

**REPORT ON:
ARATAKI ROAD SUBDIVISION STAGE 1A AND 1B**

**PROJECT:
GEOTECHNICAL INVESTIGATION**

**CLIENT:
GREENSTONE LAND DEVELOPMENTS LTD**

R-184250602-02



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1 OVERVIEW

Greenstone Land Developments Ltd engaged Resource Development Consultants Ltd. (RDCL) to carry out a geotechnical investigation for Stage 1A and 1B of a proposed subdivision of 139 Arataki Road, Havelock North (Legal Description: SEC 7 BLK IV TE MATA SD).

1.1 PURPOSE OF THIS REPORT

The purpose of this report is to provide sufficient information to support subdivision and building consent at individual Lot level.

1.2 UNDERSTANDING OF THE PROJECT

We understand the client intends to subdivide and develop the site into thirty-nine (39) new residential lots.

The proposed subdivision is divided into four stages:

- Stages 1A and 1B, 9 lots affront Arataki Road (this report); and
- Stages 2A and 2B, remaining 30 lots.

The site was originally a campground comprising cabins, campsites, and associated amenities. The proposed development will be subdivided into residential lots ranging in size from 400m² to 750m².

Minor earthworks will comprise removing ~1m material from the south-eastern part of the site for reuse elsewhere.

A geotechnical investigation and report have been requested for foundation design and to submit with resource and building consent applications.

1.3 SCOPE OF WORK

The project was undertaken in general accordance with RDCL proposal 18425, dated 17 August 2018.

2 SITE DESCRIPTION

Stage 1A and 1B of the development is located towards the northeast of the existing section at 139 Arataki Road, within a predominantly residential area.

The proposed subdivision was previously occupied by Arataki Motor Camp Holiday Park and consisted of holiday cabins, campsites, and amenities with landscaping and playground features.

The site is generally flat at an elevation of between 19 m to 22 m above sea level.

2.1 PUBLISHED GEOLOGY

The regional geological map indicates the site is underlain by Middle- to Late-Pleistocene river deposits, comprising moderately weathered undifferentiated, poorly sorted loess-covered alluvial gravel (GNS Science, 2011).

2.2 ACTIVE FAULTS

No active faults directly impacting the proposed development are identified in the GNS Active Faults Database.

2.3 LIQUEFACTION SUSCEPTIBILITY

The site is mapped as having “Medium” liquefaction vulnerability, as indicated in the Hawkes Bay Emergency Management Hazard Portal.

3 SUBSOIL INVESTIGATION

Site-specific testing completed for each of Lots 1-9 (Stages 1A and 1B) comprised (Figure 1):

- one (1) hand auger (HA) per lot with engineering geological logging of materials;
 - All tests meeting refusal on gravels at depths < 0.6 m bgl; and
- Four (4) Dynamic Cone penetrometer (DCP) tests per lot;
 - All tests meeting refusal at depths < 1.2 m bgl.

Additional sitewide testing was also undertaken to enable assessment of near-surface subsoils and liquefaction assessment across all four stages. These tests consisted of:

- Engineering geological logging of near-surface materials recovered from:
 - Five (5) test pits (TP) excavated to a maximum depth of 3.5 m bgl;
 - Three (3) observation pits (EXP), previously excavated by the contractor when removing septic tanks, to a maximum depth of 3.4 m bgl; and
- Eight (8) Cone Penetration Tests (CPT) distributed across the full development area;
 - All tests meeting refusal at depths < 2.0 m bgl due to maximum (35 MPa) cone resistance.

Results of subsurface investigations for individual lots 1-9 are attached as Appendix A; with CPT Logs attached as Appendix B.

Soils were logged in general accordance with NZGS Guidelines for Field Classification and Description of Soil and Rock for Engineering Purposes (NZGS, 2005).

3.1 SUBSURFACE CONDITIONS

Near-surface materials encountered in subsurface investigations (Appendix A) suggest the area is generally underlain by:

- TOPSOIL to between 0.1 to 0.3 m below ground level (bgl); underlain by
- Firm sandy SILT with trace gravel to between to 0.2 m to 0.6 m bgl;
 - Terminated on gravels at 0.6m
- Silty sandy GRAVELS, medium dense to at least 3.5m depth inferred from nearby test pits and observation pits.

The results of CPT investigations suggest the site is underlain by

- Soft Clay, Silt, and sandy Silt to approximately 0.5 m bgl; underlain by
- Medium dense to dense silty Sand with lenses of sand and silt up to 2 m bgl.

3.2 DCP INVESTIGATIONS

DCP test results suggest:

- soft/loose soils are locally present in the upper <0.8m bgl; with
- DCP blows generally greater than 5 per 100 mm from 0.4-0.5 m bgl.

Full DCP logs are presented in Appendix A.

3.3 CPT INVESTIGATIONS

All CPT's met refusal (>35 MPa cone resistance) at depths between 1.6-2.0 m bgl.

The results are generally consistent with DCP results, suggesting

- some variability in soil strength in the upper <0.7 m bgl; with
- Cone resistance generally exceeding 5 MPa from approximately 0.4-0.5 m bgl.

Full CPT Logs are attached as Appendix B.

3.4 GROUND WATER

Groundwater was encountered at 3.4 m bgl at the time of these investigations.

We expect groundwater levels are likely to change during the year based on seasonal and annual fluctuations.

For the purpose of our liquefaction assessment, groundwater is assumed at a level of 1.5 m bgl.

4 GEOTECHNICAL ASSESSMENT

4.1 SEISMIC SOIL CLASSIFICATION

The site is classified as site subsoil “Class D – Deep Soil Site” in accordance with NZS1170.5:2004, part 5: Earthquake Actions – New Zealand.

This classification is based on a review of the Hawke’s Bay Well Database which indicates interbedded gravel and clay to at least 34 m depth within the area.

4.2 LIQUEFACTION ASSESSMENT

A liquefaction assessment was carried out on the results of CPT, TP and DCP investigations (Appendix C & D). Our assessment suggests:

- The proposed subdivision area is at low risk of liquefaction.

4.2.1 TEST PIT BASED LIQUEFACTION ASSESSMENT

A liquefaction assessment was undertaken using the results of test pit and DCP investigations using PEYSANJ (Novo Tech Software Ltd, 2016).

The results of that assessment indicate, for both the Serviceability Limit State (SLS) and Ultimate Limit State (ULS) design events:

- Medium dense to dense silty sandy gravel layers below the assumed water table (1.5 m) are not expected to liquefy; and
- Lateral spreading and vertical settlement is considered unlikely due to generally flat topography.

4.2.2 CPT BASED LIQUEFACTION ASSESSMENT

Further liquefaction assessment was carried out for CPT results, using industry standard software CLiq (Geoligoismiki, 2014).

The result of that assessment (Appendix D) indicates:

- Low risk of liquefaction during ULS and SLS events.

4.2.2.1 BASIS OF ASSESSMENT

The liquefaction assessment for the site were undertaken using PEYSANJ, accepted industry software package (Novo Tech Software Ltd, 2016), DCP data of current ground conditions, soil logs from Test Pit investigations and the following input parameters:

- Magnitude (M) = 7.5 (SLS & ULS);
- Peak Ground Acceleration (PGA) = 0.11g (SLS) & 0.44g (ULS), based on:
 - Ch(T) = 1.12 (Class D Soil);
 - Z = 0.39 (Hastings);
 - R = 0.25 (SLS) & 1.0 (ULS);
 - N(T,D) = 1.0.
- Groundwater level assumed at 1.5 m bgl.

The design earthquake was chosen on the basis of the probability of recurrence. The probability is based on historical earthquakes. A 7.5 magnitude earthquake for an importance level category 2 correlates with a 25 year return period (SLS) and 500 year return period (ULS).

4.3 SHALLOW BEARING

Correlation of DCP results suggests:

- 300 kPa Ultimate Bearing Capacity is available between 0.5 m to 0.8 m depth.

Indicative depths for shallow bearing are presented below in Table 1, section 5.2.

5 GEOTECHNICAL CONSIDERATIONS

Recommendations and opinions contained in this report are based on data from site investigations as outlined in Section 3 and geotechnical assessment outlined in Section 4. The nature and continuity of subsoils away from these locations are inferred and actual conditions may vary from the assumed model.

5.1 SUSCEPTIBILITY TO LIQUEFACTION-INDUCED GROUND DAMAGE

Based on liquefaction assessments completed, we consider

- The subdivision area is at low risk of liquefaction-induced ground damage.

5.2 FOUNDATION RECOMMENDATIONS

Based on site-specific investigations, we consider:

- The upper soft to loose silts should be removed to the depths specified below to achieve 300 kPa Ultimate bearing capacity in accordance with NZS3604:2011.

Indicative depths to 300 kPa are presented in Table 1.

TABLE 1: SUMMARY OF SHALLOW ULTIMATE BEARING CAPACITY

Proposed Lot Number	Depth to 300 kPa (m bgl)
Lot 1	0.8
Lot 2	0.6
Lot 3	0.5
Lot 4	0.5
Lot 5	0.6
Lot 6	0.6
Lot 7	0.6
Lot 8	0.6
Lot 9	0.8

Organic loose and deleterious materials should be stripped from beneath all building footprints prior to construction.

6 REFERENCES

GNS Science. (2014). HAWKE'S BAY. *Institute of Geological and Nuclear Sciences, 1:250,000 Geological Map 8*. (J. Lee, K. Bland, D. Townsend, & P. Kamp, Compilers) GNS Science.

NZS3604 (2011). NZS3604:2011 Timber-framed Buildings. *Australia/New Zealand Standard*.

NZS4431 (1989) *NZS4431:1989* - Code of Practice for Earthfill for Residential Development. *Standards New Zealand*

NZGS (2005) Field Description of Soil and Rock NZS1170.5. (2004, December 22).

Geoligismiki. (2014). CLiq v.1.7.6.34.

PEYSANJ (Novo Tech Software Ltd, 2016)

7 LIMITATIONS

- This report has been prepared for the particular purpose outlined in the project scope and no responsibility is accepted for the use of any part in other contexts or for any other purpose.
- Ground conditions assessed in this report are inferred from published sources, site inspection and the investigation described. Variations from the interpreted conditions may occur, and special conditions relating to the site may not have been revealed by this investigation, and which are therefore not taken into account. No warranty is included either expressed or implied that the actual conditions will conform to the interpretation contained in this report.
- No responsibility is accepted by Resource Development Consultants Ltd for inaccuracies in data supplied by others. Where data has been supplied by others, it has been assumed that this information is correct.
- Groundwater conditions can vary with season or due to other events. Any comments on groundwater conditions are based on observation at the time.
- This report is provided for sole use by the client and Hastings District Council and is confidential to the client and their professional advisors. No responsibility whatsoever for the contents of this report shall be accepted by any person other than the client.

We trust this meets your current needs. Should you wish to discuss any aspect of the contents of this document please contact the undersigned on 06 877-1652.

Sincerely,

Prepared by:



B Bistouni

MSc

Senior Engineering Geologist

Approved by:

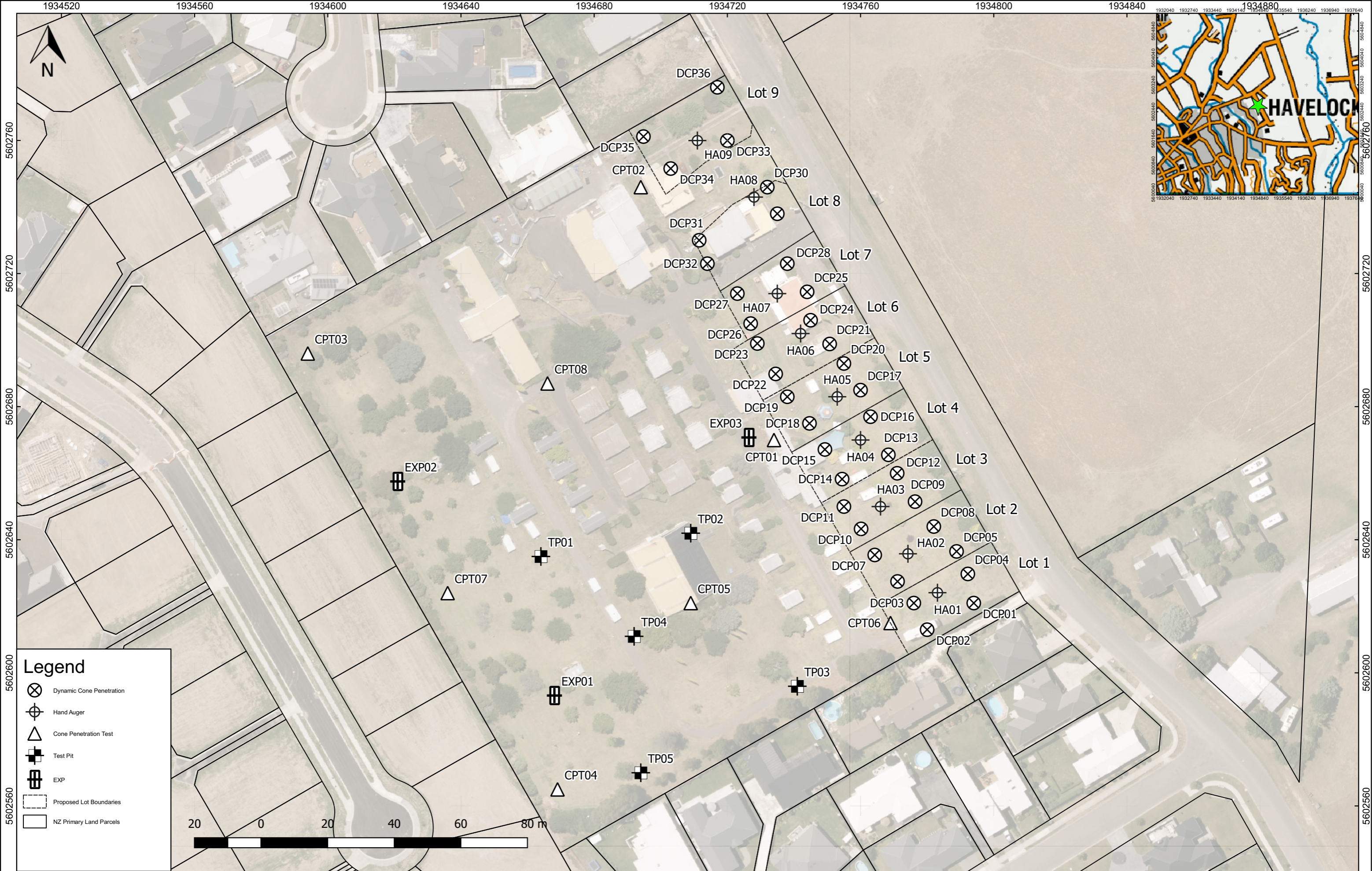


CA Wylie

MSc, MIPENZ; CPEng

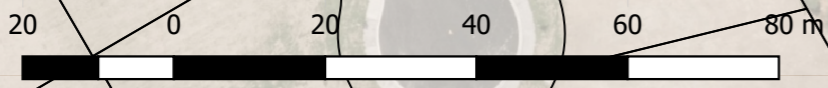
Principal

FIGURES



Legend

- ⊗ Dynamic Cone Penetration
- ⊕ Hand Auger
- △ Cone Penetration Test
- ⊞ Test Pit
- ⊞ EXP
- - - Proposed Lot Boundaries
- ▭ NZ Primary Land Parcels



	RDCL PO Box 28057 8/308 Queen St East Hastings New Zealand Tel: +64 6 877 1652 Fax: +64 6 877 5015 Email: info@rdcl.co.nz www.rdcl.co.nz	Title Site Investigation Layout_Stage 1A & 1B Project Arataki Road Subdivision Client Greenstone Land Development Ltd	DRAWN BY TD DATE 25/08/18 PLOTTED DRAWING SIZE: A4 CHECKED BY BB DATE 25/08/18 FILE NAME: FINAL APPROVED BY TB DATE 25/08/18	Figure Number: 1					
	1934520	1934560	1934600	1934640	1934680	1934720	1934760	1934800	1934840

APPENDIX A

DCP, HAND AUGER AND TEST PIT LOGS OUTPUTS



HAND AUGER LOG

HA01

SHEET 1 OF 9

CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 1
PROJECT: 184250602	EASTING: 1934779.00	STARTED: 20/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602625.00	FINISHED: 20/08/2018
OFFICE: RDCL	DATUM:	LOGGED BY: SD DATE: 16/08/2018
ENGINEER: TB	ELEVATION: -	CHECKED BY: TB DATE:
	DIAMETER: 0mm	STATUS: Final data

CONTRACTOR: RDCL OPERATOR:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.5	-0.5			Silty TOPSOIL; dark brown. Firm; non-plastic; moist; some rootlets.		FM			● FSV: 0.35m 115/47kPa ● FSV: 0.50m 113/35kPa	
				Sandy SILT, with trace rootlets; light brown, orange mottling. Stiff; non-plastic; moist; sand, fine.	M	SF				
				Silty SAND, with trace rootlets; light greyish brown, orange mottling. Medium dense; moist; sand, fine.		MD				
1.0	-1.0			EOH: 0.65m Termination: HA grinding; no recovery						
1.5	-1.5									
2.0	-2.0									
2.5	-2.5									
3.0	-3.0									
3.5	-3.5									

REMARKS

SYMBOLS

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



HAND AUGER LOG

HA02

SHEET 2 OF 9

CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 2
PROJECT: 184250602	EASTING: 1934772.00	STARTED: 20/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602640.00	FINISHED: 20/08/2018
OFFICE: RDCL	DATUM:	LOGGED BY: SD DATE: 16/08/2018
ENGINEER: TB	ELEVATION: -	CHECKED BY: TB DATE:
	DIAMETER: 0mm	STATUS: Final data

CONTRACTOR: RDCL OPERATOR:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.5	-0.5			TOPSOIL; dark brown. Firm; moist; Some rootlets; non plastic. Sandy SILT, with trace rootlets and gravel; brown. Firm; low plasticity; moist; sand, fine; gravel, fine, subround. EOH: 0.60m Termination: HA grinding on gravel; no recovery	M	FM			FSV: 0.30m 45/20kPa	
1.0	-1.0									
1.5	-1.5									
2.0	-2.0									
2.5	-2.5									
3.0	-3.0									
3.5	-3.5									

REMARKS

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



HAND AUGER LOG

HA03

SHEET 3 OF 9

CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 3
PROJECT: 184250602	EASTING: 1934766.00	STARTED: 20/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602650.00	FINISHED: 20/08/2018
OFFICE: RDCL	DATUM:	LOGGED BY: SD DATE: 16/08/2018
ENGINEER: TB	ELEVATION: -	CHECKED BY: TB DATE:
	DIAMETER: 0mm	STATUS: Final data

CONTRACTOR: RDCL OPERATOR:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
				TOPSOIL; dark brown. Firm; moist; Non Plastic, Some Rootlets.	M	FM			FSV: 0.15m 60/54kPa	
0.5	-0.5			Sandy SILT, with trace gravel; brown. Firm; low plasticity; moist; sand, fine to medium; gravel, fine, subround to round.						
				EOH: 0.15m Termination: HA grinding on gravel; no recovery						
1.0	-1.0									
1.5	-1.5									
2.0	-2.0									
2.5	-2.5									
3.0	-3.0									
3.5	-3.5									

REMARKS

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



HAND AUGER LOG

HA04
SHEET 4 OF 9

CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 4
PROJECT: 184250602	EASTING: 1934760.00	STARTED: 20/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602670.00	FINISHED: 20/08/2018
OFFICE: RDCL	DATUM:	LOGGED BY: SD DATE: 16/08/2018
ENGINEER: TB	ELEVATION: -	CHECKED BY: TB DATE:
	DIAMETER: 0mm	STATUS: Final data

CONTRACTOR: RDCL OPERATOR:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
				TOPSOIL; dark brown. Firm; moist; Non Plastic, Some Rootlets.	M	FM			FSV: 0.20m 51/45kPa	
0.5	-0.5			Sandy SILT, with trace rootlets and gravel; brown. Firm; low plasticity; moist; sand, fine to medium; gravel, fine, subbound.						
				EOH: 0.30m Termination: HA grinding on gravel; no recovery						
1.0	-1.0									
1.5	-1.5									
2.0	-2.0									
2.5	-2.5									
3.0	-3.0									
3.5	-3.5									

	REMARKS
	SYMBOLS
	<ul style="list-style-type: none"> ▼ Standing Water Level ◁ Out flow ▷ In flow



HAND AUGER LOG

HA05

SHEET 5 OF 9

CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 5
PROJECT: 184250602	EASTING: 1934753.00	STARTED: 20/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602683.00	FINISHED: 20/08/2018
OFFICE: RDCL	DATUM:	LOGGED BY: SD DATE: 16/08/2018
ENGINEER: TB	ELEVATION: -	CHECKED BY: TB DATE:
	DIAMETER: 0mm	STATUS: Final data

CONTRACTOR: RDCL OPERATOR:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
				TOPSOIL; dark brown. Firm; moist; Non Plastic, Trace Rootlets.						
				Sandy SILT, with some gravel; brown. Firm; low plasticity; moist; sand, fine to medium; gravel, fine, subround.	M	FM			● FSV: 0.25m 76/30kPa	
-0.5	-0.5			EOH: 0.45m Termination: HA grinding on gravel; no recovery						
-1.0	-1.0									
-1.5	-1.5									
-2.0	-2.0									
-2.5	-2.5									
-3.0	-3.0									
-3.5	-3.5									

REMARKS

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



HAND AUGER LOG

HA06

SHEET 6 OF 9

CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 6
PROJECT: 184250602	EASTING: 1934742.00	STARTED: 20/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602702.00	FINISHED: 20/08/2018
OFFICE: RDCL	DATUM:	LOGGED BY: SD DATE: 16/08/2018
ENGINEER: TB	ELEVATION: -	CHECKED BY: TB DATE:
	DIAMETER: 0mm	STATUS: Final data

CONTRACTOR: RDCL OPERATOR:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
				Gravelly TOPSOIL; dark brown. Stiff; moist; gravel, fine to medium, subround to round; non plastic; some lime.	M	SF				
0.5	-0.5			EOH: 0.15m Termination: HA grinding on surface gravel						
1.0	-1.0									
1.5	-1.5									
2.0	-2.0									
2.5	-2.5									
3.0	-3.0									
3.5	-3.5									

REMARKS
 Attempted two hand augers in Lot 6 and both refused approximately at 0.15 m

SYMBOLS

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



HAND AUGER LOG

HA07

SHEET 7 OF 9

CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 7
PROJECT: 184250602	EASTING: 1934735.00	STARTED: 20/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602714.00	FINISHED: 20/08/2018
OFFICE: RDCL	DATUM:	LOGGED BY: SD DATE: 16/08/2018
ENGINEER: TB	ELEVATION: -	CHECKED BY: TB DATE:
	DIAMETER: 0mm	STATUS: Final data

CONTRACTOR: RDCL OPERATOR:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.5	-0.5			Gravelly TOPSOIL; dark brown. Stiff; moist; gravel, fine to coarse, subround; Non Plastic. EOH: 0.05m Termination: HA grinding on surface gravel	M	SF				
1.0	-1.0									
1.5	-1.5									
2.0	-2.0									
2.5	-2.5									
3.0	-3.0									
3.5	-3.5									

REMARKS
 Attempted two hand augers in Lot 7 and both refused approximately at 0.05 m

SYMBOLS
 ▼ Standing Water Level
 ◁ Out flow
 ▷ In flow



HAND AUGER LOG

HA08

SHEET 8 OF 9

CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 8
PROJECT: 184250602	EASTING: 1934728.00	STARTED: 20/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602743.00	FINISHED: 20/08/2018
OFFICE: RDCL	DATUM:	LOGGED BY: SD DATE: 20/08/2018
ENGINEER: TB	ELEVATION: -	CHECKED BY: TB DATE:
	DIAMETER: 0mm	STATUS: Final data

CONTRACTOR: RDCL OPERATOR:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
				TOPSOIL, with some gravel, with trace sand; dark brown. Firm; moist; gravel, fine to medium, subround to round; some rootlets; non plastic.	M	FM				
0.5	-0.5			SAND, with some silt and gravel; brown. Medium dense; non-plastic; moist; sand, fine to coarse; gravel, fine to medium, subround.		MD				
				EOH: 0.55m Termination: HA grinding on gravel; no recovery						

REMARKS

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



HAND AUGER LOG

HA09
SHEET 9 OF 9

CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 9
PROJECT: 184250602	EASTING: 1934711.00	STARTED: 20/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602760.00	FINISHED: 20/08/2018
OFFICE: RDCL	DATUM:	LOGGED BY: SD DATE: 20/08/2018
ENGINEER: TB	ELEVATION: -	CHECKED BY: TB DATE:
	DIAMETER: 0mm	STATUS: Final data

CONTRACTOR: RDCL OPERATOR:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
				TOPSOIL, with some gravel; dark brown. Firm; moist; gravel, fine, subround to round; Some Roots.	M	FM				
0.5	-0.5			Silty SAND, with trace gravel; brown. Dense; non-plastic; moist; sand, fine to coarse; gravel, fine to medium, subround.		D				
				EOH: 0.50m Termination: HA grinding on gravel; no recovery						

	REMARKS
	SYMBOLS
	<p>▼ Standing Water Level</p> <p>◁ Out flow</p> <p>▷ In flow</p>

CLIENT: Greenstone Land Developments Ltd PROJECT: 184250602 LOCATION: 139 Arataki Road OFFICE: RDCL ENGINEER: TB	PROJECTION: NZTM EASTING: 1934794.00 NORTHING: 5602621.00 DATUM: ELEVATION: 0 AZUMITH: 0° PLUNGE: 90°	LOCATION: Lot 1 STARTED: 16/08/2018 FINISHED: 16/08/2018 LOGGED BY: SD/BR DATE: 16/08/2018 CHECKED BY: TB DATE: STATUS: Final data
--	--	---

CONTRACTOR: RDCL	MACHINE:	OPERATOR:
------------------	----------	-----------

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
					5 10 15 20		
0.5	-0.5	Groundwater Not Encountered		3 4 2 2 2 3 2 4 11			
1.0	-1.0			Double bounce			
1.5	-1.5						
2.0	-2.0						
2.5	-2.5						
3.0	-3.0						
3.5	-3.5						

REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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CLIENT: Greenstone Land Developments Ltd PROJECT: 184250602 LOCATION: 139 Arataki Road OFFICE: RDCL ENGINEER: TB	PROJECTION: NZTM EASTING: 1934780.00 NORTHING: 5602613.00 DATUM: ELEVATION: 0 AZUMITH: 0° PLUNGE: 90°	LOCATION: Lot 1 STARTED: 16/08/2018 FINISHED: 16/08/2018 LOGGED BY: SD/BR DATE: 16/08/2018 CHECKED BY: TB DATE: STATUS: Final data
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CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
					5 10 15 20		
0.5	-0.5	Groundwater Not Encountered		4 6 6 6 8 6 6 8			
1.0	-1.0			Double bounce			
1.5	-1.5						
2.0	-2.0						
2.5	-2.5						
3.0	-3.0						
3.5	-3.5						

REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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CLIENT: Greenstone Land Developments Ltd PROJECT: 184250602 LOCATION: 139 Arataki Road OFFICE: RDCL ENGINEER: TB	PROJECTION: NZTM EASTING: 1934776.00 NORTHING: 5602621.00 DATUM: ELEVATION: 0 AZUMITH: 0° PLUNGE: 90°	LOCATION: Lot 1 STARTED: 16/08/2018 FINISHED: 16/08/2018 LOGGED BY: SD/BR DATE: 16/08/2018 CHECKED BY: TB DATE: STATUS: Final data
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CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
					5 10 15 20		
0.5	-0.5	Groundwater Not Encountered		1 3 2 1 3 2 3 7			
1.0	-1.0			Double bounce			
1.5	-1.5						
2.0	-2.0						
2.5	-2.5						
3.0	-3.0						
3.5	-3.5						

REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 1
PROJECT: 184250602	EASTING: 1934792.00	STARTED: 16/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602627.00	FINISHED: 16/08/2018
OFFICE: RDCL	DATUM:	LOGGED BY: SD/BR DATE: 16/08/2018
ENGINEER: TB	ELEVATION: 0	CHECKED BY: TB DATE:
	AZUMITH: 0° PLUNGE: 90°	STATUS: Final data

CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
					5 10 15 20		
0.5	-0.5	roundwater Not Encountered		1 2 3 4 10			
1.0	-1.0			double bounce			
1.5	-1.5						
2.0	-2.0						
2.5	-2.5						
3.0	-3.0						
3.5	-3.5						

REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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Produced with Core-GS by Geotec

CLIENT: Greenstone Land Developments Ltd PROJECT: 184250602 LOCATION: 139 Arataki Road OFFICE: RDCL ENGINEER: TB	PROJECTION: NZTM EASTING: 1934788.00 NORTHING: 5602633.00 DATUM: ELEVATION: 0 AZUMITH: 0° PLUNGE: 90°	LOCATION: Lot 2 STARTED: 16/08/2018 FINISHED: 16/08/2018 LOGGED BY: SD/BR DATE: 16/08/2018 CHECKED BY: TB DATE: STATUS: Final data
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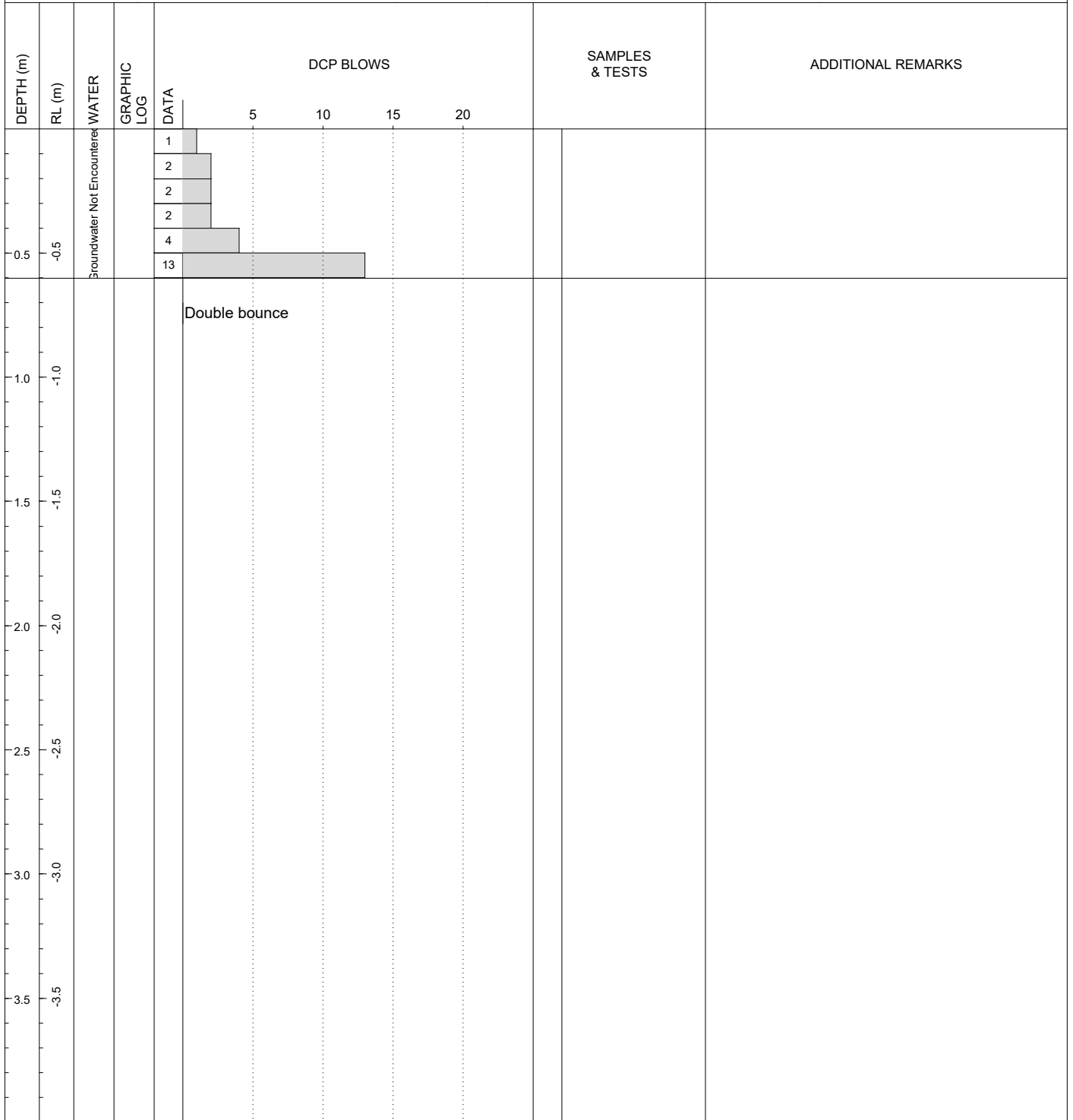
CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
					5 10 15 20		
0.5	-0.5	Groundwater Not Encountered		1 2 2 2 2 6 10			
1.0	-1.0			Double bounce			
1.5	-1.5						
2.0	-2.0						
2.5	-2.5						
3.0	-3.0						
3.5	-3.5						

REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 2
PROJECT: 184250602	EASTING: 1934772.00	STARTED: 16/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602625.00	FINISHED: 16/08/2018
OFFICE: RDCL	DATUM:	LOGGED BY: SD/BR DATE: 16/08/2018
ENGINEER: TB	ELEVATION: 0	CHECKED BY: TB DATE:
	AZUMITH: 0° PLUNGE: 90°	STATUS: Final data

CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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REMARKS	SYMBOLS
	▼ Standing Water Level ◁ Out flow ▷ In flow

CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 2
PROJECT: 184250602	EASTING: 1934763.00	STARTED: 16/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602634.00	FINISHED: 16/08/2018
OFFICE: RDCL	DATUM:	LOGGED BY: SD/BR DATE: 16/08/2018
ENGINEER: TB	ELEVATION: 0	CHECKED BY: TB DATE:
	AZUMITH: 0° PLUNGE: 90°	STATUS: Final data

CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
					5 10 15 20		
0.5	-0.5	roundwater Not Encountered		1 2 3 3 8 9			
1.0	-1.0			Double bounce			
1.5	-1.5						
2.0	-2.0						
2.5	-2.5						
3.0	-3.0						
3.5	-3.5						

REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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CLIENT: Greenstone Land Developments Ltd PROJECT: 184250602 LOCATION: 139 Arataki Road OFFICE: RDCL ENGINEER: TB	PROJECTION: NZTM EASTING: 1934782.00 NORTHING: 5602644.00 DATUM: ELEVATION: 0 AZUMITH: 0° PLUNGE: 90°	LOCATION: Lot 2 STARTED: 16/08/2018 FINISHED: 16/08/2018 LOGGED BY: SD/BR DATE: 16/08/2018 CHECKED BY: TB DATE: STATUS: Final data
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CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
					5 10 15 20		
0.5	-0.5	Groundwater Not Encountered		1 2 2 1 6 12			
1.0	-1.0			Double bounce			
1.5	-1.5						
2.0	-2.0						
2.5	-2.5						
3.0	-3.0						
3.5	-3.5						

REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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CLIENT: Greenstone Land Developments Ltd PROJECT: 184250602 LOCATION: 139 Arataki Road OFFICE: RDCL ENGINEER: TB	PROJECTION: NZTM EASTING: 1934780.00 NORTHING: 5602650.00 DATUM: ELEVATION: 0 AZUMITH: 0° PLUNGE: 90°	LOCATION: Lot 3 STARTED: 16/08/2018 FINISHED: 16/08/2018 LOGGED BY: SD/BR DATE: 16/08/2018 CHECKED BY: TB DATE: STATUS: Final data
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CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
					5 10 15 20		
		Underwater Not Encountered		1			
				3			
				1			
				1			
				13			
0.5	-0.5						Double bounce
1.0	-1.0						
1.5	-1.5						
2.0	-2.0						
2.5	-2.5						
3.0	-3.0						
3.5	-3.5						

REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 3
PROJECT: 184250602	EASTING: 1934761.00	STARTED: 16/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602639.00	FINISHED: 16/08/2018
OFFICE: RDCL	DATUM:	LOGGED BY: SD/BR DATE: 16/08/2018
ENGINEER: TB	ELEVATION: 0	CHECKED BY: TB DATE:
	AZUMITH: 0° PLUNGE: 90°	STATUS: Final data

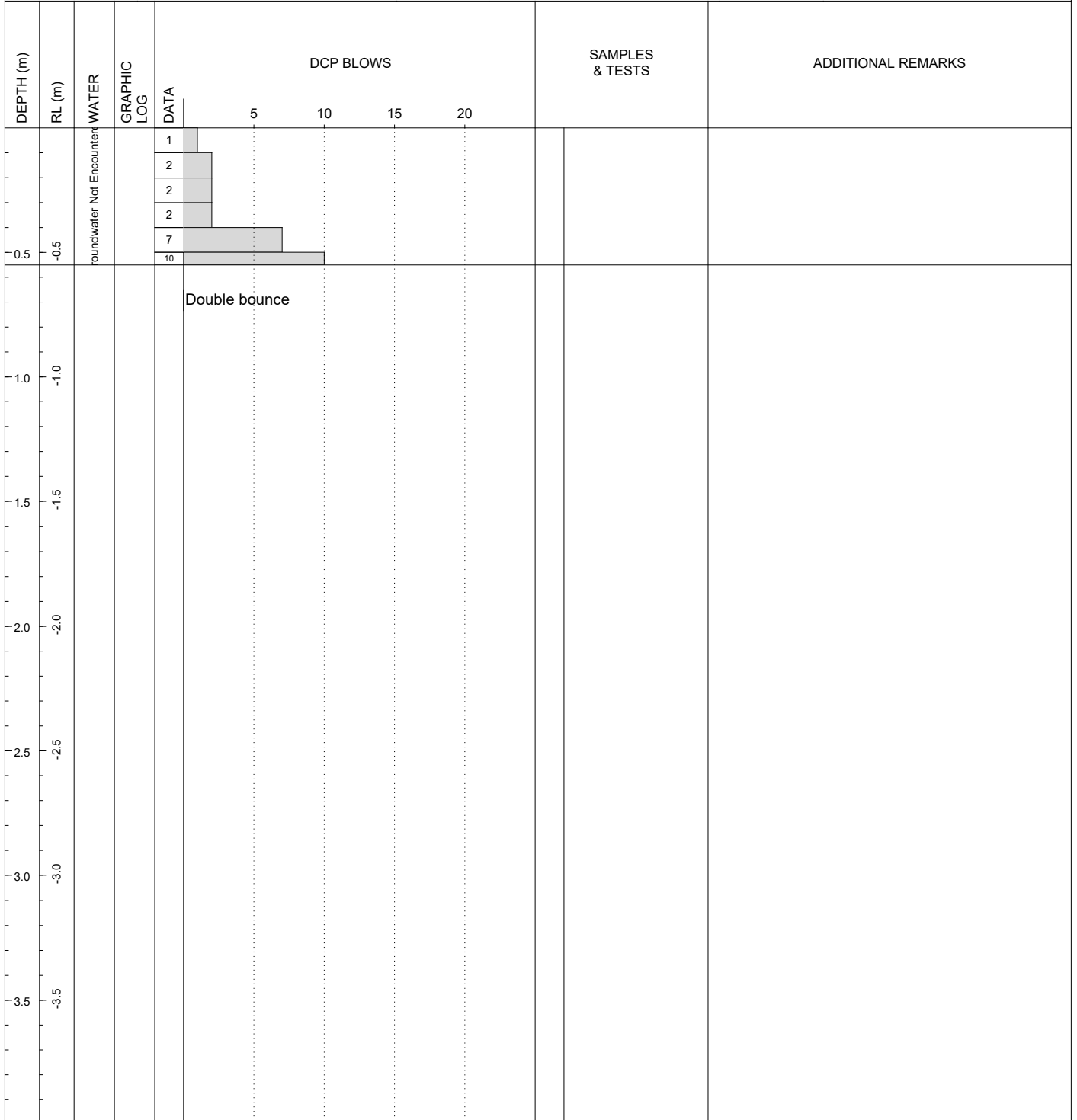
CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
					5 10 15 20		
0.5	-0.5	roundwater Not Encountered		1 2 2 3 8 10			
1.0	-1.0			Double bounce			
1.5	-1.5						
2.0	-2.0						
2.5	-2.5						
3.0	-3.0						
3.5	-3.5						

REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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CLIENT: Greenstone Land Developments Ltd PROJECT: 184250602 LOCATION: 139 Arataki Road OFFICE: RDCL ENGINEER: TB	PROJECTION: NZTM EASTING: 1934755.00 NORTHING: 5602650.00 DATUM: ELEVATION: 0 AZUMITH: 0° PLUNGE: 90°	LOCATION: Lot 3 STARTED: 16/08/2018 FINISHED: 16/08/2018 LOGGED BY: SD/BR DATE: 16/08/2018 CHECKED BY: TB DATE: STATUS: Final data
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CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 3
PROJECT: 184250602	EASTING: 1934771.00	STARTED: 16/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602660.00	FINISHED: 16/08/2018
OFFICE: RDCL	DATUM:	LOGGED BY: SD/BR DATE: 16/08/2018
ENGINEER: TB	ELEVATION: 0	CHECKED BY: TB DATE:
	AZUMITH: 0° PLUNGE: 90°	STATUS: Final data

CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS				SAMPLES & TESTS	ADDITIONAL REMARKS
					5	10	15	20		
		Underwater Not Encountered		2 2 1 5 7						
0.5	-0.5			Double bounce						
1.0	-1.0									
1.5	-1.5									
2.0	-2.0									
2.5	-2.5									
3.0	-3.0									
3.5	-3.5									

REMARKS	SYMBOLS  Standing Water Level  Out flow  In flow
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CLIENT: Greenstone Land Developments Ltd PROJECT: 184250602 LOCATION: 139 Arataki Road OFFICE: RDCL ENGINEER: TB	PROJECTION: NZTM EASTING: 1934767.00 NORTHING: 5602664.00 DATUM: ELEVATION: 0 AZUMITH: 0° PLUNGE: 90°	LOCATION: Lot 4 STARTED: 16/08/2018 FINISHED: 16/08/2018 LOGGED BY: SD/BR DATE: 16/08/2018 CHECKED BY: TB DATE: STATUS: Final data
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CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS	
					5 10 15 20			
0.5	-0.5	Underwater Not Encountered		2				
				2				
				2				
				3				
				10				
				Double bounce				
1.0	-1.0							
1.5	-1.5							
2.0	-2.0							
2.5	-2.5							
3.0	-3.0							
3.5	-3.5							

REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 4
PROJECT: 184250602	EASTING: 1934753.00	STARTED: 16/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602655.00	FINISHED: 16/08/2018
OFFICE: RDCL	DATUM:	LOGGED BY: SD/BR DATE: 16/08/2018
ENGINEER: TB	ELEVATION: 0	CHECKED BY: TB DATE:
	AZUMITH: 0° PLUNGE: 90°	STATUS: Final data

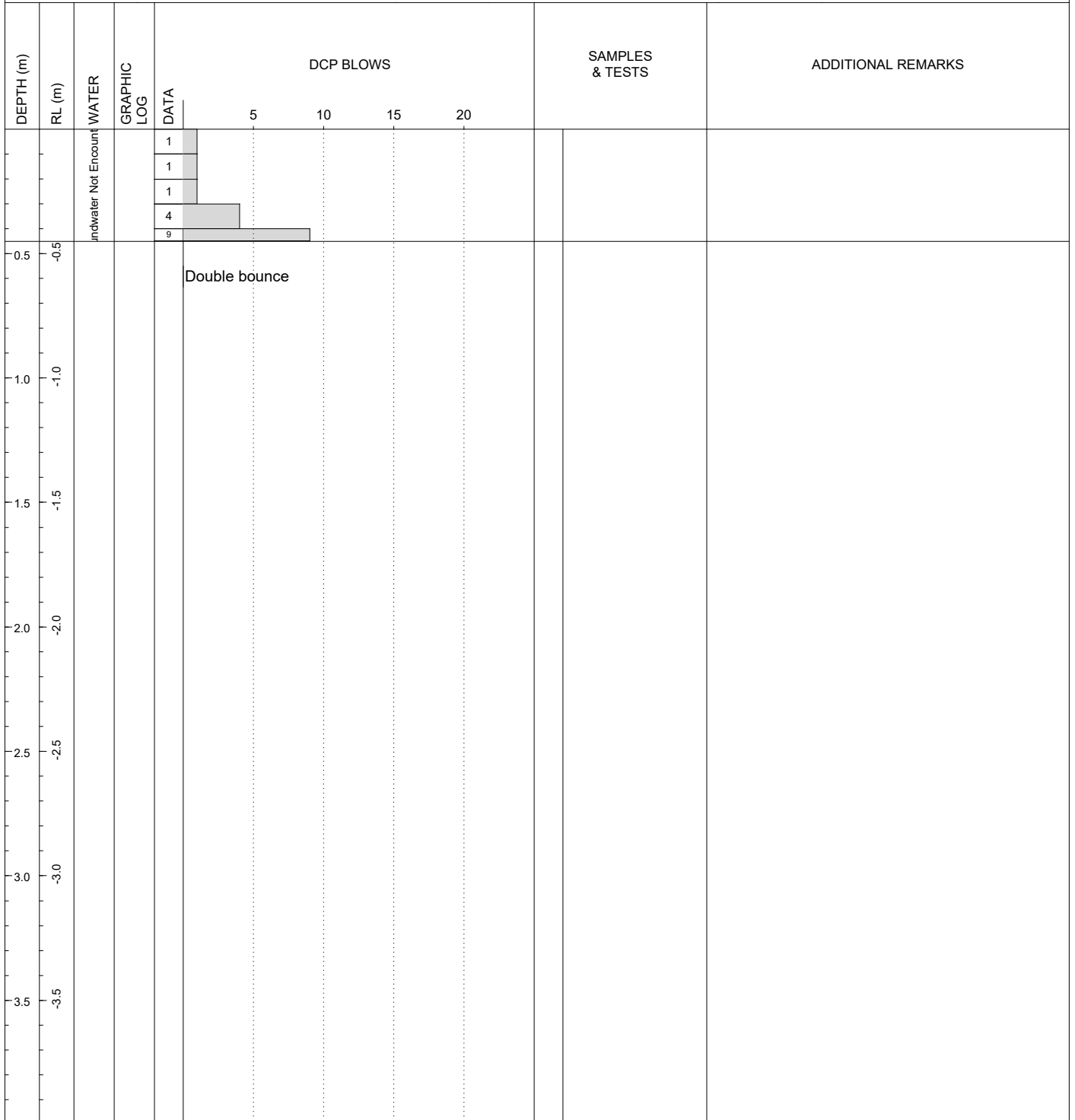
CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS				SAMPLES & TESTS	ADDITIONAL REMARKS
					5	10	15	20		
0.5	-0.5	Underwater Not Encountered		2 2 2 3 10						
1.0	-1.0			double bounce						
1.5	-1.5									
2.0	-2.0									
2.5	-2.5									
3.0	-3.0									
3.5	-3.5									

REMARKS	SYMBOLS  Standing Water Level  Out flow  In flow
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CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 4
PROJECT: 184250602	EASTING: 1934746.00	STARTED: 16/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602668.00	FINISHED: 16/08/2018
OFFICE: RDCL	DATUM:	LOGGED BY: SD/BR DATE: 16/08/2018
ENGINEER: TB	ELEVATION: 0	CHECKED BY: TB DATE:
	AZUMITH: 0° PLUNGE: 90°	STATUS: Final data

CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 4
PROJECT: 184250602	EASTING: 1934763.00	STARTED: 16/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602677.00	FINISHED: 16/08/2018
OFFICE: RDCL	DATUM:	LOGGED BY: SD/BR DATE: 16/08/2018
ENGINEER: TB	ELEVATION: 0	CHECKED BY: TB DATE:
	AZUMITH: 0° PLUNGE: 90°	STATUS: Final data

CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
					5 10 15 20		
		Underwater Not Encountered		1 2 2 5 9			
0.5	-0.5			Double bounce			
1.0	-1.0						
1.5	-1.5						
2.0	-2.0						
2.5	-2.5						
3.0	-3.0						
3.5	-3.5						

REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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DCP LOG

DCP17

SHEET 17 OF 36

CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 5
PROJECT: 184250602	EASTING: 1934760.00	STARTED: 16/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602685.00	FINISHED: 16/08/2018
OFFICE: RDCL	DATUM:	LOGGED BY: SD/BR DATE: 16/08/2018
ENGINEER: TB	ELEVATION: -	CHECKED BY: TB DATE:
	AZUMITH: 0° PLUNGE: 90°	STATUS: Final data

CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS				SAMPLES & TESTS	ADDITIONAL REMARKS
					5	10	15	20		
		Underwater Not Encountered		2 2 1 5 7						
0.5	-0.5			Double bounce						
1.0	-1.0									
1.5	-1.5									
2.0	-2.0									
2.5	-2.5									
3.0	-3.0									
3.5	-3.5									

REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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Produced with Core-GS by Geotec

CLIENT: Greenstone Land Developments Ltd PROJECT: 184250602 LOCATION: 139 Arataki Road OFFICE: RDCL ENGINEER: TB	PROJECTION: NZTM EASTING: 1934742.00 NORTHING: 5602677.00 DATUM: ELEVATION: - AZUMITH: 0° PLUNGE: 90°	LOCATION: Lot 5 STARTED: 16/08/2018 FINISHED: 16/08/2018 LOGGED BY: SD/BR DATE: 16/08/2018 CHECKED BY: TB DATE: STATUS: Final data
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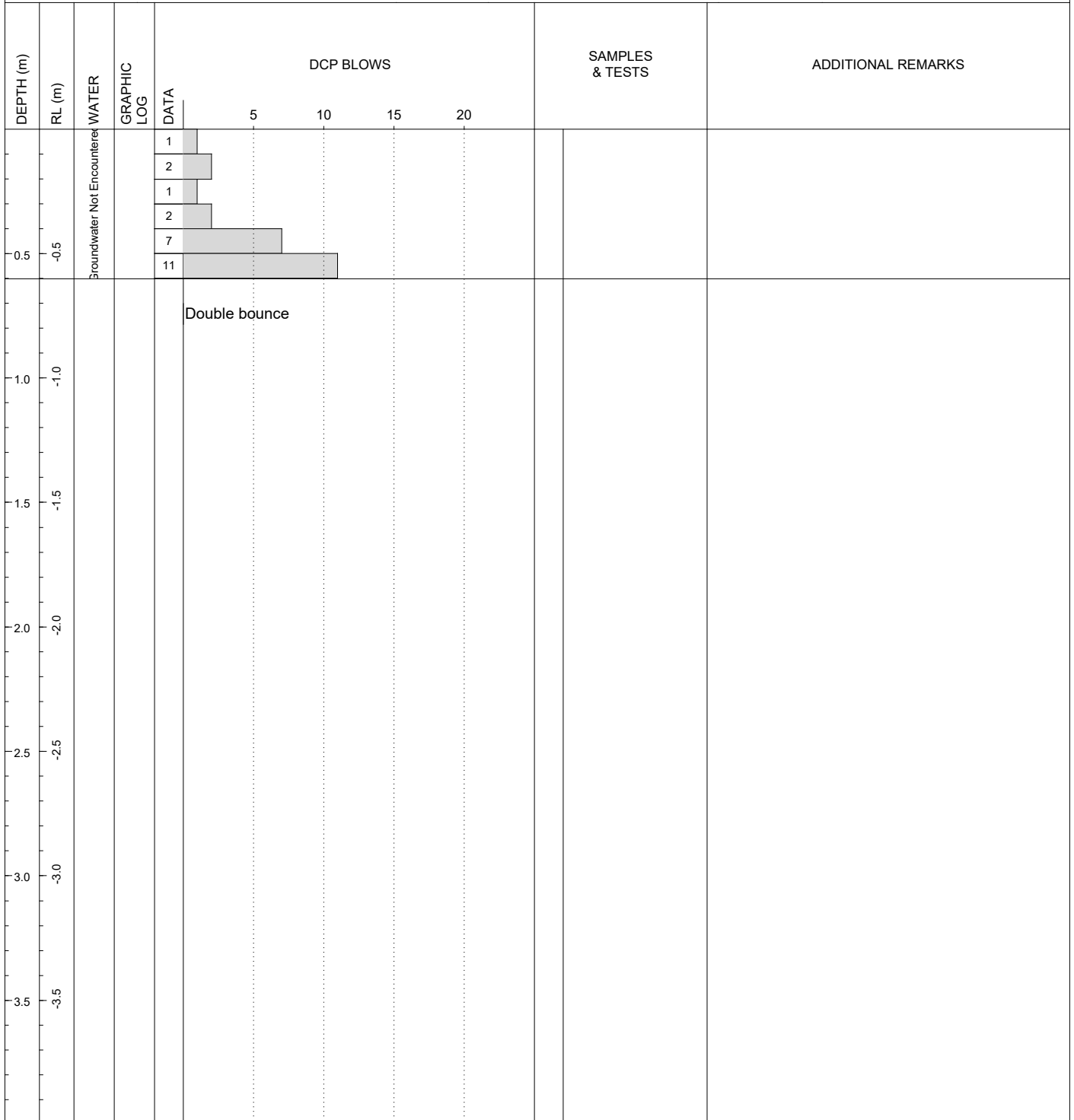
CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
					5 10 15 20		
0.5	-0.5	Groundwater Not Encountered		1 1 1 1 2 9			
1.0	-1.0			Double bounce			
1.5	-1.5						
2.0	-2.0						
2.5	-2.5						
3.0	-3.0						
3.5	-3.5						

REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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CLIENT: Greenstone Land Developments Ltd PROJECT: 184250602 LOCATION: 139 Arataki Road OFFICE: RDCL ENGINEER: TB	PROJECTION: NZTM EASTING: 1934738.00 NORTHING: 5602683.00 DATUM: ELEVATION: - AZUMITH: 0° PLUNGE: 90°	LOCATION: Lot 5 STARTED: 16/08/2018 FINISHED: 16/08/2018 LOGGED BY: SD/BR DATE: 16/08/2018 CHECKED BY: TB DATE: STATUS: Final data
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CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 5
PROJECT: 184250602	EASTING: 1934755.00	STARTED: 16/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602693.00	FINISHED: 16/08/2018
OFFICE: RDCL	DATUM:	LOGGED BY: SD/BR DATE: 16/08/2018
ENGINEER: TB	ELEVATION: -	CHECKED BY: TB DATE:
	AZUMITH: 0° PLUNGE: 90°	STATUS: Final data

CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
					5 10 15 20		
0.5	-0.5	Groundwater Not Encountered		1 2 4 4 6 12			
1.0	-1.0			Double bounce			
1.5	-1.5						
2.0	-2.0						
2.5	-2.5						
3.0	-3.0						
3.5	-3.5						

REMARKS	SYMBOLS
	▼ Standing Water Level ◁ Out flow ▷ In flow

CLIENT: Greenstone Land Developments Ltd PROJECT: 184250602 LOCATION: 139 Arataki Road OFFICE: RDCL ENGINEER: TB	PROJECTION: NZTM EASTING: 1934753.00 NORTHING: 5602697.00 DATUM: ELEVATION: - AZUMITH: 0° PLUNGE: 90°	LOCATION: Lot 6 STARTED: 16/08/2018 FINISHED: 16/08/2018 LOGGED BY: SD/BR DATE: 16/08/2018 CHECKED BY: TB DATE: STATUS: Final data
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CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
					5 10 15 20		
0.5	-0.5	roundwater Not Encountered		1 3 2 1 2 7			
1.0	-1.0			Double bounce/50mm			
1.5	-1.5						
2.0	-2.0						
2.5	-2.5						
3.0	-3.0						
3.5	-3.5						

REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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CLIENT: Greenstone Land Developments Ltd PROJECT: 184250602 LOCATION: 139 Arataki Road OFFICE: RDCL ENGINEER: TB	PROJECTION: NZTM EASTING: 1934737.00 NORTHING: 5602692.00 DATUM: ELEVATION: - AZUMITH: 0° PLUNGE: 90°	LOCATION: Lot 6 STARTED: 16/08/2018 FINISHED: 16/08/2018 LOGGED BY: SD/BR DATE: 16/08/2018 CHECKED BY: TB DATE: STATUS: Final data
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CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
					5 10 15 20		
0.5	-0.5	roundwater Not Encountered		2 1 2 2 6 7			
1.0	-1.0			Double bounce/50mm			
1.5	-1.5						
2.0	-2.0						
2.5	-2.5						
3.0	-3.0						
3.5	-3.5						

REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 6
PROJECT: 184250602	EASTING: 1934729.00	STARTED: 16/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602699.00	FINISHED: 16/08/2018
OFFICE: RDCL	DATUM:	LOGGED BY: SD/BR DATE: 16/08/2018
ENGINEER: TB	ELEVATION: -	CHECKED BY: TB DATE:
	AZUMITH: 0° PLUNGE: 90°	STATUS: Final data

CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
					5 10 15 20		
0.5	-0.5	Groundwater Not Encountered		3			
				2			
				2			
				2			
				7			
				12			
1.0	-1.0			Double bounce			
1.5	-1.5						
2.0	-2.0						
2.5	-2.5						
3.0	-3.0						
3.5	-3.5						

REMARKS	SYMBOLS
	▼ Standing Water Level ◁ Out flow ▷ In flow

CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 6
PROJECT: 184250602	EASTING: 1934745.00	STARTED: 16/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602706.00	FINISHED: 16/08/2018
OFFICE: RDCL	DATUM:	LOGGED BY: SD/BR DATE: 16/08/2018
ENGINEER: TB	ELEVATION: -	CHECKED BY: TB DATE:
	AZUMITH: 0° PLUNGE: 90°	STATUS: Final data

CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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REMARKS	SYMBOLS
	▼ Standing Water Level ◁ Out flow ▷ In flow

CLIENT: Greenstone Land Developments Ltd PROJECT: 184250602 LOCATION: 139 Arataki Road OFFICE: RDCL ENGINEER: TB	PROJECTION: NZTM EASTING: 1934740.00 NORTHING: 5602715.00 DATUM: ELEVATION: - AZUMITH: 0° PLUNGE: 90°	LOCATION: Lot 7 STARTED: 16/08/2018 FINISHED: 16/08/2018 LOGGED BY: SD/BR DATE: 16/08/2018 CHECKED BY: TB DATE: STATUS: Final data
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CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.5	-0.5	Groundwater Not Encountered		9 2 2 2 3 12	5 10 15 20		0.0m - 0.1m: Double bounce
1.0	-1.0			Double bounce			
1.5	-1.5						
2.0	-2.0						
2.5	-2.5						
3.0	-3.0						
3.5	-3.5						

REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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CLIENT: Greenstone Land Developments Ltd PROJECT: 184250602 LOCATION: 139 Arataki Road OFFICE: RDCL ENGINEER: TB	PROJECTION: NZTM EASTING: 1934727.00 NORTHING: 5602705.00 DATUM: ELEVATION: - AZUMITH: 0° PLUNGE: 90°	LOCATION: Lot 7 STARTED: 16/08/2018 FINISHED: 16/08/2018 LOGGED BY: SD/BR DATE: 16/08/2018 CHECKED BY: TB DATE: STATUS: Final data
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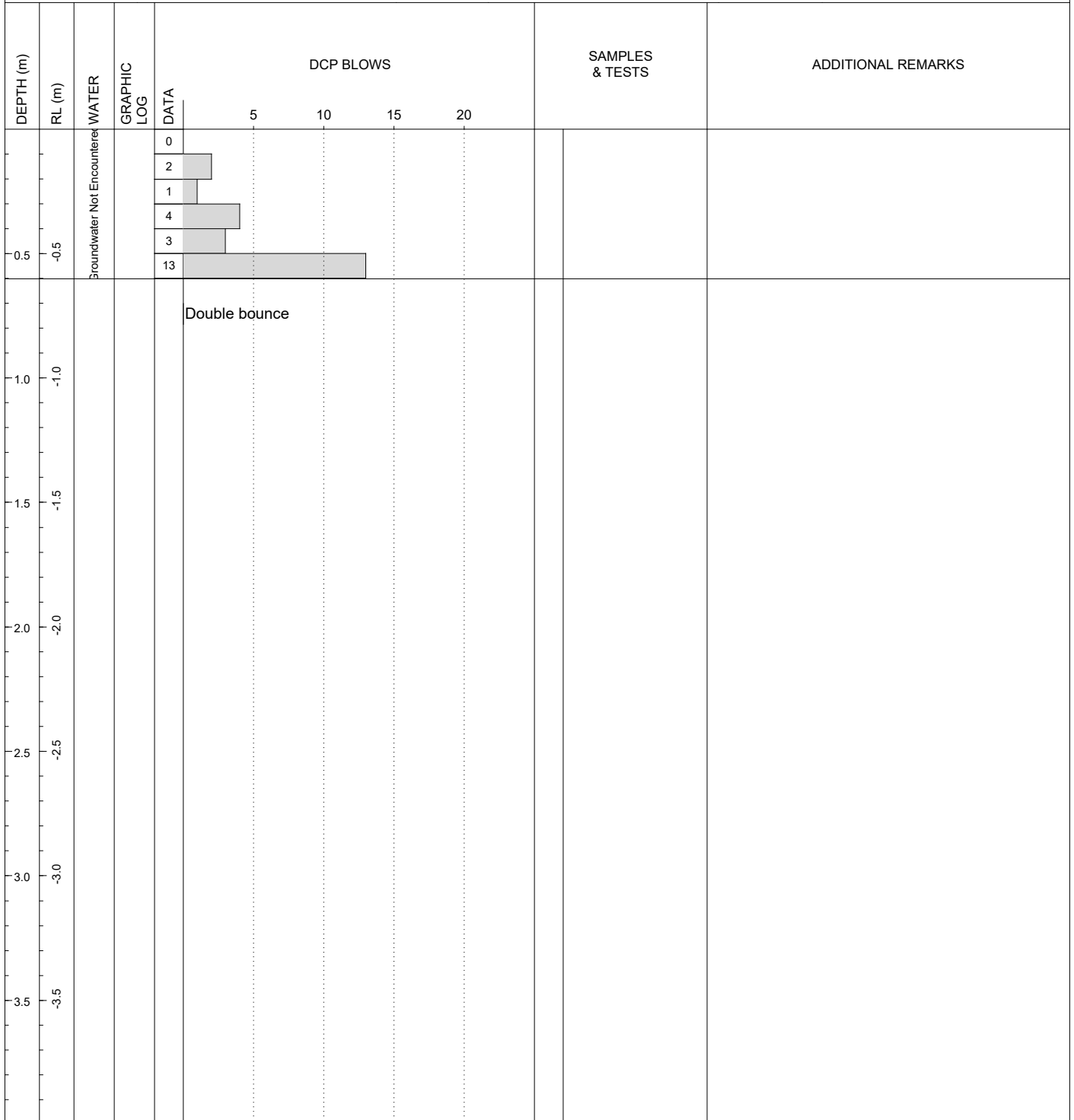
CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS				SAMPLES & TESTS	ADDITIONAL REMARKS	
					5	10	15	20			
0.5	-0.5	Underwater Not Encountered		4							
				4							
				4							
				3							
				11							
				Double bounce							
1.0	-1.0										
1.5	-1.5										
2.0	-2.0										
2.5	-2.5										
3.0	-3.0										
3.5	-3.5										

REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 7
PROJECT: 184250602	EASTING: 1934723.00	STARTED: 16/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602714.00	FINISHED: 16/08/2018
OFFICE: RDCL	DATUM:	LOGGED BY: SD/BR DATE: 16/08/2018
ENGINEER: TB	ELEVATION: -	CHECKED BY: TB DATE:
	AZUMITH: 0° PLUNGE: 90°	STATUS: Final data

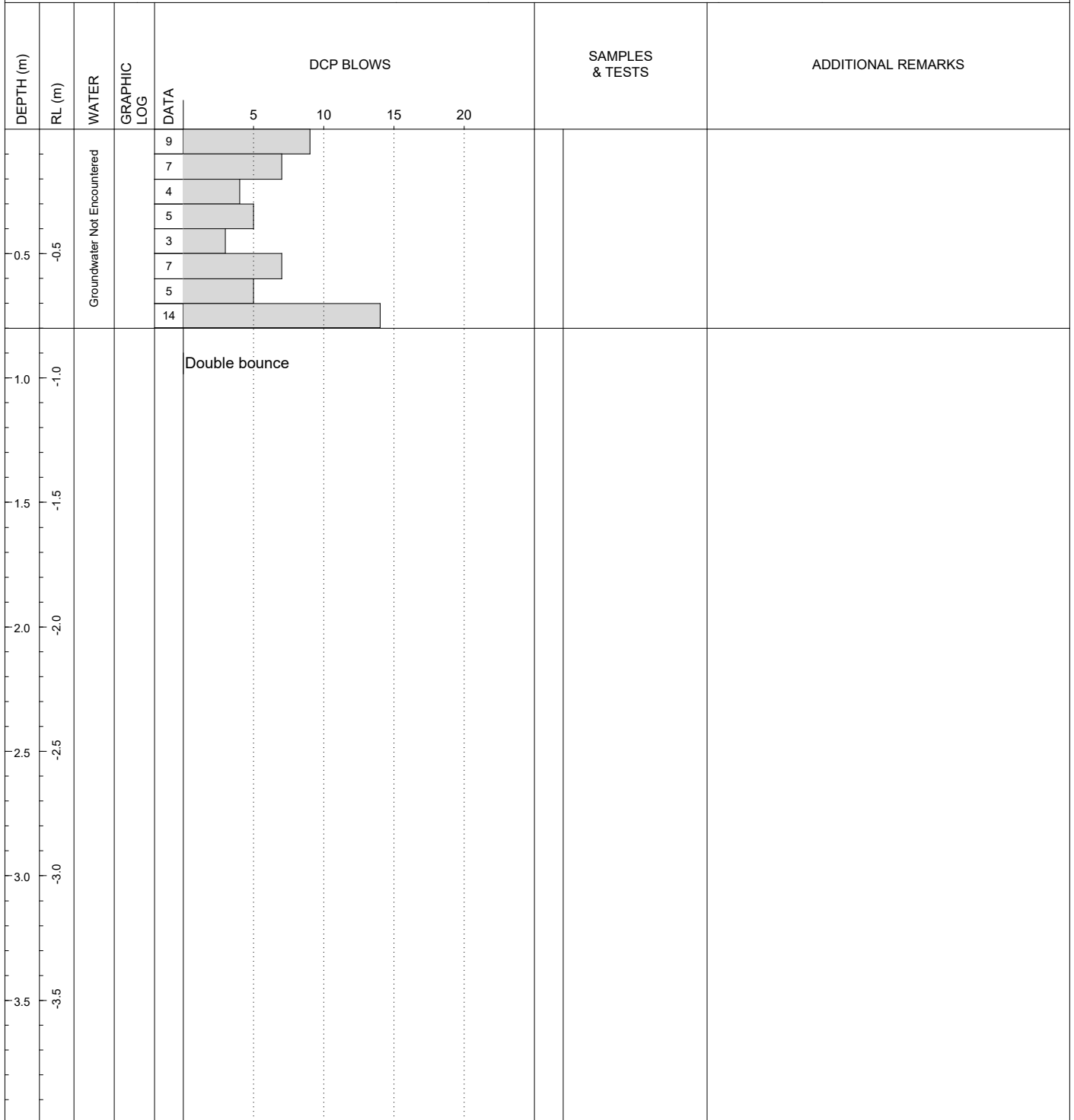
CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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REMARKS	SYMBOLS
	▼ Standing Water Level ◁ Out flow ▷ In flow

CLIENT: Greenstone Land Developments Ltd PROJECT: 184250602 LOCATION: 139 Arataki Road OFFICE: RDCL ENGINEER: TB	PROJECTION: NZTM EASTING: 1934738.00 NORTHING: 5602723.00 DATUM: ELEVATION: - AZUMITH: 0° PLUNGE: 90°	LOCATION: Lot 7 STARTED: 16/08/2018 FINISHED: 16/08/2018 LOGGED BY: SD/BR DATE: 16/08/2018 CHECKED BY: TB DATE: STATUS: Final data
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CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 8
PROJECT: 184250602	EASTING: 1934735.00	STARTED: 20/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602738.00	FINISHED: 20/08/2018
OFFICE: RDCL	DATUM:	LOGGED BY: TS DATE: 20/08/2018
ENGINEER: TB	ELEVATION: -	CHECKED BY: TB DATE:
	AZUMITH: 0° PLUNGE: 90°	STATUS: Final data

CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
					5 10 15 20		
0.5	-0.5	Groundwater Not Encountered		1 2 3 4 10 15			
1.0	-1.0			Double bounce			
1.5	-1.5						
2.0	-2.0						
2.5	-2.5						
3.0	-3.0						
3.5	-3.5						

REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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CLIENT: Greenstone Land Developments Ltd PROJECT: 184250602 LOCATION: 139 Arataki Road OFFICE: RDCL ENGINEER: TB	PROJECTION: NZTM EASTING: 1934732.00 NORTHING: 5602746.00 DATUM: ELEVATION: - AZUMITH: 0° PLUNGE: 90°	LOCATION: Lot 8 STARTED: 20/08/2018 FINISHED: 20/08/2018 LOGGED BY: TS DATE: 20/08/2018 CHECKED BY: TB DATE: STATUS: Final data
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CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
					5 10 15 20		
0.5	-0.5	Groundwater Not Encountered		1 1 1 3 2 6 10 12			
1.0	-1.0			Double bounce			
1.5	-1.5						
2.0	-2.0						
2.5	-2.5						
3.0	-3.0						
3.5	-3.5						

REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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CLIENT: Greenstone Land Developments Ltd PROJECT: 184250602 LOCATION: 139 Arataki Road OFFICE: RDCL ENGINEER: TB	PROJECTION: NZTM EASTING: 1934710.00 NORTHING: 5602730.00 DATUM: ELEVATION: - AZUMITH: 0° PLUNGE: 90°	LOCATION: Lot 8 STARTED: 20/08/2018 FINISHED: 20/08/2018 LOGGED BY: TS DATE: 20/08/2018 CHECKED BY: TB DATE: STATUS: Final data
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CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
					5 10 15 20		
0.5	-0.5	Groundwater Not Encountered		4 3 5 4 10 11 12			
1.0	-1.0			Double bounce			
1.5	-1.5						
2.0	-2.0						
2.5	-2.5						
3.0	-3.0						
3.5	-3.5						

REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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CLIENT: Greenstone Land Developments Ltd PROJECT: 184250602 LOCATION: 139 Arataki Road OFFICE: RDCL ENGINEER: TB	PROJECTION: NZTM EASTING: 1934714.00 NORTHING: 5602723.00 DATUM: ELEVATION: - AZUMITH: 0° PLUNGE: 90°	LOCATION: Lot 8 STARTED: 20/08/2018 FINISHED: 20/08/2018 LOGGED BY: TS DATE: 20/08/2018 CHECKED BY: TB DATE: STATUS: Final data
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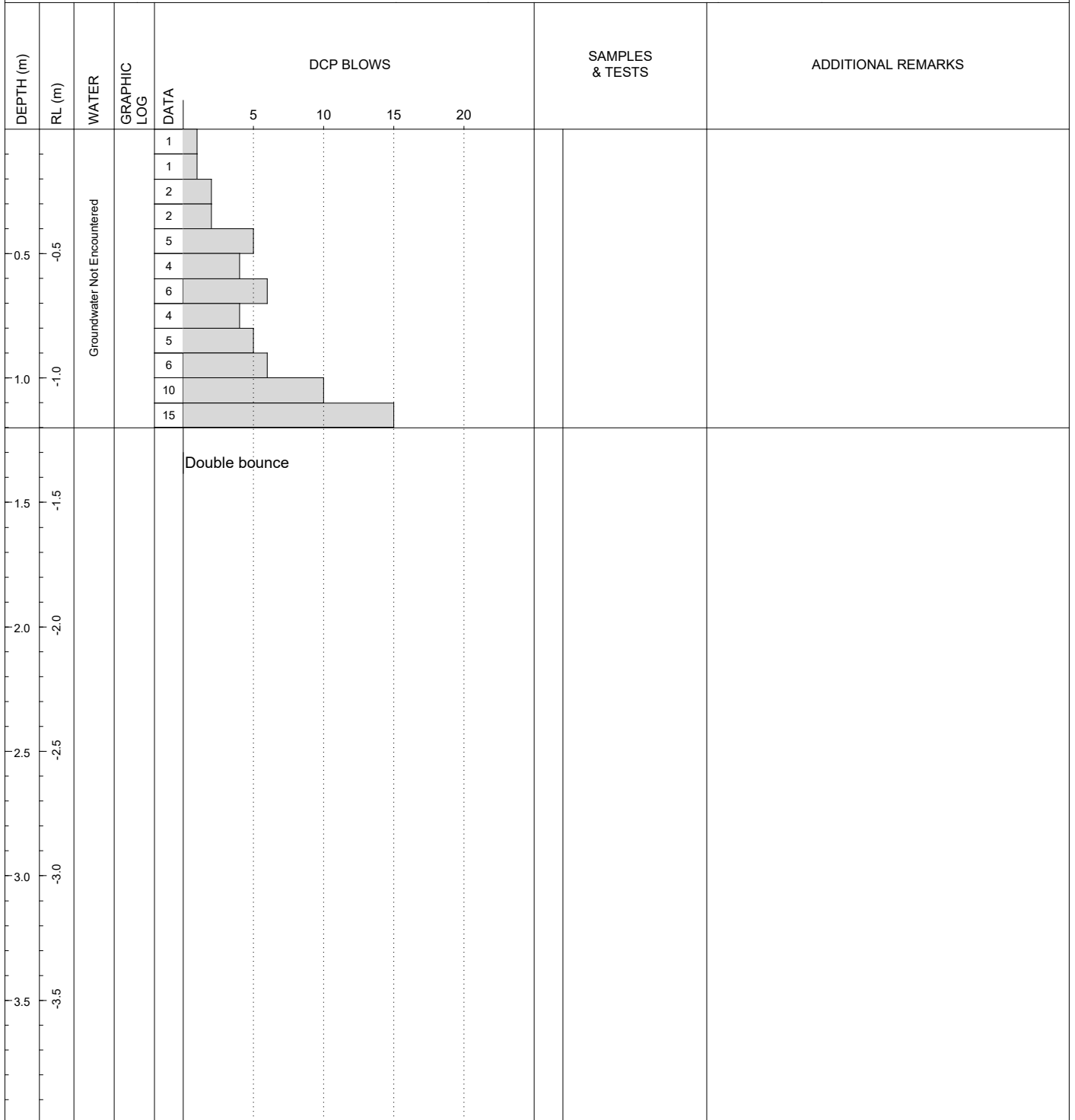
CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
					5 10 15 20		
0.5	-0.5	Groundwater Not Encountered		1 2 2 4 9 12			
1.0	-1.0			Double bounce			
1.5	-1.5						
2.0	-2.0						
2.5	-2.5						
3.0	-3.0						
3.5	-3.5						

REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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CLIENT: Greenstone Land Developments Ltd PROJECT: 184250602 LOCATION: 139 Arataki Road OFFICE: RDCL ENGINEER: TB	PROJECTION: NZTM EASTING: 1934720.00 NORTHING: 5602760.00 DATUM: ELEVATION: - AZUMITH: 0° PLUNGE: 90°	LOCATION: Lot 9 STARTED: 20/08/2018 FINISHED: 20/08/2018 LOGGED BY: TS DATE: 20/08/2018 CHECKED BY: TB DATE: STATUS: Final data
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CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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CLIENT: Greenstone Land Developments Ltd PROJECT: 184250602 LOCATION: 139 Arataki Road OFFICE: RDCL ENGINEER: TB	PROJECTION: NZTM EASTING: 1934701.00 NORTHING: 5602750.00 DATUM: ELEVATION: - AZUMITH: 0° PLUNGE: 90°	LOCATION: Lot 9 STARTED: 20/08/2018 FINISHED: 20/08/2018 LOGGED BY: TS DATE: 20/08/2018 CHECKED BY: TB DATE: STATUS: Final data
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CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
					5 10 15 20		
0.2	-0.2	Groundwater Not Encountered		2			
0.3	-0.3		2				
0.4	-0.4		2				
0.5	-0.5		3				
0.6	-0.6		3				
0.7	-0.7		2				
0.8	-0.8		4				
0.9	-0.9		9				
1.0	-1.0		8				
1.1	-1.1		11				
1.2	-1.2				double bounce		
1.5	-1.5						
2.0	-2.0						
2.5	-2.5						
3.0	-3.0						
3.5	-3.5						

REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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DCP LOG

DCP35

SHEET 35 OF 36

CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 9
PROJECT: 184250602	EASTING: 1934694.00	STARTED: 20/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602764.00	FINISHED: 20/08/2018
OFFICE: RDCL	DATUM:	LOGGED BY: TS DATE: 20/08/2018
ENGINEER: TB	ELEVATION: -	CHECKED BY: TB DATE:
	AZUMITH: 0° PLUNGE: 90°	STATUS: Final data

CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
					5 10 15 20		
0.5	-0.5	Groundwater Not Encountered		1			
			2				
			3				
			2				
			1				
			1				
			6				
			7				
1.0	-1.0		11				
			6				
1.5	-1.5				double bounce		
2.0	-2.0						
2.5	-2.5						
3.0	-3.0						
3.5	-3.5						

REMARKS	SYMBOLS
	<ul style="list-style-type: none"> ▼ Standing Water Level ◁ Out flow ▷ In flow

CLIENT: Greenstone Land Developments Ltd PROJECT: 184250602 LOCATION: 139 Arataki Road OFFICE: RDCL ENGINEER: TB	PROJECTION: NZTM EASTING: 1934717.00 NORTHING: 5602776.00 DATUM: ELEVATION: - AZUMITH: 0° PLUNGE: 90°	LOCATION: Lot 9 STARTED: 20/08/2018 FINISHED: 20/08/2018 LOGGED BY: TS DATE: 20/08/2018 CHECKED BY: TB DATE: STATUS: Final data
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CONTRACTOR: RDCL	MACHINE:	OPERATOR:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
					5 10 15 20		
0.5	-0.5	Groundwater Not Encountered		1			
			2				
			1				
			1				
			2				
1.0	-1.0		11				
1.5	-1.5			Double bounce			
2.0	-2.0						
2.5	-2.5						
3.0	-3.0						
3.5	-3.5						

REMARKS	SYMBOLS ▼ Standing Water Level ◁ Out flow ▷ In flow
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TEST PIT LOG

EXP01
SHEET 1 OF 8

CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM2000	STARTED: 15/08/2018
PROJECT: 184250602	EASTING: 1934668.06	FINISHED: 15/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602593.21	
OFFICE: RDCL	DATUM:	LOGGED BY: SD DATE: 15/08/2018
ENGINEER: TB	ELEVATION: -	CHECKED BY: TB DATE:
	DIMENSIONS: m x m	STATUS: Final data

CONTRACTOR: RDCL MACHINE TYPE & MODEL:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	-0.5	Groundwater Not Encountered		TOPSOIL; dark brown. Firm; moist; non plastic.	M	FM				
0.5	SILT, with some sand; brown. Firm; low plasticity; moist; sand, fine to medium.			MD						
1.0	-1.0			GRAVEL, with some silt; brown. Medium dense; non-plastic; moist; well graded; gravel, fine to coarse, subround to round.						
1.2	-1.2			EOH: 1.20m						
1.5	-1.5									
2.0	-2.0									
2.5	-2.5									
3.0	-3.0									
3.5	-3.5									

REMARKS

SYMBOLS

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



TEST PIT LOG

EXP02
SHEET 2 OF 8

CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM2000	STARTED: 15/08/2018
PROJECT: 184250602	EASTING: 1934620.99	FINISHED: 15/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602657.55	
OFFICE: RDCL	DATUM:	LOGGED BY: SD DATE: 15/08/2018
ENGINEER: TB	ELEVATION: -	CHECKED BY: TB DATE:
	DIMENSIONS: m x m	STATUS: Final data

CONTRACTOR: RDCL MACHINE TYPE & MODEL:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	-0.5	Groundwater Not Encountered		TOPSOIL; dark brown. Firm; moist; some roots and rootlets; non plastic.	M	FM				
0.5	-1.0			SILT, with some sand, with trace rootlets; brown. Firm; low plasticity; moist; sand, fine to medium.						
1.0	-1.5			GRAVEL, with trace silt; brown. Medium dense; non-plastic; moist; gravel, fine to medium, subround.						
1.5	-2.0			GRAVEL, with some silt; brown. Medium dense; non-plastic; moist; gravel, fine to coarse, subround.						
2.0	-2.5			EOH: 1.10m						
2.5	-3.0									
3.0	-3.5									

REMARKS

SYMBOLS

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



TEST PIT LOG

EXP03
SHEET 3 OF 8

CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM2000	STARTED: 15/08/2018
PROJECT: 184250602	EASTING: 1934726.47	FINISHED: 15/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602670.76	
OFFICE: RDCL	DATUM:	LOGGED BY: SD DATE: 15/08/2018
ENGINEER: TB	ELEVATION: -	CHECKED BY: TB DATE:
	DIMENSIONS: m x m	STATUS: Final data

CONTRACTOR: RDCL MACHINE TYPE & MODEL:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0				TOPSOIL; dark brown. Firm; moist; trace rootlets, non plastic.						
0.5	-0.5			SILT, with trace rootlets and sand; brown. Firm; low plasticity; moist; sand, fine.		FM				
1.0	-1.0			GRAVEL, with some sand; brown. Medium dense; moist; well graded; gravel, fine to coarse, subround; non plastic.						
1.5	-1.5				M					
2.0	-2.0					MD				
2.5	-2.5									
3.0	-3.0									
3.5	-3.5									

Groundwater Not Encountered

EOH: 2.70m

REMARKS

SYMBOLS
 ▼ Standing Water Level
 ◁ Out flow
 ▷ In flow



TEST PIT LOG

TP01
SHEET 4 OF 8

CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM2000	STARTED: 21/08/2018
PROJECT: 184250602	EASTING: 1934664.00	FINISHED: 21/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602635.00	
OFFICE: RDCL	DATUM: -	LOGGED BY: SD DATE: 21/08/2018
ENGINEER: TB	ELEVATION: -	CHECKED BY: TB DATE: -
	DIMENSIONS: m x m	STATUS: Final data

CONTRACTOR: RDCL MACHINE TYPE & MODEL:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
				TOPSOIL; dark brown. Firm; moist; non plastic; some rootlets.		FM				
0.5	-0.5			Sandy SILT; brown. Medium dense; non-plastic; moist; sand, fine to medium.				B		
1.0	-1.0			SAND, with trace gravel; brown. Medium dense; moist; sand, medium; gravel, fine to medium, subround to round; non plastic.		MD			B	
1.5	-1.5			Silty sandy GRAVEL; brown. Medium dense; non-plastic; moist; gravel, fine to coarse, subround to round; sand, medium.						
2.0	-2.0			SAND, with some silt; light brown. Medium dense; non-plastic; moist; sand, fine to medium.						
2.5	-2.5			SAND, with some silt; greyish brown. Medium dense; low plasticity; moist; sand, fine.	M					
3.0	-3.0			Silty sandy GRAVEL, with trace cobbles; brown. Dense; non-plastic; moist; gravel, fine to coarse, subround to round; sand, fine to medium; cobbles, subround to round.						
3.5	-3.5			Silty sandy GRAVEL, with some cobbles; brown. Dense; non-plastic; moist; gravel, subround to round; sand, medium to coarse; cobbles, subround to round.		D				
				Silty sandy GRAVEL, with some cobbles. Dense; non-plastic; wet; gravel, fine to coarse, subround to round; sand, medium to coarse; cobbles, subround to round.		W				
				Silty sandy GRAVEL, with some cobbles; brown. Dense; non-plastic; saturated; gravel, fine to coarse, subround to round; sand, medium to coarse; cobbles, subround to round.		S				
				EOH: 3.50m						

REMARKS

SYMBOLS

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



TEST PIT LOG

TP02
SHEET 5 OF 8

CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM2000	STARTED: 21/08/2018
PROJECT: 184250602	EASTING: 1934709.00	FINISHED: 21/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602642.00	
OFFICE: RDCL	DATUM: -	LOGGED BY: SD DATE: 21/08/2018
ENGINEER: TB	ELEVATION: -	CHECKED BY: TB DATE: -
	DIMENSIONS: m x m	STATUS: Final data

CONTRACTOR: RDCL MACHINE TYPE & MODEL:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	-0.5			TOPSOIL; dark brown. Firm; moist; non plastic; trace rootlets.		FM				
0.0	-0.5			SANDY SILT, with trace rootlets; brown. Medium dense; non-plastic; moist; sand, fine to medium.				B		
0.5	-1.0			SAND; greyish brown. Medium dense; moist; sand, medium; non plastic.						
0.5	-1.0			Silty sandy GRAVEL, with trace cobbles; brown. Medium dense; non-plastic; moist; gravel, fine to coarse, subround to round; cobbles, subround to round.				B		
1.0	-1.5					MD				
1.5	-2.0			GRAVEL, with some clay and silt, with trace cobbles; greyish brown. Medium dense; non-plastic; moist; gravel, fine to coarse, subround to round; cobbles, subround to round.	M					
2.0	-2.5			Silty sandy GRAVEL, with trace cobbles; brown. Dense; non-plastic; moist; gravel, fine to coarse, subround to round; sand, medium to coarse; cobbles, subround to round.		D				
2.5	-3.0			Silty sandy GRAVEL, with some cobbles; brown. Dense; non-plastic; moist; gravel, fine to coarse, subround to round; sand, medium to coarse; cobbles, subround to round.						
3.0	-3.5									
3.5	-3.5			EOH: 3.10m						

REMARKS

SYMBOLS

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



TEST PIT LOG

TP03
SHEET 6 OF 8

CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM2000	STARTED: 21/08/2018
PROJECT: 184250602	EASTING: 1934741.00	FINISHED: 21/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602596.00	
OFFICE: RDCL	DATUM:	LOGGED BY: SD DATE: 21/08/2018
ENGINEER: TB	ELEVATION: -	CHECKED BY: TB DATE:
	DIMENSIONS: m x m	STATUS: Final data

CONTRACTOR: RDCL MACHINE TYPE & MODEL:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
				TOPSOIL; dark brown. Firm; moist; some rootlets; non plastic.		FM				
0.5	-0.5			Silty SAND; brown. Medium dense; non-plastic; moist; sand, fine to medium.				B		
1.0	-1.0			Silty sandy GRAVEL; brown. Medium dense; non-plastic; moist; gravel, fine to coarse, subround to round; sand, medium to coarse.			MD	B		
1.5	-1.5			SAND, with some rootlets, with trace silt; brown. Medium dense; non-plastic; moist.			M			
2.0	-2.0			Silty sandy GRAVEL; brown. Medium dense; non-plastic; moist; gravel, fine to coarse, subround to round; sand, medium to coarse.						
2.5	-2.5			SAND, with trace silt; brown. Medium dense; non-plastic; moist; sand, medium.						
3.0	-3.0			Silty sandy GRAVEL, with trace cobbles; brown. Dense; non-plastic; moist; gravel, fine to coarse, subround to round; cobbles, subround to round.		D				
				GRAVEL, with trace clay and sand; light grey. Medium dense; non-plastic; moist; gravel, fine to coarse, subround to round; sand, coarse.		MD				
				Silty sandy GRAVEL, with some cobbles; brown. Dense; non-plastic; moist; gravel, fine to coarse, subround to round; cobbles, subround to round.		D				
3.5	-3.5			EOH: 3.10m						

REMARKS

SYMBOLS

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

Produced with Core-GS by Geric

CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM2000	STARTED: 21/08/2018
PROJECT: 184250602	EASTING: 1934692.00	FINISHED: 21/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602611.00	
OFFICE: RDCL	DATUM:	LOGGED BY: SD DATE: 21/08/2018
ENGINEER: TB	ELEVATION: -	CHECKED BY: TB DATE:
	DIMENSIONS: m x m	STATUS: Final data

CONTRACTOR: RDCL	MACHINE TYPE & MODEL:
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
			TS	TOPSOIL; dark brown. Firm; moist; some roots; non plastic.						
-0.5	-0.5		TS	Sandy SILT, with trace gravel; brown. Firm; non-plastic; moist; sand, medium to coarse; gravel, fine, subround to round.		FM				
			TS	TOPSOIL; dark brown. Firm; moist; non plastic; some roots.						
-1.0	-1.0		X	SILT, with some sand; brownish grey. Firm; low plasticity; moist; sand, fine.						
-1.5	-1.5		O	Silty sandy GRAVEL; brown. Medium dense; non-plastic; moist; gravel, fine to coarse, subround to round.	M					
-2.0	-2.0		O			MD				
-2.5	-2.5		O							
-3.0	-3.0		O	GRAVEL, with trace clay and cobbles; greyish brown. Dense; non-plastic; moist; gravel, fine to coarse, subround to round; cobbles, subround to round.		D				
-3.5	-3.5		O	Silty sandy GRAVEL, with some cobbles; brown. Dense; non-plastic; moist; gravel, fine to coarse, subround to round; cobbles, subround to round.						
				EOH: 3.10m						

REMARKS

SYMBOLS

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



TEST PIT LOG

TP05
SHEET 8 OF 8

CLIENT: Greenstone Land Developments Ltd	PROJECTION: NZTM2000	STARTED: 21/08/2018
PROJECT: 184250602	EASTING: 1934694.00	FINISHED: 21/08/2018
LOCATION: 139 Arataki Road	NORTHING: 5602570.00	
OFFICE: RDCL	DATUM:	LOGGED BY: SD DATE: 21/08/2018
ENGINEER: TB	ELEVATION: -	CHECKED BY: TB DATE:
	DIMENSIONS: m x m	STATUS: Final data

CONTRACTOR: RDCL MACHINE TYPE & MODEL:

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
				TOPSOIL; dark brown. Firm; moist; some rootlets; non plastic.						
0.5	-0.5			Sandy SILT, with trace gravel; brown. Firm; non-plastic; moist; gravel, fine, subround to round.		FM				
1.0	-1.0			Silty sandy GRAVEL; brown. Medium dense; non-plastic; moist; gravel, fine to medium, subround; sand, medium to coarse.						
1.5	-1.5			SAND, with some silt; brown. Medium dense; non-plastic; moist; sand, medium to coarse.	M					
2.0	-2.0			Silty sandy GRAVEL; brown. Medium dense; non-plastic; moist; gravel, fine to coarse, subround to round.		MD				
3.0	-3.0			GRAVEL, with trace clay and cobbles; grey. Dense; non-plastic; moist; gravel, fine to coarse, subround to round; cobbles, subround to round.		D				
3.5	-3.5			Silty sandy GRAVEL, with some cobbles; brown. Dense; non-plastic; moist; gravel, fine to coarse, subround to round; cobbles, subround to round.						
				EOH: 3.10m						

REMARKS

SYMBOLS

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

APPENDIX B

CPT LOGS OUTPUTS



CONE PENETRATION TEST

Job: 184250602

CPT No.: CPT01

Name: Arataki Road Subdivision Stage 1A
Client: Greenstone Land Developments Ltd
Location: 139 Arataki Road

Grid: NZTM

Datum: -

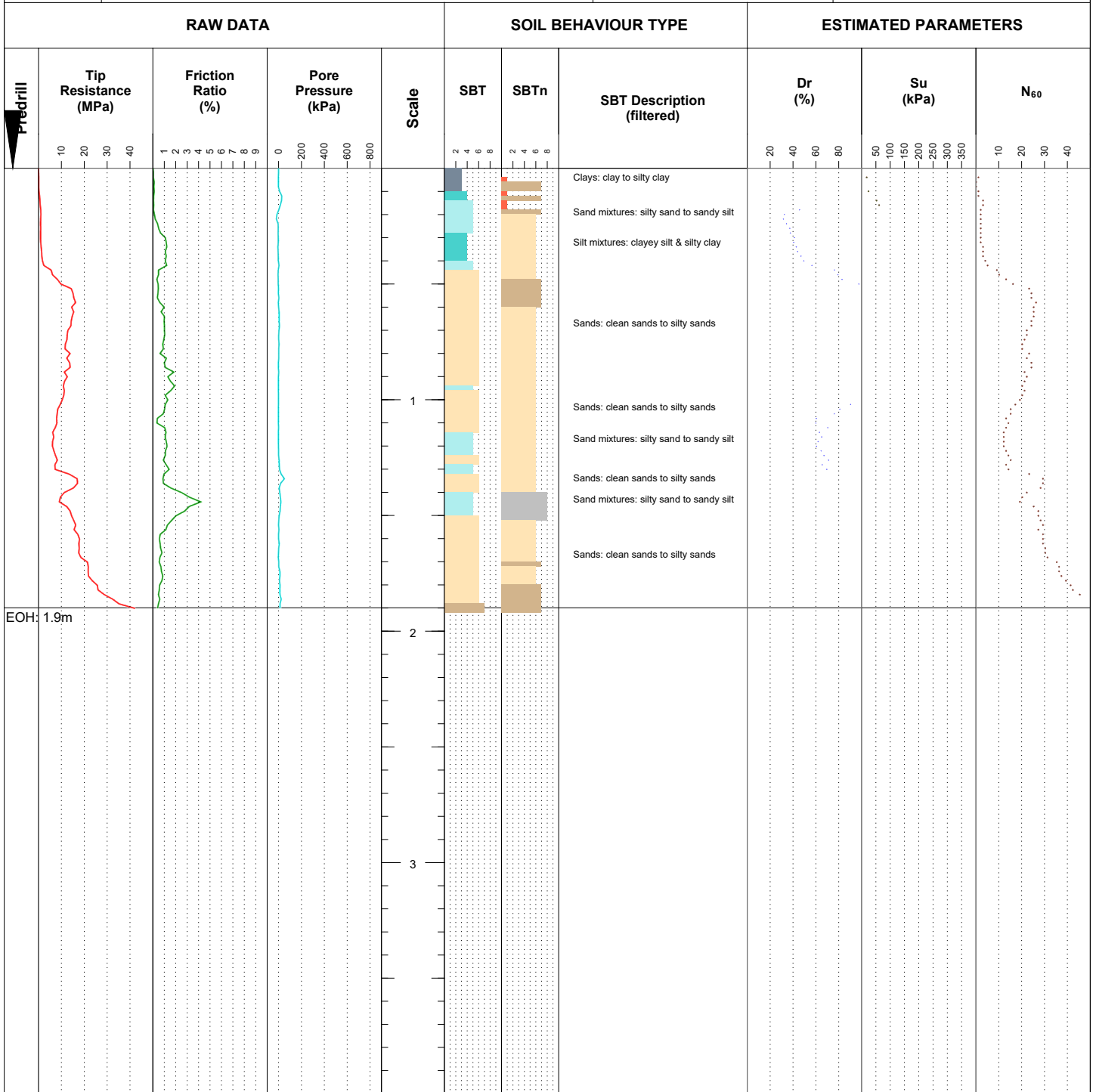
Termination: 35 TIP RESISTAN

North (m): 5602670.00

East (m): 1934734.00

Elevation (m): 20.00

Hole Depth (m): 1.90



Soil Behaviour Type (SBT) - Robertson et al. 1986

- | | |
|--|--|
| 0 Undefined | 5 Sand mixtures: silty sand to sandy silt |
| 1 Sensitive fine-grained | 6 Sands: clean sands to silty sands |
| 2 Clay - organic soil | 7 Dense sand to gravelly sand |
| 3 Clays: clay to silty clay | 8 Stiff sand to clayey sand |
| 4 Silt mixtures: clayey silt & silty clay | 9 Stiff fine-grained |

Notes & Limitations

Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P. K. Robertson and K.L. Cabal (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use, and should be carefully reviewed by the user. Geroc Solutions Ltd do not warrant the correctness or the applicability of any of the geotechnical soil and design parameters shown and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Remarks

