# 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  $400m^2$  to  $750m^2$ .

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 loesscovered 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 fours 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).



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#### 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.



Geotechnical Investigation for Arataki Road Subdivision Stage 1A & 1B

3.4 GROUND WATER

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

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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.



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### 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.

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

### TABLE 1: SUMMARY OF SHALLOW ULTIMATE BEARING CAPACITY

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:

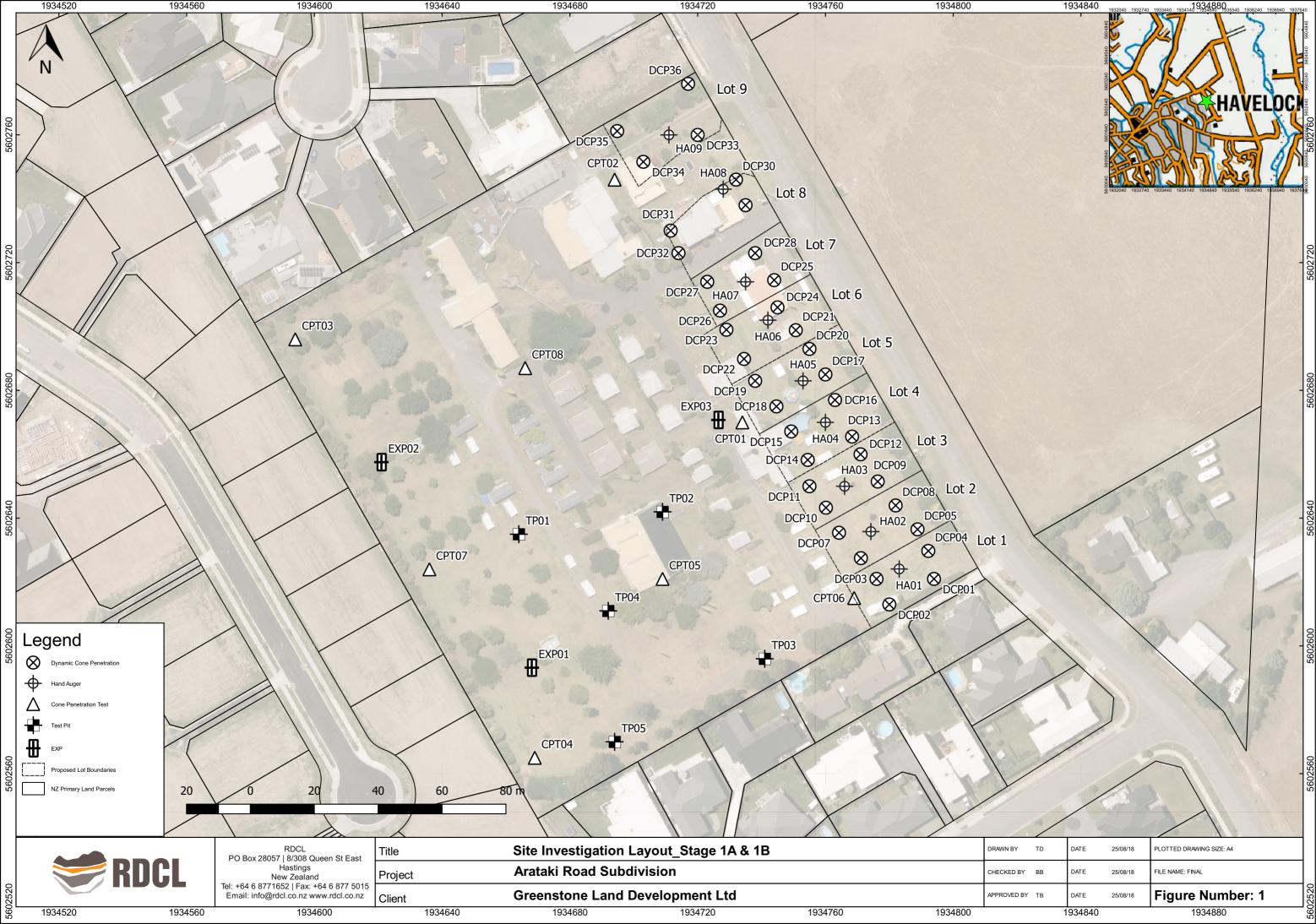
CA Wylie MSc, MIPENZ; CPEng Principal



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FIGURES





# **APPENDIX A**

# DCP, HAND AUGER AND TEST PIT LOGS OUTPUTS





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										4	Standing Water Level Out flow In flow				
	<b>RDCL</b> 8/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand Ph: +64 6 8771652   Email: info@rdcl.co.nz														



													SHEET 7 OF 9	
CL	ENT:	Gre	ensto	ne Land Developments Ltd	PROJECTIC	DN: N	IZTM				LOCATION: Lot 7			
PR	OJEC	CT:	18425	50602	EASTING:	19	3473	5.00			STARTED: 20/08/2018			
LO	CATI	ON:	139 A	rataki Road	NORTHING	: 56	0271	4.00			FINISHED: 20/08/2018			
					DATUM:						LOGGED BY: SD DATE: 16/08/20			
OF	FICE		RDCL		ELEVATION: -						CHECKED BY: T	в	DATE:	
		ER:			DIAMETER: 0mm						STATUS: Final da			
			R: R	DCI	OPERATOR:									
						1		7						
DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION		MOISTURE	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS		SAMPLES & TESTS	A	DDITIONAL REMARKS	
-	-		ALC S	Gravelly TOPSOIL; dark brown. Stiff; moist; gra coarse, subround; Non Plastic.	avel, fine to	M	SF							
-	-													
-	-			EOH: 0.05m Termination: HA grinding on surface gravel										
-0.5	-0.5													
-	F													
-	ŀ													
-1.0														
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[	F													
4.5	-1.5													
- 1.5 -	-													
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-2.0	-2.0													
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-3.5	- ~													
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	<u> </u>	<u> </u>		1		<u> </u>	<u> </u>				MARKS npted two hand augers in 05 m	n Lot 7 a	nd both refused approximately	
										SYN	IBOLS			
											Standing Water Level			
					Out flow ▷- In flow									
<u> </u>					סחס	1								
	<b>RDCL</b> 8/308 Queen St East, Hastings   PO Box 28057, Havelock No Ph: +64 6 8771652   Email: info@rdcl.cc									h 413 z	30   New Zealand			



SHE	FT 8	OF	9
	- 0	<u> </u>	0

												SHEET & OF 9
CL	ENT:	Gre	ensto	ne Land Developments Ltd	PROJECTIC	N: N	IZTM				LOCATION: Lot 8	
PR	OJEC	CT:	18425	50602	EASTING:	19	3472	8.00			STARTED: 20/08	8/2018
LO	CATI	ON:	139 A	rataki Road	NORTHING:	56	0274	3.00			FINISHED: 20/08	8/2018
					DATUM:						LOGGED BY: SI	D DATE: 20/08/2018
OF	FICE	:	RDCL		ELEVATION	: -					CHECKED BY: TE	
		ER:			DIAMETER:		ım				STATUS: Final da	
			R: R	DCI	OPERATOR							
								_				
DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION		MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS		SAMPLES & TESTS	ADDITIONAL REMARKS
-	-		<u>а</u> н з ы ТС ан ы ан	TOPSOIL, with some gravel, with trace sand; d Firm; moist; gravel, fine to medium, subround t some rootlets; non plastic.	lark brown. o round;	м	FM					
	- 0.5			SAND, with some silt and gravel; brown. Mediu -plastic; moist; sand, fine to coarse; gravel, fine subround.	ım dense; non e to medium,		MD					
				EOH: 0.55m Termination: HA grinding on gravel; no recovery								
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											IBOLS	
											Standing Water Level	
											Out flow In flow	
					RDC							
				8/308 Queen St East, Hastings Ph: +64 6	8   PO Box 280 8771652   Em	)57, H nail: ii	lavel	lock I rdcl.c	North	n 413 z	30   New Zealand	



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													SHEET 9 OF 9
CLI	ENT:	Gre	ensto	ne Land Developments Ltd	PROJECTIC	N: N	IZTM				LOCATION: Lot 9		
PR	OJEC	CT:	18425	0602	EASTING:	19	3471	1.00			STARTED: 20/08	/2018	
LO	CATIO	ON:	139 A	rataki Road	NORTHING:	56	0276	0.00			FINISHED: 20/08	/2018	
					DATUM:						LOGGED BY: SE	)	DATE: 20/08/2018
OFI	FICE		RDCL		ELEVATION	: -					CHECKED BY: TE	3	DATE:
		ER:			DIAMETER:		ım				STATUS: Final dat		
			R: R	DCI	OPERATOR								
					0. 2			7					
DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION		MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS		SAMPLES & TESTS	AD	DDITIONAL REMARKS
-	-		200 2 20 TS 200 - 200 20 - 200	TOPSOIL, with some gravel; dark brown. Firm; gravel, fine, subround to round; Some Roots.	moist;	м	FM						
				Silty SAND, with trace gravel; brown. Dense; n moist; sand, fine to coarse; gravel, fine to medi	on-plastic; um,		D						
- 0.5	- 9 -			EOH: 0.50m									
-	-			Termination: HA grinding on gravel; no recovery									
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	_												
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-3.0	-3.0												
-	-												
- 3.5	-3.5												
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-	-												
										REI	MARKS		
										SYI	MBOLS		
										⊻	Standing Water Level		
											Out flow		
											In flow		
				8/308 Queen St East, Hastings Ph: +64 6	RDC   PO Box 280 8771652   Em	)57, ł	Havel വ്ര@	lock I rdcl c	Norti	h 41: z	30   New Zealand		
L				1 11. 104 0						-			



										SHEET 1 OF 36
CL	IENT:	Gre	eensto	ne L	and Developments Ltd	PROJECT	ION	I: NZTM	LOCATION: Lot 1	
PR	OJEC	CT:	18425	5060	2	EASTING:		1934794.00	STARTED: 16/08/2018	
LO	CATI	ON:	139 A	rata	ki Road	NORTHIN	G:	5602621.00	FINISHED: 16/08/2018	
						DATUM:			LOGGED BY: SD/BR	DATE: 16/08/2018
OF	FICE	:	RDCL	-		ELEVATIO	DN:	0	CHECKED BY: TB	DATE:
EN	GINE	ER:	тв			AZUMITH:	0°	PLUNGE: 90°	STATUS: Final data	
СС	NTR/	ACTO	DR: R	DCL	MA	CHINE:			OPERATOR:	
ĥ					DCP BLOWS			SAMPLES	ADDITIONAL	REMARKS
DEPTH (m)	Ê	ËR	HIG	∢				& TESTS	, BBHHORA	
DEP	RL (m)	WATER	GRAPHIC LOG	DATA	5 10 15	20				
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									′ Standing Water Level ├- Out flow	
									⊢ Out flow ─ In flow	
						RD	CL			
					8/308 Queen St East, Hasti Ph: +6	ngs   PO Box 2 4 6 8771652   F	805 Ema	i7, Havelock North 41 il: info@rdcl.co.nz	130   New Zealand	
L					1.1. 10					

Produced with Core-GS by Geroc



												SHEET 2 OF 36
					and Developmer	nts Ltd		PROJEC			LOCATION: Lot 1	
			18425					EASTING		934780.00	STARTED: 16/08/2018	
LOC	CATIO	ON:	139 Ai	ratak	ki Road				NG: 5	602613.00	FINISHED: 16/08/2018	
								DATUM:			LOGGED BY: SD/BR	DATE: 16/08/201
	FICE		RDCL					ELEVATI			CHECKED BY: TB	DATE:
		ER:						AZUMITH	l: 0°	PLUNGE: 90°	STATUS: Final data	
CO	NTRA	ACTO	R: RI	DCL			MAC	HINE:			OPERATOR:	
H (m)	-	£	HIC			DCP BLO	WS			SAMPLES & TESTS	ADDITIONAL	REMARKS
DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	5	10	15	20				
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											- In flow	



								SHEET 3 OF 36
CLIENT: (	Greensto	ne Land Developme	nts Ltd	PROJE	CTION: NZTM	LOC	CATION: Lot 1	
PROJECT:	18425	0602		EASTIN	IG: 1934776.00	STA	ARTED: 16/08/2018	
LOCATION	: 139 A	rataki Road		NORTH	IING: 5602621.00	FIN	ISHED: 16/08/2018	
				DATUM	l:	LOC	GGED BY: SD/BR	DATE: 16/08/2018
OFFICE:	RDCL			ELEVA	TION: 0	CHE	ECKED BY: TB	DATE:
ENGINEER	: TB			AZUMI	TH: 0° PLUNG	E: 90° STA	TUS: Final data	
CONTRAC	FOR: R	DCL	Μ	ACHINE:		OPE	ERATOR:	
					SAMPLES			
DEPTH (m) RL (m)	GRAPHIC LOG	DATA 2	DCP BLOWS	20	& TESTS		ADDITIONAL R	EMARKS
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REMARKS						SYMBOL	S	
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						🗁 In flow		



CLIENT: Greenstone Lan			
	d Developments Ltd	PROJECTION: NZTM	LOCATION: Lot 1
PROJECT: 184250602		EASTING: 1934792.00	STARTED: 16/08/2018
LOCATION: 139 Arataki F	Road	NORTHING: 5602627.00	FINISHED: 16/08/2018
		DATUM:	LOGGED BY: SD/BR DATE: 16/08/201
OFFICE: RDCL		ELEVATION: 0	CHECKED BY: TB DATE:
ENGINEER: TB		AZUMITH: 0° PLUNGE: 90°	STATUS: Final data
CONTRACTOR: RDCL	MACHI		OPERATOR:
	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
DEPTH (m) RL (m) WATER GRAPHIC LOG DATA	F 40 45	20	
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		SY	MBOLS
REMARKS			Standing Water Level
REMARKS		1 -	Standing Water Lever
REMARKS			- Out flow



										-		SHEET 5 OF 36
					and Developme	ents Ltd				NZTM	LOCATION: Lot 2	
			18425					EASTIN		1934788.00	STARTED: 16/08/2018	
LOC	ATIC	DN:	139 A	ratak	ki Road			NORTH	IING:	5602633.00	FINISHED: 16/08/2018	
								DATUN			LOGGED BY: SD/BR	DATE: 16/08/207
OFF	ICE:	I	RDCL					ELEVA	TION:	C	CHECKED BY: TB	DATE:
ENG	INE	ER:	ТВ					AZUMI	ΓΗ: 0°	PLUNGE: 90	° STATUS: Final data	
CON	ITRA	СТО	R: R				MA	CHINE:			OPERATOR:	
DEPTH (m)	m)	TER	GRAPHIC LOG	A		DCP B	LOWS			SAMPLES & TESTS	ADDITIONAL	REMARKS
DEP	RL (m)	WATER	GRA LOG		5	10	15	20				
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													SHEET 6 OF 36
					lopmer	nts Ltd			PROJEC	TION	: NZTM		
ATIC	ON:	139 A	ratak	ki Road					NORTHI	IG:	5602625.00	FINISHED: 16/08/201	3
									DATUM:			LOGGED BY: SD/BR	DATE: 16/08/20
ICE:		RDCL									0	CHECKED BY: TB	DATE:
										l: 0°	PLUNGE: 90		
ITRA	СТО	R: R	DCL					MACH	INE:			OPERATOR:	
n)	ER	PHIC	A			DCP E	BLOWS				SAMPLES & TESTS	ADDITIONAL	REMARKS
RL (r	WAT	GRA LOG	DAT		5	10	1	5	20				
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	t Enco		2										
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ARK	S											 SYMBOLS	
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												✓ Standing Water Level	
												├─ In flow	
	-3.5 -3.0 -2.5 -2.0 -1.5 -1.0 -0.5 RL (m) 21 21 21 22 21 21 22 21 21 22 22 21 22 22	-7:2 -7:2 -7:2 -7:2 -7:2 -7:2 -7:2 -7:2	JECT: 18425 ATION: 139 A ICE: RDCL INEER: TB ITRACTOR: R Plant Auteur sucondwater NATER Signification (m) Signification	JECT:       18425060         ATION:       139 Aratal         ICE:       RDCL         INEER:       TB         ITRACTOR:       RUCL         Q:       Q:         <	JECT:       184250602         ATION:       139 Arataki Road         ICE:       RDCL         INEER:       TB         ITRACTOR:       RDCL         (ii)       NATER         III       NATER         IIII       NATER         IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	JECT:       184250602         ATION:       139 Arataki Road         ICE:       RDCL         INEER:       TE         ITRACTOR:       RDCL         INTRACTOR:       RDCL         INTRACTOR:       RDCL         INTRACTOR:       INTRACTOR:         INT	ATION: 139 Arataki Road	JECT:       184250602         ATION:       139 Arataki Road         ICE:       RDCL         INEER:       TB         ITRACTOR:       RDCL         ITRACTOR:       RDCL         ITRACTOR:       RDCL         ITRACTOR:       ITRACTOR:         ITRACTOR:       ITTRACTOR:         ITTRACTOR:       ITTRACTOR:         ITTRACTOR:	JECT:       184250602         ATION:       139 Arataki Road         ICE:       RDCL         INEER:       TB         ITRACTOR:       RDCL         INEER:       TO         INE       TO         INE <t< td=""><td>JUECT:       184250602       EASTING         ATION:       139 Arataki Road       NORTHIN         INCET:       RDCL       ELEVATI         INCET:       RDCL       MACHINE:         INTRACTOR:       RDCL       MACHINE:         ITRACTOR:       RDCL       I         ITRACTOR:       RDCL       I         ITRACTOR:       RDCL       I         ITRACTOR:       I       I         ITRACTOR:       RDCP BLOWS       I         ITRACTOR:       I       I         ITRACTOR:       I       I         ITRACTOR:       I       I         ITTRACTOR:       I       I         ITTRACTOR:</td><td>USECT:       184250602       EASTING:       NORTHING:         ATION:       13       ELEVATION:       AZUMITH: 0°         ITRACTOR:       ROCL       MACHINE:       Image: 100 million of 10</td><td>UECT:       184250602       EASTING:       1934772.00         ATION:       139 Arataki Road       DATUM:       ELEVATION:       0         UCE:       RDCL       RDC       AZUMITH:       0       PUNGE:       90         TRACTOR:       RDC       MACHINE:       SAMPLES       SAMPLES       ************************************</td><td>UECT:     184250602     EASTING:     1934772.00     STARTED:     1908/201       LTDN:     193 Arstahl Road     NORTHING:     5602625.00     CHECKED 97:     DOR       INEER:     TR     ZUMITH:     O'     PUNCE:     00'     STARTED:     1908/201       INEER:     TR     DCP BLOWS     AZUMITH:     O'     PUNCE:     00'     STARTED:     1908/201       INTRACTOR:     ROL     DCP BLOWS     SAMPLES     ADDITIONAL     SAMPLES     ADDITIONAL       Image:     Image:     Image:     DCP BLOWS     SAMPLES     ADDITIONAL       Image:     Image:     Image:     Image:     Image:     ADDITIONAL       Image:     Image:     Image:     Image:     Image:     Image:     Image:       Image:     Image:     Image:     Image:     Image:     Image:     Image:     Image:       Image:     Image:     Image:     Image:     Image:     Image:     Image:     Image:     Image:       Image:     Image:     Image:     Image:     Image:     Image:     Image:     Image:     Image:       Image:     Image:     Image:     Image:     Image:     Image:     Image:       Image:     Image:     I</td></t<>	JUECT:       184250602       EASTING         ATION:       139 Arataki Road       NORTHIN         INCET:       RDCL       ELEVATI         INCET:       RDCL       MACHINE:         INTRACTOR:       RDCL       MACHINE:         ITRACTOR:       RDCL       I         ITRACTOR:       RDCL       I         ITRACTOR:       RDCL       I         ITRACTOR:       I       I         ITRACTOR:       RDCP BLOWS       I         ITRACTOR:       I       I         ITRACTOR:       I       I         ITRACTOR:       I       I         ITTRACTOR:       I       I         ITTRACTOR:	USECT:       184250602       EASTING:       NORTHING:         ATION:       13       ELEVATION:       AZUMITH: 0°         ITRACTOR:       ROCL       MACHINE:       Image: 100 million of 10	UECT:       184250602       EASTING:       1934772.00         ATION:       139 Arataki Road       DATUM:       ELEVATION:       0         UCE:       RDCL       RDC       AZUMITH:       0       PUNGE:       90         TRACTOR:       RDC       MACHINE:       SAMPLES       SAMPLES       ************************************	UECT:     184250602     EASTING:     1934772.00     STARTED:     1908/201       LTDN:     193 Arstahl Road     NORTHING:     5602625.00     CHECKED 97:     DOR       INEER:     TR     ZUMITH:     O'     PUNCE:     00'     STARTED:     1908/201       INEER:     TR     DCP BLOWS     AZUMITH:     O'     PUNCE:     00'     STARTED:     1908/201       INTRACTOR:     ROL     DCP BLOWS     SAMPLES     ADDITIONAL     SAMPLES     ADDITIONAL       Image:     Image:     Image:     DCP BLOWS     SAMPLES     ADDITIONAL       Image:     Image:     Image:     Image:     Image:     ADDITIONAL       Image:     Image:     Image:     Image:     Image:     Image:     Image:       Image:     Image:     Image:     Image:     Image:     Image:     Image:     Image:       Image:     Image:     Image:     Image:     Image:     Image:     Image:     Image:     Image:       Image:     Image:     Image:     Image:     Image:     Image:     Image:     Image:     Image:       Image:     Image:     Image:     Image:     Image:     Image:     Image:       Image:     Image:     I



												SHEET 7 OF 36
CLIE	ENT:	Gre	ensto	ne L	and Developmer	nts Ltd		PROJE	CTION	: NZTM	LOCATION: Lot 2	
			18425					EASTIN		1934763.00	STARTED: 16/08/2018	
LOC	ATIC	ON:	139 A	ratał	ki Road			NORTH	ING:	5602634.00	FINISHED: 16/08/2018	
								DATUM	:		LOGGED BY: SD/BR	DATE: 16/08/201
OFF	ICE:		RDCL	-				ELEVAT	ION:	0	CHECKED BY: TB	DATE:
		ER:						AZUMIT	H: 0°	PLUNGE: 90°	STATUS: Final data	
CON	ITRA	АСТО	R: R	DCL			MA	CHINE:			OPERATOR:	
( m)		£	ЭH			DCP BL	ows			SAMPLES & TESTS	ADDITIONAL	REMARKS
DEPTH (m)	RL (m)	oundwater Not Encounter	GRAPHIC LOG	DATA	5	10	15	20				
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													SHEET 8 OF 36
					and Developm	ents Ltd			PROJEC1			LOCATION: Lot 2	
PRO	DJEC	T:	18425	6060	2				EASTING	:	1934782.00	STARTED: 16/08/2018	
LOC	CATIO	ON:	139 A	ratal	ki Road				NORTHIN	G:	5602644.00	FINISHED: 16/08/2018	
									DATUM:			LOGGED BY: SD/BR	DATE: 16/08/20
OFF	ICE:		RDCL						ELEVATIO	DN:	0	CHECKED BY: TB	DATE:
ENC	GINE	ER:	ТВ						AZUMITH	: 0°	PLUNGE: 90	° STATUS: Final data	
CO	NTR/	АСТС	R: R					MACHI	NE:			OPERATOR:	
(m			U			DCP	BLOWS				SAMPLES & TESTS	ADDITIONAL	REMARKS
DEPTH (m)	RL (m)	roundwater Not Encountered WATER	GRAPHIC LOG	DATA	-	10					α TESTS		
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													SHEET 9 OF 36
CLIE	ENT:	Gre	ensto	ne L	and Devel	opment	s Ltd		PROJ	ECTION	: NZTM	LOCATION: Lot 3	
PRC	DJEC	T:	18425	0602	2				EASTI	NG:	1934780.00	STARTED: 16/08/2018	3
LOC	ATIC	ON:	139 Ai	ratak	ki Road				NORT	HING:	5602650.00	FINISHED: 16/08/2018	3
									DATU	M:		LOGGED BY: SD/BR	DATE: 16/08/2018
OFF	ICE:		RDCL						ELEV	ATION:	0	CHECKED BY: TB	DATE:
ENG	SINE	ER:	тв						AZUM	ITH: 0°	PLUNGE: 90	° STATUS: Final data	
			R: RI	DCL				MAC	HINE:			OPERATOR:	
DEPTH (m)	(m)	WATER	GRAPHIC LOG	-			DCP BLO	WS			SAMPLES & TESTS	ADDITIONAL	REMARKS
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													SHEET 10	OF 36
CLIENT: Greenstone Land Developments Ltd PROJECTION										NZTM	: Lot 3			
PR	OJEC	CT:	18425	50602				EAS	TING:	1934761.00	STARTED:	16/08/2018		
LOCATION: 139 Arataki Road									THING:	5602639.00	FINISHED:	16/08/2018		
									UM:		LOGGED B	BY: SD/BR	DATE: 16	/08/2018
OFFICE: RDCL									/ATION:	0	CHECKED	BY: TB	DATE:	
EN	GINE	ER:	ТВ					AZUI	MITH: 0°	PLUNGE: 90	° STATUS: F	inal data		
CO			DR: R	DCL			M	ACHINE:			OPERATO	र:		
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					8/30	)8 Queen	St East, Has	tings   PO	<b>RDCL</b> Box 28057	7, Havelock North	4130   New Zea	land		
					2,00		Ph: +	64 6 87716	52   Emai	l: info@rdcl.co.nz				



SHEET	11	OF	36

												SHEET 11 OF 36		
CLIENT: Greenstone Land Developments Ltd									CTION	: NZTM	LOCATION: Lot 3			
PROJECT: 184250602									NG:	1934755.00	STARTED: 16/08/2018	3		
LOCATION: 139 Arataki Road									HING:	5602650.00	FINISHED: 16/08/2018	3		
								DATU			LOGGED BY: SD/BR			
OF	FICE:		RDCL					ELEVA		0	CHECKED BY: TB	DATE:		
		ER:						AZUMI				DATE.		
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					8/308 C	ueen St	East, Hasti Ph <sup>.</sup> +6	ings   PO Bo	x 2805	7, Havelock North il: info@rdcl.co.nz	h 4130   New Zealand z			
							1 11. 10				-			



Produced with Core-GS by Geroc

# DCP LOG

SHEET 12 OF 36

CLIENT: Greenstone Land Developments Ltd								PROJEC	TION	I: NZTM	LOCATION: Lot 3		
PR	OJEC	CT:	18425	0602	2			EASTING	:	1934771.00	STARTED: 16/08/2018		
LO	CATIO	ON:	139 A	ratak	ki Road			NORTHIN	IG:	5602660.00	FINISHED: 16/08/2018		
								DATUM:			LOGGED BY: SD/BR	DATE: 16/08/2018	
OFI	FICE		RDCL					ELEVATI	ON:	0	CHECKED BY: TB	DATE:	
EN	GINE	ER:	тв					AZUMITH	l: 0°	PLUNGE: 90°	STATUS: Final data		
со	NTRA	АСТО	R: R	DCL			MACH	IINE:			OPERATOR:		
Ē						DOD				SAMPLES			
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DEPTH (m)	RL (m)	WAT	GRAPHIC LOG	DATA	5	10	15	20					
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					8/30	8 Queen S	t East, Hasting	s   PO Box 2	2805	7, Havelock North 47	130   New Zealand		
							Ph: +64 6	8771652	⊾ma	il: info@rdcl.co.nz			



Produced with Core-GS by Geroc

# DCP LOG

SHEET 13 OF 36

CLIENT: Greenstone Land Developments Ltd								PROJECT	ION	I: NZTM	LOCATION: Lot 4
PR	OJEC	CT:	18425	50602	2			EASTING	:	1934767.00	STARTED: 16/08/2018
LO	CATIO	ON:	139 A	ratał	ki Road			NORTHIN	G:	5602664.00	FINISHED: 16/08/2018
								DATUM:			LOGGED BY: SD/BR DATE: 16/08/2018
OF	FICE		RDCL	-				ELEVATIO	ON:	0	CHECKED BY: TB DATE:
EN	GINE	ER:	ТВ					AZUMITH	: 0°	PLUNGE: 90	STATUS: Final data
со	NTRA	АСТС	R: R	DCL			MACH	INE:			OPERATOR:
_ ب						DCP BLOW	S			SAMPLES	ADDITIONAL REMARKS
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DEP	RL (m)	WAT	GRAPHIC LOG	DATA	5	10	15	20			
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					8/308 Q	ueen St Eas	t, Hastings Ph: +64 6	s   PO Box 2 8771652	2805 Ema	7, Havelock North il: info@rdcl.co.nz	4130   New Zealand
							-			~	



Produced with Core-GS by Geroc

													SHEET	14 OF 36
CLI	ENT:	Gre	ensto	ne L	and Developmen	ts Ltd		PROJECT	TION	I: NZTM		LOCATION: Lot 4		
PR	OJEC	T:	18425	6060	2			EASTING	:	1934753.00		STARTED: 16/08/2018		
LOC	CATIO	ON:	139 A	ratał	ki Road				IG:	5602655.00		FINISHED: 16/08/2018		
								DATUM:				LOGGED BY: SD/BR		16/08/2018
	FICE:		RDCL					ELEVATIO				CHECKED BY: TB	DATE:	
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					8/308 Qi	ueen St Eas	t, Hasting		DCL 2805	7, Havelock North	h 413	30   New Zealand		
							Ph: +64 6	8771652	Ema	ill: info@rdcl.co.nz	z	•		



