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Project Number 30093.000.001

Geotechnical Investigation Report

Otaihanga Retirement Village , Paraparaumu

Prepared for: Summerset Villages

ENGEO Document Control:

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Statement of Experience

This Geotechnical Investigation Report has been prepared under supervision of Rowan Cook, who is employed as an Associate Engineering Geologist by ENGEO, an Environmental and Geotechnical Consultancy. Rowan Cook is based in Auckland. He provides expert advice on a variety of land development projects across New Zealand and is a Chartered Engineering Geologist with Engineering New Zealand.

Code of Conduct

While this is not a matter before the Environment Court Rowan has read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023 ('Code') and has complied with that Code in the preparation of this report.

The data, information, facts and assumptions Rowan has considered as part of this report are set out in this report. The reasons for the conclusions of the report are also set out in this report. Unless stated otherwise, the matters addressed in this report are within Rowans expertise and he has not omitted to consider material facts known to him that might alter or detract from the opinions expressed.



Rowan Cook, CMEngNZ, PEngGeol

23 October 2026

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1 Introduction

1.1 Project Background

Summerset Villages (Paraparaumu) Ltd (Summerset) has engaged ENGEO Ltd (ENGEO) to undertake a Geotechnical Investigation Report of the properties at Otaihanga Retirement Village , Paraparaumu, (herein referred to as 'the site' and shown in Figure 1) to support the development of a new comprehensive care retirement village. This work has been carried out in accordance with our signed agreement dated 21 January 2026.

The purpose of this assessment is to characterise the ground conditions, identify pertinent natural hazards and assess whether the associated geotechnical risks can be suitably managed through design and construction. This report provides geotechnical recommendations to support landform and future building design considerations and is intended to support a substantive application for resource consent under the Fast-track Approvals Act 2024 for the development described herein.

1.2 Site Description and Proposed Development

The site comprises two properties legally described as part of LOT 4 DP 58017 (65 Ratanui Road) and LOT 3 DP 497389 (73 Ratanui Road). The two lots make up a broadly rectangular 12.7 Ha parcel of undulating rural land elevated at between approximately 12 m RL and 5 m RL (NZVD 2016).

The site is currently primarily covered by pasture either a farm shed and ancillary structures on the site's western boundary. The site is bisected by a narrow highly modified stream, and a pond is present in the southern corner of the site within No. 73.

ENGEO has been provided a concept development masterplan (Refer Figure 1) prepared by Summerset (ref MASTER PLAN – UNIT TYPES & MIX PLAN 064 AR.011 Rev. 8 dated 17 September 2026). This depicts a retirement facility consisting of 257 independent living units being a combination of villas, cottages and town houses. The development includes a central main building, a number of ancillary buildings and amenity areas including sheds, glass houses, and sports courts. The development is spread around a series of linking streets with smaller cul-de-sacs, with the main access being solely from Ratanui Road to the southeast.

The existing modified stream is to be further modified with the inclusion of stormwater wetland and forebay infrastructure consisting of a total of four ponds, with two located either side of the existing stream. The stormwater wetland and forebay infrastructure will have a total area of 7,140 m^2. A smaller pond of approximately 913 m^2 is proposed on the site's western boundary.

Landform earthworks plans issued by CKL depict a reforming of the existing undulating landform to be generally levelled at between 6 m RL and 8 m RL (NZVD) for the development areas, reducing to approximately 4.0 m RL within the ponds and highly modified stream. This is to be achieved predominantly by infilling the interdune troughs and south-eastern pond and cutting some of the larger dune crests. Overall earthworks quantities for the scheme suggest cuts of approximately 43,142 m^3 and fills of 119,437 m^3 with an imbalance of approximately 76,295 m^3 required to be imported to reach desired levels.



Excerpt from drawing AR011 Rev A dated 15/10/2026

Figure 1: Site Masterplan

2 Desktop Study

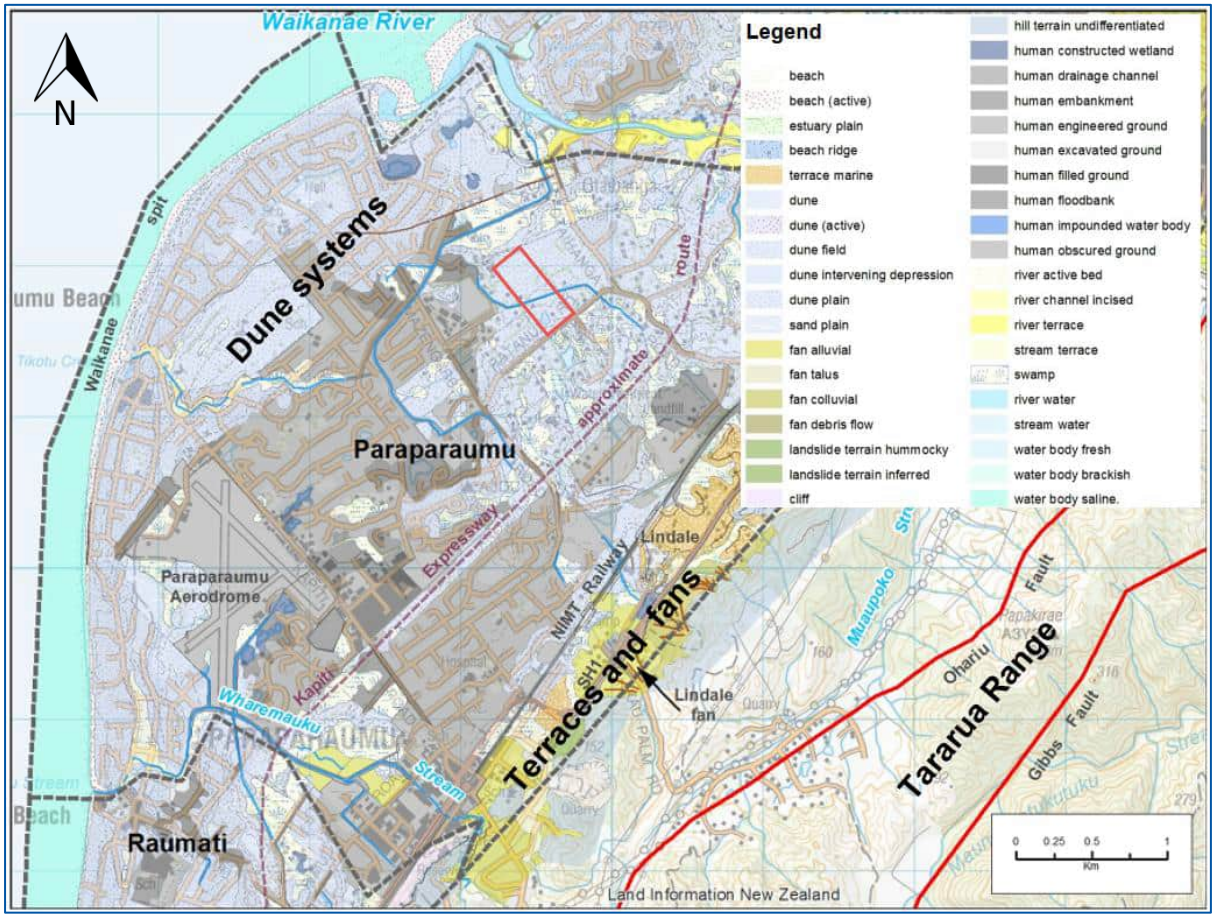
2.1 Regional Geological Setting

The site is situated on the Kapiti coastal plain, a coastal lowland at the toe of the rapidly uplifting Taraurua Ranges to the east of the site. The coastal plain is formed as sediment is eroded from the uplifting hills and transported westward by watercourses, such as the nearby Waikanae River. This sediment is either deposited by fluvial processes or reworked along the coast by wind and wave action forming extensive dune systems[1].

The coastal plain consists of several geomorphologies. At the foothills of the Tararua's a series of truncated marine terraces are preserved since the last sea level highstand (approximately 7000 years ago). Below these terraces, sand dunes have been forming since the last interglacial period prograding towards the sea. Dune formation impeding the formation of waterways has resulted in the formation of interdune swampland across the plain. The distinct undulating landform across the site is typical of the local coastal Holocene age dune system. The key regional geomorphological environments are presented in Figure 2.

1 D. B. Townsend., G.D. Dellow., 2016. Detailed geomorphological mapping of the coastal plain of the Kapiti Coast District. GNS Science Report 2016/37.

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Modified from Townsend & Dellow (2016). Approximate site location shown by red rectangle.

Figure 2: Regional Geomorphological Map

2.2 Mapped Geology

The site is mapped by Earth Science New Zealand (ESNZ[2]) at 1:25,000 scale as being underlain by Holocene age stable dune deposits consisting of now inactive, windblown sand dunes. These deposits are considered part of the Pakihi supergroup.

2.3 Mapped Natural Hazards

2.3.1 Seismicity

The active faults generating the uplift of the Tararua Range are part of the North Island Shear Belt; numerous northeast predominantly strike slip faults that accommodate the movement resulting from the oblique collision of the Australian and Pacific tectonic plates.

2 https://data.gns.cri.nz/geology/ accessed 23/09/2026

The nearest mapped active fault (ESNZ[3]) to the site is the Ohariu Fault located 3.2 km southeast of the site. The Ohariu fault is a dextral strike slip fault with a moderate slip rate and a recurrence rate of between 2,000 and 3,500 years. Its single event displacement is described as moderate with the last known rupture event approximately 1,000 years ago. The site is also close to another dextral strike slip fault; the Gibbs Fault, located 4.2 km southeast of the site. There is no known information regarding the estimated displacement or recurrence rate of the Gibbs Fault, and therefore its average recurrence interval has been estimated[4] as greater than that of the Ohariu fault at between 3,500 and 5000 years. The mapped location of both of these faults are shown on Figure 2 above.

Geological maps have also indicated a non-active structural fault splay off the Ohariu fault within the western portion of the Tararua Range, with no evidence of its direction within the lower fan and terrace deposits which form the basis for Paraparaumu township. This fault splay is approximately 2 km southeast of the site.

Greater Wellington Regional Council (GWRC) hazard maps indicate the site area has a combined earthquake hazard rating of 'moderate'[5]. This is derived from a 'moderate' ground shaking potential hazard and a 'high' liquefaction potential hazard. These maps are regional in scale and the hazard potential indicated does not necessarily apply to a specific site and should not be used in place of site-specific data.

2.3.2 Flooding

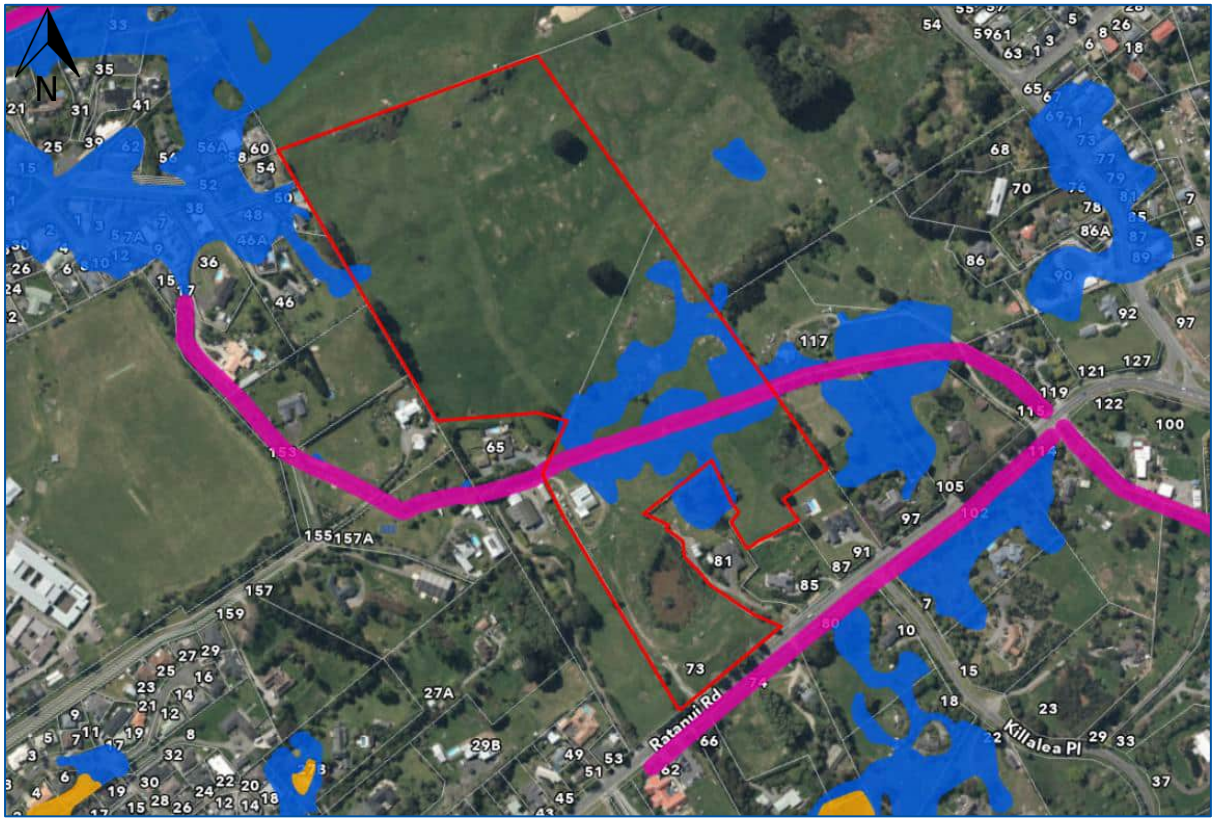
The site is mapped by Kapiti District Council (KCDC) as being at risk of flooding[6]. Potential floodable areas are largely limited to the property at 73 Ratanui Road, with areas of ponding mapped being the lower dune trough zones across the site. The hazard maps provided by KCDC do not show anticipated depth of flooding. An excerpt from the flood hazard map is presented in Figure 3 below. The site is outside of the area mapped as at risk from coastal flooding or flooding as a result of a tsunami reaching the Kapiti Coast.

3 https://data.gns.cri.nz/af/ accessed 23/09/2026

4 https://www.kapiticoast.govt.nz/community/cdem/earthquake-fault-rupture-hazards/

5https://www.gw.govt.nz/environment/environmental-data-and-information/geographic-mapping-information/ accessed 23/09/2026

6 https://maps.kapiticoast.govt.nz/LocalMaps/viewer/?webmap=c175aff2c7204271ace771c326c4a98f accessed 23/09/2026



Modified from KDC flood hazard map. Approximate site boundary shown in red.

Figure 3: Flood Hazard Map

2.4 Historical Aerial Photography Review

ENGEO has reviewed historical aerial photographs held on Retrolens[7] and Google Earth dated from 1941 to 2026. These show that, with the exception of the drain which was already in existence in 1941, the site was largely undeveloped prior to construction of the farm buildings which began in the 1980s. Landform modifications undertaken on-site appear to be limited to earthworks associated with the construction of level building platforms for farm structures, and farm races.

2.5 Previous Geotechnical Investigations

2.5.1 Previous Reporting

Riley Consultants Ltd (Riley) completed a geotechnical investigation of the site between February 2022 and November 2024 to support a plan change application to KCDC for a previously proposed residential development. Riley completed the following intrusive investigations:

- Three machine boreholes denoted MH01 to MH03 to depths of up to 24.7 m. Groundwater monitoring piezometers were installed in MH02 and MH03.
- Twenty-three cone penetrometer tests (CPTs) denoted CPT01 to CPT22 and CPT12A to depths of up to 20.75 m.

7 https://retrolens.co.nz/ accessed 24/09/2026

- Fifteen dynamic cone penetrometer tests to depths of 950 mm.
- Collection of seven shallow soil samples for geotechnical laboratory testing.

Locations of the Riley CPT tests used for our geotechnical analyses are presented on the plan in Appendix 2.

The Riley investigations identified soils to be generally consistent with the mapped geology surficial soils including silty sand, typical of aeolian (wind-blown) dune sands, over coarser dune sands which generally increased in density with depth. The investigation report also made reference to peat deposits encountered in the southern corner of the site associated with infilling of the area around the existing pond. Organic soils in topographic lows between dune landforms are consistent with the local geomorphology.

2.5.2 New Zealand Geotechnical Database

Review of the New Zealand Geotechnical Database identified several investigation records held for the site including six test pits and three DCPs completed in the southern corner of the site. These test pits and penetrometers encountered ground conditions consistent with a layer of topsoil or reworked sand over persistent medium dense dune sands.

3 Site Investigation

ENGEO's intrusive geotechnical investigations were conducted in September 2026 and comprised the following:

- Nine CPTs named CPT101 through CPT109 undertaken by subcontractor Griffiths.
- Installation of groundwater level logger within the standpipe piezometers installed by Riley.
- Soakage testing of six locations within the proposed ponds, wetlands and bioretention devices undertaken by subcontractor Soakage Testing Limited.

CPT locations were chosen to infill gaps in the data provided by the previous geotechnical investigation of the site, and to inform the design of the western soakage area and boundary retaining, as well as broad coverage of the soil and groundwater profile across site. Locations of our investigations are presented on our investigations are presented on our Geotechnical Investigation Plan in Appendix 1.

4 Engineering Geological Model

4.1 Model Development

A conceptual geological model for the site has been developed using the results of our desktop study, the historical geotechnical investigation data, and the results of our site investigations. This is supplemented by our understanding of the local geomorphology, natural hazards and how they may interact with the proposed development.

We consider the amount of data currently available for the site suitable for the intended purpose of assessing the suitability of the site as part of a Resource Consent application and to advance preliminary design of the proposed structures and civil works aspects of the development.

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4.2 Conceptual Engineering Geological Model

The results of the CPTs indicate ground conditions are in general accordance with the mapped geology, geomorphology and our understanding of the area. The general soil profile encountered across the site can be summarised as follows:

- The upper 1 – 3 m of the site comprises a loose silty sand, with typical cone resistance (q_c) of < 10 MPa. This is typical of aeolian dune sands.
- Below this coarser medium dense dune sand is encountered. This soil has a q_c of between 10 and 20 MPa and is encountered between 6 and 10 m below ground level.
- Medium dense dune sand is underlain by a 0.5 to 1 m thick layer of silt interbedded with sand and clay. This more cohesive soil may represent a paleosol (historic topsoil bed); being the upper surface of an older dune system.
- A sequence of older, medium dense to dense dune sands, generally increasing in density with depth with q_c typically between 15 and 30 MPa. These sands were encountered to the base of the CPT tests.

Locally, variations to the above ground conditions, not encountered within our exploratory hole locations, are anticipated on site based on our understanding of the site history and the dynamic environment of cyclic and fixed dune geomorphology. It is expected that soft unconsolidated mullock organic silt and peat deposits may also be encountered in the base of the existing pond and waterway zones. Undocumented fill is also likely to be encountered within the footprints of existing and historical farm structures.

4.3 Groundwater

Two piezometers were installed in the groundwater monitoring standpipes within the Riley boreholes. Piezometer PZ01 was installed within MH02, and PZ02 was installed within MH03. Groundwater levels were recorded continuously from 8 September 2026 to 21 September 2026.

Data collected from the piezometers indicated that the groundwater at site appears to be dipping generally to the north, with the water level in PZ01 elevated at on average 1.8 m RL. In PZ02, groundwater was elevated on average at 4.3 m RL. This is consistent with the observed water level in the nearby drain and pond. Full results of the groundwater monitoring are presented in Appendix 3.

Groundwater levels were difficult to accurately determine in the CPT tests based on pore pressure trace data given the variability in soil types in the upper surface leading to negative pore pressure results. Groundwater levels post testing was undertaken in the CPT testing but was inaccurate due to sand collapse.

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4.4 Soakage Testing Results

A summary of the results of the soakage testing are presented in Table 1 below. Full results are presented in Appendix 3, locations of the soakage tests are shown on the plan in Appendix 1. Soakage testing was carried out within the proposed soakage ponds, bioretention ponds and wetland areas. At each location both a constant head and falling head test, in accordance with NZ Building Code E1/VM1 was undertaken.

Table 1: Soakage Test Results

Test Location	Unfactored Falling Head Soakage Rate (mm/hr)	Unfactored Constant Head Soakage Rate (mm/hr)
Bioretention 1	624	3181
Bioretention 2	222	1083
Soakage 1	604	2930
Soakage 2	475	2019
Wetland 1	845	4673
Wetland 2	612	2698

5 Geotechnical Analyses

We consider the following geotechnical aspects should be assessed to evaluate the safe and economical development of the site:

- Seismic Hazards
- Liquefaction and Lateral Spreading
- Static Settlement
- Bearing Capacity
- Undocumented fills/Historical Landform modification
- Slope stability

5.1 Seismic Hazards

Potential seismic hazards resulting from nearby moderate to major earthquakes can generally be classified as primary and secondary. The primary effect is ground rupture, also called surface faulting. The common secondary seismic hazards include ground shaking, ground lurching, regional subsidence or uplift, soil liquefaction, lateral spreading, and landslides. The following sections present a discussion of seismic hazards as they apply to the site.

5.1.1 Ground Rupture

The site is located approximately 3.2 km from the nearest mapped active fault. At this distance, fault related ground rupture and ground lurching are considered unlikely.

However, given the tectonic setting, regional subsidence may be experienced following a large earthquake on faults in the area. In seismically active areas there is always a risk that unmapped active faults may be present, particularly when the faults may have a low recurrence interval and may be buried under younger alluvial sediments. However, regionally geological maps indicate only one non-active fault trending towards the township of Paraparaumu and at least 2 km from the subject site. The absence of mapped faults and active fault zones for the site is the same risk for the wider Paraparaumu township and is unlikely to be determined through traditional fault trenching investigation methods given the age and variability of the geology found across this area.

5.1.2 Ground Shaking

Ground shaking and subsequent effects on structures, infrastructure and engineering systems can be extensive and affect large areas. The intensity, frequency and duration of ground shaking drives the effect of earthquake loading on structures, while the severity of ground shaking drives the level of ground deformation. In geotechnical assessments, amplitude, frequency and duration of shaking are the main factors considered.

The proposed site development includes Importance Level 2 (IL2) structures with reference to NZS1170.0, including the main building works. Peak horizontal ground accelerations (a_{max}) for use in geotechnical assessment are provided in Table 2 below below. a_{max} values have been taken from the recommended values provided in Table A1 – Appendix A of MBIE/NZGS Module 1 for Paraparaumu.

Table 2: Peak Horizontal Ground Acceleration

Limit State	Return Period	a_{max}	Magnitude
SLS	25 years	0.13 g	6.5
ULS	500 years	0.68 g	7.7

5.2 Liquefaction and Lateral Spreading

5.2.1 Liquefaction

Soil liquefaction and lateral spreading results from loss of strength during cyclic loading such as those imposed by earthquakes. Soils most susceptible to liquefaction are clean, loose, saturated, uniformly graded cohesionless materials. Empirical evidence indicates that loose to medium dense gravels, sands, silty sands, low-plasticity silts and some low plasticity silty clays are also potentially liquefiable, with the more cohesive soils more likely to undergo strain-softening than true liquefaction. In addition, thin layers bound by non-liquefiable soils are unlikely to liquefy, particularly if they are laterally constrained.

The dune sands below the water table include soils typically considered to be susceptible to liquefaction. We have assessed the potential for liquefaction triggering and liquefaction induced settlement occurring at the site using the following methods and analyses from data collected from our CPT testing and those of Riley Consultants conducted previously:

- Liquefaction triggering method: Boulanger and Idriss (2014)[8]
- Ground motions as shown in Table 2.
- A threshold probability of liquefaction (PL) of 16% as recommended by Module 3[9]
- Estimated fines content based on CPT data methods outlined by Boulanger and Idriss (2014).
- A soil behaviour type index (Ic) cut-off value of 2.6 to differentiate between susceptible and non-susceptible to liquefaction soils for the CPT analysis.
- The Zhang, Robertson, and Brachman (2002) procedure for estimating volumetric strain and vertical settlement for the CPT analysis[10]
- The Boulanger and Idriss relationship between fines content and Ic with a fitting parameter (CFC) of 0.0 for the CPT analysis.
- Earthquake groundwater levels to reflect the groundwater monitoring results:
    - A groundwater level of 1.78 m RL for the north of the site to reflect the results in PZ01.
    - A groundwater level of 4.3 m RL for the south of the site to reflect the results in PZ02.
    - An intermediate groundwater level of 2.53 m RL representing a 0.75 m increase from the lower groundwater level, for the investigation locations immediately south of PZ01.
    - No allowance has been made for any groundwater increase as a result of climate change effects, given the distance of the site from the coast.
- Analysis to reflect proposed cuts and fills required to achieve the design landform.
- Liquefaction induced settlements presented as total and indexed to the upper 10 m.

Full results of our analysis are presented in Appendix 4 with a summary provided in Table 3 below.

8 Boulanger, R. W., and Idriss, I. M. (2014). CPT and SPT based liquefaction triggering procedures. Center for Geotechncial modeling, Department of Civil and Environmental Engineering, University of California, Davis. Report No: UCD/CGM-14/01.

9 NZGS & MBIE (2021). "Earthquake Geotechnical Engineering Practice – Module 3: Liquefaction Hazards" Rev. 1. Issue date November 2021.

10 Zhang, G., Robertson, P. K., and Brachman, R. W. I. (2002). Estimating liquefaction-induced ground settlements from CPT for level ground. Canadian Geotechnical Journal, 39, 1168-1180.

Table 3: Summary of Liquefaction Results

Limit State	Estimated Total Settlement (mm)			LSN			LPI		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Total									
SLS	Liquefaction not triggered								
ULS	30	150	95	2	117 (21*)	20 (10*)	5	28	16
Indexed 10 m									
SLS	Liquefaction not triggered								
ULS	20	115	60	2	115 (21*)	19 (10*)	2	25	12

Notes

*. LSN maximum and average lower values reflect discounting data within proposed stormwater ponds which result in dramatically inflated LSN not reflective of overall site response.

5.2.2 Lateral Spreading

Lateral spread involves lateral ground movement as the result of liquefaction and seismic shaking. Lateral spread is most common in sloping ground or where a face of liquefiable soil is exposed, termed a ‘free face’. Free faces are typically riverbanks, lake shores or creek terraces but can include any steep slope.

The proposed stormwater ponds and water courses form free faces towards which lateral spreading may occur during a liquefaction inducing earthquake. To assess the risk of lateral spreading, we undertook quantitative stability analysis using idealised ground models representing the stream edge and pond edge conditions using limit equilibrium analysis software Slide 2, version 9 (RocScience).

Soil strength parameters were selected based on the results of our investigations and cross referenced to our existing soil database and experience of soils in the region. In order to model the effects of liquefaction, a vertical stress ratio for the liquefied soils, determined from the CPT liquefaction analysis was applied, along with a minimum shear strength of 3 kPa. The assumed parameters are presented in the slope stability analysis outputs presented in Appendix 5.

Our analysis predicted the edge of the stormwater ponds and stream are vulnerable to liquefaction induced lateral spreading, with failure surfaces predicted to occur up to 10 m back from the crest of free face slopes. The effect of internal lateral stretch within this 10 m width is difficult to predict, however are likely to be beyond building code requirements (25 mm over 6 m or an angular distortion of 1:240) unless addressed through remediation works.

5.2.3 Summary of Liquefaction Hazard

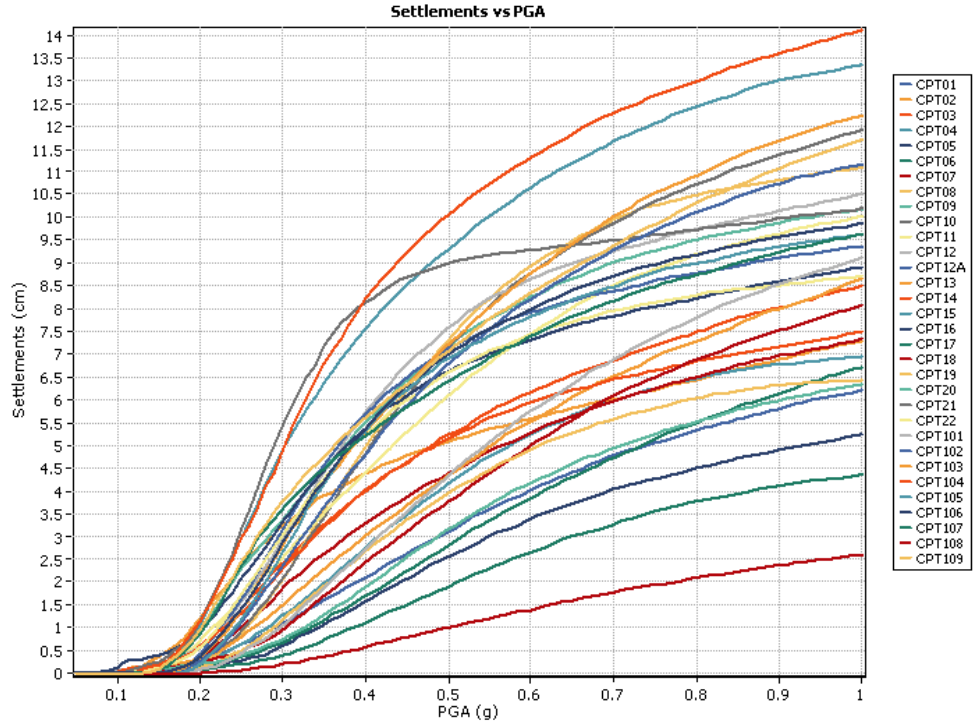
The results of our analysis indicate that liquefaction occurs under ULS conditions but is not triggered under SLS conditions. Under ULS conditions liquefaction occurs within the Holocene age dune sands immediately below the groundwater table and occurs within several layers throughout the soil column that are up to several metres thick; average Liquefaction Potential Index (LPI) values of 12 and 16 indicate a high to very high risk of liquefaction occurring.

Liquefaction Severity Number (LSN) is an index used to estimate the likelihood and severity of liquefaction of soil at depth causing damage to the ground surface. It is influenced by the thickness of the non-liquefiable layer between the liquefiable soil and the ground surface which forms stiff crust that resists the highly damaging effects of surface manifestation (such as ejector) from liquefaction occurring at depth. High LSN values indicative of major to severe surface damage were determined for CPTs in the location of stormwater ponds where proposed cuts will lower the ground surface, close to the prevailing groundwater table reducing (or removing) the non-liquefiable crust. LSN values from investigations within the remainder of the site returned values typically around 10 with highs of 21 indicating minor to moderate surface expression of liquefaction.

Figure 4 below presents a parametric analysis carried out on the CPT data showing estimated liquefaction induced settlement against peak ground acceleration. The analysis shows that liquefaction induced settlements have a typically linear relationship with PGA, rather than a significant step change effect following triggering. This is important for the design of structures and consideration of where the step change occurs in relation to serviceability and ultimate limit state design of such structures. An exception to this is in the location of CPT104 which shows a rapid triggering of liquefaction induced settlement at low PGA. The location of CPT104 is within the proposed main building area, step change effects will need to be considered as part of the structural and geotechnical design interaction for this build to confirm that design considerations are incorporated that address this risk.

Comparison of PGA to LPI (Figure 5) indicates that liquefaction is unlikely to trigger until a PGA of 0.25 g is achieved. This corresponds to an annual recurrence interval of slightly below 100 years.

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Settlements in graph not indexed

Figure 4: Parametric Analysis of Liquefaction Induced Settlement

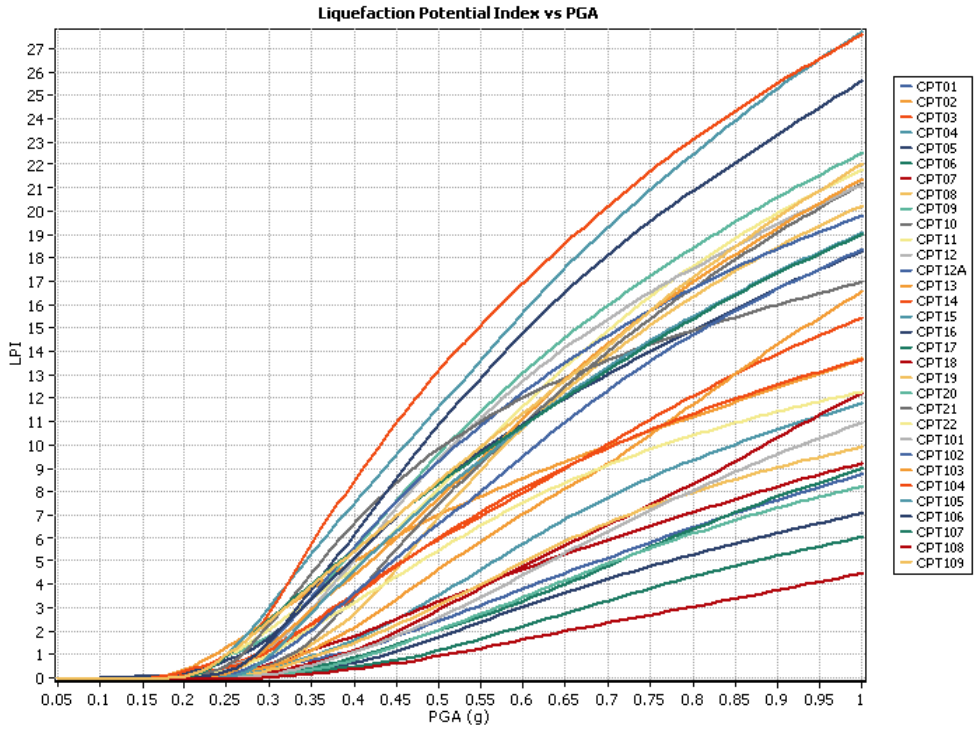


Figure 5: Parametric Analysis of LPI

Based on the characteristic LPI and LSN values, when compacted to Table 5.1 of Module 3 of the MBIE/NZGS Guidelines, the site corresponds to a marginal L2 / L3 performance level reflecting moderate to high effects of excess pore water pressure, liquefaction and lateral spreading. For the purposes of residential building design, the predicted liquefaction effects at the site have been assessed against the performance criteria set out in Table 3.1 of the MBIE Canterbury Guidelines (Part A)[11] which nationally have been adopted for residential building development in liquefication prone areas:

- For the majority of the site, indexed liquefaction induced settlements are typically below 100 mm and have a low risk of lateral spreading. These areas we consider can be classified as Technical Category 2.
- The area around CPTs 15, 104,105 are vulnerable to ULS settlements in excess of 100 mm. Villa, cottage and terrace sites within this designated area may be classed as Technical Category 2/3 Hybrid with shallow ground improvement required to provide suitable ground conditions.
- Villa, cottage and terraces sites, where any part of the dwelling falls within 20 m of a pond or stream vulnerable to lateral spreading may be classed as Technical Category 2/3 Hybrid with edge stability remediation works required to provide suitable ground conditions.
- The main building is outside of the remit of the Canterbury Guidelines and technical categories do not apply. Specific design of this building will be required. However, given its proximity to the proposed wetlands, bioretention devices and stream zone, shallow ground improvement works will be required to support the building foundations for this structure. Further discussion is outlined in Section 6.1.4 below.

Specific remediation recommendations for edge stability and liquefaction risks to address the above points are covered in Section 6 below.

5.3 Slope Stability

The northern boundary of the site is marked by an approximately 8 m high dune feature with slopes as steep as 1V:2H falling towards the site. A future building platform is nominated approximately 3 m away from the toe of this slope. Finished development levels indicate that this dune feature is to be laid back to slope gradients of approximately 1V:3H as part of the landform design for this development. Due to the gradient and proximity of this slope to future buildings, specific static and seismic stability analysis was undertaken using limit equilibrium software Slide 2, version 9 (RocScience). Ground model parameters were adopted from our analysis in Section 5.2.2. Our analyses included consideration of elevated pore water pressures from an extreme rainfall event above the inferred groundwater table, together with seismic conditions and a pseudostatic liquefied post-seismic case. Full results of our analyses are presented in Appendix 6. A summary is presented in Table 4 below.

11 Ministry of Business, Innovation and Employment (MBIE). Repairing and rebuilding houses affected by the Canterbury earthquakes, Part A: Technical Guidance (TC1 and TC2). December 2012. Version 3.

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Table 4: Slope Stability Analysis Summary

Scenario	Target Factor of Safety	Critical Factor of Safety	Comment
Static	1.5	2.40	Acceptable
Elevated Pore Pressure	1.3	1.67	Acceptable
Seismic ULS	1	0.63	Unacceptable, yield acceleration and displacement analysis checked
Pseudostatic (Liquefied)	1	2.40	Acceptable

Our analysis of the boundary dune slopes indicate that the proposed landform is stable under static and elevated pore water pressure conditions, however it is unstable under seismic conditions, where some slope displacement is likely to occur in response to significant earthquake shaking. A Newmark seismic slope displacement assessment was carried out in general accordance with NZGS Slope Stability Guidelines.

The results of our yield acceleration assessment and subsequent displacement checks using a range of referenced methods indicate that moderate slope movement is likely to occur with between 50 and 150 mm of displacement occurring following a significant earthquake, with the displacement following a plastic / ductile deformation type response and is considered a dry slope failure, not liquefaction induced flow failure under this circumstance. As the proposed buildings are located approximately 3 m away from the toe of the slope, the predicted slope movement does not present a credible hazard to the proposed future building.

5.4 Undocumented Fill

Based on historic aerials and our desktop review the site has undergone minor landform modifications to create access tracks, construct building platforms and infill ponds. The development will also require the removal of existing farm buildings. As a result it is likely that there are local undocumented fills on-site.

Undocumented fills are typically not considered to be suitable as a bearing stratum. As we cannot be sure of their compaction history they are considered meta-stable, which means although they may appear competent, they are vulnerable to future total and differential settlement as a result of vibration, inundation with water or loading. If encountered, all undocumented fills located beneath proposed buildings, driveways, infrastructure and future engineered fill should be removed and replaced with engineered fill.

5.5 Static Settlement

Based on the generally medium dense to dense sands beneath the site, load induced settlement from future developments is expected to be elastic and largely built out during construction. Total and differential static settlements are expected to be less than 25 mm for a single storey development (combined widespread live and dead serviceability limit state loads not exceeding 12 kPa) and therefore within NZ Building Code limits for the proposed development. For heavier foundation loads, specific geotechnical assessment will be required once specific foundation arrangement and loads are known, this includes assessment of the main building in relation to static settlement.

5.6 Geotechnical Ultimate Bearing Capacity

It is widely published that near-surface liquefaction may cause bearing failures and lead to overall instability with tilting and / or overturning of structures on poorly designed foundations. Potential punching failures through a non-liquefiable surface crust and reduction of the foundation bearing capacity must be considered in the design. Liquefaction in the immediate foundation soils or their vicinity would usually result in excessive transient and permanent displacements / settlements and potential damage to the foundations that could propagate to the superstructure.

Liquefaction is predicted to occur immediately below the groundwater table. Depth to liquefiable soil is variable across the site; the groundwater table slopes generally towards the north, from around 4 m – the level of the observed standing water at the south of the site – to around 2 m RL in the north of the site. The design landform falls towards the central stream. From 8 m to 6 m near the stream. This gives a minimum depth to liquefiable soil of 1.7 m close to the stream, that increases with distance.

Based on our investigation and assessment of near surface soils, we consider that where natural soils and cut ground is at or below 6.5 m RL for finished levels, a reduced static geotechnical ultimate bearing capacity of 200 kPa should be assumed for future foundation design. Where in fill, or above 6.5 m RL a geotechnical ultimate bearing capacity of 300 kPa may be assumed. Geotechnical bearing capacities will be confirmed following earthworks as part of geotechnical completion investigations and reporting.

The above bearing capacities should be multiplied by the following bearing capacity reduction factors in general accordance with the MBIE Module 4[12] :

- All ULS load combinations (including earthquakes) 0.50
- Serviceability Limit State cases 0.33

Further, specific geotechnical bearing capacity recommendations will be provided for the Main Building development, with reference to foundation sizing and influence on any ground improvement works, together with foundation punching failure assessments under seismic conditions.

6 Geotechnical Recommendations

Based on the conclusions of our geotechnical assessment, we consider the site to be geotechnically suitable for the intended development, subject to the geotechnical recommendations provided within this report being followed as intended.

12 New Zealand Geotechnical Society (NZGS) and Ministry of Business, Innovation and Employment (MBIE) (2021). Earthquake geotechnical engineering practice Module 4: Earthquake resistant foundation design, Version 1, November 2021.

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The proposed development is at risk of liquefaction induced lateral spreading and liquefaction resulting from significant earthquakes. There is also the potential for the site to be locally underlain by undocumented fills. The natural near surface soils are also loose and provide a low bearing capacity for future buildings. To mitigate against the potential for these geohazards to adversely impact the development geotechnical remediation solutions are required as discussed in the following sections.

6.1 Foundations

6.1.1 General

Due to the identified liquefaction risk, the site soils do not meet the definition of 'good ground' in accordance with NZS3604:2011. Based on the shallow groundwater level, free field settlements and potential for surface manifestation, villas / cottages / terraces have been classified as various Technical Categories in keeping with the MBIE Canterbury guidance which has been nationally adopted for residential building development. Standard foundation solutions provided below are considered repairable (by grout injection or relevelling) in the event of differential settlements following a ULS event.

It is important for the options below, specific details and limitations such as future building weight requirements must be noted in accordance with the specific guidance documents. Other foundation solutions may be specifically designed to account for the anticipated site performance outlined in this report subject to iteration between ENGEO (or another suitably qualified geotechnical professional) and the project Structural Engineer.

Please refer to the appended geotechnical remediation zoning plan for spatial extents of the following foundation design recommendations.

6.1.2 Technical Category 2 (TC2) Foundations

For slab-on-grade foundations for TC2 structures we recommend either an Option 1 enhanced foundation slab (300 or 400 mm thick) or Option 4 waffle slabs in general accordance with Section 5.3.1 of the MBIE Canterbury Guidance Part A are considered appropriate for future building development within this zone. For timber-floored dwellings, NZS3604 style foundations may be considered.

Please refer to Section 5.6 for reference to preliminary geotechnical bearing capacities based on finished levels and earthworks.

6.1.3 Technical Category 2/3 Hybrid with Edge Stability Remediation

Where a dwelling or a portion of a dwellings is located within 20 m of a proposed pond or stream, it may be considered a Technical Category 2/3 Hybrid Site, however, the building platform will overlap with the required remedial edge stability earthworks. In this instance, foundation recommendations for a Technical Category 2 site should be followed. Further information is provided in section 6.2 below.

6.1.4 Specific Design

The main building foundations will require specific design to resist the predicted liquefaction induced outlined in section 5.2. This will likely comprise a combination of shallow foundation system bearing on shallow ground improvement such as a geogrid reinforced raft underlying the whole building.

For geogrid reinforced raft design we recommend following the T-method as outlined by Lees and Matthias (2019)[13] to reduce required raft thickness. This requires the use of a granular fill with a friction angle greater than 40 degrees compacted to > 95% MDD (such as GAP65) with geogrid placed at a minimum of 0.3 m spacing, starting with one later at the base and a minimum of two layers. Geogrid must be an engineer approved stiff, punched and drawn triaxial, triplanar or 40 kN biaxial polypropylene geogrid.

Suitable shallow foundation types will depend on structural requirements but may include ground beams or structurally connected pads. The dimensions of these foundations will govern the vertical extent of shallow ground improvement with broader pads or beams applying building loads to greater depths and generally resulting in deeper required ground improvement, however, for preliminary estimation purposes, a nominal raft thickness of 1.2 m may be considered. Interaction of utilities with the ground improvement layer should be considered during design, as installation of services through the geogrid reinforcement will be impractical.

6.2 Edge Stability

The proposed edge of the highly modified stream and ponds present steep slopes, exposing liquefiable soil faces forming ‘free faces’ vulnerable to lateral spreading. Our analyses indicate that the effects of lateral spreading are anticipated to occur 10 m back from the crest of these faces. On this basis the proposed landform is not suitable to support the development as buildings and infrastructure are proposed within this zone of influence.

As a result, remedial measures are required to stabilise the pond edges and stream banks. We recommend remedial earthworks comprising construction of these faces as basal geogrid reinforced embankments. The banks should be over excavated and rebuilt up to construction level with geogrid reinforced engineered fill. Three layers of geogrid would be placed at the base of the fill with 300 mm vertical spacing between layers. Geogrid shall be 40 kN biaxial minimum for this remedial work to provide sufficient resistance against flow failure conditions.

To evaluate the effectiveness of this approach, additional slope stability analysis has been undertaken using limit equilibrium software Slide 2, version 9 to analyse the stability of this conceptual design. Figure 6 below shows an illustrative sketch of this solution. The results of the analysis are presented in Appendix 7.

13 Lees, A., & Matthias, P. (2019). Bearing capacity of a geogrid-stabilised granular layer on clay. Ground engineering, 10.

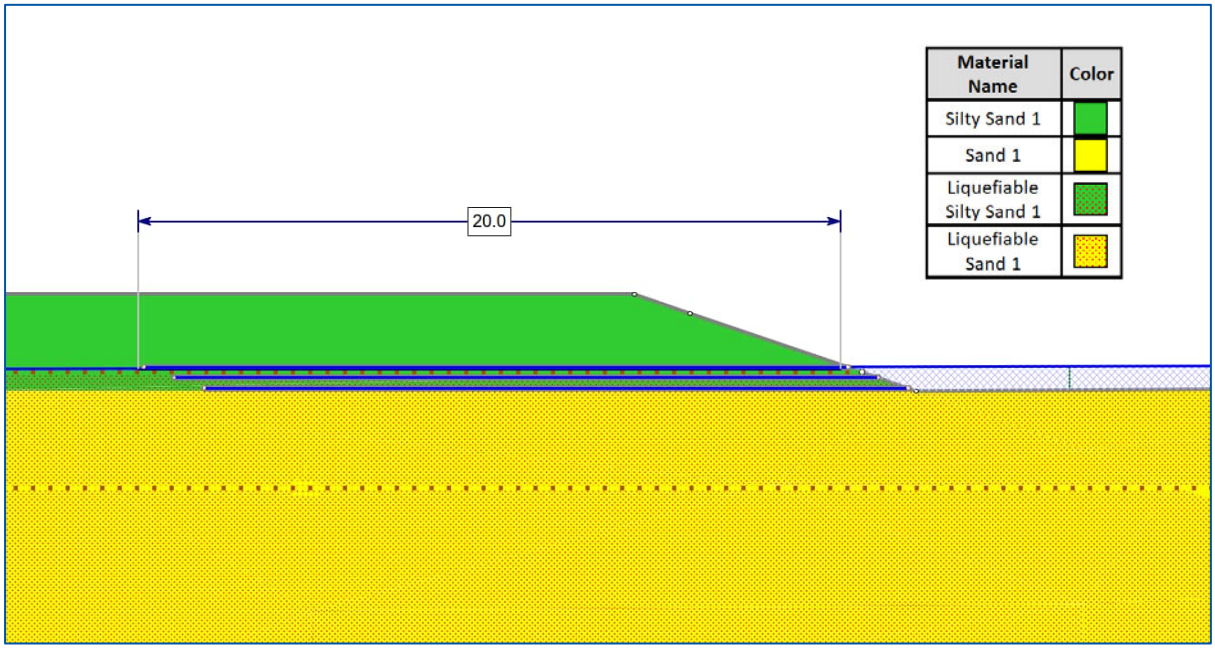


Figure 6: Illustrative Sketch of Bank Reinforcement

Geogrid layers are anticipated to extend 20 m back from the pond / stream face. With the exclusion of the main building where a separate shallow ground improvement system is in place, where a 20 m geogrid length extends beneath a building platform, it must cover the entire building platform to prevent differential performance.

Reference to the masterplan building locations will be critical as part of edge stability remediation to provide suitable cover for building platform areas in proximity to free face areas are adequately remediated. Typically, it is best to terminate geogrid reinforcement wherever new blocks of building occur or where road reserves are proposed. Locations where this is anticipated are shown on the attached plan in Appendix 8. Where buildings dwellings are proposed above edge stability basal reinforcement, foundation design options are as per a Technical Category 2 Foundation.

6.3 Retaining Walls

The site plans depicts the requirement for construction of five retaining walls around the boundary of the site to support landform changes with the adjacent properties. These walls vary with height along their alignment reflecting the undulating dune landform, increasing in height to up to 2 m over short distances. As the walls fall on the property boundary, they will be subject to detailed design by a Chartered Professional Engineer to incorporate boundary loading effects and constraints from neighbouring sites. Wall design will need to consider local soil parameters, as well as surcharge loads, foreslope and backslope angles and drainage requirements. Where walls exceed 1.0 m a barrier is required to be constructed to safeguard people from falling.

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Cantilevered walls are not considered to be an appropriate solution for boundary walls on this site as they are likely to embed within liquefiable soils and thus may lose capacity as a result of liquefaction, in addition to significant overdesign aspects related to groundwater buoyancy effects. We recommend a block or gravity wall design is adopted for the walls required here. Ground improvement measures undertaken during earthworks may also be required to support construction of gravity wall designs where in cut ground or where groundwater levels are likely to be in close proximity to the wall foundation zone.

We anticipate that wall backfill soils will comprise imported dune sands. Based on this we have provided soil parameters for retaining wall design in Table 5 below.

Table 5: Retaining Wall Design Parameters

Soil Type	Unit Weight	Friction Angle φ
Medium dense dune sand	17	30
Engineered sand fill	18	38

6.4 Pump Station

It is proposed to install a wet well associated with a new pump station to the service the village. The depth to invert is 6.89 m below proposed ground level. No detailed design has been undertaken at the time of writing this report however we anticipate that a dewatering / drawdown assessment, coupled with temporary shoring, and dewatering (such as sheet piles) will be required to facilitate construction. The dewatering and drawdown assessment shall consider nearby structures and affects.

6.5 Earthworks

6.5.1 General

All earthworks operations shall be completed and certified under the guidance of a suitably qualified and experienced Chartered Professional Engineer in accordance with NZS4431:2022 and the recommendations contained within this report. The Engineer should be familiar with the contents of this report.

6.5.2 Site Preparation

Prior to the placement of any engineered fill including gravel raft placement (where adopted) or building foundations, all vegetation, tree stumps, topsoil, and uncontrolled fill should be stripped to expose the underlying natural soils.

Stripped surfaces should be free of any roots greater than 20 mm in diameter, along with root clusters and areas where more than 5% of the soil is occupied by roots. A geotechnical professional shall observe that natural subgrade once exposed to confirm it is suitable prior to fill placement. As part of the subgrade observation procedure, the subgrade shall be tested by the geotechnical professional to confirm the preliminary bearing capacity stated above is available. If any isolated soft spots or sensitive soils are encountered, they will be locally undercut and recompacted to engineered fill standard within the zone of influence of future foundations.

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6.5.3 Fill Materials

Where fill soils are sourced from off-site, they should be similar to the existing natural sand unless otherwise specified as part of specifically designed shallow ground improvement. Imported fills should be free of topsoil, peat, organic matter, rubbish or other suitable material. Compaction criteria should be based on granular soils, where a percentage of maximum dry density is achieved (typically 95%). Imported fill materials should be approved by the Geotechnical Engineer prior to use as engineered fill.

6.5.4 Fill Placement

Granular fill shall be placed in layers with a maximum lose thickness of 250 mm. Fill shall be compacted to 95% Maximum Dry Density, based on quarry sourced laboratory results. Filling should be carried out in dry conditions, free of surface water.

Fill shall be tested under the guidance of a geotechnical professional with a Nuclear Densometer (NDM) or other approved method to confirm that any fill has adequate compaction. The frequency of testing shall be advised by the geotechnical professional once the earthworks plans and construction programme have been finalised but should generally be in accordance with NZS4431:2022.

6.5.5 Geogrid Specification and Placement

Where adopted, geogrid should comprise high strength biaxial geogrid with a minimum ultimate tensile strength of 40 kN unless specified. Geogrid should be placed level on prepared subgrade soils. Where used as part of a geogrid reinforced raft it may be rolled in any direction. When used as basal reinforcement to resist lateral spread it must be rolled perpendicular to the free face. Laterally adjacent layers should overlap by a minimum of 300 mm.

Geogrid shall be and tensioned and secured with pins or weighted down with small piles of aggregate prior to covering. The geogrid may not be tracked by machinery until minimum cover complies with manufacturers guidance.

6.5.6 Stormwater Pond Earthworks

The proposed masterplan and earthworks plans show two bioretention ponds and two wetland ponds with their base at approximately 4 m RL requiring cuts of approximately 2.0 m. At this depth, it is likely that the pond will intercept prevailing groundwater level which was determined to be approximately 4 m RL.

In order to excavate the ponds to below the groundwater table some consideration will need to be given to dewatering controls such as dewatering spears, to depress the local groundwater table. Any requirement for lining of ponds will require assessment with respect to buoyancy and ballasting of such liners.

6.6 Building Restriction Lines

6.6.1 Slopes

A slope building restriction line (BRL) has been designated to protect future housing and infrastructure development from the dunes along the northern site boundary. This BRL has been determined based on the results of our Newmark seismic slope displacement analysis and is projected 1 m from the toe of the slope.

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All building restriction lines will be subject to further geotechnical assessment and final construction landform survey and finalised as part of the geotechnical completion reporting for the development.

6.6.2 Retaining Walls

For preliminary assessment we recommend a retaining wall building setbacks of 1.0 times the retained height of all future retaining walls. Specific building restriction lines and offsets from walls should be refined during specific design of each wall and confirmed during geotechnical completion reporting.

6.7 Stormwater Disposal

It is understood that specific stormwater design is intended for the Site and that stormwater will be taken into a reticulated system and discharged into the system of central bioretention ponds and wetland areas before discharging into the modified stream.

For the design of stormwater disposal via soakage methods within the proposed stormwater devices indicated on the masterplan, we recommend taking the reduced average rate from our falling head test results, having an unfactored soakage rate of 400 mm/hr (lower quartile value). NZBC E1 requires that soakage rates include a 0.5 factor for design purposes to provide suitable factors of safety.

6.8 Surface Water Management

During construction, appropriate measures shall be undertaken to control and treat stormwater runoff, with silt and erosion controls complying with local body guidelines for erosion and sediment control. This is particularly relevant for the site due to the proximity to a stormwater receptor, being the highly modified stream and stormwater pond to the north. Surface cut-off drains or appropriate stormwater flow paths should be maintained outside of the proposed development area, both during and following construction. These drains and impervious surfaces will divert water away from any buildings and minimise possible movement in sensitive soils during and post construction.

Stormwater from paved areas shall be taken in a piped system and disposed of into an approved stormwater system. Uncontrolled discharge onto land or uncontrolled disposal via in-ground systems must be avoided.

All service trenches should be capped with low permeability materials, so that excavations do not become points of entry for surface run-off.

7 Assessment Against Section 106 RMA and 2025 NPS

The proposed development is situated on or near land that is subject to natural hazards. Section 106 of the Resource Management Act 1991 and the National Policy Statement (NPS for Natural Hazards) requires a combined assessment of the likelihood of the hazards, the material damage (consequences) of the hazard, and whether the proposed use of the land would accelerate or worsen the hazard. We have assessed the natural hazards in Table 6 overleaf in accordance with the 2025 NPS for Natural Hazards.

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Table 6: Natural Hazards Assessment

Natural Hazard	Hazard Description specific to the site	Likelihood	Consequence	Assessed Risk	Details / Mitigation Measures	Likelihood	Consequence	Assessed Risk	Are the works likely to accelerate or worsen the hazard?
Active Faults	Rupture of an active fault present within or within proximity to the site.	Rare	Major	Medium	Nearest active fault located 3.2 km away. No specific mitigation measures.	Rare	Major	Medium	No
Liquefaction	Ground settlement causing damage to structures	Likely	Major	High	Shallow ground improvement for building foundations	Likely	Minor	Medium	No
	Lateral spreading causing damage to structures and land	Likely	Major	High	Remedial earthworks of free-faces including basal reinforcement	Likely	Minor	Medium	No
Tsunami	Inundation from wave action from coastal tsunami causing damage to structures and land	Very Rare	Major	Medium	No specific mitigation proposed. Site is outside of active Tsunami inundation zones, but conceivably at risk of inundation in a 1 in 5,000 year event for which no modelling exists but must be considered	Very Rare	Major	Medium	No

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Natural Hazard	Hazard Description specific to the site	Likelihood	Consequence	Assessed Risk	Details / Mitigation Measures	Likelihood	Consequence	Assessed Risk	Are the works likely to accelerate or worsen the hazard?
Consolidation Settlement	Static settlement of soils beneath infrastructure / future development	Very Rare	Moderate	Low	Soils encountered beneath development are granular. Settlement anticipated to occur during construction and not present major risk to development.	Very Rare	Moderate	Low	No
Landslide	Moderate slope movement (50 -150 mm) anticipated due to large earthquake	Rare	Negligible	Low	1 m building restriction line from toe of slope	Rare	Negligible	Low	No
Flooding	Ponding anticipated within dune troughs	Possible	Moderate	Medium	Design landform will infill dune troughs elevating site above flood level.	Rare	Moderate	Low	No
Erosion	Site is beyond mapped coastal erosion hazards	Very Rare	Negligible	Low	No specific mitigation measures.	Rare	Negligible	Low	No

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8 Future Work

The findings of our investigations and assessment of natural hazards demonstrate the site is suitable for future development, subject to recommendations outlined above. The following items shall be addressed during detailed design and construction works:

- Detailed review of landform / earthworks design.
- Detailed assessment and design of the pump station wet well.
- Review of edge stability geogrid extents.
- Specific geotechnical input for main building foundation design.
- Preparation / review of the earthworks specification.
- Observation and certification of earthworks and retaining walls including all stripping and undercuts, engineered fill and geogrid placement in accordance with the earthworks and retaining wall specifications.
- Preparation of Geotechnical Completion Report (GCR) on completion of earthworks. This report should be included by not be limited to the following:
    - Drawings including pre-development landform, final landform, and cut and fill plans.
    - A factual account of earthworks undertaken on-site, including any deviations from the agreed specifications.
    - A record of settlement monitoring undertaken (where required).
    - To provide specific recommendations for building foundations on a lot-by-lot basis.
    - Review and provision of building restriction lines as required.

9 Conclusion

Based on the investigations and assessments presented in this report, the site is considered geotechnically suitable for the proposed retirement village development and associated earthworks, subject to implementation of the recommendations set out in this report. The identified natural hazards and geotechnical constraints—including liquefaction, lateral spreading, local slope instability, flooding, undocumented fill and variable near-surface ground conditions—can be appropriately managed through the recommended landform design, engineered earthworks, ground improvement, edge-stability measures, foundation solutions, building restriction lines, stormwater management, detailed design and construction monitoring. Provided these measures are incorporated into the design and works, the development is not expected to accelerate or worsen the identified natural hazards, and the residual geotechnical effects can be managed to an acceptable level.

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10 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Summerset Villages (Paraparaumu) Ltd, their professional advisers, and the expert consenting panel in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.

ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.

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

iv. This Limitation should be read in conjunction with the Engineering NZ / ACENZ Standard Terms of Engagement.

v. This report is not to be reproduced either wholly or in part without our prior written permission.

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (04) 472 0820 if you require any further information.

Report prepared by

[redacted]

Jamie Lott, CGeol, CMEngNZ (PEngGeol)

Senior Engineering Geologist

Report reviewed by

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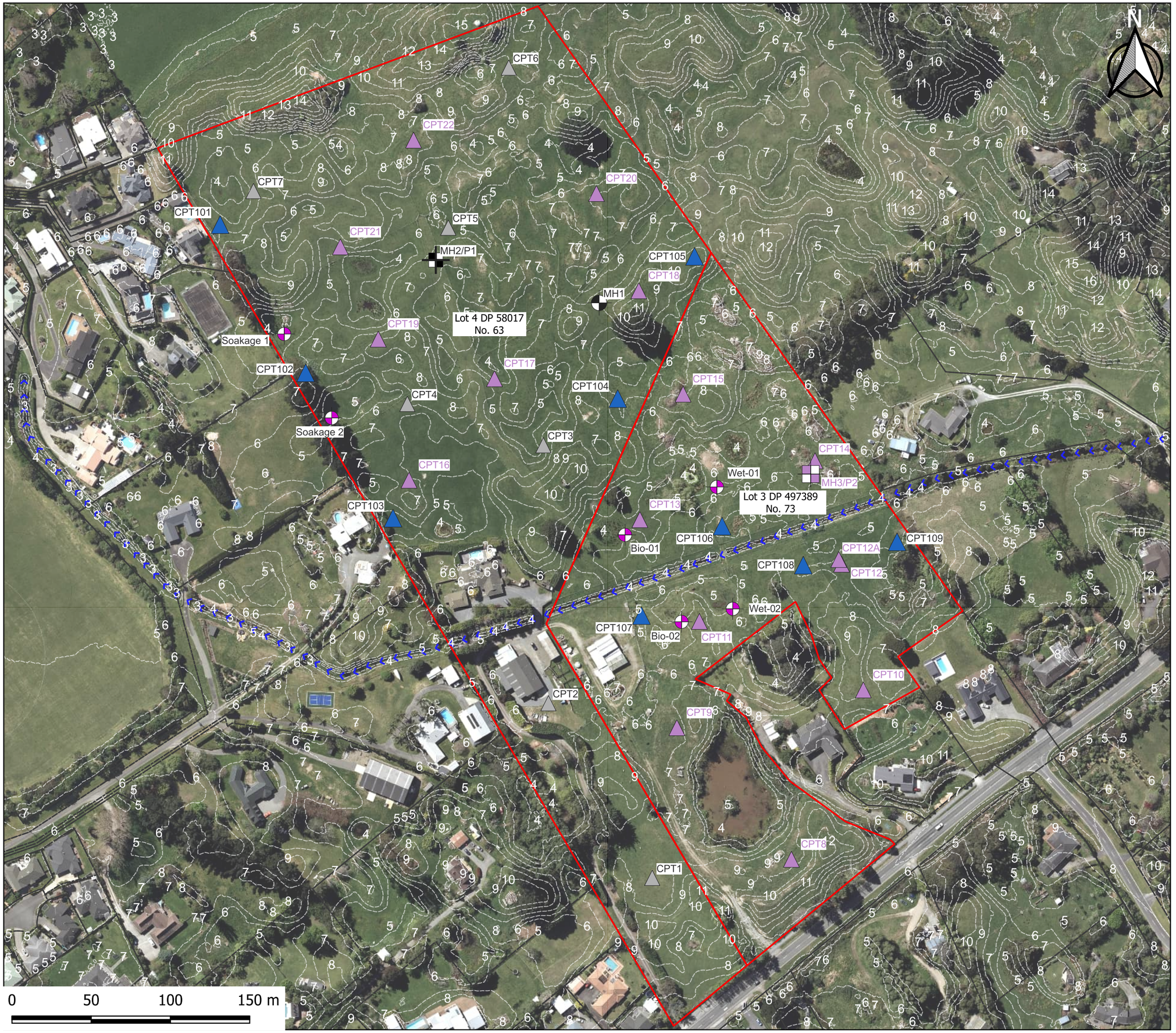
Rowan Cook, CMEngNZ (PEngGeol)

Associate Engineering Geologist

Appendix 1:

Geotechnical Investigation Plan

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LEGEND

Features

- Overland Flow Path

Ground Investigations

- ENGEO 2026 Soakage Test Locations
- ENGEO CPT Locations 2026
- Riley Cone Penetrometer Tests (CPT) (2022 Location)
- Riley Cone Penetrometer Tests (CPT) (2024 Location)
- Riley Machine Borehole and Piezometer (2022)
- Riley Machine Borehole and Piezometer (2024)
- Riley Machine Borehole Locations (2022)

Base Layers

- Propetry Boundaries
- 65 & 73 Ratanui Road (Site Boundaries)
- 1.0 m Kapiti Coast Contours (LINZ, 2025)

0.075 m Kapiti Coast Aerial Photos (LINZ, 2025)

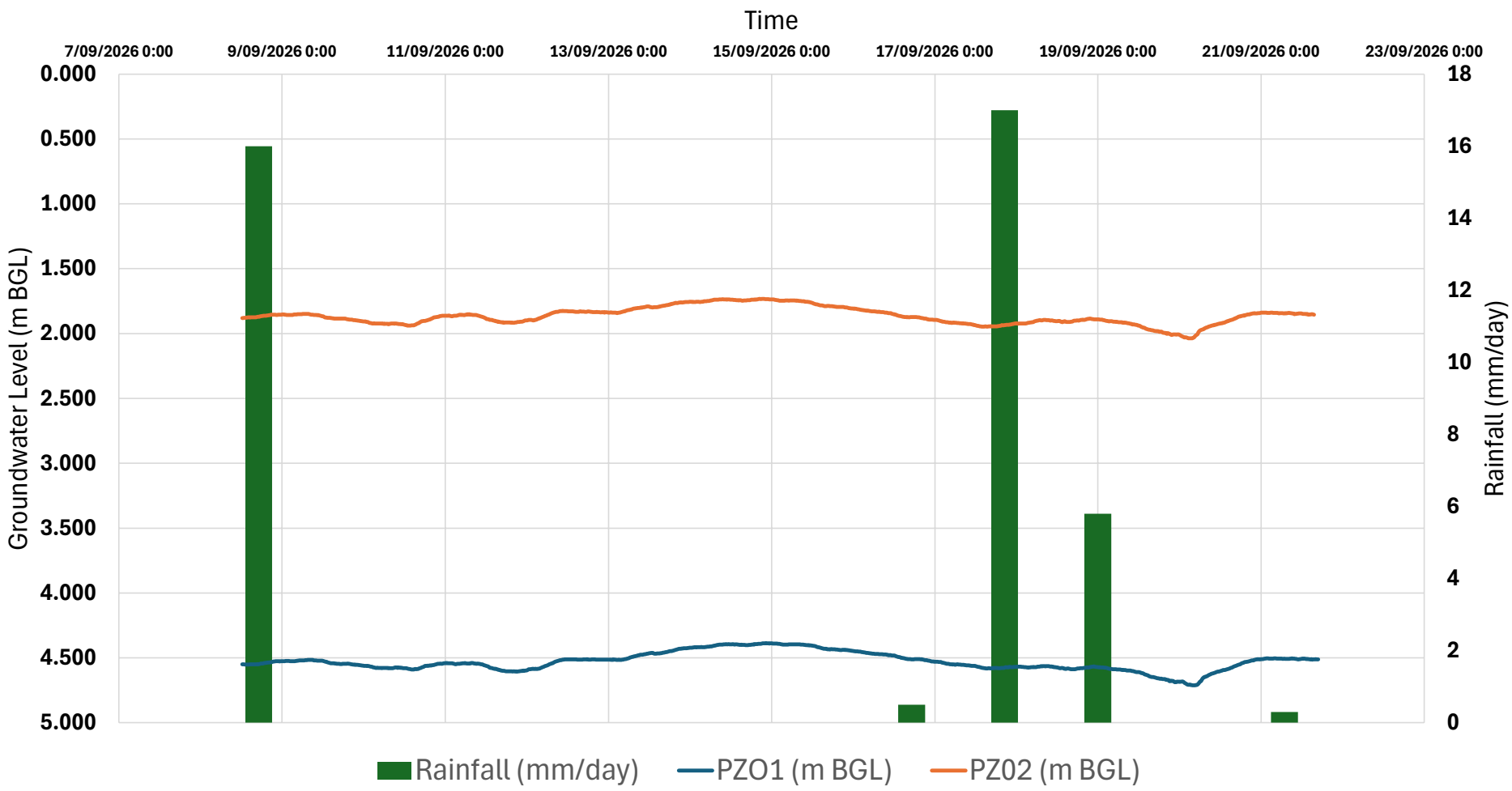
ENGEO

Projection: NZTM 2000NZGD2000 / New Zealand Transverse Mercator 2000		
Client: Summerset Group Holding Ltd		
Title: ENGEO & Riley Geotechnical Investigation Plan		Appendix No. 1 Size: A3 Sheet
Project: Summerset Otaihanga, Paraparaumu	Drawn: KAJJ	
Date: 30/09/2026	Checked: RC	
Proj No: 30093.000.001	Scale: 1:2250 @ A3	Version: 1.0

Appendix 2:

Groundwater Monitoring Data

Groundwater Monitoring (09/09/2026 to 21/09/2026)



ENGEO	Wellington **Office** Plimmer Towers, 2–6 Gilmer Terrace Wellington 6011 Tel: 04 472 0820	**Site Address** 65 and 73 Ratanui Road, Paraparaumu	**Date:**	24/09/2026	**Client:**	Summerset Group Holdings Ltd
			Drawn:	HN/SC	**Project:**	Summerset Otaihanga
			Reviwed:	JT	**Description:**	Groundwater monitoring
			Appendix:		**Project No.**	030093.000.001

Appendix 3:

Soakage Testing Results

Soakage Testing Ltd
021 101 6431
info@soakagetesting.co.nz

SOAKAGE DATA REPORT

Site:	64 Otaihanga rd - Bioretention 1
Client:	Engeo
Report Date:	09 September 2026
Test ID:	unit0004_20260908_1226
Revision:	R01

Purpose

This document presents the soakage test data for 64 Otaihanga rd - Bioretention 1. Infiltration testing was conducted in accordance with NZ Building Code E1/VM1 methodology using automated volumetric equipment. Both constant head (Reynolds) and falling head (E1/VM1) results are reported.

This data is intended to support the design of on-site stormwater soakage systems. The soakage rate(s) reported may be used directly by the project engineer or designer for soak pit sizing calculations.





Issued subject to Soakage Testing Ltd Scope of Services & Terms of Engagement.

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1. Site & Test Data

1.1 Site Information

Test Date:	08 September 2026	**Soil Conditions:**	Coarse sand
Latitude:	-40.887215	**Hole Diameter:**	150 mm
Longitude:	175.011686	**Hole Depth:**	1500 mm
Groundwater:	Encountered at 1500 mm	**Test ID:**	unit0004_20260908_1226

GPS coordinates recorded via automated testing equipment. Accuracy within approximately 3m radius.

1.2 Presoak Results

Presoak Start:	12:26:42
Presoak End:	12:42:40
Duration:	15m 58s
Volume Used:	57.3 L

Presoak terminated prior to the 4-hour minimum. Reason: groundwater encountered during presoak. The volume delivered is considered sufficient to saturate the surrounding soil for the test depth.

1.3 Infiltration Test Results

Constant Head Rate (K):	624 mm/hr
F(u) Testing Uncertainty Factor:	1.2
Constant Head Design Rate:	520 mm/hr

Soil conditions at the test depth were observed to be Coarse sand. The sorptive number $\alpha = 36\ m^{-1}$ has been selected based on the observed soil texture classification in accordance with Reynolds (2010) Table 1.

Falling Head Rate (min slope):	3181 mm/hr
Falling Head Safety Factor:	4
Falling Head Design Rate:	795 mm/hr

The falling head rate has been derived from the 5–50% segment of the drawdown curve, rather than the minimum slope at very low head, in accordance with E1/VM1 9.0.2(d), which permits the lower rates to be discarded where there is a marked decrease in soakage rate as the hole becomes nearly empty.

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2. Test Procedure & Methodology

2.1 Percolation Test Procedure (E1/VM1 9.0.2)

a) Bore test holes of 100 mm to 150 mm diameter to the depth of the proposed soak pit. If groundwater is encountered, this depth shall be taken as the depth of the soak pit.

b) Fill the hole with water and maintain full for at least 4 hours (unless soakage is so great that the hole completely drains in a short time).

c) Fill the hole with water to within 750 mm of ground level, and record the drop in water level against time, at intervals of no greater than 30 minutes, until the hole is almost empty, or over 4 hours, whichever is the shortest.

d) Plot the drop in water level against time on a graph, and the soakage rate in mm/hr is determined from the minimum slope of the curve. If there is a marked decrease in soakage rate as the hole becomes nearly empty, the lower rates may be discarded and the value closer to the average can be adopted.

2.2 Constant Head Test (Reynolds Method)

The constant head hydraulic conductivity is determined using the Reynolds (2010) steady-flow analysis for a cased borehole permeameter:

$$K = Q / [\pi D(H + 1/\alpha) + \pi(D/2)^2]$$

Where:

K = field-saturated hydraulic conductivity (m/s) Q = steady-state flow rate (m^3/s) D = casing internal diameter (m) H = constant water head in cased borehole (m) α = sorptive number (m^{-1}) — selected from soil texture classification per Reynolds (2010) Table 1.

The sorptive number α accounts for capillary effects in the soil surrounding the borehole. Higher values correspond to coarser-grained soils where gravity-driven flow dominates.

The hydraulic conductivity K is converted to mm/hr and reduced by the testing uncertainty factor F(u) per GD2021/007 Table 6 to derive the constant head design rate.

Reference: Reynolds W.D. 2010. Measuring Soil Hydraulic Properties Using a Cased Borehole Permeameter: Steady Flow Analyses, Vadose Zone Journal 9(3): 637-652.

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2.3 Automated Testing System

Soakage testing was conducted using an automated volumetric system which controls the presoak phase then switches to timer mode. The system registers the time for each 50 mm drop in water level, capturing accurate results in accordance with E1/VM1 requirements.

2.4 References

- NZ Building Code Clause E1 – Surface Water, 1st Edition, Amendment 12 (Nov 2023)
- Verification Method E1/VM1
- Wellington Water Regional Standard for Water Services

2.5 Limitations

The soakage testing and associated calculations presented in this report relate only to the specific test location and ground conditions encountered at the time of testing.

The presoak procedure was undertaken in accordance with NZBC E1/VM1 methodology and is intended to saturate the soil profile surrounding the test bore to simulate storm loading conditions at the tested depth. Groundwater conditions encountered during testing are recorded in Section 1 of this report. However, this testing does not constitute long-term groundwater monitoring, and seasonal groundwater fluctuations may occur. Verification of minimum groundwater separation at the time of construction remains the responsibility of the developer and/or contractor.

Ground conditions may vary across the site. The derived soakage rate is assumed to be representative only of the tested location and similar ground within the immediate vicinity.

No assessment has been undertaken of proximity to boundaries, services, slopes, retaining walls, adjacent structures, or cumulative groundwater effects beyond the tested location.

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Soak Test Results

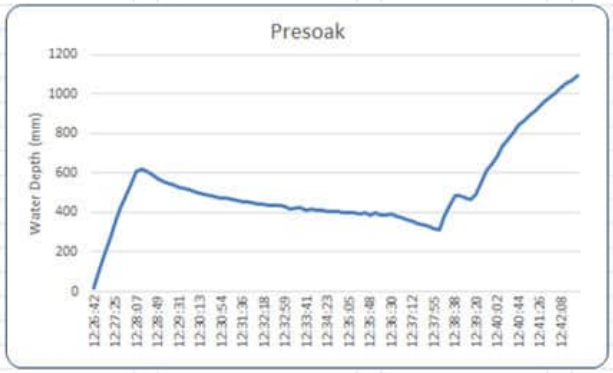
Date test conducted:	2026-09-08
Time started:	12:26:41
Latitude:	-40.887215
Longitude:	175.011686
Test ID:	unit0004_20260908_1226

Test Hole Dia.(m):	0.15
Area = π × (D/2)² (m²):	0.0177
Depth of hole(m):	1.500
Benchmark to sensor (m):	1.716
Head (m):	1.036

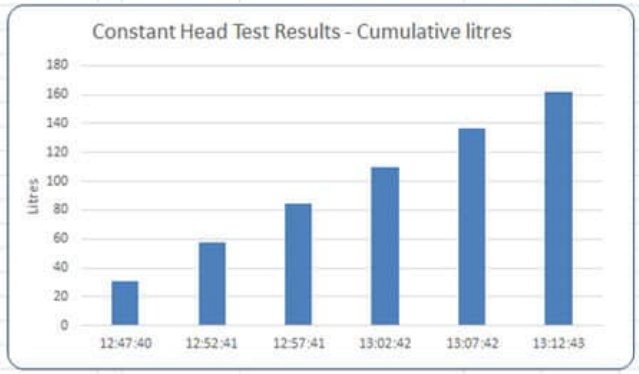
Client:	Engeo
Address:	64 Otaihanga rd - Bioretention 1
Test by:	Soakage Testing Ltd
Soil Conditions:	**Coarse sand**

Soakage Testing Ltd

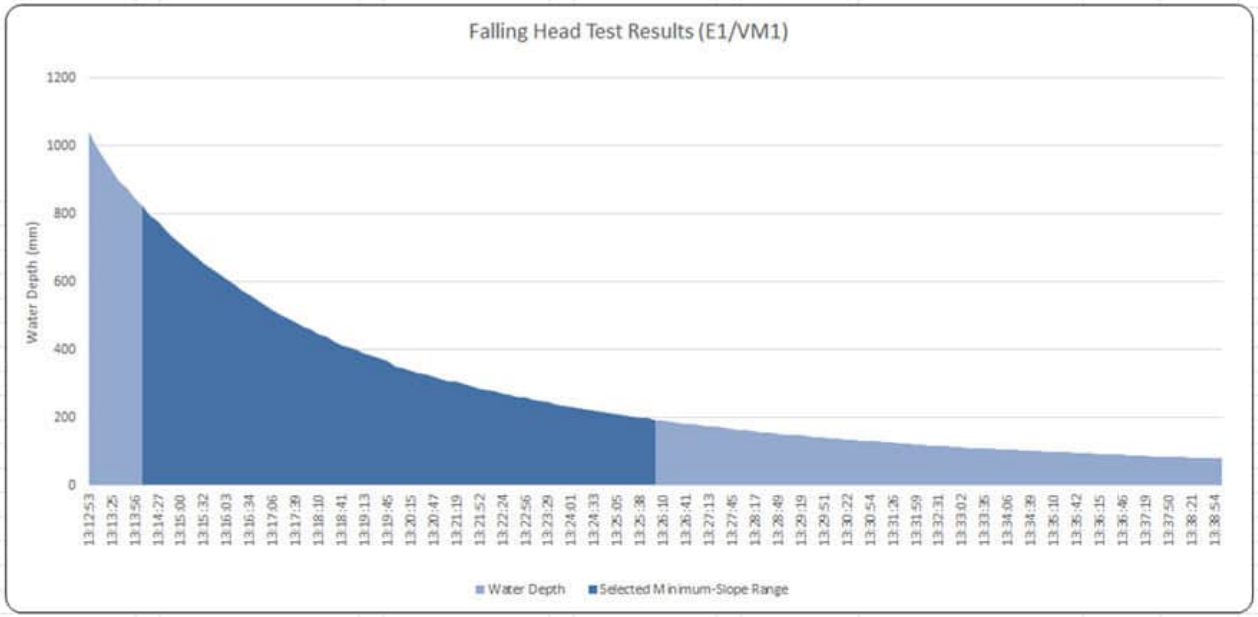
Presoak Results:	
Start Time:	12:26:42
End time:	12:42:40
Duration (h:mm):	0:15
Volume(L):	57.27



Constant Head Test Results:	
Reynolds K Formula:	
$K = (Q/3600) / [\pi D(H + 1/\alpha) + \pi(D/2)^2]$	
Start Volume (L):	57.27
End Volume (L):	219.34
Volume Change (L):	162.07
Duration (minutes):	30
Flow Rate (L/min):	5.402
Q = Flow Rate (m³/hr):	0.324
D = Standpipe Diameter (m):	0.15
H = Measured Head (m):	1.0362
α = Alpha (m⁻¹):	36
K Hydraulic Conductivity (m/s):	0.000173
K Hydraulic Conductivity (mm/hr):	624
F(u) - Testing Uncertainty Factor:	1.2
K Design Rate (mm/hr):	520



Falling Head Test Results (E1/VM1):	
Falling Head Formula:	
Soakage Rate (mm/hr) = (Start water depth−End water depth) / Duration_minutes × 60	
Start Water Depth (mm):	1041
End Water Depth (mm):	80
Water Depth Change (mm):	961.00
Duration (minutes):	26.18
Average soakage Rate (mm/hr):	2202
minimum slope start %:	5
minimum slope end %:	50
Avg. water depth selected (mm):	404
Min. slope Duration (min):	11.88
Min. slope distance change(mm):	630.00
Minimum slope:	3180.93
Factor of safety:	4
Infiltration rate(mm/hr):	795



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SOAKAGE DATA REPORT

Site:	64 Otaihanga rd - Bioretention 2
Client:	Engeo
Report Date:	09 September 2026
Test ID:	unit0002_20260908_0907
Revision:	R01

Purpose

This document presents the soakage test data for 64 Otaihanga rd - Bioretention 2. Infiltration testing was conducted in accordance with NZ Building Code E1/VM1 methodology using automated volumetric equipment. Both constant head (Reynolds) and falling head (E1/VM1) results are reported.

This data is intended to support the design of on-site stormwater soakage systems. The soakage rate(s) reported may be used directly by the project engineer or designer for soak pit sizing calculations.





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1. Site & Test Data

1.1 Site Information

Test Date:	08 September 2026	**Soil Conditions:**	Coarse sand
Latitude:	-40.887664	**Hole Diameter:**	150 mm
Longitude:	175.012167	**Hole Depth:**	2000 mm
Groundwater:	Encountered at 1100 mm	**Test ID:**	unit0002_20260908_0907

GPS coordinates recorded via automated testing equipment. Accuracy within approximately 3m radius.

1.2 Presoak Results

Presoak Start:	09:07:21
Presoak End:	09:22:33
Duration:	15m 12s
Volume Used:	21.3 L

Presoak terminated prior to the 4-hour minimum. Reason: groundwater encountered during presoak. The volume delivered is considered sufficient to saturate the surrounding soil for the test depth.

1.3 Infiltration Test Results

Constant Head Rate (K):	222 mm/hr
F(u) Testing Uncertainty Factor:	1.2
Constant Head Design Rate:	185 mm/hr

Soil conditions at the test depth were observed to be Coarse sand. The sorptive number $\alpha = 36\ m^{-1}$ has been selected based on the observed soil texture classification in accordance with Reynolds (2010) Table 1.

Falling Head Rate (min slope):	1083 mm/hr
Falling Head Safety Factor:	4
Falling Head Design Rate:	271 mm/hr

The falling head rate has been derived from the 0–40% segment of the drawdown curve, rather than the minimum slope at very low head, in accordance with E1/VM1 9.0.2(d), which permits the lower rates to be discarded where there is a marked decrease in soakage rate as the hole becomes nearly empty.

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2. Test Procedure & Methodology

2.1 Percolation Test Procedure (E1/VM1 9.0.2)

a) Bore test holes of 100 mm to 150 mm diameter to the depth of the proposed soak pit. If groundwater is encountered, this depth shall be taken as the depth of the soak pit.

b) Fill the hole with water and maintain full for at least 4 hours (unless soakage is so great that the hole completely drains in a short time).

c) Fill the hole with water to within 750 mm of ground level, and record the drop in water level against time, at intervals of no greater than 30 minutes, until the hole is almost empty, or over 4 hours, whichever is the shortest.

d) Plot the drop in water level against time on a graph, and the soakage rate in mm/hr is determined from the minimum slope of the curve. If there is a marked decrease in soakage rate as the hole becomes nearly empty, the lower rates may be discarded and the value closer to the average can be adopted.

2.2 Constant Head Test (Reynolds Method)

The constant head hydraulic conductivity is determined using the Reynolds (2010) steady-flow analysis for a cased borehole permeameter:

$$K = Q / [\pi D(H + 1/\alpha) + \pi(D/2)^2]$$

Where:

K = field-saturated hydraulic conductivity (m/s) Q = steady-state flow rate (m^3/s) D = casing internal diameter (m) H = constant water head in cased borehole (m) α = sorptive number (m^{-1}) — selected from soil texture classification per Reynolds (2010) Table 1.

The sorptive number α accounts for capillary effects in the soil surrounding the borehole. Higher values correspond to coarser-grained soils where gravity-driven flow dominates.

The hydraulic conductivity K is converted to mm/hr and reduced by the testing uncertainty factor F(u) per GD2021/007 Table 6 to derive the constant head design rate.

Reference: Reynolds W.D. 2010. Measuring Soil Hydraulic Properties Using a Cased Borehole Permeameter: Steady Flow Analyses, Vadose Zone Journal 9(3): 637-652.

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2.3 Automated Testing System

Soakage testing was conducted using an automated volumetric system which controls the presoak phase then switches to timer mode. The system registers the time for each 50 mm drop in water level, capturing accurate results in accordance with E1/VM1 requirements.

2.4 References

- NZ Building Code Clause E1 – Surface Water, 1st Edition, Amendment 12 (Nov 2023)
- Verification Method E1/VM1
- Wellington Water Regional Standard for Water Services

2.5 Limitations

The soakage testing and associated calculations presented in this report relate only to the specific test location and ground conditions encountered at the time of testing.

The presoak procedure was undertaken in accordance with NZBC E1/VM1 methodology and is intended to saturate the soil profile surrounding the test bore to simulate storm loading conditions at the tested depth. Groundwater conditions encountered during testing are recorded in Section 1 of this report. However, this testing does not constitute long-term groundwater monitoring, and seasonal groundwater fluctuations may occur. Verification of minimum groundwater separation at the time of construction remains the responsibility of the developer and/or contractor.

Ground conditions may vary across the site. The derived soakage rate is assumed to be representative only of the tested location and similar ground within the immediate vicinity.

No assessment has been undertaken of proximity to boundaries, services, slopes, retaining walls, adjacent structures, or cumulative groundwater effects beyond the tested location.

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Soak Test Results

Date test conducted:	2026-09-08
Time started:	09:07:20
Latitude:	-40.887664
Longitude:	175.012167
Test ID:	unit0002_20260908_0907

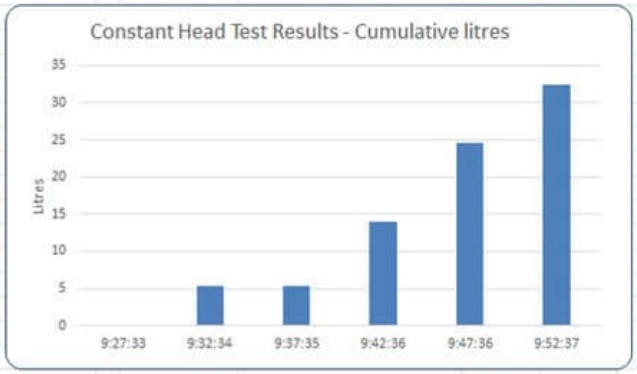
Test Hole Dia.(m):	0.15
Area = π × (D/2)² (m²):	0.0177
Depth of hole(m):	2.000
Benchmark to sensor (m):	1.477
Head (m):	0.556

Client:	Engeo
Address:	64 Otaihanga rd - Bioretention 2
Test by:	Soakage Testing Ltd
Soil Conditions:	Coarse sand

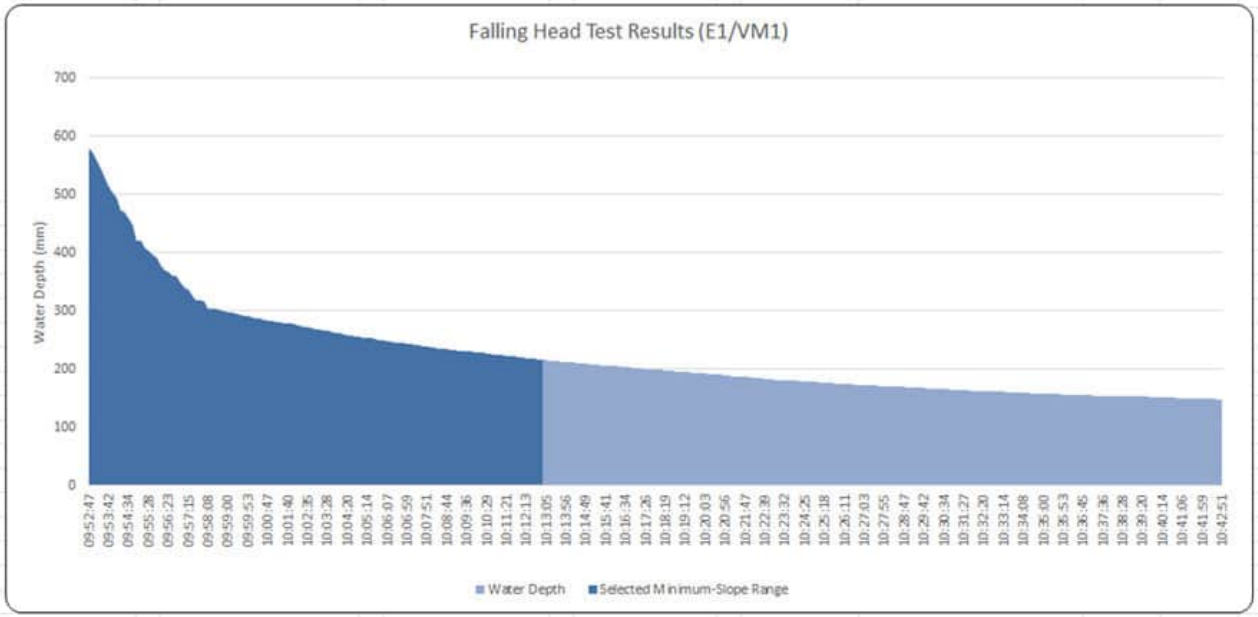
Soakage Testing Ltd

Presoak Results:	
Start Time:	09:07:21
End time:	09:22:33
Duration (h:mm):	0:15
Volume(L):	21.33





Constant Head Test Results:	
Reynolds K Formula:	
$K = (Q/3600) / [\pi D(H + 1/\alpha) + \pi(D/2)^2]$	
Start Volume (L):	21.33
End Volume (L):	53.74
Volume Change (L):	32.41
Duration (minutes):	30
Flow Rate (L/min):	1.080
Q = Flow Rate (m³/hr):	0.065
D = Standpipe Diameter (m):	0.15
H = Measured Head (m):	0.5557
α = Alpha (m⁻¹):	36
K Hydraulic Conductivity (m/s):	0.000062
K Hydraulic Conductivity (mm/hr):	222
F(u) - Testing Uncertainty Factor:	1.2
K Design Rate (mm/hr):	185



Falling Head Test Results (E1/VM1):	
Falling Head Formula:	
Soakage Rate (mm/hr) = (Start water depth−End water depth) / Duration_minutes × 60	
Start Water Depth (mm):	580
End Water Depth (mm):	148
Water Depth Change (mm):	432.00
Duration (minutes):	50.07
Average soakage Rate (mm/hr):	518
minimum slope start %:	0
minimum slope end %:	40
Avg. water depth selected (mm):	299
Min. slope Duration (min):	20.12
Min. slope distance change(mm):	363.00
Minimum slope:	1082.68
Factor of safety:	4
Infiltration rate(mm/hr):	271

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SOAKAGE DATA REPORT

Site:	64 Otaihanga rd - Soakage 1
Client:	Engeo
Report Date:	09 September 2026
Test ID:	unit0005_20260908_1530
Revision:	R01

Purpose

This document presents the soakage test data for 64 Otaihanga rd - Soakage 1. Infiltration testing was conducted in accordance with NZ Building Code E1/VM1 methodology using automated volumetric equipment. Both constant head (Reynolds) and falling head (E1/VM1) results are reported.

This data is intended to support the design of on-site stormwater soakage systems. The soakage rate(s) reported may be used directly by the project engineer or designer for soak pit sizing calculations.





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1. Site & Test Data

1.1 Site Information

Test Date:	08 September 2026	**Soil Conditions:**	Coarse sand
Latitude:	-40.886088	**Hole Diameter:**	150 mm
Longitude:	175.009169	**Hole Depth:**	1300 mm
Groundwater:	Encountered at 1300 mm	**Test ID:**	unit0005_20260908_1530

GPS coordinates recorded via automated testing equipment. Accuracy within approximately 3m radius.

1.2 Presoak Results

Presoak Start:	15:30:47
Presoak End:	15:46:33
Duration:	15m 46s
Volume Used:	105.0 L

Presoak terminated prior to the 4-hour minimum. Reason: groundwater encountered during presoak. The volume delivered is considered sufficient to saturate the surrounding soil for the test depth.

1.3 Infiltration Test Results

Constant Head Rate (K):	604 mm/hr
F(u) Testing Uncertainty Factor:	1.2
Constant Head Design Rate:	503 mm/hr

Soil conditions at the test depth were observed to be Coarse sand. The sorptive number $\alpha = 36\ m^{-1}$ has been selected based on the observed soil texture classification in accordance with Reynolds (2010) Table 1.

Falling Head Rate (min slope):	2930 mm/hr
Falling Head Safety Factor:	4
Falling Head Design Rate:	733 mm/hr

The falling head rate has been derived from the 5–50% segment of the drawdown curve, rather than the minimum slope at very low head, in accordance with E1/VM1 9.0.2(d), which permits the lower rates to be discarded where there is a marked decrease in soakage rate as the hole becomes nearly empty.

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2. Test Procedure & Methodology

2.1 Percolation Test Procedure (E1/VM1 9.0.2)

a) Bore test holes of 100 mm to 150 mm diameter to the depth of the proposed soak pit. If groundwater is encountered, this depth shall be taken as the depth of the soak pit.

b) Fill the hole with water and maintain full for at least 4 hours (unless soakage is so great that the hole completely drains in a short time).

c) Fill the hole with water to within 750 mm of ground level, and record the drop in water level against time, at intervals of no greater than 30 minutes, until the hole is almost empty, or over 4 hours, whichever is the shortest.

d) Plot the drop in water level against time on a graph, and the soakage rate in mm/hr is determined from the minimum slope of the curve. If there is a marked decrease in soakage rate as the hole becomes nearly empty, the lower rates may be discarded and the value closer to the average can be adopted.

2.2 Constant Head Test (Reynolds Method)

The constant head hydraulic conductivity is determined using the Reynolds (2010) steady-flow analysis for a cased borehole permeameter:

$$K = Q / [\pi D(H + 1/\alpha) + \pi(D/2)^2]$$

Where:

K = field-saturated hydraulic conductivity (m/s) Q = steady-state flow rate (m^3/s) D = casing internal diameter (m) H = constant water head in cased borehole (m) α = sorptive number (m^{-1}) — selected from soil texture classification per Reynolds (2010) Table 1.

The sorptive number α accounts for capillary effects in the soil surrounding the borehole. Higher values correspond to coarser-grained soils where gravity-driven flow dominates.

The hydraulic conductivity K is converted to mm/hr and reduced by the testing uncertainty factor F(u) per GD2021/007 Table 6 to derive the constant head design rate.

Reference: Reynolds W.D. 2010. Measuring Soil Hydraulic Properties Using a Cased Borehole Permeameter: Steady Flow Analyses, Vadose Zone Journal 9(3): 637-652.

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2.3 Automated Testing System

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2.4 References

- NZ Building Code Clause E1 – Surface Water, 1st Edition, Amendment 12 (Nov 2023)
- Verification Method E1/VM1
- Wellington Water Regional Standard for Water Services

2.5 Limitations

The soakage testing and associated calculations presented in this report relate only to the specific test location and ground conditions encountered at the time of testing.

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Soak Test Results

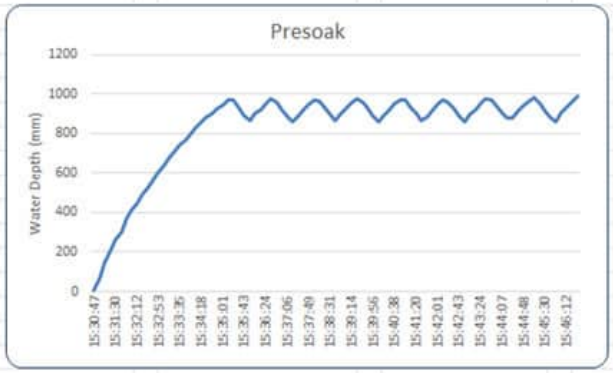
Date test conducted:	2026-09-08
Time started:	15:30:46
Latitude:	-40.886088
Longitude:	175.009169
Test ID:	unit0005_20260908_1530

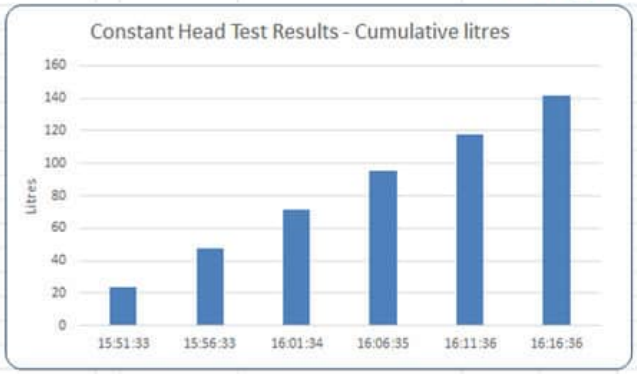
Test Hole Dia.(m):	0.15
Area = π × (D/2)² (m²):	0.0177
Depth of hole(m):	1.300
Benchmark to sensor (m):	2.390
Head (m):	0.932

Client:	Engeo
Address:	64 Otaihanga rd - Soakage 1
Test by:	Soakage Testing Ltd
Soil Conditions:	**Coarse sand**

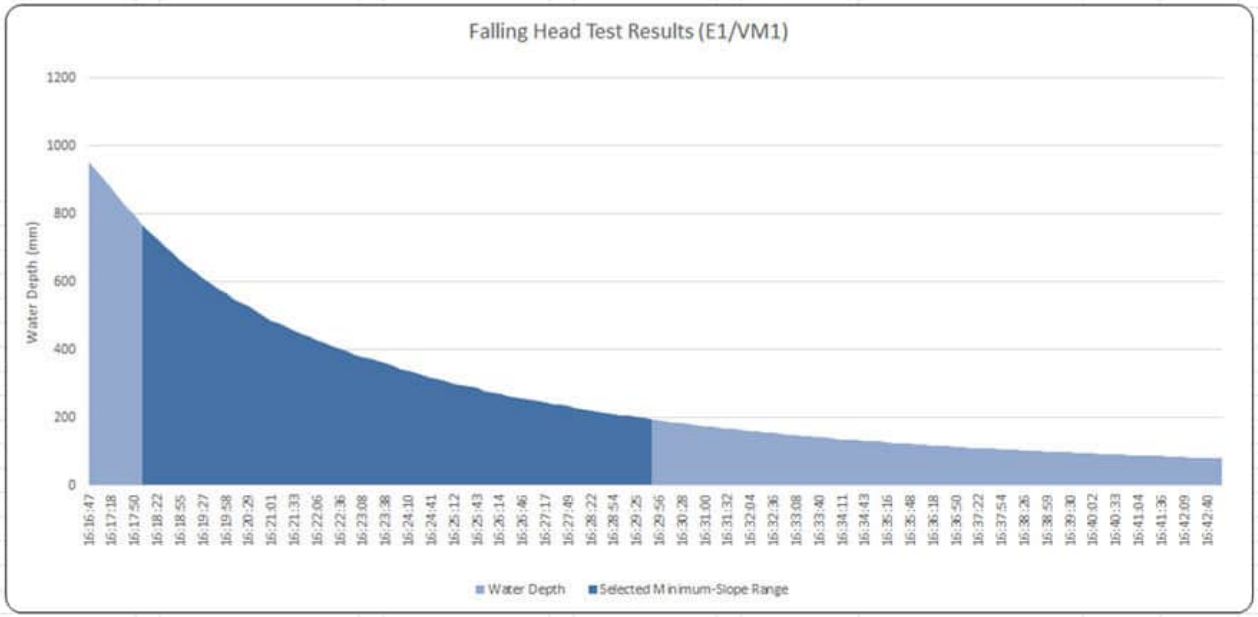
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Presoak Results:	
Start Time:	15:30:47
End time:	15:46:33
Duration (h:mm):	0:15
Volume(L):	104.97





Constant Head Test Results:	
Reynolds K Formula:	
$K = (Q/3600) / [\pi D(H + 1/\alpha) + \pi(D/2)^2]$	
Start Volume (L):	104.97
End Volume (L):	246.78
Volume Change (L):	141.81
Duration (minutes):	30
Flow Rate (L/min):	4.727
Q = Flow Rate (m³/hr):	0.284
D = Standpipe Diameter (m):	0.15
H = Measured Head (m):	0.9315
α = Alpha (m⁻¹):	36
K Hydraulic Conductivity (m/s):	0.000168
K Hydraulic Conductivity (mm/hr):	604
F(u) - Testing Uncertainty Factor:	1.2
K Design Rate (mm/hr):	503



Falling Head Test Results (E1/VM1):	
Falling Head Formula:	
Soakage Rate (mm/hr) = (Start water depth−End water depth) / Duration_minutes × 60	
Start Water Depth (mm):	953
End Water Depth (mm):	80
Water Depth Change (mm):	873.00
Duration (minutes):	26.23
Average soakage Rate (mm/hr):	**1997**
minimum slope start %:	5
minimum slope end %:	50
Avg. water depth selected (mm):	389
Min. slope Duration (min):	11.73
Min. slope distance change(mm):	573.00
Minimum slope:	2930.11
Factor of safety:	4
Infiltration rate(mm/hr):	733

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SOAKAGE DATA REPORT

Site:	64 Otaihanga rd - Soakage 2
Client:	Engeo
Report Date:	09 September 2026
Test ID:	unit0002_20260908_1434
Revision:	R01

Purpose

This document presents the soakage test data for 64 Otaihanga rd - Soakage 2. Infiltration testing was conducted in accordance with NZ Building Code E1/VM1 methodology using automated volumetric equipment. Both constant head (Reynolds) and falling head (E1/VM1) results are reported.

This data is intended to support the design of on-site stormwater soakage systems. The soakage rate(s) reported may be used directly by the project engineer or designer for soak pit sizing calculations.





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1. Site & Test Data

1.1 Site Information

Test Date:	08 September 2026	**Soil Conditions:**	Coarse sand
Latitude:	-40.886488	**Hole Diameter:**	150 mm
Longitude:	175.009650	**Hole Depth:**	1500 mm
Groundwater:	Encountered at 1500 mm	**Test ID:**	unit0002_20260908_1434

GPS coordinates recorded via automated testing equipment. Accuracy within approximately 3m radius.

1.2 Presoak Results

Presoak Start:	14:34:10
Presoak End:	14:49:34
Duration:	15m 24s
Volume Used:	86.3 L

Presoak terminated prior to the 4-hour minimum. Reason: groundwater encountered during presoak. The volume delivered is considered sufficient to saturate the surrounding soil for the test depth.

1.3 Infiltration Test Results

Constant Head Rate (K):	475 mm/hr
F(u) Testing Uncertainty Factor:	1.2
Constant Head Design Rate:	396 mm/hr

Soil conditions at the test depth were observed to be Coarse sand. The sorptive number $\alpha = 36\ m^{-1}$ has been selected based on the observed soil texture classification in accordance with Reynolds (2010) Table 1.

Falling Head Rate (min slope):	2019 mm/hr
Falling Head Safety Factor:	4
Falling Head Design Rate:	505 mm/hr

The falling head rate has been derived from the 3–40% segment of the drawdown curve, rather than the minimum slope at very low head, in accordance with E1/VM1 9.0.2(d), which permits the lower rates to be discarded where there is a marked decrease in soakage rate as the hole becomes nearly empty.

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2. Test Procedure & Methodology

2.1 Percolation Test Procedure (E1/VM1 9.0.2)

a) Bore test holes of 100 mm to 150 mm diameter to the depth of the proposed soak pit. If groundwater is encountered, this depth shall be taken as the depth of the soak pit.

b) Fill the hole with water and maintain full for at least 4 hours (unless soakage is so great that the hole completely drains in a short time).

c) Fill the hole with water to within 750 mm of ground level, and record the drop in water level against time, at intervals of no greater than 30 minutes, until the hole is almost empty, or over 4 hours, whichever is the shortest.

d) Plot the drop in water level against time on a graph, and the soakage rate in mm/hr is determined from the minimum slope of the curve. If there is a marked decrease in soakage rate as the hole becomes nearly empty, the lower rates may be discarded and the value closer to the average can be adopted.

2.2 Constant Head Test (Reynolds Method)

The constant head hydraulic conductivity is determined using the Reynolds (2010) steady-flow analysis for a cased borehole permeameter:

$$K = Q / [\pi D(H + 1/\alpha) + \pi(D/2)^2]$$

Where:

K = field-saturated hydraulic conductivity (m/s) Q = steady-state flow rate (m^3/s) D = casing internal diameter (m) H = constant water head in cased borehole (m) α = sorptive number (m^{-1}) — selected from soil texture classification per Reynolds (2010) Table 1.

The sorptive number α accounts for capillary effects in the soil surrounding the borehole. Higher values correspond to coarser-grained soils where gravity-driven flow dominates.

The hydraulic conductivity K is converted to mm/hr and reduced by the testing uncertainty factor F(u) per GD2021/007 Table 6 to derive the constant head design rate.

Reference: Reynolds W.D. 2010. Measuring Soil Hydraulic Properties Using a Cased Borehole Permeameter: Steady Flow Analyses, Vadose Zone Journal 9(3): 637-652.

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2.3 Automated Testing System

Soakage testing was conducted using an automated volumetric system which controls the presoak phase then switches to timer mode. The system registers the time for each 50 mm drop in water level, capturing accurate results in accordance with E1/VM1 requirements.

2.4 References

- NZ Building Code Clause E1 – Surface Water, 1st Edition, Amendment 12 (Nov 2023)
- Verification Method E1/VM1
- Wellington Water Regional Standard for Water Services

2.5 Limitations

The soakage testing and associated calculations presented in this report relate only to the specific test location and ground conditions encountered at the time of testing.

The presoak procedure was undertaken in accordance with NZBC E1/VM1 methodology and is intended to saturate the soil profile surrounding the test bore to simulate storm loading conditions at the tested depth. Groundwater conditions encountered during testing are recorded in Section 1 of this report. However, this testing does not constitute long-term groundwater monitoring, and seasonal groundwater fluctuations may occur. Verification of minimum groundwater separation at the time of construction remains the responsibility of the developer and/or contractor.

Ground conditions may vary across the site. The derived soakage rate is assumed to be representative only of the tested location and similar ground within the immediate vicinity.

No assessment has been undertaken of proximity to boundaries, services, slopes, retaining walls, adjacent structures, or cumulative groundwater effects beyond the tested location.

This document presents test data only and does not constitute a soak pit design. The responsibility for soak pit design, siting, and construction compliance rests with the project engineer or designer.

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Soak Test Results

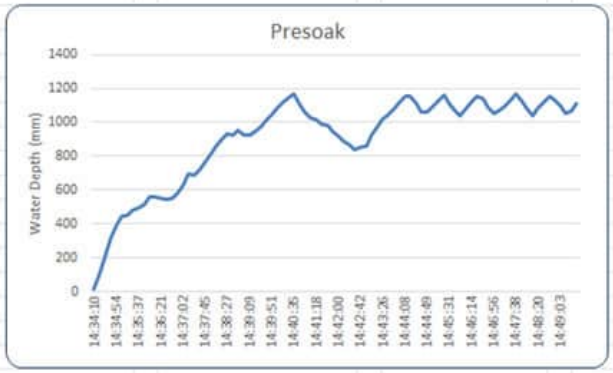
Date test conducted:	2026-09-08
Time started:	14:34:09
Latitude:	-40.886488
Longitude:	175.009650
Test ID:	unit0002_20260908_1434

Test Hole Dia.(m):	0.15
Area = π × (D/2)² (m²):	0.0177
Depth of hole(m):	1.500
Benchmark to sensor (m):	1.819
Head (m):	1.033

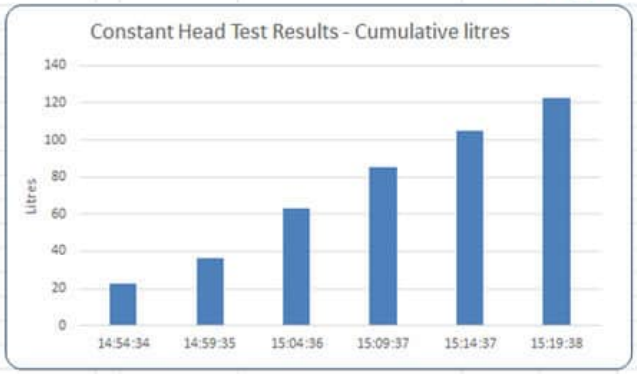
Client:	Engeo
Address:	64 Otaihanga rd - Soakage 2
Test by:	Soakage Testing Ltd
Soil Conditions:	**Coarse sand**

Soakage Testing Ltd

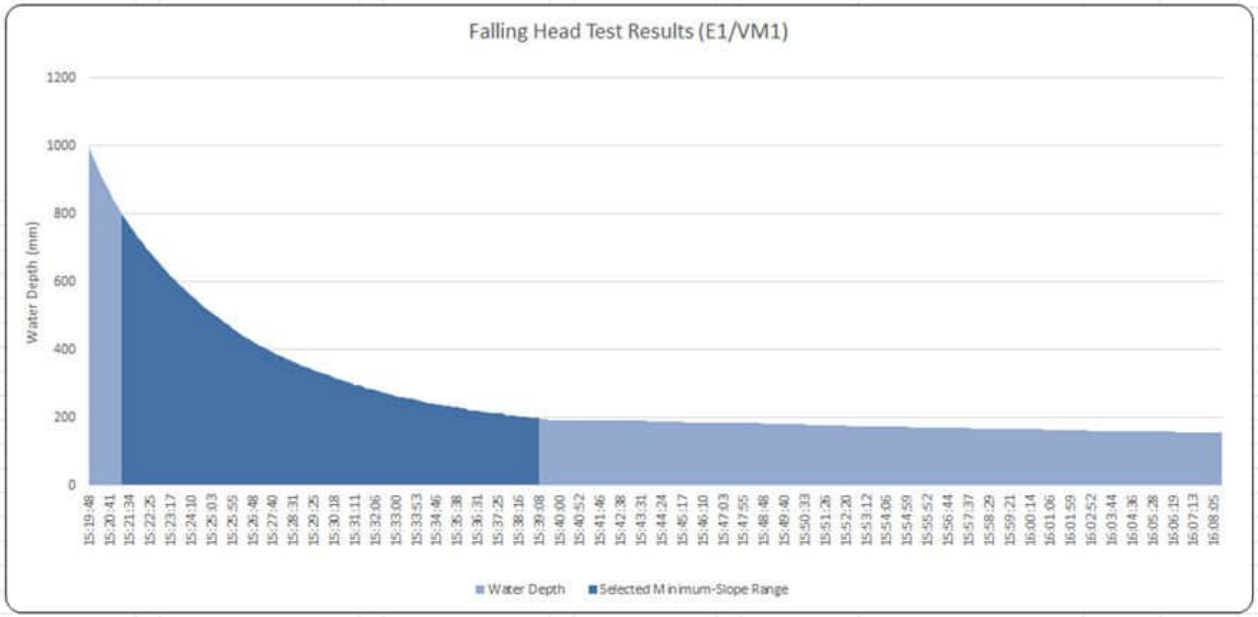
Presoak Results:	
Start Time:	14:34:10
End time:	14:49:34
Duration (h:mm):	0:15
Volume(L):	86.3



Constant Head Test Results:	
Reynolds K Formula:	
$K = (Q/3600) / [\pi D(H + 1/\alpha) + \pi(D/2)^2]$	
Start Volume (L):	86.3
End Volume (L):	209.19
Volume Change (L):	122.89
Duration (minutes):	30
Flow Rate (L/min):	4.096
Q = Flow Rate (m³/hr):	0.246
D = Standpipe Diameter (m):	0.15
H = Measured Head (m):	1.0332
α = Alpha (m⁻¹):	36
K Hydraulic Conductivity (m/s):	0.000132
K Hydraulic Conductivity (mm/hr):	475
F(u) - Testing Uncertainty Factor:	1.2
K Design Rate (mm/hr):	396



Falling Head Test Results (E1/VM1):	
Falling Head Formula:	
Soakage Rate (mm/hr) = (Start water depth−End water depth) / Duration_minutes × 60	
Start Water Depth (mm):	998
End Water Depth (mm):	156
Water Depth Change (mm):	842.00
Duration (minutes):	48.63
Average soakage Rate (mm/hr):	1039
minimum slope start %:	3
minimum slope end %:	40
Avg. water depth selected (mm):	377
Min. slope Duration (min):	17.92
Min. slope distance change(mm):	603.00
Minimum slope:	2019.35
Factor of safety:	4
Infiltration rate(mm/hr):	505



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SOAKAGE DATA REPORT

Site:	64 Otaihanga rd - Wetland 1
Client:	Engeo
Report Date:	09 September 2026
Test ID:	unit0001_20260908_1111
Revision:	R01

Purpose

This document presents the soakage test data for 64 Otaihanga rd - Wetland 1. Infiltration testing was conducted in accordance with NZ Building Code E1/VM1 methodology using automated volumetric equipment. Both constant head (Reynolds) and falling head (E1/VM1) results are reported.

This data is intended to support the design of on-site stormwater soakage systems. The soakage rate(s) reported may be used directly by the project engineer or designer for soak pit sizing calculations.





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1. Site & Test Data

1.1 Site Information

Test Date:	08 September 2026	**Soil Conditions:**	Coarse sand
Latitude:	-40.887030	**Hole Diameter:**	150 mm
Longitude:	175.012438	**Hole Depth:**	2200 mm
Groundwater:	Encountered at 2200 mm	**Test ID:**	unit0001_20260908_1111

GPS coordinates recorded via automated testing equipment. Accuracy within approximately 3m radius.

1.2 Presoak Results

Presoak Start:	11:12:00
Presoak End:	11:27:16
Duration:	15m 16s
Volume Used:	145.6 L

Presoak terminated prior to the 4-hour minimum. Reason: groundwater encountered during presoak. The volume delivered is considered sufficient to saturate the surrounding soil for the test depth.

1.3 Infiltration Test Results

Constant Head Rate (K):	845 mm/hr
F(u) Testing Uncertainty Factor:	1.2
Constant Head Design Rate:	704 mm/hr

Soil conditions at the test depth were observed to be Coarse sand. The sorptive number $\alpha = 36\ m^{-1}$ has been selected based on the observed soil texture classification in accordance with Reynolds (2010) Table 1.

Falling Head Rate (min slope):	4673 mm/hr
Falling Head Safety Factor:	4
Falling Head Design Rate:	1168 mm/hr

The falling head rate has been derived from the 8–60% segment of the drawdown curve, rather than the minimum slope at very low head, in accordance with E1/VM1 9.0.2(d), which permits the lower rates to be discarded where there is a marked decrease in soakage rate as the hole becomes nearly empty.

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2. Test Procedure & Methodology

2.1 Percolation Test Procedure (E1/VM1 9.0.2)

a) Bore test holes of 100 mm to 150 mm diameter to the depth of the proposed soak pit. If groundwater is encountered, this depth shall be taken as the depth of the soak pit.

b) Fill the hole with water and maintain full for at least 4 hours (unless soakage is so great that the hole completely drains in a short time).

c) Fill the hole with water to within 750 mm of ground level, and record the drop in water level against time, at intervals of no greater than 30 minutes, until the hole is almost empty, or over 4 hours, whichever is the shortest.

d) Plot the drop in water level against time on a graph, and the soakage rate in mm/hr is determined from the minimum slope of the curve. If there is a marked decrease in soakage rate as the hole becomes nearly empty, the lower rates may be discarded and the value closer to the average can be adopted.

2.2 Constant Head Test (Reynolds Method)

The constant head hydraulic conductivity is determined using the Reynolds (2010) steady-flow analysis for a cased borehole permeameter:

$$K = Q / [\pi D(H + 1/\alpha) + \pi(D/2)^2]$$

Where:

K = field-saturated hydraulic conductivity (m/s) Q = steady-state flow rate (m^3/s) D = casing internal diameter (m) H = constant water head in cased borehole (m) α = sorptive number (m^{-1}) — selected from soil texture classification per Reynolds (2010) Table 1.

The sorptive number α accounts for capillary effects in the soil surrounding the borehole. Higher values correspond to coarser-grained soils where gravity-driven flow dominates.

The hydraulic conductivity K is converted to mm/hr and reduced by the testing uncertainty factor F(u) per GD2021/007 Table 6 to derive the constant head design rate.

Reference: Reynolds W.D. 2010. Measuring Soil Hydraulic Properties Using a Cased Borehole Permeameter: Steady Flow Analyses, Vadose Zone Journal 9(3): 637-652.

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2.3 Automated Testing System

Soakage testing was conducted using an automated volumetric system which controls the presoak phase then switches to timer mode. The system registers the time for each 50 mm drop in water level, capturing accurate results in accordance with E1/VM1 requirements.

2.4 References

- NZ Building Code Clause E1 – Surface Water, 1st Edition, Amendment 12 (Nov 2023)
- Verification Method E1/VM1
- Wellington Water Regional Standard for Water Services

2.5 Limitations

The soakage testing and associated calculations presented in this report relate only to the specific test location and ground conditions encountered at the time of testing.

The presoak procedure was undertaken in accordance with NZBC E1/VM1 methodology and is intended to saturate the soil profile surrounding the test bore to simulate storm loading conditions at the tested depth. Groundwater conditions encountered during testing are recorded in Section 1 of this report. However, this testing does not constitute long-term groundwater monitoring, and seasonal groundwater fluctuations may occur. Verification of minimum groundwater separation at the time of construction remains the responsibility of the developer and/or contractor.

Ground conditions may vary across the site. The derived soakage rate is assumed to be representative only of the tested location and similar ground within the immediate vicinity.

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This document presents test data only and does not constitute a soak pit design. The responsibility for soak pit design, siting, and construction compliance rests with the project engineer or designer.

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Soak Test Results

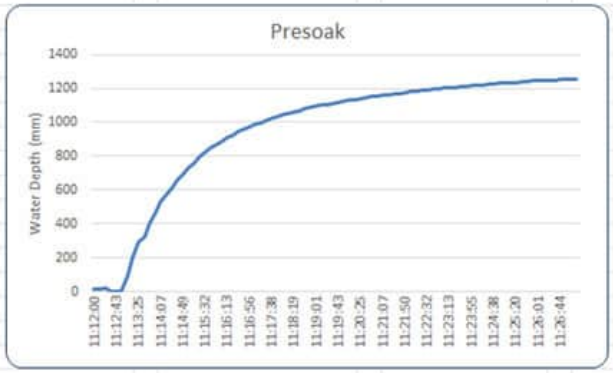
Date test conducted:	2026-09-08
Time started:	11:11:59
Latitude:	-40.887030
Longitude:	175.012438
Test ID:	unit0001_20260908_1111

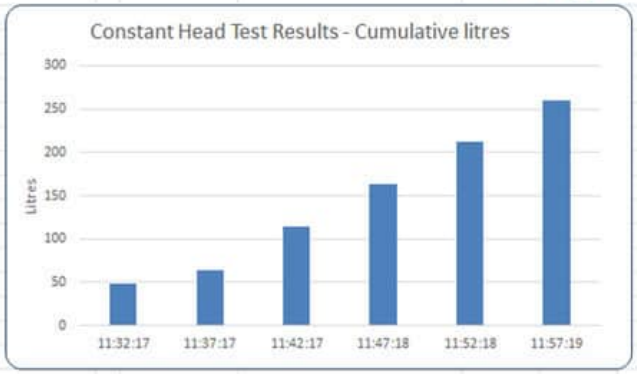
Test Hole Dia.(m):	0.15
Area = π × (D/2)² (m²):	0.0177
Depth of hole(m):	2.200
Benchmark to sensor (m):	2.454
Head (m):	1.238

Client:	Engeo
Address:	64 Otaihanga rd - Wetland 1
Test by:	Soakage Testing Ltd
Soil Conditions:	**Coarse sand**

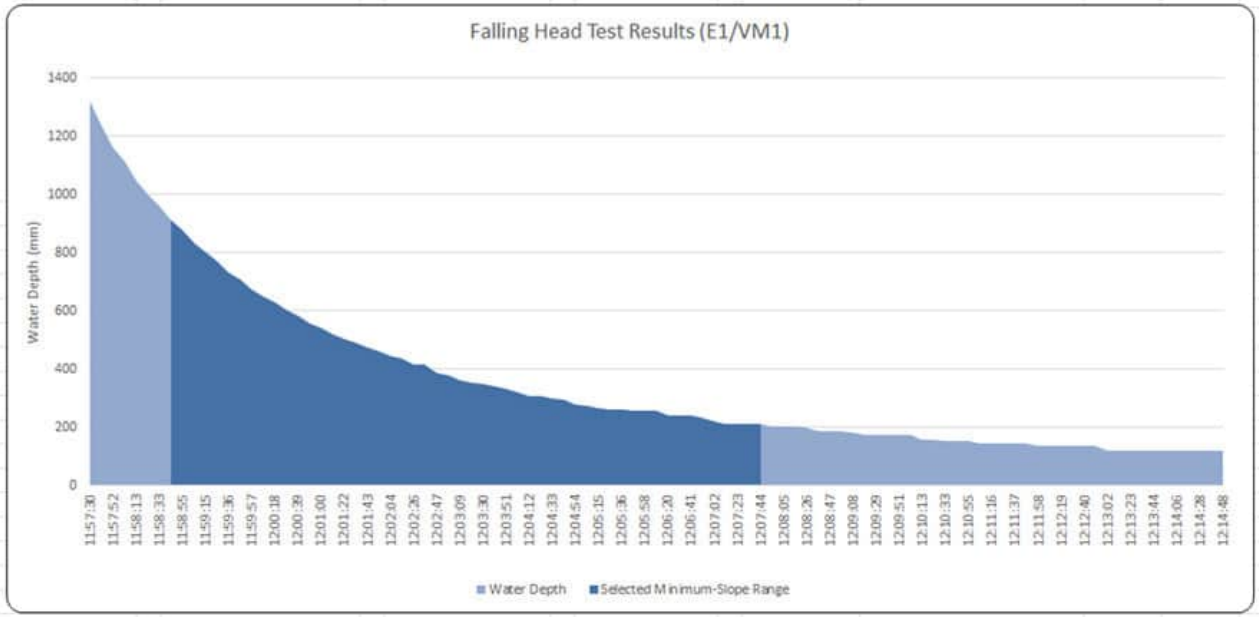
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Presoak Results:	
Start Time:	11:12:00
End time:	11:27:16
Duration (h:mm):	0:15
Volume(L):	145.62





Constant Head Test Results:	
Reynolds K Formula:	
$K = (Q/3600) / [\pi D(H + 1/\alpha) + \pi(D/2)^2]$	
Start Volume (L):	145.62
End Volume (L):	405.12
Volume Change (L):	259.5
Duration (minutes):	30
Flow Rate (L/min):	8.650
Q = Flow Rate (m³/hr):	0.519
D = Standpipe Diameter (m):	0.15
H = Measured Head (m):	1.2375
α = Alpha (m⁻¹):	36
K Hydraulic Conductivity (m/s):	0.000235
K Hydraulic Conductivity (mm/hr):	845
F(u) - Testing Uncertainty Factor:	1.2
K Design Rate (mm/hr):	704



Falling Head Test Results (E1/VM1):	
Falling Head Formula:	
Soakage Rate (mm/hr) = (Start water depth−End water depth) / Duration_minutes × 60	
Start Water Depth (mm):	1322
End Water Depth (mm):	119
Water Depth Change (mm):	1203.00
Duration (minutes):	17.30
Average soakage Rate (mm/hr):	4172
minimum slope start %:	8
minimum slope end %:	60
Avg. water depth selected (mm):	427
Min. slope Duration (min):	9.00
Min. slope distance change(mm):	701.00
Minimum slope:	4673.33
Factor of safety:	4
Infiltration rate(mm/hr):	1168

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SOAKAGE DATA REPORT

Site:	64 Otaihanga rd - Wetland 2
Client:	Engeo
Report Date:	09 September 2026
Test ID:	unit0004_20260908_1000
Revision:	R01

Purpose

This document presents the soakage test data for 64 Otaihanga rd - Wetland 2. Infiltration testing was conducted in accordance with NZ Building Code E1/VM1 methodology using automated volumetric equipment. Both constant head (Reynolds) and falling head (E1/VM1) results are reported.

This data is intended to support the design of on-site stormwater soakage systems. The soakage rate(s) reported may be used directly by the project engineer or designer for soak pit sizing calculations.





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1. Site & Test Data

1.1 Site Information

Test Date:	08 September 2026	**Soil Conditions:**	Coarse sand
Latitude:	-40.887681	**Hole Diameter:**	150 mm
Longitude:	175.012538	**Hole Depth:**	1200 mm
Groundwater:	Encountered at 600 mm	**Test ID:**	unit0004_20260908_1000

GPS coordinates recorded via automated testing equipment. Accuracy within approximately 3m radius.

1.2 Presoak Results

Presoak Start:	10:00:32
Presoak End:	10:17:11
Duration:	16m 39s
Volume Used:	56.4 L

Presoak terminated prior to the 4-hour minimum. Reason: groundwater encountered during presoak. The volume delivered is considered sufficient to saturate the surrounding soil for the test depth.

1.3 Infiltration Test Results

Constant Head Rate (K):	612 mm/hr
F(u) Testing Uncertainty Factor:	1.2
Constant Head Design Rate:	510 mm/hr

Soil conditions at the test depth were observed to be Coarse sand. The sorptive number $\alpha = 36\ m^{-1}$ has been selected based on the observed soil texture classification in accordance with Reynolds (2010) Table 1.

Falling Head Rate (min slope):	2698 mm/hr
Falling Head Safety Factor:	4
Falling Head Design Rate:	674 mm/hr

The falling head rate has been derived from the 5–40% segment of the drawdown curve, rather than the minimum slope at very low head, in accordance with E1/VM1 9.0.2(d), which permits the lower rates to be discarded where there is a marked decrease in soakage rate as the hole becomes nearly empty.

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2. Test Procedure & Methodology

2.1 Percolation Test Procedure (E1/VM1 9.0.2)

a) Bore test holes of 100 mm to 150 mm diameter to the depth of the proposed soak pit. If groundwater is encountered, this depth shall be taken as the depth of the soak pit.

b) Fill the hole with water and maintain full for at least 4 hours (unless soakage is so great that the hole completely drains in a short time).

c) Fill the hole with water to within 750 mm of ground level, and record the drop in water level against time, at intervals of no greater than 30 minutes, until the hole is almost empty, or over 4 hours, whichever is the shortest.

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2.2 Constant Head Test (Reynolds Method)

The constant head hydraulic conductivity is determined using the Reynolds (2010) steady-flow analysis for a cased borehole permeameter:

$$K = Q / [\pi D(H + 1/\alpha) + \pi(D/2)^2]$$

Where:

K = field-saturated hydraulic conductivity (m/s) Q = steady-state flow rate (m^3/s) D = casing internal diameter (m) H = constant water head in cased borehole (m) α = sorptive number (m^{-1}) — selected from soil texture classification per Reynolds (2010) Table 1.

The sorptive number α accounts for capillary effects in the soil surrounding the borehole. Higher values correspond to coarser-grained soils where gravity-driven flow dominates.

The hydraulic conductivity K is converted to mm/hr and reduced by the testing uncertainty factor F(u) per GD2021/007 Table 6 to derive the constant head design rate.

Reference: Reynolds W.D. 2010. Measuring Soil Hydraulic Properties Using a Cased Borehole Permeameter: Steady Flow Analyses, Vadose Zone Journal 9(3): 637-652.

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2.3 Automated Testing System

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2.4 References

- NZ Building Code Clause E1 – Surface Water, 1st Edition, Amendment 12 (Nov 2023)
- Verification Method E1/VM1
- Wellington Water Regional Standard for Water Services

2.5 Limitations

The soakage testing and associated calculations presented in this report relate only to the specific test location and ground conditions encountered at the time of testing.

The presoak procedure was undertaken in accordance with NZBC E1/VM1 methodology and is intended to saturate the soil profile surrounding the test bore to simulate storm loading conditions at the tested depth. Groundwater conditions encountered during testing are recorded in Section 1 of this report. However, this testing does not constitute long-term groundwater monitoring, and seasonal groundwater fluctuations may occur. Verification of minimum groundwater separation at the time of construction remains the responsibility of the developer and/or contractor.

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Soak Test Results

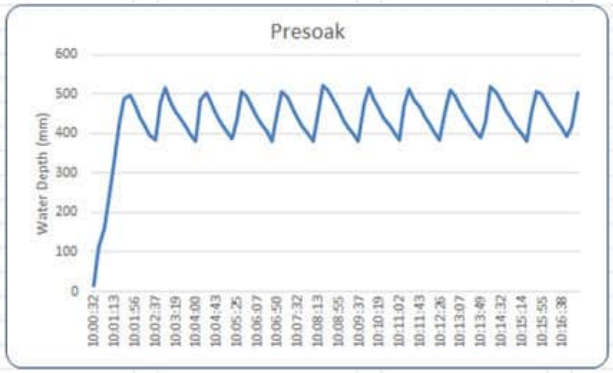
Date test conducted:	2026-09-08
Time started:	10:00:31
Latitude:	-40.887681
Longitude:	175.012538
Test ID:	unit0004_20260908_1000

Test Hole Dia.(m):	0.15
Area = π × (D/2)² (m²):	0.0177
Depth of hole(m):	1.200
Benchmark to sensor (m):	1.762
Head (m):	0.452

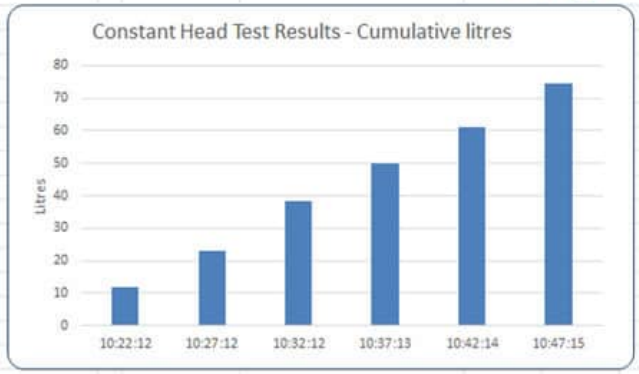
Client:	Engeo
Address:	64 Otaihanga rd - Wetland 2
Test by:	Soakage Testing Ltd
Soil Conditions:	**Coarse sand**

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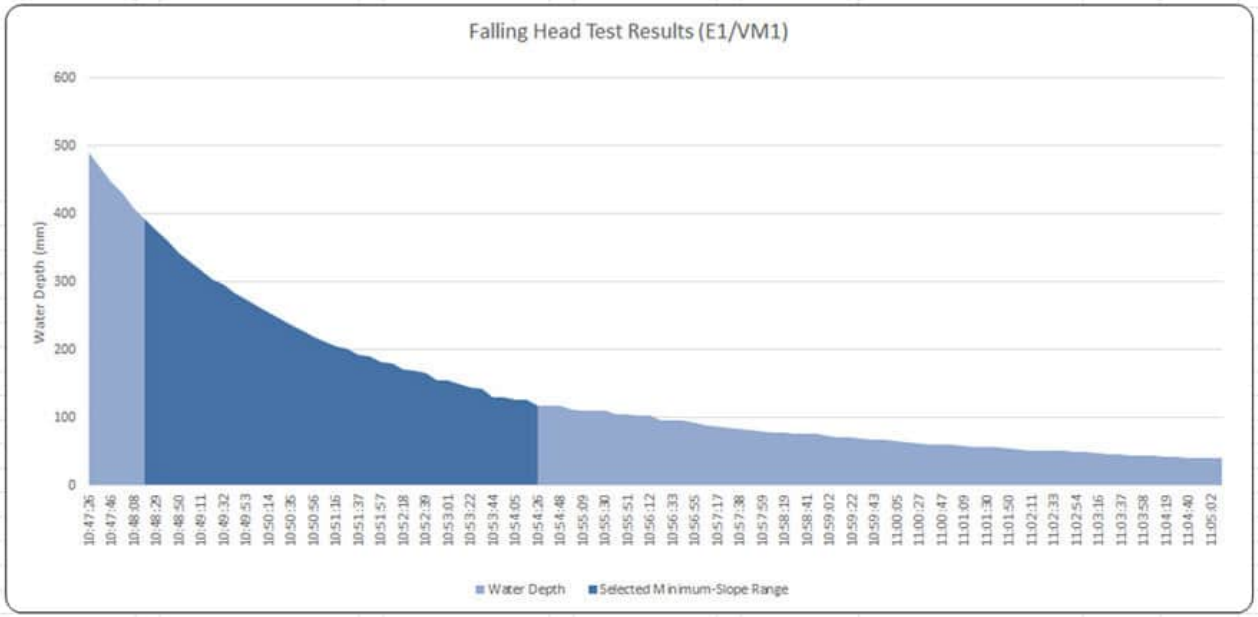
Presoak Results:	
Start Time:	10:00:32
End time:	10:17:11
Duration (h:mm):	0:16
Volume(L):	56.35



Constant Head Test Results:	
Reynolds K Formula:	
$K = (Q/3600) / [\pi D(H + 1/\alpha) + \pi(D/2)^2]$	
Start Volume (L):	56.35
End Volume (L):	130.95
Volume Change (L):	74.6
Duration (minutes):	30
Flow Rate (L/min):	2.487
Q = Flow Rate (m³/hr):	0.149
D = Standpipe Diameter (m):	0.15
H = Measured Head (m):	0.4523
α = Alpha (m⁻¹):	36
K Hydraulic Conductivity (m/s):	0.000170
K Hydraulic Conductivity (mm/hr):	612
F(u) - Testing Uncertainty Factor:	1.2
K Design Rate (mm/hr):	**510**



Falling Head Test Results (E1/VM1):	
Falling Head Formula:	
Soakage Rate (mm/hr) = (Start water depth−End water depth) / Duration_minutes × 60	
Start Water Depth (mm):	491
End Water Depth (mm):	40
Water Depth Change (mm):	451.00
Duration (minutes):	17.78
Average soakage Rate (mm/hr):	**1522**
minimum slope start %:	5
minimum slope end %:	40
Avg. water depth selected (mm):	222
Min. slope Duration (min):	6.12
Min. slope distance change(mm):	275.00
Minimum slope:	2697.55
Factor of safety:	4
Infiltration rate(mm/hr):	**674**



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Appendix 4:

Liquefaction Analysis

ENGEO
20B Newton Street
Mount Maunganui
3116

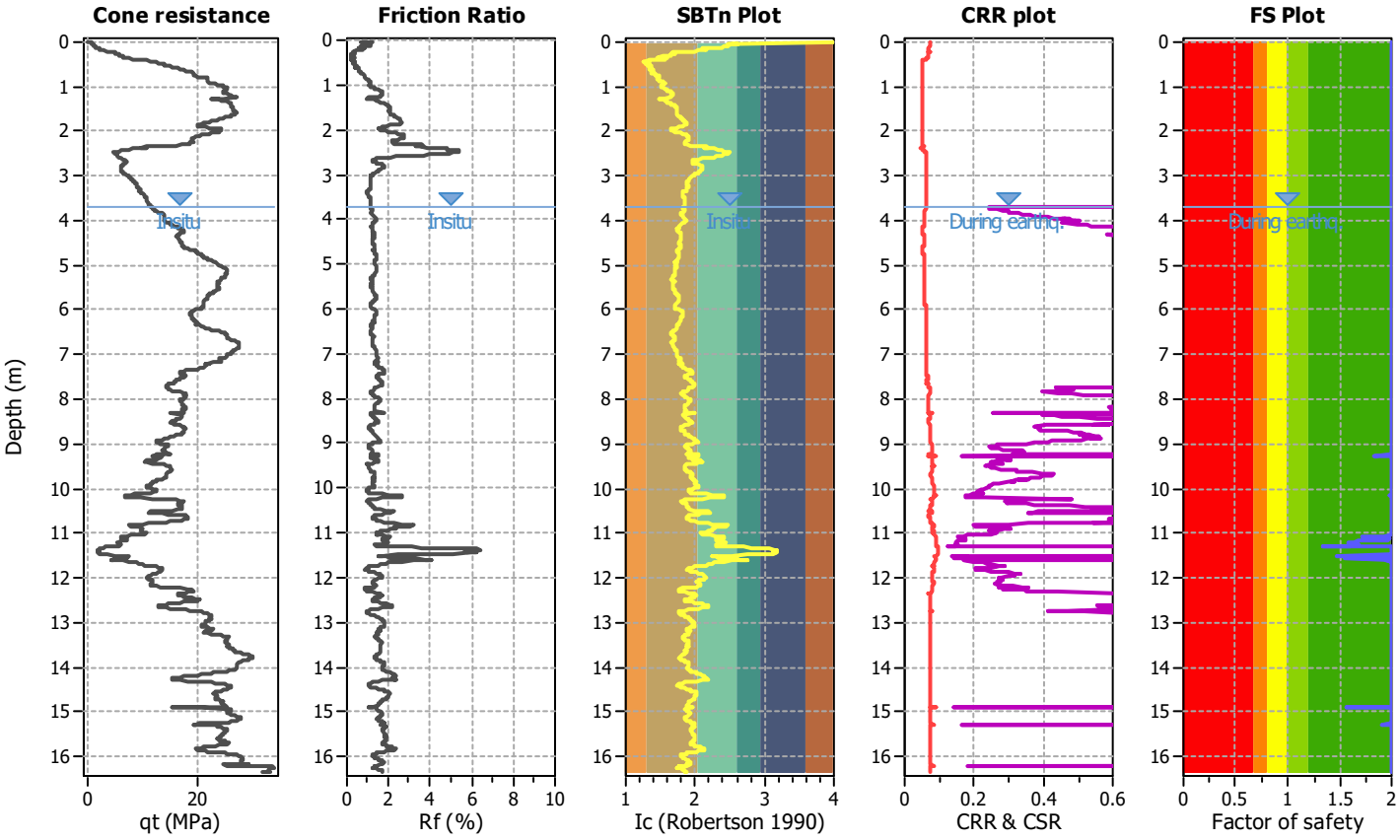
LIQUEFACTION ANALYSIS REPORT

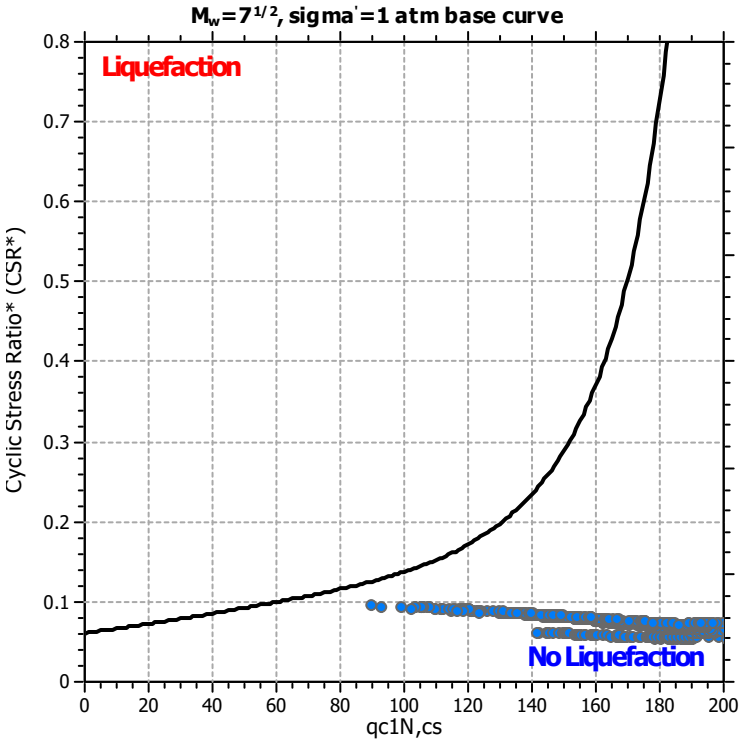
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

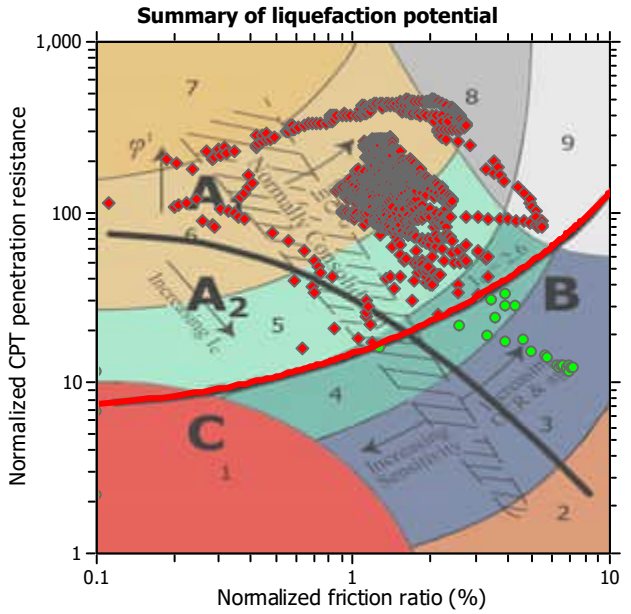
CPT file : CPT01

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	3.70 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

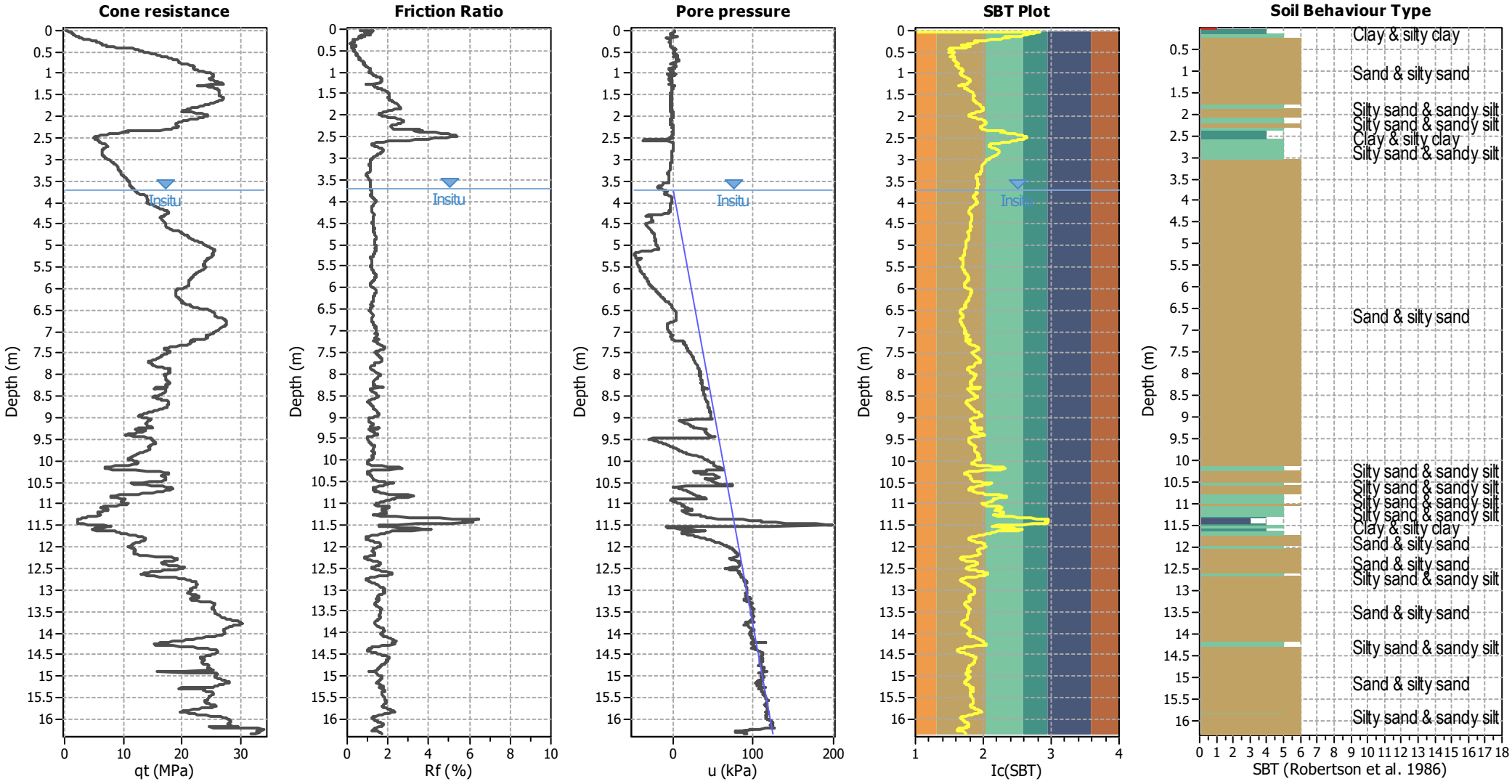






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



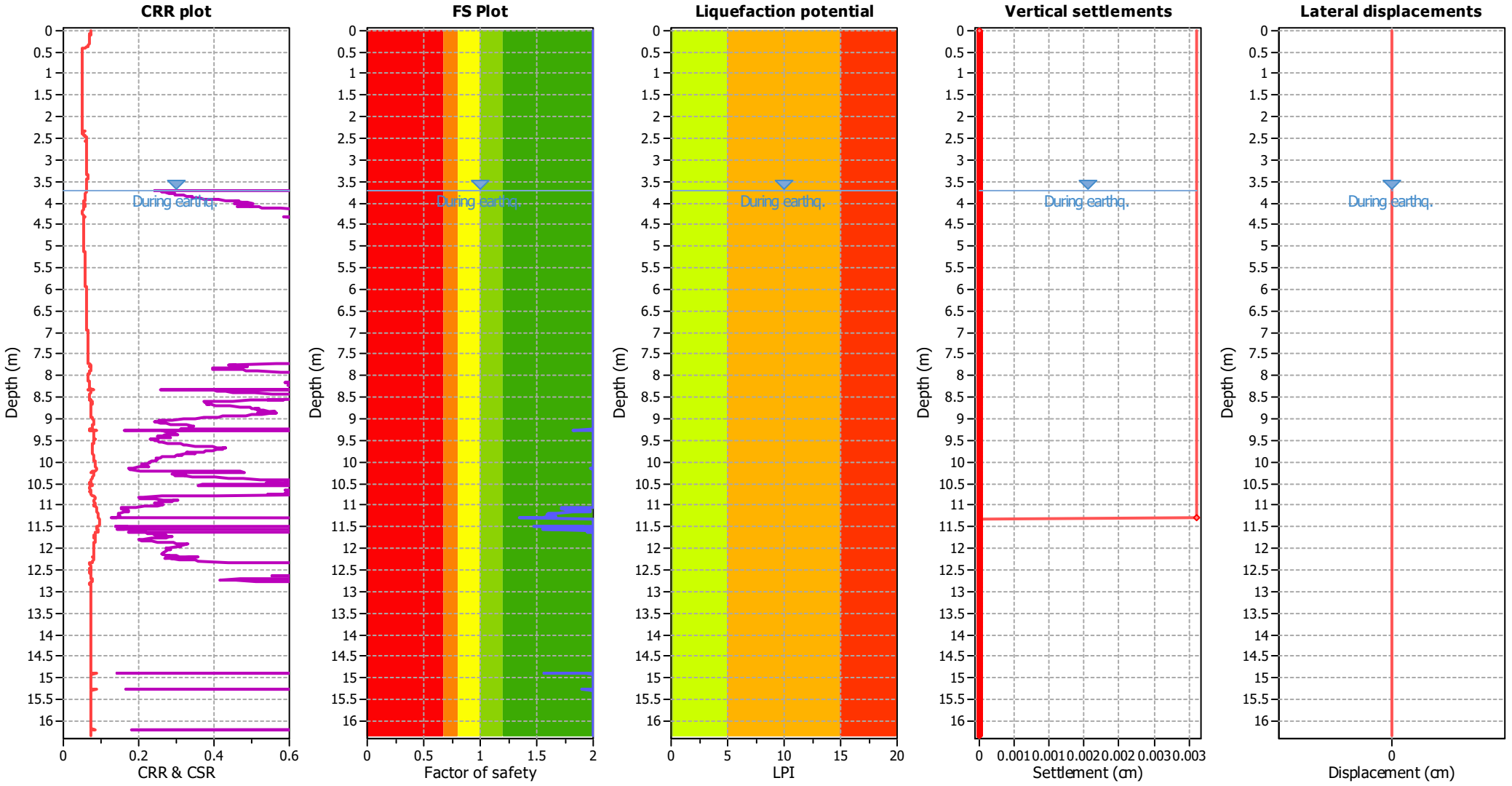
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	3.70 m	Fill height:	N/A	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	3.70 m	Fill height:	N/A	Limit depth:	N/A

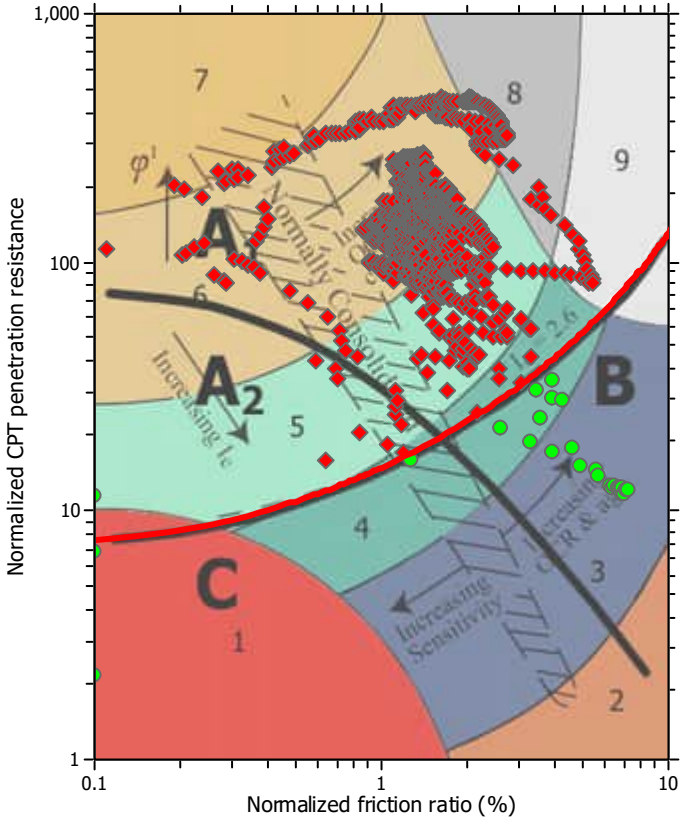
F.S. color scheme

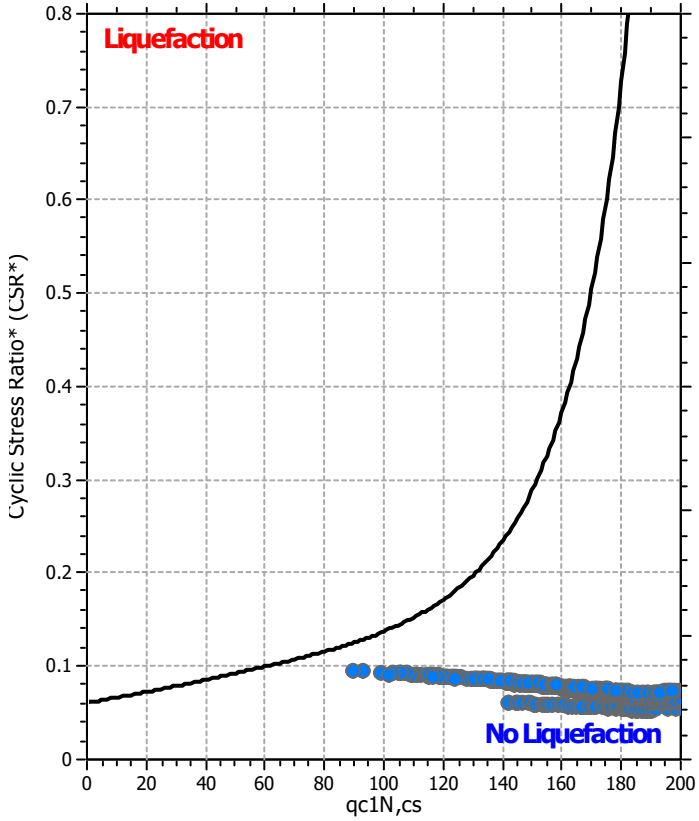
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

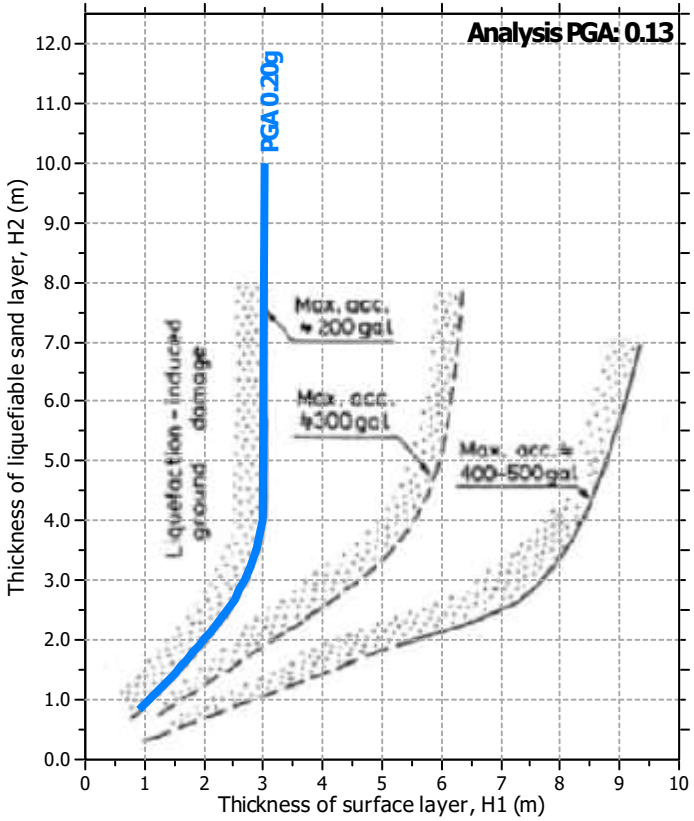
LPI color scheme

- 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.):	3.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	3.70 m	Fill height:	N/A	Limit depth:	N/A

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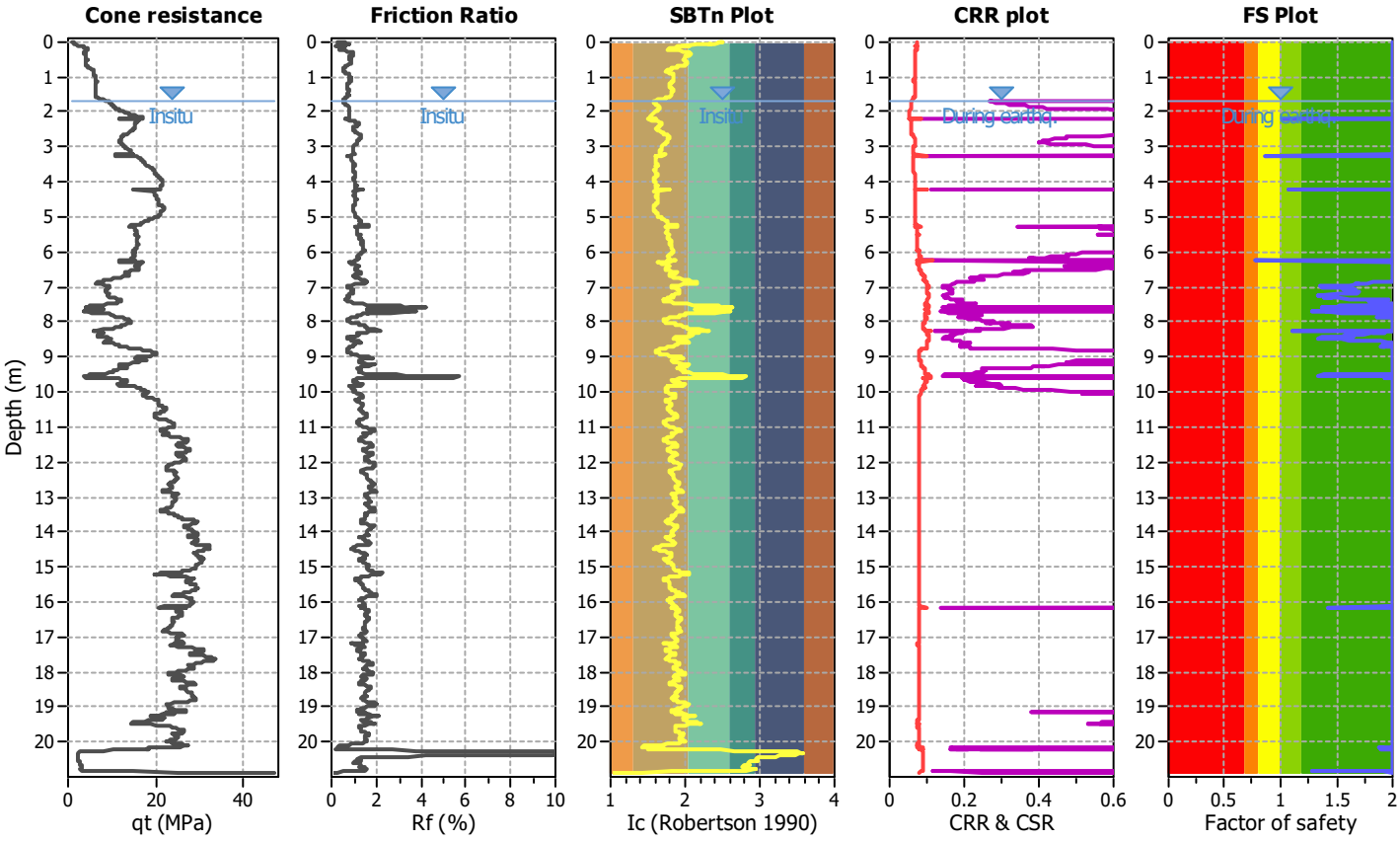
LIQUEFACTION ANALYSIS REPORT

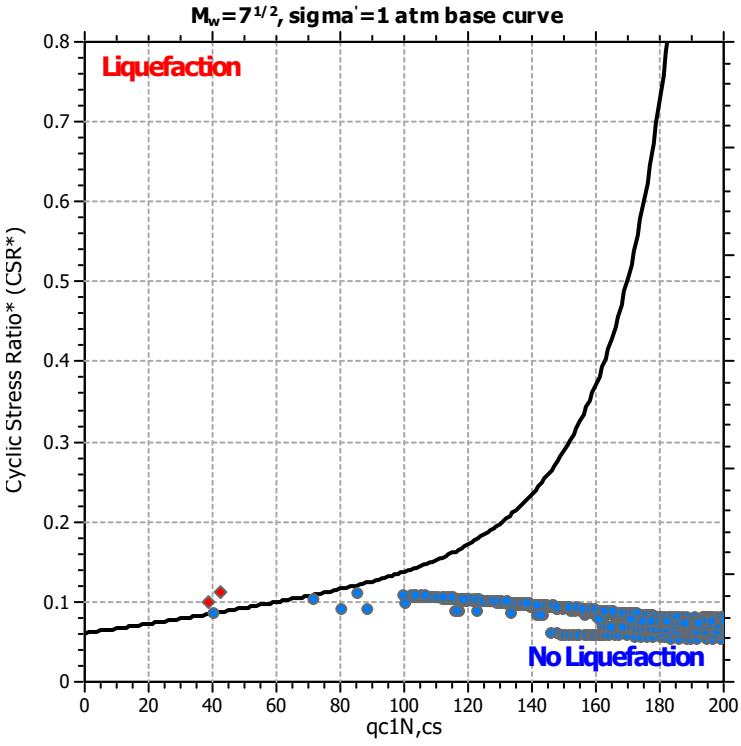
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

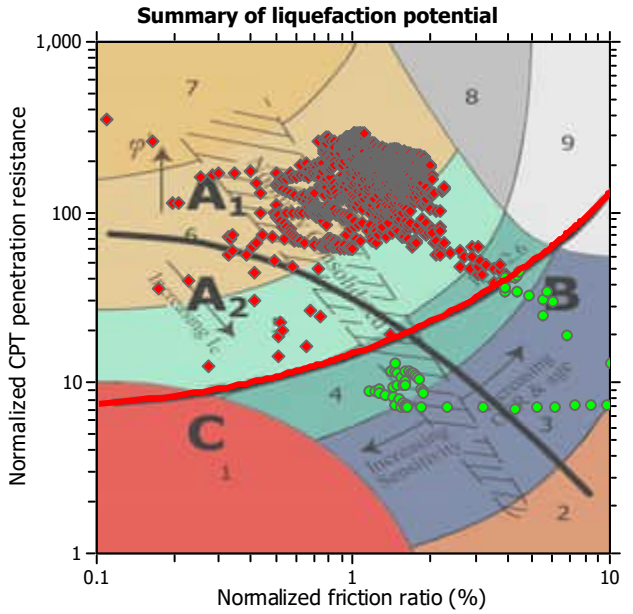
CPT file : CPT02

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

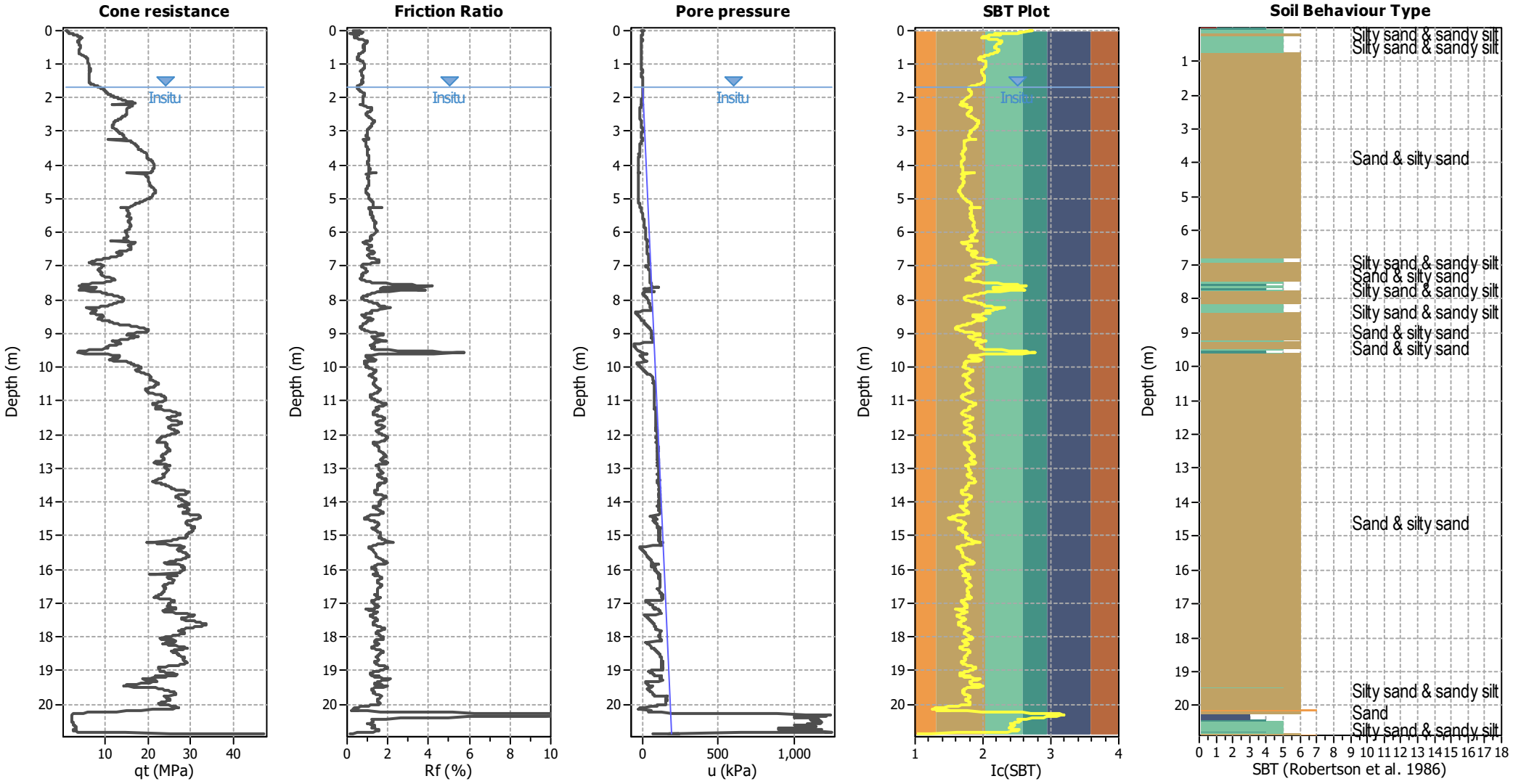






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



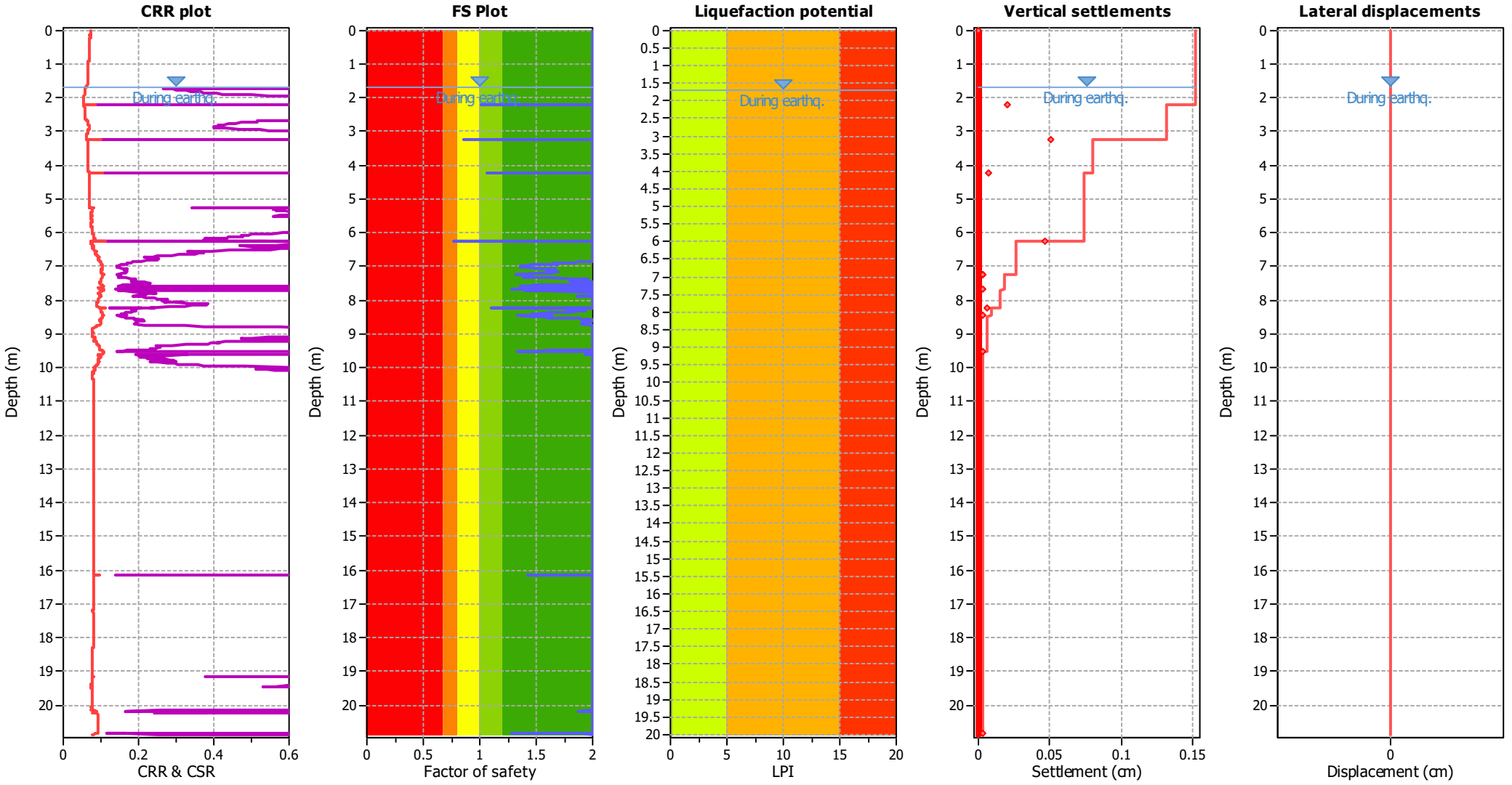
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	N/A

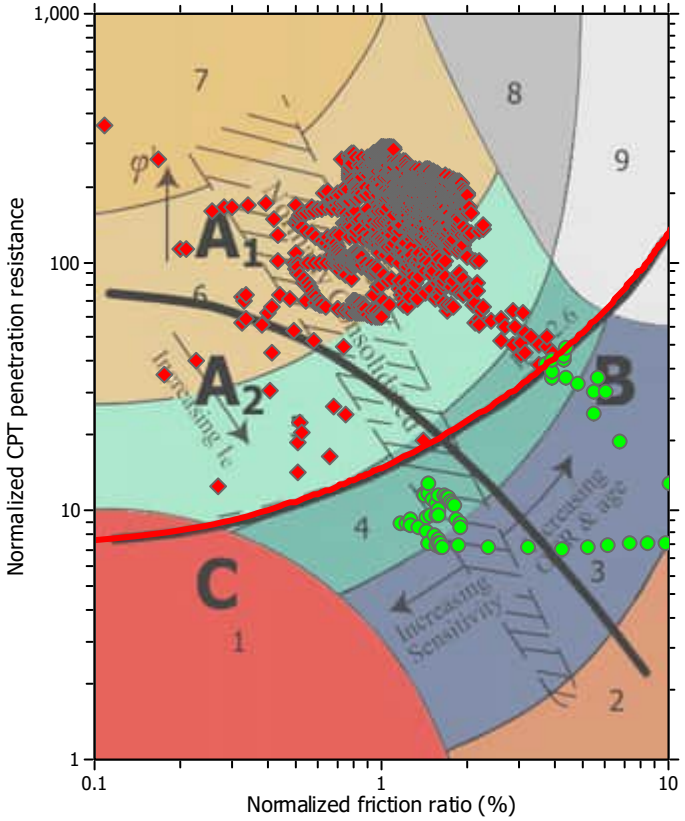
F.S. color scheme

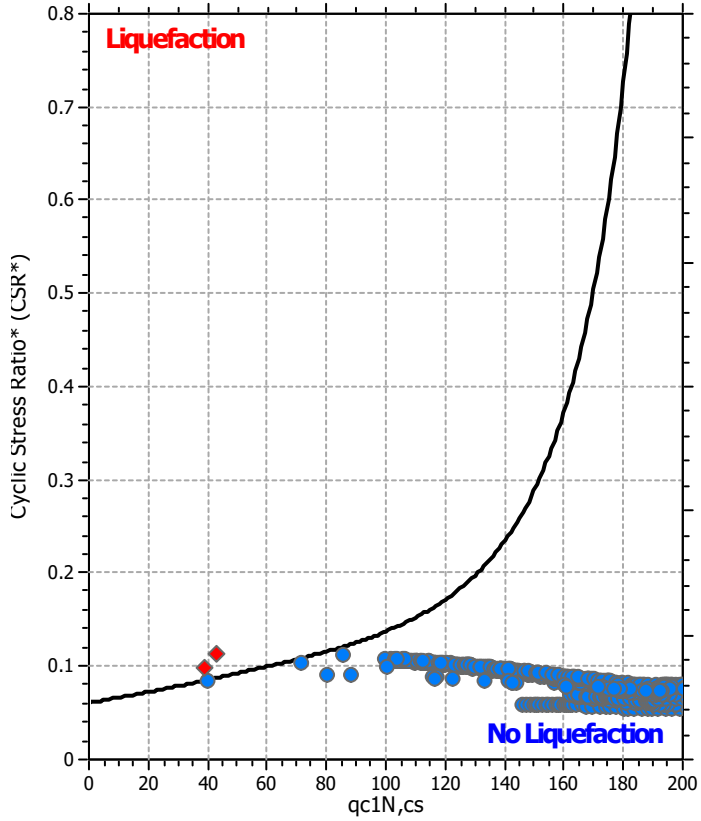
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

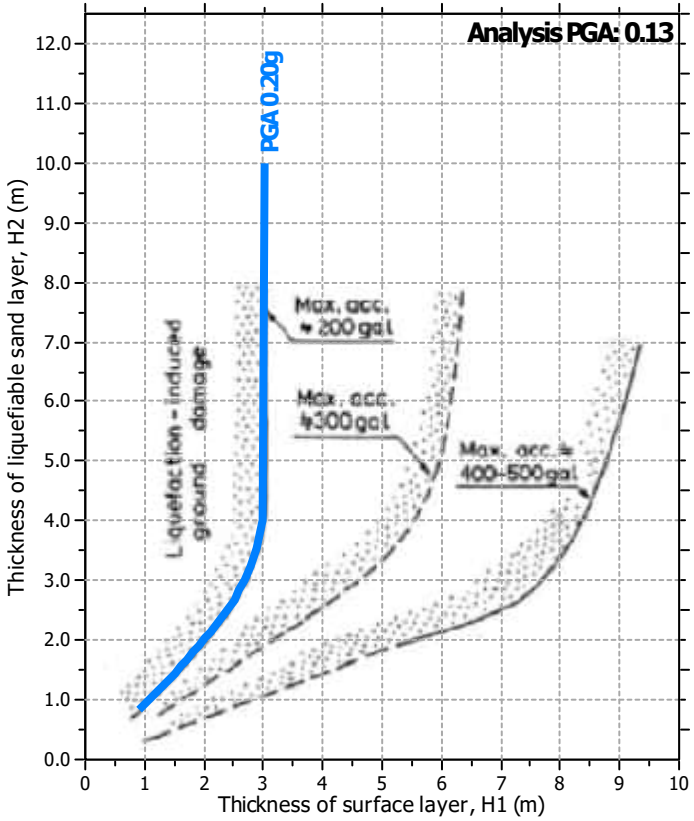
LPI color scheme

- 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.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	N/A

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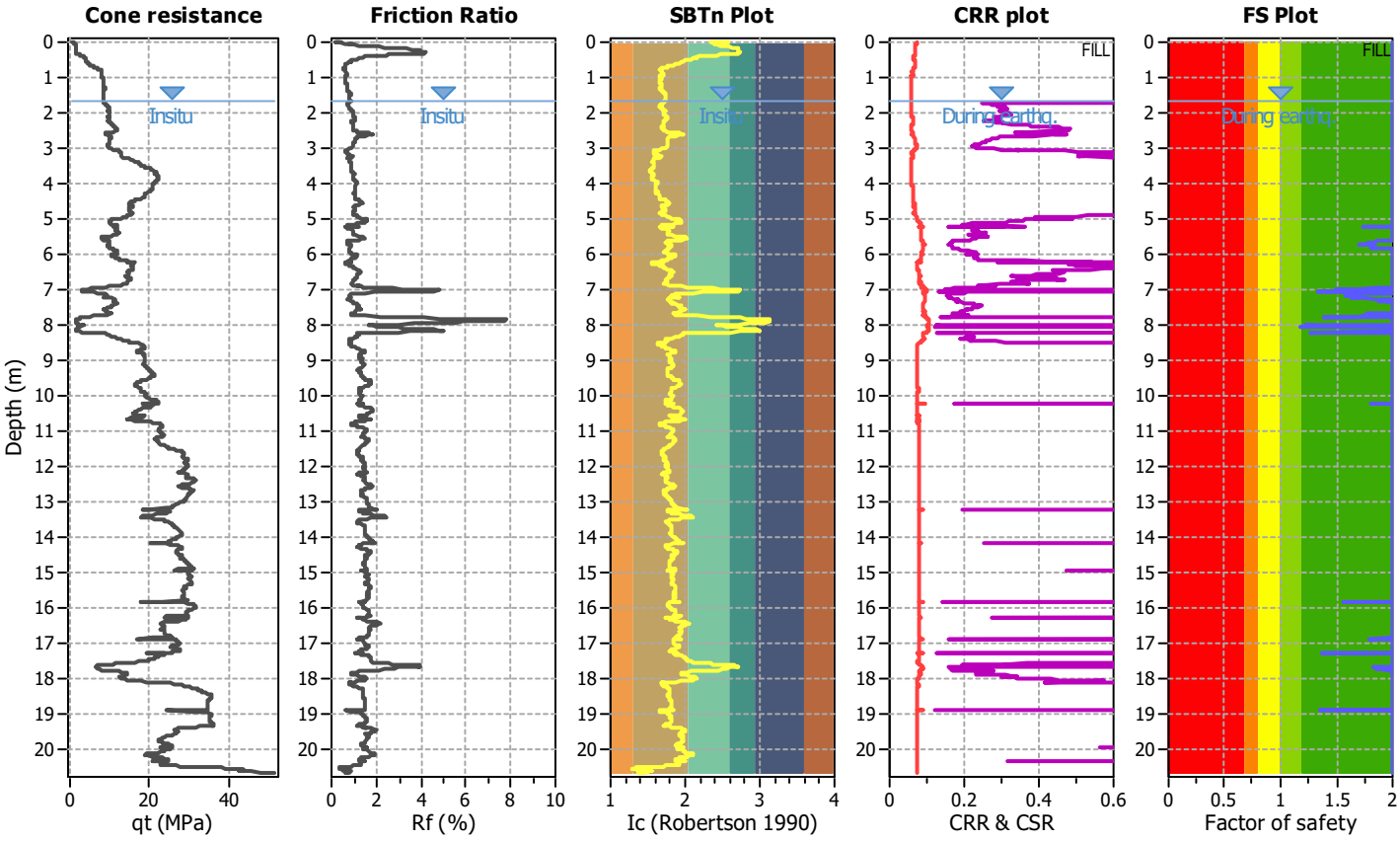
LIQUEFACTION ANALYSIS REPORT

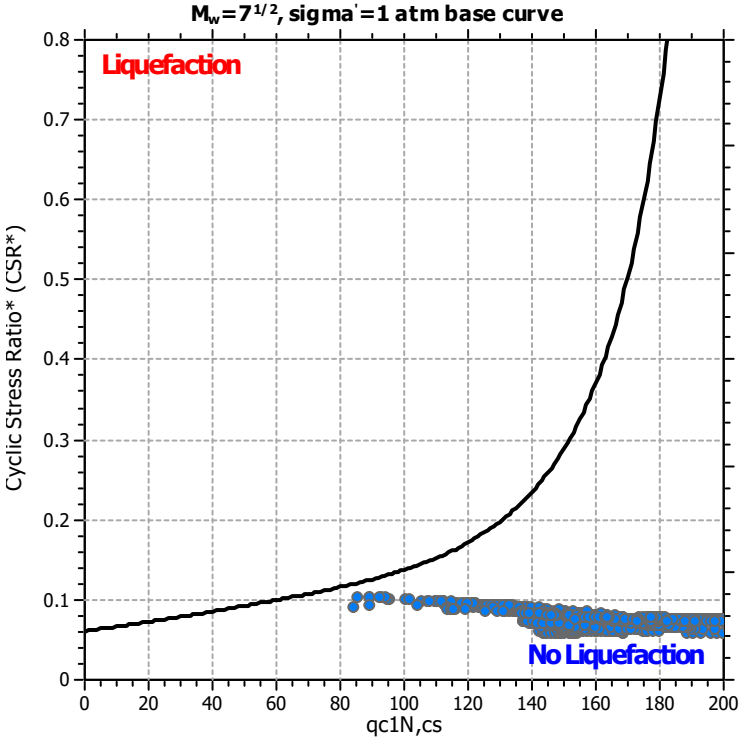
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

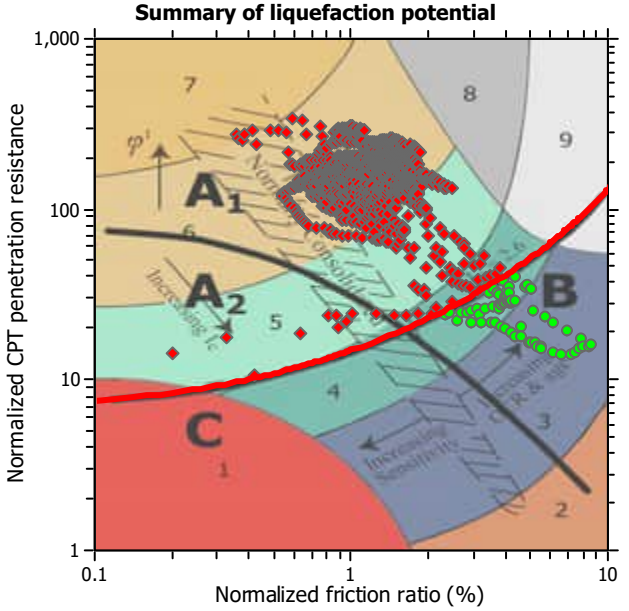
CPT file : CPT03

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.70 m	Fill height:	1.00 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