Hole Depth (m): 1.90

Sheet 1 of 8



CONE PENETRATION TEST

Job: 184250602

CPT No.: CPT02

Name: Arataki Road Subdivision Stage 1A
Client: Greenstone Land Developments Ltd
Location: 139 Arataki Road

Grid: NZTM

Datum: -

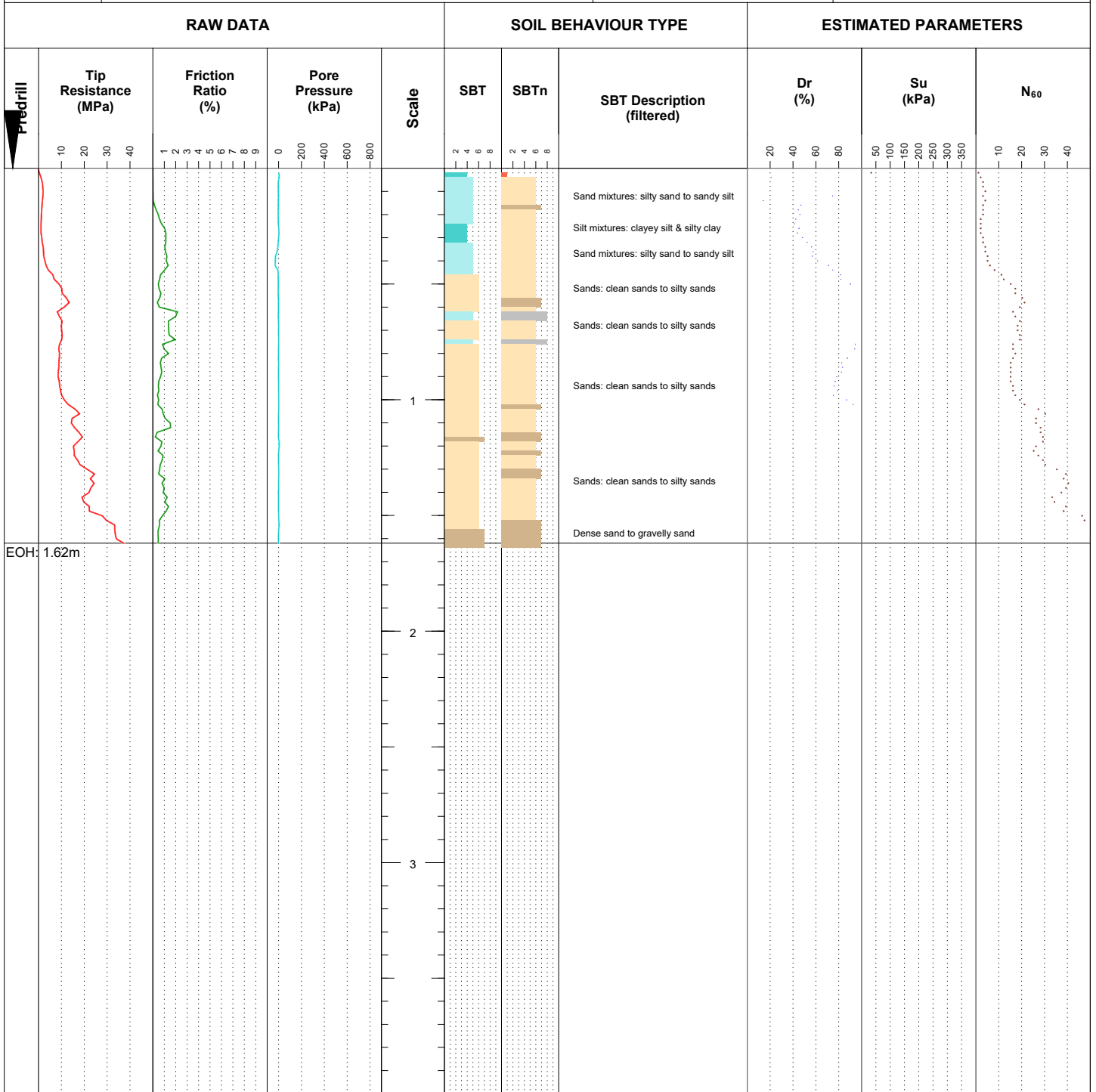
Termination: 35 TIP RESISTAN

North (m): 5602746.00

East (m): 1934694.00

Elevation (m): 0.00

Hole Depth (m): 1.62



Soil Behaviour Type (SBT) - Robertson et al. 1986

- 0** Undefined
- 1** Sensitive fine-grained
- 2** Clay - organic soil
- 3** Clays: clay to silty clay
- 4** Silt mixtures: clayey silt & silty clay
- 5** Sand mixtures: silty sand to sandy silt
- 6** Sands: clean sands to silty sands
- 7** Dense sand to gravelly sand
- 8** Stiff sand to clayey sand
- 9** Stiff fine-grained

Notes & Limitations

Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P. K. Robertson and K.L. Cabal (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use, and should be carefully reviewed by the user. Geroc Solutions Ltd do not warrant the correctness or the applicability of any of the geotechnical soil and design parameters shown and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Remarks

Hole Depth (m): 1.62

Sheet 2 of 8



CONE PENETRATION TEST

Job: 184250602

CPT No.: CPT03

Name: Arataki Road Subdivision Stage 1A
Client: Greenstone Land Developments Ltd
Location: 139 Arataki Road

Grid: NZTM

Datum: -

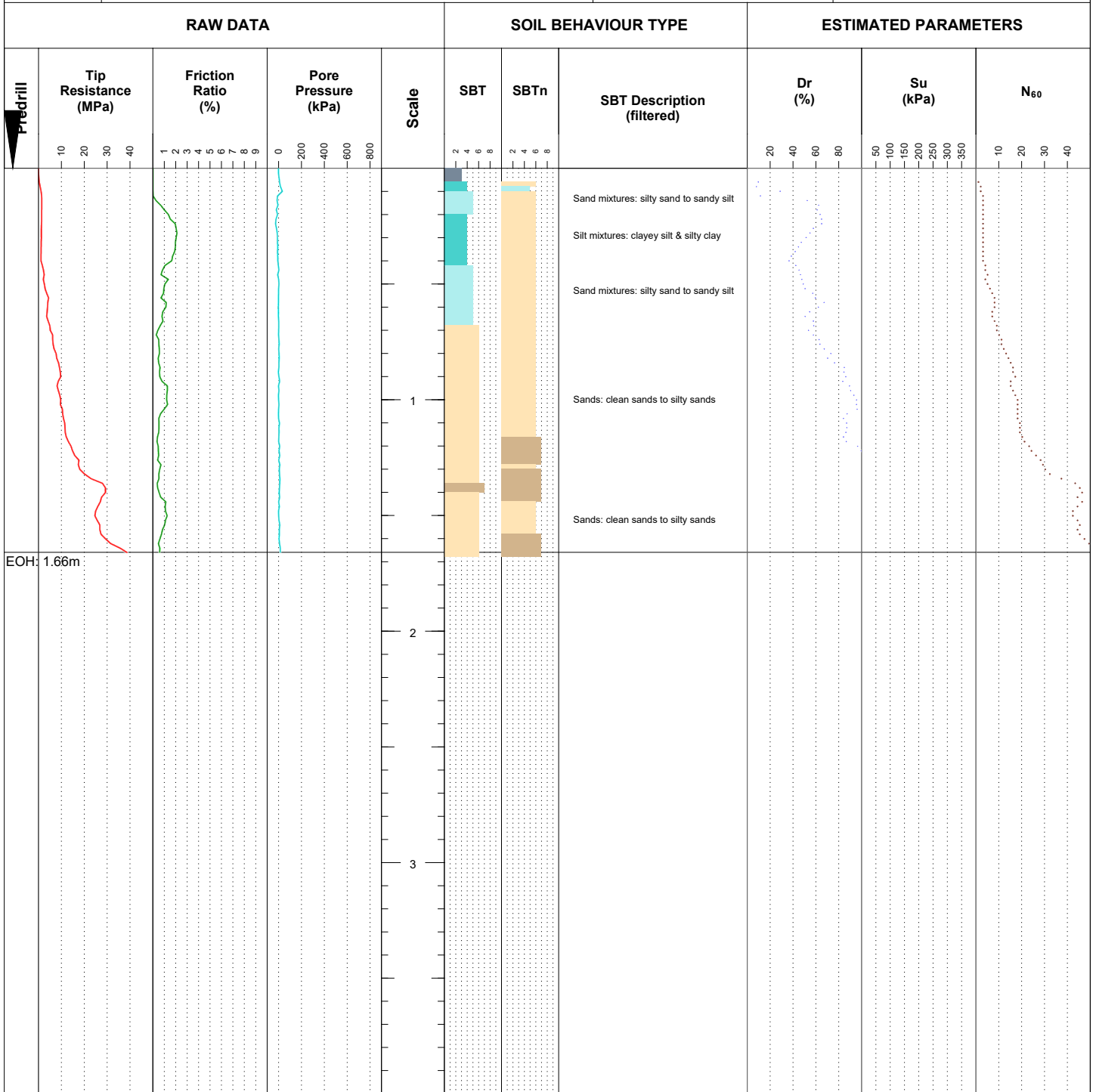
Termination: 35 TIP RESISTAN

North (m): 5602696.00

East (m): 1934594.00

Elevation (m): 0.00

Hole Depth (m): 1.66



Soil Behaviour Type (SBT) - Robertson et al. 1986

- 0 Undefined
- 1 Sensitive fine-grained
- 2 Clay - organic soil
- 3 Clays: clay to silty clay
- 4 Silt mixtures: clayey silt & silty clay
- 5 Sand mixtures: silty sand to sandy silt
- 6 Sands: clean sands to silty sands
- 7 Dense sand to gravelly sand
- 8 Stiff sand to clayey sand
- 9 Stiff fine-grained

Notes & Limitations

Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P. K. Robertson and K.L. Cabal (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use, and should be carefully reviewed by the user. Geroc Solutions Ltd do not warrant the correctness or the applicability of any of the geotechnical soil and design parameters shown and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Remarks

Hole Depth (m): 1.66

Sheet 3 of 8



CONE PENETRATION TEST

Job: 184250602

CPT No.: CPT04

Name: Arataki Road Subdivision Stage 1A
Client: Greenstone Land Developments Ltd
Location: 139 Arataki Road

Grid: NZTM

Datum: -

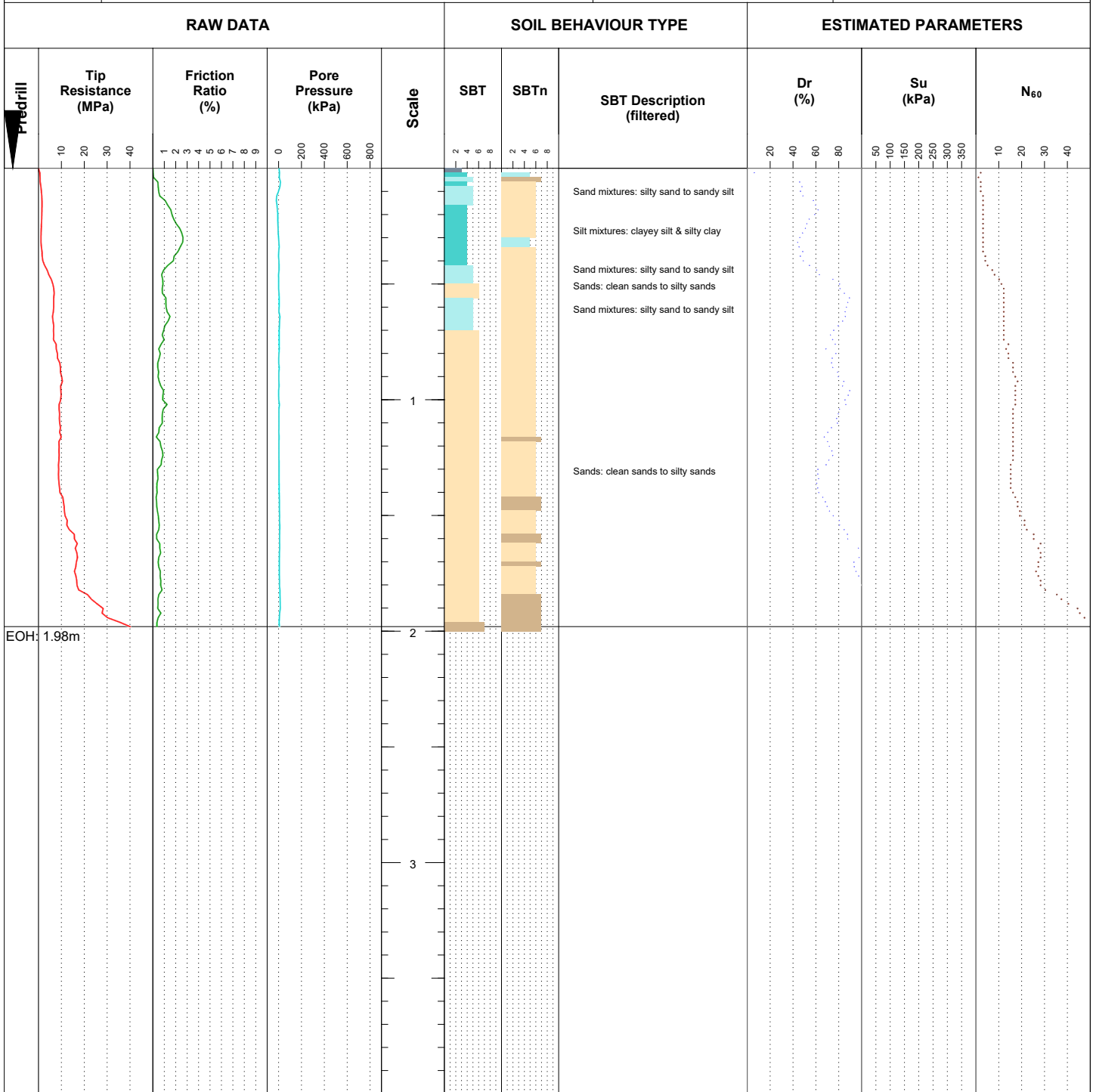
Termination: 35 TIP RESISTAN

North (m): 5602565.00

East (m): 1934669.00

Elevation (m): 0.00

Hole Depth (m): 1.98



Soil Behaviour Type (SBT) - Robertson et al. 1986

- | | |
|--|--|
| 0 Undefined | 5 Sand mixtures: silty sand to sandy silt |
| 1 Sensitive fine-grained | 6 Sands: clean sands to silty sands |
| 2 Clay - organic soil | 7 Dense sand to gravelly sand |
| 3 Clays: clay to silty clay | 8 Stiff sand to clayey sand |
| 4 Silt mixtures: clayey silt & silty clay | 9 Stiff fine-grained |

Notes & Limitations

Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P. K. Robertson and K.L. Cabal (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use, and should be carefully reviewed by the user. Geroc Solutions Ltd do not warrant the correctness or the applicability of any of the geotechnical soil and design parameters shown and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Remarks

Hole Depth (m): 1.98

Sheet 4 of 8



CONE PENETRATION TEST

Job: 184250602

CPT No.: CPT05

Name: Arataki Road Subdivision Stage 1A
 Client: Greenstone Land Developments Ltd
 Location: 139 Arataki Road

Grid: NZTM

Datum: -

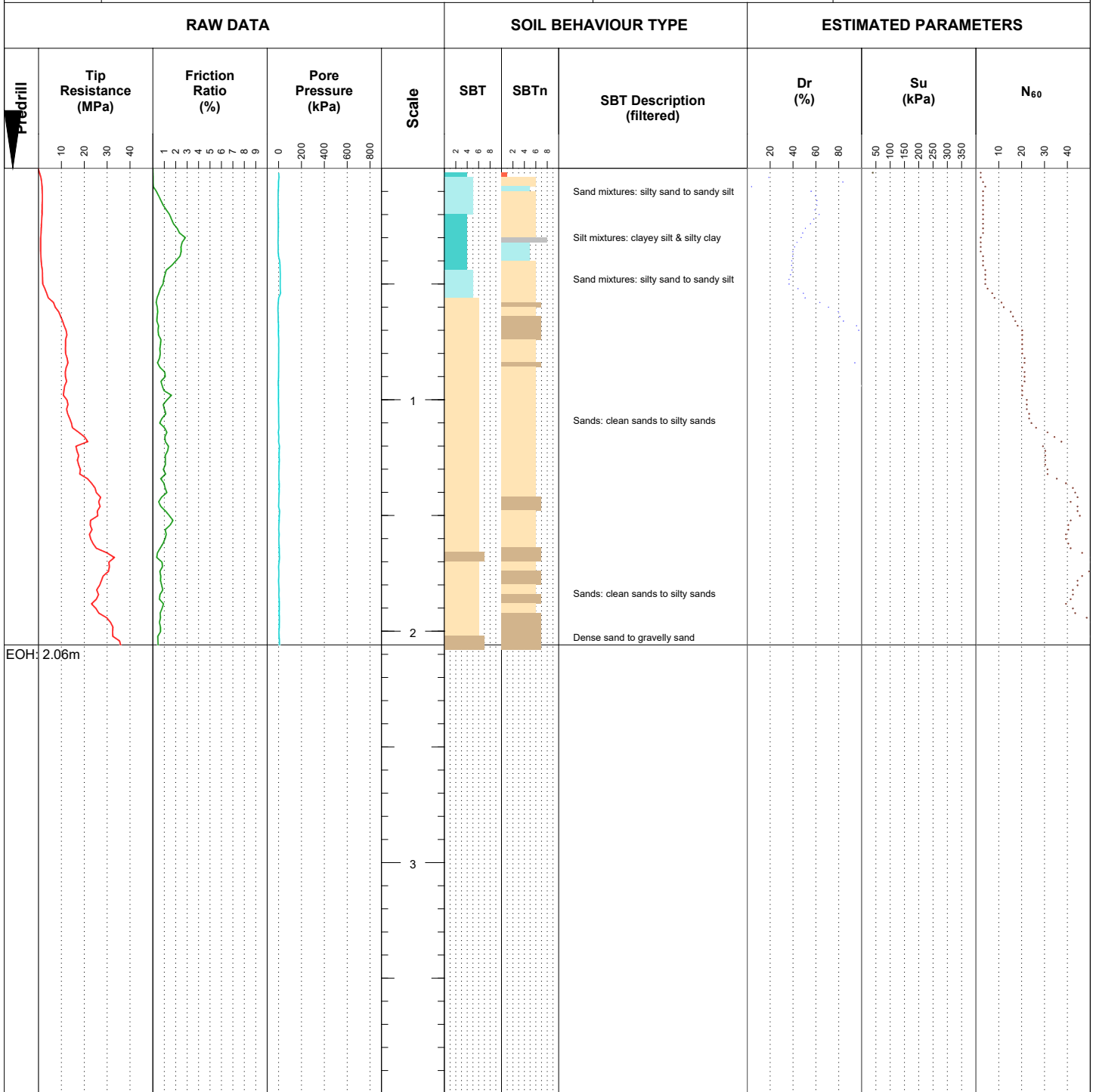
Termination: 35 TIP RESISTAN

North (m): 5602621.00

East (m): 1934709.00

Elevation (m): 0.00

Hole Depth (m): 2.06



Soil Behaviour Type (SBT) - Robertson et al. 1986

- | | |
|--|--|
| 0 Undefined | 5 Sand mixtures: silty sand to sandy silt |
| 1 Sensitive fine-grained | 6 Sands: clean sands to silty sands |
| 2 Clay - organic soil | 7 Dense sand to gravelly sand |
| 3 Clays: clay to silty clay | 8 Stiff sand to clayey sand |
| 4 Silt mixtures: clayey silt & silty clay | 9 Stiff fine-grained |

Notes & Limitations

Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P. K. Robertson and K.L. Cabal (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use, and should be carefully reviewed by the user. Geroc Solutions Ltd do not warrant the correctness or the applicability of any of the geotechnical soil and design parameters shown and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Remarks

Hole Depth (m): 2.06

Sheet 5 of 8



CONE PENETRATION TEST

Job: 184250602

CPT No.: CPT06

Name: Arataki Road Subdivision Stage 1A
Client: Greenstone Land Developments Ltd
Location: 139 Arataki Road

Grid: NZTM

Datum: -

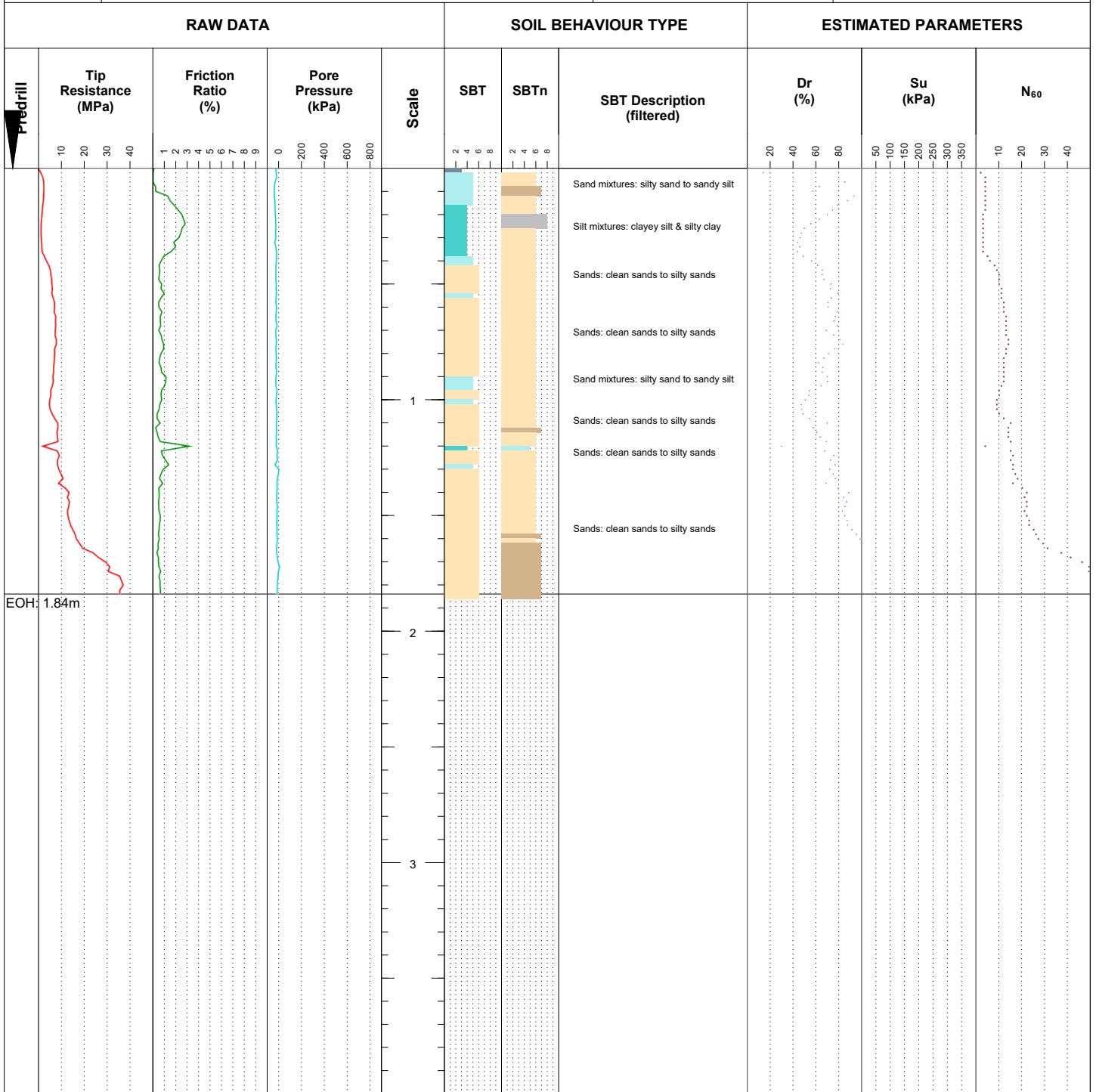
Termination: 35 TIP RESISTAN

North (m): 5602615.00

East (m): 1934769.00

Elevation (m): 0.00

Hole Depth (m): 1.84



Soil Behaviour Type (SBT) - Robertson et al. 1986

- | | |
|--|--|
| 0 Undefined | 5 Sand mixtures: silty sand to sandy silt |
| 1 Sensitive fine-grained | 6 Sands: clean sands to silty sands |
| 2 Clay - organic soil | 7 Dense sand to gravelly sand |
| 3 Clays: clay to silty clay | 8 Stiff sand to clayey sand |
| 4 Silt mixtures: clayey silt & silty clay | 9 Stiff fine-grained |

Notes & Limitations

Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P. K. Robertson and K.L. Cabal (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use, and should be carefully reviewed by the user. Geroc Solutions Ltd do not warrant the correctness or the applicability of any of the geotechnical soil and design parameters shown and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Remarks

Hole Depth (m): 1.84

Sheet 6 of 8



CONE PENETRATION TEST

Job: 184250602

CPT No.: CPT07

Name: Arataki Road Subdivision Stage 1A
Client: Greenstone Land Developments Ltd
Location: 139 Arataki Road

Grid: NZTM

Datum: -

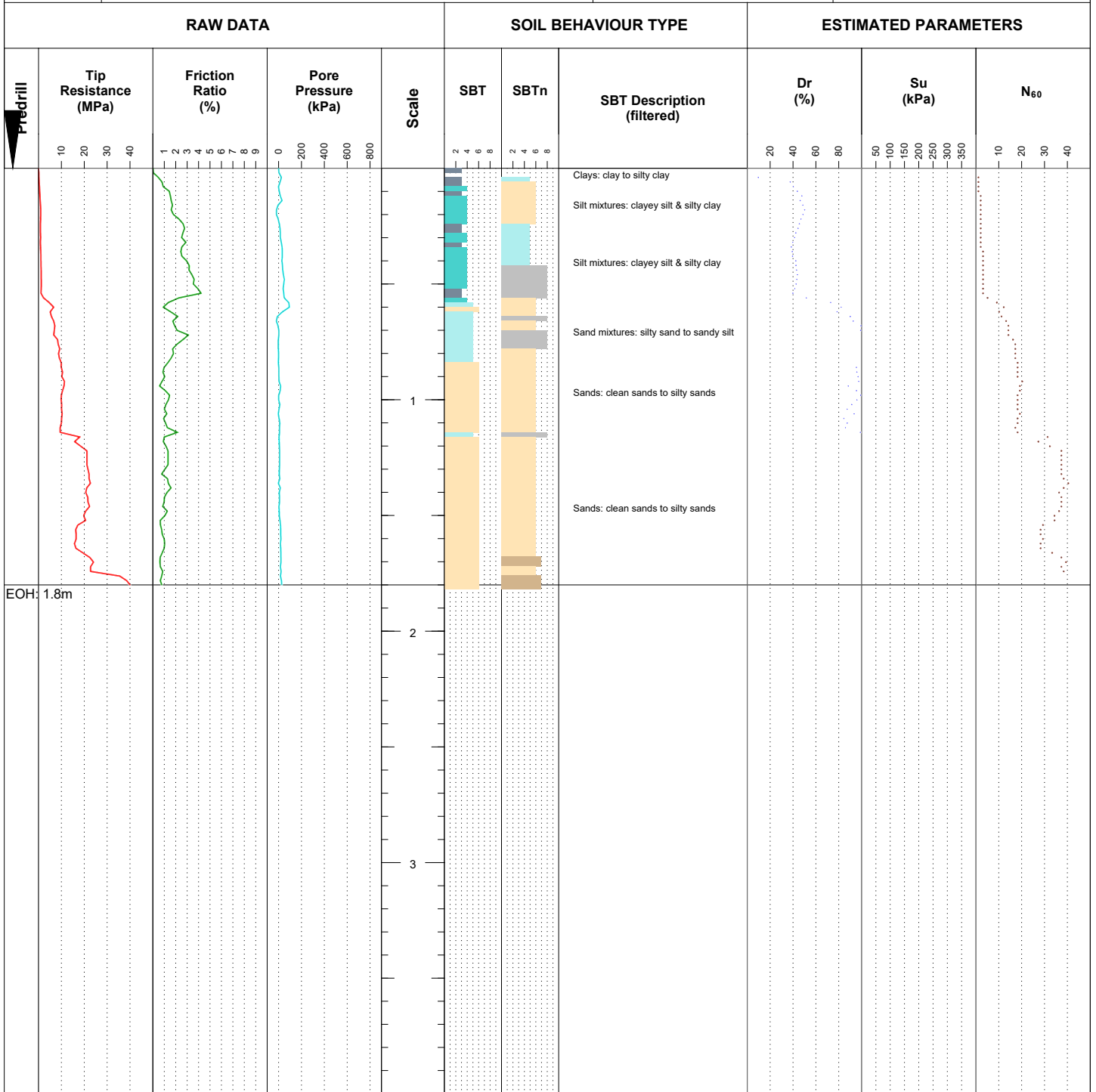
Termination: 35 TIP RESISTAN

North (m): 5602624.00

East (m): 1934636.00

Elevation (m): 0.00

Hole Depth (m): 1.80



Soil Behaviour Type (SBT) - Robertson et al. 1986

- 0** Undefined
- 1** Sensitive fine-grained
- 2** Clay - organic soil
- 3** Clays: clay to silty clay
- 4** Silt mixtures: clayey silt & silty clay
- 5** Sand mixtures: silty sand to sandy silt
- 6** Sands: clean sands to silty sands
- 7** Dense sand to gravelly sand
- 8** Stiff sand to clayey sand
- 9** Stiff fine-grained

Notes & Limitations

Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P. K. Robertson and K.L. Cabal (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use, and should be carefully reviewed by the user. Geroc Solutions Ltd do not warrant the correctness or the applicability of any of the geotechnical soil and design parameters shown and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Remarks

Hole Depth (m): 1.80

Sheet 7 of 8



CONE PENETRATION TEST

Job: 184250602

CPT No.: CPT08

Name: Arataki Road Subdivision Stage 1A
 Client: Greenstone Land Developments Ltd
 Location: 139 Arataki Road

Grid: NZTM

Datum: -

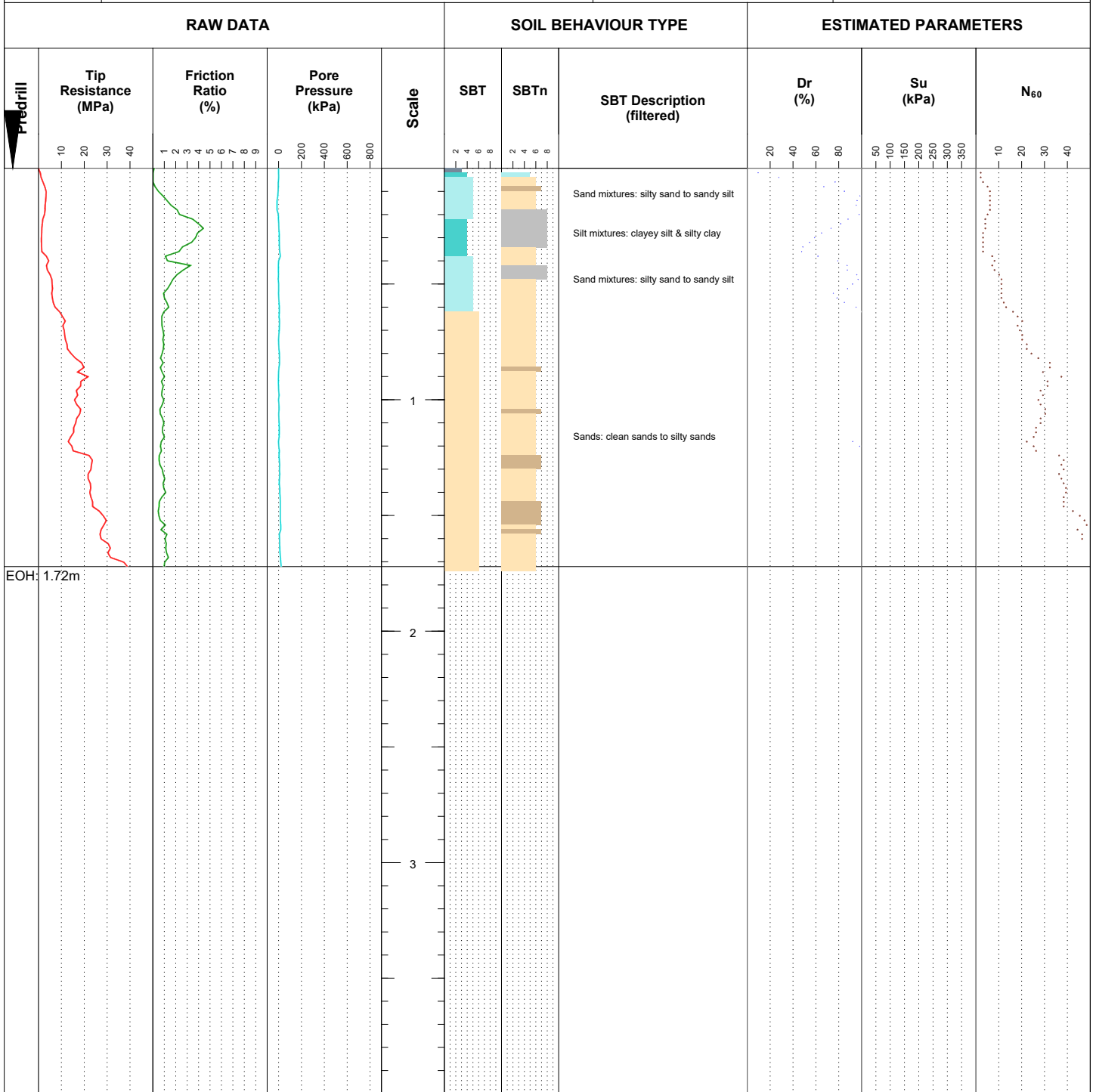
Termination: 35 TIP RESISTAN

North (m): 5602687.00

East (m): 1934666.00

Elevation (m): 0.00

Hole Depth (m): 1.72



Soil Behaviour Type (SBT) - Robertson et al. 1986

- 0 Undefined
- 1 Sensitive fine-grained
- 2 Clay - organic soil
- 3 Clays: clay to silty clay
- 4 Silt mixtures: clayey silt & silty clay
- 5 Sand mixtures: silty sand to sandy silt
- 6 Sands: clean sands to silty sands
- 7 Dense sand to gravelly sand
- 8 Stiff sand to clayey sand
- 9 Stiff fine-grained

Notes & Limitations

Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P. K. Robertson and K.L. Cabal (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use, and should be carefully reviewed by the user. Geroc Solutions Ltd do not warrant the correctness or the applicability of any of the geotechnical soil and design parameters shown and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Remarks

Hole Depth (m): 1.72

Sheet 8 of 8

SOUNDING DETAILS: CPT01**Sounding: 1**

Machine: Geoprobe 54LT	Water Level: -
Operator: TS	Tip Resistance Initial: 7.6345
Cone Reference: 4447	Tip Resistance Final: -0.0278
Cone Area Ratio: 0.85	Local Friction Initial: 123.5
Cone Type: -	Local Friction Final: 0.2
Date: 15/08/2018	Pore Pressure Initial: 238
Predrill: 0.00	Pore Pressure Final: -0.3

SOUNDING DETAILS: CPT02**Sounding: 1**

Machine: Geoprobe 54LT	Water Level: -
Operator: TS	Tip Resistance Initial: 7.612
Cone Reference: 4447	Tip Resistance Final: -0.0077
Cone Area Ratio: 0.85	Local Friction Initial: 123.8
Cone Type: -	Local Friction Final: -0.2
Date: 15/08/2018	Pore Pressure Initial: 238.5
Predrill: 0.00	Pore Pressure Final: -1

SOUNDING DETAILS: CPT03**Sounding: 2**

Machine: Geoprobe 54LT	Water Level: -
Operator: TS	Tip Resistance Initial: 7.5931
Cone Reference: 4447	Tip Resistance Final: -0.0189
Cone Area Ratio: 0.85	Local Friction Initial: 124.1
Cone Type: -	Local Friction Final: -0.5
Date: 15/08/2018	Pore Pressure Initial: 238.7
Predrill: 0.00	Pore Pressure Final: -1.8

SOUNDING DETAILS: CPT04**Sounding: 3**

Machine: Geoprobe 54LT	Water Level: -
Operator: TS	Tip Resistance Initial: 7.6232
Cone Reference: 4447	Tip Resistance Final: -0.0023
Cone Area Ratio: 0.85	Local Friction Initial: 123.4
Cone Type: -	Local Friction Final: 0.3
Date: 15/08/2018	Pore Pressure Initial: 235.3
Predrill: 0.00	Pore Pressure Final: 2.1

SOUNDING DETAILS: CPT05**Sounding: 4**

Machine: Geoprobe 54LT	Water Level: -
Operator: TS	Tip Resistance Initial: 7.6232
Cone Reference: 4447	Tip Resistance Final: 0.0219
Cone Area Ratio: 0.85	Local Friction Initial: 123.7
Cone Type: -	Local Friction Final: -0.3
Date: 15/08/2018	Pore Pressure Initial: 238.8
Predrill: 0.00	Pore Pressure Final: -1.7

SOUNDING DETAILS: CPT06**Sounding: 5**

Machine: Geoprobe 54LT	Water Level: -
Operator: TS	Tip Resistance Initial: 7.6256
Cone Reference: 4447	Tip Resistance Final: -0.0036
Cone Area Ratio: 0.85	Local Friction Initial: 123.8
Cone Type: -	Local Friction Final: 0.1
Date: 15/08/2018	Pore Pressure Initial: 260.6
Predrill: 0.00	Pore Pressure Final: -2

SOUNDING DETAILS: CPT07**Sounding: 1**

Machine: Geoprobe 54LT	Water Level: -
Operator: TS	Tip Resistance Initial: 7.6481
Cone Reference: 4447	Tip Resistance Final: -0.0515
Cone Area Ratio: 0.85	Local Friction Initial: 123.4
Cone Type: -	Local Friction Final: 0.2
Date: 16/08/2018	Pore Pressure Initial: 238.4
Predrill: 0.00	Pore Pressure Final: -0.9

SOUNDING DETAILS: CPT08**Sounding: 1**

Machine: Geoprobe 54LT	Water Level: -
Operator: TS	Tip Resistance Initial: 7.6463
Cone Reference: 4447	Tip Resistance Final: 0.0148
Cone Area Ratio: 0.85	Local Friction Initial: 123.4
Cone Type: -	Local Friction Final: 0
Date: 16/08/2018	Pore Pressure Initial: 238.9
Predrill: 0.00	Pore Pressure Final: -1.2

APPENDIX C

TEST PIT BASED LIQUEFACTION ASSESSMENT

Liquefaction Assessment Report

PEYSANJ
geotechnical engineering software

Designed & Programmed by: Alireza Afkhami (MAsc, MCP, PEng)
www.NovotechSoftware.com

Project Title: Liquefaction Assessment
Client: Greenstone land Developments Ltd
Address: Havelock North
Job Code: 184250602

**Resource Development Consultants
Ltd**
Geotechnical Engineers
Hawke's Bay
www.rdcl.co.nz

PGA max : 0.11

M=7.5

Water Level : 1.5 m

Analysis Method : Japan' Bridge Code

MSF Method : Seed & Idriss (1982)

MSF = 1

Minimum Required Factor of Safety : 1.0

Depth (m)	SPT
0.3	1
0.6	8
0.8	10
1	12
1.4	12
2.5	35
2.8	35
3.5	35

Thickness (m)	Density (kN/m ³)	Bottom (m)	D50 (mm)	Fines Content (%)
0.3	16	0.3	100	60
0.3	18	0.6	100	40
0.2	18	0.8	80	5
0.2	20	1	75	15
0.4	20	1.4	100	10
2.1	22	3.5	20	15

Project Title: Liquifaction Assessment
Client: Greenstone land Developments Ltd
Address: Havelock North
Job Code: 184250602

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Hawke's Bay
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Project Title: Liquefaction Assessment
Client: Greenstone land Developments Ltd
Address: Havelock North
Job Code: 184250602

**Resource Development Consultants
 Ltd**
 Geotechnical Engineers
 Hawke's Bay
 www.rdcl.co.nz

∴ Notes:

Sv : Total overburden stress S'v : Effective overburden stress
 Cn : SPT correction factor Ks : K(sigma) due to the effect of overburden stress
 CRR : Cyclic Resistance Ratio CSR : Cyclic Stress Ratio
 LDI : Lateral Displacement Index St : Post-liquefaction settlement of the site
 Sr : Post-liquefaction residual strength

∴ Total estimated post-liquefaction movements:

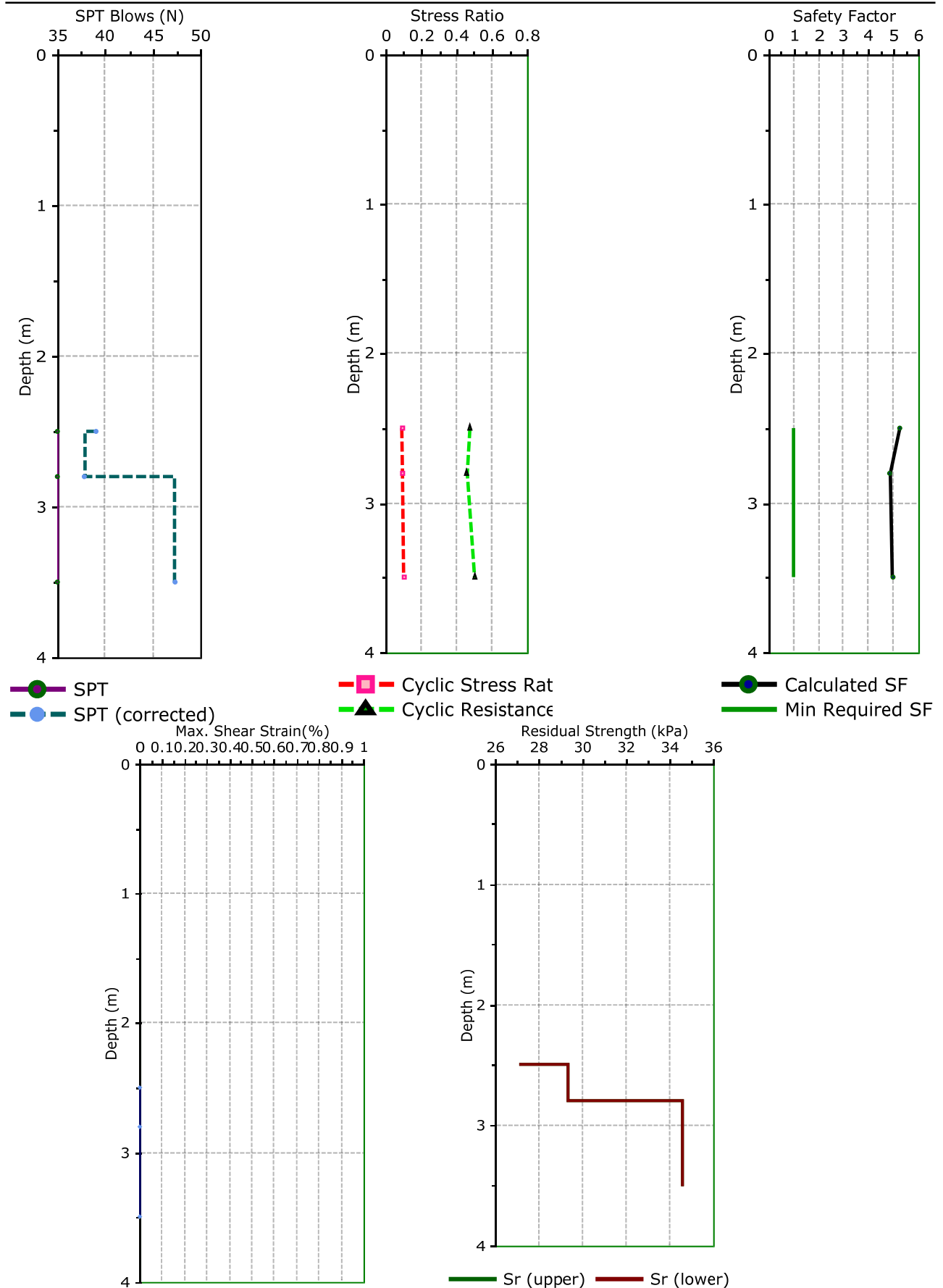
Lateral Displacement =0 m

Site Settlement =0 m

Depth (m)	Sv (kPa)	S'v (kPa)	D50 (mm)	SPT	Cn,Cr,Cb,Cs	Corr. SPT	Ks	CRR	CSR	Factor of Safety	Max. Shear Strain (%)	LDI (m)	St (m)	Min. Sr (kPa)	Max. Sr (kPa)
2.5	49.99	38.7	20	35	1.34	39.1	1	0.48	0.091	5.26	0	0	0	0.28	0.28
2.8	56.58	41.91	20	35	1.3	37.9	1	0.46	0.094	4.88	0	0	0	0.3	0.3
3.5	71.98	49.4	20	35	1.62	47.3	1	0.5	0.101	4.96	0	0	0	0.35	0.35

Project Title: Liquifaction Assessment
Client: Greenstone land Developments Ltd
Address: Havelock North
Job Code: 184250602

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Ltd**
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Hawke's Bay
www.rdcl.co.nz



Liquefaction Assessment Report

PEYSANJ
geotechnical engineering software

Designed & Programmed by: Alireza Afkhami (MAsc, MCP, PEng)
www.NovotechSoftware.com

Project Title: Liquefaction Assessment
Client: Greenstone land Developments Ltd
Address: Havelock North
Job Code: 184250602

**Resource Development Consultants
Ltd**
Geotechnical Engineers
Hawke's Bay
www.rdcl.co.nz

PGA max : 0.44

M=7.5

Water Level : 1.5 m

Analysis Method : Japan' Bridge Code

MSF Method : Seed & Idriss (1982)

MSF = 1

Minimum Required Factor of Safety : 1.0

Depth (m)	SPT
0.3	1
0.6	8
0.8	10
1	12
1.4	12
2.5	35
2.8	35
3.5	35

Thickness (m)	Density (kN/m ³)	Bottom (m)	D50 (mm)	Fines Content (%)
0.3	16	0.3	100	60
0.3	18	0.6	100	40
0.2	18	0.8	80	5
0.2	20	1	75	15
0.4	20	1.4	100	10
2.1	22	3.5	20	15

Project Title: Liquifaction Assessment
Client: Greenstone land Developments Ltd
Address: Havelock North
Job Code: 184250602

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Project Title: Liquefaction Assessment
Client: Greenstone land Developments Ltd
Address: Havelock North
Job Code: 184250602

**Resource Development Consultants
 Ltd**
 Geotechnical Engineers
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∴ Notes:

Sv : Total overburden stress S'v : Effective overburden stress
 Cn : SPT correction factor Ks : K(sigma) due to the effect of overburden stress
 CRR : Cyclic Resistance Ratio CSR : Cyclic Stress Ratio
 LDI : Lateral Displacement Index St : Post-liquefaction settlement of the site
 Sr : Post-liquefaction residual strength

∴ Total estimated post-liquefaction movements:

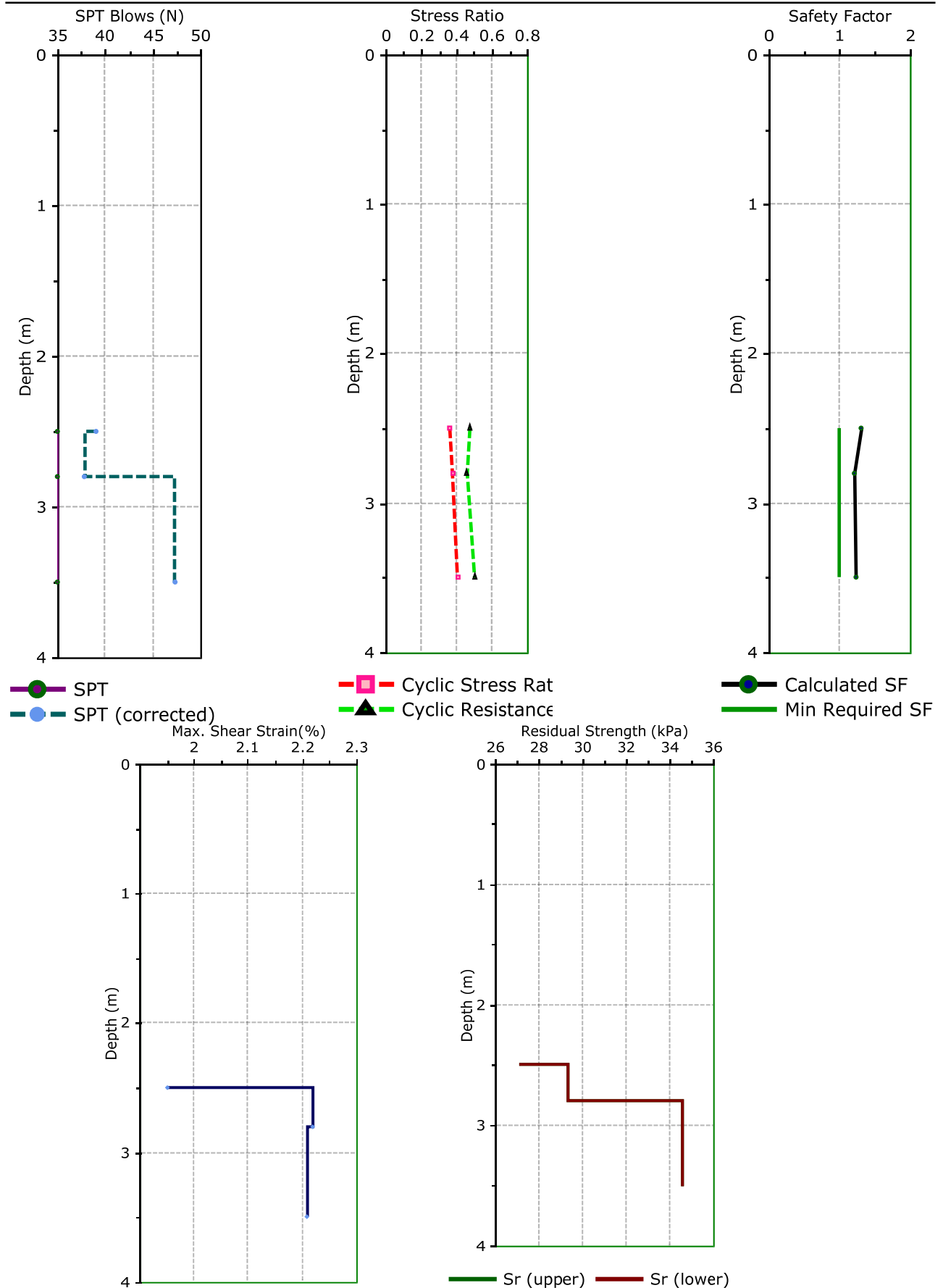
Lateral Displacement =0.03 m

Site Settlement =0 m

Depth (m)	Sv (kPa)	S'v (kPa)	D50 (mm)	SPT	Cn,Cr,Cb,Cs	Corr. SPT	Ks	CRR	CSR	Factor of Safety	Max. Shear Strain (%)	LDI (m)	St (m)	Min. Sr (kPa)	Max. Sr (kPa)
2.5	49.99	38.7	20	35	1.34	39.1	1	0.48	0.362	1.32	1.95	4.87	0	0.28	0.28
2.8	56.58	41.91	20	35	1.3	37.9	1	0.46	0.378	1.22	2.22	5.53	0	0.3	0.3
3.5	71.98	49.4	20	35	1.62	47.3	1	0.5	0.406	1.24	2.21	7.08	0	0.35	0.35

Project Title: Liquifaction Assessment
Client: Greenstone land Developments Ltd
Address: Havelock North
Job Code: 184250602

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APPENDIX D

CPT BASED LIQUEFACTION ASSESSMENT

LIQUEFACTION ANALYSIS REPORT

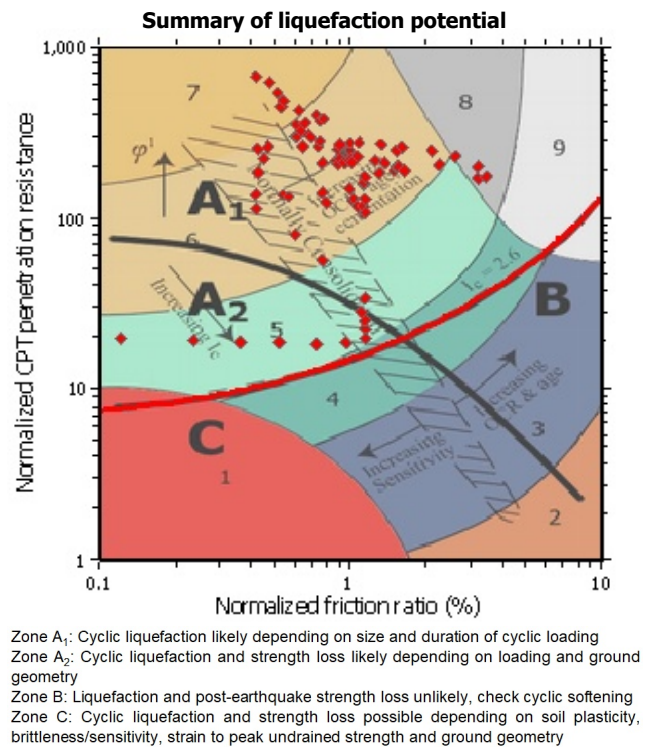
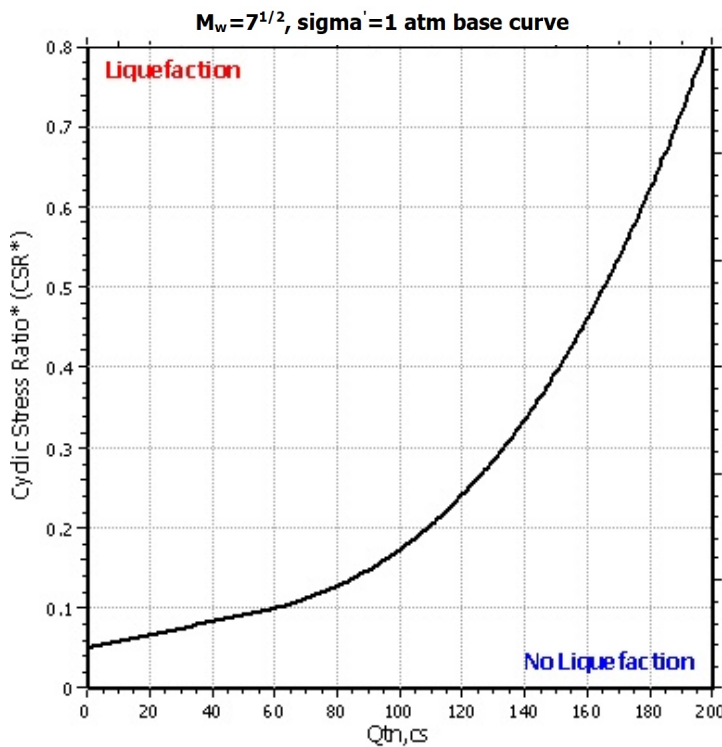
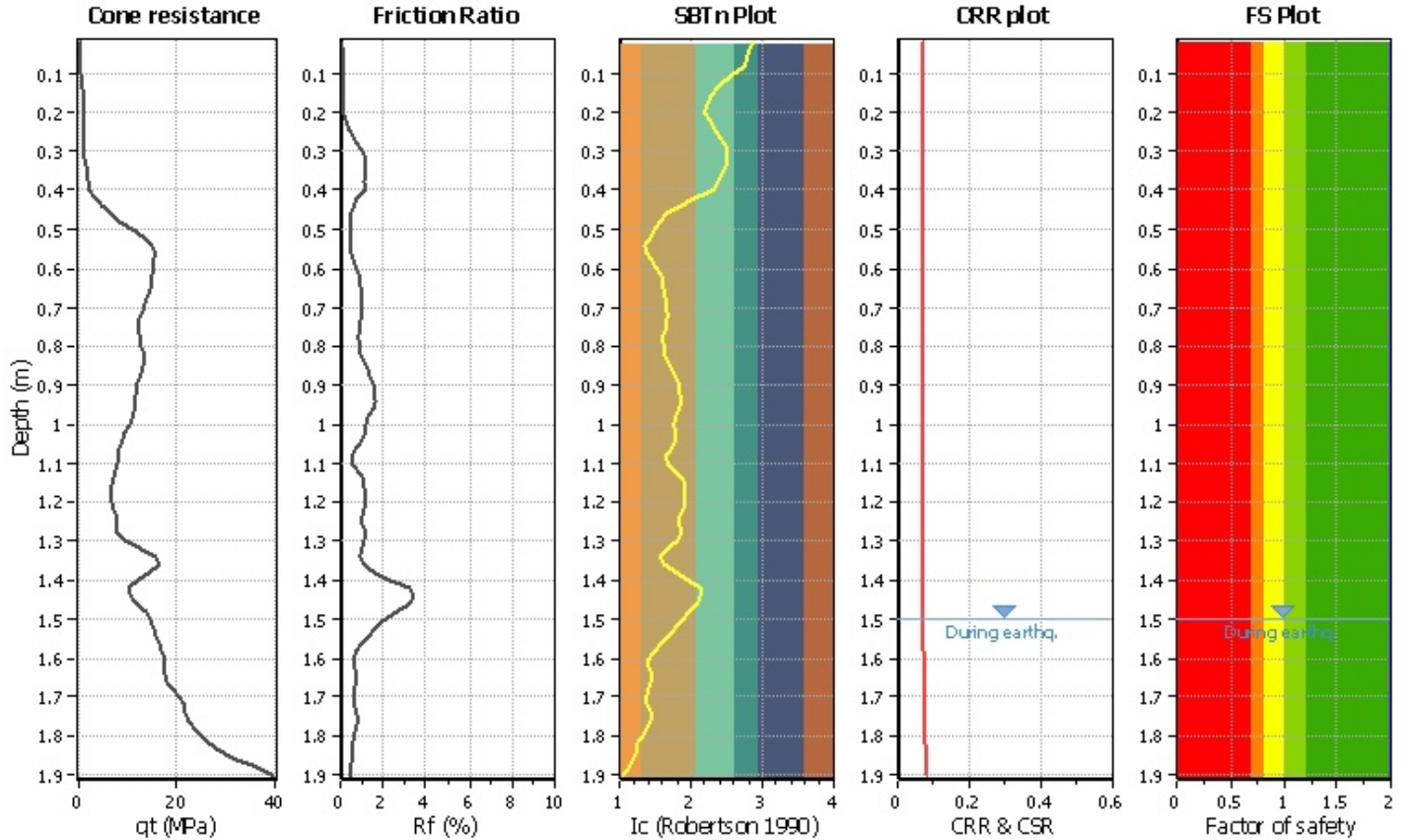
Project title : Geotechnical Investigation

Location : Arataki Road Subdivision

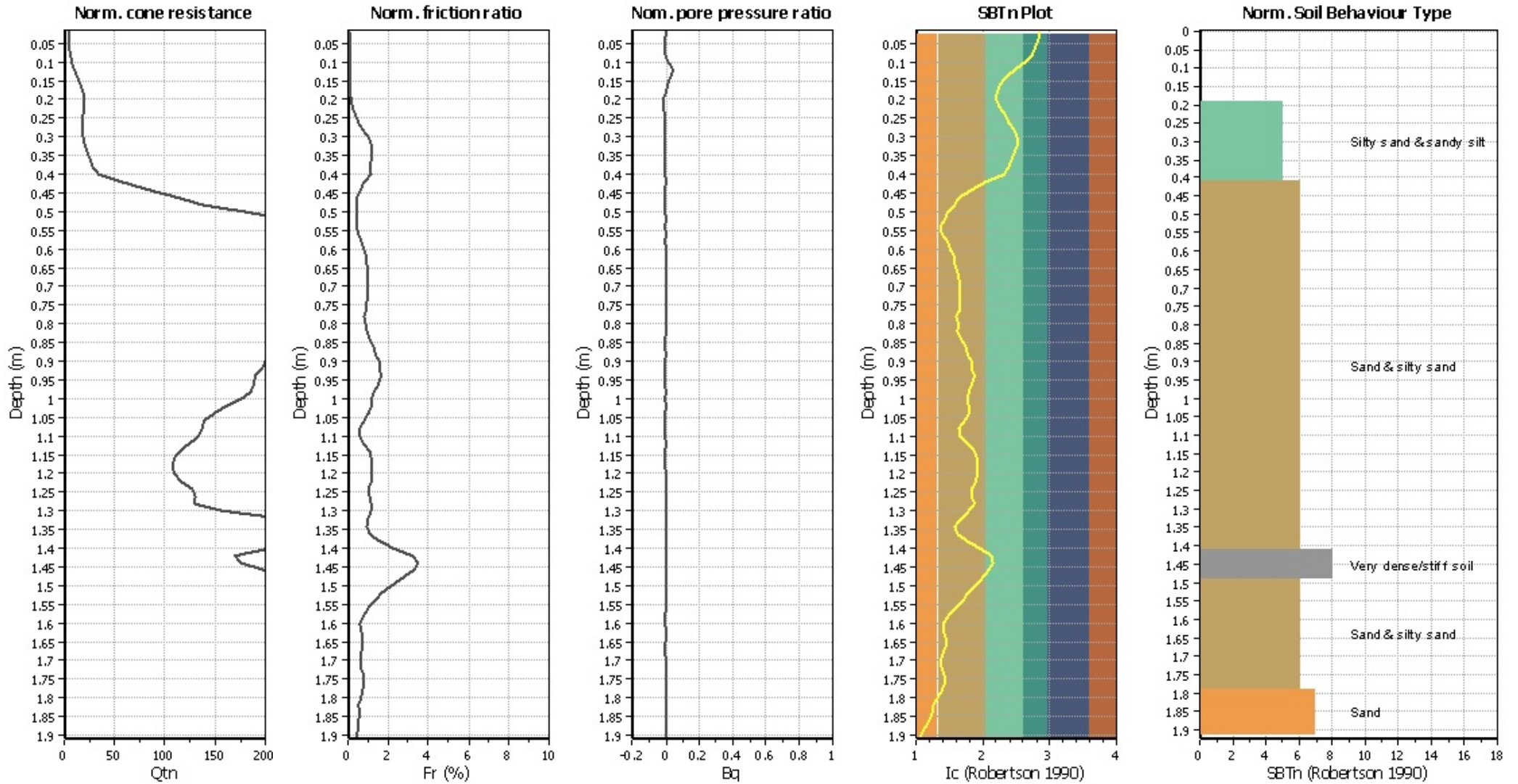
CPT file : CPT01_SLS

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.11	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:	Method based



CPT basic interpretation plots (normaliz



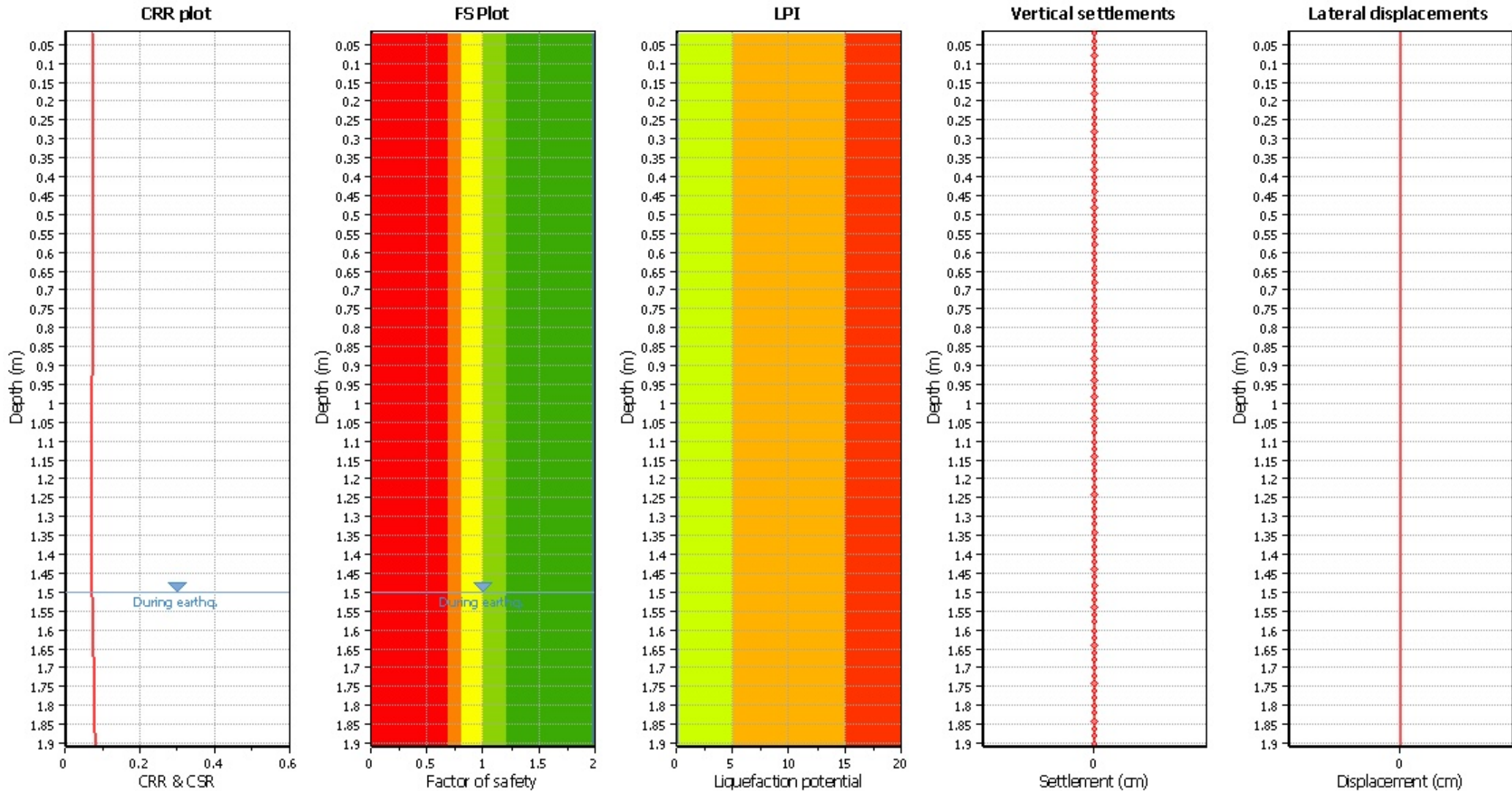
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.11	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	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 :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.11	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

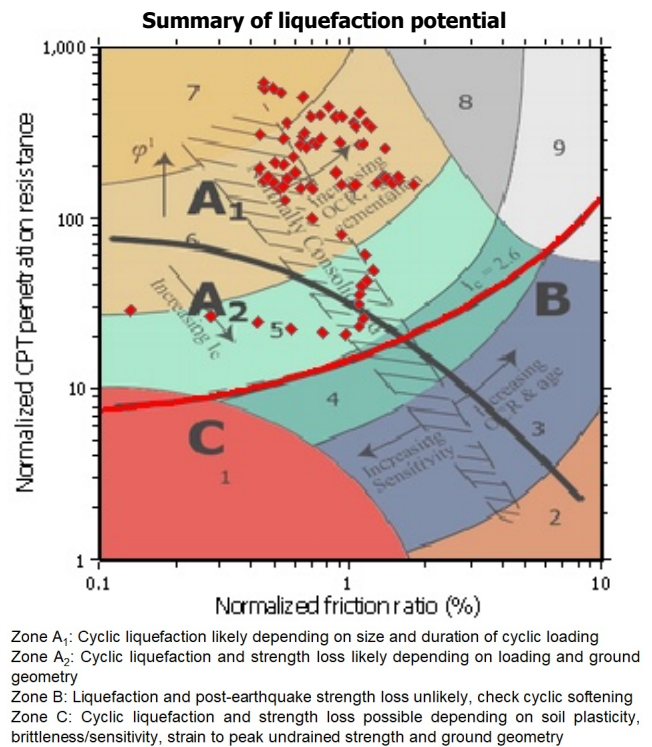
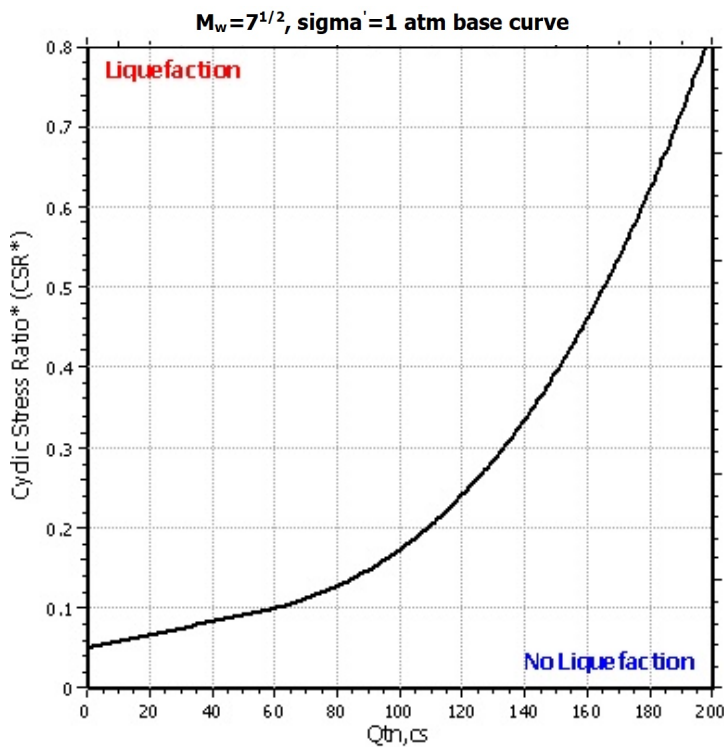
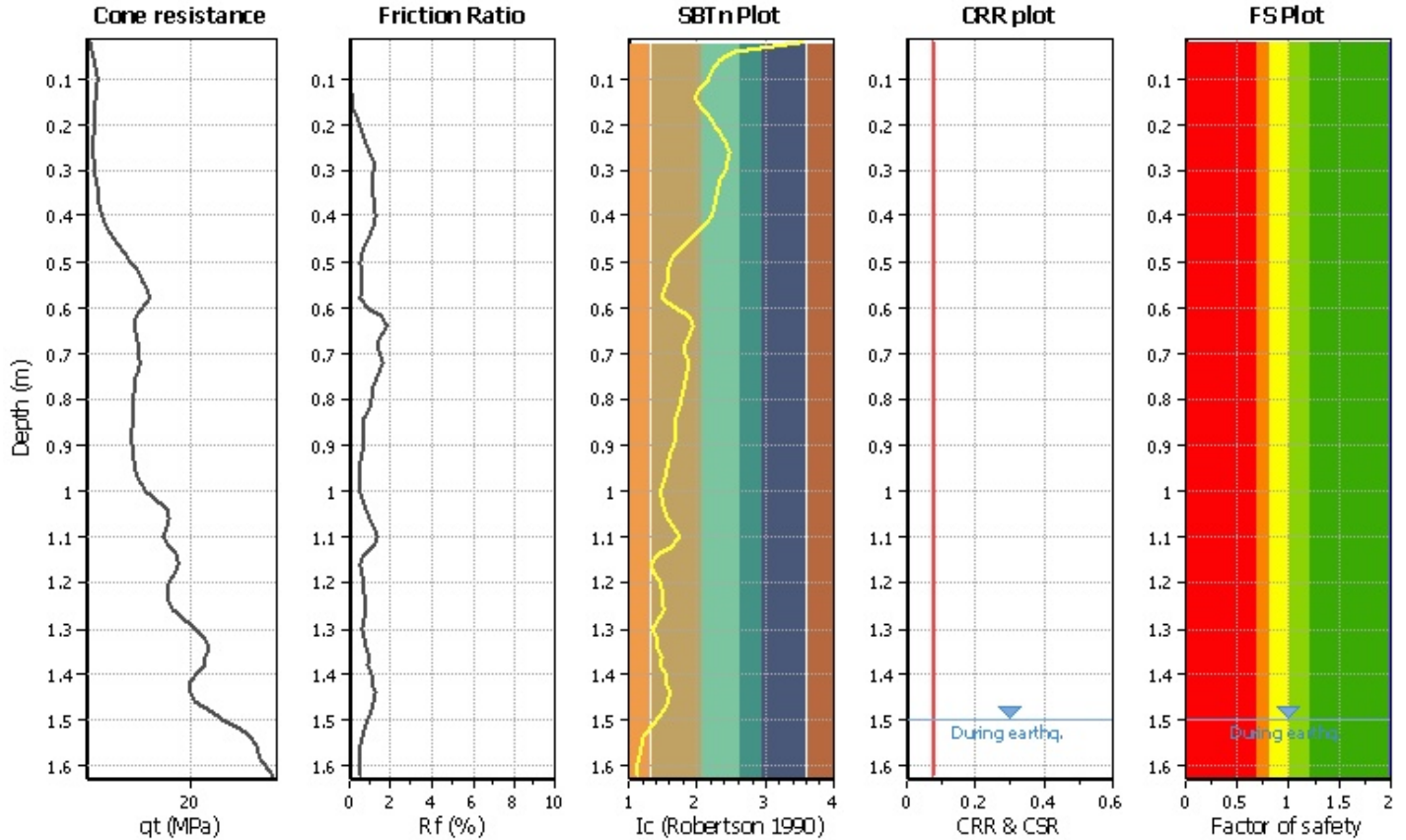
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

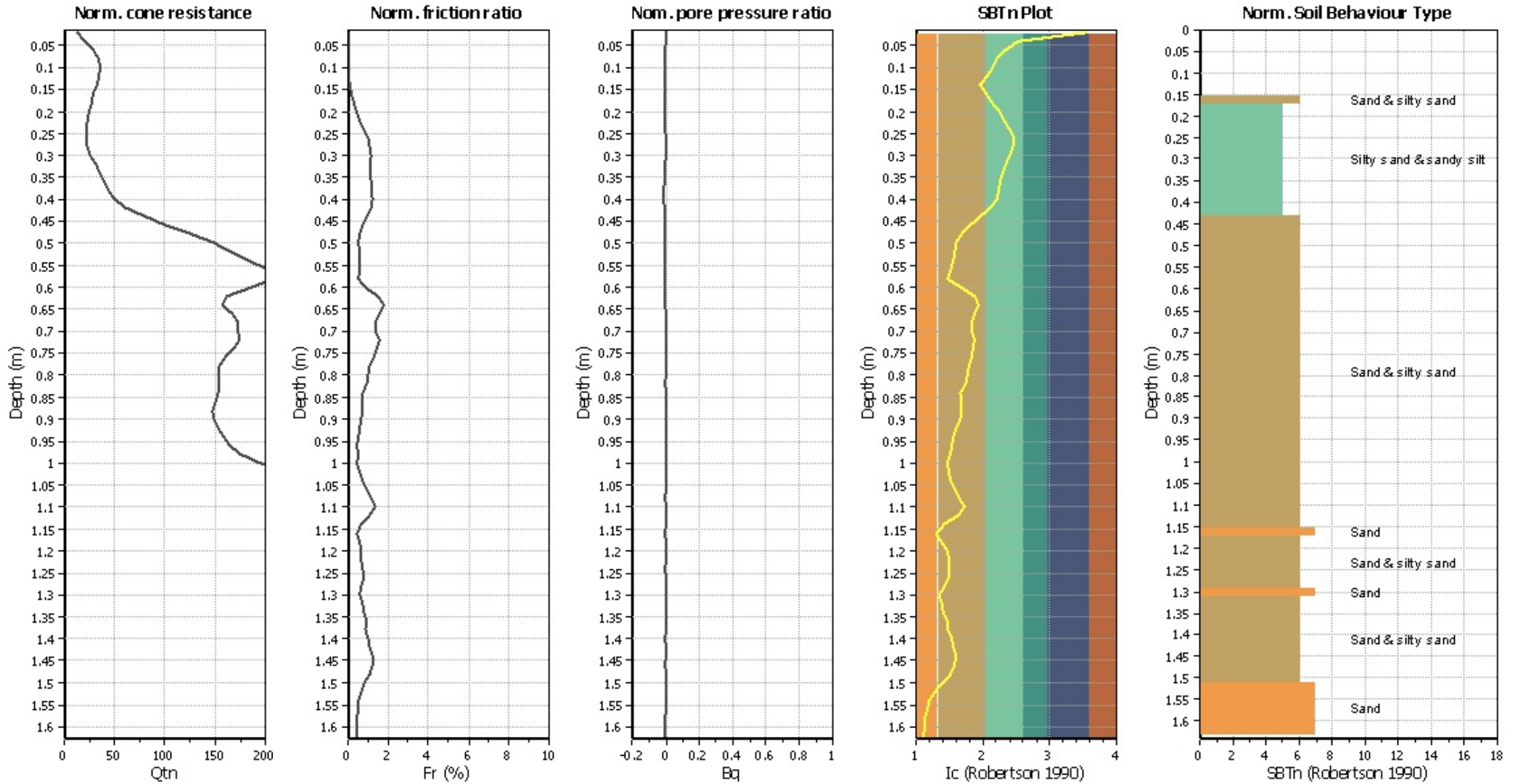
- Very high risk
- High risk
- Low risk

LIQUEFACTION ANALYSIS REPORT
Project title : Geotechnical Investigation
Location : Arataki Road Subdivision
CPT file : CPT02_SLS
Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.11	Unit weight calculation:	Based on SBT	K_0 applied:	Yes		



CPT basic interpretation plots (normaliz



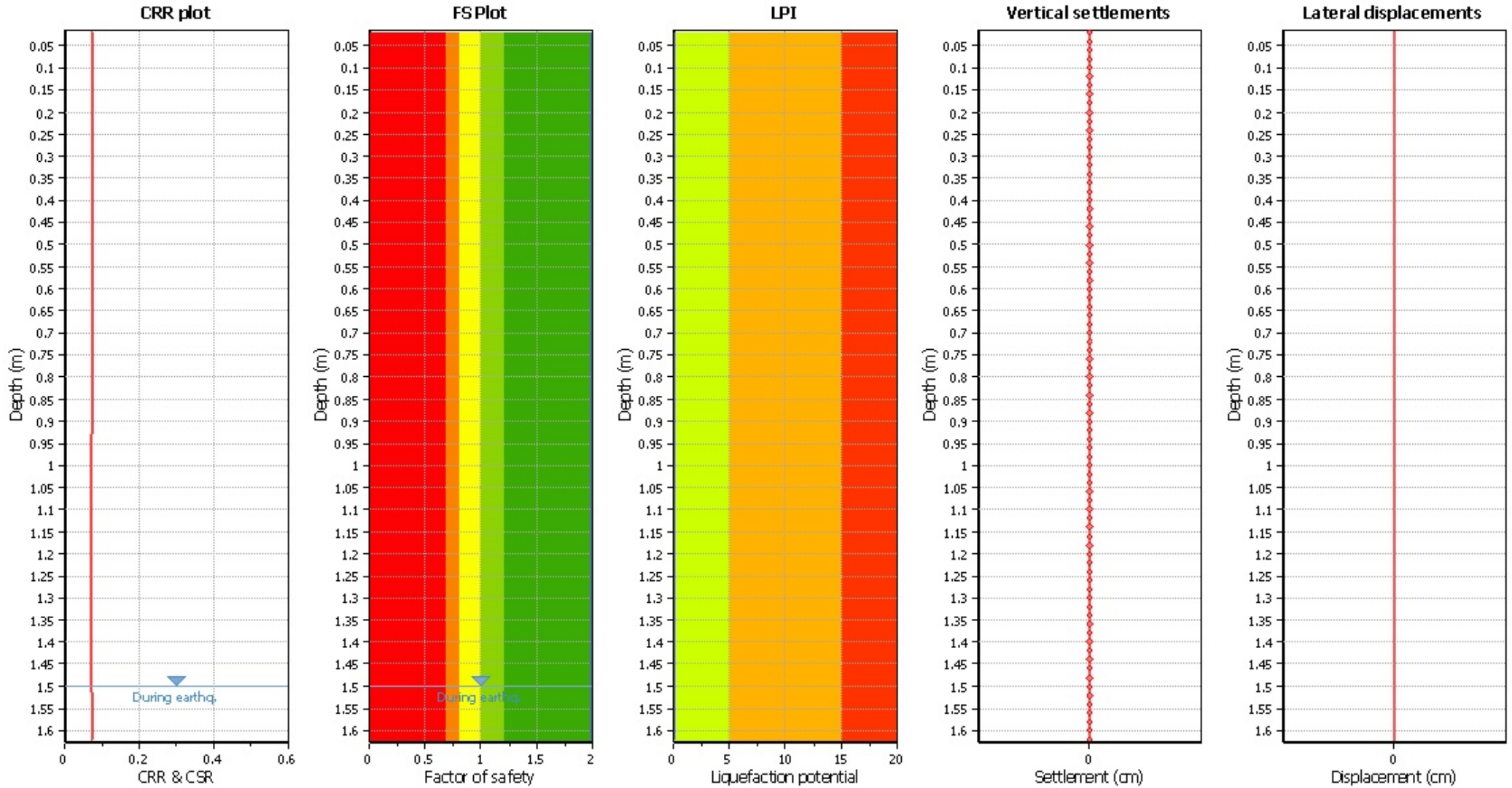
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.11	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_0 applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.11	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

LIQUEFACTION ANALYSIS REPORT

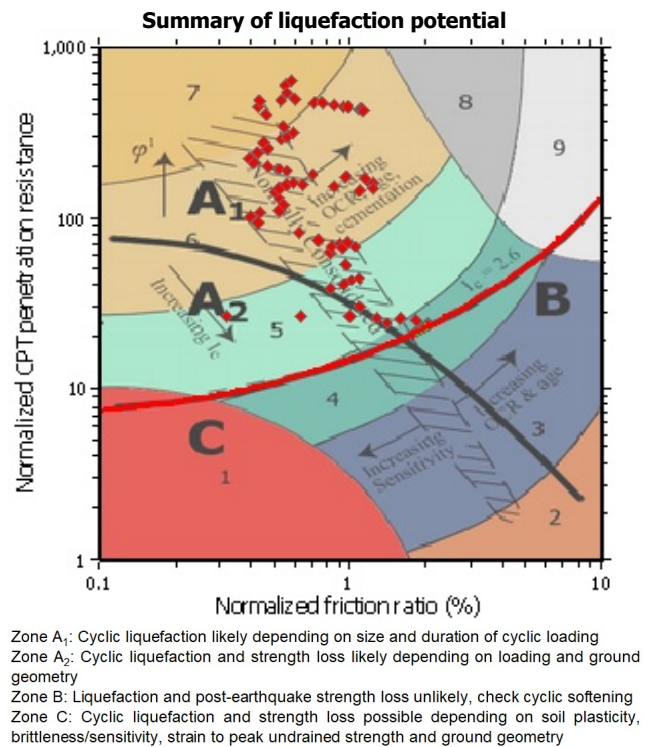
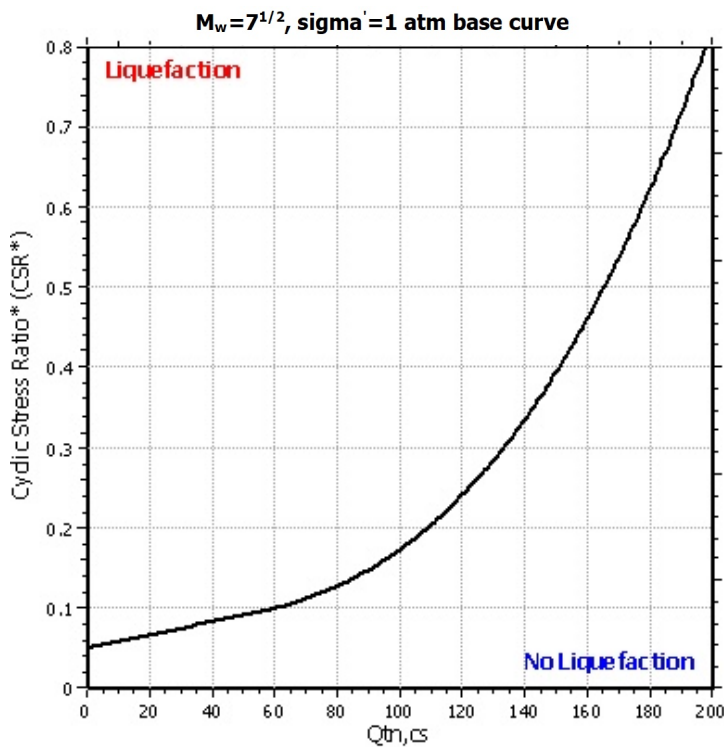
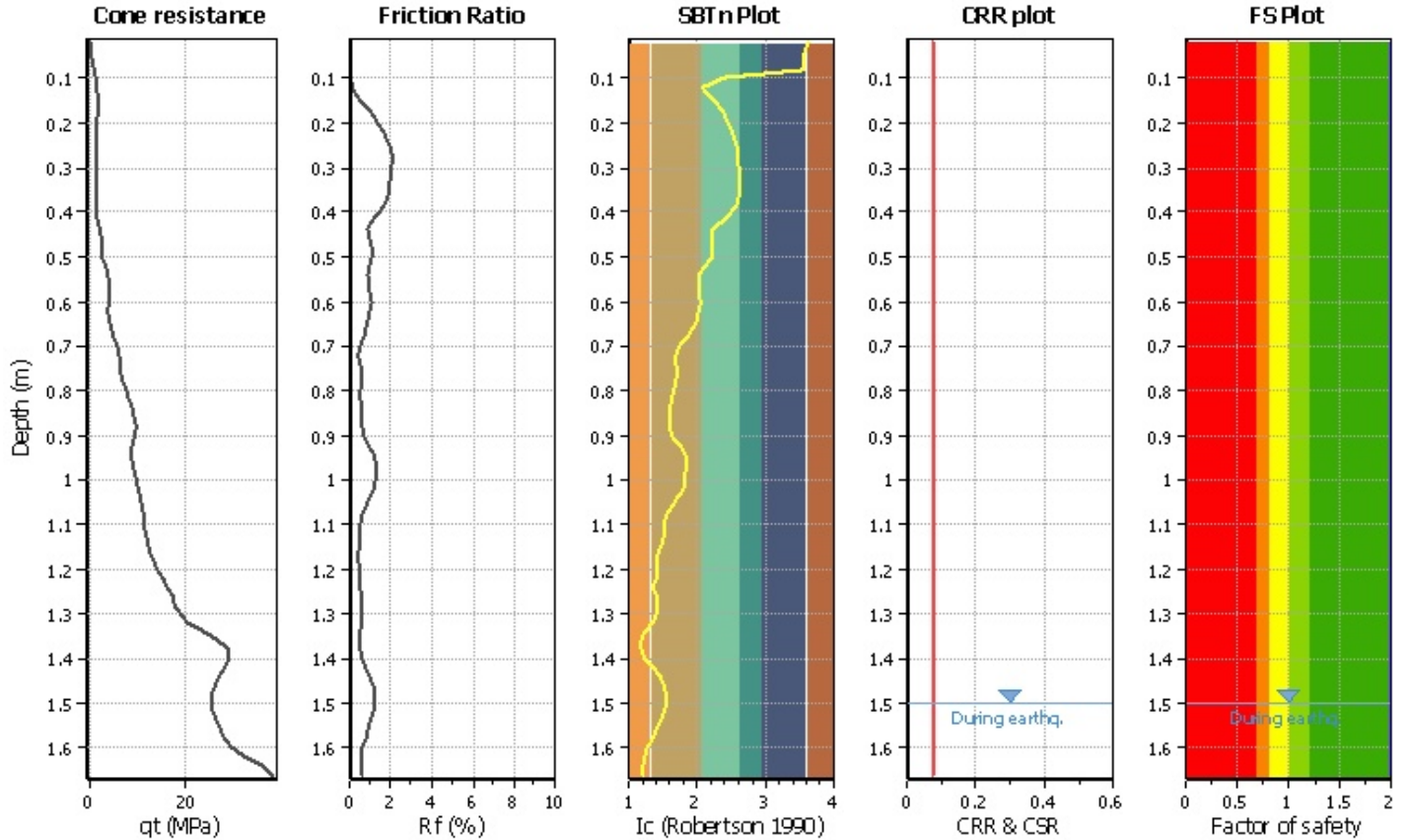
Project title : Geotechnical Investigation

Location : Arataki Road Subdivision

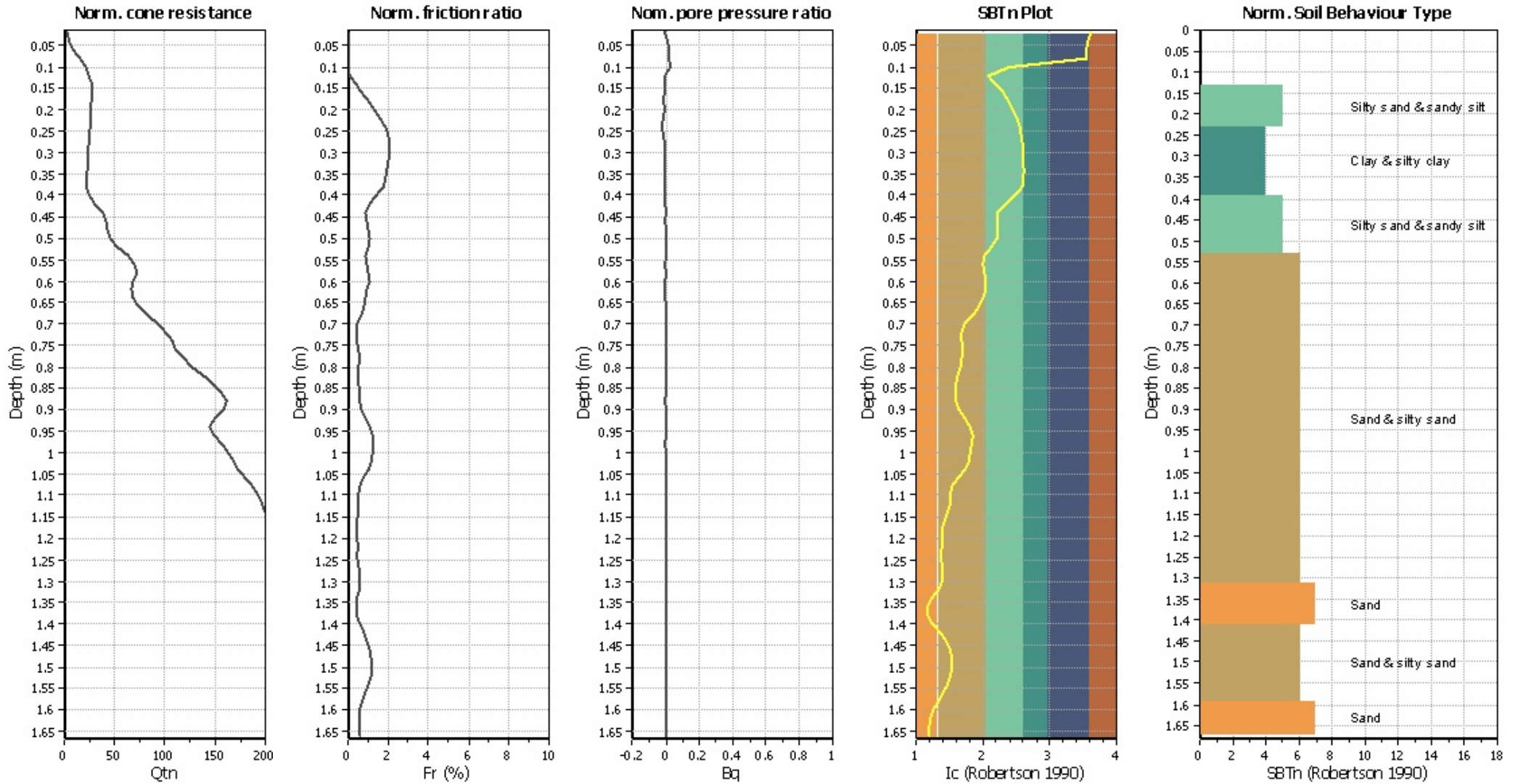
CPT file : CPT03_SLS

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.11	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



CPT basic interpretation plots (normaliz



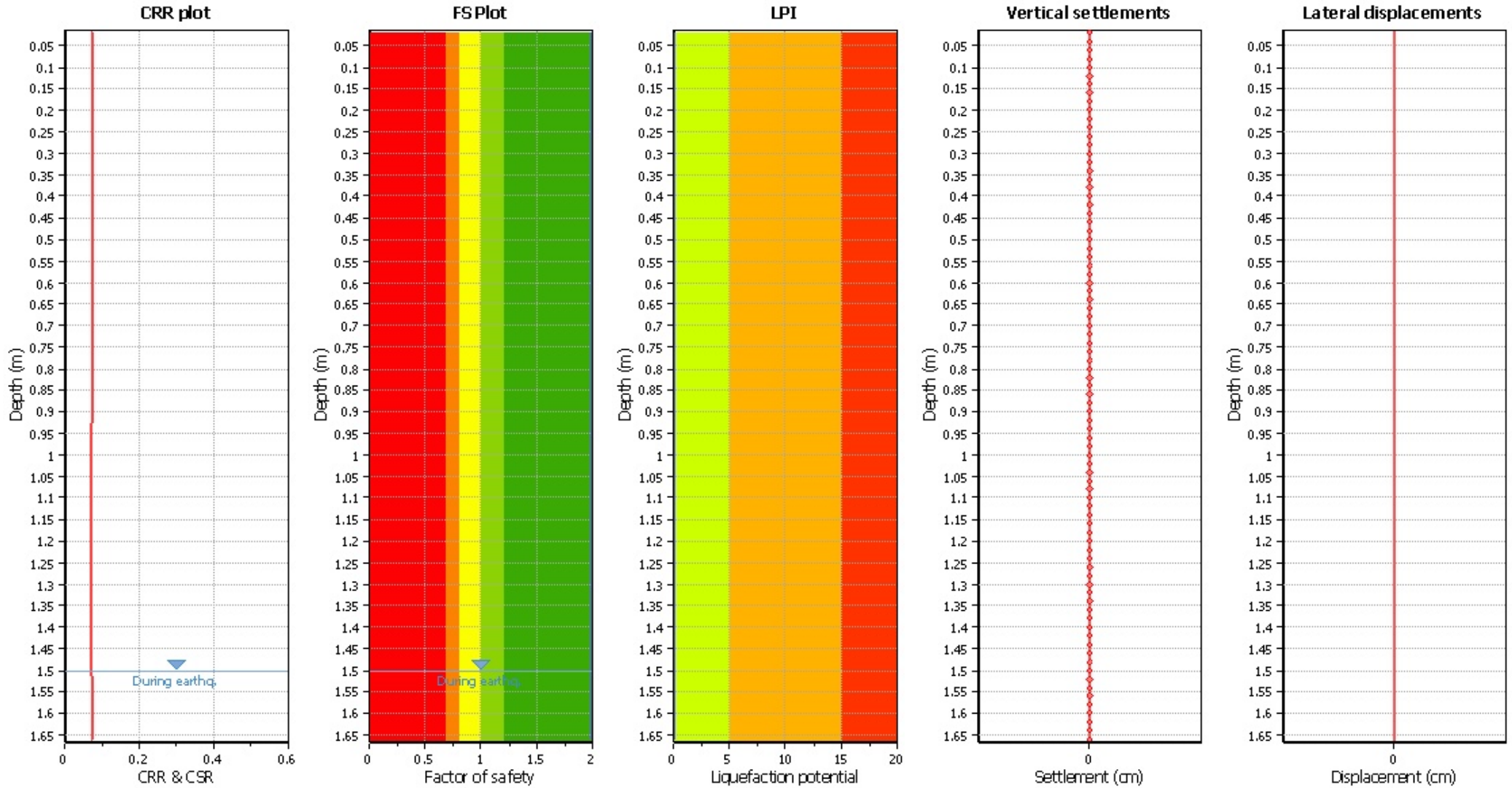
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_0 applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.11	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_0 applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.11	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

