Appendix I – Preliminary Geotechnical Report prepared by HD Geo

TAMAHERE COUNTRY CLUB

PRELIMINARY GEOTECHNICAL REPORT

PROJECT NO: HD2812
SANDERSON GROUP
REFERENCE: PGR-1
01 MAY 2023

26 London Street | Hamilton New Zealand | 07 957 2727 | **hdgeo.co.nz**

Executive summary

Sanderson Group have engaged us to undertake a preliminary geotechnical assessment for the site located at 56, 70, 82 and 92 Tamahere Drive, Tamahere. They propose to remove all existing dwellings and create a future retirement complex. This report is intended to help guide planning for future development and may be submitted to the Waikato District Council in support of the resource consent application.

We believe the site is suitable for the proposed development subject to the geotechnical recommendations within this report.

Our scope included

- a desktop study of the site including a review of geology maps, aerial photography, contour maps, and the NZ Geotechnical Database (NZGD)
- a site walkover to identify geohazards onsite
- an intrusive investigation which included:
  - 5 hand augers (HA) to 3.0 m depth with strength testing
  - 5 soakage tests (ST) up to 2.0 m depth
- a natural hazards assessment, including a quantitative liquefaction assessment
- a high level earthworks discussion
- a indicative pavement conditions
- a discussion of foundation conditions

Our key findings and outcomes were

- materials encountered on site within the hand augers (silts and sands) were consistent with the mapped Hinuera Formation
- based on the ground conditions encountered, the site does not meet the requirements for 'good ground' in accordance with NZS 3604:2011 due to loose soils (in the upper 2.2 m)
- we encountered groundwater within HA05 at 2.4 m below ground level. Given the elevated nature of the site (RL 48) above the gully system (RL 29) to the east, we expect the water we found was perched and global groundwater is deeper.
- based on the results of the testing, soakage is likely to be a viable method of disposing stormwater
- the site lies within performance level L0 (insignificant anticipated liquefaction effects)
- lateral spreading under liquefied conditions is unlikely at the site due to deep groundwater (> 43 m) and distance to the free face (40 m)
- testing shows that the soils along Site 1 and Site 2 are generally loose to medium dense within the upper 1.0 m and a CBR of 2 to 3 is representative of the natural soils

Our recommendations are that:

Given the low strength soils, foundations will need to be designed for reduced bearing. We expect suitable foundations to be:

- shallow excavation and re-compaction of the soils in the upper 0.5 m to 1.0 m bgl
- a stiffened raft foundation (ie Firth X-Pod or similar) designed for low bearing soils

Additional input will be required for elements of the future development including:

- Review of plans and updating of this report
- Further testing and specific assessment for bearing capacity and settlement for any structures
- Engineered foundation design for any structures

Contents

Executive summary 1
Introduction 4
Scope 4
Site description 4
Desk study 5
Site investigation 5
Ground conditions 6
Groundwater 6
Geotechnical assessment 7
Liquefaction 8
Earthworks 10
Pavements 10
Foundations 11
Future works 11
Limitation 11
Appendix A ..... A
Drawing 01: Site plan ..... A
Appendix B ..... B
Historical aerial images ..... B
Appendix C C
Drawing 02: Site investigation plan C
Investigation data C
Appendix D ..... D
Liquefaction assessment ..... D

PREPARED BY: **Retha Richards**

GEOTECHNICAL ENGINEER

Retha@hdgeo.co.nz

Tel 027 309 4555

REVIEWED BY **Kent Morgan, CPEng**

GEOTECHNICAL ENGINEER

Kent@hdgeo.co.nz

Introduction

Sanderson Group have engaged us to undertake a preliminary geotechnical assessment for the site located at 56, 70, 82 and 92 Tamahere Drive, Tamahere. They propose to remove all existing dwellings and create a future retirement complex. This report is intended to help guide planning for future development and may be submitted to the Waikato District Council in support of resource consent application.

We believe the site is suitable for the proposed development subject to the geotechnical recommendations within this report.

Scope

The scope of our assessment included:

- a desktop study of the site including a review of geology maps, aerial photography, contour maps, and the NZ Geotechnical Database (NZGD)
- a site walkover to identify geohazards onsite
- an intrusive investigation which included:
  - 5 hand augers (HA) to 3.0 m depth with strength testing
  - 5 soakage tests (ST) up to 2.0 m depth
- a natural hazards assessment, including a quantitative liquefaction assessment
- a high level earthworks discussion
- a indicative pavement conditions
- a discussion of foundation conditions

Site description

The site consists of 2 areas which are 56 and 70 Tamahere Drive ('Site 1') and 82 and 92 Tamahere Drive ('Site 2'). A plan of the site is shown in Drawing 01 in Appendix A.

The site is bounded by Tamahere Drive to the east and new residential development to the north and west of Site 1 and the north of Site 2.

Site 1 is legally described as Lot 1 DPS 59441 and Lot 1 DPS 80372 and covers an area of approximately 1.8 ha, generally covered with pasture and existing dwellings.

Site 2 is legally described as Lot 1 DP 565970 and PT Lot 11 DP9747 and covers an area of approximately 4 ha, generally covered with a tree plantation, existing dwellings, and other structures.

The overall site is relatively flat. The nearest sloping ground, which is a gully system, is located approximately 30 m to the east.

Desk study

We completed a desktop study prior to the site investigation to identify areas of interest. This included a review of geology maps[1], New Zealand Geotechnical Database (NZGD)[2], and historical[3] and recent[4] aerial images.

Geological setting

The geologic map of the area shows the site is underlain by Late Pleistocene river deposits of the Hinuera Formation. The Hinuera Formation is described as cross-bedded pumice sand, silt and gravel with interbedded peat.

Aerial photography

We have reviewed the historic and recent aerial images to identify past land uses and any geomorphic changes at the site or surrounding areas. Aerial photos are provided in Appendix B.

The aerial images indicated:

- the site has remained largely as undeveloped farmland since 1943
- between 1953 and 1973, the tree plantation has been established, as well as additional dwellings
- between 2021 and 2022, the new residential development is in progress to the north and west

From the review, there appears to be no significant changes to the geomorphology at the site or surrounding area over the period reviewed.

NZGD

We have reviewed the NZ Geotechnical Database (NZGD) to determine whether ground investigations have been conducted at or near the site.

2 hand augers and 2 cone penetration tests were completed to the south of Site 1. 15 hand augers and 11 cone penetration tests were completed to the north of Site 2.

The soil logs found a mixture of clay, silt and sand consistent with the Hinuera Formation. Groundwater was encountered in hand augers between 3.0 m and 3.9 m below ground level. No groundwater was recorded for the CPTs.

Site investigation

Our onsite investigation was completed on 29 March and 04 April 2023. We assessed ground conditions by reviewing available testing (13 cone penetration tests) on, or near the site and by conducting 5 hand augers (HA) with strength testing and 5 soakage tests (ST). In-situ strength testing was undertaken using a shear vane and dynamic cone penetrometer test (DCP). Our intrusive site investigation found ground conditions that were consistent with the published geology.

[1] 1:250,000 Geological Map of New Zealand (QMAP). *New Zealand Geology Web Map*. GNS, 2013. http://data.gns.cri.nz/geology/
[2] New Zealand Geotechnical Database. https://www.nzgd.org.nz/default.aspx
[3] Sourced from http://retrolens.nz and licensed by LINZ CC-BY
[4] Google Earth Pro

Ground conditions

The hand augers had a target depth of 3.0 m which was achieved for all tests. The test location plan and soil logs are included in Appendix C.

The materials encountered on site within the hand augers were consistent with the mapped Hinuera Formation. The ground conditions found during the hand auger investigation are summarised below.

For Site 1, the ground conditions encountered were:

- topsoil up to between 0.2 m and 0.5 m below ground level (bgl);
- sand and silt, with interbedded lenses of clay
    - peak shear strength ranged between 134 and 140 kPa, showing the cohesive material to be very stiff
    - DCP values ranged between 2 to 6 blows per 100 mm showing the material to be loose to medium dense

For Site 2, the ground conditions encountered were:

- topsoil up to between 0.2 m and 0.3 m below ground level (bgl);
- sand and silt, with interbedded lenses of clay
    - peak shear strengths ranged between 135 and 209+ kPa, showing the cohesive material to be very stiff to hard
    - DCP values ranged between 1 to 12 blows per 100 mm showing the material to be very loose to dense

Groundwater

We encountered groundwater within the hand augers at 2.4 m below ground level within HA05. The dynamic pore pressure response within the CPTs indicates that there is perched water within near surface soil layers (top 3 m to 5 m), but consistent response wasn't observed to the depth of testing (43 m).

Given the elevated nature of the site (RL 48) above the gully system (RL 29) to the east, we expect the water we found was perched and global groundwater is deeper. We have used a conservative groundwater level of 3.0 m bgl for our assessment below.

Soakage testing

We undertook falling head permeability tests within the proposed Site 1 and Site 2 to determine the capacity of the soils to receive concentrated stormwater flows. The falling head tests were undertaken generally in accordance with the Regional Infrastructure Technical Specifications (RITS) and the NZBC E1 Method.

Soakage testing was undertaken in the following locations:

- 2 within Site 1 boundary
- 3 within Site 3 boundary

The testing was undertaken within a mixture of silt and sand interpreted as Hinuera Formation. Results of the falling head permeability tests are in Appendix C.

Table 1: Summary of soakage results

Description	Location	Design soakage (mm/hr)*
ST01	Site 1, west of existing dwelling	1500 +
ST02	Site 1, north of existing dwelling	165
ST03	Site 2, near northern corner	280
ST04	Site 2, north-west of existing dwelling	220
ST05	Site 2, near southern corner	200

* a 50% reduction rate has been applied as per the RITS[5]

The minimum soakage threshold of 150 mm/hr specified in the RITS manual is achieved for all tests. It is recommended that a design rate of 1500 mm/hr is adopted for ST01.

Based on the soakage rates, disposal of stormwater via soakage is viable for Site 1 and Site 2.

Geotechnical assessment

The ground conditions encountered onsite are generally suitable for development, so long as the geotechnical recommendations below are incorporated into the design and best practice construction methods are adopted. There are no major hazards identified that prelude future development of the site.

Natural hazards

We have carried out a natural hazards assessment. As per Section 106 of the Resource Management Act, we consider the site to have no significant risk of the following natural hazards:

- **Earthquake and liquefaction:** liquefaction is assessed as insignificant for the site (see 'Liquefaction' section below). The general earthquake hazard in the area is low with no active faults nearby.
- **Volcanic, geothermal, or sedimentation activity**: The site is not near any known sources of these hazards.
- **Land slips or slope instability**: The site is near level and there is no risk of instability.
- **Erosion**: we observed no indications of erosion during the site walkover and as the site is near level and there are no free faces nearby, we consider the risk of erosion damage to the site as low.
- **Flooding**: The site is not mapped within the Waikato Regional Hazards Portal[6] as being at risk to flooding.
- **Expansive soils**: We did not encounter natural soils with high plasticity in the near-surface soils during our site investigation. Risk of damage caused by expansive soils on the site is low.
- **Subsidence**: The risk of the site to general subsidence is low (refer to 'Foundations' section below.

[5] 'Regional Infrastructure Technical Specification' v1.0, Waikato Local Authority Shared Services, dated May 2018.
[6] Waikato Regional Hazards Portal, River Flooding
https://waikatoregion.maps.arcgis.com/apps/MapSeries/index.html?appid=f2b48398f93146e8a5cf0aa3fddce92c

Table 2: Natural hazards risk matrix

RISK ASSESMENT MATRIX		LIKELIHOOD				
		Very unlikely	Unlikely	Possible	Likely	Very likely
POTENTIAL CONSEQUENCES	Severe					
	Moderate					
	Minor	- Flooding - Landslips or slope instability	- Liquefaction - Lateral spreading			
	Negligible	- Earthquake - Volcanic, geothermal or sedimentation activity - Expansive soils - Erosion - Subsidence				

Liquefaction

We have undertaken a quantitative liquefaction assessment using the CPT data obtained from NZGD. The assessment has been undertaken in accordance with the NZGS and MBIE guidelines[7]. Outputs from the CPT analysis are included in Appendix C. The liquefaction assessment is included in Appendix D.

Assessment inputs

We completed a screening analysis using the CPT data for a 1 in 500-year (ULS) and 1 in 25-year (SLS) design events. The test results were analysed using the proprietary software CLIQ (Geologismiki) and engineering calculations in accordance with recent NZGS guidelines.

The design earthquake for the analysis of liquefaction susceptibility has been taken from Module 1: Overview of the guidelines[8] of MBIE and NZGS. Input parameters for the analysis are listed below:

Table 2: Input parameters used for our quantitative liquefaction assessment

Parameter	Input
Site seismic classification[9]:	Class D (deep soils)*
Structural importance level[10]:	Importance level 2 – residential
Peak ground acceleration[11]:	0.06 g (SLS) for a 1 in 25-year event 0.25 g (ULS) for a 1 in 500-year event, 5.9 magnitude earthquake
Groundwater depth:	3.0 m bgl
Limit depth:	10 m from current ground level (for indexing)

*The site is Class D, however following Module 1 requirements, the PGA is based on Class C conditions.

[7] Ministry of Business Innovation and Employment (MBIE) / New Zealand Geotechnical Society (NZGS). Module 3: Identification, assessment, and mitigation of liquefaction hazards. Dated November 2021.

[8] Ministry of Business Innovation and Employment (MBIE) / New Zealand Geotechnical Society (NZGS). Module 1: Overview of the guidelines. Dated November 2021.

[9] NZS 1170.5:2004. *Structural design actions – Earthquake Actions (New Zealand). SANZ*

[10] NZS 1170.0:2002. *Structural design actions – General Principles. SANZ*

[11] GNS Science: National Seismic Hazard Model. https://nshm.gns.cri.nz/HazardCurves.

Liquefaction susceptibility

The susceptibility of a site to liquefaction is a combination of the expected earthquake shaking for the required design return period, the soil types and their strength/density state, and the groundwater conditions at the site. There are several measures of a site's overall susceptibility to liquefaction including liquefaction potential index (LPI), liquefaction severity number (LSN), ground surface settlement, and lateral spreading.

The CPTs have been assessed under ULS conditions with the analysis limited to 10 m depth for the screening assessment in accordance with the guidelines. Beneath 10 m the effects of liquefaction may contribute to global settlements however are unlikely to have significant surface expression. Liquefaction should be considered below 10 m if deep foundations are proposed.

Serviceability Limit State (SLS) Earthquake

An SLS earthquake is an event after which there is high expectation that the building or structure can be used as intended without repair or with minimal repair. The assessment showed that under SLS conditions there is no liquefaction damage expected at the site.

Ultimate Limit State (ULS) Earthquake

A ULS earthquake is an event after which a building should retain its integrity to allow safe evacuation of people but is likely to be severely damaged and may not be repairable. The assessment showed that under ULS conditions there is a liquefaction hazard at the site.

Under ULS conditions, our assessment indicated:

- between 0 and 25 mm of predicted vertical settlement
- Liquefaction Potential Index (LPI) of between 0 and 1 (insignificant risk)
- Liquefaction Severity Number (LSN) of between 0 and 5 (insignificant expression expected)
- limited potentially liquefiable layers across the entire soil profile below the ground water level (3.0 m)

Groundwater sensitivity check

We have assessed the site with the encountered groundwater conditions. To understand the overall liquefaction risk, we have completed a sensitivity analysis on the groundwater conditions and assumed a peak high groundwater table of 1.0 m higher (2.0 m below ground level).

The sensitivity analysis predicted:

- slight increase in overall vertical settlement of 5 to 10 mm
- Liquefaction Potential Index (LPI) between 0 to 2 (insignificant to mild risk)
- Liquefaction Severity Number (LSN) between 1 and 9 (insignificant to mild expression expected)

Under a higher groundwater level, the site performance will increase to L1 (mild anticipated liquefaction effects).

Site performance level

Our assessment indicates that the site lies within performance level L0 to L1 (insignificant to mild anticipated liquefaction effects) in accordance with Table 5.1 of the latest MBIE and NZGS guidelines[12]. This performance level is defined as:

- liquefaction occurs in layers of limited thickness
- negligible ground deformation and very small total and differential settlements

Lateral spreading

Lateral spreading is a phenomenon were liquefied material allows the soil above to move laterally towards a free face, such as a stream bank. There is free face towards the east of the site approximately 40 m away.

Lateral spreading under liquefied conditions is unlikely at the site due to the estimated depth (> 43 m) to groundwater and the distance to the free face.

Earthworks

There is no current design for cut to fill at the site however, we would expect that earthworks will be required to create level or near-level building platforms and gentle road alignments.

Any earthworks with fill depths greater than 0.6 m, or any fill relied on for the support of foundations, should only be undertaken in accordance with NZS4431:2022 “Code of practice for Earthfill for Residential Development” and with input by a suitably qualified engineer.

The granular materials of the Hinuera Formation present across the site, are suitable for reuse as earthwork material. During very dry weather, materials can become dry of optimum, and wetting can be needed to condition them.

In general, we expect any externally sourced sand fill to be suitable for use as fill if placed in accordance with NZS4431:2022. Externally sourced clay materials will require further laboratory testing, assessment and specification.

Pavements

Currently the road grading design has not been completed and so subgrade levels are not known. Our testing shows that the soils along Site 1 and Site 2 are generally loose to medium dense within the upper 1.0 m and a CBR of 2 to 3 is representative of the natural soils.

During design and construction, testing will be needed to confirm the subgrade and low strength areas may need undercutting. Once the design of the subdivision is complete, testing should be undertaken, and the pavement requirements confirmed.

[12] Module 3: Identification, assessment and mitigation of liquefaction hazards. Prepared by Ministry for the Environment and Ministry of Business, Innovation and Employment, dated November 2021.

Foundations

Based on the ground conditions encountered during the site investigation, the site does not meet the requirements for 'good ground' in accordance with NZS 3604:2011 due to loose soils. Given the low strength soils, foundations will need to be designed for reduced bearing.

We expect suitable foundations to be:

- shallow excavation and re-compaction of the soils in the upper 0.5 m to 1.0 m bgl
- a stiffened raft foundation (ie Firth X-Pod or similar) designed for low bearing soils

Further assessment and refining of these recommendations (i.e. available bearing capacity, and anticipated settlement under the proposed building loads) will be needed for the design phase of the development. Foundation options for future buildings will need to be specifically assessed in accordance with geotechnical guidelines.

Future works

Based on our assessment, the site is geotechnically suitable for the proposed development, subject to the recommendations within this report. Additional geotechnical investigation and assessment are needed to confirm ground conditions and recommendations for developing the site. Additional input will be required for elements of the future development including:

- Review of plans and updating of this report to support building consent
- Further testing and specific assessment for bearing capacity and settlement for any structures
- Engineered foundation design for any structures

Limitation

This report has been prepared for our client, Sanderson Group, and their professional advisers, for the purposes detailed above and may not be relied on by any other party for any other purposes. This report contains a preliminary assessment to provide information about current ground conditions and likely requirements for developing the site based on a site walkover and testing in discrete locations. Further testing and assessment are required during the development of the site. Inferences about the conditions at the site have been made based on the testing undertaken and our understanding of the geological environment in which the site lies.

We recommend that HD Geo is engaged to undertake further testing and assessment for building consent, and to observe works during the site preparation.

APPENDIX A

Drawing 01: Site plan

LEGEND

Site 1 boundary

Site 2 boundary

PROJECT: Tamahere Country Club

PROJECT No: HD2812

CLIENT: Sanderson Group

TITLE: Site investigation plan

SCALE: N/A

Drawing No: 01

Drawing By: RR

Rev no:

1	initial

APPENDIX B

Historical aerial images

HD2812 – Tamahere Country Club - Historical aerials – Accessed 29.03.23

Figure 1. Historical Imagery from 1943. Approximate site location marked in yellow. (Imagery from http://retrolens.nz/)

Figure 2. Historical Imagery from 1953. Approximate site location marked in yellow. (Imagery from http://retrolens.nz/)

Figure 3. Historical Imagery from 1973. Approximate site location marked in yellow. (Imagery from http://retrolens.nz/)

Figure 4. Historical Imagery from 1979. Approximate site location marked in yellow. (Imagery from http://retrolens.nz/)

Figure 5. Historical Imagery from 1995. Approximate site location marked in yellow. (Imagery from http://retrolens.nz/)

Figure 6. Historical Imagery from 2008. Approximate site location marked in yellow. (Imagery from Google Earth Pro)

Figure 7. Historical Imagery from 2015. Approximate site location marked in yellow. (Imagery from Google Earth Pro)

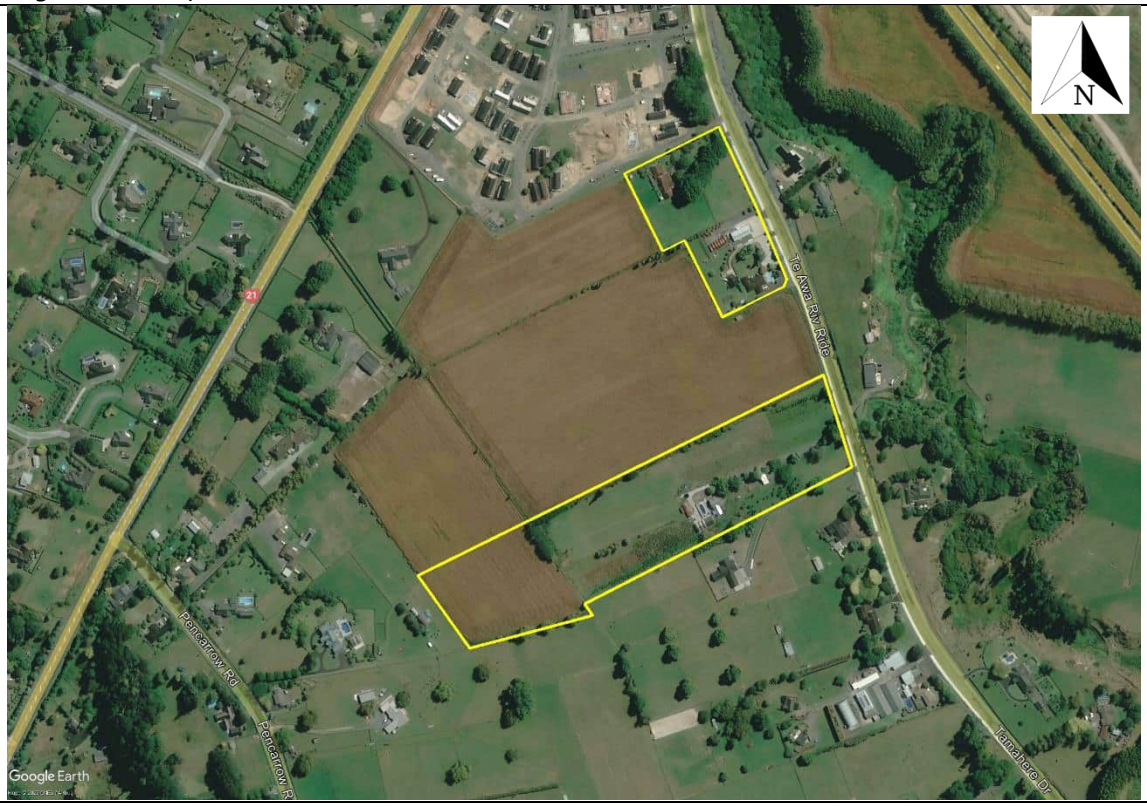


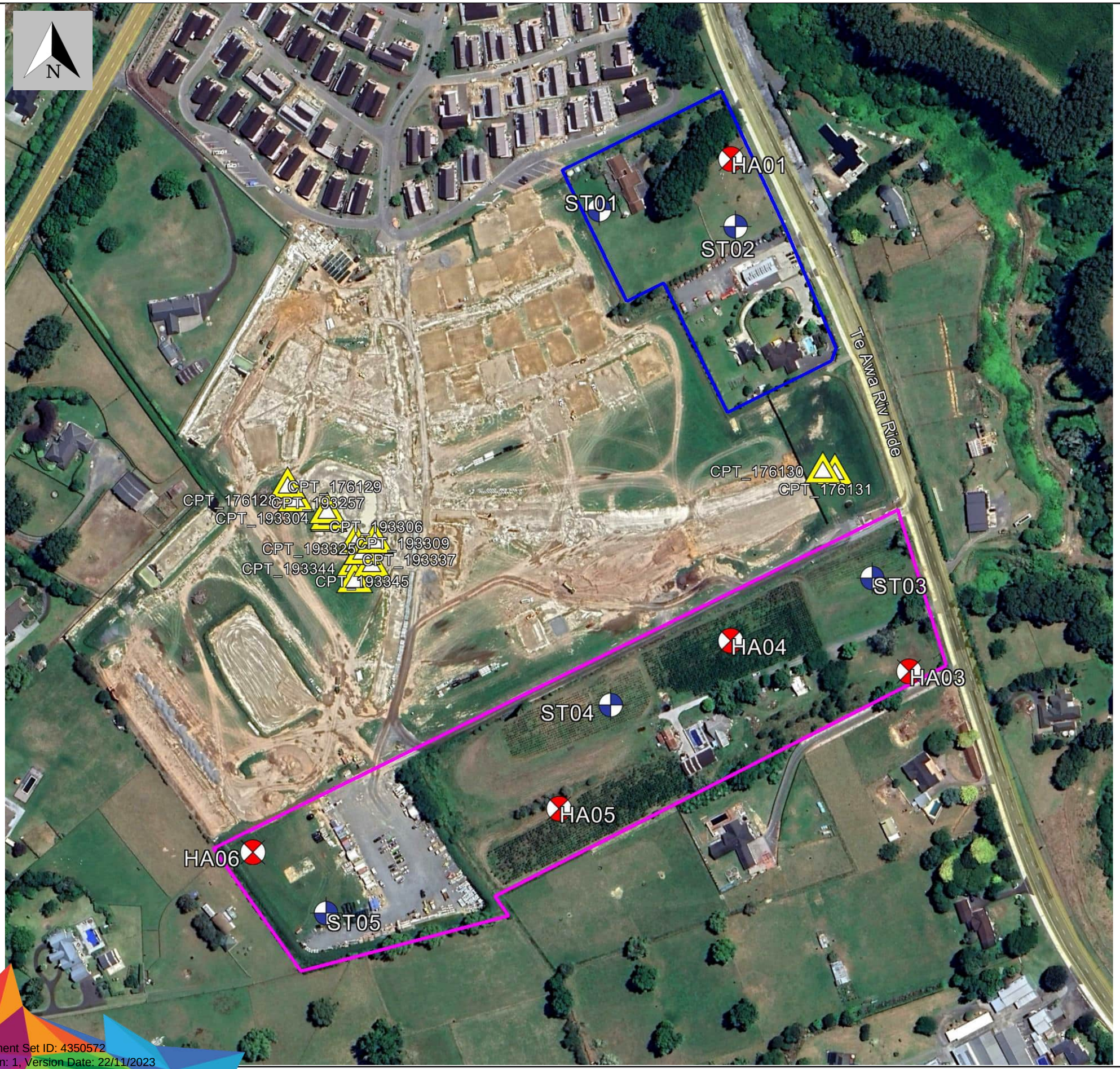
Figure 8. Historical Imagery from 2021. Approximate site location marked in yellow. (Imagery from Google Earth Pro)

Figure 9. Historical Imagery from 2022. Approximate site location marked in yellow. (Imagery from Google Earth Pro)

APPENDIX C

Drawing 02: Site investigation plan

Investigation data



hd GEO

LEGEND

Site 1 boundary

Site 2 boundary

Hand Auger (HA)

Soakage Test (ST)

Cone penetration test (CPT) - *NZGD*

PROJECT: Tamahere Country Club

PROJECT No: HD2812

CLIENT: Sanderson Group

TITLE: Site investigation plan

SCALE: N/A

Drawing No: 02

Drawing By: RR

Rev no:

1	initial

INVESTIGATION LOG

Client:	Tamahere Country Club
Project:	Tamahere Country Club PGR
Location:	-
Co-ordinates:	1807557mE, 5809993mN
Elevation:	Ground

Job No.: HD2812

No.: HA01

Date: 04.04.23

Logged By: SW

Checked By: RR

Geology	Geological Interpretation (refer to separate Geotechnical and Geological Information sheet for further information)	Depth (m)
Topsoil	Sandy TOPSOIL; greyish brown. Dry; sand, fine.	0.2
Hinuera Formation	Sandy SILT; light brown. Medium dense; moist; sand, fine.	0.8
	Silty CLAY, with some sand; brown. Hard; moist; sand, medium, Quartz.	1.0
	SAND, with trace clay; brown. Medium dense; moist; sand, medium.	1.4
	SAND, with trace silt; greyish brown. Loose to medium dense; wet; sand, fine to medium.	1.8
	Silty CLAY, with minor sand; light grey. Very stiff; moist; moderate plasticity, sensitive to moderately sensitive; sand, fine.	2.4
	SAND, with minor silt; light grey. Medium dense; moist; sand, fine.	3.0
	Silty CLAY; light grey. Very stiff; moist; moderate plasticity, moderately sensitive.	
	EOH: 3.00 m	

Legend: TS

Scala Penetrometer (Blows / 100 mm)

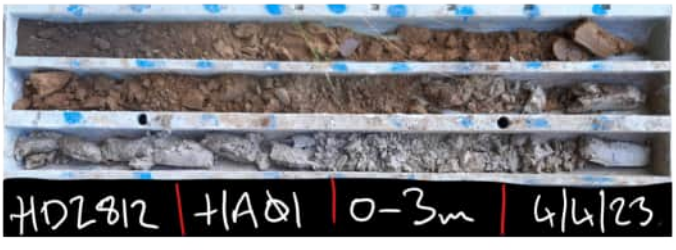
Depth (m)	Blows / 100 mm
0.2	4, 4
0.4	4, 3
0.6	4, 5
0.8	6, 4
1.0	4, 4
1.2	4, 3
1.4	4, 6
1.6	6, 5
1.8	2, 2
2.0	2, 2
2.2	2, 2
2.4	4, 4
2.6	3, 3
2.8	4, 4
3.0	4, 4
	3

Vane Shear Strength (kPa) Vane: 2639

Depth (m)	Peak	Remoulded
0.4	122	18
0.8	181	33
1.0	208+	-
2.0	134	33
2.2	140	30
2.4	148	56
3.0	134	45

Water: Groundwater Not Encountered

Photo



Remarks

End of HA at 3.0 meters_ Target depth achieved.