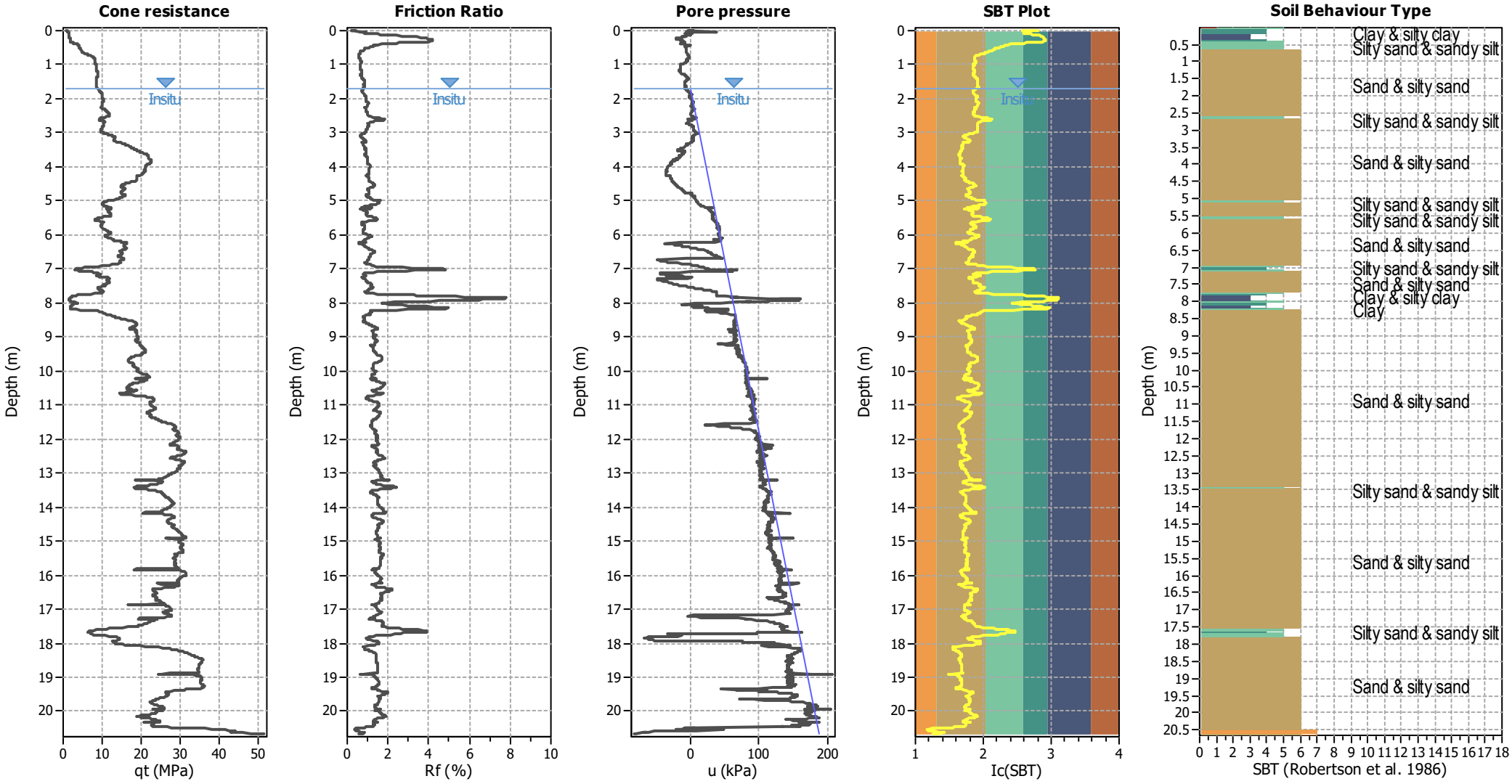






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



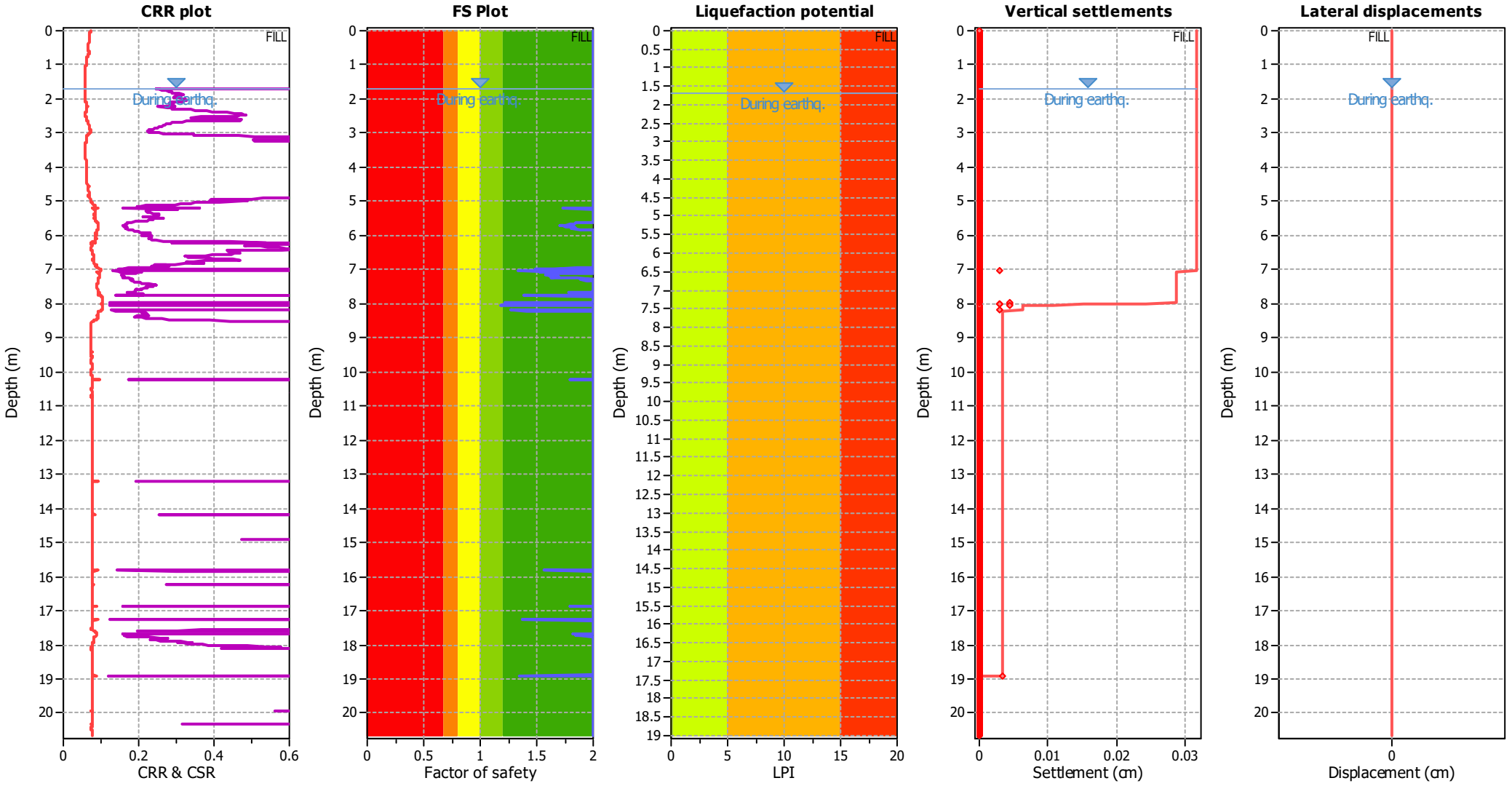
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.70 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	1.00 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.70 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	1.00 m	Limit depth:	N/A

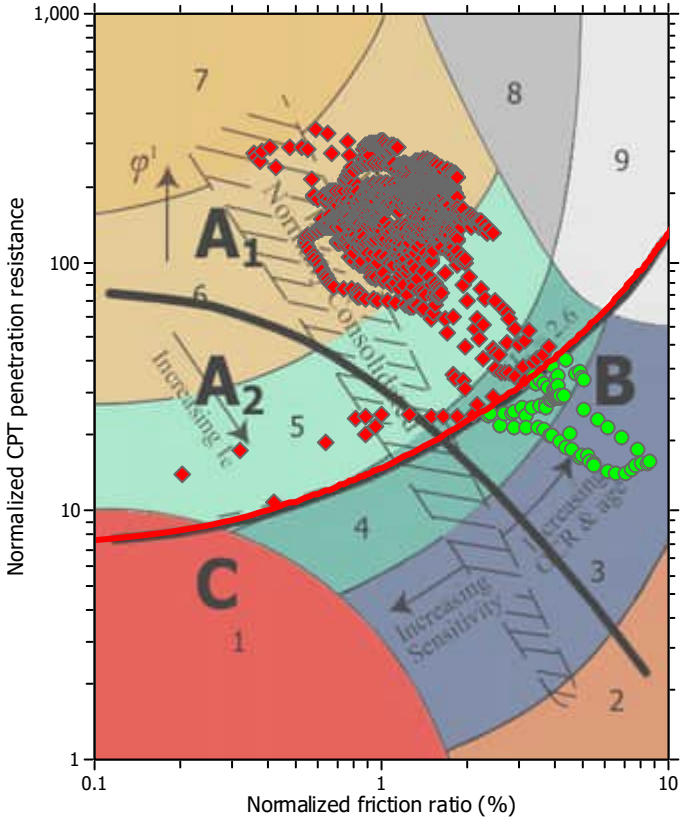
F.S. color scheme

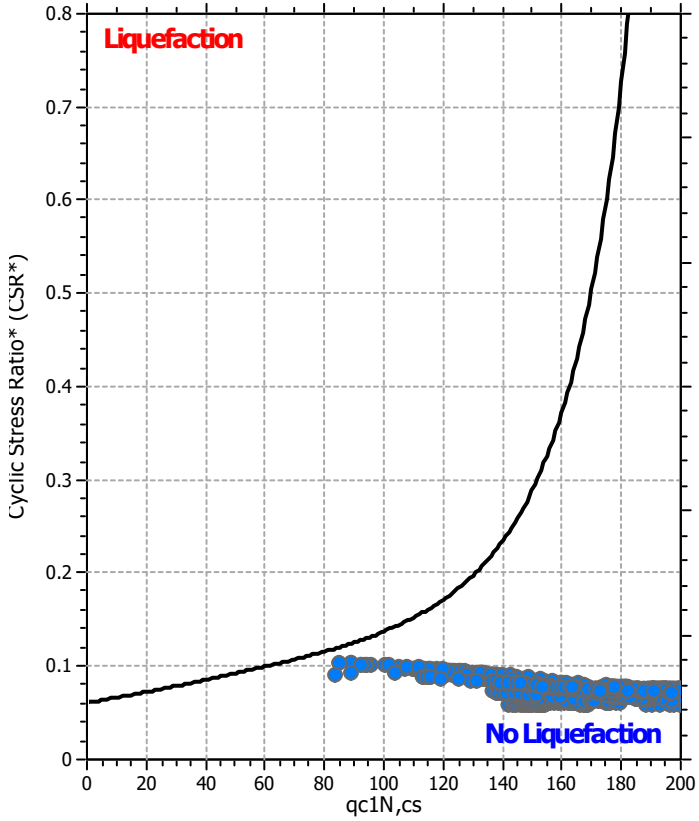
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

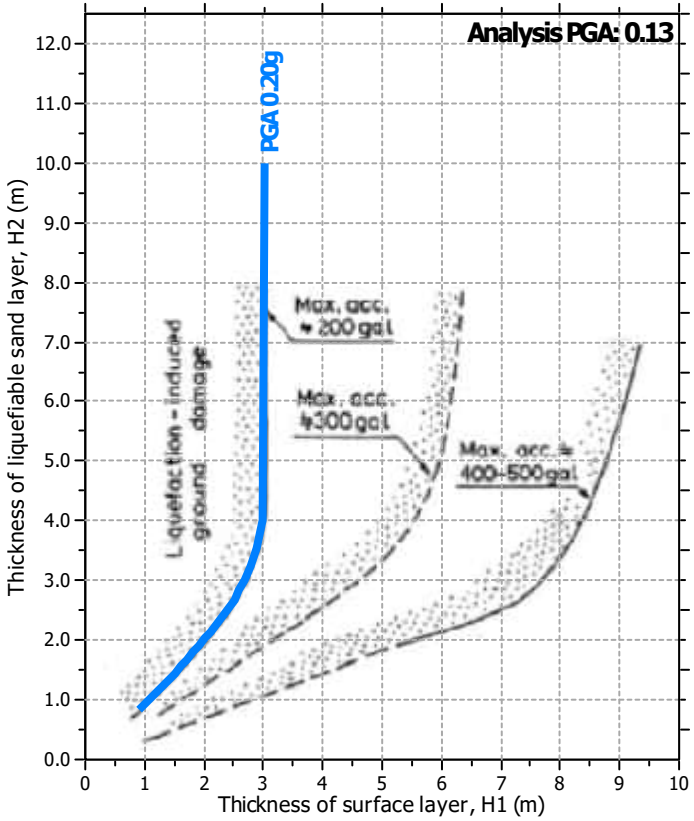
LPI color scheme

- 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.):	2.70 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	1.00 m	Limit depth:	N/A

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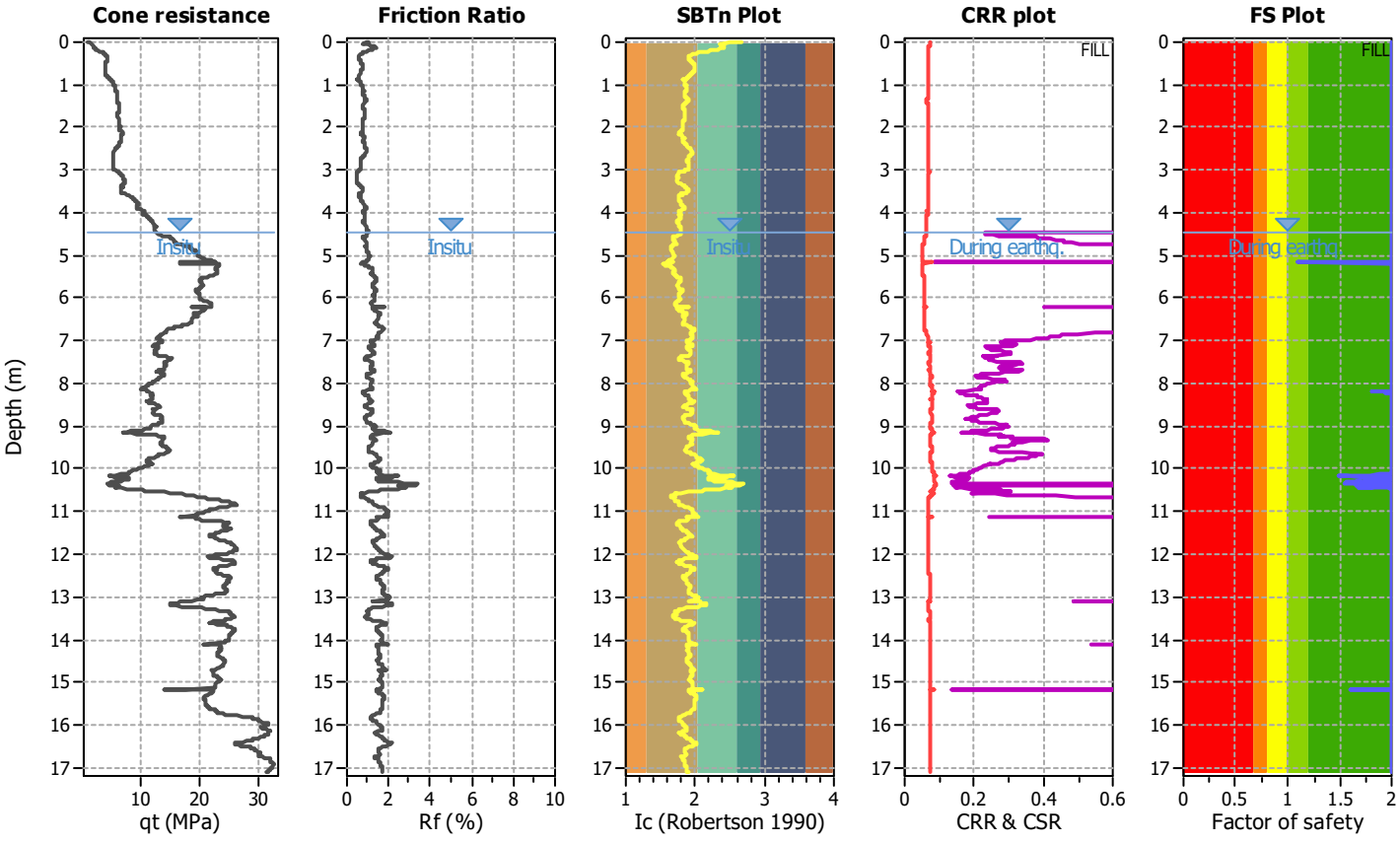
LIQUEFACTION ANALYSIS REPORT

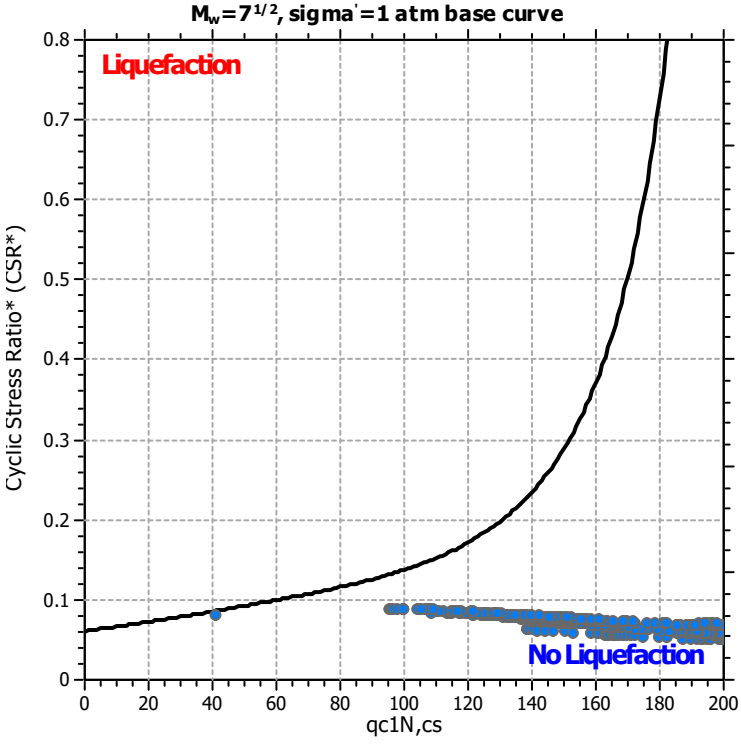
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

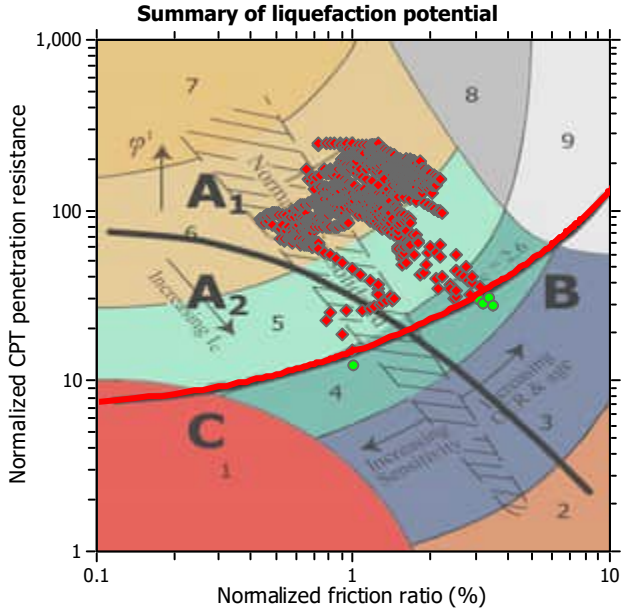
CPT file : CPT04

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	4.47 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	4.82 m	Fill height:	0.35 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

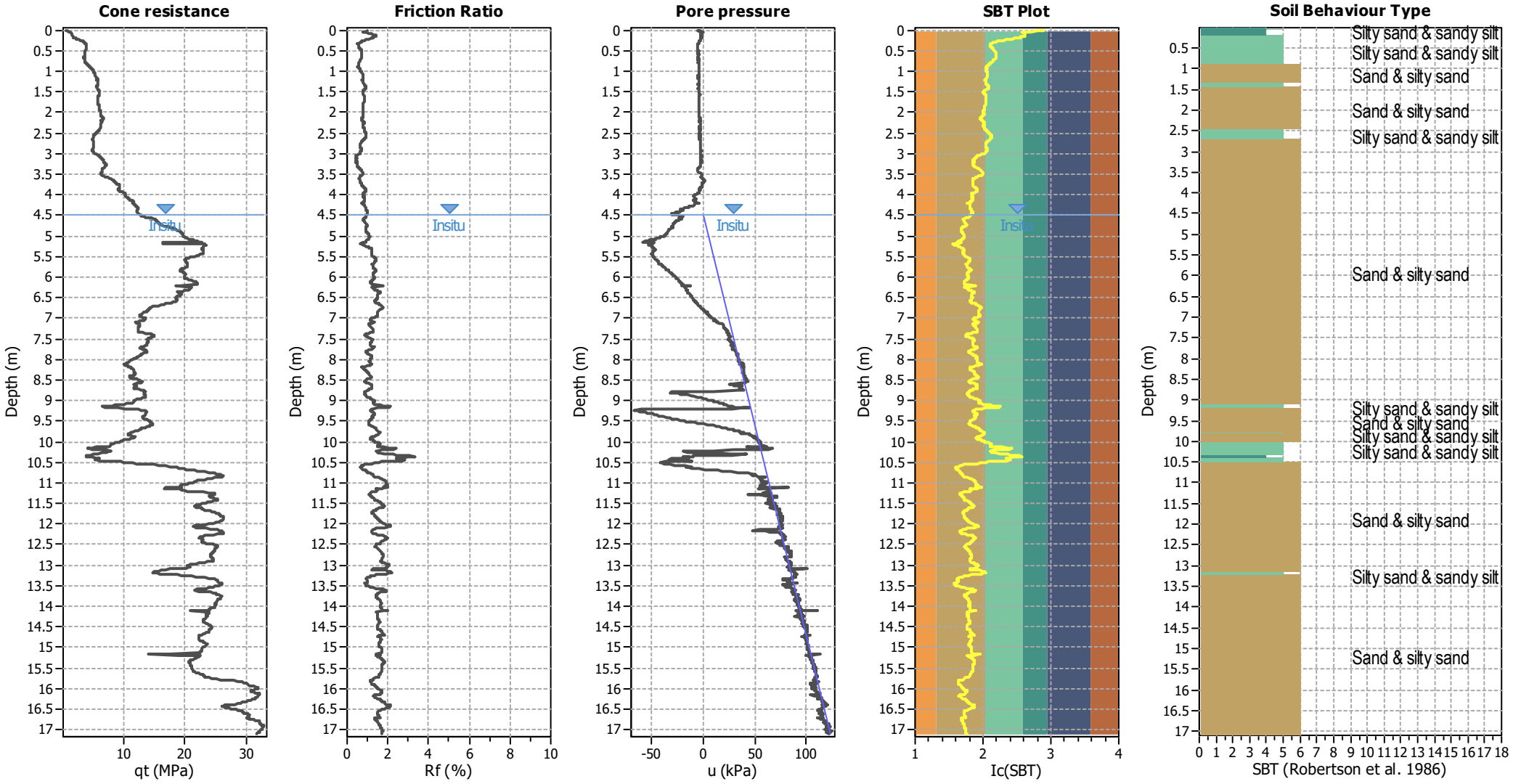






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



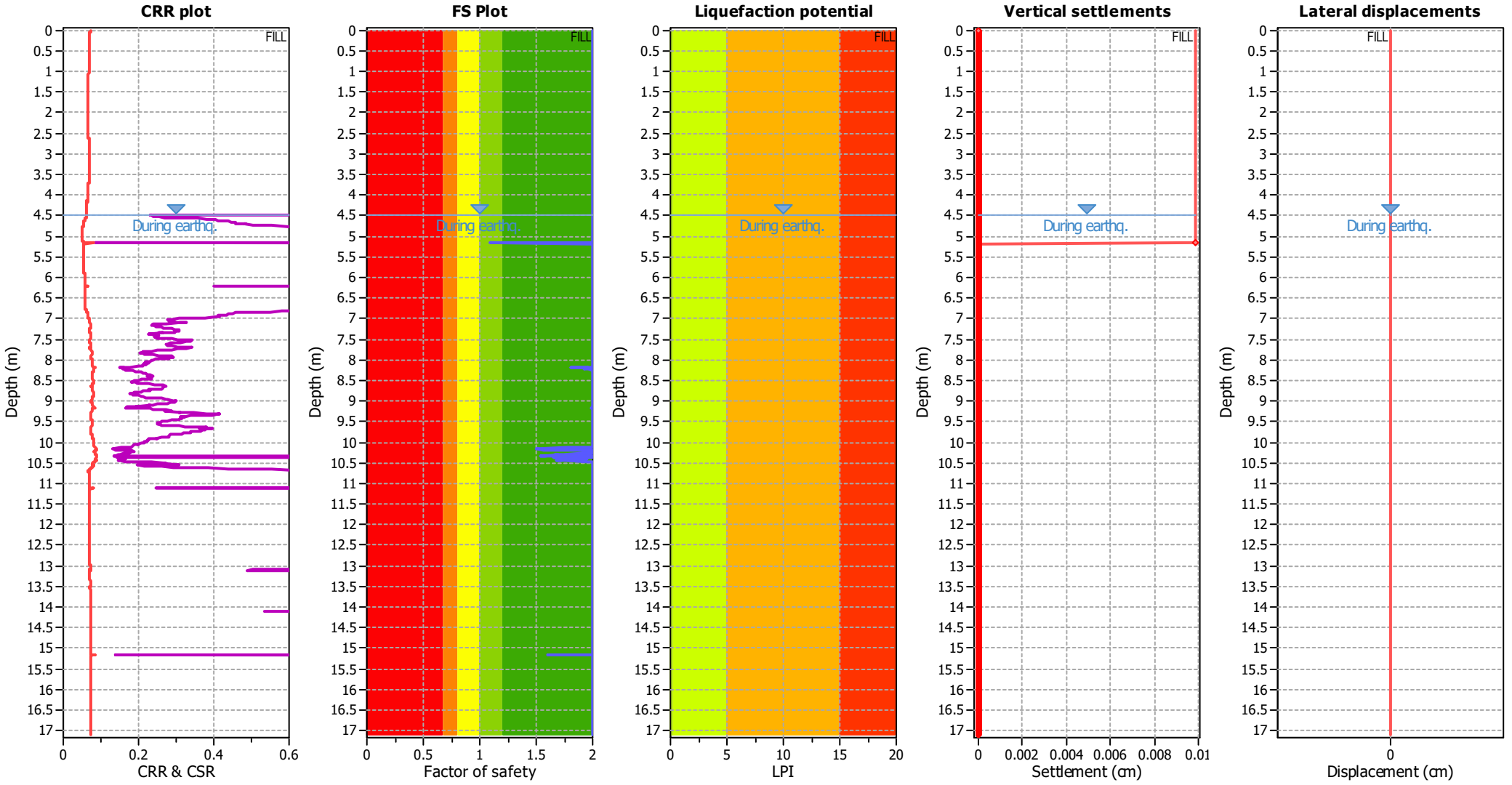
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	4.82 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	4.47 m	Fill height:	0.35 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	4.82 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	4.47 m	Fill height:	0.35 m	Limit depth:	N/A

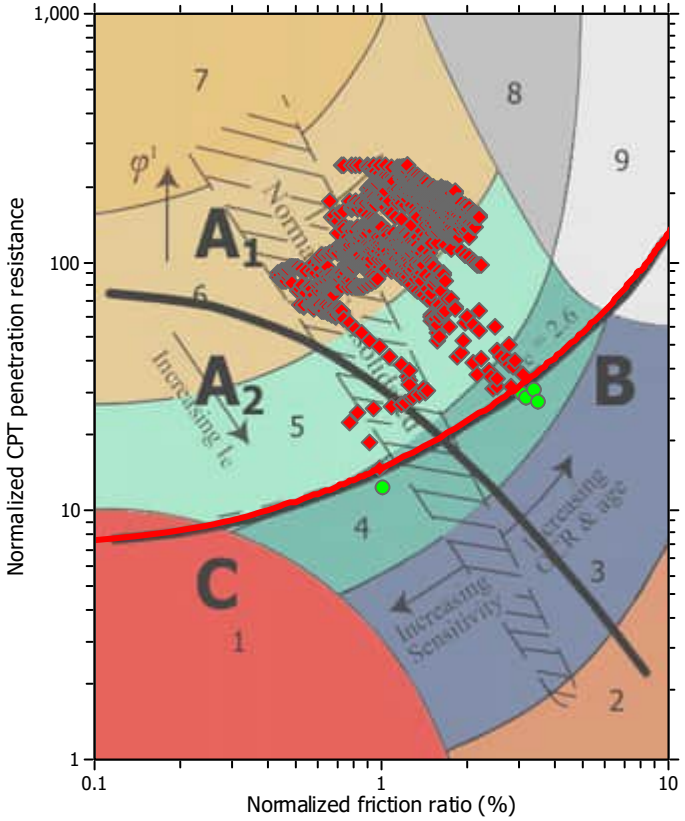
F.S. color scheme

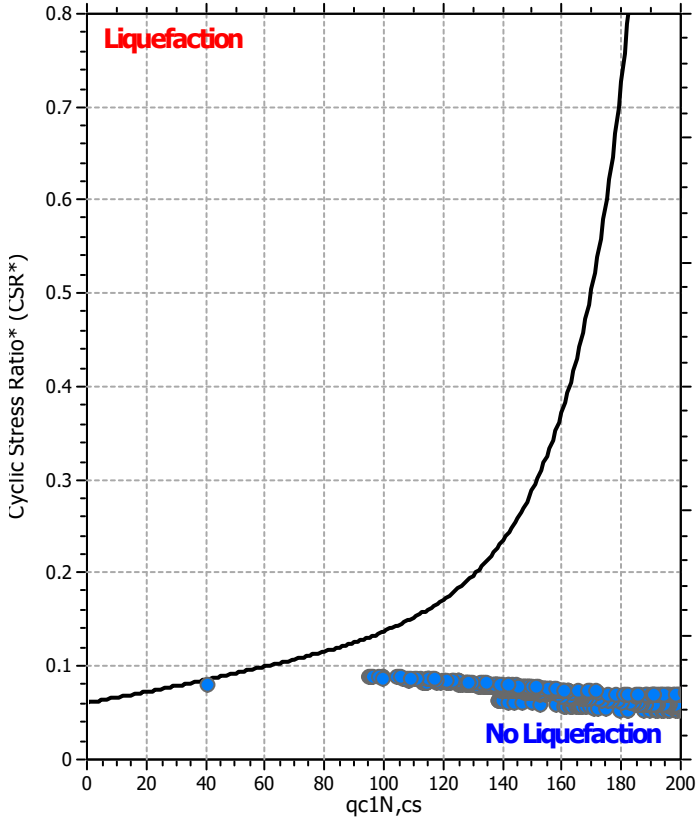
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

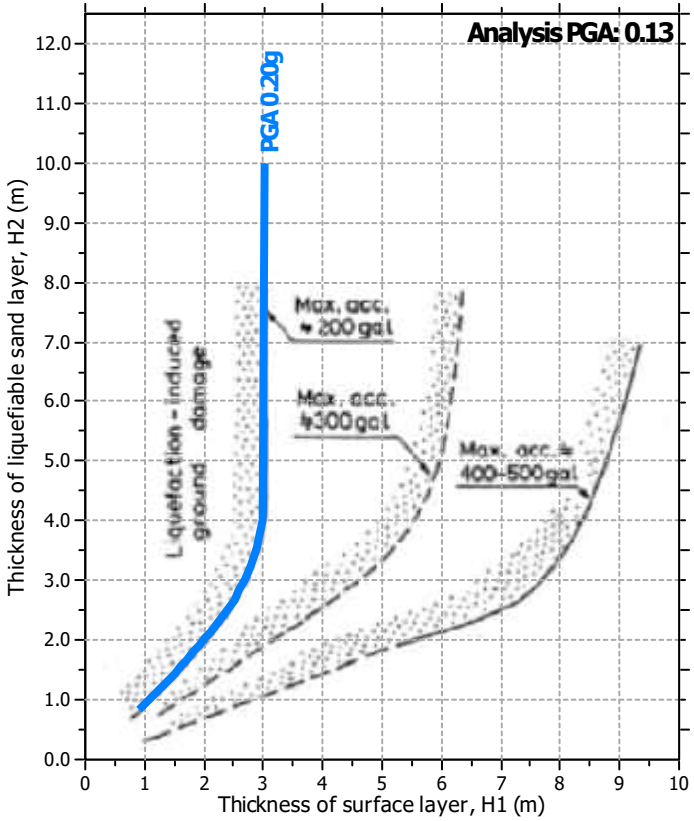
LPI color scheme

- 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.):	4.82 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	4.47 m	Fill height:	0.35 m	Limit depth:	N/A

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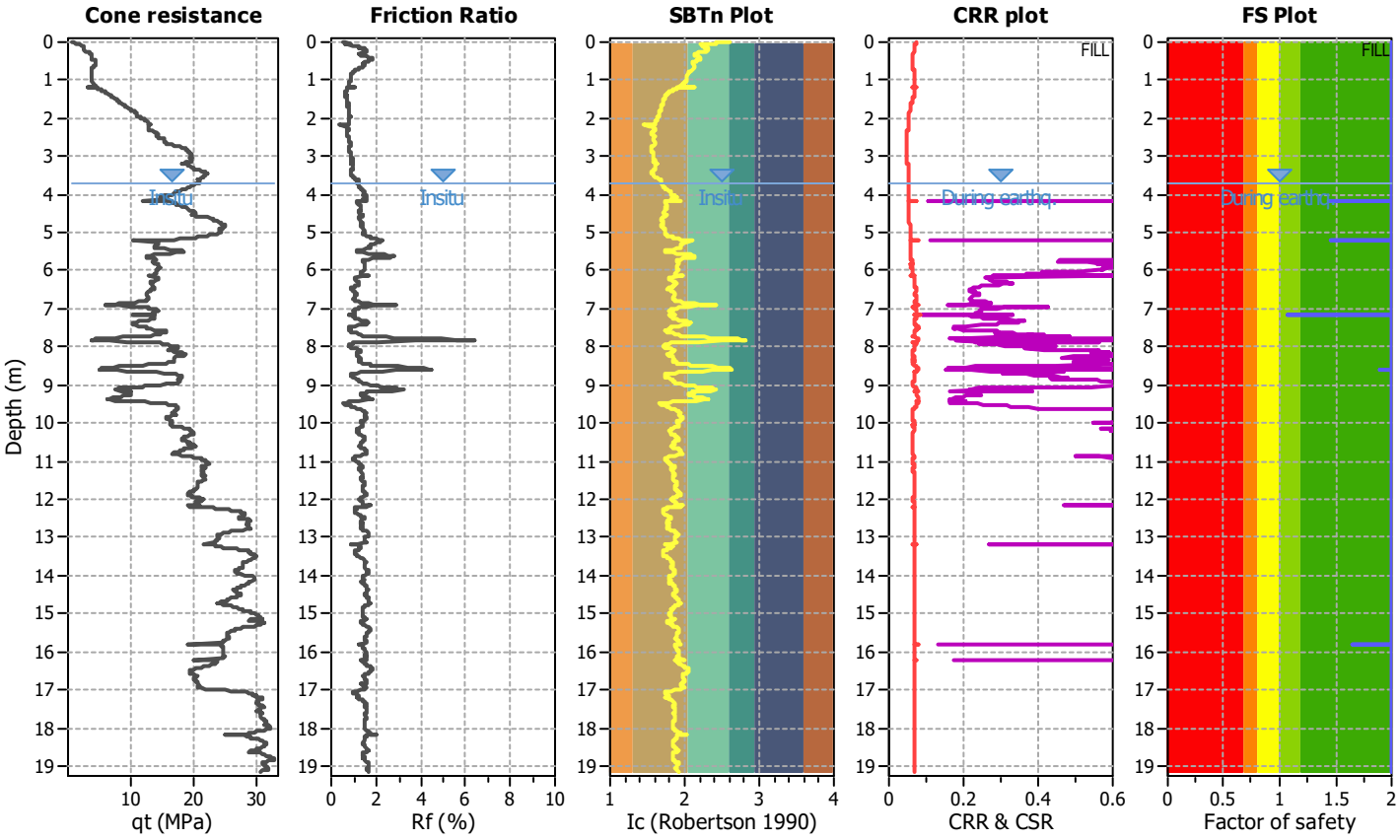
LIQUEFACTION ANALYSIS REPORT

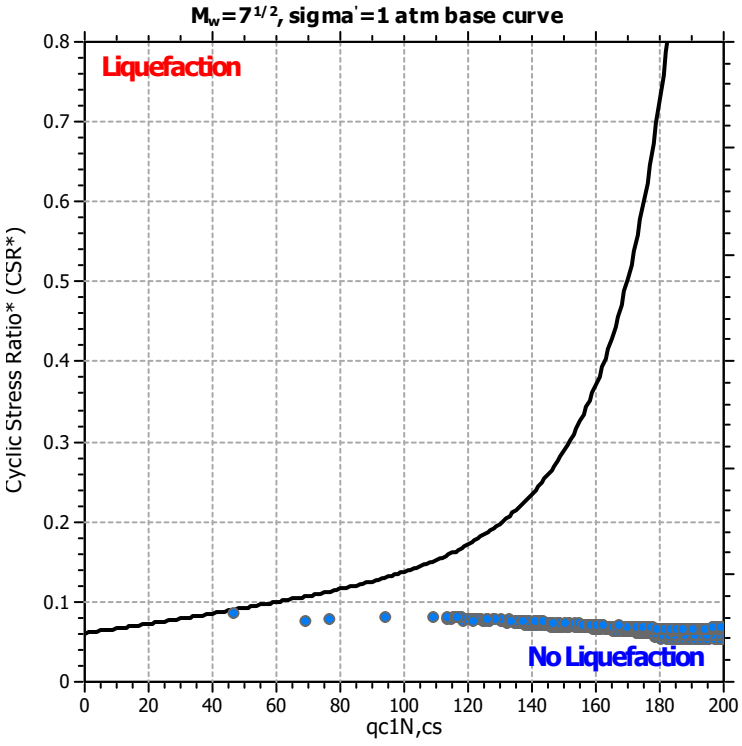
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

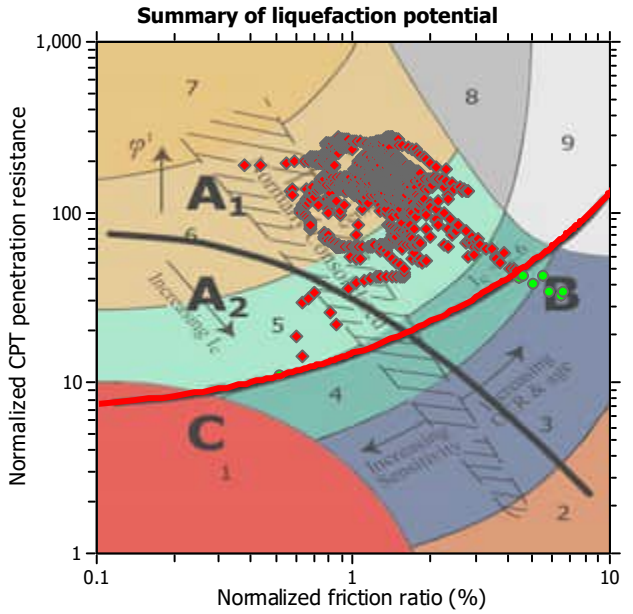
CPT file : CPT05

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.72 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	6.22 m	Fill height:	2.50 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

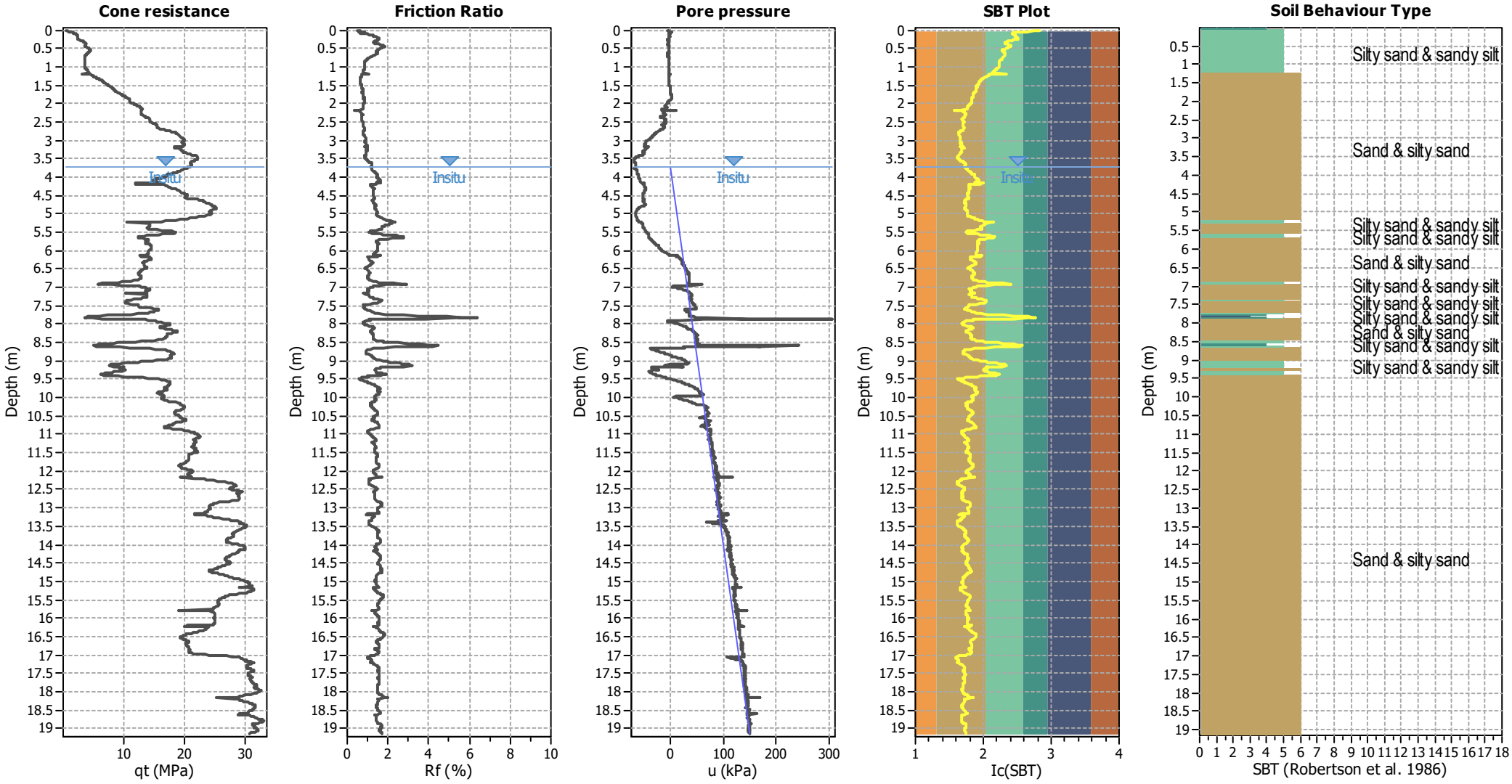






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



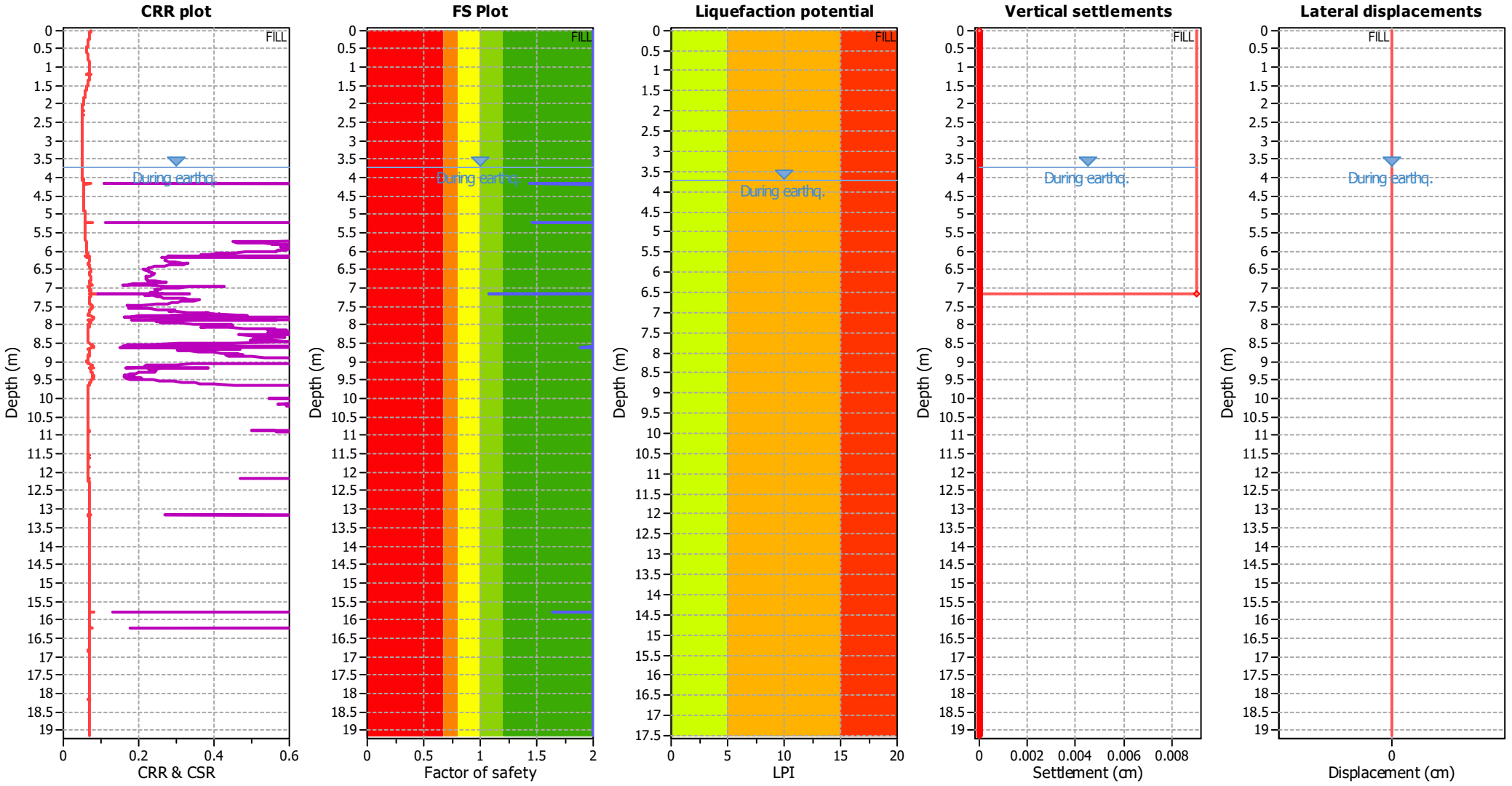
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	3.72 m	Fill height:	2.50 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	3.72 m	Fill height:	2.50 m	Limit depth:	N/A

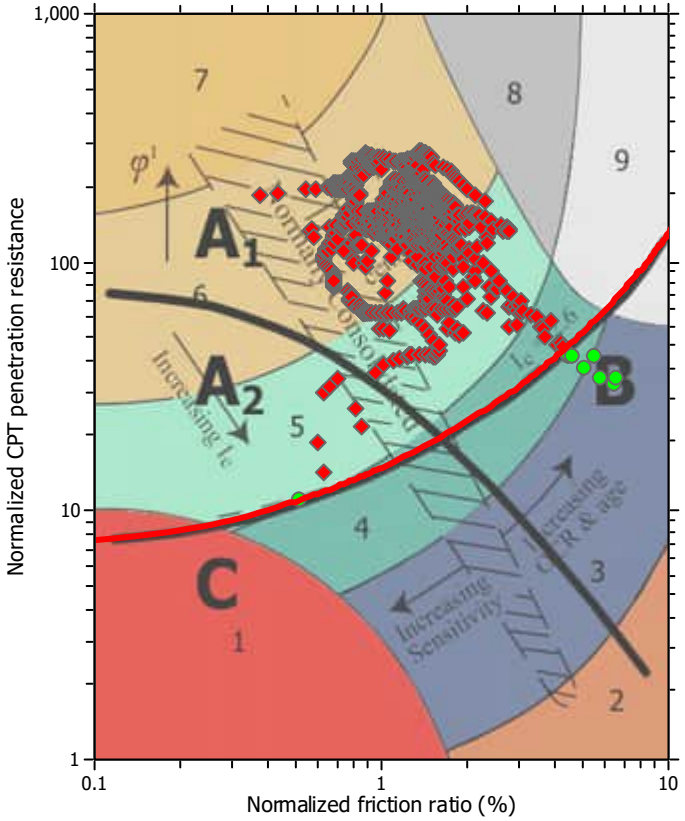
F.S. color scheme

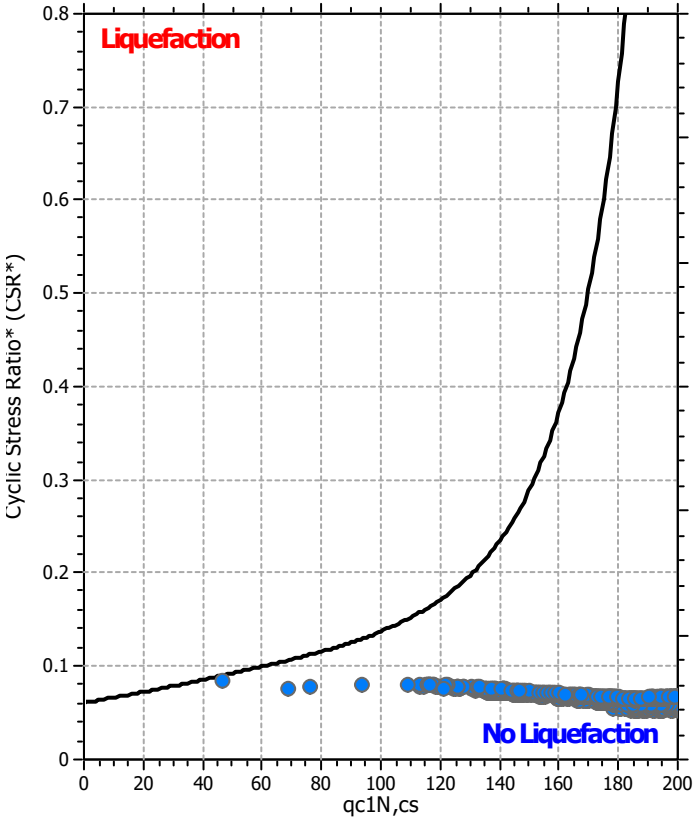
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

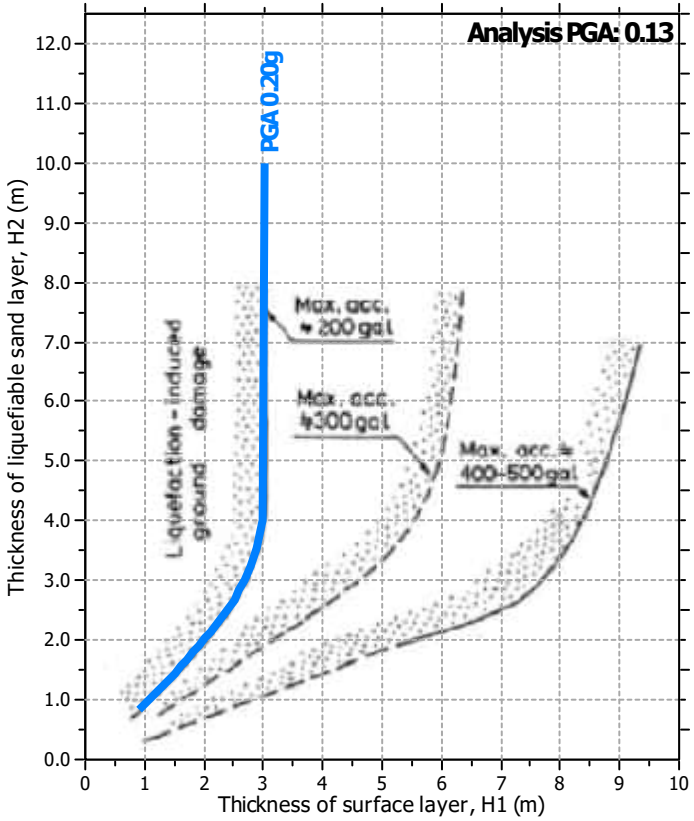
LPI color scheme

- 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.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	3.72 m	Fill height:	2.50 m	Limit depth:	N/A

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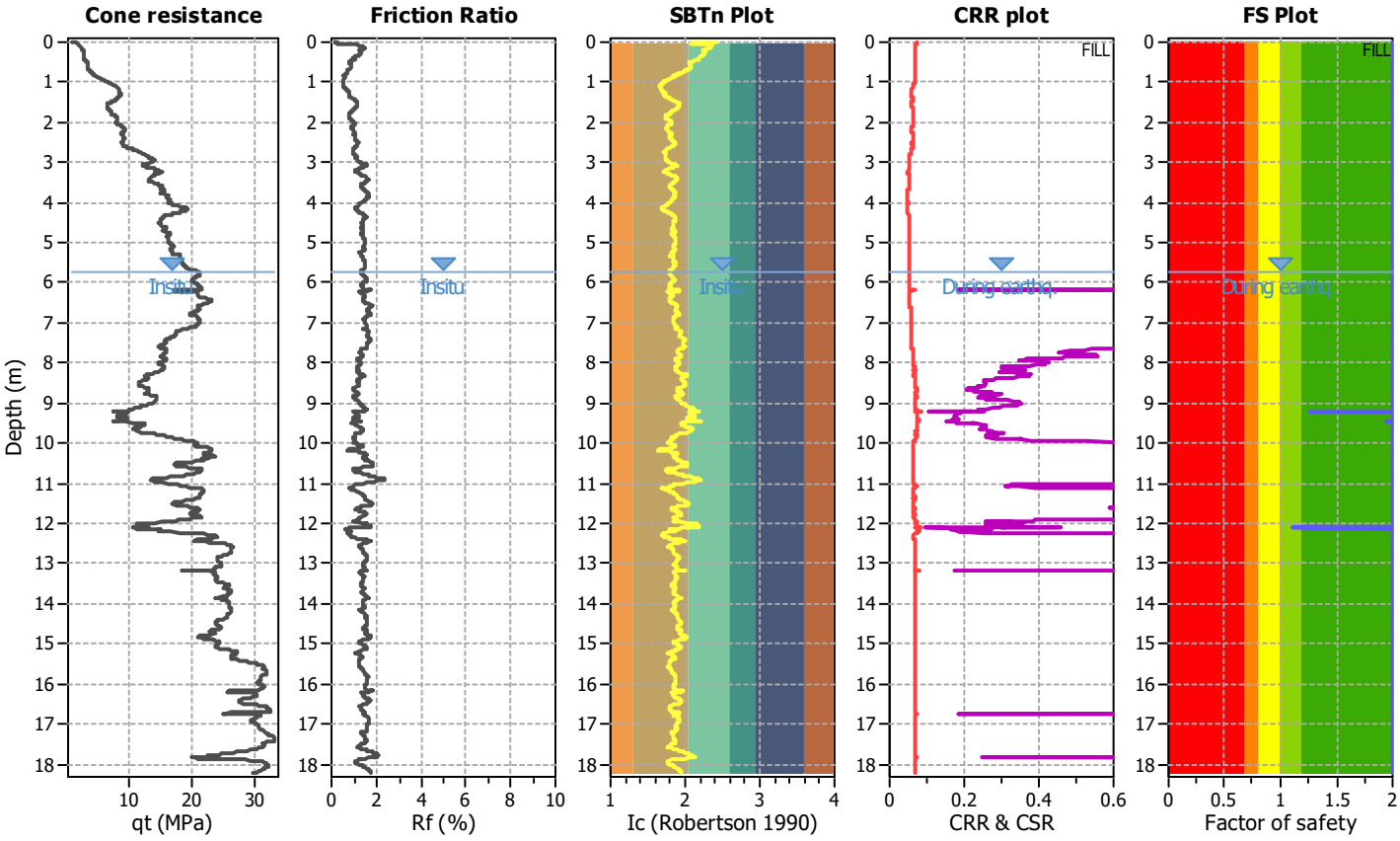
LIQUEFACTION ANALYSIS REPORT

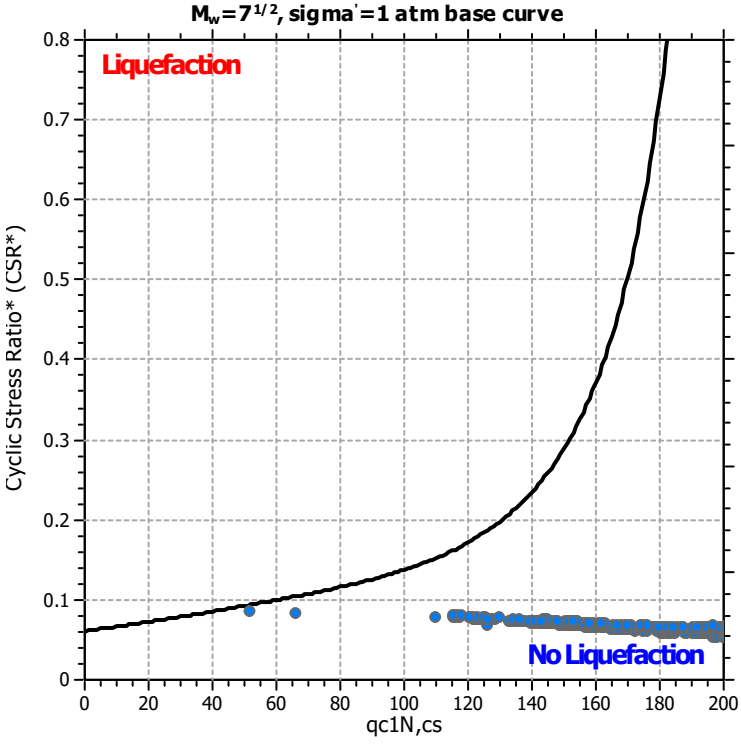
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

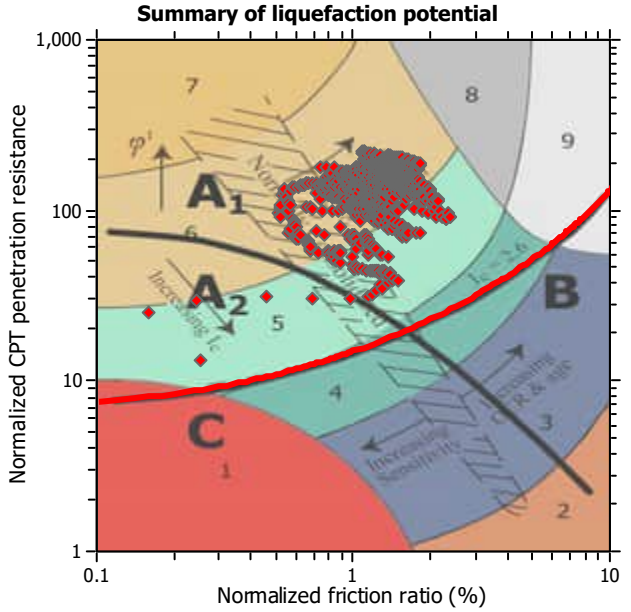
CPT file : CPT06

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.72 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	6.22 m	Fill height:	0.50 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	19.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

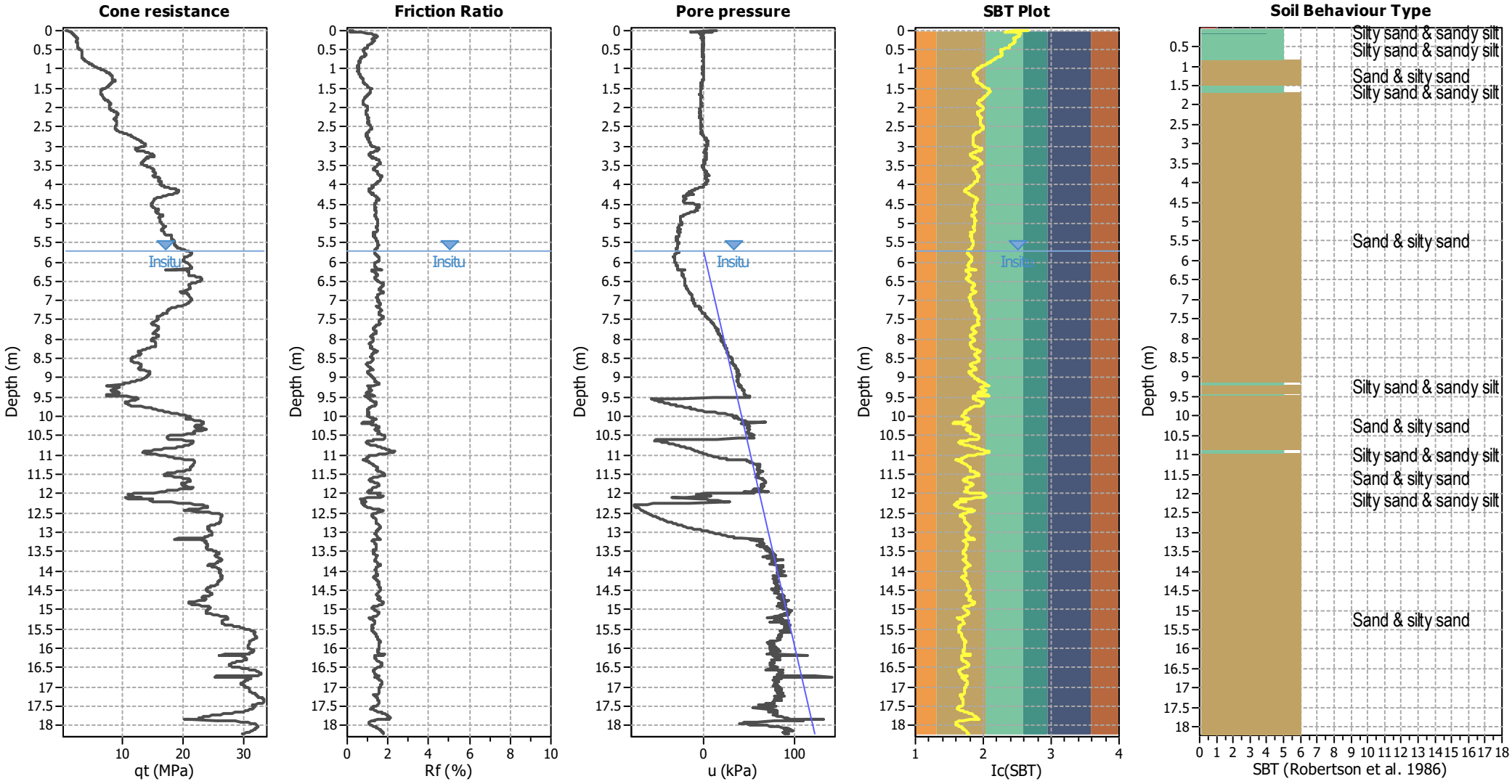






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



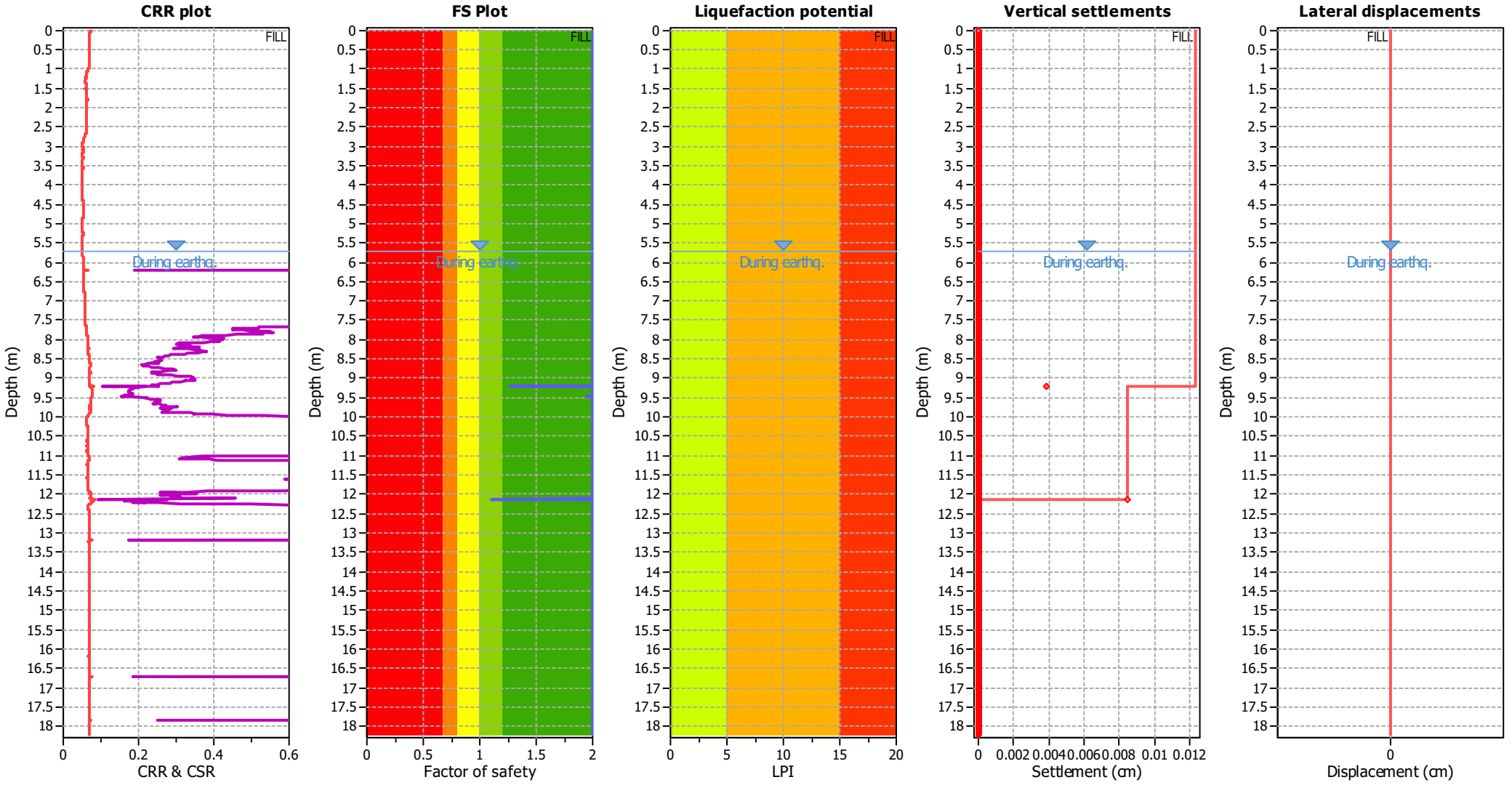
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.22 m	Fill weight:	19.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.72 m	Fill height:	0.50 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.22 m	Fill weight:	19.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.72 m	Fill height:	0.50 m	Limit depth:	N/A

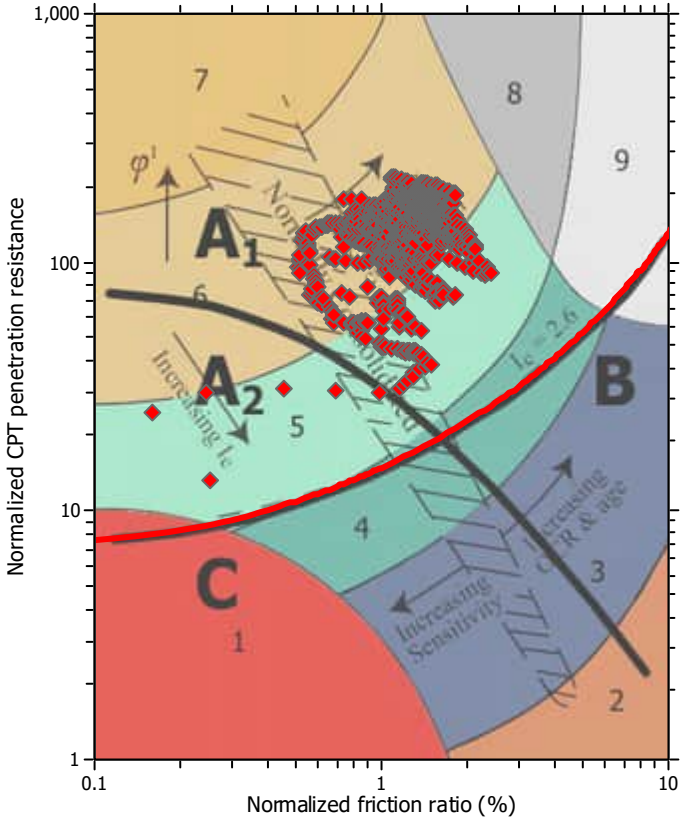
F.S. color scheme

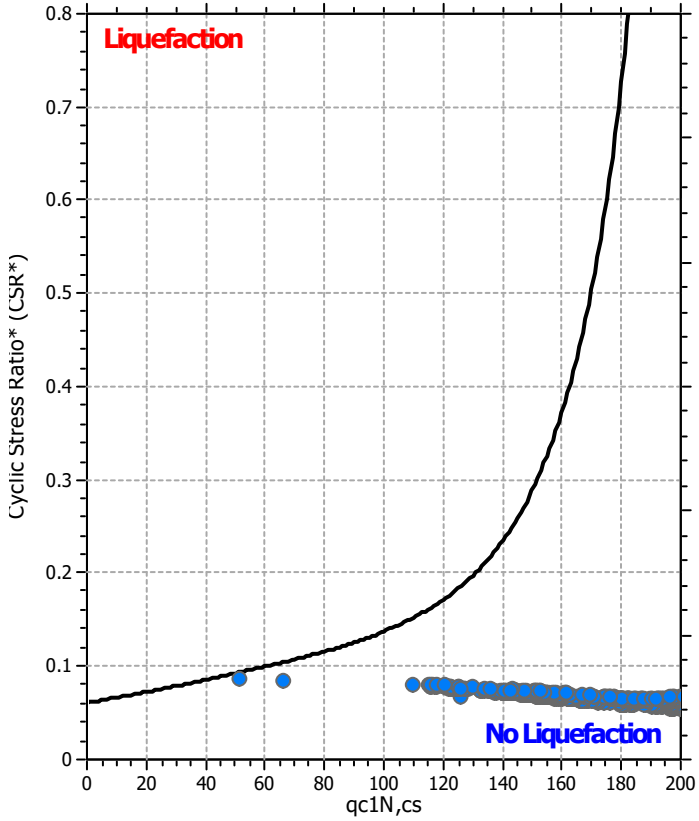
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

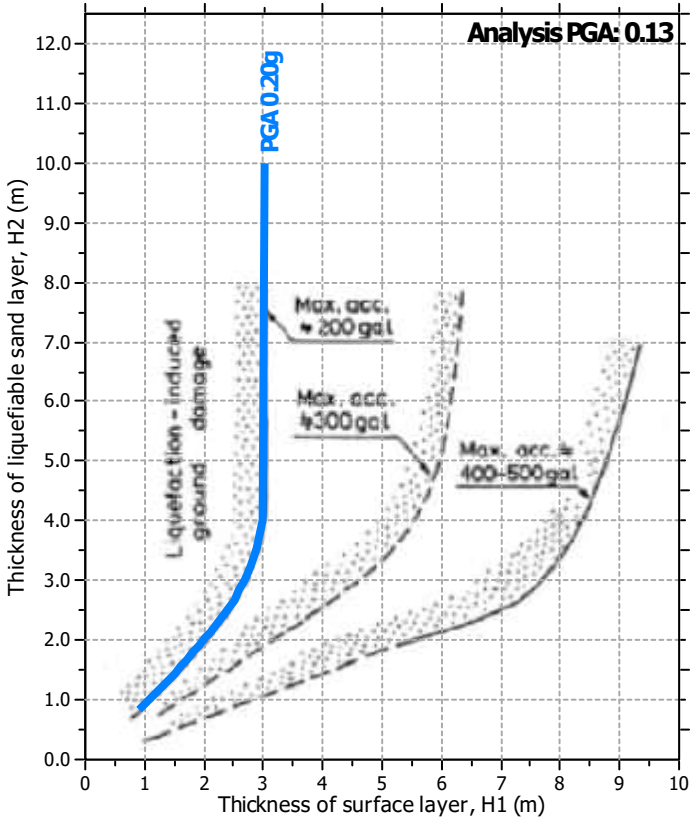
LPI color scheme

- 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.):	6.22 m	Fill weight:	19.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.72 m	Fill height:	0.50 m	Limit depth:	N/A

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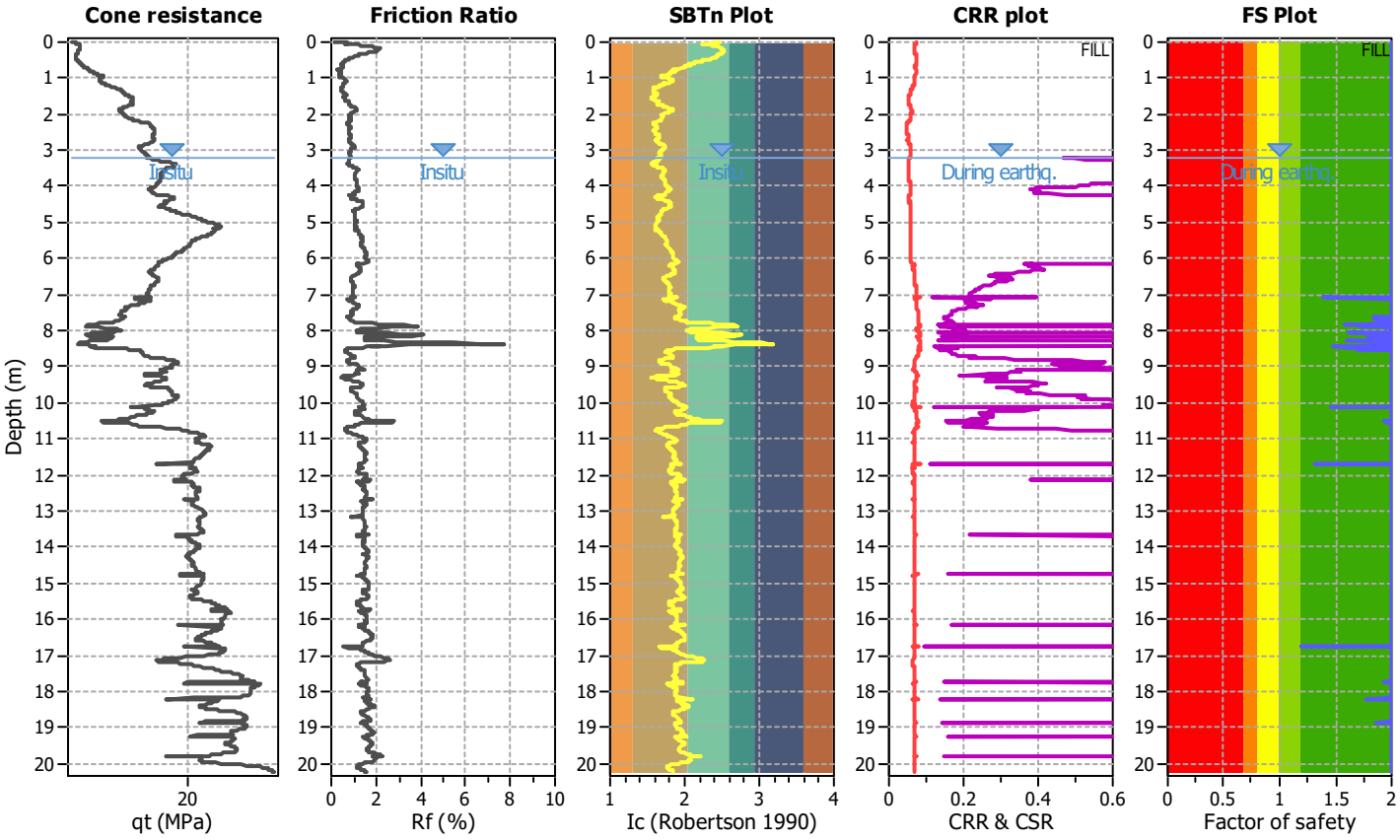
LIQUEFACTION ANALYSIS REPORT

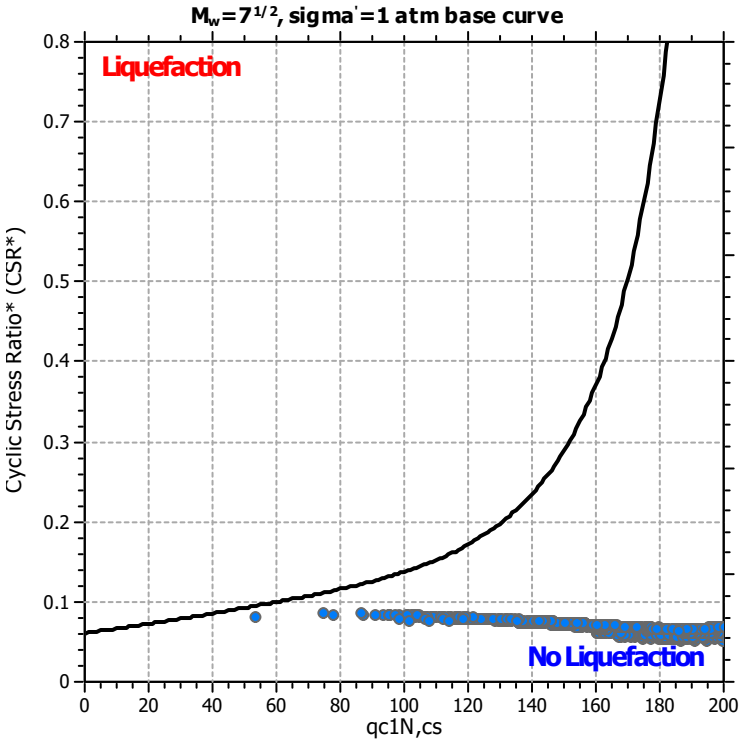
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

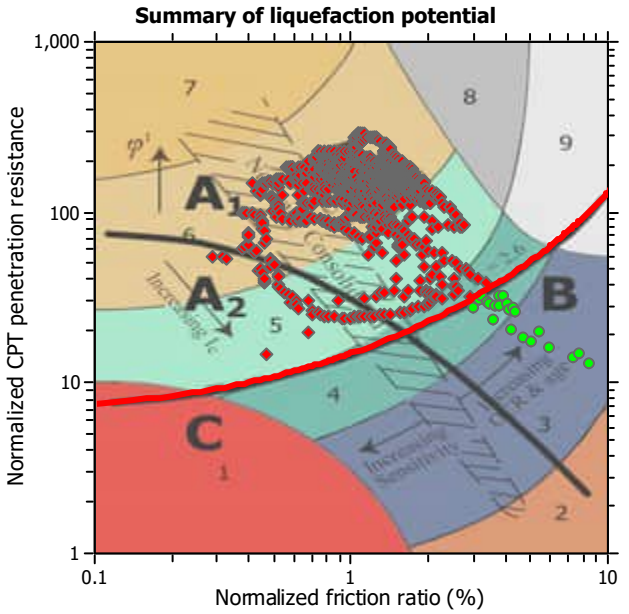
CPT file : CPT07

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.22 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	6.22 m	Fill height:	3.00 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

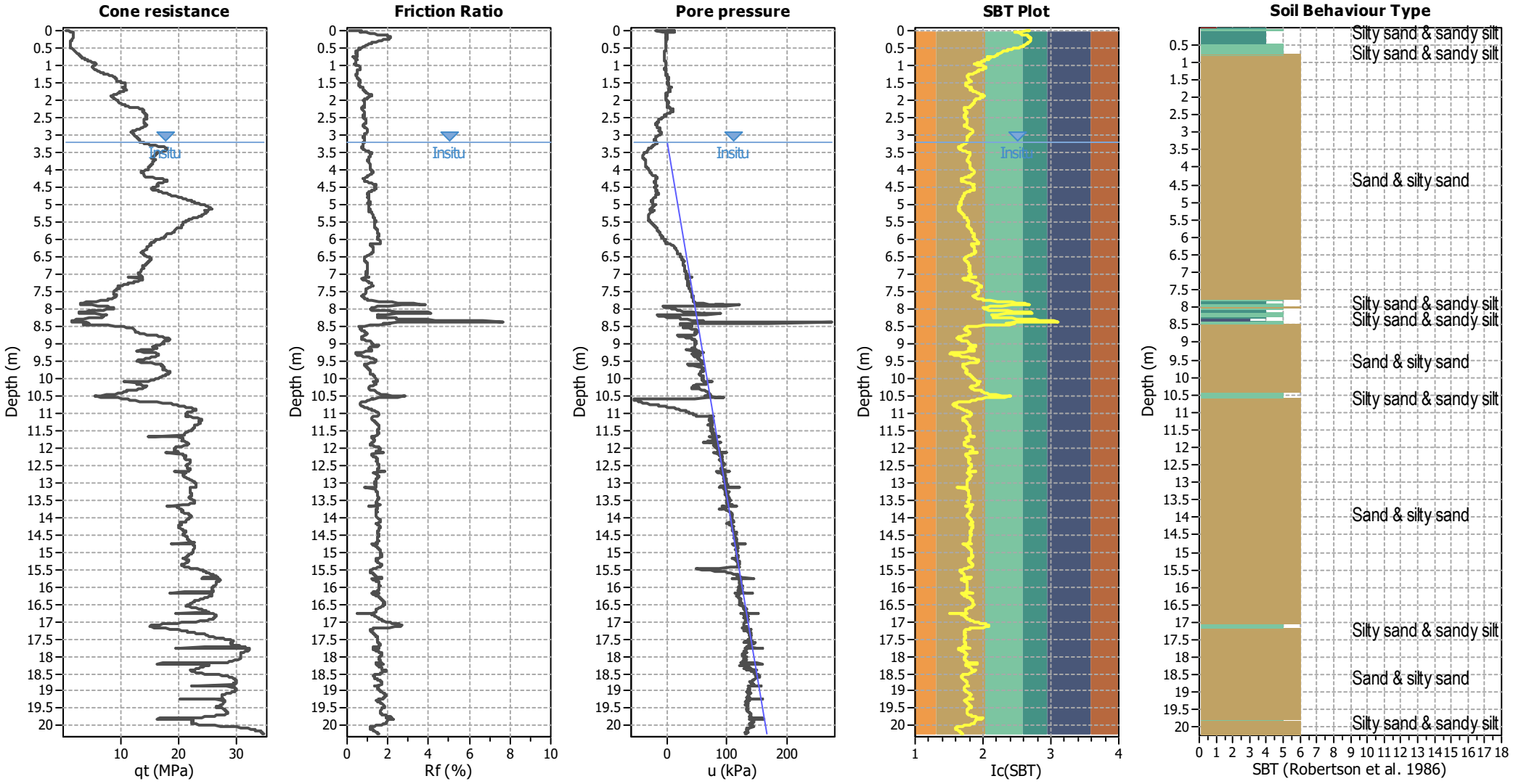






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



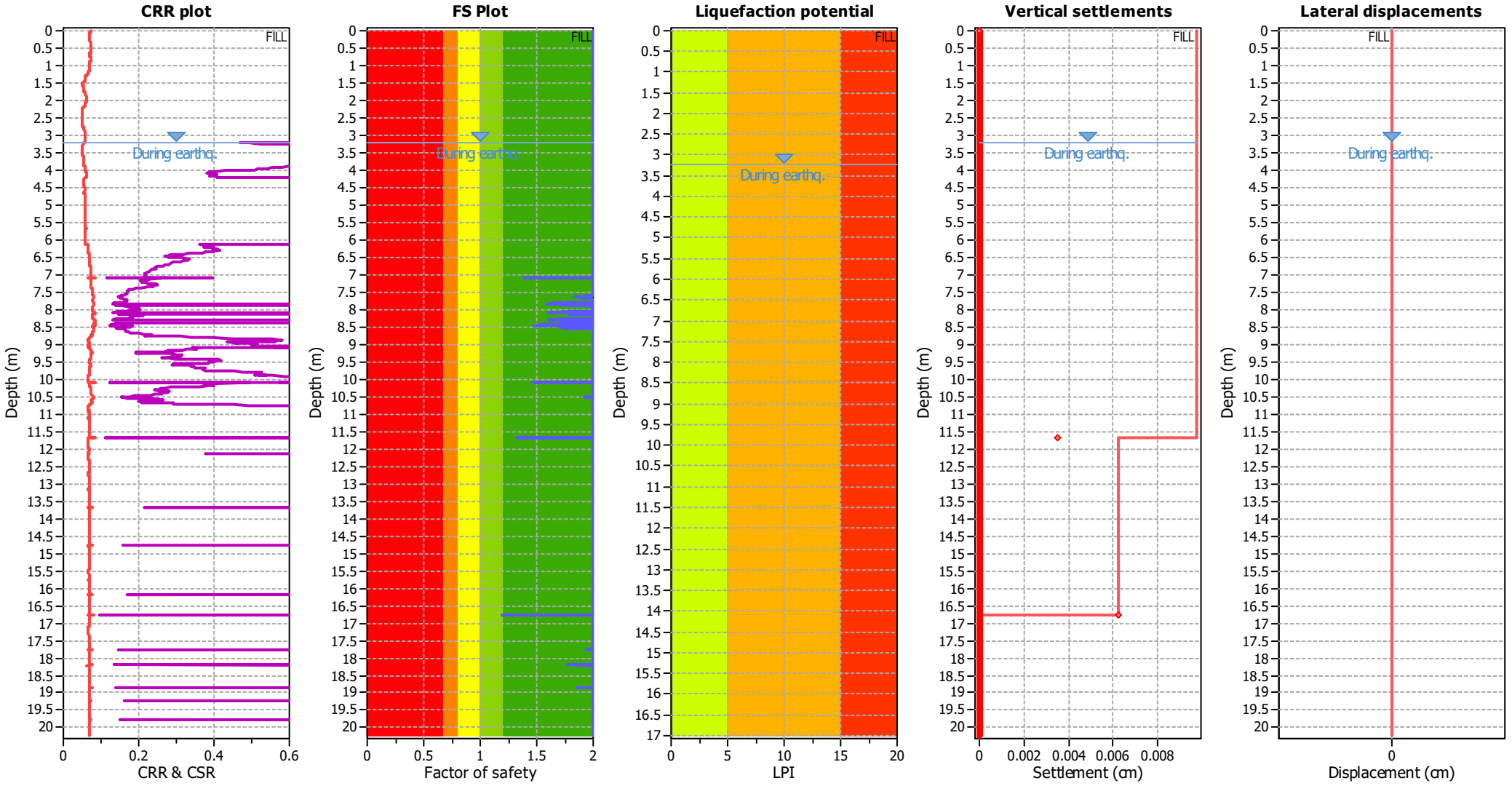
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	3.22 m	Fill height:	3.00 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	3.22 m	Fill height:	3.00 m	Limit depth:	N/A

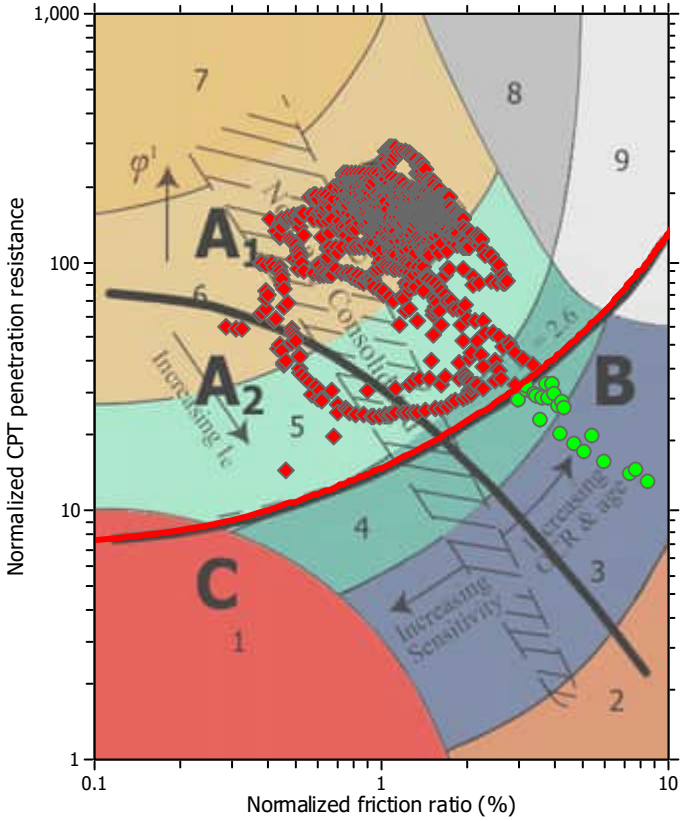
F.S. color scheme

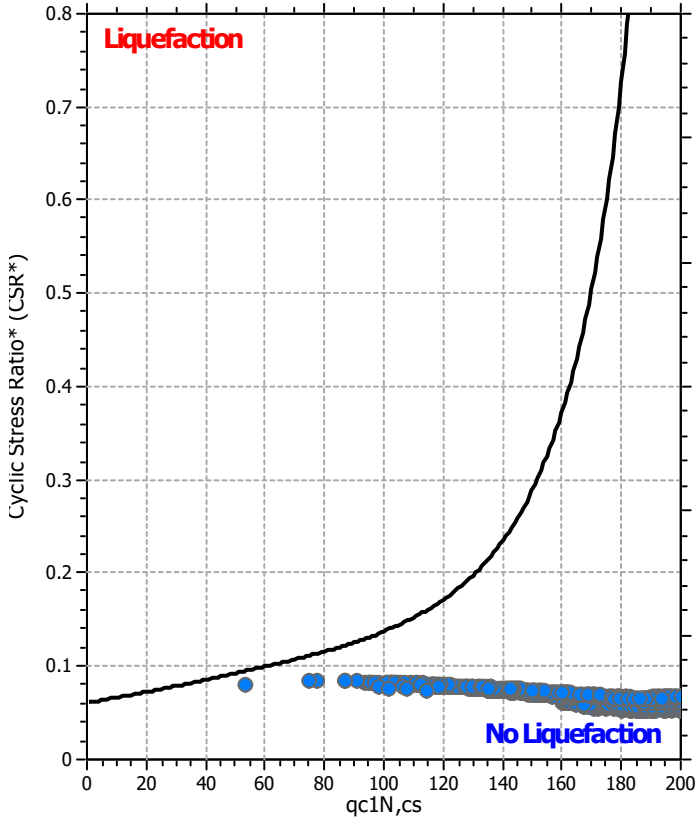
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

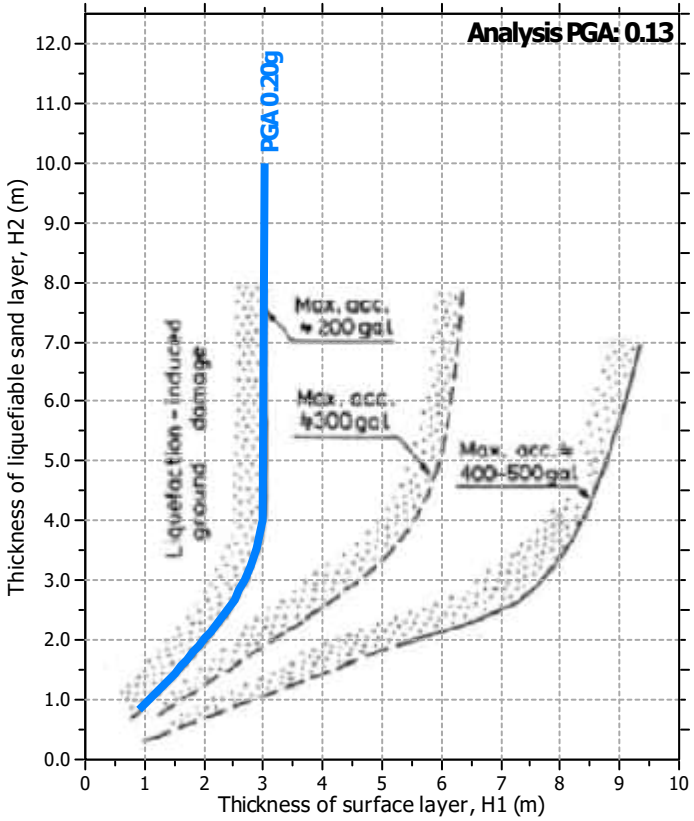
LPI color scheme

- 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.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	3.22 m	Fill height:	3.00 m	Limit depth:	N/A

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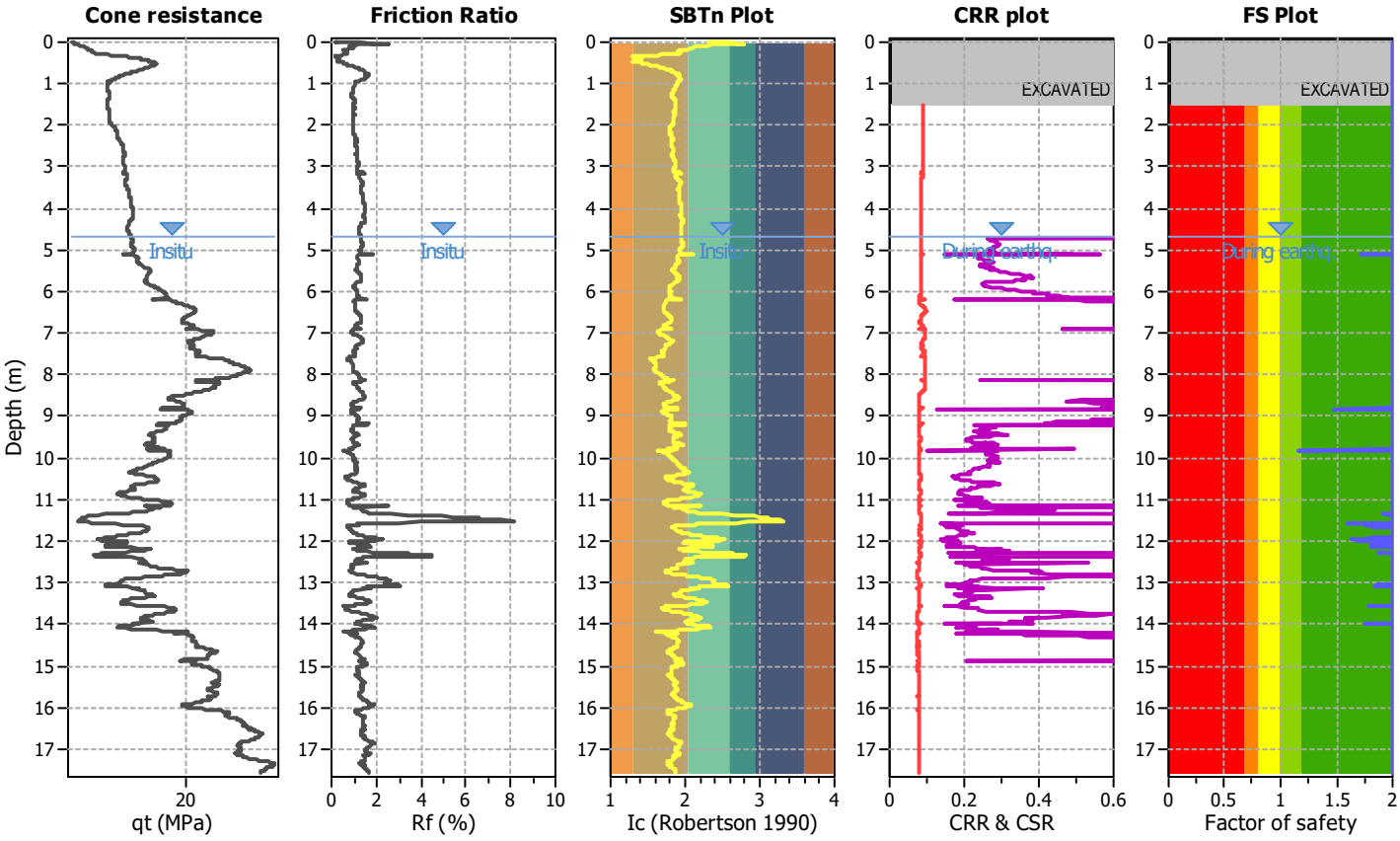
LIQUEFACTION ANALYSIS REPORT

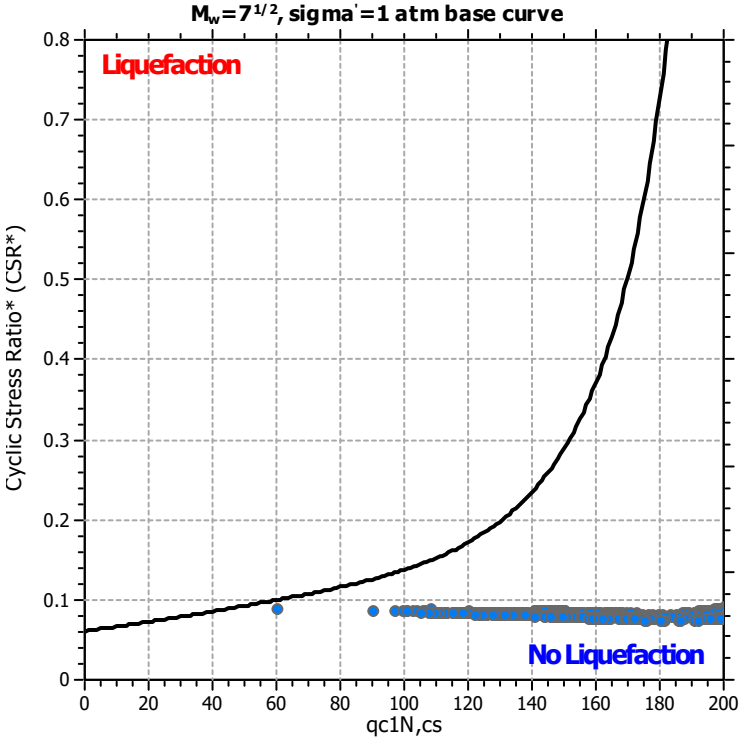
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

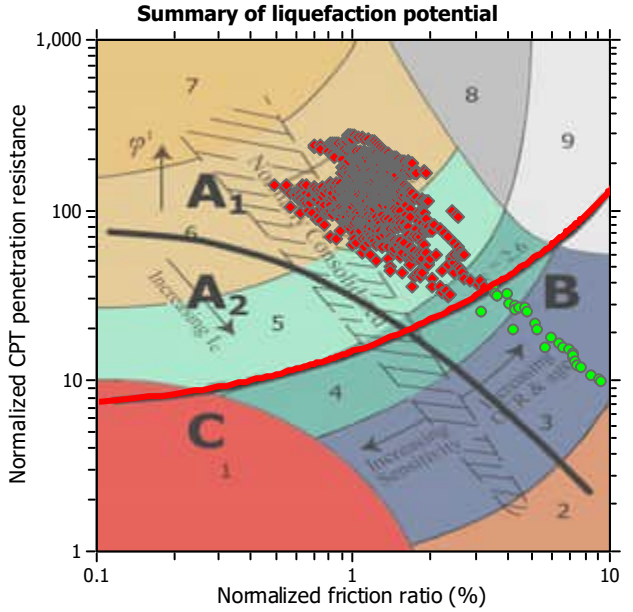
CPT file : CPT08

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	4.70 m	Excavation:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	4.70 m	Excavation depth:	1.50 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Footing load:	500.00 kPa	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

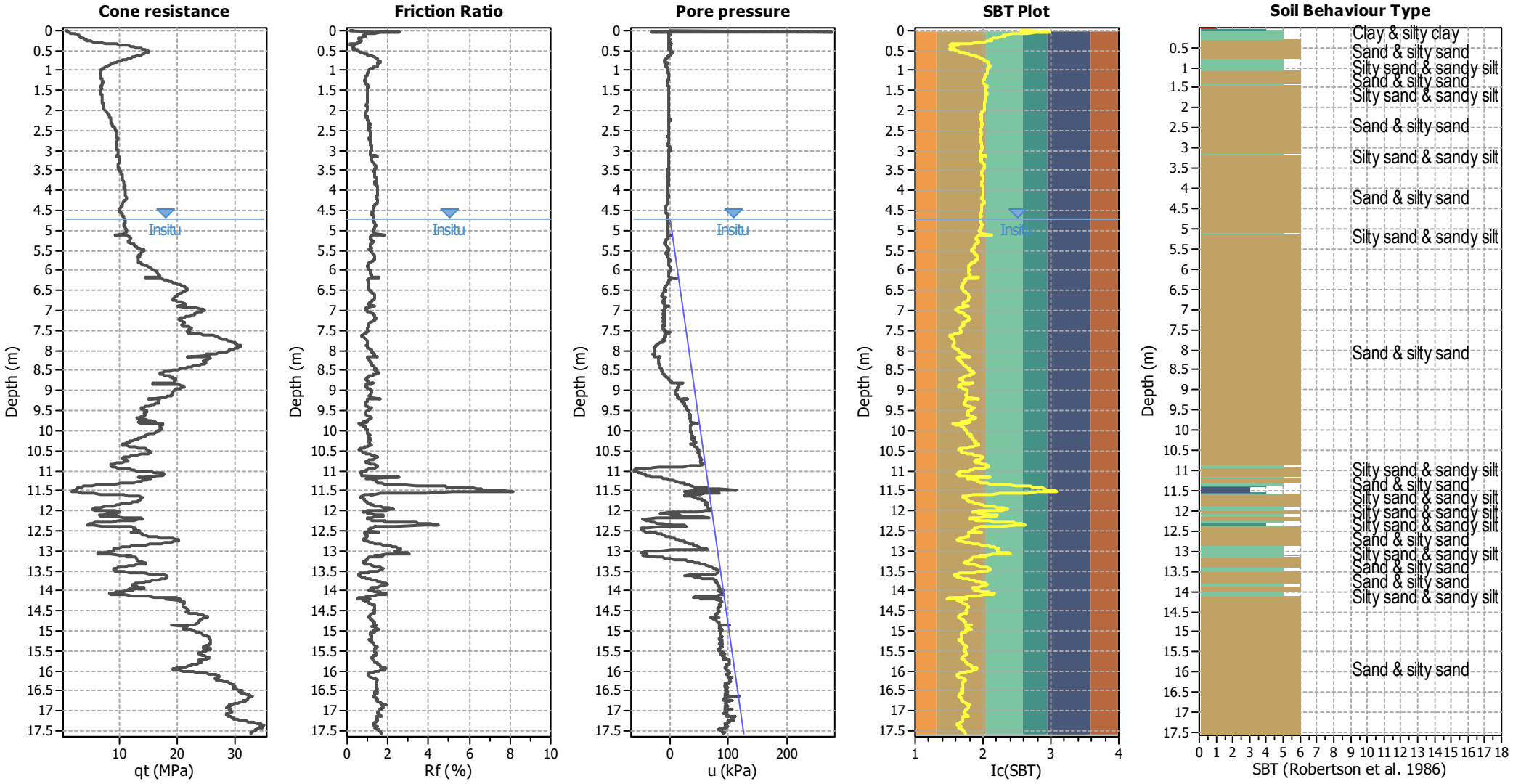






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



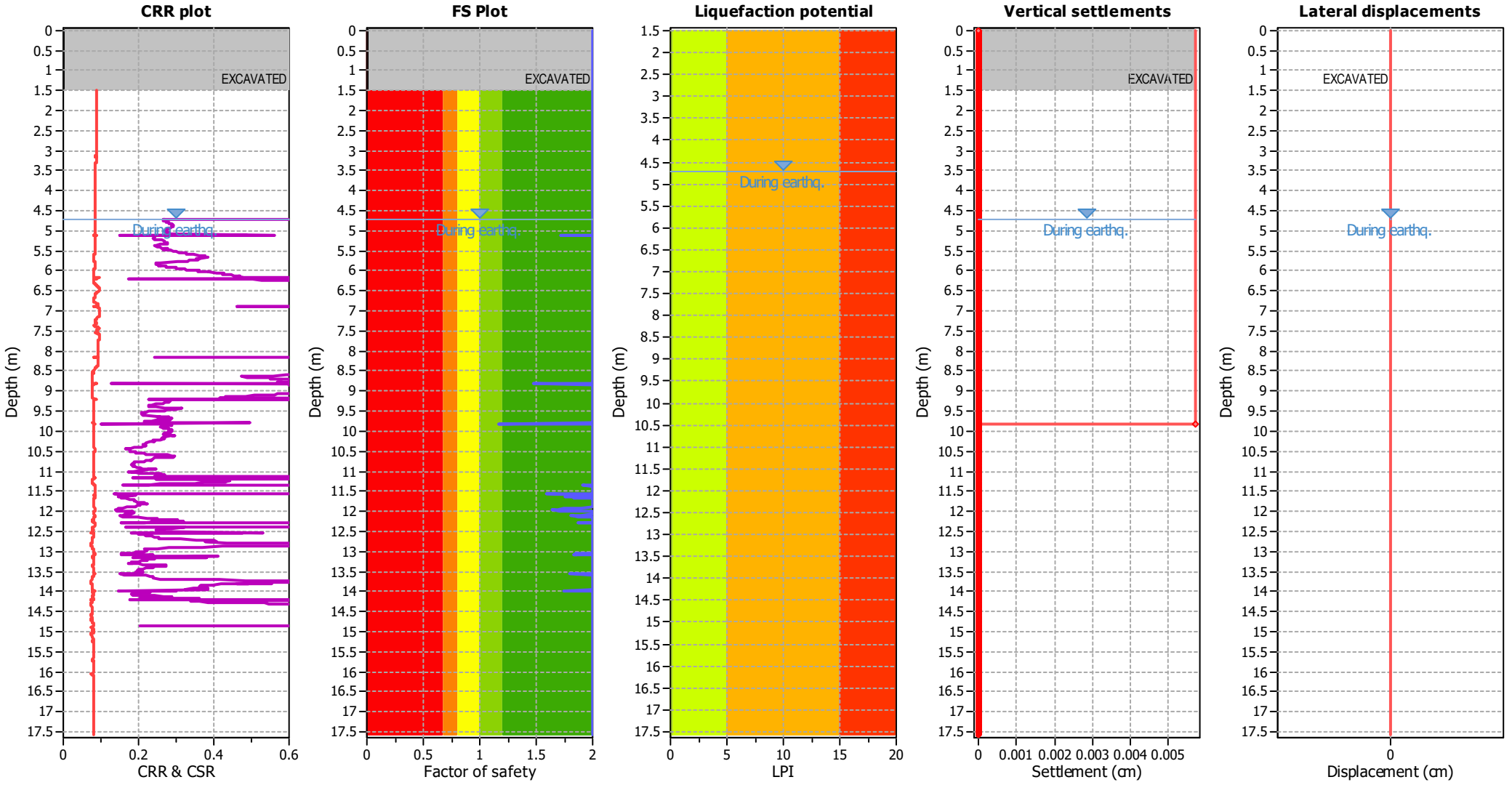
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	4.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	4.70 m	Excavation depth:	1.50 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	4.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	4.70 m	Excavation depth:	1.50 m	Limit depth:	N/A

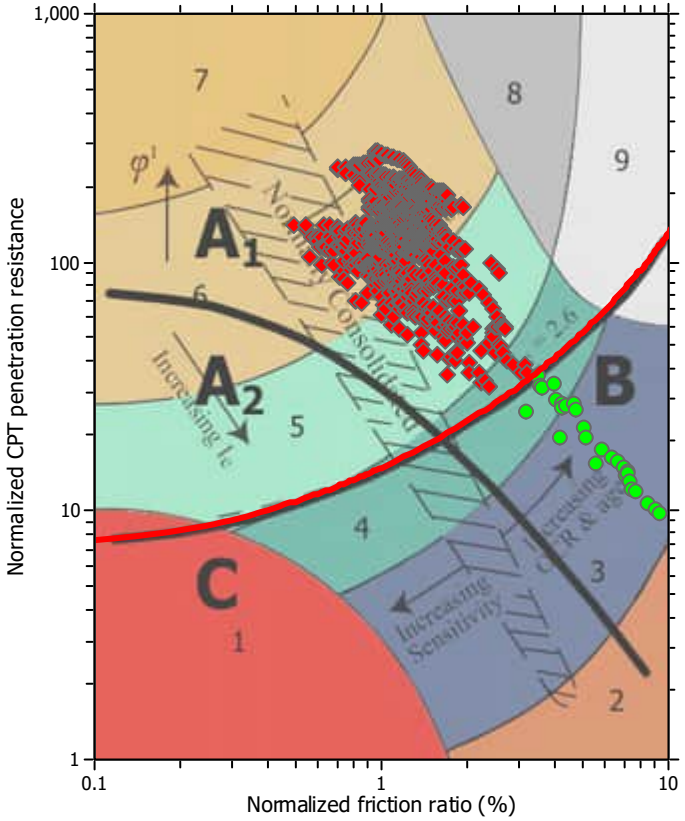
F.S. color scheme

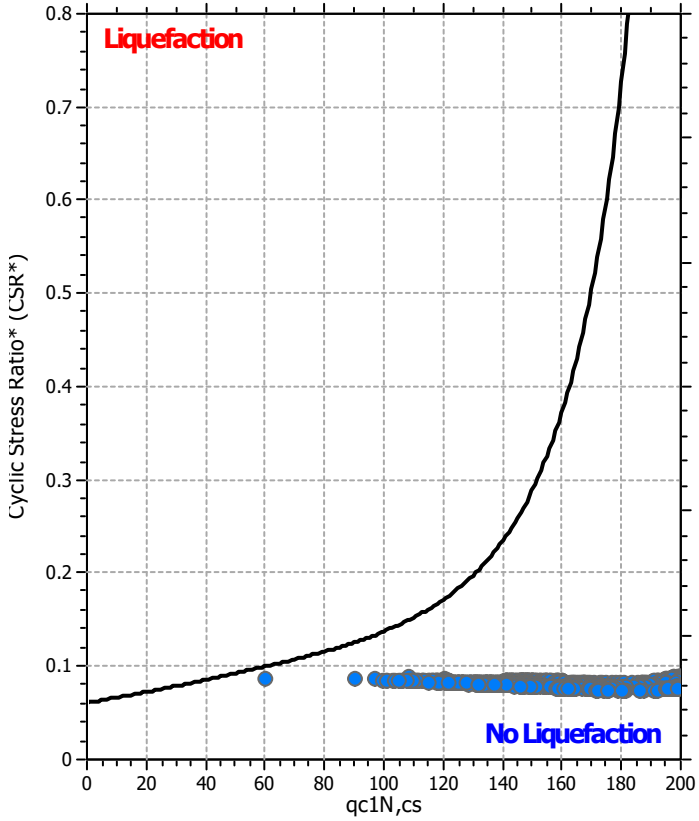
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

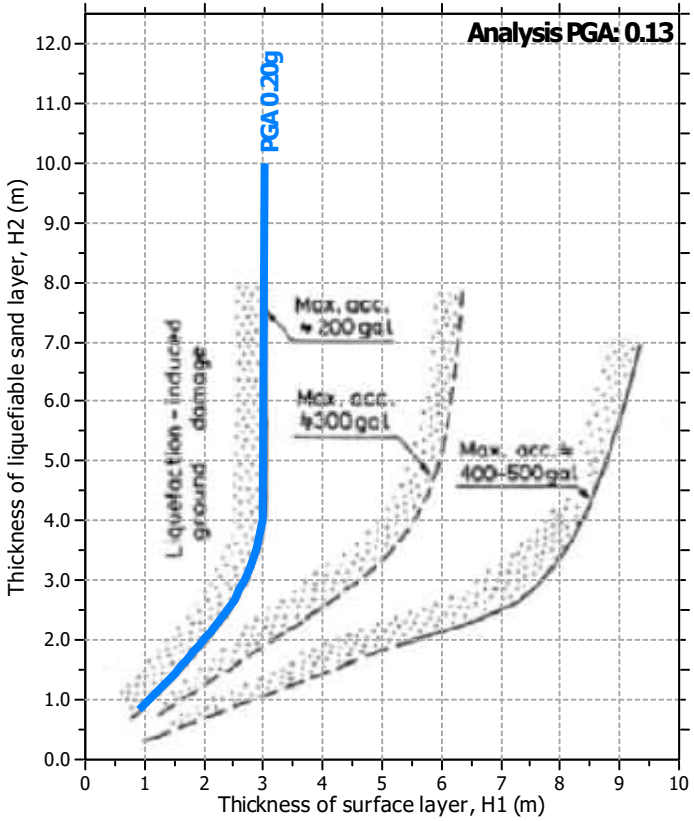
LPI color scheme

- 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.):	4.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	4.70 m	Excavation depth:	1.50 m	Limit depth:	N/A

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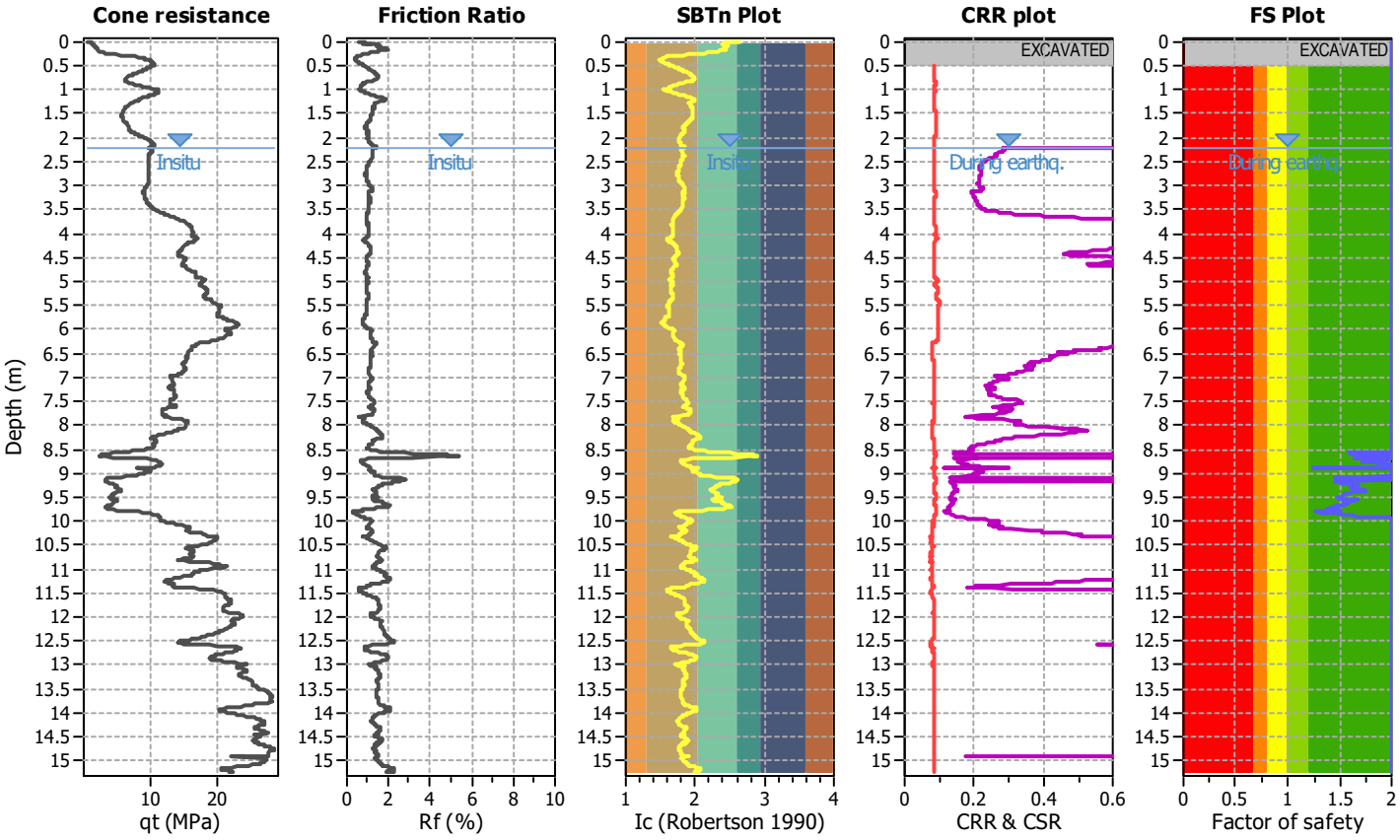
LIQUEFACTION ANALYSIS REPORT

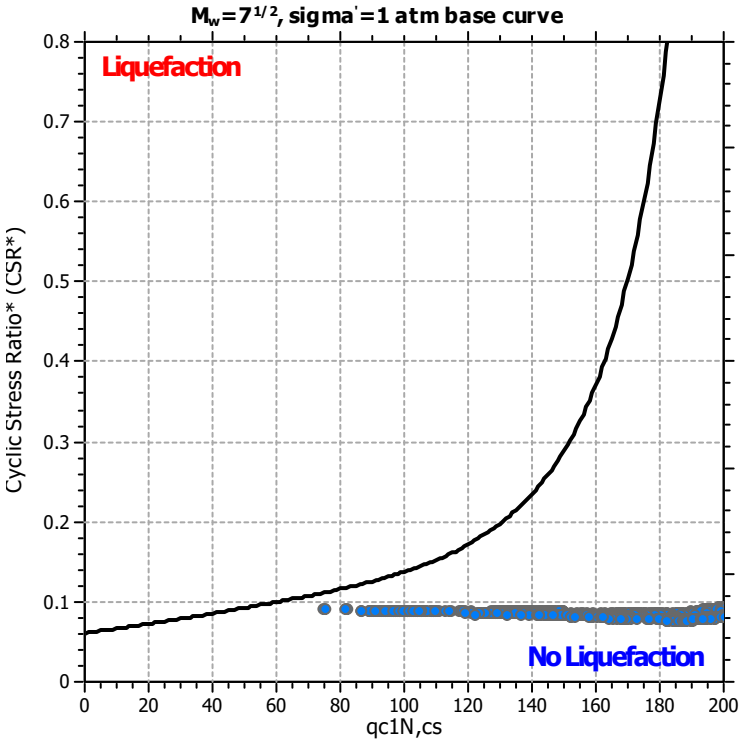
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

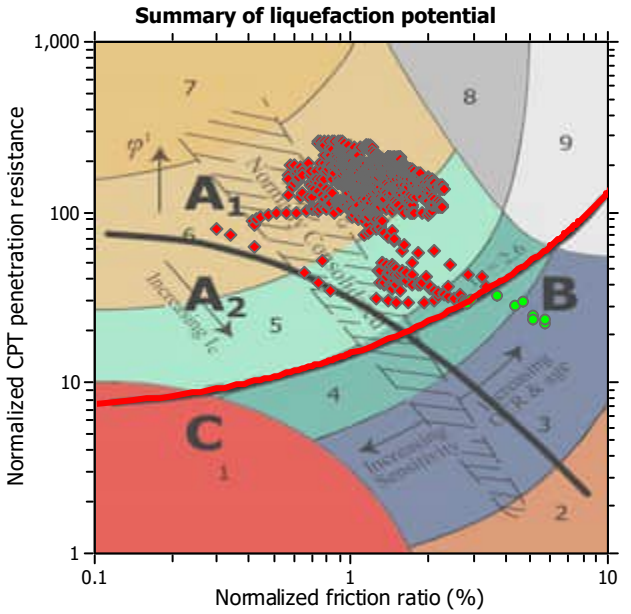
CPT file : CPT09

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.20 m	Excavation:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.20 m	Excavation depth:	0.50 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Footing load:	500.00 kPa	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

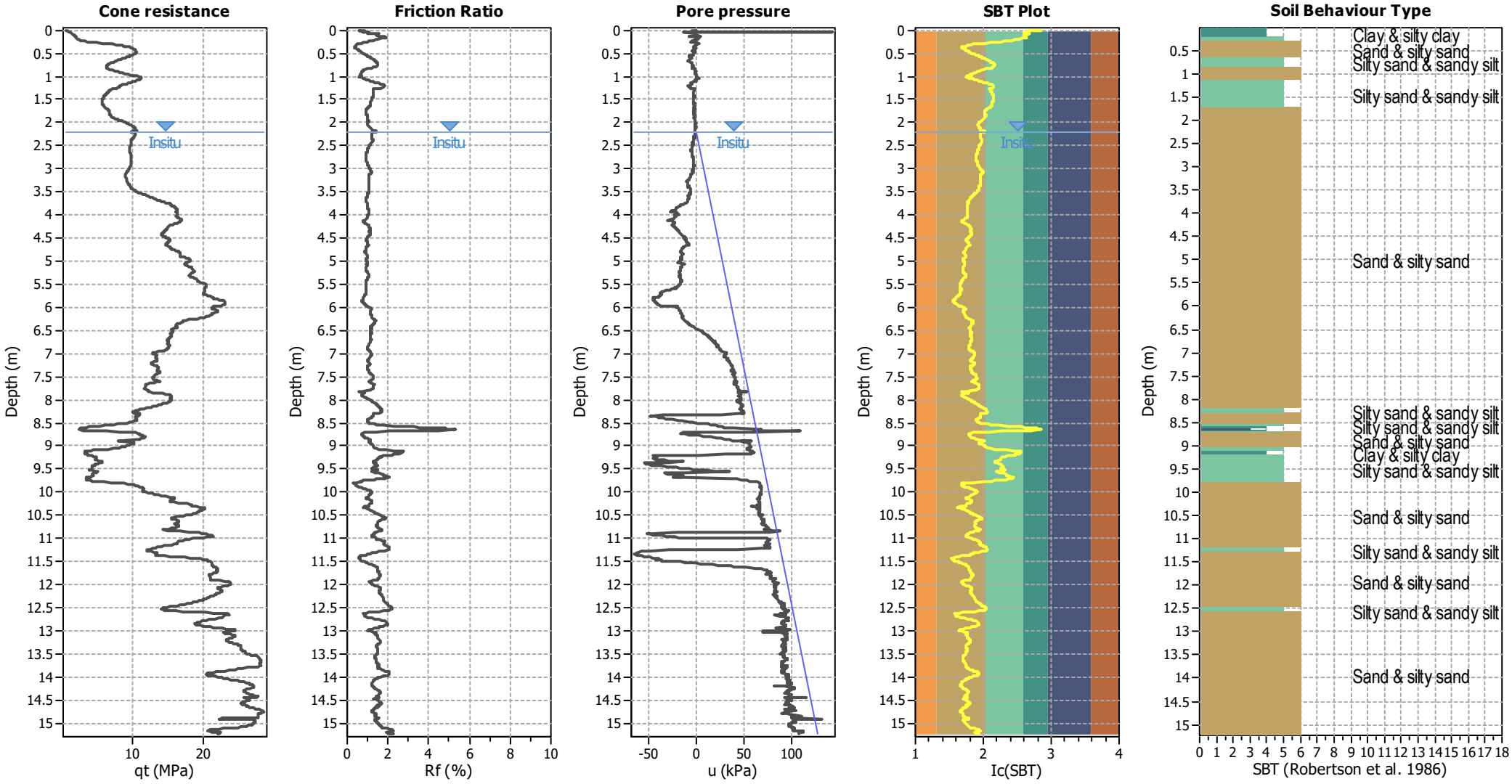






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



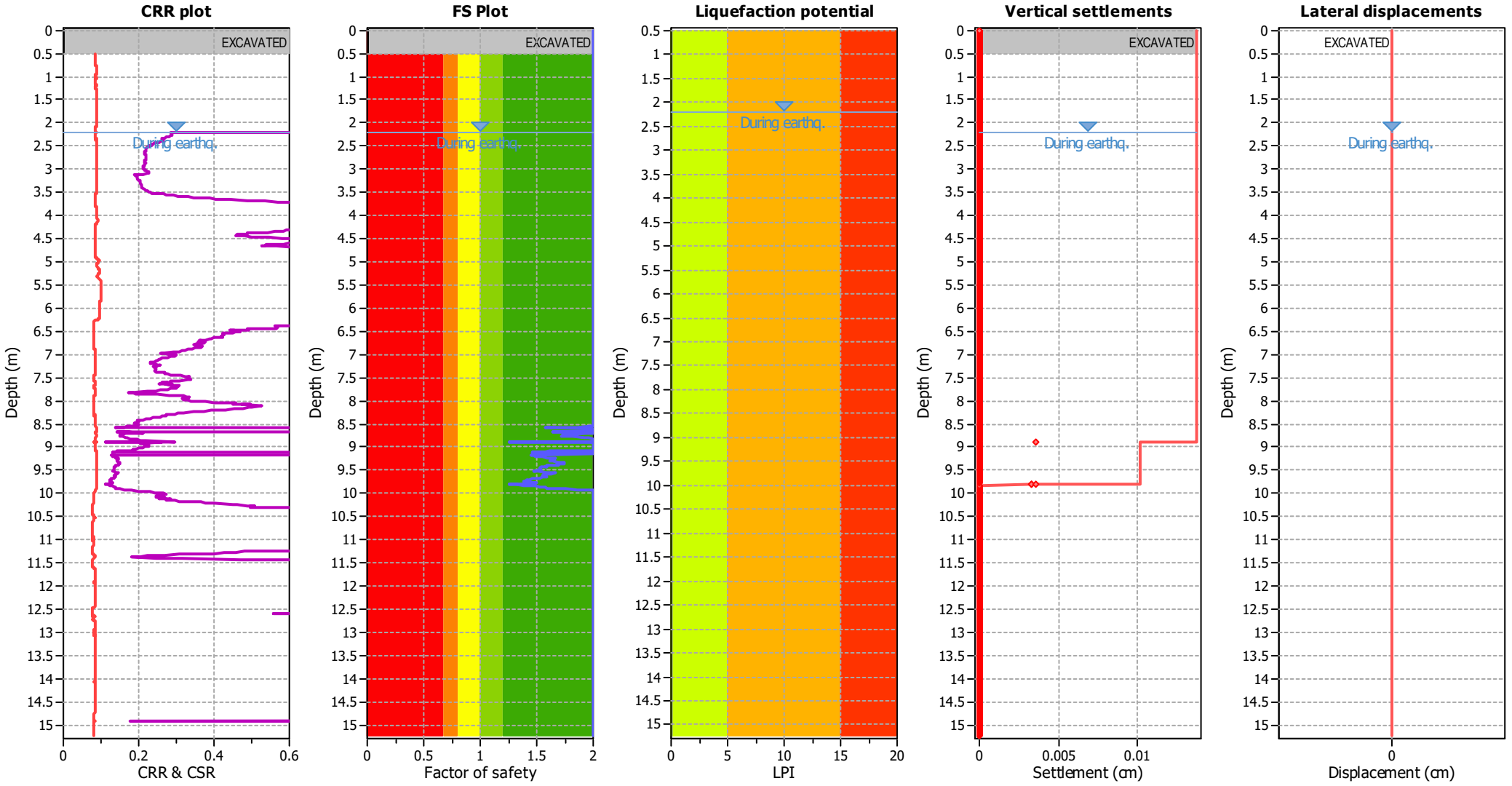
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	2.20 m	Excavation depth:	0.50 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	2.20 m	Excavation depth:	0.50 m	Limit depth:	N/A

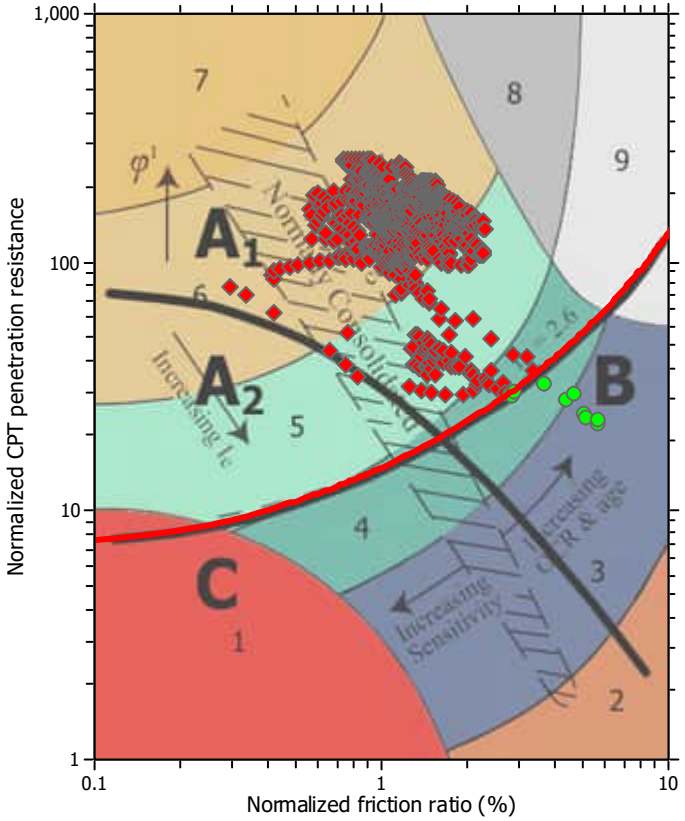
F.S. color scheme

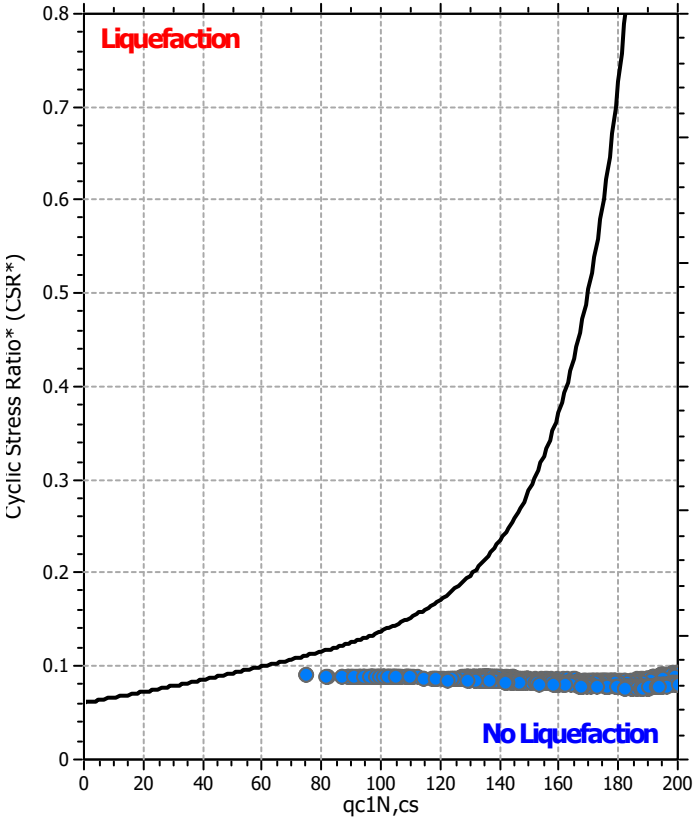
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

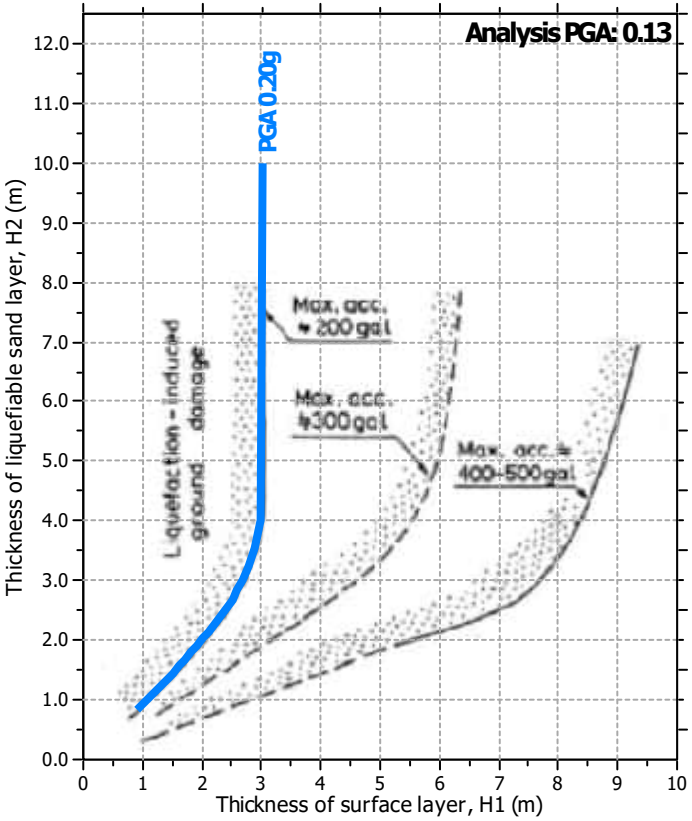
LPI color scheme

- 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.):	2.20 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	2.20 m	Excavation depth:	0.50 m	Limit depth:	N/A

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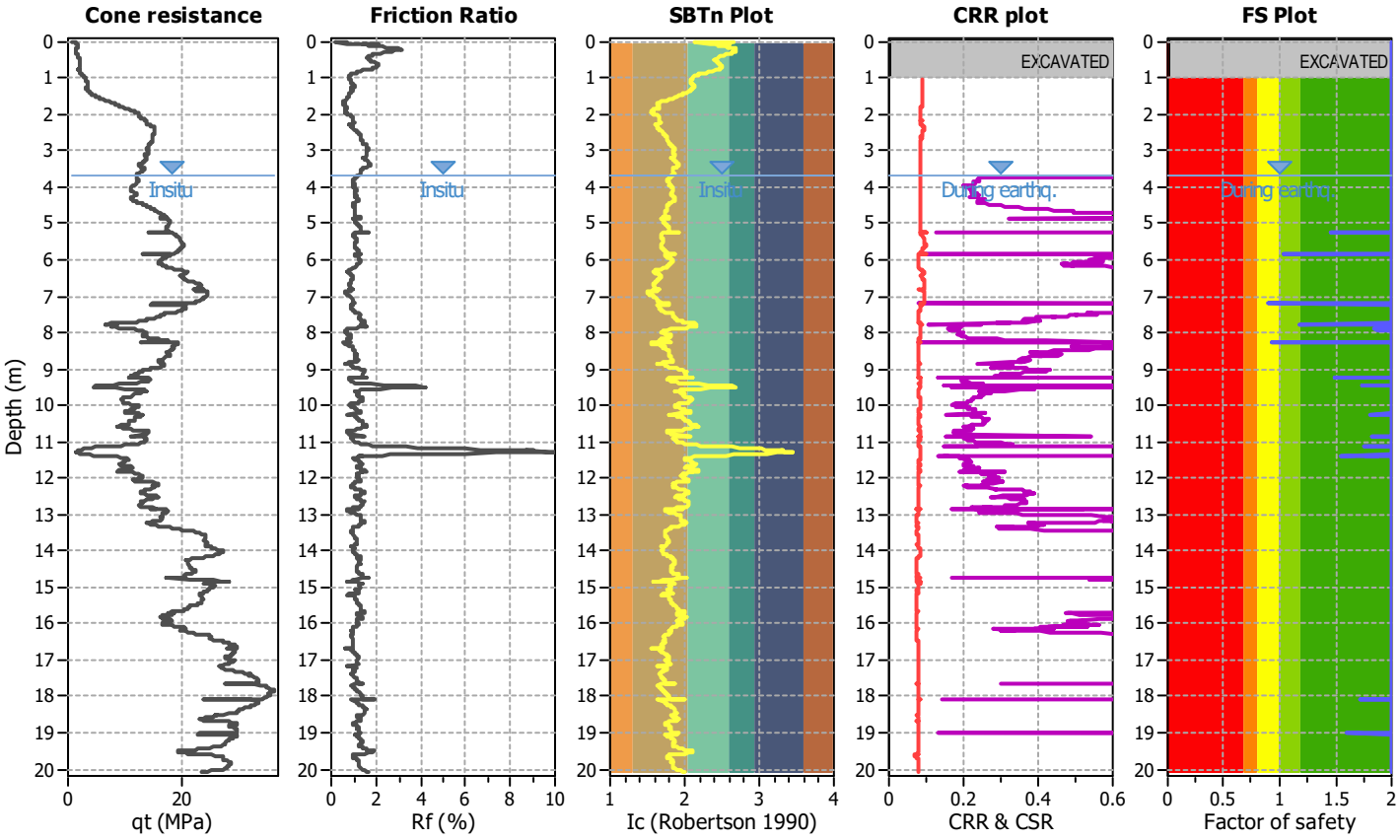
LIQUEFACTION ANALYSIS REPORT

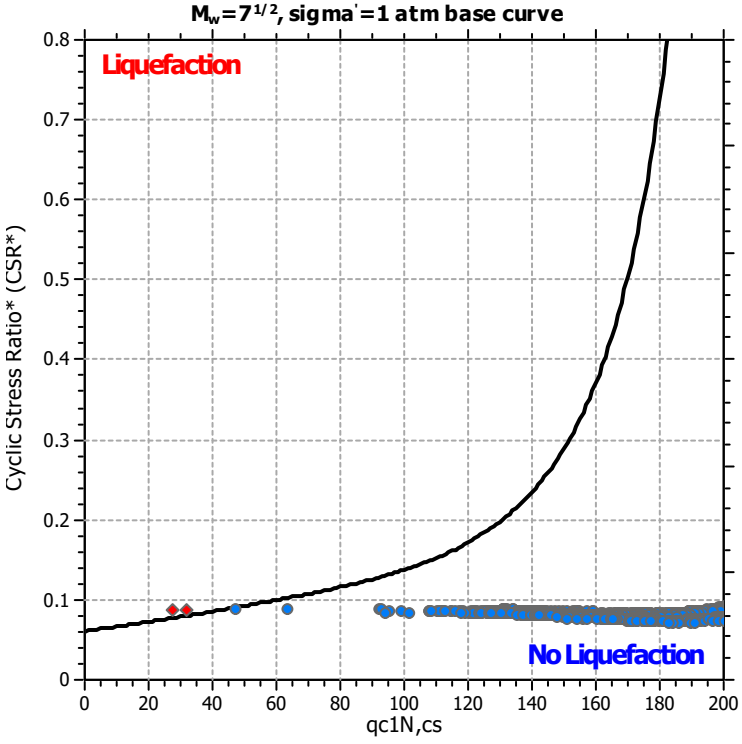
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

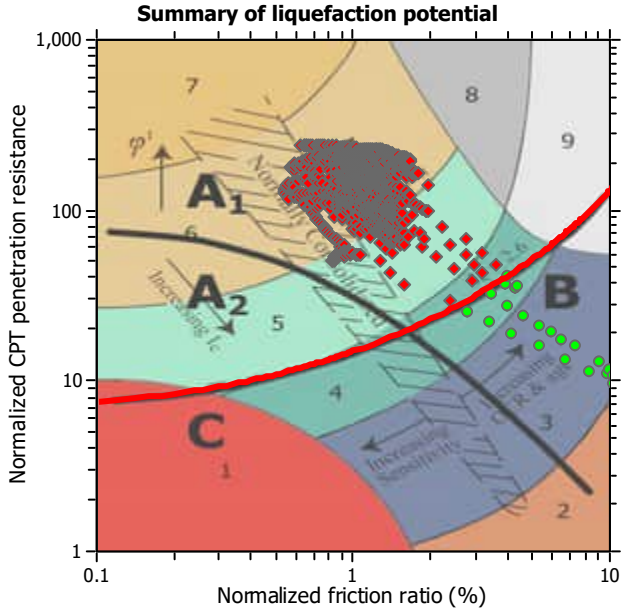
CPT file : CPT10

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.70 m	Excavation:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	3.70 m	Excavation depth:	1.00 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Footing load:	500.00 kPa	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

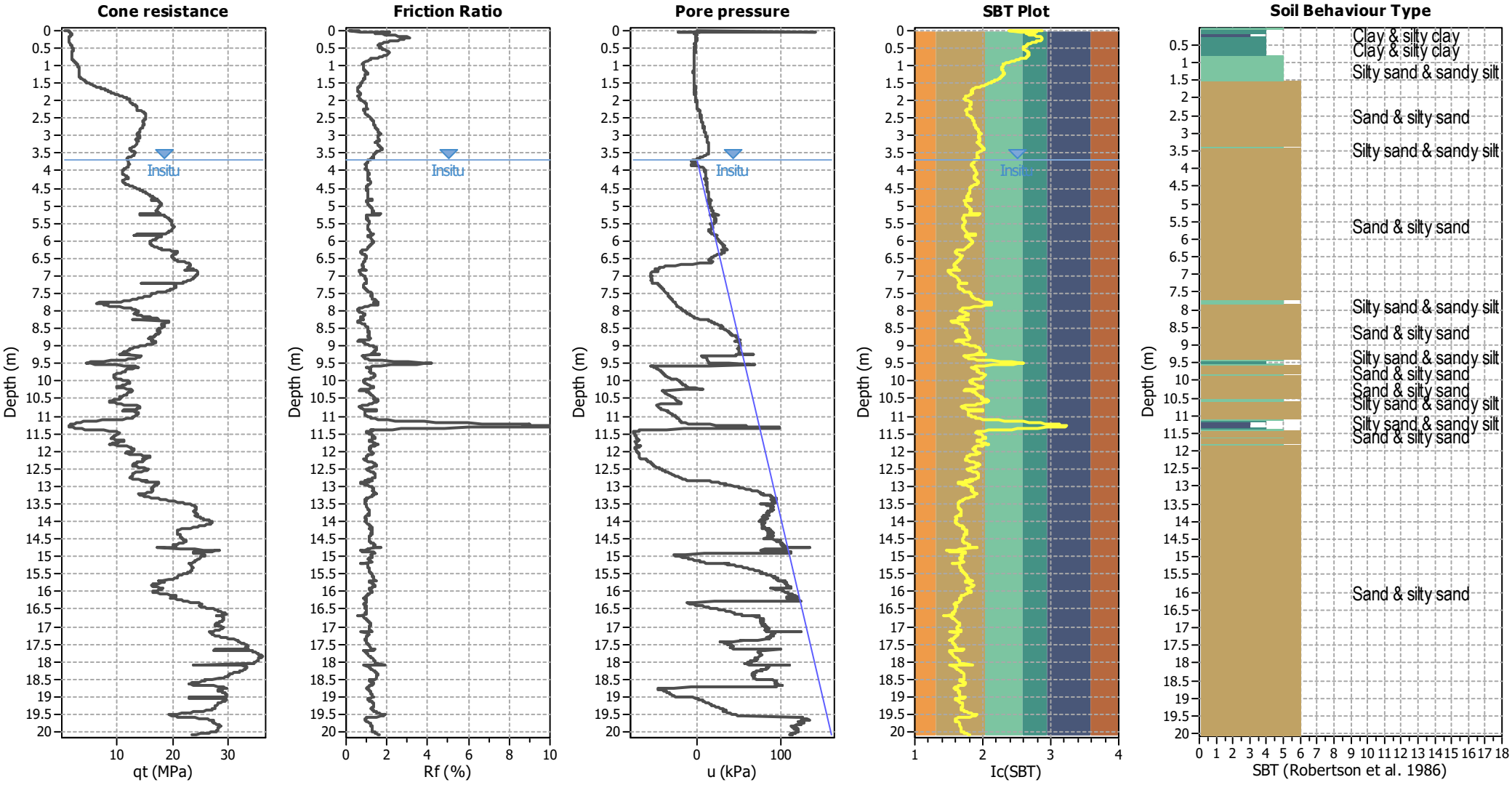






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



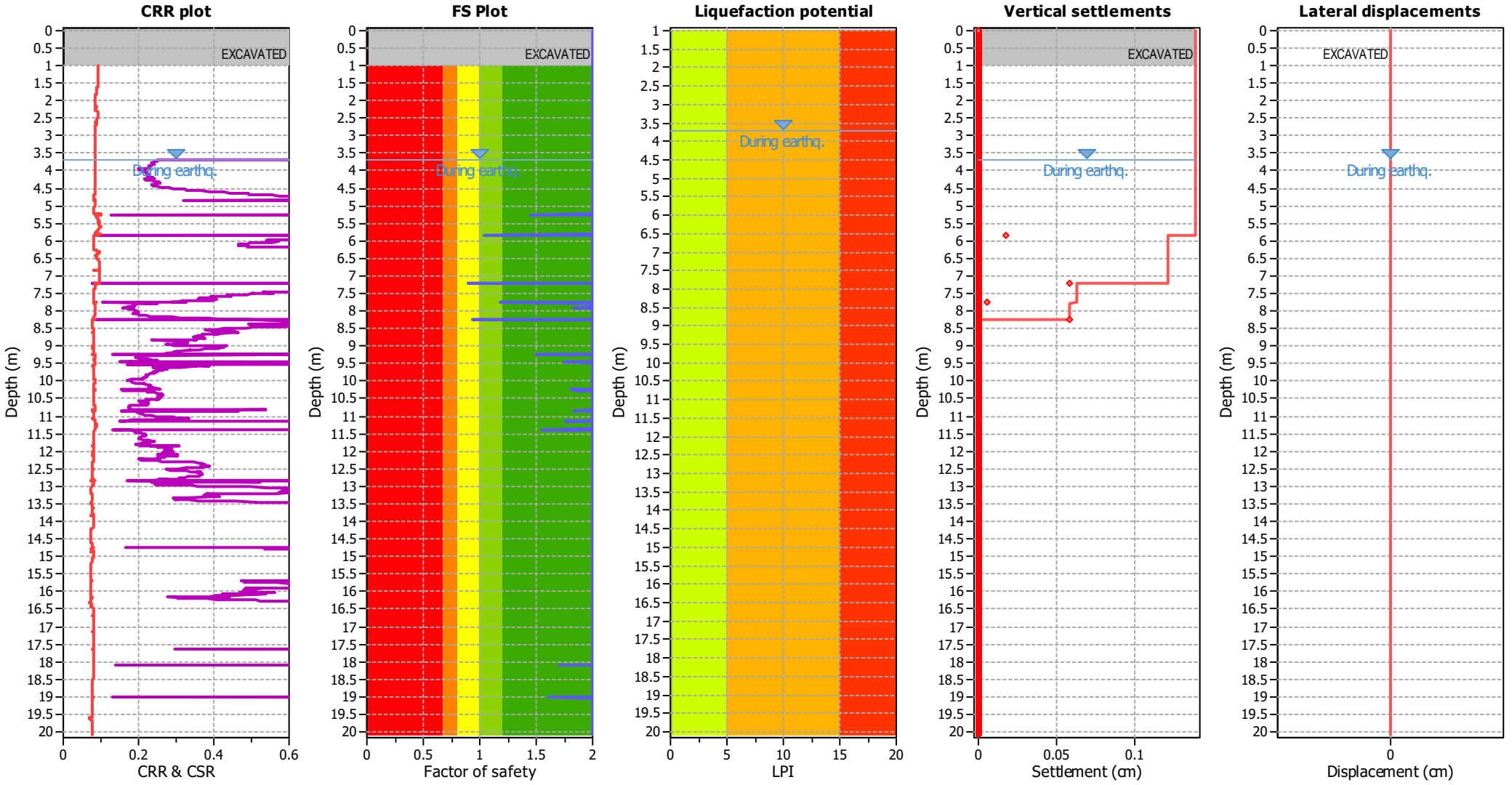
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	3.70 m	Excavation depth:	1.00 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	3.70 m	Excavation depth:	1.00 m	Limit depth:	N/A

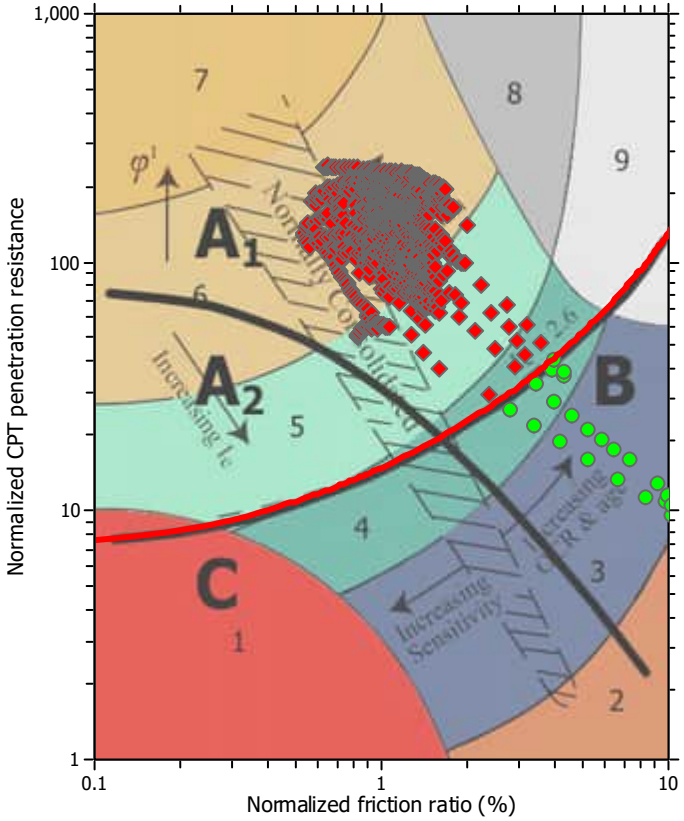
F.S. color scheme

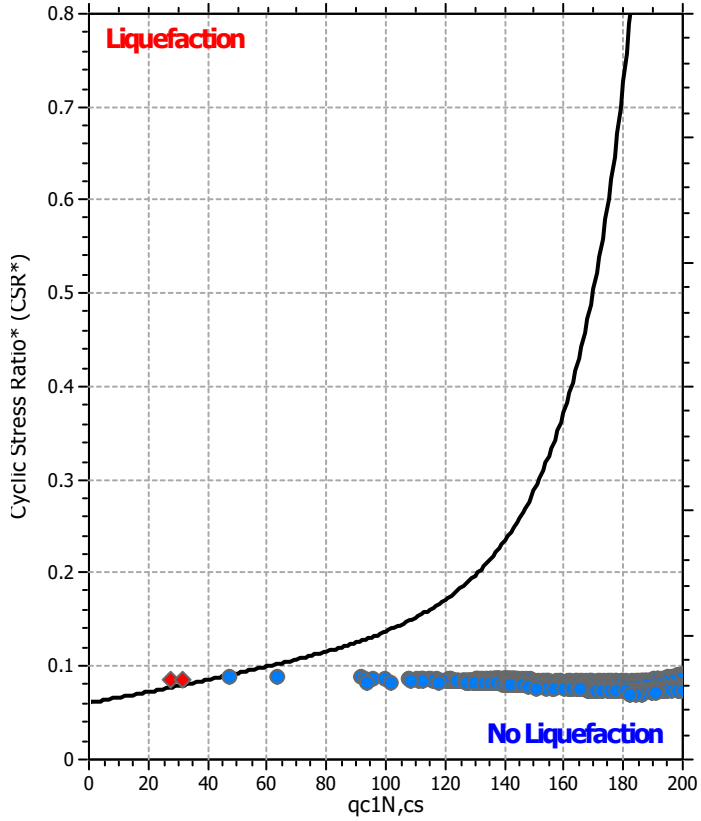
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

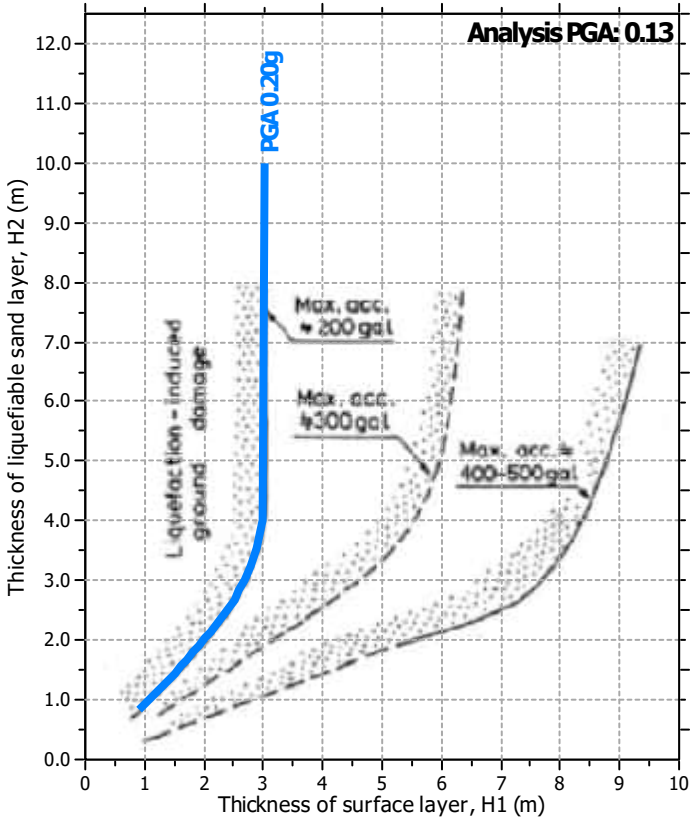
LPI color scheme

- 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.):	3.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	3.70 m	Excavation depth:	1.00 m	Limit depth:	N/A

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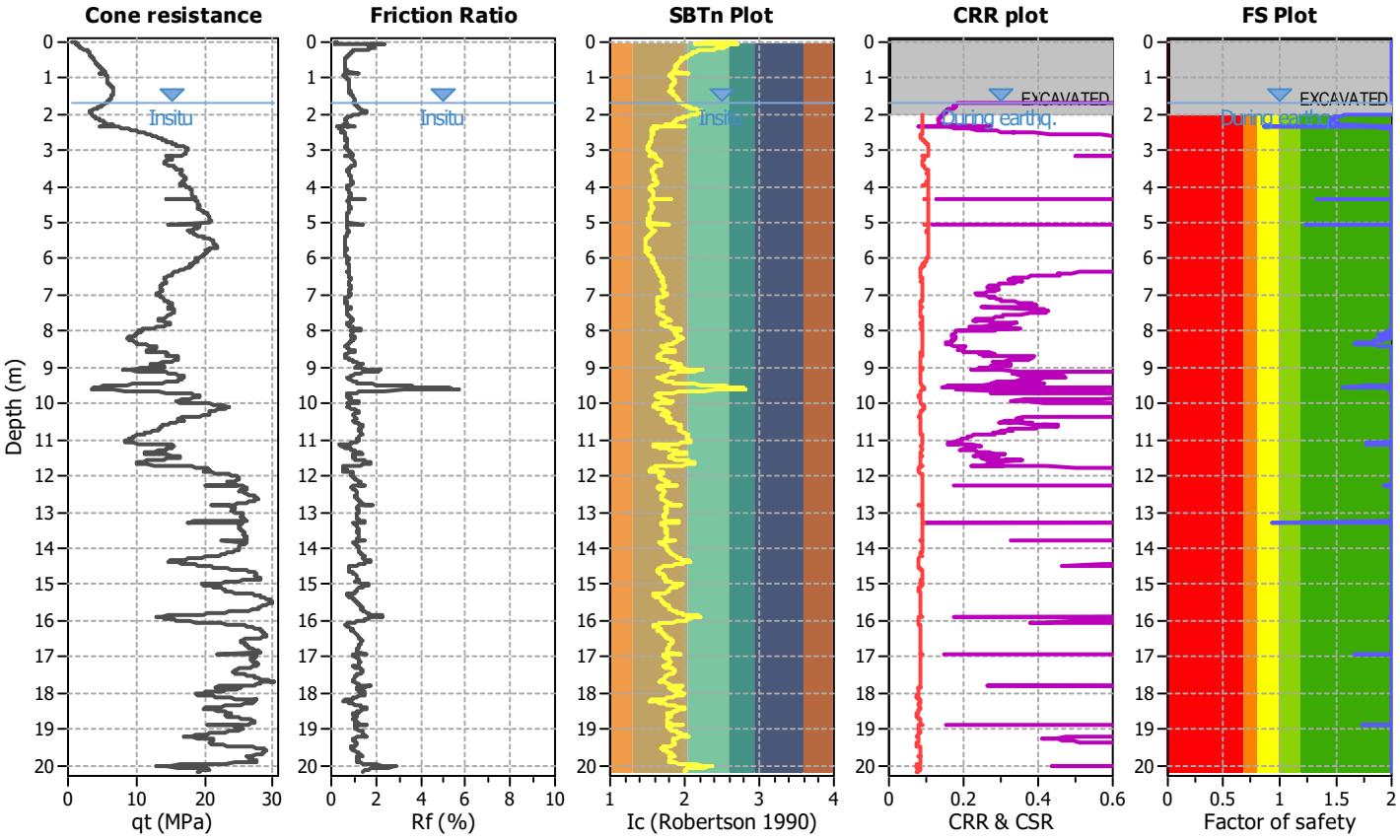
LIQUEFACTION ANALYSIS REPORT

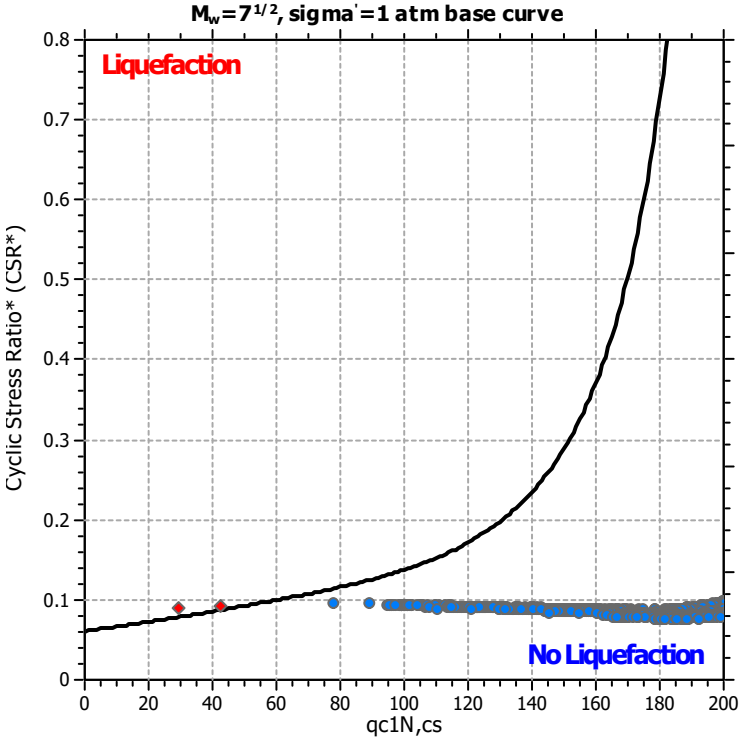
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

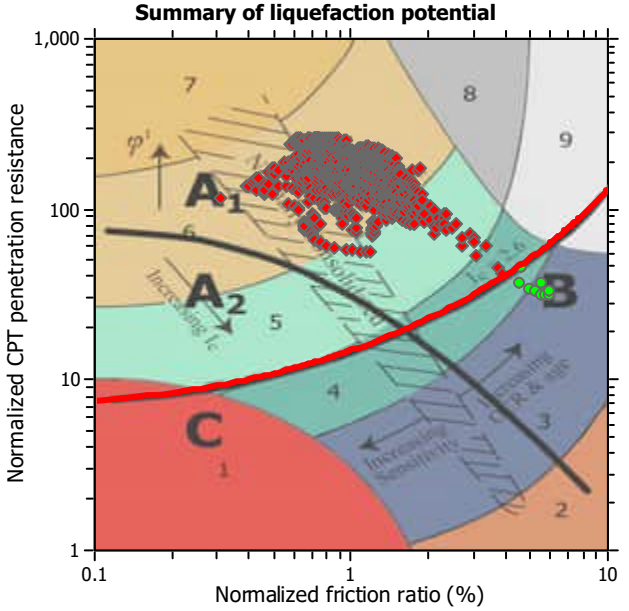
CPT file : CPT11

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Excavation:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Excavation depth:	2.00 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Footing load:	500.00 kPa	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

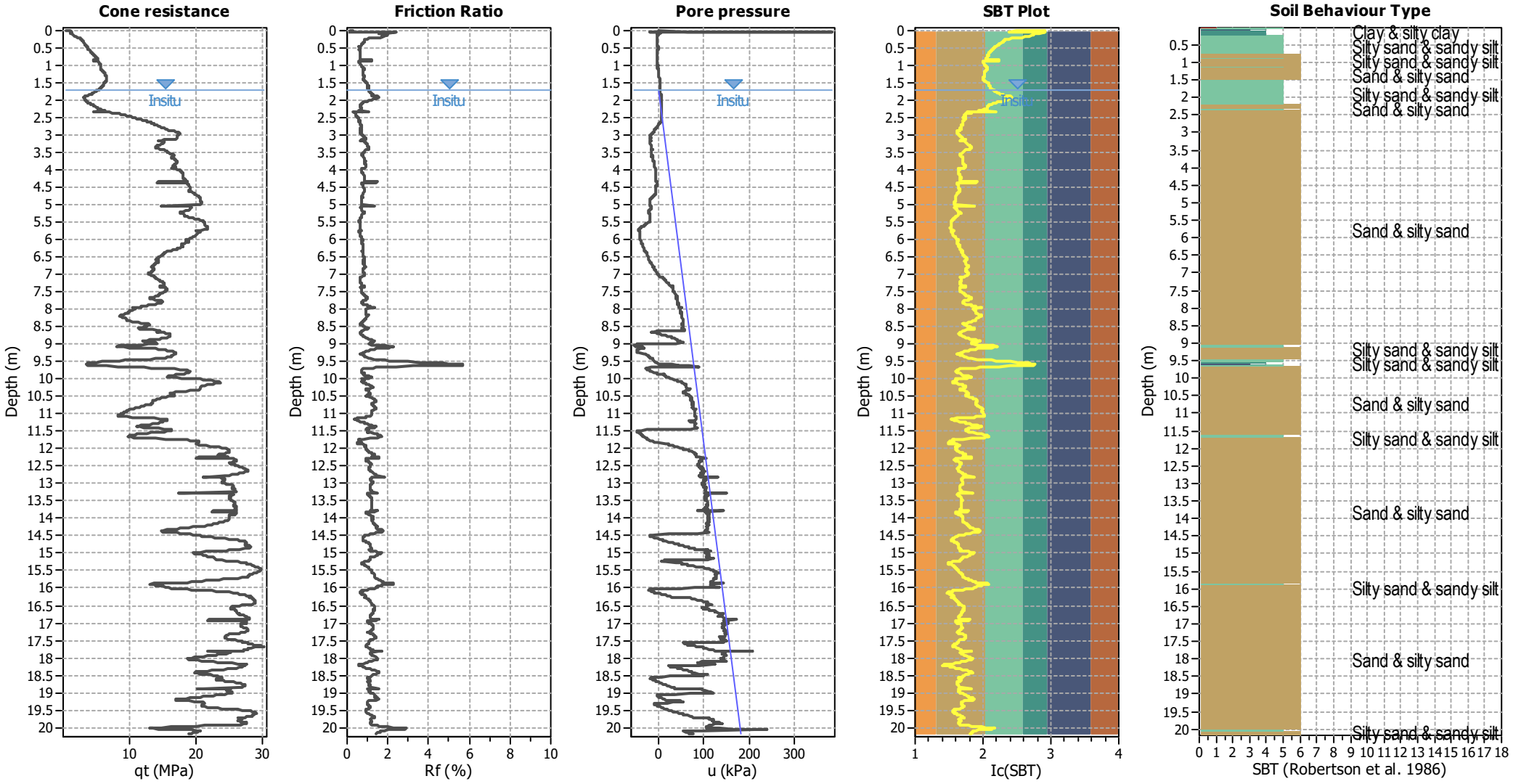






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



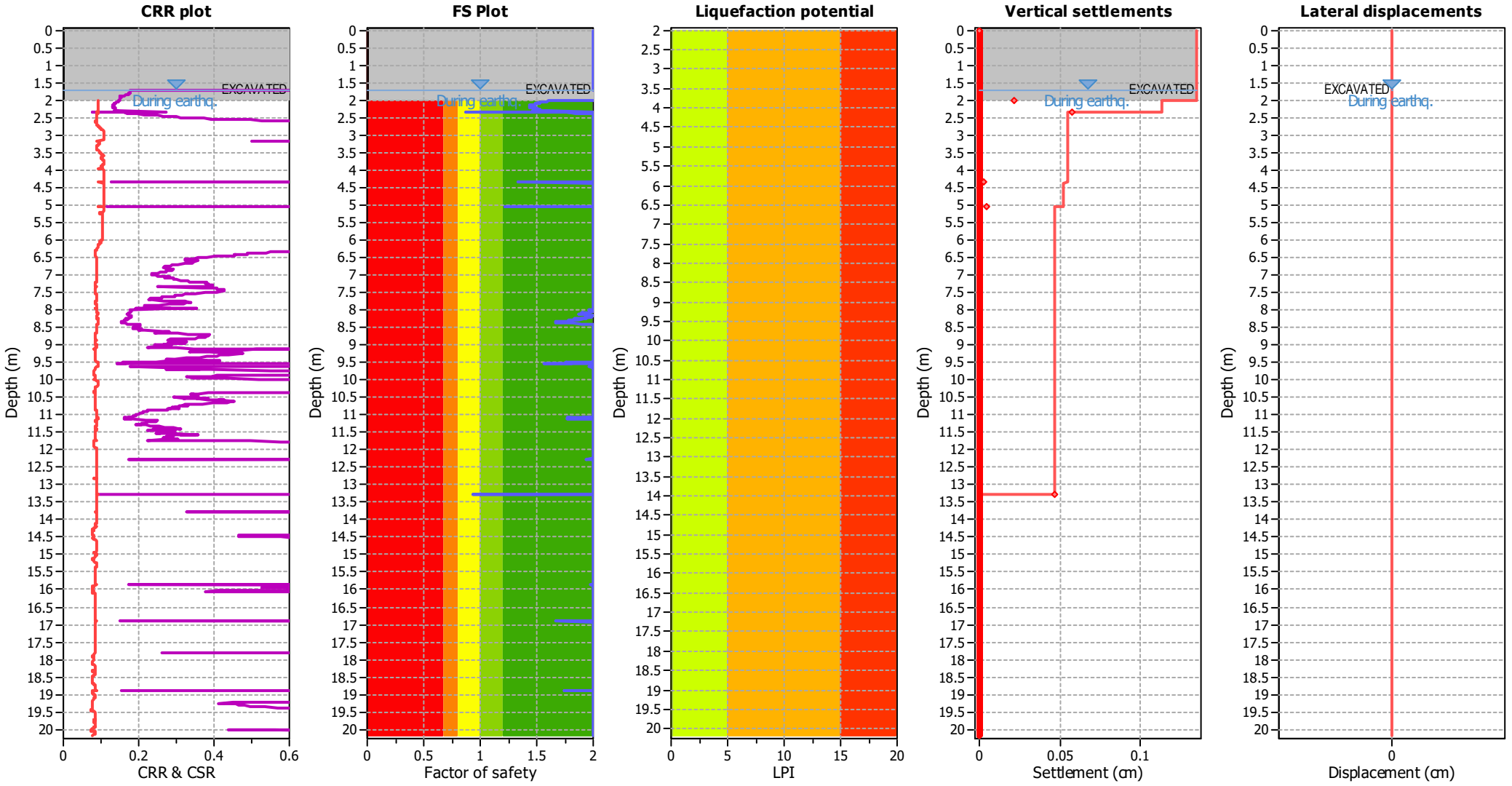
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Excavation depth:	2.00 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Excavation depth:	2.00 m	Limit depth:	N/A

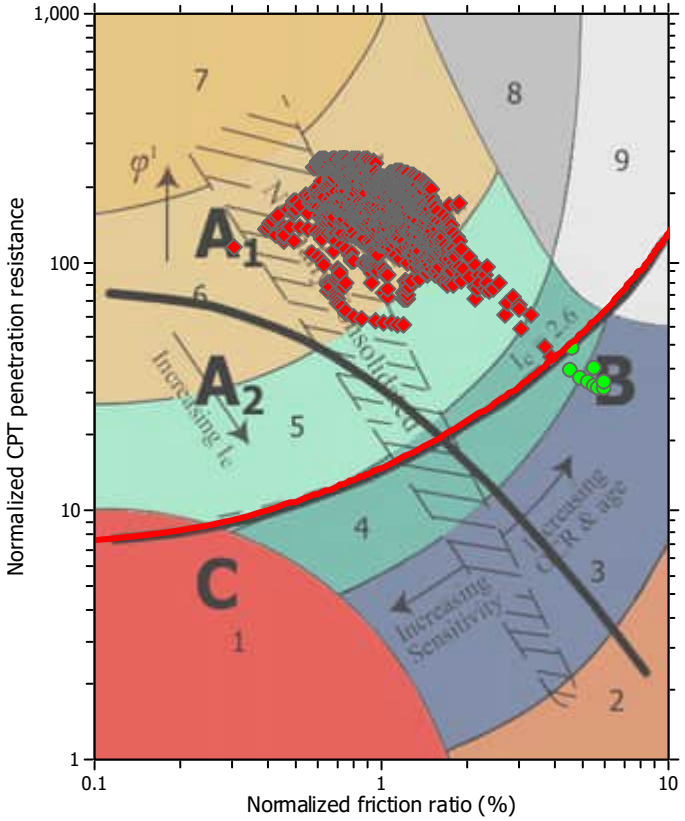
F.S. color scheme

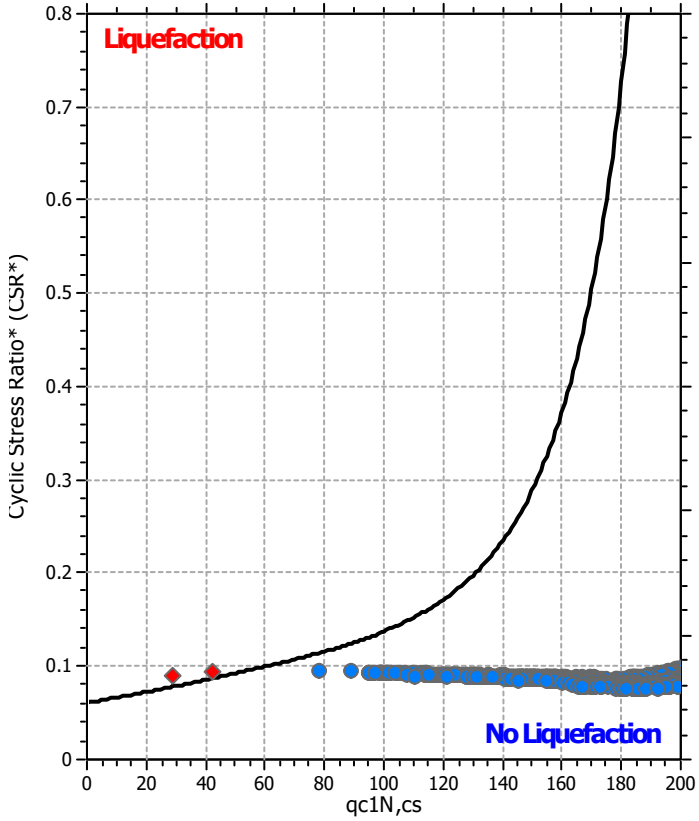
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

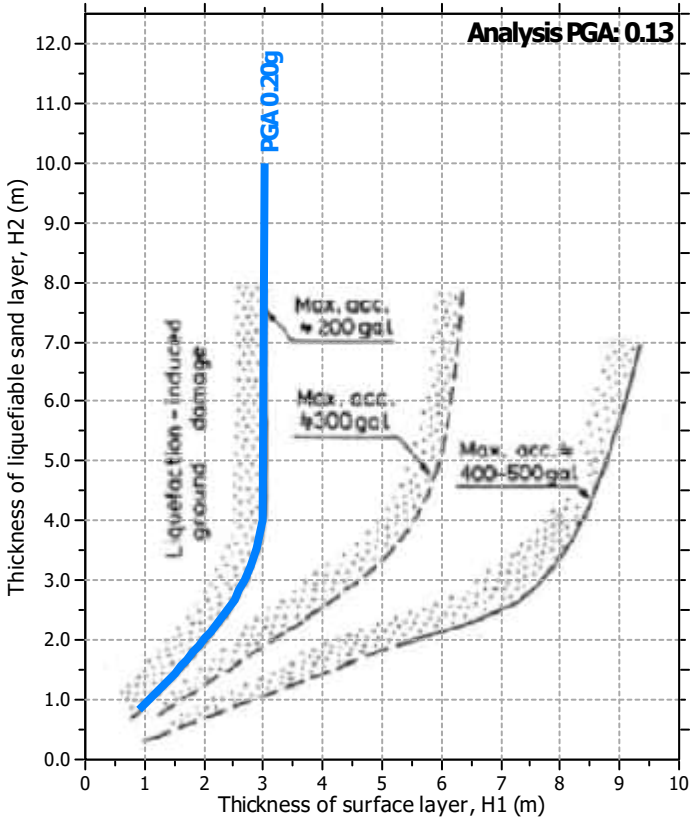
LPI color scheme

- 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.):	1.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Excavation depth:	2.00 m	Limit depth:	N/A

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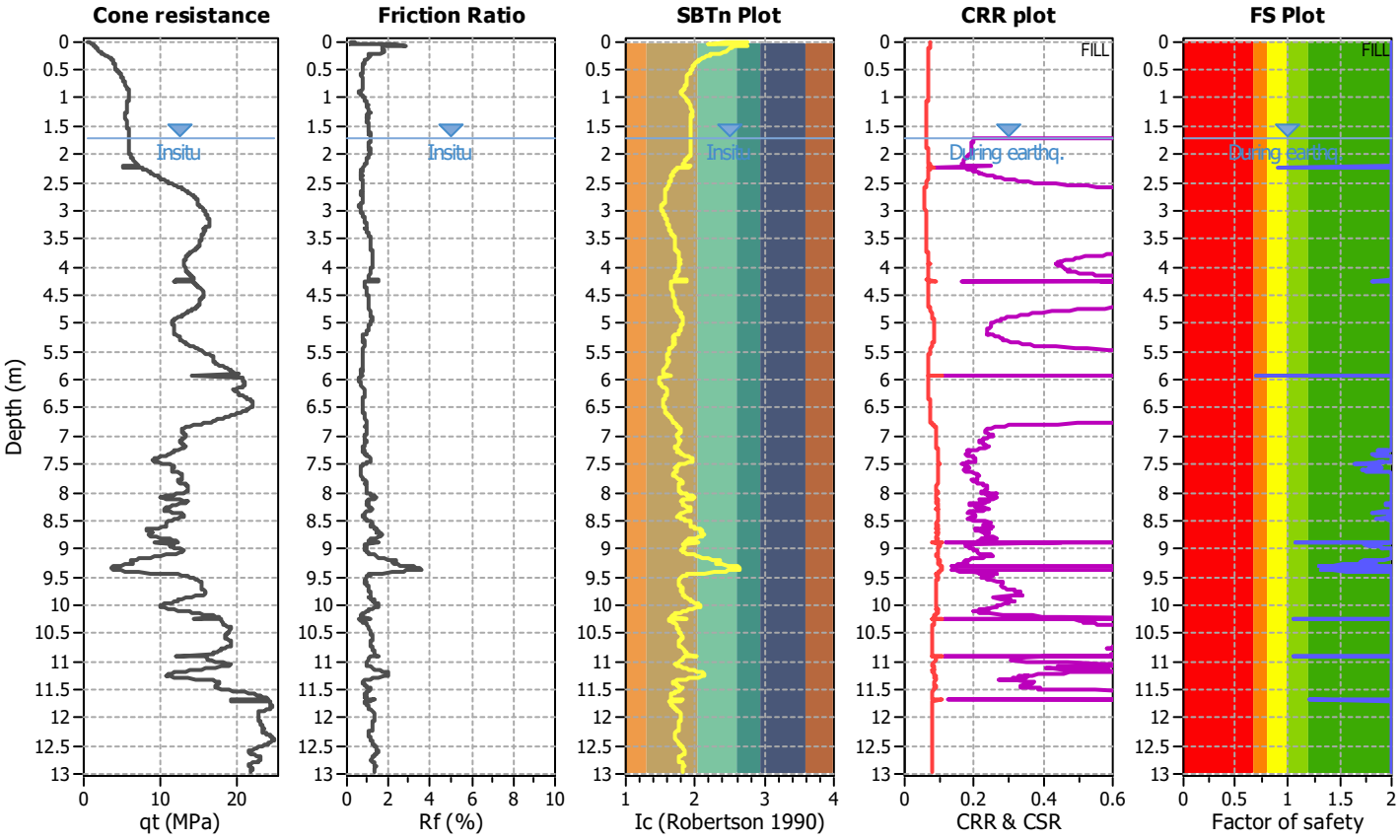
LIQUEFACTION ANALYSIS REPORT

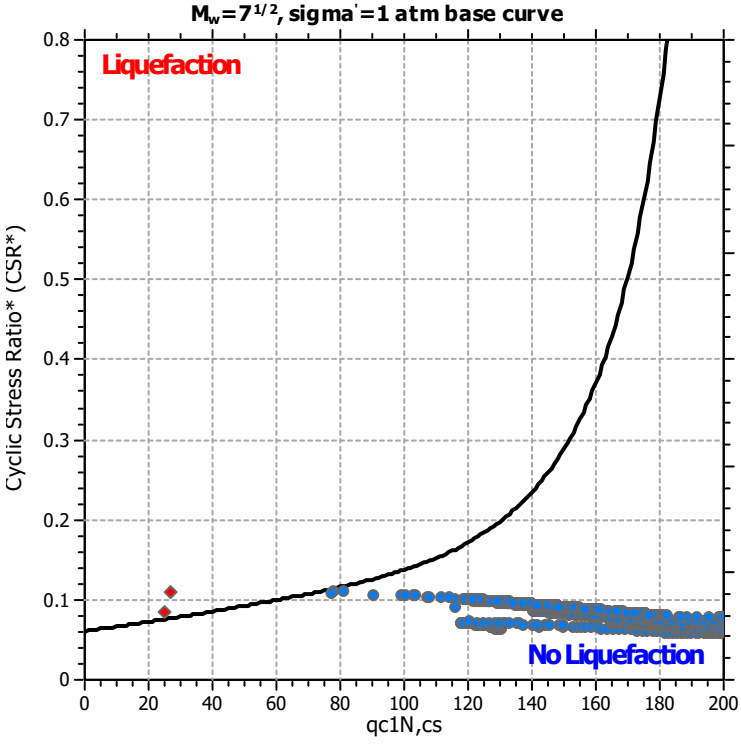
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

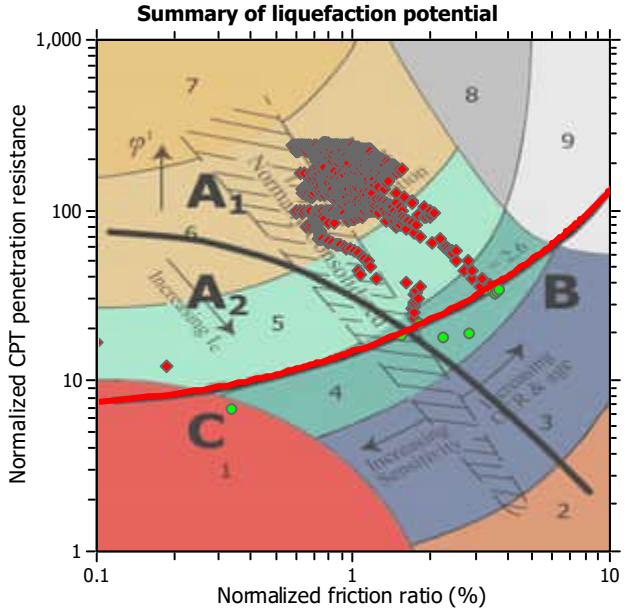
CPT file : CPT12

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.10 m	Fill height:	0.40 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

