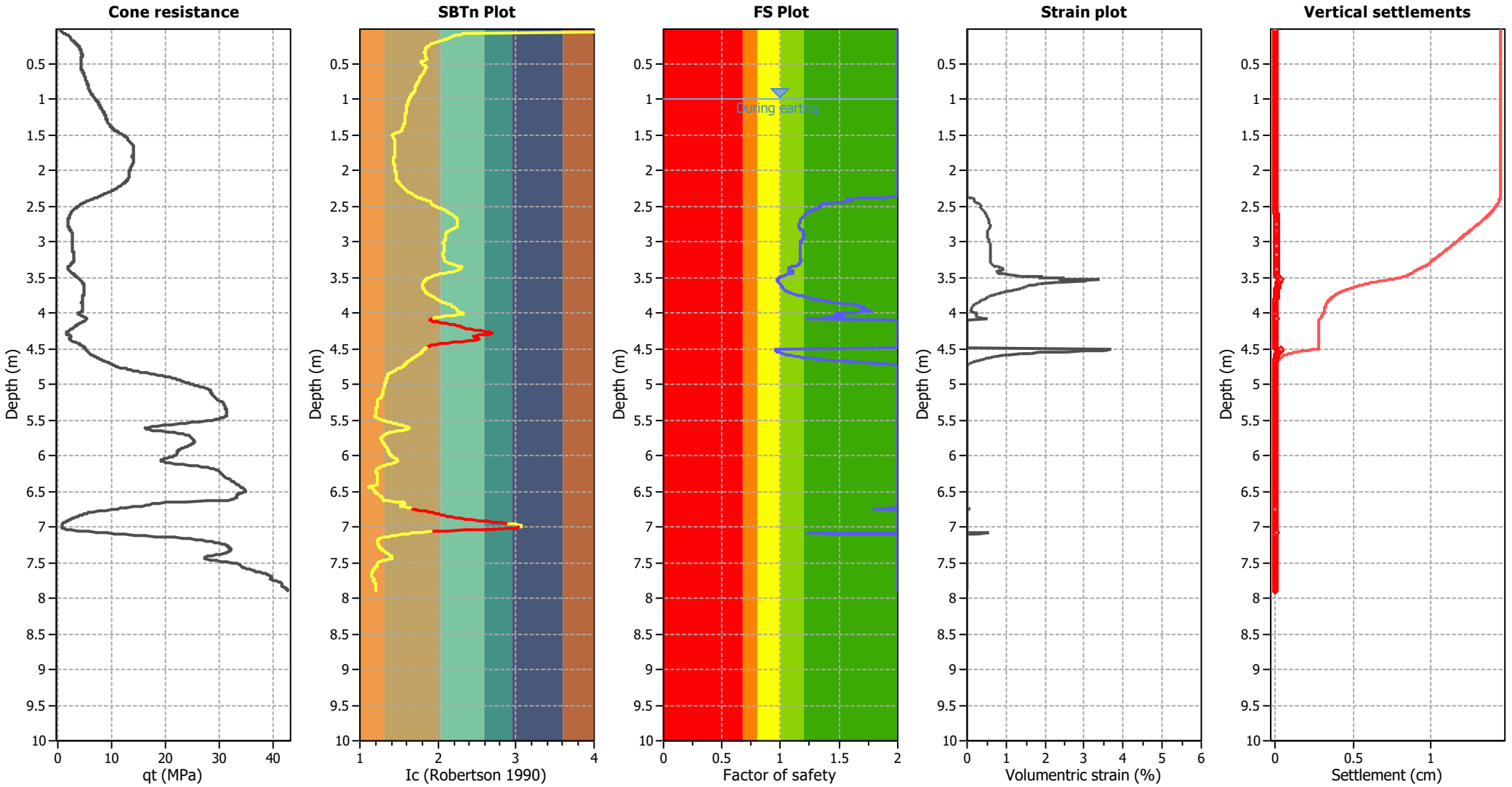
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	790
I_c maximum check value:	3.00	Total points excluded:	71
I_c change ratio value:	0.0100	Exclusion percentage:	8.99%
Minimum number of points in layer:	4	Number of layers detected:	6

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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179 Courtenay Street, New Plymouth
www.btw.nz

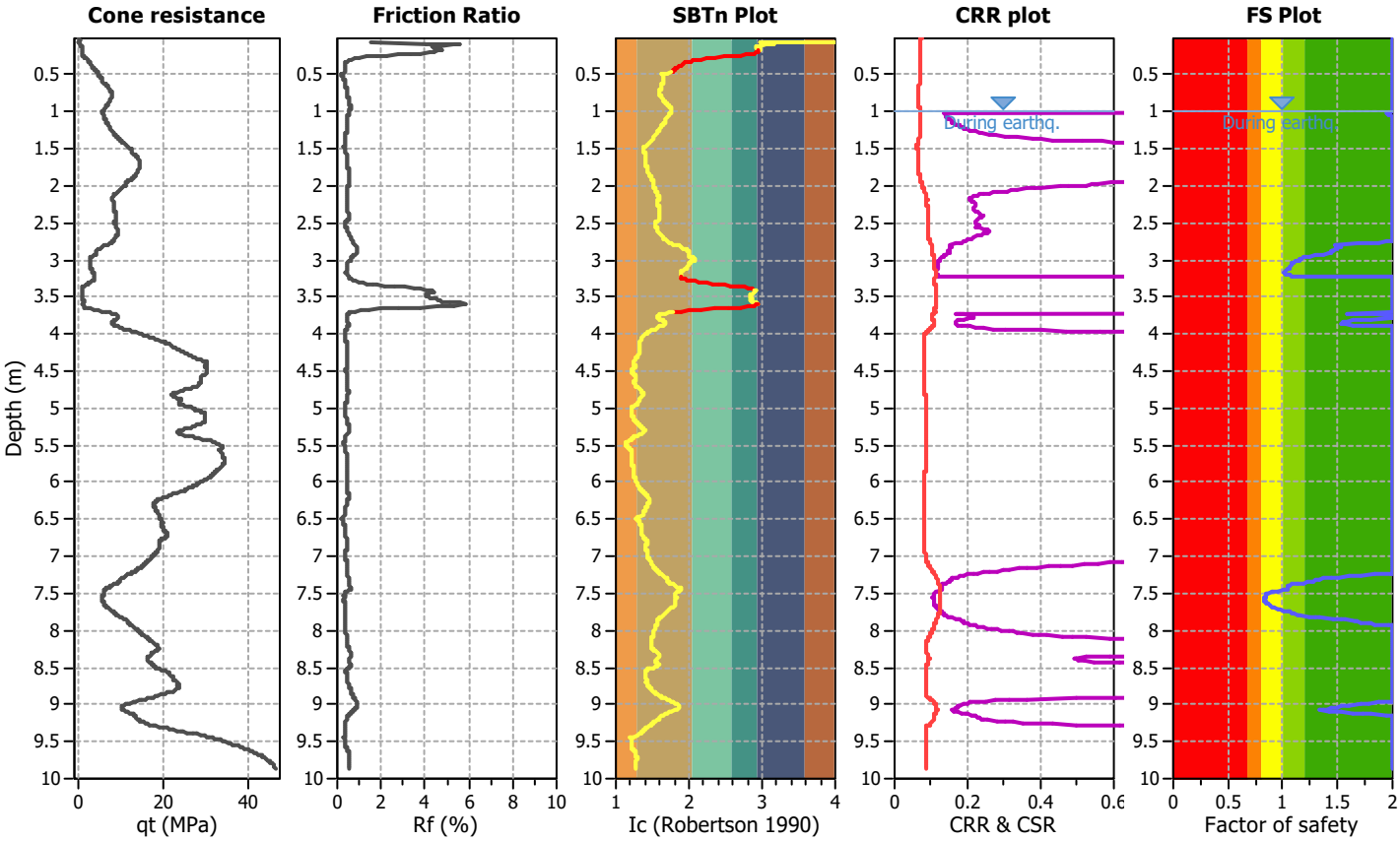
LIQUEFACTION ANALYSIS REPORT

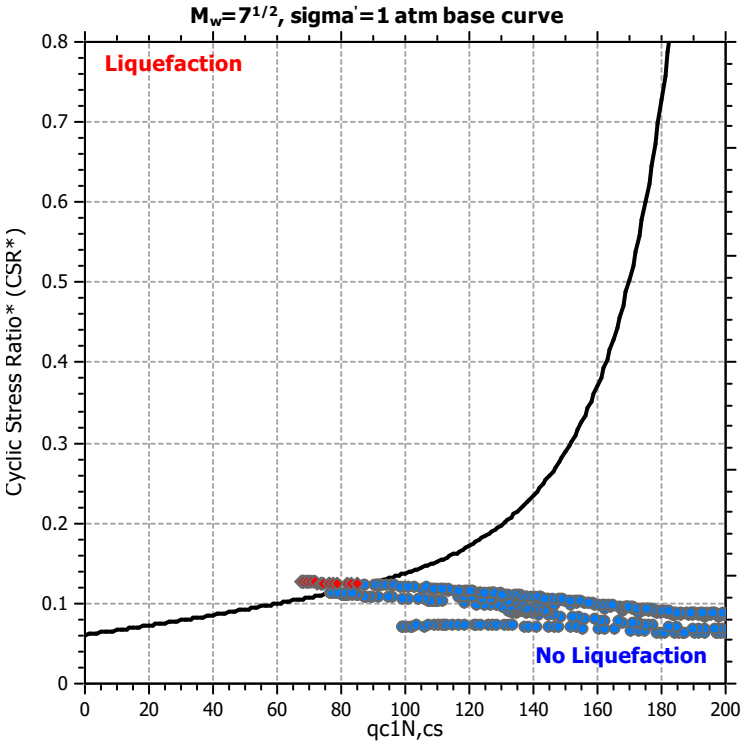
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

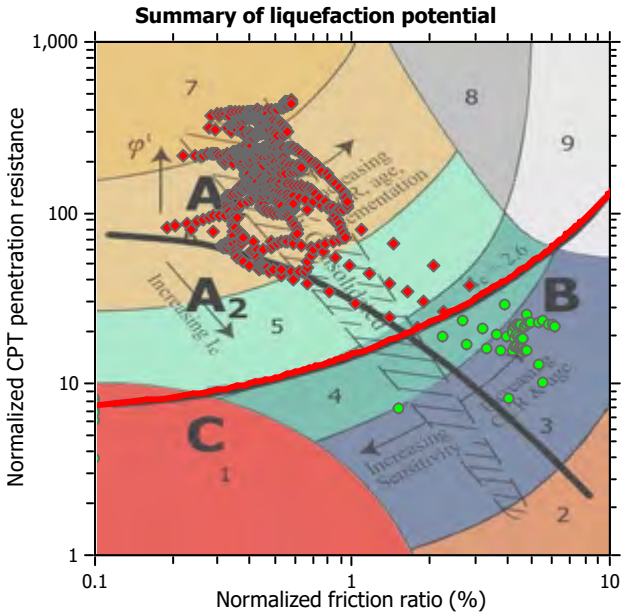
CPT file : CPT14_SLS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	6.40	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

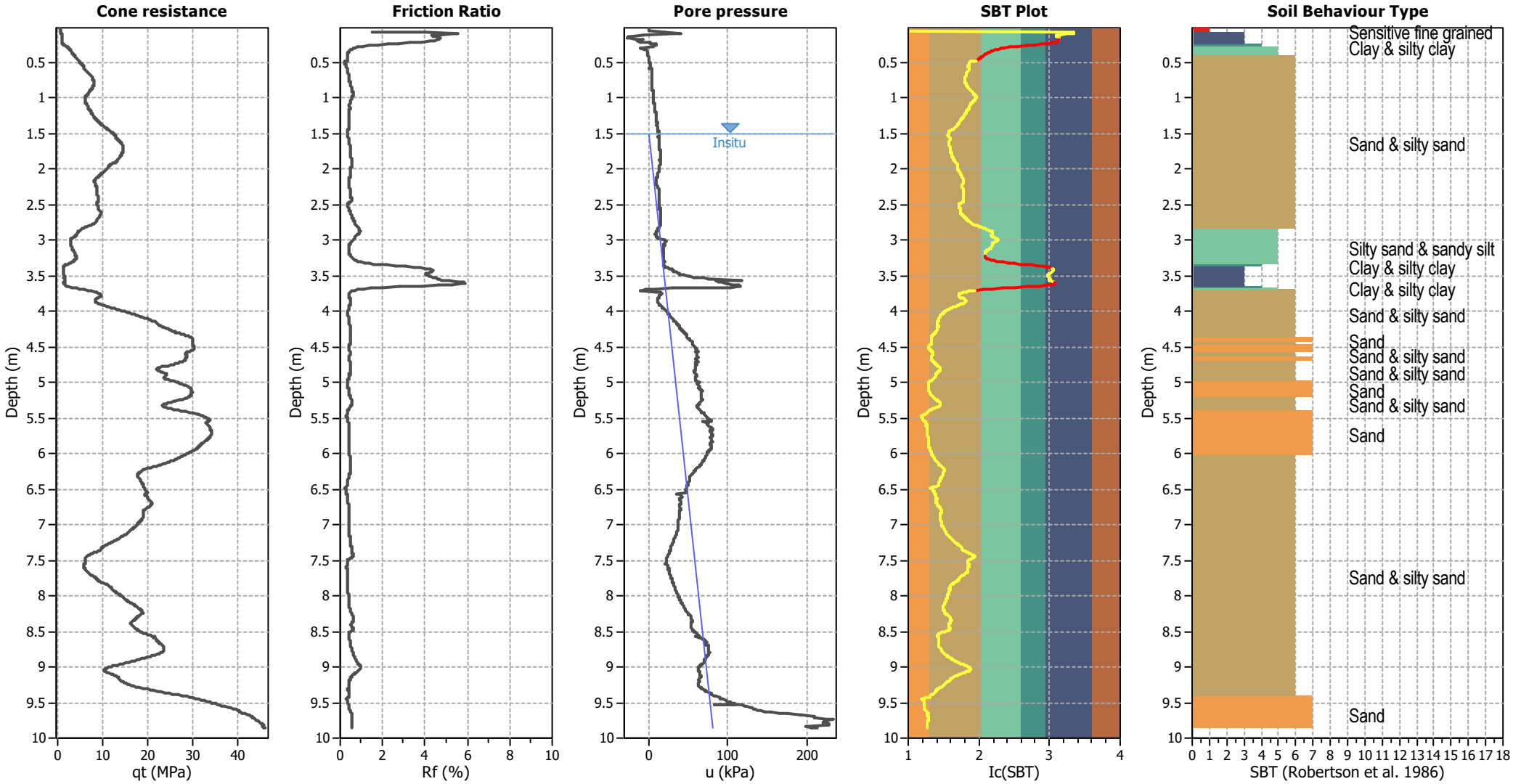






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



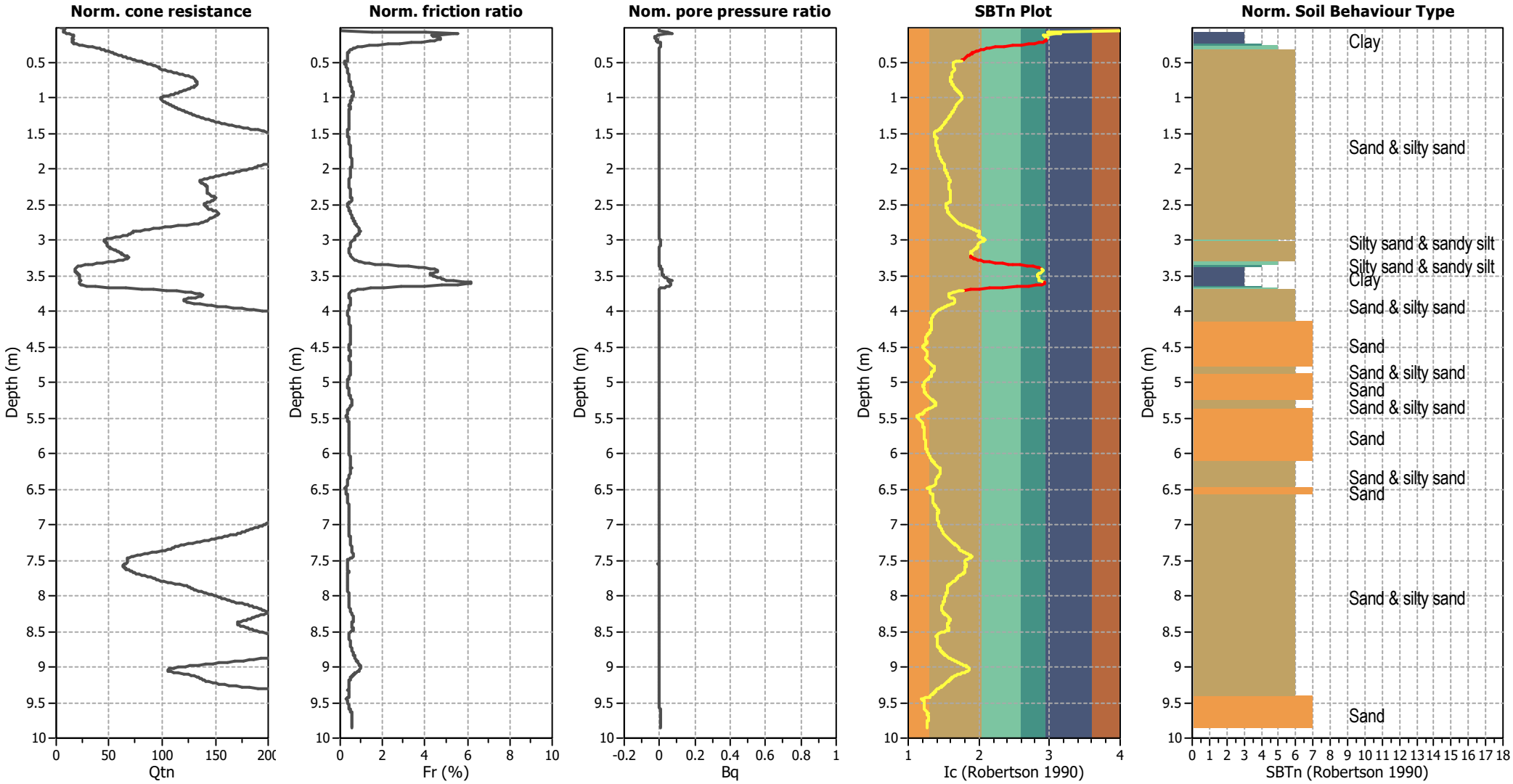
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



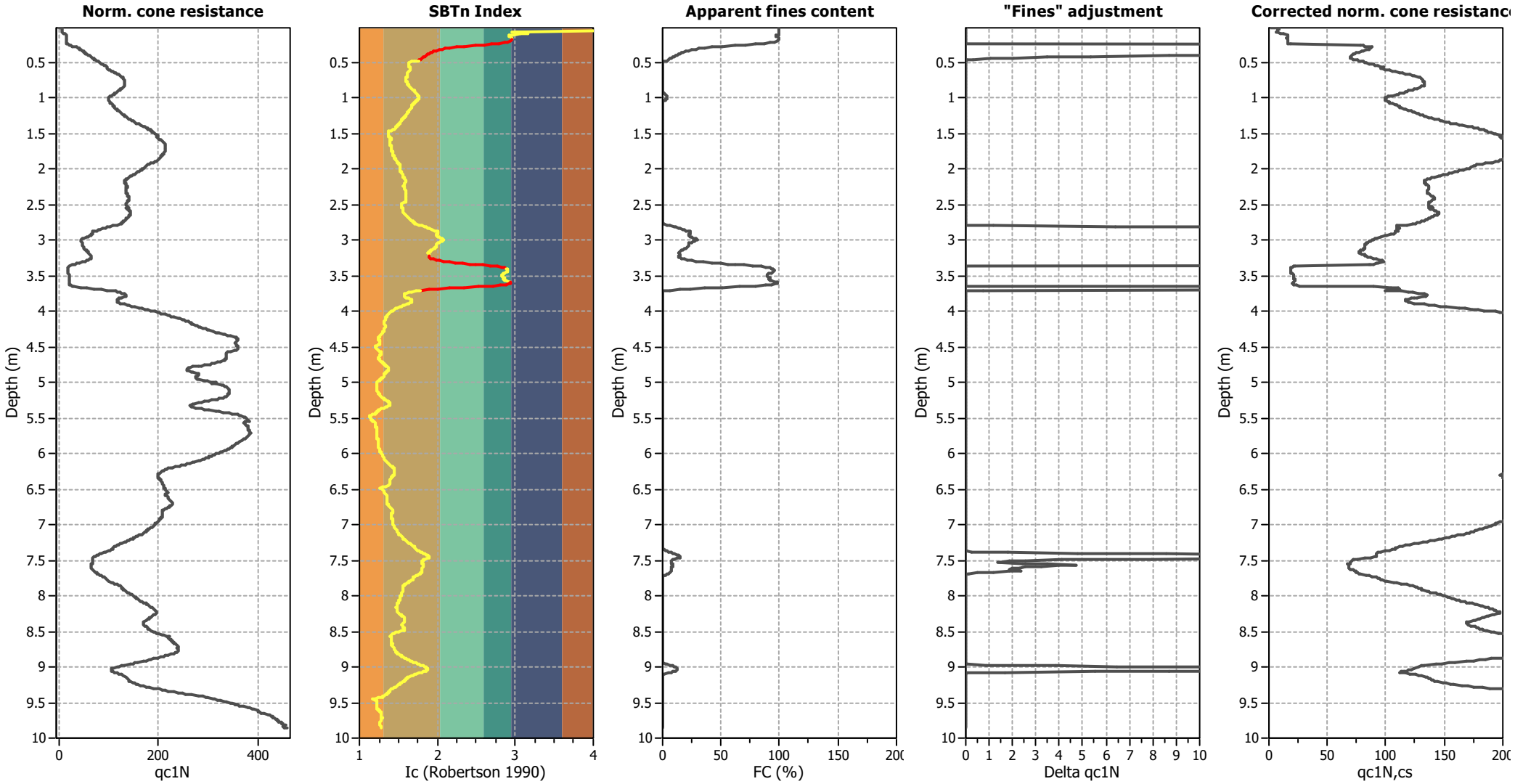
Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

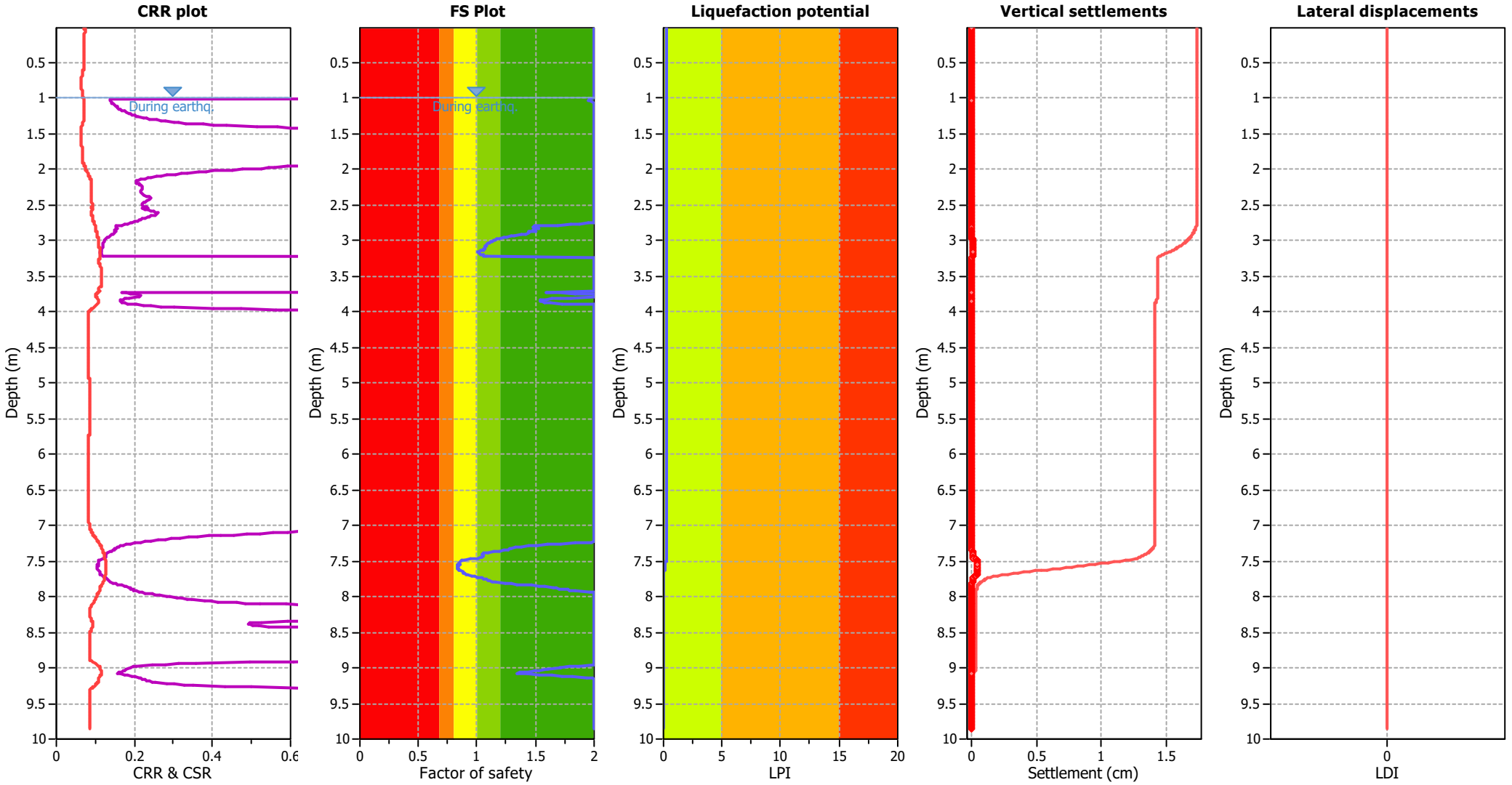
Liquefaction analysis overall plots (intermediate results)



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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