Shear Vanes
- Peak
- Remoulded

Water
- Standing Water Level
- Out flow
- In flow

Investigation Type
- [x] Hand Auger
- [ ] Investigation Pit
- [ ] Machine Borehole

INVESTIGATION LOG

Job No.:	HD2812
Client:	Tamahere Country Club
Project:	Tamahere Country Club PGR
No.:	HA03
Location:	-
Co-ordinates:	1807665mE, 5809655mN
Elevation:	Ground
Date:	29.03.23
Logged By:	TD
Checked By:	RR

Geology	Geological Interpretation (refer to separate Geotechnical and Geological Information sheet for further information)	Depth (m)	Legend	Scala Penetrometer (Blows / 100 mm)	Vane Shear Strength (kPa) Vane: 3423	Water
Topsoil	SILT; brown. Very stiff; moist, sensitive to moderately sensitive.	0.2		1, 2, 3	161 / 39	Groundwater Not Encountered
Hinuera Formation	Sandy SILT; light greyish brown. Moist; sand, fine.	0.4, 0.6, 0.8		3, 2, 1, 1, 2	120 / 36	
	SILT; light grey. Hard to very stiff; moist, moderately sensitive.	1.0		3, 1, 5	209+ / -	
	SAND; grey. Medium dense; moist; sand, fine.	1.2, 1.4, 1.6		5, 4, 5, 4, 5	135 / 42	
	CLAY; light grey. Moist; moderate plasticity.	1.8		4		
	SAND; grey. Medium dense to dense; moist; sand, fine to medium.	2.0, 2.2		4, 8, 5, 5, 5, 3		
	Clayey SILT; light grey. Very stiff; wet; moderate plasticity, moderately sensitive.	2.4		6, 8	191 / 57	
	SAND; light grey. Medium dense to dense; wet; sand, fine.	2.6		6, 5		
	Sandy SILT; light grey. Dense; wet; sand, fine.	2.8		9, 7		
	SAND; light grey. Medium dense; wet; sand, fine to medium.	3.0		6		
	EOH: 3.00 m					

Photo

Remarks

End of log at 3.0m. Target depth.

Shear Vanes
- Peak
- Remoulded

Water
- Standing Water Level
- Out flow
- In flow

Investigation Type
- [x] Hand Auger
- [ ] Investigation Pit
- [ ] Machine Borehole

INVESTIGATION LOG

Job No.:	HD2812
Client:	Tamahere Country Club
No.:	HA04
Project:	Tamahere Country Club PGR
Location:	-
Date:	04.04.23
Co-ordinates:	1807520mE, 5809666mN
Logged By:	SW
Elevation:	Ground
Checked By:	RR

Geology	Geological Interpretation (refer to separate Geotechnical and Geological Information sheet for further information)	Depth (m)
Topsoil	TOPSOIL; brown. Moist.	0.2
Hinuera Formation	Silty CLAY; light brown streaked orange. Hard; moist; low to moderate plasticity, sensitive.	0.4
	SAND, with minor silt; light brown. Loose to medium dense; moist; sand, fine to medium.	0.6, 0.8, 1.0
	SAND, with some silt; light brown. Medium dense; moist to wet; uniformly graded; sand, fine.	1.2, 1.4, 1.6, 1.8
	SILT, with some sand; light grey. Medium dense to dense; wet; sand, fine.	2.0
	SAND, with some silt; light grey. Medium dense to dense; wet; uniformly graded; sand, fine.	2.2, 2.4
	SILT, with some sand; light grey. Medium dense to dense; wet; sand, fine.	2.6
	SAND, with trace silt; grey. Medium dense to dense; wet to saturated; well graded; sand, fine to coarse.	2.8
	EOH: 3.00 m	3.0

Legend

Scala Penetrometer (Blows / 100 mm)

Depth (m)	Blows / 100 mm
0.2	3, 2
0.4	2, 3, 3
0.6	3, 4
0.8	3, 3
1.0	3, 2
1.2	5, 6
1.4	7, 6
1.6	4, 3
1.8	3, 10
2.0	6, 3
2.2	3, 4
2.4	9, 10
2.6	8, 6
2.8	5, 7
3.0	7

Vane Shear Strength (kPa) Vane: 2639

Depth (m)	Peak	Remoulded
0.4	202	45
1.2	202	36

Water

Groundwater Not Encountered

Photo

Remarks

End of HA at 3.0 meters_ Target depth achieved.

Shear Vanes

- Peak
- Remoulded

Water

- Standing Water Level
- Out flow
- In flow

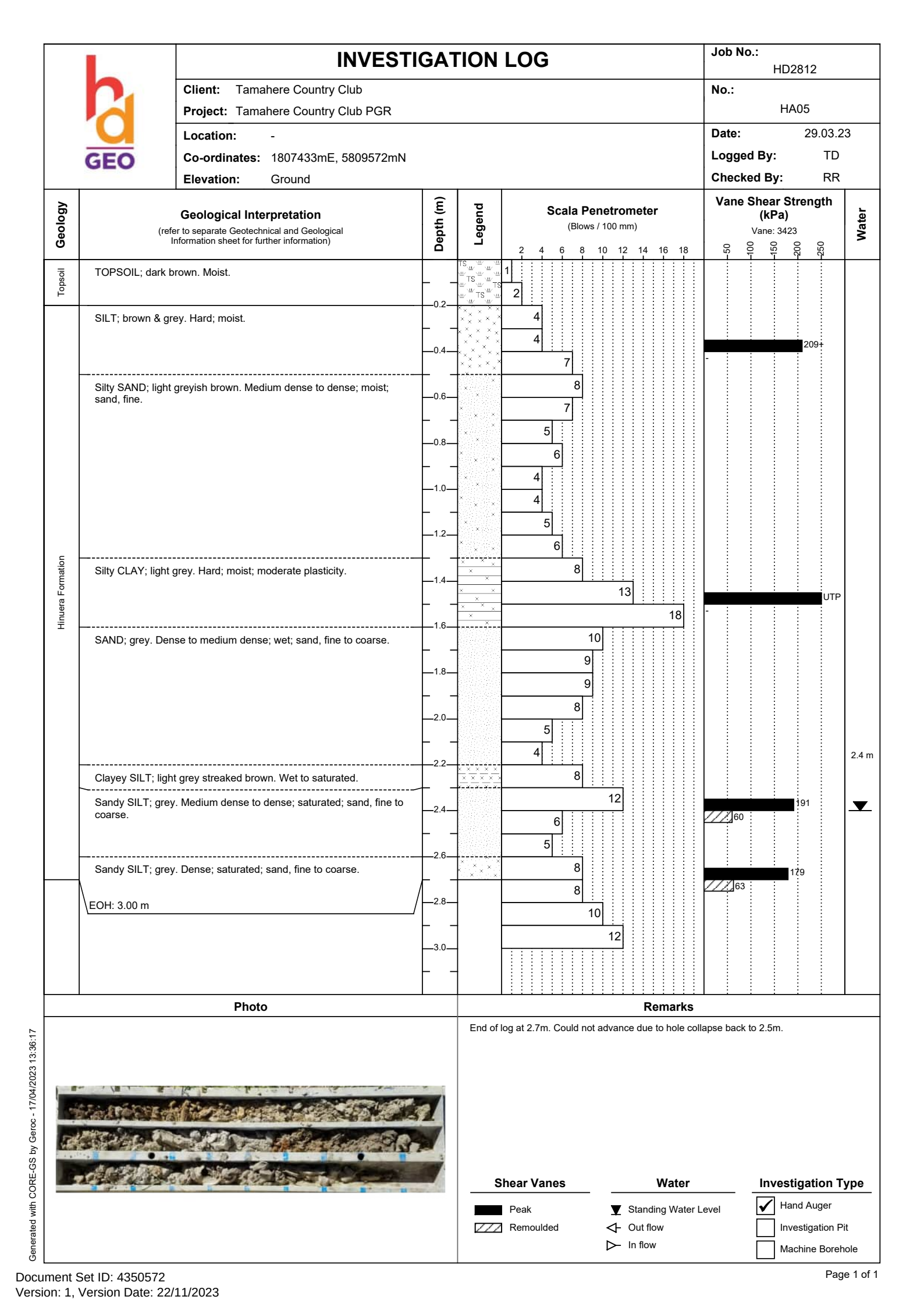
Investigation Type

- [x] Hand Auger
- [ ] Investigation Pit
- [ ] Machine Borehole

INVESTIGATION LOG

Job No.:	HD2812
Client:	Tamahere Country Club
No.:	HA05
Project:	Tamahere Country Club PGR
Location:	-
Date:	29.03.23
Co-ordinates:	1807433mE, 5809572mN
Logged By:	TD
Elevation:	Ground
Checked By:	RR

Geology	Geological Interpretation (refer to separate Geotechnical and Geological Information sheet for further information)	Depth (m)
Topsoil	TOPSOIL; dark brown. Moist.	0.2
Hinuera Formation	SILT; brown & grey. Hard; moist.	0.4
	Silty SAND; light greyish brown. Medium dense to dense; moist; sand, fine.	0.6
		0.8
		1.0
		1.2
	Silty CLAY; light grey. Hard; moist; moderate plasticity.	1.4
		1.6
	SAND; grey. Dense to medium dense; wet; sand, fine to coarse.	1.8
		2.0
		2.2
	Clayey SILT; light grey streaked brown. Wet to saturated.	2.4
	Sandy SILT; grey. Medium dense to dense; saturated; sand, fine to coarse.	2.6
	Sandy SILT; grey. Dense; saturated; sand, fine to coarse.	2.8
	EOH: 3.00 m	3.0



Photo

Remarks

End of log at 2.7m. Could not advance due to hole collapse back to 2.5m.

Shear Vanes
- Peak
- Remoulded

Water
- Standing Water Level
- Out flow
- In flow

Investigation Type
- [x] Hand Auger
- [ ] Investigation Pit
- [ ] Machine Borehole

INVESTIGATION LOG

Job No.:	HD2812
Client:	Tamahere Country Club
No.:	HA06
Project:	Tamahere Country Club PGR
Location:	-
Date:	04.04.23
Co-ordinates:	1807231mE, 5809548mN
Logged By:	SW
Elevation:	Ground
Checked By:	RR

Geology	Geological Interpretation (refer to separate Geotechnical and Geological Information sheet for further information)	Depth (m)
Topsoil	TOPSOIL; dark blackish brown. Moist.	0.2
Hinuera Formation	SAND, with some clay, with trace silt; light brown. Loose to medium dense; moist; sand, fine.	0.6
	SAND, with minor silt; light grey brown. Very loose to medium dense; moist; sand, fine.	1.2
	SAND; grey. Loose; moist to wet; sand, fine.	1.4
	SILT, with some clay and sand; brown grey. Very stiff; wet, sensitive; sand, fine.	1.6
	SAND, with trace clay; light brown grey. Medium dense; wet; poorly graded; sand, fine to medium.	2.0
	SILT, with some sand; light grey. Medium dense; wet; sand, fine.	2.2
	SAND, with trace silt; light grey. Loose to medium dense; wet; poorly graded; sand, fine to medium.	2.4
	SILT, with minor sand; light grey. Medium dense; wet; moderate dilatency; sand, fine.	2.6
	SAND; grey. Medium dense to dense; wet; sand, fine to coarse.	2.8
	EOH: 3.00 m	3.0

Legend

Scala Penetrometer (Blows / 100 mm)

Scala blow counts: 4, 3, 2, 2, 2, 3, 3, 1, 2, 3, 2, 4, 2, 2, 4, 5, 3, 4, 4, 4, 4, 2, 3, 5, 4, 8, 6, 6, 6, 5

Vane Shear Strength (kPa) — Vane: 2639

Peak: 154, 95, 148 — Remoulded: 30, 27, 30

Water: Groundwater Not Encountered

Photo

Remarks

End of log at 3.0 meters_ Target depth achieved.

Shear Vanes
- Peak
- Remoulded

Water
- Standing Water Level
- Out flow
- In flow

Investigation Type
- [x] Hand Auger
- [ ] Investigation Pit
- [ ] Machine Borehole

INVESTIGATION LOG

Job No.:	HD2812
Client:	Tamahere Country Club
No.:	ST01
Project:	Tamahere Country Club PGR
Location:	-
Date:	04.04.23
Co-ordinates:	1807470mE, 5809962mN
Logged By:	SW
Elevation:	Ground
Checked By:	RR

Geology	Geological Interpretation (refer to separate Geotechnical and Geological Information sheet for further information)	Depth (m)
Topsoil	Sandy TOPSOIL; dark blackish brown. Moist; sand, medium.	0.2
Hinuera Formation	SAND, with trace clay; brown. Moist; poorly graded; sand, medium.	0.4
	SAND; orange brown. Moist; sand, fine.	0.6
	SAND, with trace clay and silt; light brown. Moist; poorly graded; sand, fine.	0.8
	Silty CLAY; light grey. Moist to wet; low to moderate plasticity.	1.0
	SAND, with trace gravel; grey brown. Wet; sand, fine to medium; gravel, fine, subround.	1.2
	Silty CLAY; light grey. Wet; low to moderate plasticity.	1.4
	SAND, with some silt; light grey. Wet; sand, fine.	1.6
	Silty CLAY, with minor sand; light grey. Wet; low to moderate plasticity; sand, fine.	1.8
	EOH: 2.00 m	2.0

Legend

Scala Penetrometer (Blows / 100 mm)

2 4 6 8 10 12 14 16 18

Vane Shear Strength (kPa)

Vane:

50 100 150 200 250

Water

Groundwater Not Encountered

Photo

Remarks

End of log at 2.0 meters_ Target depth achieved.

Shear Vanes

- Peak
- Remoulded

Water

- Standing Water Level
- Out flow
- In flow

Investigation Type

- [ ] Hand Auger
- [ ] Investigation Pit
- [x] Machine Borehole

Job name	Tamahere Country Club
Job number	HD2812
Date	04/04/2023
Plotted by	SW (RR)
Reviewed by	BS

Perc test results

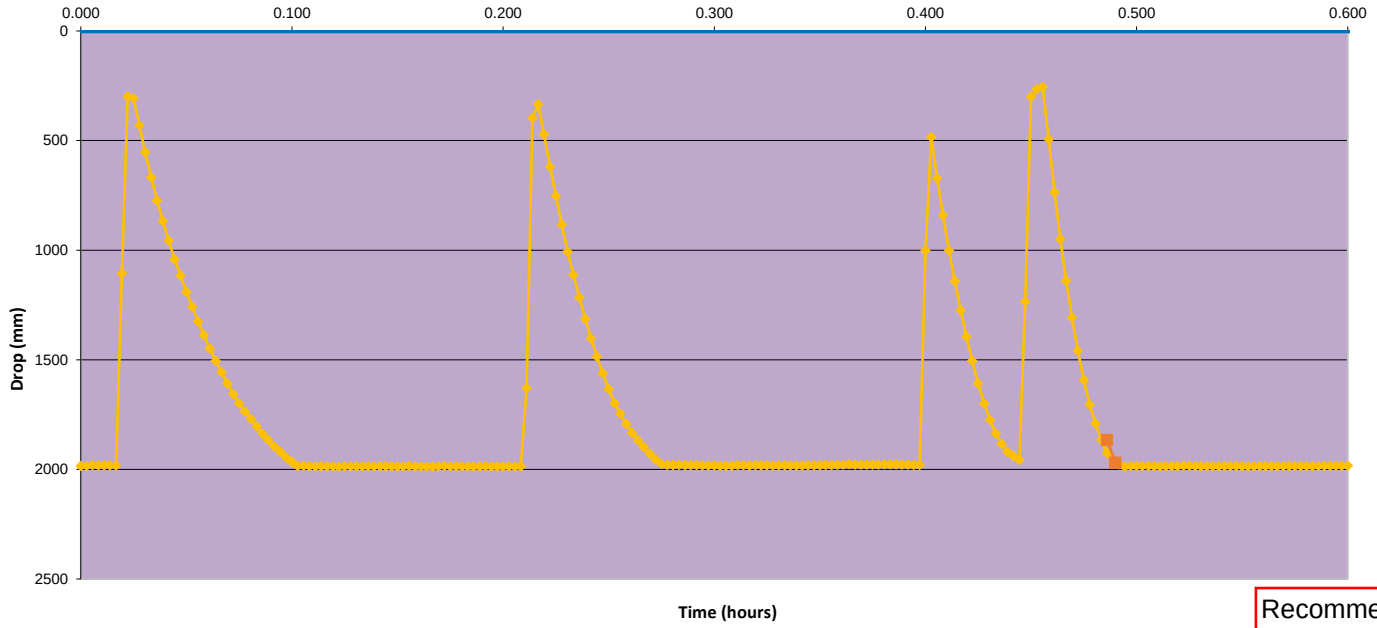
ST01

Calculated in general accordance with E1/VM1 - Surface Water, Section 9.0

Logger depth: 2.000 m

Ground water depth: NA m

Notes:



Recommended design rate
1500 mm/hr

Percolation rate calculation:

Time (Hour)	Drop (mm)	
0.49	1866	Minimum slope (lower)
0.49	1969	Minimum slope (upper)

Percolation rate = 25750 mm/hr

50% Percolation rate = **12875 mm/hr**

INVESTIGATION LOG

Job No.:	HD2812
No.:	ST02
Client:	Tamahere Country Club
Project:	Tamahere Country Club PGR
Location:	-
Co-ordinates:	1807559mE, 5809949mN
Elevation:	Ground
Date:	04.04.23
Logged By:	SW
Checked By:	RR

Geology	Geological Interpretation (refer to separate Geotechnical and Geological Information sheet for further information)	Depth (m)
Topsoil	Sandy TOPSOIL; dark blackish brown. Moist; sand, medium.	0.2
		0.4
Hinuera Formation	Silty CLAY, with minor sand; greyish brown streaked red brown. Moist; moderate plasticity; sand, fine.	0.6
	SAND, with minor clay; brown. Moist; poorly graded; sand, medium.	0.8
	SAND, with trace clay; orange brown. Moist; poorly graded; sand, medium to coarse.	1.0
	Clayey SILT; grey. Moist.	1.2
	SAND; greyish. Moist; poorly graded; sand, fine to medium.	1.4
		1.6
	Clayey SILT; light grey. Moist; moderate plasticity.	1.8
	SAND, with minor silt; grey. Moist; uniformly graded; sand, fine.	2.0
	EOH: 2.00 m	

Legend

Scala Penetrometer (Blows / 100 mm): 2 4 6 8 10 12 14 16 18

Vane Shear Strength (kPa) — Vane: 50 100 150 200 250

Water: Groundwater Not Encountered

Photo

Remarks

End of log at 2.0 meters_ Target depth achieved.

Shear Vanes
- Peak
- Remoulded

Water
- Standing Water Level
- Out flow
- In flow

Investigation Type
- [ ] Hand Auger
- [ ] Investigation Pit
- [x] Machine Borehole

Job name	Tamahere Country Club
Job number	HD2812
Date	04/04/2023
Plotted by	SW (RR)
Reviewed by	BS

Perc test results

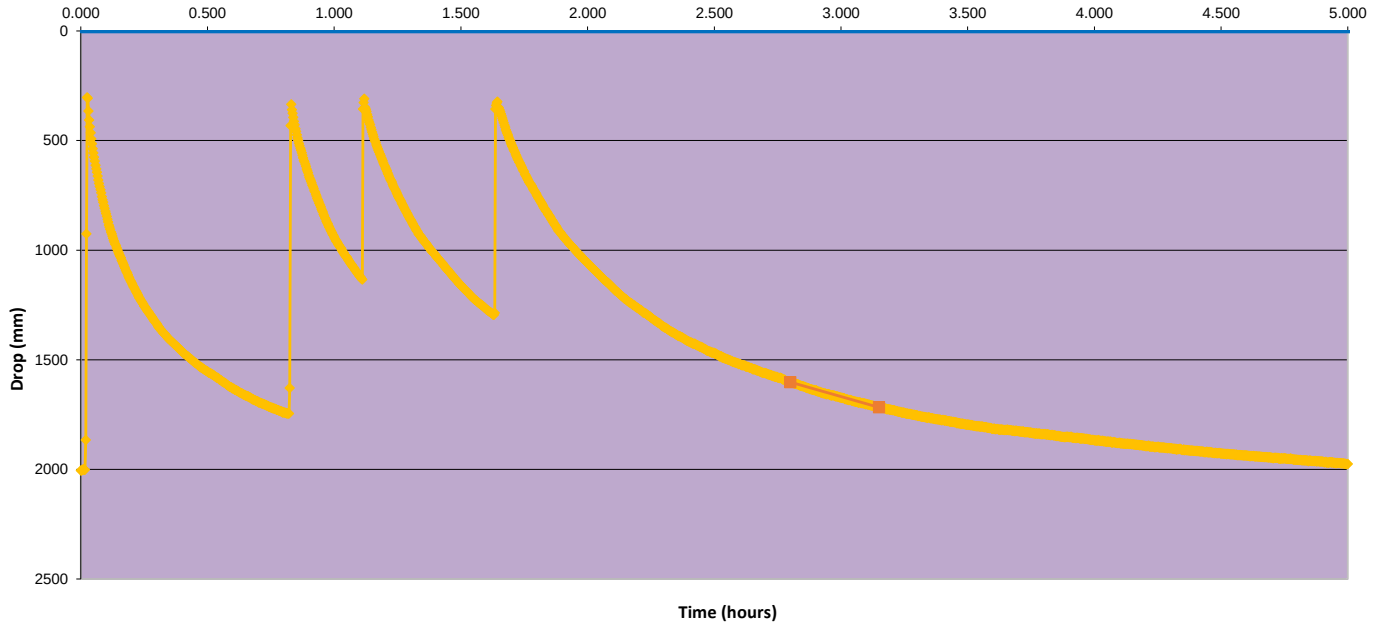
ST02

Calculated in general accordance with E1/VM1 - Surface Water, Section 9.0

Logger depth: 2.000 m

Ground water depth: NA m

Notes:



Percolation rate calculation:

Time (Hour)	Drop (mm)	
2.80	1602	Minimum slope (lower)
3.15	1717	Minimum slope (upper)

Percolation rate = 329 mm/hr

50% Percolation rate = **164 mm/hr**

INVESTIGATION LOG

Job No.:	HD2812
Client:	Tamahere Country Club
No.:	ST03
Project:	Tamahere Country Club PGR
Location:	-
Date:	29.03.23
Co-ordinates:	1807643mE, 5809717mN
Logged By:	TD
Elevation:	Ground
Checked By:	RR

Geology	Geological Interpretation (refer to separate Geotechnical and Geological Information sheet for further information)	Depth (m)
Topsoil	TOPSOIL; dark brown. Moist.	0.2
Hinuera Formation	SILT; brown. Moist.	0.4
	SAND, with trace silt; light brownish grey. Moist; sand, fine to medium.	0.6
		0.8
	Clayey SILT; light grey. Moist; low plasticity.	1.0
	Sandy SILT; light grey. Moist; sand, fine.	1.2
	SAND, with trace silt; light grey. Moist; sand, fine to medium.	1.4
		1.6
	CLAY, with minor silt; light grey. Moist; moderate plasticity.	1.8
	SAND; grey. Wet; sand, fine to coarse.	2.0
	EOH: 2.00 m	

Legend

Scala Penetrometer (Blows / 100 mm): 2 4 6 8 10 12 14 16 18

Vane Shear Strength (kPa) — Vane: 50 100 150 200 250

Water: Groundwater Not Encountered

Photo

Remarks

End of log at 2.0m. Target depth.

Shear Vanes
- Peak
- Remoulded

Water
- Standing Water Level
- Out flow
- In flow

Investigation Type
- ☐ Hand Auger
- ☐ Investigation Pit
- ☑ Machine Borehole

Job name	Tamahere Country Club
Job number	HD2812
Date	29/03/2023
Plotted by	TD (RR)
Reviewed by	BS

Perc test results

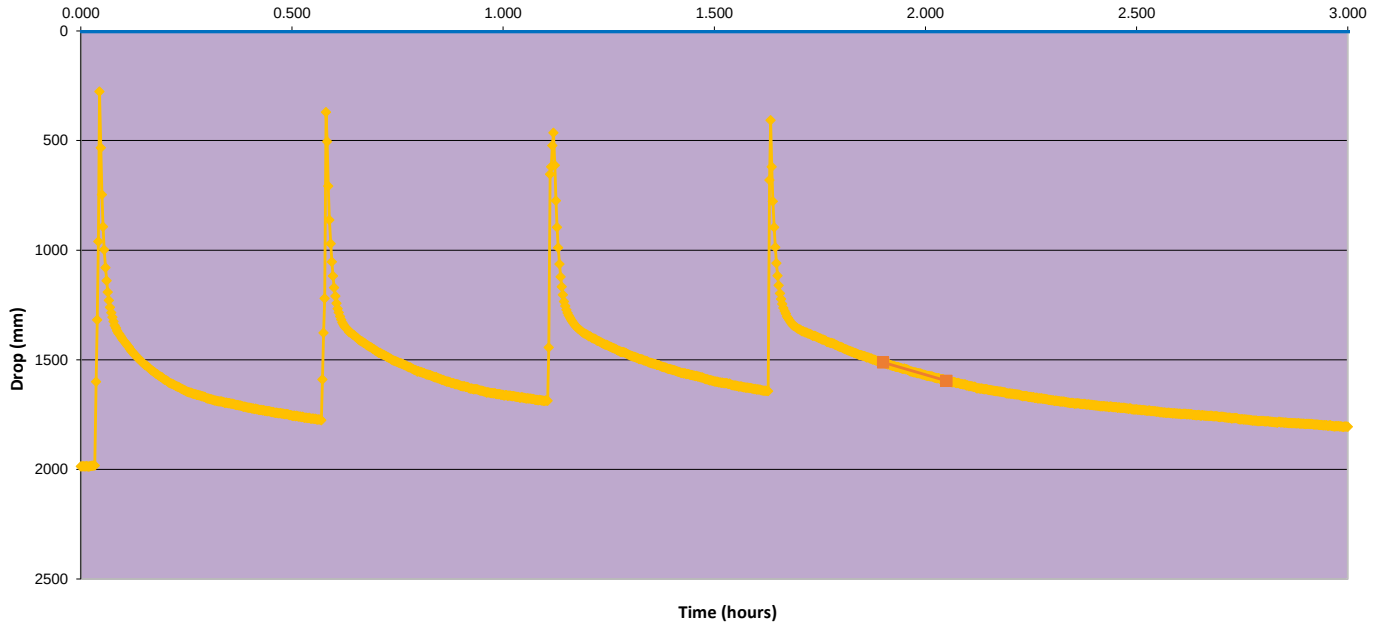
ST03

Calculated in general accordance with E1/VM1 - Surface Water, Section 9.0

Logger depth: 2.000 m

Ground water depth: NA m

Notes:



Percolation rate calculation:

Time (Hour)	Drop (mm)	
1.90	1512	Minimum slope (lower)
2.05	1596	Minimum slope (upper)

Percolation rate = 560 mm/hr

50% Percolation rate = **280 mm/hr**

INVESTIGATION LOG

Job No.:	HD2812
Client:	Tamahere Country Club
No.:	ST04
Project:	Tamahere Country Club PGR
Location:	-
Date:	29.03.23
Co-ordinates:	1807469mE, 5809638mN
Logged By:	TD
Elevation:	Ground
Checked By:	RR

Geology	Geological Interpretation (refer to separate Geotechnical and Geological Information sheet for further information)	Depth (m)
Topsoil	TOPSOIL; dark brown. Moist.	0.2
Hinuera Formation	SILT, with trace sand; light greyish brown. Moist.	0.4
	SAND, with minor silt; light grey. Moist; sand, fine to medium.	0.6
	SAND; grey mottled brown. Moist; sand, fine to coarse.	0.8
		1.0
	SILT, with trace clay; light grey. Moist.	1.2
	Silty SAND; light greyish brown. Moist; sand, fine.	1.4
	CLAY, with minor silt; light grey streaked orange brown. Moist; moderate plasticity.	1.6
		1.8
	SAND, with minor silt; greyish brown. Moist; sand, fine.	2.0
	EOH: 2.00 m	

Legend

Scala Penetrometer (Blows / 100 mm): 2 4 6 8 10 12 14 16 18

Vane Shear Strength (kPa) — Vane: 50 100 150 200 250

Water: Groundwater Not Encountered

Photo

Remarks

End of log at 2.0m. Target depth.

Shear Vanes
- Peak
- Remoulded

Water
- Standing Water Level
- Out flow
- In flow

Investigation Type
- [ ] Hand Auger
- [ ] Investigation Pit
- [x] Machine Borehole

Job name	Tamahere Country Club
Job number	HD2812
Date	29/03/2023
Plotted by	TD (RR)
Reviewed by	BS

Perc test results

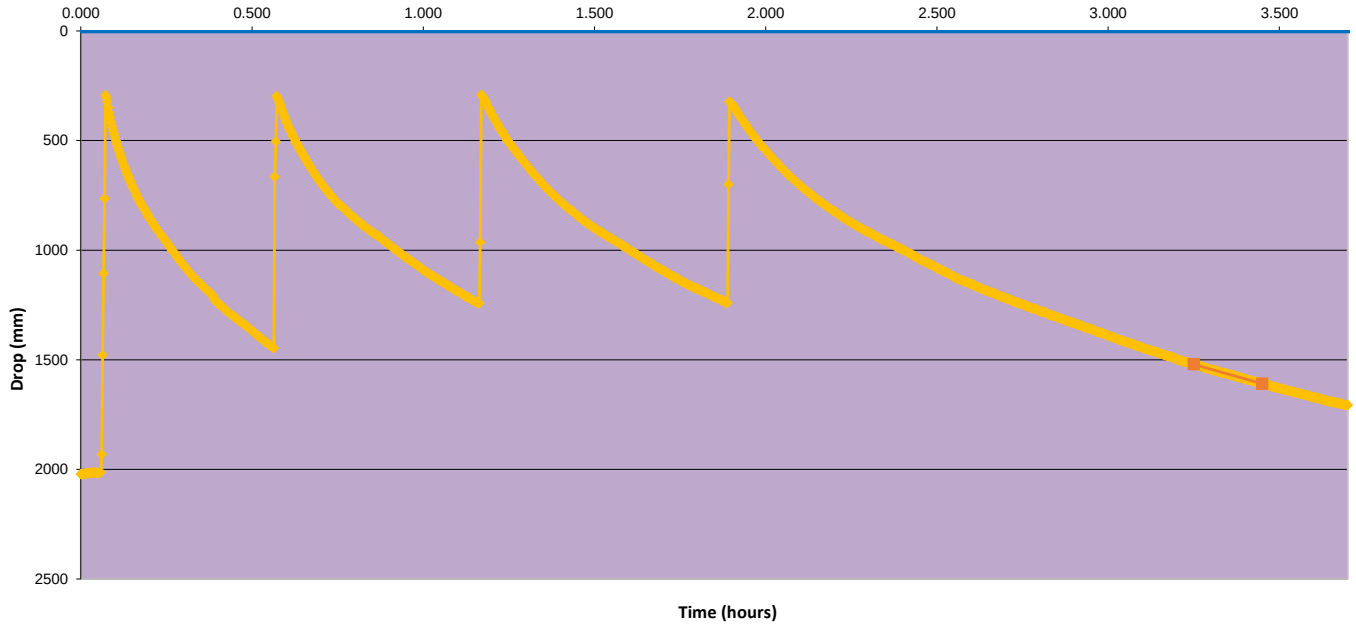
ST04

Calculated in general accordance with E1/VM1 - Surface Water, Section 9.0

Logger depth: 2.000 m

Ground water depth: NA m

Notes:



Percolation rate calculation:

Time (Hour)	Drop (mm)	
3.25	1521	Minimum slope (lower)
3.45	1609	Minimum slope (upper)

Percolation rate = 440 mm/hr

50% Percolation rate = **220 mm/hr**

INVESTIGATION LOG

Job No.:	HD2812
Client:	Tamahere Country Club
No.:	ST05
Project:	Tamahere Country Club PGR
Location:	-
Date:	04.04.23
Co-ordinates:	1807279mE, 5809507mN
Logged By:	SW
Elevation:	Ground
Checked By:	RR

Geology	Geological Interpretation (refer to separate Geotechnical and Geological Information sheet for further information)	Depth (m)
Topsoil	TOPSOIL; brown. Moist.	
Hinuera Formation	SAND, with some silt; brown. Moist; sand, fine to medium.	0.2
	SAND; light brown. Moist; sand, fine.	0.4
		0.6
		0.8
	SAND, with some silt; grey streaked orange. Moist; poorly graded; sand, fine.	1.0
	SAND; grey. Moist to wet; sand, fine.	1.2
		1.4
	SILT, with minor sand, with trace clay; grey. Wet; moderate plasticity, moderate dilatancy; sand, fine.	1.6
		1.8
	EOH: 2.00 m	2.0

Legend

Scala Penetrometer (Blows / 100 mm): 2 4 6 8 10 12 14 16 18

Vane Shear Strength (kPa) — Vane: 50 100 150 200 250

Water: Groundwater Not Encountered

Photo

Remarks

End of log at 2.0 meters_ Target depth achieved.