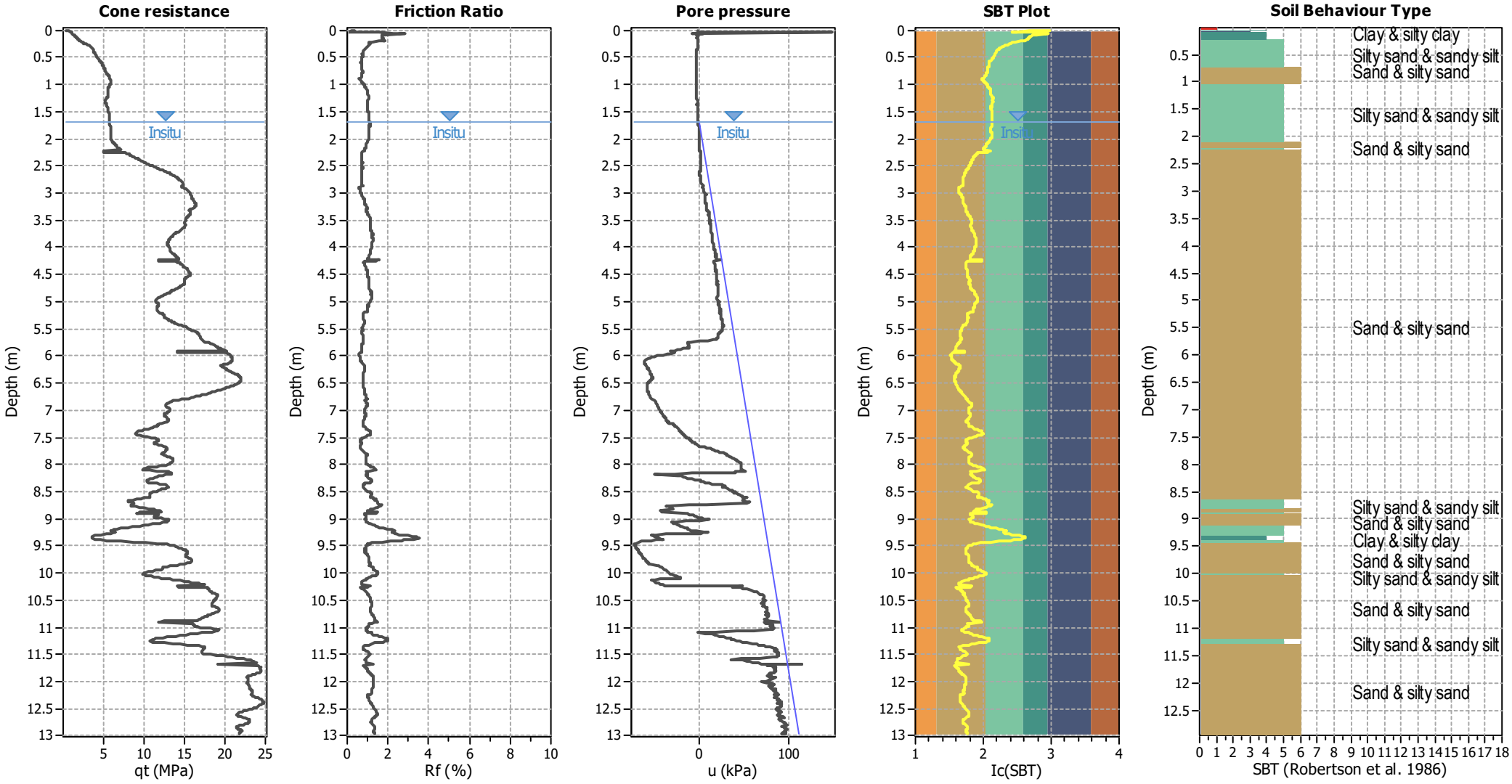






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



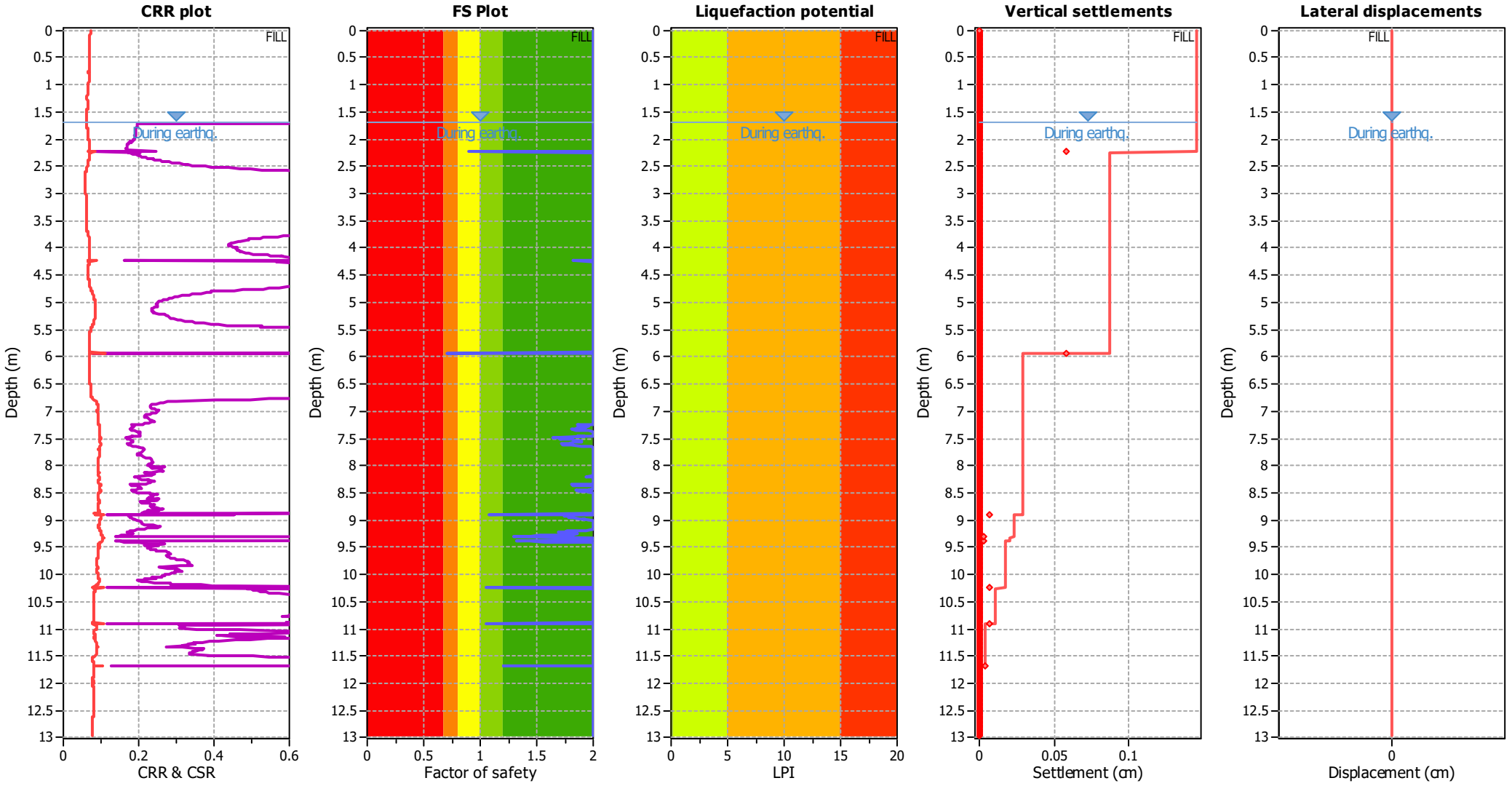
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	0.40 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	0.40 m	Limit depth:	N/A

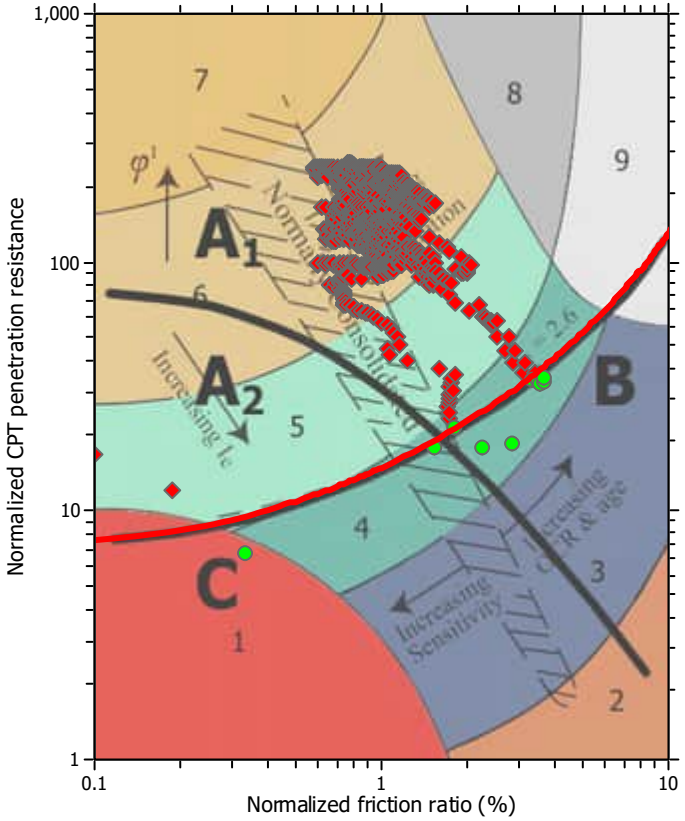
F.S. color scheme

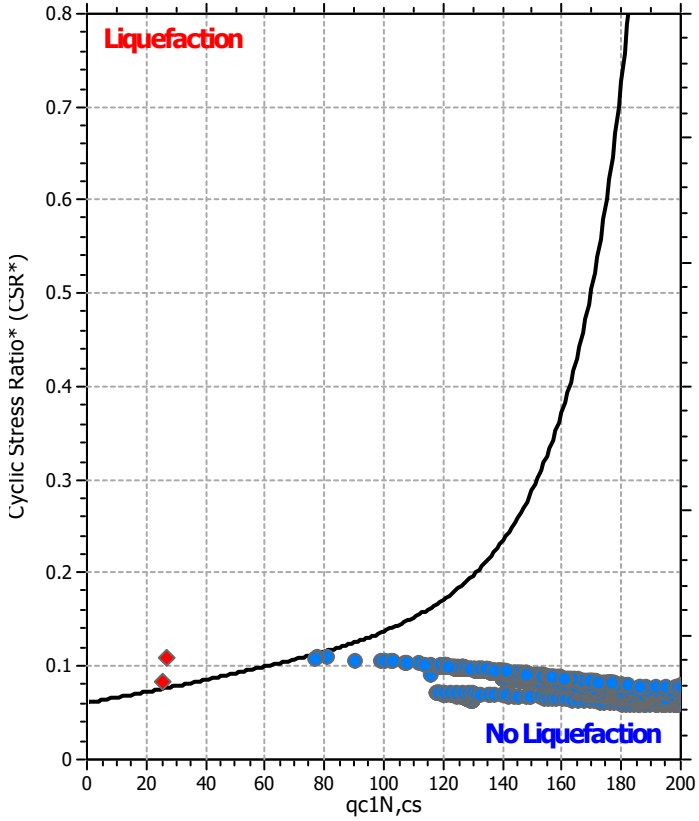
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

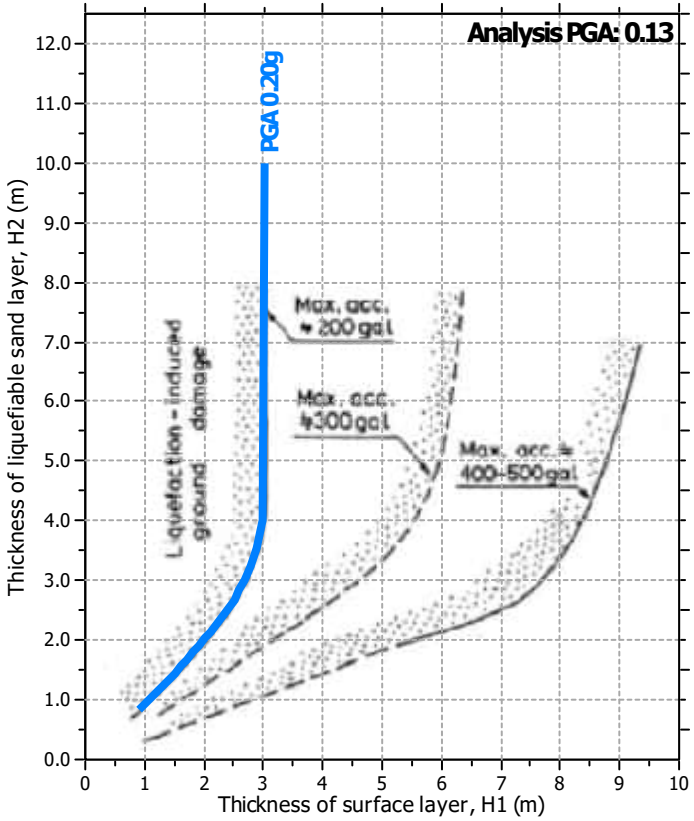
LPI color scheme

- 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.):	2.10 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	0.40 m	Limit depth:	N/A

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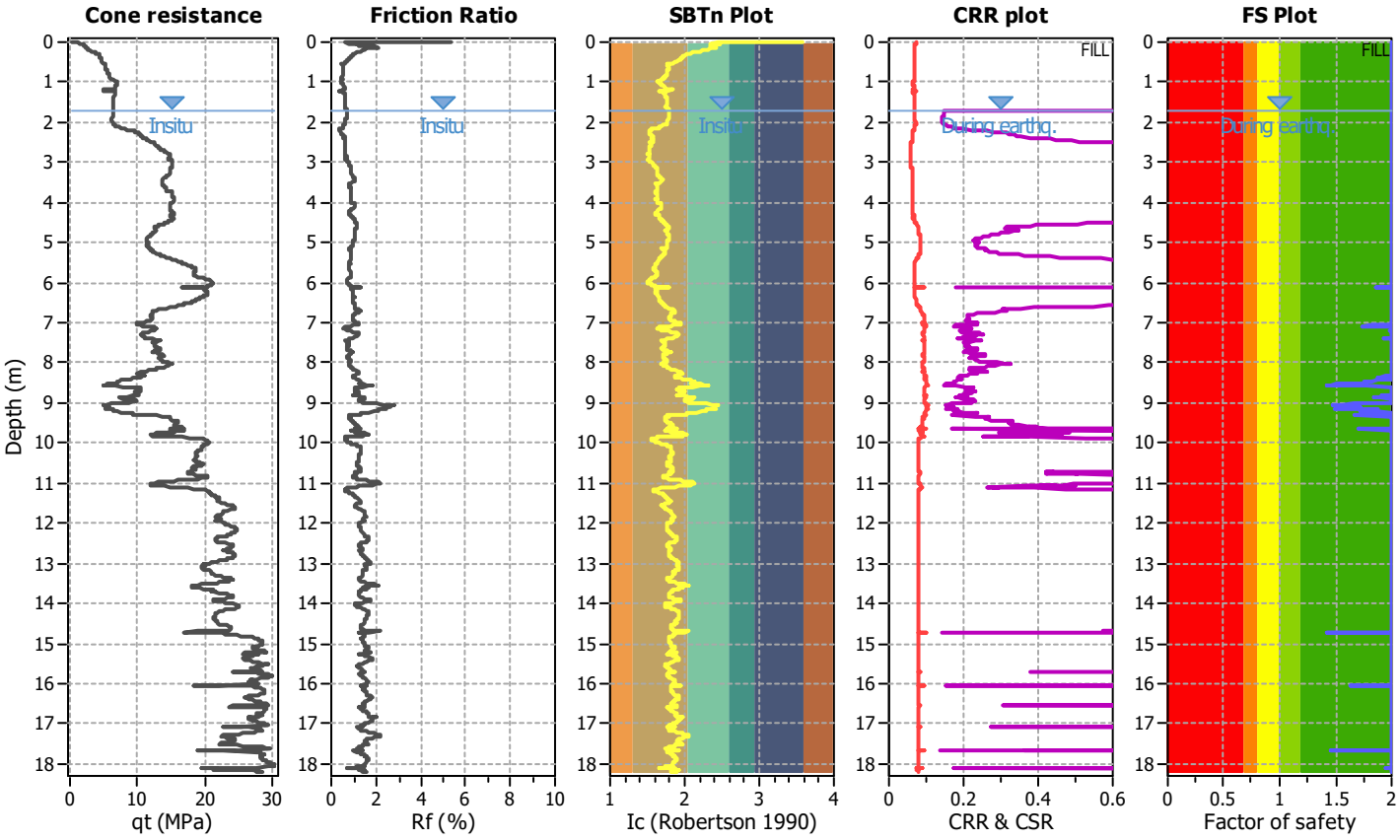
LIQUEFACTION ANALYSIS REPORT

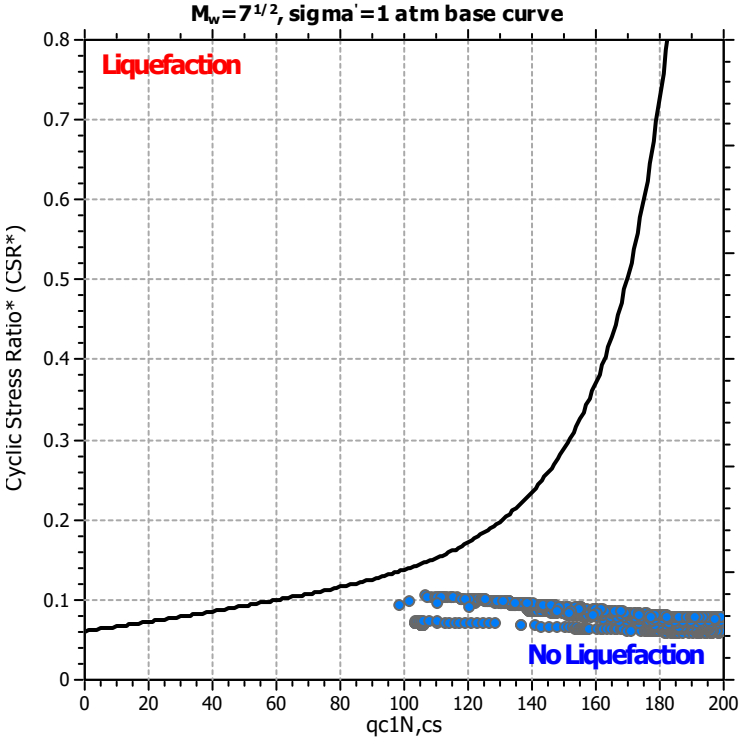
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

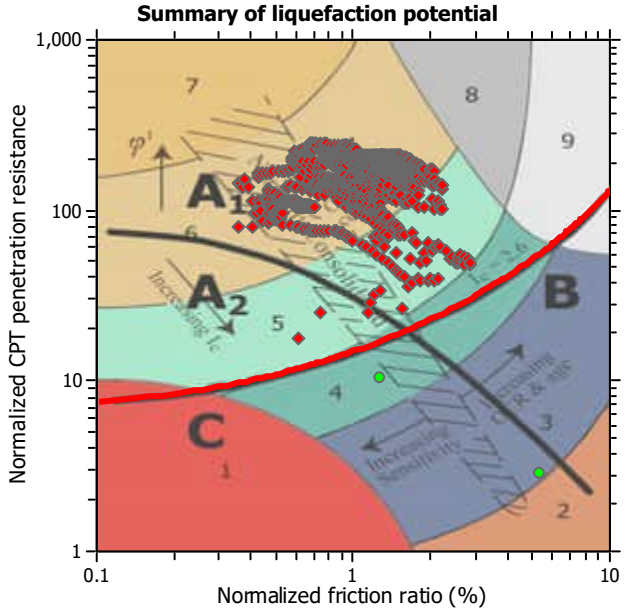
CPT file : CPT12A

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.10 m	Fill height:	0.40 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

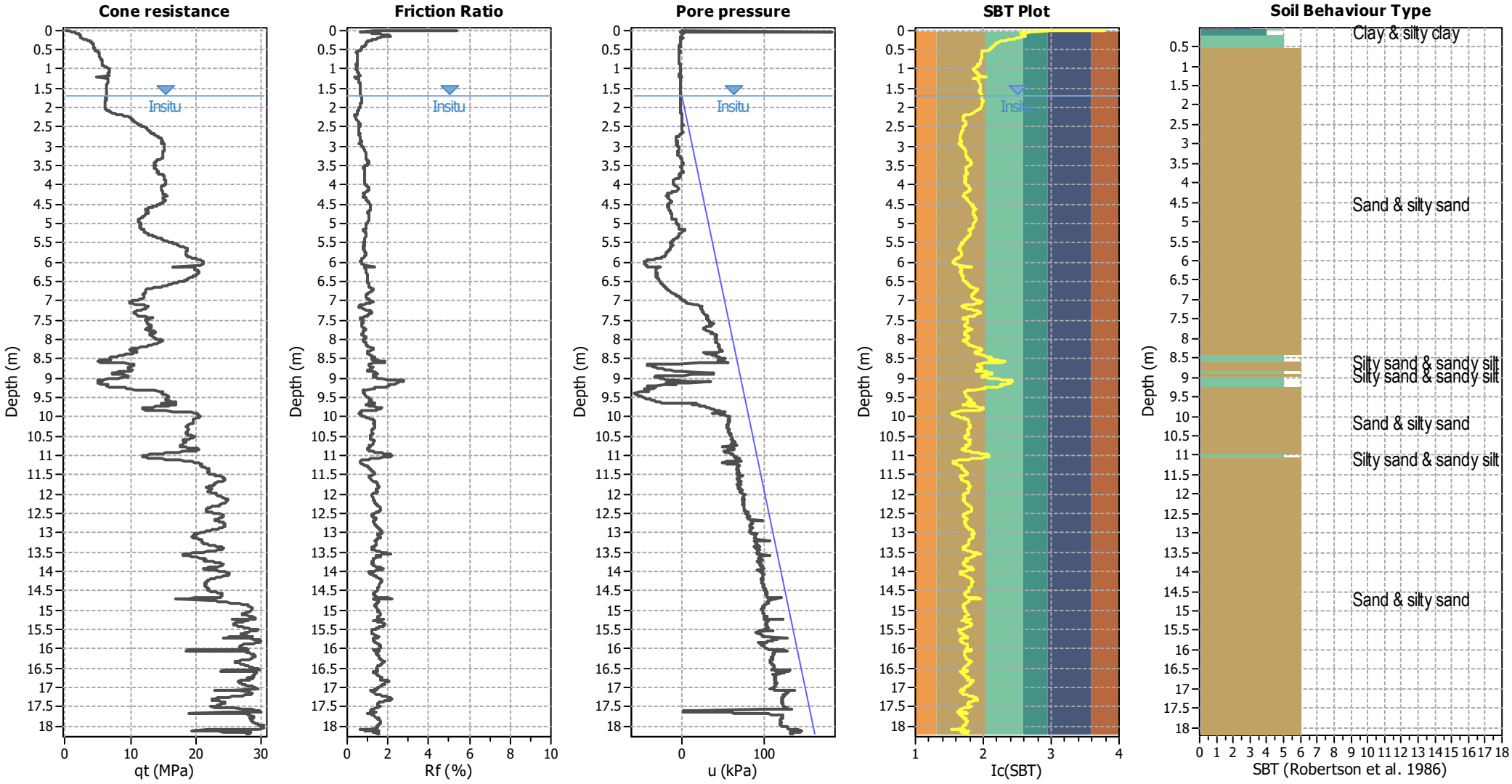






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



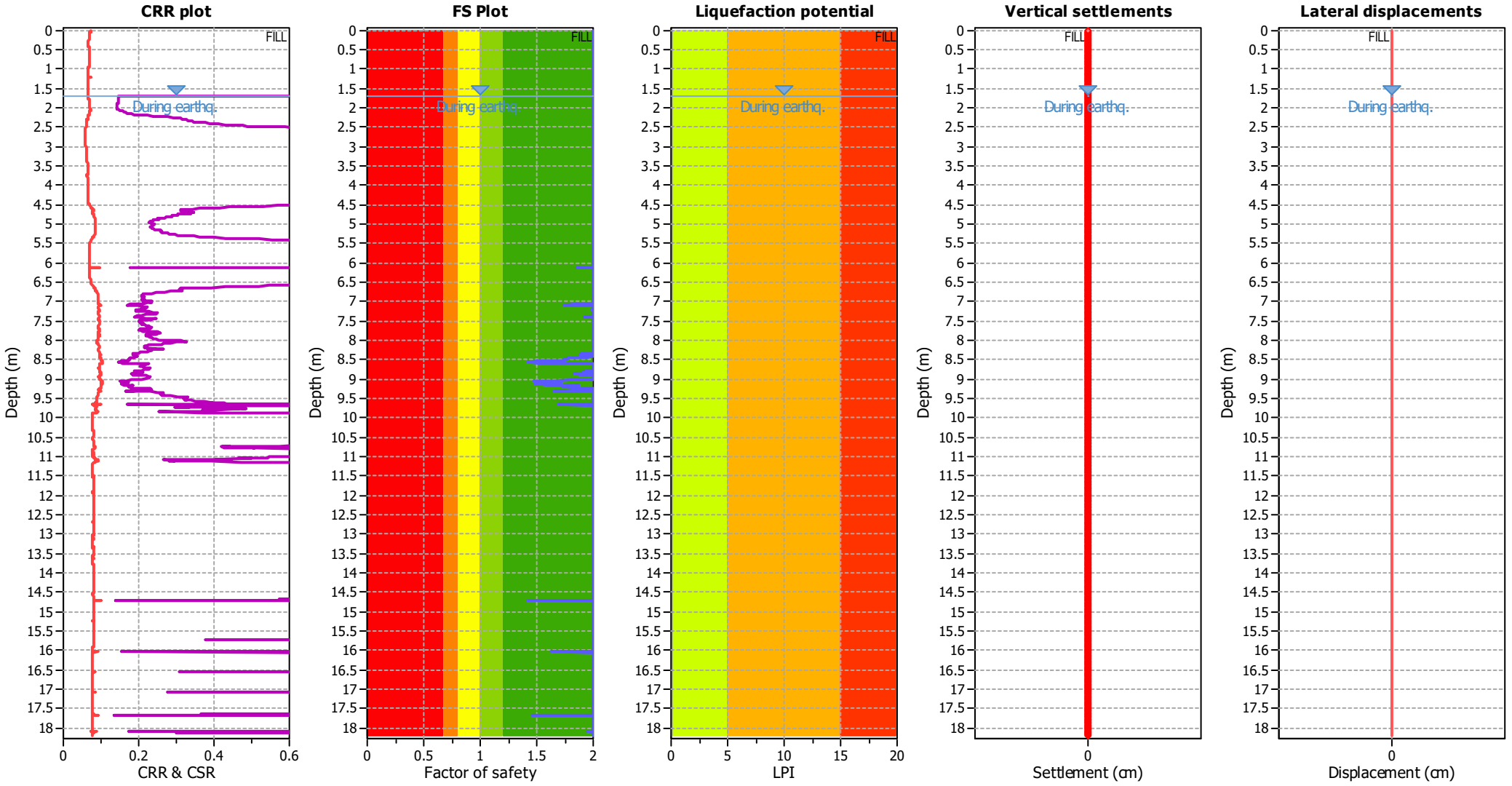
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	0.40 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	0.40 m	Limit depth:	N/A

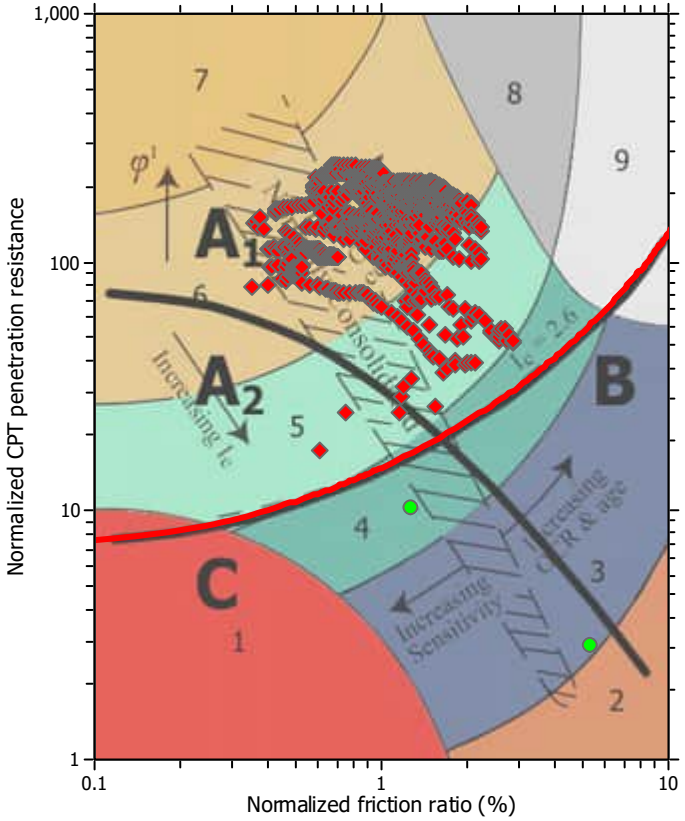
F.S. color scheme

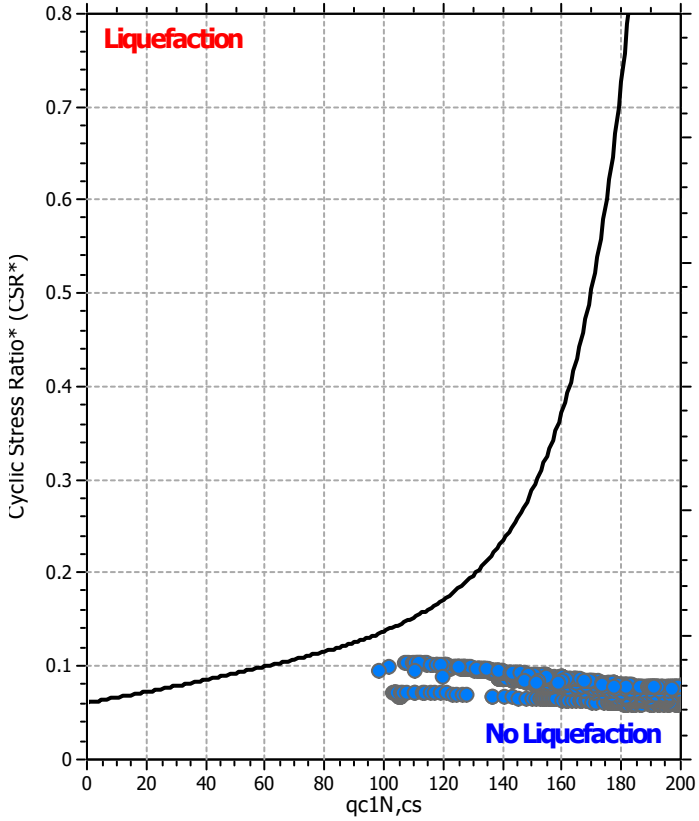
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

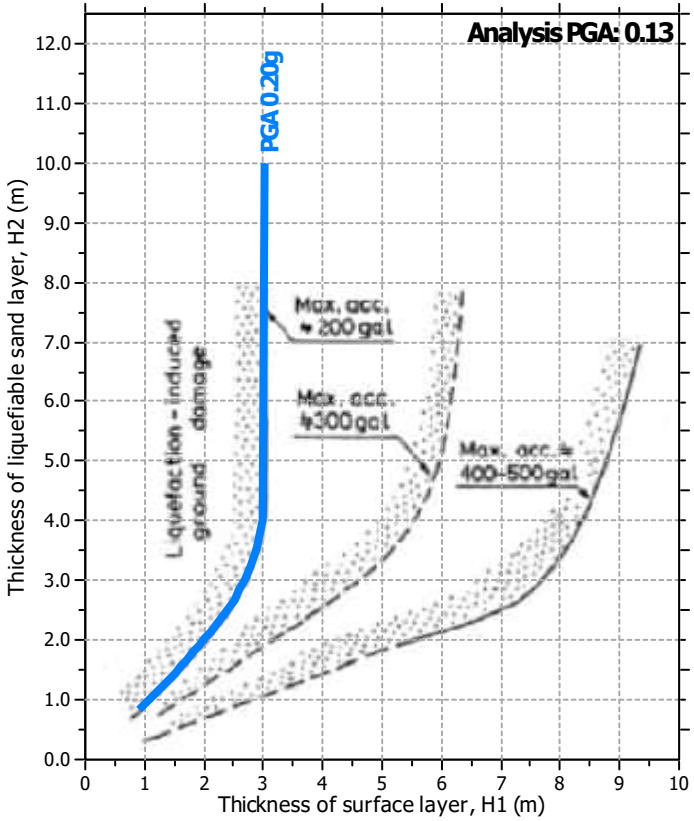
LPI color scheme

- 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.):	2.10 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	0.40 m	Limit depth:	N/A

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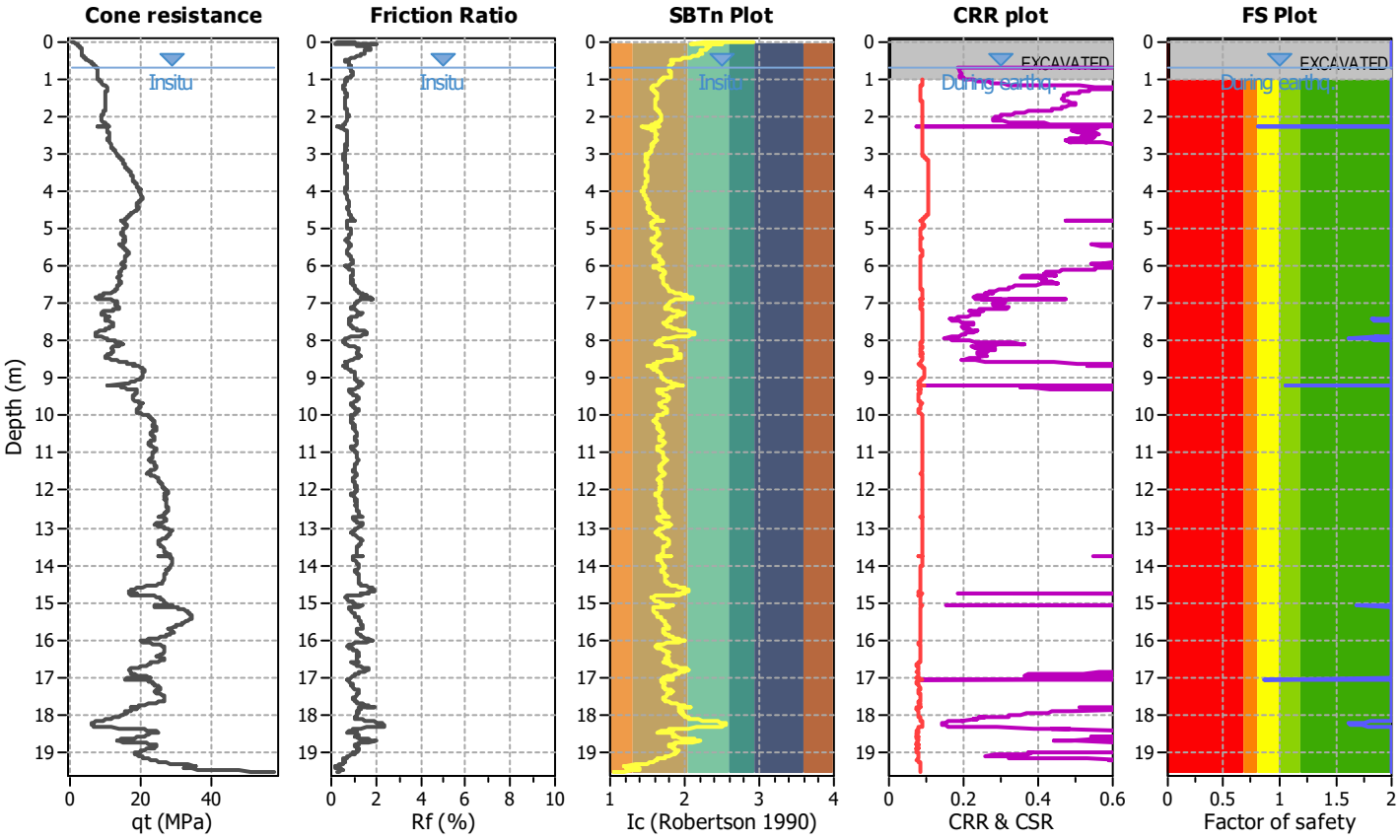
LIQUEFACTION ANALYSIS REPORT

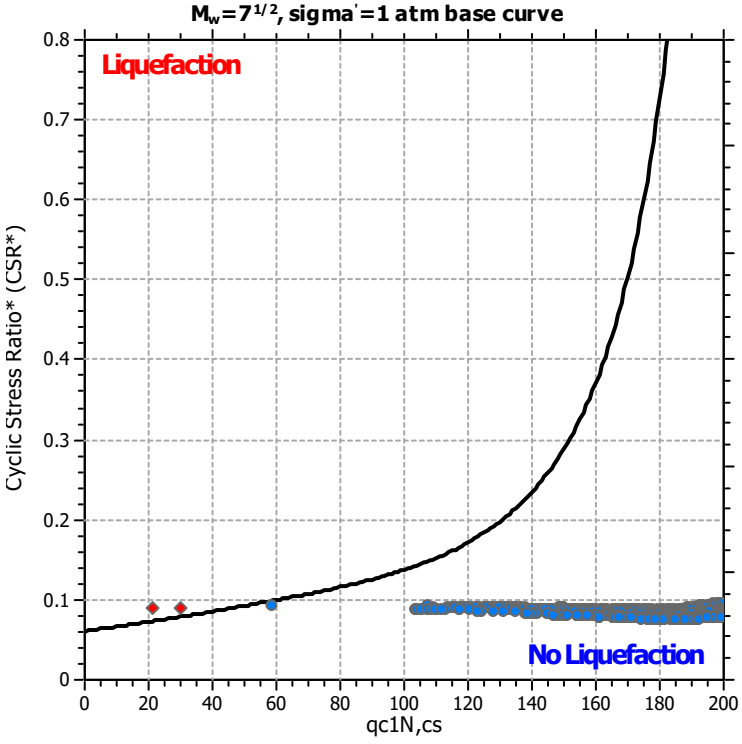
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

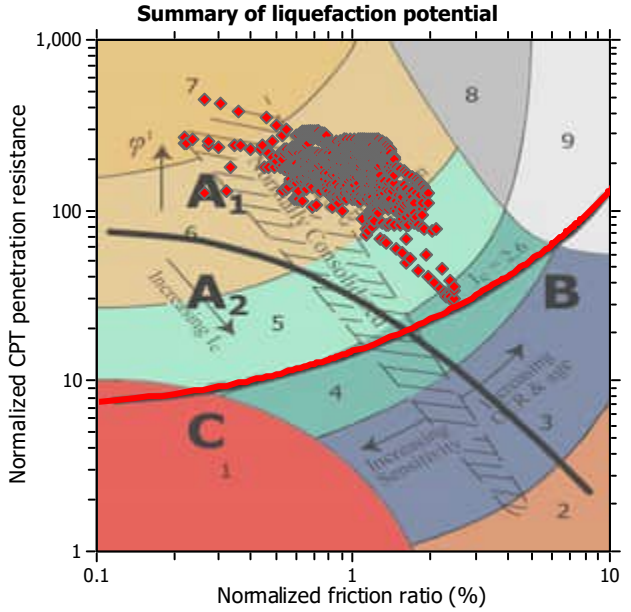
CPT file : CPT13

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.70 m	Excavation:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.70 m	Excavation depth:	1.00 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Footing load:	500.00 kPa	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

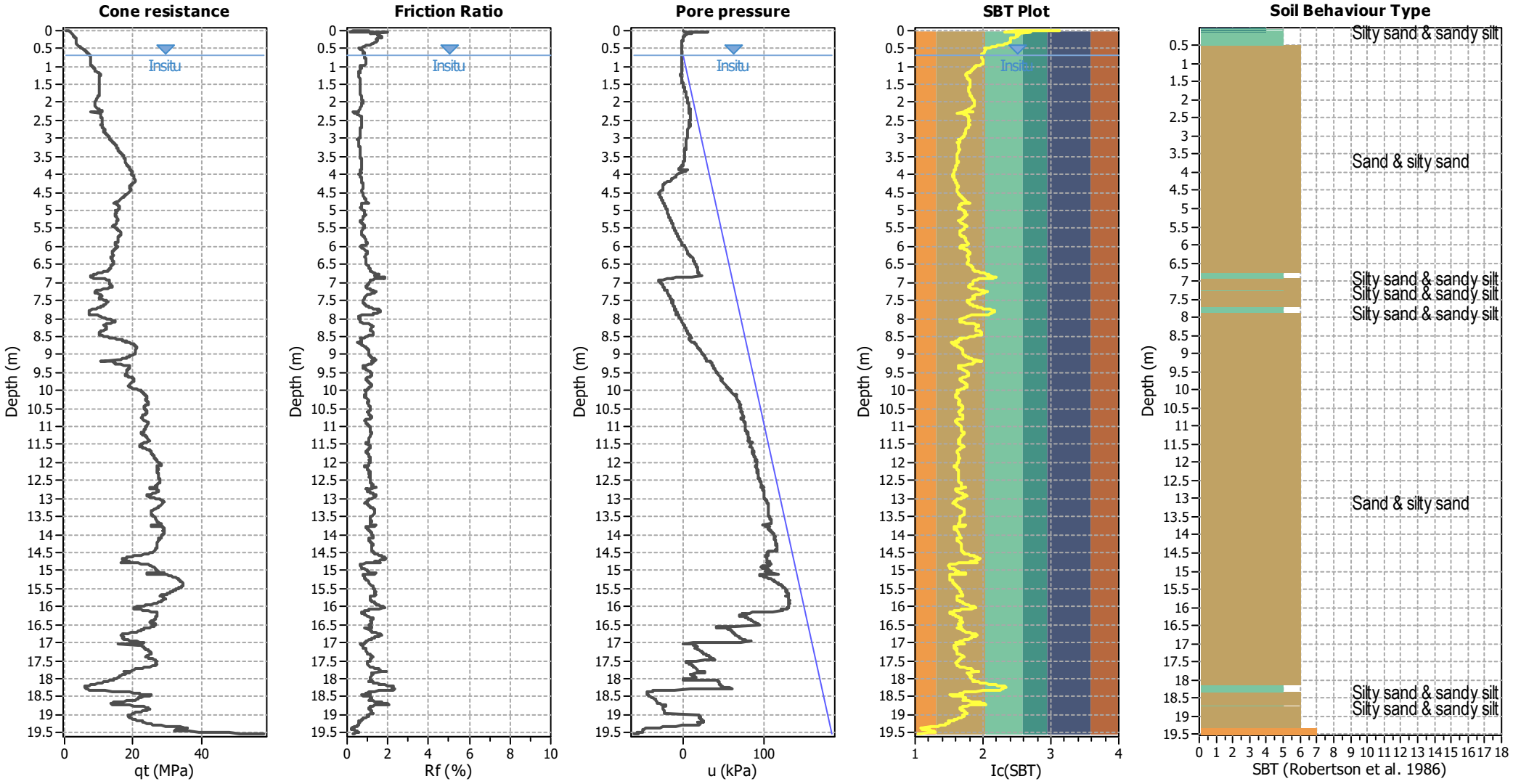






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



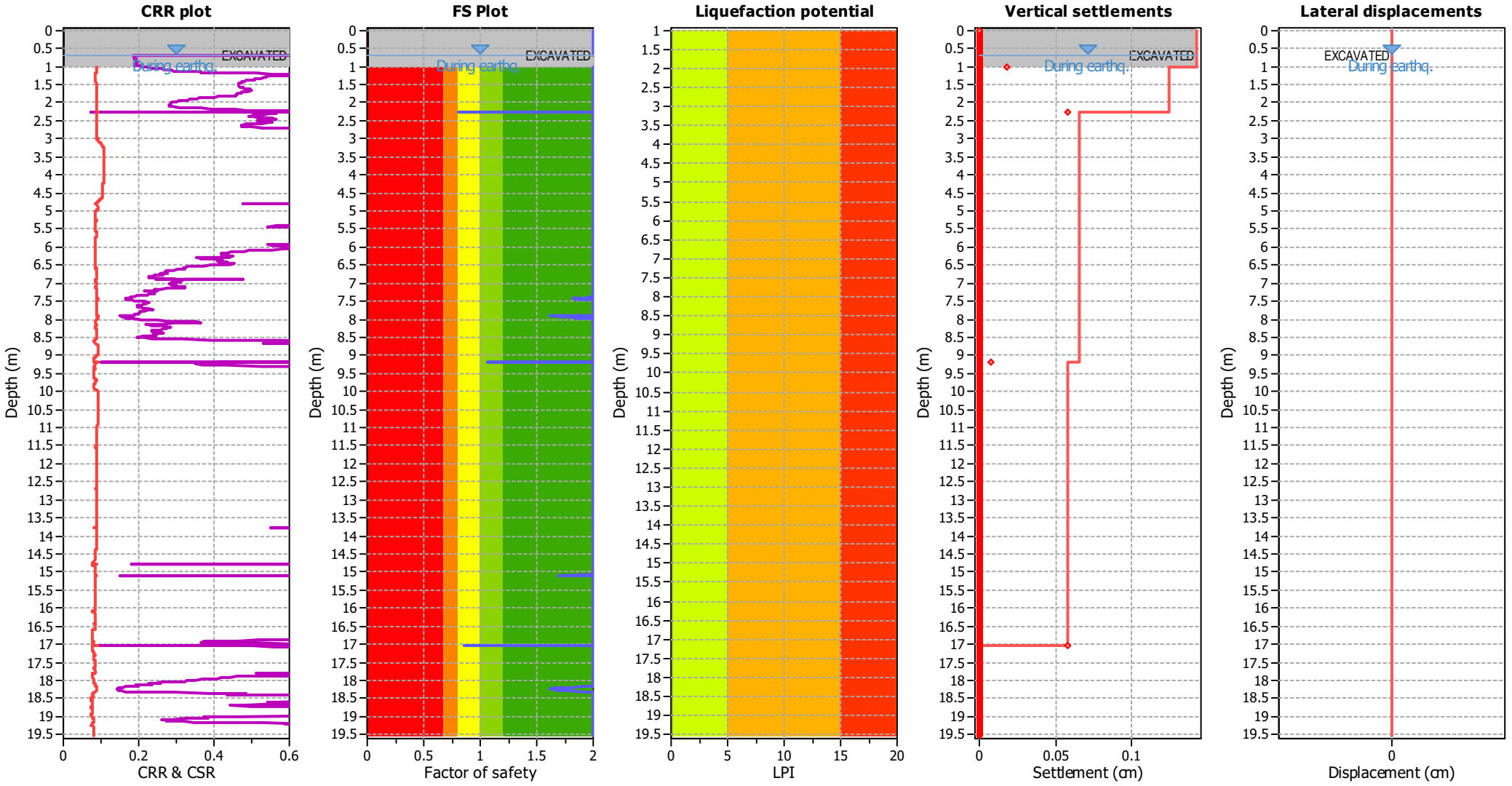
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	0.70 m	Excavation depth:	1.00 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	0.70 m	Excavation depth:	1.00 m	Limit depth:	N/A

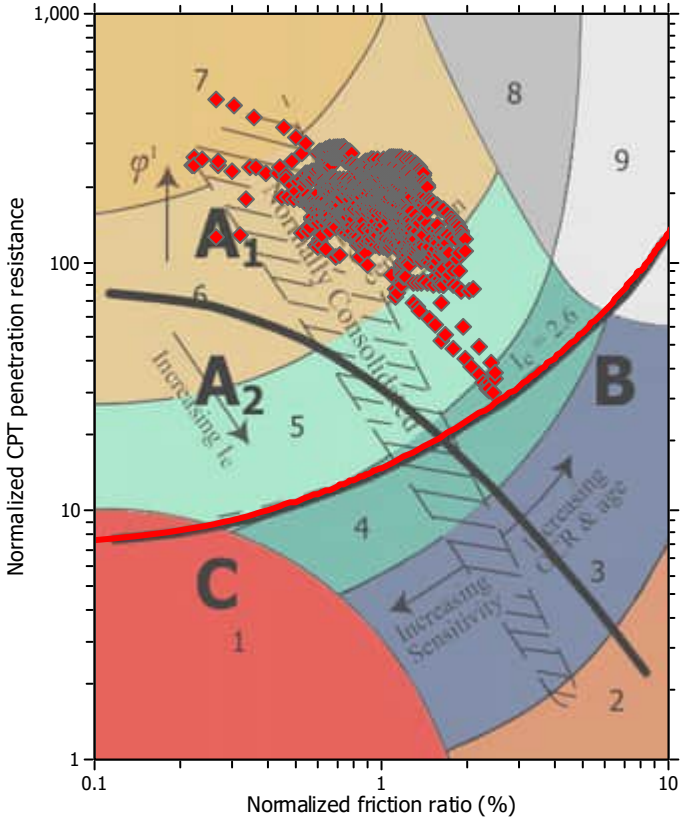
F.S. color scheme

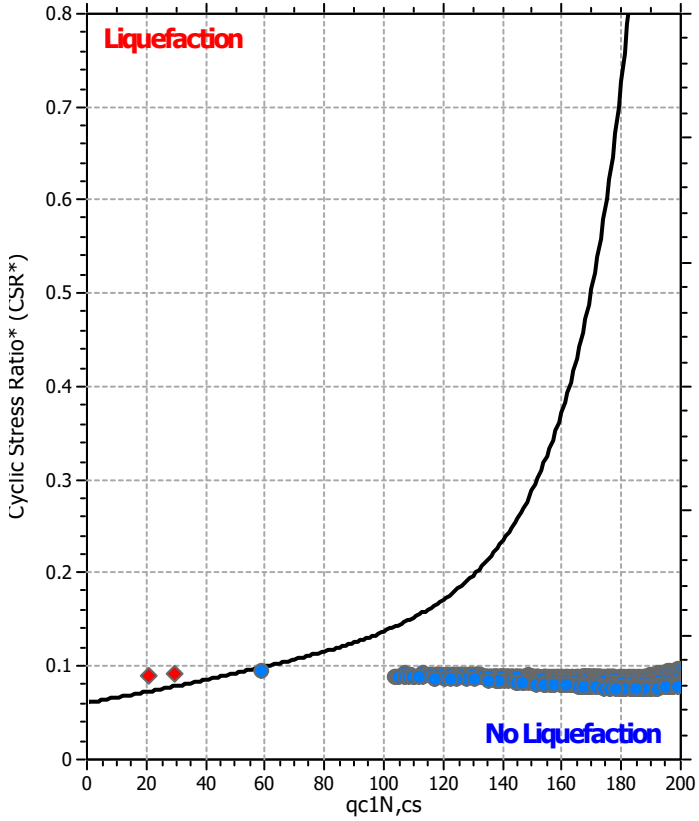
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

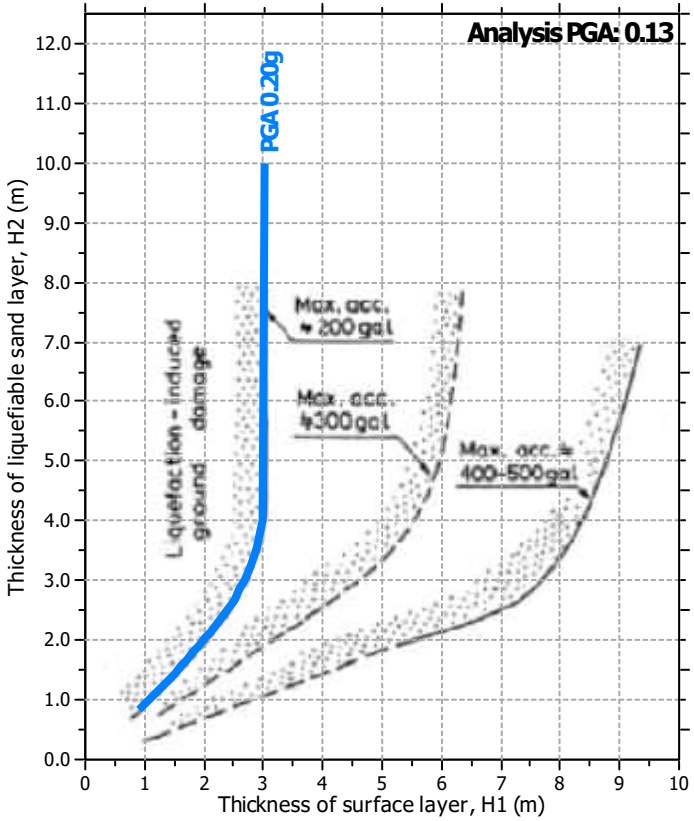
LPI color scheme

- 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.):	0.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	0.70 m	Excavation depth:	1.00 m	Limit depth:	N/A

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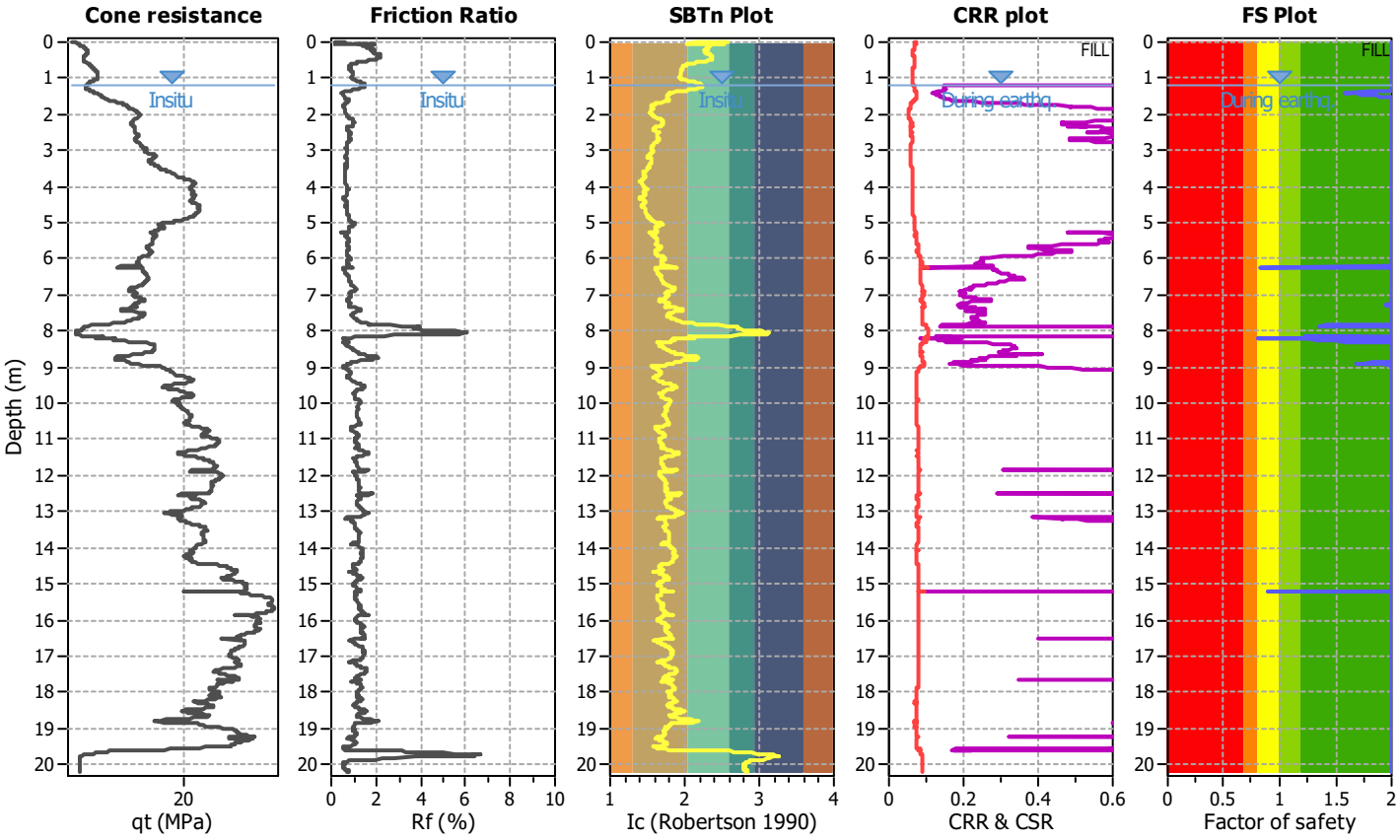
LIQUEFACTION ANALYSIS REPORT

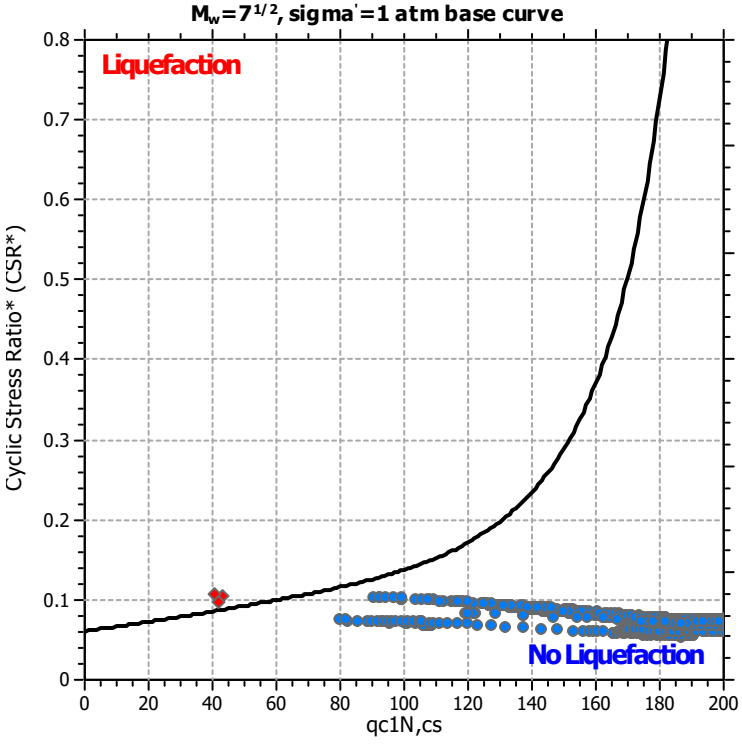
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

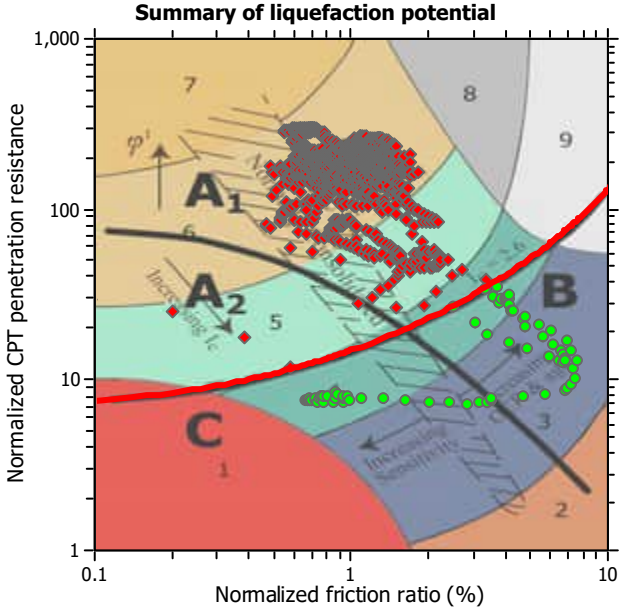
CPT file : CPT14

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.20 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.70 m	Fill height:	1.50 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

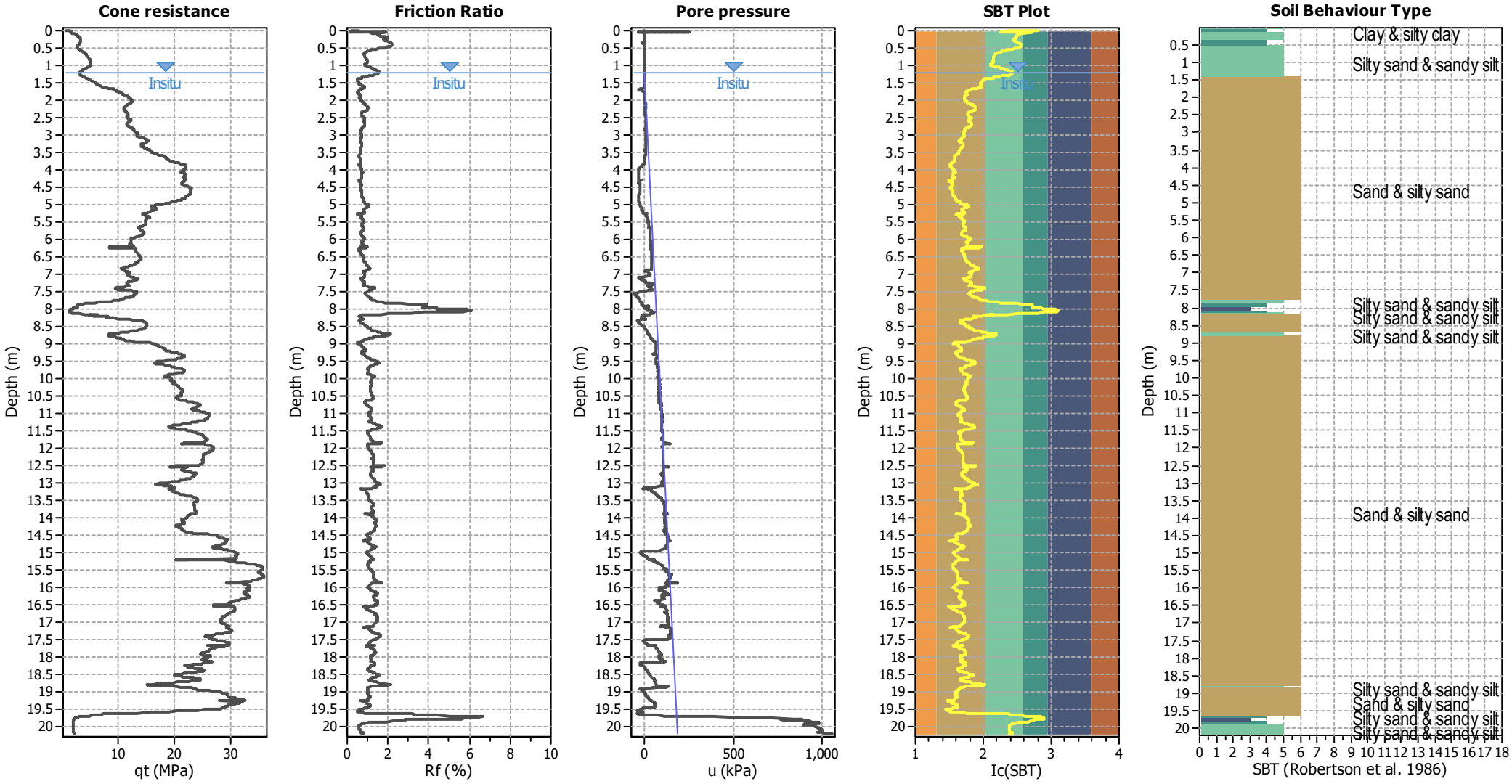






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



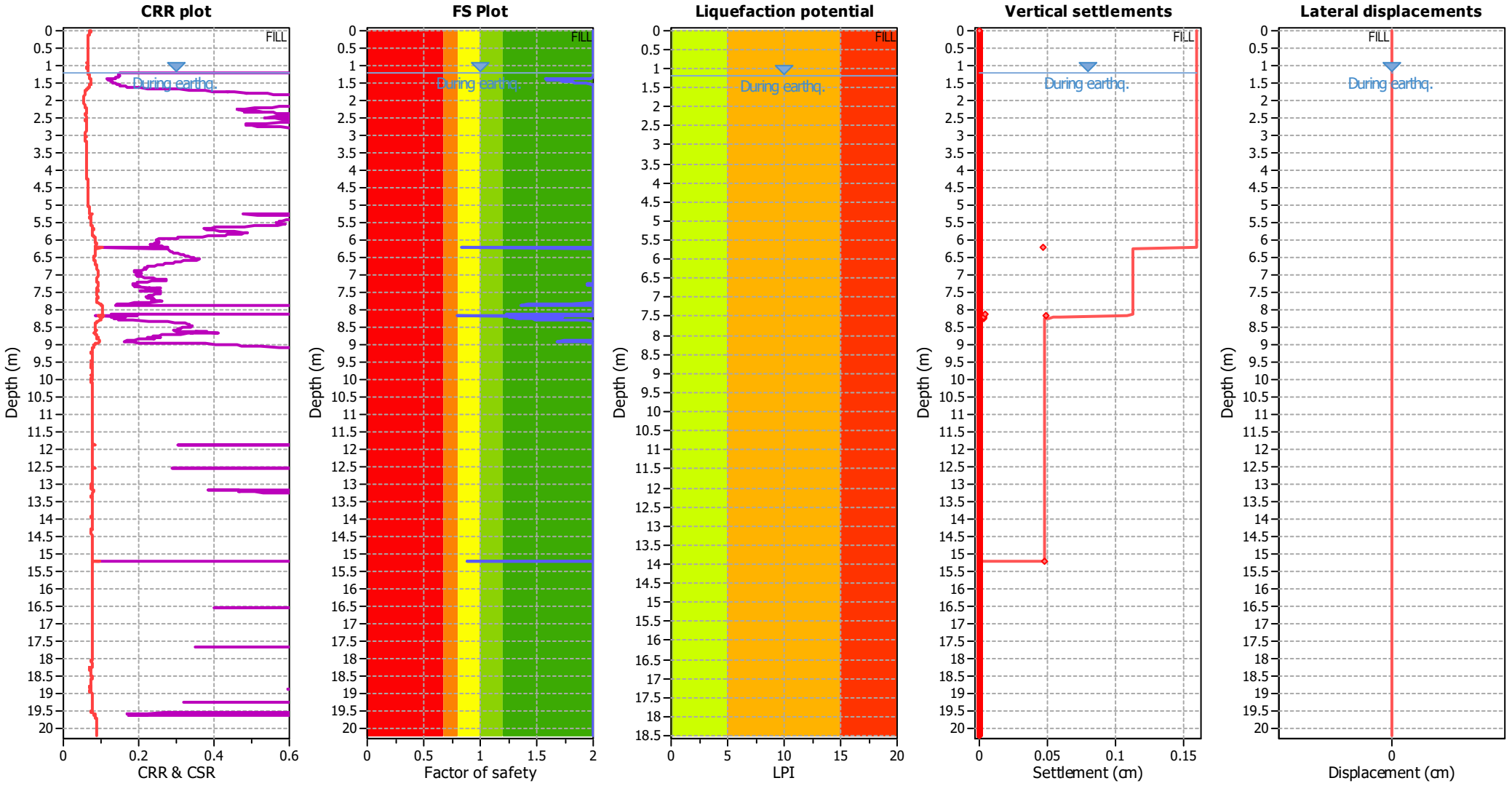
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.70 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.20 m	Fill height:	1.50 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.70 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.20 m	Fill height:	1.50 m	Limit depth:	N/A

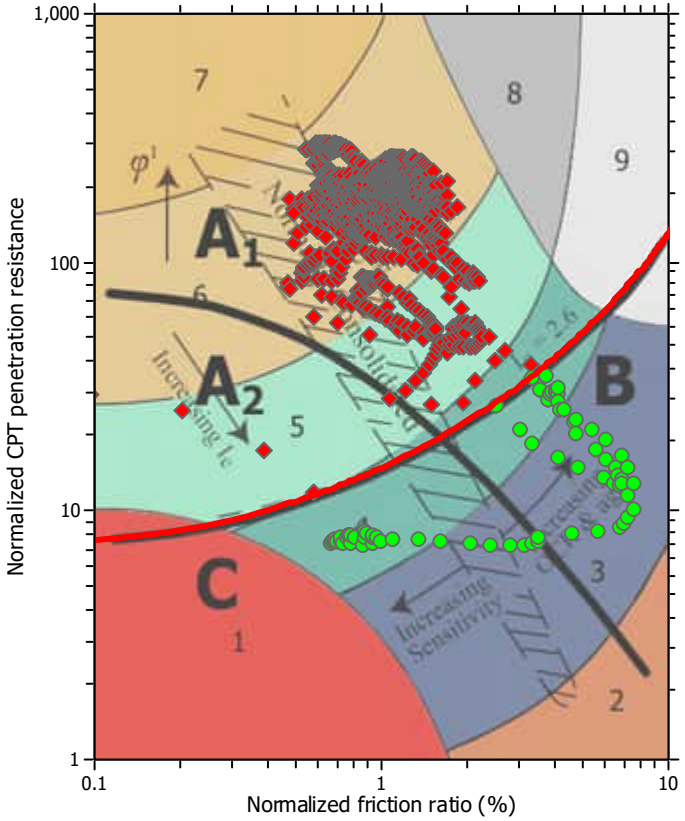
F.S. color scheme

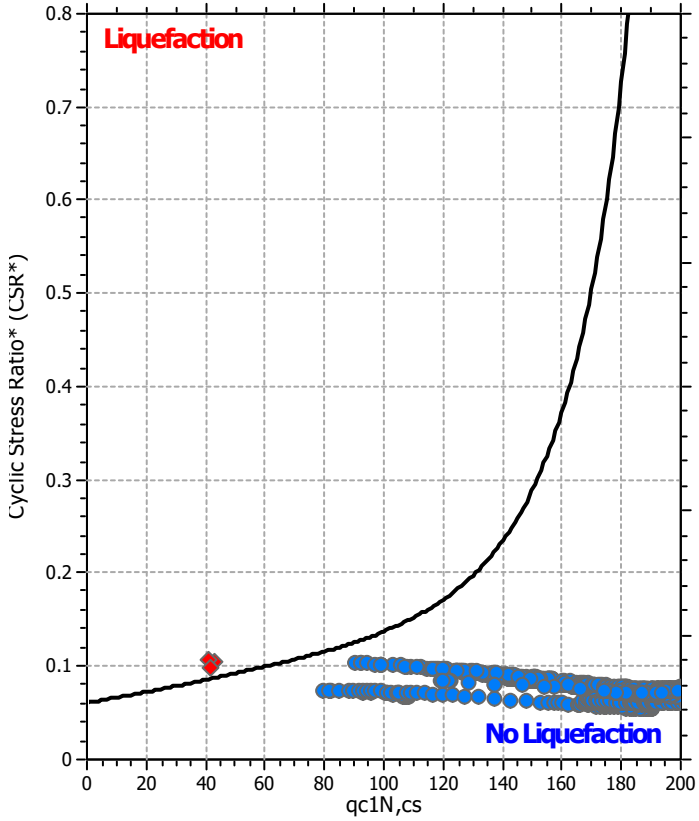
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

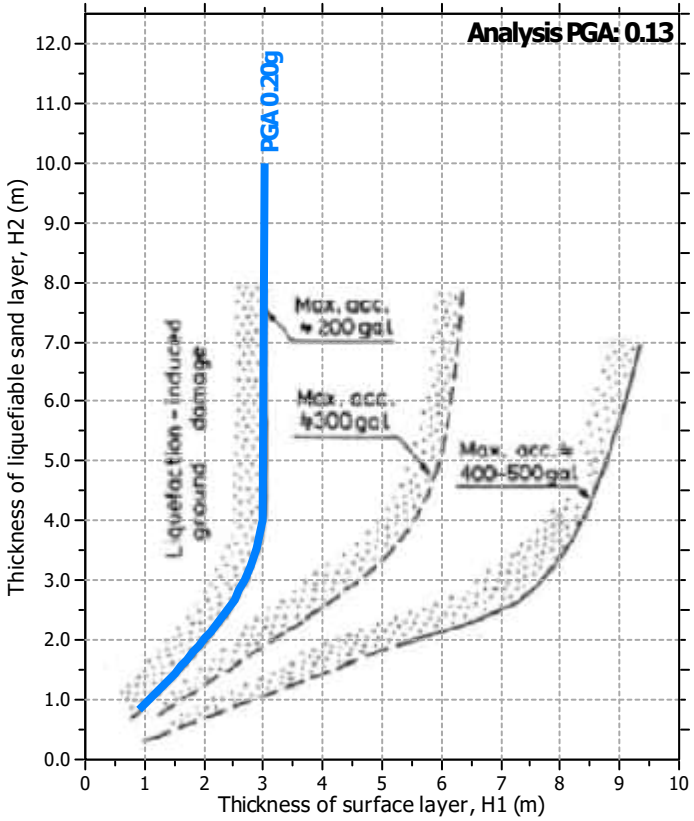
LPI color scheme

- 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.):	2.70 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.20 m	Fill height:	1.50 m	Limit depth:	N/A

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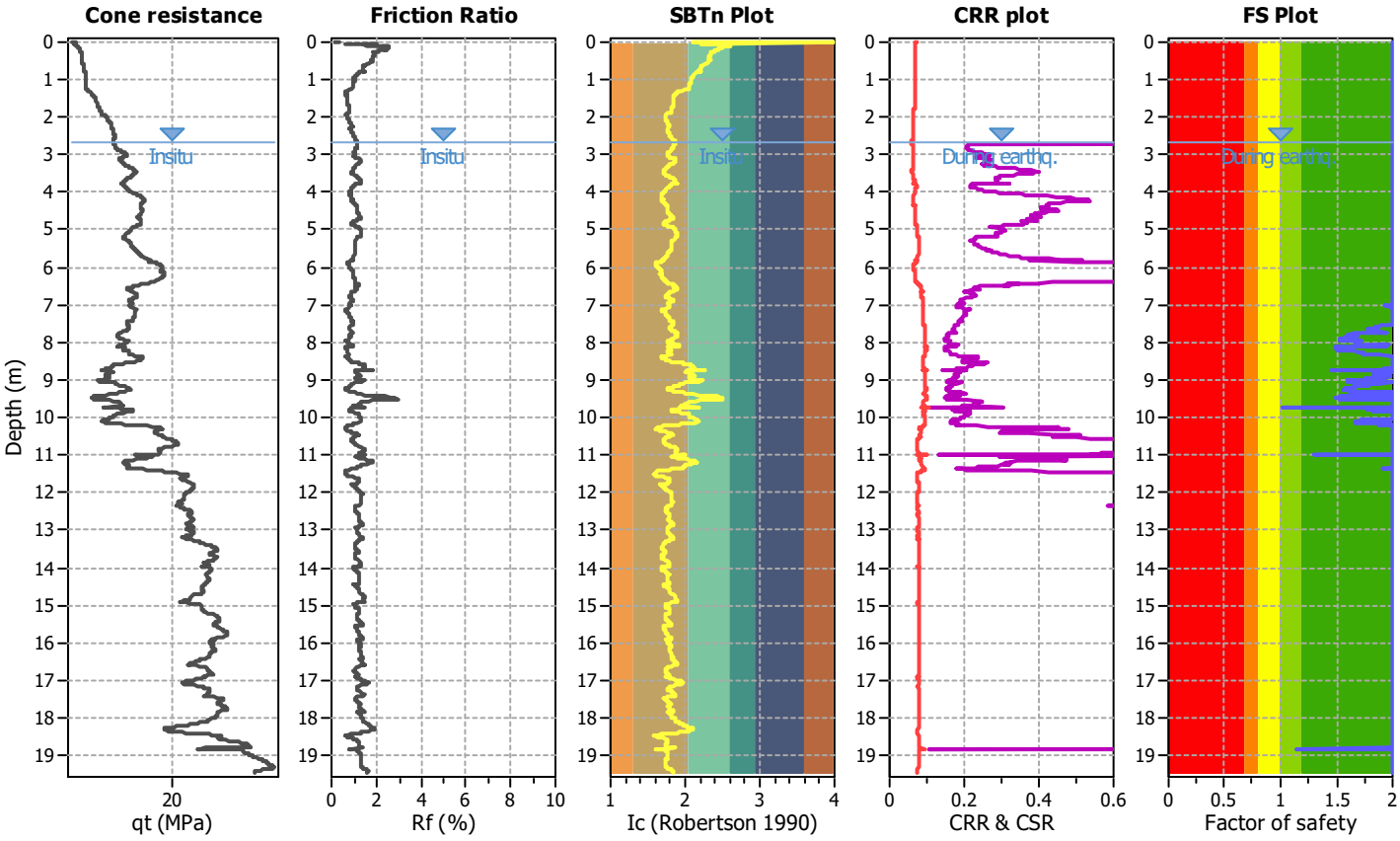
LIQUEFACTION ANALYSIS REPORT

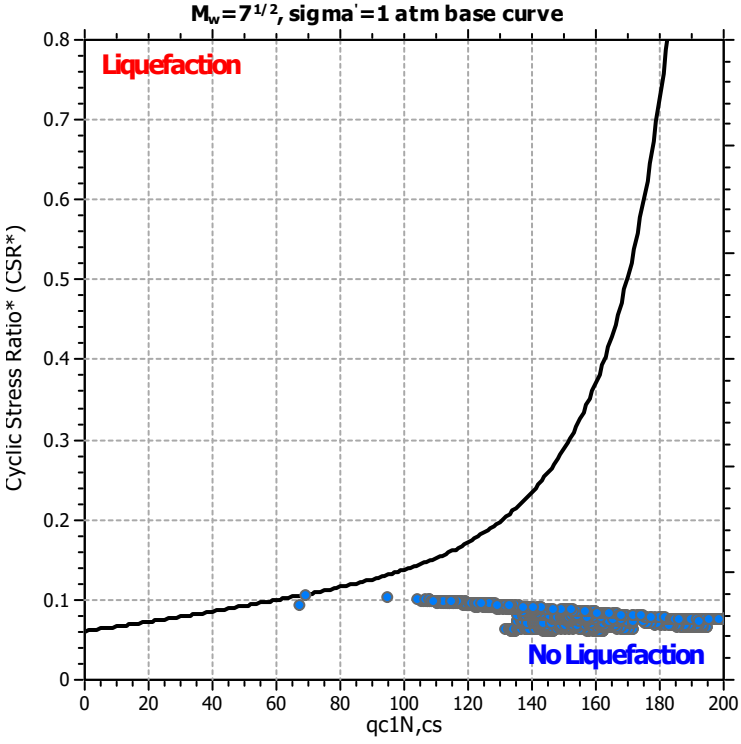
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

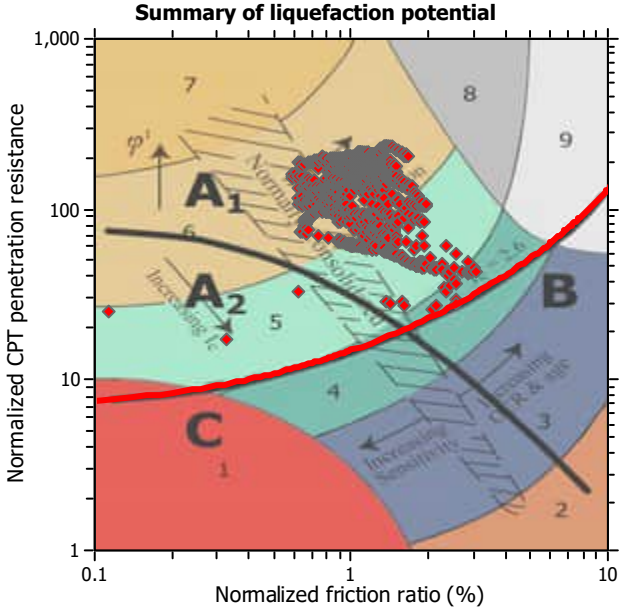
CPT file : CPT15

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.70 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

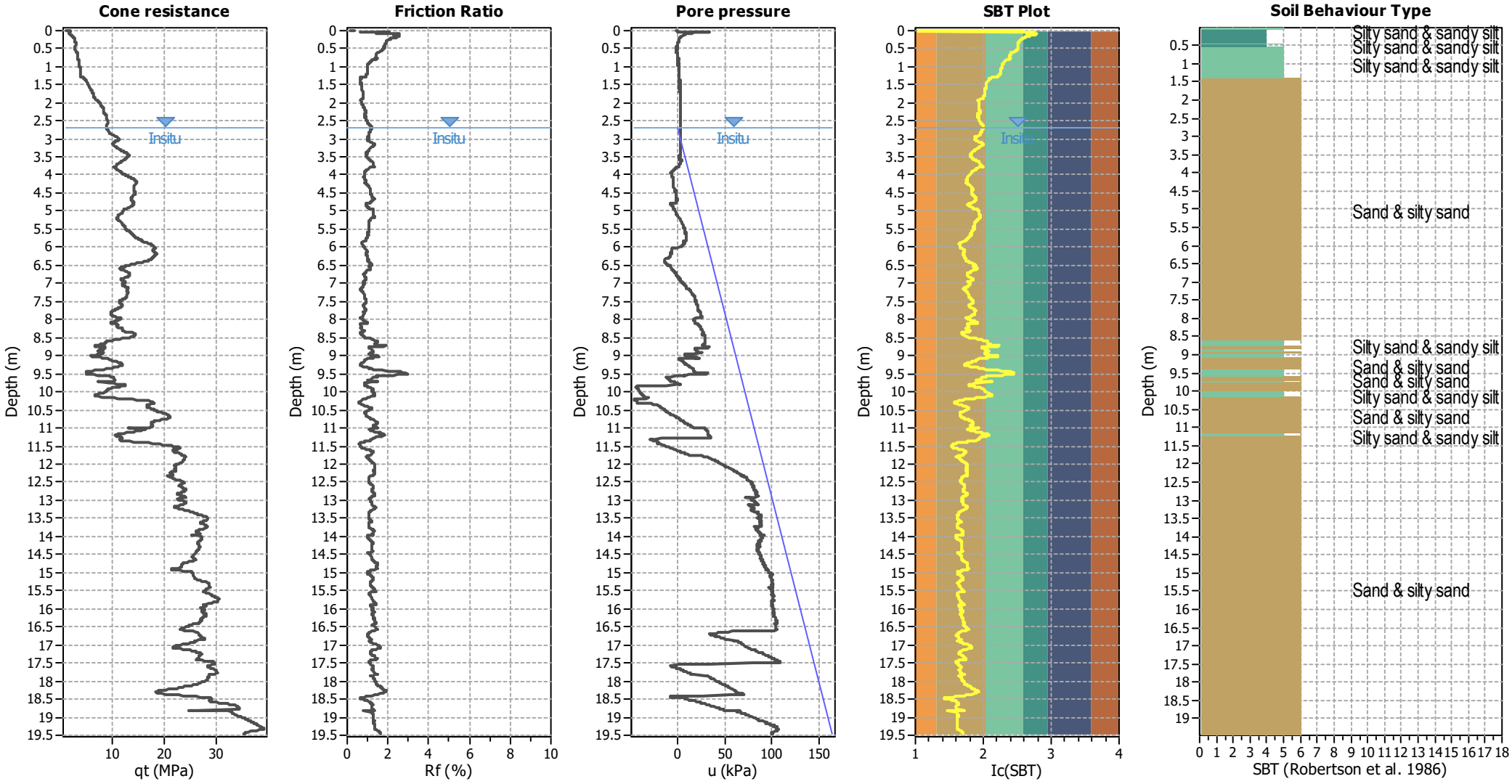






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



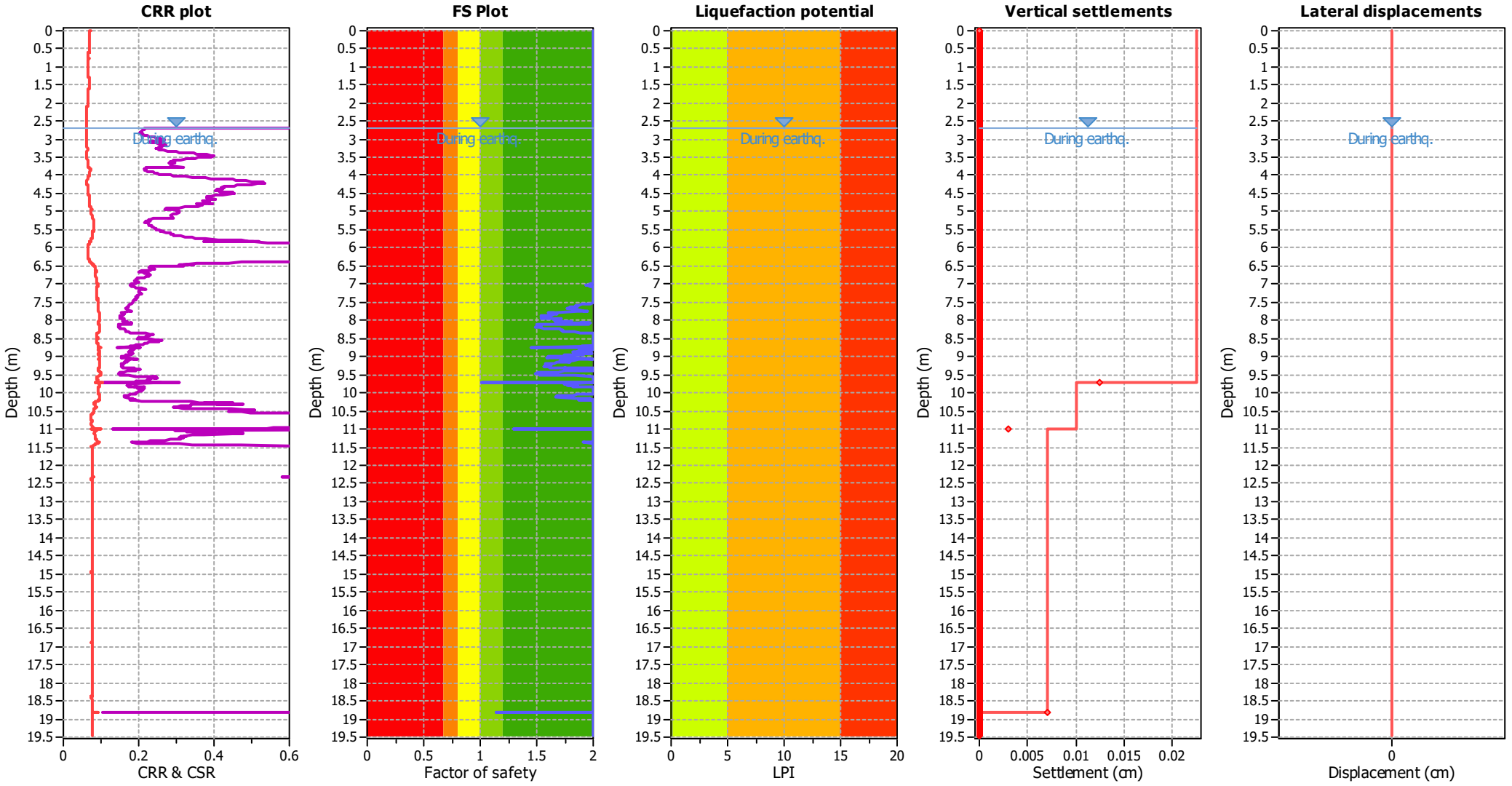
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	2.70 m	Fill height:	N/A	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	2.70 m	Fill height:	N/A	Limit depth:	N/A

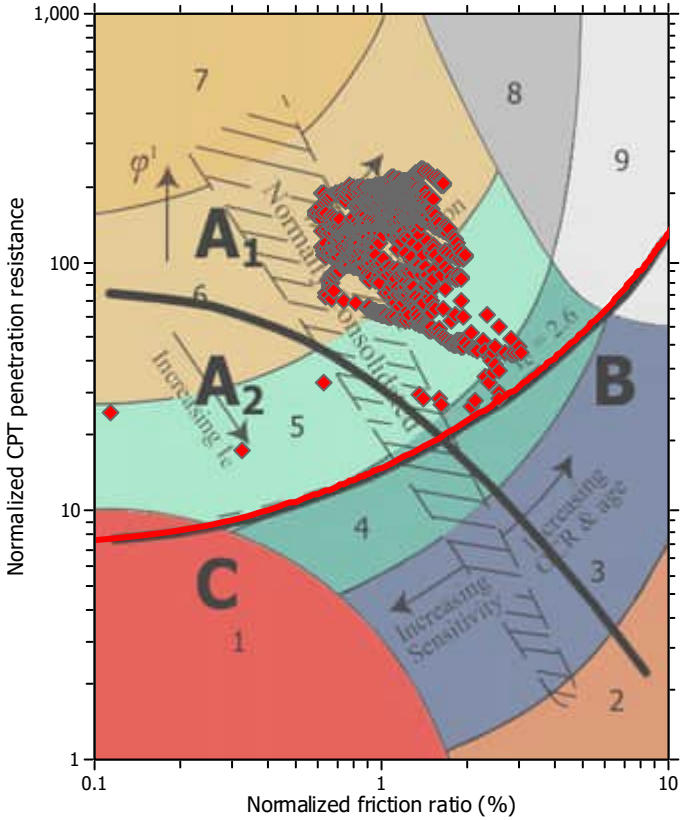
F.S. color scheme

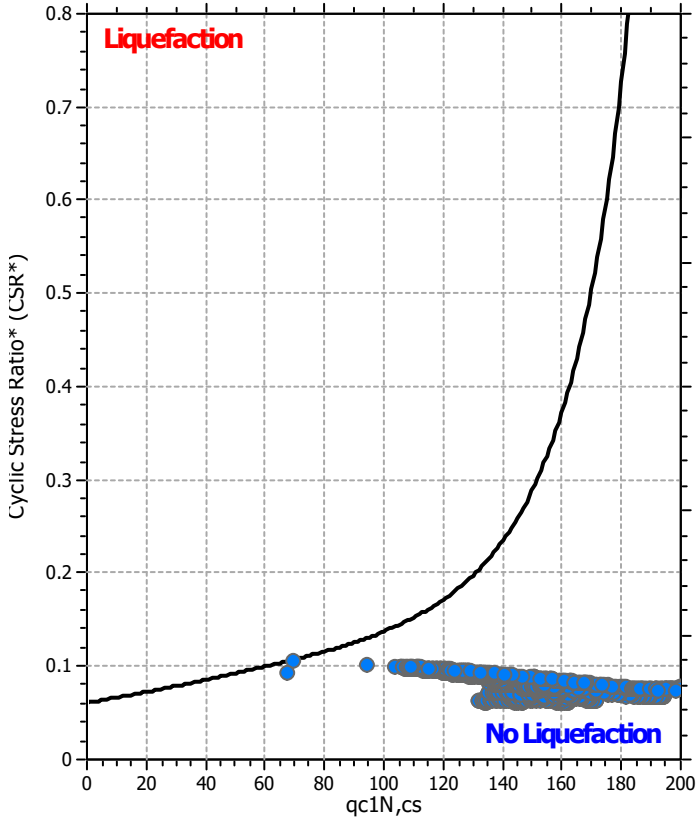
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

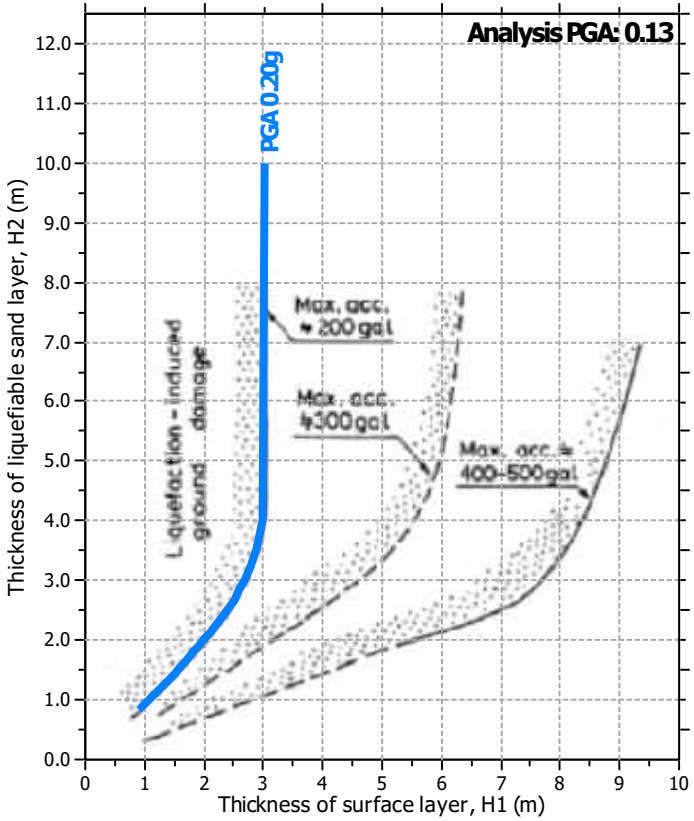
LPI color scheme

- 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.):	2.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	2.70 m	Fill height:	N/A	Limit depth:	N/A

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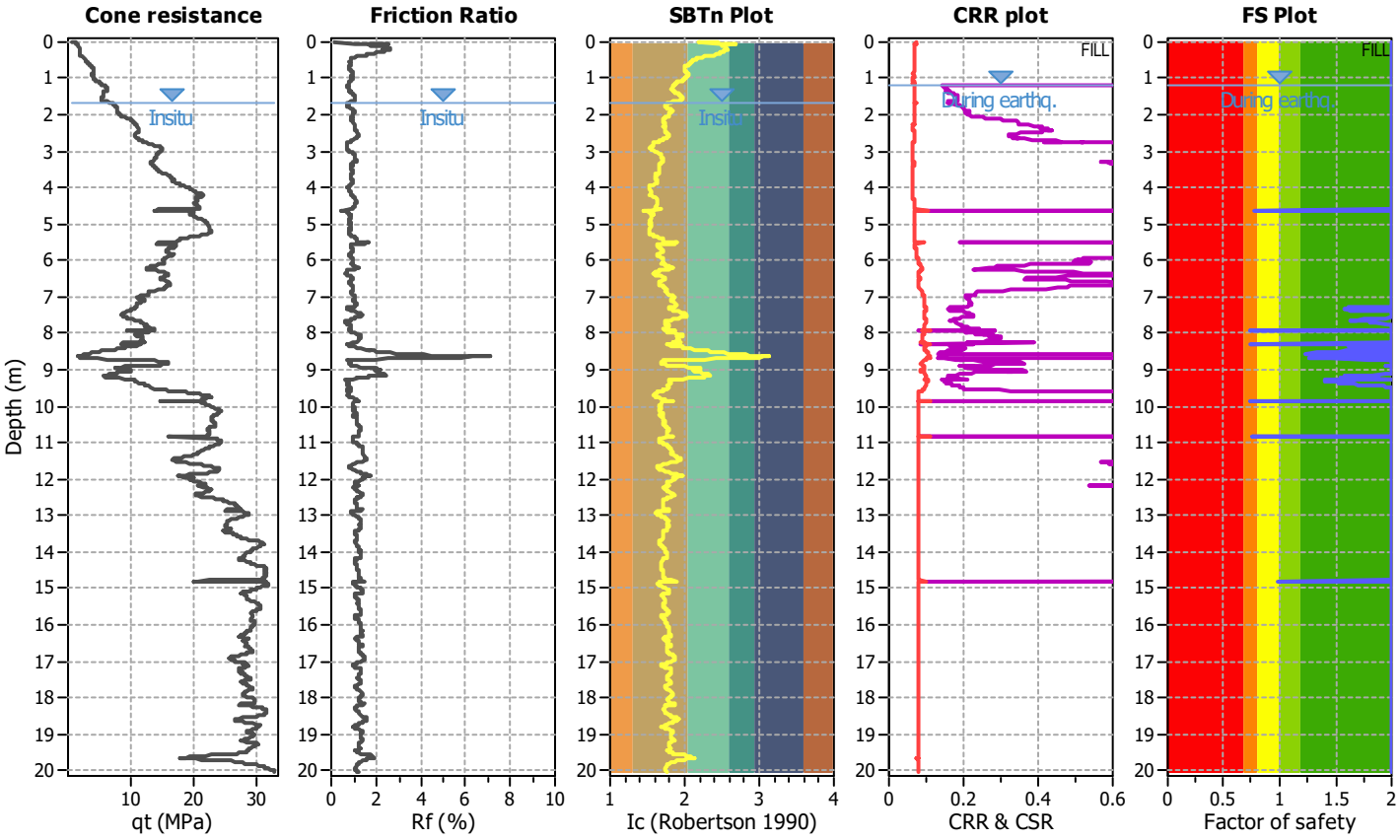
LIQUEFACTION ANALYSIS REPORT

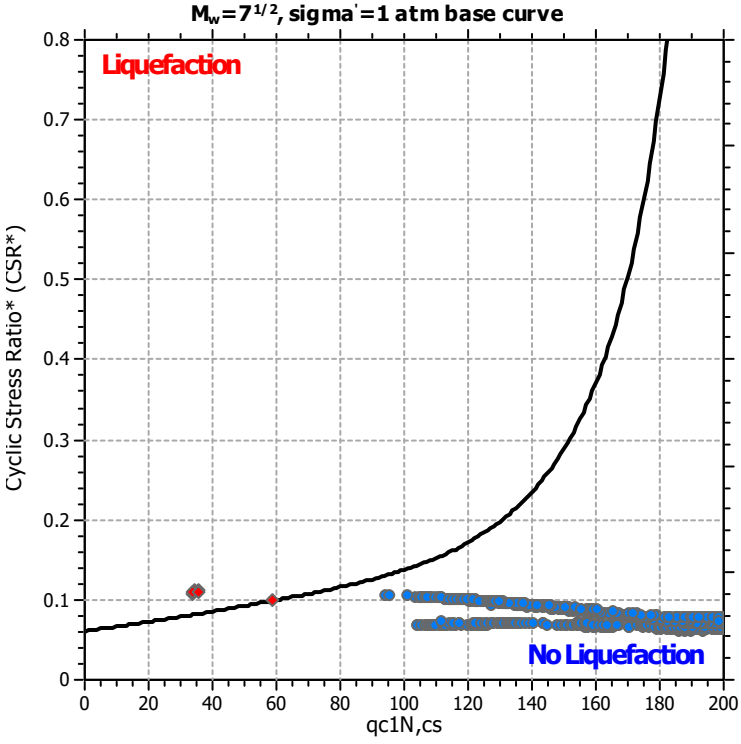
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

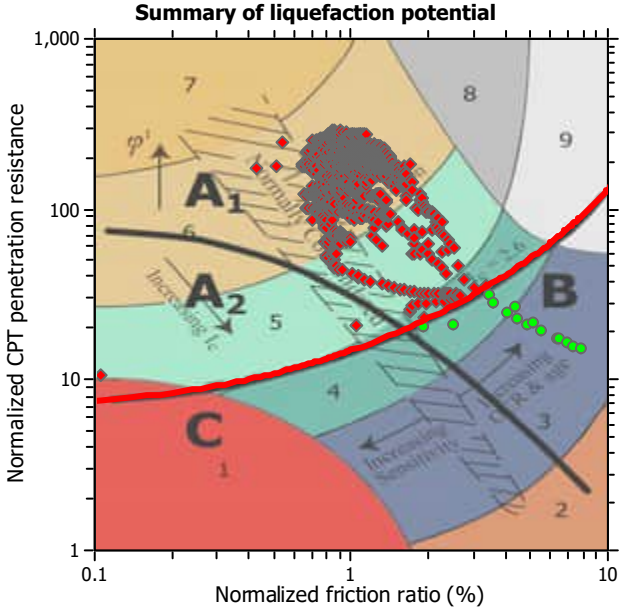
CPT file : CPT16

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.20 m	Fill height:	1.00 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

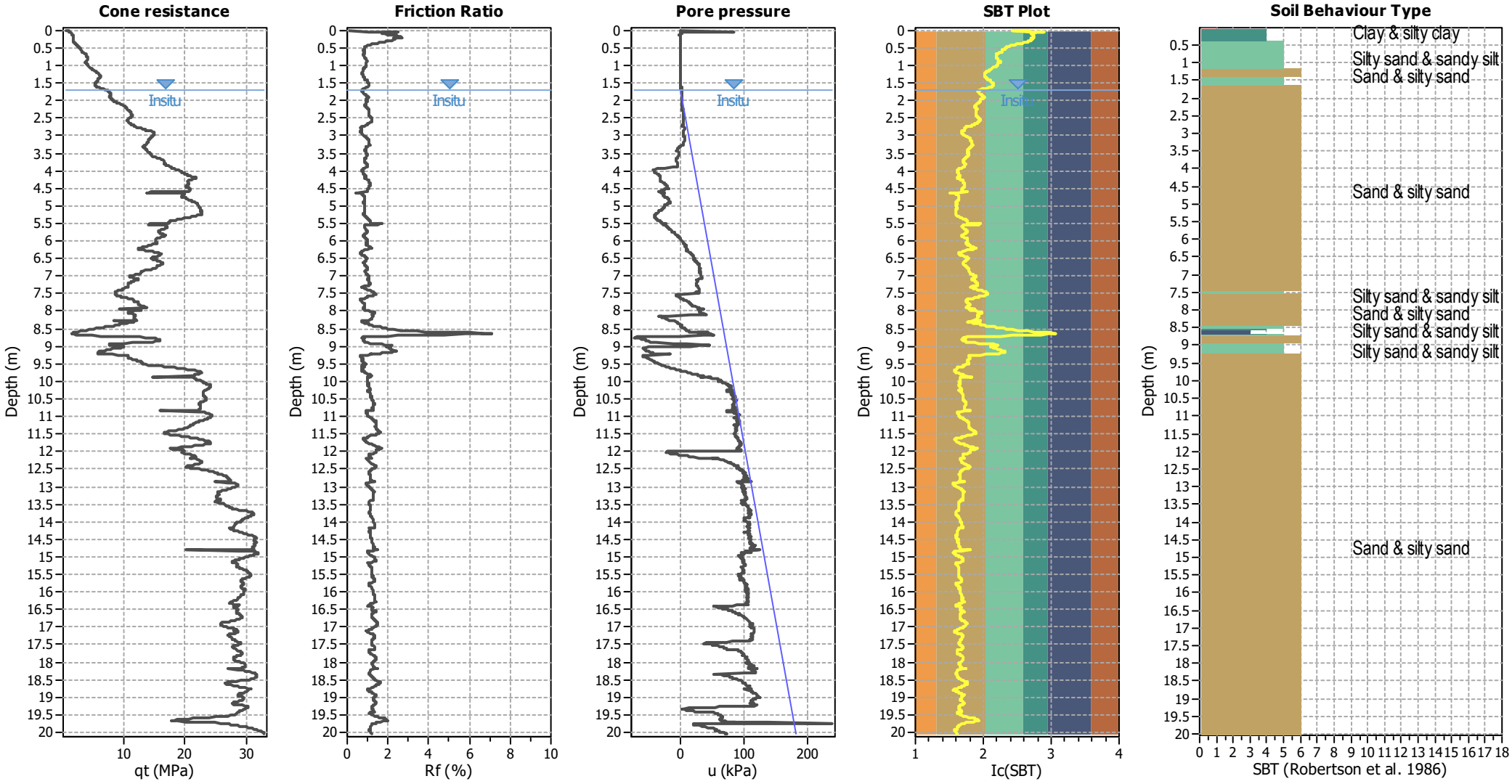






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



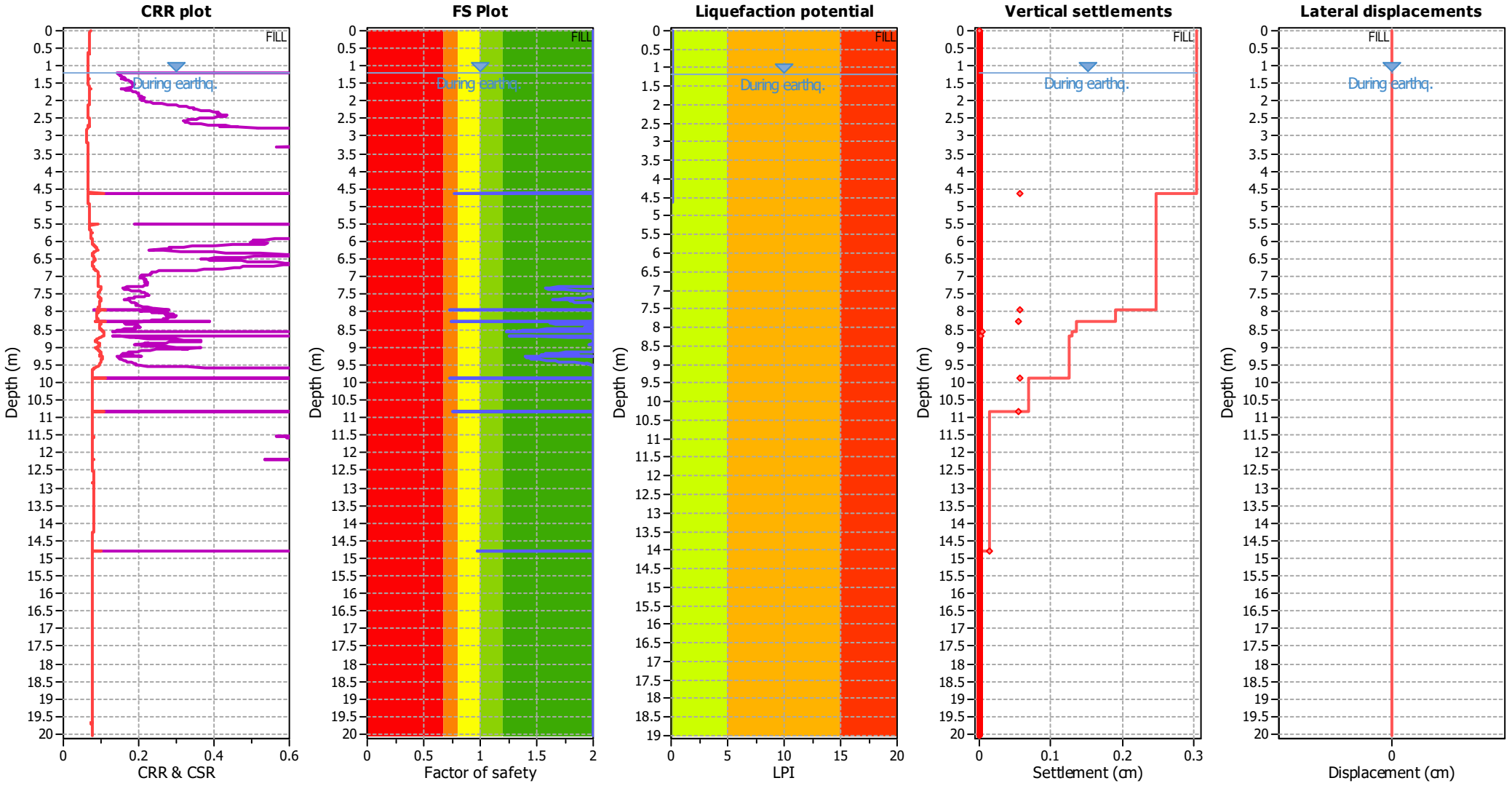
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	1.00 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	1.00 m	Limit depth:	N/A

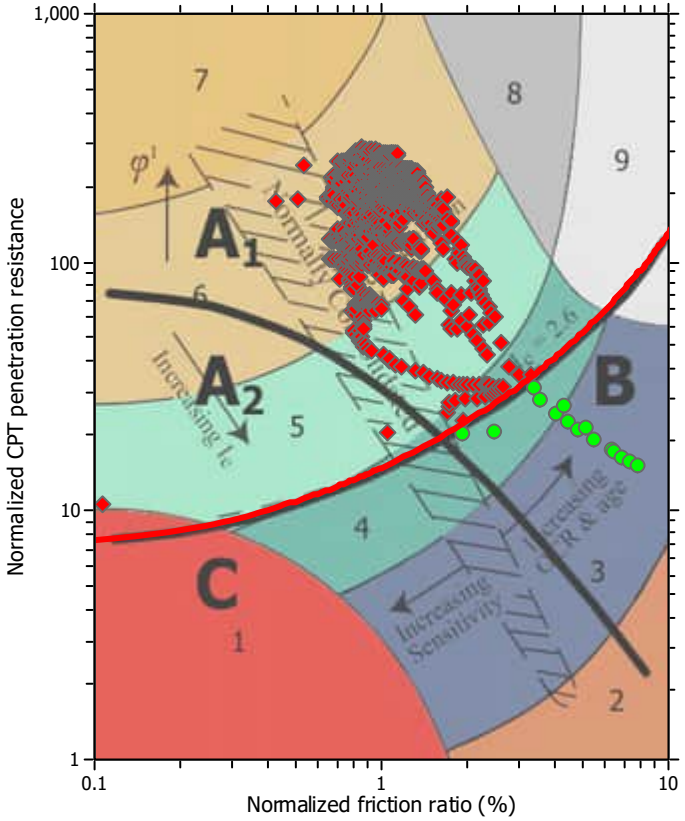
F.S. color scheme

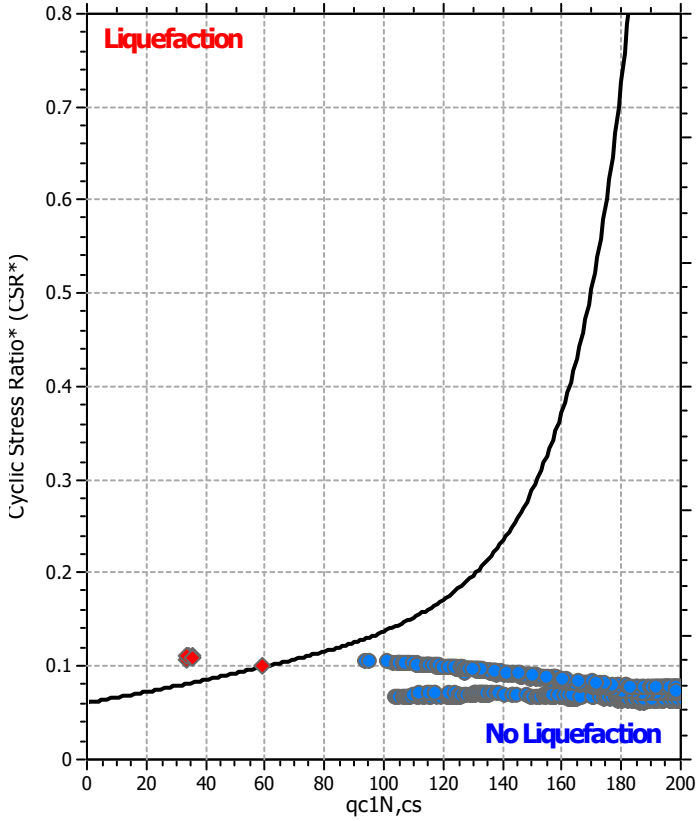
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

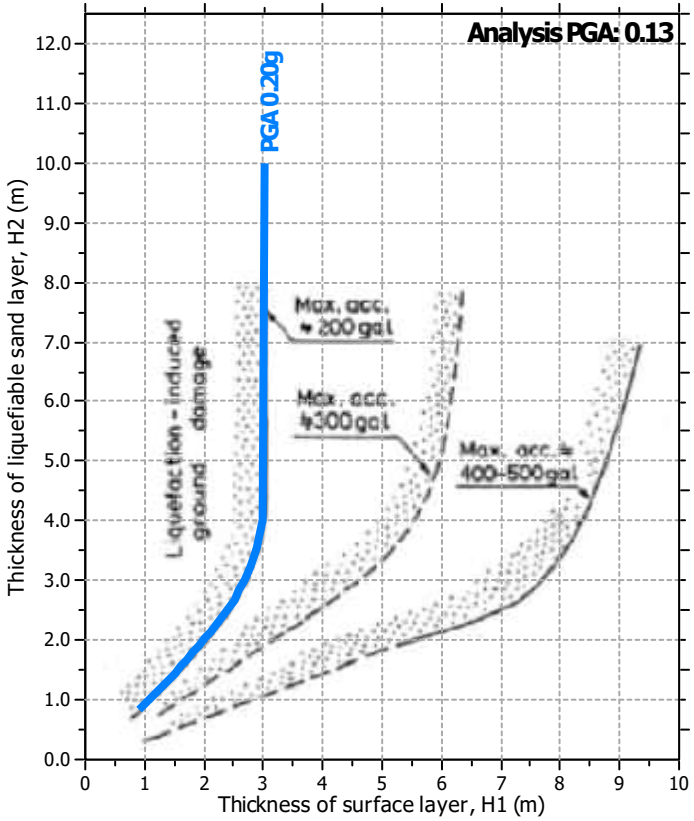
LPI color scheme

- 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.):	2.20 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	1.00 m	Limit depth:	N/A

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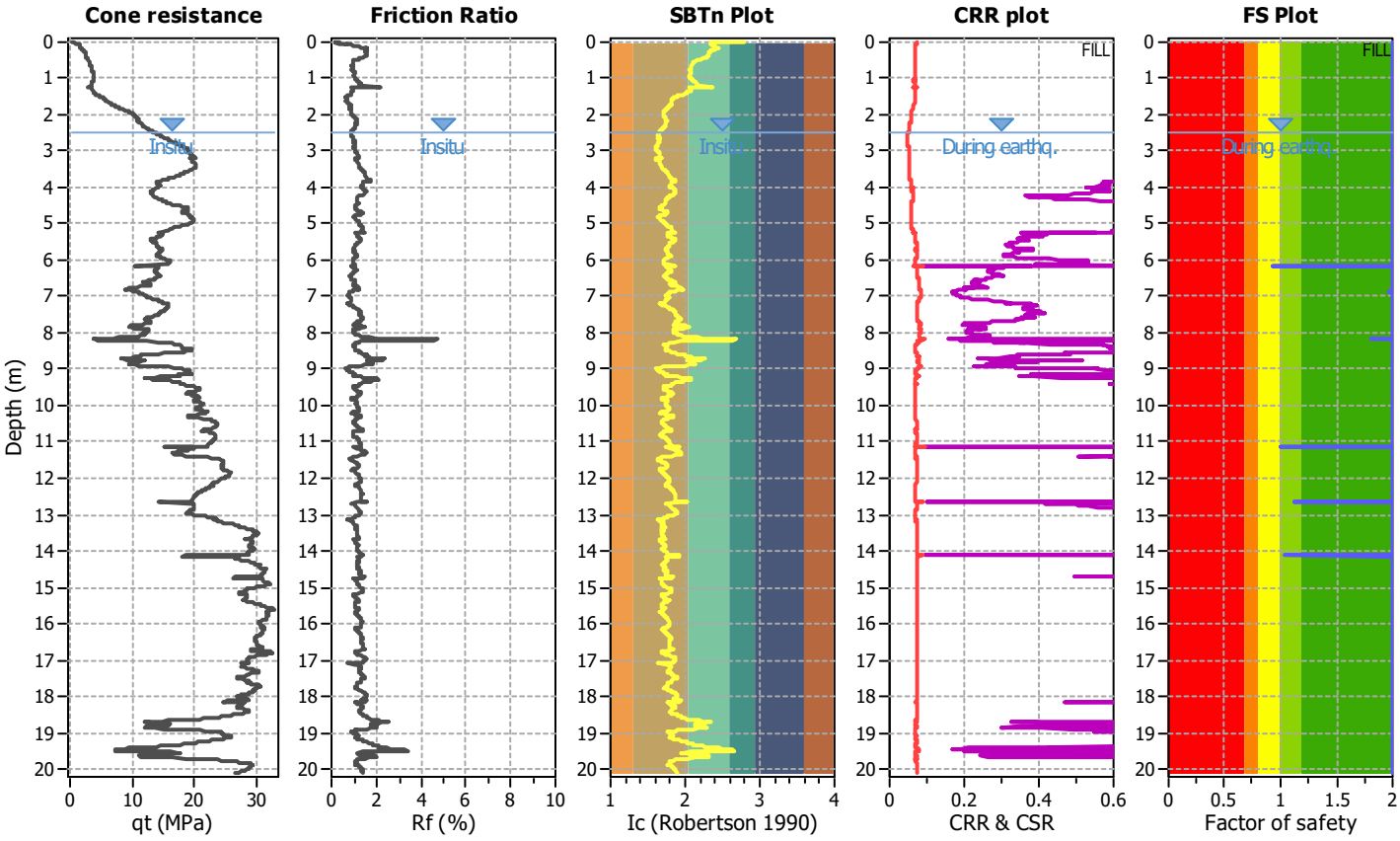
LIQUEFACTION ANALYSIS REPORT

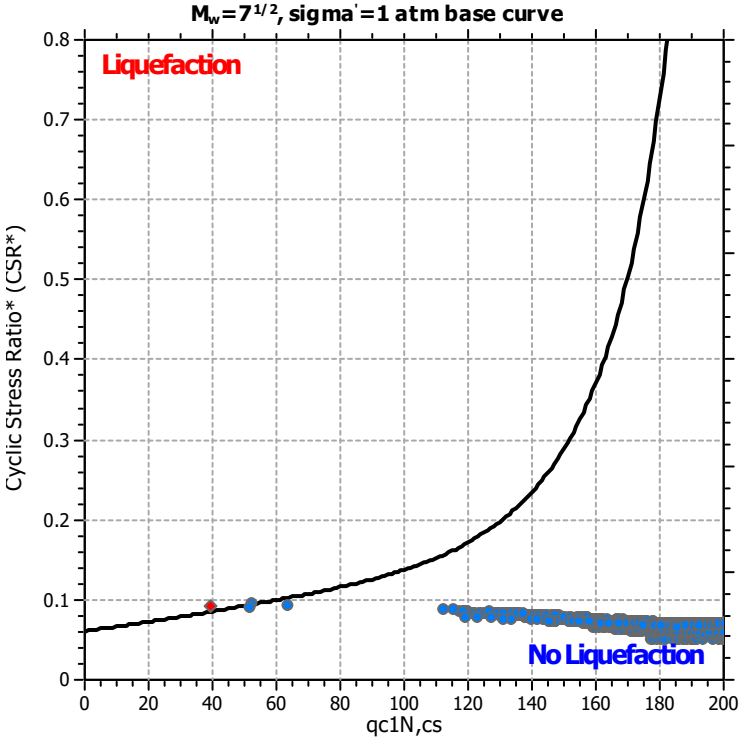
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

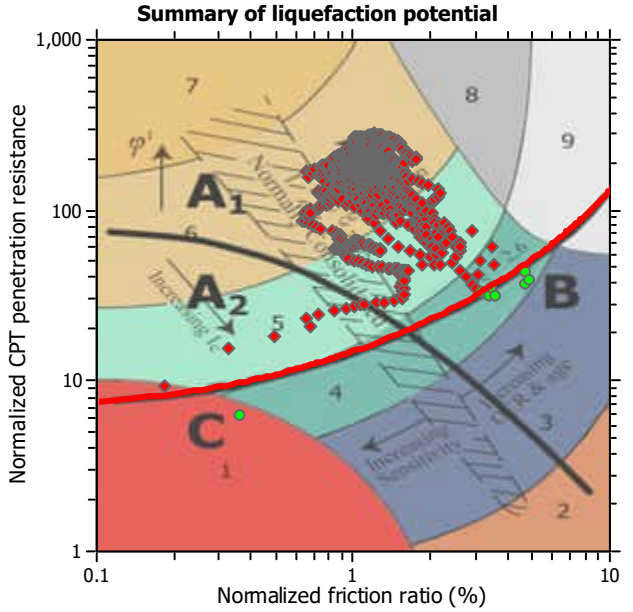
CPT file : CPT17

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.47 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	4.47 m	Fill height:	2.00 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

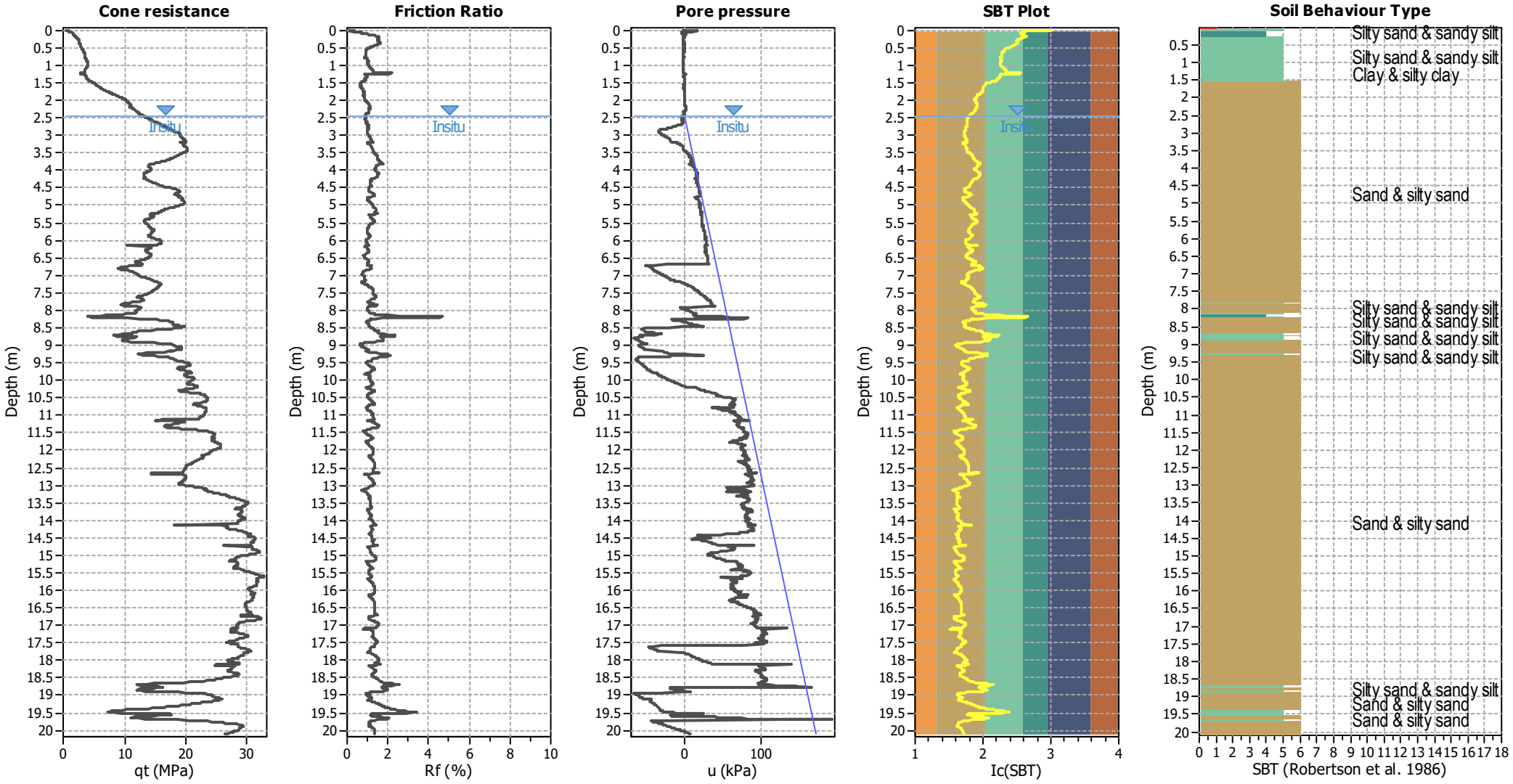






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



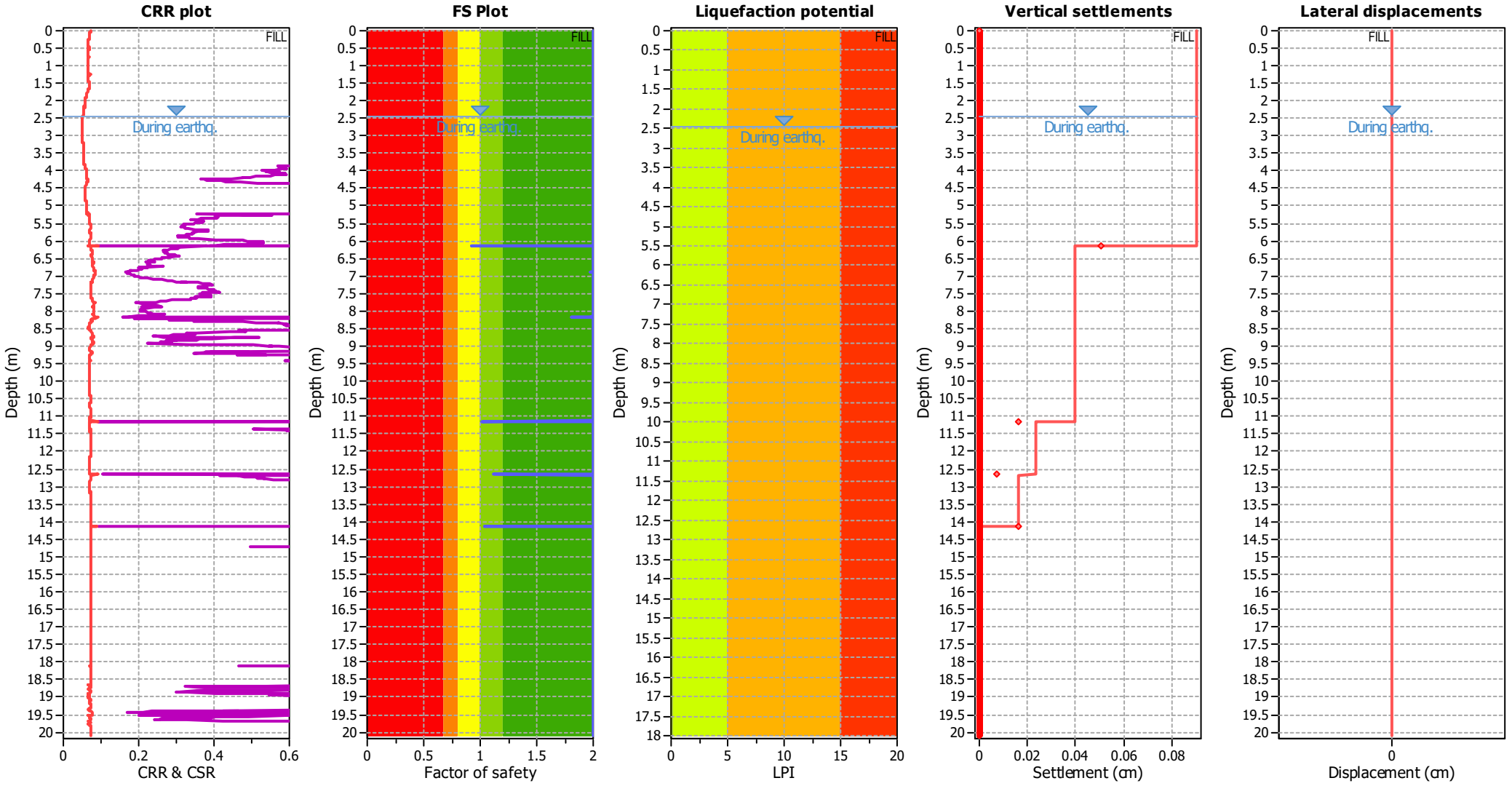
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	4.47 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	2.47 m	Fill height:	2.00 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	4.47 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	2.47 m	Fill height:	2.00 m	Limit depth:	N/A

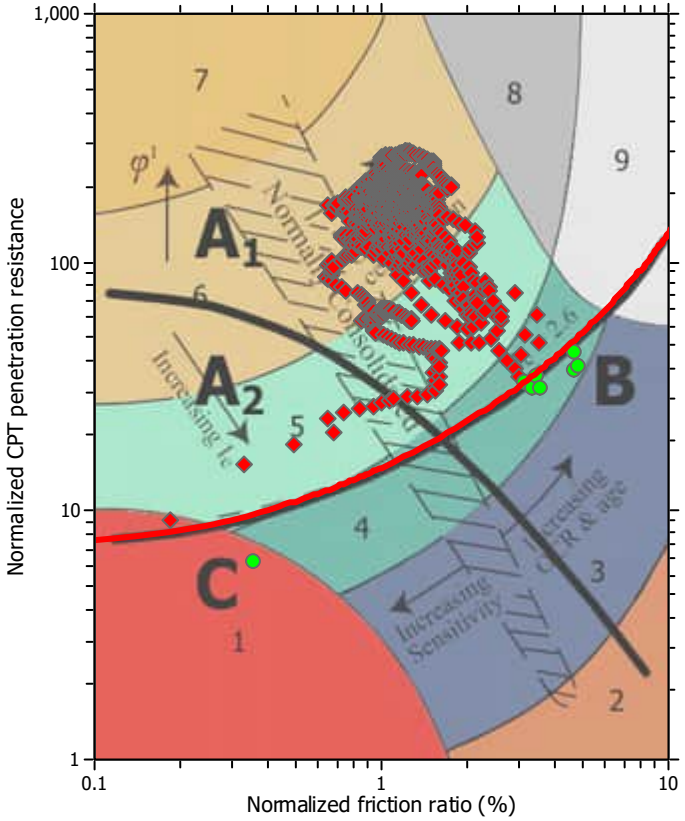
F.S. color scheme

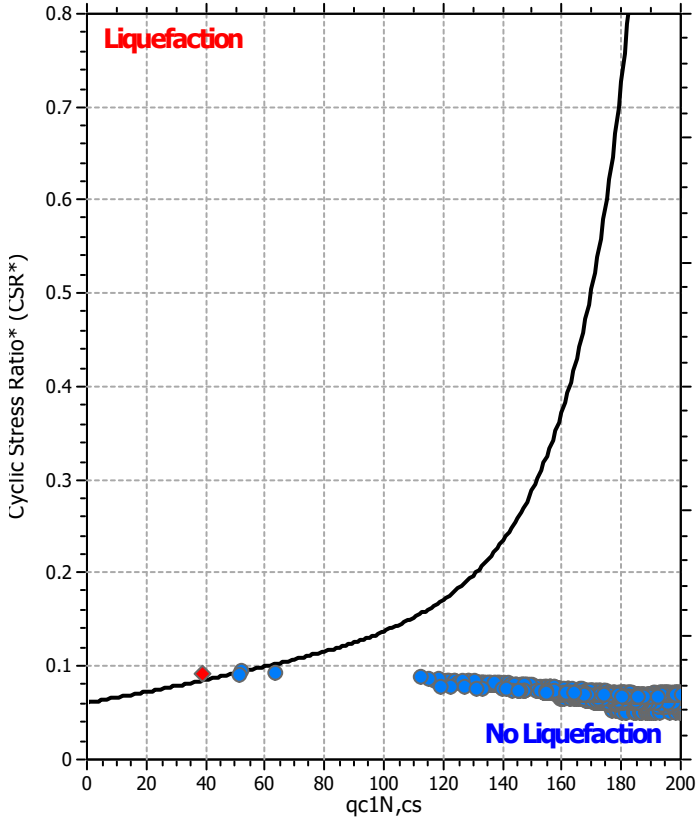
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

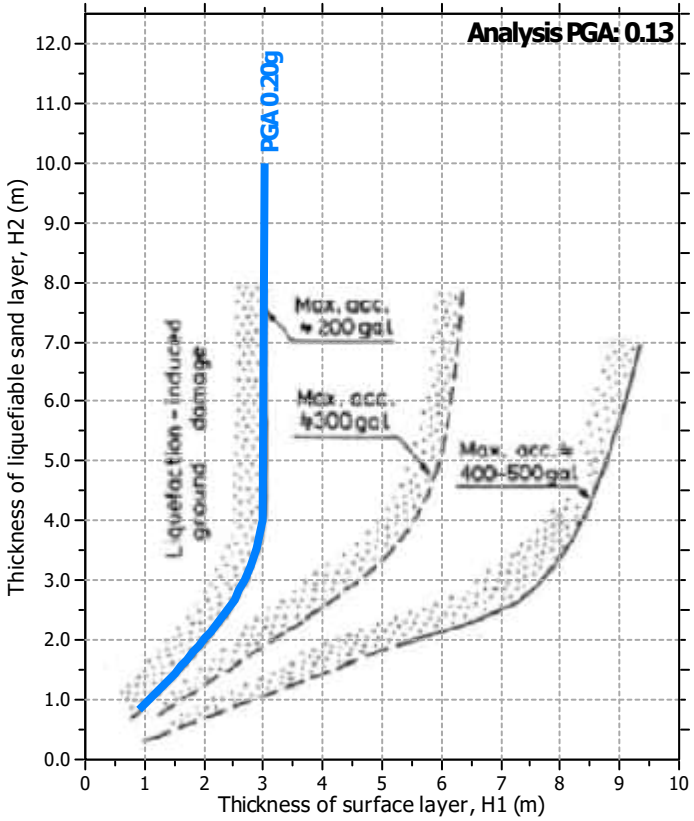
LPI color scheme

- 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.):	4.47 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	2.47 m	Fill height:	2.00 m	Limit depth:	N/A

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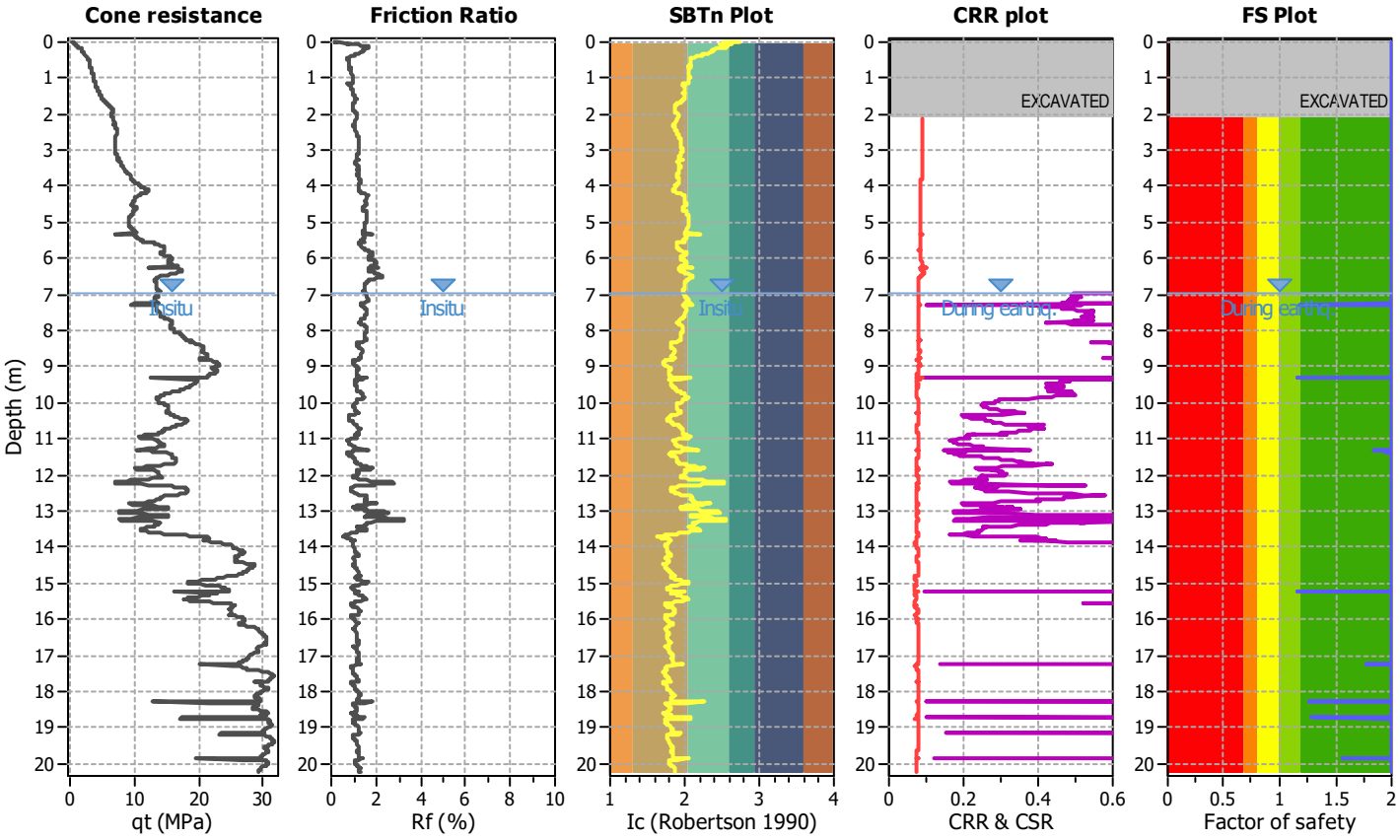
LIQUEFACTION ANALYSIS REPORT

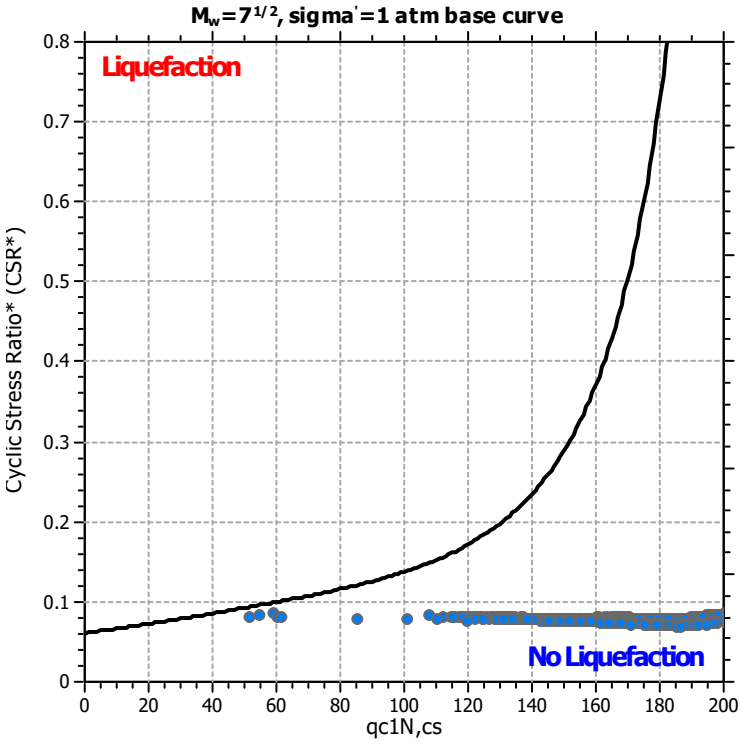
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

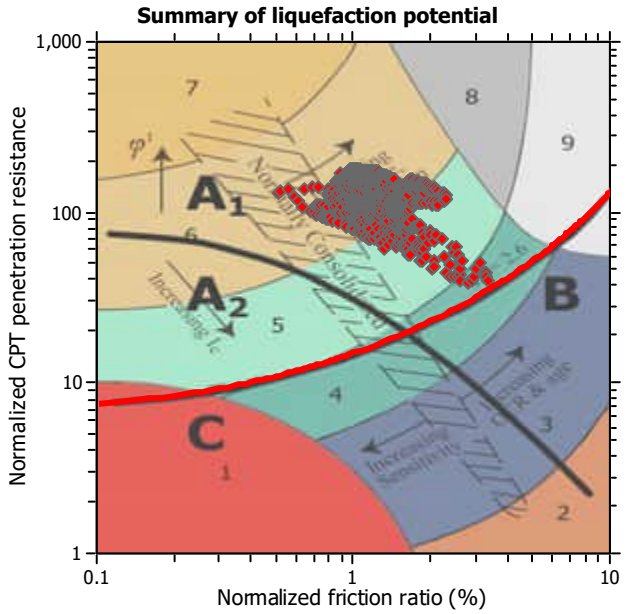
CPT file : CPT18

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	6.97 m	Excavation:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	6.97 m	Excavation depth:	2.10 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Footing load:	500.00 kPa	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

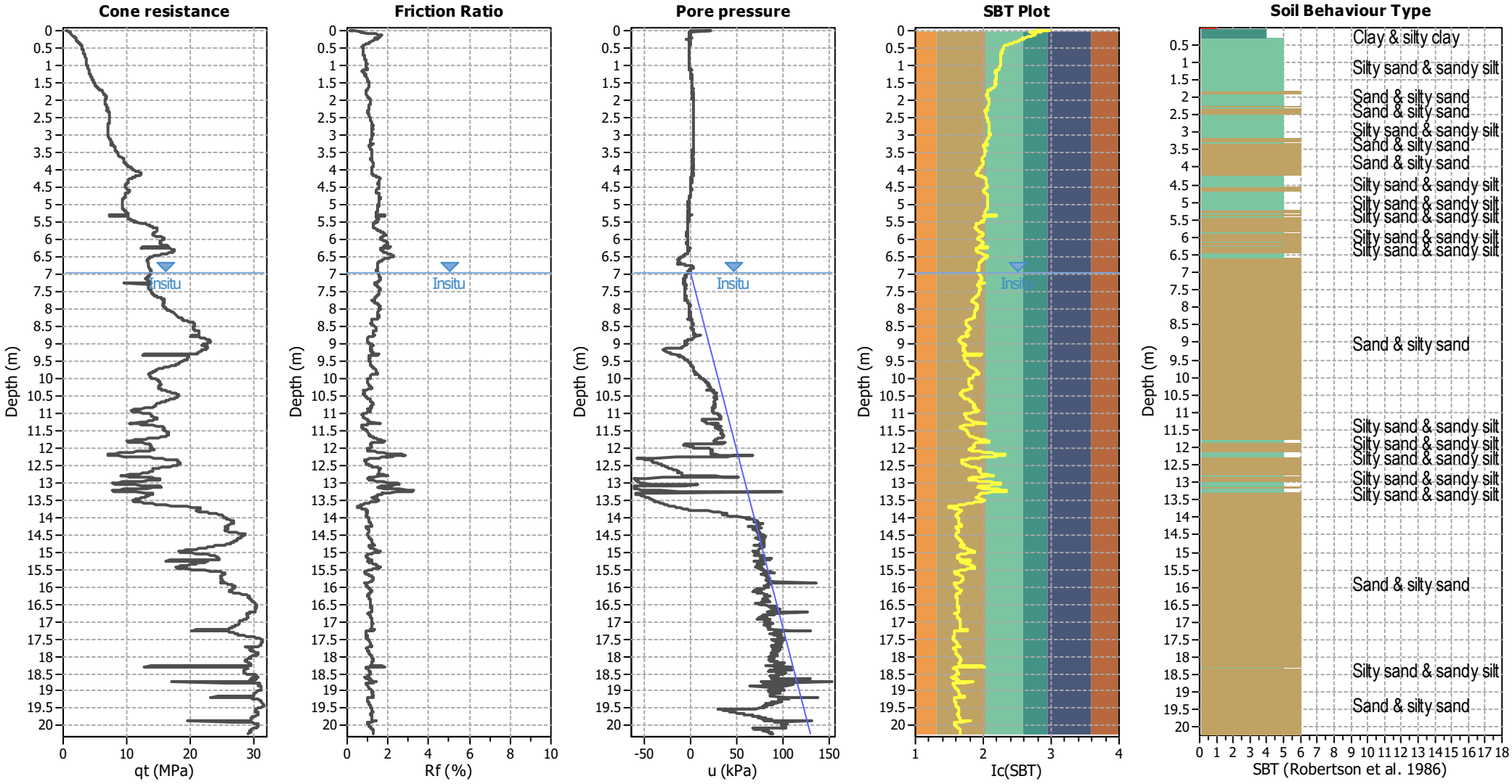






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



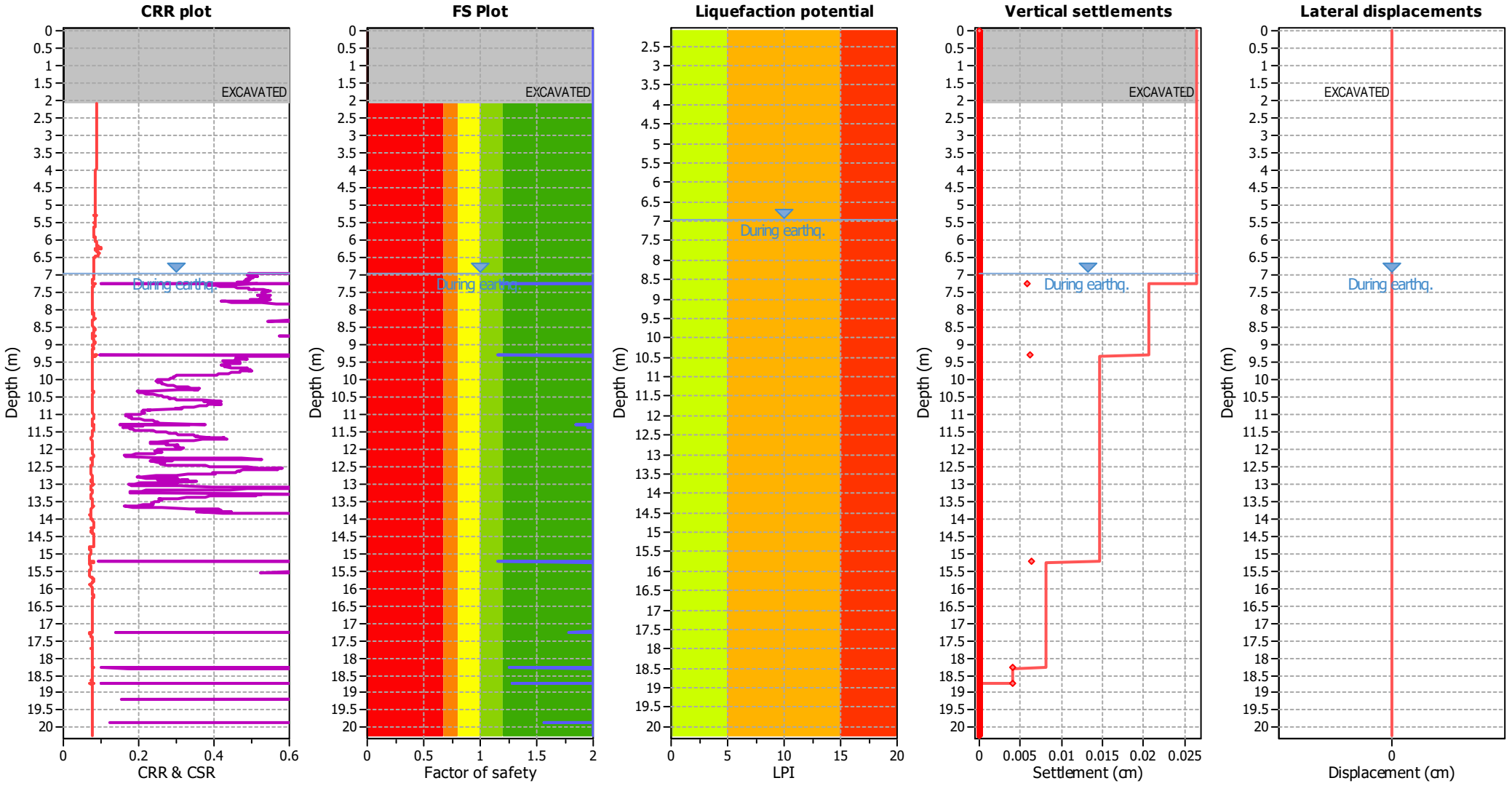
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.97 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	6.97 m	Excavation depth:	2.10 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.97 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	6.97 m	Excavation depth:	2.10 m	Limit depth:	N/A

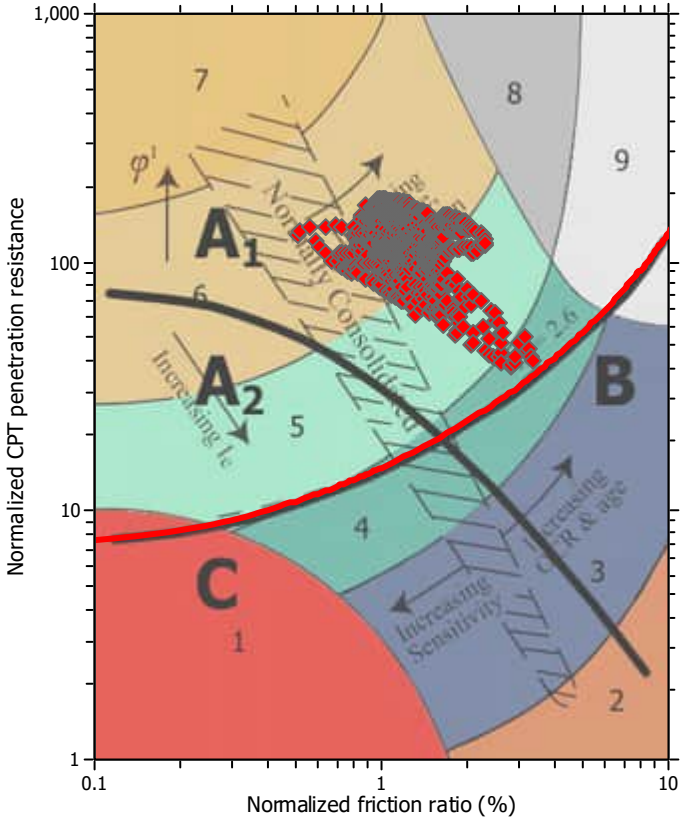
F.S. color scheme

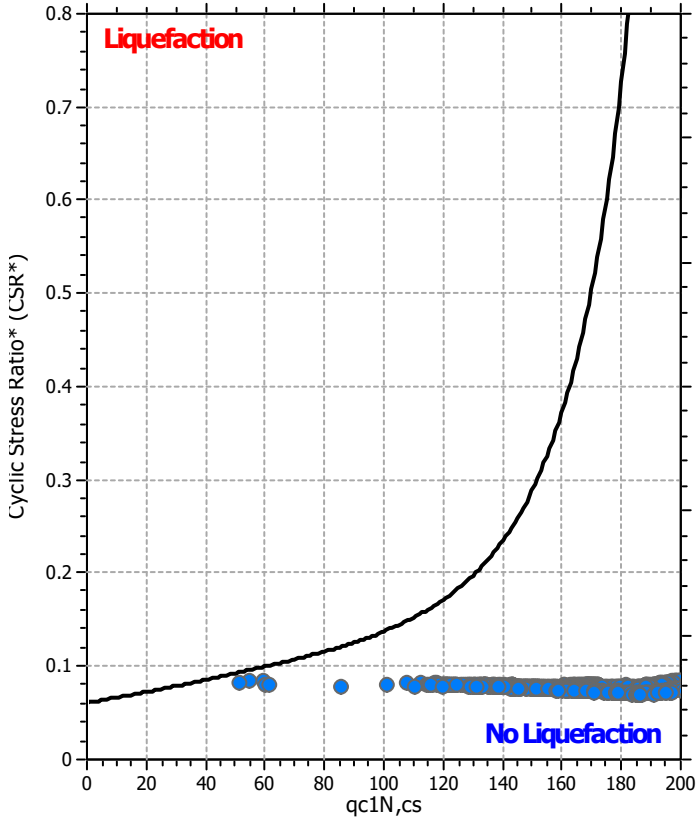
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

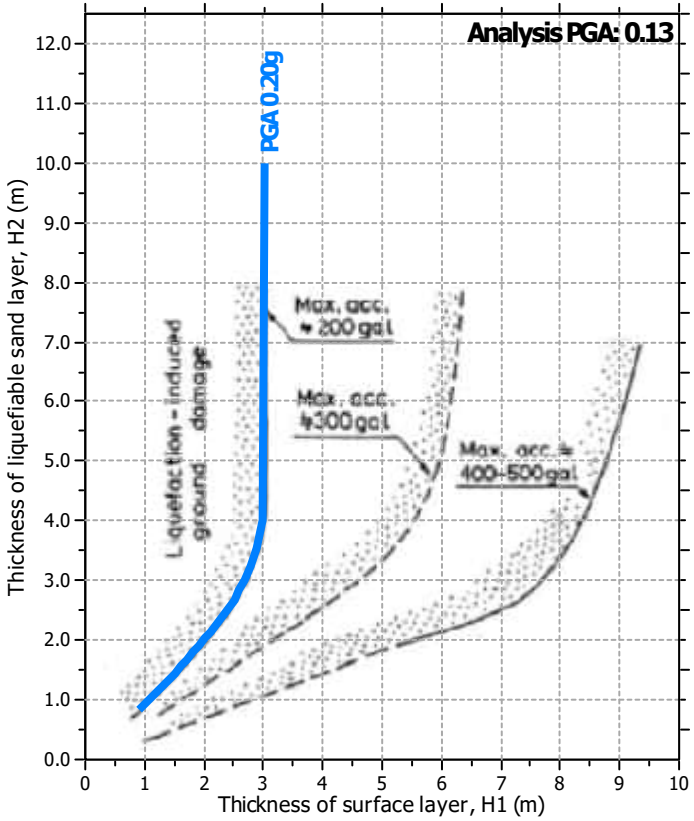
LPI color scheme

- 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.):	6.97 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	6.97 m	Excavation depth:	2.10 m	Limit depth:	N/A

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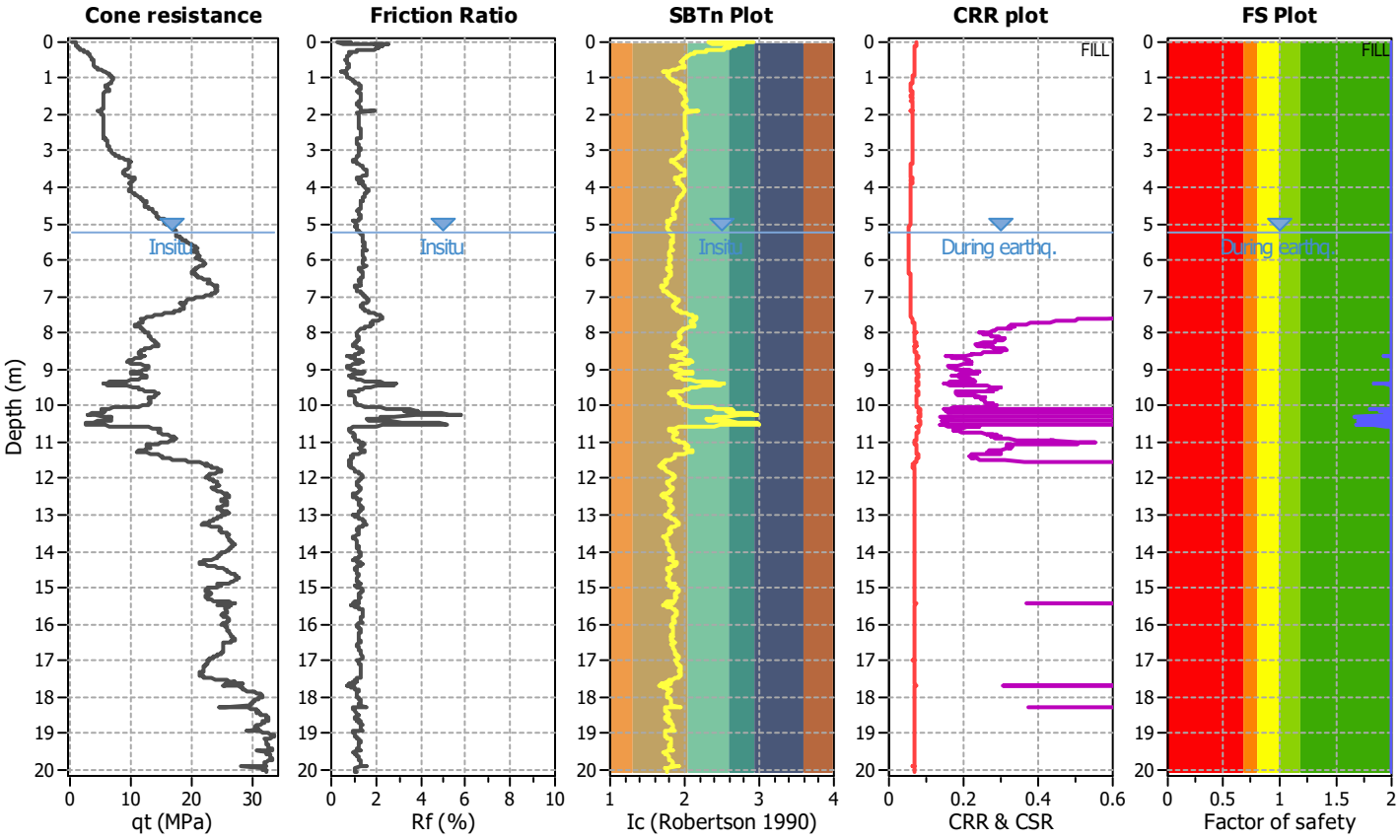
LIQUEFACTION ANALYSIS REPORT

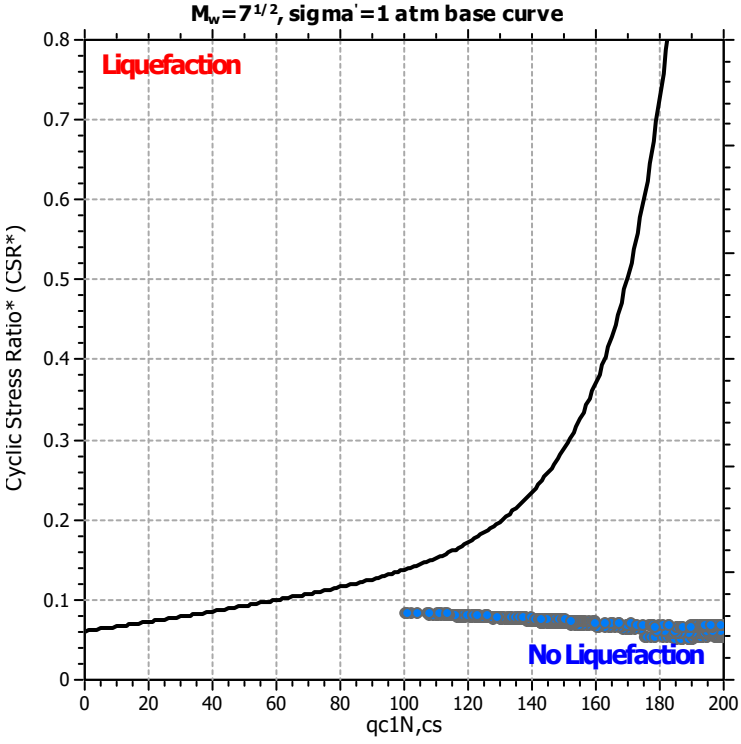
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

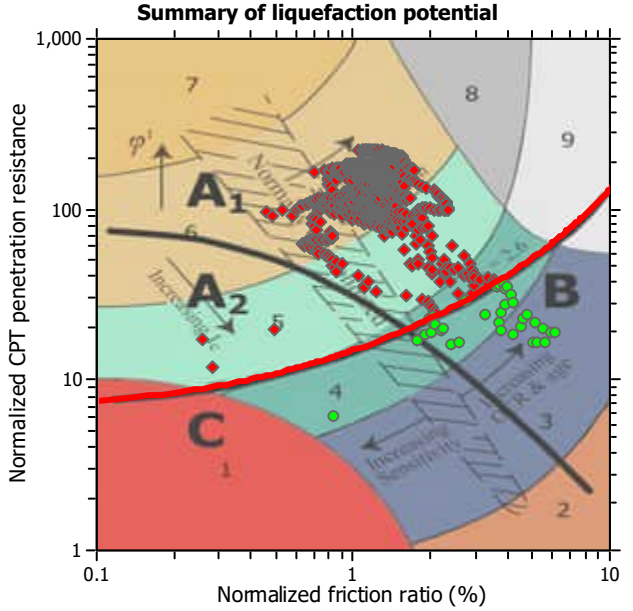
CPT file : CPT19

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.22 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.72 m	Fill height:	0.50 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	19.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

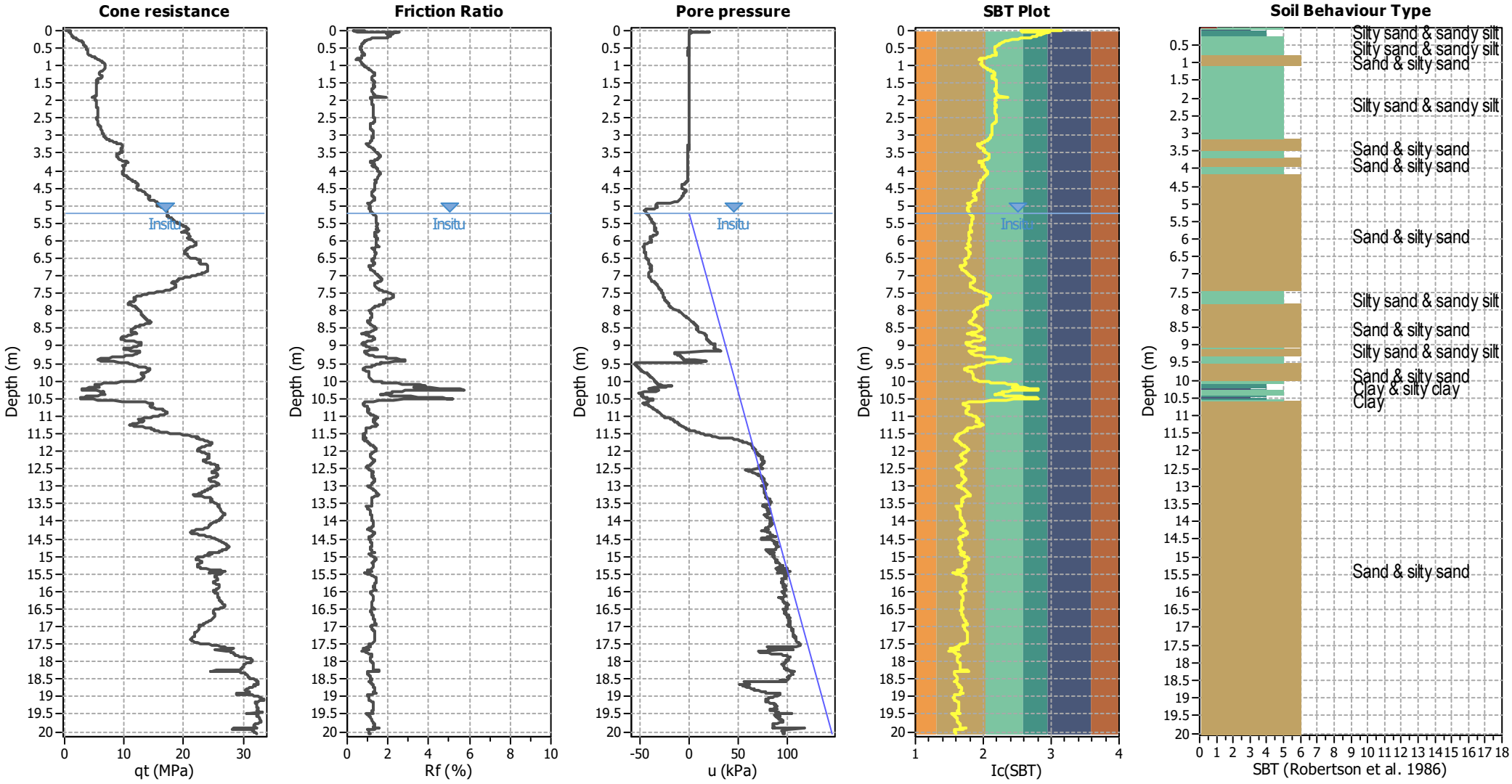






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



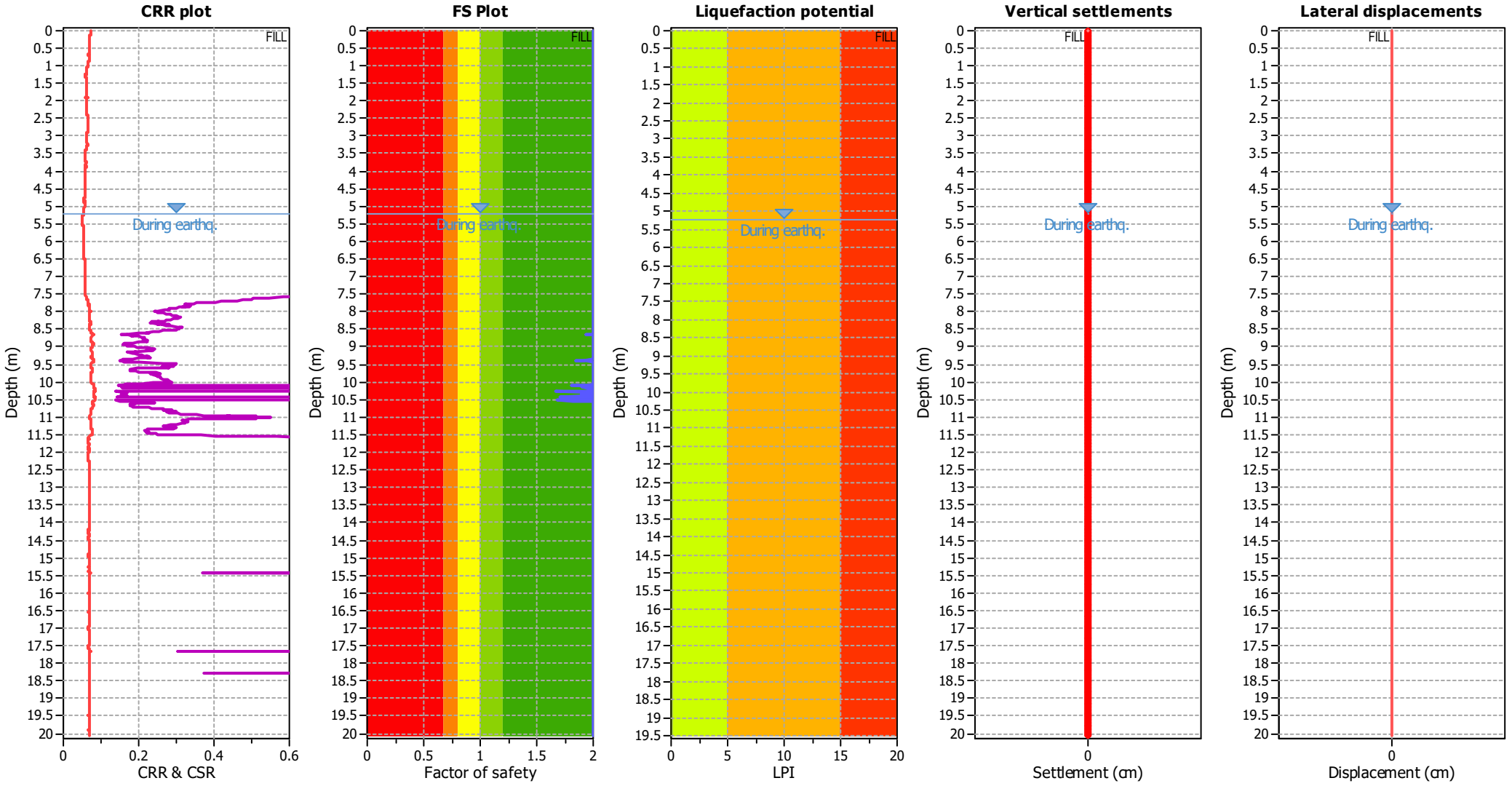
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	5.72 m	Fill weight:	19.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.22 m	Fill height:	0.50 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	5.72 m	Fill weight:	19.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.22 m	Fill height:	0.50 m	Limit depth:	N/A

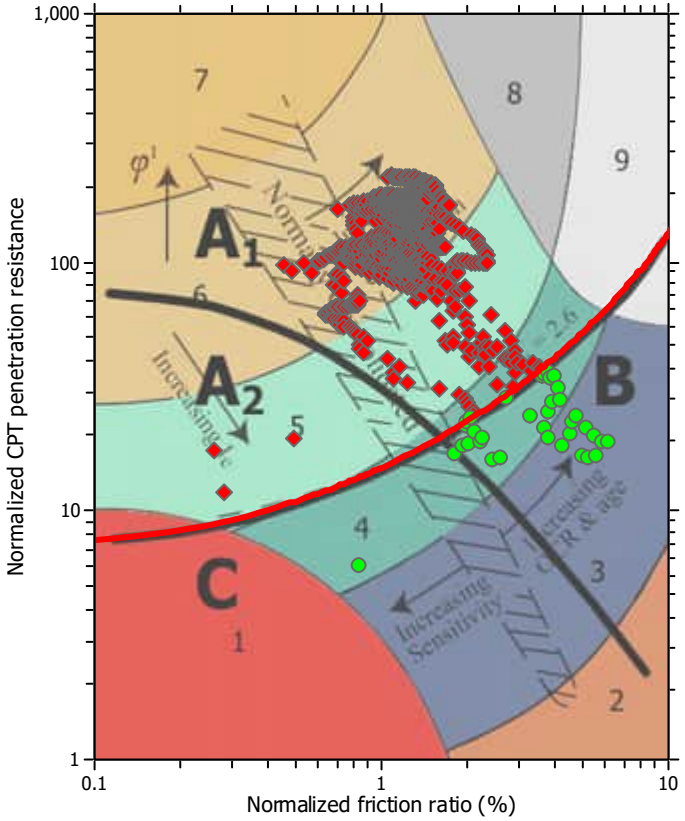
F.S. color scheme

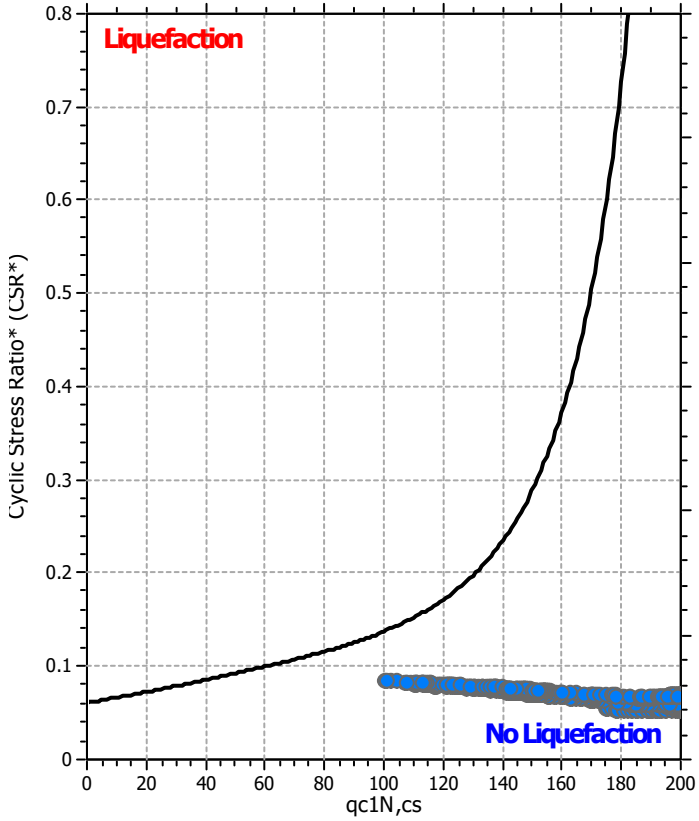
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

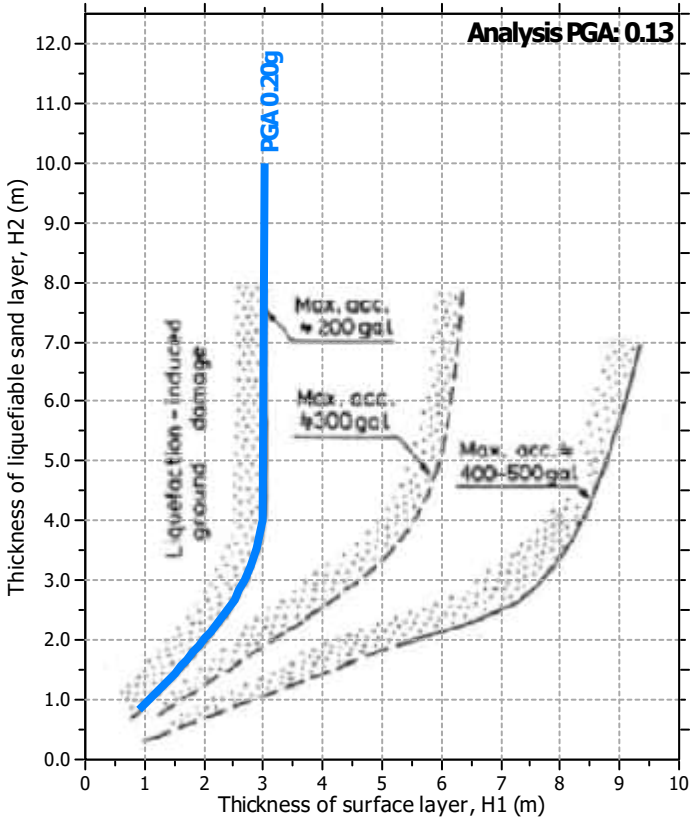
LPI color scheme

- 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.):	5.72 m	Fill weight:	19.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.22 m	Fill height:	0.50 m	Limit depth:	N/A

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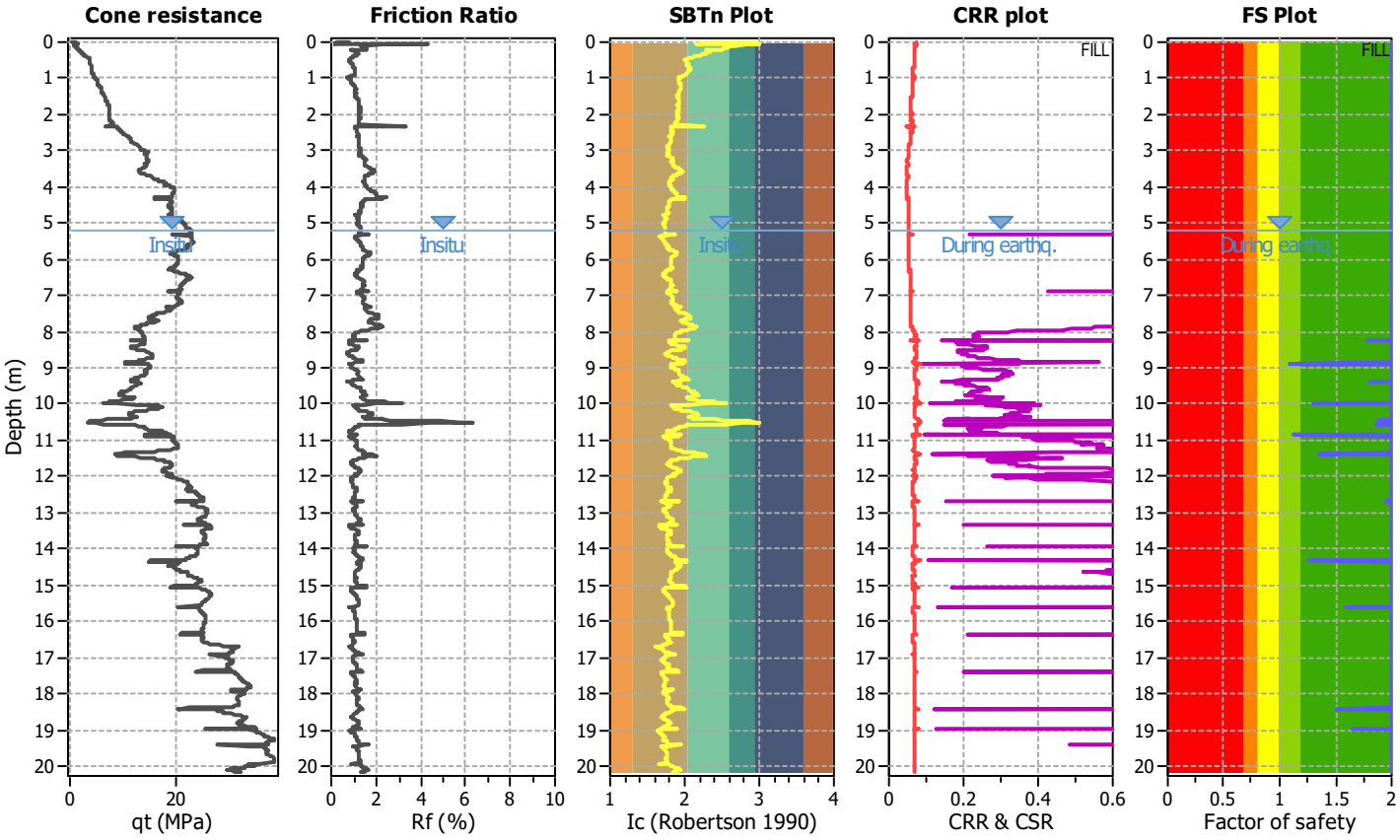
LIQUEFACTION ANALYSIS REPORT

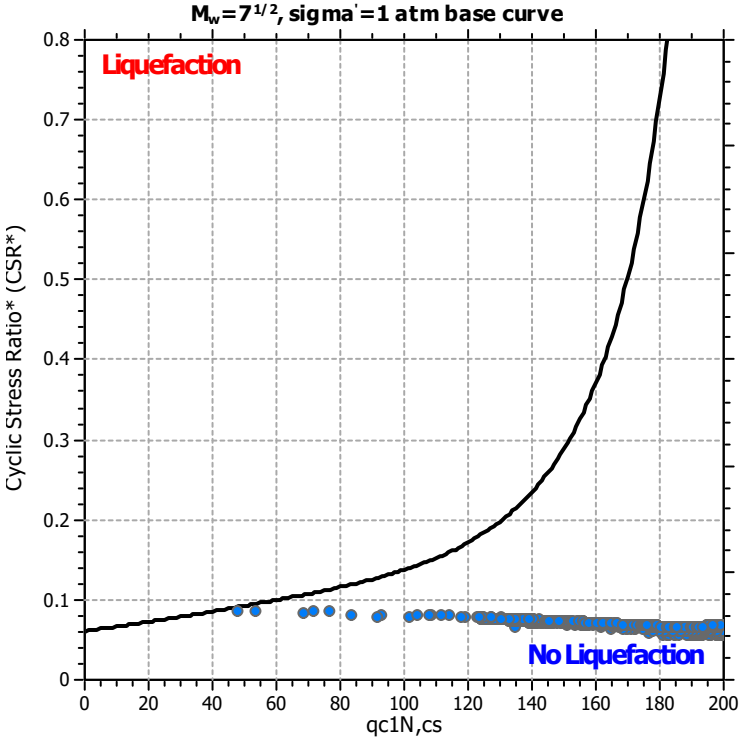
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

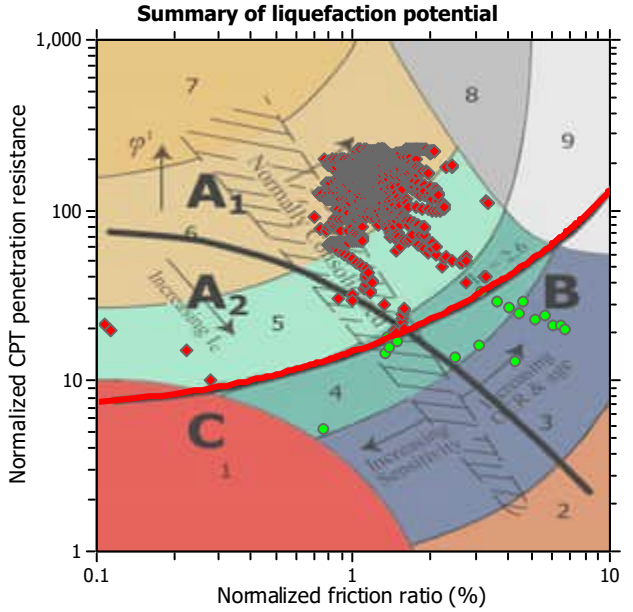
CPT file : CPT20

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.22 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	6.22 m	Fill height:	1.00 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	19.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

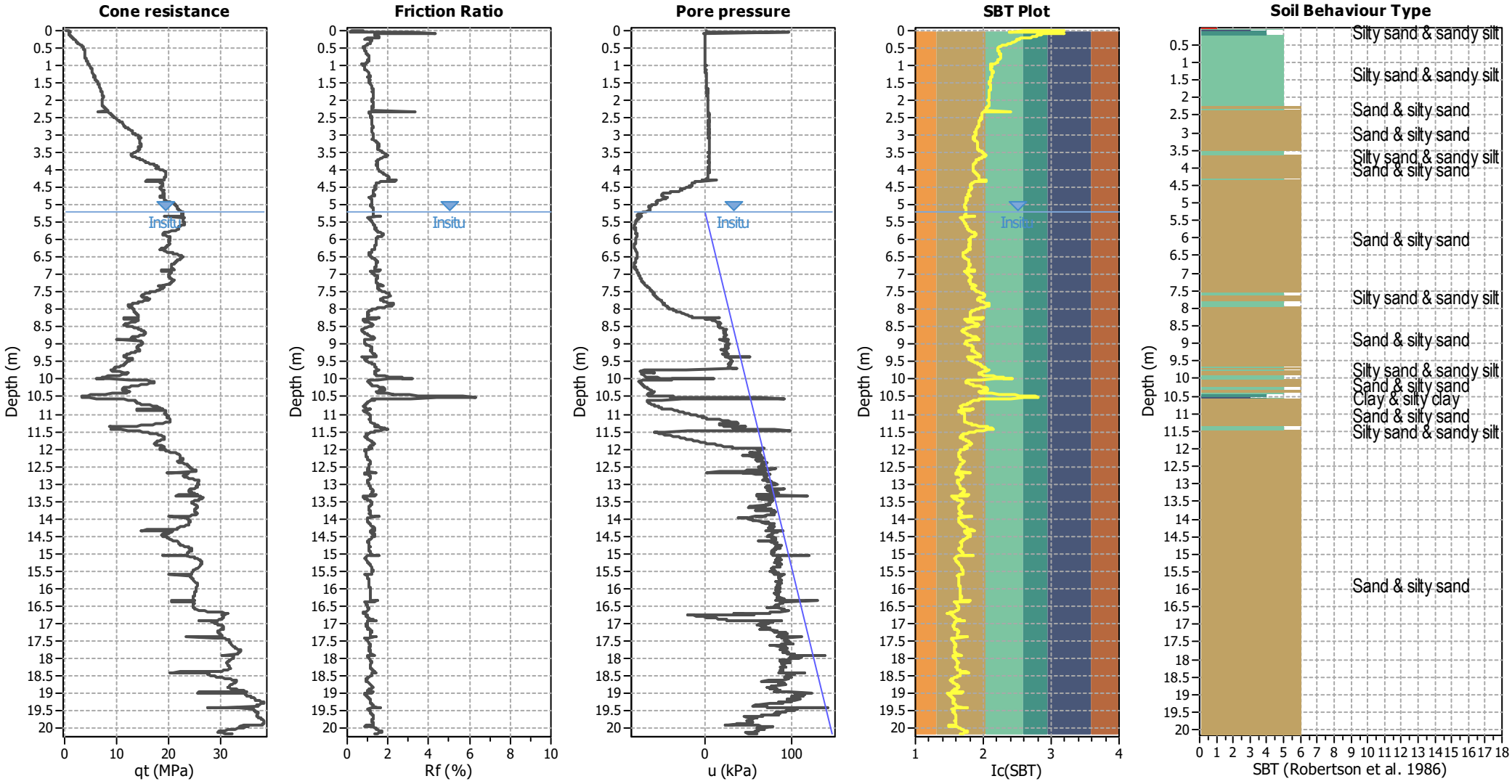






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



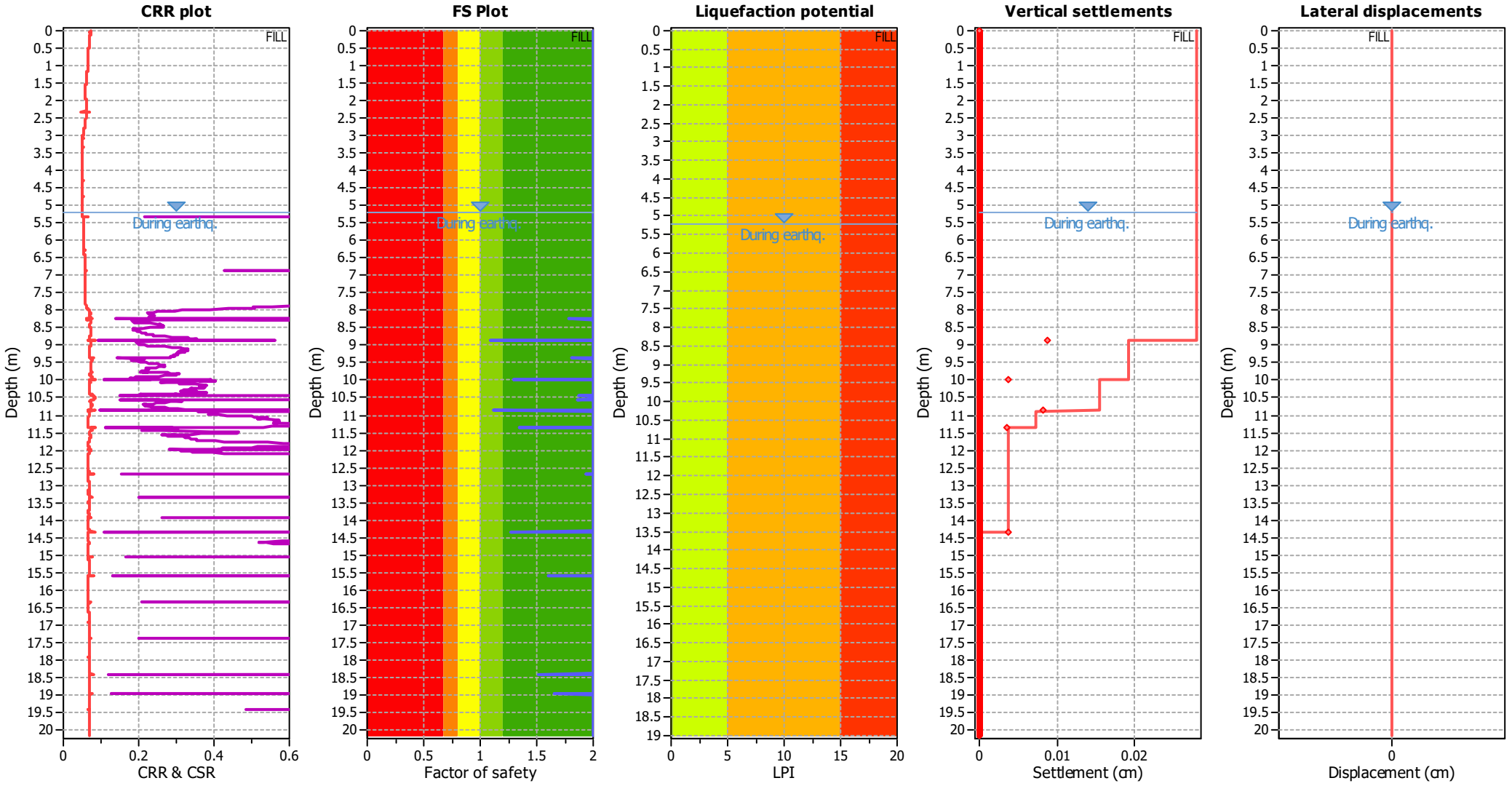
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.22 m	Fill weight:	19.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.22 m	Fill height:	1.00 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.22 m	Fill weight:	19.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.22 m	Fill height:	1.00 m	Limit depth:	N/A