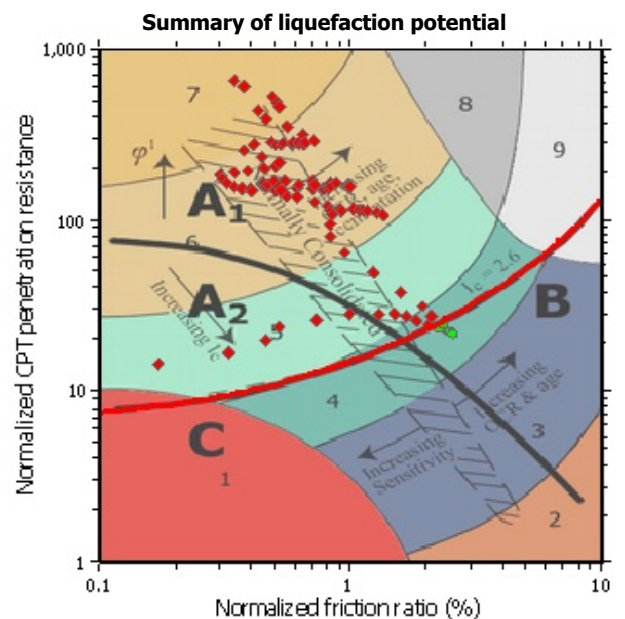
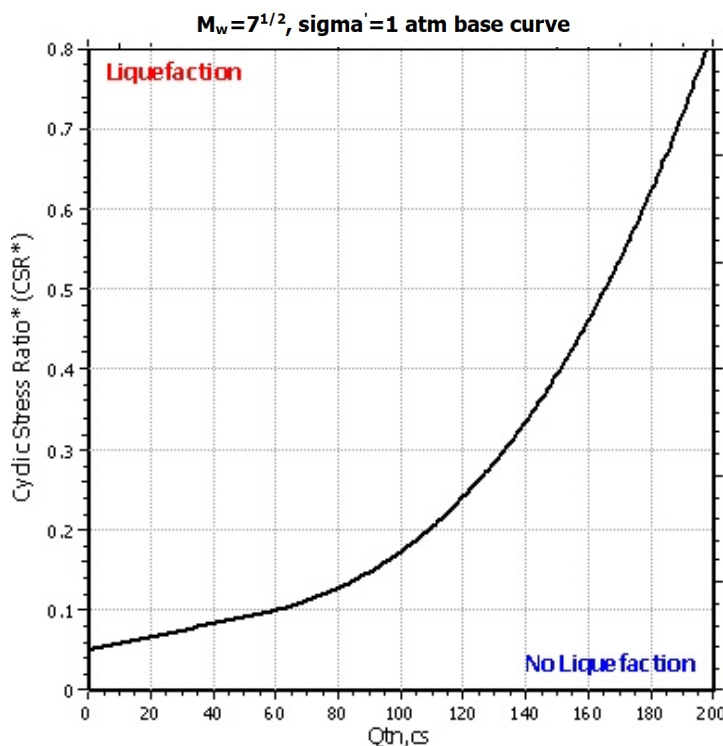
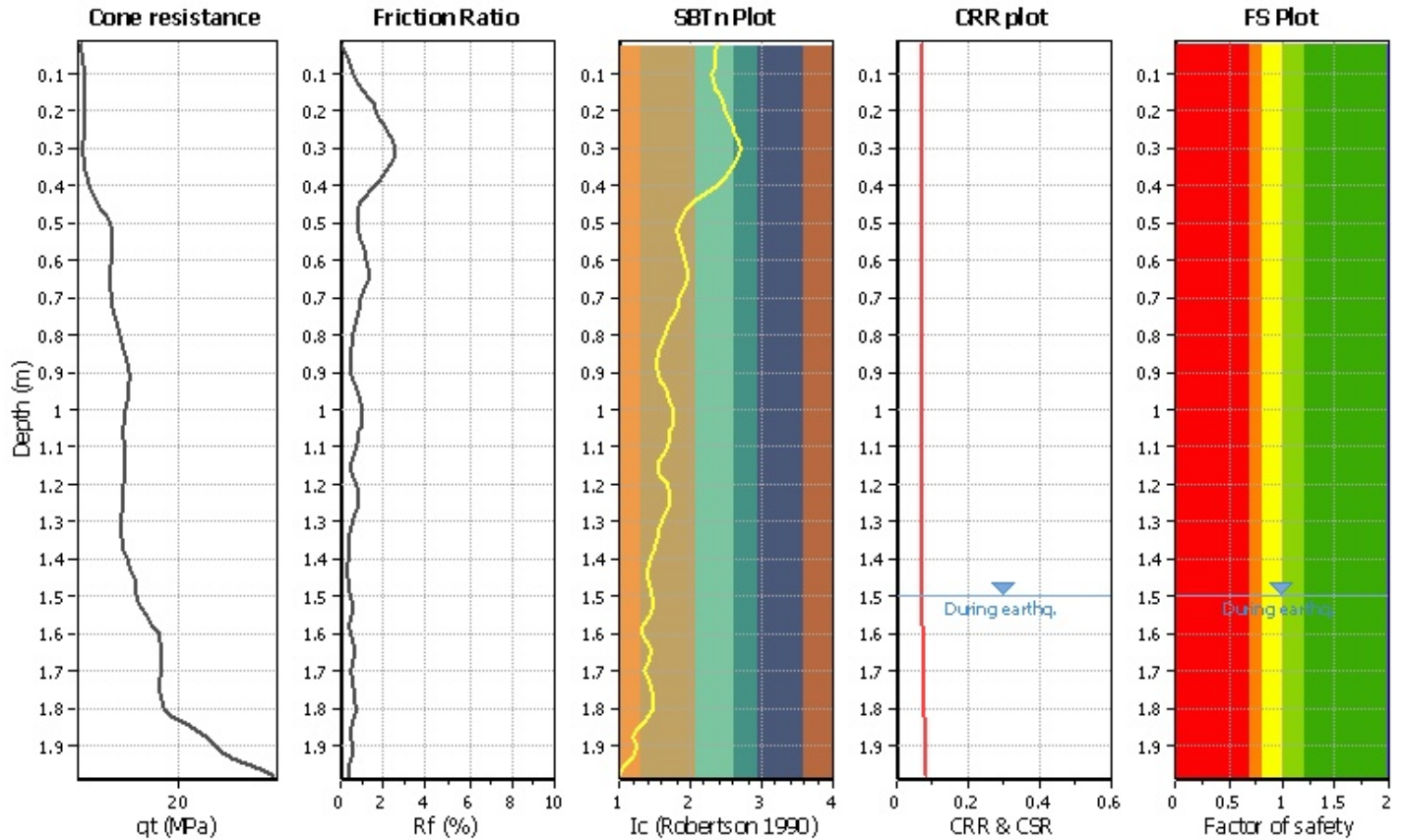
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

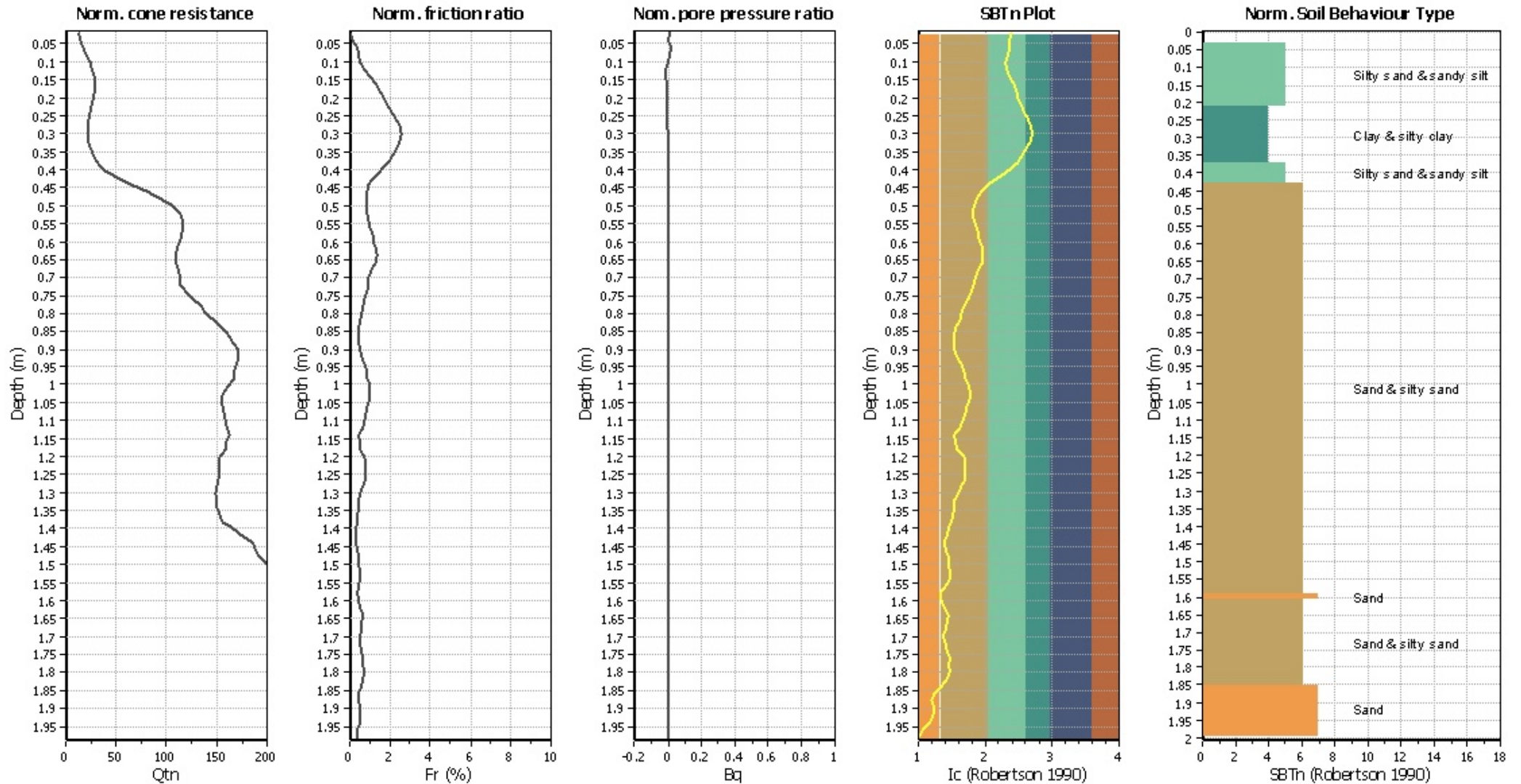
LIQUEFACTION ANALYSIS REPORT
Project title : Geotechnical Investigation
Location : Arataki Road Subdivision
CPT file : CPT04_SLS
Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.11	Unit weight calculation:	Based on SBT	K_0 applied:	Yes		



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

CPT basic interpretation plots (normaliz



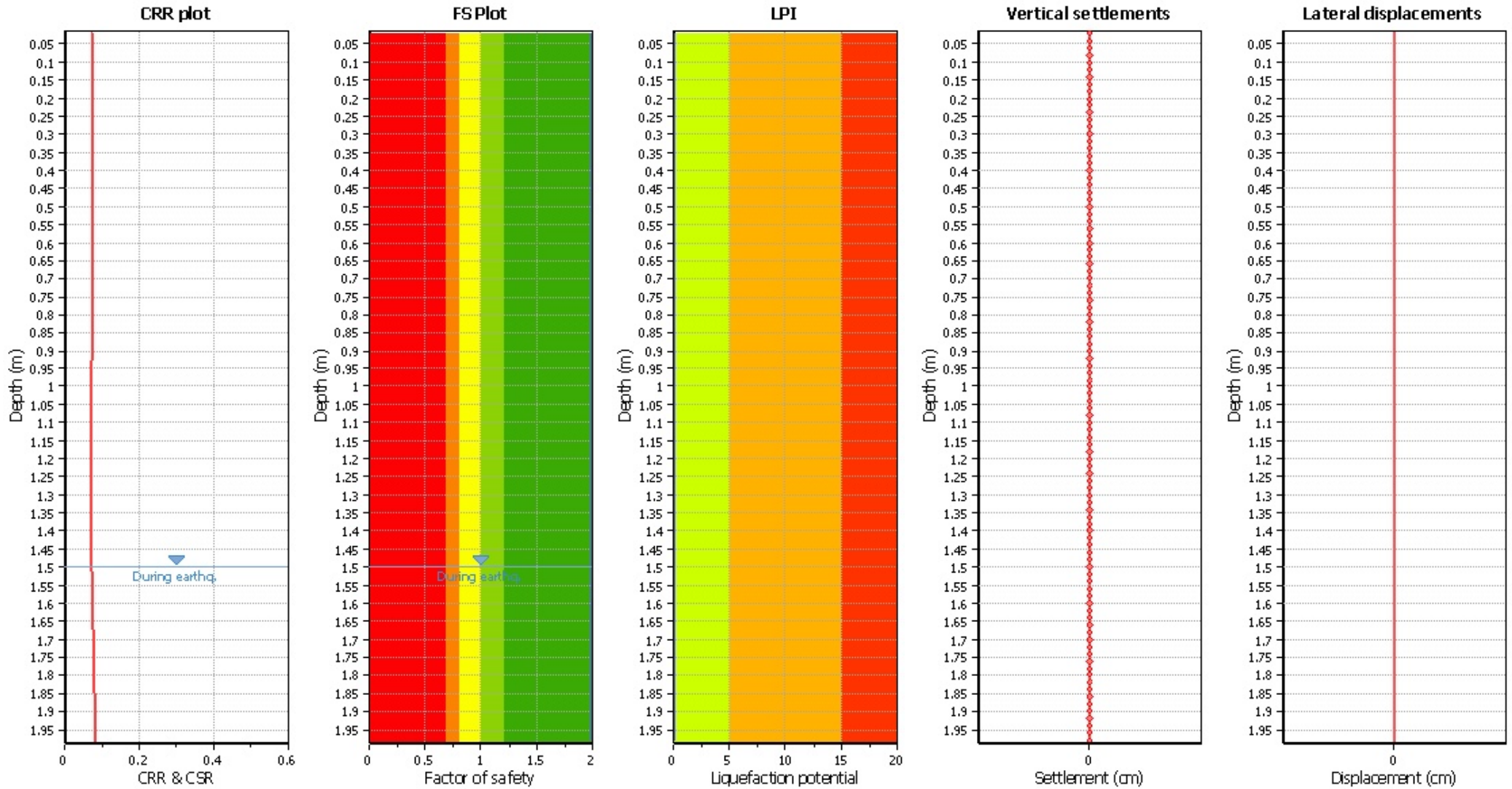
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_v applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.11	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	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 :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.11	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk



LIQUEFACTION ANALYSIS REPORT

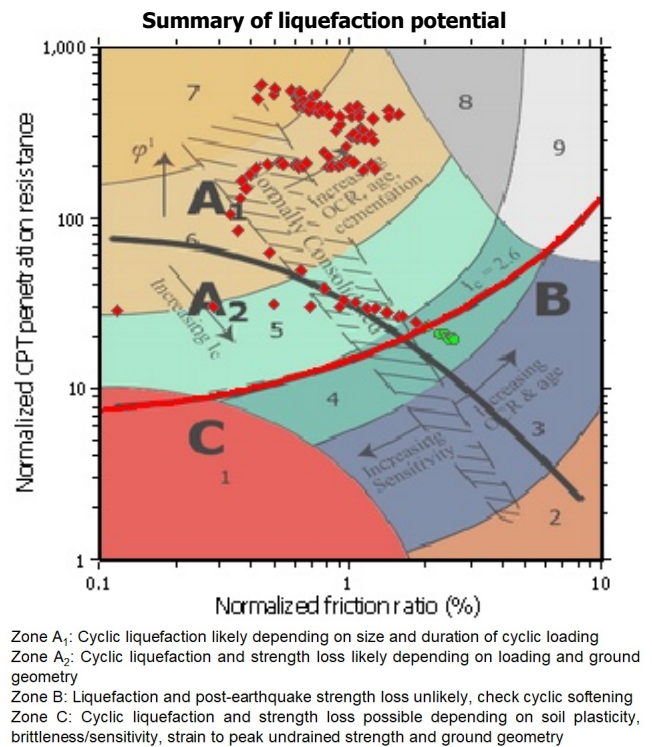
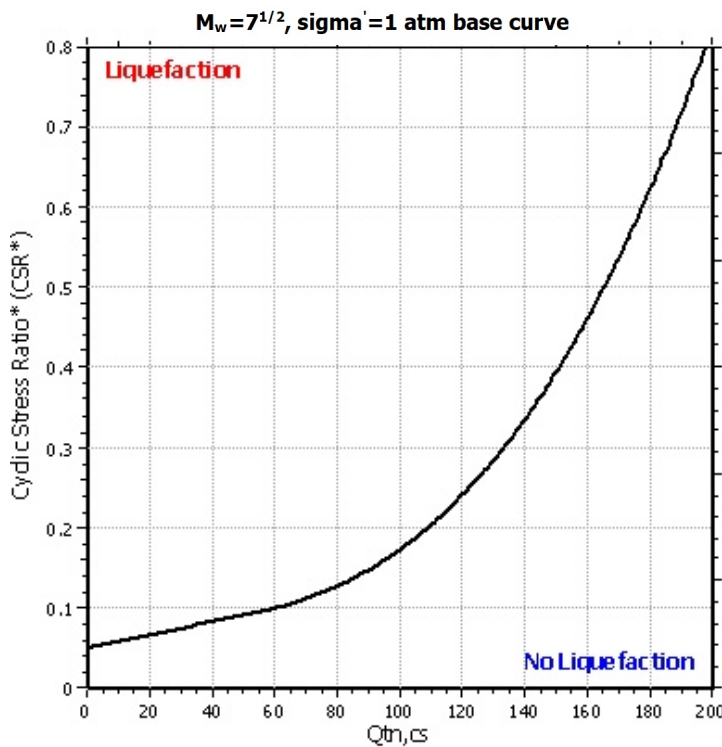
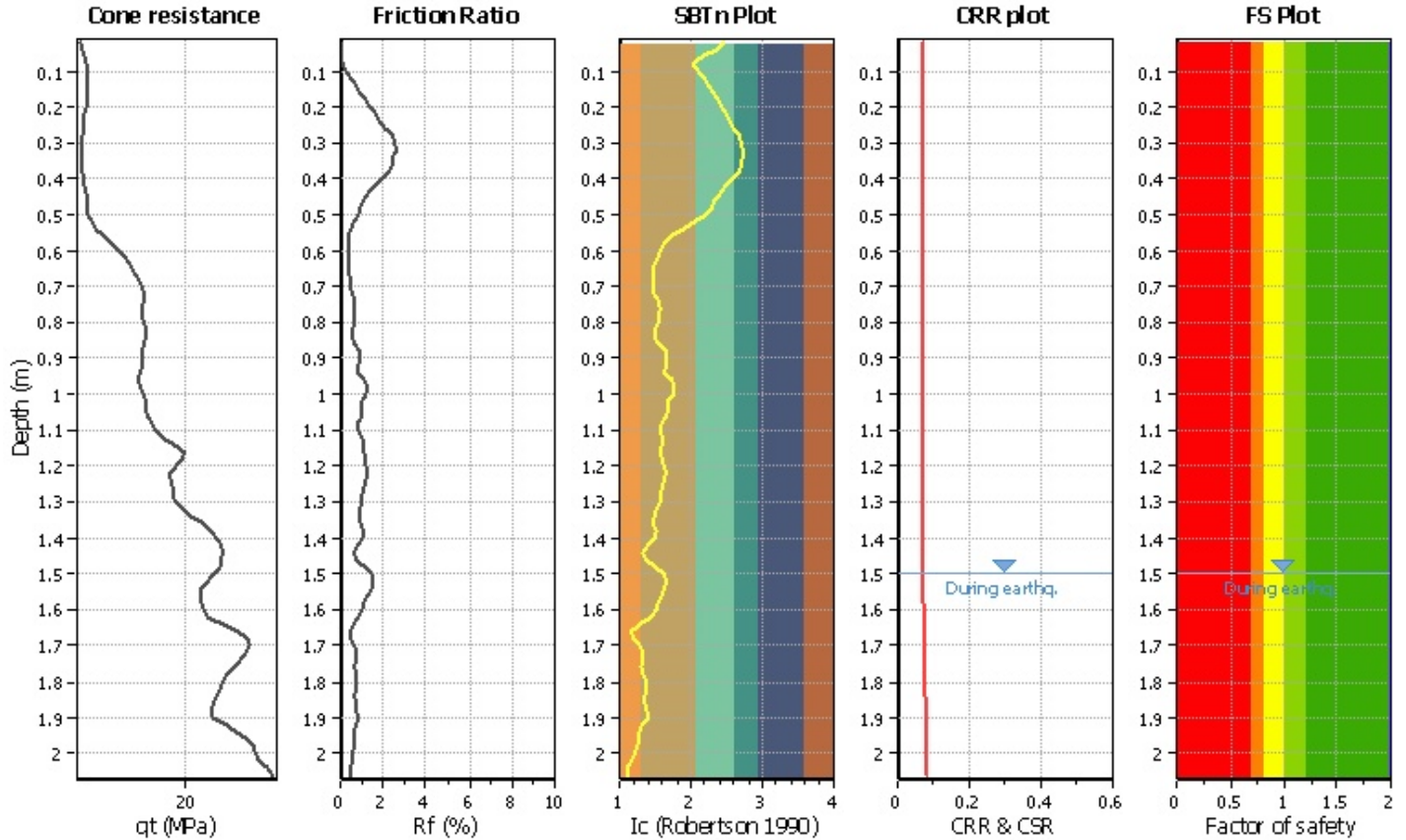
Project title : Geotechnical Investigation

Location : Arataki Road Subdivision

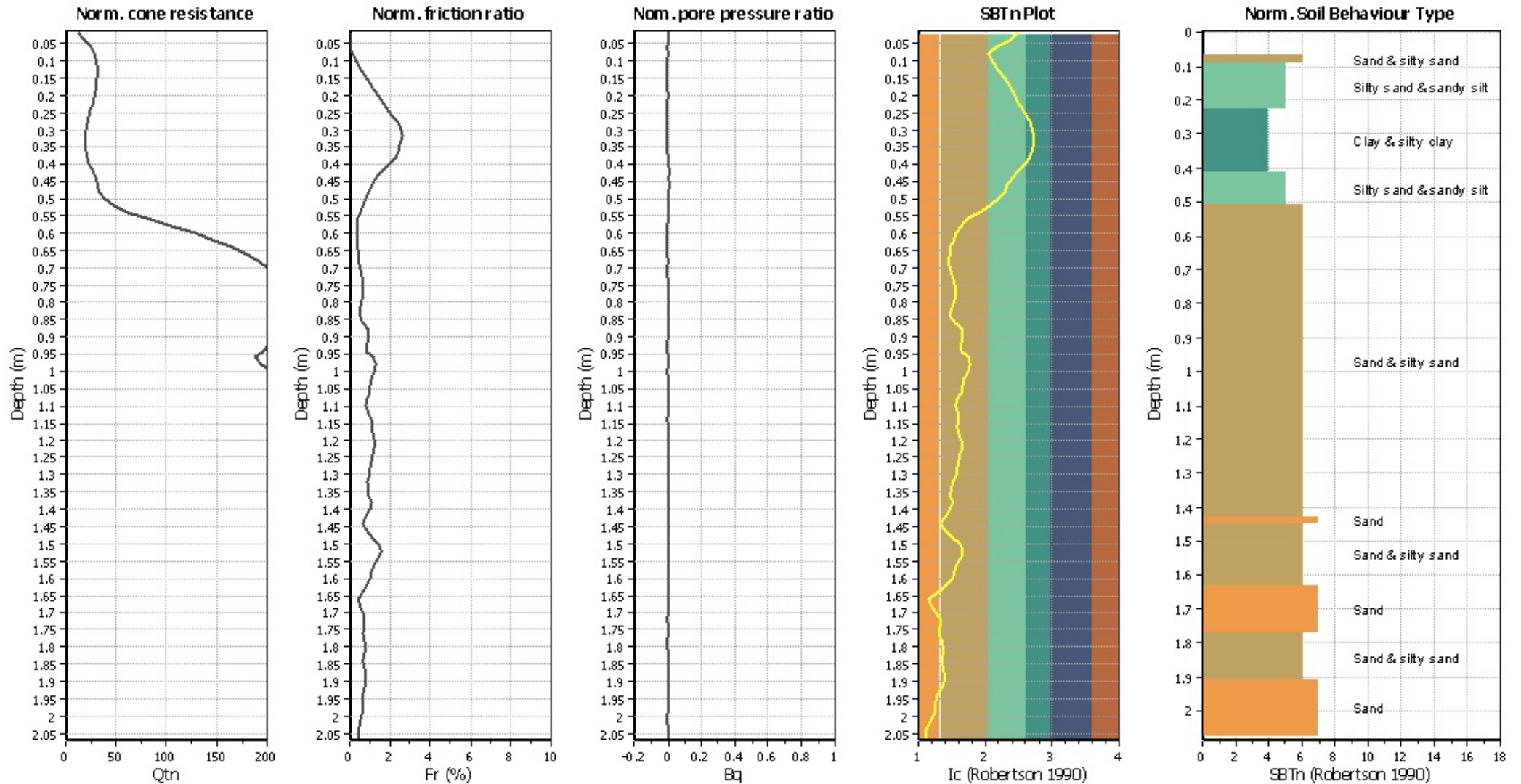
CPT file : CPT05_SLS

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.11	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



CPT basic interpretation plots (normaliz



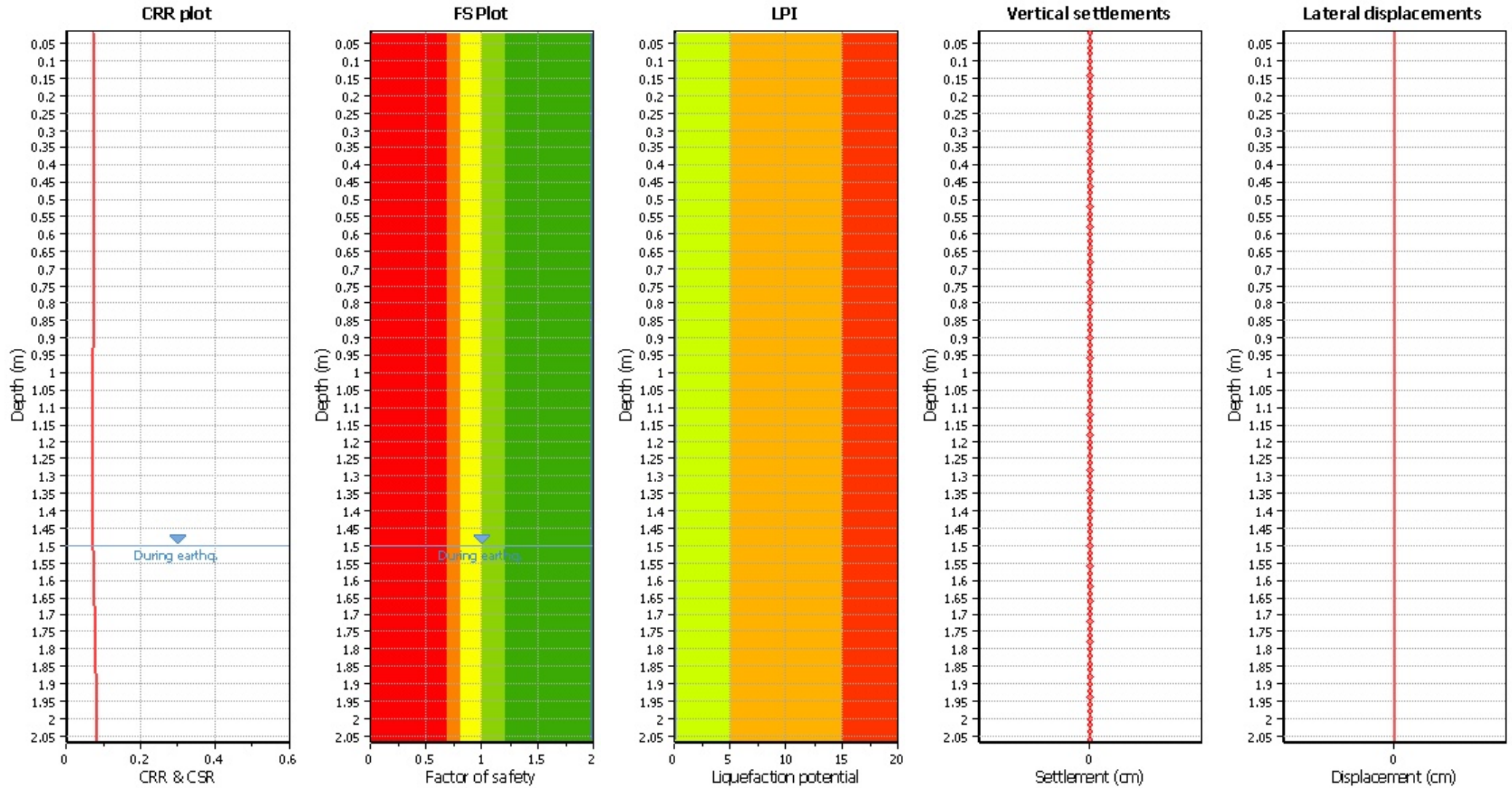
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.11	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	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 :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.11	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

LIQUEFACTION ANALYSIS REPORT

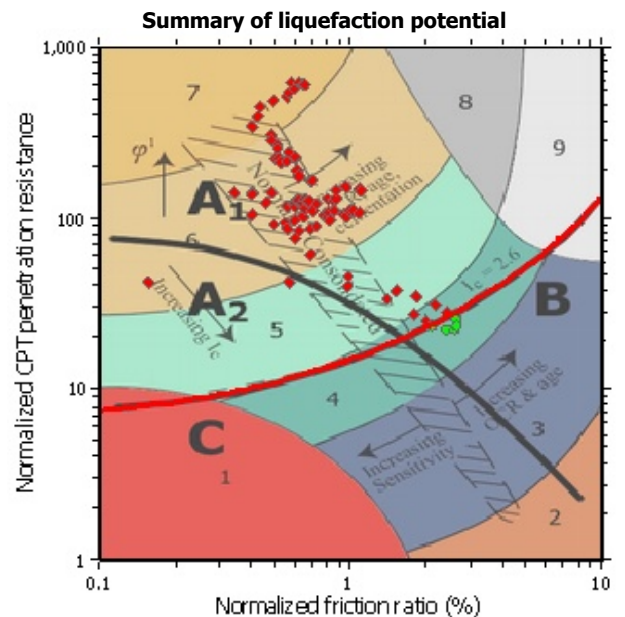
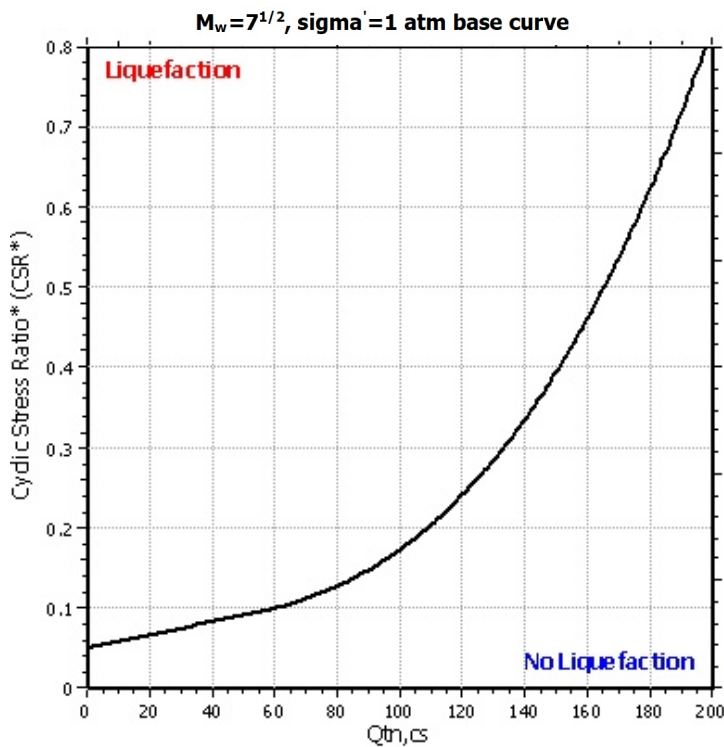
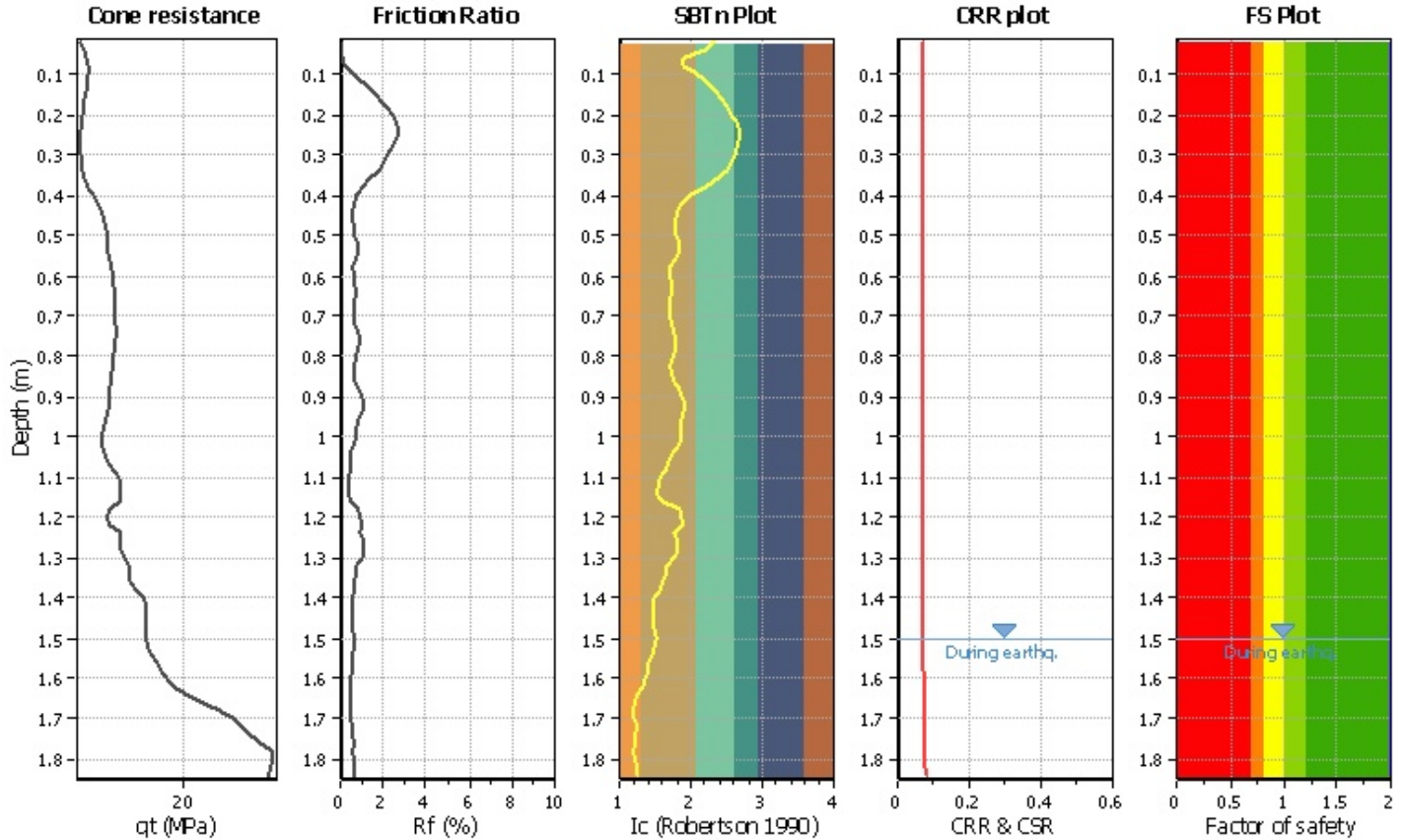
Project title : Geotechnical Investigation

Location : Arataki Road Subdivision

CPT file : CPT06_SLS

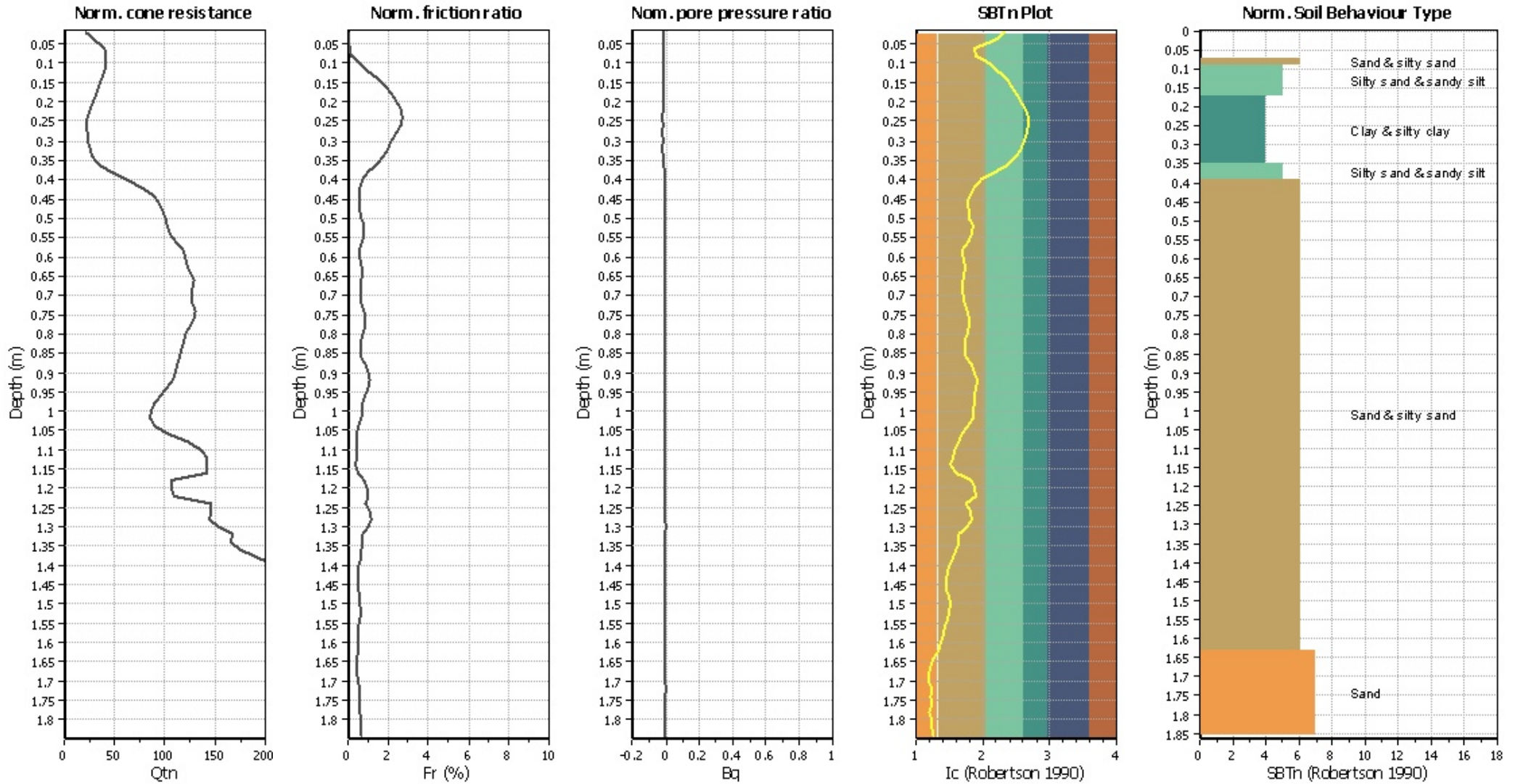
Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.11	Unit weight calculation:	Based on SBT	K_0 applied:	Yes		



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

CPT basic interpretation plots (normaliz



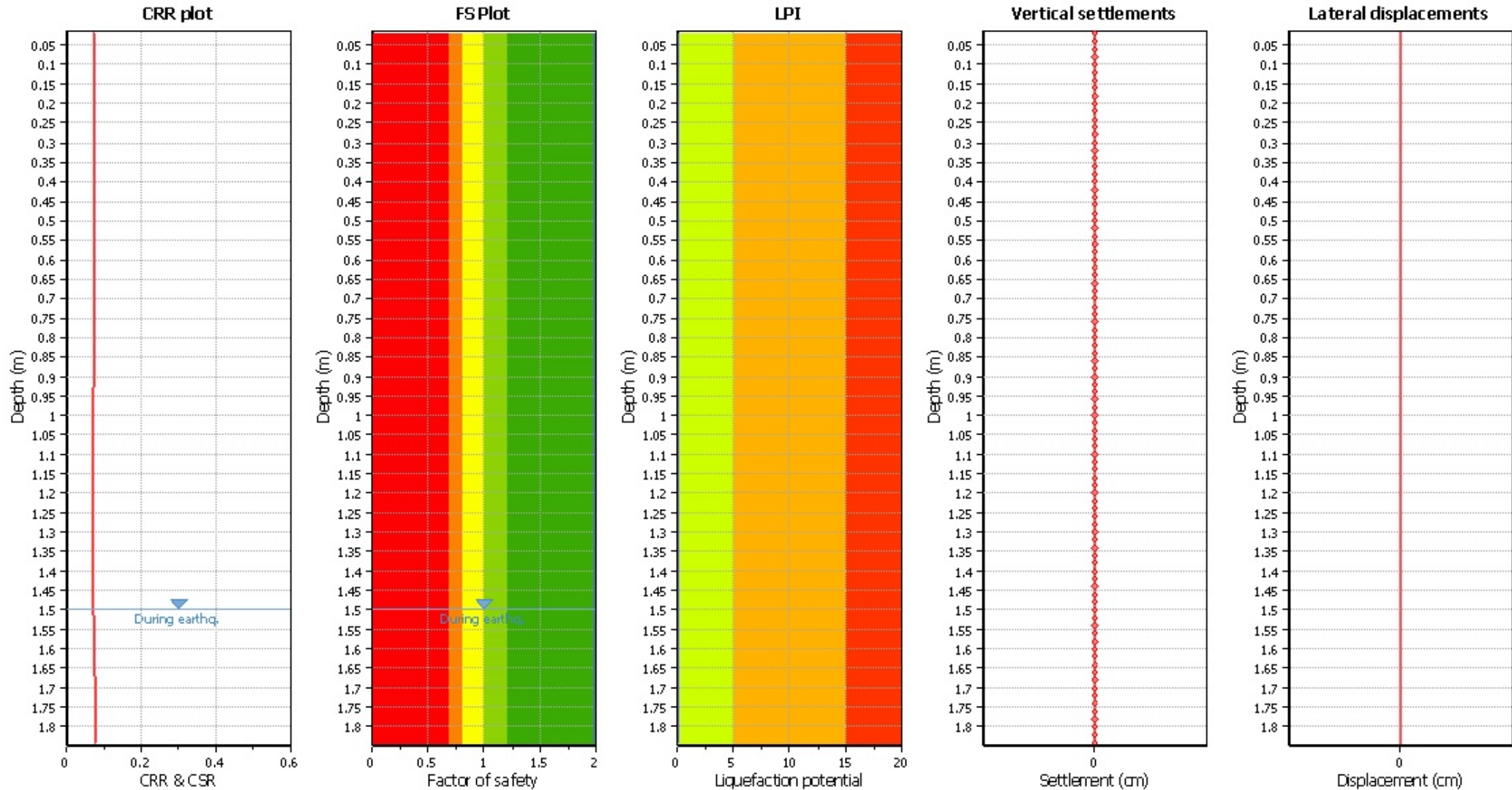
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.11	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_0 applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.11	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

LIQUEFACTION ANALYSIS REPORT

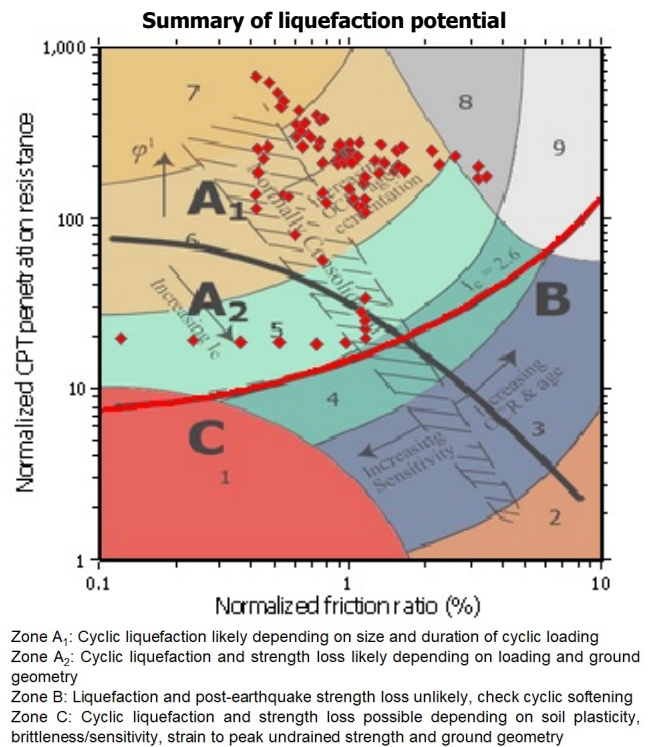
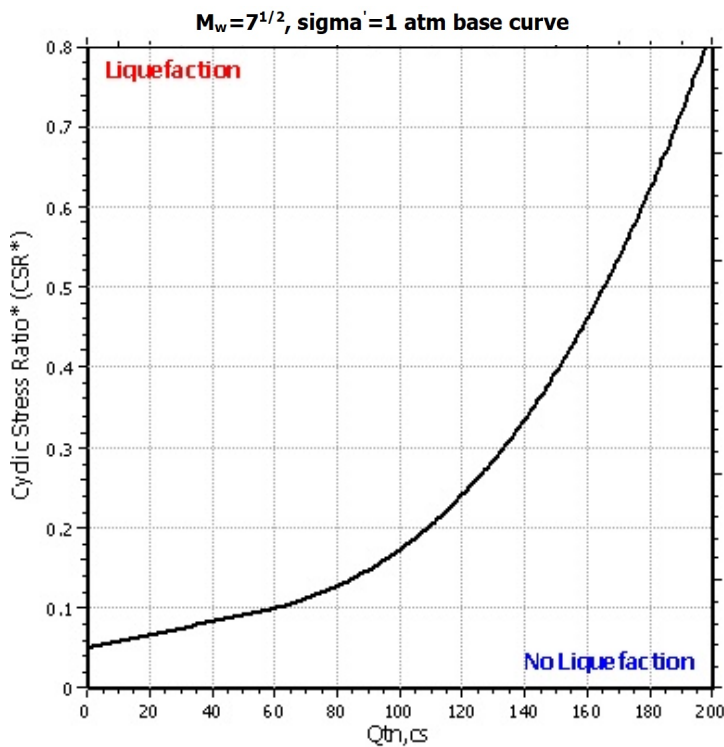
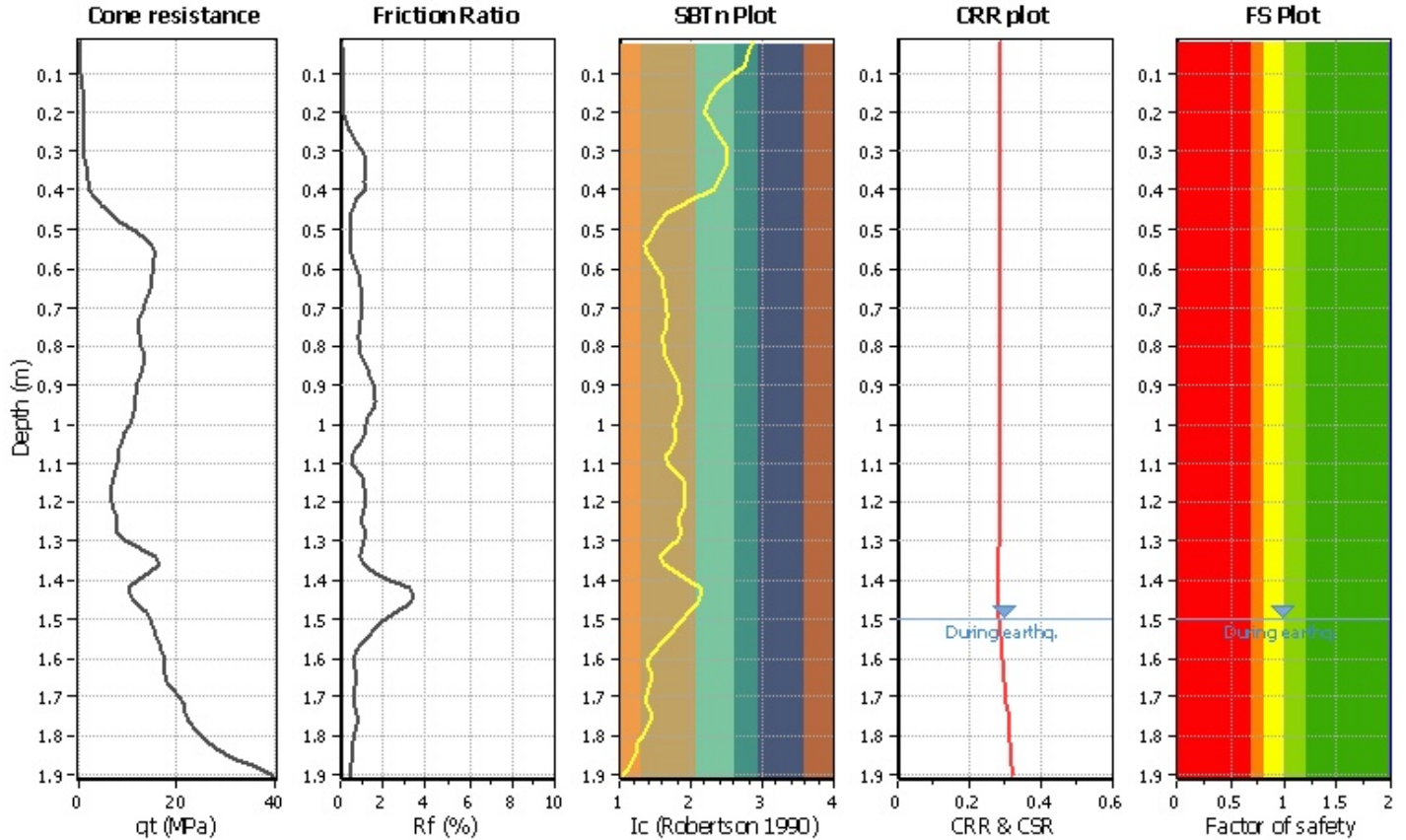
Project title : Geotechnical Investigation