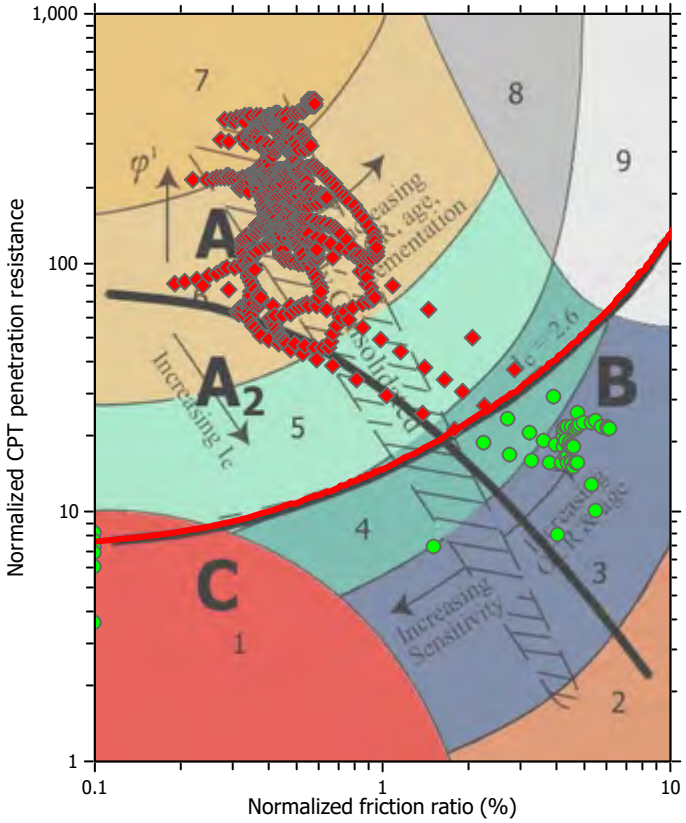
F.S. color scheme

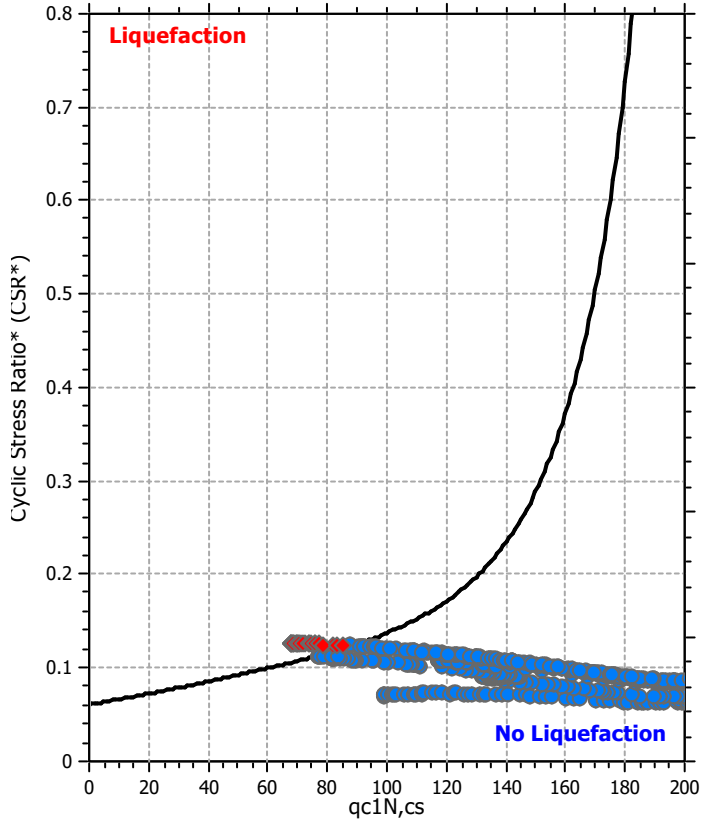
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

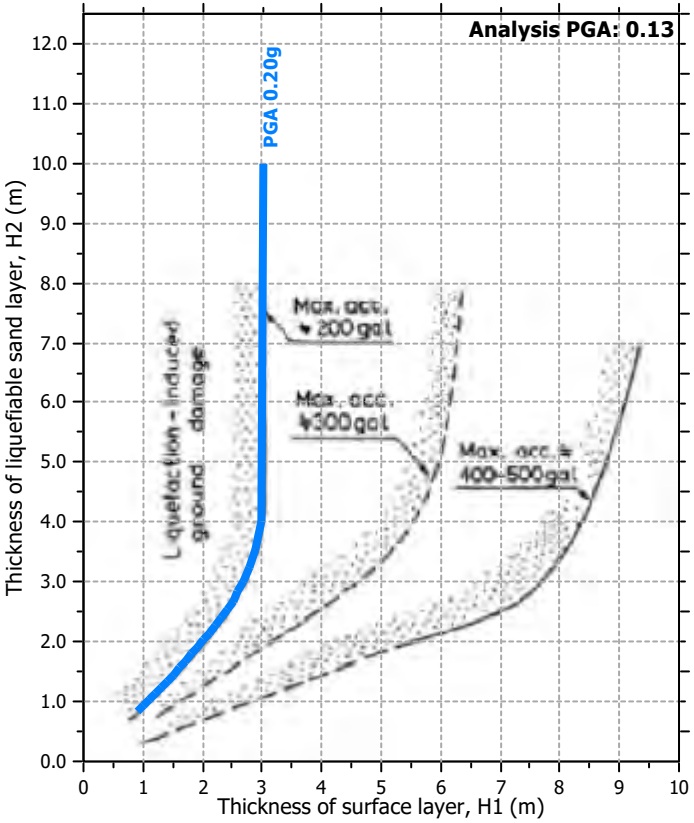
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



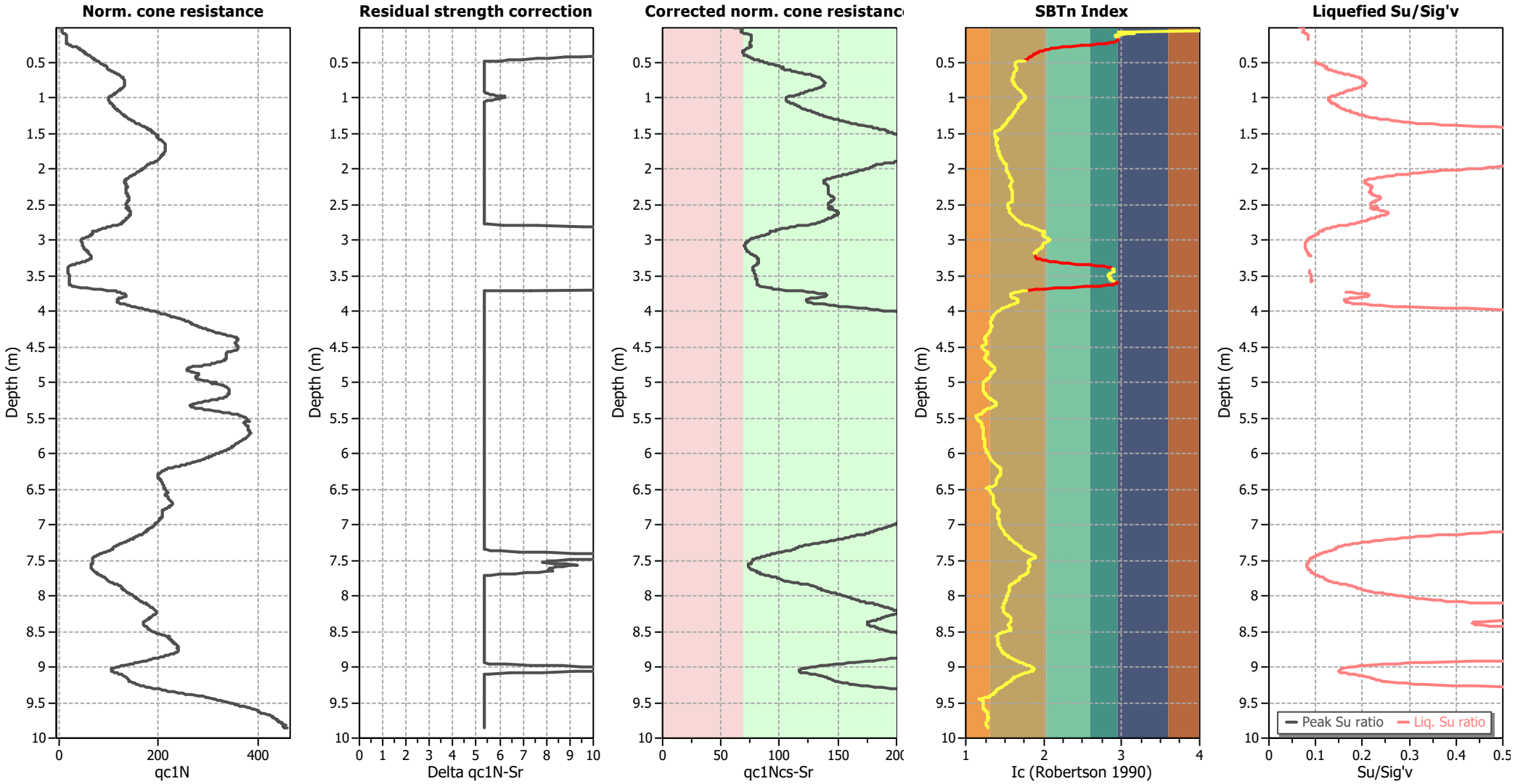




Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

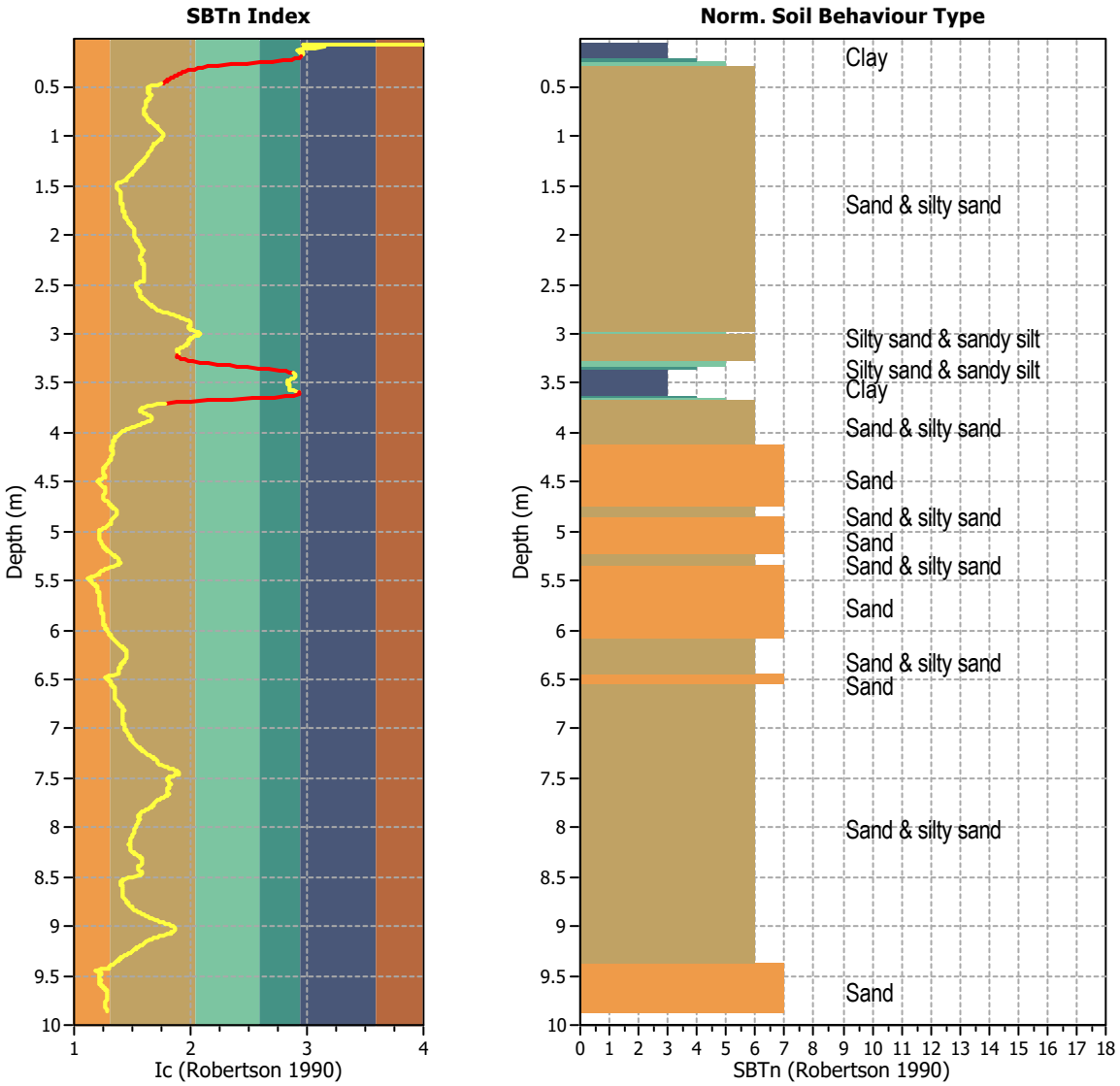
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

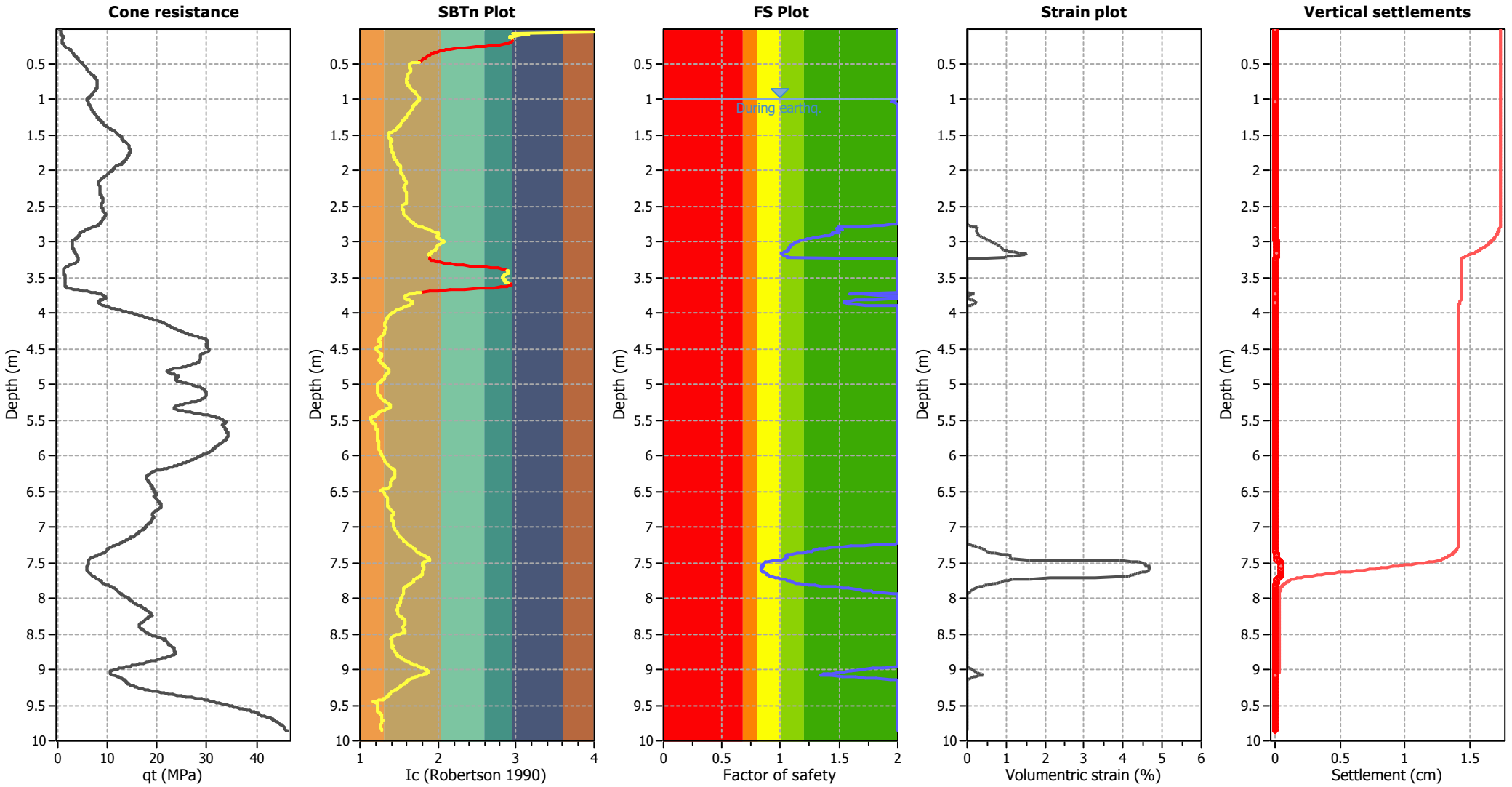
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	986
I_c maximum check value:	3.00	Total points excluded:	61
I_c change ratio value:	0.0100	Exclusion percentage:	6.19%
Minimum number of points in layer:	4	Number of layers detected:	3

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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LIQUEFACTION ANALYSIS REPORT

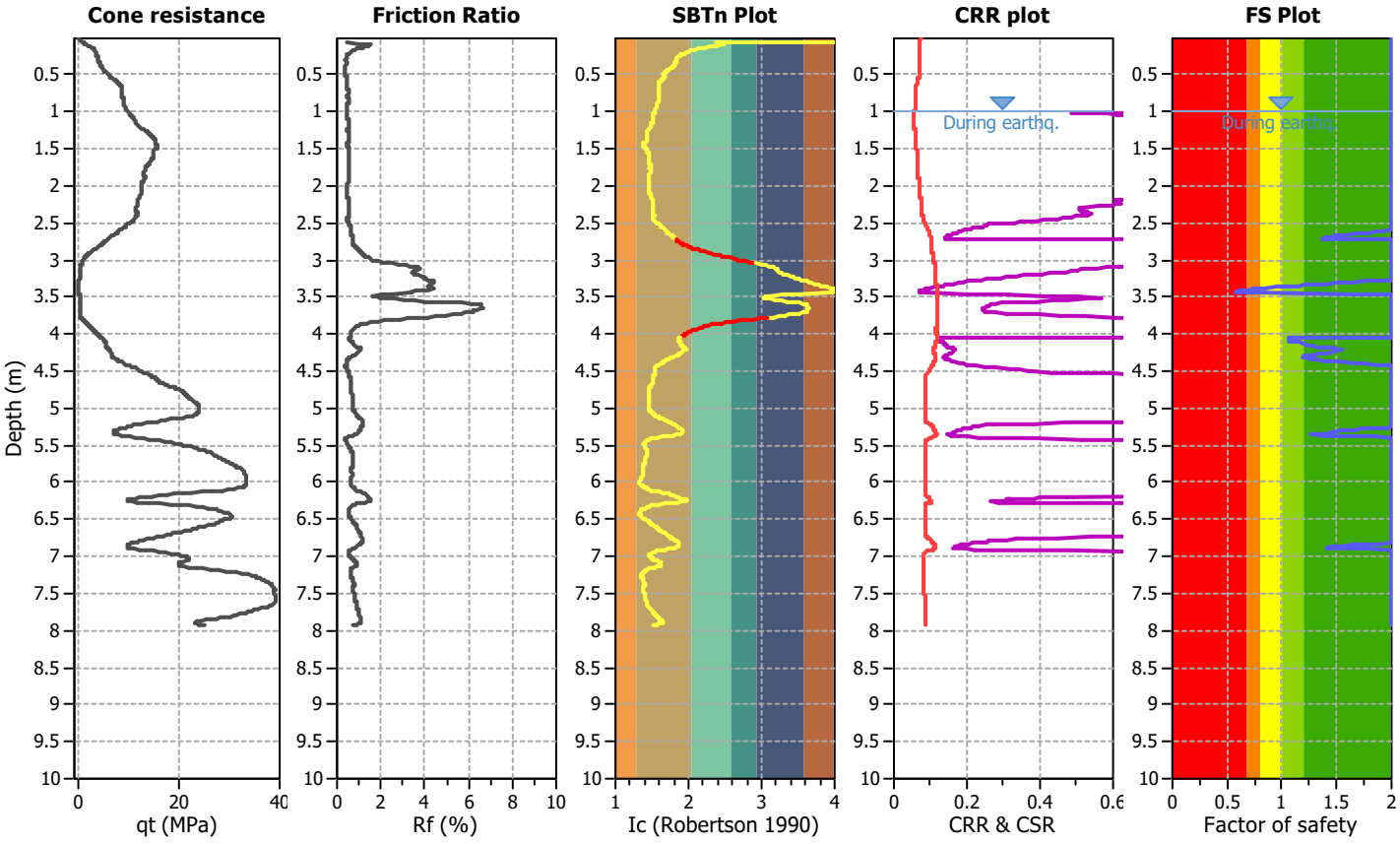
Project title : Foxton Solar Farm

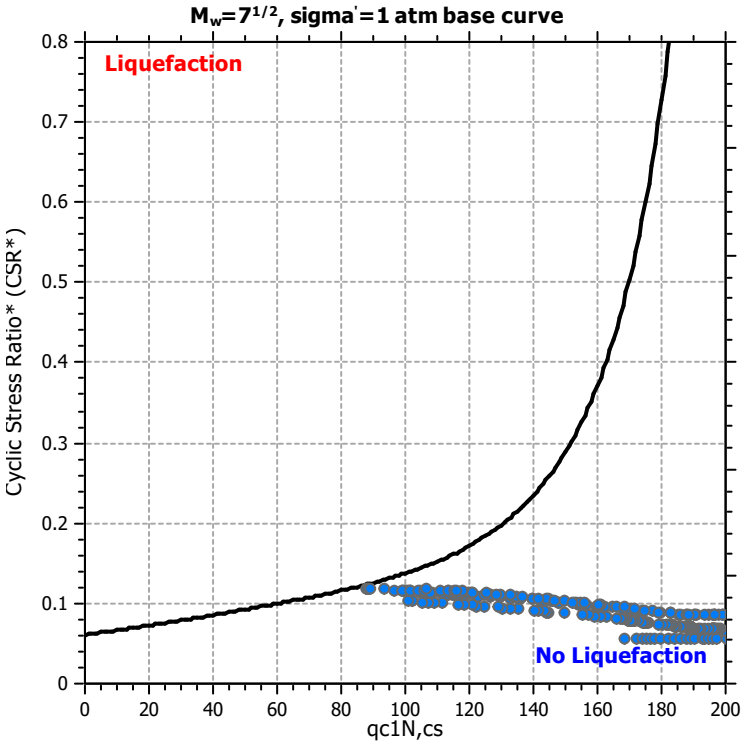
Location : Foxton, New Zealand

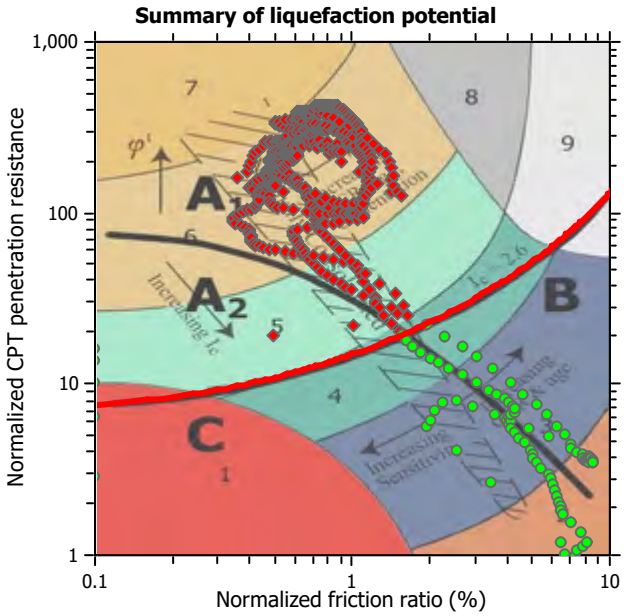
CPT file : CPT15_SLS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	6.40	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