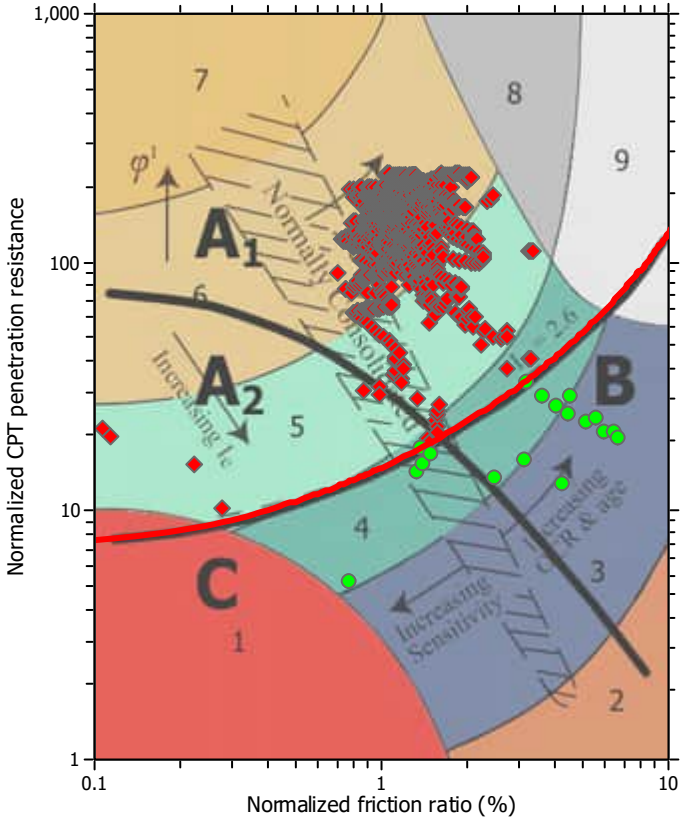
F.S. color scheme

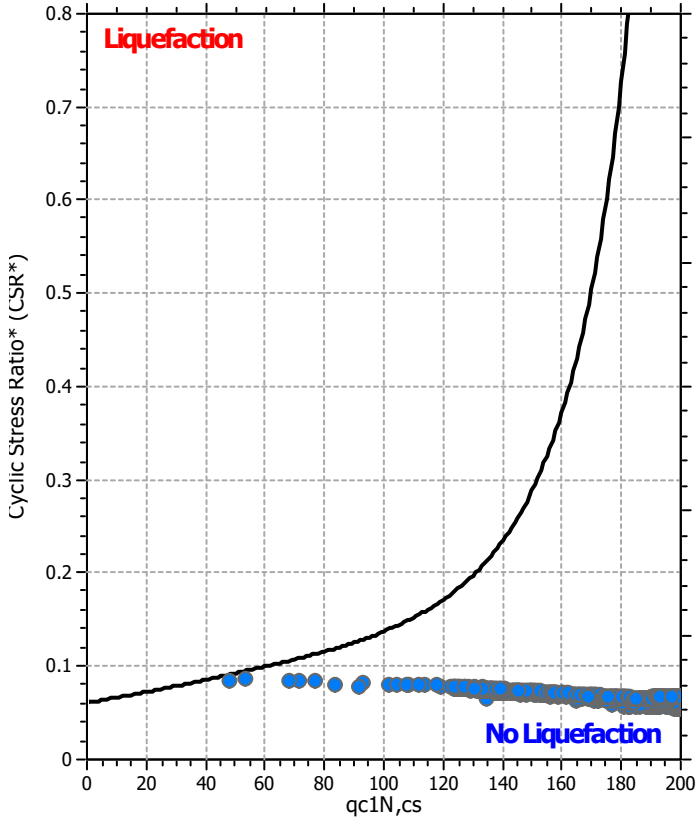
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

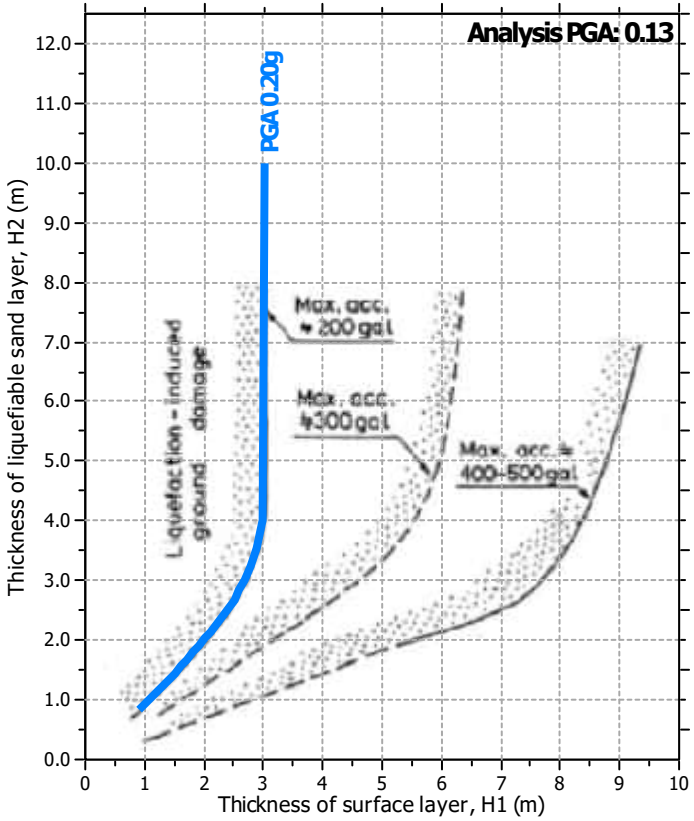
LPI color scheme

- 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.):	6.22 m	Fill weight:	19.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.22 m	Fill height:	1.00 m	Limit depth:	N/A

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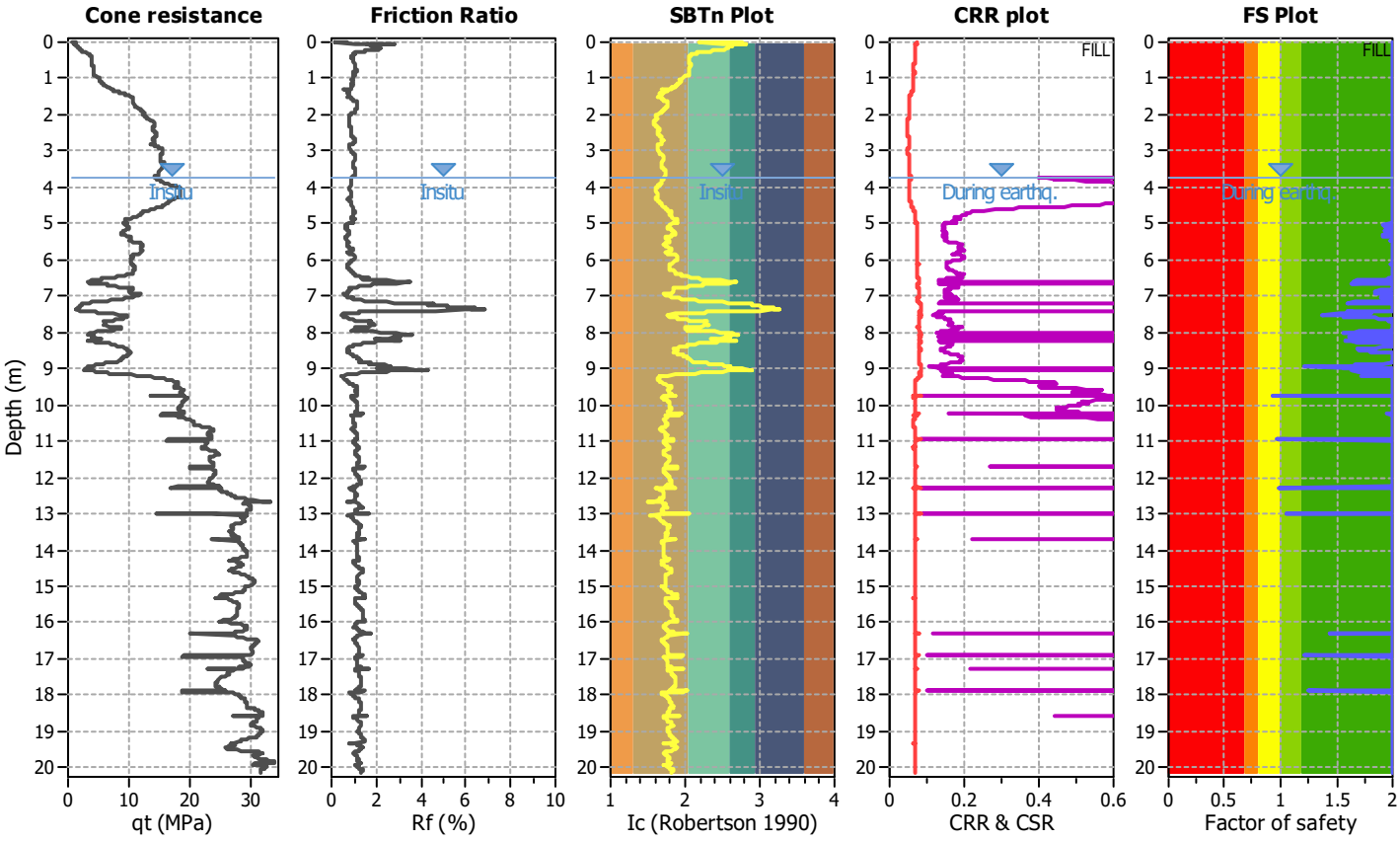
LIQUEFACTION ANALYSIS REPORT

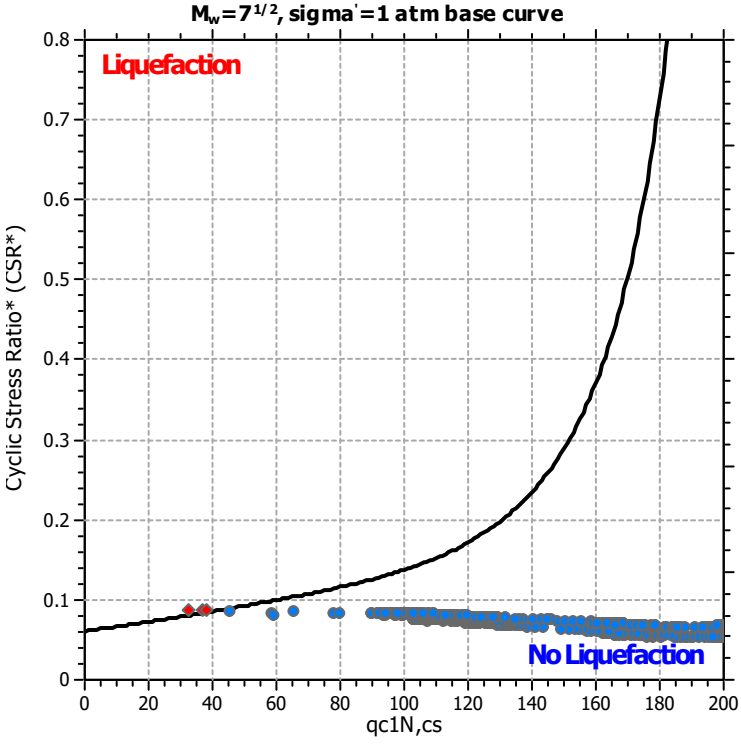
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

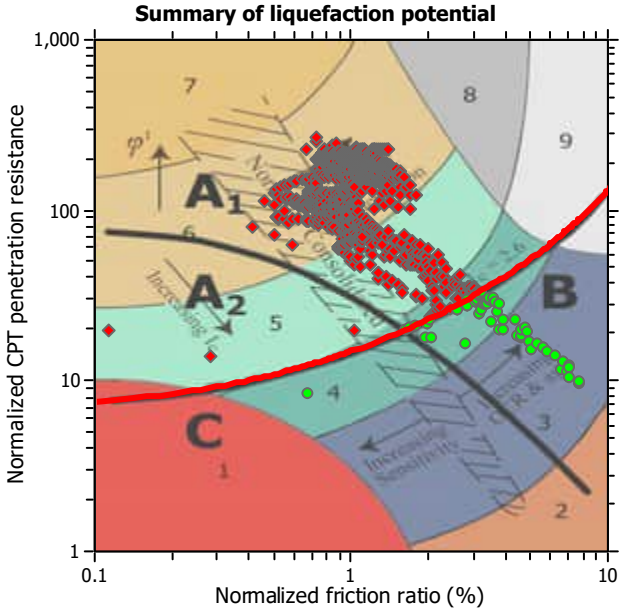
CPT file : CPT21

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.72 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	6.07 m	Fill height:	2.35 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

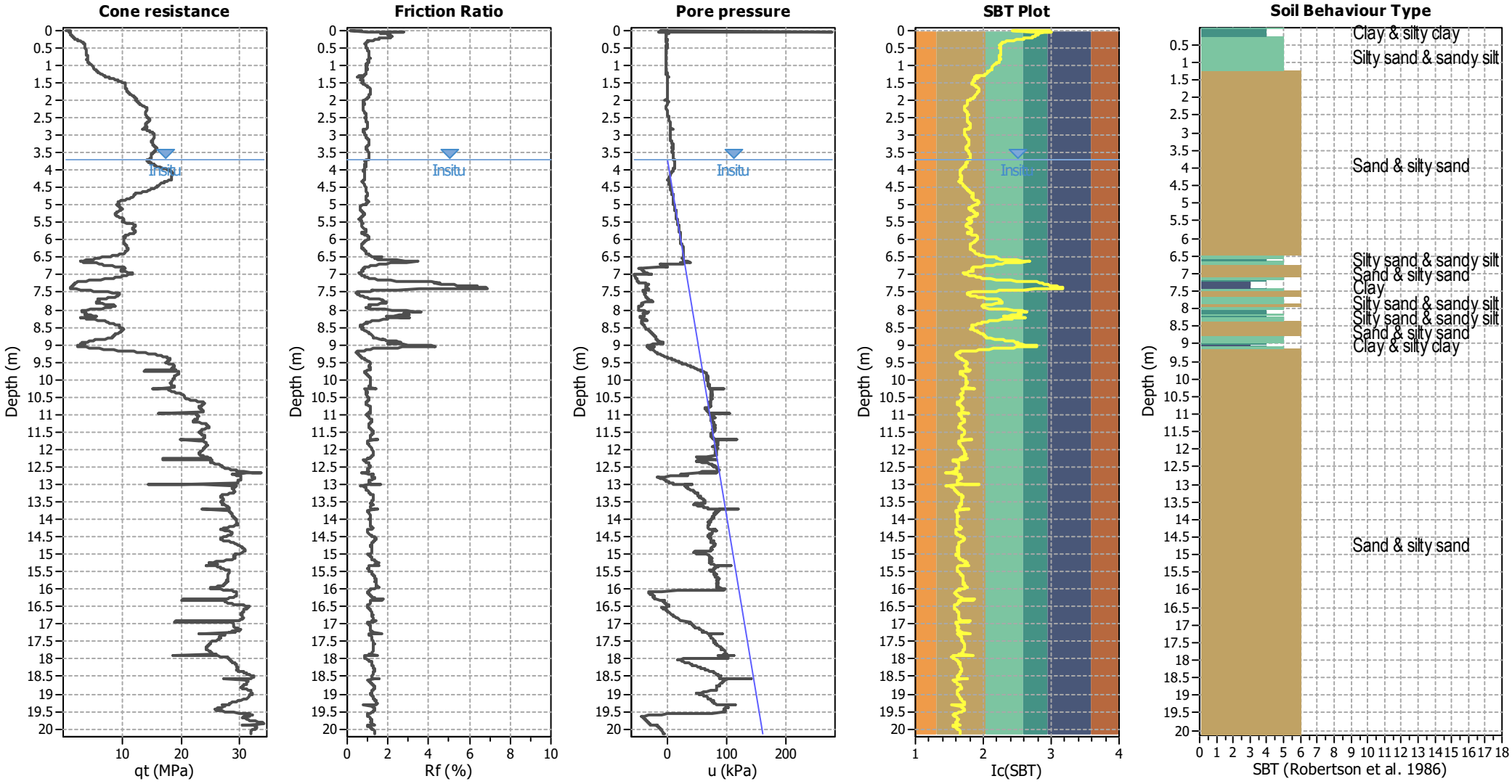






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



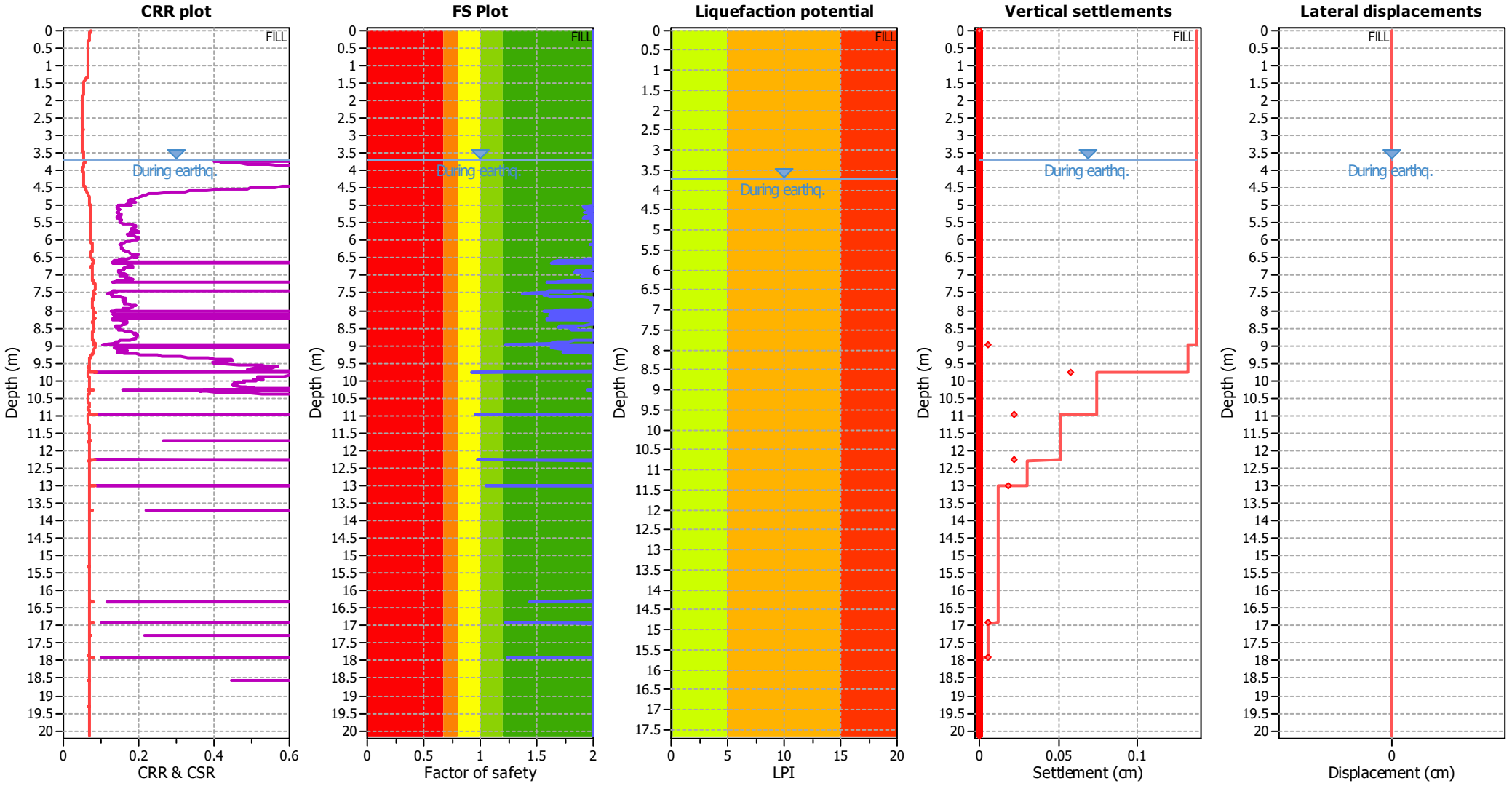
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.07 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	3.72 m	Fill height:	2.35 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.07 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	3.72 m	Fill height:	2.35 m	Limit depth:	N/A

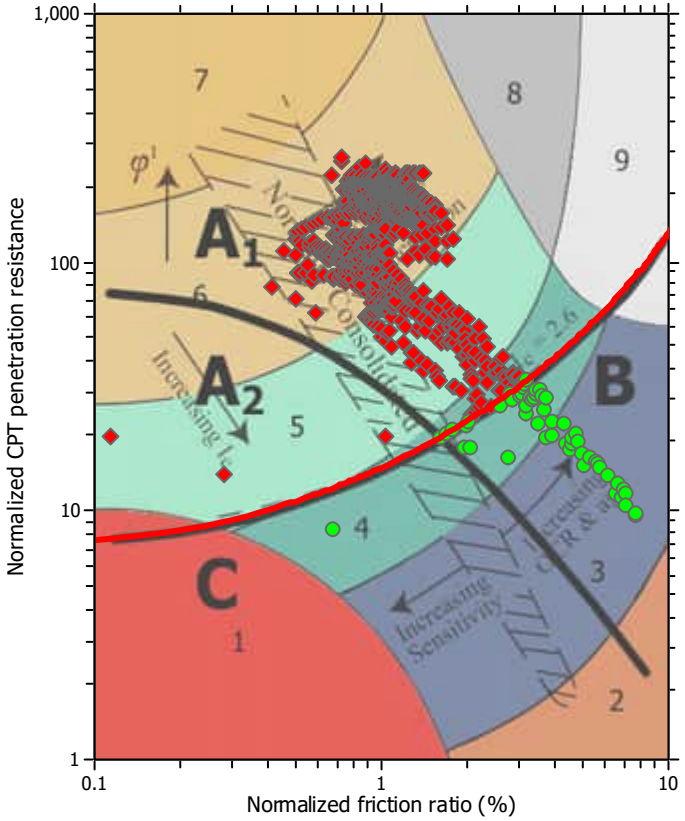
F.S. color scheme

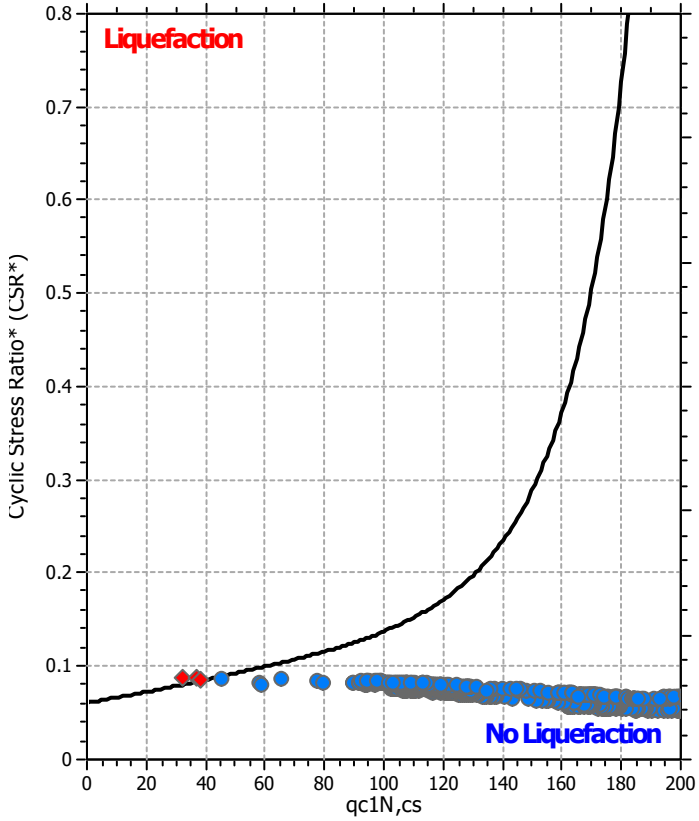
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

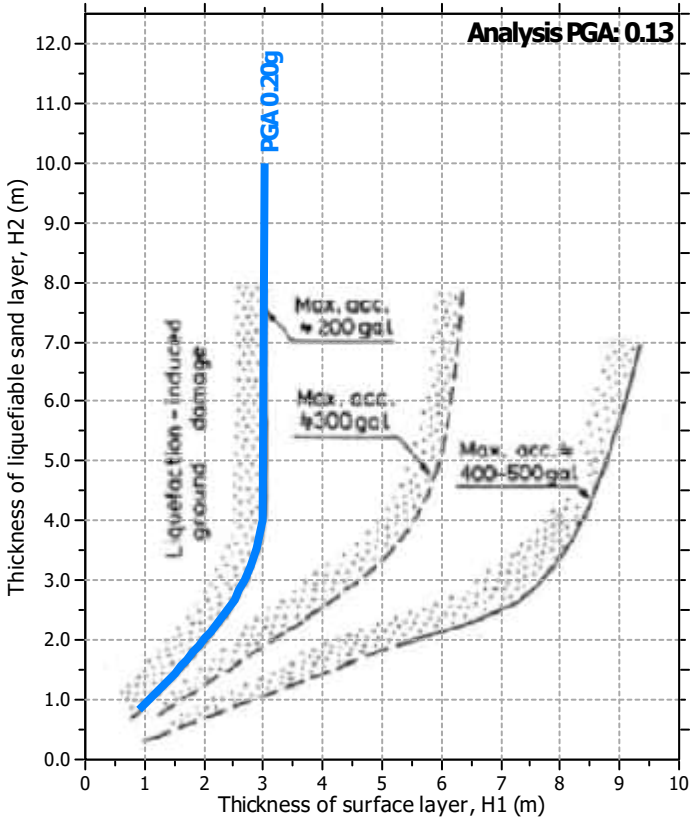
LPI color scheme

- 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.):	6.07 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	3.72 m	Fill height:	2.35 m	Limit depth:	N/A

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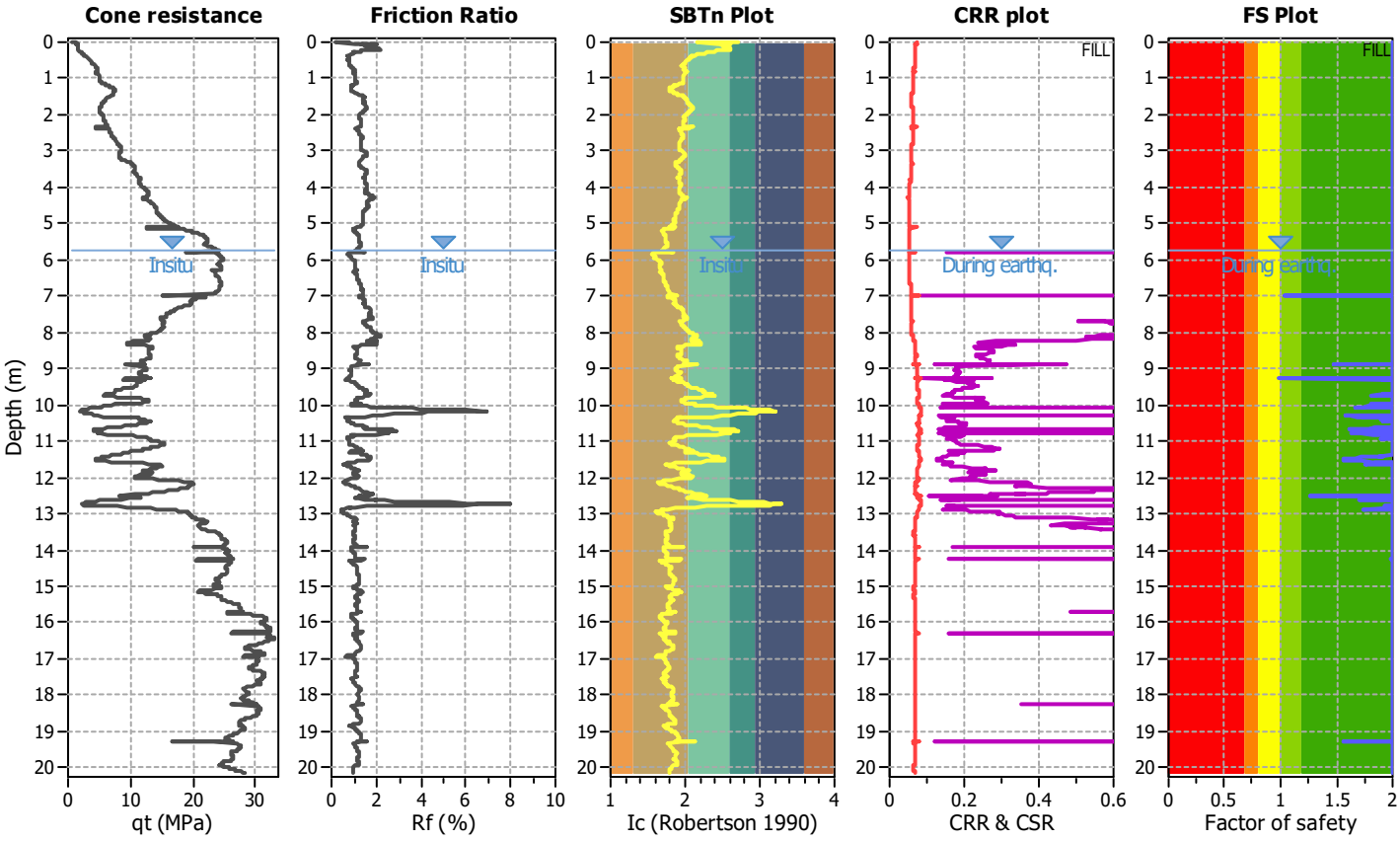
LIQUEFACTION ANALYSIS REPORT

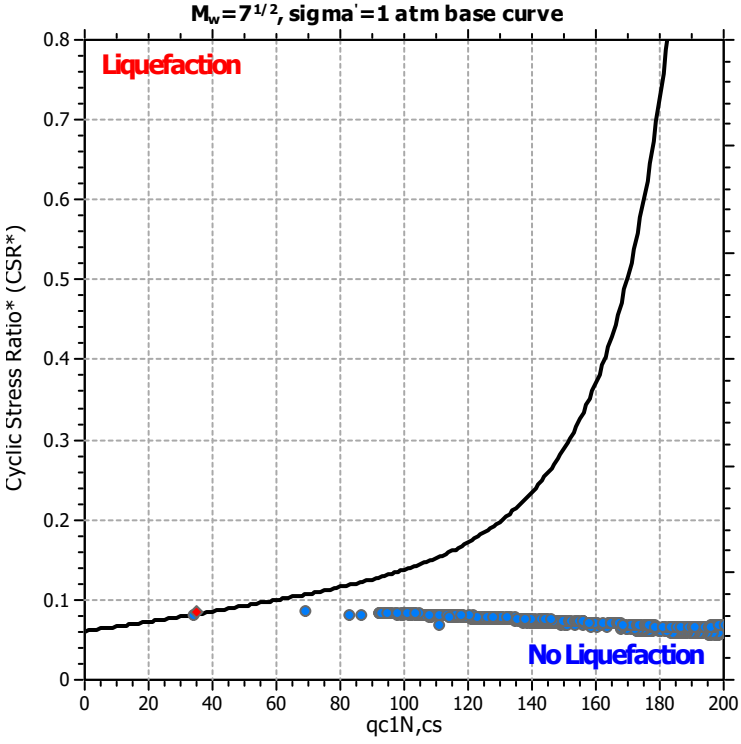
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

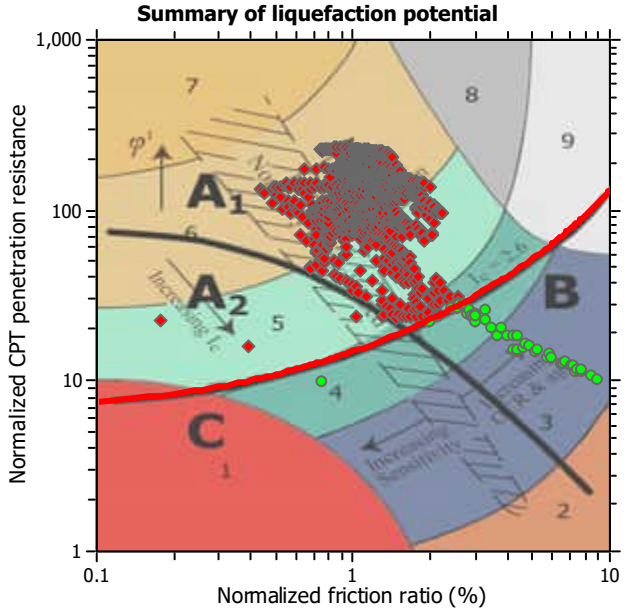
CPT file : CPT22

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.72 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	6.22 m	Fill height:	0.50 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

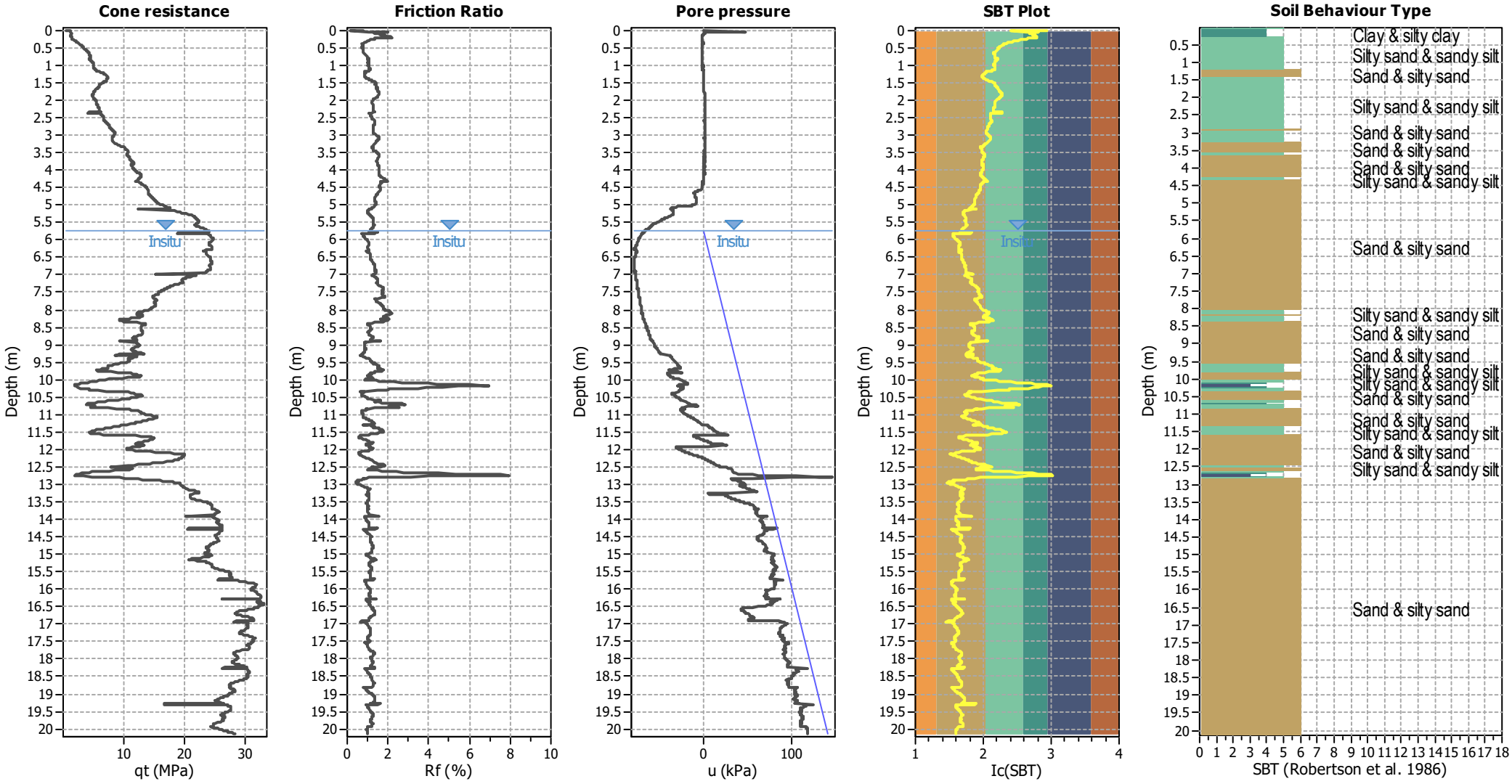






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



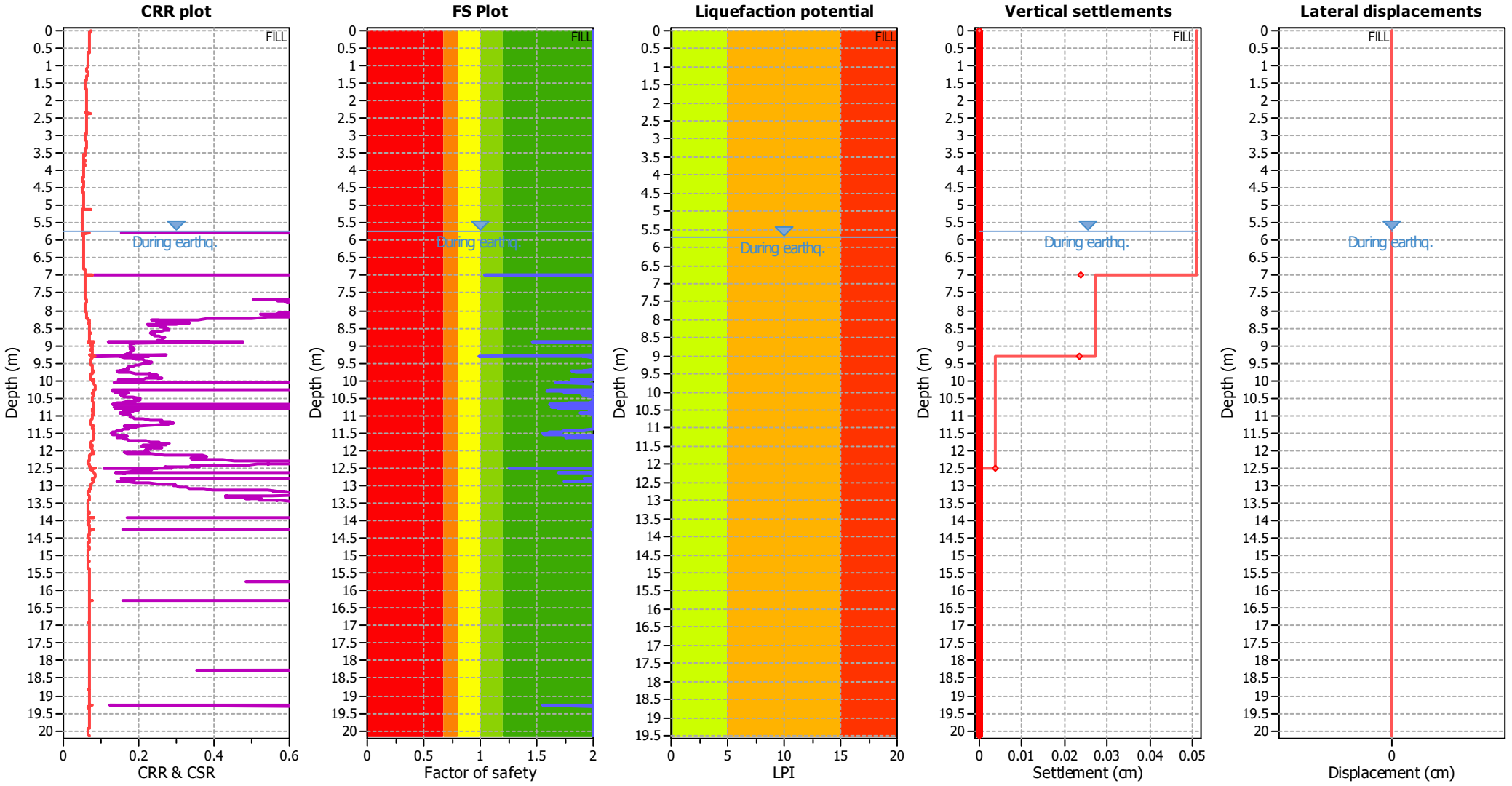
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.72 m	Fill height:	0.50 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.72 m	Fill height:	0.50 m	Limit depth:	N/A

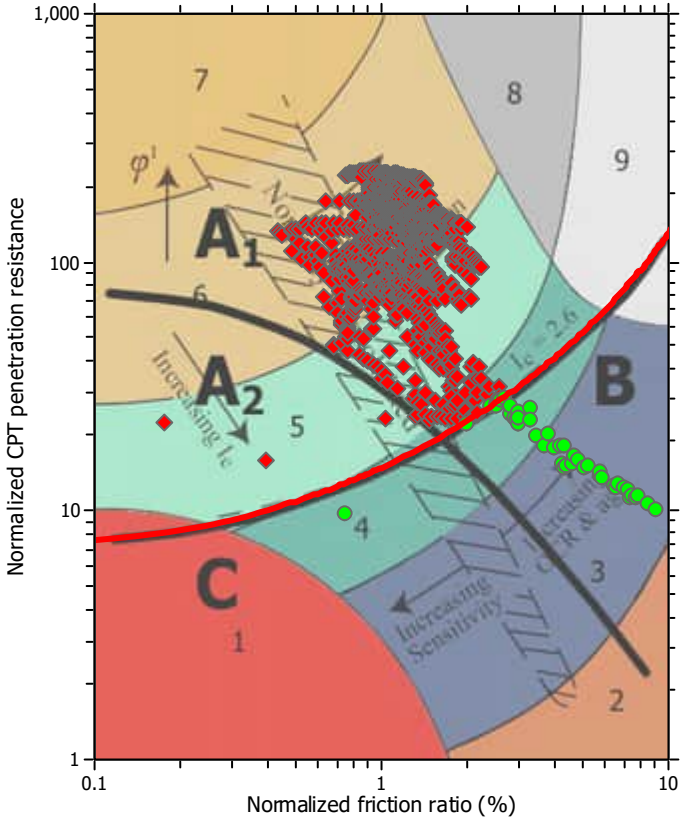
F.S. color scheme

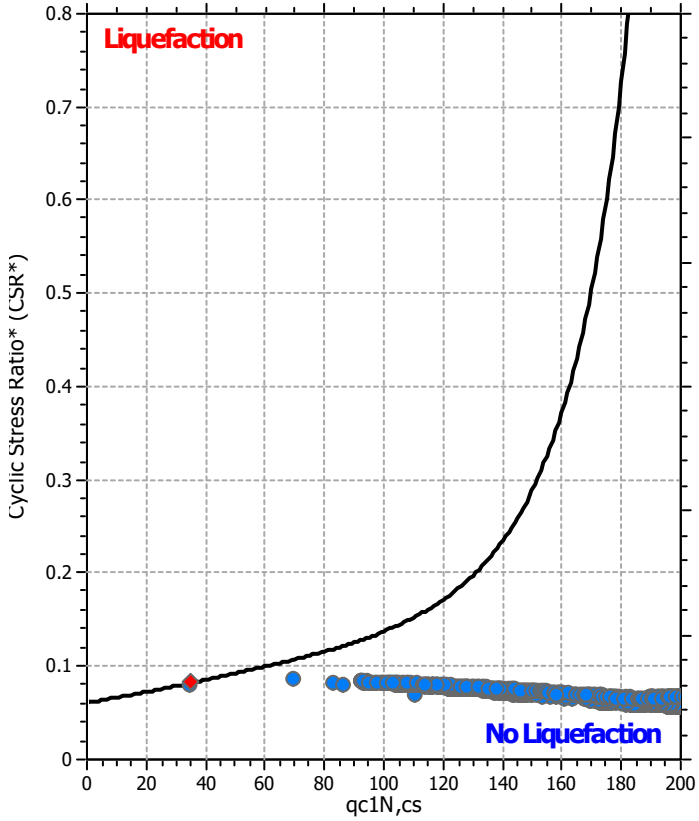
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

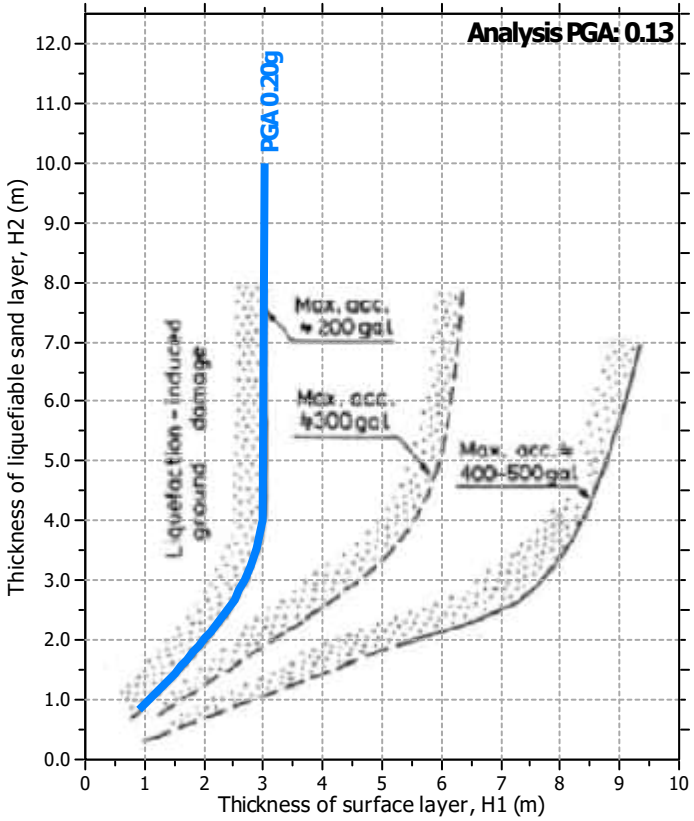
LPI color scheme

- 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.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.72 m	Fill height:	0.50 m	Limit depth:	N/A

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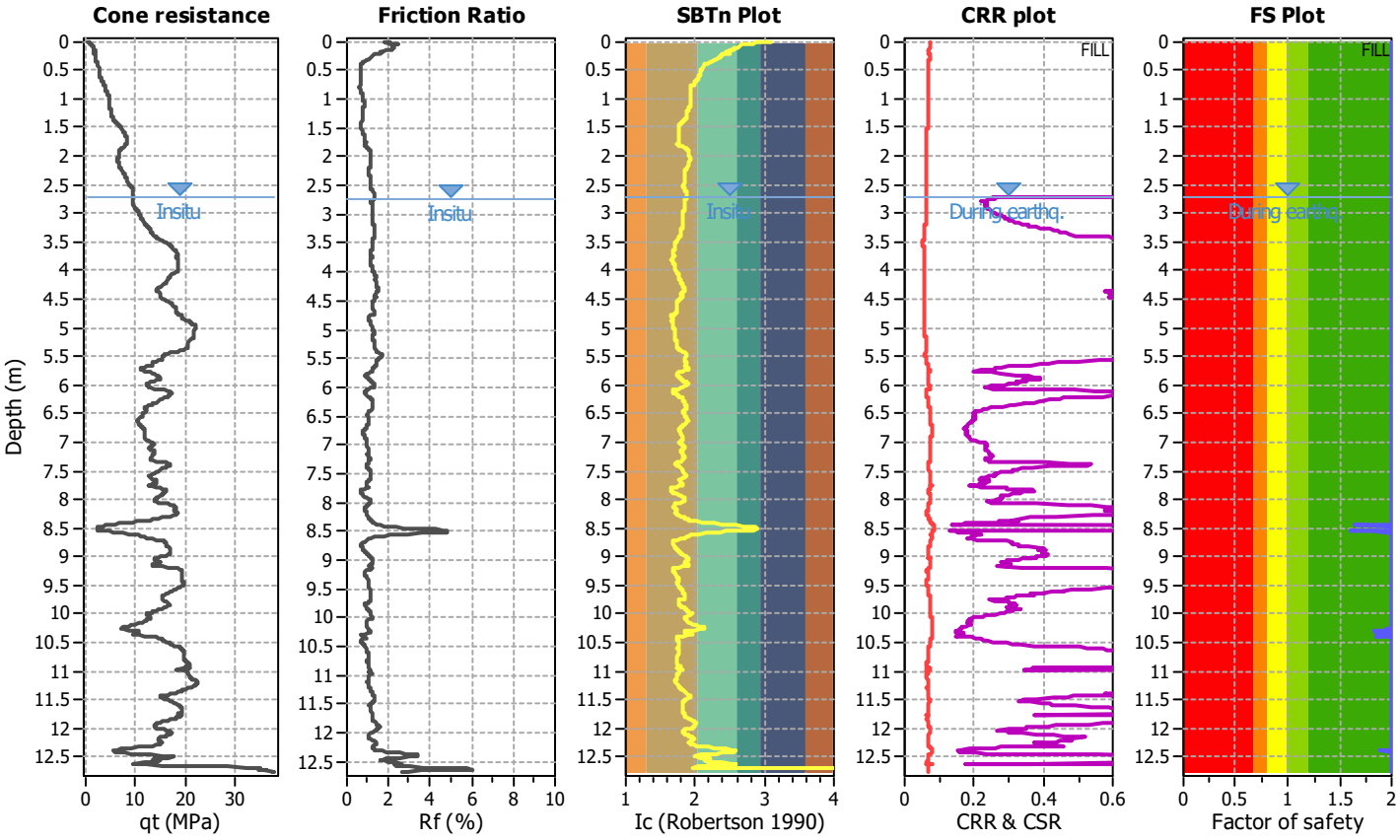
LIQUEFACTION ANALYSIS REPORT

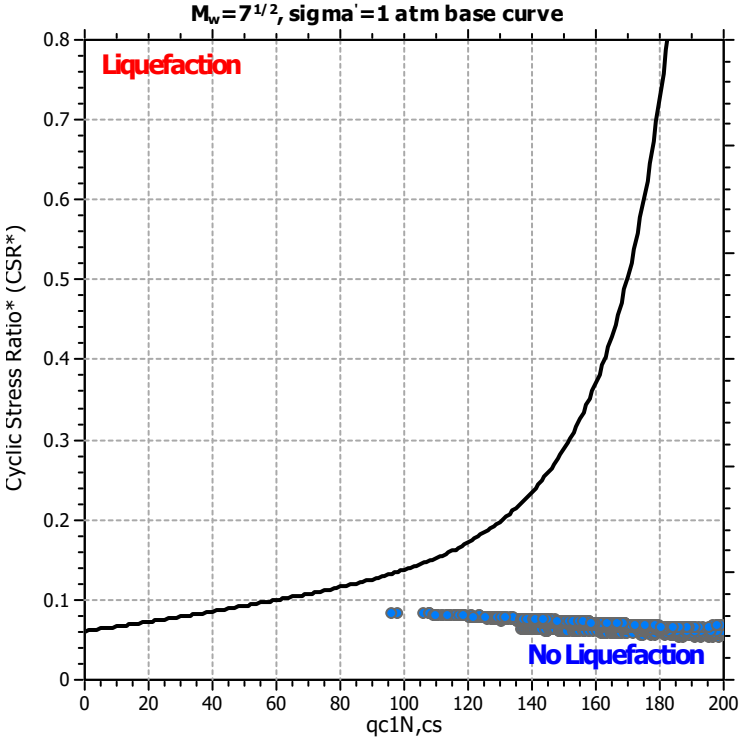
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

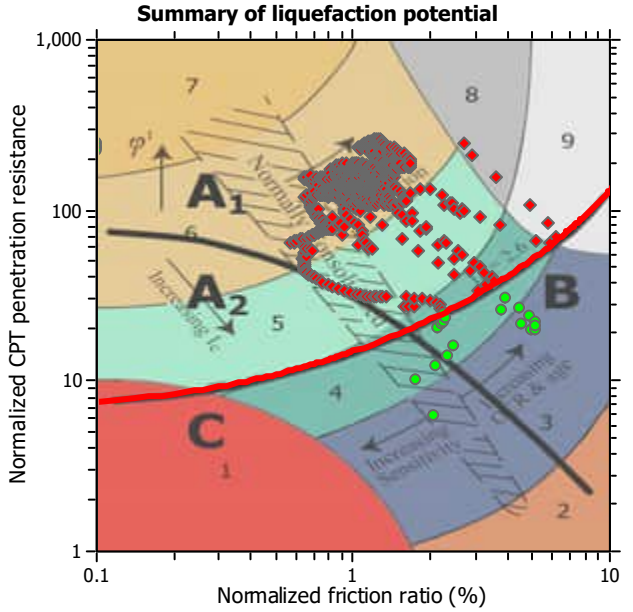
CPT file : CPT101

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.72 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	6.22 m	Fill height:	3.50 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

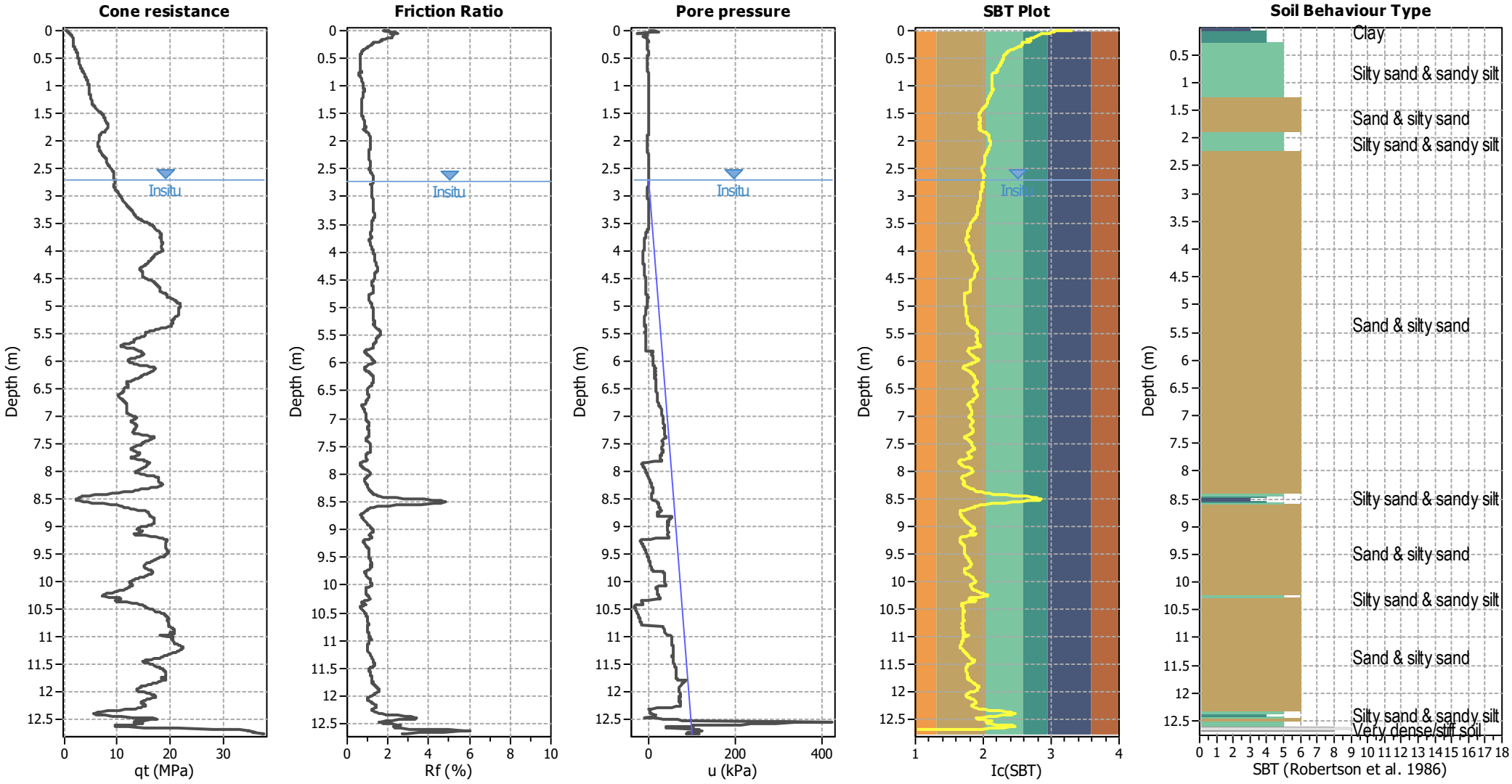






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



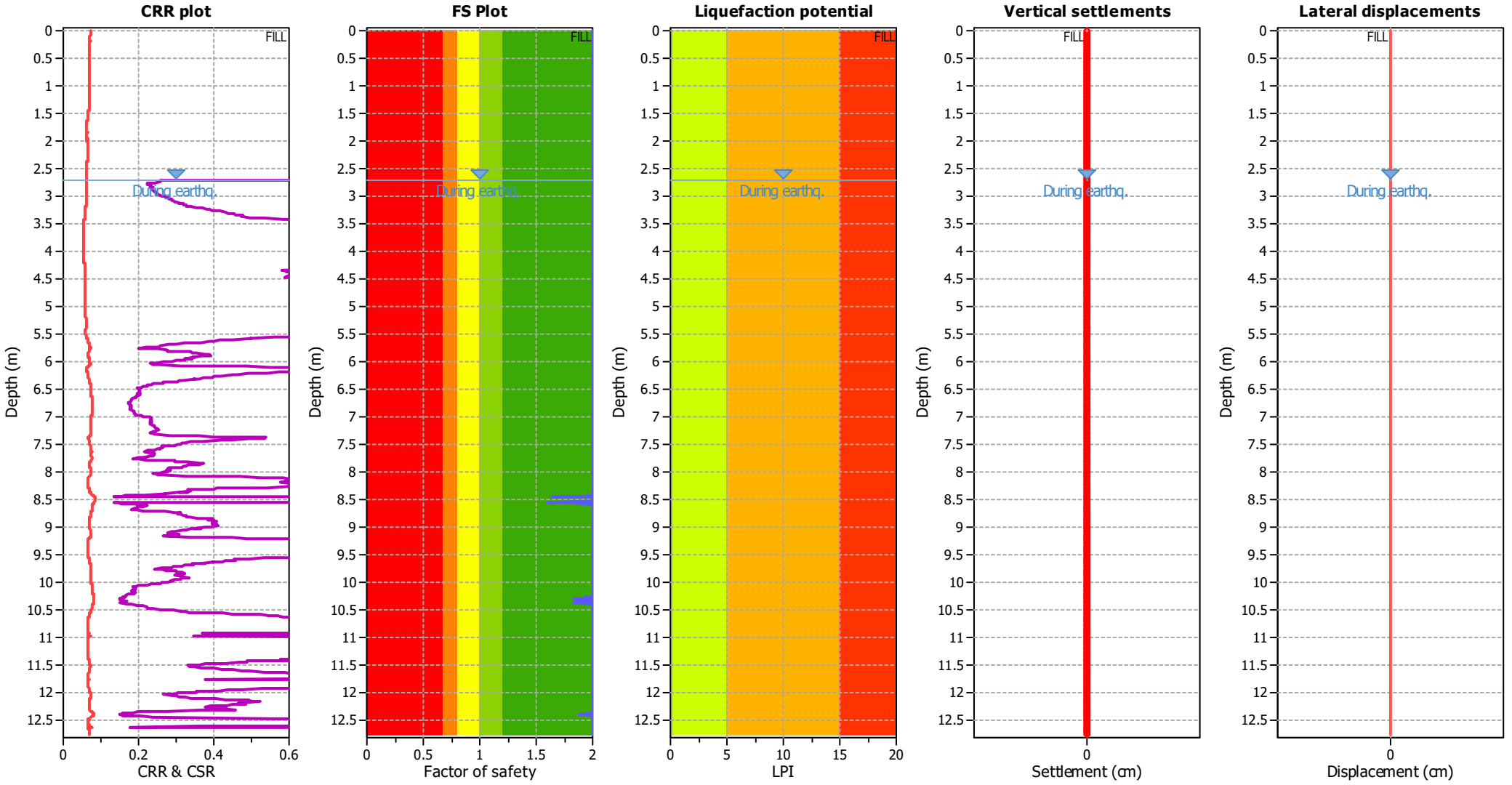
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	2.72 m	Fill height:	3.50 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	2.72 m	Fill height:	3.50 m	Limit depth:	N/A

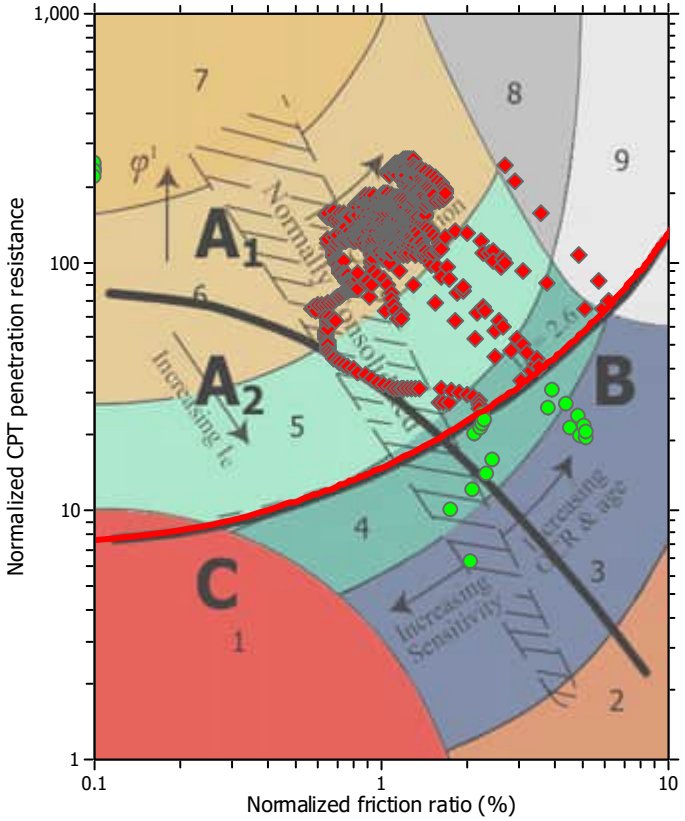
F.S. color scheme

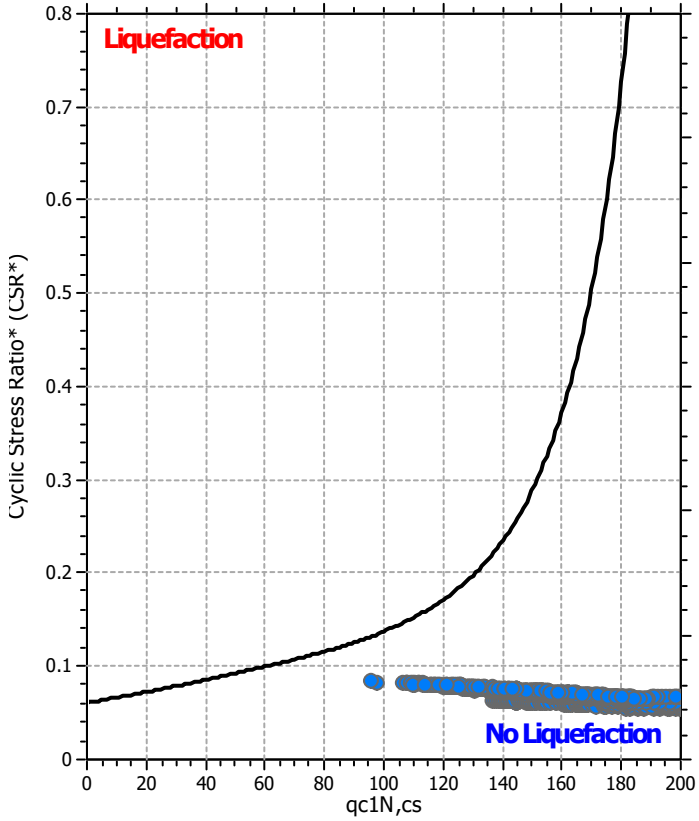
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

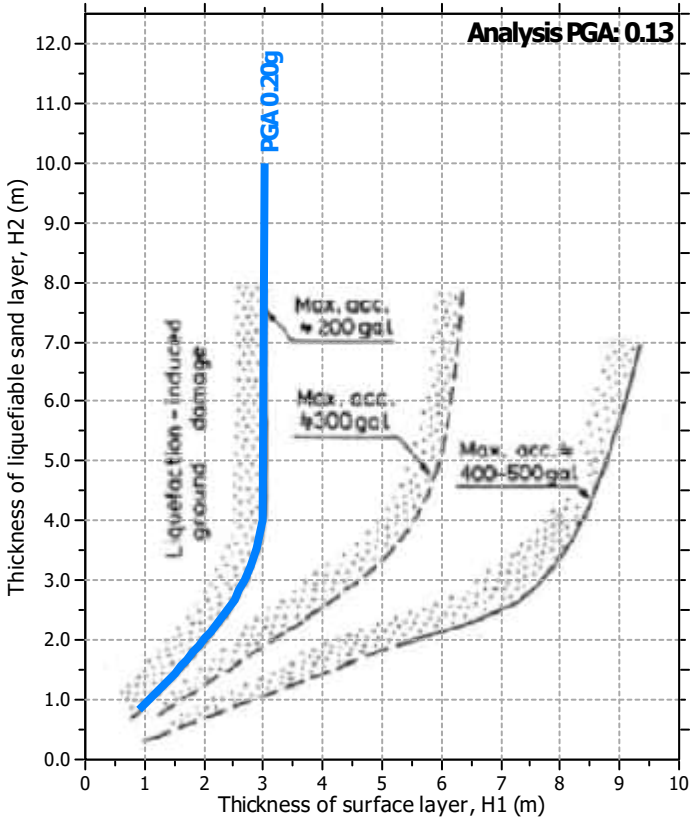
LPI color scheme

- 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.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	2.72 m	Fill height:	3.50 m	Limit depth:	N/A

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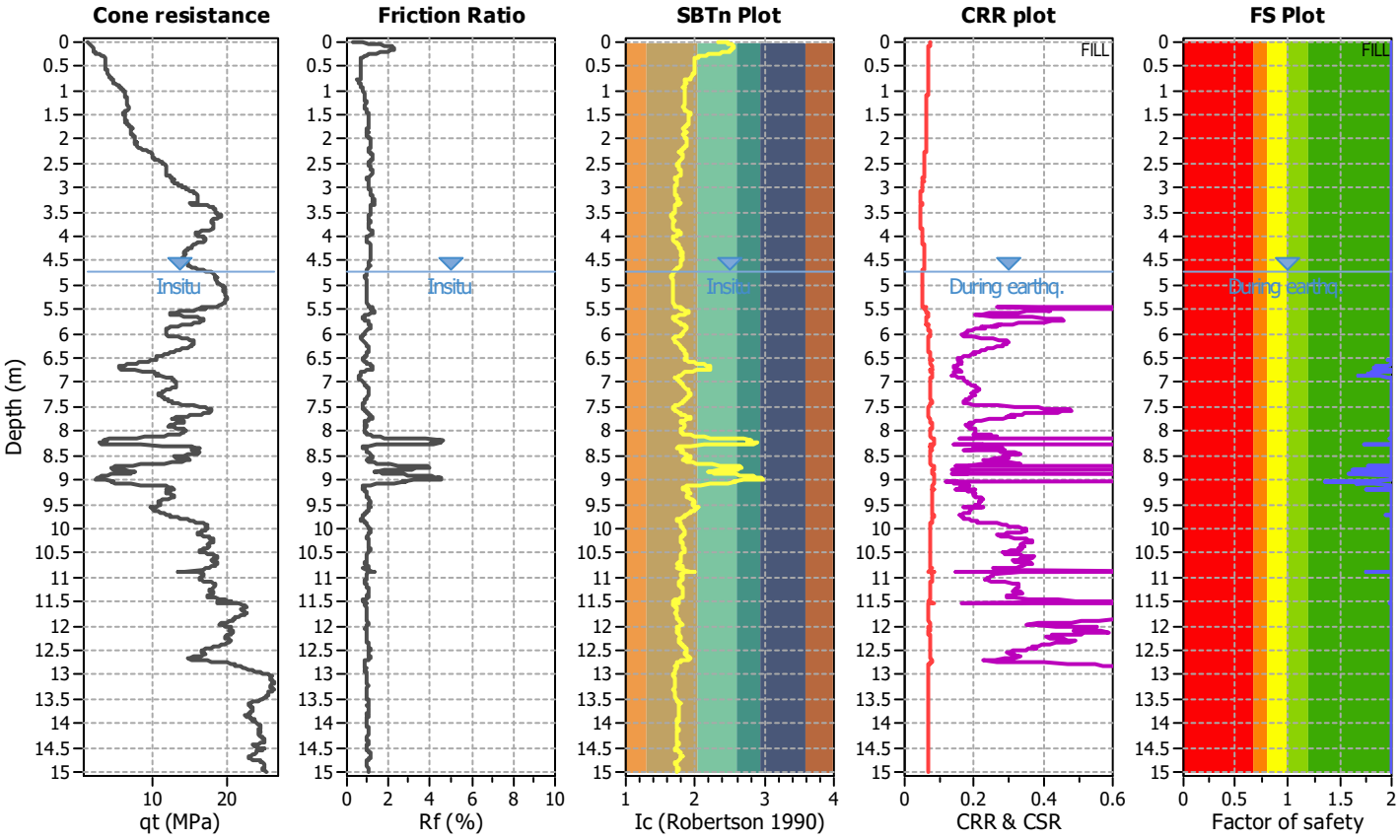
LIQUEFACTION ANALYSIS REPORT

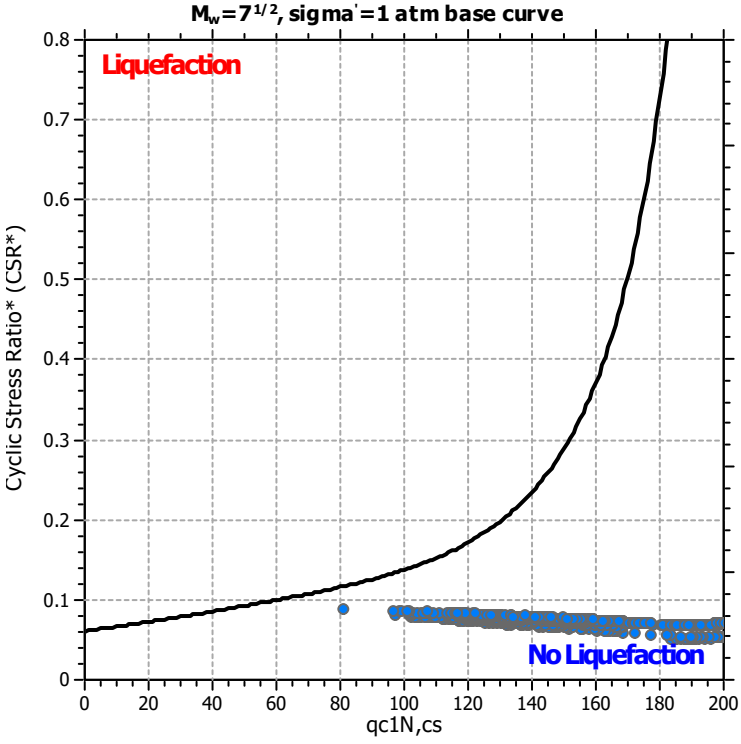
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

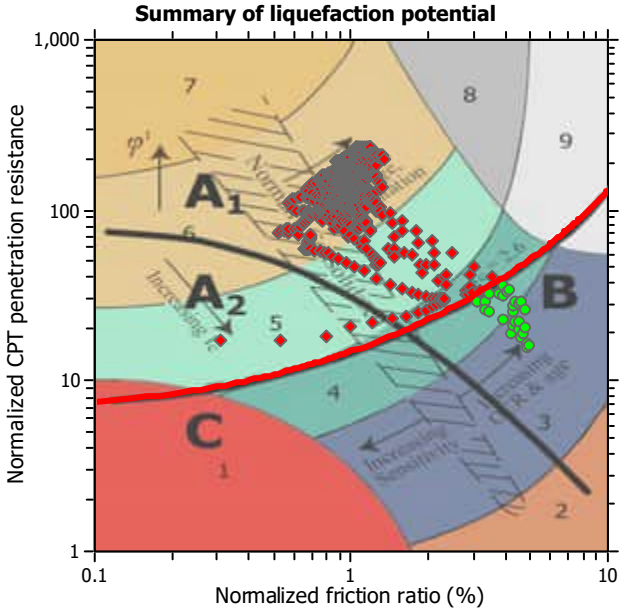
CPT file : CPT102

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	4.72 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.22 m	Fill height:	0.50 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

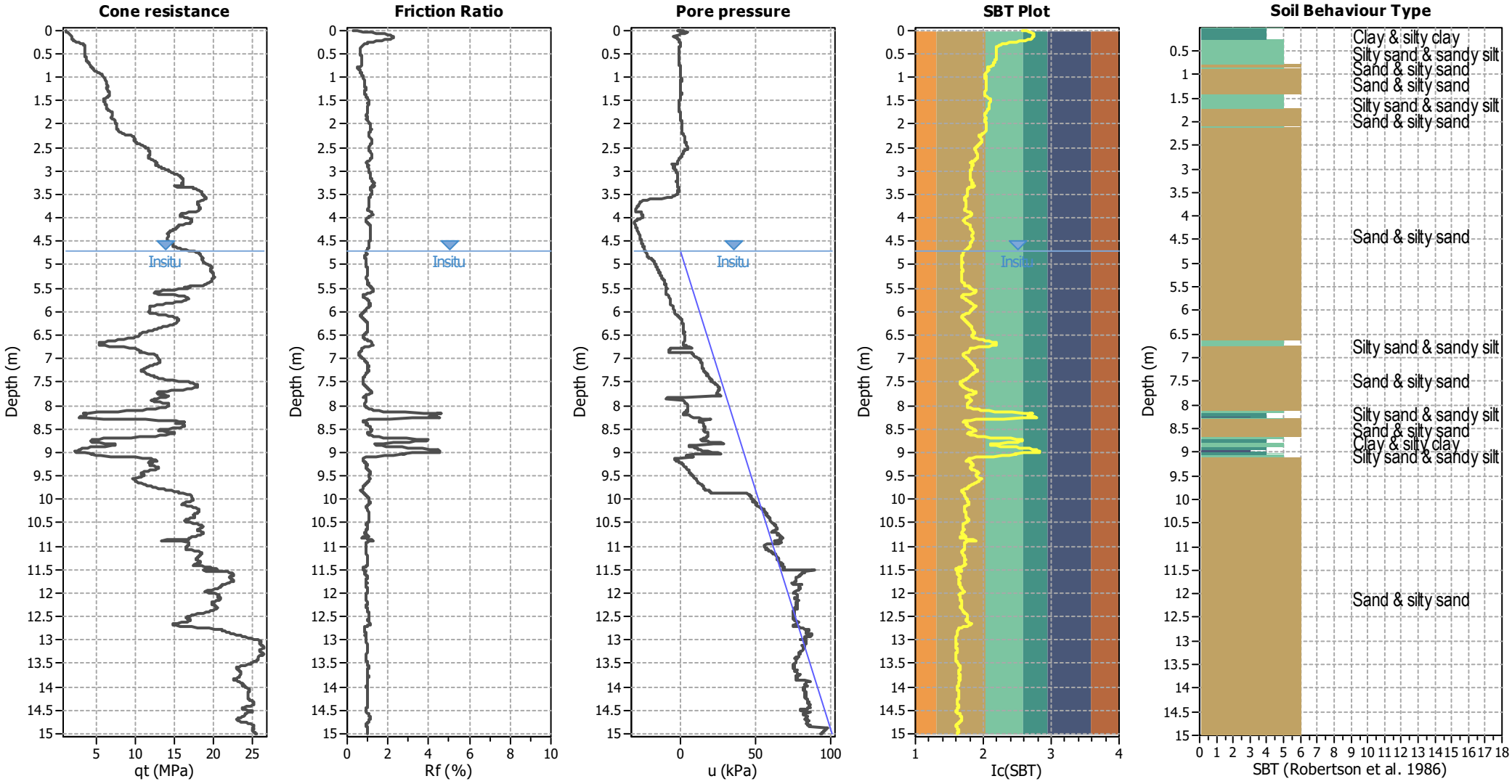






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



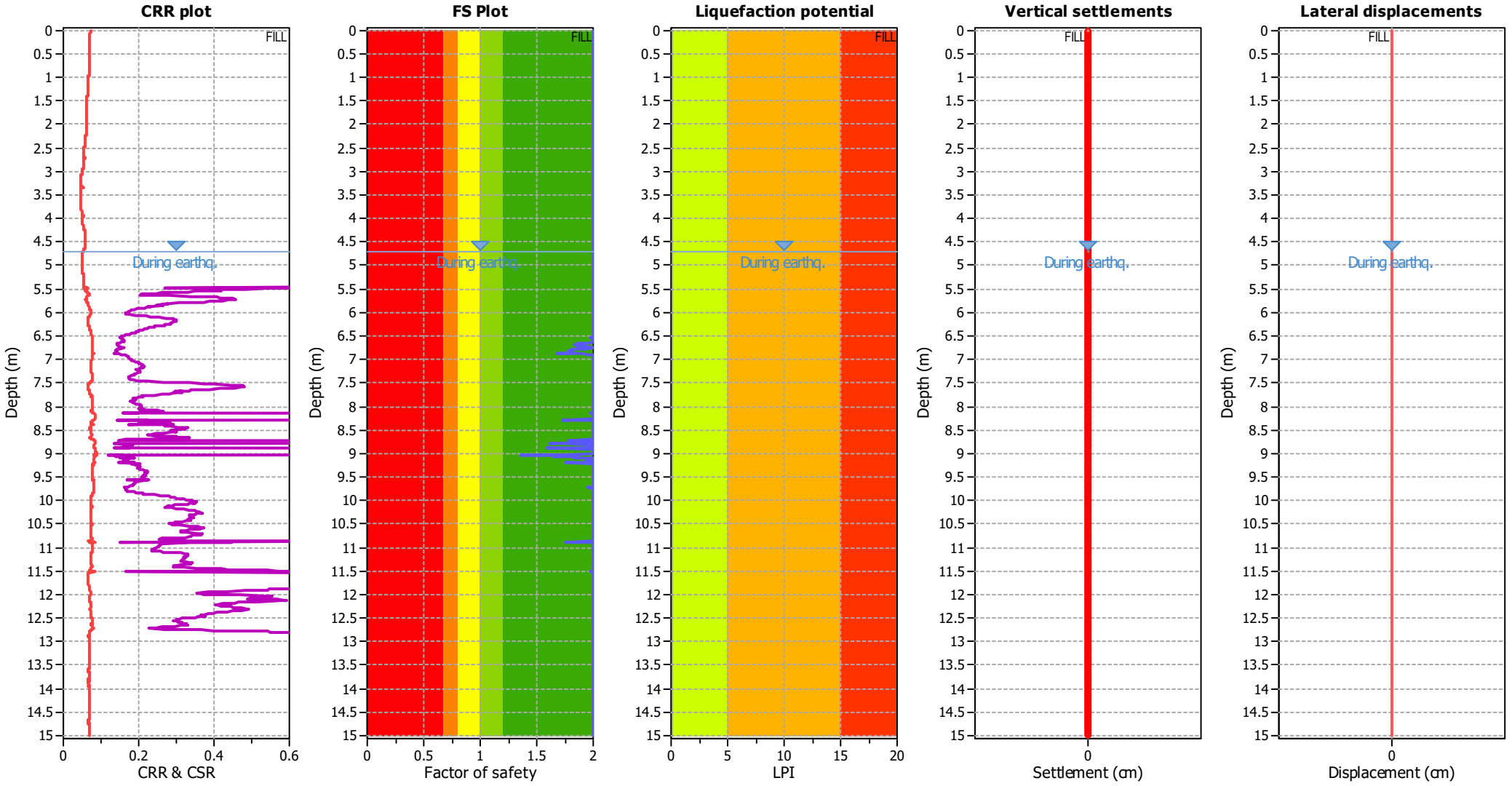
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	5.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	4.72 m	Fill height:	0.50 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	5.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	4.72 m	Fill height:	0.50 m	Limit depth:	N/A

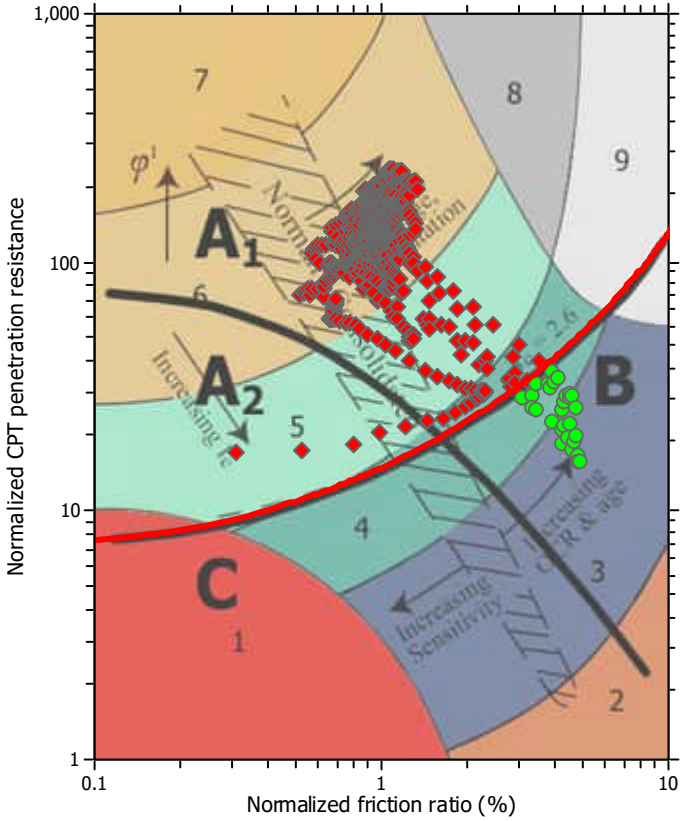
F.S. color scheme

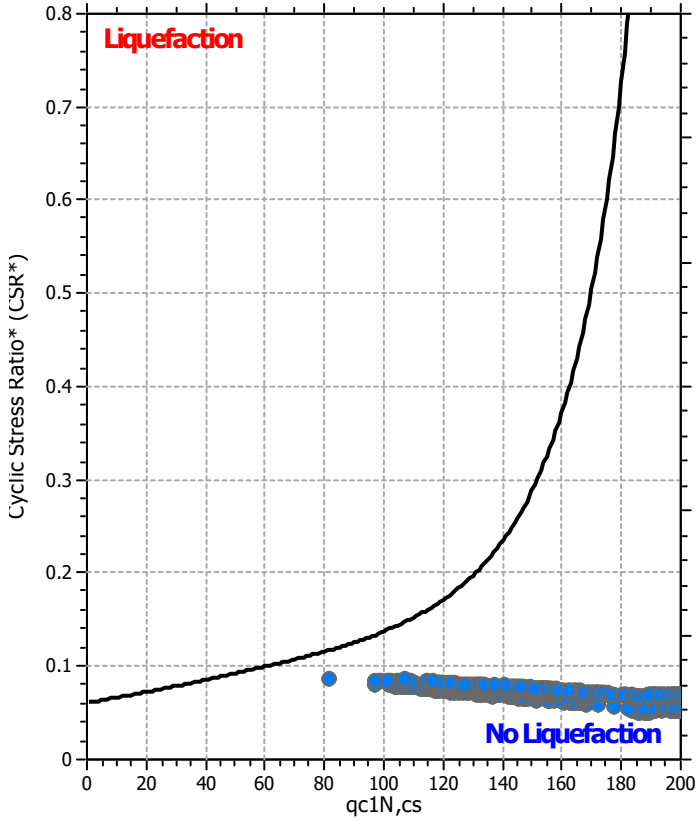
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

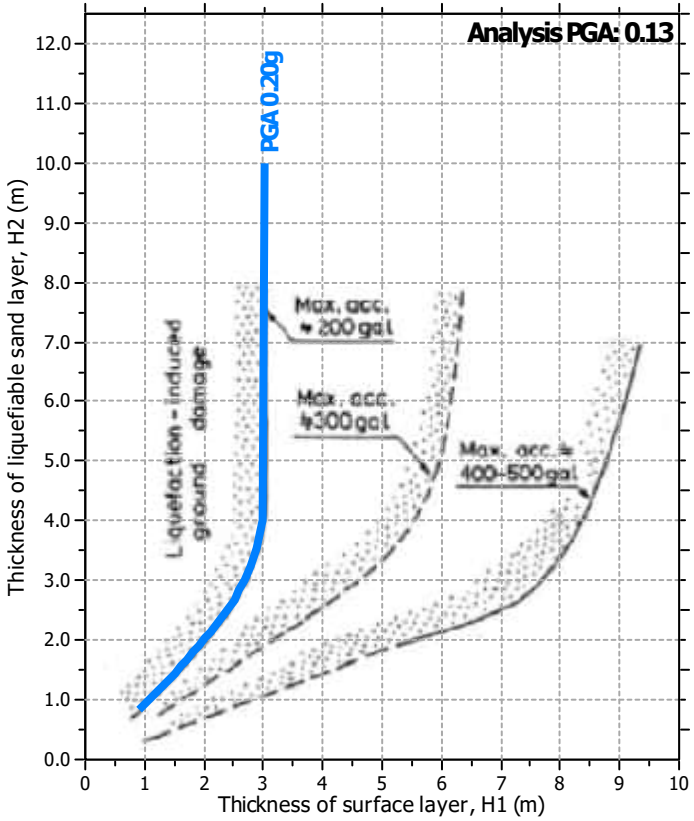
LPI color scheme

- 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.):	5.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	4.72 m	Fill height:	0.50 m	Limit depth:	N/A

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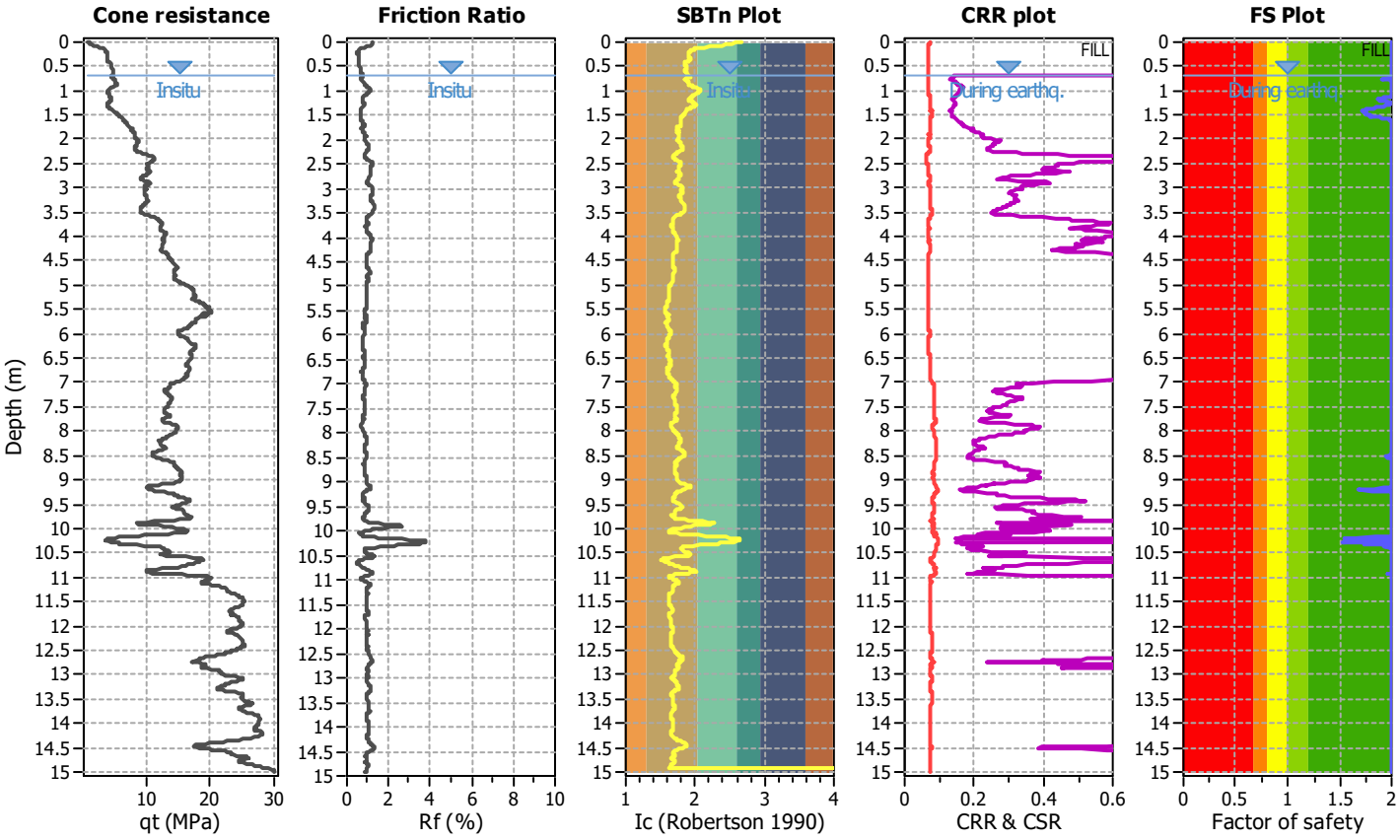
LIQUEFACTION ANALYSIS REPORT

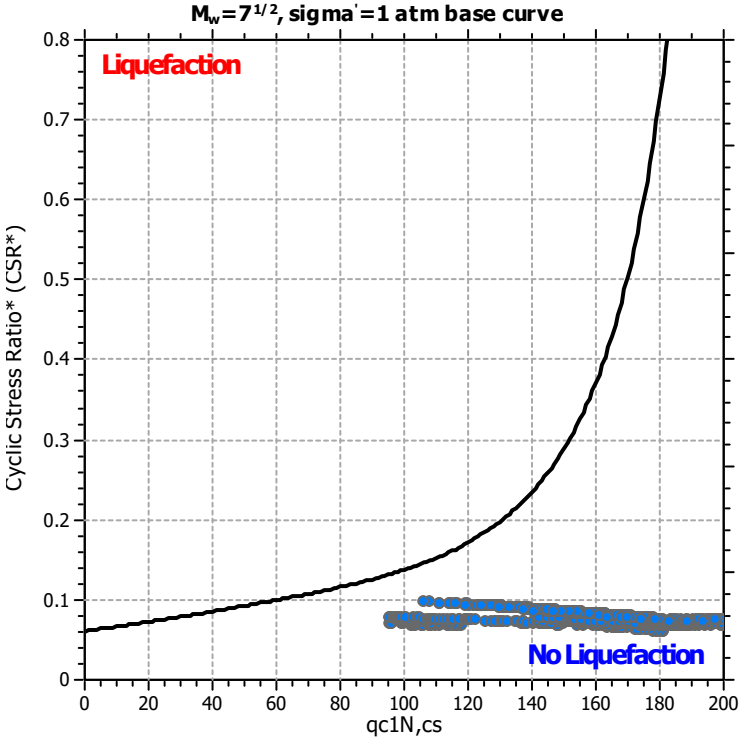
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

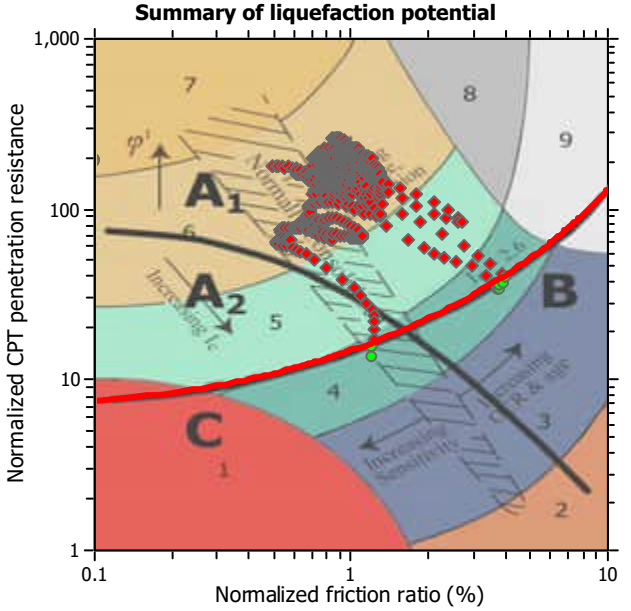
CPT file : CPT103

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.70 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	3.10 m	Fill height:	2.40 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

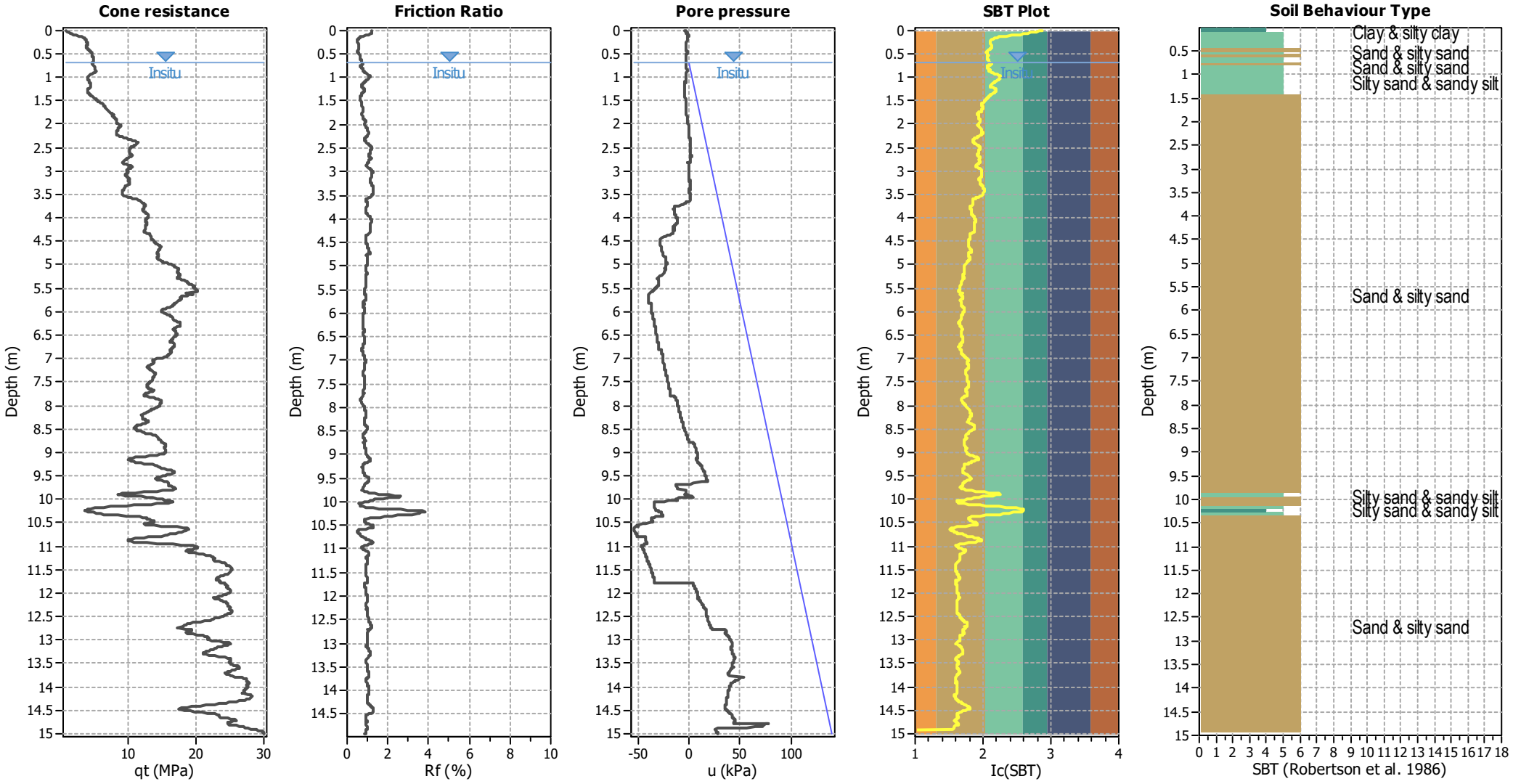






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



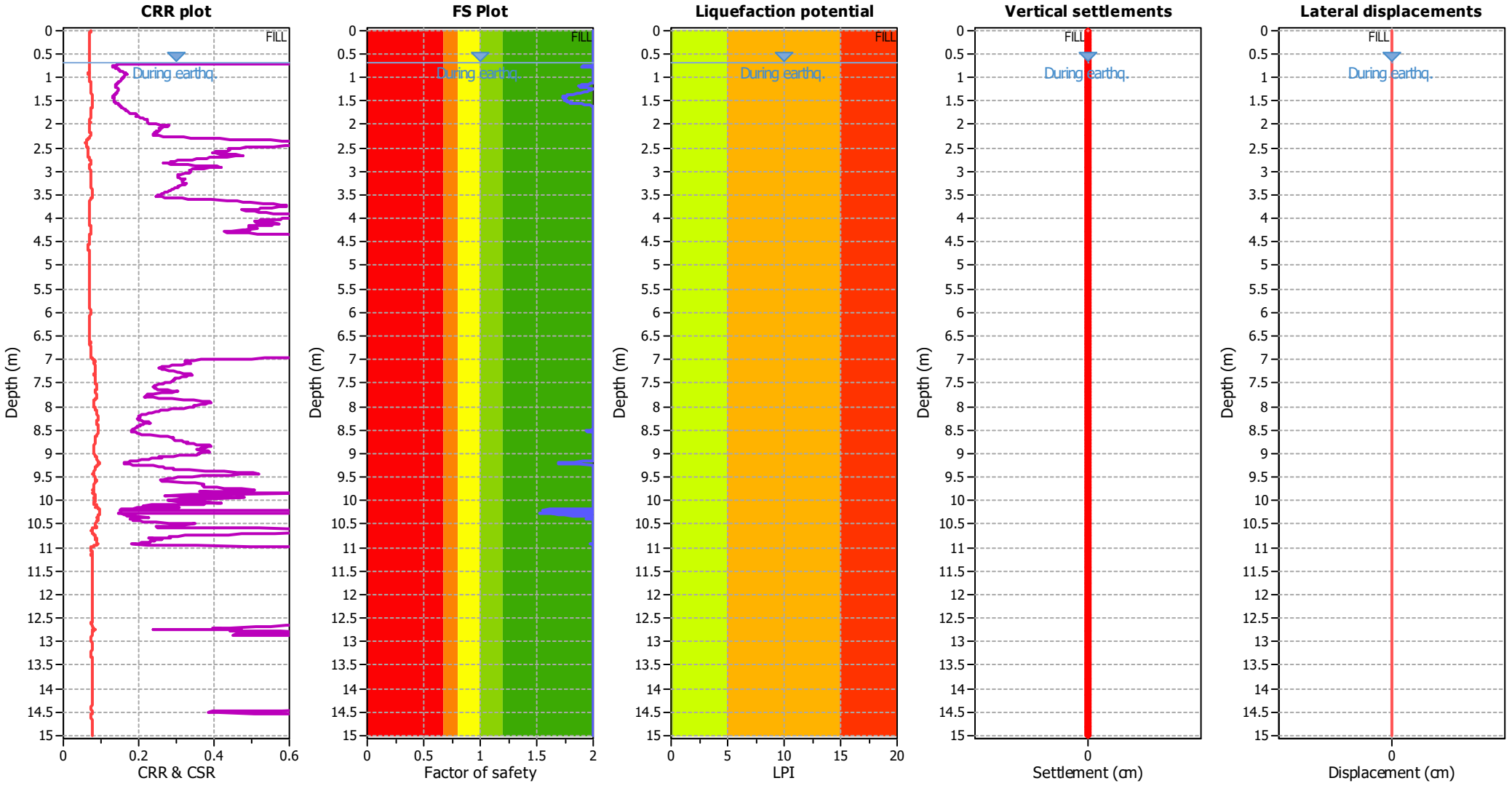
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.10 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	0.70 m	Fill height:	2.40 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.10 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	0.70 m	Fill height:	2.40 m	Limit depth:	N/A

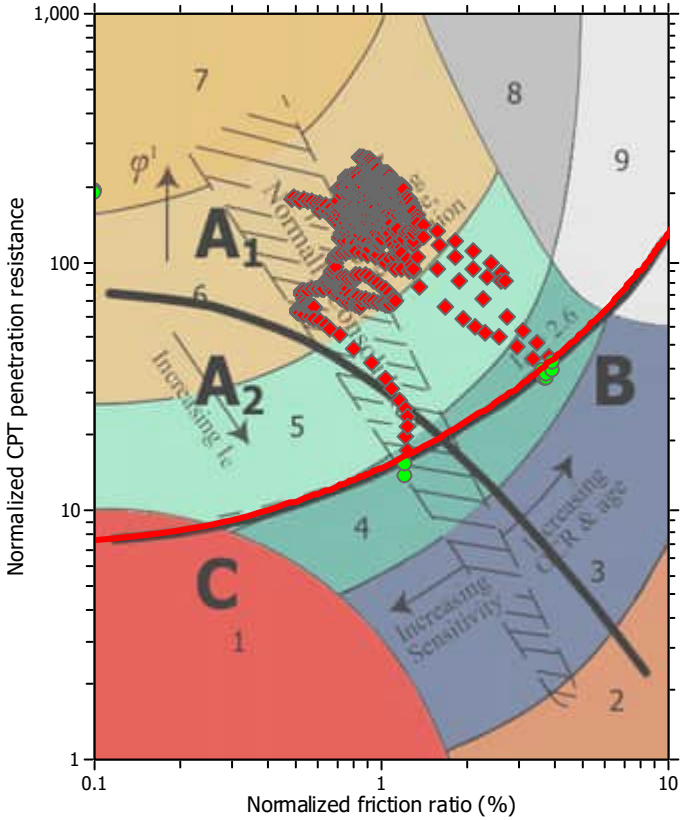
F.S. color scheme

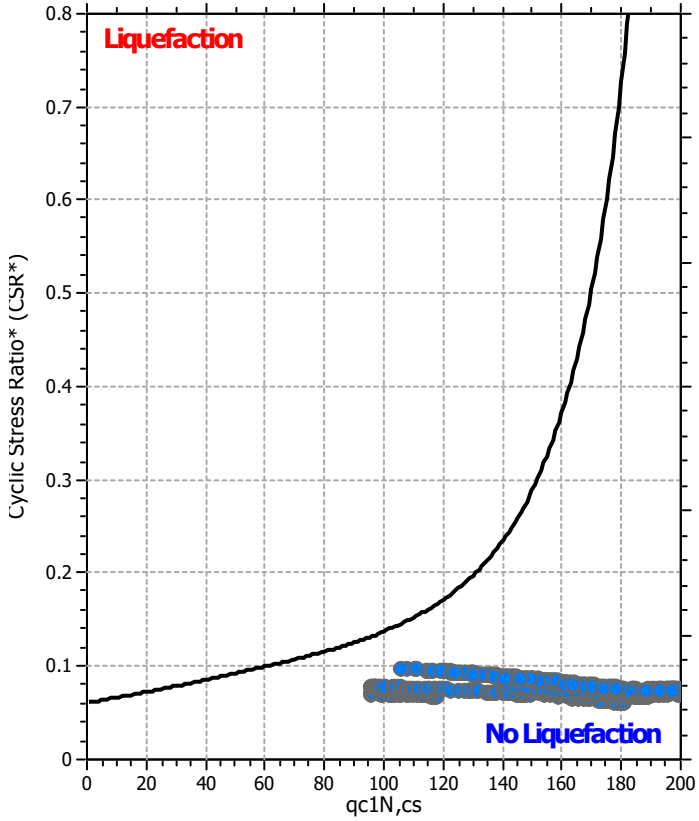
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

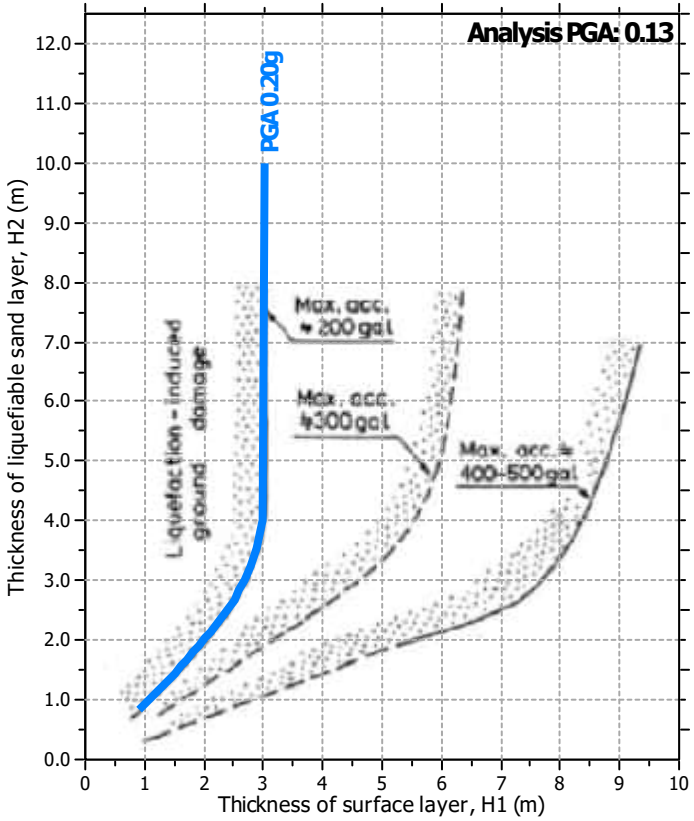
LPI color scheme

- 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.):	3.10 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	0.70 m	Fill height:	2.40 m	Limit depth:	N/A

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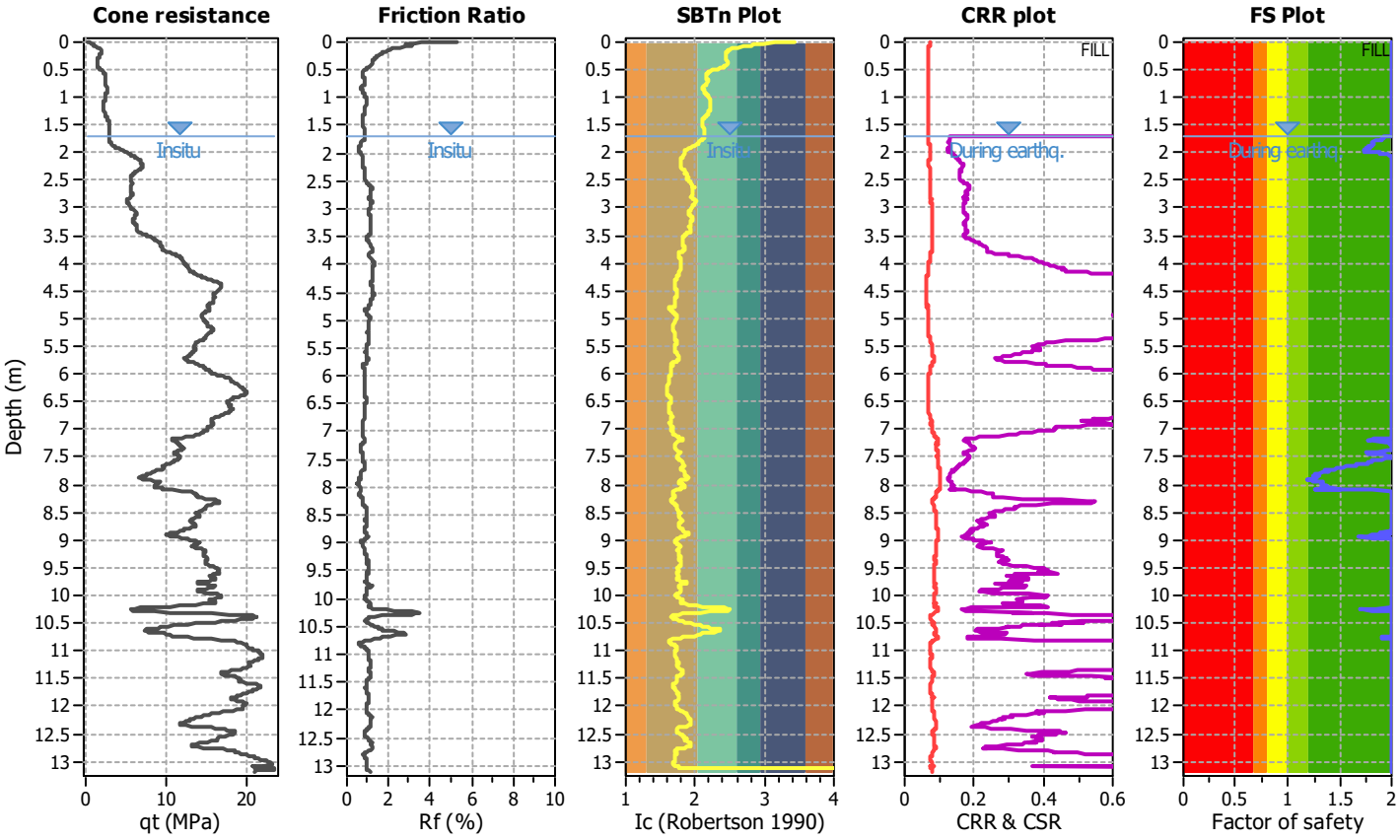
LIQUEFACTION ANALYSIS REPORT

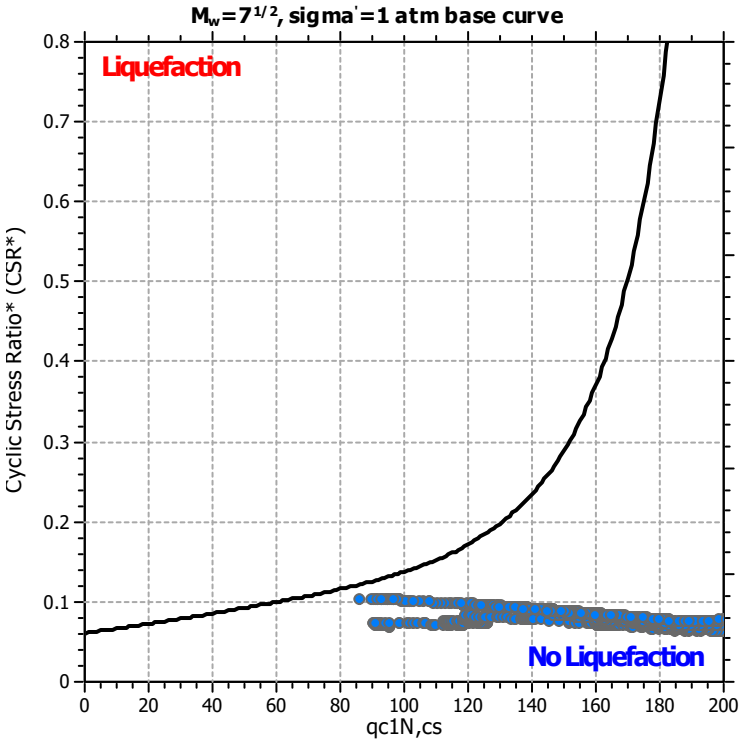
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

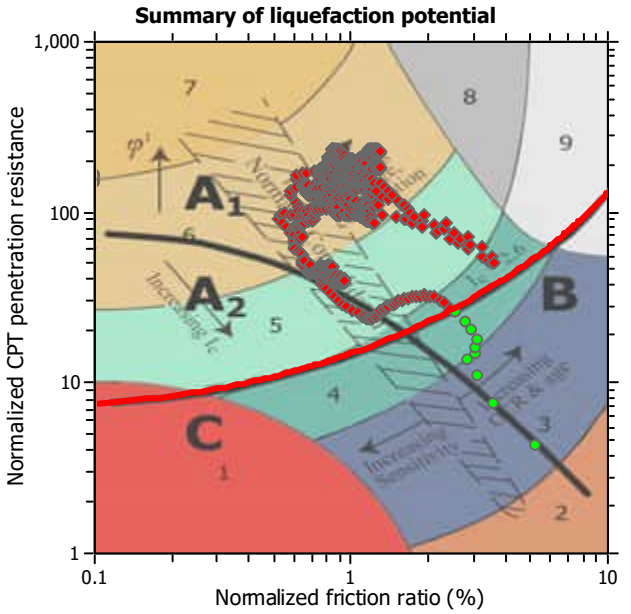
CPT file : CPT104

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.70 m	Fill height:	1.00 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

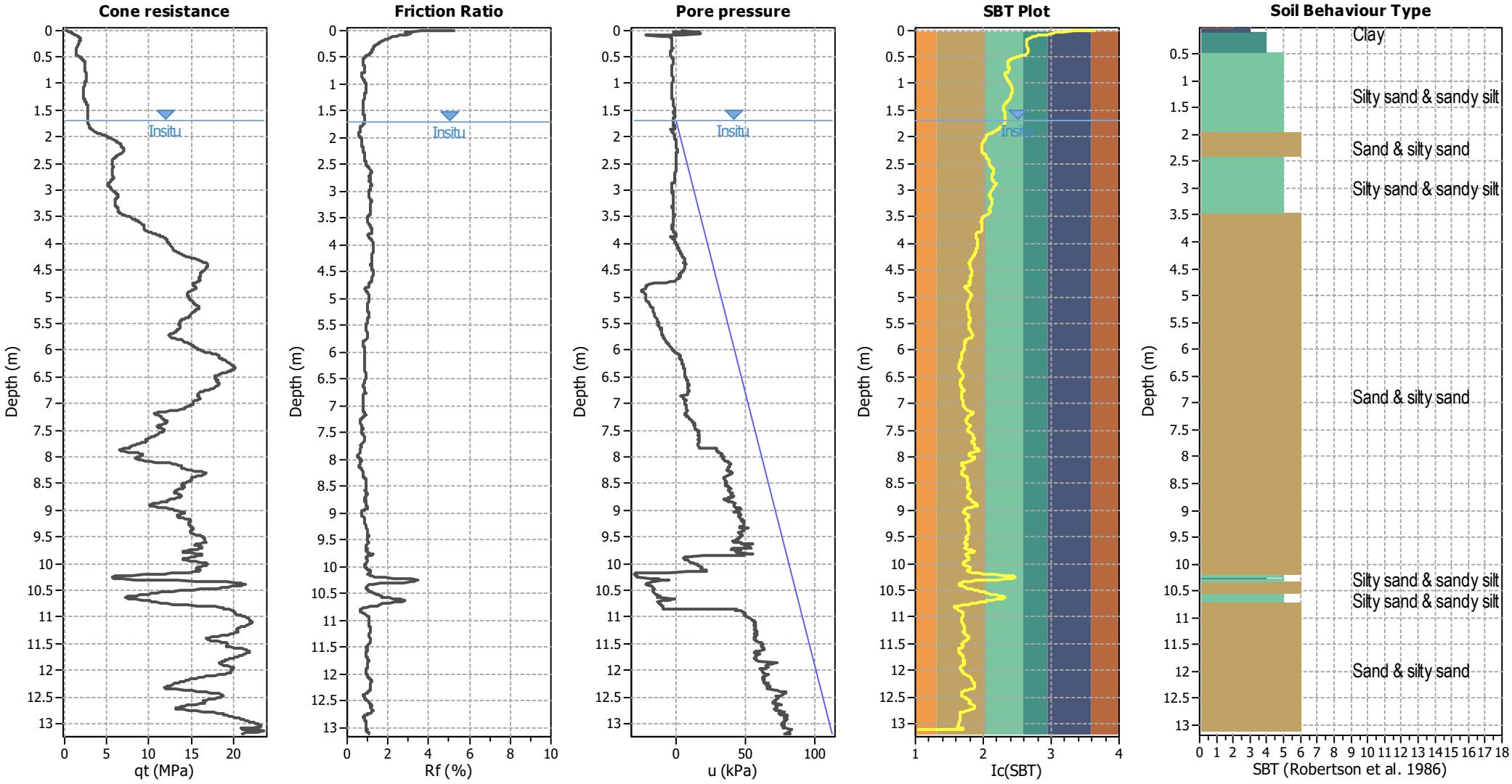






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



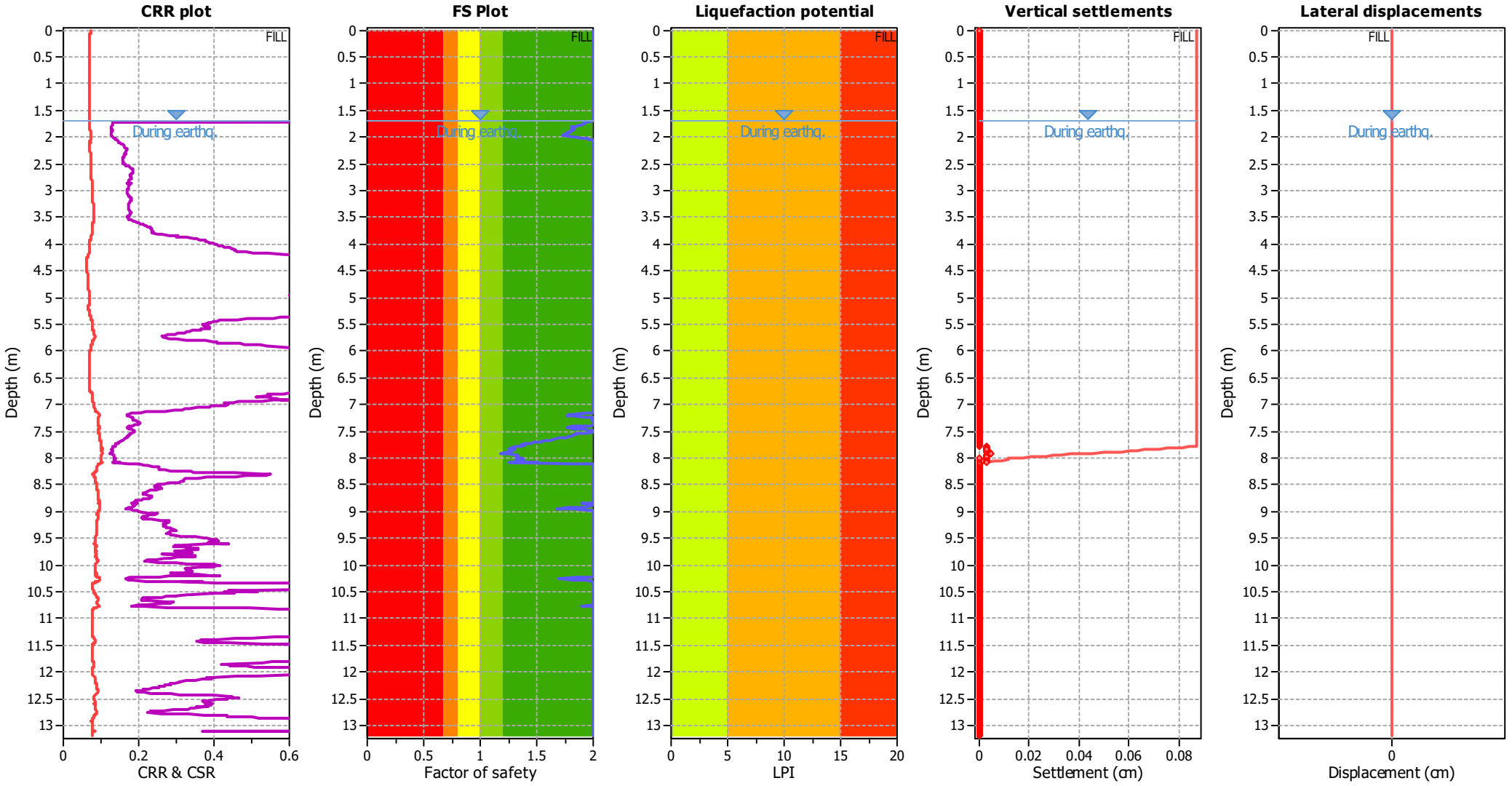
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.70 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	1.00 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.70 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	1.00 m	Limit depth:	N/A

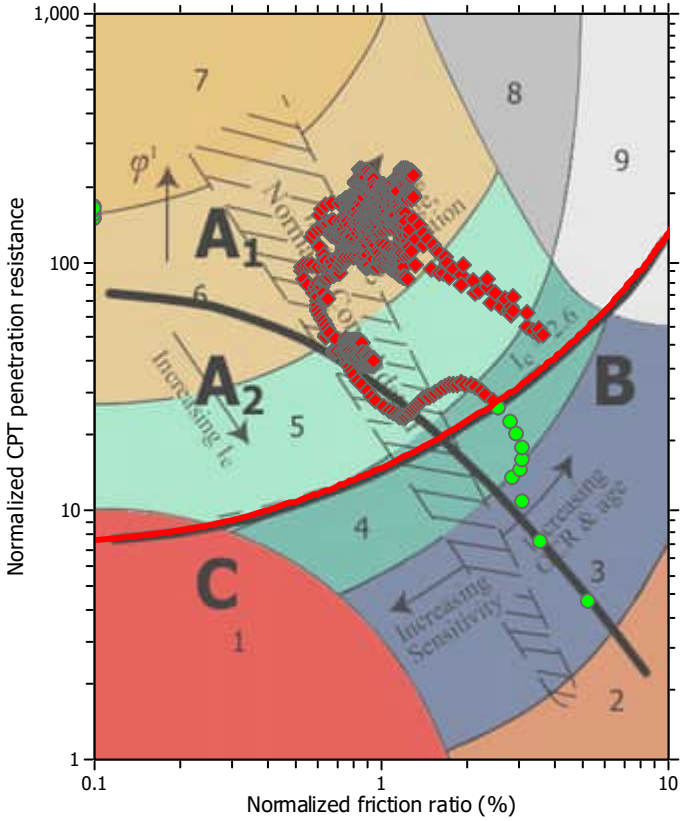
F.S. color scheme

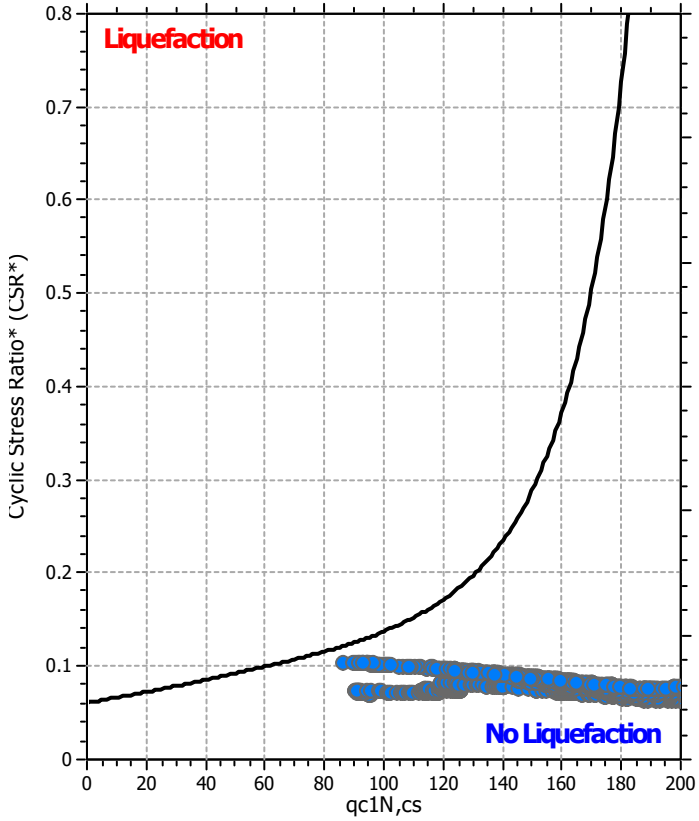
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

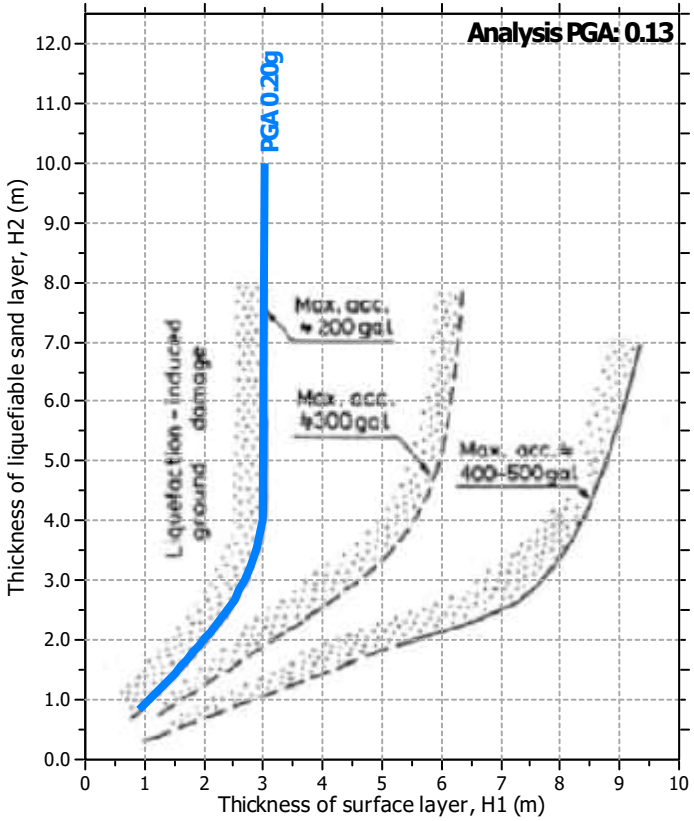
LPI color scheme

- 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.):	2.70 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	1.00 m	Limit depth:	N/A

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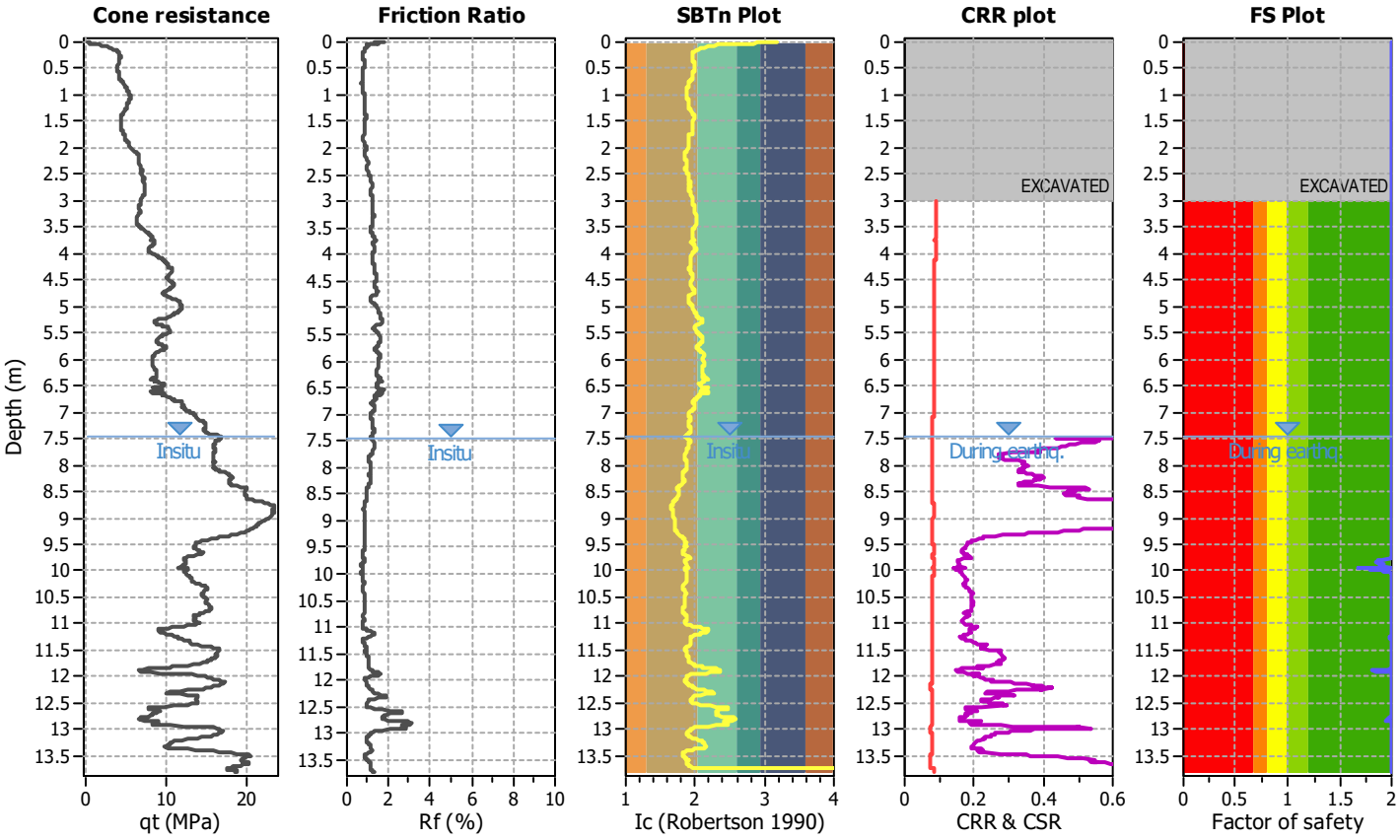
LIQUEFACTION ANALYSIS REPORT

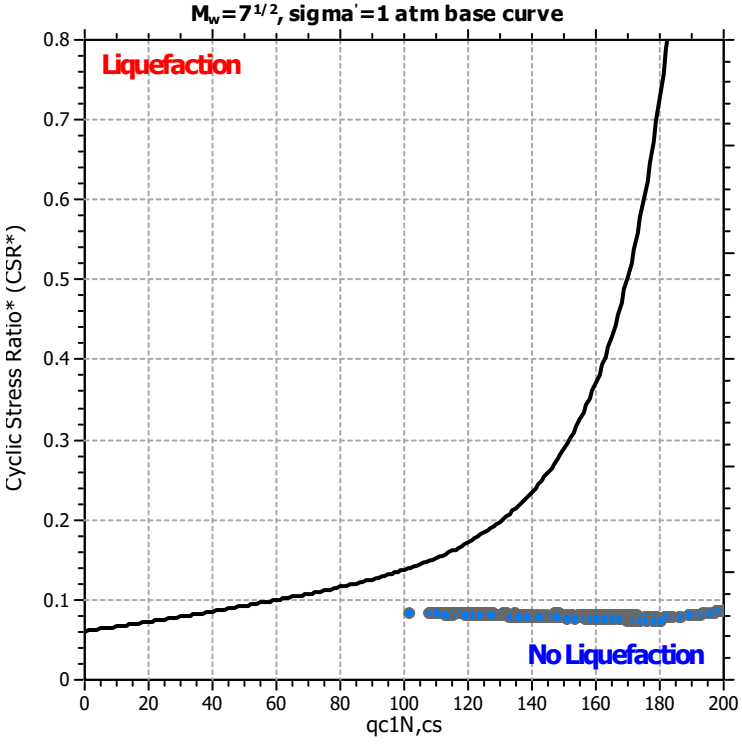
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

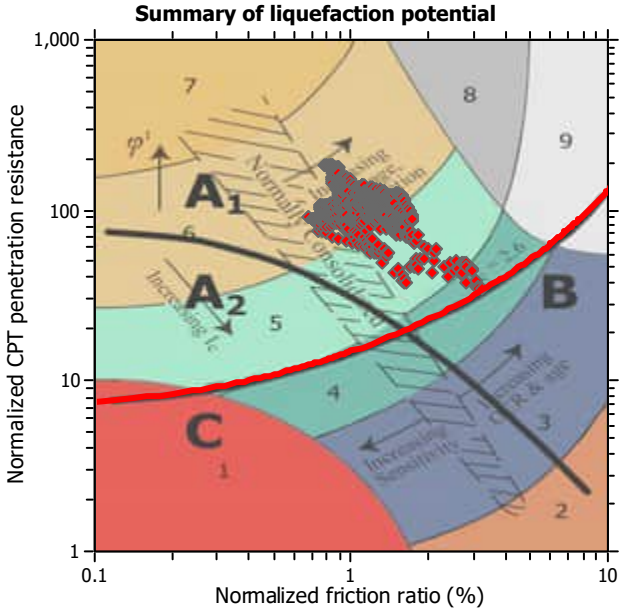
CPT file : CPT105

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	7.47 m	Excavation:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	7.47 m	Excavation depth:	3.00 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Footing load:	500.00 kPa	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

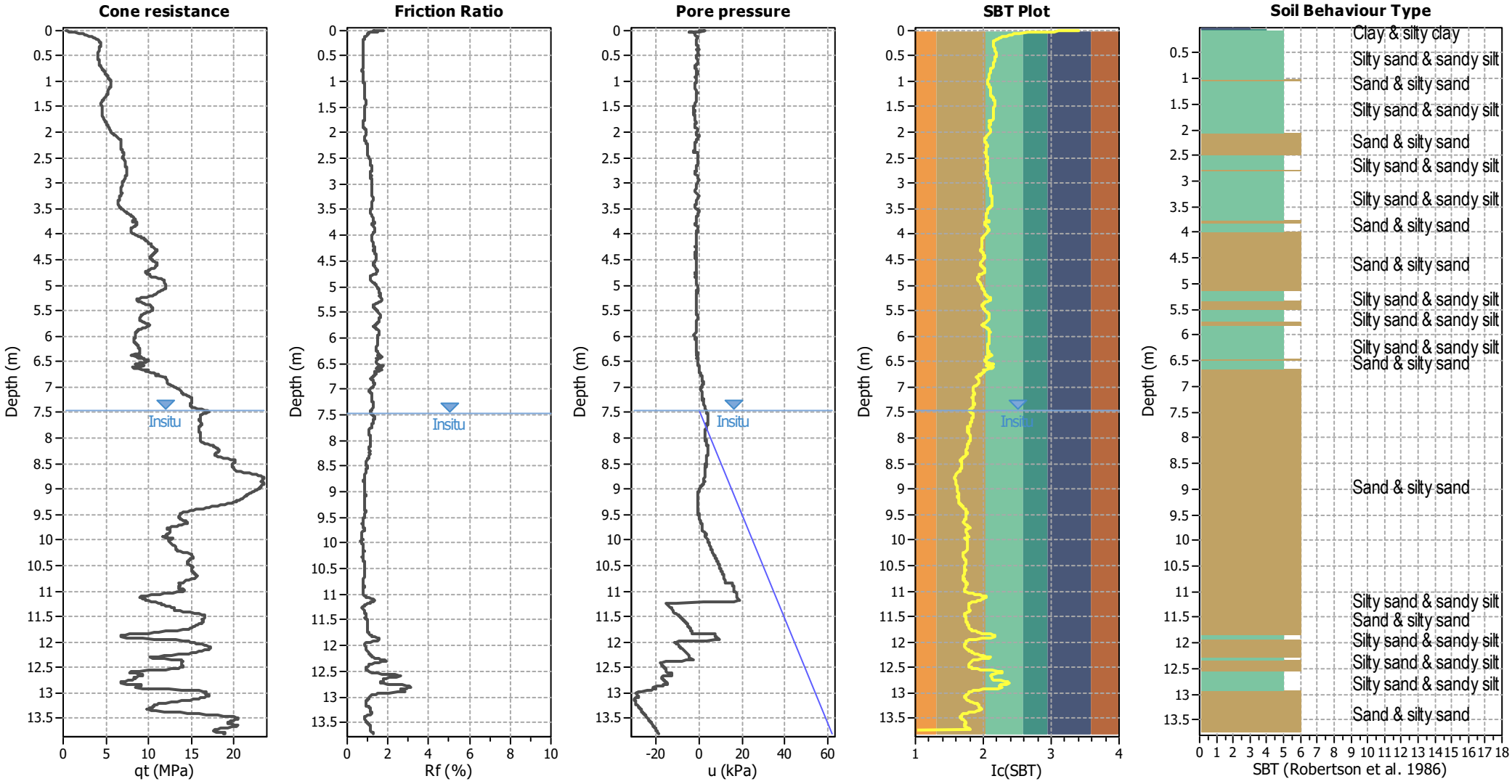






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



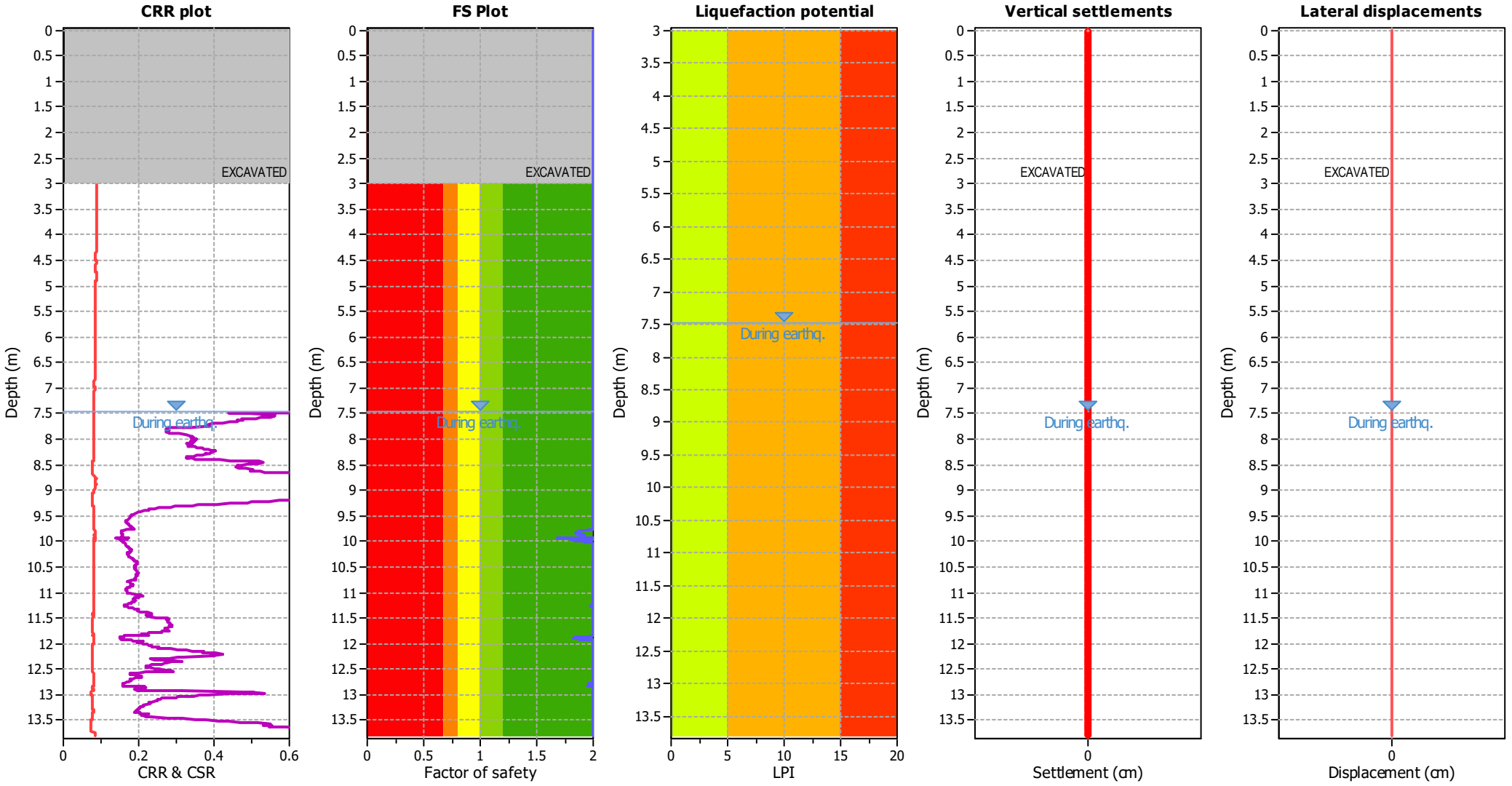
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	7.47 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	7.47 m	Excavation depth:	3.00 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	7.47 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	7.47 m	Excavation depth:	3.00 m	Limit depth:	N/A

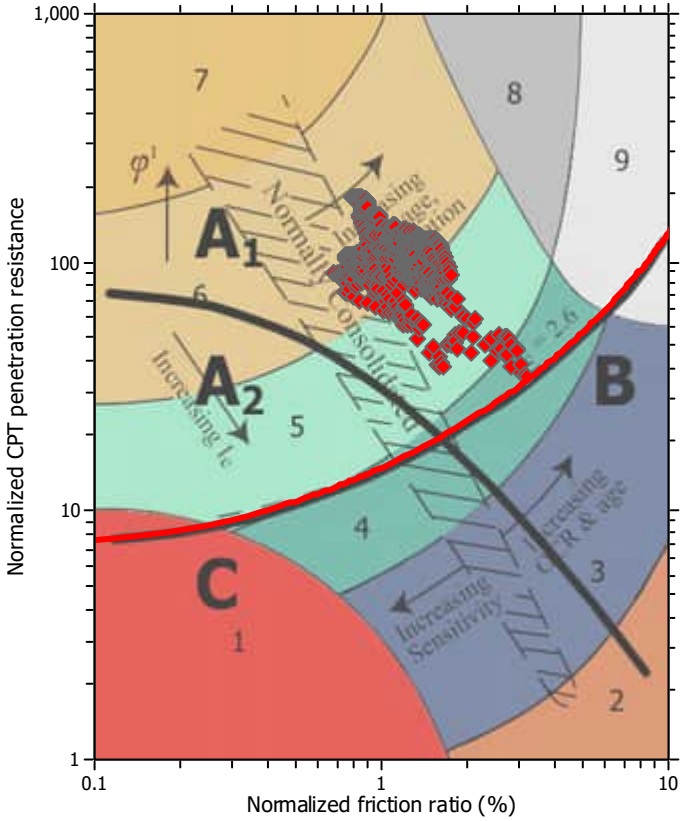
F.S. color scheme

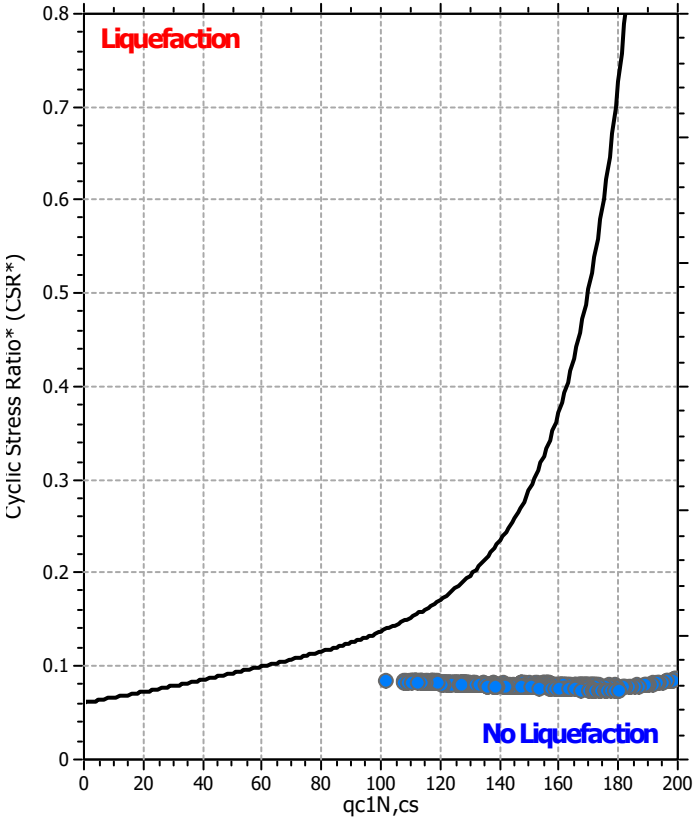
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

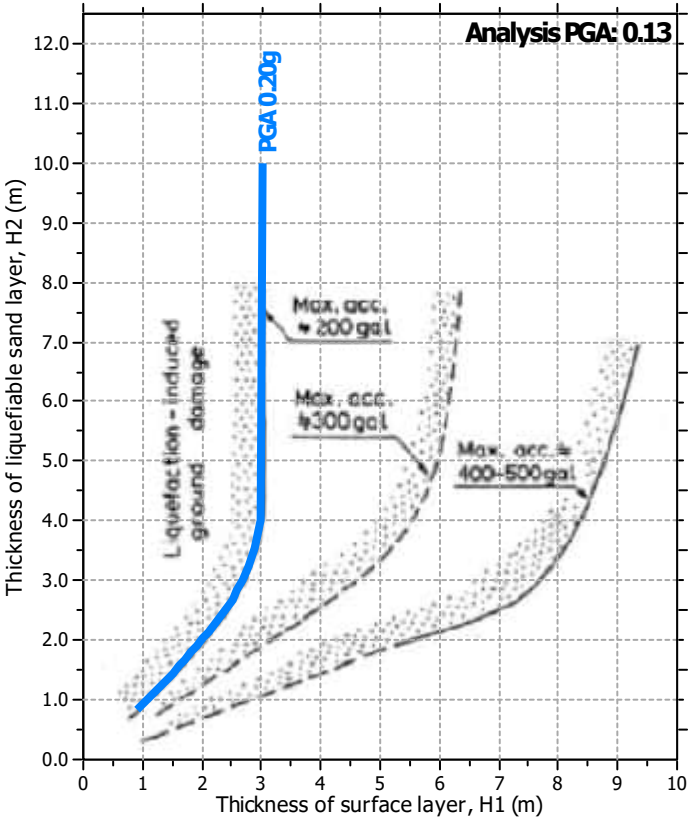
LPI color scheme

- 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.):	7.47 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	7.47 m	Excavation depth:	3.00 m	Limit depth:	N/A

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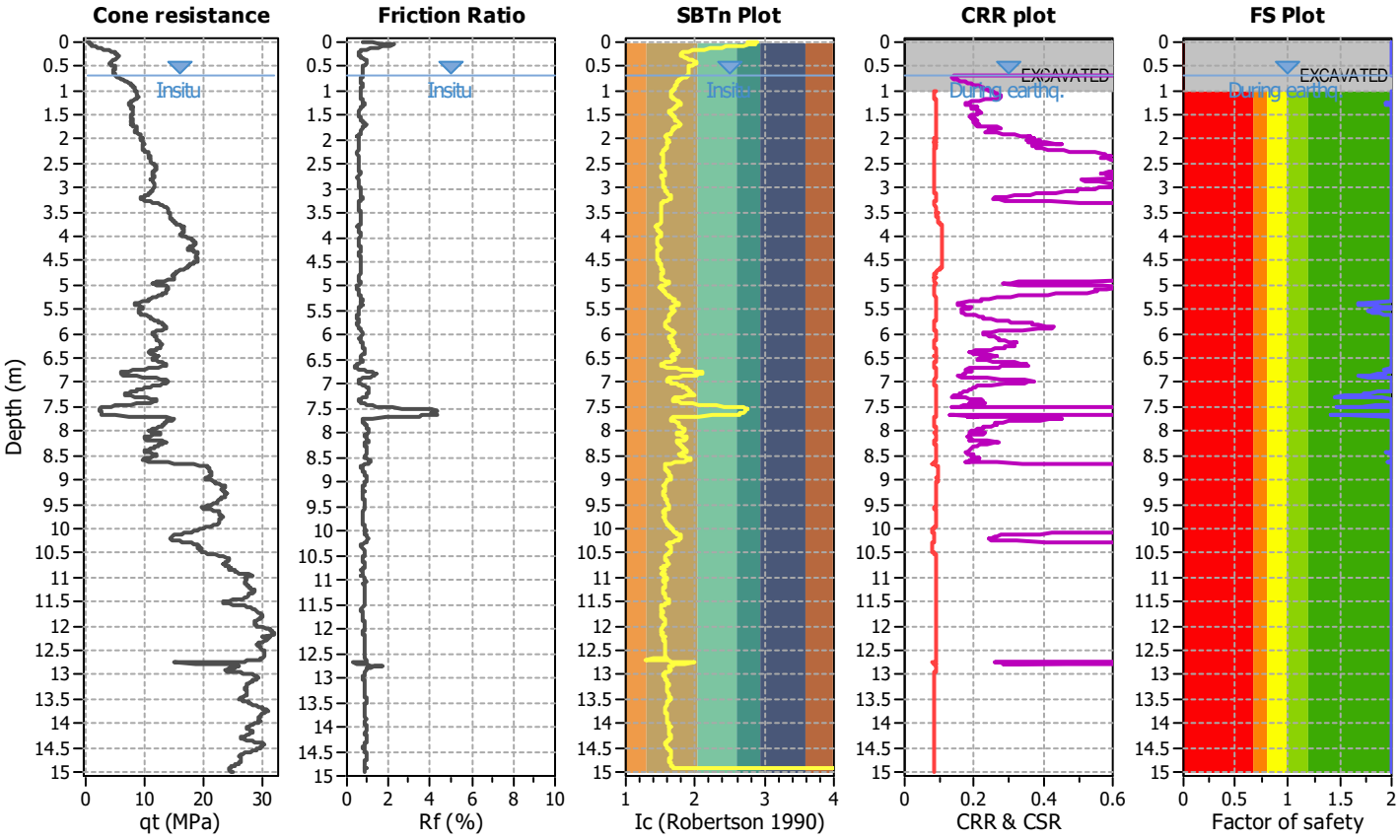
LIQUEFACTION ANALYSIS REPORT

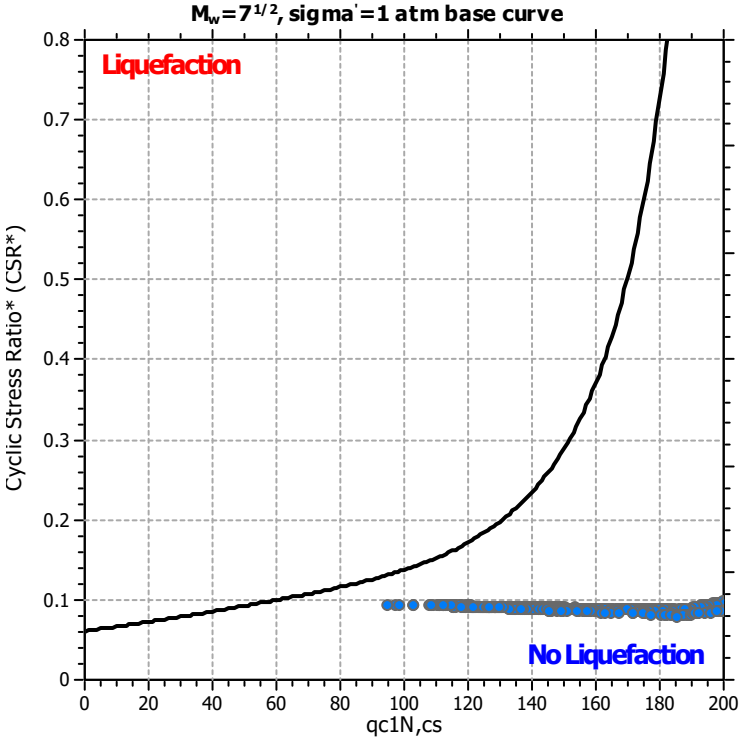
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

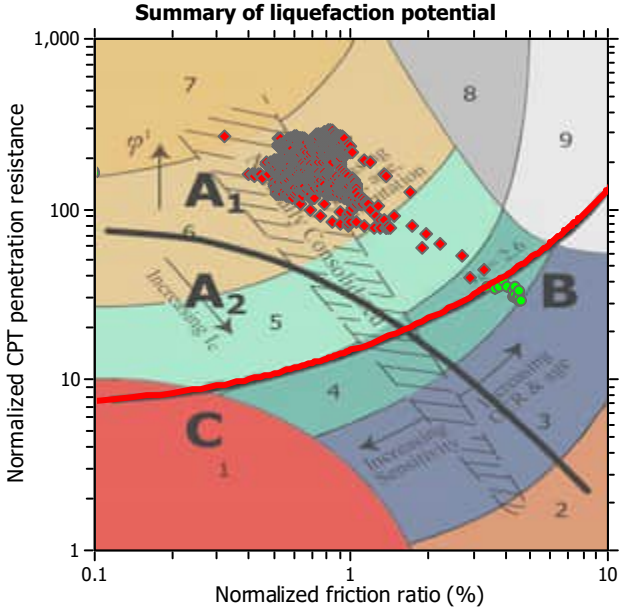
CPT file : CPT106

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.70 m	Excavation:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.70 m	Excavation depth:	1.00 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Footing load:	500.00 kPa	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

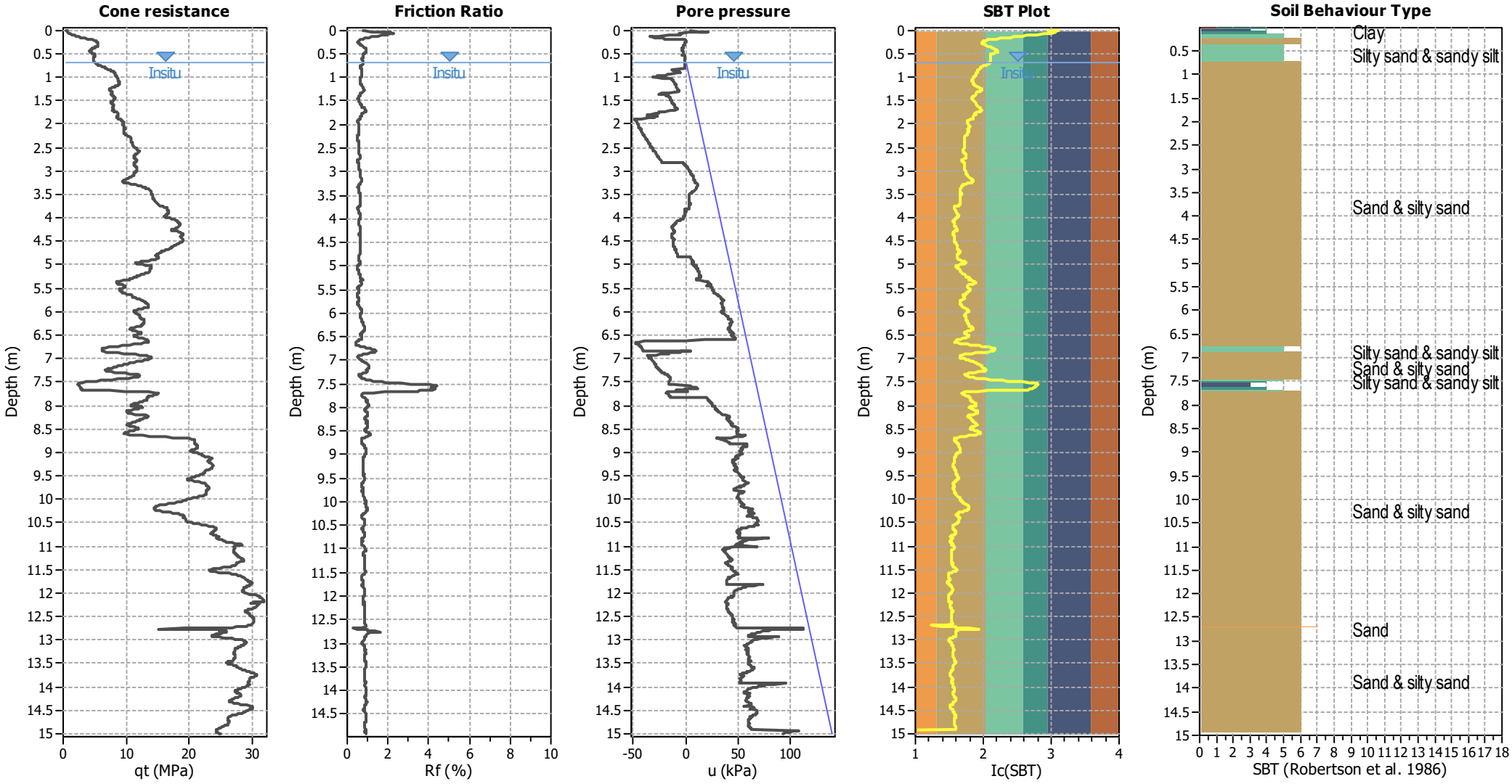






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



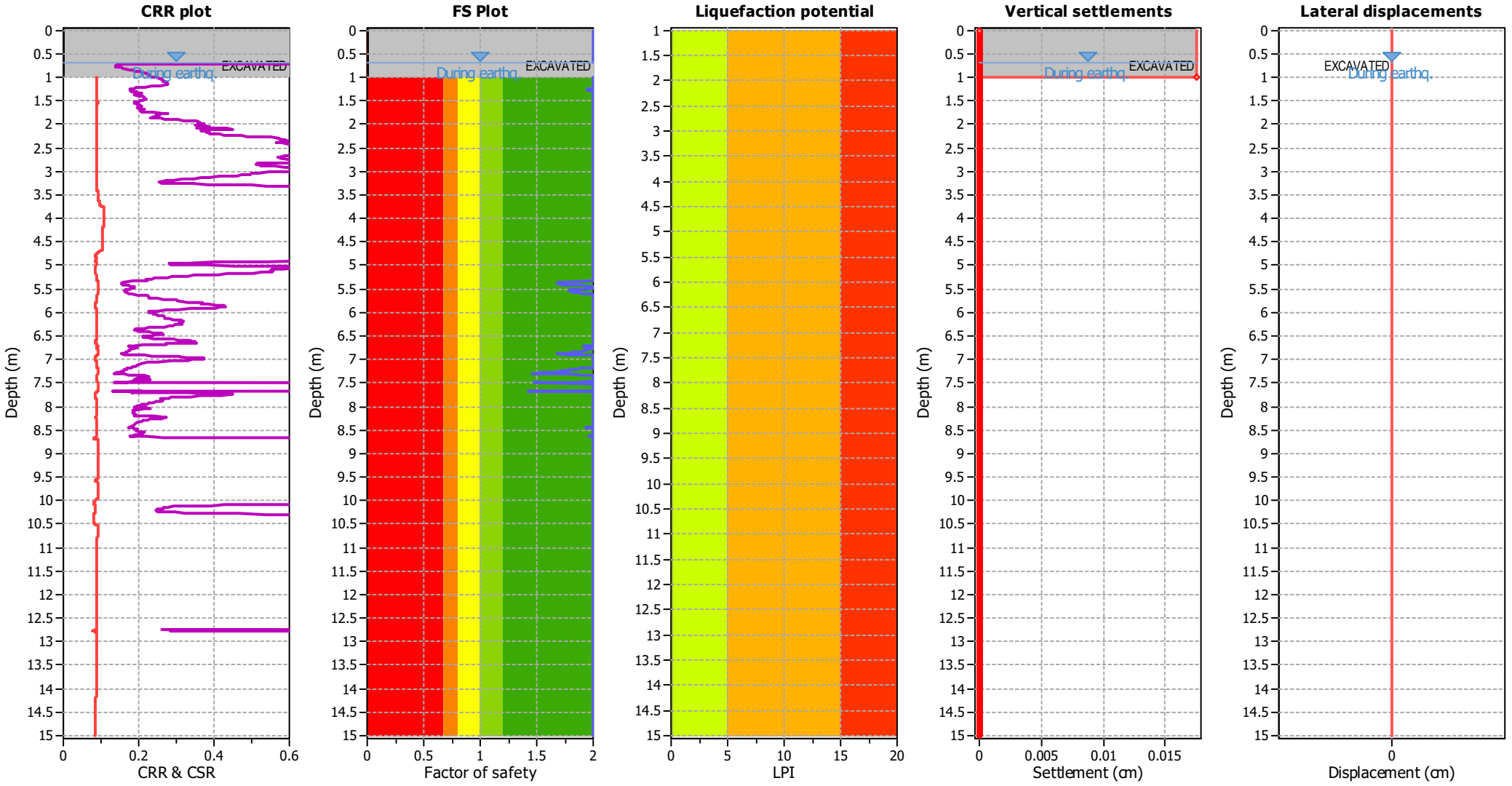
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	0.70 m	Excavation depth:	1.00 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	0.70 m	Excavation depth:	1.00 m	Limit depth:	N/A

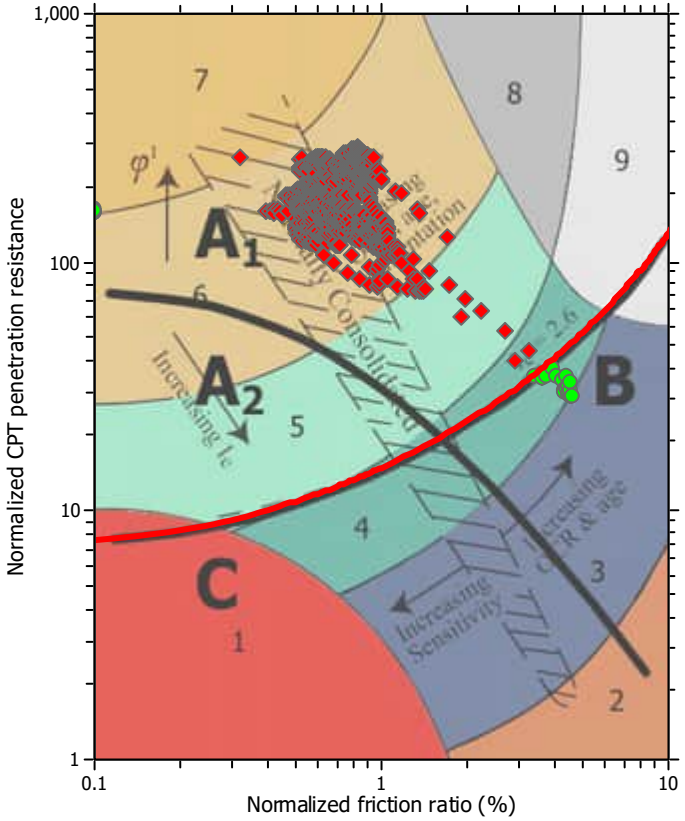
F.S. color scheme

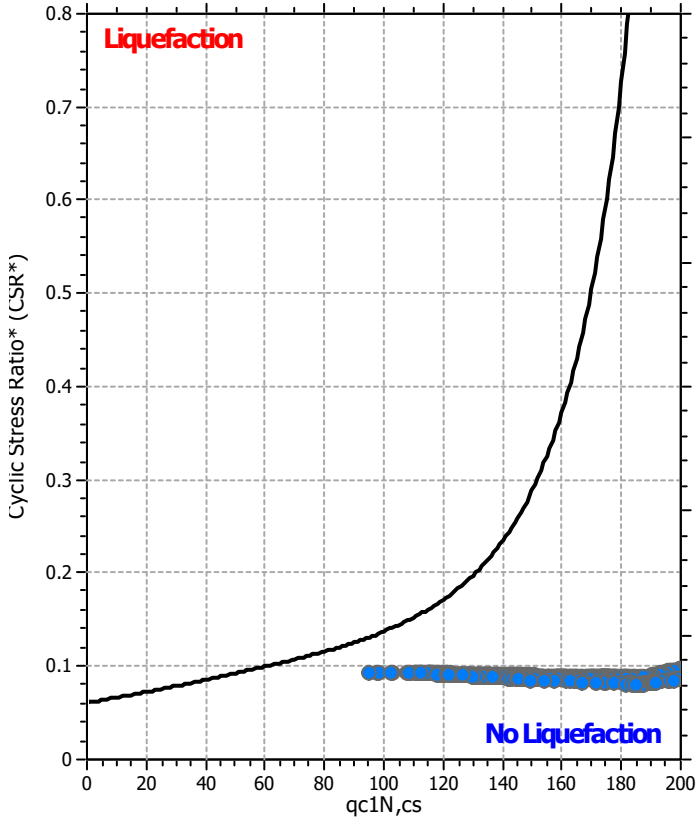
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

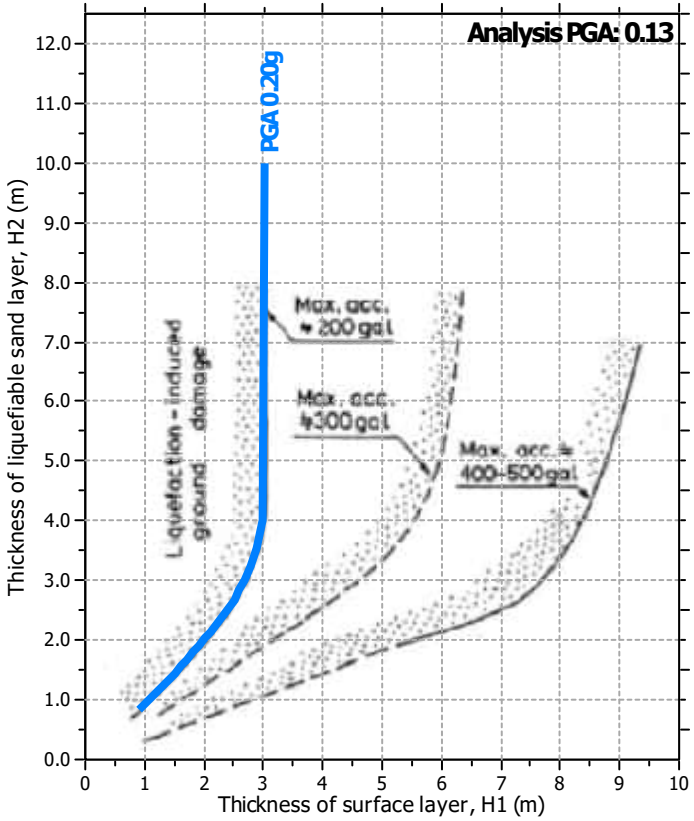
LPI color scheme

- 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.):	0.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	0.70 m	Excavation depth:	1.00 m	Limit depth:	N/A

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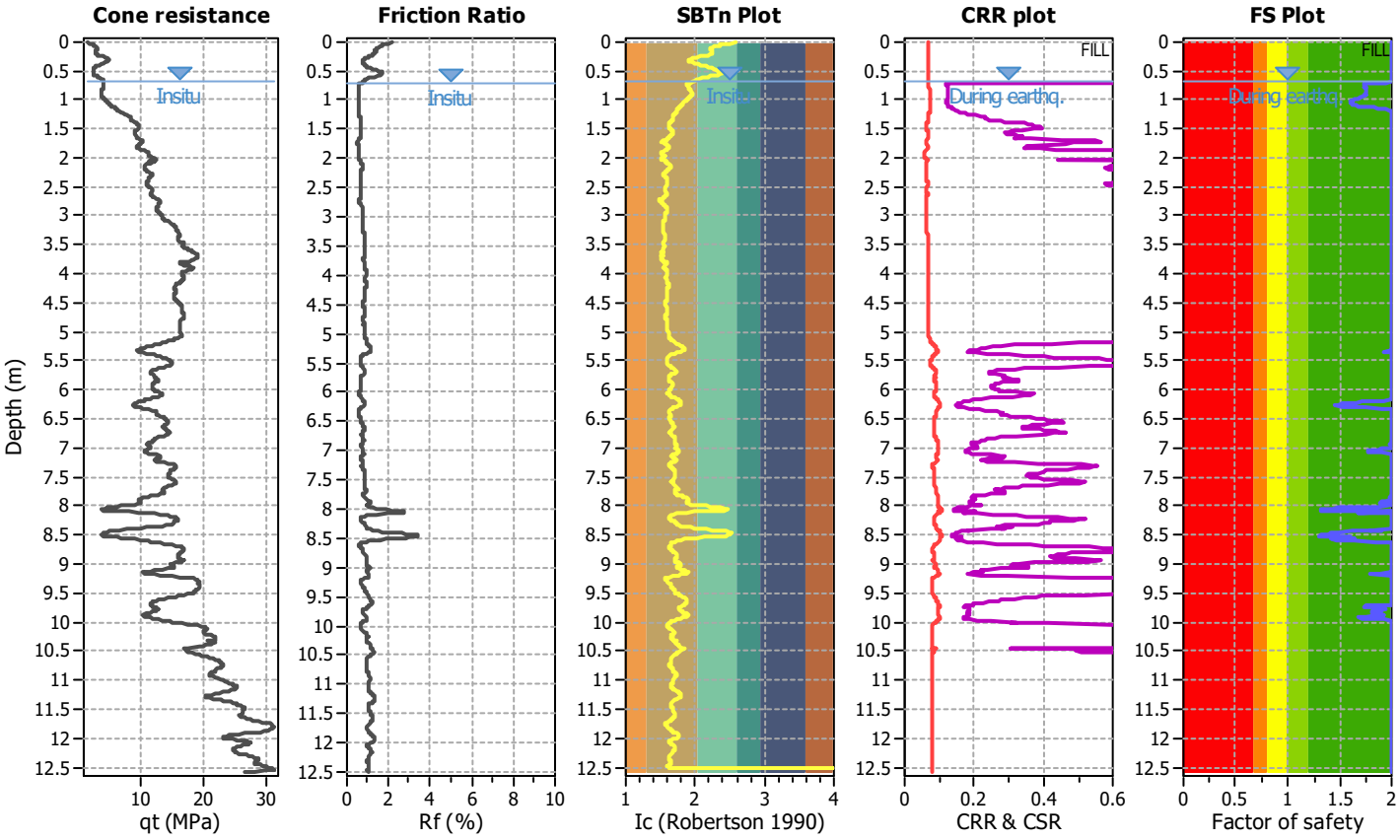
LIQUEFACTION ANALYSIS REPORT

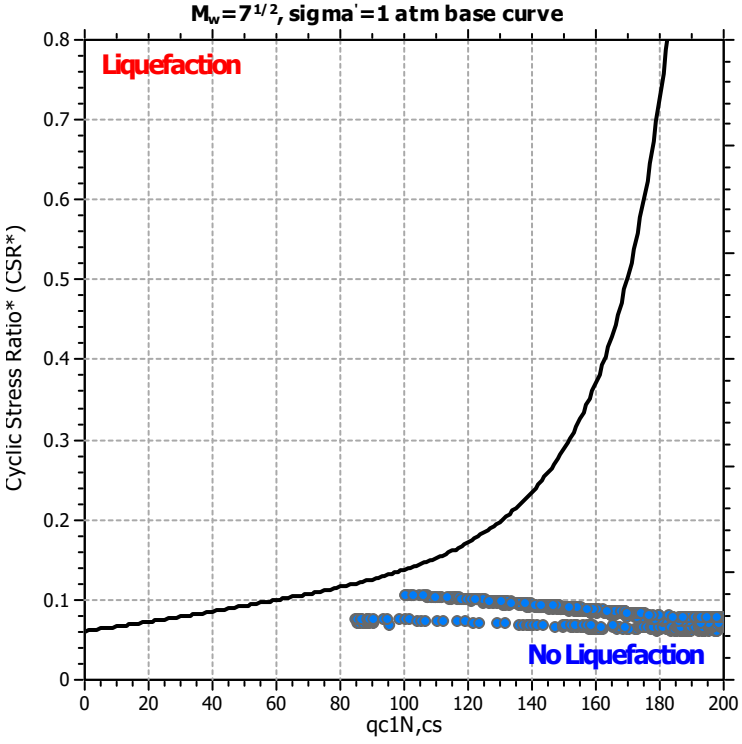
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

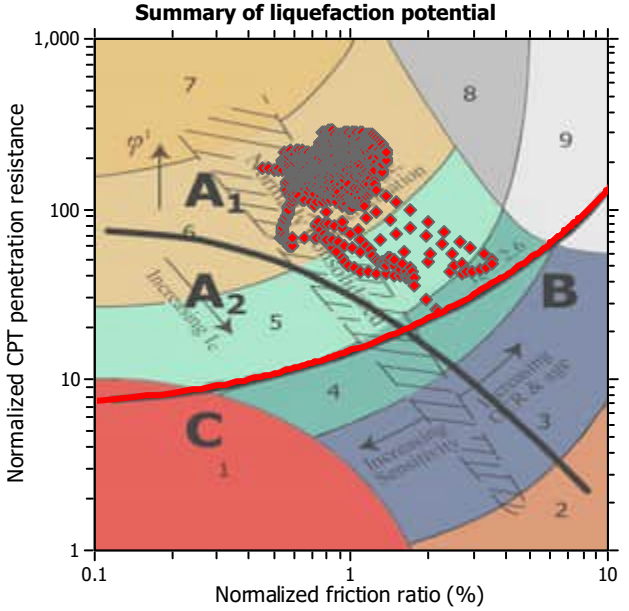
CPT file : CPT107

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.70 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.10 m	Fill height:	1.40 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	19.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

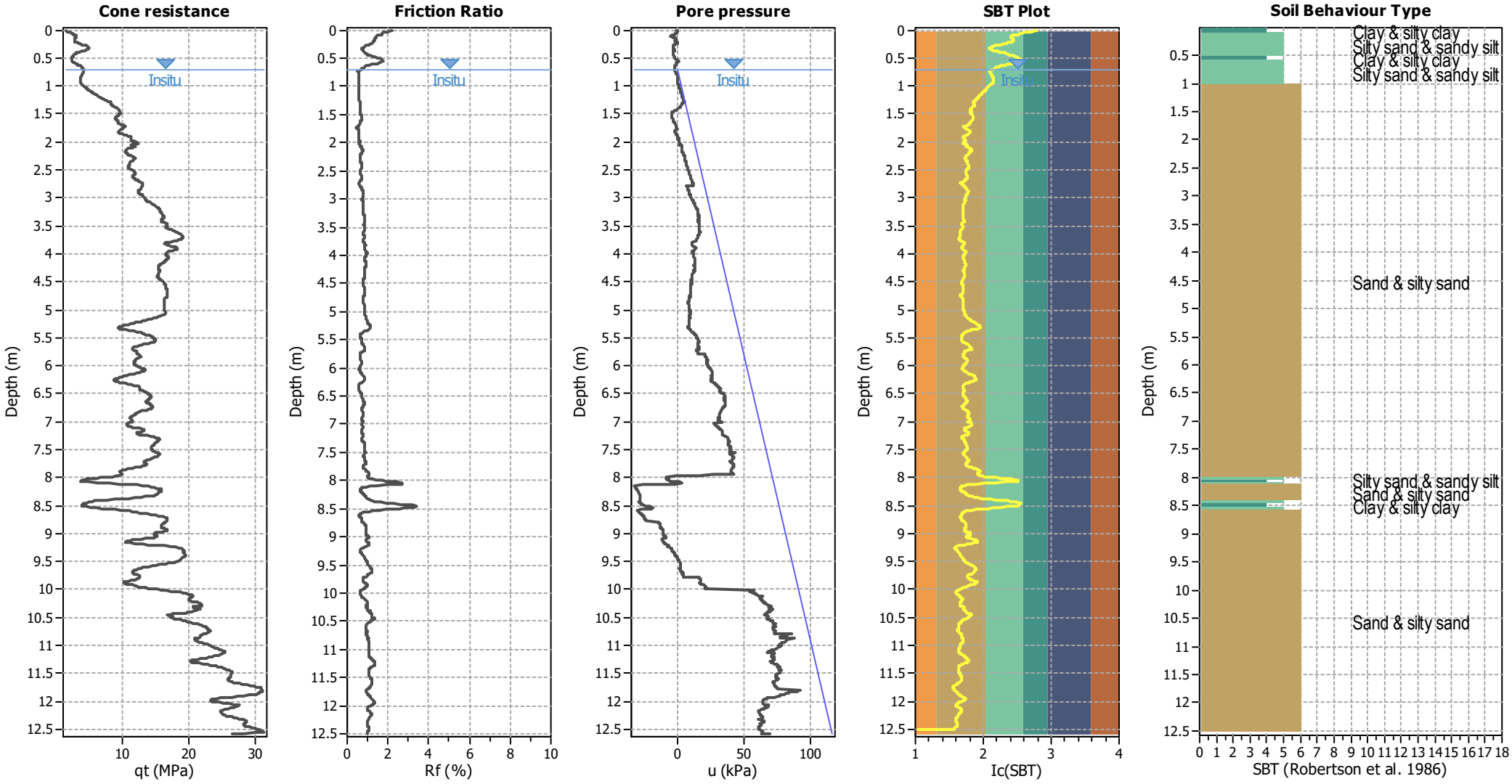






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



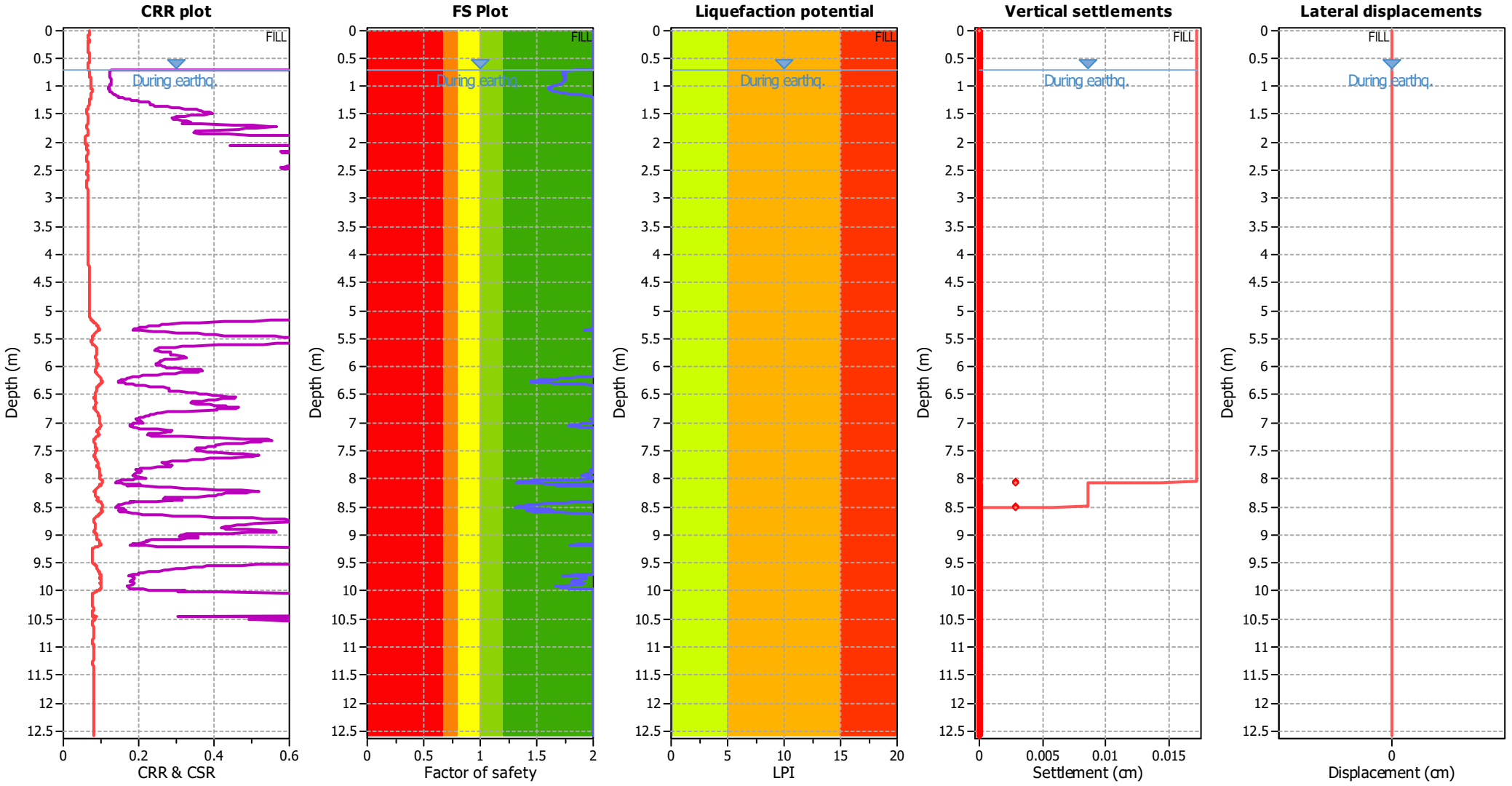
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	19.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	0.70 m	Fill height:	1.40 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	19.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	0.70 m	Fill height:	1.40 m	Limit depth:	N/A