Produced with Core-GS by Geroc

												SHEET 15 OF 36
CLI	ENT:	Gre	ensto	ne La	and Developmen	ts Ltd		PROJE	CTION	: NZTM	LOCATION: Lot 4	
PR	OJEC	CT:	18425	0602	2			EASTIN	IG:	1934746.00	STARTED: 16/08/2018	6
LOO	CATIO	ON:	139 A	ratak	i Road			NORTH	IING:	5602668.00	FINISHED: 16/08/2018	6
								DATUM	1:		LOGGED BY: SD/BR	DATE: 16/08/2018
OF	FICE	:	RDCL					ELEVA	TION:	0	CHECKED BY: TB	DATE:
ENG	GINE	ER:	ТВ					AZUMI	TH: 0°	PLUNGE: 90	° STATUS: Final data	
CO	NTR/	АСТС	R: R	DCL			MA	CHINE:			OPERATOR:	
۲						DCP BLO	WS			SAMPLES	ADDITIONAL	REMARKS
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					0,300 QI	Joon of Ea	Ph: +6	4 6 8771652	2003 !   Ema	il: info@rdcl.co.nz	TTO THOW Zealally	



												SHEET 16 OF 36
CLIE	ENT:	Gre	ensto	ne La	and Developme	nts Ltd		PROJE	CTION:	NZTM	LOCATION: Lot 4	
			18425					EASTIN		1934763.00	STARTED: 16/08/2018	
LOC	ATIC	ON:	139 A	ratak	ki Road			NORTH	ING:	5602677.00	FINISHED: 16/08/2018	
								DATUM	:		LOGGED BY: SD/BR	DATE: 16/08/2018
OFF	ICE:		RDCL					ELEVA	FION: (	)	CHECKED BY: TB	DATE:
ENG	SINE	ER:	ТВ					AZUMI	Ή: 0°	PLUNGE: 90°	STATUS: Final data	
CON	ITR/	АСТО	R: R	DCL			MA	CHINE:			OPERATOR:	
Ê						DCP BL	OWS			SAMPLES	ADDITIONAL F	PEMARKS
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	-											SHEET 17 OF 36
CL	IENT:	Gre	ensto	one L	and Developments	Ltd		PROJEC1	ION	: NZTM	LOCATION: Lot 5	
PR	OJEC	CT:	1842	5060	2			EASTING	:	1934760.00	STARTED: 16/08/2018	3
LO	CATI	ON:	139 A	Aratal	ki Road			NORTHIN	IG:	5602685.00	FINISHED: 16/08/2018	3
								DATUM:			LOGGED BY: SD/BR	DATE: 16/08/2018
OF	FICE	:	RDCL	L				ELEVATIO	DN:	-	CHECKED BY: TB	DATE:
EN	GINE	ER:	ТВ					AZUMITH	: 0°	PLUNGE: 90	° STATUS: Final data	
co	NTR	ACTC	R: R	RDCL			MACHIN	NE:			OPERATOR:	
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					8/308 Que	en St East, P	Hastings h: +64 6 8	PO Box 2	2805	7, Havelock North il: info@rdcl.co.nz	4130   New Zealand	

Produced with Core-GS by Geroc



OFFICE:         RDCL         ELEVATION:         CHECKED BY:         DATE:           ENGINEER:         TB         MACHINE:         OPERATOR:         SAMPLES         ADDITIONAL REMARKS           Image: Status:         Image: Status:         Image: Status:         SAMPLES         ADDITIONAL REMARKS           Image: Status:         Image: Status:         Image: Status:         Image: Status:         ADDITIONAL REMARKS           Image: Status:         Image: Status:         Image: Status:         Image: Status:         Image: Status:         ADDITIONAL REMARKS           Image: Status:         Ima													SHEET 18 OF 36
LOCATION: 139 Arataki Read DATUM: DATUM: DATUM: ELEVATION: - RORDER: TB AZUMITH: 0' PLUNGE: 00' STATUS: Final data OFFACTOR: RDCL MACHINE OFFACTOR: RDCL MACHIN							nts Ltd		PROJECT	ION	I: NZTM	LOCATION: Lot 5	
DATUM:         LOGGED 9*: SD/8*         DATE:           ELEVATION:         -         COGED 9*: SD/8*         DATE:           CONTRACTOR:         RDCI         MACHINE:         OPERATOR:         OPERATOR:           Open of the subscription of the	PR	OJEC	CT:	18425	060	2			EASTING	:	1934742.00	STARTED: 16/08/2018	•
OFFICE:       RCL       ELEVATION: - AZUMTH: 0'       CHECKED BY: TB       DATE: STATUS: Final data         ONTRACTOR:       RDC       MACHINE:       OPFICE:       00         OUTRACTOR:       RDC       MACHINE:       OPFICE:       00         OUTRACTOR:       RDC       MACHINE:       OPFICE:       00         OUTRACTOR:       RDC       DOP BLOWS       SMPLES STBTS       ADDITIONAL REMARKS         OUTRACTOR:       DO       1       1       1       1       1         OUTRACTOR:       DO       1       1       1       1       1         OUTRACTOR:       DO       DO       0       1       1       1       1         OUTRACTOR:       DO       DO       0       1       1       1       1       1         OUTRACTOR:       DO       DO       0       0       1       1       1       1       1       1         DO       0<	LO	CATI	ON:	139 A	ratał	ki Road			NORTHIN	IG:	5602677.00	FINISHED: 16/08/2018	1
ENGINEER:       TB       AZUMITH:       PLUNCE:       STATUS:       Final data         CONTRACTOR       ROCL       MACHINE       OPERATOR       ADDITIONAL REMARKS         august discussion       0									DATUM:			LOGGED BY: SD/BR	DATE: 16/08/2018
CONTRACTOR:         RDCL         MACHINE:         OPERATOR:           Image: State of the state of	OFI	FICE		RDCL					ELEVATIO	DN:	-	CHECKED BY: TB	DATE:
OF         OP         DCP BLOWS         SAMPLES A TESTS         ADDITIONAL REMARKS           0         0         1         1         1         1         1           10         1         1         1         1         1         1           20         1         1         1         1         1         1         1           10         1<	EN	GINE	ER:	тв					AZUMITH	: 0°	PLUNGE: 90°	STATUS: Final data	
OF         OP         DCP BLOWS         SAMPLES A TESTS         ADDITIONAL REMARKS           0         0         1         1         1         1         1           10         1         1         1         1         1         1           20         1         1         1         1         1         1         1           10         1<	со	NTR/	АСТС	R: R	DCL			MACHI	NE:			OPERATOR:	
Statistic       Statistic       Statistic         Statistic       Statistic													
Statistic       Statistic       Statistic         Statistic       Statistic													
a       1	(E		~	2			DCP BLOWS				SAMPLES & TESTS	ADDITIONAL	REMARKS
a       1	РТН	E)	VTEF	GPF	AL	1							
a       Double bounce         13       -?         20       -?         21       -?         22       -?         33       -?         34       -?         35       -?         36       -?         37       Image: State in the st	DE	Ч	Ň	RG	DA	5	10 1	5	20				
a       Double bounce         13       -?         20       -?         21       -?         22       -?         33       -?         34       -?         35       -?         36       -?         37       Image: State in the st	-	-	Intere		-	_							
a       Double bounce         13       -?         20       -?         21       -?         22       -?         33       -?         34       -?         35       -?         36       -?         37       Image: State in the st	-	-	Encol		<u> </u>	_							
a       Double bounce         13       -?         20       -?         21       -?         22       -?         33       -?         34       -?         35       -?         36       -?         37       Image: State in the st	-	-	Not E		<u> </u>	_							
a       Double bounce         13       -?         20       -?         21       -?         22       -?         33       -?         34       -?         35       -?         36       -?         37       Image: State in the st	-	-	vater		<u> </u>								
a       Double bounce         13       -?         20       -?         21       -?         22       -?         33       -?         34       -?         35       -?         36       -?         37       Image: State in the st	-0.5	-0.5	puno		-								
10       -9         10       -9 <td></td> <td></td> <td>- \[\]</td> <td>-</td> <td>É</td> <td></td> <td></td> <td></td> <td></td> <td>-</td> <td></td> <td></td> <td></td>			- \[\]	-	É					-			
15       -9         20       -9         -9       -9         30       -9         -9       -9         30       -9         -9       -9	-	F				Double bounce							
15       -9         20       -9         -9       -9         30       -9         -9       -9         30       -9         -9       -9	-	[											
15       -9         20       -9         -9       -9         30       -9         -9       -9         30       -9         -9       -9	-10	0.											
20       -9         20       -9	- 1.0	- <sup>-</sup>											
20       -9         20       -9	-	-											
20       -9         20       -9	-	-											
20       -9         20       -9	-	-											
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25       - 5         30       - 5         33       - 6         34       - 6         1       - 1     <	-	-							-				
25       - 5         30       - 5         33       - 6         34       - 6         1       - 1     <	-	-											
3.0       - ??         3.5       - ??         3.6       - ??         3.7       ??         SEMARKS       SYMBOLS         REMARKS       SYMBOLS         V       Standing Water Level         - Out flow       >         B/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand	-2.0	- Ģ											
3.0       - ??         3.5       - ??         3.6       - ??         3.7       ??         SEMARKS       SYMBOLS         REMARKS       SYMBOLS         V       Standing Water Level         - Out flow       >         B/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand	_	[											
3.0       - ??         3.5       - ??         3.6       - ??         3.7       ??         SEMARKS       SYMBOLS         REMARKS       SYMBOLS         V       Standing Water Level         - Out flow       >         B/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand	-												
3.0       - ??         3.5       - ??         3.6       - ??         3.7       ??         SEMARKS       SYMBOLS         REMARKS       SYMBOLS         V       Standing Water Level         - Out flow       >         B/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand	-	-											
3.0       - ??         3.5       - ??         3.6       - ??         3.7       ??         SEMARKS       SYMBOLS         REMARKS       SYMBOLS         V       Standing Water Level         - Out flow       >         B/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand	-2.5	-2.5											
3.5       - 9         - 9       - 9         - 9       - 9         - 9       - 9         - 9       - 9         REMARKS       SYMBOLS         REMARKS       Image: Standing Water Level         - 0 Out flow       > In flow         B/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand	-	-											
3.5       - 9         - 9       - 9         - 9       - 9         - 9       - 9         - 9       - 9         REMARKS       SYMBOLS         REMARKS       Image: Standing Water Level         - 0 Out flow       > In flow         B/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand	-	╞											
3.5       - 9         - 9       - 9         - 9       - 9         - 9       - 9         - 9       - 9         REMARKS       SYMBOLS         REMARKS       Image: Standing Water Level         - 0 Out flow       > In flow         B/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand	-	╞											
3.5       - 9         - 9       - 9         - 9       - 9         - 9       - 9         - 9       - 9         REMARKS       SYMBOLS         REMARKS       Image: Standing Water Level         - 0 Out flow       > In flow         B/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand	-	-											
3.5       ¬?         -       -         REMARKS       SYMBOLS         Y       Standing Water Level         <->       Out flow         >>       In flow         RDCL       8/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand	-3.0	- ကုံ											
3.5       ¬?         -       -         REMARKS       SYMBOLS         Y       Standing Water Level         <->       Out flow         >>       In flow         RDCL       8/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand	-	[											
3.5       ¬?         -       -         REMARKS       SYMBOLS         Y       Standing Water Level         <->       Out flow         >>       In flow         RDCL       8/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand	_	Ĺ											
3.5       ¬?         -       -         REMARKS       SYMBOLS         Y       Standing Water Level         <->       Out flow         >>       In flow         RDCL       8/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand	-	ļ											
REMARKS SYMBOLS The field of the second se	-3.5	3.5											
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▼ Standing Water Level	RFN		l (S	1		:	:	:		-	l S'	⊥ YMBOLS	
CL 8/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand			-										
RDCL 8/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand													
8/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand													
8/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand									R	DCL	1		
						8/308 Q	ueen St East,	Hastings	PO Box 2	2805	7, Havelock North 4	130   New Zealand	



												SHEET 19 OF 36
CLI	ENT:	Gre	eensto	ne L	and Developm	ents Ltd		PROJEC	ΓΙΟΝ	I: NZTM	LOCATION: Lot 5	
PR	OJEC	CT:	18425	5060	2			EASTING	:	1934738.00	STARTED: 16/08/2018	3
LO	CATI	ON:	139 A	rata	ki Road			NORTHIN	IG:	5602683.00	FINISHED: 16/08/2018	}
								DATUM:			LOGGED BY: SD/BR	DATE: 16/08/2018
OF	FICE	:	RDCL					ELEVATI	ON:	-	CHECKED BY: TB	DATE:
EN	GINE	ER:	тв					AZUMITH	: 0°	PLUNGE: 90°	STATUS: Final data	
СО	NTR	ACTC	R: R	DCL			MACH	HINE:			OPERATOR:	
DEPTH (m)		Ľ.	GRAPHIC LOG			DCP BL	OWS			SAMPLES & TESTS	ADDITIONAL	REMARKS
DEPT	RL (m)	Sroundwater Not Encountered WATER	OG	DATA	5	10	15	20				
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	Ē	Icount		2								
	[	lot Er		1								
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REM	/ARk	Ś	-	-			·			s	YMBOLS	
											Standing Water Level	
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										1	≻ In flow	
					8/308	Queen St E	ast, Hasting Ph: +64 (	s   PO Box	<b>DCL</b> 2805 Ema	7, Havelock North 4 il: info@rdcl.co.nz	130   New Zealand	



												SHEET 20 OF 36
					and Developme	ents Ltd		PROJE			LOCATION: Lot 5	
			18425					EASTIN		934755.00	STARTED: 16/08/2018	
LOC	ATIC	ON:	139 A	ratak	i Road			NORTH	ING: 8	602693.00	FINISHED: 16/08/2018	
								DATUM	:		LOGGED BY: SD/BR	DATE: 16/08/201
OFF	ICE:		RDCL					ELEVAT	ION:	-	CHECKED BY: TB	DATE:
		ER:						AZUMIT	Ή: 0°	PLUNGE: 90°		
CON	ITRA	АСТО	R: R	DCL			MA	CHINE:			OPERATOR:	
Ê			0			DCP B	LOWS			SAMPLES	ADDITIONAL F	REMARKS
DEPTH (m)	Ê	TER	GRAPHIC LOG	A						& TESTS		
DEF	RL (m)	WA.	Lo GR	DATA	5	10	15	20				
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										1	≻ In flow	



												SHEET 21 OF 36
CLI	ENT:	Gre	ensto	ne L	and Developme	nts Ltd		PROJEC	TION	: NZTM	LOCATION: Lot 6	
PR	OJEC	CT:	18425	6060	2			EASTING	G:	1934753.00	STARTED: 16/08/2018	
LO	CATI	ON:	139 A	ratał	ki Road			NORTHI	NG:	5602697.00	FINISHED: 16/08/2018	
								DATUM:			LOGGED BY: SD/BR	DATE: 16/08/2018
OF	FICE	:	RDCL					ELEVATI		-	CHECKED BY: TB	DATE:
		ER:		-				AZUMITH			STATUS: Final data	
									1. 0	I LONGE. 30		
	NIK/		R: R				MAC	CHINE:			OPERATOR:	
Ê			0			DCP BLO	NS			SAMPLES	ADDITIONAL F	REMARKS
DEPTH (m)	<del>آ</del>	ĒR	HI	A						& TESTS		
DEP	RL (m)	WATER	GRAPHIC LOG	DATA	5	10	15	20				
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											Standing Water Level	
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											≻ In flow	
					8/308 C	ueen St Ea	st Hactin	R R PO Roy	DCL 2805	7, Havelock North 4	130   New Zealand	
					0/000 6		Ph: +64	6 8771652	Ema	il: info@rdcl.co.nz		

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		_									SHEET 22 OF 36
CLI	ENT:	Gre	ensto	ne L	and Developme	nts Ltd	PROJEC	TION	: NZTM	LOCATION: Lot 6	
PR	OJEC	CT:	18425	060	2		EASTING	i:	1934737.00	STARTED: 16/08/2018	
LO	CATIO	ON:	139 A	ratał	ki Road		NORTHIN	IG:	5602692.00	FINISHED: 16/08/2018	
							DATUM:			LOGGED BY: SD/BR	DATE: 16/08/2018
OF	FICE:		RDCL				ELEVATI	ON∙	-	CHECKED BY: TB	DATE:
		ER:					AZUMITH			STATUS: Final data	DATE.
								1. U	PLUNGE. 90		
CO	NIRA		R: R			MA	CHINE:	1		OPERATOR:	
Ê						DCP BLOWS			SAMPLES	ADDITIONAL	DEMADKS
L (L	Ê	۲. ۲	HC			DCF BLOWS			& TESTS	ADDITIONAL	REWARKS
DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	5	10 15	20				
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-	-	oundwater Not Encounter		1							
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REN	/ARK	(S							SY	MBOLS	
										Standing Water Level	
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										- In flow	
					8/208 0	Jueen St Fast Hasti		DCL	7, Havelock North 41	30   New Zealand	
					0/300 G	Ph: +6	4 6 8771652	Ema	il: info@rdcl.co.nz	COLING A COUNT	

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														SHEET 23 OF 36
CLI	ENT:	Gre	eensto	ne L	and Devel	opments	Ltd		PROJECT	ION	NZTM		LOCATION: Lot 6	
PR	OJEC	CT:	18425	5060	2				EASTING:		1934729.00		STARTED: 16/08/2018	3
LO	CATI	ON:	139 A	ratal	ki Road				NORTHIN	G:	5602699.00		FINISHED: 16/08/2018	3
									DATUM:				LOGGED BY: SD/BR	DATE: 16/08/2018
OF	FICE	:	RDCL						ELEVATIC	N:	-		CHECKED BY: TB	DATE:
EN	GINE	ER:	ΤВ						AZUMITH:	0°	PLUNGE:	90°	STATUS: Final data	
CO	NTR/	АСТС	R: R	DCL				MACH	INE:				OPERATOR:	
-						_					SAMPLES			
DEPTH (m)	2	L.	GRAPHIC LOG			Ľ	OCP BLOWS				& TESTS		ADDITIONAL	REMARKS
DEPT	RL (m)	VATE	OG	DATA	.	5	10 ·	15	20					
		tered		3										
-	-	Groundwater Not Encountered WATER		2		-								
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-	-	ater N		2										
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REN	/ARK	Ś	-	-								SY	MBOLS	
												<b>T</b>	Standing Water Level	
													- Out flow	
										<u> </u>			- In flow	
					8/	'308 Quee	en St East.	Hastings	<b>RD</b> s   PO Box 2	UL 8057	7, Havelock No	orth 41	30   New Zealand	
							F	h: +64 6	8771652   E	mai	l: info@rdcl.co	.nz		

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												SHEET 24 OF 36
CLI	ENT:	Gre	ensto	ne L	and Developme	nts Ltd		PROJEC	TION:	NZTM	LOCATION: Lot 6	
PR	OJEC	CT:	18425	0602	2			EASTIN	G:	1934745.00	STARTED: 16/08/2018	
LO	CATIO	ON:	139 Ai	ratak	ki Road			NORTHI	NG:	5602706.00	FINISHED: 16/08/2018	
								DATUM:			LOGGED BY: SD/BR	DATE: 16/08/2018
OFI	FICE:		RDCL					ELEVAT	ON:	-	CHECKED BY: TB	DATE:
		ER:						AZUMITI				
			R: RI				MAC	HINE:		00 00	OPERATOR:	
00							IVIAC	/ IIN <b>L</b> .				
DEPTH (m)	(	ж.	HIC			DCP BLC	ows			SAMPLES & TESTS	ADDITIONAL F	EMARKS
DEPT	RL (m)	WATER	GRAPHIC LOG	DATA	5	10	15	20				
	-	oundwater Not Encountered		0								
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	-				Double bounce							
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									DCL		> IIOW	



		-										SHEET 25 OF 36
CLI	ENT:	Gre	ensto	ne L	and Developme	nts Ltd		PROJEC	TION:	NZTM	LOCATION: Lot 7	
			18425					EASTING	: 1	934740.00	STARTED: 16/08/2018	
LO	CATIO	ON:	139 A	ratak	ki Road			NORTHIN	IG: 5	602715.00	FINISHED: 16/08/2018	
								DATUM:			LOGGED BY: SD/BR	DATE: 16/08/2018
OFI	FICE:		RDCL					ELEVATI	ON: -		CHECKED BY: TB	DATE:
EN	GINE	ER:	тв					AZUMITH	l: 0°	PLUNGE: 90°	STATUS: Final data	
СО	NTRA	АСТО	R: R	DCL			MAC	HINE:			OPERATOR:	
										SAMPLES		
E T		Ľ	님			DCP BLC	WS			& TESTS	ADDITIONAL	REMARKS
DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	5	10	15	20				
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-	-	Broundwater Not Encountered		2								
-	-	ot Enc		2								
		ter No		2								
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		Brot		12								
-	-				Double bounce							
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											Standing Water Level	
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											≻ In flow	
									DCL			
					8/308 C	ueen St Ea	est, Hastin Ph: +64	gs   PO Box 1 6 8771652	∠8057, Email:	Havelock North 4 info@rdcl.co.nz	130   New Zealand	

duced with Core-GS by Geroc



												1	SHEET 26 OF 36
CLI	ENT:	Gre	ensto	ne L	and Develo	opment	s Ltd		PROJE	CTION	: NZTM	LOCATION: Lot 7	
PR	OJEC	CT:	18425	5060	2				EASTI	NG:	1934727.00	STARTED: 16/08/201	8
LO	CATI	ON:	139 A	ratal	ki Road				NORTH	HING:	5602705.00	FINISHED: 16/08/201	8
									DATUN	<b>/</b> :		LOGGED BY: SD/BR	DATE: 16/08/2018
OF	FICE	:	RDCL						ELEVA		-	CHECKED BY: TB	DATE:
		ER:							AZUMI				BATE.
			R: R							111. 0	TEONGE. 30	OPERATOR:	
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<u> </u>										RDCL			
					8/3	308 Qu	een St Ea	ast, Hast	ings   PO Bo	x 2805	7, Havelock North	4130   New Zealand	
								Ph: +6	6 8771652	2 I Emai	il: info@rdcl.co.nz		

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												SHEET 27 OF 36
CLI	ENT	Gre	ensto	ne L	and Developme	ents Ltd		PROJEC	FION	: NZTM	LOCATION: Lot 7	
PR	OJEC	CT:	18425	5060	2			EASTING	:	1934723.00	STARTED: 16/08/2018	
LO	CATI	ON:	139 A	ratał	ki Road			NORTHIN	IG:	5602714.00	FINISHED: 16/08/2018	
								DATUM:			LOGGED BY: SD/BR	DATE: 16/08/2018
OF	FICE		RDCL					ELEVATION	٦NI	_	CHECKED BY: TB	DATE:
		ER:		-				AZUMITH				DATE.
-									. 0	PLUNGE. 90		
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(L						DCP BL	OWS			SAMPLES	ADDITIONAL F	REMARKS
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DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	5	10	15	20				
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					8/308 0	Queen St E	ast, Hasting Ph: +64 6	s   PO Box 2	2805	7, Havelock North 4 il: info@rdcl.co.nz	130   New Zealand	



													SHEET 28 OF 36
					and Developmer	nts Ltd		PROJEC				ON: Lot 7	
			18425					EASTING		1934738.00		ED: 16/08/2018	
LO	CATI	ON:	139 A	ratał	ki Road				IG:	5602723.00		ED: 16/08/2018	
								DATUM:				D BY: SD/BR	
	FICE		RDCL					ELEVATIO				ED BY: TB	DATE:
		ER:						AZUMITH	l: 0°	PLUNGE: 90		S: Final data	
CO	NTR/	ACTC	R: R	DCL			MACH	INE:			OPERA	TOR:	
DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	5	DCP BLOWS	15	20		SAMPLES & TESTS		ADDITIONAL	REMARKS
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					8/308 Q	ueen St East, F	Hastings h: +64 6	s   PO Box 2	<b>DCL</b> 28057 Emai	7, Havelock North l: info@rdcl.co.nz	4130   New Z	ealand	



														SHEET 29 OF 36
CLIE	ENT:	Gre	ensto	ne L	and Develo	pments	Ltd		PROJEC	ΓΙΟΝ	NZTM	LOCATION	I: Lot 8	
PRC	JEC	CT:	18425	060	2				EASTING	:	1934735.00	STARTED:	20/08/2018	
LOC	ATIC	ON:	139 A	ratał	ki Road				NORTHIN	IG:	5602738.00	FINISHED:	20/08/2018	
									DATUM:			LOGGED E	BY: TS	DATE: 20/08/2018
OFF	ICE:		RDCL						ELEVATI	ON:	-	CHECKED	BY: TB	DATE:
ENG	SINE	ER:	тв						AZUMITH	: 0°	PLUNGE: 90	° STATUS: I	-inal data	
CON	NTRA	асто	R: R	DCL				MACH	INE:			OPERATO	R:	
DEPTH (m)	(	ĸ	HIC			C	OCP BLOWS	3			SAMPLES & TESTS		ADDITIONAL	REMARKS
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					and Develo	pment	s līd						LOCATION: Lot 8	
			18425							TING:	1934732.00		STARTED: 20/08/2018	
LOG	CATI	ON:	139 A	ratak	ki Road						5602746.00		FINISHED: 20/08/2018	
<b>c</b> -			<b>DC</b>							UM:			LOGGED BY: TS	DATE: 20/08/201
	FICE		RDCL	-						VATION:			CHECKED BY: TB	DATE:
		ER:								MITH: 0°	PLUNGE: 9	90°	STATUS: Final data	
CO	NTR/		R: R					M	IACHINE:				OPERATOR:	
DEPTH (m)	(m	IER	GRAPHIC LOG	A.			DCP BLC	ows			SAMPLES & TESTS		ADDITIONAL R	EMARKS
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													Standing Water Level	
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					8/3	08 Que	een St F	ast. Has	stinas   PO	RDCL Box 2805	7, Havelock Nor	th 41?	80   New Zealand	
					0,0			Ph: +	+64 6 8771	652   Ema	ail: info@rdcl.co.n	1Z		



												SHEET 31 OF 36
CLI	ENT:	Gre	ensto	ne L	and Developm	ents Ltd		PROJEC		: NZTM	LOCATION: Lot 8	
			18425					EASTIN		1934710.00	STARTED: 20/08/2018	
LO	CATIO	ON:	139 A	ratał	ki Road			NORTHI	NG:	5602730.00	FINISHED: 20/08/2018	
								DATUM:			LOGGED BY: TS	DATE: 20/08/2018
OFI	FICE	:	RDCL					ELEVAT	ION:	-	CHECKED BY: TB	DATE:
EN	GINE	ER:	ТВ					AZUMITI	H: 0°	PLUNGE: 90°	STATUS: Final data	
со	NTRA	АСТО	R: R	DCL			MA	CHINE:			OPERATOR:	
DEPTH (m)		r	l₽			DCP BL	OWS			SAMPLES & TESTS	ADDITIONAL I	REMARKS
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											Standing Water Level	
											✓ Out flow	
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									DCL			
					8/308	Queen St E	ast, Hasti: Ph <sup>.</sup> +6	ngs   PO Box 4 6 8771652	2805 I Fmai	7, Havelock North 4 il: info@rdcl.co.nz	130   New Zealand	

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												SHEET 32 OF 36
CLIE	NT:	Gre	ensto	ne L	and Developme	ents Ltd		PF	ROJECTION	: NZTM	LOCATION: Lot 8	
PRO	JEC	T:	18425	060	2			EA	STING:	1934714.00	STARTED: 20/08/2018	
LOCA	ATIC	DN:	139 A	ratał	ki Road			NC	ORTHING:	5602723.00	FINISHED: 20/08/2018	
								DA	TUM:		LOGGED BY: TS	DATE: 20/08/201
OFFI	CE:	I	RDCL					EL	EVATION:	-	CHECKED BY: TB	DATE:
ENGI	INE	ER:	ТВ					AZ	UMITH: 0°	PLUNGE: 90	)° STATUS: Final data	
CON	TRA	СТО	R: R	DCL			N	ACHINE:			OPERATOR:	
~							BLOWS			SAMPLES	ADDITIONAL	DEMARKS
ч) Н	<u>_</u>	БR	UHC	-		DCP	SLOWS			& TESTS	ADDITIONAL	REMARKS
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									RDCL			



										SHEET 33 OF 36
					and Developments Ltd	PROJEC			LOCATION: Lot 9	
			18425			EASTING		1934720.00	STARTED: 20/08/2018	
LO	CATIO	ON:	139 A	rata	ki Road		NG:	5602760.00	FINISHED: 20/08/2018	
						DATUM:			LOGGED BY: TS	DATE: 20/08/2018
OF	FICE		RDCL	-		ELEVATI	ON:	-	CHECKED BY: TB	DATE:
EN	GINE	ER:	ТВ			AZUMITH	H: 0°	PLUNGE: 90°	STATUS: Final data	
со			R: R		. MAC	CHINE:			OPERATOR:	
DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	20		SAMPLES & TESTS	ADDITIONAL	REMARKS
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-3.5	-3.5									
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	-							 		
REN	MARK	(S						2	YMBOLS ✓ Standing Water Level → Out flow → In flow	
REN	ИАКК				8/308 Queen St East, Hastir Ph: +64	igs   PO Box	<b>DCL</b> 2805 Ema		✓ Standing Water Level	