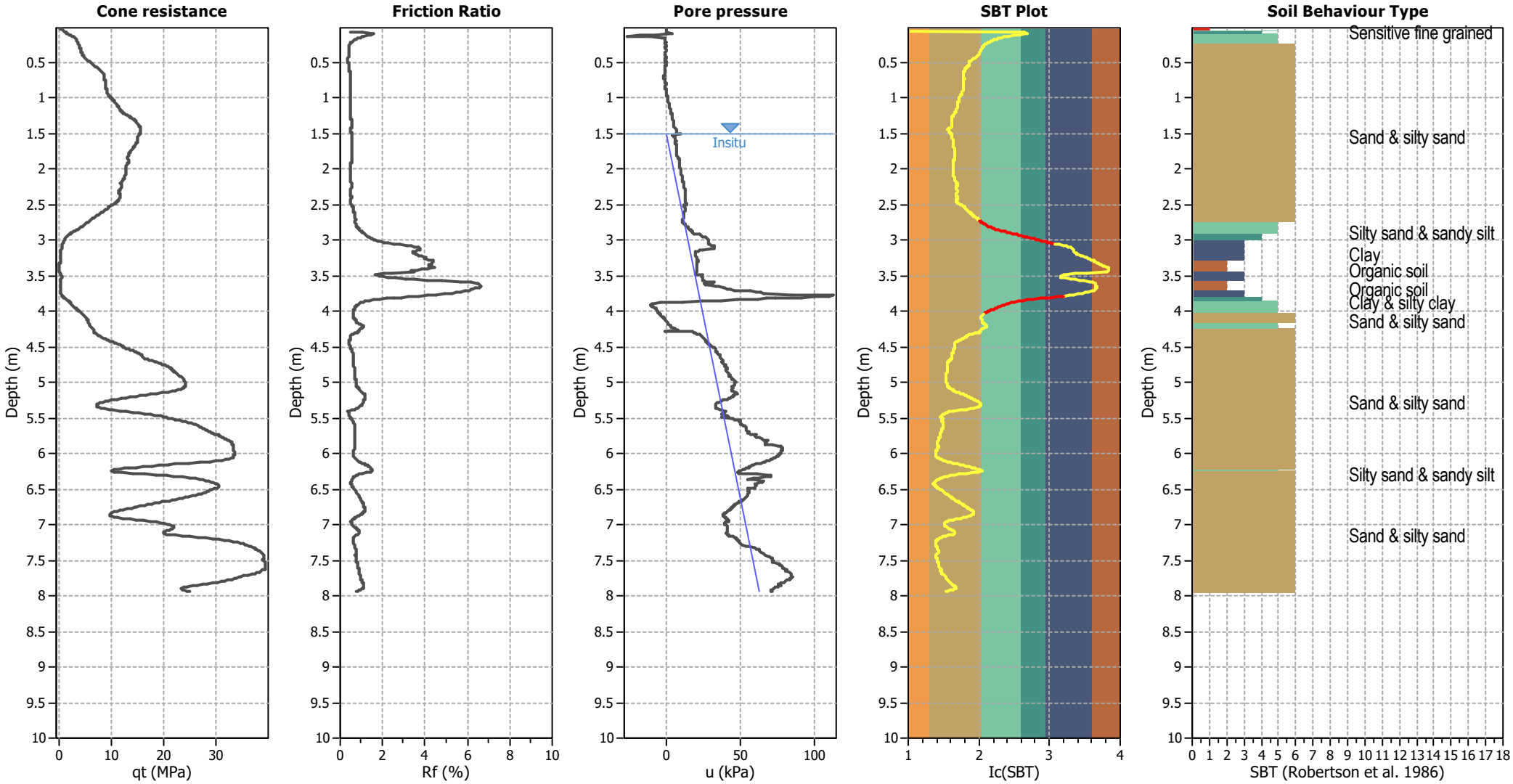






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



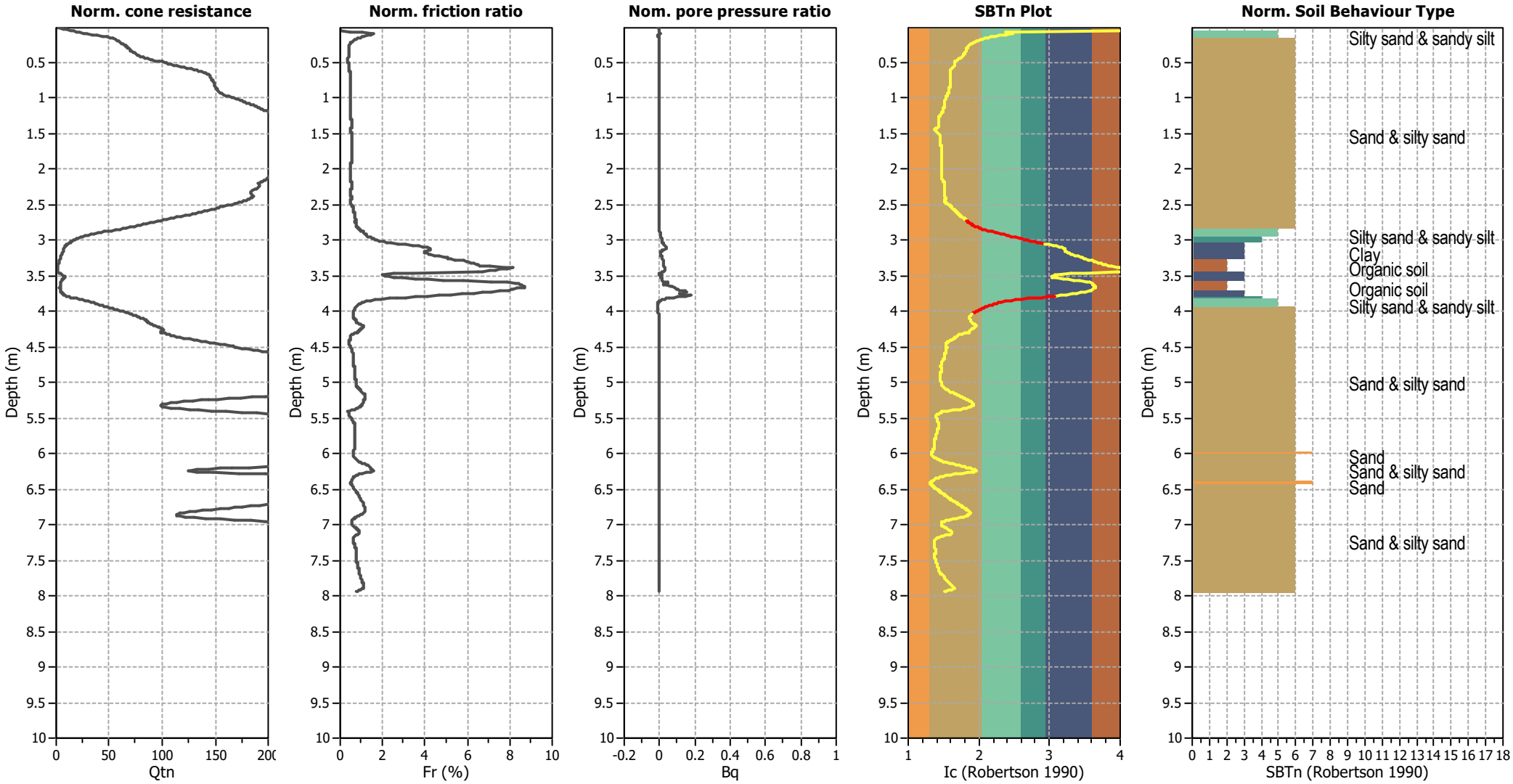
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



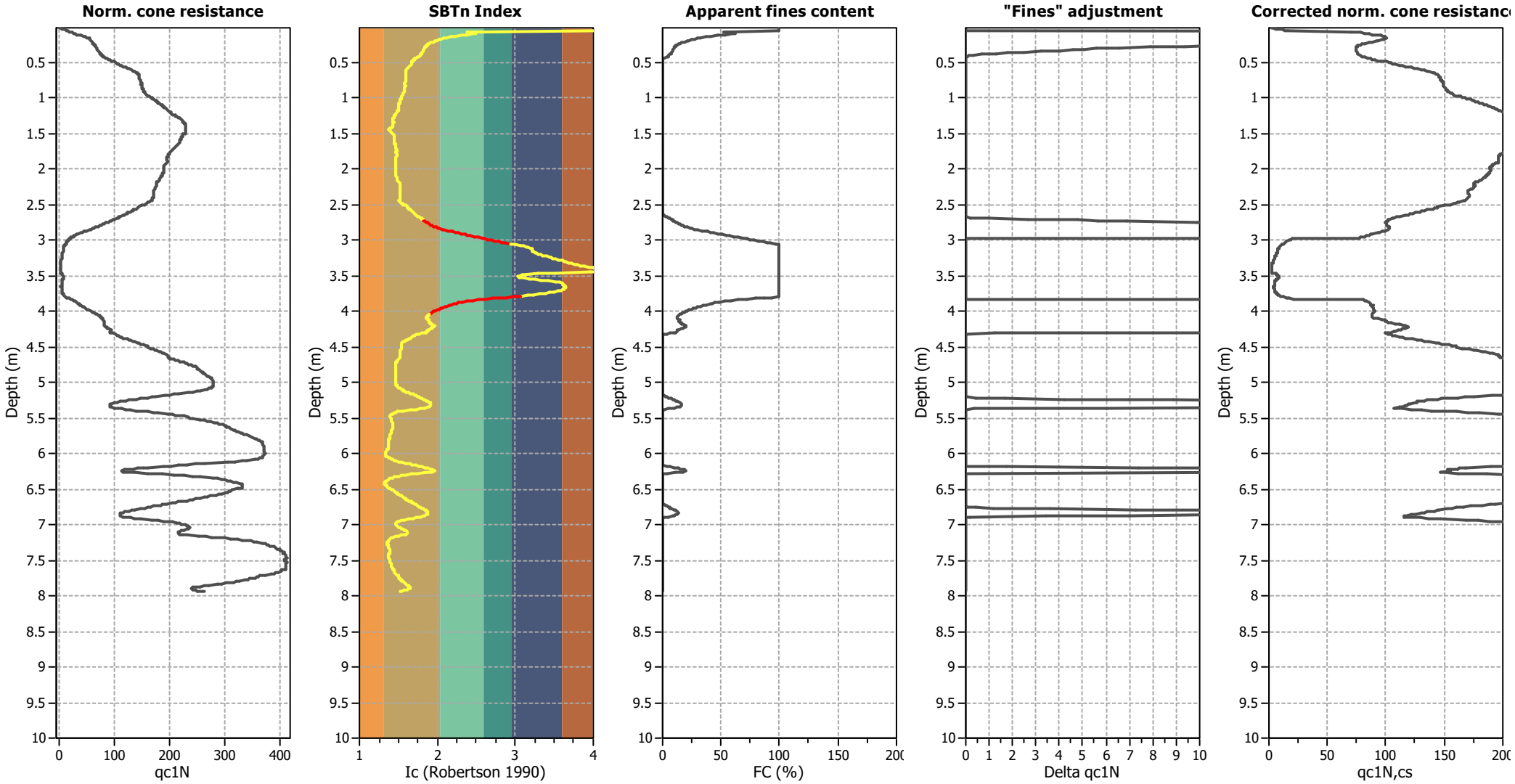
Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

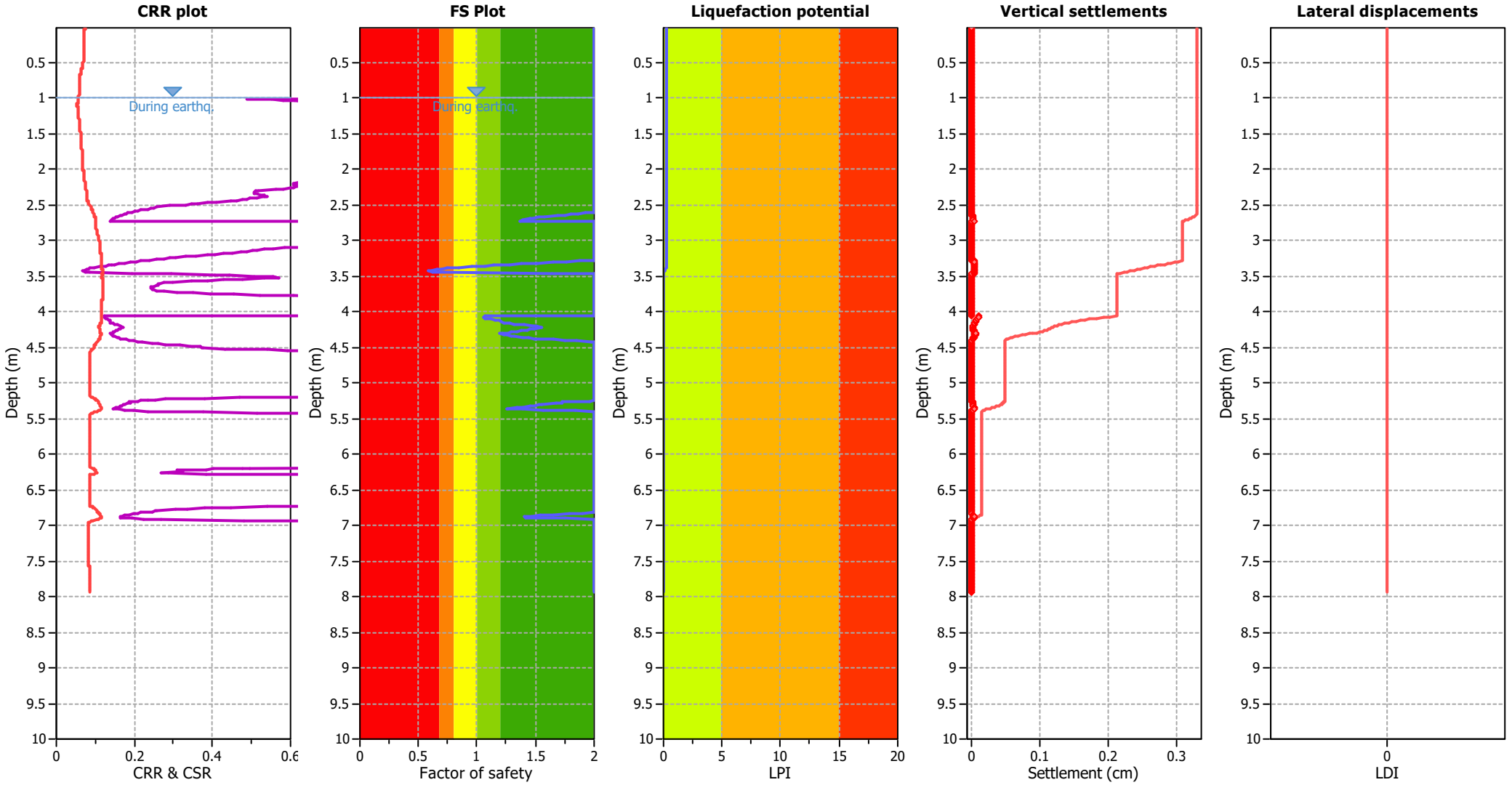
Liquefaction analysis overall plots (intermediate results)



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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

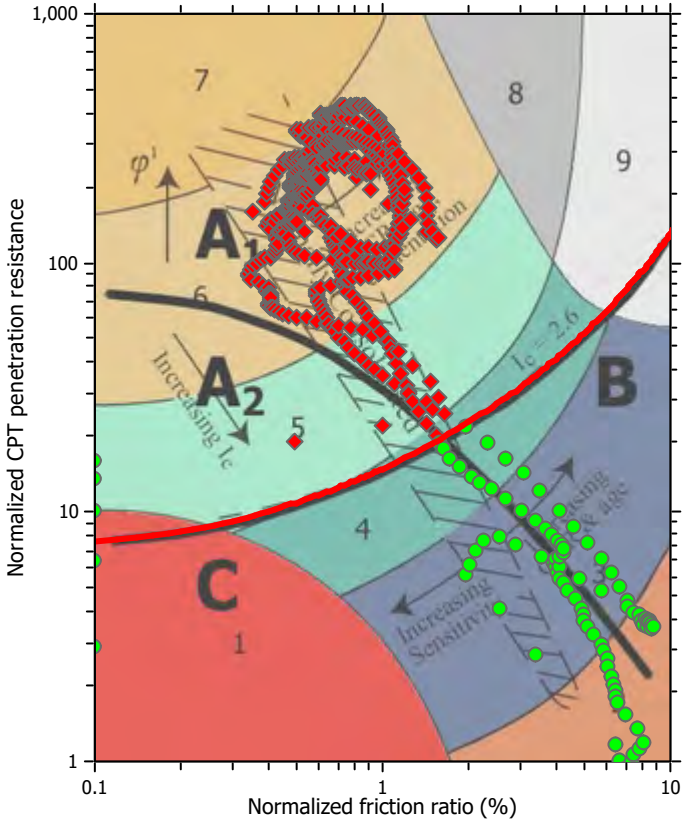
F.S. color scheme

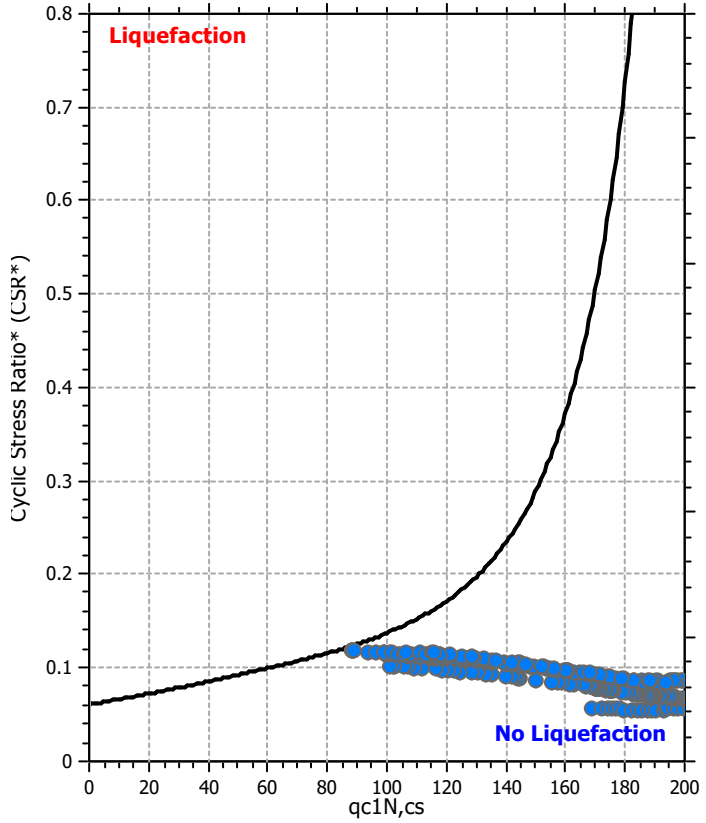
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

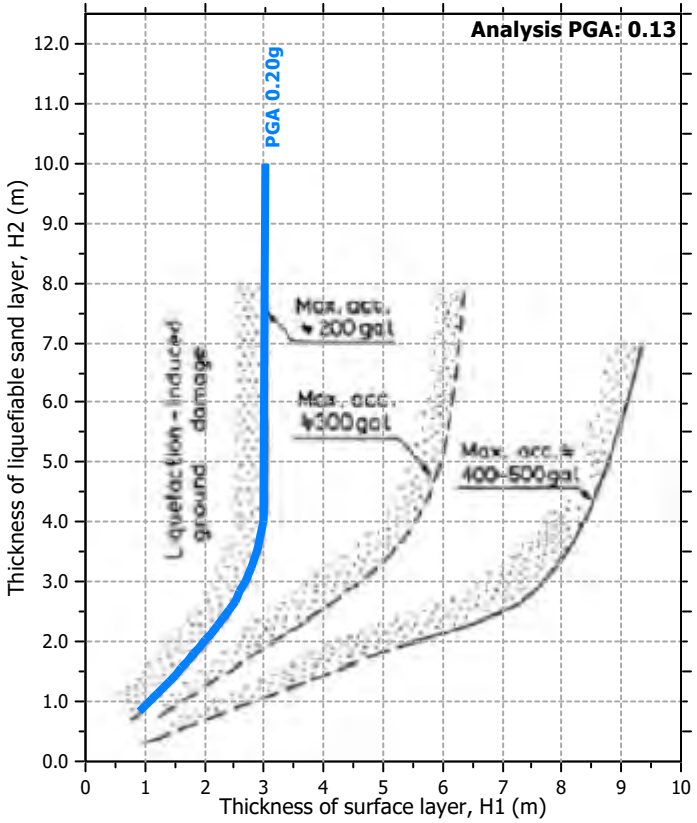
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



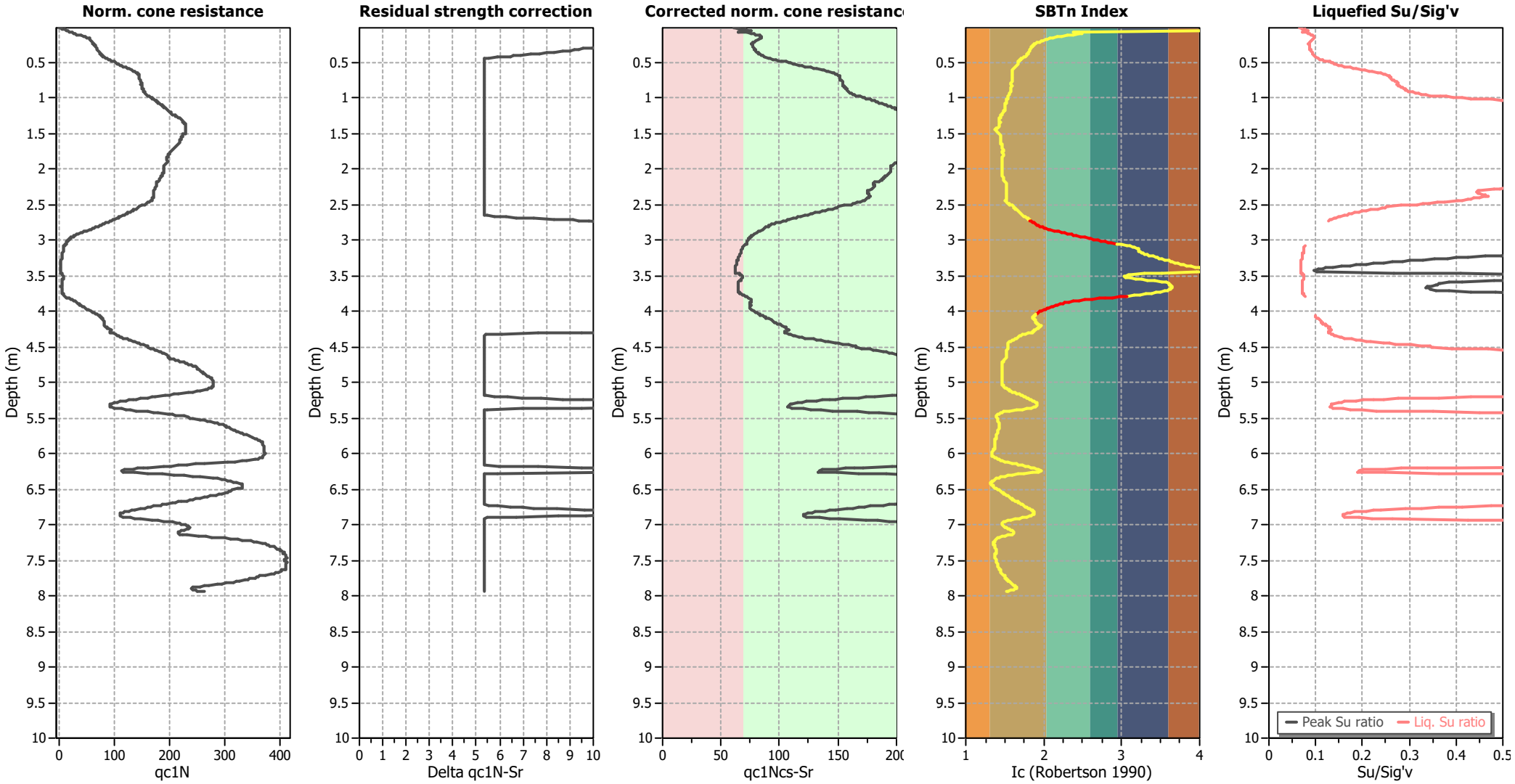




Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

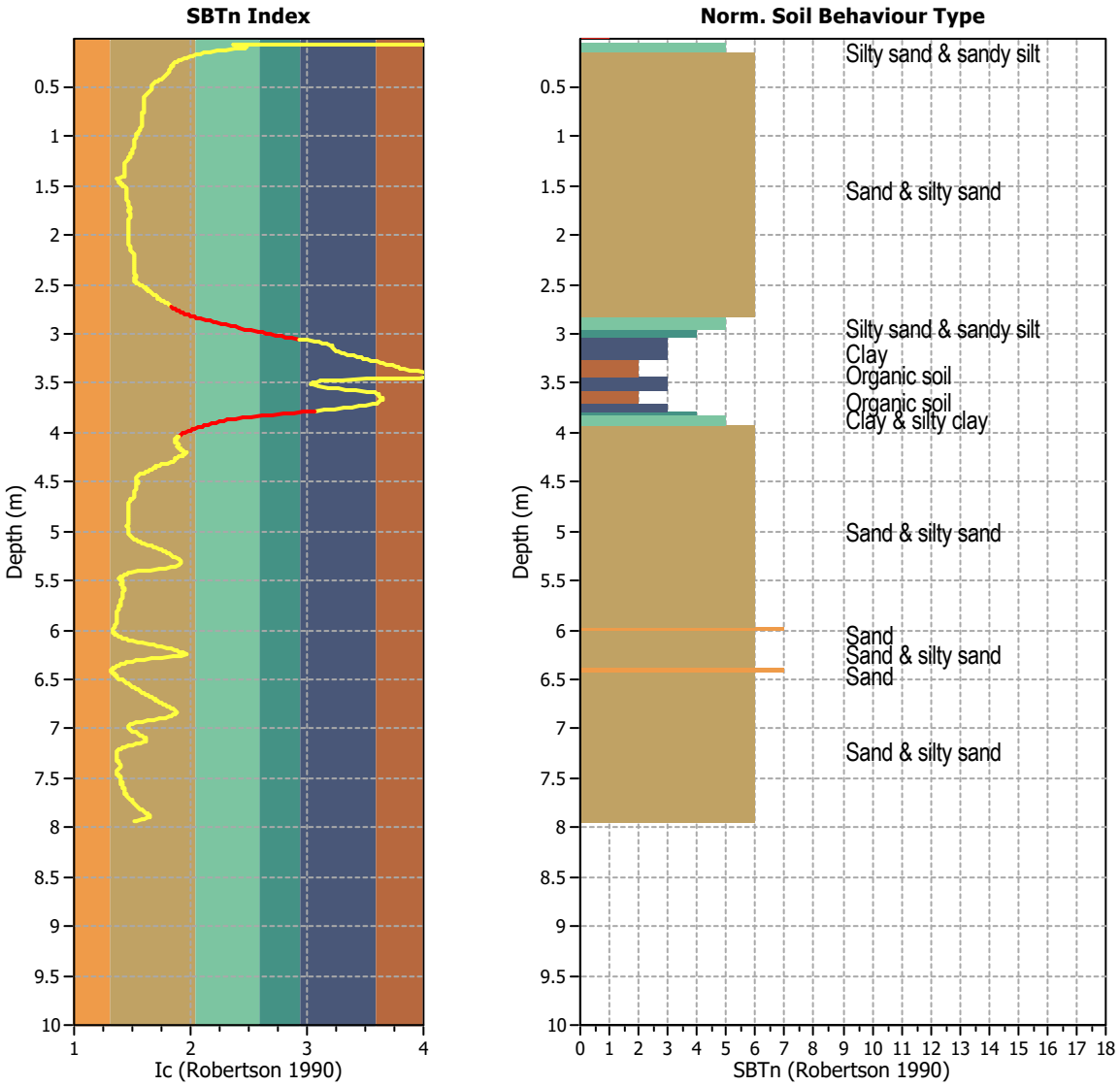
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