Shear Vanes
- Peak
- Remoulded

Water
- Standing Water Level
- Out flow
- In flow

Investigation Type
- [ ] Hand Auger
- [ ] Investigation Pit
- [x] Machine Borehole

Job name	Tamahere Country Club
Job number	HD2812
Date	04/04/2023
Plotted by	SW (RR)
Reviewed by	BS

Perc test results

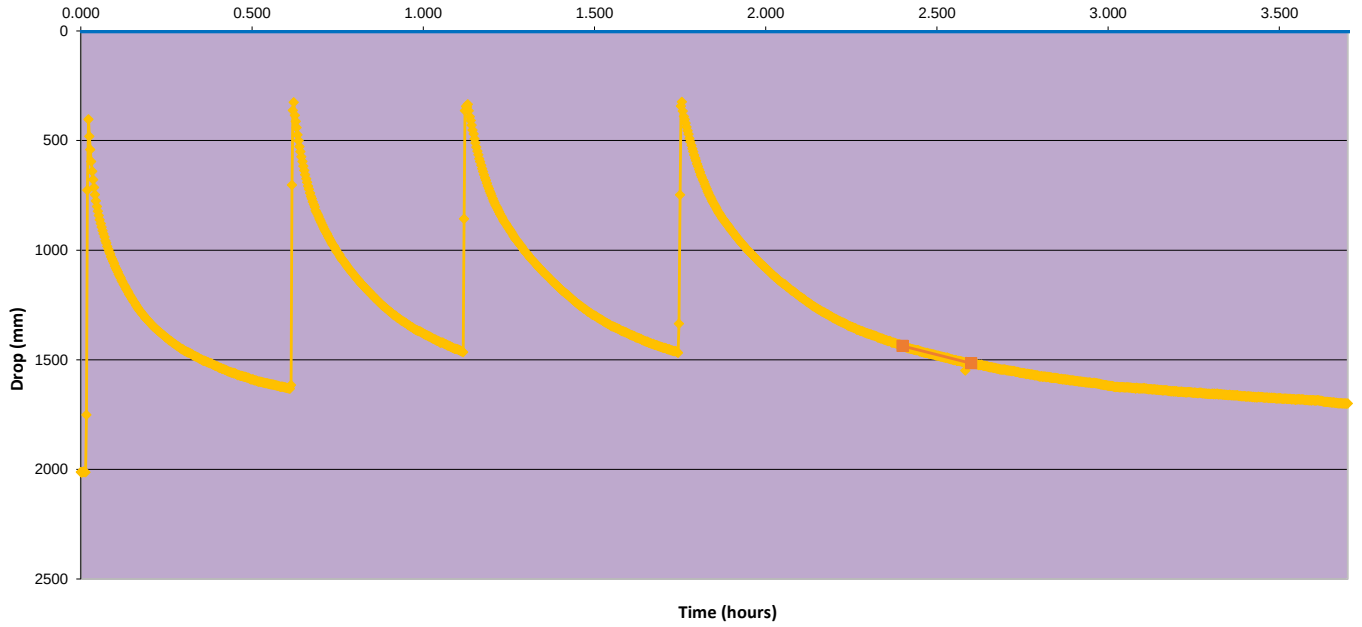
ST03

Calculated in general accordance with E1/VM1 - Surface Water, Section 9.0

Logger depth: 2.000 m

Ground water depth: NA m

Notes:



Percolation rate calculation:

Time (Hour)	Drop (mm)	
2.40	1437	Minimum slope (lower)
2.60	1516	Minimum slope (upper)

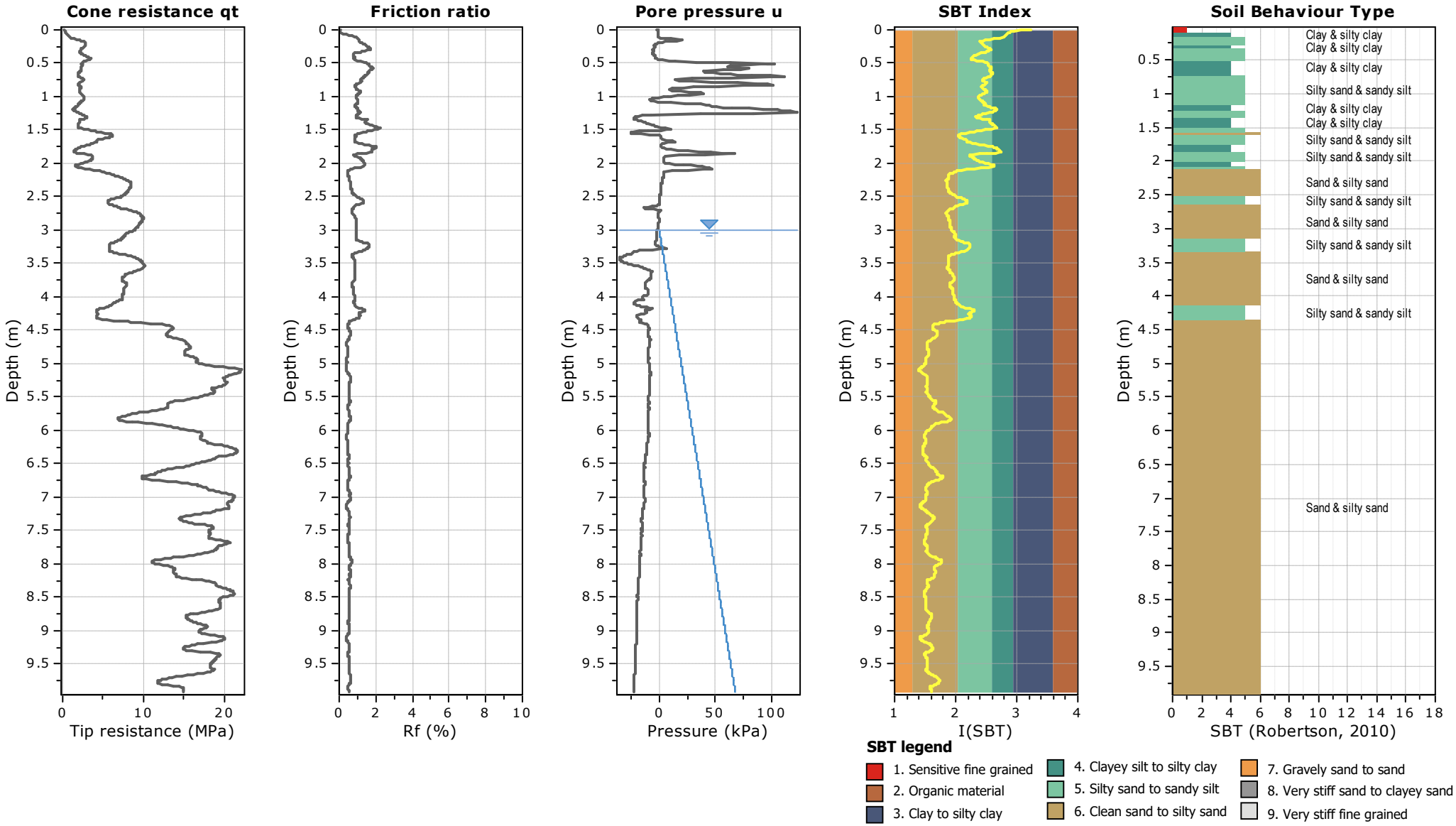
Percolation rate = 395 mm/hr

50% Percolation rate = **197 mm/hr**

HD Geo Limited
26 London Street
Hamilton Central, Hamilton
http://www.hdgeo.co.nz

CPT: CPT01
Total depth: 9.92 m, Date: 18/04/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

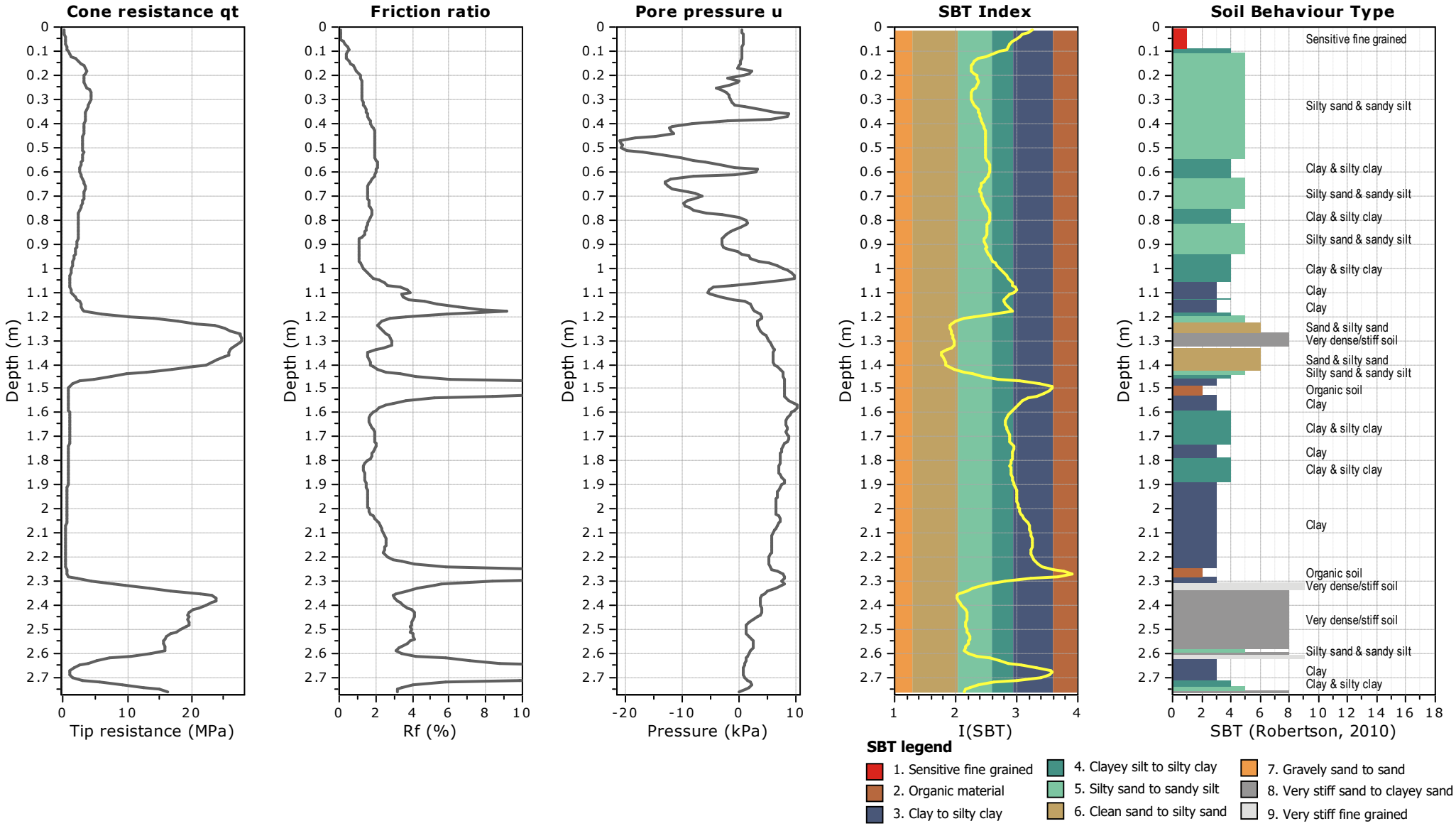
Project: HD2812 - Tamahere Country Club
Location: 46 Tamahere Drive, Tamahere



HD Geo Limited
26 London Street
Hamilton Central, Hamilton
http://www.hdgeo.co.nz

CPT: CPT02
Total depth: 2.76 m, Date: 18/04/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

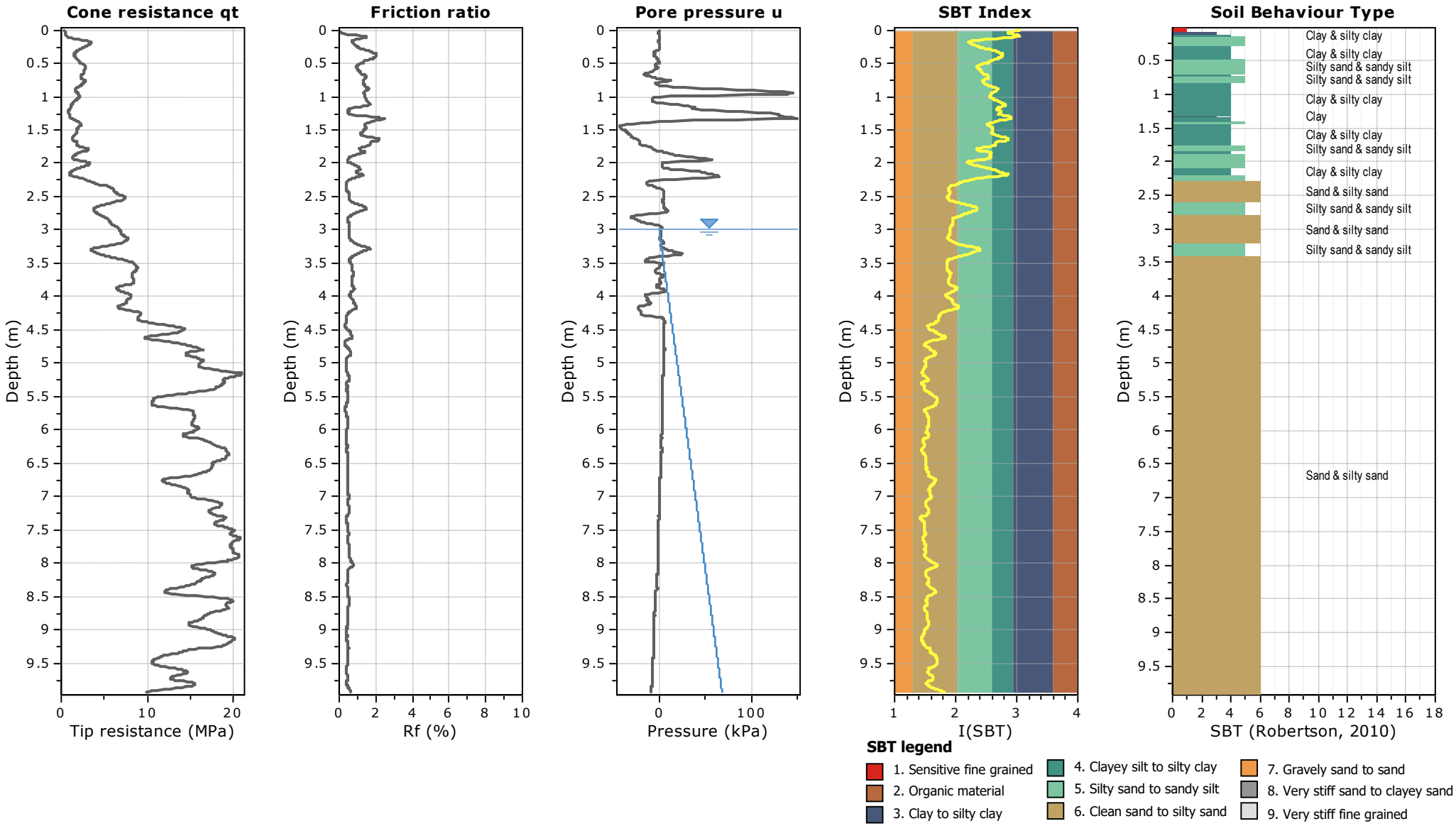
Project: HD2812 - Tamahere Country Club
Location: 46 Tamahere Drive, Tamahere



HD Geo Limited
26 London Street
Hamilton Central, Hamilton
http://www.hdgeo.co.nz

CPT: CPT02a
Total depth: 9.93 m, Date: 18/04/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

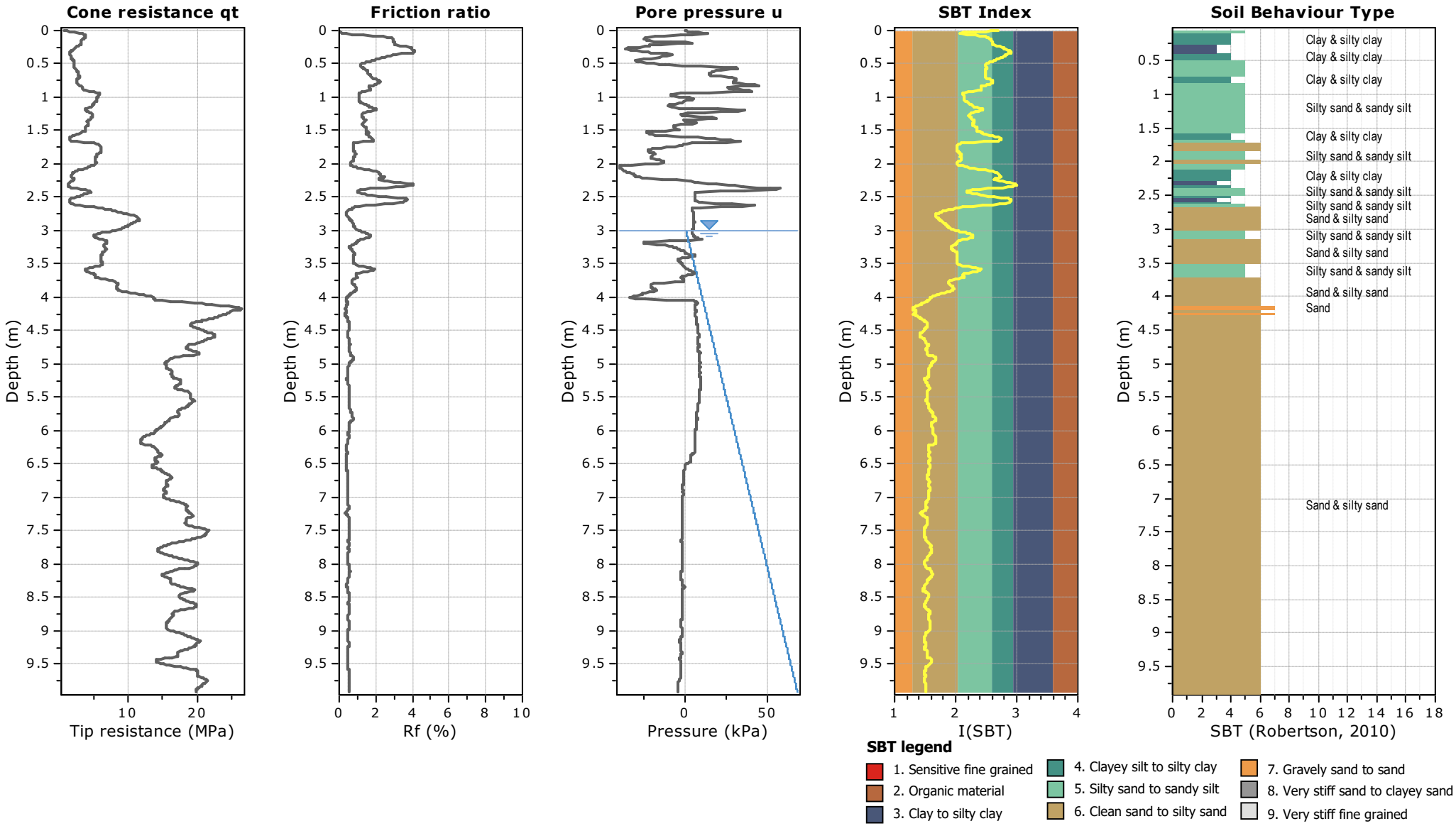
Project: HD2812 - Tamahere Country Club
Location: 46 Tamahere Drive, Tamahere



HD Geo Limited
26 London Street
Hamilton Central, Hamilton
http://www.hdgeo.co.nz

CPT: CPT06
Total depth: 9.92 m, Date: 18/04/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

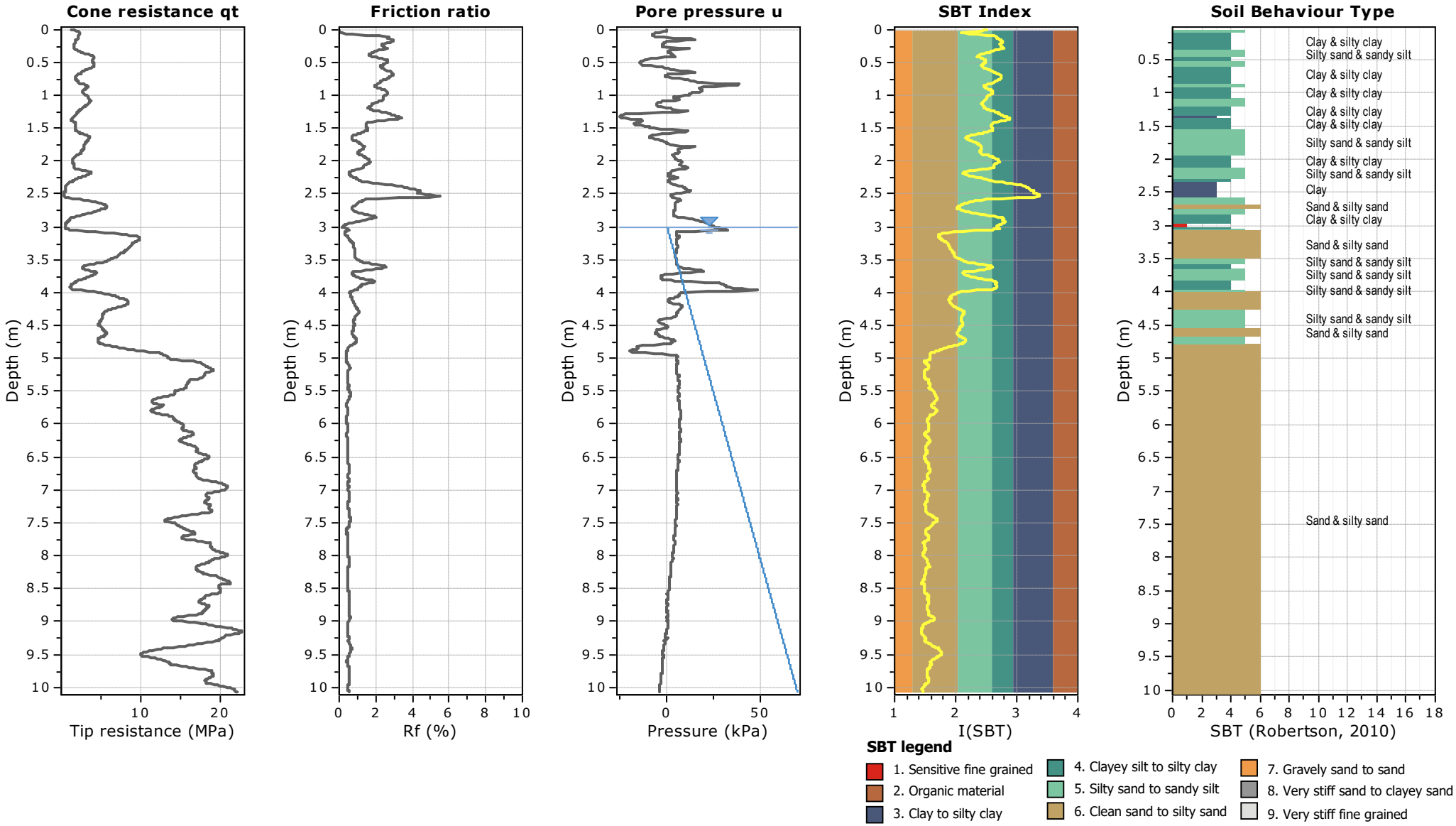
Project: HD2812 - Tamahere Country Club
Location: 46 Tamahere Drive, Tamahere



HD Geo Limited
26 London Street
Hamilton Central, Hamilton
http://www.hdgeo.co.nz

CPT: CPT07
Total depth: 10.07 m, Date: 18/04/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

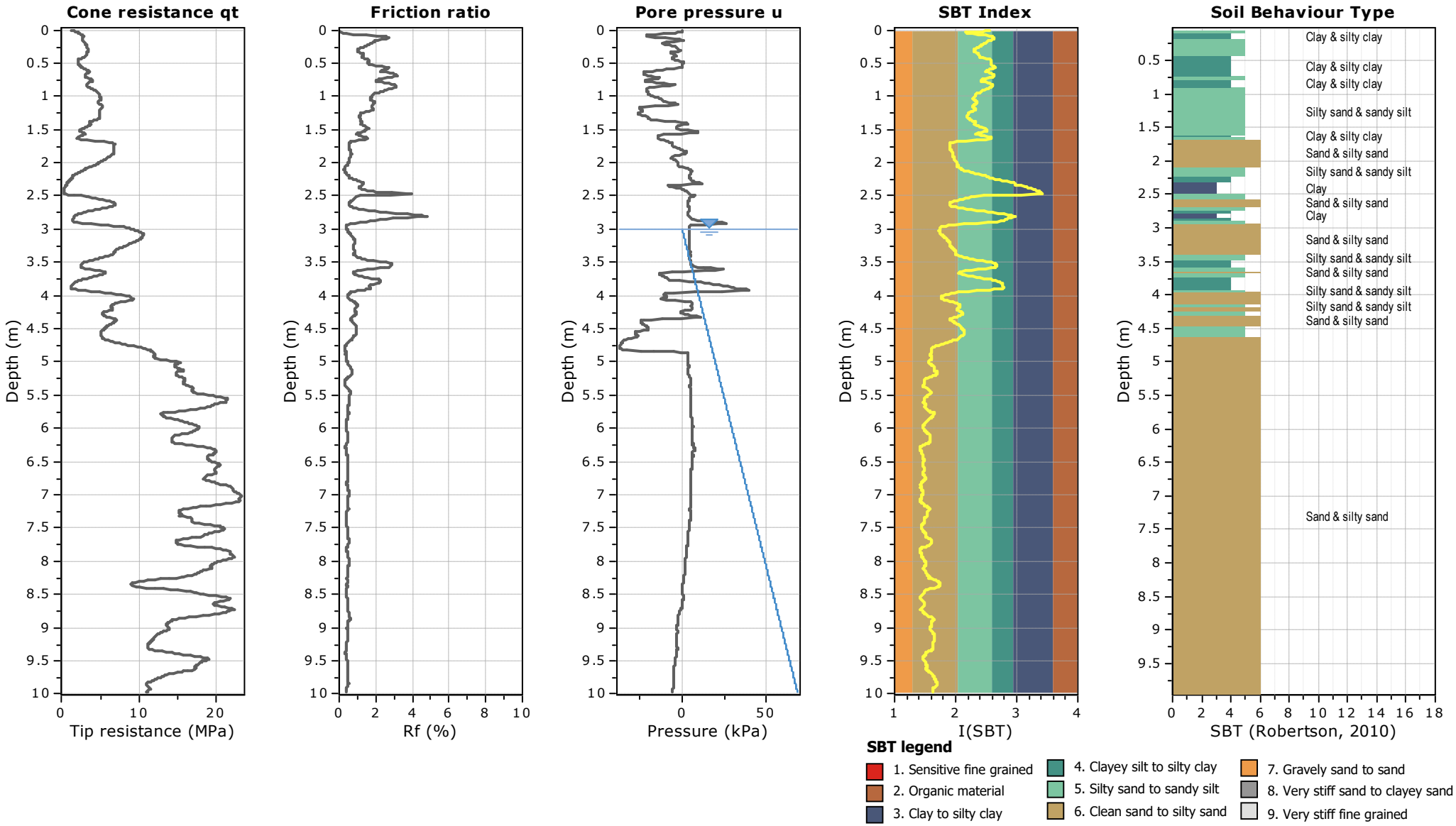
Project: HD2812 - Tamahere Country Club
Location: 46 Tamahere Drive, Tamahere



HD Geo Limited
26 London Street
Hamilton Central, Hamilton
http://www.hdgeo.co.nz

CPT: CPT08
Total depth: 9.97 m, Date: 18/04/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