Location : Arataki Road Subdivision

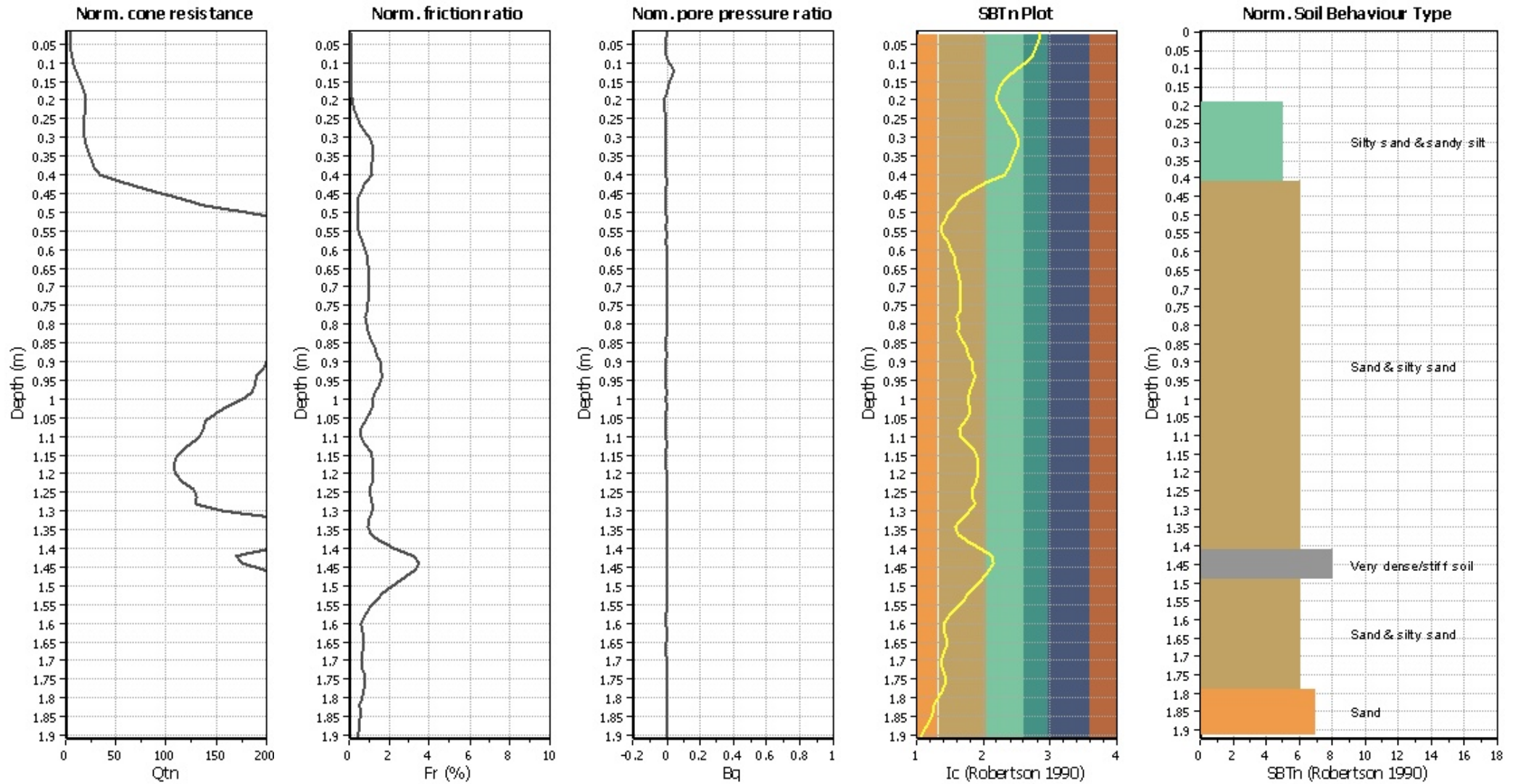
CPT file : CPT01_ULS

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.44	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based



CPT basic interpretation plots (normaliz



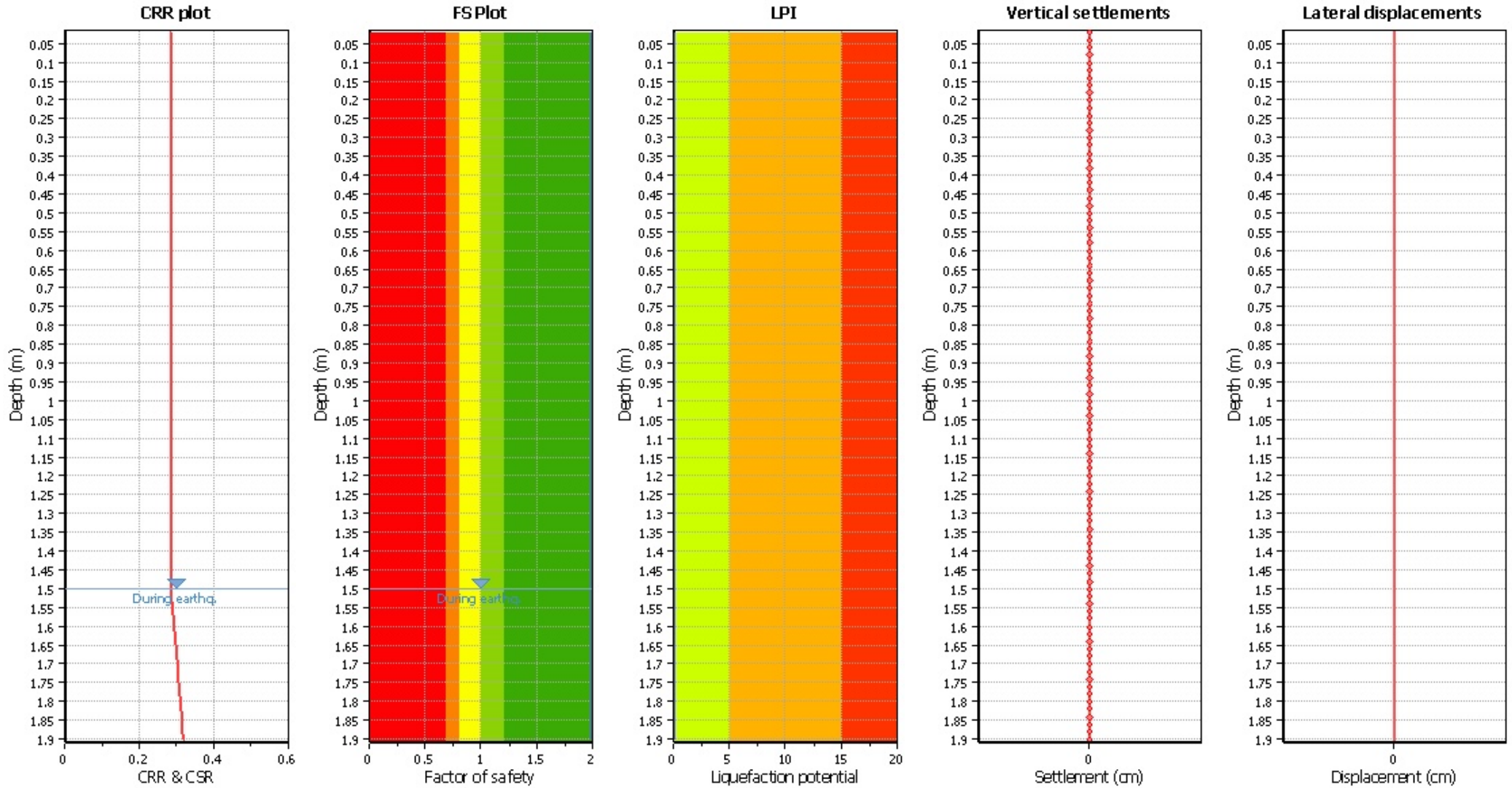
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.44	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	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 :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.44	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

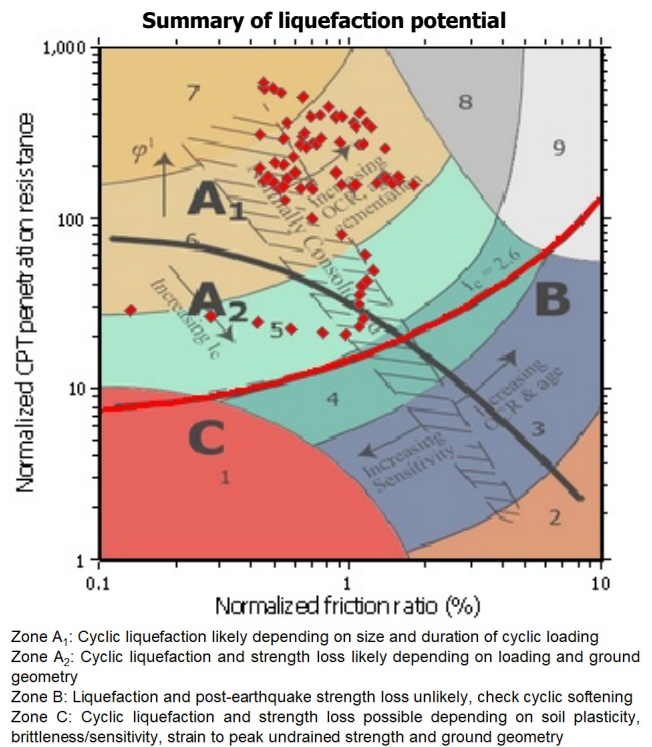
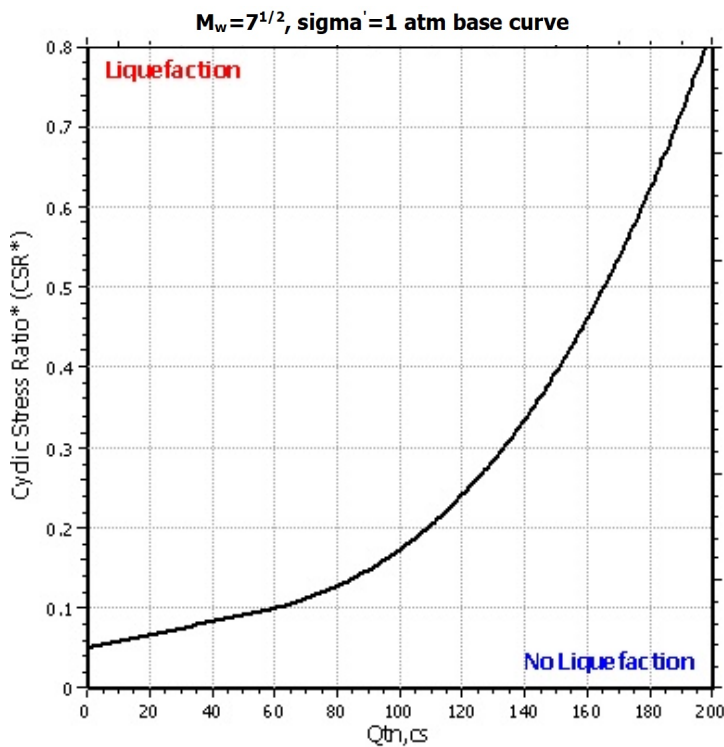
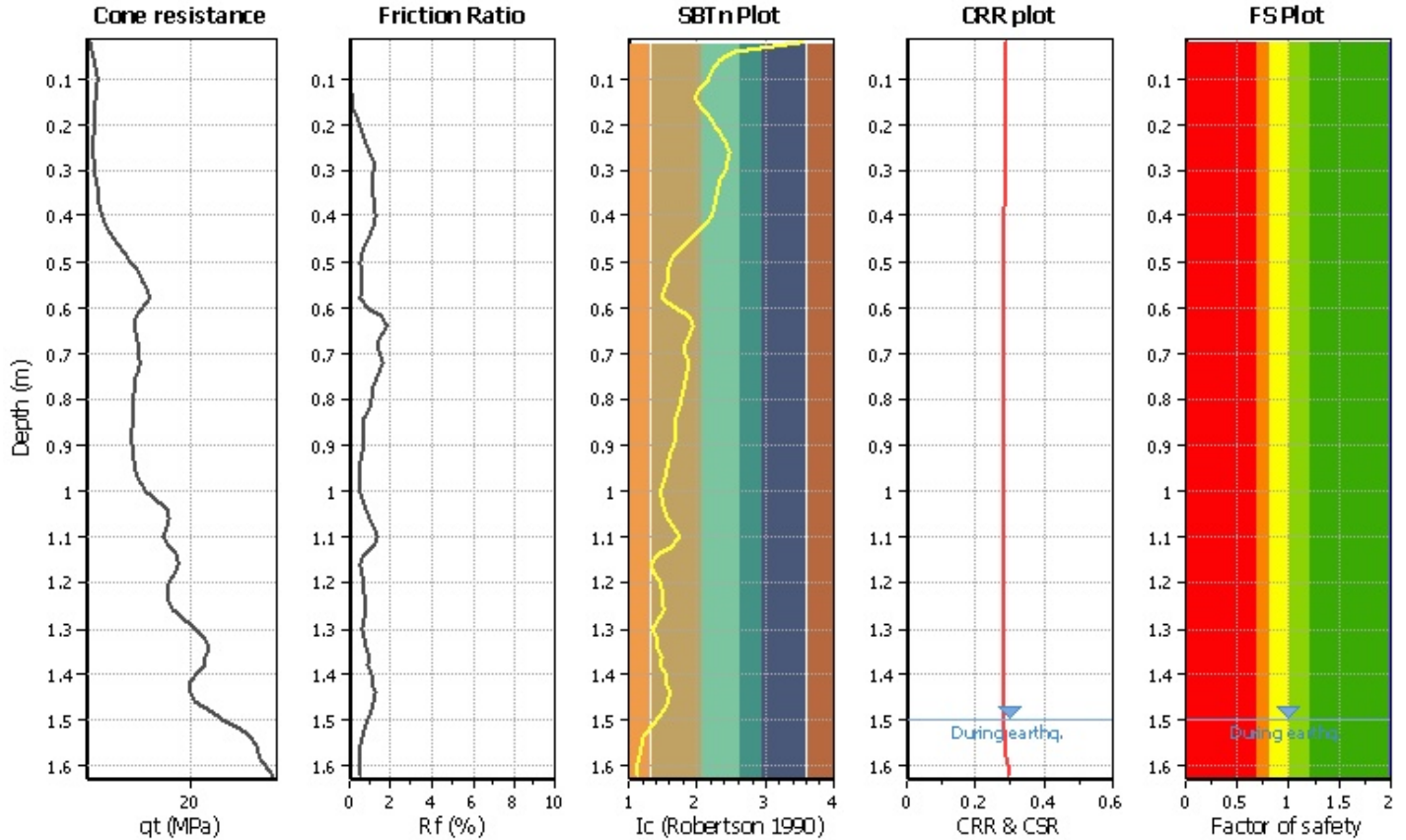
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

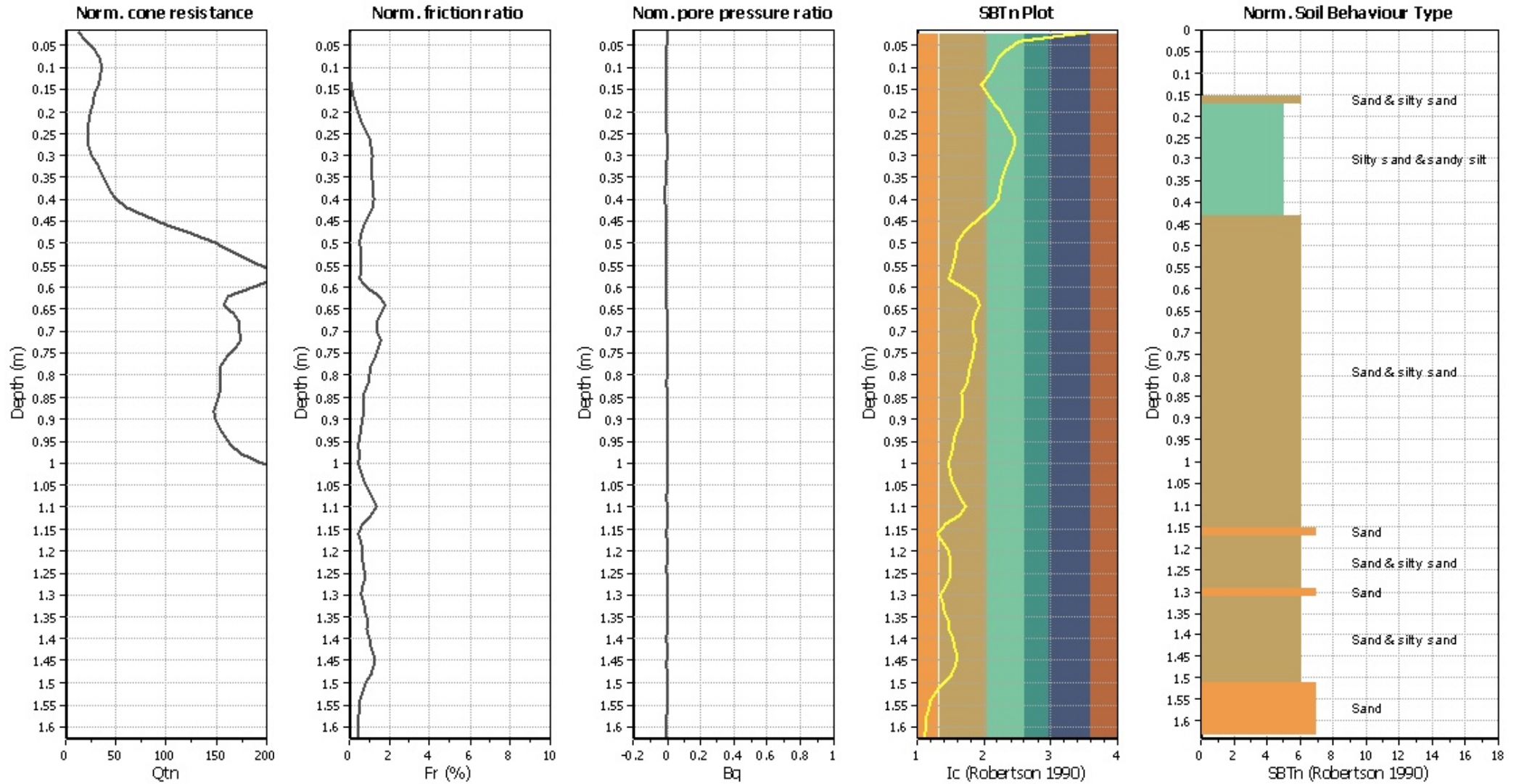
- Very high risk
- High risk
- Low risk

LIQUEFACTION ANALYSIS REPORT
Project title : Geotechnical Investigation
Location : Arataki Road Subdivision
CPT file : CPT02_ULS
Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.44	Unit weight calculation:	Based on SBT	K_0 applied:	Yes		



CPT basic interpretation plots (normaliz



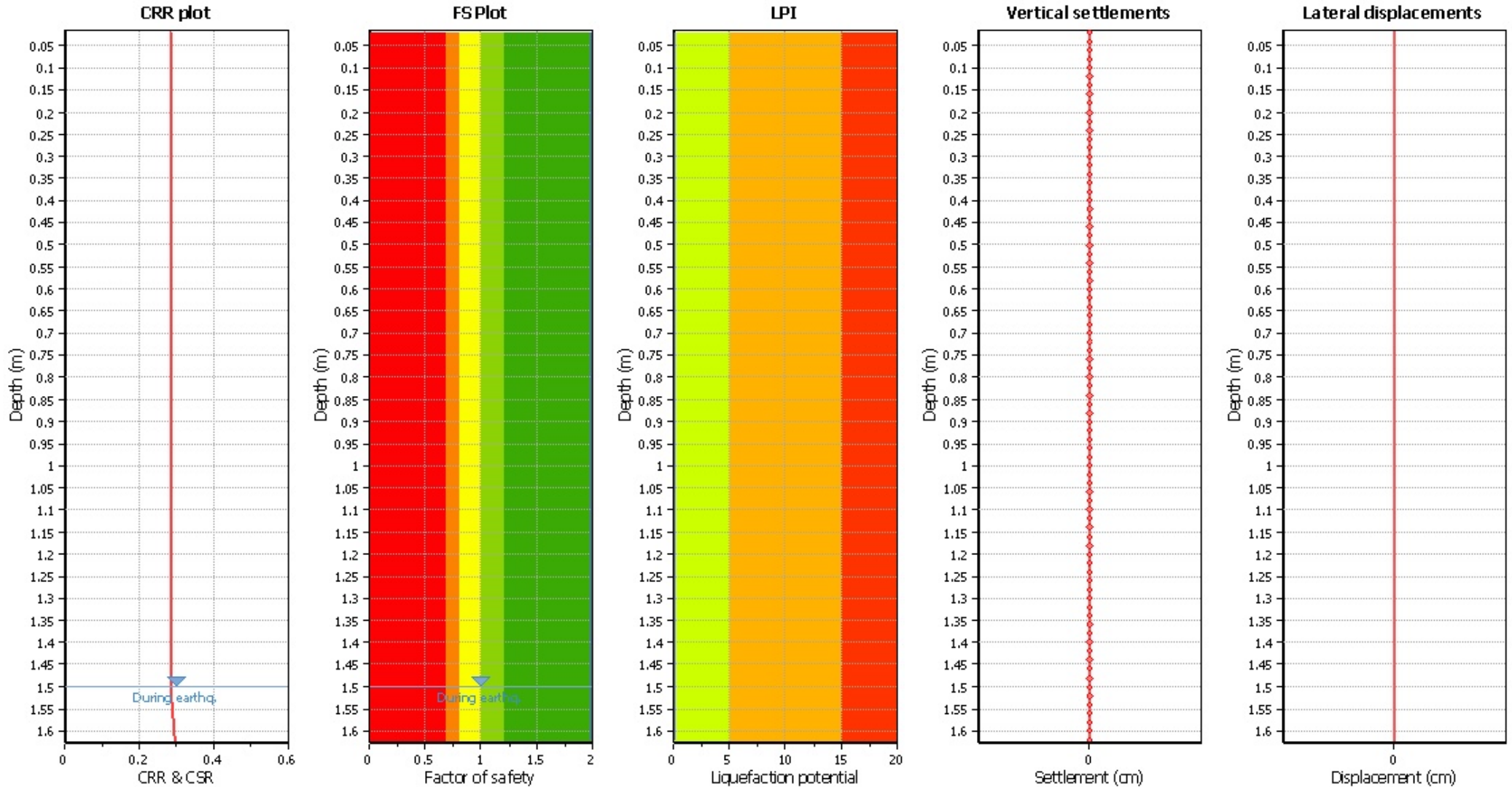
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_0 applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.44	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	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 :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.44	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

LIQUEFACTION ANALYSIS REPORT

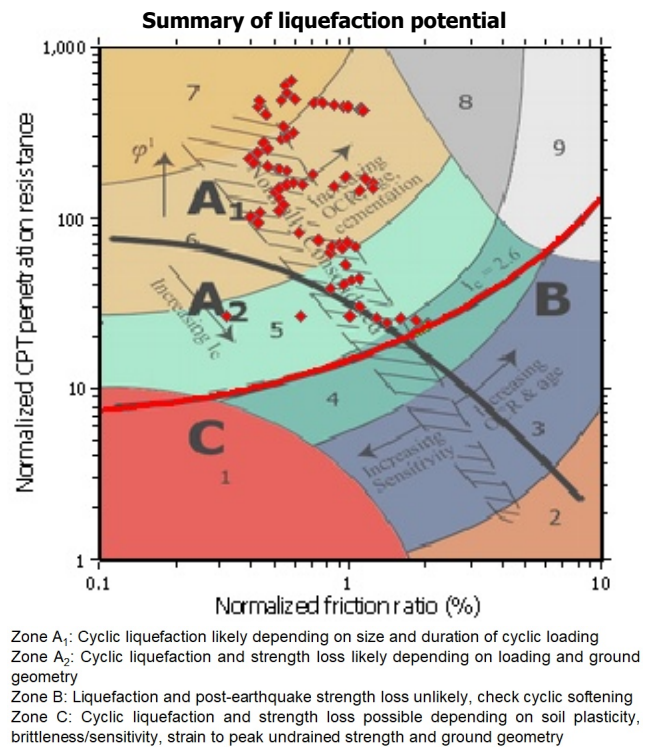
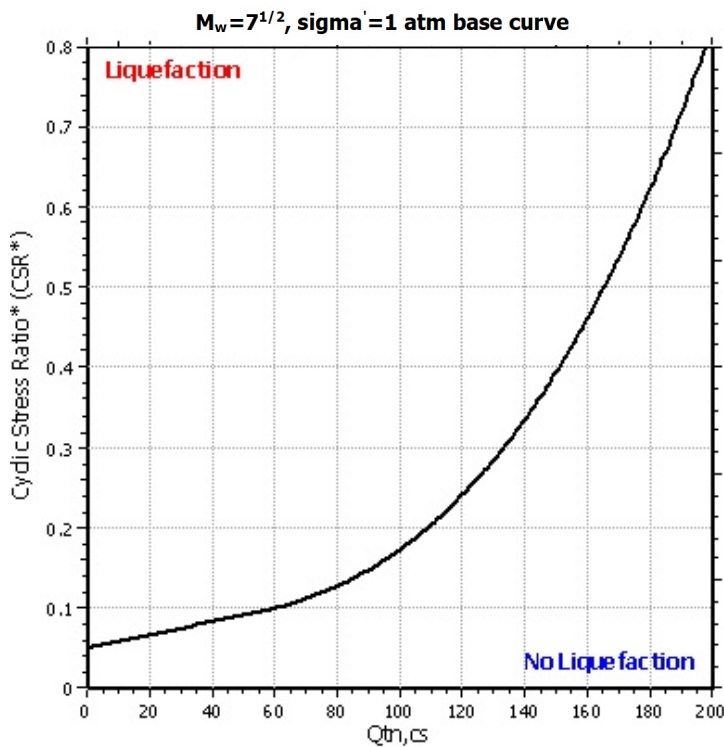
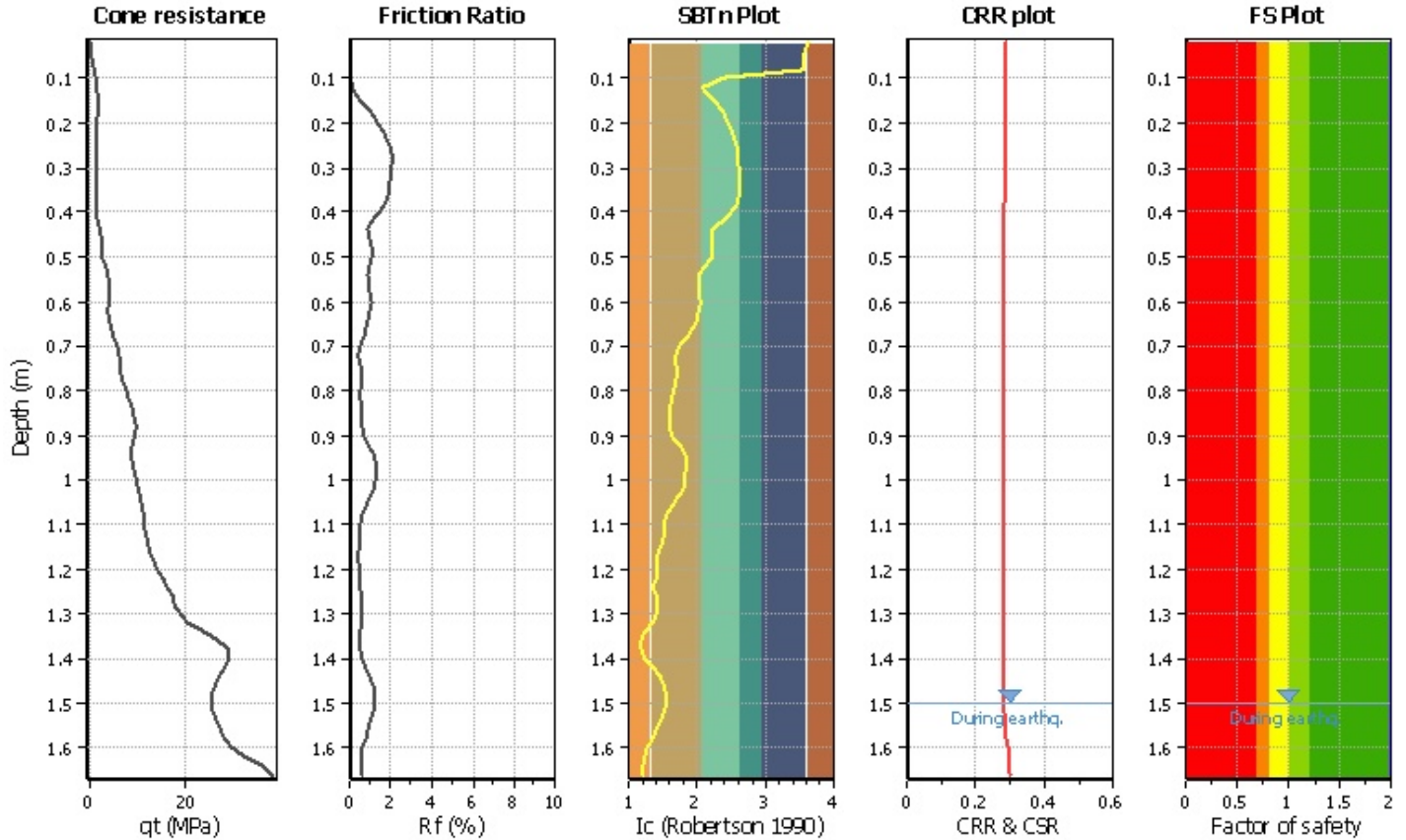
Project title : Geotechnical Investigation

Location : Arataki Road Subdivision

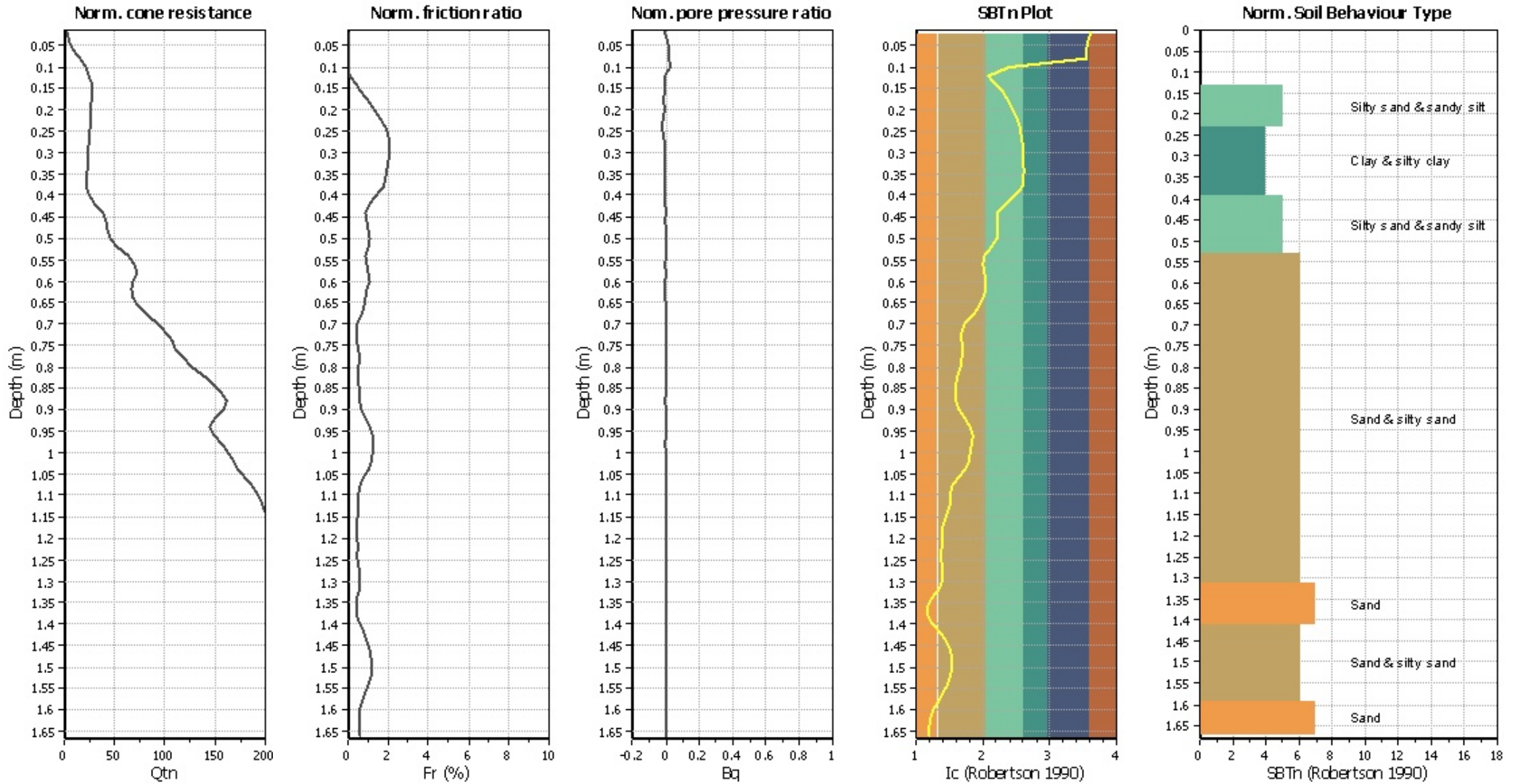
CPT file : CPT03_ULS

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.44	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



CPT basic interpretation plots (normaliz



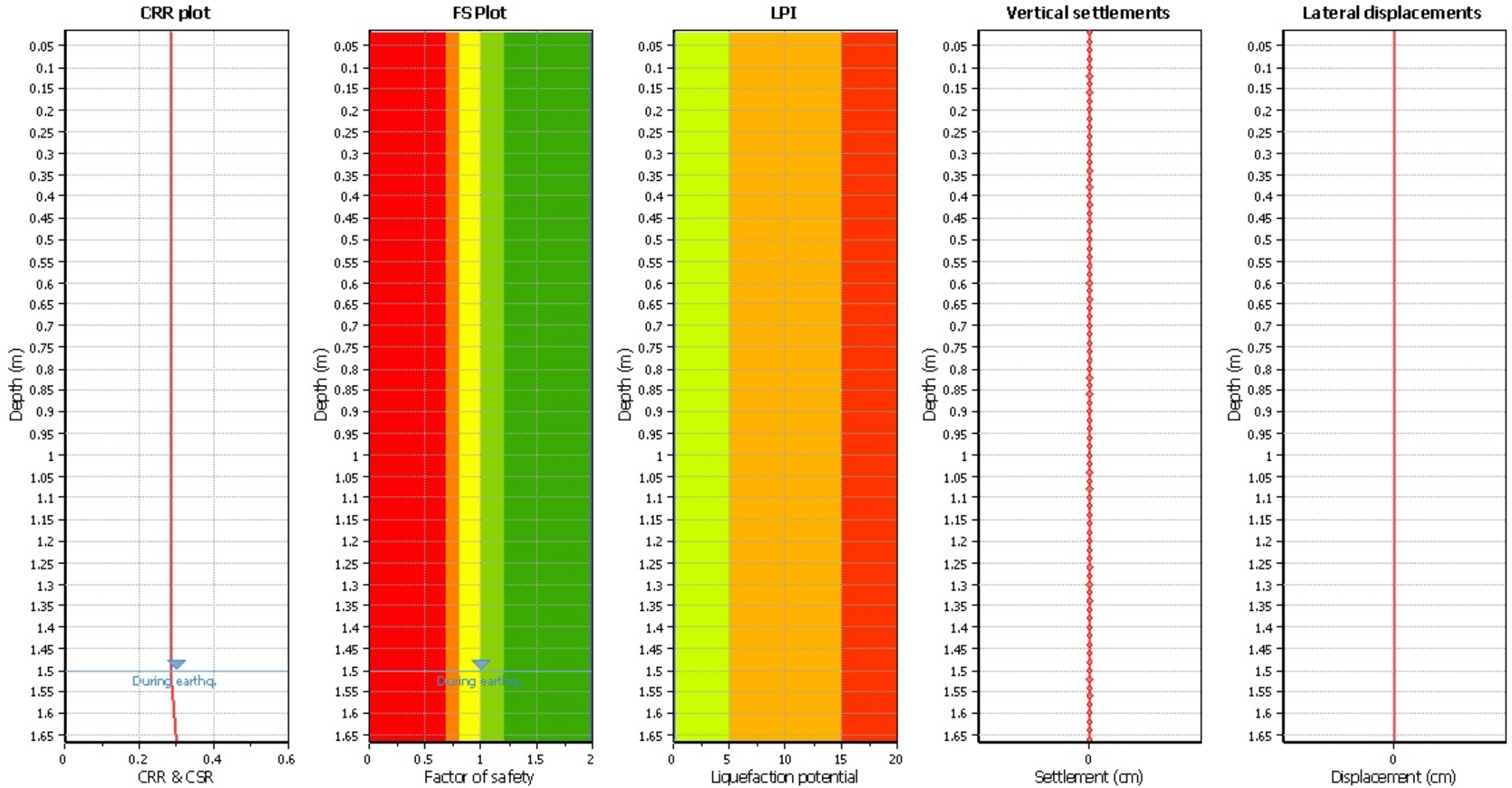
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.44	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	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 :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.44	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

LIQUEFACTION ANALYSIS REPORT

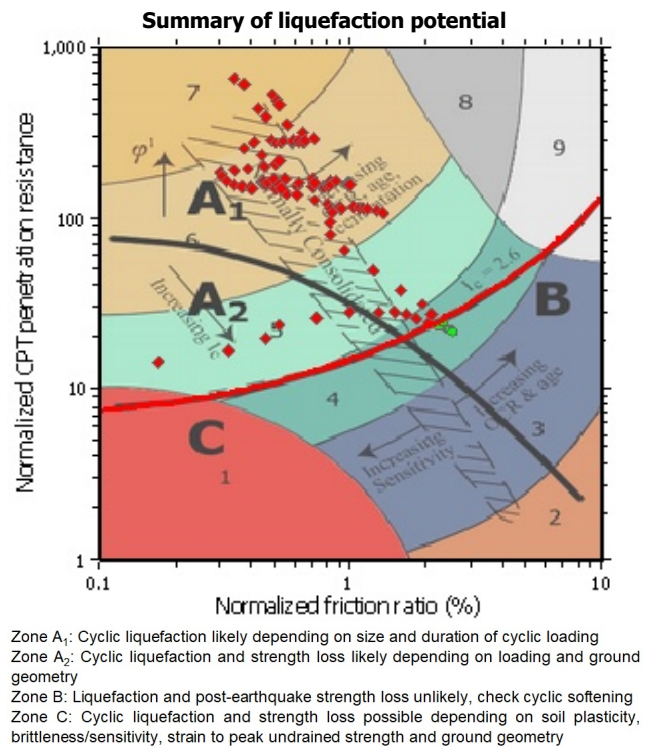
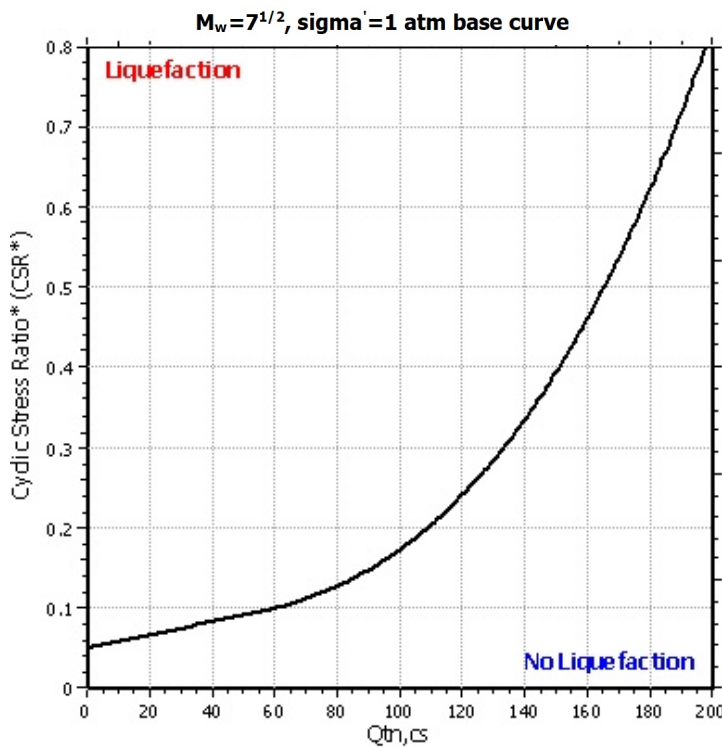
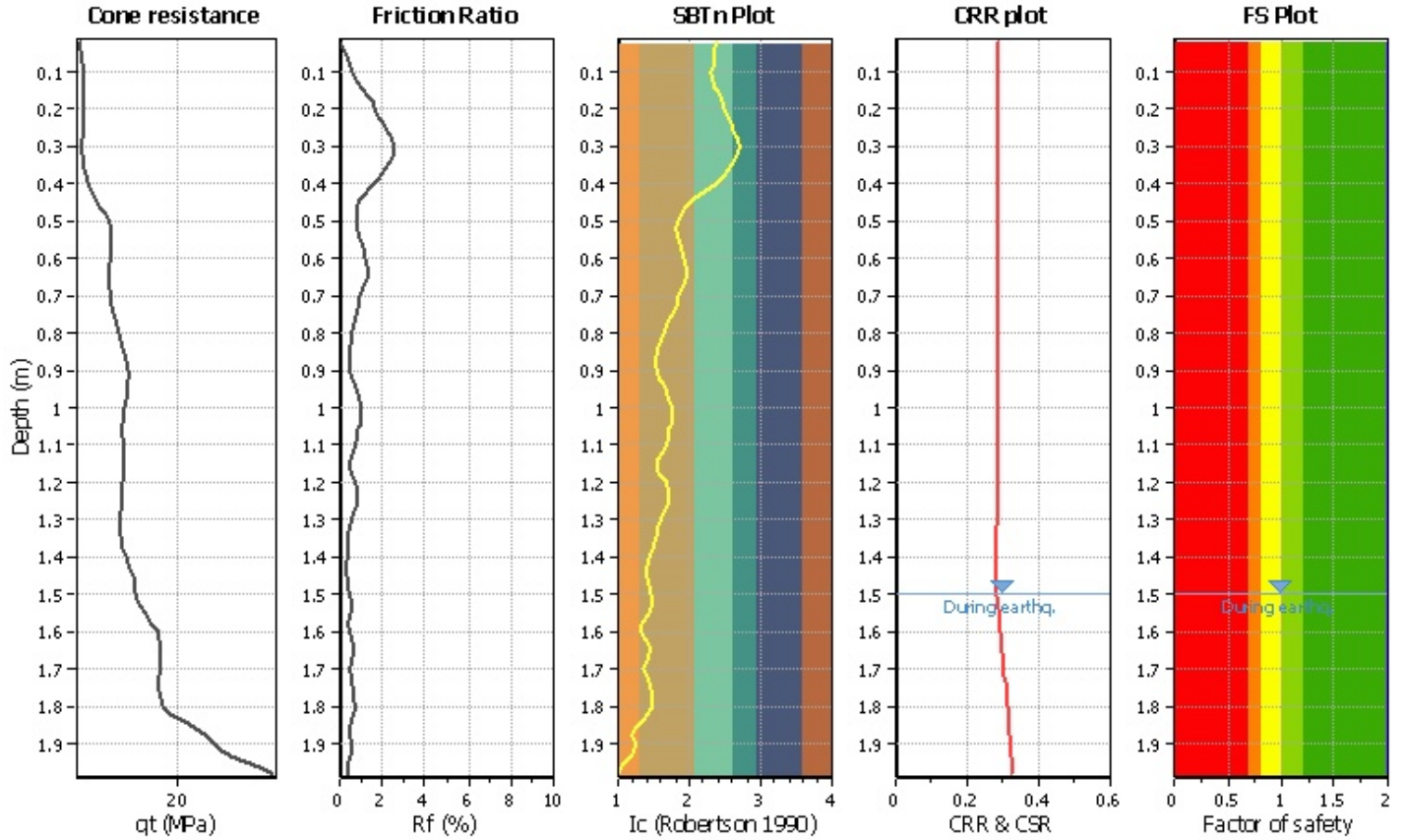
Project title : Geotechnical Investigation