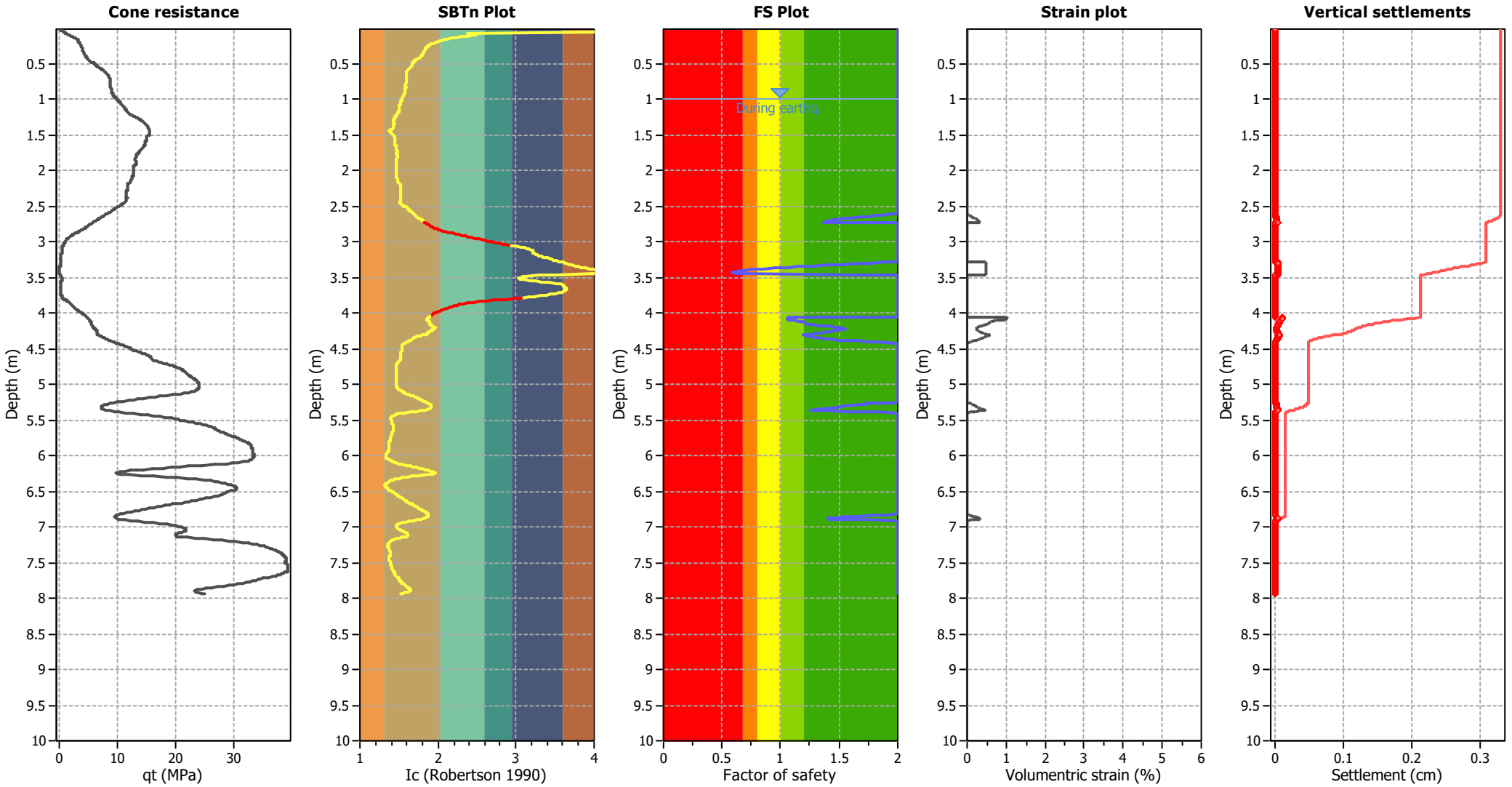
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	794
I_c maximum check value:	3.00	Total points excluded:	61
I_c change ratio value:	0.0100	Exclusion percentage:	7.68%
Minimum number of points in layer:	4	Number of layers detected:	2

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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www.btw.nz

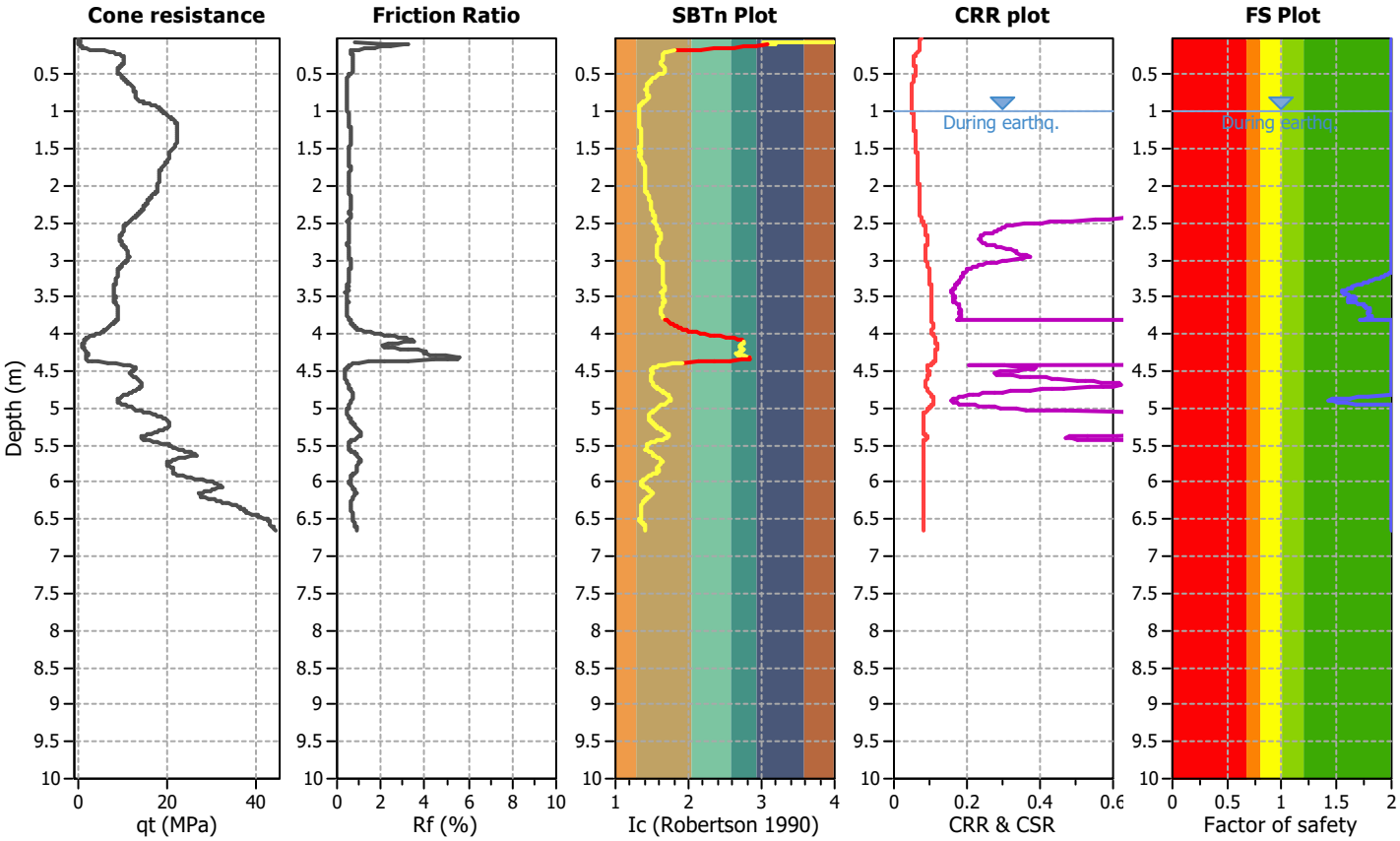
LIQUEFACTION ANALYSIS REPORT

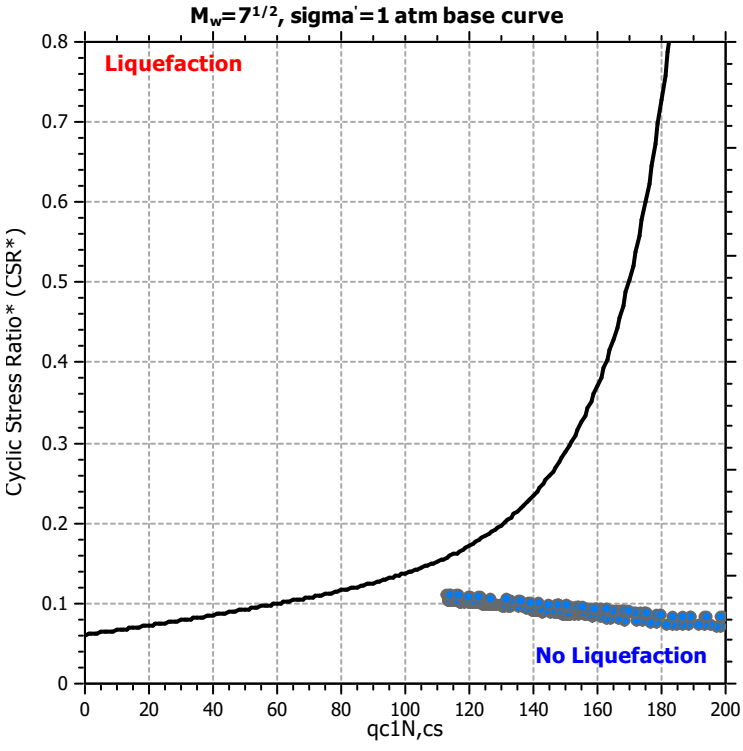
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

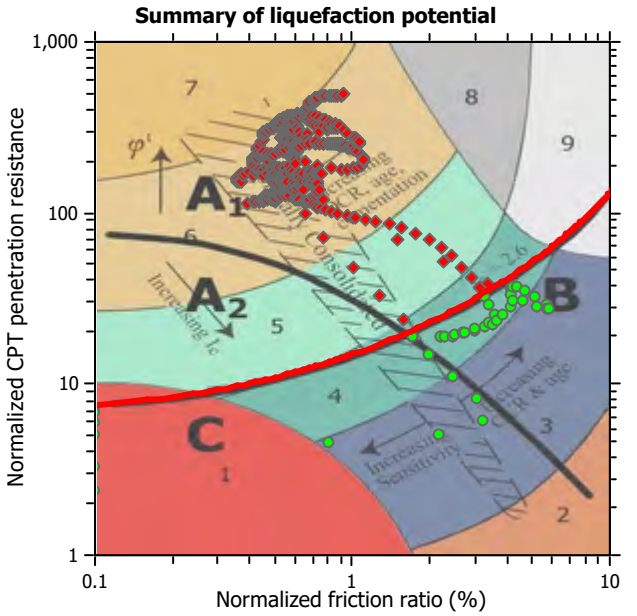
CPT file : CPT16_SLS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	6.40	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

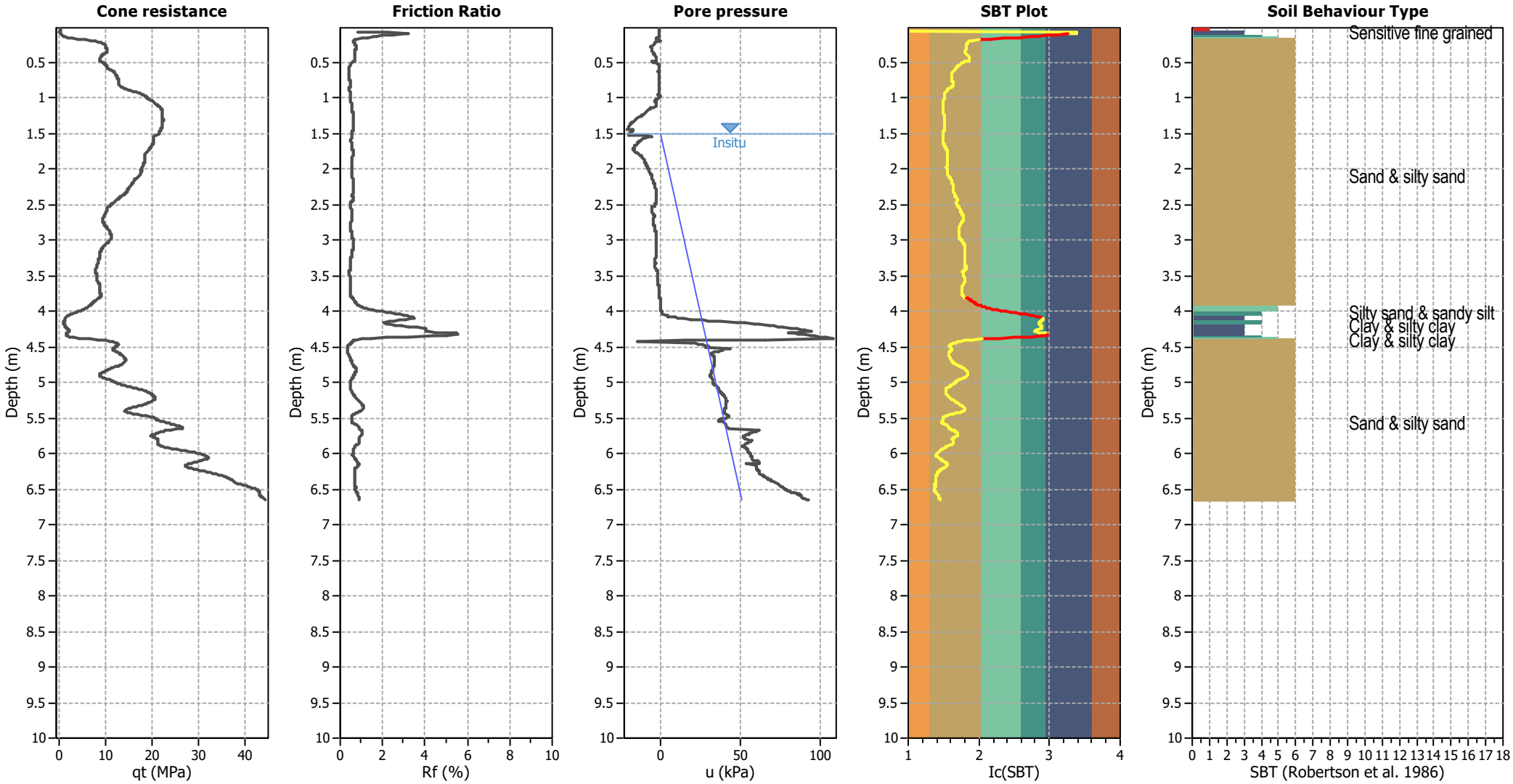






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



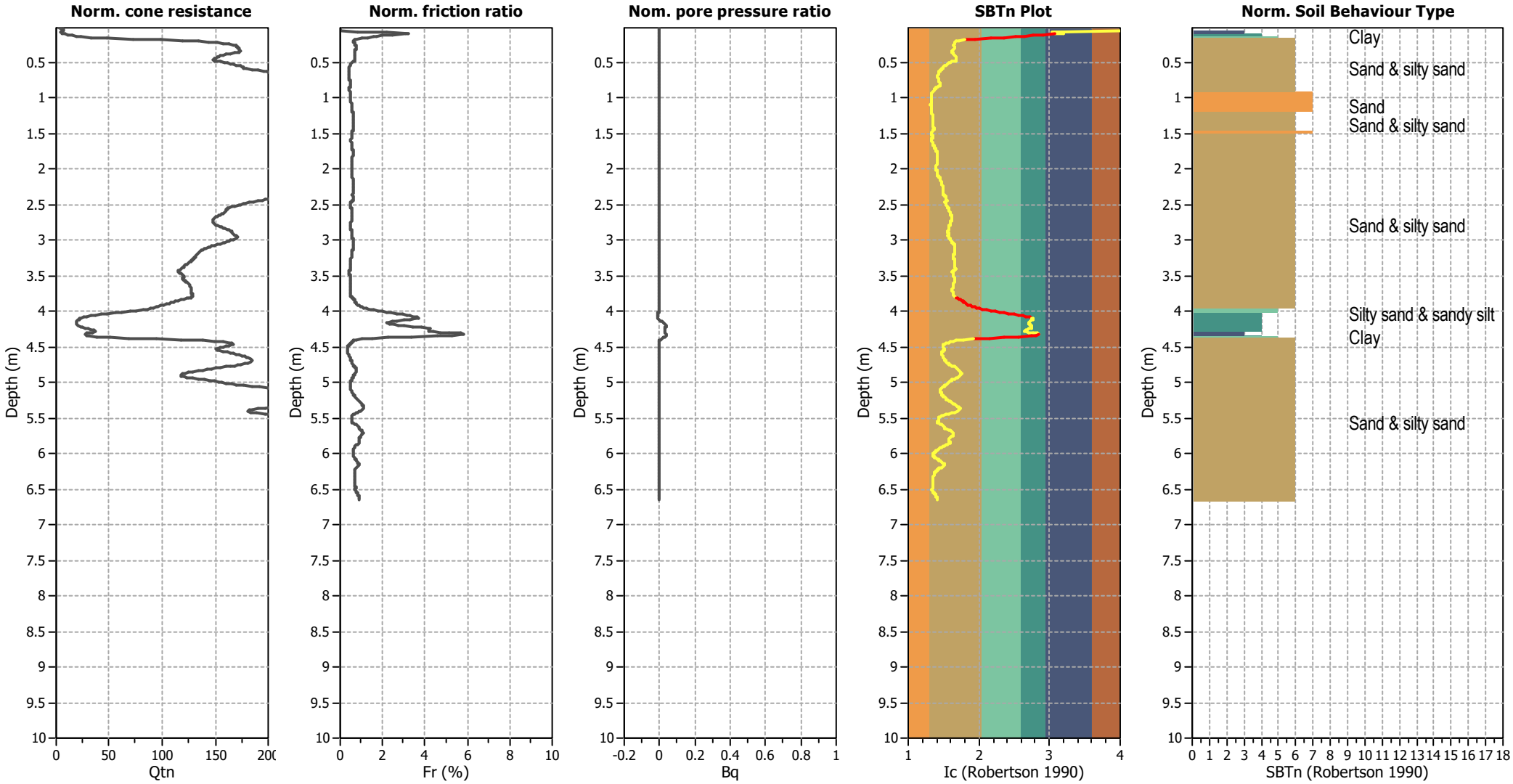
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



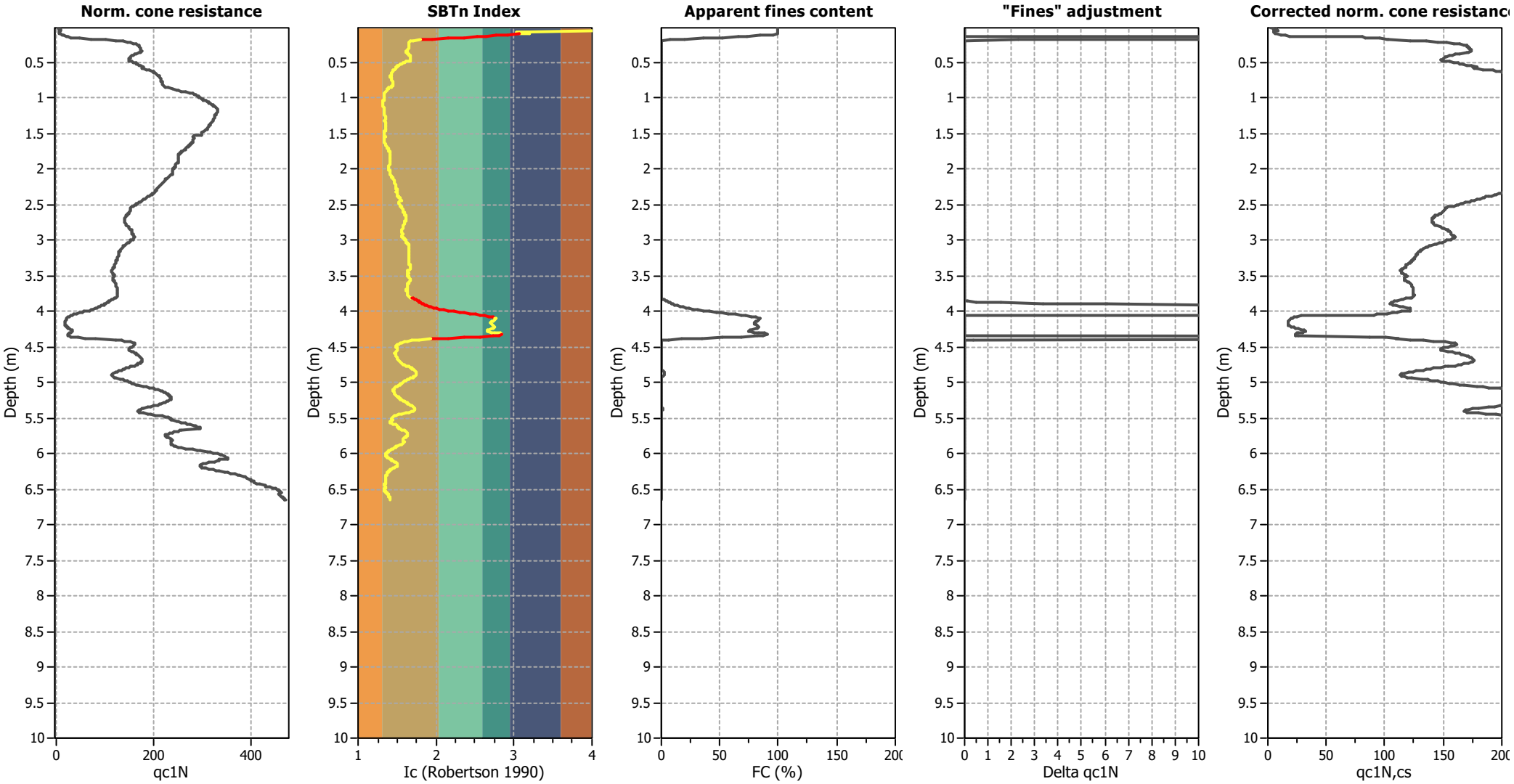
Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

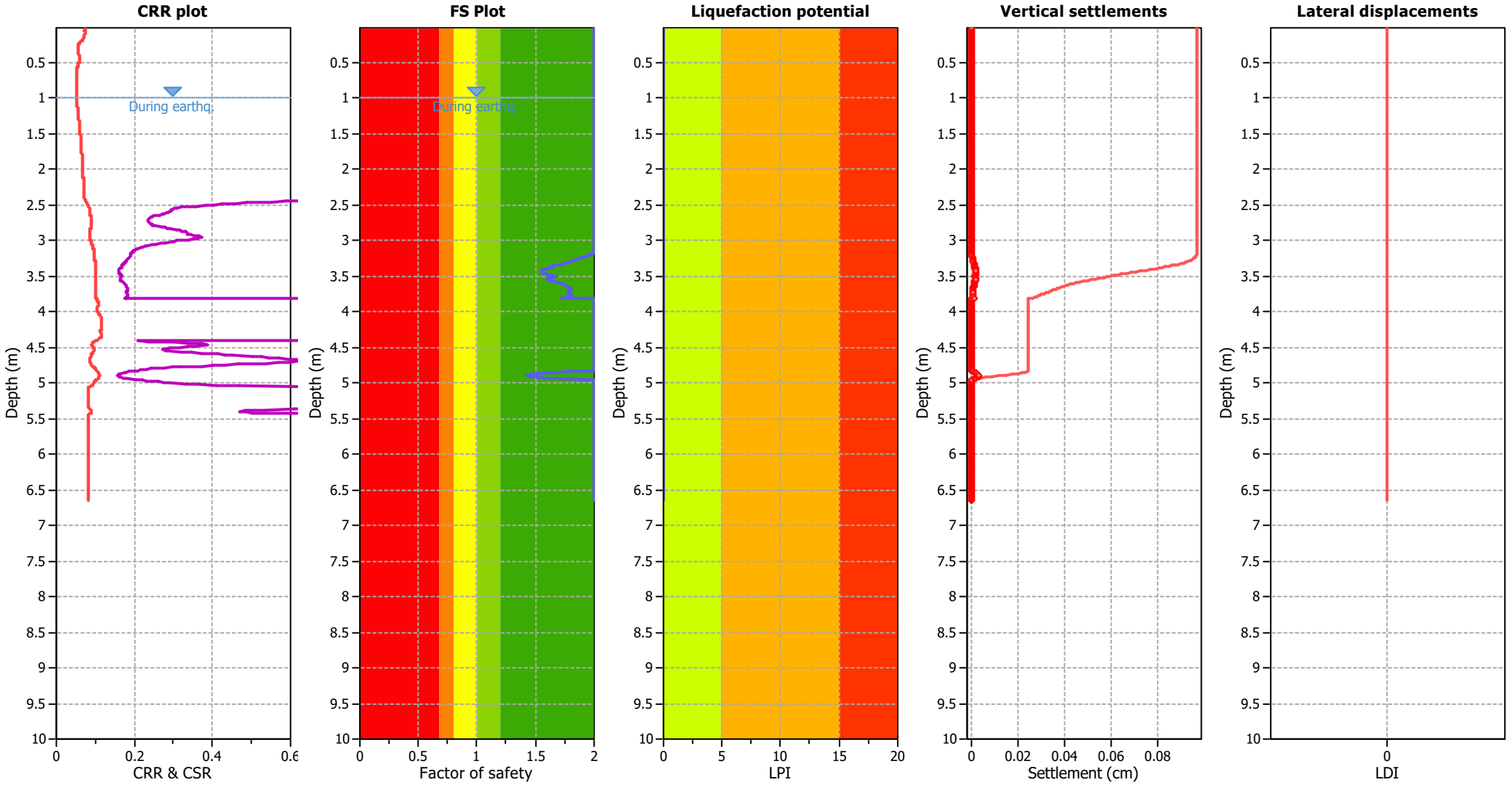
Liquefaction analysis overall plots (intermediate results)



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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