LUENT: Greenstane Land Qewignments Lui PPOLECTION: RZTM UCATION: Lot 9 FROJECT: 1926/2002 LOCATION: 193 Arateli Road DOFICE: ROL EXAMINE: TR COL EXAMINE:														SHEET 34 OF 36
LOCATION: 138 Aratabi Road       NORTHING: 5802750.00       FINSHED: 2008/2018         OFFICE:       ROCL       LEVATION: -       NORTHING: 5902750.00         EXAMPLES:       RS       AZUMTI: 0'       PLUNCE: 60'         CONTRACTOR:       ROL       MCHINE:       OFFICE:       TS         CONTRACTOR:       ROL       MCHINE:       OFFICE:       TS       DATE         CONTRACTOR:       ROL       MCHINE:       OFFICE:       TS       DATE         OFFICE:       ROL       MCHINE:       OFFICE:       TS       ADTIONKLIEMARKS         Control       OFFICE:       ROL       Image: State for the st	CLI	ENT:	Gre	ensto	ne La	and Developmer	nts Ltd		PROJEC	FION	I: NZTM		LOCATION: Lot 9	
OFFICE     ROCL     DATUM: ELEVATION: PLUNCE: 00     COGED BY: TS     DATE: 2008/2018 CHECKED DY: TS       CONTRACTOR:     ROCL     MACHINE:     OPERATOR: SAMPLES     OPERATOR: SAMPLES     OPERATOR: SAMPLES       Total     Total     Total     Total     Total     Total       Total	PR	OJEC	CT:	18425	60602	2			EASTING	:	1934701.00		STARTED: 20/08/2018	3
DEFICE:     RDL     ELEVATION:     CHECKED BY: TB     DATE:       ENDIFIE:     TB     TB     TB     TB     TB       CONTRACTOR:     RDL     MCHINE     OPERATOR:     OPERATOR:       OUTING TOR:     RDL     DEP BLOWS     SAMPLES     ADDITIONAL REMARKS       TB     TB     TB     TB     TB     ADDITIONAL REMARKS       TB     TB     TB     TB     TB     ADDITIONAL REMARKS	LO	CATIO	ON:	139 A	ratak	i Road			NORTHIN	IG:	5602750.00		FINISHED: 20/08/2018	3
ENDINER: TB     TAUMIT: 0     PUNGE: 00     TATUS: Final data       CONTRACTOR: RDL     RDC     MACHINE     OPERATOR:       0     0     0     0     0     0       0     0     0     0     0     0     0       0     0     0     0     0     0     0       0     0     0     0     0     0     0       0     0     0     0     0     0     0       0     0     0     0     0     0     0       0     0     0     0     0     0     0       0     0     0     0     0     0     0       0     0     0     0     0     0     0       0     0     0     0     0     0     0       0     0     0     0     0     0     0       0     0     0     0     0     0     0       0     0     0     0     0     0     0       0     0     0     0     0     0     0       0     0     0     0     0     0     0       0     0									DATUM:				LOGGED BY: TS	DATE: 20/08/2018
CONTRACTOR: RDCL     MACHINE:     OPERATOR:       0 </td <td>OFI</td> <td>FICE:</td> <td>:</td> <td>RDCL</td> <td></td> <td></td> <td></td> <td></td> <td>ELEVATI</td> <td>ON:</td> <td>-</td> <td></td> <td>CHECKED BY: TB</td> <td>DATE:</td>	OFI	FICE:	:	RDCL					ELEVATI	ON:	-		CHECKED BY: TB	DATE:
0       0	EN	GINE	ER:	тв					AZUMITH	: 0°	PLUNGE: 90	0°	STATUS: Final data	
Structure       Structure	CO	NTR/	АСТС	R: R	DCL			MACH	INE:				OPERATOR:	
Structure       Structure														
1       2       2       3       3       2       3       3       2       3       3       2       3       3       2       3	ب							ws.						REMARKS
10       2       2       3       2       3       2       3       2       3       2       3       2       3       2       3       2       3       2       3       2       3       3       2       3       3       2       3       3       2       3       3       2       3       3       2       3       3       2       3       3       2       3       3       2       3       3       2       3       3       2       3       3       2       3       3       2       3	TH (r	<u>ب</u>	ЯÄ	HIG	⊲		DOI DEO				& TESTS		AbbinionAl	
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-135       -9         -135       -9         -240       -9         -250       -9         -260       -9         -270	-	-				double bounce								
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1       1		-												
1       1	-15	- 2.1												
-25       -57         -25       -57         -30       -67         -30       -67         -31       -10         -32       -67         -33       -67         -34       -10         -35       -67         -36       -67         -37       -10         -38       -67         -39       -10         -30       -67         -31       -10         -32       -67         -33       -67         -34       -10         -35       -67         -36       -67         -37       -10         -38       -67         -39       -10         -30       -67         -33       -67         -33       -67         -33       -67         -34       -10         -35       -67         -36       -67         -37       -77         -38       -77         -39       -77         -30       -77         -30       -77         -30       -	-	-												
-25       -7?         -25       -7?         -30       -7?         -30       -7?         -31       -7?         -32       -7?         -33       -7?         -34       -7?         -35       -7?         -36       -7?         -37       -7?         -38       -7?         -39       -7?         -30       -7?         -31       -7?         -32       -7?         -33       -7?         -34       -7?         -35       -7?         -36       -7?         -37       -7?         -38       -7?         -39       -7?         -30       -7?         -33       -7?         -35       -7?         -36       -7?         -37       -7?         -38       -7?         -39       -7?         -30       -7?         -30       -7?         -30       -7?         -30       -7?         -30       -7?         -30       -	-	-												
-25       -7?         -25       -7?         -30       -7?         -30       -7?         -31       -7?         -32       -7?         -33       -7?         -34       -7?         -35       -7?         -36       -7?         -37       -7?         -38       -7?         -39       -7?         -30       -7?         -31       -7?         -32       -7?         -33       -7?         -34       -7?         -35       -7?         -36       -7?         -37       -7?         -38       -7?         -39       -7?         -30       -7?         -33       -7?         -35       -7?         -36       -7?         -37       -7?         -38       -7?         -39       -7?         -30       -7?         -30       -7?         -30       -7?         -30       -7?         -30       -7?         -30       -	-	-												
-25       -7?         -25       -7?         -30       -7?         -30       -7?         -31       -7?         -32       -7?         -33       -7?         -34       -7?         -35       -7?         -36       -7?         -37       -7?         -38       -7?         -39       -7?         -30       -7?         -31       -7?         -32       -7?         -33       -7?         -34       -7?         -35       -7?         -36       -7?         -37       -7?         -38       -7?         -39       -7?         -30       -7?         -33       -7?         -35       -7?         -36       -7?         -37       -7?         -38       -7?         -39       -7?         -30       -7?         -30       -7?         -30       -7?         -30       -7?         -30       -7?         -30       -	-													
1       1	-2.0													
1       1	Ī	-												
1       1														
1       1	-	-												
-3.5       -9?         -1.5       -9?	-2.5	-2.5												
-3.5       -9?         -1.5       -9?	-	-												
-3.5       -9?         -1.5       -9?	-	-												
-3.5       -9?         -1.5       -9?	F	-												
-3.5       -9?         -1.5       -9?	20	0.2												
REMARKS   SYMBOLS ✓ Standing Water Level ✓ Out flow ✓ In flow B/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand	3.0	<sup>ײ</sup>												
REMARKS   SYMBOLS ✓ Standing Water Level ✓ Out flow ✓ In flow B/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand	ŀ	-												
REMARKS   SYMBOLS ✓ Standing Water Level ✓ Out flow ✓ In flow B/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand	-	-												
REMARKS   SYMBOLS ✓ Standing Water Level ✓ Out flow ✓ In flow B/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand	-													
▼ Standing Water Level         <- Out flow	-3.5	-3.5												
▼ Standing Water Level         <- Out flow	Ī	t												
▼ Standing Water Level         <- Out flow														
▼ Standing Water Level         <- Out flow	ŀ	-												
▼ Standing Water Level         <- Out flow												0.00		
CHOUT flow → In flow RDCL 8/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand	KEN	MARK	.5											
Characteristic       Characteristic         B/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand														
8/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand														
8/308 Queen St East, Hastings   PO Box 28057, Havelock North 4130   New Zealand														
Ph: +64 6 8771652   Email: info@rdcl.co.nz						8/308 Q	ueen St Ea	ast, Hasting: Ph <sup>.</sup> +64 6	s   PO Box 2 8771652	2805 Ema	i7, Havelock North	n 4130 z	)   New Zealand	



Produced with Core-GS by Geroc

### DCP LOG

SHEET 35 OF 36

CLI	ENT:	Gre	ensto	ne L	and Developme	nts Ltd		PROJECT	ION	I: NZTM	LOCATION: Lot 9
PR	OJEC	CT:	18425	50602	2			EASTING	:	1934694.00	STARTED: 20/08/2018
LOO	CATIO	ON:	139 A	ratał	ki Road			NORTHIN	G:	5602764.00	FINISHED: 20/08/2018
								DATUM:			LOGGED BY: TS DATE: 20/08/2018
OF	FICE:		RDCL					ELEVATIO	DN:	-	CHECKED BY: TB DATE:
EN	GINE	ER:	ТВ					AZUMITH	: 0°	PLUNGE: 90	° STATUS: Final data
CO	NTRA	АСТО	R: R	DCL			MACH	INE:			OPERATOR:
Ê							0			SAMPLES	
ц Н	(c	ĸ	HIC	_		DCP BLOW	5			& TESTS	ADDITIONAL REMARKS
DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	5	10	15	20			
		-		1							
_		_		2							
-	-	Groundwater Not Encountered		3							
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-	-	water		1	-						
		puno		6							
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-1.0	- 1-			11 6							
-	-										
-	-				double bounce			-			
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- 1.5	-1.5										
-	- '										
-	-										
-	-										
-	_										
-2.0	-2.0										
-	_										
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-3.0	-3.0										
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-	-							-			
- 3.5	-3.5										
- 3.5	- "										
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-	-										
REM	1ARK	s		1							SYMBOLS
											▼ Standing Water Level
											<- Out flow
											├─ In flow
					8/308 C	ueen St Eas	t, Hastinos	<b>RI</b> S   PO Box 2	DCL 2805	7, Havelock North	4130   New Zealand
							Ph: +64 6	8771652	Ema	il: info@rdcl.co.nz	•



								SHEET 36 OF 36
CLIEN	T: Gro	eensto	ne Land Developments Ltd		PROJECT	ION: NZTM	LOCATION: Lot 9	
PROJE	ECT:	18425	0602		EASTING	1934717.00	STARTED: 20/08/2018	
LOCAT	FION:	139 A	ataki Road		NORTHIN	G: 5602776.00	FINISHED: 20/08/2018	
					DATUM:		LOGGED BY: TS	DATE: 20/08/207
OFFIC	E:	RDCL			ELEVATIO	DN: -	CHECKED BY: TB	DATE:
ENGIN	IEER:	ТВ			AZUMITH	0° PLUNGE: 90°	STATUS: Final data	
CONTR	RACTO	DR: R	DCL	MACH	INE:		OPERATOR:	
DEPTH (m) RL (m)	WATER	GRAPHIC LOG	DCP BLOW			SAMPLES & TESTS	ADDITIONAL	REMARKS
<u>R</u>	Ś	<u><u> </u></u>	Y         5         10           1         1         1         1	15	20			
-			2					
Ĺ	ered		1					
ŀ	count		1		-			
0.5 - 0.5	Lot Er		2					
ŀ	/ater ♪		11					
F	Groundwater Not Encountered							
Ĺ	Ğ							
1.0								
-								
			Double bounce					
_								
<u>ب</u> 1.5 – <del>ب</del>								
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2.0 - Ņ								
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REMAR	RKS					S	SYMBOLS	
							Standing Water Level	
							<⊢ Out flow	
							├── In flow	



EXP01	
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													SHEET 1 OF 8
	ENT:			stone Land Developments Ltd	PROJECTIC						STARTED: 15/08		
			18425		EASTING:		3466				FINISHED: 15/08	/2018	
LO	CATI	ON:	139 Ai	rataki Road	NORTHING:	56	0259	3.21					
05					DATUM:						LOGGED BY: SE		DATE: 15/08/2018
	FICE		RDCL		ELEVATION						CHECKED BY: TE		DATE:
		ER:									STATUS: Final da	ta	
00			R: RI		MACHINE T	TPE			-:				
DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION		MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS		SAMPLES & TESTS	A	DDITIONAL REMARKS
	-		<u>⊴</u> 24 ⊵TS	TOPSOIL; dark brown. Firm; moist; non plastic.									
	_	tered		SILT, with some sand; brown.		1	FM						
	- 10	count	×××	Firm; low plasticity; moist; sand, fine to mediu	n.								
-0.5 - -	-0.5	Groundwater Not Encountered		GRAVEL, with some silt; brown. Medium dense; non-plastic; moist; well graded; to coarse, subround to round.	gravel, fine	м							
- 1.0 -	1.0	Ground		EOH: 1.20m			MD						
-	F												
- 1.5	- 1.5												
	-												
	-												
-2.0	-2.0												
2.0	-												
	-												
2.5	- ?i -												
3.0	-3.0												
	ŀ												
	ļ												
3.5	-3.5												
	F												
	L												
										PF	MARKS		
										SY	MBOLS		
										⊻	Standing Water Level		
											- Out flow		
											- In flow		
				8/308 Queen St East, Hastings	<b>RDC</b> PO Box 280		lave	lock	Nort	h 41	30   New Zealand		
				Ph: +64 6	8771652   En	nail: i	nfo@	rdcl.	co.n	z	1		



	ENT:		Green	stone Land Developments Ltd	PROJECTIC	)N· N	JZTM	2000	<u>ן</u>	S	TARTED: 15/	/08/2018	SHEET 2 OF 8
	DJEC		18425		EASTING:		3462				INISHED: 15/		
LOC	CATIO	ON:	139 Ai	rataki Road	NORTHING	: 56	0265	7.55					
					DATUM:					L	OGGED BY:	SD	DATE: 15/08/2018
OF	FICE:		RDCL		ELEVATION	l: -				С	HECKED BY:	ТВ	DATE:
		ER:			DIMENSION					S	TATUS: Final	data	
CO	NTRA	ACTC	R: RI		MACHINE T	YPE	& MC	DEI	.:				
DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION		MOISTURE	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS		SAMPLES & TESTS	F	ADDITIONAL REMARKS
	-		<u>4</u> 6 <u>4</u> TC	TOPSOIL; dark brown. Firm; moist; some roots and rootlets; non plas									
	_	Intered		SILT, with some sand, with trace rootlets; bro	wn.	/	FM						
	-0.5	Encot		Firm; low plasticity; moist; sand, fine to mediu	m.	-							
0.5	- q -	Groundwater Not Encountered		GRAVEL, with trace silt; brown. Medium dense; non-plastic; moist; gravel, fine subround.	to medium,	м	MD						
1.0	- 1.0	Ground		GRAVEL, with some silt; brown. Medium dense; non-plastic; moist; gravel, fine subround.	to coarse,								
	-			EOH: 1.10m	,								
1.5	-1.5												
1.5	-												
	-												
2.0	-2.0												
	-												
	-												
2.5	-2.5												
	-												
3.0	- 3.0												
5.0	-												
	-												
3.5	-3.5												
	-												
	-												
						1				REMAF	RKS		
										SYMBO	OLS		
											nding Water Level		
										<}- Out	flow		
					RDC	1				▷ In fl	ow		
				8/308 Queen St East, Hastings	s   PO Box 280	)57, I					New Zealand		
				Ph: +64 6	8771652   En	nail: ii	nto@	rdcl.	co.n	2			



EXP03
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	IENT:		Green	stone Land Developments Ltd	PROJECTIC		17714	2000	<u> </u>	STARTED: 15/08/	2010	SHEET 3 OF 8
			Green 18425		EASTING:		12 T IVI 3472(			FINISHED: 15/08/		
				rataki Road	NORTHING							
					DATUM:					LOGGED BY: SD	)	DATE: 15/08/2018
OF	FICE	:	RDCL		ELEVATION	: -				CHECKED BY: TB		DATE:
	IGINE				DIMENSION					STATUS: Final dat	а	
СС	DNTR/	ACTC	R: RI	DCL	MACHINE T	YPE	& MC	DEL	-:	I		
DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION		MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	A	DDITIONAL REMARKS
-	-		<u>⊴</u> 24 ⊵TS	TOPSOIL; dark brown. Firm; moist; trace rootlets, non plastic.								
-	ļ			SILT, with trace rootlets and sand; brown.		-	FM					
-	-0.5		× × ·	Firm; low plasticity; moist; sand, fine.								
-0.5 -	- Ŷ			GRAVEL, with some sand; brown.								
-	-			Medium dense; moist; well graded; gravel, fine subround; non plastic.	to coarse,							
- 1.0	- 1-	ered										
-	L	Icount										
	ŀ	Not Er	$ \circ \circ \rangle$			м						
-1.5	-1.5	Groundwater Not Encountered										
-	-	Ground	$ ^{\circ} > _{-}$				MD					
-	-											
-2.0	-2.0											
-	-											
-	2											
-2.5	- 4		Lº.2									
			<u>Po</u> _	EOH: 2.70m								
_	0											
-3.0 -	- 3.0											
	-											
- 3.5	- 2.5											
- 3.5	- ~											
-	F											
_	-											
										REMARKS		
										SYMBOLS		
										▼ Standing Water Level		
										✓ Out flow		
										▷ In flow		
				8/308 Queen St East, Hastings		)57, ł						
					8771652   En							



<b>TP01</b>	
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Image: Service of the service of th	EASTING: 1934664.00 FINISHED: 21/08/2018 NORTHING: 5602635.00 DATUM: LOGGED BY: SD DATE: 21/08/2018 ELEVATION: - CHECKED BY: TB DATE: DIMENSIONS: m x m STATUS: Final data MACHINE TYPE & MODEL: OCK / SOIL DESCRIPTION WILLIGGES BY B DATE: OCK / SOIL DESCRIPTION Not build state in the state of the
LOCATION: 139 Arataki Road NORTHING: 5602635.00 DATUM: LOGGED BY: SD DATUM: CHECKED BY: TB ENGINEER: TB DIMENSIONS: m x m STATUS: Final data CONTRACTOR: RDCL MACHINE TYPE & MODEL:	NORTHING: 5602635.00 DATUM: LOGGED BY: SD DATE: 21/06/2018 ELEVATION: - CHECKED BY: TB DATE: DIMENSIONS: m x m STATUS: Final data MACHINE TYPE & MODEL: OCK / SOIL DESCRIPTION WEDESCRIPTION OV. Passic: some rootlets. n. n-plastic: moist; sand, fine to medium. gravel; thrown. objets. some funditur; gravel, fine to coarse, : and, medium. shift gravel, subround to round. EL, with some cobbles; thrown. : cobbles, subround to round. : cob
DOTION     DOTUM:     LOGGED BY: SD       OFFICE:     RDCL     ELEVATION: -     CHECKED BY: TB       ENGINEER:     TB     DIMENSIONS: m x m     STATUS: Final data       CONTRACTOR:     RDCL     MACHINE TYPE & MODEL:     Image: Status in the status in the	DATUM: LOGGED BY: SD DATE: 21/08/2018 ELEVATION: - DIMENSIONS: m x m STATUS: Final data MACHINE TYPE & MODEL: OCK / SOIL DESCRIPTION USUEDSWORD OCK / SOIL DESCRIPTION OCK / SOIL DESCRIPTION DEL SUEDSWORD OCK / SOIL DESCRIPTION DEL SUEDSWORDE
OFFICE:       RDCL       ELEVATION: -       CHECKED BY: TB         ENGINEER:       TB       DIMENSIONS: m x m       STATUS: Final data         CONTRACTOR:       RDCL       MACHINE TYPE & MODEL:         Image: transmit in the state of the st	ELEVATION: -       CHECKED BY: TB       DATE:         DIMENSIONS: m x m       STATUS: Final data         MACHINE TYPE & MODEL:         OCK / SOIL DESCRIPTION       Image: Status in the image: Status i
ENGINEER: TB DIMENSIONS: m x m CONTRACTOR: RDCL MACHINE TYPE & MODEL:	DIMENSIONS: m x m STATUS: Final data  MACHINE TYPE & MODEL:  OCK / SOIL DESCRIPTION  WINTER CONTRACT OF CONTACT OF CONTRACT OF CONTACT OF CONTACT OF CONTACT OF CO
CONTRACTOR:     RDCL     MACHINE TYPE & MODEL:       Image: Stand Sta	MACHINE TYPE & MODEL:         OCK / SOIL DESCRIPTION       VILLEXESSIGNED       Samples       ADDITIONAL REMARKS         OWN.       Image: Stress       ADDITIONAL REMARKS         Own.       Image: Stress       ADDITIONAL REMARKS         Own.       Image: Stress       Image: Stress       ADDITIONAL REMARKS         Image: brown.       Image: Stress       Image: Stress       Image: Stress       Image: Stress         Image: brown.       Image: Stress       Image: Stress <td< td=""></td<>
Image: Second second	OCK / SOIL DESCRIPTION     NOTE       00m.     125 (15)       1astic; some rootlets.     m       n.     FM       gravel; brown.     FM       olst sand, medium; gravel, fine to     FM       MD     B       B     B       B     B       B     B       B     B       Cliptic for courd; non plastic.     B       EL; brown.     FM       m-plastic; moist; sand, fine to medium.       gravel; brown.       rsit; gravel, fine to coarse,       sand, medium.       gravel; brown.       rsit; gravel, fine to coarse,       sand, medium.       gravel; brown.       rsit; gravel, fine to coarse,       sand, medium.       gravel; brown.       rsit; gravel, fine to coarse,       sand, medium.       gravel; brown.       rsit; gravel, fine to coarse, subround to round.       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D <tr< td=""></tr<>
-0.5     -0.7	own.     Image: Some rootlets.     FM       n.     modelum:     FM       gravel; brown.     gravel; brown.       oist; sand, medium:     gravel; brown.       or plastic; moist; gravel, fine to coarse,     Image: Some rootlets.       mon-plastic; moist; gravel, fine to coarse,     Image: Some rootlets.       mon-plastic; moist; gravel, fine to coarse,     Image: Some rootlets.       is silt; light brown.     Image: Some rootlets, some rootlets, some rootlets, subround to round.       EL, with some cobbles; brown.     Image: Some rootlets, subround to round.       EL, with some cobbles, subround to round.     Image: Some rootlets, subround to round.       EL, with some cobbles, subround to round.     Image: Some rootlets, subround to round.       EL, with some cobbles, subround to round.     Image: Some rootlets, subround to round.       EL, with some cobbles, subround to round.     Image: Some rootlets, subround to round.       EL, with some cobbles, subround to round.     Image: Some rootlets, subround to round.       EL, with some cobbles, subround to round.     Image: Some rootlets, subround to round.       EL, with some cobbles; brown.     Some rootlets; brown.       c; saturated; gravel, fine to coarse, subround to round.     Image: Some rootlets; brown.
-0.5     -0.5	own.       Plastic; some rootlets.         n.       phastic; some rootlets.         m.       phastic; some rootlets.         m.       phastic; some rootlets.         gravel; brown.       gravel; brown.         oist; sand, medium; gravel, fine to coarse, ; sand, medium.       MD         B       B         EL; brown.       B         no-plastic; moist; gravel, fine to coarse, ; sand, medium.       B         isit; gravel, subrown.       MD         moplastic; moist; sand, fine to medium.       B         isit; gravel, fine to coarse, subround to round.       M         EL, with some cobbles; brown.       C         c; moist; gravel, fine to coarse, subround to round.       D         EL, with some cobbles; brown.       C         c; wet; gravel, fine to coarse, subround to round.       W         EL, with some cobbles; brown.       C         c; wet; gravel, fine to coarse, subround to round.       W         EL, with some cobbles.       S         c; wet; gravel, fine to coarse, subround to round.       W
0.5     -0     Medium dense; non-plastic; moist; sand, fine to medium.       1.0     -0       1.0     -0       1.0     -0       1.0     -0       1.0     -0       1.0     -0       1.0     -0       1.0     -0       1.0     -0       1.0     -0       1.0     -0       1.0     -0       1.0     -0       1.0     -0       1.0     -0       1.0     -0       1.0     -0       1.0     -0       1.0     -0       1.1     -0       1.2     -0       1.3     -0       1.4     -0       1.5     -0       1.5     -0       1.5     -0       1.5     -0       1.5     -0       1.5     -0       1.5     -0       1.6     -0       1.7     -0       2.0     -0       2.1     -0       2.2     -0       2.3     -0       2.4     -0       2.5     -0       2.6     -0       2.7     -0	pn-plastic; moist; sand, fine to medium.         gravel; brown.         oist; sand, medium; gravel, fine to         1 to round; non plastic.         EL; brown.         pn-plastic; moist; gravel, fine to coarse,         is silt; gipt brown.         noplastic; moist; sand, fine to medium.         rs silt; gravel, fine to coarse, subround         w plasticity; moist; sand, fine.         EL, with some cobbles; brown.         c; moist; gravel, fine to coarse, subround to round.         EL, with some cobbles; brown.         c; moist; gravel, fine to coarse, subround to round.         EL, with some cobbles, brown.         c; wot; gravel, fine to coarse, subround to round.         W         EL, with some cobbles, brown.         c; wot; gravel, fine to coarse, subround to round.         W         W         EL, with some cobbles, brown.         c; wet; gravel, fine to coarse, subround to round.         W         W         EL, with some cobbles, brown.         c; saturated; gravel, fine to coarse,         c; saturated; gravel, fine to coarse,
1.0     -9     Medium dense; mon-plastic; moist; gravel, fine to coarse, subround to round; sand, medium.     MD       1.1.0     -9     Silty sandy GRAVEL; brown.     MD       Medium dense; non-plastic; moist; gravel, fine to coarse, subround to round; sand, medium.     MD       1.1.5     -9       1.5     -9       2.0     -9       2.1.5     -9       3.0     -9       3.0     -9       3.0     -9	oist: sand, medium: gravel, fine to         EL; brown.         proplastic; moist; gravel, fine to coarse,         ; sand, medium.         silt; light brown.         on-plastic; moist; sand, fine to medium.         silt; gravel, brown.         w plasticity; moist; sand, fine.         EL, with trace cobbles; brown.         c; moist; gravel, fine to coarse, subround         e to medium; cobbles, subround to round.         D         EL, with some cobbles; brown.         c; moist; gravel, subround to round.         EL, with some cobbles; brown.         c; wet; gravel, subround to round.         W         W         EL, with some cobbles.         c; wet; gravel, fine to coarse, subround to round.         W         W         EL, with some cobbles.         c; wet; gravel, fine to coarse, subround to round.         W         W         W         EL, with some cobbles, subround to round.         EL, with some cobbles, subround to round.         W         S         c; saturated; gravel, fine to coarse,
1.0       -7       Silly sandy GRAVEL, with some cobbles; brown.         1.15       -7       -7         1.15       -7<	Dr.plastic; moist; gravel, fine to coarse,         ; sand, medium.         silt; tight brown.         on-plastic; moist; sand, fine to medium.         silt; greyish brown.         w plasticity; moist; sand, fine.         EL, with race cobbles; brown.         c; moist; gravel, fine to coarse, subround         le to medium; cobbles, subround to round.         EL, with some cobbles; brown.         c; moist; gravel, subround to round.         EL, with some cobbles, subround to round.         EL, with some cobbles.         c; wet; gravel, fine to coarse, subround to round.         W         W         EL, with some cobbles.         c; wet; gravel, fine to coarse, subround to round.         W         EL, with some cobbles.         c; wet; gravel, fine to coarse, subround to round.         W         EL, with some cobbles.         c; wet; gravel, fine to coarse, subround to round.         W         EL, with some cobbles; brown.         c; saturated; gravel, fine to coarse,
1.5       9       Medium dense; non-plastic; moist; sand, fine to medium.       M         1.5       9       SAND, with some silt; greyish brown. Medium dense; low plasticity; moist; sand, fine.       M         2.0       9       Silty sandy GRAVEL, with trace cobbles; brown. Dense; non-plastic; moist; gravel, fine to coarse, subround to round.       M         2.0       9       Silty sandy GRAVEL, with some cobbles; brown. Dense; non-plastic; moist; gravel, subround to round.       D         2.0       9       Silty sandy GRAVEL, with some cobbles; brown. Dense; non-plastic; moist; gravel, subround to round; sand, medium to coarse; cobbles, subround to round.       D         3.0       9       Silty sandy GRAVEL, with some cobbles. Dense; non-plastic; wet; gravel, fine to coarse, subround to round.       W	on-plastic; moist; sand, fine to medium.         silt; greyish brown.         w plasticity; moist; sand, fine.         EL, with trace cobbles; brown.         c; moist; gravel, fine to coarse, subround to round.         EL, with some cobbles; brown.         c; moist; gravel, subround to round; sand,         c; cobbles, subround to round; sand,         c; cobbles, subround to round.         EL, with some cobbles:         c; wet; gravel, fine to coarse, subround to round.         W         W         EL, with some cobbles.         c; wet; gravel, fine to coarse, subround to round.         W         W         EL, with some cobbles.         c; wet; gravel, fine to coarse, subround to round.         W         EL, with some cobbles.         c; wet; gravel, fine to coarse, subround to round.         W         EL, with some cobbles.         c; wet; gravel, fine to coarse, subround to round.         W         EL, with some cobbles; brown.         c; saturated; gravel, fine to coarse,
1.5	El., with trace cobbles; brown.         c; moist; gravel, fine to coarse, subround to round.         EL, with some cobbles; brown.         c; moist; gravel, subround to round.         EL, with some cobbles; brown.         c; moist; gravel, subround to round, sand,         c; cobbles, subround to round.         EL, with some cobbles.         c; wet; gravel, fine to coarse, subround to round.         W         EL, with some cobbles.         c; wet; gravel, fine to coarse, subround to round.         W         EL, with some cobbles.         c; wet; gravel, fine to coarse, subround to round.         W
2.0       - N       Dense; non-plastic; moist; gravel, fine to coarse, subround to round.         2.0       - N       Dense; non-plastic; moist; gravel, subround to round.         2.1       - N       Dense; non-plastic; moist; gravel, subround to round.         2.5       - N       Dense; non-plastic; moist; gravel, subround to round; sand, medium to coarse; cobbles, subround to round; sand, medium to coarse; cobbles.       Dense; non-plastic; moist; gravel, subround to round.         -3.0       - N       Dense; non-plastic; wei; gravel, fine to coarse, subround to round.       W	c; moist; gravel, fine to coarse, subround to round.  EL, with some cobbles; brown. c; moist; gravel, subround to round; sand, ; cobbles, subround to round.  EL, with some cobbles. c; wet; gravel, fine to coarse, subround to ium to coarse; cobbles, subround to round.  EL, with some cobbles; brown. c; saturated; gravel, fine to coarse,
2.5     N     Silty sandy GRAVEL, with some cobbles; brown. Dense; non-plastic; moist; gravel, subround to round; sand, medium to coarse; cobbles, subround to round.     D       3.0     N     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	EL, with some cobbles; brown. c; moist; gravel, subround to round; sand, ; cobbles, subround to round. EL, with some cobbles. c; wet; gravel, fine to coarse, subround to ium to coarse; cobbles, subround to round. EL, with some cobbles; brown. c; saturated; gravel, fine to coarse, S
2.5       N       Silty sandy GRAVEL, with some cobbles; brown.         O       Dense; non-plastic; moist; gravel, subround to round; sand, medium to coarse; cobbles, subround to round.         -3.0       N         -3.0 </td <td>EL, with some cobbles; brown.      </td>	EL, with some cobbles; brown.
-3.0     P     O     medium to coarse; cobbles, subround to round.       -3.0     P     O     Silty sandy GRAVEL, with some cobbles. Dense; non-plastic; wet; gravel, fine to coarse, subround to round.       -3.0     P     O     Dense; non-plastic; wet; gravel, fine to coarse, subround to round.	; cobbles, subround to round. EL, with some cobbles. c; wet; gravel, fine to coarse, subround to ium to coarse; cobbles, subround to round. W EL, with some cobbles; brown. c; saturated; gravel, fine to coarse, S
3.0 O Dense; non-plastic; wet; gravel, fine to coarse, subround to round; sand, medium to coarse; cobbles, subround to round.	c; wet; gravel, fine to coarse, subround to ium to coarse; cobbles, subround to round.          W       W         EL, with some cobbles; brown.       S         c; saturated; gravel, fine to coarse,       S
	c; saturated; gravel, fine to coarse,
Dense; non-plastic; saturated; gravel, fine to coarse, subround to round; sand, medium to coarse; cobbles, subround to round.	; sand, medium to coarse; cobbles,
- EOH: 3.50m	
REMARKS	REMARKS