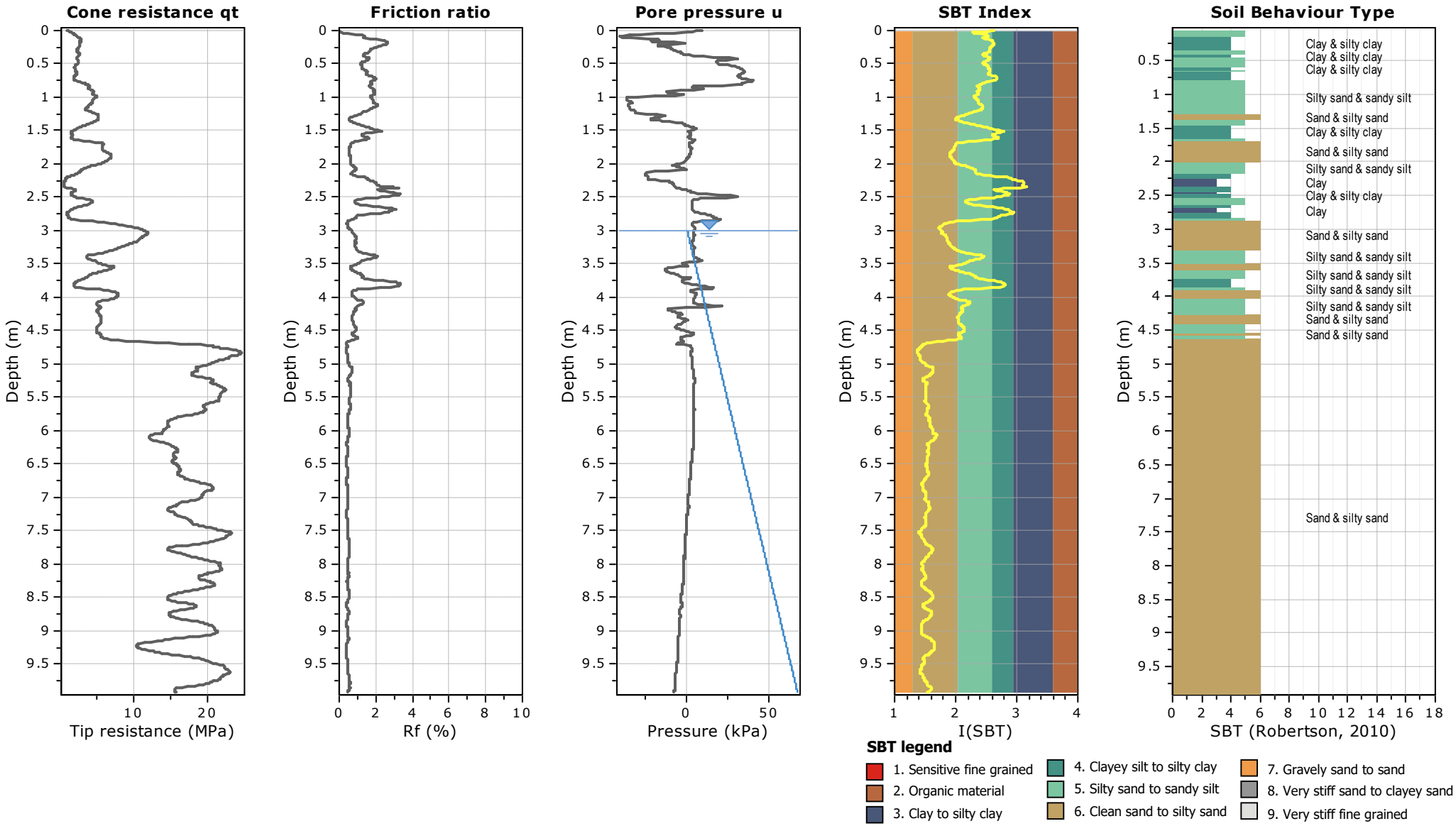
Project: HD2812 - Tamahere Country Club
Location: 46 Tamahere Drive, Tamahere



HD Geo Limited
26 London Street
Hamilton Central, Hamilton
http://www.hdgeo.co.nz

CPT: CPT09
Total depth: 9.92 m, Date: 18/04/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

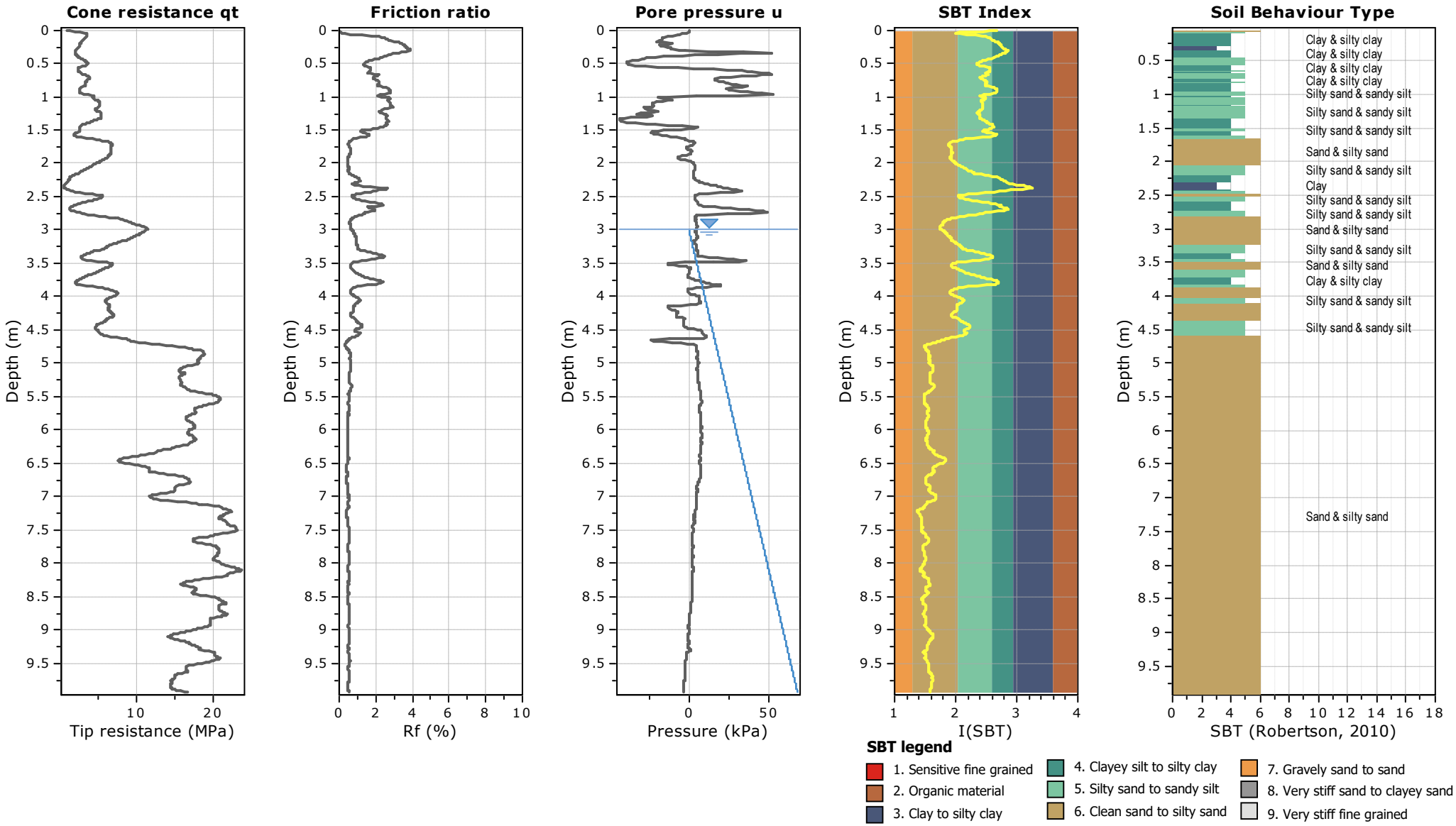
Project: HD2812 - Tamahere Country Club
Location: 46 Tamahere Drive, Tamahere



HD Geo Limited
26 London Street
Hamilton Central, Hamilton
http://www.hdgeo.co.nz

CPT: CPT10
Total depth: 9.93 m, Date: 18/04/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

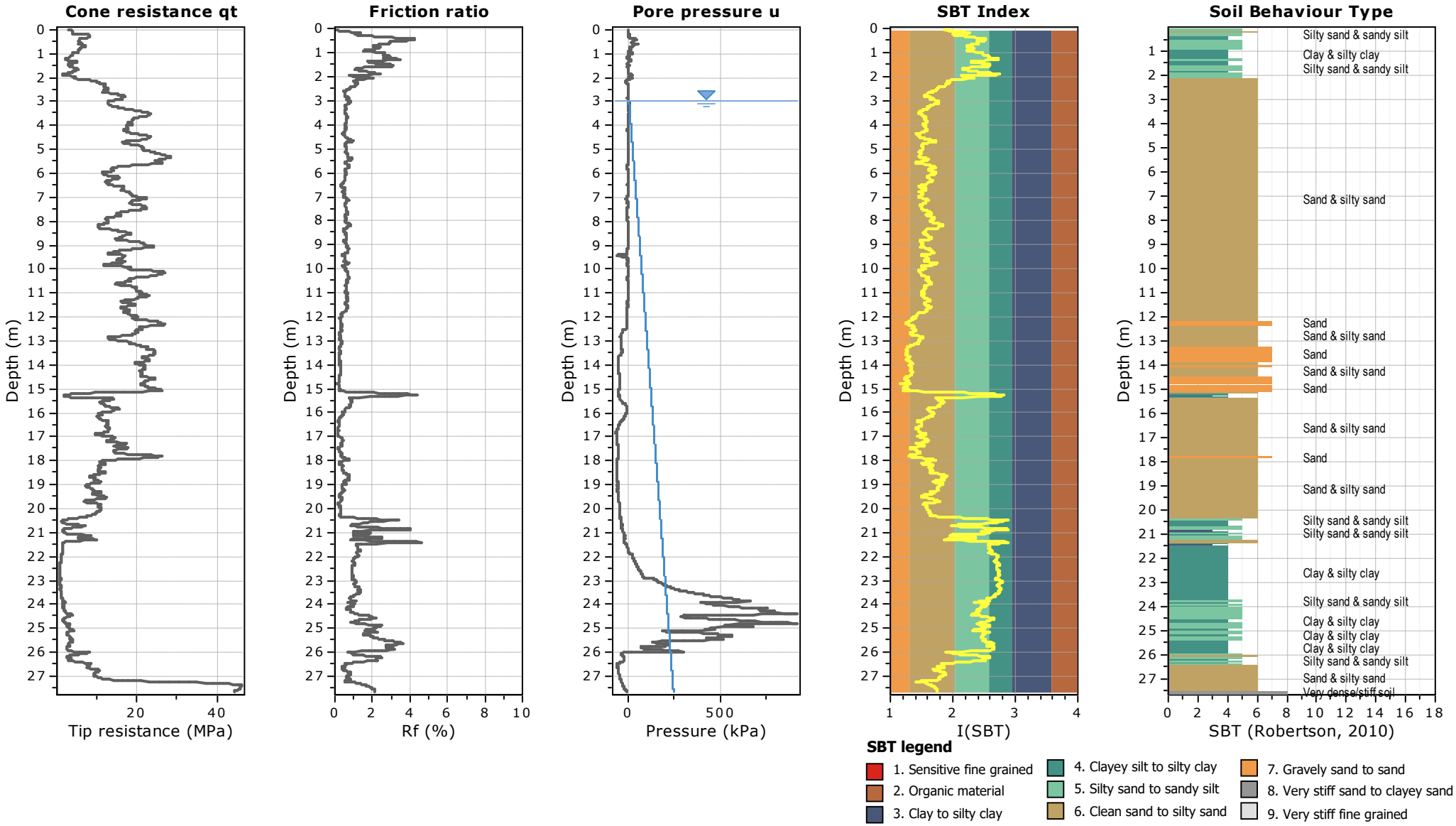
Project: HD2812 - Tamahere Country Club
Location: 46 Tamahere Drive, Tamahere



HD Geo Limited
26 London Street
Hamilton Central, Hamilton
http://www.hdgeo.co.nz

CPT: CPT101
Total depth: 27.65 m, Date: 18/04/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

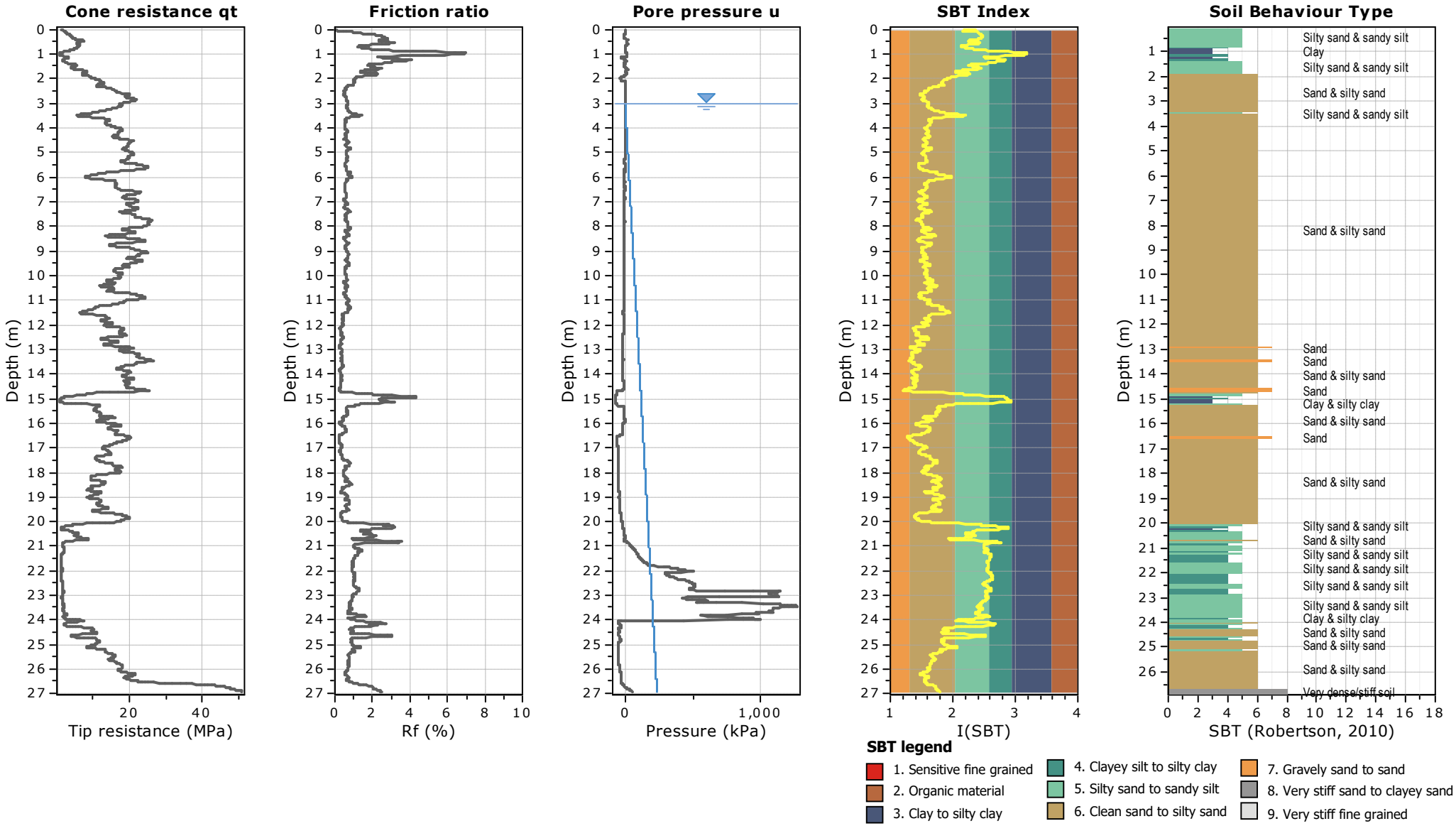
Project: HD2812 - Tamahere Country Club
Location: 46 Tamahere Drive, Tamahere



HD Geo Limited
26 London Street
Hamilton Central, Hamilton
http://www.hdgeo.co.nz

CPT: CPT102
Total depth: 26.92 m, Date: 18/04/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

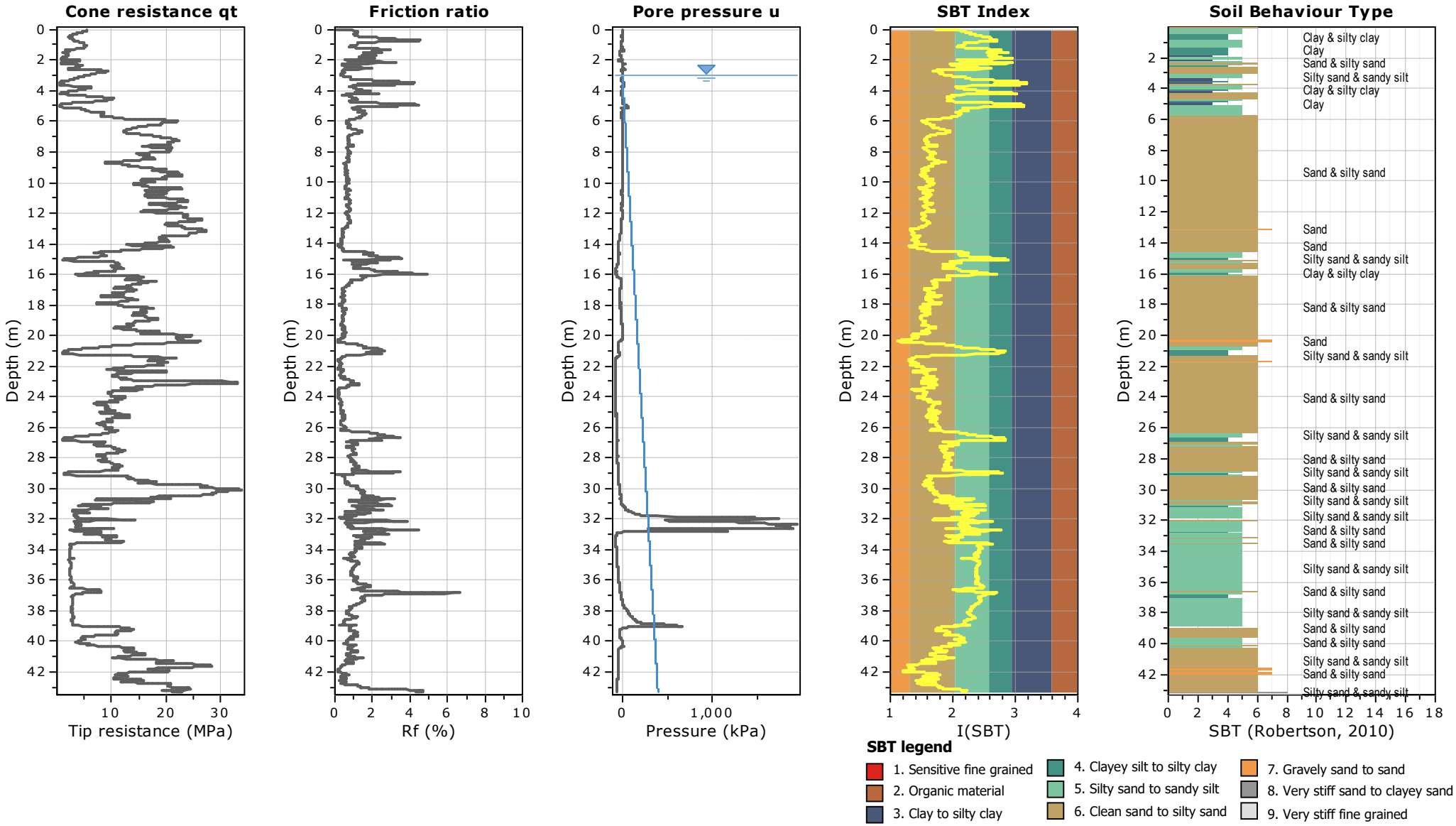
Project: HD2812 - Tamahere Country Club
Location: 46 Tamahere Drive, Tamahere



HD Geo Limited
26 London Street
Hamilton Central, Hamilton
http://www.hdgeo.co.nz

CPT: CPT103
Total depth: 43.31 m, Date: 18/04/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

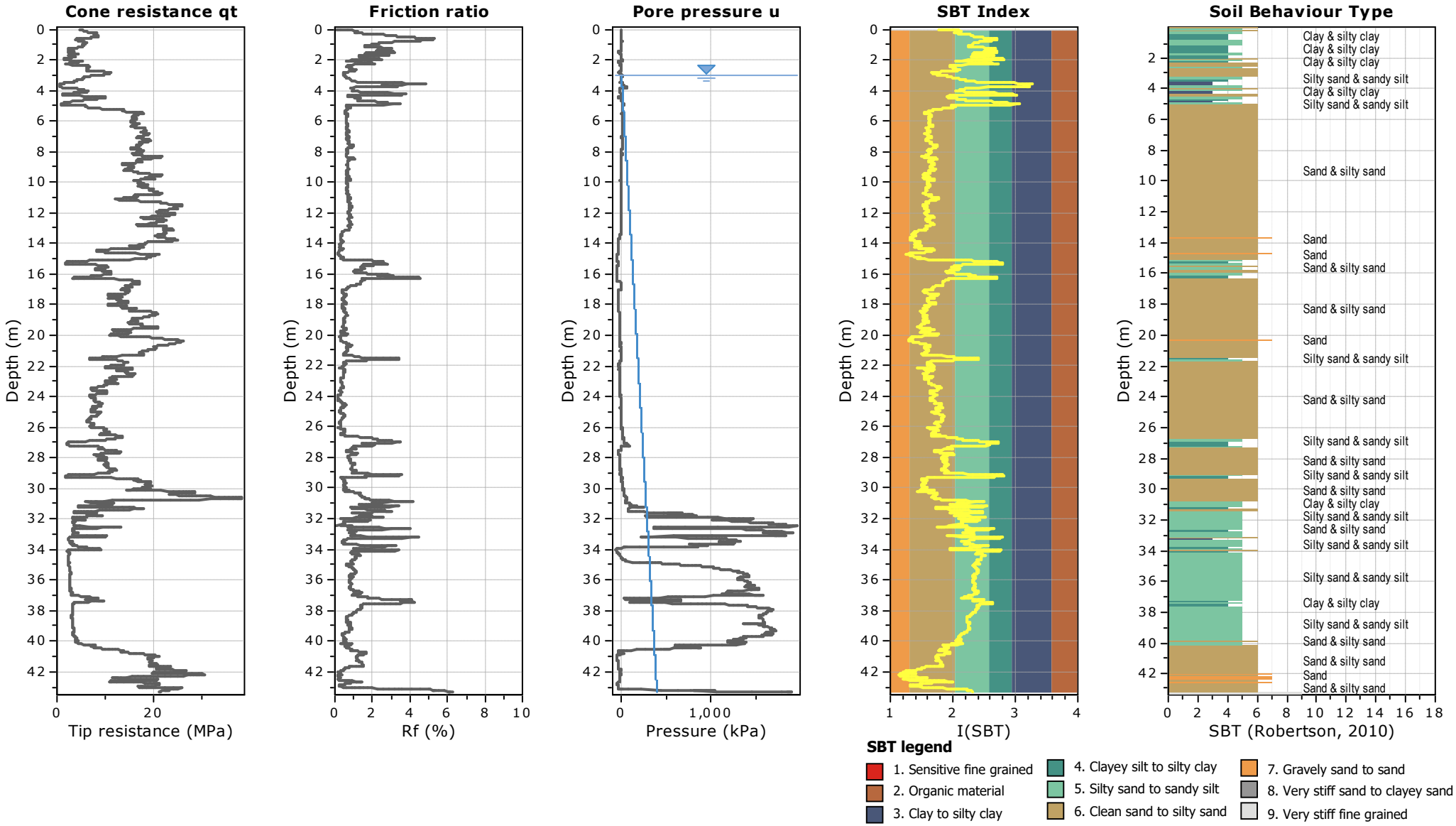
Project: HD2812 - Tamahere Country Club
Location: 46 Tamahere Drive, Tamahere



HD Geo Limited
26 London Street
Hamilton Central, Hamilton
http://www.hdgeo.co.nz

CPT: CPT104
Total depth: 43.34 m, Date: 18/04/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

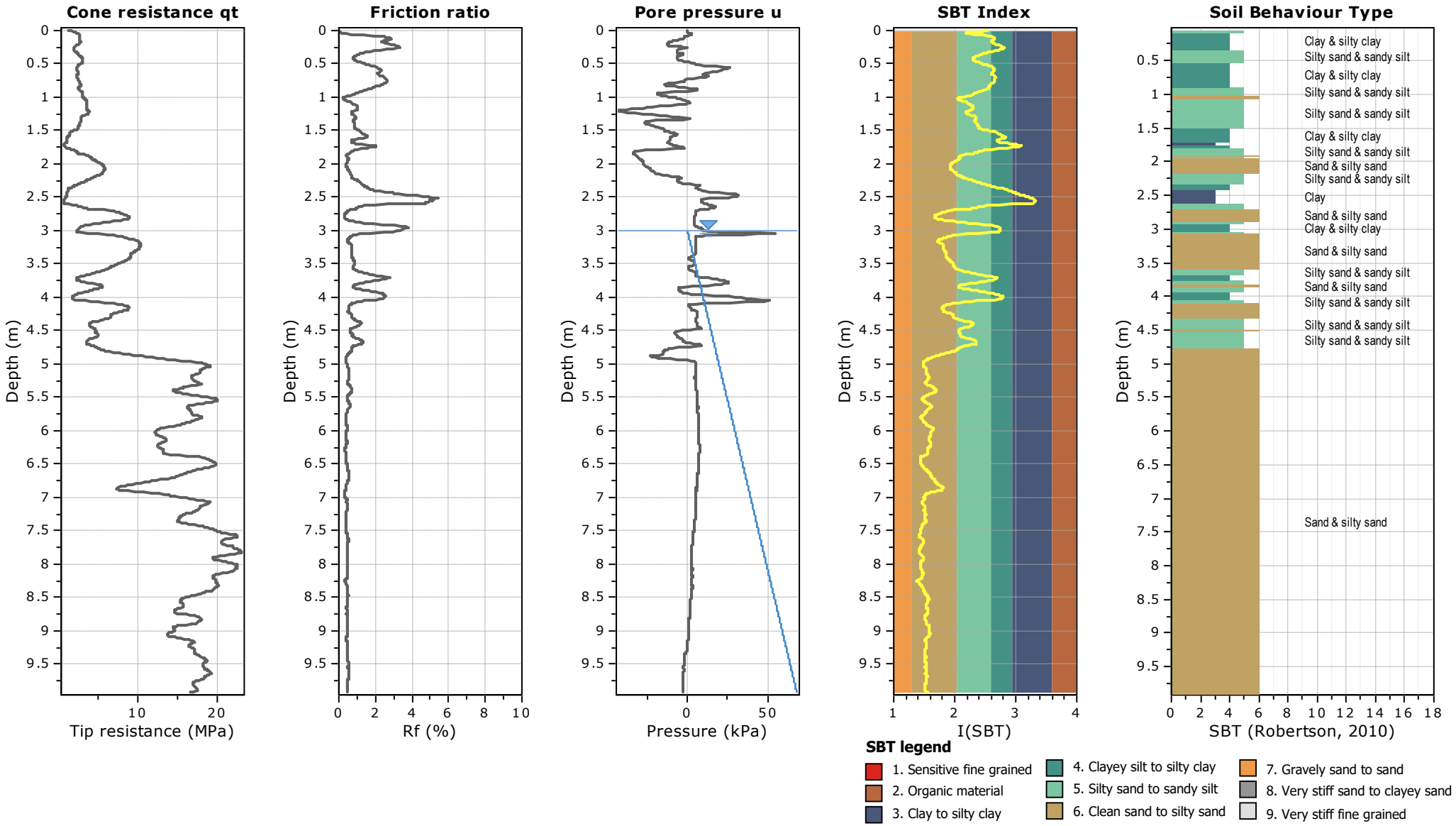
Project: HD2812 - Tamahere Country Club
Location: 46 Tamahere Drive, Tamahere



HD Geo Limited
26 London Street
Hamilton Central, Hamilton
http://www.hdgeo.co.nz

CPT: CPT14
Total depth: 9.92 m, Date: 18/04/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

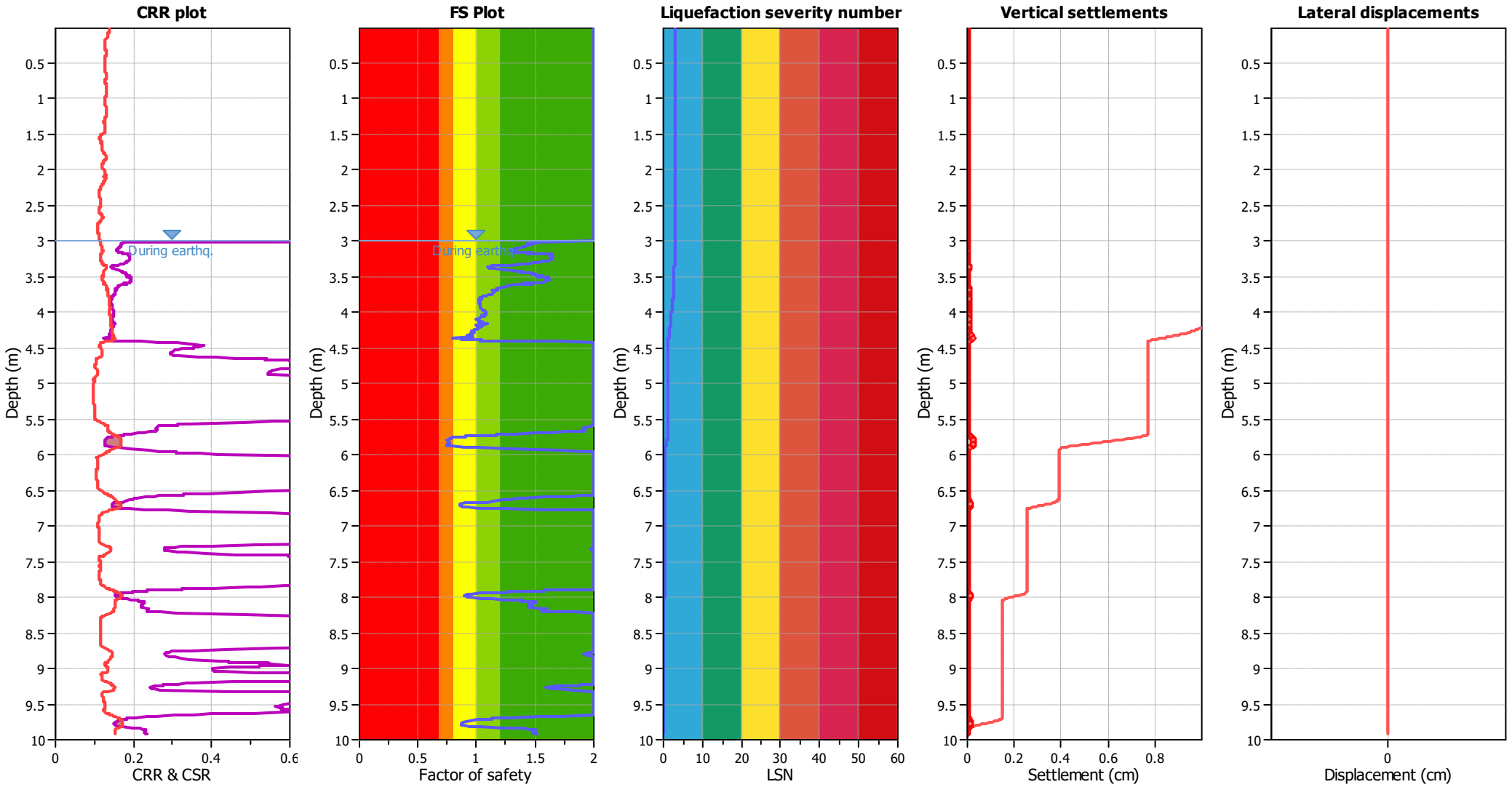
Project: HD2812 - Tamahere Country Club
Location: 46 Tamahere Drive, Tamahere