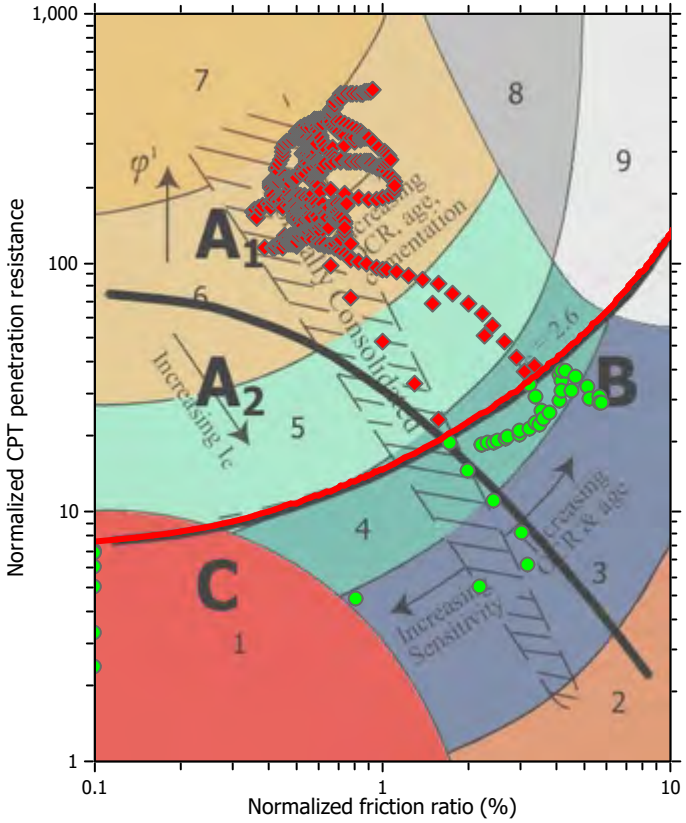
F.S. color scheme

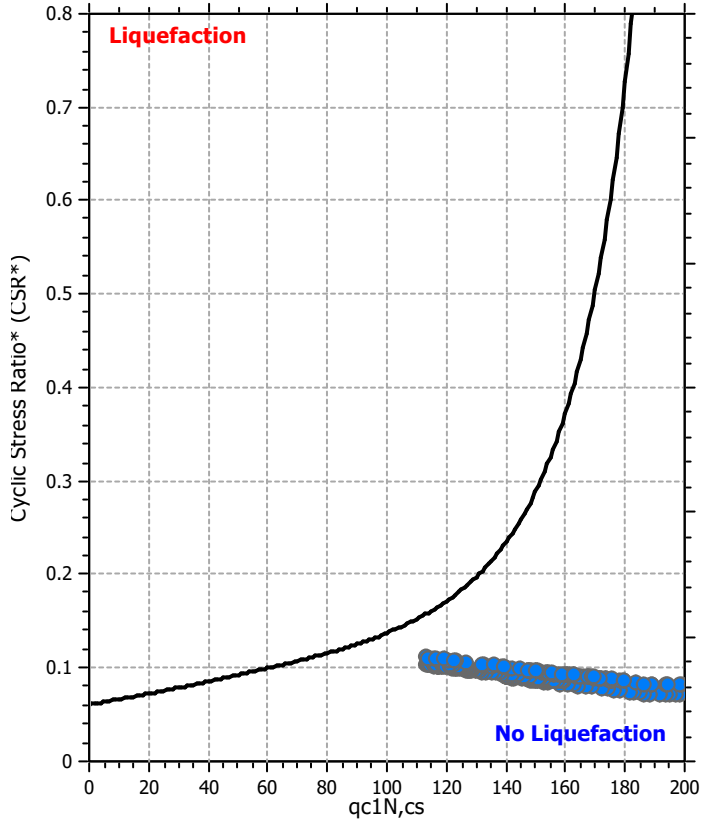
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

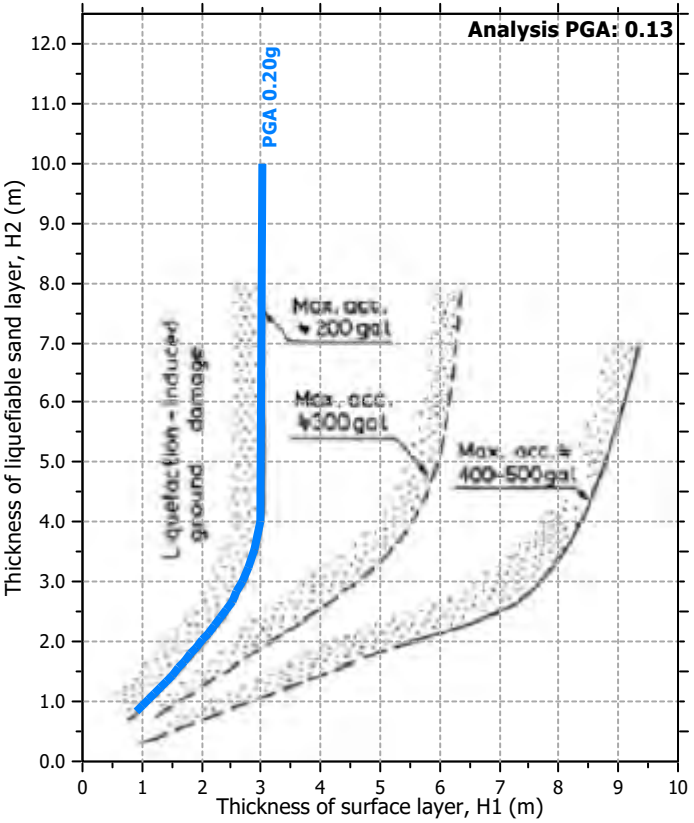
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



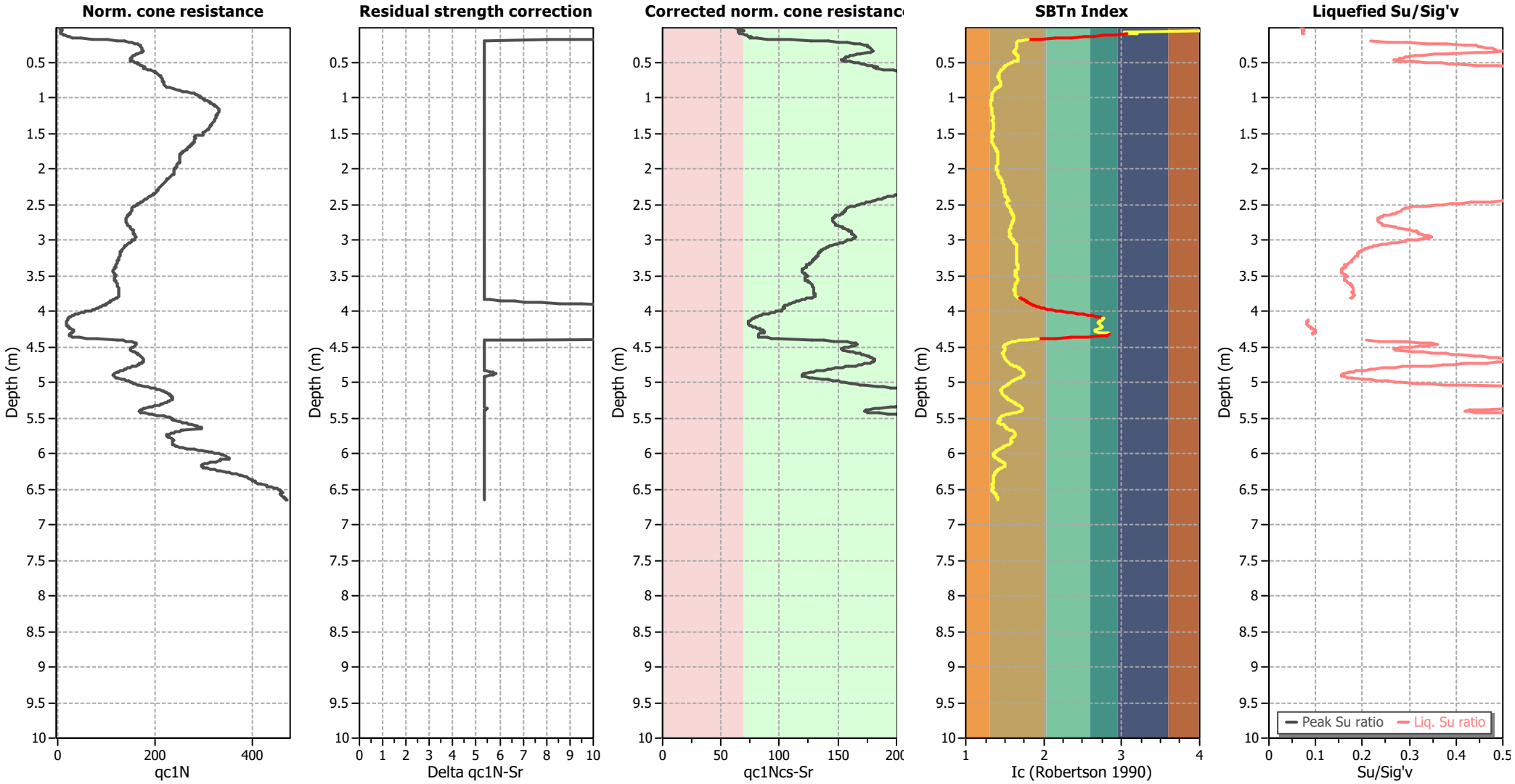




Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

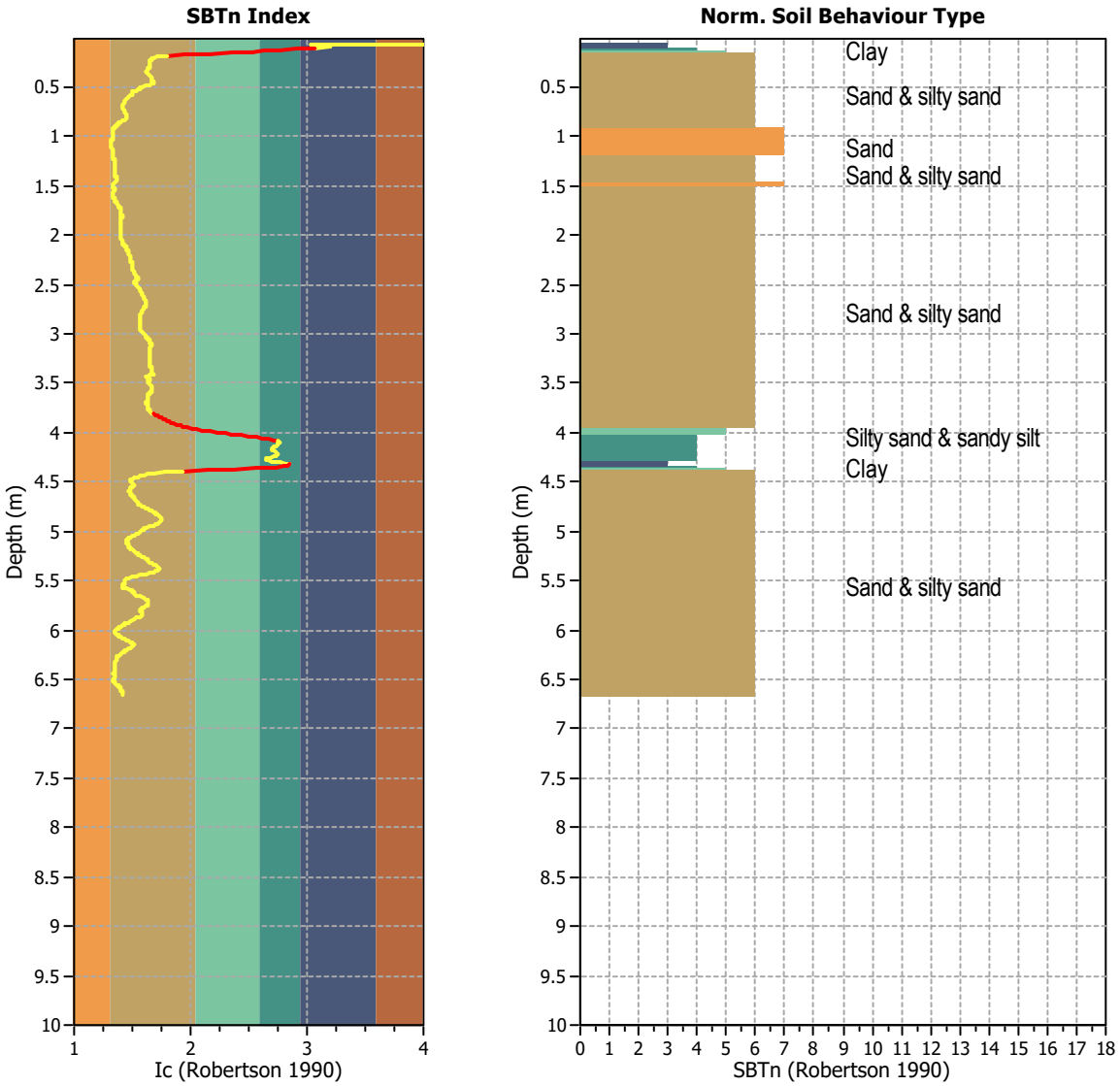
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

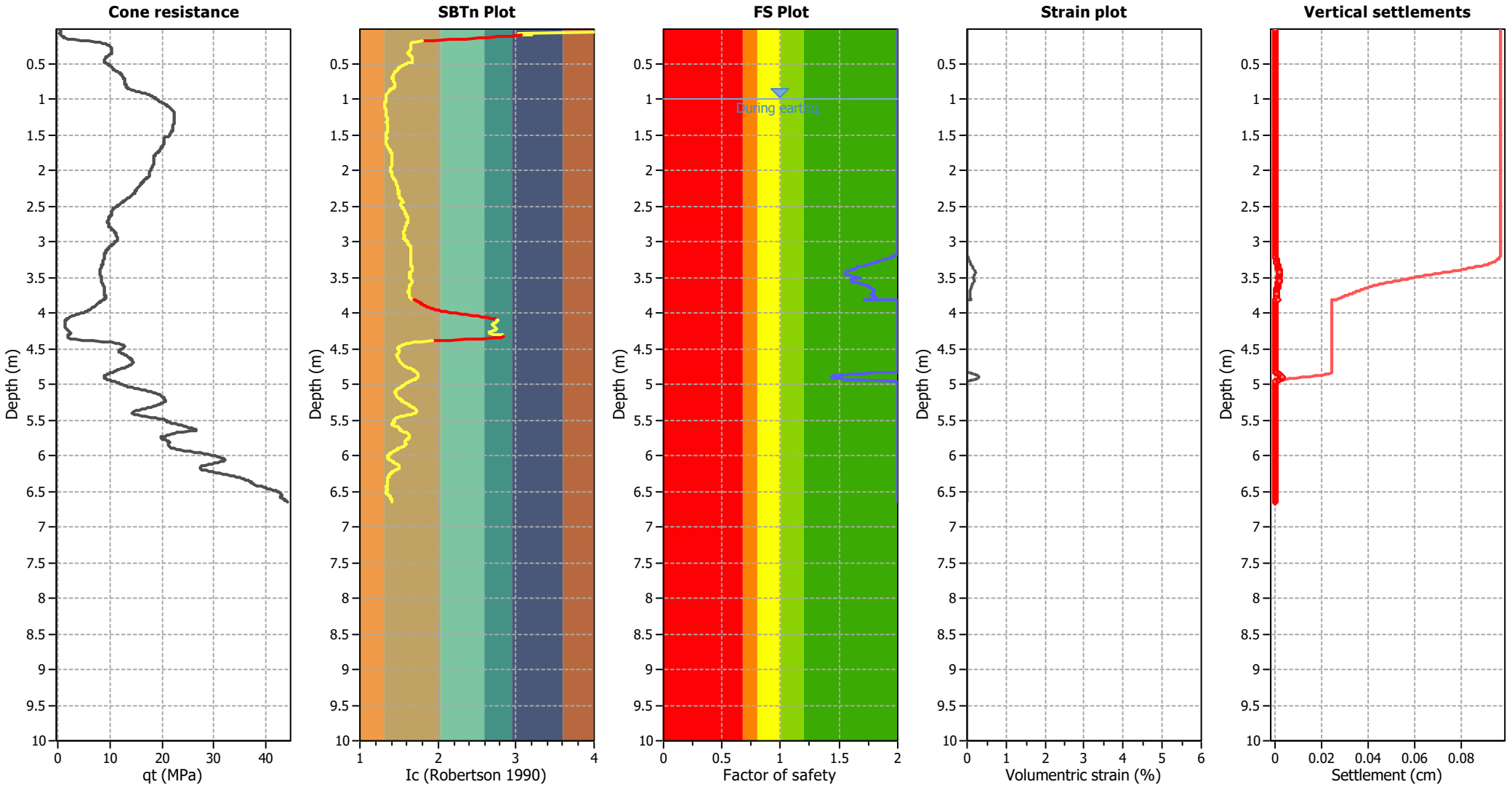
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	665
I_c maximum check value:	3.00	Total points excluded:	46
I_c change ratio value:	0.0100	Exclusion percentage:	6.92%
Minimum number of points in layer:	4	Number of layers detected:	3

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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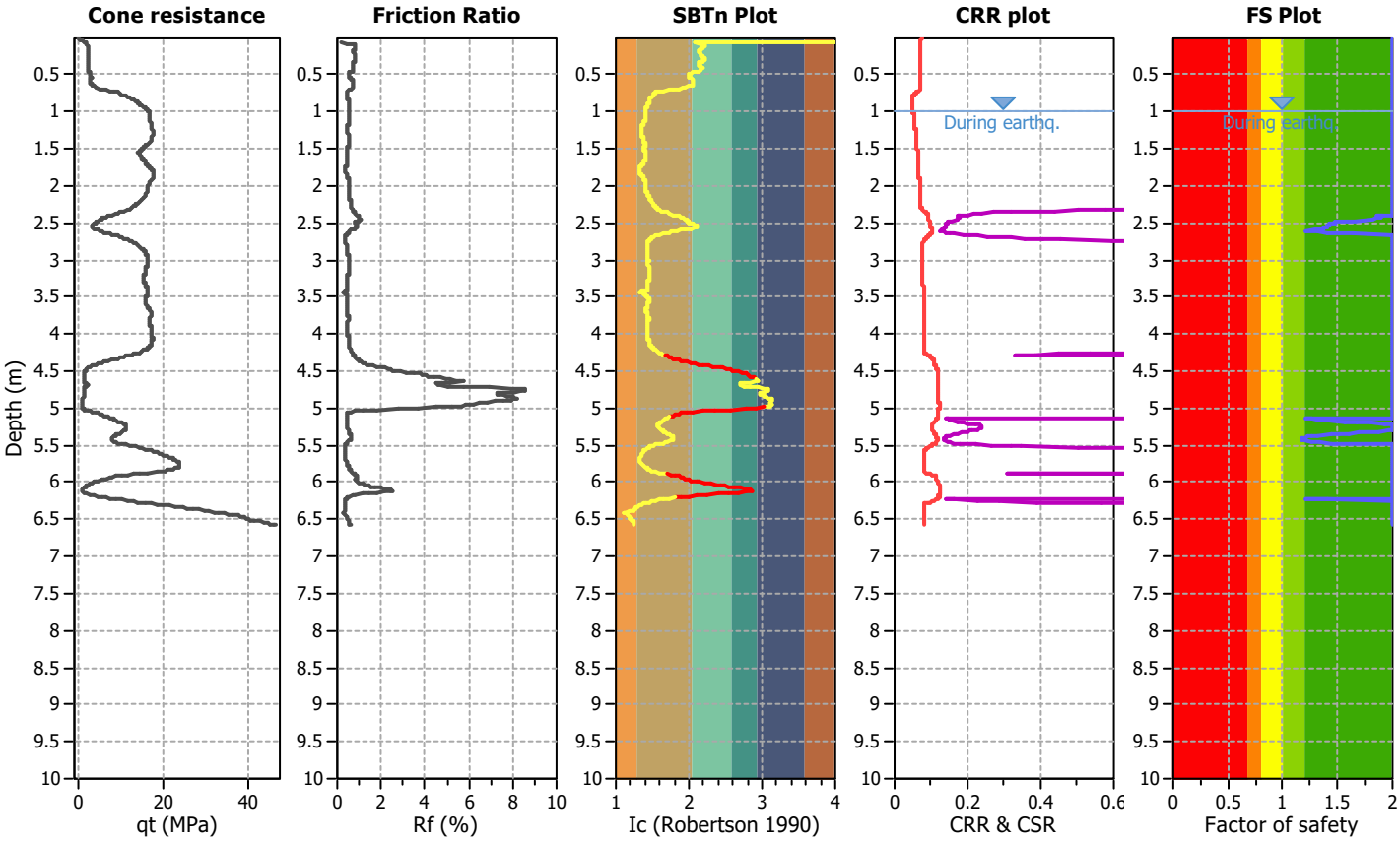
LIQUEFACTION ANALYSIS REPORT

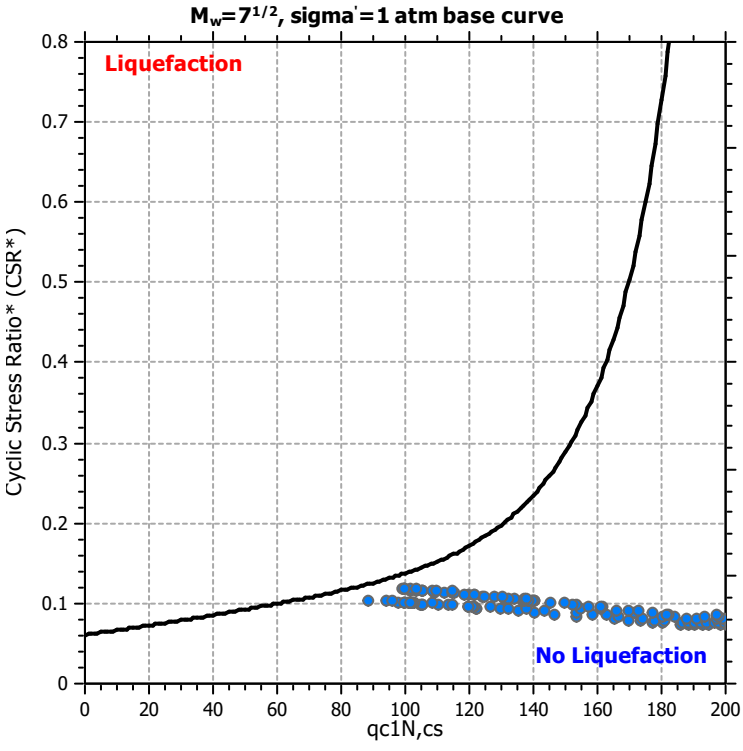
Project title : Foxton Solar Farm **Location : Foxton, New Zealand**

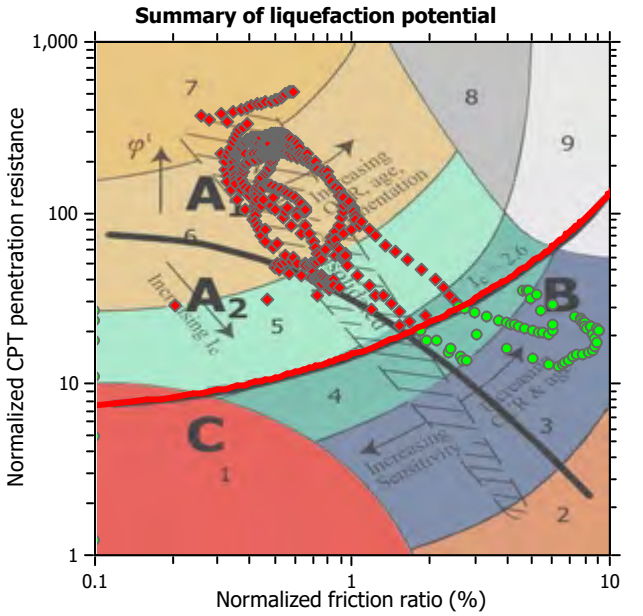
CPT file : CPT17_SLS

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:	Sand & Clay
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:	20.00 m
Earthquake magnitude M_w:	6.40	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