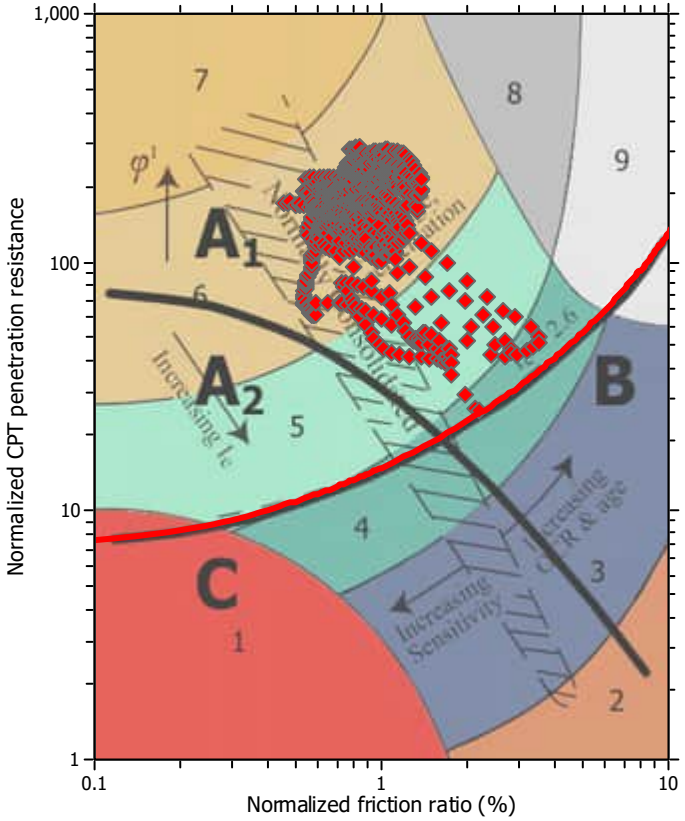
F.S. color scheme

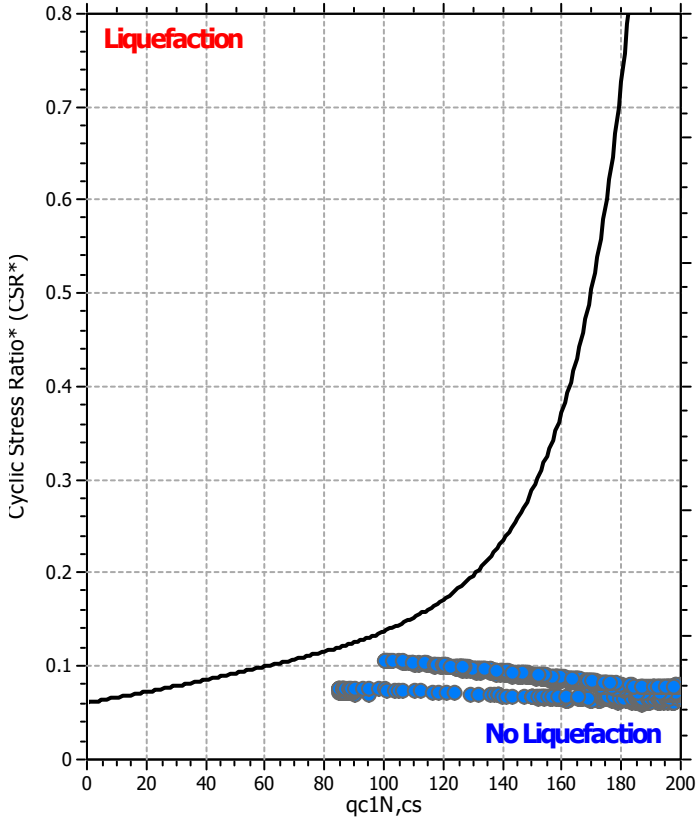
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

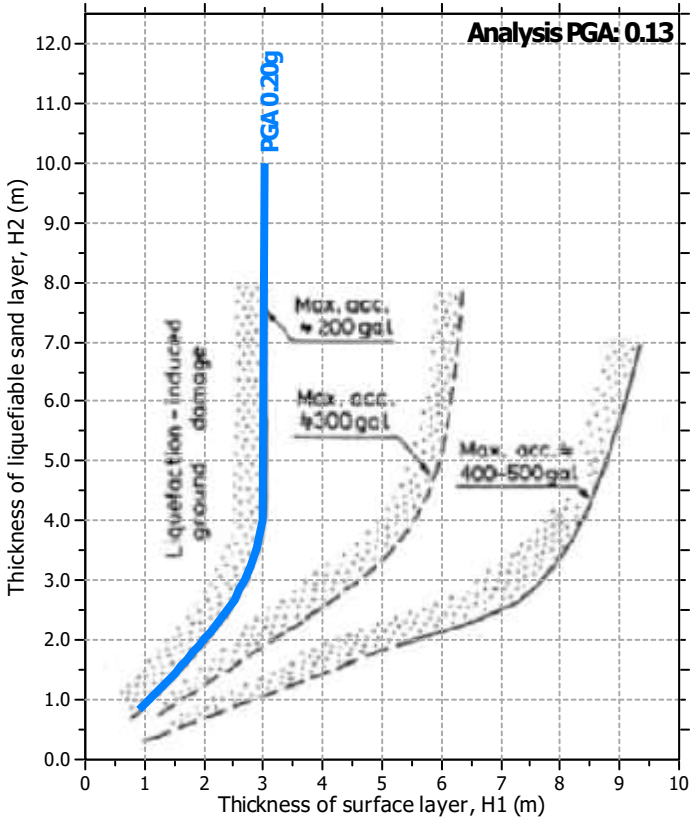
LPI color scheme

- 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.):	2.10 m	Fill weight:	19.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	0.70 m	Fill height:	1.40 m	Limit depth:	N/A

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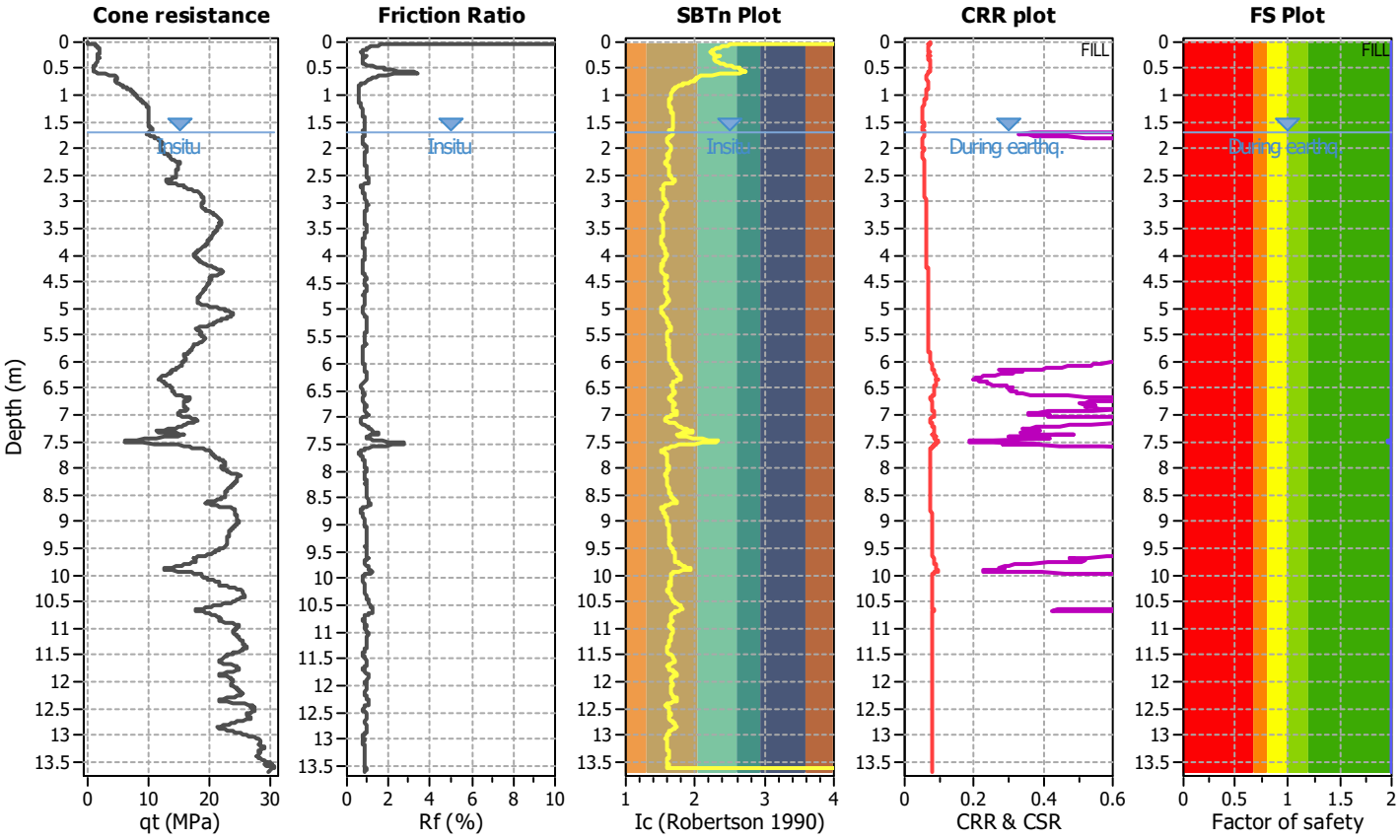
LIQUEFACTION ANALYSIS REPORT

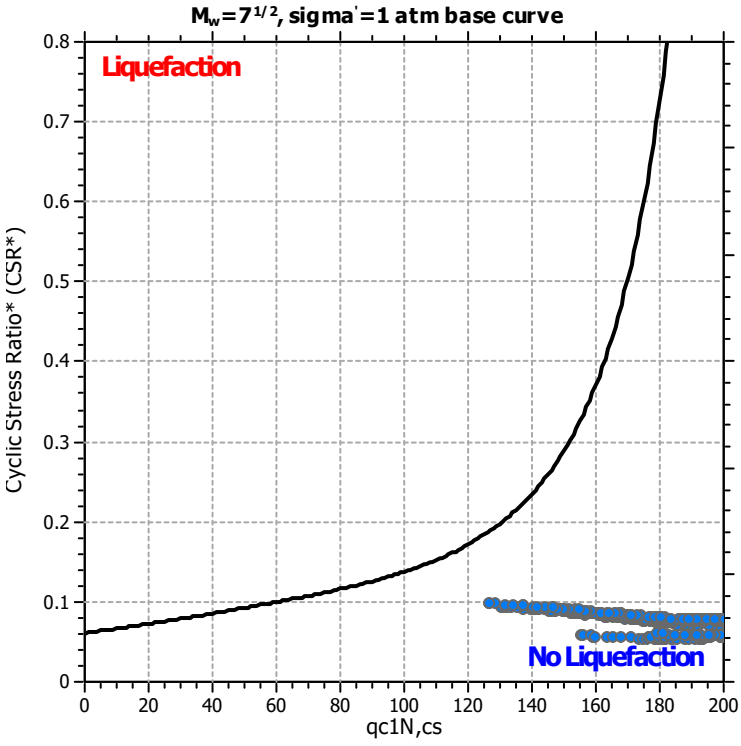
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

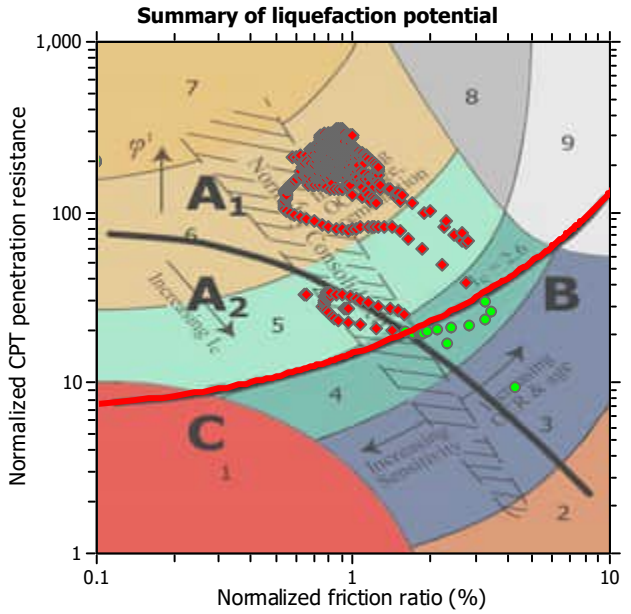
CPT file : CPT108

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	0.30 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

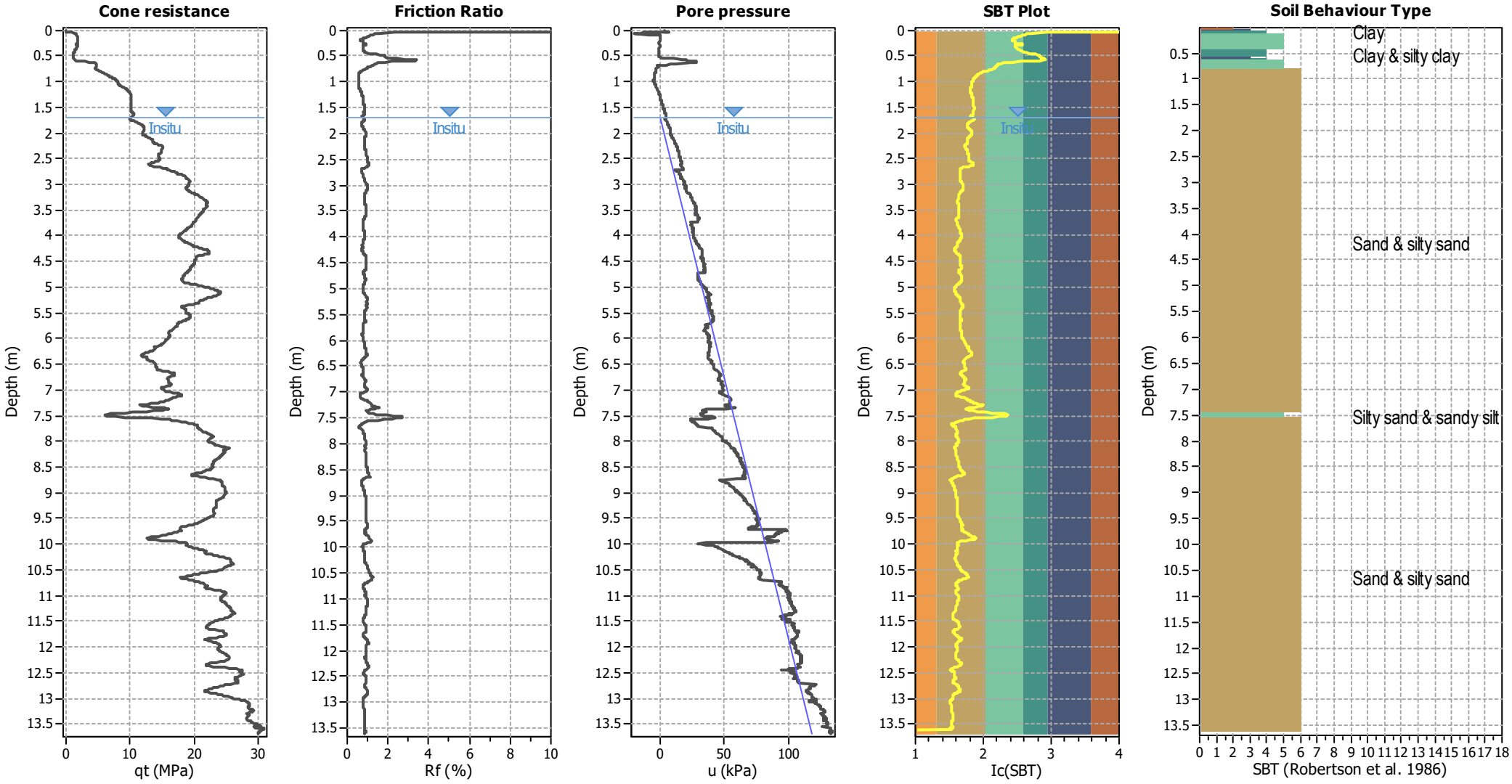






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



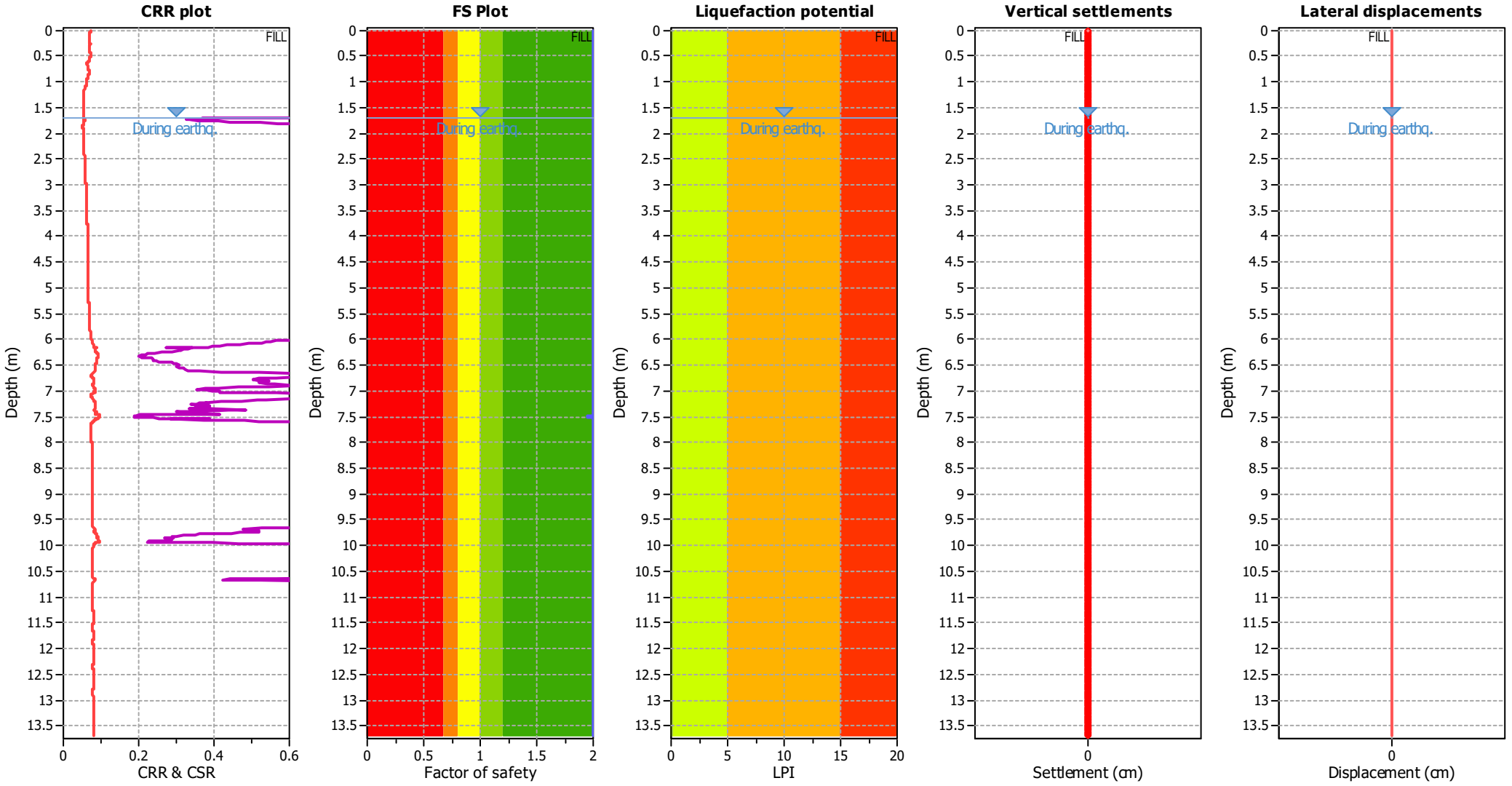
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	0.30 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	0.30 m	Limit depth:	N/A

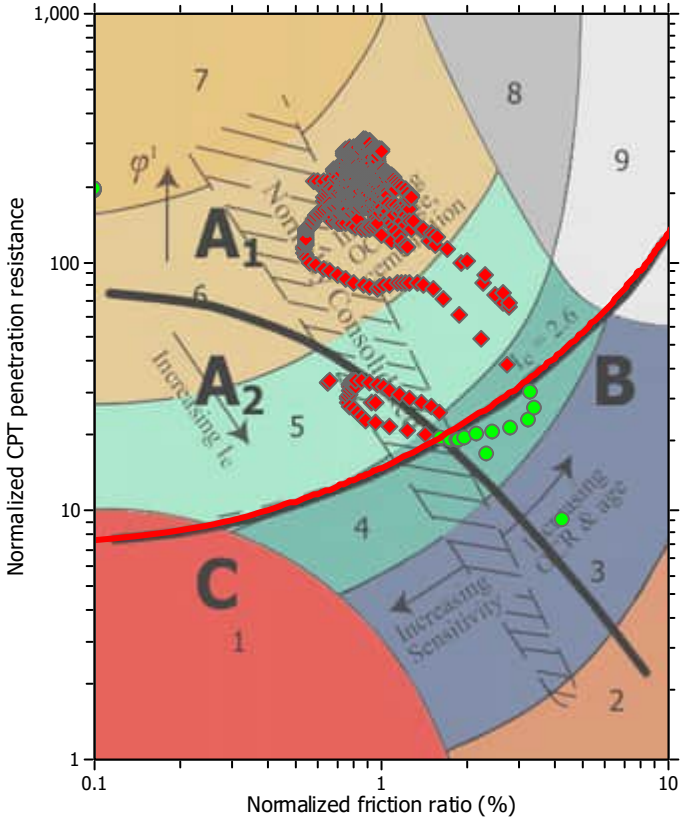
F.S. color scheme

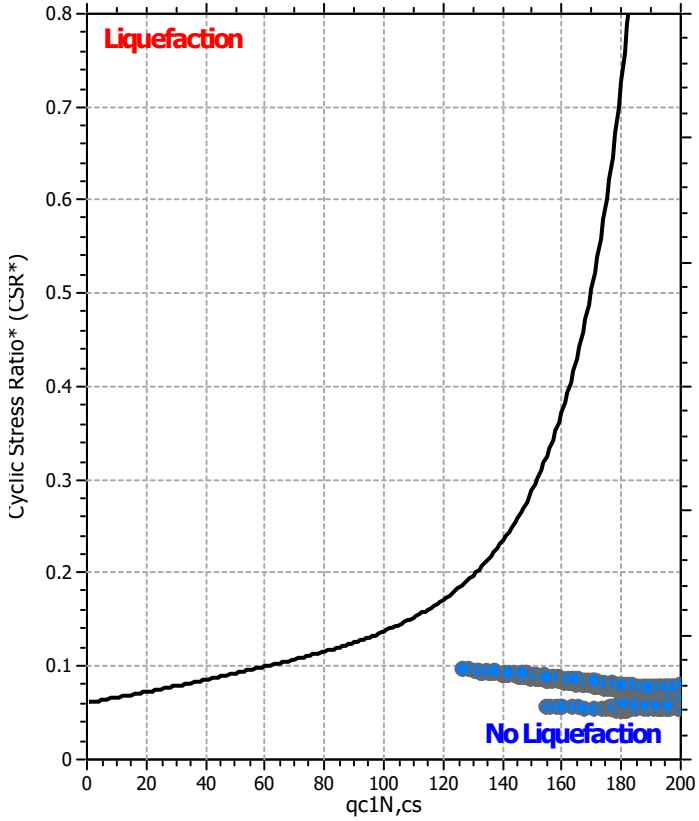
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

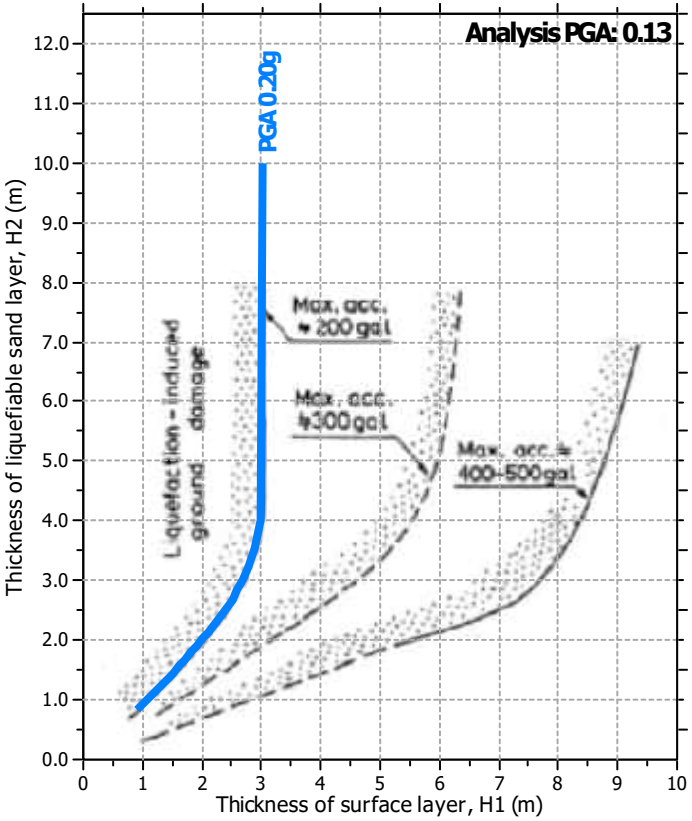
LPI color scheme

- 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.):	2.00 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	0.30 m	Limit depth:	N/A

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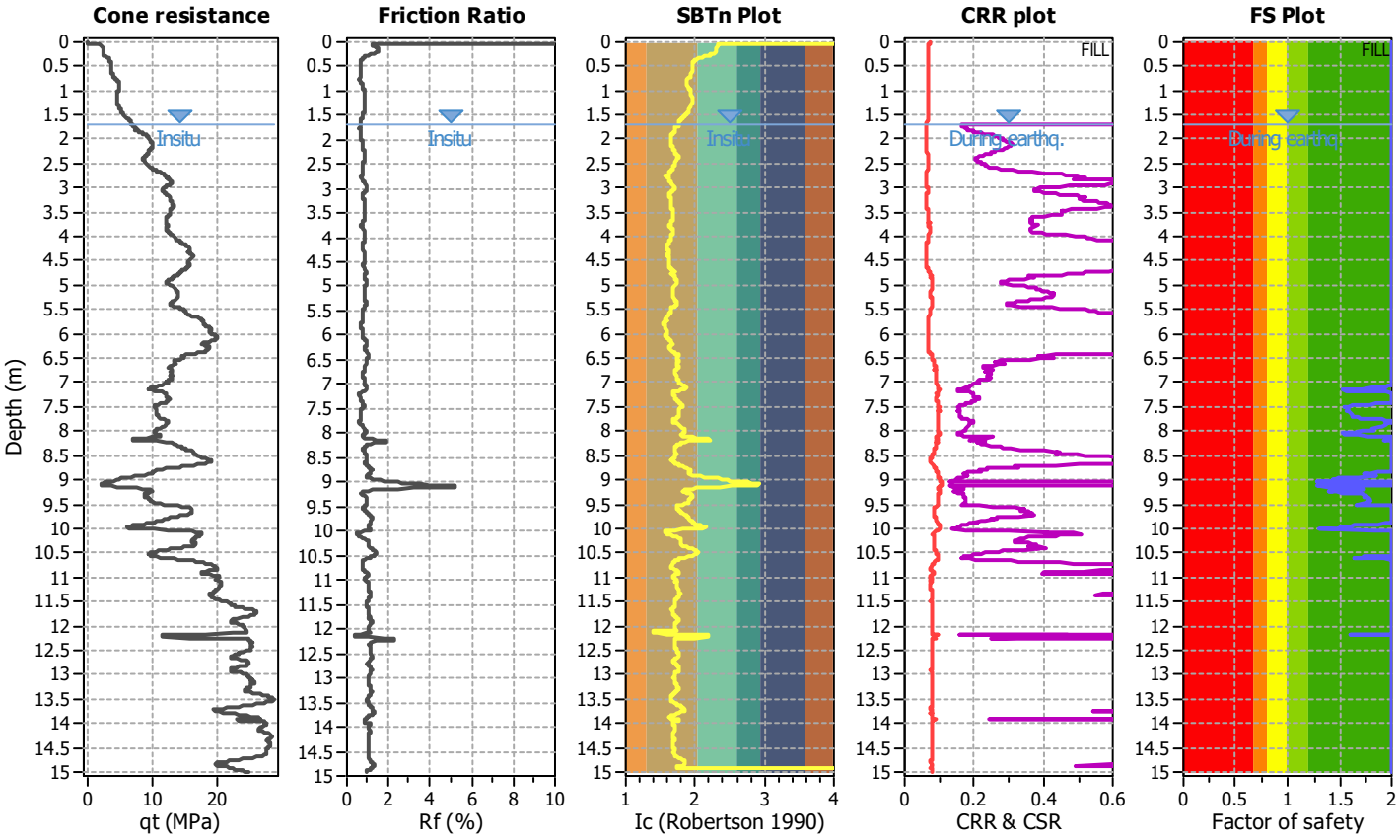
LIQUEFACTION ANALYSIS REPORT

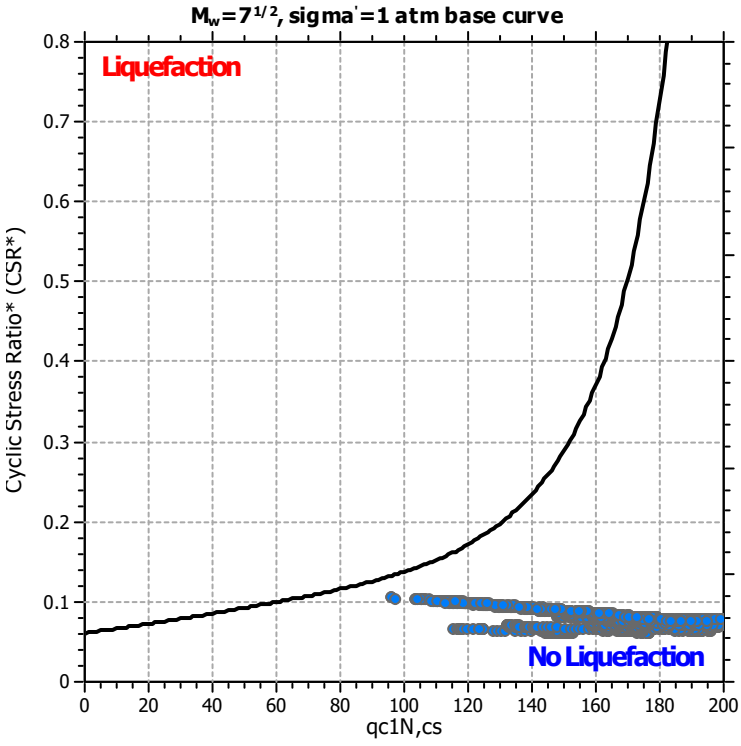
Project title : SLS - Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

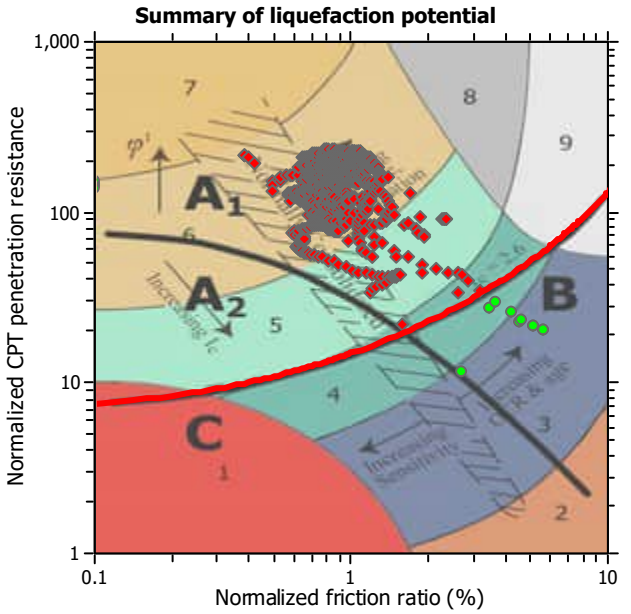
CPT file : CPT109

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.40 m	Fill height:	0.70 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	19.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	6.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

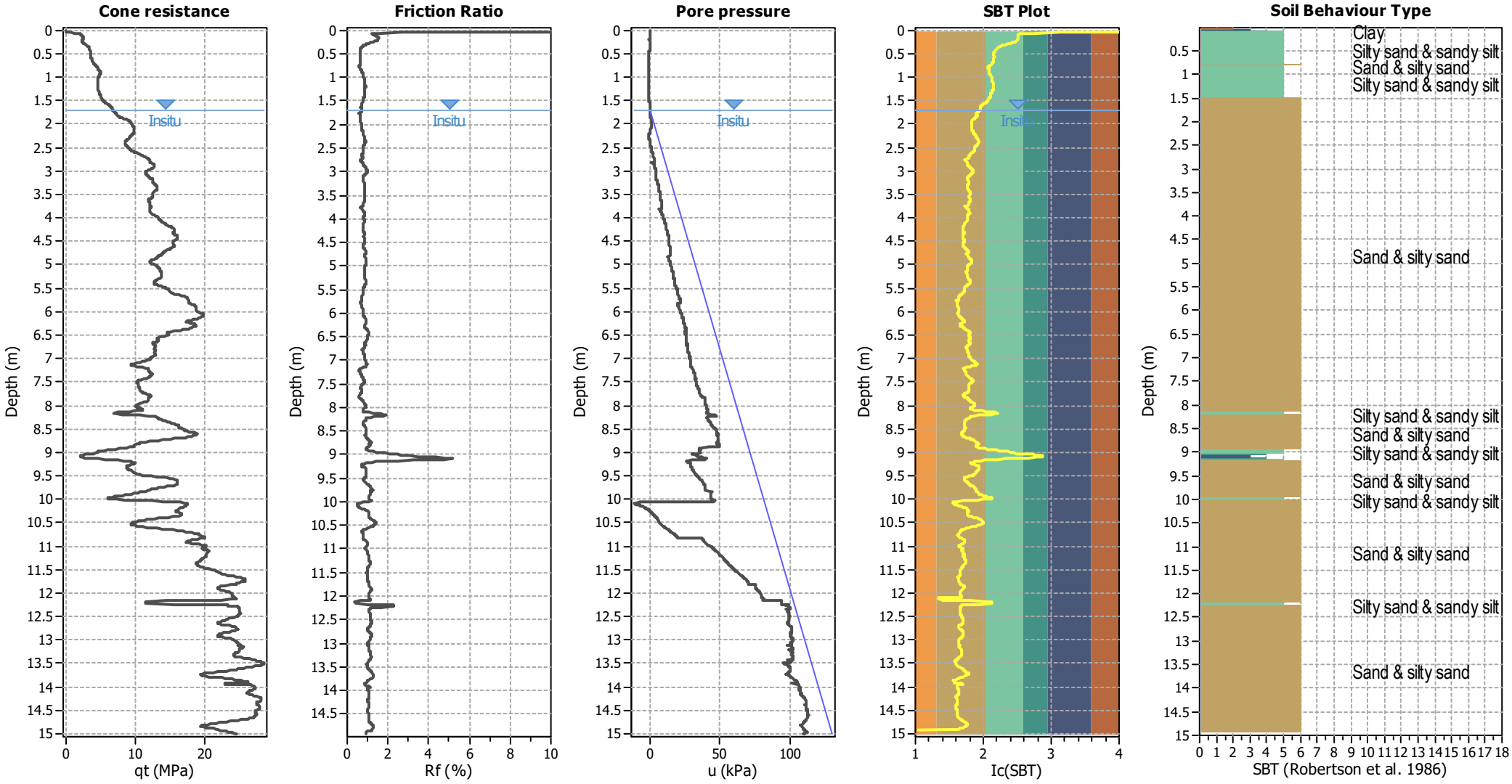






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



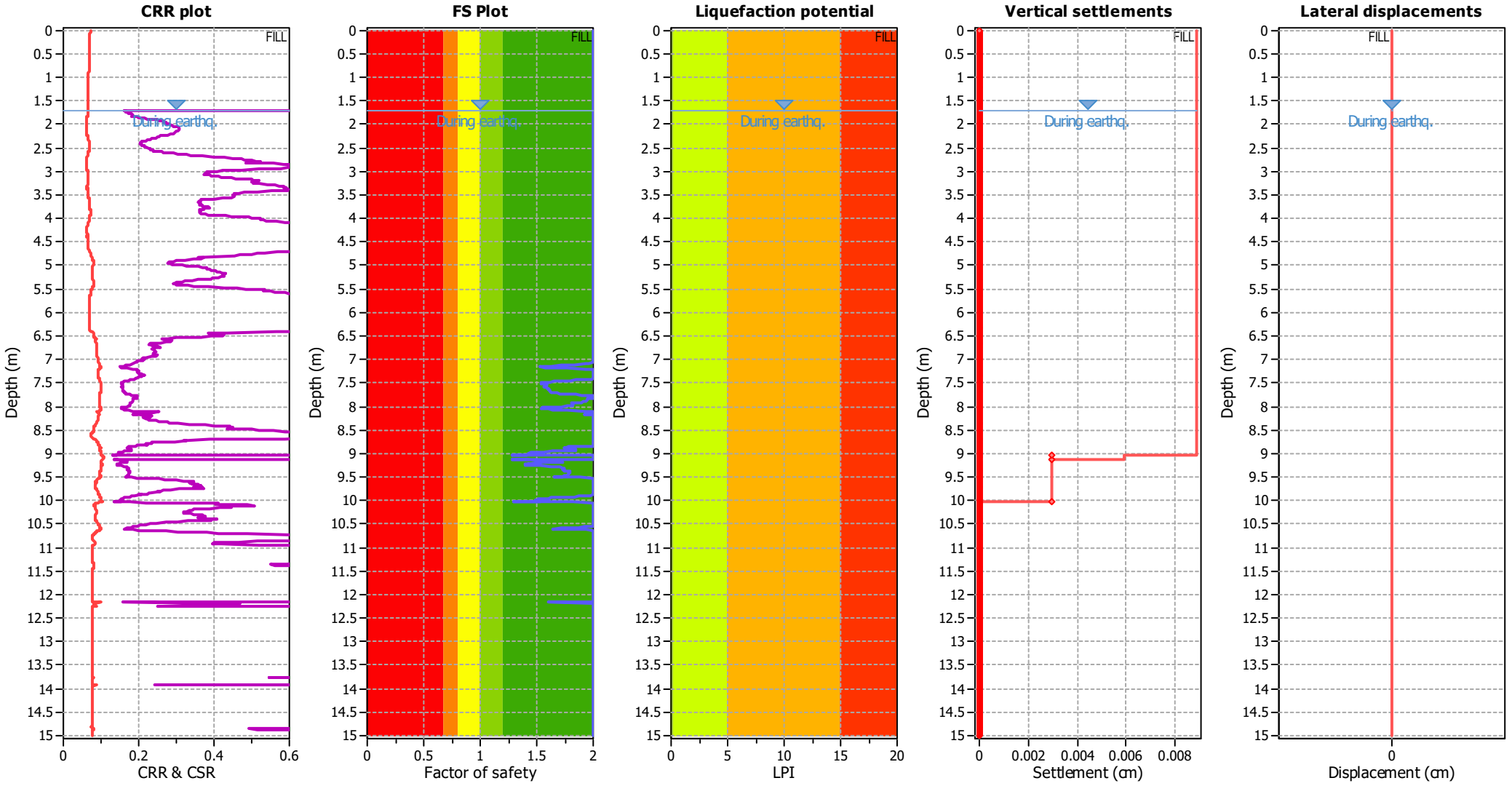
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.40 m	Fill weight:	19.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	0.70 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.40 m	Fill weight:	19.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	0.70 m	Limit depth:	N/A

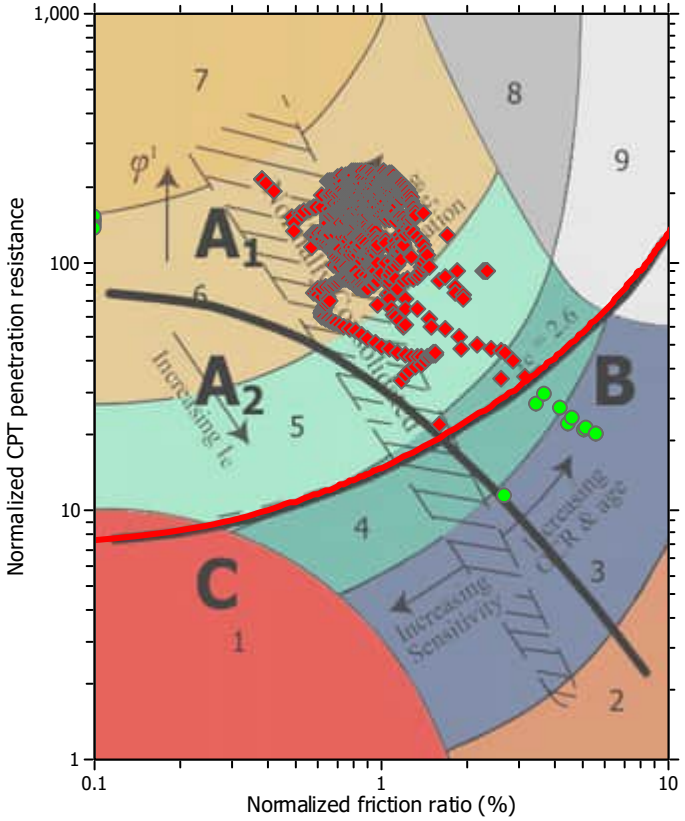
F.S. color scheme

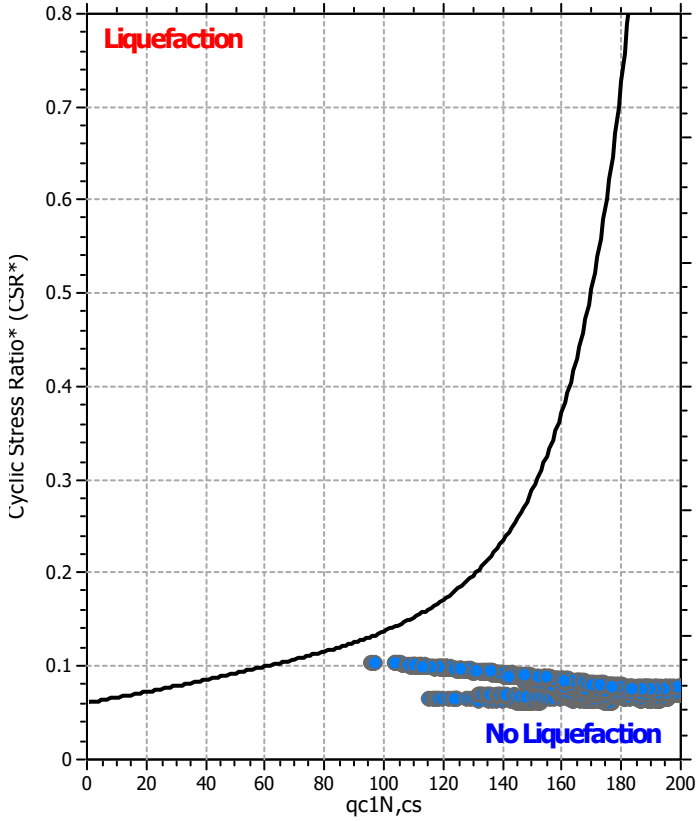
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

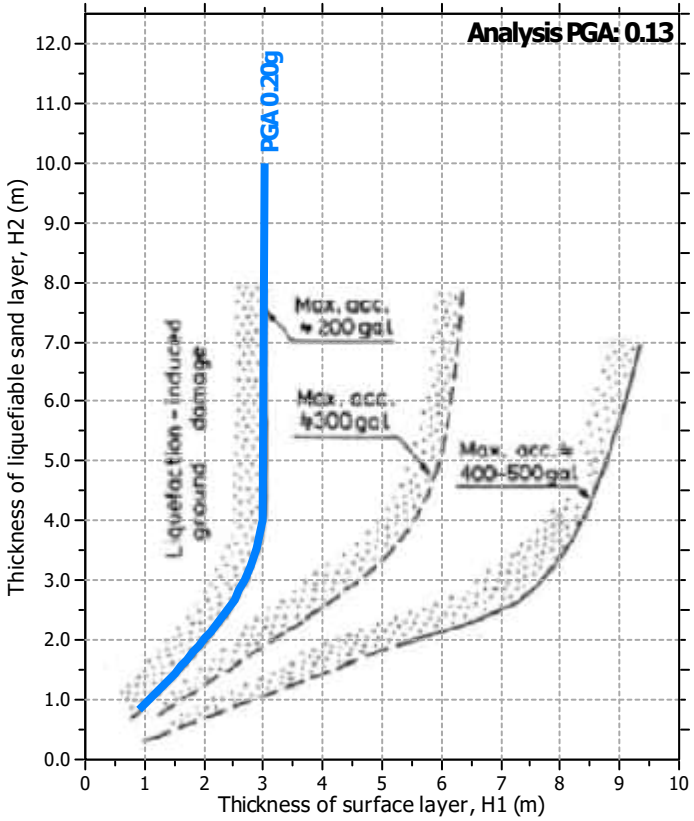
LPI color scheme

- 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.):	2.40 m	Fill weight:	19.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	0.70 m	Limit depth:	N/A

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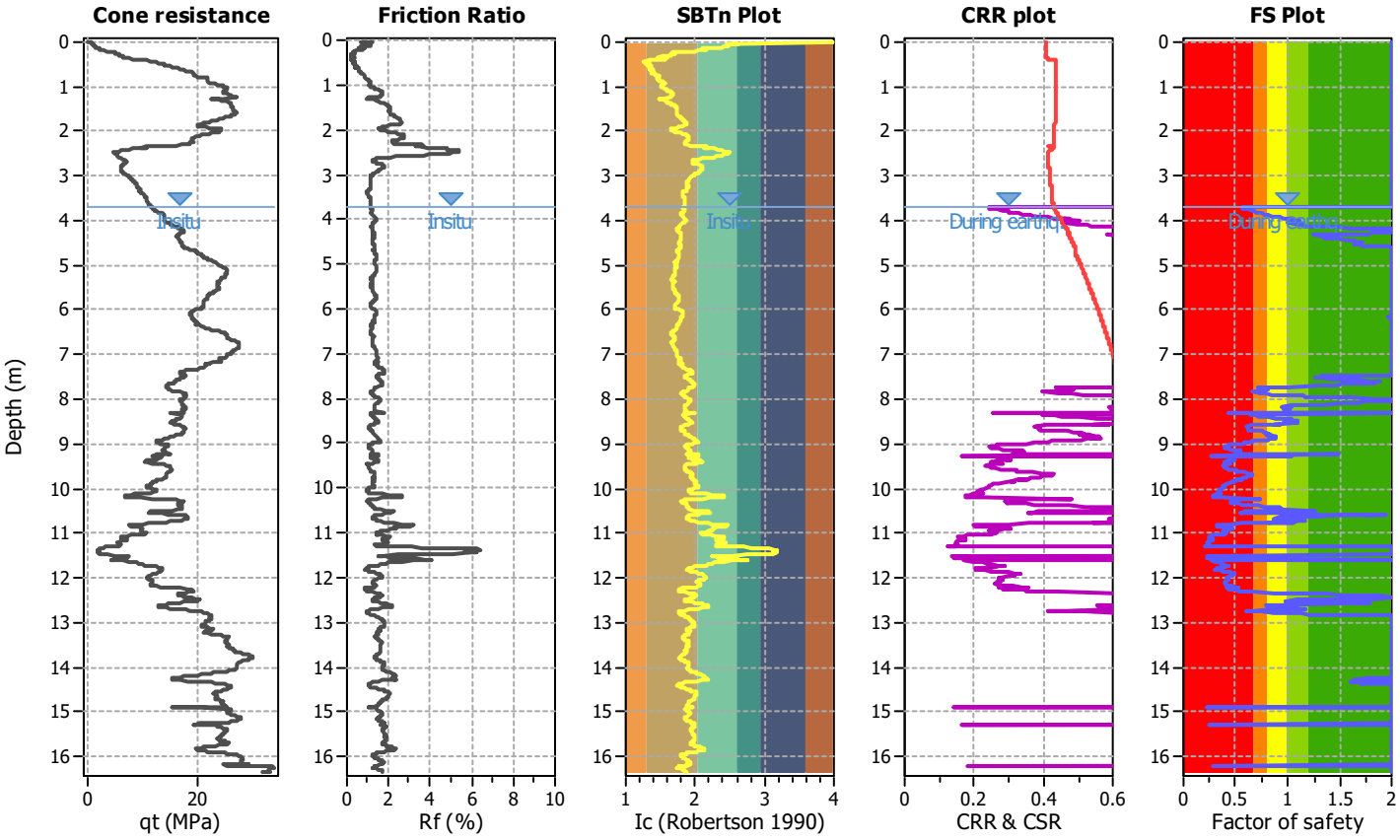
LIQUEFACTION ANALYSIS REPORT

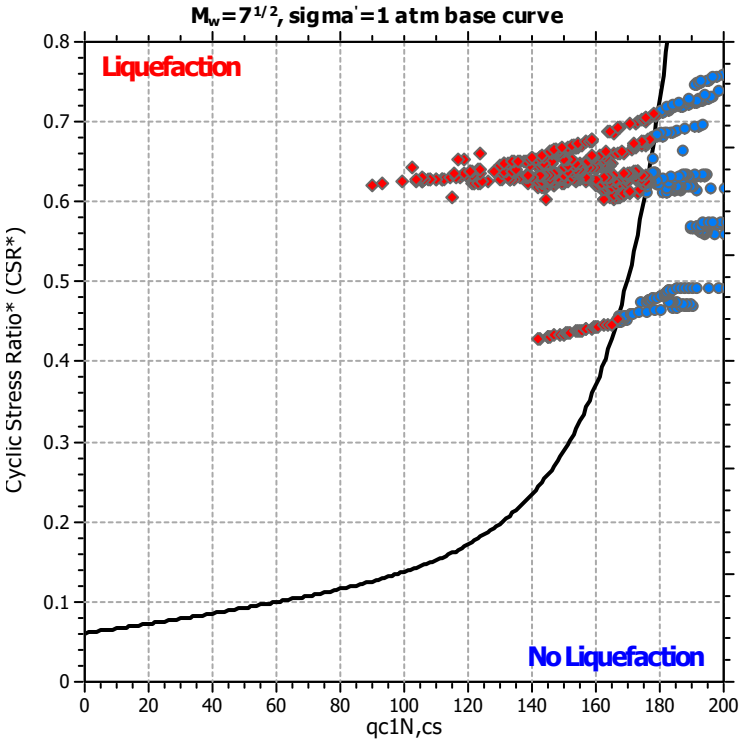
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

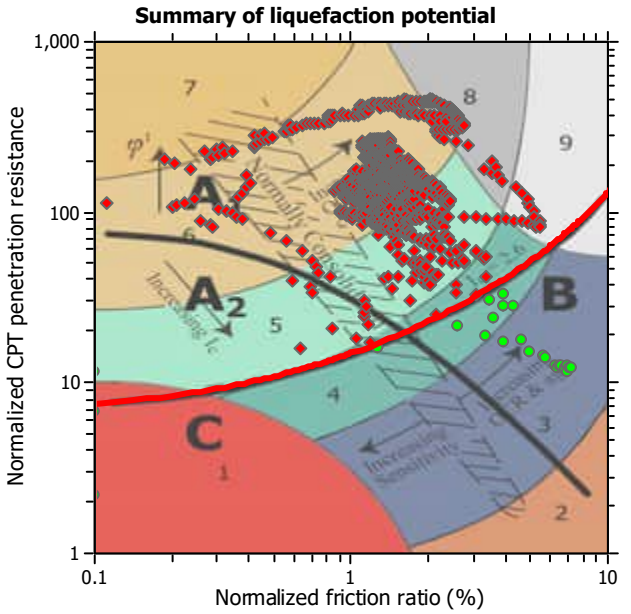
CPT file : CPT01

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	3.70 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

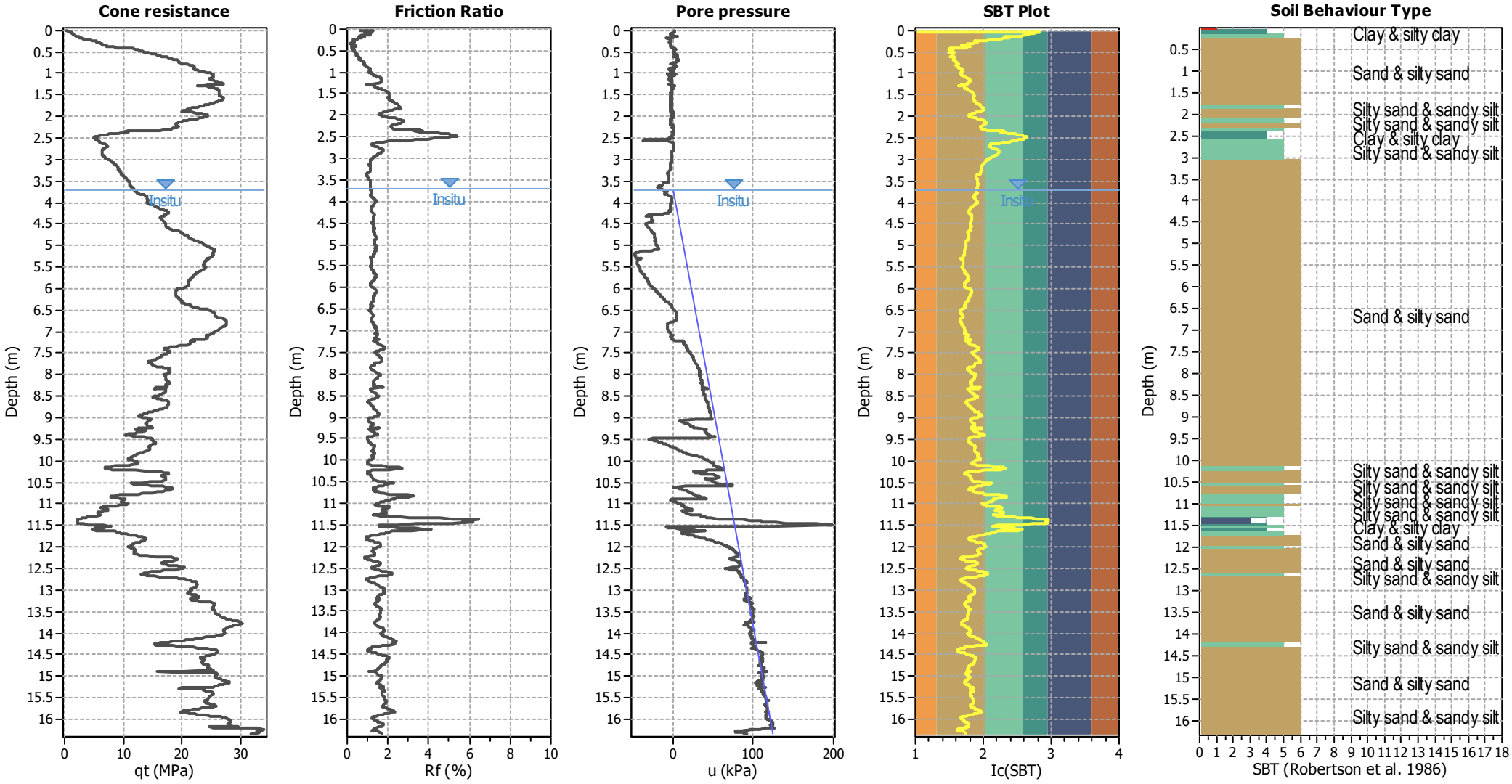






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



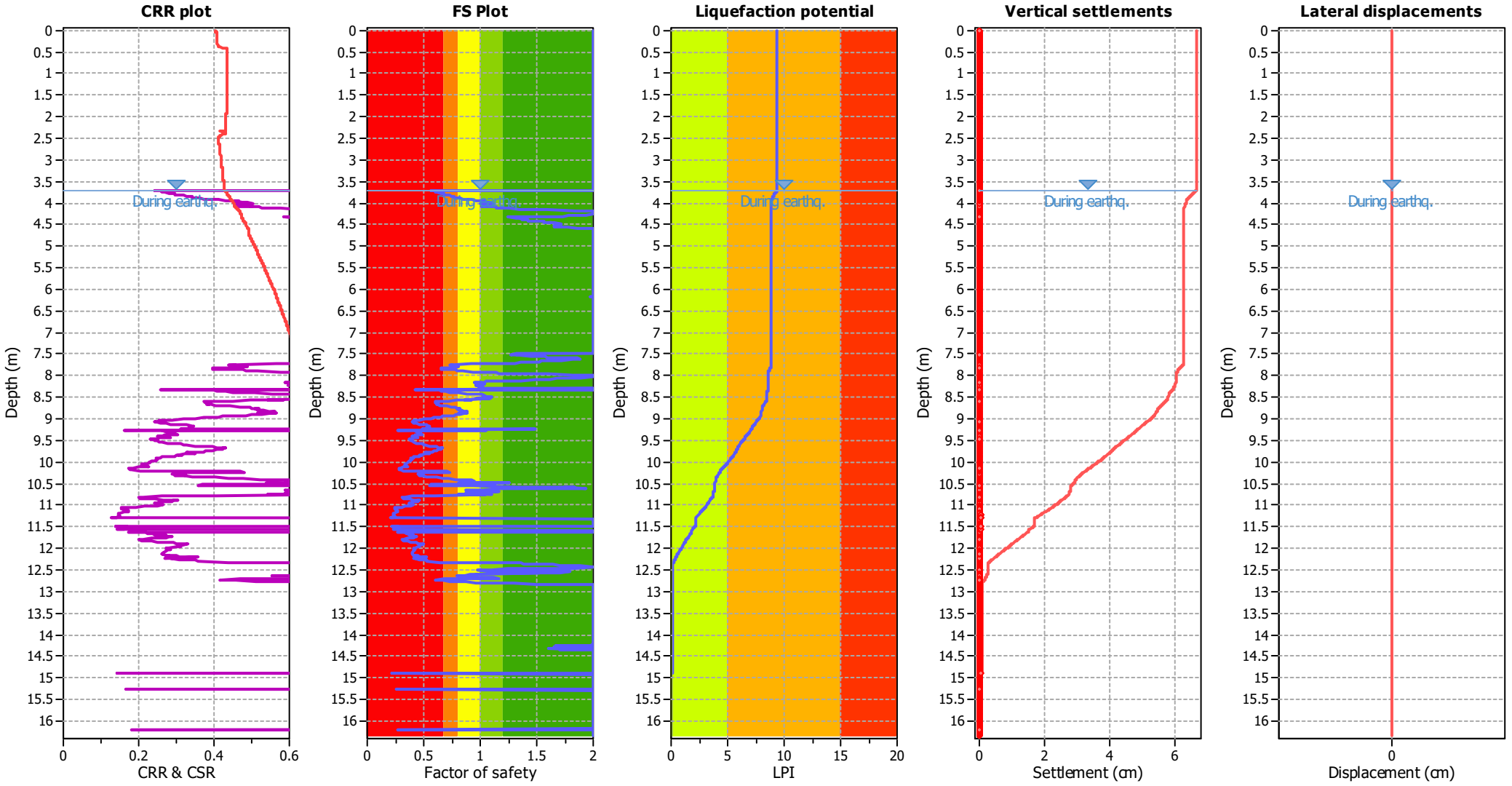
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	3.70 m	Fill height:	N/A	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	3.70 m	Fill height:	N/A	Limit depth:	N/A

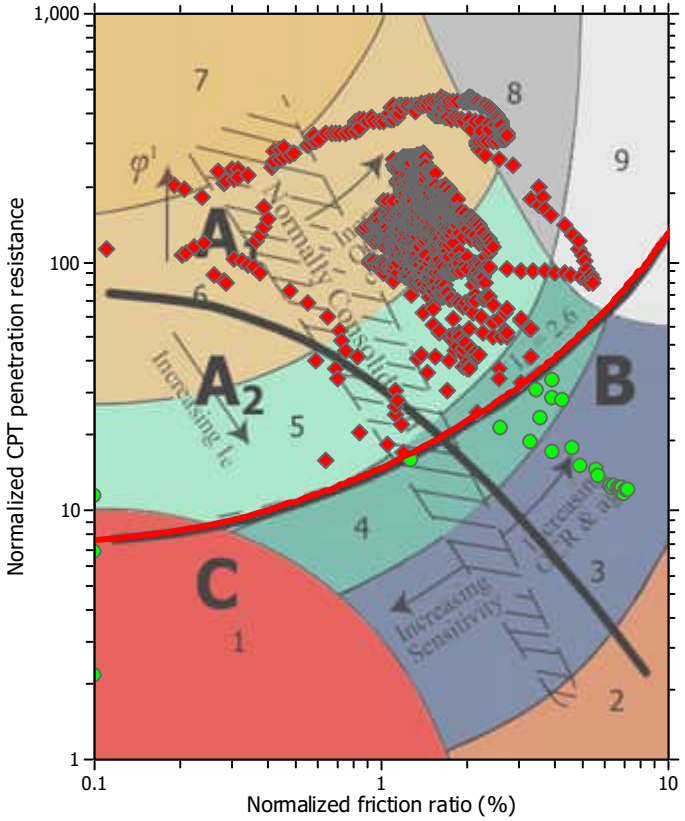
F.S. color scheme

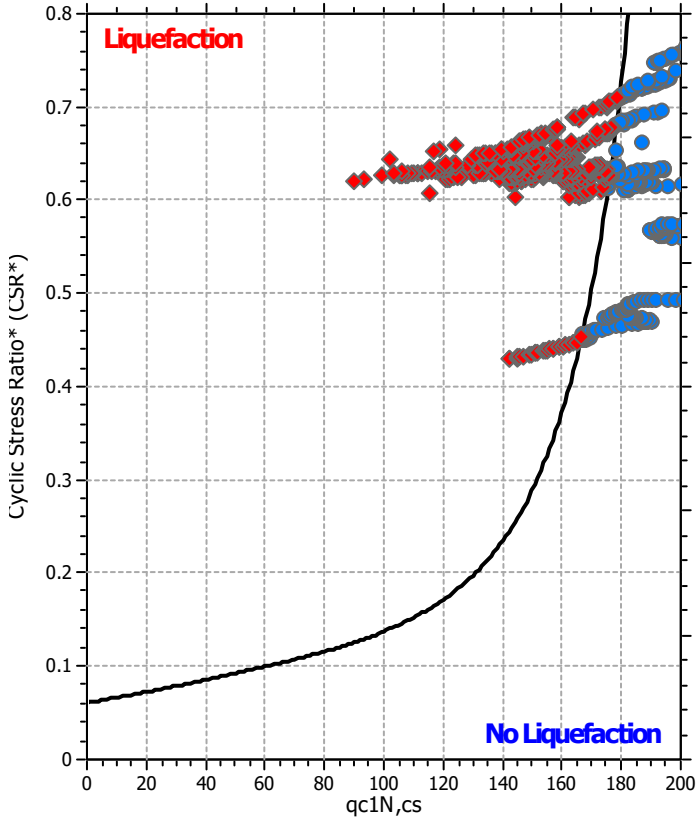
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

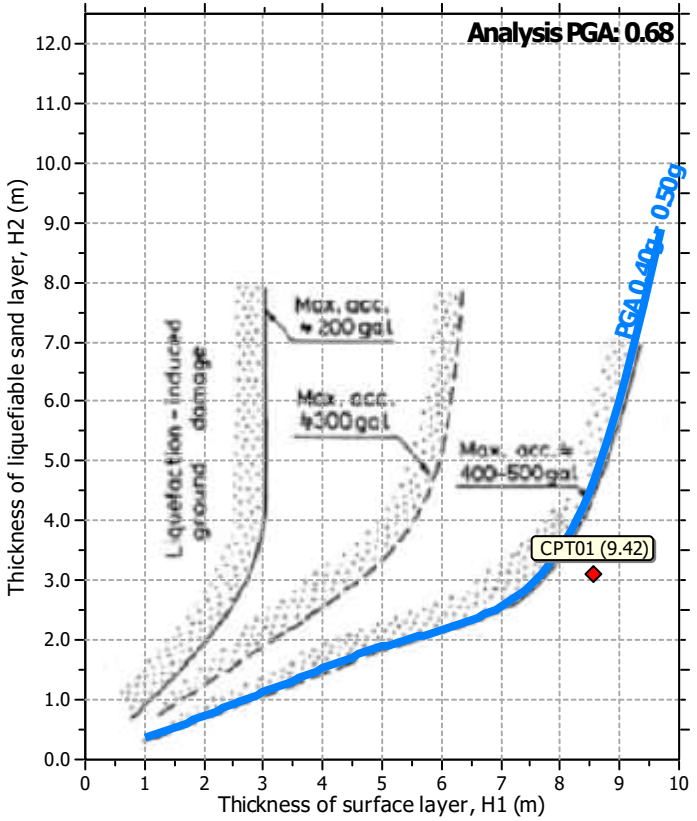
LPI color scheme

- 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.):	3.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	3.70 m	Fill height:	N/A	Limit depth:	N/A

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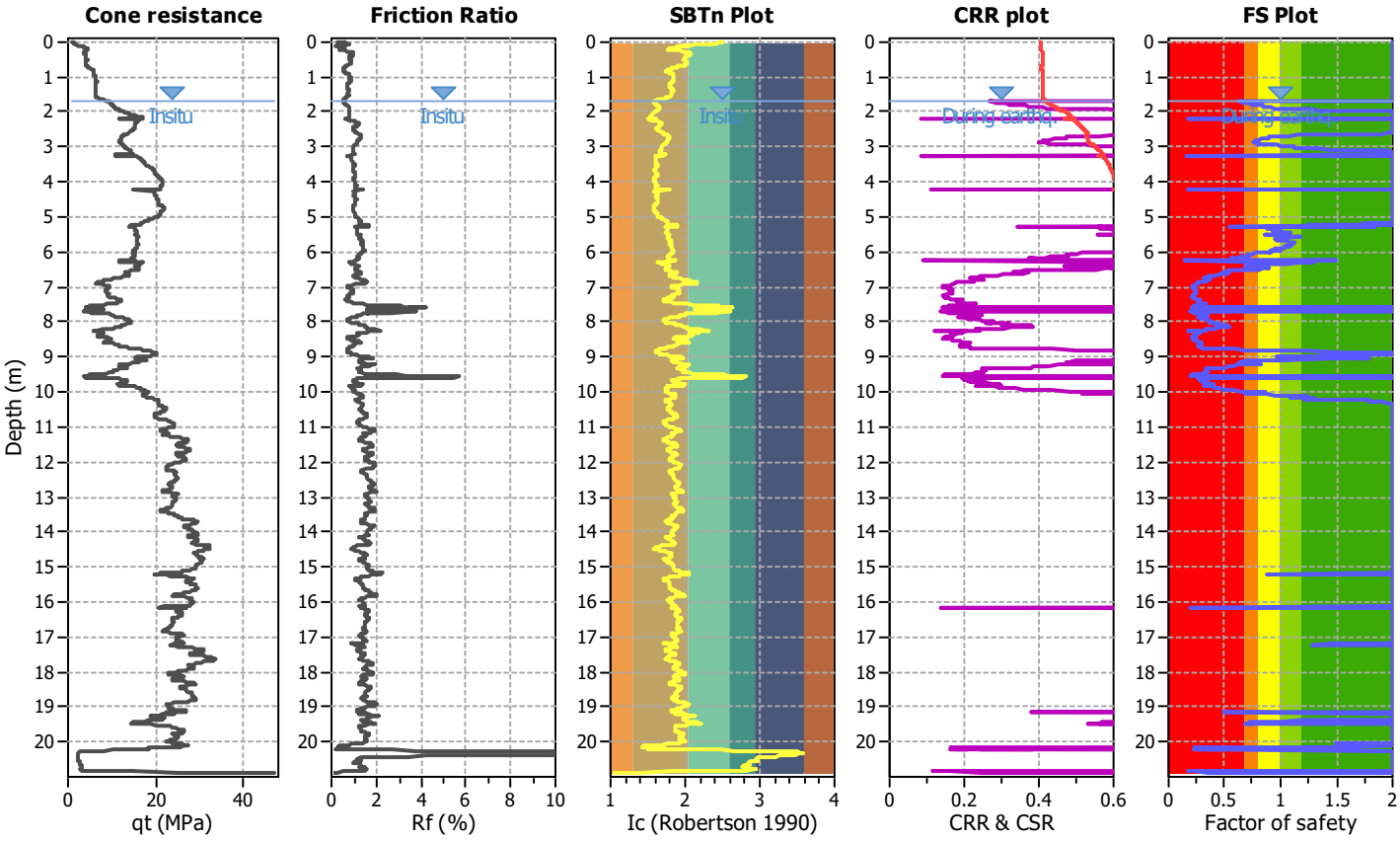
LIQUEFACTION ANALYSIS REPORT

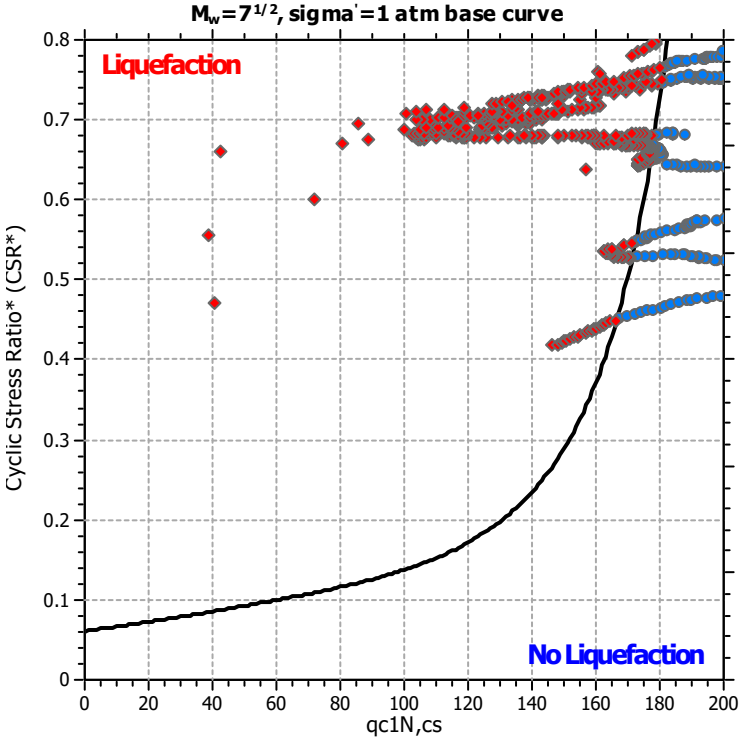
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

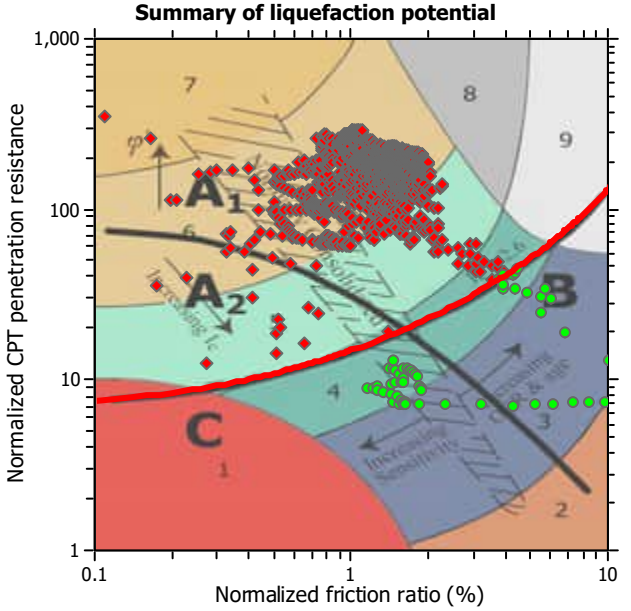
CPT file : CPT02

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

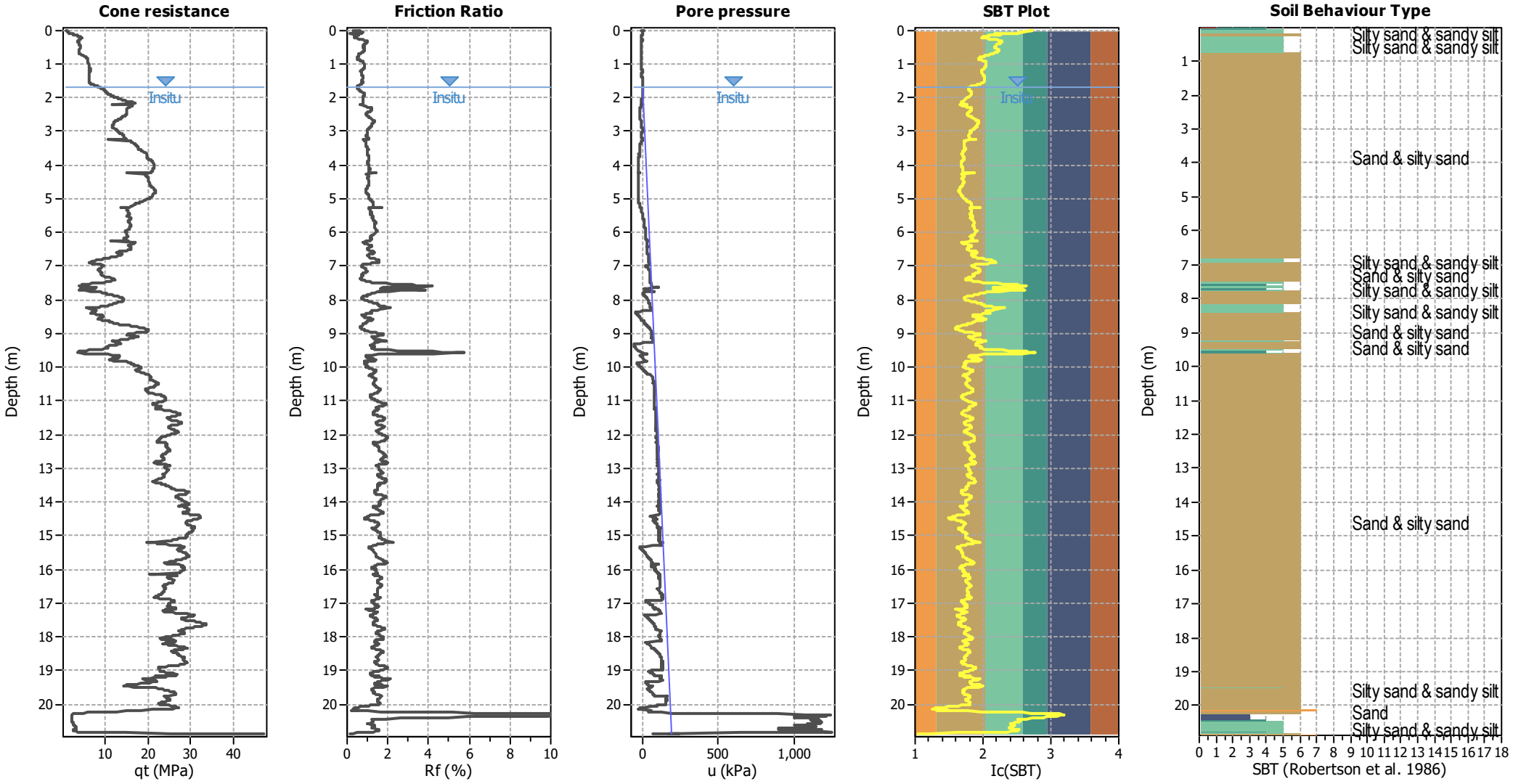






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



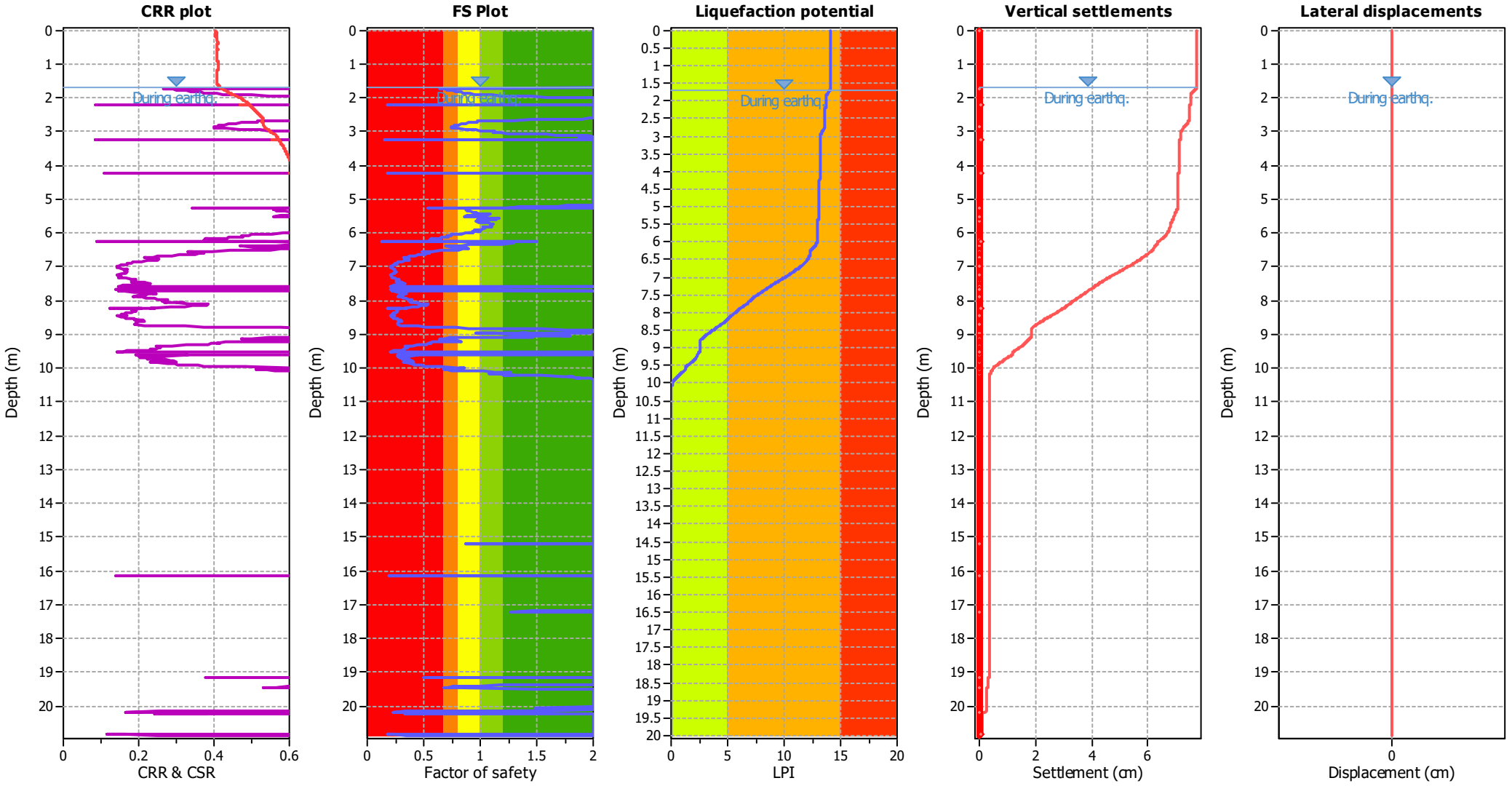
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	N/A

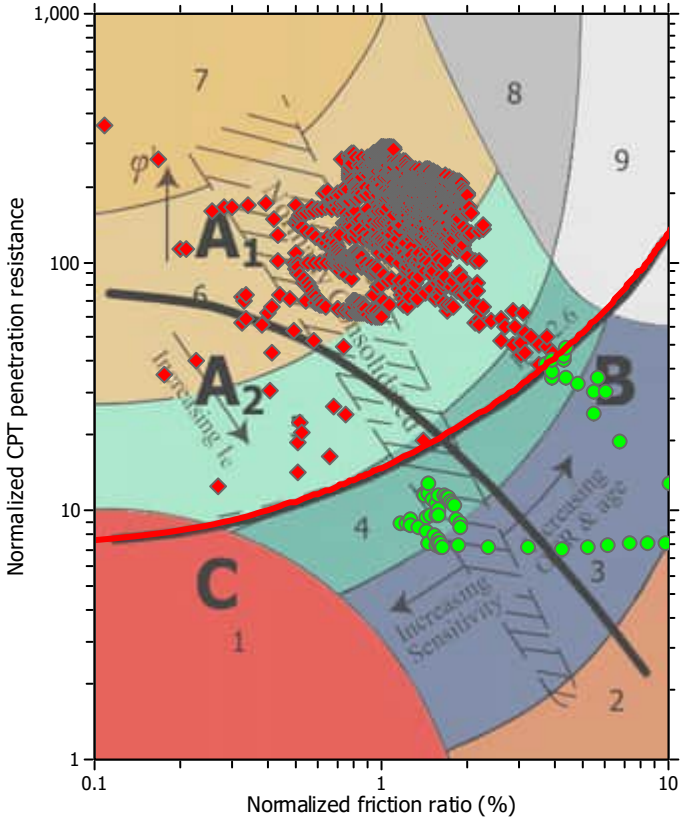
F.S. color scheme

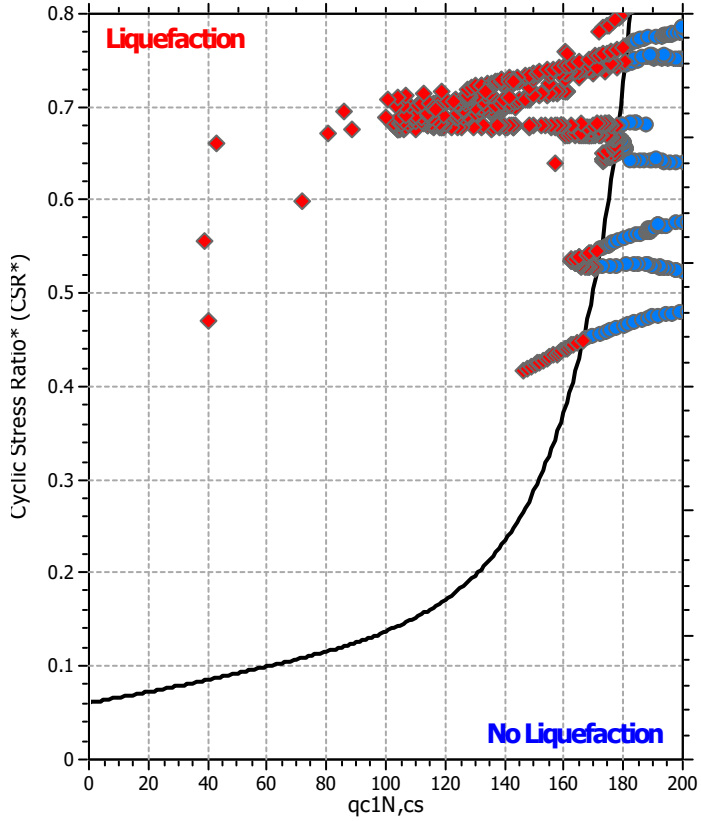
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

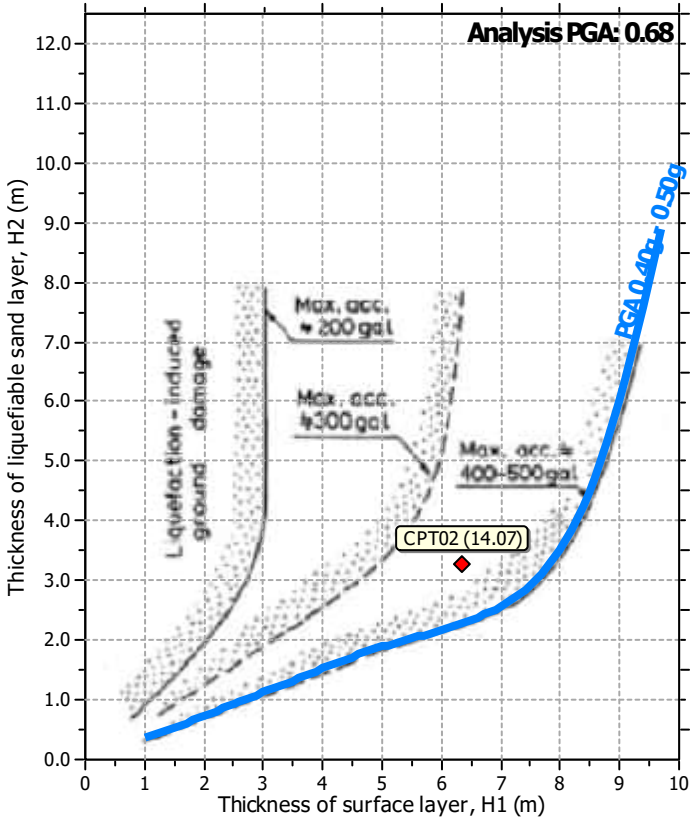
LPI color scheme

- 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.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	N/A

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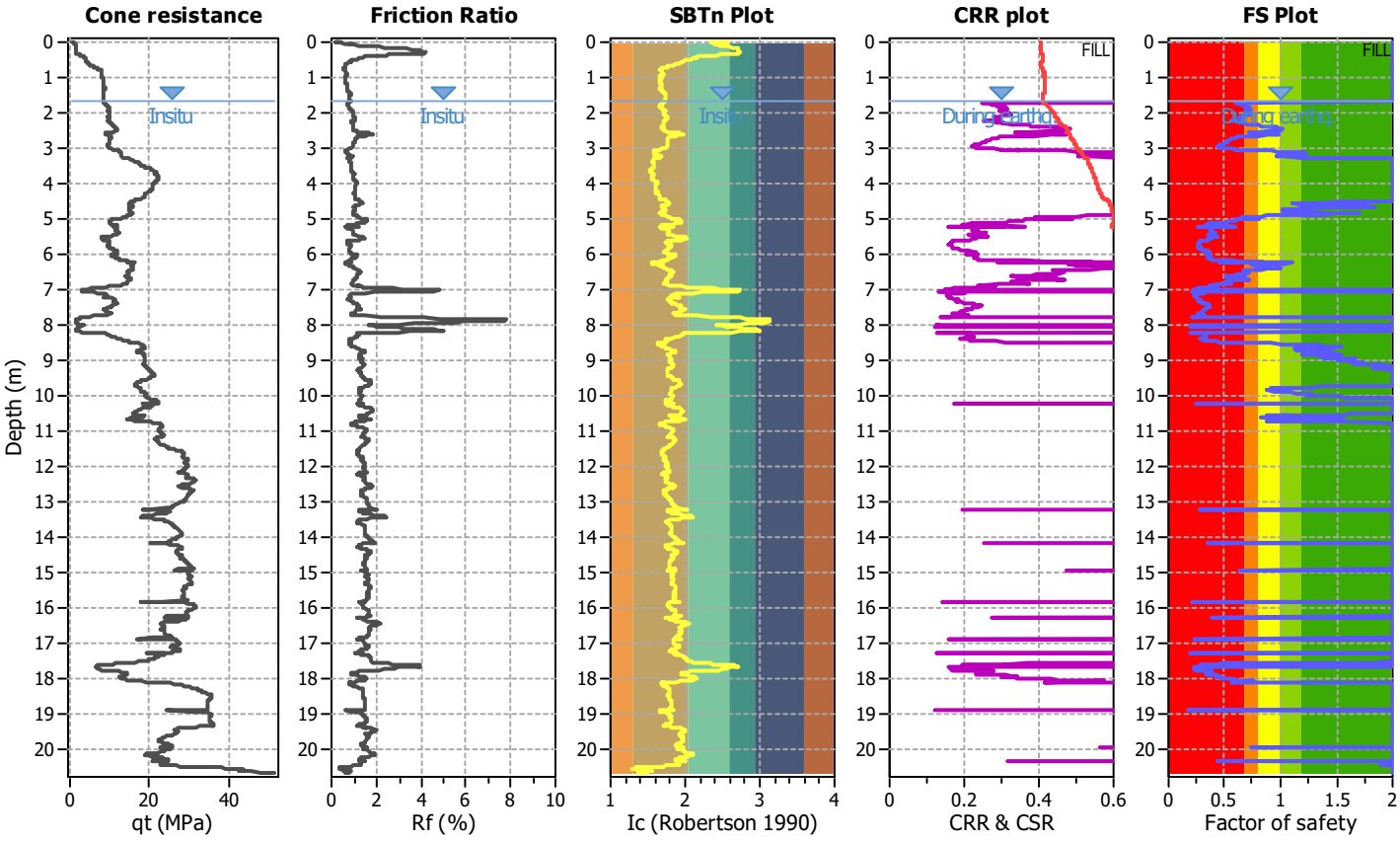
LIQUEFACTION ANALYSIS REPORT

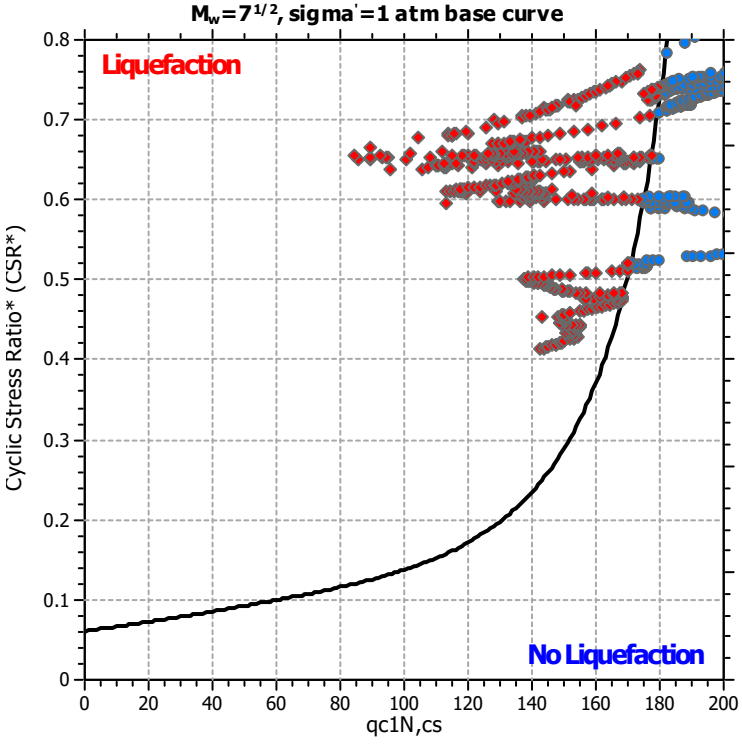
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

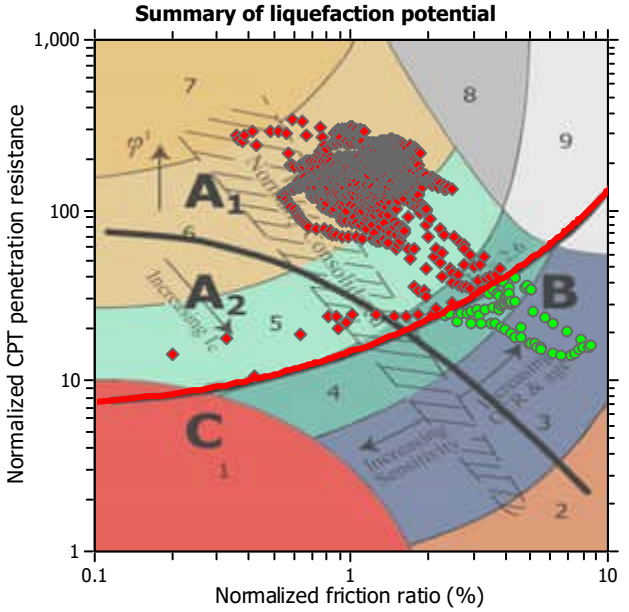
CPT file : CPT03

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.70 m	Fill height:	1.00 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

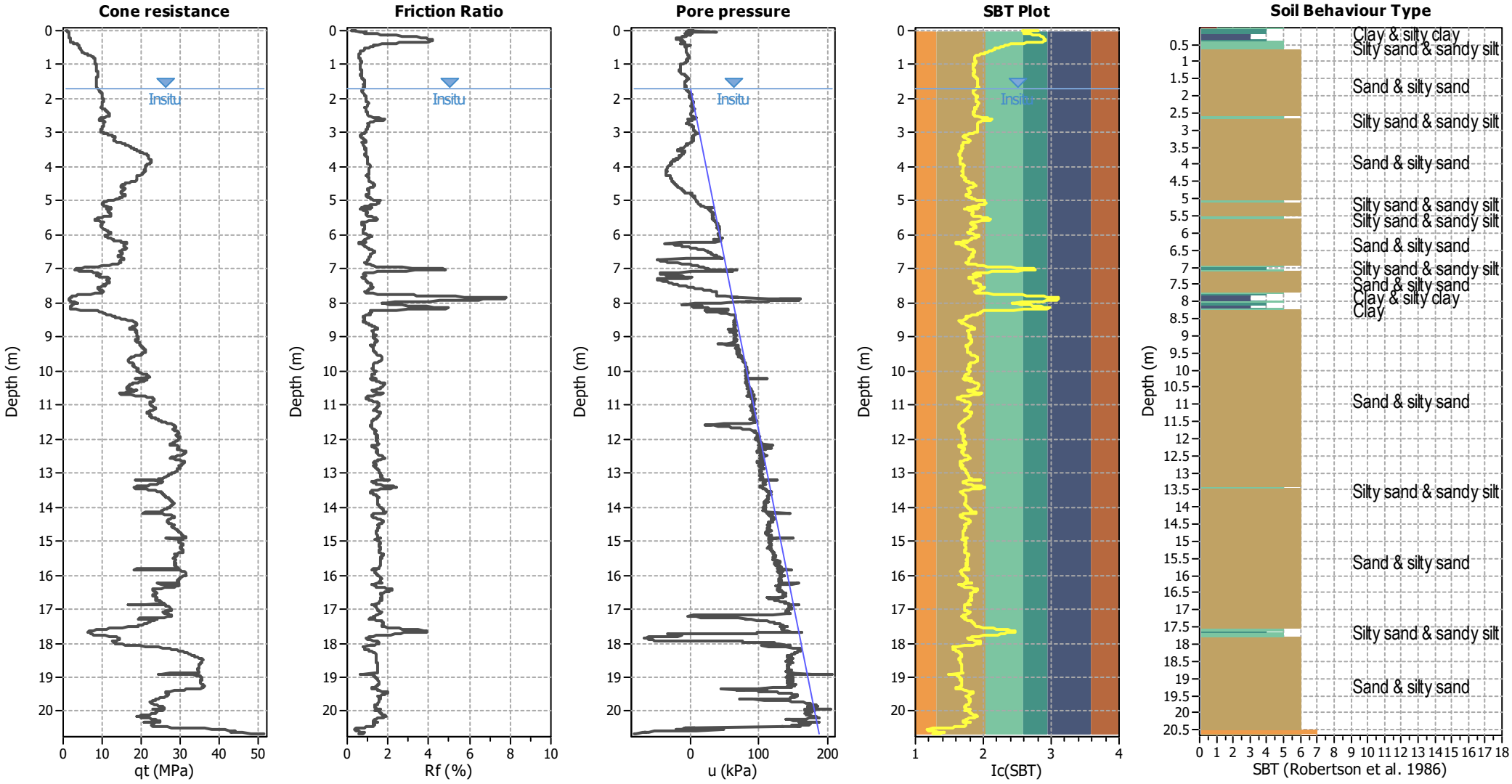






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



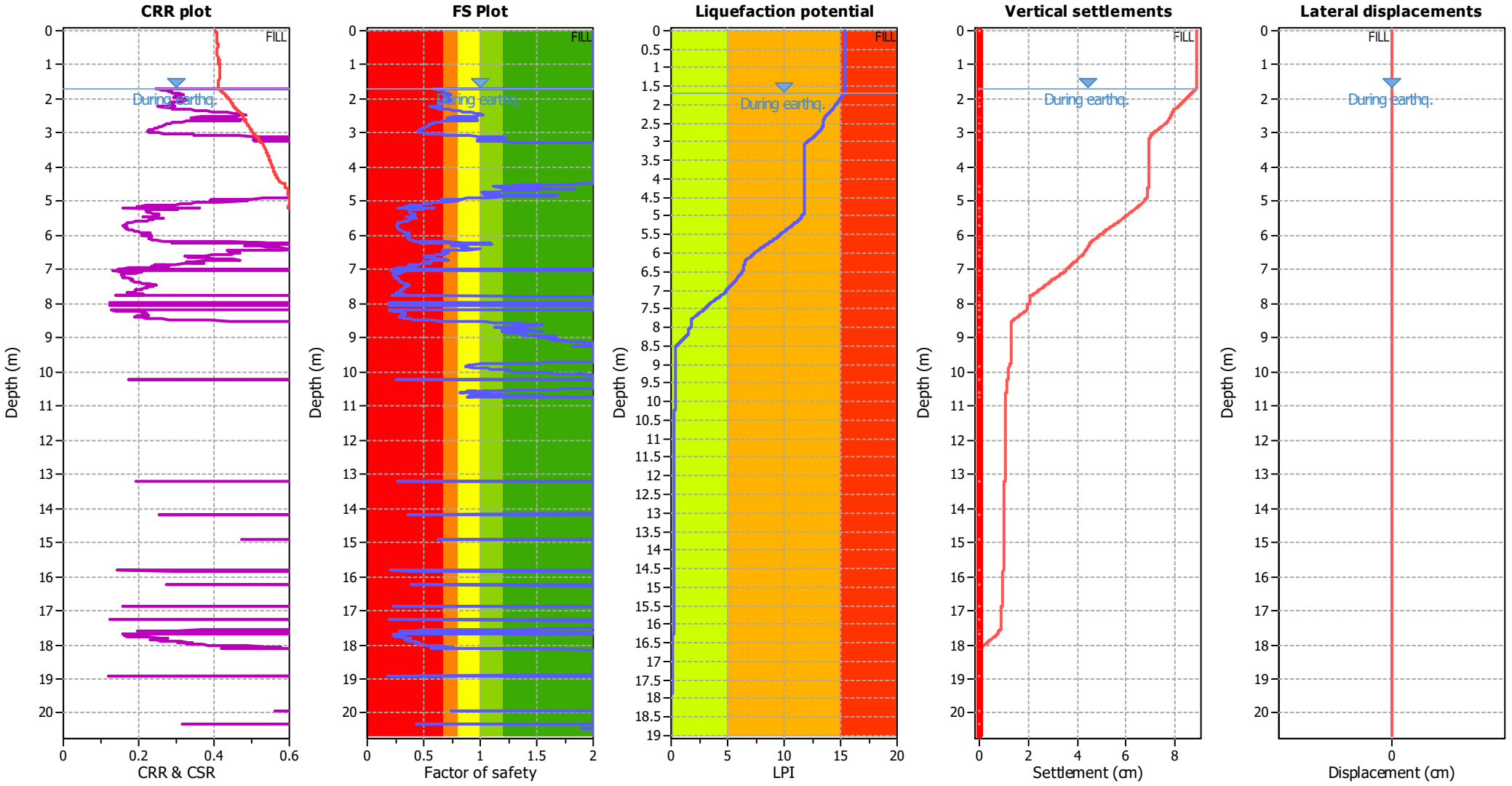
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.70 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	1.00 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.70 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	1.00 m	Limit depth:	N/A

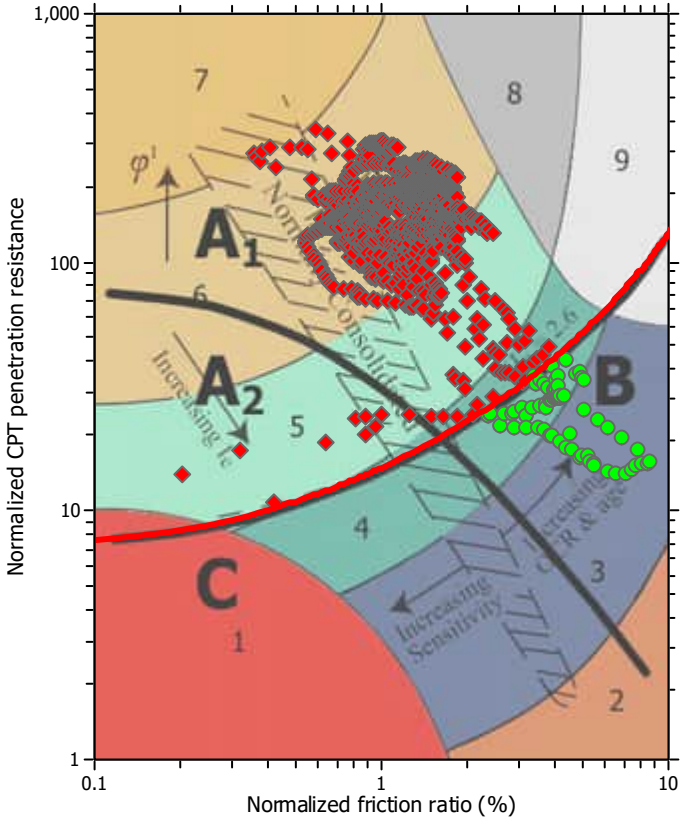
F.S. color scheme

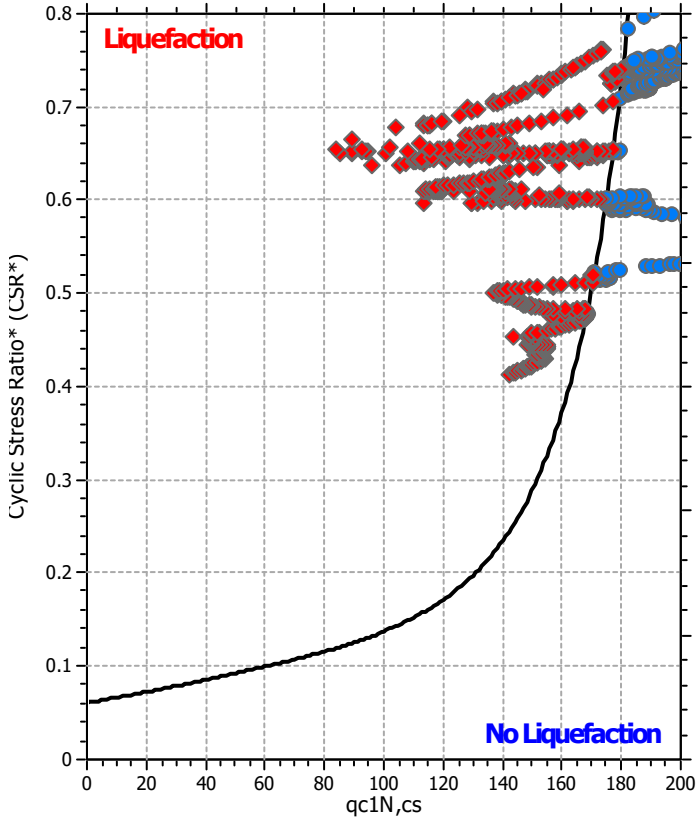
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

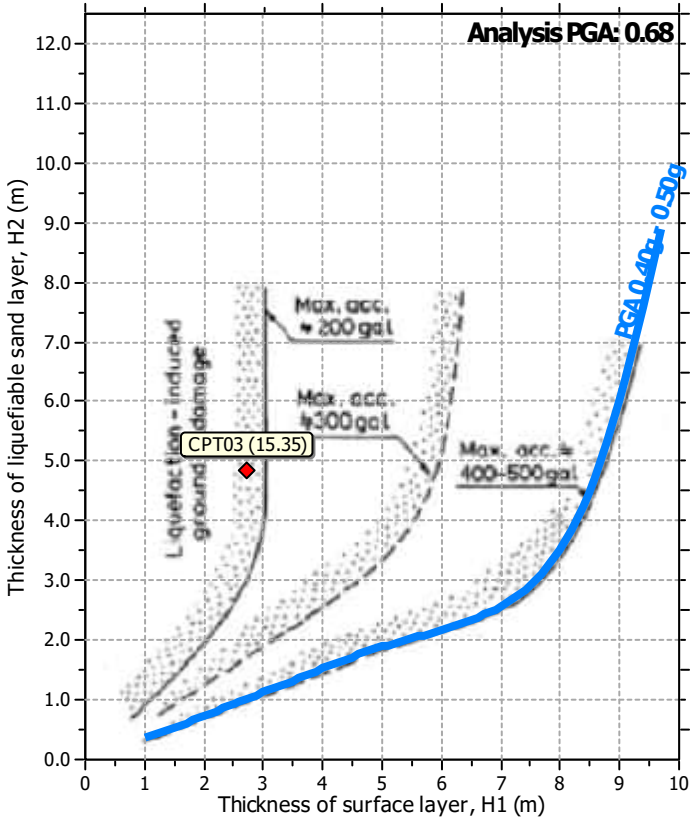
LPI color scheme

- 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.):	2.70 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	1.00 m	Limit depth:	N/A

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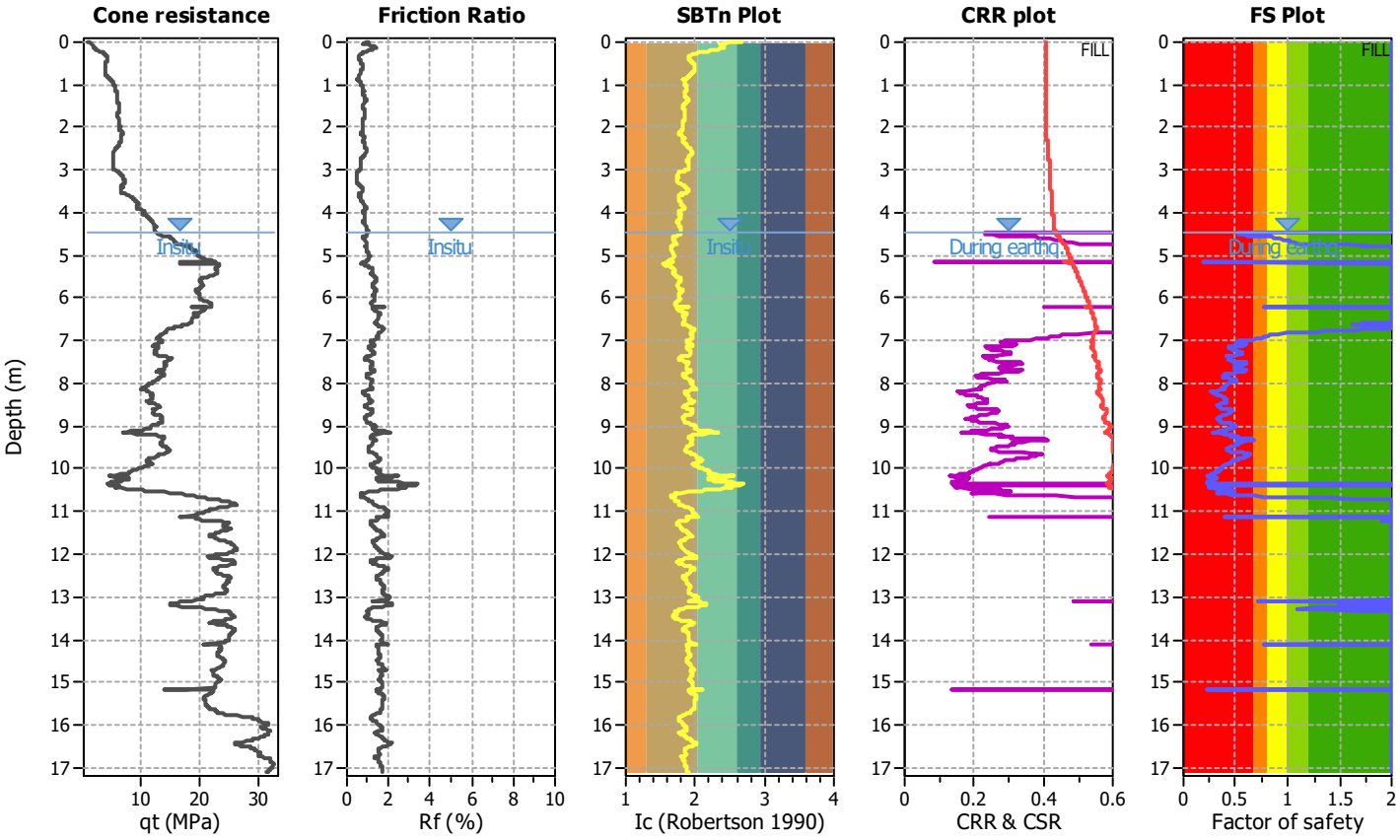
LIQUEFACTION ANALYSIS REPORT

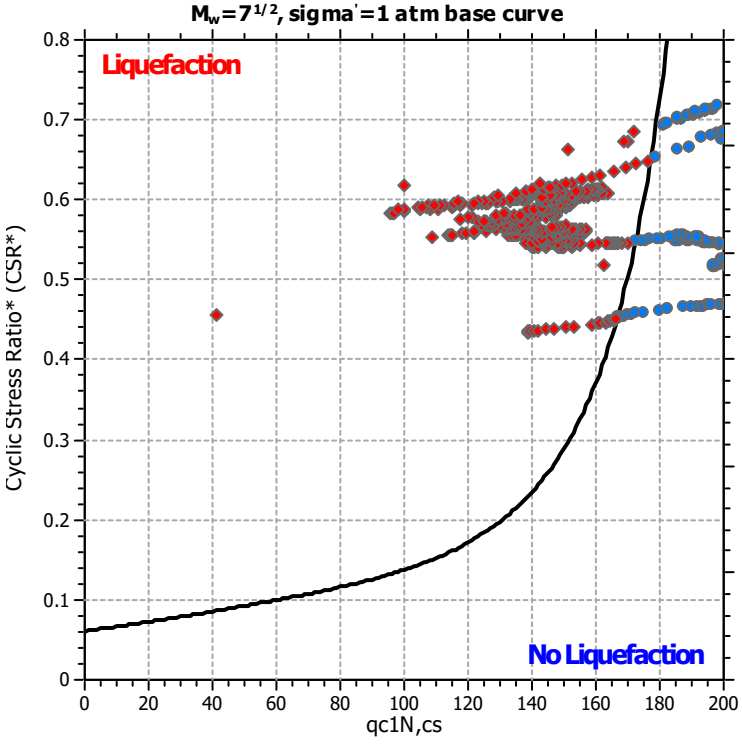
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

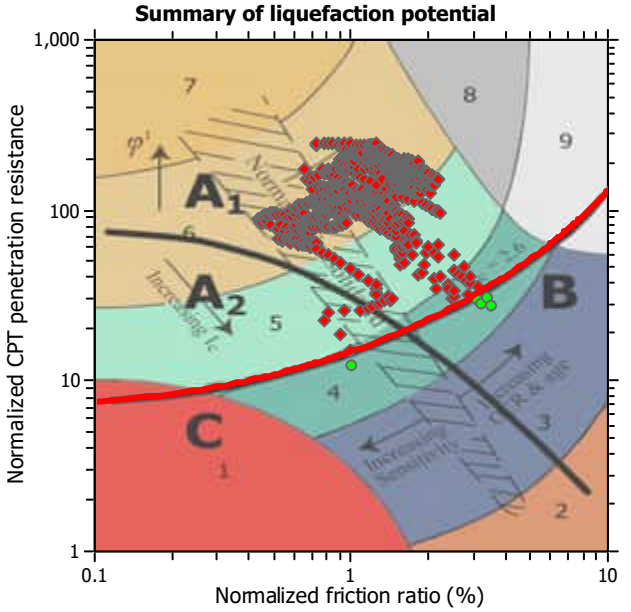
CPT file : CPT04

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	4.47 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	4.82 m	Fill height:	0.35 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

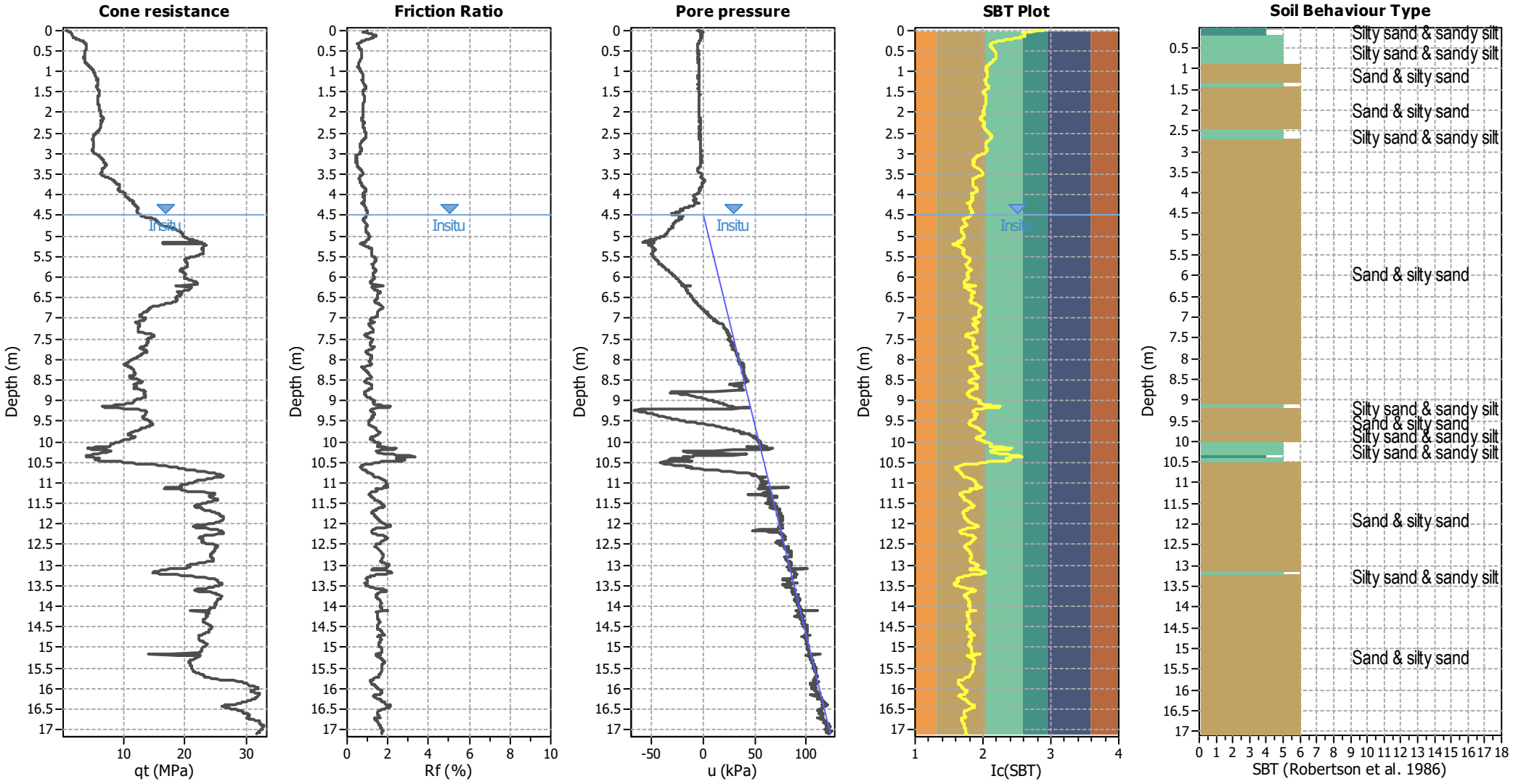






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



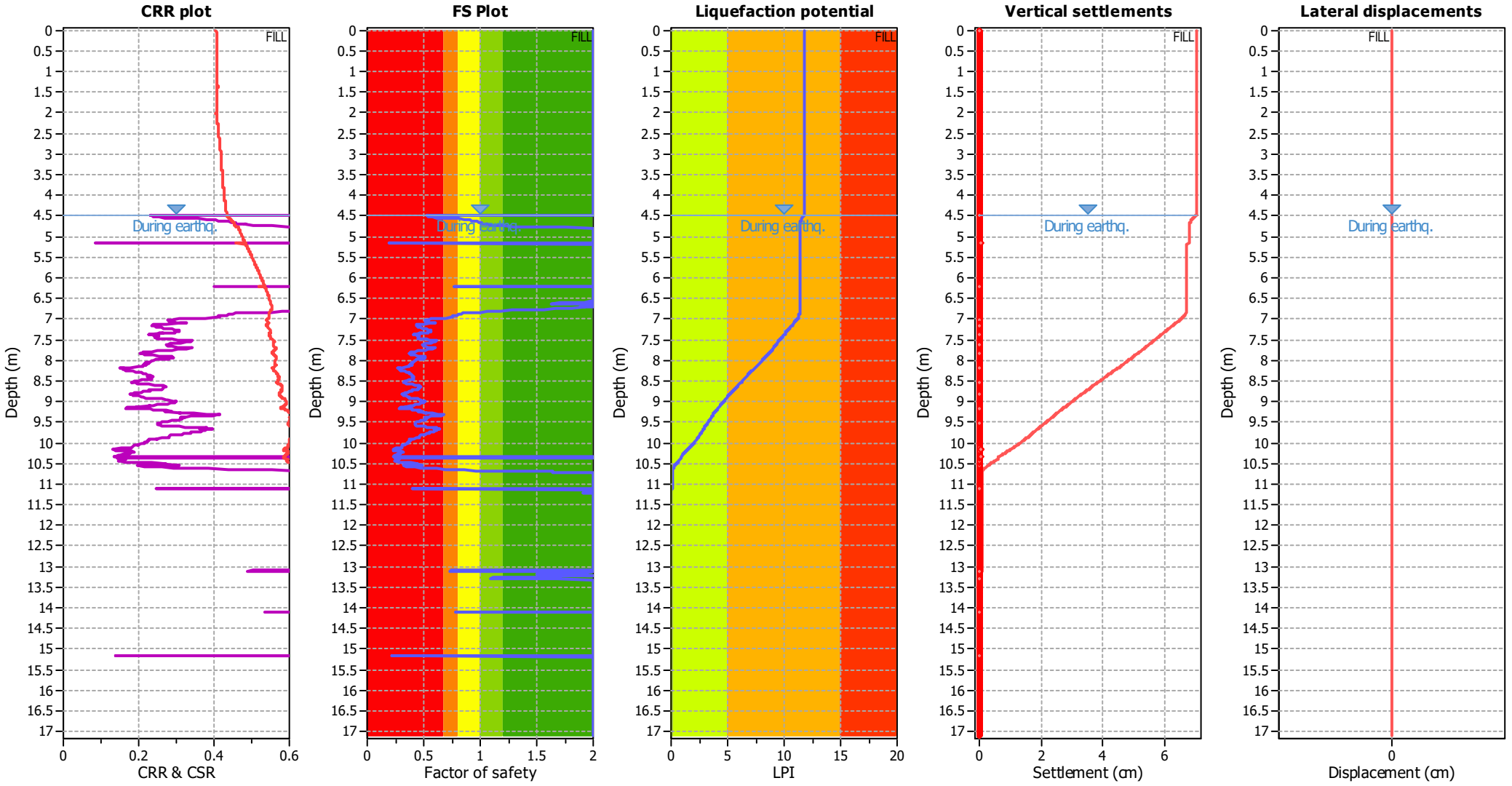
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	4.82 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	4.47 m	Fill height:	0.35 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	4.82 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	4.47 m	Fill height:	0.35 m	Limit depth:	N/A

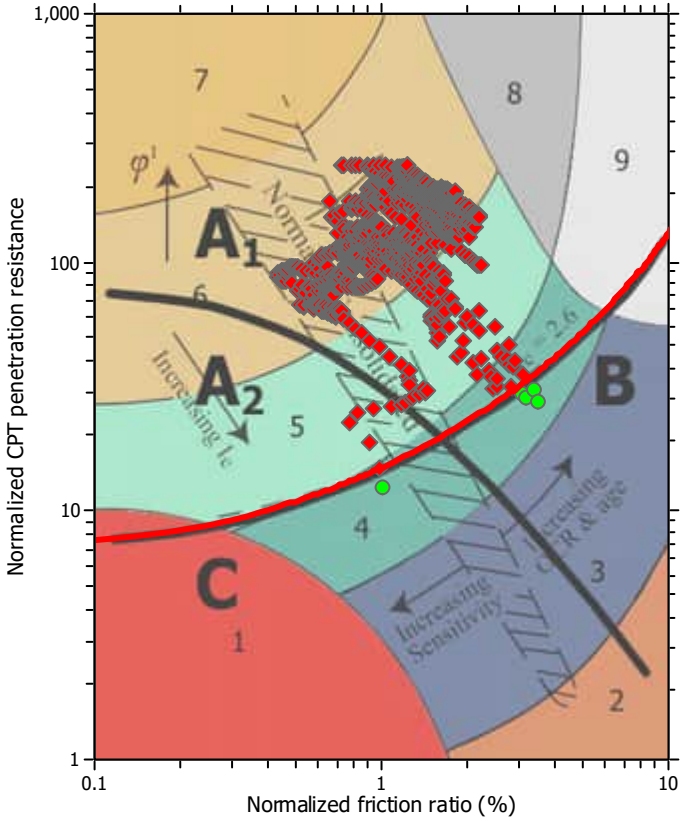
F.S. color scheme

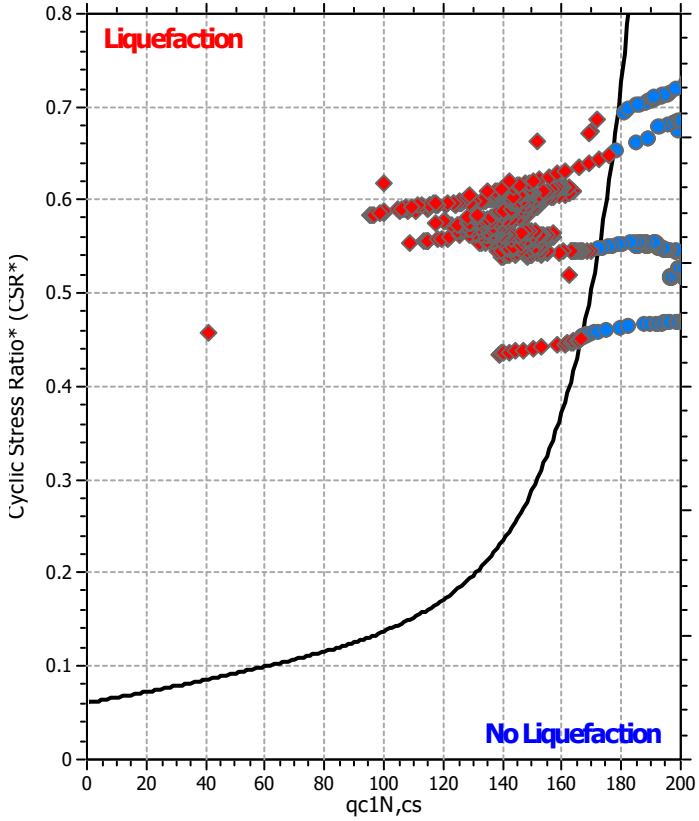
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

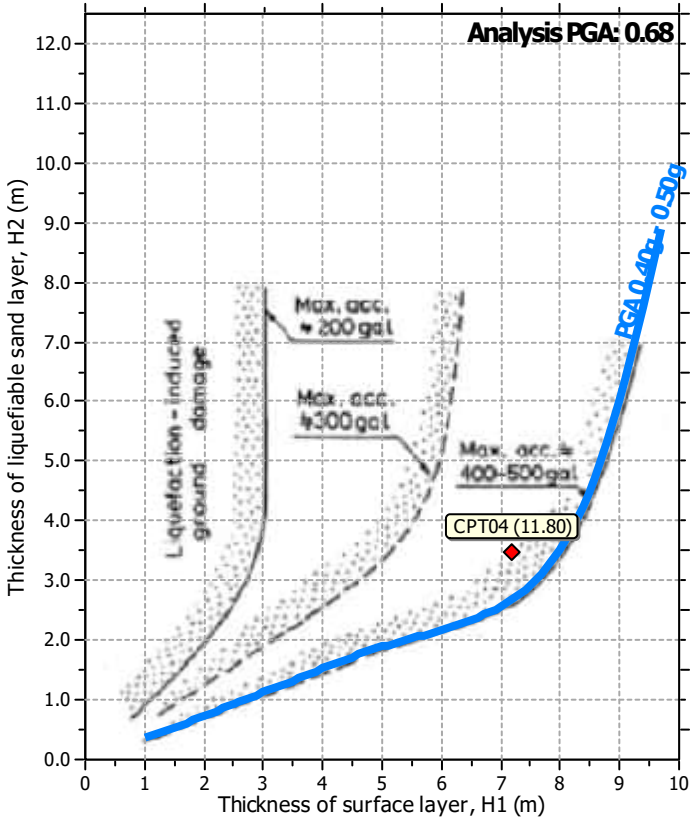
LPI color scheme

- 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.):	4.82 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	4.47 m	Fill height:	0.35 m	Limit depth:	N/A

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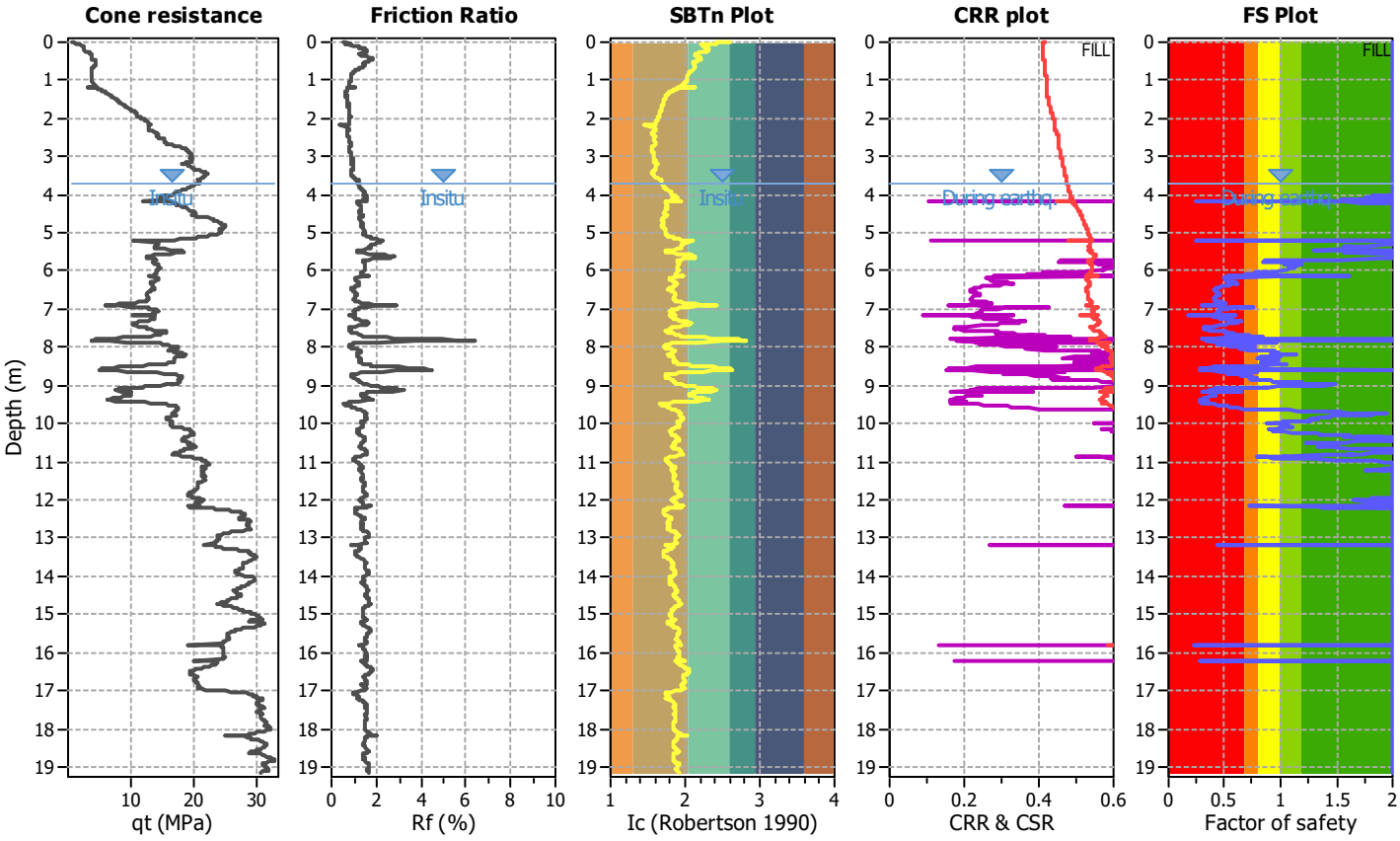
LIQUEFACTION ANALYSIS REPORT

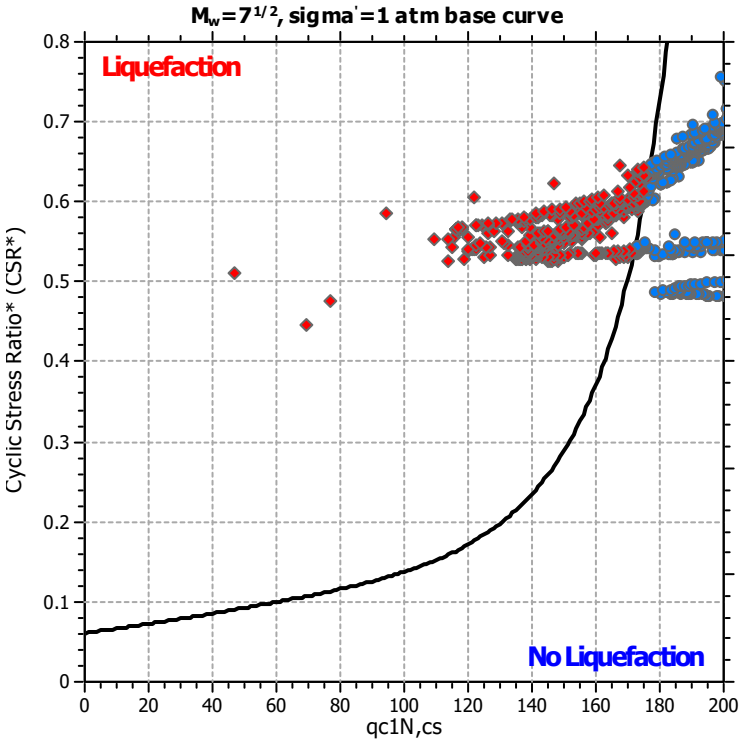
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

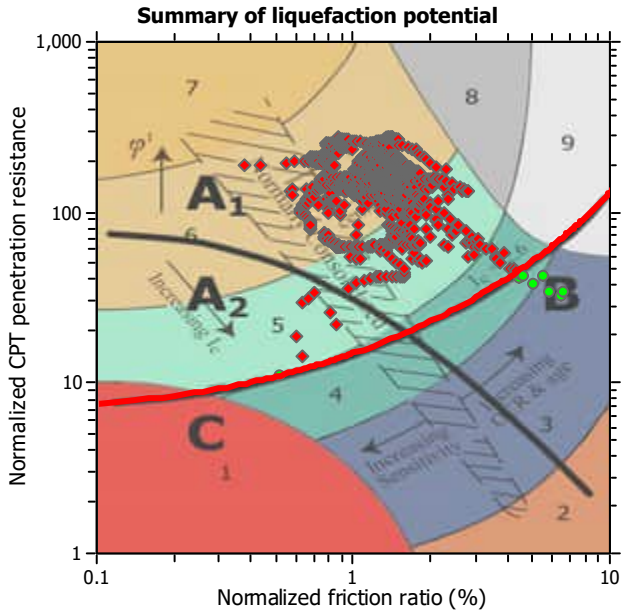
CPT file : CPT05

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.72 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	6.22 m	Fill height:	2.50 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

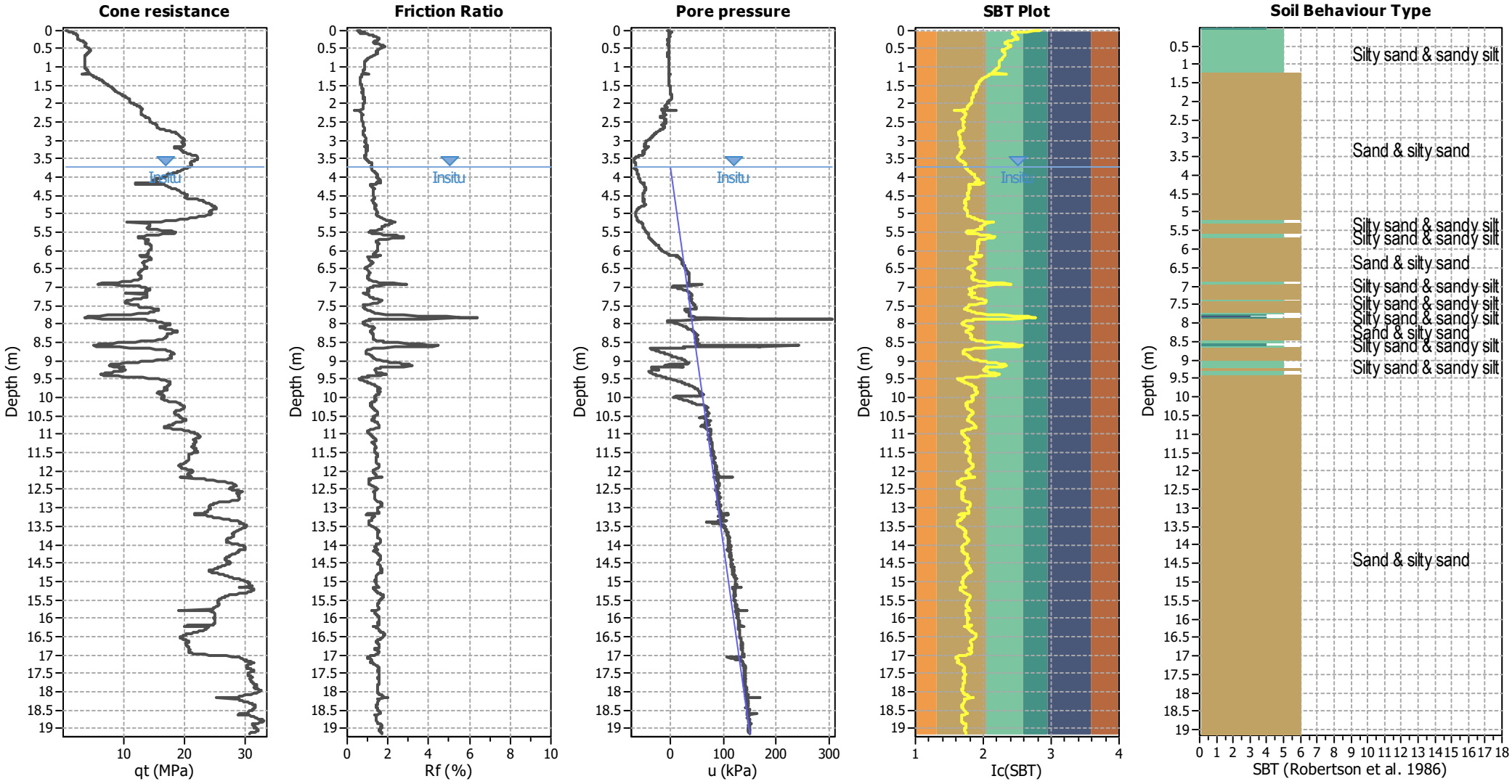






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



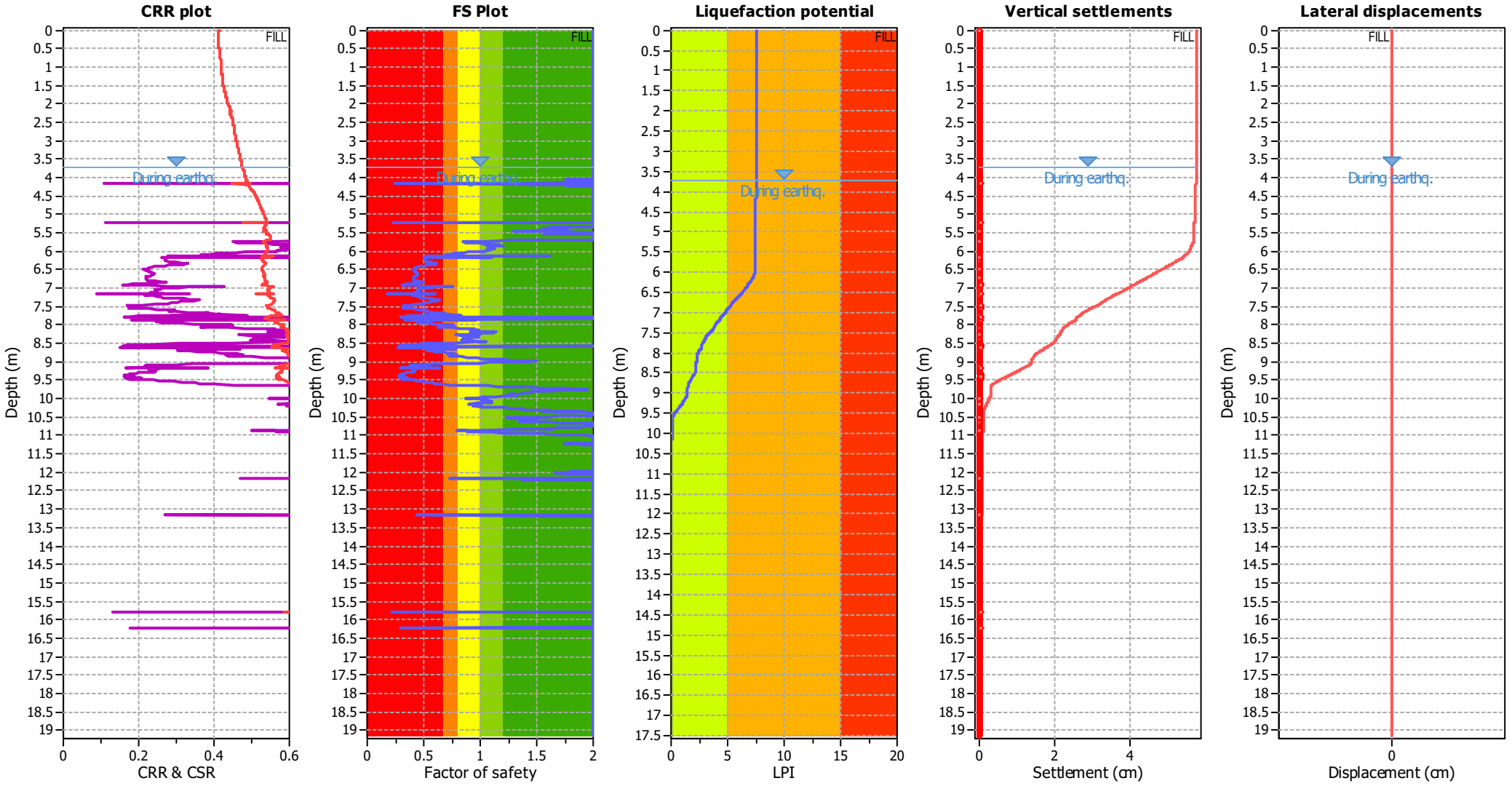
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	3.72 m	Fill height:	2.50 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	3.72 m	Fill height:	2.50 m	Limit depth:	N/A

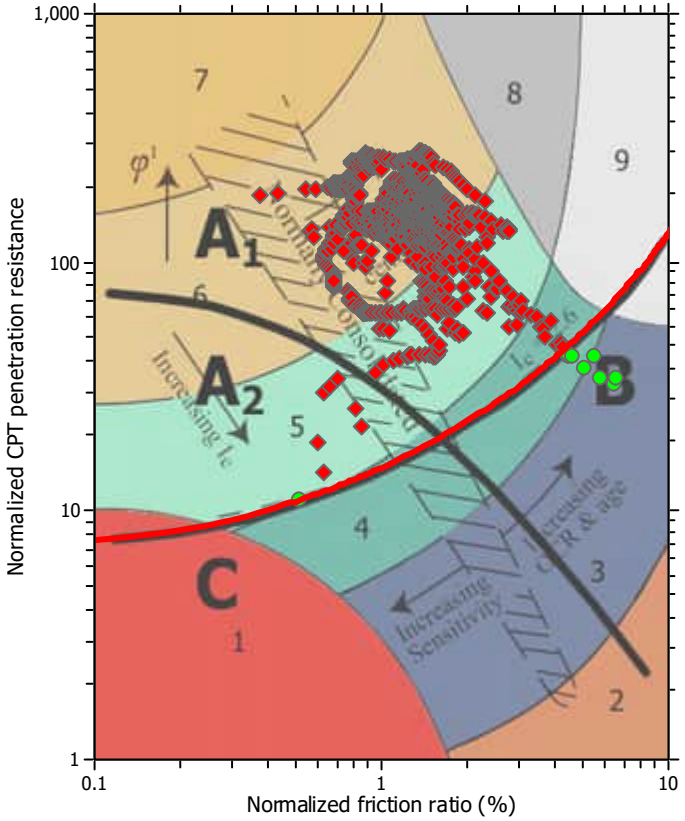
F.S. color scheme

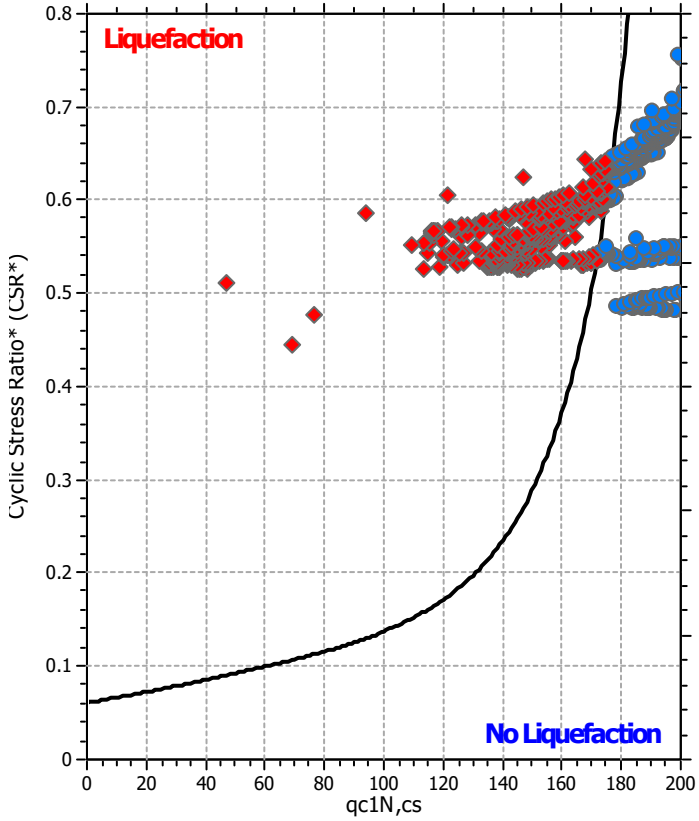
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

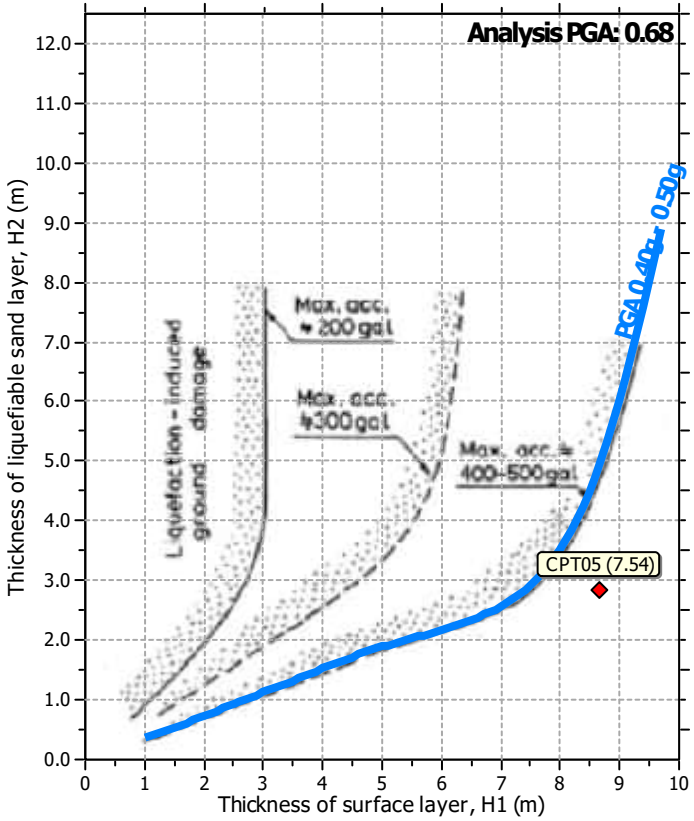
LPI color scheme

- 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.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	3.72 m	Fill height:	2.50 m	Limit depth:	N/A

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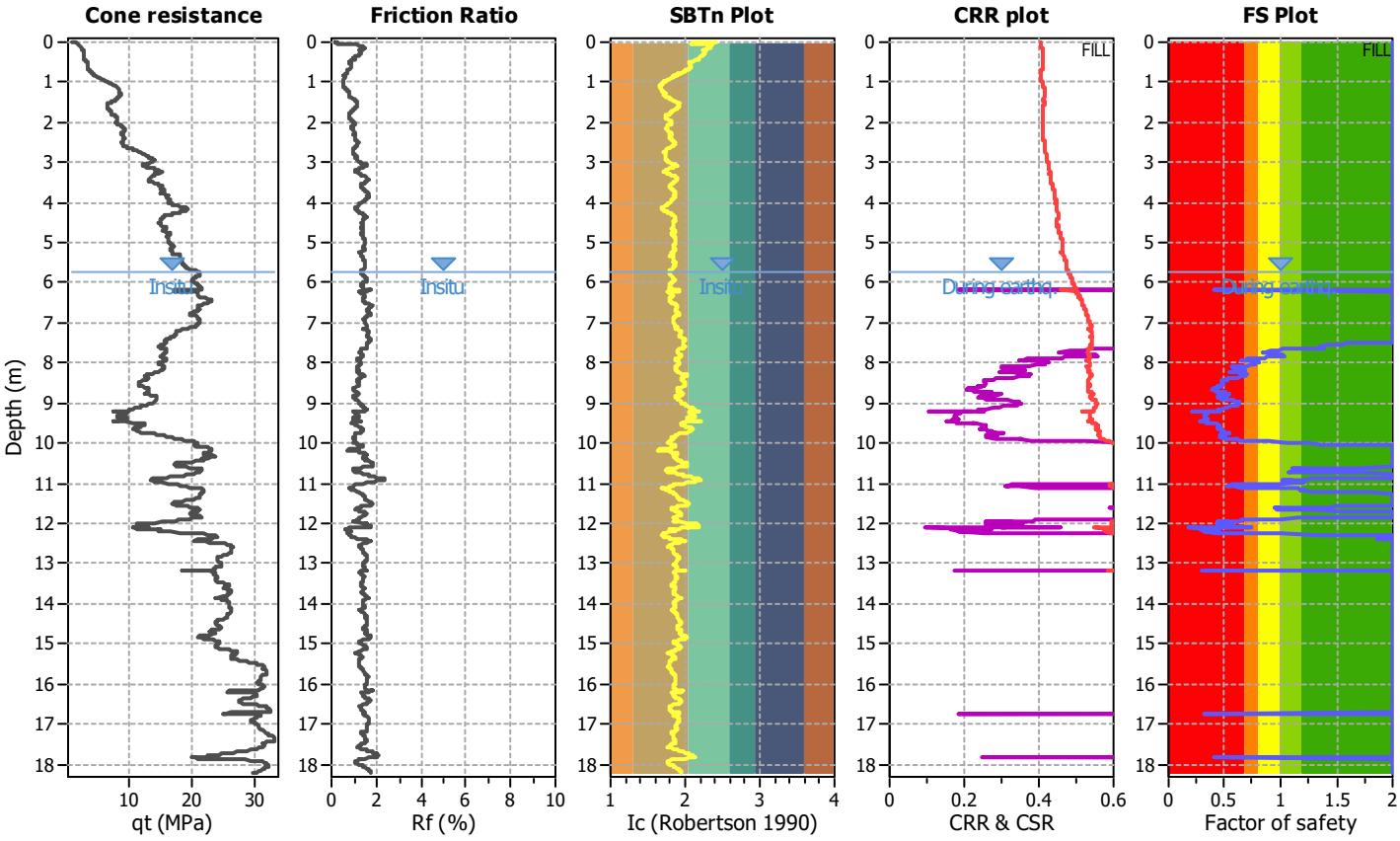
LIQUEFACTION ANALYSIS REPORT

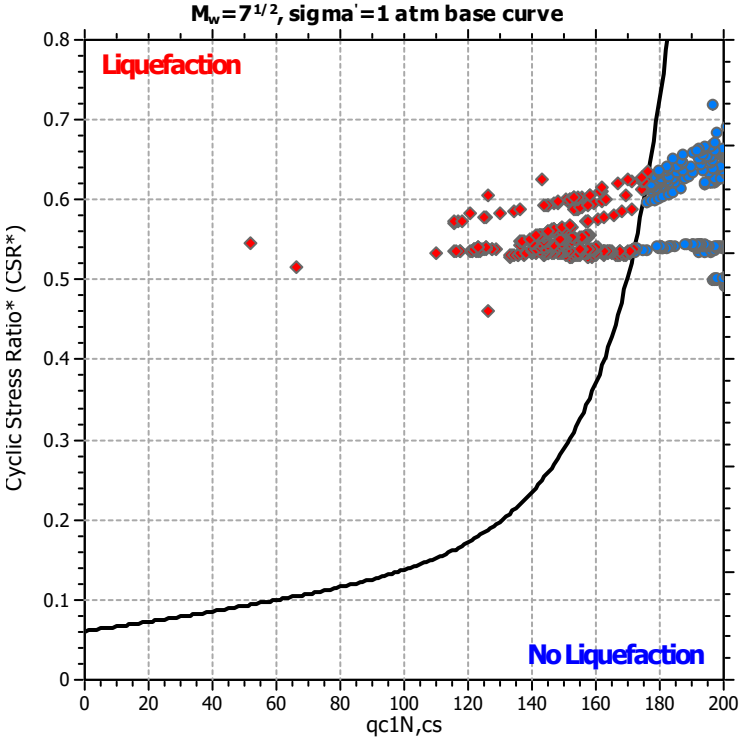
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

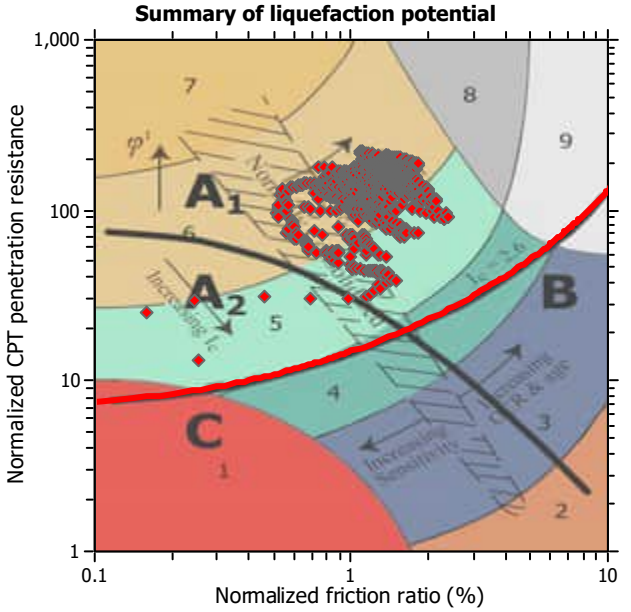
CPT file : CPT06

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.72 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	6.22 m	Fill height:	0.50 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

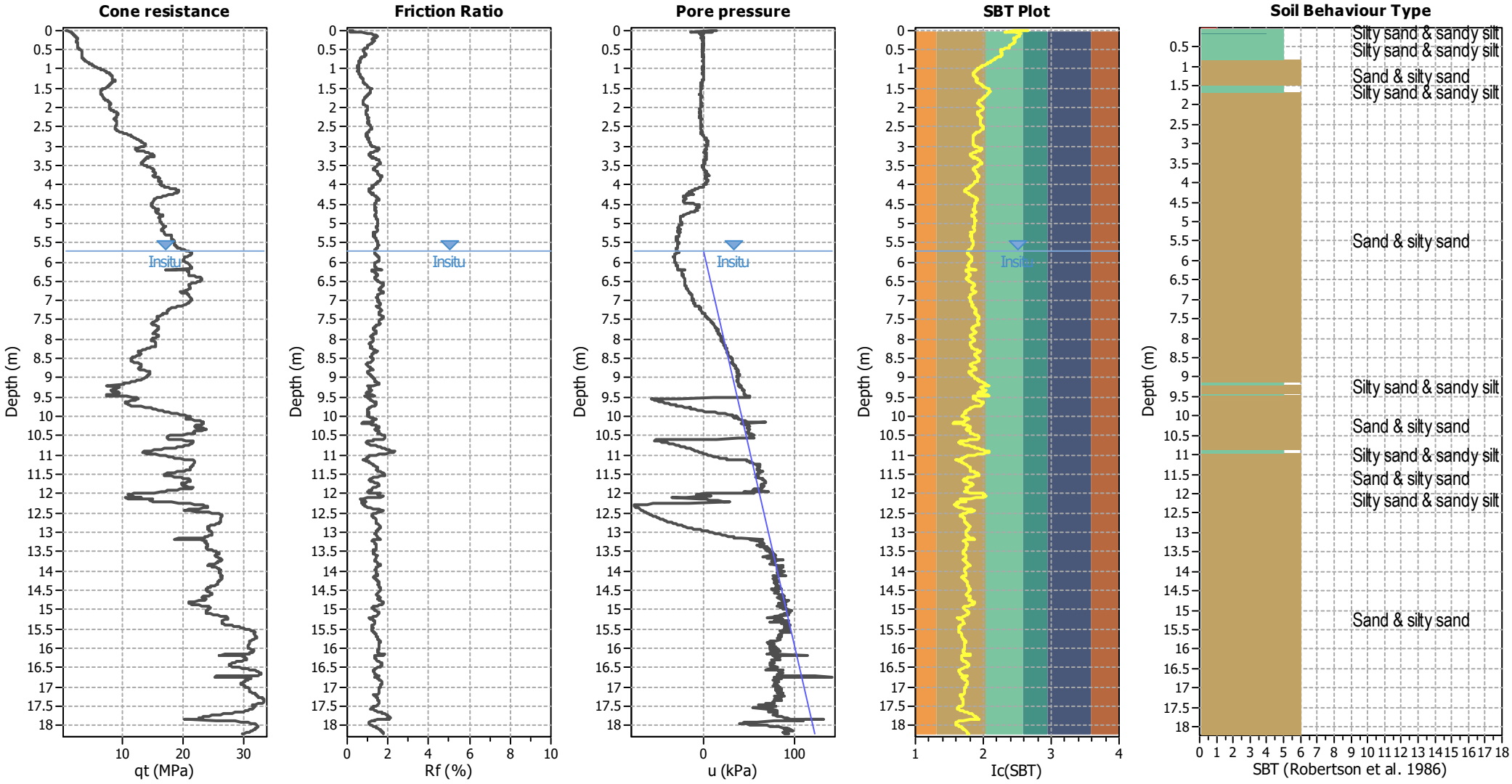






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



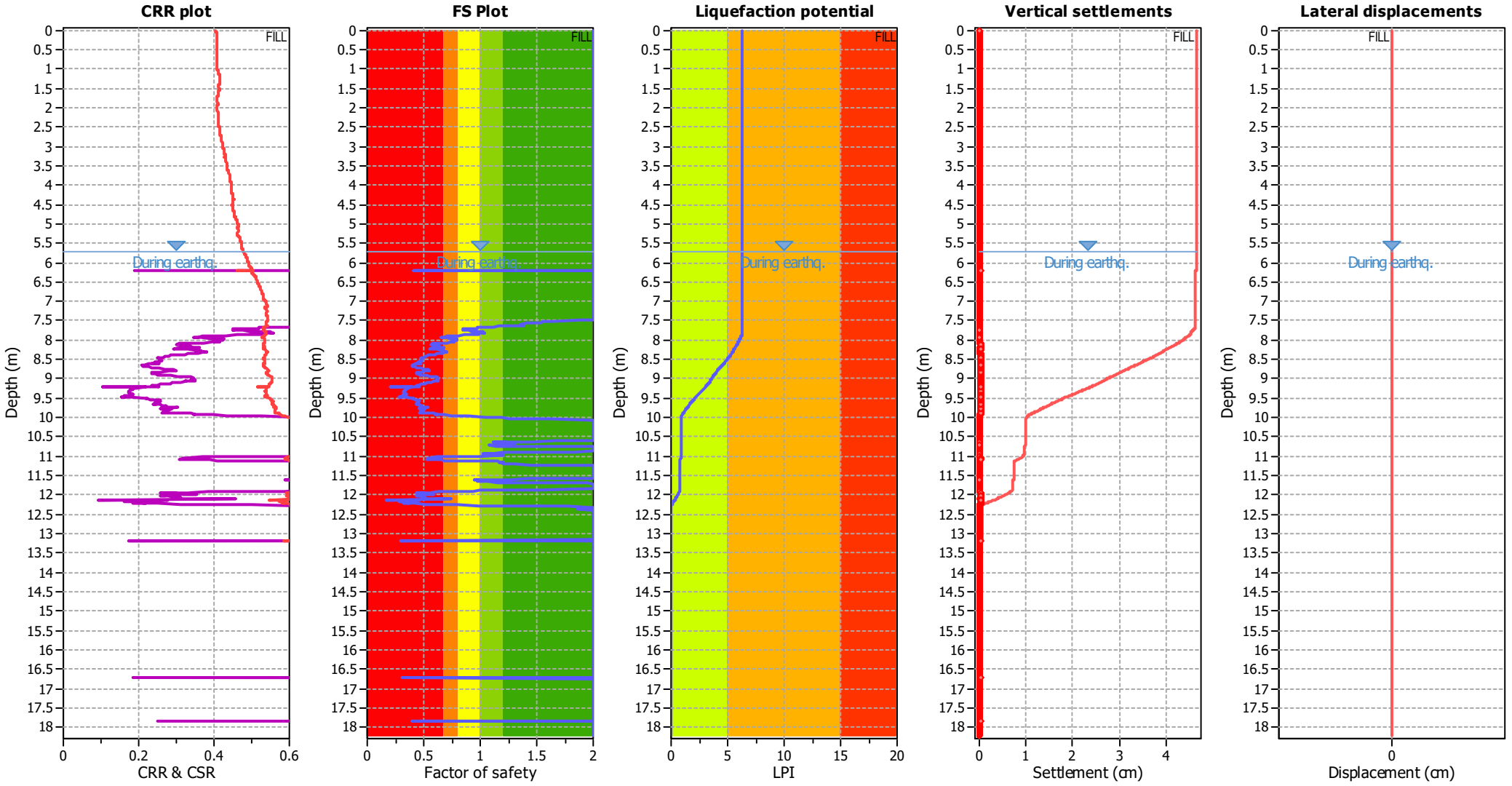
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.72 m	Fill height:	0.50 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.72 m	Fill height:	0.50 m	Limit depth:	N/A

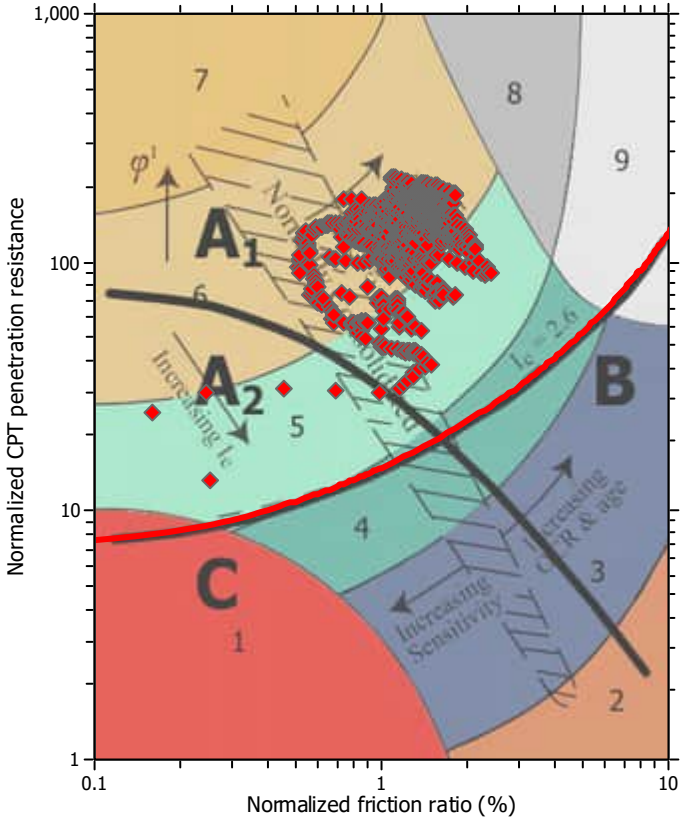
F.S. color scheme

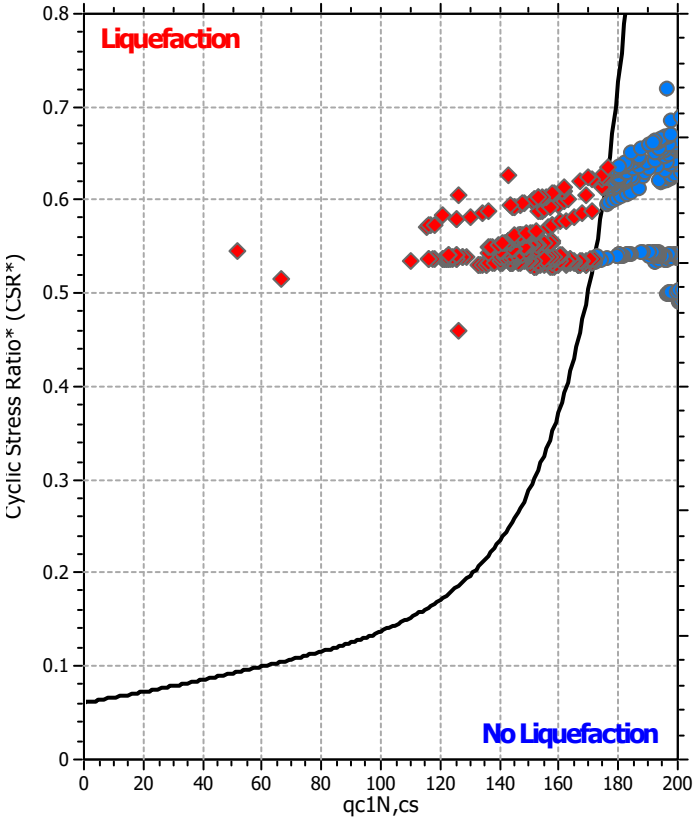
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

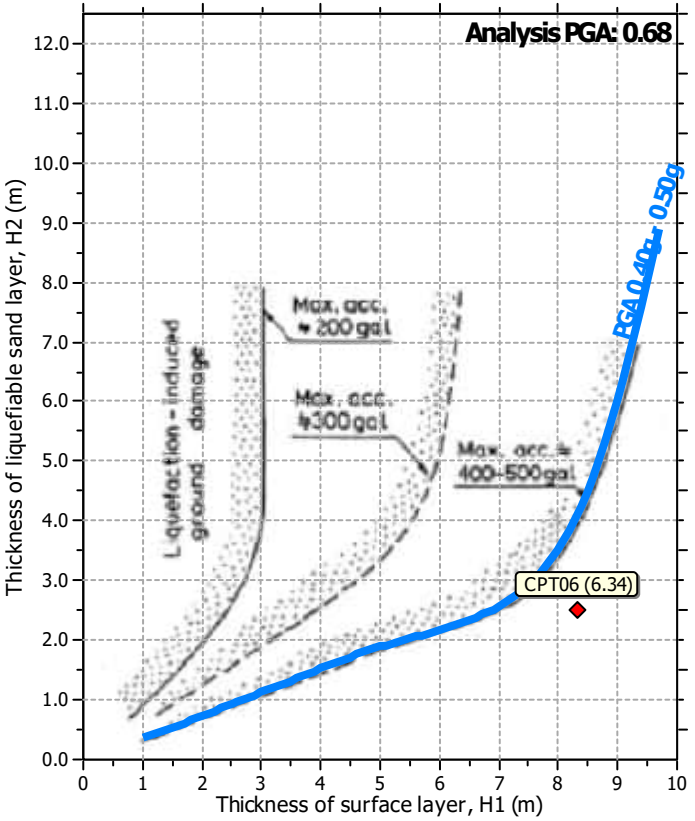
LPI color scheme

- 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.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.72 m	Fill height:	0.50 m	Limit depth:	N/A

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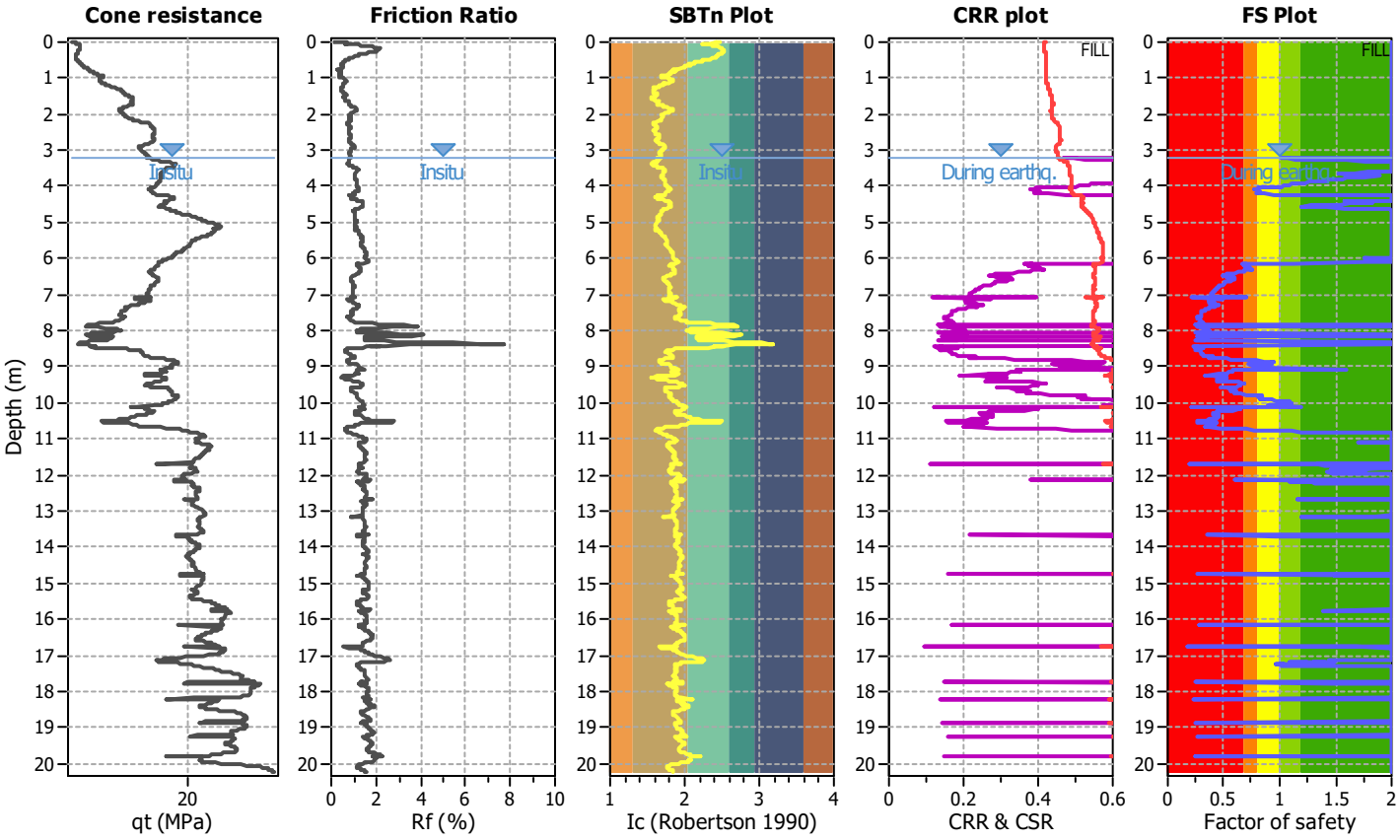
LIQUEFACTION ANALYSIS REPORT

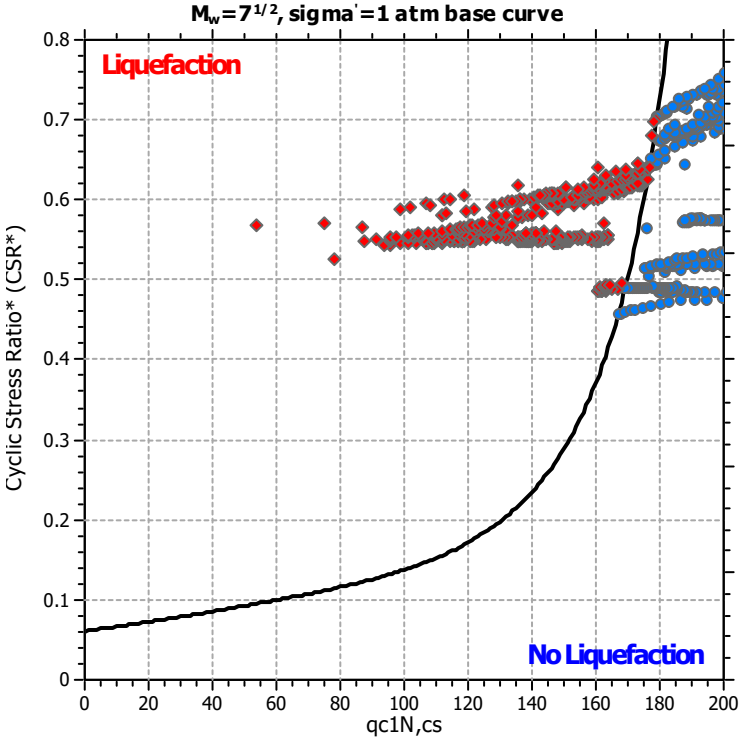
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

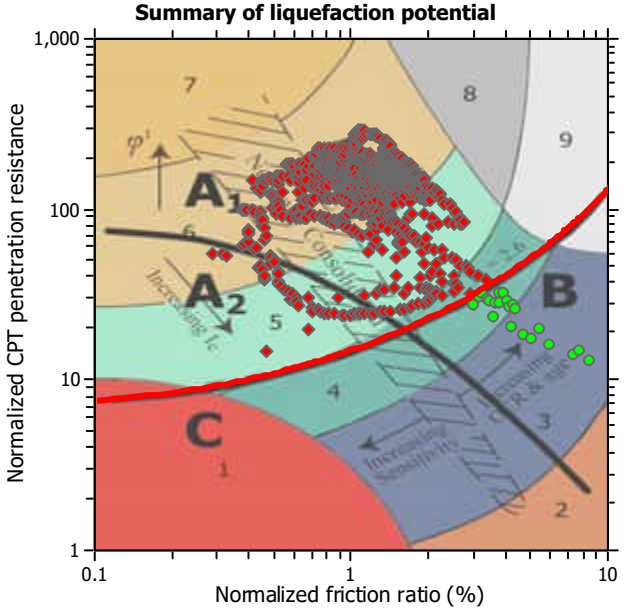
CPT file : CPT07

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.22 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	6.22 m	Fill height:	3.00 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

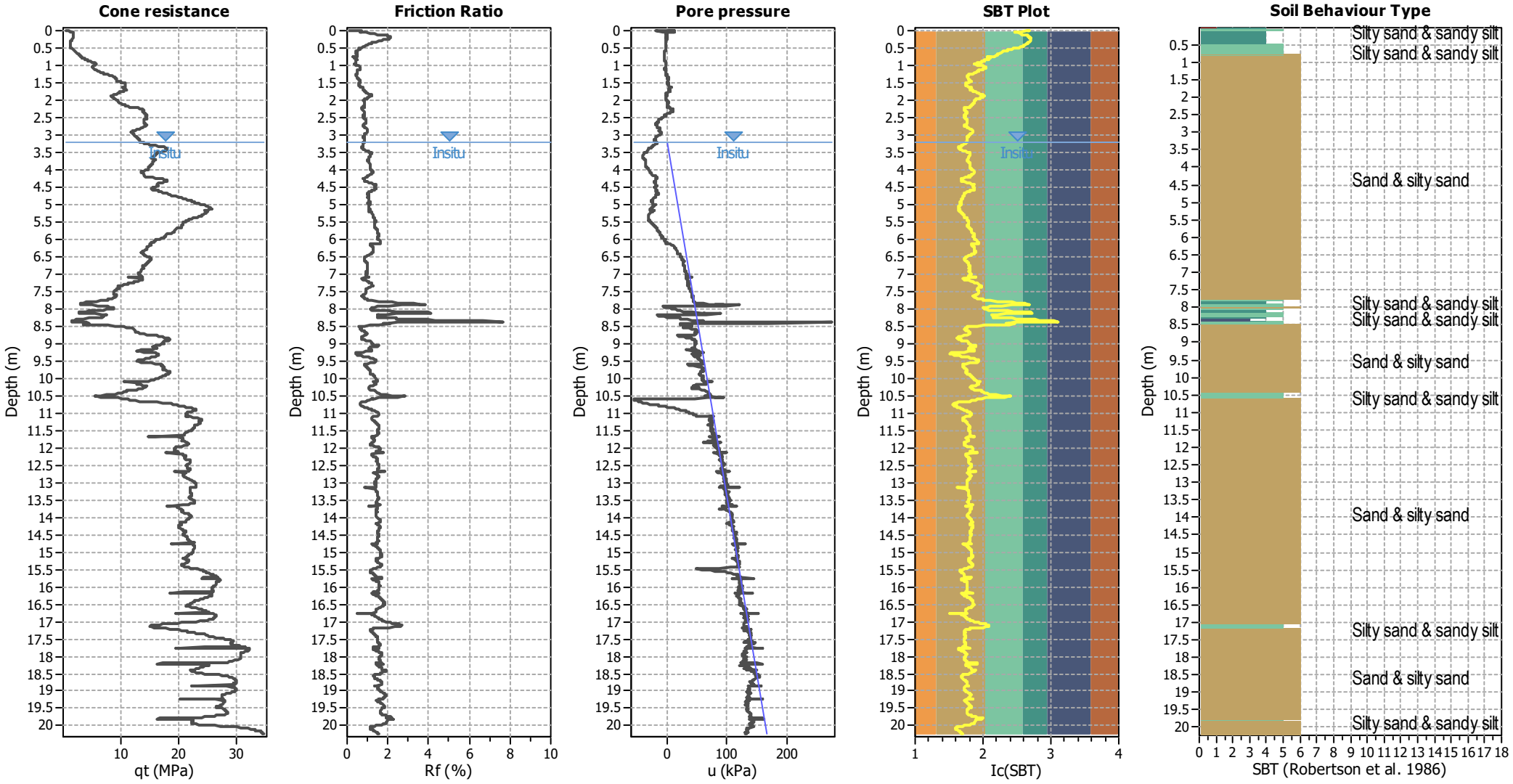






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



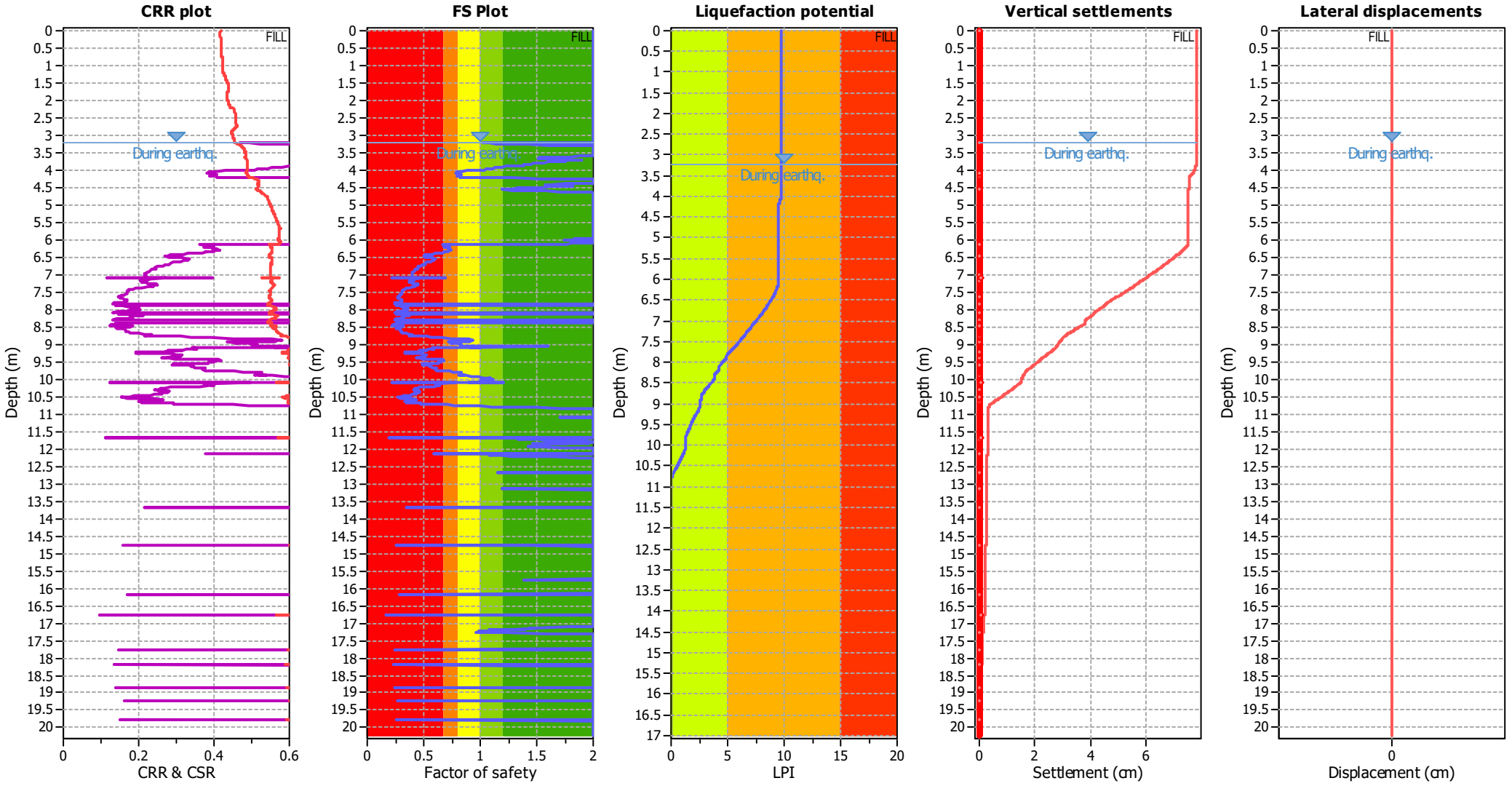
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	3.22 m	Fill height:	3.00 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	3.22 m	Fill height:	3.00 m	Limit depth:	N/A

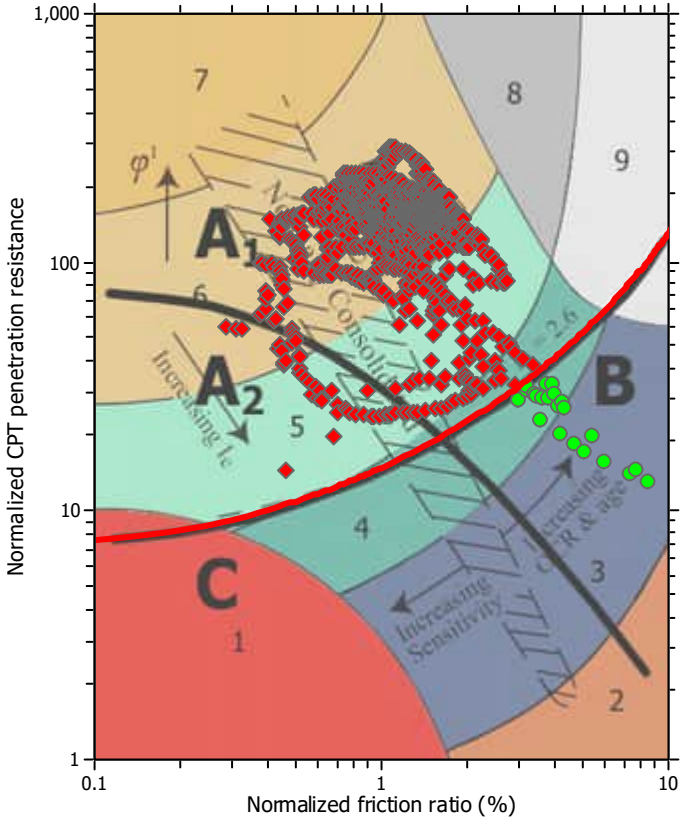
F.S. color scheme

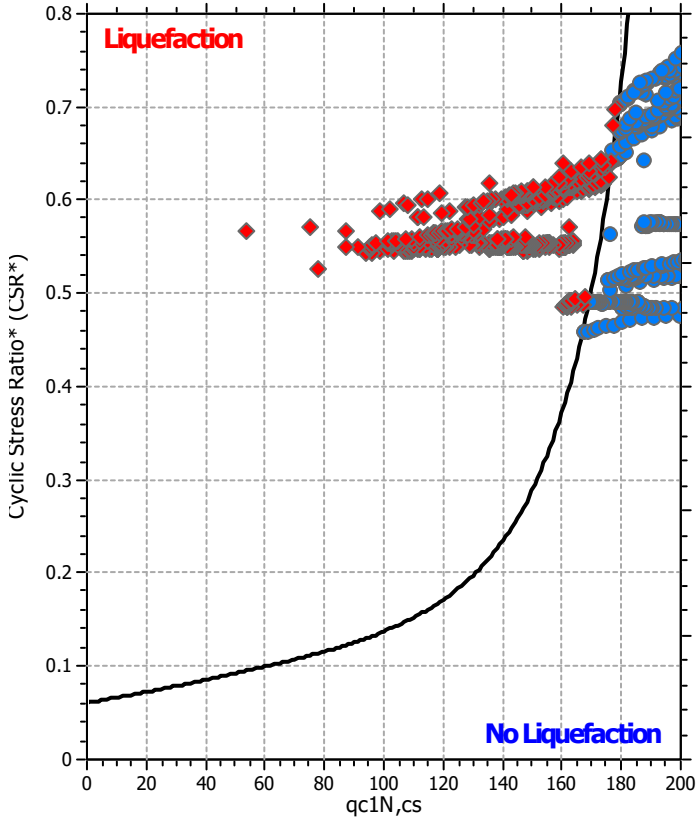
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