APPENDIX D

Liquefaction assessment

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.00 m	Fill height:	N/A	Limit depth:	10.00 m

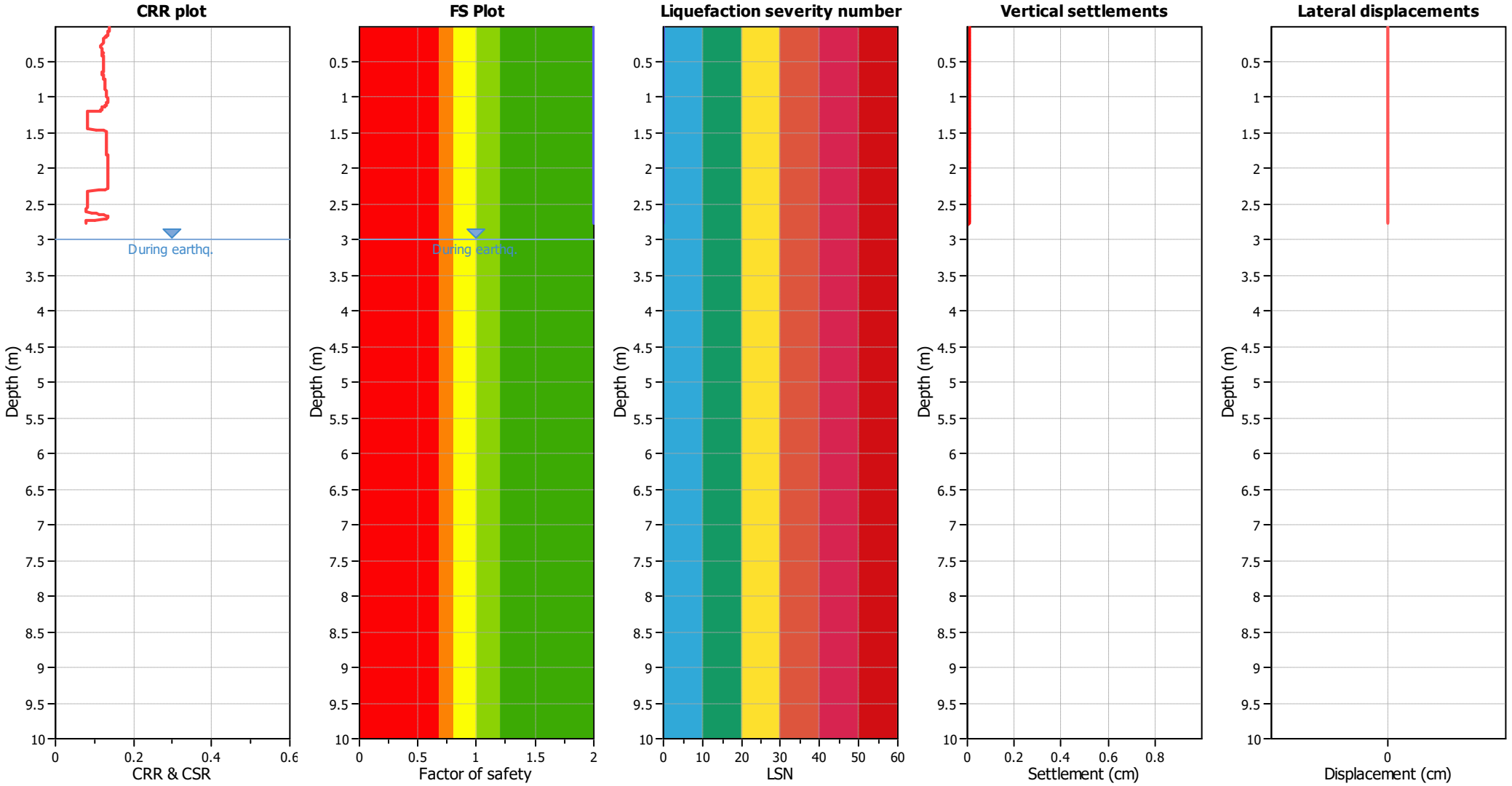
F.S. color scheme

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

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.00 m	Fill height:	N/A	Limit depth:	10.00 m

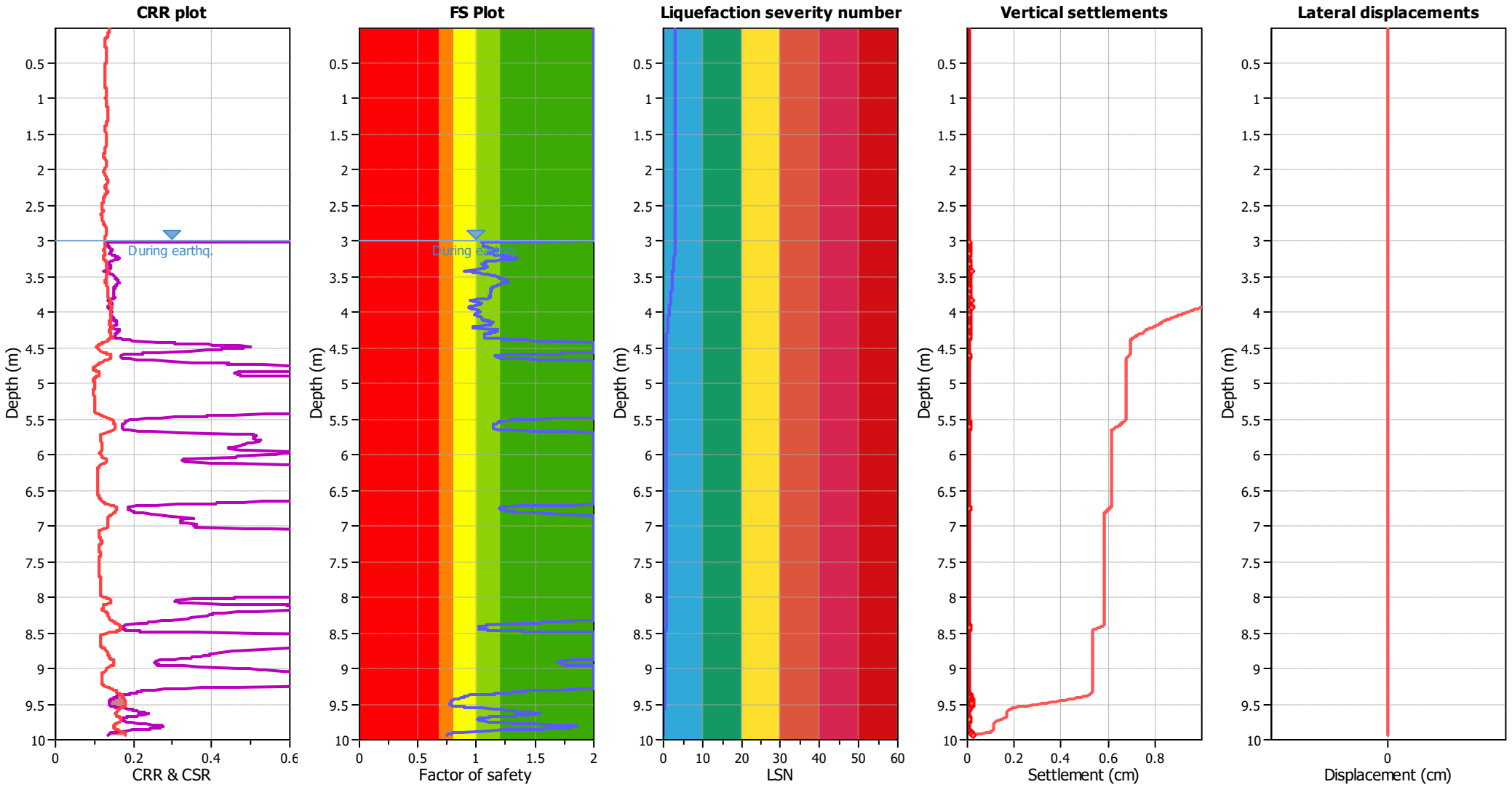
F.S. color scheme

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

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.00 m	Fill height:	N/A	Limit depth:	10.00 m

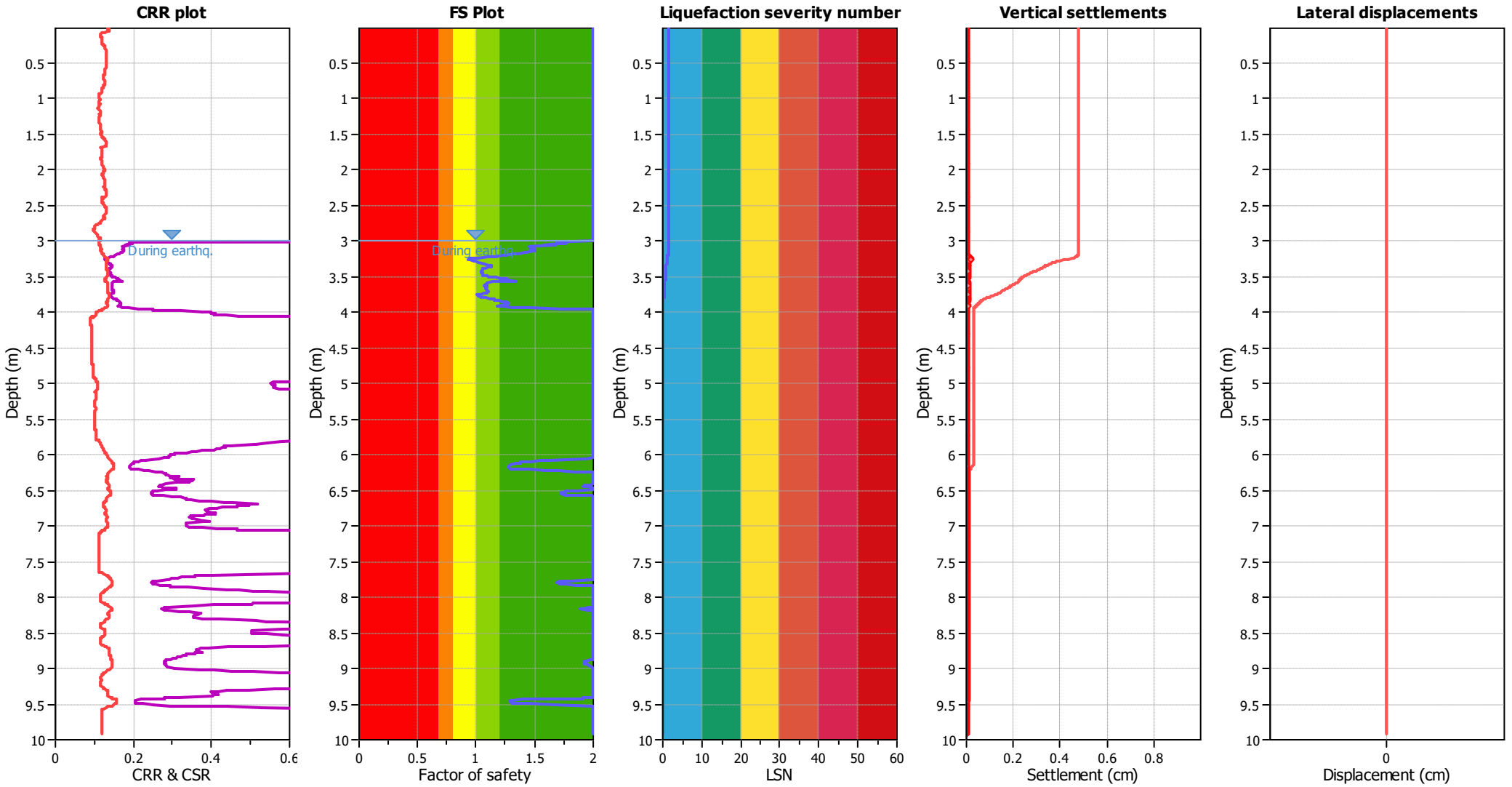
F.S. color scheme

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

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.00 m	Fill height:	N/A	Limit depth:	10.00 m

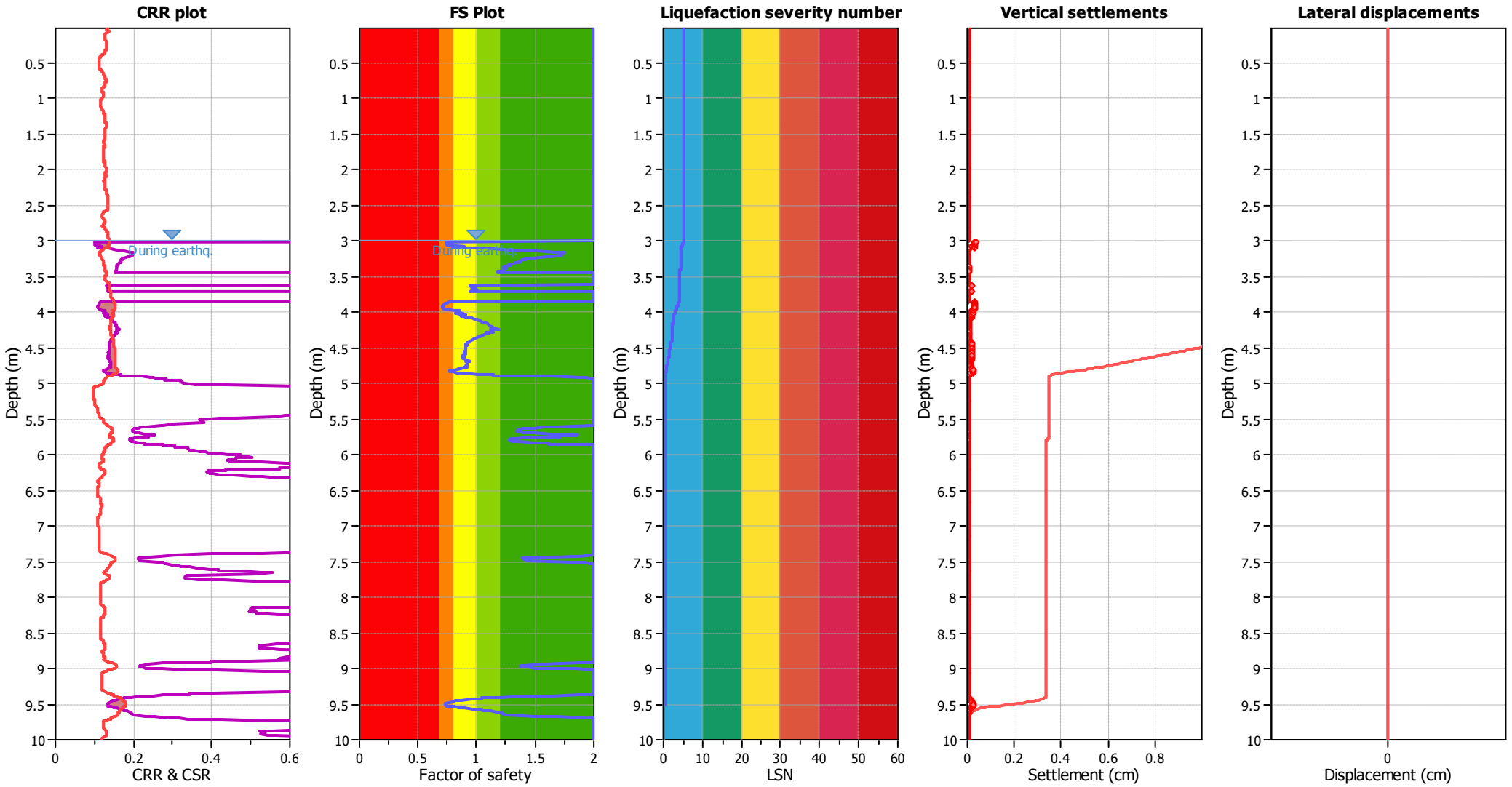
F.S. color scheme

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

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.00 m	Fill height:	N/A	Limit depth:	10.00 m

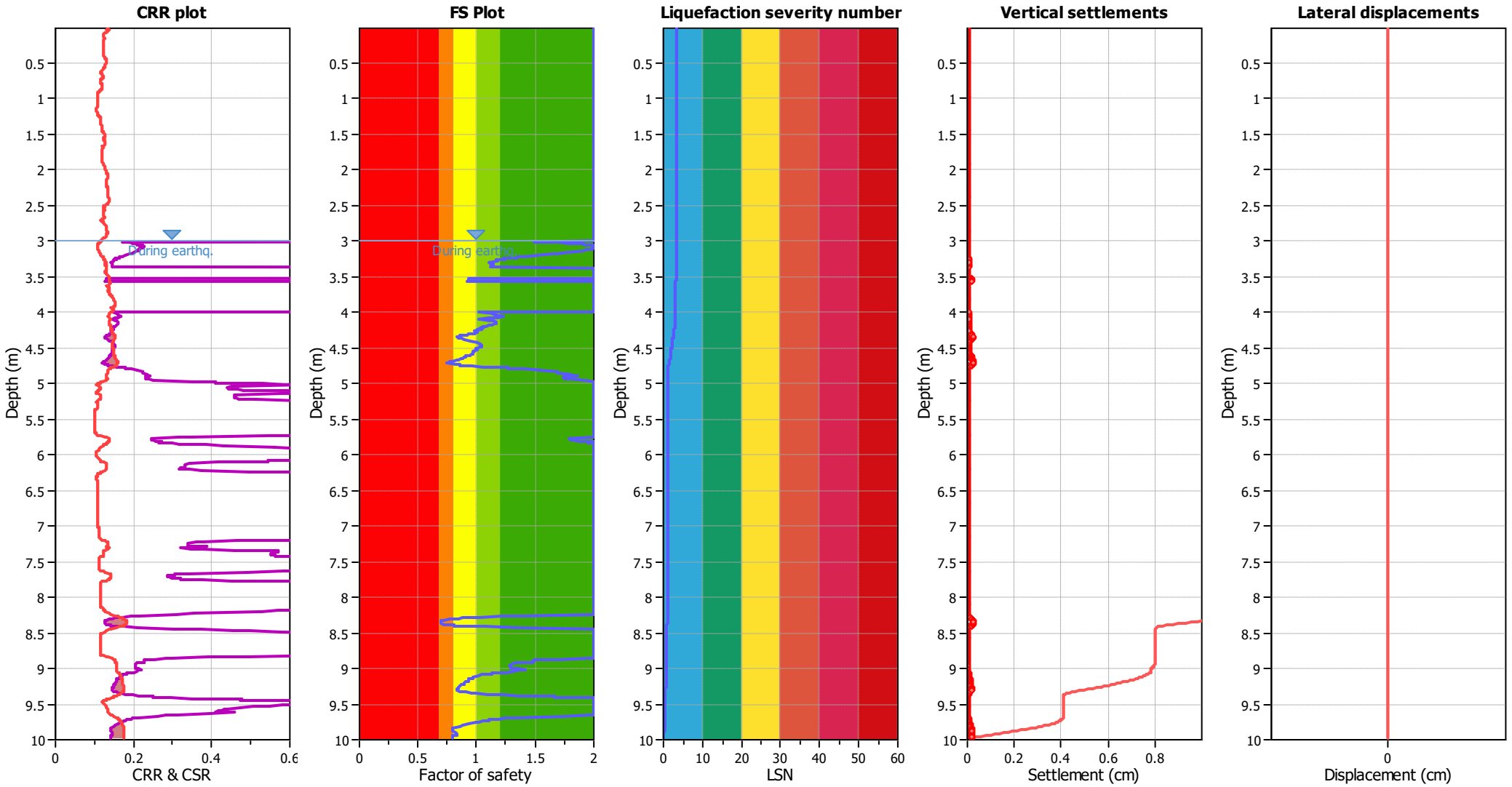
F.S. color scheme

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

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.00 m	Fill height:	N/A	Limit depth:	10.00 m

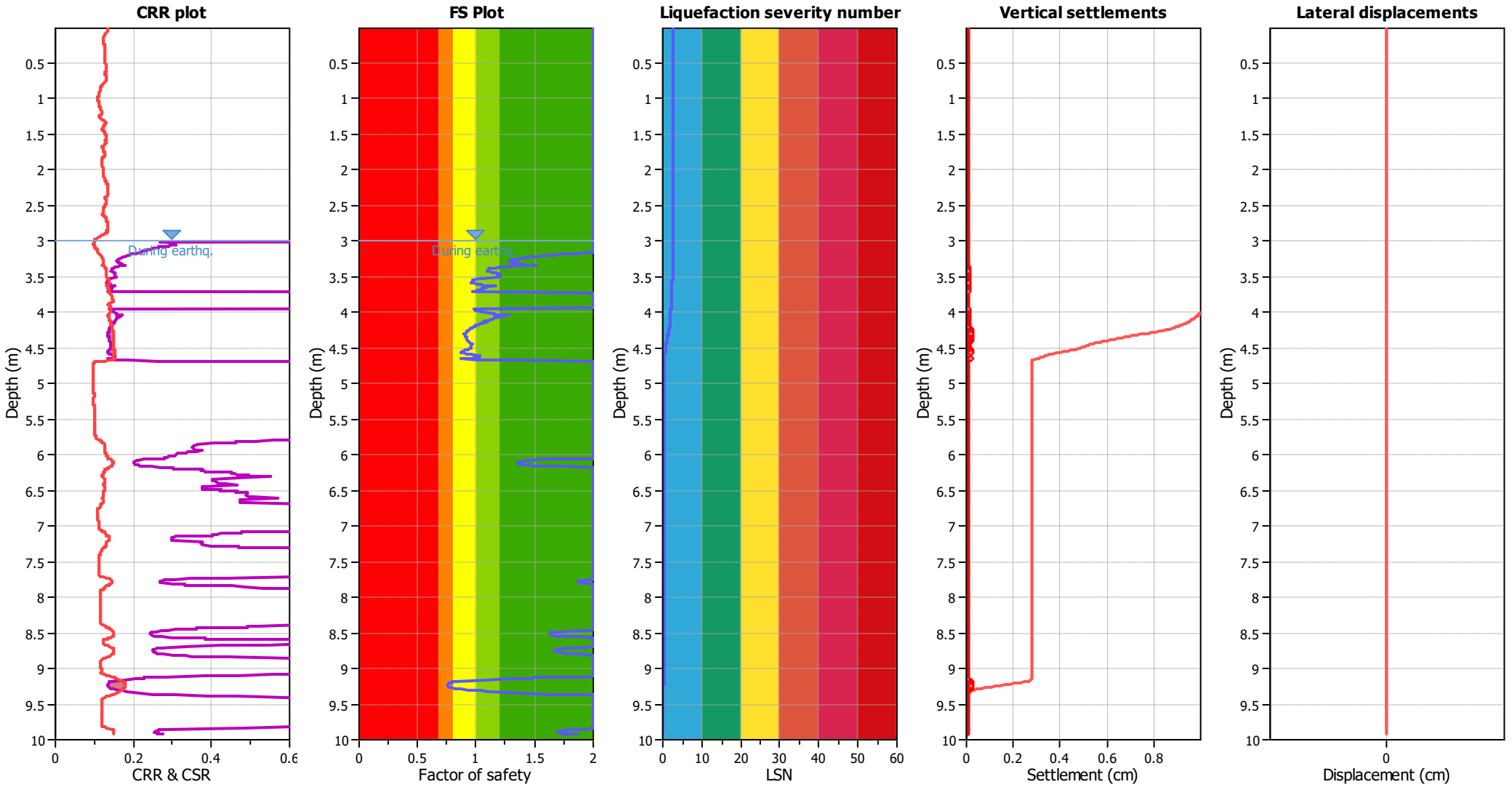
F.S. color scheme

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

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.00 m	Fill height:	N/A	Limit depth:	10.00 m

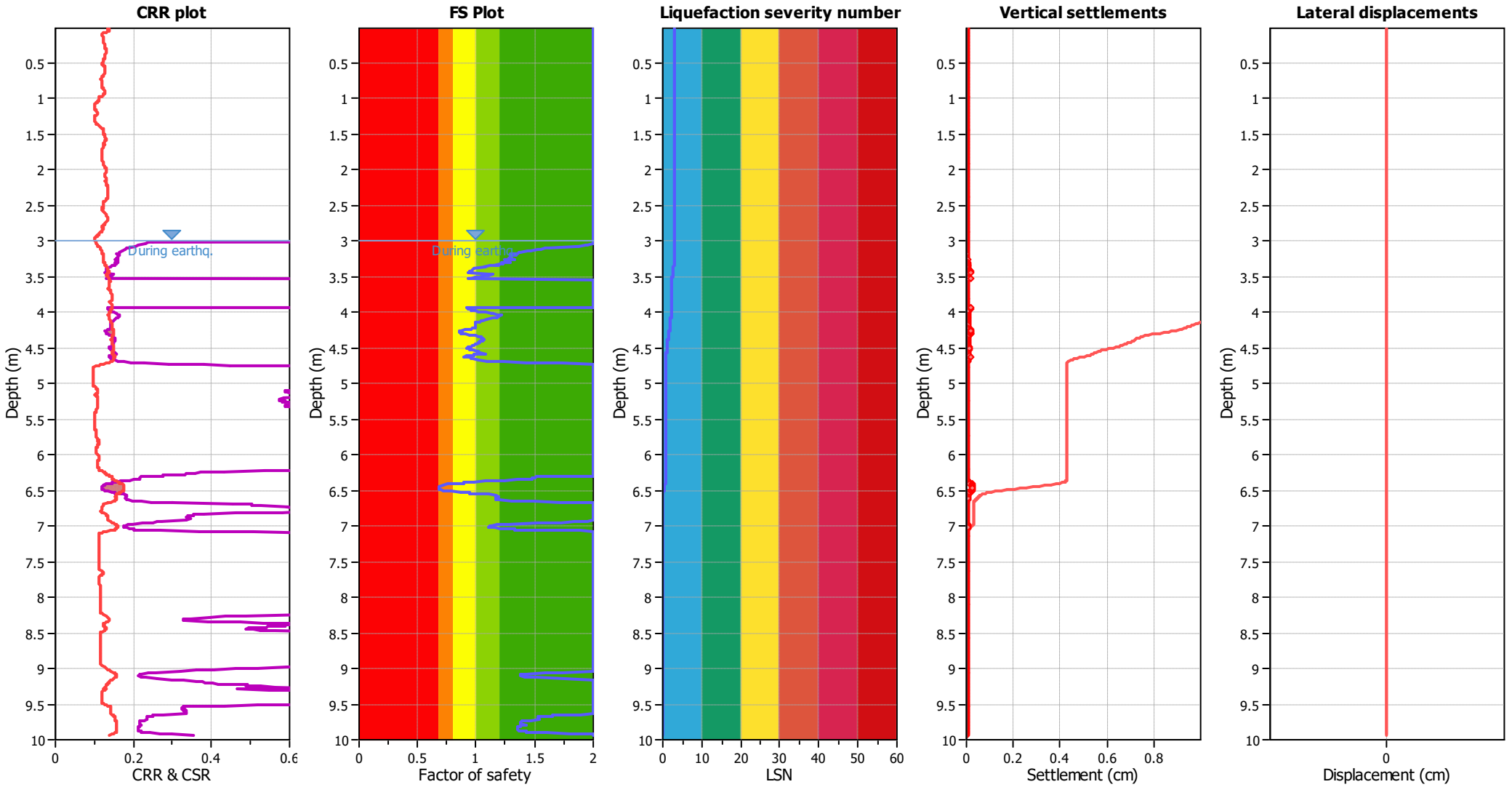
F.S. color scheme

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

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.00 m	Fill height:	N/A	Limit depth:	10.00 m

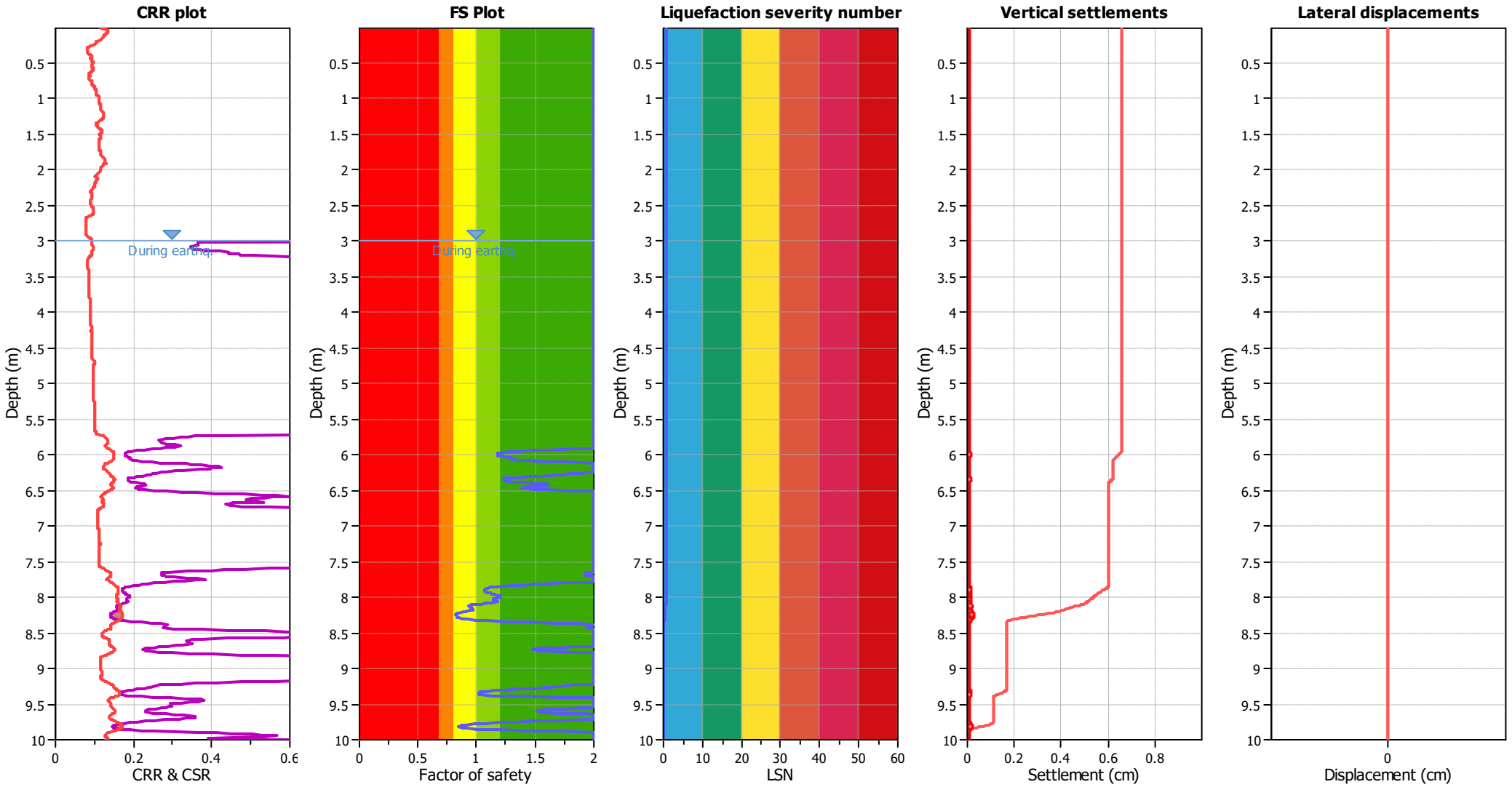
F.S. color scheme

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

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.00 m	Fill height:	N/A	Limit depth:	10.00 m