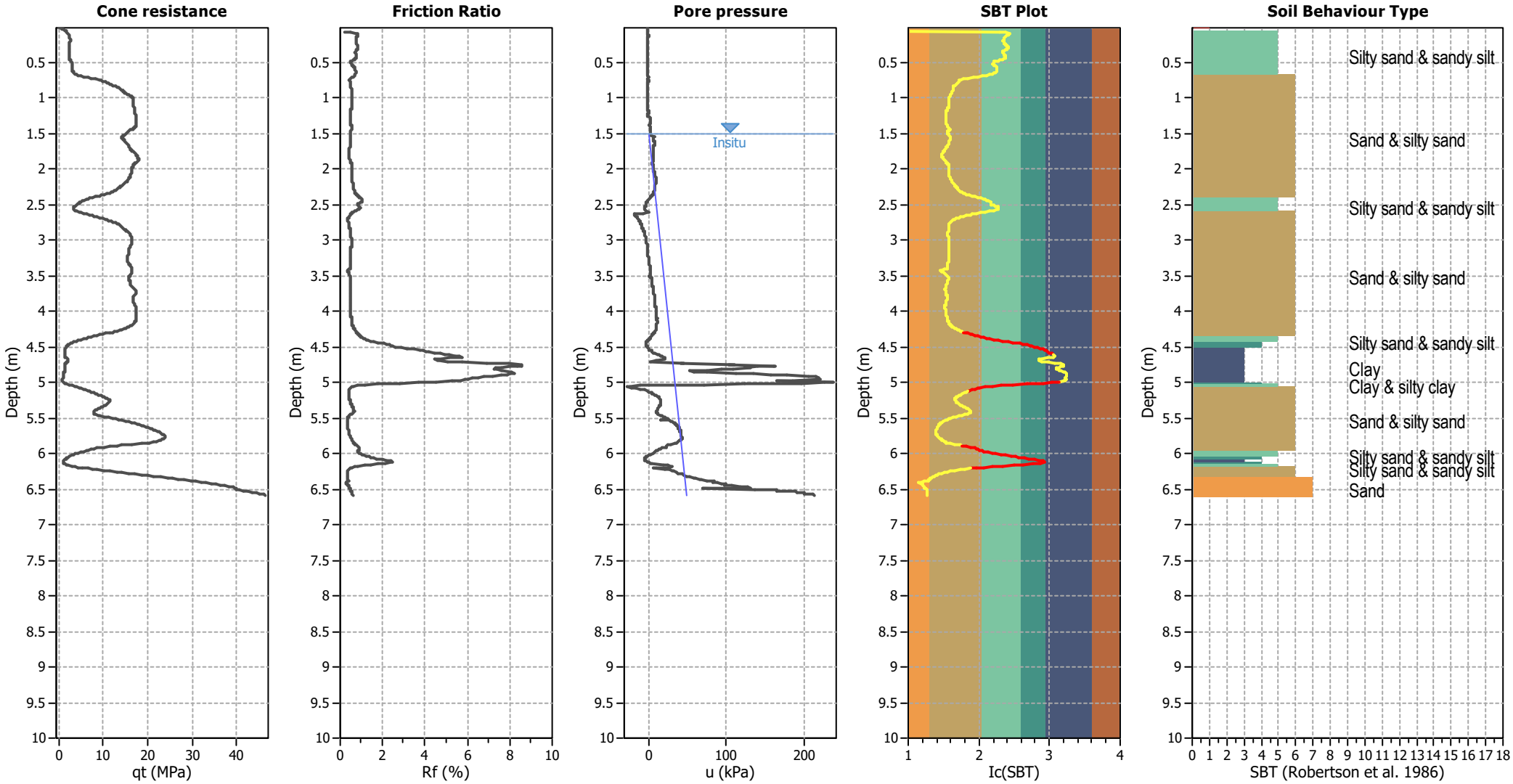






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



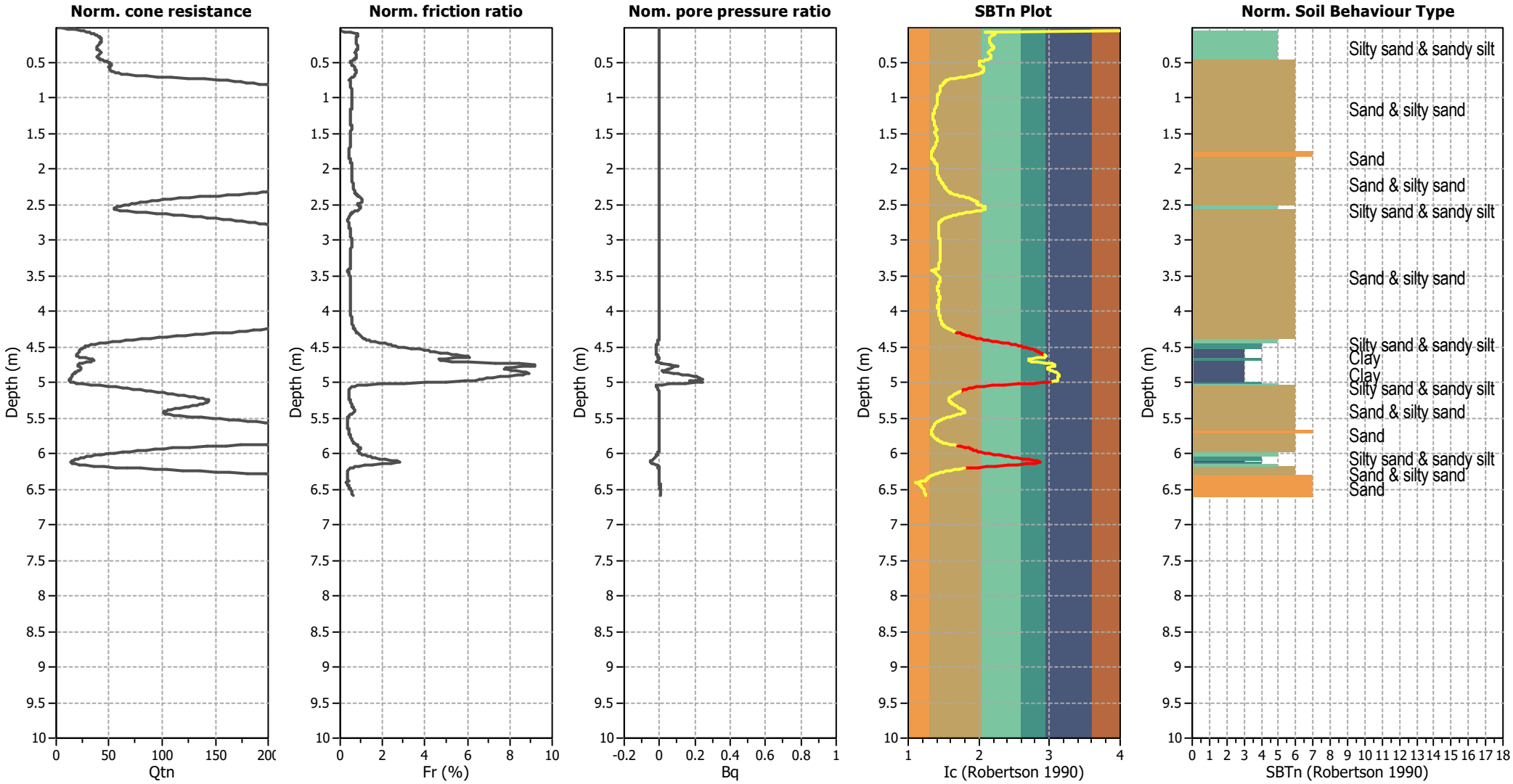
Input parameters and analysis data

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_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

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

CPT basic interpretation plots (normalized)



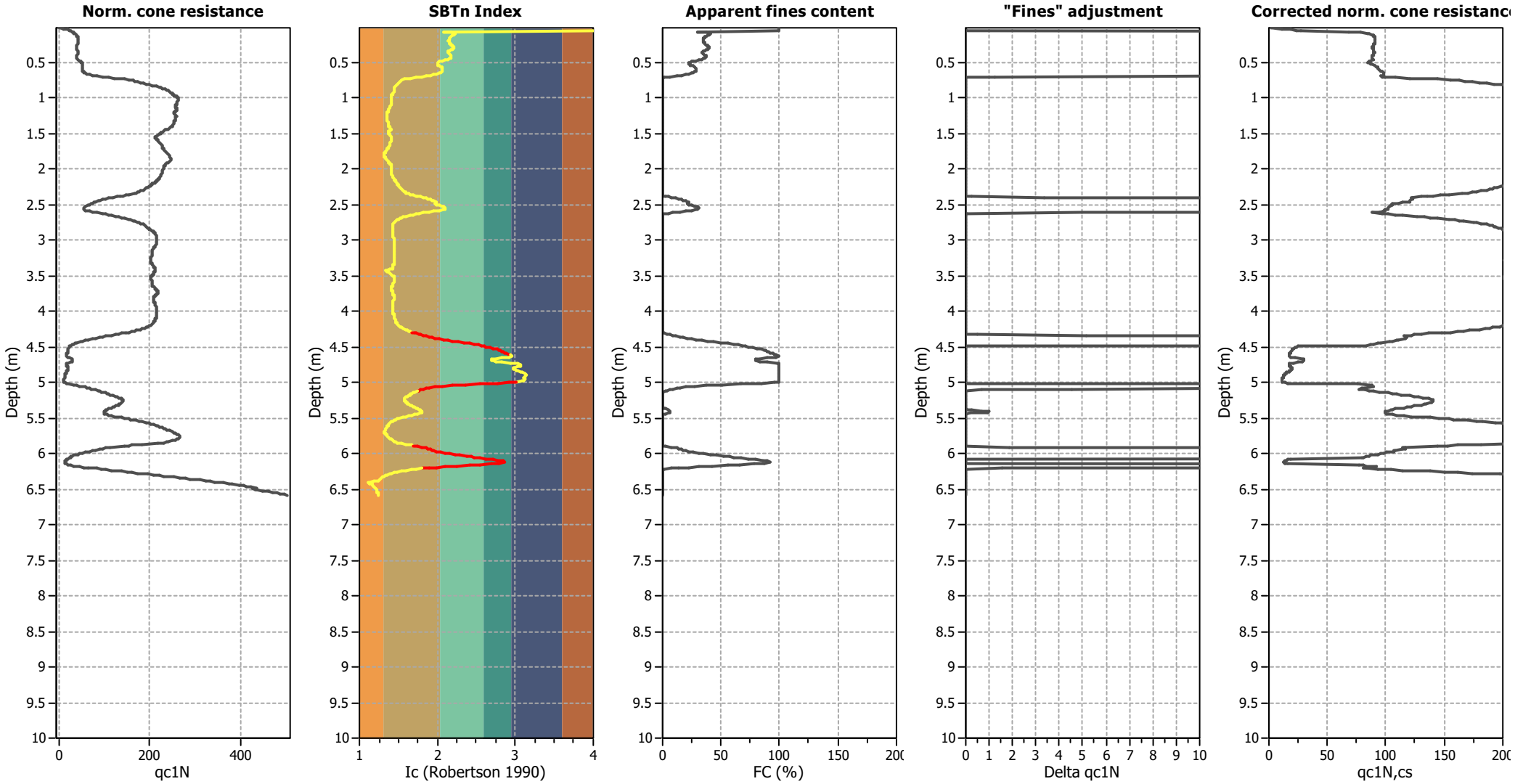
Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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

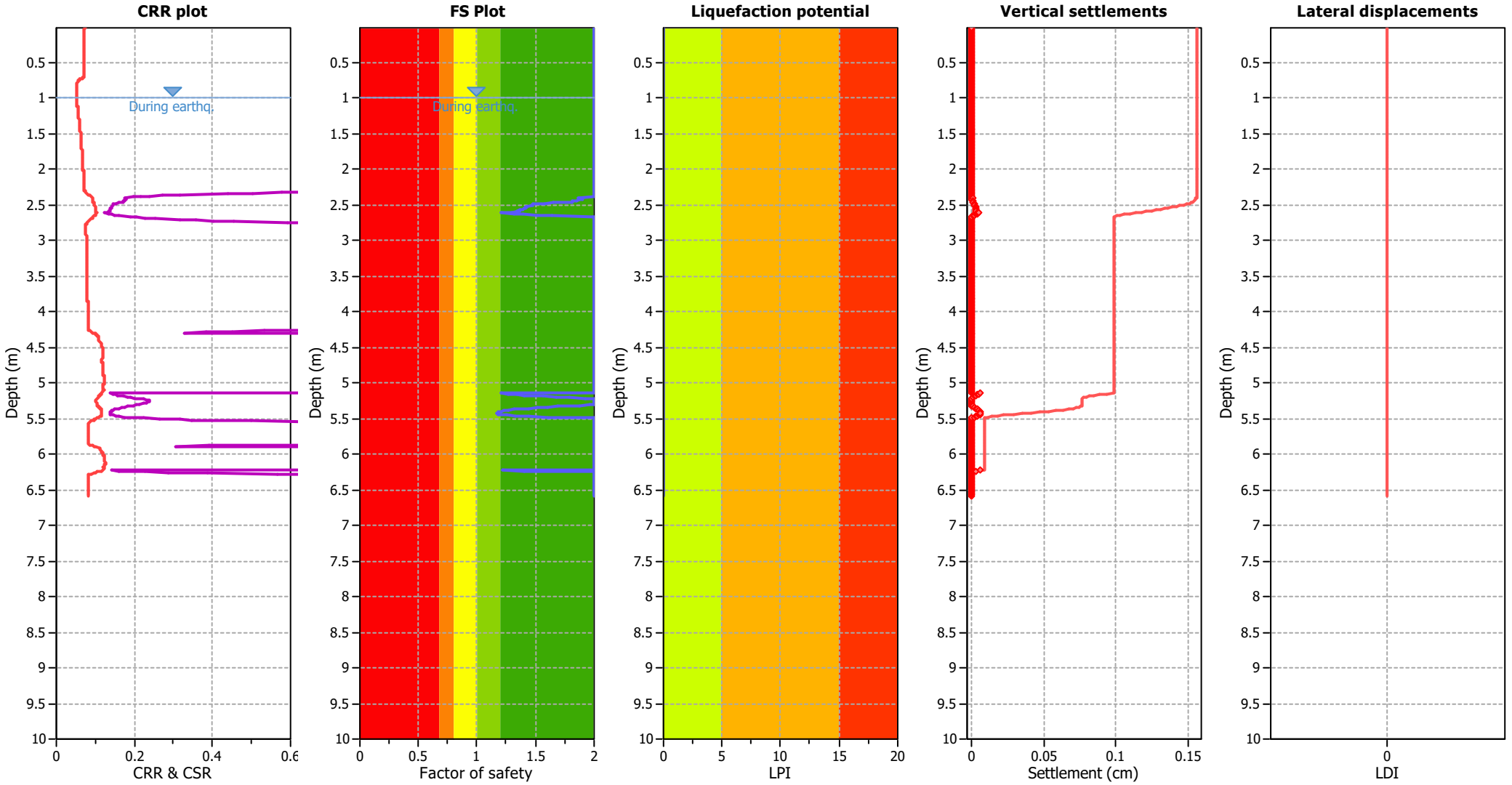
Liquefaction analysis overall plots (intermediate results)



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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

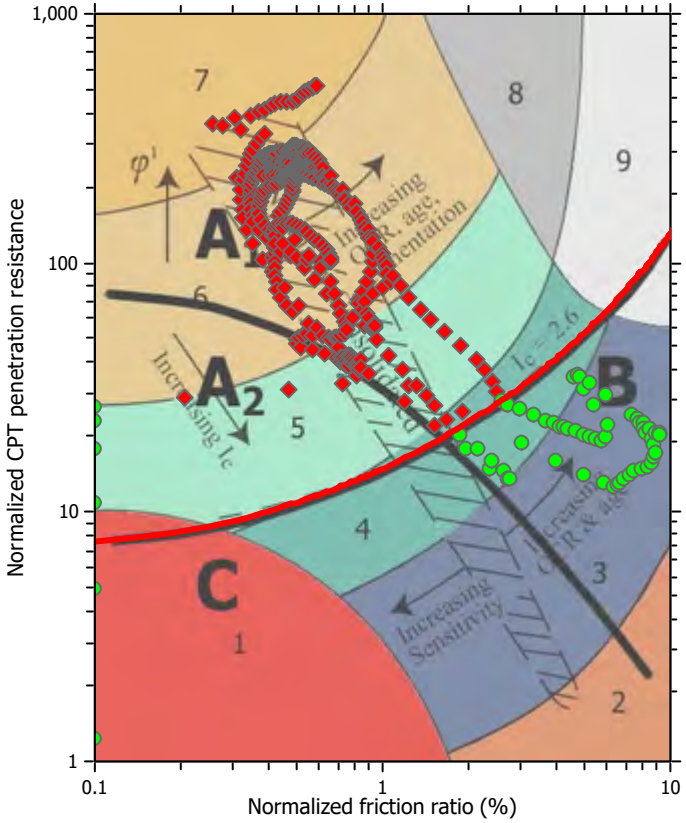
F.S. color scheme

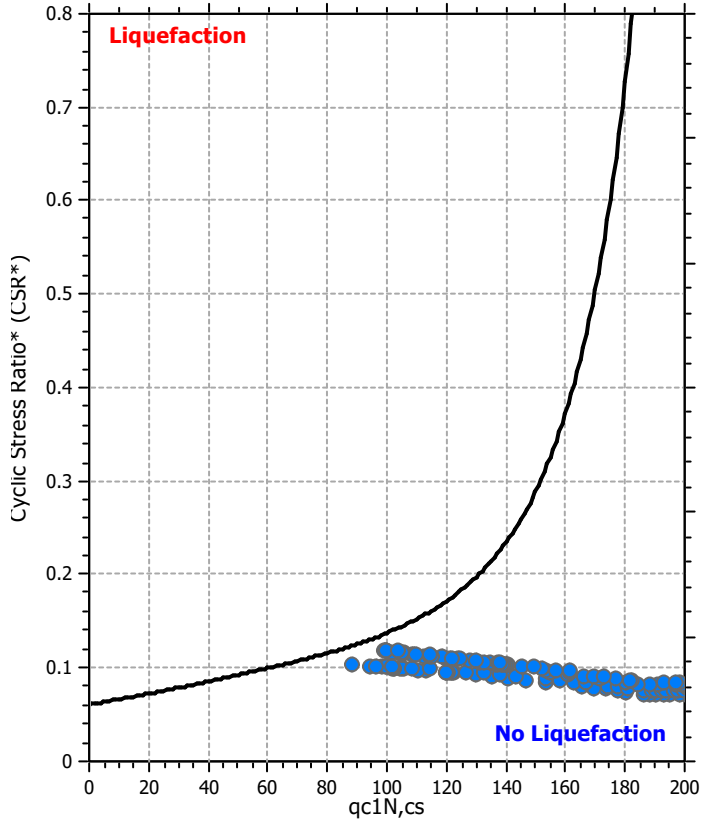
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

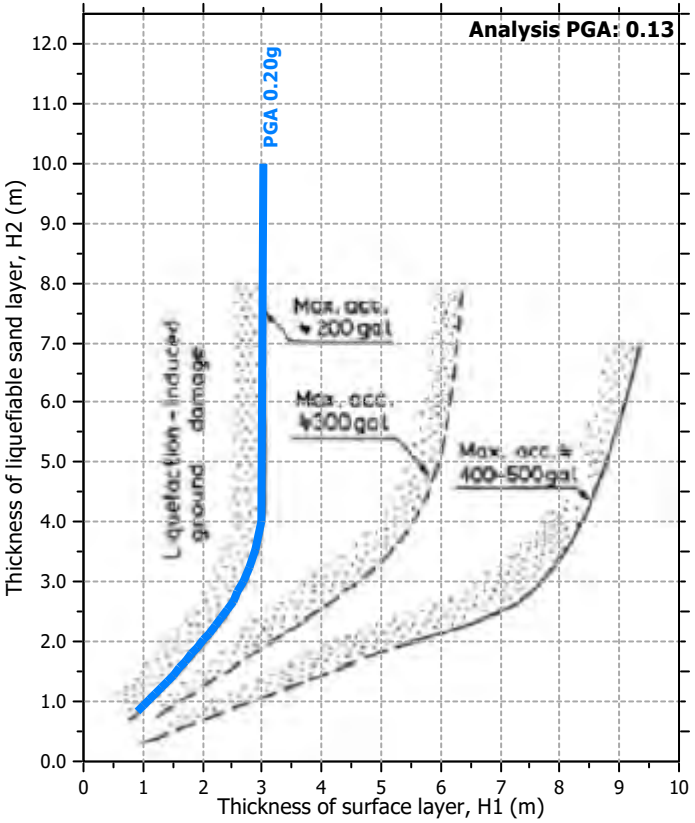
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



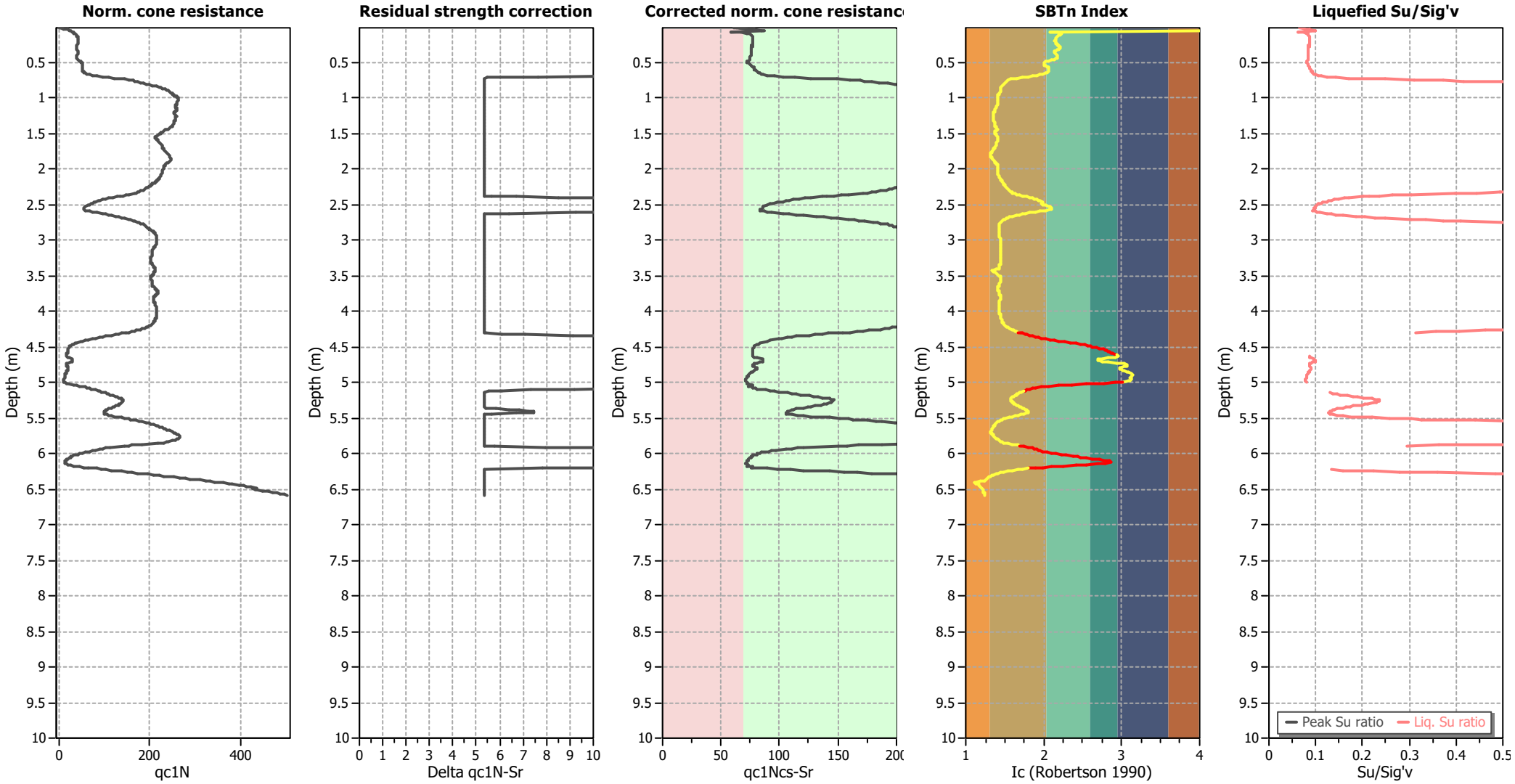




Input parameters and analysis data

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:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

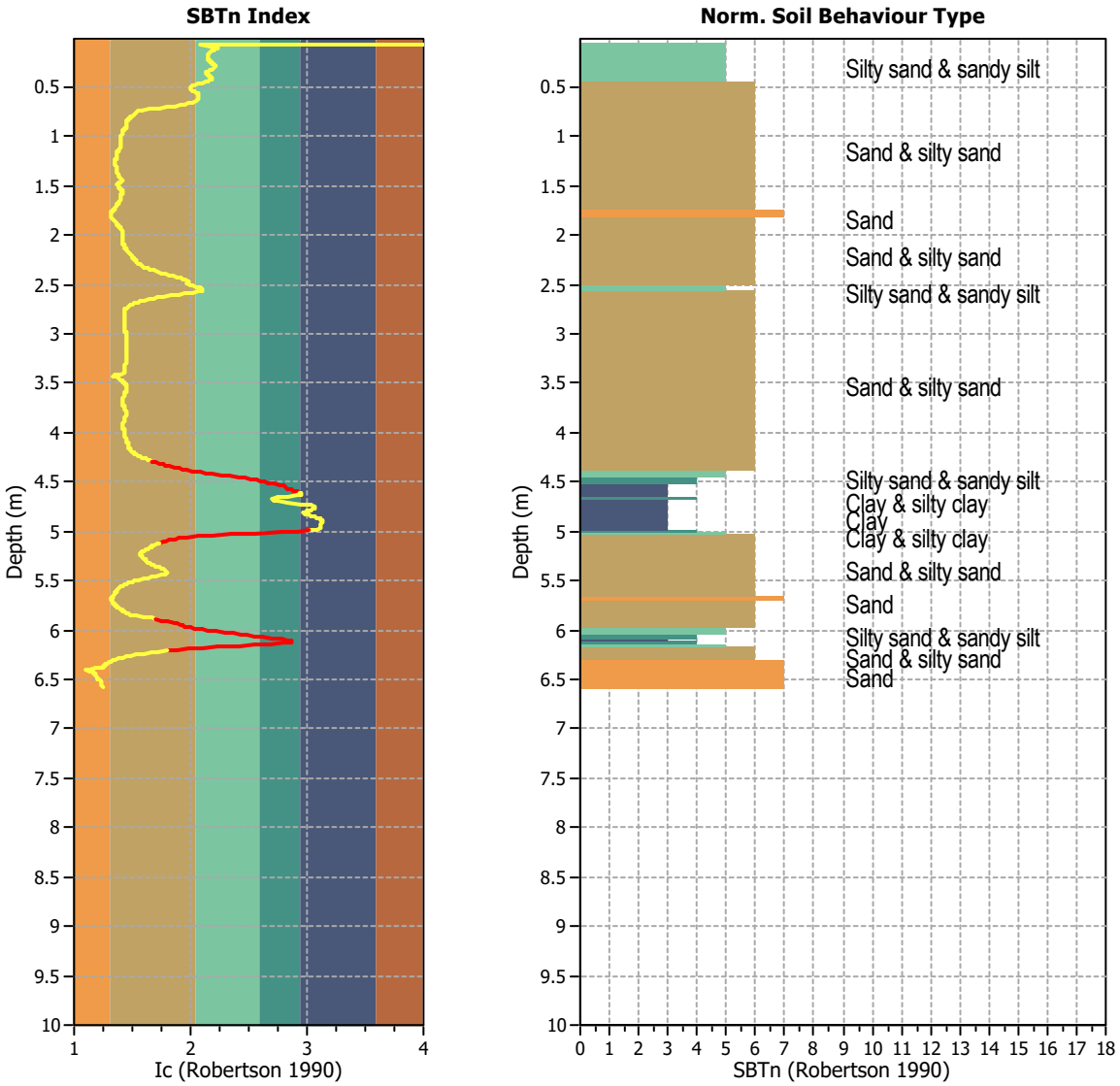
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.40	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	20.00 m