TP02	)
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													SHEET 5 OF 8	
CLI	ENT:		Green	stone Land Developments Ltd	PROJECTIO	N: N	IZTM	2000	)		STARTED: 21/08	/2018		
PRO	DJEC	T:	18425	0602	EASTING:	19	3470	9.00		FINISHED: 21/08/2018				
LOC	CATIO	ON:	139 Aı	ataki Road	NORTHING: 5602642.00									
					DATUM:						LOGGED BY: SE	)	DATE: 21/08/2018	
	OFFICE: RDCL ELEVATION: -										CHECKED BY: TE		DATE:	
		ER:			DIMENSION						STATUS: Final da	ia		
CO	NIR/	ACTO	DR: RI		MACHINE T	YPE	& MC	DEL	.:					
DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION		MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS		SAMPLES & TESTS	AI	DDITIONAL REMARKS	
-	-		≜≜ TS	TOPSOIL; dark brown. Firm; moist; non plastic; trace rootles.			FM							
-	-			Sandy SILT, with trace rootlets; brown.	/	1				в				
- 0.5	-0.5			Medium dense; non-plastic; moist; sand, fine to	medium.									
-	-			SAND; greyish brown. Medium dense; moist; sand, medium; non plast	lic.									
-	- 1-			Silty sandy GRAVEL, with trace cobbles; brown	/ I.	1				В				
- 1.0 -		σ		Medium dense; non-plastic; moist; gravel, fine t subround to round; cobbles, subround to round.	o coarse,									
-	-	Groundwater Not Encountered												
- 1 5	- 1.5	t Enco					MD							
- 1.5	- `'	er Not				м								
-	-	Indwa												
- 2.0	- 2.0	Grou												
-	-													
-	-													
- 2.5				GRAVEL, with some clay and silt, with trace co	bbles;	1								
- 2.5	- 9			greyish brown. Medium dense; non-plastic; moist; gravel, fine t	o coarse,									
-	-			subround to round; cobbles, subround to round. Silty sandy GRAVEL, with trace cobbles; brown			D							
- 3.0	-3.0		ల ని	Dense; non-plastic; moist; gravel, fine to coarse to round; sand, medium to coarse; cobbles, sub round.	e, subround									
-	-			Silty sandy GRAVEL, with some cobbles; brown Dense; non-plastic; moist; gravel, fine to coarse to round; sand, medium to coarse; cobbles, sub	e, subround									
-3.5	-3.5			FOH: 3.10m										
-	-				,									
								L		RE	MARKS			
										SYN	MBOLS			
										T	Standing Water Level			
										4	Out flow			
											In flow			
				8/308 Queen St East, Hastings	RDC	)57, ŀ	lave	lock I	Nort	h 41:	30   New Zealand			
				Pn: +64 6	8771652   Em	iall: lí	110@	ruCl.0	JO.N.	۷				

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													SHEET 6 OF 8
	ENT:			stone Land Developments Ltd	PROJECTIC						STARTED: 21/08		
			18425	rataki Road	EASTING:		3474 0259				FINISHED: 21/08	/2018	
LU	JAIN	JN.	139 A		DATUM:	. 00	0200	0.00			LOGGED BY: SI	)	DATE: 21/08/2018
OF	FICE:	:	RDCL		ELEVATION	l: -					CHECKED BY: TE	3	DATE:
EN	GINE	ER:	ТВ		DIMENSION	IS: m	x m				STATUS: Final da	ta	
СО	NTRA	АСТС	R: R	DCL	MACHINE T	YPE	& MC	DEL	.:	1			
DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION		MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS		SAMPLES & TESTS	A	DDITIONAL REMARKS
	-		<u>⊴</u> ∞ ⊴ ⊵ TS ⊴ <u>∞</u> ,	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	o medium.					В	-		
	-			, Silty sandy GRAVEL; brown. Medium dense; non-plastic; moist; gravel, fine	to coarse					в	-		
			0.05	subround to round; sand, medium to coarse.	to obtaise,						-		
1.0	- 1-	-											
	-	untered					MD						
-1.5	- 1.5	ot Enco		SAND, with some rootlets, with trace silt; brow Medium dense; non-plastic; moist.	wn.								
	- - -	Groundwater Not Encountered		Silty sandy GRAVEL; brown. Medium dense; non-plastic; moist; gravel, fine subround to round; sand, medium to coarse.	to coarse,	м							
2.0		Ö		SAND, with trace silt; brown. Medium dense; non-plastic; moist; sand, mediu				-					
2.5			$\frac{1}{2}$ $\frac{1}$	Silty sandy GRAVEL, with trace cobbles; brown Dense; non-plastic; moist; gravel, fine to coars to round; cobbles, subround to round.			D						
	-			GRAVEL, with trace clay and sand; light grey. Medium dense; non-plastic; moist; gravel, fine subround to round; sand, coarse.	to coarse,		MD						
-3.0	-3.0			Silty sandy GRAVEL, with some cobbles; brow Dense; non-plastic; moist; gravel, fine to coars to round; cobbles, subround to round.			D						
-3.5	-3.5			EOH: 3.10m									
	-												
	-									RE	MARKS		
										SY	MBOLS		
											Standing Water Level - Out flow		
											- In flow		
				8/308 Queen St East, Hastings Ph <sup>.</sup> +64 6	<b>RDC</b> PO Box 280   8771652   En	)57, I	-lavel	lock rdcl	Nort	:h 41 z	30   New Zealand		
				111.104.0		II				÷			



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											SHEET 7 OF 8
	ENT:			stone Land Developments Ltd	PROJECTIC EASTING:				)	STARTED: 21/08/20 FINISHED: 21/08/20	
			18425		NORTHING:		34692 0261			FINISHED: 21/08/20	510
LO	JAIR	JN:	139 AI	rataki Road	DATUM:	. 50	0201	1.00		LOGGED BY: SD	DATE: 21/08/2018
OF	FICE:		RDCL		ELEVATION	l: -				CHECKED BY: TB	DATE: 21/08/2018
	GINE				DIMENSION		x m			STATUS: Final data	DATE.
со	NTRA	ACTO	R: RI	DCL	MACHINE T			DEL			
							-	Z			
DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION		MOISTURE	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
-	-		i⊴e ⊴ ⊵ TS	TOPSOIL; dark brown. Firm; moist; some roots; non plastic.							
- - 0.5	-0.5			Sandy SILT, with trace gravel; brown. Firm; non-plastic; moist; sand, medium to coar fine, subround to round.	se; gravel,		FM				
-	-		<u>20</u> 20 <u>20</u> 20 <u>2</u> 5 200	TOPSOIL; dark brown. Firm; moist; non plastic; some roots.		1					
- 1.0	-1.0			SILT, with some sand; brownish grey. Firm; low plasticity; moist; sand, fine.				-			
-	-	countered		Silty sandy GRAVEL; brown. Medium dense; non-plastic; moist; gravel, fine subround to round.	to coarse,						
- 1.5 - -		Groundwater Not Encountered				м					
- 	-2.0	Ground					MD				
- - 2.5 -	-2.5										
- 3.0	-3.0		X:0 60:0 •0	GRAVEL, with trace clay and cobbles; greyish Dense; non-plastic; moist; gravel, fine to coars to round; cobbles, subround to round.			D	-			
- - 				Silty sandy GRAVEL, with some cobbles; brow Dense; non-plastic; moist; gravel, fine to coars to round; cobbles, subround to round. EOH: 3.10m							
-	-									REMARKS	
										SYMBOLS	
										▼ Standing Water Level	
										<⊢ Out flow	
					RDC	L				D In flow	
				8/308 Queen St East, Hastings Ph: +64 6		)57, I					



											SHEET 8 OF 8
	ENT:			stone Land Developments Ltd	PROJECTIC					STARTED: 21/08	
	OJEC		18425		EASTING:		3469			FINISHED: 21/08	/2018
LO	CATIO	ON:	139 A	rataki Road	NORTHING: DATUM:	56	0257	0.00		LOGGED BY: SE	
	FICE		RDCL		ELEVATION					CHECKED BY: TB	
		ER:			DIMENSION		v m			STATUS: Final dat	BRITE.
			R: R	DCL	MACHINE T			DDEL			
								7			
DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION		MOISTURE	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
	-		<u>⊴</u> ∧ _2 ⊵ TS ⊴⊵	TOPSOIL; dark brown. Firm; moist; some rootlets; non plastic.							
0.5				Sandy SILT, with trace gravel; brown. Firm; non-plastic; moist; gravel, fine, subroun	d to round.	_	FM				
1.0		q		Silty sandy GRAVEL; brown. Medium dense; non-plastic; moist; gravel, fine subround; sand, medium to coarse.	e to medium,						
1.5	- 1	Groundwater Not Encountered		SAND, with some silt; brown. Medium dense; non-plastic; moist; sand, med	ium to coarse	м					
2.0	- 1	Groundwate		Medium dense, non-plastic, moist, dana, med Silty sandy GRAVEL; brown. Medium dense; non-plastic; moist; gravel, fine subround to round.			MD				
2.5	- 1										
	-			•							
3.0	- 3.0			GRAVEL, with trace clay and cobbles; grey. Dense; non-plastic; moist; gravel, fine to coar to round; cobbles, subround to round.	se, subround	-	D				
3.5	-3.5			Silty sandy GRAVEL, with some cobbles; bro Dense; non-plastic; moist; gravel, fine to coar to round; cobbles, subround to round.							
0.0	-			EOH: 3.10m							
	-									REMARKS	
										SYMBOLS Standing Water Level Out flow In flow	
					RDC	L					
				8/308 Queen St East, Hasting Ph: +64		)57, I					

### APPENDIX B

**CPT** LOGS OUTPUTS



# **CONE PENETRATION TEST**

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

Job:	184250602
CPT No.:	CPT01
Grid: NZTM	North (m): 5602670.00
Deturn	East (m): 1934734.00
Datum: -	Elevation (m): 20.00
Termination: 35 TIP RESIS	TAN Hole Depth (m): 1.90

		RAW DATA	A			SOIL B	EHAVIOUR TYPE	E	STIMA	ED P	ARAMI	ETERS	\$	
	Tip Resistance (MPa)	Friction Ratio (%)	Pore Pressure (kPa)	Scale	SBT	SBTn	SBT Description (filtered)	Dr (%)		Su (kPa			N <sub>60</sub>	
	- 10 - 20 - 40	− 0 0 4 û 0 × ∞ 0	0 200 600 800		0 4 0 8	2 4 9 8		20 60	20 80	100 150 200	-250 -300 -350	9 9	07 R	
Ť							Clays: clay to silty clay							
					-		Sand mixtures: silty sand to sandy silt							
							Silt mixtures: clayey silt & silty clay							
1	$\mathbf{i}$	5												
	}	ΙŞ			_									
							Sands: clean sands to silty sands							
	}	<pre>\{</pre>												
	{	<b>}</b>		- 1			Sands: clean sands to silty sands							
		Κ					Sand mixtures: silty sand to sandy silt							
							Cana mixtures, sity sand to sandy site							
	2	$ \langle \rangle$					Sands: clean sands to silty sands Sand mixtures: silty sand to sandy silt							
	$\sum$						and and a set of the set of							
	l (						Sands: clean sands to silty sands							
. 1	1.9m													
				- 2	-									
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					-									
								aviour Type		_ ^	e <b>rtson (</b> d mixtur			
								ndefined	Ę	2 san	d to san	dy silt		
								ensitive fine- rained	e	to s	ds: clea ilty sand	S	;	
							2 C	lay - organic soi	1 7	Den grav	ise sand /elly san	l to d		
							3 C	lays: clay to silty ay	6	3 Stiff	sand to d	clayey		
							Si	ilt mixtures: clay It & silty clay	ey 🤅	_	fine-gra	ined		
te	es & Limitation	IS					<u> </u>		Rema	rks				
Da	ata shown on this	report has been as					of Soil Behaviour Type (SBT)							
tin	chnical soil and design parameters using methods published g for Geotechnical Engineering, 4th Edition. The interpretation				re present	ed only as	a guide for geotechnical use,	and should be	Lala	Dont	h (m):		1 00	
et d	design parameter	Ily reviewed by the user. Geroc Solutions Ltd do not warrar sign parameters shown and does not assume any liability f					in any design or review. The u	otechnical soil user should be	HOIE		<b>h (m):</b> Sheet 1		1.90	
	fully	aware of the techni	ques and limitations	of any m	ethod use	d to derive	e data shown in this report.				Printed		08/2	

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# **CONE PENETRATION TEST**

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

Job:	184250602
CPT No.:	CPT02
Grid: NZTM	North (m): 5602746.00
Determ	East (m): 1934694.00
Datum: -	Elevation (m): 0.00
Termination: 35 TIP RESISTAN	Hole Depth (m): 1.62

		RAW DATA	<b>A</b>			SOIL E	BEHAVIOUR TYPE	E	STIMATI	ED PARAM	ETERS
Predrill	Tip Resistance (MPa)	Friction Ratio (%)	Pore Pressure (kPa)	Scale	SBT	SBTn	SBT Description (filtered)	Dr (%)		Su (kPa)	N <sub>60</sub>
	- 10 - 20 - 40	-00400reo	- 0 - 200 - 400 - 600 - 800		0400	~ 4 0 0			202	-150 -200 -250 -300 -350	- 10 - 30 - 40
							Sand mixtures: silty sand to sandy silt				
		N					Silt mixtures: clayey silt & silty clay				
							Sand mixtures: silty sand to sandy silt				
	$\mathbf{X}$	(					Sands: clean sands to silty sands		•		
	~	5					Sands: clean sands to silty sands				
		5									
					-		Sands: clean sands to silty sands				
	$\mathbf{i}$			- 1							
	>	٤									
		Ιζ					Sands: clean sands to silty sands				
	<	}									
	1.62m	(					Dense sand to gravelly sand				
					-						
								aviour Type			
								idefined	5	Sand mixtur	dy silt
								nsitive fine- ained	6	Sands: clea to silty sand	s
							<b>2</b> Cla	ay - organic soi	7	Dense sand gravelly san	
							3 Cla	ays: clay to silty y	8	Stiff sand to sand	clayey
							Sil	t mixtures: clay & silty clay	ey 9	Stiff fine-gra	ined
	es & Limitation								Remark	S	
geote	echnical soil and d	esign parameters u	sing methods publis	hed in P.	K. Robert	son and h	of Soil Behaviour Type (SBT) a K.L. Cabal (2010), Guide to Con	e Penetration			
care	efully reviewed by	the user. Geroc So	lutions Ltd do not wa	arranty th	ne correctr	ness or the	s a guide for geotechnical use, e applicability of any of the geo	technical soil	Hole	Depth (m):	1.62
and							in any design or review. The use data shown in this report.	ser should be		Sheet 2	of 8

## **CONE PENETRATION TEST**

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

Job:	184250602
CPT No.:	CPT03
Grid: NZTM	North (m): 5602696.00
Deturn	East (m): 1934594.00
Datum: -	Elevation (m): 0.00
Termination: 35 TIP RESISTAN	Hole Depth (m): 1.66

					RAW	DAT	4								SOIL E	EHAVIOUR TYPE		E	STI	ИАТІ	ED I	PAR	AME	ETER	s		
Predrill		Tip Resista (MPa	ance		Frictic Ratic (%)			Pres	ore sure Pa)	)	Scale		SBT		SBTn	SBT Description (filtered)		Dr (%)				u Pa)			N <sub>6</sub>	0	
	6	- 50	- 40	6 - 6	ი 4 ი c	6 - 8	0	-200	- 600	-800			0400		8 4 2		- 20	- 40	- 80	- 50	- 150	-250	-300	- 10	- 20	8 9	- 40
							}				-	-				Sand mixtures: silty sand to sandy silt	· .										
				$\left \right\rangle$							-	-				Silt mixtures: clayey silt & silty clay											
											F															-	-
	$\left \right\rangle$			2							_	-				Sand mixtures: silty sand to sandy silt											
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											-	-															
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				2							1					Sands: clean sands to silty sands											
											-	4															
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																Si		res: cla	yey	9	-		e-gra	ined			
No	tes	& Lim	itation	s													enty		Re	mark	s						—
																of Soil Behaviour Type (SBT) a											
Test	ting f	for Geo	technic	al Eng	gineerin	g, 4th	Editio	on. T	he in	iterpr	etations	s are	preser	nte	d only as	K.L. Cabal (2010), Guide to Cor s a guide for geotechnical use,	and sh	ould be			Der	th /	m).		1.0	6	
			ameter	s sho	wn and	does	not a	ssum	e an	ıy liat	oility for	any	use of	the	e results	e applicability of any of the geo in any design or review. The u				lole	рер			of 0	1.6	o	—
			fully	aware	e of the	techni	ques	and	limita	ations	s of any	me	thod us	ed	to deriv	e data shown in this report.						SNG	eet 3	01.8			

# **CONE PENETRATION TEST**

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

Job:	184250602
CPT No.:	CPT04
Grid: NZTM	North (m): 5602565.00
Determine	East (m): 1934669.00
Datum: -	Elevation (m): 0.00
Termination: 35 TIP RESISTAN	Hole Depth (m): 1.98

		RAW DATA	A			SOIL E		E	STIMAT	ED PARAM	ETERS
Predrill	Tip Resistance (MPa)	Friction Ratio (%)	Pore Pressure (kPa)	Scale	SBT	SBTn	SBT Description (filtered)	Dr (%)		Su (kPa)	N <sub>60</sub>
	- 10 - 20 - 40	− 0 0 4 0 0 − 0 0	- 0 -200 -400 -600 -800		0.4.0.8	0400			20 80 20 80	- 150 - 150 - 250 - 300 - 350	10 - 30 + 0
		N					Sand mixtures: silty sand to sandy silt				
							Silt mixtures: clayey silt & silty clay				
							Sand mixtures: silty sand to sandy silt				
							Sands: clean sands to silty sands				
		}					Sand mixtures: silty sand to sandy silt				
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		}		- 1	-						
		$\langle$		- ·							
		{					Sands: clean sands to silty sands				
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	1.00	<u>}</u>		- 2							
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										<b>D</b> -h	-4 -1 4000
								naviour Type	(SBT) - 5	Sand mixtur	es: silty
								ensitive fine-	6	Sand to san	n sands
								ained lay - organic soi		Ito silty sand Dense sand gravelly san	to
							G C	lays: clay to silty ay			
							Si	ay ilt mixtures: clay It & silty clay	ey 9	_	ined
ot	tes & Limitation	IS							Remar	ks	
eot	echnical soil and d	design parameters ι	ising methods publis	shed in P.	K. Robert	tson and I	of Soil Behaviour Type (SBT) : K.L. Cabal (2010), Guide to Co	ne Penetration			
est ar	ing for Geotechnic efully reviewed by	al Engineering, 4th the user. Geroc Sc	Edition. The interpre- plutions Ltd do not w	etations a /arranty th	re present	ed only a ness or th	s a guide for geotechnical use, e applicability of any of the geo	and should be technical soil	Hole	Depth (m):	1.98
nd	design parameter fully	s shown and does aware of the techni	not assume any liab ques and limitations	outy for an of any m	ny use of tl nethod use	ne results d to deriv	in any design or review. The use data shown in this report.	iser should be		Sheet 4	of 8

# **CONE PENETRATION TEST**

Job:	184250602				
CPT No.:	CPT05				
Grid: NZTM	North (m): 5602621.00				
Determine	East (m): 1934709.00				
Datum: -	Elevation (m): 0.00				
Termination: 35 TIP RESISTAN	Hole Depth (m): 2.06				

	RAW DATA				SOIL E	BEHAVIOUR TYPE	ESTIMATED PARAMETERS				
Predrill	Tip Resistance (MPa)	Friction Ratio (%)	Pore Pressure (kPa)	Scale	SBT	SBTn	SBT Description (filtered)	Dr (%)		Su (kPa)	N <sub>60</sub>
		← 0 ∞ 4 û û ∧ ∞ 0	- 0 - 200 - 400 - 600 - 800		0 4 0 8	0 4 0 0			10 20		- 10 - 20 - 40
			-				Sand mixtures: silty sand to sandy silt				
							Silt mixtures: clayey silt & silty clay				
		/					Sand mixtures: silty sand to sandy silt				
		}									
		ξ	-				Sands: clean sands to silty sands				
		ξ	-								
		}									
	2	{									
		Ş	-				Sands: clean sands to silty sands				
EOH	2.06m	<u>}</u>		2			Dense sand to gravelly sand				
			-								
			-								
			-	— 3 —	-						
								naviour Type	(SBT) - F 5	Sand mixtur	es: silty
							I Se	ensitive fine-	6	sand to san Sands: clea	n sands
								ained lay - organic soi		to silty sand Dense sand	to
								lays: clay to silty		gravelly san Stiff sand to	
							Si	ay ilt mixtures: clay lt & silty clay		sand Stiff fine-gra	ined
	tes & Limitation								Remark	s	
geot	technical soil and d	lesign parameters u	ising methods publis	hed in P.	K. Robert	tson and <b>I</b>	of Soil Behaviour Type (SBT) a K.L. Cabal (2010), Guide to Cor s a guide for geotechnical use,	ne Penetration			
car	efully reviewed by	the user. Geroc So	lutions Ltd do not wa	arranty th	e correctr	ness or the	e applicability of any of the geo in any design or review. The u	technical soil	Hole [	Depth (m):	2.06
							e data shown in this report.			Sheet 5	of 8

# **CONE PENETRATION TEST**

Job:	184250602
CPT No.:	CPT06
Grid: NZTM	North (m): 5602615.00
Determine	East (m): 1934769.00
Datum: -	Elevation (m): 0.00
Termination: 35 TIP RESISTAN	Hole Depth (m): 1.84
'	

RAW DATA					SOIL E	BEHAVIOUR TYPE	ESTIMATED PARAMETE			ETERS	
	Tip Resistance (MPa)	Friction Ratio (%)	Pore Pressure (kPa)	Scale	SBT	SBTn	SBT Description (filtered)	Dr (%)		Su (kPa)	N <sub>60</sub>
	- 10 - 20 - 40	− ∩ ≈ 4 ∽ ∞ ∽ ∞ ∞	- 0 - 200 - 400 - 600 - 800		0 4 0 0	0 4 9 8		- 20 - 40 - 60	- 50 - 100	-150 -200 -250 -300 -350	40 30 40
				_	-		Sand mixtures: silty sand to sandy silt				
		}		_	-		Silt mixtures: clayey silt & silty clay				
		5					Sands: clean sands to silty sands				
		Ş		_			Sands: clean sands to silty sands				
		<pre>   </pre>		-			Sand mixtures: silty sand to sandy silt				
		{		-	-		Sands: clean sands to silty sands				
-	$\leq$	$\sum$		_			Sands: clean sands to silty sands				
		S		 	-		Sands: clean sands to silty sands				
				- - - - - - - - - - - - - - - - - - -				aviour Type		Robertson (	
							1 Se gra 2 Cl: 3 Cl: 6 Sil	ndefined ensitive fine- ained ay - organic so ays: clay to silt ay t mixtures: clay t & silty clay	/ 8 /ey 9	sand to san Sands: clea to silty sand Dense sand gravelly san Stiff sand to sand Stiff fine-gra	dy silt n sands ls l to ld o clayey
	es & Limitation ata shown on this		sessed to provide a	a basic int	terpretatior	n in terms	of Soil Behaviour Type (SBT) a	and various	Remark	S	
ote	chnical soil and d		ising methods publis	shed in P.	. K. Robert	son and l	K.L. Cabal (2010), Guide to Cor	ne Penetration			
							e applicability of any of the geo			Depth (m):	1.84

# **CONE PENETRATION TEST**

Job:	184250602
CPT No.:	CPT07
Grid: NZTM	North (m): 5602624.00
Deturn	East (m): 1934636.00
Datum: -	Elevation (m): 0.00
Termination: 35 TIP RESISTAN	Hole Depth (m): 1.80

	RAW DATA					SOIL E	BEHAVIOUR TYPE	ESTIMATED PARAMETERS					
	redrill		Tip sistance (MPa)	Friction Ratio (%)	Pore Pressure (kPa)	Scale	SBT	SBTn	SBT Description (filtered)	Dr (%)		Su (kPa)	N <sub>60</sub>
		- 10	- 20 - 30 - 40	− α α 4 α α ► ∞ 0	- 0 -200 -400 -600		0400	0408		20 80	- 50	- 150 - 200 - 250 - 300 - 350	- 10 - 20 - 40
	,			$\mathbb{N}$					Clays: clay to silty clay	· .			
				L L					Silt mixtures: clayey silt & silty clay				
						 			Silt mixtures: clayey silt & silty clay				
				<b>}</b>					Sand mixtures: silty sand to sandy silt				
				\{ }					Sands: clean sands to silty sands				
									Sands: clean sands to silty sands		Э		
E	EOH:	1.8m											
						2							
						— 3 —							
F		:	<u> </u>						Soil Be	haviour Type (	SBT) - I	Robertson (	et al. 1986
										Jndefined	5	Sand mixtur	es: silty
										Sensitive fine- grained	6	Sands: clea to silty sand	n sands
eroc									_	Clay - organic soil	7	Dense sand gravelly san	to
by G										Clays: clay to silty clay	8	Stiff sand to sand	
re-GS									S	Silt mixtures: claye silt & silty clay	<sup>9</sup>	Stiff fine-gra	ined
Generated with Core-GS by Geroc					popped to provide	hooi- int-	rprotetie	in to me -	of Soil Pohovieur Turce (OPT)		Remarl	s	
ed wi	geot	echnica	al soil and	design parameters u	ising methods publi	shed in P.	K. Robert	son and l	of Soil Behaviour Type (SBT) K.L. Cabal (2010), Guide to Co	one Penetration			
herat	care	efully re	eviewed by	the user. Geroc So	olutions Ltd do not v	varranty the	e correctr	ness or the	s a guide for geotechnical use e applicability of any of the ge in any design or review. The	otechnical soil	Hole	Depth (m):	1.80
Ger	anu	ucaiyii							e data shown in this report.			Sheet 7	of 8