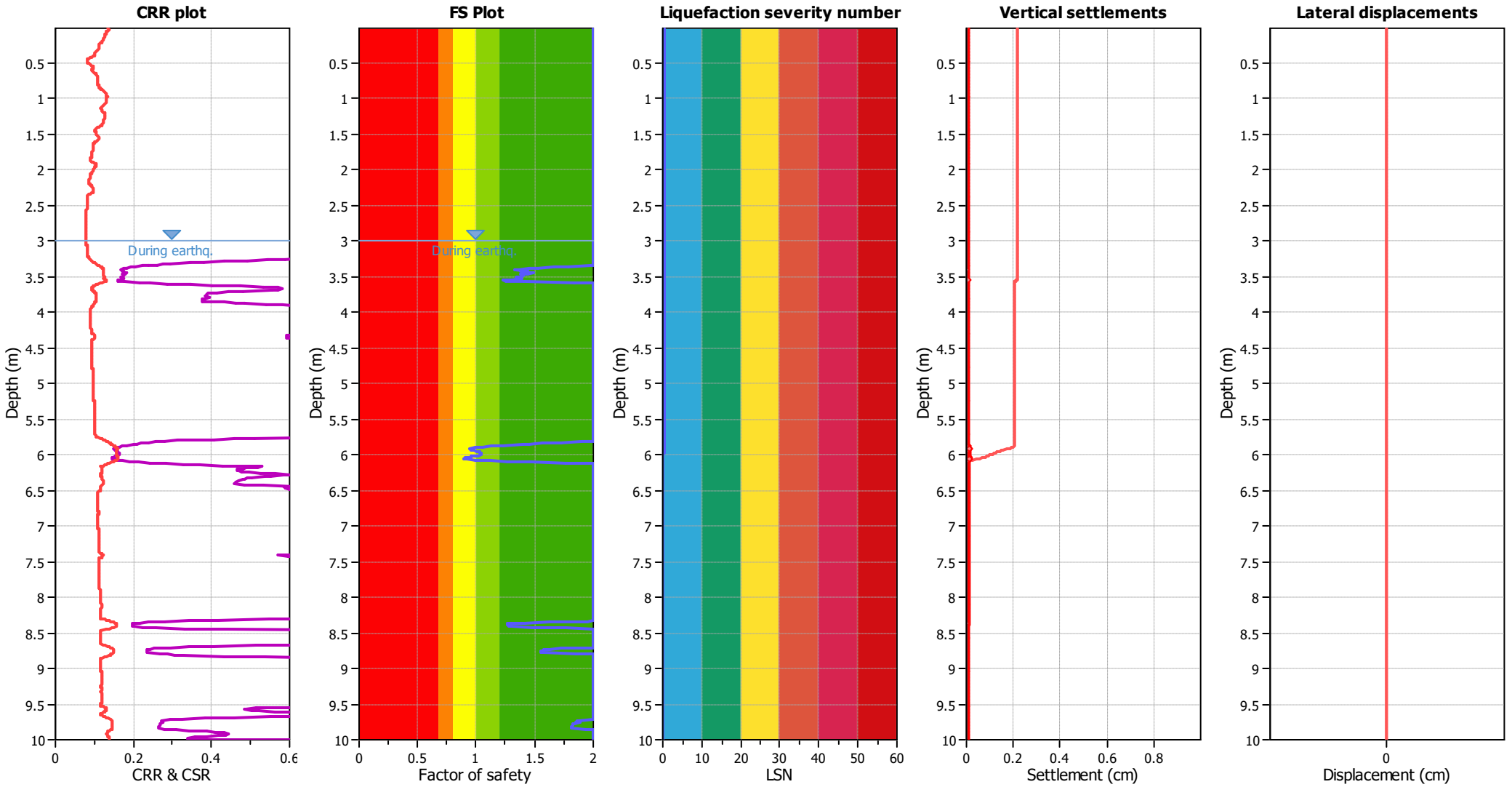
F.S. color scheme

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

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.00 m	Fill height:	N/A	Limit depth:	10.00 m

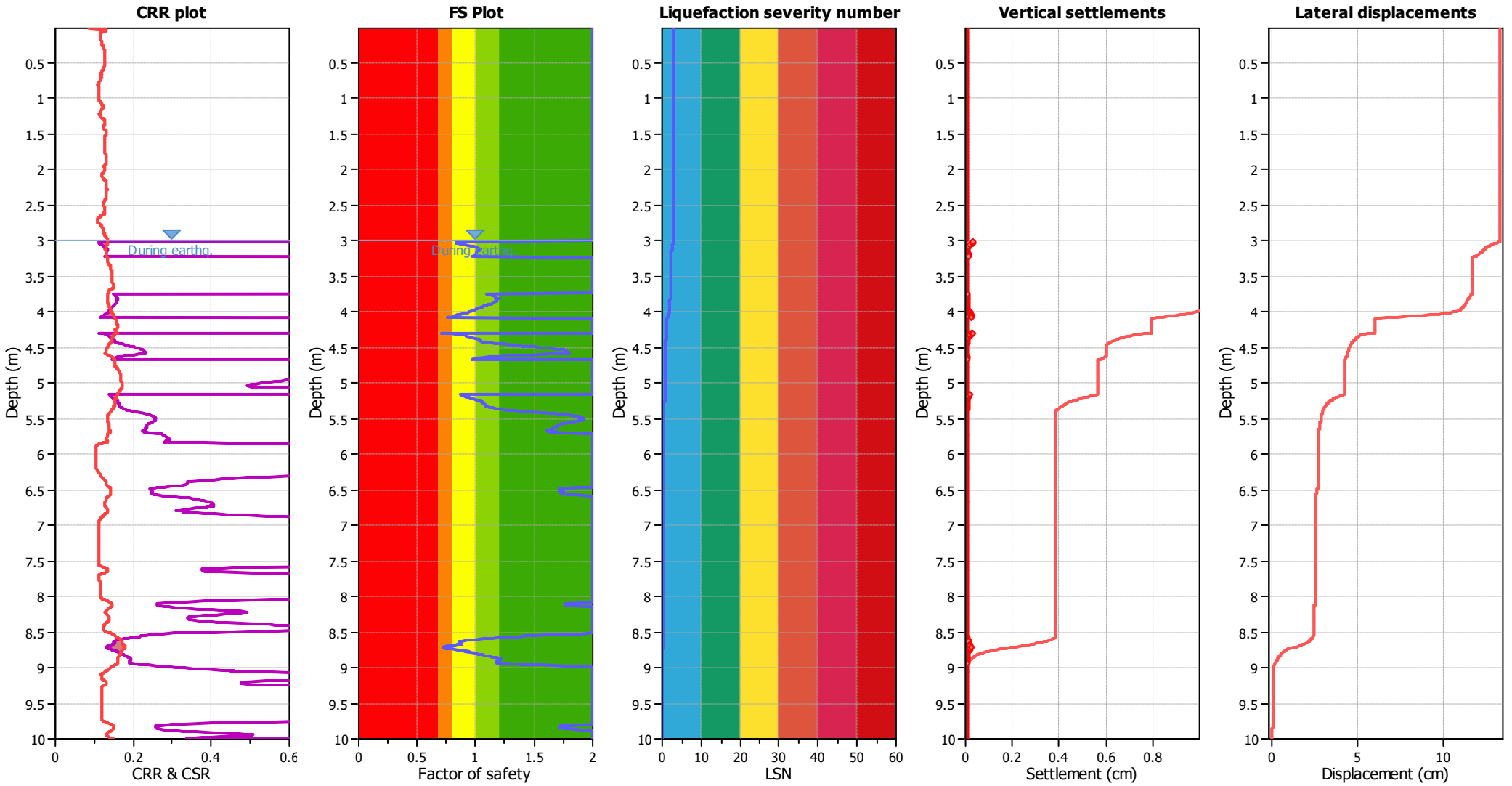
F.S. color scheme

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

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.00 m	Fill height:	N/A	Limit depth:	10.00 m

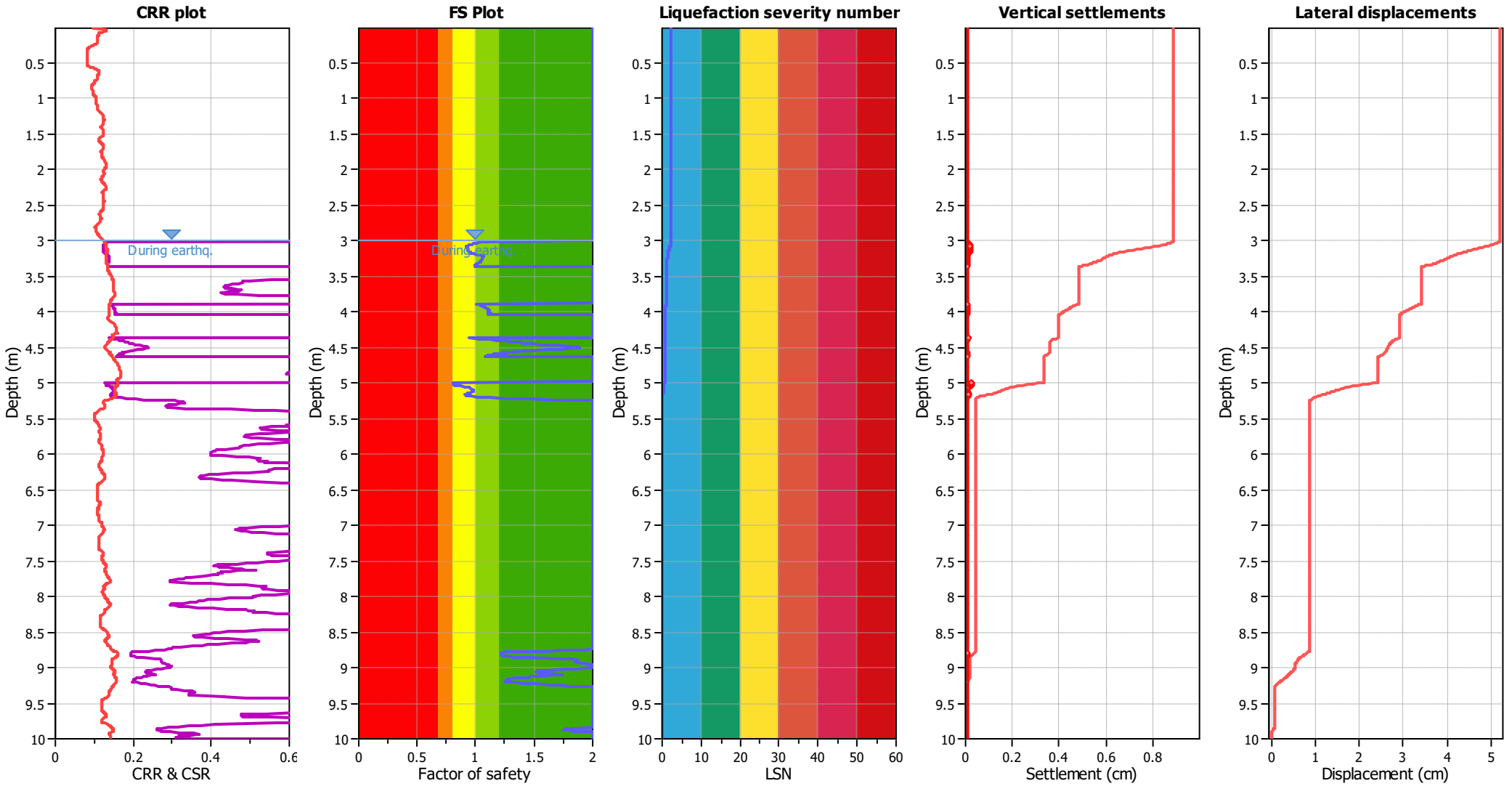
F.S. color scheme

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

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.00 m	Fill height:	N/A	Limit depth:	10.00 m

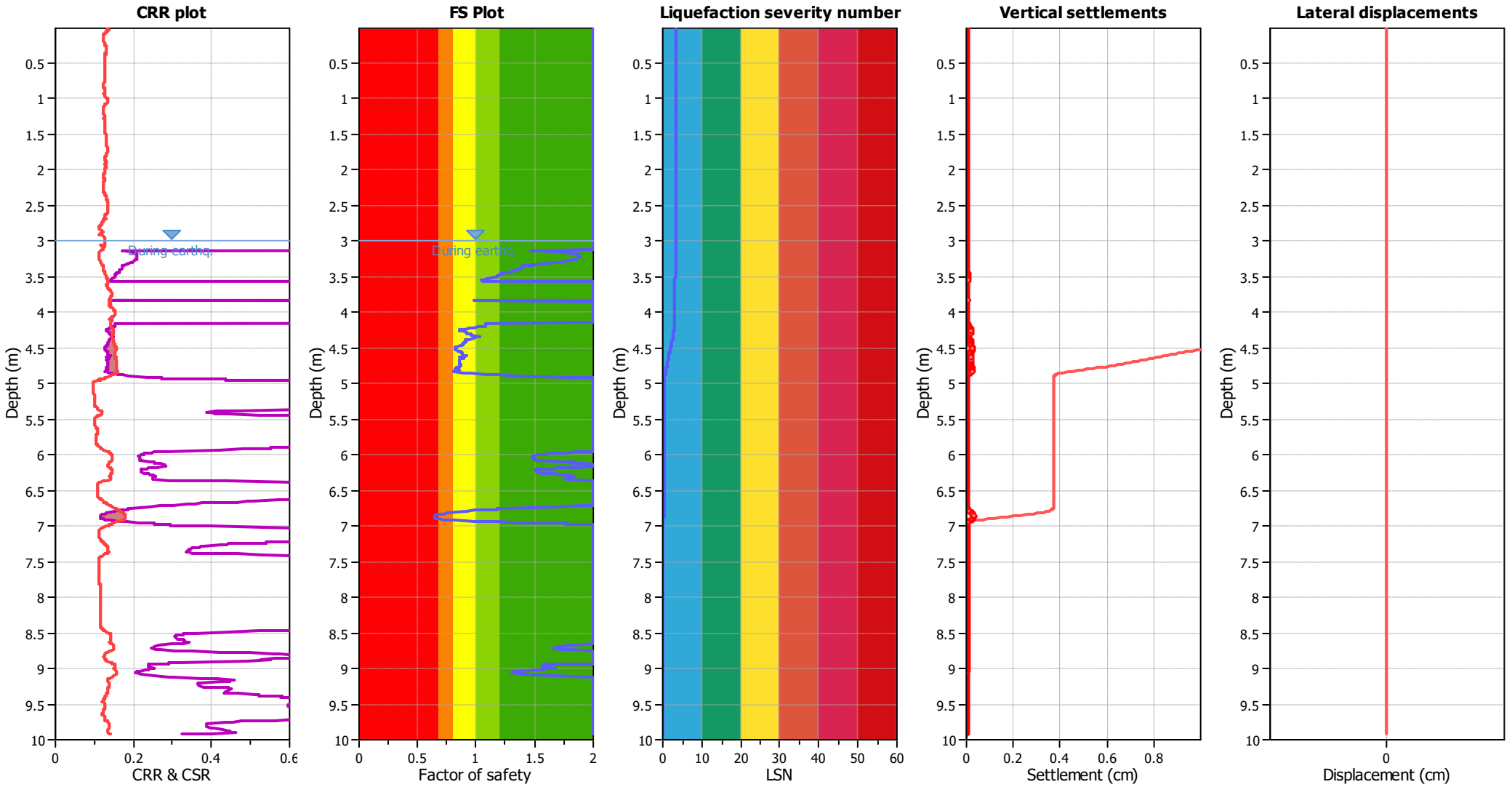
F.S. color scheme

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

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LSN color scheme

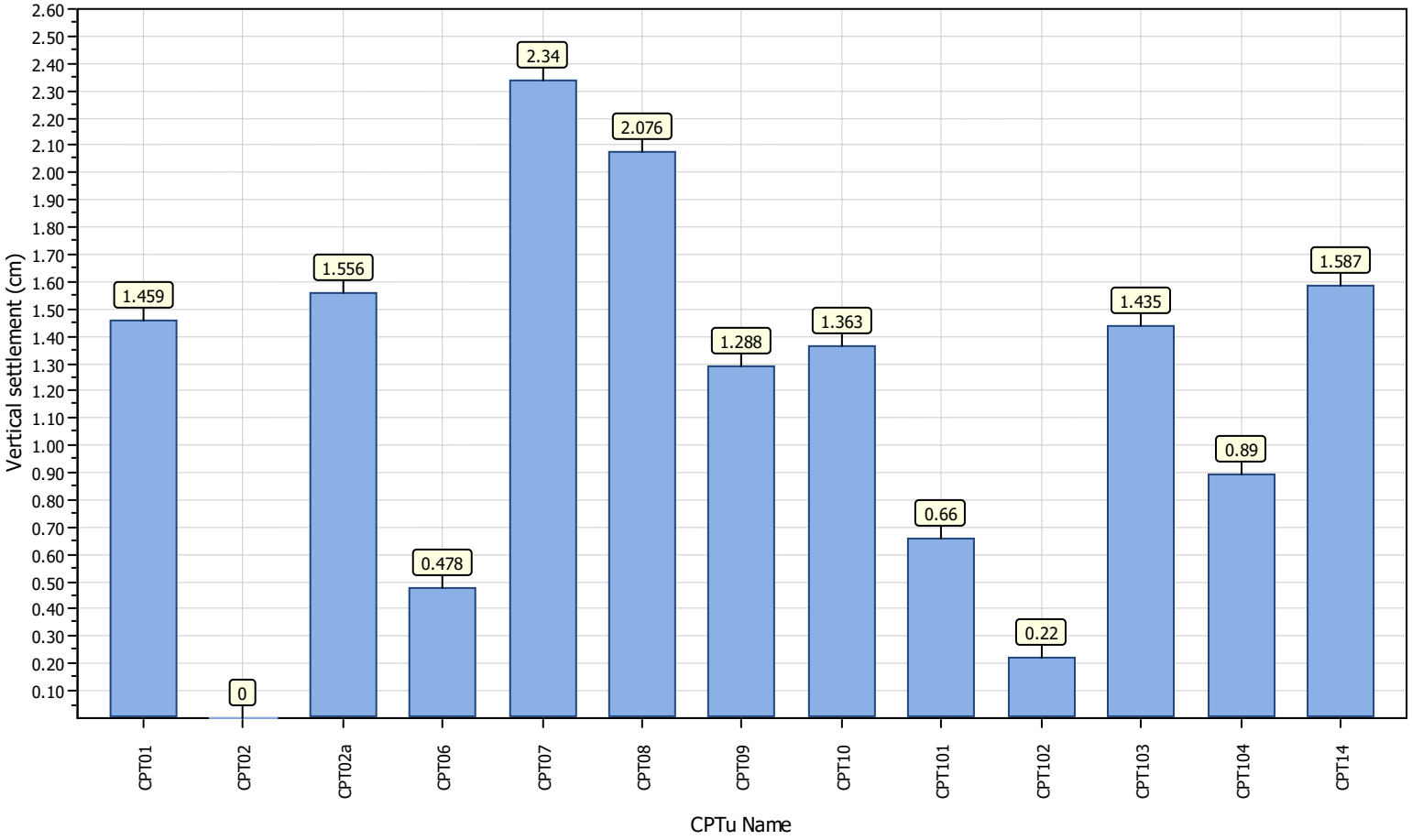
- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

HD Geo Limited
26 London Street
Hamilton Central, Hamilton
http://www.hdgeo.co.nz

Project title : HD2812 - Tamahere Country Club

Location : 46 Tamahere Drive, Tamahere

Overall vertical settlements report

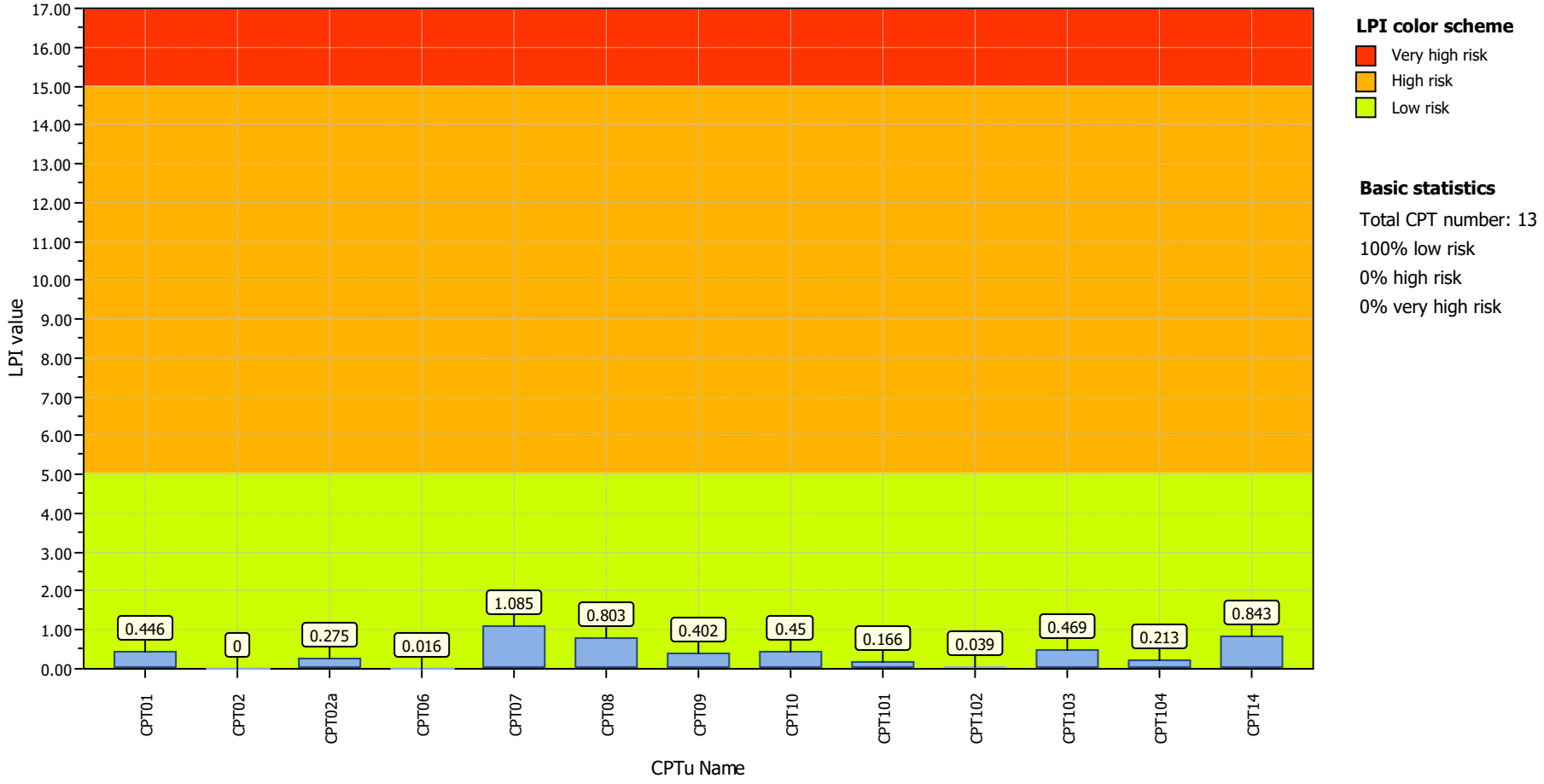


HD Geo Limited
26 London Street
Hamilton Central, Hamilton
http://www.hdgeo.co.nz

Project title : HD2812 - Tamahere Country Club

Location : 46 Tamahere Drive, Tamahere

Overall Liquefaction Potential Index report



LPI color scheme

- Very high risk
- High risk
- Low risk

Basic statistics

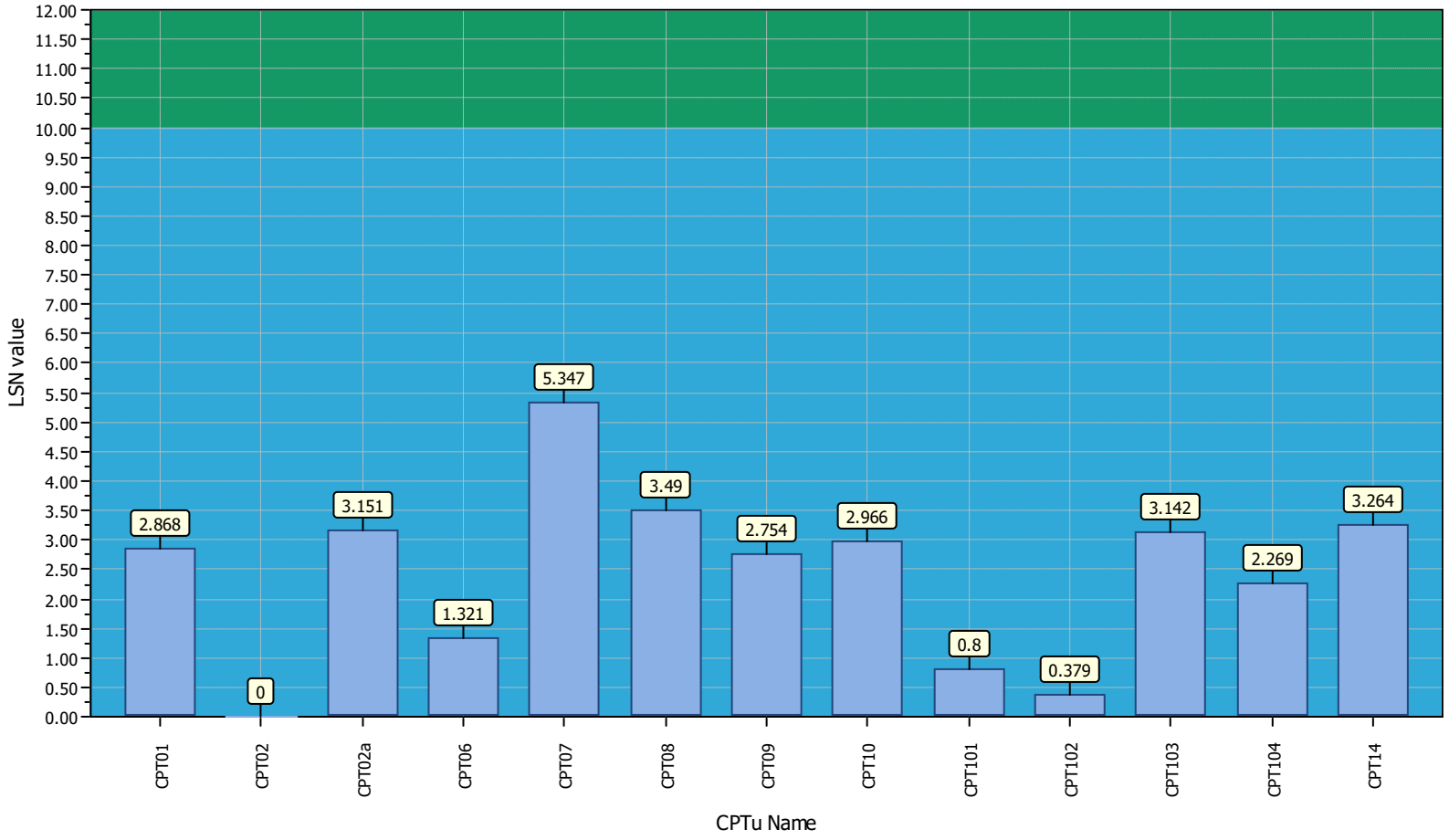
Total CPT number: 13
100% low risk
0% high risk
0% very high risk

HD Geo Limited
26 London Street
Hamilton Central, Hamilton
http://www.hdgeo.co.nz