Location : Arataki Road Subdivision

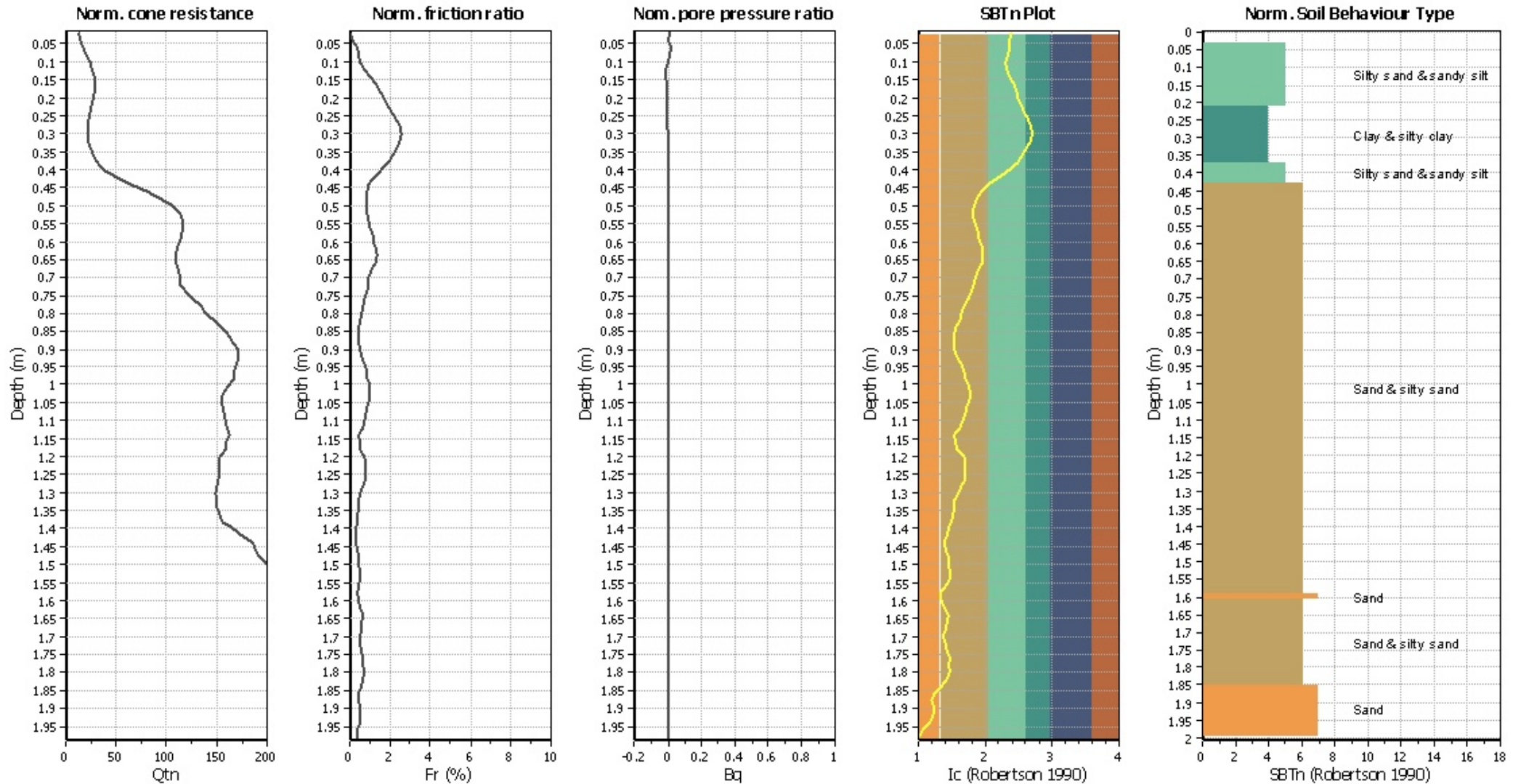
CPT file : CPT04_ULS

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.44	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:	Method based



CPT basic interpretation plots (normaliz



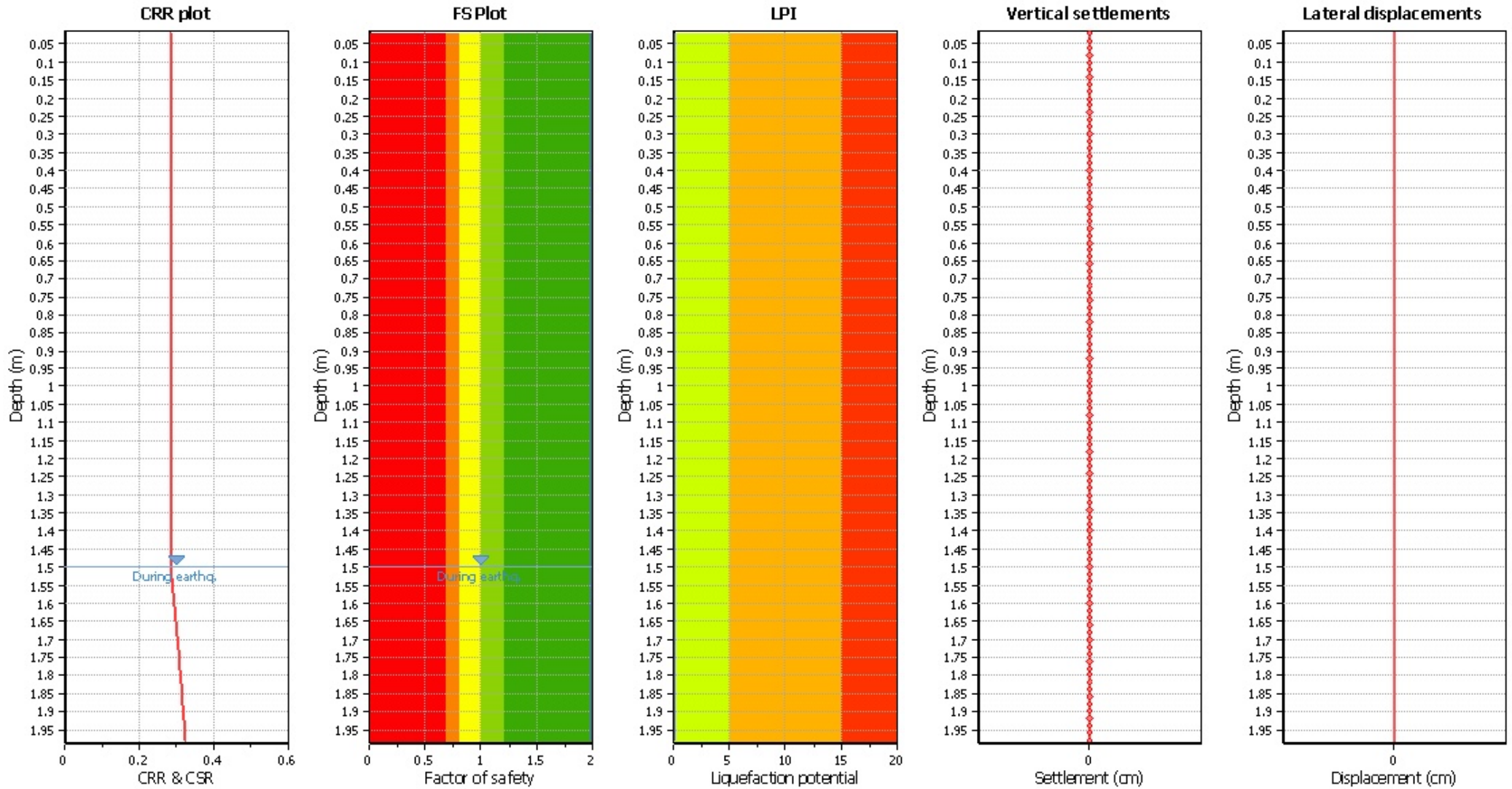
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.44	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	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 :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.44	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- 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



RDCL

RDCL
 Geotechnical Specialists
 8/308 Queen St, Hastings
 http://www.rdcl.co.nz

LIQUEFACTION ANALYSIS REPORT

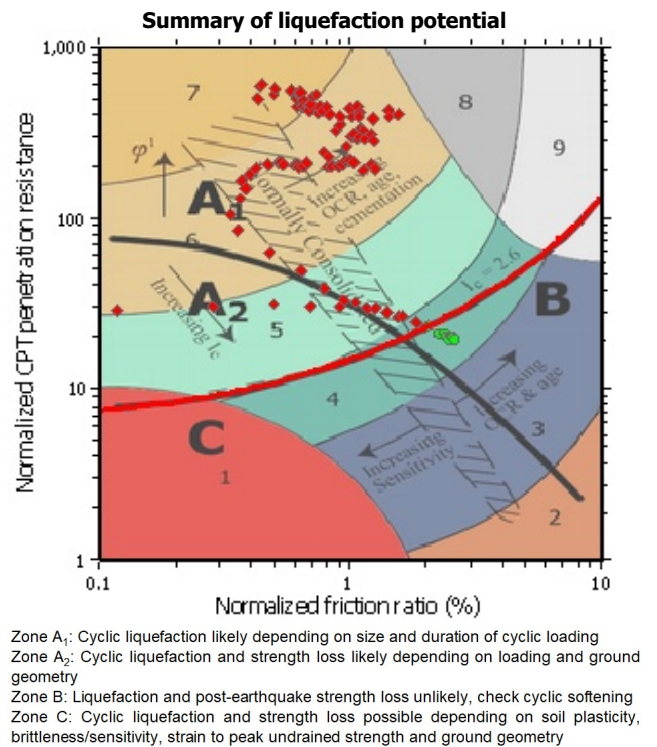
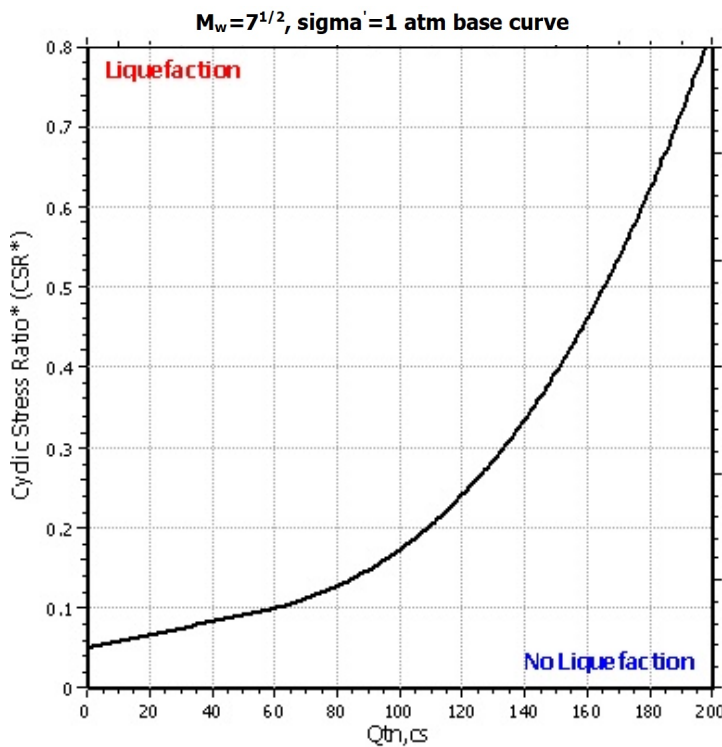
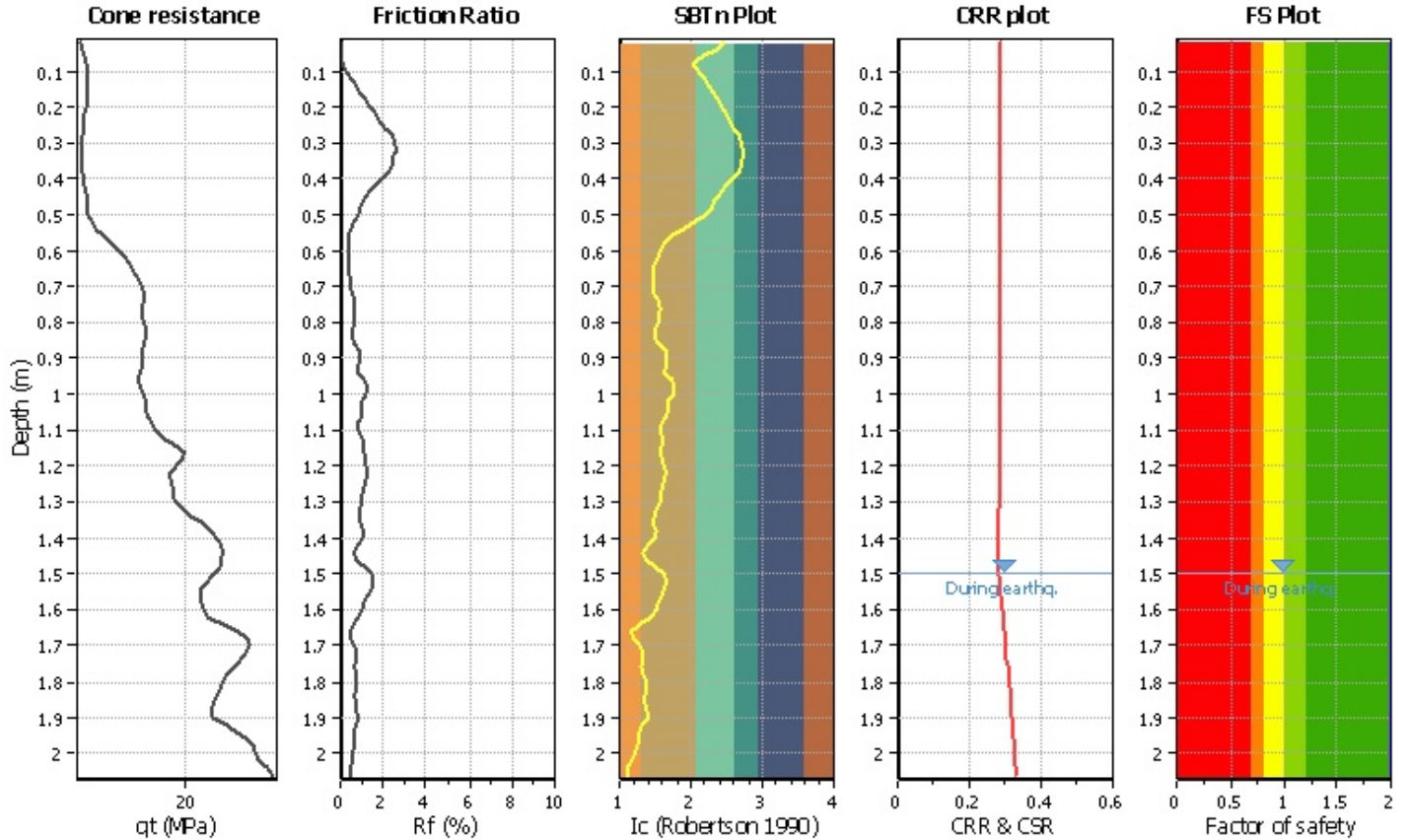
Project title : Geotechnical Investigation

Location : Arataki Road Subdivision

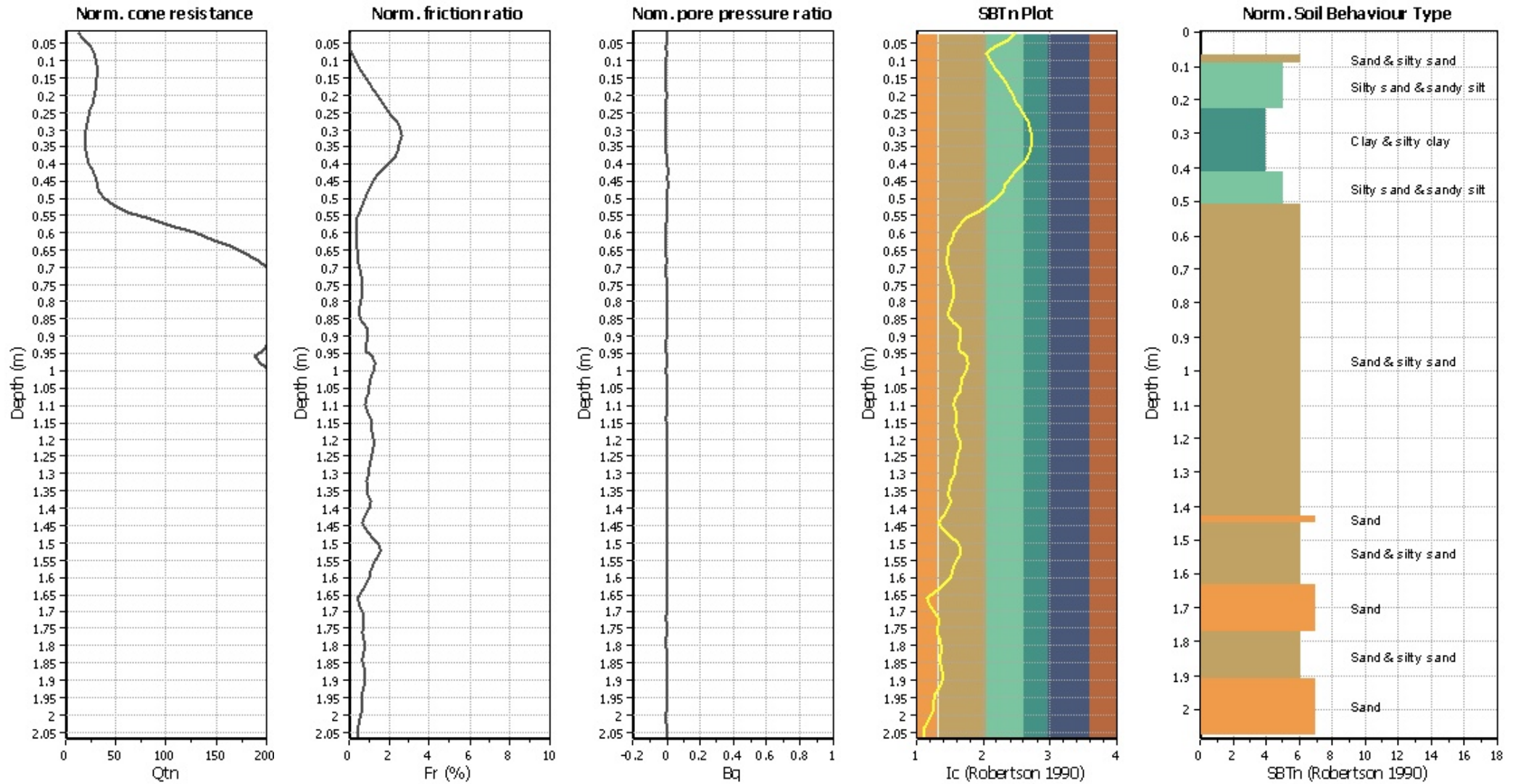
CPT file : CPT05_ULS

Input parameters and analysis data

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Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.44	Unit weight calculation:	Based on SBT	K_0 applied:	Yes		



CPT basic interpretation plots (normaliz



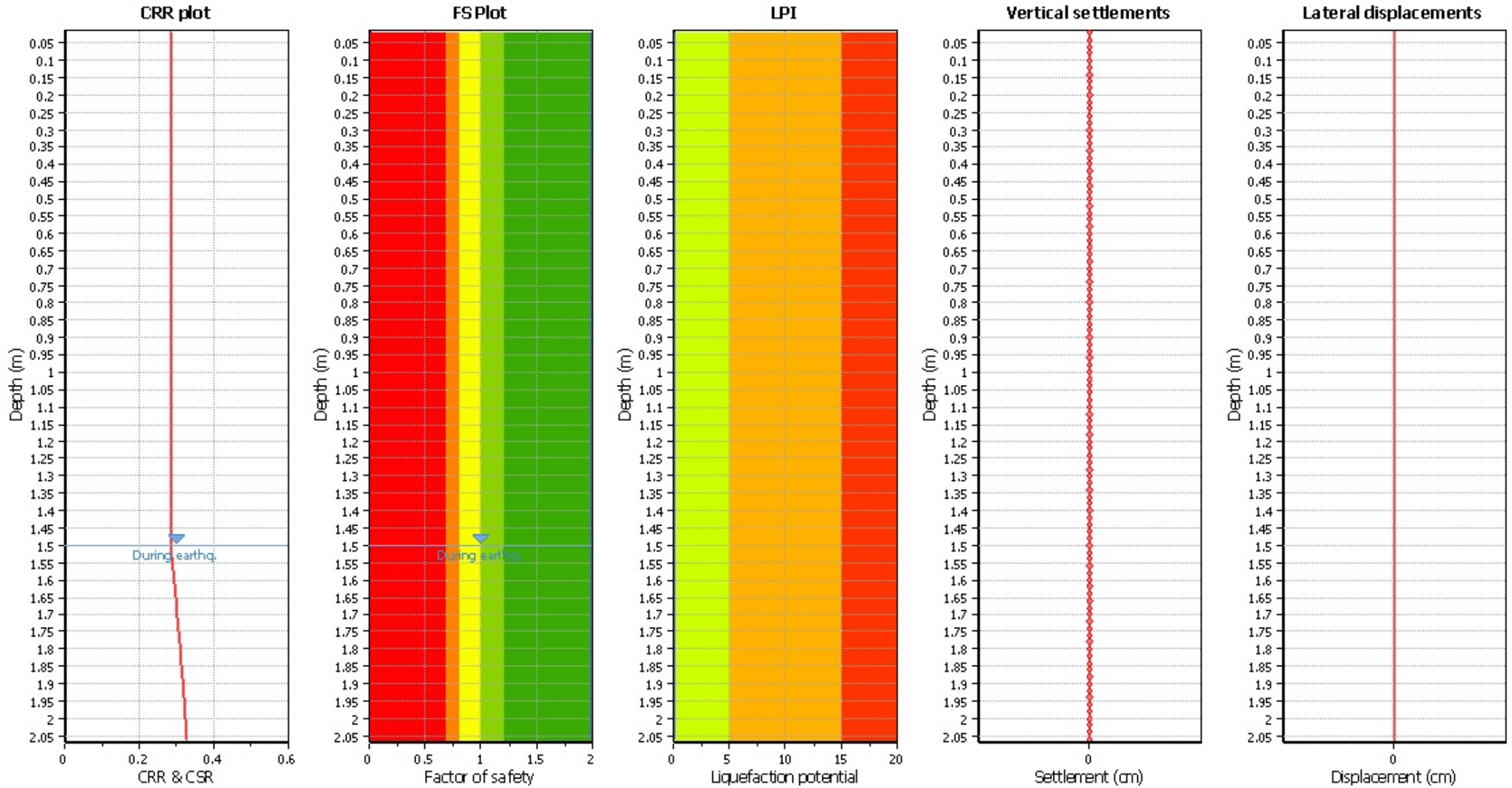
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.44	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_0 applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.44	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

LIQUEFACTION ANALYSIS REPORT

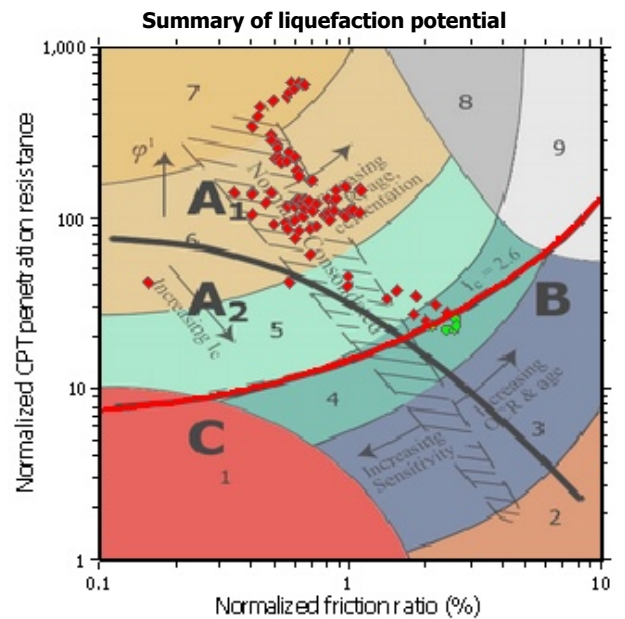
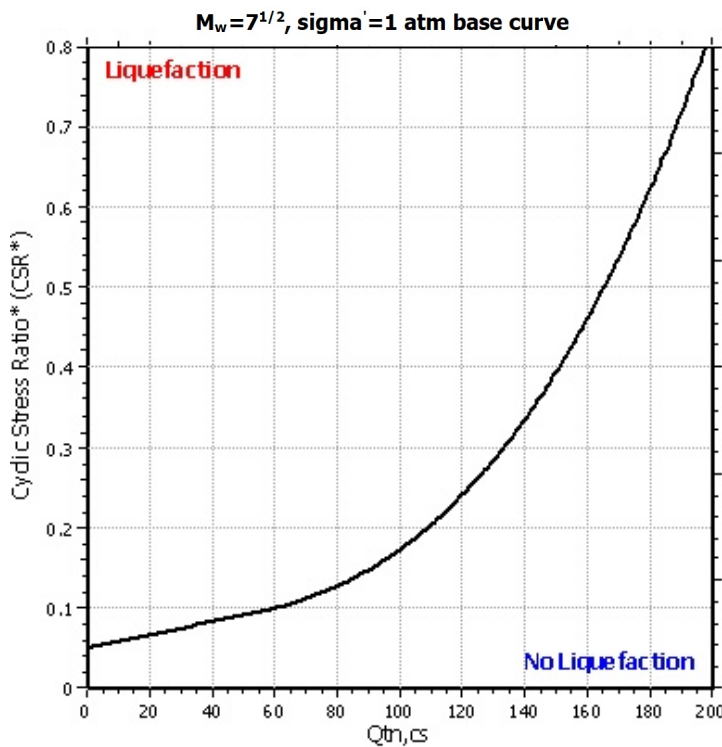
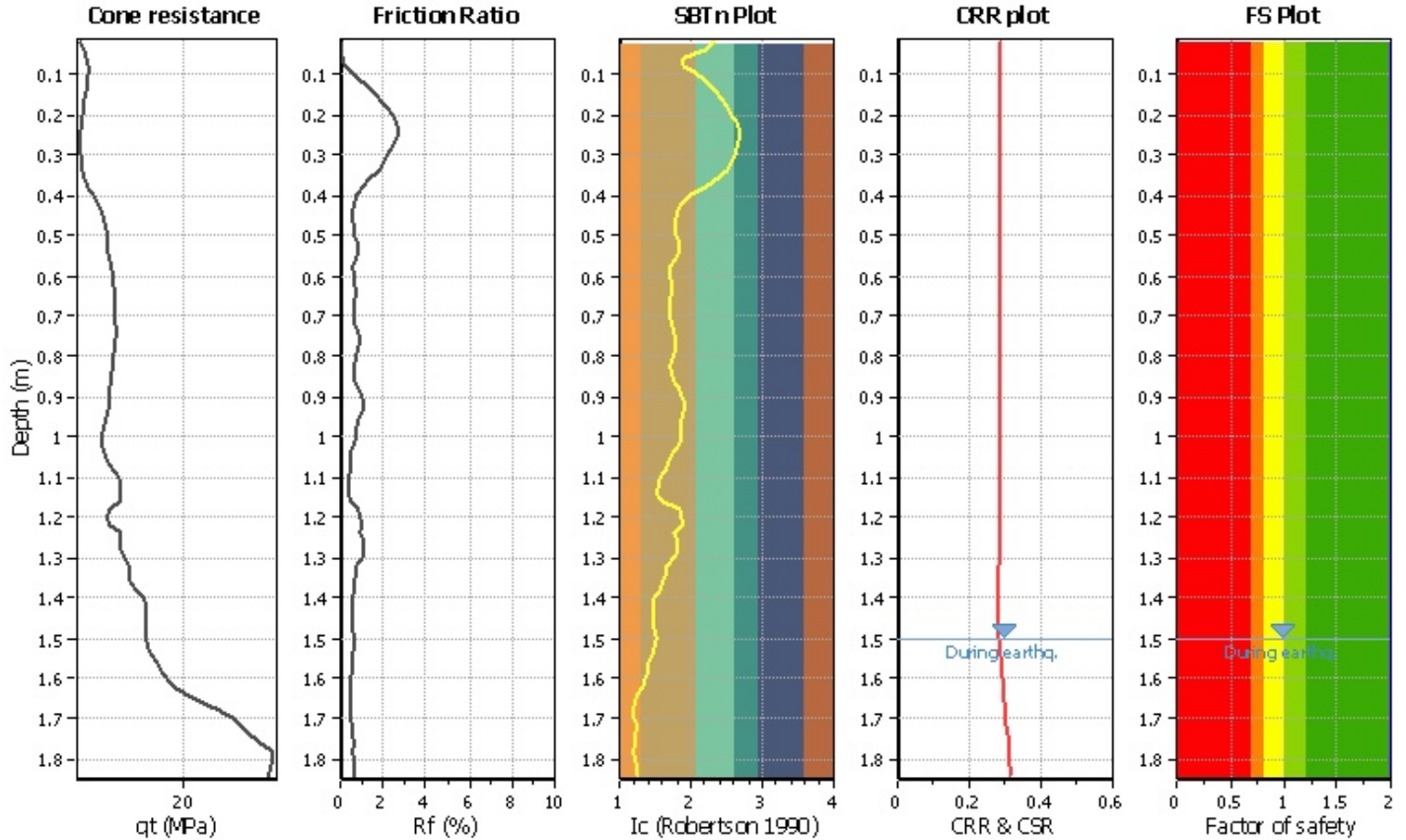
Project title : Geotechnical Investigation

Location : Arataki Road Subdivision

CPT file : CPT06_ULS

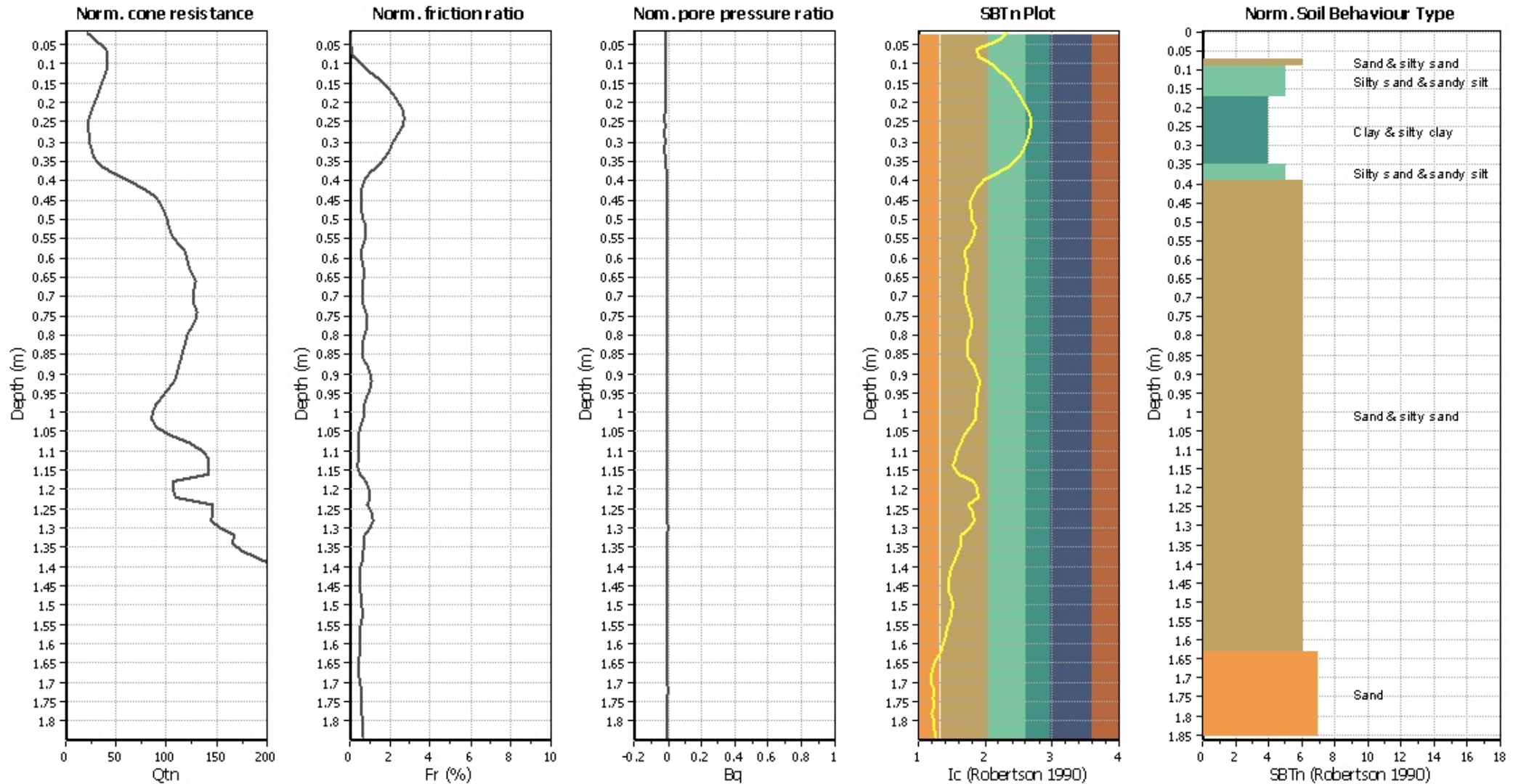
Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.44	Unit weight calculation:	Based on SBT	K_0 applied:	Yes		



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

CPT basic interpretation plots (normaliz



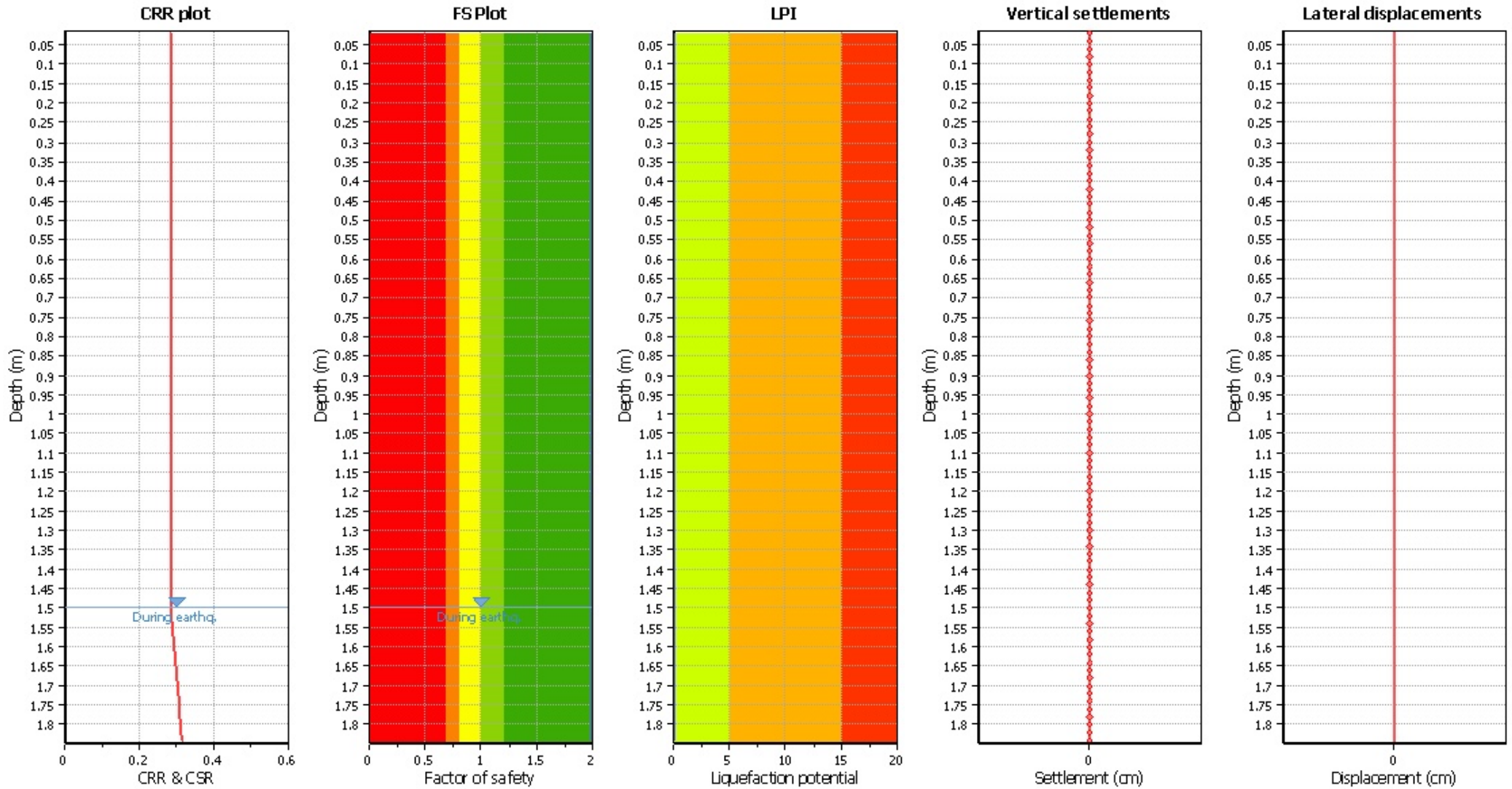
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.44	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_0 applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.44	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

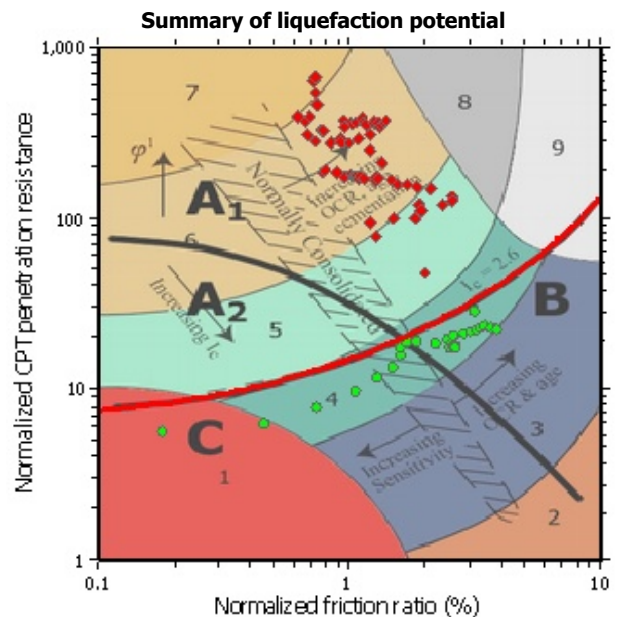
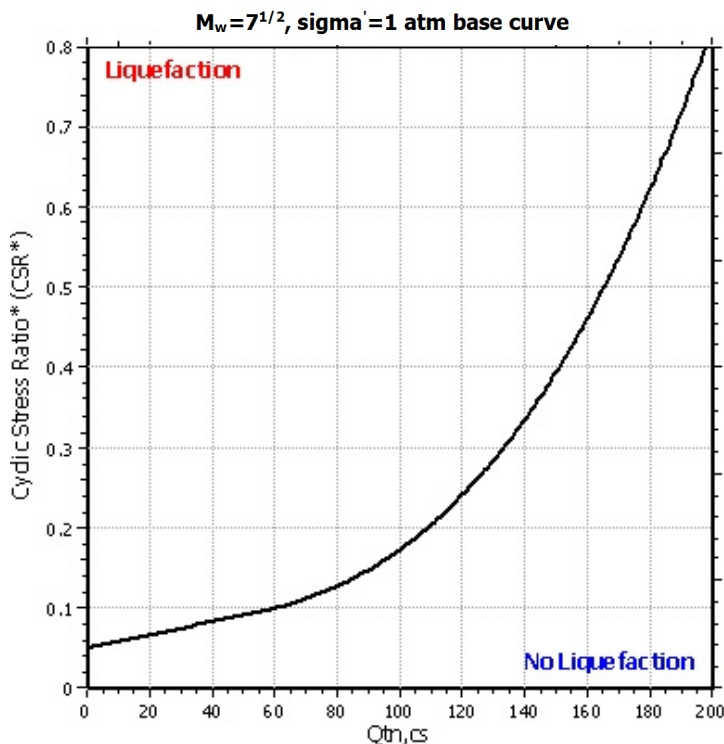
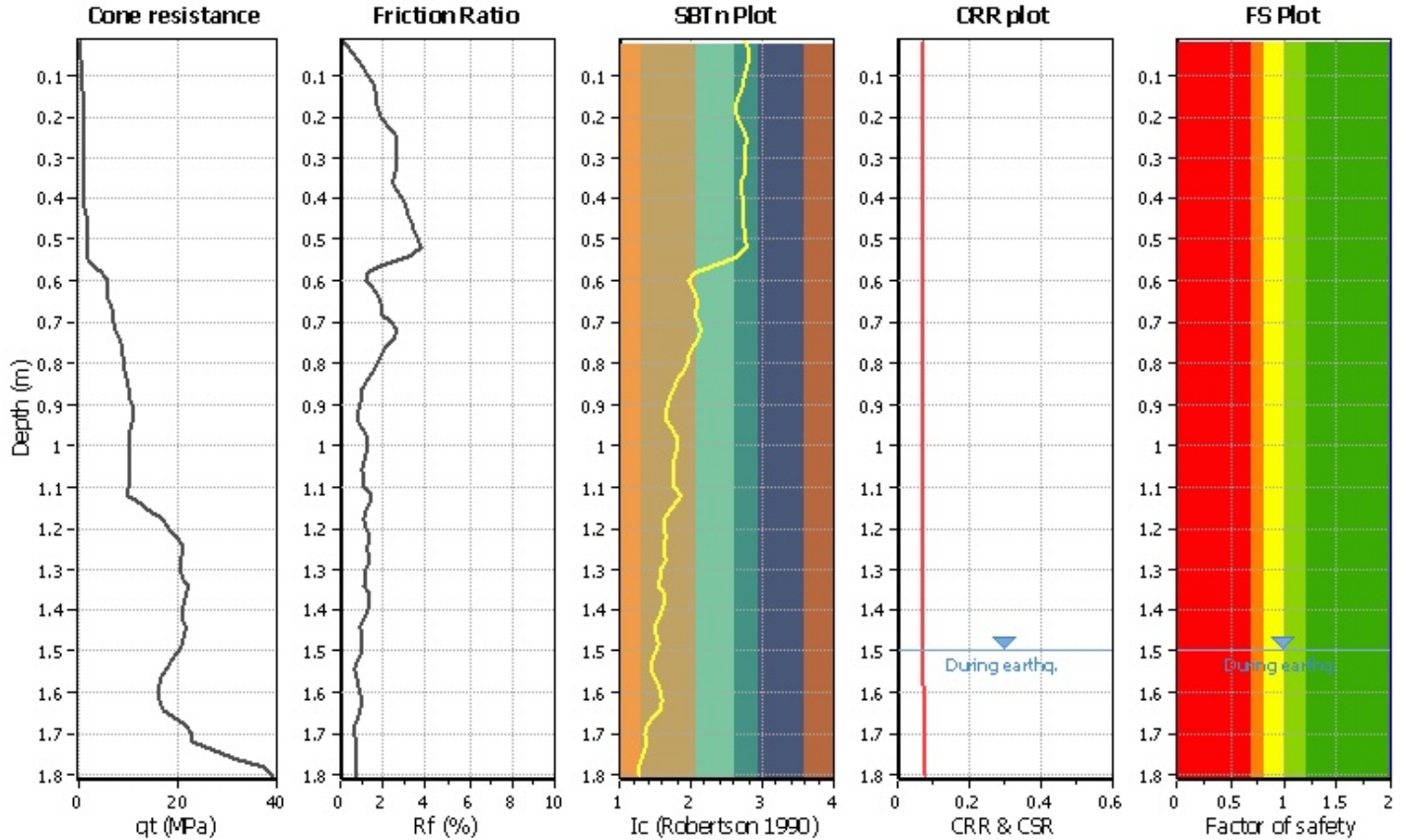
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

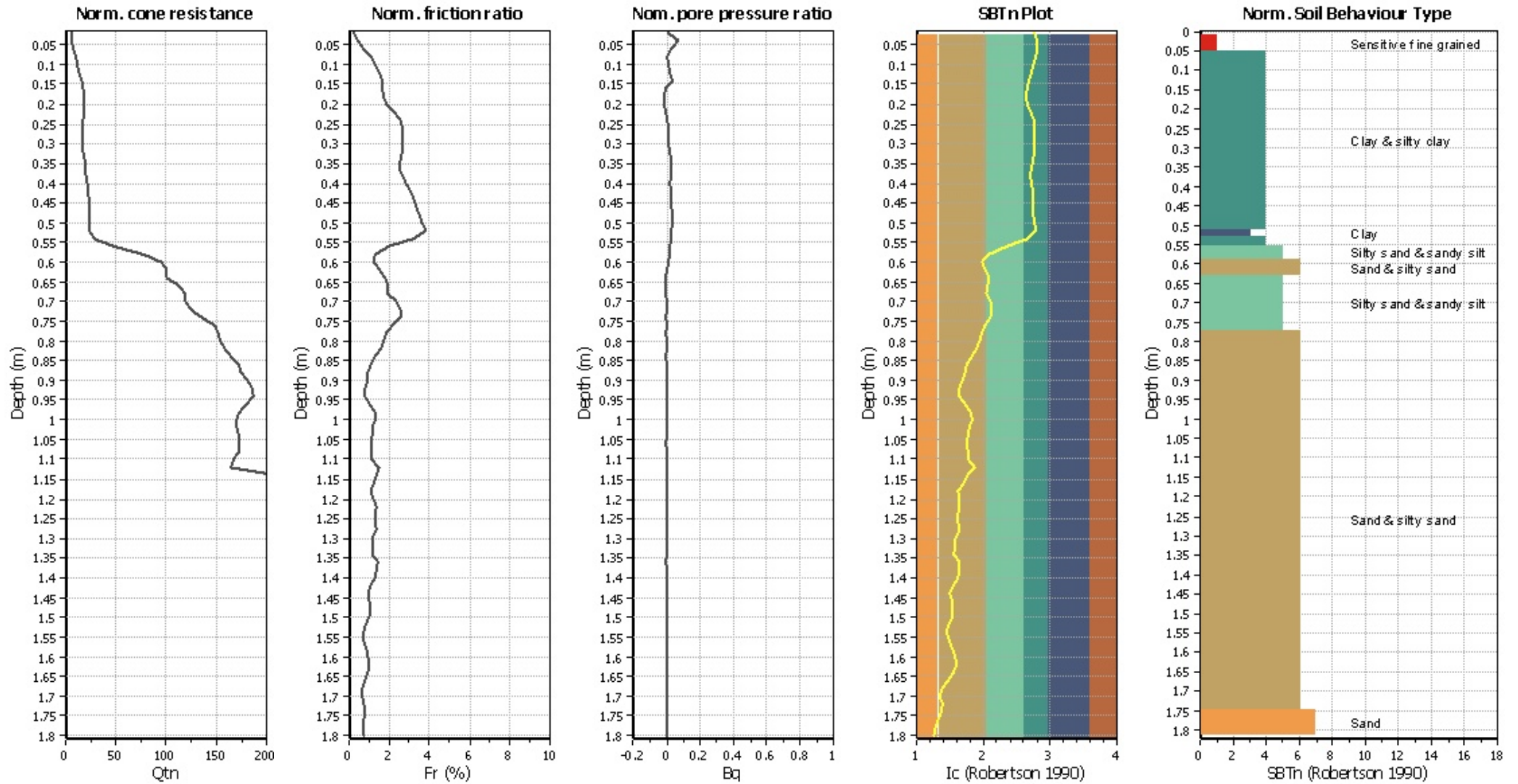
LIQUEFACTION ANALYSIS REPORT
Project title : Geotechnical Investigation
Location : Arataki Road Subdivision
CPT file : CPT07_SLS
Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.11	Unit weight calculation:	Based on SBT	K_0 applied:	Yes		