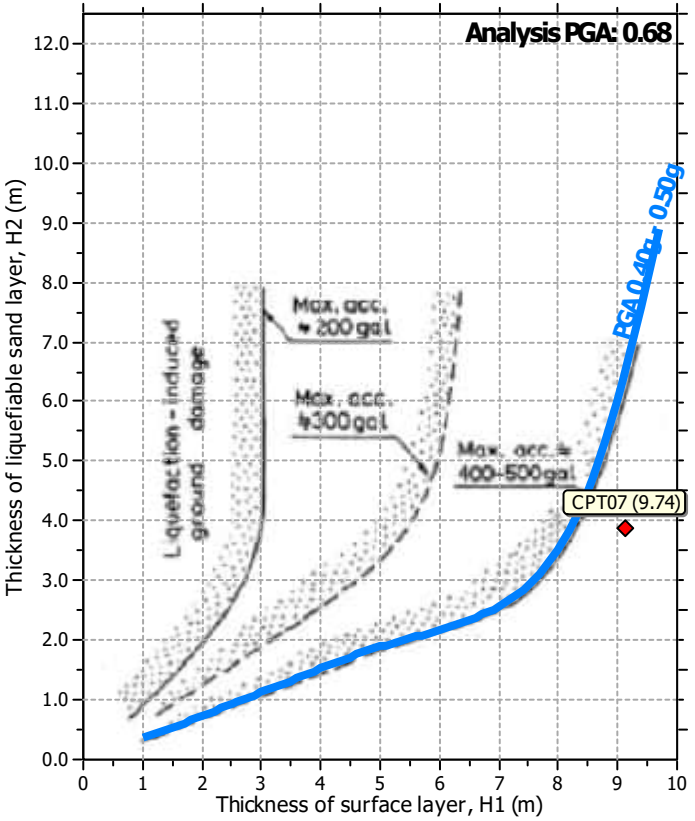
LPI color scheme

- 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.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	3.22 m	Fill height:	3.00 m	Limit depth:	N/A

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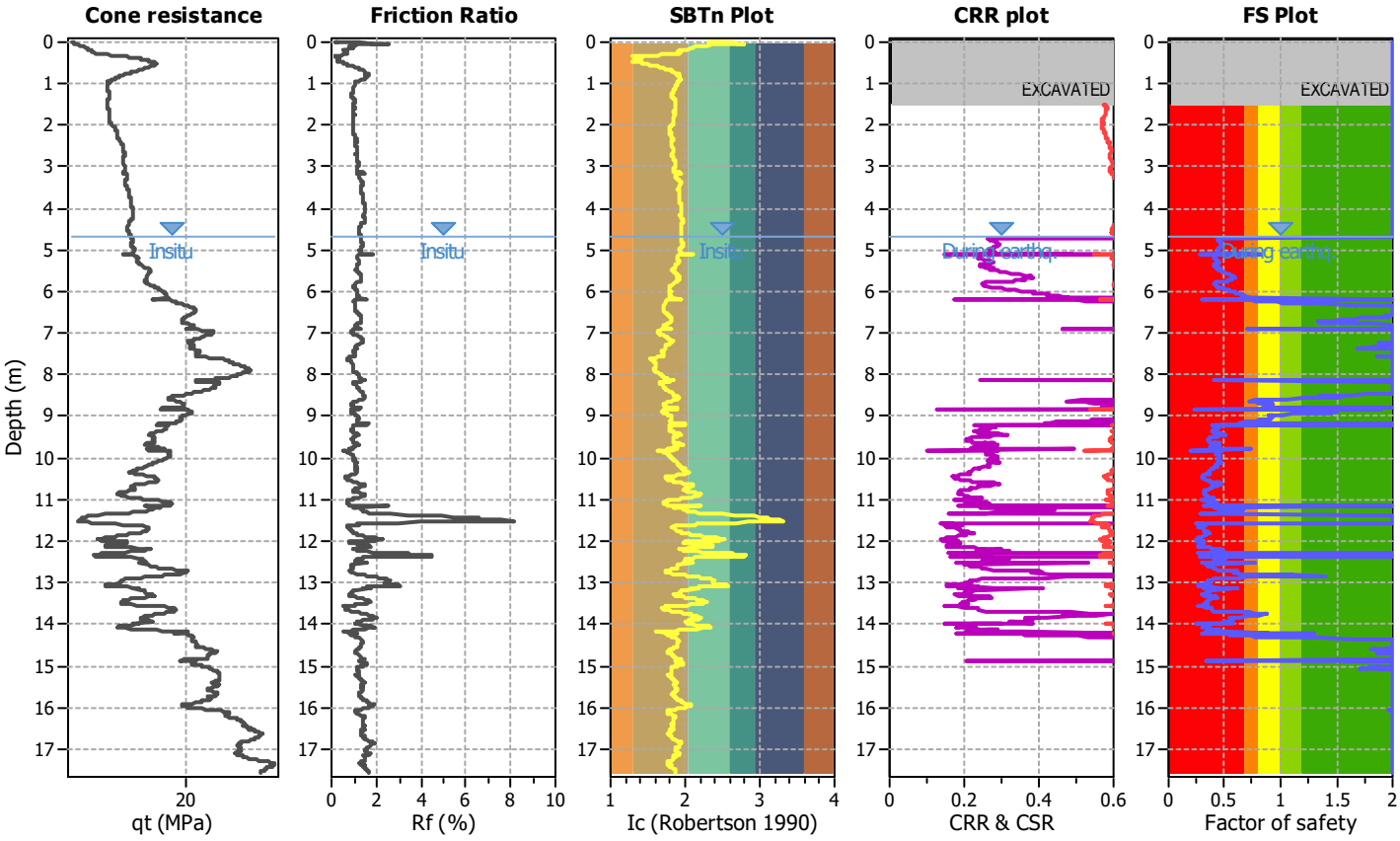
LIQUEFACTION ANALYSIS REPORT

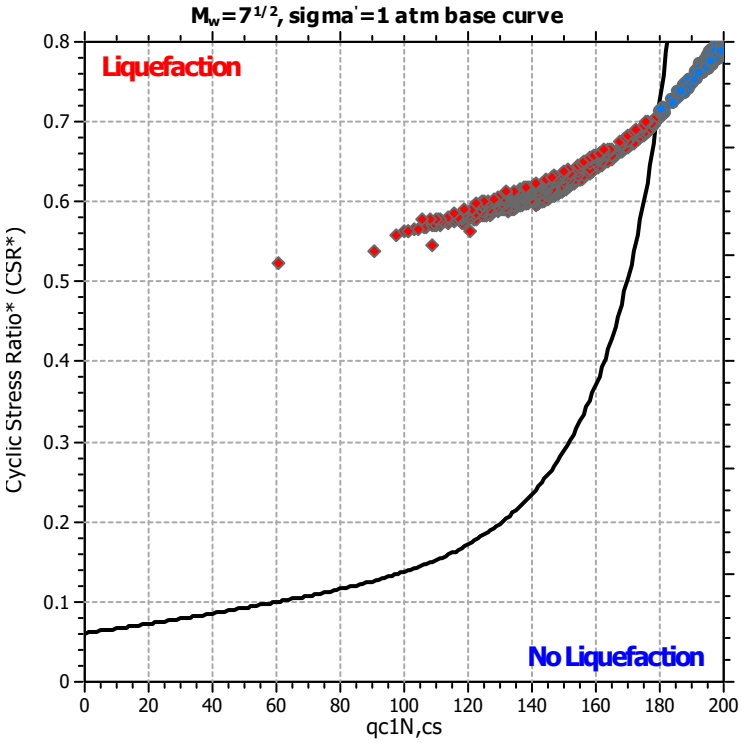
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

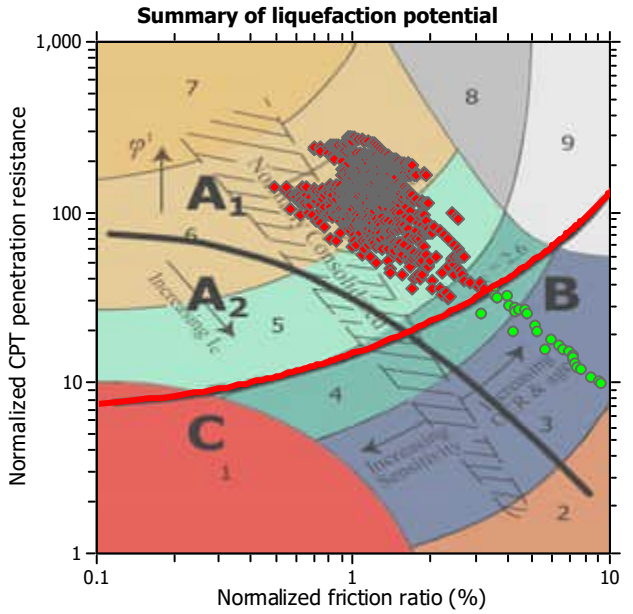
CPT file : CPT08

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	4.70 m	Excavation:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	4.70 m	Excavation depth:	1.50 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Footing load:	500.00 kPa	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

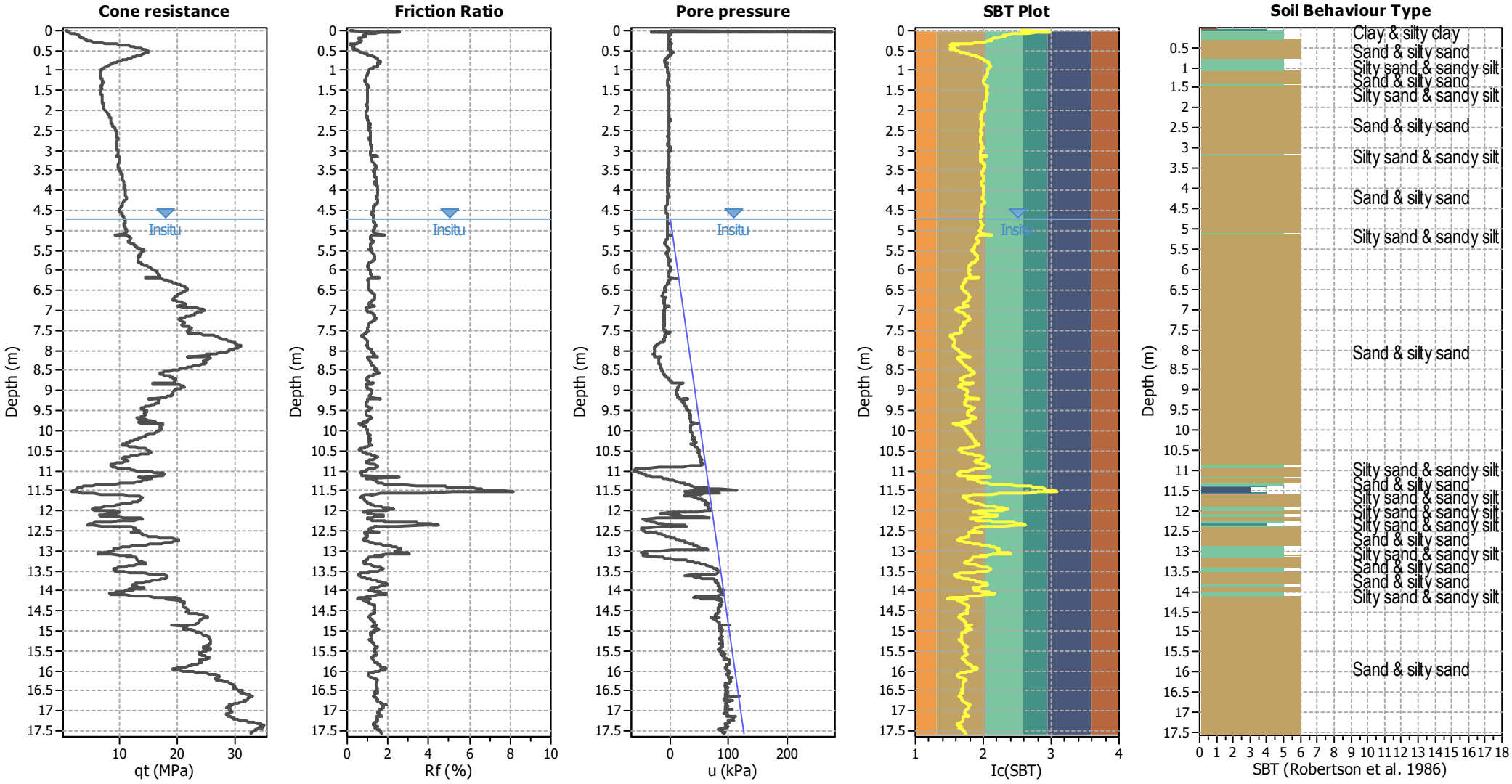






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



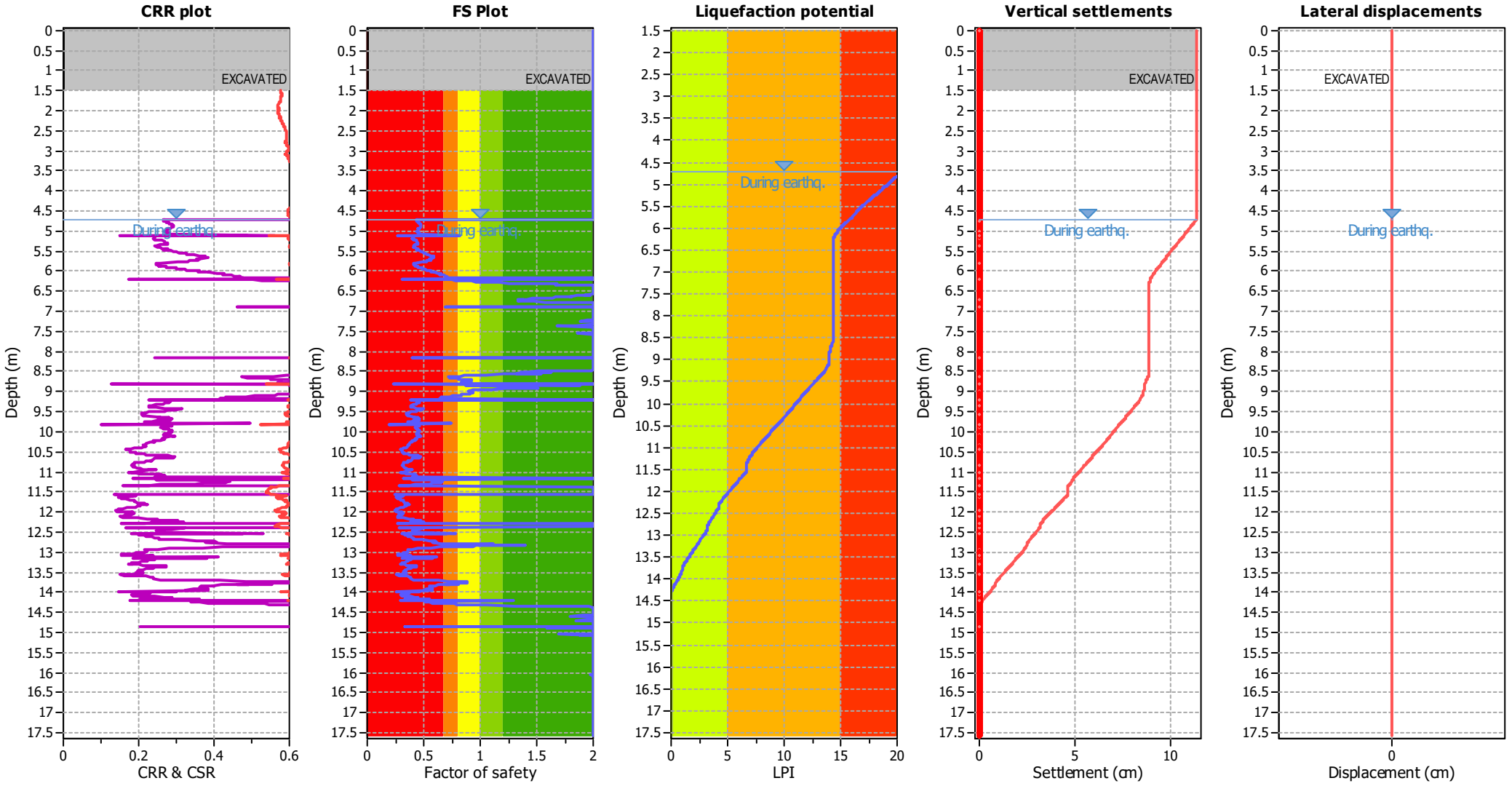
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	4.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	4.70 m	Excavation depth:	1.50 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	4.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	4.70 m	Excavation depth:	1.50 m	Limit depth:	N/A

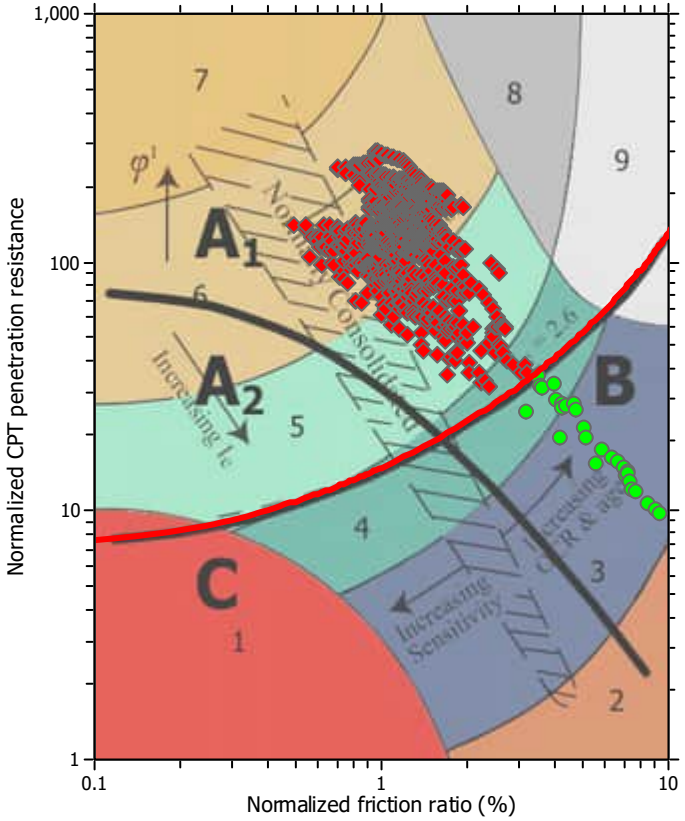
F.S. color scheme

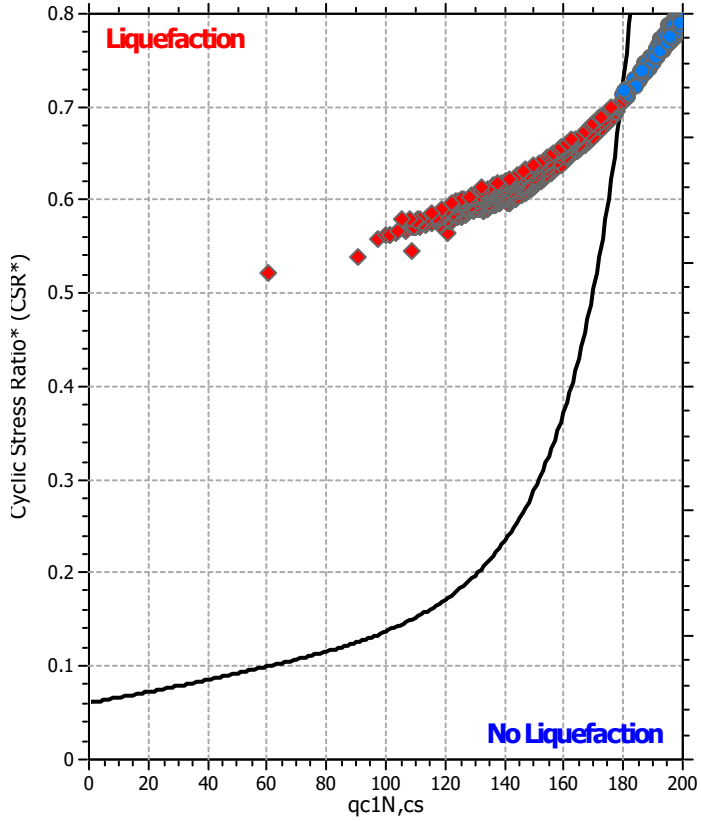
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

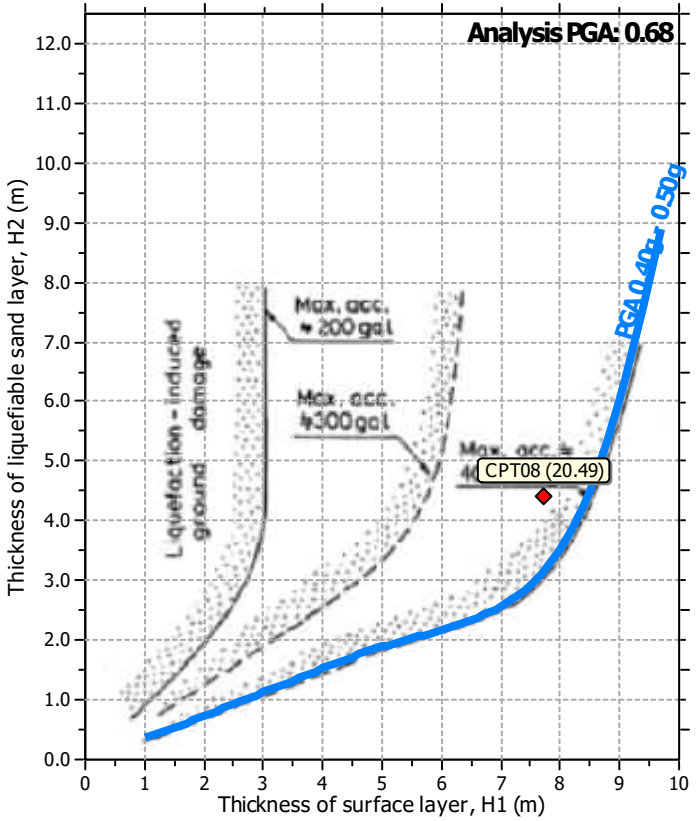
LPI color scheme

- 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.):	4.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	4.70 m	Excavation depth:	1.50 m	Limit depth:	N/A

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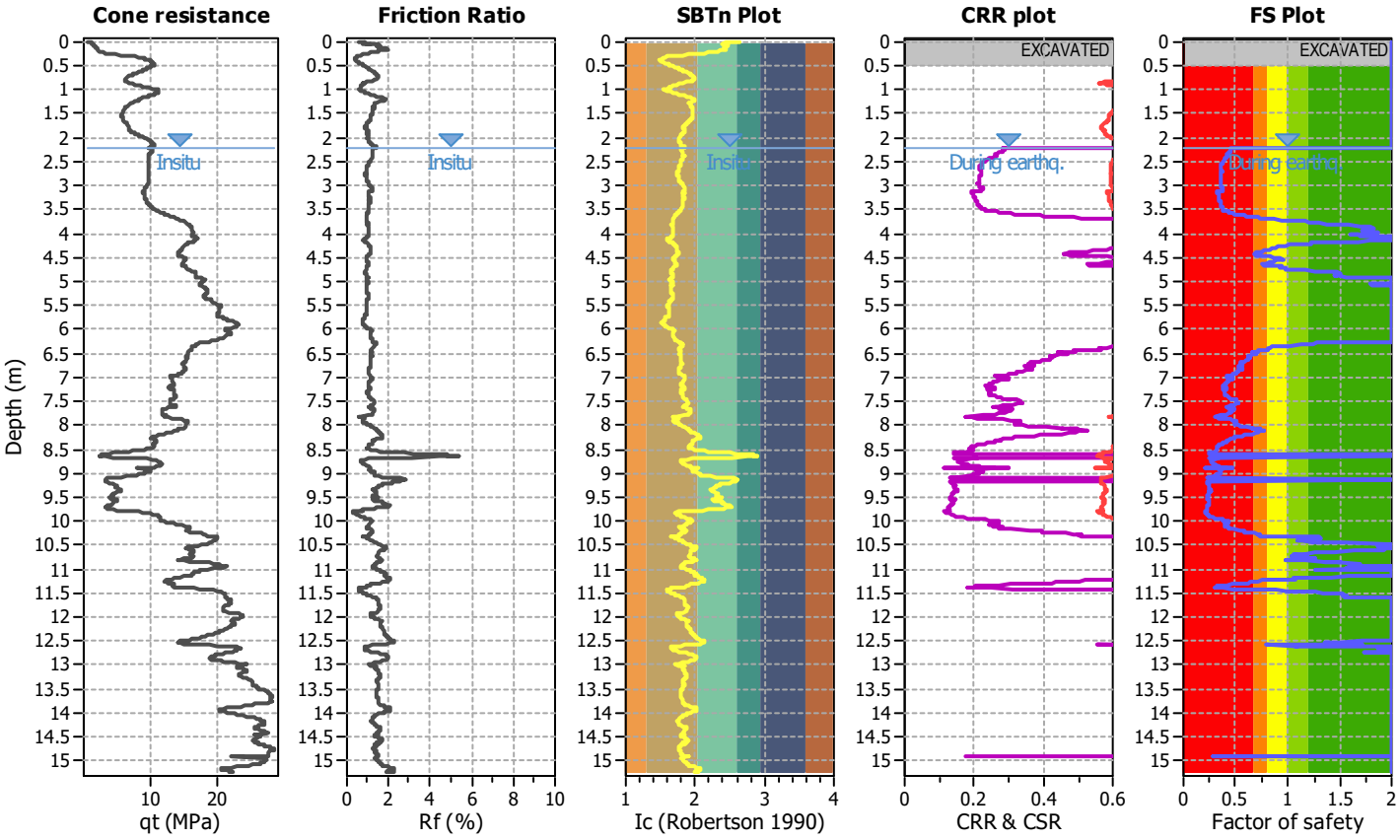
LIQUEFACTION ANALYSIS REPORT

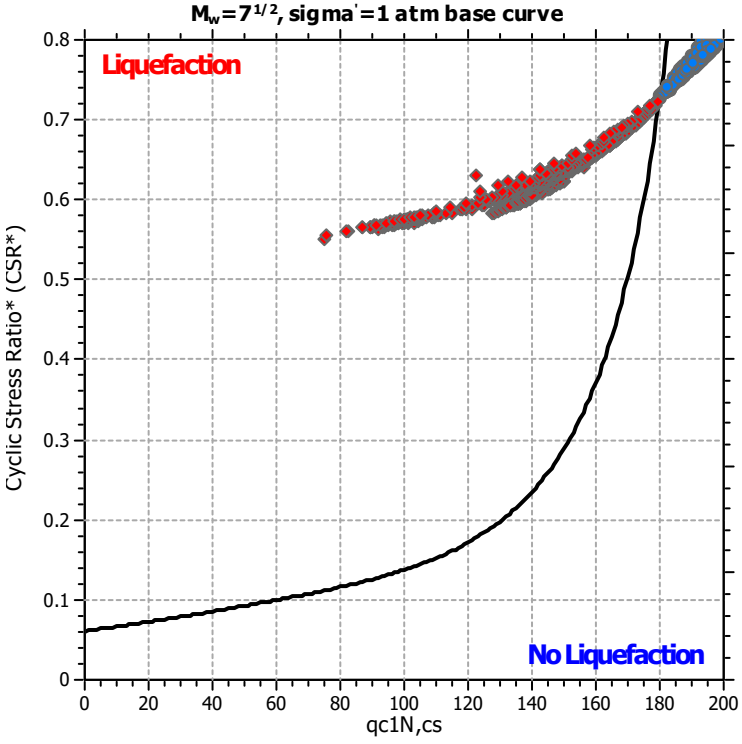
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

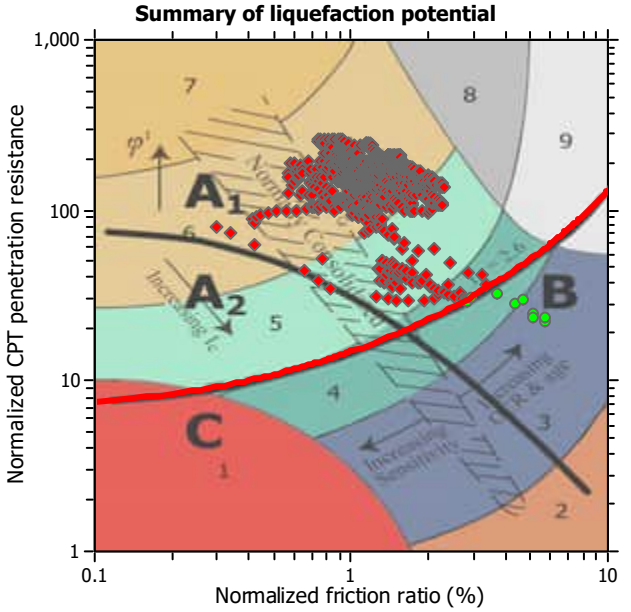
CPT file : CPT09

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.20 m	Excavation:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.20 m	Excavation depth:	0.50 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Footing load:	500.00 kPa	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

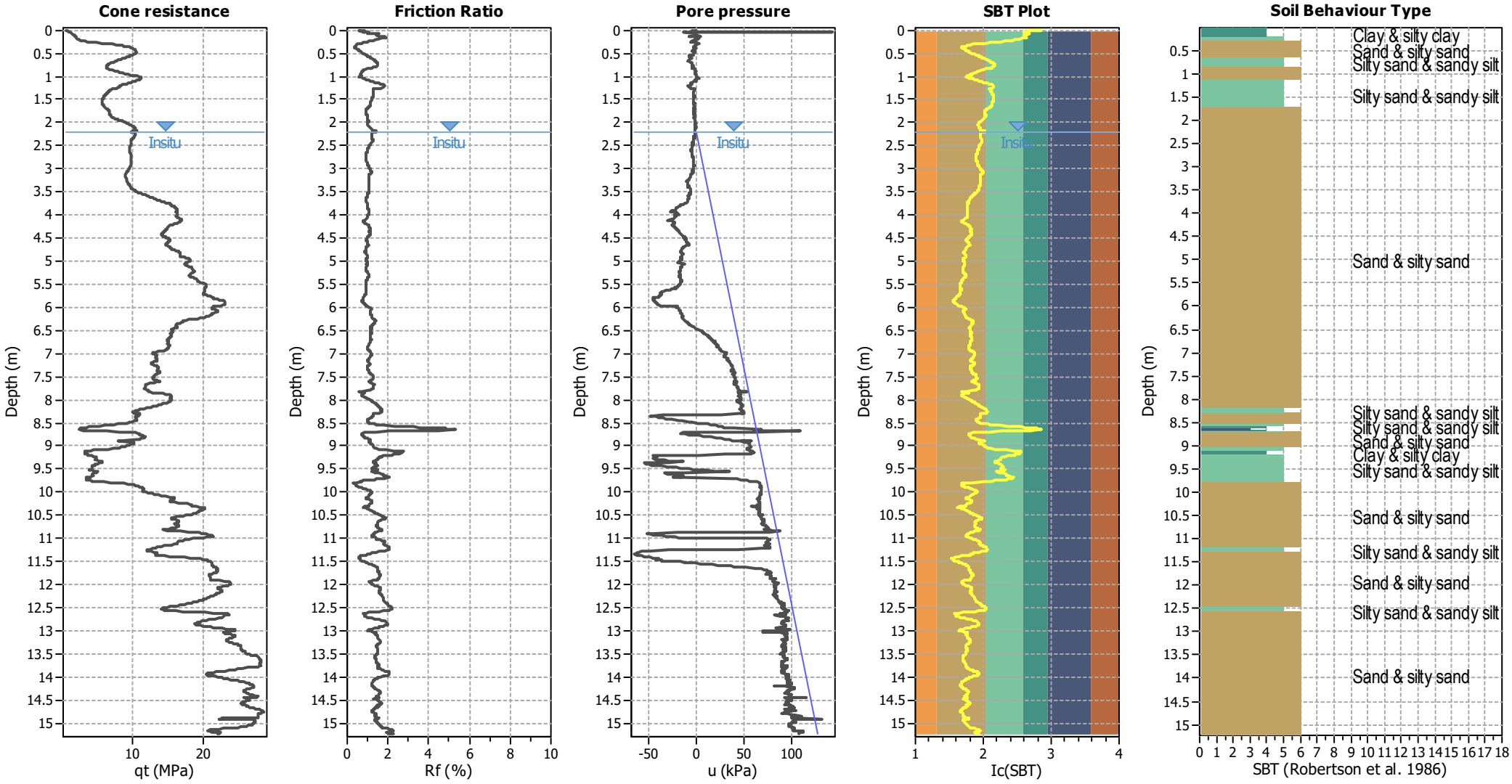






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



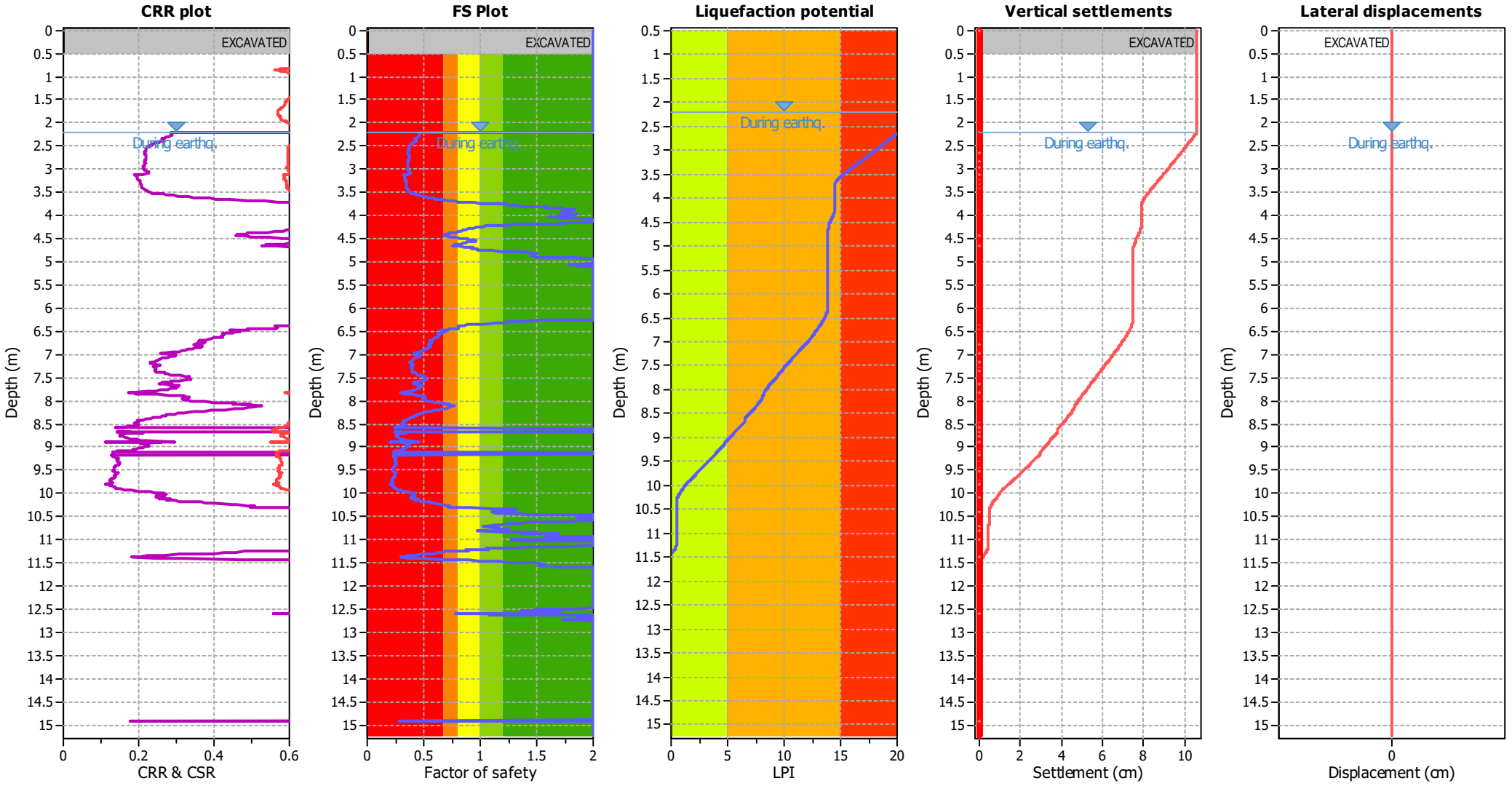
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	2.20 m	Excavation depth:	0.50 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	2.20 m	Excavation depth:	0.50 m	Limit depth:	N/A

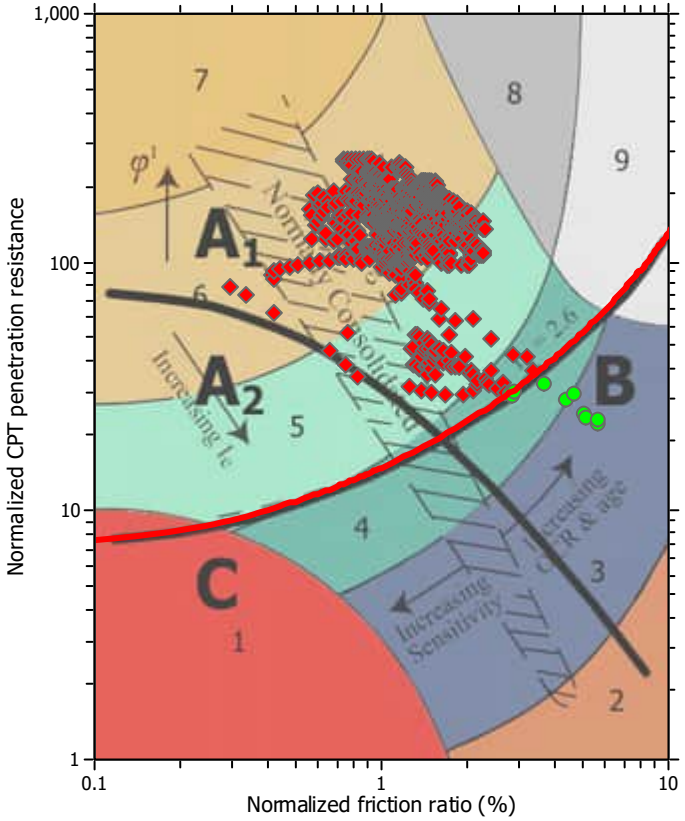
F.S. color scheme

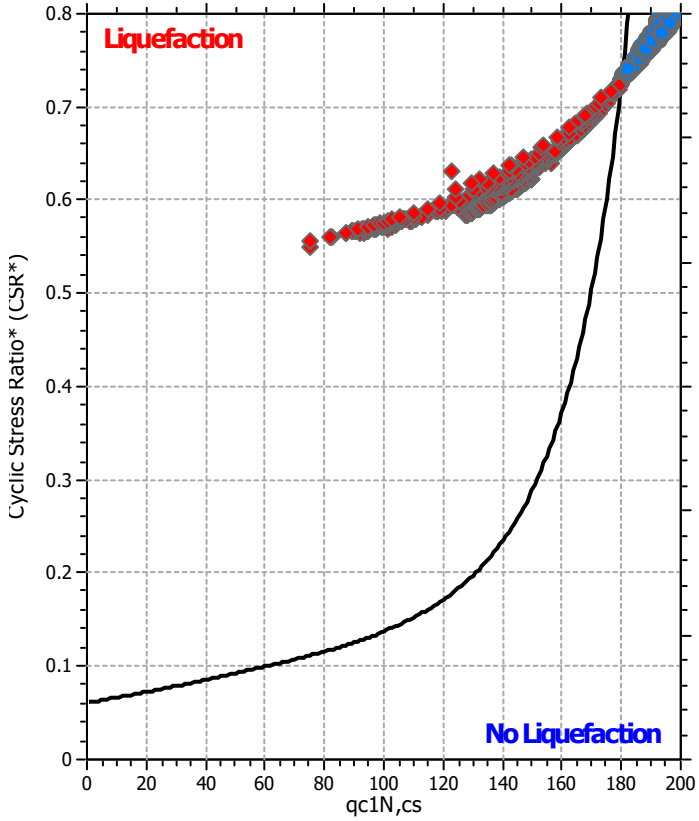
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

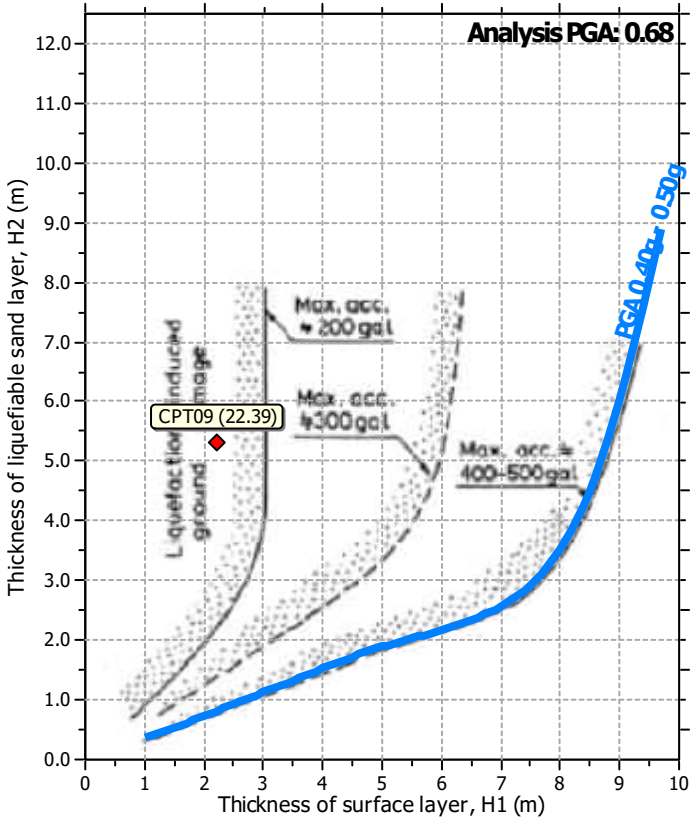
LPI color scheme

- 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.):	2.20 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	2.20 m	Excavation depth:	0.50 m	Limit depth:	N/A

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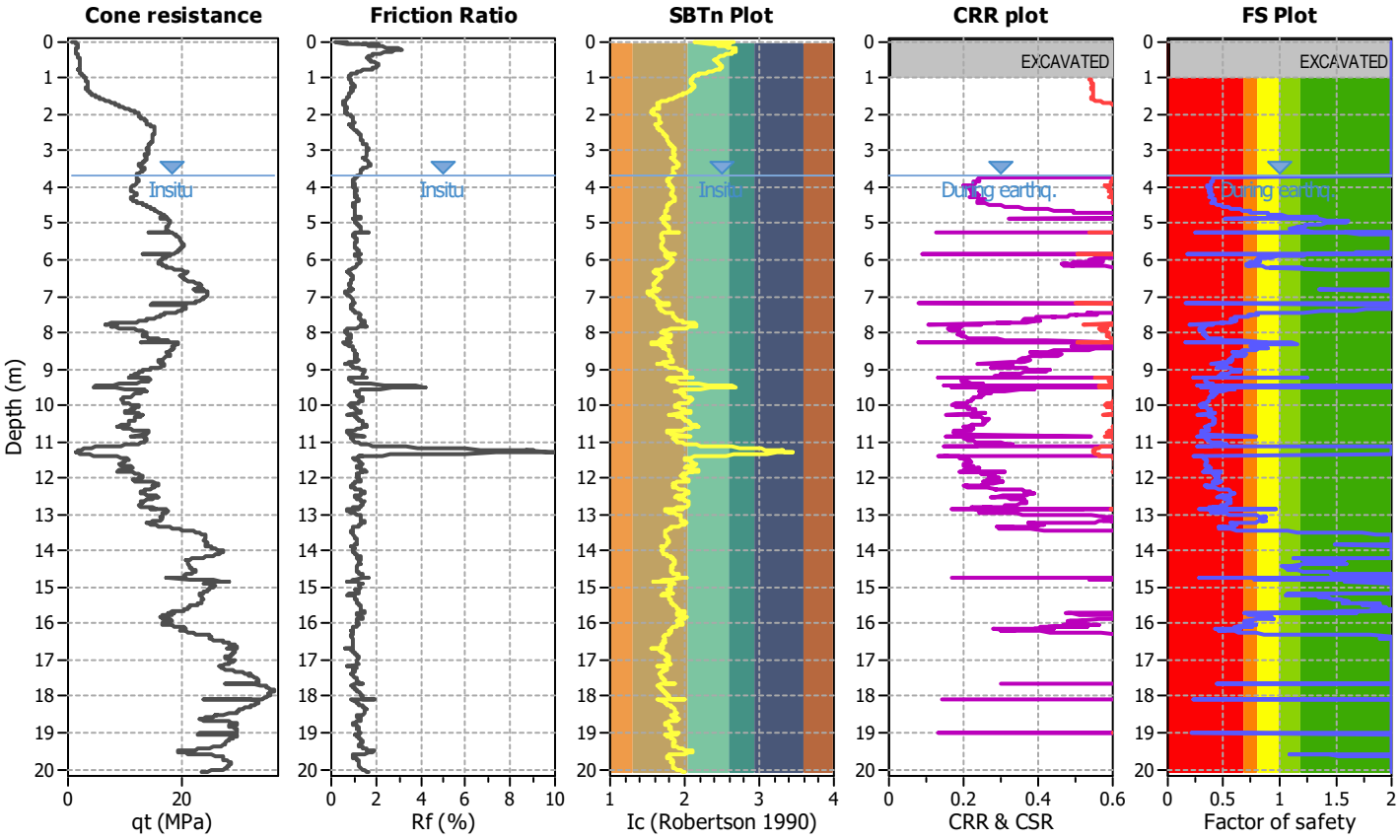
LIQUEFACTION ANALYSIS REPORT

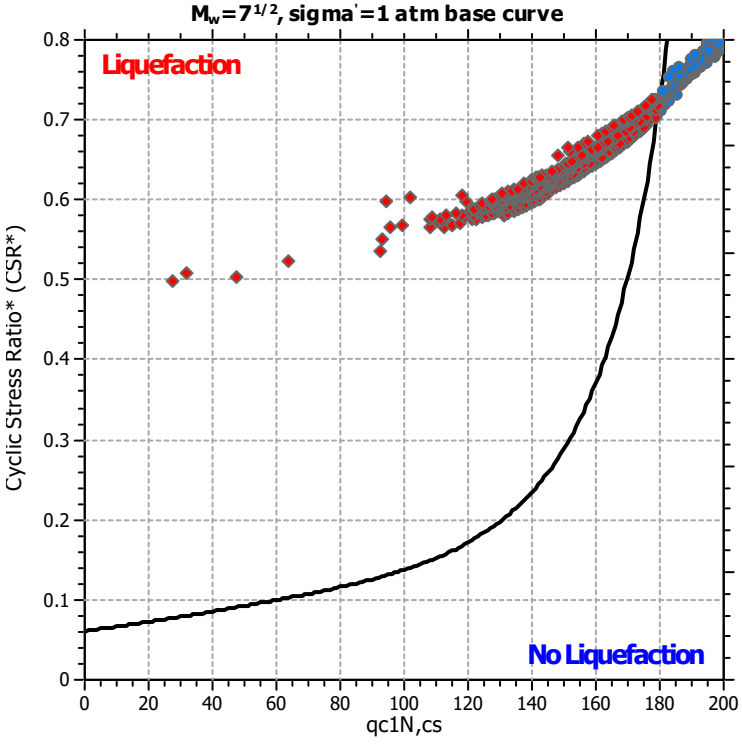
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

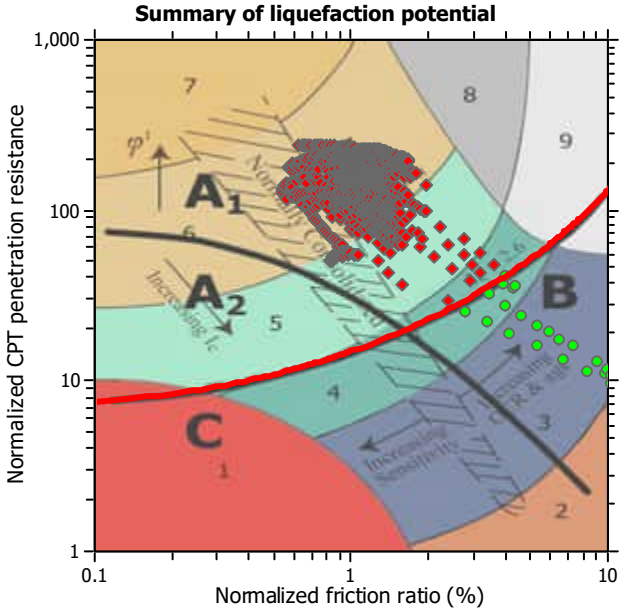
CPT file : CPT10

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.70 m	Excavation:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	3.70 m	Excavation depth:	1.00 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Footing load:	500.00 kPa	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

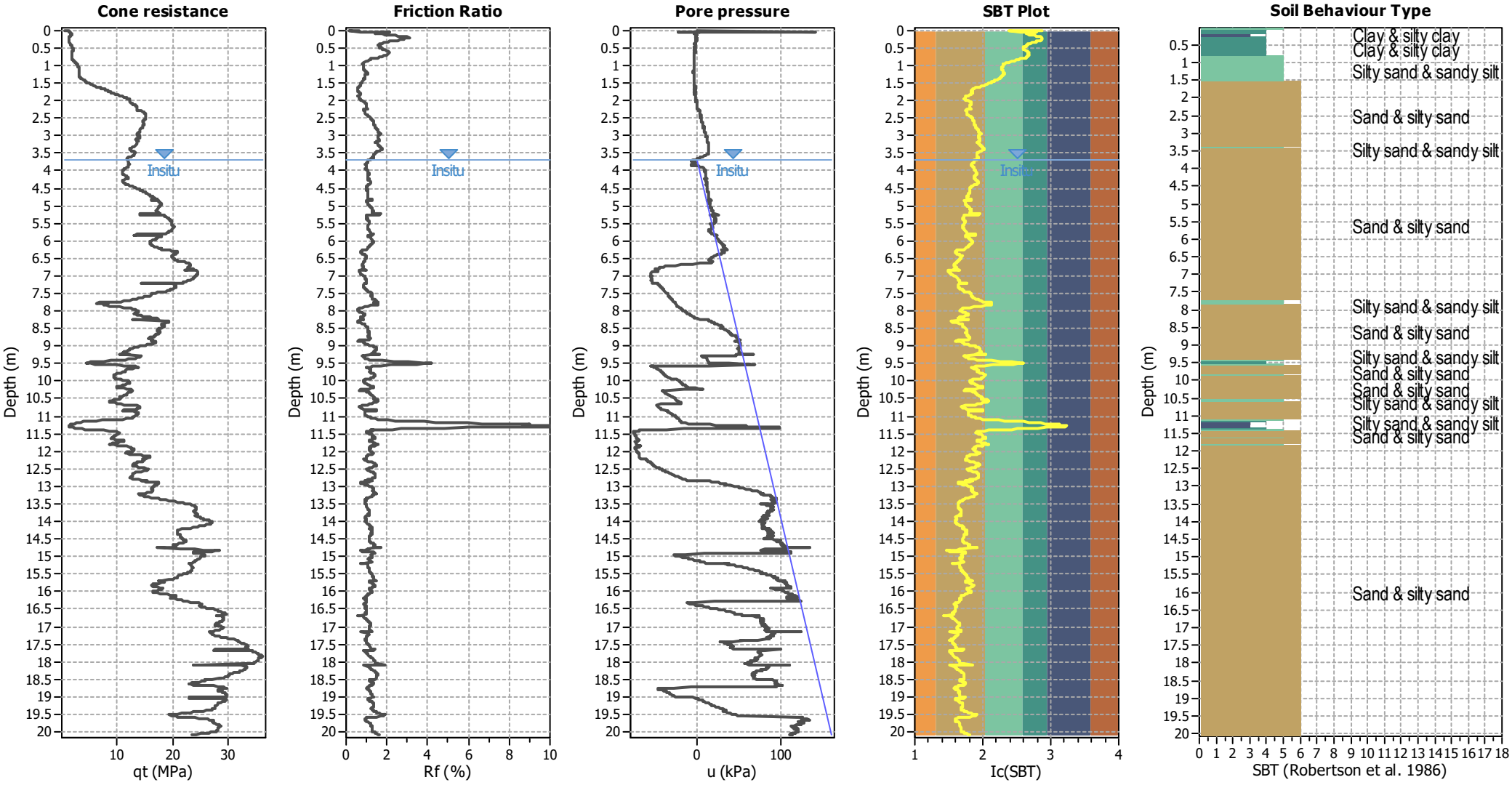






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



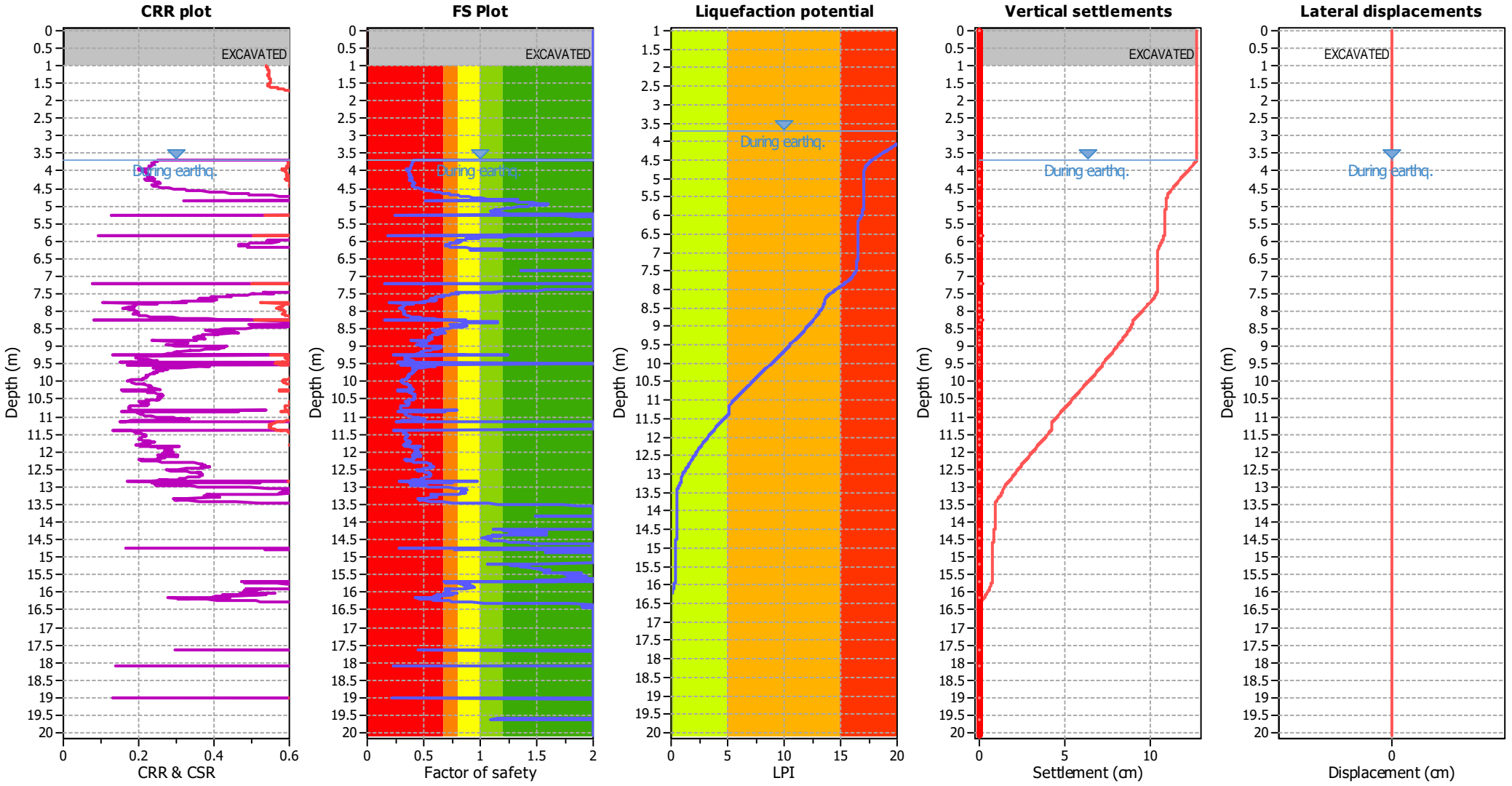
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	3.70 m	Excavation depth:	1.00 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	3.70 m	Excavation depth:	1.00 m	Limit depth:	N/A

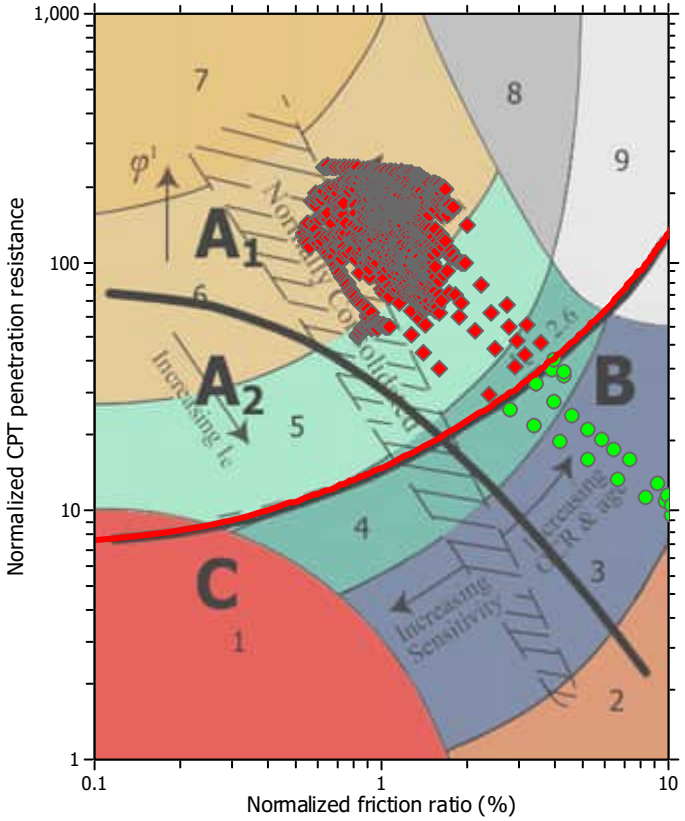
F.S. color scheme

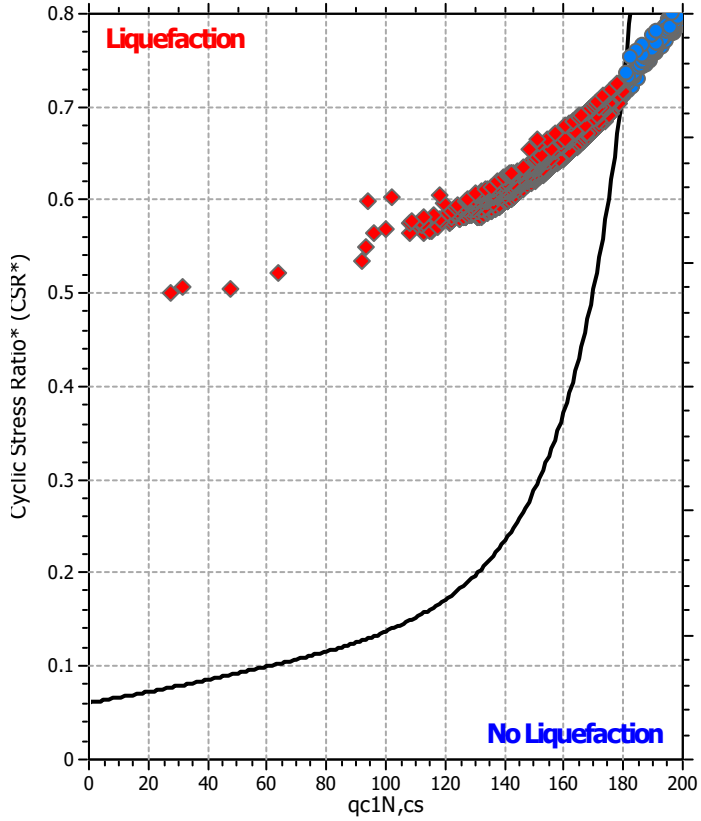
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

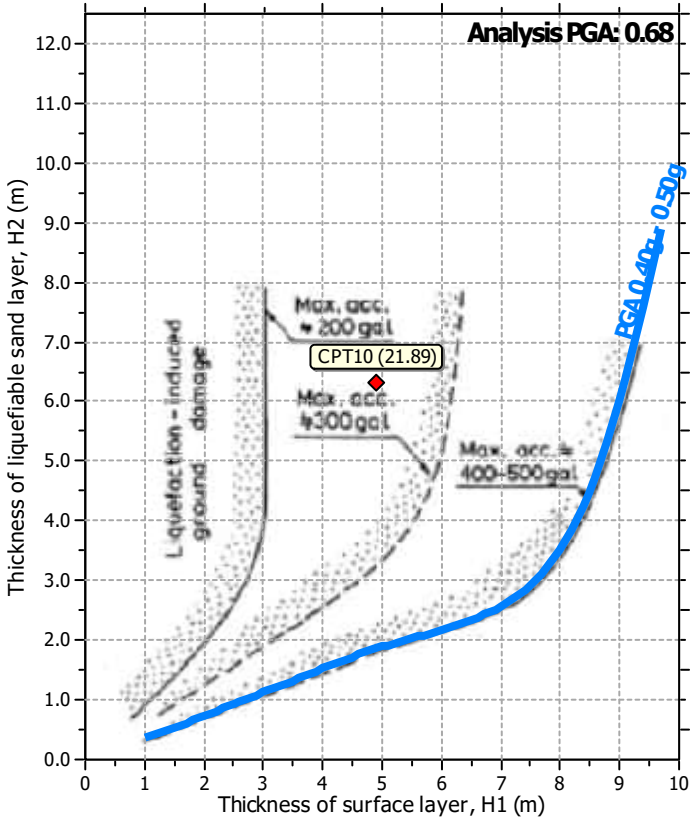
LPI color scheme

- 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.):	3.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	3.70 m	Excavation depth:	1.00 m	Limit depth:	N/A

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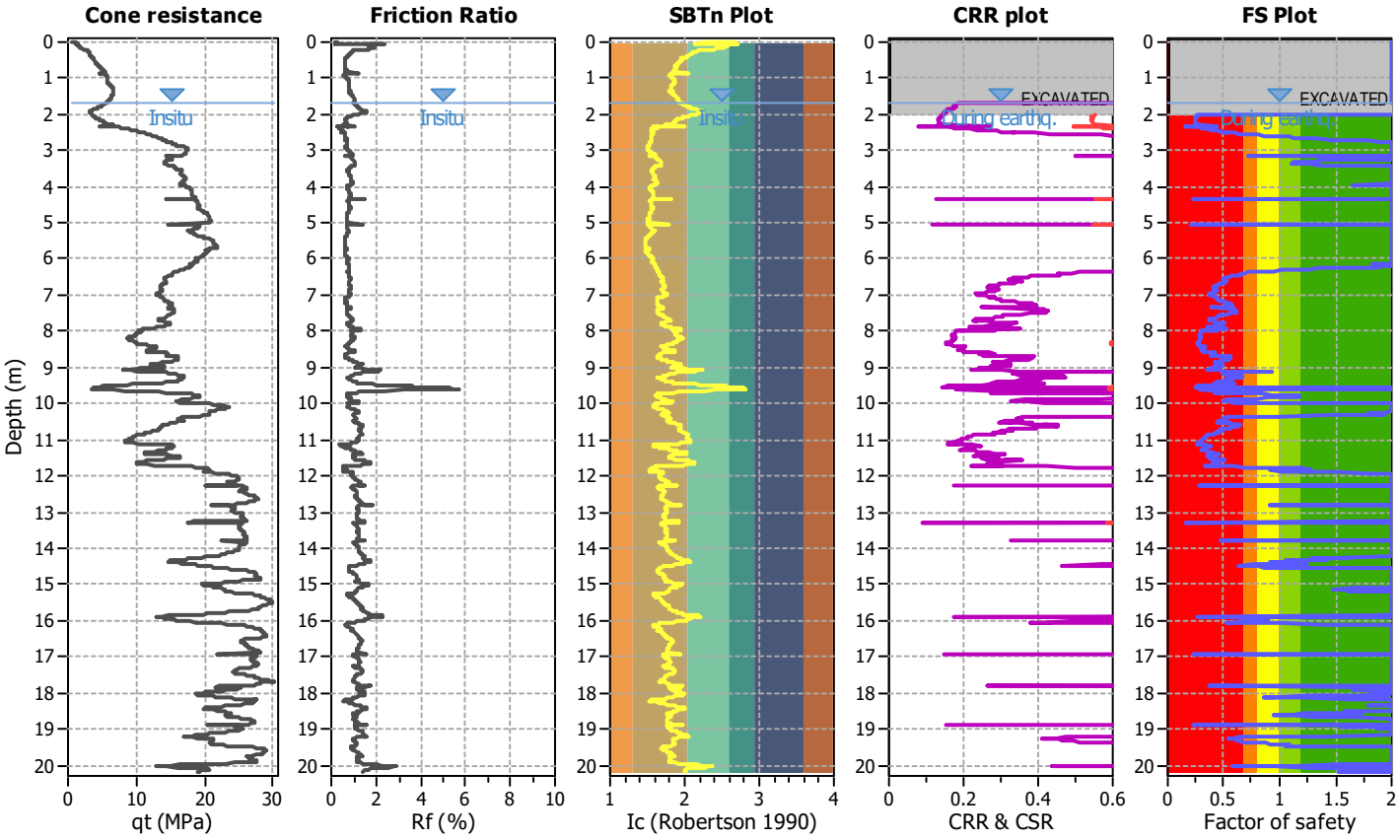
LIQUEFACTION ANALYSIS REPORT

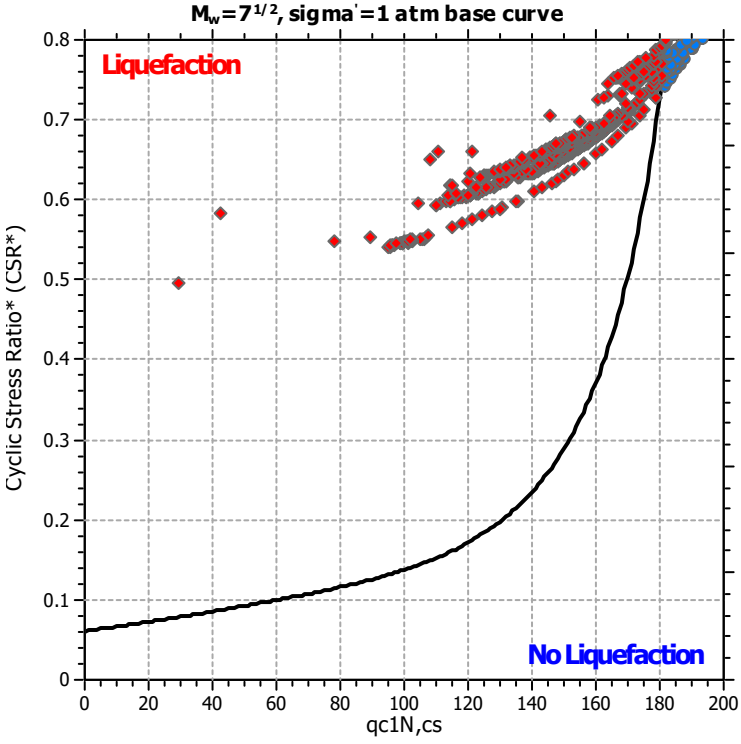
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

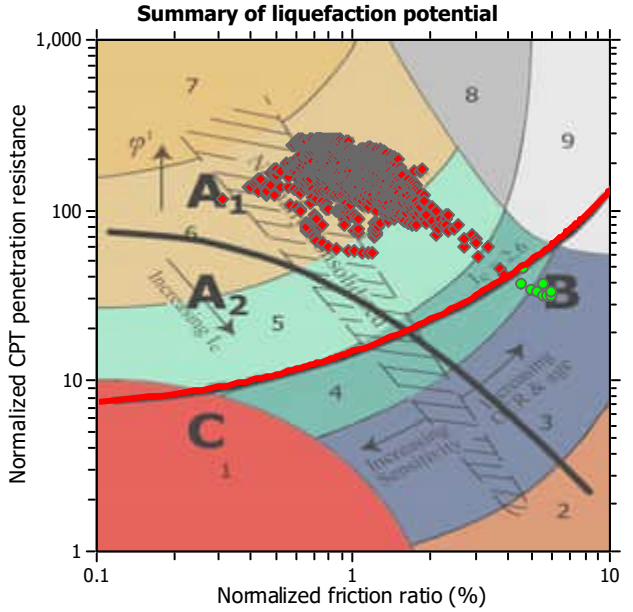
CPT file : CPT11

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Excavation:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Excavation depth:	2.00 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Footing load:	500.00 kPa	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

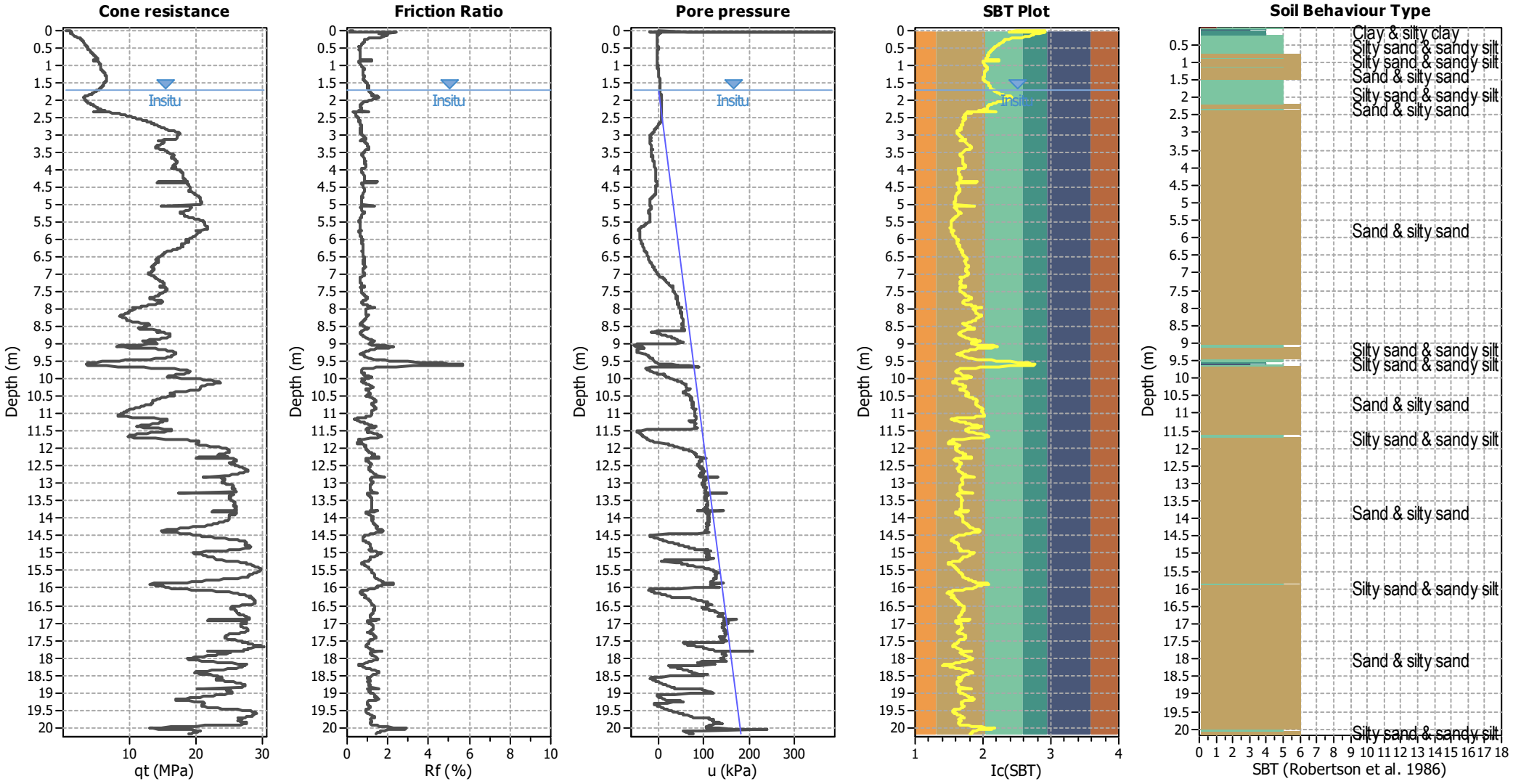






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



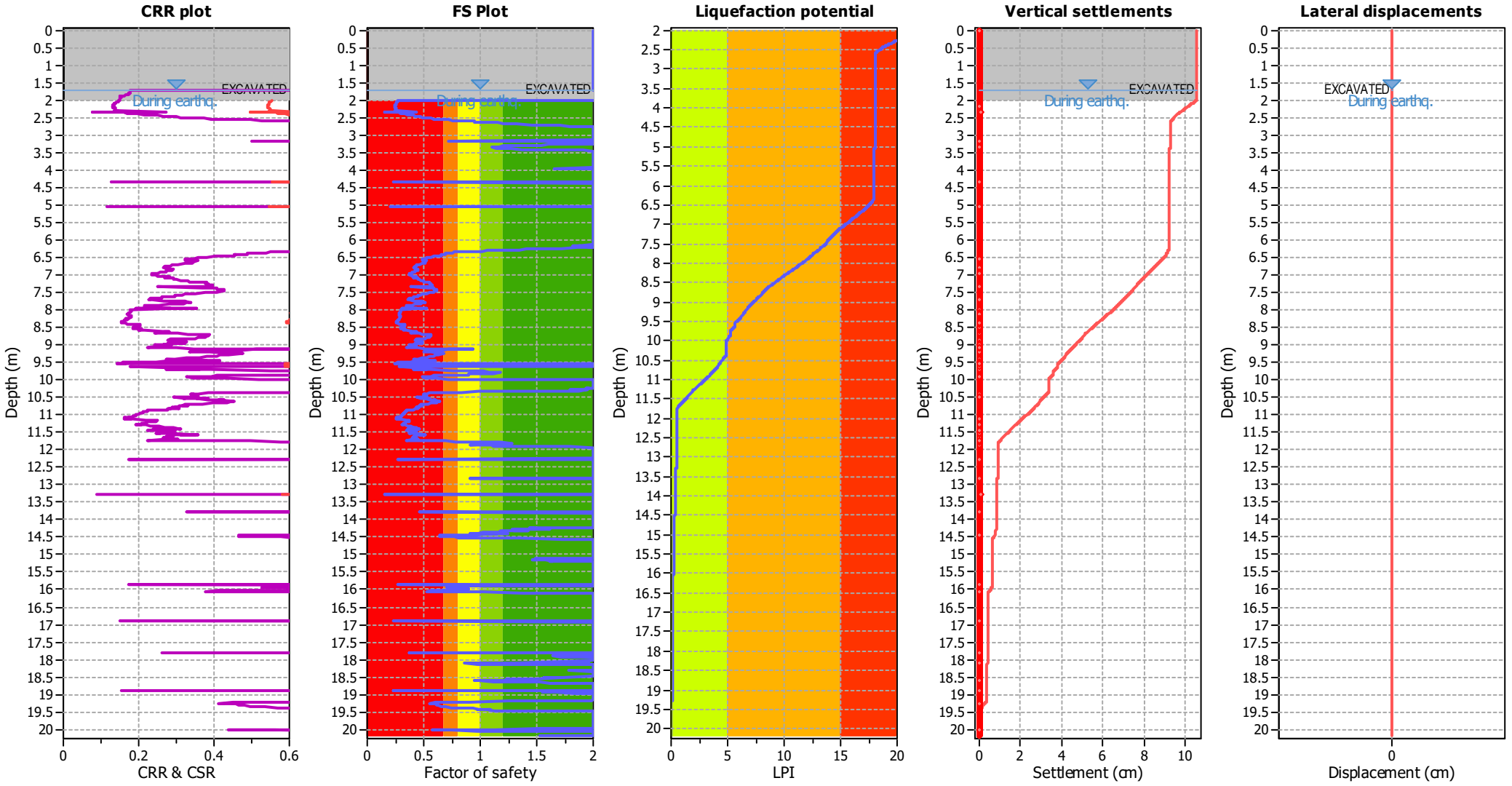
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Excavation depth:	2.00 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Excavation depth:	2.00 m	Limit depth:	N/A

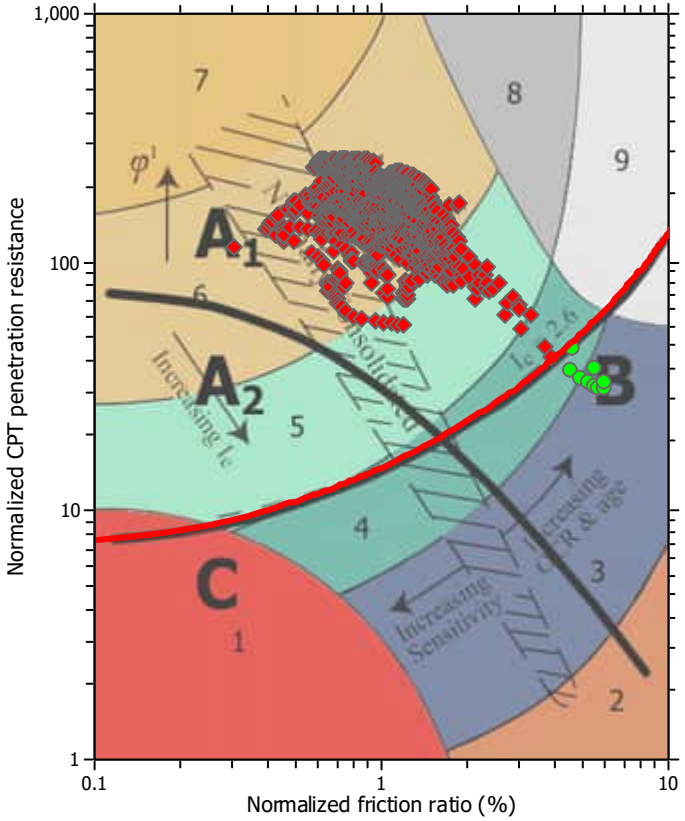
F.S. color scheme

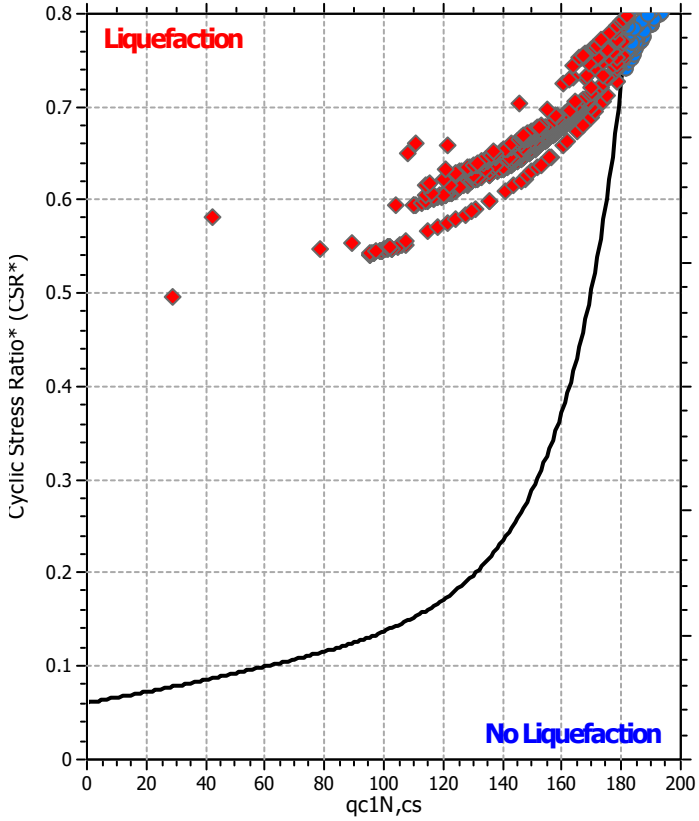
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

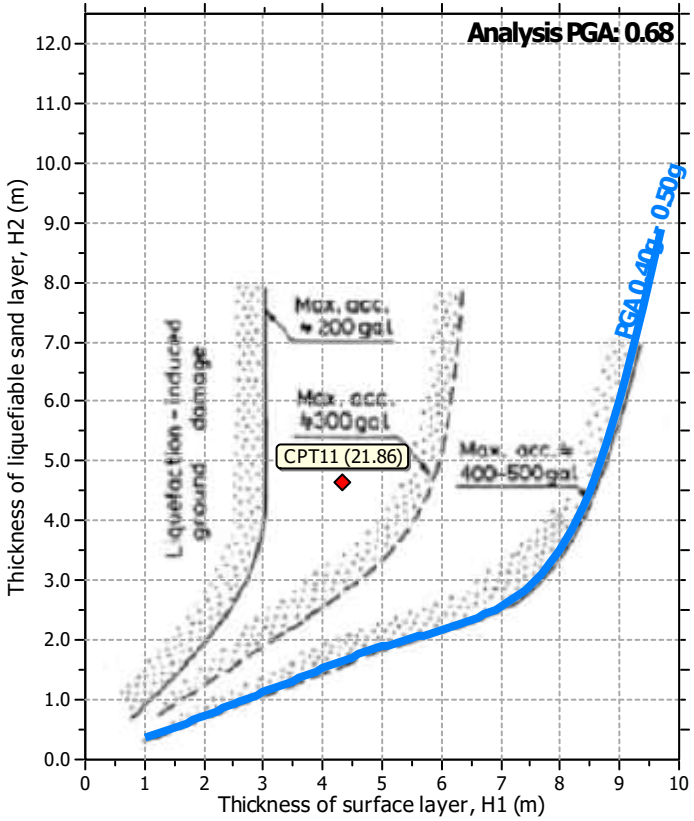
LPI color scheme

- 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.):	1.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Excavation depth:	2.00 m	Limit depth:	N/A

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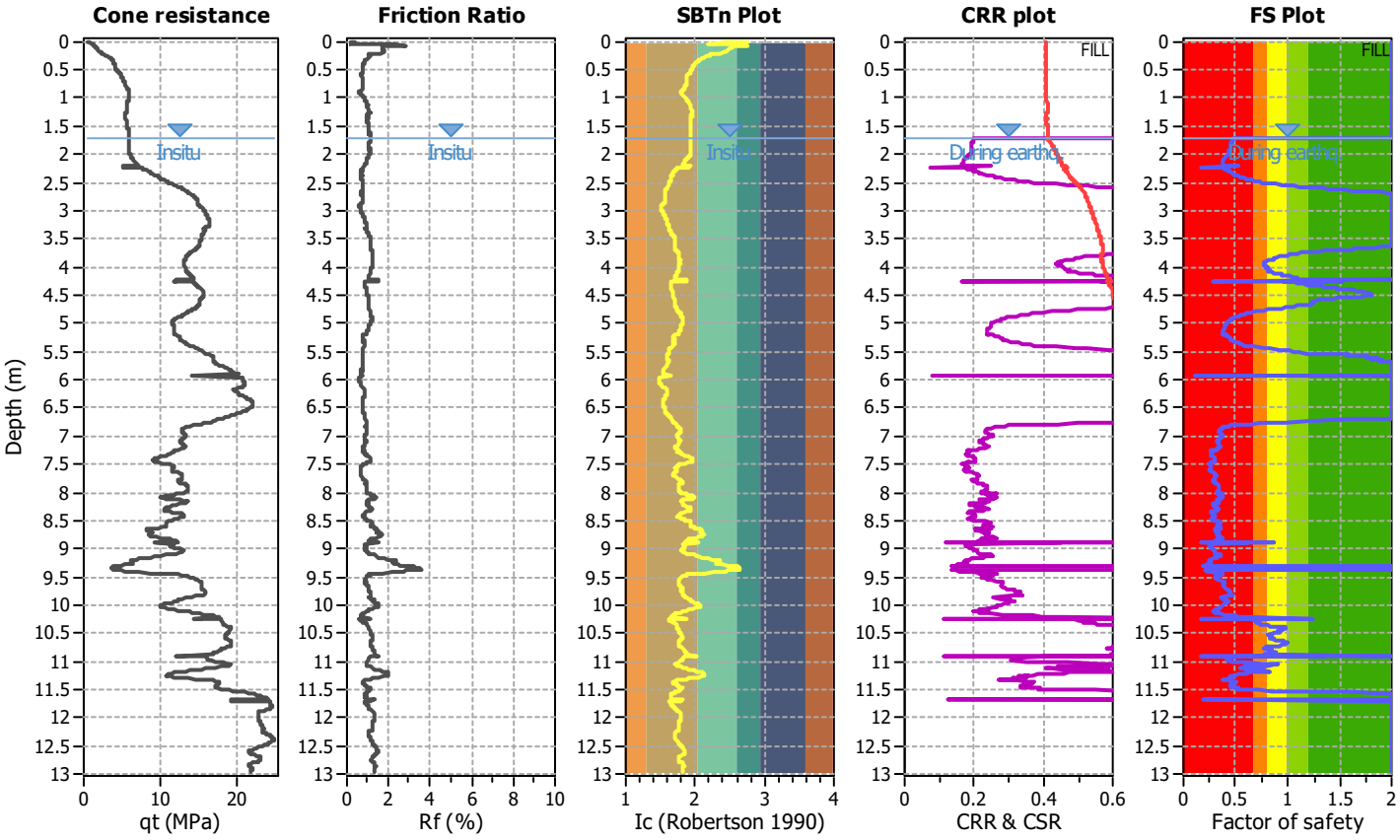
LIQUEFACTION ANALYSIS REPORT

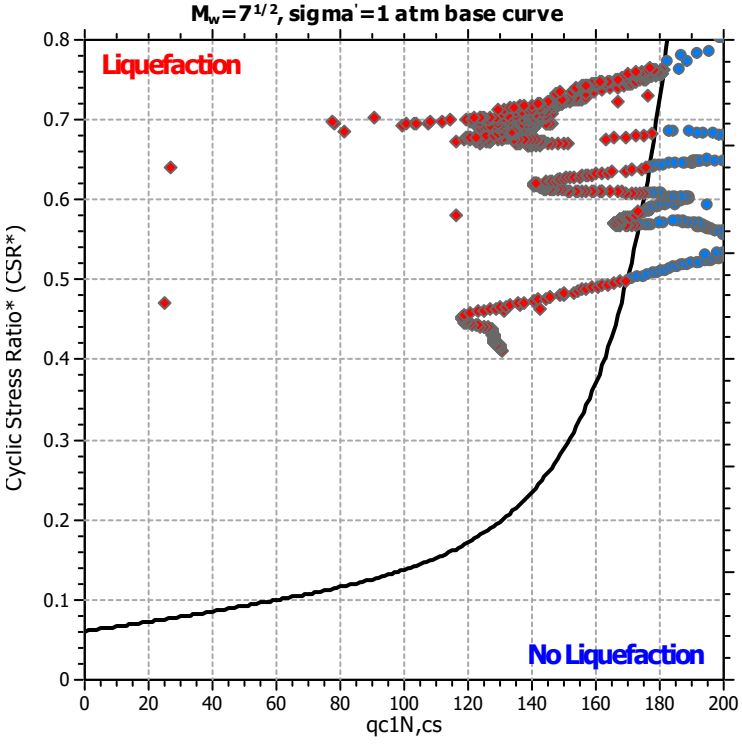
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

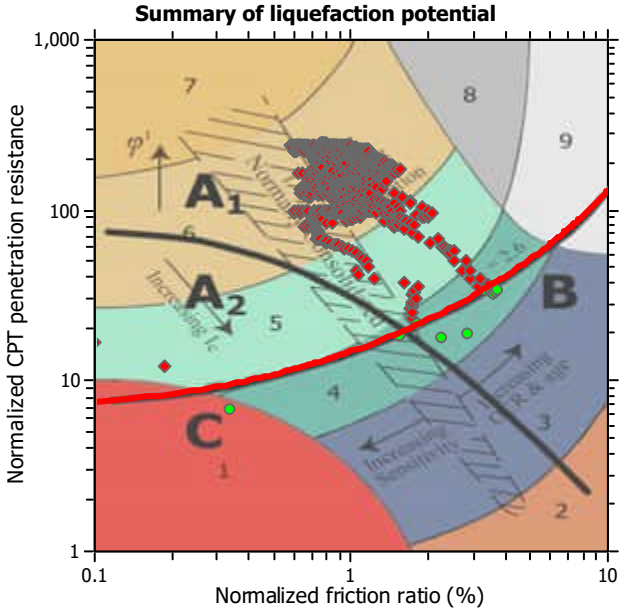
CPT file : CPT12

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.10 m	Fill height:	0.40 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

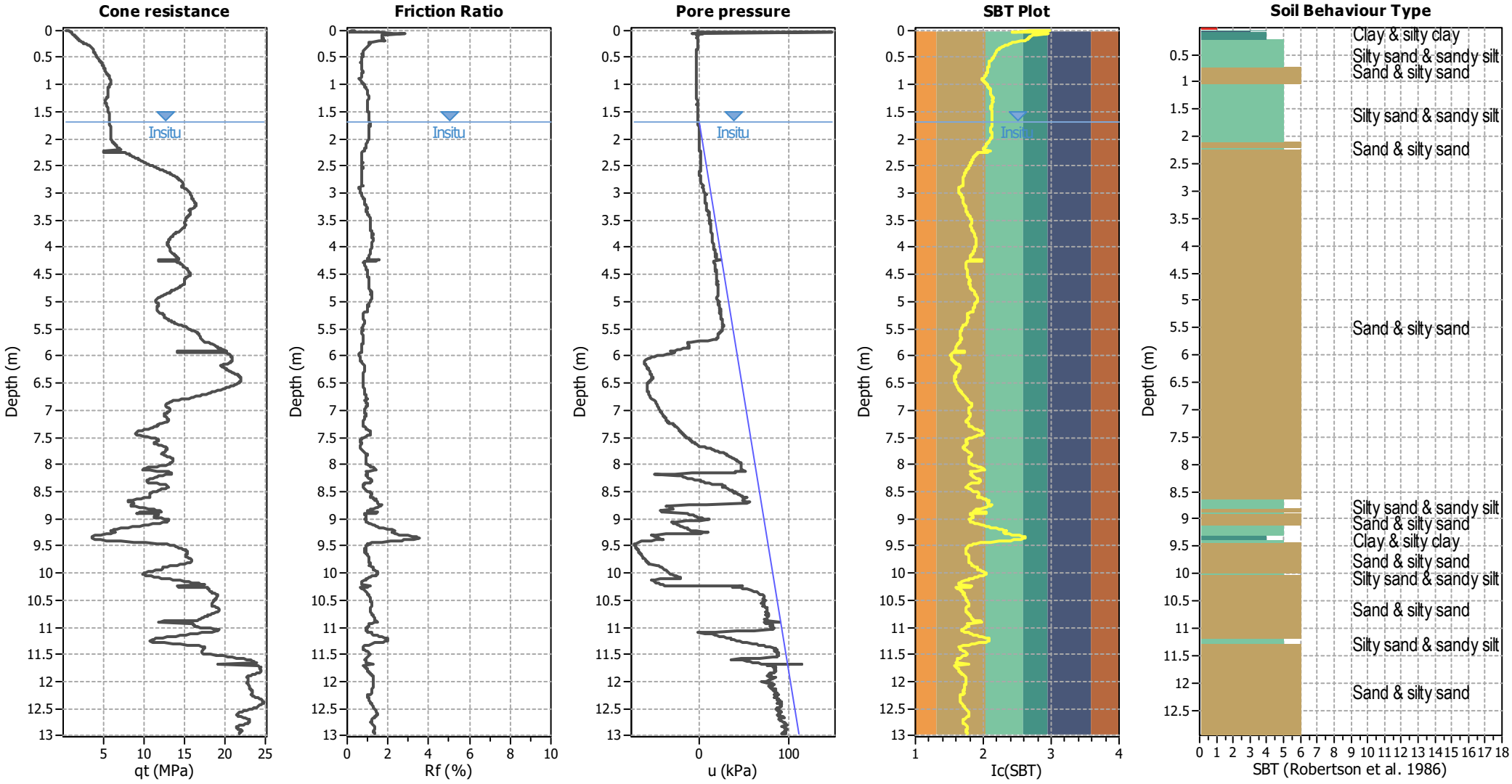






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



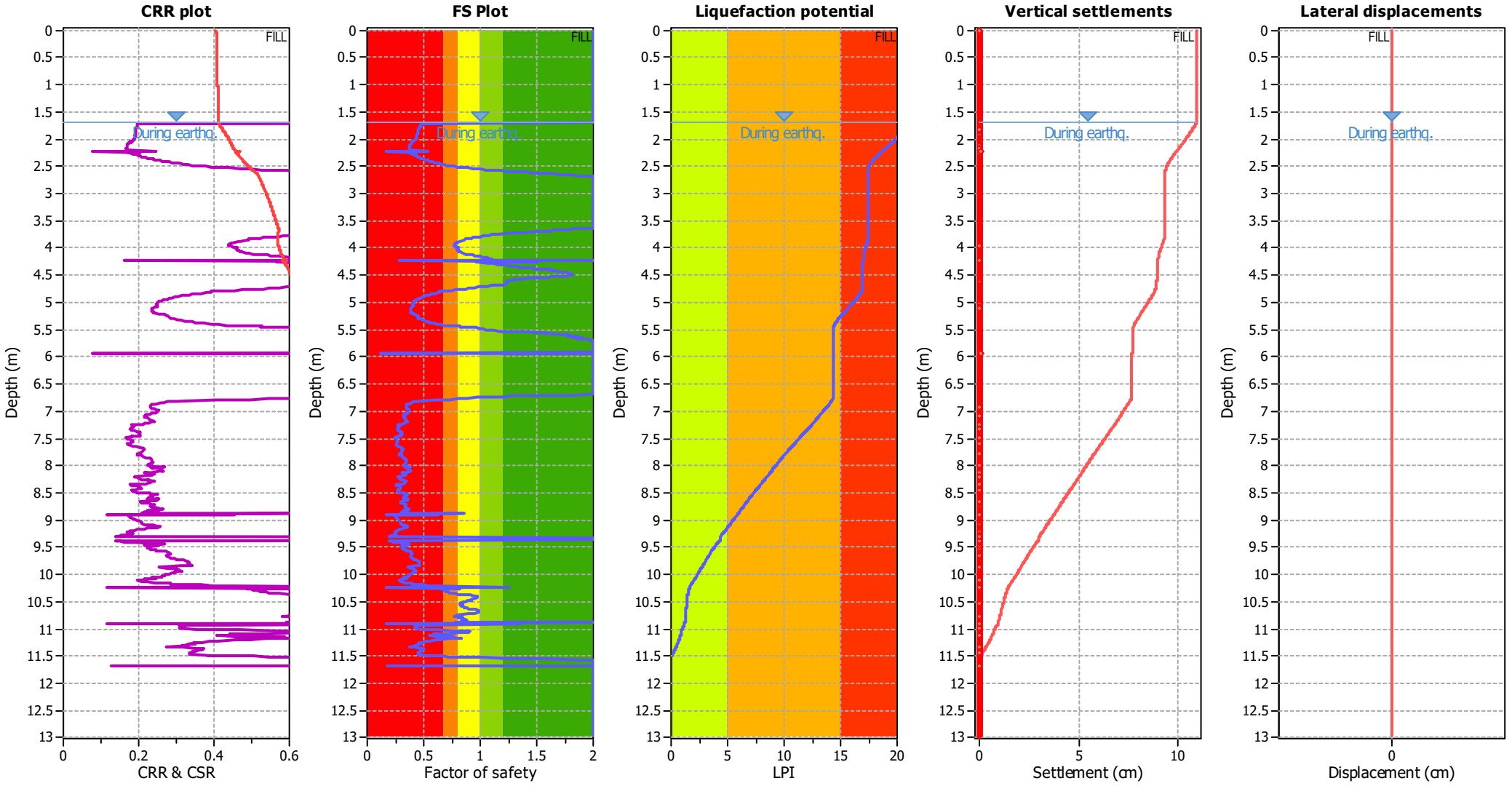
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	0.40 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	0.40 m	Limit depth:	N/A

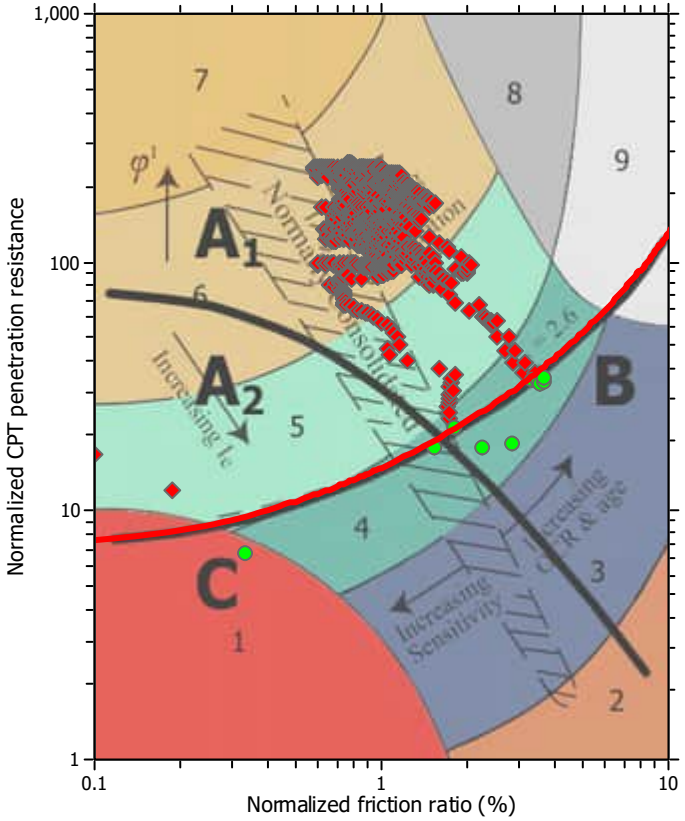
F.S. color scheme

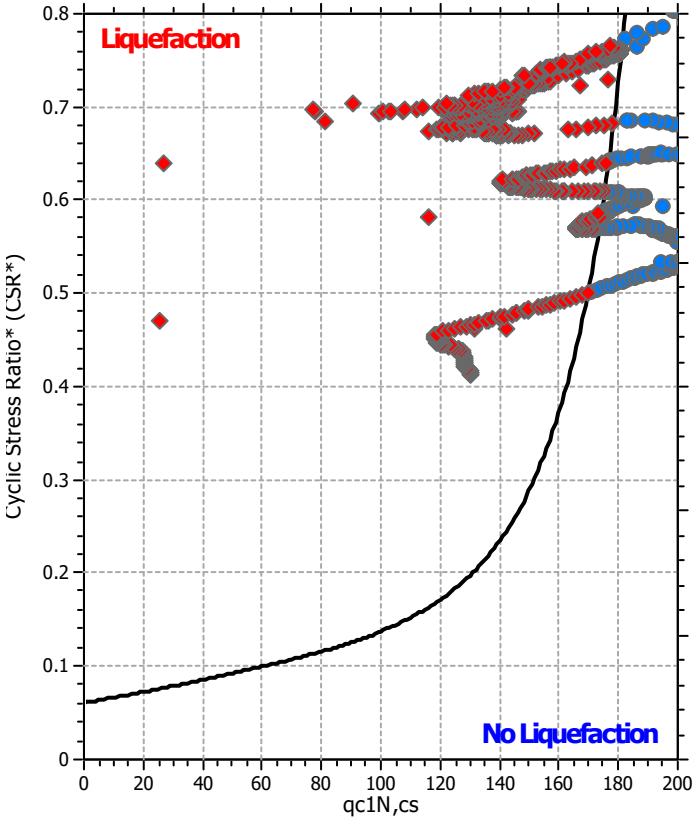
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

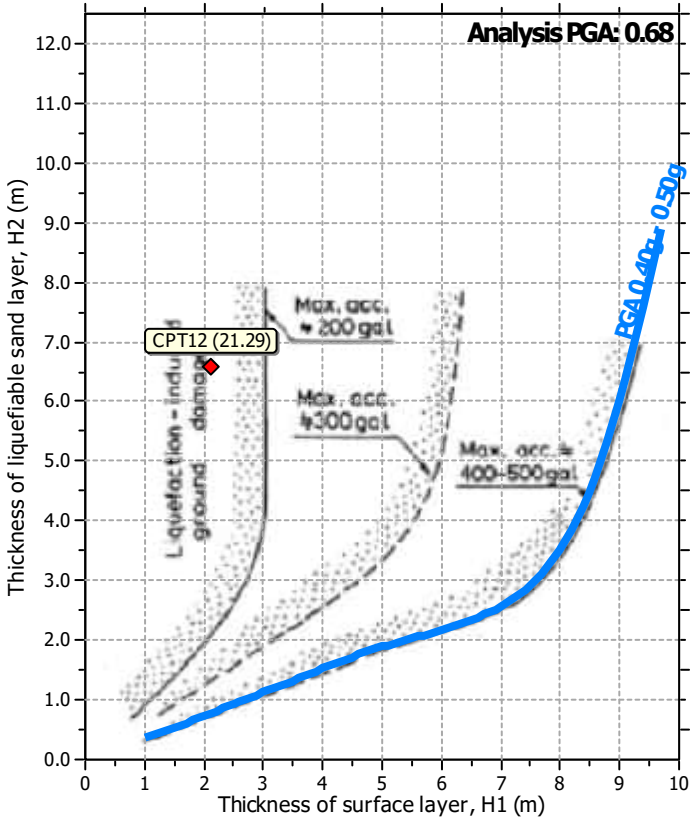
LPI color scheme

- 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.):	2.10 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	0.40 m	Limit depth:	N/A

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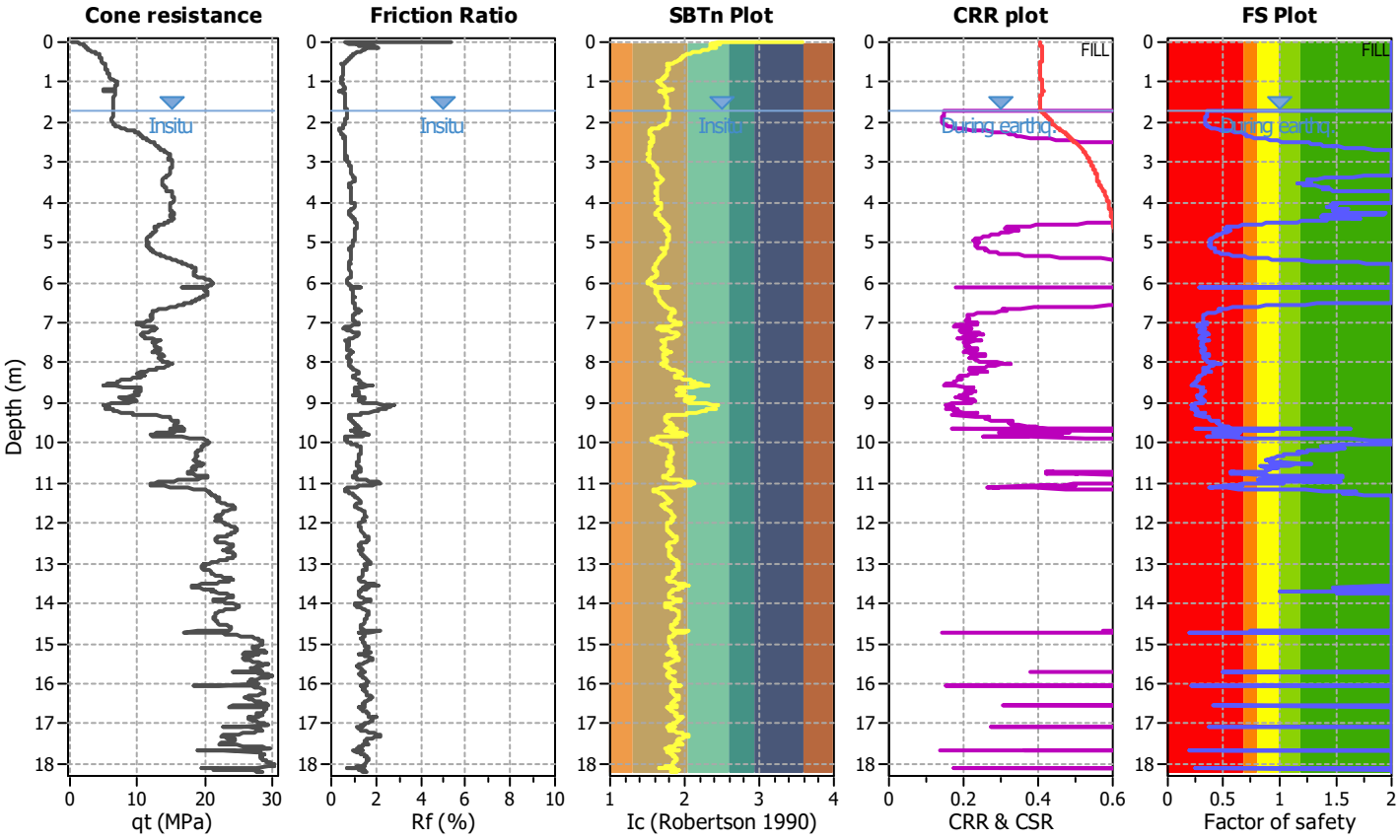
LIQUEFACTION ANALYSIS REPORT

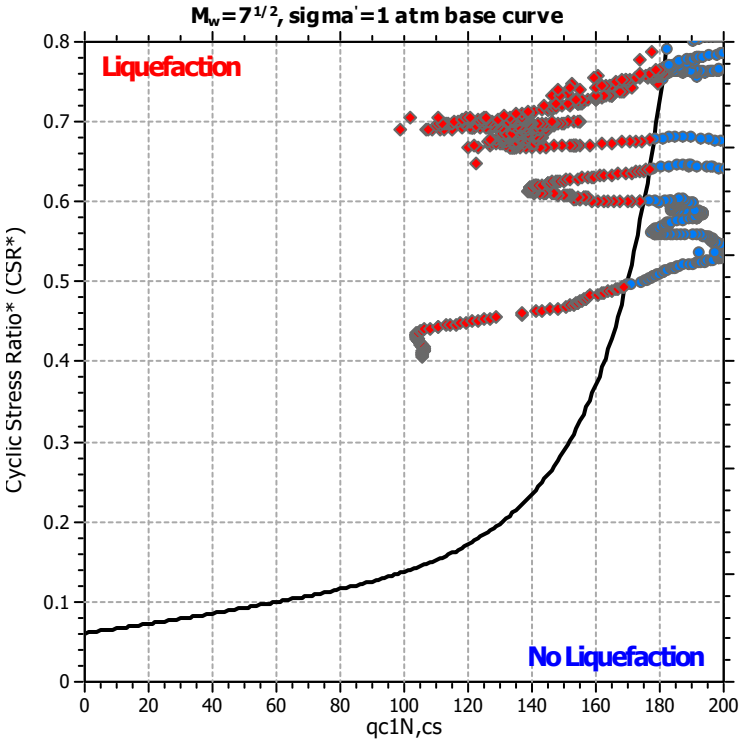
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

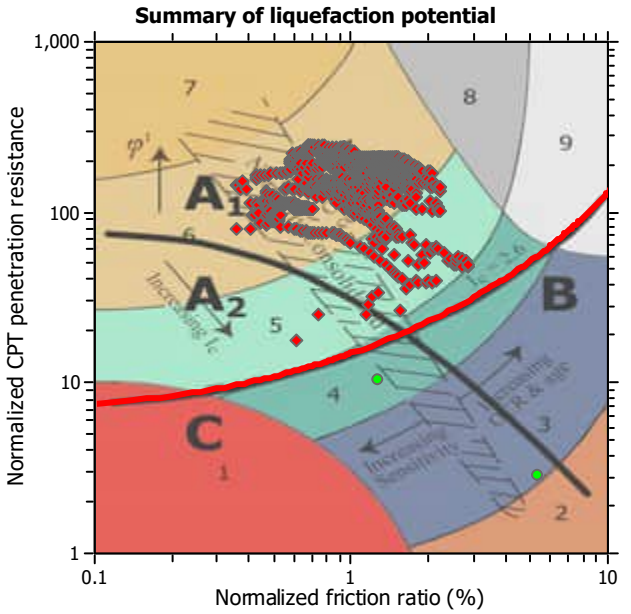
CPT file : CPT12A

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.10 m	Fill height:	0.40 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

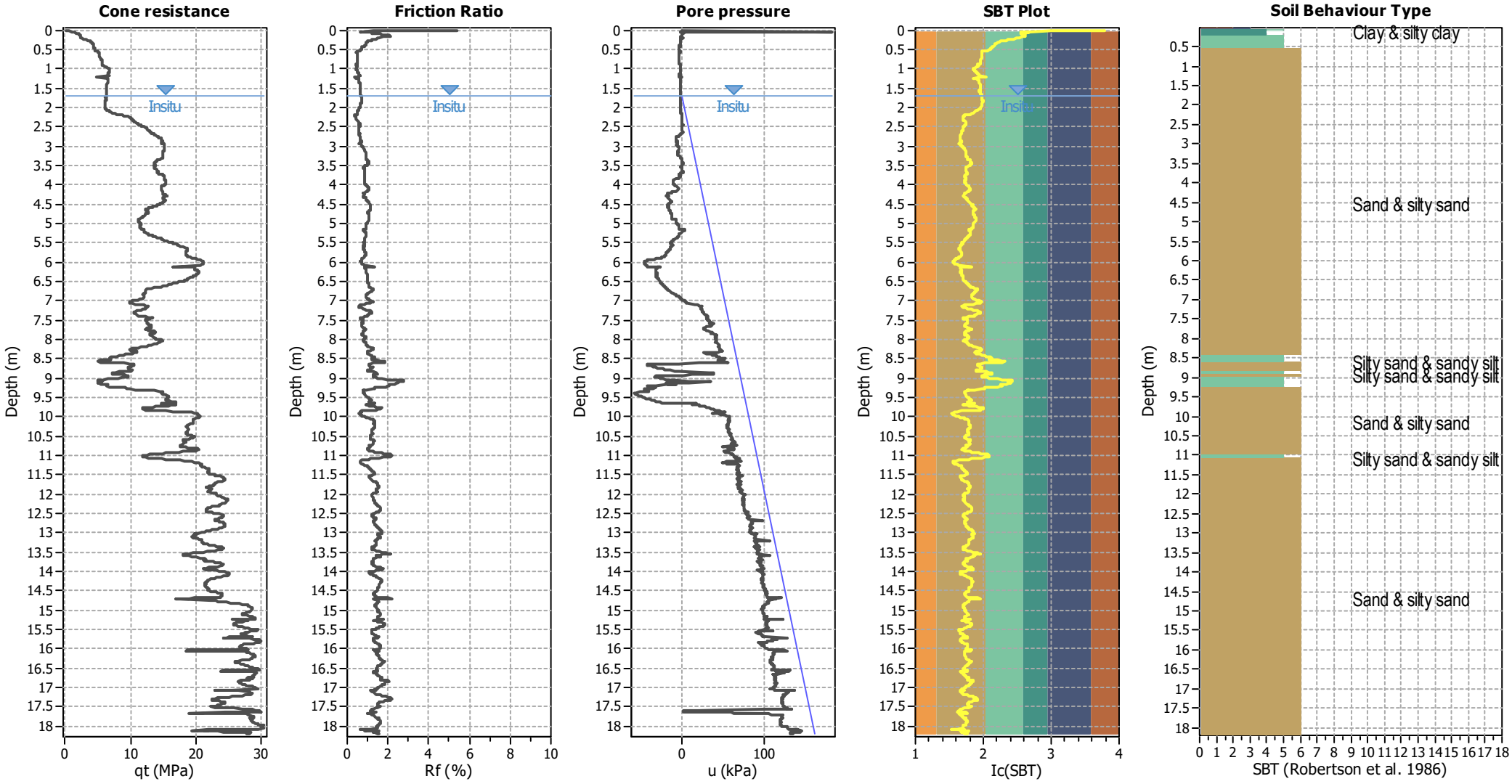






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



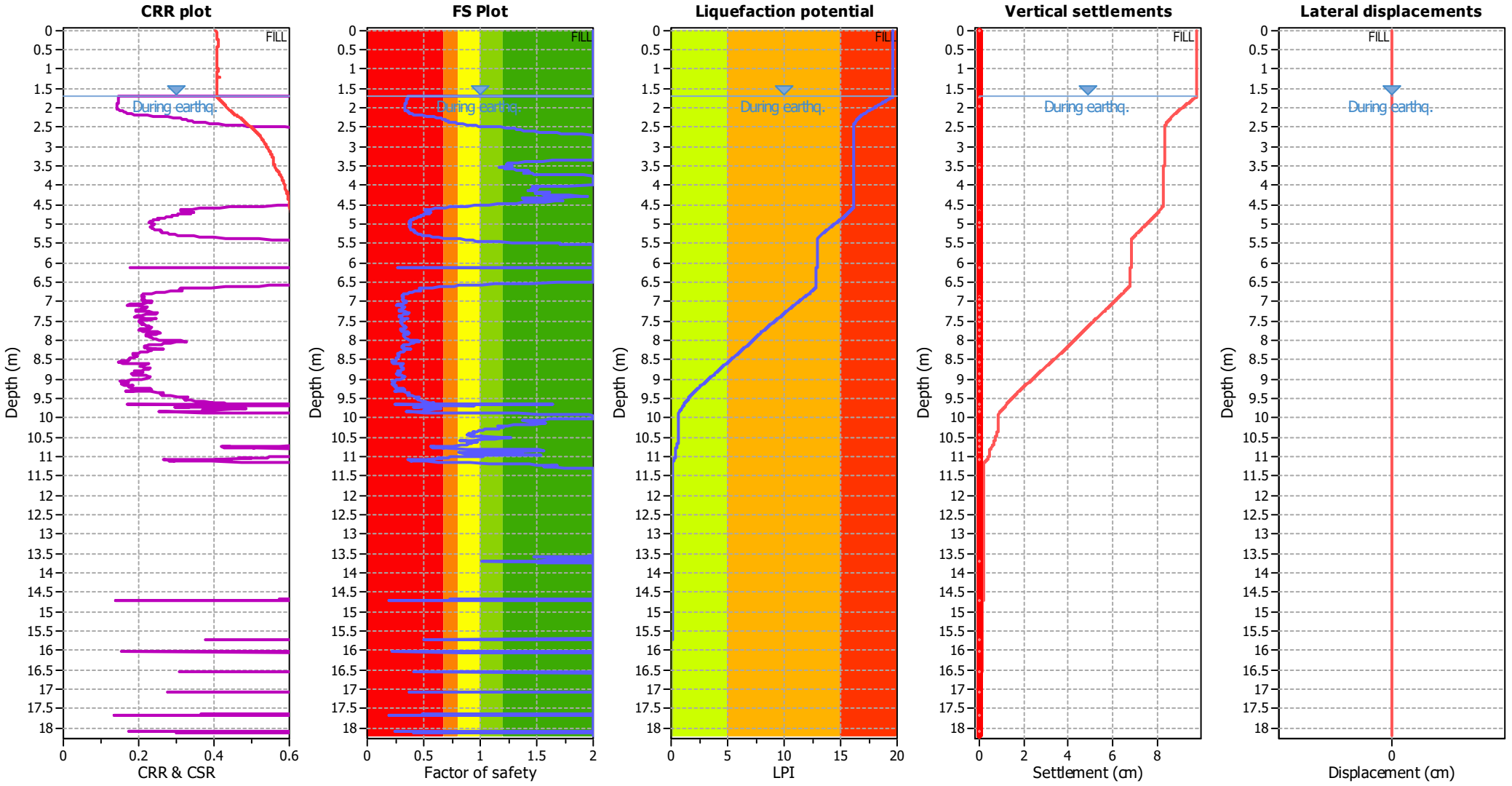
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	0.40 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	0.40 m	Limit depth:	N/A

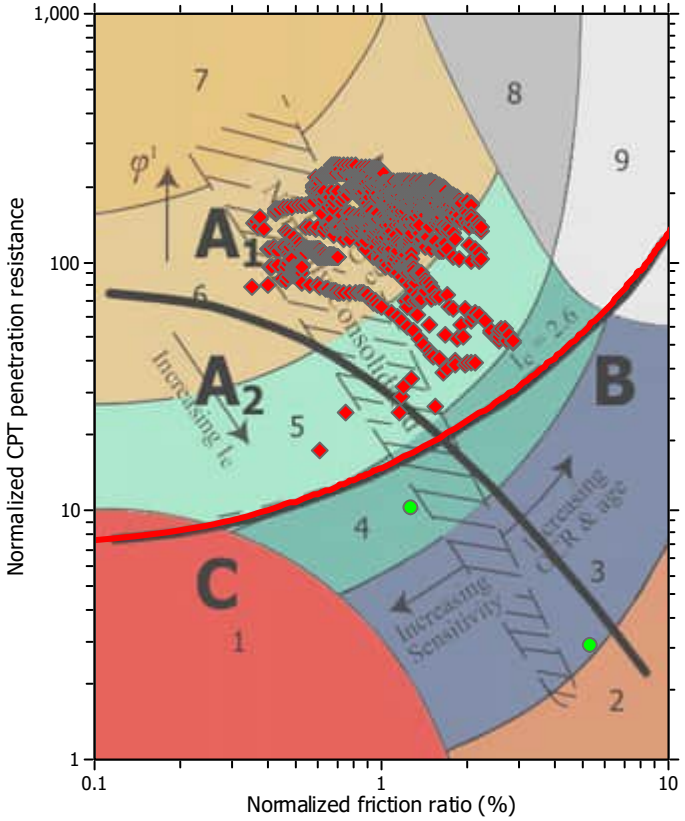
F.S. color scheme

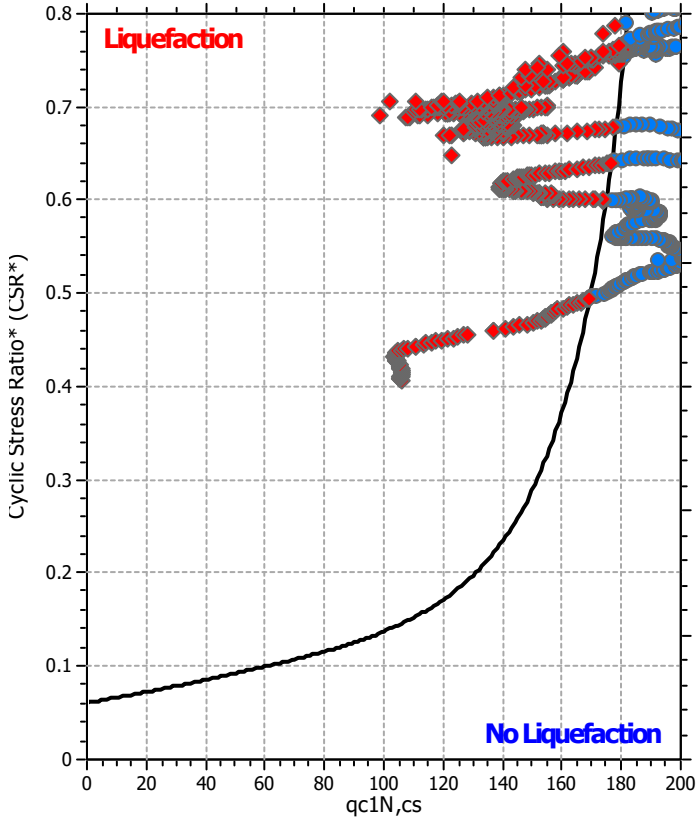
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

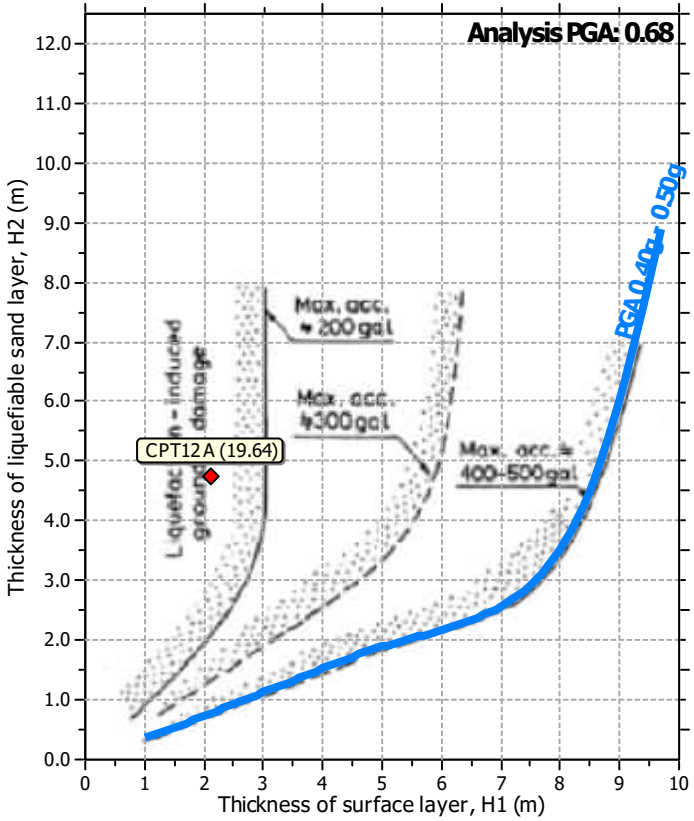
LPI color scheme

- 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.):	2.10 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	0.40 m	Limit depth:	N/A

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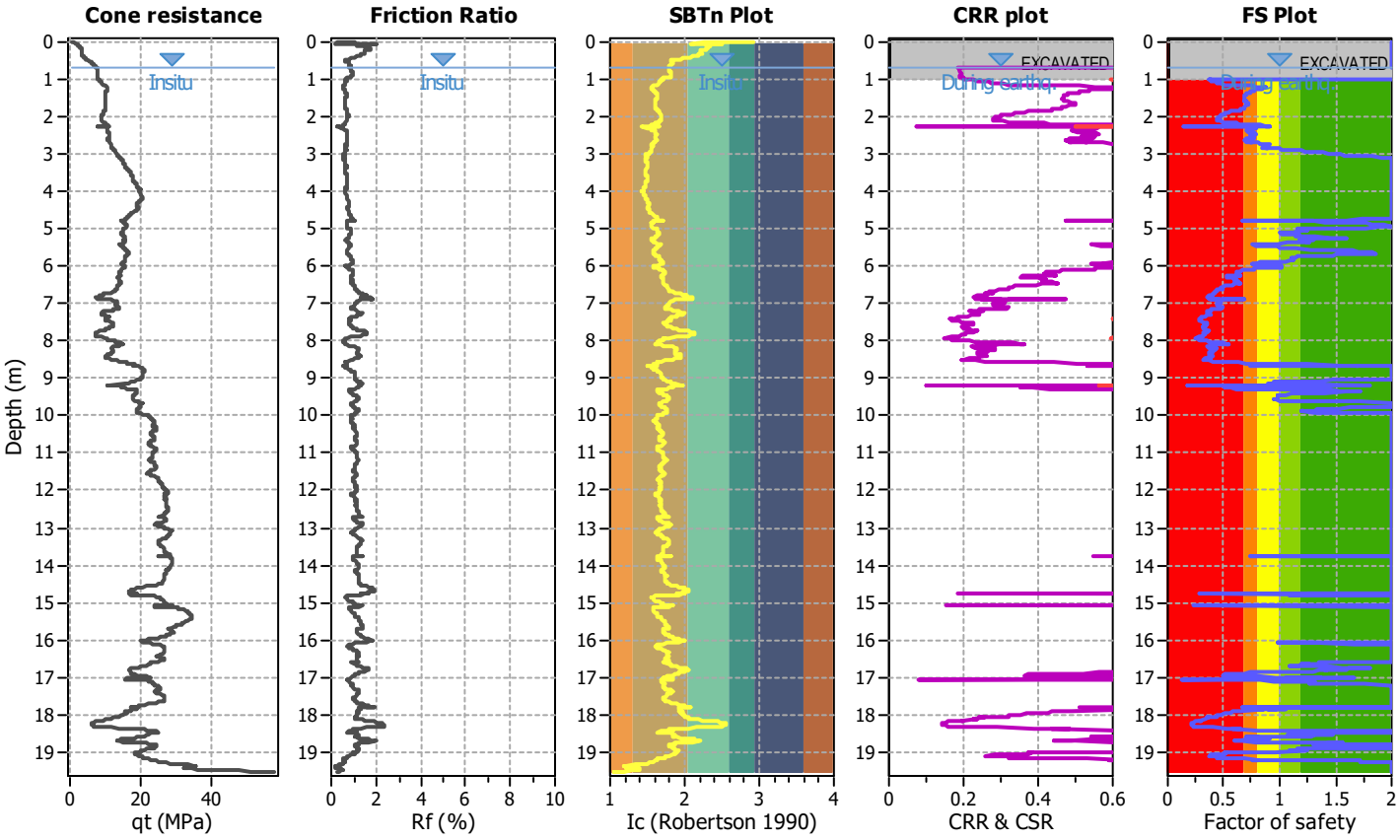
LIQUEFACTION ANALYSIS REPORT

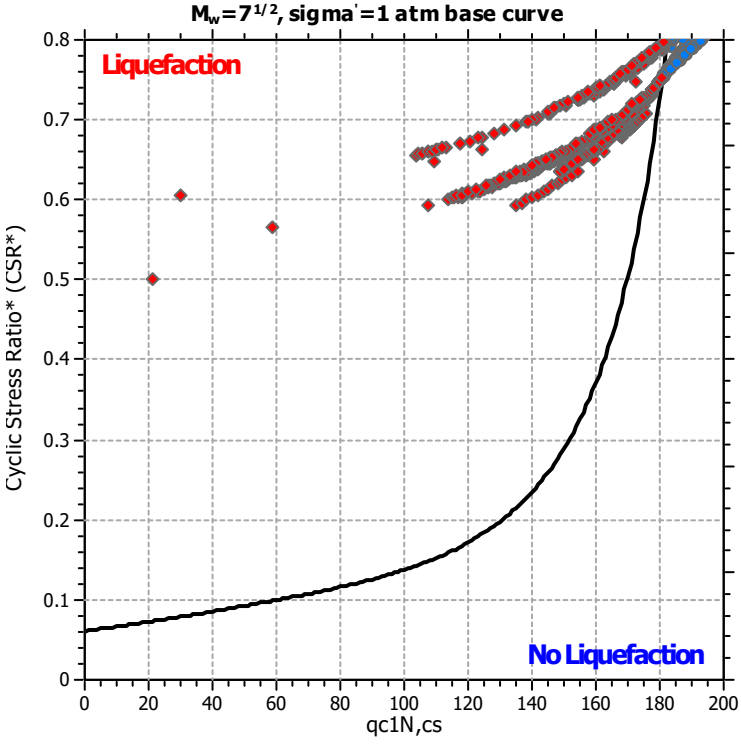
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

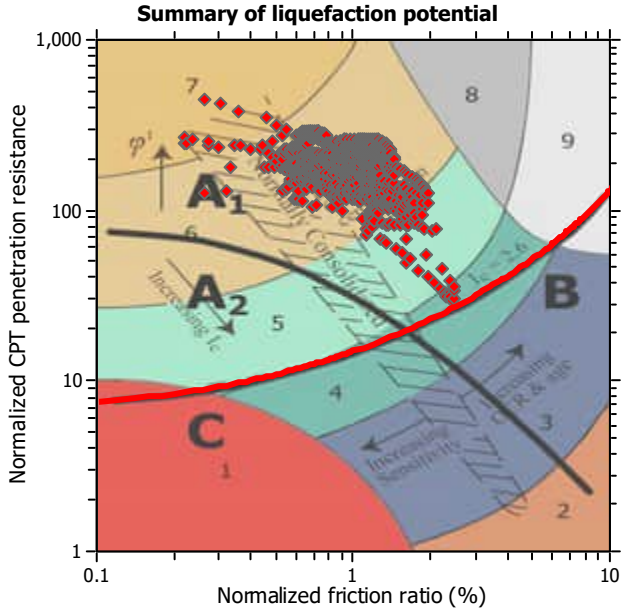
CPT file : CPT13

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.70 m	Excavation:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.70 m	Excavation depth:	1.00 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Footing load:	500.00 kPa	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

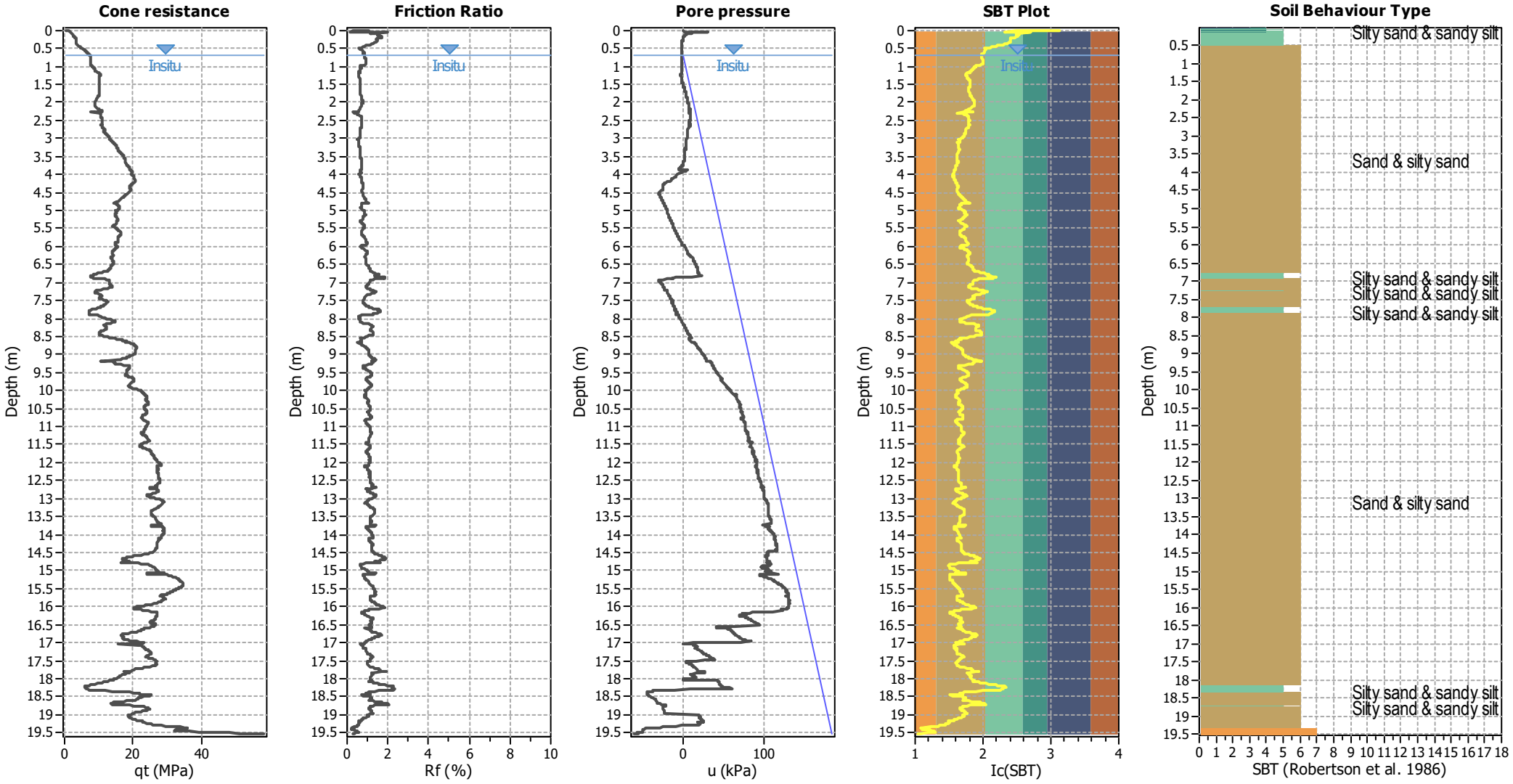






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



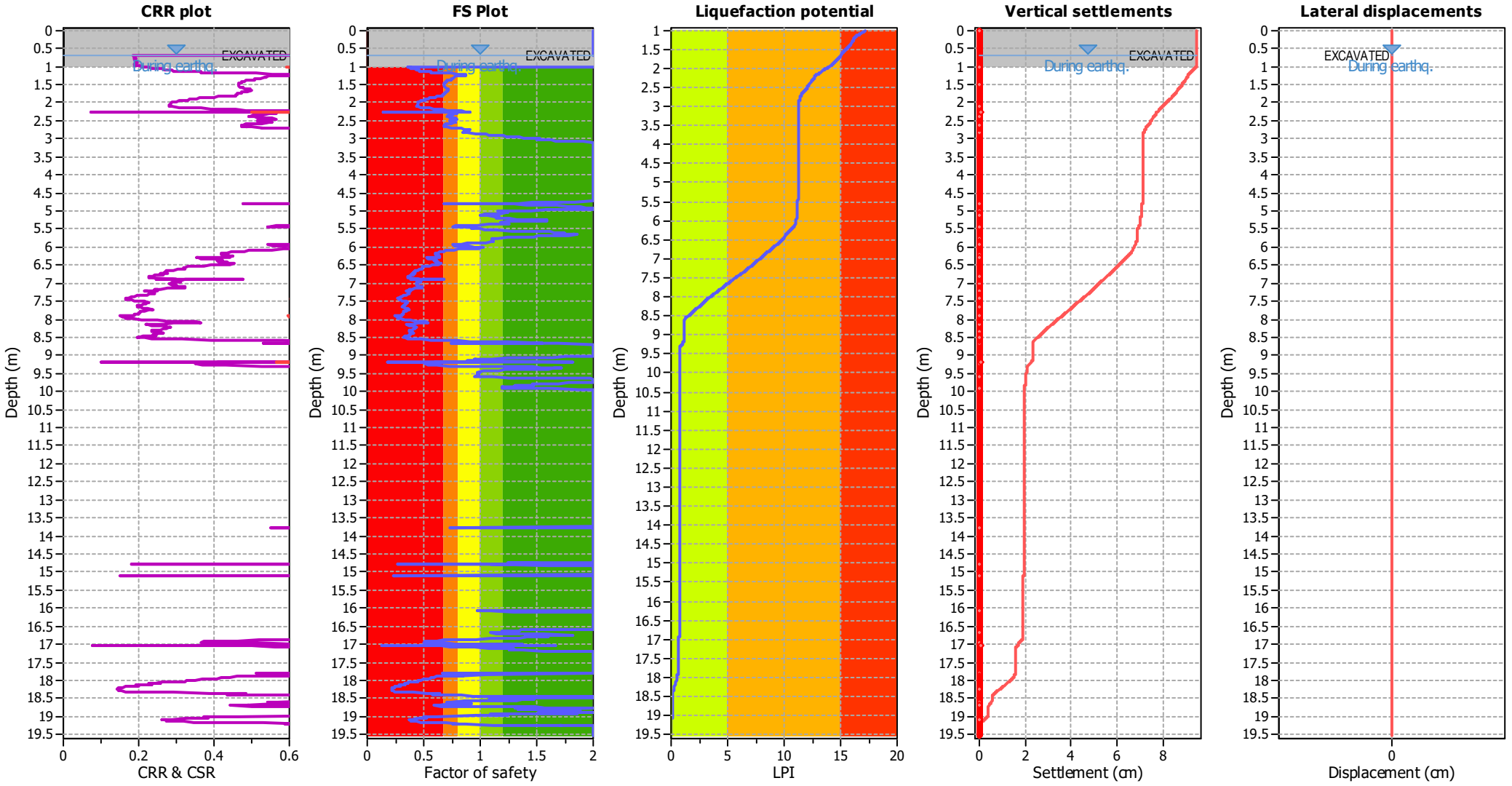
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	0.70 m	Excavation depth:	1.00 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	0.70 m	Excavation depth:	1.00 m	Limit depth:	N/A

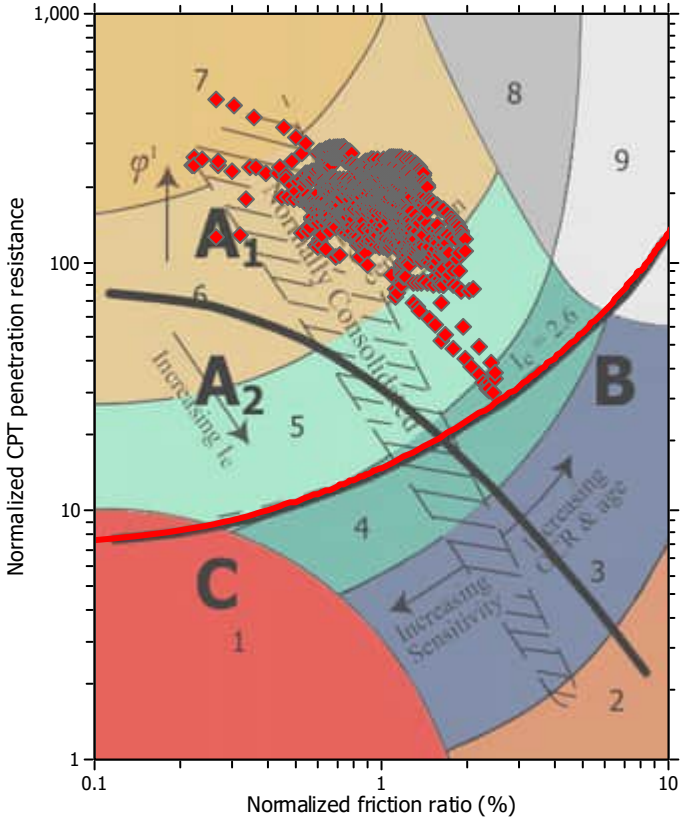
F.S. color scheme

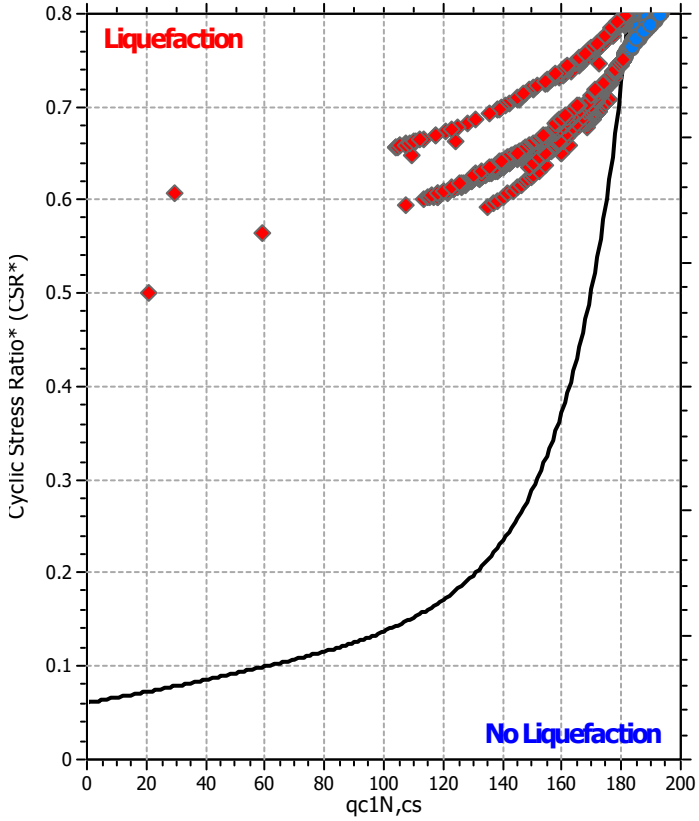
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

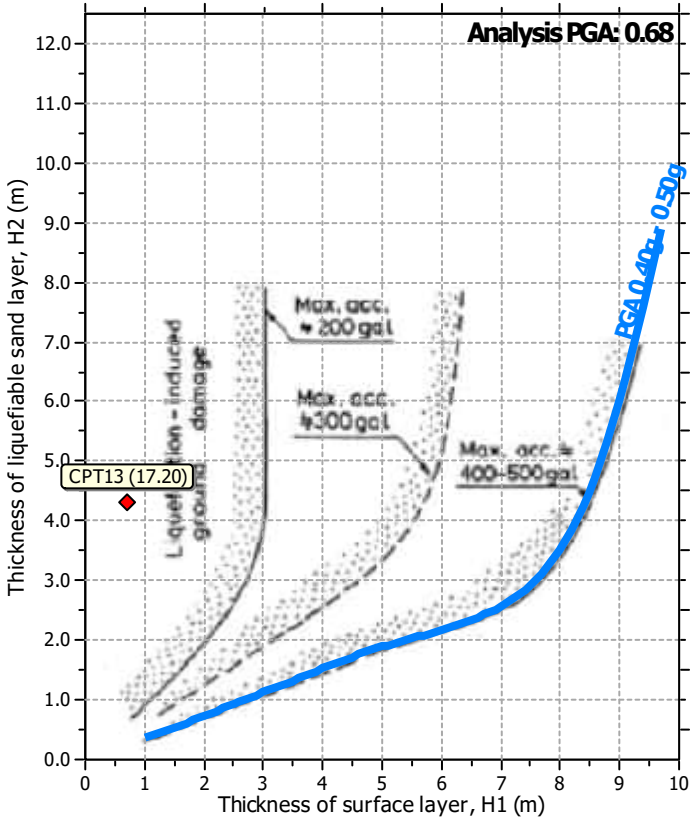
LPI color scheme

- 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.):	0.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	0.70 m	Excavation depth:	1.00 m	Limit depth:	N/A

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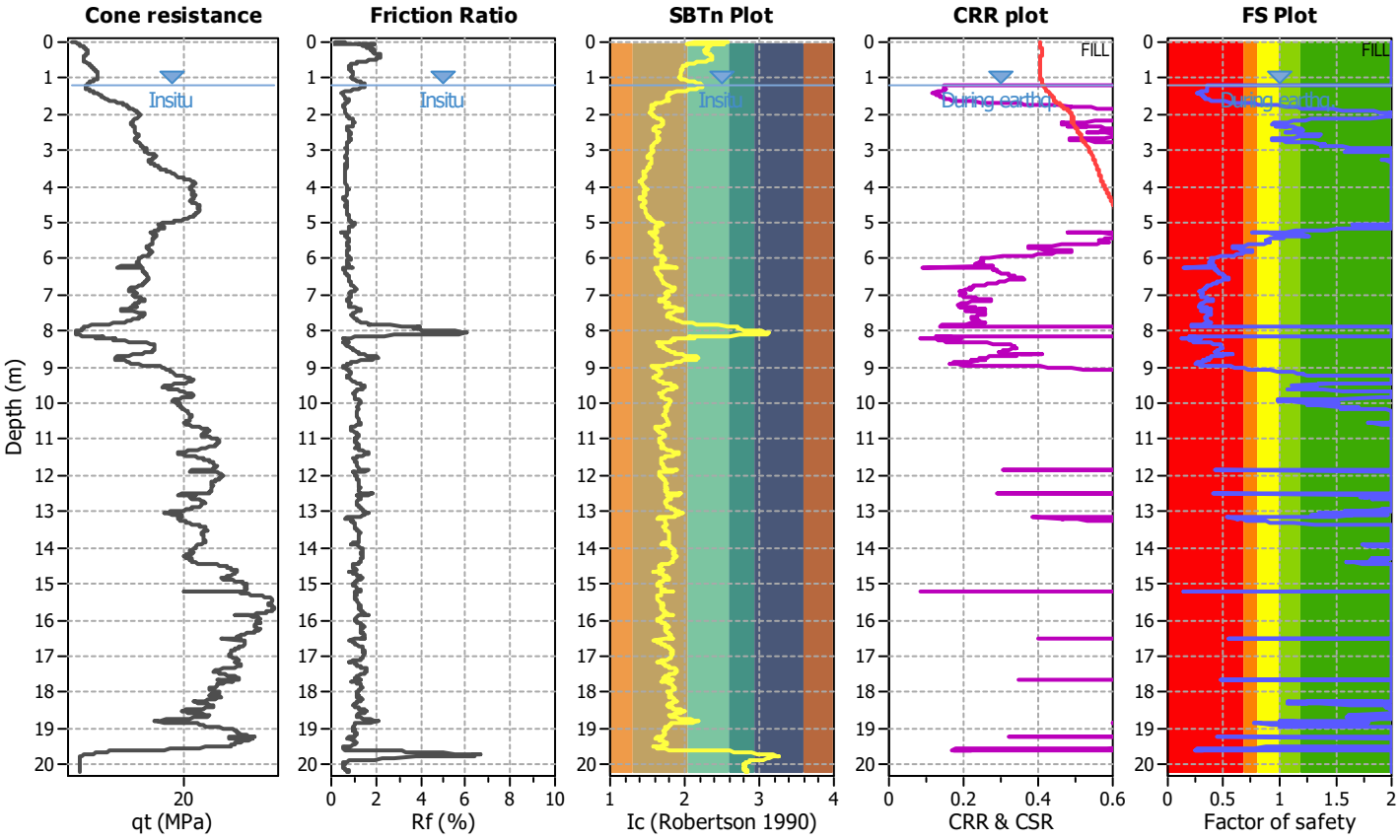
LIQUEFACTION ANALYSIS REPORT

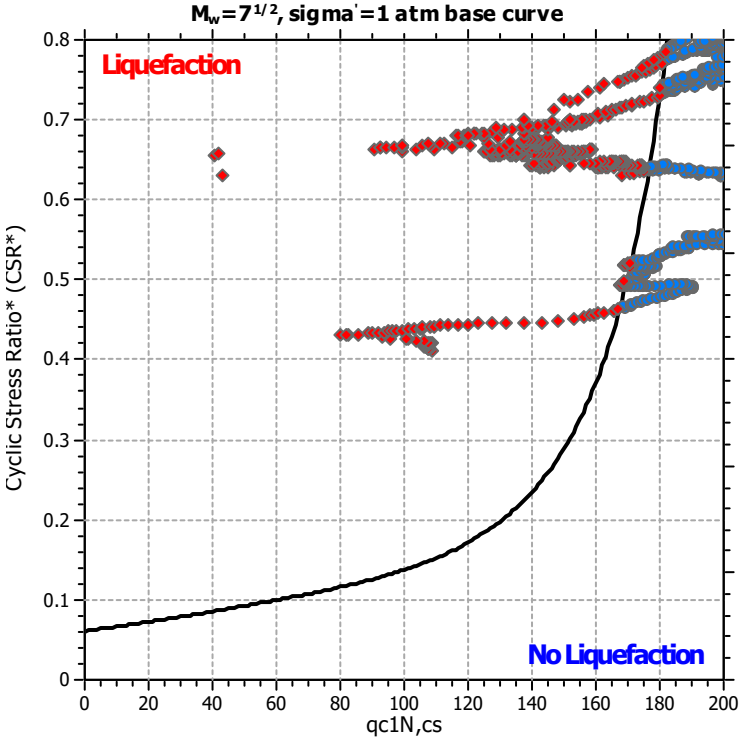
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

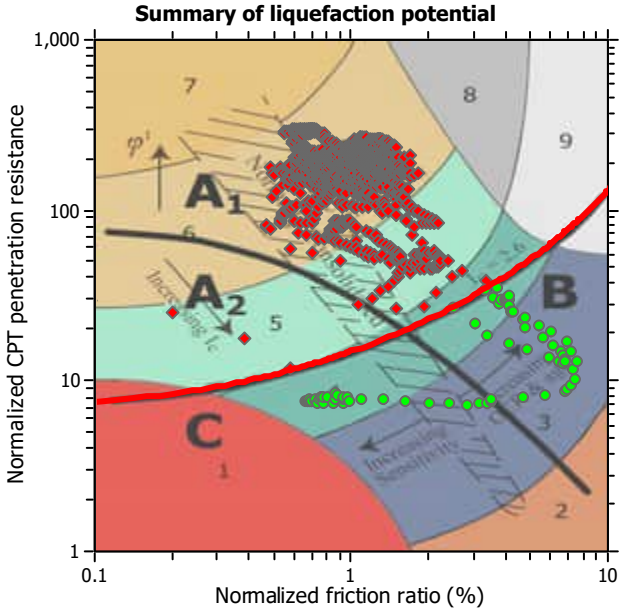
CPT file : CPT14

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.20 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.70 m	Fill height:	1.50 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

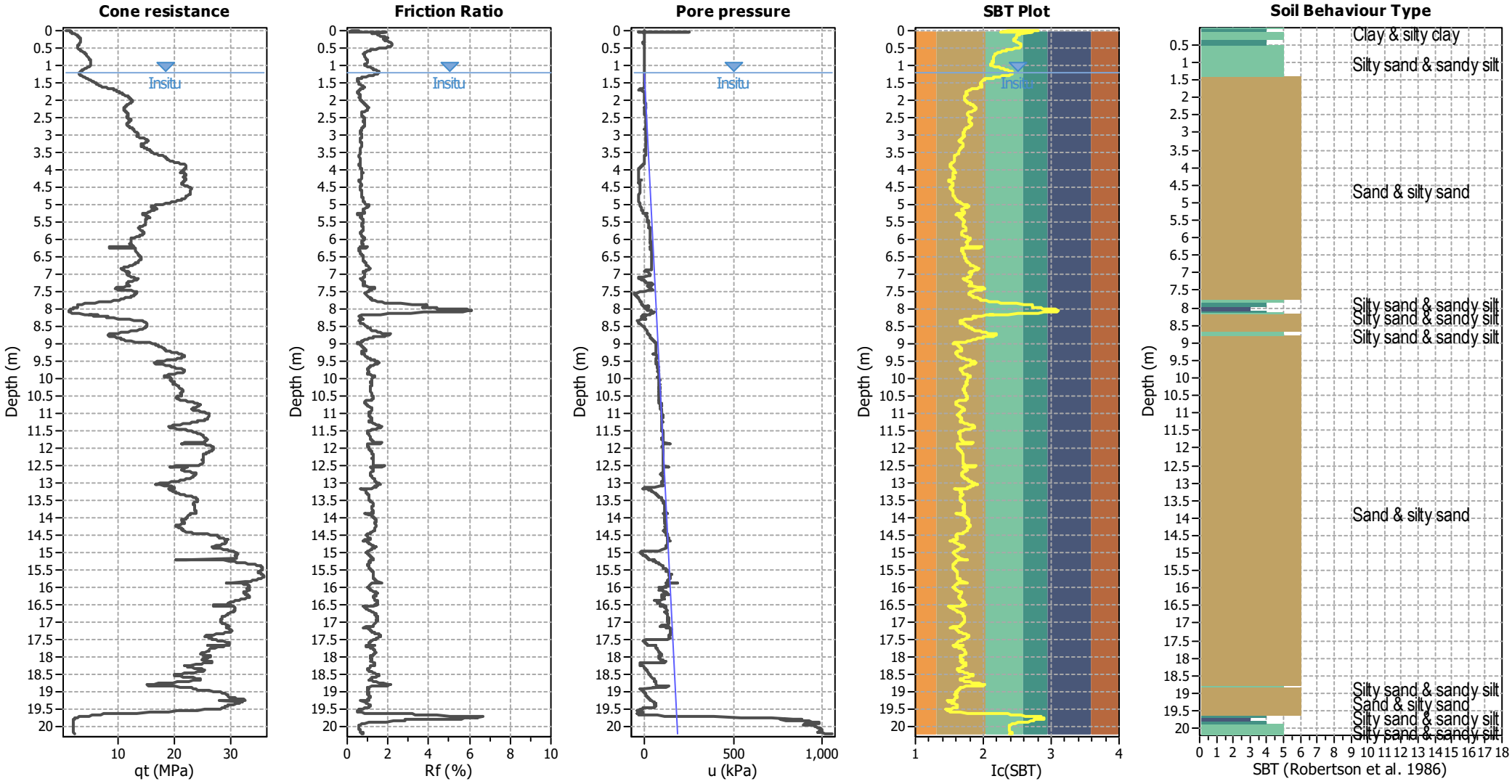






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



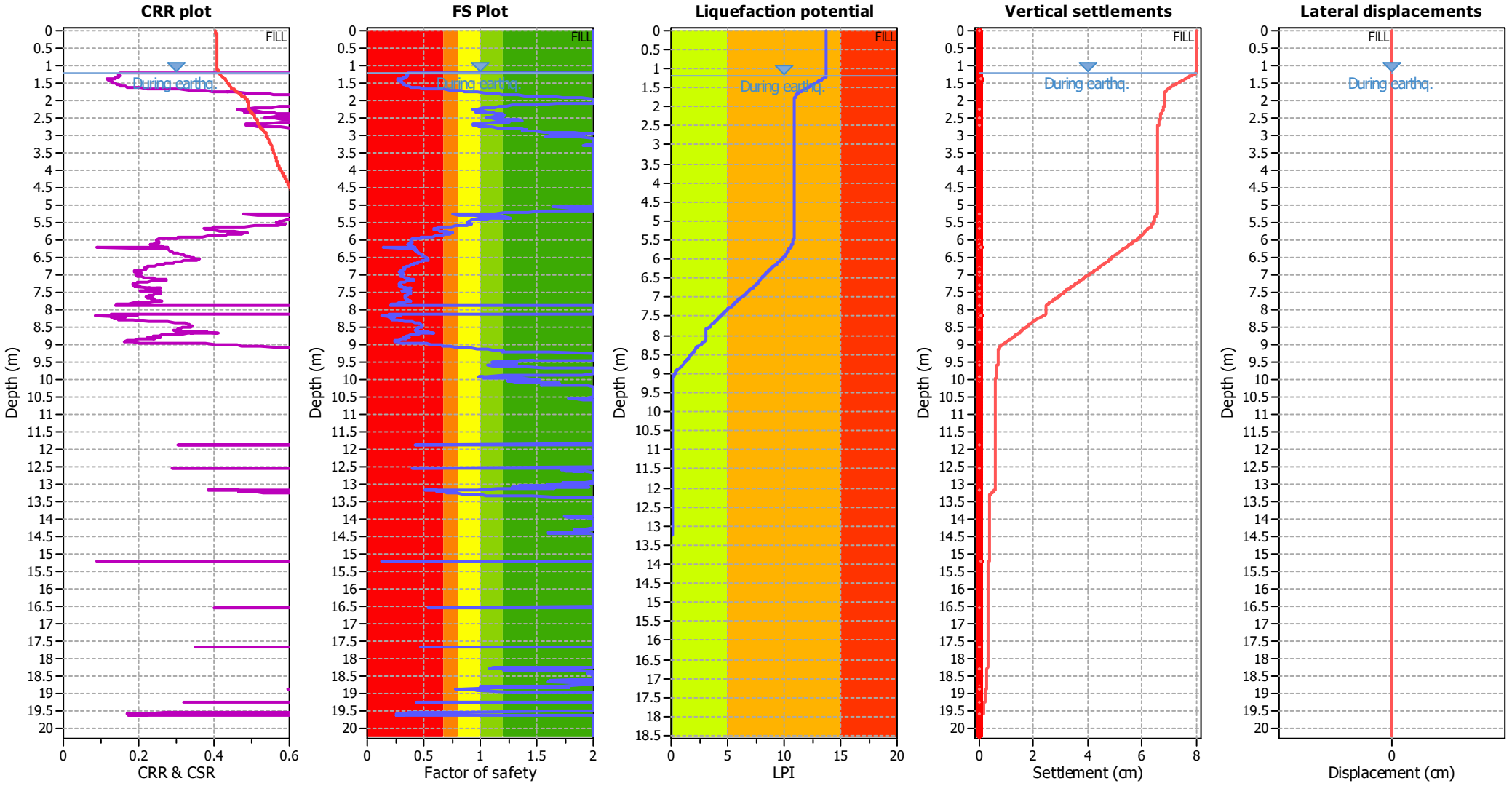
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.70 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.20 m	Fill height:	1.50 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.70 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.20 m	Fill height:	1.50 m	Limit depth:	N/A

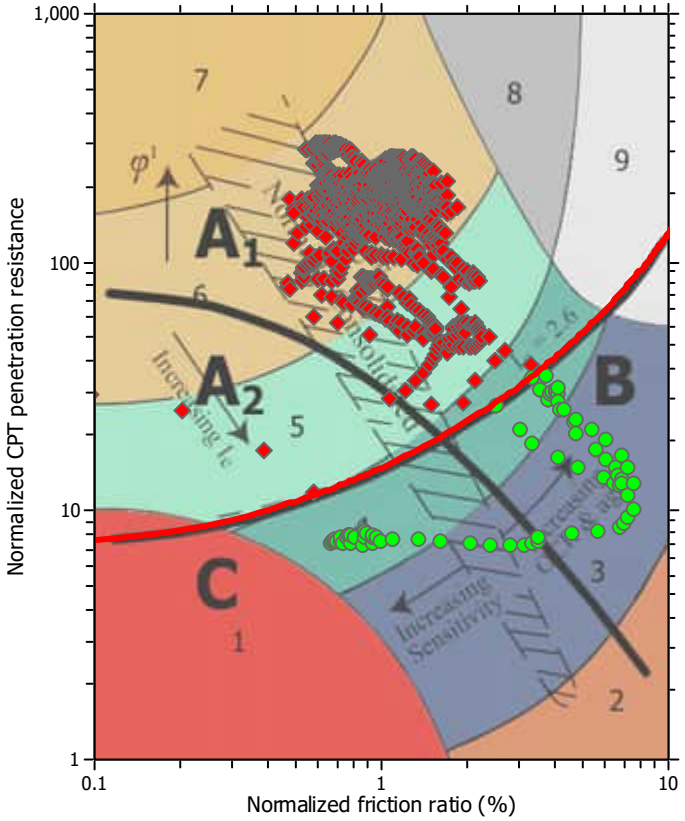
F.S. color scheme

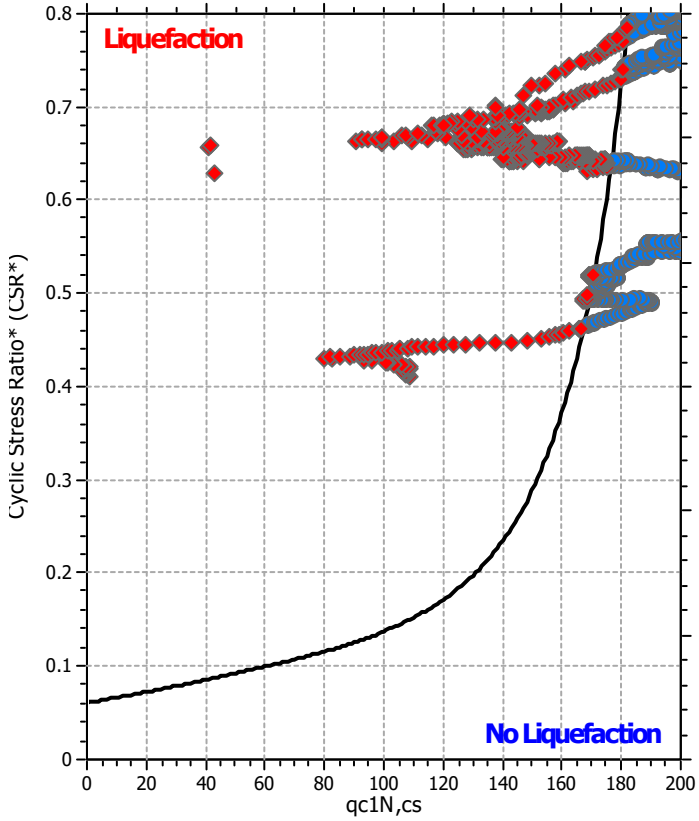
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

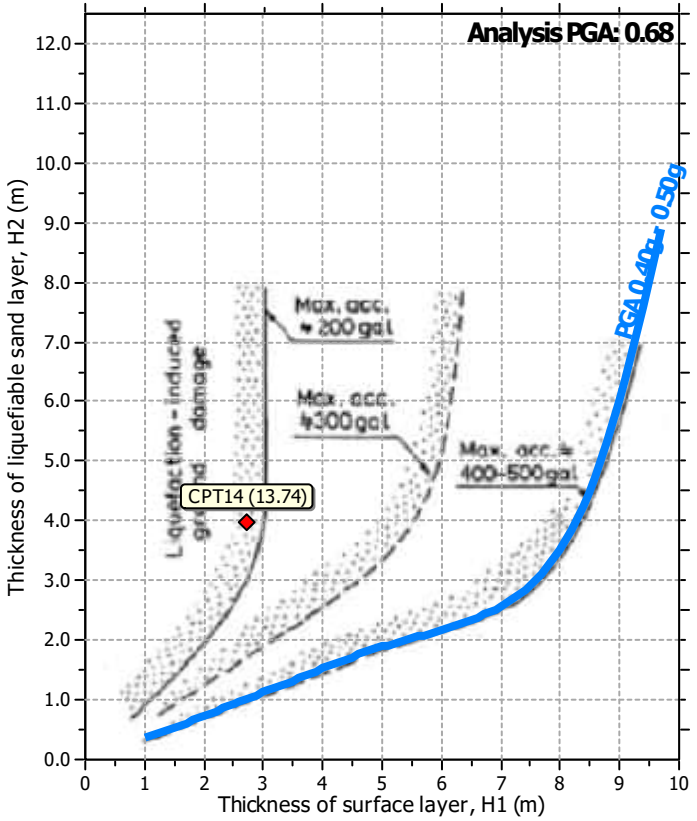
LPI color scheme

- 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.):	2.70 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.20 m	Fill height:	1.50 m	Limit depth:	N/A

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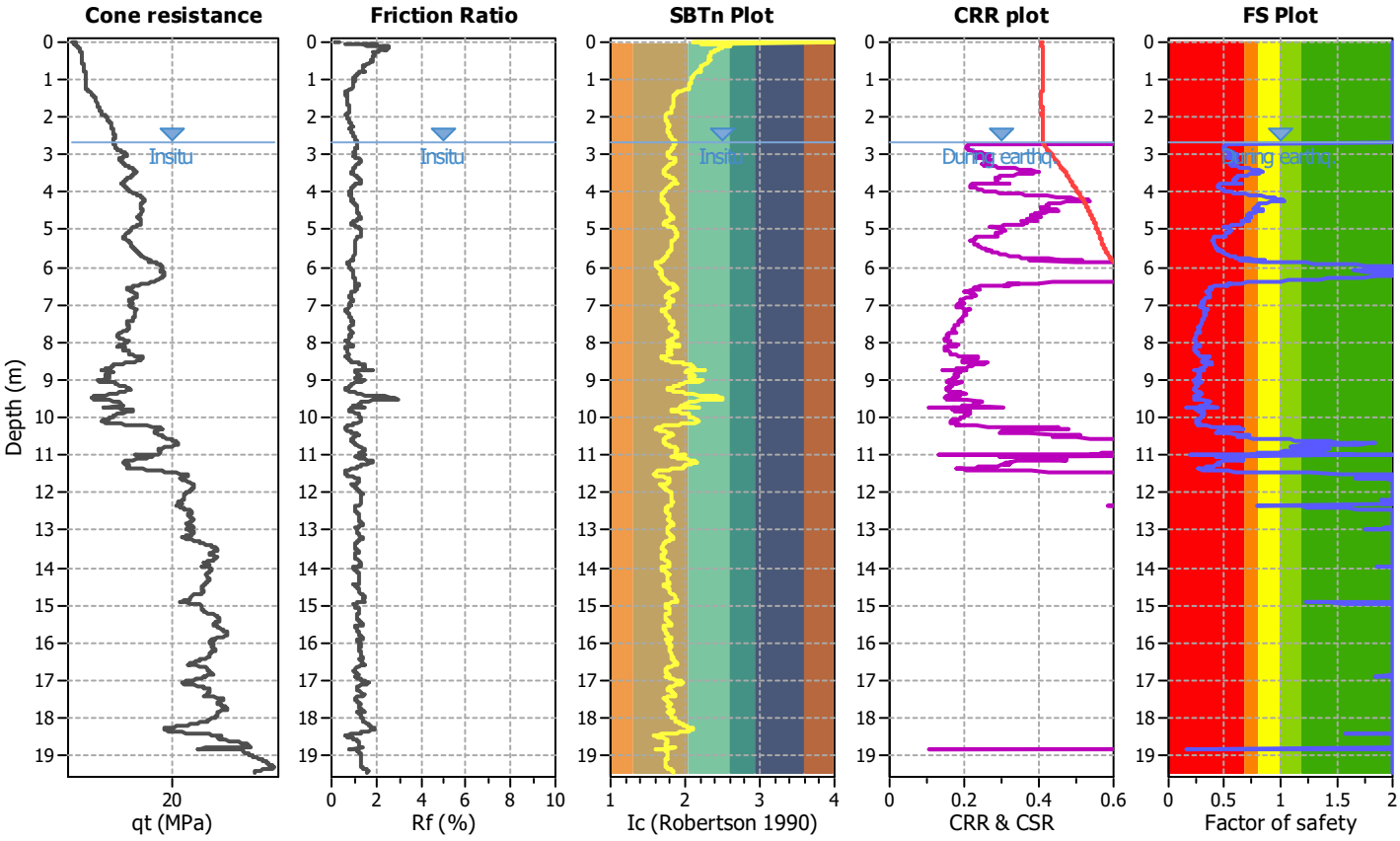
LIQUEFACTION ANALYSIS REPORT

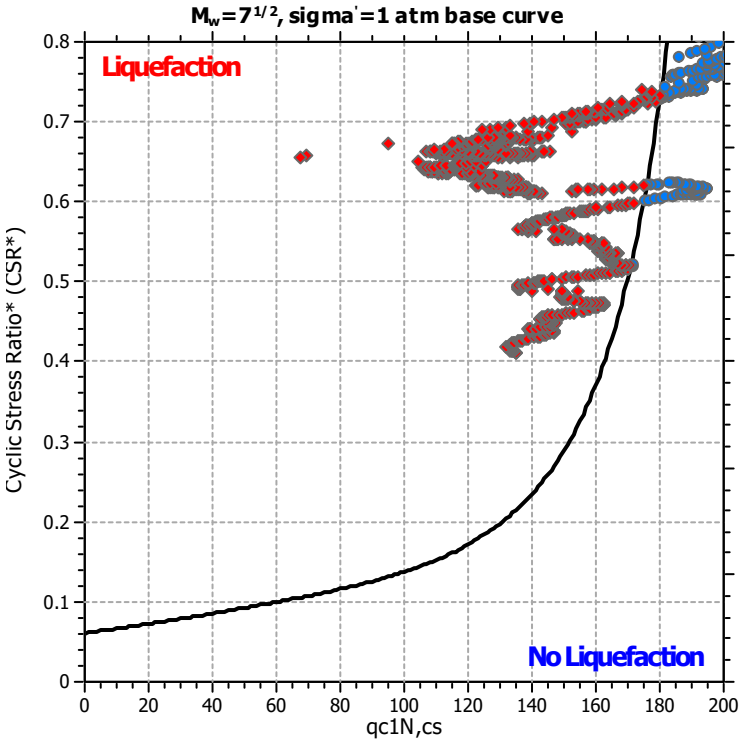
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

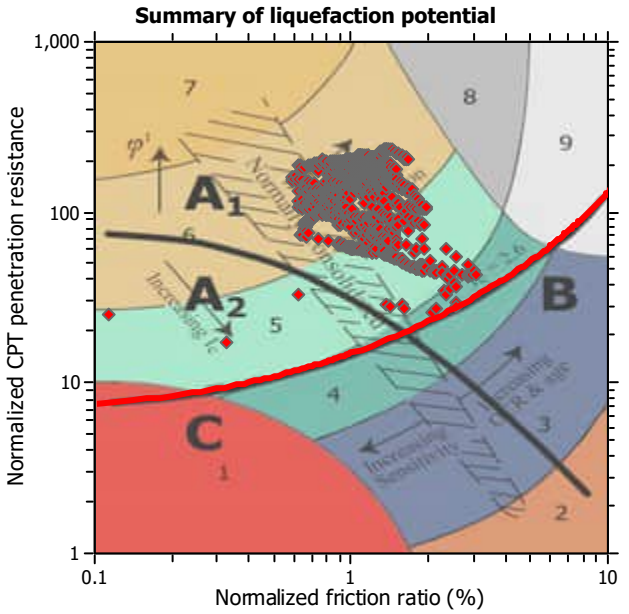
CPT file : CPT15

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.70 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

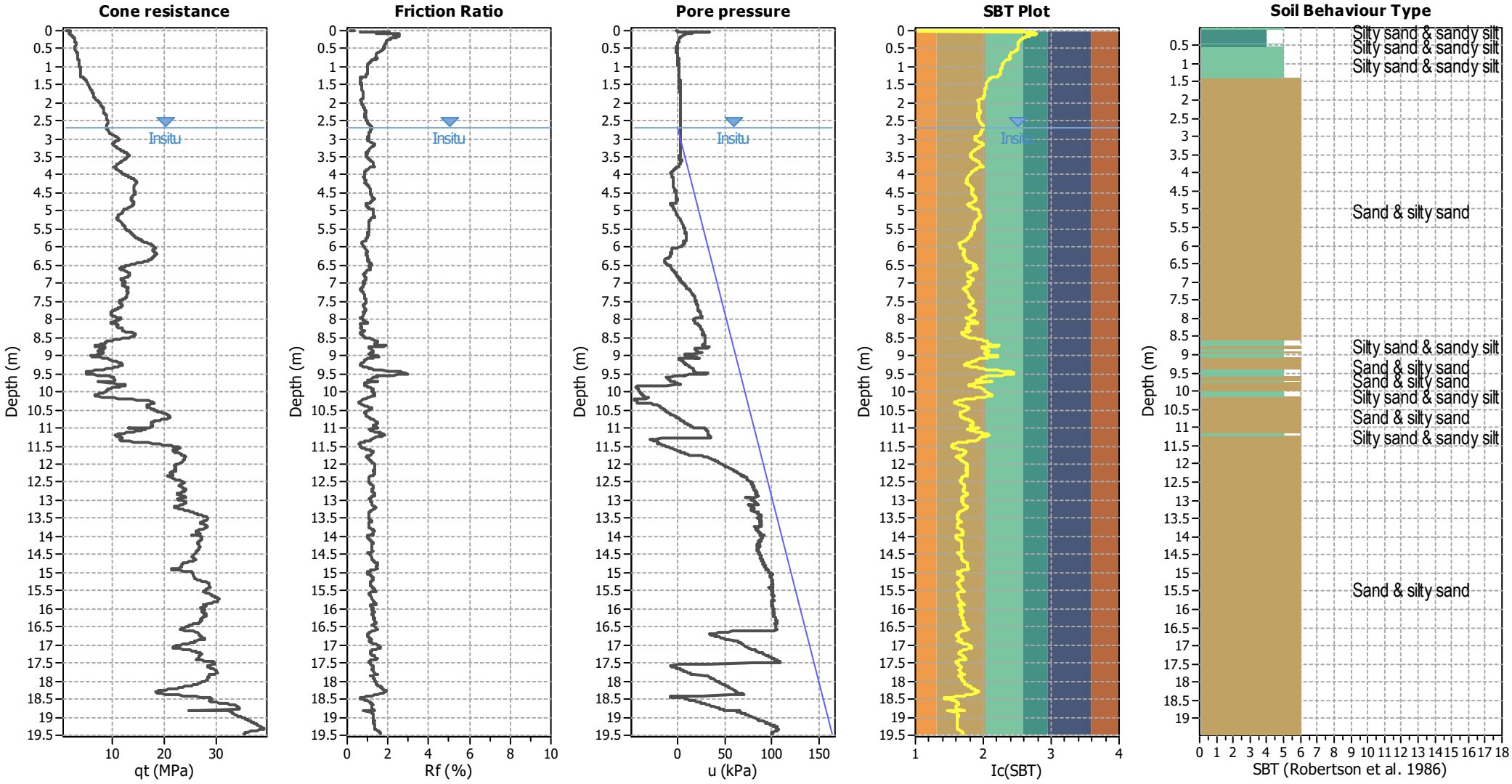






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



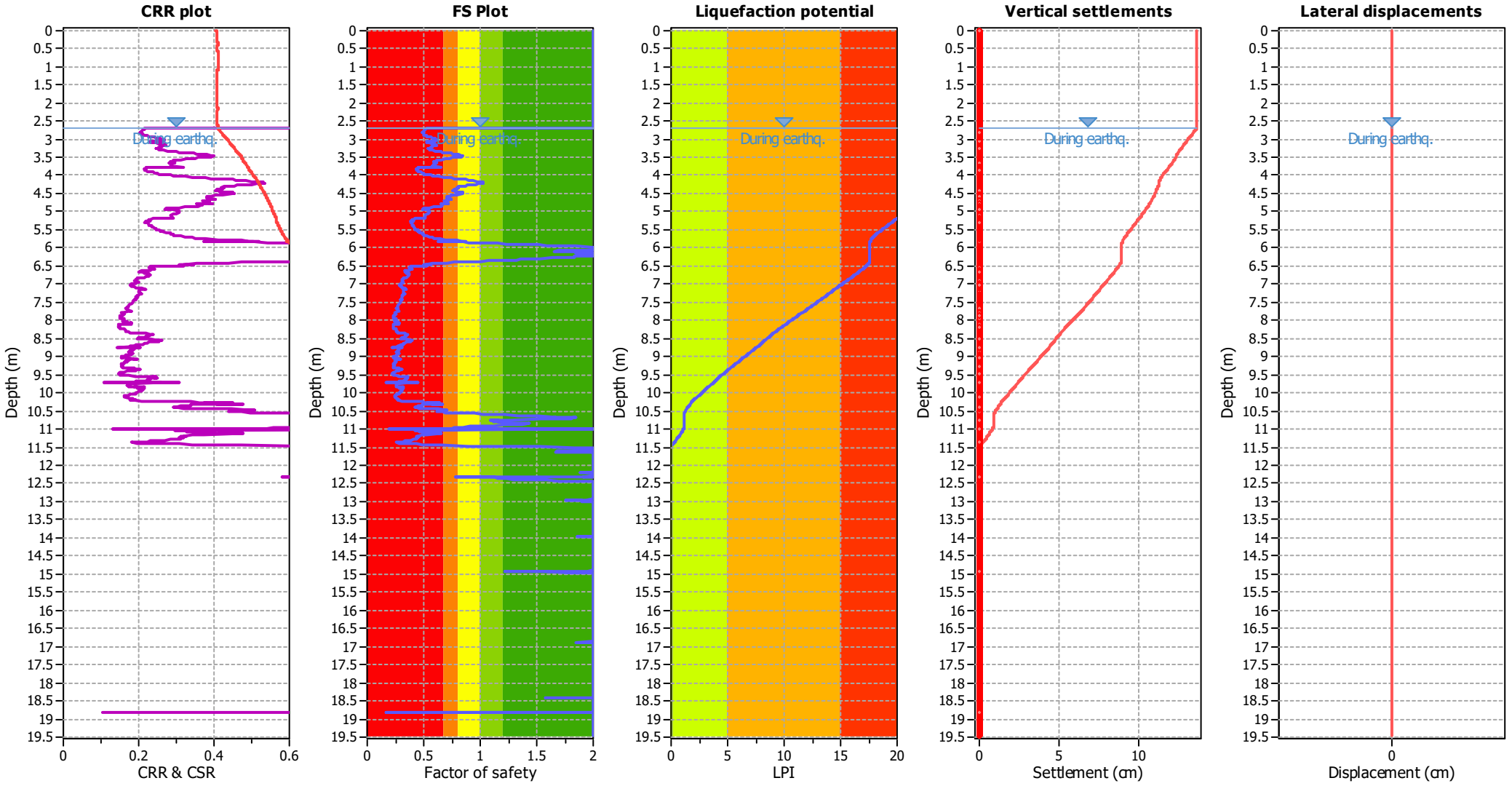
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	2.70 m	Fill height:	N/A	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	2.70 m	Fill height:	N/A	Limit depth:	N/A

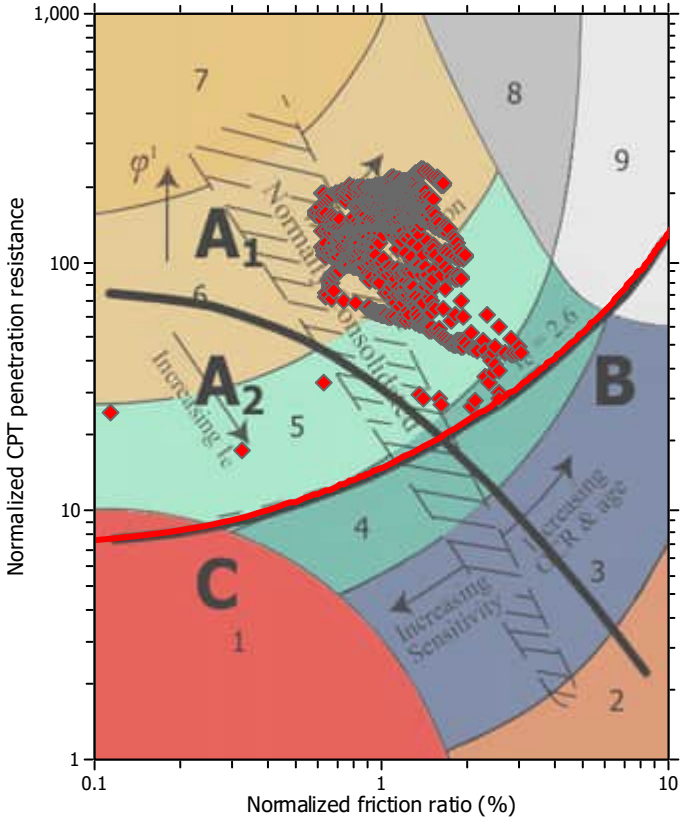
F.S. color scheme

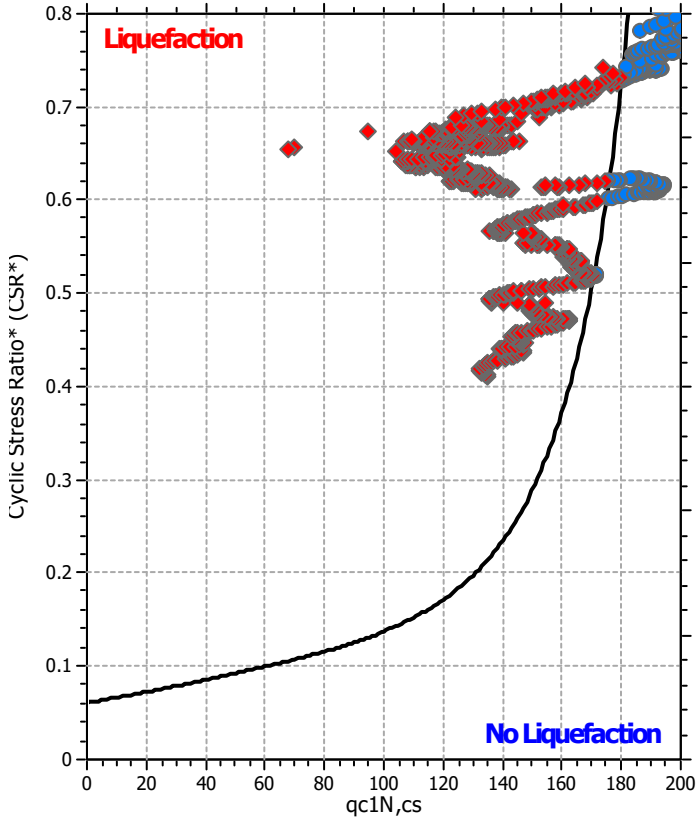
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

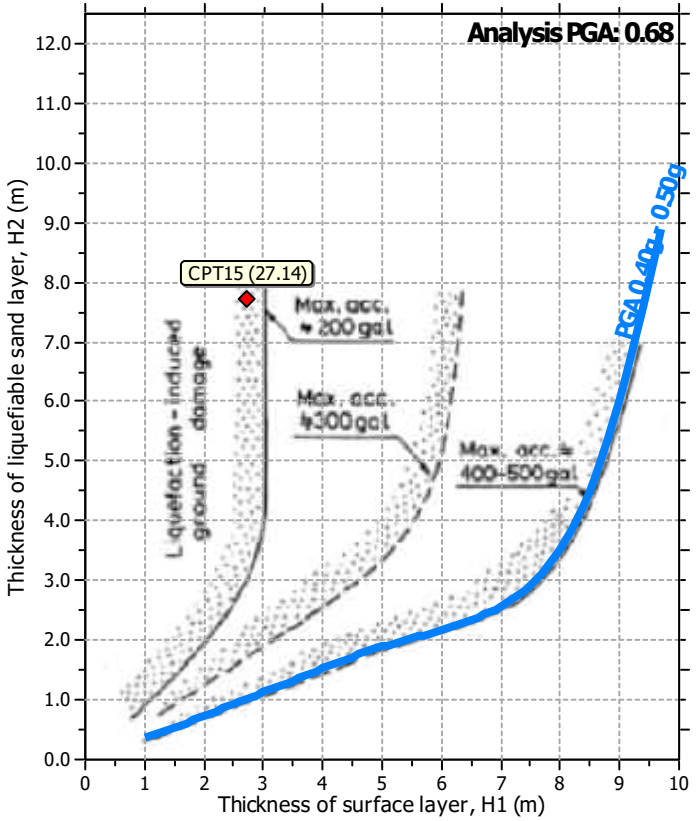
LPI color scheme

- 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.):	2.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	2.70 m	Fill height:	N/A	Limit depth:	N/A