Project title : HD2812 - Tamahere Country Club

Location : 46 Tamahere Drive, Tamahere

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: 13

100% little liquefaction

0% minor liquefaction

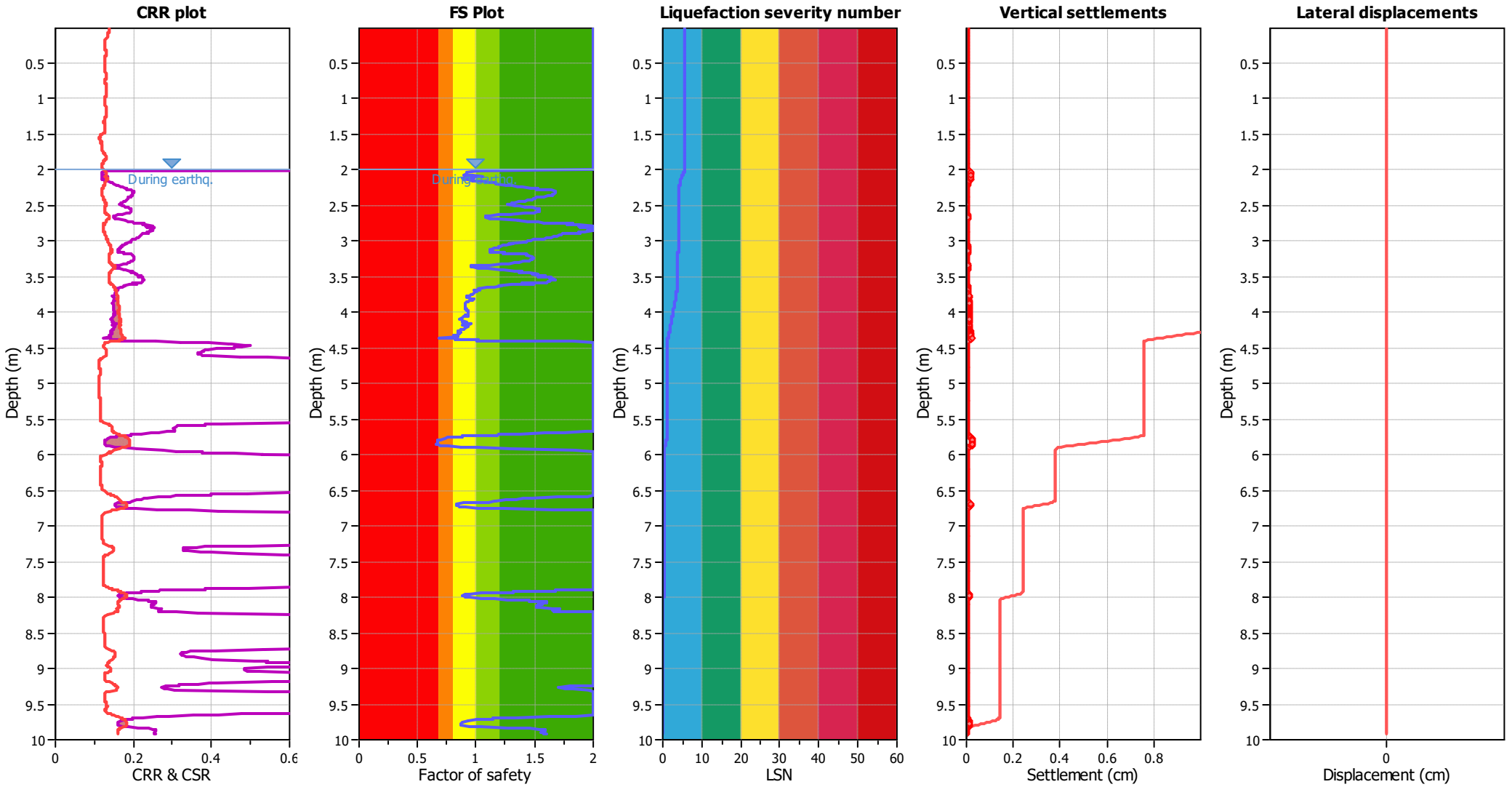
0% moderate liquefaction

0% moderate to major liquefaction

0% major liquefaction

0% severe liquefaction

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

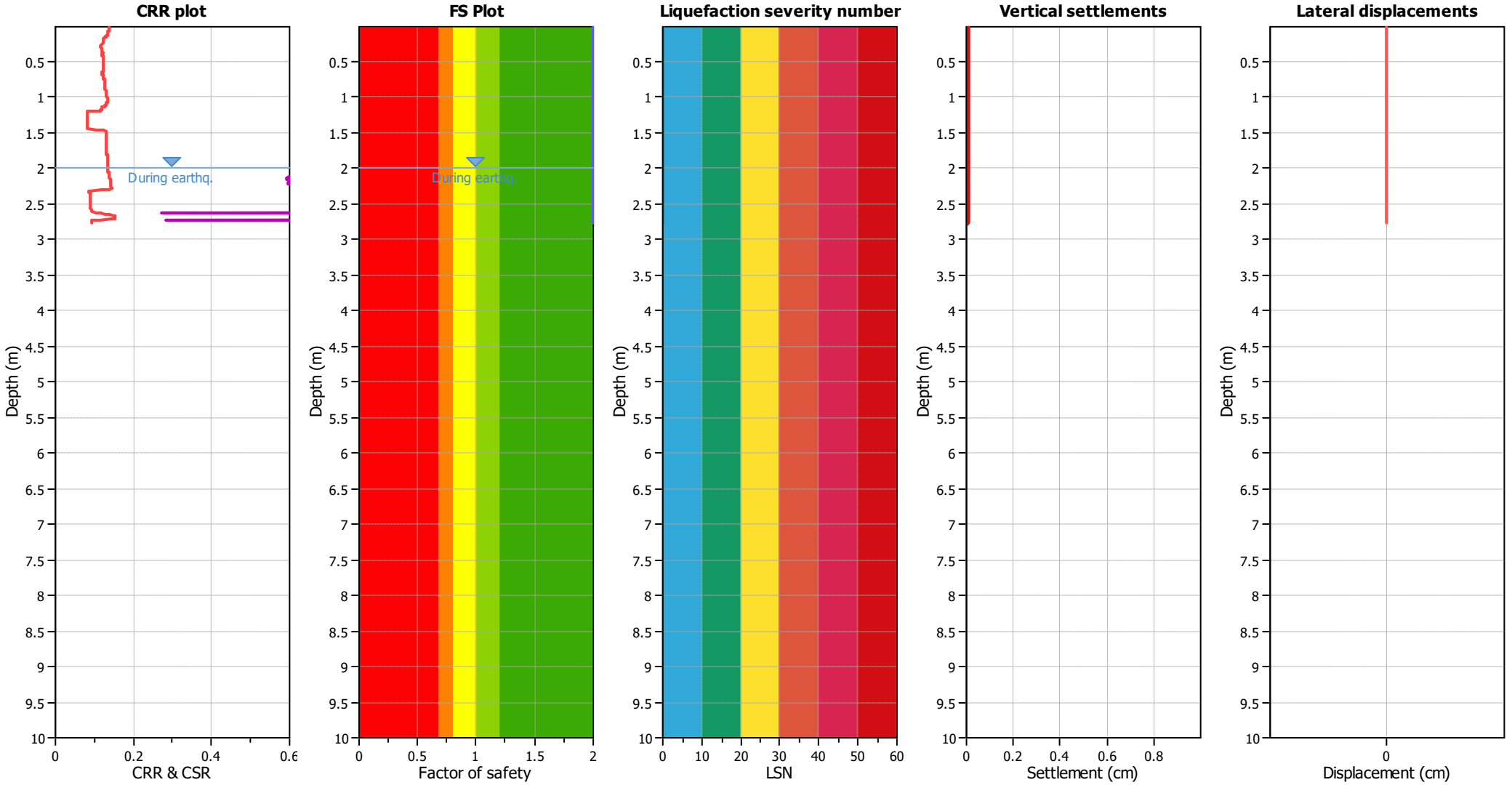
F.S. color scheme

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

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

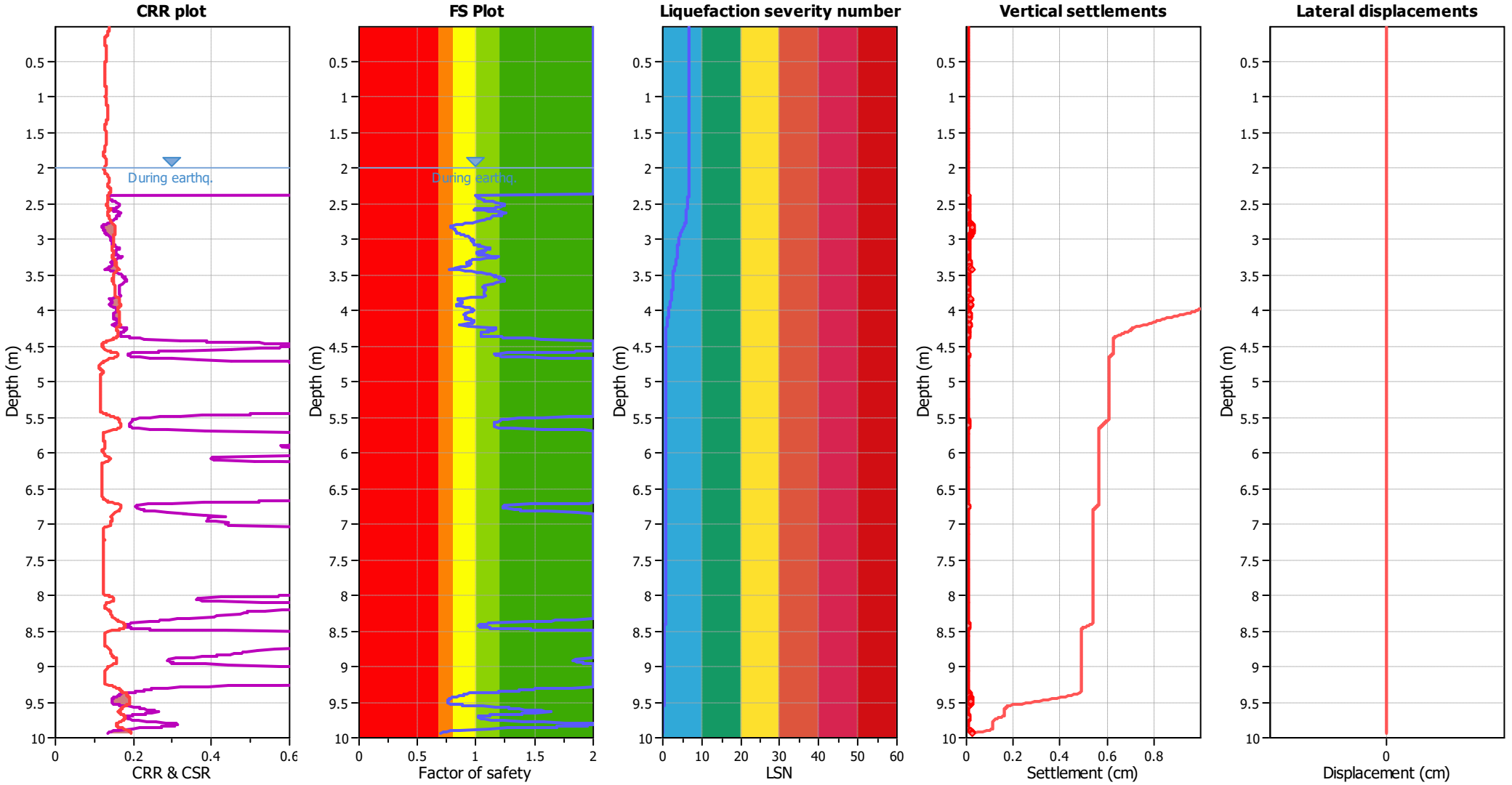
F.S. color scheme

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

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

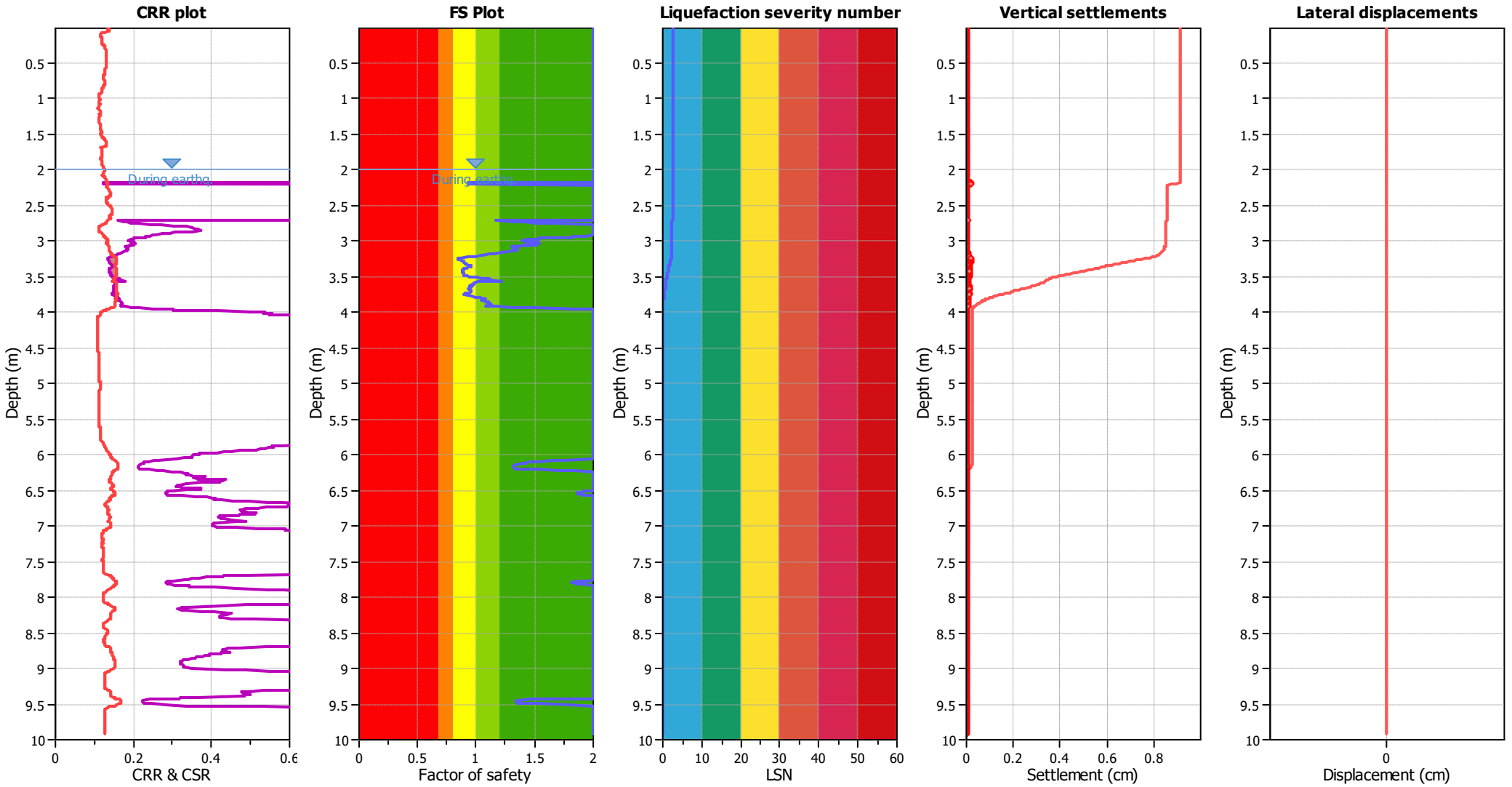
F.S. color scheme

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

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

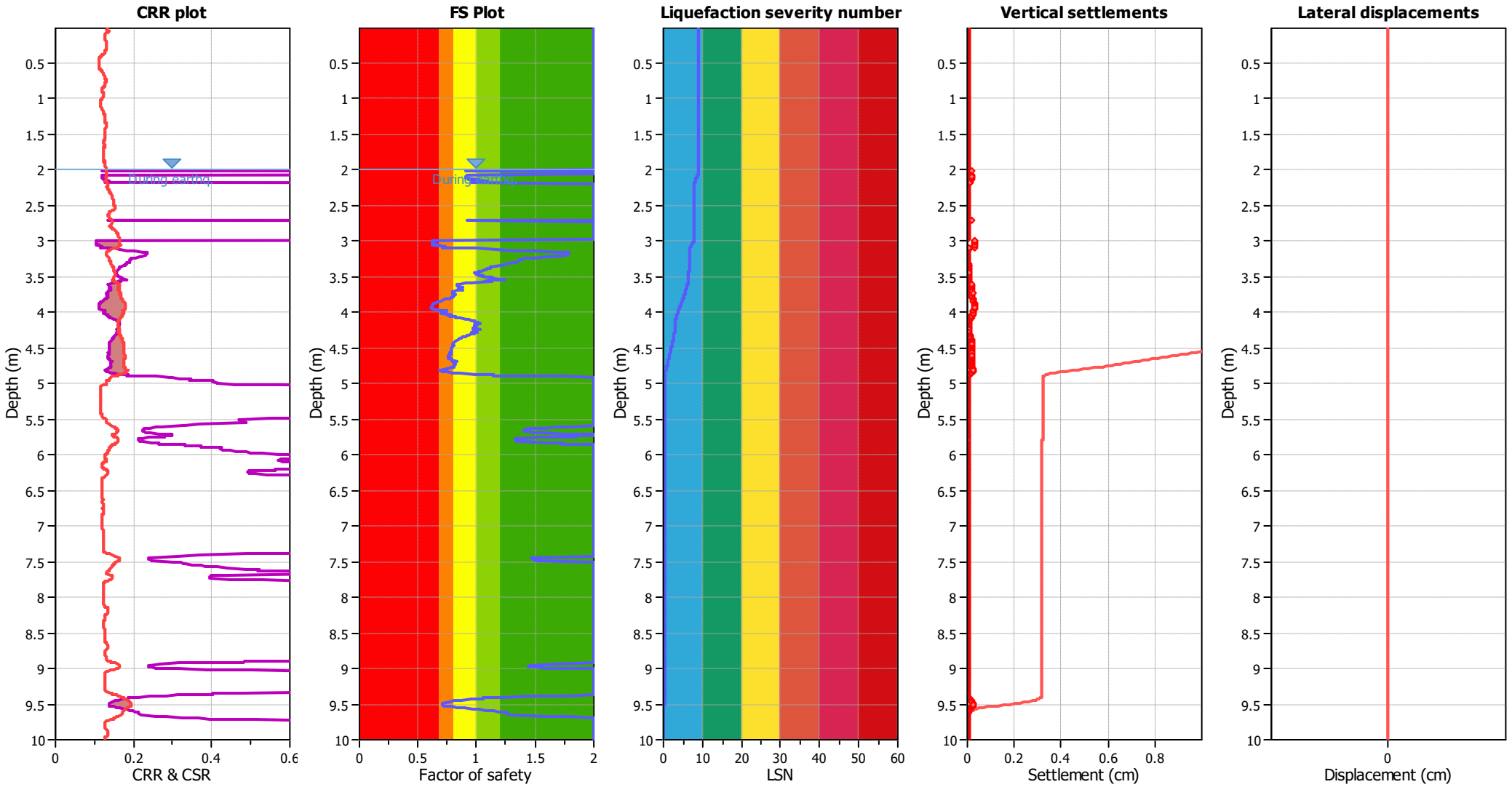
F.S. color scheme

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

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

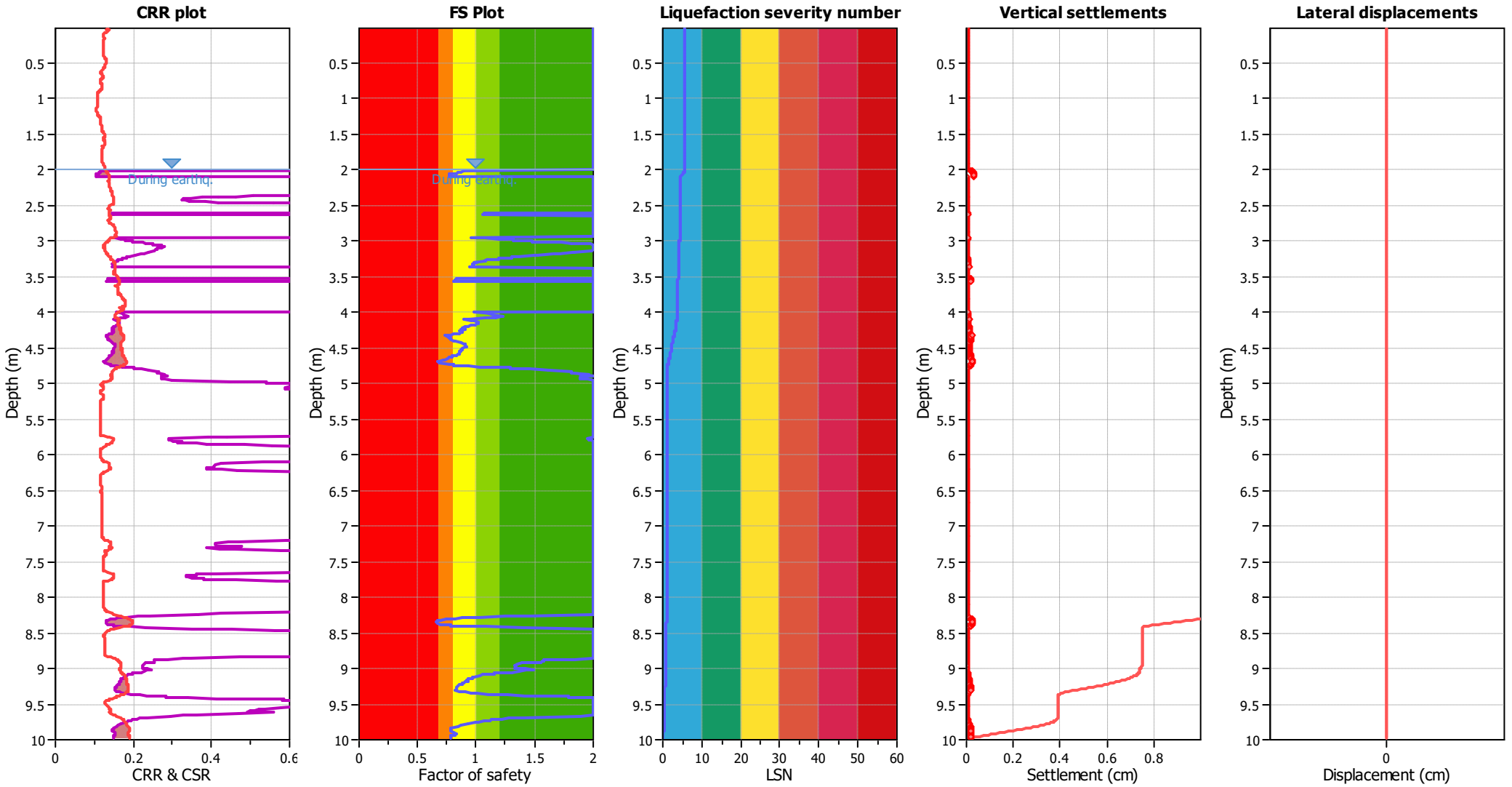
F.S. color scheme

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

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

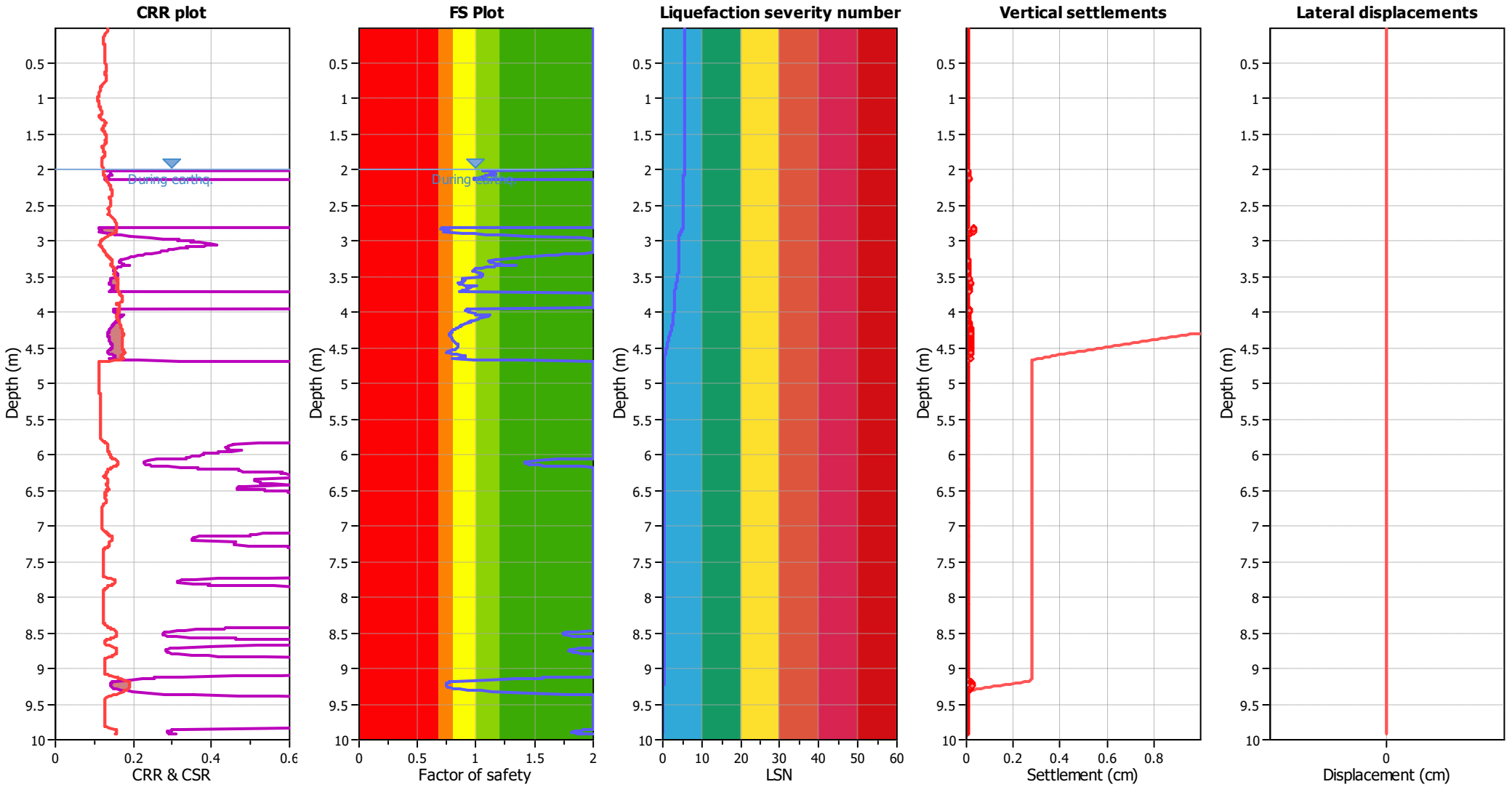
F.S. color scheme

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

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

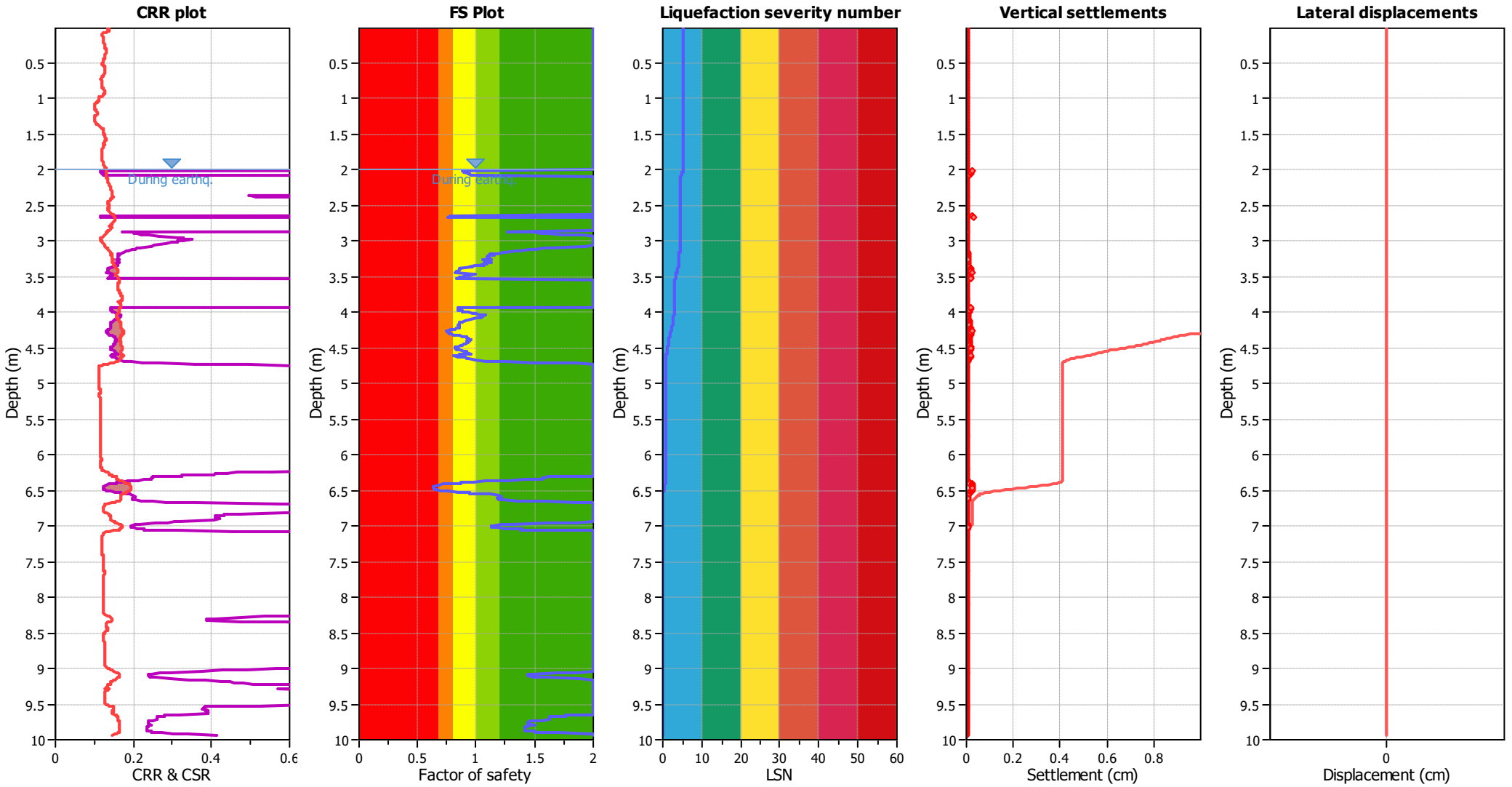
F.S. color scheme

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

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

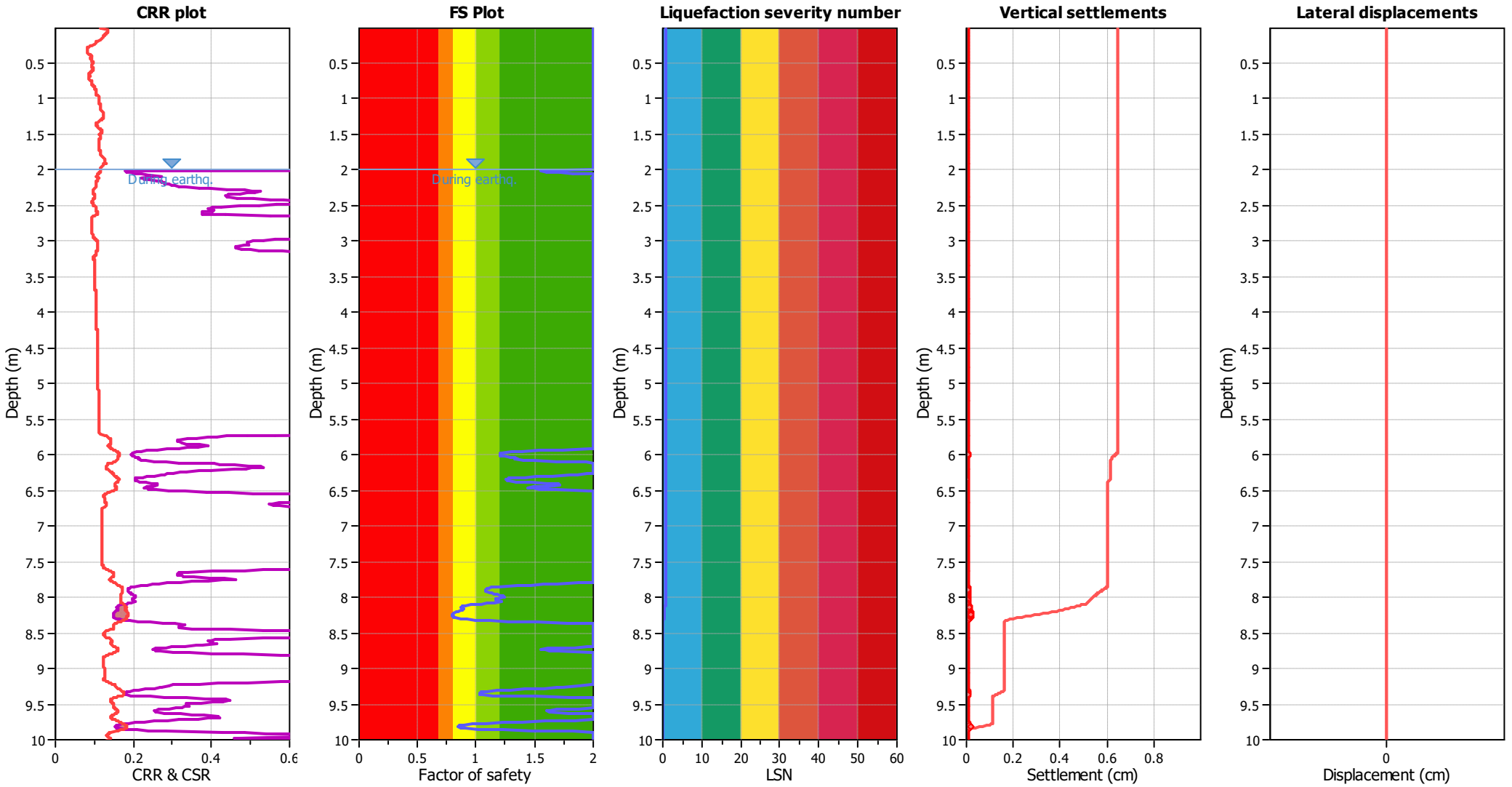
F.S. color scheme

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

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

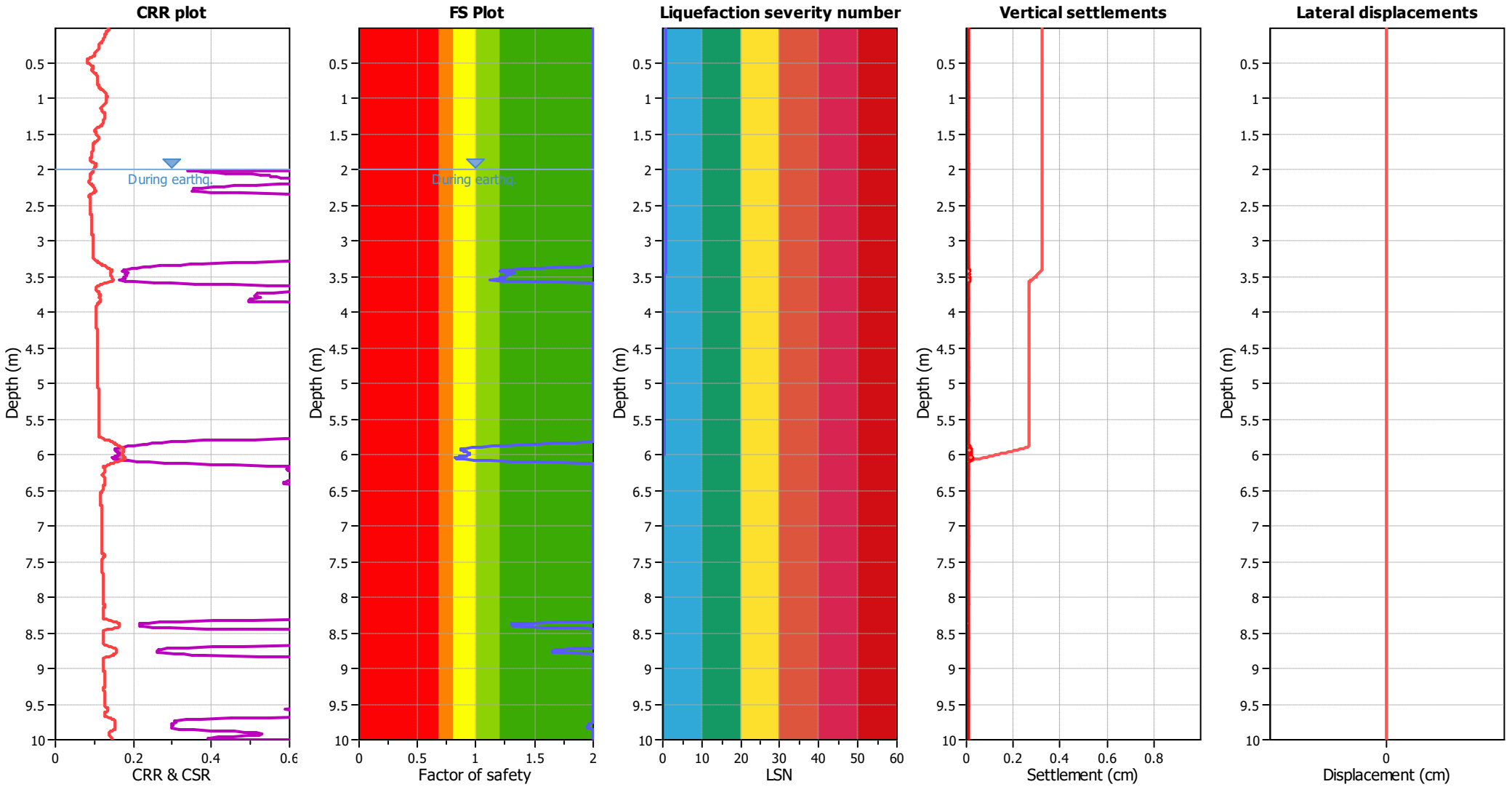
F.S. color scheme

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

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