# **CONE PENETRATION TEST**

Job	):	184250602				
CPT No.		CPT08				
Grid: NZTM	1	North (m): 5602687.00				
Determ		East (m): 1934666.00				
Datum: -		Elevation (m): 0.00				
Termination: 35 TIF	P RESISTAN	Hole Depth (m): 1.72				

	RAW DATA					SOIL E	BEHAVIOUR TYPE	ESTIMATED PARAMETERS			
Predrill	Tip Resistance (MPa)	Friction Ratio (%)	Pore Pressure (kPa)	Scale	SBT	SBTn	SBT Description (filtered)	Dr (%)		Su (kPa)	N <sub>60</sub>
	10	− 0 ∞ 4 ω ω ⊂ ∞ ∞	- 0 -200 -400 -600		0400	0400		20 - 60	- 50	-150 -200 -250 -300 -350	- 10 - 30 - 40
		K	-				Sand mixtures: silty sand to sandy silt	· · ·			
		$\left \right\rangle$					Silt mixtures: clayey silt & silty clay				
	5	$\left \right\rangle$					Silt mixtures, dayey silt & silty day				
		/	-		-		Sand mixtures: silty sand to sandy silt				
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		}	-		-		Sands: clean sands to silty sands				
	2	<b>\</b>	-								
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	ζ	<pre>}</pre>			-						
EOH:	1.72m	γ	-								
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								aviour Type		Robertson	
								idefined	5	sand to san Sands: clea	dy silt
								ained	6	to silty sand	s
								ay - organic soi		Dense sand gravelly san	d
							S cla		0	Stiff sand to sand	clayey
								t mixtures: clay & silty clay	ey 9	Stiff fine-gra	ined
	es & Limitation								Remark	S	
geot	echnical soil and de	esign parameters u	sing methods publis	shed in P.	K. Roberts	son and I	of Soil Behaviour Type (SBT) a K.L. Cabal (2010), Guide to Con	e Penetration			
Test car	ing for Geotechnica efully reviewed by f	al Engineering, 4th l the user. Geroc So	Edition. The interpre lutions Ltd do not w	etations a arranty th	re presente ne correctne	ed only as	s a guide for geotechnical use, a e applicability of any of the geot	and should be technical soil	Hole I	Depth (m):	1.72
and							in any design or review. The us e data shown in this report.	ser should be		Sheet 8	of 8

## SOUNDING DETAILS: CPT01

### Sounding: 1

Machine: Geoprobe 54LT Operator: TS Cone Reference: 4447 Cone Area Ratio: 0.85 Cone Type: -Date: 15/08/2018 Predrill: 0.00

## SOUNDING DETAILS: CPT02

### Sounding: 1

Machine: Geoprobe 54LT Operator: TS Cone Reference: 4447 Cone Area Ratio: 0.85 Cone Type: -Date: 15/08/2018 Predrill: 0.00

### Water Level: -Tip Resistance Initial: 7.6345 Tip Resistance Final: -0.0278 Local Friction Initial: 123.5 Local Friction Final: 0.2 Pore Pressure Initial: 238 Pore Pressure Final: -0.3

Water Level: -Tip Resistance Initial: 7.612 Tip Resistance Final: -0.0077 Local Friction Initial: 123.8 Local Friction Final: -0.2 Pore Pressure Initial: 238.5 Pore Pressure Final: -1

## SOUNDING DETAILS: CPT03

### Sounding: 2

Machine: Geoprobe 54LT Operator: TS Cone Reference: 4447 Cone Area Ratio: 0.85 Cone Type: -Date: 15/08/2018 Predrill: 0.00

#### SOUNDING DETAILS: CPT04

# Sounding: 3

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

Water Level: -Tip Resistance Initial: 7.6232 Tip Resistance Final: -0.0023 Local Friction Initial: 123.4 Local Friction Final: 0.3 Pore Pressure Initial: 235.3 Pore Pressure Final: 2.1

## SOUNDING DETAILS: CPT05

## Sounding: 4

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

## SOUNDING DETAILS: CPT06

### Sounding: 5

Machine: Geoprobe 54LT Operator: TS Cone Reference: 4447 Cone Area Ratio: 0.85 Cone Type: -Date: 15/08/2018 Predrill: 0.00

## SOUNDING DETAILS: CPT07

# Sounding: 1

Machine: Geoprobe 54LT Operator: TS Cone Reference: 4447 Cone Area Ratio: 0.85 Cone Type: -Date: 16/08/2018 Predrill: 0.00 Water Level: -Tip Resistance Initial: 7.6256 Tip Resistance Final: -0.0036 Local Friction Initial: 123.8 Local Friction Final: 0.1 Pore Pressure Initial: 260.6 Pore Pressure Final: -2

Water Level: -Tip Resistance Initial: 7.6481 Tip Resistance Final: -0.0515 Local Friction Initial: 123.4 Local Friction Final: 0.2 Pore Pressure Initial: 238.4 Pore Pressure Final: -0.9

## SOUNDING DETAILS: CPT08

# Sounding: 1

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

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/m3)	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

PEYSANJ Geotechnical Software (v 5.0.2016.1010) Printed On 27/08/2018 at 17:30:23.5555406 Licensed to : RDCL

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

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

.:. Notes:

Sv : Total overburden stressS'v : Effective overburden stressCn : SPT correction factorKs : K(sigma) due to the effect of overburden stressCRR : Cyclic Resistance RatioCSR : Cyclic Stress RatioLDI : Lateral Displacement IndexSt : Post-liquefaction settlement of the siteSr : Post-liquefaction residual strength

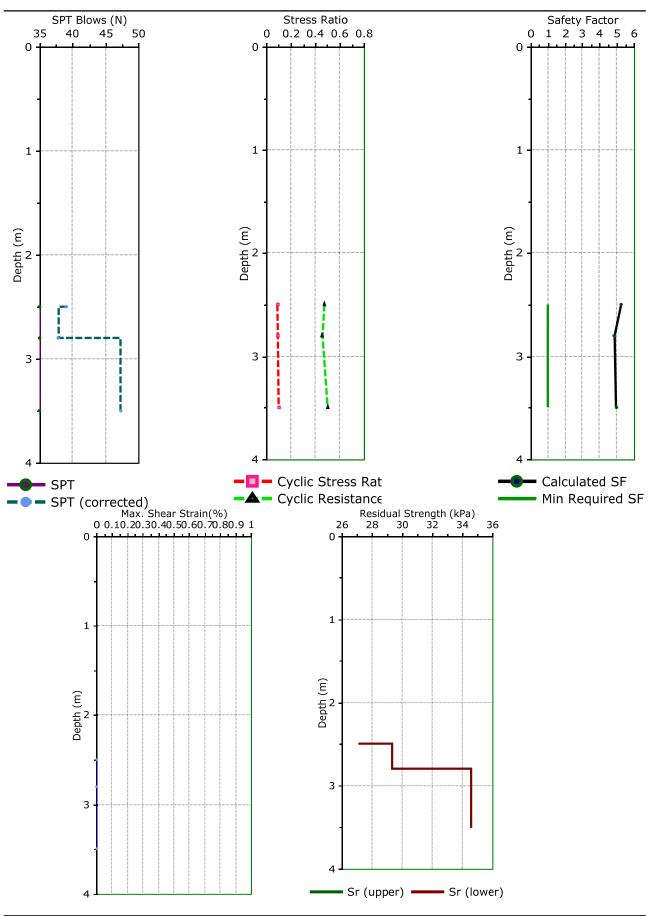
.:. Total estimated post-liquefaction movements: Lateral Displacement =0 m Site Settlement =0 m

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 (%)	(m) IDI	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

Project Title:Liquifaction AssessmentClient:Greenstone land Developments LtdAddress:Havelock NorthJob Code:184250602

Geotechnical Engineers Hawke's Bay www.rdcl.co.nz



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# **Liquefaction Assessment Report**

# PEYSANJ geotechnical engineering software

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

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/m3)	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

<code>PEYSANJ</code> Geotechnical Software (v 5.0.2016.1010) Printed On 27/08/2018 at 17:29:56.0104741 Licensed to : RDCL

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

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

.:. Notes:

Sv : Total overburden stressS'v : Effective overburden stressCn : SPT correction factorKs : K(sigma) due to the effect of overburden stressCRR : Cyclic Resistance RatioCSR : Cyclic Stress RatioLDI : Lateral Displacement IndexSt : Post-liquefaction settlement of the siteSr : Post-liquefaction residual strength

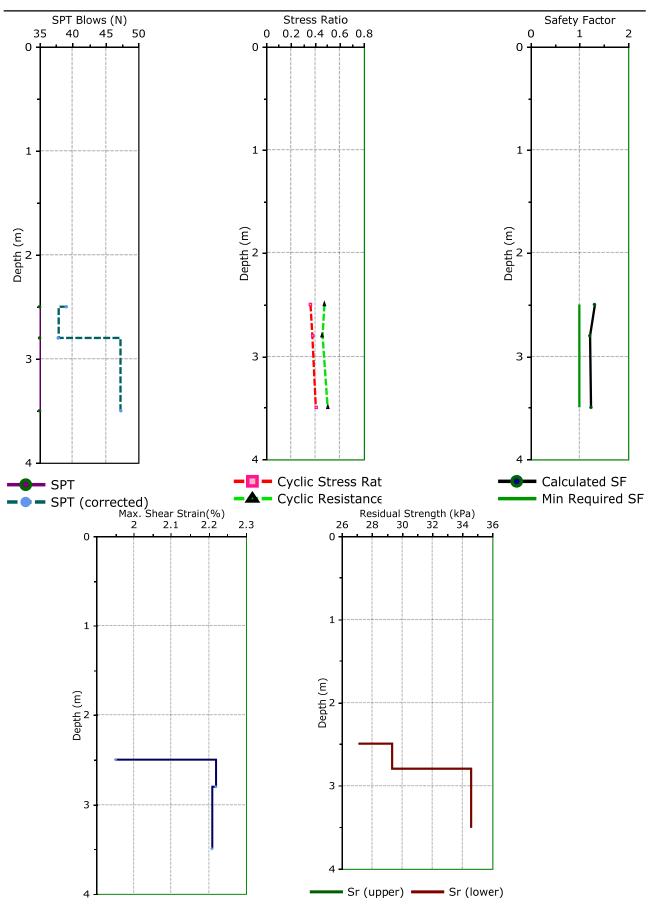
.:. Total estimated post-liquefaction movements: Lateral Displacement =0.03 m Site Settlement =0 m

Depth (m)	Sv (kPa)	S'v (kPa)	D50 (mm)	SPT	Cn.Cr.Cb.Cs	Сонт. SPT	ks	CRR	CSR	Factor of Safety	Max. Shear Strain (%)	(m) IDI	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

Project Title:Liquifaction AssessmentClient:Greenstone land Developments LtdAddress:Havelock NorthJob Code:184250602

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# APPENDIX D

CPT BASED LIQUEFACTION ASSESSMENT

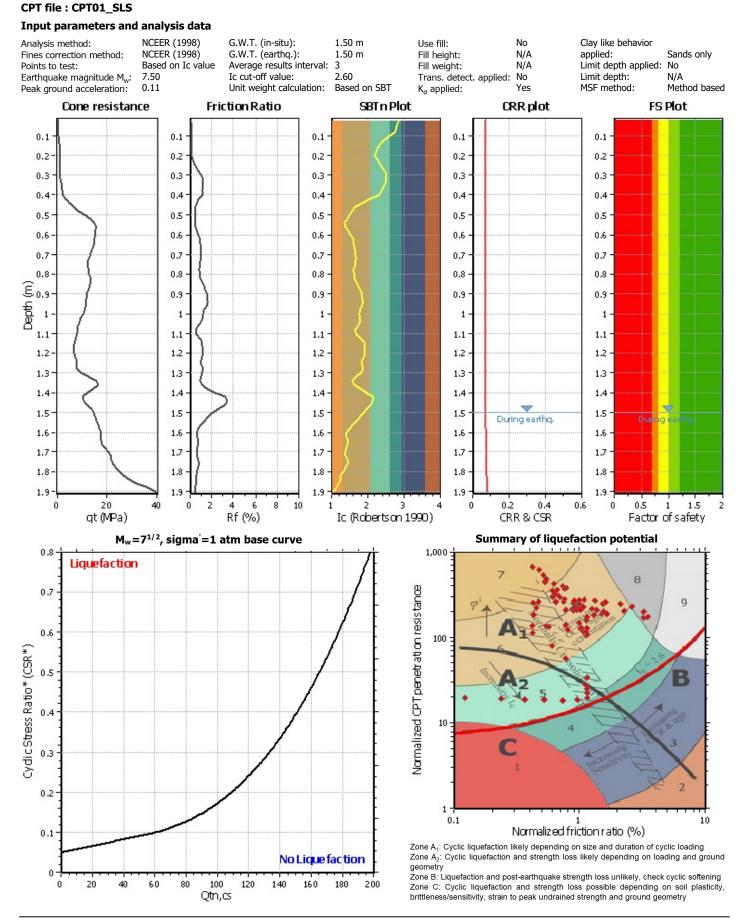


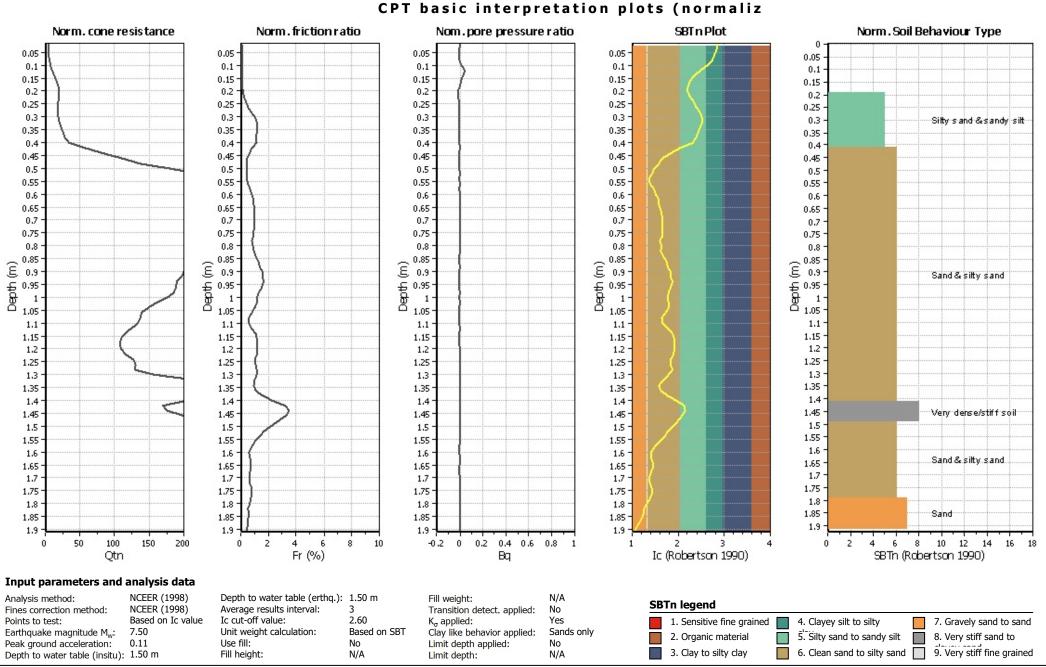


LIQUEFACTION ANALYSIS REPORT

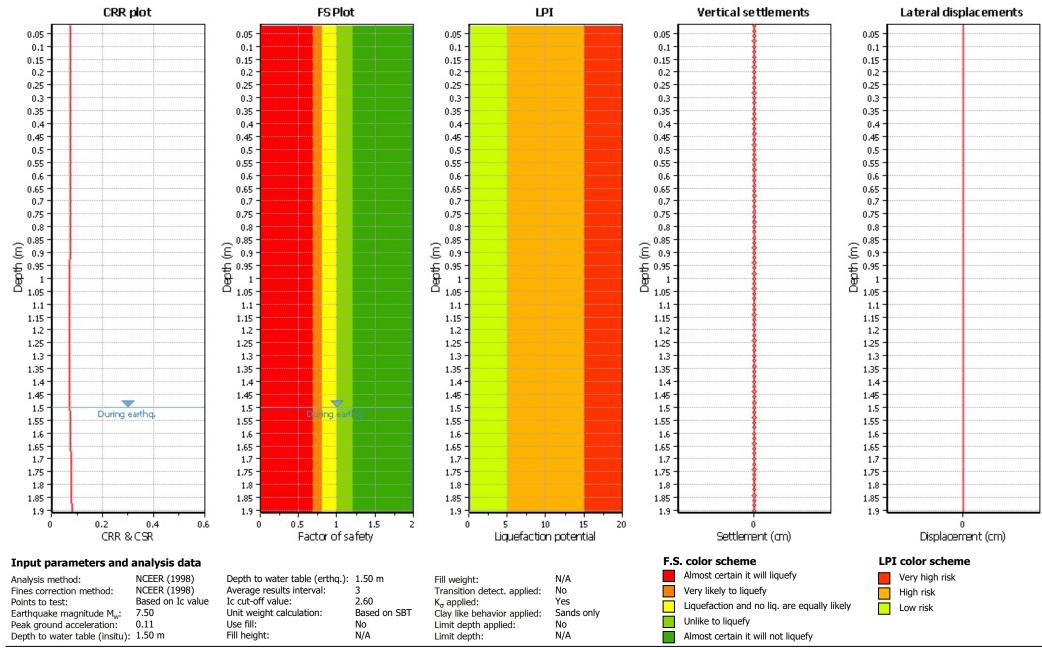
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### Location : Arataki Road Subdivision





# Liquefaction analysis overall plot



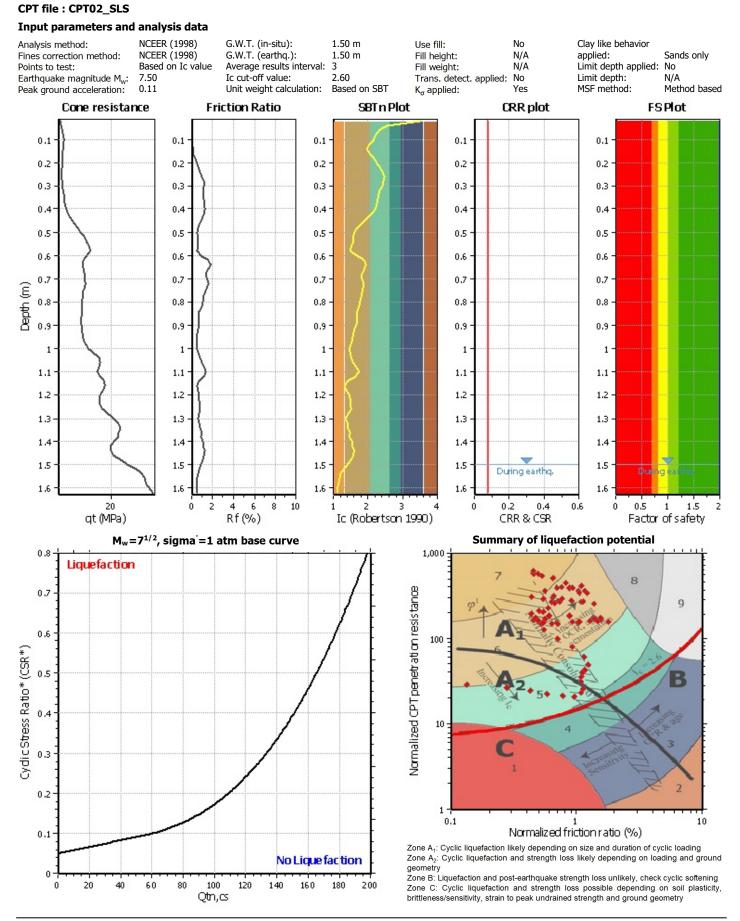


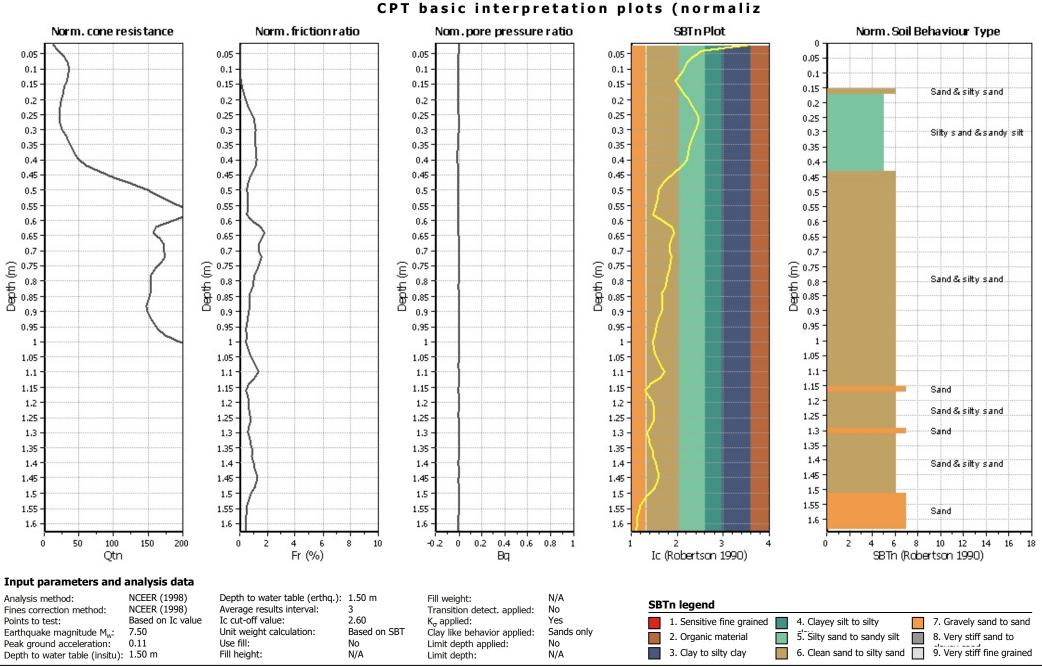
RDCL Geotechnical Specialists 8/308 Queen St, Hastings http://www.rdcl.co.nz

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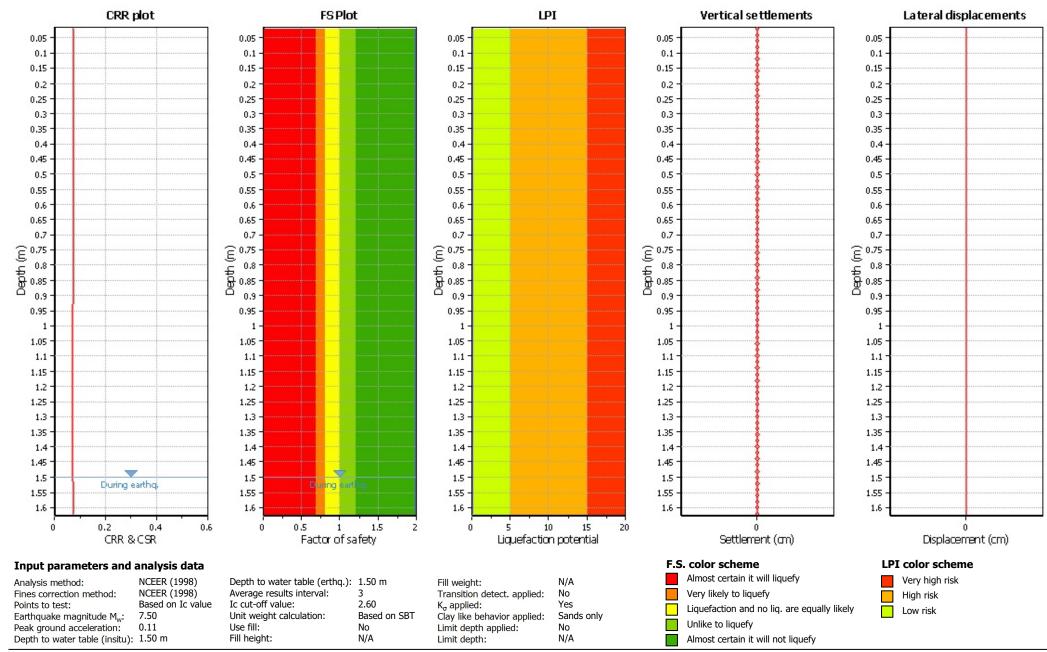
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### Location : Arataki Road Subdivision





# Liquefaction analysis overall plot



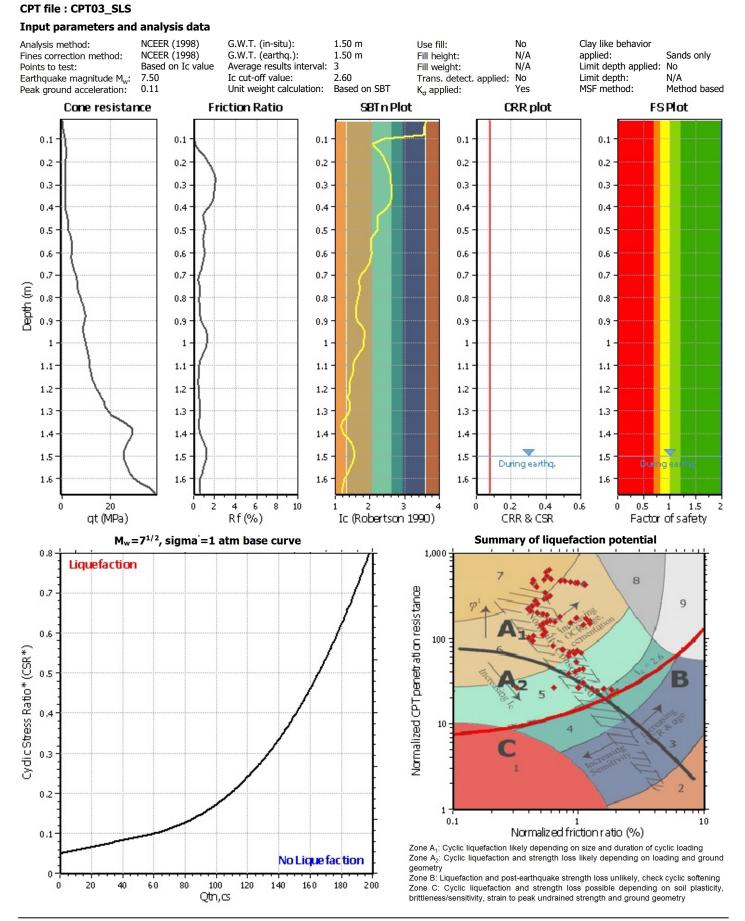


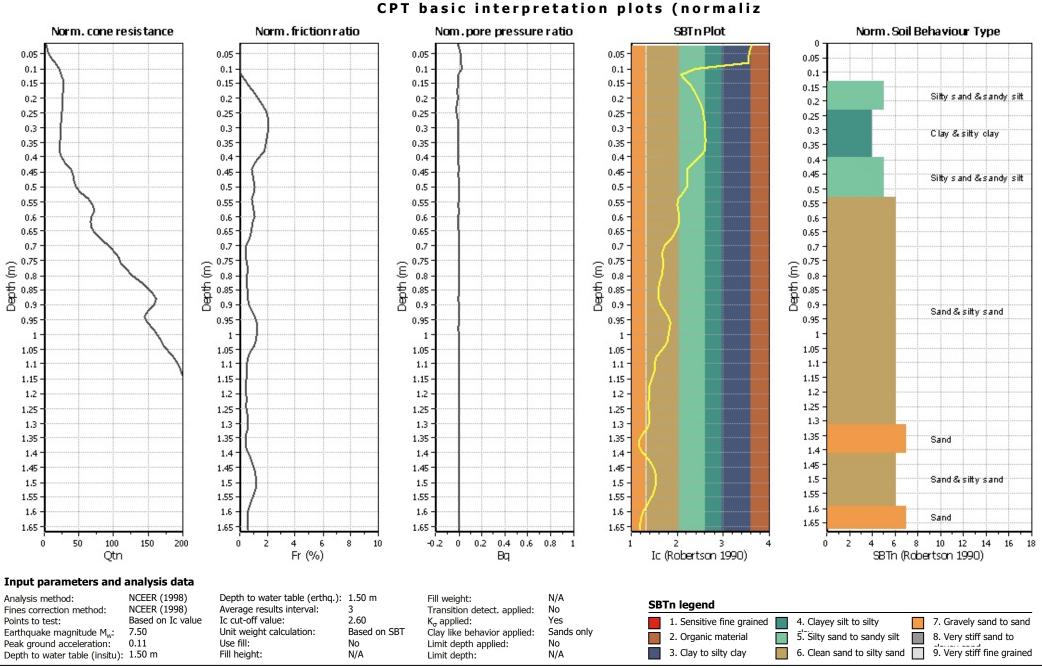
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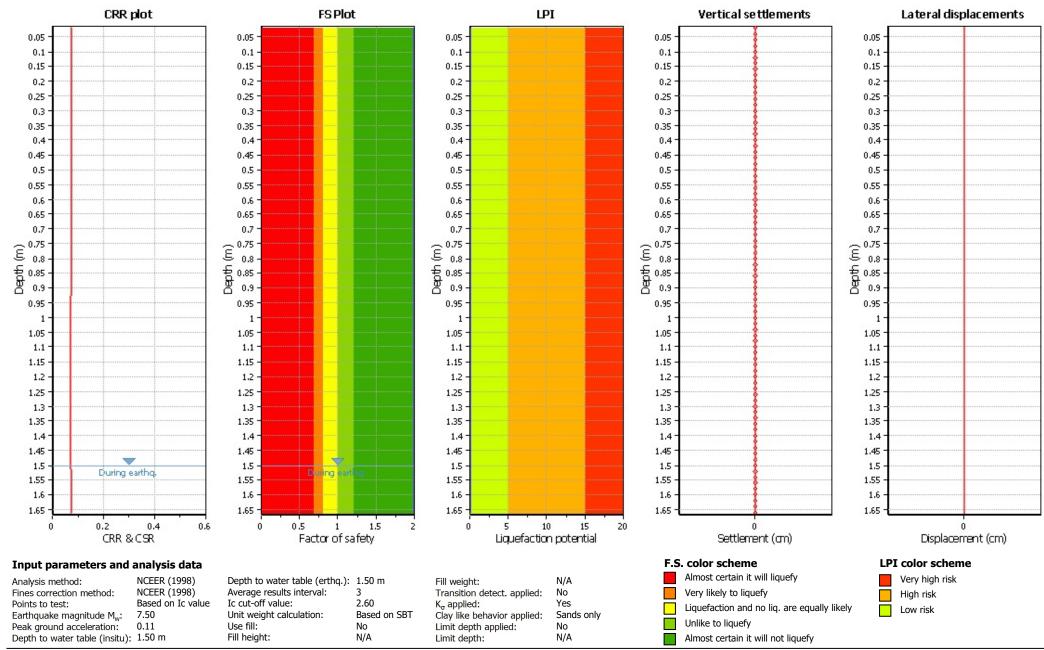
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# Liquefaction analysis overall plot