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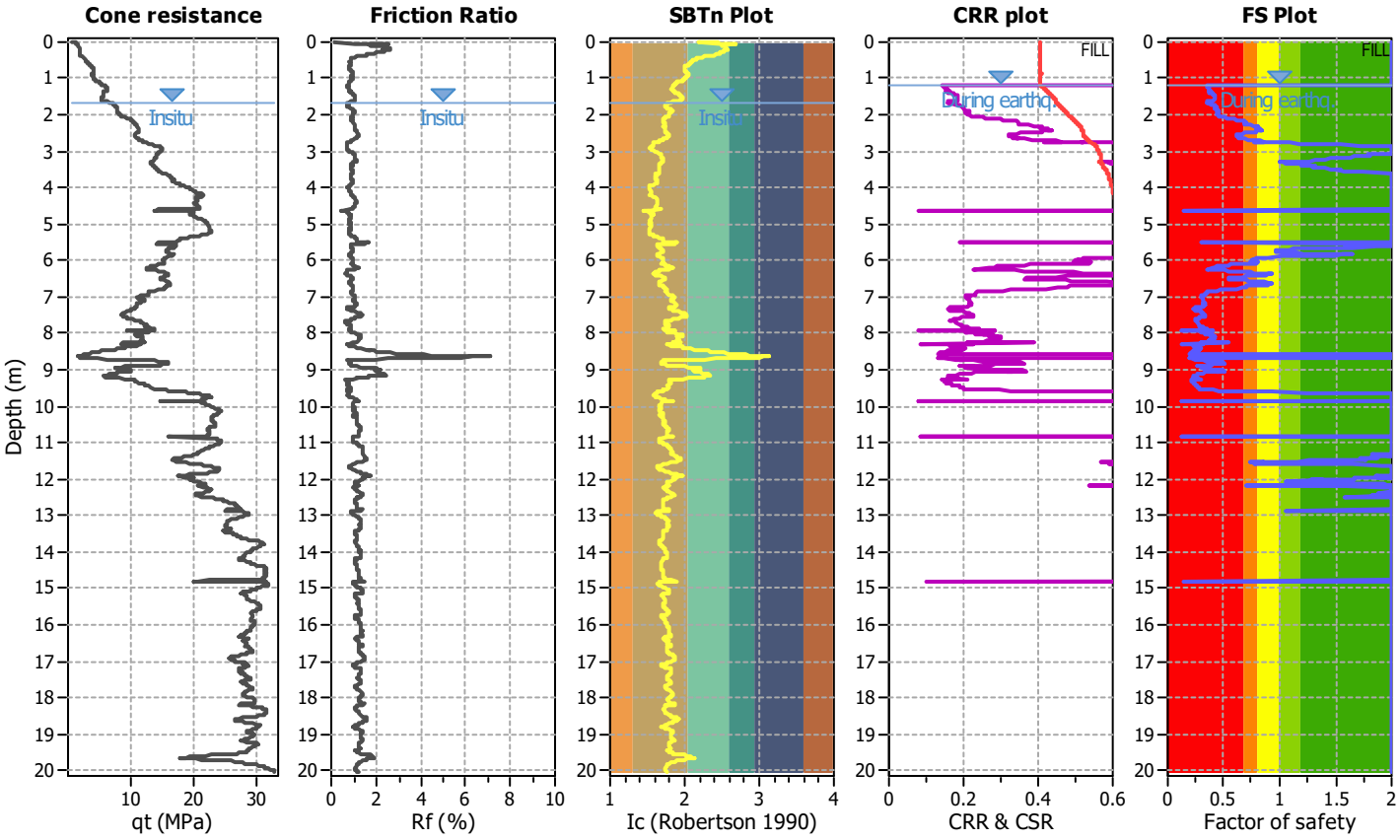
LIQUEFACTION ANALYSIS REPORT

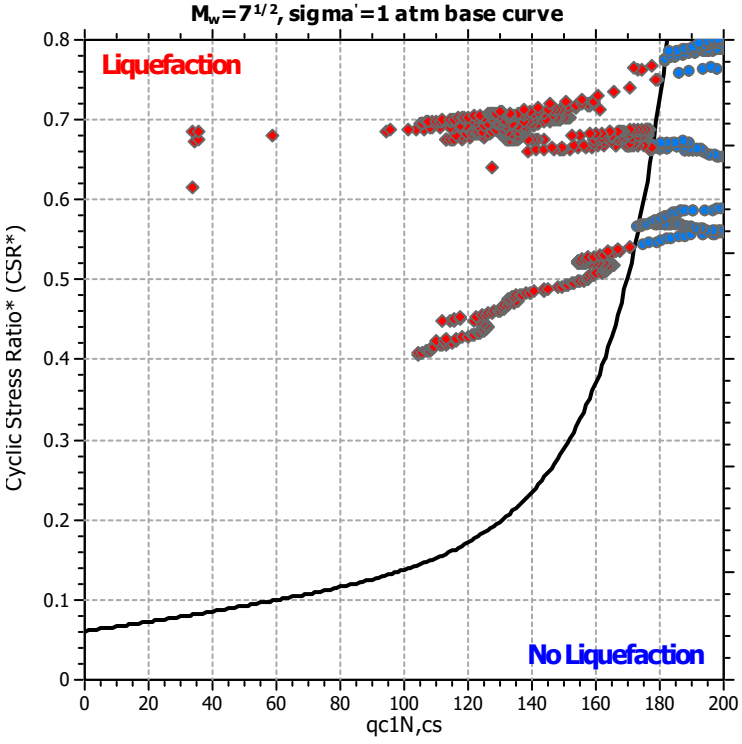
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

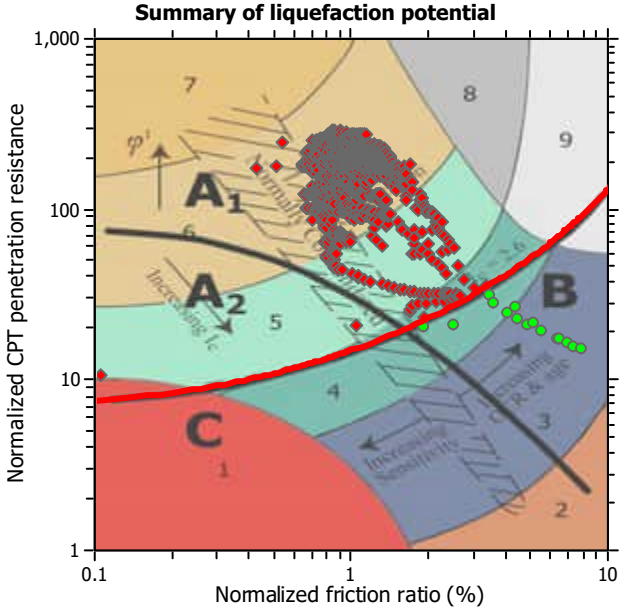
CPT file : CPT16

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.20 m	Fill height:	1.00 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

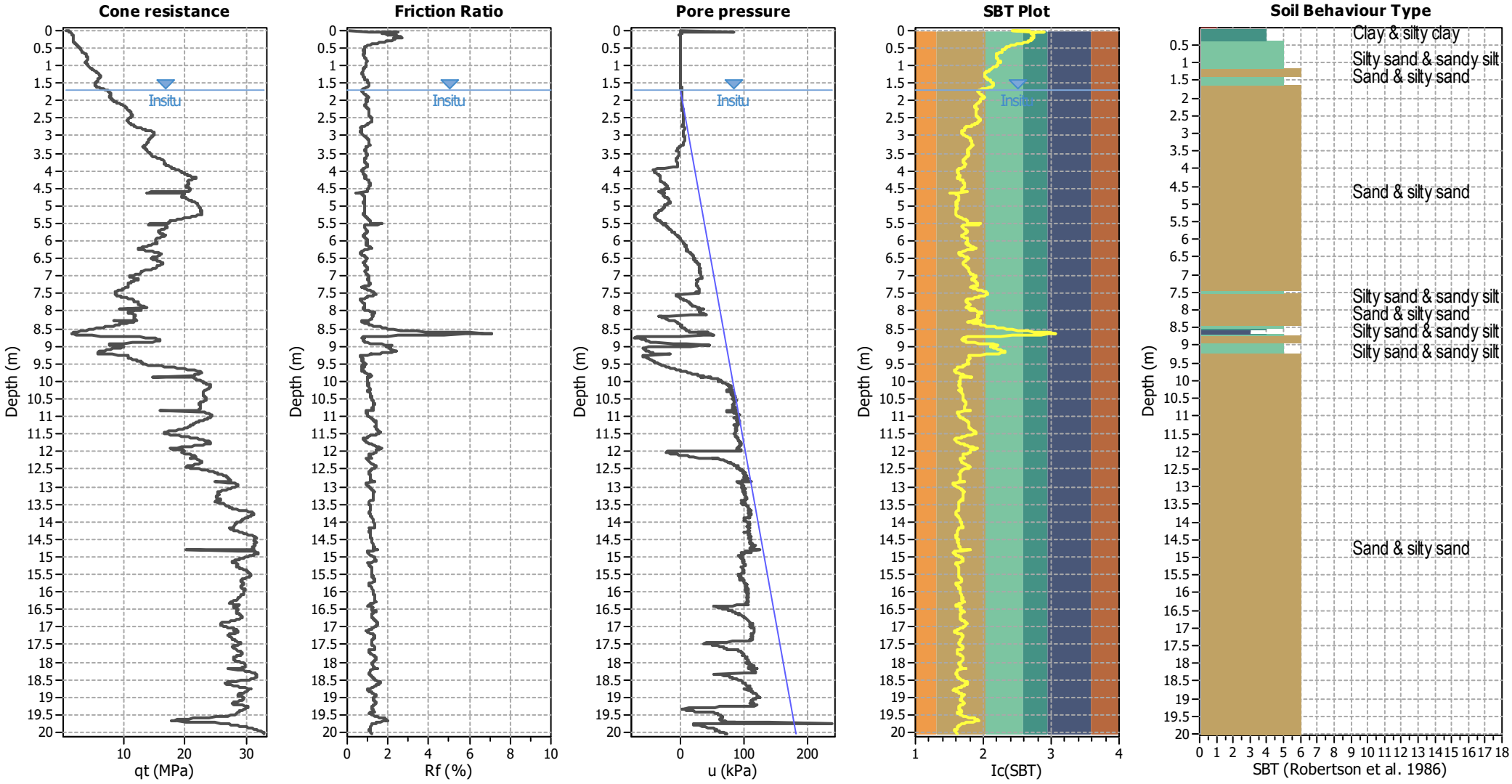






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



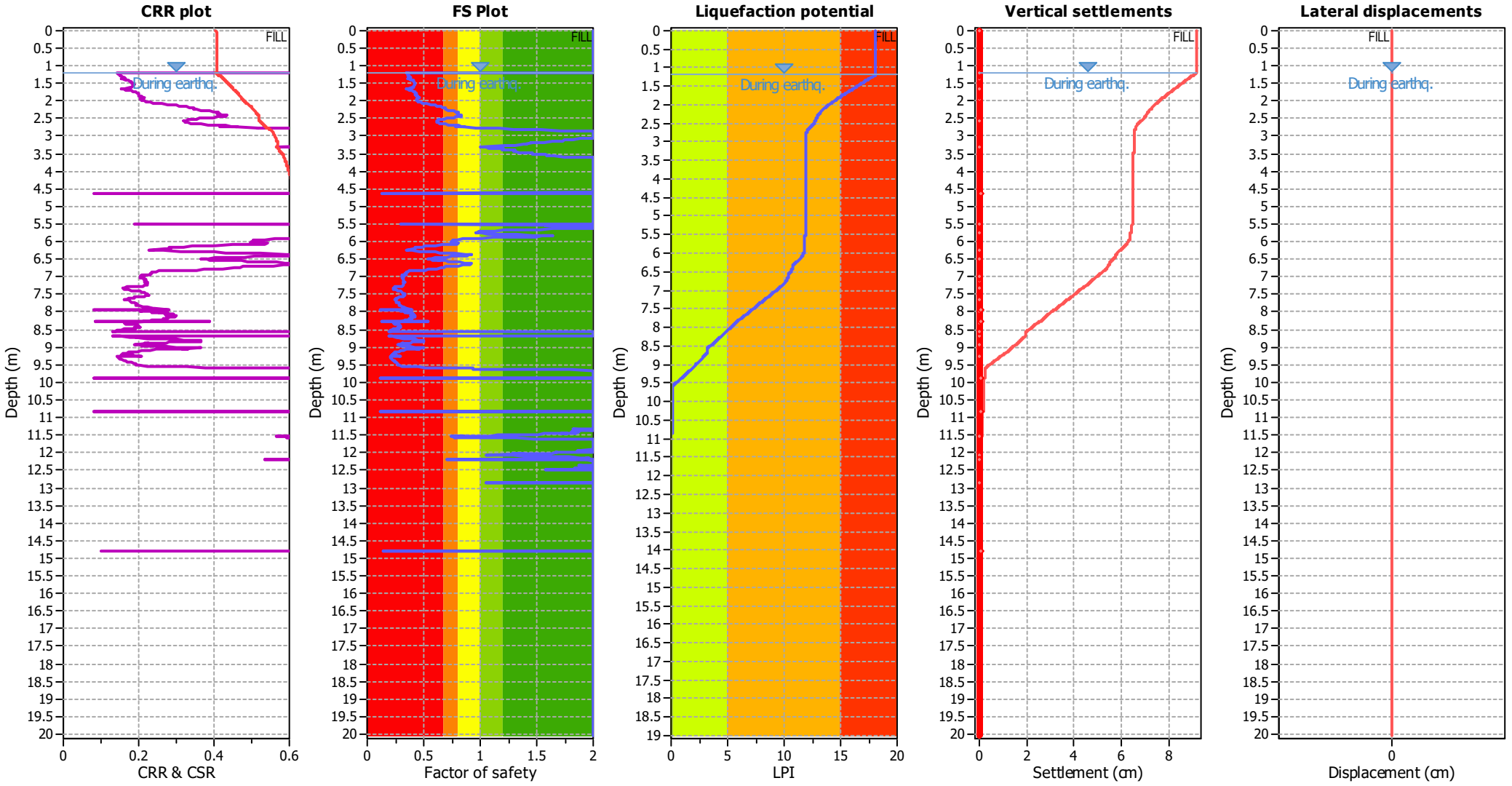
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	1.00 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.20 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	1.00 m	Limit depth:	N/A

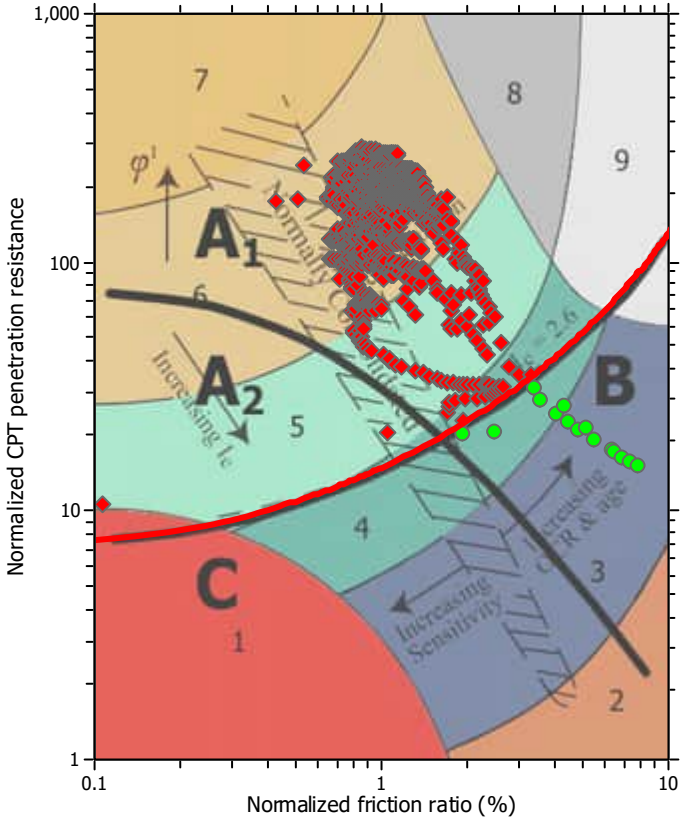
F.S. color scheme

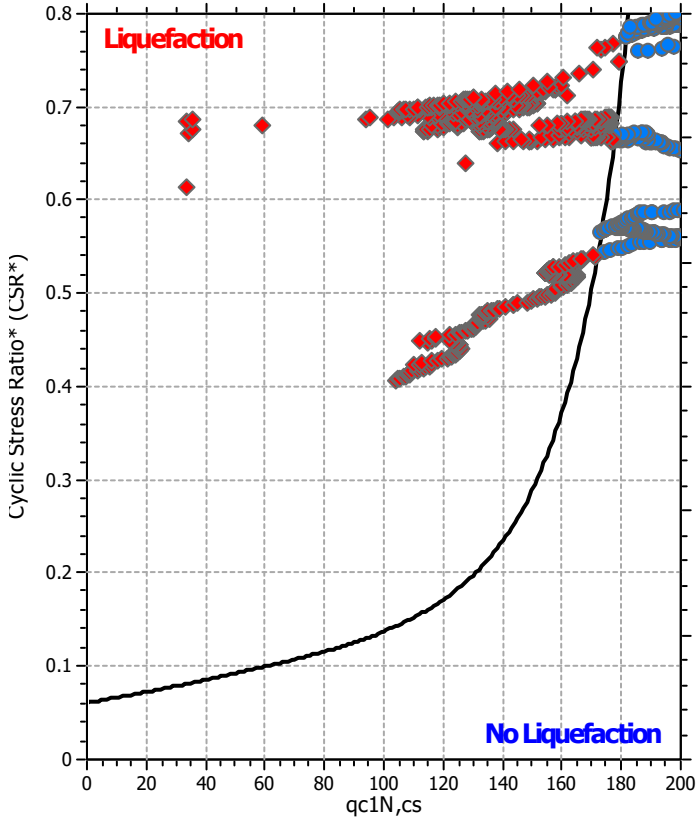
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

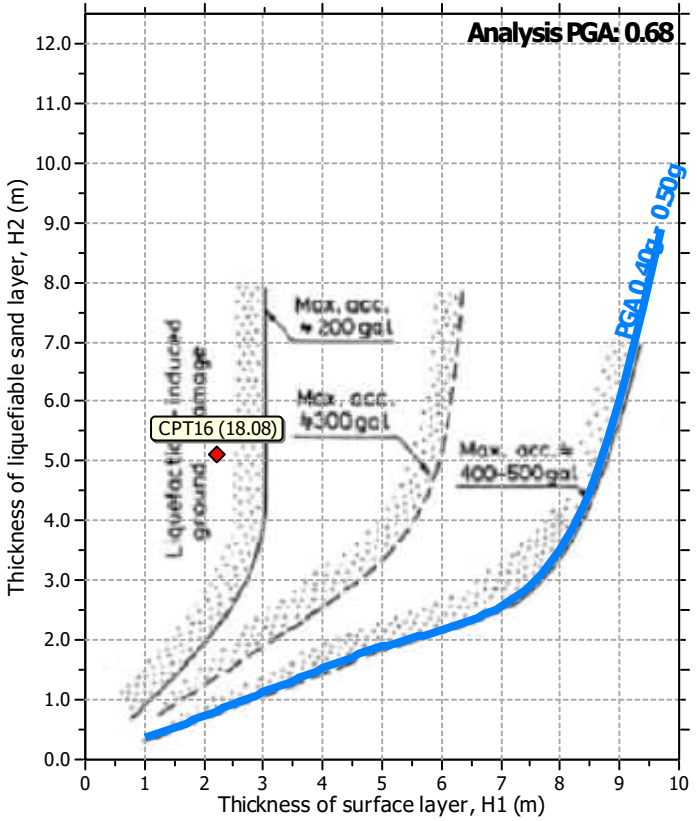
LPI color scheme

- 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.):	2.20 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	1.00 m	Limit depth:	N/A

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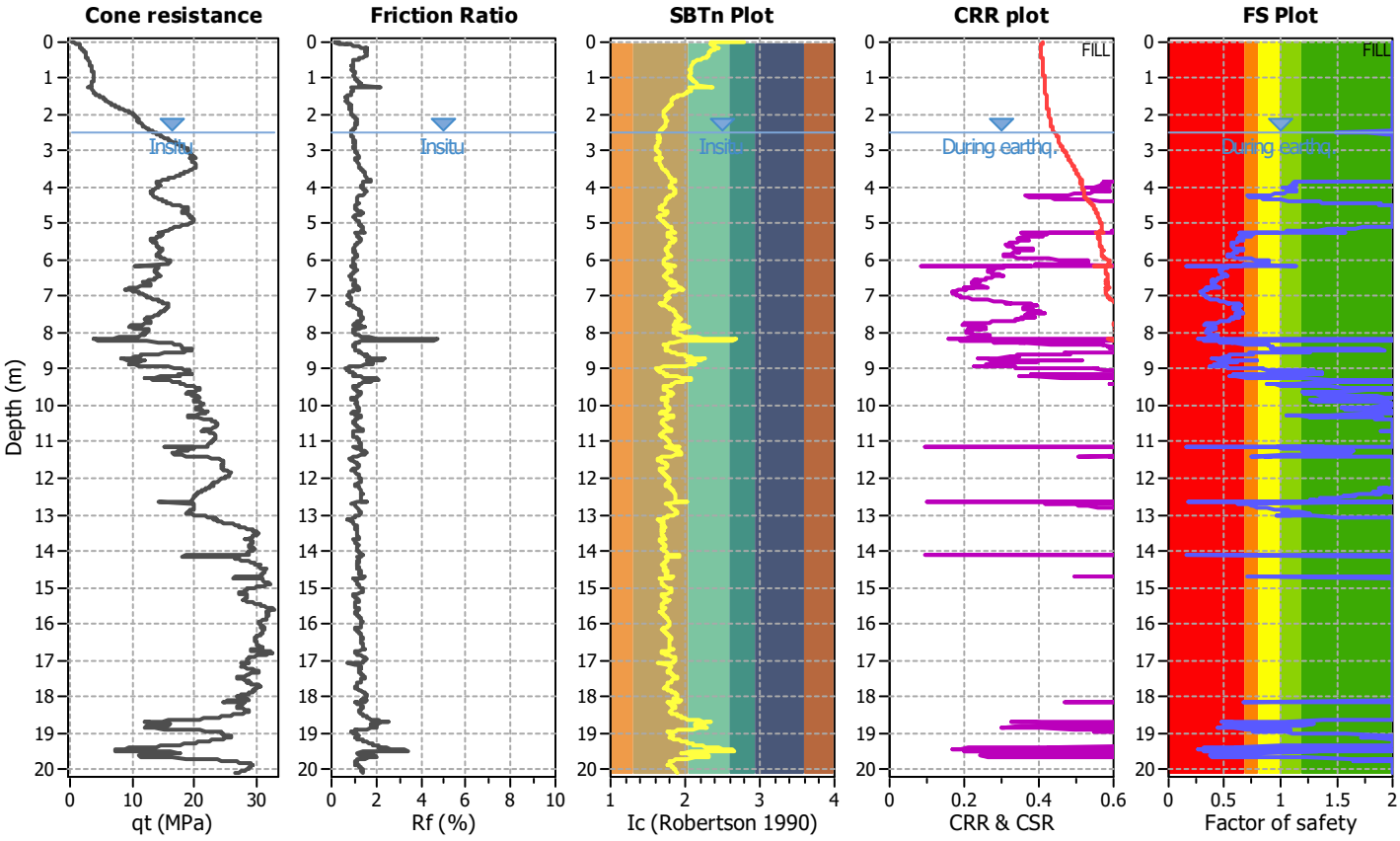
LIQUEFACTION ANALYSIS REPORT

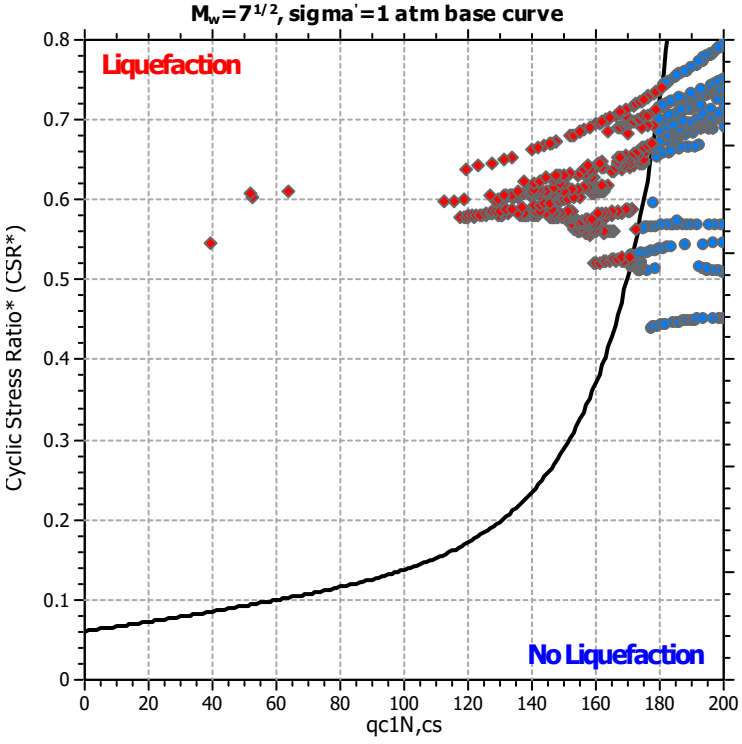
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

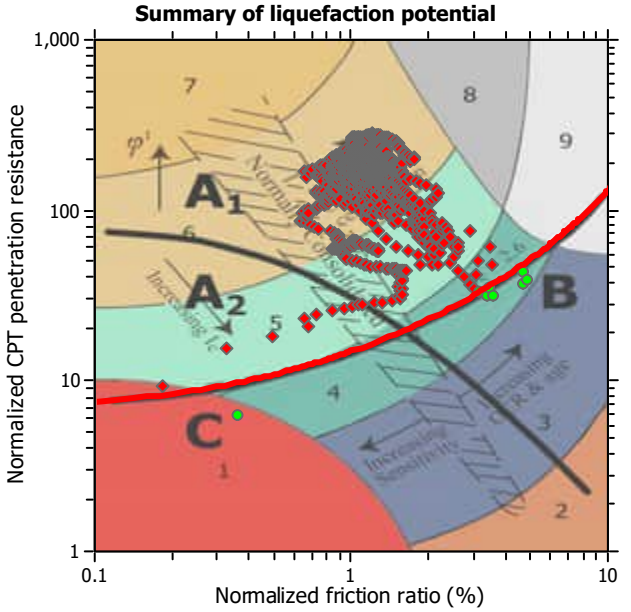
CPT file : CPT17

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.47 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	4.47 m	Fill height:	2.00 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

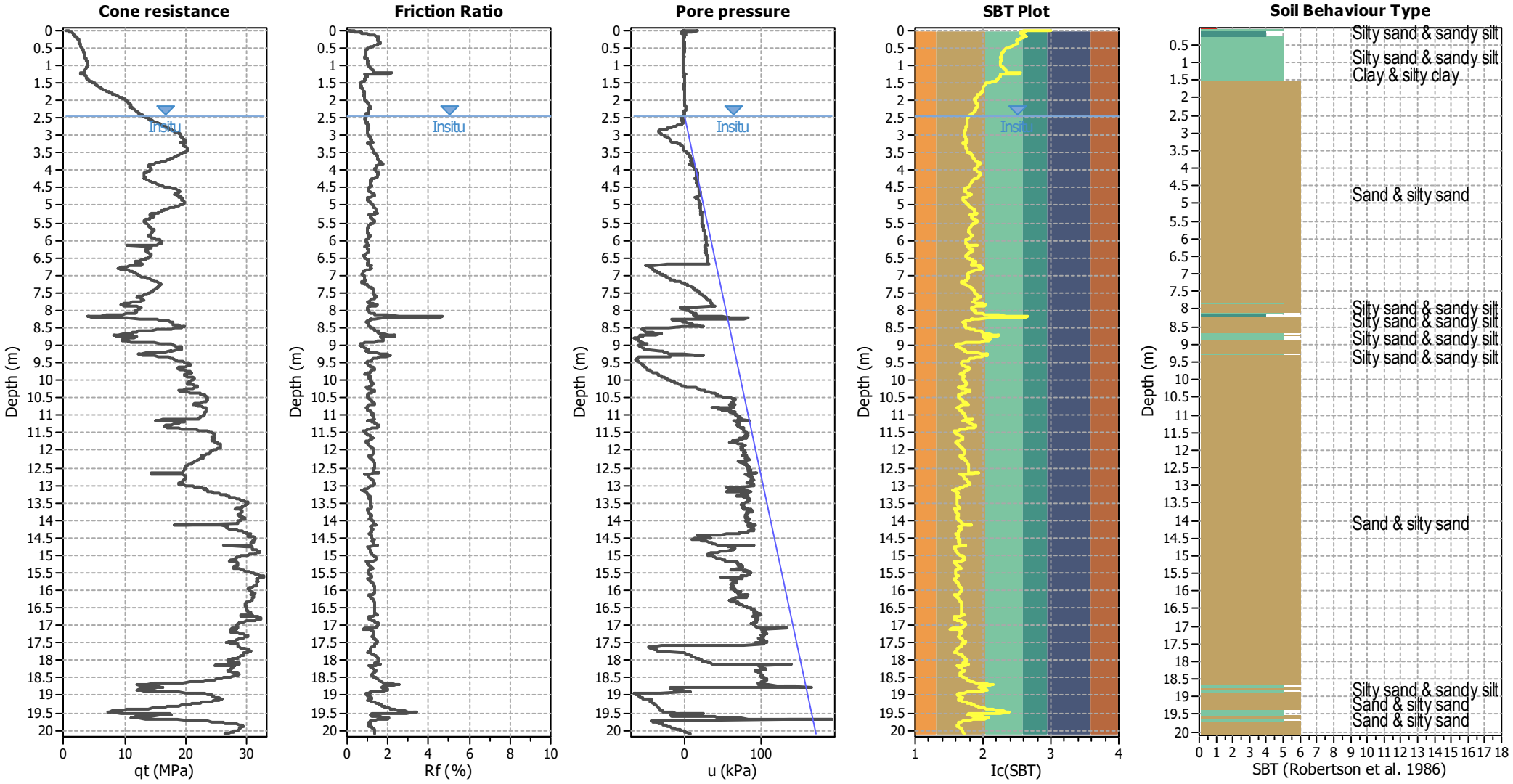






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



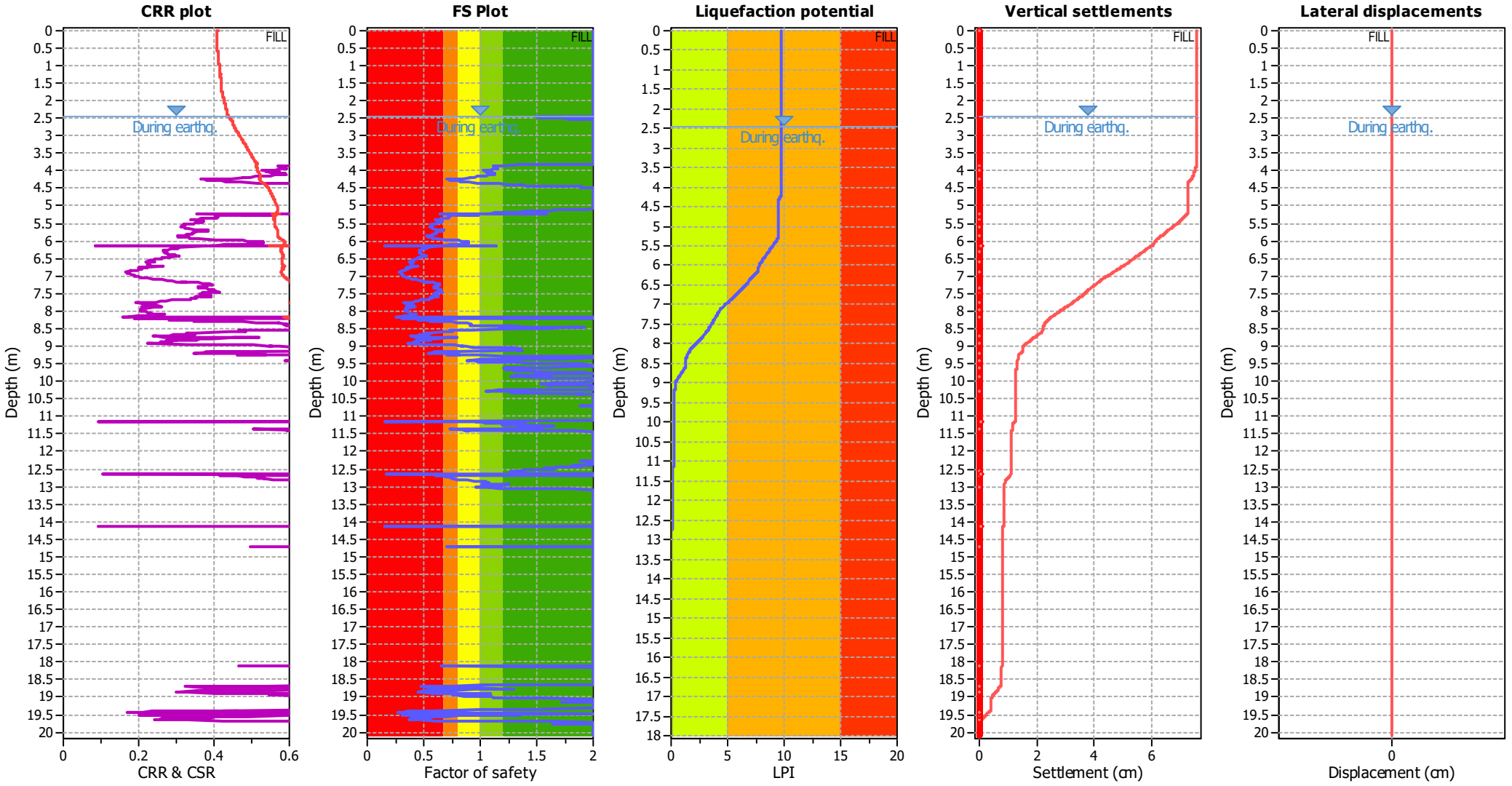
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	4.47 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	2.47 m	Fill height:	2.00 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	4.47 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	2.47 m	Fill height:	2.00 m	Limit depth:	N/A

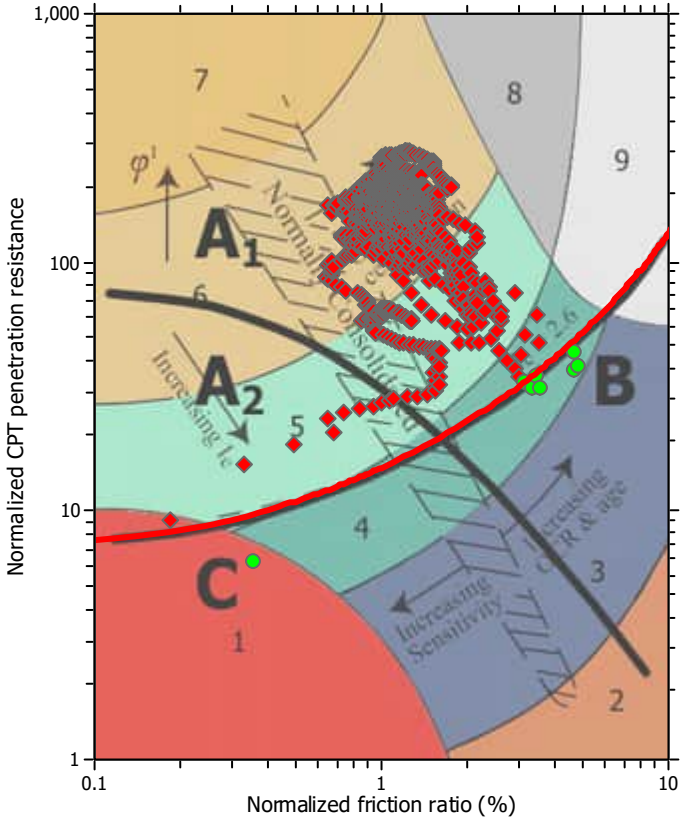
F.S. color scheme

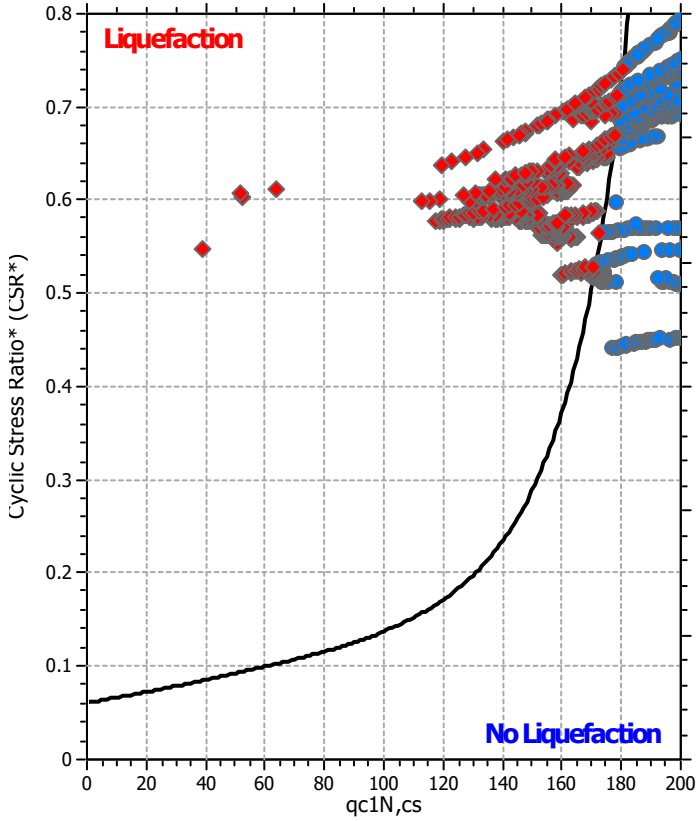
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

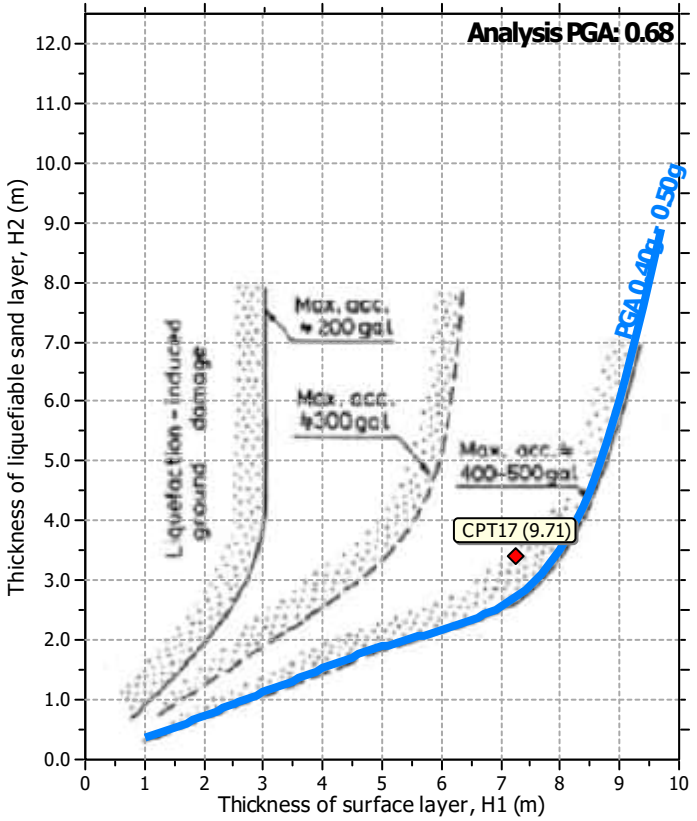
LPI color scheme

- 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.):	4.47 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	2.47 m	Fill height:	2.00 m	Limit depth:	N/A

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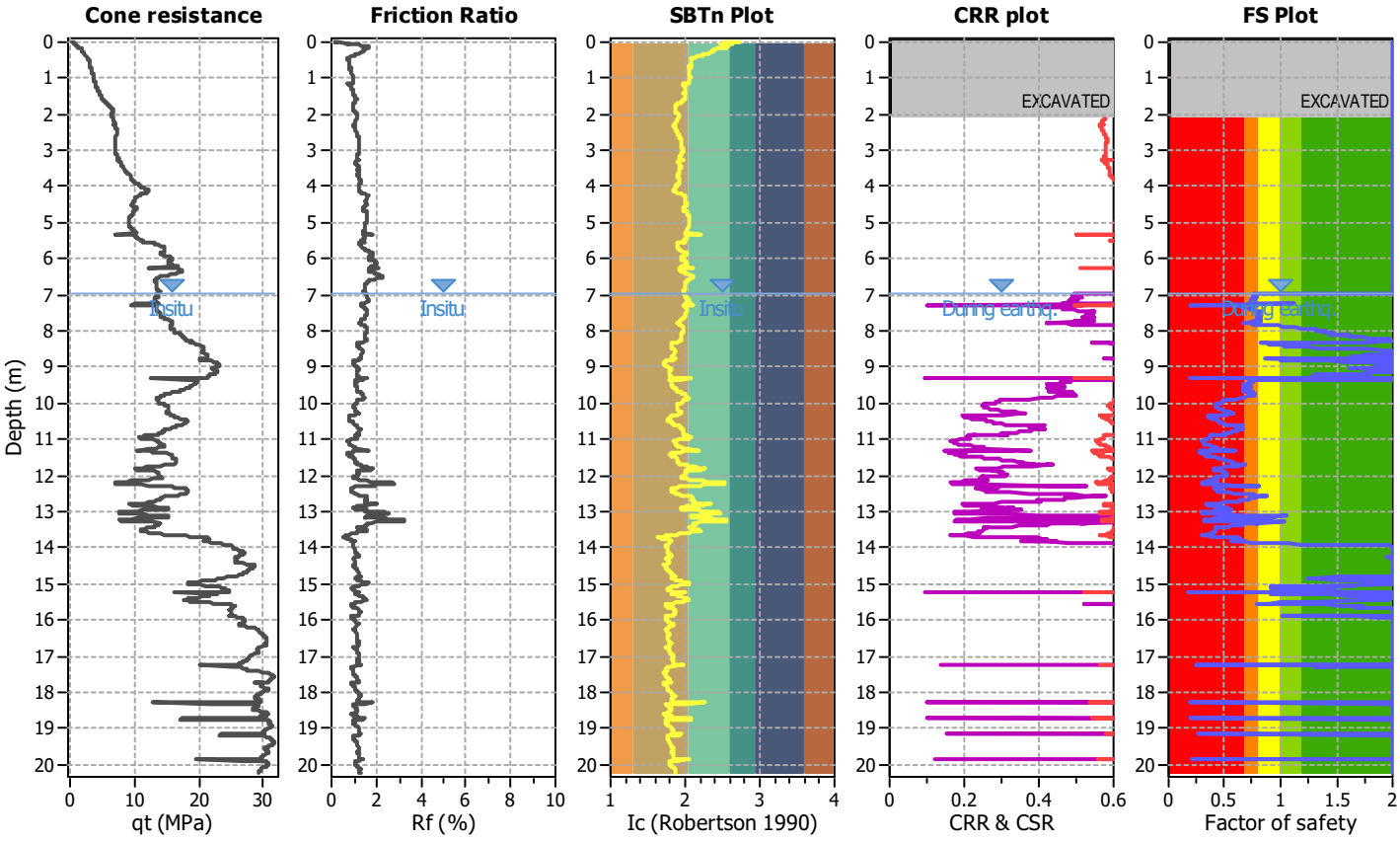
LIQUEFACTION ANALYSIS REPORT

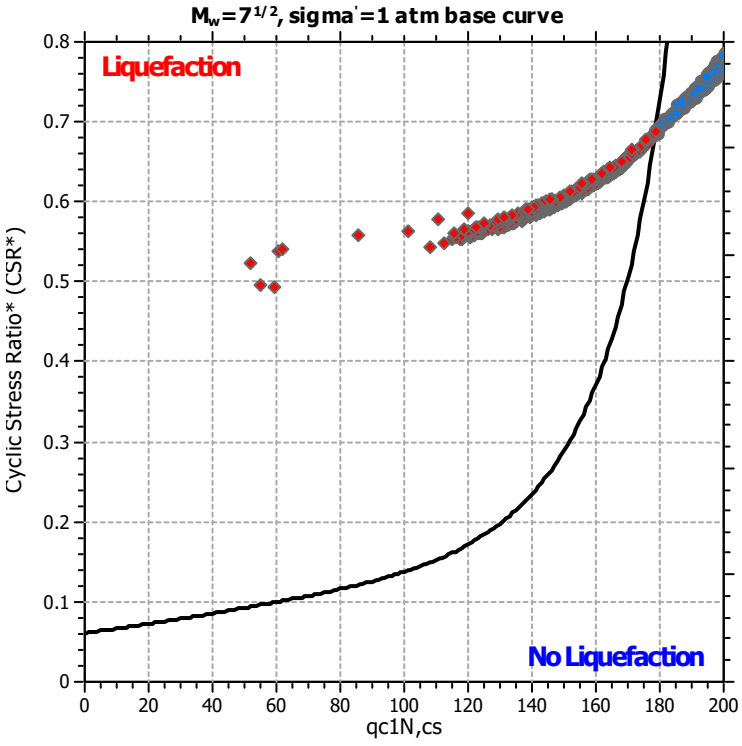
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

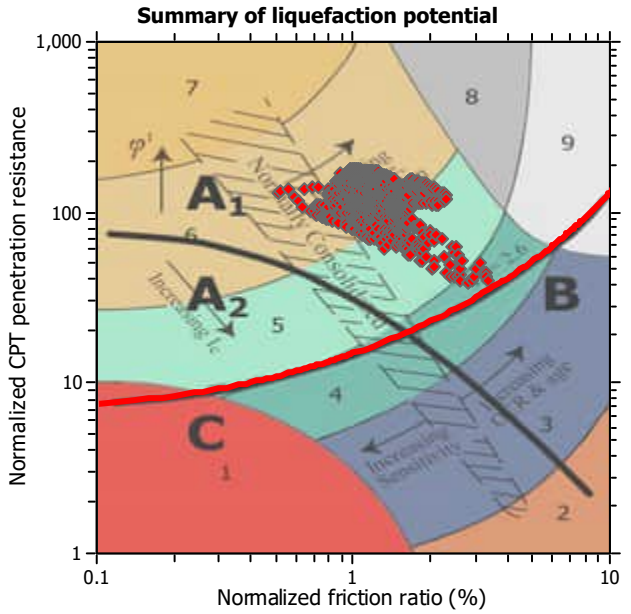
CPT file : CPT18

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	6.97 m	Excavation:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	6.97 m	Excavation depth:	2.10 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Footing load:	500.00 kPa	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

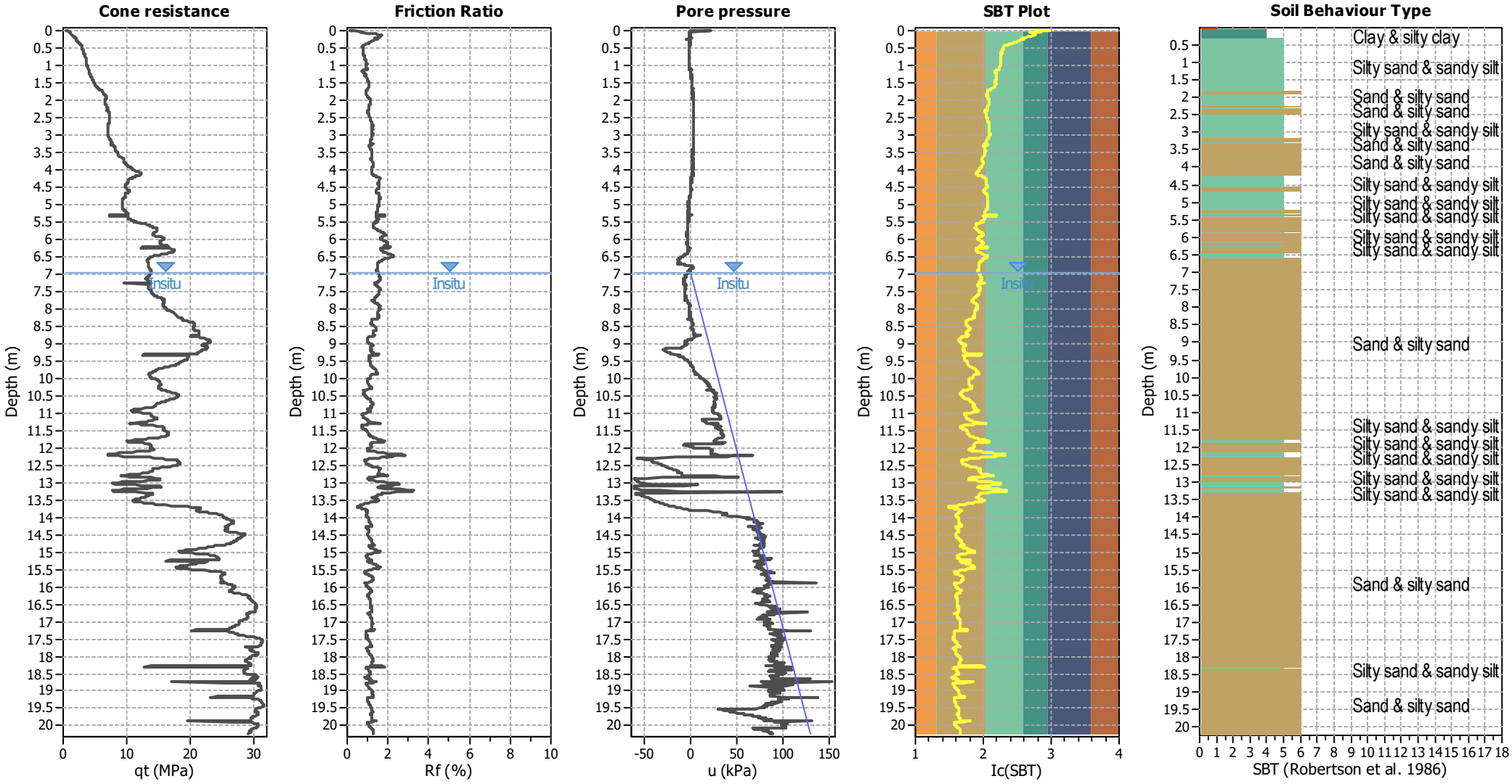






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



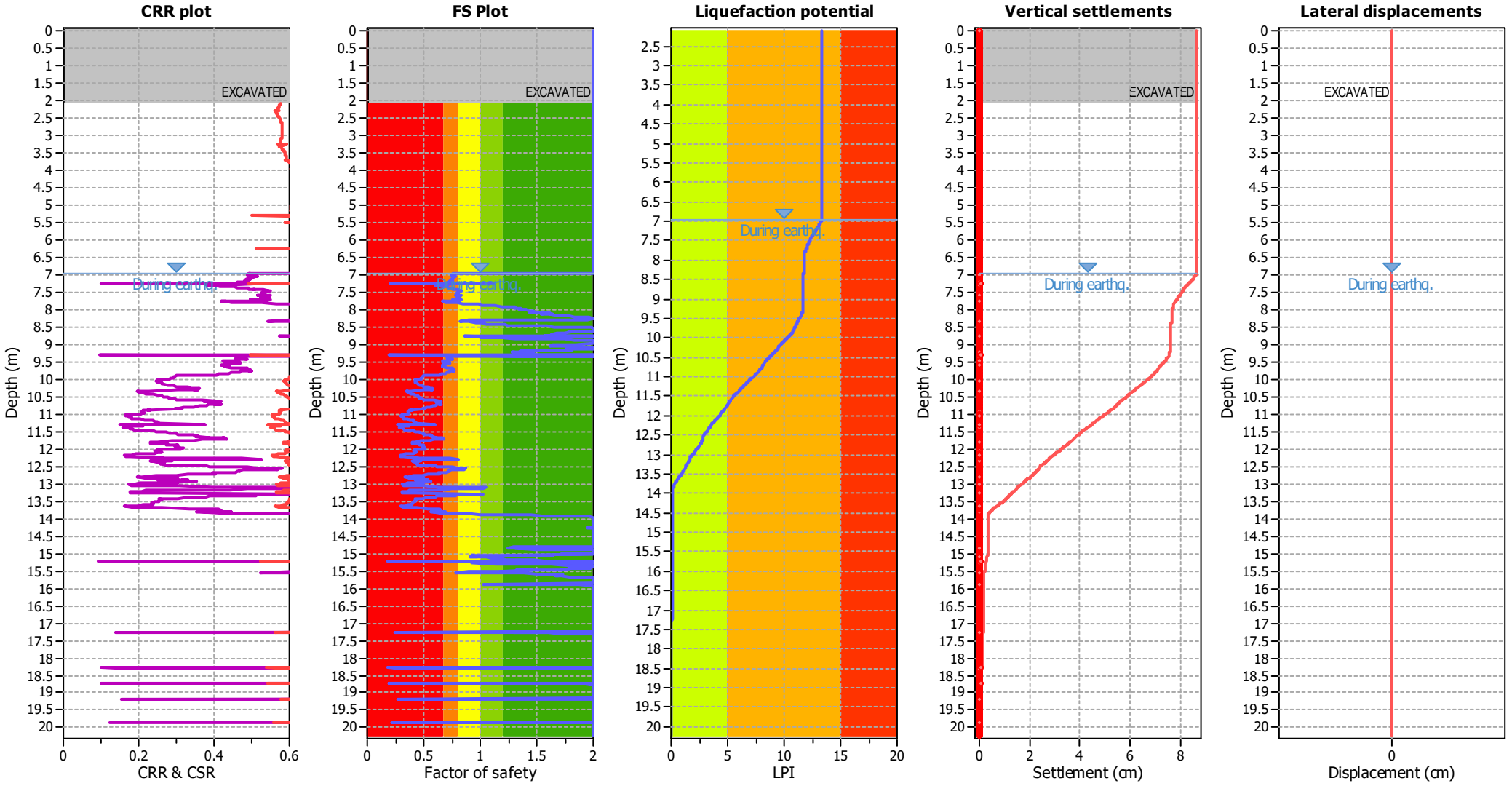
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.97 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	6.97 m	Excavation depth:	2.10 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.97 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	6.97 m	Excavation depth:	2.10 m	Limit depth:	N/A

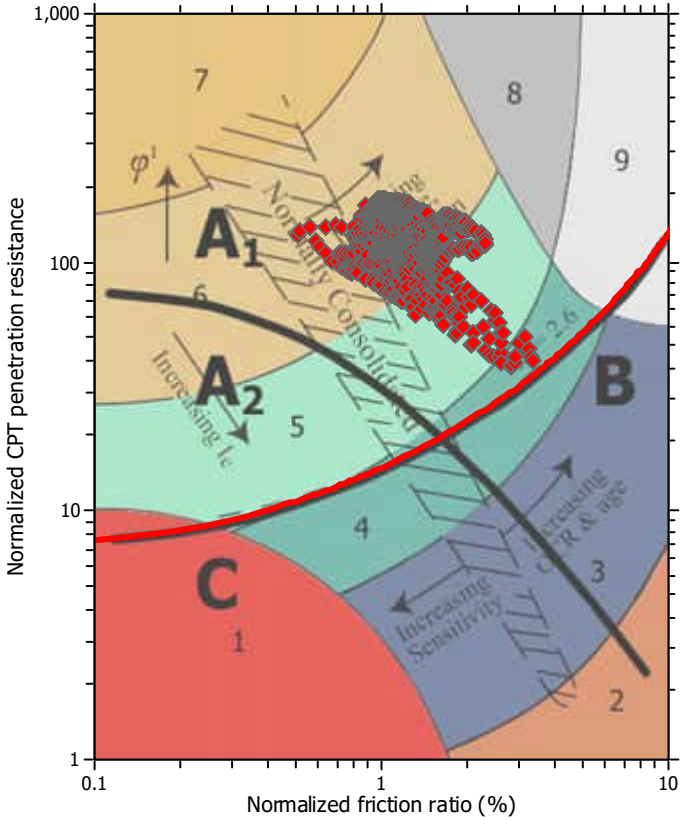
F.S. color scheme

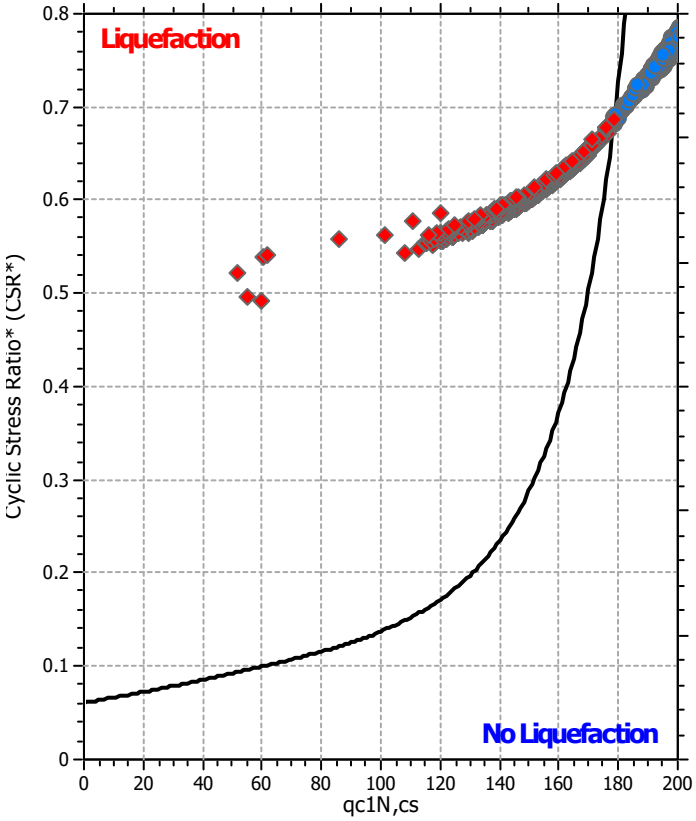
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

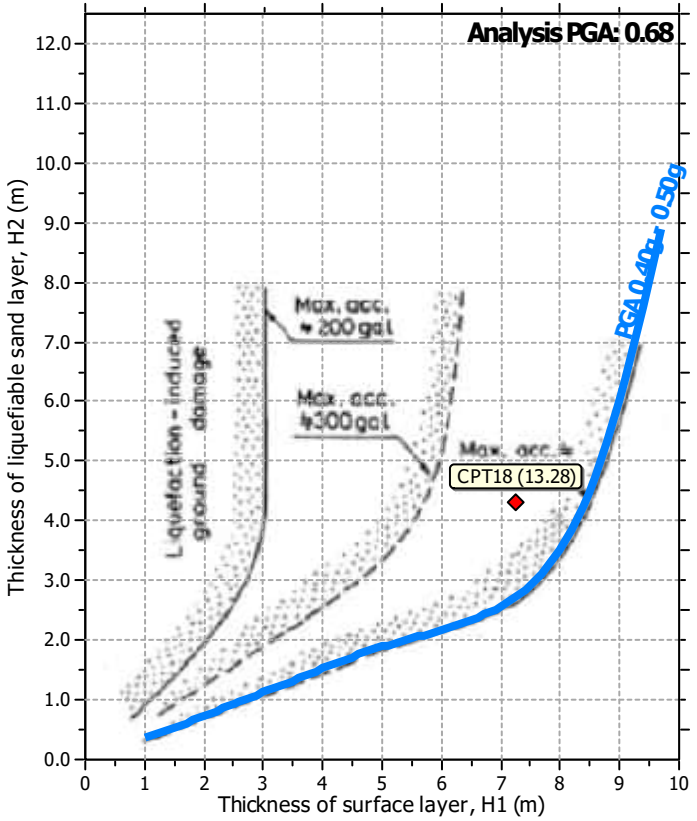
LPI color scheme

- 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.):	6.97 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	6.97 m	Excavation depth:	2.10 m	Limit depth:	N/A

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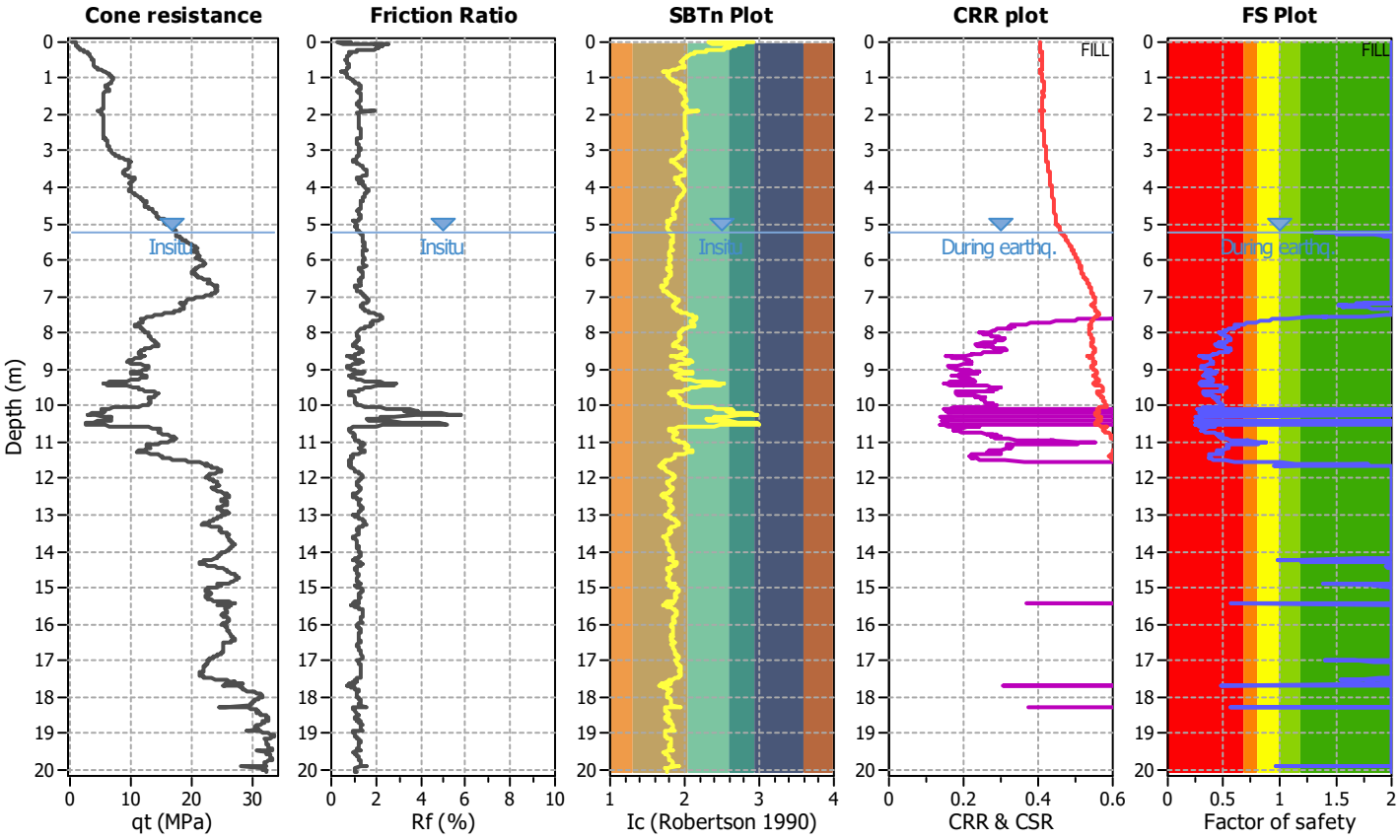
LIQUEFACTION ANALYSIS REPORT

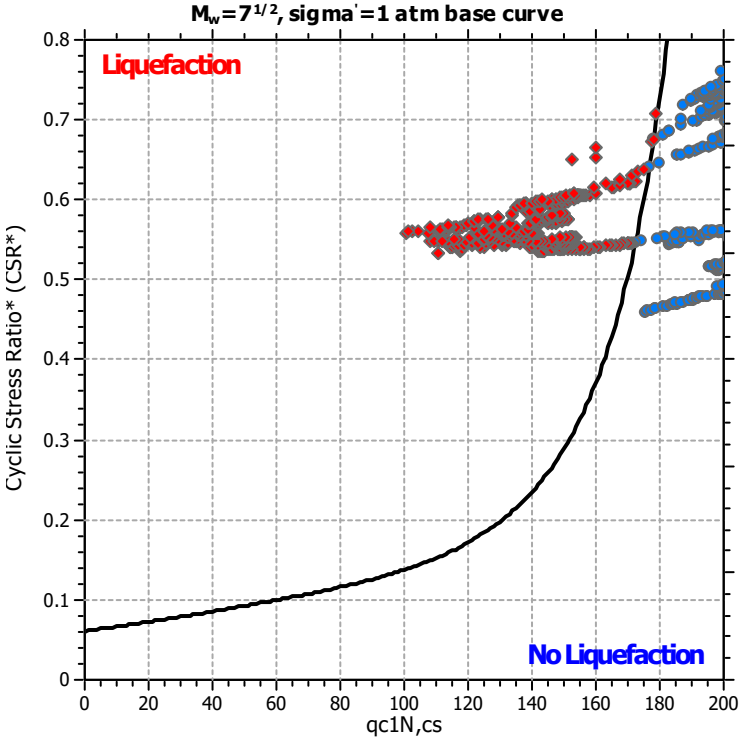
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

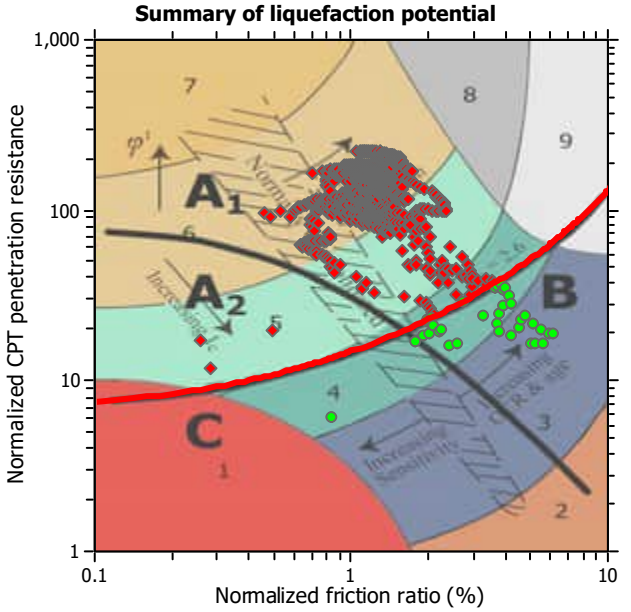
CPT file : CPT19

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.22 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.72 m	Fill height:	0.50 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

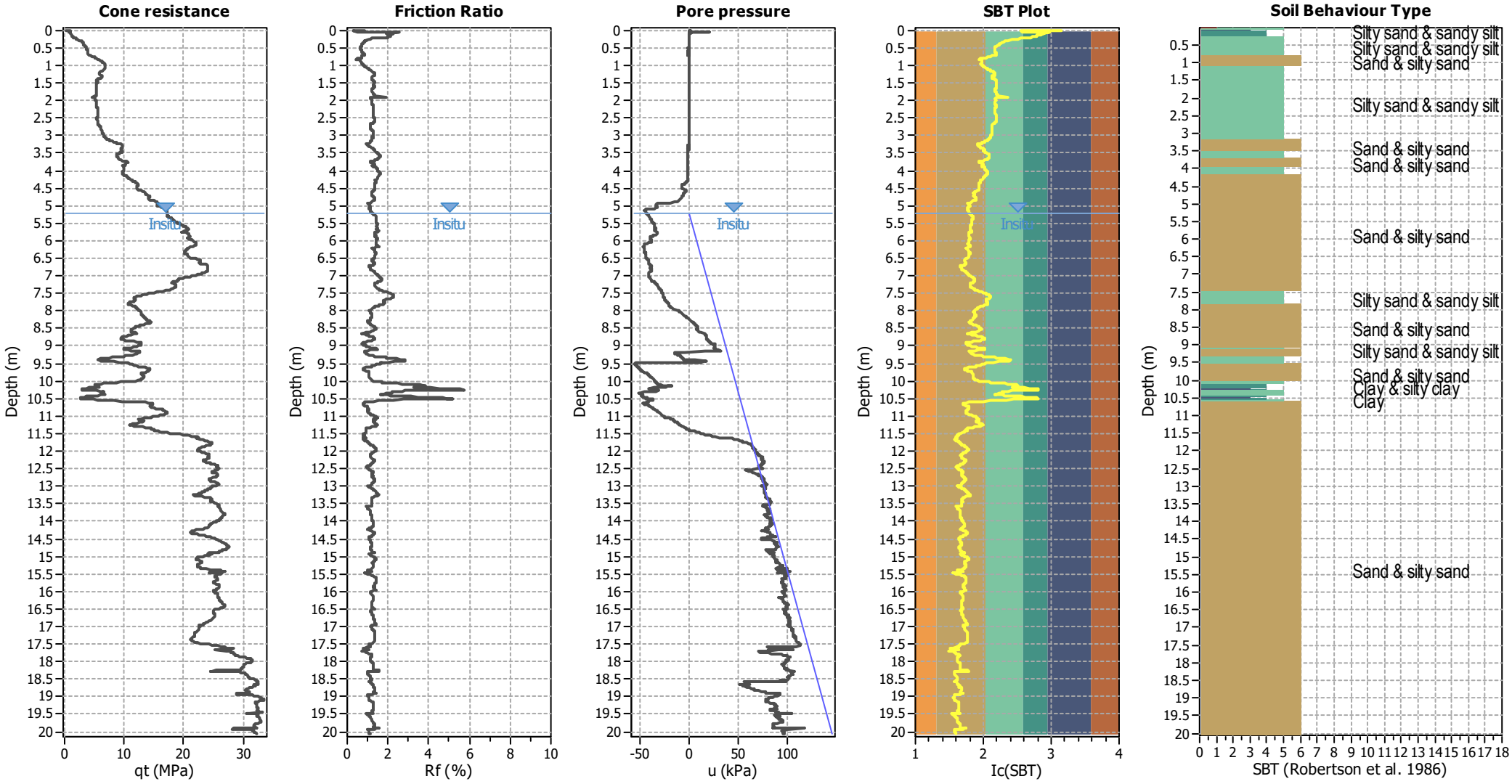






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



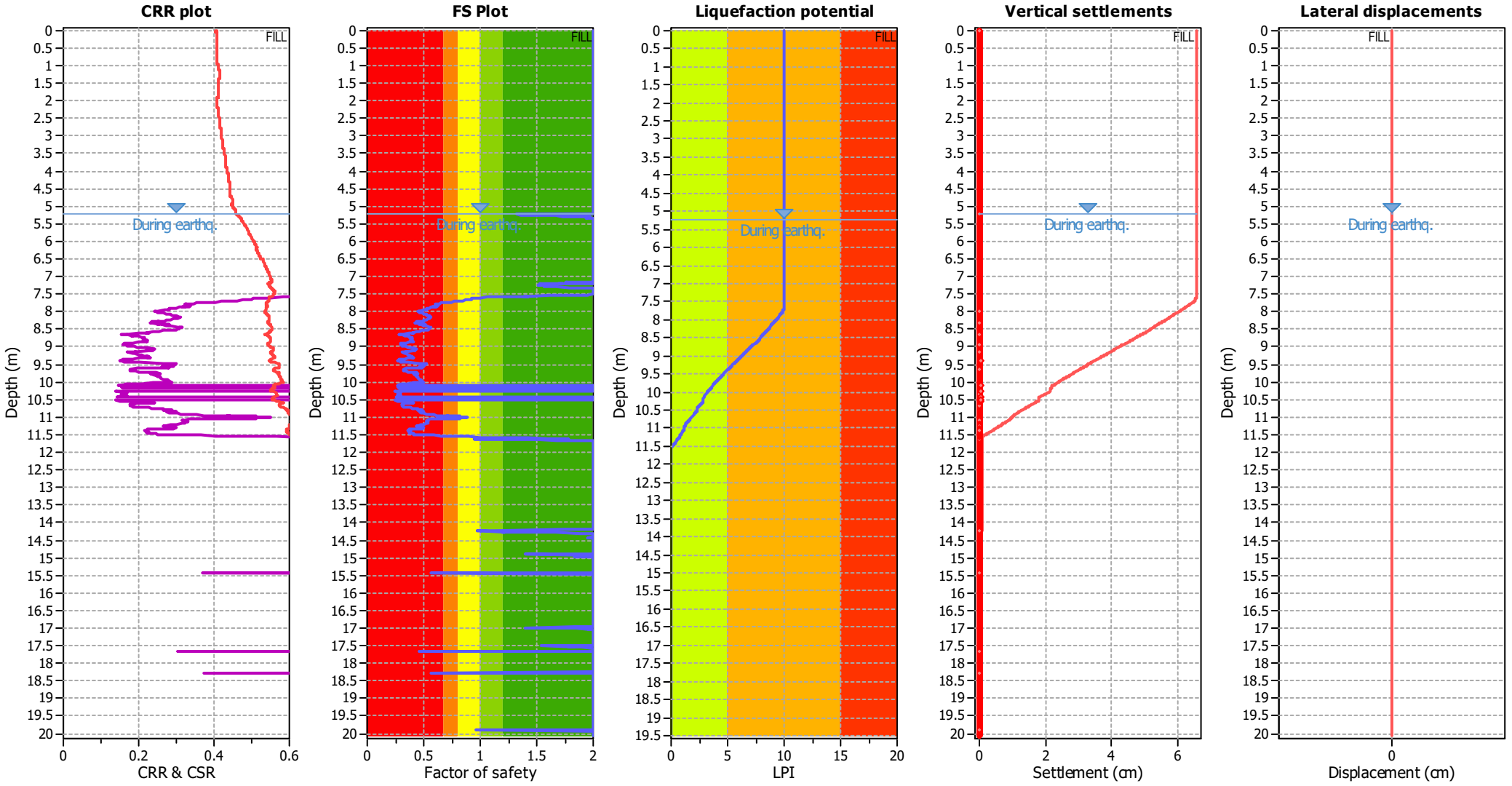
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	5.72 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.22 m	Fill height:	0.50 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	5.72 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.22 m	Fill height:	0.50 m	Limit depth:	N/A

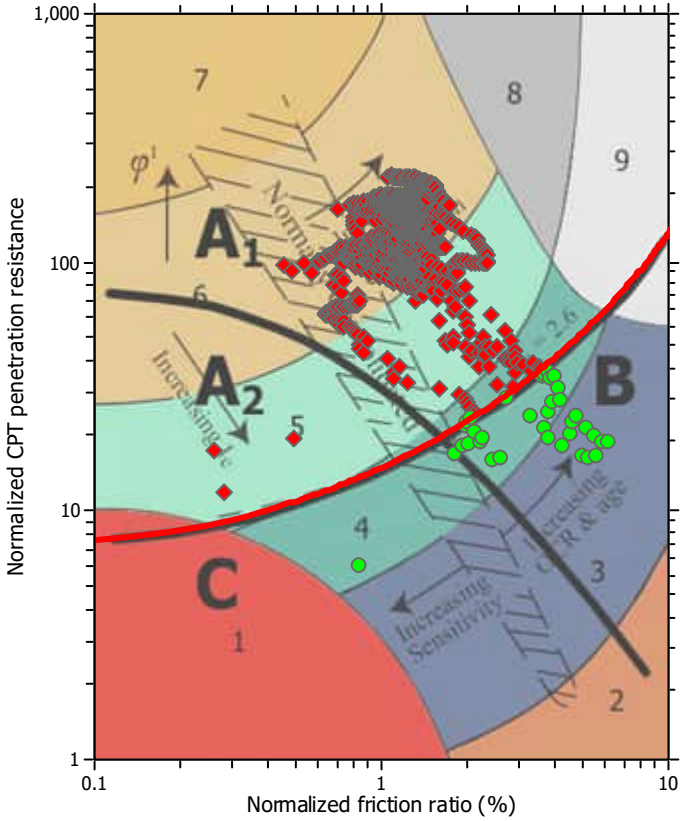
F.S. color scheme

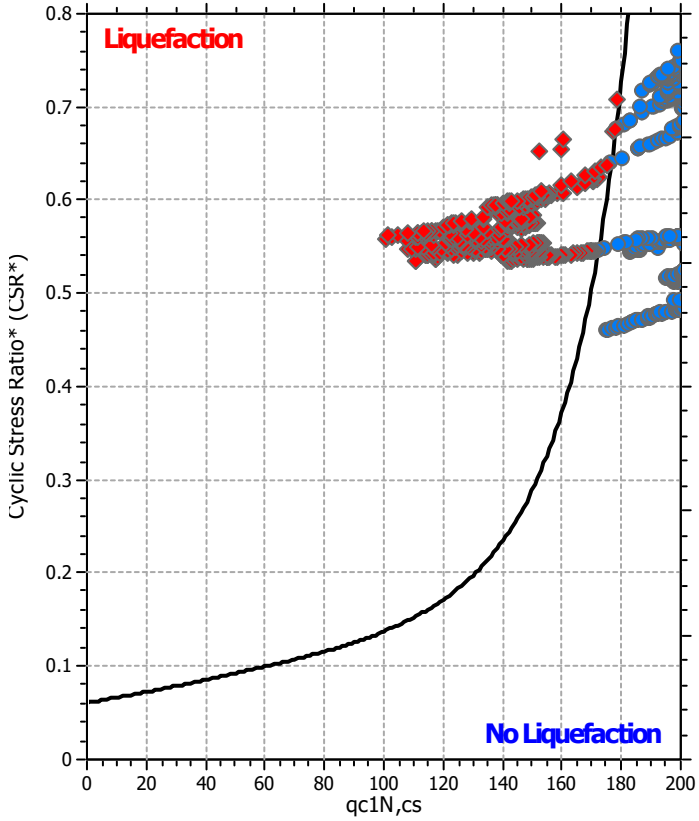
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

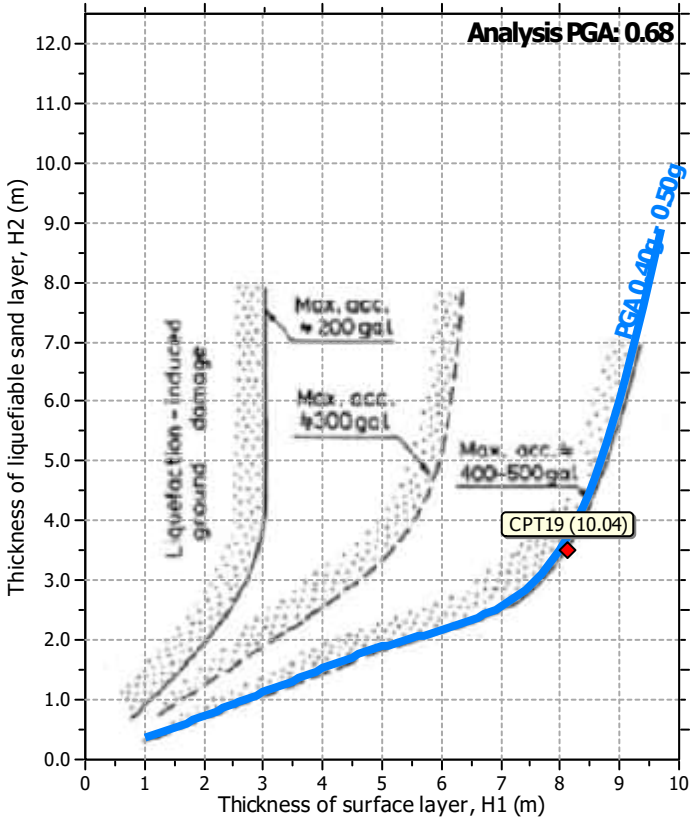
LPI color scheme

- 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.):	5.72 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.22 m	Fill height:	0.50 m	Limit depth:	N/A

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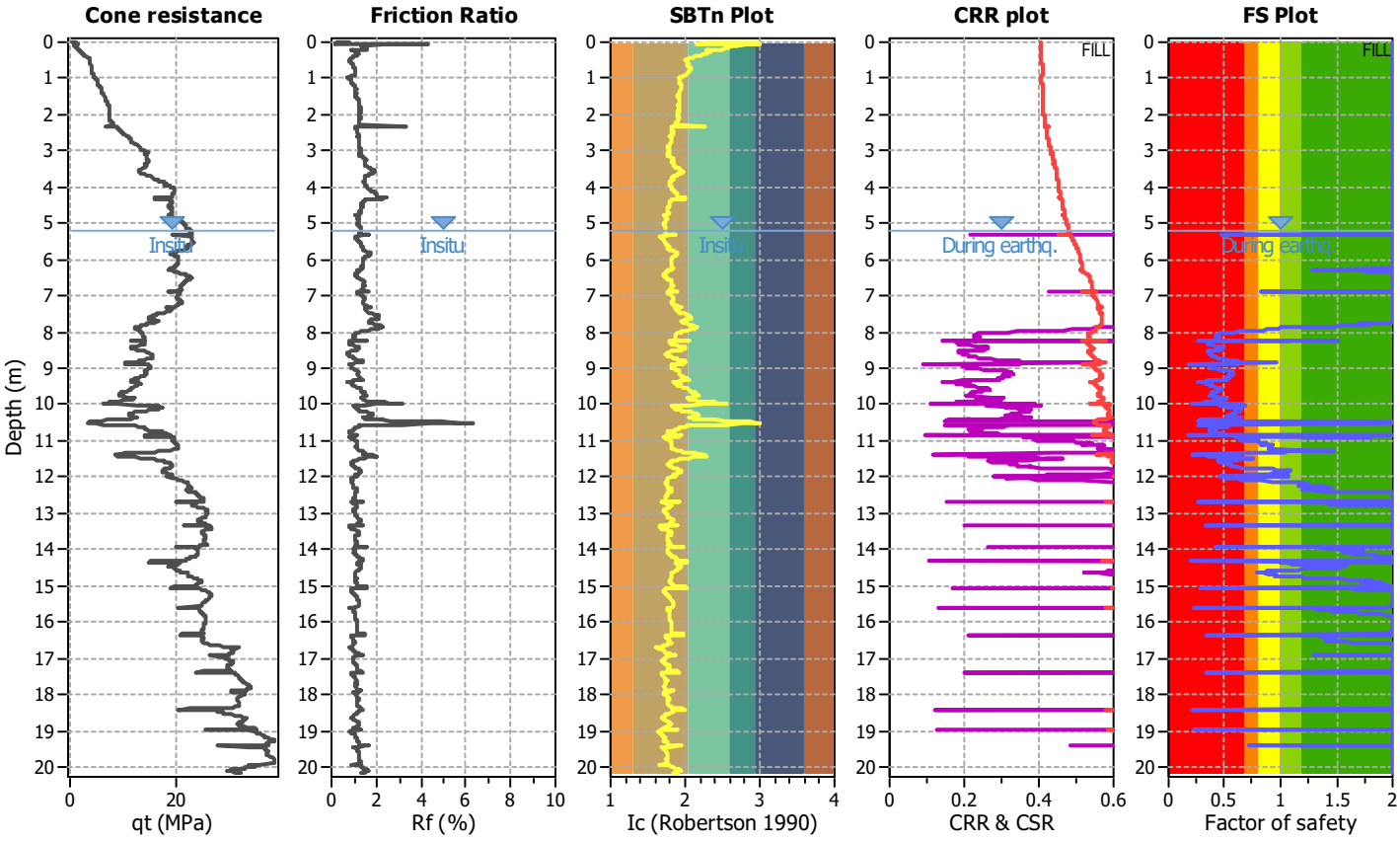
LIQUEFACTION ANALYSIS REPORT

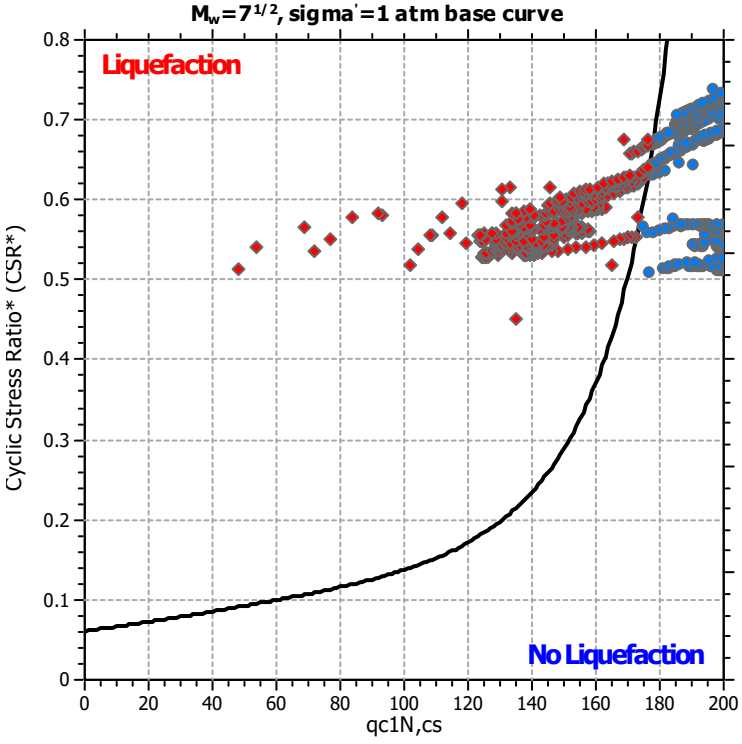
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

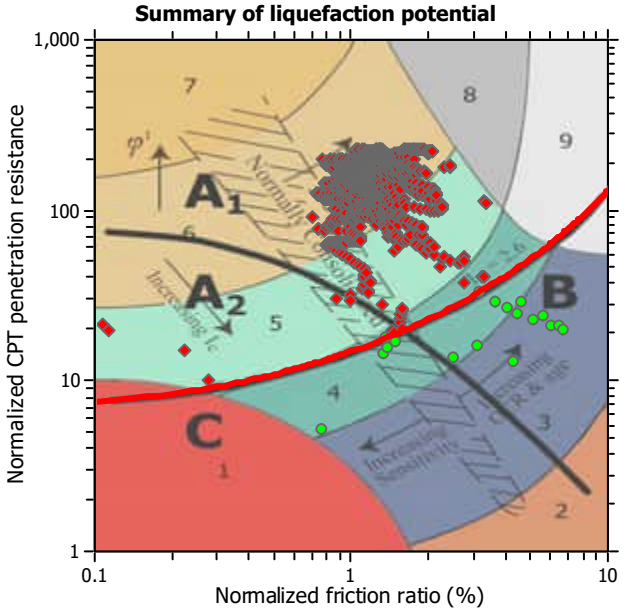
CPT file : CPT20

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.22 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	6.22 m	Fill height:	1.00 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

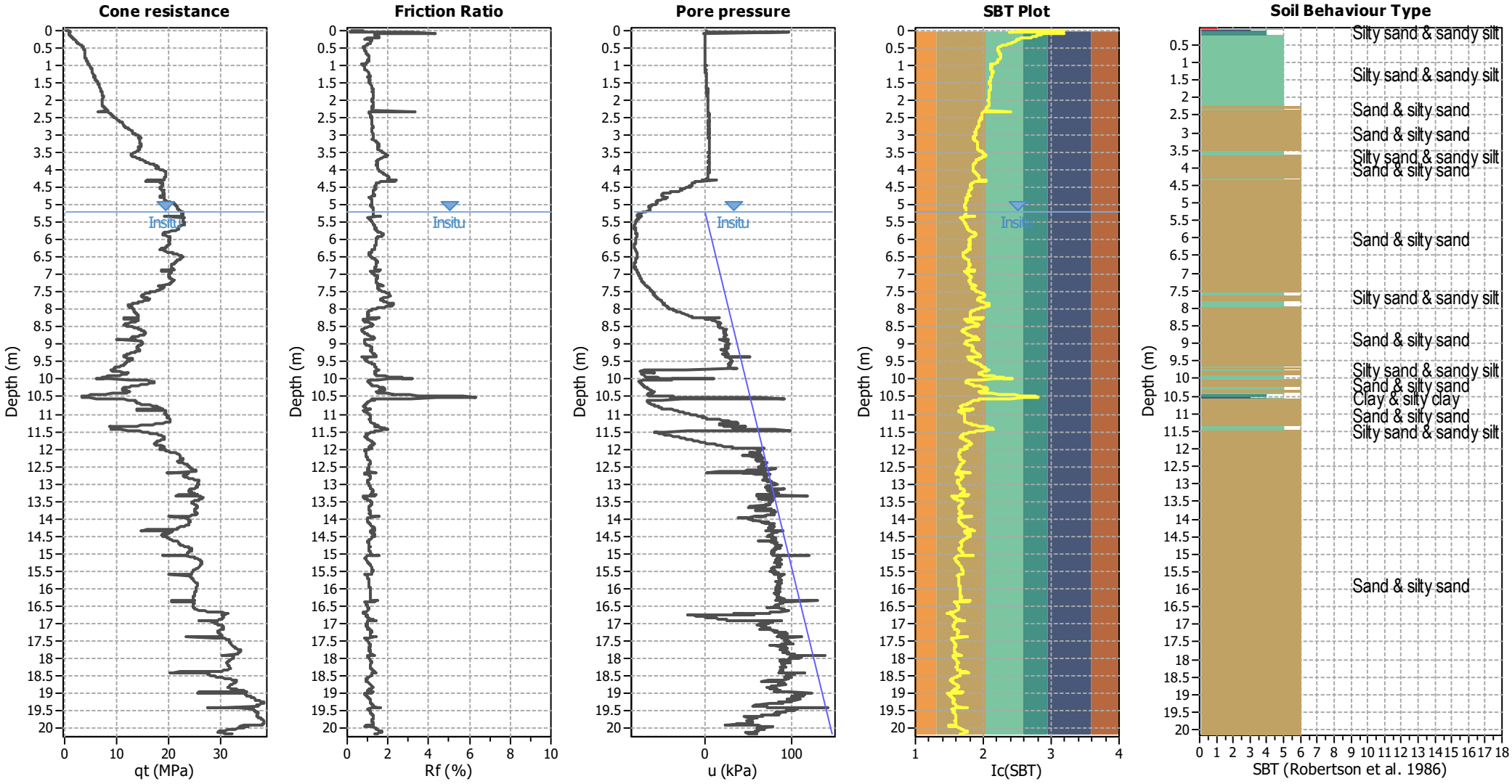






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



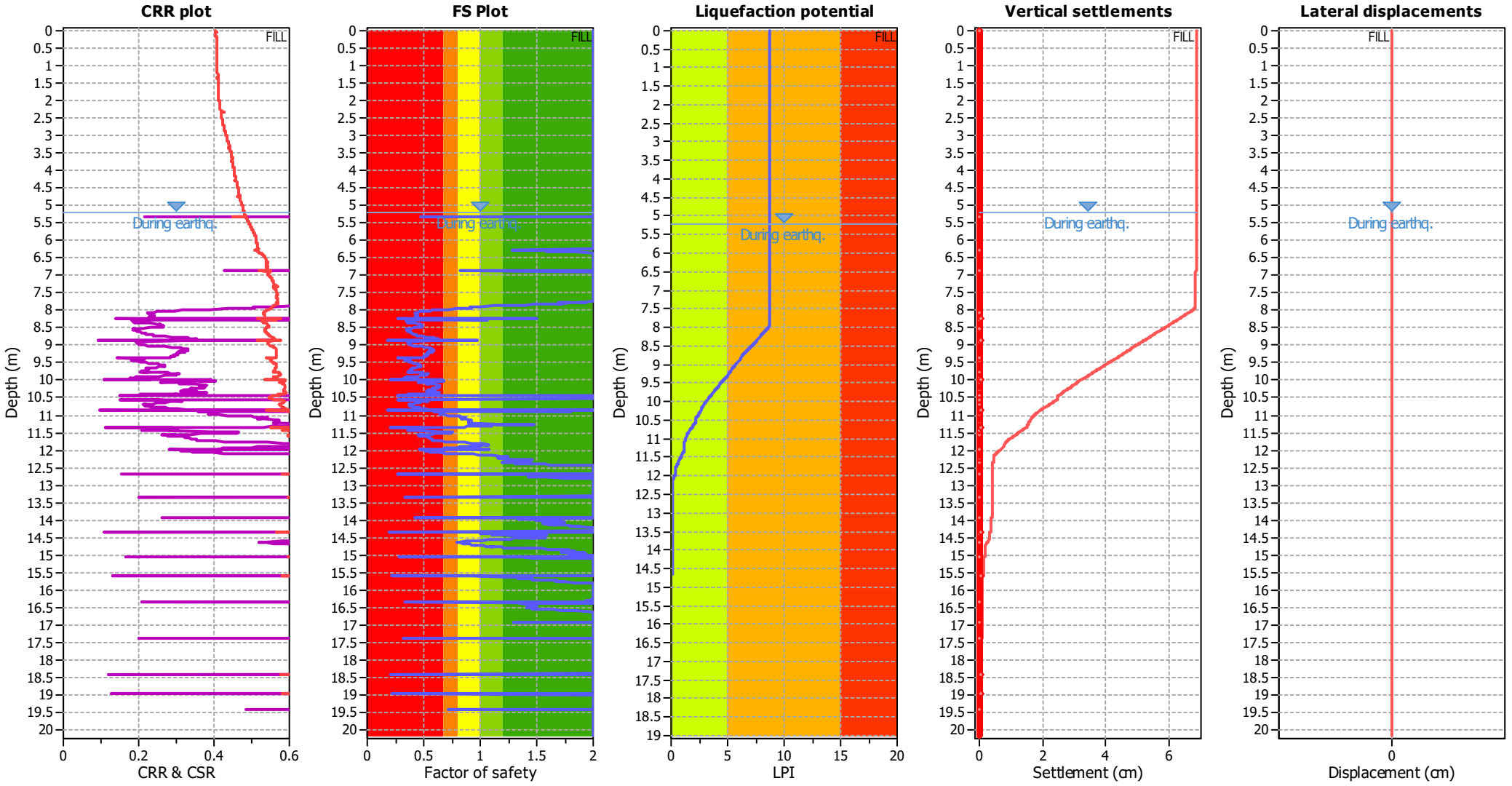
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.22 m	Fill height:	1.00 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.22 m	Fill height:	1.00 m	Limit depth:	N/A

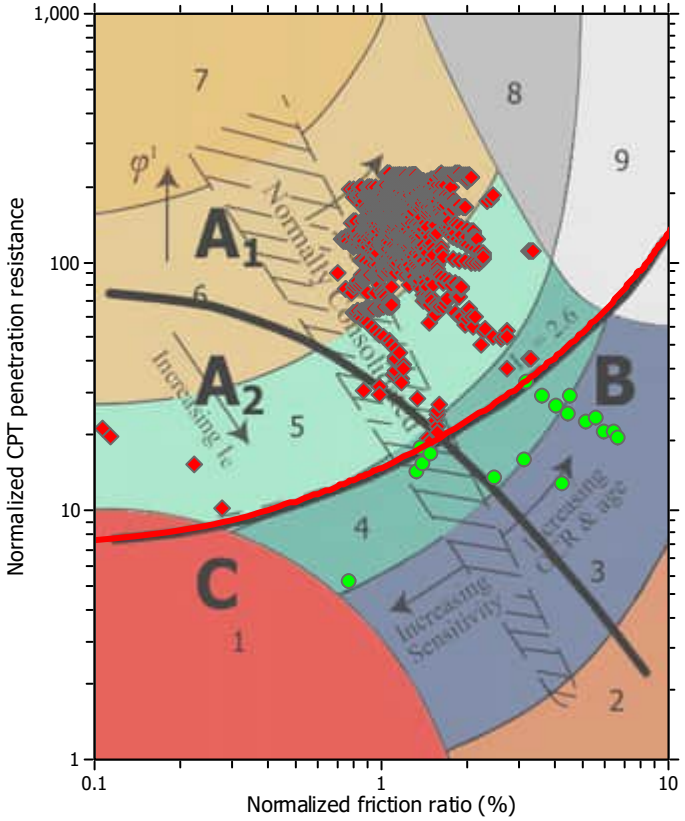
F.S. color scheme

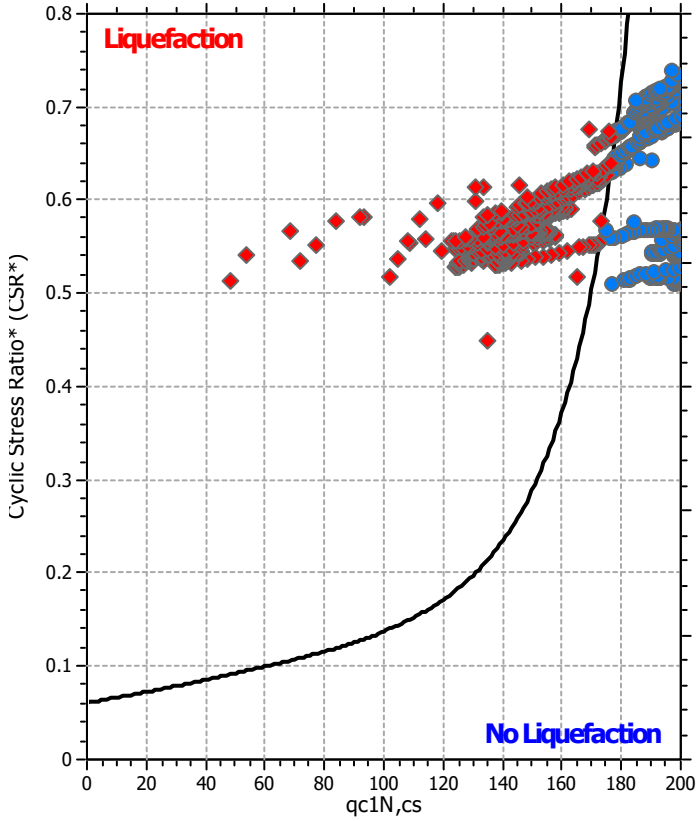
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

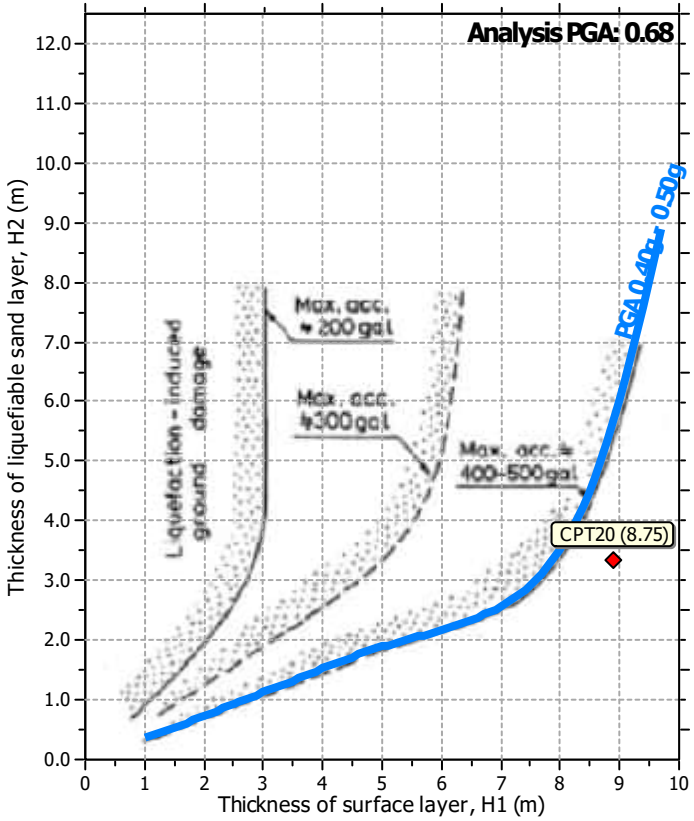
LPI color scheme

- 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.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.22 m	Fill height:	1.00 m	Limit depth:	N/A

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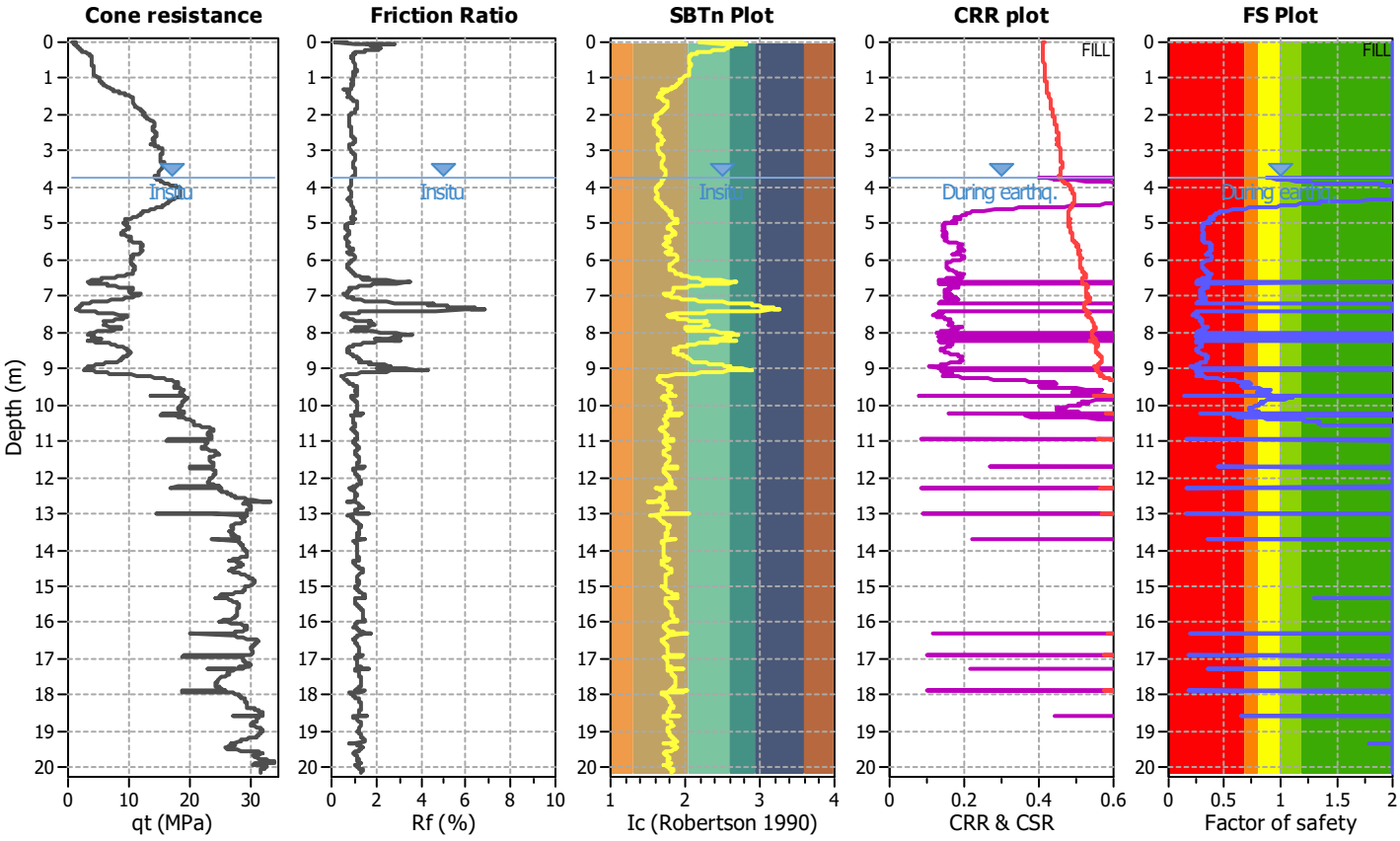
LIQUEFACTION ANALYSIS REPORT

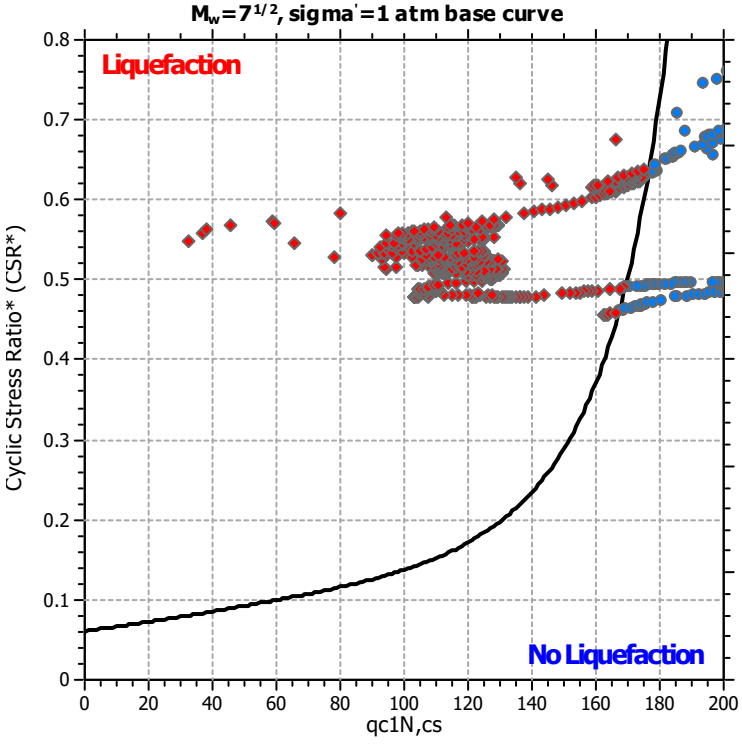
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

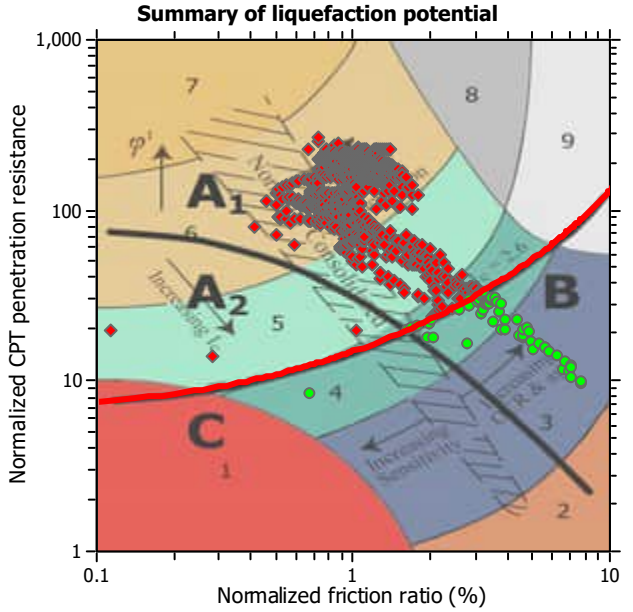
CPT file : CPT21

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	3.72 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	6.07 m	Fill height:	2.35 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

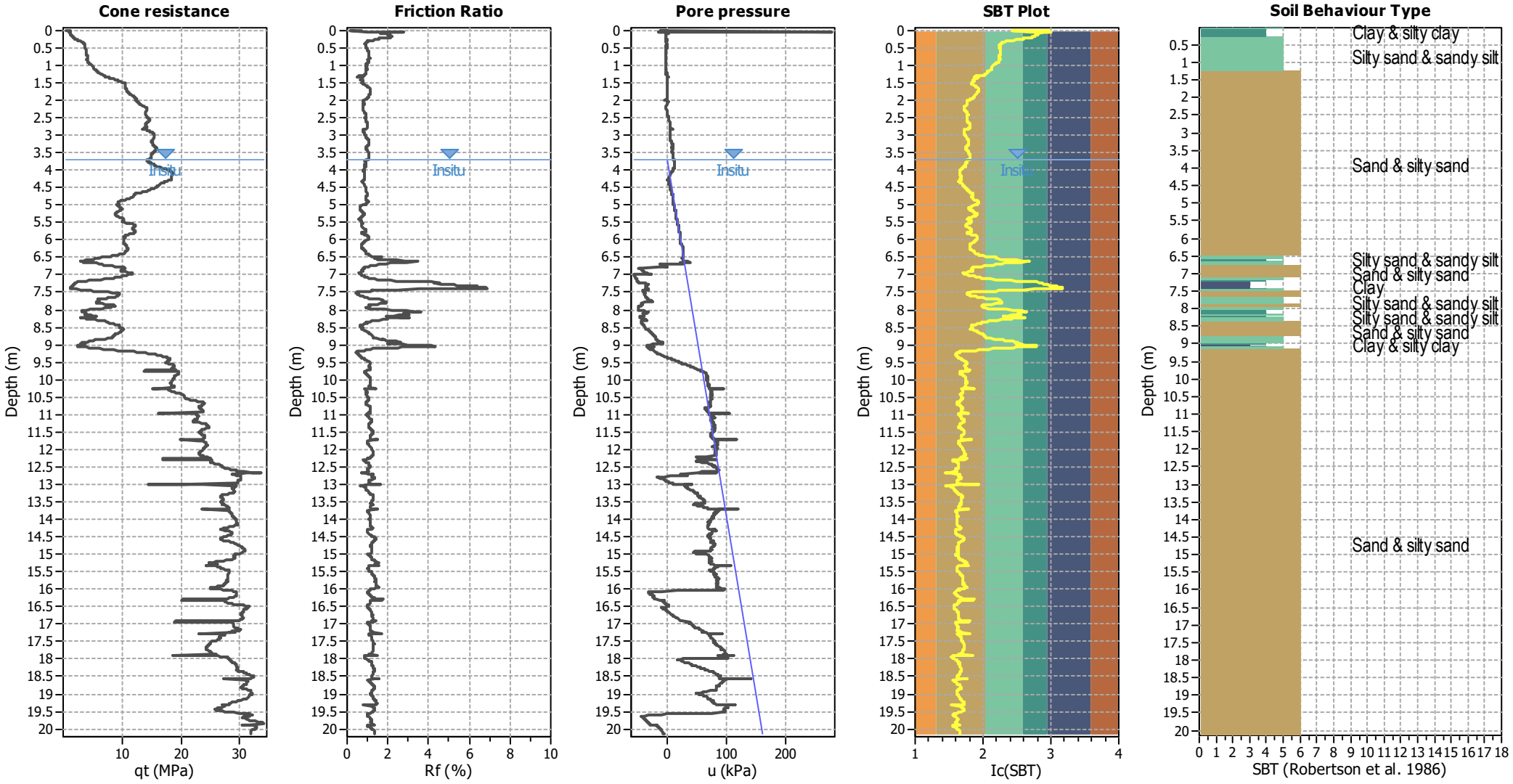






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



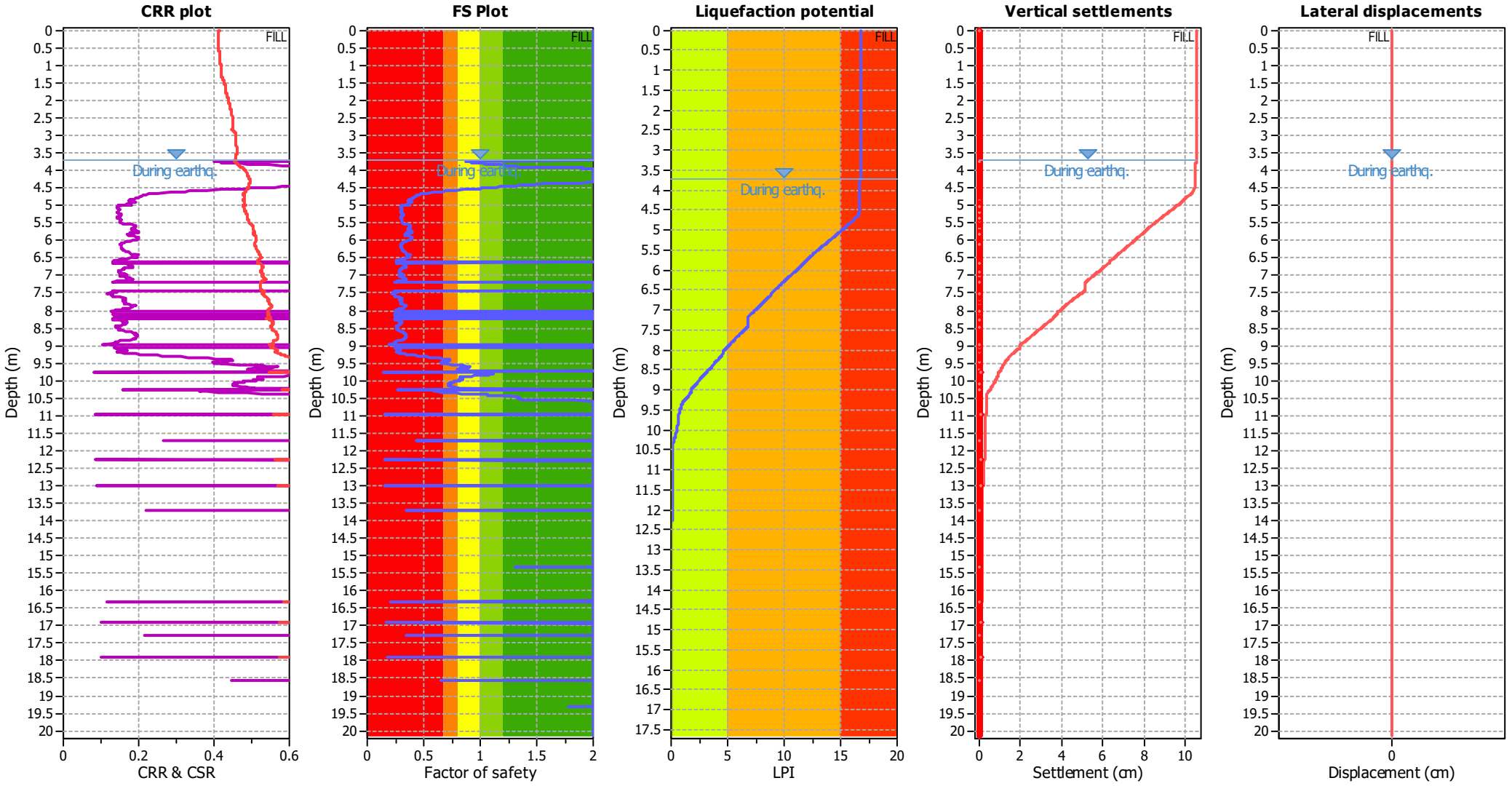
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.07 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	3.72 m	Fill height:	2.35 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.07 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	3.72 m	Fill height:	2.35 m	Limit depth:	N/A

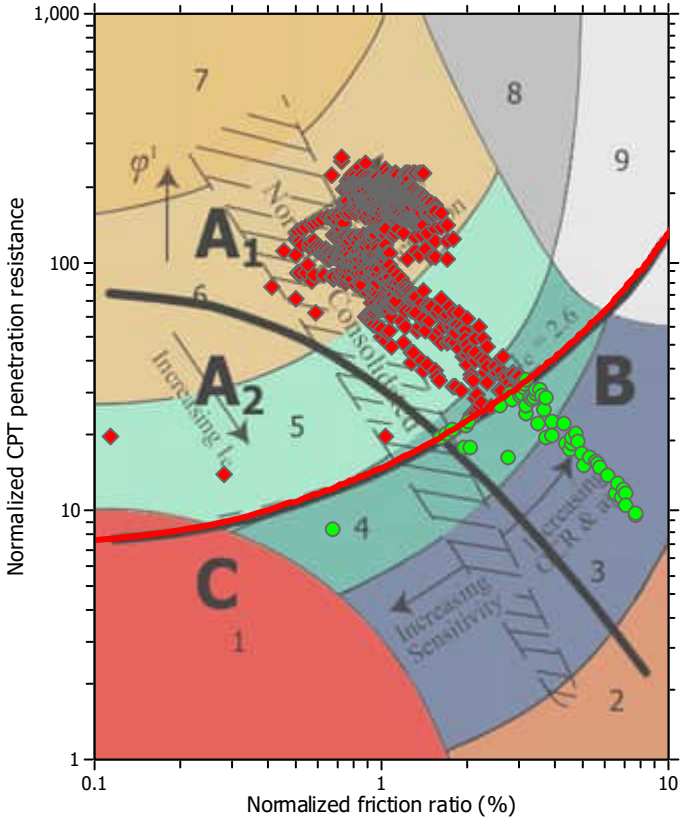
F.S. color scheme

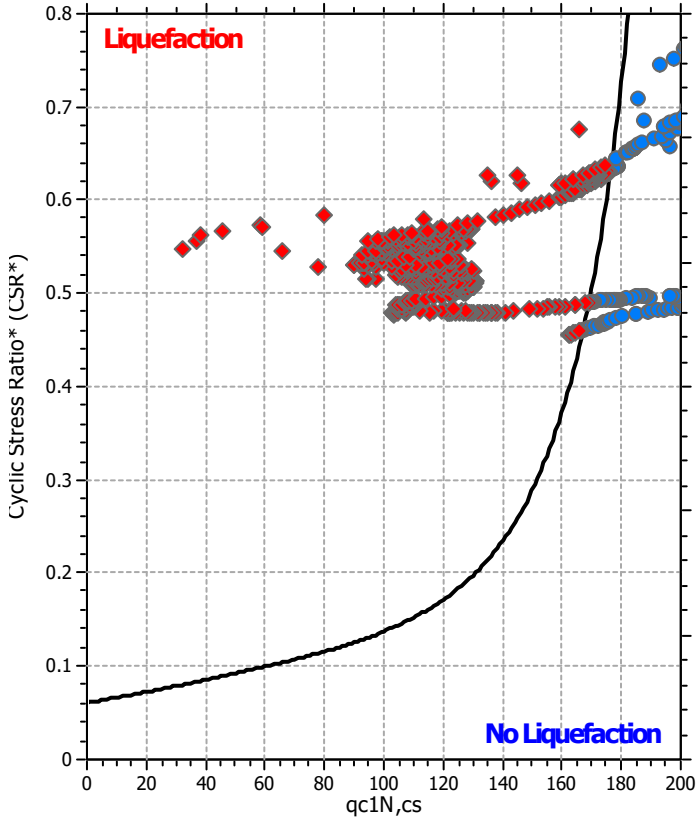
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

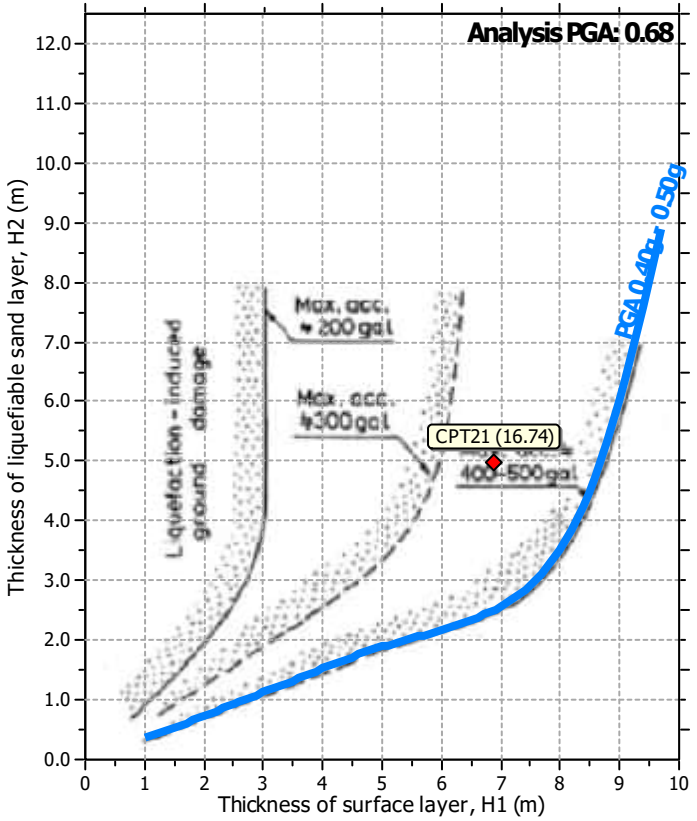
LPI color scheme

- 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.):	6.07 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	3.72 m	Fill height:	2.35 m	Limit depth:	N/A

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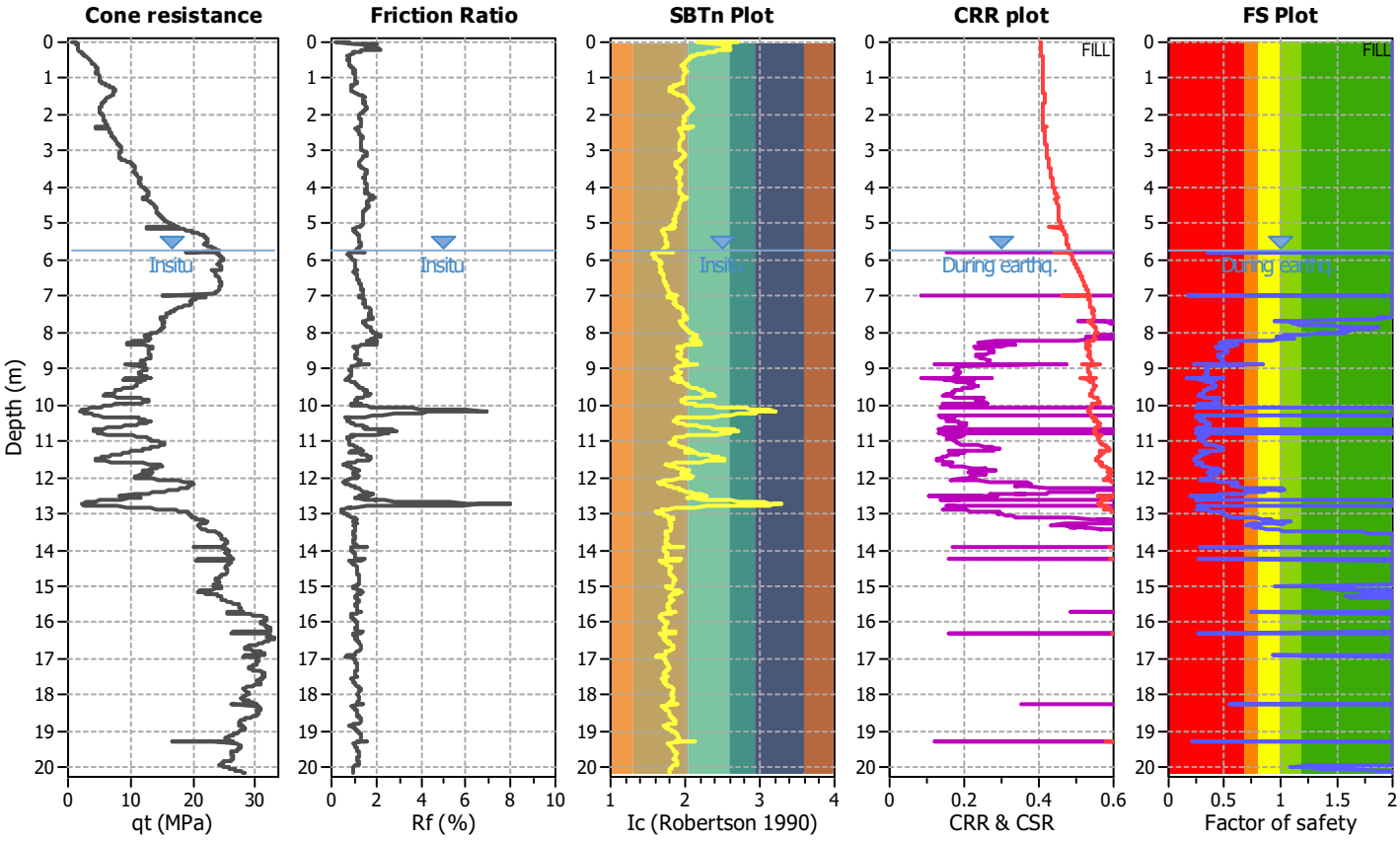
LIQUEFACTION ANALYSIS REPORT

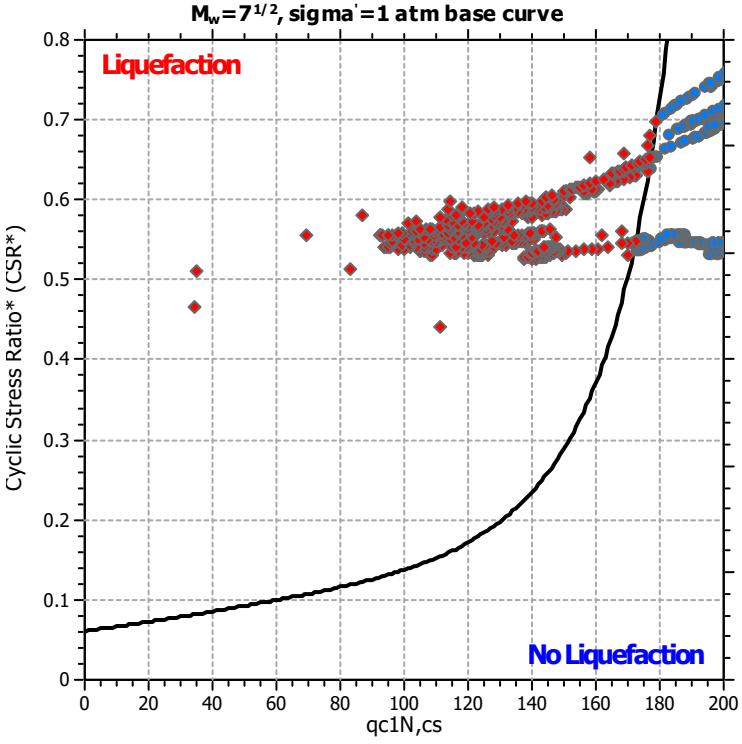
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

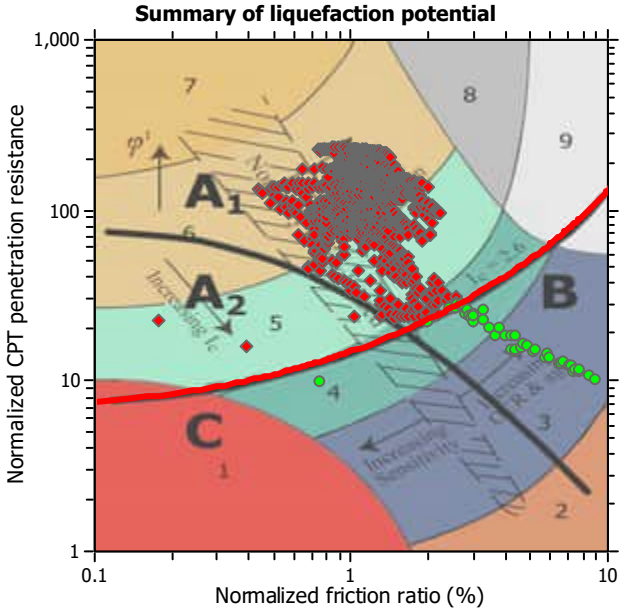
CPT file : CPT22

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.72 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	6.22 m	Fill height:	0.50 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

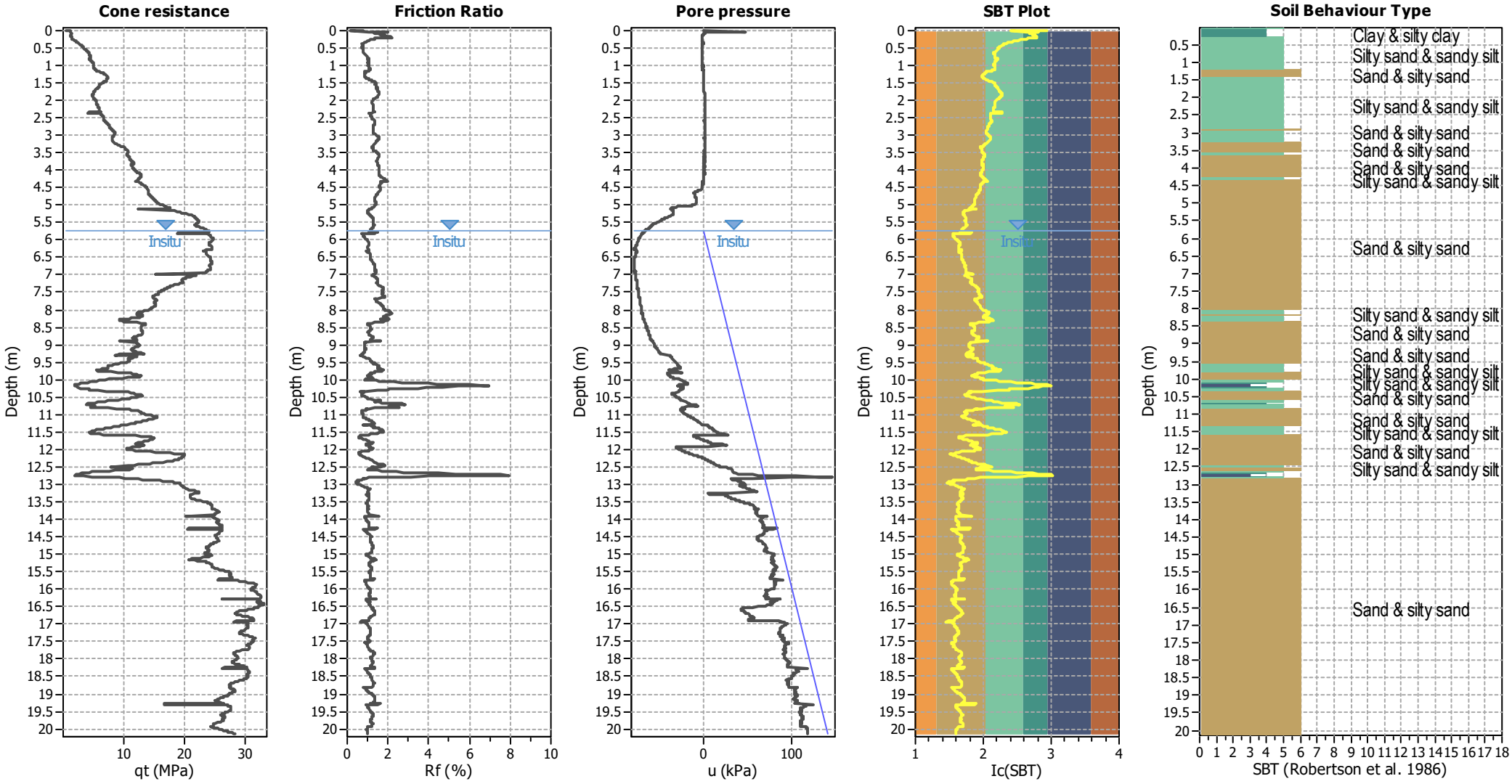






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



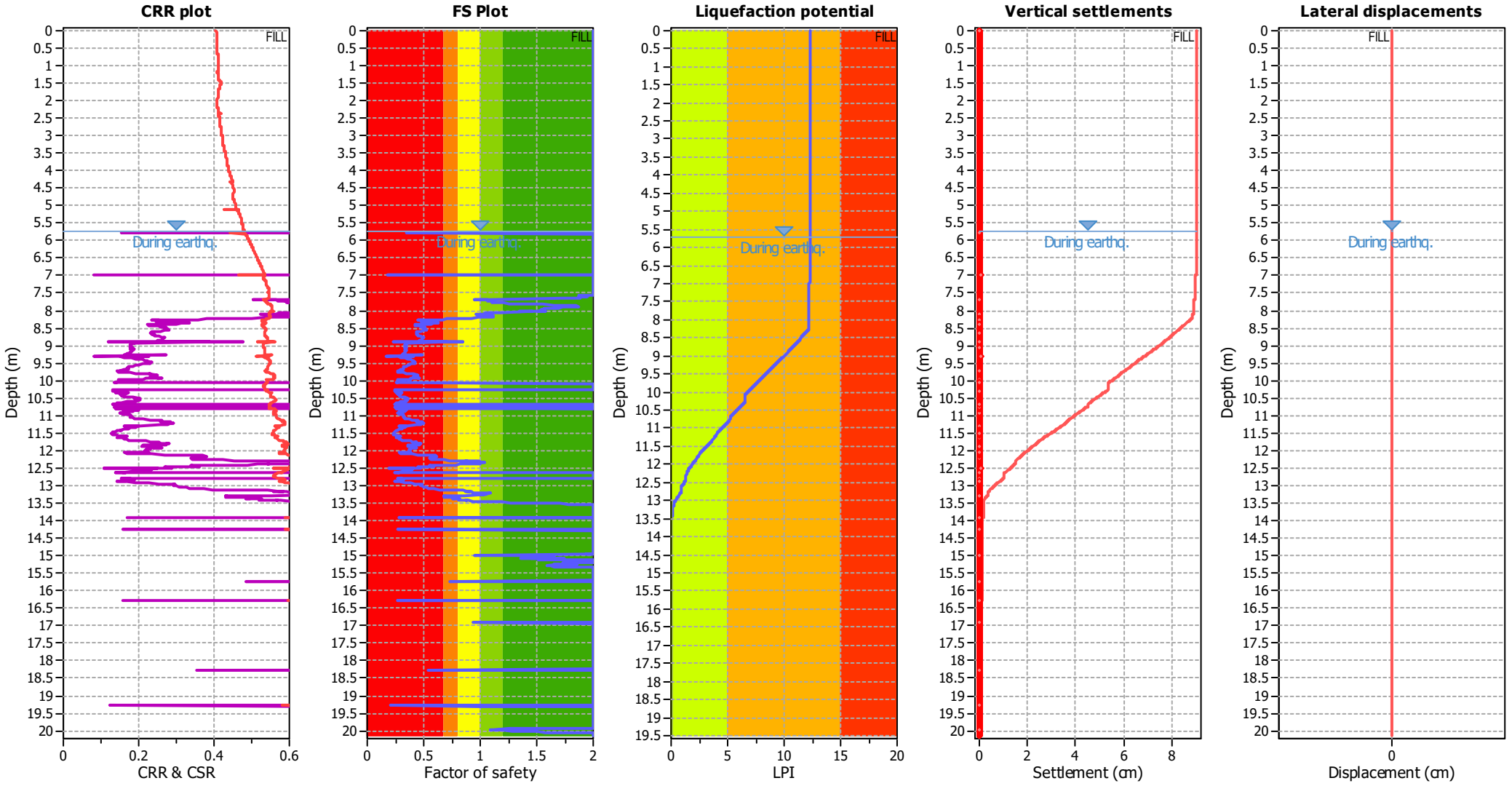
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.72 m	Fill height:	0.50 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.72 m	Fill height:	0.50 m	Limit depth:	N/A

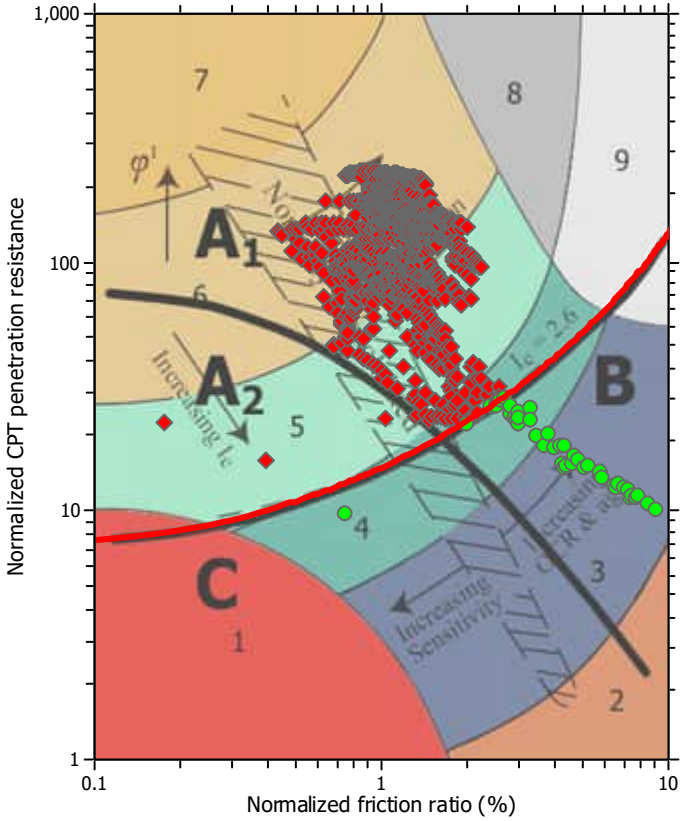
F.S. color scheme

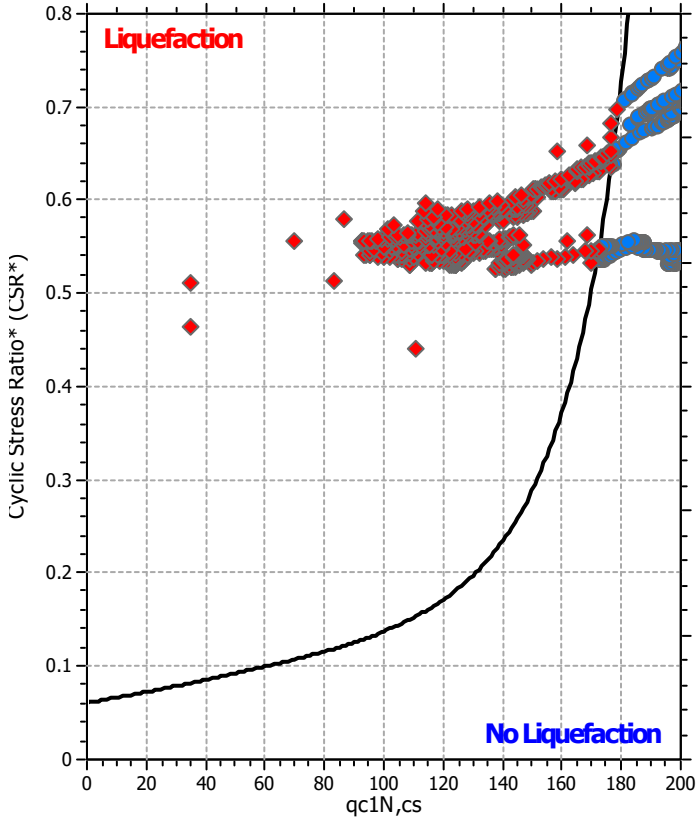
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

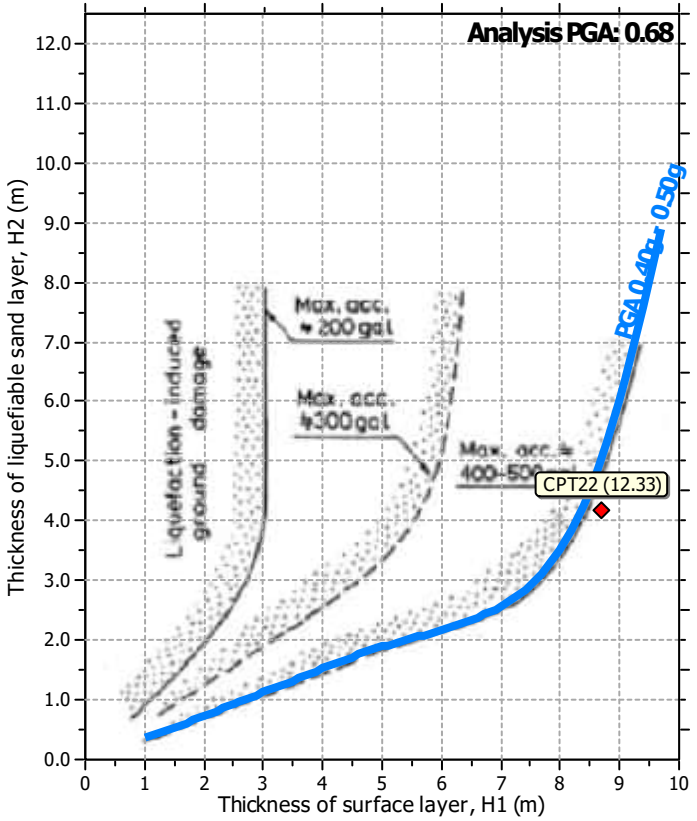
LPI color scheme

- 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.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.72 m	Fill height:	0.50 m	Limit depth:	N/A

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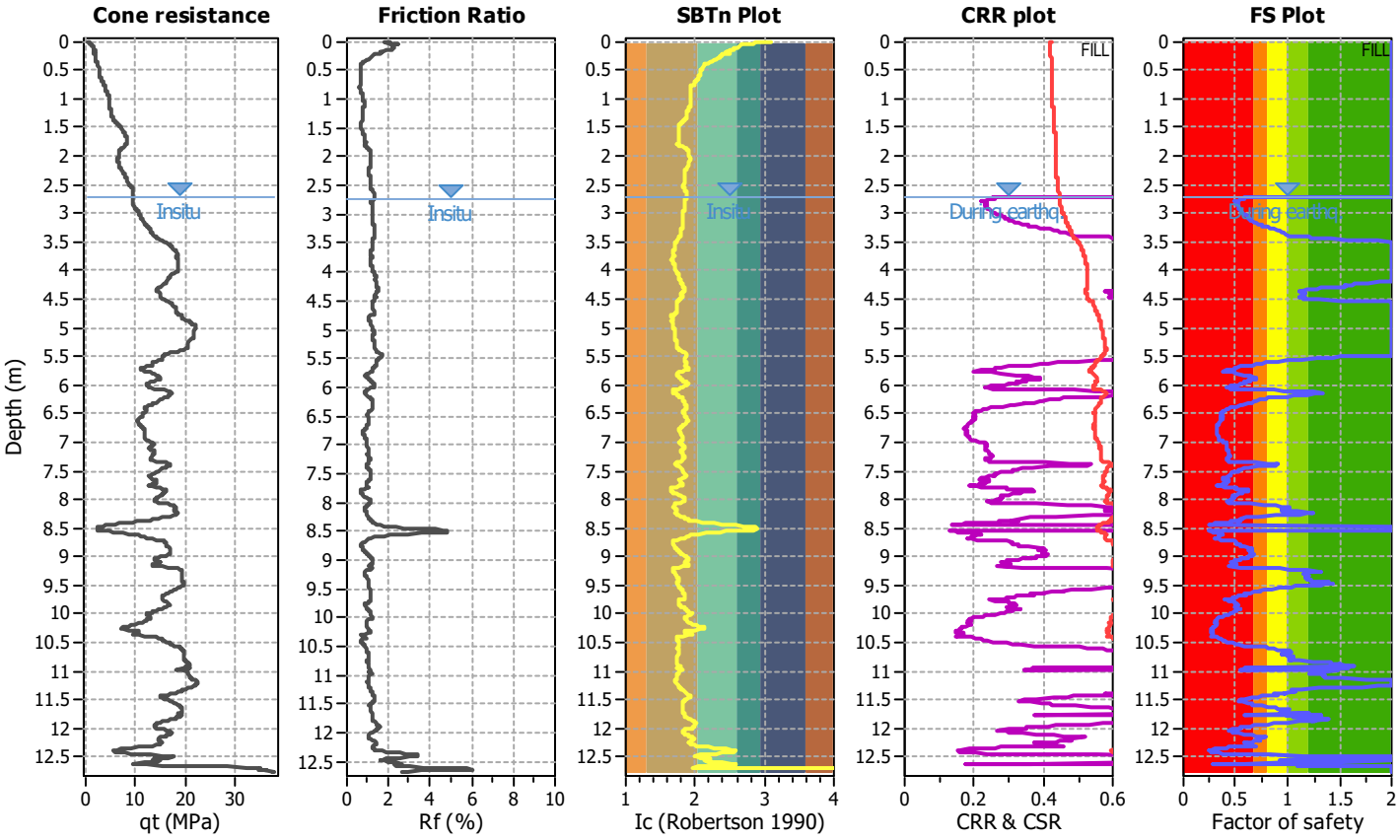
LIQUEFACTION ANALYSIS REPORT

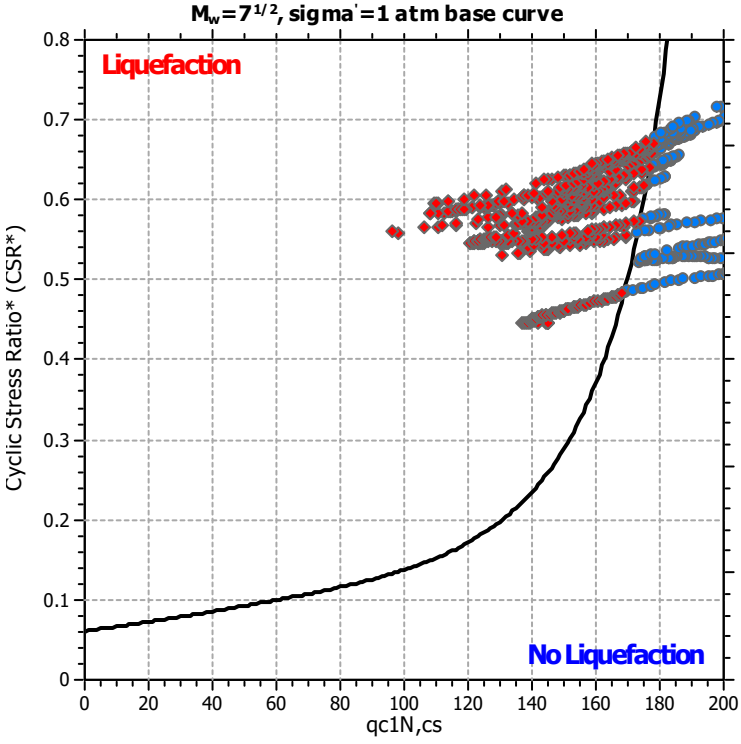
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

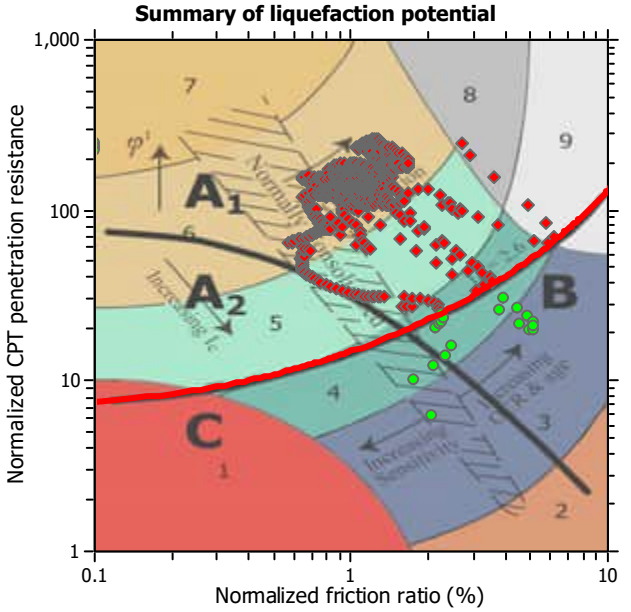
CPT file : CPT101

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.72 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	6.22 m	Fill height:	3.50 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

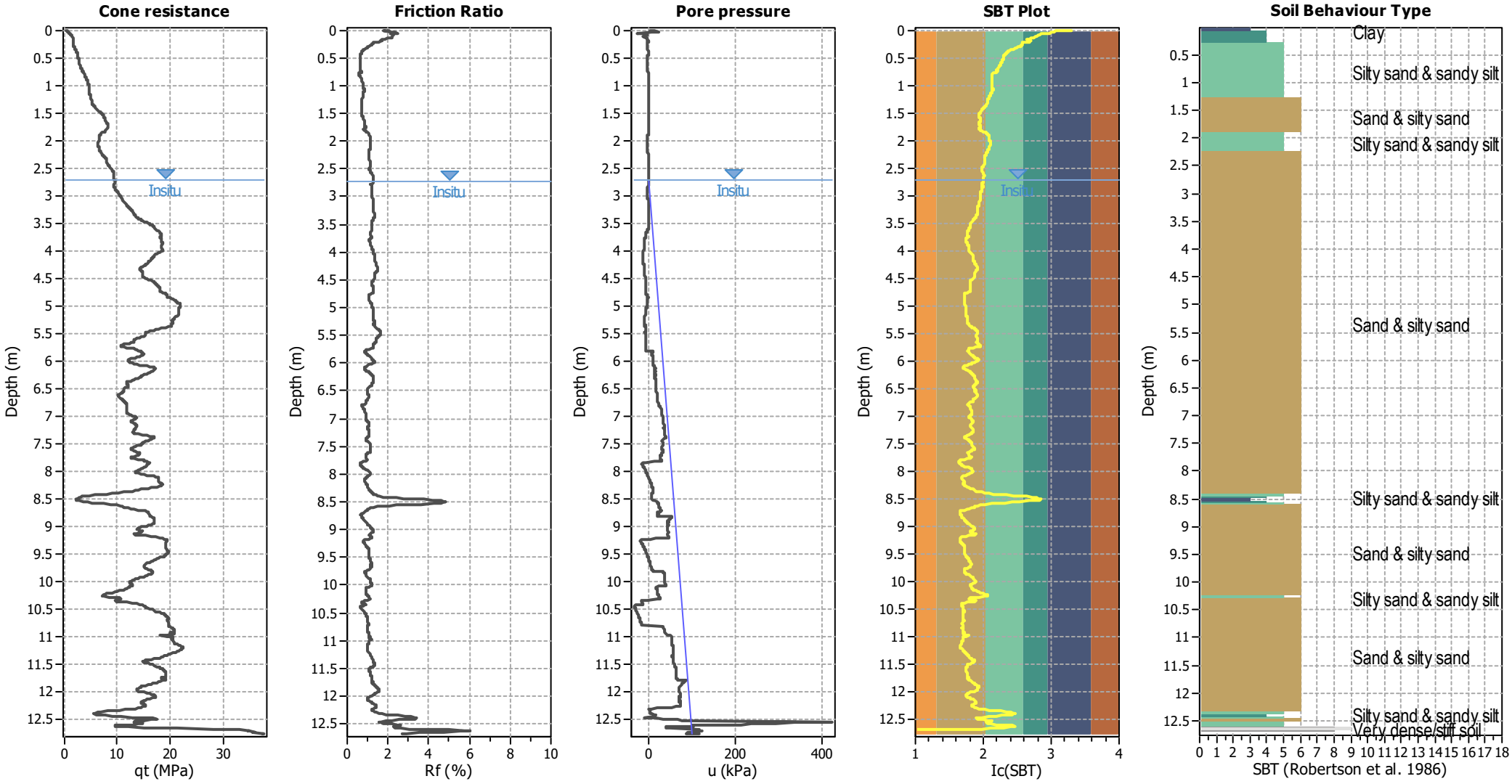






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



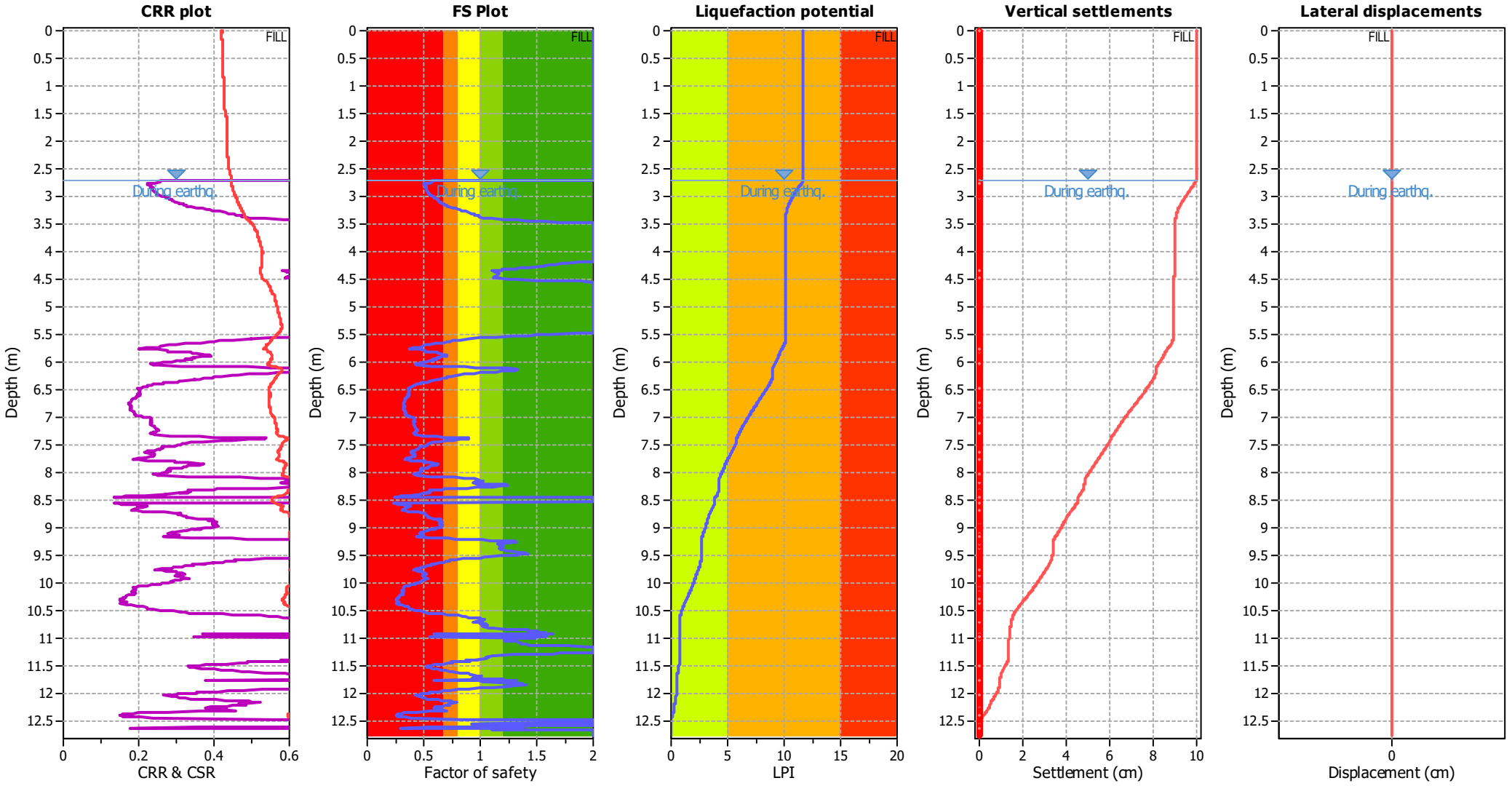
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	2.72 m	Fill height:	3.50 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	2.72 m	Fill height:	3.50 m	Limit depth:	N/A

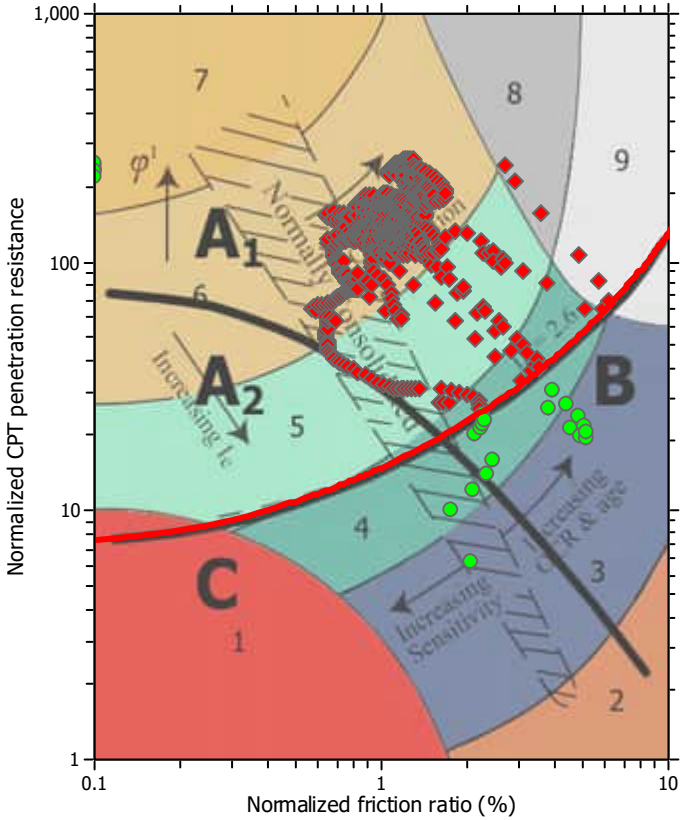
F.S. color scheme

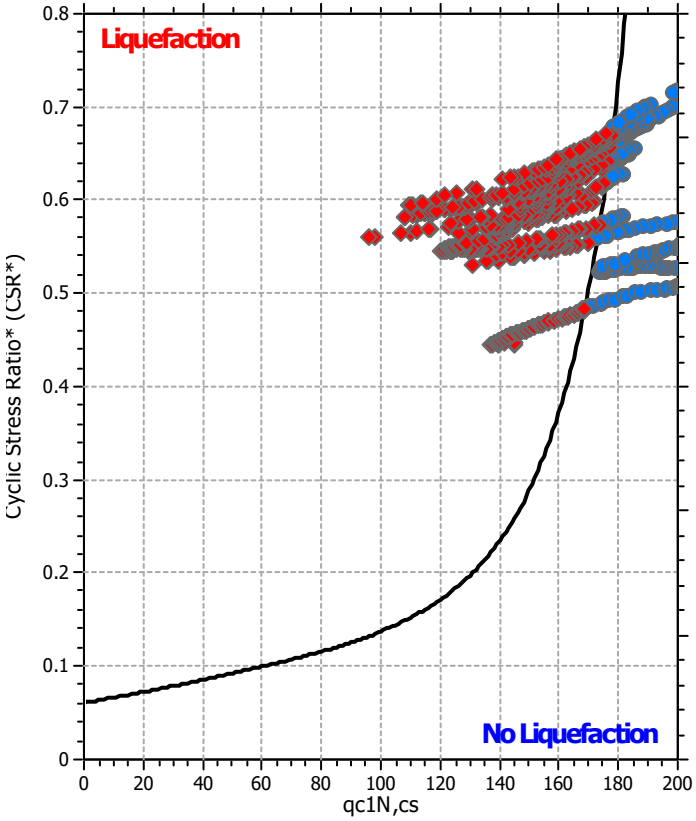
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

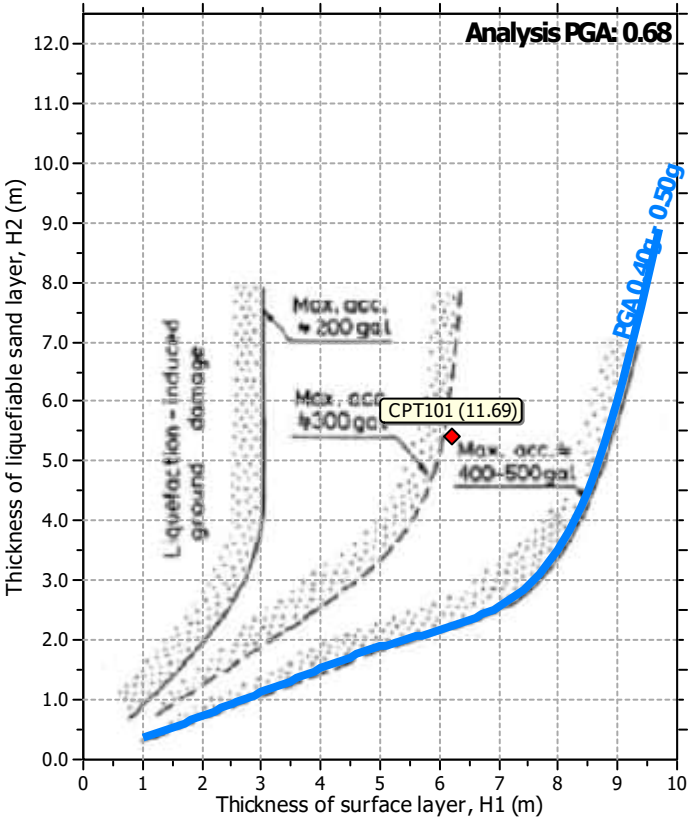
LPI color scheme

- 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.):	6.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	2.72 m	Fill height:	3.50 m	Limit depth:	N/A

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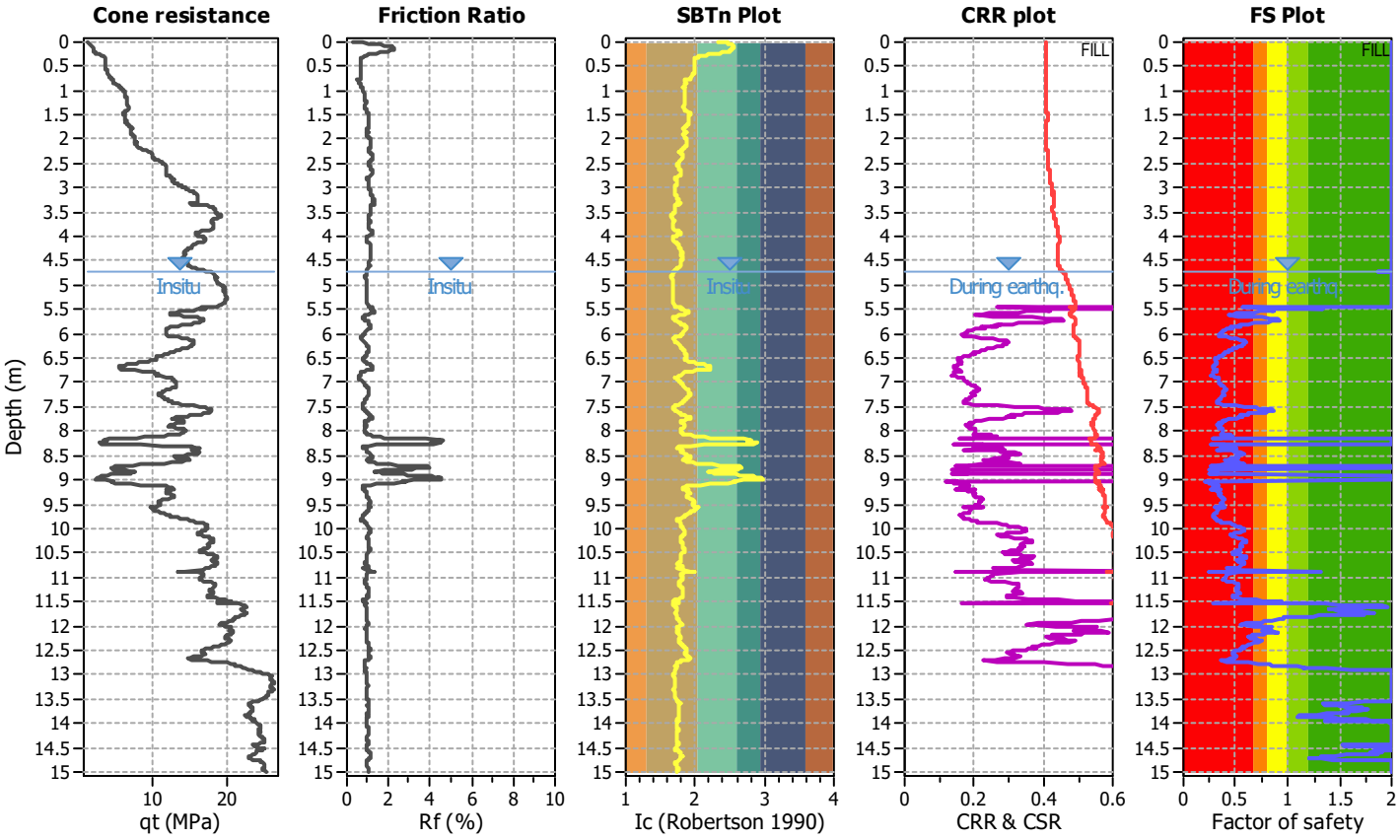
LIQUEFACTION ANALYSIS REPORT

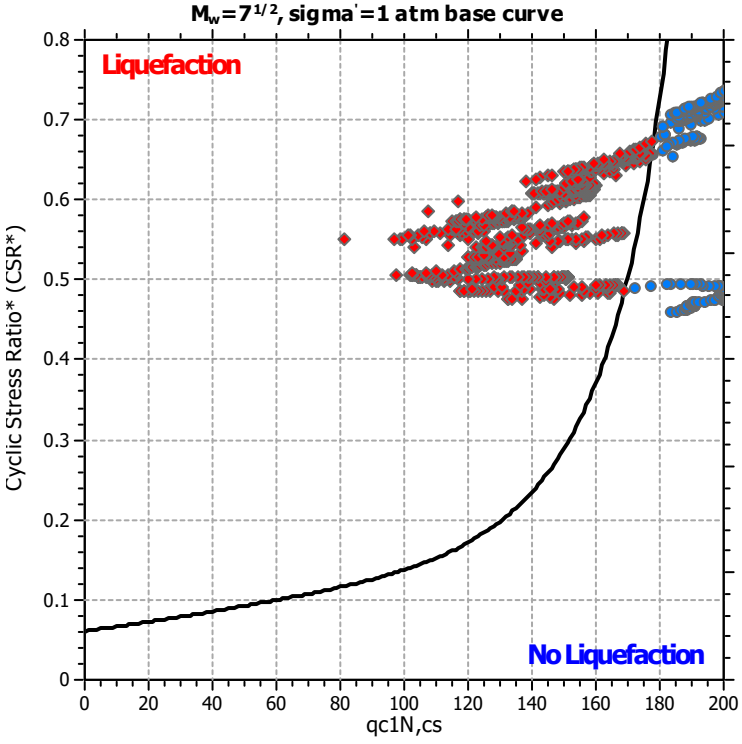
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

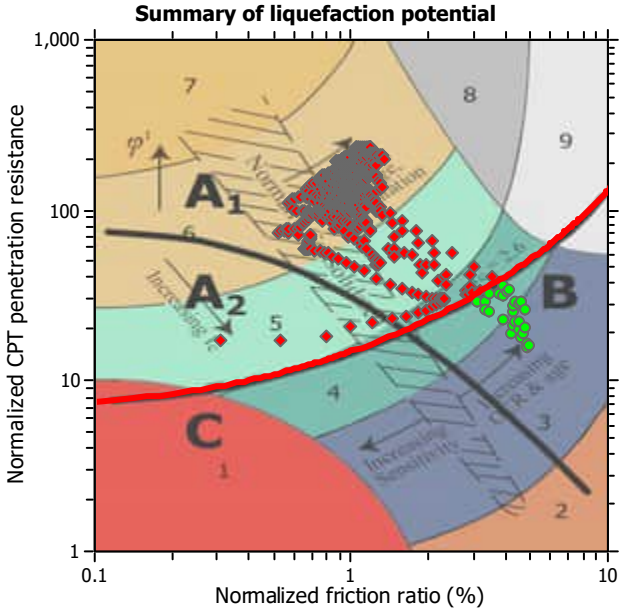
CPT file : CPT102

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	4.72 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.22 m	Fill height:	0.50 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

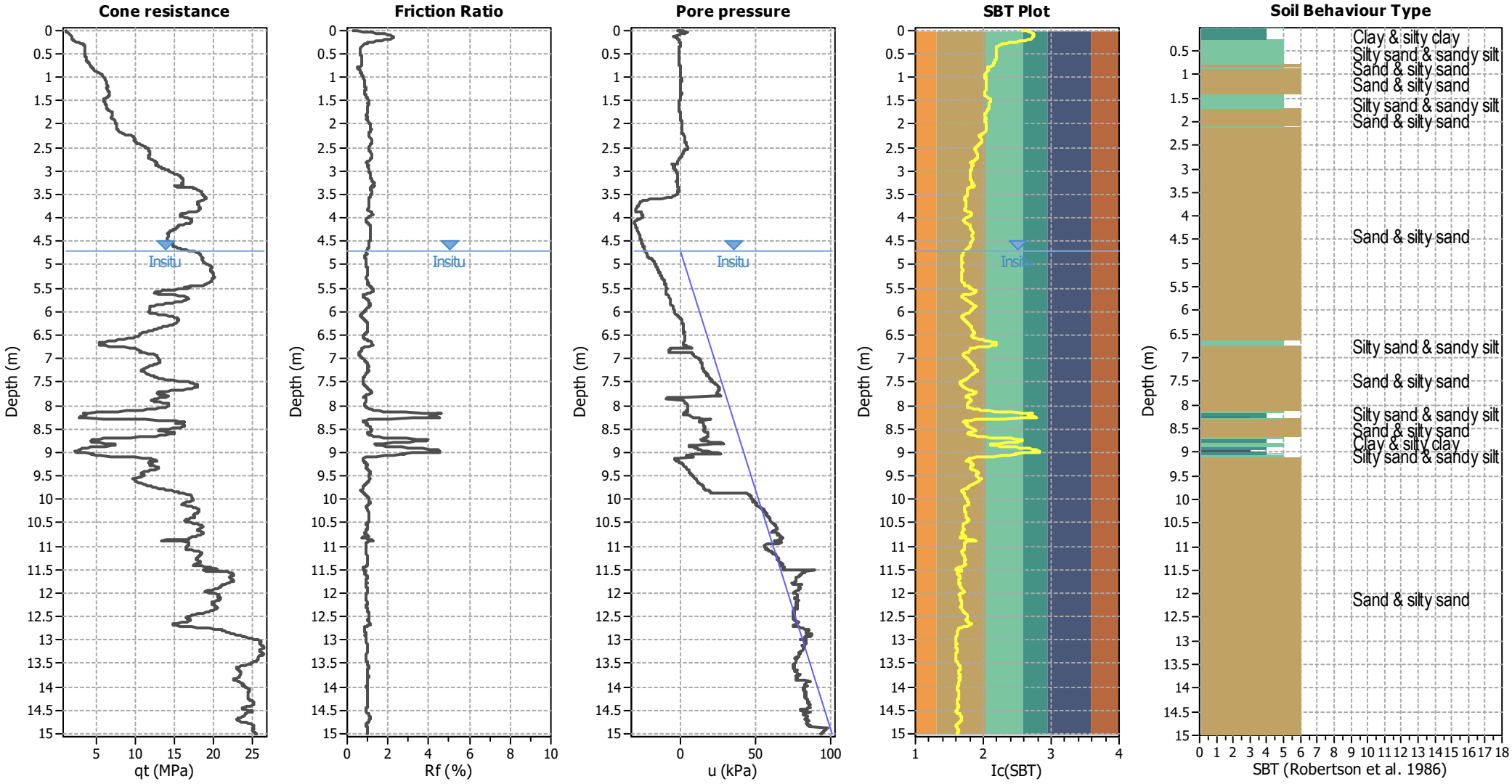






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



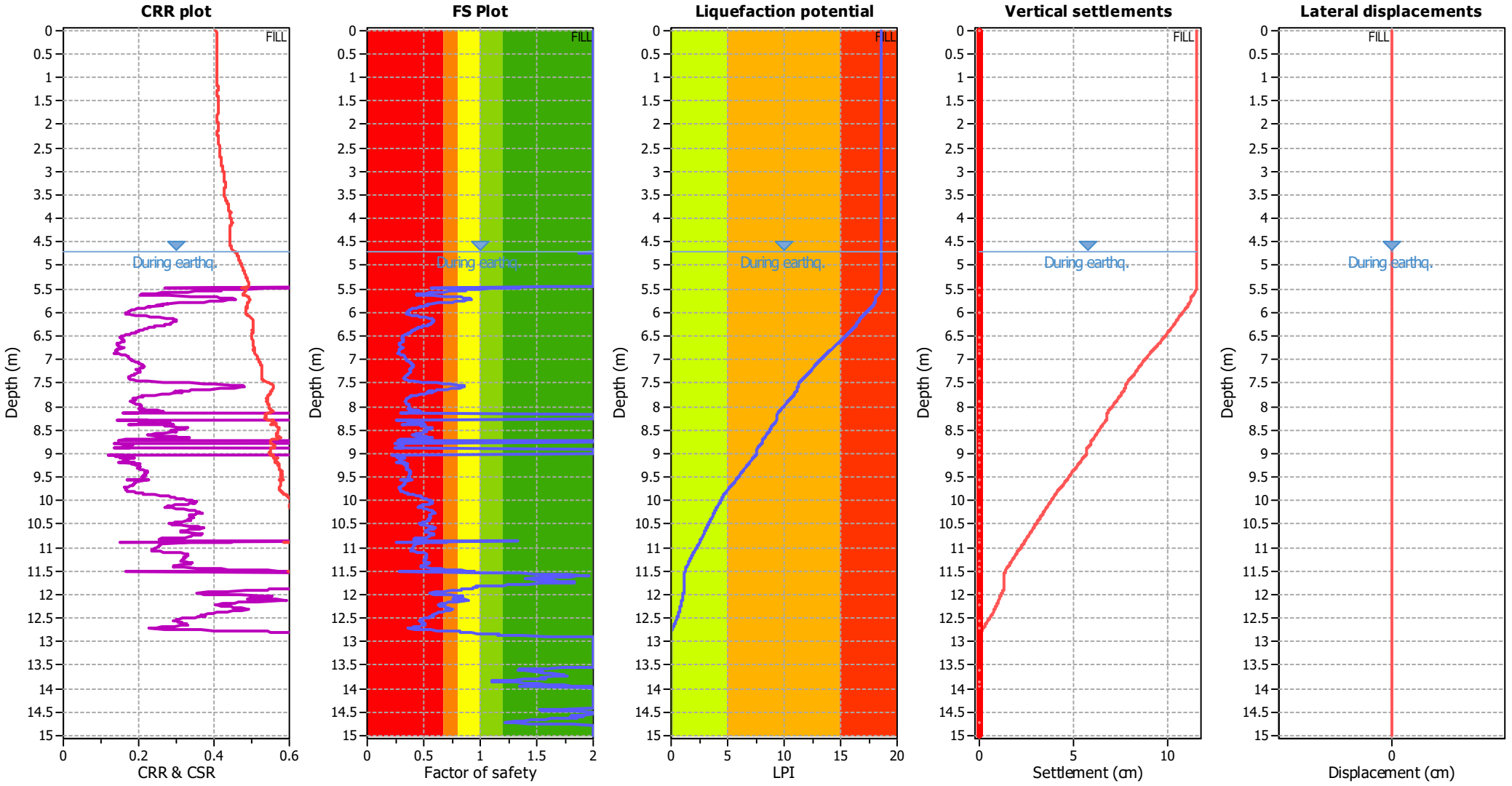
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	5.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	4.72 m	Fill height:	0.50 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	5.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	4.72 m	Fill height:	0.50 m	Limit depth:	N/A

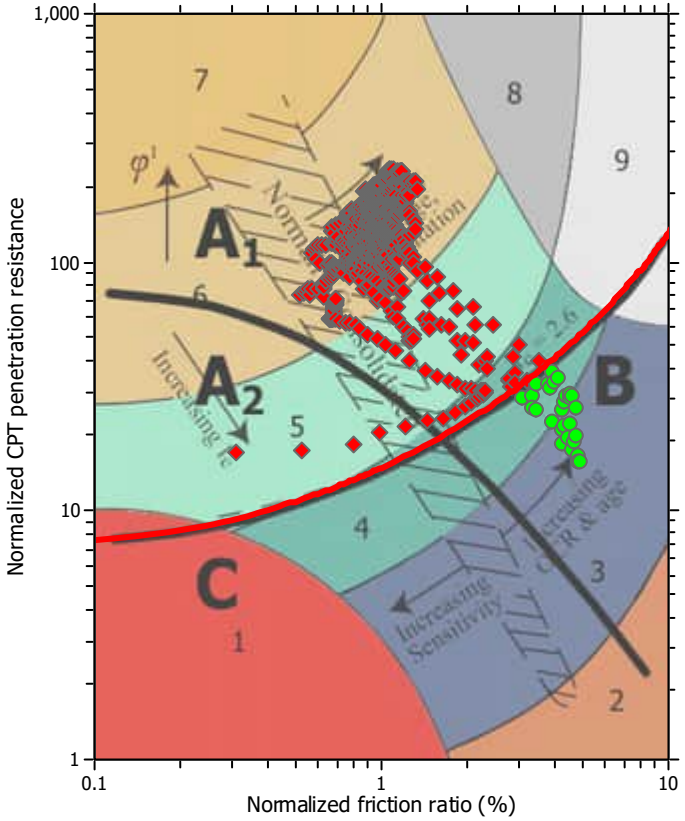
F.S. color scheme

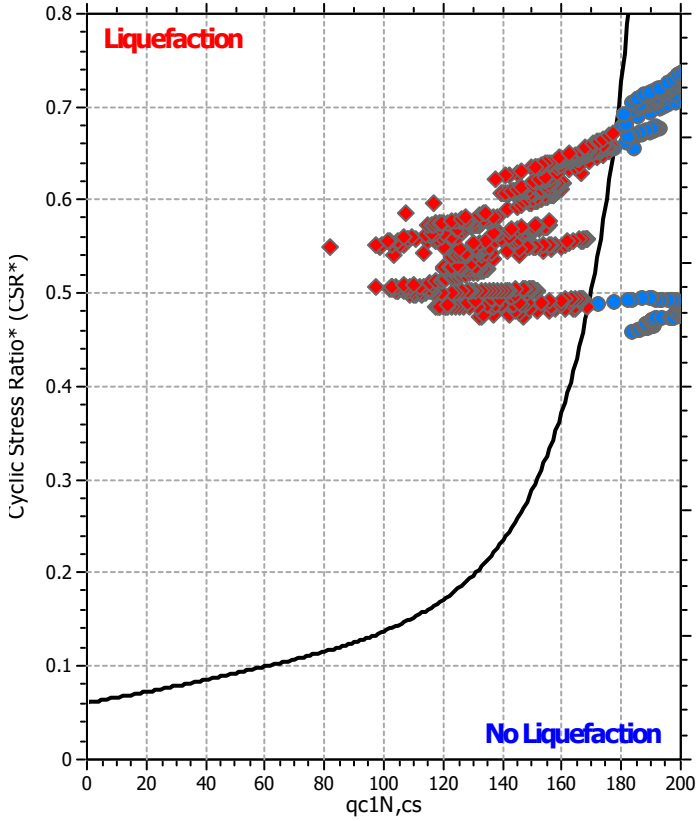
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

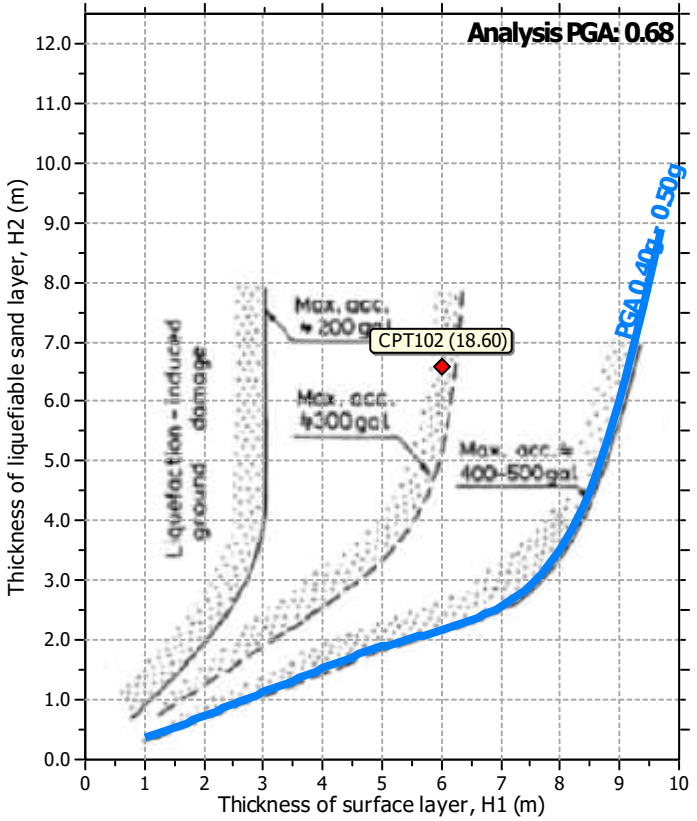
LPI color scheme

- 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.):	5.22 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	4.72 m	Fill height:	0.50 m	Limit depth:	N/A