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

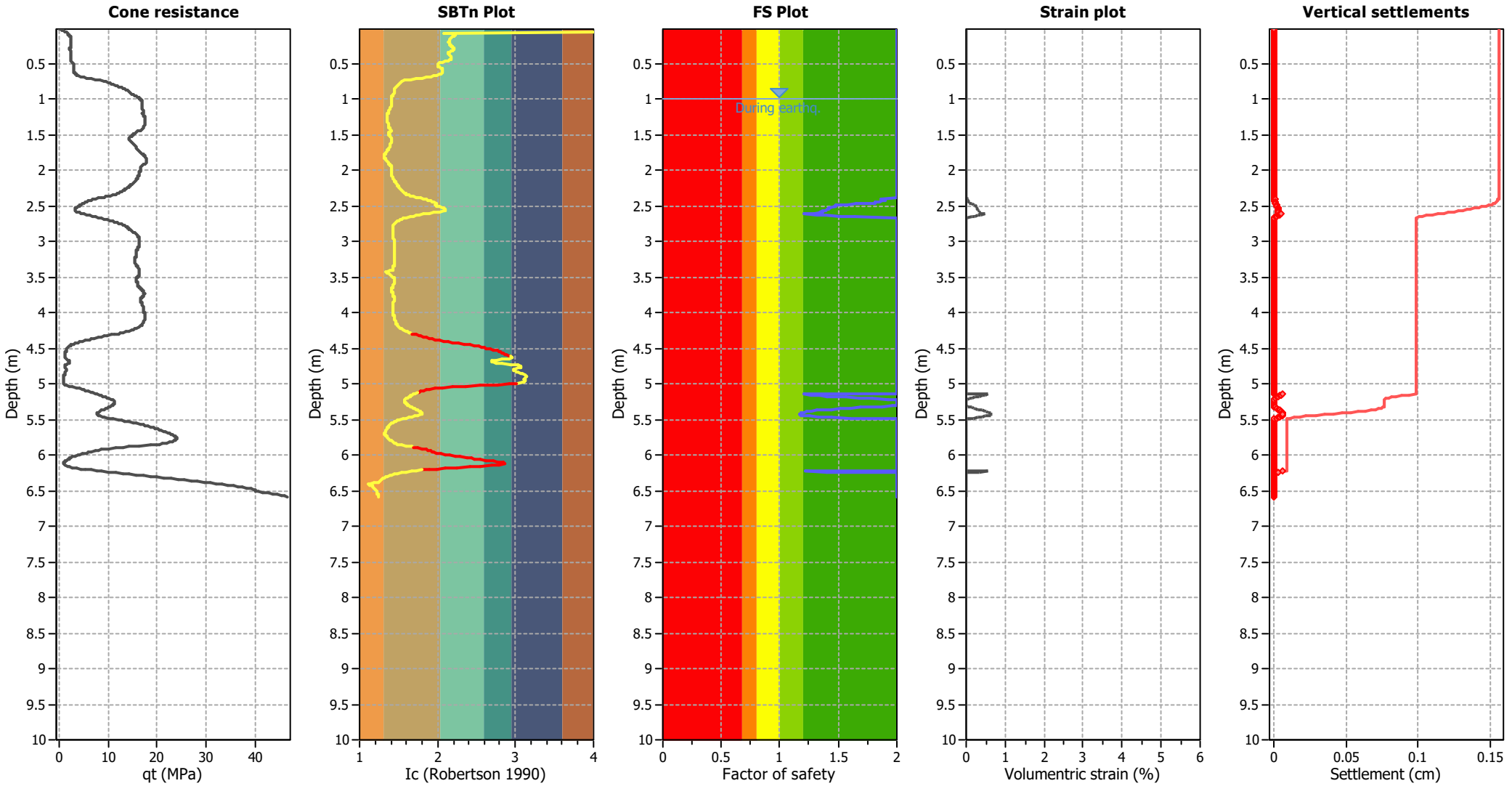
The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	658
I_c maximum check value:	3.00	Total points excluded:	80
I_c change ratio value:	0.0100	Exclusion percentage:	12.16%
Minimum number of points in layer:	4	Number of layers detected:	4

Estimation of post-earthquake settlements

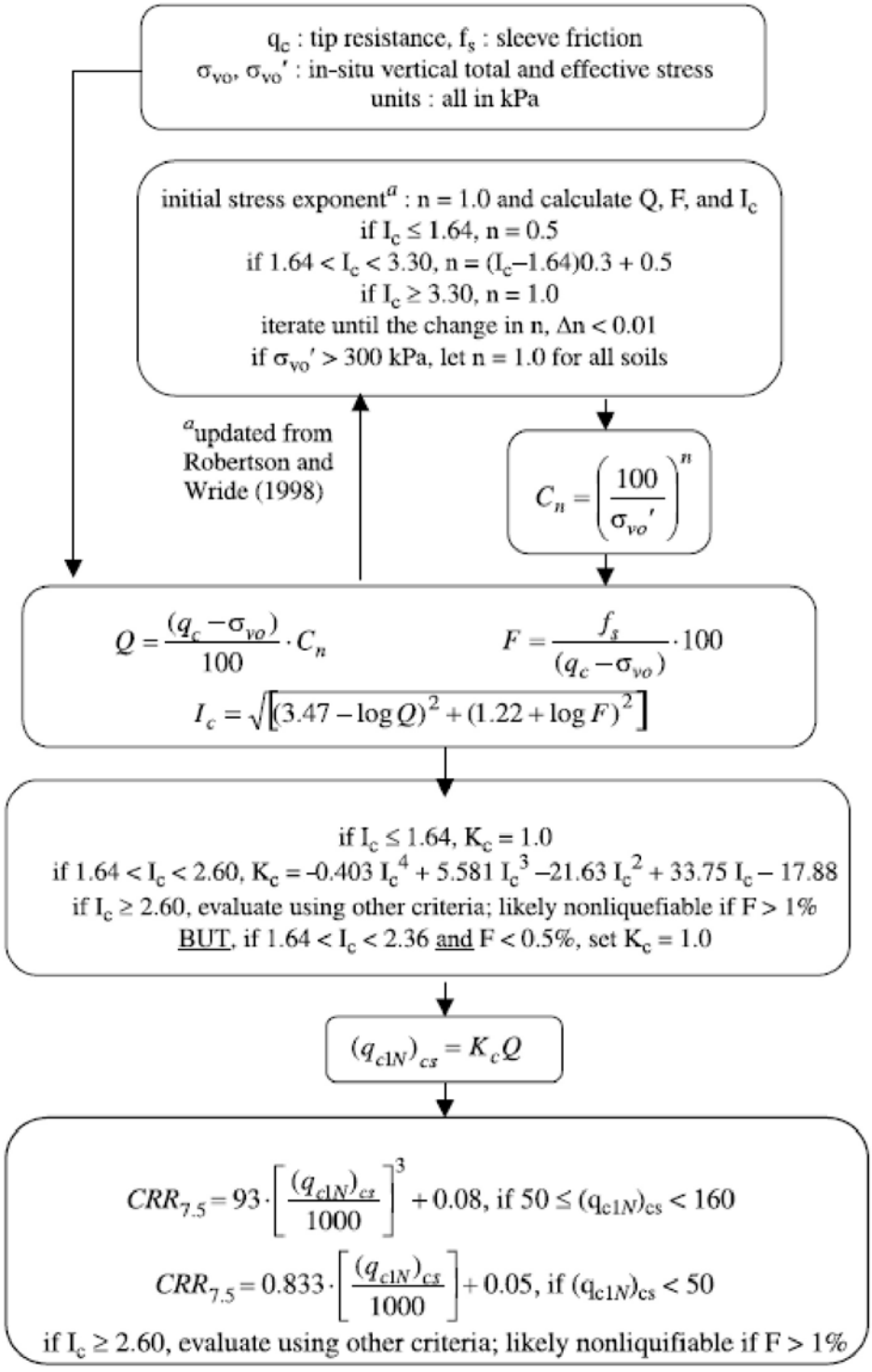


Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Procedure for the evaluation of soil liquefaction resistance, NCEER (1998)

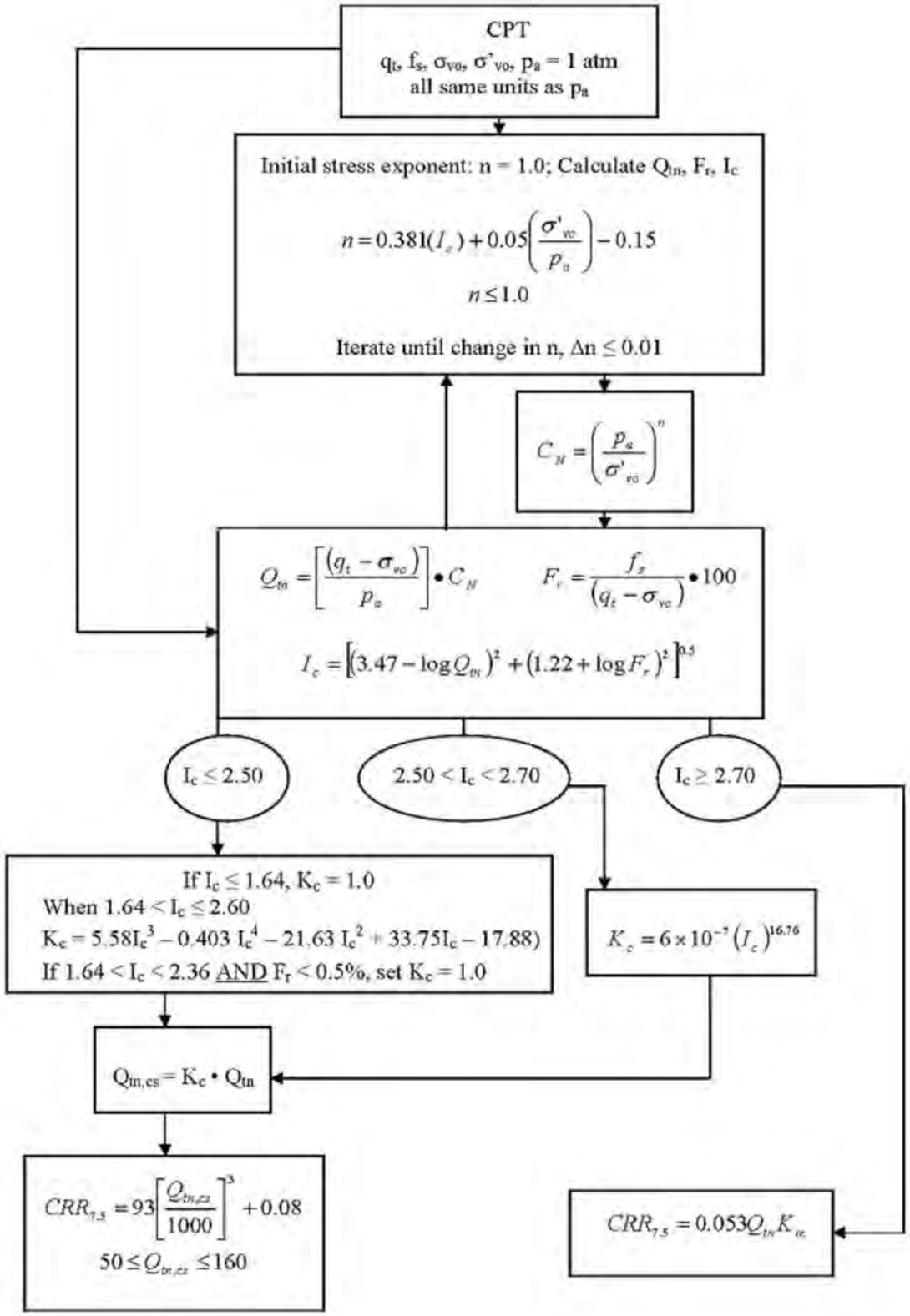
Calculation of soil resistance against liquefaction is performed according to the Robertson & Wride (1998) procedure. The procedure used in the software, slightly differs from the one originally published in NCEER-97-0022 (Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils). The revised procedure is presented below in the form of a flowchart[1]:



[1] "Estimating liquefaction-induced ground settlements from CPT for level ground", G. Zhang, P.K. Robertson, and R.W.I. Brachman

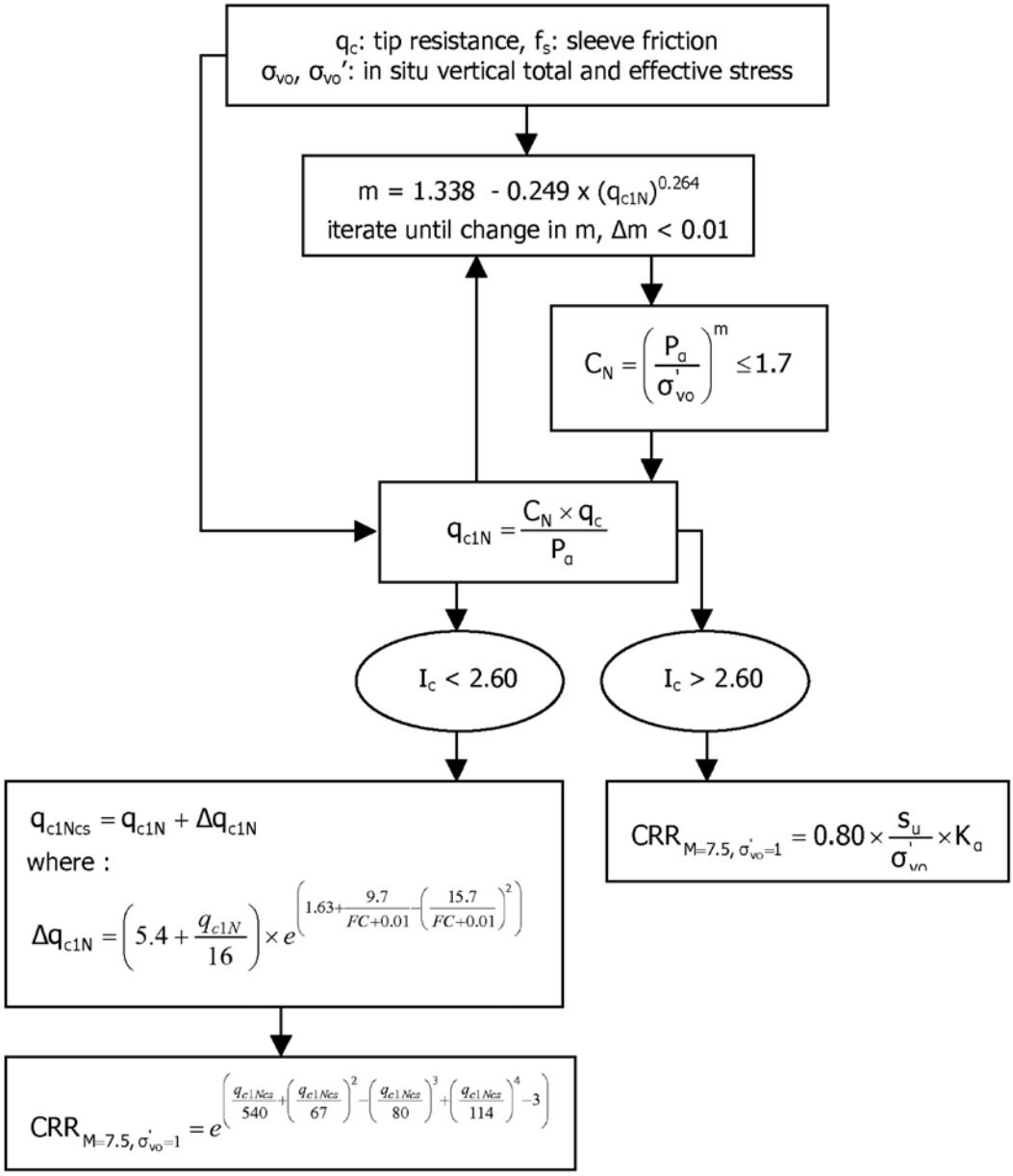
Procedure for the evaluation of soil liquefaction resistance (all soils), Robertson (2010)

Calculation of soil resistance against liquefaction is performed according to the Robertson & Wride (1998) procedure. This procedure used in the software, slightly differs from the one originally published in NCEER-97-0022 (Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils). The revised procedure is presented below in the form of a flowchart[1]:

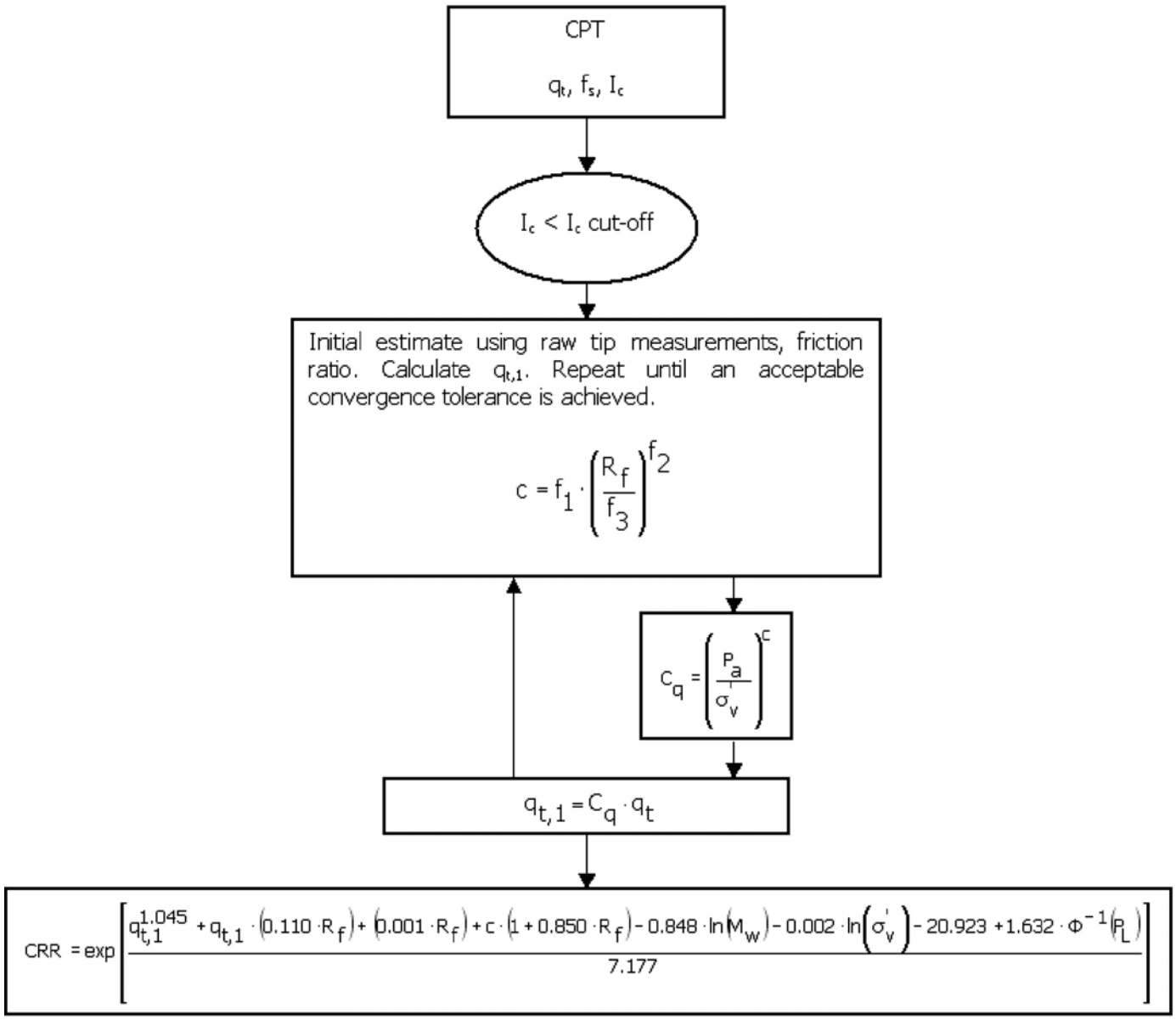


[1] P.K. Robertson, 2009. "Performance based earthquake design using the CPT", Keynote Lecture, International Conference on Performance-based Design in Earthquake Geotechnical Engineering – from case history to practice, IS-Tokyo, June 2009

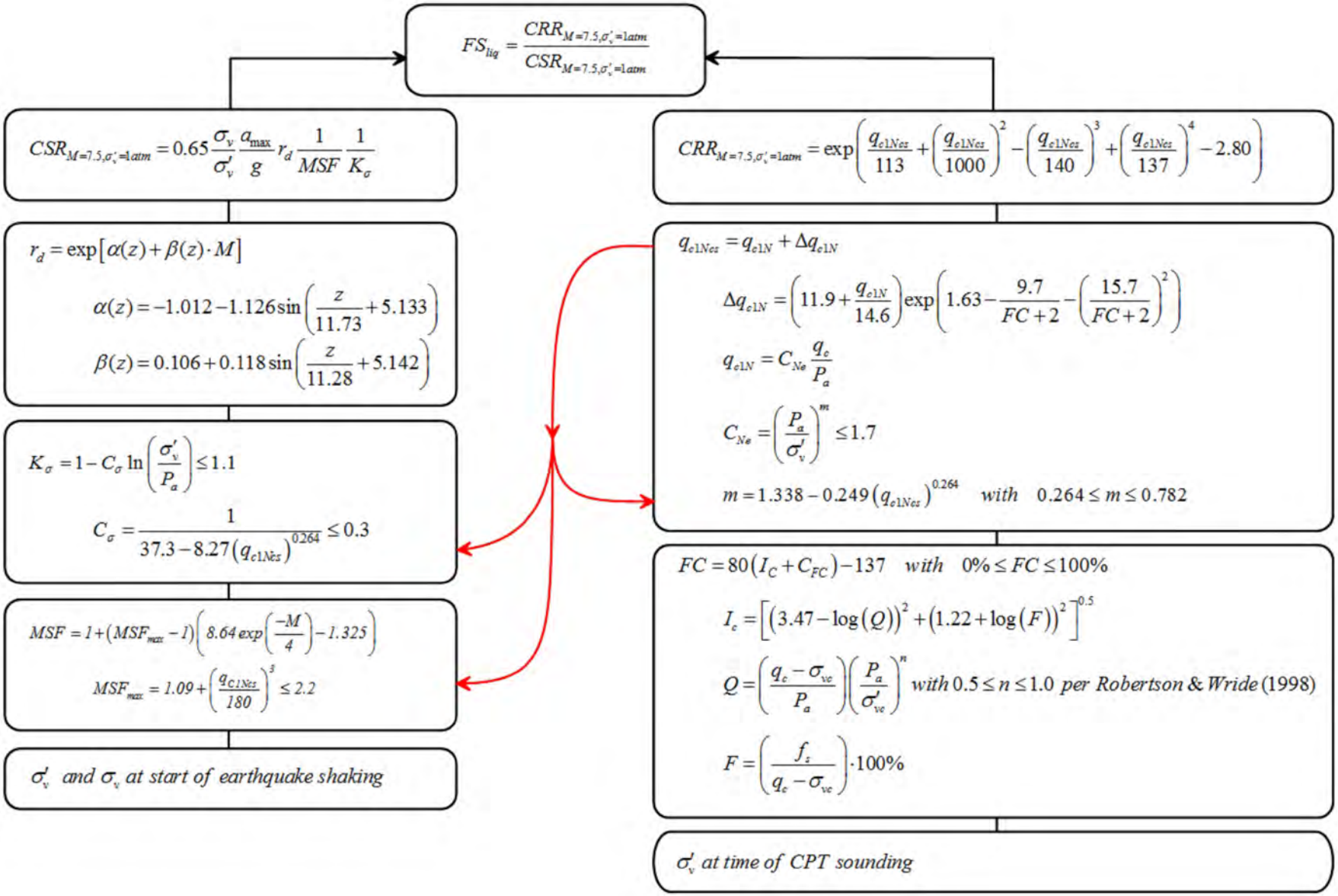
Procedure for the evaluation of soil liquefaction resistance, Idriss & Boulanger (2008)



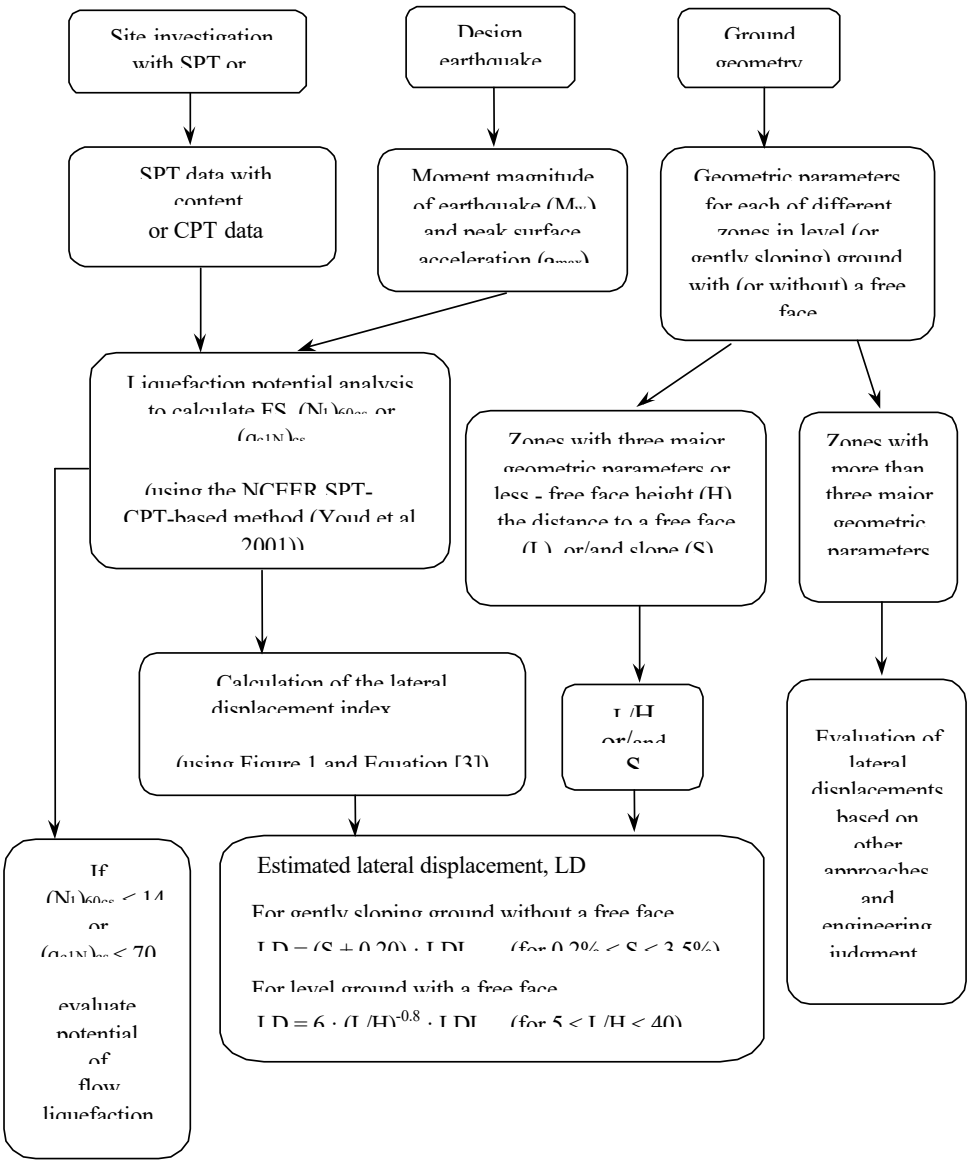
Procedure for the evaluation of soil liquefaction resistance (sandy soils), Moss et al. (2006)