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

CPT basic interpretation plots (normaliz



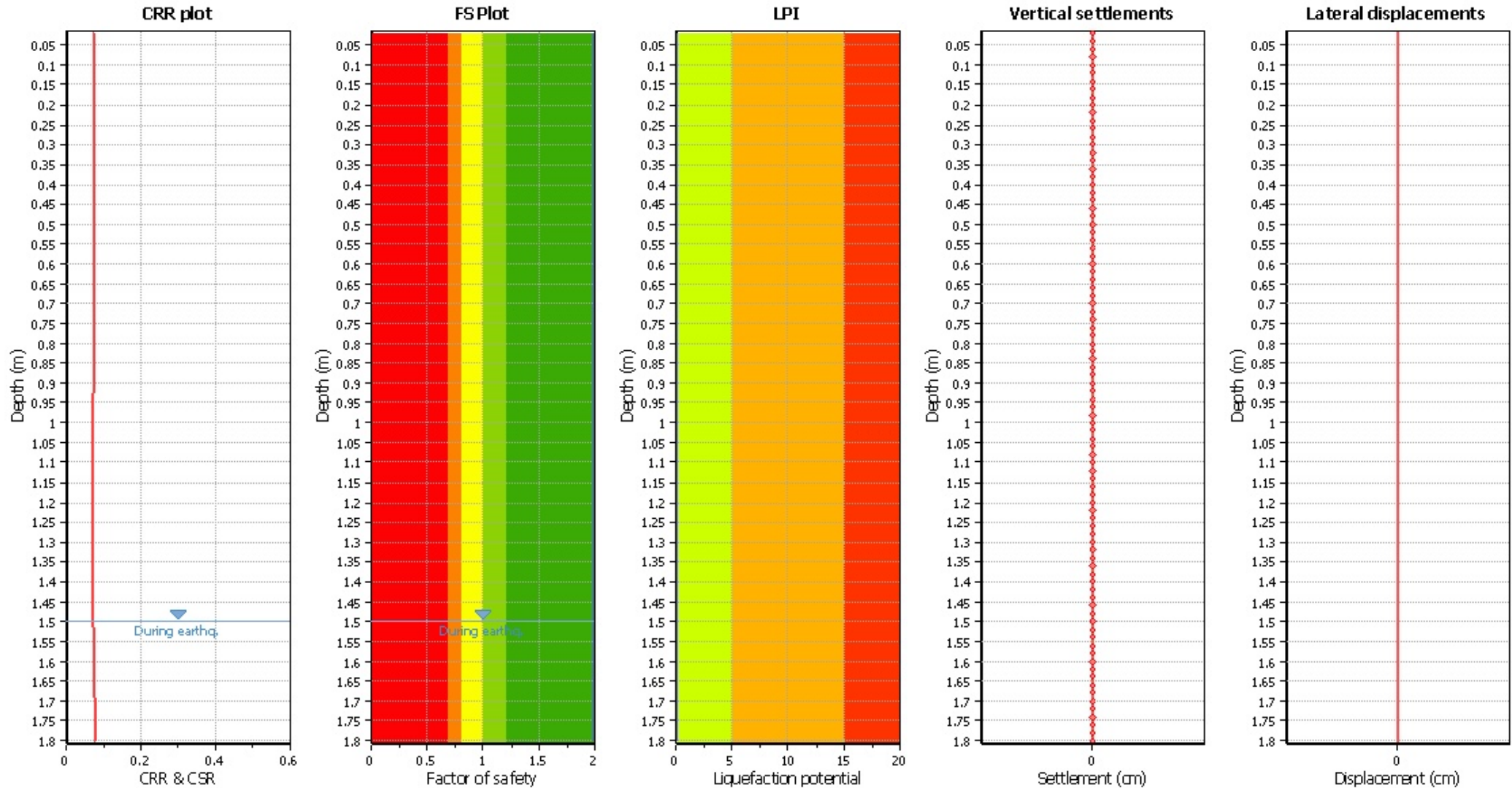
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.11	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_0 applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.11	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

LIQUEFACTION ANALYSIS REPORT

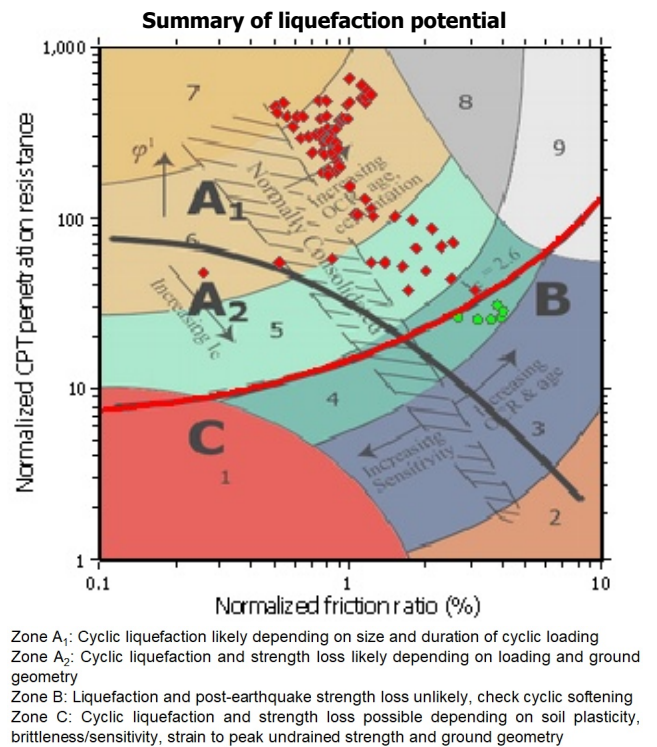
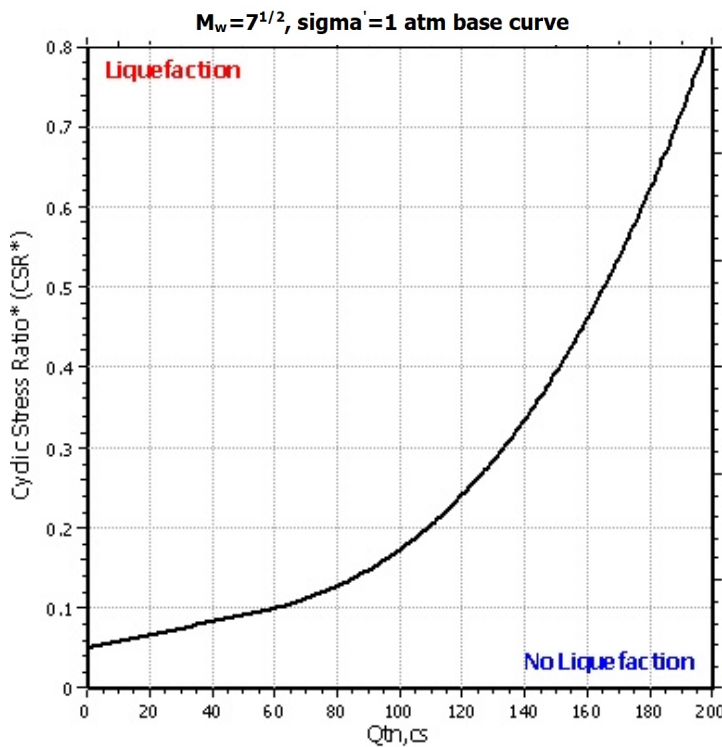
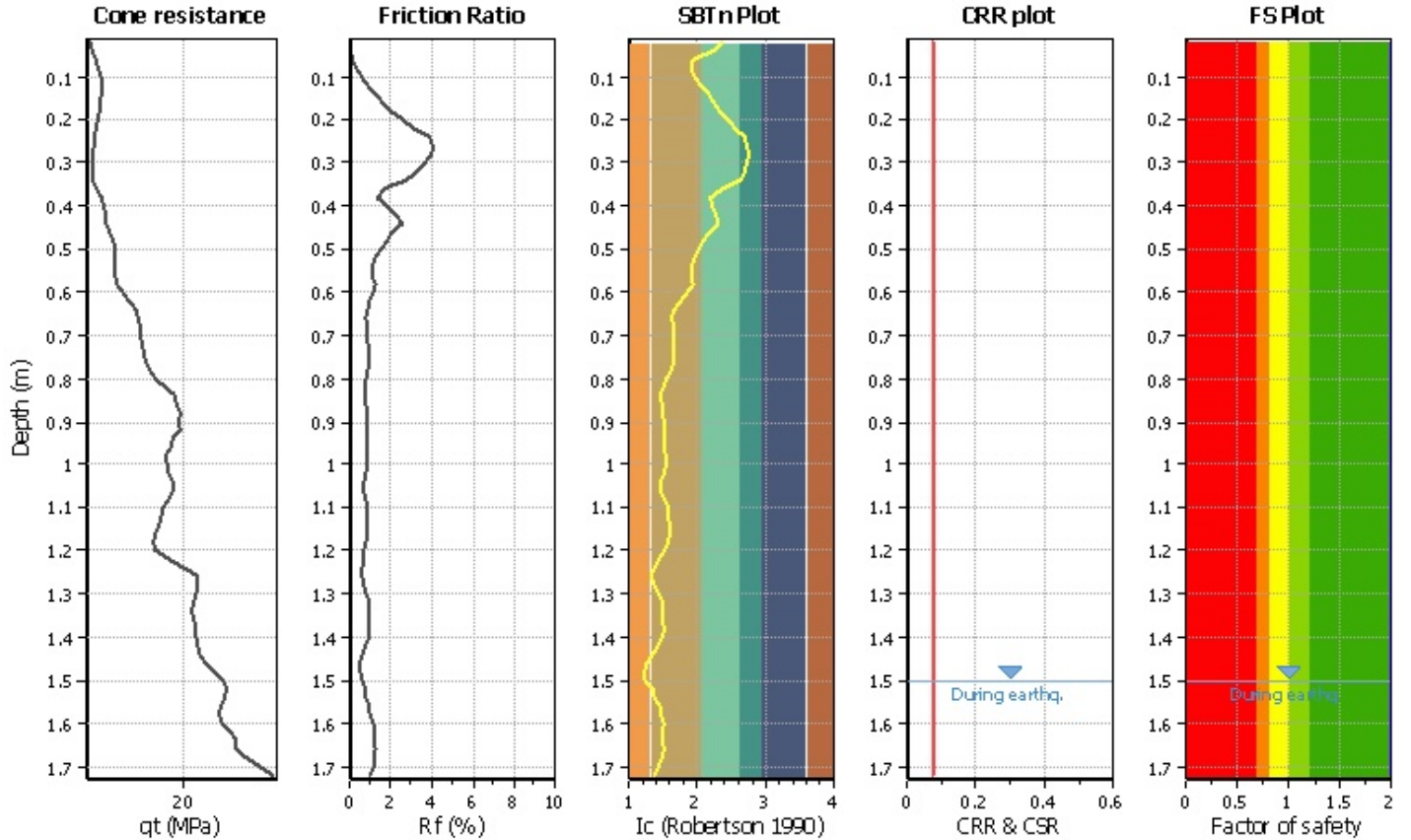
Project title : Geotechnical Investigation

Location : Arataki Road Subdivision

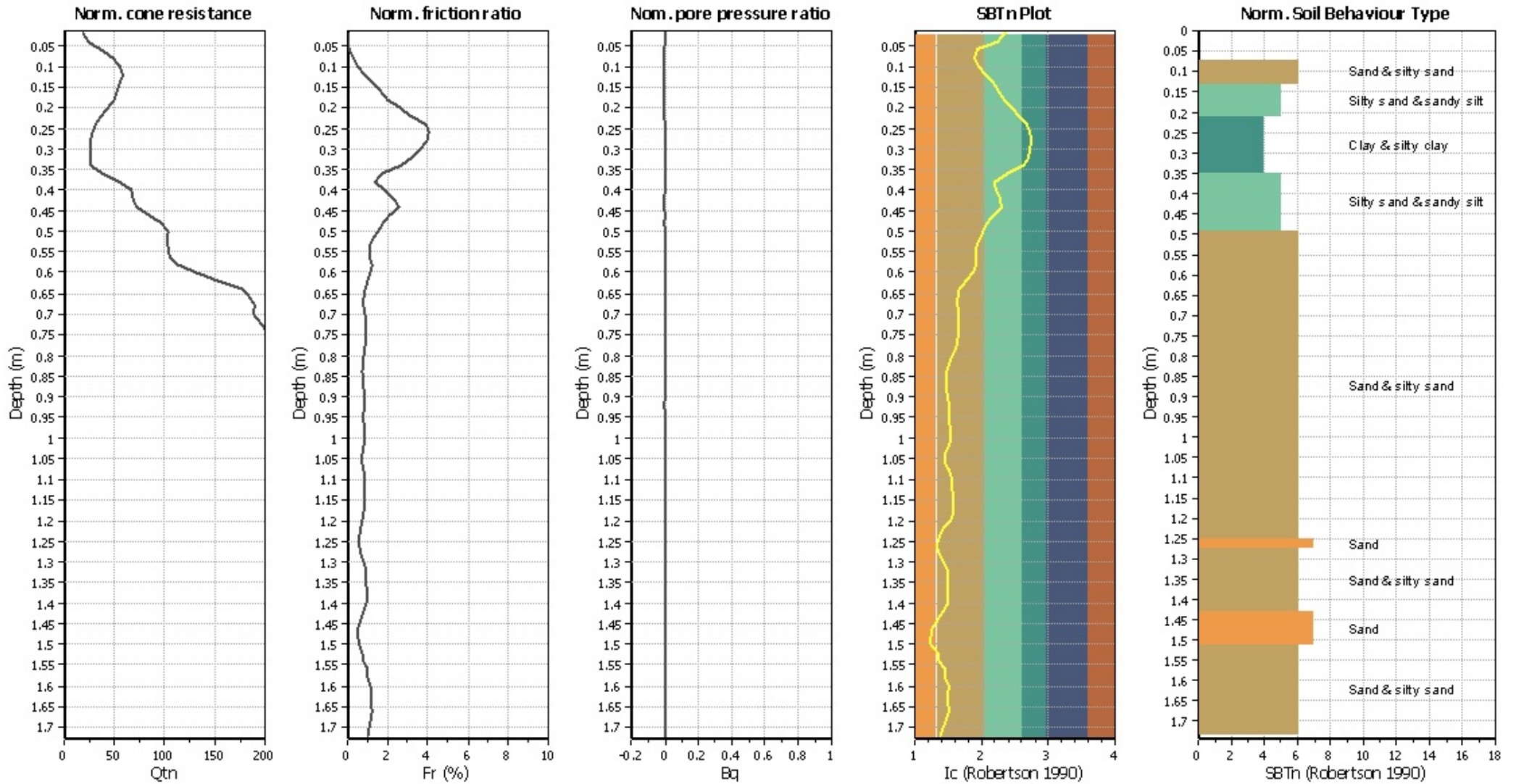
CPT file : CPT08_SLS

Input parameters and analysis data

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Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.11	Unit weight calculation:	Based on SBT	K_0 applied:	Yes		



CPT basic interpretation plots (normaliz



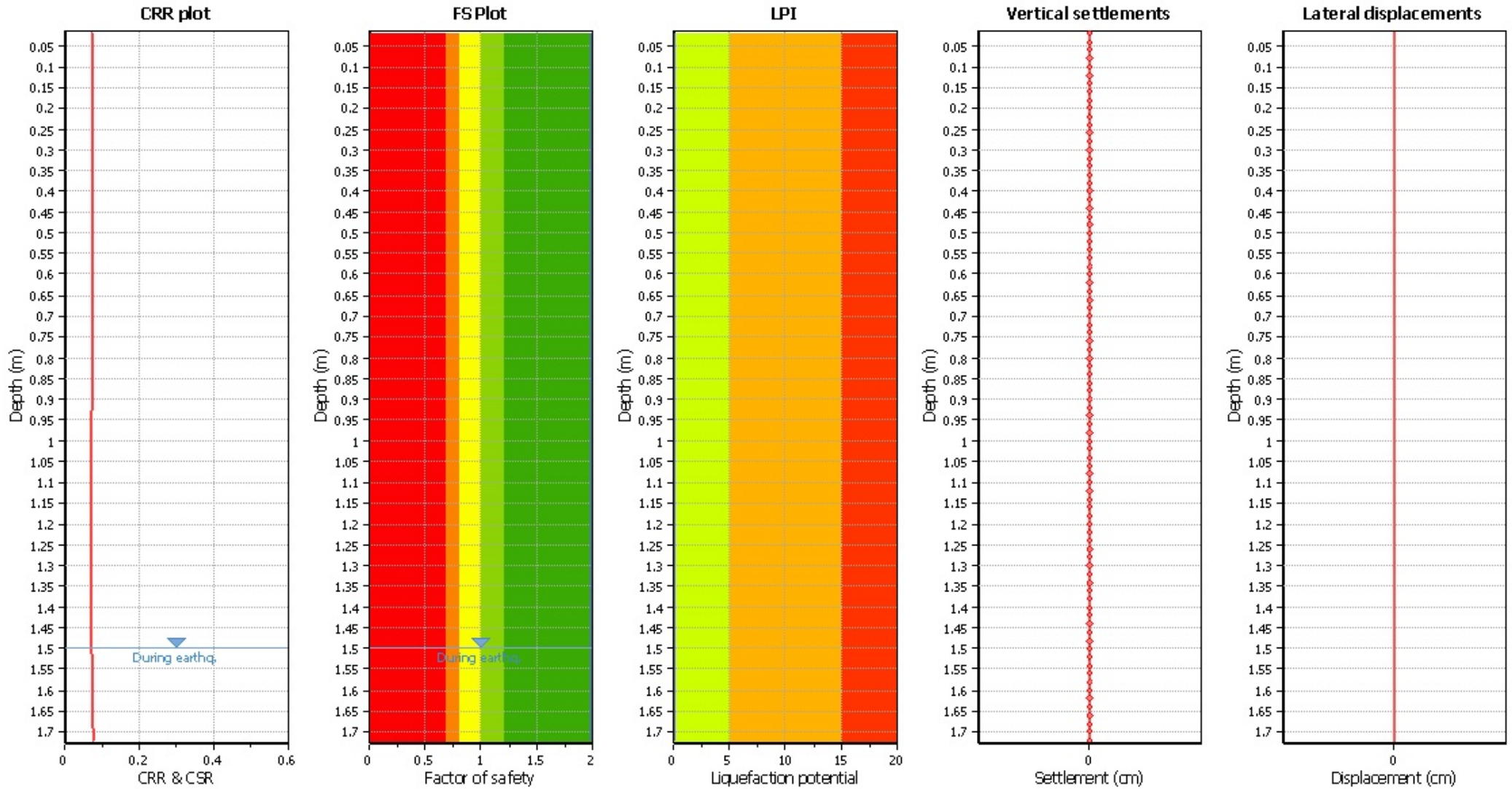
Input parameters and analysis data

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Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.11	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_0 applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.11	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

LIQUEFACTION ANALYSIS REPORT

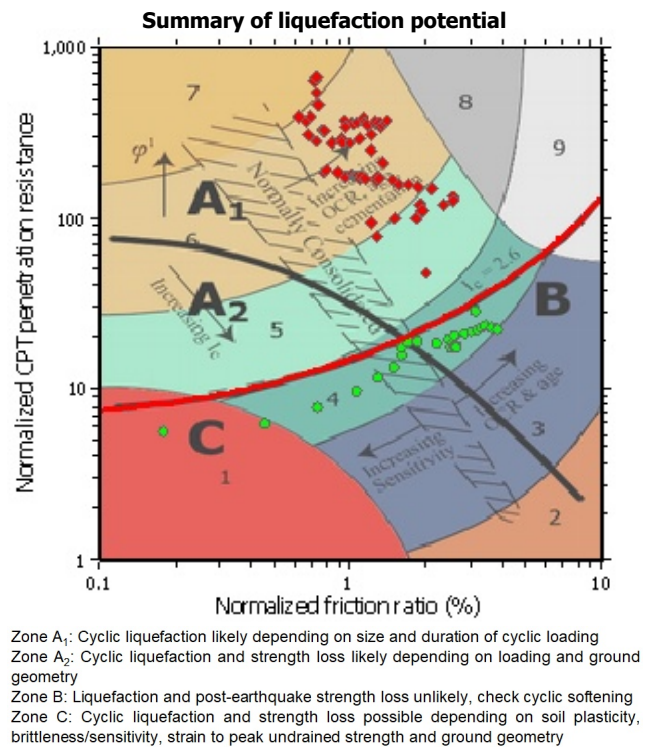
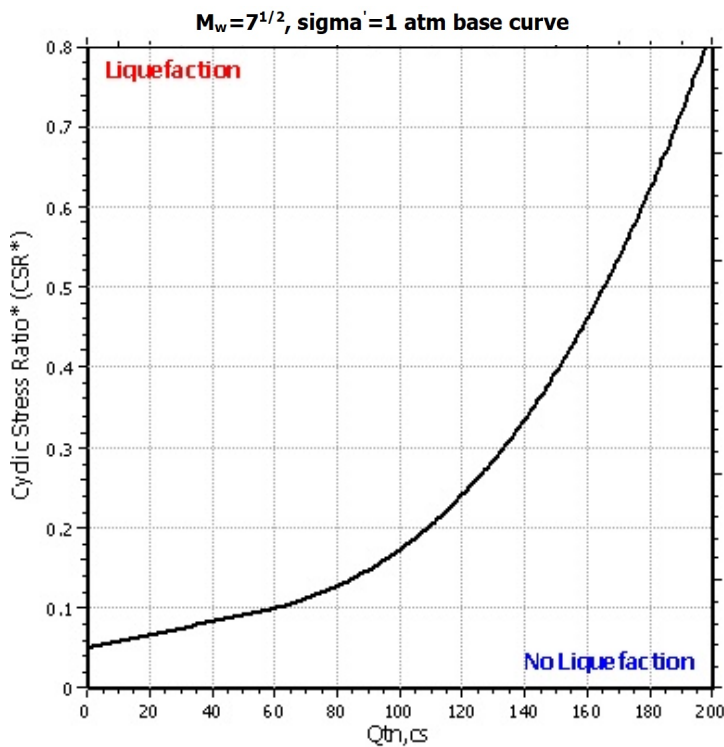
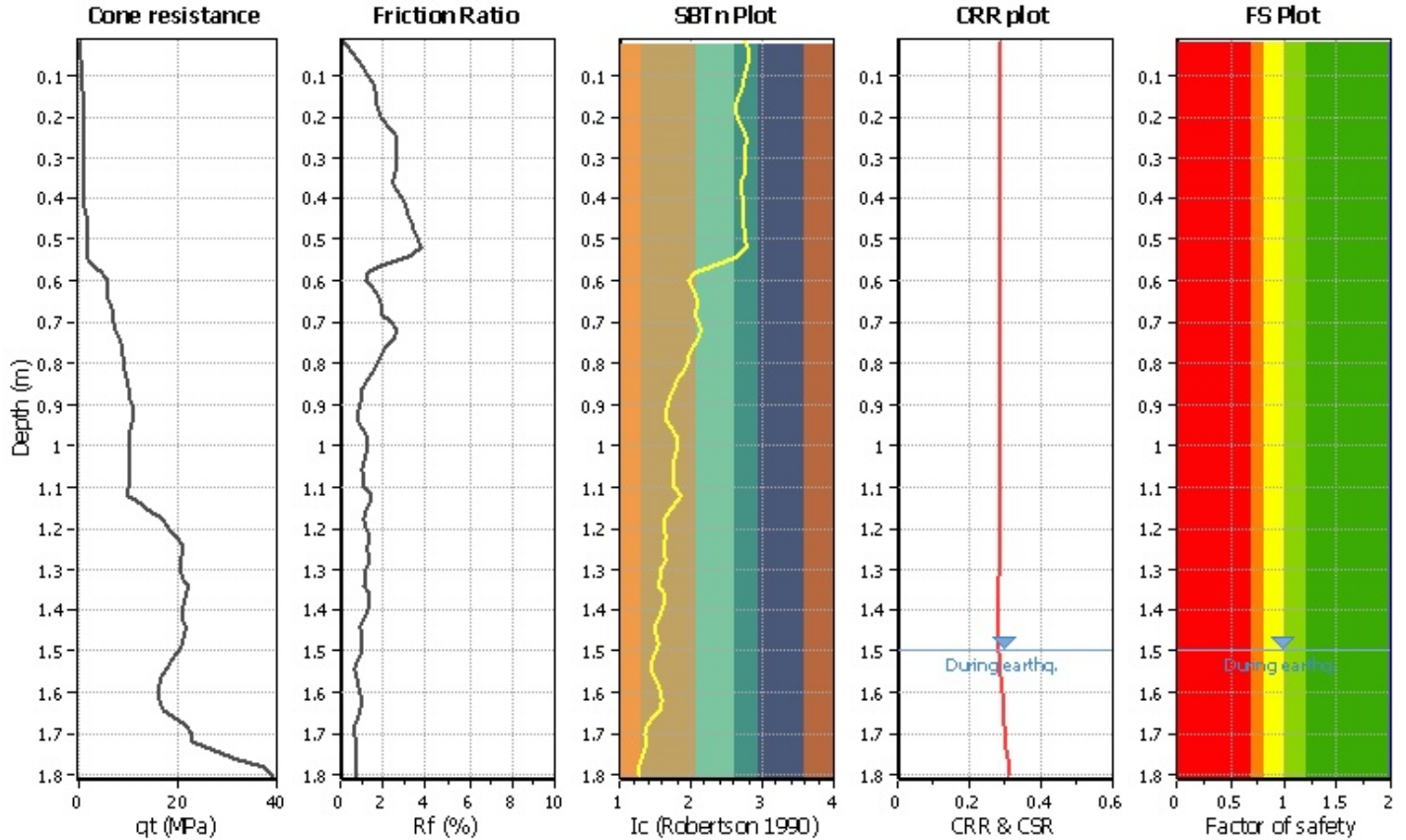
Project title : Geotechnical Investigation

Location : Arataki Road Subdivision

CPT file : CPT07_ULS

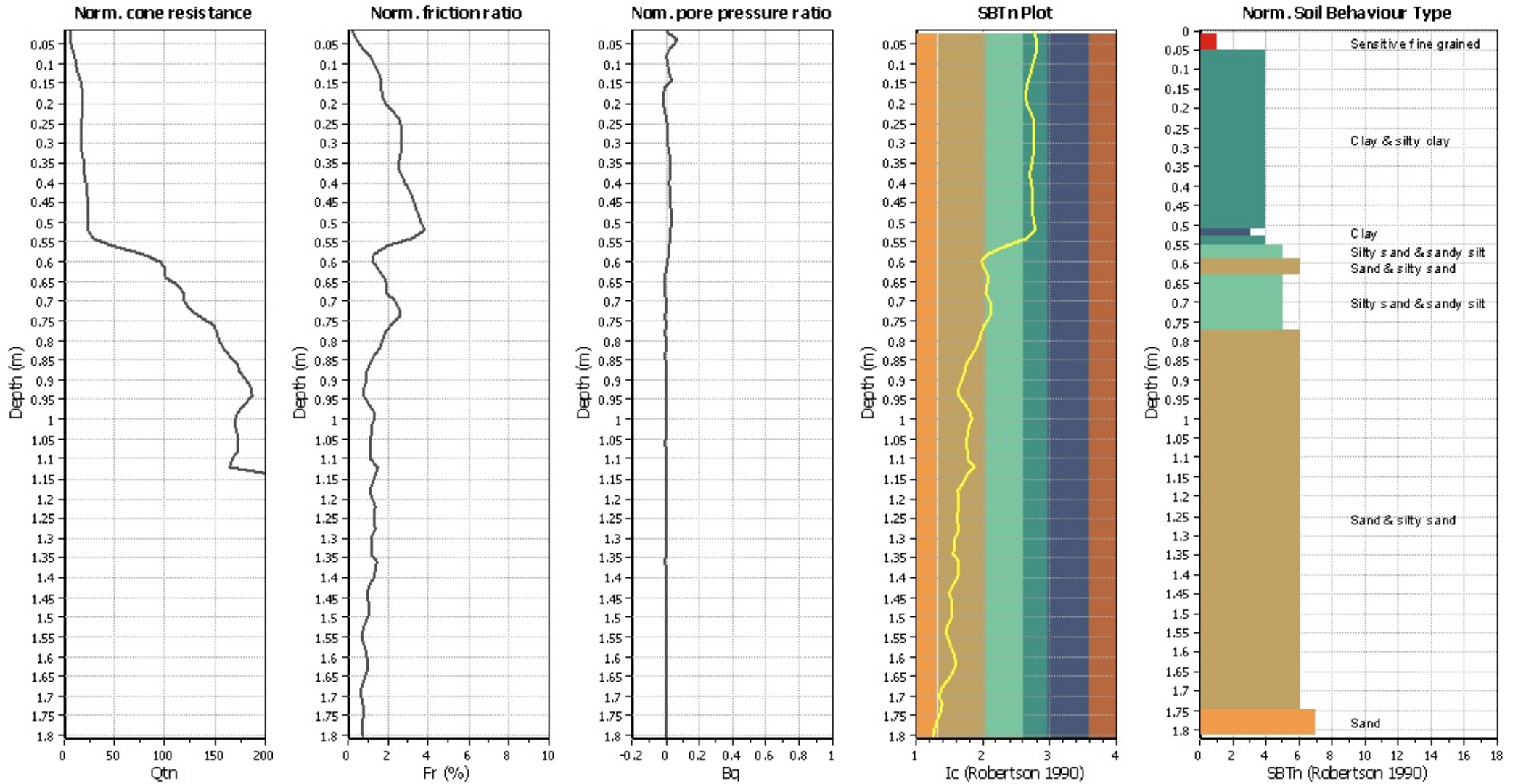
Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.44	Unit weight calculation:	Based on SBT	K_0 applied:	Yes		



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

CPT basic interpretation plots (normaliz



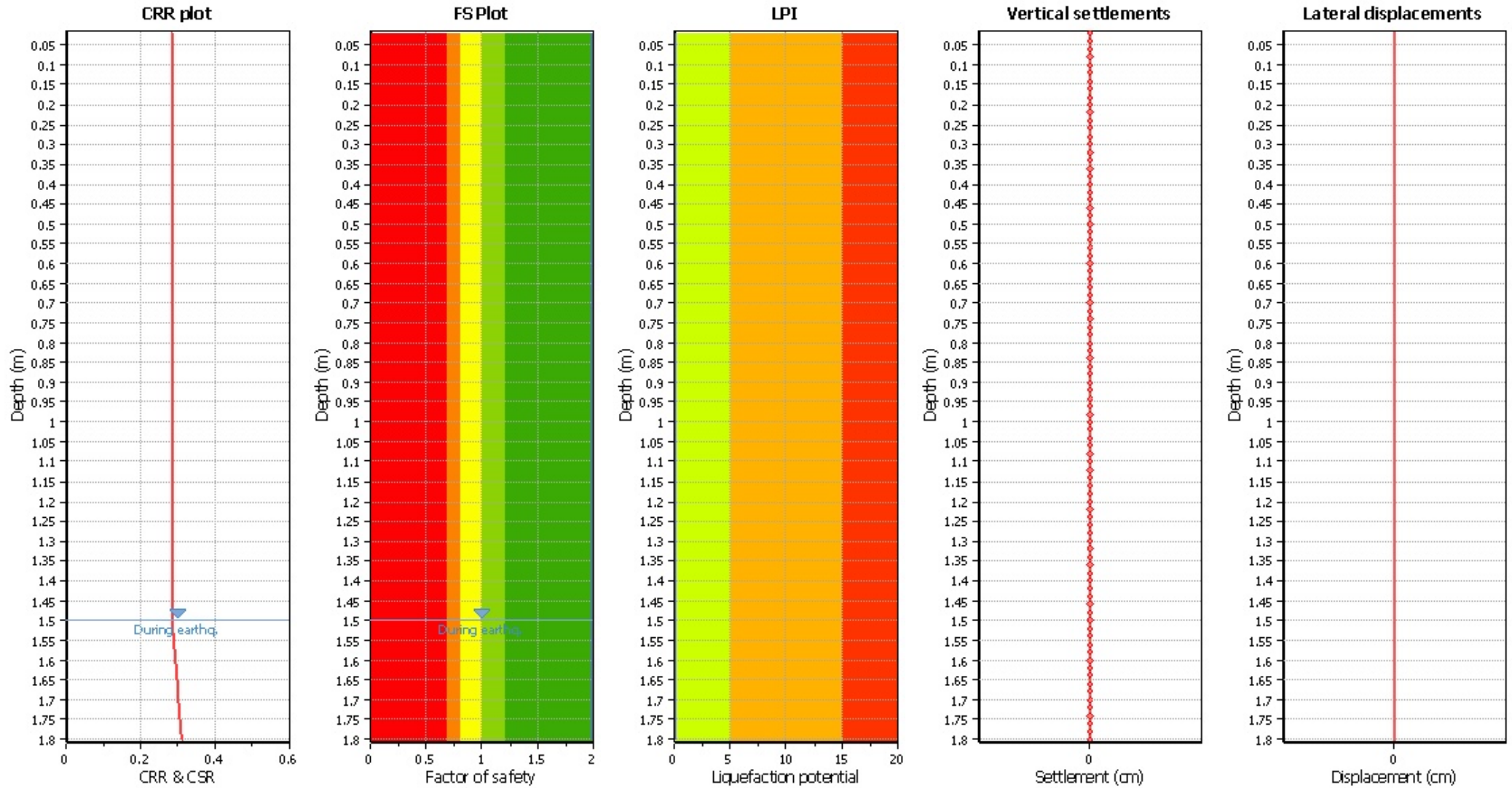
Input parameters and analysis data

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Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.44	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_0 applied:	Yes
Earthquake magnitude M_w :	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.44	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
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- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
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LIQUEFACTION ANALYSIS REPORT

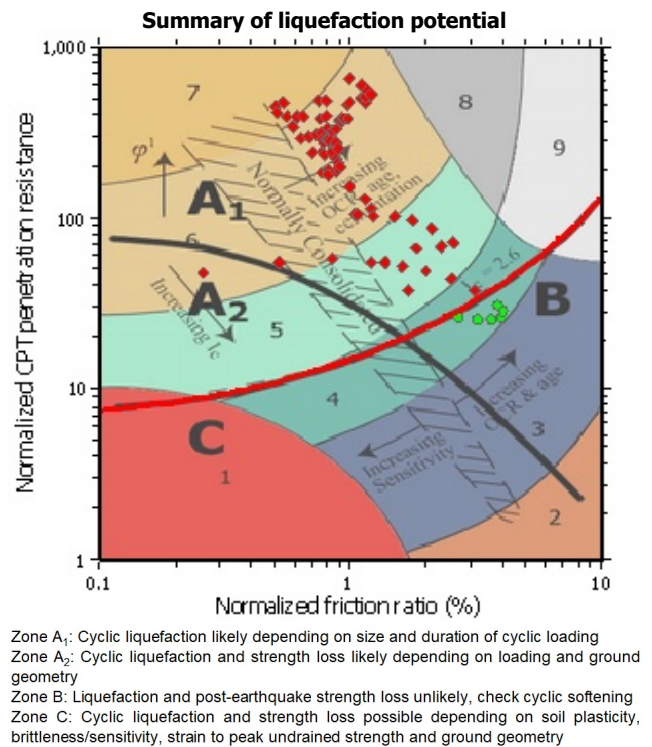
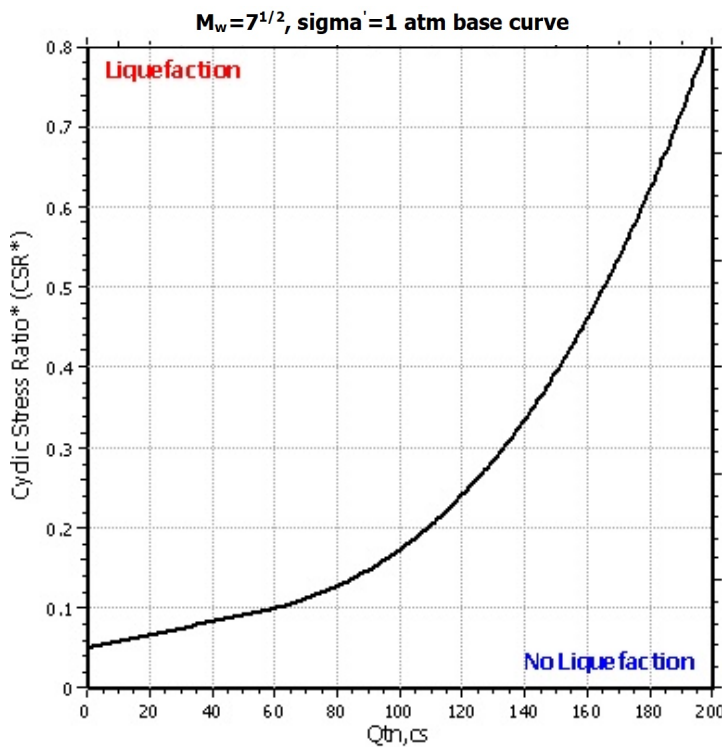
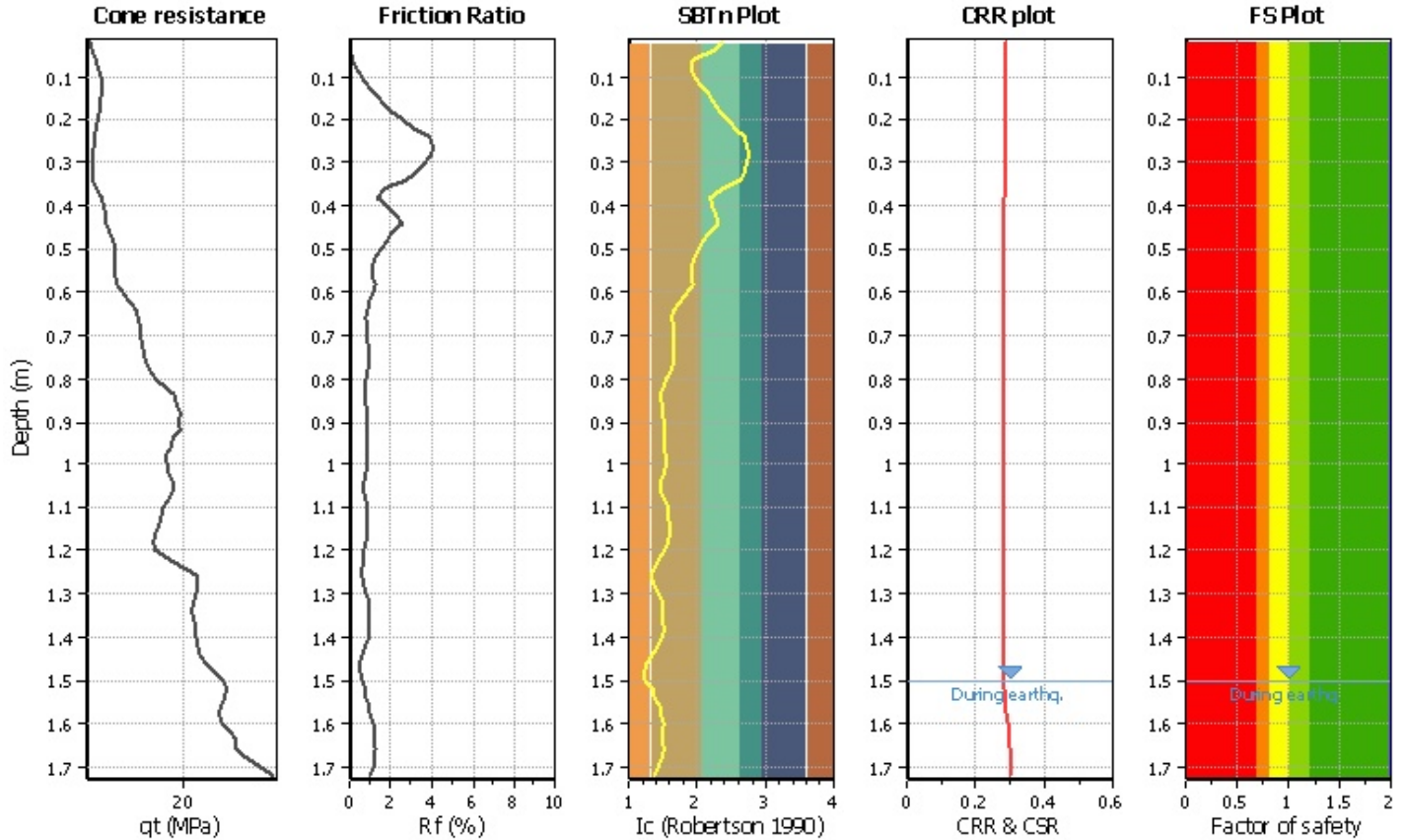
Project title : Geotechnical Investigation

Location : Arataki Road Subdivision

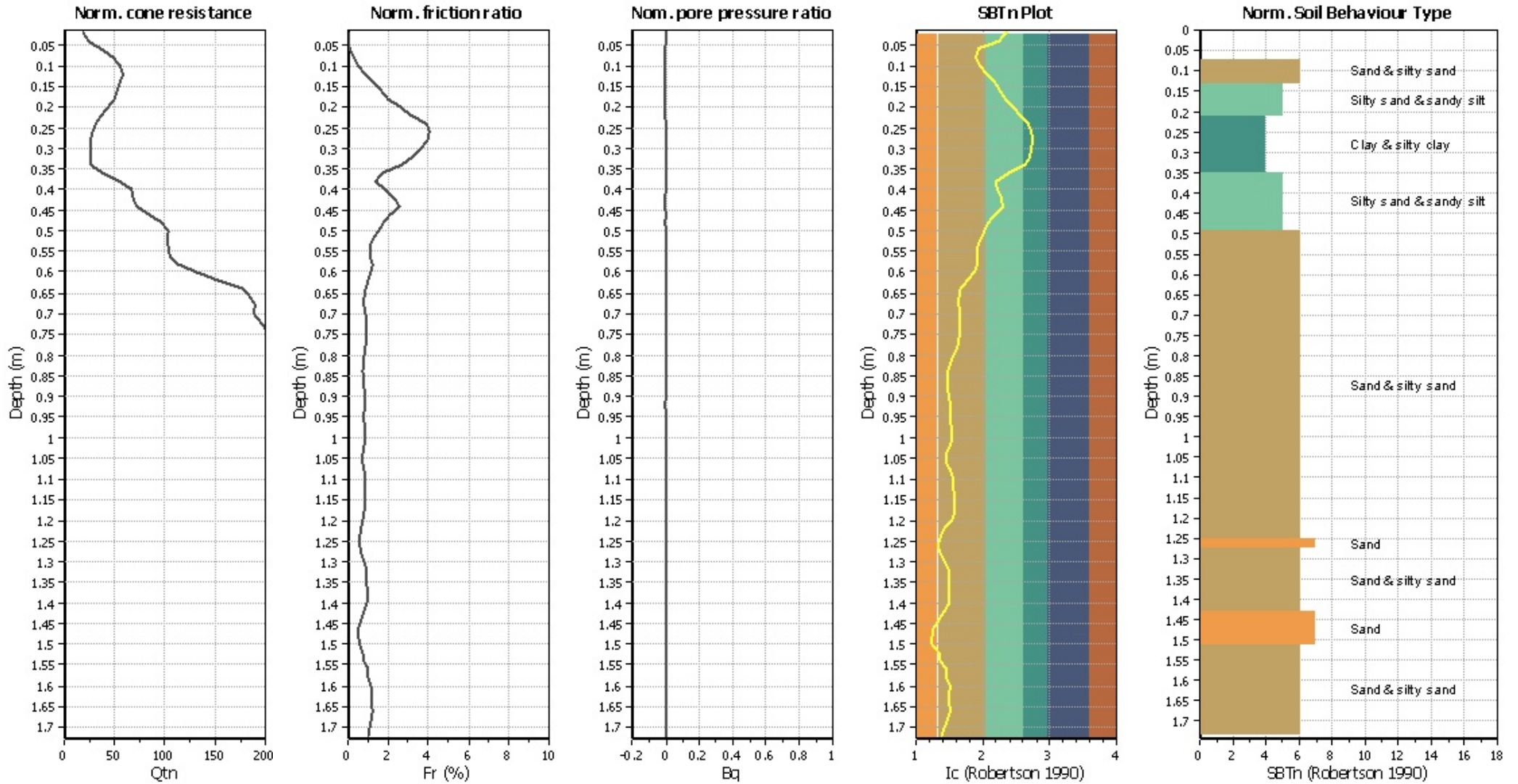
CPT file : CPT08_ULS

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w :	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.44	Unit weight calculation:	Based on SBT	K_0 applied:	Yes		



CPT basic interpretation plots (normaliz



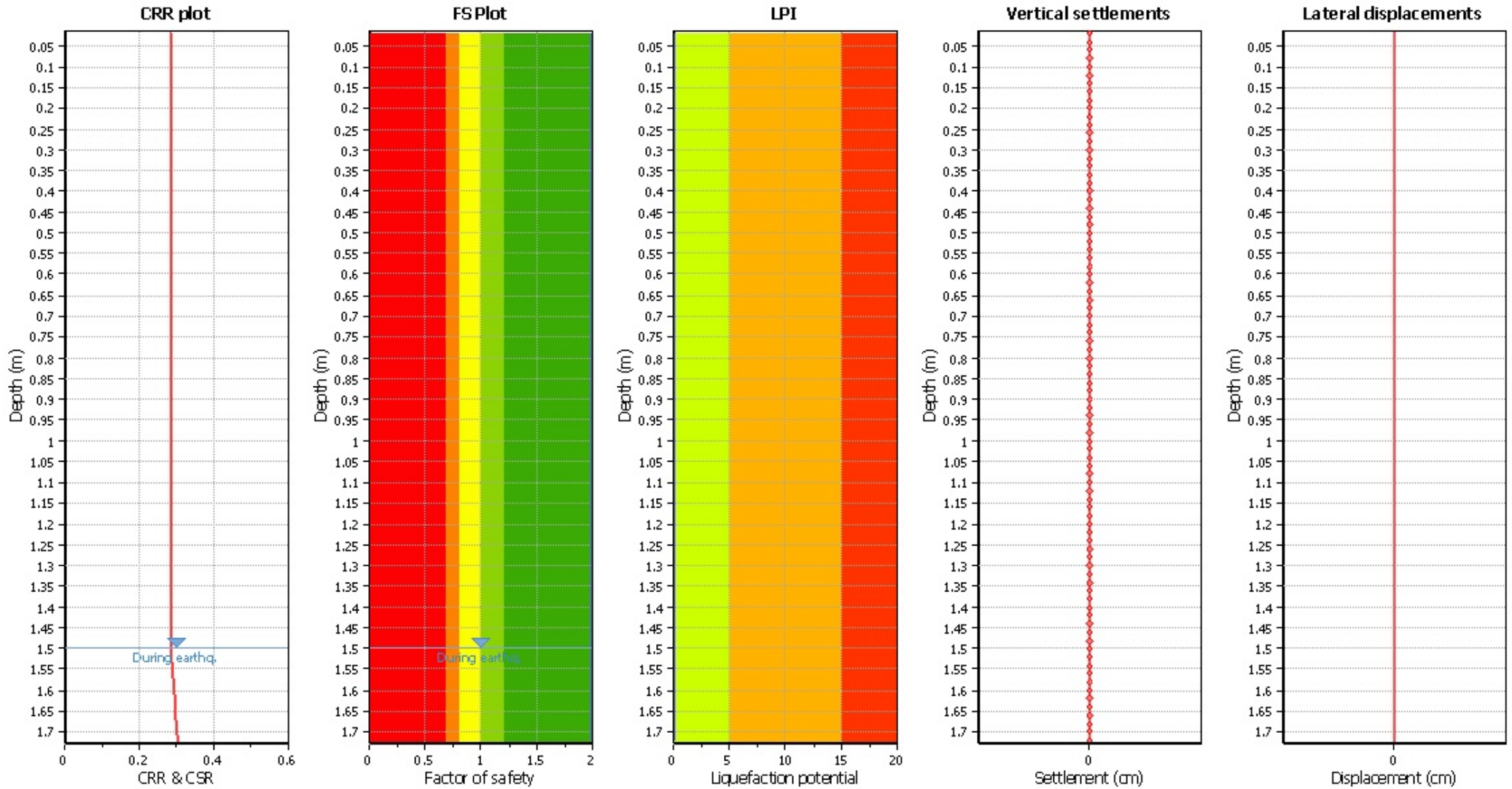
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
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SBTn legend

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3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	1.50 m	Fill weight:	N/A
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F.S. color scheme

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LPI color scheme

- Very high risk
- High risk
- Low risk

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be, and, in general, if you are the least bit uncertain about the continued reliability of this report, contact your geotechnical engineer before applying it.* A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may

perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old*.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, *proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration*. Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. *Geotechnical engineers are not building-envelope or mold specialists*.



Telephone: 301/565-2733

e-mail: info@geoprofessional.org www.geoprofessional.org