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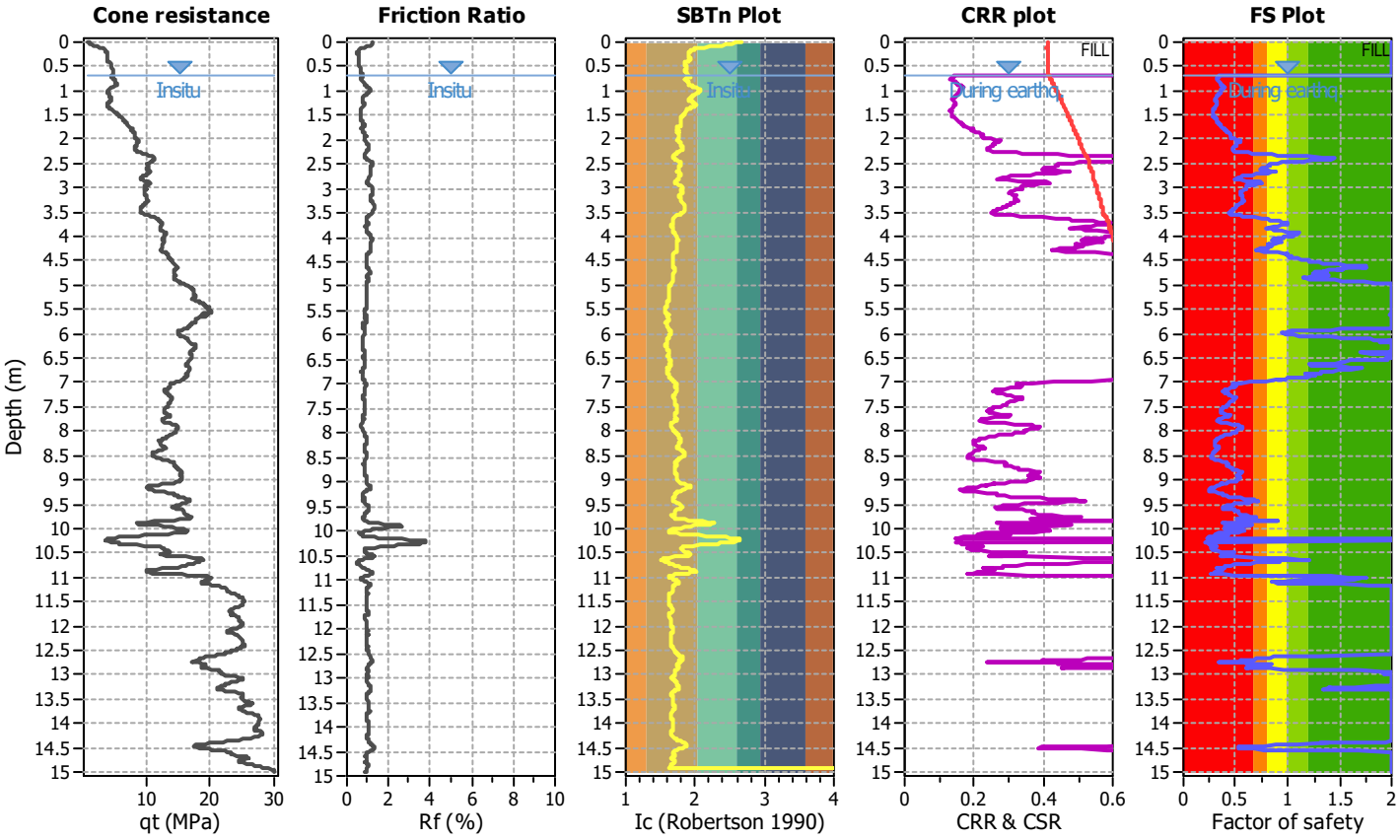
LIQUEFACTION ANALYSIS REPORT

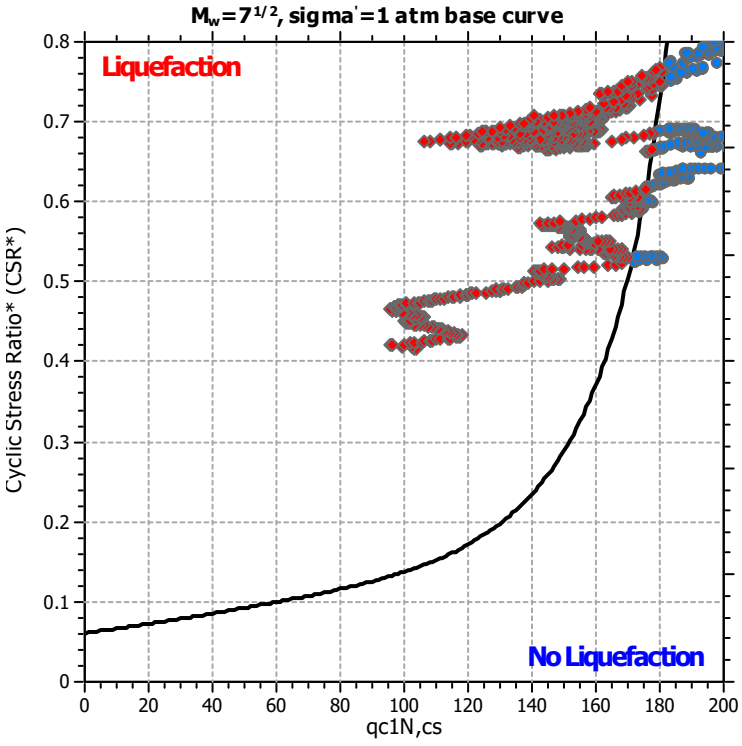
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

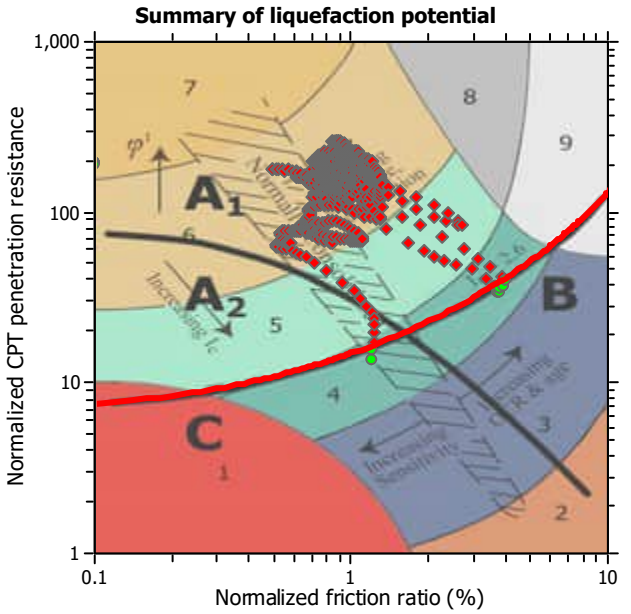
CPT file : CPT103

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.70 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	3.10 m	Fill height:	2.40 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

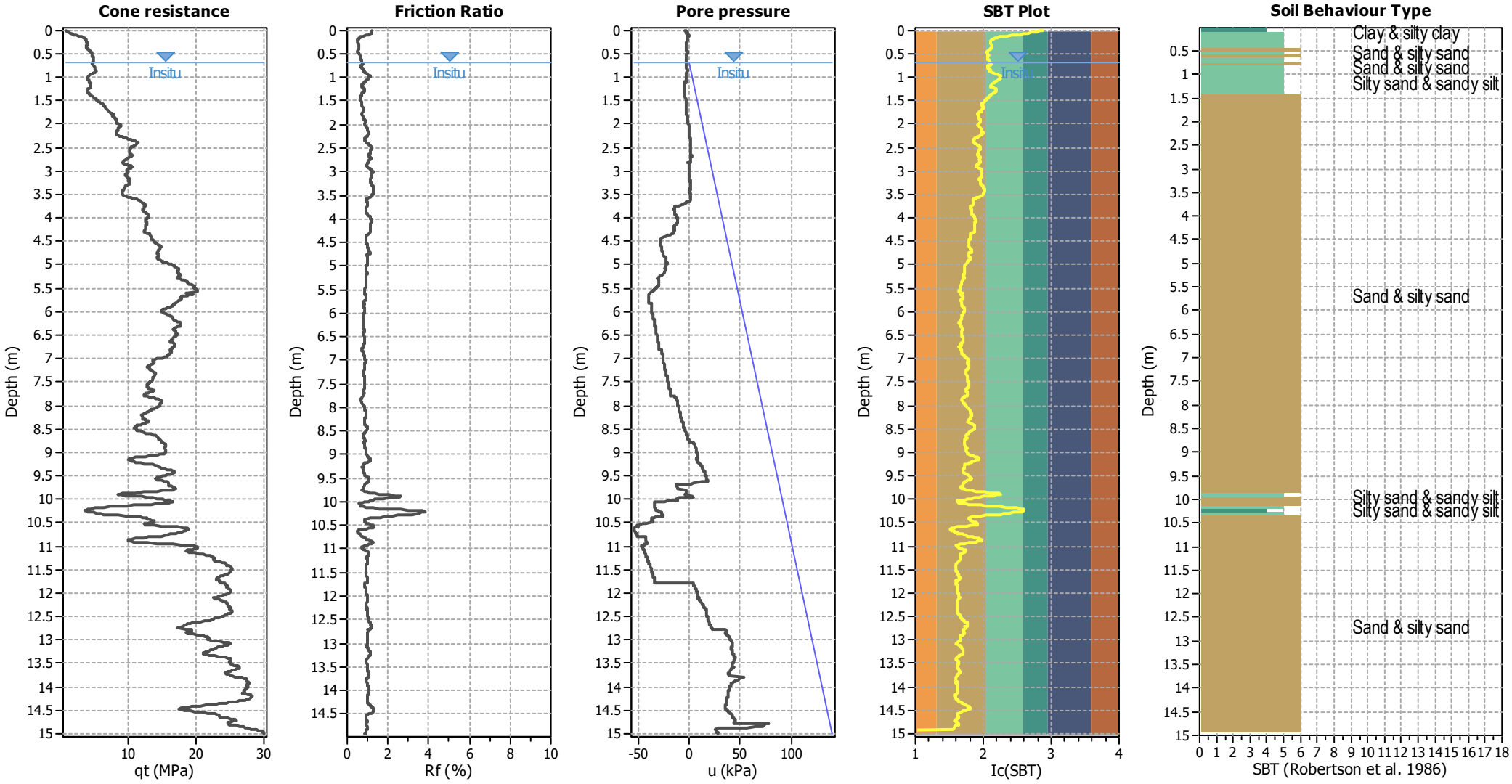






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



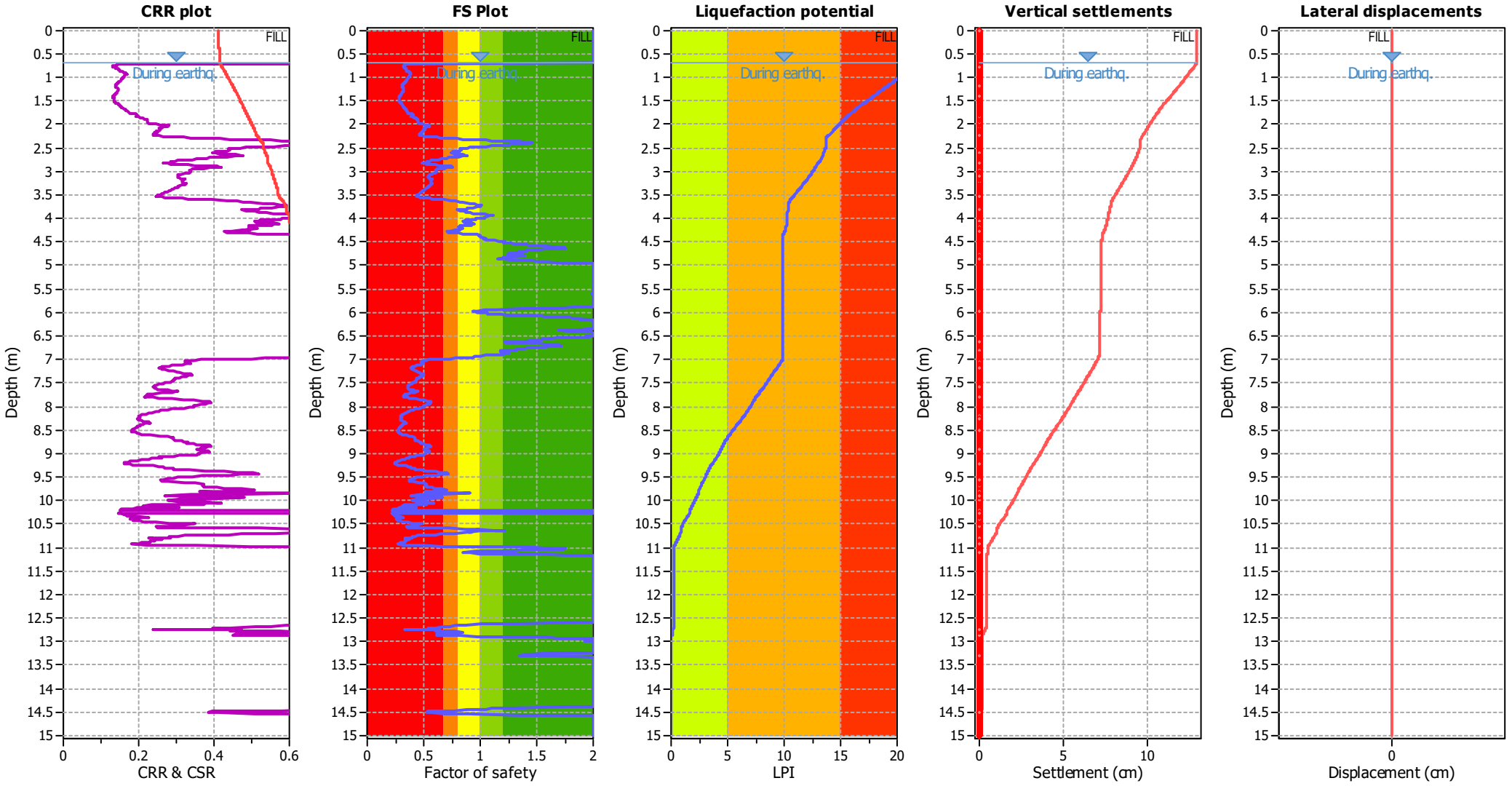
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.10 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	0.70 m	Fill height:	2.40 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	3.10 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	0.70 m	Fill height:	2.40 m	Limit depth:	N/A

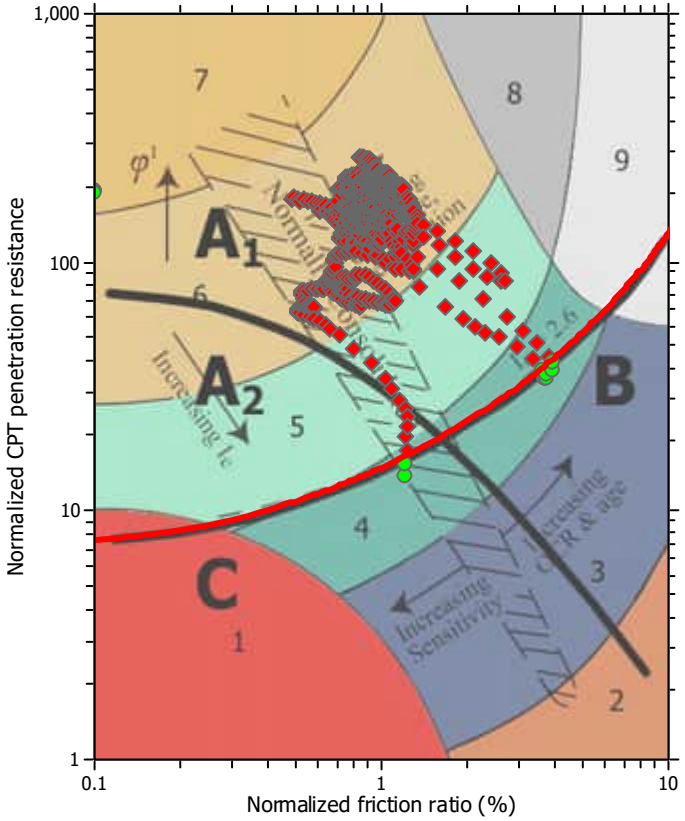
F.S. color scheme

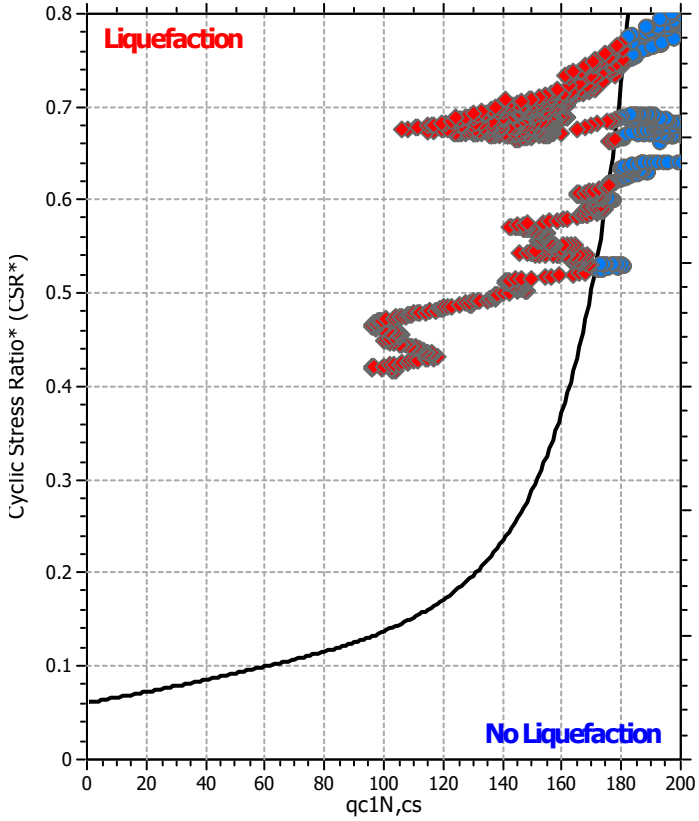
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

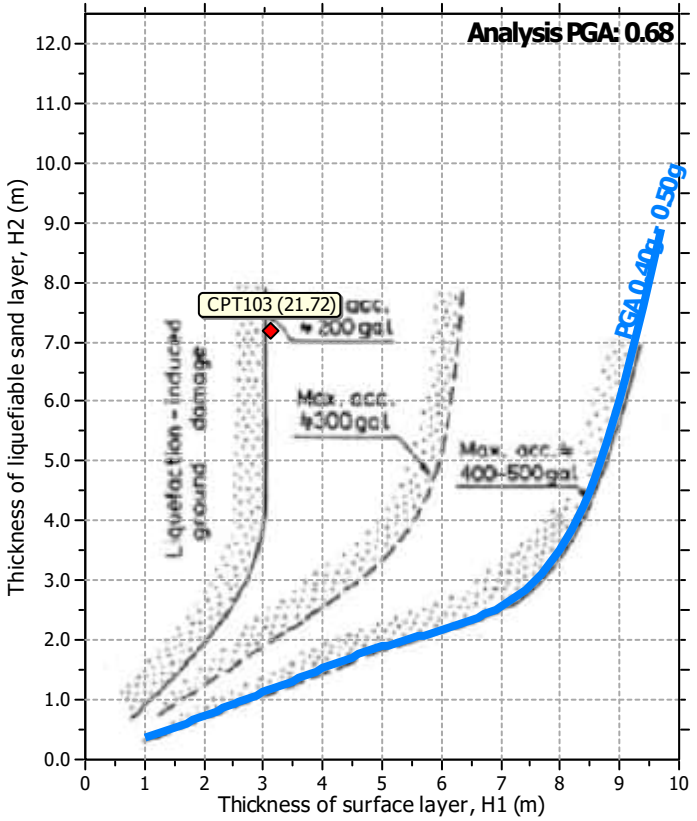
LPI color scheme

- 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.):	3.10 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	0.70 m	Fill height:	2.40 m	Limit depth:	N/A

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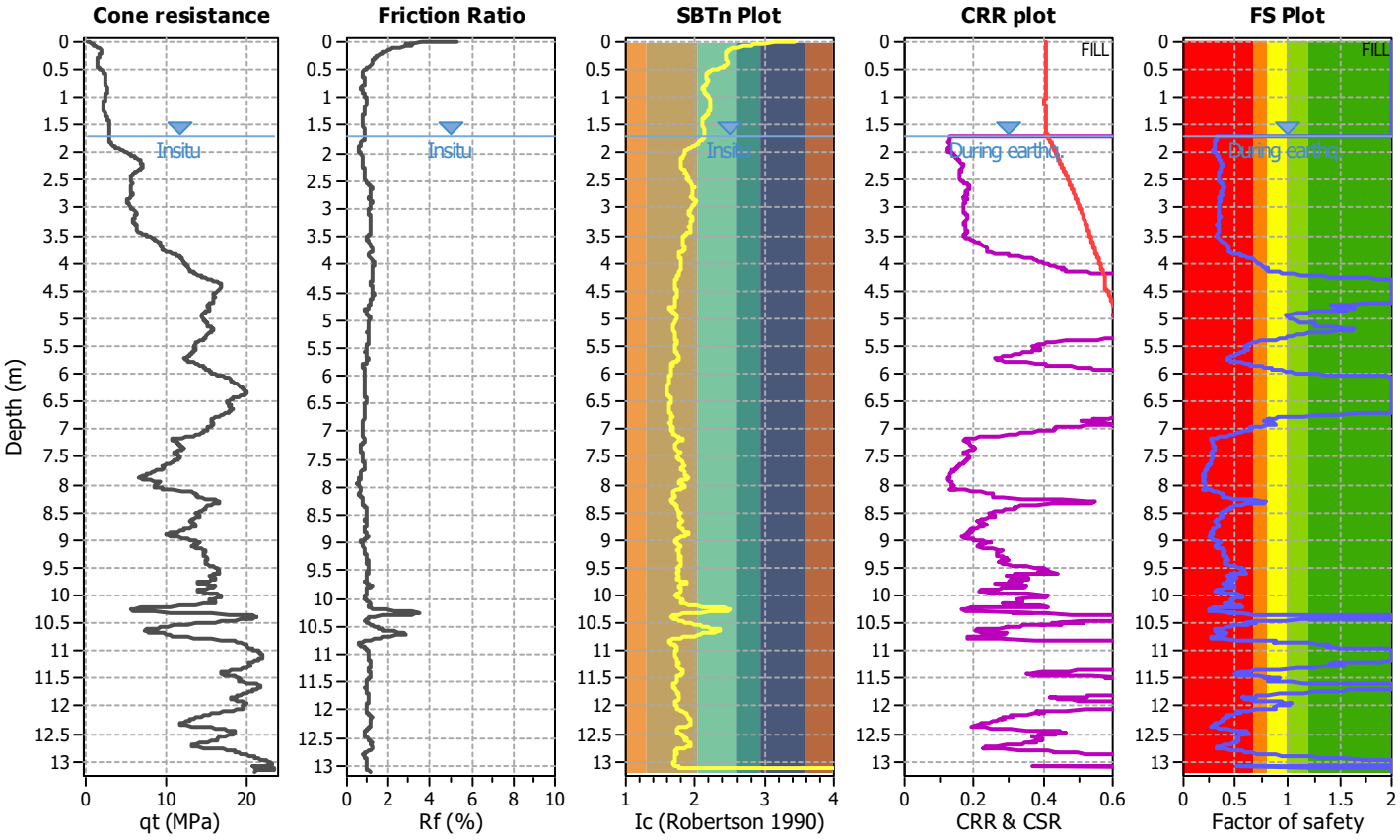
LIQUEFACTION ANALYSIS REPORT

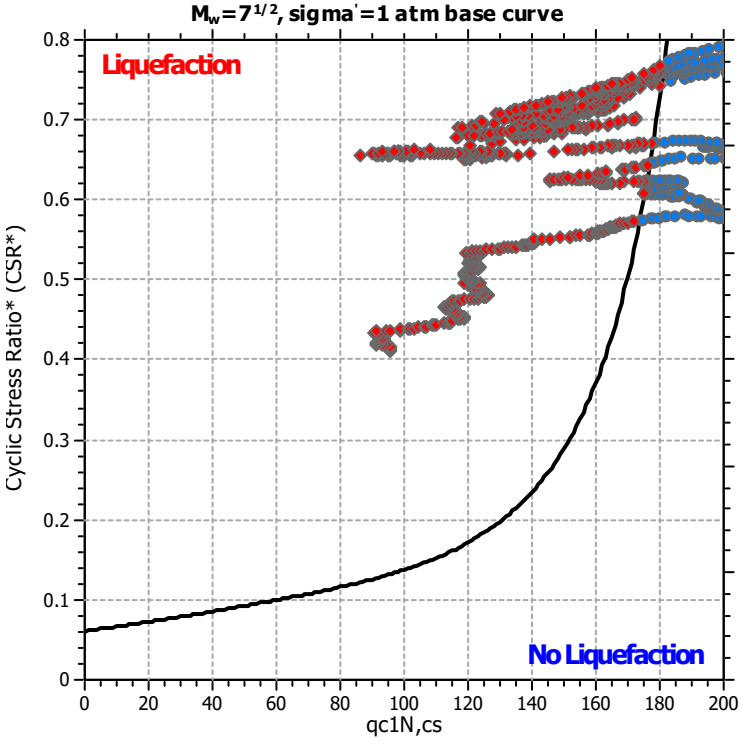
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

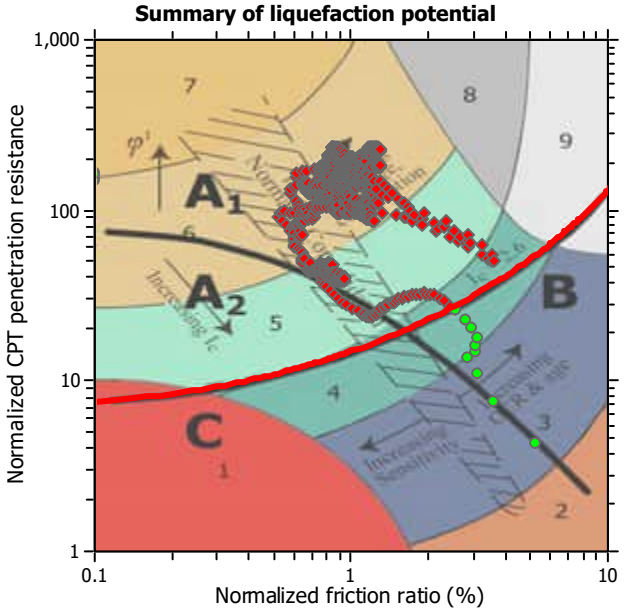
CPT file : CPT104

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.70 m	Fill height:	1.00 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

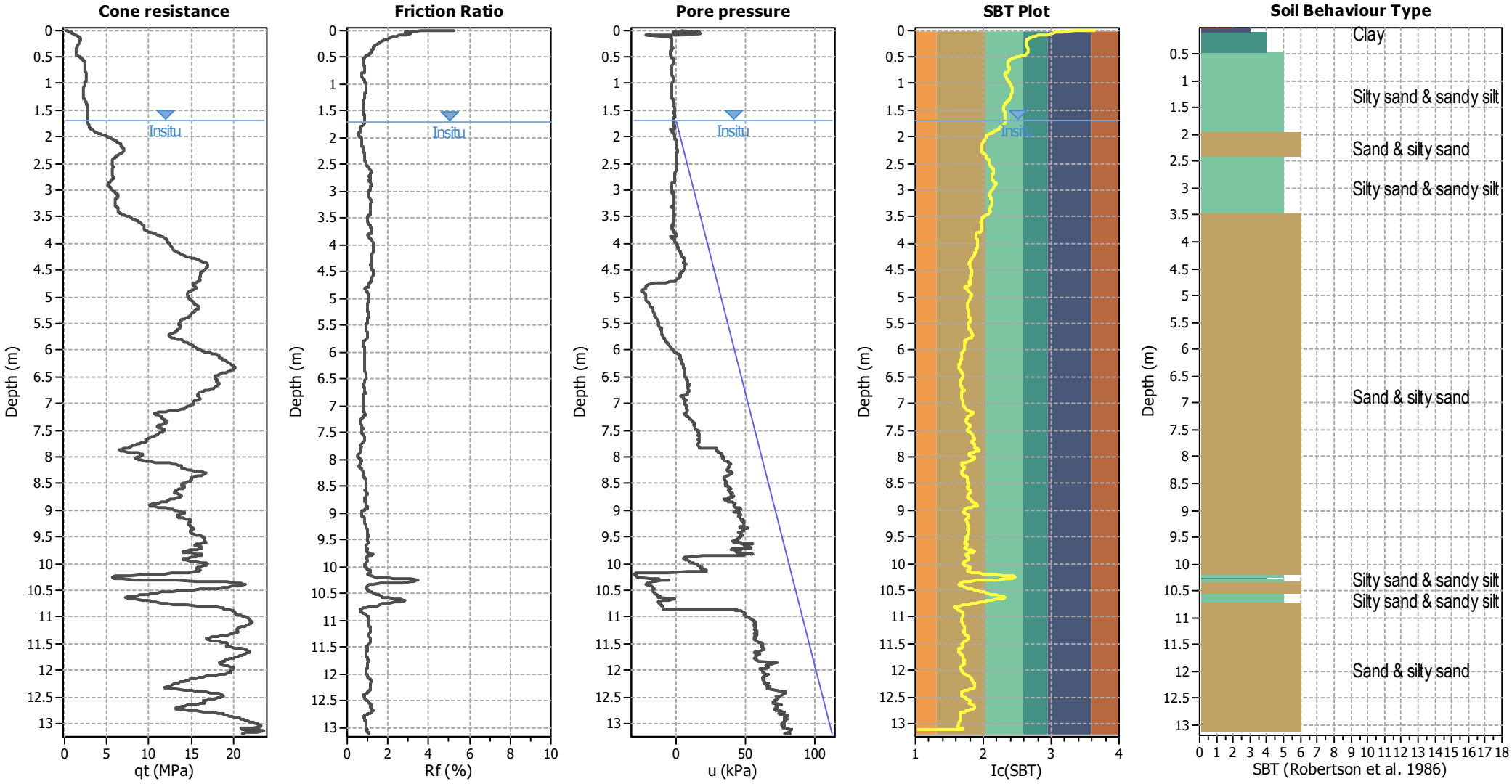






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



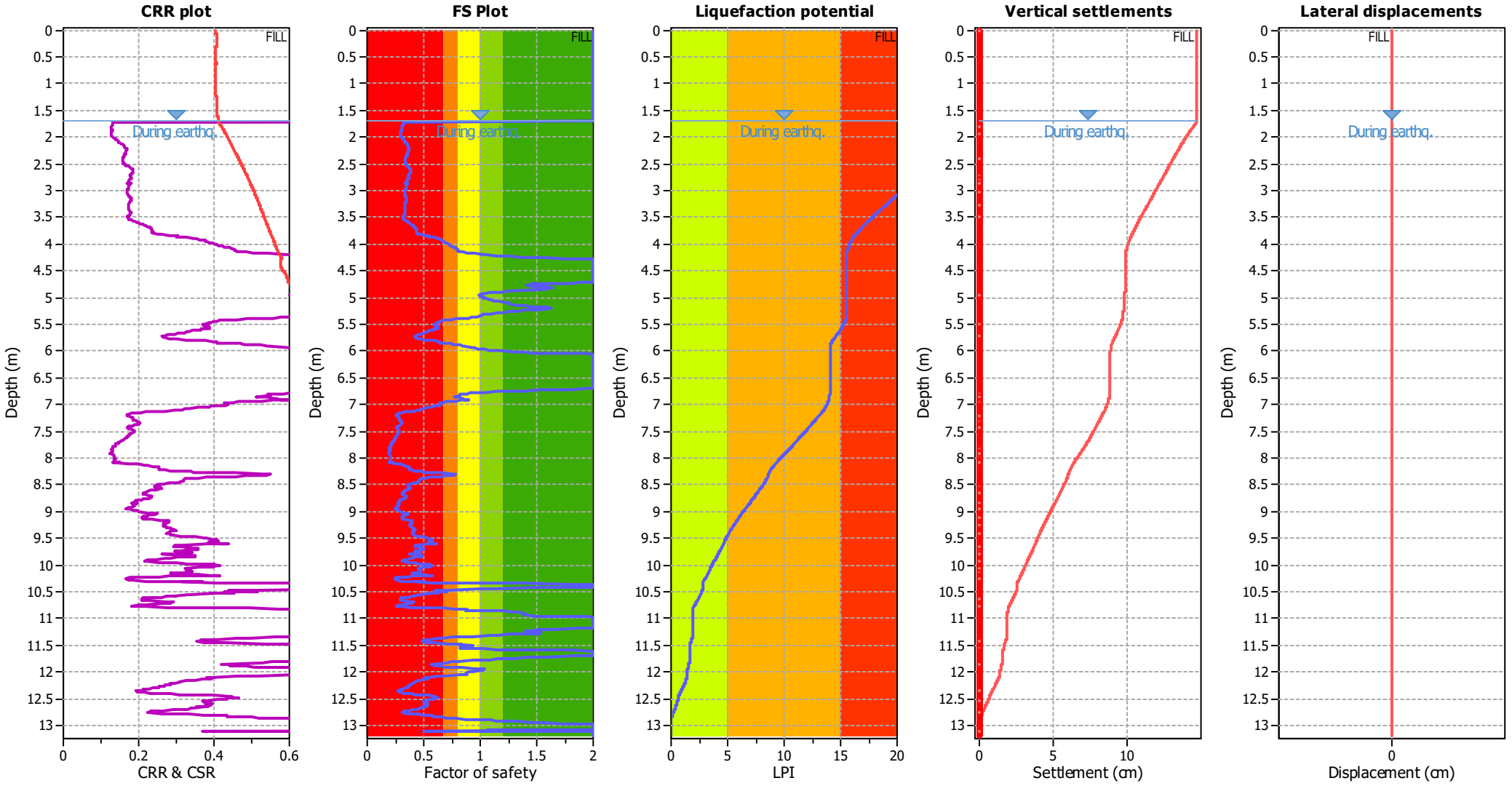
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.70 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	1.00 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.70 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	1.00 m	Limit depth:	N/A

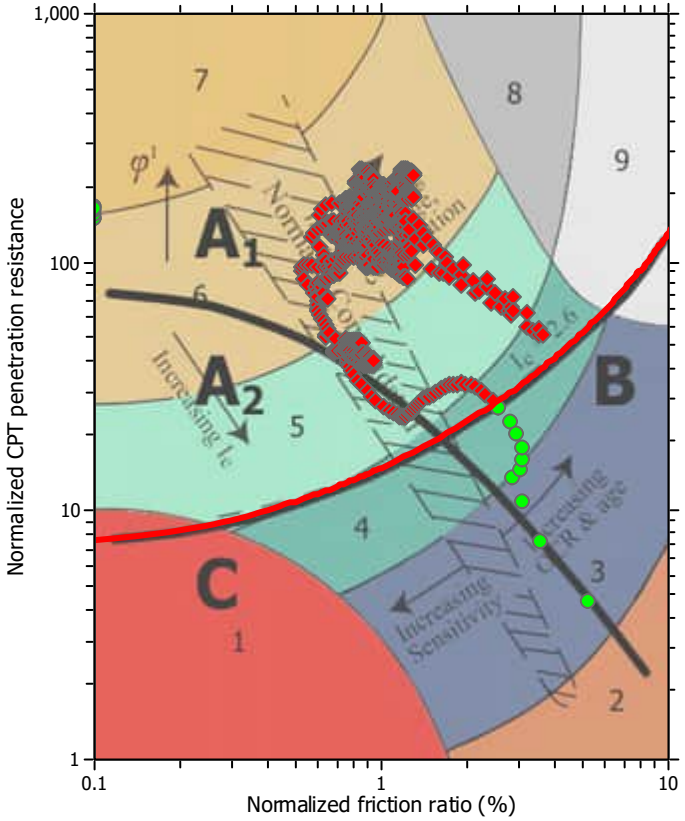
F.S. color scheme

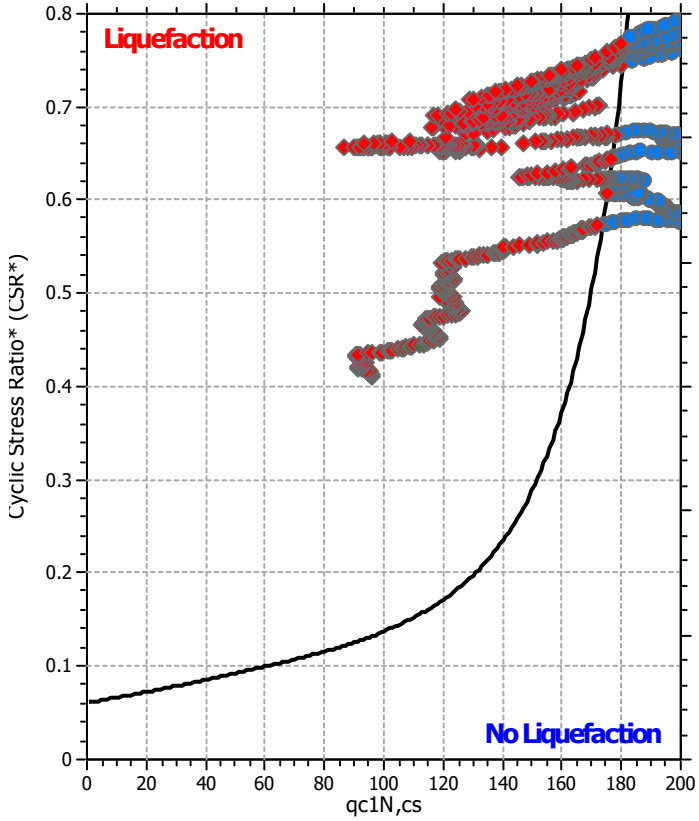
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

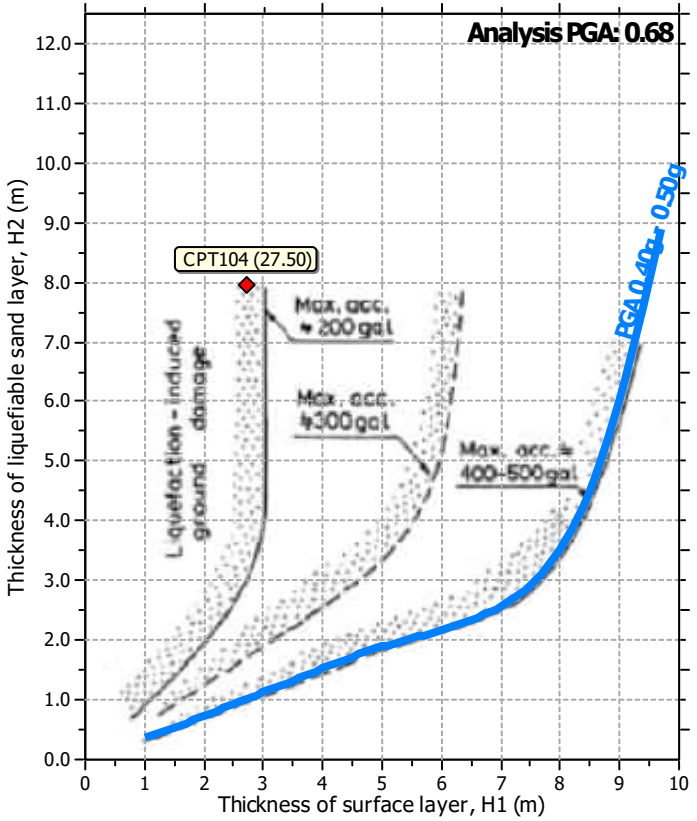
LPI color scheme

- 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.):	2.70 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	1.00 m	Limit depth:	N/A

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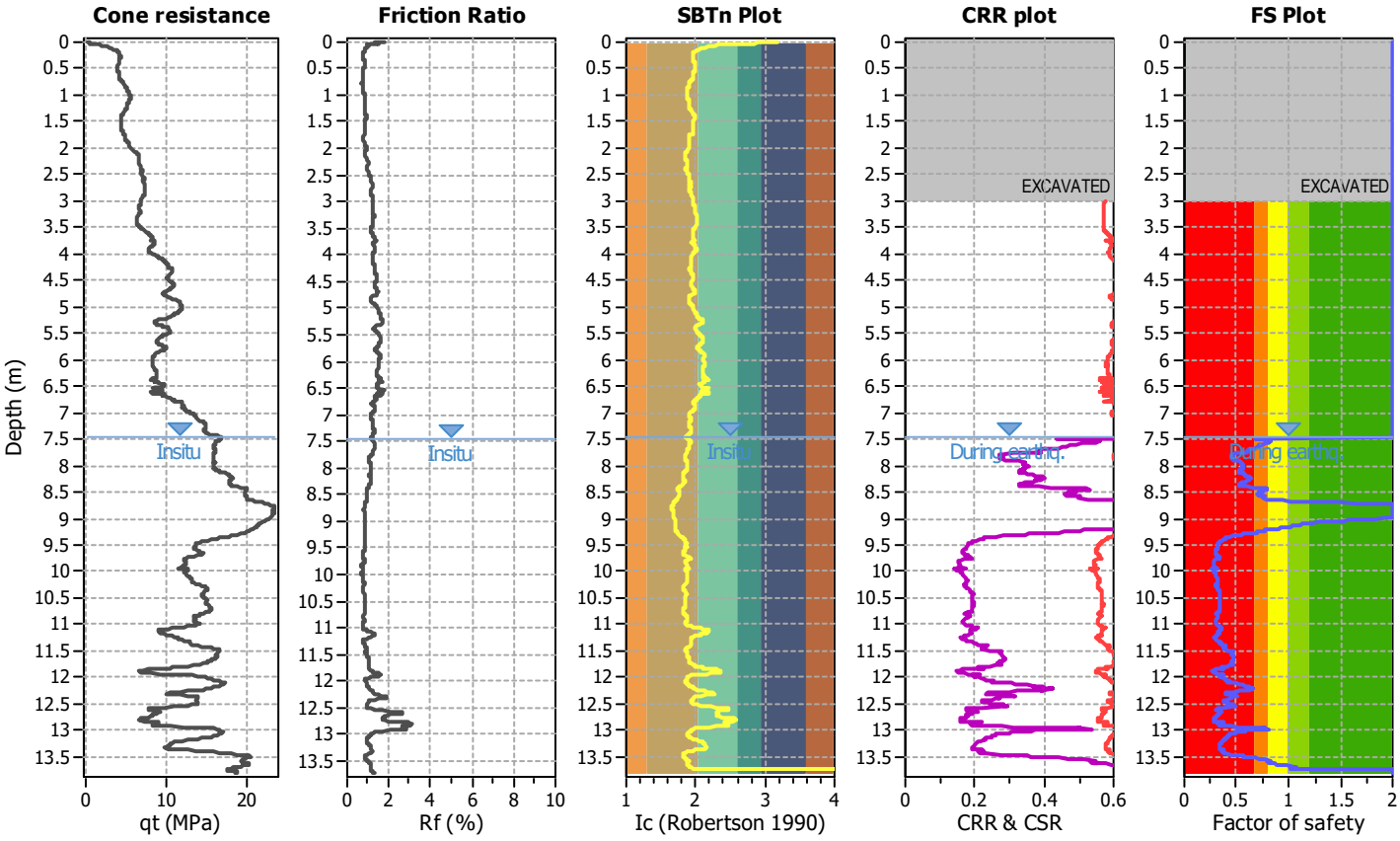
LIQUEFACTION ANALYSIS REPORT

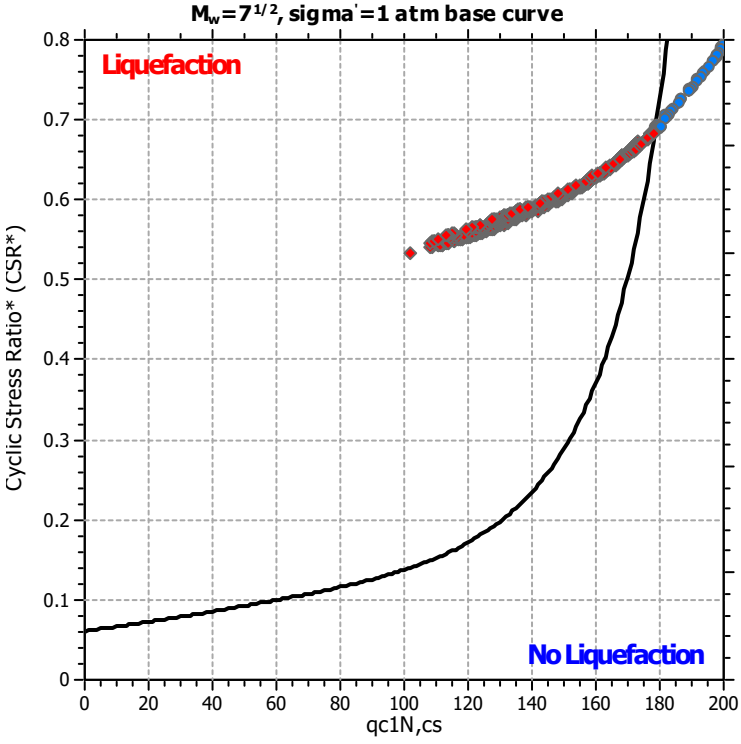
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

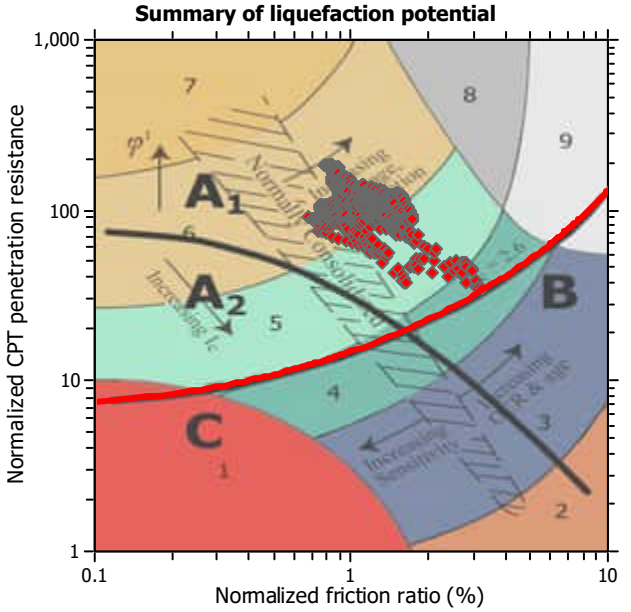
CPT file : CPT105

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	7.47 m	Excavation:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	7.47 m	Excavation depth:	3.00 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Footing load:	500.00 kPa	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

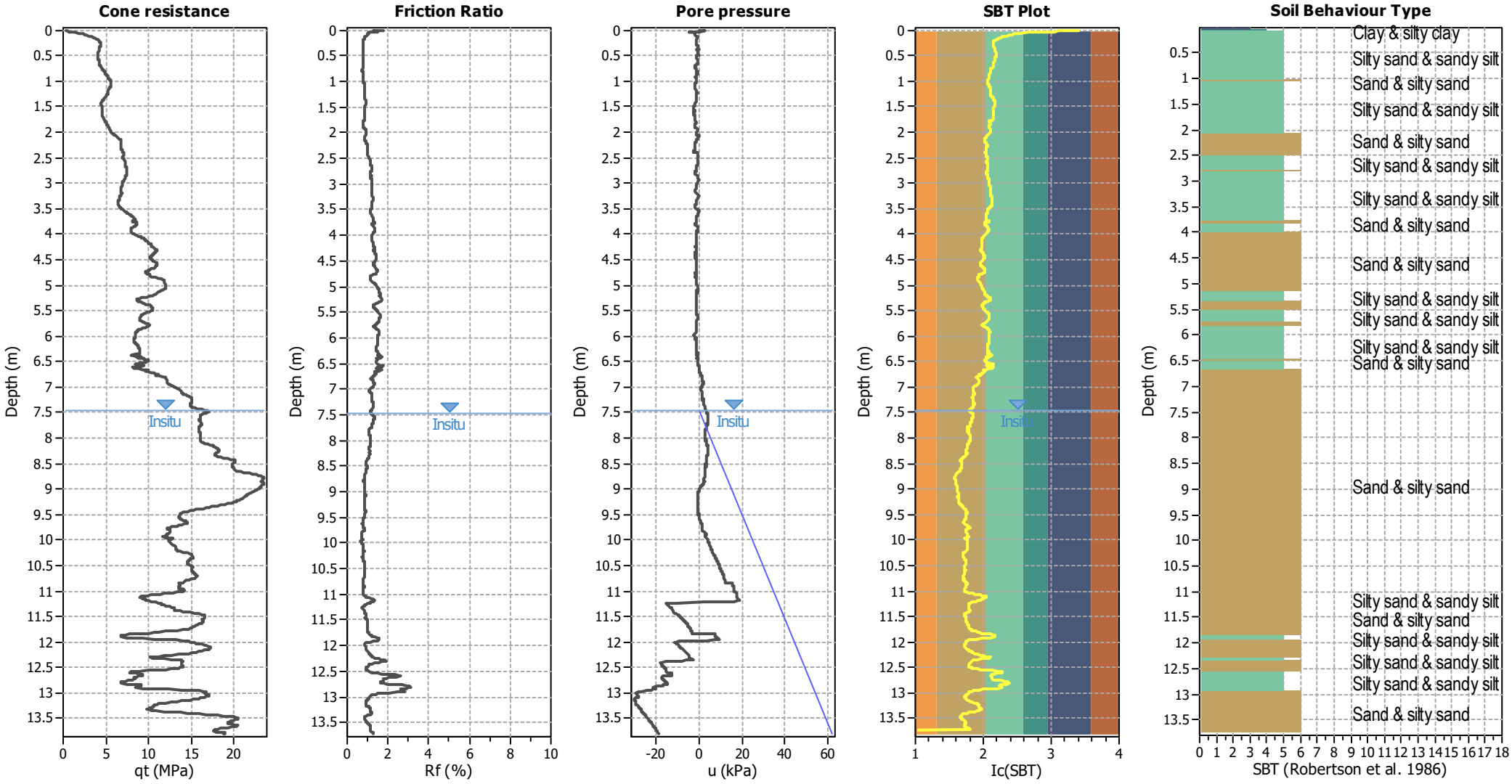






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



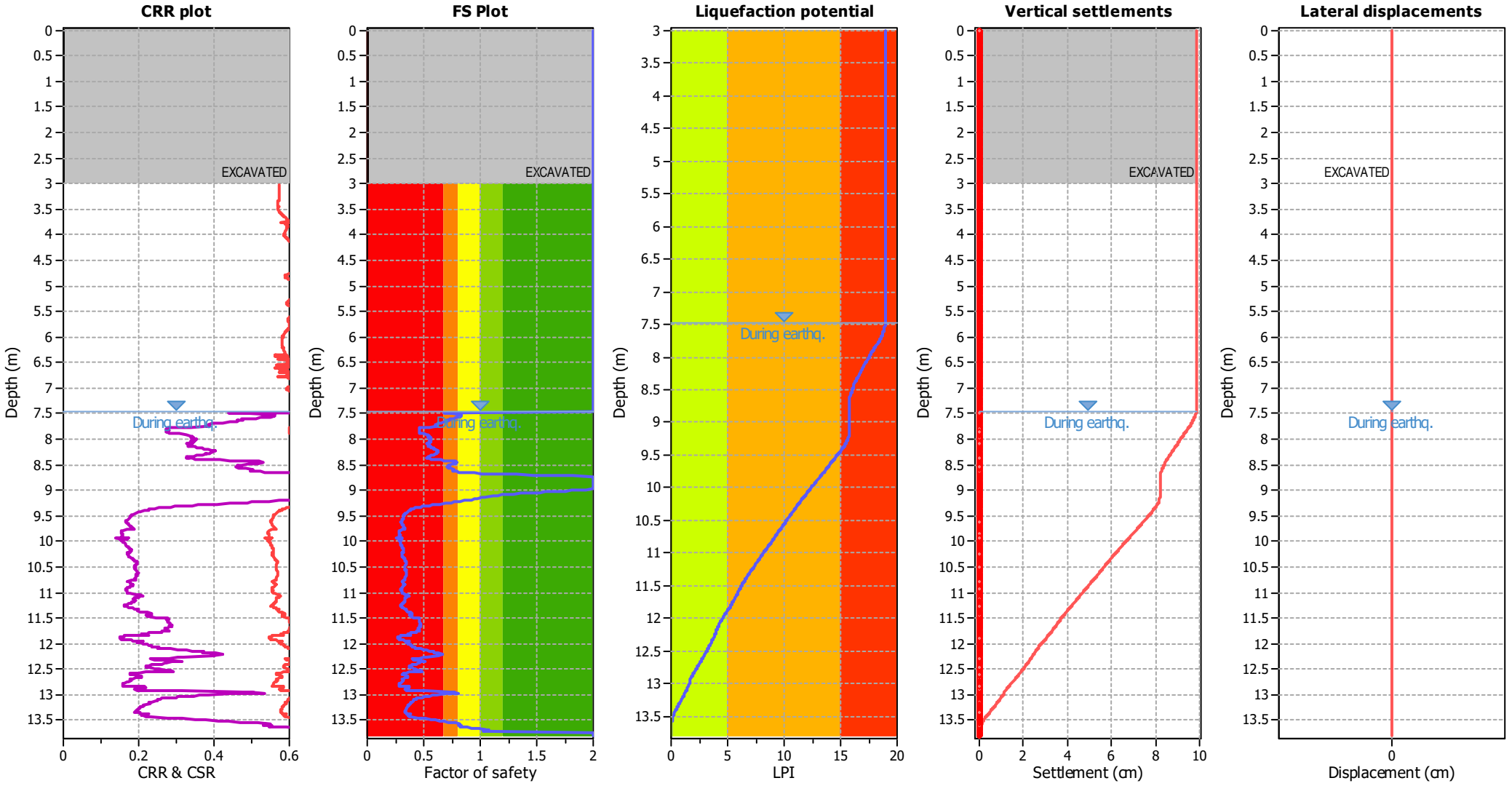
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	7.47 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	7.47 m	Excavation depth:	3.00 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	7.47 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	7.47 m	Excavation depth:	3.00 m	Limit depth:	N/A

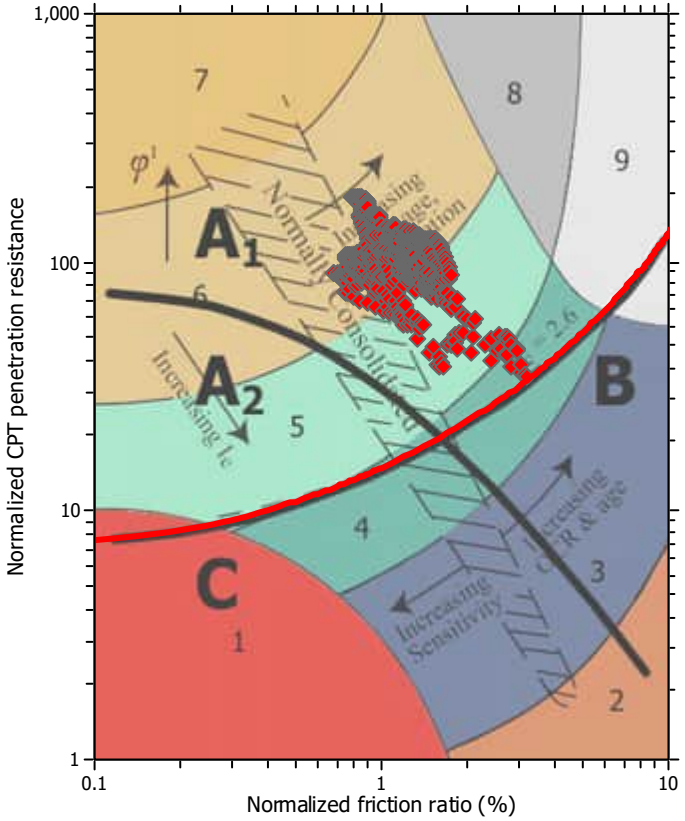
F.S. color scheme

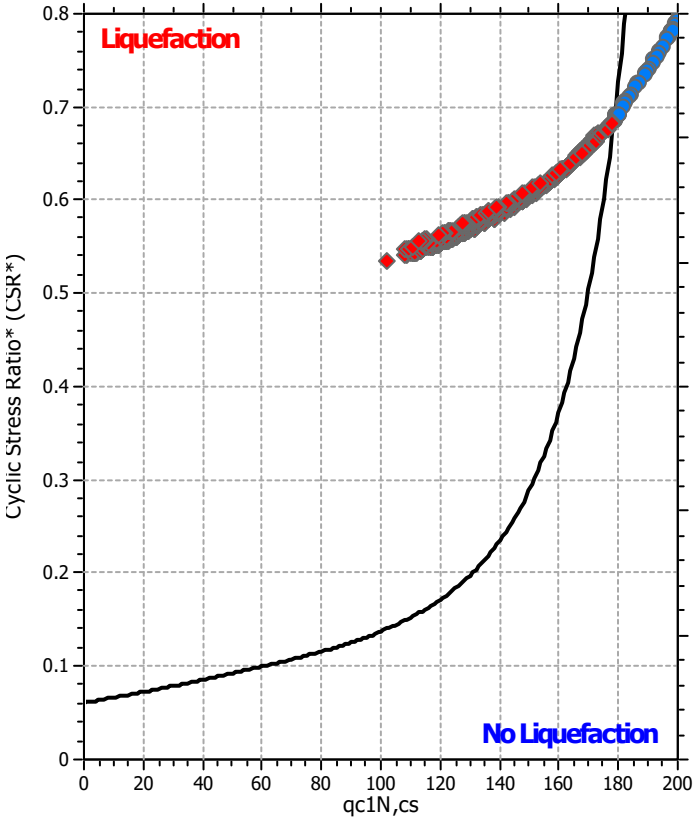
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

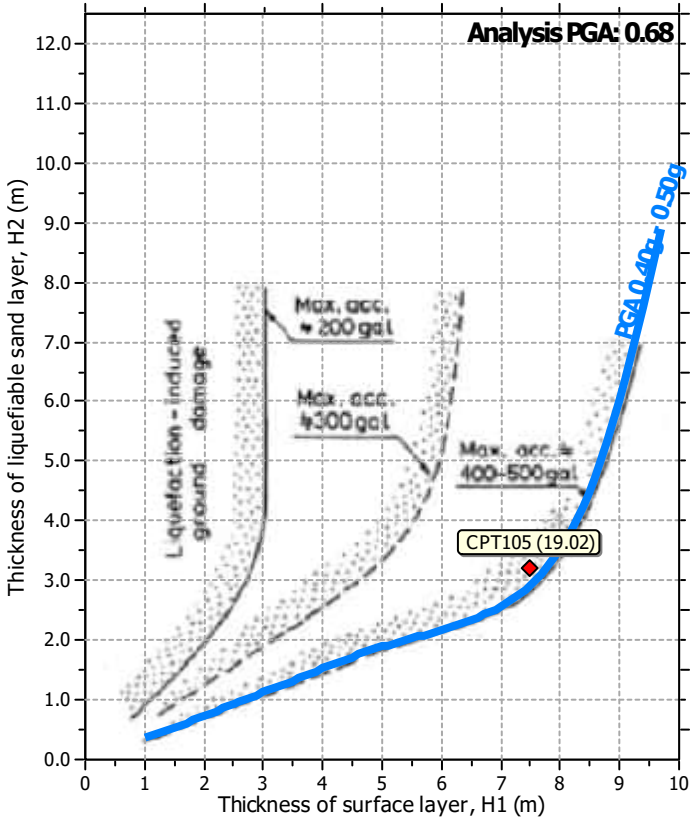
LPI color scheme

- 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.):	7.47 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	7.47 m	Excavation depth:	3.00 m	Limit depth:	N/A

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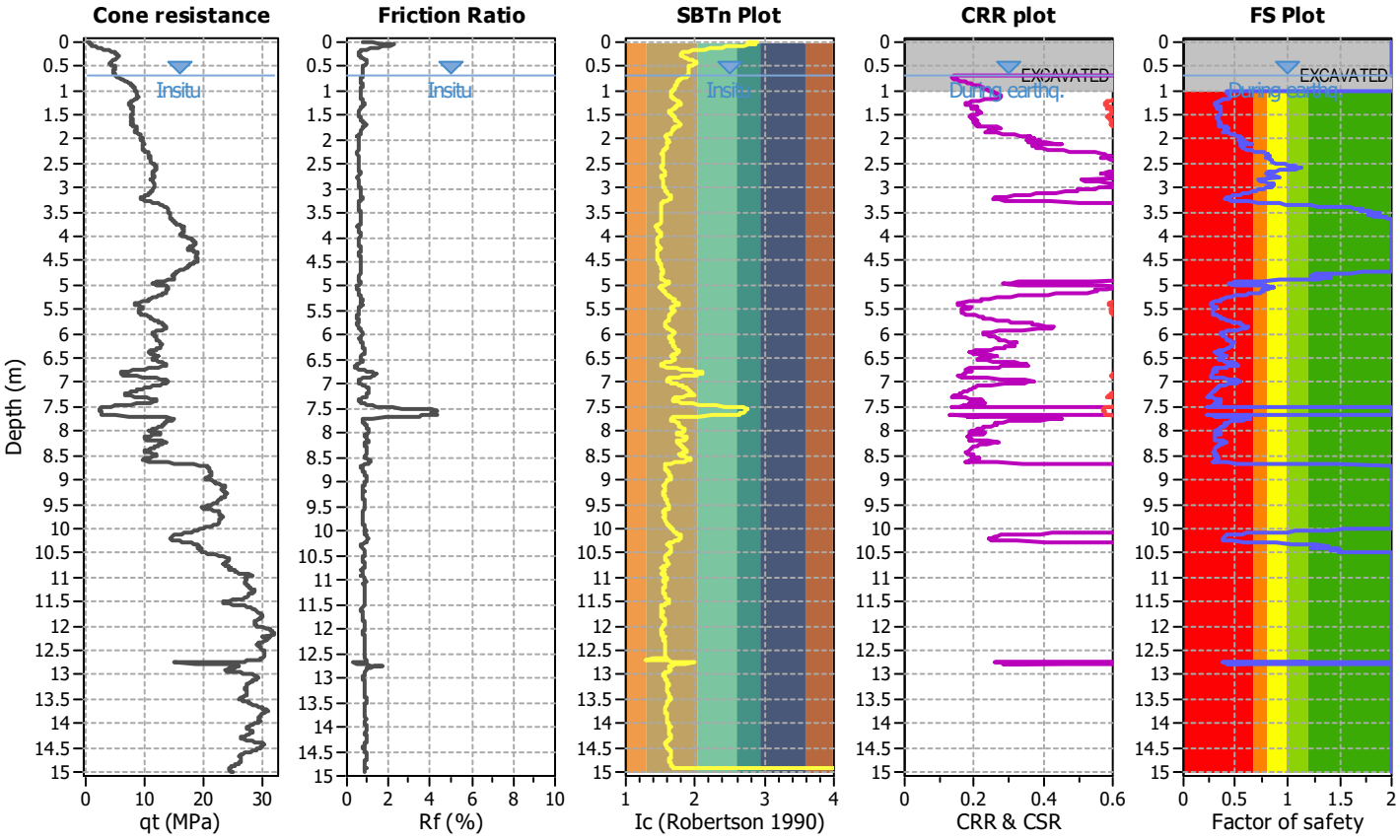
LIQUEFACTION ANALYSIS REPORT

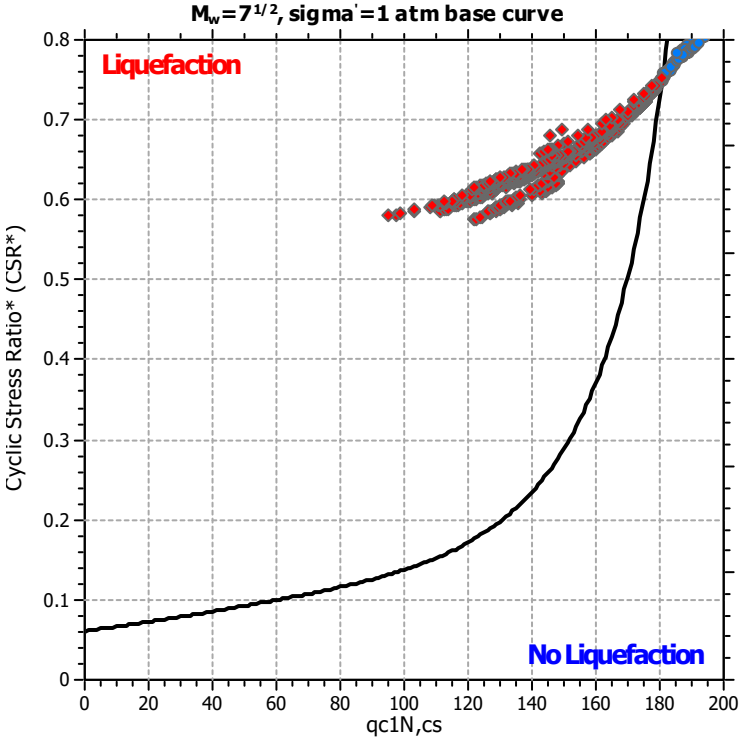
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

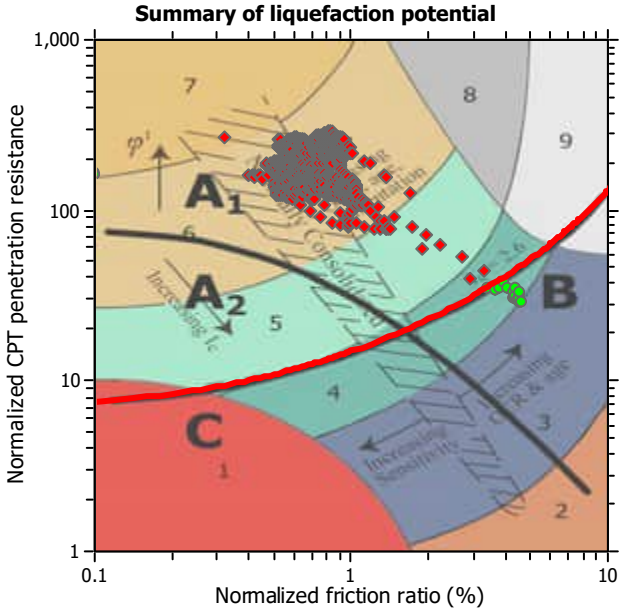
CPT file : CPT106

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.70 m	Excavation:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.70 m	Excavation depth:	1.00 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Footing load:	500.00 kPa	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

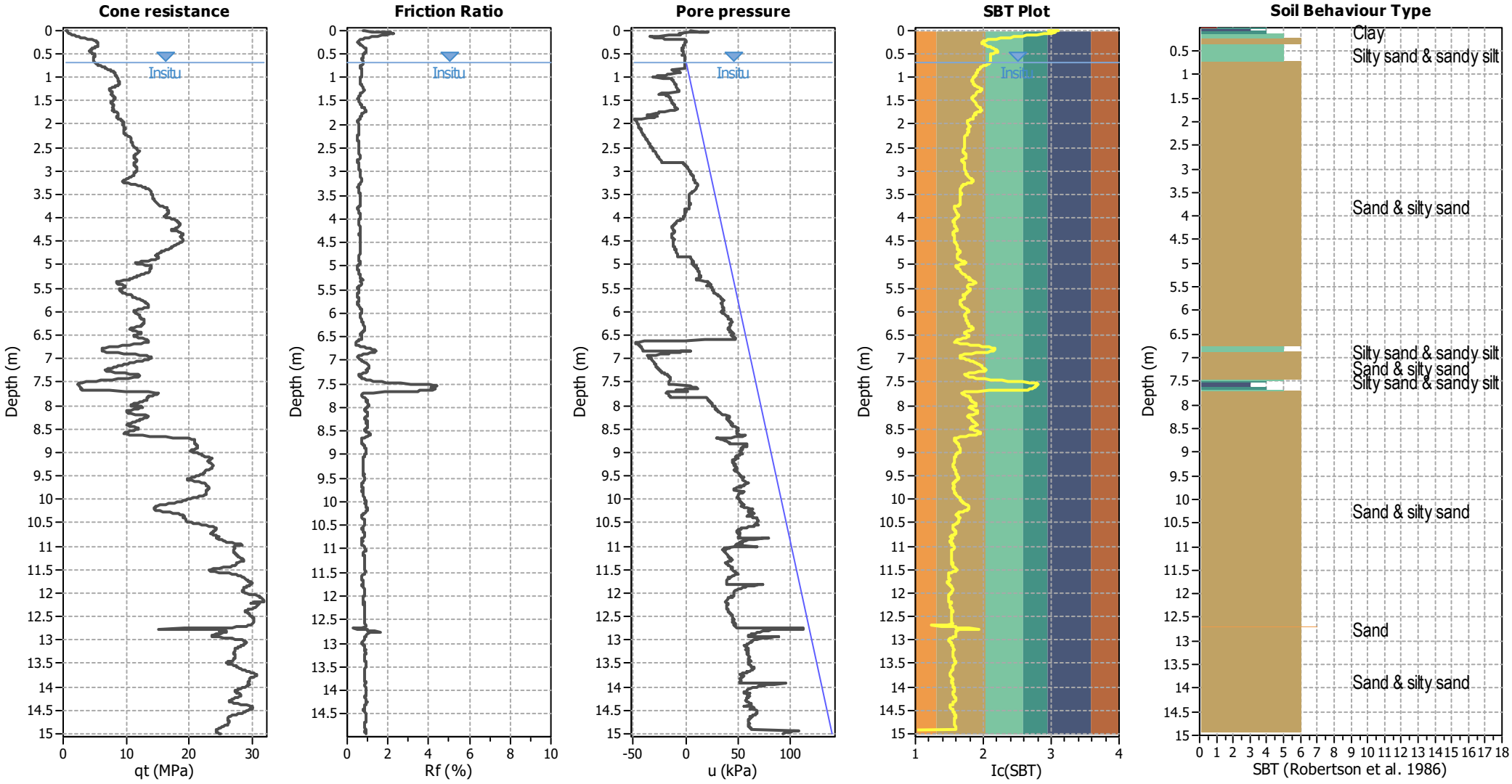






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



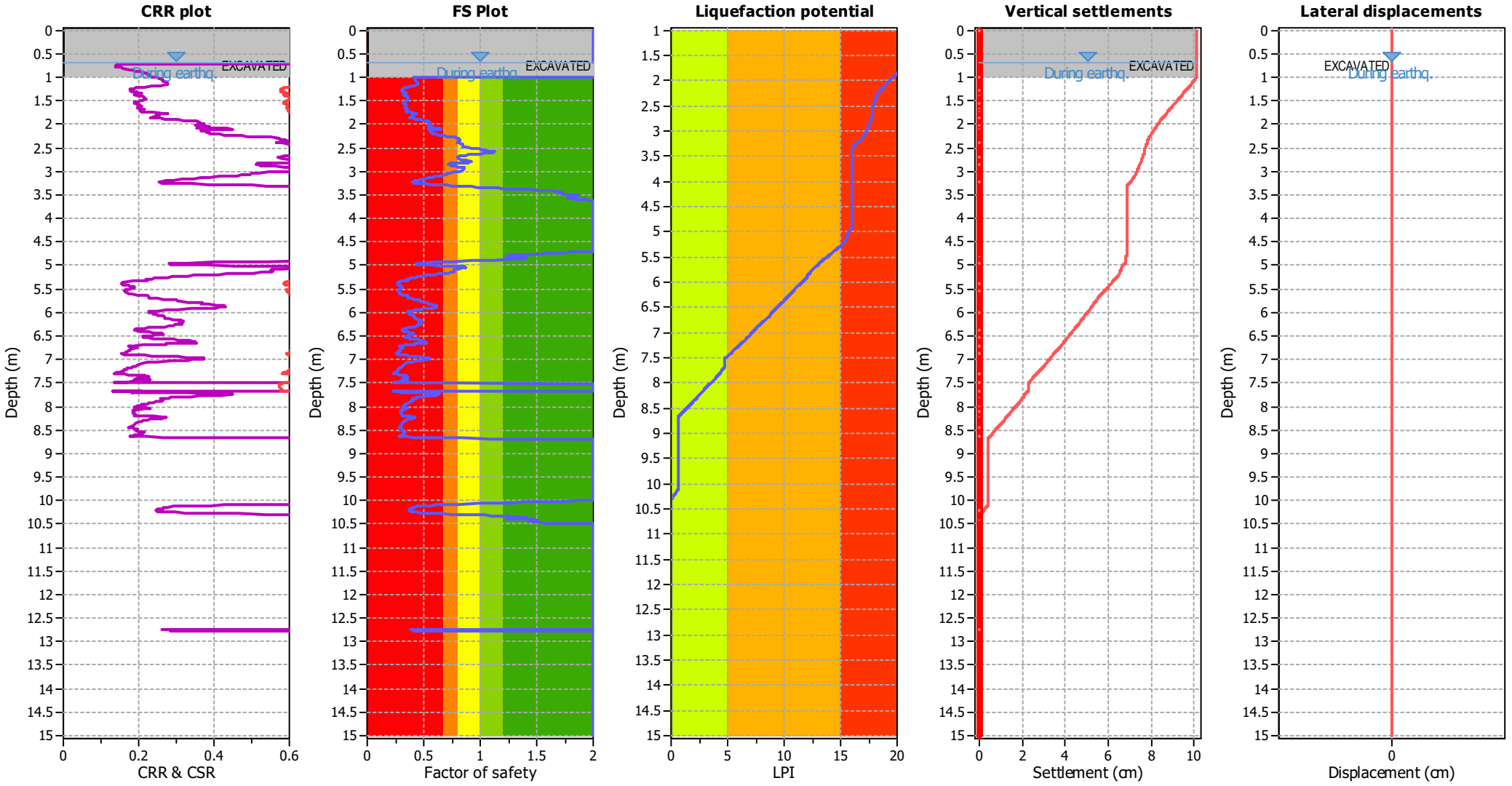
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	0.70 m	Excavation depth:	1.00 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	0.70 m	Excavation depth:	1.00 m	Limit depth:	N/A

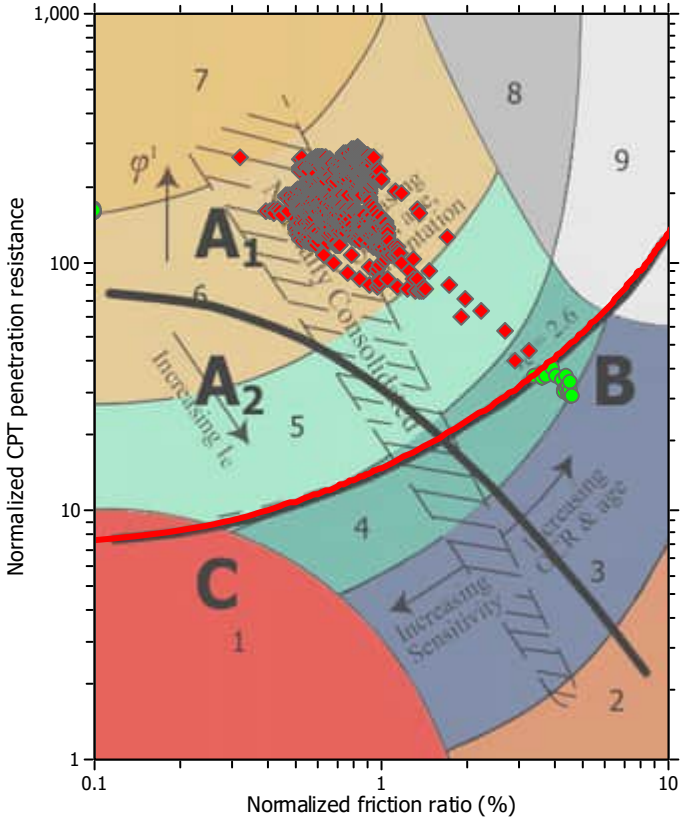
F.S. color scheme

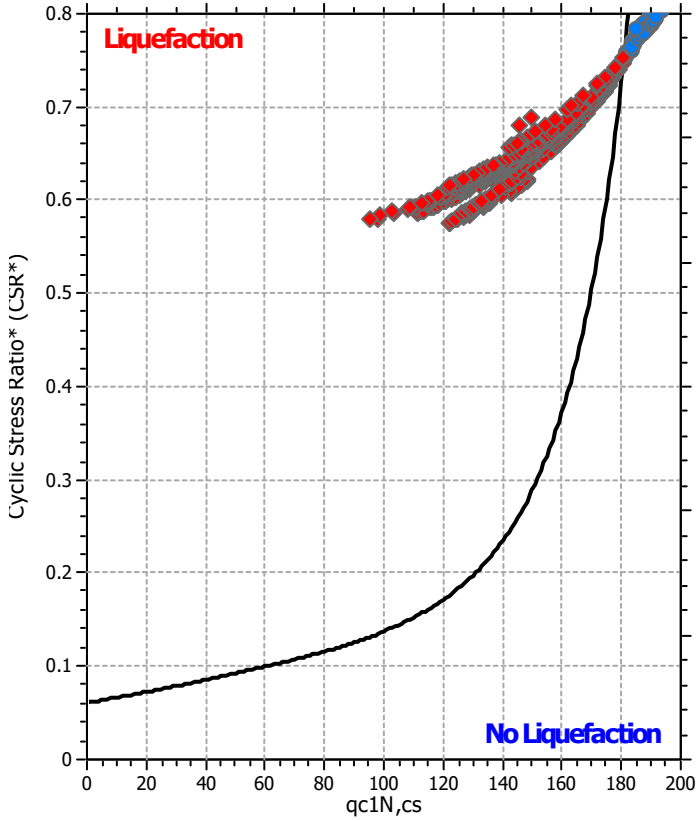
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

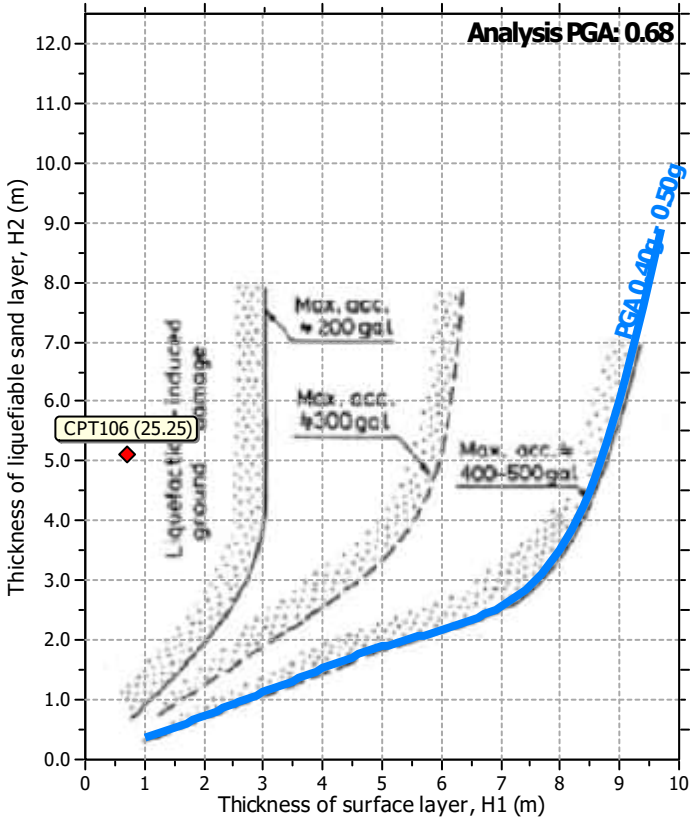
LPI color scheme

- 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.):	0.70 m	Footing load:	500.00 kPa
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	0.70 m	Excavation depth:	1.00 m	Limit depth:	N/A

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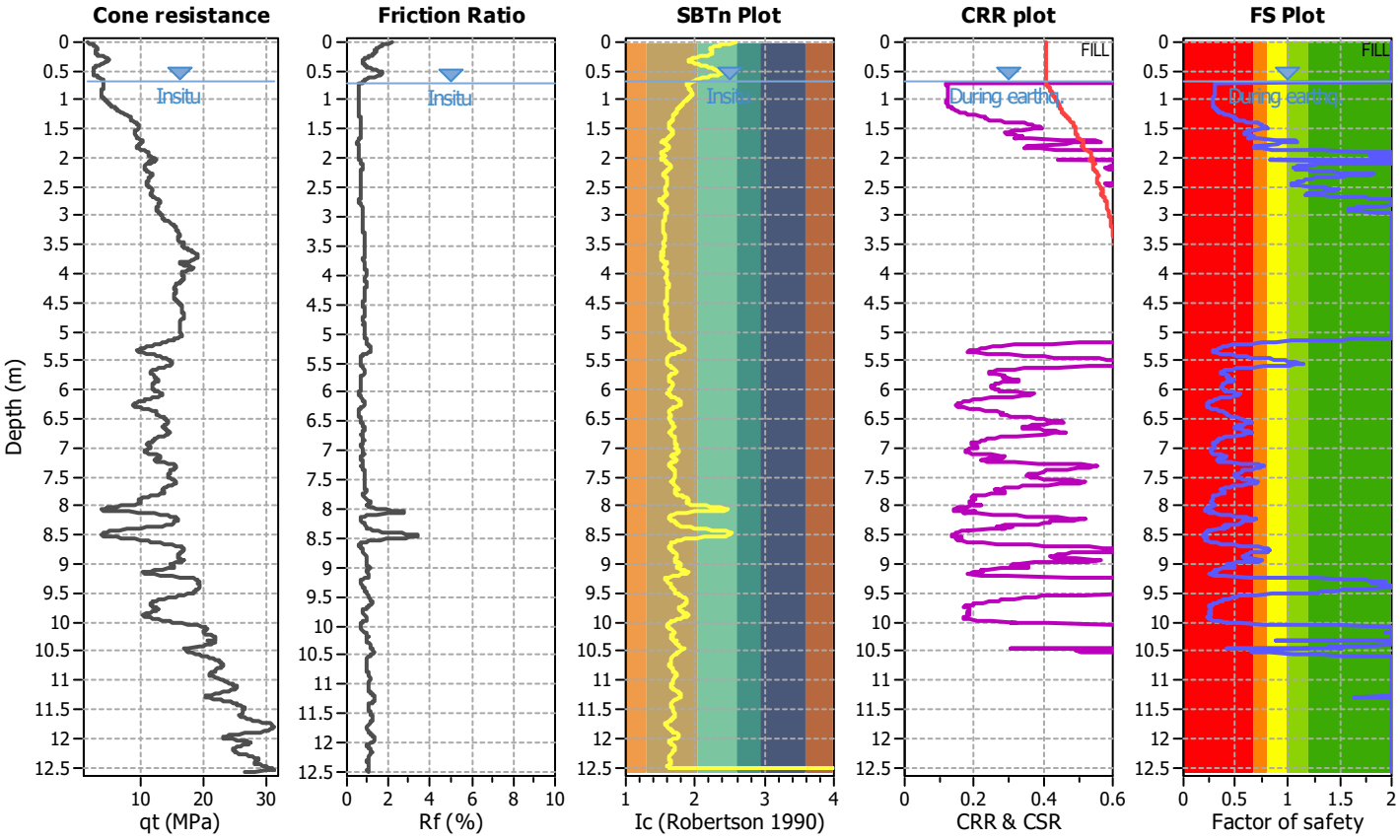
LIQUEFACTION ANALYSIS REPORT

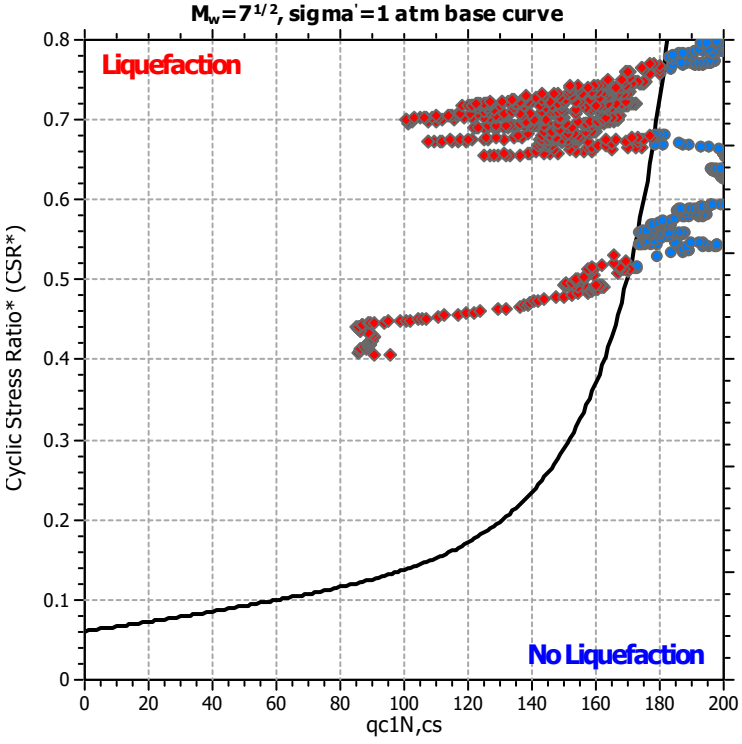
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

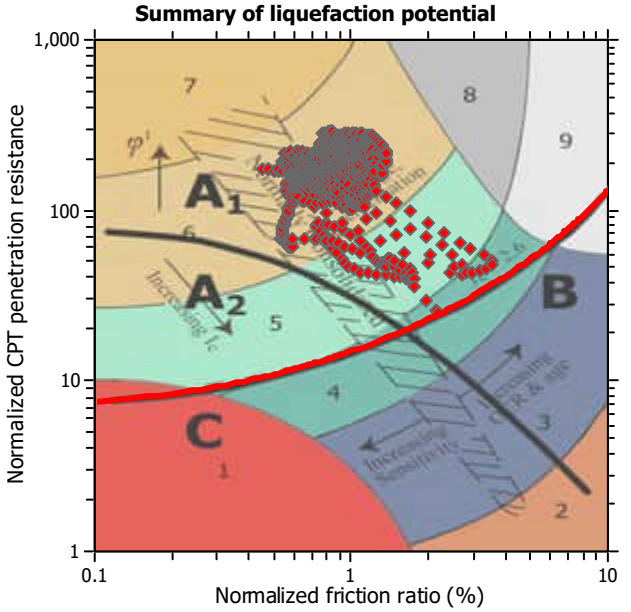
CPT file : CPT107

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.70 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.10 m	Fill height:	1.40 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

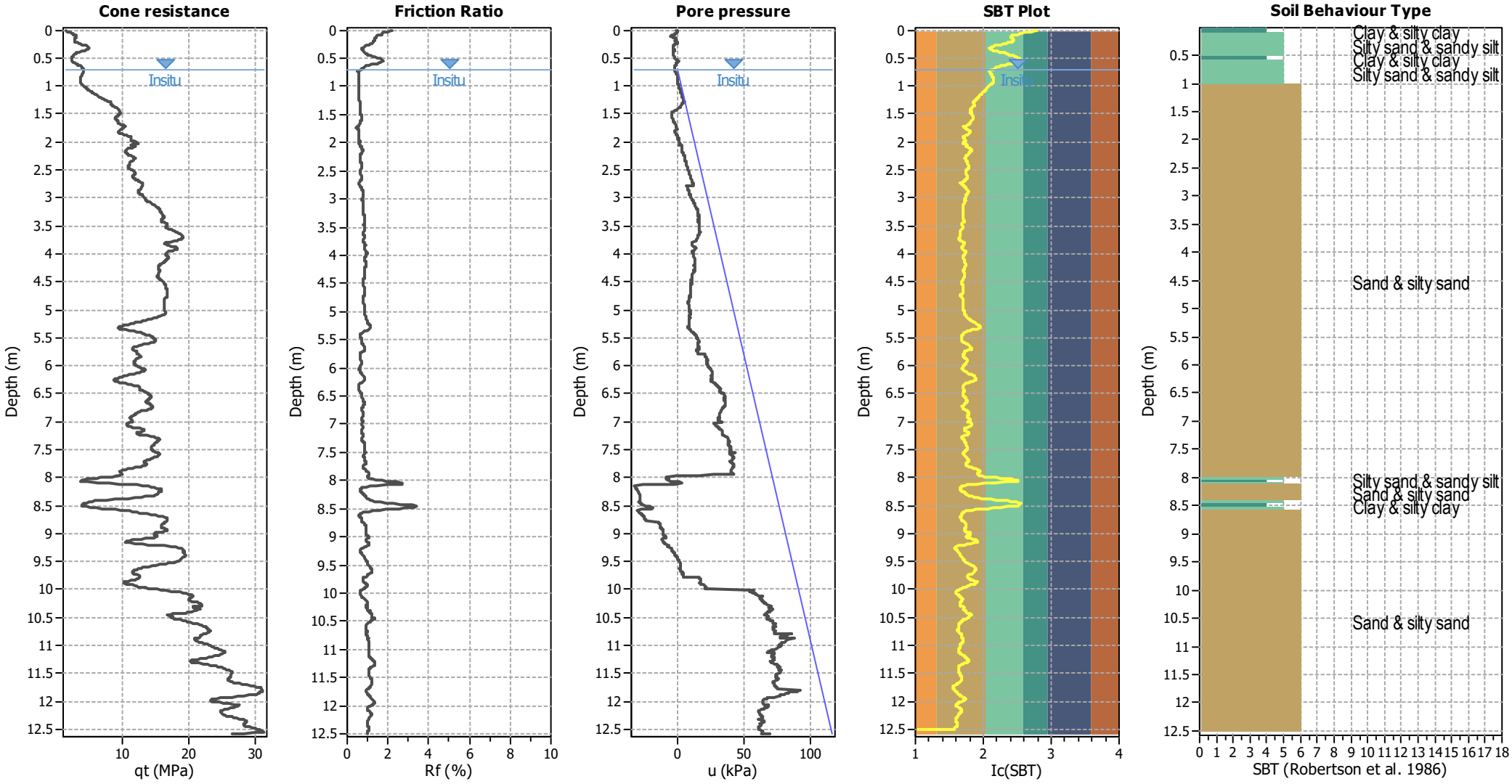






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



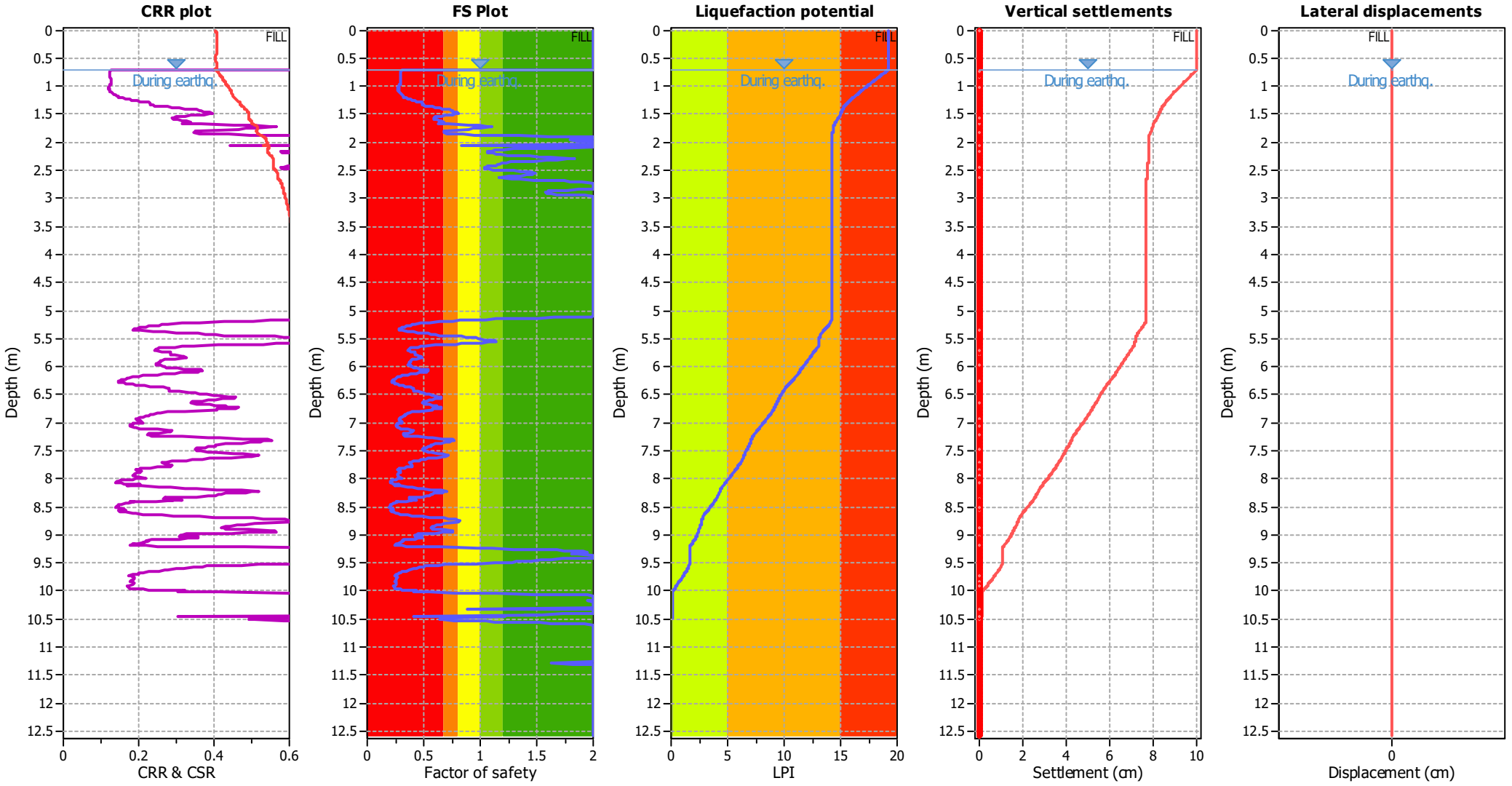
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	0.70 m	Fill height:	1.40 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.10 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	0.70 m	Fill height:	1.40 m	Limit depth:	N/A

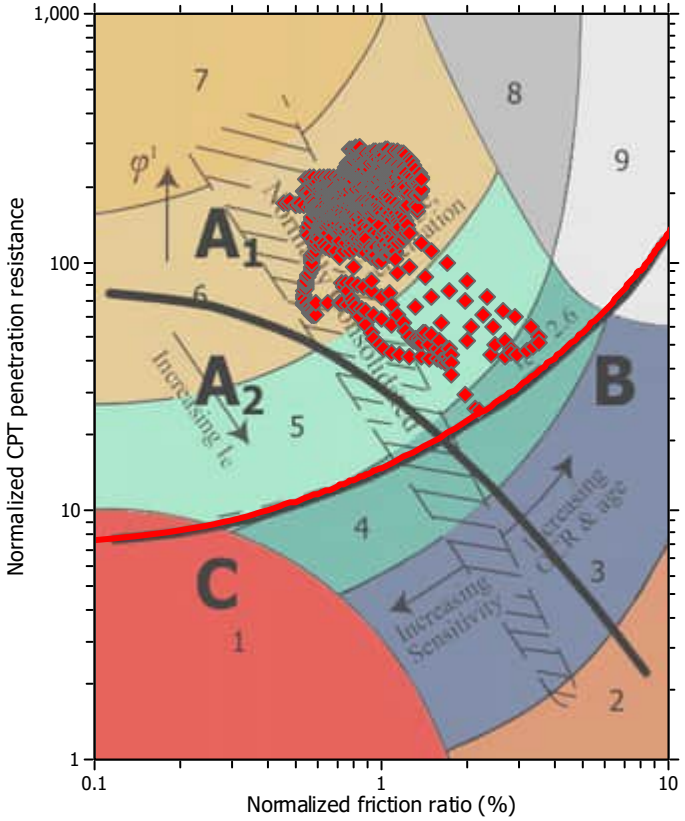
F.S. color scheme

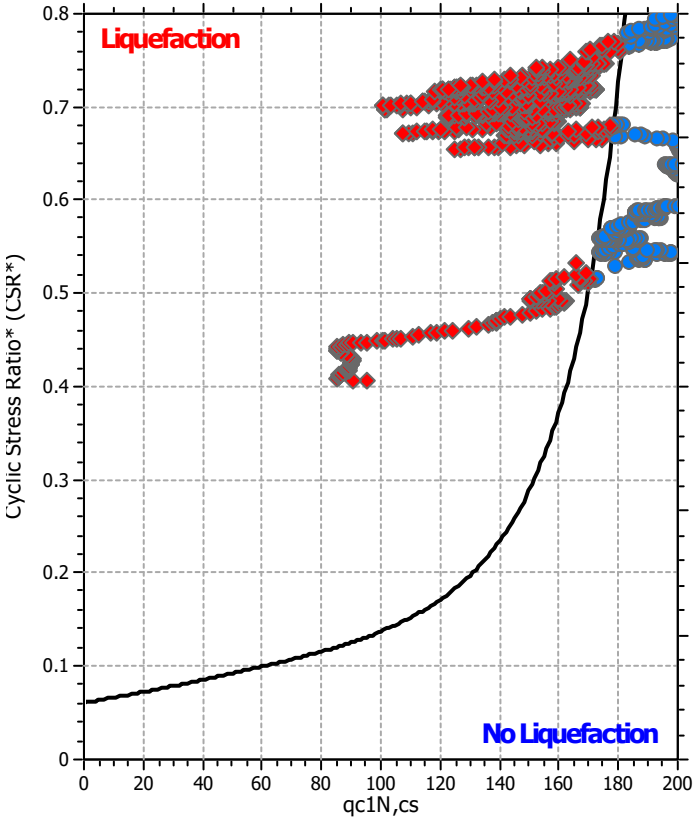
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

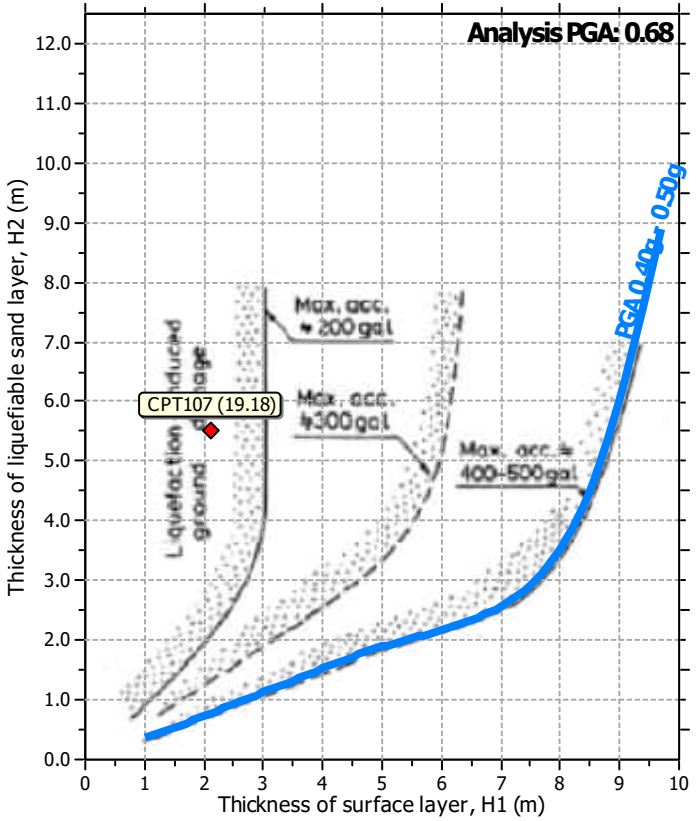
LPI color scheme

- 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.):	2.10 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	0.70 m	Fill height:	1.40 m	Limit depth:	N/A

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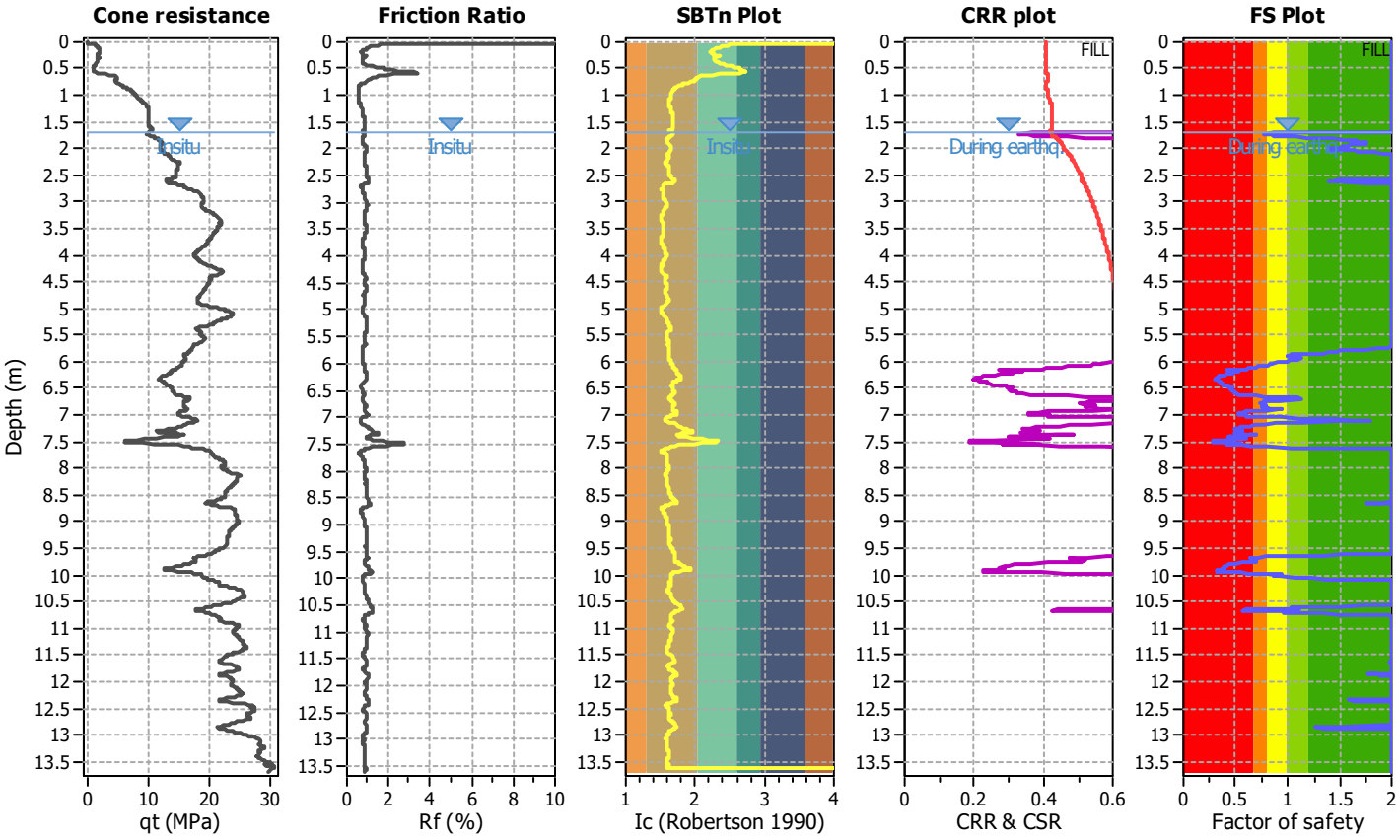
LIQUEFACTION ANALYSIS REPORT

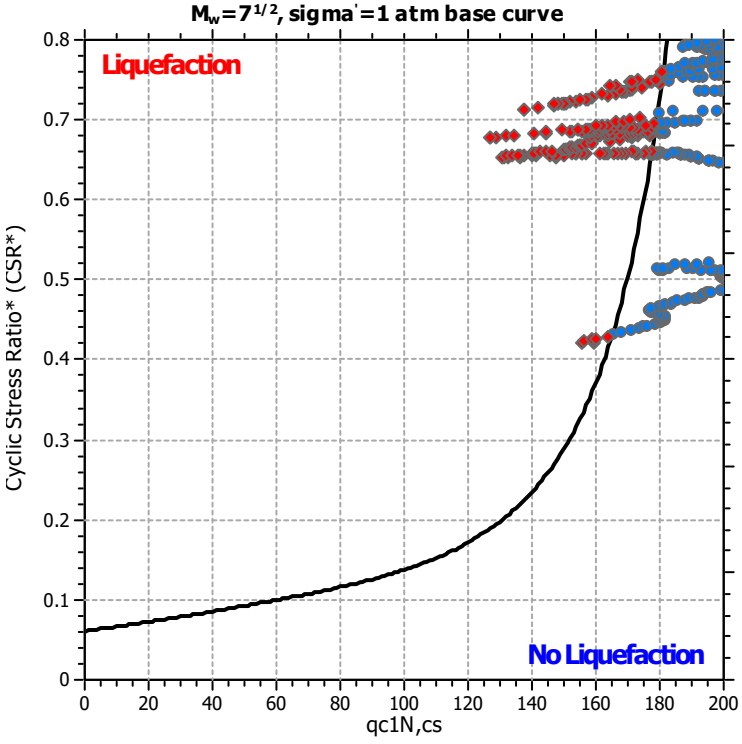
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

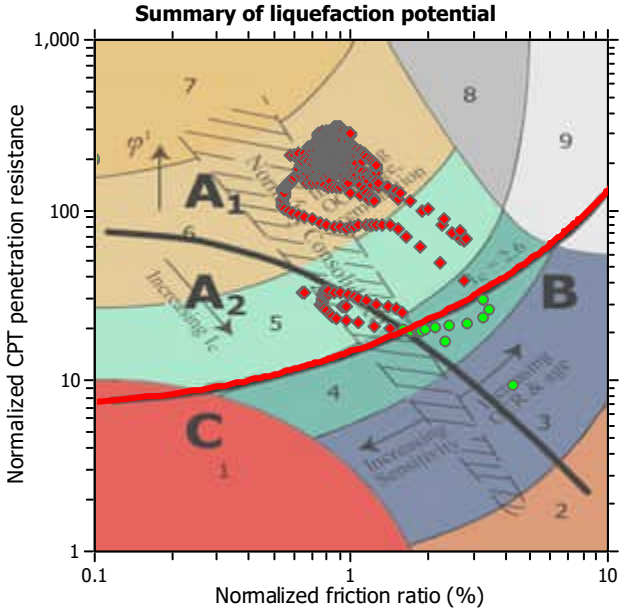
CPT file : CPT108

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	0.30 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

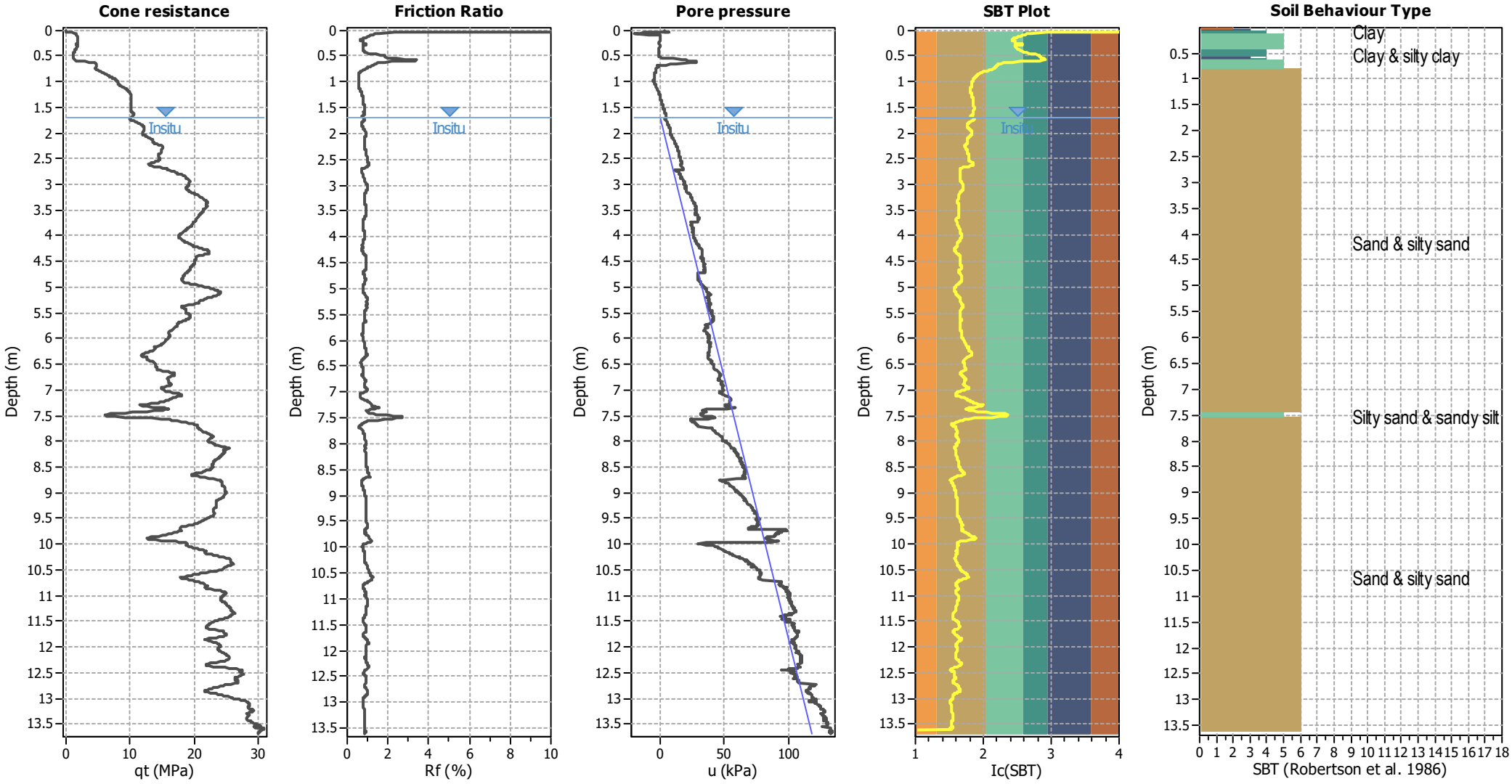






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



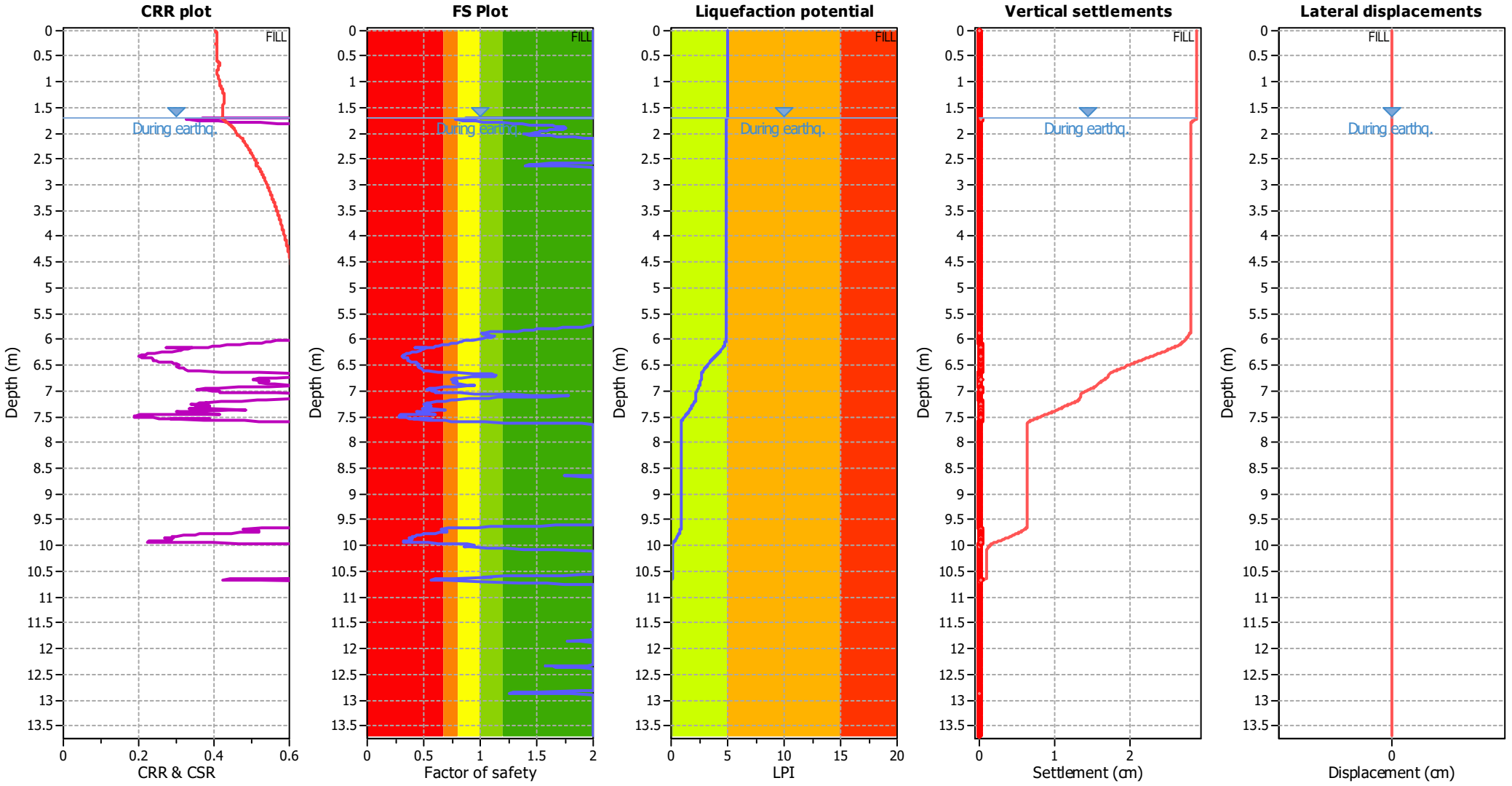
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	0.30 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	0.30 m	Limit depth:	N/A

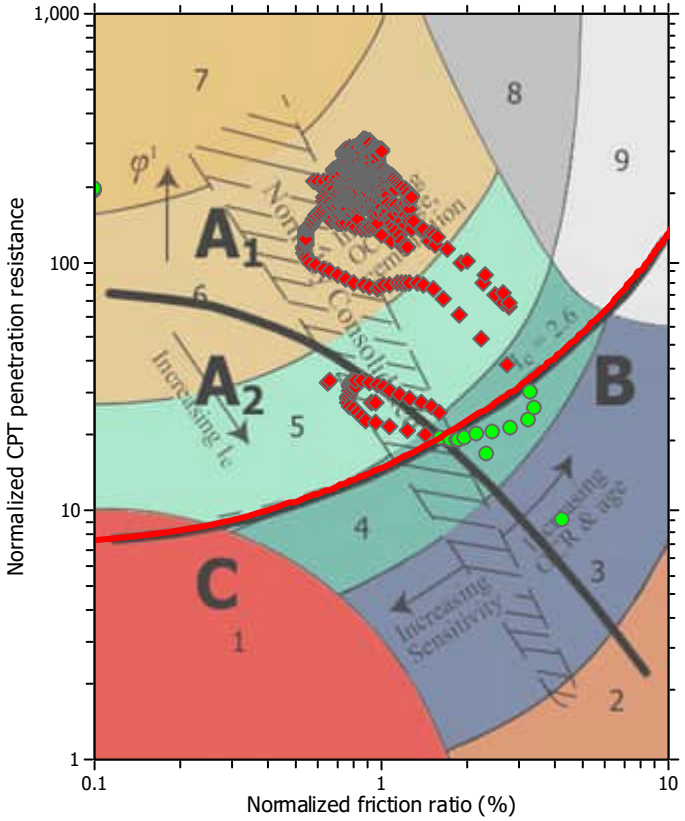
F.S. color scheme

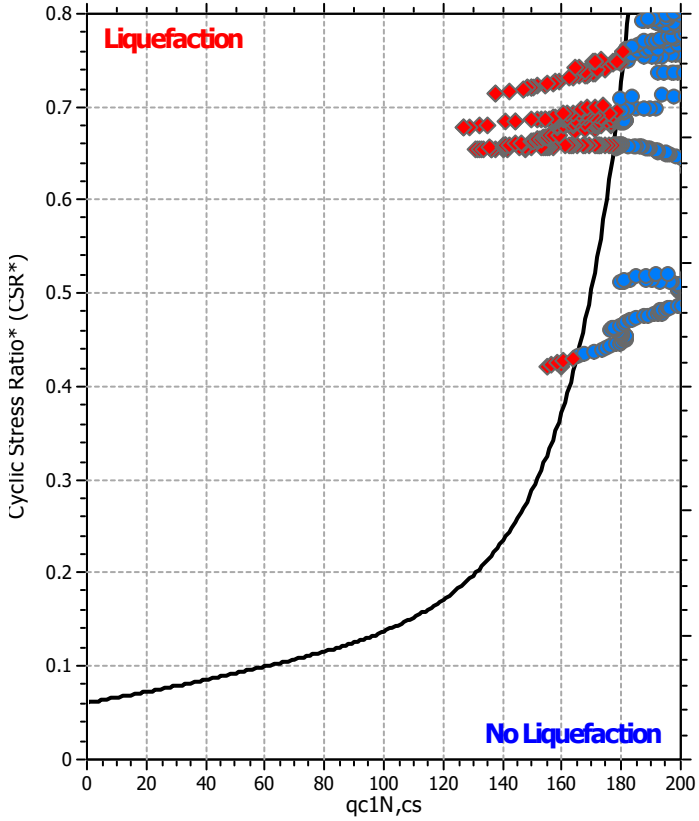
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

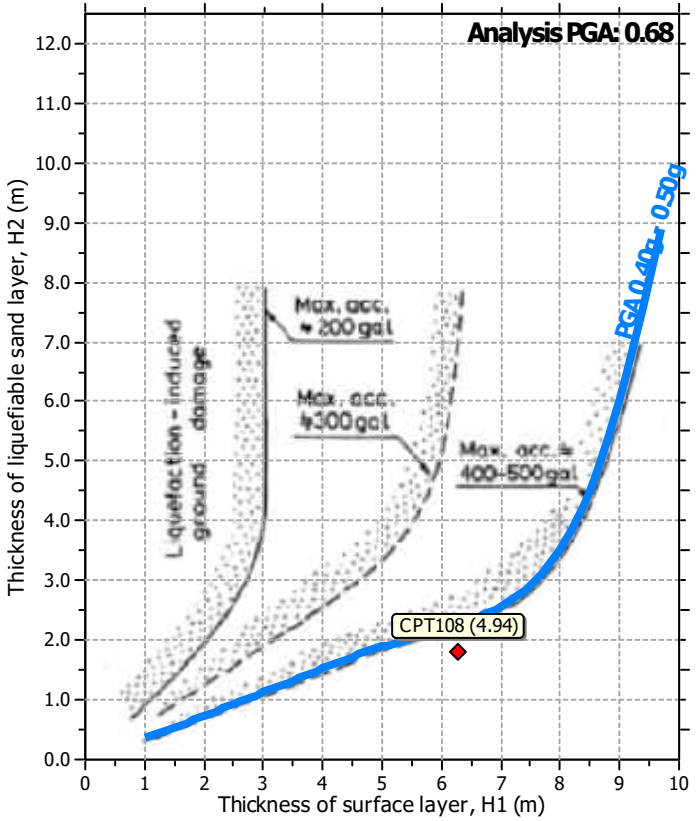
LPI color scheme

- 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.):	2.00 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	0.30 m	Limit depth:	N/A

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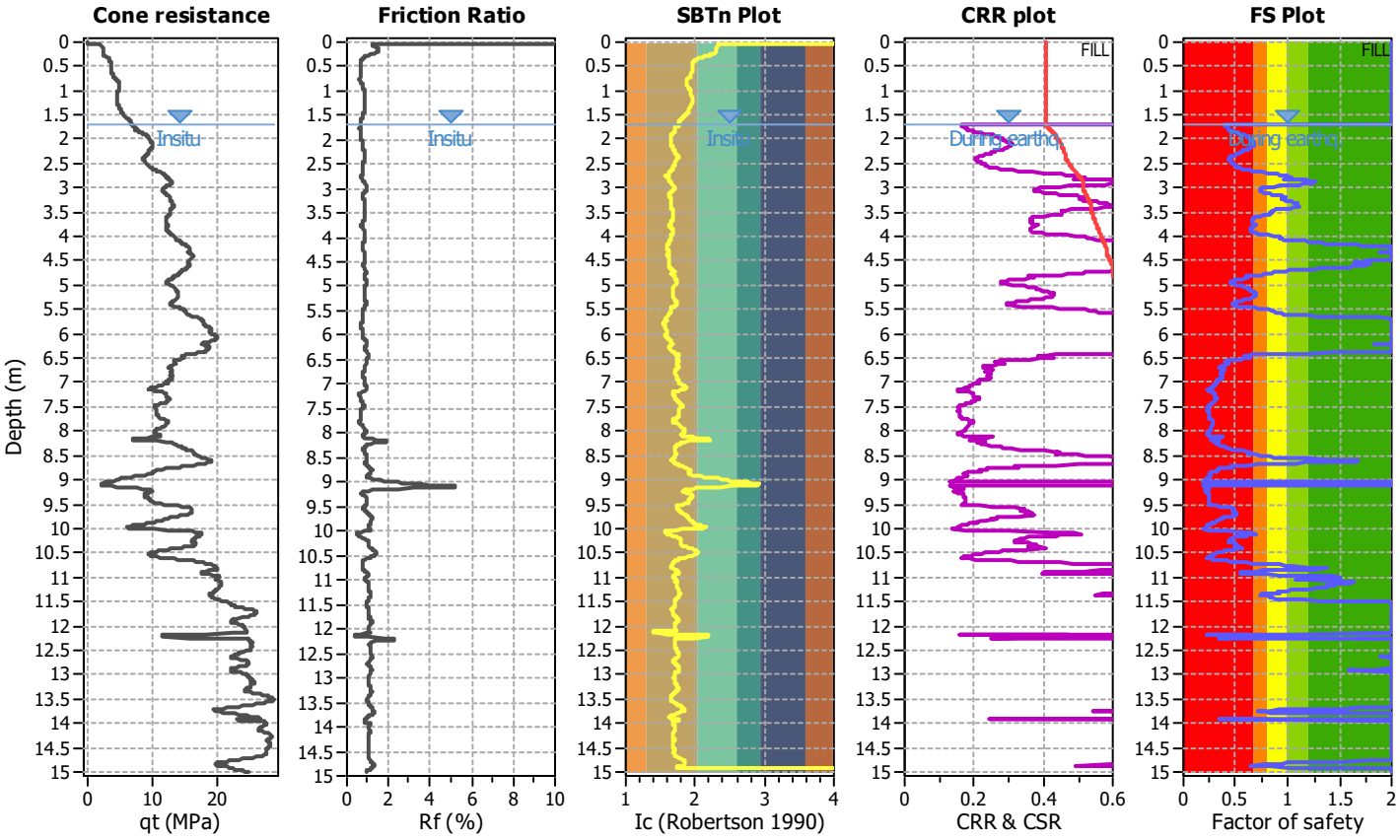
LIQUEFACTION ANALYSIS REPORT

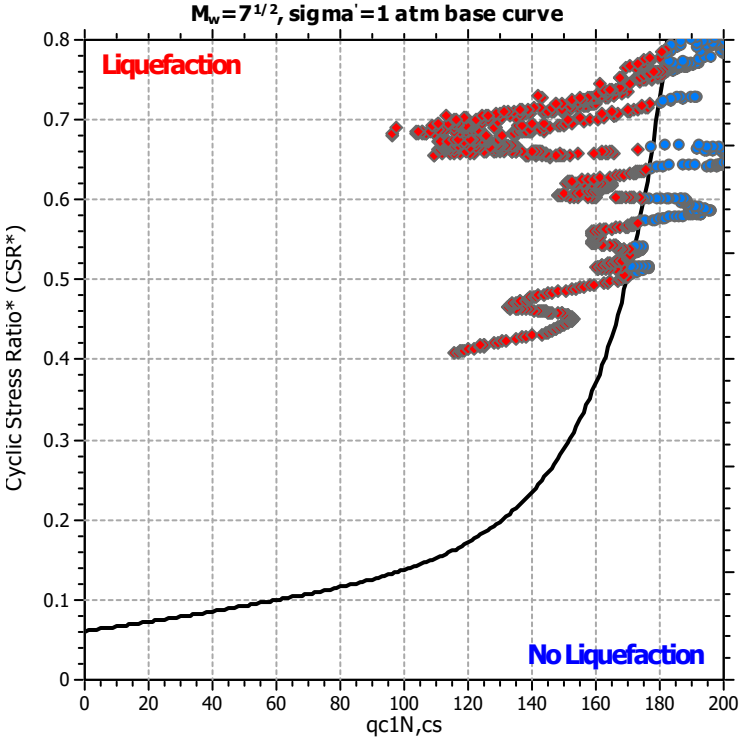
Project title : Summetset Otaihanga, Paraparaumu **Location : 65 & 73 Ratanui Road**

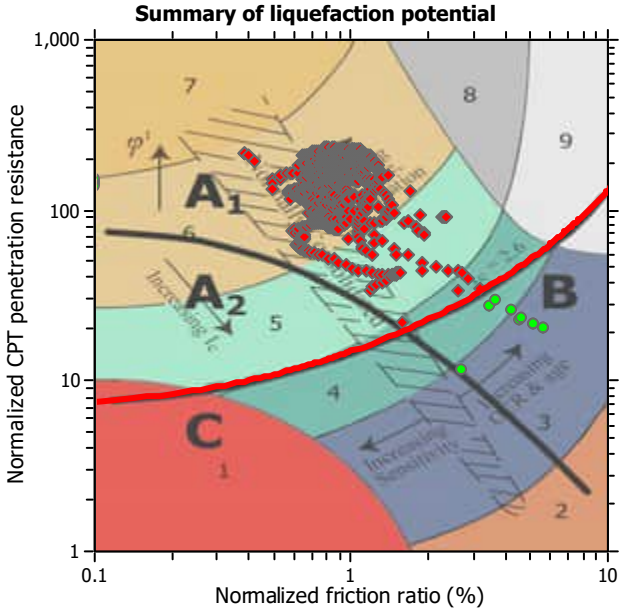
CPT file : CPT109

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.40 m	Fill height:	0.70 m	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	18.00 kN/m³	Limit depth:	N/A
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

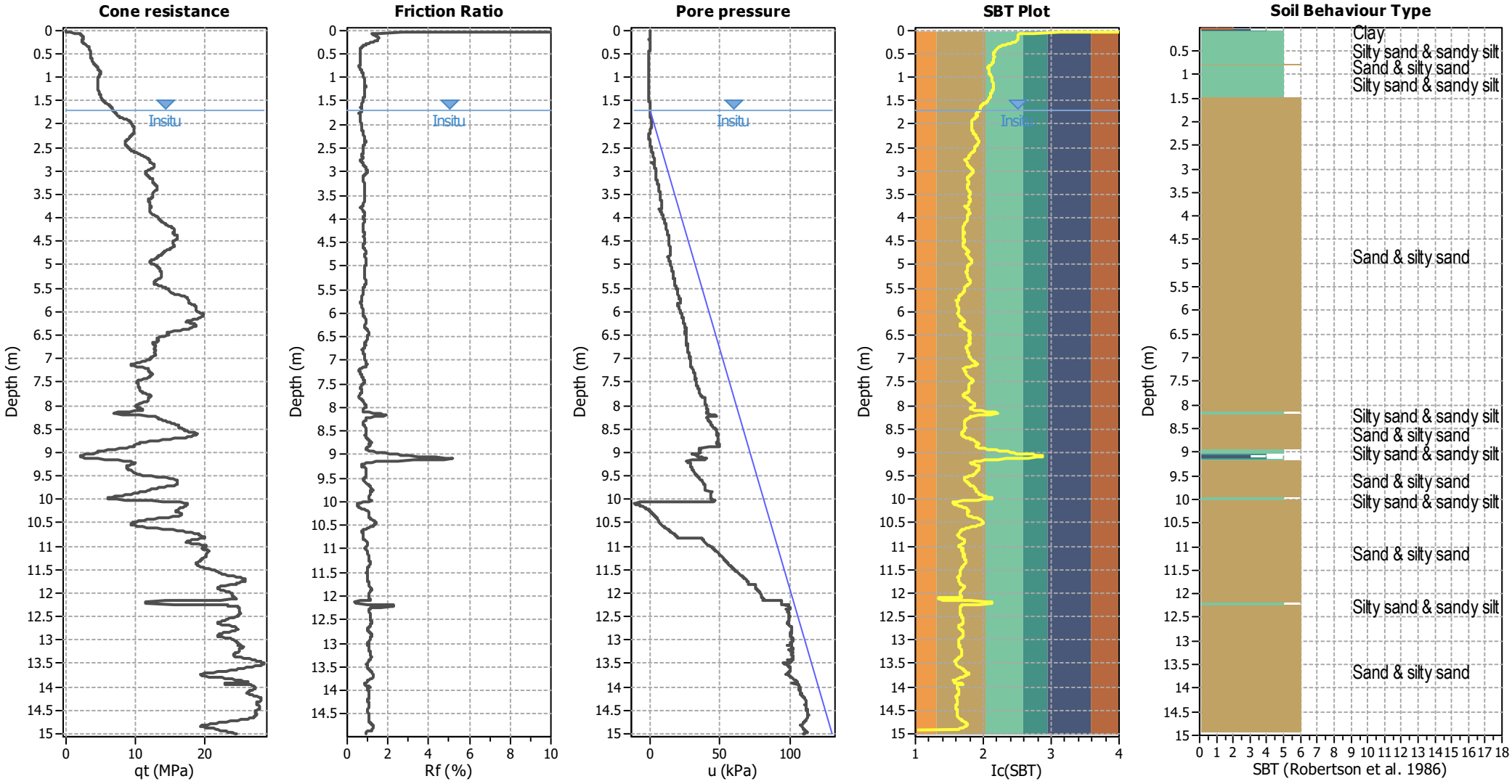






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



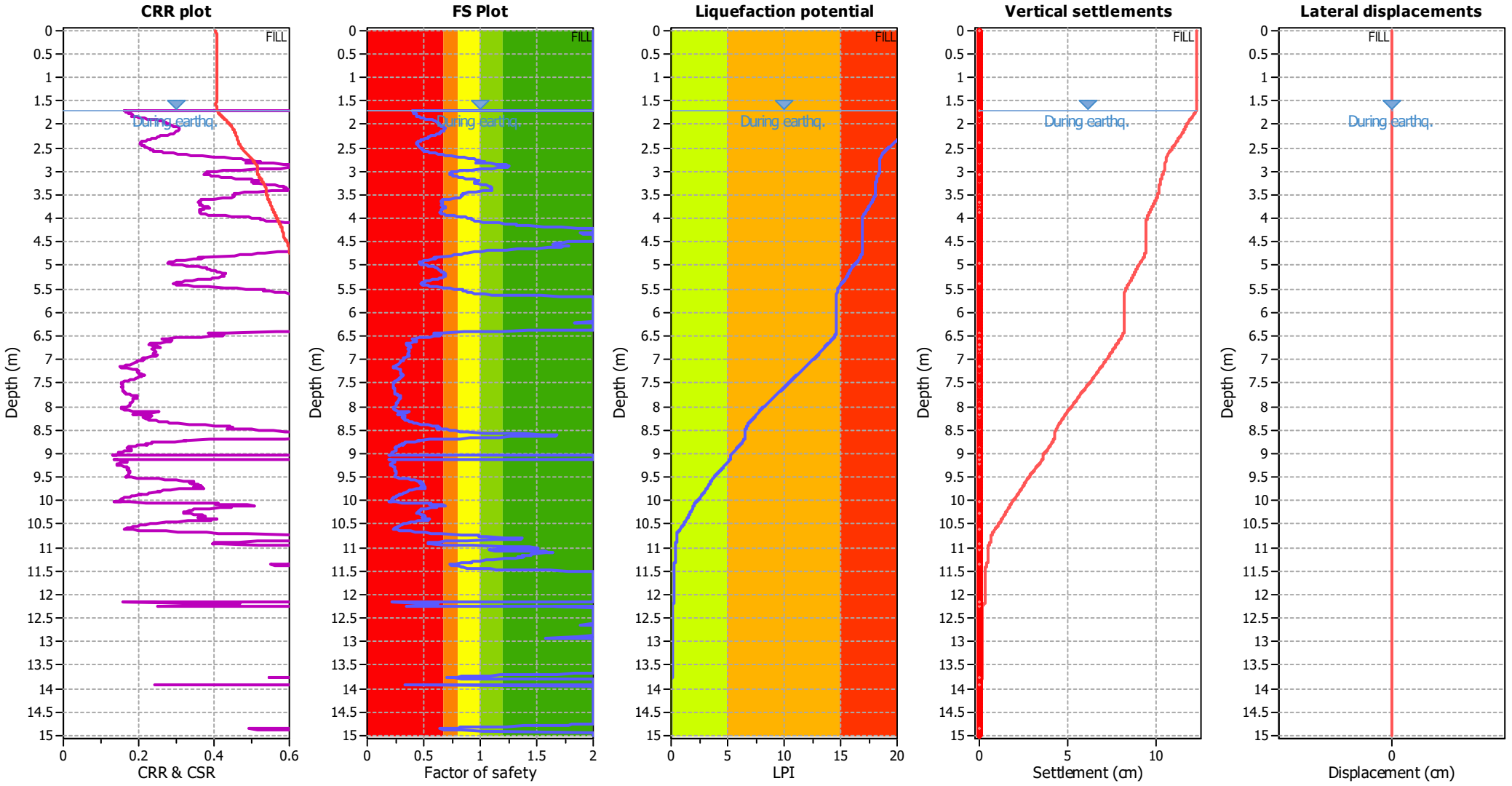
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.40 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	0.70 m	Limit depth:	N/A

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.40 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	0.70 m	Limit depth:	N/A

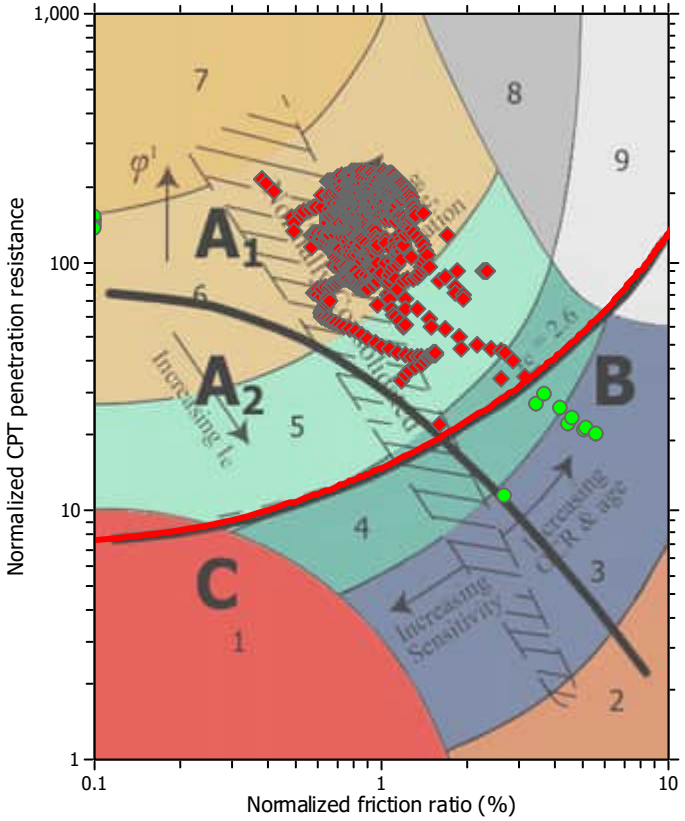
F.S. color scheme

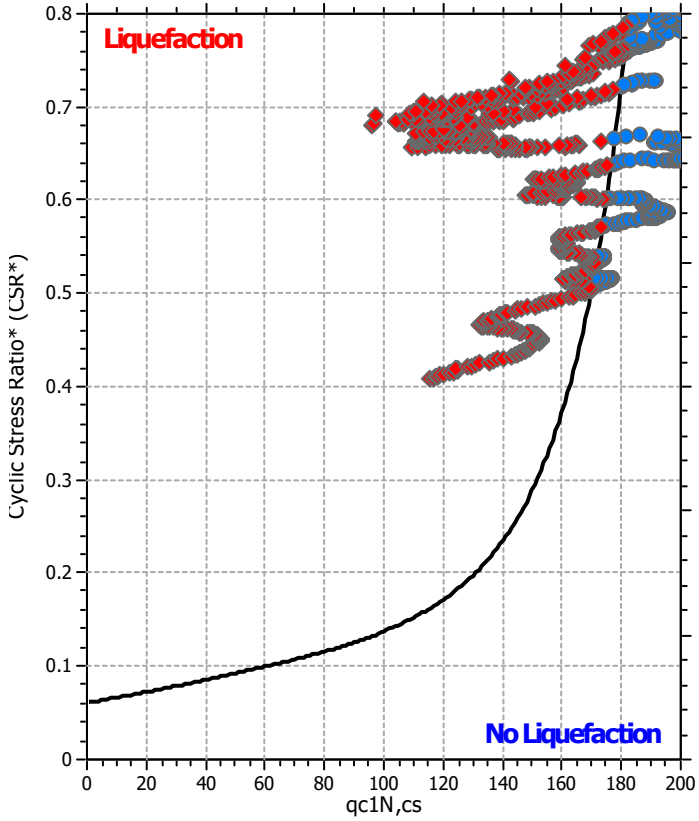
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

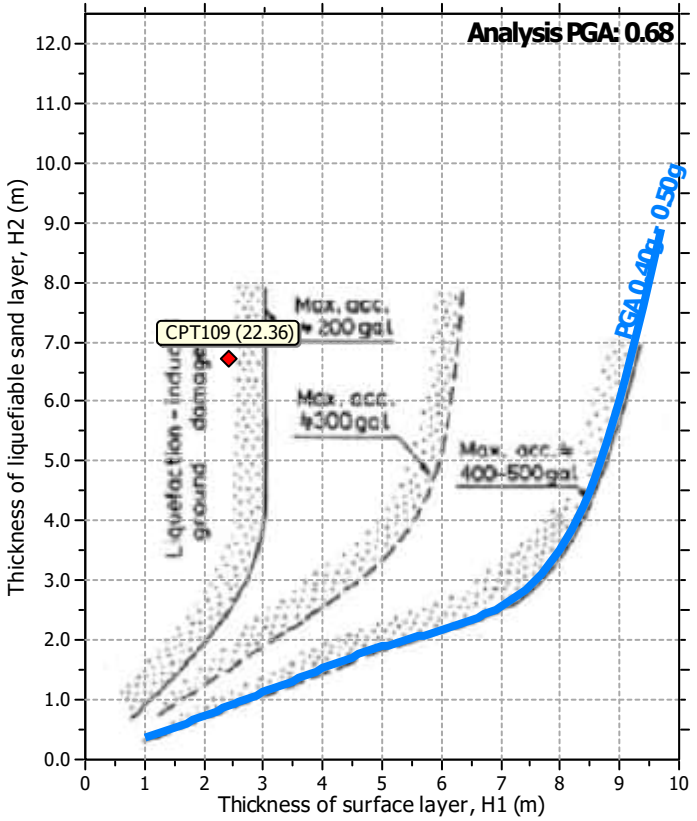
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots







Input parameters and analysis data

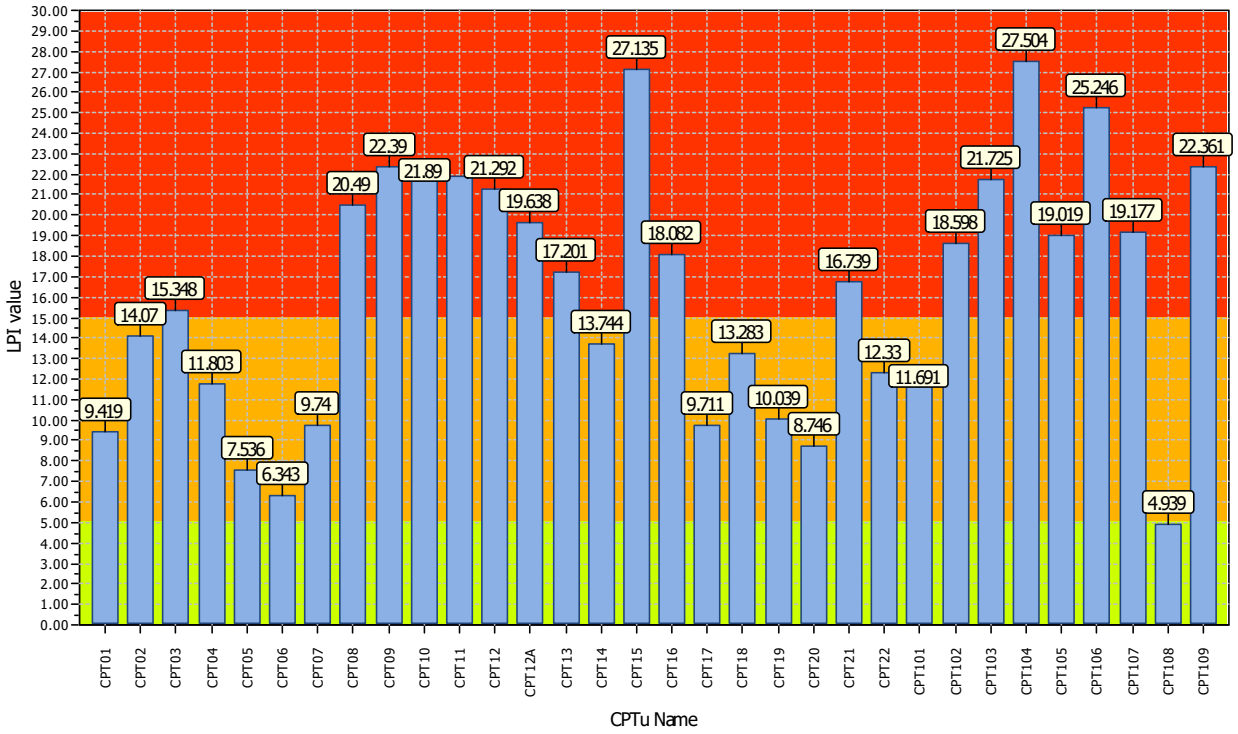
Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.40 m	Fill weight:	18.00 kN/m³
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	1.70 m	Fill height:	0.70 m	Limit depth:	N/A

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Project title : Summetset Otaihanga, Paraparaumu

Location : 65 & 73 Ratanui Road

Overall Liquefaction Potential Index report



LPI color scheme

- Very high risk
- High risk
- Low risk

Basic statistics

Total CPT number: 32

3% low risk

41% high risk

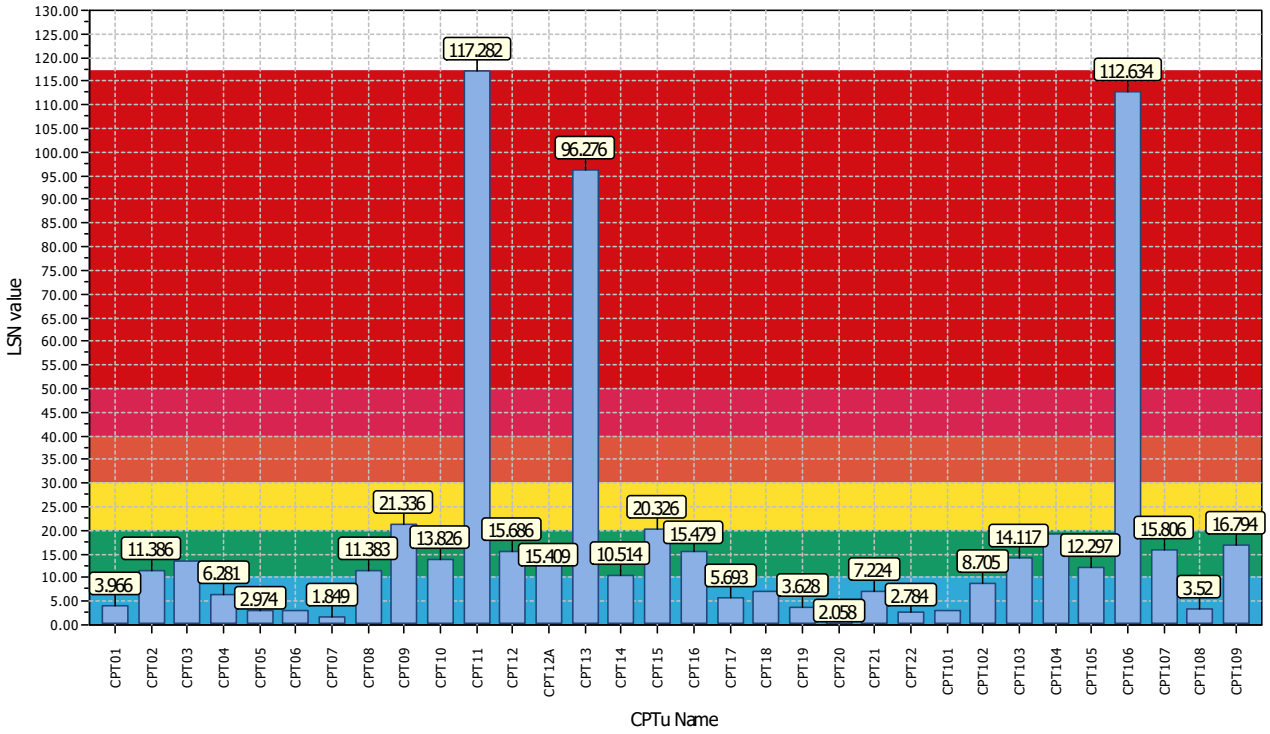
56% very high risk

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3116

Project title : Summetset Otaihanga, Paraparaumu

Location : 65 & 73 Ratanui Road

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: 32

44% little liquefaction

41% minor liquefaction

6% moderate liquefaction

0% moderate to major liquefaction

0% major liquefaction

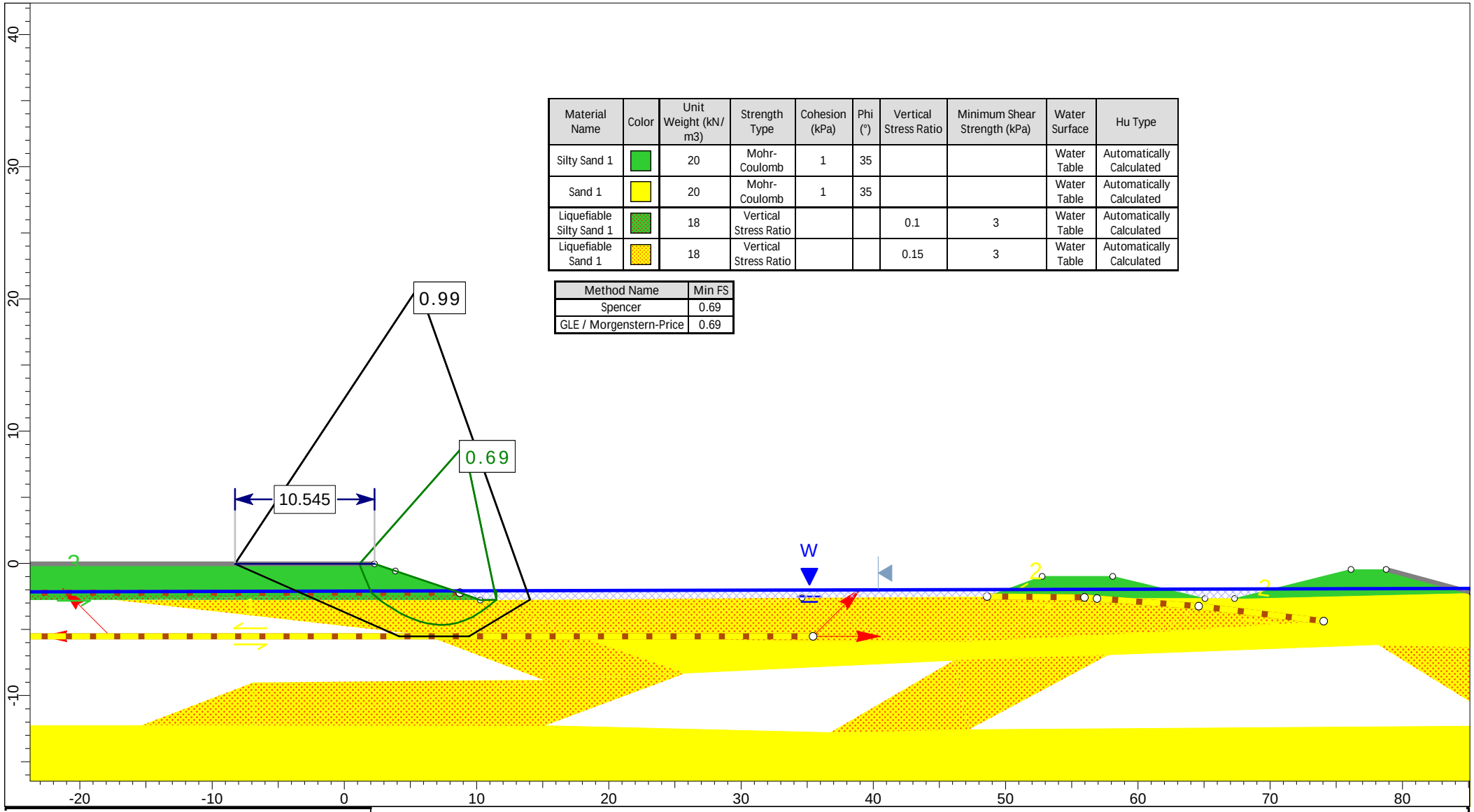
9% severe liquefaction

Appendix 5:

Lateral Spread Analysis

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Vertical Stress Ratio	Minimum Shear Strength (kPa)	Water Surface	Hu Type
Silty Sand 1		20	Mohr-Coulomb	1	35			Water Table	Automatically Calculated
Sand 1		20	Mohr-Coulomb	1	35			Water Table	Automatically Calculated
Liquefiable Silty Sand 1		18	Vertical Stress Ratio			0.1	3	Water Table	Automatically Calculated
Liquefiable Sand 1		18	Vertical Stress Ratio			0.15	3	Water Table	Automatically Calculated

Method Name	Min FS
Spencer	0.69
GLE / Morgenstern-Price	0.69



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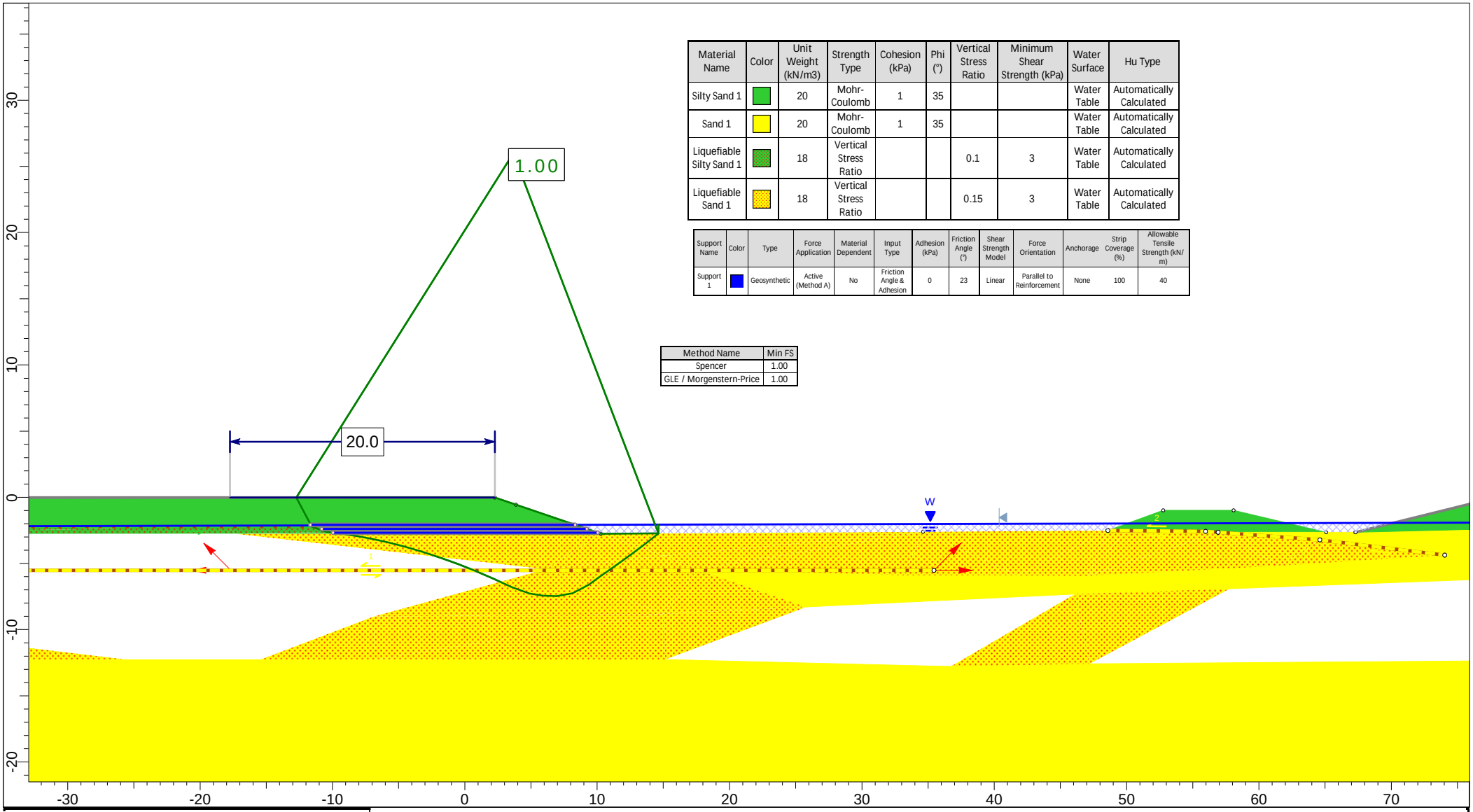
SLIDEINTERPRET 9.044

Project	Summerset Otaihanga		
Group	Northern Pond	Scenario	Liquefied
Drawn By	JL	Company	ENGEO
Date	28/08/2026, 4:46:22 pm	File Name	Lateral Spreading - Stormwater Ponds.slmd

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Vertical Stress Ratio	Minimum Shear Strength (kPa)	Water Surface	Hu Type
Silty Sand 1		20	Mohr-Coulomb	1	35			Water Table	Automatically Calculated
Sand 1		20	Mohr-Coulomb	1	35			Water Table	Automatically Calculated
Liquefiable Silty Sand 1		18	Vertical Stress Ratio			0.1	3	Water Table	Automatically Calculated
Liquefiable Sand 1		18	Vertical Stress Ratio			0.15	3	Water Table	Automatically Calculated

Support Name	Color	Type	Force Application	Material Dependent	Input Type	Adhesion (kPa)	Friction Angle (°)	Shear Strength Model	Force Orientation	Anchorage	Strip Coverage (%)	Allowable Tensile Strength (kN/m)
Support 1		Geosynthetic	Active (Method A)	No	Friction Angle & Adhesion	0	23	Linear	Parallel to Reinforcement	None	100	40

Method Name	Min FS
Spencer	1.00
GLE / Morgenstern-Price	1.00



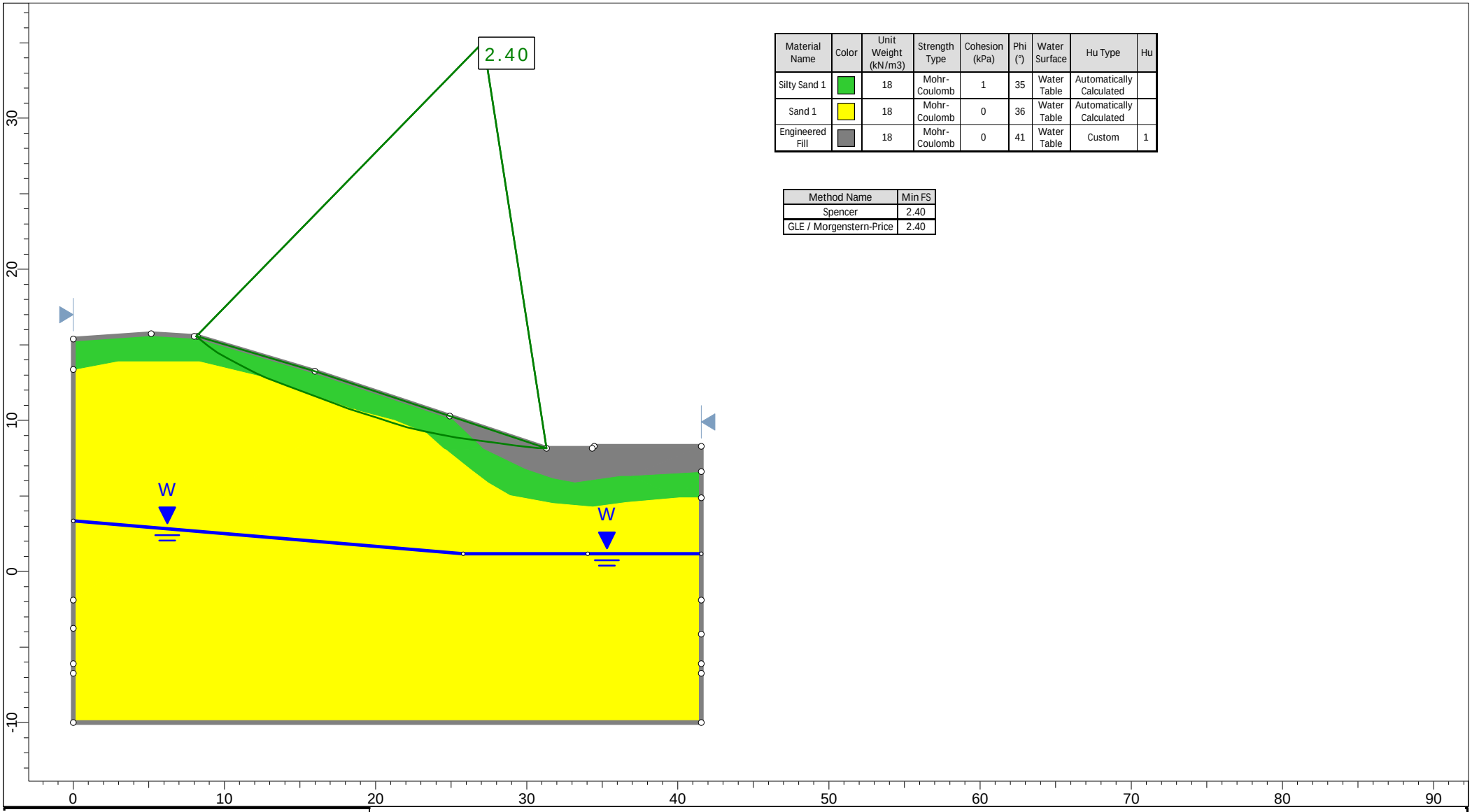
ENGEO

SLIDEINTERPRET 9.044

Project	Summerset Otaihanga		
Group	Northern Pond	*Scenario*	Geogrid Reinforcement
Drawn By	JL	*Company*	ENGEO
Date	28/08/2026, 4:46:22 pm	*File Name*	Lateral Spreading - Big Stormwater Ponds.slmd

Appendix 6:

Slope Stability Analysis



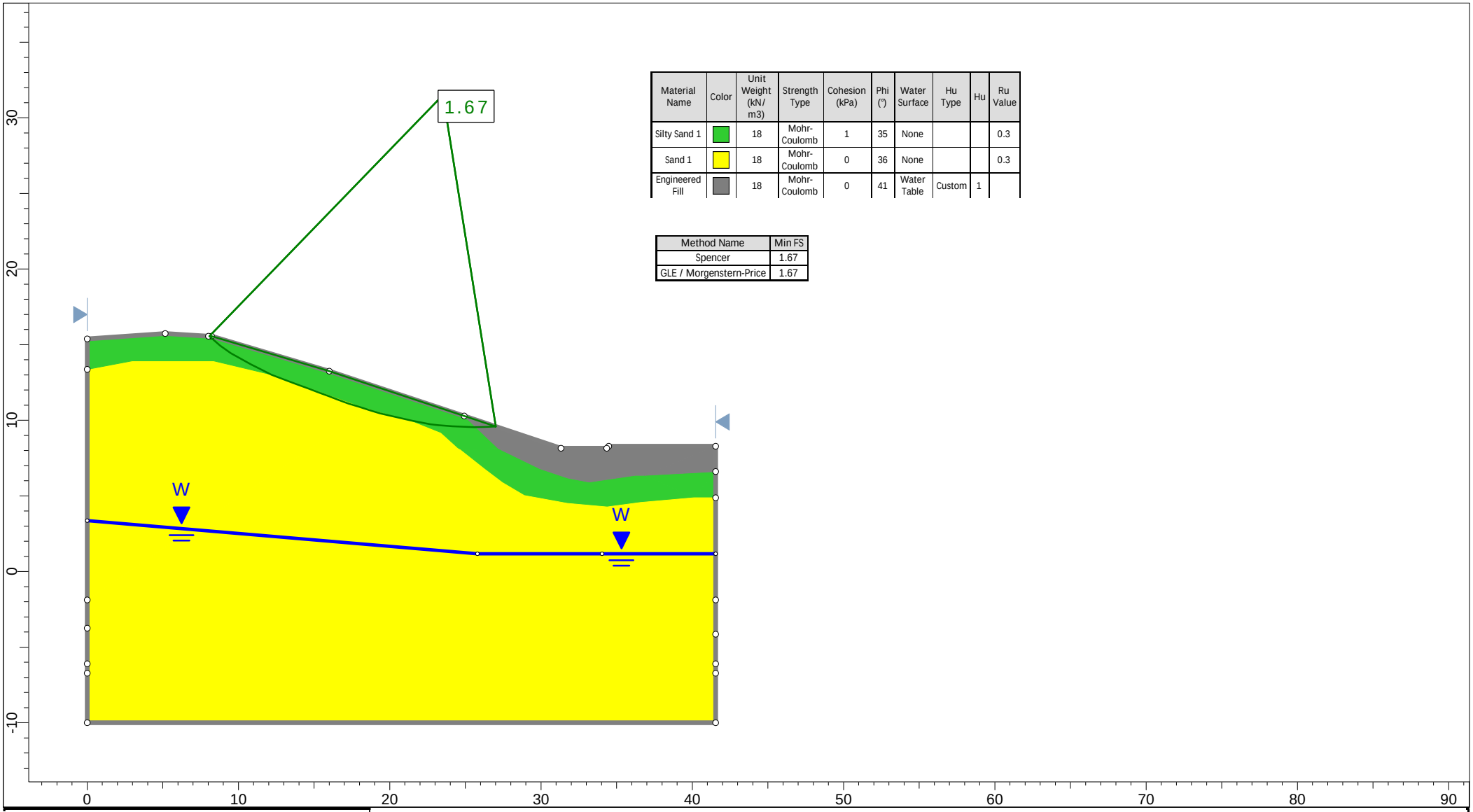
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu
Silty Sand 1		18	Mohr-Coulomb	1	35	Water Table	Automatically Calculated	
Sand 1		18	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Engineered Fill		18	Mohr-Coulomb	0	41	Water Table	Custom	1

Method Name	Min FS
Spencer	2.40
GLE / Morgenstern-Price	2.40

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SLIDEINTERPRET 9.044

Project	Summerset Otaihanga		
Group	Group 3	*Scenario*	Static
Drawn By	JL	*Company*	ENGEO
Date	28/08/2026, 4:46:22 pm	*File Name*	Boundary Stability - Section 2.slmd



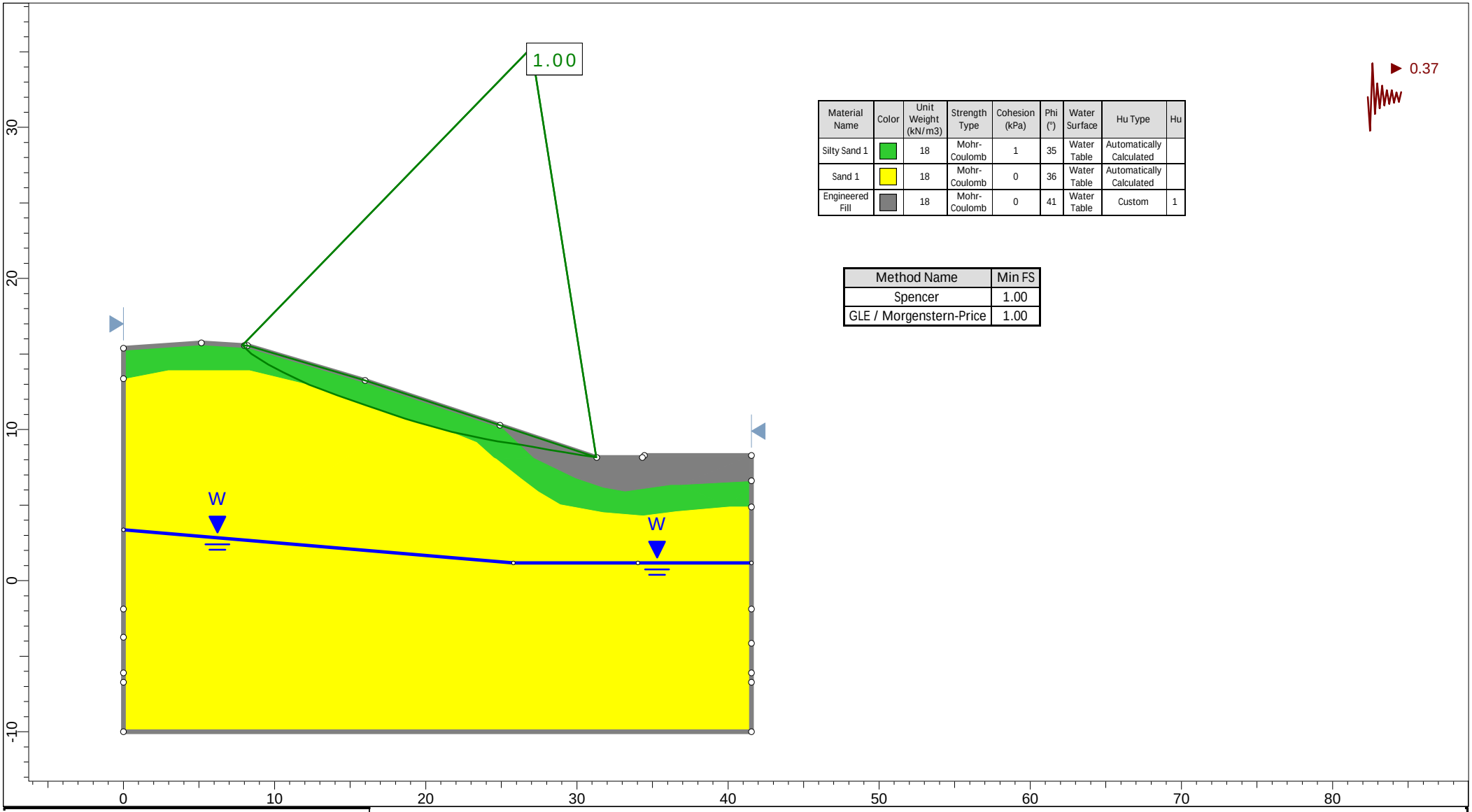
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu	Ru Value
Silty Sand 1		18	Mohr-Coulomb	1	35	None			0.3
Sand 1		18	Mohr-Coulomb	0	36	None			0.3
Engineered Fill		18	Mohr-Coulomb	0	41	Water Table	Custom	1	

Method Name	Min FS
Spencer	1.67
GLE / Morgenstern-Price	1.67

ENGEO

SLIDEINTERPRET 9.044

Project	Summerset Otaihanga		
Group	Group 3	*Scenario*	Extreme Rainfall
Drawn By	JL	*Company*	ENGEO
Date	28/08/2026, 4:46:22 pm	*File Name*	Boundary Stability - Section 2.slmd



0.37

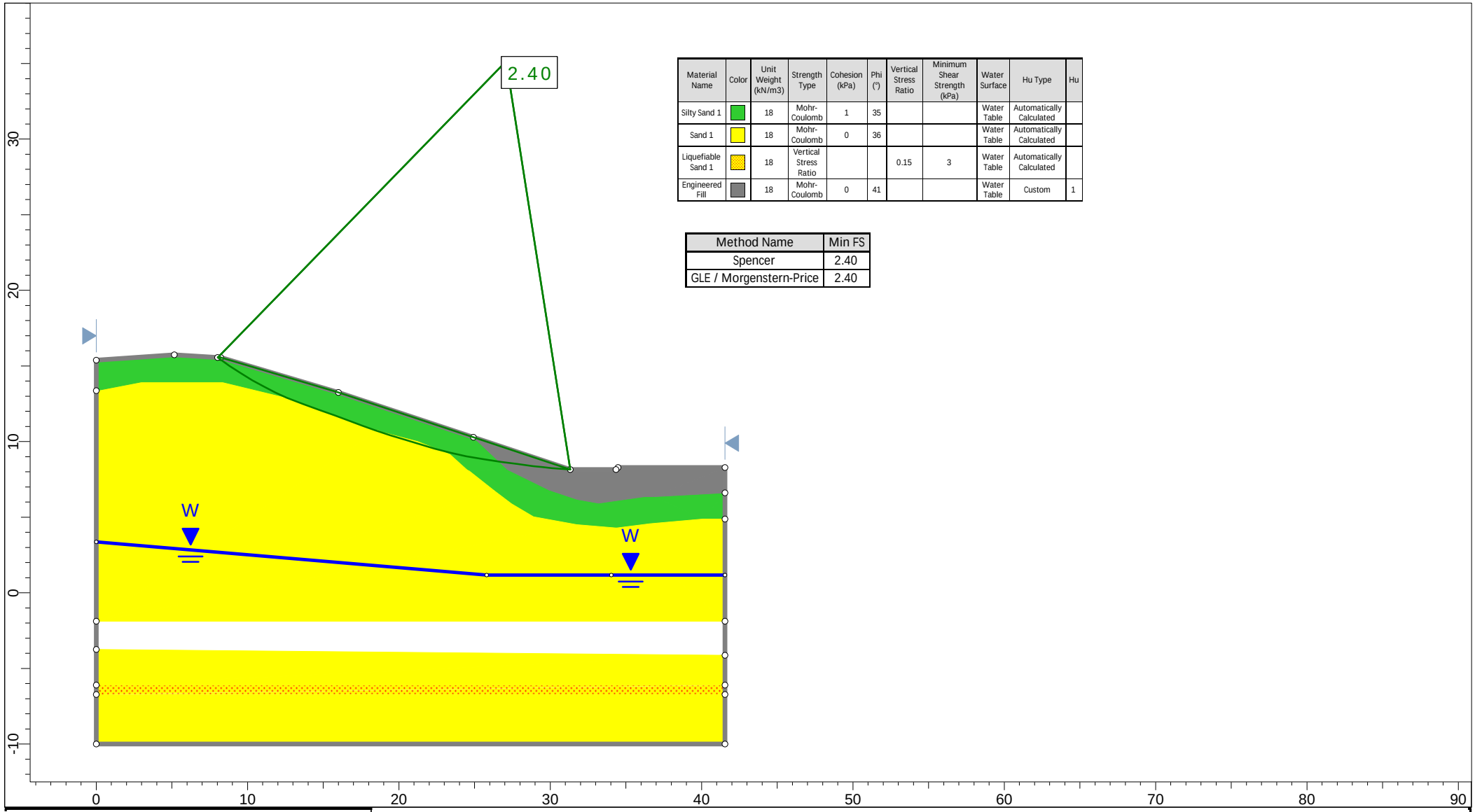
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu
Silty Sand 1		18	Mohr-Coulomb	1	35	Water Table	Automatically Calculated	
Sand 1		18	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Engineered Fill		18	Mohr-Coulomb	0	41	Water Table	Custom	1

Method Name	Min FS
Spencer	1.00
GLE / Morgenstern-Price	1.00

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SLIDEINTERPRET 9.044

Project	Summerset Otaihanga		
Group	Group 3	*Scenario*	Yield
Drawn By	JL	*Company*	ENGEO
Date	28/08/2026, 4:46:22 pm	*File Name*	Boundary Stability - Section 2.slmd



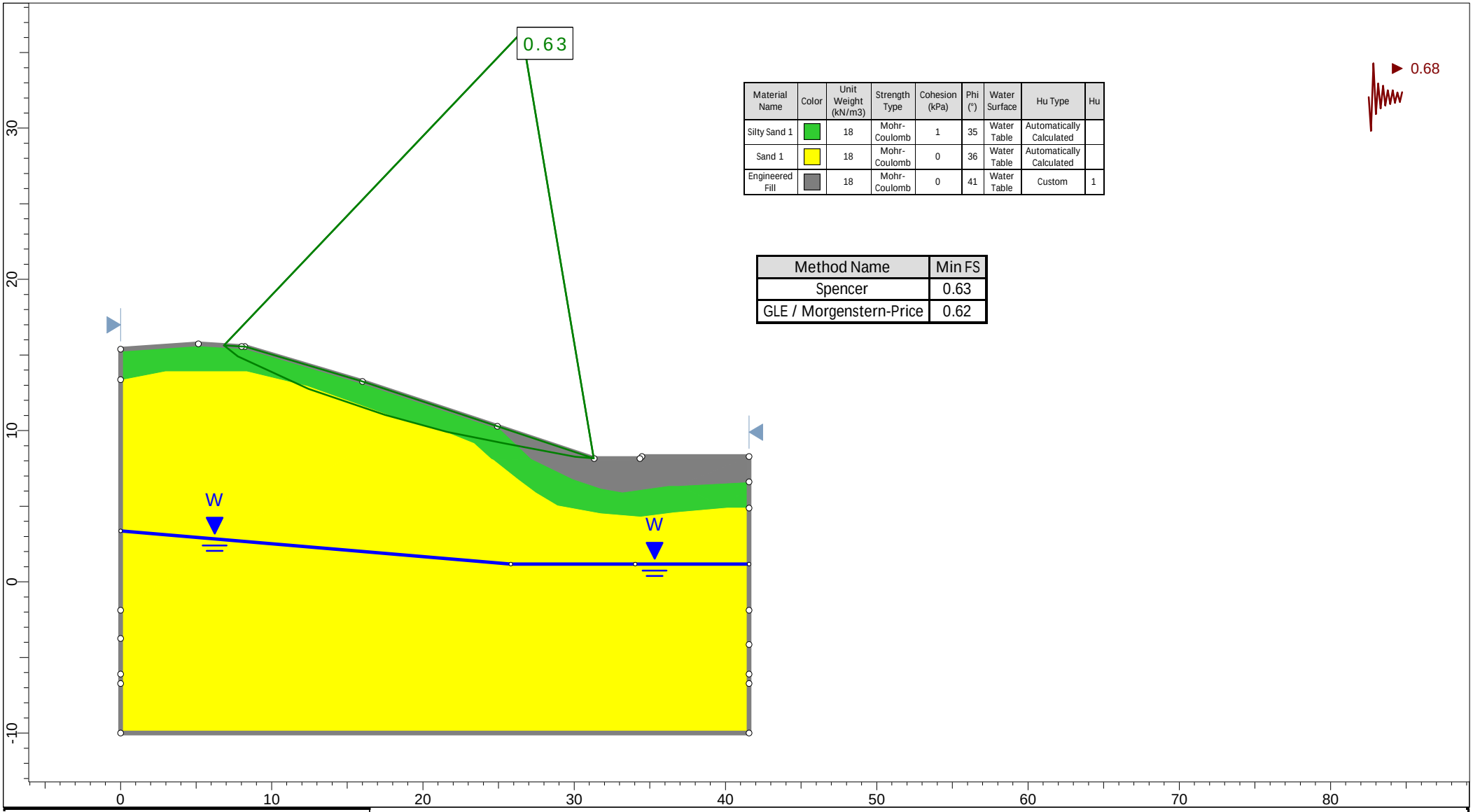
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Vertical Stress Ratio	Minimum Shear Strength (kPa)	Water Surface	Hu Type	Hu
Silty Sand 1		18	Mohr-Coulomb	1	35			Water Table	Automatically Calculated	
Sand 1		18	Mohr-Coulomb	0	36			Water Table	Automatically Calculated	
Liquefiable Sand 1		18	Vertical Stress Ratio			0.15	3	Water Table	Automatically Calculated	
Engineered Fill		18	Mohr-Coulomb	0	41			Water Table	Custom	1

Method Name	Min FS
Spencer	2.40
GLE / Morgenstern-Price	2.40

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SLIDEINTERPRET 9.044

Project	Summerset Otaihanga		
Group	Group 3	*Scenario*	Liquefied
Drawn By	JL	*Company*	ENGEO
Date	28/08/2026, 4:46:22 pm	*File Name*	Boundary Stability - Section 2.slmd



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu
Silty Sand 1		18	Mohr-Coulomb	1	35	Water Table	Automatically Calculated	
Sand 1		18	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Engineered Fill		18	Mohr-Coulomb	0	41	Water Table	Custom	1

Method Name	Min FS
Spencer	0.63
GLE / Morgenstern-Price	0.62

ENGEO

SLIDEINTERPRET 9.044

Project	Summerset Otaihanga		
Group	Group 3	*Scenario*	ULS Seismic
Drawn By	JL	*Company*	ENGEO
Date	28/08/2026, 4:46:22 pm	*File Name*	Boundary Stability - Section 2.slmd

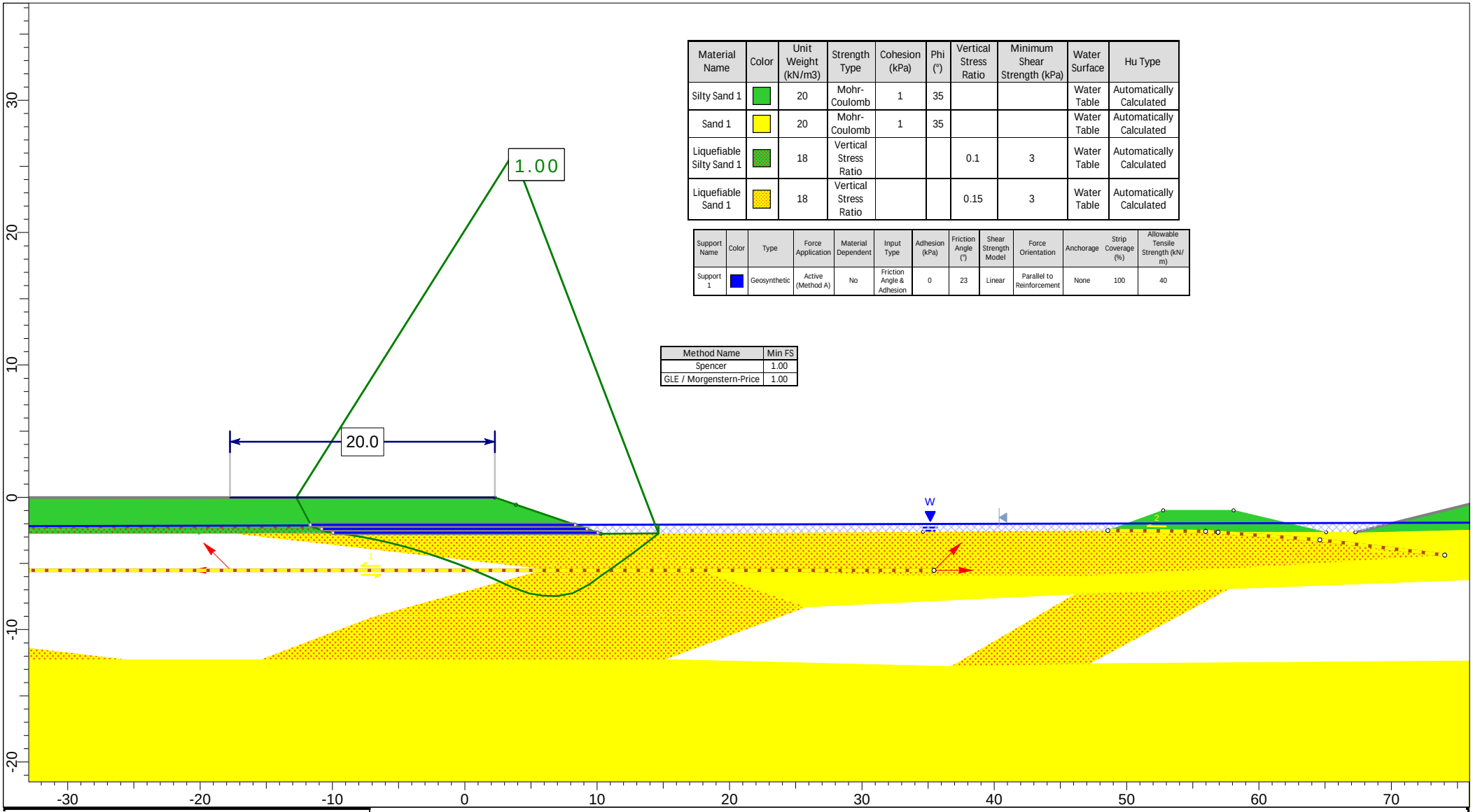
Appendix 7:

Edge Stability Remediation

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Vertical Stress Ratio	Minimum Shear Strength (kPa)	Water Surface	Hu Type
Silty Sand 1		20	Mohr-Coulomb	1	35			Water Table	Automatically Calculated
Sand 1		20	Mohr-Coulomb	1	35			Water Table	Automatically Calculated
Liquefiable Silty Sand 1		18	Vertical Stress Ratio			0.1	3	Water Table	Automatically Calculated
Liquefiable Sand 1		18	Vertical Stress Ratio			0.15	3	Water Table	Automatically Calculated

Support Name	Color	Type	Force Application	Material Dependent	Input Type	Adhesion (kPa)	Friction Angle (°)	Shear Strength Model	Force Orientation	Anchorage	Strip Coverage (%)	Allowable Tensile Strength (kN/m)
Support 1		Geosynthetic	Active (Method A)	No	Friction Angle & Adhesion	0	23	Linear	Parallel to Reinforcement	None	100	40

Method Name	Min FS
Spencer	1.00
GLE / Morgenstern-Price	1.00



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Project	Summerset Otaihanga		
Group	Northern Pond	*Scenario*	Geogrid Reinforcement
Drawn By	JL	*Company*	ENGEO
Date	28/08/2026, 4:46:22 pm	*File Name*	Lateral Spreading - Big Stormwater Ponds.slmd

Appendix 8:

Geotechnical Remediation Zonation Plan

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Legend

- Technical Category 2 Foundations
- Technical Category 2/3 Hybrid with Edge Stability Remediation
- Specific Foundation Design
- - - 1m Slope Building Restriction Line

Rev	Date	Description	Drwn	Chkd
1	9/30/26	Draft	JL	GS

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Title: Geotechnical Remediation Zoning Plan

Client: Summersrt Group Holding

Project: Summerset Otaihanga, Paraparaumu

Designed: JL
Drawn: JL
Checked: GMS
Date: 9/30/26
Scale: NTS

Proj No:

Figure No: A8
Size: A3
Rev:

ORIGINAL FIGURE PRINTED IN COLOUR