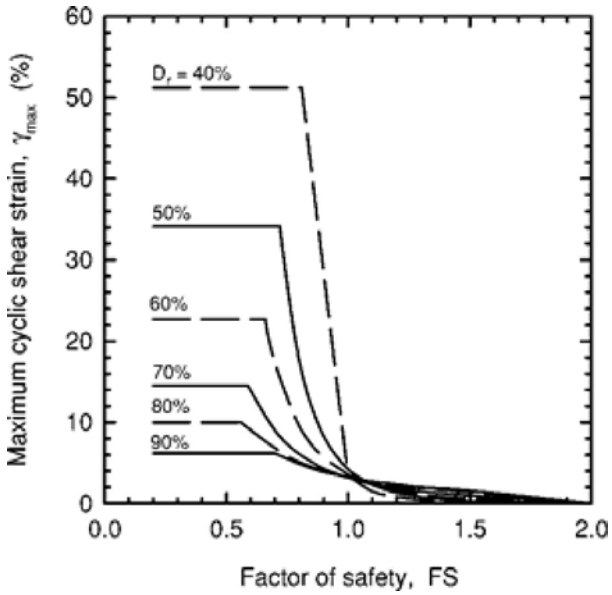
Procedure for the evaluation of soil liquefaction resistance, Boulanger & Idriss(2014)



Procedure for the evaluation of liquefaction-induced lateral spreading displacements



[1] Flow chart illustrating major steps in estimating liquefaction-induced lateral spreading displacements using the proposed approach



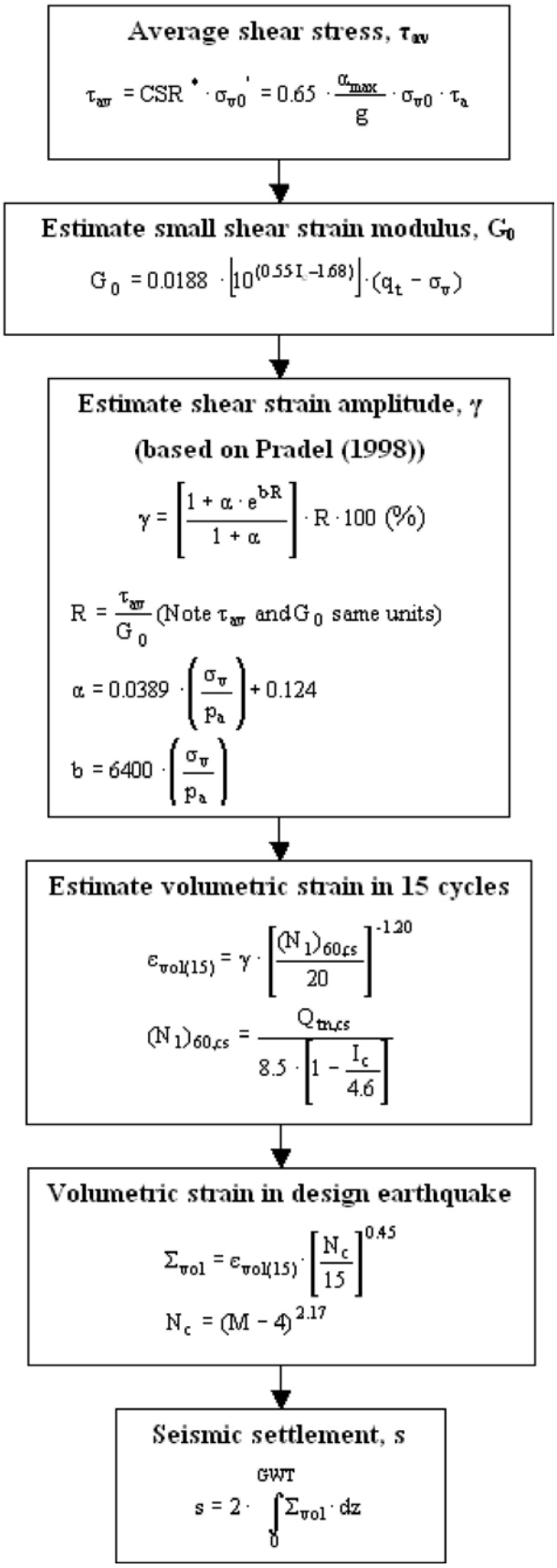
[1] **Figure 1**

$$LDI = \int_0^{Z_{max}} \gamma_{max} dz$$

[1] **Equation [3]**

[1] "Estimating liquefaction-induced ground settlements from CPT for level ground", G. Zhang, P.K. Robertson, and R.W.I. Brachman

Procedure for the estimation of seismic induced settlements in dry sands



Robertson, P.K. and Lisheng, S., 2010, "Estimation of seismic compression in dry soils using the CPT" FIFTH INTERNATIONAL CONFERENCE ON RECENT ADVANCES IN GEOTECHNICAL EARTHQUAKE ENGINEERING AND SOIL DYNAMICS, Symposium in honor of professor I. M. Idriss, San Diego, CA

Liquefaction Potential Index (LPI) calculation procedure

Calculation of the Liquefaction Potential Index (LPI) is used to interpret the liquefaction assessment calculations in terms of severity over depth. The calculation procedure is based on the methology developed by Iwasaki (1982) and is adopted by AFPS.

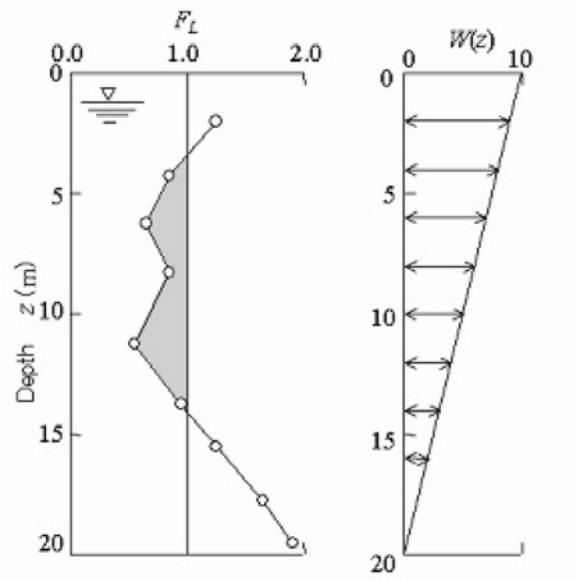
To estimate the severity of liquefaction extent at a given site, LPI is calculated based on the following equation:

$$\mathbf{LPI} = \int_0^{20} (10 - 0{,}5z) \times F_L \times dz$$

where:
F_L = 1 - F.S. when F.S. less than 1
F_L = 0 when F.S. greater than 1
z depth of measurment in meters

Values of LPI range between zero (0) when no test point is characterized as liquefiable and 100 when all points are characterized as susceptible to liquefaction. Iwasaki proposed four (4) discrete categories based on the numeric value of LPI:

- LPI = 0 : Liquefaction risk is very low
- 0 < LPI <= 5 : Liquefaction risk is low
- 5 < LPI <= 15 : Liquefaction risk is high
- LPI > 15 : Liquefaction risk is very high



Graphical presentation of the LPI calculation procedure

Shear-Induced Building Settlement (Ds) calculation procedure

The shear-induced building settlement (Ds) due to liquefaction below the building can be estimated using the relationship developed by Bray and Macedo (2017):

$$Ln(Ds) = c1 + c2 * LBS + 0.58 * Ln\left(Tanh\left(\frac{HL}{6}\right)\right) + 4.59 * Ln(Q) - 0.42 * Ln(Q)^2 - 0.02 * B + 0.84 * Ln(CAVdp) + 0.41 * Ln(Sa1) + \varepsilon$$

where Ds is in the units of mm, c1= -8.35 and c2= 0.072 for LBS ≤ 16, and c1= -7.48 and c2= 0.014 otherwise. Q is the building contact pressure in units of kPa, HL is the cumulative thickness of the liquefiable layers in the units of m, B is the building width in the units of m, CAVdp is a standardized version of the cumulative absolute velocity in the units of g-s, Sa1 is 5%-damped pseudo-acceleration response spectral value at a period of 1 s in the units of g, and ε is a normal random variable with zero mean and 0.50 standard deviation in Ln units. The liquefaction-induced building settlement index (LBS) is:

$$LBS = \sum W * \frac{\varepsilon_{shear}}{z} dz$$

where z (m) is the depth measured from the ground surface > 0, W is a foundation-weighting factor wherein W = 0.0 for z less than Df, which is the embedment depth of the foundation, and W = 1.0 otherwise. The shear strain parameter (ε_shear) is the liquefaction-induced free-field shear strain (in %) estimated using Zhang et al. (2004). It is calculated based on the estimated Dr of the liquefied soil layer and the calculated safety factor against liquefaction triggering (FSL).

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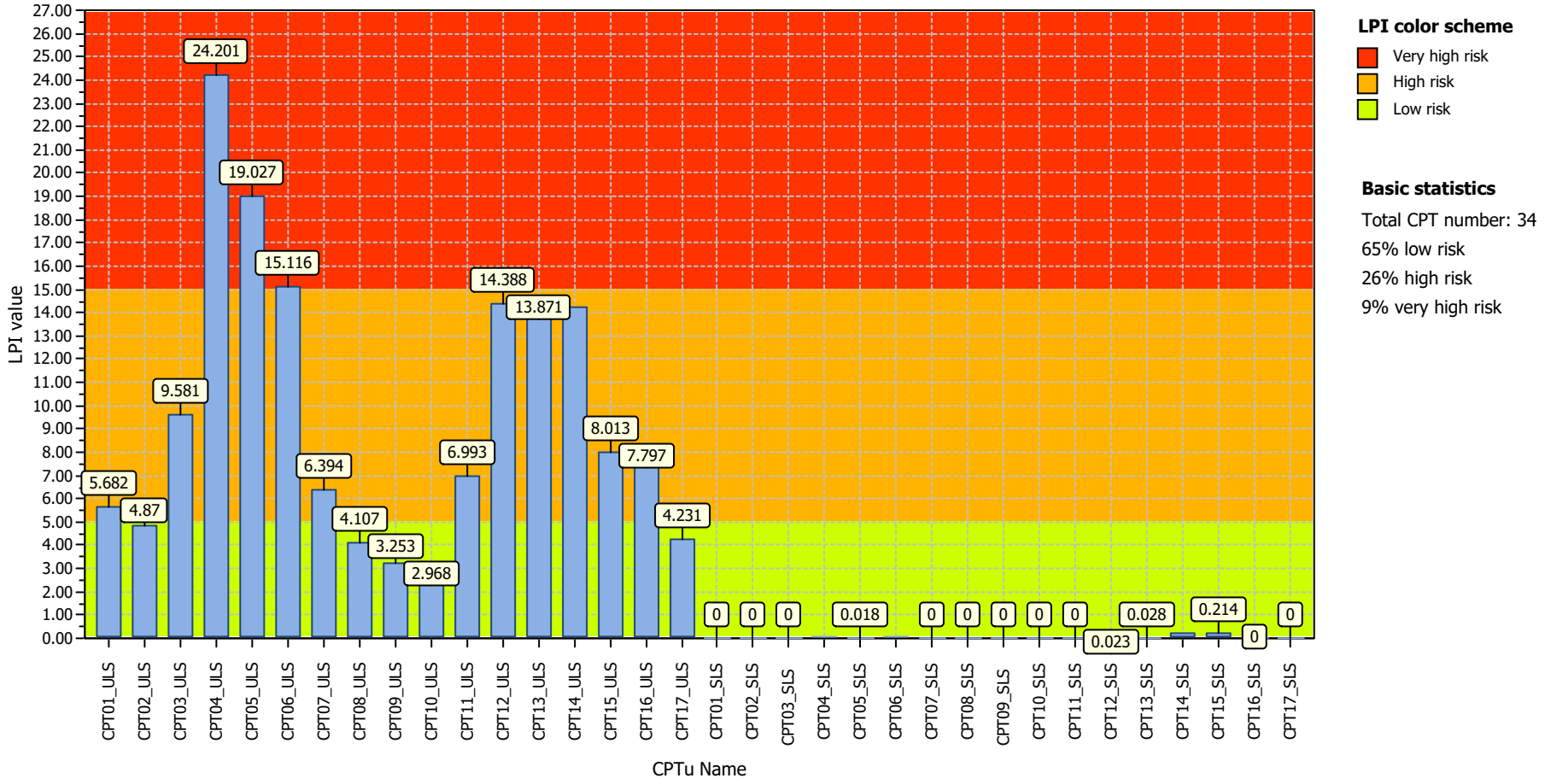
- Jonathan D. Bray & Jorge Macedo, Department of Civil & Environmental Engineering, Univ. of California, Berkeley, CA, USA, Simplified procedure for estimating liquefaction-induced building settlement, *Proceedings of the 19th International Conference on Soil Mechanics and Geotechnical Engineering, Seoul 201*

BTW Company
Engineering Geologists, Civil Engineers
179 Courtenay Street, New Plymouth
www.btw.nz

Project title : Foxton Solar Farm

Location : Foxton, New Zealand

Overall Liquefaction Potential Index report



LPI color scheme

- Very high risk
- High risk
- Low risk

Basic statistics

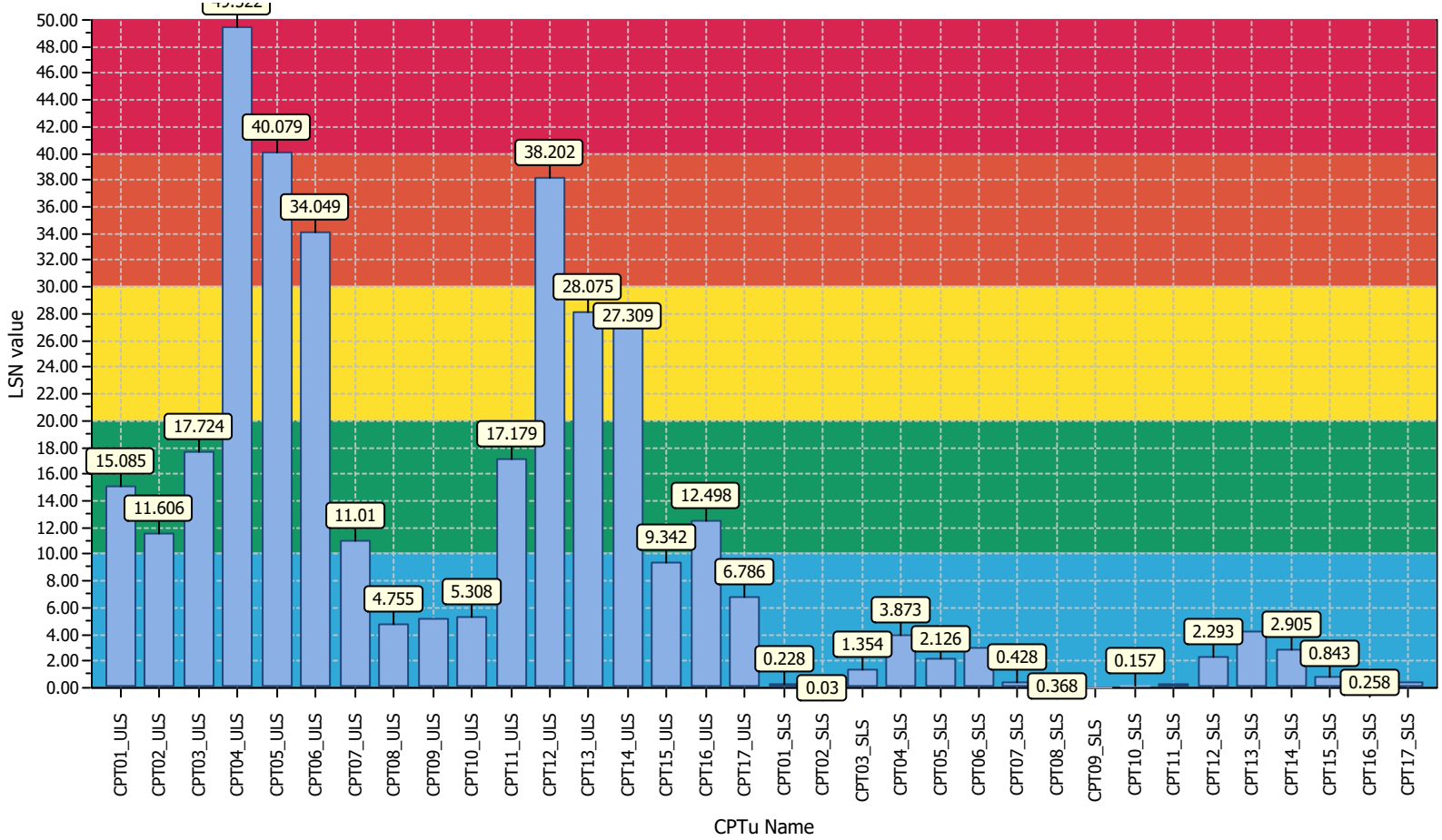
Total CPT number: 34
65% low risk
26% high risk
9% very high risk

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Project title : Foxton Solar Farm

Location : Foxton, New Zealand

Overall Liquefaction Severity Number report



LSN color scheme

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

Basic statistics

Total CPT number: 34

65% little liquefaction

18% minor liquefaction

6% moderate liquefaction

6% moderate to major liquefaction

6% major liquefaction

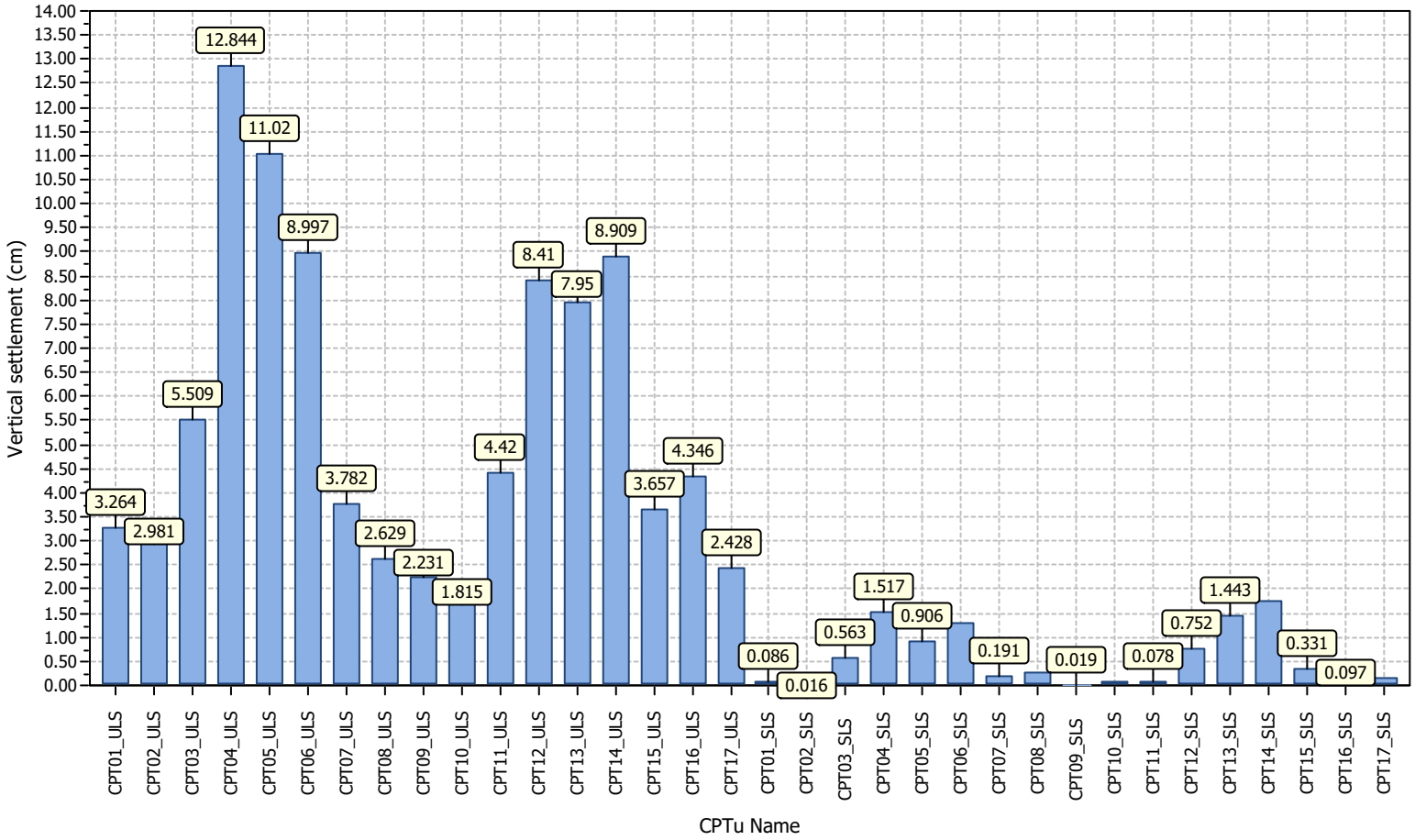
0% severe liquefaction

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Project title : Foxton Solar Farm

Location : Foxton, New Zealand

Overall vertical settlements report

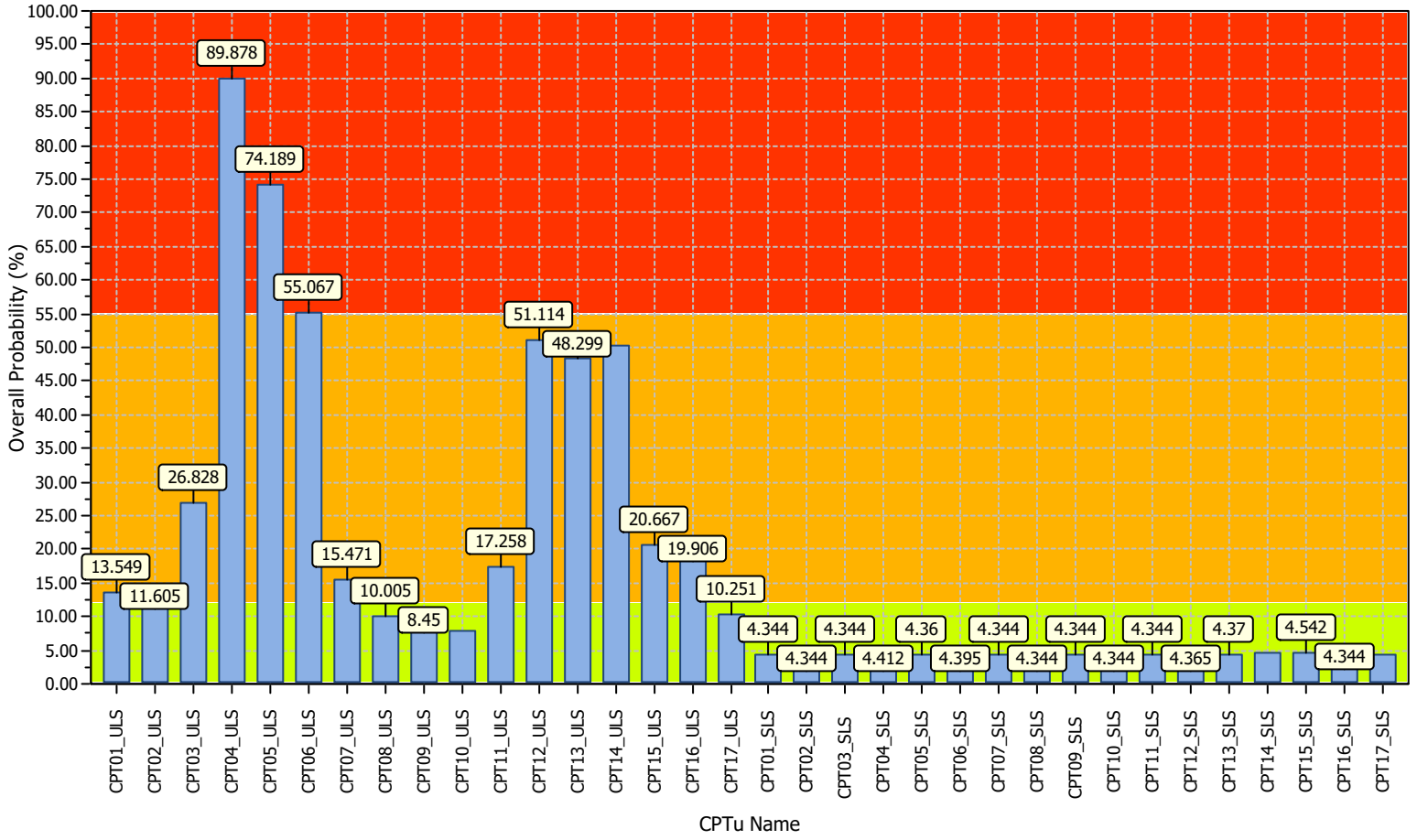


BTW Company
Engineering Geologists, Civil Engineers
179 Courtenay Street, New Plymouth
www.btw.nz

Project title : Foxton Solar Farm

Location : Foxton, New Zealand

Overall Probability for Liquefaction report



Probability color scheme

- Very High Probability
- High Probability
- Low Probability

Basic statistics

Total CPT number: 38
65% low probability
26% high probability
9% very high probability