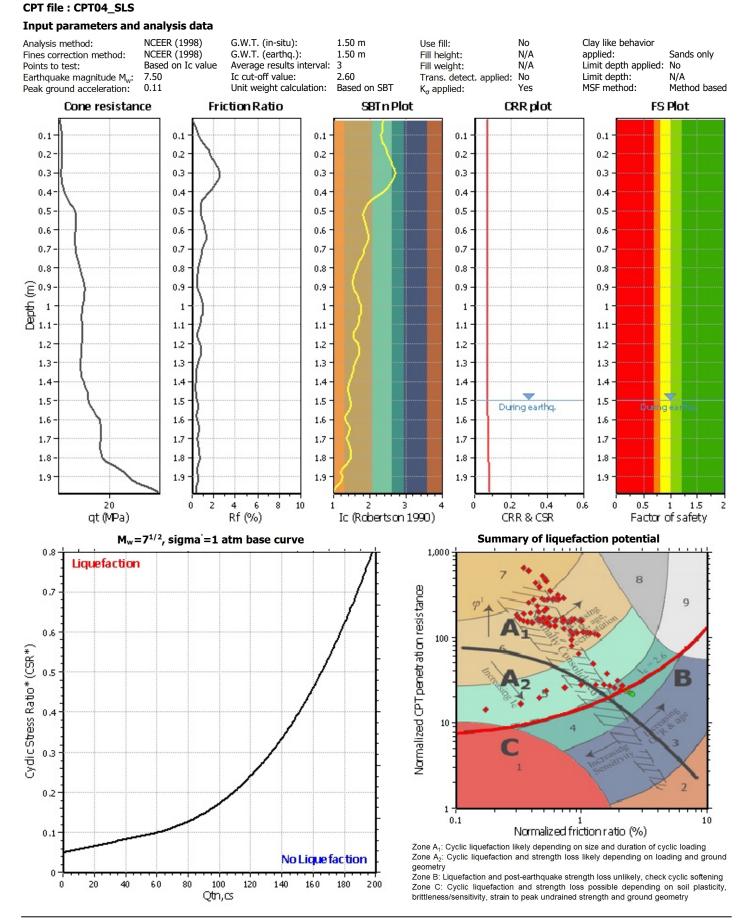


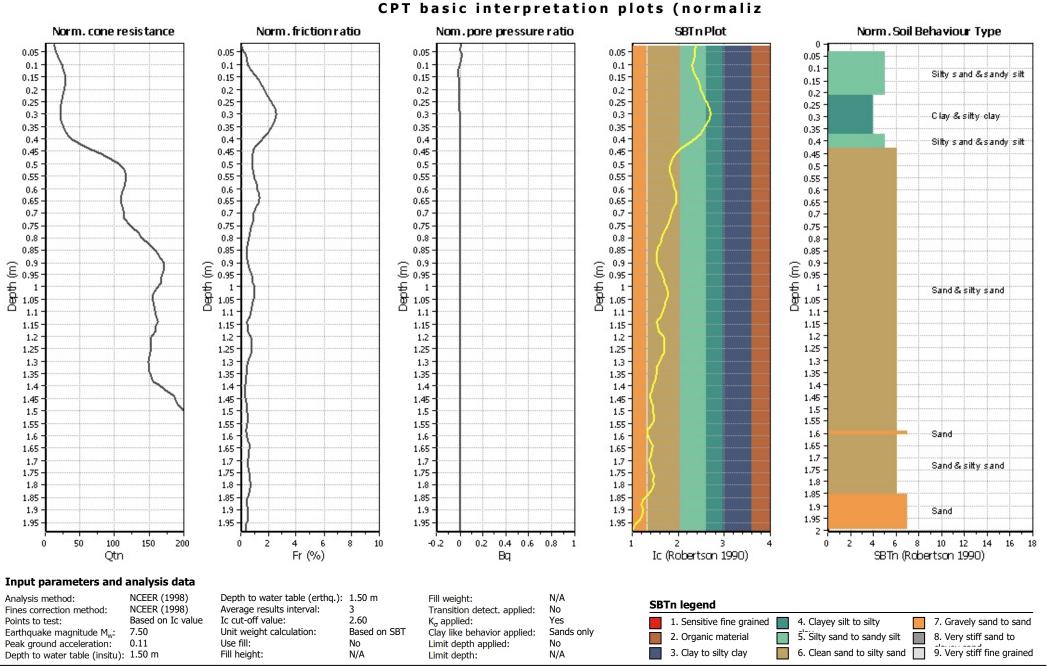
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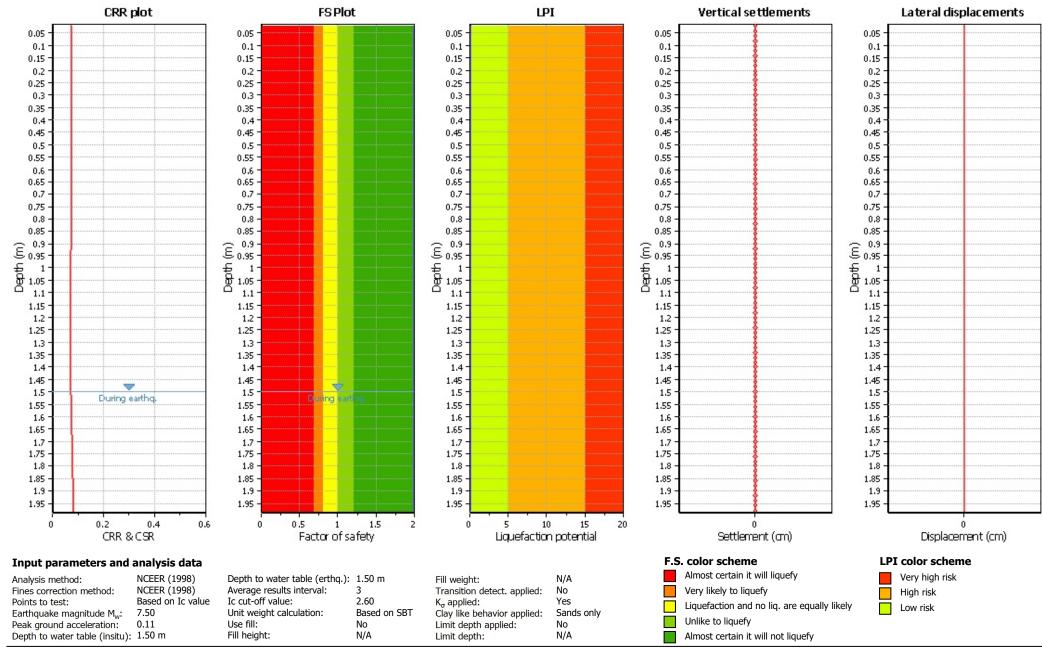
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# Liquefaction analysis overall plot



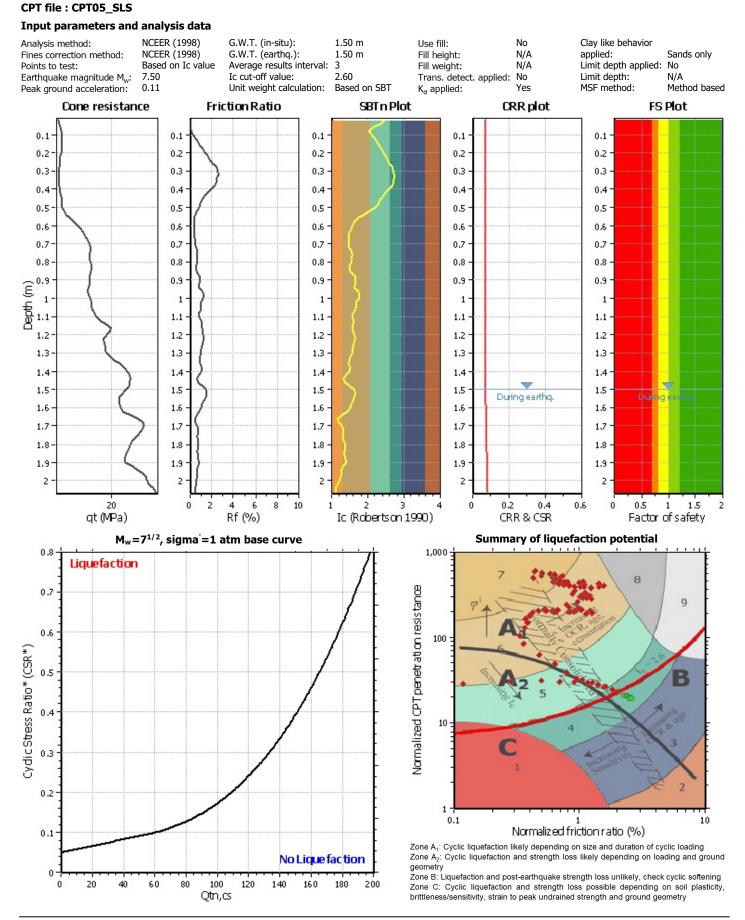


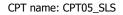
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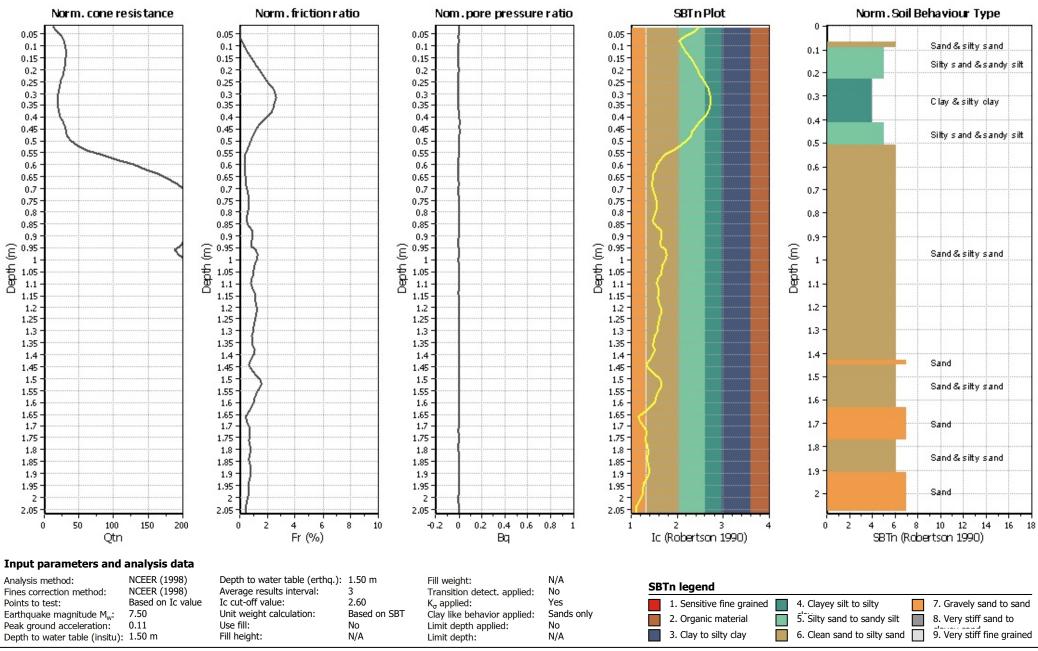
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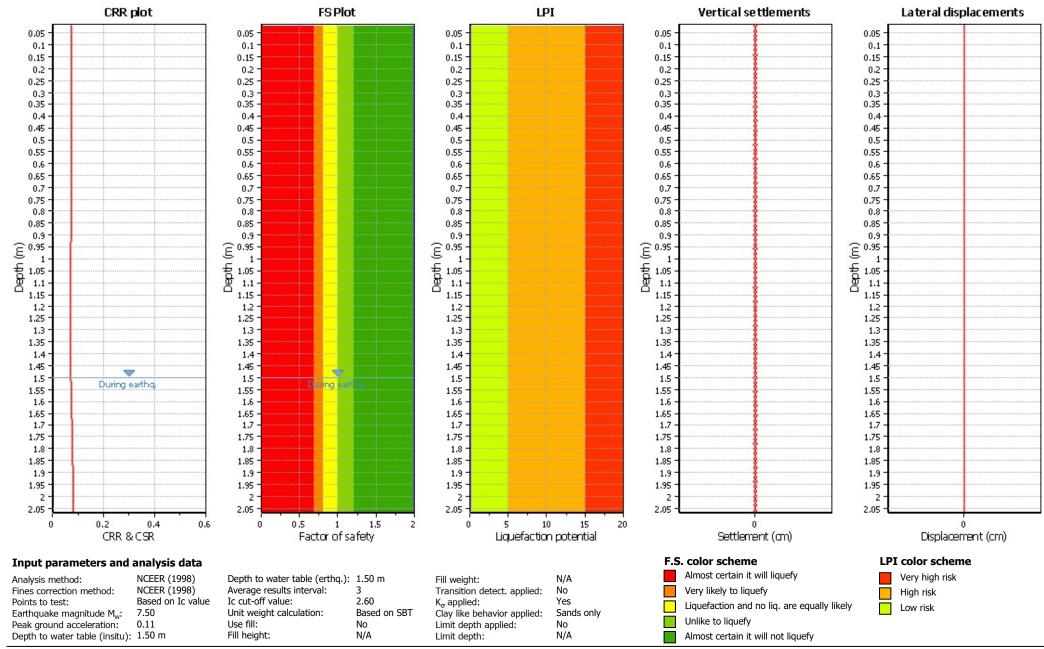




# CPT basic interpretation plots (normaliz



# Liquefaction analysis overall plot



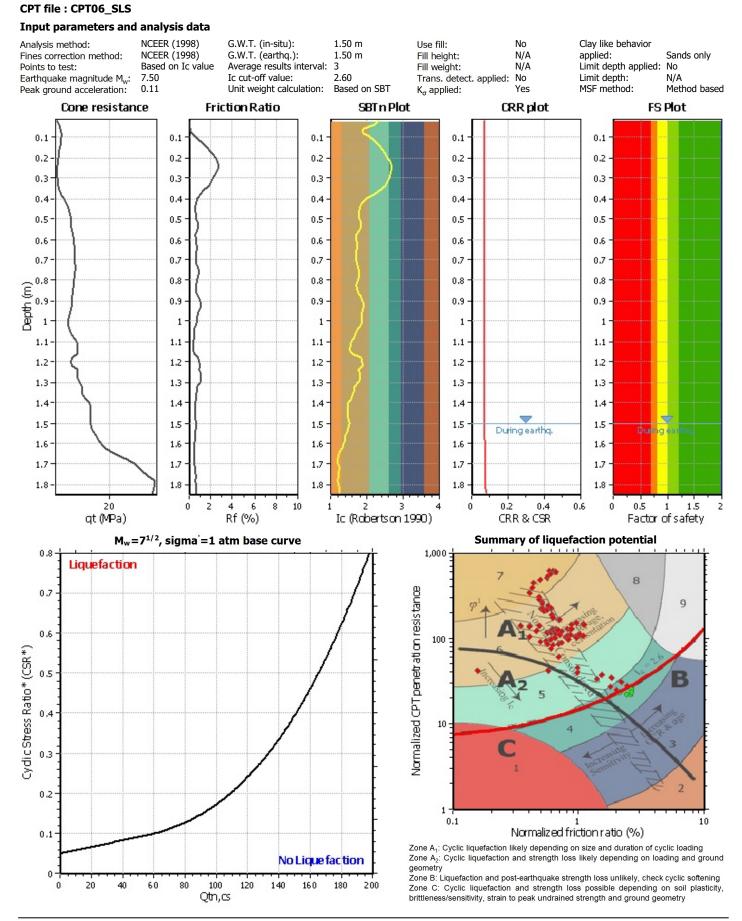


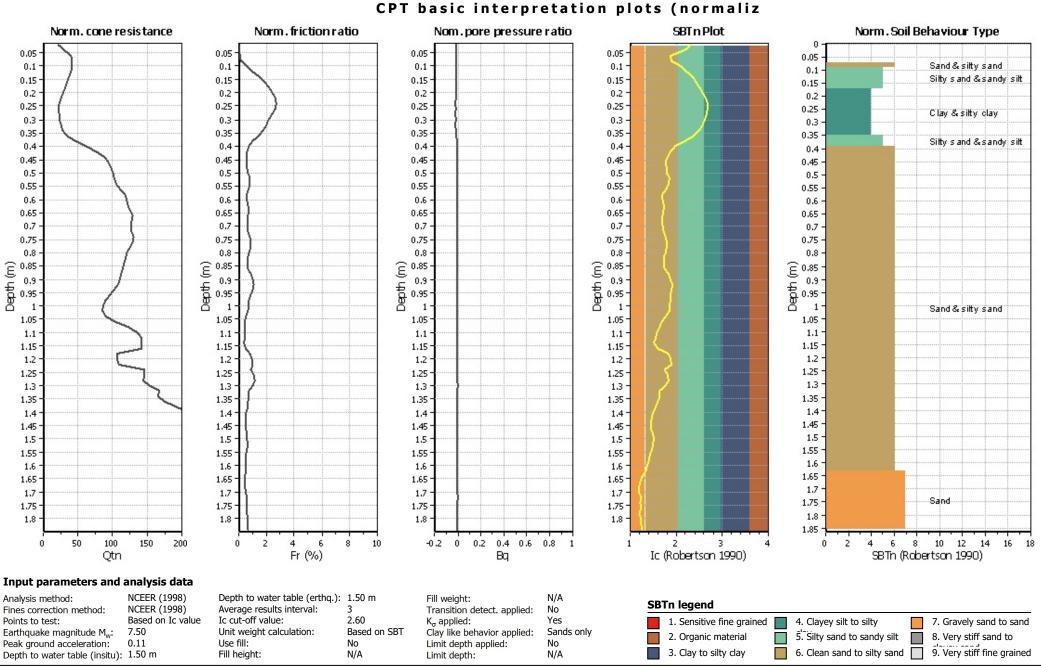
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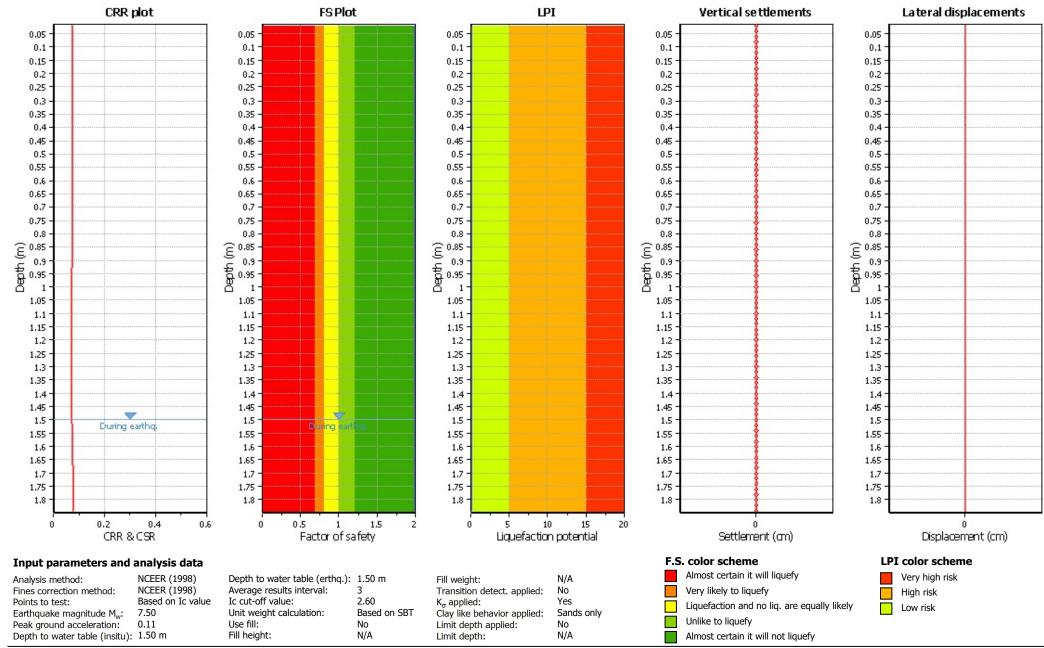
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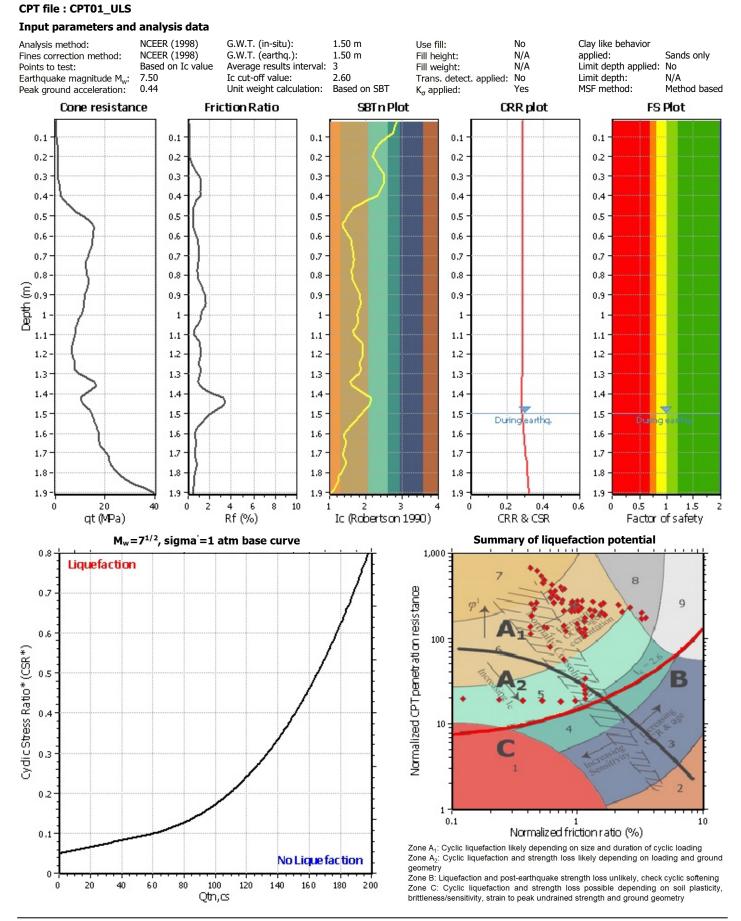
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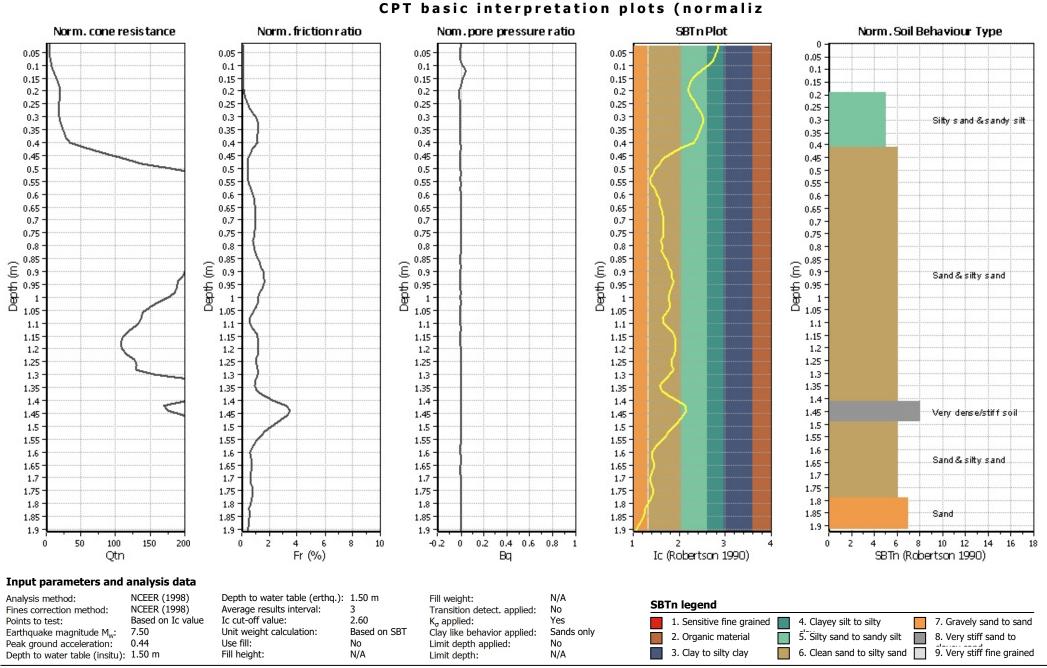