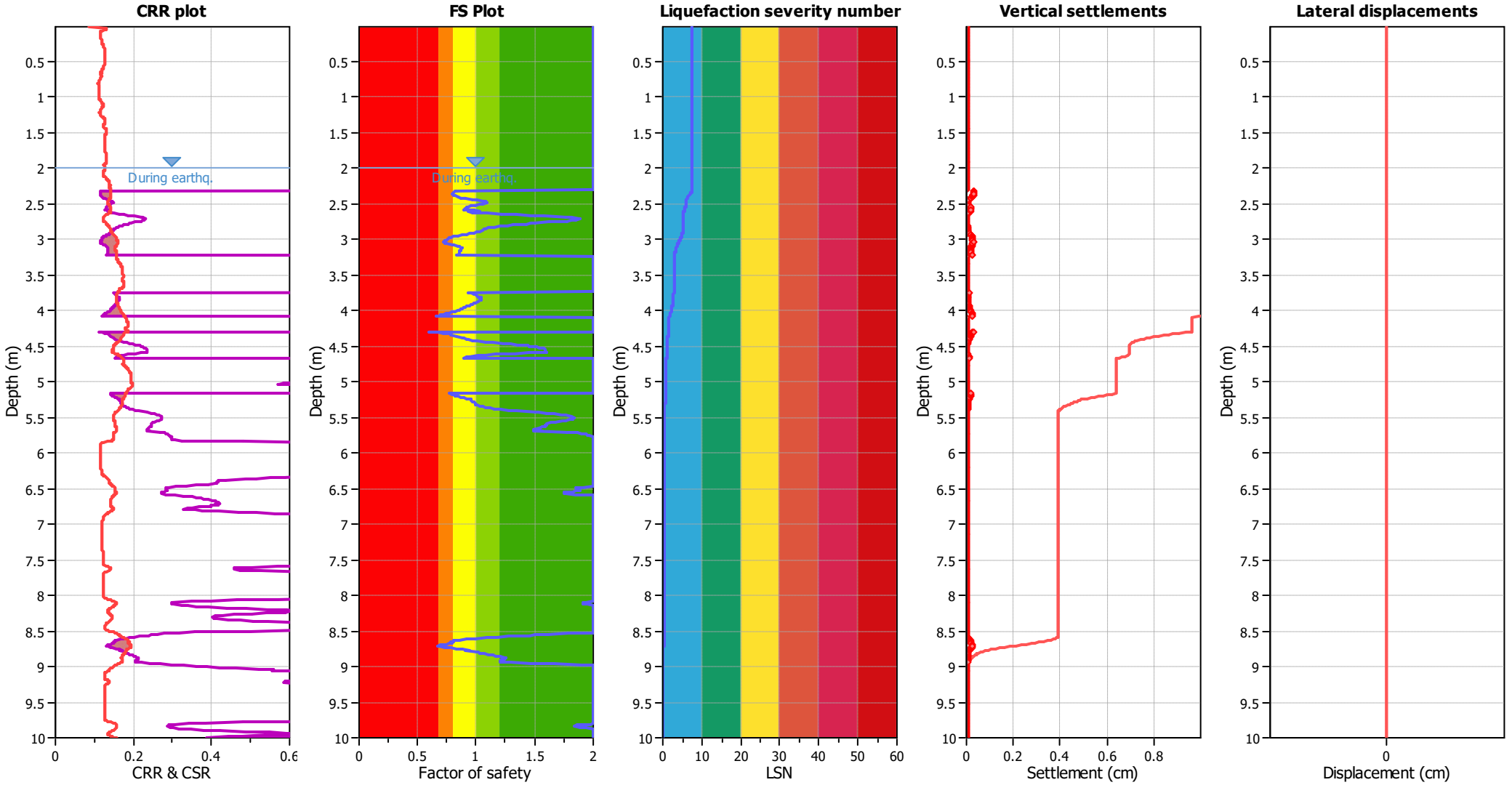
F.S. color scheme

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

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

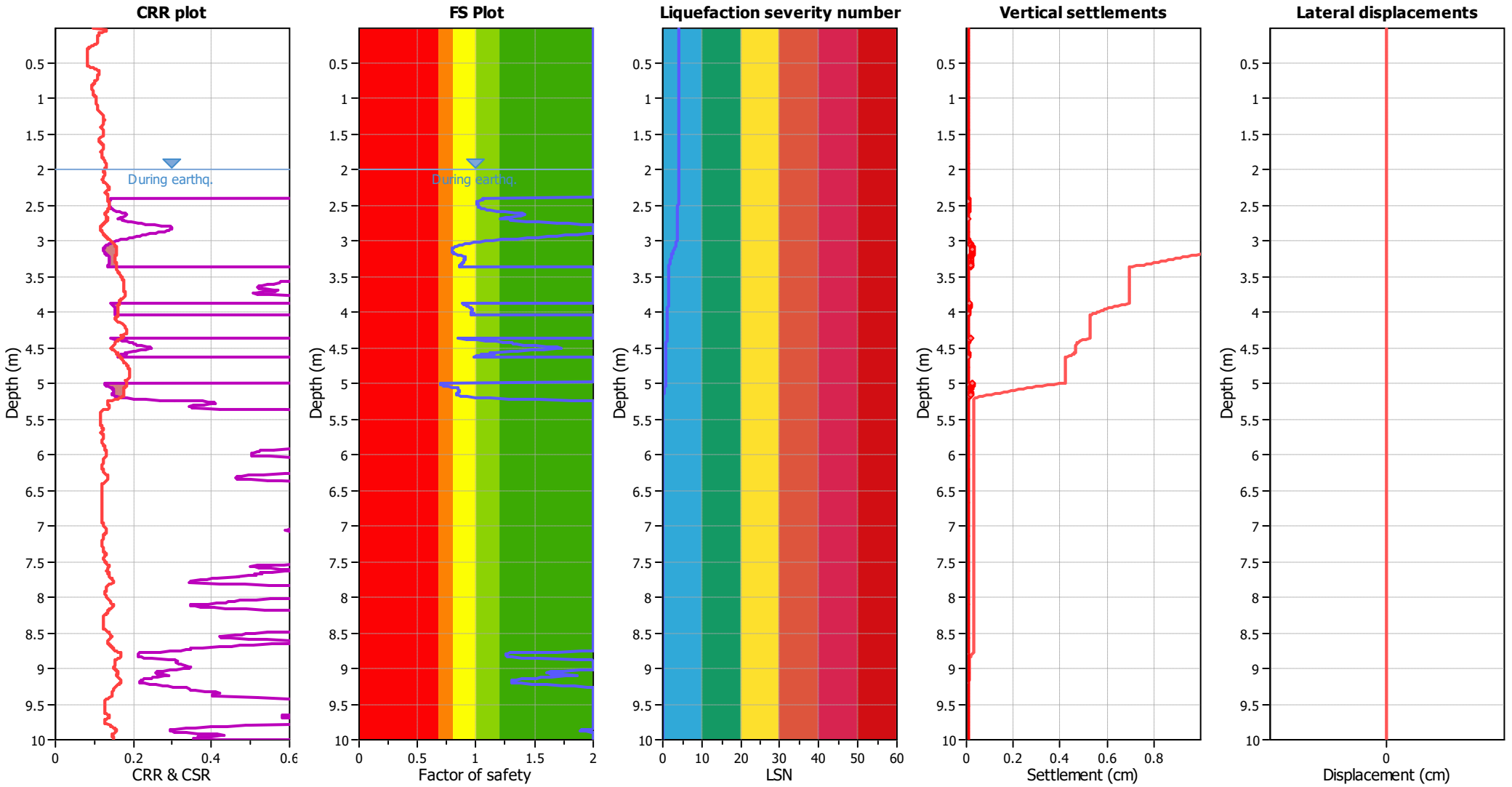
F.S. color scheme

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

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

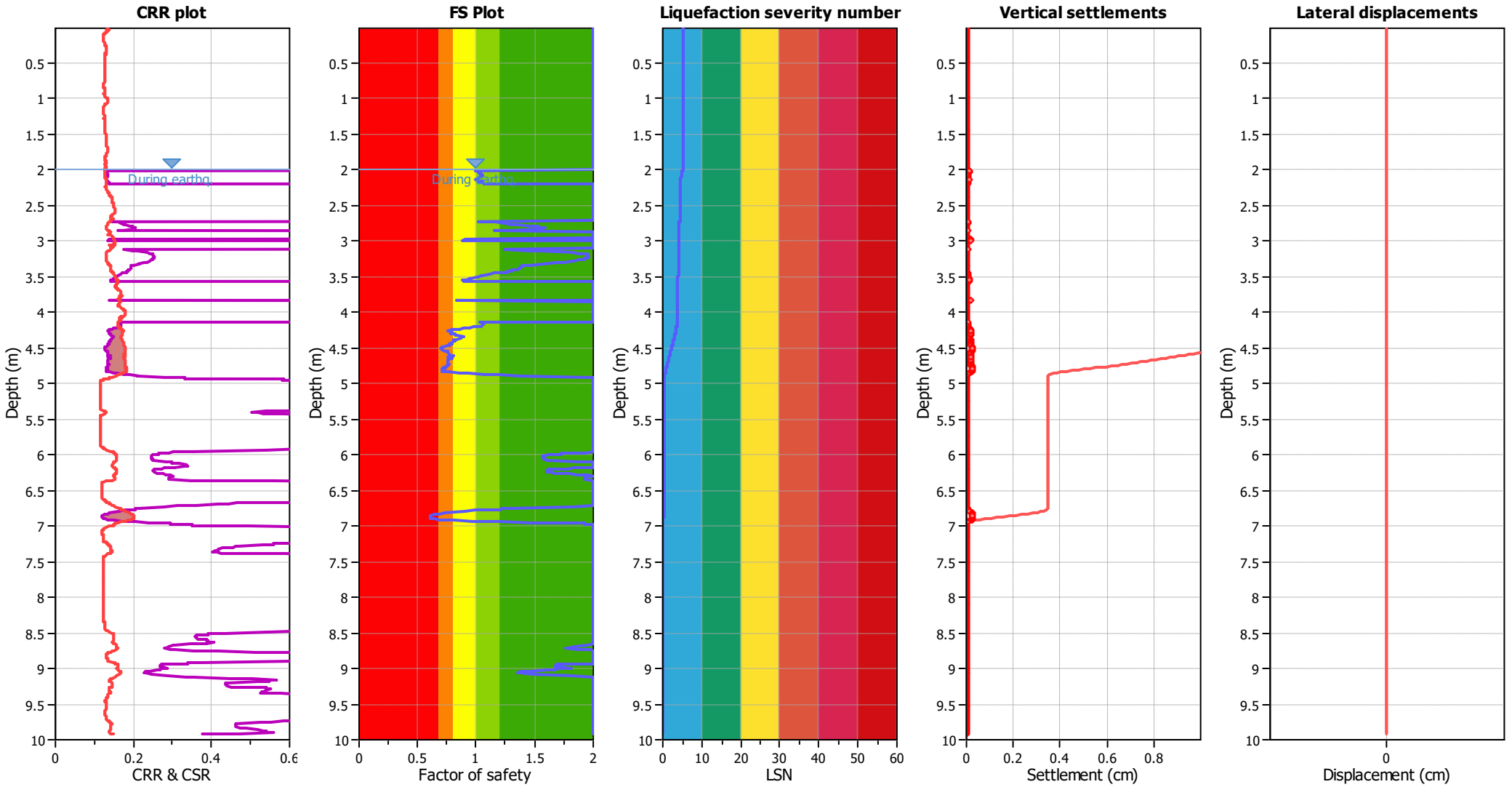
F.S. color scheme

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

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 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:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	2.00 m	Fill height:	N/A	Limit depth:	10.00 m

F.S. color scheme

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

LSN color scheme

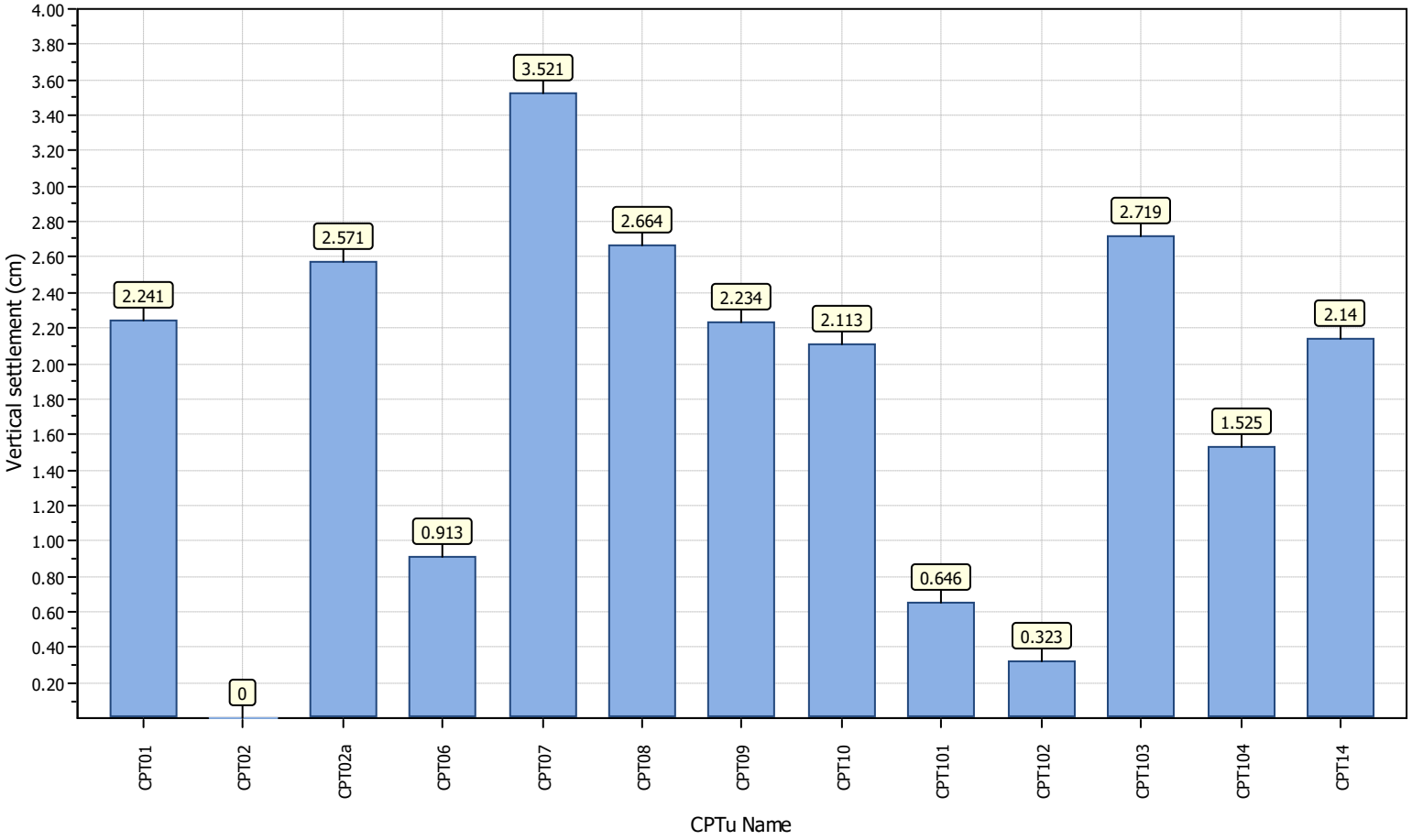
- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

HD Geo Limited
26 London Street
Hamilton Central, Hamilton
http://www.hdgeo.co.nz

Project title : HD2812 - Tamahere Country Club

Location : 46 Tamahere Drive, Tamahere

Overall vertical settlements report

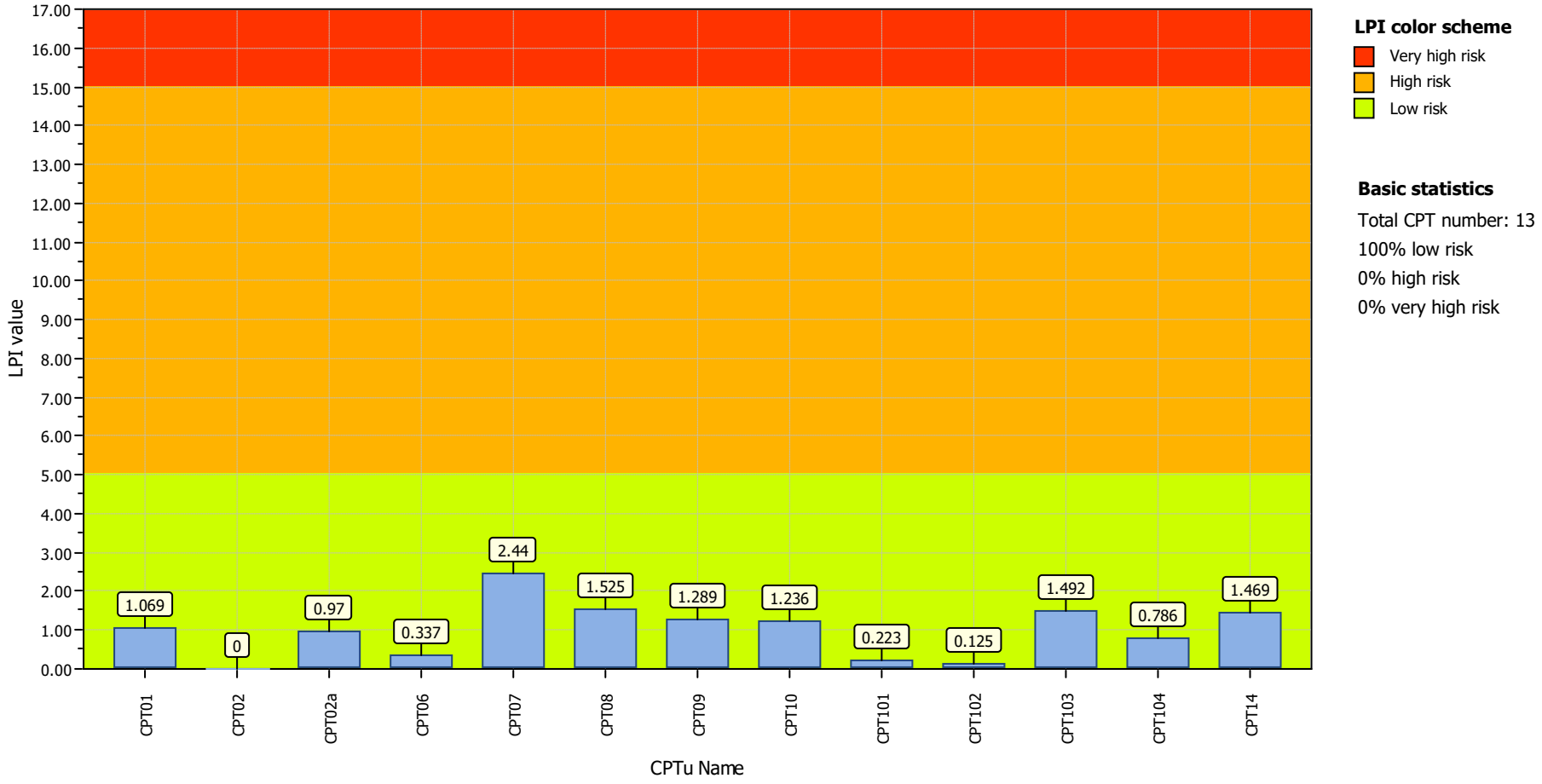


HD Geo Limited
26 London Street
Hamilton Central, Hamilton
http://www.hdgeo.co.nz

Project title : HD2812 - Tamahere Country Club

Location : 46 Tamahere Drive, Tamahere

Overall Liquefaction Potential Index report



LPI color scheme

- Very high risk
- High risk
- Low risk

Basic statistics

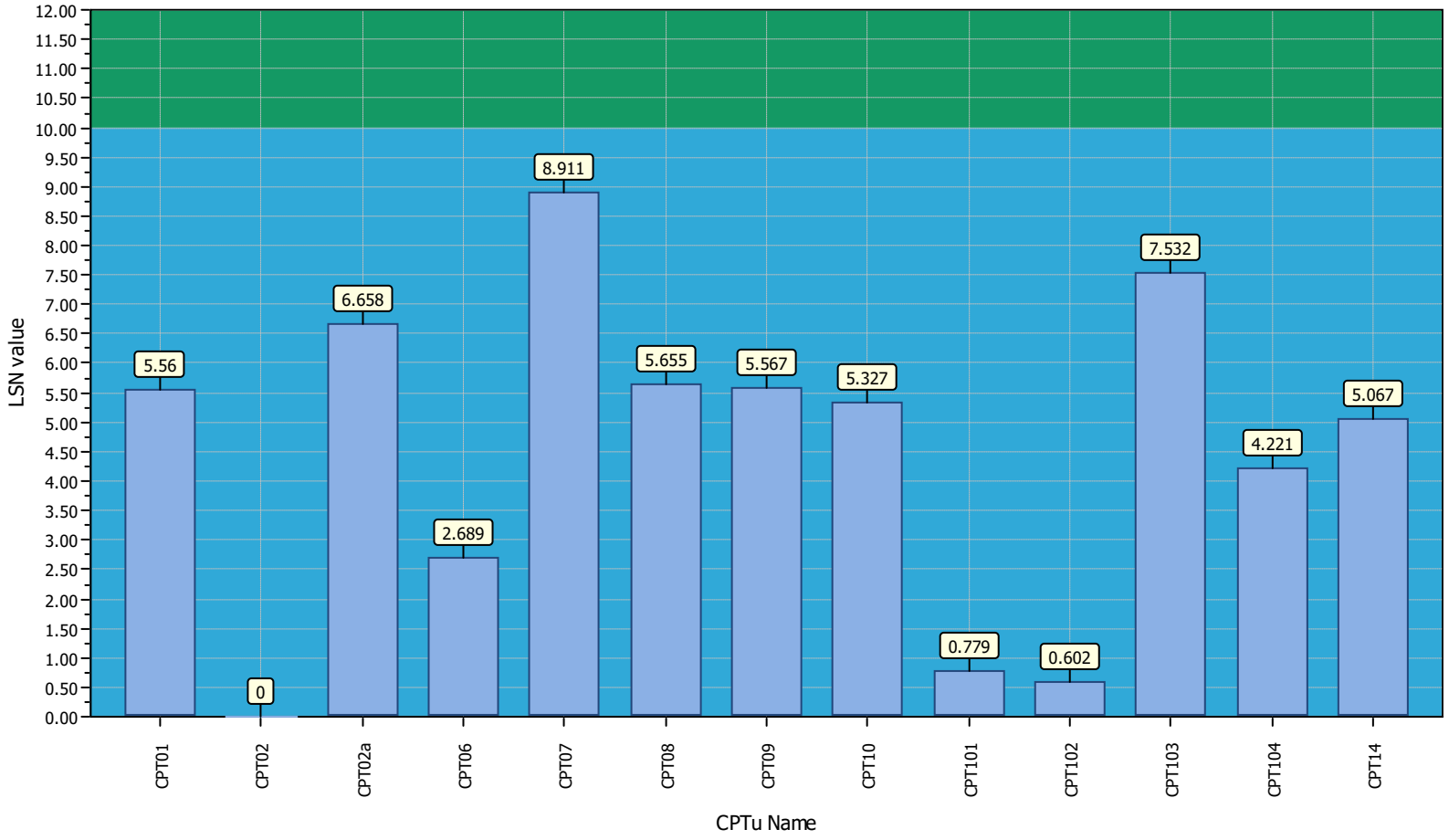
Total CPT number: 13
100% low risk
0% high risk
0% very high risk

HD Geo Limited
26 London Street
Hamilton Central, Hamilton
http://www.hdgeo.co.nz

Project title : HD2812 - Tamahere Country Club

Location : 46 Tamahere Drive, Tamahere

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: 13

100% little liquefaction

0% minor liquefaction

0% moderate liquefaction

0% moderate to major liquefaction

0% major liquefaction

0% severe liquefaction