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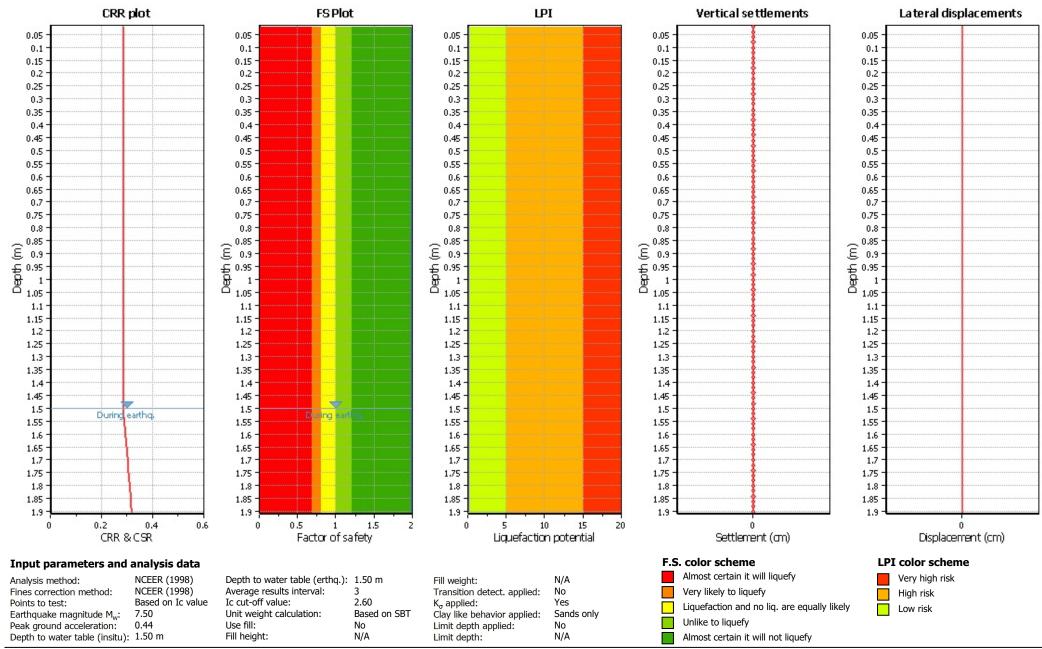
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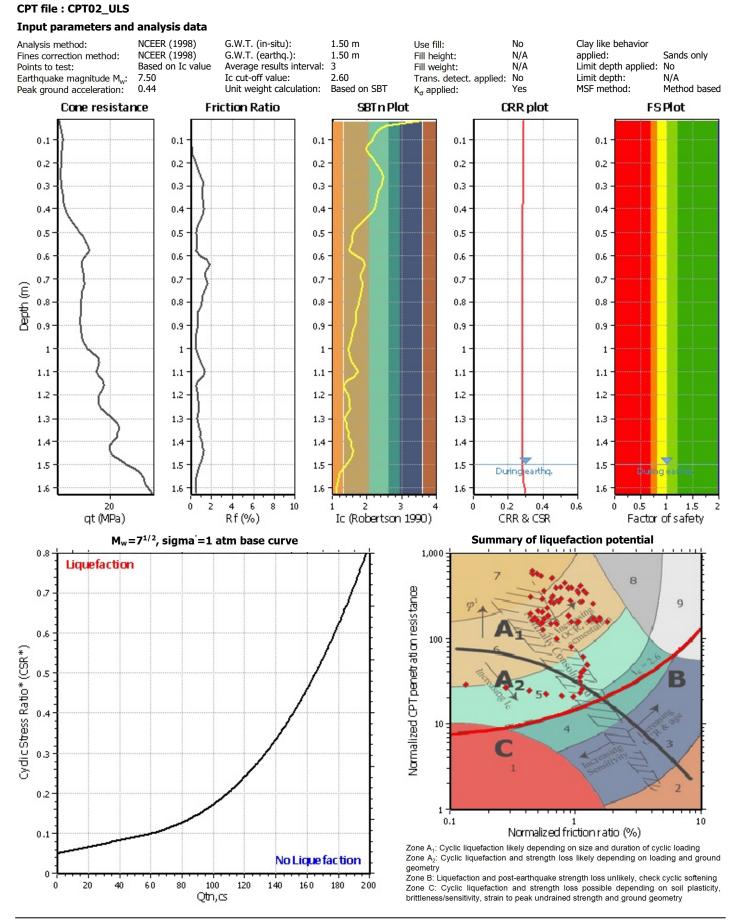
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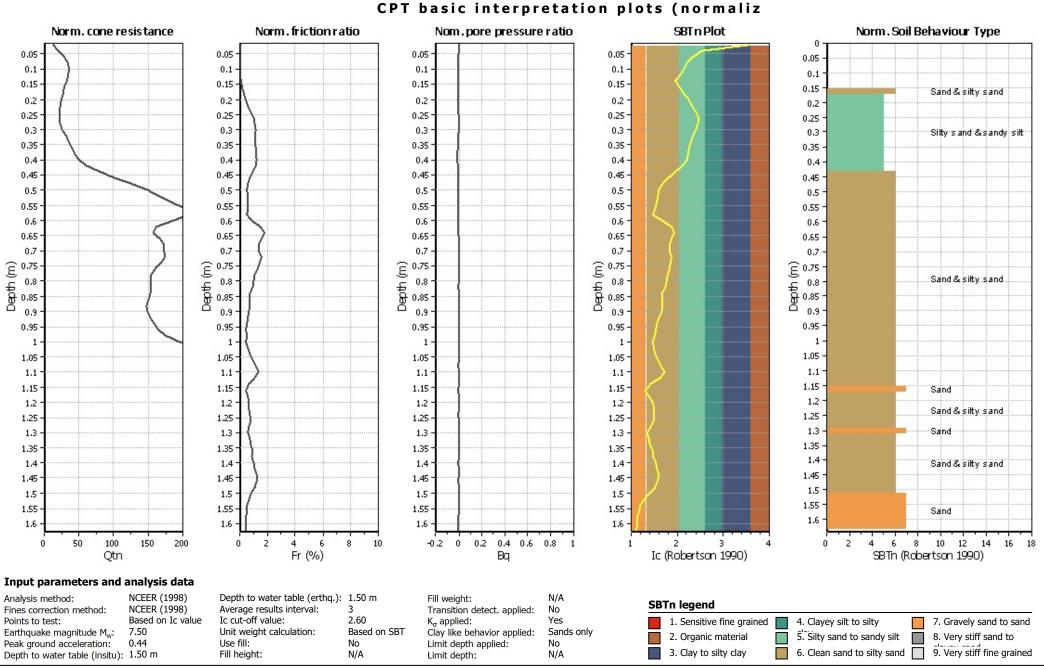
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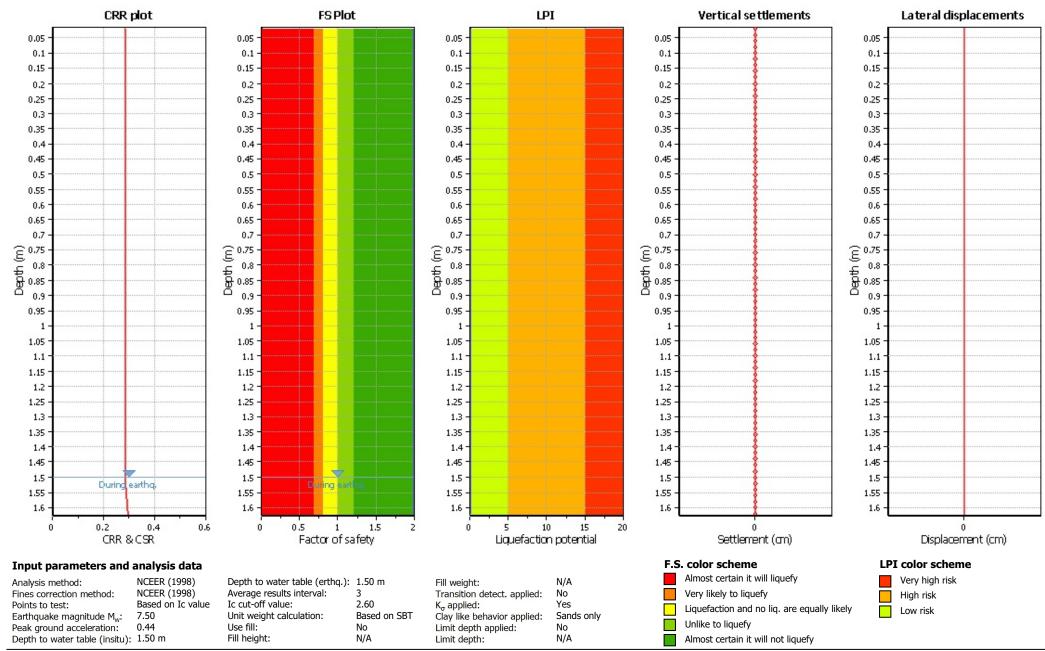
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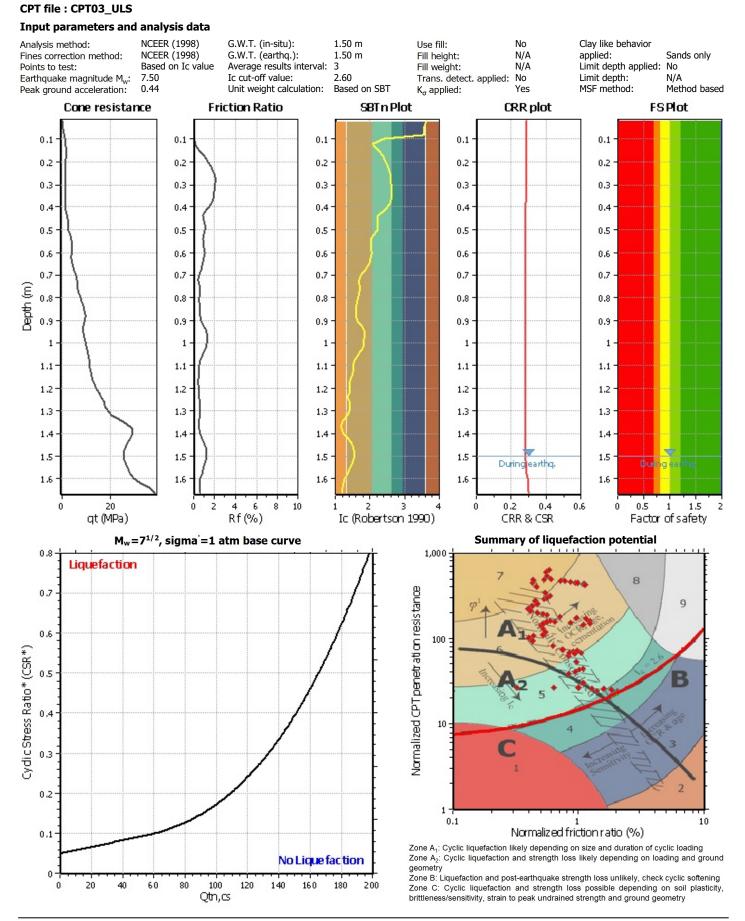
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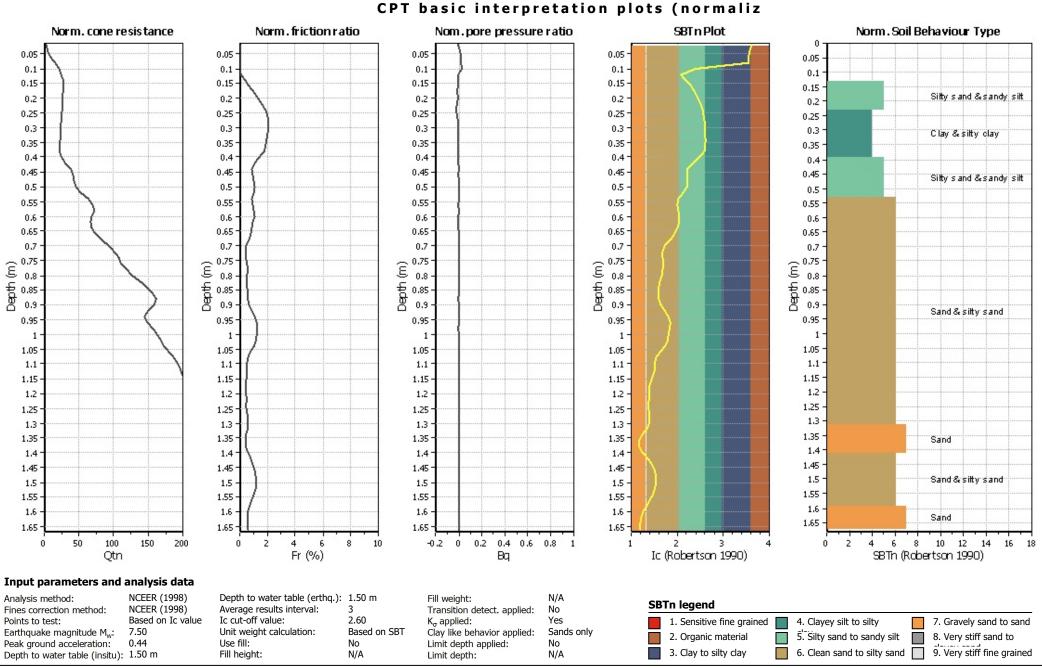
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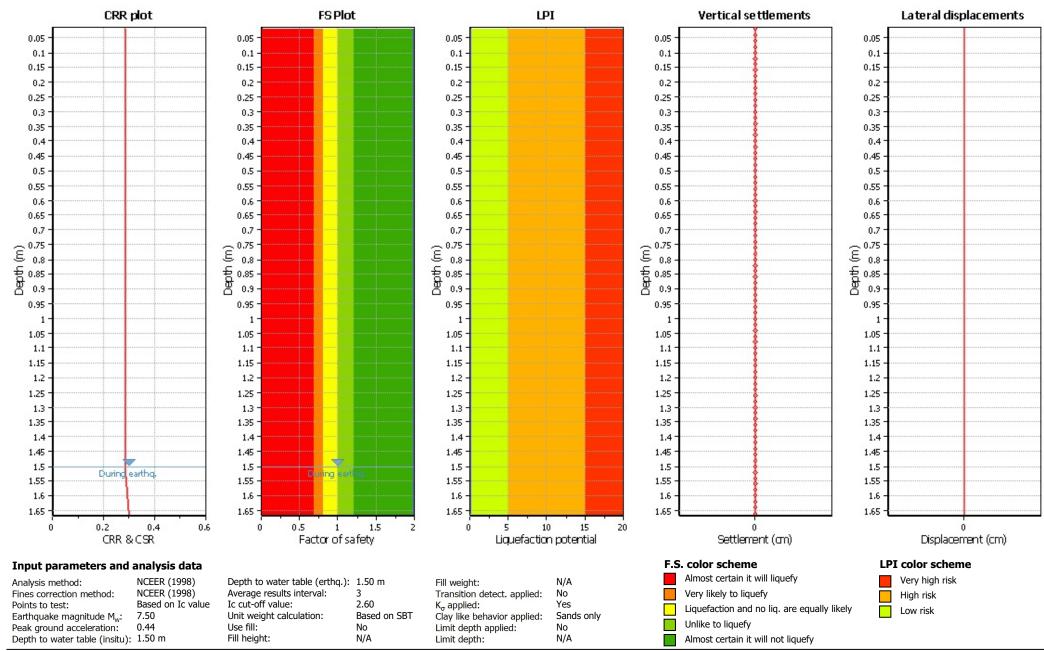
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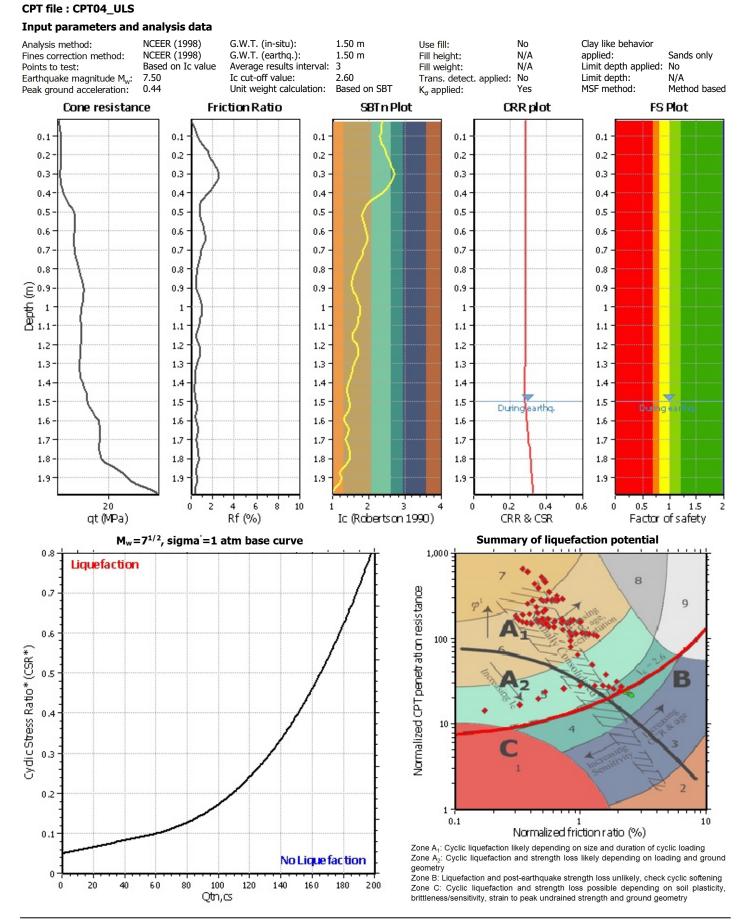
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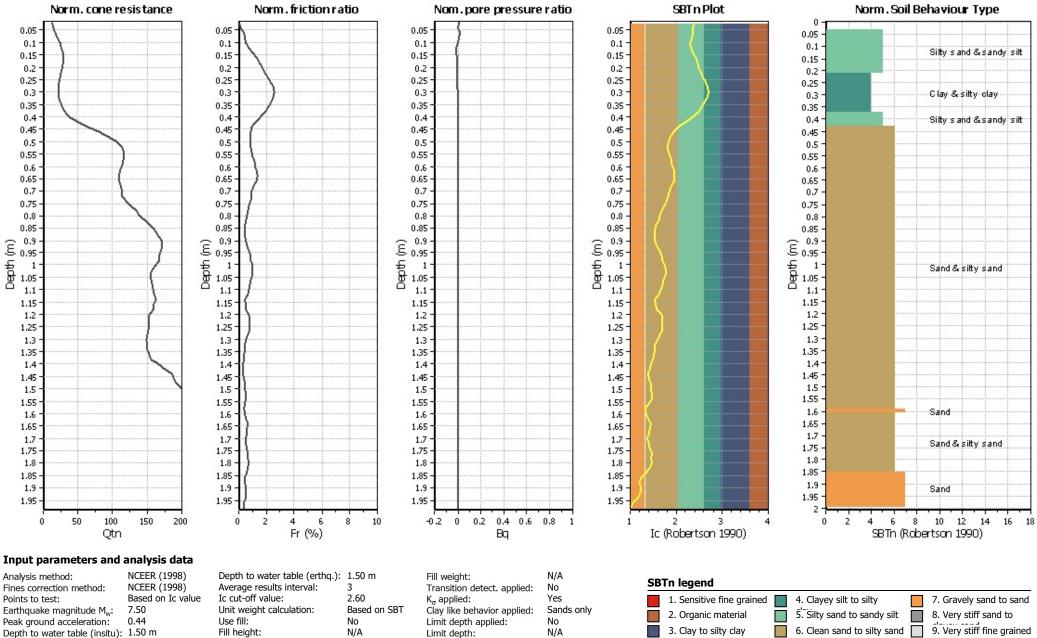
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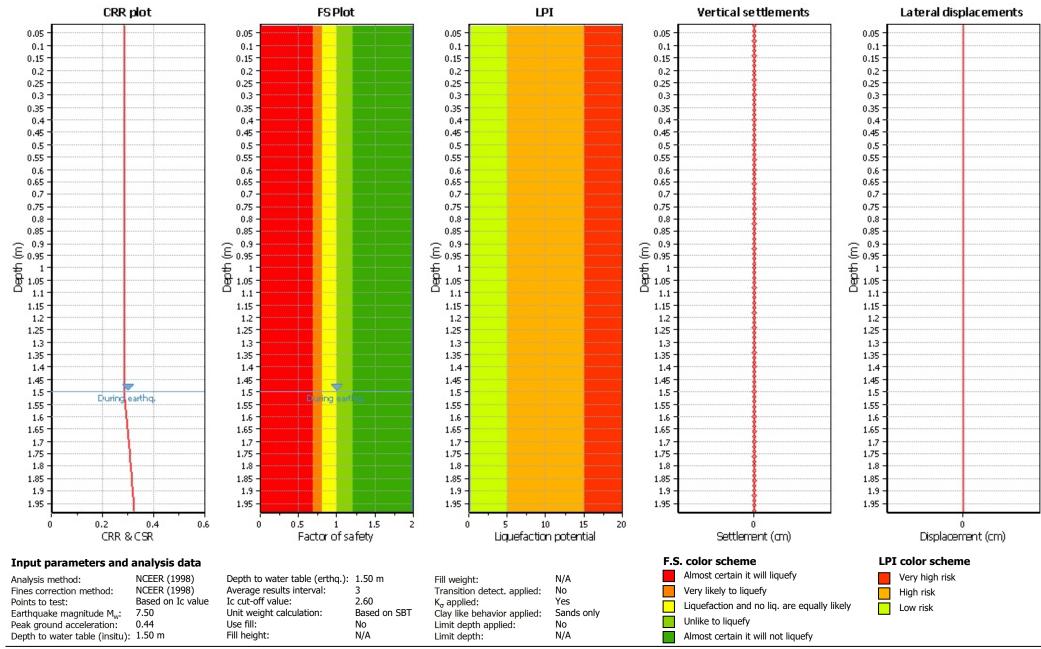
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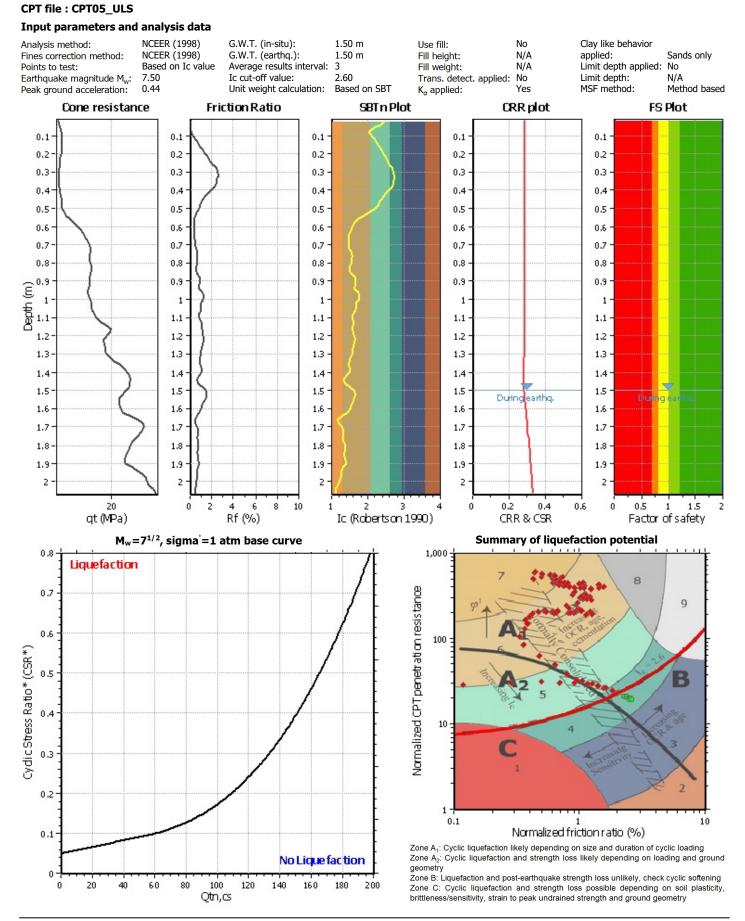
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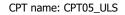
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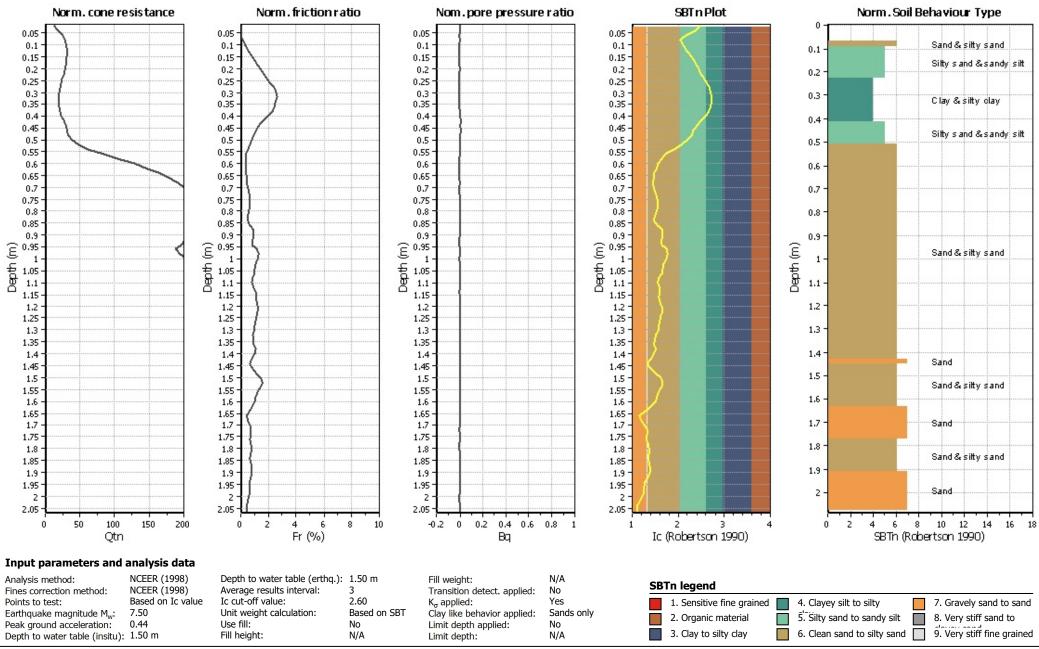
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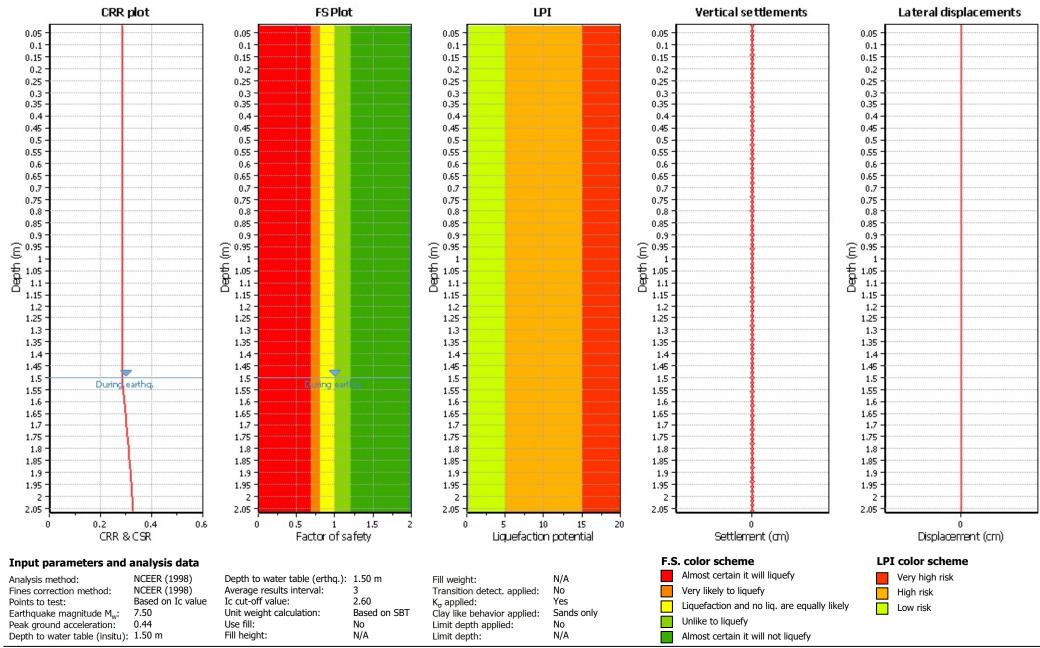
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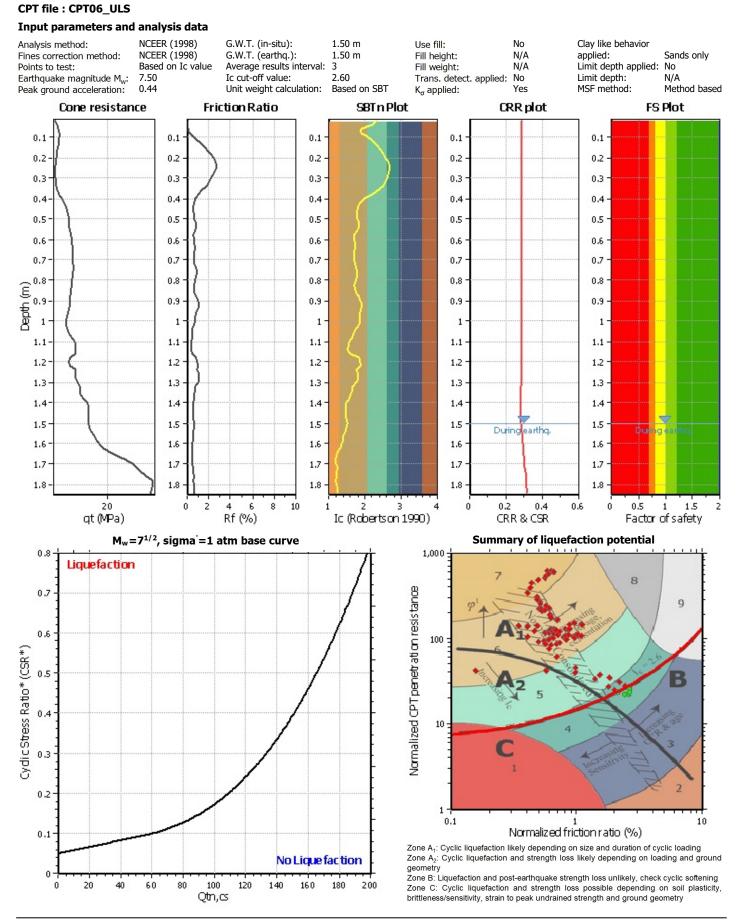
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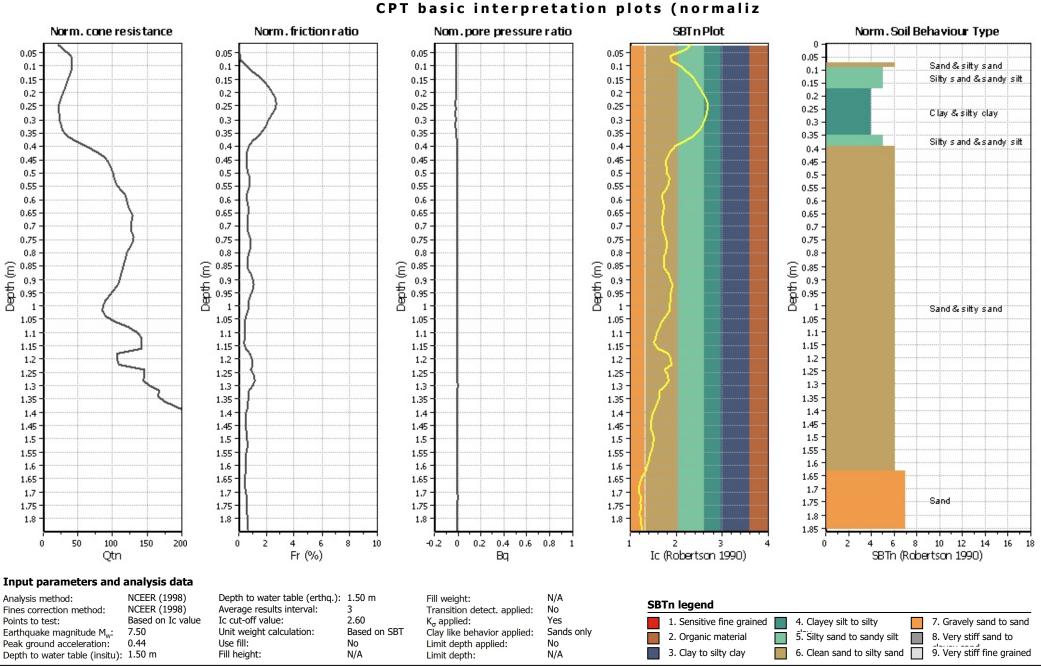
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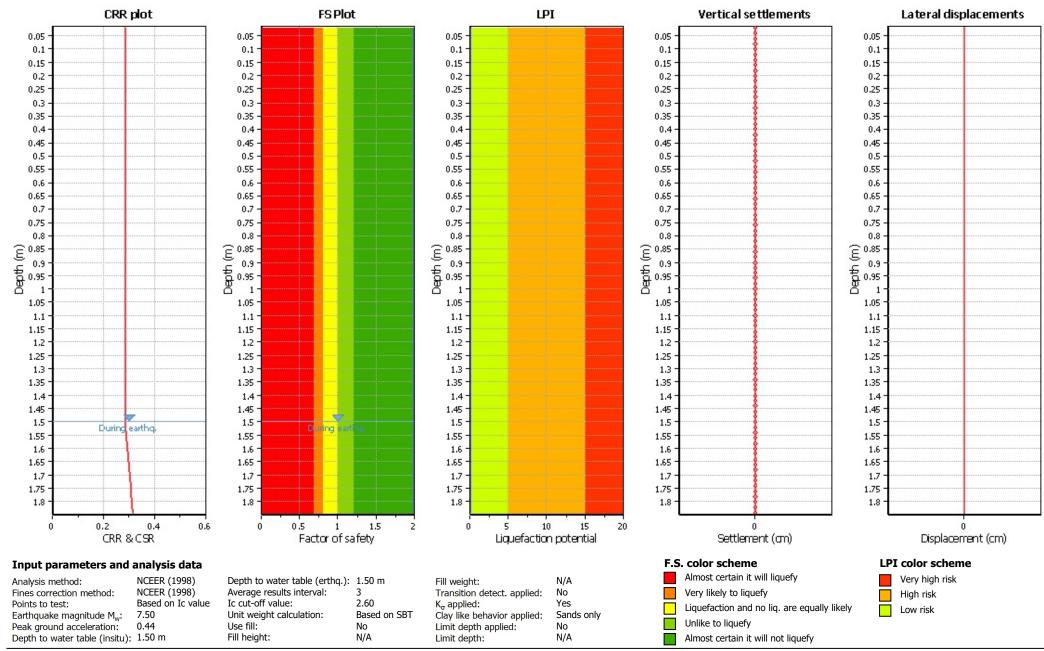
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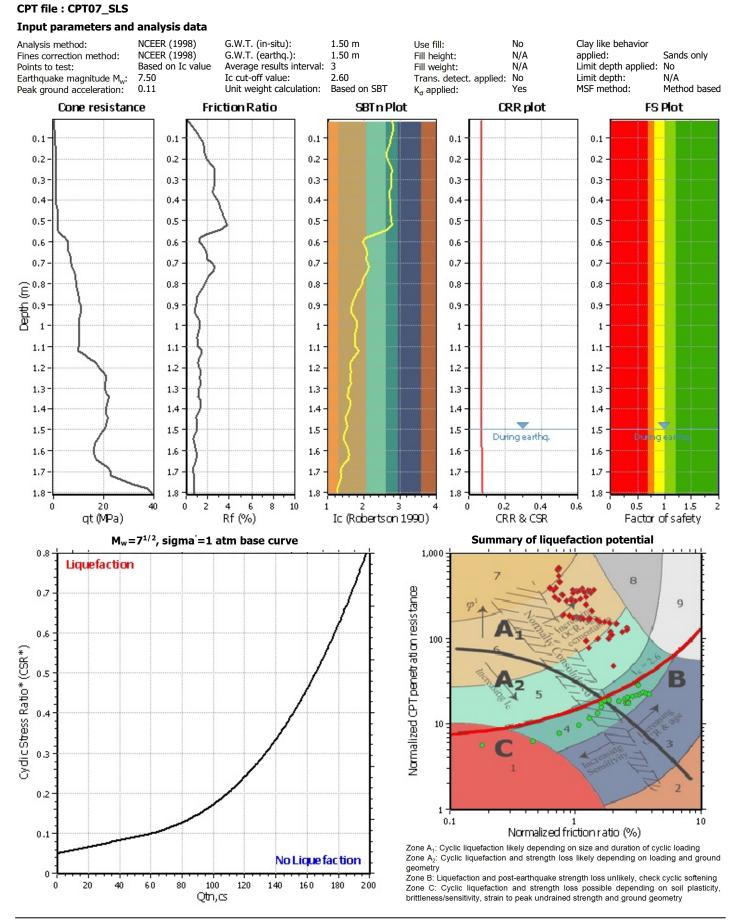
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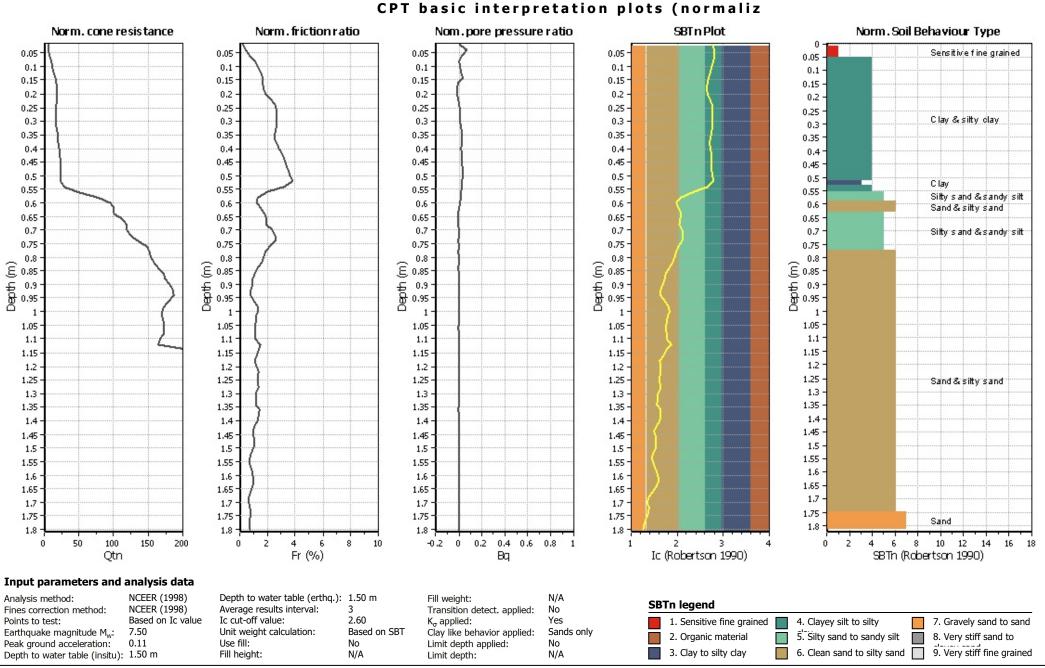
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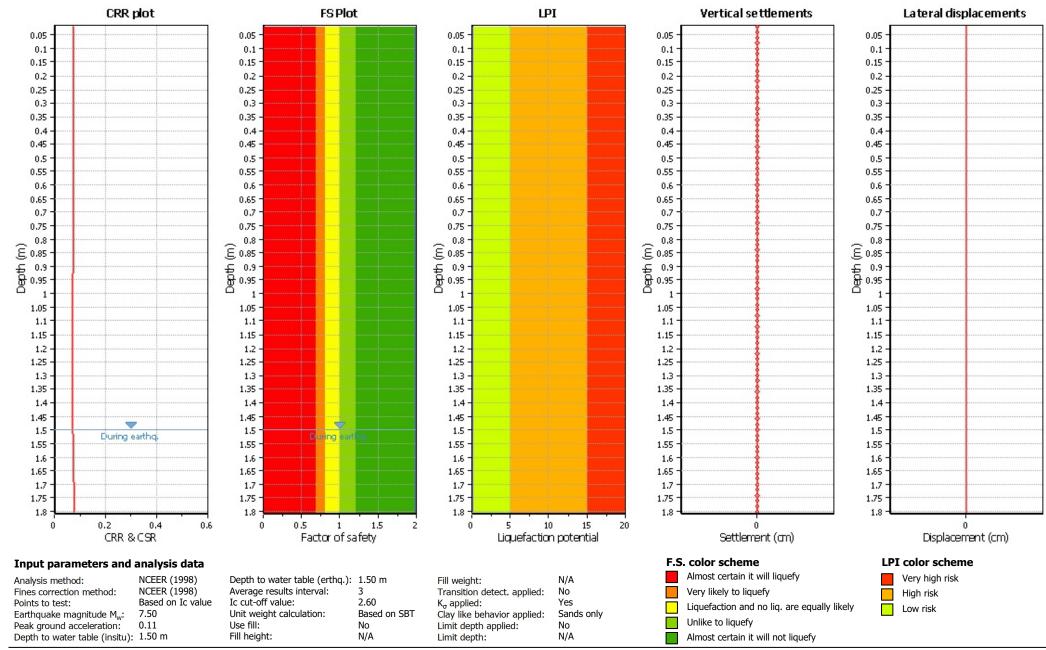
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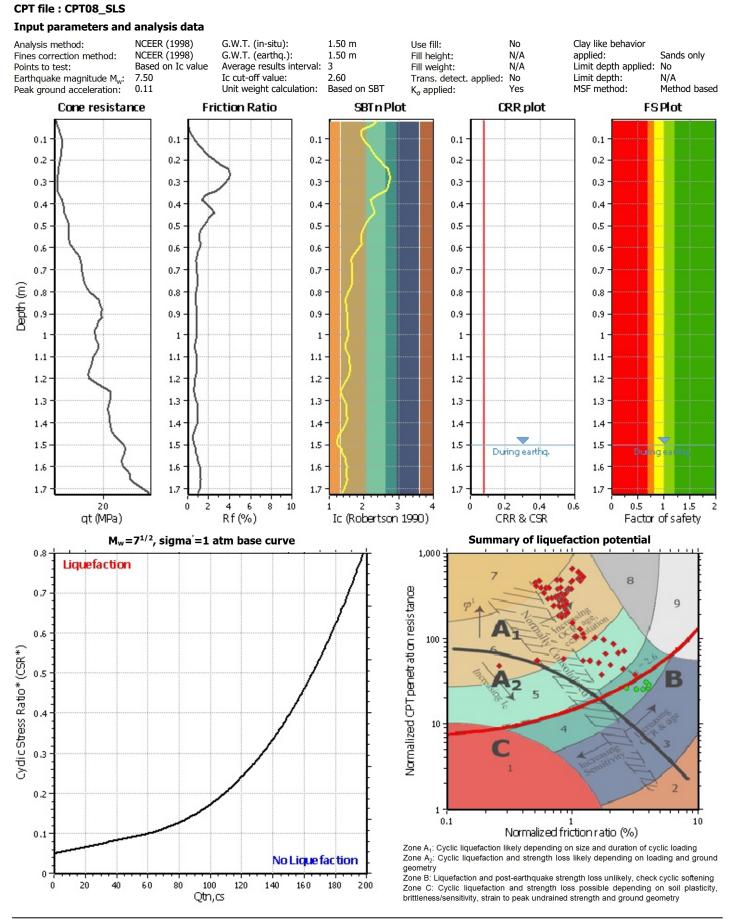
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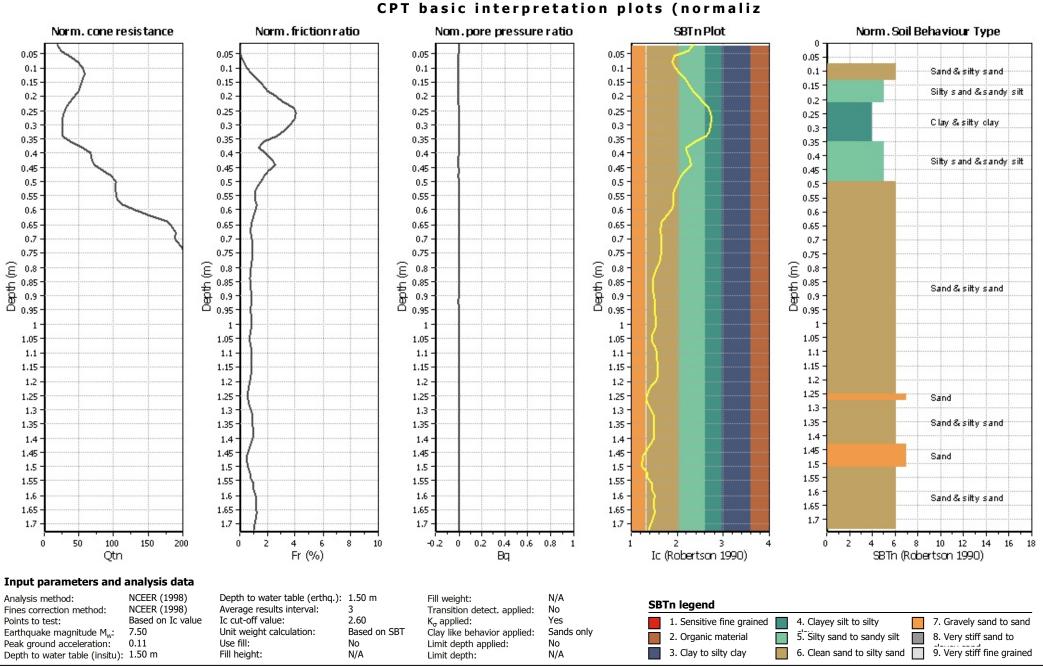


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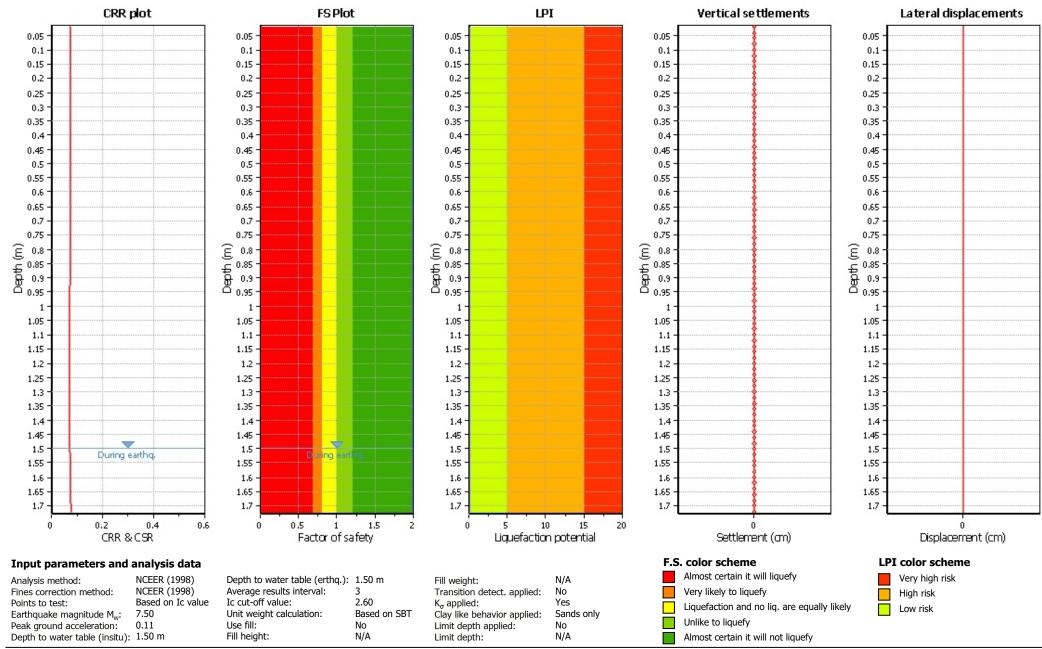
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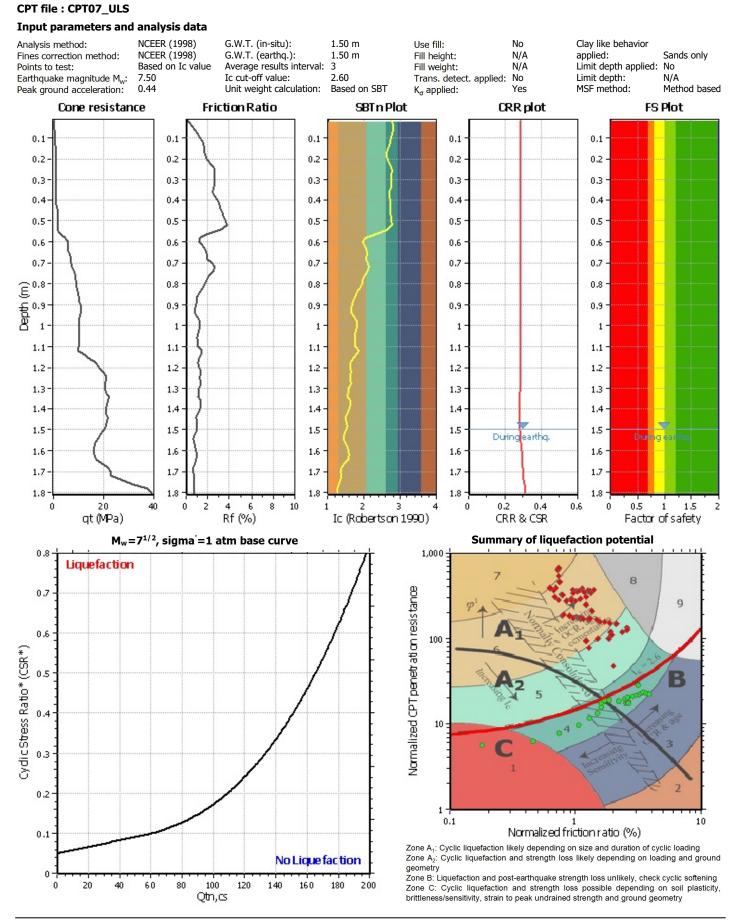
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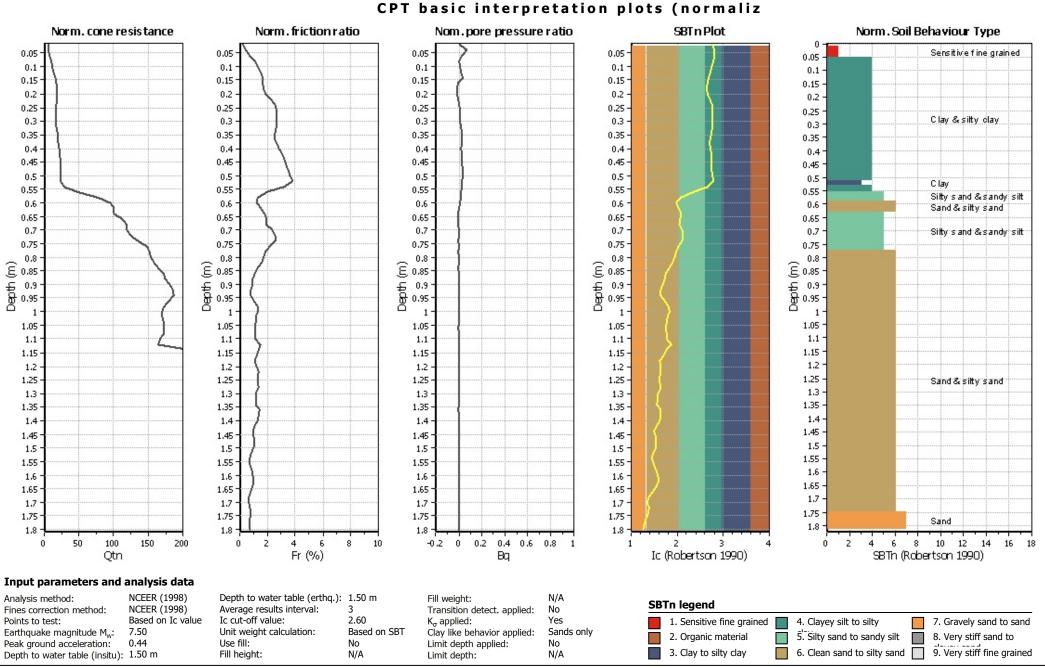
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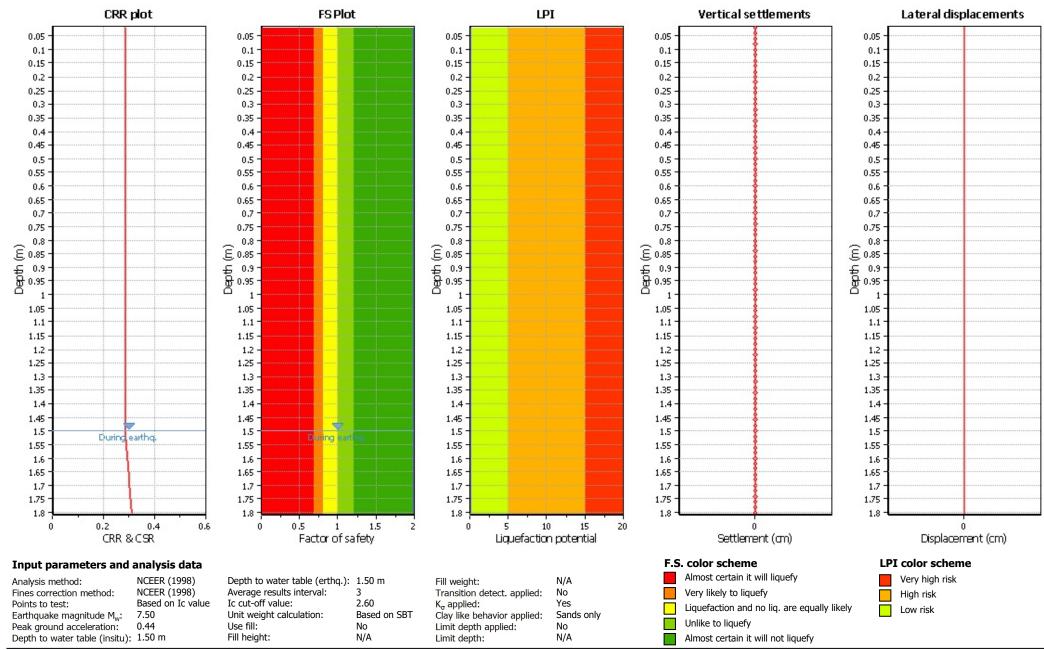
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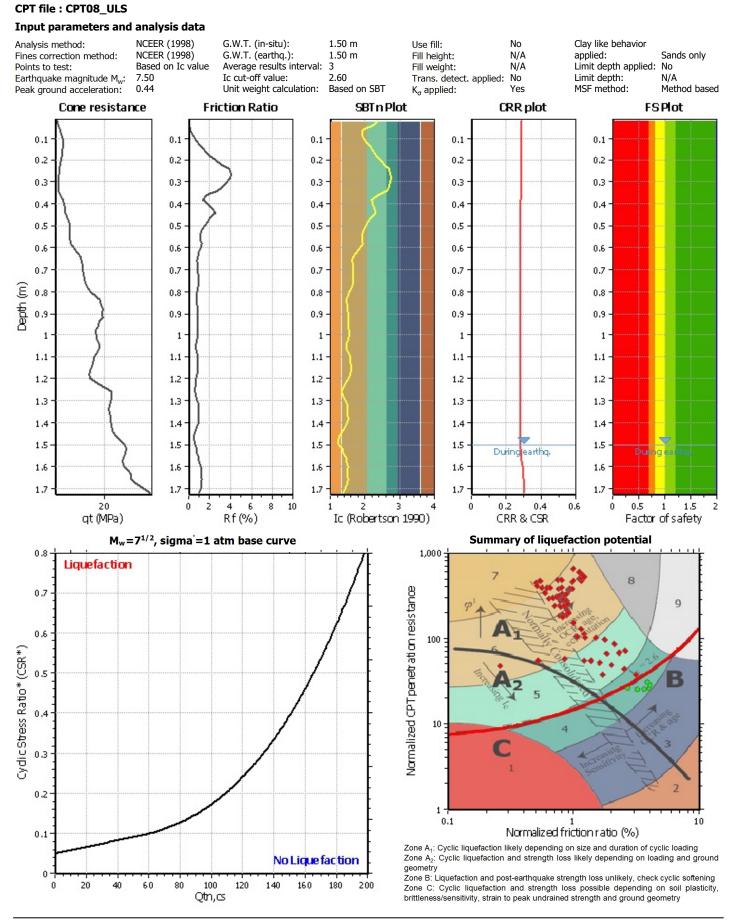
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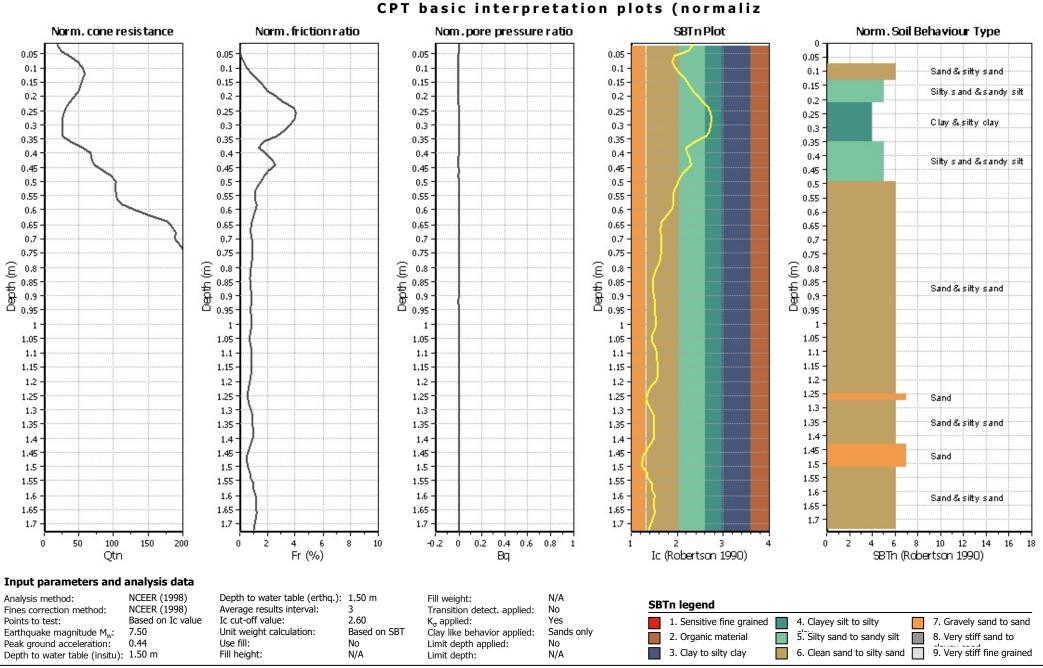
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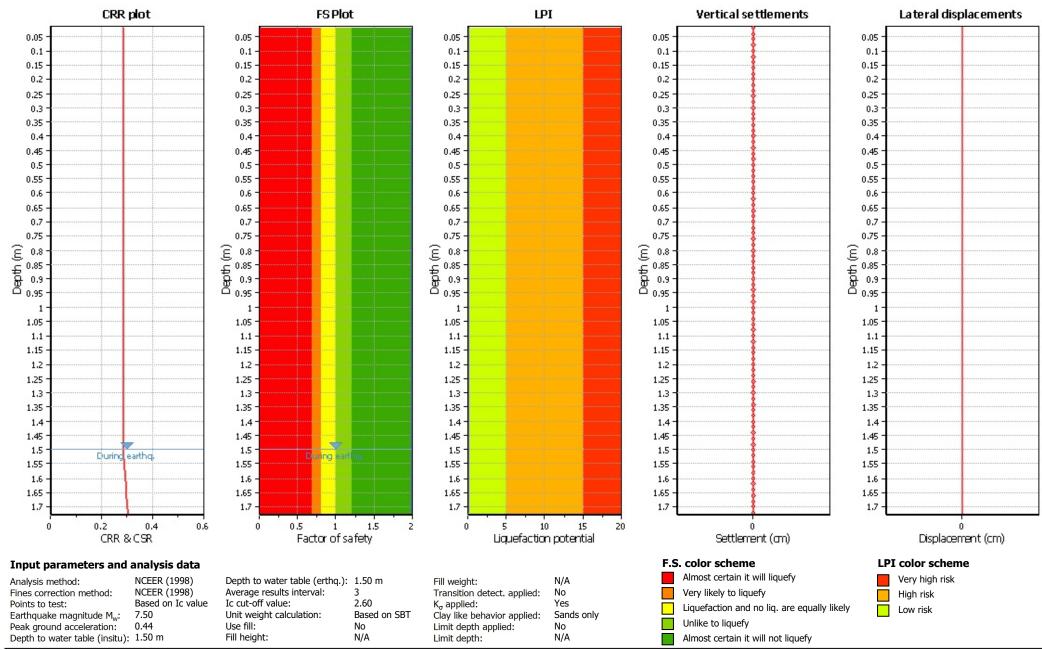
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# Important Information about This Geotechnical-Engineering Report

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 civilworks constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnicalengineering 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 geotechnicalengineering 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 confirmationdependent recommendations if you fail to retain that engineer to perform construction observation*.

# This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnicalengineering 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 geotechnicalengineering 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 buildingenvelope or mold specialists*.



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